2103406 Rev. AE

PGC1000 Chromatograph

User's Manual

TOTALFLOW
MEASUREMENT & CONTROL SYSTEMS

ABB

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Introduction

This manual is written to provide an experienced chromatography technician with the requirements necessary to install, set up and operate the Totalflow PGC1000 Process Gas Chromatograph.

Each of the chapters in this manual presents information in an organized and concise manner. Readers are able to look at the headings and get a broad picture of the content without reading every word. Also, there are overviews at the beginning of each chapter that provides the user with an idea of what is in the chapter and how it fits into the overall manual.

Chapter Descriptions

This manual provides the following information:

Chapter	Name	Description
1	System Description	Provides a description of the Totalflow PGC1000 system components and specifications.
2	Installation	Includes unpacking and detailed procedures for set up and installation.
3	PGC1000 Startup	Provides the user with a tutorial on how to get a newly installed PGC1000 system up and running.
4	Maintenance	Provides procedures on how to remove and replace major modules.
5	Troubleshooting	Provides a troubleshooting chart and procedures on how to correct most problems.
6	Special Applications	Provides information of the special applications that the user will encounter with the PGC1000.
7	Application Column Train Definitions	Provides information on the particular column trains that the user will encounter with the PGC1000.
Appendix A	Modbus® Register Tables	Provides a listing of all valid Modbus® registers.
Appendix B	Definitions & Acronyms	Provides quick access to the majority of terms and abbreviations as well as their definitions.
Appendix C	Projects Section	For the convenience of customers, site specific information will be included in the Projects section. This includes site schematics, site communication schemes and special enclosures.

Getting Help

Totalflow takes pride in the ongoing support provided to customers. When purchasing a product, the user receives documentation which should answer their questions; however, Totalflow technical support provides an 800 number as an added source of information.

If requiring assistance, call:

USA: (800) 442-3097 International: 001-918-338-4888

Before Calling

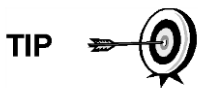
- Know the Totalflow model and serial number. Serial numbers can be found on a plate located on each unit.

- Be prepared to give the customer service representative a detailed description of the problem.
- Note any alarms or messages as they appear.
- Prepare a written description of problem.
- Know the software version, board and optional part numbers.

Key Symbols

The following symbols are used frequently in the manual. These are intended to draw attention to important information.

Intended to draw the user's attention to useful information or to clarify a statement made earlier.



Intended to draw the user's attention to a fact that may be useful or helpful in understanding a concept.

Intended to draw the user's attention to a statement that might keep them from making a mistake, keep them from destroying equipment or parts or keep them from creating a situation that could cause personal injury if caution is not used. Please refer to the Safety Practices and Precautions section for additional information.

Intended to draw the user's attention to a statement regarding the likelihood of personal injury or fatality that could result from improper access or techniques used while working in hazardous locations. Please refer to the Safety Practices and Precautions section for additional information.

Indicates procedures that are only valid if the system design includes an environmental enclosure.

Safety Practices and Precautions

This manual contains information and warnings which have to be followed by the user to ensure safe operation and to retain the product in a safe condition. Installation, maintenance and repairs should only be performed by a trained and qualified technician. Please refer to the certification drawings shipped with this unit for specific guidelines. Extra copies of the certification drawings, referenced on the unit's name tag, can be obtained, free of charge, by contacting Totalflow technical support at the number listed in the Getting Help section.

Safety Guidelines

- DO NOT open the equipment to perform any adjustments, measurements, maintenance, parts replacement or repairs until all external power supplies have been disconnected.
- Only a properly trained technician should work on any equipment with power still applied.
- When opening covers or removing parts, exercise extreme care. Live parts or connections can be exposed.
- Installation and maintenance must be performed by person(s) qualified for the type and area of installation according to national and local codes.

- Capacitors in the equipment can still be charged even after the unit has been disconnected from all power supplies.

Safety First

Various statements in this manual that are identified as conditions or practices that could result in equipment damage, personal injury or loss of life are highlighted using the following icons:

Exercise caution while performing this task. Carelessness could result in damage to the equipment, other property and personal injury.

STOP. Do not proceed without first verifying that a hazardous condition does not exist. This task may not be undertaken until proper protection has been obtained or the hazardous condition has been removed. Personal injury or fatality could result. Examples of these warnings include:

- Removal of enclosure cover(s) in a hazardous location must follow guidelines stipulated in the certification drawings shipped with the unit.
- If the unit is installed or to be installed in a hazardous location, the technician must follow the guidelines stipulated in the certification drawings shipped with the unit.
- Access to the unit via a PCCU cable in a hazardous location must follow guidelines stipulated in the certification drawings shipped with the unit.
- Connecting or disconnecting equipment in a hazardous location for the installation or maintenance of electric components must follow guidelines stipulated in the certification drawings shipped with the unit.

WARNING indicates a personal injury hazard immediately accessible as one reads the markings.

CAUTION indicates a personal injury hazard not immediately accessible as one reads the markings or a hazard to property, including the equipment itself.

Equipment Markings

Protective ground (earth) terminal.

Grounding the Product

If a grounding conductor is required, it should be connected to the grounding terminal before any other connections are made.

Operating Voltage

Before switching on the power, check that the operating voltage listed on the equipment agrees with the power being connected to the equipment.

Danger From Loss of Ground

A grounding conductor may or may not be required depending on the hazardous classification. If required, any interruption of the grounding conductor inside or outside the equipment or loose connection of the grounding conductor can result in a dangerous unit. Intentional interruption of the grounding conductor is not permitted.

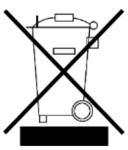
Safe Equipment

If it is determined that the equipment cannot be operated safely, it should be taken out of operation and secured against unintentional usage.

Compliance

EU Directive 2012/19/EU - Waste Electrical and Electronic Equipment (WEEE)

ABB Industrial Automation, Measurement and Analytics, is committed to actively protecting the environment. Do not dispose of WEEE as unsorted municipal waste. Collect WEEE separately. Participation in the management of WEEE is critical to the success of WEEE collection.



Electrical and electronic equipment marked using the crossed-out wheeled bin symbol shall not be mixed with general household waste. Correct disposal at a recycling facility will help save valuable resources and prevent potential negative effects on health and the environment. These steps ensure compliance with the Waste Electrical and Electronic Equipment (WEEE) Directive.

Waste electrical and electronic equipment (WEEE) shall be treated separately using the national collection framework available to customers for the return, recycling, and treatment of WEEE.

1.0 SYSTEM DESCRIPTION

1.1 System Overview

This chapter introduces the user to the ABB Totalflow Model PGC1000 Series Process Gas Chromatographs. The PGC1000 is designed to continually analyze online process gas streams, determine composition and store the analysis information.

1.1.1 Framework

Based on the ABB Totalflow XSeries technology, the PGC1000 features a common platform that combines the expandable framework of the XSeries equipment with the capabilities of a remote gas chromatograph. This new platform is designed for operation on the Windows® CE Real-Time Operating System.

1.1.2 Calibration

Once installed, the unit can immediately begin analyzing the component makeup of the process gas. The user may use their own calibration blend to adjust the unit to their company's standards or take advantage of the automatic operational features by using Totalflow's recommended calibration gas.

1.1.3 Typical Installation

This compact unit requires minimal installation time and is fully configured and calibrated at the factory. A typical single stream installation includes a sample probe, optional sample conditioning module and carrier and calibration gas (see

Figure 1-1 Typical Single Stream Installation

). A multiple stream installation includes an installation where sample probes may be connected to the PGC1000 (see Figure 1-2).

The PGC1000 can be a two or four train chromatograph, respectively. All trains are configurable based on the user's requirements. Standard trains have been developed by ABB Totalflow to support a wide variety of chromatographic applications. The following is an example of some of the special applications that are available. This is only an example list. If the user's application is not listed, please contact an ABB Totalflow project engineer.

- C3+, Air or H_2, C1, CO_2, C2= (ethylene), C2
- C3+, Air or H_2, C1, CO_2, C2= (ethylene), C2, H_2S and H_2O
- C1+, He, H_2, O_2, N_2, CO
- C6+, C3, IC4, NC4, neoC5, IC5, NC5
- H_2S in fuel gas
- C7+ C3, IC4, NC4, neoC5, IC5, NC5, C6s and H_2S
- C9+, C6s, C7s and C8s
- C3+, Air or H2, C1, CO_2, C2, CO_2, C2, H_2S and H_2O
- C6+, C3, IC4, NC4, neoC5, IC5, NC5 and H_2S

Again, the above list is only a sample of the trains available. Contact an ABB Totalflow project engineer to help select the appropriate trains for the application.

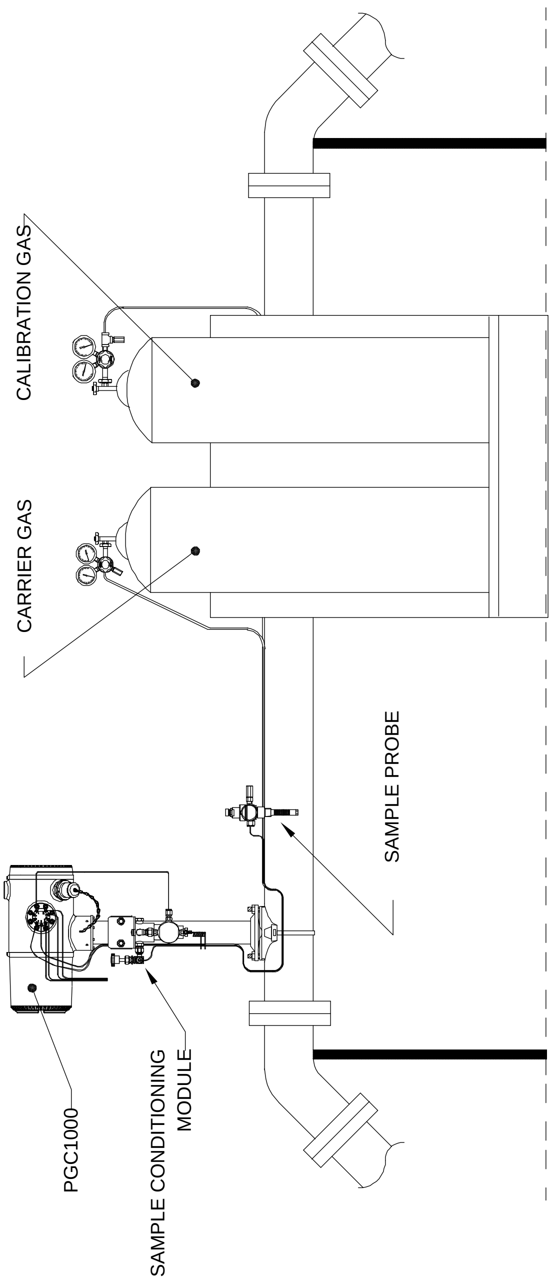
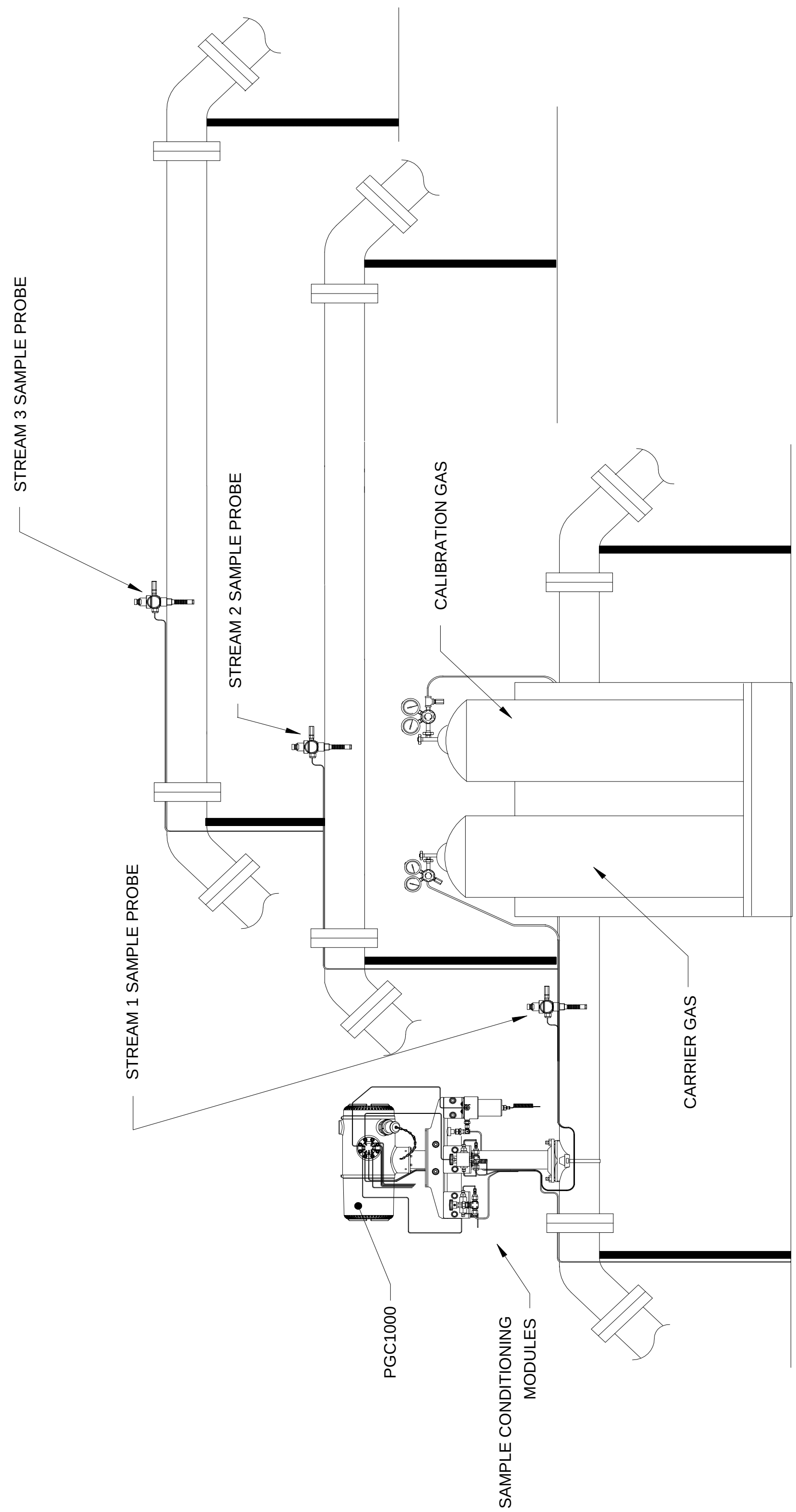


Figure 1-1 Typical Single Stream Installation



TIP For clarity, the unit is shown mounted on an outside meter run. For sample line length considerations, the unit should be mounted on the middle pipe run.

Figure 1-2 Typical Multi-Stream Installation

1.2 Processing a Sample

In the first phase of the cycle, a process gas sample is extracted from the process stream. This sample is then processed for particulate removal and phase integrity by the sample conditioning system (optional). Upon completion, the sample is transported to the PGC1000 and injected in the chromatographic columns where component separation occurs.

The PGC1000 analyzes each sample and uses established chromatographic techniques. The resulting information consists of mole percent values for each component. These values can be used to perform a variety of calculations.

The processed sample is then vented with the carrier gas, and the results are stored in memory and communicated to other devices, as needed. All of these values, as well as composition, are available in various Modbus® communication protocols.

1.2.1 Hydrocarbons

Table 1–1 Hydrocarbons displays additional details for several common hydrocarbons and presents key information to include the boiling point of the component. The boiling point of each component correlates to the order each component will exit the column.

Table 1–1 Hydrocarbons

Molecular Formula	Common Abbreviation	Component	Boiling Point
C1H4	C1	Methane	-161.6
C2H4	C2=	Ethylene	-103.75
C2H6	C2	Ethane	-88.65
C3H6	C3=	Propylene	-47.65
C3H8	C3	Propane	-42.05
C4H10	IC4	Isobutane	-11.65
C4H8	C4=	Butylene	-6.95
C4H10	C4	Butane	-.45
C5H12	NeoC5	Neopentane	9.85
C5H12	IC5	Isopentane	27.85
C5H12	C5	Pentane	34.85
C6H14	C6	Hexane	68.85
C7H16	C7	Heptane	97.85
C8H18	C8	Octane	125.55
C9H20	C9	Nonane	150.95
C10H22	C10	Decane	173.95

1.3 Hardware Systems

Table 1–2 System Specifications

	12 Vdc		24 Vdc	
	No Aux. Heater	W/Aux Heater	No Aux. Heater	W/Aux Heater
Supply Voltage	10.5-16 Vdc	10.5-16 Vdc	21-28 Vdc	21-28 Vdc
Recommended AC Power Supply	14.5V	14.5V	25V	25V
Maximum Instantaneous Current[1]	4 Amp	8.2 Amp	2.2Amp	5.2Amp
Avg. Power Consumption After Startup[2]	Up to 7 Watts	Up to 53 Watts	Up to 7 Watts	Up to 64 Watts
Environmental Temperature	Storage		-22°F to +140°F (-30°C to 60°C)	
	Normal Operation		0°F to +131°F (-18°C to 55°C)	
	W/Environmental Enclosure		-40°F to +131°F (-40° C to 55°C)	
Repeatability	Dependent on the application. See Chapter 7.0			
{Helium/Hydrogen} Carrier	Consumption Rate: Dependent upon the application and specific column trains.			
Analysis Time	Approximately Five Minutes: Dependent upon the application and specific column trains (interval between cycles is adjustable).			
Calibration/Validation Streams	Up to two dedicated (reduces sample stream for each dedicated calibration stream). Must use dedicated stream(s) for Auto-Cal feature.			
Sample Streams	Up to four (with manual calibration streams).			
Construction	• NEMA/Type 4X (IP56) • Aluminum alloy with white polyester powder coating. • Explosion Proof – See specification sheet for certifications.			
Installation Time	Requires 2-3 hours for installation. Minimum eight hour run time for repeatability.			
Mounting	Pipe run, free-standing pipe, shelf or environmental enclosure.			

PGC1000 Dimensions		Width	Height	Depth	Weight
	US	9.5”	8.82”	15.64”	29 lbs
	Metric	241.3 mm	224.0 mm	397.3 mm	10.8 kg

1.3.1 Standard Hardware Features

The ABB Totalflow PGC1000 features a rugged, field-ready design. Installation, start-up and troubleshooting times have been greatly reduced due to these user-friendly hardware features:

- Enclosure, compact design
- Cast aluminum housing with six exterior hubs

---

[1] Usually experienced at startup. Use this for power supply sizing requirements (includes approximately 20% buffer and is calculated for maximum allowable power supply voltages).

[2] At Recommended AC Power Supply Voltage. Highly temperature dependant with feed-through heater operating continuously. Usually occurs at only the coldest ambient operating temperature, i.e., 0°F (-18°C).

- Powder coating
- Weatherproof construction
- Modular design (see Figure 1-3)
- Digital controller assembly
- Analytical module with compact design and single bolt replacement
- Feed-through assembly with flame path arrestors
- Termination panel
- State-of-the-art electronics
- 32-bit digital controlling electronics (i.e., no analog control loops)
- Low power operation
- Dual digital carrier pressure regulation
- Digital temperature control
- Digital detector electronics
- Low EMI/RFI design
- Operates on Windows® CE®
- Auto-start with diagnostics
- Factory calibrated

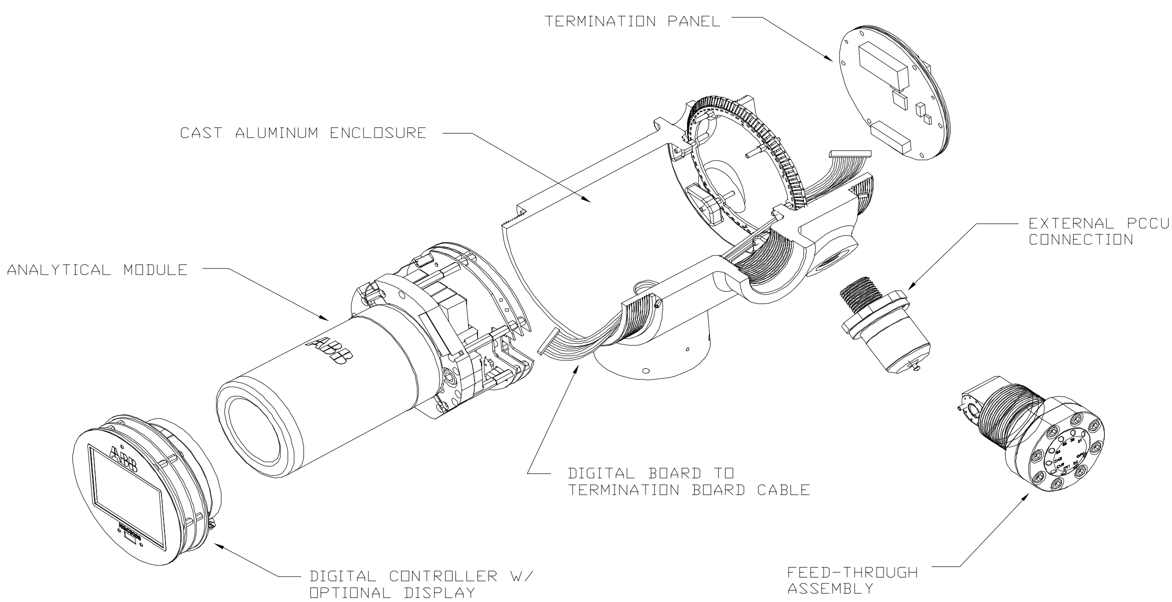


Figure 1-3 Modular Design PGC1000

1.3.2 Recommended Spare Parts

Totalflow has provided a recommended spares list for the PGC1000. Consideration was given to the cost of the repair time and the cost of stocking repair parts. The PGC1000's modular design is uniquely suited for quick repair times. A more comprehensive discussion of recommended spare parts can be found in Chapter 4 – Maintenance.

1.3.3 Cast Aluminum Enclosure

The custom designed, explosion-proof enclosure consists of a cylindrical shaped, cast aluminum housing, powder coated, with front and rear end caps for access to internal components. Figure 1-4 through Figure 1-7 displays the outline dimensions of the PGC1000.

The end caps have precision engineered threading and are susceptible to damage if treated roughly. Enclosure and all fittings, including feed-through, MMI connection and breather, are tested to NEMA/Type 4X. The end caps are protected from unauthorized removal with a 1/16” hex socket set screw.

This enclosure may be pipe mounted using a pipe saddle, stand-alone pipe, shelf mount or optional mount in an environmental enclosure (ENC82). The unit may be directionally positioned using 1/8” hex socket set screws that are located in the neck of the enclosure.

1.3.3.1 Exterior Hubs

The unit enclosure features six exterior hubs:

- Gas feed-through assembly
- Explosion-proof local MMI port
- Four (4) miscellaneous hubs, including:
  - Communication hub
  - Power hub
  - Digital Input/Output wire hub
  - Undefined hub

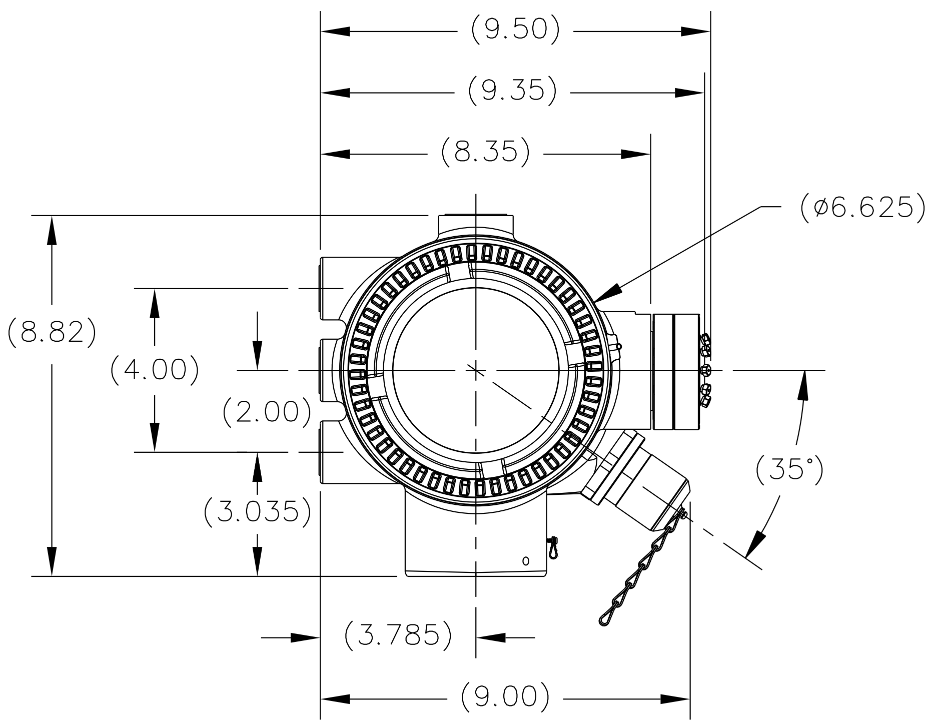


Figure 1-4 PGC1000 Enclosure

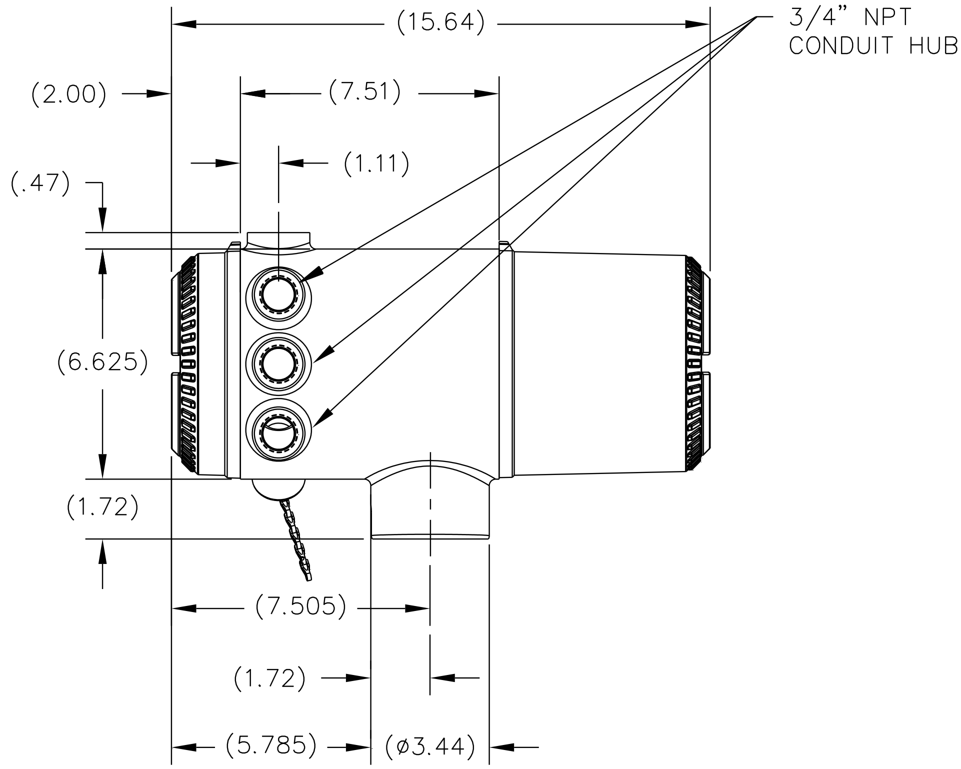


Figure 1-5 PGC1000 Enclosure Left Side

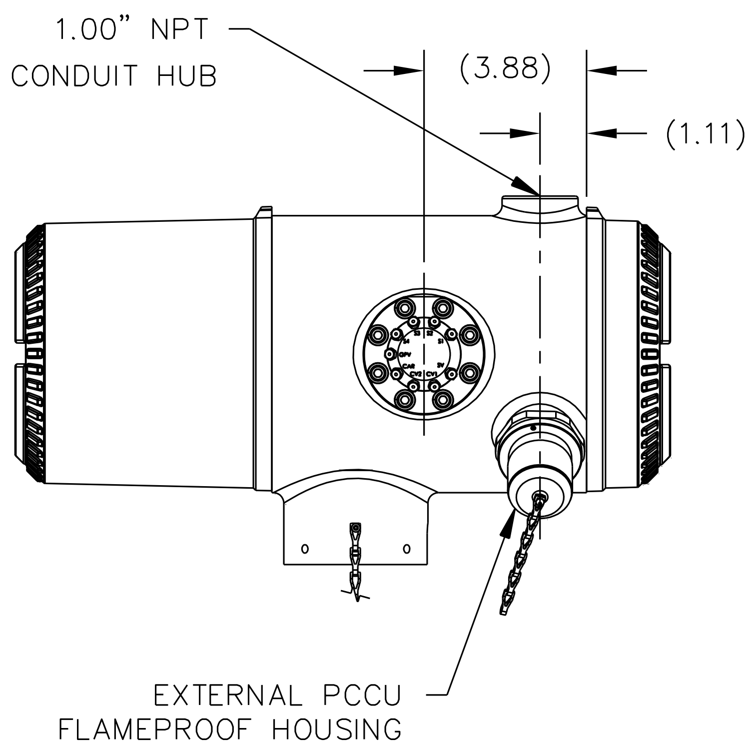


Figure 1-6 PGC1000 Enclosure Right Side

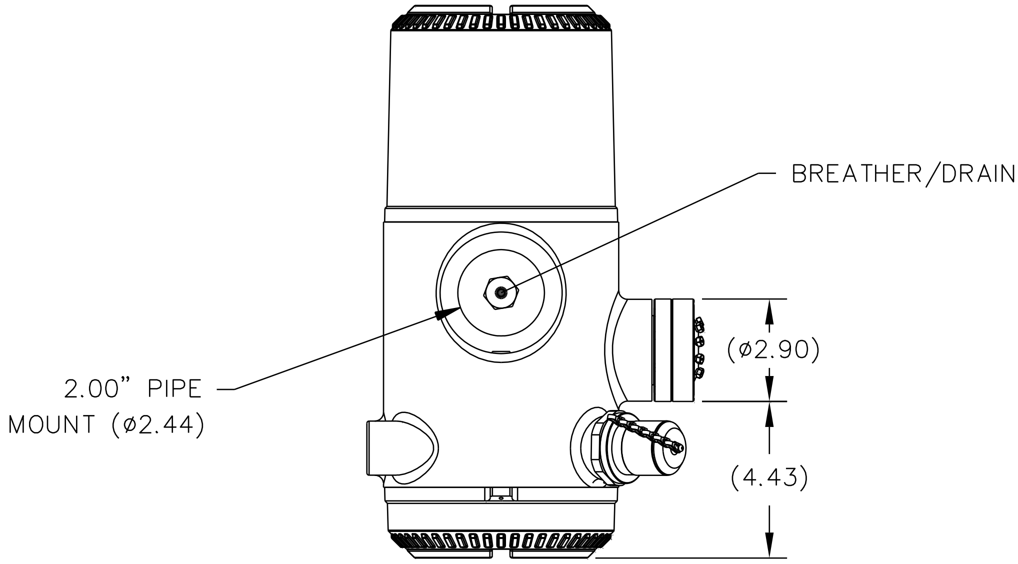


Figure 1-7 PGC1000 Enclosure Bottom View

1.3.4 Feed-Through Assembly

Independent process streams are connected to the PGC1000 directly through the feed-through assembly (see Figure 1-8) or through an optionally installed sample conditioning system. The feed-through assembly also serves as the connection for carrier gas and calibration streams and contains the vents for sample and column gases. The feed-through assembly comes in three configurations:

- Without Auxiliary Heater
- With 12 Vdc Auxiliary Heater
- With 24 Vdc Auxiliary Heater

The assembly with the auxiliary heater features a heater with a temperature sensor cable that makes a connection to the analytical module and is replaceable. Please note that this cable will also come in two configurations: 12 Vdc and 24 Vdc.

1.3.4.1 Inlets

All inlets have internal, replaceable 0.5 micron filters. Available inlets are:

- 1–4 Sample Stream Inputs, Calibration Blend Streams
- 1–3 Sample Streams with 1 Dedicated Auto Cal Stream
- 1–2 Sample Streams with 1–2 Dedicated Auto Cal Streams
- 1–4 Sample Streams with 1–2 Manual Calibration Streams
- 1 Carrier Input Stream

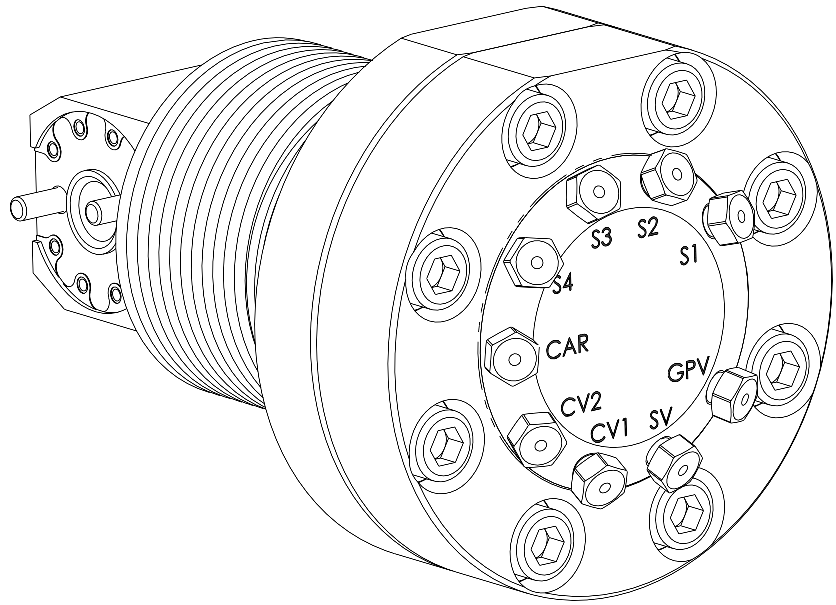


Figure 1-8 PGC1000 Feed-Through Assembly

CAUTION The 0.5 micron filters should NOT be considered a replacement for the primary filtering system. Optional sample conditioning modules are designed for this purpose.

1.3.4.2 Vents

Feed-through assembly vents do not have filters but will require vent tubing to be attached and routed accordingly. These are:

- Two (2) column vents (CV1 and CV2)
- One (1) sample vent (S1, S2, S3 and S4)
- One (1) gauge port vent (GPV)

1.3.5 Analytical Module

The modular design of the analytical module is enhanced by the single bolt removal feature. This assembly is comprised of the manifold and analytical processor. These parts are not field replaceable. The GC module is an important part of the analytical module but is field replaceable.

The analytical module comes in two configurations: 12 Vdc and 24 Vdc.

The sub-assemblies that comprise the analytical module and GC module come in two configurations: 12 Vdc and 24 Vdc.

In Figure 1-9, the user can see the analytical module assembly removed from the enclosure.

1.3.5.1 Features

- High-speed serial interface to digital controller board
- 32-bit digital signal processor
- Flash memory

- Analog to digital conversion circuits
- Digital oven temperature controller
- Digital auxiliary heater controller (optional feed-through heater)
- Dual digital pressure regulators
- Sample pressure sensor
- Pressure sensors (100 PSI max.)
- Thermal conductivity detectors
- System level voltage monitoring
- Analytical processor board level temperature sensor
- LED board status indicators

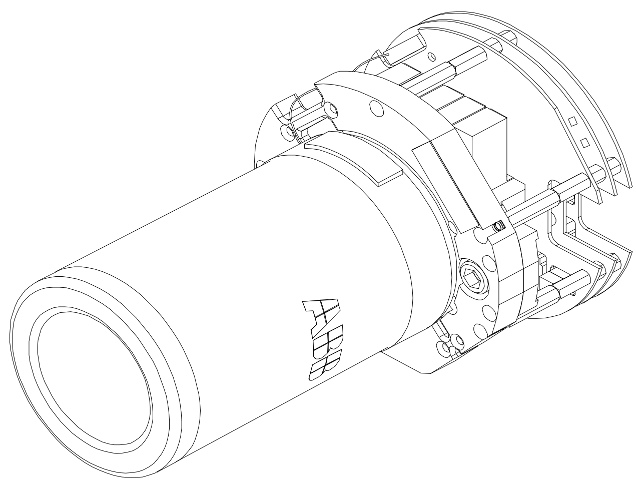


Figure 1-9 Analytical Module

1.3.5.2 Manifold Assembly

The manifold assembly is comprised of the manifold plate, heater, valves and various cables to other major components. The manifold plate and heater maintain a constant temperature for the GC module and columns. The valve controls the stream processing and carrier and calibration gases. The cables complete the information chain from the GC module to the analytical processor and the digital controller assembly.

Figure 1-10 shows the manifold assembly. This is not a field replaceable part.

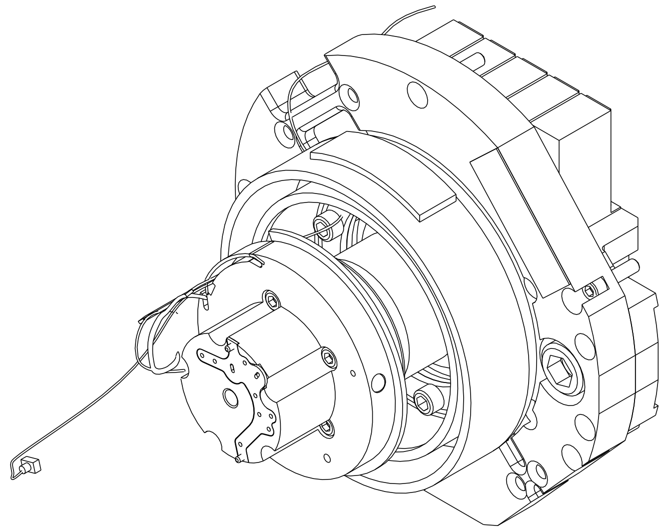


Figure 1-10 Manifold Assembly

1.3.5.3 Analytical Processor Assembly

The analytical processor provides real-time system control and measurement of the analytical processes within the PGC1000. This is accomplished by interfacing with all of the sensors in the GC module (and optional feed-through temperature sensor) as well as controlling the carrier pressure regulator valves, sample stream valves, the pilot valve and the heaters. The data generated by the analytical processor is passed to the digital controller board via a high speed serial interface.

The analytical processor also has two status LEDs used for troubleshooting. The red LED indicates that the board is powered on. If the board is remotely powered down by the digital controller or has no power, this LED will be off. The yellow LED indicates that the analytical processor's CPU has booted its program successfully and is controlling its processes as directed by the digital controller. This LED should be flashing at a high speed (between 20-40Hz). If this LED is off or is solid (not flashing), the software in the analytical processor is not running properly.

The analytical processor has as an auxiliary temperature override switch. This two position dip switch constitutes a hardware enable/disable for the auxiliary heater. Some applications may require the auxiliary heater (also referred to as the feed-through heater) to maintain the proper temperature. The auxiliary temperature override switch has two positions: Normal and Override. If the user’s unit DOES NOT employ the auxiliary heater, the switch should be in the Override position. If the unit DOES use the auxiliary heater, place the switch in the Normal position.

Figure 1-11 displays the analytical processor assembly. This is not a field replaceable part.

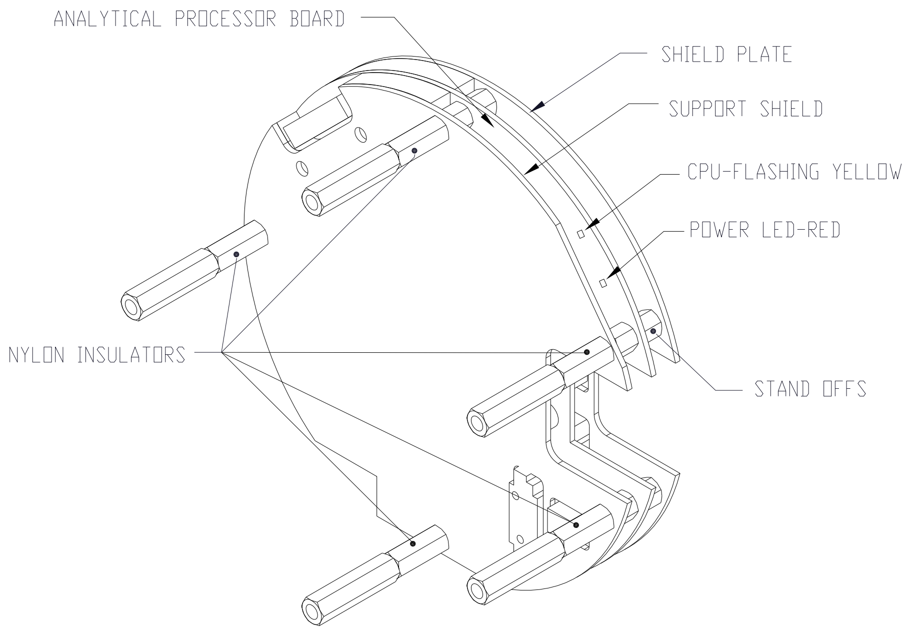


Figure 1-11 Analytical Processor Assembly

1.3.5.4 GC Module

The GC module is comprised of three components: columns, chromatographic valve and GC module circuit board. The valve controls the flow of gas within the system. The columns perform the separation of the gas into component parts for analysis. The GC module circuit board contains the sensors for the carrier pressure regulators, the sample pressure sensor and the thermal conductivity detectors (TCDs) which detect the different gas components as they leave the GC columns. It also contains an EEPROM or FLASH memory for storage of calibration and characterization information of the module and its sensors.

Figure 1-12 displays the GC module with the oven wall removed.

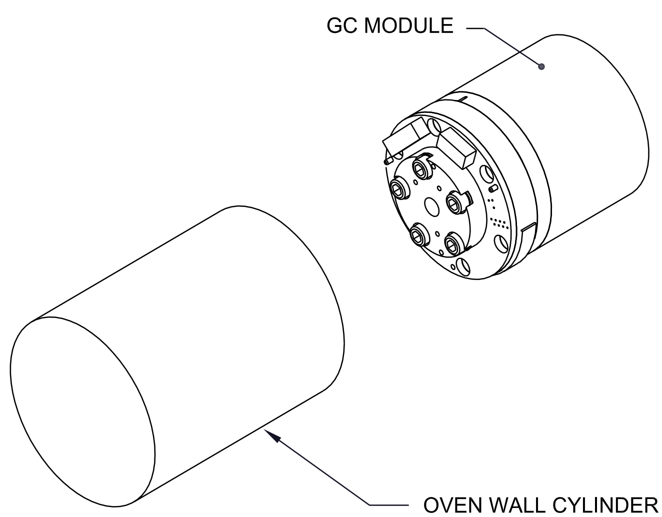


Figure 1-12 GC Module Assembly

1.3.6 Digital Controller Assembly with VGA Display

This assembly (see Figure 1-13) contains the digital electronic board, mounting assembly and an optional VGA display.

The digital controller board provides control parameters to the analytical processor board and stores and processes the data sent from the analytical processor board. The digital controller also processes communication with other devices.

The digital controller board features:

- 16 MB pseudo static ram (application), lithium battery backed
- 3 MB NAND flash memory (boot/application/storage)
- 4 MB static CMOS memory (storage)
- One (1) secure digital card socket with up to 4 GB removable storage (optional)

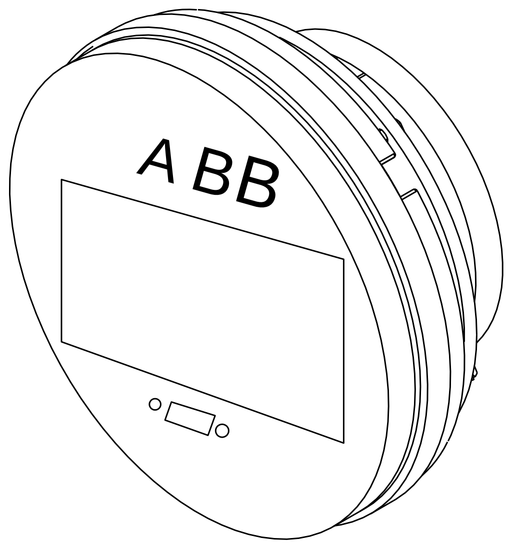


Figure 1-13 Digital Controller Assembly with Optional Display

1.3.7 VGA Display (Optional Equipment)

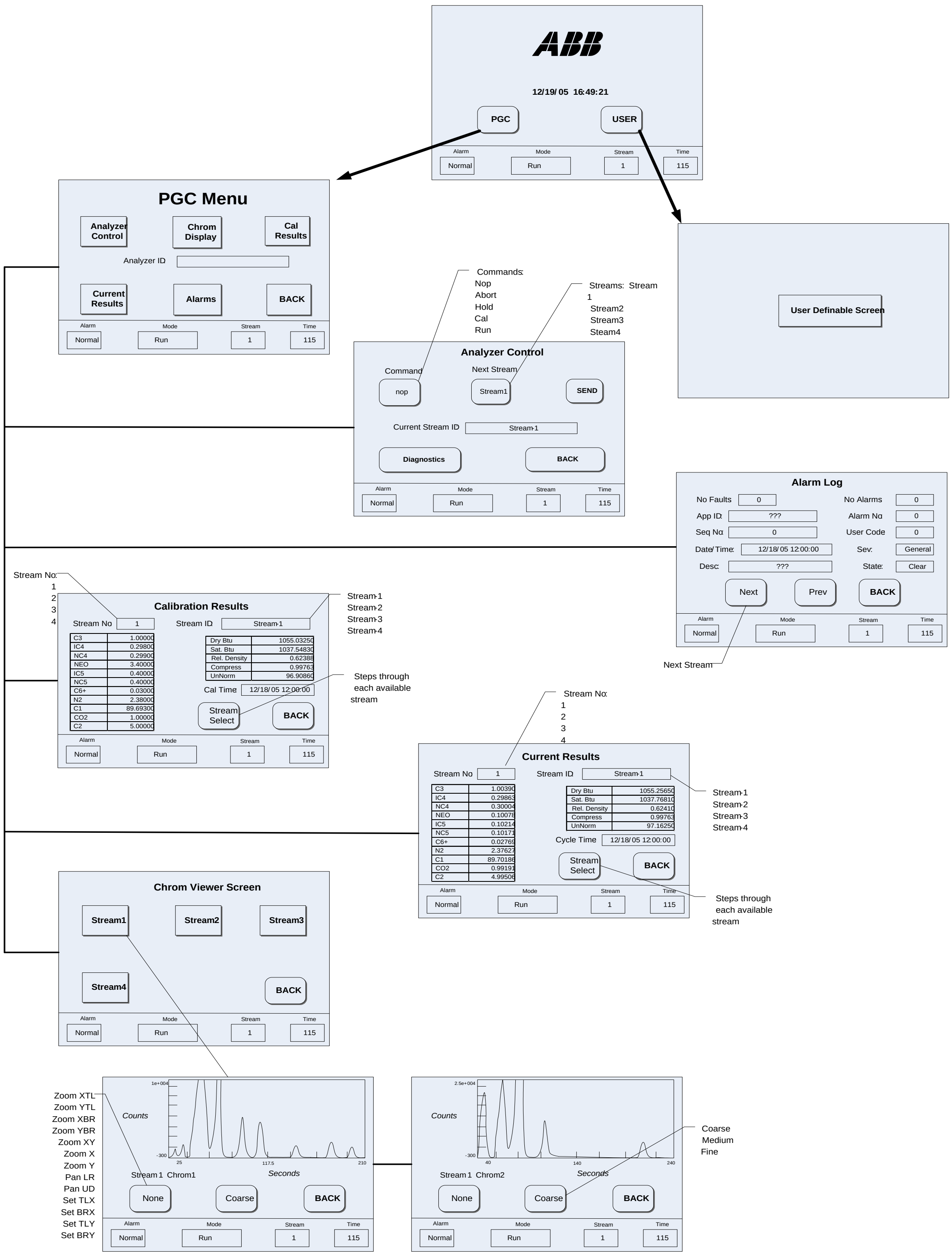
The display board provides a ¼ panel VGA monochromatic display to monitor the process and results. It also provides six magnetic switches to allow a user to navigate through various screens of data and control the processes (stop operation, start operation and calibrate).

If the PGC1000 is configured with the front panel display, available screens and user-defined screens may be navigated using the display magnet.

The optional VGA display features:

- ¼ panel VGA circuit board
- Two (2) LED status indicators; user-programmable
- User interface with Hall-Effect magnet navigation for monitoring the PGC1000 operation

Figure 1-14 shows the flow of information accessible through the display.



C3	1.00000
IC4	0.29800
NC4	0.29900
NEO	3.40000
IC5	0.40000
NC5	0.40000
C6+	0.03000
N2	2.38000
C1	89.69300
CO2	1.00000
C2	5.00000

Dry Btu	1055.03250
Sat. Btu	1037.54830
Rel. Density	0.62388
Compress	0.99763
UnNorm	96.90860

C3	1.00390
IC4	0.29863
NC4	0.30004
NEO	0.10078
IC5	0.10214
NC5	0.10171
C6+	0.02769
N2	2.37627
C1	89.70186
CO2	0.99191
C2	4.99506

Dry Btu	1055.25650
Sat. Btu	1037.76810
Rel. Density	0.62410
Compress	0.99763
UnNorm	97.16250

Figure 1-14 Optional PGC1000 VGA Display Screens

1.3.8 Termination Board

The PGC1000 termination board acts as a connection to the outside world. It features transient protection, a voltage regulator for the digital controller, positive temperature co-efficient fuses (PTC) and many other safeguards to protect the remainder of the system from electrical damage (see Figure 1-15). All outside communications and I/O are channeled through this board. It is designed to be a low cost, field replaceable maintenance solution and is designed to operate on either 12 Vdc or 24 Vdc.

1.3.8.1 Features

- Transient protection
- EMI/RFI protection
- PTC fuses
- Voltage regulator for digital controller
- Dedicated local serial data interface (up to 115200 bps)
- Two (2) LED status indicators (software programmable)
- One (1) power monitor status indicator
- 1 5 Vdc LED status indicator
- Two (2) DI's and two (2) DO's connected to the digital controller
- Two (2) remote serial ports (RS232/RS422/RS485 software selectable)
- Optional Ethernet interface with three (3) LED status indicators
- Optional USB host and client interface

1.3.8.2 Local Interface

This local PC interface requires PCCU32 version 6.0 or higher, a laptop PC and a MMI Cable, either USB or serial RS-232. The software operates within the full range of Windows® 95, 98, 2000, NT and XP utilities. Maintenance functions can be performed by personnel with little or no knowledge of gas chromatography; see the online help files for more information.

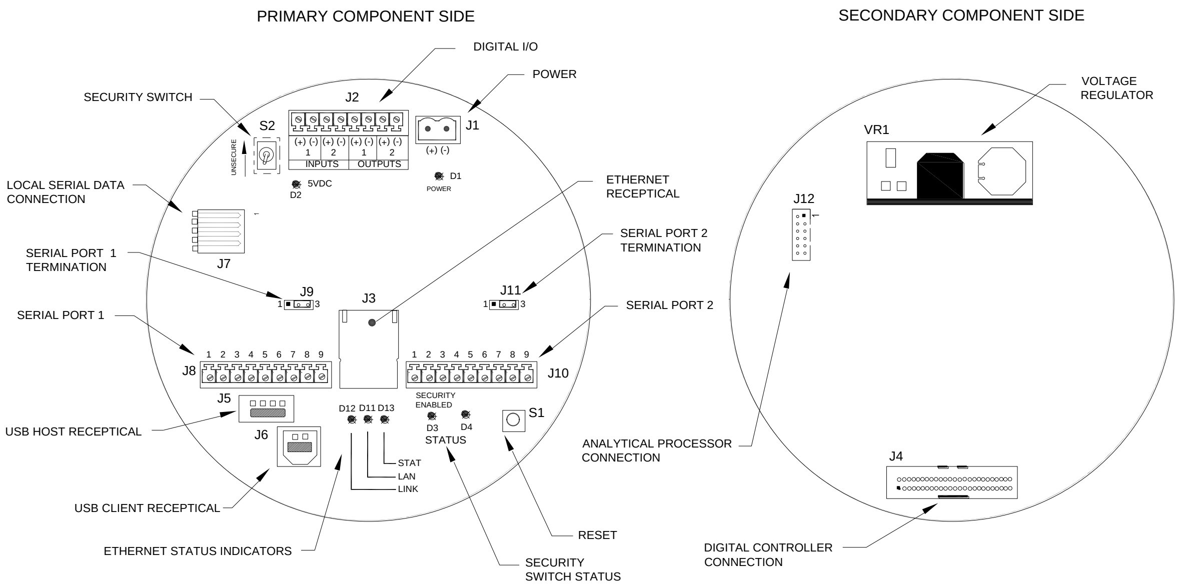


Figure 1-15 Termination Board

1.4 Grounding the PGC1000

The PGC1000 must be properly grounded. The PGC1000 has a grounding lug on the mounting neck of the enclosure. This lug should be tied to a good earth ground with no smaller than #12AWG wire. The PGC1000 cannot be connected to any pipeline or process system employing cathodic protection. If the user's system uses cathodic protection, the PGC1000 must be mounted on a section of pipeline that has been electrically isolated from the cathodic currents (see Figure 1-16).

1.4.1 Power Supply

The power supply for the PGC1000 should have an isolated output (i.e., the negative side of the 12 Vdc output should not be electrically connected to the chassis or earth ground). In many instances, the power supply will be collocated with a radio. If the radio is connected to the PGC1000 via RS232/485/422, the communications should share the power ground. The communication shield should only be connected at the PGC1000 end. The other end should be left to float (left unconnected).

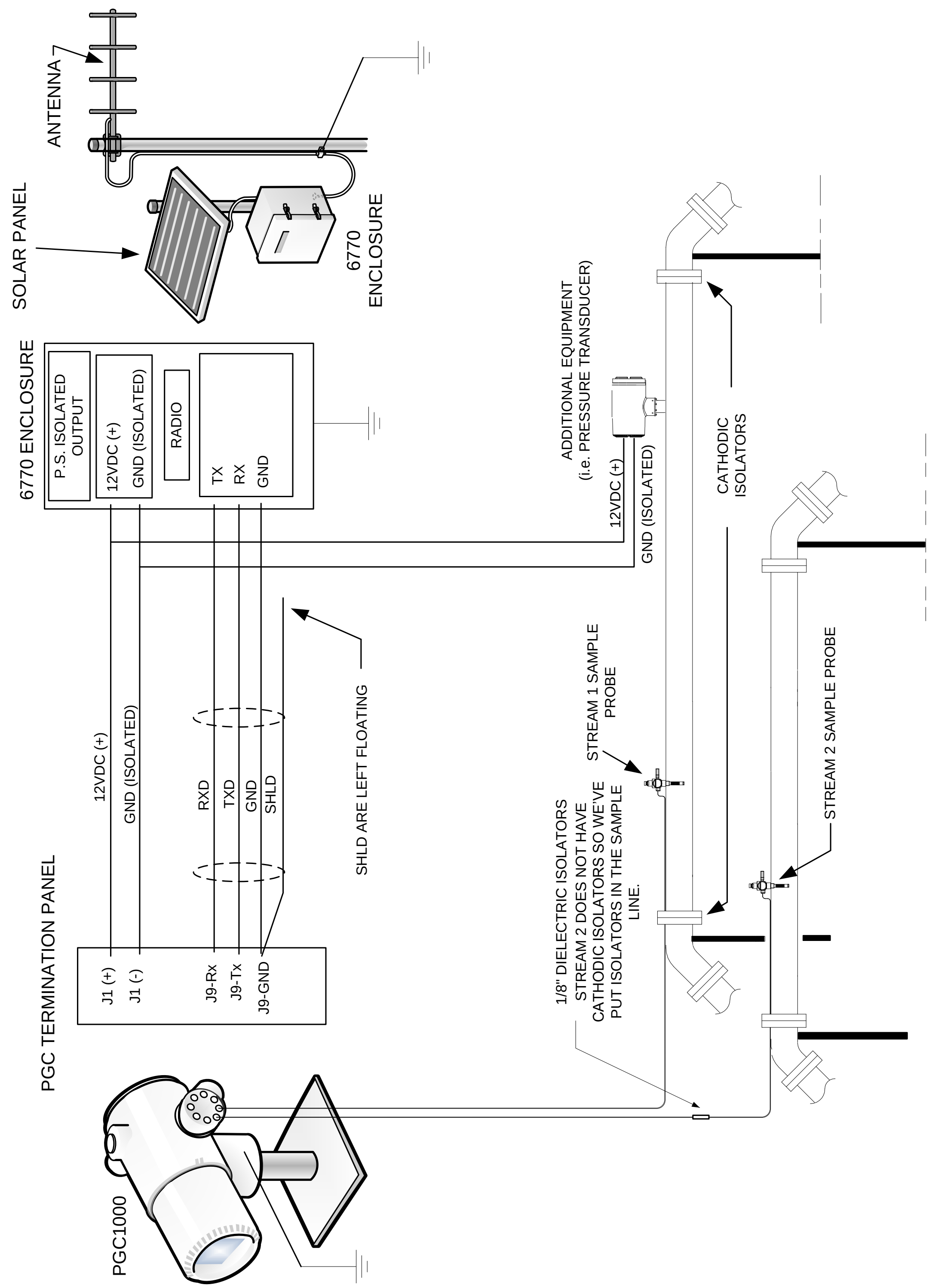


Figure 1-16 PGC1000 Grounding Considerations

1.4.2 Sample Probe

If the user's sample probe is mounted to a section of pipe or tubing where cathodic currents may exist, the user will have to put isolators in the sample tubing between the sample probe and the PGC1000. Any time that the sample probe is on a section of pipe other than the one where the PGC1000 is directly mounted, tubing isolators should be employed. It is very important that probe ground and the PGC1000 ground be at the same potential. If this cannot be ensured, tubing isolators must be used.

1.4.3 Other Considerations

If other devices are to be powered from the same isolated power supply that is powering the PGC1000, ensure that ground loops are avoided. The various devices should be connected in a star configuration. It is also important that any additional powered devices be able to handle a fairly wide range of input voltages, as the PGC1000's heater will draw about four (4) Amps (if the auxiliary heater is installed, it might be as much as eight (8) Amps). This load (4-8 Amps) being drawn across any considerable length of cable can result in a substantial voltage drop. Refer to the Cable Length Power Specifications table. The resulting lower input voltage to the additional device could affect its operation. Input voltage excursions will fluctuate with the toggling of the PGC1000's heater(s). The heater(s) will be turning on and off in an effort to maintain a constant internal temperature for the PGC1000's GC module.

In an office environment, ensure there is a good earth ground to the PGC1000. Often, the third pin (ground) on the power cable is missing or has been removed. Improper grounding can lead to erratic behavior. If the unit is not properly grounded, the user could have as much as 60 Vac (half-line voltage) on the case of the equipment due to capacitive coupling within the power supply.

1.5 Calibration/Validation Stream

On the PGC1000 feed-through assembly, one or two of the sample streams may be used for a calibration input. ABB Totalflow recommends a metal diaphragm regulator set to 15 $\pm$ 2 PSIG input. Specific calibration blends are discussed in detail in this manual's Application section; however, a few things are worth mentioning here.

For best results, the calibration blend should be as close as possible to what the associated process stream is processing. Avoid having any component concentration in the calibration blend less than 10% of what the user would expect it to measure in the process stream. For example, if the user expects to see about 5mol% of ethane (C2) in the process stream, do not put less than .5mol% ethane in the calibration blend.

Also, be very careful that the PGC1000 does not draw a sample from the calibration blend while it is below its dew point. If the temperature drops below the calibration blend's dew point, some of the heavier components will drop out of the gaseous state and become liquids in the calibration bottle. If the PGC1000 were to draw a calibration sample at this point, it would alter the calibration blend from this point on. If this is the case, take the blend to the user's supplier and have it analyzed and have a new blend tag placed on the bottle. This is a more economical solution than having them mix another bottle of the calibration blend.

Higher pressures and lower temperatures will move the calibration blend closer to its dew point or to the condition in which the heavier components start to transition from a gaseous state to a liquid state. Lower bottle pressures and higher temperatures will move the calibration blend away from its dew point; however, lower bottle pressures also mean less calibration gas is in the bottle.

1.6 Operating Voltages and Cable Lengths

The PGC1000 is designed for connection to a 12 Vdc or 24 Vdc power source. The 12 Volt power source must provide a minimum of 10.5 Vdc to a maximum of 16 Vdc at 4 Amps minimum. The 24 Volt power source must provide a minimum of 21 Vdc to a maximum of 28 Vdc at 2.2 Amps. Configurations with the auxiliary feed-through heater will increase requirements.

Adequate wire size is a function of the distance between the PGC1000 and the DC power supply. When running wire from the power source to the PGC1000, consideration must be given to the voltage dropped between the power source and the PGC1000. Smaller wire gauges have greater resistance and, therefore, a greater voltage drop across the wiring. The following tables (Table 1–3 and Table 1–4) display multiple cable sizes and corresponding maximum cable lengths for DC and AC installations, with and without the auxiliary feed-through assembly heater.

Additional devices connected to the PGC1000 and requiring power (XMVs, radios, etc.) must be factored into this calculation. Refer to their technical specifications for the requirements of each or call ABB Totalflow for help computing cable requirements for additional loads.

Table 1–3 12 Vdc Battery Power Supply System Maximum Cable Lengths

(No External Devices Connected to PGC1000, 12 Vdc Battery Power Supply Only)

Model/Option	Min. Batt Voltage (V)	Units	10AWG[3]	12 AWG	14 AWG	16 AWG	6 mm^2 [3]	4 mm^2 [3]	2.5 mm^2	1.5 mm^2
12 Vdc PGC1000 w/o Feed-Through Heater	12.00	(ft)	78.28	49.44	30.97	19.43	90.03	60.17	37.42	22.92
		(m)	23.86	15.07	9.44	5.92	27.44	18.34	11.41	6.99
12 Vdc PGC1000 with Feed-Through Heater	12.00	(ft)	38.74	24.47	15.32	9.62	44.55	29.78	18.52	11.34
		(m)	11.81	7.46	4.67	2.93	13.58	9.08	5.64	3.46

Table 1–4 AC Power Supply System Maximum Cable Lengths

(No External Devices Connected to PGC1000, AC Power Supply Only)

Model/Option	Recommended PS Voltage (V)	Units	10 AWG[3]	12 AWG	14 AWG	16 AWG	6 mm^2 [3]	4 mm^2 [3]	2.5 mm^2	1.5 mm^2
12 Vdc PGC1000 w/o Feed-Through Heater	14.50	(ft)	469.67	296.64	185.81	116.61	540.20	361.03	224.55	137.54
		(m)	143.16	90.41	56.63	35.54	164.65	110.04	68.44	41.92
12 Vdc PGC1000 with Feed-Through Heater	14.50	(ft)	232.43	146.80	91.95	57.71	267.33	178.66	111.12	68.06
		(m)	70.84	44.74	28.03	17.59	81.48	54.46	33.87	20.75
24 Vdc PGC1000 w/o Feed-Through Heater	25.00	(ft)	809.52	511.27	320.25	200.98	931.07	622.26	387.02	237.06
		(m)	246.74	155.84	97.61	61.26	283.79	189.67	117.96	72.26
24 Vdc PGC1000 with Feed-Through Heater	25.00	(ft)	336.97	212.83	133.31	83.66	387.57	259.03	161.10	98.68
		(m)	102.71	64.87	40.63	25.50	118.13	78.95	49.10	30.08

[3] This wire size may require splicing in 12 AWG or 2.5mm^2 or smaller wires at each end of the cable to be able to fit screw terminals.

1.7 Sample Transport Tubing Design

Information in this section enables the user to design the sample transport tubing connected between the TCR sample probe and the installed PGC1000. Minimizing transport lag time and maintaining a single vapor phase sample are important factors to consider when selecting transport tubing.

Lag time is the time required to purge out one volume of transport tubing and the volume of the sample conditioning system.

1.7.1 Tube Quality

Use only good quality, clean, stainless steel chromatographic-grade transport tubing for carrier, calibration gas and sample lines. Use of poor quality stainless steel tubing will deliver unsatisfactory results.

CAUTION DO NOT use any type of plastic, Teflon® or Teflon®-lined braided steel tubing.

Transport tubing must be chromatographically clean. Tubing should be free of hydrocarbon contamination and particle free. During cutting, fitting and deburring, the technician should ensure that no particles are allowed to remain in the tubing.

1.7.2 Calculation

Sample transport lag time estimated calculations do not consider the volume of the sample conditioning system. As such, the following equation can be used as a quick method to estimate lag time because normal transport tubing volume is much greater than sample conditioning system tubing volume.

$$\text{Lag Time} = \frac{(\text{Volume}[\text{cc}]\ \text{per Foot of Tubing}) \times (\text{Feet of Tubing})}{\text{Actual Sample Flow Rate (cc/min.)}}$$

For a detailed method of calculating lag time, see the Calculating Lag Time section.

1.7.3 Analysis Time

If analysis results are used for process control or custody transfer, it is important to minimize the amount of time the sample spends in transit from the TCR sample probe to the PGC1000. To arrive at the total cycle time between representative samples, sample transit time must be added to the PGC1000 cycle time.

1.7.4 Transit Volume

The total volume of sample gas in transit is calculated by multiplying the volume per foot of sample transport tubing by the total length of tubing. To assist in making these calculations, refer to Table 1–5 for the internal volume of commonly used sample transport tubing.

Table 1–5 Internal Volume of Commonly Used Sample Transport Tubing

Tube Outside Diameter (in.)	Tube Wall Thickness (in.)	Volume per Foot (cc)
1/8	0.02	1
1/4	0.035	5
3/8	0.035	15
1/2	0.035	25

1.7.5 Gas Volume in Transit Tubing

Gases are compressible, and the volume of gas in the transport tubing for standard conditions (atmospheric pressure and 70°F [21.1°C]) is a function of gas pressure and temperature within the tubing.

Ideal gas equation: $PV = nRT$

Where:

P = Pressure

V = Volume

T = Temperature

R = Universal Gas Constant

n = Number of moles in sample transport tubing

“n” is used to calculate the number of moles of gas sample contained in a certain volume of sample transport tubing.

1.7.6 Mole

Mole is a fundamental unit that describes the number of chemical molecules. One mole always represents one Avogadro’s number (6.02x1023) of molecules. The number of moles can be determined by the calculation formula: n=PV/RT.

Because sample and transport tubing volume and temperature are usually constant, the number of sample moles in transit is a function of pressure in sample transport tubing. Reducing gas sample pressure reduces the mass of gas in the sample transport tubing. This is referred to as “line peak”. Once transport volume is known for standard conditions, transport lag time can be determined.

1.7.7 Maintaining Phase

When designing sample transport tubing, the phase of the sample must be maintained. Gases that contain high concentrations of high boiling components can cause problems when they condense on the inside of the transport tubing surface. To prevent condensation from occurring, heat the trace transport tubing using electrical power, steam or hot glycol. This prevents components from condensing on transport tubing walls and prevents any water within the tubing from freezing and blocking the sample flow.

1.7.8 Heat Tracing Sample Lines

If there is a possibility that the vapor sample could condense in the sample transport line, heat tracing the sample line should be considered (see Figure 1-17).

To determine the heat tracing temperature, a dew point calculation can be performed based on the worst case sample composition and transport pressure.

WARNING Heat tracing should conform to the requirements of national and local codes.

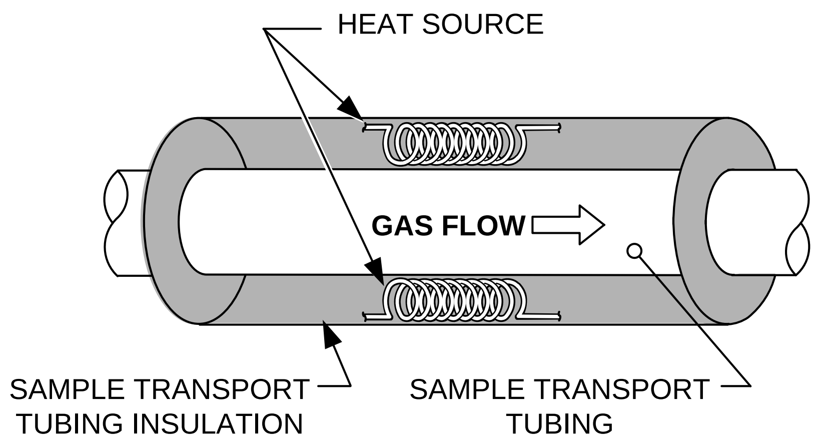


Figure 1-17 Heat Tracing Sample Line

1.7.9 Tube Corrosion

When designing transport tubing, the effect that corrosion has on tubing must be considered. For hydrocarbon service, stainless steel transport tubing, type 316SS is recommended.

For the selection of transport tubing for different types of service, the user should refer to reference information applicable to material applications for corrosive environments.

1.7.10 Tube Preparation

In the course of installing (cutting and fitting) the tubing at an installation, it is important to dress the ends of any cut tubing and to ensure that, in the cutting and deburring process, no particles are allowed to remain in the tubing.

1.8 Calculating Lag Time

The following calculations assume that all pressure drops occur across the valves HV-1, HV-2 and HV-6 and that the Rotameters, RM-1, RM-2 and RM-3, are measuring flow at atmospheric pressure (see Figure 1-18).

FYI Figure 1-18 is for reference purposes only, but it is typical of a sample conditioning module with liquid separator and liquid shutoff.

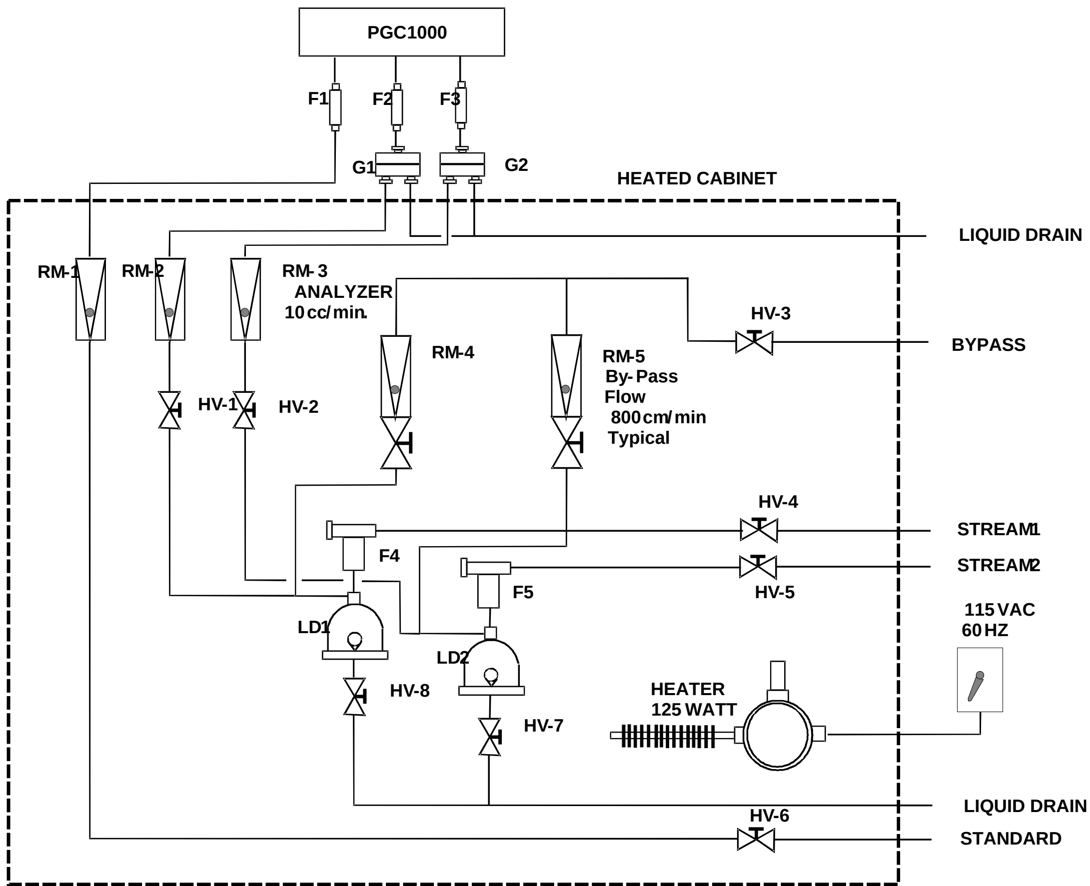


Figure 1-18 Typical Sample Installation Diagram

1.8.1 Calculations

Lag time calculation qualifying factors are as follows:

- The sample for calculation contains mostly methane gas that flows through 100 feet of ¼-inch stainless steel tubing with a wall thickness of 0.020-inch. The sample temperature is 80°F (26.7°C). Pressure is 15 PSIG (29.7 psia). The bypass rotameter in the sample conditioning system reads 50% of full scale and is calibrated with air to 1180 cc/min at full scale. Air density is 0.075 lbs/cu. ft.
- To compute transport tubing lag time, perform the calculation below:

1.8.2 Calculating Using Actual Pressure

Calculating lag time using actual pressure:

$$t = \frac{VL}{F_S}\left[\frac{P+15}{15}\right]\times\left[\frac{530}{T+460}\right]\times\left[\frac{1}{Z_P}\right]$$

Where:

T = Purge Time	L = Line Length, ft.
V = Tubing Volume, cc/ft.	Fs = Standard Flow, cc/min.

P = Actual Pressure, PSIG T = Actual Temperature, 8F

Zp = Compressibility at P Pressure

TIP In this equation, the lowest possible pressure should be used. This minimizes transport tubing lag time to reduce line or molecule peak. Care should be taken to ensure that enough pressure is available. This keeps the sample flowing throughout the analysis system.

1.9 PGC1000 Standard Software Features

ABB Totalflow’s onboard and host software work in concert to provide many key features that enable the user to access, control and share data. The user-friendly interface allows multi-faceted report and communication capabilities without compromising the integrity of the system or data.

- Modular software design with application-based plug-in software modules
- Audit quality historical data
- Operational alarms
- Tri-level software security system
- Multiple calculation options
- Selectable engineering units
- Analysis reporting
- Communication protocol selection
- Web-enabled data collection

1.9.1 Audit Quality Data

ABB Totalflow’s software design creates a historically accurate file system that uses date and time stamped events to create an audit-quality data structure.

The unit can collect, analyze and retain (default) stream data for the last 480 analysis cycles, retain the last 35 days of daily stream averages, retain the last 480 diagnostics reports, retain the last 480 alarms and retain the last 480 events. These functions can be reconfigured by the user.

1.9.2 Security System

Users implementing PCCU version 7.6.0 or higher have access to three types of security:

- Hardware security (bi-level)
- PCCU enforced security (bi-level)
- Role Based Access Control (multi-level)

Both the hardware and PCCU security functions are legacy systems. The hardware security consists of the security switch located on the termination board and is set to either On or Off. The PCCU security system forces the user to log on as either an administrator or a user.

Role Based Access Control (RBAC) is a new feature within PCCU that is designed to allow an administrator to designate roles and control access levels to various applications and processes in Totalflow G4 devices.

Beginning with a set of default roles, it is possible to duplicate, rename and delete these items to create a working list of access roles which are relevant to the user’s company hierarchy. From this role list, it is then possible to create and customize user accounts with various roles. The user is also given the ability to take the newly created configuration and save it in the form of a security file to their PC. This security file can then be sent to a G4 device, where it is then implemented. It is important to note that RBAC can override the hardware security switch.

See the help files in the host software package for more information.

1.9.3 Engineering Units

User selectable engineering units may be defined individually, per measurement stream. These include most metric system units as well as standard US units. Access to this capability requires turning on the Unit Conversion application and may be applied to data reporting and visual readings on the VGA screen. For additional information, please see the host software help files.

1.9.4 Supported Protocols

The PGC1000 hardware and software support several communication protocols:

- ABB Totalflow Local
- ABB Totalflow Remote
- LevelMaster
- Modbus® Slave (ASCII)
- Modbus® Slave (RTU)
- Modbus® Host (ASCII)
- Modbus® Host (RTU)
- ABB Totalflow TCP (Ethernet Connector)
- Modbus® TCP Server
- Modbus® TCP Client

Supported protocols operate at 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200 baud rates.

ABB Totalflow offers the software package TDS (Totalflow Data Server) to support OPC applications.

1.10 PCCU Local Communication Options

Local communication with the PGC1000 requires the use of PCCU32 software running on a PC and a man machine interface (MMI) cable. ABB Totalflow recommends using a USB cable for high speed local communication in remote locations. RS-232 serial communication with the PGC1000 can also be a high speed application for users operating a PC with the Windows® XP operating system or newer.

When operating the PGC1000 in a network environment, using Ethernet is an excellent and practical solution.

For example, Table 1–6 compares communication times between the different available options for several common operational tasks.

Table 1–6 Communication Option Comparison

	Operational Task[4]		
Communication	**Data Collection Single Stream**	**Save Files**	**Restore Files**
Serial: 38,400 Baud	10 Seconds	2.5 Minutes	2.5 Minutes
Serial: 115,200 Baud[5]	4 Seconds	1.1 Minutes	1.1 Minutes
USB	3 Seconds	1.5 Minutes	1.5 Minutes
Ethernet	3 Seconds	1.5 Minutes	1.5 Minutes

1.11 PGC1000 Start-Up Diagnostics

The ABB Totalflow PGC1000 has an extensive, built-in list of tests which are performed each time the unit is started. This startup. testing may be disabled, but it is recommended that it be left enabled. These diagnostics consist of four areas of testing:

- Carrier Pressure Regulator Test
- Oven Temperature Test
- Processor Control Test
- Stream Test

These startup tests may also be performed on a regular schedule. Please see the PCCU help files for more information on scheduling diagnostics.

1.11.1 Carrier Pressure Regulator Tests

This test compares the actual column pressure to the column pressure set point using carrier gas. A failure of this test indicates that the carrier pressure is not meeting or over exceeding the expected level of pressure.

1.11.2 Oven Temperature Test

This test compares the actual oven temperature to the oven temperature set point. A failure of this test indicates that the oven is not maintaining the required temperature.

1.11.3 Processor Control Test

This test contains three test areas: column 1 carrier pressure, column 2 carrier pressure and oven temperature. In each area, the test measures the effort required to maintain the required value. From those measurements, the test develops a standard deviation and makes a series of comparisons. The failure of any of these comparisons indicates that an erratic deviation exists. This means that the processor is not able to control the function.

1.11.4 Stream Test

This test measures various pressures for each available stream. Failure of a stream indicates an inability to meet certain criteria.

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4 Operational task speed directly correlates to PC processor speed.

5 Personal computer operating on Windows XP operating system or newer.

During the initial startup, all streams will be disabled. During the stream test, streams with input pressure will be re-enabled, tested and either passed or failed. Streams with no initial input pressure will fail.

1.12 Historical Data

The PGC1000 compiles historical data that can be used for custody transfer needs, verifies PGC1000 operation over time and provides a limited data backup for communication link reliability. Data retained by the PGC1000 can be collected via a remote communication link or by a laptop PC operator interface.

1.12.1 Retaining Data

The user can configure how much data is retained by the PGC1000 via the operator interface. The default configuration is as follows:

1.12.2 Analysis Cycles

The last 480 Analysis Cycles (default):

- Normalized components
- Un-normalized components
- Ideal Btu/CV
- Real Btu/CV (wet (inferior CV)and dry (superior CV))
- Relative density (specific gravity)
- Density
- GPM
- Wobbe index [dry Btu (superior CV)]
- Alarms

1.12.3 Stream Averages

- Last 840 hour averages
- Last 35 daily averages
- Last monthly average

1.12.4 Diagnostic Reports

The last 480 analysis cycles:

- Selected peak times
- Selected peak areas
- Ideal Btu/CV
- Carrier regulator pressure
- Oven temperature
- Enclosure temperature
- Sample pressure
- Detector noise values
- Detector balance values

1.12.5 Audit Logs

- Last 100 alarms
- Last 100 events

1.13 TCR Sample Probe (Optional Equipment)

The temperature compensated regulator (TCR) sample probe is used to capture the process sample for PGC1000 analysis. To capture the sample, it is recommended that the TCR sample probe be mounted horizontally. It can be mounted vertically if this is more suitable to the user's installation.

The TCR sample probe is specifically selected for operation with the PGC1000. The design of the probe prevents icing without the need for electrical power.

TIP It is the customer's responsibility to install and weld a ¾-inch, female, NPT-standard pipeline coupling on the main meter run gas flow pipe. This coupling allows installation of the TCR sample probe.

The user can refer to Table 1–7 to ensure that they have the correct sample probe for their installation. The length of the sample probe is dependent on the diameter of the user's process line.

ABB Totalflow recommends that a TCR be installed with the PGC1000. Refer to Figure 1-19.

Table 1–7 Optional Temperature Compensated Regulator (TCR)

Length (inches)	Description
4	Temperature Compensated Sample Probe/Regulator/Relief Valve
8	Temperature Compensated Sample Probe/Regulator/Relief Valve

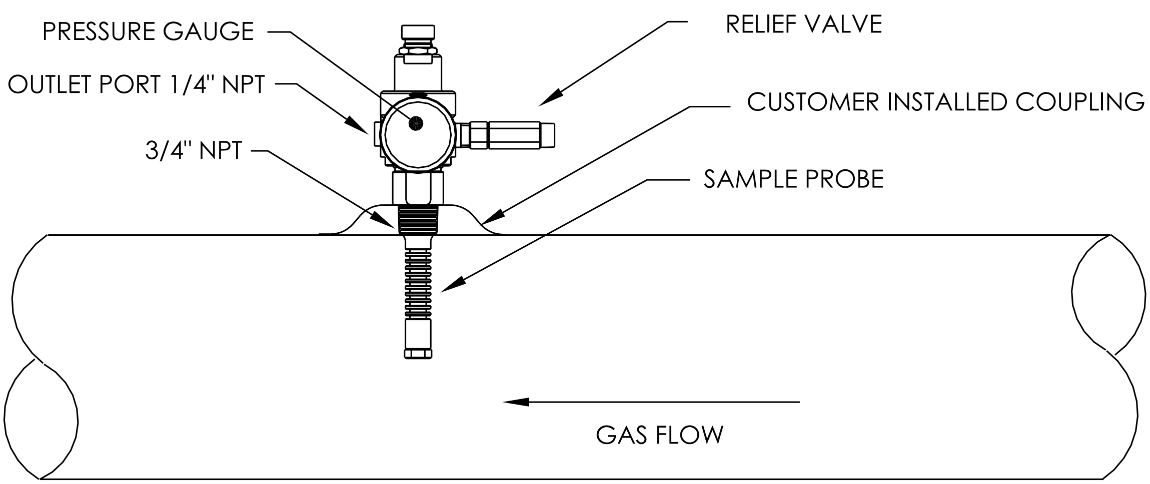


Figure 1-19 Temperature Compensated Regulator with Sample Probe

1.13.1 Location

- Locate the coupling in close proximity to the PGC1000. This allows the stainless steel sample line, from sample probe to chromatograph, to be as short as possible.
- The coupling should be mounted so that the probe can be installed horizontally or vertically.
- The sample probe should not be mounted at the end of headers, dead "Ts", large volume accumulators or other areas where gas is likely to be stagnant.

- Installation should allow the probe to penetrate the center 1/3 of the stream being processed. This allows sufficient heat transfer with the flowing sample. The sample probe inlet should be high enough to avoid the sampling of any liquids at bottom of the line.
- The sample probe must be installed where the probe has access to the fastest flow of sample gas within the line.
- The sample probe should be mounted a minimum of five line diameters from any device which could cause aerosols or significant pressure drops.

1.13.1.1 Other Considerations

TCR sample probe line pressure should be as close to 1-atmosphere as possible to reduce sample transport lag times due to "line pack". Sample pressure at the PGC1000 should be 15 ± 2 PSIG (103 ± 14 Kpa).

To maintain this pressure at the PGC1000 filters, it may be necessary to increase TCR sample probe pressure to a value greater than 15 PSIG. Pressure is dependent on the sample transport tubing length between the TCR sample probe and the analyzer.

Be sure to use tubing electrical isolators on the sample tubing when connected to the pipe or lines that are not isolated from cathodic protection.

1.14 ENC82 Environmental Enclosure (Optional Equipment)

In colder climates (ambient temperatures 0°F to -40°F), the environmental enclosure (ENC82) allows mounting of the PGC1000 directly on the pipe. This insulated, weatherproof enclosure has brackets for the PGC1000 and a small start up/calibration bottle. Having the calibration bottle in the heated enclosure ensures a much more stable and consistent calibration.

1.14.1 Standard Features

- Available with either an electric or catalytic heater option:
  - The catalytic heater is a 1500 Btu/hour input. This includes a standard filter/drain kit.
  - The electric heater option features 120 Vac/400W heater and thermostat.
- Sample conditioning system
- Heated line entry
- Rigid conduit
- Mounts either as a free-standing unit or pipe-mounted unit:
  - Large enclosure may be pipe mounted on 4" through 12" pipe.
  - Small enclosure may be pipe mounted on 2" through 5" pipe.

1.14.1.1 Enclosure

The heater and enclosure are designed to maintain a 40°F inside temperature when outside temperature is -40°F. Two enclosures are available for installation depending upon site requirements. The large enclosure (ENC82L) will hold a single or dual unit PGC1000 and features a large foot print (38"w x 31"d x30.5"h) (see Figure 1-20 and Figure 1-21). The small enclosure (ENC82S) is designed for a single PGC1000 unit and features a smaller foot print (24"w x 19"d x 21"h) (see Figure 1-22 and Figure 1-23).

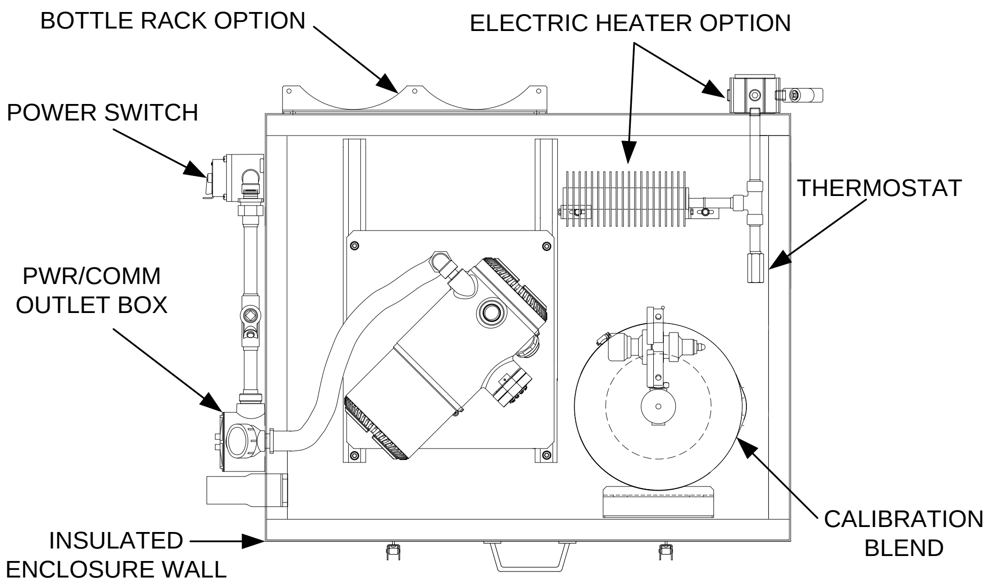


Figure 1-20 ENC82L Environmental Enclosure with Electric Heater

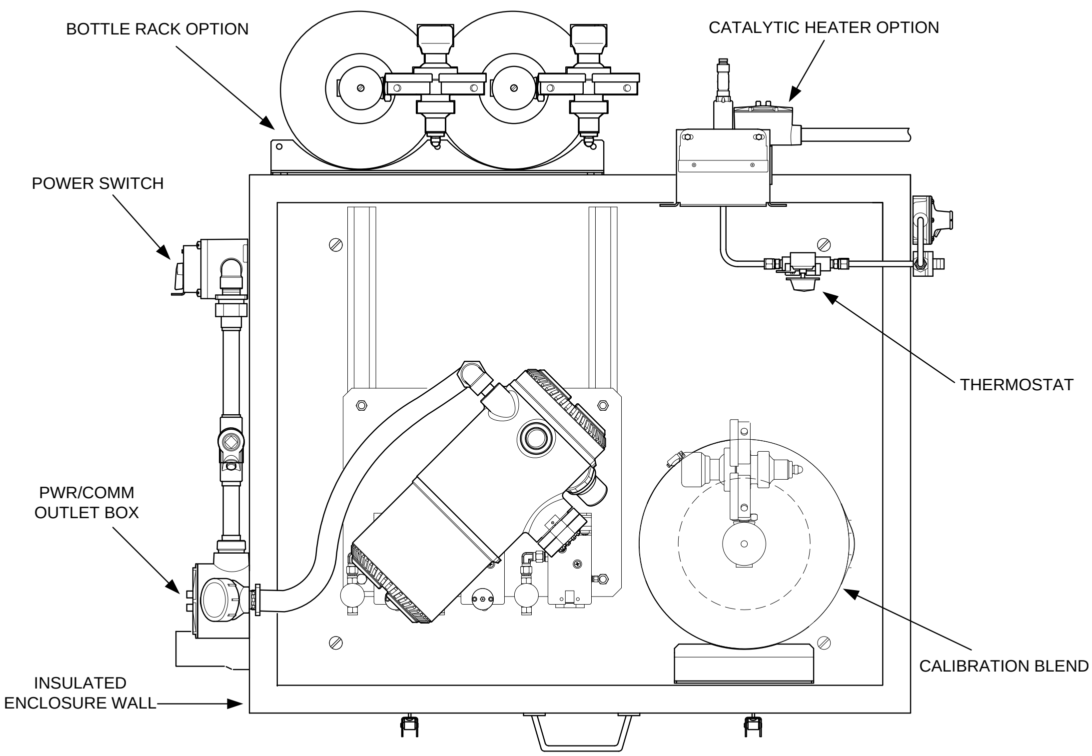


Figure 1-21 ENC82L Environmental Enclosure with Catalytic Heater

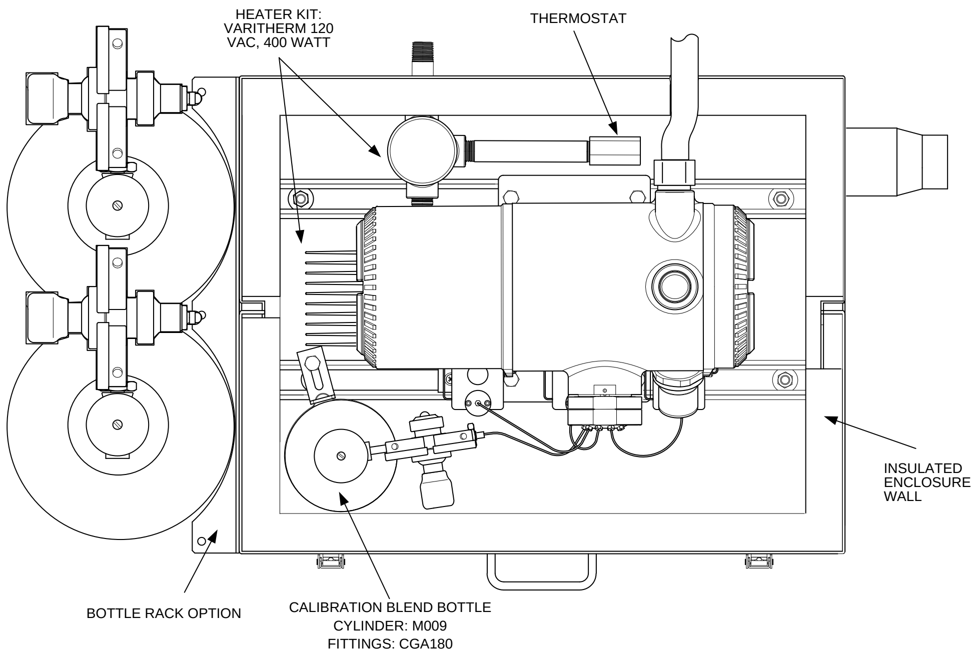


Figure 1-22 ENC82S Environmental Enclosure with Electric Heater

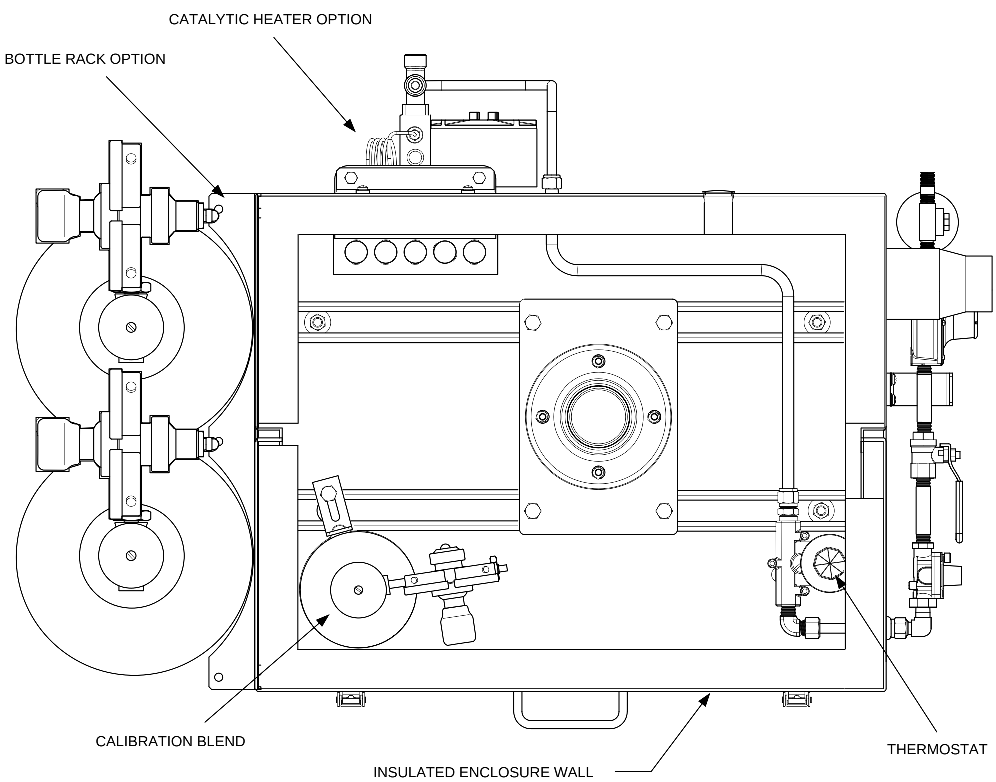


Figure 1-23 ENC82S Environmental Enclosure with Catalytic Heater

1.14.1.2 Mounting Options

The ENC82 may be mounted directly on the pipe run, with or without the sample probe enclosed. Optional support leg(s) are available for added support when mounted on the pipe run.

Optionally, a free-standing kit may be used to mount the enclosure next to the process line.

1.14.2 Optional Features

The following is a list of optional features:

- Calibration blend
- DC power switch (large enclosure only)
- Dual bottle rack

1.15 Sample Conditioning Modules (Optional Equipment)

For some PGC1000 installations, it may be necessary to install an optional sample system conditioning module to compensate for non-ideal process gas samples. These optional modules are pre-engineered to provide various levels of protection and bypass flows (see Figure 1-24). All of the sample conditioning modules include a level of particulate protection and come in two flow sizes: 50 CC and 450 CC per minute (see Table 1–8).

For installations where the gas is ideal and the sample probe is located less that 10’ from the PGC1000, no sample conditioning module is required.

1.15.1 Gas Types

The user can select from one of four sample conditioning modules for installations where the gas samples do not meet the ideal clean and dry conditions (see Figure 1-24). The following definitions describe what is meant by the condition of gas to be sampled:

- Clean gas is defined as having no particles larger than one micron and no more than one milligram of solids per cubic meter of gas.
- Dry gas is defined as having no more than seven pounds of water per million cubic feet of gas. Gas has less than 0.1 PPM of liquid at the coldest ambient condition expected at the coldest point in the system. The liquid can be water, oil, synthetic lubrication, glycol, condensed sample or any other non-vapor contaminate.
- Stable gas is a vapor containing less than 0.1 PPM of liquid when vapor is cooled to 18.3°F (10°C) below the coldest ambient temperature possible at any point in the system.

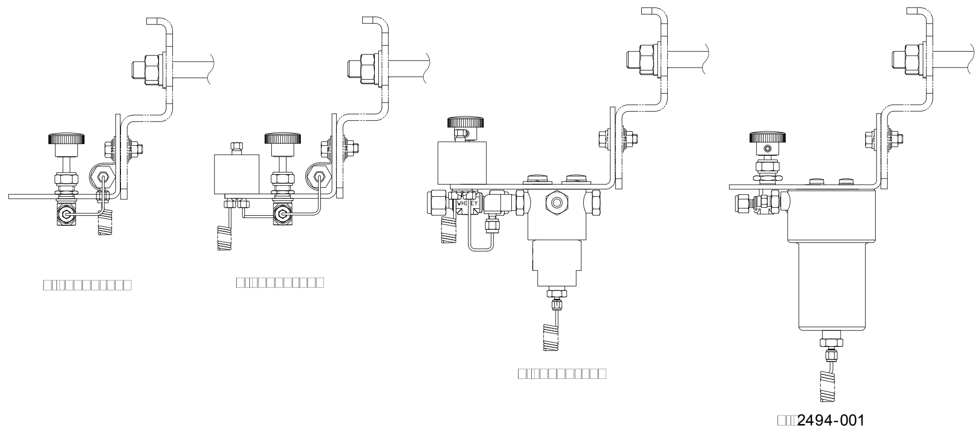


Figure 1-24 Available Sample Conditioning Modules

Table 1–8 Sample Conditioning Module Descriptions

Part Number	Description
2102023-001	Designed for clean, dry, stable gas with minor amounts of particulate contamination where the sample point is more than 10’ (3m) and less than 50’ (15m) from the PGC1000. The user must guarantee that upset conditions, compressor failure or other problems do not occur. It is also suitable where a high quality sampling system already exists. PGC1000 bypass flow is expected to be 10 cc/min. System features: • Two (2) micron filters
2102023-002	Designed for clean, stable gas sample point distances greater than 10’ (3m) and less than 50’ (15m) and containing minor amounts of liquids such as glycol, compressor oil or water. This system also handles minor amounts of particulate contamination. System features: • Two (2) micron filters • Liquid/Vapor separator
2102024-001	Designed for sample point distances greater than 10’ (3m) and less than 150’ (50m) with known particulate and liquid contamination. Designed for stable gas samples containing pipe scale and other solid contaminates and possibly minor amounts of liquid contamination. System features: • Particulate/Coalescing filter • Liquid/Vapor separator
2102494-001	Designed for sample point distance greater than 50’ (15m) and less than 150’ (50m). The sample gas is known to contain particulate and liquid contamination with a good probability of line flooding in upset conditions, enough at times to overflow the coalesce (A+ Avenger) filter. Also has a Genie® membrane for liquid rejection and a Genie® liquid shut-off to be used when liquid carry over would harm the chromatograph if it was introduced as a sample. This model contains a liquid shut-off to protect the GC. The liquid shut- off resets itself when liquids are no longer present. • Particulate/Coalescing filter • Liquid/Vapor separator

1.15.2 Mounting Brackets

Two sample conditioning system mounting brackets are available: a single stream bracket or a multiple stream bracket (see Figure 1-25) for up to three modules.

See Figure 1-26 and Figure 1-27 for installed dimensions.

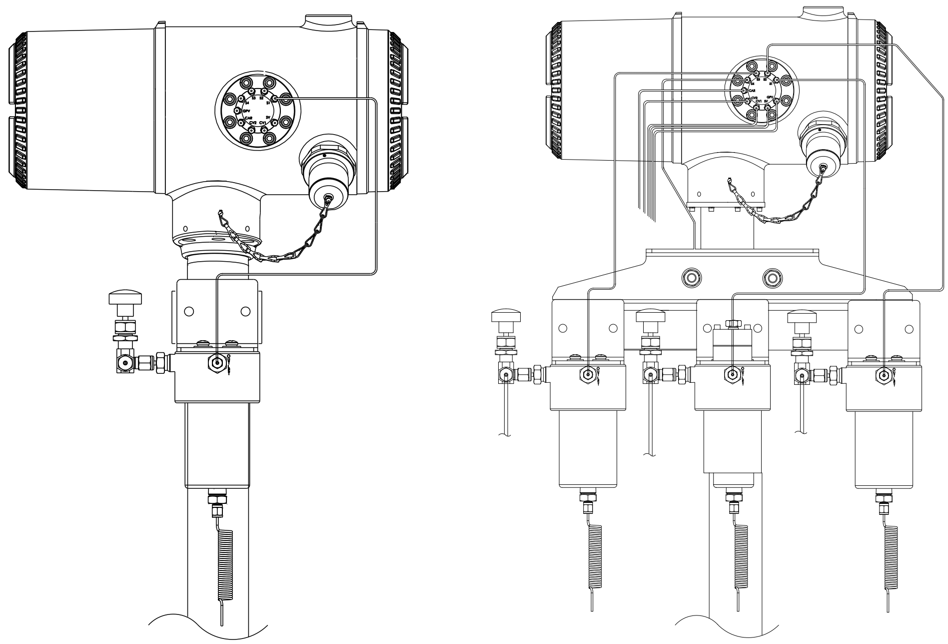


Figure 1-25 Single and Multiple Stream Sample Conditioning Assemblies

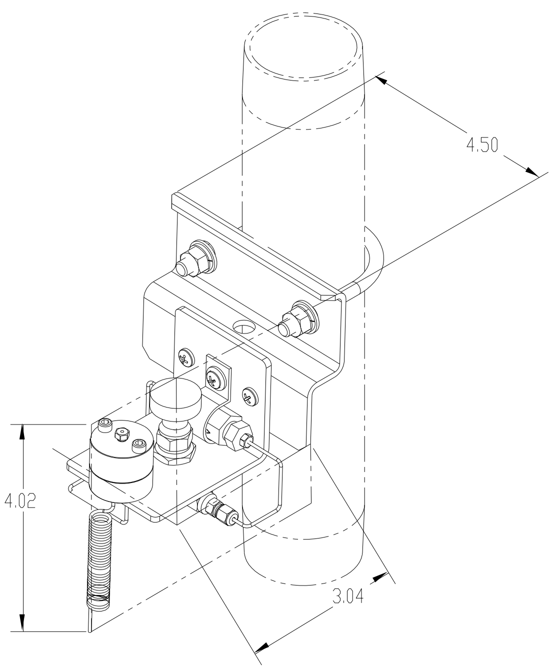


Figure 1-26 Single Stream Conditioning Module Dimensions

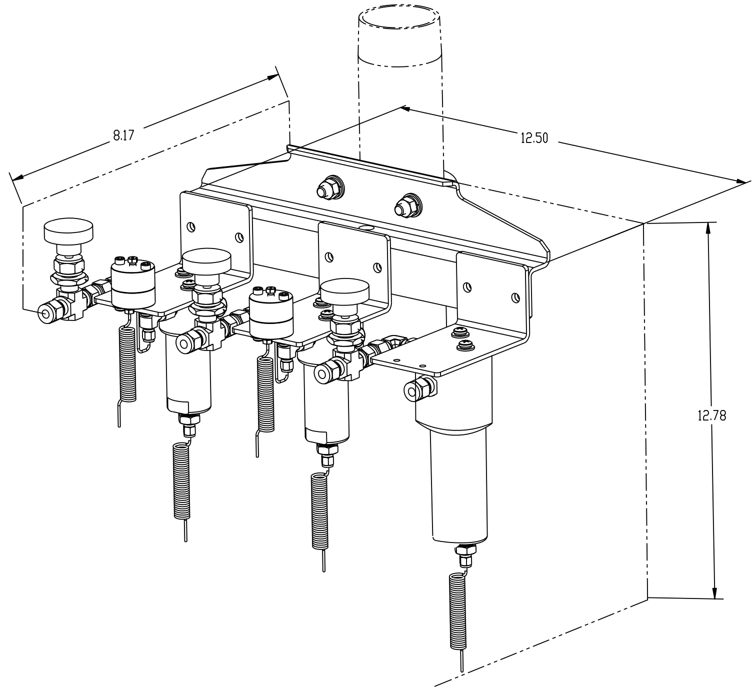


Figure 1-27 Multiple Stream Conditioning Module Dimensions

1.16 Security Seal (Optional Equipment)

For some PGC1000 installations, it may be preferred to attach a security seal on the enclosure's front and rear end caps. To accommodate the seal, please note the holes located in the tab that are on each end cap (See Figure 1-28).

1.16.1 Customer Supplied Materials

- One (1) each security wire seal
- Seal press

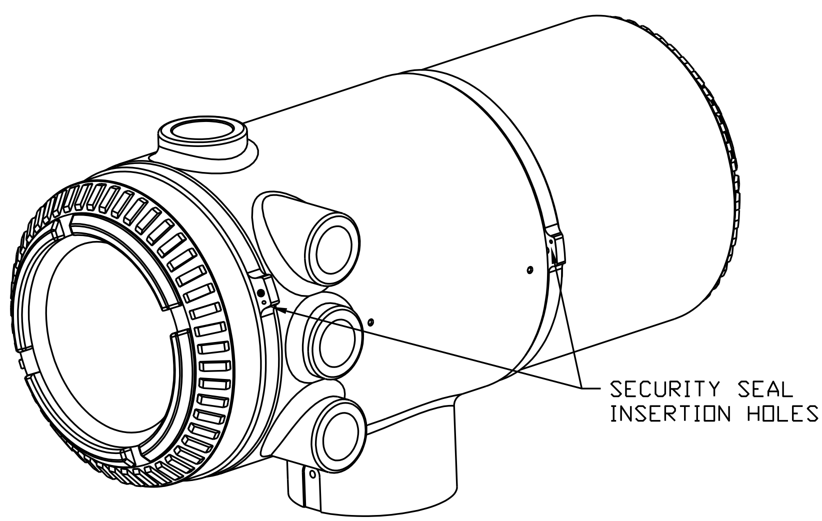


Figure 1-28 PGC1000 End Cap Tabs for Security Seal

1.16.2 Instructions

1) Insert the security wire through the holes located on the end cap tabs.
2) Bring the ends together. Upon completion, insert through the holes in the security seal (see Figure 1-29).
3) Use the seal press to compress the seal into the wire. Ensure that the wire is firmly captured inside the seal.

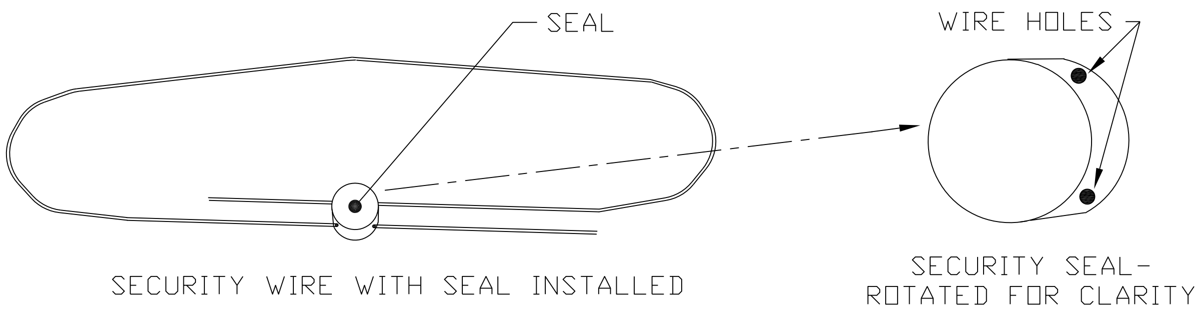


Figure 1-29 Security Wire with Seal

1.17 Optional Equipment Enclosure (Optional Equipment)

If the optional equipment enclosure is used, it may be configured to include other options. These options include, but are not limited to, a battery pack to provide power to the PGC1000, communication equipment, solar power charger and additional I/O.

Three enclosures are commonly used for PGC1000 installations: the 6200, 6700 and 6800 optional equipment enclosure.

The 6200 enclosure supports AC to DC. There is no battery backed option in this installation.

The 6700 enclosure supports AC to DC. There is no battery backed option in this installation.

The 6800 enclosure supports battery backed[6] operation for the PGC1000 via solar power or a UPS system, AC to DC power or communication equipment.

Following local codes for installation, these units would normally be located in a Division 2 or general purpose area. The units may be mounted on a 2” pipe or mounted on a flat surface such as a wall.

1.17.1 6200 Optional Equipment Enclosure

The 6200 can accommodate the following equipment:

- 110/240 Volt to 12 Vdc
- 110/240 Volt to 24 Vdc

1.17.2 6700 Optional Equipment Enclosure

The 6700 enclosure can accommodate the following:

- 120/240 Vac 12 Vdc power supply

---

[6] Autonomy measured in hours.

- 110/240 Volt to 12 Vdc
- 110/240 Volt to 24 Vdc
- Communications kit

1.17.3 6800 Optional Equipment Enclosure

The 6800 enclosure can accommodate the following:

- Communication kit
- Solar panel power option
  - Two (2) each - 110 AH batteries
- 115/230 Vac UPS power option (24 Vdc systems only)
  - Two (2) each - 40–110 AH batteries

1.18 Power Supply Options (Optional Equipment)

Power supply options available for the PGC1000 are as follows:

- 110/240 Vac to 12/24 Vdc
- 115/230 Vac to 12/24 Vdc (explosion-proof)
- 24 Vdc to 12 Vdc converter
- 12/24 Vdc solar panel power pack
- 115/230 Vac with UPS to 24 Vdc

1.18.1 12/24 Vdc Solar Panel Power Pack

The solar panel power pack employs a solar controller to maintain voltage on two 110 AH batteries:

- 14-day autonomy with standard 110 AH batteries without optional heater
- Five (5) day autonomy with standard 110 AH batteries with optional heater

Space is provided for communication equipment. Additionally, fusing for auxiliary equipment is also provided. Auxiliary fusing supports a maximum of two 1 Amp loads. The system disconnects batteries when the voltage drops below the minimum recharge level.

Minimum configuration consists of dual 50W solar panels. The system is designed to accommodate dual 110W solar panels as a maximum.

CAUTION Auxiliary fusing is not available when using the optional heater.

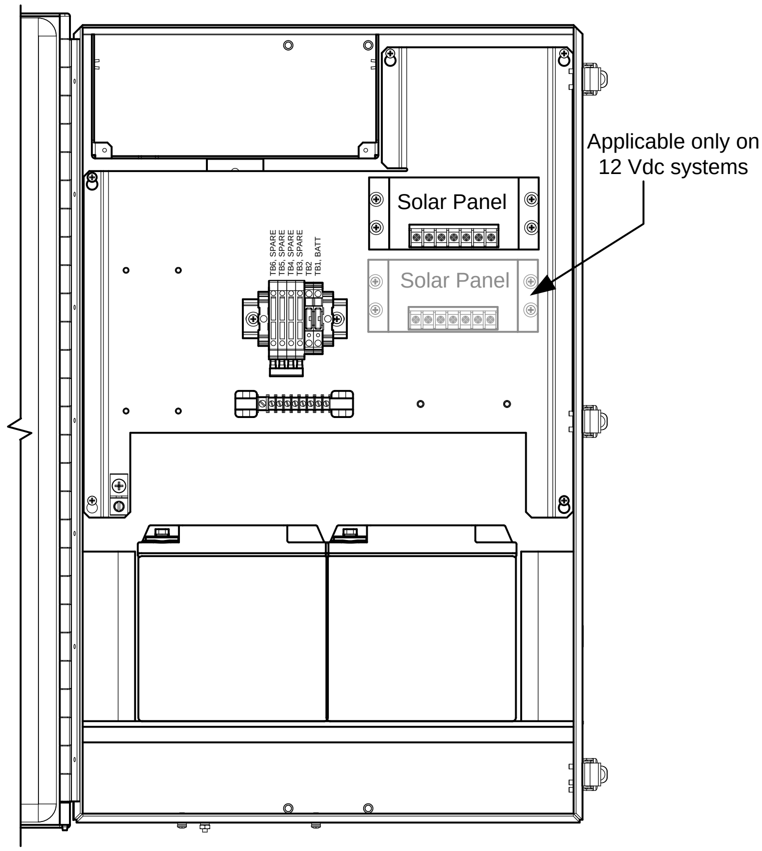


Figure 1-30 6800 Enclosure with 12/24 Vdc Solar Panel Power Pack Option

1.18.2 115/230 Vac UPS Power Option (24 Vdc Systems Only)

This option assumes the site availability of 115/230 Vac power. A Uninterruptable Power Supply (UPS) and two 50 AH batteries provide backup power for short power interruptions. 100 AH batteries are available for longer autonomy:

- Three (3) day autonomy with standard 50 AH batteries and no optional heater
- 36 hour autonomy with standard 50 AH batteries and optional heater

Space is provided for communication equipment. Additionally, fusing for auxiliary equipment is also provided. Auxiliary fusing supports a maximum of three 1 amp loads. The system disconnects batteries when the voltage drops below the minimum recharge level.

FYI Auxiliary fusing is disabled when using UPS power.

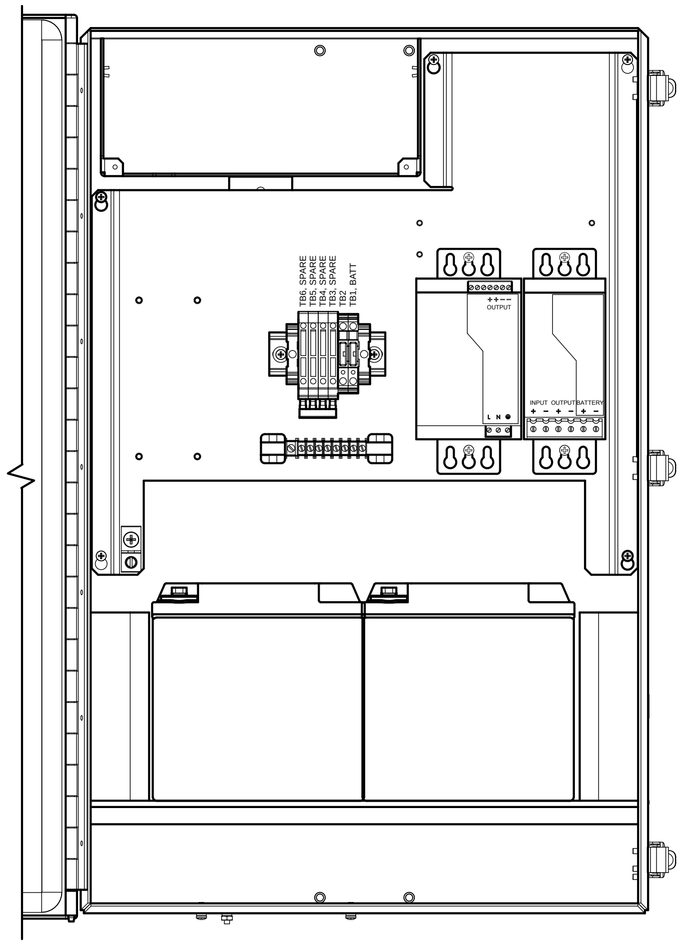


Figure 1-31 6800 Enclosure with 115/230 Vac UPS Power Option

1.18.3 Explosion-Proof Power Supply (Optional Equipment)

For installations requiring an explosion-proof power supply, ABB Totalflow provides two power supplies (115 Vac and 230 Vac to 12/24 Vdc) that meet these requirements and are housed in explosion-proof enclosures.

1.18.3.1 Enclosure

The custom-designed, explosion-proof enclosure consists of a square shaped, cast aluminum housing, powder coated, with a top, explosion-proof threaded cap for access to internal components (see Figure 1-32).

The top cap has precision engineered threading and is susceptible to damage if treated roughly. The top cap is water-tight, corrosion-resistant and NEMA 4X-rated. Unauthorized removal of the cap is protected with a hex socket set screw-on cap.

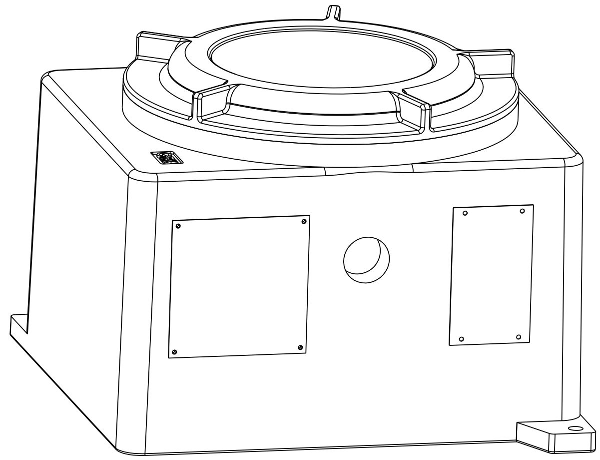


Figure 1-32 Explosion Proof AC Power Supply

2.0 INSTALLATION

2.1 Overview

This chapter provides information for the field installation of the PGC1000 and optional equipment. After completing the procedures within this chapter, the PGC1000 is ready for start-up.

The PGC1000 is designed to be pipe mounted (see Figure 2-1). Optionally, a shelf mounting kit (see Figure 2-2) may be purchased for use in mounting the unit on a wall, inside or outside of a building or on a mounting plate for use in the optional environmental enclosure.

WARNING The installation instructions in this chapter are to be performed only when the area is known to be non-hazardous.

FYI It is highly recommended that the user thoroughly read this chapter to establish an installation plan. Also, before beginning, refer to the wiring diagrams delivered with the new PGC1000.

2.1.1 What this Means

CWE Installation instructions that feature this icon are applicable ONLY when the installation involves an environmental enclosure (ENC82). All other instructions may or may not be applicable.

2.1.2 Organization

The following instruction sections are organized in the suggested installation order. Not all installation instructions will apply to the user’s situation. For example, some procedures may vary when the installation does not require certain equipment.

FYI Please note that, where applicable, “typical” instructions are first and variations or “specialized” instructions follow.

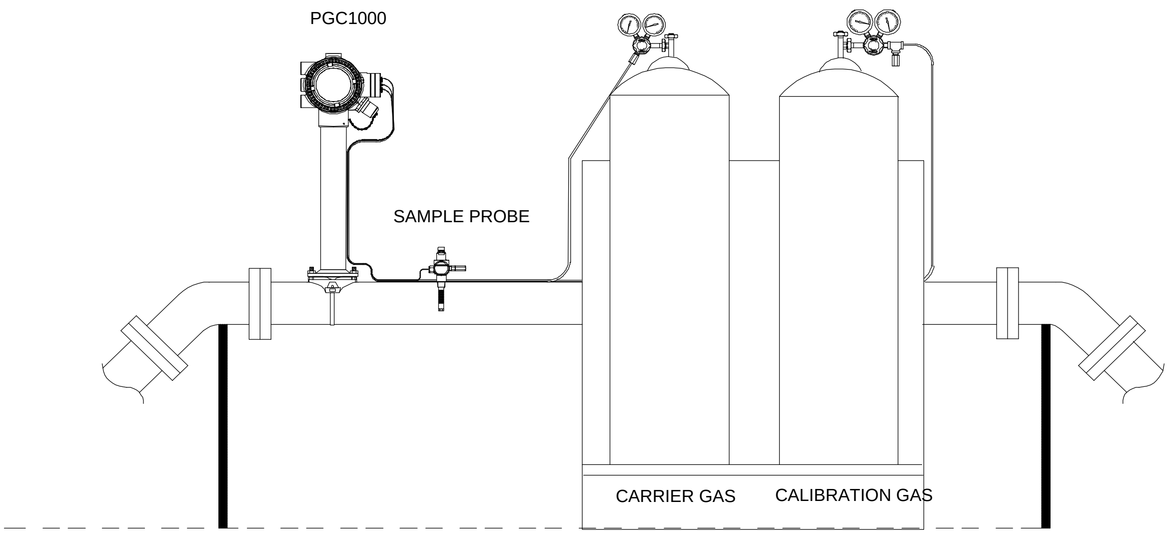


Figure 2-1 Basic Meter Run Installation

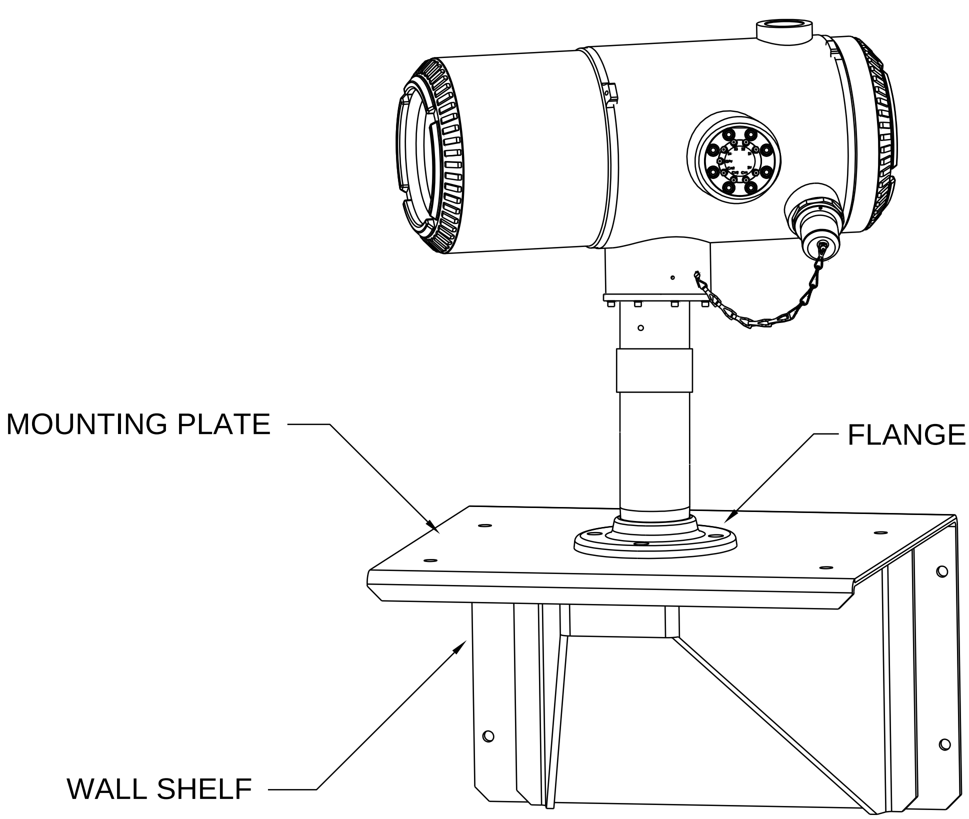


Figure 2-2 Typical Wall Shelf Mount Installation

2.1.3 Locating Area for Installation

The PGC1000 is designed for mounting on large process lines, 2-inch to 12-inch pipe sizes. Each type of installation is described within this chapter.

Be certain the installation site is clean and free of foreign debris that could affect PGC1000 operation.

The PGC1000 should be located as close as possible to the sample probe installation point. This prevents the need for high gas flow rates through the sample lines to ensure the analysis accuracy of the current sample.

If there is more than one stream being analyzed, locate the PGC1000 in a central location to all sample points.

2.1.4 Installation

The following information (see Table 2–1) is designed to enable the user to determine the procedures to follow depending upon the type of installation: pipe-mount, free-standing, wall shelf or one of the two environmental enclosures (ENC82L/ENC82S) for inclement climates. While a set of instructions may be indicated for the user's particular installation, it may not be required specifically.

The PGC1000 is certified for installation in classified hazardous locations. The heater and fittings in the environmental enclosure may not have the same ratings. All components of the installation, including accessories and fittings, must be approved for the classification rating of the area of installation.

Table 2–1 Installation Matrix

Pipe -Mount	Free-Standing	Wall Shelf	ENC82L	ENC82S	Installation Instructions	Section
•	•	•	•	•	Sample Probe Installation	2.3
	•				Stand-Alone Installation	2.4
			•		Large Free-Standing Environmental Enclosure	2.5
				•	Small Free-Standing Environmental Enclosure	2.6
			•		Large Pipe-Mounted Environmental Enclosure Mounting Kit	2.7
			•		Optional Support Leg Kit	2.8
				•	Small Pipe-Mounted Environmental Enclosure Mounting Kit	2.9
•					Pipe Saddle Installation	2.10
		•			Shelf Installation	2.11
•	•	•	•	•	PGC1000 Installation	2.12
•	•	•	•	•	Sample Conditioning Module Installation	2.13
•	•	•	•	•	Sample Line Connections	2.14
			•	•	Sample Line(s) to PGC1000 Inside of ENC82	2.15

Pipe -Mount	Free-Standing	Wall Shelf	ENC82L	ENC82S	Installation Instructions	Section
			•		ENC82L Optional Pwr/Comm Outlet Box Assembly	2.16
•	•	•			Carrier/Calibration Bottle Rack Installation on Meter Run	2.17
			•	•	ENC82 Carrier Gas Bottle Rack Installation	2.18
•	•	•	•	•	Carrier Gas Regulator Installation	2.19
			•		ENC82L Calibration Gas Bottle Installation	2.20
				•	ENC82S Calibration Gas Bottle Installation	2.21
•	•	•	•	•	Calibration Gas Regulator Installation	2.22
•	•	•	•	•	Carrier Gas and Calibration Gas Connections	2.23
•	•	•	•	•	Vent Lines Connections	2.24
			•		ENC82L Optional Catalytic Heater Installation	2.25
				•	ENC82S Optional Catalytic Heater Installation	2.26
			•	•	ENC82 Optional Electric Heater Installation	2.27
			•	•	Sealing Environmental Enclosure	2.28
•	•	•	•	•	Optional Equipment Enclosure Installation	2.29
•	•	•	•	•	115/230 Vac UPS Power Supply (24 Vdc Systems)	2.30
•	•	•	•	•	115/230 Vac to 12 Vdc Explosion-Proof Power Supply	2.31
•	•	•	•	•	110/240 Vac to 12/24 Vdc Power Supply	2.32
•	•	•	•	•	24 Vdc to 12 Vdc Power Converter	2.33
•	•	•	•	•	Battery Pack Installation	2.34
•	•	•	•	•	Solar Panel Installation	2.35
•	•	•	•	•	Solar Power Pack	2.36
•	•	•	•	•	DC Power Installation	2.37
•	•	•	•	•	Remote Communication Installation	2.38

2.2 Unpacking and Inspection

2.2.1 Shipping Carton

Ensure that there is no external damage to the shipping container. If there is significant, visible external damage, contact the receiving group, and report the damage to the trucking company for a freight damage claim.

2.2.2 Unpacking

The PGC1000 is shipped in a specially designed shipping carton which contains the unit, mounting brackets, parts list and wiring and interconnect diagrams. Optional equipment is shipped in a separate carton.

Carefully remove all internal and external packing material, and remove all items from the box.

2.2.3 Bill of Lading

After removing the protective shipping cover from the PGC1000, compare the shipped contents with those listed on the bill of lading. All items should match those on the bill of lading.

2.2.4 Inspection

Examine the internal PGC1000 components for evidence of damage.

Points of inspection are:

- Visually inspect the exterior of the unit for dents, chipped paint, scratches, damaged threads, broken glass plate, etc.
- Physically inspect the rear interior-mounted circuit boards, cables and front-interior mounted circuit boards for loose cables, boards, display, mounting screws, etc.
- If applicable, inspect the calibration/carrier gas bottles to ascertain they are correct for the installation.

2.2.5 Damaged Components

If there is any damage or noticeable defects, notify the local ABB Totalflow representative. Keep all shipping materials as evidence of damage for the carrier's inspection. ABB Totalflow will arrange for immediate repair or replacement.

Telephone:

USA: 1-800-HELP-365 or 1-800-435-7365

2.3 Sample Probe Installation

If a sample probe has previously been installed, the user may skip these instructions.

TIP Sample probe pipe coupling should be located on the top of the process line but may be mounted vertically or horizontally.

2.3.1 Materials

- ¾" NPT pipe coupling (previously installed)
- Sample probe (configuration to be determined by the technician and is based on installation and local codes)
- Teflon® tape
- Or customer-supplied pipe dope (suitable for chromatography)

2.3.2 Instructions

1) Shut down the process line, and isolate it from the gas source. Be sure to use proper lockout and tagging procedures.

2) Bleed off gas from the process line.

3) Ensure the installed mounting coupling is free of dirt and debris.

4) Ensure the sample probe threads are free of dirt and debris.

5) Using Teflon® tape or pipe dope, wrap or cover the NPT threads of the sample probe (see Figure 2-3).

6) Insert the gas probe into the process line coupling (see Figure 2-4).

7) Using the correct tool, tighten the probe. Securely tighten so there is no gas leakage. DO NOT OVER TIGHTEN.

8) Install the shut-off valve on the secondary side of the sample probe, if preferred.

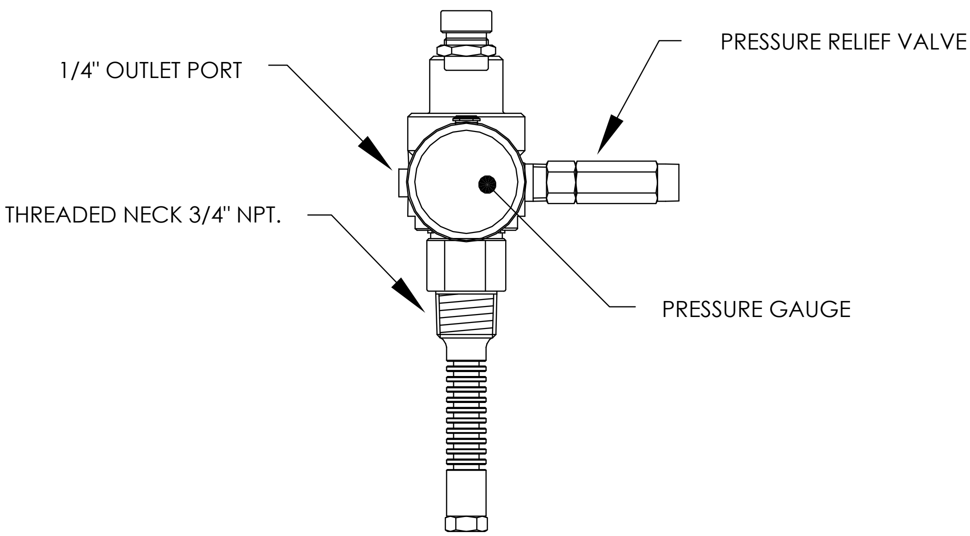


Figure 2-3 Sample Probe

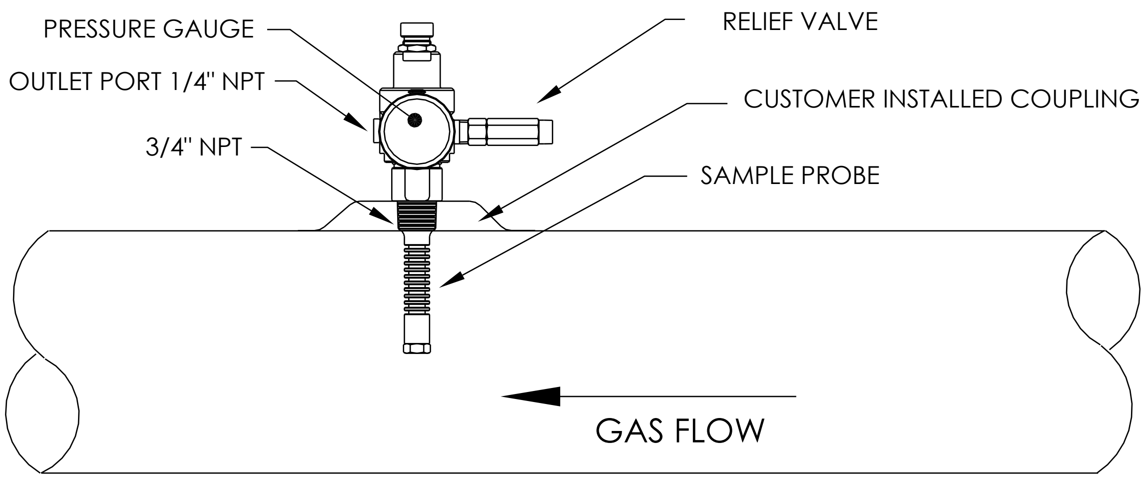


Figure 2-4 Sample Probe Insertion

2.4 Stand-Alone Installation

If the user is installing a PGC1000 using a free-standing pipe, use this procedure to install the pipe. Before beginning, review the procedure and the materials required for installation.

2.4.1 Materials Not Supplied

- One (1) 2" pipe with flange
- One (1) 2" pipe coupling

or

- One (1) 2" mounting pipe (installed). Length dependent upon the final overall preferred height of the PGC1000.

FYI Optional equipment may be ordered from ABB Totalflow.

2.4.2 Instructions

1) Select a location to install the mounting pipe that allows for easy user access and is close to the sample probe. Lines should be as short as possible.

2) Install the mounting pipe. Be careful to ensure the pipe is vertically aligned.

3) Screw the 2" pipe coupling onto the top of the mounting pipe.

4) Screw the optional mounting flange pipe into the top of the pipe coupling.

FYI Continue to the PGC1000 Installation instructions.

The method of installation must be consistent with the user's company policy.

2.5 Large Free-Standing Environmental Enclosure Installation

If the installation includes a free-standing environmental enclosure, follow these instructions; otherwise, move to the next section.

The following steps will typically require two people.

2.5.1 Materials

- Four (4) each - ½-13 x 1 ¼ SST bolt
- Four (4) each - ½ SST flat washer
- Four (4) each - ½” SST split washer
- One (1) each - Stand

2.5.2 Instructions

1) The stand is made symmetrical so that the top and bottom are identical. Situate the stand base on a flat, stable surface.

2) Set the enclosure on top of the stand. Orientate so that the stand brace is horizontal with the front of the enclosure (see Figure 2-5).

3) Place a split washer and then a flat washer on one of the 1 ¼” bolts. Insert through the bolt hole located in the angle iron and then into the outermost corner of the enclosure (see Figure 2-6).

4) Move the channel nut into position so that the bolt will screw into the nut. Screw the bolt into the nut. Do not tighten.

5) Repeat for all other corners.

6) Position the enclosure on the stand, centering the stand underneath; otherwise, offset, as preferred. Upon completion, tighten all bolts.

7) Foot plate mounting holes are pre-drilled for mounting to a pad. The hardware is to be supplied by the user.

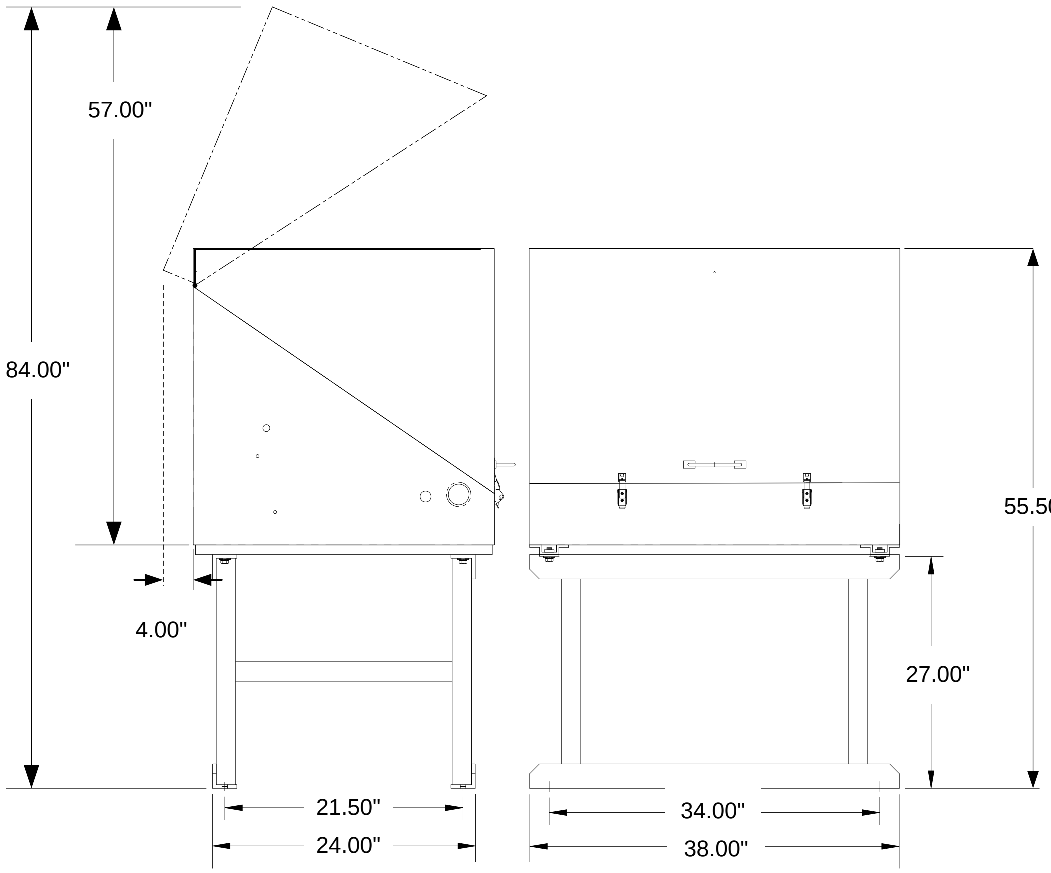


Figure 2-5 ENC82L–Enclosure Stand Installation

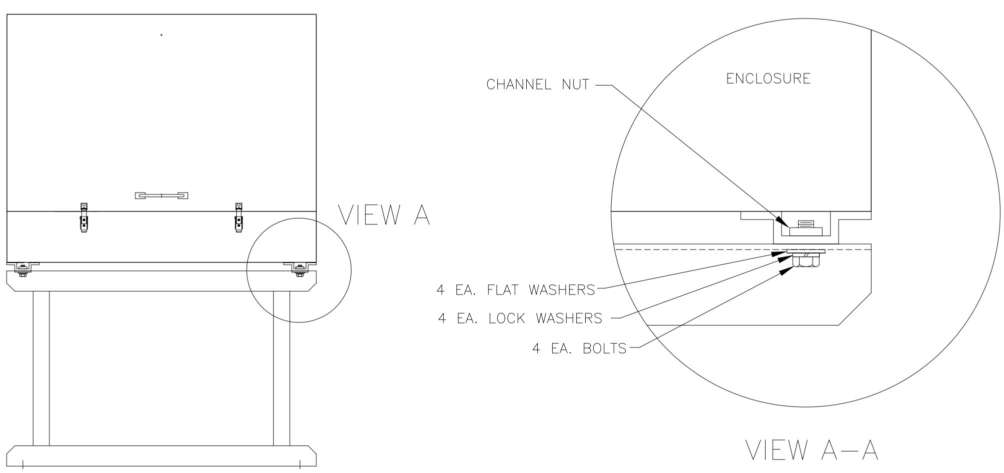


Figure 2-6 ENC82L–Enclosure Mounting Hardware

2.6 Small Free-Standing Environmental Enclosure Installation

If the installation includes a small, free-standing environmental enclosure, follow these instructions; otherwise, move to the next section.

2.6.1 Materials

- Four (4) each - ½-13 x 1 ¼ SST bolt
- Four (4) each - ½ SST flat washer
- Four (4) each - ½” SST split washer
- One (1) Stand

2.6.2 Instructions

1) The stand is NOT made symmetrical. Locate the angle iron with the slotted holes for floor anchors, and place the stand base on a flat, stable surface.

2) Set the enclosure on top of the stand. Orientate so that the stand brace is horizontal with the front of the enclosure (see Figure 2-7).

3) Place a split washer and then a flat washer on one of the 1 ¼” bolts. Insert through the bolt hole located in the angle iron and into the outermost corner of the enclosure (see Figure 2-8).

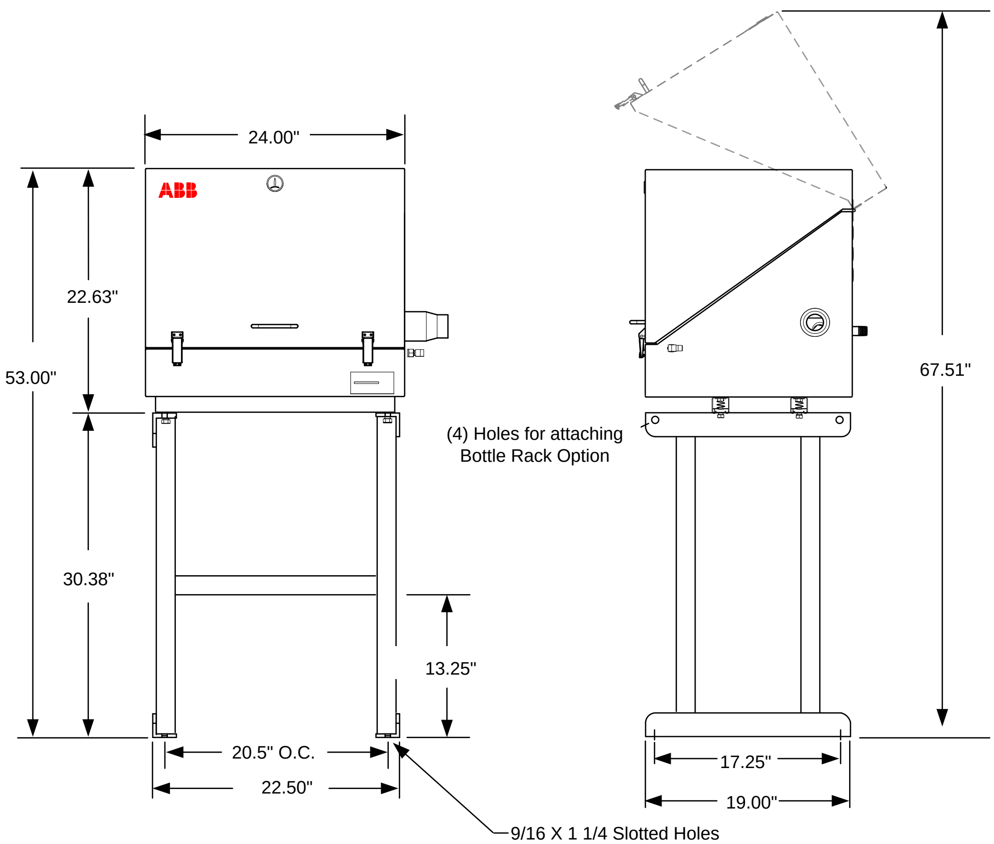


Figure 2-7 ENC82S–Enclosure Installation

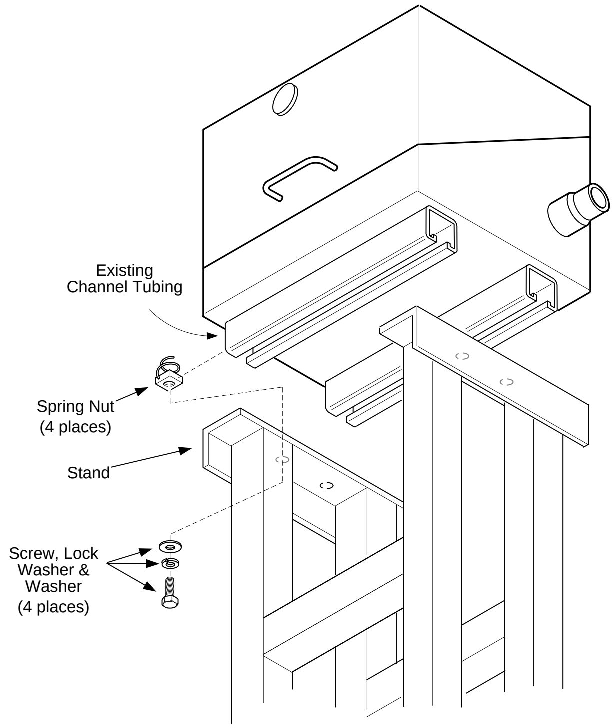


Figure 2-8 ENC82S–Enclosure Mounting Hardware

4) Move the channel spring nut into position so that the bolt will screw into the nut. Screw the bolt into the nut. Do not tighten.

5) Repeat for all other corners.

6) Position the enclosure on the stand, centering the stand underneath; otherwise, offset, as preferred. Tighten all bolts.

7) Foot plate mounting holes are pre-drilled for mounting to a pad. The hardware is to be supplied by the user.

2.7 Large Pipe-Mounted Environmental Enclosure Mounting Kit

If the installation includes a pipe mounted environmental enclosure, follow these instructions as well as the optional support leg instructions; otherwise, continue to the next applicable set of instructions.

2.7.1 Materials

- Four (4) each - ½” -13 x 1 ¼ SST bolt
- Four (4) each - ½” SST flat washer
- Four (4) each - ½” SST split washer
- Two (2) each - 2 ½” x ¼” 43” steel angle iron

FYI 

May be used in conjunction with the optional support leg kit. See Support Leg Installation procedures within this chapter.

2.7.2 Instructions

1) Set two pieces of angle iron (see Figure 2-9) on the bottom of the upside down enclosure. Ensure that the side with the holes is facing the bottom of the enclosure and the solid sides of the angle iron are facing each other. Angle iron should be spaced so that the diameter of the pipe will fit in between.

2) Place a split washer and then a flat washer on one of the 1 ¼" bolts (see Figure 2-10).

3) Insert the bolt through one of the slotted holes located in the angle iron and into the outermost corner of the enclosure. Move the channel nut into position so that the bolt will screw into the nut.

4) Screw the bolt into the nut. Leave loose for later adjustment.

5) Install the other bolt, split washer and flat washer into the other slotted hole.

6) Repeat for the other angle iron. Final tightening of the bolts is performed after the unit is mounted on the pipe to allow for left-to-right and front-to-back positioning.

7) Remove the nut and washers from the adjustment assembly, if necessary (see Figure 2-11).

8) Insert the all-thread through the round hole on the adjustment side of the angle iron.

9) Place the flat washer, split washer and nut on the all-thread.

10) Screw the nut onto the all-thread until the top of the nut is level with the top of the all-thread. Final tightening may be performed after the mounting chain is in place.

FYI  Lift the enclosure above the meter run. Allow enough clearance to clear the pipe.

11) Set the enclosure on top of the pipe between the angle iron mounting brackets. Keep the unit steady on top of the pipe.

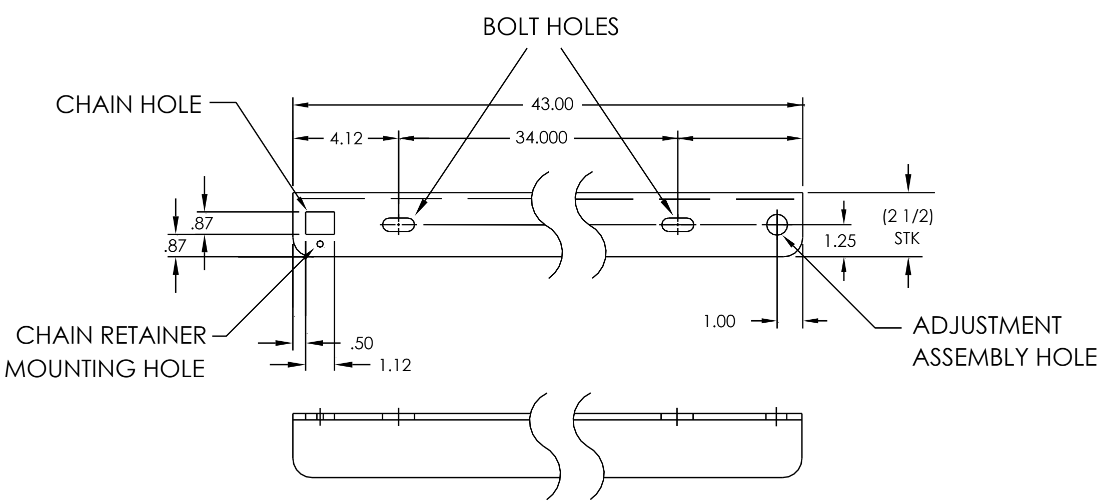


Figure 2-9 ENC82L–Mounting Brackets

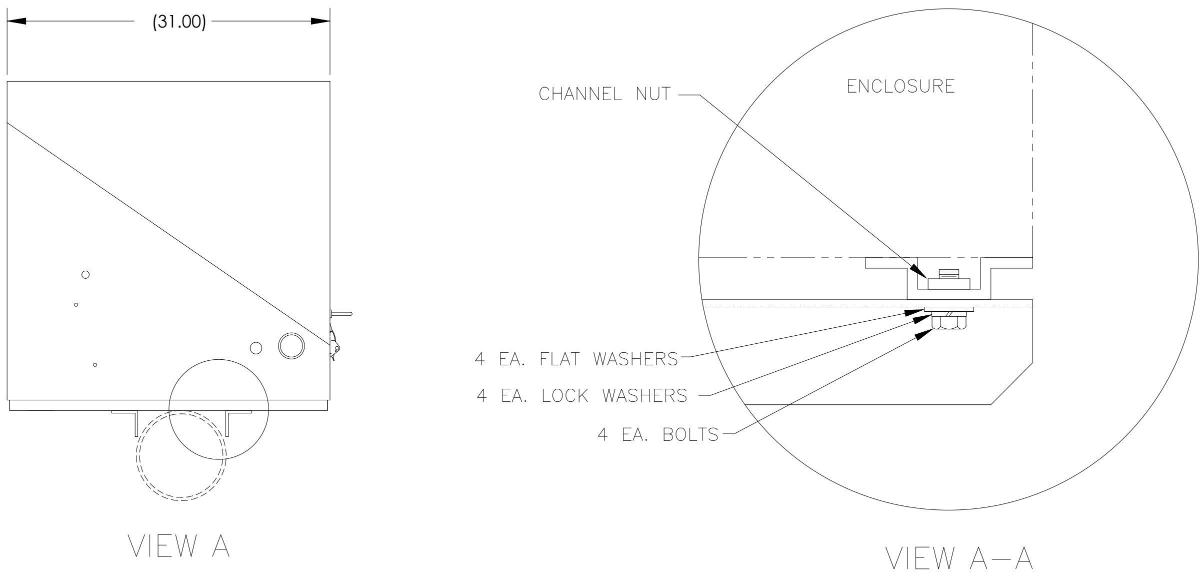


Figure 2-10 ENC82L–Mounting Hardware Installation

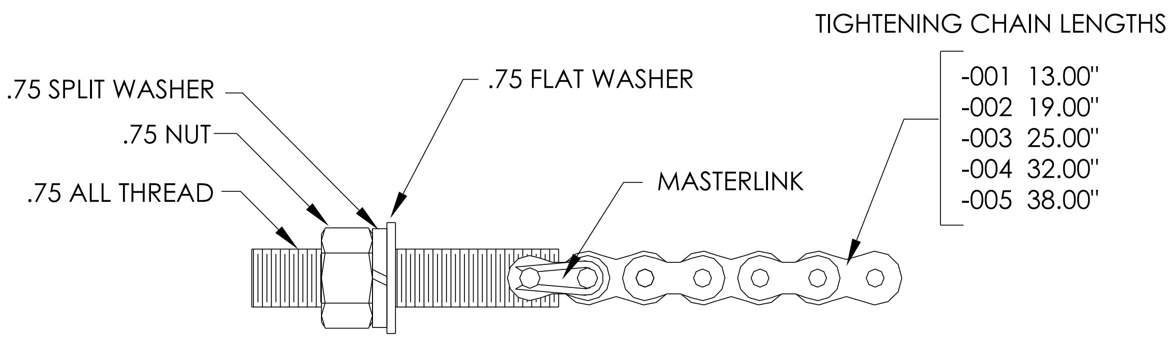


Figure 2-11 ENC82L–Adjustment Assembly

12) Wrap the mounting chain underneath the pipe (see Figure 2-12). Feed the chain up through the square retainer hole of the angle iron. Pull up until most of the slack has been taken out of the mounting chain.

13) Feed the long, flat end of the chain retainer (see Figure 2-13) through the middle of a chain link. Upon completion, move the retainer lock into position where the round peg fits into the small, round mounting hole.

14) Adjust the enclosure into final position on the pipe. Tighten the nut on the all-thread (adjustment assembly) until the unit is securely in place.

15) Adjust the enclosure position on the angle iron, if necessary, and then tighten the bolts until secure.

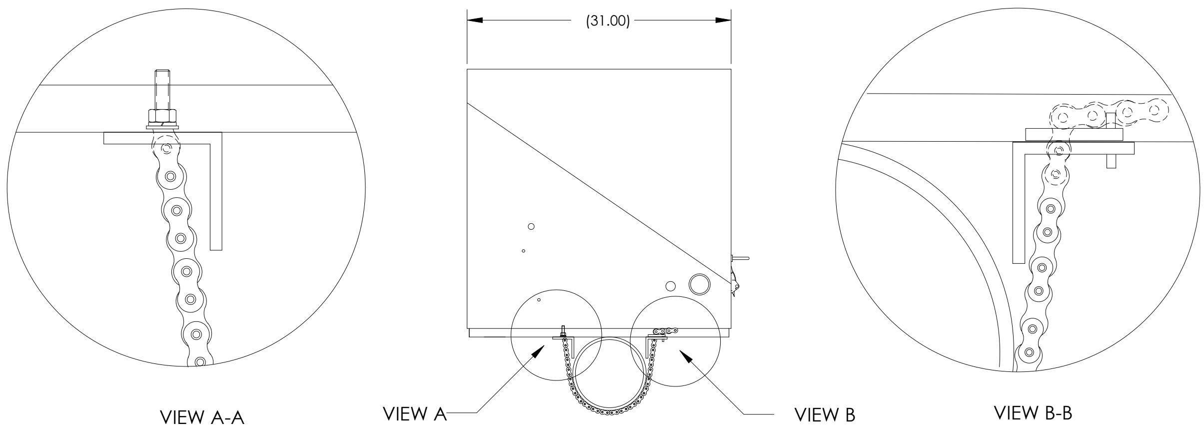


Figure 2-12 ENC82L–Pipe Mount installation

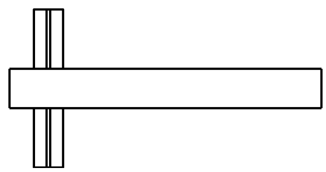


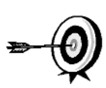
Figure 2-13 ENC82L–Chain Retainer Lock

2.8 Optional Support Leg Kit Installation

If the installation includes a pipe-mounted environmental enclosure and requires an optional support leg, follow these instructions; otherwise, continue to the next applicable set of instructions.

2.8.1 Materials

- Two (2) each - ½-13 x 1 ¼ SST bolt
- Two (2) each - ½ SST flat washer
- Two (2) each - ½" SST split washer
- One (1) each - Pre-assembled adjustable height support leg

TIP  Must use with the pipe-mounting kit.

2.8.2 Instructions

1) Set the support leg underneath the front or rear (or both if using two kits) of the pipe-mounted enclosure. Orientate so that the leg brace is horizontal with the front of the enclosure (see Figure 2-14).

2) Place the split washer and then the flat washer on one of the 1 ¼" bolts.

3) Insert the bolt through the hole located in the angle iron and into the outermost corner of the enclosure. Move the channel nut into position so that the bolt will screw into the nut.

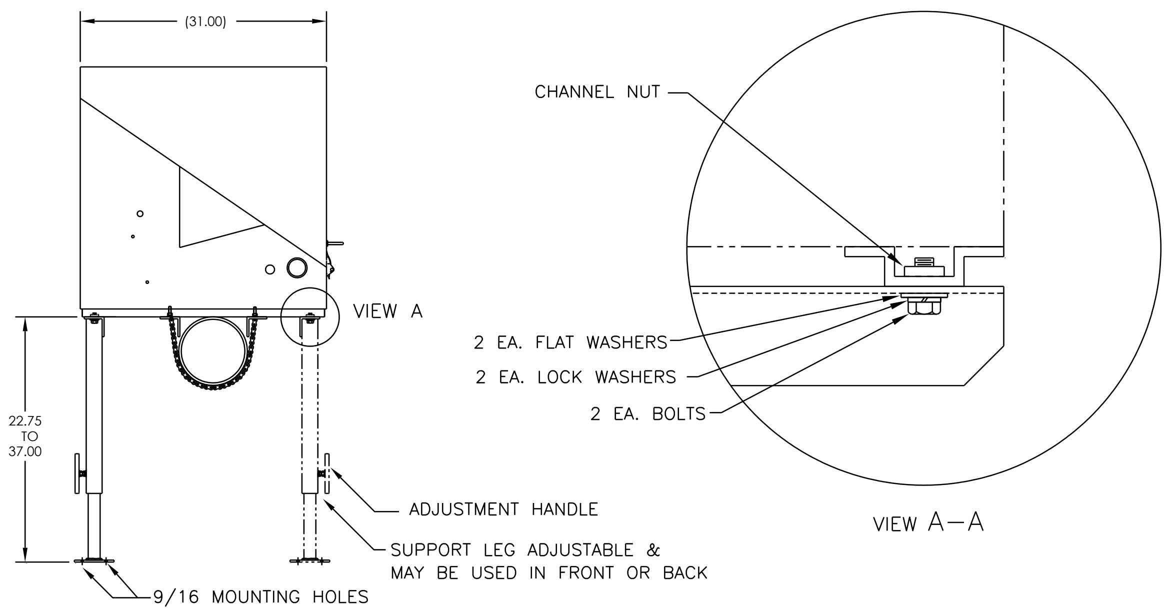


Figure 2-14 ENC82L–Optional Support Leg Overview

4) Screw the bolt into the nut, but leave loose for later adjustment. Repeat for the other corner.

5) If installing two support legs, repeat for the other angle iron. Final tightening of the bolts may be performed after the support leg(s) are in the preferred positioned on a flat, stable surface.

6) Loosen the adjustment handle. Drop the leg foot down, and retighten the adjustment handle.

7) Foot plate mounting holes are pre-drilled for mounting to a pad. The hardware is to be supplied by the user.

2.9 Small Pipe-Mounted Environmental Enclosure Mounting Kit

If the installation includes a pipe-mounted environmental enclosure, follow these instructions; otherwise, continue to the next applicable set of instructions. The mounting kit available for 2”, 3”, 4” and 6” pipe only.

2.9.1 Materials

- Two (2) each - Split U-brackets w/hardware
- Two (2) each - 10 ½” channel tubes
- Four (4) each - ½” spring nut
- Four (4) each - ½” SST split washer
- Four (4) each - ½-13 x 1 ¼ SST bolt
- Four (4) each - ½” SST split washer

2.9.2 Instructions

1) Place the enclosure upside down to gain access to the channel tubing on the bottom of the enclosure.

2) Insert and move each spring nut into the approximate position inside of the existing channel tubing (see Figure 2-15).

3) Set two pieces of the channel tubing on the bottom of the upside down enclosure. Ensure that the side with the holes is facing the bottom of the enclosure and that they are at a 90-degree angle to the existing tubing.

4) Insert and move the spring nut into the approximate position inside of the existing channel tubing.

5) Place the split washer and then the flat washer on one of the 1 ¼" bolts.

6) Insert the bolt through the hole located in the channel tubing and into the spring nut inside of the existing channel tubing. Move the channel nut into position so that the bolt will screw into the nut. Do not tighten.

7) Repeat for the remaining screws and nuts.

8) Remove the screw and nut from both U-brackets (see Figure 2-16).

9) Slide both sides of the U-bracket into the newly mounted channel tubing (see Figure 2-17). Ensure that the pieces are correctly oriented to fit around the pipe. Repeat for the second bracket and tubing.

10) Separate the U-brackets to allow for mounting on the pipe. Set the unit on the pipe, and move the brackets together so that they surround the pipe.

11) Reassemble the U-bracket with the screw and nut. Leave loose until the enclosure has been centered over the pipe and adjusted for position (see Figure 2-18). Tighten.

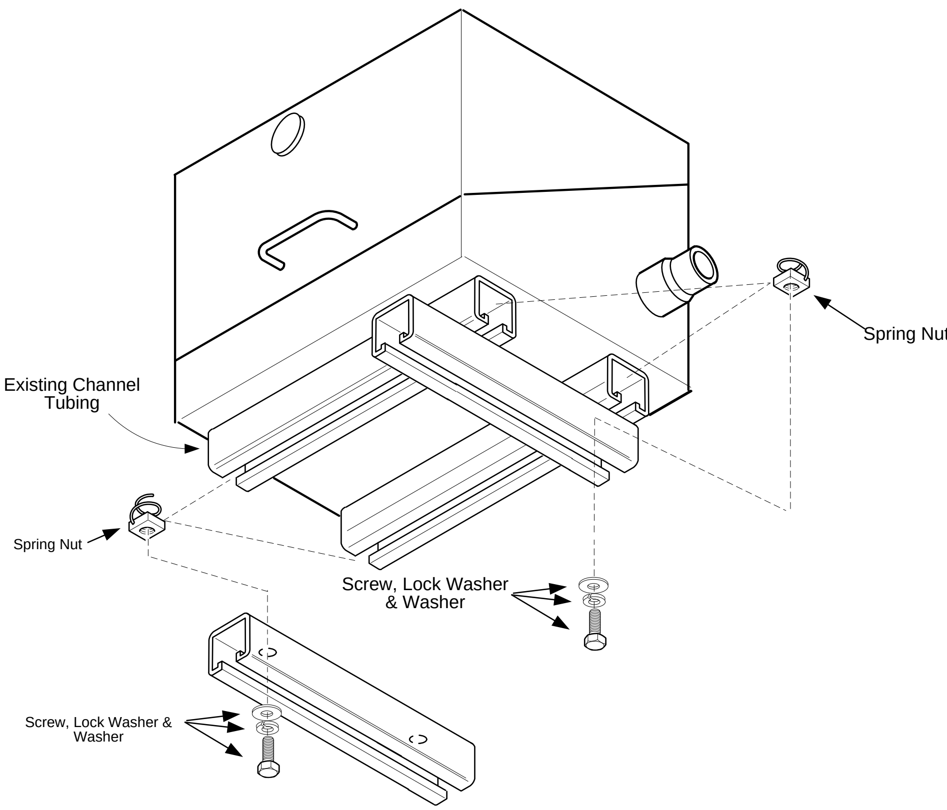


Figure 2-15 ENC82S–Channel Tubing Installation

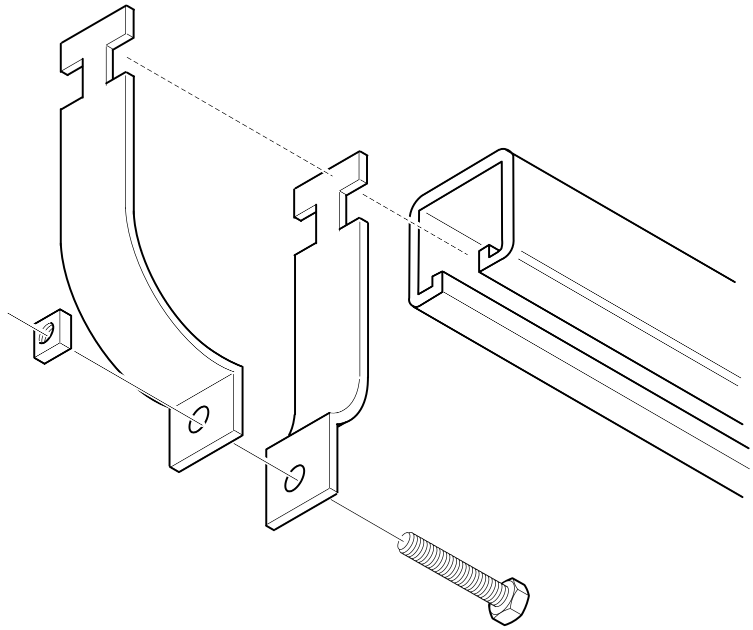


Figure 2-16 ENC82S–Pipe-Mount Split Brackets

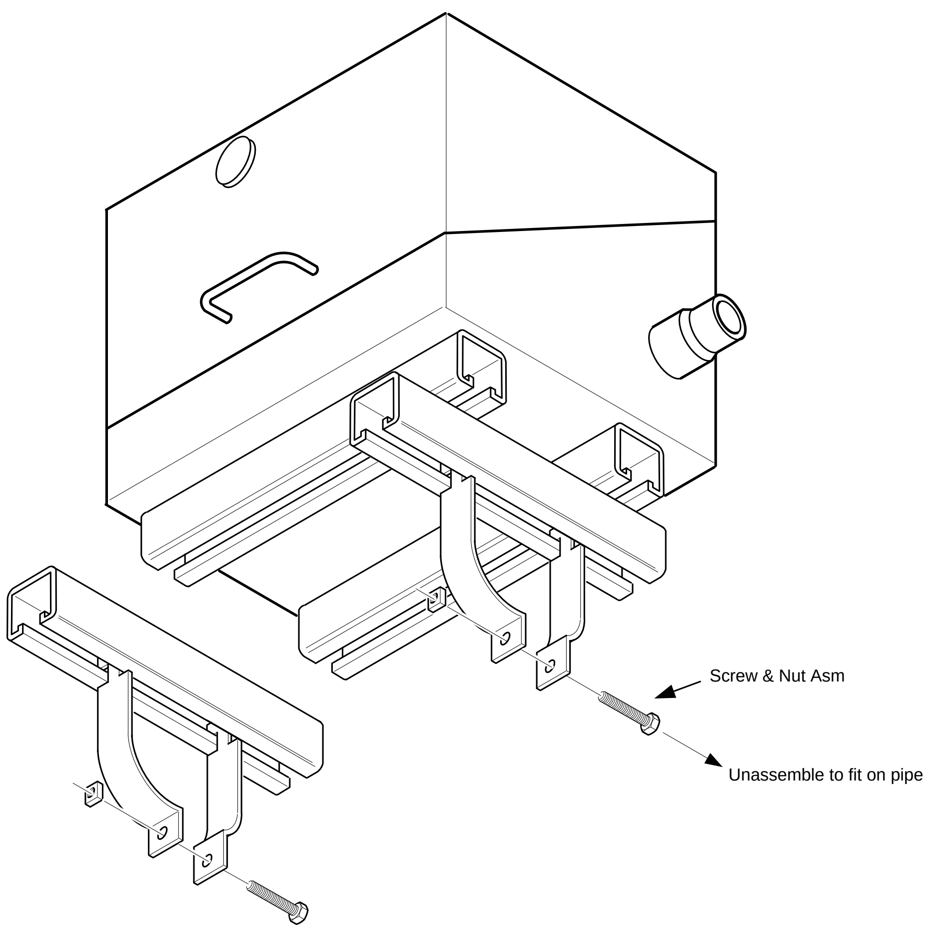


Figure 2-17 ENC82S– Pipe-Mount Assembly

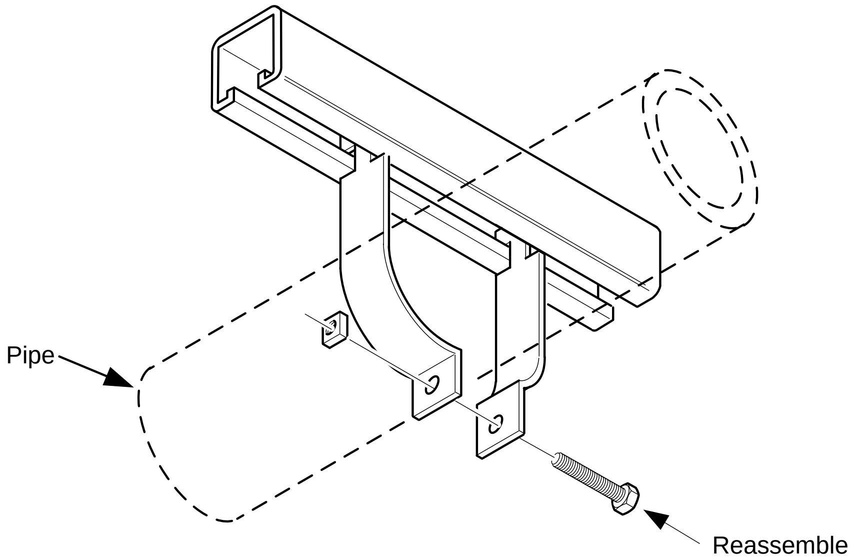


Figure 2-18 ENC82S–Pipe-Mounted

2.10 Pipe Saddle Installation

If the user is installing a PGC1000 using the pipe saddle mounting kit, use this procedure to install the pipe saddle. Before beginning, review the procedure and the materials required for installation. The optional pipe with flange may be used in installations requiring additional stability.

2.10.1 Materials Not Supplied

- One (1) each - Pipe saddle
- One (1) each - 2” mounting pipe. The length is dependent upon the preferred height of the PGC1000.
- One (1) each - 2” pipe with flange (optional)
- One (1) each - 2” pipe coupling(optional)

FYI Optional equipment may be ordered from ABB Totalflow.

2.10.2 Instructions

1) Position the pipe saddle on the process line. Select a location that allows easy user access and is close to the sample probe. Lines should be as short as possible.

2) Temporarily attach the saddle on the pipe. Use a U-bolt and associated hardware (see Figure 2-19).

3) Screw one end of the 2” pipe into the saddle flange on the pipe saddle until it is “wrench tight”. Place a level against the pipe, and vertically align. Adjust the saddle until vertical alignment is achieved.

4) After vertical alignment, securely tighten the saddle mounting bolts.

5) If configuration includes the optional pipe with flange, screw the 2” pipe coupling onto the top of the mounting pipe.

6) Screw the optional mounting pipe with flange into the top of the pipe coupling.

FYI Continue to the PGC1000 Installation instructions. The method of installation must be consistent with the user's company policy.

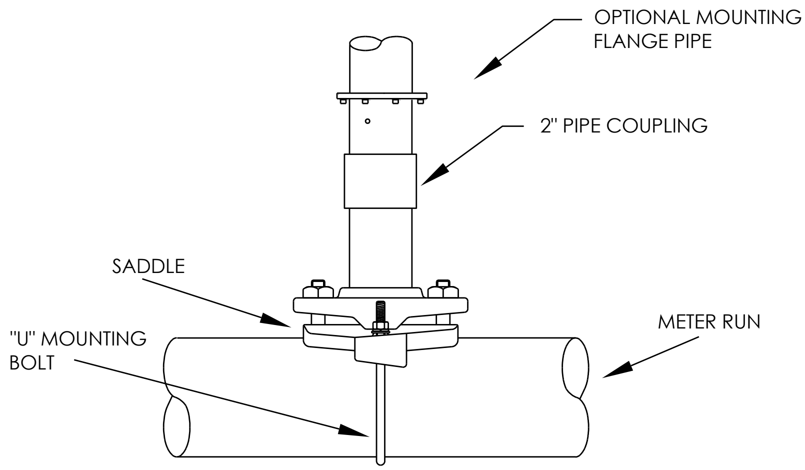


Figure 2-19 Typical Pipe Saddle Installation

2.11 Shelf Installation

If the installation calls for the PGC1000 shelf mounting kit, use this procedure to mount the shelf; otherwise, continue to the next applicable set of instructions. Before beginning, review the procedure and the materials required for installation.

2.11.1 Materials

- Four (4) each - ¼" x 20 1" SST hex head machine screws
- PGC1000 mounting shelf with flange
- One (1) each - 2" mounting pipe. The length is dependent upon the preferred height of the PGC1000.
- One (1) each - 2" pipe with flange (optional)
- One (1) each - 2" pipe coupling (optional)

2.11.2 Instructions

1) Locate the wall position where the PGC1000 is to be mounted. The shelf should be positioned high enough on the wall so all components are accessible to service personnel.

The shelf should be installed in close proximity to the installed sample probe.

2) Mount the shelf to the wall (be careful to keep level) using four ¼ x 20, 1-inch SST hex head machine screws in each of the four shelf mounting holes. Refer to Figure 2-20.

3) Screw one end of the 2" mounting pipe into the flange on the mounting plate until "wrench tight".

4) If the configuration includes the optional pipe with flange, screw the 2" pipe coupling onto the top of the mounting pipe.

5) Screw the optional mounting pipe with flange into the top of the pipe coupling.

FYI 

Continue to the PGC1000 Installation instructions. The method of installation must be consistent with the user's company policy.

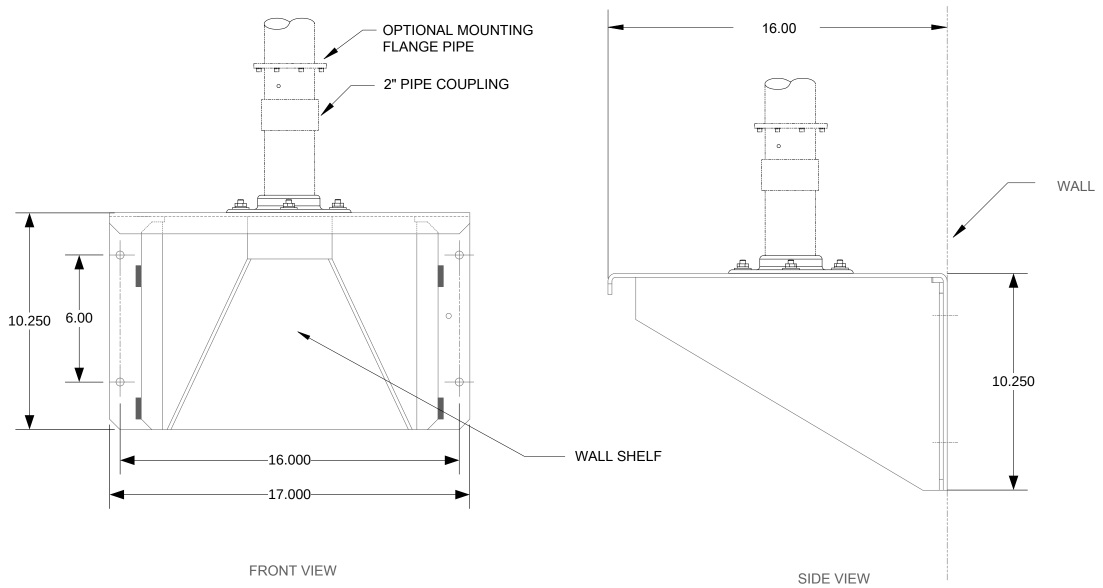


Figure 2-20 Shelf Installation

2.12 PGC1000 Installation

Once the mounting system has been installed, these instructions should be followed to install the PGC1000 onto the mounting pipe. These instructions are relevant to all of the mounting system types that have been presented within this manual.

Both the large and small environmental enclosures are shipped with the PGC1000 mounting system installed inside the environmental enclosure.

Before beginning, review the procedure and the materials required for installation.

2.12.1 Materials

- Installed mounting pipe
- Four (4) each - 5/16" hex socket screws (optional - for use with mounting pipe with flange kit)
- PGC1000

2.12.2 Instructions

FYI  When positioning the unit, the user should take into consideration the mounting of the sample conditioning system, conduit locations and access to the rear end cap of the unit.

1) Position the PGC1000 on top of the 2" pipe stand (see Figure 2-21). The positioning needs to be in close approximation to the correct orientation.

2) If the installation has the optional mounting pipe with flange, ensure the screw holes in the upper flange align with the holes located in the PGC1000 neck bottom (see Figure 2-22).

- For installation inside of an environmental enclosure, the front display of the unit would normally face left with the feed-through assembly facing the front opening of the enclosure. This allows screen visibility and access to the feed-through assembly and the termination board that is located in the rear of the housing.
- For shelf mounted units, the unit would be oriented with the feed-through assembly also facing forward. Sufficient clearance is required when mounted near an inside corner.

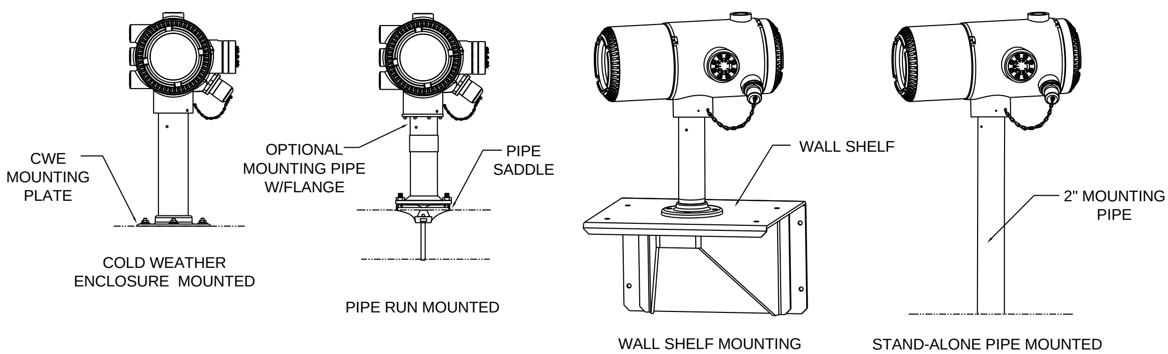


Figure 2-21 PGC1000 Mounting

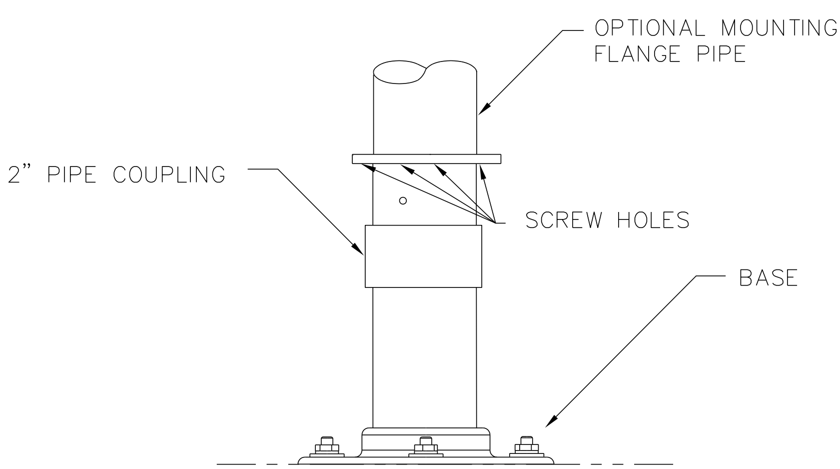


Figure 2-22 PGC1000 Optional Mounting Flange Pipe

3) Secure in place by tightening the hex socket set screw, located in the neck of the unit, using a 1/8" hex wrench.

4) If the installation has the optional mounting flange pipe, insert the hex socket screw through the hole in the welded flange and into the neck bottom of the unit. Tighten using the ¼" hex wrench. Repeat for all screws.

5) If the installation has the optional mounting flange pipe, small adjustments may be made to the orientation by applying additional pressure to the mounting pipe with the pipe wrench. Tighten the mounting pipe into the shelf mounted flange or pipe saddle flange.

   Otherwise, loosen the hex socket set screw, rotate unit and retighten.

2.13 Sample Conditioning Module Installation

2.13.1 Materials

- Installed PGC1000
- Single or multiple module mounting kit (see Figure 2-23)
- One (1) each -. .312 x 2.5 x 3.62 x 1.5 U-bolt
- Two (2) each - 5/16" SST split washer
- Two (2) each - 5/16" SST flat washer
- Two (2) each - 5/16-18 SST lock nut
- Sample conditioning module(s) and hardware (see Figure 2-23 and Figure 2-24)

2.13.2 Mounting Kits

Both sample conditioning module mounting brackets are installed identically. The single module bracket will hold a single-stream sample conditioning module, while the multiple module bracket will hold up to three sample conditioning modules.

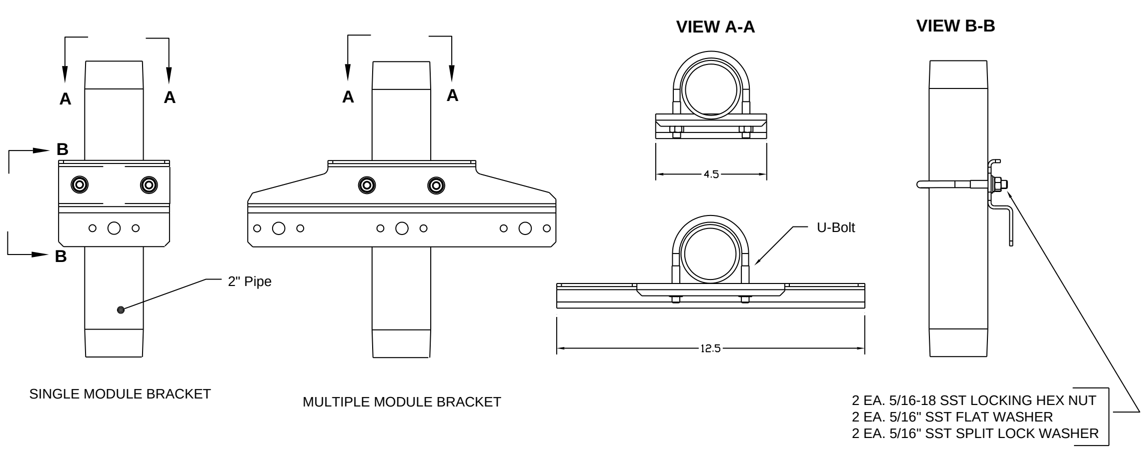


Figure 2-23 Sample System Mounting Kits

2.13.3 Instructions

CAUTION When installing the module bracket inside of the ENC82S small environmental enclosure, the mounting bracket must be installed upside down to allow for the required space; otherwise, the module bracket installed inside of the ENC82L large environmental enclosure should be oriented as shown in Figure 2-24.

1) On the sample conditioning module, align the mounting holes to the corresponding holes in the bracket. Insert the bolt through the hole in the bracket, from front to back, and then through the mounting hole in the module (see Figure 2-23). Place the split washer and then the flat washer on the bolt. Screw the nut onto the end of the bolt, finger tight. Repeat for the second mounting bolt. Tighten both nuts.

2) Repeat for all additional modules.

3) Straddle the mounting pipe with the U-bolt, and insert the threaded ends through the holes located in the bracket. Ensure that the bracket back fits flat against the pipe and the module mounting lip sets away from the pipe (see Figure 2-23).

4) Place the flat washer and then a split washer on the end of the U-bolt. Screw the nut onto the end of the bolt, finger tight.

5) Repeat step 4 for the other side of the U-bolt.

6) Move the bracket into position underneath the PGC1000. Ensure there is enough clearance for the sample conditioning module(s).

7) Tighten both nuts.

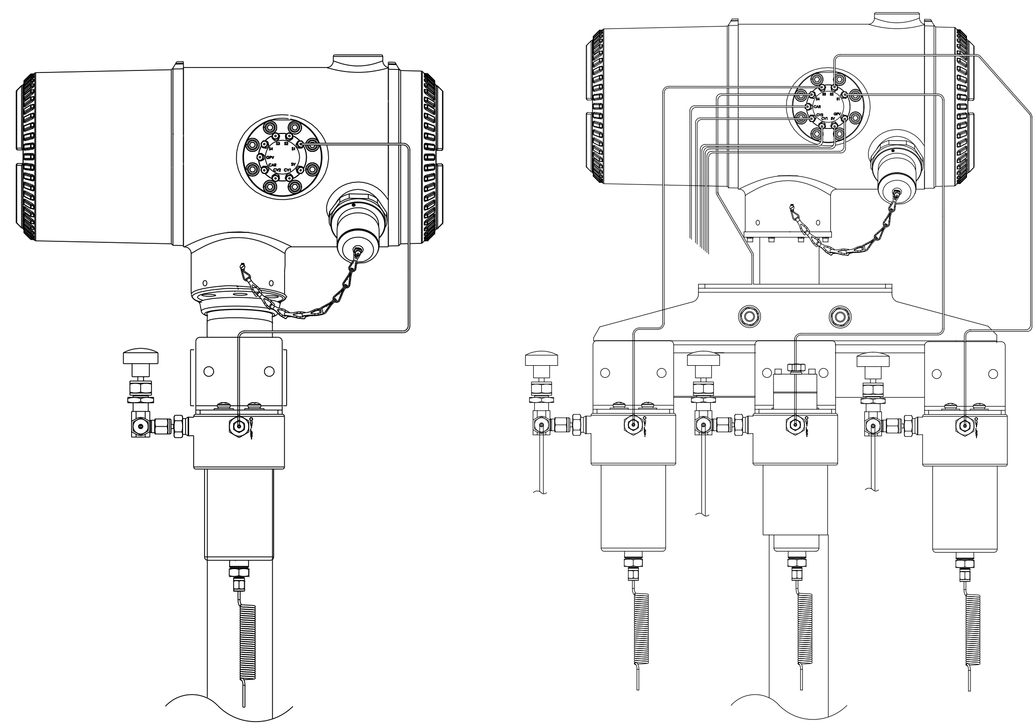


Figure 2-24 Single and Multiple Stream Sample Conditioning Assemblies

2.14 Sample Line Connections

Following the installation of the sample conditioning module(s), the sample tubing from the sample probe to the sample conditioning system and then on to the PGC1000 feed-through assembly should be installed.

TIP If the sample conditioning module and the PGC1000 are located inside an ENC82, review the Sample Line Connections to PGC1000 Inside of the ENC82 section for information pertaining to this installation.

2.14.1 Materials

- 1/8” SST chromatography-grade transport tubing. The length of the tubing should be determined by the technician and is based on the distance from the sample probe to the sample conditioning module and the number of sample streams.
- Two (2) each - Ferrule and nut (for each sample stream)
- One (1) each - ¼” NPT to 1/8” reducer or other size as determined from the sample probe output port (for each sample stream)
- One (1) each - Sample conditioning module transport tubing (supplied with the sample conditioning module)

2.14.2 Instructions

TIP Ensure that the ends of the stainless steel tubing are open and not restricted.

1) Locate the sample input fitting on the sample conditioning module (see Figure 2-25).

2) Locate the sample output fitting on the installed sample probe.

3) Measure and cut the SST tubing to the required length.

4) Make the necessary bends in the tubing to ease the installation of the ferrule and nut into the sample conditioning module input port.

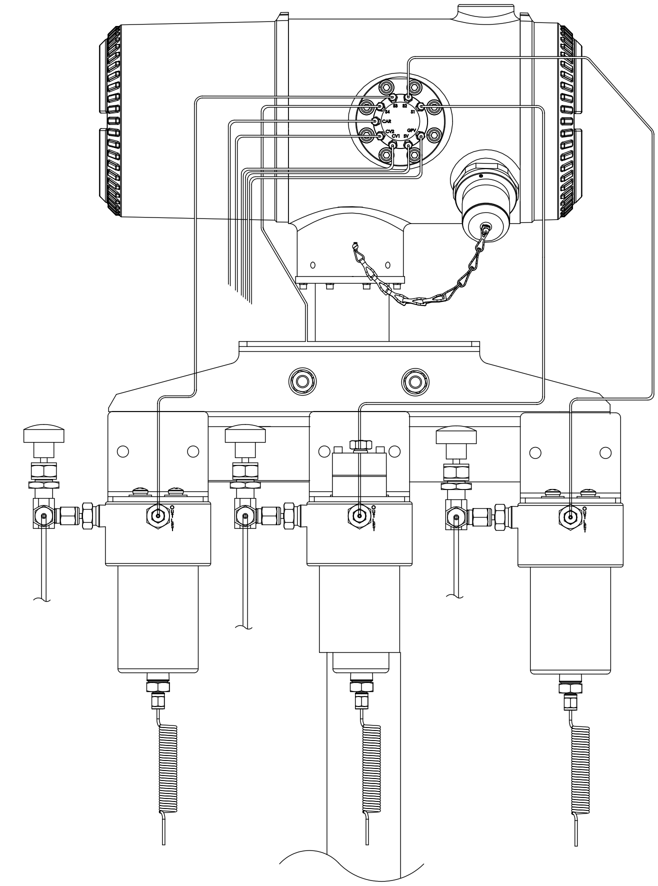


Figure 2-25 Sample Conditioning Module Line Installation

TIP If the sample conditioning module and the PGC1000 are located inside an ENC82, review the Sample Line(s) to PGC1000 Inside of Environmental Enclosure section for information pertaining to this installation.

FYI Tube, ferrule and nut should always enter the connection at a right angle.

5) If necessary, install the reducer into the sample probe output fitting.

6) Install the ferrule and nut onto one end of the sample tubing.

7) Insert the tubing with the ferrule into the reducer/sample probe output fitting. Move the nut down onto the ferrule, screw onto the fitting and tighten.

8) Install the ferrule and nut onto the other end of the sample tubing.

9) Insert the ferrule into the sample conditioning module input fitting. Move the nut down onto the ferrule, screw onto the fitting and tighten.

10) Locate the sample output fitting on the sample conditioning module.

11) Locate the sample input on the PGC1000 feed-through assembly, and remove the sealing screw.

12) Make the necessary bends in the tubing to ease the installation of the tubing into the output fitting on the sample conditioning module and the ferrule and Valco® nut into the input on the PGC1000 feed-through assembly.

13) Insert the tubing with the ferrule into the output fitting on the sample conditioning module. Move the nut down onto the ferrule, screw onto the fitting and tighten.

14) Remove the plastic caps from the restrictor coils, the sealing screws from the feed-through column vents and the sealing screws from the sample vent lines.

15) Purge the air from the transport tubing by opening the shut-off valve. The valve is located on the sample probe.

WARNING The user needs to ensure they are following the requirements of national and local codes when performing this purge.

16) Insert the tubing with the ferrule into the corresponding input port located on the PGC1000 feed-through assembly. Move the Valco® nut down onto the ferrule, screw into the port and tighten.

17) Repeat for each sample stream.

CAUTION DO NOT over tighten. After securing the tubing, check for gas leaks.

2.15 Sample Line(s) to PGC1000 Inside of ENC82

CWE The sample line(s) being installed to a unit, located inside the ENC82, require making minute changes to the instructions listed for their installation. The following information and steps should be noted during the installation.

2.15.1 Materials

- Installed sample conditioning module for each stream
- 1/8” SST chromatography-grade transport tubing (amount to be determined by the technician and is based on the distance from the sample probe to the sample conditioning module and the number of sample streams)
- Two (2) each - Ferrule and nut (for each sample stream)
- One (1) each - ¼” NPT to 1/8” reducer or other size as determined from the sample probe output port (for each sample stream)
- One (1) each - Sample conditioning module transport tubing (supplied with the sample conditioning module)
- 1/16” or larger vent tubing and materials for making connection to the 1/16” purge coil to vent outside of the enclosure (provided by customer for each stream)
- Heat trace materials provided by customer for each stream

2.15.2 Instructions

TIP Ensure that the ends of the stainless steel tubing are open and not restricted.

1) Locate the sample input fitting on the sample conditioning module (see Figure 2-26) and the sample output fitting on the installed sample probe.

2) Locate the sample boot on the side of the environmental enclosure. Sample lines must feed through the sample boot that is located on the side of the enclosure.

3) Measure and cut the SST tubing to the required length. Feed the sample tubing through the sample boot.

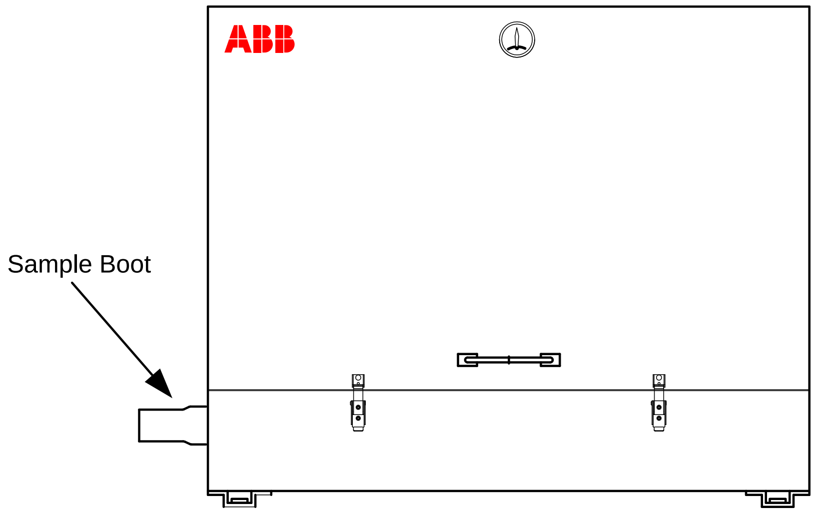


Figure 2-26 ENC82L–Environmental Enclosure Sample Boot

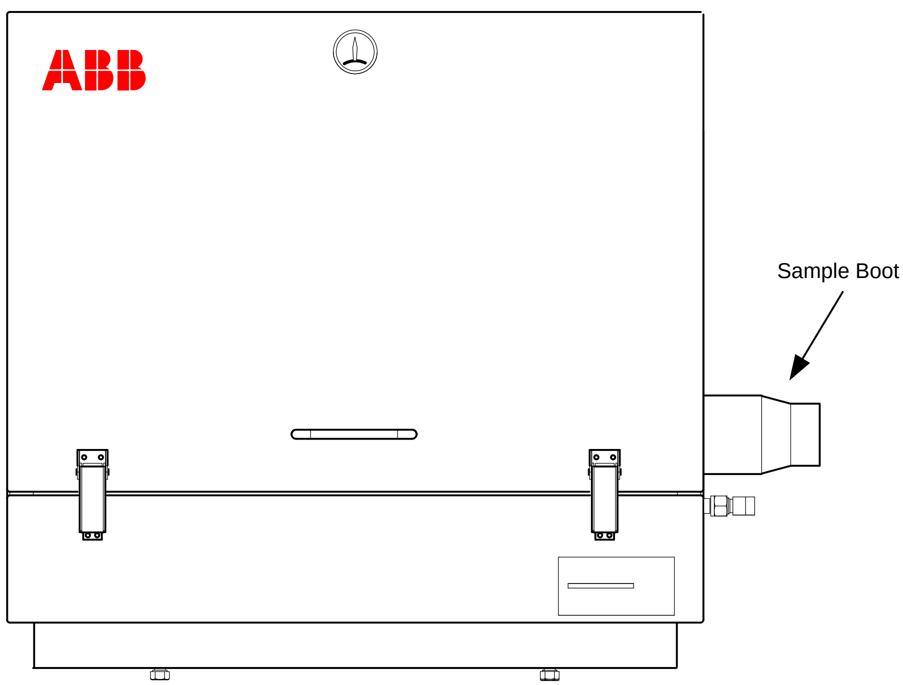


Figure 2-27 ENC82S–Environmental Enclosure Sample Boot

4) If necessary, install the reducer into the sample probe output fitting.

5) Install the ferrule and nut onto one end of the sample tubing.

6) Insert the tubing with the ferrule into the reducer/sample probe output fitting. Move the nut down onto the ferrule, and screw onto the fitting. Upon completion, tighten.

7) Install the ferrule and nut onto the other end of the sample tubing.

8) Insert the ferrule into the sample conditioning module input fitting. Move the nut down onto the ferrule, screw onto the fitting and tighten.

9) Locate the sample output fitting on the sample conditioning module.

10) Locate the sample input on the PGC1000 feed-through assembly, and remove the sealing screw.

CAUTION Leave the sealing screw in any unused ports. If the unused stream ports are not sealed, moisture can enter the manifold and can damage the instrument and void warranty.

11) Make the necessary bends in the tubing to ease installation of the tubing into the output fitting on the sample conditioning module and the ferrule and Valco® nut into the input on the PGC1000 feed-through assembly.

12) Insert the tubing with the ferrule into the output fitting on the sample conditioning module. Move the nut down onto the ferrule, screw onto the fitting and tighten.

13) Remove the plastic caps from the restrictor coils, the sealing screws from the feed-through column vents and the sealing screw from sample vent lines.

14) Purge the air from the transport tubing by opening the shut-off valve located on the sample probe.

WARNING Follow the requirements of national and local codes when performing this purge.

15) Insert the tubing with the ferrule into the corresponding input port located on the PGC1000 feed-through assembly. Move the Valco® nut down onto the ferrule, screw into the port and tighten.

16) Repeat for each additional sample stream.

CAUTION DO NOT over tighten. After securing the tubing, check for gas leaks.

17) Measure and cut the vent tubing to a sufficient length to guarantee the purge coils vent outside of the enclosure. Feed the vent tubing through the sample boot.

18) Make the necessary bends in the tubing to ease installation of the tubing into the required the fittings on the end of the sample conditioning module purge coil.

19) Please follow the Heat Trace manufacturer's suggested installation instructions for applying Heat Trace equipment to additional sample streams.

2.16 ENC82L Optional Pwr/Comm Outlet Box Assembly

Environmental Enclosure

If installing the PGC1000 inside an ENC82, use this procedure to install the optional RS-232/RS-485/RS-422 outlet box, if required; otherwise, continue to the next series of applicable instructions. Before beginning, review the procedure and the materials required for installation.

FYI

These instructions are only applicable to the large environmental enclosure. This option is NOT available for the small enclosure.

2.16.1 Materials

- One (1) each - Outlet box assembly
- One (1) each - Internal PGC1000 connection assembly
- One (1) each - Flexible cable assembly
- One (1) each - DC power switch box
- One (1) each - Support bracket
- Two (2) each - 10-32 x ¾” SS pan head screw, Phillips
- Two (2) each - #10 SST flat washer
- Two (2) each - #20 SST split washer

2.16.2 Customer Supplied Materials

- 14 AWG wire-materials for external wiring (to outlet box) not provided by ABB Totalflow. The quantity is to be determined by the technician based on installation and local codes.

2.16.3 Instructions

1) Gain access to the rear termination board by loosening the countersunk hex socket locking set screw in the rear end cap. Use a 1/16” hex wrench. Upon completion, unscrew the end cap.

2) Remove the hub plug from the bottom most access hub.

3) Beginning with the internal connection assembly (see Figure 2-28), feed the 13” wire bundle (elbow end of the assembly) through the open hub. Continue to pull the wire past the terminations until the nipple fitting is in position to screw into the hub.

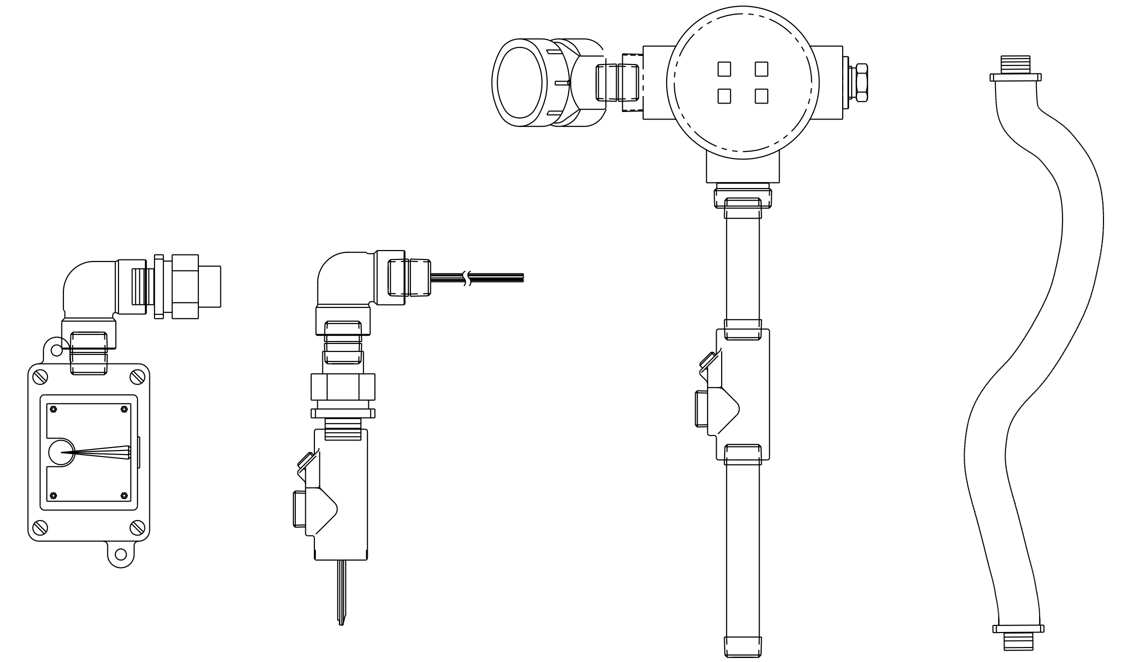


Figure 2-28 Power Communication Outlet Box Assembly

4) Moving the assembly clockwise, screw the nipple fitting into the hub until the assembly is tight and hanging straight down at a 1808.

5) Feed the other end of the wire bundle through the flexible cable assembly. Begin at the end with the sealing gasket until the threads meet the conduit seal.

6) Rotate the flexible cable assembly clockwise. Screw the threads into the conduit seal until tight. For explosion-proof installations, a minimum of five (5) threads must be engaged.

7) Feed wires through the small hole located near the sample boot in the lower front of the enclosure (see Figure 2-29).

8) Remove the cover from the outlet box assembly.

TIP Remove the elbow cap on the outlet box assembly to facilitate feeding the wrapped wire around the elbow.

9) Feed wires through the outlet box elbow and out past the wiring panel. Move the assembly up to the threaded end of the cable.

10) Begin threading the outlet box assembly onto the end of the flexible cable assembly. Rotate the entire outlet box assembly clockwise until it is snug and is in a vertical (3608) position. For explosion-proof installations, the final assembly must have a minimum of five (5) threads engaged.

11) Locate the support bracket mounting holes on the enclosure.

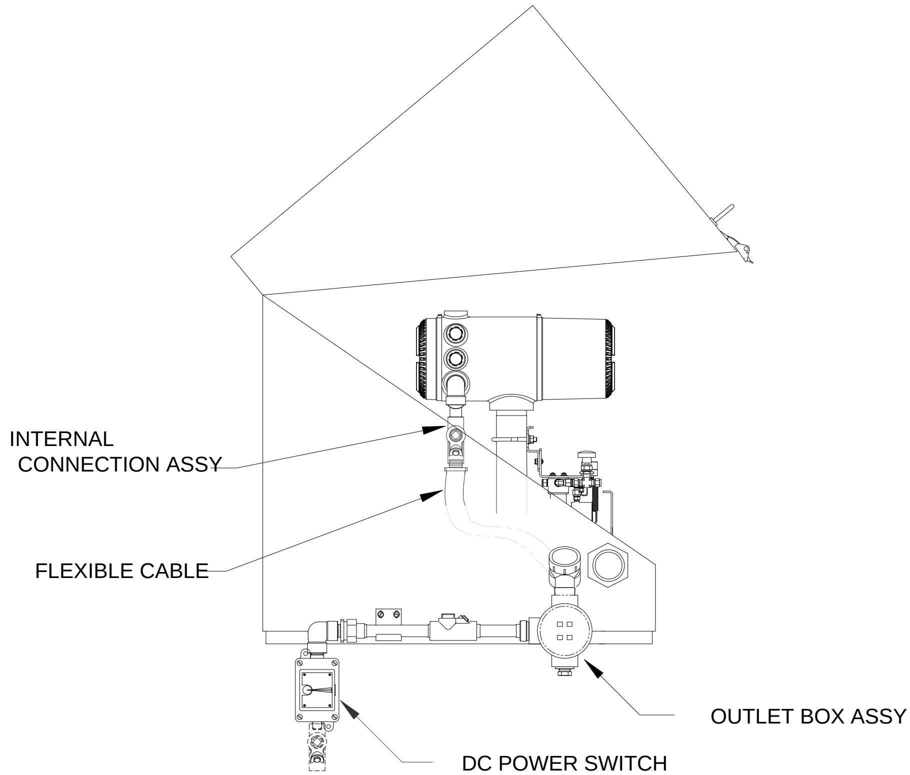


Figure 2-29 ENC82L Large Enclosure

12) Place the split washer and then a flat washer on the end of each screw.

13) Insert the screw through the mounting bracket and into the hole on the side of the enclosure.

14) Using a Phillips-point screwdriver, start the screw into the hole. Do not tighten.

15) Repeat steps 13 through 14 for the second screw.

16) Locate the support bracket mounting holes on the enclosure.

17) Place the split washer and then a flat washer on the end of each screw.

18) Insert the screw through the mounting bracket and into the hole on the side of the enclosure.

19) Using a Phillips-point screwdriver, start the screw into the hole. Do not tighten.

20) Repeat steps 18 through 19 for the second screw.

21) Level the bracket. Tighten the screws until snug.

22) Move the outlet box assembly down so that it rests on the mounting bracket (see Figure 2-30).

23) At the PGC1000 termination board, trim and strip the wire ends.

24) Remove the power field termination J1 connector from the termination board.

25) Using the wiring instructions in Figure 2-31, install each wire into the correct terminal. Upon completion, replace the connector on the board.

26) Trim and strip the wire ends that are located in the external outlet box.

27) Remove the power field termination J3 connector from the outlet box panel.

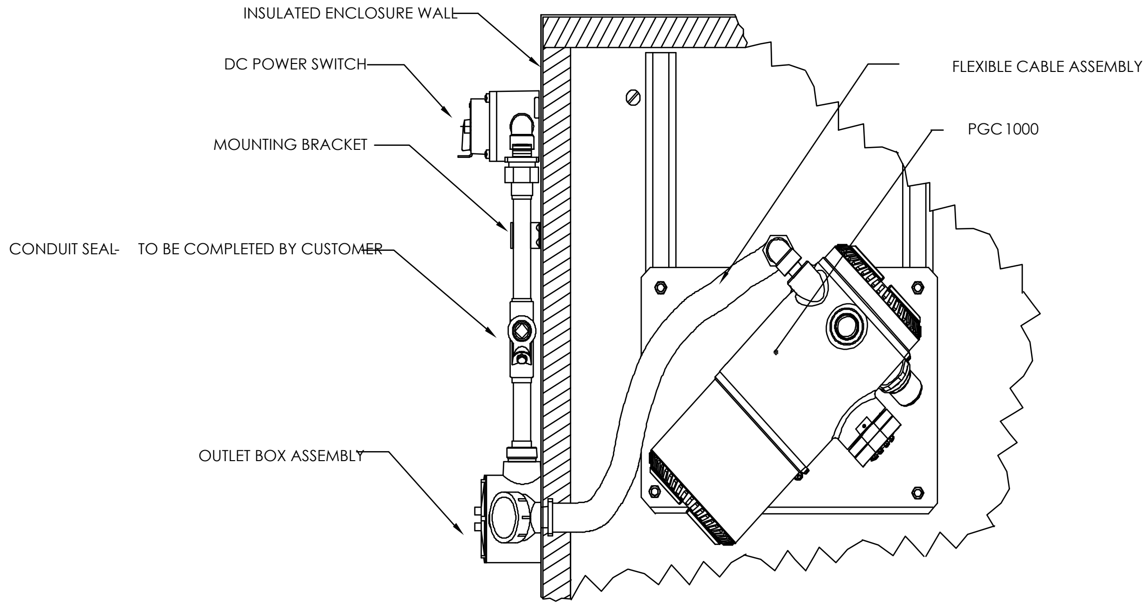


Figure 2-30 Assembled Power/Communication Assembly

28) Using the wiring instructions in Figure 2-31, install each wire into the correct terminal. Upon completion, replace the connector on the board.

29) Remove the DC power switch box cover.

30) Remove the switch mounting screws. Upon completion, remove the switch.

31) Cut a 3' length of power (+) wire.

TIP

Optionally, communication wires may be run directly to the spare conduit hub located on the bottom of the outlet box assembly. Follow the requirements of national and local codes.

For the purpose of this manual, it is assumed that the communication wiring will be included with the power wiring in one conduit run.

32) Tape the 3' power (+) wire, ground and communication wire ends together.

33) Feed the wires through the conduit hub located on the bottom of the DC power switch box. Feed the wires past the cover opening, around the elbow and then out.

34) Continue pulling the wire until approximately 2' of wire is extending out of the DC power switch box.

TIP

Be careful to not pull the 3' power (+) wire past the DC power switch box opening.

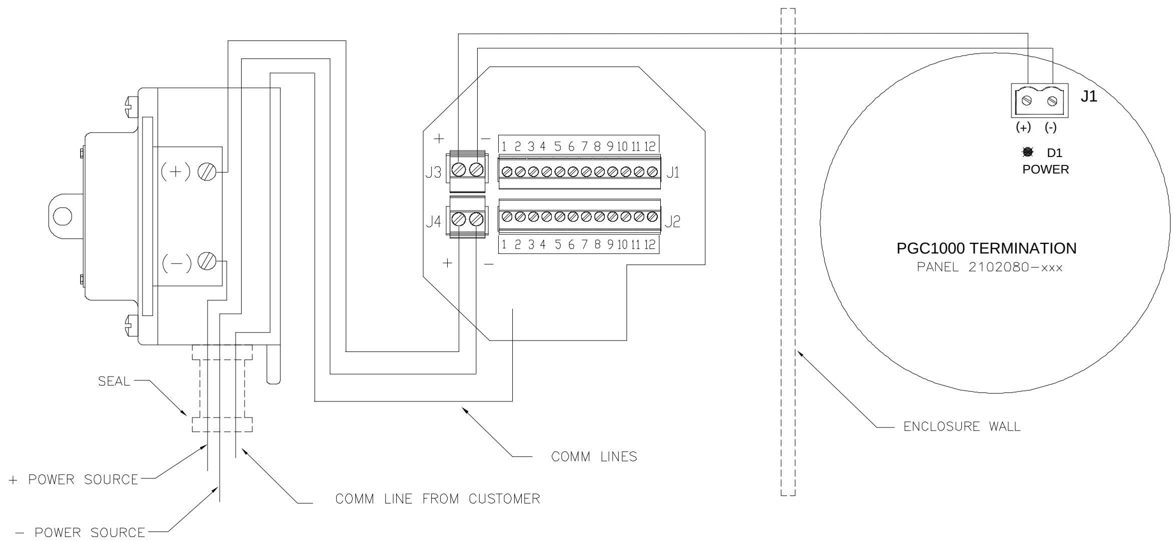


Figure 2-31 Power Wiring Diagram

35) Feed the excess wire through the 6" nipple fitting, the conduit seal, the 5" nipple fitting and then out into the outlet box opening. Pull out enough wire to complete field wiring.

36) Remove the power field termination J4 connector from the outlet box panel.

37) Using the wiring instructions in Figure 2-31, install power (+) and power (-) wires into the correct terminal pins. Upon completion, replace the connector on the board.

38) Holding the wires, slide the DC power switch box up to the 6" nipple fitting on the end of the outlet box assembly.

39) Slide the conduit union onto the end of the nipple fitting. Upon completion, screw on.

40) Loosen the terminal screws on the DC power switch.

41) Using the wiring instructions in Figure 2-31, wire power (+) to the upper terminal screw. Tighten.

42) Bring the new power (+) wire into the power switch enclosure, and pull the short length out to allow for wiring.

43) Using the wiring instructions in Figure 2-31, wire the new power (+) length to the bottom terminal screw. Tighten.

44) Re-install the DC power switch into the box.

45) Using the wiring instructions in Figure 2-32 (RS-232), Figure 2-33 (RS-485) or Figure 2-34 (RS-422), make the field connections to plug the PGC1000 termination board com port (s), and re-insert into the corresponding connector in the termination board.

46) Make the field connections to plug J1, and re-insert into the corresponding connector in the outlet box.

47) Make field connections to plug J2, and re-insert into the corresponding connector in the outlet box.

FYI Communication wiring terminations inside the power/communication outlet box assembly are pass-through connections. This means that J1-pin 1 is associated with J2-pin 1; therefore, pin outs may be user-defined. This being the case, wiring instructions for this assembly are only suggestions.

CAUTION External wiring and connections should be performed by an experienced technician and follow the requirements of national and local codes.

48) Following the instructions included with unit, complete the seal between the DC power switch and the outlet box assembly.

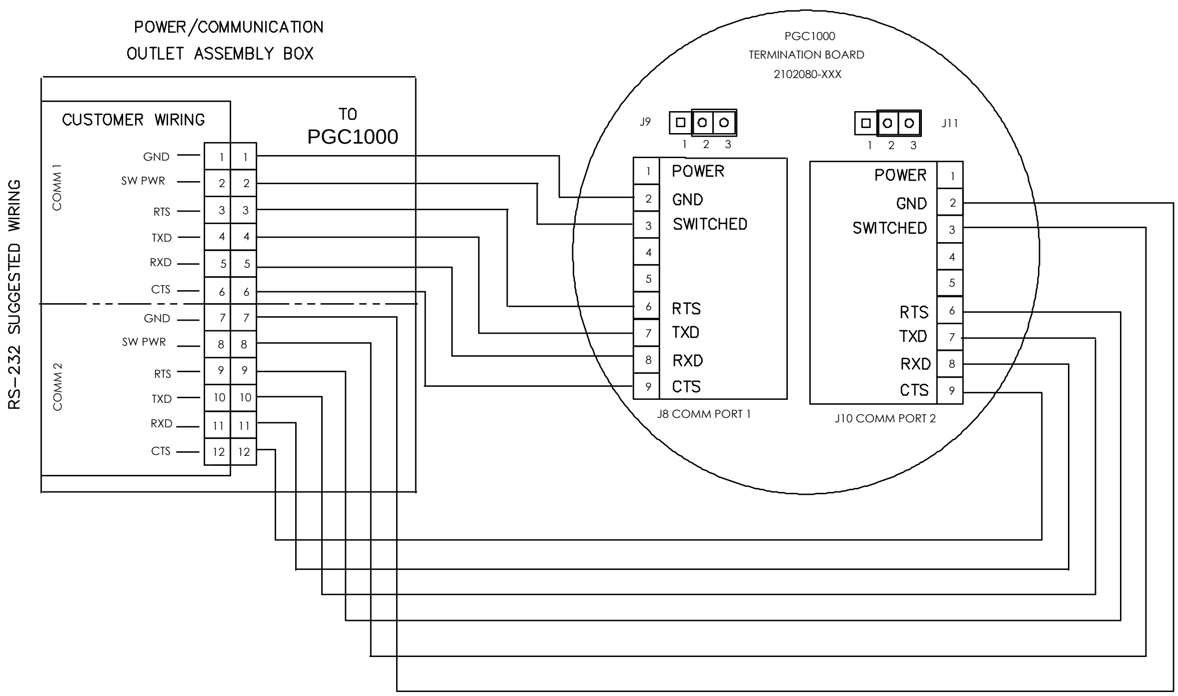


Figure 2-32 Suggested RS-232 Wiring Instructions

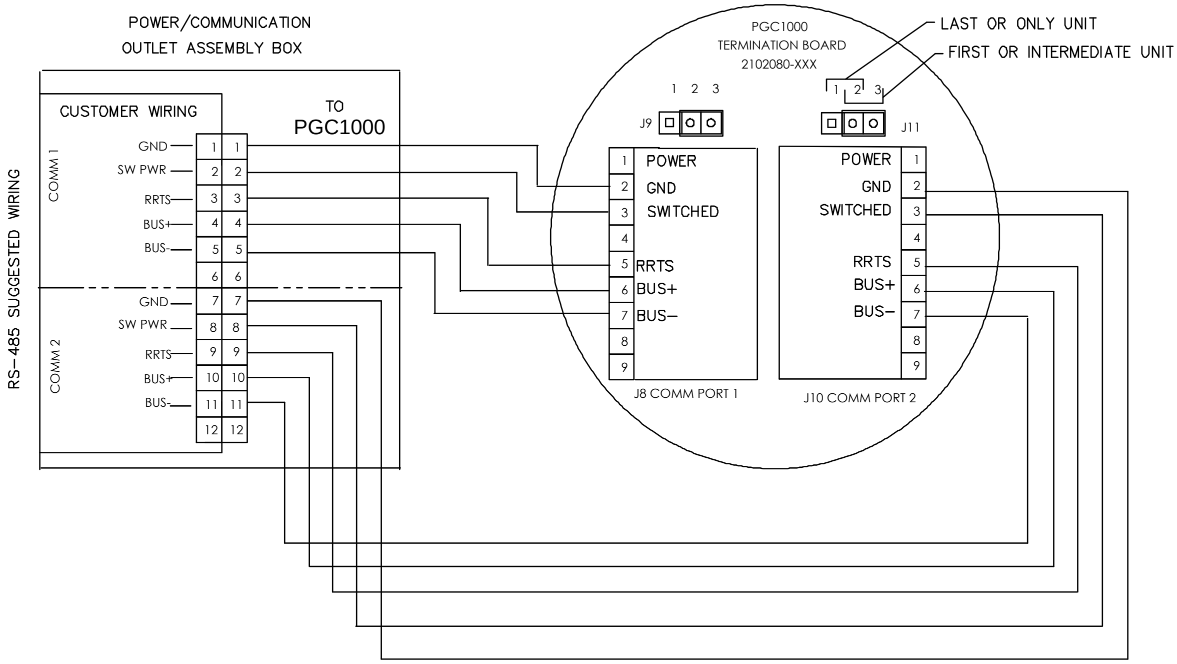


Figure 2-33 Suggested RS-485 Wiring Instructions

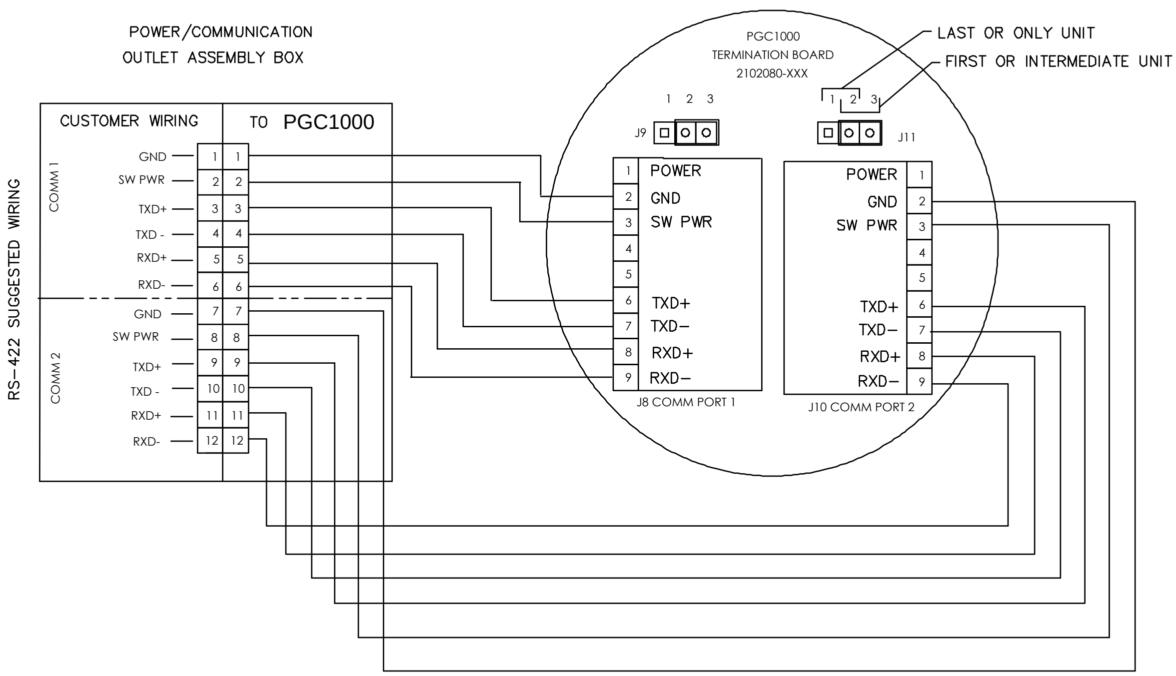


Figure 2-34 Suggested RS-422 Wiring Instructions

2.17 Carrier/Calibration Bottle Rack Installation on a Process Line

The carrier/calibration gas bottle rack is used to hold the carrier and calibration gas bottles on installations not using an ENC82. A gas regulator should be installed on each gas bottle (see Figure 2-35). This bottle rack is not available through ABB Totalflow; therefore, the instructions are generalized.

2.17.1 Instructions

1) Position the bottle rack in close proximity to the PGC1000.

2) Secure the rack to the process line with the provided mounting hardware.

3) Install both the carrier and calibration gas bottles in the rack.

4) Strap both bottles in the rack to prevent their falling.

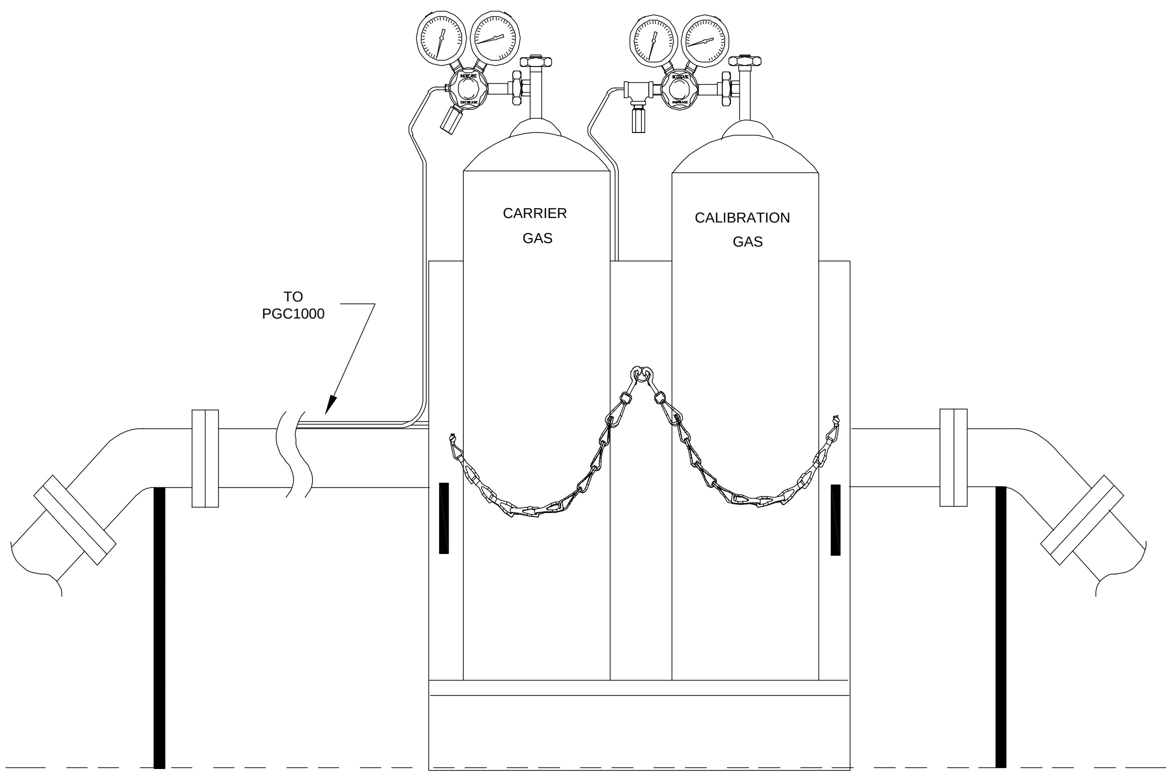


Figure 2-35 Carrier/Calibration Gas Bottle Rack Installation

2.18 ENC82 Carrier Gas Bottle Rack Installation

The carrier gas bottle rack is used to hold carrier gas bottles and is installed on the back of the ENC82L or the side of the ENC82S.

FYI 

A gas regulator should be installed on each gas bottle (see Figure 2-36).

2.18.1 Materials

- One (1) each - Bracket with chain assembly attached
- Two (2) each - 3/8”-16 x 5/8 SST hex head bolt
- Two (2) each - 3/8” SST split washers
- Two (2) each - 3/8” SST flat washers

2.18.2 Instructions

1) Locate bracket holes on the rear of the large enclosure or the side of the small enclosure stand.

2) Place a split washer then a flat washer on one of the 5/8” bolts. Upon completion, insert through the bolt hole that is located in the bottle rack bracket and into the corresponding hole located along the bottom edge of the enclosure. Tighten (see Figure 2-37).

FYI The enclosure hole contains a captive nut.

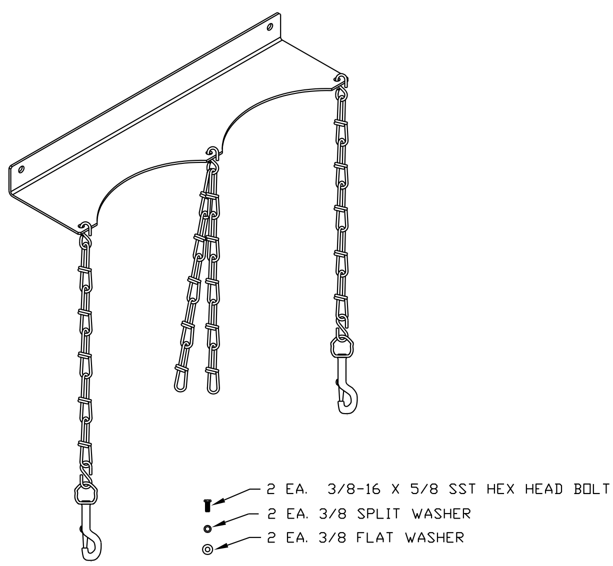


Figure 2-36 Dual Bottle Rack Assembly

3) Screw the bolt into the captive nut on the large enclosure or the nut provided with the small enclosure kit. Tighten.

4) Repeat for the second bolt.

5) Install the carrier gas bottle in the bottle rack.

6) Using chains, strap the bottle(s) to the rack by attaching the bolt snap to one of the center chains.

7) Repeat step 5 - 6 if installing a second bottle.

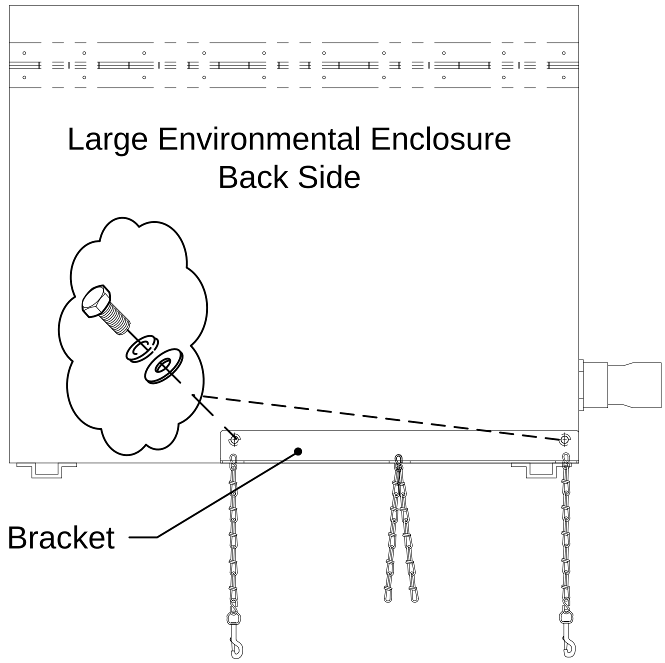


Figure 2-37 ***ENC82L–Dual Bottle Rack Installation***

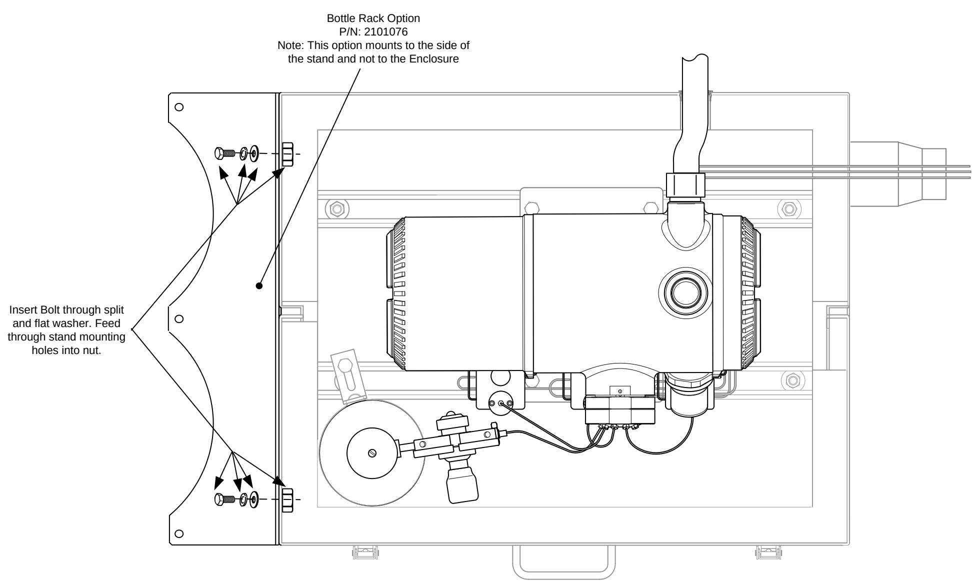


Figure 2-38 ENC82S–Dual Bottle Rack Installation

2.19 Carrier Gas Regulator Installation

The following instructions are valid for all installations.

2.19.1 Materials

- Carrier regulator assembly with low pressure switch (see Figure 2-39)
- Installed carrier gas bottle

FYI These instructions assume that the carrier gas bottle has previously been installed.

2.19.2 Instructions

1) Remove the protective cap from the high pressure inlet, if required.
2) Insert the ferrule on the regulator high pressure inlet into the carrier gas bottle outlet.
3) Screw the nut onto the thread. Tighten.

WARNING DO NOT connect the low pressure switch directly to the PGC1000 without a barrier.

4) Remove the J2 field wiring connector from the PGC1000 termination board that is located inside the rear of the enclosure (see Figure 2-40).
5) Using a small, flat-blade screwdriver, loosen DI1 pins 1 and 2.
6) Insert the red wire into the (+) terminal (pin 1).
7) Retighten pin 1.
8) Insert the black wire into the (-) terminal (pin 2).
9) Retighten pin 2.
10) Replace the termination connector in the J2 board connector.

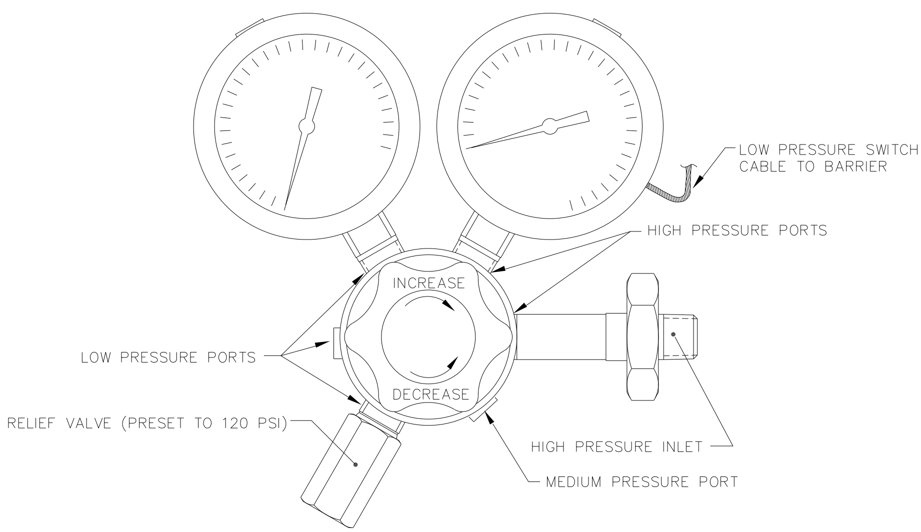


Figure 2-39 Carrier Gas Pressure Regulator with Relief Valve

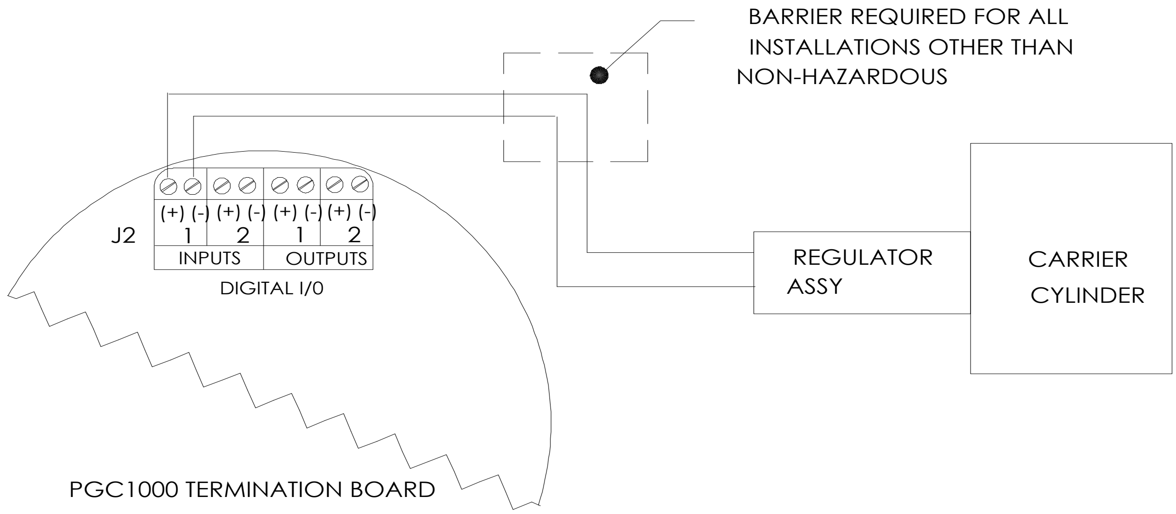


Figure 2-40 Carrier Gas Low Pressure Switch Wiring Instructions

2.20 ENC82L Calibration Gas Bottle Installation

The calibration gas bottle mounting rack is used to hold the calibration gas bottle when located inside of the large environmental enclosure. Refer to Figure 2-41.

FYI 

A gas regulator should be installed on each gas bottle.

2.20.1 Materials

- Strapping material (shipped with the environmental enclosure)
- Calibration gas blend bottle

2.20.2 Instructions

1) Locate the bottle bracket in the right front area of the environmental enclosure (see Figure 2-41).

2) Set the calibration bottle inside of the enclosure, situated against the bottle bracket.

3) Thread the strap through the holes in the bracket and around the bottle. Insert the end of strap into the worm gear.

4) Using a flat-blade screwdriver, turn the screw on the worm gear until the strap is snug.

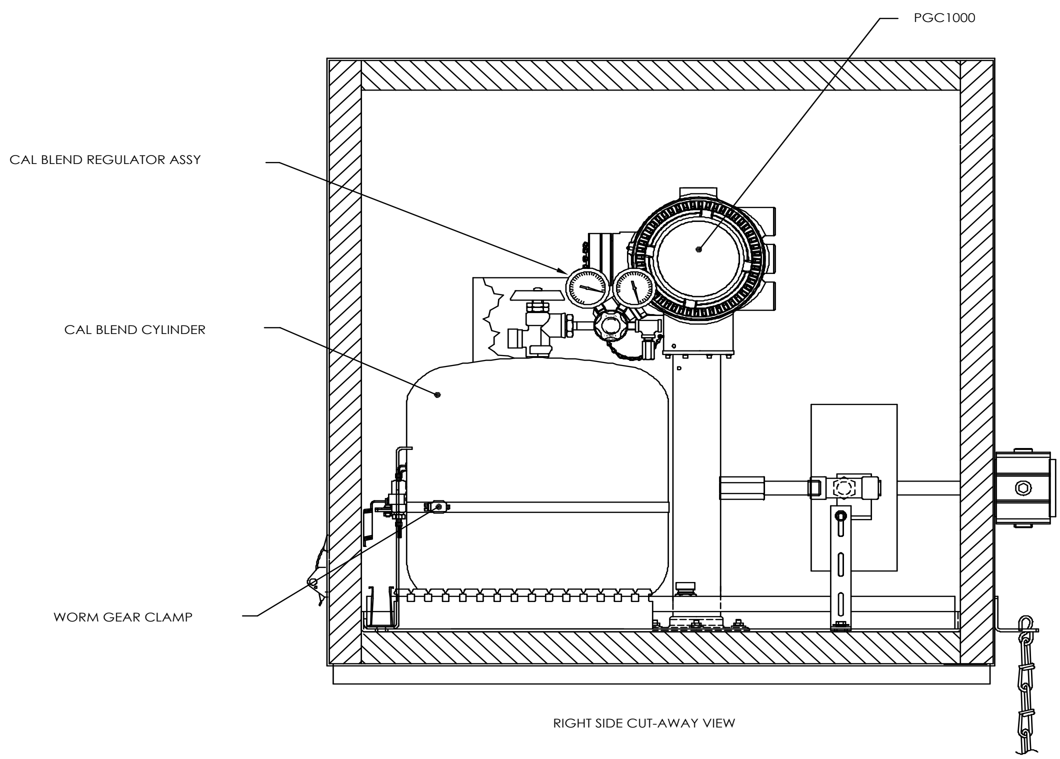


Figure 2-41 Calibration Bottle Location

2.21 ENC82S Calibration Gas Bottle Installation

The calibration gas bottle mounting rack is used to hold the calibration gas bottle when located inside of the small environmental enclosure. Refer to Figure 2-42.

FYI A gas regulator should be installed on each gas bottle.

2.21.1 Materials

- Strapping material (shipped with the environmental enclosure)
- Calibration gas blend bottle

2.21.2 Instructions

1) Locate the bottle bracket and the bottle clamp in the left front area of the environmental enclosure (see Figure 2-42).

2) Loosen the worm drive clamp, if needed, so that the calibration bottle may be inserted through the clamp.

3) Set the calibration bottle inside of the clamp, situated against the bottle bracket.

4) Using a flat-blade screwdriver, turn the screw on the worm gear until the strap around bottle is snug.

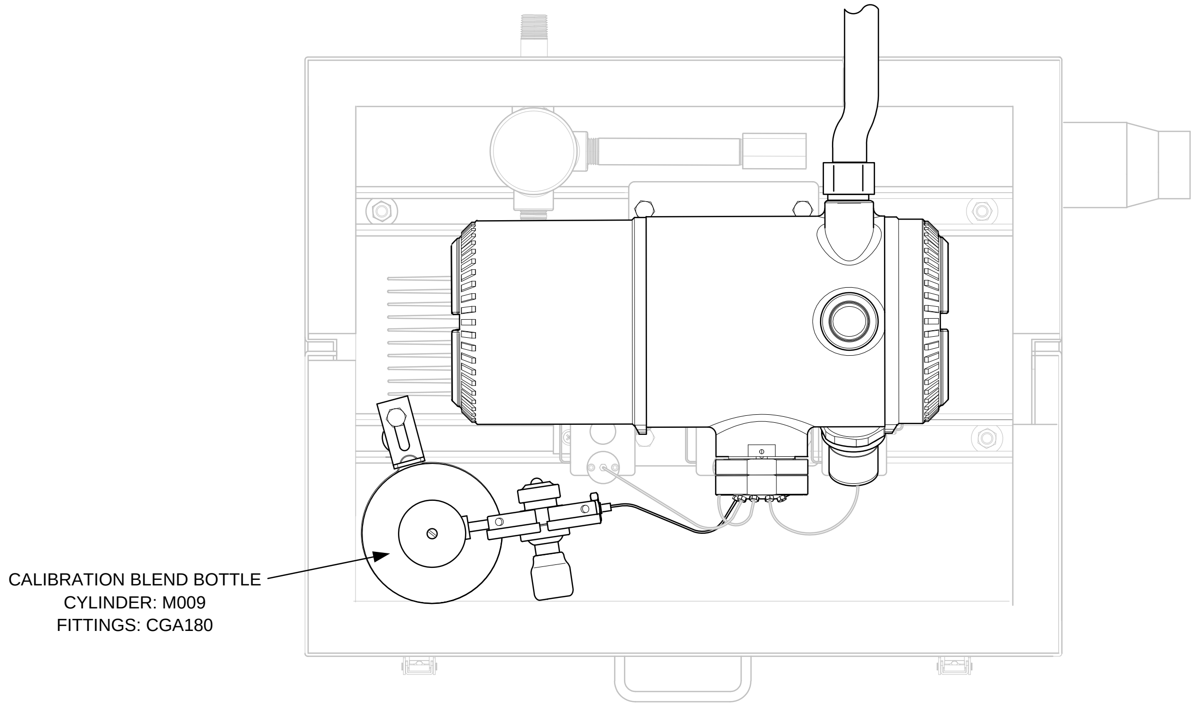


Figure 2-42 Calibration Bottle Location

2.22 Calibration Gas Regulator Installation

The following instructions are valid for all installations.

2.22.1 Materials

- Calibration blend regulator assembly with low pressure switch (see Figure 2-43)
- Installed calibration gas bottle

2.22.2 Instructions

FYI These instructions assume that the carrier gas bottle has previously been installed.

1) Remove the protective cap from the high pressure inlet, if required.

2) Insert the ferrule on the regulator high pressure inlet into the calibration gas bottle outlet.

3) Screw the nut onto the thread, and tighten.

WARNING DO NOT connect the low pressure switch directly to the PGC1000 without a barrier.

4) Remove the J2 field wiring connector from the PGC1000 termination board that is located inside the rear of the enclosure (see Figure 2-44).

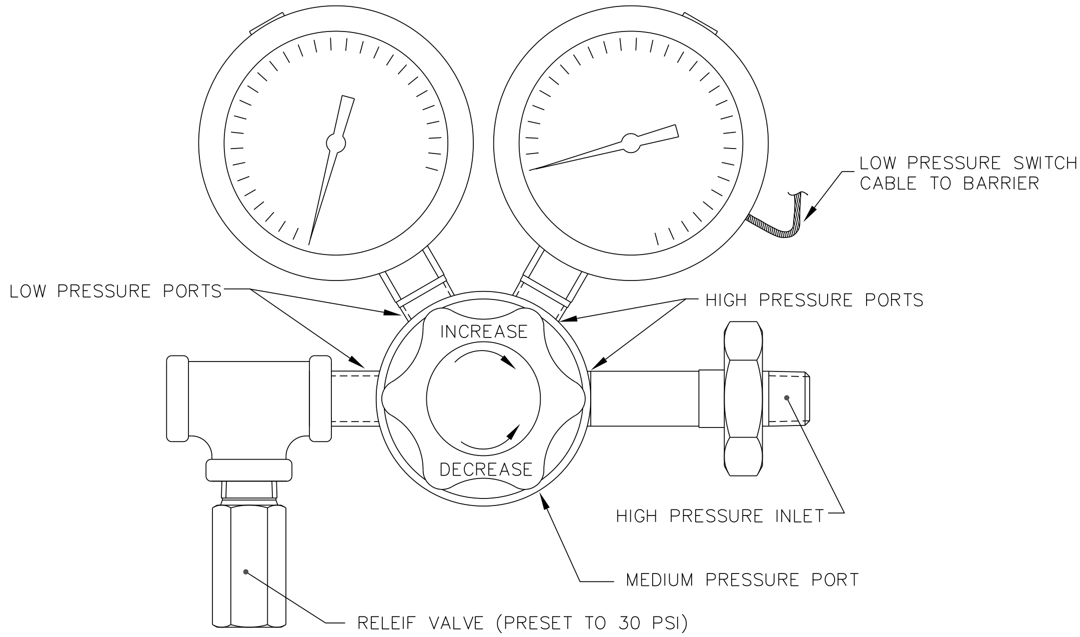


Figure 2-43 Calibration Gas Pressure Regulator with Relief Valve

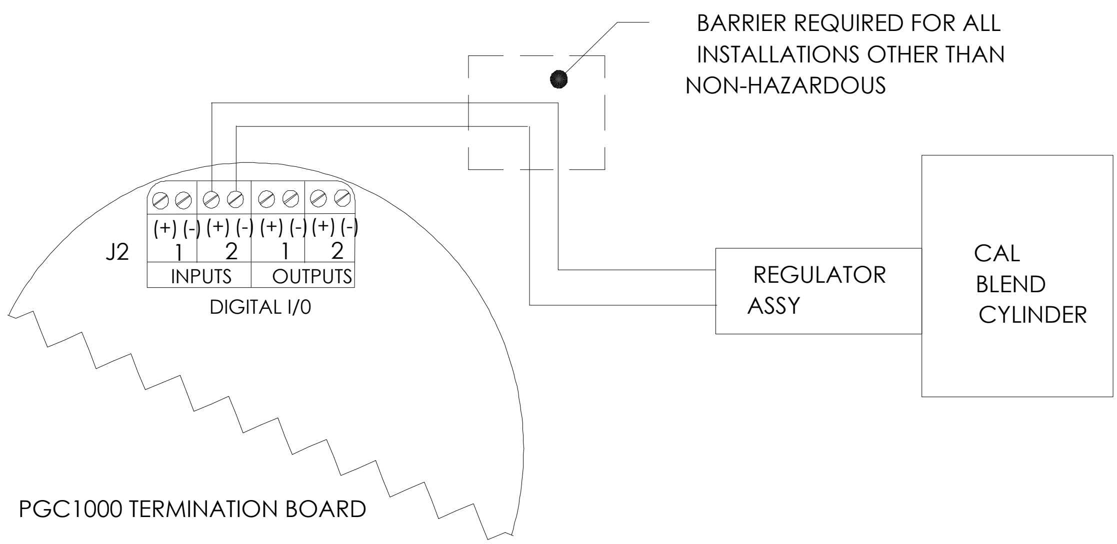


Figure 2-44 Calibration Blend Low Pressure Switch Wiring Instruction

5) Using a small, flat-blade screwdriver, loosen the DI2 pins 3 and 4.

6) Insert the red wire into the (+) terminal (Pin 3).

7) Retighten pin 3.

8) Insert the black wire into the (-) terminal (pin 4).

9) Retighten pin 4.

10) Replace the termination connector in the J2 board connector.

2.23 Carrier Gas and Calibration Gas Connections

The following procedures describe the steps for connecting the external carrier gas and calibration gas lines from their respective regulators to the feed-through assembly on the PGC1000. They are applicable for both a process line and ENC82 installation.

2.23.1 Materials

- Installed carrier gas pressure regulator
- 1/16” SST chromatography grade transport tubing (Amount to be determined by the technician and is based on the distance from the carrier gas bottle regulator to the sample input filter)
- Installed calibration gas pressure regulator
- 1/16” SST chromatography grade transport tubing (Amount to be determined by the technician and is based on the distance from the calibration gas bottle regulator to the sample input filter)
- Four (4) each - 1/16” ferrule and nut
- Two (2) each - ¼” NPT to 1/16” reducer or other size, as determined from the carrier/calibration gas regulator

FYI These instructions assume that the regulators and gas bottles have previously been installed.

2.23.2 Instructions

1) Locate the carrier gas input port (CAR) on the PGC1000 feed-through assembly (see Figure 2-45).

2) Locate the ¼” low pressure output fitting on the installed pressure regulator.

3) Measure and cut the 1/16” SST tubing to the required length.

4) Make the necessary bends in the tubing to ease the installation of the tubing into the PGC1000 and the pressure regulator.

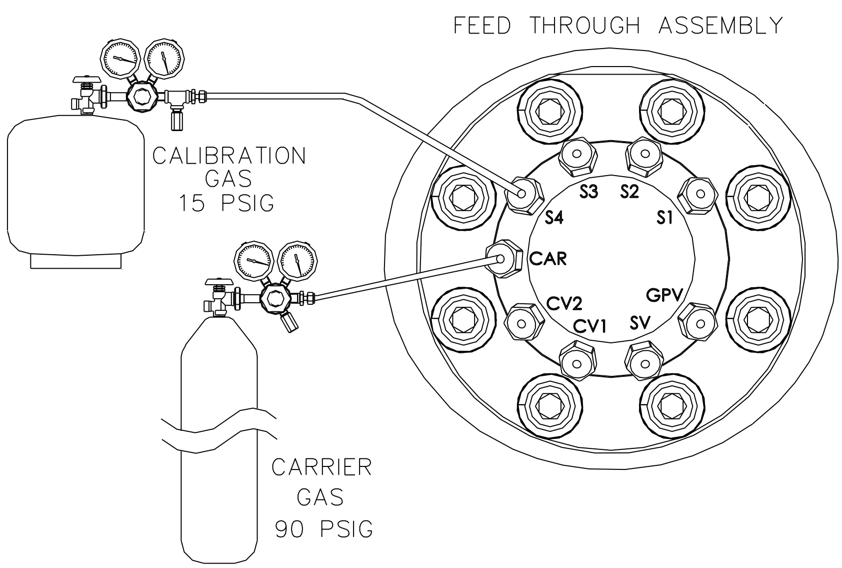


Figure 2-45 Carrier and Calibration Gas Connections

TIP Tube, ferrule and nut should always enter the connection at a right angle.

5) Install the reducer into the carrier gas regulator.

6) Insert the tube with the ferrule into the reducer/pressure regulator output fitting. Move the nut down onto the ferrule, screw onto the fitting and tighten.

7) Carrier gas pressure should be set at 90 PSIG.

8) Purge the air from the transport tubing by opening the shut-off valve. This is located on the regulator.

WARNING Follow the requirements of national and local codes when performing this purge.

9) Insert the tube with the ferrule into the CAR on the feed-through assembly. Move the Valco® nut down onto the ferrule, screw into the port and tighten.

10) Determine the input port for the calibration gas (typically S4) on the PGC1000 feed-through assembly (see Figure 2-45).

11) Locate the ¼" low pressure output fitting on the installed pressure regulator on the calibration gas bottle.

12) Measure and cut the 1/16" SST tubing to the required length.

13) Make the necessary bends in the tubing to ease installation of the ferrule and tubing into the PGC1000 and pressure regulator.

TIP Tube, ferrule and nut should always enter the connection at a right angle.

14) Install the reducer into the calibration gas regulator, if required.

15) Insert the tube with the ferrule into the reducer/pressure regulator output fitting. Move the nut down onto the ferrule, screw onto the fitting and tighten.

16) Calibration gas pressure should be set at 15 PSIG.

17) Purge the air from the transport tubing by opening the shut-off valve. This is located on the regulator.

WARNING Follow the requirements of national and local codes when performing this purge.

18) Insert the tube with the ferrule into the calibration gas input port (S4) on the feed-through assembly. Move the Valco® nut down onto the ferrule, screw into the port and tighten.

WARNING Leak test ALL gas connections when completed.

2.24 Vent Line Connections

The following procedure provides general steps for connecting the external vent lines from the respective output ports on the feed-through assembly. When the PGC1000 is installed in a ENC82, the sample vent line MUST vent outside of the

ENC82. Other installations may only require short lines. Please follow the requirements of national and local codes during this installation.

2.24.1 Materials

- Four (4) each - 1/16” ferrule and nut
- Four (4) each - 1/16” SST vent tubing (supplied with PGC1000) or
- Four (4) each - 1/16” SST tubing (Amount to be determined by the technician and is based on the distance from the PGC1000 to the external vent location)

2.24.2 Instructions

1) Locate the gauge port vent (GPV), sample vent (SV), column vent 1 (CV1) and column vent 2 (CV2) ports on the PGC1000 feed-through assembly (see Figure 2-46). Remove the sealing screws for the vent ports.

2) Using the supplied vent tubing (if sufficient length) and ferrule, place the nut and ferrule onto the short end of the bent tubing. Insert the tubing and ferrule into one of the vent ports with the open end of the tubing pointing down. Move the Valco® nut down onto the ferrule, screw into the port and tighten.

If the vent tubing is not of sufficient length, measure and cut the new tubing (not supplied by ABB Totalflow). Make the necessary bends to install the tubing. Place the nut and ferrule onto the corresponding end of the tubing. Insert the tubing and ferrule into one of the vent ports. Be careful to keep the tubing horizontal with the open end of the tubing pointing down. Move the Valco® nut down onto ferrule, screw into the port and tighten.

3) Repeat step 2 for ALL other vents, as listed in step 1.

CAUTION All four vents MUST be open to atmospheric pressure without back pressure. Position the vent tubing in a downward direction so that moisture does not accumulate in the tubing.

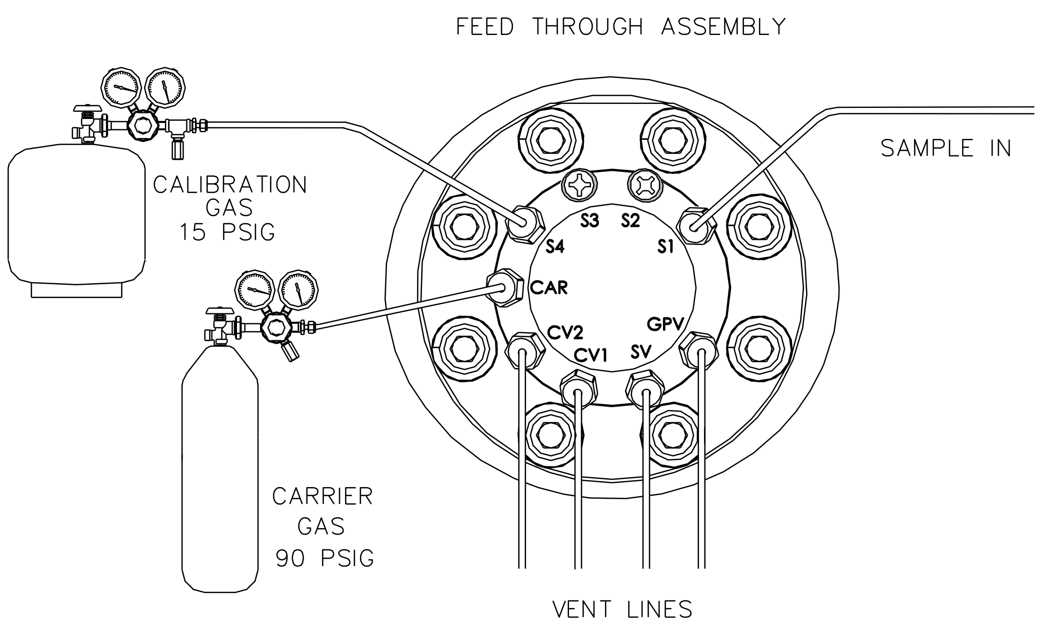


Figure 2-46 Vent Line Connections on Feed-Through Assembly

2.25 ENC82L Optional Catalytic Heater Installation

Environmental Enclosure The following procedures describe the steps for installing a catalytic heater for the environmental enclosure.

WARNING Verify the heater and fittings are approved for the classification rating of the area of installation.

FYI These instructions are only applicable to the large environmental enclosure. In the small environmental enclosure, the catalytic heater is already installed.

2.25.1 Materials

- Catalytic heater (installed at factory)
- Thermostat assembly with temperature probe
- Regulator assembly with shut-off
- T-assembly
- Tubing
- Filter/Drain assembly
- Temperature probe mounting clip
- Teflon® tape
- ¼" male pipe connection from external gas source to catalytic heater. Materials for gas source are not provided by ABB Totalflow. Quantities and materials are to be determined by the technician and are based on installation and local codes.
- DC power source wiring. Materials for the external power source for electrical preheat wiring are not provided by ABB Totalflow. Quantities and materials are to be determined by the technician and are based on installation and local codes.

2.25.2 Instructions

1) Locate the installed catalytic heater on the rear of the environmental enclosure (see Figure 2-47).

2) Remove the protective end cap from the catalytic heater input fitting, if required.

3) Apply Teflon® tape to the threads at the male end of the T-assembly (see Figure 2-48).

4) Screw the threaded end of the T-assembly into the ¼" female fitting located on the factory-installed catalytic heater. This is accomplished by turning the entire assembly clockwise until tight (see Figure 2-49).

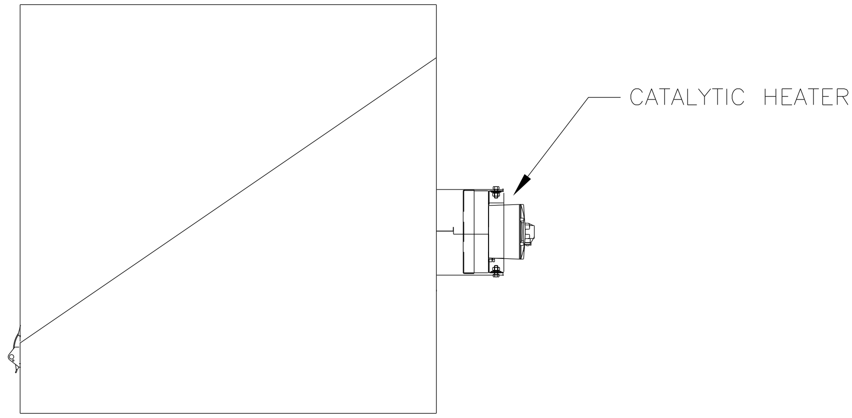


Figure 2-47 Catalytic Heater Option in Environmental Enclosure

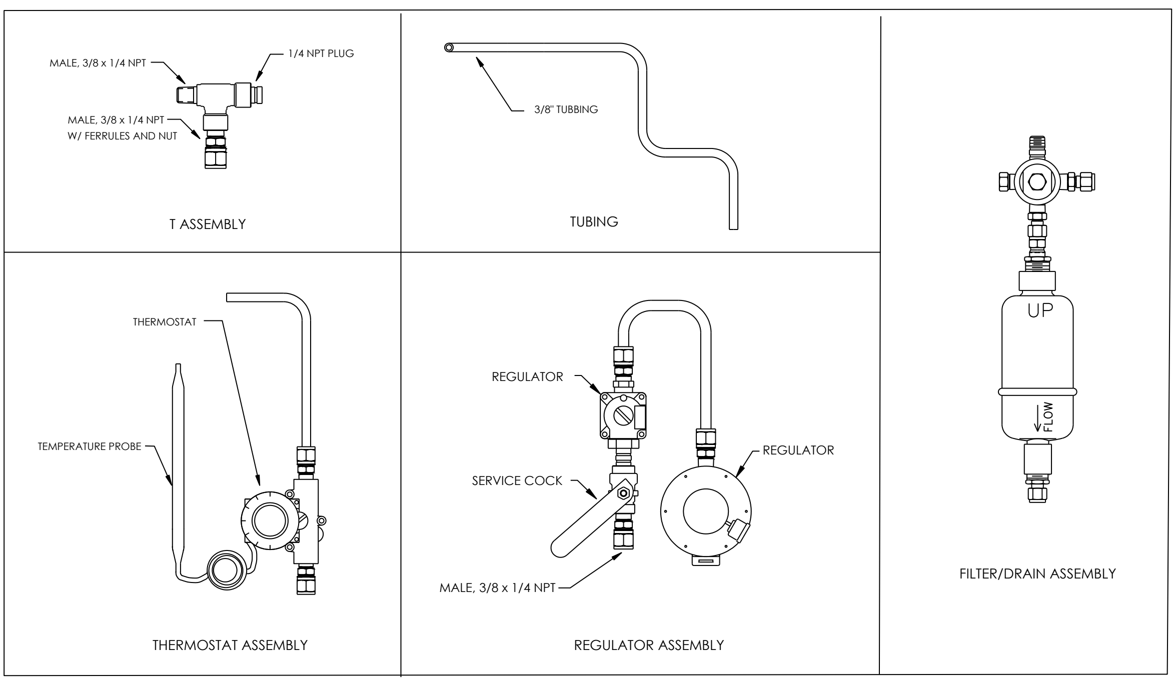


Figure 2-48 Catalytic Heater Assemblies

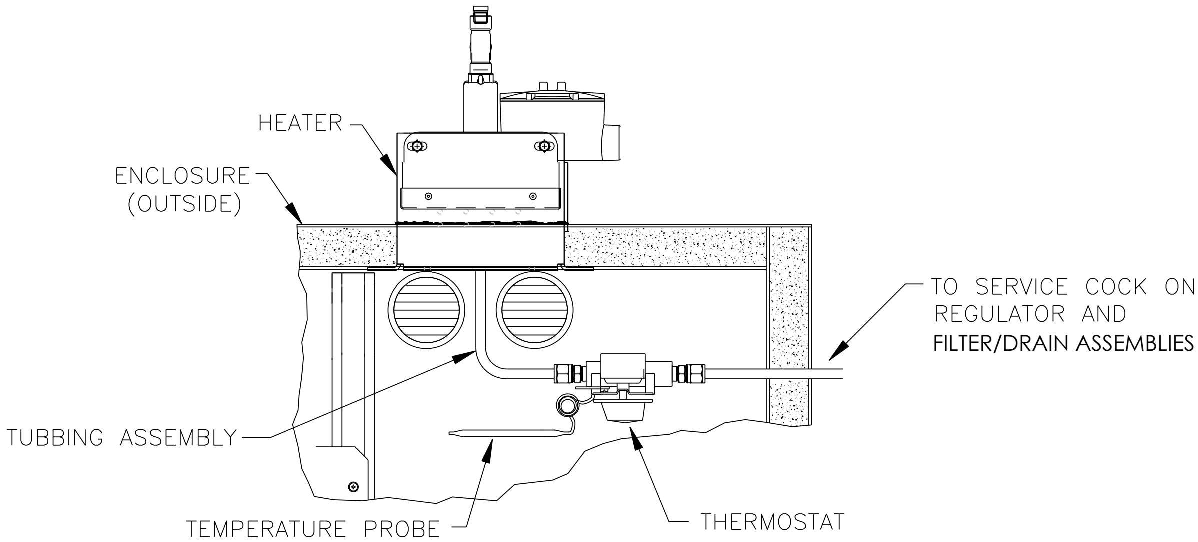


Figure 2-49 Thermostat Assembly Installed

5) Screw the threaded end of the T-assembly into the ¼" female fitting located on the factory installed catalytic heater. This is accomplished by turning the entire assembly clockwise until tight (see Figure 2-50).

6) Remove the ferrules and nut from the bottom of the T-assembly. Apply Teflon® tape to the threads.

7) Insert the short, bent end of the 3/8" tubing closest to the longest straight portion of the tubing and then through hole located below the catalytic heater.

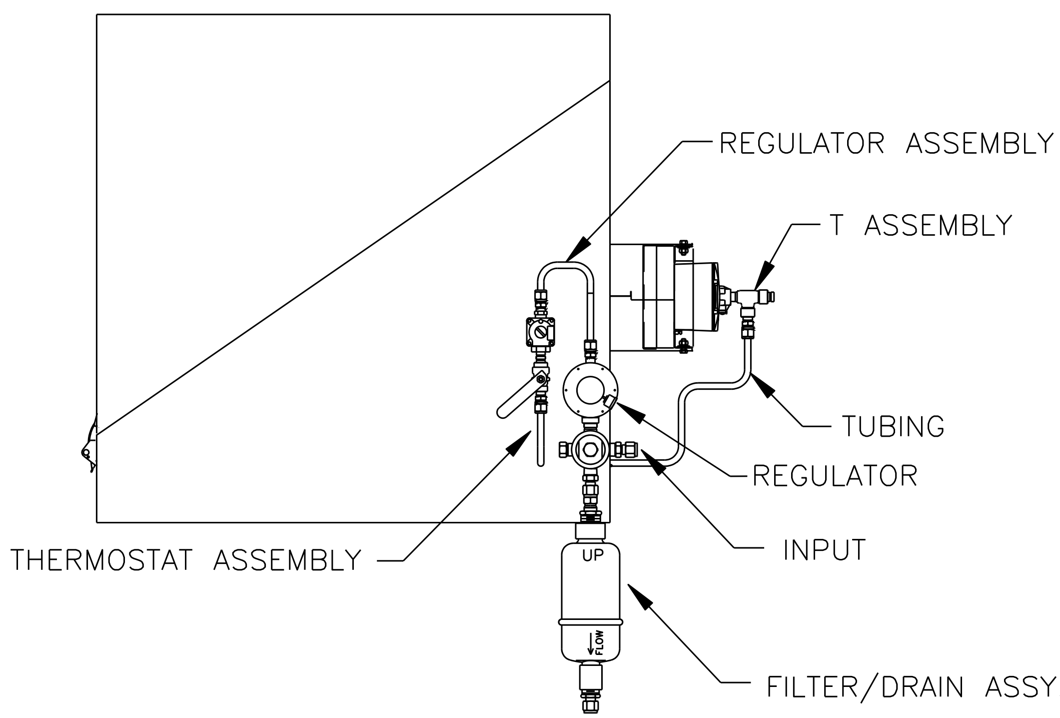


Figure 2-50 Regulator and Filter/Drain Assembly Installed

8) Place the nut, front ferrule and back ferrule onto the opposite end of the tubing. Position so that the ferrules and nut screw onto the bottom of T-assembly. Screw nut until tight.

9) Remove the ferrules and nut from the thermostat end of the thermostat assembly. Apply Teflon® tape to the threads.

10) Insert the tube end of the thermostat assembly through the exterior wall on the side of the enclosure (see Figure 2-50).

11) Place the nut, front ferrule and back ferrule onto the end of the 3/8" bent tubing inside of the enclosure. Position the thermostat assembly so that the nut and ferrules screw onto the thermostat assembly.

12) Remove the ferrules and nut from the end of the regulator assembly closest to the service cock. Apply Teflon® tape to the threads.

13) Place the nut, front ferrule and back ferrule onto the end of the thermostat assembly that is protruding from the enclosure.

14) Hold the regulator assembly with the curved tubing up above the protruding tubing. Screw the ferrules and nut onto the nipple (see Figure 2-50).

15) Apply Teflon® tape to the port one nipple on the filter/drain assembly.

16) Insert the port one nipple on the filter/drain assembly into the output port on the regulator. Upon completion, tighten the nut.

17) Gently uncoil the temperature probe capillary tubing from the thermostat, and insert through the hole that is located below the thermostatic gas valve. Be careful to not crimp or make sharp bends in the capillary tubing (see Figure 2-51).

18) Remove the mounting screw and washers from right rear PGC1000 mounting bracket (see Figure 2-51).

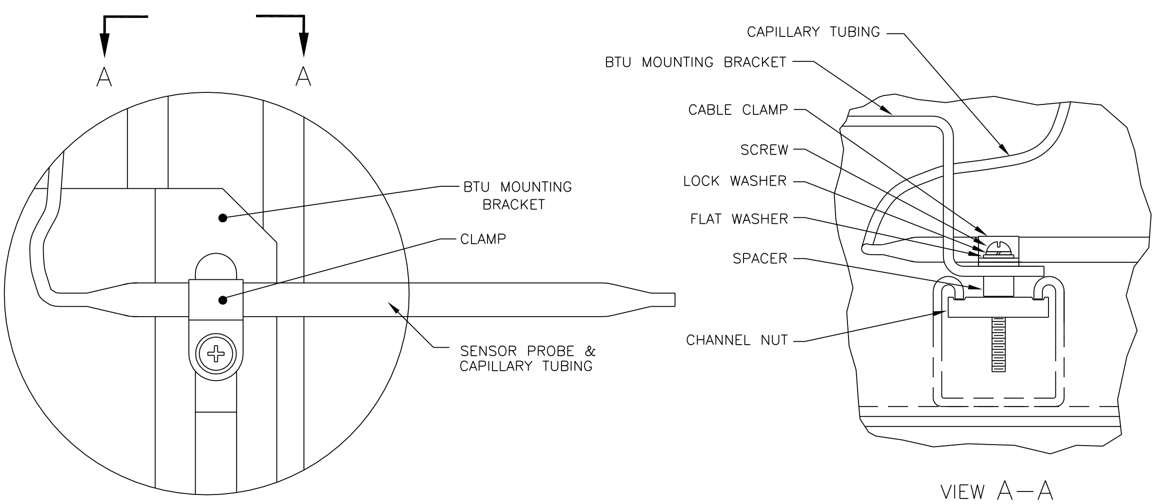


Figure 2-51 Temperature Probe Installation

19) Insert the screw with the washers still in place through the hole located on the mounting clip, and re-insert through the mounting bracket into the channel nut (see Figure 2-51).

20) Position the probe underneath the mounting clip. Tighten the screw into the channel nut to hold the probe in place.

WARNING The technician responsible for installing the gas supply should follow local and national codes.

21) Using the regulator manufacturer's instructions supplied with regulator, make the external gas connections.

WARNING The technician responsible for installing the power supply should follow local and national codes.

22) Using the wiring instructions shown in Figure 2-52 and the manufacturer's instructions enclosed with heater, make the external connections.

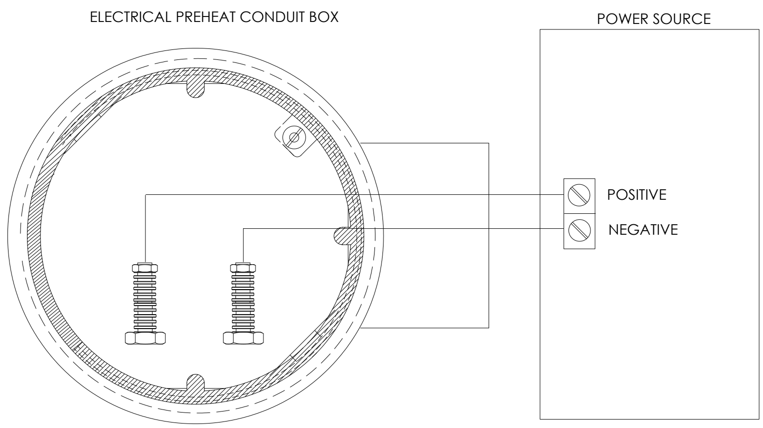


Figure 2-52 Electrical Pre-Heater Wiring Instructions

2.26 ENC82S Optional Catalytic Heater Installation

Environmental Enclosure These instructions are only applicable to the small environmental enclosure (ENC82S).

WARNING Verify the heater and fittings are approved for the classification rating of the area of installation.

If the optional catalytic heater is configured for the small environmental enclosure, external gas connections, electrical pre-heater wiring and installation of the filter drain kit are the only things required.

2.26.1 Materials

- Teflon® tape
- ¼" male pipe connection from external gas source to catalytic heater. Materials for the gas source are not provided by ABB Totalflow. Quantities and materials are to be determined by the technician and are based on installation and local codes.
- DC power source wiring. Materials for the external power source for the electrical preheat wiring are not provided by ABB Totalflow. Quantities and materials are to be determined by the technician and are based on installation and local codes.

2.26.2 Instructions

WARNING The technician responsible for installing the gas supply should follow local and national codes.

1) Using the regulator manufacturer's instructions supplied with regulator, make the external gas connections.
2) Apply Teflon® tape to the port one nipple on the filter/drain assembly.
3) Insert the port one nipple on the filter/drain assembly into the output port on the regulator. Tighten the nut (see Figure 2-53).

WARNING The technician responsible for installing the power supply should follow local and national codes.

4) Using the wiring instructions shown in Figure 2-52 and the manufacturer's instructions enclosed with heater, make the external connections.

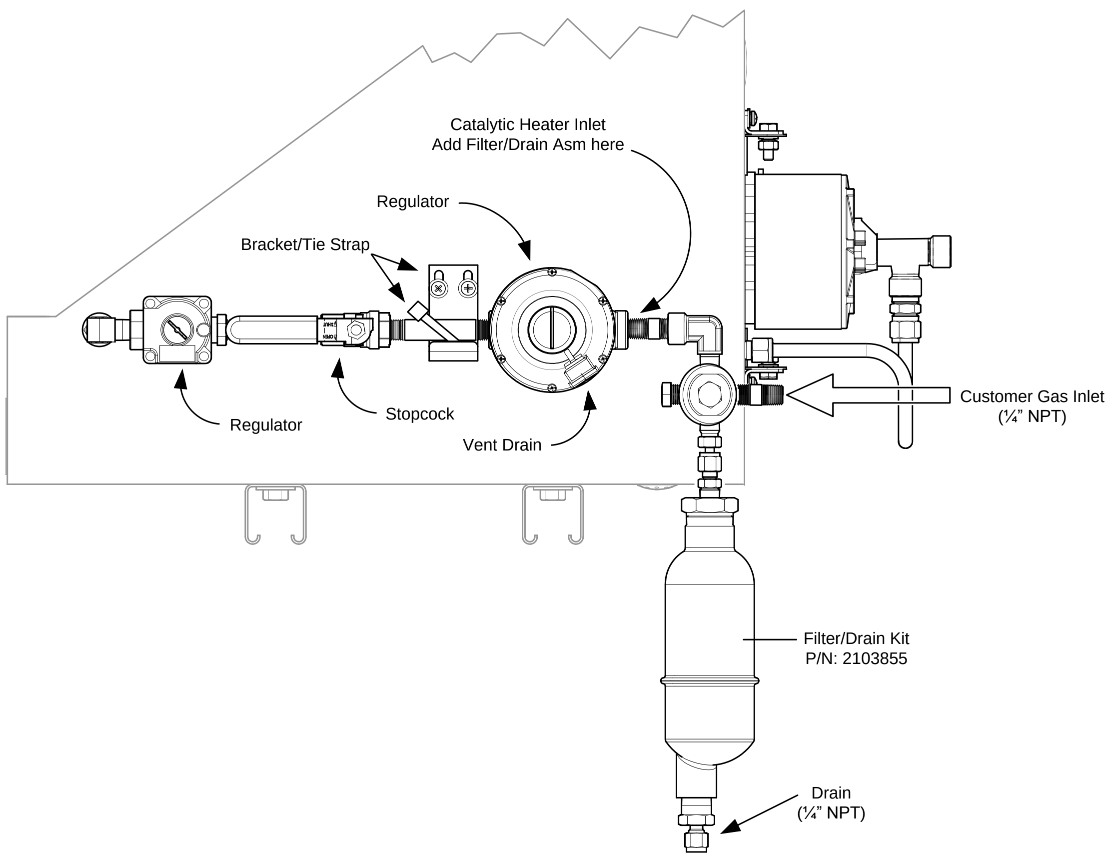


Figure 2-53 ENC82S Filter/Drain Assembly Installation

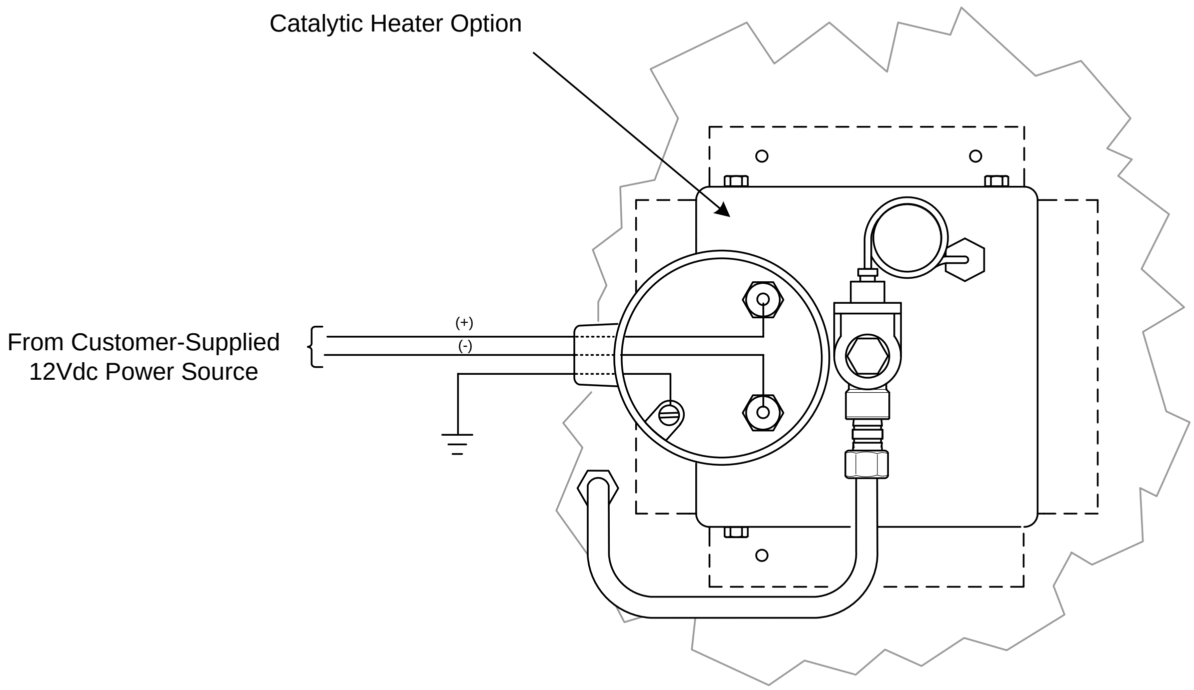
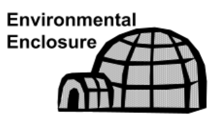


Figure 2-54 ENC82S Catalytic Heater Pre-Heat Wiring

2.27 ENC82 Optional Electric Heater Installation



The following procedures describe the steps for wiring an electric heater for the environmental enclosure.

Verify the heater and fittings are approved for the classification rating of the area of installation.

2.27.1 Materials

- Electric heater option (Factory Installed. See Figure 2-55 and Figure 2-56).
- AC power source wiring. Materials for external power source for electric heater wiring are not provided by ABB Totalflow. Quantities and materials are to be determined by the technician and are based on installation and local codes.

The technician responsible for installing the power supply should follow local codes.

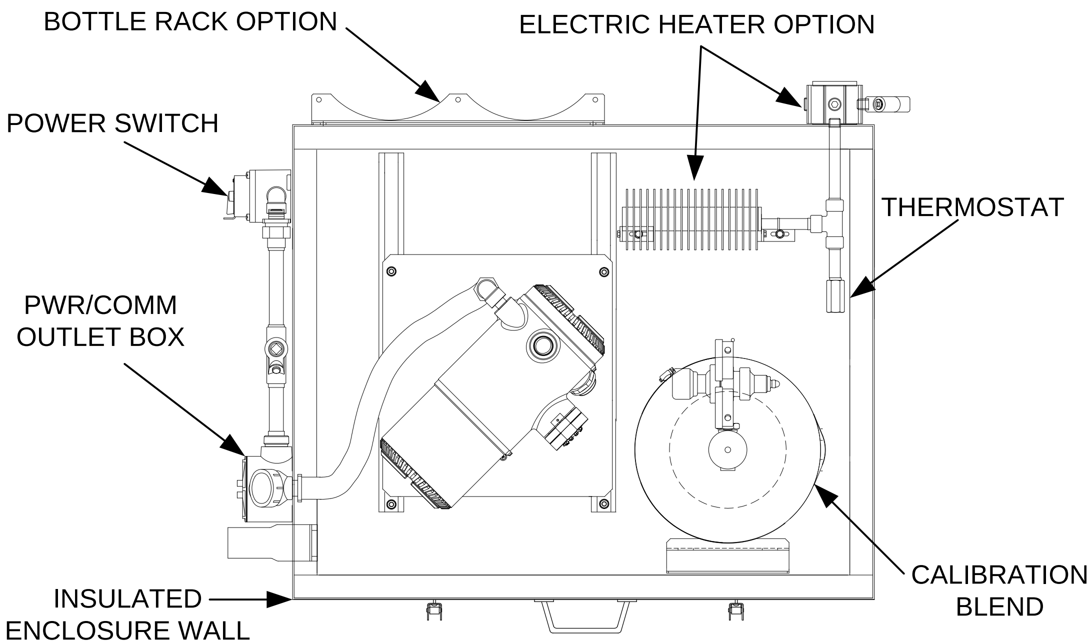


Figure 2-55 ENC82L Electric Heater Installed in Enclosure

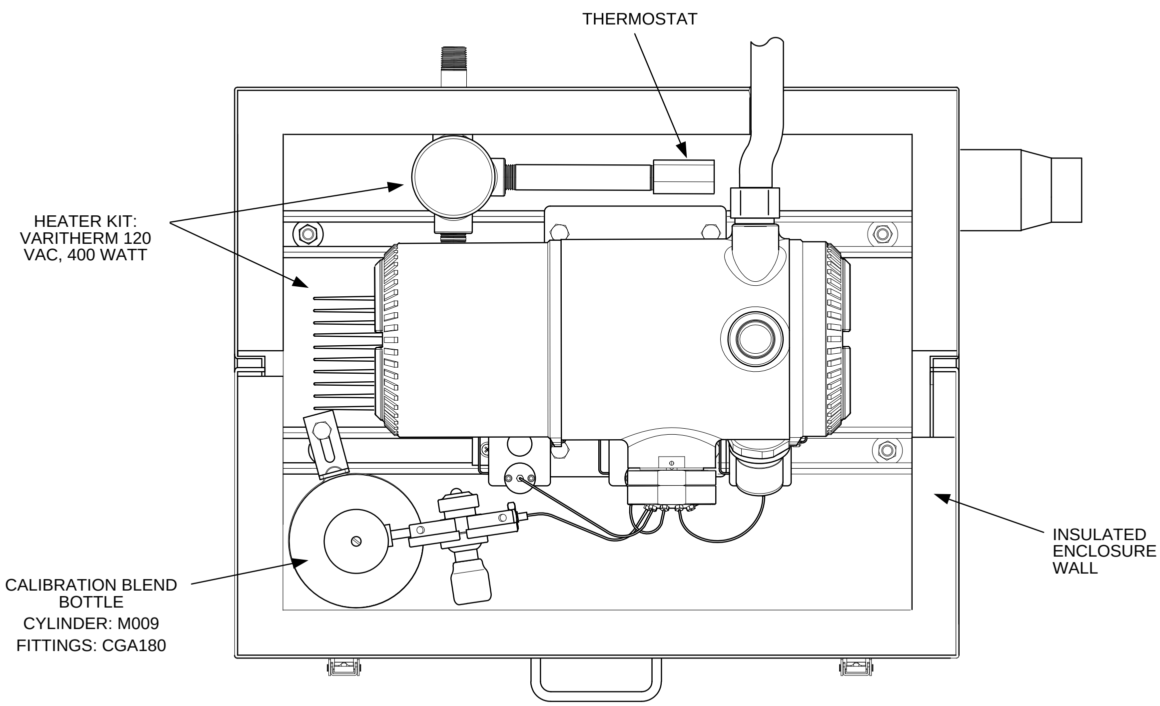


Figure 2-56 ENC82S Electric Heater Installed in Enclosure

2.27.2 Instructions

1) Using the wiring instructions shown in Figure 2-57 or the manufacturer's instructions enclosed with the heater, make the external connections.

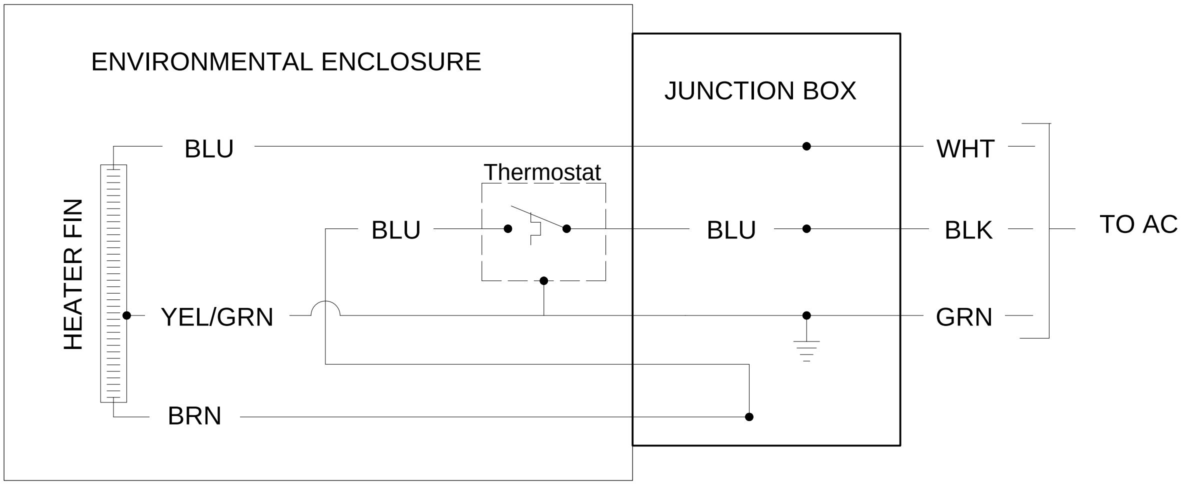


Figure 2-57 ENC82L Electric Heater Option Wiring Instructions

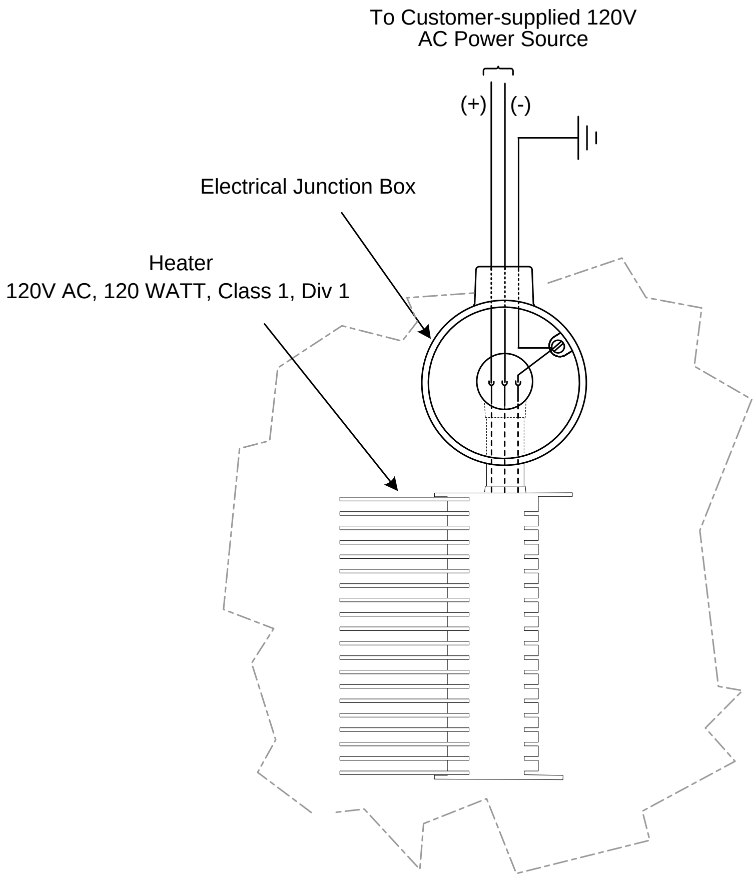


Figure 2-58 ENC82S Electric Heater Option Wiring Instructions

2.28 Sealing Environmental Enclosure

Environmental Enclosure

When all sample and vent tubing has been installed and leak tested, the sample boot must be sealed. The following procedures describe the steps for sealing the environmental enclosure.

2.28.1 Customer Supplied Materials

- Aerosol insulating foam

2.28.2 Instructions

1) When all sample and vent connections are complete, apply aerosol insulating foam from inside the enclosure. The user needs to ensure that they are pointing toward the outside of boot. Make sure that the overspray falls outside the enclosure.

2.29 Optional Equipment Enclosure Installation

If the optional equipment enclosure is used, it may be configured to include other options including, but not limited to, a battery pack to provide reserve power to the PGC1000, communication equipment, solar power charger and additional I/O.

Three enclosures are commonly used for the PGC1000 installation: the 6200, 6700 or 6800 enclosures. The unit may be mounted on a 2” pipe or mounted on a flat surface such as a wall.

If configured, the battery and solar panel are packed and shipped separately from the enclosure.

Before beginning, review the procedures and the materials required for the installation. Inspect all power cables where they terminate and the connector for breakage.

WARNING

The optional equipment enclosure may be approved for classified hazardous locations or potentially explosive atmospheres. Verify the rating listed on the unit tag, and install per the referenced control drawing. Be sure to follow the requirements of national and local codes when installing the optional equipment enclosure.

FYI

If using a battery(s) to power the device, ensure that the mounting method is capable of supporting the weight of the complete installation.

2.29.1 6200 Enclosure

The 6200 enclosure can accommodate the following equipment:

- Power supply kit for 6200
  - 110/240 Volt to 12 Vdc
  - 110/240 Volt to 24 Vdc

The 6200 installation will be for AC and 24 Vdc sites. There is no battery-backed option in this installation.

2.29.2 6700 Enclosure

The 6700 enclosure can accommodate the following:

- Power supply kit
    - 120/240 Vac / 12 Vdc power supply
    - 110/240 Volt to 12 Vdc
    - 110/240 Volt to 24 Vdc

2.29.3 6800 Enclosure

The 6800 enclosure can accommodate the following:

- Solar panel power option (12 or 24 Vdc option)
- 115/230 Vac UPS power option (24 Vdc systems only)

2.29.4 Location

Mount the enclosure on a nearby wall, panel or pole. Make sure that the approved conduit can be installed between the power supply's enclosure and the PGC1000. Avoid obstructions.

2.29.5 Pipe-Mount Instructions

The enclosure mounting brackets and fastening hardware are supplied with the unit. The user must provide a 2" pipe of suitable length (see Figure 2-59).

If a charging source such as a solar panel is preferred, this procedure may be adapted to mount the solar panel on the upper portion of the pipe.

The instructions assume the mounting pipe has been previously installed. If not, refer to the previous installation sections within this chapter for either free-standing pipe installation or pipe-saddle installation.

1) When the unit is received, unpack and inspect all components for evidence of damage. Report damage to the shipping carrier and to ABB Totalflow's service department.

2) Using instructions supplied with mounting kit, attach the bracket to the back of the enclosure unit.

3) Position the unit on the 2" mounting pipe, and secure in place with two U-bolts, split washers, flat washers and two bolts (see Figure 2-59, Figure 2-60 and Figure 2-61).

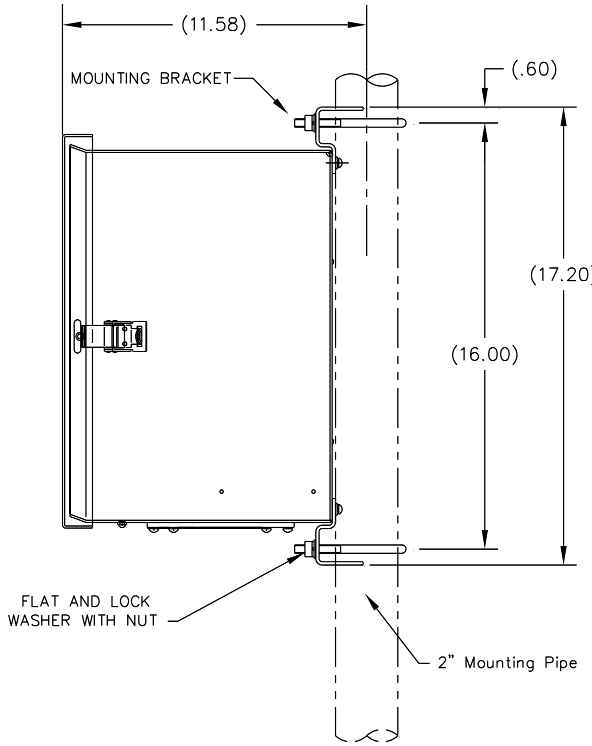


Figure 2-59 6200 Enclosure Pipe-Mounting Installation

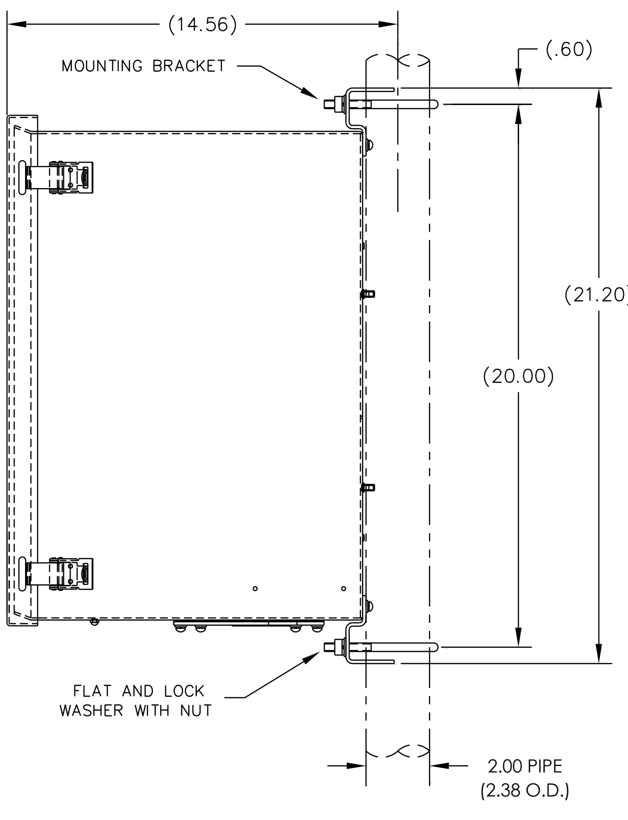
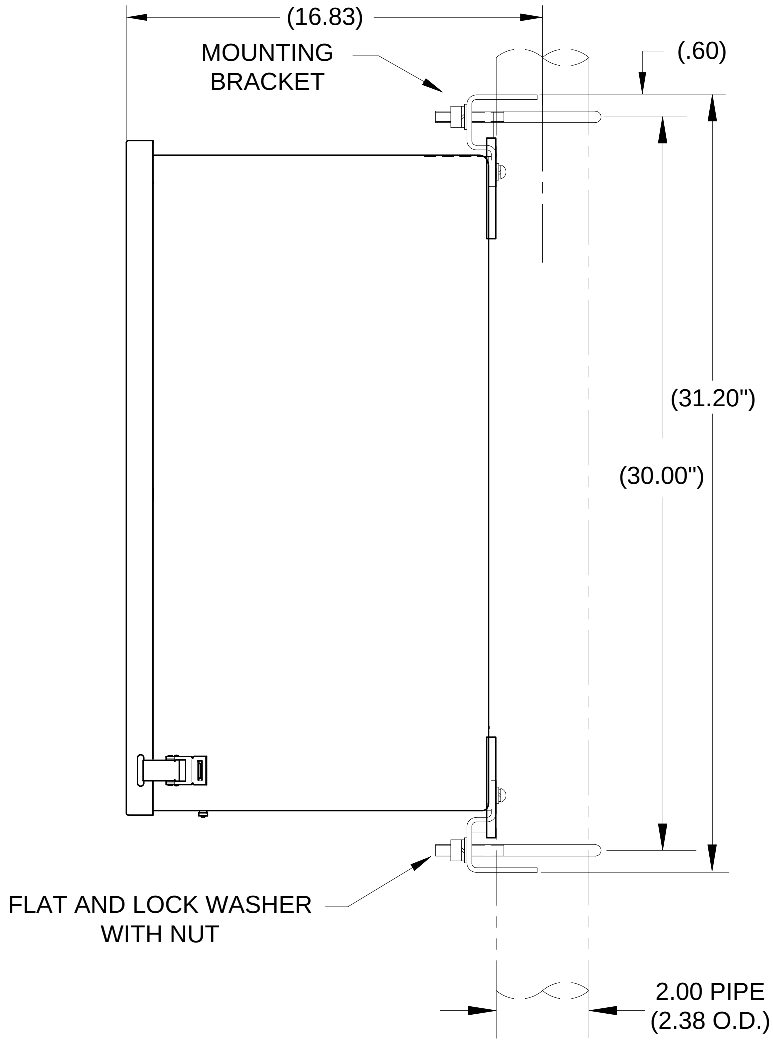


Figure 2-60 6700 Enclosure Pipe-Mounting Installation


(16.83)
MOUNTING
BRACKET
(.60)
(31.20")
(30.00")
FLAT AND LOCK WASHER
WITH NUT
2.00 PIPE
(2.38 O.D.)

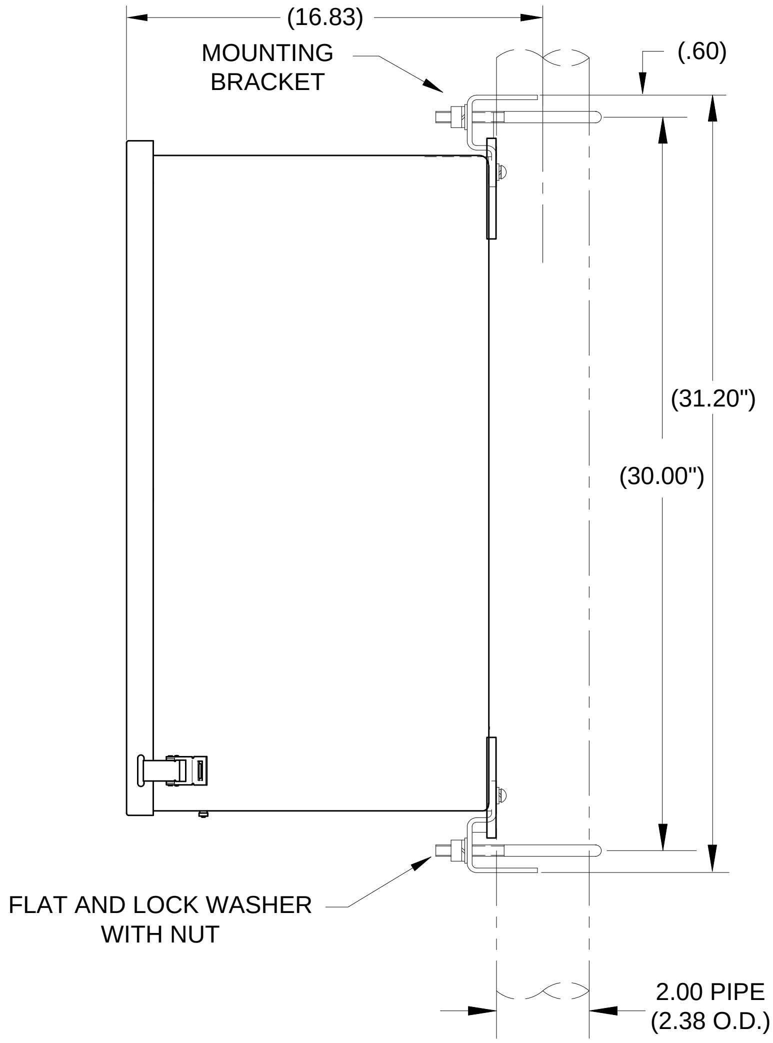


Figure 2-61 6800 Enclosure Pipe-Mounting Installation

2.29.6 Wall-Mount Instructions

Before beginning, review the procedures and the materials required for installation. A typical installation should be similar to Figure 2-62, Figure 2-63 and Figure 2-64.

Enclosure mounting brackets and fastening hardware are supplied with the unit.

1) When the unit is received, unpack and inspect all components for evidence of damage. Report damage to the shipping carrier and to ABB Totalflow's service department.

2) Using instructions supplied with the mounting kit, attach the bracket to the back of the enclosure unit.

3) Prepare the wall surface for mounting, and mount the enclosure to the wall.

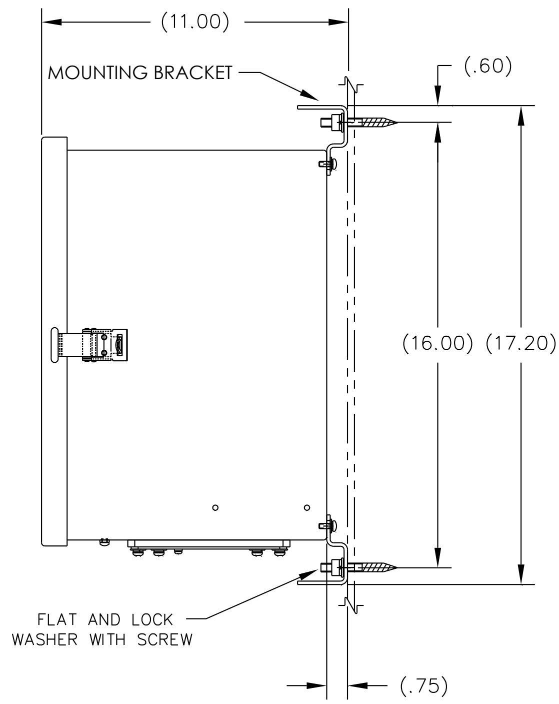


Figure 2-62 6200 Enclosure Wall-Mounted Installation

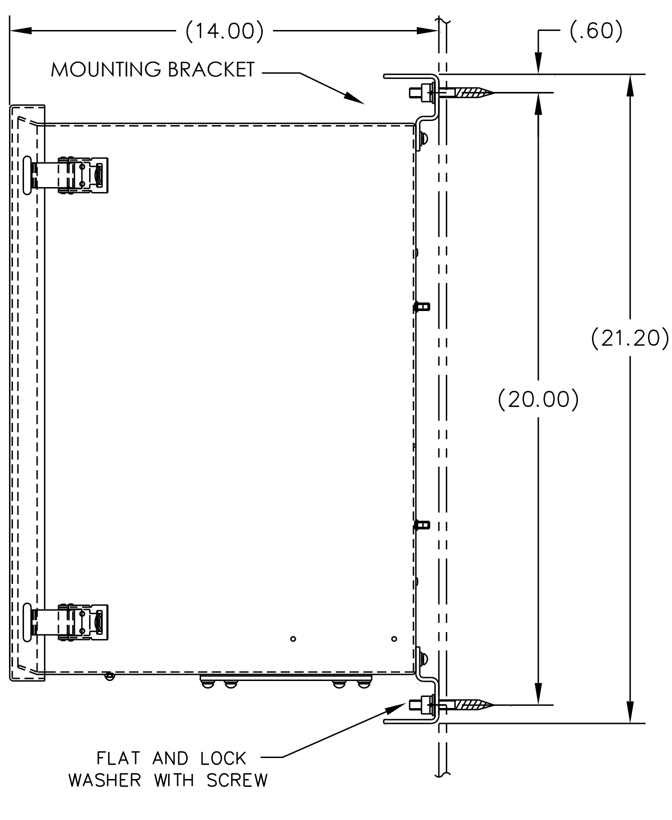
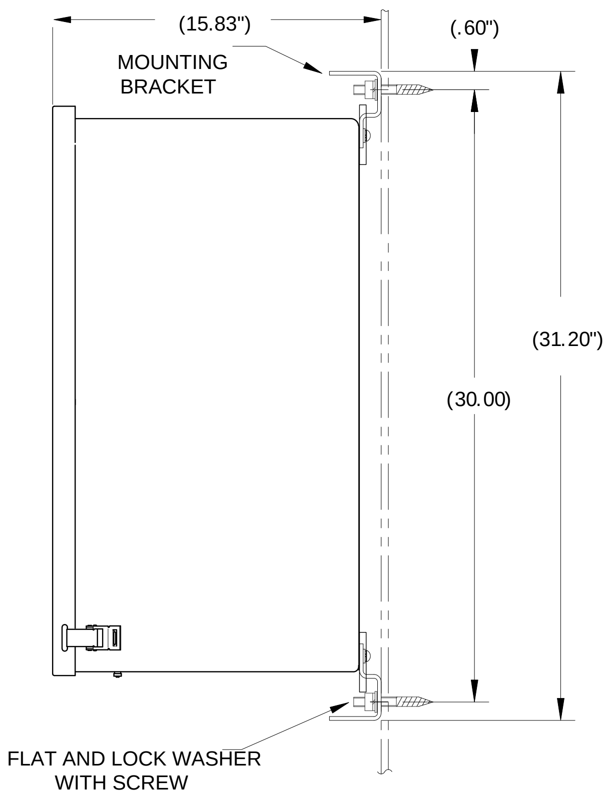


Figure 2-63 6700 Enclosure Wall-Mounted Installation


(15.83")
(.60")
MOUNTING
BRACKET
(31.20")
(30.00)
FLAT AND LOCK WASHER
WITH SCREW

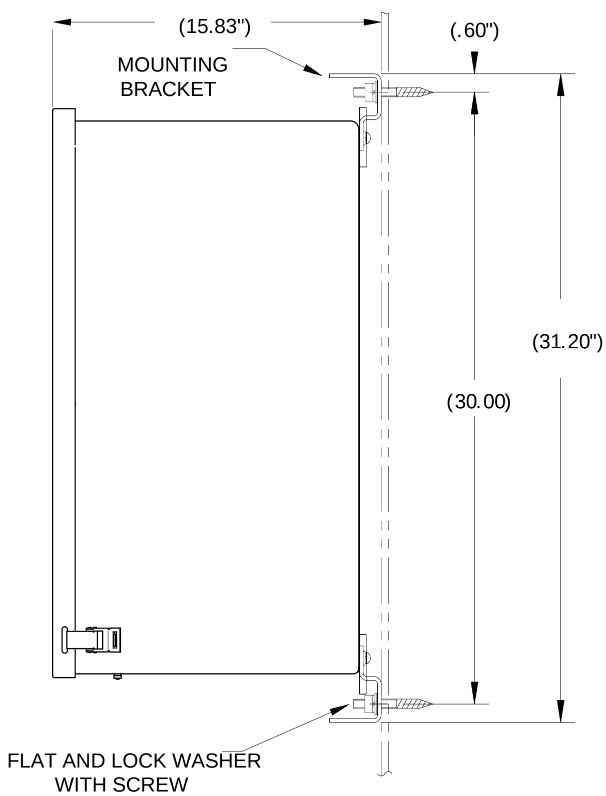

(15.83")
(.60")
MOUNTING
BRACKET
(31.20")
(30.00)
FLAT AND LOCK WASHER
WITH SCREW

Figure 2-64 6800 Enclosure Wall-Mounted Installation

2.30 115/230 Vac UPS Power Pack (24 Vdc Systems)

Before beginning, review the procedures and the materials required for installation.

WARNING

This power pack may be approved for classified hazardous locations or potentially explosive atmospheres. Verify the rating listed on the unit tag, and install per the referenced control drawing. Be sure to follow the requirements of national and local codes when installing the power pack.

WARNING

Installation must be performed by person(s) qualified for the type and area of installation according to national and local codes.

2.30.1 Instructions

1) If configured, the optional equipment unit should contain an installed power pack. The optional equipment enclosure should be installed using the previous instructions within this chapter.

2) Remove the necessary plugs from the side of the enclosure to install the rigid conduit.

3) Pipe the conduit and associated AC wiring into the enclosure.

CAUTION

Please review the Grounding the PGC1000 section in Chapter 1 - System Description before making power connections.

4) Using the wiring instructions in Figure 2-65, make the field connections from the 115 Vac hot and neutral or the two hot wires for 230 Vac as shown in the wiring instructions.

5) Pipe the conduit and associated DC wiring from the PGC1000 into the power pack enclosure. See Table 1–4 in Chapter 1 for wire sizes.

6) Remove the J1 connector from the PGC1000 termination board. Using the wiring instructions in Figure 2-65, make field connections from the power pack wire to the J1 connector (+) pin. Connect the ground wire to the J1 connector (-) pin. DO NOT re-insert the J1 connector to the termination board.

7) Move to the Battery Pack Installation section later in this chapter.

8) Move to the DC Power Installation section later in this chapter.

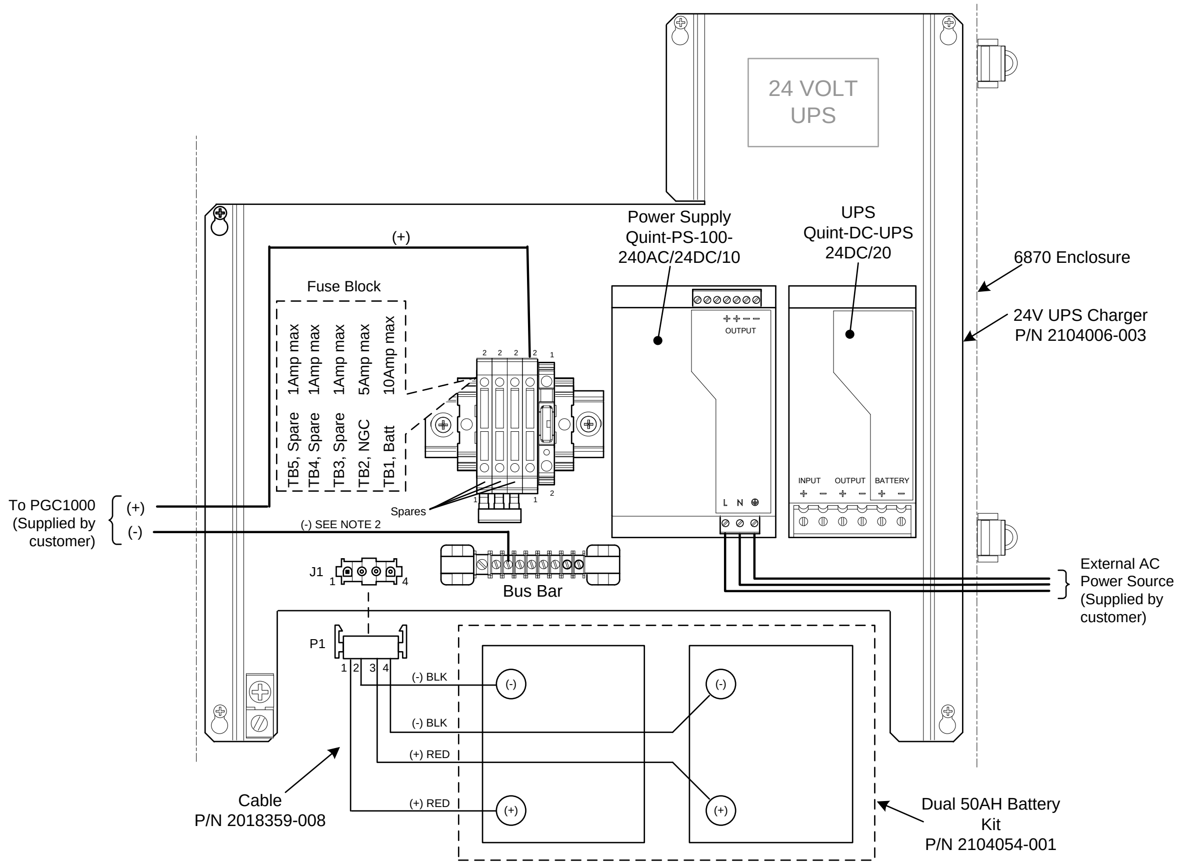


Figure 2-65 115/230 Vac UPS Power Pack Option

2.31 115/230 Vac to 12 Vdc Explosion-Proof Power Supply Installation

WARNING

The power supply may be approved for classified hazardous locations or potentially explosive atmospheres. Verify the rating listed on the unit tag, and install per the referenced control drawing. Be sure to follow the requirements of the national and local codes when installing the power supply.

WARNING

Installation must be performed by person(s) qualified for the type and area of installation according to national and local codes.

2.31.1 Customer Supplied Materials

- Plastic cable ties
- AC wiring. Please refer to the cable recommendation charts in Chapter 1 (see Table 1–3 and Table 1–4).
- Explosion-proof conduit with fittings and poured seals or approved explosion-proof/flame-proof, flexible cable with fittings according to the requirements of the national and local codes.

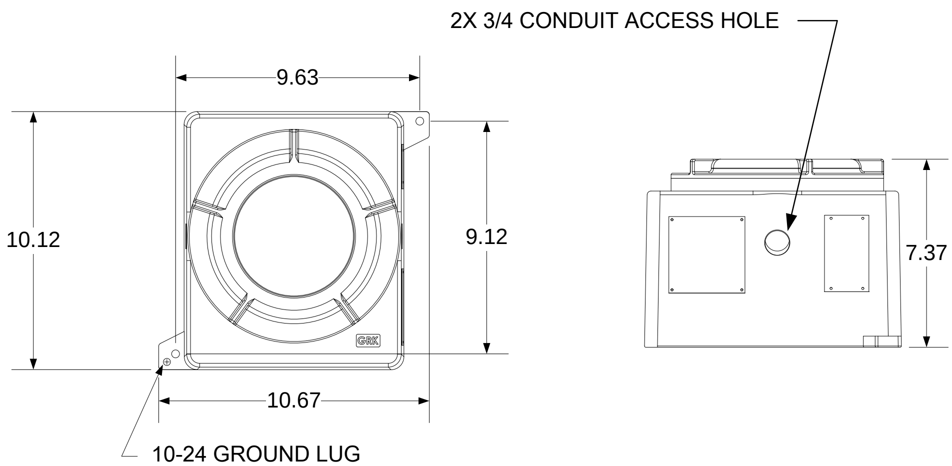


Figure 2-66 Explosion-Proof AC Power Supply Top/Front Dimensions

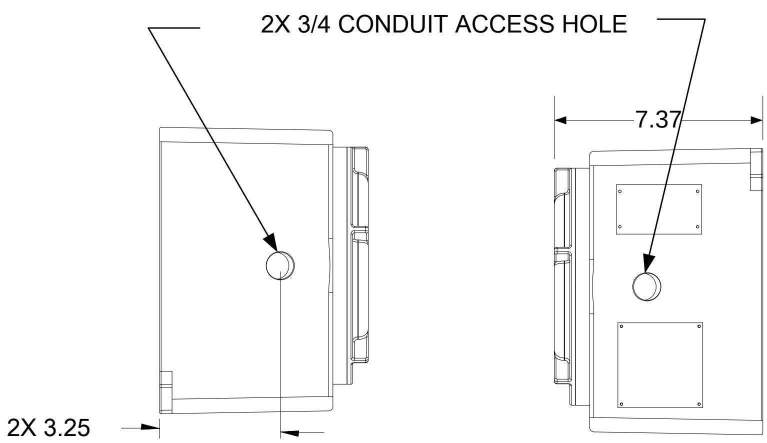


Figure 2-67 Explosion-Proof AC Power Supply Side Dimensions

2.31.2 Instructions

1) The AC power supply is shipped separately. When the unit is received, unpack and inspect all components for evidence of damage. Report damage to the shipping carrier and to ABB Totalflow’s service department.

2) Mount the explosion-proof enclosure on a nearby wall or panel. Make sure that the rigid, explosion-proof conduit or appropriate flexible conduit can be installed between the power supply’s explosion-proof enclosure and the PGC1000. Avoid obstructions.

3) Remove the necessary plugs from the side of the explosion-proof enclosure to install the rigid conduit.

CAUTION Please review the Grounding the PGC1000 section in Chapter 1-System Description before making power connections.

4) Pipe the conduit and associated AC wiring from the external power source into the AC power supply enclosure.

5) Using the wiring instructions in Figure 2-68, make the necessary field connections.

6) Pipe the conduit and associated DC wiring from the PGC1000 into the power supply enclosure. See Table 1–3 in Chapter 1 for wire sizes.

7) Go to the DC Power Installation section later in this chapter.

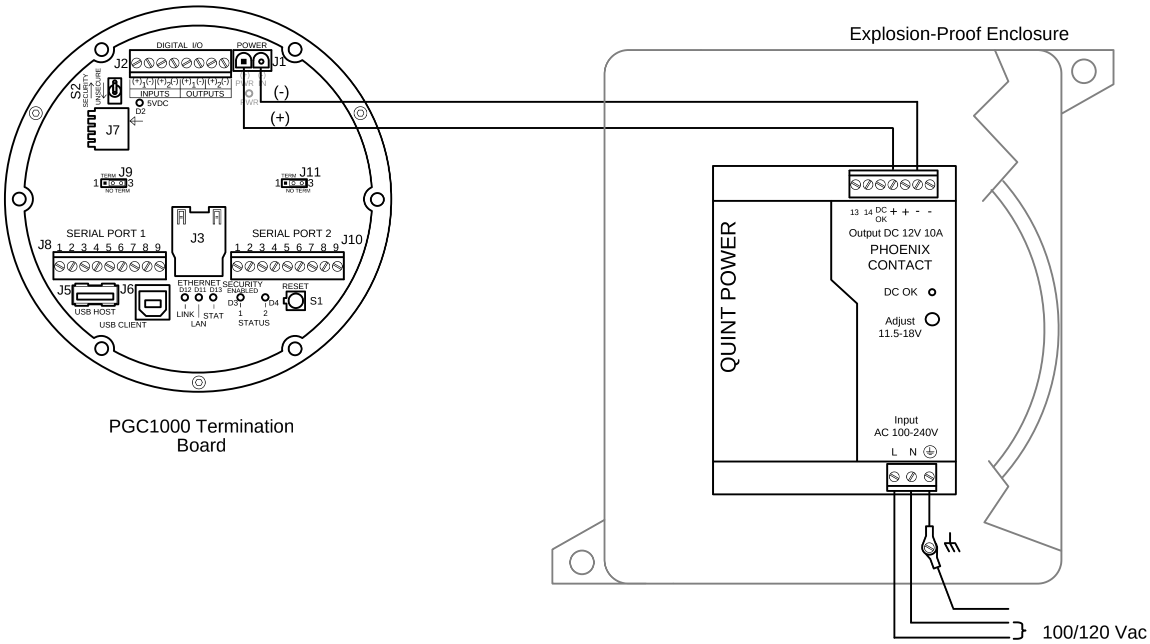


Figure 2-68 Explosion-Proof AC Power Supply Wiring Instructions

2.32 110/240 Vac to 12/24 Vdc Power Supply Installation

The power supply may be approved for classified hazardous locations or potentially explosive atmospheres. Verify the rating listed on the unit tag, and install per the referenced control drawing. Be sure to follow the requirements of the national and local codes when installing the power supply.

Installation must be performed by person(s) qualified for the type and area of installation according to national and local codes.

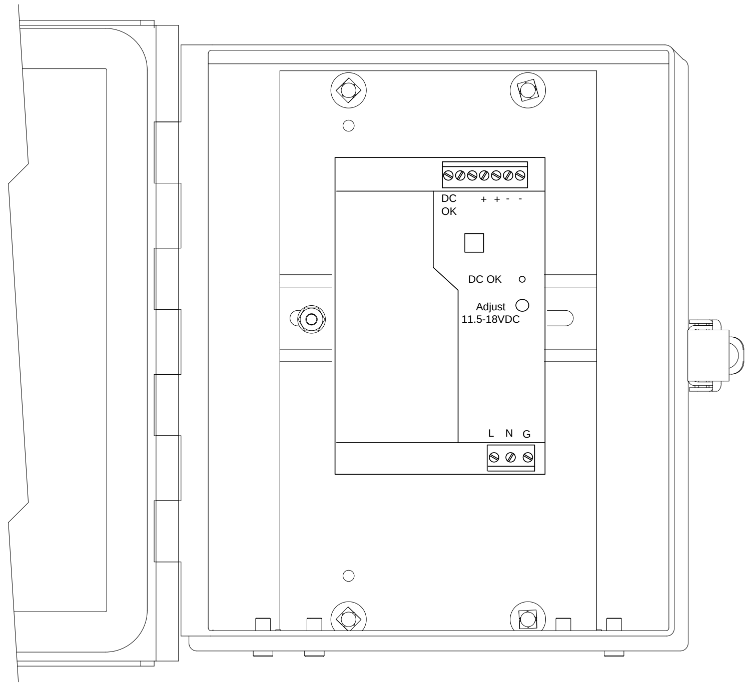


Figure 2-69 6200 Optional Equipment Enclosure with Power Supply

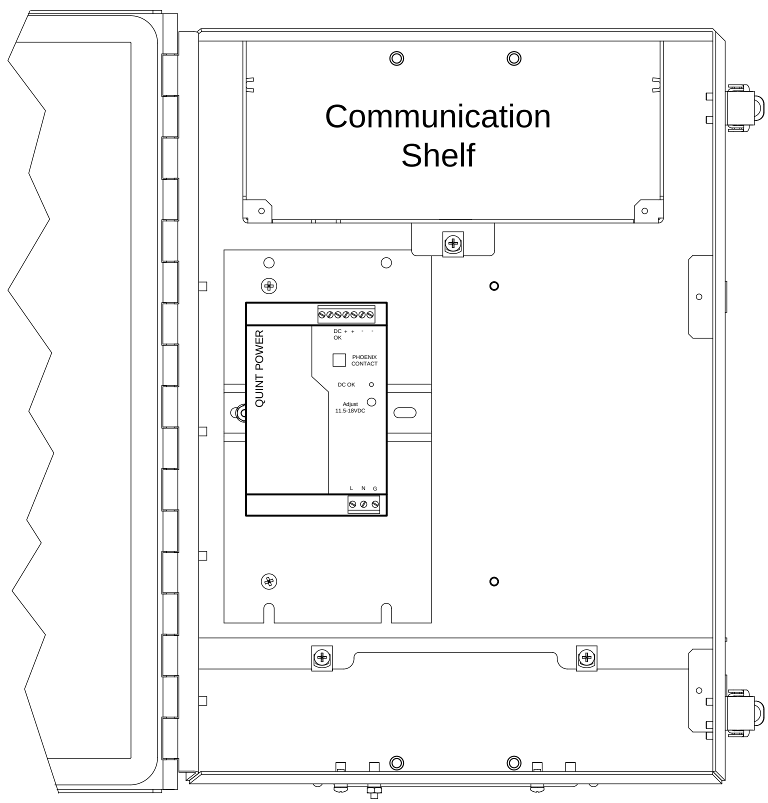


Figure 2-70 6700 Optional Equipment Enclosure Unit with Power Supply

2.32.1 Instructions

1) If configured, the optional equipment enclosure should contain an installed AC power supply. The enclosure should be installed using instructions detailed previously in this chapter.

2) Remove the necessary plugs from the side of the enclosure to install the rigid conduit.

3) Pipe the conduit and associated AC wiring into the enclosure.

CAUTION Please review the Grounding the PGC1000 section in Chapter 1-System Description before making power connections.

4) Using the wiring instructions in Figure 2-71, make the necessary field connections.

5) Pipe the conduit and associated DC wiring from the PGC1000 into the power supply enclosure. See Table 1–3 in Chapter 1 for wire sizes.

6) Remove the J1 connector from the PGC1000 termination board. Using the wiring instructions in Figure 2-71, make the field connections.

7) Go to the DC Power Installation section later in this chapter.

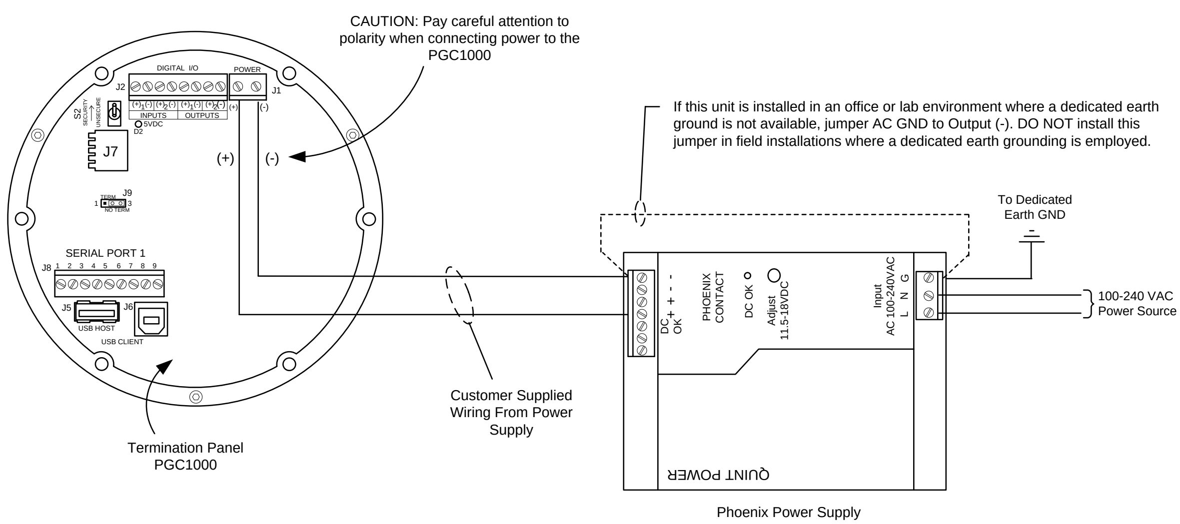


Figure 2-71 AC/DC Converter Wiring Instructions

2.33 Battery Pack Installation

FYI To extend the life of the battery pack, fully charge the battery prior to installation. Systems using solar panels may not fully charge the battery. Charging the battery quickly removes the oxide buildup and improves the life of the battery.

CAUTION DO NOT overcharge the battery pack.

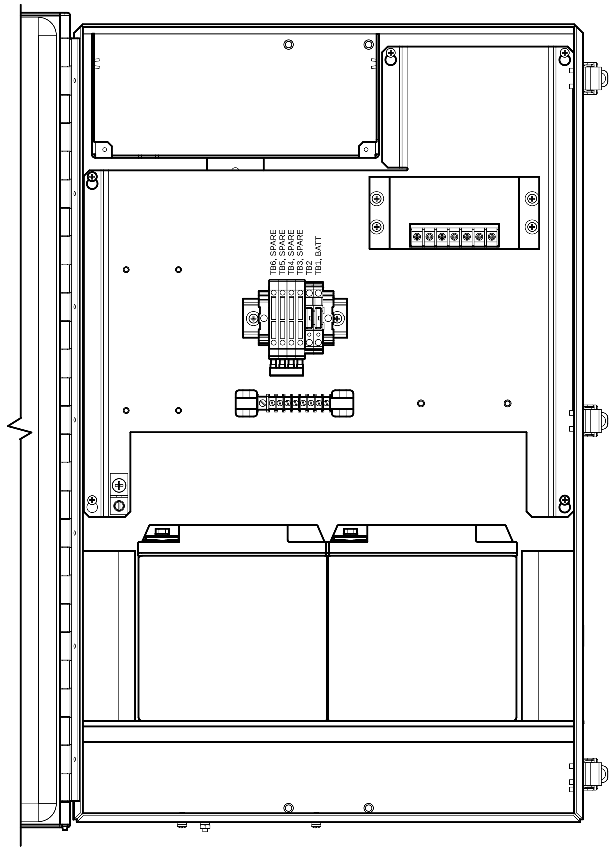


Figure 2-72 Optional 6800 Enclosure with Battery Pack

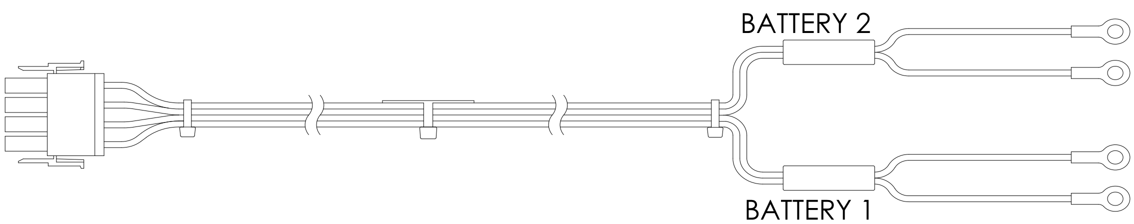
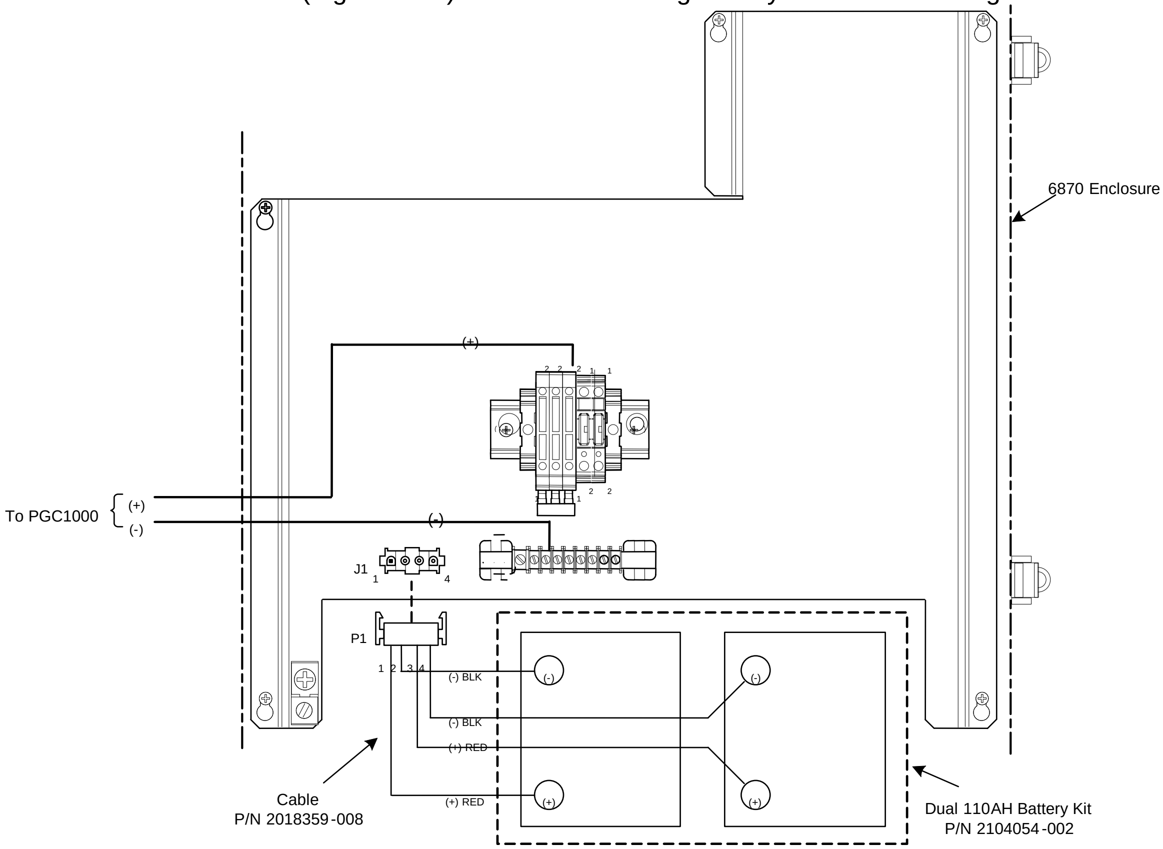


Figure 2-73 24 Vdc Dual Battery Pack Cable

2.33.1 Instructions

1) Insert the battery(s) into the battery compartment with the terminals facing up (see Figure 2-72).

For the 24 Vdc solar power system or the 24 Vdc UPS power system, a dual battery cable is provided with the unit (Figure 2-73). Make the following battery connections using



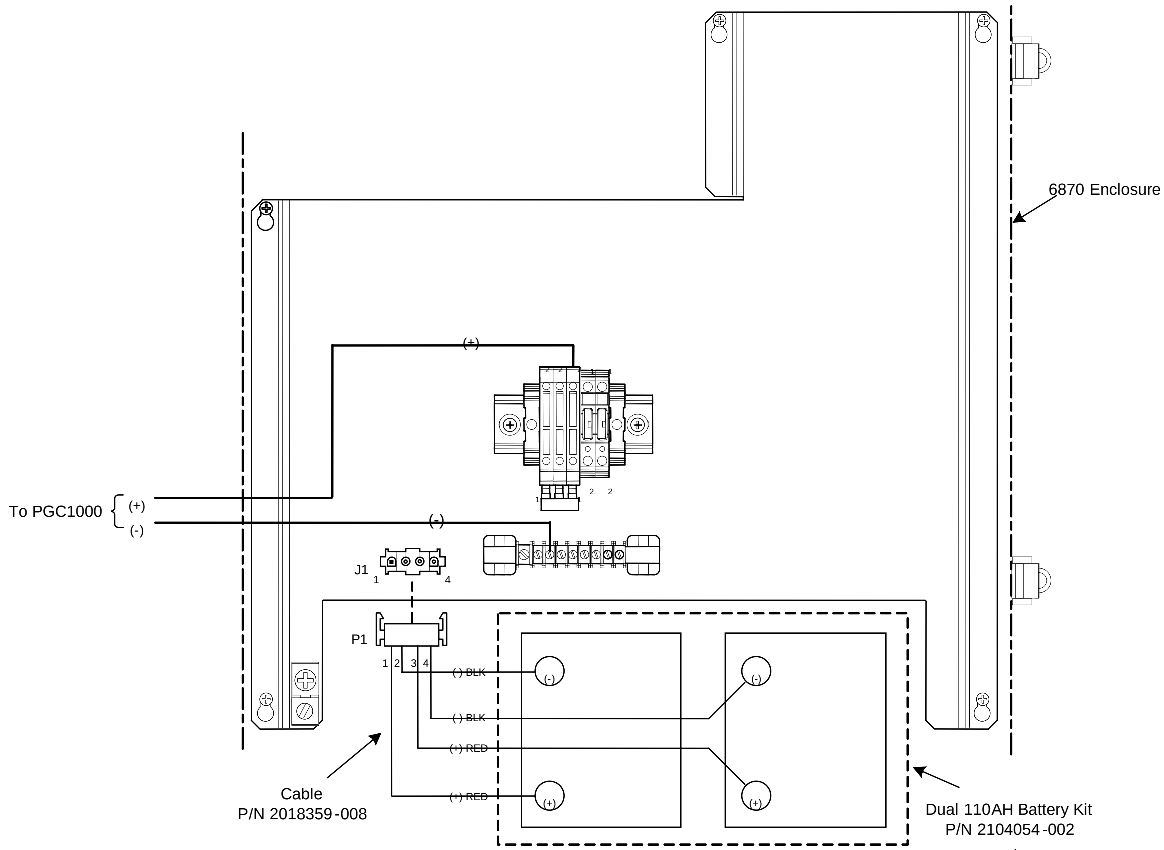
2) Figure 2-74 for 12 or 24 Vdc.

- Connect the battery 1 red wire lug to battery 1 positive terminal.
- Connect the battery 1 black wire lug to battery 1 negative terminal.
- Connect the battery 2 red wire lug to battery 2 positive terminal.
- Connect the battery 2 black wire lug to battery 2 negative terminal.

3) If the system calls for a solar panel charging system, proceed to the solar panel instructions presented later in this chapter.

4) Go to the DC Power Installation later in this chapter.

CAUTION Please review Grounding the PGC1000 section in Chapter-1 System Description before making power connections.


6870 Enclosure
(+)
To PGC1000
(+)
(-)
(-)
J1
1
4
P1
1 2 3 4
(-) BLK
(-) BLK
(+) RED
(+) RED
(-)
(-)
(+)
(+)
Cable
P/N 2018359-008
Dual 110AH Battery Kit
P/N 2104054-002

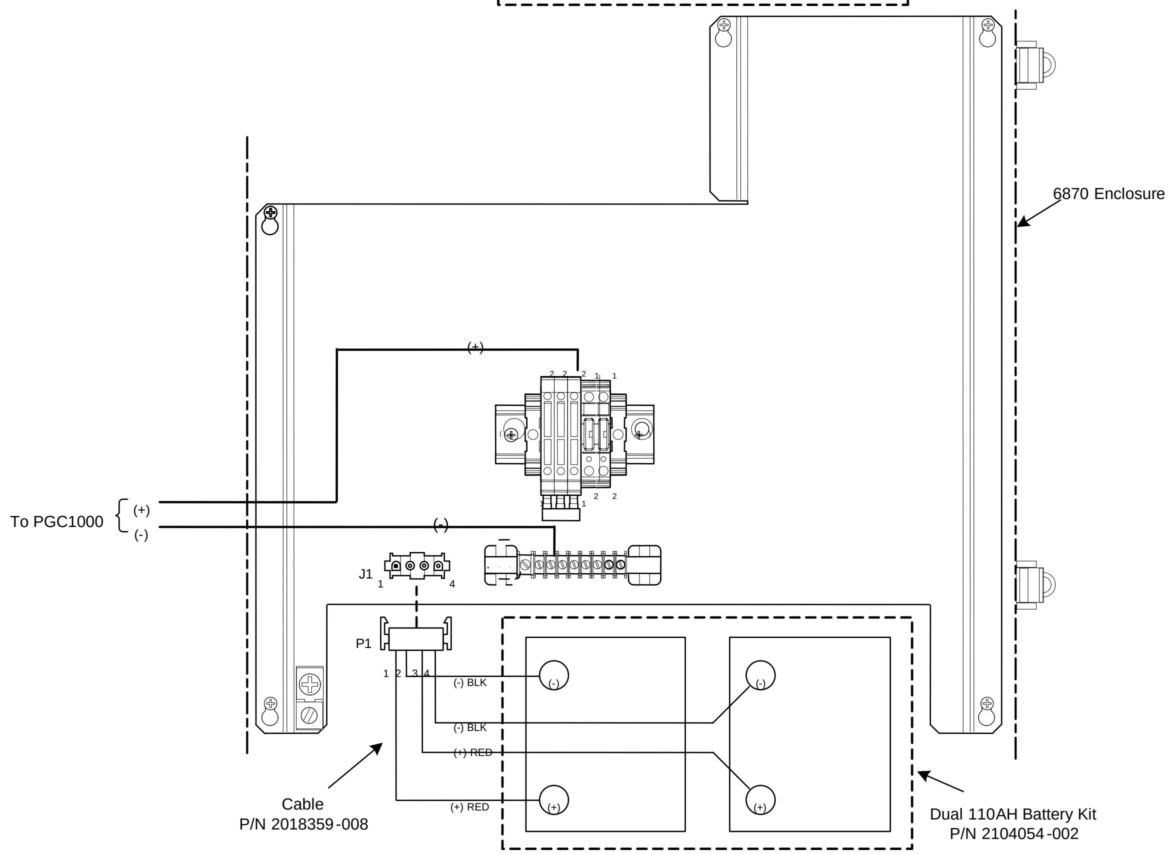

6870 Enclosure
(+)
To PGC1000
(+)
(-)
(-)
J1
1
4
P1
1 2 3 4
(-) BLK
(-) BLK
(+) RED
(+) RED
(-)
(-)
(+)
(+)
Cable
P/N 2018359-008
Dual 110AH Battery Kit
P/N 2104054-002

Figure 2-74 Battery Pack with DC Power Supply Wiring Instructions

2.34 Solar Panel Power Pack

WARNING The power pack may be approved for classified hazardous locations or potentially explosive atmospheres. Verify the rating listed on the unit tag, and install per the referenced control drawing. Be sure to follow the requirements of national and local codes when installing the power pack.

WARNING Installation must be performed by person(s) qualified for the type and area of installation according to national and local codes.

2.34.1 Instructions

1) If configured, the optional equipment enclosure should contain an installed power pack. The enclosure should be installed using instructions detailed previously in this chapter.

2) Remove the plug from the access hole in the equipment enclosure. Insert the solar panel power cable through an access hole on the side of the case. Allow enough power cable for field wiring to the solar charger connector, pins 3 and 4.

CAUTION Please review the Grounding the PGC1000 section in Chapter 1-System Description before making power connections.

3) Pipe the conduit and associated DC wiring from the PGC1000 into the power supply enclosure. See Table 1–3 in Chapter 1 for wire sizes.

4) Field wire the solar panel cables to the solar charger inside the enclosure. Make the field connections.

- Loosen the terminal block securing screws, insert the wire and then retighten. Connect the solar panel (+) lead to pin 4 and (-) wire to pin 3 terminals. Verify the main battery pack is connected.

5) Following connection of the solar panel power cable, secure the cable to the 2’ extension pipe and mounting pipe cable with the provided plastic tie-wraps.

6) Move to the DC Power Installation section later in this chapter.

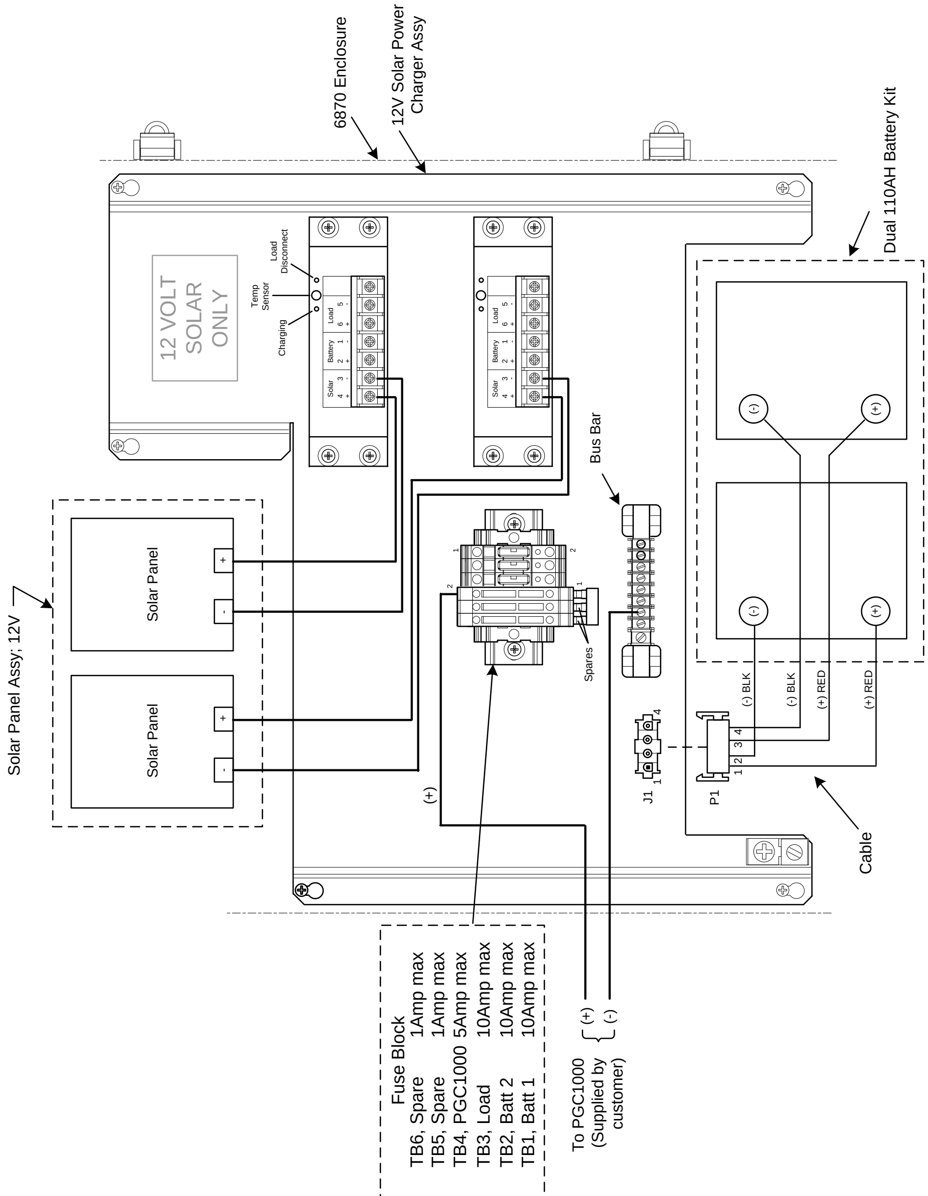


Figure 2-75 12 Vdc Battery Pack/Solar Panel Wiring Instructions

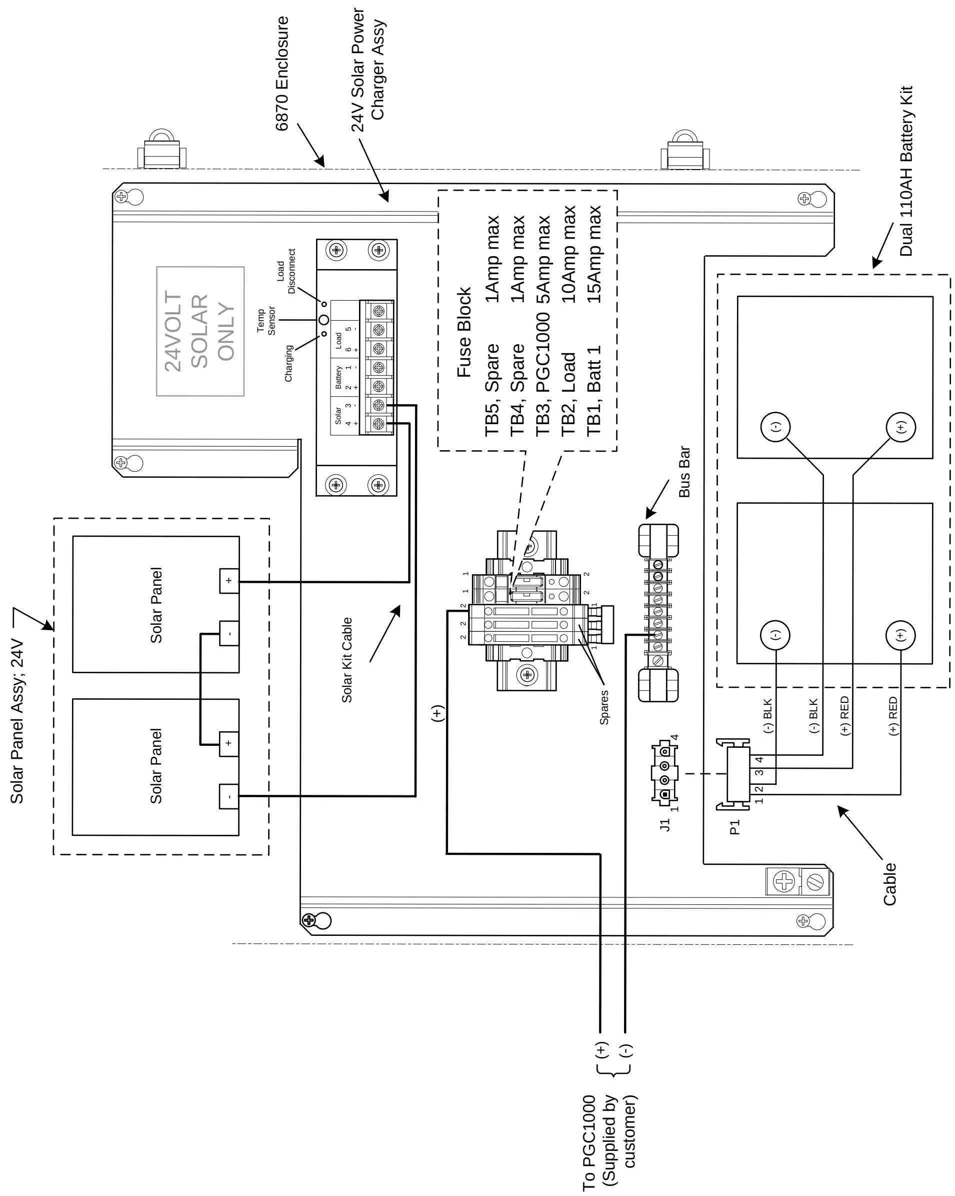


Figure 2-76 24 Vdc Battery Pack/Solar Panel Wiring Instructions

2.35 DC Power Installation

TIP These instructions assume that all external wiring has been completed to the point where connections have been made to the field termination connector, but the connector has not been plugged into the termination board.

2.35.1 Instructions

1) If installation includes the optional power switch:

- Apply power to the switch, and turn switch to the “ON” position.

2) If the installation includes the enclosure with the optional power supply:

- Apply power to the power supply.

3) If installation includes a solar panel connected to a battery:

- Plug in the charger regulator battery connector.

4) Test power using a multi-meter connected to the J1 terminals on the Phoenix connector:

- 12 Volt system: Voltage is between 11.5 and 16.0 Volts (see Table 1–3).
- 24 Volt system: Voltage is between 21.0 and 28.0 Volts (see Table 1–4).

If Volts are within range, the power should be disconnected, the Phoenix connector inserted into the termination board J1 connector and the power re-applied.

During startup operations, the unit will require:

- 12 Volt system: 11.5 Volts minimum.
- 24 Volt system: 21.0 Volts minimum.

5) If the PGC1000 has a VGA screen, the unit will display “ABB Totalflow Boot Loader” followed by the navigational screen, when functional.

6) The unit will begin Startup Diagnostics and oven stabilization. This completes the hardware installation. Proceed to the next chapter to begin unit setup and operation.

2.36 Remote Communication Installation

As the remote communication installation is specific to the communication transceiver, only basic information is supplied here. Additionally, wiring instructions should be shipped with the unit. Both communication ports (serial port 1 and 2) can function as RS-232, RS-422 or RS-485. Table 2–2 shows serial port pin outs and termination settings.

Table 2–2 Port 1 and Port 2 Pin-Outs/Terminations

	RS-232	**RS-485**	**RS-422**
PIN	**PORT 1 (J8)**	**PORT 2 (J8)**	**PORT 1 (J8)**
1	Power Out	Power Out	Power Out
2	Ground	Ground	Ground
3	Switched Power Out	Switched Power Out	Switched Power Out
4	Operate	Operate	Operate
5	Not Used	RRTS	RTS
6	Request To Send	Bus +	Transmit Bus +
7	Transmit Data	Bus -	Transmit Bus -
8	Receive Data	No Connection	Receive Bus +
9	Clear To Send (CTS)	No Connection	Receive Bus -
PIN	**PORT 2 (J10)**	**PORT 2 (J10)**	**PORT 2 (J10)**
1	Power Out	Power Out	Power Out
2	Ground	Ground	Ground
3	Switched Power Out	Switched Power Out	Switched Power Out

	RS-232	RS-485	RS-422
PIN	**PORT 1 (J8)**	**PORT 2 (J8)**	**PORT 1 (J8)**
4	Operate	Operate	Operate
5	Not Used	RRTS	RTS
6	Request To Send	Bus +	Transmit Bus +
7	Transmit Data	Bus -	Transmit Bus -
8	Receive Data	No Connection	Receive Bus +
9	Clear To Send (CTS)	No Connection	Receive Bus -
TERMINATIONS		**PORT 1 (J9)**	**PORT 2 (J11)**
First or Intermediate Unit (RS-485)		Pins 2–3	Pins 2–3
Last or Only Unit (RS-485)		Pins 1–2	Pins 1–2
RS-232		Pins 2–3	Pins 2–3

3.0 PGC1000 START UP

This chapter describes the minimum requirements to start up a newly installed PGC1000 system. Specific details to further customize the PGC1000 are discussed in the PCCU32 help files.

WARNING DO NOT open or remove covers, including the PCCU local communications cover, unless the area is known to be non-hazardous. This includes the internal volume of the enclosure.

FYI Before beginning, the user should complete the tasks outlined in Chapter 2.0 - Installation.

3.1 PCCU32 Installation and Set Up

ABB Totalflow's PCCU32 6.0 (or later) software is required to communicate with the PGC1000. Previous versions of PCCU32 are not compatible with the PGC1000.

PCCU32 software, running in a laptop Windows® desktop environment, offers the most capabilities for programming the PGC1000. The Windows®-environment features user-friendly help files and easy to follow menus that enable the user to step through many of the required choices.

The PGC1000 hardware is designed using Windows® Mobile technology CE operating system; therefore, communication between a personal computer and the PGC1000 may be accomplished using a USB cable. When this method of communication is preferred, Windows® ActiveSync is required and supplied with PCCU32.

3.1.1 Software Installation

1) Insert the PCCU32 disk into the PC drive. If the CD drive is set to Auto Play, the installation program should begin; otherwise, click the Start button, and select the Run option. In the Run dialog box, type in the following: D:\Disk1\setup.exe (D being the CD Drive designation).

2) Follow the screen prompts during the installation. When the user is asked if they want to install ActiveSync, the answer will depend on whether the unit was shipped with a USB (default) or a round RS-232 military-type connector as the local port connector. This is the connector on the outside of the unit with the round, explosion-proof cap. If USB, the user needs to check the Install ActiveSync box. If communicating via RS-232, click the Next button. If communicating with a PDA, ActiveSync is already installed; however, if it is a later version of the software, the user will have the ability to upgrade to the latest version. To verify the version, open ActiveSync, and click Help. From the drop-down, select About Microsoft ActiveSync.

3) The next screen prompt will allow the user to select the correct port for communication: USB Port for connecting via USB or Serial Port for connecting via RS-232. If the user has previously installed the PCCU32 software and selected a port but they are in the process of re-installing or upgrading, select Keep Current Port.

4) The installation places a PCCU_NGC folder on the Window's desktop with the other shortcuts. The shortcut is correct, assuming the install directory was not changed. If the install directory was changed, the shortcut will have to be changed to the new directory path. If using a network, the PGC1000 on the Network shortcut will require a network ID or IP address. For a stand-alone desktop shortcut, right-click on the shortcut, select Create Shortcut and drag it to the desktop.

3.2 Ethernet Installation and Set Up

Installation of a PGC1000 in a network environment may be implemented using the following instructions. Some decisions may require input from the user's network administrator.

PCCU32 communication with the PGC1000 over an Ethernet connection requires the use of a hub, switch or router (see Figure 3-1). Ethernet (local) communication in a remote area may also be used but is not covered in these instructions as there are other high-speed options for communicating locally.

PCCU32 makes use of the Windows® DHCP Utility. Dynamic Host Configuration Protocol (DHCP) can randomly assign a unique IP address within the defined subnet mask. This utility also allows the user to define a more user-friendly network ID. This ID must be unique within the subnet mask.

Disabling the DHCP requires that a unique IP address be assigned. This is taken care of by the network administrator.

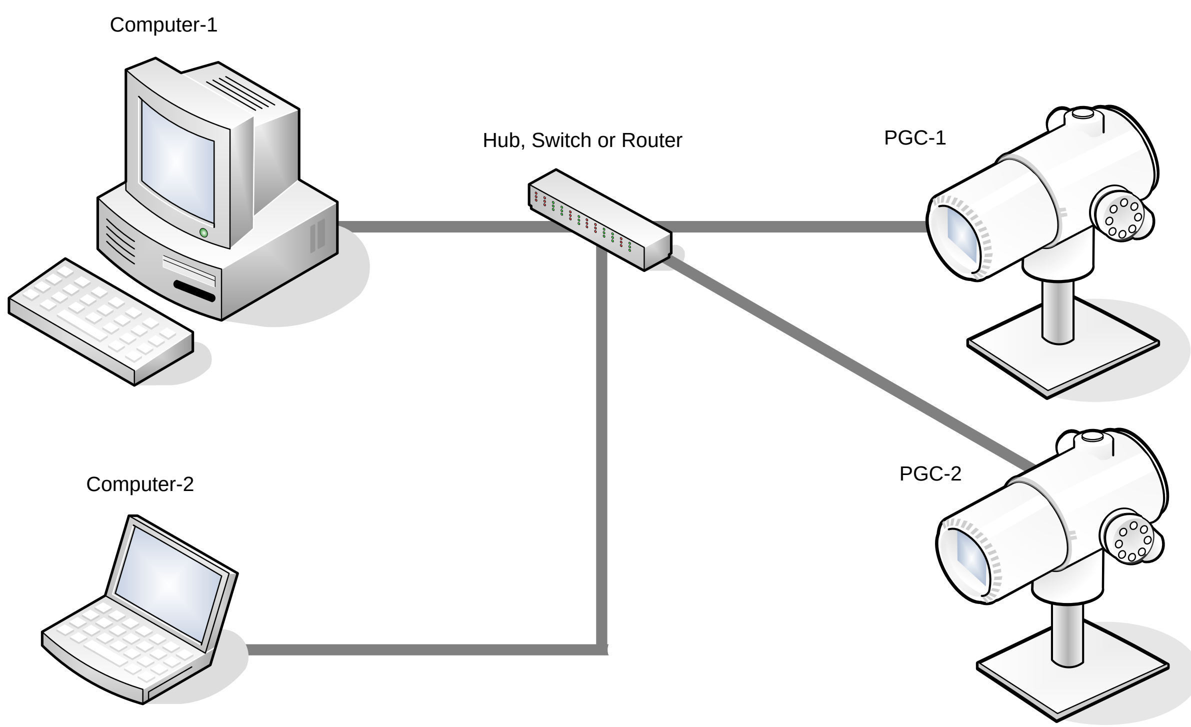


Figure 3-1 Ethernet Connections

3.2.1 TCP/IP Network Connection

3.2.1.1 Materials Required

- Ethernet straight-through cable (see Figure 3-2)
- Hub, switch or router and associated wiring to PGC1000 (see Figure 3-1)

3.2.1.2 Instructions

1) Acquire TCP/IP Network Settings:

- Click the Windows® Start button. From the pop-up menu, select Run.
- In the Run dialog box, type the program name: “CMD”.
- Press OK.
- At the command prompt, type ipconfig /all (space after …ipconfig).
- Record the PC and LAN settings displayed for later use.

2) Make the local connection to the PGC1000 using either the USB or RS-232 cable. This will begin the initial setup of the parameters.

3) From the Analyzer Operation screen in PCCU32, click on the Show Tree-View button in the upper left corner of the screen.

4) Click on Communications to display the Communication Setup screen.

5) Select the Network tab.

FYI If using a Windows® network, the user can use the network ID feature. Network IDs are limited to 15 alphanumeric digits with limited special characters. Please see the Windows® help files for more information on naming computers.

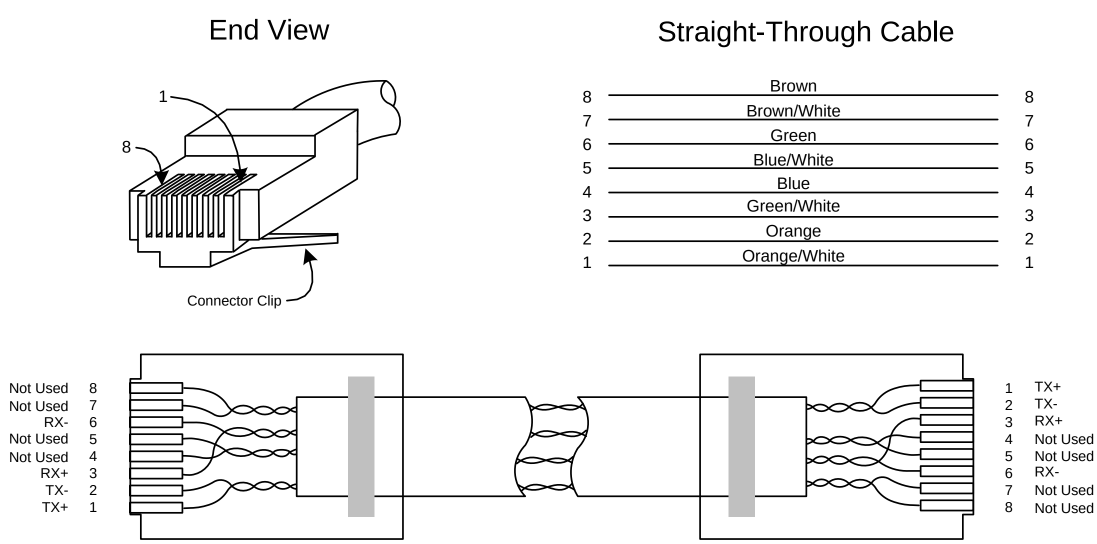


Figure 3-2 Ethernet Cable-Typical

6) Enable or disable the dynamic host configuration protocol (DHCP). To disable the DHCP and assigned IP address, set the parameter to No. Continue to the next step; otherwise, select Yes, and move to step 7.

7) Enter the IP address assigned by the network administrator and subnet mask, if different (default is 255.255.255.0).

8) When all the preferred changes have been made, select Send.

9) Reset the PGC1000 by pressing the Reset button. This is located on the termination board housed in the rear of PGC1000 enclosure.

10) Verify the Ethernet communication:

- Change to TCP/IP network cable.
- From the Windows® Start menu, select Run. From the Run dialog box, type CMD to open the Command window.
- At the prompt ">", type "ping" followed by a space. Type in either the network ID or IP address, and press Enter. A successful communication will show multiple replies for the unit.

3.2.2 TCP/IP Local Connection

3.2.2.1 Material Required

- Ethernet cross-over cable (see Figure 3-3).

3.2.2.2 Instructions

1) Make the local connection to the PGC1000 using either a USB or RS-232 cable. This will enable the user to perform the initial setup of the parameters.

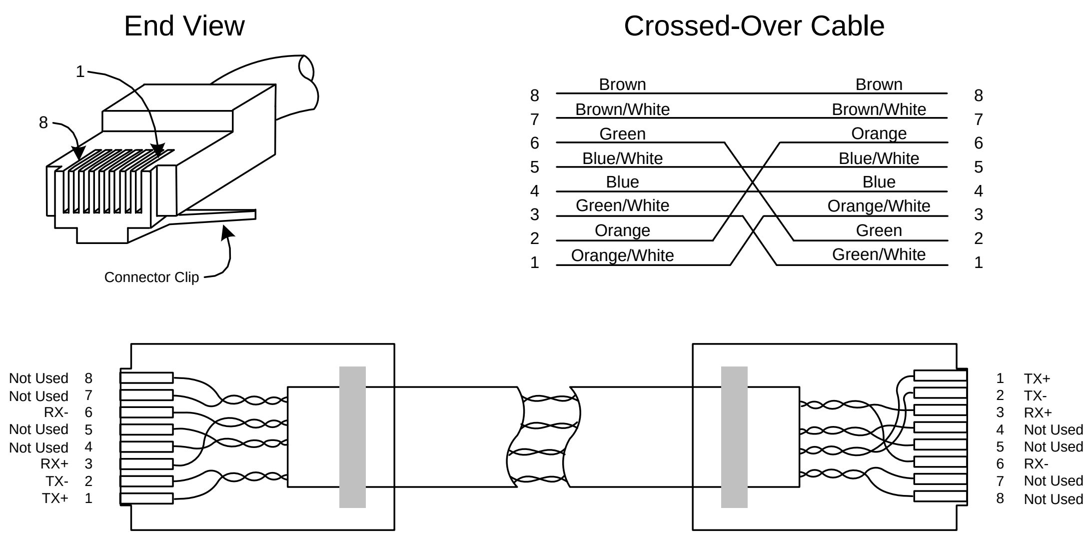


Figure 3-3 Ethernet Cross-Over Cable

2) From the Analyzer Operation screen in PCCU32, click on Show Tree-View button in the upper left corner of screen.

3) Click on Communications to display the Communication Setup screen.

4) Select the Network tab. Enable DHCP. Send the changes, and record a new IP address for later use.

5) Exit PCCU32, and disconnect the local communication cable.

6) Connect the Ethernet cross-over cable between the PC and PGC1000.

7) Open the PCCU32 software. Click on Operate on the menu bar. Navigate through the drop-down list to Setup. From the fly-out menu, select System Setup.

8) Under Communications, set the PCCU32 com port to TCP. Enter the IP address previously noted in the network ID or IP box. Close the System Setup screen.

9) Verify the TCP/IP communications by clicking the Entry button on the main screen (upper most left button).

FYI

If receiving a “Communication Link Failed” error message, investigate the following possible causes:

- Verify a cross-over Ethernet cable is being used and not a straight-through Ethernet cable.
- If using a network hub or network, verify the firewall is not blocking the IP address.
- If the laptop is connected to a network, verify a virtual private network (VPN) is not being used to access a corporate network. The VPN may need to be disconnected before a local Ethernet connection is possible.

3.3 Connecting to the PGC1000’s Local Port

The laptop computer connects to the local port via USB or RS-232 and uses one of two cables (See Figure 3-4).

FYI

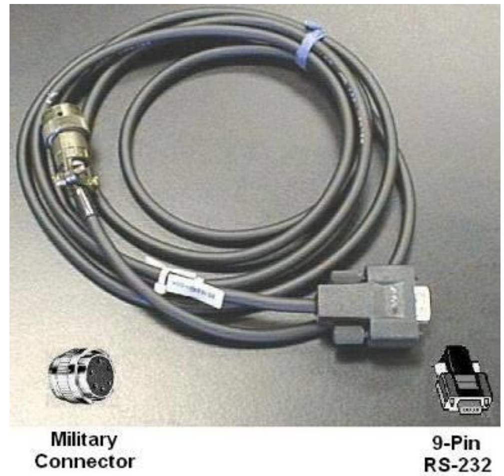
ActiveSync software is required to communicate when using USB. If ActiveSync was not installed during the PCCU32 installation, connecting the USB cable should trigger the ActiveSync installation to begin.

3.3.1 Instructions

1) Connect the MMI cable to the designated port on the PC and to the local port. This is located on the outside of the PGC1000. If the unit is configured for the RS-232 MMI cable, connect to the appropriate communication port on the PC (default is COM1). If the unit is configured for a USB cable, connect the host end of the USB cable to any USB port on the PC.

2) Click on the Windows® Start button, and select Programs - PCCU_NGC (or correct program folder if changed during installation). Select PCCU32. This will display the PCCU32’s initial screen.

USB Cable



RS-232 Cable

Figure 3-4 MMI Communication Cables

3) Assuming the MMI cable is connected, select the Connect icon (left-most icon at the top of the screen). If this unit had been previously set up, the Local Connect screen will display with various labeled buttons.

TIP If the Invalid Security Code screen should appear, enter four zeros (0000) for the new code, and click OK. The PGC1000 should have defaulted to 0000 on start-up.

4) Again, if the unit has already been set up, the Local Connect screen displays two buttons: Entry Setup and Collect Historical Data. Clicking on Entry Setup will take the user to the Analyzer Operation screen. This screen has links to other operations. Daily operations should be performed from this screen.

FYI If the user receives a communication error, click on the Setup icon along the top of the screen, and verify the PCCU32 com port. If using USB, this should indicate USB; if not, click on the down arrow. The user will then need to scroll down and select USB. If the user is using serial communications with the round connector on the PGC1000 end, select the communications port being used (COM1, etc.). When finished, close the Setup screen, and click the Connect icon again.

3.4 PGC1000 Diagnostics

In Chapter 2-Installation, the DC power circuit to the PGC1000 was completed. Once power was applied to the unit, the PGC1000 began the startup procedure:

- Unit cold started and loaded start-up information into RAM memory.
- Start-up Diagnostics to run. If diagnostics are not successful, the unit will return a system fault and cease start-up.

Start-up Diagnostics consist of four areas of testing:

- Carrier Pressure Regulator Test

- Oven Temperature Test
- Processor Control Test
- Stream Test

As noted above, the oven temperature test is one of the diagnostic tests run. To pass this test, the oven temperature must reach 60° C and stabilize. Additionally, part of the processor control test is testing the amount of effort the oven controller takes to keep the oven at its set point of 60° C. Based on the ambient temperature, this could take up to an hour.

During the initial start-up, all streams are disabled. During the stream test, streams with input pressure will be re-enabled, tested and either passed or failed. Streams with no initial input pressure will fail and are left disabled. Streams can always be re-enabled later, if they will be used.

During the diagnostics or upon completion, the user may view the status of the diagnostic tests by clicking on the Diagnostics button on the Analyzer Operation screen. Part of the start-up diagnostic takes the user to the Diagnostic screen. When the unit completes the start-up diagnostics and has passed the appropriate tests, with the exception of streams with no pressure, the unit will move into Hold mode. ABB Totalflow recommends that the unit be allowed to run at least eight (8) hours to completely stabilize and then a calibration be performed.

3.5 Security System Setup

3.5.1 Hardware Security

The PGC1000 board has a bi-level security system built in. For the purpose of this manual, this is referred to as hardware security. The security switch, located on the termination board of the PGC1000, must be switched down for the hardware security system to be functional. The switch must be switched up to change the device’s security code. Security codes are checked via remote communication, whether the switch is on or off.

3.5.2 PCCU Security

When the PGC1000 is accessed through the PCCU32 or WINCCU host software packages, either remotely or locally, there is a second level of security included. This is referred to as the software security.

The security switch, located on the termination board of the PGC1000, must be switched on for the hardware security system to be functional. The switch must be switched off to change the device’s security code. Security codes are checked via remote communication, whether the switch is on or off.

When the system is set up, each user logs onto the system with a unique user name and a 4-digit alphanumeric password. This takes place before the user connects to the unit.

The software security system is designed to have two levels of user access:

- Reading data files – read-only access (User)
- Sending application and configurations - read/write access (Admin)

By default, user access is restricted from modifying the application table or from downloading files to the device’s TfData and TfCold drives but has all other user-type privileges. These default privileges can be edited by the administrator and consists of 4-digit alphanumeric pass codes (level 1 and level 2).

TIP The PGC1000 does not send an error message when trying to write an operation where the proper hardware security code does not exist; it simply will not accept value changes.

3.5.3 Role Based Access Control (RBAC)

The RBAC system is effective in PCCU versions 7.16.0 or higher. RBAC adds a third level of security to the PGC1000 and supersedes the hardware security system.

While available for setup, RBAC will not be operational when the new system is delivered. This allows the customer to define any specific roles beyond the basic four (4) defined roles:

- Basic
- Advanced
- Expert
- Administrator

Administrators can develop additional roles, set up and assign specific users a role and define application access independently for each user. Levels of access for each application are:

- Yes or No
- Read, Write or Read/Write

Users accessing the device or changing the security settings will automatically generate a record to a security log.

Once roles and access have been defined, the *.RBA file can be saved to a PC and then downloaded to additional devices.

Additional information may be found in the PCCU help files.

3.6 Alarm Definitions

The user has the ability to define the threshold for the PGC1000 alarm parameters. The PGC1000 provides 124 standard alarms. Of these, a number of alarms are defaulted to Enabled (see Table 3–1). Many of these are considered system alarms, and the user is cautioned not to make changes to the logic. A multitude of additional alarms are available and user-configurable.

Table 3–1 Defaulted Alarm Definitions

Alarm Description	Logic Type	Threshold Default	Severity
Pressure Regulator	GT	0	Fault
Sample Pressure	GT	0	Fault
Oven Temperature Error	GT	0	System Fault
No Stream Valve Selected	GT	0	System Fault
Digital-Analog Bd Comm Error	GT	0	System Fault
Calculation Error	GT	0	Fault
Calibration Un-Normalized Total	GT	0	Fault
Stream Sequence Error	GT	0	Fault
Calibration CV Percent Error	GT	0	Fault

Alarm Description	Logic Type	Threshold Default	Severity
RF Pct Error	GT	0	Fault
Analog Bd Ambient Temp	GT	0	Warning
Analog Power Supply	GT	0	Warning
Out of Carrier Gas (DI1)	LT	1	System Fault
Out of Cal Gas (DI2)	LT	1	System Fault
GCM Chrom Process	GT	0	System Fault
Bad Bead	GT	0	Fault
Sample Flow Detect	GT	0	Fault
Cpu Loading	GT	85	Warning
System Memory Available	LT	500000	Warning
Ram File Available	LT	1000000	Warning
Flash File Available	LT	1000000	Warning
Missing Peak-Cal Not Used	GT	0.0000	Warning
Stream Un-Normalized Total	GT	0.000	Warning

4.0 MAINTENANCE

4.1 Overview

This chapter provides the user with maintenance information and instructions on how to remove and install PGC1000 components. Performance of the recommended procedures maintains the unit in optimal operating condition, reduces system downtime and ensures accuracy of sample analysis.

It is recommended that the user develop regularly scheduled daily, weekly or monthly maintenance programs. By establishing such programs, PGC1000 downtime will be reduced, and the system will operate at optimum analytical efficiency. Perform all recommended procedures as they are presented within this chapter.

Practical experience permits updating the maintenance procedures and associated schedules over time. This results in many procedures being performed on a routine basis before potential problem(s) result in a failure.

For all maintenance steps: remove power from the device, or ensure the area is known to be non-hazardous, including the internal volume of the enclosure, before removing any enclosure cover or performing any of the maintenance steps in this section.

4.1.1 Help

If technical assistance is required during the performance of maintenance functions or if returning parts, the user should contact the ABB Totalflow customer service department at the following phone number:

USA: 1-800-HELP-365 or 1-800-435-7365

4.1.2 Maintaining Cleanliness

It is important that an inspection time period be established to examine the unit for internal and external cleanliness and damage.

Because a PGC1000 installation is primarily exposed to external environmental conditions, it is important that it be regularly inspected for cleanliness, both externally and internally. Even though the PGC1000 is tightly sealed against moisture and foreign contamination, it is recommended that the internal components be examined for both conditions. If contamination is found, the system should be shut down and cleaned. If such contamination is not removed, it could render the PGC1000 inoperable.

4.1.3 Returning Part(s) for Repair

If an ABB Totalflow component is to be returned for repair, securely wrap it in protective anti-static packaging. Before returning a component, call ABB Totalflow for a Return for Authorization number (RA). Affix this number to the outside of the return package.

Parts shipments must be prepaid by the user. Any part not covered by the original system warranty will be shipped to the user, F.O.B.

TIP

When removing the front or rear end caps, the user's hands can become coated with a black-thread lubricant. If this happens, wash hands before performing maintenance functions. Use Go-Jo or an equivalent type hand cleanser. The lubricant MUST NOT come in contact with components. DO NOT wipe lubricant on clothing, as it cannot be removed easily.

If the enclosure needs more thread lubricant, use Vaseline.

4.2 Spare Part Components

The information in this section presents the user with the components (see Figure 4-1) and parts that are accessible for removal and installation. Replacement components will be covered first. Subsequent sections will have instructions for replacing spare parts.

4.2.1 Replacement Components

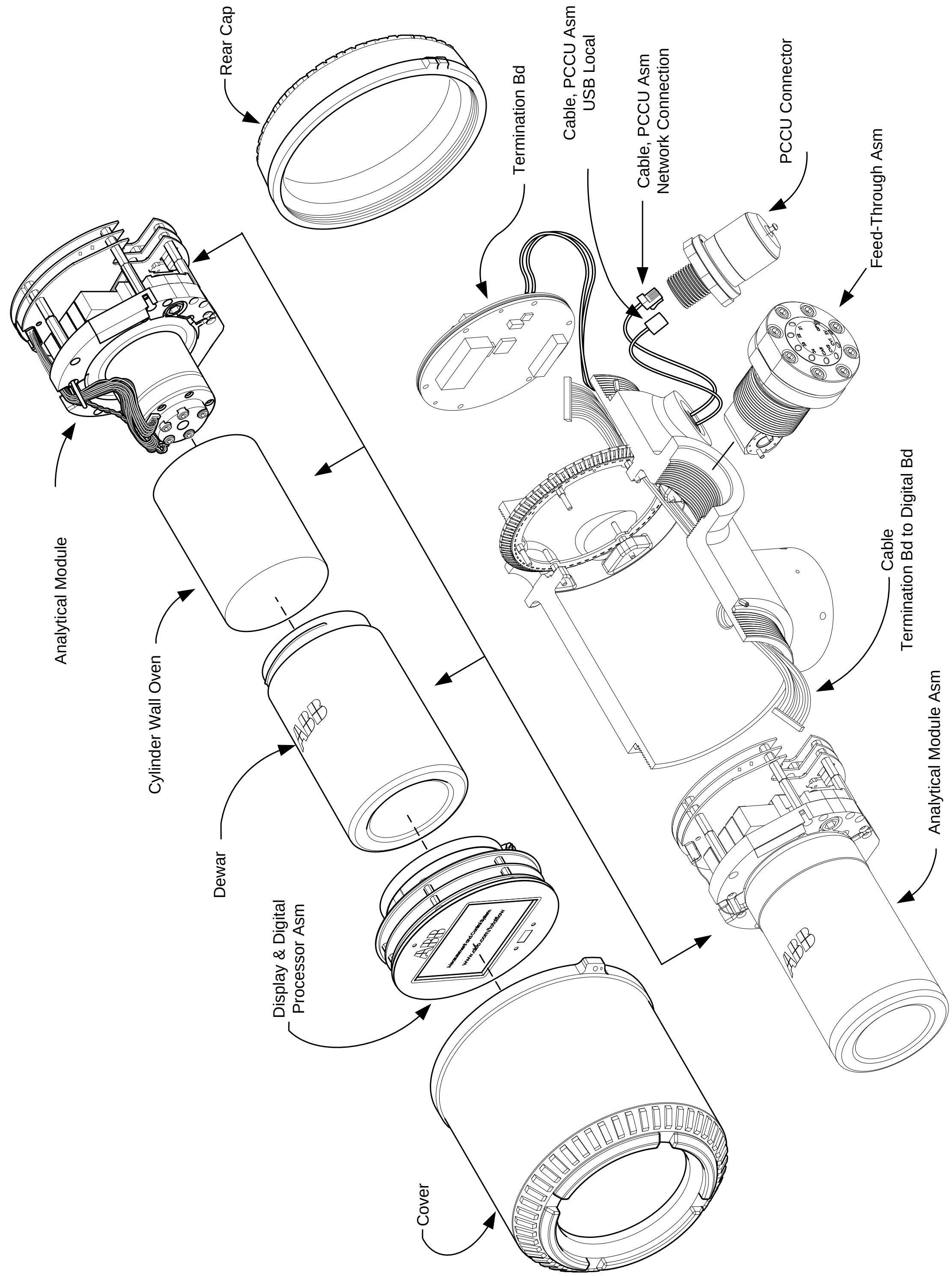
The following is a list of components that can be replaced:

- Analytical module (12 or 24 Vdc) with or without GC module (see Figure 4-2)
- GC module (custom for application)
- Digital controller assembly with display
- Termination board
- Feed-through assembly without preheat (see Figure 4-3)
- Feed-through assembly with preheat (12 or 24 Vdc)

4.2.2 Replacement Parts

The following is a list of parts that may be replaced:

- Lithium battery
- Frit filters
- Analytical processor to termination board cable
- Termination board to digital controller cable
- Feed-through O-ring
- Feed-through interface gasket
- Feed-through manifold gasket
- Feed-through heater with temperature sensor (12 or 24 Vdc)
- GC Module temperature sensor


Rear Cap
Termination Bd
Cable, PCCU Asm
USB Local
Cable, PCCU Asm
Network Connection
PCCU Connector
Feed-Through Asm
Cable
Termination Bd to Digital Bd
Analytical Module Asm
Analytical Module
Cylinder Wall Oven
Dewar
Display & Digital
Processor Asm
Cover

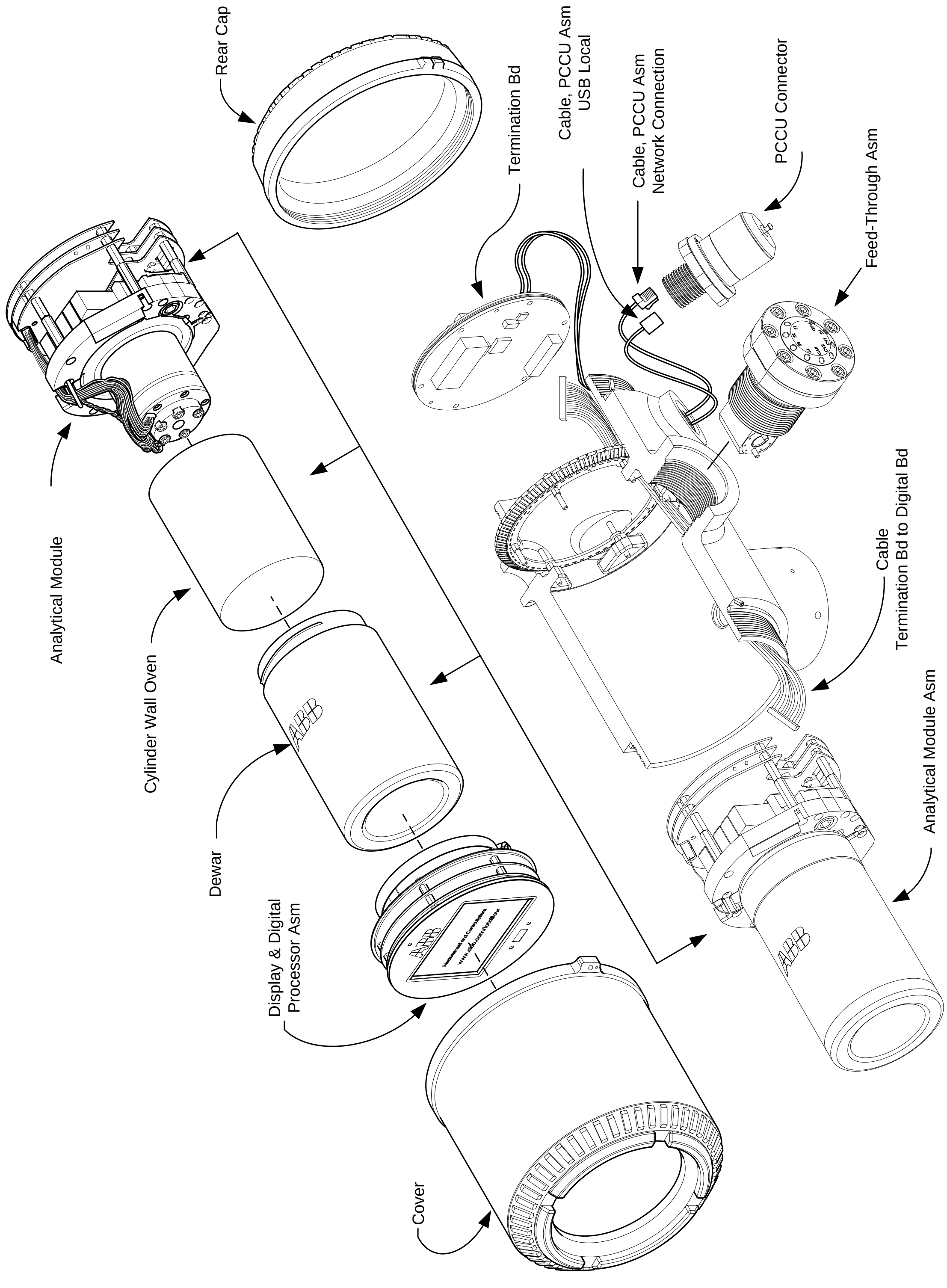


Figure 4-1 PGC1000 Overall View

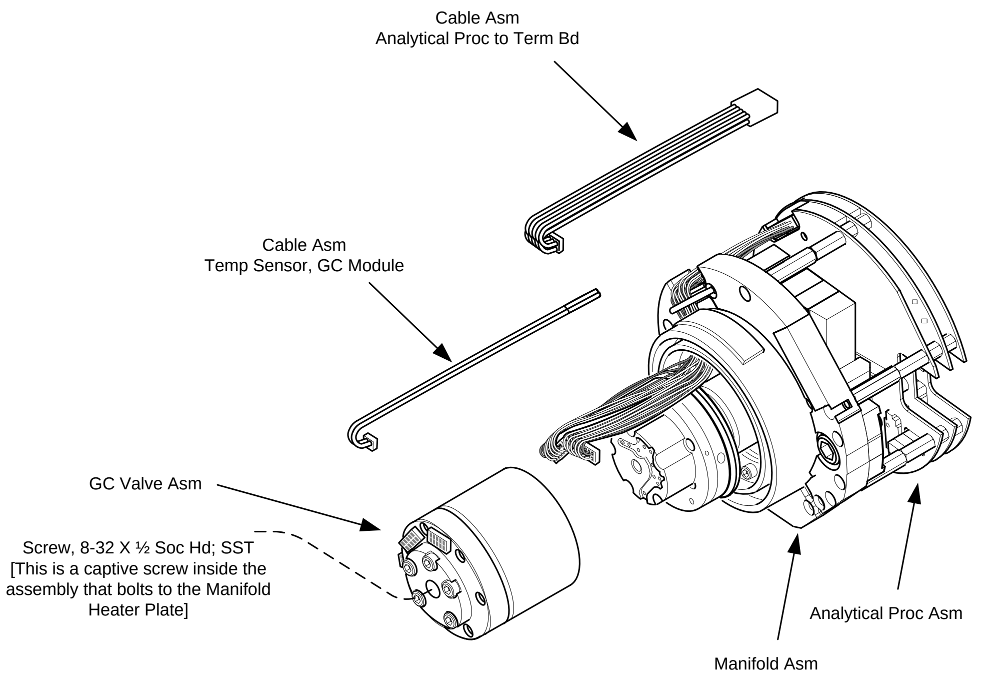


Figure 4-2 Analytical Module View, Exploded

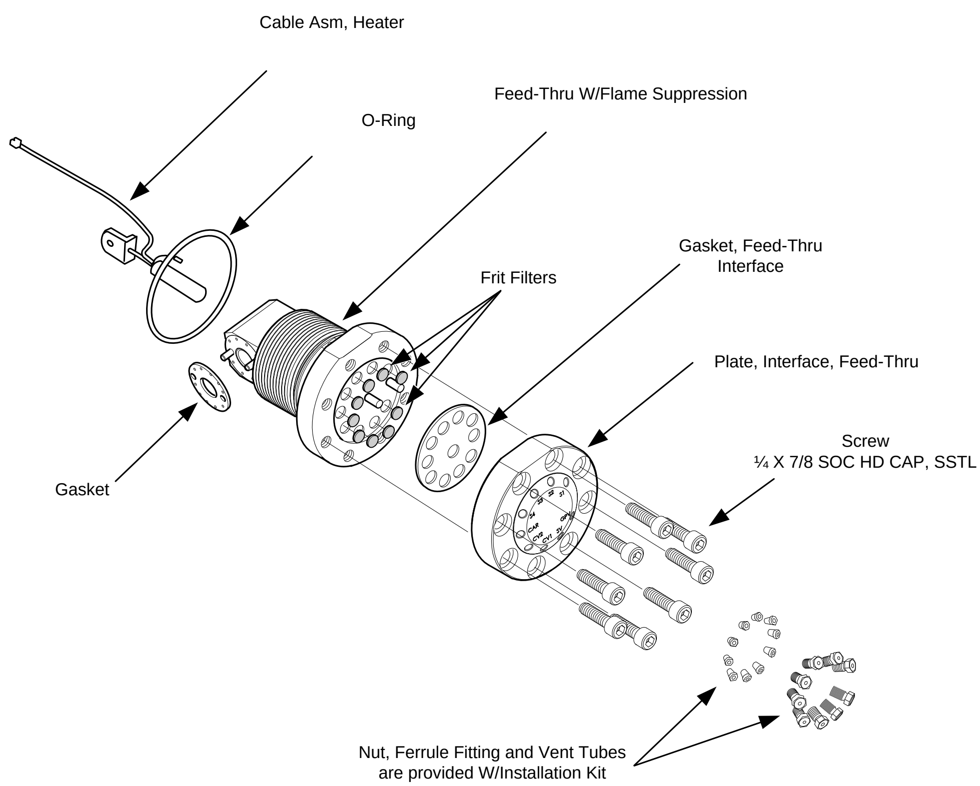


Figure 4-3 Feed-Through Assembly

4.2.3 Repair Time

ABB Totalflow has provided a recommended spares list for the PGC1000. Consideration was given to the cost of the repair time and the cost of stocking the repair parts. The PGC1000's modular design is uniquely suited for quick repair times. The following table lists four categories that concern repair times and the spares required to achieve those various repair times. Repair days are represented as work days not calendar days.

Table 4–1 Repair Time vs. Down Time

Repair Time	Requirements
No down time	If the application cannot allow for any down time, the user will need to consider having two units up and running. When one fails, the user can simply switch to the backup unit and send the failed unit in for repair.
In less than 8 hours	If the user is required to have a down time of less than eight hours, the user will have to stock replacement parts on-site. The repair parts required would depend on the variety of applications at the site. If the user has multiple units or applications at a single site, this would be a typical scenario.
In less than 48 hours	This category is for applications where the parts would be stocked at the factory. Overnight delivery of the part would allow for repair the next day. This might be typical for a fixed application that could tolerate a 48-hour repair time.
In less than 120 hours	This category is suited for any application or mix of applications. Within five working days, the site can receive shipment of stocked or built-to-order parts.

4.2.4 Recommended Spares

Recommended spares are provided for each of these categories, depending upon whether there is a single or multiple unit at the site(s) and whether the applications are fixed applications (stocked at the factory) or built-to-order (not stocked at the factory). The user will need to balance the cost of the spares with the cost of the repair time. With the variety of options available, the user can manage the repair time for the units, as needed.

4.2.5 Customer Service

Customer service can be called out and may have the stocked applications available for replacement (depending upon usage by the individual on service calls). The scheduling for a call-out is typically a week. If service personnel are needed in a more timely fashion, maintenance contracts may need to be considered. Phone support from the factory is available to help with the diagnosis of a problem. Alarms from the unit are also a key to quick diagnosis and repair of any failure.

Table 4–2 Recommended Spare Parts

Part Description	Stock Application	
	1 unit	>1 unit
12 Vdc Analytical Module Assy. w/o GC Module		1
12 Vdc Analytical Module Assy. With GC Module	1	
24 Vdc Analytical Module Assy. w/o GC Module		1
24 Vdc Analytical Module Assy. With GC Module	1	
Cable Between the Analog Processor and the Termination Board	1	1
Digital Controller Board & Display, Completed Assy.	1	1 per application
Digital Controller Board Assembly (Auxiliary Unit With no Display)	1	1 per application
Filter Frit for Feed-Through Assembly	2	2
GC Module Tested and Characterized		1 per application
MMI Port RS-232	1	1
Ribbon Cable for Connection Between the Digital Controller and the Termination Board	1	1
Termination Board	1	
USB Local MMI Port	1	1

4.3 Field Tool Kit

The recommended PGC1000 maintenance tools (see Table 4–3) are included in the optional field tool kit.

Table 4–3 Tool Requirements

Qty	-001	-002	Part Number	Description
1	●	●	2102304-001	Bag, ABB Nylon 11” x 6” Tool
1	●		1800683-01	Cutter, 1/16” Tubing
1	●	●	1801690-001	Extractor Tool, IC 8-24 Pin
1	●	●	T10790	Hex Key, Set 1/16-5/16 (12 Pcs)
1	●	●	T10440	Screwdriver, 3/32 x 2” Standard
1	●	●	T10601	Stripper, Wire
1	●	●	1801821-001	Tool, Ball Driver, 10.3” Long, 5/16”
1	●	●	1801822-001	Tools, Nut Driver, 6” Shank, ¼”
1	●		1801820-001	Wrench, 10” Adjustable
1	●	●	T10805	Wrench, 3/8 x 7/16 Open End
1	●	●	T10800	Wrench ,1/4 x 5/16 Open End
1	●	●	1801819-001	Wrench, 6” Adjustable

4.4 Visual Inspection

Periodically, the PGC1000 should be given an external, visual examination. Visual checks maintain optimum system operation and accuracy of the sample analysis.

4.4.1 Inspection

During the visual inspection, components should be examined for the following conditions:

- Pipe or wall-mounting: Unit must be in a vertical position and the mounting brackets tightened on the pipe. The wall-mounting bracket must be securely affixed to the mounting wall.
- Carrier gas bottle mounting rack: Mounting rack should be tilted backward slightly to keep the bottles from falling forward.
- Bottles within mounting rack: Bottles must be securely strapped in the mounting rack.
- Bottle regulators: Must be tightened securely and checked for leaks.
- Pipe mounted sample probe: Must be securely mounted in the pipe meter run using an approved probe adapter.
- Stainless steel tubing connected between sample probe and PGC1000: Must not be bent or closed off. Connections must be tight. Such conditions impede sample flow to the PGC1000.
- Tightness of front and rear end caps: Hand tightening gently is adequate.
- Input/output terminations, external power or signal cable runs: All input/output cable and power and signal conduit runs to Div 2 or non-hazardous areas must be sealed per NEC codes.

4.5 Backing up Configuration Files (Save)

Before beginning any maintenance on the PGC1000, the user should first collect the data. They will then need to backup all configuration files to the laptop's hard drive or a floppy disk. This safeguards the data and allows the user to re-start the unit without the trouble associated with re-configuring the PGC1000 should any problems arise.

Although there are Save buttons in the Entry mode screens that allows the user to back up Entry mode data items, a complete system backup is only accomplished by using the Save and Restore Utility. When using this utility to back up files, the user should also download the files to the TfCold drive. This safeguards the system in the event of a "cold" start.

4.5.1 Instructions

1) Collect data from the unit.

2) While in PCCU32, use the Save and Restore Utility found under File Utilities in the Operate drop-down menu on the main PCCU32 toolbar. The user can also click the Save and Restore Utility icon on the toolbar.

3) In the Save and Restore window, click the Save Station Files button.

4) When the Save Station Files window displays, verify the default name and path for the files. Click OK. This will save the TfData files to the PC.

5) When finished saving the station files, a new window will offer the option to restore the station files to the TfCold drive. If Yes is selected, the station files will be downloaded to that drive.

FYI The user may not want to restore the station files to TfCold. Some problems addressed in the Troubleshooting chapter may require a selective restore. For more information, see the Troubleshooting chapter and the PCCU help files.

4.6 Restore Configuration Files

Following various maintenance procedures or when configuration files need to be downloaded to the PGC1000, the Restore function will accomplish this.

If, prior to performing maintenance, the Save Configuration Files was selected, these files are downloaded to the user's laptop's hard drive or on a floppy disk. The Restore function uploads these files into the PGC1000's TfCold drive. This safeguards the data and allows the user to re-start the unit without the problems of re-configuring the PGC1000 should any problems arise.

4.6.1 Instructions

1) While in PCCU32, use the Save and Restore Utility found under File Utilities in the Operate drop-down menu on the PCCU32 main toolbar The user can also click the Save and Restore Utility icon on the toolbar.

2) In the Save and Restore window, click the Restore Station Files button.

3) When the Restore Station Files window displays, verify the default name and path for the files. Click OK. This will restore the files to the TfCold drive.

4) Verify the unit is functioning properly.

FYI The user may not want to restore the station files to TfCold. Some problems addressed in the Troubleshooting chapter may require a selective restore. For more information, see the Troubleshooting chapter and PCCU help files.

4.7 Reset Procedures

On occasion, it may be necessary to reset the unit. There are two types of reset procedures: warm or cold.

4.7.1 Warm Start Instructions

A warm start occurs when the main power is removed and then re-applied while memory backup is enabled. This does not clear the data stored in RAM. The warm start will only reset the PGC1000's microprocessor and will not disturb any data that has been stored in RAM. A warm start can be used when a power or communication interruption caused the PGC1000 microprocessor to lock up.

1) Collect data from the unit.

2) Using the Lithium Battery Status instructions, verify the battery status is satisfactory before proceeding.

CAUTION As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components. This voids any warranty.

3) Gain access to the rear termination board of the PGC1000 by loosening the countersunk hex socket locking set screw in the rear end cap. Use a 1/16" hex wrench. Upon completion, unscrew the end cap.

4) To warm start the unit, depress the S1 reset switch on the termination board.

Or, to remove the PGC1000 from service, disconnect the power connector J1 from the board.

5) To place PGC1000 back into service, return the power connection J1 to the termination board.

4.7.2 Cold Start Instructions

A cold start clears all the data that is stored in RAM as well as resetting all entered variables to their factory default values. Discretionary use of this procedure is advised.

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

CAUTION As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components. This will void any warranty.

2) Gain access to the digital controller assembly by loosening the countersunk hex socket locking set screw in the front end cap. Use a 1/16” hex wrench. Upon completion, unscrew the end cap.

3) Gain access to the rear termination board of the PGC1000 by loosening the countersunk hex socket locking set screw in the rear end cap. Use a 1/16” hex wrench. Upon completion, unscrew the end cap.

Unplug the lithium battery connector from the J5 receptacle on the digital controller board (see

4) Figure 4-4).

5) Push the reset button located on the termination board. This is located in the rear of the enclosure.

6) Initially, the Boot Loader screen will appear on the front display.

7) When the Navigation screen displays, restore the lithium battery connection on the digital controller board.

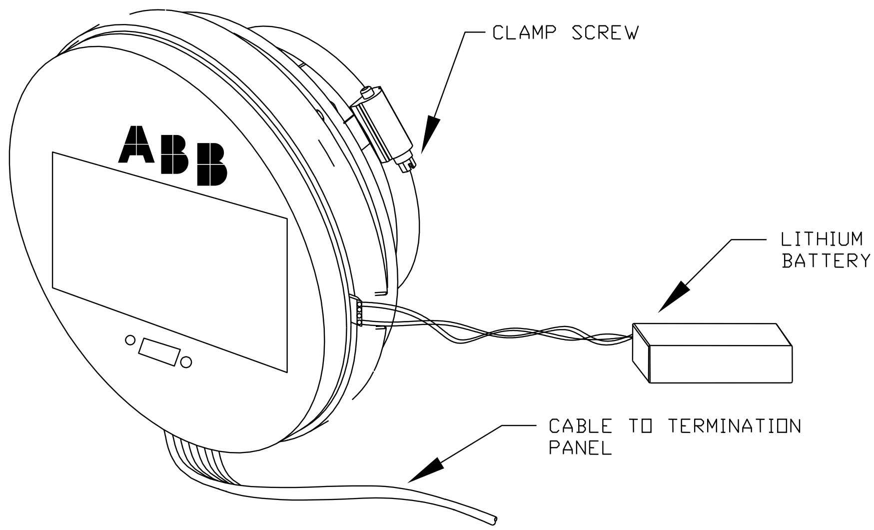


Figure 4-4 Digital Controller Complete Assembly

4.8 Restore Factory Defaults

Occasionally, it may be necessary to restore factory defaults. If critical configuration data is accidentally changed or erroneous results have been produced, the unit may require a reset to factory defaults. Inadvertently changing setup data, including critical local communication protocol settings, may call for the user to revert all setup information (configuration data) to factory settings. This includes the following items:

- Communication port settings
- Calibration gas concentrations
- Instantiated applications
- PGC1000 setup information
- Startup wizard re-initialized
- Electronic pressure settings
- All application parameters including display changes

This procedure will require the user to delete both the TfData folder (current setup data being used to operate the PGC1000) and the TfCold folder (non-volatile backup of the setup data).

CAUTION This procedure should not be a normal operation. It should only be used when all other setup and troubleshooting options have been exhausted or only used when a technical specialist recommends this procedure. If questions exist, call ABB Totalflow support at (800) 442-3097 – option 2.

4.8.1 Instructions

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

2) Collect data from the unit.

3) Shut down PCCU32.

TIP The system may not allow the deletion of active files when the PGC1000 is in normal operation (running from FLASH); therefore, the user should force the unit into Boot Loader mode.

4) Force the PGC1000's operating system into Boot Loader mode.

- Press the Reset button on the PGC1000's termination board.
- Wait about eight seconds until the Initializing System screen displays.
- Press the Reset button a second time.
- The unit should now be in Boot Loader mode. The screen will revert to the TOTALFLOW display screen.

5) Right-click on the Activesync icon located in the System Tray on the PC. From the pop-up screen, select Explore.

6) In the new window, highlight the TfData folder under Mobile Devices.

7) Right-click on the TfData folder. From the menu that displays, select Delete. The folder should disappear.

8) Open the Flash folder by double-clicking on it.

9) Highlight the TfCold folder. Right-click on it, and select Delete. The folder should disappear.

10) Press the Reset button on the termination board. This action should cause the \Flash\Factory\TfCold information, saved at the factory, to be copied into a new TfData folder. This will restore all factory settings. If the reset was successful, the user will see the Startup Wizard when they reconnect to PCCU32.

4.9 Lithium Battery Status

Prior to various maintenance procedures, especially when a cold start is not preferred or feasible, the user should verify that the lithium battery status is satisfactory.

If the user is directed to these instructions from another set of instructions, please return to them when the status has been verified.

4.9.1 Instructions

1) While in the PCCU32 Analyzer Operation screen, select Station Setup from the icons across the top of the screen.

2) Select the value beside the Lithium Battery Status.

3) If the Lithium Battery Status value reads OK, the power may be removed from the unit without causing a cold start.

4) If the Lithium Battery Status reads Low Voltage or Not Connected, the lithium battery should be connected or replaced prior to removing power from the unit. See the Replacing the Lithium Battery instructions later in the chapter.

4.10 Changing the PGC1000 Clock

When measurement streams are turned on within the PGC1000, changing the clock could affect the time when log period entries are made. To protect the integrity of accounting audit trails, the PGC1000 handles these types of clock changes as follows:

FYI Examples are based on a 60-minute log period.

4.10.1 Clock Change Not Crossing a Log Period Boundary

When the next log period entry is made, the clock is not altered.

Example: If the present time is 4:15 p.m. and the clock is changed to 4:05 p.m. of the same day, the daily flow record is the same. The entry reflects the accumulation over a 70-minute time period (15-minutes plus 55-minutes).

4.10.2 Forward Clock Change Crossing a Log Period Boundary

This forces a log period entry for part of the log period that has accumulated since the last log period entry. PGC1000 then advances to a new data flow record and begins maintaining the balance of the day's data in a newly defined boundary.

Example: If the present time is 4:55 p.m. and the clock is changed to 5:05 p.m. of the same day, the entry reflects only a 55-minute average accumulation. A new flow record is then written. This period is also based on a 55-minute accumulation.

4.10.3 Backward Clock Change Crossing a Log Period Boundary

This forces a log period entry for part of the log period that has accumulated since the last log period entry. This is the same as for a forward clock change crossing an hourly boundary. PGC1000 advances to a new day's data flow record and maintains the balance of the day's data in a new record.

Example: If the present time is 5:05 p.m. and the clock is changed to 4:55 p.m. of the same day, the log period record entry reflects only a 5-minute average accumulation (5:00 to 5:05). A new flow record is then written. This log period is based on a 5-minute accumulation (4:55 to 5:00).

FYI

A backward clock change uses two (2) daily records to maintain data integrity. This assures that previously recorded data is not overwritten.

If it is necessary to make small backward time changes less than one (1) hour, the user should wait until the current hour has progressed far enough to make a change that does not cross an hour boundary.

4.11 Replacing Calibration or Carrier Gas Bottle(s)

When calibration or carrier gas bottle(s) require replacement, please use the following instructions.

4.11.1 Instructions

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

2) Turn off the calibration and/or carrier gas at the bottle.

3) Remove the regulator from the bottle.

4) Exchange the bottle with the full bottle.

5) Re-Install the regulator into the bottle. Verify that the pressure regulator is set correctly to either 15 PSIG for calibration gas or 90 PSIG for carrier gas. Open the shut-off valve on the regulator.

6) At the PGC1000 feed-through assembly, loosen the nut and ferrule from the corresponding inlet. Allow the air to purge from the line.

WARNING Be sure to follow the requirements of the national and local codes when performing this purge.

7) Re-insert the ferrule and nut into the correct inlet. Upon completion, tighten.

8) Leak test the connections at the bottle regulator and the feed-through assembly.

9) In PCCU32, run two single cycles. Make sure that the unit is still in hold. Inspect the chromatograms to determine if the unit is processing correctly. If the chroms are satisfactory, return the unit to normal operation.

4.12 Removing Digital Controller Assembly

This section presents the procedures for removal and installation of the digital controller assembly and mounting bracket. If the user has been directed here from another procedure, return back to the corresponding procedure when disassembly is complete.

CAUTION As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components. This voids any warranty.

1.1.1 Instructions

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

2) Gain access to the digital controller assembly by loosening the countersunk hex socket locking set screw in the front end cap. Use a 1/16” hex wrench. Upon completion, unscrew the end cap.

3) Using a flat-blade screwdriver, loosen the screw in the mounting clamp.

4) Unplug the ground cable from the digital controller assembly.

5) Slide the assembly off of the thermal flask. Be careful to not unplug the flat ribbon cable connecting the digital controller assembly to the termination board or the lithium battery.

CAUTION DO NOT remove the mounted lithium battery or the termination board cable from the PGC1000 board at this time. Removing the lithium battery will cause a cold start. When replacing the lithium battery, the termination board cable must remain connected to power the digital controller assembly; otherwise, the unit will cold start. The user will receive specific instructions during each procedure detailing if either cable should be unplugged.

6) To reassemble, perform steps 3–5 in reverse order. Be careful to align the display screen horizontally before tightening the screw.

4.13 Replacing Digital Controller Complete Assembly

Access to the digital controller assembly is gained by removing the front-mounted digital controller assembly from the analytical module.

CAUTION As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components. This voids any warranty.

4.13.1 Instructions

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

2) Collect data from the unit.

3) Back up the configuration files. Follow the instructions detailed previously in the Backing Up Configuration Files section.

4) Turn off all sample streams, calibration gas and carrier gas.

5) Disconnect or remove power from the PGC1000 unit either externally or by removing the J1 connector from the termination board.

6) Remove the digital controller assembly. For instructions on performing this task, refer to the Removing Digital Controller Assembly section.

7) Unplug the termination board to the digital controller assembly flat ribbon cable. Leave the lithium battery connected.

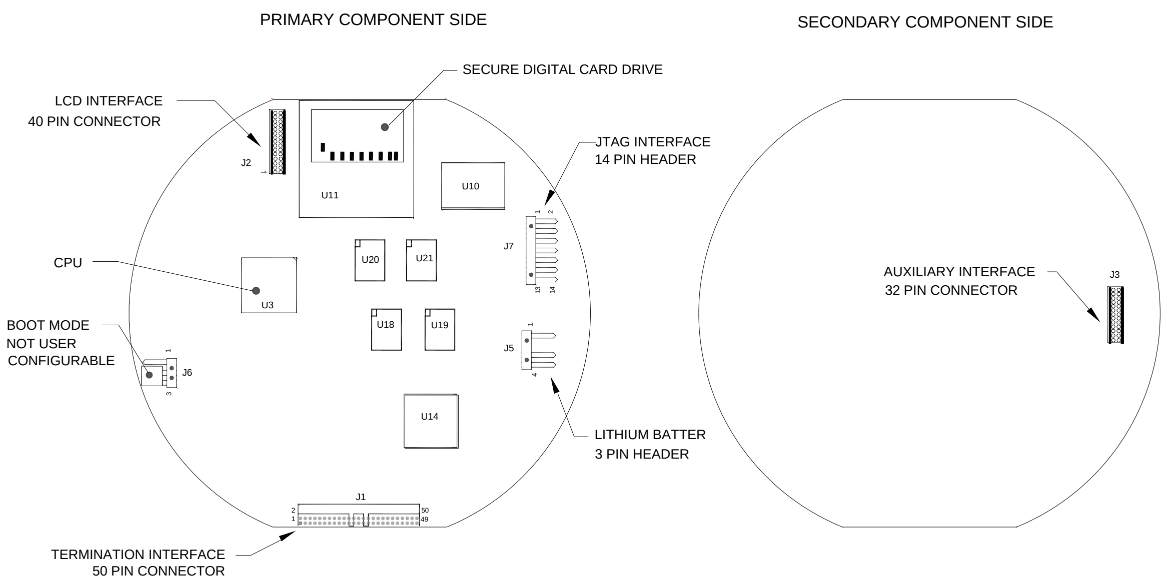


Figure 4-5 Digital Controller Board

8) To reassemble using the replacement assembly, perform steps 6–7 in reverse order. Be careful to align the display screen before tightening. Check the lithium battery plug for proper installation on the connector.

CAUTION

Please note that the termination board to digital controller ribbon cable pin 1 wire is NOT red. On the digital controller board, the red edge (pin 1) of the cable should plug onto pin 50, the right side of plug. The plug is keyed. As such, do not force the plug into the connector.

9) Re-plug the ground cable into the new assembly.

10) Once assembled, apply power to the PGC1000 (step 5).

11) Adjust the contrast potentiometer R18 for optimum display (located on the VGA display board). To adjust the display contrast, use an extra small Phillips-point screwdriver to turn the potentiometer R18 clockwise for more contrast or counter-clockwise for less.

12) Restore the configuration files. Use the instructions detailed in the Restore Configuration Files section.

13) Re-install the front and rear end caps.

CAUTION

For the purposes of returning this assembly to ABB Totalflow service for warranty or repair, please contact ABB Totalflow customer service for an RA number. Please keep the lithium battery connected to the digital controller board for return.

FYI

Please note that since power was removed from this unit, the PGC1000 will perform Startup Diagnostics and stabilize. If the user has disabled the Startup Diagnostics, this should be enabled and power cycled to the unit. If power has been withheld from the unit for an unknown or lengthy period of time, a complete startup should be performed.

For more information on enabling the diagnostics in PCCU32, click the Diagnostics button and then the Help button.

4.14 Replacing Analytical Module

This section presents the procedures for removal and installation of the analytical module. The module is a completely self-contained unit and is part of the PGC1000. Read through all procedural steps before beginning disassembly.

Before beginning this procedure, verify that the module is appropriately rated for the system voltage. Compare the module voltage to the ID tag. The ID tag is located on the side of the enclosure.

CAUTION

When the analytical module is removed, the module should be placed on a clean, dirt-free work surface. Care should be taken that gas ports are free from lint or dust particles. ABB Totalflow strongly suggests that the GC replacement module be kept in a sealed, static-free envelope until the last possible moment before installation.

It is important that the bottom surface of the module be placed on a clean, lint-free cloth to prevent the components from being scratched, damaged or contaminated.

4.14.1 Instructions

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

2) Collect data from the unit.

3) Back up the configuration files. Follow the instructions detailed previously in the Backing Up Configuration Files section.

4) Using the Lithium Battery Status instructions, verify the battery status is satisfactory before proceeding.

5) Turn off all sample streams, calibration gas and carrier gas.

6) Disconnect or remove power from the PGC1000 unit either externally or by removing the J1 connector from the termination board.

CAUTION As with all electronic components, caution should be used when handling the boards. Static electricity can potentially damage board components. This voids the warranty.

7) Gain access to the digital controller assembly by loosening the countersunk hex socket locking set screw in the front end cap. Use a 1/16” hex wrench. Upon completion, unscrew the end cap.

8) Remove the assembly. Use the instructions detailed previously in the Digital Controller Assembly Mounting Bracket section. If weather/circumstances permit, the digital controller assembly may be suspended by the cables to eliminate stress on the cable connections. Upon completion, the user may move to step 10.

9) Carefully unplug the cable to the termination board. Leave the lithium battery plugged in. Set the digital controller assembly aside on a clean, lint-free surface.

10) Using a 5/16” hex wrench, loosen the mounting screw holding the analytical module in place until the module can be slowly lifted from the enclosure. Take care to not pull the wires attached to the rear of the assembly (see Figure 4-6).

11) If the auxiliary heater is installed, detach the analytical module rear-face jumpers, J1 and J4 (see Figure 4-7).

12) Set module on a clean, lint-free surface.

13) Verify that the gasket on the feed-through assembly manifold interface is in place, in good condition and free from metal filings or other contamination. If the gasket has fallen off inside the enclosure or stuck to the GC module, replace onto the feed-through manifold interface. Ensure that the gasket does NOT cover the gas portholes.

14) Verify the S1 auxiliary heater switch is set to the correct position. If using the auxiliary feed-through heater, set position to Normal.

15) Insert the mounting screw into the analytical module.

16) Holding the analytical module at the opening of the enclosure, reconnect the jumpers J1 and J4 if the auxiliary heater is installed (see Figure 4-7).

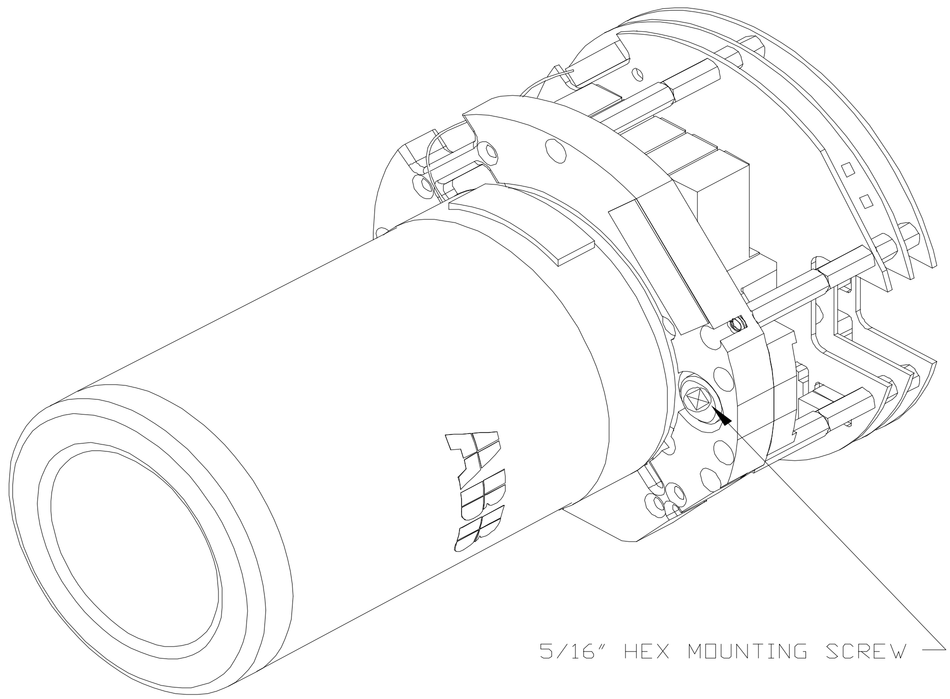


Figure 4-6 Analytical Module

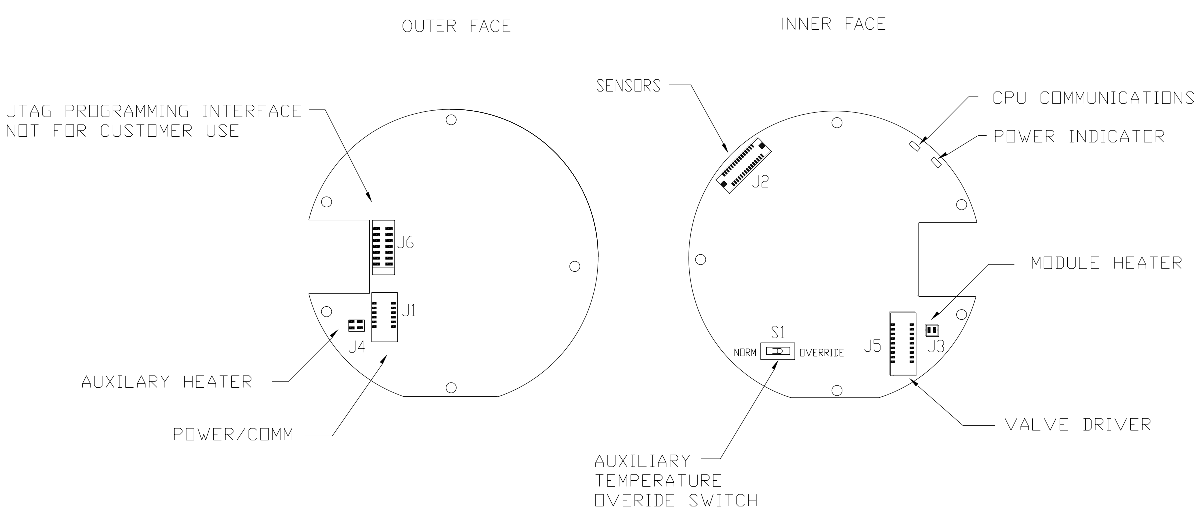


Figure 4-7 Analytical Processor Board

17) Carefully insert the module into the enclosure. Rotate the module to ensure the rear components clear the manifold interface on the inside area of the feed-through assembly. The feed-through manifold interface and analytical module are keyed to ensure proper alignment.

18) When the analytical module is in place, tighten the mounting screw.

19) Re-assemble the digital controller assembly. Use the instructions previously detailed in this chapter.

20) Plug the termination board to digital controller ribbon cable into the digital controller assembly.

CAUTION

Please note that the termination board to digital controller ribbon cable pin 1 wire is NOT red. On the digital controller board, the red edge (pin 1) of the cable should plug into pin 50, the right side of plug. The plug is keyed. As such, do not force the plug into the connector.

21) Insert the lithium battery pack into the enclosure between the enclosure and the thermal flask.

22) Once the unit is reassembled, apply power to the PGC1000 (step 6).

23) Re-install the front and rear end caps.

TIP

For the purposes of returning this assembly to ABB Totalflow service for warranty or repair, please contact ABB Totalflow customer service for an RA number.

FYI

Please note that since power was removed from this unit, the PGC1000 will perform Startup Diagnostics and stabilize. If the user has disabled the Startup Diagnostics, it should be enabled and power cycled to the unit. If power has been withheld from the unit for an unknown or lengthy period of time, a complete startup should be performed.

For more information on enabling the diagnostics in PCCU32, click the Diagnostics button and then the Help button.

4.15 Replacing GC Module

This section presents the procedures for removal and installation of the GC module. The module is a completely self-contained unit and is part of the analytical module. Read through all the procedural steps before removing the assembly.

Before beginning the procedure, verify that the module is appropriately rated for the system voltage. Compare the module voltage to the ID tag. The ID tag is located on the side of the enclosure.

CAUTION

When the GC module is removed, the module should be placed on a clean, dirt-free work surface. It is important that the bottom surface of the module be placed on a clean, lint-free cloth to prevent its base from being scratched or damaged. Additionally, the gas sample flow line openings should be free of foreign contaminants.

If the GC module is not being immediately replaced, put the thermal flask back in place to prevent the mandrel from being scratched or damaged. Additionally, the gas sample flow line openings should be free of foreign contaminants. Also, be careful with the miniature D-type connector pins.

4.15.1 Instructions

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.
2) Collect data from the unit.
3) Back up the configuration files. Follow the instructions detailed previously in the Backing Up Configuration Files section.
4) Using the Lithium Battery Status instructions, verify the battery status is satisfactory before proceeding.
5) Turn off all sample streams, calibration gas and carrier gas.
6) Disconnect or remove the power from the PGC1000 unit either externally or by removing the J1 connector from the termination board.

CAUTION As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components. This voids the warranty.

7) Gain access to the digital controller assembly by loosening the countersunk hex socket locking set screw in the front end cap. Use a 1/16" hex wrench. Upon completion, unscrew the end cap.
8) Following the instructions detailed previously in the Digital Controller Assembly Mounting Bracket section, remove the assembly. If weather/circumstances permit, the digital controller assembly may be suspended by the cables to eliminate stress on the cable connections. The user may move to step 10.
9) Carefully unplug the cable to the termination board. Leave the lithium battery plugged in. Set the digital controller assembly aside on a clean, lint-free surface.
10) Unscrew the thermal flask counterclockwise (see Figure 4-8). When loose, lift the flask from the unit. Set aside.
11) Unscrew the oven wall counterclockwise (oven wall may be hot). When loose, lift the cylinder from the GC module. Set aside.
12) Using the extraction tool, remove the cable connectors from jumpers J1, J2 and J3. DO NOT pull the connectors from the board by the wires.
13) Using a 9/64" hex wrench, loosen the mounting screw inside the center of the assembly. When loose, lift the assembly from the manifold assembly. Set aside on a clean, lint-free surface.
14) Verify that the manifold heater plate gasket is in place and in good condition.
15) Carefully insert the replacement module onto the manifold assembly. Rotate the module to ensure the key holes line up and the module rests on the base. The unit should not turn once it is seated correctly.
16) When the GC module is in place, tighten the mounting screw.
17) Carefully restore the cable connectors to jumpers J1, J2 and J3. Be careful to not press against the wires attached to the connector head.
18) Replace the oven wall onto the GC module. Be careful to not pinch or bind any of the cables. When fully on, turn the oven wall clockwise to tighten.

19) Replace the thermal flask over the GC module. When the flask reaches the mounting bracket, turn clockwise to tighten.

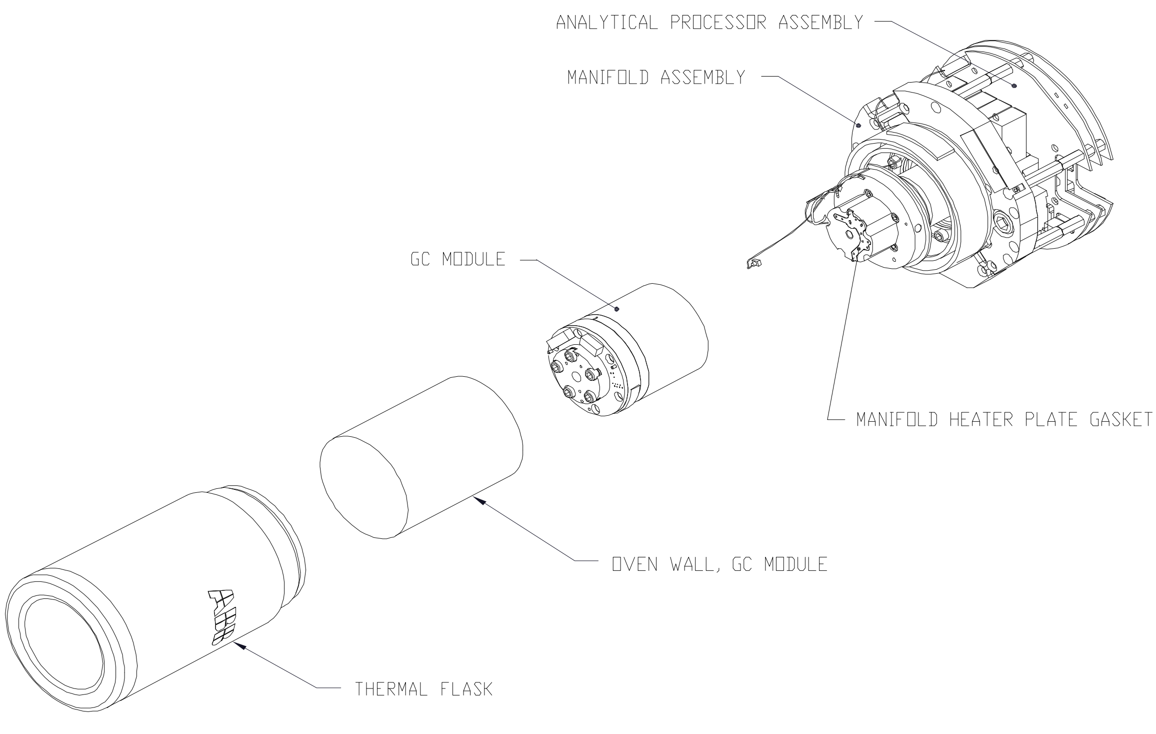


Figure 4-8 GC Module, Exploded View

20) Using the instructions previously covered in this chapter, re-assemble the digital controller assembly.

21) Plug the termination board to the digital controller ribbon cable into the digital controller assembly, if disconnected.

CAUTION Please note that the termination board to the digital controller ribbon cable pin 1 wire is NOT red. On the digital controller board, the red edge (pin 1) of the cable should plug into pin 50, the right side of plug. The plug is keyed. Do not force the plug into the connector.

22) Insert the lithium battery pack into the enclosure between the enclosure and the thermal flask.

23) Once the unit is reassembled, apply power to the PGC1000 (step 6).

TIP For the purposes of returning this assembly to ABB Totalflow service for warranty or repair, please contact ABB Totalflow customer service for an RA number.

24) Re-install the front and rear end caps.

FYI

Please note that since power was removed from this unit, the PGC1000 will perform Startup Diagnostics and stabilize. If the user has disabled the Startup Diagnostics, it should be enabled and power cycled to the unit. If the power has been withheld from the unit for an unknown or lengthy period of time, a complete startup should be performed.

For more information on enabling the diagnostics in PCCU32, click the Diagnostics button and then the Help button.

4.16 Replacing Termination Board

This section presents the procedures for removal and installation of the power termination board. This board is located in rear of the PGC1000. Read through all procedural steps before removing the assembly.

4.16.1 Instructions

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

2) Collect data from the unit.

3) Back up the configuration files. Follow the instructions detailed previously in Backing Up Configuration Files section.

4) Using the Lithium Battery Status instructions, verify the battery status is sufficient before proceeding.

5) Gain access to the rear termination board of the PGC1000 by loosening the countersunk hex socket locking set screw in the rear end cap. Use a 1/16” hex wrench. Upon completion, unscrew the end cap.

CAUTION

As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components. This voids the warranty.

6) Disconnect or remove power from the PGC1000 unit either externally or by removing the J1 connector from the termination board (see Figure 4-9).

7) Disconnect all connectors from the board: J2 digital I/O, J8 and J10 serial ports, J3 Ethernet and J6 USB client connectors. Move wires out of the way.

8) Using a 5/16” nut driver, loosen and remove the six nuts holding the termination board in place.

9) Lift the protective overlay out.

10) Lift the termination board out. Be careful of the wires fed into the enclosure through the hubs and the cables connected to the back. DO NOT REMOVE EMI GASKET.

11) Carefully unplug the ribbon cable to the digital controller from the back of the termination board, J4, and analytical processor, J12. Set board aside.

CAUTION

Please note that the termination board to the digital controller ribbon cable pin 1 wire is NOT red. On the termination board, the red edge (pin 1) of the cable should plug into pin 50, the right side of plug. The plug is keyed. Do not force the plug into the connector.

12) Holding the replacement board at the opening of the enclosure, reconnect the ribbon cable to the digital controller into the back of the termination board, J4, and the analytical processor cable into J12.

13) Insert the termination board into the enclosure. Be careful to not pinch the wires between the mounting stud and the board.

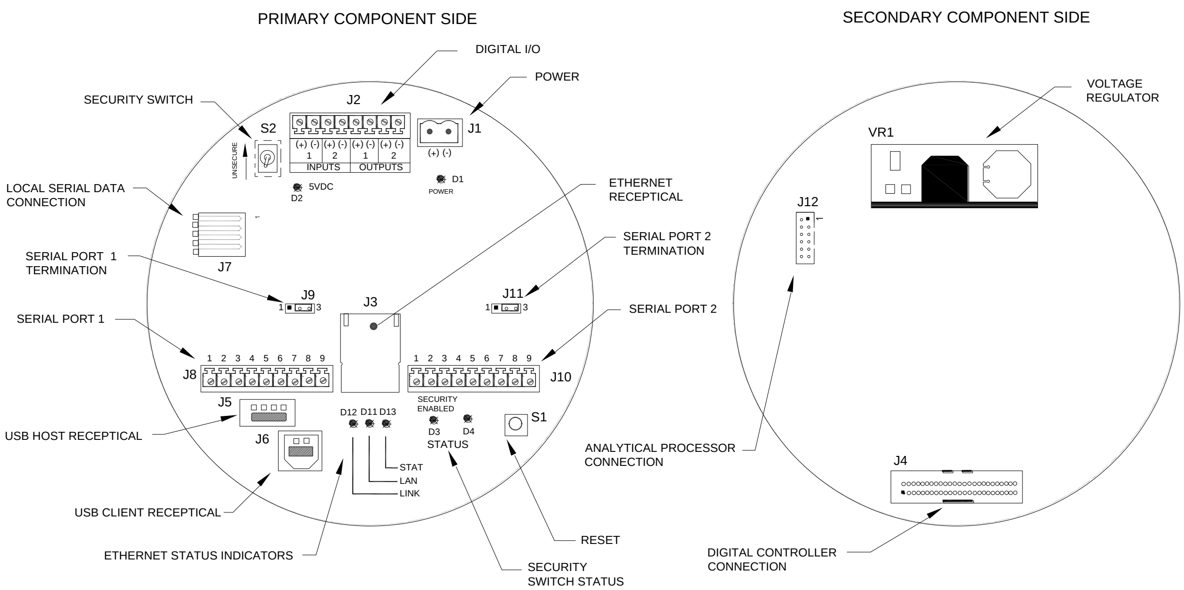


Figure 4-9 Termination Board

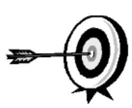
14) Replace the protective overlay into the enclosure on the mounting studs.

15) Replace the nuts to hold the termination board in place.

16) Restore the J2, J8, J10, J3 and J6 connections, if applicable.

17) Once the unit is reassembled, apply power to the PGC1000 (step 6).

18) Reinstall the front and rear end caps.

TIP 

For the purposes of returning this assembly to ABB Totalflow service for warranty or repair, please contact ABB Totalflow customer service for an RA number.

FYI 

Please note that since the power was removed from this unit, the PGC1000 will perform Startup Diagnostics and stabilize. If the user has disabled the Startup Diagnostics, it should be enabled and power cycled to the unit. If power has been withheld from the unit for an unknown or lengthy period of time, a complete startup should be performed.

For more information on enabling the diagnostics in PCCU, click the Diagnostics button and then the Help button.

4.17 Replacing Feed-Through Assembly

This section presents the procedures for removal and installation of the feed-through assembly. This assembly is located on the side of the PGC1000. Read through all procedural steps before removing the assembly.

Before beginning the procedure, verify that the module is appropriately rated for the system voltage. Compare the module voltage to the ID tag. The ID tag is located on the side of the enclosure.

4.17.1 Instructions

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

2) Collect data from the unit.

3) Back up the configuration files. Follow the instructions detailed previously in the Backing Up Configuration Files section.

4) Using the Lithium Battery Status instructions, verify the battery status is sufficient before proceeding.

5) Turn off all sample streams, calibration gas and carrier gas.

6) Disconnect or remove the power from the PGC1000 unit either externally or by removing the J1 connector from the termination board.

CAUTION As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components. This voids any warranty.

7) Gain access to the digital controller assembly by loosening the countersunk hex socket locking set screw in the front end cap. Use a 1/16” hex wrench. Upon completion, unscrew the end cap.

Following the instructions detailed previously in the Digital Controller Assembly Mounting Bracket section, remove the assembly (see

8) Figure 4-4). If weather/circumstances permit, the digital controller assembly may be suspended by the cables to eliminate stress on the cable connections. The user may move to step 10.

9) Carefully unplug the cable to the termination board. Leave the lithium battery plugged in. Set the digital controller assembly aside on a clean, lint-free surface.

10) Using a 5/16” hex wrench, loosen the mounting screw holding the analytical module in place until the module can be slowly lifted from the enclosure. Take care to not pull wires attached to the rear of the assembly (see Figure 4-6).

11) Detach the analytical module rear-face jumpers, J1 and J4, if the auxiliary heater is installed.

12) Set the module on a clean, lint-free surface.

13) Using a ¼” open end wrench, loosen the Valco® nut. Upon completion, remove the input line. Repeat for all sample, carrier and calibration gas lines.

14) Using a 5/64” hex wrench, loosen the feed-through set screw.

15) Unscrew the feed-through assembly. By hand, turn counter-clockwise until free.

16) On the replacement assembly, install the O-ring and manifold gasket that are supplied with the new feed-through assembly (see Figure 4-10).

17) Carefully apply the sealing thread lubricant to the threads on the feed-through assembly. Be careful to not contaminate the feed-through manifold and gasket.

18) Verify the O-ring and feed-through manifold gasket are in place and not damaged (see Figure 4-10).

19) Insert the replacement feed-through assembly, and screw in clockwise until completely set. Do not tighten.

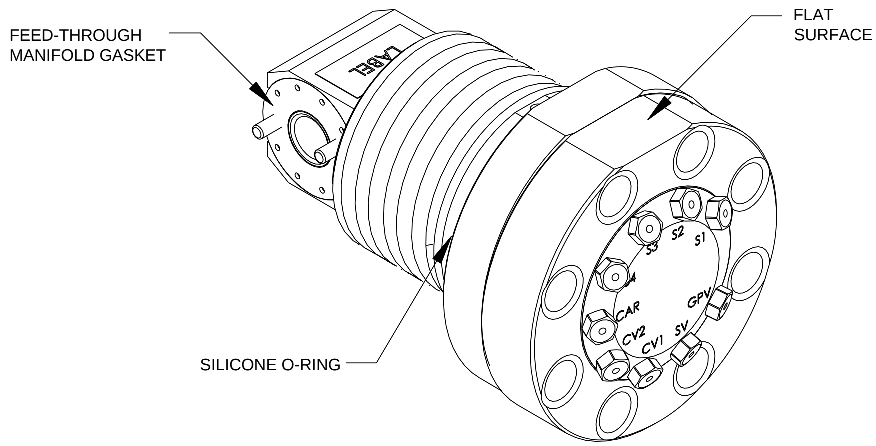


Figure 4-10 Feed-Through Assembly

20) The user will now need to reverse the direction. Unscrew the feed-through assembly counter-clockwise a minimum of one full rotation but less than two full rotations. Stop when the flat edge is on top and horizontal.

21) Using a 5/64” hex wrench, tighten the feed-through set screw.

22) Insert the mounting screw into the analytical module.

23) Holding the analytical module at the opening of the enclosure, reconnect the jumpers, J1 and J4, if the auxiliary heater is installed (see Figure 4-7).

24) Carefully insert the module into the enclosure. Rotate the module to ensure the rear components clear the manifold interface on the inside area of the feed-through assembly. The feed-through manifold interface and analytical module are keyed to ensure proper alignment.

25) When the analytical module is in place, tighten the mounting screw.

26) Reassemble the digital controller assembly. Use the instructions covered previously in this chapter.

27) Plug the termination board to the digital controller ribbon cable into the digital controller assembly.

CAUTION

Please note that the termination board to the digital controller ribbon cable pin 1 wire is NOT red. On the digital controller board, the red edge (pin 1) of the cable should plug onto pin 50, the right side of plug. The plug is keyed. Do not force the plug into the connector.

28) Insert the lithium battery pack into the enclosure. This will be between the enclosure and the thermal flask.

29) Once the unit is reassembled, apply power to the PGC1000 (step 6).

30) Re-install the front and rear end caps.

FYI

Please note that since power was removed from this unit, the PGC1000 will perform Start-Up Diagnostics and stabilize. If the user has disabled the Start-Up Diagnostics, it should be enabled and power cycled to the unit. If power has been withheld from the unit for an unknown or lengthy period of time, a complete start-up should be performed.

For more information on enabling the diagnostics in PCCU, click the Diagnostics button and then the Help button.

4.18 Replacing Lithium Battery

This section presents the procedures for the removal and installation of a new lithium battery. The lithium battery is inside of the front end cap and is wedged between the thermal flask and the enclosure wall. Read through all procedural steps before removing the assembly.

4.18.1 Instructions

CAUTION

DO NOT REMOVE POWER TO UNIT! Loss of power to the unit will initiate a cold start. All data and configuration files will be destroyed.

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

2) Collect data from the unit.

3) Back up the configuration files. Follow the instructions detailed previously in the Backing Up Configuration Files section.

CAUTION

As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components. This will void any warranty.

4) Gain access to the digital controller assembly by loosening the countersunk hex socket locking set screw in the front end cap. Use a 1/16” hex wrench. Upon completion, unscrew the end cap.

5) Unplug the lithium battery connector from the J5 receptacle on the digital controller board (see Figure 4-11).

6) Plug in the replacement lithium battery to J5 on the digital controller board.

7) Insert the lithium battery pack into the enclosure. This will be between the enclosure and the thermal flask.

8) Using the lithium battery status instructions, verify the battery status is sufficient before proceeding.

9) Reinstall the front end cap.

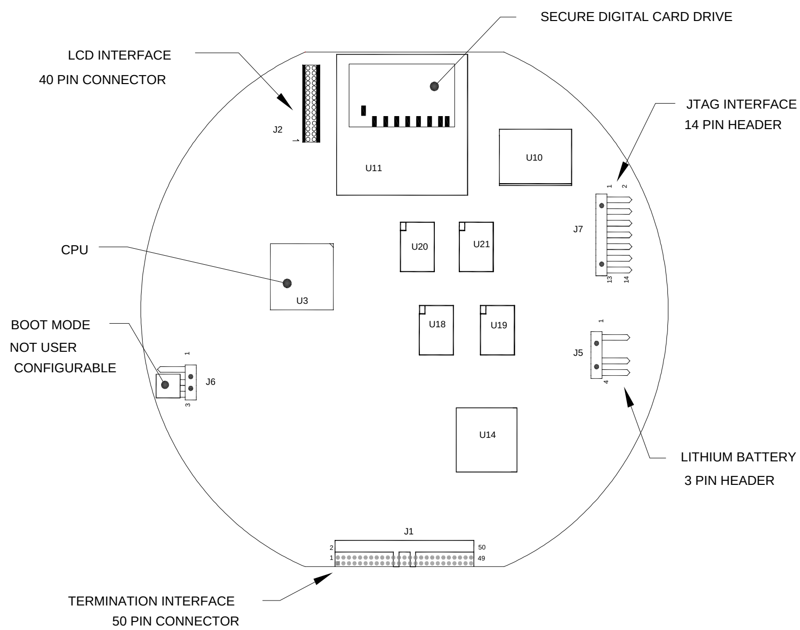


Figure 4-11 Primary Component Side Digital Controller Board

4.19 Replacing Frit Filters

Several reasons exist for replacing the frit filters. Reasons can range from a scheduled maintenance procedure to decreased sample pressure due to clogged filters. When replacing the filters on a regularly scheduled maintenance plan, it will most likely not require that the sample lines be removed from the external plate. When replacing the filters as the result of troubleshooting, the user should remove the sample input lines and use compressed air to clear the pathway. For the purposes of this manual, the following instructions will contain the steps for the worst-case scenario.

4.19.1 Instructions

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

2) Collect data from the unit.

3) Back up the configuration files Follow the instructions detailed previously in the Backing Up Configuration Files section.

4) Turn off all sample streams, calibration gas and carrier gas.

5) Using a 7/32” hex wrench, loosen, and remove all 8–¼” hex socket screws (see Figure 4-12).

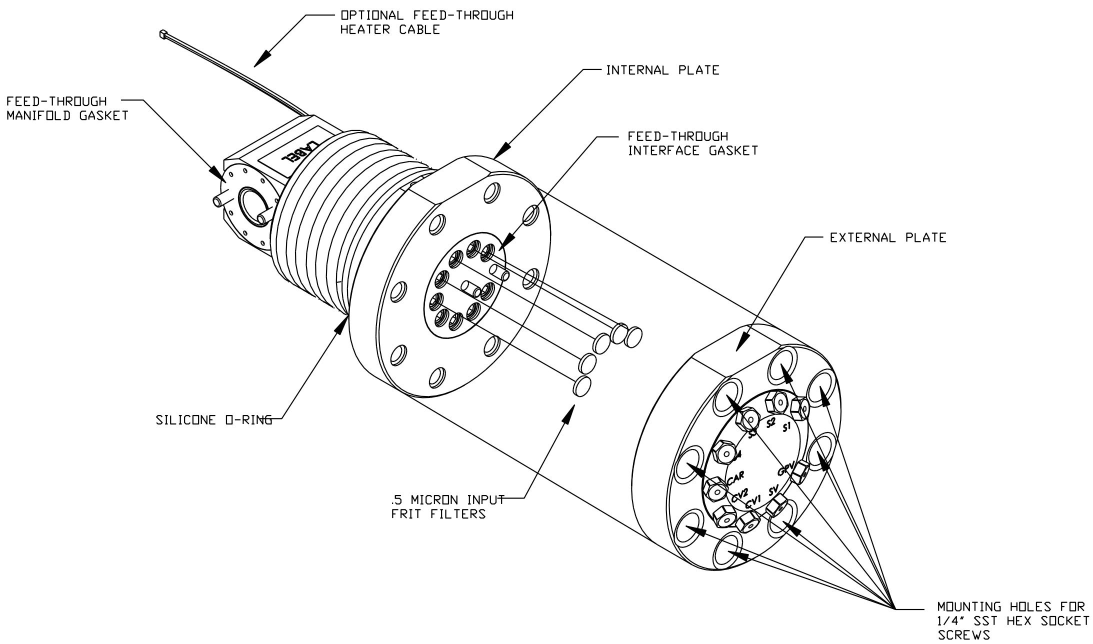


Figure 4-12 Feed-Through Assembly - Exploded View

6) If space permits, lift the external plate away from the internal plate. This will enable the user to view the frit filters. If space does not permit lifting the plate away enough to view the filters, the user must remove the sample input lines and the carrier and calibration gas lines.

7) If filters appear soiled, it will be necessary to remount the external plate and remove the input lines. To remove the input lines, continue to the next step; otherwise, move to step 9.

8) Using a ¼" open-end wrench, loosen the Valco® nut. Upon completion, remove the input line. Repeat for all sample, carrier and calibration gas lines.

9) Remove the 8–¼" hex socket mounting screws.

10) Remove the used filters from the filter sockets. Using an edged instrument, put pressure on the outermost edge of each filter to remove them.

11) If replacing filters due to clogging, the user should also use compressed air to blow out the input holes in the external plate. It may also be necessary to wipe the gasket clean. The gasket is located on the internal plate. If the gasket does not require this action, move to the next step.

12) Using a replacement filter, carefully lay the filter into the filter socket. Apply uniform pressure to the filter. DO NOT use any pointed instrument to push the filter into place. Repeat for each input stream and the carrier and calibration gas inputs. Vents do not require filters.

13) Reseat the external plate. Align the mounting pins on the internal plate to the corresponding holes on the external plate.

14) Replace the 8–¼" mounting screws. Use a star pattern when tightening the screws.

15) If the sample, carrier and calibration gas lines were removed, purge air from the transport tubing. Upon completion, reconnect to the corresponding ports.

CAUTION DO NOT over tighten. After securing the tubing, check for gas leaks.

4.20 Replacing Feed-Through Interface Gasket

Should the feed-through interface gasket require replacement (see Figure 4-12), follow these instructions. Typically, the user would change the gasket while performing another procedure; however, for the purposes of this manual, the instructions will start and finish as a complete procedure.

4.20.1 Instructions

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

2) Collect data from the unit.

3) Back up the configuration files. Follow the instructions detailed previously in the Backing Up Configuration Files section.

4) Turn off all sample streams, calibration gas and carrier gas.

5) Using a 7/32” hex wrench, loosen and remove all 8–¼” hex socket screws.

6) If space permits, lift the external plate away from the internal plate, and remove the damaged gasket from the internal plate. If space does not permit lifting the plate away enough to replace the gasket, the user must remove the sample input lines and the carrier and calibration gas lines.

7) Remount the external plate, and remove the input lines. To remove the input lines, continue to the next step; otherwise, move to step 9.

8) Using a ¼” open-end wrench, loosen the Valco® nut. Upon completion, remove the input line. Repeat for all sample, carrier and calibration gas lines.

9) Remove the 8–¼” hex socket mounting screws.

10) Remove the damaged gasket from the internal plate.

11) Clean the gasket area on the internal plate. Use a clean, dry, lint-free cloth before placing the new gasket on the internal plate. The gasket is keyed to ensure that it is placed correctly. The gasket should not cover any holes in the internal plate.

12) Reseat the external plate. Align the mounting pins on the internal plate to the corresponding holes on the external plate.

13) Replace the 8–¼” mounting screws. Use a star pattern when tightening the screws.

14) If the sample, carrier and calibration gas lines were removed, purge air from the transport tubing. Upon completion, reconnect to the corresponding ports.

CAUTION DO NOT over tighten. After securing the tubing, check for gas leaks.

4.21 Replacing Feed-Through Manifold Gasket

Should the feed-through manifold gasket require replacement (see Figure 4-12), follow these instructions. Typically, the user would change the gasket while performing another procedure; however, for the purposes of this manual, the instructions will start and finish as a complete procedure.

4.21.1 Instructions

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

2) Collect data from the unit.

3) Back up the configuration files. Follow the instructions detailed previously in the Backing Up Configuration Files section.

4) Using the Lithium Battery Status instructions, verify the battery status is sufficient before proceeding.

5) Turn off all sample streams, calibration gas and carrier gas.

6) Disconnect or remove the power from the PGC1000 unit either externally or by removing the J1 connector from the termination board.

CAUTION As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components. This will void any warranty.

7) Gain access to the digital controller assembly by loosening the countersunk hex socket locking set screw in the front end cap. Use a 1/16" Hex wrench. Upon completion, unscrew the end cap.

Following the instructions detailed previously in the Digital Controller Assembly Mounting Bracket section, remove the assembly (see

8) Figure 4-4). If weather/circumstances permit, the digital controller assembly may be suspended by the cables to eliminate stress on the cable connections. The user may move to step 10.

9) Carefully unplug the cable to the termination board. Leave the lithium battery plugged in. Set the digital controller assembly aside on a clean, lint-free surface.

10) Using a 5/16" hex wrench, loosen the mounting screw holding the analytical module in place until the module can be slowly lifted from the enclosure. Take care to not pull the wires that are attached to the rear of the assembly (see Figure 4-6).

11) Detach the analytical module rear-face jumpers, J1 and J4, if the auxiliary heater is installed.

12) Set the module on a clean, lint-free surface.

13) Replace the gasket on the feed-through assembly manifold interface. Ensure that the gasket does NOT cover the gas port holes.

14) Insert the mounting screw into the analytical module.

15) Holding the analytical module at the opening of the enclosure, reconnect jumpers J1 and J4, if the auxiliary heater is installed (see Figure 4-7).

16) Carefully insert the module into the enclosure. Rotate the module to ensure the rear components clear the manifold interface on the inside area of the feed-through assembly. The feed-through manifold interface and the analytical module are keyed to ensure proper alignment.

17) When the analytical module is in place, tighten the mounting screw.

18) Re-assemble the digital controller assembly. Use the instructions previously covered in this chapter.

19) Plug the termination board to the digital controller ribbon cable into the digital controller assembly.

CAUTION

Please note that the termination board to the digital controller ribbon cable pin 1 wire is NOT red. On the digital controller board, the red edge (pin 1) of the cable should plug into pin 50, the right side of plug. The plug is keyed. Do not force the plug into the connector.

20) Insert the lithium battery pack into the enclosure. This will be between the enclosure and the thermal flask.

21) Once the unit is reassembled, apply power to the PGC1000 (step 6).

22) Reinstall the front and rear end caps.

FYI

Please note that since power was removed from this unit, the PGC1000 will perform Start-Up Diagnostics and stabilize. If the user has disabled the Start-Up Diagnostics, it should be enabled and power cycled to the unit. If the power has been withheld from the unit for an unknown or lengthy period of time, a complete start-up should be performed.

For more information on enabling the diagnostics in PCCU, click the Diagnostics button and then the Help button.

4.22 Replacing Termination Board to the Digital Controller Cable

Should the termination board to the digital controller cable become damaged and require replacement, follow these instructions. Typically, the user would change the cable while performing another procedure; however, for the purposes of this manual, the instructions will start and finish as a complete procedure.

4.22.1 Instructions

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

2) Collect data from the unit.

3) Back up the configuration files. Follow the instructions detailed previously in the Backing Up Configuration Files section.

4) Using the Lithium Battery Status instructions, verify the battery status is sufficient before proceeding.

5) Turn off all sample streams, calibration gas and carrier gas.

6) Disconnect or remove power from the PGC1000 unit either externally or by removing the J1 connector from the termination board.

CAUTION As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components. This voids any warranty.

7) Gain access to the digital controller assembly by loosening the countersunk hex socket locking set screw in the front end cap. Use a 1/16” hex wrench. Upon completion. Unscrew the end cap.

Following the instructions detailed previously in the Removing Digital Controller Assembly section, remove the assembly (see

8) Figure 4-4). If weather/circumstances permit, the digital controller assembly may be suspended by the cables to eliminate stress on the cable connections. The user may move to step 10.

9) Carefully unplug the cable to the termination board. Leave the lithium battery plugged in. Set the digital controller assembly aside on a clean, lint-free surface.

10) Using a 5/16” hex wrench, loosen the mounting screw holding the analytical module in place. Slowly lift the module from the enclosure. Take care to not pull the wires attached to the rear of the assembly (see Figure 4-6).

11) Detach the analytical module rear-face jumpers, J1 and J4, if the auxiliary heater is installed.

12) Set the module on a clean, lint-free surface.

13) Reach into the enclosure through the front opening, and unplug the ribbon cable from the rear of the termination board, J4.

14) On the replacement cable, verify the orientation by viewing the keyed receptacle on the termination board and cable. Insert the plug into the J4 connector.

15) Verify that the gasket on the feed-through assembly manifold interface is in place and in good condition. If the gasket has fallen off inside the enclosure or is stuck to the GC module, replace onto the feed-through manifold interface. Ensure that the gasket does NOT cover the gas portholes.

16) Insert the mounting screw into the analytical module.

17) Holding the analytical module at the opening of the enclosure, reconnect jumpers J1 and J4, if the auxiliary heater is installed.

18) Carefully insert the module into the enclosure. Rotate the module to ensure the rear components clear the manifold interface on the inside area of the feed-through assembly. The feed-through manifold interface and the analytical module are keyed to ensure proper alignment.

19) When the analytical module is in place, tighten the mounting screw.

20) Re-assemble the digital controller assembly. Use the instructions previously covered in this chapter.

21) Plug the termination board to the digital controller ribbon cable into the digital controller assembly.

CAUTION Please note that the termination board to the digital controller ribbon cable pin 1 wire is NOT red. On the digital controller board, the red edge (pin 1) of the cable should plug into pin 50, the right side of plug. The plug is keyed. Do not force the plug into the connector.

22) Insert the lithium battery pack into the enclosure. This will be between the enclosure and the thermal flask.

23) Once the unit is reassembled, apply power to the PGC1000 (step 6).

24) Re-install the front and rear end caps.

FYI

Please note that since the power was removed from this unit, the PGC1000 will perform Start-Up Diagnostics and stabilize. If the user has disabled the Start-Up Diagnostics, it should be enabled and power cycled to the unit. If the power has been withheld from the unit for an unknown or lengthy period of time, a complete start-up should be performed.

For more information on enabling the diagnostics in PCCU, click the Diagnostics button and then the Help button.

4.23 Replacing Analytical Processor to the Termination Board Cable

Should the cable connecting the analytical processor to the termination board require replacement, use the following instructions.

4.23.1 Instructions

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

2) Collect data from the unit.

3) Back up the configuration files. Follow the instructions detailed previously in the Backing Up Configuration Files section.

4) Using the Lithium Battery Status instructions, verify the battery status is sufficient before proceeding.

5) Disconnect or remove power from the PGC1000 unit either externally or by removing the J1 connector from the termination board.

CAUTION

As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components. This voids any warranty.

6) Following the instructions detailed previously in the Replacing Termination Board section, remove the board. Upon completion, unplug the cable. Reaching into the enclosure, unplug the analytical processor to the termination board cable from the analytical processor assembly (see Figure 4-7).

7) Using the replacement cable, insert into the enclosure Upon completion, plug into the power/communication connector, J1. Connect the cable to the back of the termination board's J12 connector (see Figure 4-9).

8) Re-install the termination board.

CAUTION

Please note that the termination board to the digital controller ribbon cable pin 1 wire is NOT red. On the digital controller board, the red edge (pin 1) of the cable should plug into pin 50, the right side of plug. The plug is keyed. Do not force the plug into the connector.

9) Once the unit is reassembled, apply power to the PGC1000 (step 6).

TIP For the purposes of returning this assembly to ABB Totalflow service for warranty or repair, please contact ABB Totalflow customer service for an RA number.

10) Re-install the rear end cap.

FYI Please note that since the power was removed from this unit, the PGC1000 will perform Start-Up Diagnostics and stabilize. If the user has disabled the Start-Up Diagnostics, it should be enabled and power cycled to the unit. If power has been withheld from the unit for an unknown or lengthy period of time, a complete start-up should be performed.

For more information on enabling the diagnostics in PCCU, click the Diagnostics button and then the Help button.

5.0 TROUBLESHOOTING

5.1 Overview

To serve as an aid in troubleshooting the PGC1000, this chapter will provide troubleshooting guidelines for the various subsystems of the PGC1000. Some of these procedures will differ slightly from other ABB Totalflow products because the communications, power charger/source and other I/O are contained in a separate enclosure rather than within the PGC1000 enclosure.

Some of the procedures are based on tests performed on the PGC1000 termination board, and others are based on tests performed on components located in a separate enclosure. The user will determine which of these procedures correspond to their particular unit. If using equipment other than the ABB Totalflow enclosure, the user will need to refer to the manufacturer's procedures for troubleshooting their equipment.

WARNING DO NOT open or remove covers, including the PCCU local communications cover, unless the area is known to be non-hazardous, including the internal volume of the enclosure.

5.1.1 Troubleshooting Support

If troubleshooting instructions do not lead to a resolution and assistance is required, the user can contact the ABB Totalflow service department.

USA: 1-800-HELP-365 or 1-800-435-7365

5.1.2 Getting Started

Using Figure 5-1, determine which section will most likely need to be used. Upon determination, move to that particular area.

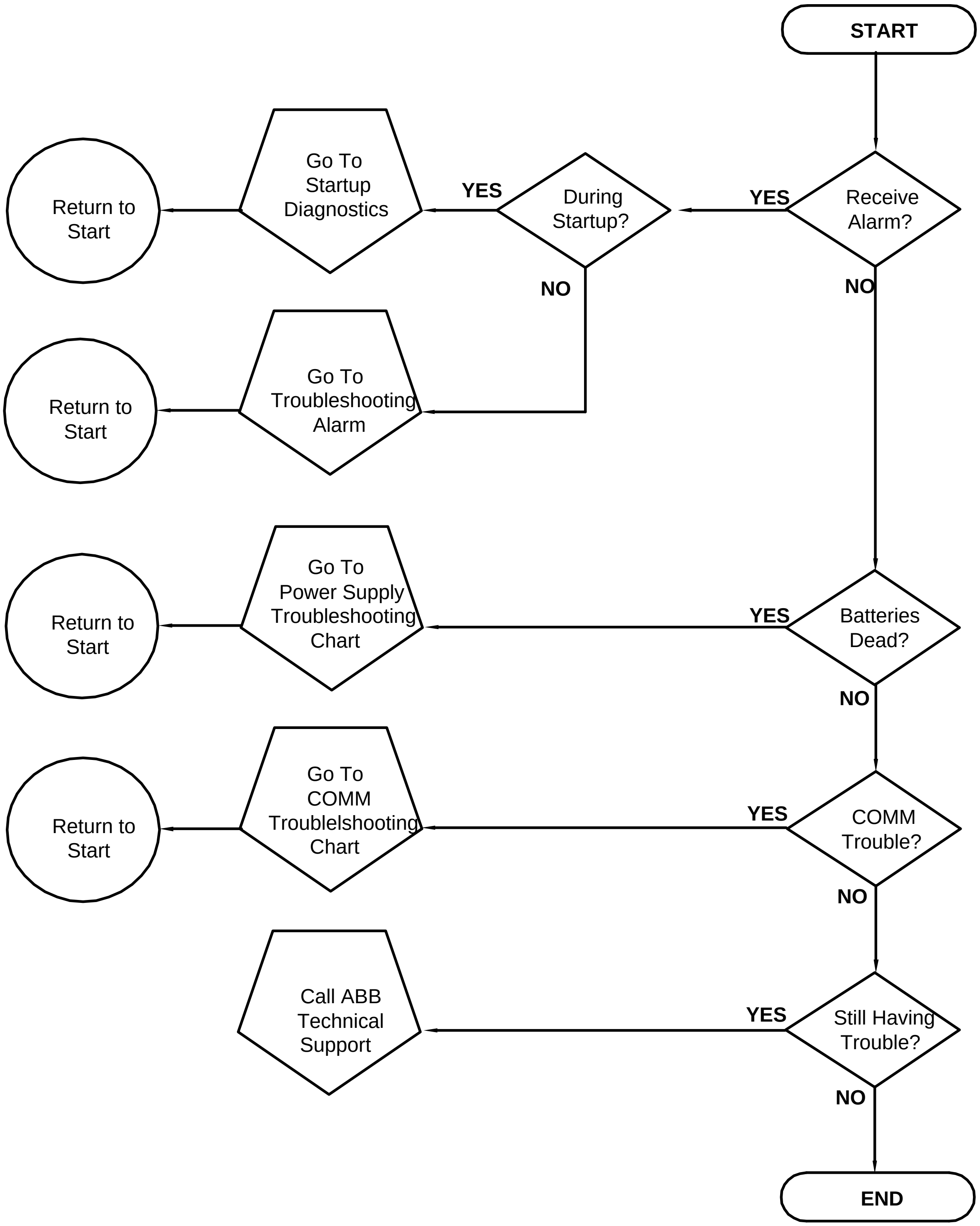


Figure 5-1 Troubleshooting Flowchart

5.2 Start-Up Diagnostic Troubleshooting

This section focuses on determining what has caused an alarm during Start-Up Diagnostics. The ABB Totalflow PGC1000 has an extensive, built-in list of tests which are performed each time the unit is started. This start-up testing may be disabled, but ABB Totalflow recommends that it be left enabled.

These diagnostics consist of four areas of testing:

- Carrier pressure regulator test
- Oven temperature test
- Processor control test
- Stream test

These start-up tests may also be performed on a regular schedule. Please see the PCCU help files for more information on scheduling diagnostics.

FYI ABB Totalflow has performed extensive testing on each PGC1000, prior to shipment, and each unit is factory calibrated using our standard calibration blend.

TIP During the stream test, streams with no gas pressure will fail, and they will be disabled in the stream sequence. To enable these streams, please click on the Stream Setup button on the Analyzer Operation screen.

5.2.1 Status

The following descriptive statuses and definitions are standard for all start-up diagnostics. Additionally, each test group will have status results that will narrow down the possibilities for troubleshooting.

Status	Description
Idle	No tests are running.
In Progress	Test(s) are in progress.
Passed	Basic and/or additional tests, if required, passed.
Failed	The basic test failed. Additionally, more in-depth tests were run and also failed.
Aborted	Tests were aborted by the user using the abort command.

5.2.2 Carrier Pressure Regulator Test

If the carrier pressure test failed, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may take the user to other procedures. When those procedures are complete, the user should return to these procedures to continue.

5.2.2.1 Description

These alarms are indicative of low carrier pressure. The causes range from a closed carrier bottle regulator to a blockage inside the GC module.

5.2.2.2 Status

The following descriptive statuses and definitions are applicable for the carrier pressure regulator test only. They should be considered additional to those defined for all start-up diagnostics.

Status	Description
Low Reg Pressure	Pressure is too low to continue the test. Possible causes are the carrier bottle is low, the regulator on the carrier bottle needs to be turned up to 90 PSIG, carrier line from bottle to the PGC1000 is plugged, etc.
Flow Blocked	A blockage was detected during one of the tests. The flow test was run in an attempt to dislodge the blockage but was not successful. See Flow Test below.
Pressure Reg Test	This is an additional test that is in-progress because the basic test failed. A different status will be displayed after the test has finished.
Flow Test	The flow test is in progress. The flow test is initiated when a blockage is detected. The flow test will raise the pressure in an attempt to blow the plug out through the vent. If unsuccessful, the flow blocked status will be displayed.
Failed	The additional tests cannot prove with certainty but either the GC module or the manifold assembly is bad.

5.2.2.3 Instructions

1) Verify the carrier gas bottle pressure regulator is open. If not, open the regulator on the carrier gas bottle; otherwise, continue to the next step.

2) Verify the carrier gas bottle pressure regulator set point is 90 PSIG. If not, correct the set point to 90 PSIG (620.5 kPa or 6.2 bars); otherwise, continue to the next step

3) Perform the column vent pressure test procedure in this chapter for all column vents. If either test failed, proceed to the next step.

4) Using the Replacing Analytical Module Assembly instructions in Chapter 4-Maintenance, replace the analytical module assembly.

CAUTION

ABB Totalflow recommends that a replacement analytical module be installed at this point and additional steps be performed in a clean, lint-free atmosphere. Because the customer does not have the required equipment to determine which specific module needs replaced, the final instructions are by process of elimination. This will begin with the most likely module.

The ABB Totalflow repair department offers a range of services for troubleshooting and repairing/replacing the non-functioning parts. For more information regarding the repair service, contact customer service:

USA: 1-800-HELP-365 or 1-800-435-7365

5) Using the Replacing GC Module instructions in Chapter 4-Maintenance, replace the GC module.

5.2.3 Oven Temperature Test

If the oven temperature test failed, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may take the user to other procedures. When those procedures are complete, the user should return to these procedures to continue.

5.2.3.1 Description

This alarm is indicative of a temperature condition. The causes range from an unplugged cable to a bad module heater.

5.2.3.2 Instructions

1) Verify that the cable is plugged in and in good repair. If the cable is unplugged, plug the cable in; otherwise, continue to the next step.

2) Using the Replacing Analytical Processor to GC Module Cable instructions in Chapter 4-Maintenance, verify that the cable is plugged in and in good repair. If the cable is unplugged or appears to be damaged, replace or plug the cable in; otherwise, continue to the next step.

3) Using the Replacing Analytical Module Assembly instructions in Chapter 4-Maintenance, replace the analytical processor.

CAUTION

ABB Totalflow recommends that a replacement analytical module be installed at this point and additional steps be performed in a clean, lint free atmosphere.

The ABB Totalflow repair department offers a range of services for troubleshooting and repairing/replacing the non-functioning parts. For more information regarding the repair service, contact customer service:

USA: 1-800-HELP-365 or 1-800-435-7365

5.2.4 Processor Control Test

If the Col 1 or Col 2 carrier pressure test failed or the oven temperature test failed, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may take the user to other procedures. When those procedures are complete, the user should return to these procedures to continue.

5.2.4.1 Description

These alarms are indicative of a lack of ability to control a function. If the failure is any of the column carrier pressure tests, it could be a missing or failed gasket. If the failure is in the oven control temperature test, it could be something as easy as a missing GC module cover or analytical module thermal flask.

5.2.4.2 Instructions

1) If the start-up diagnostics are being performed and follow the disassembly/replacement of a module or spare part, ensure that the unit is completely re-assembled to include the thermal flask and both the front and rear end caps. Re-start the diagnostics. If the diagnostics fail again, repeat the disassembly steps, and verify that all gaskets and connections are tight and correctly installed; otherwise continue to the next step.

2) If the start-up diagnostics are being performed from an initial start-up, verify that the analytical module is not loose inside the enclosure.

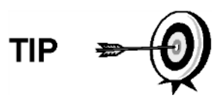
3) Verify that the GC module is tight and that the cables are correctly installed and not damaged.

4) Re-assemble the unit, and restart diagnostics. If the unit continues to fail, replace the entire analytical module. Return the module to ABB Totalflow for warranty repair/replacement.

5.2.5 Stream Test

The stream flow diagnostics go through a series of tests that test the stream pressure at different conditions, as listed below. Each column will display the pressure results after that part of the test has completed. The status column will reflect the current and final status of the tests.

The following procedures will step the user through the troubleshooting process. On occasion, these instructions may take the user to other procedures. When those procedures are complete, the user should return to these procedures to continue.



During the stream test, streams with no gas pressure will fail. As a result, they will be disabled in the stream sequence. To enable these streams, please click on the Stream Setup button on the Analyzer Operation screen.

5.2.5.1 Status

The following descriptive statuses and definitions are applicable for only the stream test. These should be considered additional to those defined for all start-up diagnostics.

Status	Description
Failed Initial Pressure	Failed the initial pressure test.
Failed Resting Pressure	Failed the resting pressure test.
Failed No Pressure	Failed the maximum pressure test.
Failed Holding Pressure	Failed the holding pressure test.
Failed Flowing Pressure	Failed the flowing pressure test.
Failed Ending Pressure	Failed the ending pressure test.
Waiting	This will be displayed by streams waiting to be tested. The tests are run sequentially.

5.2.5.2 Description

These alarms are indicative of a sample pressure problem. The causes range from a plugged frit filter to a bad GC module.

5.2.5.3 Instructions

1) Perform the sample vent pressure test procedure for the sample vent. If the test failed, proceed to the next step.

2) Perform the feed-through assembly blockage test on the sample vent. If the test fails, replace the feed-through assembly with the new or refurbished assembly; otherwise, continue to the next step.

CAUTION

ABB Totalflow recommends that a replacement analytical module be installed at this point and additional steps be performed in a clean, lint-free atmosphere. Because the user does not have the required equipment to determine which specific module needs to be replaced, the final instructions are performed by process of elimination. This will begin with the most likely module.

The ABB Totalflow repair department offers a range of services for troubleshooting and repairing/replacing the non-functioning parts. For more information regarding the repair service, contact customer service:

USA: 1-800-HELP-365 or 1-800-435-7365

3) Using the Replacing GC Module instructions in Chapter 4-Maintenance, replace the GC module.

5.3 Troubleshooting Alarms

This section focuses on determining what has caused an alarm, following normal operation. The ABB Totalflow PGC1000 has an extensive, built-in list of alarms. Many of these are user-configurable. These alarms may be grouped into three areas: warning, fault and system fault. See Table 5–1 for a list of all enabled alarms. To view all the available alarms, select Setup under Stream 1 on the Analyzer Operation screen. Upon completion, select Alarm Definitions.

FYI

Additionally, the Component High/Low Concentration, Component Peak not Found and Component RF Limit Exceeded alarms are available but disabled. These alarms may be enabled by the user but are not included in this manual. Please see the PCCU32 help files for more information regarding these.

Table 5–1 PGC1000 Alarms

Description	Enable	Type	Severity
Pressure Regulator	Yes	GT	Fault
Sample Pressure	Yes	GT	Fault
Oven Temperature Error	Yes	GT	System Fault
No Stream Valve Selected	Yes	GT	System Fault
Digital-Analog Bd Comm Error	Yes	GT	System Fault
Calculation Error	Yes	GT	Fault
Calibration Un-Normalized Total	Yes	GT	Fault
Stream Sequence Error	Yes	GT	Fault
Calibration CV Percent Error	Yes	GT	Fault
RF Pct Error	Yes	GT	Fault
Analog Bd Ambient Temp	Yes	GT	Warning
Analog Power Supply	Yes	GT	Warning
Low Carrier Gas Bottle (DI1)	Yes	LT	Warning
Low Cal Gas Bottle (DI2)	Yes	LT	Warning
GCM Chrom Process	Yes	GT	System Fault

Description	Enable	Type	Severity
Bad Bead	Yes	GT	Fault
No Pilot Valve Change Detected	Yes	GT	Fault
Sample Flow Detect	Yes	GT	Fault
CPU Loading	Yes	GT	Warning
System Memory Available	Yes	LT	Warning
Ram File Available	Yes	LT	Warning
Flash File Available	Yes	LT	Warning
Missing Peak-Cal Not Used	Yes	GT	Warning
Stream Un-Normalized Total	Yes	GT	Warning

5.3.1 Operators

- GT = Greater Than
- LT = Less Than
- And = Including
- Or = Instead of
- GE = Greater Than or Equal To
- LE = Less Than or Equal To
- Nand = And Not
- Nor = Not Or
- Plus = In addition to
- Minus = Not Included or subtract from

5.3.2 Alarm Severity

Level	Description
General:	Indicates that an alarm exists but is not critical to the operation of the unit. Use when testing for some condition that may occur from time to time and there is a need to know when it happens.
Warning:	Indicates that an alarm exists; typically is not critical but may indicate or provide unexpected results.
Fault:	Indicates that a malfunction exists that may affect the operation of the unit and most likely will provide unexpected results. The fault will keep any affected streams from having their data updated; however, a fault would not stop a scheduled or manually initiated calibration from occurring. Additionally, if the calibration corrects the alarm condition, the alarm will be cleared.
System Fault:	This typically indicates that a maintenance problem exists. Analysis processing will still occur, depending on the problem; however, results will not be updated for any stream while this condition exists. Default system faults are already defined. Additionally, unless the user has a situation in which they want to stop all stream data from being updated, they should not use this category of alarm.

5.3.3 Pressure Regulator Alarm

If a pressure regulator alarm is in fault status, the following procedures will step the user through the troubleshooting process. On occasion, these instructions may take the user to other procedures. When those procedures are complete, the user should return to these procedures to continue.

5.3.3.1 Description

These alarms are indicative of low or restricted carrier pressure. The causes range from an empty or low carrier bottle, restricted pressure or to a blockage inside the GC module.

5.3.3.2 Instructions

1) If the carrier bottle regulator includes an installed low pressure switch, investigate if the low carrier gas bottle warning is also present. If the low carrier gas bottle warning is present, replace the carrier gas bottle; otherwise, continue to the next step.

2) Verify the carrier gas bottle pressure is above 90 PSIG. If the pressure is below 90 PSIG, replace the carrier gas bottle; otherwise, continue to the next step.

3) Verify the carrier gas bottle pressure regulator set point is 90 PSIG. If not, correct the set point to 90 PSIG; otherwise, continue to the next step.

4) Verify the column vents, sample vent (SV) and gauge port vent (GPV) are open and unobstructed.

5) Check the sampling system for leaks and tubing restrictions. Repair the leak or restriction, if found; otherwise, continue to the next step.

6) Perform the Start-Up Diagnostics. If the carrier pressure regulator 1 and 2 tests both pass, continue to the next step.

7) Perform the Column Vent Pressure Test procedure for all column vents. This test procedure is found within this chapter. If either test failed, proceed to the next step.

8) Perform the Feed-Through Assembly Blockage Test procedure on column vent 1 (CV1) and column vent 2 (CV2). This test procedure is found within this chapter. If the test fails, replace the feed-through assembly with the new or refurbished assembly; otherwise, continue to the next step.

CAUTION

ABB Totalflow recommends that a replacement analytical module be installed at this point and additional steps be performed in a clean, lint-free atmosphere.

Because the user does not have the required equipment to determine which specific module needs replaced, the final instructions are by process of elimination. This begins with the most likely module.

The ABB Totalflow repair department offers a range of services for troubleshooting and repairing/replacing the non-functioning parts. For more information regarding the repair service, contact customer service:

USA: 1-800-HELP-365 or 1-800-435-7365

9) Using the Replacing Analytical Module instructions in Chapter 4-Maintenance, replace the analytical module assembly.

10) Using the Replacing GC Module instructions in Chapter 4-Maintenance, replace the GC module.

5.3.4 Sample Pressure Alarm

If the sample pressure alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may take the user to other procedures. When those procedures are complete, the user should return to these procedures to continue.

5.3.4.1 Description

These alarms are indicative of low sample or calibration gas pressure. The causes can range from an empty or low calibration gas bottle to a blockage inside the GC module.

5.3.4.2 Instructions

1) If the calibration gas bottle regulator includes an installed low pressure switch, investigate if the low bottle calibration gas warning is also present. If the low bottle calibration gas warning is present, replace the calibration gas bottle; otherwise, continue to the next step.

2) Verify the calibration gas bottle pressure is above 15 PSIG. If the pressure is below 15 PSIG, replace the calibration gas bottle; otherwise, continue to the next step.

3) Verify the calibration gas bottle pressure regulator set point is 15 PSIG. If not, correct the set point to 15 PSIG; otherwise, continue to the next step.

4) Verify the sample vent is open and unobstructed.

5) Perform the Sample Vent Pressure Test procedures. This test is found within this chapter. If the test failed, continue to the next step; otherwise, skip to step 7.

6) Perform the Feed-Through Assembly Blockage Test procedures on the sample vent. This test is found in this chapter. If the test fails, replace the feed-through assembly; otherwise, continue to the next step.

7) Check the sampling system for leaks and tubing restrictions. Repair the leak or restriction, if found; otherwise, continue to the next step.

8) Perform Start-Up Diagnostics. If the stream test fails, continue to the next step.

9) Following the Replacing Frit Filters instructions in Chapter 4-Maintenance, verify the filters are clean and free of obstructions. If needed, replace filters.

CAUTION

ABB Totalflow recommends that a replacement analytical module be installed at this point and additional steps be performed in a clean, lint-free atmosphere.

Because the user does not have the required equipment to determine which specific module needs replaced, the final instructions are by process of elimination. This begins with the most likely module.

The ABB Totalflow repair department offers a range of services for troubleshooting and repairing/replacing the non-functioning parts. For more information regarding the repair service, contact customer service:

USA: 1-800-HELP-365 or 1-800-435-7365

10) Using the Replacing Analytical Module instructions in Chapter 4-Maintenance, replace the analytical module assembly.

11) Using the Replacing GC Module instructions in Chapter 4-Maintenance, replace the GC module.

5.3.5 Oven Temperature Error Alarm

If the oven temperature error alarm is in system fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

TIP The information provided for troubleshooting this alarm is only intended to cover basic steps that can be performed in the field. On occasion, additional troubleshooting steps may be provided by ABB Totalflow technical support. This can lead to reducing down time. Additionally, it may be preferred to return a module to ABB Totalflow for comprehensive testing and/or repair.

5.3.5.1 Description

This alarm is indicative of an issue surrounding the ability to control the oven temperature. The causes can range from an unplugged cable to an inability to communicate with a sensor.

5.3.5.2 Instructions

1) Verify that the auxiliary heater switch on the analytical processor board coincides with the feed-through assembly configuration. If the feed-through assembly has an installed auxiliary heater, verify that the switch on the board is set to Normal. If no auxiliary heater is installed, the switch should be set to Override.

2) Verify that the temperature sensor is plugged into the GC module.

3) Follow the Temperature Sensor Test procedure found in this chapter. If the test fails, follow the Temperature Sensor to GC Module Assembly Replacement instructions in Chapter 4-Maintenance; otherwise, continue to the next step.

4) The remaining options are not field repairable. Following the Replacing Analytical Module Assembly instructions in Chapter 4-Maintenance, replace the manifold.

5.3.6 No Stream Valve Selected Alarm

If the no stream valve selected alarm is in system fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

TIP

The information provided for troubleshooting this alarm is only intended to cover basic steps that can be performed in the field. On occasion, additional troubleshooting steps may be provided by ABB Totalflow technical support. This can lead to a reduction in down time. Additionally, it may be preferred to return a module to ABB Totalflow for comprehensive testing and/or repair.

5.3.6.1 Description

These alarms are indicative of an attempt to run a cycle with insufficient sample pressure. If the sample pressure is too low when the diagnostics are run, it will disable all streams but will continue to try to and run chroms. This can also be caused if the digital and analytical boards are out of synchronization.

5.3.6.2 Instructions

1) Check the sampling system for leaks, tubing restrictions and incorrect pressure settings. Repair the leak or restriction or adjust the pressure setting, if found; otherwise, continue to the next step.

2) Place the PGC1000 in hold, allow ten minutes (approximately two cycles) to lapse and then run a single cycle. If the alarm re-appears, continue to the next step.

3) The unit should still be in hold. Manually enable all streams.

4) Perform the Start-Up Diagnostics. If the stream test fails, continue to the next step.

5) Perform a warm start.

5.3.7 Digital-Analog Board Communication Error Alarm

If the digital-analog board communication error alarm is in system fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

TIP

The information provided for troubleshooting this alarm is only intended to cover basic steps that can be performed in the field. On occasion, additional troubleshooting steps may be provided by ABB Totalflow technical support. This can lead to a reduction in down time. Additionally, it may be necessary to return a module to ABB for comprehensive testing and/or repair.

5.3.7.1 Description

These alarms are indicative of a communication error between the digital board and the analytical processor board. Verify the cable connectors are firmly and correctly connected to both the digital and analytical processor boards.

5.3.7.2 Instructions

1) In the alarm log, check the frequency of the error. If multiple errors exist, place the unit in hold. Upon completion, launch a cycle.

2) If the alarms continue to register, perform a warm start.

3) When the unit completes the Start-Up Diagnostics without error, place the unit in run.

4) Following 2-3 cycles, verify that no new alarms are registering. If the alarms continue to register, call ABB Totalflow technical support.

5.3.8 Calculation Error Alarm

If the calculation error alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

TIP

The information provided for troubleshooting this alarm is only intended to cover basic steps that can be performed in the field. On occasion, additional troubleshooting steps may be provided by ABB Totalflow technical support. This can lead to a reduction in down time. Additionally, it may be necessary to return a module to ABB Totalflow for comprehensive testing and/or repair.

5.3.8.1 Description

These alarms are indicative of the AGA-8 compressibility calculation not functioning properly. Typically, this error would be caused by a gas sample being out of specification for AGA-8 but could indicate that the component's peak has shifted.

5.3.8.2 Instructions

1) Following the Calibrating the PGC1000 instructions in Chapter 3- Startup, perform a calibration Ensure that the Next Mode is set to Hold.

2) When the unit enters hold, select Peak Find.

3) Verify that the peaks are correctly labeled and integrated. If the peaks are not correctly labeled and integrated, continue to the next step; otherwise, skip to step 5.

4) In the Peak Find screen, select Run Auto PF. This process will typically require 45 minutes to complete. When the cycle is complete, repeat step 3.

5) Under Next Mode, select Run.

6) Allow the unit to run a minimum of an hour and then perform a calibration.

5.3.9 Calibration Un-Normalized Error Alarm

If the calibration un-normalized error alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

TIP

The information provided for troubleshooting this alarm is only intended to cover basic steps that can be performed in the field. On occasion, additional troubleshooting steps may be provided by ABB Totalflow technical support. This can lead to a reduction in down time. Additionally, it may be necessary to return a module to ABB Totalflow for comprehensive testing and/or repair.

5.3.9.1 Description

These alarms are indicative of a change to the un-normalized total of sufficient percentage to activate the alarm. This alarm will discontinue a scheduled calibration and will need to be disabled prior to calibrating the unit.

5.3.9.2 Instructions

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

2) Verify the calibration blend concentrations to the calibration blend concentrations that are listed on the Calibration Setup screen. If errors exist, make corrections. Upon completion, send the setup.

3) Under Stream Setup - Alarm Definitions, locate the calibration un-normalized error alarm. When located, set the Alarm Enable to No. Send the change. Repeat for any additional streams with this alarm.

4) Following the Calibrating the PGC1000 instructions in Chapter 3-Startup, perform a calibration. Ensure that the Next Mode is set to Hold.

5) When the unit enters hold, select Peak Find.

6) Verify that the peaks are correctly labeled and integrated. Upon verification that they are correct, return the unit to operation; otherwise, continue to the next step.

7) Select Peak Find from the Analyzer Operation screen. Ensure that Automatic is check-marked. Once completed, select Run Auto PF. This procedure will require approximately 45 minutes.

8) When the unit enters hold, verify that the peaks are correctly labeled and integrated. Upon verification they are correct, return unit to operation; otherwise, contact ABB Totalflow technical support.

9) Reset the Alarm Enable to Yes. Verify that the alarm threshold is a valid configuration. Typically, the un-normalized total should be within 6.50% (between 99.5 and 100.5).

10) Return the unit to regular operation.

5.3.10 Stream Sequence Error Alarm

If the stream sequence error alarm is in fault status, the following procedure will step the user through the troubleshooting process On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

5.3.10.1 Description

These alarms are indicative of a synchronization problem that follows a manual data post process in Factory mode.

5.3.10.2 Instructions

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

2) Following the Reset Procedure instructions in Chapter 4-Maintenance, perform a warm start.

5.3.11 Calibration CV Percent Error Alarm

If the calibration CV percent error alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

TIP The information provided for troubleshooting this alarm is only intended to cover basic steps that can be performed in the field. On occasion, additional troubleshooting steps may be provided by ABB Totalflow technical support. This can lead to a reduction in down time. Additionally, it may be necessary to return a module to ABB Totalflow for comprehensive testing and/or repair.

5.3.11.1 Description

These alarms are indicative of a change to the CV percent of sufficient percentage to activate the alarm. This alarm will discontinue a scheduled calibration and will need to be disabled prior to calibrating the unit.

5.3.11.2 Instructions

1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

2) Verify the calibration blend concentrations to the calibration blend concentrations listed on the Calibration Setup screen. If errors exist, make corrections. Once completed, send the setup.

3) Under Stream Setup - Alarm Definitions, locate the Calibration CV Percent Error Alarm. When located, set Alarm Enable to No. Send the change. Repeat for any additional streams with this alarm.

4) Following the Calibrating the PGC1000 instructions in Chapter 3-Startup, perform a calibration. Ensure that the Next Mode is set to Hold.

5) When unit enters hold, select Peak Find.

6) Verify that the peaks are correctly labeled and integrated. Upon verification that these are correct, return the unit to operation.

7) Reset the Alarm Enable to Yes. Verify that the alarm threshold is a valid configuration.

8) Return the unit to regular operation.

5.3.12 Calibration RF Percent Error Alarm

If the response factor (RF) percent error alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

TIP

The information provided for troubleshooting this alarm is only intended to cover basic steps that can be performed in the field. On occasion, additional troubleshooting steps may be provided by ABB Totalflow technical support. This can lead to a reduction in down time. Additionally, it may be necessary to return a module to ABB Totalflow for comprehensive testing and/or repair.

5.3.12.1 Description

These alarms are indicative of a change to the response factor of sufficient percentage to activate the alarm. This alarm will discontinue a scheduled calibration and will need to be disabled prior to calibrating the unit.

5.3.12.2 Instructions

1) Verify the calibration blend concentrations to the calibration blend concentrations listed on the Calibration Setup screen. If errors exist, make corrections. Upon completion, send the setup.

2) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

3) Under Stream Setup-Alarm Definitions, locate the RF Percent Error Alarm. Upon location, set Alarm Enable to No. Send the change. Repeat for any additional streams with this alarm.

4) When the unit enters hold, select Peak Find. Select Run Auto PF.

5) Verify that the peaks are correctly labeled and integrated. Upon verification, return the unit to operation.

6) Allow the unit to cycle 3-4 times.

7) Following the Calibrating the PGC1000 instructions in Chapter 3-Startup, perform a calibration. Ensure that the Next Mode is set to Hold.

8) Reset the Alarm Enable to Yes. Verify that the alarm threshold is a valid configuration.

9) Return the unit to regular operation.

5.3.13 Enclosure Temperature Alarm

If the enclosure temperature alarm is in warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

5.3.13.1 Description

These alarms are indicative of either extremely high or low temperatures inside the enclosure. The causes could range from external temperatures being extremely high or low to a bad temperature sensor on the analytical board.

5.3.13.2 Instructions

1) Compare the outside temperature with the temperature reading on the Analyzer Operation screen - Enclosure Temperature. Atmospheric temperature could be less than the enclosure temperature by as much as

20 degrees. If the temperature differential seems reasonable, the unit may be operating out of range. This unit is designed to operate between 08F and 1208F; otherwise, continue to the next step.

2) If the temperature differential does not seem reasonable, the analytical processor assembly may have a bad temperature sensor. As this alarm is only a warning, it will not affect the operation of the unit. The user may replace the analytical module when needed.

FYI

The ABB Totalflow repair department offers a range of services for troubleshooting and repairing/replacing the non-functioning parts. For more information regarding the repair service, contact customer service:

USA: 1-800-HELP-365 or 1-800-435-7365

5.3.14 Power Supply Alarm

If the power supply alarm is in warning status, the following procedure will step the user through the troubleshooting process. . On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

5.3.14.1 Description

These alarms are indicative of input voltage either below 11 Volts or above 16 Volts. The causes may range from a power supply issue to a bad cable.

5.3.14.2 Instructions

1) Following the instructions detailed later in this chapter, check the power supply to the termination board. If the test fails, restore the power supply to proper working specifications; otherwise, continue to the next step.

2) Following the cable replacement instructions in Chapter 4-Maintenance, check the analytical processor to the termination board cable for damage. If the cable is damaged, replace; otherwise, continue to the next step.

3) Following the cable replacement instructions in Chapter 4-Maintenance, check the termination board to the digital controller cable for damage. If the cable is damaged, replace; otherwise, contact ABB Totalflow technical support for additional instructions.

5.3.15 Low Carrier Gas Bottle (DI1) Alarm

If the low carrier gas bottle (DI1) alarm is in warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

5.3.15.1 Description

These alarms are indicative of carrier gas bottle pressure below the threshold.

5.3.15.2 Instructions

1) Verify that the carrier gas bottle regulator low pressure switch threshold is set around 90 PSIG. The alarm is switched when the pressure drops below the threshold.

2) If the threshold is above the current bottle PSIG, replace the carrier gas bottle.

3) If the threshold is below the current bottle PSIG, verify the regulator is functioning properly.

5.3.16 Low Cal Gas Bottle (DI2) Alarm

If the low bottle calibration gas (DI2) alarm is in warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

5.3.16.1 Description

These alarms are indicative of calibration gas bottle pressure below the threshold.

5.3.16.2 Instructions

1) Verify that the calibration gas bottle regulator low pressure switch threshold is set around 15 PSIG. The alarm is switched when the pressure drops below the threshold.

2) If the threshold is above the current bottle PSIG, replace the calibration gas bottle.

3) If the threshold is below the current bottle PSIG, verify the regulator is functioning properly.

5.3.17 GCM Processing Error Alarm

If the GCM chrom process alarm is in warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

5.3.17.1 Description

This alarm is indicative of an error that stops the GCM application from signaling the chrom application to process a chromatogram. The following internal errors could instigate this alarm: communication response error, polling error, sequence error and data error.

TIP

The information provided for troubleshooting this alarm is only intended to cover basic steps that can be performed in the field. On occasion, additional troubleshooting steps may be provided by ABB Totalflow technical support. This can lead to a reduction in down time. Additionally, it may be necessary to return a module to ABB Totalflow for comprehensive testing and/or repair.

5.3.17.2 Instructions

1) In the alarm log, check the frequency of the error. If multiple errors exist, place the unit in hold. Upon completion, launch a cycle.

2) If the alarms continue to register, perform a warm start.

3) When the unit completes the Start-Up Diagnostics without error, place the unit in run.

4) Following 2-3 cycles, verify that no new alarms are registering.
5) If the alarms continue to register, call ABB Totalflow technical support.

5.3.18 Bad Bead Alarm

If the bad bead alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

5.3.18.1 Description

These alarms are indicative of a problem with the GC module.

5.3.18.2 Instructions

1) Following the GC Module Replacement instructions in Chapter 4-Maintenance, replace the GC module.

5.3.19 No Pilot Valve Charge Detected Alarm

If the no pilot valve change detected alarm is in warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

5.3.19.1 Description

These alarms are indicative of a pressure regulator problem on the manifold. During the backflush, a valve is changed, but no disturbance is registered.

5.3.19.2 Instructions

1) Verify the carrier gas bottle pressure is above 90 PSIG. If the pressure is below 90 PSIG, replace the carrier gas bottle; otherwise, continue to next step.
2) Verify the carrier gas bottle pressure regulator set point is 90 PSIG. If not, correct the set point to 90 PSIG; otherwise, continue to next step.
3) Following the Manifold Replacement instructions in Chapter 4-Maintenance, replace the manifold.

5.3.20 Sample Flow Detection Alarm

If the sample flow detection alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

5.3.20.1 Description

These alarms are indicative of a pressure issue. These issues can be anything from a blocked vent tube, a too short bleed cycle or a stream test is in Auto.

5.3.20.2 Instructions

1) Inspect the vent tubes for blockage. This includes crimps in the tubing, dirt or debris.

2) Following the instructions detailed later in this chapter, perform the sample pressure test.
3) Verify the sample bleed time is set to greater than 1 second.
4) Following the GC Module Replacement instructions in Chapter 4-Maintenance, replace the GC module.

5.3.21 CPU Loading Alarm

If the CPU loading alarm is in warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

5.3.21.1 Description

These alarms are indicative of the processor being overloaded. An occasional spike in processor loading is to be expected. Multiple occurrences are not field-repairable.

5.3.21.2 Instructions

1) View the alarm history for multiple occurrences. If an occasional warning is registered, this is not a problem.
2) If multiple alarm occurrences exist, contact ABB Totalflow technical support for additional help.

5.3.22 System Memory Available Alarm

If the system memory available alarm is in warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

5.3.22.1 Description

These alarms are indicative of the task memory resource becoming full. The recommended files size for task memory is 1 to 2 MB. This alarm may be received after adding additional applications.

5.3.22.2 Instructions

1) View the alarm history for multiple occurrences. If an occasional warning is registered, this is not a problem.
2) View Resources from the PCCU32 Entry screen to check available memory. If applicable, the available memory could be increased incrementally.

FYI When increasing the available memory, the available RAM file space is reduced. Caution should be used.

3) Following the Reset Procedure instructions in Chapter 4-Maintenance, warm start the unit to defrag the system memory.
4) Reducing the number of instantiated applications may be required. Contact ABB Totalflow technical support for assistance.

5.3.23 RAM File Available Alarm

If the RAM file available alarm is in warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

5.3.23.1 Description

These alarms are indicative of the TfData file resource becoming full. The recommended files size for TfData is 2 to 3 MB. This alarm may be received after changing the log period frequency, adding applications or setting up additional trend files.

5.3.23.2 Instructions

1) View the alarm history for multiple occurrences. If an occasional warning is registered, this is not a problem.

2) View Resources from the PCCU32 Entry screen to check the available RAM file space. If applicable, the RAM file space could be increased incrementally.

FYI When increasing the RAM file space, the available memory file space is reduced. Caution should be used.

3) Following the Reset Procedure instructions in Chapter 4-Maintenance, warm start the unit to defrag the system memory.

4) Reducing the number of instantiated applications, trend files or lengthening the log periods may be required. Contact ABB Totalflow technical support for assistance.

5.3.24 FLASH File Available Alarm

If the FLASH file available alarm is in warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

5.3.24.1 Description

These alarms are indicative of a shortage of files space in the 32 MB FLASH. Typically, this space is not user accessible; however, instantiating too many applications may cause an alarm.

5.3.24.2 Instructions

1) View the alarm history for multiple occurrences. If an occasional warning is registered, this is not a problem; otherwise, please contact ABB Totalflow technical support for assistance.

5.3.25 Missing Peak-Calibration Not Used

If the missing peak-calibration not used is in warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

5.3.25.1 Description

These alarms are indicative of a missing peak during a calibration cycle. As a result, calibration will not be used.

5.3.25.2 Instructions

1) Verify the calibration blend concentrations to the calibration blend concentrations listed on the Calibration Setup screen. If errors exist, make corrections, and send the setup.

2) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

3) When unit enters hold, select Peak Find. Select Run Auto PF.

4) Verify that the peaks are correctly labeled and integrated. Upon verification, return the unit to operation.

5) Allow unit to cycle 3-4 times.

6) Following the Calibrating the PGC1000 instructions in Chapter 3-Startup, perform a calibration. Ensure that the Next Mode is set to Hold.

7) When the unit enters hold, verify that the peaks are correctly labeled and integrated. Upon verification, return the unit to operation; otherwise, continue to the next step.

8) Select Peak Find from the Analyzer Operation screen. Ensure that Automatic is check-marked. Upon finishing, select Run Auto PF. This procedure will require approximately 45 minutes.

9) When the unit enters hold, verify that the peaks are correctly labeled and integrated. Upon verification, return the unit to operation; otherwise, contact ABB Totalflow technical support.

5.3.26 Stream Un-Normalized Total

If the stream un-normalized total is in warning status (default), the following procedure will step the user through the troubleshooting process. If the severity of the alarm is set to fault, the new stream data is not allowed to update. On occasion, these instructions may move the user to other procedures. When they are complete, the user should return to these procedures and continue.

5.3.26.1 Description

These alarms are indicative of a change to the process stream un-normalized total of sufficient percentage to activate the alarm.

5.3.26.2 Instructions

1) Verify that the alarm threshold is a valid configuration. Typically, the un-normalized total should be within 6.50% (between 99.5 and 100.5).

2) Verify the calibration blend concentrations to the calibration blend concentrations that are listed on the Calibration Setup screen. If errors exist, make corrections. When finished, send the setup.

3) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.

4) When the unit enters hold, select Peak Find. Select Run Auto PF. Ensure that Automatic is check-marked. Upon finishing, select Run Auto PF. This procedure will require approximately 45 minutes.
5) Verify that the peaks are correctly labeled and integrated. Upon verification, return the unit to operation; otherwise, continue to the next step.
6) Allow the unit to cycle 3-4 times.
7) Following the Calibrating the PGC1000 instructions in Chapter 3-Startup, perform a calibration.

5.4 Alarm Troubleshooting Tests

5.4.1 Sample Vent Pressure Test

5.4.1.1 Instructions

1) Attach the flow meter to the sample valve.
2) From the Analyzer Operation screen, click on Diagnostics.
3) Select the Manual Operation tab.
4) Under Manual Control, open the Sample Shutoff Valve.
5) When opened, the sample valve should measure a spike to 15 sccm. Close the valve when finished reading.
6) If the sample valve does not spike to 15 sccm, the test has failed.
7) Return to the troubleshooting instructions.

5.4.2 Column Vent Pressure Test

5.4.2.1 Instructions

1) Attach the flow meter to CV1.
2) From the Analyzer Operation screen, click on Diagnostics.
3) Select the Manual Operation tab.
4) Under Manual Control, select Open Stream 1 Valve.
5) When opened, CV1 should measure between 3–12 sccm. Close the valve when finished reading.
6) If CV1 measures within the range, continue to the next step. If CV1 does not measure within the range, the test has failed. Return to the troubleshooting alarm instructions.
7) Attach the flow meter to CV2.
8) Select Open Stream 1 Valve.
9) When opened, the CV2 should measure between 3–12 sccm. Close the valve when finished reading.
10) If CV2 does not measure within range, the test has failed. Return to the troubleshooting alarm instructions.

5.4.3 Sample Pressure Test

5.4.3.1 Instructions

1) Place the unit in hold.
2) From the Analyzer Operation screen, click on Diagnostics.
3) Click the Manual Operation tab, and select Monitor.
4) Read sample pressure from the current reading.
5) Under Manual Control, open the Stream 1 Valve or stream reflecting alarm.
6) Under Manual Control, close the Sample Shutoff Valve.
7) The sample pressure reading under Current should increase.
8) Under Manual Control, open the Sample Shutoff Valve.
9) The sample pressure reading under Current should decrease rapidly.
10) If pressure decreases slowly, return to the troubleshooting alarm instructions as the test has failed.

5.4.4 Feed-Through Assembly Blockage Test

5.4.4.1 Instructions

1) Following the Feed-Through Assembly instructions in Chapter 4-Maintenance, remove the feed-through assembly from the PGC1000. If testing from the pressure regulator 1 or 2 alarms, continue to 2. If testing from the stream test in the Start-Up Diagnostics or from the sample pressure alarm, skip to step 3.
2) Attach the pressure source to CV1. Upon completion, activate. If the flow through the assembly is impeded, the test has failed. Return to the troubleshooting alarm instructions; otherwise, continue to the next step.
3) Attach the pressure source to CV2. Upon completion, activate. If the flow through the assembly is impeded, the test has failed. Return to the column vent pressure test.
4) Attach the pressure source to the sample valve. Upon completion, activate. If the flow through the assembly is impeded, the test has failed. Return to the troubleshooting alarm instructions.

5.4.5 Temperature Sensor Test

5.4.5.1 Instructions

1) Following the Replacing Temperature Sensor to the GC Module Cable instructions in Chapter 4-Maintenance, unplug the sensor from the GC module.
2) Connect the digital multi-meter (DVM). Once connected, set it to read resistance – positive lead to pin 1 and negative lead to pin 2.
3) The meter should indicate a resistance reading between approximately 10K Ohms and 1M Ohms. The resistance value is dependent on the temperature of the gas chromatograph oven and the ambient temperature; therefore, any reading in this range should indicate a functioning temperature sensor.

5.4.6 Abnormal Calibration Gas Depletion

5.4.6.1 Description

If the calibration (and/or carrier) gas has depleted significantly sooner than expected, there may one or more issues:

5.4.6.2 Instructions

1) If the PGC1000 has been running normally but consuming too much calibration (and/or carrier) gas, carefully leak test the gas bottle regulator, tubing and connections to the PGC1000.

2) If the unit is new start-up installation, check and tighten the analytical module mounting bolt. The module may have been loosened due to vibration during shipping.

3) If the unit has been disassembled recently, re-check and tighten all assemblies to include the analytical module mounting bolt.

4) If the PGC1000 has been powered down for any significant length of time, the calibration (also carrier and sample) gas should be shut-off. Some valves may be left in an open or partially open state. This allows gas to continue flowing.

5.5 Power Troubleshooting

5.5.1 Overview

This section focuses on determining what has caused the PGC1000 to lose power. Generally, loss of power can be attributed to only the power supply system. However, if the power supply system is used for powering a transceiver or other peripheral equipment, a problem with that equipment may drain the battery and cause the PGC1000 to lose power. Notice that the power troubleshooting flowchart (see Figure 5-2) takes the user through several tests but also directs them to the communication troubleshooting flowchart located further in this chapter.

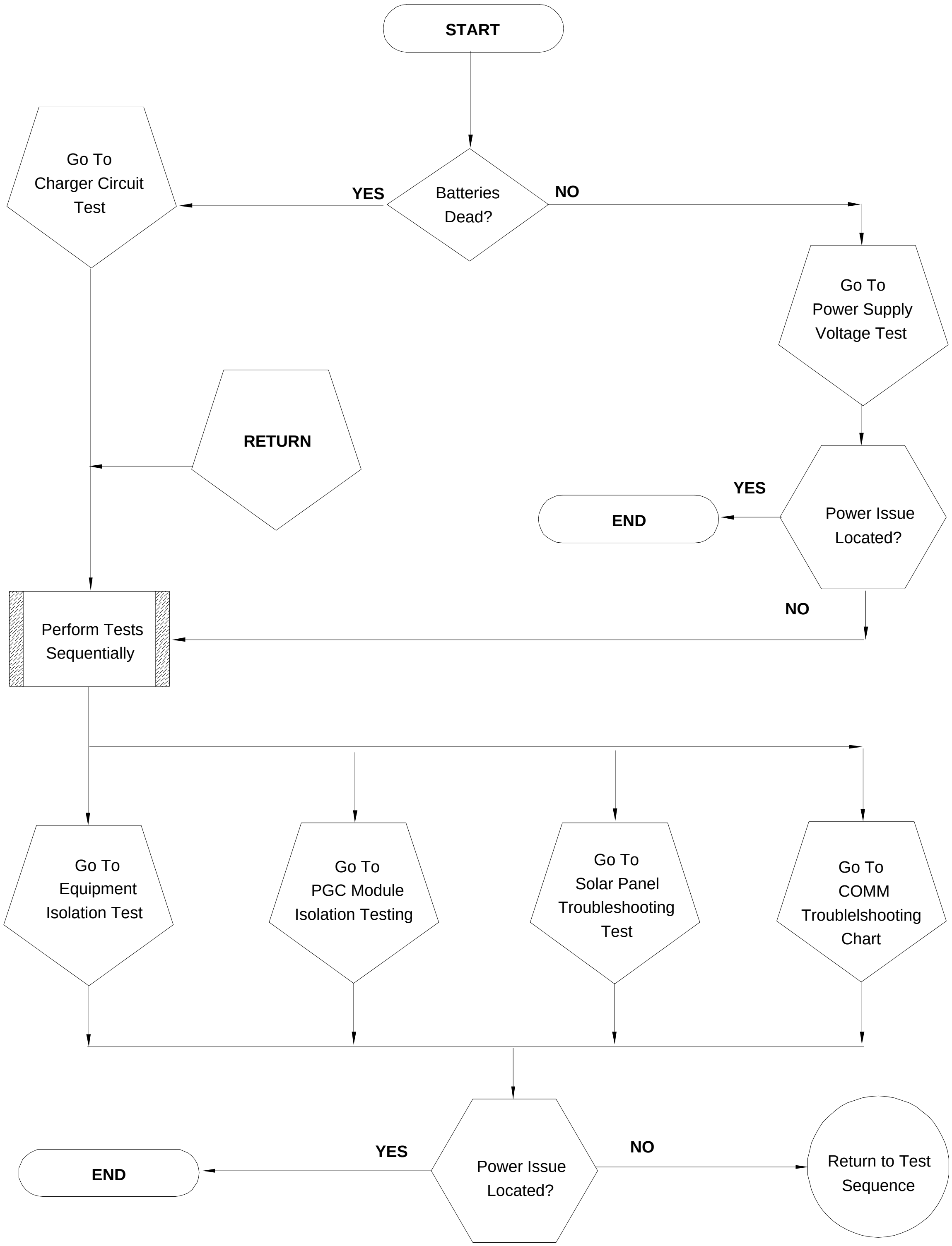


Figure 5-2 Power Troubleshooting Flowchart

5.5.2 Power Supply Voltage Test

TIP This test assumes a power supply that is in good working order and that has previously been tested and qualified to power a PGC1000. If the power supply is under suspicion, it is recommended that it be replaced with a known, good power supply before conducting these tests.

5.5.2.1 Instructions

1) Check that the power supply voltage setting, the power supply current rating and the cables used for the installation meet the recommended requirements (see System Specifications in Chapter 1).

If this is a new installation and external equipment is being powered from the PGC1000 termination board, call ABB Totalflow technical support for help in evaluating the user's cable and power supply installation requirements.

2) Correct and retest, as necessary.

3) Check for a poor cable connection in the cable between the PGC1000 and the power source. Verify all field wiring screw terminals are tight.

4) Correct and retest, as necessary.

5) Verify that there are no other devices that may drop an excessive voltage across them in the power supply circuit (to the PGC1000) like a fuse, diode or a barrier device.

6) Correct and retest, as necessary.

7) Disconnect the power supply cable at the PGC1000 termination board, J1.

8) Measure the power supply cable voltage at the connector. Compare with the ABB Totalflow recommendations (see Table 1–3 and Table 1–4).

9) If the power supply voltage does not meet the recommendations, check the cabling and other loads on the power supply. Also, check the power supply output voltage setting.

10) Correct and retest, as necessary.

11) Reconnect the power supply cable to the PGC1000 termination board, J1.

5.5.3 Equipment Isolation Test

This test isolates peripheral equipment to verify that excessive current is not being drawn from the power source. This reduces the amount of power supplied to the PGC1000.

This procedure assumes that the previous power supply voltage test was performed and that no errors were found.

5.5.3.1 Instructions

1) While the PGC1000 is operating, verify that the voltage at the PGC1000 termination board is between 11.5 Vdc-16 Vdc (for 12 Vdc systems) or 22 Vdc to 28 Vdc (for 24 Vdc systems).

TIP

The PGC1000 uses pulse width modulation technology to drive its heaters and valves. Due to this feature, a DVM may not show the voltage present at the PGC1000 termination board accurately. However, in no case, even under load, should the DVM indicate a voltage less than 11.5 Vdc (or 22 Vdc for 24 Vdc system) if the proper cables are used. It may be necessary to have a digital volt meter capable of capturing "fast transients" (less than 1 ms in duration).

For example: While using a DVM with fast transient capture capability, set the DVM to "capture" the minimum voltage (sometimes this is a Min/Max measurement). Use its fast transient capability and then let it monitor the PGC1000 while operating for a few minutes. This should provide a good indication of the minimum voltage appearing at the PGC1000 terminals.

2) Is voltage within limits? If no, continue to the next step. If yes, no physical problem is found.

3) Is the external equipment, such as a radio or other device, being powered from the PGC1000 termination board? If not, return to Figure 5-2 and continue the test sequence. If yes, continue to the next step.

4) Disconnect the peripheral equipment from the PGC1000.

5) While the PGC1000 is operating, verify that the voltage at the PGC1000 termination board is between 11.5 Vdc-16 Vdc (for 12 Vdc systems) or 22 Vdc to 28 Vdc (for 24 Vdc systems).

6) Is the voltage within limits? If no, return to Figure 5-2, and continue the test sequence. If yes, the external equipment is drawing excessive current. Check the equipment and related wiring. Correct and retest, if necessary.

5.5.4 PGC1000 Module Isolation Test

This test isolates the PGC1000 module to pinpoint equipment failure.

This procedure assumes that the previous power supply voltage test and equipment isolation test were performed and that no errors were found.

5.5.4.1 Instructions

1) With the power still supplied to the termination board J1 connector, disconnect the power supply cable at the termination board.

2) Using instructions in the Chapter 4-Digital Controller Assembly Mounting Bracket section, remove the digital controller. Upon completion, disconnect the termination board to the digital controller cable.

3) Using instructions in the Chapter 4-Replacing Analytical Module section, remove the analytical module.

4) With the power still disconnected from the PGC1000, measure the voltage at the J1 connector screw terminals. Record the value as power supply voltage (open circuit).

5) Reconnect the power supply cable at the PGC1000 termination board, J1.

6) Measure the voltage at the termination board J1 connector screw terminals. The voltage should be within 0.1 Vdc of the power supply voltage (open circuit). For example, only 0.1 Vdc drop maximum between the PS and the PGC1000.

7) If the voltage drop is greater than 0.1Vdc, replace the termination board using the instructions in Chapter 4-Replacing Termination Board. Upon completion, return to step 6. If the voltage drop is greater than 0.1 Vdc again, call ABB Totalflow technical support. Follow the instructions in the Getting Help section at the beginning of the manual.

If the drop is less than 0.1Vdc, check the termination board to the analytical processor cable for pinched or exposed insulation. Also, check the feed-through auxiliary heater cable for similar damage.

8) Was the damaged cable found? If yes, replace the appropriate cable. Use the instructions detailed in Chapter 4.

If no, use the instructions in Chapter 4-Replacing Analytical Module. Replace the module. Move to step 10.

9) Re-install the analytical module.

10) Re-install the digital controller assembly.

11) If disconnected during a procedure, reconnect the J1 power supply connector to the termination board. It may require 10-60 seconds for the processors in the PGC1000 to fully boot and for the device to start drawing normal to full power. However, under normal operation, the PGC1000 should never, at anytime, draw current beyond its rated values.

12) Return to the equipment isolation test.

5.5.5 Charger Circuit Test

If the system setup includes a battery pack, solar board or AC charger/power supply connected to the optional enclosure and the unit’s battery is not staying charged, the user will need to test the battery pack, AC charger/power supply and/or solar panel.

The following instructions contain the steps required to perform the circuit testing.

5.5.5.1 Things to Consider

The following list points to other troubleshooting procedures that the user may want to consider:

- Solar panel troubleshooting test
- AC charger/power supply troubleshooting test

5.5.5.2 Instructions

1) Begin by disconnecting the power from the AC charger/power supply. This is located in the optional enclosure.

2) Replace the battery with a known, good battery. Use the battery pack replacement procedure located in Chapter 4-Maintenance.

3) Reconnect the power to the charger/supply. If the battery pack is charged through an AC charger, move to step 5; otherwise, continue to step 4.

4) Measure the solar panel charging voltage at the charger regulator. Use a DVM connecting the (+) and (-) leads to the (+) and (-) solar panel wires. Loaded voltage should be greater than or equal to the specification listed in Table 5–2. If the voltage is within range, the battery was bad.

If the loaded voltage is not above the minimum, perform the solar panel troubleshooting test found later in this chapter.

5) If the unit uses an AC charger, perform the AC charger/power supply troubleshooting test found later in this chapter.

6) If all other testing to this point has not located the error, return to Figure 5-1 and continue.

Table 5–2 Specifications for Solar Panels

Panel	Max	Volts @P_{MAX}	Open Circuit	Load Resistance	Loaded Voltage
50	54W	17.4V	21.7V	5 Ω 100W	16–18 VDC
85	87W	17.4V	21.7V	5 Ω 100W	16–18 VDC

5.5.6 Solar Panel Troubleshooting Test

If the system setup includes a solar panel connected to the unit and it is not supplying the required voltage and current to the PGC1000 unit, the user may need to test the solar panel.

The following instructions contain the steps required to do so.

5.5.6.1 Things to Consider

The following list points to other troubleshooting procedures that the user may want to consider:

- Power consumption test (remote equipment)
- AC charger/power supply troubleshooting test

5.5.6.2 Required Equipment

- Digital multi-meter with 0-20 Vdc range
- Required resistors for testing specific panels listed in Table 5–2

FYI In continuous low sunlight conditions, the unit may not supply the required voltage. The solar panel should be positioned so it receives the most sunlight. Do not place it in a shaded area.

5.5.6.3 Instructions

1) Measure the solar panel voltage at the controller assembly. Use a DVM connecting the (+) and (-) leads to the (+) and (-) solar panel wires. Loaded voltage should be greater than or equal to the specification listed in Table 5–2. If the solar panel is not above the minimum, replace the solar panel, and continue to step 2.

2) Check the solar panel angle and direction. In the northern hemisphere, the panel should face due south. In the southern hemisphere, the panel should face due north.

3) Check the solar panel for any physical damage or obstructions to sunlight. Sunlight obstruction prevents the solar panel from receiving enough sunlight to charge the installed battery pack. Clear any debris from the cell face of the panel.

4) Check the solar panel wiring to ascertain it is correctly connected to the associated termination pins. These are located in the enclosure (see Figure 5-3).

5) Disconnect the solar panel from the field device.

6) Set the DVM range to read over 20 Vdc.

7) Determine if the open circuit voltage is greater than or equal to the specification listed in Table 5–2. This is accomplished by clipping the positive lead of the DVM to the positive wire and clipping the negative lead of the DVM to the negative wire. If the solar panel is not above the minimum, continue to the next step.

8) Using the selected resistor from Table 5–2 for the solar panel wattage, attach the selected resistor between the two solar panel wires.

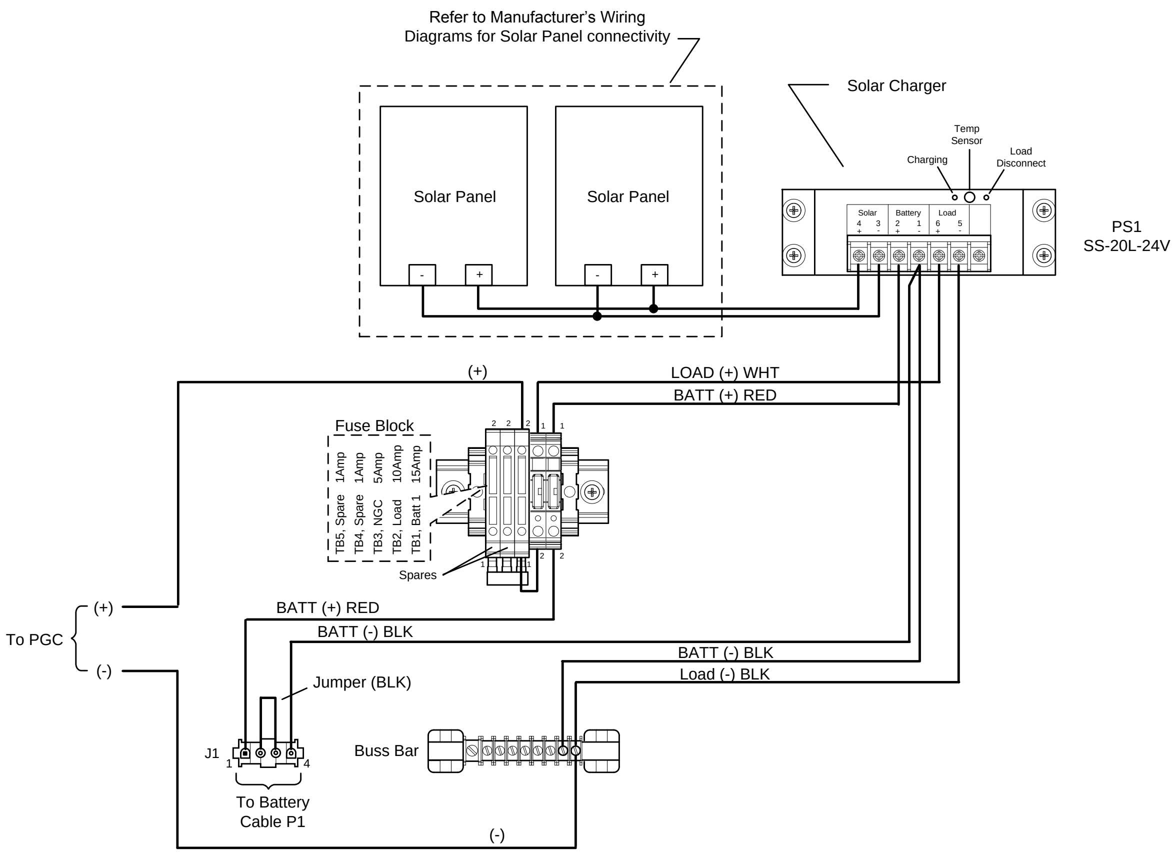


Figure 5-3 Solar Panel Wiring Instructions

9) Clip the positive lead of the DMM to the one side of the test resistor.

10) Clip the negative lead of the DMM to the other side of the test resistor.

11) Determine if the loaded voltage is greater than or equal to the specification listed in Table 5–2. If the solar panel is not above the minimum, replace the solar panel, and return to step 3.

5.5.7 AC Charger/Power Supply Troubleshooting Test

If the system setup includes an AC charger/power supply connected to the optional enclosure and is not supplying the required voltage to the PGC1000, the user may need to test the AC charger/power supply. The following instructions contain the steps required to do so.

5.5.7.1 Instructions

1) Check the input AC voltage to the enclosure power supply. Be certain the primary AC voltage is correct.
2) If the primary input AC voltage level is correct and there is no DC output from the power supply, replace the F1 charger fuse (see Figure 5-4).
3) If the fuse is not faulty or there is no charger DC output voltage after replacing the fuse, replace the AC charger/power supply.

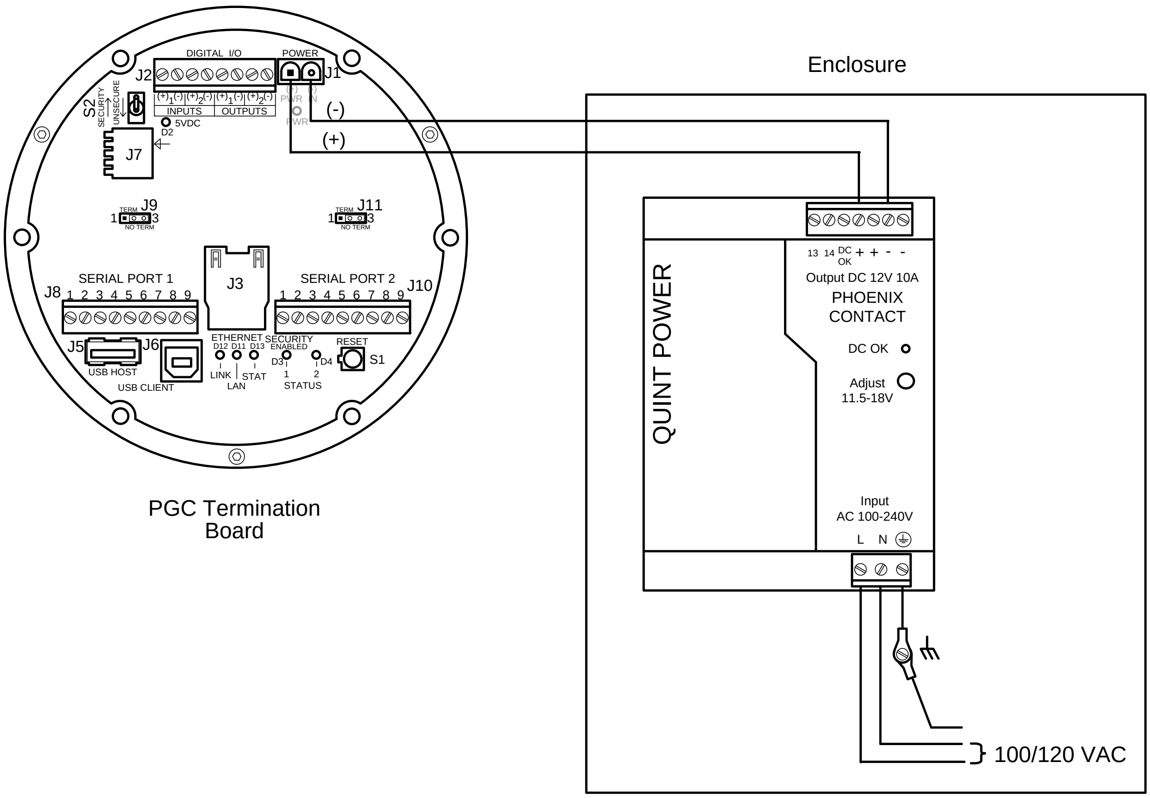


Figure 5-4 AC Charger/Power Supply Wiring

5.6 Troubleshooting Communications

5.6.1 Overview

These troubleshooting procedures are applicable to a PGC1000 with an installed radio in the optional equipment enclosure. Use Figure 5-5 as an aid for troubleshooting communication problems.

Troubleshooting the communications for this unit requires that equipment in two areas be tested: the PGC1000 Comm Ports and the external communication device.

Additional communication troubleshooting information is shared in the following categories:

- RS-232 communications
- RS-485 communications
- RS-422 communications

The radio/modem may be powered one of two ways: always on or switched. The user's specific system set- up will determine what steps are needed to power the radio/modem.

When switching power to a radio with inhibit (SLEEP) mode, the serial port 1 or 2 switched power line will go to the radio's inhibit (SLEEP) mode input. Power out will go to the radio's power input.

5.6.2 Communication

5.6.2.1 Setting Up Communication

After the installation of the communication equipment and before placing the communication system into operation, the user should note the following:

- Verify the field wiring terminations on the PGC1000 termination board.
- Verify the field wiring from the PGC1000 to the termination strip inside the optional enclosure.
- Verify the field wiring from the termination strip to the radio.
- Check the PGC1000 identifier (ID). Log the ID for future reference.
- Log the PGC1000 access security code, baud rate, listen cycle, protocol and interface for future reference.

FYI

The following helpful hints aid the user after the communication equipment has been installed and set up:

- When the communication equipment is powered/switched on, the PGC1000 displays the communication icon after it recognizes the PGC1000 ID and is responding.
- Check the baud rate of the PGC1000 transmission and LISTEN time settings. The baud rate and time settings can be changed by entering the Station Setup window from the Analyzer Operation screen. The default settings are 1200 baud, the listening time is four (4) seconds and the communications interface is turned off.
- The minimum power required for operating the remote communications is 11.9 Vdc (default) or as set by user. Should the power fall below this level, remote communications will be terminated.
- Test the remote communications using the RS-232 troubleshooting cable. Use the RS-232 to RS-485 communication converter in conjunction the with RS-232 troubleshooting cable to test the RS-485 remote communications.

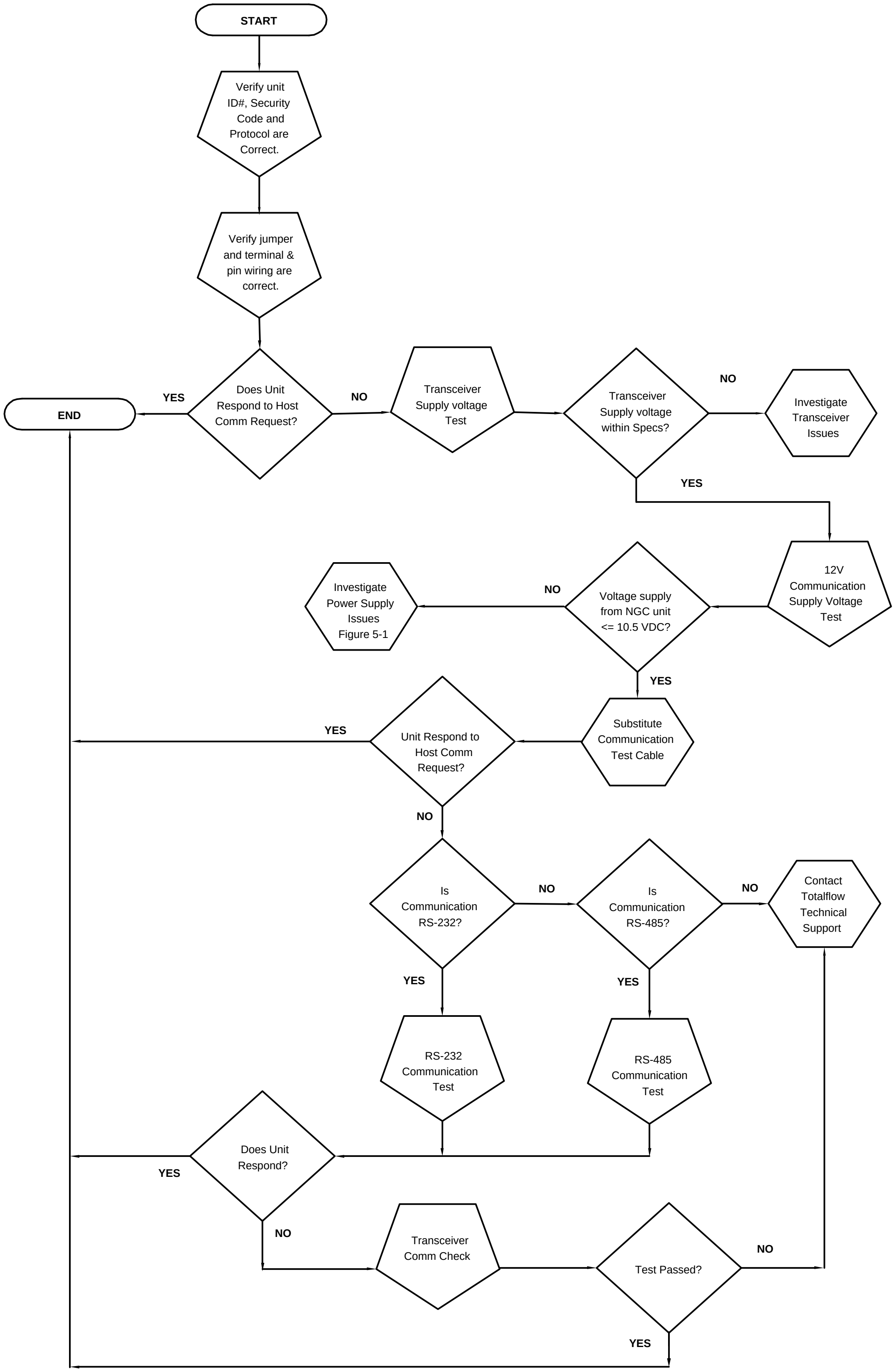


Figure 5-5 Communication Troubleshooting Flowchart

5.6.3 Transceiver Supply Voltage Test

Using the wiring information and guidelines supplied by the transceiver's manufacturer, verify that the transceiver is receiving the manufacturer's suggested voltage. If the unit is receiving sufficient voltage, continue to the optional equipment enclosure wiring voltage test.

FYI If the transceiver is not receiving sufficient voltage, investigate the power supply issues. These may involve the wiring irregularities at the AC charger/power supply, XFC/XRC board or at the power relay, if using relay for switching power to radio.

5.6.4 12 Vdc Communications Supply Voltage

5.6.4.1 Instructions

If the transceiver does not feature a SLEEP mode and the power is supplied through an optional relay, begin with step 1.

If the transceiver features a SLEEP mode or is continuously powered, begin with step 2.

1) If the transceiver does not feature a SLEEP mode and receives power through an optional relay, activate serial port 1 or 2 switched power out (pin 3). Additionally, using a digital multi-meter (DVM) set to DC Volts, measure the voltage at the relay between relay coil terminals.

If the voltage reads the same as the supplied voltage (12 Vdc) and the transceiver is still not receiving power, the relay may be incorrectly wired (use normally open contacts), or the relay may be bad.

If relay is not receiving power, continue to step 2.

2) If the transceiver features a SLEEP mode or is continuously powered, using a digital multi-meter (DVM) set to DC volts, measure the voltage at the next supply junction. Verify the wiring is firmly connected; otherwise, continue to the charger relay. Once there, measure the voltage between:

Power (+) and Ground (-).

The voltage should be greater than or equal to 11.9 Vdc for this unit. If the voltage is less than 11.9 Vdc, return to the test sequence outlined in Figure 5-5.

5.6.5 Transceiver Check

5.6.5.1 Instructions

1) If available, use a wattmeter to check the transceiver output power. Refer to the manufacturer's documentation for measuring instructions.

2) If available, use two (2) hand-held transceivers to verify the communication path between the master and remote sites. The voice-activated interface can be used, if available.

3) Verify that the transceiver is set to the correct frequency. Refer to the manufacturer's documentation for checking the frequency instructions.

4) If a directional antenna is used, verify the orientation from the antenna to the master site.

FYI

If a communication problem still exists and the unit has passed the transceiver check test, contact ABB Totalflow customer service for additional help.

5.6.6 RS-232 Communication Test

The following RS-232 serial communication test procedure is directed from Figure 5-5 and will assist the user in what may be the possible cause for the indicated error message.

Before performing this test, please verify that the field wiring is correct (see Table 5–3).

Table 5–3 RS-232 Field Wiring on PGC1000 Termination Board

	Description	Description
PIN	**Jumper 8-Port 1**	**Jumper 10-Port 2**
1	Power Out	Power Out
2	Ground	Ground
3	Switched Power Out	Switched Power Out
4	Operate	Operate
5	Not Used	Not Used
6	Request to Send	Request to Send
7	Transmit Data	Transmit Data
8	Receive Data	Receive Data
9	Clear to Send	Clear to Send

TIP

When troubleshooting the RS-232 mode, verify the termination settings of serial port 1-J9 and serial port 2-J11 on the termination board have pins 2 and 3 jumpered.

5.6.6.1 Instructions

The voltage on the following steps may be hard to see using a digital multi-meter. If available, an oscilloscope will provide a more accurate reading. To verify, the host software must be continuously polling the PGC1000.

TIP

Generally speaking, these tests performed on the terminal board will only verify incorrect or damaged wiring. If all previous testing passed and all wiring, jumper and terminations have been verified correct, the board will need to be replaced. Contact ABB Totalflow customer service. See the Getting Help section at the beginning of the manual for instructions.

1) Using an oscilloscope, measure the receiving data voltage on the termination board, J8 or J10, between:

Port 1, J8–Pin 2 (Ground) and Pin 8 (Receive Data) or

Port 2, J10–Pin 2 (Ground) and Pin 8 (Receive Data)

When the unit is receiving data from the host, the voltage should vary between -5 Vdc and +5 Vdc. This would indicate that the unit is receiving data. Continue to step 2. If the unit is not receiving data, investigate the wiring issues (see Table 5–3).

2) Using an oscilloscope, measure the request to send the voltage on the termination board, J8 or J10, between:

Port 1, J8–Pin 2 (Ground) and Pin 6 (Request to Send) or

Port 2, J10–Pin 2 (Ground) and Pin 6 (Request to Send)

When the unit is communicating with the host, the voltage should be +5 Vdc and remain +5 Vdc until the XFC transmit stops. This would indicate that the unit is transmitting data. Continue to step 3. If the unit is not receiving data, investigate the wiring issues (see Table 5–3).

3) Using an oscilloscope, measure the transmit data voltage on the termination board, J8 or J10, between:

Port 1, J8–Pin 2 (Ground) and Pin 7 (Transmit Data) or

Port 2, J10–Pin 2 (Ground) and Pin 7 (Transmit Data)

When the unit is transmitting to the host, the voltage should vary between -5 Vdc and +5 Vdc. This would indicate that the unit is transmitting data. If the unit is still not responding, continue to the next test as directed in Figure 5-5.

5.6.7 RS-485 Communications

The following RS-485 serial communication test procedure is directed from Figure 5-5 and will assist the user in what may be the possible cause for the indicated error message.

Before performing this test, please verify that the field wiring is correct (see Table 5–4).

Table 5–4 RS-485 Terminations

Serial Comm Port	1	2
Jumper	J9	J11
First or Intermediate Unit	Pins 2–3	Pins 2–3
Last or Only Unit	Pins 1–2	Pins 1–2

5.6.8 RS-485 Communication Test

Before performing this test on the termination board, please verify that the wiring is correct (see Table 5–5).

Table 5–5 RS-485 Field Wiring on PGC1000 Termination Board

	Description	**Description**
PIN	**J8-Port 1**	**J10-Port 2**
1	Power	Power
2	Ground	Ground
3	Switched Power Out	Switched Power Out
4	Operate	Operate
5	Remote Request to Send	Remote Request to Send
6	Transmit Bus (+)	Transmit Bus (+)
7	Transmit Bus (-)	Transmit Bus (-)
8	Receive Bus (+) (RS-422)	Receive Bus (+) (RS-422)
9	Receive Bus (-) (RS-422)	Receive Bus (-) (RS-422)

5.6.8.1 Instructions

The voltage on the following steps may be hard to see using a digital multi-meter. If available, an oscilloscope will provide a more accurate reading. To verify, the host software must be continuously polling the meter.

FYI

Generally speaking, these tests performed on the termination board will only verify incorrect or damaged wiring. If all previous testing passed and all wiring, jumper and terminations have been verified correct, the termination board may need to be replaced. Contact ABB Totalflow customer service. See the Getting Help section in the beginning of the manual for instructions.

1) Using an oscilloscope, measure the line driver voltage on the termination board, J8 or J10, between:

Port 1, J8–Pin 7 (BUS-) and Pin 6 (BUS+) or

Port 2, J10–Pin 7 (BUS-) and Pin 6 (BUS+)

When the unit is receiving data from the host, the voltage should vary between +5 Vdc and 0 Vdc. This would indicate that the unit is receiving data.

2) Using an oscilloscope, measure the remote request to send the voltage on the termination board, J8 or J10:

Port 1, J8–Pin 2 (Ground) and Pin 5 (RRTS)

Port 2, J10–Pin 2 (Ground) and Pin 5 (RRTS)

When the unit is transmitting data, the voltage should vary between +5 Vdc and 0 Vdc. This would indicate that the RRTS is working correctly.

3) If any inaccuracy exists, investigate the wiring errors or damaged wires.

FYI

If a communication problem still exists and the unit has passed the tests in steps 1 and 2, additional testing will be required.

6.0 SPECIAL APPLICATIONS

6.1 Introduction

The Special Applications section contains information pertinent to specific chromatographic applications (e.g., landfill, C9+, H2S, etc.). Different applications often require different chromatographic columns or trains. A C6+ application requires different column trains than a landfill application.

ABB provides an assortment of column trains (see Table 6–1) to support a variety of applications. Column trains are identified by a three character identifier (BBD, BBF, etc.). Each train is designed to identify a specific series of components. The BBD train identifies the following components: C3+, Air or H2, C1, CO2, C2=, C2, C2*, H2S and H2O.

Some of the other column trains follow:

Table 6–1 Column Train Listing

ID	Description
BBC	C3+, Air or H2, C1, CO2, C2=, C2, C2*
BBD	C3+, Air or H2, C1, CO2, C2=, C2, C2*, H2S and H2O
BBF	C3+, Air or H2, C1, CO2, C2=, C2
BBG	C3+, Air or H2, C1, CO2, C2=, C2, H2S and H2O
BBH	C1+, He, H2, O2, N2, CO
BBJ	C5+, C3, C3= and C2*, IC4, NC4, H2S, B-1 and IC4=, tB-2, cB-2, 1, 3-BD
BBK	C6+, C3, IC4, NC4, Neo-C5, IC5, NC5
BBM	C6+, C3, IC4, NC4, Neo-C5, IC5, NC5 and H2S
BBR	H2S in fuel gas
BBS	C7+, C3, IC4, NC4, Neo-C5, IC5, NC5, C6s and H2S
BBT	C9+, C6s, C7s, C8s
BBX	C4+, CYC3, PD, MA
BCB	C3+, Air or H2, C1, CO2, C2, CO2, H2S, H2O
BCC	C6+, C3, IC4, NC4, Neo-C5, IC5, NC5
BCD	C6+, C3, IC4, NC4, Neo-C5, IC5, NC5
BCF	C3+, Air or H2, C1, CO2, C2=, C2
BCG	C3+, Air or H2, C1, CO2, C2=, C2
BCH	C7+, C3, IC4, NC4, Neo-C5, IC5, NC5, C6s and H2S
BCM	H2S 0-30 ppm
BBP	He (ppm), H2, O2, N2, CO
BBW	0-30 ppm O2 w/N2 & HCS
Note: Many of the trains identify similar components but will have differing cycle times. This is dependent upon the carrier gas being used.	

Table 6–2 Component Listing

Component Definitions	
C2=	Ethylene
C2*	Acetylene
B-1	1-Butene
IC4=	Isobutylene
tB-2	Trans-Butene-2
cB-2	Cis-Butene-2
1,3-BD	1,3-Butadiene
CYC3	Cyclopropane
PD	Propadiene
MA	Methylacetylene
C3=	Propylene
MeOH	Methanol

The information in this document is NOT intended to replace the help files in PCCU32. The PCCU32 help files are intended to be generic to several applications (Landfill, C6+, etc.). This document is intended to supplement the PCCU32 help files and to provide information more specific to the user's particular application. The PCCU32 help files will help the user understand the tools available within PCCU32 to perform the various procedures necessary for successful operation of the PGC1000.

As the users begins to familiarize themselves with the PGC1000 chromatograph, use the help screens provided with PCCU32. As the user moves between the various functionalities available within PCCU32 (data collection, chromatograms, setups, etc.), the help screens will follow them and provide the appropriate help screen at the click of the Help button.

6.1.1 Using the Special Applications Section

The Special Application section contains the column train specifications, reference chromatograms and data specific to performing a manual peak find. Each of the various column trains will have these three pieces of information. The Column Train Data Sheet presents the column specifications in a tabular format. The user will notice that the table supports helium and hydrogen carriers. Be sure to refer to the correct section. Next, a reference chromatogram is shown. Generally, the reference chromatogram has been generated using a helium carrier (but not always). The user will be able to tell which carrier was used by referring to the various components' elution times. The last table is the Column Data for Manual Peak Find. This table contains data pertinent to performing a manual peak find on the specific column train.

Any chromatographic application will require the appropriate column trains. Some applications require only two trains to identify the components of interest. Some applications may require three or four column trains. Depending on the application, the user will employ a GC module with some combination of the previously mentioned column trains. For example, if the application is C6+, the GC module must employ two column trains: the BBF and the BBK. If the application were C9+, three column trains would be needed: the BBT, BBF and BBK.

The column trains cannot be ordered separately. The user will order a GC module meeting the requirements for their specific application. GC modules supporting the more common applications (landfill, C9+, etc.) are kept in inventory for quick replacement of a faulty module. GC modules supporting less common applications are built to order. ABB project engineers will be able to help the user determine what GC module (and which column trains) fits their application.

Much of the information in the Special Application section is used in performing a manual peak find on the PGC1000. The Generic Manual Peak Find discussion will walk the user through the details of using the various Column Train data sheets.

6.2 General Manual Peak Find Procedure

6.2.1 Purpose

The purpose of this section is to provide the user with a generic procedure to perform a manual peak find on their special application (e.g., Landfill, C9+, H2S, etc.). ABB Totalflow provides documentation for all of the available column trains. These column train documents are be included in this Special Applications section. The generic peak find procedure is intended to be used in conjunction with the column train segment. By following the generic peak find procedure and applying the appropriate parameters from the included column train information, the user will be able to successfully perform a manual peak find on the equipment.

Some column trains may require specific peak find procedures that are not mentioned in this section. Be sure to carefully read the column definition pertinent to the GC. Any special requirements will be discussed in those column definition pages.

The information in this section is NOT intended to replace the help files in PCCU32. PCCU32 help files are intended to be generic to several applications (Landfill, C6+, etc.). This document is intended to supplement the PCCU32 help files and to provide information more specific to the user's particular application. PCCU32 help files will help the user to understand the tools available within PCCU32 to perform the various procedures necessary for successful operation of their PGC1000.

As the user begins become familiar with the PGC1000 chromatograph, use the help screens provided with the PCCU32. As the user moves between the various functionalities available within PCCU32 (data collection, chromatograms, setups, etc.), the help screens will follow the user and provide the appropriate help screen at the click of the Help button.

6.2.2 PCCU32 and the User-Interface

PCCU32 (a user-interface) is supplied with each PGC1000. PCCU32 is a software package that will run in Microsoft® Windows ® 2000, XP or Vista environments. The user's PC can be directly connected to the PGC1000 via an RS-232, USB or Ethernet connection. Remote connections (phone modem, radio, cell phone, satellite, etc.) are also available. PCCU cables and connectivity are discussed further in the General section of this manual. PCCU32 supports all the functionality needed to set up, run and collect data from the PGC1000. A majority of the functionality typically employed by the user resides on the PGC1000 Operations screen (see Figure 6-1). The PGC1000 provides the user with a tremendous amount of functionality, power and flexibility. In an effort to minimize complexity but retain the vast feature set, ABB Totalflow has created a three-tiered user interface:

Basic	This is the most basic of the three tiers. Users would seldom need anything beyond the Basic level. The PGC1000 Operations graphic

	screen supports much of the functionality required in typical operation: calibration, diagnostics and data.
Advanced	Caution is recommended when entering the Advanced tier. The user should be knowledgeable concerning the operation of the PGC1000. Unintended entries can cause the PGC1000 to behave erratically.
Expert	Caution is recommended when entering the Expert tier. The user should be knowledgeable concerning the operation of the PGC1000. Unintended entries can cause the PGC1000 to behave erratically.

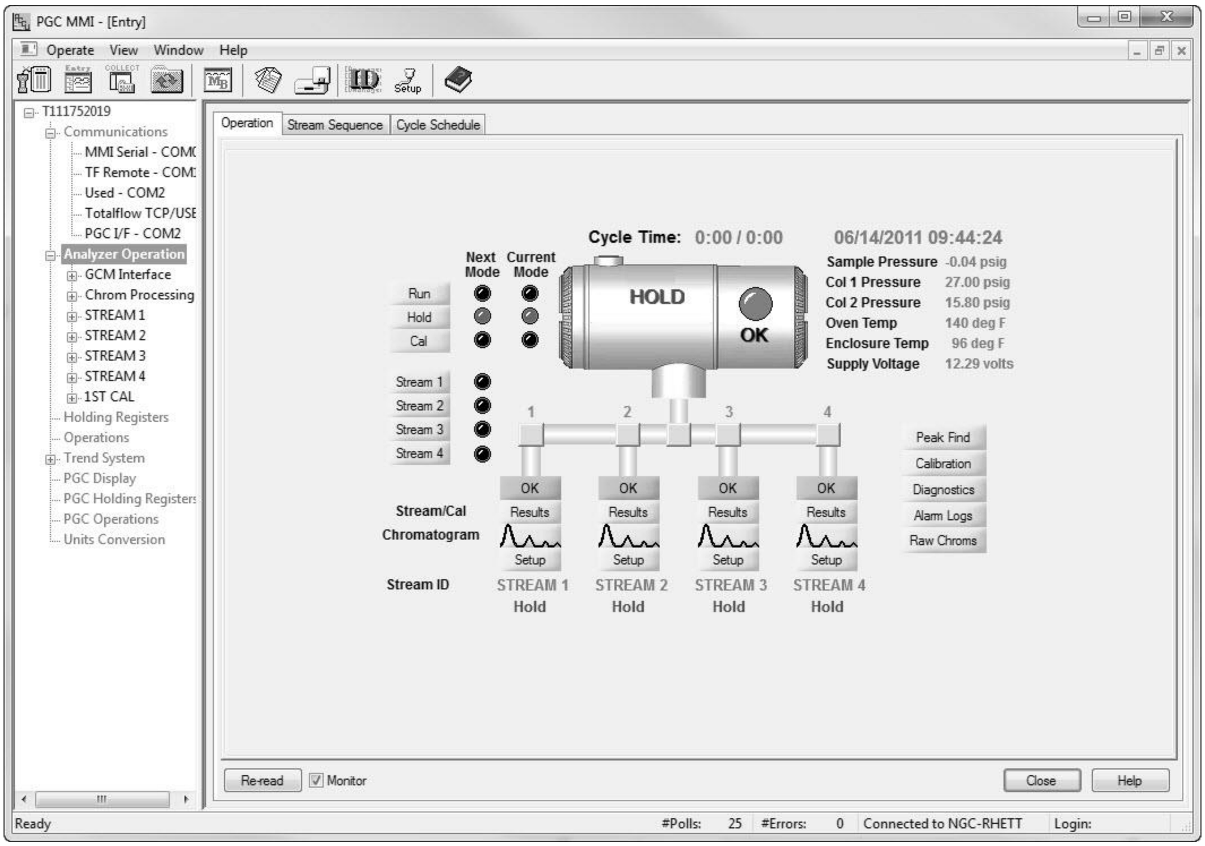


Figure 6-1 PGC1000 Operations Screen

From the PGC1000 Operation screen, the user can access all the functionality required for most typical applications (see Table 6–3).

Table 6–3 Analyzer Operation screen Functionality

Application	Description
Run, Hold, Cal	These allow the user to select the next mode of operation.
Streams 1-4	Allows for the selection of an individual stream. These buttons let the user work around the stream sequencing established under the Stream Sequence tab.
Peak Find	Opens a screen that supports manual and auto peak find (auto peak find is only available with the C6+ application), auto gating and carrier pressures.
Calibration	Opens a screen that supports calibration blend and other calibration parameters.

Diagnostics	Opens a screen that supports diagnostics and diagnostic scheduling.
Alarm Logs	Displays current and logged alarms.
Raw Chroms	Graphic display of raw chromatograms, various temperatures and pressures.
Results	Displays a tabular formatting of the stream's current results (i.e., BTU, Density, Wobbe, Un-normalized Total, Mole percentages, etc.).
Setup	Much of the stream setup can be performed on these screens (i.e., ID, calibration blend, C6+ split, type of calculation, gas factors, alarms and limits, etc.).

The PGC1000 also supports an optional ¼-VGA interactive display allowing user access to basic analysis data. The user can access most of the operational functions from this front display without the use of a laptop.

6.2.3 Before Starting – Save and Restore

Before making changes to any operational parameters, save the station files. The PGC1000 has several folders that the user needs to be aware of: TfCold and TfData. TfCold and TfData hold the configuration, or station files, for the PGC1000. TfCold is a non-volatile memory that holds the PGC1000's configuration, regardless of power loss. Even disconnecting the lithium cell will not lose the data in TfCold. On the other hand, TfData is volatile memory (RAM) and is lost whenever power (and its lithium backup) is removed. The lithium cell is connected to TfData to prevent memory loss when the main power is interrupted. If the main power is interrupted and the lithium cell is removed, TfData will be lost. When the power is restored, TfCold (non-volatile memory) will be written to TfData (volatile RAM) during system start-up.

As secure as this memory loss system is, the operator should save station files to their laptop for back-up purposes. The Operate/File Utilities/ Save and Restore is used for this purpose.

The Save Station Files button (see Figure 6-3) will save the PGC1000's configuration to the user's laptop. The Restore Station Files button will restore the configuration files from the laptop to the PGC1000.

Should the user ever get to the point that they would like to go back to the original factory settings, the user can cold boot the PGC1000 from the PCCU32 program.

To perform a cold boot from the PCCU32, click on the 32-Bit Loader icon on the toolbar (see Figure 6-2). The files paths can be blank.

- Select Reload.
- Select Shutdown Flash.
- Select Delete TfData Directory.
- Select Start Flash.
- Lastly, click on the Start button in the lower right.

At this point, the PGC1000 will perform a cold boot and rebuild TfData from TfCold.

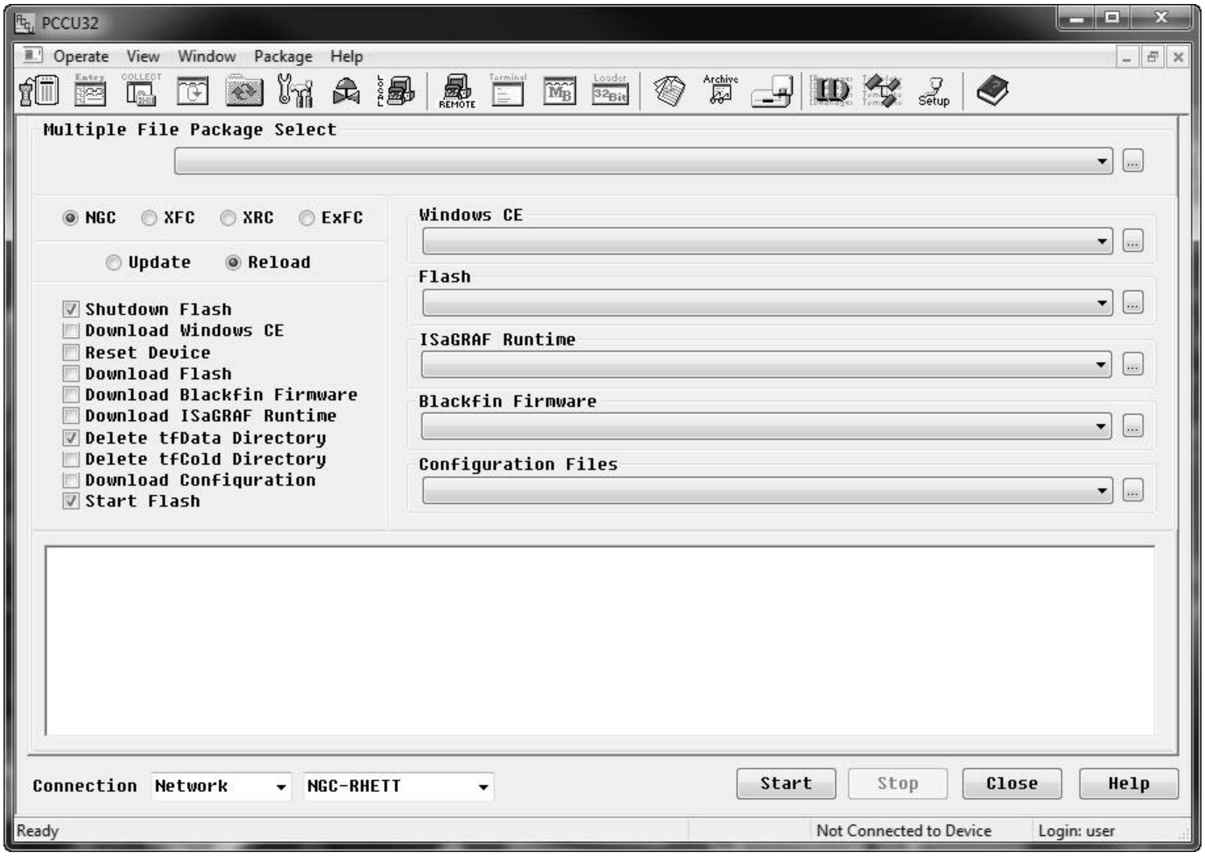


Figure 6-2 PGC1000 Cold Boot via PCCU32 and the 32-Bit Loader

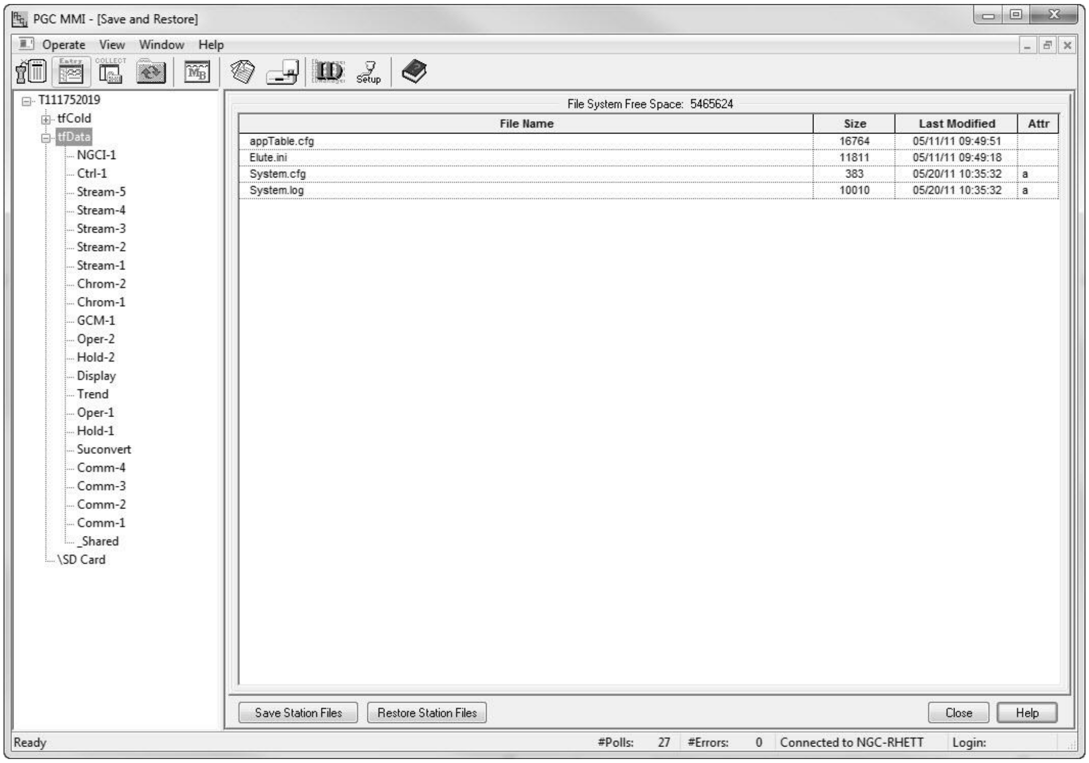


Figure 6-3 Save and Restore TfCold and TfData

6.2.4 General Setup Checklist (Per PGC1000 Start-Up Guide)

6.2.4.1 Installation

1) Mount the PGC1000.

2) Install the sample probes.

3) Connect the sample streams.

4) Connect the vents, carrier and calibration gas lines.

5) Set the carrier to 90 PSIG.

Set the calibration and process streams to 15 PSIG ±2 PSIG.

6) Check the system for leaks.

7) Adjust the power at the termination board between 11.5 Vdc and 14.5 Vdc.

6.2.4.2 Start-Up

1) Install the PCCU32 software on the laptop.

2) Connect the laptop to the PGC1000 unit.

3) Start PCCU32.

FYI

Before moving to the calibration step, it is a good idea to take a look at the component peaks and see if they match up with the reference chromes. Also, make certain that all the peaks are correctly labeled.

FYI The equipment, as delivered from the factory, should not require a manual peak find. Normal column aging, differences in barometric pressure and minor contamination may necessitate performing a manual peak find. If the user feels that a manual peak find may be required, contact ABB Totalflow personnel for possible alternatives.

4) Calibrate the PGC1000.

FYI Allow the PGC1000 at least eight (8) hours to stabilize before performing a calibration cycle.

5) Verify the stream sequencing.

6) Put unit into Run mode.

6.2.5 Generic Manual Peak Find

The user's equipment has been set up and configured at the factory. It should not be necessary to do a manual peak find. If the user feels that a manual peak find is required, contact ABB's customer service (1-800-HELP-365) personnel for possible alternatives.

However, should it be determined that a manual peak find is required, the following will walk the user through the procedure. The documentation will also try to point out any possible pitfalls along the way. Manual peak find can be accessed through the Advanced view.

FYI The following discussion, while generic in scope, will use C6+ column trained definitions (BBF and BBK) for the specific example.

6.2.5.1 The Manual Peak Find Screen

The following is a walk-through of the various parameters that the user will encounter during the manual peak find process. The following is a screen shot of the Peak Find dialog screen (see Figure 6-4).

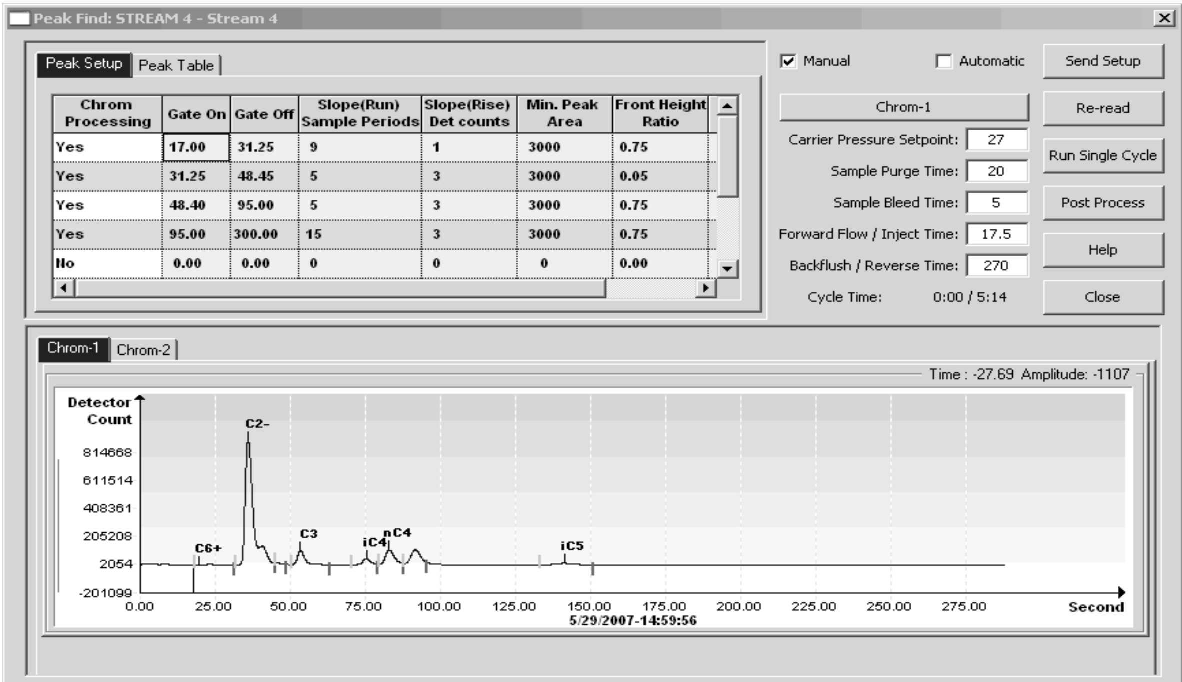
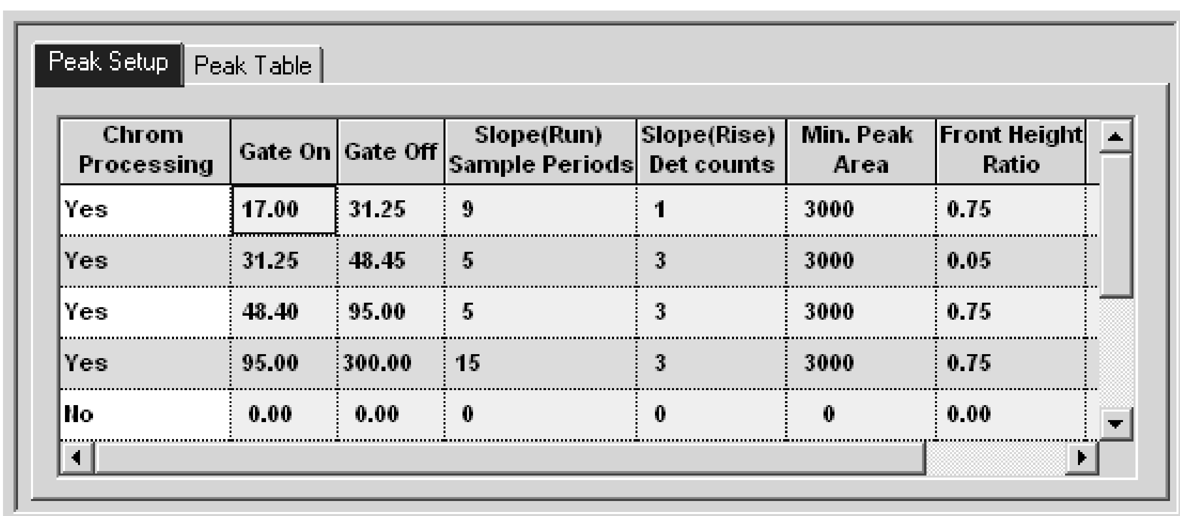


Figure 6-4 Manual Peak Find Dialog Screen

Figure 6-4 has three major sections: the top-left displays the parameter columns for finding component peaks (see Figure 6-5), the top-right allows the user to adjust several physical parameters and the bottom section displays the current chromatograms.



Chrom Processing	Gate On	Gate Off	Slope(Run) Sample Periods	Slope(Rise) Det counts	Min. Peak Area	Front Height Ratio
Yes	17.00	31.25	9	1	3000	0.75
Yes	31.25	48.45	5	3	3000	0.05
Yes	48.40	95.00	5	3	3000	0.75
Yes	95.00	300.00	15	3	3000	0.75
No	0.00	0.00	0	0	0	0.00

Figure 6-5 Parameter Columns

The parameter columns section has seven columns that can be used to apply seven different sets of parameter values to different sections of the chromatogram. In the above screen shot, the chromatogram has been broken into four different areas. These areas follow four different sets of rules for finding component peaks.

FYI To examine the results of changes to this section does not require the unit to run a new cycle. The new results can be applied by clicking on the Post Process button.

The first set of rules applies between 17 seconds and 31.25 seconds. The peak algorithm works from the top of the chromatogram and moves down, identifying any peaks in the area between 17 and 31.25 seconds. For instance, assume that one peak is identified in this region and that it has a peak area of 3000 or greater. This peak area satisfies the Min. Peak Area rule. Peaks with areas less than 3000 will not be automatically gated. In the example, the peak had an area greater than 3000 and was identified. Additionally, the user wants the algorithm to automatically gate that particular peak, i.e., locate a front and back gate for the peak. This requires applying the last two rules: Run/Rise and Front Height Ratio.

Run and Rise work together to determine where on the front and back slopes of a component peak to place the front and back gates. Longer runs, with respect to Rise, imply gentler slopes. Shorter runs for a given Rise imply steeper slopes. In the above screen shot, the regions between 17-31.25 and 95-300 (seconds) are looking for component peaks that rise less abruptly from the baseline.

The algorithm that defines the front and back gates of a component peak starts at the top of the peak and works its way down. The following drawing is NOT to scale but may explain the process (see Figure 6-6).

FYI The example shows the algorithm being applied to the component peak's front slope. The same method is applied to the back slope and back gate.

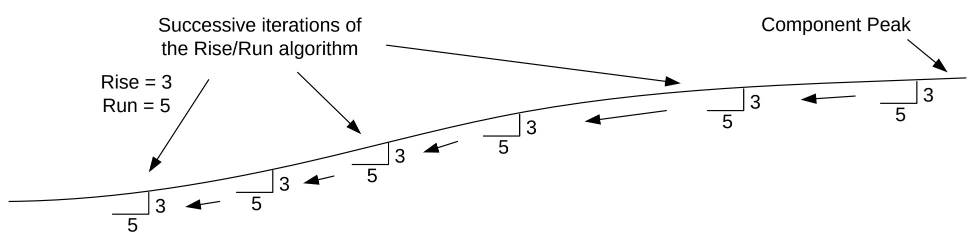


Figure 6-6 Failure to Define a Front Gate

In Figure 6-6, the algorithm has failed to define a front gate. This component peak's front slope is too gradual to be detected by a Rise of 3 and a Run of 5. For a front gate to be established, the Run of 5 must intersect the component's front slope. That point of intersection determines the position of the front gate.

In the following example (see Figure 6-7), Rise remains at 3 but has stretched the Run to 9. The longer Run will help to establish the front gate of the more gradual front slope. The user can see that by lengthening the Run to 9. The algorithm eventually intersects the front slope. This intersection of the Run and the front slope establishes the front gate for this component.

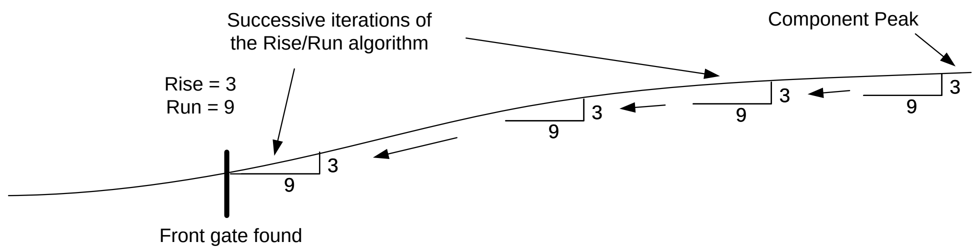


Figure 6-7 A Successful Front Gate Determination

In the example, it is assumed that the Rise/Run algorithm began its work at the component's peak. This is generally true. Beginning at the peak, the Rise/Run algorithm works its way down with either side looking for that condition (intersection of the Run with the peak's slope) that would satisfy the Rise/Run algorithm.

What if the chromatogram displayed a double peak similar to the illustration below (see Figure 6-8)? This is where the Front Height rule becomes useful. The Front Height Ratio can be set anywhere between zero (the bottom of the peak) and one (the top of the peak). The Front Height Ratio informs the Rise/Run algorithm where on the peak's slope to begin working its way down and looks for a front and back gate. Previously, it was assumed that the Rise/Run algorithm started at the top of the component peak. That is not always the case.

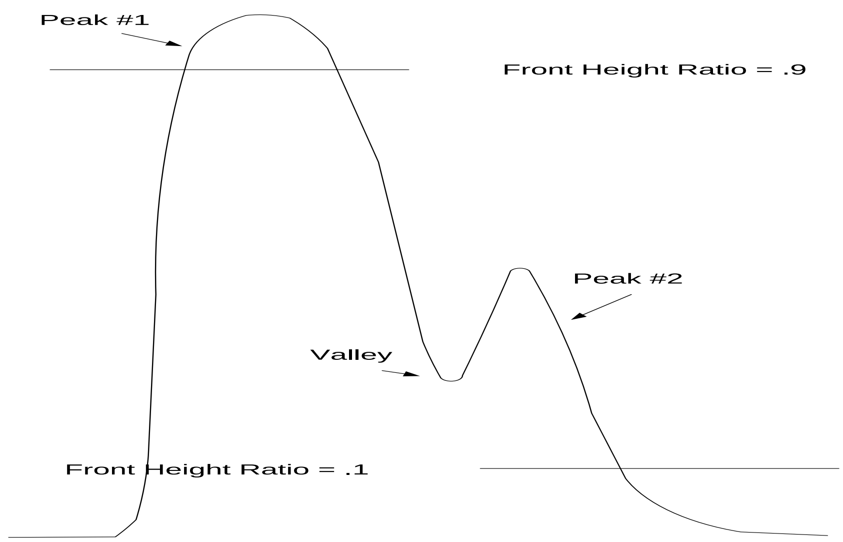


Figure 6-8 Double Peak Chromatogram

If selecting a Front Height Ratio higher than the valley, the Rise/Run algorithm will be instructed to start near the top of the component peak (e.g., FHR = .9). As the algorithm slides down the back slope, it will establish a back gate for Peak #1 inside the valley. Peak #2 will be handled (and possibly integrated) as a separate peak.

Suppose Peak #2 is to be included as part of Peak #1. In other words, Peak #2 is not to be handled as a separate peak. In that case, the Front Height Ratio is set at something below the valley, along the lines of FHR = 0.1. This tells the Rise/Run algorithm to not begin looking for a gate (front or back) until it is well past the valley. The Rise/Run algorithm will work its way down the front slope of Peak #1 and down the back slope of Peak #2, starting at 0.1 of the front height. It will not detect the valley and will conclude that Peak #1 and Peak #2 are not separate peaks. Peak #1 and Peak #2 will be handled as if they are one inclusive peak.

The upper-right section of the Peak Find screen holds the physical parameters. The following settings are also discussed in the PCCU32 help files (see Figure 6-9).

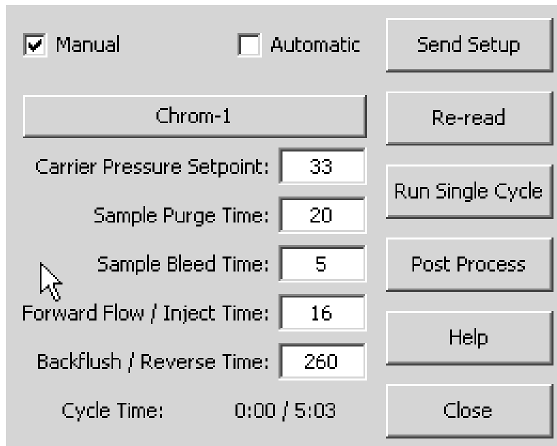


Figure 6-9 Manual Peak Find Screen Physical Parameters

Table 6–4 discusses each parameter in detail.

FYI To examine the results of changes to the physical parameters section requires that the operator run a single cycle. The Post Process button CANNOT process physical changes (e.g., pressure, inject times, purge times, etc.), only rule changes can be post-processed.

Table 6–4 Manual Peak Find Parameters

Parameter	Description
Manual check box	To perform a Manual Peak Find, this check box must be selected. Manual Peak Find is supported in the Advanced view. As Manual Peak Find is being discussed in this section, Manual is checked.
Automatic check box	Automatic Peak Find is only supported in the C6+ application. All other applications must use the Manual Peak Find procedure.
Chrom-1/Chrom-2	This button toggles between support of Chrom-1 and Chrom-2.
Carrier Pressure Setpoint	This value can be modified by the user. Changing column pressure will cause the component peaks to move. Increasing carrier pressure will cause the components to elute more quickly (move to the left). Decreasing carrier pressure will cause the components to elute more slowly (move to the right).
Sample Purge Time	This is the amount of time (in seconds) that the sample is run through the sample loops prior to any measurement. The default value should be correct.

Sample Bleed Time	This is the amount of time (in seconds) allowed for the sample to bleed down to atmospheric pressure after the sample has been shut-off. The default value should be correct. NOTE: Too long of a Sample Bleed Time can result in atmospheric air diffusing into the sample loop. This can result in analysis error.
Forward Flow/ Inject Time	This is the amount of time (in seconds) that the sample is allowed to flow into the column trains prior to Backflush/Reverse Time. The default value should be correct. The default time is 15 sec (±1.5 sec). Column pressure should be used to make other necessary adjustments.
Backflush/Reverse Time	This is the amount of time (in seconds) that flow is reversed and the sample is carried backwards (via the carrier gas) through the columns and across the detectors.
Send Setup	Making any change to the Peak Setup or the various setpoints will necessitate sending these changes to the system.
Re-read	Reads the current settings for the setpoints and Peak Setup.
Run Single Cycle	This will run a single cycle on the calibration stream. If any of the physical parameters have been changed (e.g., column pressure, bleed time, inject time, etc.), it will be necessary to run a single cycle to see the results of those changes.
Post Process	If making changes to the rules (e.g., run, rise, front height ratio, etc.), the user can view the results of those changes by clicking on this button. Post Processing will be much faster than running a new single cycle.
Help	This button will display the Peak Find help files.
Close	This button closes the Peak Find screen.

6.2.5.2 Column Train Documents

In the current example, the C6+ application employs two column trains. One column train is used for the lights (model BBF) and another for the heavies (model BBK). Some applications require two column trains while others require three or four column trains; however, all column trains are set- up using a similar manual peak find procedure. The user's manual will have documentation describing the particulars of the column trains used in their application. This documentation is referenced during the peak find process to provide various parameter values. Again, the peak find procedure that is being discussed is generic. It will pertain to all column trains. The specifics of the user's application are covered in the column train documentation.

In the ongoing discussion, one of the two column trains required by the C6+ application is dealt with, specifically the column separating the heavies (the BBK column train). The following is an example document dealing with the BBK column train data (see Figure 6-10).

The table is divided into two sections: the top section for the more common Helium carrier and a bottom section for a Hydrogen carrier. The key, or target, component and its expected elution time are identified. This information helps the user to set the column pressure. Each component and the expected elution time are listed as well as typical Gate On and Off times and peak slope descriptions (Rise/Run). NC5 will be the target component when performing the manual peak find. Furthermore, the expected retention time for NC5 is about 166 seconds.

Many of the various parameters discussed should be familiar to the user. These are similar to the parameters discussed when the Manual Peak Find screens were covered.

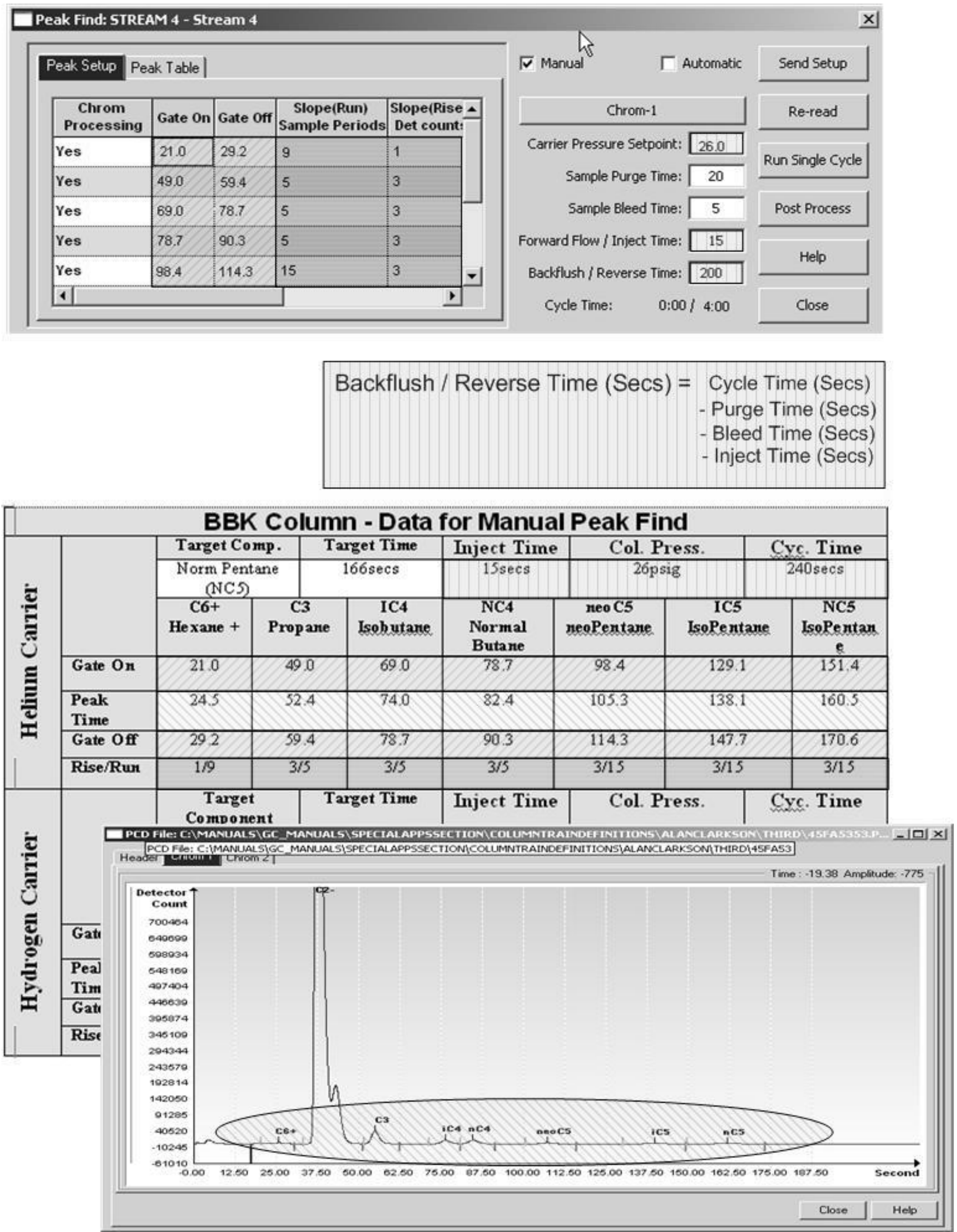


Figure 6-10 Column Data Example

6.2.6 Generic Manual Peak Find Procedure

There are three types of peak gating available in the PGC1000 (see Table 6–5): Timed Gating, Auto Peak Gating (not to be confused with Auto Peak Find which is only available on ABB Totalflow's C6+ NGC8206) and Auto Peak Group Gating (see Figure 6-11). The Timed Gating identifies a single peak. Auto Peak Gating identifies and tabulates each component peak area within the prescribed time window. Auto Peak Group Gating identifies multiple component peaks within the prescribed time window but adds the individual peak areas together and attributes the overall peak area to a single component.

FYI The user's equipment has been set up and configured at the factory. It should not be necessary to do a manual peak find. If the user feels that a manual peak find is required, contact ABB's customer service (1-800-HELP-365) personnel for possible alternatives.

Table 6–5 Three Methods for Gating the Components of Interest

Method	**Description**
Note: The user must be in Expert mode to select the appropriate gating methods	
Timed Peak Gating	There are seven sets of gating rules that can be applied to each Chrom. Each of these gating rules has a Gate On and a Gate Off time. The Gate On and Off times could be set around a single component peak. Seven component peaks could then be Time Gated using these seven rules. In Figure 6-12 each of the seven component peaks has been individually Time Gated.
Auto Peak Gating	Again, looking at Figure 6-12, notice that the three pentanes (neoC5, IC5 and NC5) have very similar peaks. These peaks are similar in peak area and similar in the rise and fall of the front and back slopes. The same rise, run, front height ratio and peak area rules could be applied to all three component peaks. Using Auto Peak Gating, a Gate On could be set at about 90 seconds and a Gate Off time at about 185 seconds. The Auto Peak Gating algorithm will identify and report individually the three pentanes using the one rule. NOTE: In a C6+ application, NC5 and its two isomers (IC5 and neo-C5) are all measured and reported individually. Isomers of heavier components (e.g., C7 and C8) are too numerous to be handled individually. This is where Auto Peak Group Gating becomes useful (See below).
Auto Peak Group Gating	This method is useful in a C9+ application. The isomers of heavier components (e.g., C7 and C8) can be too numerous to identify and report individually. Refer to Figure 6-13. For the sake of the example, it is supposed that the user is establishing Gate On and Off times that will capture C7 and its isomers. The Gate On time would be placed on the back side of NC6 (85 seconds) and the Gate Off time on the back side of NC7 (146 seconds). The Auto Peak Group Gating algorithm will identify NC7 and its isomers. The individual peak areas will be summed together and reported as NC7. The isomers will NOT be reported individually.

	NOTE: In the C9+ application, the C8s would be handled similarly to the C7s.

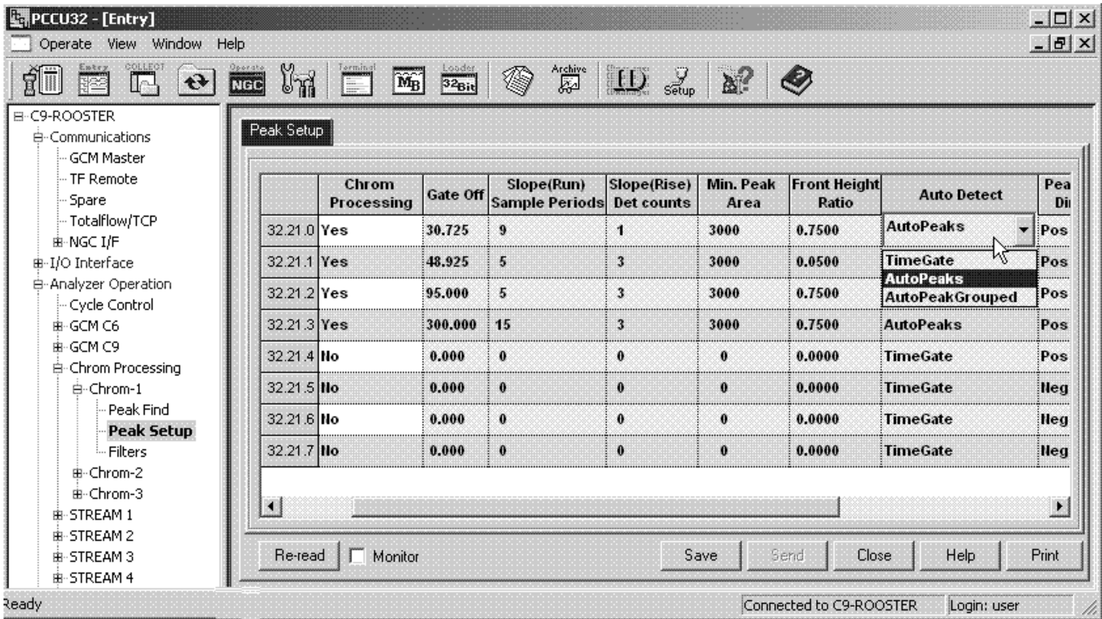


Figure 6-11 Peak Gating Methods

Figure 6-12 Manual Peak Find Setup Screen

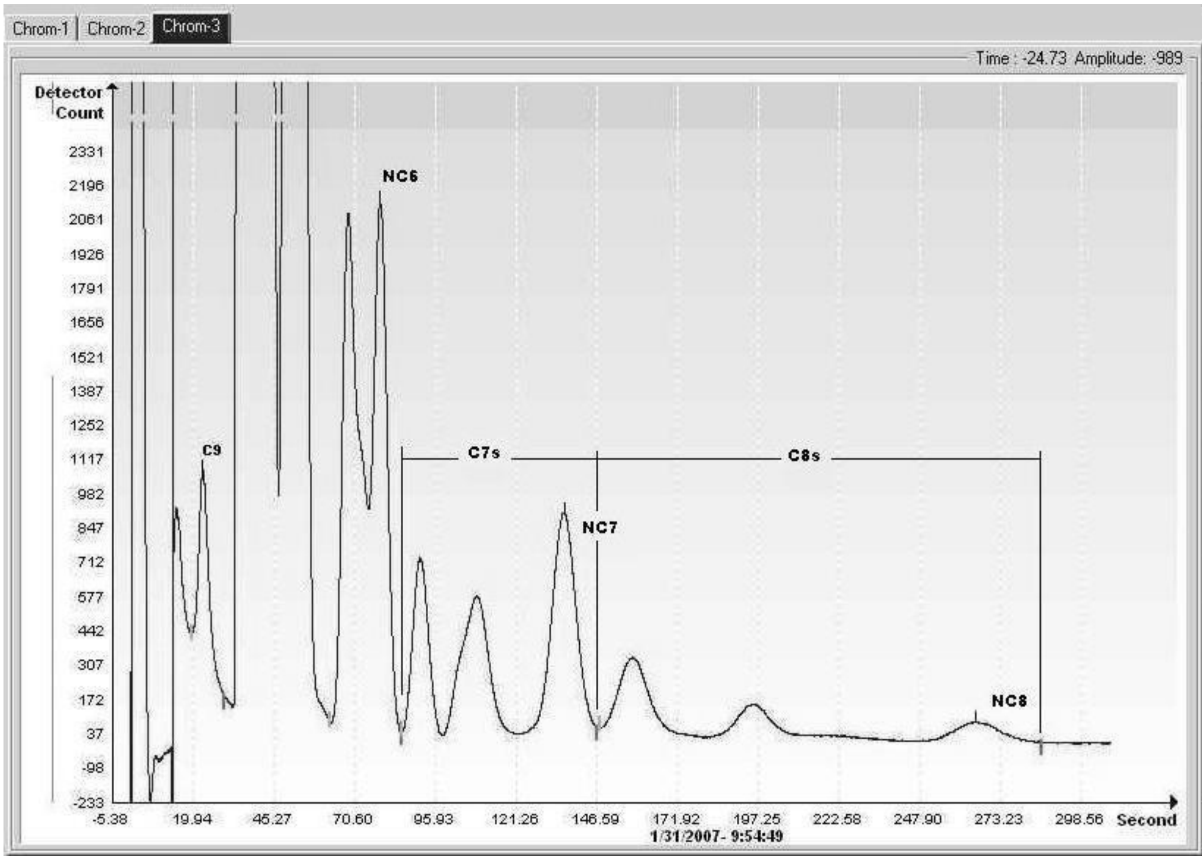


Figure 6-13 Example of a C9+ Chromatogram

6.2.6.1 Timed (or Hard) Peak Gating

Based on the previous material, the following will place that information into context. The example that follows represents time peaked gating (see Figure 6-14). Each of the seven component peaks is identified by placing the recommended On/Off gates around each component.

1) After connecting to the PGC1000, pull up the Peak Find Setup screen.

2) Using the BBK Column Train document, fill out the parameter columns section of the Peak Find screen. Use helium as a carrier. Input the documented gate times for the various components. In this same area, the user will find suggested values for the Rise/Run algorithm. Enter the following values:

Chrom Processing	Gate On	Gate Off	Slope Run	Slope Rise
Yes	21.0	29.2	9	1
Yes	49.0	59.4	5	3
Yes	69.0	78.7	5	3
Yes	78.7	90.3	5	3
Yes	98.4	114.3	15	3
Yes	129.1	147.7	15	3
Yes	151.4	170.6	15	3

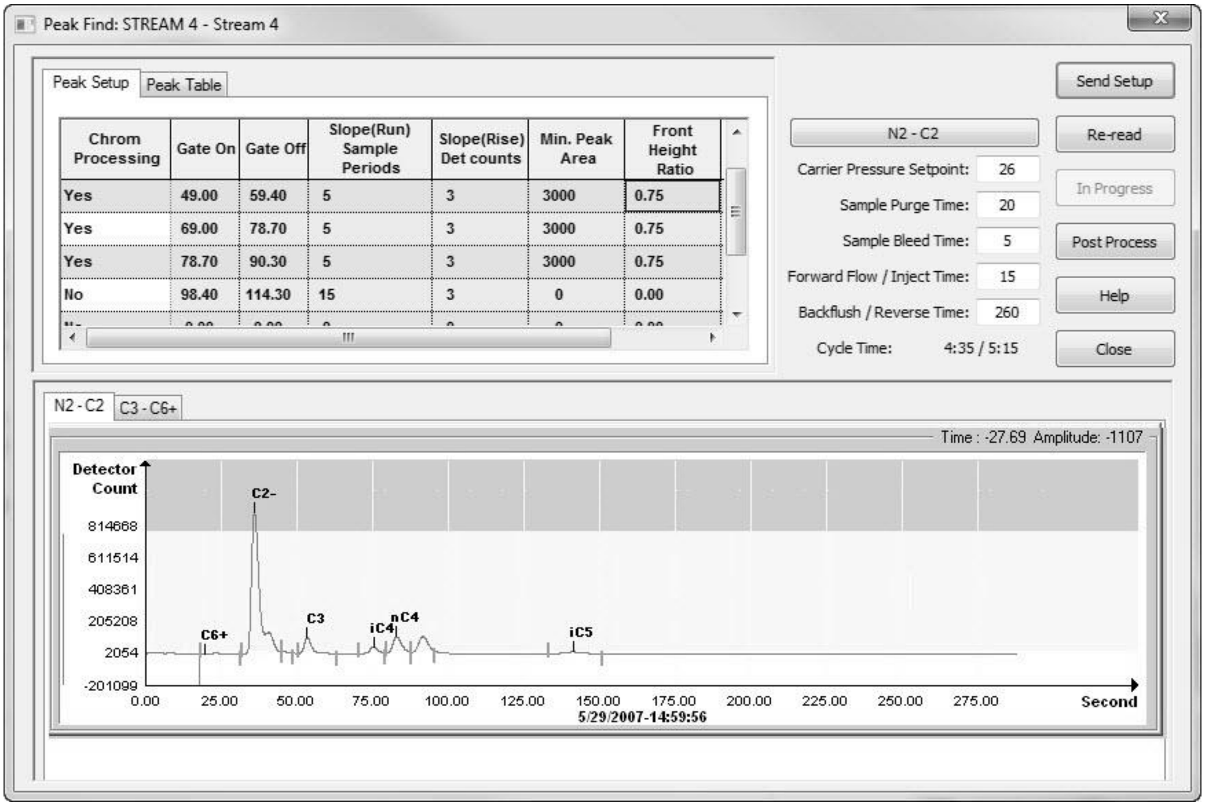


Figure 6-14 Manual Peak Find Setup Screen

3) Input the starting points for Min. Peak Area and Front Height Ratio as 3000 and .75, respectively.

4) With the parameter columns section filled out, input the physical parameters which are found in the Column Train documentation.

Helium is listed as the carrier and NC5 (normal pentane) is identified as the target component. The elution time for NC5 (the time in seconds that NC5 appears on the chromatogram) is listed as 166 seconds (±1.0%). The overall cycle time is listed at about 240 seconds. The Inject Time is 15 seconds (±1.0%), and the suggested column pressure is 26 psig (±15%).

Suggested default values will work for the Sample Purge Time (20 sec.), Sample Bleed time (5 sec.) and Reverse Time (240 sec.).

After entering all of this information, the user must click the Send Setup button.

5) After sending the setup, click on the Run Single Cycle button. After about five (5) minutes (a single cycle), the new chromatogram representing all the new parameters is displayed (see Figure 6-15).

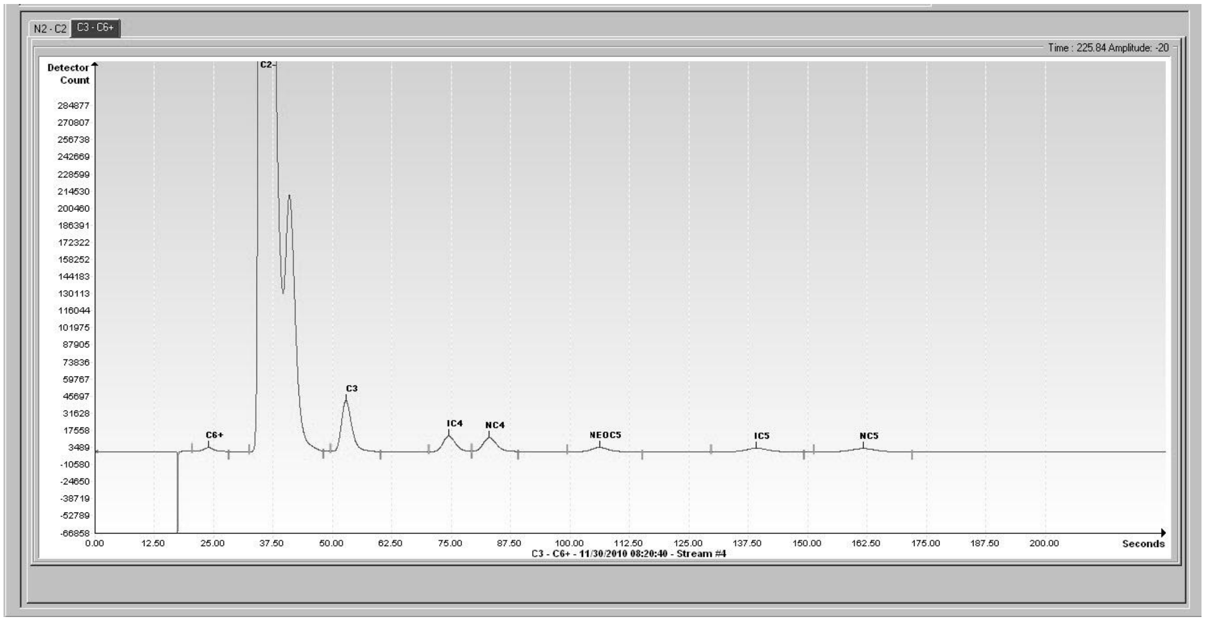


Figure 6-15 Run Cycle Chromatogram

6) Analyze the results. Compare the chromatogram to a reference chromatogram in the Column Train documents.

FYI  **The user needs to will need to zoom in on the chromatogram to better display the various components.**

- Does the user see the component peaks they expected to see?
- Can the user identify the target component?
- Is this component coming out at the target time?
- Are the peaks correctly labeled?
- For each component peak of interest, can the user identify one (and only one) start and stop gate?

6.2.6.2 Possible Exceptions to the Expected

- What might have happened that was unexpected?
- Does the user see the component peaks that they expected?

If the user is not seeing the expected component peaks, what peaks are being seen? Is it possible for the user to identify any of the peaks that were expected?

The example that was used is ABB Totalflow's standard calibration blend for C6+. As such, this blend has certain recognizable features. This blend deals with heavies (C3-C6+). The butanes and pentanes have the following composition:

Component	Mole%	Component	Mole%
Isobutane	.3	Isopentane	.1
Normal butane	.3	Normal pentane	.1
Neopentane	.1		

- Can the user identify the target component?

In this blend, the butanes have three times the concentration of the pentanes. If looking at a reference chromatogram of this blend, the user would expect to see two butane peaks (about the same size) followed by three smaller pentane peaks (smaller by a factor of about 3). In this way, it is easier to identify the various components. It is necessary for the user to know what the calibration blend looks like. In this way, the user can compare the current chromatogram to this known reference.

- Is this component coming out at the target time?

If the target component (in this case, NC5) is not seen, the user may need to change the column pressure to bring it into the display. If the user does see the target component, they will want to adjust column pressure to get the target component close to the target time (166 seconds). Increasing column pressure moves peaks to the left (earlier elution). Decreasing column pressure moves peaks to the right (later elution). It may require several cycles to properly adjust the peaks.

- Is the key component coming out at the right time?
- Adjust column pressure (increasing carrier pressure moves peaks to the left).
- Send Setup.
- Run Single Cycle.
- Repeat as necessary.
- Are the peaks properly labeled?

If the peaks are coming out where the user would expect them, it may be necessary to adjust the gate times. In the example, the following chromatogram for the C6+ heavies was generated (see Figure 6-16).

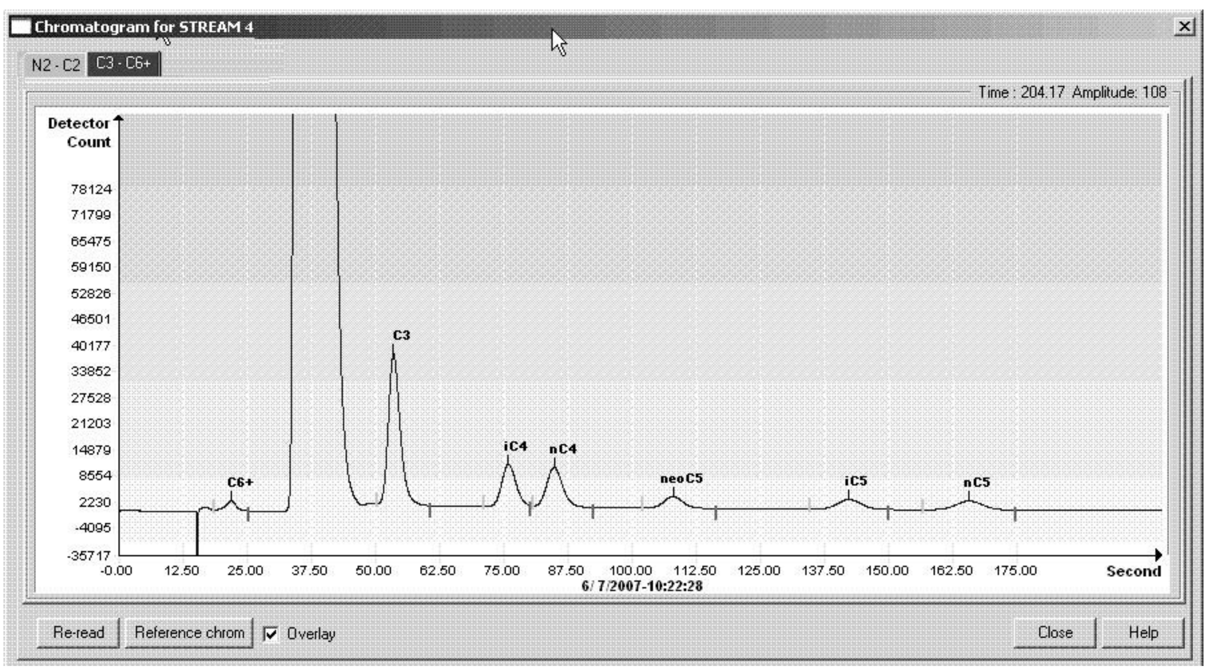


Figure 6-16 Actual Chromatogram

Compare the actual chromatogram with the reference chromatogram (see Figure 6-17). The user can see that the component peaks are coming out at about the right times. Ignore the differences in absolute peak height between the Actual and Reference chromatograms. This is just a matter of the amount of zoom employed. The user should pay attention to the relative heights (i.e., the butanes are about 3x larger than the pentanes).

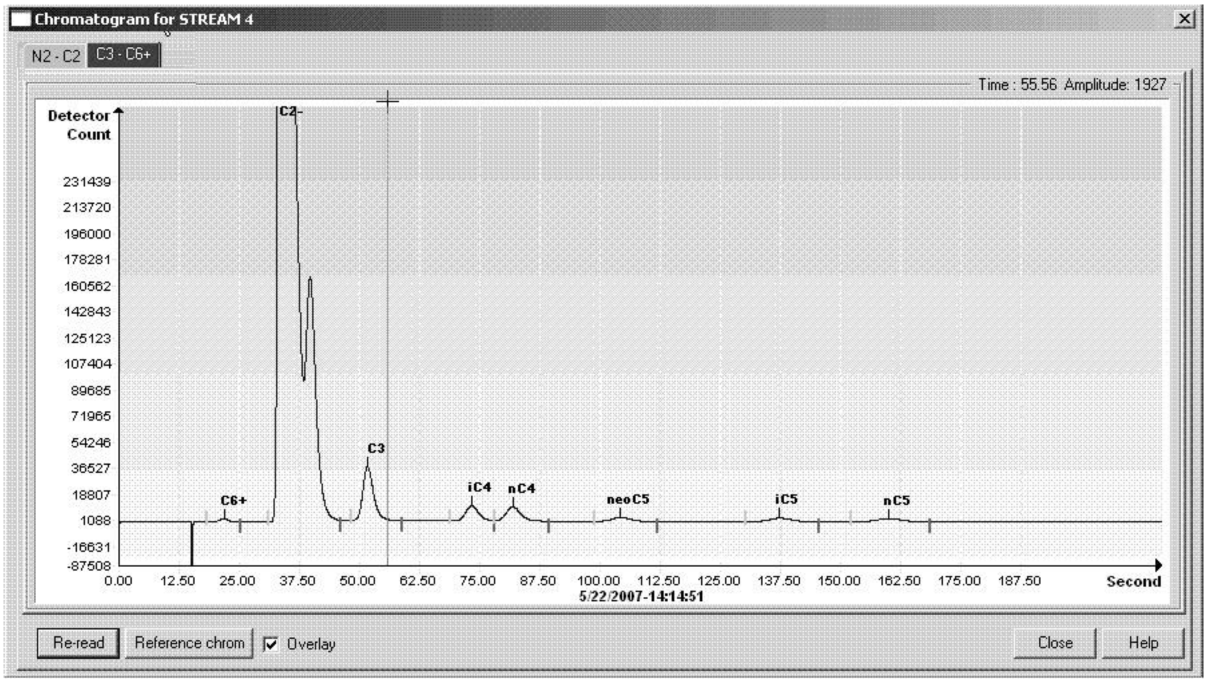


Figure 6-17 Chrom-1 Reference

If the user sees the expected component peaks and the target component is close to the targeted time but they are not correctly labeled, the user will need to manually label them. To manually label the peaks, position the cursor beneath the appropriate peak, and right-click. A dialog box will display. Click Label Peak. Pull down the Peak Comp. Select One list. From the selection, choose the appropriate component. Be sure to click the Label Peak button.

- For each component peak of interest, can the user identify one (and only one) start and stop gate?

Erratic behavior can result from improper gating. Carefully study the chromatogram. Make certain that only one start gate (green tick) and only one stop gate (red tick) is seen for each component. If the user sees more gates than would seem appropriate, consider altering some of the rules. Is the user picking up a tiny peak that could be ignored by altering the Min. Peak Area? The user could adjust the times (Gate On and Gate Off) to avoid looking for a peak in a troublesome area? If the user is missing a low level peak with a gentle front slope, they could increase the Run time rule. Be careful that the noise caused by column reversal is not being detected as a peak of interest. In the example column, reversal noise, referred to as column upset, is just to the left of C6+. Zoom in on the chromatogram enough to ensure that all of the start and stop gates are identified.

6.2.6.3 Auto Peak Gating

FYI

Auto Peak Gating should not be confused with the Auto Peak Find algorithm used on the ABB Totalflow C6+ NGC8206. Auto Peak Gating lets the user use a single rule to identify multiple peaks.

Auto Peak Gating (not to be confused with C6+ Auto Peak Find) allows the gating algorithm do most of the work. In the preceding example (Timed Peak Gating), seven sets of rules for identifying our component peaks were established. There were seven component peaks and seven slots to place the rules in. Knowing the blend, all of the pentanes could be identified. The three pentanes are all of the same concentration and appear very similar in the chromatogram. Peak areas are similar, front and back slopes are similar (very gradual) and the same Front Height Ratio would work for all three pentanes. The three pentane rules to a one pentane rule could be reduced (see Figure 6-18).

Timed Gating of the Three Pentanes					
Chrom Processing	**Gate On**	**Gate Off**	**Slope Run**	**Slope Rising**	**Front Height Ratio**
Yes	98.4	114.3	15	3	.75
Yes	129.1	147.7	15	3	.75
Yes	151.4	170.6	15	3	.75

Auto Peak Gating of the Three Pentanes					
Chrom Processing	**Gate On**	**Gate Off**	**Slope Run**	**Slope Rising**	**Front Height Ratio**
Yes	95.0	180.0	15	3	.75

When using the Auto Peak Gating feature, the user could miss an extremely low concentration component. If the user has a component of interest that is present at extremely low levels, they might want to consider time gating that component if the auto peak gating feature does not gate it properly. Individually gating the component will allow the user to select a lower Min. Peak Area or try various Run/Rise values to properly gate the front and back of the component.

FYI

It is possible that the current peak time differs from the target peak time in the user's Analyzer Operation/Stream/Setup/Component Configuration table (available in the Advanced view). If the difference in peak times between the current peak and the target time (established during the peak find procedure) exceeds ±7.5%, the user will not properly identify the component. To look at it from another angle, look at a current chromatogram and note the peak times for the various components. These should not vary more than ±7.5% from the peak times in the Component Configuration table that was mentioned previously.

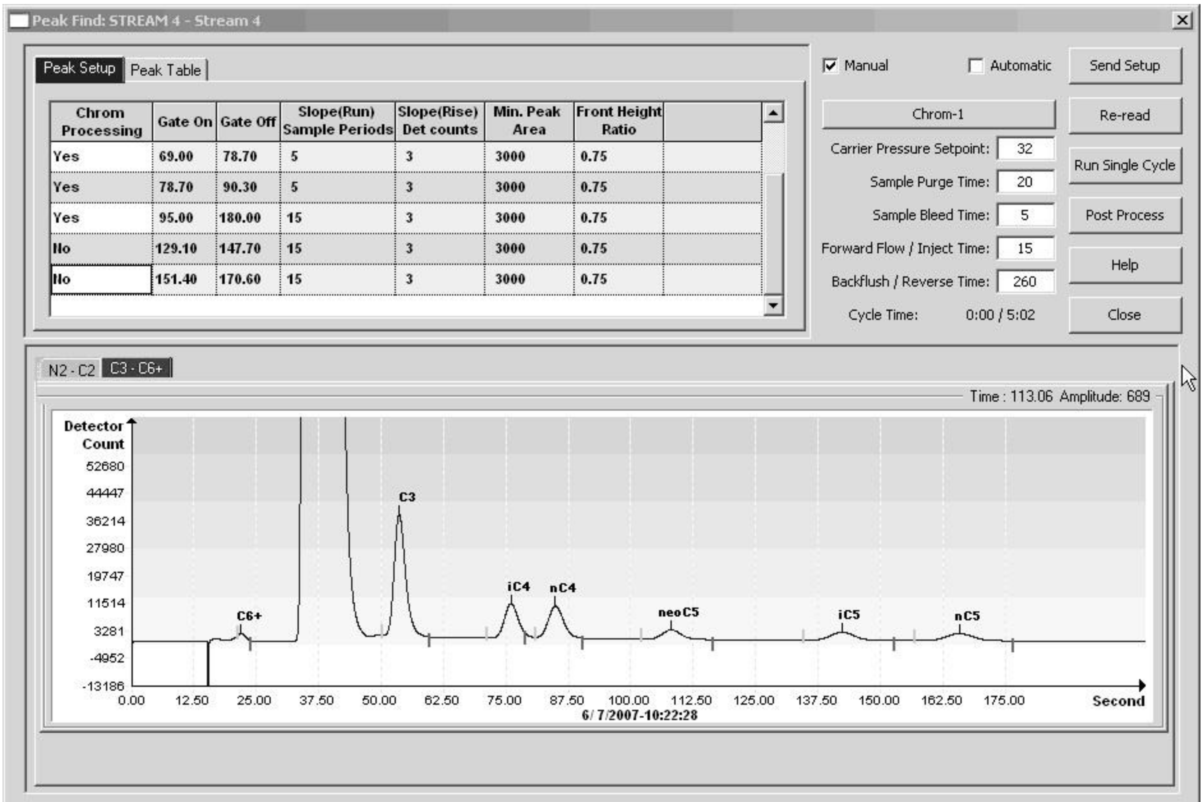


Figure 6-18 Auto Peak Gating of the Three Pentanes

6.2.6.4 Auto Peak Group Gating

FYI

Auto Peak Group Gating should not be confused with the Auto Peak Find algorithm used on the ABB Totalflow C6+ NGC8206. Auto Peak Group Gating simply allows the user to use a single rule to identify multiple peaks.

The following chromatogram is of a C9+ application (see Figure 6-19). Auto Peak Group Gating was used to identify these peaks.

In the C9+ chromatogram, the user can see several isomers of C6, C7 and C8. These isomers may be different depending upon the specific application. In the example chromatogram, the C7 isomers extend from the back gate of NC6 to the back gate of NC7. Likewise, the C8 isomers are found between the back gate of NC7 and the back gate of NC8. Rather than identifying each isomer individually, the PGC1000 will group the isomers with their Normal Component. Again, the heptanes (C7s) have been Auto Group Gated within a time window between 85-86 seconds and about 146-147 seconds. The peaks areas within the heptane gated group (the C7s) will all be summed and reported as NC7. The isomers will NOT be reported individually.

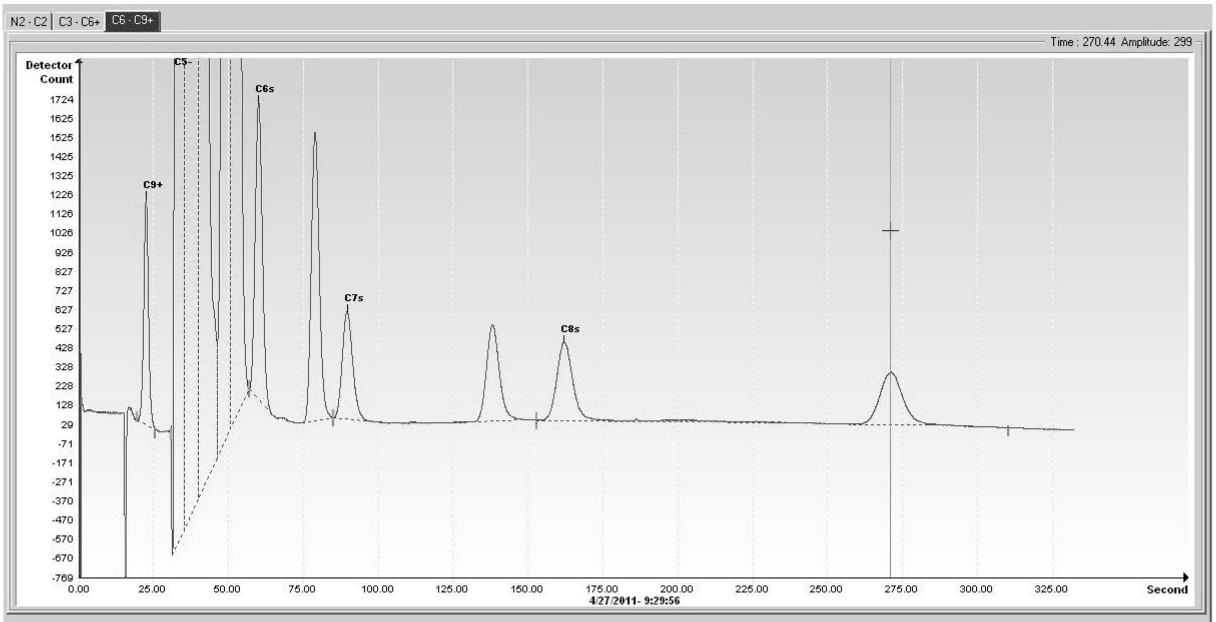


Figure 6-19 Example of a C9+ Chromatogram

It is necessary that the user be able to identify the "Normals" (NC8, NC7, etc.). A special blend may be required that has recognizable characteristics with regard to the components of interest. From this special blend, the user can identify the various components in the chromatogram and adjust the column carrier pressure to elute the key component at the appropriate time.

Auto Peak Gating of NC7 and its Isomers					
Chrom Processing	**Gate On**	**Gate Off**	**Slope Run**	**Slope Rise**	**Front Height**
Yes	85.0	146.0	15	3	.75

6.2.7 Calibration Procedure

The PGC1000 has been set up at the factory for optimum performance. The user should not have to do a peak find on the equipment. However, if for some reason a peak find is required (normal column aging, minor contamination, barometric pressure differences, etc.), the user will need to re-calibrate their equipment.

The example has exclusively concentrated on the Heavies column of a C6+ application. The user's Column Train documentation will recommend a calibration blend for the application. For the example, the following information will continue with the C6+ application.

To properly calibrate the PGC1000 for the C6+ application, ABB Totalflow recommends the following calibration blend. This blend can be ordered from ABB Totalflow or custom blended per the requirements of the user's vendor.

ABB Totalflow Recommended Calibration Blend for C6+ Application	
Component	**Standard Concentration (Mole%)**
Propane (C3)	1.0000
Iso-butane (iC4)	0.3000
Normal butane (nC4)	0.3000
Neo-pentane (neo-C5)	0.1000

Iso-pentane (iC5)	0.1000
Normal pentane	0.1000
Hexane and heavier (C6+)	0.0500
Nitrogen (N2)	2.4000
Methane (C1)	89.6200
Carbon Dioxide (CO2)	1.0000
Ethane (C2)	5.0000
Total	100.0000

When entering the calibration blend into the Calibration Setup, the user's Total Mole%"should come to 100 mole%. If they are a little high (or a little low), make the necessary adjustment to the most prevalent component. In the C6+ application, this would be methane.

FYI

Calibrating to a blend that is close in composition to the process stream will increase the linearity and accuracy of the measurements. Many users will have their process stream sampled, averaged and analyzed. Upon completion, a calibration gas will be blended to those specifications. If the composition of the process stream is sufficiently stable over time, it can be a good idea to collect the process stream, have it analyzed and labeled in a reputable lab. Once this has been accomplished, use that same analyzed process gas as the calibration blend.

Prior to actually clicking the Cal button and running a calibration cycle, the user will need to perform a calibration setup (see Figure 6-20). For most applications, the default values will get the user started; however, the user MUST enter the calibration blend that they are using for their application. An actual calibration blend for the C6+ application has been entered in the following screen.

The user can see how close the actual calibration blend is to the recommended blend in the table above.

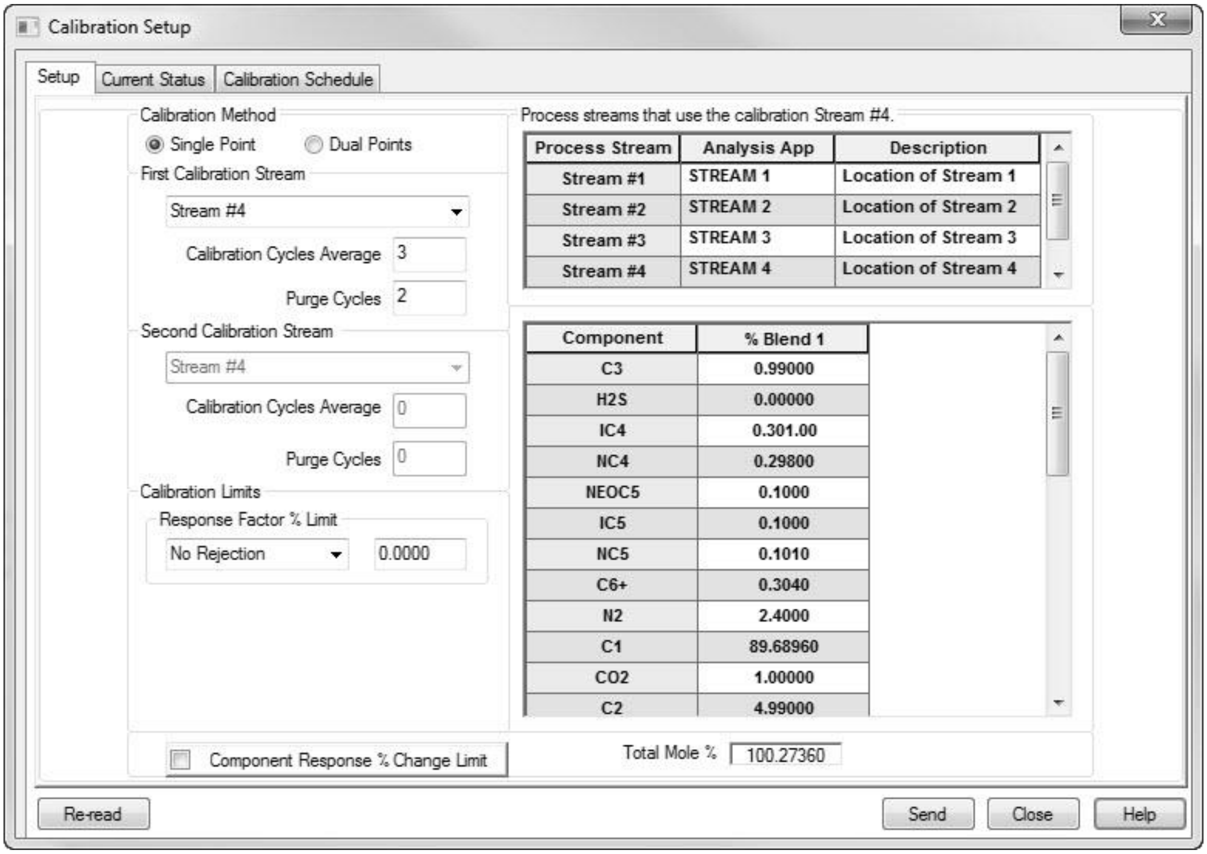


Figure 6-20 Typical Calibration Setup for a C6+ Application

6.2.8 Last Words

- After running a calibration cycle, the user should be ready to proceed. As the user moves through the various screens, do not forget to click the Help button whenever there is uncertainty about the purpose of any parameter or button.
- If the user has problems that have not been covered in the preceding documentation, they have the option of running Diagnostics. Running diagnostics can be helpful in identifying a faulty module. Manual Operation (a Diagnostic tab) can be helpful in troubleshooting the unit. In Manual Operation, the user can set pressures and temperatures and see if they respond to a new setting. Additionally, if the user is uncertain as to what a particular button or parameter might be used for, click the Help button.
- Finally, if the problem or question persists, call ABB Totalflow. ABB Totalflow has a customer service group with the expertise to answer questions. Call toll free at 1-800-HELP-365 or via the web at www.abb.com/analytical.

6.2.9 PGC1000 Available Accessories

120/240 Vac to 12 Vdc power supplies
Pole or pipeline mounting kits
Environmental enclosure (also available in pipe-mount configuration)
Cold weather thermal (future)

Modular sample system conditioner options for: • Non-pipeline, quality natural gas sample • Sample transport lag-time needs
Probes • Temperature compensating-fixed • Temperature compensating-retractable • Liquid rejection • Electrically heated, retractable
Regulators (carrier and calibration blend)
Start-up calibration/validation gas sample (±2% blend)
Carrier gas: 99.995% pure helium (chromatographic grade)
SD memory card
Export crating
Tool kit
Welker liquid shut-offs
Various maintenance kits
Customer Factory Acceptance Test (FAT)

7.0 APPLICATION COLUMN TRAIN DEFINITIONS

The following information will detail the definitions for the various column trains that the user will encounter with the PGC1000. Column refers to a tube with material either packed inside of it (packed column) or attached to the inside diameter of the tube (capillary column). The material within the column is designed to separate the different components that comprise natural gas. This enables the gas to be measured.

The train refers to the process in which certain gases are separated and measured. Each train generally has two (2) columns.

7.1 BBC (C3+, Air to Acetylene)

Table 7–1 BBC Column Train Data Sheet (C3+, Air to Acetylene)

Carrier Helium **Train** BBC

Part No. 2102992-001 Train BBC. C3+. H2. N2. C1. CO2. C2=. C2. C2*.

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	330	Seconds	**Carrier Pressure**		20 PSIG
Sort Order	1		**Carrier Pressure Variance**	±	15 %
Sample Size	40	ul	**Flow Rate**		6.4 ML/Min
Target Component	C2*		**Flow Rate Variance**	±	15 %
Target Ret. Time	290	Seconds	**Oven Temperature**		60 Deg. C

Notes Water is in the C3+ peak. Air analyzed, or Hydrogen (H2) if air not present.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Propane Plus	0.05	100	1	0.001	16.5	21.8	31.6	5	3	3000	0.75	Auto	Positive	0	0
2	Hydrogen	0.5	10	1	0.05	33	35.2	37.6	5	3	250	0.75	Auto	Positive	0	0
3	Nitrogen	0.05	100	1	0.01	37.6	40.3	48.9	5	3	3000	0.75	Auto	Positive	0	0
4	Methane	0.05	100	1	0.01	49.6	51.1	55	5	3	3000	0.75	Auto	Positive	0	0
5	Carbon Dioxide	0.1	100	1	0.02	121.4	131.5	143.5	10	1	3000	0.75	Auto	Positive	0	0
6	Ethylene	0.1	100	1	0.02	166.6	178.5	192.2	10	1	3000	0.75	Auto	Positive	0	0
7	Ethane	0.1	100	1	0.02	207.5	221.6	238.9	10	1	3000	0.75	Auto	Positive	0	0
8	Acetylene	0.2	100	2	0.03	272	290.2	309	10	1	3000	0.75	Auto	Positive	0	0

Carrier Hydrogen **Train** BBC

Part No. 2102992-001 Train BBC. C3+. H2. N2. C1. CO2. C2=. C2. C2*.

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	300	Seconds	**Carrier Pressure**		11 PSIG
Sort Order	1		**Carrier Pressure Variance**	±	15 %
Sample Size	40	ul	**Flow Rate**		6.6 ML/Min
Target Component	C2*		**Flow Rate Variance**	±	15 %
Target Ret. Time	230	Seconds	**Oven Temperature**		60 Deg. C

Notes Water is in the C3+ peak. Air analyzed,or Helium (He) if air not present.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Propane Plus	0.05	100	1	0.001	16.5	22.3	29.5	5	3	3000	0.75	Auto	Positive	0	0
2	Helium	0.5	10	1	0.05	29.5	31	33	5	3	250	0.75	Auto	Positive	0	0
3	Nitrogen	0.05	100	1	0.01	32.7	35.6	41.4	5	3	3000	0.75	Auto	Positive	0	0
4	Methane	0.05	100	1	0.01	41.4	44.3	60	5	3	3000	0.75	Auto	Positive	0	0
5	Carbon Dioxide	0.1	100	1	0.02	98.4	107	117.5	10	1	3000	0.75	Auto	Positive	0	0
6	Ethylene	0.1	100	1	0.02	133.2	143.7	156	10	1	3000	0.75	Auto	Positive	0	0
7	Ethane	0.1	100	1	0.02	164.6	176.9	191.5	10	1	3000	0.75	Auto	Positive	0	0
8	Acetylene	0.2	100	2	0.03	214.2	230.1	248.8	10	1	3000	0.75	Auto	Positive	0	0

Table 7–2 BBC Blend

Component	Blend (mole%)
C3+ (Propane plus)	5.08
C1 (Methane)	35.12
C2 (Ethane)	59.79
N2 (Nitrogen)	0.01
Note: These components have not been normalized.	

Table 7–3 BBC Column - Data for Manual Peak Find

Helium Carrier		**Target Comp.**		**Target Time**	**Inject Time**		**Col. Press.**		**Cyc. Time**
		Acetylene (C2*)		290 seconds	15 seconds		20 psig		330 seconds
		C3+ Propane Plus+	**H2 Hydrogen**	**Air**	**C1 Methane**	**CO2 Carbon Dioxide**	**C2= Ethylene**	**C2 Ethane**	**C2* Acetylene**
	Gate On	16.5	33.0	37.6	49.6	121.4	166.6	207.5	272.0
	Peak Time	21.8	35.2	40.3	51.1	131.5	178.5	221.6	290.2
	Gate Off	31.6	37.6	48.9	55.0	143.5	192.2	238.9	309.0
	Rise/Run	3/5	3/5	3/5	3/5	1/10	1/10	1/10	1/10
Hydrogen Carrier		**Target Component**		**Target Time**	**Inject Time**		**Col. Press.**		**Cyc. Time**
		Acetylene (C2*)		230 secs	15 secs		11 psig		300 secs
		C3+ Propane Plus+	**He Helium**	**Air**	**C1 Methane**	**CO2 Carbon Dioxide**	**C2= Ethylene**	**C2 Ethane**	**C2* Acetylene**
	Gate On	16.5	29.5	32.7	41.4	98.4	133.2	164.6	214.2
	Peak Time	22.3	31.0	35.6	44.3	107.0	143.7	176.9	230.1
	Gate Off	29.5	33.0	41.4	60.0	117.5	156.0	191.5	248.8
	Rise/Run	3/5	3/5	3/5	3/5	1/10	1/10	1/10	1/10

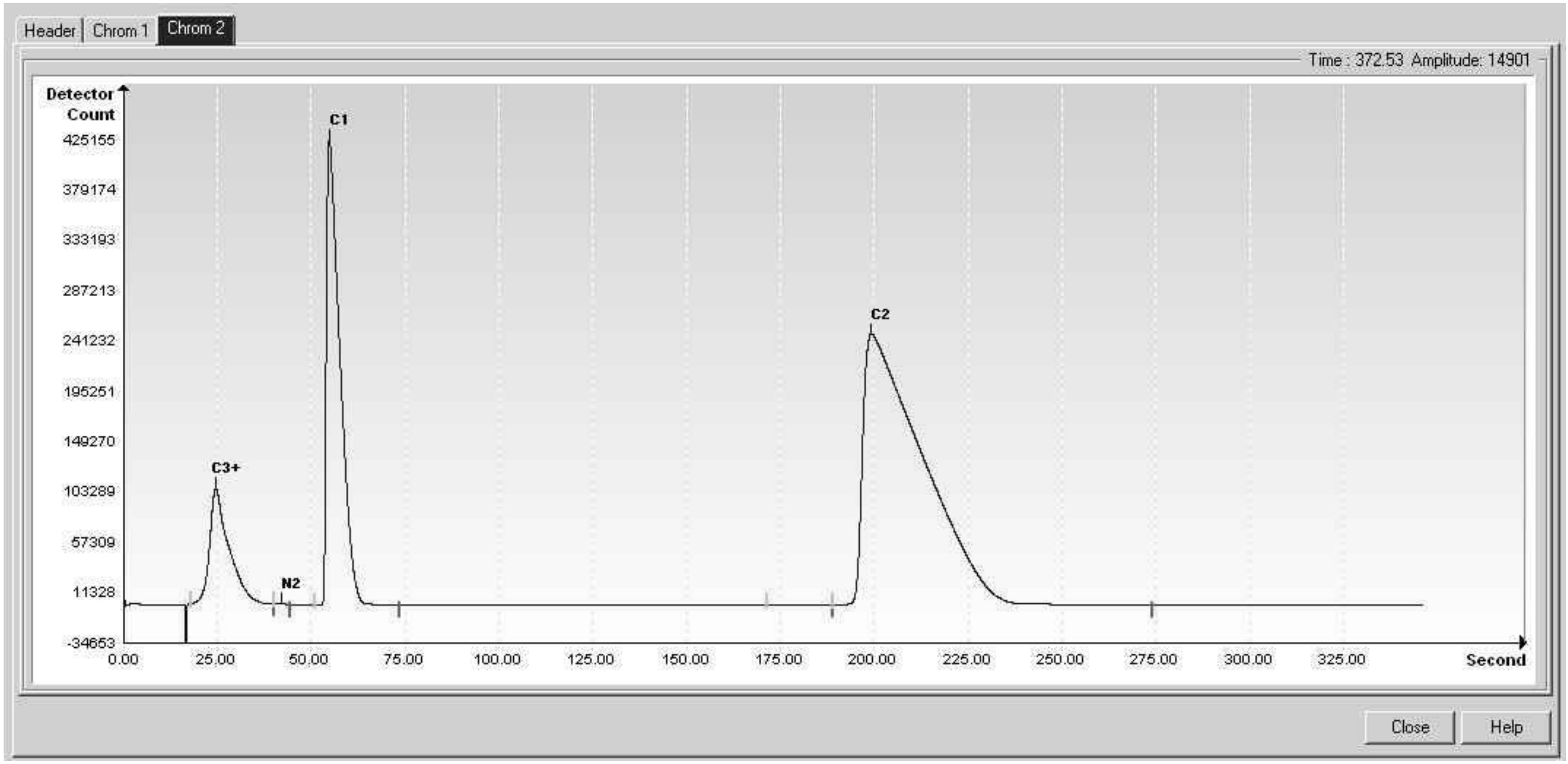


Figure 7-1 BBC Helium Reference Chromatogram

7.2 BBD (C3+, Air or Acetylene w/H2S & H2O)

Table 7–4 BBD Column Train Data Sheet (C3+, Air or Acetylene w/H2S & H2O)

Carrier Helium **Train** BBD

Part No. 2102992-002 Train BBD. C3+. Air or H2. C1. CO2. C2=. C2. C2*. H2S & H2O.

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	360	Seconds	**Carrier Pressure**		16 PSIG
Sort Order	2		**Carrier Pressure Variance**	±	15 %
Sample Size	40	ul	**Flow Rate**		3 ML/Min
Target Component	C2		**Flow Rate Variance**	±	15 %
Target Ret. Time	220	Seconds	**Oven Temperature**		60 Deg. C
Notes	NOT DEFINED.				

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Propane Plus	0	0	1	0.001	16.5	21.8	31.6	5	3	3000	0.75	Auto	Positive	0	0
2	Hydrogen	0	0	1	0.05	33	35.2	37.6	5	3	250	0.75	Auto	Positive	0	0
3	Nitrogen	0	0	1	0.01	37.6	40.3	48.9	5	3	3000	0.75	Auto	Positive	0	0
4	Methane	0	0	1	0.01	49.6	51.1	55	5	3	3000	0.75	Auto	Positive	0	0
5	Carbon Dioxide	0	0	1	0.02	121.4	131.5	143.5	10	1	3000	0.75	Auto	Positive	0	0
6	Ethylene	0	0	1	0.02	166.6	178.5	192.2	10	1	3000	0.75	Auto	Positive	0	0
7	Carbon Dioxide	0	0	1	0.01						3000	0.75	Auto	Positive	0	0
8	Methane	0	0	1	0.01						3000	0.75	Auto	Positive	0	0
9	Hydrogen	0	0	1	0.5						3000	0.75	Auto	Positive	0	0

Carrier Hydrogen **Train** BBD

Part No. 2102992-002 Train BBD. C3+. Air or H2. C1. CO2. C2=. C2. C2*. H2S & H2O.

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	330	Seconds	**Carrier Pressure**		15 PSIG
Sort Order	2		**Carrier Pressure Variance**	±	15 %
Sample Size	40	ul	**Flow Rate**		8 ML/Min
Target Component	C2		**Flow Rate Variance**	±	15 %
Target Ret. Time		Seconds	**Oven Temperature**		60 Deg. C
Notes	NOT DEFINED.				

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Propane Plus	0	0	1	0.01						3000	0.75	Auto	Positive	0	0
2	Hydrogen Sulfide	0	0	1	0.05						3000	0.75	Auto	Positive	0	0
3	Acetylene	0	0	1	0.01						3000	0.75	Auto	Positive	0	0
4	Ethylene	0	0	1	0.01						3000	0.75	Auto	Positive	0	0
5	Nitrogen	0	0	1	0.01						3000	0.75	Auto	Positive	0	0
6	Ethane	0	0	1	0.01						3000	0.75	Auto	Positive	0	0
7	Carbon Dioxide	0	0	1	0.01						3000	0.75	Auto	Positive	0	0
8	Methane	0	0	1	0.01						3000	0.75	Auto	Positive	0	0

Table 7–5 BBD Column - Data for Manual Peak Find

Carrier								
Helium Carrier		**Target Comp.**		**Target Time**	**Inject Time**	**Col. Press.**		**Cyc. Time**
		Ethane (C2)		220 secs	15 secs	16.0 psig		360 secs
		C3+ Propane Plus+	**H2 Hydrogen**	**Air**	**C1 Methane**	**CO2 Carbon Dioxide**	**C2= Ethylene**	**C2 Ethane**
	Gate On	16.5	33.0	37.6	49.6	121.4	166.6	207.5
	Peak Time	21.8	35.2	40.3	51.1	131.5	178.5	221.6
	Gate Off	31.6	37.6	48.9	55.0	143.5	192.2	238.9
	Rise/Run	3/5	3/5	3/5	3/5	1/10	1/10	1/10
Hydrogen Carrier		**Target Component**		**Target Time**	**Inject Time**	**Col. Press.**		**Cyc. Time**
		Ethane (C2)		230 secs	15 secs	15.0 psig		330 secs
		C3+ Propane Plus+	**He Helium**	**Air**	**C1 Methane**	**CO2 Carbon Dioxide**	**C2= Ethylene**	**C2 Ethane**
	Gate On	16.5	29.5	32.7	41.4	98.4	133.2	164.6
	Peak Time	22.3	31	35.6	44.3	107.0	143.7	176.9
	Gate Off	29.5	33	41.4	60.0	117.5	156.0	191.5
	Rise/Run	3/5	3/5	3/5	3/5	1/10	1/10	1/10

7.3 BBF (C3+ to Air C2)

Table 7–6 BBF Column Train Data Sheet (C3+ to Air C2)

Carrier Helium **Train** BBF

Part No.2102993-001 Train BBF. C3+. N2. C1. CO2. C2=. C2.

			Inject Time	15 Seconds
			Inject Time Variance ±	10 %
Cycle Time	315	Seconds	**Carrier Pressure**	17 PSIG
Sort Order	81		**Carrier Pressure Variance** ±	15 %
Sample Size	40	ul	**Flow Rate**	4.2 ML/Min
Target Component	C2		**Flow Rate Variance** ±	15 %
Target Ret. Time	220	Seconds	**Oven Temperature**	60 Deg. C

Notes When used in conjunction with BBK, the combination is capable of providing the following calculated performance, +/- 0.125 BTU repeatability with a C6+ analysis at room temperature. For temperatures from -18 to 55 degrees Celsius the +/- BTU performance value doubles.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Propane Plus	0.01	100	1	0.005	18	26	36	5	3	3000	0.75	Grouped	Positive	0	0
2	Nitrogen	0.01	100	1	0.005	43	48	75	5	3	3000	0.75	Auto	Positive	0	0
3	Methane	0.01	100	1	0.005	49.2	51.8	74.6	5	3	3000	0.75	Auto	Positive	0	0
4	Carbon Dioxide	0.01	100	1	0.005	75	90	110	5	3	3000	0.75	Auto	Positive	0	0
5	Ethylene	0.01	100	1	0.005	178	184	190.4	15	3	3000	0.75	Auto	Positive	0	0
6	Ethane	0.01	50	1	0.005	195	220	270	15	3	3000	0.75	Auto	Positive	0	0

Carrier Hydrogen **Train** BBF

Part No.2102993-001 Train BBF. C3+. N2. C1. CO2. C2=. C2.

			Inject Time		15	Seconds
			Inject Time Variance	±	10	%
Cycle Time	315	Seconds	Carrier Pressure		6.8	PSIG
Sort Order	81		Carrier Pressure Variance	±	15	%
Sample Size	40	ul	Flow Rate		3.1	ML/Min
Target Component	C2		Flow Rate Variance	±	15	%
Target Ret. Time	220	Seconds	Oven Temperature		60	Deg. C

Notes When used in conjunction with BBK, the combination is capable of providing the following calculated performance, +/- 0.125 BTU repeatability with a C6+ analysis at room temperature. For temperatures from -18 to 55 degrees Celsius the +/- BTU performance value doubles.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Propane Plus	0.01	100	1	0.005	19	28.3	33	5	3	3000	0.75	Auto	Positive	0	0
2	Air	0.01	100	1	0.005	33	47.2	76	5	3	3000	0.75	Auto	Positive	0	0
3	Methane	0.01	100	1	0.005	33	57.2	76	5	3	3000	0.75	Auto	Positive	0	0
4	Carbon Dioxide	0.01	100	1	0.005	76	97.6	300	5	3	3000	0.75	Auto	Positive	0	0
5	Ethylene	0.01	100	1	0.005	76	190	300	15	3	3000	0.75	Auto	Positive	0	0
6	Ethane	0.01	50	1	0.005	76	220.3	300	15	3	3000	0.75	Auto	Positive	0	0

Table 7–7 BBF Blend

Component	Blend (mole%)
N2 (Nitrogen)	2.64
C1 (Methane)	89.45
CO2 (Carbon Dioxide)	0.987
C2 (Ethane)	4.98
Note: These components have not been normalized.	

Table 7–8 BBF Column - Data for Manual Peak Find

Helium Carrier		**Target Comp.**		**Target Time**	**Inject Time**	**Col. Press.**	**Cyc.Time**
		Ethane (C2)		220 seconds	15 seconds	17 psig	315 seconds
		C3+ Propane +	**Air**	**C1 Methane**	**CO2 Carbon Dioxide**	**C2= Ethylene**	**C2 Ethane**
	Gate On	18.0	43.0	49.2	75.0	178.0	195.0
	Peak Time	26.0	48.0	51.8	90.0	184.0	220.0
	Gate Off	36.0	75.0	74.6	110.0	190.4	270.0
	Rise/Run	3/5	3/5	3/5	3/5	3/15	3/15
Hydrogen Carrier		**Target Comp.**		**Target Time**	**Inject Time**	**Col. Press.**	**Cyc.Time**
		Ethane (C2)		220 seconds	15 seconds	6.8 psig	315 seconds
		C3+ Propane +	**Air**	**C1 Methane**	**CO2 Carbon Dioxide**	**C2= Ethylene**	**C2 Ethane**
	Gate On	19.0	33.0	33.0	76.0	76.0	76.0
	Peak Time	28.3	47.2	57.2	97.6	190.0	220.3
	Gate Off	33.0	76.0	76.0	300.0	300.0	300.0
	Rise/Run	3/5	3/5	3/5	3/5	3/15	3/15

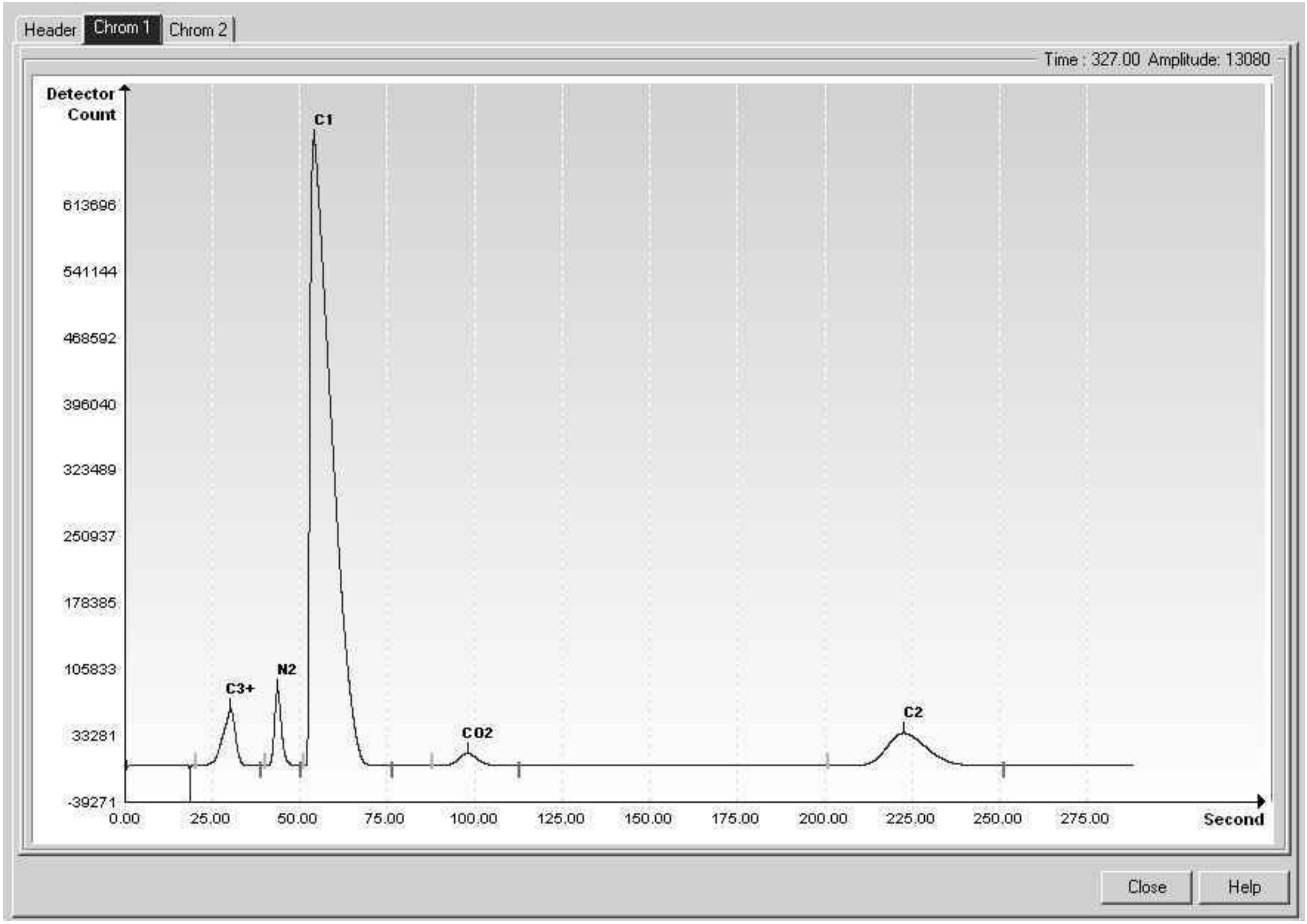


Figure 7-2 BBF Helium Reference Chromatogram

7.4 BBG (C3+ to Air, C2, 360sec, H20 and H2S)

Table 7–9 BBG Column Train Data Sheet (C3+ to Air, C2, 360sec, H2O and H2S)

Carrier Helium **Train** BBG

Part No.2102993-002 Train BBG. C3+. N2. C1. CO2. C2=. C2. H2S. H2O.

		Inject Time		15 Seconds
		Inject Time Variance	±	10 %
Cycle Time	360 Seconds	**Carrier Pressure**		15 PSIG
Sort Order	82	**Carrier Pressure Variance**	±	15 %
Sample Size	40 ul	**Flow Rate**		8 ML/Min
Target Component	C2	**Flow Rate Variance**	±	15 %
Target Ret. Time	220 Seconds	**Oven Temperature**		60 Deg. C

Notes Hydrogen Sulfide (H2S) and Water (H2O) co-elute.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Propane Plus	0.1	100	1	0.01	17.8	29	38.8	30	3	3000	0.75	Auto	Positive	0	0
2	Nitrogen	0.1	100	1	0.01	38.8	41.7	47.8	5	3	3000	0.75	Auto	Positive	0	0
3	Methane	0.1	100	1	0.01	49.2	51.8	74.6	100	3	3000	0.75	Auto	Positive	0	0
4	Carbon Dioxide	0.2	100	1	0.01	83.6	91.4	103.8	100	3	3000	0.75	Auto	Positive	0	0
5	Ethylene	0.2	100	1	0.01	178	184	190.4	100	3	3000	0.75	Auto	Positive	0	0
6	Ethane	0.2	100	1	0.01	201.4	218.7	241.4	100	3	3000	0.75	Auto	Positive	0	0
7	Hydrogen Sulfide	0.01	1	2	0.05	250	320	340	15	3	3000	0.75	Auto	Positive	0	0
8	Water	0.4	5	2	0.1	250	320	340	15	3	3000	0.75	Auto	Positive	0	0

Need BBG Blend!

Table 7–10 BBG Column - Data for Manual Peak Find

Carrier								
Helium Carrier		**Target Comp.**		**Target Time**	**Inject Time**	**Col. Press.**		**Cyc. Time**
		Ethane (C2)		220 seconds	15 seconds	15 psig		360 seconds
		C3+ Propane Plus+	**Air**	**C1 Methane**	**CO2 Carbon Dioxide**	**C2= Ethylene**	**C2 Ethane**	**H2S/H2O**
	Gate On	17.8	38.8	49.2	83.6	178.0	201.4	250.0
	Peak Time	29.0	41.7	51.8	91.4	184.0	218.7	320.0
	Gate Off	38.8	47.8	74.6	103.8	190.4	241.4	340.0
	Rise/Run	3/30	3/5	3/100	3/100	3/100	3/100	3/15
Hydrogen Carrier		**Target Component**		**Target Time**	**Inject Time**	**Col. Press.**		**Cyc. Time**
		Ethane (C2)		220 seconds	15 seconds	6.8 psig		360 seconds
		C3+ Propane Plus+	**Air**	**C1 Methane**	**CO2 Carbon Dioxide**	**C2= Ethylene**	**C2 Ethane**	**H2S/H2O**
	Gate On	21.0	32.0	48.0	95.0	95.0	95.0	95.0
	Peak Time	28.3	47.2	57.2	97.6	180.0	220.0	315.0
	Gate Off	32.0	48.0	95.0	340.0	340.0	340.0	340.0
	Rise/Run	3/5	3/5	3/5	3/5	3/15	3/15	3/15

Need picture of chrom!

7.5 BBH (C1+ to H2 or He to CO)

Table 7–11 BBH Column Train Data Sheet (C1+ to H2 or He to CO)

Carrier Helium **Train** BBH

Part No. 2102994-001 Train BBH. C1+. H2 or He. O2. N2. CO

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	330	Seconds	**Carrier Pressure**		48 PSIG
Sort Order	290		**Carrier Pressure Variance**	±	15 %
Sample Size	20	ul	**Flow Rate**		7.5 ML/Min
Target Component	CO		**Flow Rate Variance**	±	15 %
Target Ret. Time	265	Seconds	**Oven Temperature**		60 Deg. C

Notes This train can tolerate CO2, H2O, as well as hydrocarbons heavier than C1.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Methane Plus	0.4	100	2	0.1	16	38	55	15	3	3000	0.75	Auto	Positive	0	0
2	Hydrogen	0.5	20	1	0.2	74	79.2	87	15	3	3000	0.75	Auto	Positive	0	0
3	Oxygen	0.2	20	1	0.01	190	201.9	236	15	3	3000	0.75	Auto	Positive	0	0
4	Nitrogen	0.1	100	1	0.01	190	213.2	236	15	3	3000	0.75	Auto	Positive	0	0
5	Carbon Monoxide	0.2	100	2	0.02	265	277	290	15	3	3000	0.75	Auto	Positive	0	0

Carrier Hydrogen **Train** BBH

Part No. 2102994-001 Train BBH. C1+. H2 or He. O2. N2. CO

			Inject Time		15 Seconds	
			Inject Time Variance	±	10 %	
Cycle Time	240	Seconds	**Carrier Pressure**		29 PSIG	
Sort Order	290		**Carrier Pressure Variance**	±	15 %	
Sample Size	20	ul	**Flow Rate**		7.8 ML/Min	
Target Component	CO		**Flow Rate Variance**	±	15 %	
Target Ret. Time	193	Seconds	**Oven Temperature**		60 Deg. C	

Notes This train can tolerate CO2, H2O, as well as hydrocarbons heavier than C1.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
													Auto	Positive	0	0
1	Methane Plus	0.4	100	2	0.1	0	38	0	15	3	3000	0.75	Auto	Positive	0	0
2	Helium	0.5	20	1	0.2	22	44	220	15	3	3000	0.75	Auto	Positive	0	0
3	Oxygen	0.1	20	1	0.01	22	141	220	15	3	3000	0.75	Auto	Positive	0	0
4	Nitrogen	0.1	100	1	0.01	22	148	220	15	3	3000	0.75	Auto	Positive	0	0
5	Carbon Monoxide	0.1	100	2	0.02	22	193	220	15	3	3000	0.75	Auto	Positive	0	0

Table 7–12 BBH Blend

Component	Blend (mole%)
H2 (Hydrogen)	4.877
O2 (Oxygen)	1.098
N2 (Nitrogen)	5.023
CO (Carbon Monoxide)	0.237
Note: These components have not been normalized.	

Table 7–13 BBH Column - Data for Manual Peak Find

Carrier							
Helium Carrier		**Target Comp.**		**Target Time**	**Inject Time**	**Col. Press.**	**Cyc.Time**
		Carbon Monoxide (CO)		265 seconds	15 seconds	48 psig	330 seconds
		C1+ Methane +	**H2 Hydrogen**	**O2 Oxygen**	**N2 Nitrogen**	**CO Carbon Monoxide**	
	Gate On	16.0	74.0	190.0	190.0	265.0	
	Peak Time	38.0	79.2	201.9	213.2	277.0	
	Gate Off	55.0	87.0	236.0	236.0	290.0	
	Rise/Run	3/15	3/15	3/15	3/15	3/15	
Hydrogen Carrier		**Target Comp.**		**Target Time**	**Inject Time**	**Col. Press.**	**Cyc.Time**
		Carbon Monoxide (CO)		193 seconds	15 seconds	29 psig	240 seconds
		C1+ Methane +	**He Helium**	**O2 Oxygen**	**N2 Nitrogen**	**CO Carbon Monoxide**	
	Gate On	0.0	22.0	22.0	22.0	22.0	
	Peak Time	38.0	44.0	141.0	148.0	193.0	
	Gate Off	0.0	220.0	220.0	220.0	220.0	
	Rise/Run	3/15	3/15	3/15	3/15	3/15	

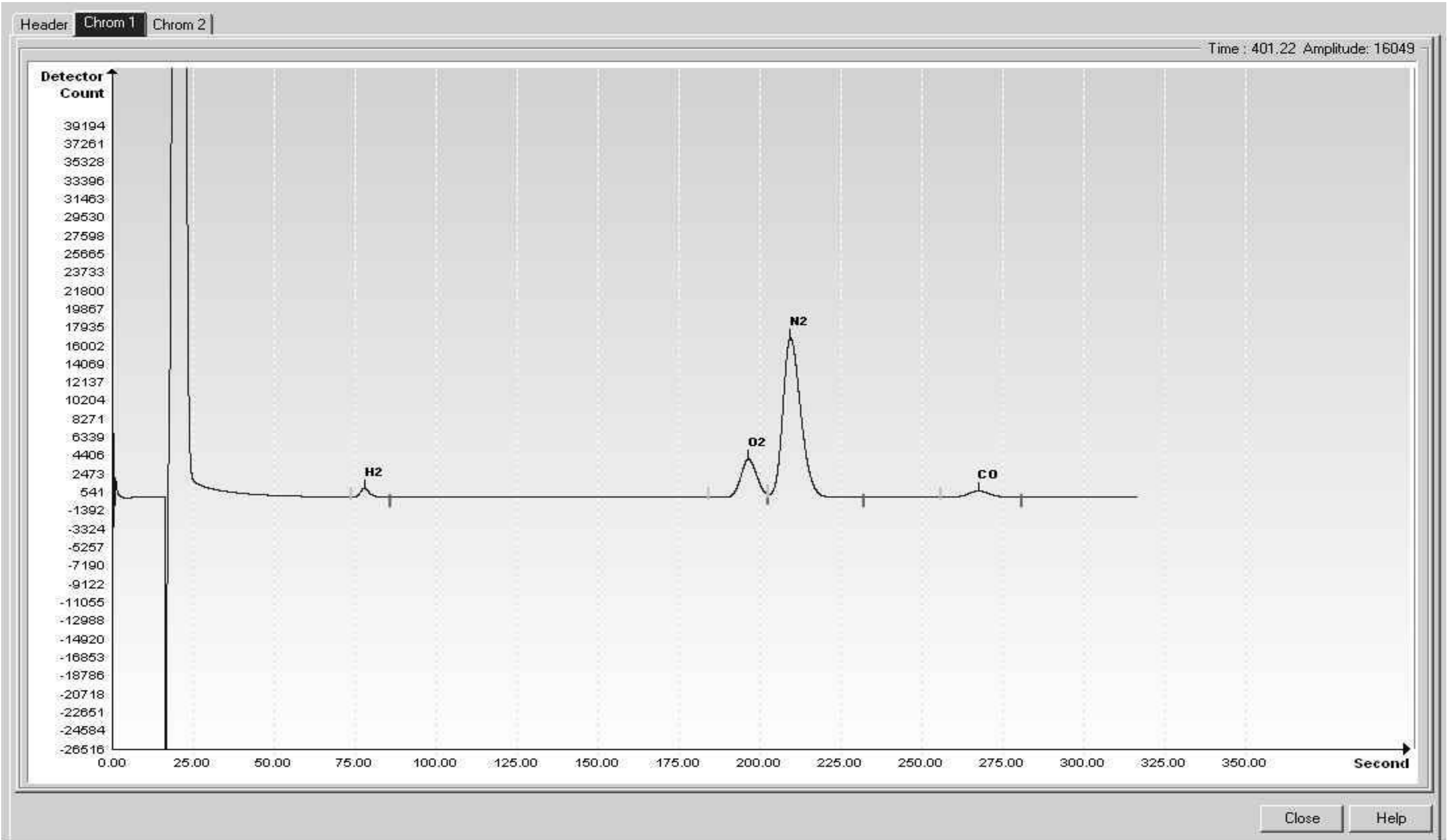


Figure 7-3 BBH Helium Reference Chromatogram

7.6 BBJ (C5+, C3 through C4 Olefins)

Table 7–14 BBJ Column Train Data Sheet (C5+, C3 through C4 Olefins)

Carrier Helium **Train** BBJ

Part No. 2102995-001 Train BBJ. C5+. C3. C3=. IC4. NC4. B-1 & IC4=. tB-2. cB-2. 1,3-

Rev	Action	Drawn	Checked	Approved	Date
AE	D22695	J.BUSHNELL	B.COOK	J.BUSHNELL	08/10/31
AD	D21786	A. KASTNER	A. KASTNER	J. BUSHNELL	08/06/11
AC	D21534	A. KASTNER	A. KASTNER	J. BUSHNELL	08/02/13

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	450	Seconds	**Carrier Pressure**		16 PSIG
Sort Order	61		**Carrier Pressure Variance**	±	15 %
Sample Size	40	ul	**Flow Rate**		2.6 ML/Min
Target Component	1,3-BD		**Flow Rate Variance**	±	15 %
Target Ret. Time	397	Seconds	**Oven Temperature**		60 Deg. C

Notes Propylene (C3=) and Acetylene (C2*) combined, Butene-1 (B-1) and Isobutylene (IC4=) combined.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Pentane Plus	0.02	50	2	0.002	15	22.6	32	1	1	3000	0.75	Auto	Positive	0	0
2	Propane	0.1	100	1	0.001	73	119	364	50	50	3000	0.75	Auto	Positive	0	0
3	Propylene	0.1	100	1	0.001	73	139	364	50	50	3000	0.75	Auto	Positive	0	0
4	Isobutane	0.1	100	1	0.001	73	169	364	50	50	3000	0.75	Auto	Positive	0	0
5	Normal Butane	0.1	100	1	0.001	73	215	364	50	50	3000	0.75	Auto	Positive	0	0
6	Butene-1 & Isobutylene	0.1	50	1	0.001	73	257	364	50	50	3000	0.75	Auto	Positive	0	0
7	Trans-Butene-2	0.1	50	1	0.001	73	303	364	50	50	3000	0.75	Auto	Positive	0	0
8	Cis-Butene-2	0.1	100	1	0.002	73	339	364	50	50	3000	0.75	Auto	Positive	0	0
9	1,3-Butadiene	0.2	100	2	0.001	364	385	418	1	1	3000	0.75	Auto	Positive	0	0

Carrier Hydrogen **Train** BBJ

Part No. 2102995-001 Train BBJ. C5+. C3. C3=. IC4. NC4. B-1 & IC4=. tB-2. cB-2. 1,3-

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	420	Seconds	**Carrier Pressure**		8 PSIG
Sort Order	61		**Carrier Pressure Variance**	±	15 %
Sample Size	40	ul	**Flow Rate**		2.5 ML/Min
Target Component	1,3-BD		**Flow Rate Variance**	±	15 %
Target Ret. Time	325	Seconds	**Oven Temperature**		60 Deg. C

Notes Propylene (C3=) and Acetylene (C2*) combined, Butene-1 (B-1) and Isobutylene (IC4=) combined.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Pentane Plus	0.02	100	2	0.002	18	24	40	10	10	3000	0.75	Auto	Positive	0	0
2	Propane	0.1	100	1	0.001	66	102	364	40	40	3000	0.75	Auto	Positive	0	0
3	Propylene	0.1	100	1	0.001	66	119	364	40	40	3000	0.75	Auto	Positive	0	0
4	Isobutane	0.1	100	1	0.001	66	145	364	40	40	3000	0.75	Auto	Positive	0	0
5	Normal Butane	0.1	100	1	0.001	66	183	364	40	40	3000	0.75	Auto	Positive	0	0
6	Butene-1 & Isobutylene	0.1	100	1	0.001	66	218	364	40	40	3000	0.75	Auto	Positive	0	0
7	Trans-Butene-2	0.1	100	1	0.001	66	257	364	40	40	3000	0.75	Auto	Positive	0	0
8	Cis-Butene-2	0.1	100	1	0.002	66	266	364	40	40	3000	0.75	Auto	Positive	0	0
9	1,3-Butadiene	0.2	100	2	0.002	309	325	355	40	40	3000	0.75	Auto	Positive	0	0

Table 7–15 BBJ Blend

Component	Blend (mole%)
C3 (Propane)	0.3236
C3= (Propylene)	2.29
IC4 (Iso Butane)	0.9959
NC4 (Normal Butane)	0.2592
B1 & IC4= (Butene-1 & Isobutylene)	2.91
tB-2 (transButene-2)	1.99
cB-2 (cisButene-2)	1.00
1,3-BD (1,3-Butadiene)	0.3665
Note: These components have not been normalized.	

Table 7–16 BBJ Column - Data for Manual Peak Find

		Target Comp.		**Target Time**	**Inject Time**		**Col. Press.**	**Cyc. Time**
		1,3-Butadiene (1,3-BD)		397 secs	15 secs		16 psig	450 secs
		C5+ Pentane +	**C3 Propane**	**C3= Propylene**	**IC4 IsoButane**	**NC4 Normal Butane**	**B1&IC4= Butene-1 & Isobutylene**	**tB-2 Trans-Butene-2**
Helium Carrier	**Gate On**	15.0	73.0	73.0	73.0	73.0	73.0	73.0
	Peak Time	22.6	119.0	139.0	169.0	215.0	257.0	303.0
	Gate Off	32.0	364.0	364.0	364.0	364.0	364.0	364.0
	Rise/Run	1/1	50/50	50/50	50/50	50/50	50/50	50/50
		cB-2 Cis-Butene 2	**1,3-Butadiene**					
	Gate On	73.0	364.0					
	Peak Time	339.0	385.0					
	Gate Off	364.0	418.0					
	Rise/Run	50/50	1/1					

BBJ Column - Data for Manual Peak Find, cont.

Target Component	Target Time	Inject Time	Col. Press.	Cyc. Time
1,3-Butadiene (1,3-BD)	325 secs	15 secs	8 psig	420 secs

Hydrogen Carrier		**C5+ Pentane**	**C3 Propane**	**C3= Propylene**	**IC4 IsoButane**	**NC4 Normal Butane**	**B1&IC4= Butene-1 & Isobutylene**	**tB-2 Trans-Butene-2**
	Gate On	18.0	66.0	66.0	66.0	66.0	66.0	66.0
	Peak Time	24.0	102.0	119.0	145.0	183.0	218.0	257.0
	Gate Off	40.0	364.0	364.0	364.0	364.0	364.0	364.0
	Rise/Run	10/10	40/40	40/40	40/40	40/40	40/40	40/40
		cB-2 Cis-Butene 2	**1,3-Butadiene**					
	Gate On	66.0	309.0					
	Peak Time	266.0	325.0					
	Gate Off	364.0	355.0					
	Rise/Run	40/40	40/40					

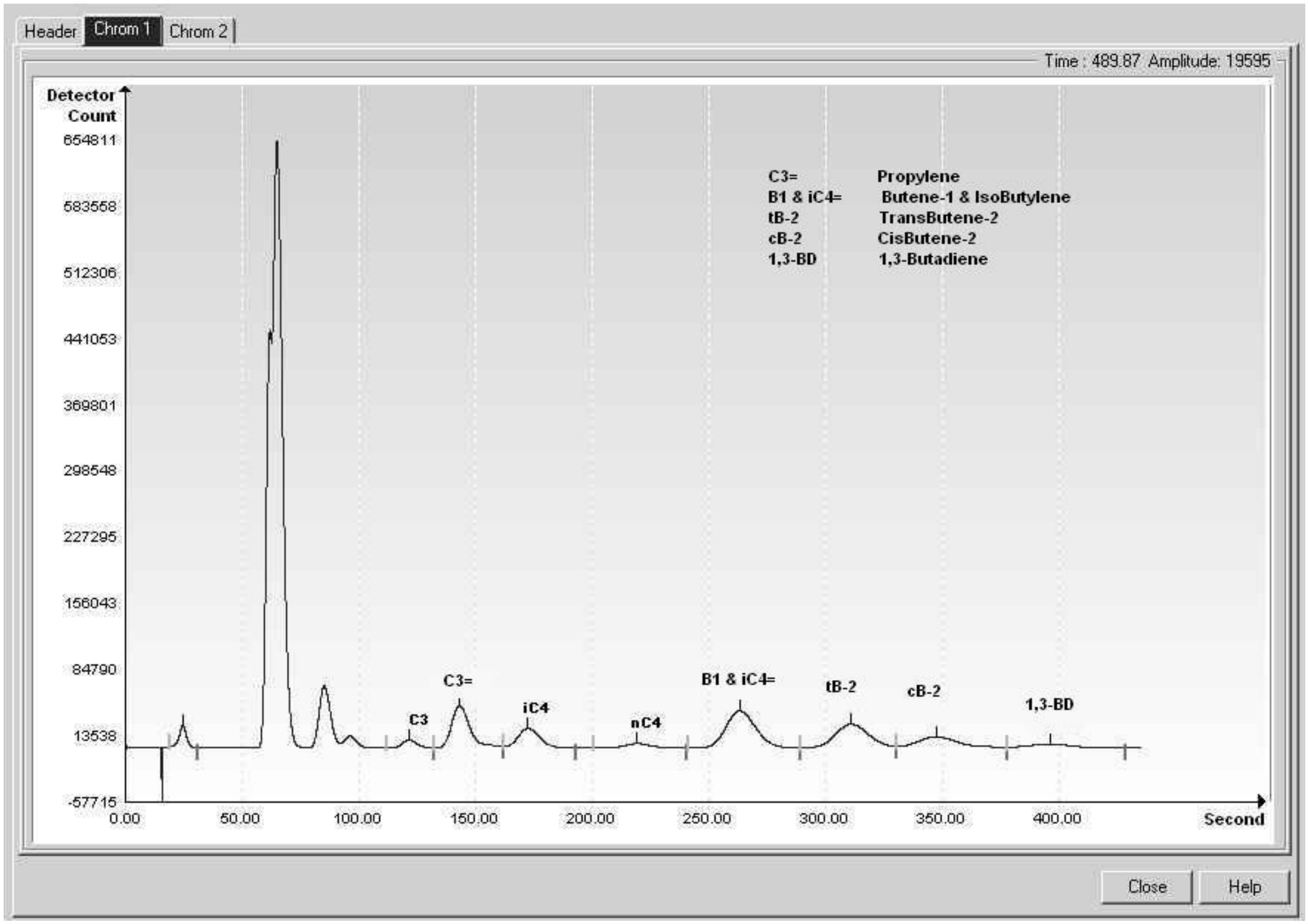


Figure 7-4 BBJ Helium Reference Chromatogram

7.7 BBK (C6+ to C3, 240 secs)

Table 7–17 BBK Column Train Data Sheet (C6+ to C3, 240 secs)

Carrier Helium **Train** BBK

Part No.2102996-001 Train BBK. C6+. C3. IC4. NC4. Neo-C5. IC5. NC5.

Inject Time		15 Seconds
Inject Time Variance	±	10 %
Carrier Pressure		26 PSIG
Carrier Pressure Variance	±	15 %
Flow Rate		8 ML/Min
Flow Rate Variance	±	15 %
Oven Temperature		60 Deg. C

Cycle Time	315	Seconds
Sort Order	21	
Sample Size	40	ul
Target Component	NC5	
Target Ret. Time	160	Seconds

Notes Hydrogen Sulfide (H2S) must be less than 0.05%. When used in conjunction with BBF the BTU repeatability is +/- 0.125 BTU at room temperature. For temperatures from -18 to 55 degrees Celsius the +/- BTU performance value doubles.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Hexane Plus	0.005	5	1	0.001	18	22	26.5	15	10	3000	0.75	Auto	Positive	0	0
2	Propane	0.005	100	1	0.001	40	42	56	15	3	3000	0.75	Auto	Positive	0	0
3	Isobutane	0.005	15	1	0.001	56	63	71	30	3	3000	0.75	Auto	Positive	0	0
4	Normal Butane	0.005	15	1	0.001	69	75	85	30	3	3000	0.75	Auto	Positive	0	0
5	Neopentane	0.005	10	1	0.001	85	95	115	60	3	3000	0.75	Auto	Positive	0	0
6	Isopentane	0.005	10	1	0.001	120	132	152	100	3	3000	0.75	Auto	Positive	0	0
7	Normal Pentane	0.005	10	1	0.001	145	160	185	100	3	3000	0.75	Auto	Positive	0	0

Carrier Hydrogen **Train** BBK

Part No.2102996-001 Train BBK. C6+. C3. IC4. NC4. Neo-C5. IC5. NC5.

			Inject Time		15	Seconds
			Inject Time Variance	±	10	%
Cycle Time	315	Seconds	**Carrier Pressure**		15	PSIG
Sort Order	21		**Carrier Pressure Variance**	±	15	%
Sample Size	40	ul	**Flow Rate**		3.6	ML/Min
Target Component	NC5		**Flow Rate Variance**	±	15	%
Target Ret. Time	160	Seconds	**Oven Temperature**		60	Deg. C

Notes Hydrogen Sulfide (H2S) must be less than 0.05%. When used in conjunction with BBF the BTU repeatability is +/- 0.125 BTU at room temperature. For temperatures from -18 to 55 degrees Celsius the +/- BTU performance value doubles.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Hexane Plus	0.005	5	1	0.001	20	25.6	33	10	10	3000	0.75	Auto	Positive	0	0
2	Propane	0.005	100	1	0.001	51	54.8	97	15	10	3000	0.75	Auto	Positive	0	0
3	Isobutane	0.005	15	1	0.001	51	76.3	97	30	30	3000	0.75	Auto	Positive	0	0
4	Normal Butane	0.005	15	1	0.001	51	84.8	97	30	30	3000	0.75	Auto	Positive	0	0
5	Neopentane	0.005	10	1	0.001	97	107.4	200	30	30	3000	0.75	Auto	Positive	0	0
6	Isopentane	0.005	10	1	0.001	97	140	200	30	30	3000	0.75	Auto	Positive	0	0
7	Normal Pentane	0.005	10	1	0.001	97	162	200	30	30	3000	0.75	Auto	Positive	0	0

Table 7–18 BBK Blend

Component	Blend (mole %)
C6+	0.028
C3 (Propane)	1.034
IC4 (Iso Butane)	0.309
NC4 (Normal Butane)	0.311
NeoC5 (Neo Pentane)	0.114
IC5 (Iso Pentane)	0.103
NC5 (Normal Pentane)	0.103
Note: These components have not been normalized.	

Table 7–19 BBK Column - Data for Manual Peak Find

Helium Carrier		**Target Comp.**	**Target Time**		**Inject Time**	**Col. Press.**		**Cyc. Time**
		Normal Pentane (NC5)	160 seconds		15 seconds	26 psig		315 seconds
		C6+ Hexane +	**C3 Propane**	**IC4 Isobutane**	**NC4 Normal Butane**	**neoC5 neoPentane**	**IC5 IsoPentane**	**NC5 Normal Pentane**
	Gate On	18.0	40.0	56.0	69.0	85.0	120.0	145.0
	Peak Time	22.0	42.0	63.0	75.0	95.0	132.0	160.0
	Gate Off	26.5	56.0	71.0	85.0	115.0	152.0	185.0
	Rise/Run	10/15	3/15	3/30	3/30	3/60	3/100	3/100
Hydrogen Carrier		**Target Component**	**Target Time**		**Inject Time**	**Col. Press.**		**Cyc. Time**
		Normal Pentane (NC5)	160 seconds		15 seconds	15 psig		315 seconds
		C6+ Hexane +	**C3 Propane**	**IC4 Isobutane**	**NC4 Normal Butane**	**neoC5 neoPentane**	**IC5 IsoPentane**	**NC5 Normal Pentane**
	Gate On	20.0	51.0	51.0	51.0	97.0	97.0	97.0
	Peak Time	25.6	54.8	76.3	84.8	107.4	140.0	162.0
	Gate Off	33.0	97.0	97.0	97.0	200.0	200.0	200.0
	Rise/Run	10/10	10/15	30/30	30/30	30/30	30/30	30/30

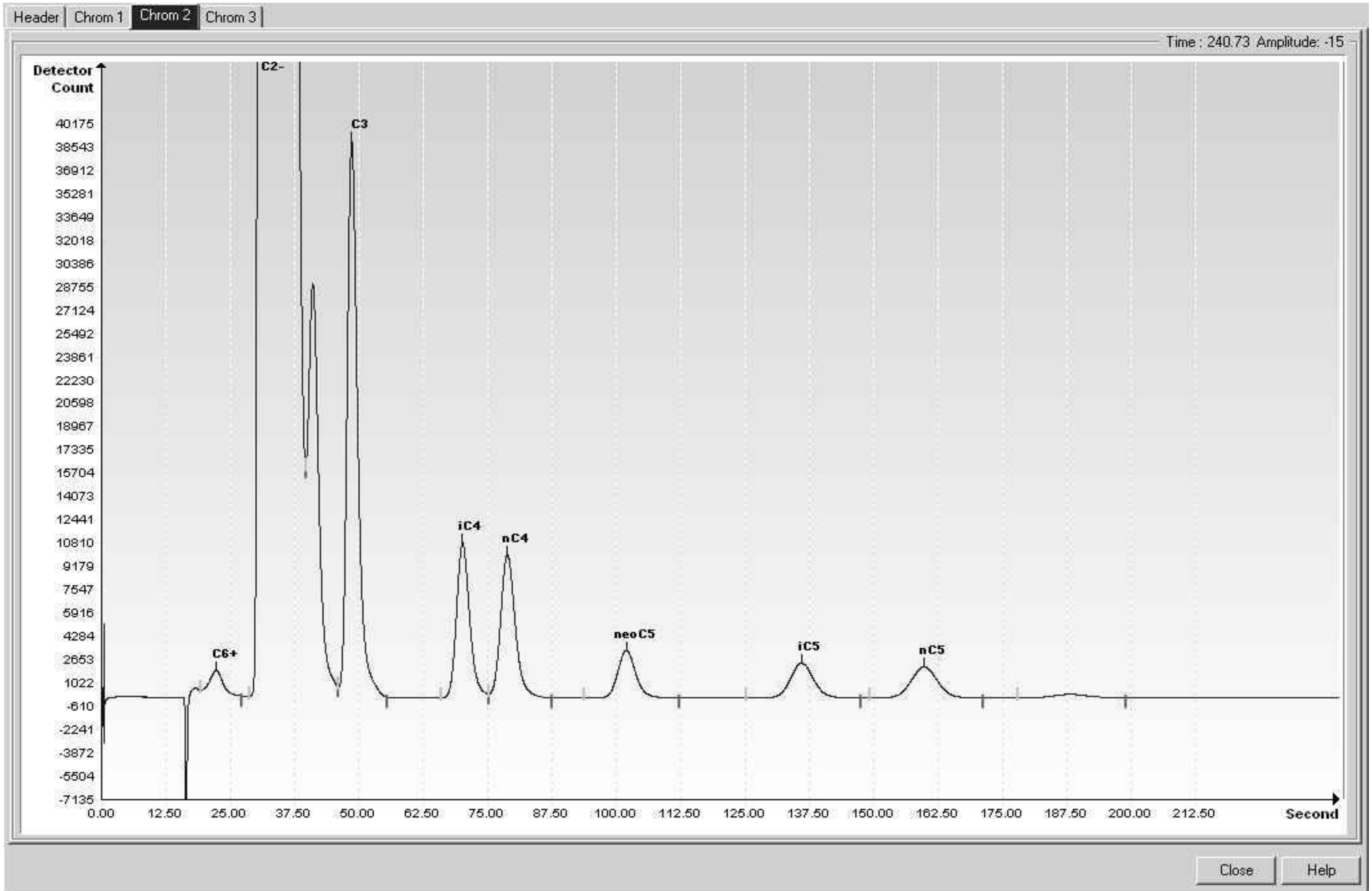


Figure 7-5 BBK Helium Reference Chromatogram

7.8 BBM (C3 to C6+ w/H2S)

Table 7–20 BBM Column Train Data Sheet (C3 to C6+ w/H2S)

Carrier Helium **Train** BBM

Part No. 2103008-001 Train BBM. C6+. C3. H2S. IC4. NC4. Neo-C5. IC5. NC5.

Rev	Action	Drawn	Checked	Approved	Date
AH	D23040	A. KASTNER	B. COOK	B.COOK	09/04/08
AG	D22686	J. BUSHNELL	J. BUSHNELL	B.COOK	08/10/31
AF	D22552	A. KASTNER	A. KASTNER	J. BUSHNELL	08/09/04

Cycle Time	300	Seconds	**Inject Time**		15 Seconds
Sort Order	321		**Inject Time Variance**	±	10 %
Sample Size	40	ul	**Carrier Pressure**		30 PSIG
Target Component	NC5		**Carrier Pressure Variance**	±	15 %
Target Ret. Time	200	Seconds	**Flow Rate**		5 ML/Min
Notes			**Flow Rate Variance**	±	15 %
			Oven Temperature		60 Deg. C

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Hexane Plus	0.005	5	1	0.001	16	22.5	32	15	10	3000	0.75	Auto	Positive	0	0
2	Propane	0.005	50	1	0.001	48	57	70	30	3	3000	0.75	Auto	Positive	0	0
3	Hydrogen Sulfide	0.02	0.12	3	0.005	70	82	93	30	3	3000	0.75	Auto	Positive	0	0
4	Isobutane	0.005	15	1	0.001	87	82	112	60	3	3000	0.75	Auto	Positive	0	0
5	Normal Butane	0.005	15	1	0.001	87	97	112	60	3	3000	0.75	Auto	Positive	0	0
6	Neopentane	0.005	10	1	0.001	102	118	300	60	3	3000	0.75	Auto	Positive	0	0
7	Isopentane	0.005	10	1	0.001	102	168	300	100	3	3000	0.75	Auto	Positive	0	0
8	Normal Pentane	0.005	10	1	0.001	102	200	300	100	3	3000	0.75	Auto	Positive	0	0

Carrier Hydrogen **Train** BBM

Part No. 2103008-001 Train BBM. C6+. C3. H2S. IC4. NC4. Neo-C5. IC5. NC5.

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	270	Seconds	**Carrier Pressure**		19 PSIG
Sort Order	321		**Carrier Pressure Variance**	±	15 %
Sample Size	40	ul	**Flow Rate**		1.8 ML/Min
Target Component	NC5		**Flow Rate Variance**	±	15 %
Target Ret. Time	220	Seconds	**Oven Temperature**		60 Deg. C
Notes					

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Hexane Plus	0.005	5	1	0.001	16	23.5	37	1	1	3000	0.75	Auto	Positive	0	0
2	Propane	0.005	50	1	0.001	63	69.8	77	5	3	3000	0.75	Auto	Positive	0	0
3	Hydrogen Sulfide	0.02	0.12	3	0.005	77	84	260	15	3	3000	0.75	Auto	Positive	0	0
4	Isobutane	0.005	15	1	0.001	77	96.5	260	15	3	3000	0.75	Auto	Positive	0	0
5	Normal Butane	0.005	15	1	0.001	77	111.4	260	15	3	3000	0.75	Auto	Positive	0	0
6	Neopentane	0.005	10	1	0.001	77	133.2	260	16	3	3000	0.75	Auto	Positive	0	0
7	Isopentane	0.005	10	1	0.001	77	183	260	15	3	3000	0.75	Auto	Positive	0	0
8	Normal Pentane	0.005	10	1	0.001	77	214.7	260	15	3	3000	0.75	Auto	Positive	0	0

Table 7–21 BBM Blend

Component	Blend (mole%)
C6+	0.0293
H2S (Hydrogen Sulfide)	0.0089
C3 (Propane)	0.997
IC4 (Iso Butane)	0.3011
NC4 (Normal Butane)	0.3079
NeoC5 (Neo Pentane)	0.1001
IC5 (Iso Pentane)	0.0996
NC5 (Normal Pentane)	0.0995
Note: These components have not been normalized.	

Table 7–22 BBM Column - Data for Manual Peak Find

Helium Carrier		**Target Comp.**	**Target Time**		**Inject Time**	**Col. Press.**		**Cyc. Time**
		Pentane (NC5)	200 secs		15 secs	30 psig		300 secs
		C6+ Hexane Plus	**C3 Propane**	**H2S Hydrogen Sulfide**	**IC4 IsoButane**	**NC4 Normal Butane**	**neoC5 Neo Pentane**	**IC5 IsoPentane**
	Gate On	16.0	48.0	70.0	87.0	87.0	102.0	102.0
	Peak Time	22.5	57.0	82.0	82.0	97.0	118.0	168.0
	Gate Off	32.0	70.0	93.0	112.0	112.0	300.0	300.0
	Rise/Run	10/15	3/30	3/30	3/60	3/60	3/60	3/100
		Target Comp.	**Target Time**		**Inject Time**	**Col. Press.**		**Cyc. Time**
		Pentane (NC5)	205 secs		15 secs	35 psig		300 secs
		NC5 Normal Pentane						
	Gate On	102.0						
	Peak Time	200.0						
	Gate Off	300.0						
	Rise/Run	3/100						

BBM Column - Data for Manual Peak Find, Cont.

Hydrogen Carrier		**Target Component**	**Target Time**		**Inject Time**		**Col. Press.**	**Cyc. Time**
		Pentane (NC5)	220 secs		15 secs		19 psig	270 secs
		C7+ Heptane Plus+	**C3 Propane**	**H2S Hydrogen Sulfide**	**IC4 IsoButane**	**NC4 Normal Butane**	**neoC5 Neo Pentane**	**IC5 IsoPentane**
	Gate On	16.0	63.0	77.0	77.0	77.0	77.0	77.0
	Peak Time	23.5	69.8	84.0	96.5	111.4	133.2	183.0
	Gate Off	37.0	77.0	260.0	260.0	260.0	260.0	260.0
	Rise/Run	1/1	3/5	3/15	3/15	3/15	3/15	3/15
		Target Component	**Target Time**		**Inject Time**		**Col. Press.**	**Cyc. Time**
		Pentane (NC5)	220 secs		15 secs		19 psig	270 secs
		NC5 Normal Pentane						
	Gate On	77.0						
	Peak Time	214.7						
	Gate Off	260.0						
	Rise/Run	3/15						

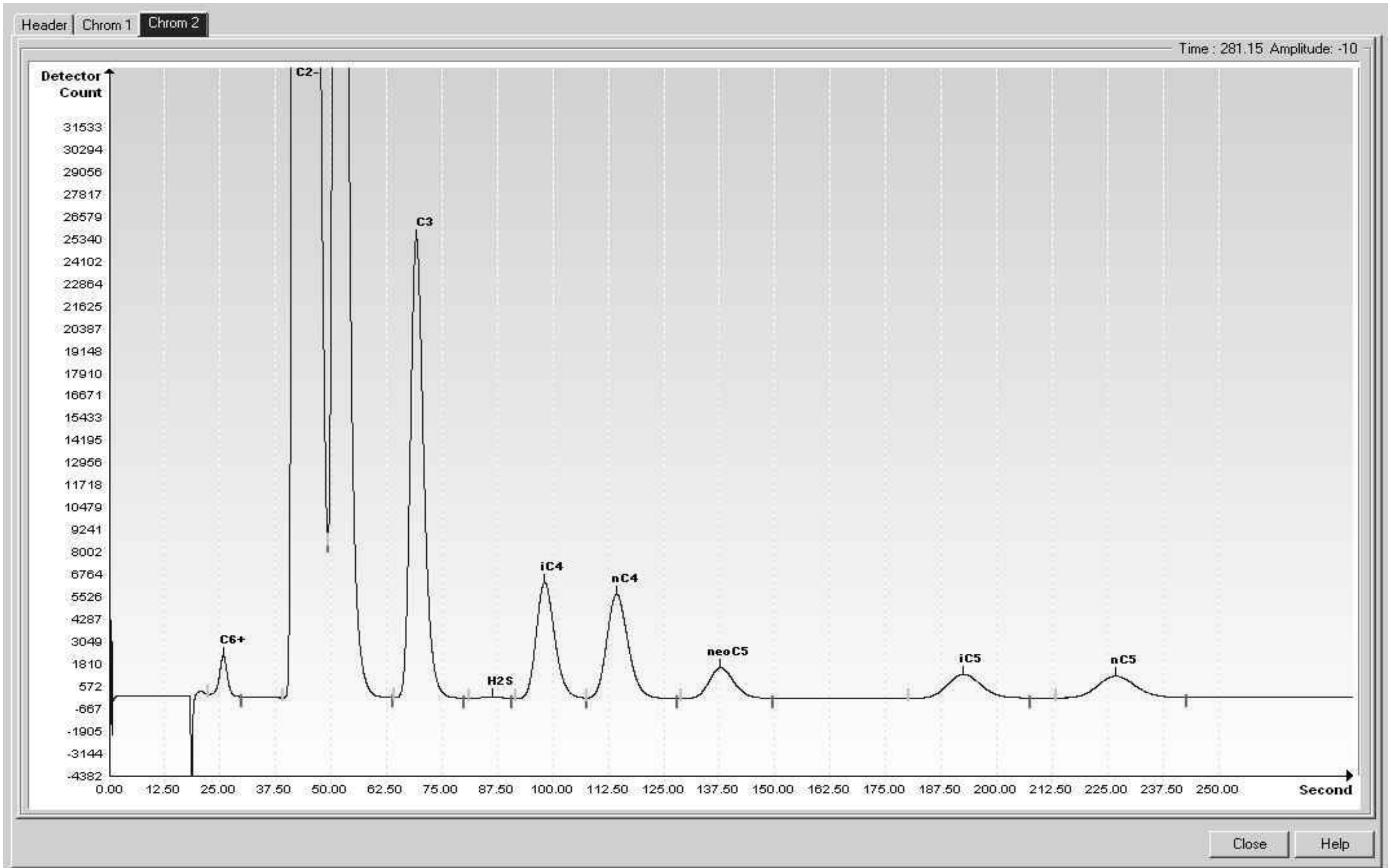


Figure 7-6 BBM Helium Reference Chromatogram

7.9 BBR (H2S in Fuel Gas)

Table 7–23 BBR Column Train Data Sheet (H2S in Fuel Gas)

Carrier Helium **Train** BBR

Part No.2102999-001 Train BBR. H2S 30-1200 ppm

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	150	Seconds	**Carrier Pressure**		37 PSIG
Sort Order	141		**Carrier Pressure Variance**	±	15 %
Sample Size	247	ul	**Flow Rate**		4.4 ML/Min
Target Component	H2S		**Flow Rate Variance**	±	15 %
Target Ret. Time	98.5	Seconds	**Oven Temperature**		60 Deg. C

Notes A common application is Hydrogen Sulfide (H2S) in Fuel Gas per 40 CFR part B. Due to the low levels of H2S measured the following items are recommended in order to insure proper performance. Calibration and carrier regulators should be stainless steel with stainless steel diaphragms. Connective tubing for calibration gas and streams should be Sulfinert or the equivalent. Brass parts cannot be used in sample wetted paths. At startup the system should be leak tested. Liquid leak detection fluids should not be used on this system. Electronic leak detectors or a pressure method are recommended. A moisture trap is recommended for the carrier bottle(s).

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Hydrogen Sulfide	0.003	1	3	0.0003	86	98.5	116	75	3	1000	1	Auto	Positive	0	0

Carrier Hydrogen **Train** BBR

Part No.2102999-001 Train BBR. H2S 30-1200 ppm

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	120	Seconds	**Carrier Pressure**		25 PSIG
Sort Order	141		**Carrier Pressure Variance**	±	15 %
Sample Size	247	ul	**Flow Rate**		4.5 ML/Min
Target Component	H2S		**Flow Rate Variance**	±	15 %
Target Ret. Time	84	Seconds	**Oven Temperature**		60 Deg. C

Notes A common application is Hydrogen Sulfide (H2S) in Fuel Gas per 40 CFR part B. Due to the low levels of H2S measured the following items are recommended in order to insure proper performance. Calibration and carrier regulators should be stainless steel with stainless steel diaphragms. Connective tubing for calibration gas and streams should be Sulfinert or the equivalent. Brass parts cannot be used in sample wetted paths. At startup the system should be leak tested. Liquid leak detection fluids should not be used on this system. Electronic leak detectors or a pressure method are recommended. A moisture trap is recommended for the carrier bottle(s).

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Hydrogen Sulfide	0.003	1	3	0.0003	80	84	93	75	5	1000	1	Auto	Positive	0	0

Table 7–24 BBR Column - Data for Manual Peak Find

		Target Comp.	Target Time		Inject Time	Col. Press.	Cyc.Time
Helium Carrier		Hydrogen Sulfide (H2S)	98.5 secs		15 seconds	37 psig	150 seconds
		H2S Hydrogen Sulfide					
	Gate On	86.0					
	Peak Time	98.5					
	Gate Off	116.0					
	Rise/Run	3/75					
Hydrogen Carrier		**Target Comp.**	**Target Time**		**Inject Time**	**Col. Press.**	**Cyc.Time**
		Hydrogen Sulfide (H2S)	84 seconds		15 seconds	25 psig	120 seconds
		H2S Hydrogen Sulfide					
	Gate On	80.0					
	Peak Time	84.0					
	Gate Off	93.0					
	Rise/Run	5/75					

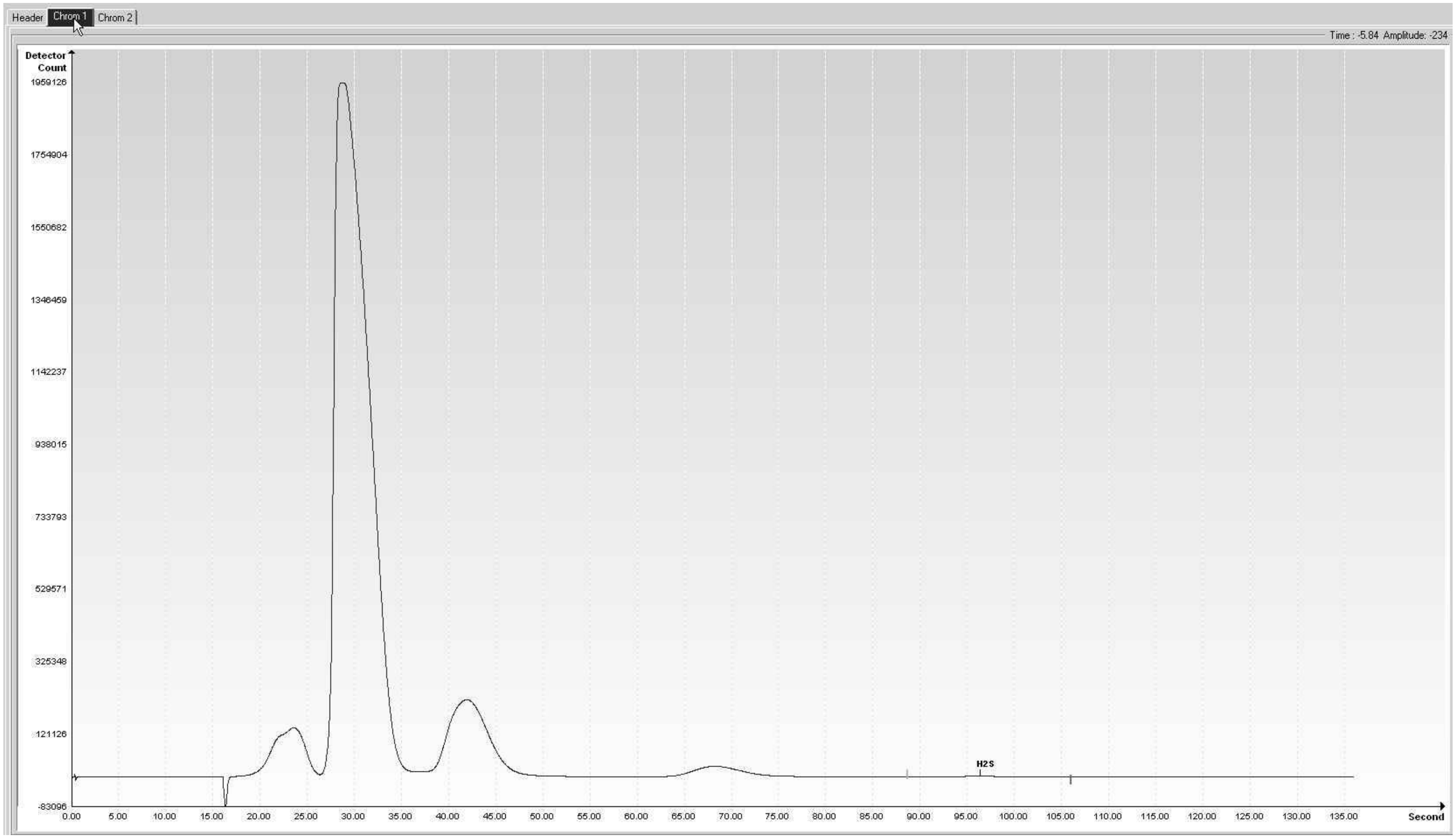


Figure 7-7 BBR Helium Reference Chromatogram

7.10 BBS (C3 to C7)

Table 7–25 BBS Column Train Data Sheet (C3 to C7)

Carrier Helium **Train** BBS

Part No. 2103000-001 Train BBS. C7+. C3. IC4. NC4. Neo-C5. IC5. NC5. C6s.

Rev	Action	Drawn	Checked	Approved	Date
AF	D22691	J.BUSHNELL	B. COOK	J. BUSHNELL	08/10/31
AE	D22553	A. KASTNER	A. KASTNER	J. BUSHNELL	08/09/04
AD	D21789	A. KASTNER	A. KASTNER	J. BUSHNELL	08/06/16

Cycle Time	360	Seconds
Sort Order	161	
Sample Size	40	ul
Target Component	NC6	
Target Ret. Time	292	Seconds
Notes		

Inject Time		15 Seconds
Inject Time Variance	±	10 %
Carrier Pressure		38 PSIG
Carrier Pressure Variance	±	15 %
Flow Rate		7.4 ML/Min
Flow Rate Variance	±	15 %
Oven Temperature		60 Deg. C

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Heptane Plus	0.05	5	1	0.001	19	22.3	27	5	8	3000	0.75	Auto	Positive	0	0
2	Propane	0.05	15	1	0.001	44	46.6	51	5	8	3000	0.75	Auto	Positive	0	0
3	Isobutane	0.05	10	1	0.001	58	62	65	5	8	3000	0.75	Auto	Positive	0	0
4	Normal Butane	0.05	10	1	0.001	65	68	73	5	8	3000	0.75	Auto	Positive	0	0
5	Neopentane	0.05	15	1	0.001	79	84	90	5	8	3000	0.75	Auto	Positive	0	0
6	Isopentane	0.05	10	1	0.001	102	108	114	5	8	3000	0.75	Auto	Positive	0	0
7	Normal Pentane	0.05	10	1	0.001	117	124	132	5	8	3000	0.75	Auto	Positive	0	0
8	Hexanes	0.05	10	2	0.01	267	280	295	15	3	3000	0.75	Auto	Positive	0	0

Carrier Hydrogen **Train** BBS

Part No. 2103000-001 Train BBS. C7+. C3. IC4. NC4. Neo-C5. IC5. NC5. C6s.

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	360	Seconds	**Carrier Pressure**		16 PSIG
Sort Order	161		**Carrier Pressure Variance**	±	15 %
Sample Size	40	ul	**Flow Rate**		2.1 ML/Min
Target Component	NC6		**Flow Rate Variance**	±	15 %
Target Ret. Time	292	Seconds	**Oven Temperature**		60 Deg. C
Notes					

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Heptane Plus	0.05	5	1	0.001	15	21.5	28	5	8	3000	0.75	Auto	Positive	0	0
2	Propane	0.05	15	1	0.001	35	44	340	5	8	3000	0.75	Auto	Positive	0	0
3	Isobutane	0.05	10	1	0.001	35	60	340	5	8	3000	0.75	Auto	Positive	0	0
4	Normal Butane	0.05	10	1	0.001	35	66	340	5	8	3000	0.75	Auto	Positive	0	0
5	Neopentane	0.05	15	1	0.001	35	84	340	5	8	3000	0.75	Auto	Positive	0	0
6	Isopentane	0.05	10	1	0.001	35	108	340	5	8	3000	0.75	Auto	Positive	0	0
7	Normal Pentane	0.05	10	1	0.001	35	126	340	5	8	3000	0.75	Auto	Positive	0	0
8	Hexanes	0.05	10	2	0.01	35	288	340	5	8	3000	0.75	Auto	Positive	0	0

Table 7–26 BBS Blend

Component	Blend (mole%)
C7+	0.05
C3 (Propane)	1.00
IC4 (Iso Butane)	0.299
NC4 (Normal Butane)	0.299
NeoC5 (Neo Pentane)	0.1
IC5 (Iso Pentane)	0.1
NC5 (Normal Pentane)	0.1
C6 (Hexane)	0.1
Note: These components have not been normalized.	

Table 7–27 BBS Column - Data for Manual Peak Find

		Target Comp.		**Target Time**	**Inject Time**	**Col. Press.**	**Cycle Time**	
Helium Carrier		Hexanes (C6s)		292 secs	15 secs	38 psig	360 secs	
		C7+ Heptane Plus+	**C3 Propane**	**IC4 IsoButane**	**NC4 Normal Butane**	**neoC5 Neo Pentane**	**IC5 IsoPentane**	**NC5 Normal Pentane**
	Gate On	19.0	44.0	58.0	65.0	79.0	102.0	117.0
	Peak Time	22.3	46.6	62.0	68.0	84.0	108.0	124.0
	Gate Off	27.0	51.0	65.0	73.0	90.0	114.0	132.0
	Rise/Run	8/5	8/5	8/5	8/5	8/5	8/5	8/5
		C6s Hexanes						
	Gate On	267.0						
	Peak Time	280.0						
	Gate Off	295.0						
	Rise/Run	8/5						
Hydrogen Carrier		**C7+ Heptane Plus+**	**C3 Propane**	**IC4 IsoButane**	**NC4 Normal Butane**	**neoC5 Neo Pentane**	**IC5 IsoPentane**	**NC5 Normal Pentane**
	Gate On	15.0	35.0	35.0	35.0	35.0	35.0	35.0
	Peak Time	21.5	44.0	60.0	66.0	84.0	108.0	126.0
	Gate Off	28.0	340.0	340.0	340.0	340.0	340.0	340.0
	Rise/Run	8/5	8/5	8/5	8/5	8/5	8/5	8/5
		C6s Hexanes						
	Gate On	35.0						
	Peak Time	288.0						
	Gate Off	340.0						
	Rise/Run	8/5						

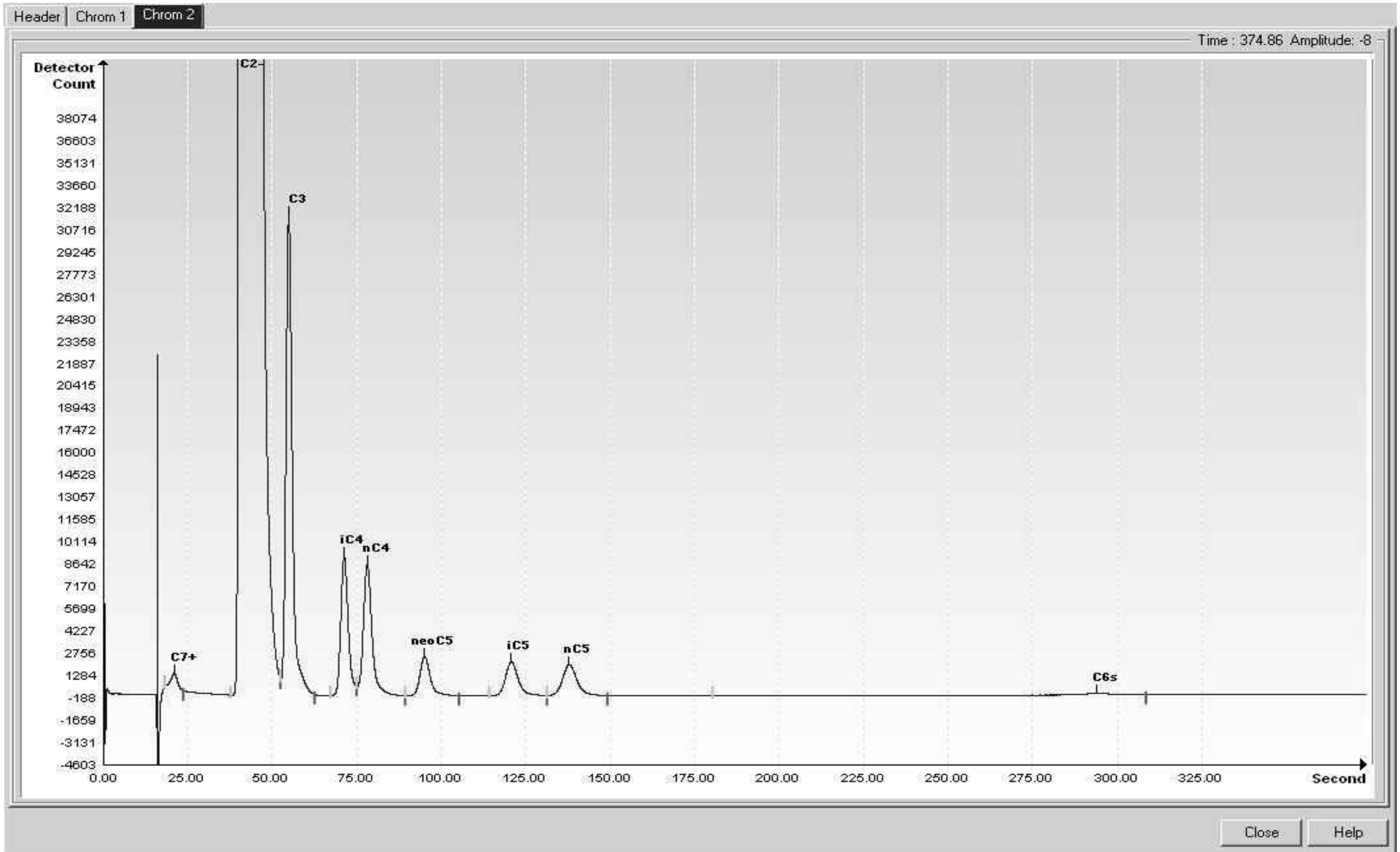


Figure 7-8 BBS Helium Reference Chromatogram

7.11 BBT (C9+, C6s to C8s)

Table 7–28 BBT Column Train Data Sheet (C9+, C6s to C8s)

Carrier Helium **Train** BBT

Part No. 2103001-002 Train BBT. C9+. C6s. C7s. C8s. Capillary

			Inject Time		15	Seconds
			Inject Time Variance	±	10	%
Cycle Time	360	Seconds	Carrier Pressure		18	PSIG
Sort Order	181		Carrier Pressure Variance	±	15	%
Sample Size	185	ul	Flow Rate		5	ML/Min
Target Component	NC8		Flow Rate Variance	±	15	%
Target Ret. Time	235	Seconds	Oven Temperature		60	Deg. C

Notes When used in conjunction with BBF & BBK trains, a calculated BTU performance of +/- 0.25 BTU with a C9+ analysis can be accomplished.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Nonane Plus	0.01	10	2	0.002	22	25	29	10	5	3000	0.75	Auto	Positive	0	0
2	Hexanes	0.01	10	1	0.001	76	86	100	15	1	1000	0.75	Grouped	Positive	0	0
3	Heptanes	0.01	10	1	0.001	100	132	170	40	1	1000	0.75	Grouped	Positive	0	0
4	Octanes	0.02	10	1	0.001	170	235	300	140	1	1000	0.75	Grouped	Positive	0	0

Carrier Hydrogen **Train** BBT

Part No. 2103001-002 Train BBT. C9+. C6s. C7s. C8s. Capillary

Cycle Time	0	Seconds	**Inject Time**		15 Seconds
Sort Order	181		**Inject Time Variance**	±	10 %
Sample Size	185	ul	**Carrier Pressure**		18 PSIG
Target Component	NC8		**Carrier Pressure Variance**	±	15 %
Target Ret. Time	235	Seconds	**Flow Rate**		4.6 ML/Min
			Flow Rate Variance	±	15 %
			Oven Temperature		60 Deg. C

Notes When used in conjunction with BBF & BBK trains, a calculated BTU performance of +/- 0.25 BTU with a C9+ analysis can be accomplished.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
0		0	0	0	0	0	0	0	0	0	3000	0.75	Auto	Positive	0	0
1	Nonane Plus	0.1	10	2	0.002	22	25	29	10	5	3000	0.75	Auto	Positive	0	0
2	Hexanes	0.1	10	1	0.001	76	86	100	15	3	3000	0.75	Grouped	Positive	0	0
3	Heptanes	0.1	10	1	0.001	100	132	170	40	3	3000	0.75	Grouped	Positive	0	0
4	Octanes	0.2	10	1	0.001	170	235	300	140	3	3000	0.75	Grouped	Positive	0	0

Table 7–29 BBT Blend

Component	Blend (mole%)
C7 (Heptane)	0.0104
C8 (Octane)	0.003
C3 (Propane)	1.034
C1 (Methane)	89.557
C2 (Ethane)	3.157
CO2 (Carbon Dioxide)	1.024
N2 (Nitrogen)	3.27
IC4 (Iso Butane)	0.309
NC4 (Normal Butane)	0.311
NeoC5 (Neo Pentane)	0.114
IC5 (Iso Pentane)	0.103
NC5 (Normal Pentane)	0.103
C((Nonane)	0.0027
C6 (Hexane)	0.0118
Note: These components have not been normalized.	

Table 7–30 BBT Column - Data for Manual Peak Find

Helium Carrier		**Target Comp.**		**Target Time**	**Inject Time**	**Col. Press.**	**Cyc.Time**
		Normal Octane (NC8)		235 seconds	15 seconds	18 psig	360 secs
		C9+ Nonane +	**C6s Hexanes**	**C7s Heptanes**	**C8s Octanes**		
	Gate On	22.0	76.0	100.0	170.0		
	Peak Time	25.0	86.0	132.0	235.0		
	Gate Off	29.0	100.0	170.0	300.0		
	Rise/Run	5/10	1/15	1/40	1/140		
Hydrogen Carrier		**Target Comp.**		**Target Time**	**Inject Time**	**Col. Press.**	**Cyc.Time**
		Normal Octane (NC8)		235 seconds	15 seconds	18 psig	0 seconds
		C9+ Nonane +	**C6s Hexanes**	**C7s Heptanes**	**C8s Octanes**		
	Gate On	22.0	76.0	100.0	170.0		
	Peak Time	25.0	86.0	132.0	235.0		
	Gate Off	29.0	100.0	170.0	300.0		
	Rise/Run	5/10	3/15	3/40	3/140		

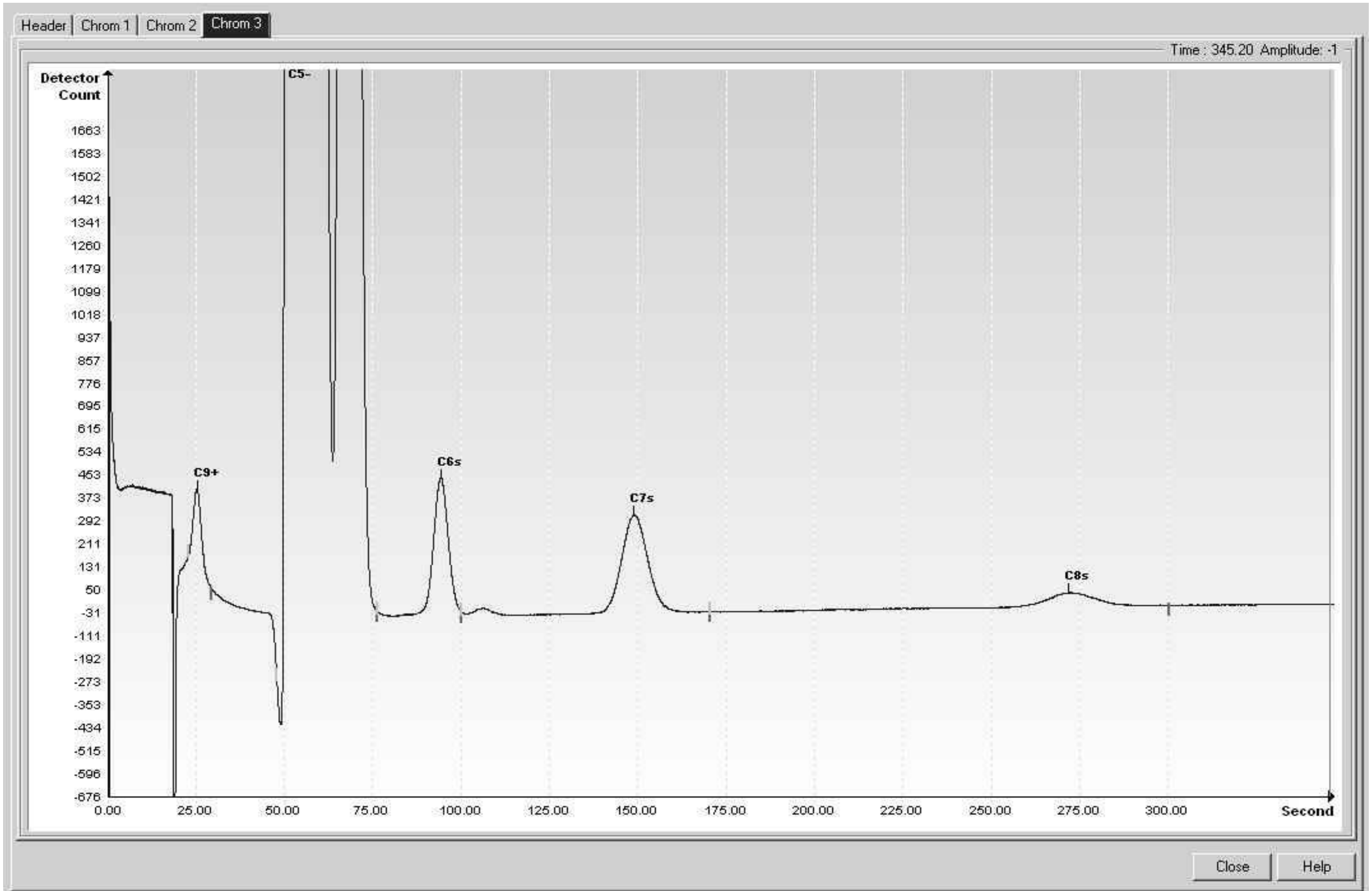


Figure 7-9 BBT Reference Chromatogram

7.12 BBX (C4+, CyC3, PD, MA) High Range

Table 7–31 BBX Column Train Data Sheet (C4+, CyC3, PD, MA) High Range

Carrier Helium **Train** BBX

Part No. 2103004-001 Train BBX. C4+. CYC3. PD. MA high range.

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	300	Seconds	**Carrier Pressure**		21 PSIG
Sort Order	241		**Carrier Pressure Variance**	±	15 %
Sample Size	40	ul	**Flow Rate**		4.3 ML/Min
Target Component	MA		**Flow Rate Variance**	±	15 %
Target Ret. Time	270	Seconds	**Oven Temperature**		60 Deg. C
Notes					

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Butane Plus	0.05	100	1	0.002	0	0	0	0	3	3000	0.75	Auto	Positive	0	0
2	Cyclopropane	0.05	20	1	0.001	150	161	173	30	3	3000	0.75	Auto	Positive	0	0
3	Propadiene	0.05	20	1	0.001	180	194	205	30	3	3000	0.75	Auto	Positive	0	0
4	Methylacetylene	0.05	40	1	0.001	252	270	284	30	3	3000	0.75	Auto	Positive	0	0

Carrier Hydrogen **Train** BBX

Part No. 2103004-001 Train BBX. C4+. CYC3. PD. MA high range.

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	270	Seconds	**Carrier Pressure**		10 PSIG
Sort Order	241		**Carrier Pressure Variance**	±	15 %
Sample Size	40	ul	**Flow Rate**		3.6 ML/Min
Target Component	MA		**Flow Rate Variance**	±	15 %
Target Ret. Time	236	Seconds	**Oven Temperature**		60 Deg. C
Notes					

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Butane Plus	0.05	100	1	0.002	0	0	0	30	3	3000	0.75	Auto	Positive	0	0
2	Cyclopropane	0.05	20	1	0.001	0	136	0	30	3	3000	0.75	Auto	Positive	0	0
3	Propadiene	0.05	20	1	0.001	0	171	0	30	3	3000	0.75	Auto	Positive	0	0
4	Methylacetylene	0.05	40	1	0.001	0	236	0	30	3	3000	0.75	Auto	Positive	0	0

Need Blend Information

Table 7–32 BBX Column - Data for Manual Peak Find (High Range)

Carrier							
Helium Carrier		**Target Comp.**		**Target Time**	**Inject Time**	**Col. Press.**	**Cyc.Time**
		MAcetylene(MA)		270 seconds	15 seconds	21 psig	300 seconds
		C4+ Butane +	**CyC3 Cyclo Propane**	**PD Propadiene**	**MA Methyl Acetylene**		
	Gate On	0.0	150.0	180.0	252.0		
	Peak Time	0.0	161.0	194.0	270.0		
	Gate Off	0.0	173.0	205.0	284.0		
	Rise/Run	3/0	3/30	3/30	3/30		
Hydrogen Carrier		**Target Comp.**		**Target Time**	**Inject Time**	**Col. Press.**	**Cyc.Time**
		MAcetylene(MA)		236 seconds	15 seconds	10 psig	270 seconds
		C4+ Butane +	**CyC3 Cyclo Propane**	**PD Propadiene**	**MA Methyl Acetylene**		
	Gate On	0.0	0.0	0.0	0.0		
	Peak Time	0.0	136.0	171.0	236.0		
	Gate Off	0.0	0.0	0.0	0.0		
	Rise/Run	3/30	3/30	3/30	3/30		

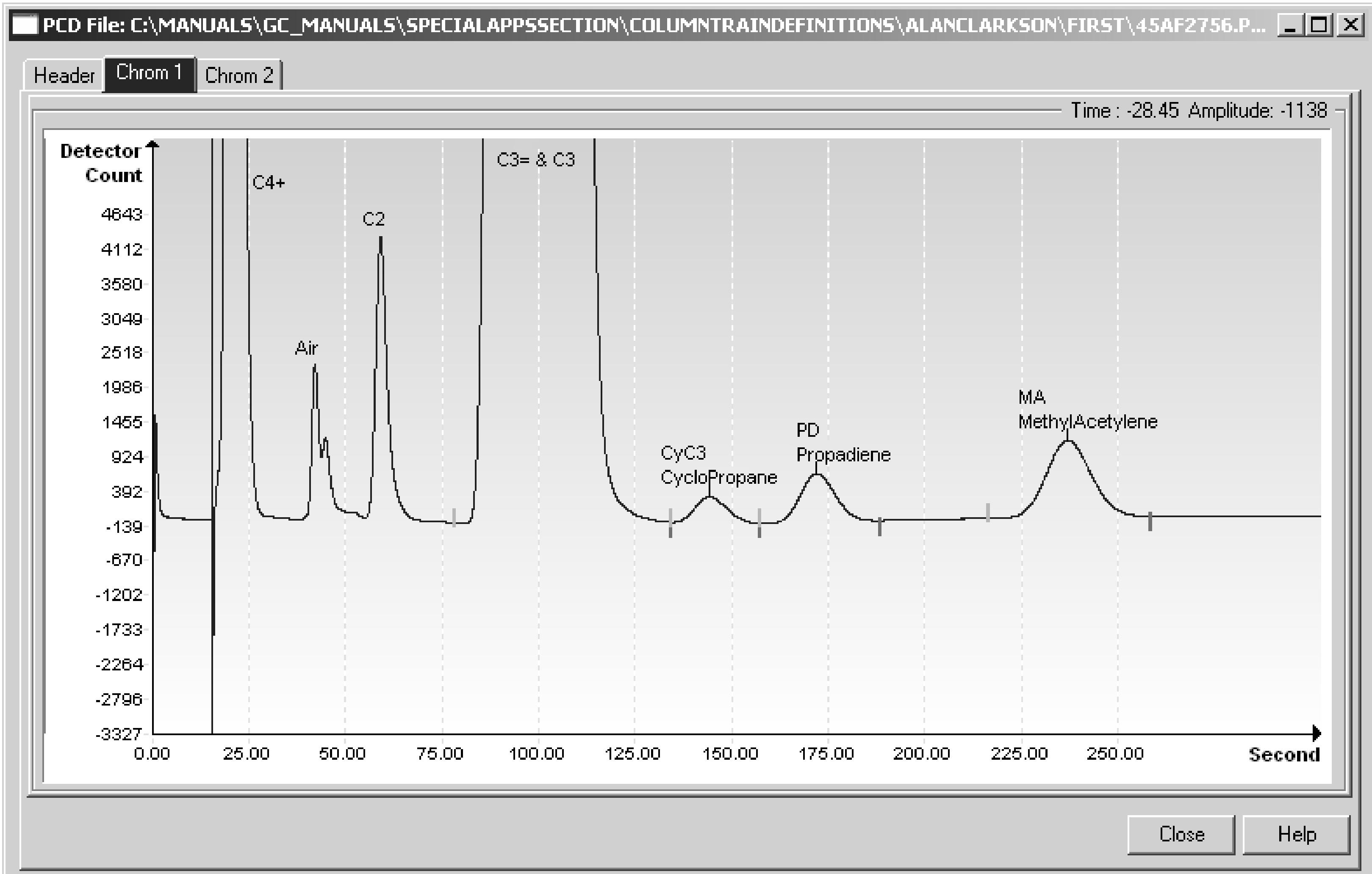


Figure 7-10 BBX Hydrogen Reference Chromatogram

7.13 BCB (C3+, Air to C2 w/ H2S and H20)

Table 7–33 BCB Column Train Data Sheet (C3+, Air to C2w/H2S&H2O)

Carrier Helium **Train** BCB

Part No. 2103007-001 Train BCB. C3+. N2 or H2. C1. CO2. C2=. C2. H2S.

Rev	Action	Drawn	Checked	Approved	Date
AF	D22687	B. COOK	J. BUSHNELL	J. BUSHNELL	08/10/31
AE	D21793	A. KASTNER	A. KASTNER	J. BUSHNELL	08/06/16
AD	D21534	A. KASTNER	A. KASTNER	J. BUSHNELL	08/02/14

			Inject Time		15	Seconds
			Inject Time Variance	±	10	%
Cycle Time	360	Seconds	Carrier Pressure		21	PSIG
Sort Order	301		Carrier Pressure Variance	±	15	%
Sample Size	40	ul	Flow Rate		6.3	ML/Min
Target Component	C2		Flow Rate Variance	±	15	%
Target Ret. Time	140	Seconds	Oven Temperature		60	Deg. C
Notes	Air analyzed, or Hydrogen (H2) if air not present					

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Propane Plus	0.05	100	1	0.001	17.5	21.3	25.2	9	1	3000	0.9	Auto	Positive	0	0
2	Hydrogen	0.5	10	1	0.05	23.3	30.2	31.4	5	3	3000	0.9	Auto	Positive	0	0
3	Nitrogen	0.05	100	1	0.001	31.4	33.3	38.4	15	3	3000	0.9	Auto	Positive	0	0
4	Methane	0.05	100	1	0.001	38.5	41.8	50	15	3	3000	0.9	Auto	Positive	0	0
5	Carbon Dioxide	0.1	100	1	0.002	50	65.5	74.4	15	3	3000	0.9	Auto	Positive	0	0
6	Ethylene	0.1	100	1	0.002	100	112	122	15	3	3000	0.9	Auto	Positive	0	0
7	Ethane	0.1	100	1	0.002	124.3	140	160	15	3	3000	0.9	Auto	Positive	0	0
8	Hydrogen Sulfide	0.01	0.12	2	0.003	175	200	225	15	3	3000	0.9	Auto	Positive	0	0

Carrier Hydrogen **Train** BCB

Part No. 2103007-001 Train BCB. C3+. N2 or H2. C1. CO2. C2=. C2. H2S.

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	360	Seconds	**Carrier Pressure**		8.9 PSIG
Sort Order	301		**Carrier Pressure Variance**	±	15 %
Sample Size	40	ul	**Flow Rate**		4.7 ML/Min
Target Component	C2		**Flow Rate Variance**	±	15 %
Target Ret. Time	140	Seconds	**Oven Temperature**		60 Deg. C

Notes No data on gating times for components./ Corrrect He Range Bottom

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
													Auto	Positive	0	0
1	Propane Plus	0.05	100	1	0.001	0	0	0	1	3	3000	0.9	Auto	Positive	0	0
2	Helium	0.5	10	1	0.05	0	0	0	1	3	3000	0.9	Auto	Positive	0	0
3	Nitrogen	0.05	100	1	0.001	0	0	0	1	3	3000	0.9	Auto	Positive	0	0
4	Methane	0.05	100	1	0.001	0	0	0	1	3	3000	0.9	Auto	Positive	0	0
5	Carbon Dioxide	0.1	100	1	0.002	0	0	0	1	3	3000	0.9	Auto	Positive	0	0
6	Ethylene	0.1	100	1	0.002	0	0	0	1	3	3000	0.9	Auto	Positive	0	0
7	Ethane	0.1	100	1	0.002	0	0	0	1	3	3000	0.9	Auto	Positive	0	0
8	Hydrogen Sulfide	0.01	0.12	2	0.003	0	0	0	1	3	3000	0.9	Auto	Positive	0	0

Table 7–34 BCB Blend

Component	Blend (mole %)
C3 (Propane)	0.0819
C1 (Methane)	43.37
CO2 (Carbon Dioxide)	45.318
CO (Carbon Monoxide)	0.236
H2 (Hydrogen)	4.85
O2 (Oxygen)	1.077
N2 (Nitrogen)	4.94
C2 (Ethane)	0.120
Note: These components have not been normalized.	

Table 7–35 BCB Column - Data for Manual Peak Find

		Target Comp.		Target Time	Inject Time	Col. Press.		Cyc. Time
Helium Carrier		Ethane (C2)		140 secs	15 secs	21 psig		360 secs
		C3+ Propane Plus	**H2 Hydrogen**	**Air**	**C1 Methane**	**CO2 Carbon Dioxide**	**C2= Ethylene**	**C2 Ethane**
	Gate On	17.5	23.3	31.4	38.5	50.0	100.0	124.3
	Peak Time	21.3	30.2	33.3	41.8	65.5	112.0	140.0
	Gate Off	25.2	31.4	38.4	50.0	74.4	122.0	160.0
	Rise/Run	1/9	3/5	3/15	3/15	3/15	3/15	3/15
		H2S Hydrogen Sulfide	**H2O Water**					
	Gate On	Gate On	175.0					
	Peak Time	Peak Time	200.0					
	Gate Off	Gate Off	225.0					

	Rise/Run	Rise/Run	3/15					

BCB Column - Data for Manual Peak Find, cont.

		Target Component		**Target Time**	**Inject Time**	**Col. Press.**		**Cyc. Time**
		Ethane (C2)		140 secs	15 secs	8.9 psig		360 secs
		C3+ Propane Plus	**H2 Hydrogen**	**Air**	**C1 Methane**	**CO2 Carbon Dioxide**	**C2= Ethylene**	**C2 Ethane**
Hydrogen Carrier	**Gate On**	NA	NA	NA	NA	NA	NA	NA
	Peak Time	NA	NA	NA	NA	NA	NA	NA
	Gate Off	NA	NA	NA	NA	NA	NA	NA
	Rise/Run	1/3	1/3	1/3	1/3	1/3	1/3	1/3
		H2S Hydrogen Sulfide	**H2O Water**					
		NA	NA					
		NA	NA					
		NA	NA					
		1/3						

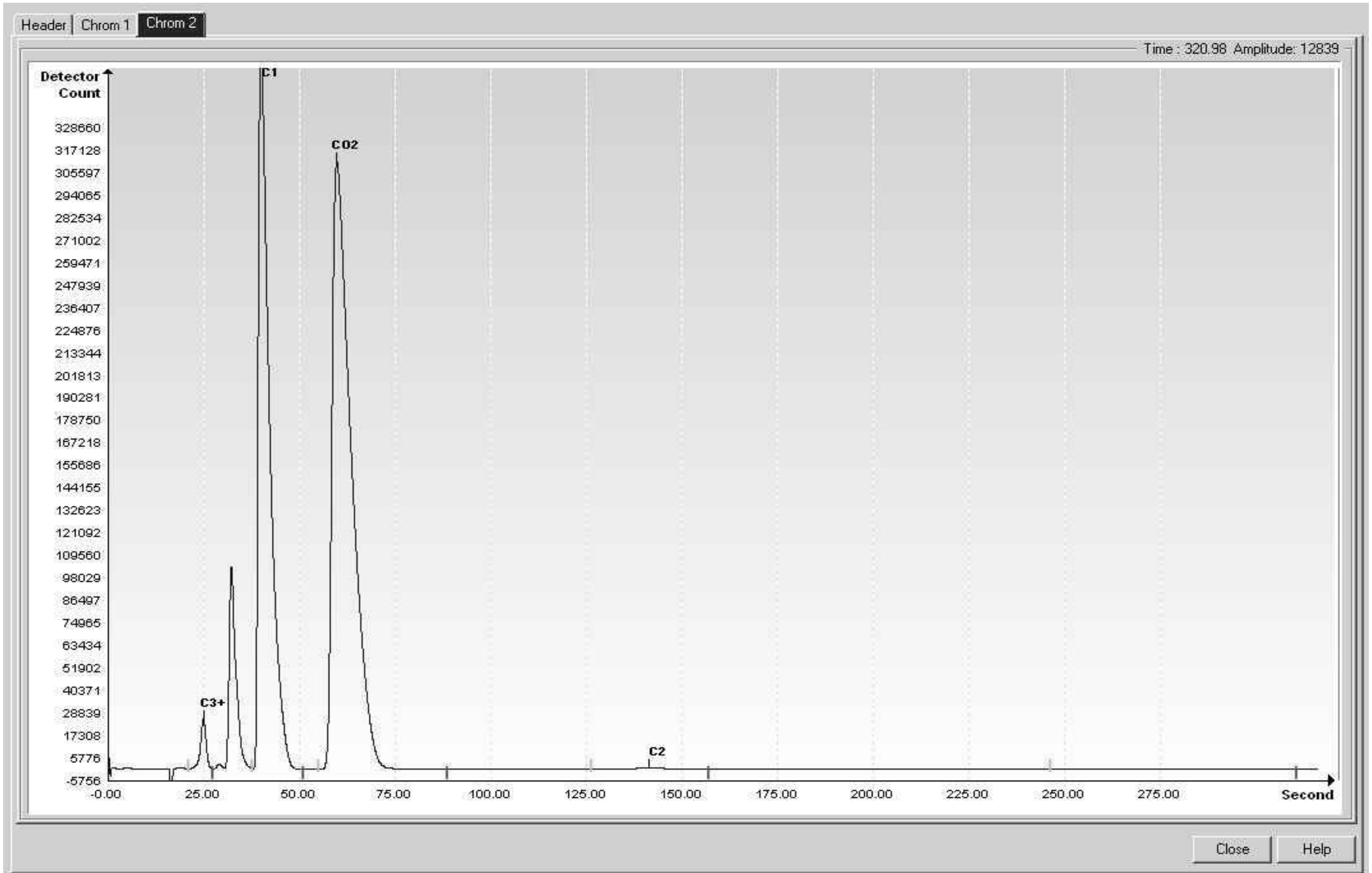


Figure 7-11 BCB Helium Reference Chromatogram

7.14 BCC (C6+ to C3, 120 sec, He)

Table 7–36 BCC Column Train Data Sheet (C6+ to C3, 120sec, He)

Carrier Helium **Train** BCC

Part No. 2102996-002 Train BCC. C6+. C3. 180 Sec He

			Inject Time		13 Seconds
			Inject Time Variance	±	10 %
Cycle Time	180	Seconds	**Carrier Pressure**		25 PSIG
Sort Order	22		**Carrier Pressure Variance**	±	15 %
Sample Size	40	ul	**Flow Rate**		7 ML/Min
Target Component	NC5		**Flow Rate Variance**	±	15 %
Target Ret. Time	132	Seconds	**Oven Temperature**		60 Deg. C
Notes					

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Hexane Plus	0.02	10	2	0.004	14	18	20	30	1	3000	0.75	Auto	Positive	0	0
2	Propane	0.1	100	2	0.002	35	40	50	15	1	3000	0.75	Auto	Positive	0	0
3	Isobutane	0.1	40	2	0.002	50	58	63	15	1	3000	0.75	Auto	Positive	0	0
4	Normal Butane	0.1	40	2	0.002	59	65	75	30	3	3000	0.75	Auto	Positive	0	0
5	Neopentane	0.1	15	2	0.002	75	84	160	60	3	3000	0.75	Auto	Positive	0	0
6	Isopentane	0.1	15	2	0.002	75	112	160	60	3	3000	0.75	Auto	Positive	0	0
7	Normal Pentane	0.1	15	2	0.002	75	132	160	60	3	3000	0.75	Auto	Positive	0	0

Table 7–37 BCC Blend

Component	Blend (mole %)
C3 (Propane)	0.994
C1 (Methane)	92.10
CO2 (Carbon Dioxide)	2.04
N2 (Nitrogen)	1.99
IC4 (Iso Butane)	0.154
NC4 (Normal Butane)	0.155
IC5 (Iso Pentane)	0.150
NeoC5 (Neo Pentane)	0.159
NC5 (Normal Pentane)	0.152
C2 (Ethane)	1.96
Note: These components have not been normalized.	

Table 7–38 BCC Column - Data for Manual Peak Find

35.0Helium Carrier		**Target Comp.**		**Target Time**	**Inject Time**	**Col. Press.**		**Cyc. Time**
		Norm Pentane (NC5)		132 secs	13 secs	25 psig		180 secs
		C6+ Hexane +	**C3 Propane**	**IC4 Isobutane**	**NC4 Normal Butane**	**neoC5 neoPentane**	**IC5 IsoPentane**	**NC5 IsoPentane**
	Gate On	14.0	35.0	50.0	59.0	75.0	75.0	75.0
	Peak Time	18.0	40.0	58.0	65.0	84.0	112.0	132.0
	Gate Off	20.0	50.0	63.0	75.0	160.0	160.0	160.0
	Rise/Run	1/30	1/15	1/15	3/30	3/60	3/60	3/60

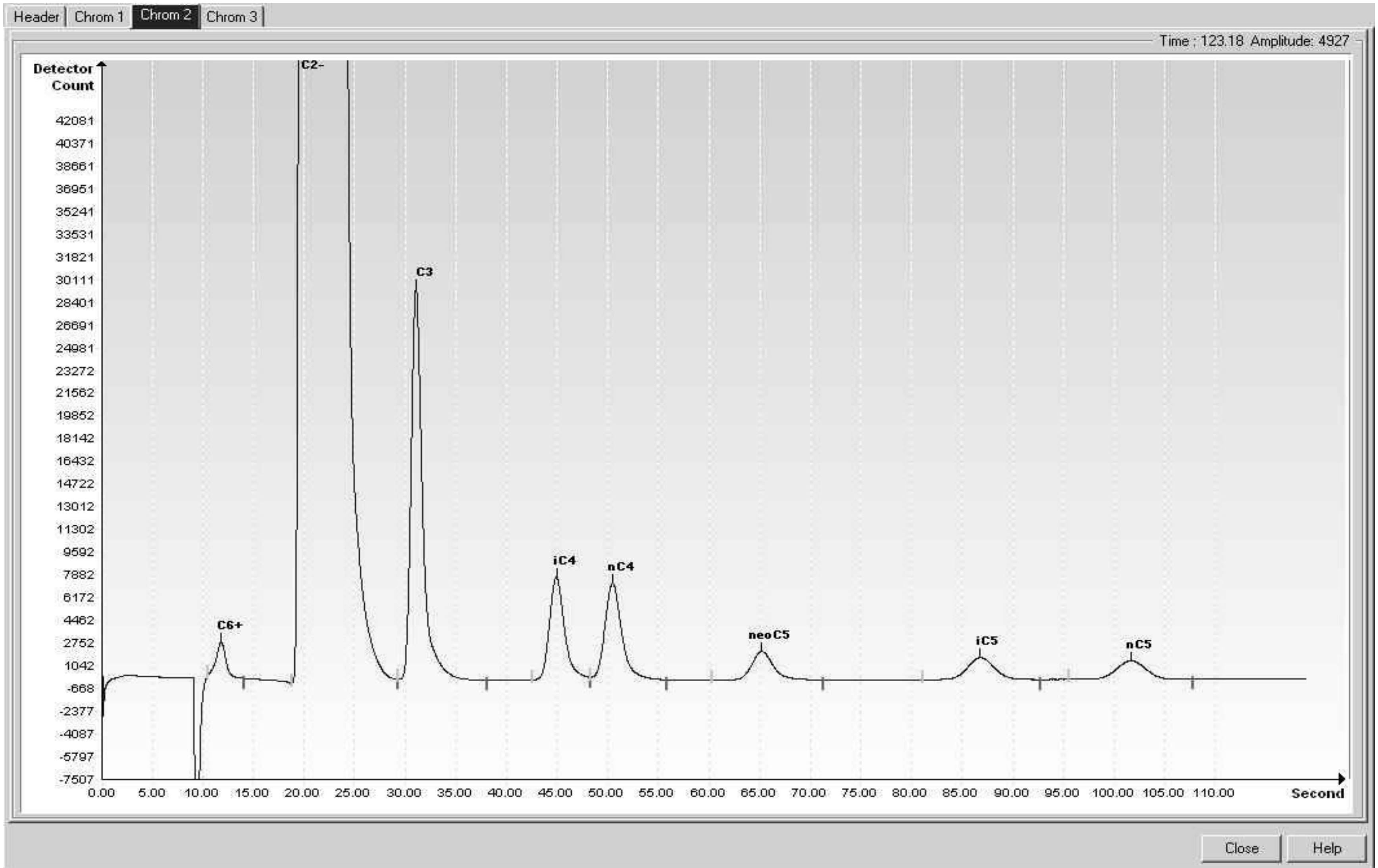


Figure 7-12 BCC Helium Reference Chromatogram

7.15 BCD (C6+ to C3, 90sec, H2)

Table 7–39 BCD Column Train Data Sheet (C6+ to C3, 90sec, H2)

Carrier Hydrogen **Train** BCD

Part No. 2102996-003 Train BCD. C6+. to C3. 90 Sec H2

			Inject Time		6 Seconds
			Inject Time Variance	±	10 %
Cycle Time	90	Seconds	**Carrier Pressure**		45 PSIG
Sort Order	83		**Carrier Pressure Variance**	±	15 %
Sample Size	40	ul	**Flow Rate**		17 ML/Min
Target Component	NC5		**Flow Rate Variance**	±	15 %
Target Ret. Time	59	Seconds	**Oven Temperature**		60 Deg. C

Notes When used in conjunction with BCG, the combination is capable of providing the following calculated performance, +/- 1 BTU at room temperature. For temperatures from -18 to 55 degrees Celsius the +/- BTU performance value doubles.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Hexane Plus	0.02	10	2	0.004	7	8.2	10	9	1	3000	0.95	Auto	Positive	0	0
2	Propane	0.1	100	2	0.002	18.3	19.4	63	5	3	3000	0.95	Auto	Positive	0	0
3	Isobutane	0.1	40	2	0.002	18.3	27.3	63	5	3	3000	0.75	Auto	Positive	0	0
4	Normal Butane	0.1	40	2	0.002	18.3	30.5	63	5	3	3000	0.75	Auto	Positive	0	0
5	Neopentane	0.1	15	2	0.002	18.3	38.9	63	5	3	3000	0.75	Auto	Positive	0	0
6	Isopentane	0.1	15	2	0.002	18.3	51	63	5	3	3000	0.75	Auto	Positive	0	0
7	Normal Pentane	0.1	15	2	0.002	18.3	59.1	63	5	3	3000	0.75	Auto	Positive	0	0

Table 7–40 BCD Blend

Component	Blend (mole %)
?C3 (Propane)	0.994
C1 (Methane)	92.10
CO2 (Carbon Dioxide)	2.04
N2 (Nitrogen)	1.99
IC4 (Iso Butane)	0.154
NC4 (Normal Butane)	0.155
IC5 (Iso Pentane)	0.150
NeoC5 (Neo Pentane)	0.159
NC5 (Normal Pentane)	0.152
C2 (Ethane)	1.96
Note: These components have not been normalized.	

Table 7–41 BCD Column - Data for Manual Peak Find

Hydrogen Carrier		Target Comp.		Target Time	Inject Time	Col. Press.		Cyc. Time
		Norm Pentane (NC5)		59 seconds	6 seconds	45 psig		90 seconds
		C6+ Hexane +	**C3 Propane**	**IC4 Isobutane**	**NC4 Normal Butane**	**neoC5 neoPentane**	**IC5 IsoPentane**	**NC5 IsoPentane**
	Gate On	7.0	18.3	18.3	18.3	18.3	18.3	18.3
	Peak Time	8.2	19.4	27.3	30.5	38.9	51.0	59.1
	Gate Off	10.0	63.0	63.0	63.0	63.0	63.0	63.0
	Rise/Run	1/9	3/5	3/5	3/5	3/5	3/5	3/5

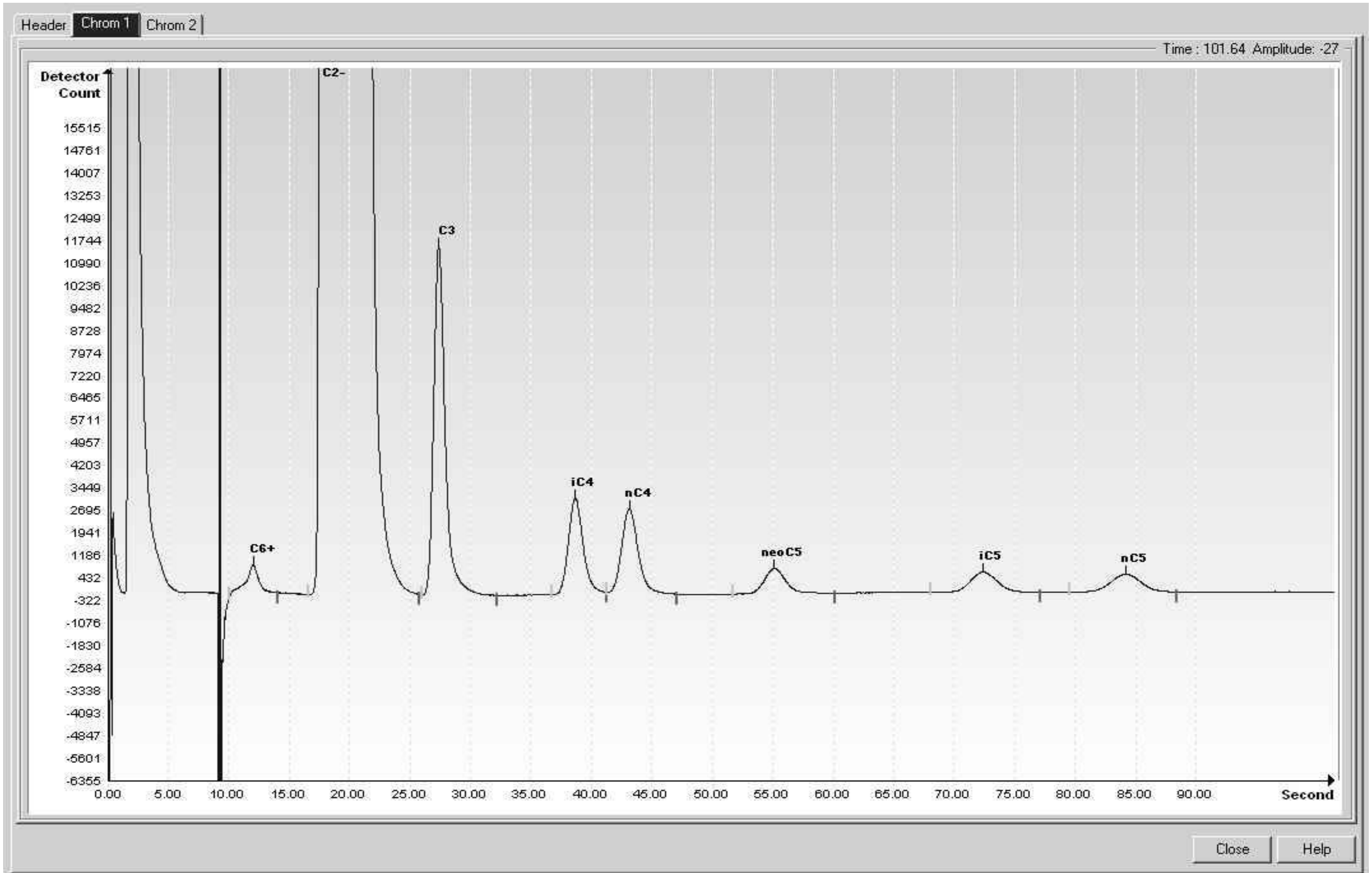


Figure 7-13 BCD Hydrogen Reference Chromatogram

7.16 BCF (C3+ to Air, 90sec, H2)

Table 7–42 BCF Column Train Data Sheet (C3+ to Air, 90sec, H2)

Carrier Hydrogen **Train** BCF

Part No. 2102993-004 Train BCF. C3+. N2. C1. CO2. C2=. C2. 90 Sec H2

Cycle Time	90	Seconds	Inject Time		6 Seconds
Sort Order	84		Inject Time Variance	±	10 %
Sample Size	40	ul	Carrier Pressure		30 PSIG
Target Component	C2		Carrier Pressure Variance	±	15 %
Target Ret. Time	56.7	Seconds	Flow Rate		20 ML/Min
Notes			Flow Rate Variance	±	15 %
			Oven Temperature		60 Deg. C

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Propane Plus	0.1	100	2	0.02	7.2	8.8	10.4	9	3	3000	0.95	Auto	Positive	0	0
2	Nitrogen	0.1	100	2	0.02	10.4	11.07	21.75	5	3	3000	0.95	Auto	Positive	0	0
3	Methane	0.1	100	2	0.02	10.4	14	21.75	5	3	3000	0.75	Auto	Positive	0	0
4	Carbon Dioxide	0.2	100	2	0.02	21.75	24	28	5	3	3000	0.75	Auto	Positive	0	0
5	Ethylene	0.2	100	2	0.02	28	44	52	5	3	3000	0.75	Auto	Positive	0	0
6	Ethane	0.2	100	2	0.02	52	57.4	64	5	3	3000	0.75	Auto	Positive	0	0

Table 7–43 BCF Blend

Component	Blend (mole %)
C3 (Propane)	0.994
C1 (Methane)	92.10
CO2 (Carbon Dioxide)	2.04
N2 (Nitrogen)	1.99
IC4 (Iso Butane)	0.154
NC4 (Normal Butane)	0.155
IC5 (Iso Pentane)	0.150
NeoC5 (Neo Pentane)	0.159
NC5 (Normal Pentane)	0.152
C2 (Ethane)	1.96
Note: These components have not been normalized.	

Table 7–44 BCF Column - Data for Manual Peak Find

Hydrogen Carrier		Target Comp.		Target Time	Inject Time	Col. Press.	Cyc. Time	
		Ethane (C2)		56.7 seconds	6 seconds	30 psig	90 seconds	
		C3+ Propane Plus	**Air**	**C1 Methane**	**CO2 Carbon Dioxide**	**C2= Ethylene**	**C2 Ethane**	
	Gate On	7.2	10.4	10.4	21.75	28.0	52.0	
	Peak Time	8.8	11.07	14.0	24.0	44.0	57.4	
	Gate Off	10.4	21.75	21.75	28.0	52.0	64.0	
	Rise/Run	3/9	3/5	3/5	3/5	3/5	3/5	

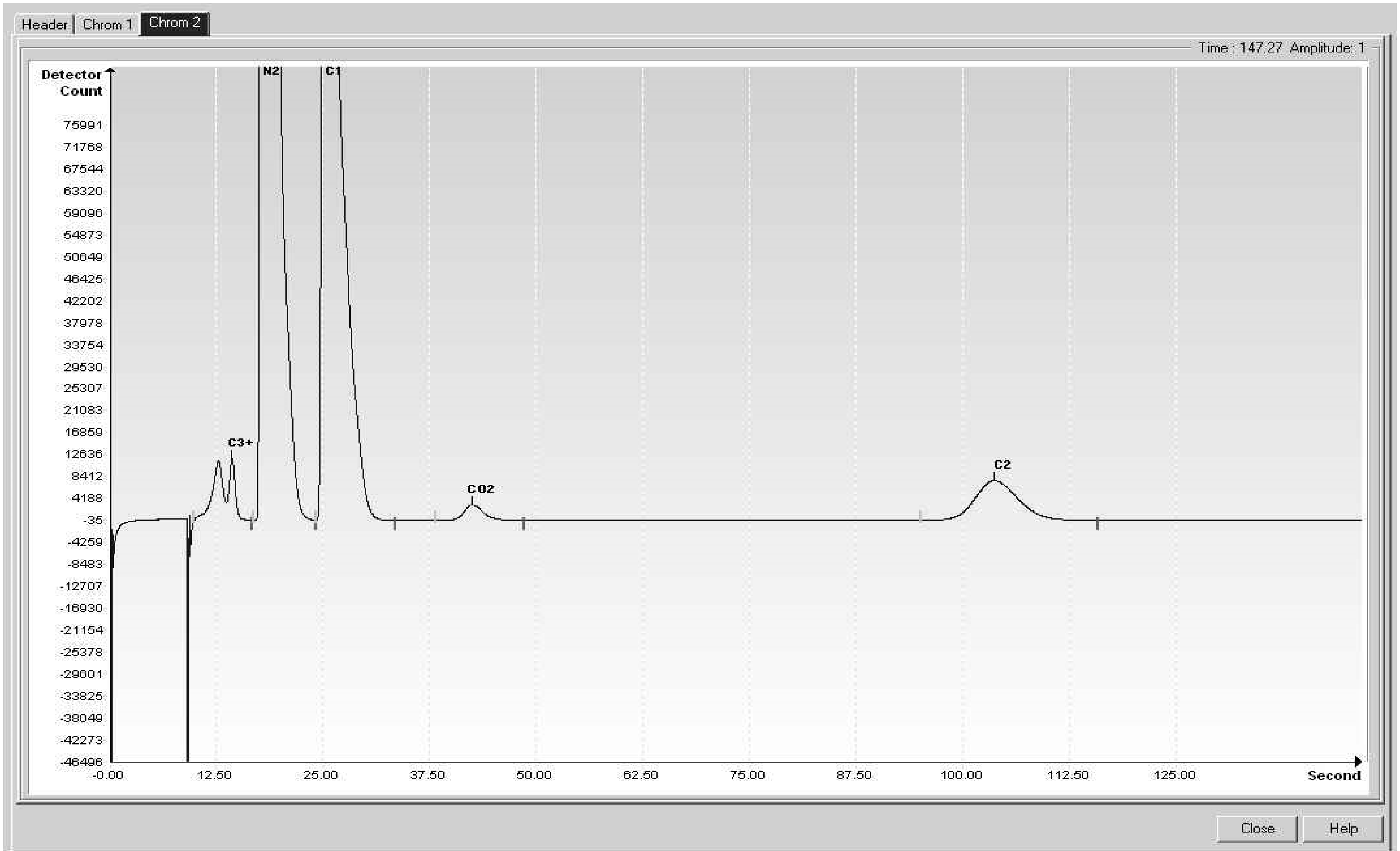


Figure 7-14 BCF Hydrogen Reference Chromatogram

7.17 BCG (C3+ to Air, C2, 120sec, He)

Table 7–45 BCG Column Train Data Sheet (C3+ to Air, C2, 120sec, He)

Carrier Helium **Train** BCG

Part No.2102993-003 Train BCG. C3+. N2. C1. CO2. C2=. C2. 180 Sec He

			Inject Time		13	Seconds
			Inject Time Variance	±	10	%
Cycle Time	180	Seconds	**Carrier Pressure**		40	PSIG
Sort Order	83		**Carrier Pressure Variance**	±	15	%
Sample Size	40	ul	**Flow Rate**		14	ML/Min
Target Component	C2		**Flow Rate Variance**	±	15	%
Target Ret. Time	146	Seconds	**Oven Temperature**		60	Deg. C

Notes When used in conjunction with BCC, the combination is capable of providing the following calculated performance, +/- 1 BTU at room temperature. For temperatures from -18 to 55 degrees Celsius the +/- BTU performance value doubles..

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Propane Plus	0.1	100	2	0.02	14	19	20	15	15	3000	0.75	Auto	Positive	0	0
2	Nitrogen	0.1	100	2	0.02	23	26	38	15	15	3000	0.75	Auto	Positive	0	0
3	Methane	0.1	100	2	0.02	23	33	38	30	3	3000	0.75	Auto	Positive	0	0
4	Carbon Dioxide	0.2	100	2	0.02	50	60	70	30	3	3000	0.75	Auto	Positive	0	0
5	Ethylene	0.2	100	2	0.02	75	126	160	30	3	3000	0.75	Auto	Positive	0	0
6	Ethane	0.2	100	2	0.02	75	146	160	30	3	3000	0.75	Auto	Positive	0	0

Table 7–46 BCG Blend

Component	Blend (mole %)
C3 (Propane)	0.994
C1 (Methane)	92.097
CO2 (Carbon Dioxide)	2.04
N2 (Nitrogen)	1.99
IC4 (Iso Butane)	0.154
NC4 (Normal Butane)	0.155
IC5 (Iso Pentane)	0.150
NeoC5 (Neo Pentane)	0.159
NC5 (Normal Pentane)	0.152
C6+ (Hexane Plus)	0.149
C2 (Ethane)	1.96
Note: These components have not been normalized.	

Table 7–47 BCG Column - Data for Manual Peak Find

Target Comp.	Target Time	Inject Time	Col. Press.	Cyc. Time
Ethane (C2)	146 seconds	13 seconds	40 psig	180 seconds

Helium Carrier		C3+ Propane Plus	Air	C1 Methane	CO2 Carbon Dioxide	C2= Ethylene	C2 Ethane	
	Gate On	14.0	23.0	23.0	50.0	75.0	75.0	
	Peak Time	19.0	26.0	33.0	60.0	126.0	146.0	
	Gate Off	20.0	38.0	38.0	70.0	160.0	160.0	
	Rise/Run	15/15	15/15	3/30	3/30	3/30	3/30	

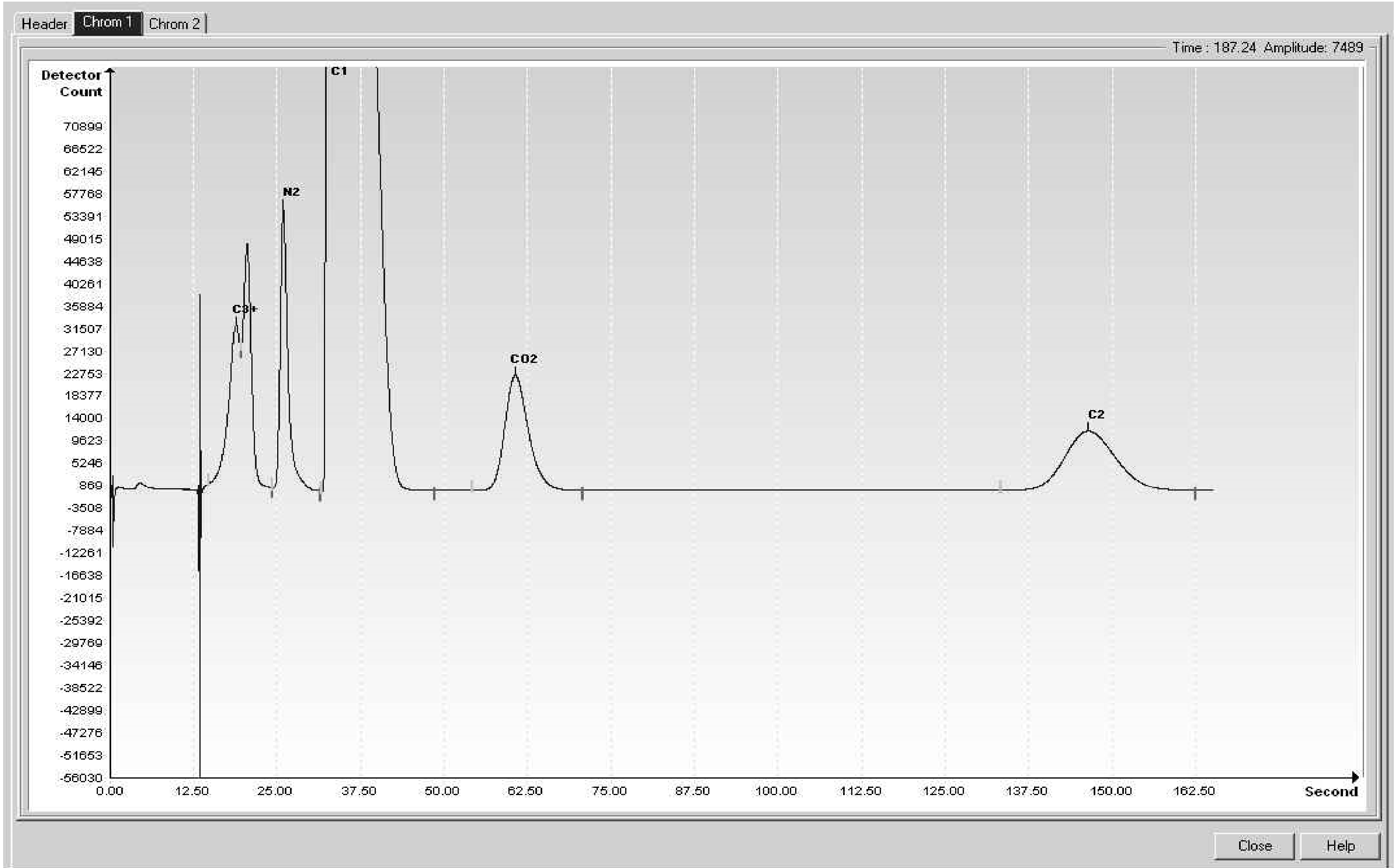


Figure 7-15 BCG Reference Chromatogram

7.18 BCH (C7+, C3 w/H2S meas to C6)

Table 7–48 BCH Column Train Data Sheet (C7+, C3 w/H2S meas to C6)

Carrier Helium **Train** BCH

Part No. 2103000-002 Train BCH. C7+. C3. H2S. IC4. NC4. Neo-C5. IC5. NC5. C6s.

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	540	Seconds	**Carrier Pressure**		48 PSIG
Sort Order	162		**Carrier Pressure Variance**	±	15 %
Sample Size	40	ul	**Flow Rate**		8.6 ML/Min
Target Component	NC6		**Flow Rate Variance**	±	15 %
Target Ret. Time	366	Seconds	**Oven Temperature**		60 Deg. C

Notes When used in conjunction with BBF, the BTU repeatability is +/- 0.25 BTU at room temperature. For temperatures from -18 to 55 degrees Celsius the +/- BTU performance value doubles.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Heptane Plus	0.005	5	2	0.001	18	21	25	6	5	3000	0.75	Auto	Positive	0	0
2	Propane	0.005	50	1	0.001	44	54	62	12	4	3000	0.75	Auto	Positive	0	0
3	Hydrogen Sulfide	0.05	1	3	0.02	63	67	72	14	2	3000	0.75	Auto	Positive	0	0
4	Isobutane	0.005	15	1	0.001	72	76	84	14	2	3000	0.75	Auto	Positive	0	0
5	Normal Butane	0.005	15	1	0.001	84	89	99	14	2	3000	0.75	Auto	Positive	0	0
6	Neopentane	0.005	10	1	0.001	101	107	118	14	2	3000	0.75	Auto	Positive	0	0
7	Isopentane	0.005	10	1	0.001	139	149	161	14	2	3000	0.75	Auto	Positive	0	0
8	Normal Pentane	0.005	10	1	0.002	165	176	189	14	2	3000	0.75	Auto	Positive	0	0
9	Hexanes	0.005	5	5	0.002	200	366	415	12	6	500	0.75	Auto	Positive	0	0

Carrier Hydrogen **Train** BCH

Part No.2103000-002 Train BCH. C7+. C3. H2S. IC4. NC4. Neo-C5. IC5. NC5. C6s.

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	450	Seconds	**Carrier Pressure**		20 PSIG
Sort Order	162		**Carrier Pressure Variance**	±	15 %
Sample Size	40	ul	**Flow Rate**		5.3 ML/Min
Target Component	NC6		**Flow Rate Variance**	±	15 %
Target Ret. Time	371	Seconds	**Oven Temperature**		60 Deg. C

Notes When used in conjunction with BBF, the BTU repeatability is +/- 0.25 BTU at room temperature. For temperatures from -18 to 55 degrees Celsius the +/- BTU performance value doubles.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Heptane Plus	0.05	5	2	0.001	18	22	37	6	5	3000	0.75	Auto	Positive	0	0
2	Propane	0.05	100	1	0.001	51	56	63	12	4	3000	0.75	Auto	Positive	0	0
3	Hydrogen Sulfide	0.05	1	3	0.02	64	70	73	14	2	3000	0.75	Auto	Positive	0	0
4	Isobutane	0.05	15	1	0.001	73	77	84	14	2	3000	0.75	Auto	Positive	0	0
5	Normal Butane	0.05	15	1	0.001	84	90	100	14	2	3000	0.75	Auto	Positive	0	0
6	Neopentane	0.05	10	1	0.001	100	106	121	14	2	3000	0.75	Auto	Positive	0	0
7	Isopentane	0.05	10	1	0.001	138	147	161	14	2	3000	0.75	Auto	Positive	0	0
8	Normal Pentane	0.05	10	1	0.002	163	173	189	14	2	3000	0.75	Auto	Positive	0	0
9	Hexanes	0.01	5	5	0.002	200	371	410	12	6	500	0.75	Auto	Positive	0	0

Need Sample Blend Information

Table 7–49 BCH Column - Data for Manual Peak Find

		Target Component	Target Time		Inject Time	Col. Press.	Cyc. Time	
Helium Carrier		Hexanes (C6s)	366 seconds		15 seconds	48 psig	540 seconds	
		C7+ Heptane Plus+	**C3 Propane**	**H2S Hydrogen Sulfide**	**IC4 IsoButane**	**NC4 Normal Butane**	**neoC5 Neo Pentane**	**IC5 IsoPentane**
	Gate On	18.0	44.0	63.0	72.0	84.0	101.0	139.0
	Peak Time	21.0	54.0	67.0	76.0	89.0	107.0	149.0
	Gate Off	25.0	62.0	72.0	84.0	99.0	118.0	161.0
	Rise/Run	5/6	4/12	2/14	2/14	2/14	2/14	2/14
		NC5 Normal Pentane	**C6s Hexanes**					
	Gate On	165.0	200.0					
	Peak Time	176.0	366.0					
	Gate Off	189.0	415.0					
	Rise/Run	2/14	6/12					

BCH Column - Data for Manual Peak Find, Cont.

Hydrogen Carrier		Target Component		Target Time	Inject Time	Col. Press.	Cyc. Time	
		Hexanes (C6s)		371 seconds	15 seconds	20 psig	450 seconds	
		C7+ Heptane Plus+	**C3 Propane**	**H2S Hydrogen Sulfide**	**IC4 IsoButane**	**NC4 Normal Butane**	**neoC5 Neo Pentane**	**IC5 IsoPentane**
	Gate On	18.0	51.0	64.0	73.0	84.0	100.0	138.0
	Peak Time	22.0	56.0	70.0	77.0	90.0	106.0	147.0
	Gate Off	37.0	63.0	73.0	84.0	100.0	121.0	161.0
	Rise/Run	5/6	4/12	2/14	2/14	2/14	2/14	2/14
		NC5 Normal Pentane	**C6s Hexanes**					
	Gate On	163.0	200.0					
	Peak Time	173.0	371.0					
	Gate Off	189.0	410.0					
	Rise/Run	2/14	6/12					

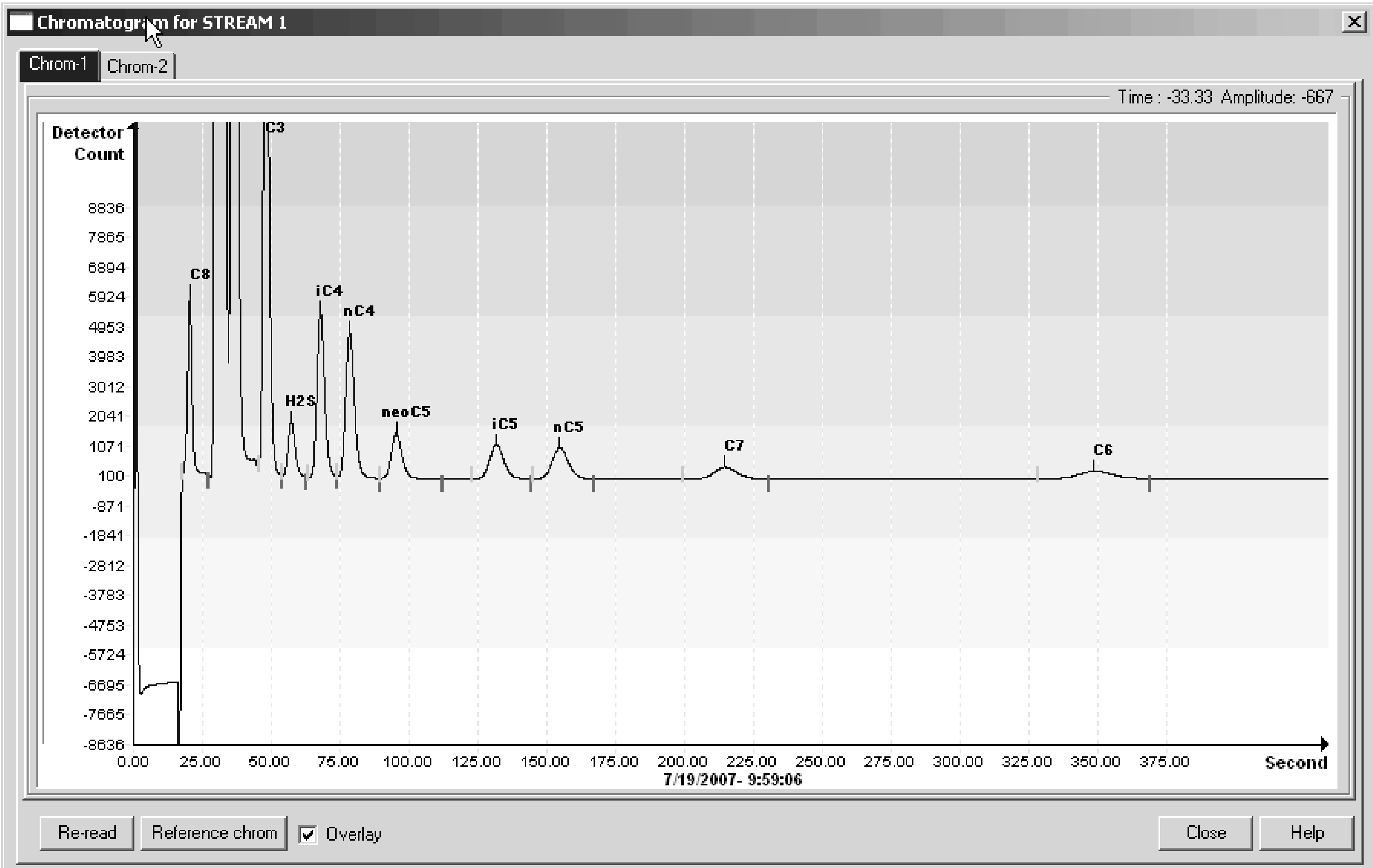


Figure 7-16 BCH Helium Reference Chromatogram

7.19 BCM (H2S 0-30 ppm)

Table 7–50 BCM Column Train Data Sheet (H2S 0-30 ppm)

Carrier Helium **Train** BCM

Part No.2102999-002 Train BCM. H2S 0-30 ppm

Cycle Time	150	Seconds
Sort Order	142	
Sample Size	1483	ul
Target Component	H2S	
Target Ret. Time	125	Seconds

Inject Time		16 Seconds
Inject Time Variance	±	10 %
Carrier Pressure		21 PSIG
Carrier Pressure Variance	±	15 %
Flow Rate		6.5 ML/Min
Flow Rate Variance	±	15 %
Oven Temperature		60 Deg. C

Notes This train can be utilized to provide H2S in Fuel Gas with a lower low ppm H2S limit but still capable of performing to levels required by CFR 60. Due to the low levels of H2S measured the following items are recommended in order to insure proper performance. Calibration and carrier regulators should be stainless steel with stainless steel diaphragms. Connective tubing for calibration gas and streams should be Sulfinert or the equivalent. Brass parts cannot be used in sample wetted paths. At startup the system should be leak tested. Liquid leak detection fluids should not be used on this system. Electronic leak detectors or a pressure method are recommended. A moisture trap is recommended for the carrier bottle(s). Expected performance should provide H2S +/- 3 ppm, or better.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Hydrogen Sulfide	0.0002	1	10	0.0002	110	125	140.5	15	3	300	0.9	Auto	Positive	0	0

Carrier Hydrogen **Train** BCM

Part No. 2102999-002 Train BCM. H2S 0-30 ppm

			Inject Time		16	Seconds
			Inject Time Variance	±	10	%
Cycle Time	120	Seconds	**Carrier Pressure**		13	PSIG
Sort Order	142		**Carrier Pressure Variance**	±	15	%
Sample Size	1483	ul	**Flow Rate**		7.6	ML/Min
Target Component	H2S		**Flow Rate Variance**	±	15	%
Target Ret. Time	105	Seconds	**Oven Temperature**		60	Deg. C

Notes This train can be utilized to provide H2S in Fuel Gas with a lower low ppm H2S limit but still capable of performing to levels required by CFR 60. Due to the low levels of H2S measured the following items are recommended in order to insure proper performance. Calibration and carrier regulators should be stainless steel with stainless steel diaphragms. Connective tubing for calibration gas and streams should be Sulfinert or the equivalent. Brass parts cannot be used in sample wetted paths. At startup the system should be leak tested. Liquid leak detection fluids should not be used on this system. Electronic leak detectors or a pressure method are recommended. A moisture trap is recommended for the carrier bottle(s). The expected performance for H2S is +/- 3 ppm, or better.

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Hydrogen Sulfide	0.0002	1	10	0.0002	92	105	115	15	3	300	0.9	Auto	Positive	0	0

Table 7–51 BCM Blend

Component	Blend (mole %)
C3 (Propane)	5.08
C1 (Methane)	35.12
H2S (Hydrogen Sulfide)	0.0004
N2 (Nitrogen)	0.01
C2 (Ethane)	59.79
Note: These components have not been normalized.	

Table 7–52 BCM Column - Data for Manual Peak Find

		Target Component	Target Time		Inject Time	Col. Press.		Cyc. Time
Helium Carrier		Hydrogen Sulfide (H2S)	125 seconds		16 seconds	21 psig		150 seconds
		H2S Hydrogen Sulfide						
	Gate On	110.0						
	Peak Time	125.0						
	Gate Off	140.5						
	Rise/Run	3/15						

BCM Column - Data for Manual Peak Find, Cont.

		Target Component		**Target Time**	**Inject Time**	**Col. Press.**		**Cyc. Time**
		Hydrogen Sulfide (H2S)		105 seconds	16 seconds	13 psig		120 seconds
Hydrogen Carrier		**H2S Hydrogen Sulfide**						
	Gate On	92.0						
	Peak Time	105.0						
	Gate Off	115.0						
	Rise/Run	3/5						

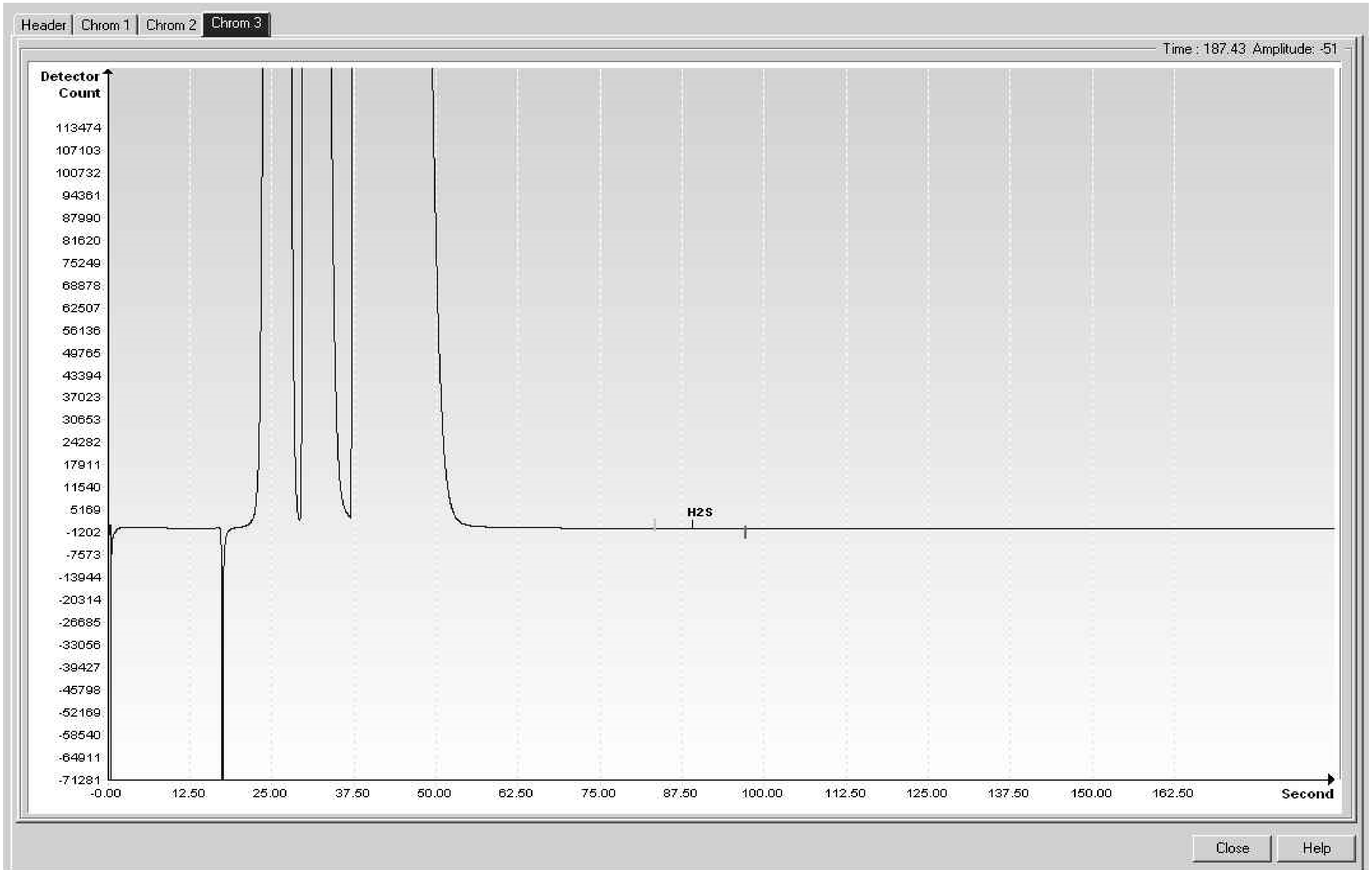


Figure 7-17 BCM Helium Reference Chromatogram

7.20 BBP (30-2000 ppm O2 w/N2 & HCS)

Table 7–53 BBP Column Train Data Sheet (30-2000 ppm O2 w/N2 & HCS)

Carrier Helium **Train** BBP

Part No. 2102998-001 Train BBP. 30-2000 ppm O2 W/N2 & HCS

Cycle Time	330	Seconds
Sort Order	121	
Sample Size	815	ul
Target Component	O2	
Target Ret. Time	247	Seconds
Notes	30-2000 ppm Oxygen	

Inject Time		15 Seconds
Inject Time Variance	±	10 %
Carrier Pressure		40 PSIG
Carrier Pressure Variance	±	15 %
Flow Rate		5.4 ML/Min
Flow Rate Variance	±	15 %
Oven Temperature		60 Deg. C

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Oxygen	0.003	0.2	3	0.0003	220	248	290	100	1	100	0.75	Auto	Positive	310	312

Table 7–54 BBP Blend

Component	Blend (mole %)
C3 (Propane)	1.033
C1 (Methane)	89.56
N2 (Nitrogen)	3.27
C2 (Ethane)	3.16
CO2 (Carbon Dioxide)	1.02
IC4 (Iso Butane)	0.309
NC4 (Normal Butane)	0.311
IC5 (Iso Pentane)	0.103
NeoC5 (Neo Pentane)	0.114
NC5 (Normal Pentane)	0.103
C6 (Hexane)	0.012
C2 (Ethane)	3.157
C7 (Heptane)	0.010
C8 (Octane)	0.003
C9 (Nonane)	0.003
Note: These components have not been normalized.	

Table 7–55 BBP Column - Data for Manual Peak Find

Helium Carrier		**Target Component**	**Target Time**		**Inject Time**	**Col. Press.**		**Cyc. Time**
		Oxygen (O2)	247 seconds		15 seconds	40 psig		330 seconds
		O2 Oxygen						
	Gate On	220.0						
	Peak Time	248.0						
	Gate Off	290.0						
	Rise/Run	1/100						

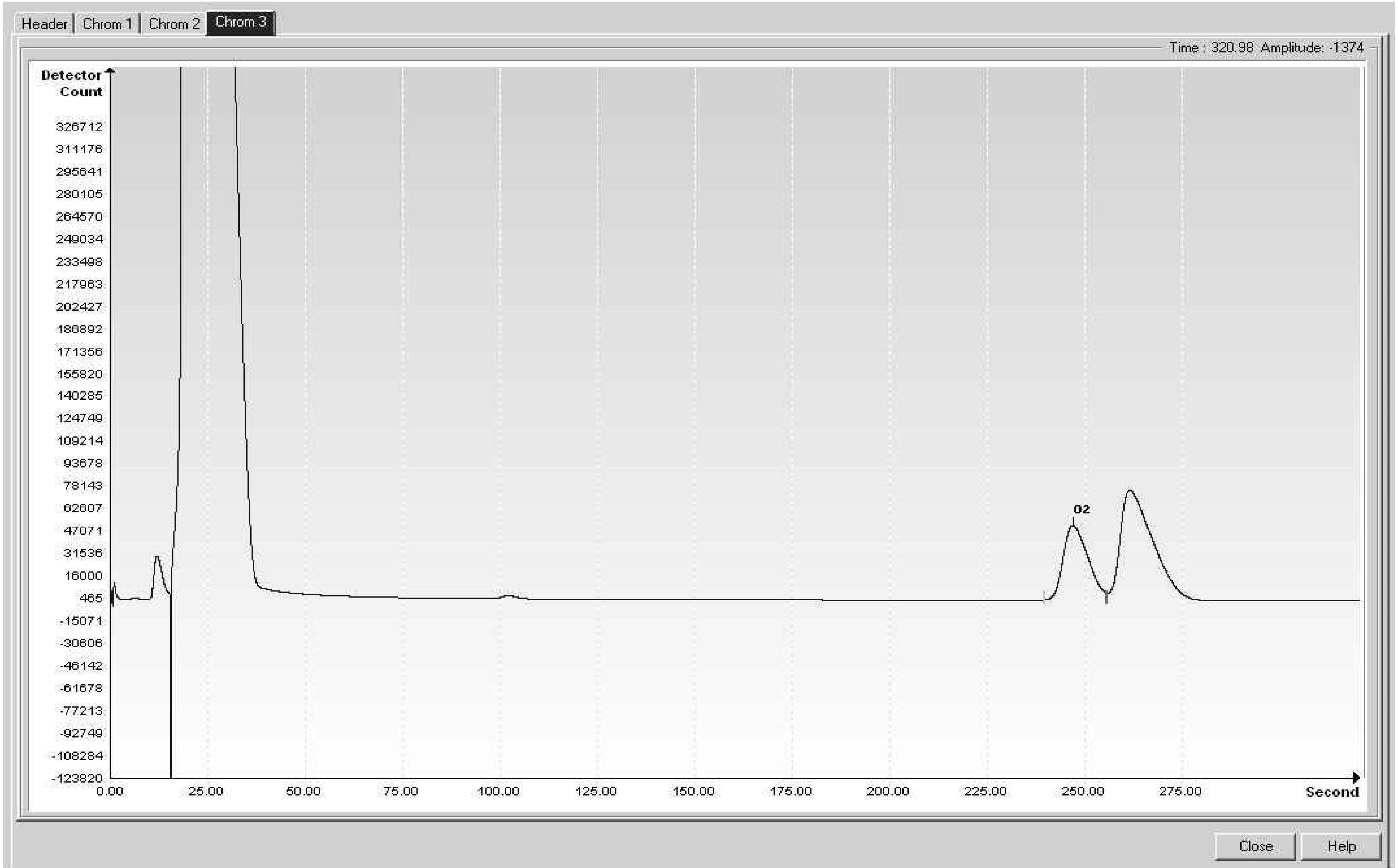


Figure 7-18 BBP Helium Reference Chromatogram

7.21 BBW (0-30 ppm O2 w/N2 & HCS)

Table 7–56 BBW Column Train Data Sheet (0-30 ppm O2 w/N2 & HCS)

Carrier Helium **Train** BBW

Part No. 2102998-002 Train BBW. 0-30 ppm O2 W/N2 & HCS

			Inject Time		15 Seconds
			Inject Time Variance	±	10 %
Cycle Time	330	Seconds	**Carrier Pressure**		40 PSIG
Sort Order	221		**Carrier Pressure Variance**	±	15 %
Sample Size	815	ul	**Flow Rate**		5.4 ML/Min
Target Component	O2		**Flow Rate Variance**	±	15 %
Target Ret. Time	247	Seconds	**Oven Temperature**		60 Deg. C
Notes	Maximum allowed N2 is 4%				

Stream Components

Component Number	Component	Range Bottom	Range Top	Repeat (±%)	MDL	Gate On	Peak Retention Time	Gate Off	Slope (Run)	Slope (Rise)	Minimum Peak Area	Front Height Ratio	Peak Detection Method	Peak Direction	Baseline Segment Start	Baseline Segment End
1	Oxygen	0.0002	0.003	25	0.0002	228	247	290	100	1	100	0.75	Auto	Positive	310	312

Table 7–57 BBW Blend

Component	Blend (mole %)
?C3 (Propane)	1.033
C1 (Methane)	89.56
N2 (Nitrogen)	3.27
C2 (Ethane)	3.16
CO2 (Carbon Dioxide)	1.02
IC4 (Iso Butane)	0.309
NC4 (Normal Butane)	0.311
IC5 (Iso Pentane)	0.103
NeoC5 (Neo Pentane)	0.114
NC5 (Normal Pentane)	0.103
C6 (Hexane)	0.012
C2 (Ethane)	3.157
C7 (Heptane)	0.010
C8 (Octane)	0.003
C9 (Nonane)	0.003
Note: These components have not been normalized.	

Table 7–58 BBW Column - Data for Manual Peak Find

Helium Carrier		Target Component	Target Time		Inject Time	Col. Press.		Cyc. Time
		Oxygen (O2)	247 secs		15 secs	40 psig		330 secs
		O2 Oxygen						
	Gate On	228.0						
	Peak Time	247.0						
	Gate Off	290.0						
	Rise/Run	1/100						

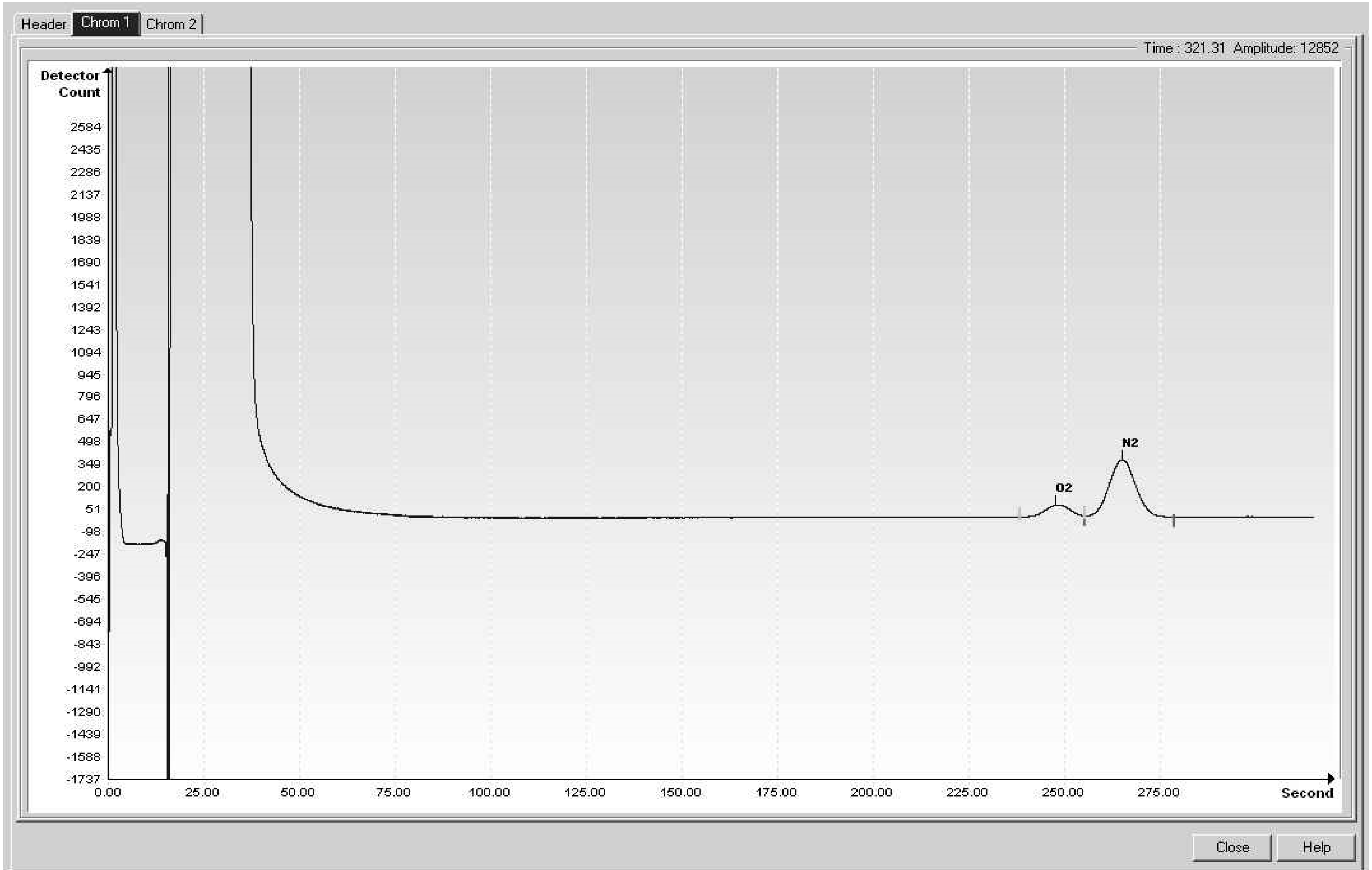


Figure 7-19 BBW Helium Reference Chromatogram

APPENDIX A MODBUS® REGISTERS

Modbus® Reg # 32-bit	16-bit	Input Reg	Description
Component Index for Stream			
3001	3001	51.200.0	Component Table #1 Component Index #1(C3)
3002	3002	51.200.1	Component Table #1 Component Index #2(IC4)
3003	3003	51.200.2	Component Table #1 Component Index #3(NC4)
3004	3004	51.200.3	Component Table #1 Component Index #4(Neo C5)
3005	3005	51.200.4	Component Table #1 Component Index #5(IC5)
3006	3006	51.200.5	Component Table #1 Component Index #6(NC5)
3007	3007	51.200.6	Component Table #1 Component Index #7(C6+)
3008	3008	51.200.7	Component Table #1 Component Index #8(N2)
3009	3009	51.200.8	Component Table #1 Component Index #9(C1)
3010	3010	51.200.9	Component Table #1 Component Index #10(CO2)
3011	3011	51.200.10	Component Table #1 Component Index #11(C2)
3012	3012	51.200.11	Component Table #1 Component Index #12(C6s)
3013	3013	51.200.12	Component Table #1 Component Index #13(C7s)
3014	3014	51.200.13	Component Table #1 Component Index #14(C8s)
3015	3015	51.200.14	Component Table #1 Component Index #15(C9s)
3016	3016	51.200.15	Component Table #1 Component Index #16(Spare)
3017	3017	51.200.0	Component Table #2 Component Index #1
3018	3018	51.200.1	Component Table #2 Component Index #2
3019	3019	51.200.2	Component Table #2 Component Index #3
3020	3020	51.200.3	Component Table #2 Component Index #4
3021	3021	51.200.4	Component Table #2 Component Index #5
3022	3022	51.200.5	Component Table #2 Component Index #6
3023	3023	51.200.6	Component Table #2 Component Index #7
3024	3024	51.200.7	Component Table #2 Component Index #8
3025	3025	51.200.8	Component Table #2 Component Index #9
3026	3026	51.200.9	Component Table #2 Component Index #10
3027	3027	51.200.10	Component Table #2 Component Index #11
3028	3028	51.200.11	Component Table #2 Component Index #12
3029	3029	51.200.12	Component Table #2 Component Index #13
3030	3030	51.200.13	Component Table #2 Component Index #14
3031	3031	51.200.14	Component Table #2 Component Index #15
3032	3032	51.200.15	Component Table #2 Component Index #16
3033	3033	51.201.1	Analysis Time (in1/30ths of 1 second) (N/A)
3034	3034	51.201.0	Current Stream Number(15.0.28)
3035	3035	51.201.1	Mask of streams associated with Component Table 41 (N/A)
3036	3036	51.201.3	Current Month (1-12) (15.1.8)
3037	3037	51.201.4	Current Day (1-31) (15.1.9)
3038	3038	51.201.5	Current Year (0-99) (15.1.10)

3039	3039	51.201.6	Current Hour (0-24) (15.1.11)
3040	3040	51.201.7	Current Minutes (0-59) (15.1.12)
3041	3041	51.201.8	Cycle Start Month (1-12) (15.1.13)
3042	3042	51.201.9	Cycle Start Day (1-31) (15.1.14)
3043	3043	51.201.10	Cycle Start Year (0-99) (15.1.15)
3044	3044	51.201.11	Cycle Start Hour (0-24) (15.1.16)
3045	3045	51.201.12	Cycle Start Minutes (0-59) (15.1.17)
3046	3046	51.201.42	Bit Flags Transmitter
3047	3047	51.201.43	Bit Flags Transmitter
3048	3048	51.201.1	Bit Flags Stream #1 Low (N/A)
3049	3049	51.201.1	Bit Flags Stream #1 High (N/A)
3050	3050	51.201.1	Bit Flags Stream #2 Low (N/A)
3051	3051	51.201.1	Bit Flags Stream #2 High (N/A)
3052	3052	51.201.1	Bit Flags Stream #3 Low (N/A)
3053	3053	51.201.1	Bit Flags Stream #3 High (N/A)
3054	3054	51.201.1	Bit Flags Stream #4 Low (N/A)
3055	3055	51.201.1	Bit Flags Stream #4 High (N/A)
3056	3056	51.201.1	Bit Flags Stream #5 Low (N/A)
3057	3057	51.201.1	Bit Flags Stream #5 High (N/A)
Int16 for Stream			
3058	3058	51.201.2	New Data Flag(15.1.7)
3059	3059	51.201.13	Cal/Analysis Flag(15.1.18)
3060	3060	51.201.32	Read the Current State (19.1.0)
3061	3061	51.201.33	Read the Next State (19.1.0)
3062	3062	51.201.1	Auto Calibration During Start-up (N/A)
3063	3063	51.201.22	Alternate Purge Cycles (15.0.24)
3064	3064	51.201.23	Alternate Calibration Cycles (15.0.19)
3065	3065	51.201.24	Number of Purge Cycles (15.0.23)
3066	3066	51.201.25	Number of Calibration Cycles (15.0.18)
3067	3067	51.201.1	Low Carrier Mode (N/A)
3068	3068	51.201.1	Low Power Mode (N/A)
3069	3069	51.201.1	Pre-Purge Selection (Future)
3070	3070	51.201.1	Normal Status (N/A)
3071	3071	51.201.1	Fault Status (N/A)
3072	3072	51.201.26	Carrier Bottle Low (DI1) (11.0.0)
3073	3073	51.201.27	Calibration Bottle Low (DI2) (11.0
3074	3074	51.201.1	Manual Update Response Factors (N/A)
3075	3075	51.201.1	Auto Update Response Factors (N/A)
3076	3076	51.201.1	Disable Stream Switching (N/A)
3077	3077	51.201.1	Transmitter Current Warning (N/A)
3078	3078	51.201.1	Transmitter Current Fault (N/A)

3079	3079	51.201.1	Transmitter Initial Warning (N/A)
3080	3080	51.201.1	Transmitter Initial Fault (N/A)
3081	3081	51.201.18	Stream #1 Current Warning (15.128.1)
3082	3082	51.201.19	Stream #2 Current Warning (16.128.1)
3083	3083	51.201.20	Stream #3 Current Warning (17.128.1)
3084	3084	51.201.21	Stream #4 Current Warning (18.128.1)
3085	3085	51.201.14	Stream #1 Current Fault (15.128.0)
3086	3086	51.201.15	Stream #2 Current Fault (16.128.0)
3087	3087	51.201.16	Stream #3 Current Fault (17.128.0)
3088	3088	51.201.17	Stream #4 Current Fault (18.128.0)
3089	3089	51.201.38	Stream #1 Initial Warning (15.128.3)
3090	3090	51.201.39	Stream #2 Initial Warning (16.128.3)
3091	3091	51.201.40	Stream #3 Initial Warning (17.128.3)
3092	3092	51.201.41	Stream #4 Initial Warning (18.128.3)
3093	3093	51.201.34	Stream #1 Initial Fault (15.128.2)
3094	3094	51.201.35	Stream #2 Initial Fault (16.128.2)
3095	3095	51.201.36	Stream #3 Initial Fault (17.128.2)
3096	3096	51.201.37	Stream #4 Initial Fault (18.128.2)
3097	3097	51.201.28	Stream #1 Skip Flag (19.0.7)
3098	3098	51.201.29	Stream #2 Skip Flag (19.0.8)
3099	3099	51.201.30	Stream #3 Skip Flag (19.0.9)
3100	3100	51.201.31	Stream #4 Skip Flag (19.0.10)
5001	5001	51.208.2	Cycle Clock (19.2.2)
5002	5003	51.208.1	Cycle Time (19.2.1)
5003	5005	51.208.0	Detector 0 (N/A))
5004	5007	51.208.0	Detector 1 (N/A))
5005	5009	51.208.0	Detector 2 (N/A)
5006	5011	51.208.0	Detector 3 (N/A)
Mole % for Stream			
7001	7001	51.203.0	Mole % - Component #1
7002	7003	51.203.1	Mole % - Component #2
7003	7005	51.203.2	Mole % - Component #3
7004	7007	51.203.3	Mole % - Component #4
7005	7009	51.203.4	Mole % - Component #5
7006	7011	51.203.5	Mole % - Component #6
7007	7013	51.203.6	Mole % - Component #7
7008	7015	51.203.7	Mole % - Component #8
7009	7017	51.203.8	Mole % - Component #9
7010	7019	51.203.9	Mole % - Component #10
7011	7021	51.203.10	Mole % - Component #11
7012	7023	51.203.11	Mole % - Component #12

7013	7025	51.203.12	Mole % - Component #13
7014	7027	51.203.13	Mole % - Component #14
7015	7029	51.203.14	Mole % - Component #15
7016	7031	51.203.15	Mole % - Component #16
GPM % for Stream			
7017	7033	51.204.0	GPM % - Component #1
7018	7035	51.204.1	GPM % - Component #2
7019	7037	51.204.2	GPM % - Component #3
7020	7039	51.204.3	GPM % - Component #4
7021	7041	51.204.4	GPM % - Component #5
7022	7043	51.204.5	GPM % - Component #6
7023	7045	51.204.6	GPM % - Component #7
7024	7047	51.204.7	GPM % - Component #8
7025	7049	51.204.8	GPM % - Component #9
7026	7051	51.204.9	GPM % - Component #10
7027	7053	51.204.10	GPM % - Component #11
7028	7055	51.204.11	GPM % - Component #12
7029	7057	51.204.12	GPM % - Component #13
7030	7059	51.204.13	GPM % - Component #14
7031	7061	51.204.14	GPM % - Component #15
7032	7063	51.204.15	GPM % - Component #16
Floats for Stream			
7033	7065	51.202.0	BTU - Dry(15.4.5)
7034	7067	51.202.1	BTU - Saturated(15.4.6)
7035	7069	51.202.2	Specific Gravity(15.4.9)
7036	7071	51.202.3	Compressibility(15.4.11)
7037	7073	51.202.4	WOBBE Index(15.4.7)
7038	7075	51.202.6	Total UN-normalized mole(15.4.12)
7039	7077	51.202.13	Total GPM (15.4.13)
7040	7079	51.202.8	Ideal BTU (15.4.4)
7041	7081	51.202.9	Density Normal (15.4.10)
7042	7083	51.202.10	Inferior WOBBE (15.4.8)
7043	7085	51.202.11	Methane Number (15.4.27)
7044	7087	51.202.12	Speed of Sound (15.4.54)
7045	7089	51.241.0	Rolling Average #1
7046	7091	51.241.1	Rolling Average #2
7047	7093	51.241.2	Rolling Average #3
7048	7095	51.241.3	Rolling Average #4

7049	7097	51.241.4	Rolling Average #5
7050	7099	51.241.5	Rolling Average #6
7051	7101	51.241.6	Rolling Average #7
7052	7103	51.241.7	Rolling Average #8
7053	7105	51.241.8	Rolling Average #9
7054	7107	51.241.9	Rolling Average #10
7055	7109	51.241.10	Rolling Average #11
7056	7111	51.241.11	Rolling Average #12
7057	7113	51.241.12	Rolling Average #13
7058	7115	51.241.13	Rolling Average #14
7059	7117	51.241.14	Rolling Average #15
7060	7119	51.241.15	Rolling Average #16
7061	7121	51.206.0	24 Hour Average for Component #1
7062	7123	51.206.1	24 Hour Average for Component #2
7063	7125	51.206.2	24 Hour Average for Component #3
7064	7127	51.206.3	24 Hour Average for Component #4
7065	7129	51.206.4	24 Hour Average for Component #5
7066	7131	51.206.5	24 Hour Average for Component #6
7067	7133	51.206.6	24 Hour Average for Component #7
7068	7135	51.206.7	24 Hour Average for Component #8
7069	7137	51.206.8	24 Hour Average for Component #9
7070	7139	51.206.9	24 Hour Average for Component #10
7071	7141	51.206.10	24 Hour Average for Component #11
7072	7143	51.206.11	24 Hour Average for Component #12
7073	7145	51.206.12	24 Hour Average for Component #13
7074	7147	51.206.13	24 Hour Average for Component #14
7075	7149	51.206.14	24 Hour Average for Component #15
7076	7151	51.206.15	24 Hour Average for Component #16
7077	7153	51.207.0	Previous 24 Hour Average for Component #1
7078	7155	51.207.1	Previous 24 Hour Average for Component #2
7079	7157	51.207.2	Previous 24 Hour Average for Component #3
7080	7159	51.207.3	Previous 24 Hour Average for Component #4
7081	7161	51.207.4	Previous 24 Hour Average for Component #5
7082	7163	51.207.5	Previous 24 Hour Average for Component #6
7083	7165	51.207.6	Previous 24 Hour Average for Component #7
7084	7167	51.207.7	Previous 24 Hour Average for Component #8
7085	7169	51.207.8	Previous 24 Hour Average for Component #9
7086	7171	51.207.9	Previous 24 Hour Average for Component #10
7087	7173	51.207.10	Previous 24 Hour Average for Component #11
7088	7175	51.207.11	Previous 24 Hour Average for Component #12
7089	7177	51.207.12	Previous 24 Hour Average for Component #13
7090	7179	51.207.13	Previous 24 Hour Average for Component #14

7091	7181	51.207.14	Previous 24 Hour Average for Component #15
7092	7183	51.207.15	Previous 24 Hour Average for Component #16
7093	7185	51.244.44	Rolling Average BTU - Dry
7094	7187	51.244.39	Rolling Average BTU - Sat
7095	7189	51.244.51	Rolling Average Specific Gravity
7096	7191	51.244.40	Rolling Average Compressibility
7097	7193	51.244.41	Rolling Average Superior Wobbe
7098	7195	51.244.47	Rolling Average Total Un-Normalized Mole
7099	7197	51.244.48	Rolling Average Total GPM
7100	7199	51.244.50	Rolling Average Ideal BTU
7101	7201	51.244.46	Rolling Average Density Normal
7102	7203	51.245.44	24 Hour Average for BTU - Dry
7103	7205	51.245.39	24 Hour Average for BTU - Sat
7104	7207	51.245.51	24 Hour Average for Specific Gravity
7105	7209	51.245.40	24 Hour Average for Compressibility
7106	7211	51.245.41	24 Hour Average for Superior Wobbe
7107	7213	51.245.47	24 Hour Average for Total Un-Normalized Mole
7108	7215	51.245.48	24 Hour Average for Total GPM
7109	7217	51.245.50	24 Hour Average for Ideal BTU
7110	7219	51.245.46	24 Hour Average for Density Normal
7111	7221	51.246.44	Previous 24 Hour Average for BTU - Dry
7112	7223	51.246.39	Previous 24 Hour Average for BTU - Sat
7113	7225	51.246.51	Previous 24 Hour Average for Specific Gravity
7114	7227	51.246.40	Previous 24 Hour Average for Compressibility
7115	7229	51.246.41	Previous 24 Hour Average for Superior Wobbe
7116	7231	51.246.47	Previous 24 Hour Average for Total Un-Normalized Mole
7117	7233	51.246.48	Previous 24 Hour Average for Total GPM
7118	7235	51.246.50	Previous 24 Hour Average for Ideal BTU
7119	7237	51.246.46	Previous 24 Hour Average for Density Normal
7120-7199	N/A	51.202.7	(N/A)
Floating Point Register Group - Transmitter			
7200	7399	51.202.7	Ground Reference (N/A)
7201	7401	51.202.18	Power (12.247.9)
7202	7403	51.202.19	Mandrel Temp (12.247.7)
7203	7405	51.202.20	Column 1 Pressure (12.247.5)
7204	7407	51.202.21	Column 2 Pressure (12.247.6)
7205	7409	51.202.7	Analog Input #6 - Spare (N/A)

7206	7411	51.202.7	Ambient Temp (N/A)
7207	7413	51.202.7	Voltage Reference (N/A)
7208	7415	51.202.7	(N/A)
7209	7417	51.233.0	Calibration Standard - Component #1 (15.31.0)
7210	7419	51.233.1	Calibration Standard - Component #2 (15.31.1)
7211	7421	51.233.2	Calibration Standard - Component #3 (15.31.2)
7212	7423	51.233.3	Calibration Standard - Component #4 (15.31.3)
7213	7425	51.233.4	Calibration Standard - Component #5 (15.31.4)
7214	7427	51.233.5	Calibration Standard - Component #6 (15.31.5)
7215	7429	51.233.6	Calibration Standard - Component #7 (15.31.6)
7216	7431	51.233.7	Calibration Standard - Component #8 (15.31.7)
7217	7433	51.233.8	Calibration Standard - Component #9 (15.31.8)
7218	7435	51.233.9	Calibration Standard - Component #10 (15.31.9)
7219	7437	51.233.10	Calibration Standard - Component #11 (15.31.10)
7220	7439	51.233.11	Calibration Standard - Component #12 (15.31.11)
7221	7441	51.233.12	Calibration Standard - Component #13 (15.31.12)
7222	7443	51.233.13	Calibration Standard - Component #14 (15.31.13)
7223	7445	51.233.14	Calibration Standard - Component #15 (15.31.14)
7224	7447	51.233.15	Calibration Standard - Component #16 (15.31.15)
7225	7449	51.205.0	Response Factor - Component #1 (15.5.0)
7226	7451	51.205.1	Response Factor - Component #2 (15.5.1)
7227	7453	51.205.2	Response Factor - Component #3 (15.5.2)
7228	7455	51.205.3	Response Factor - Component #4 (15.5.3)
7229	7457	51.205.4	Response Factor - Component #5 (15.5.4)
7230	7459	51.205.5	Response Factor - Component #6 (15.5.5)
7231	7461	51.205.6	Response Factor - Component #7 (15.5.6)
7232	7463	51.205.7	Response Factor - Component #8 (15.5.7)
7233	7465	51.205.8	Response Factor - Component #9 (15.5.8)
7234	7467	51.205.9	Response Factor - Component #10 (15.5.9)
7235	7469	51.205.10	Response Factor - Component #11 (15.5.10)
7236	7471	51.205.11	Response Factor - Component #12 (15.5.11)
7237	7473	51.205.12	Response Factor - Component #13 (15.5.12)
7238	7475	51.205.13	Response Factor - Component #14 (15.5.13)
7239	7477	51.205.14	Response Factor - Component #15 (15.5.14)
7240	7479	51.205.15	Response Factor - Component #16 (15.5.15)
7241	7481	51.239.0	Alt Calibration Standard - Component #1 (15.40.0)
7242	7483	51.239.1	Alt Calibration Standard - Component #2 (15.40.1)
7243	7485	51.239.2	Alt Calibration Standard - Component #3 (15.40.2)

7244	7487	51.239.3	Alt Calibration Standard - Component #4 (15.40.3)
7245	7489	51.239.4	Alt Calibration Standard - Component #5 (15.40.4)
7246	7491	51.239.5	Alt Calibration Standard - Component #6 (15.40.5)
7247	7493	51.239.6	Alt Calibration Standard - Component #7 (15.40.6)
7248	7495	51.239.7	Alt Calibration Standard - Component #8 (15.40.7)
7249	7497	51.239.8	Alt Calibration Standard - Component #9 (15.40.8)
7250	7499	51.239.9	Alt Calibration Standard - Component #10 (15.40.9)
7251	7501	51.239.10	Alt Calibration Standard - Component #11 (15.40.10)
7252	7503	51.239.11	Alt Calibration Standard - Component #12 (15.40.11)
7253	7505	51.239.12	Alt Calibration Standard - Component #13 (15.40.12)
7254	7507	51.239.13	Alt Calibration Standard - Component #14 (15.40.13)
7255	7509	51.239.14	Alt Calibration Standard - Component #15 (15.40.14)
7256	7511	51.239.15	Alt Calibration Standard - Component #16 (15.40.15)
7257	7513	51.240.0	Alt Response Factor - Component #1 (15.43.0)
7258	7515	51.240.1	Alt Response Factor - Component #2 (15.43.1)
7259	7517	51.240.2	Alt Response Factor - Component #3 (15.43.2)
7260	7519	51.240.3	Alt Response Factor - Component #4 (15.43.3)
7261	7521	51.240.4	Alt Response Factor - Component #5 (15.43.4)
7262	7523	51.240.5	Alt Response Factor - Component #6 (15.43.5)
7263	7525	51.240.6	Alt Response Factor - Component #7 (15.43.6)
7264	7527	51.240.7	Alt Response Factor - Component #8 (15.43.7)
7265	7529	51.240.8	Alt Response Factor - Component #9 (15.43.8)
7266	7531	51.240.9	Alt Response Factor - Component #10 (15.43.9)
7267	7533	51.240.10	Alt Response Factor - Component #11 (15.43.10)
7268	7535	51.240.11	Alt Response Factor - Component #12 (15.43.11)
7269	7537	51.240.12	Alt Response Factor - Component #13 (15.43.12)
7270	7539	51.240.13	Alt Response Factor - Component #14 (15.43.13)
7271	7541	51.240.14	Alt Response Factor - Component #15 (15.43.14)
7272	7543	51.240.15	Alt Response Factor - Component #16 (15.43.15)
7273	7346	51.202.14	Detector 0 value (12.247.0)
7274	7348	51.202.15	Detector 1 value (12.247.1)
7275	7350	51.202.16	Detector 2 value (12.247.2)
7276	7352	51.202.17	Detector 3 value (12.247.3)
7277 - 7400	N/A	51.202.7	N/A
Registers 7400-7599 are for stream #1			
7401	7801	51.210.0	Mole % - Component #1(C3)

7402	7803	51.210.1	Mole % - Component #2(IC4)
7403	7805	51.210.2	Mole % - Component #3(NC4)
7404	7807	51.210.3	Mole % - Component #4(Neo C5)
7405	7809	51.210.4	Mole % - Component #5(IC5)
7406	7811	51.210.5	Mole % - Component #6(NC5)
7407	7813	51.210.6	Mole % - Component #7(C6+)
7408	7815	51.210.7	Mole % - Component #8(N2)
7409	7817	51.210.8	Mole % - Component #9(C1)
7410	7819	51.210.9	Mole % - Component #10(C02)
7411	7821	51.210.10	Mole % - Component #11(C2)
7412	7823	51.210.11	Mole % - Component #12(C6s)
7413	7825	51.210.12	Mole % - Component #13(C7s)
7414	7827	51.210.13	Mole % - Component #14(C8)
7415	7829	51.210.14	Mole % - Component #15(C9)
7416	7831	51.210.15	Mole % - Component #16(spare)
7417	7833	51.211.0	GPM % - Component #1
7418	7835	51.211.1	GPM % - Component #2
7419	7837	51.211.2	GPM % - Component #3
7420	7839	51.211.3	GPM % - Component #4
7421	7841	51.211.4	GPM % - Component #5
7422	7843	51.211.5	GPM % - Component #6
7423	7845	51.211.6	GPM % - Component #7
7424	7847	51.211.7	GPM % - Component #8
7425	7849	51.211.8	GPM % - Component #9
7426	7851	51.211.9	GPM % - Component #10
7427	7853	51.211.10	GPM % - Component #11
7428	7855	51.211.11	GPM % - Component #12
7429	7857	51.211.12	GPM % - Component #13
7430	7859	51.211.13	GPM % - Component #14
7431	7861	51.211.14	GPM % - Component #15
7432	7863	51.211.15	GPM % - Component #16
	7865		
7433	7867	51.209.0	BTU - Dry
7434	7869	51.209.1	BTU - Saturated
7435	7871	51.209.2	Specific Gravity
7436	7873	51.209.3	Compressibility
7437	7875	51.209.4	WOBBE Index
7438	7877	51.209.5	Total UN-normalized mole

	7879		
7439	7881	51.209.11	Total GPM
7440	7883	51.209.6	Ideal BTU
7441	7885	51.209.7	Density Normal
7442	7887	51.209.8	Inferior WOBBE
7443	7889	51.209.9	Methane Number
7444	7891	51.209.10	Speed of Sound
	7893		
7445	7895	51.235.0	Rolling Average #1
7446	7897	51.235.1	Rolling Average #2
7447	7899	51.235.2	Rolling Average #3
7448	7901	51.235.3	Rolling Average #4
7449	7903	51.235.4	Rolling Average #5
7450	7905	51.235.5	Rolling Average #6
7451	7907	51.235.6	Rolling Average #7
7452	7909	51.235.7	Rolling Average #8
7453	7911	51.235.8	Rolling Average #9
7454	7913	51.235.9	Rolling Average #10
7455	7915	51.235.10	Rolling Average #11
7456	7917	51.235.11	Rolling Average #12
7457	7919	51.235.12	Rolling Average #13
7458	7801	51.235.13	Rolling Average #14
7459	7803	51.235.14	Rolling Average #15
7460	7805	51.235.15	Rolling Average #16
7461	7521	51.212.0	24 Hour Average for Component #1
7462	7523	51.212.1	24 Hour Average for Component #2
7463	7525	51.212.2	24 Hour Average for Component #3
7464	7527	51.212.3	24 Hour Average for Component #4
7465	7529	51.212.4	24 Hour Average for Component #5
7466	7531	51.212.5	24 Hour Average for Component #6
7467	7533	51.212.6	24 Hour Average for Component #7
7468	7535	51.212.7	24 Hour Average for Component #8
7469	7537	51.212.8	24 Hour Average for Component #9
7470	7539	51.212.9	24 Hour Average for Component #10
7471	7541	51.212.10	24 Hour Average for Component #11
7472	7543	51.212.11	24 Hour Average for Component #12
7473	7545	51.212.12	24 Hour Average for Component #13
7474	7547	51.212.13	24 Hour Average for Component #14
7475	7549	51.212.14	24 Hour Average for Component #15

7476	7551	51.212.15	24 Hour Average for Component #16
7477	7553	51.213.0	Previous 24 Hour Average for Component #1
7478	7555	51.213.1	Previous 24 Hour Average for Component #2
7479	7557	51.213.2	Previous 24 Hour Average for Component #3
7480	7559	51.213.3	Previous 24 Hour Average for Component #4
7481	7561	51.213.4	Previous 24 Hour Average for Component #5
7482	7563	51.213.5	Previous 24 Hour Average for Component #6
7483	7565	51.213.6	Previous 24 Hour Average for Component #7
7484	7567	51.213.7	Previous 24 Hour Average for Component #8
7485	7569	51.213.8	Previous 24 Hour Average for Component #9
7486	7571	51.213.9	Previous 24 Hour Average for Component #10
7487	7573	51.213.10	Previous 24 Hour Average for Component #11
7488	7575	51.213.11	Previous 24 Hour Average for Component #12
7489	7577	51.213.12	Previous 24 Hour Average for Component #13
7490	7579	51.213.13	Previous 24 Hour Average for Component #14
7491	7581	51.213.14	Previous 24 Hour Average for Component #15
7492	7583	51.213.15	Previous 24 Hour Average for Component #16
7493	7985	51.247.44	Rolling Average BTU - Dry
7494	7987	51.247.39	Rolling Average BTU - Sat
7495	7989	51.247.51	Rolling Average Specific Gravity
7496	7991	51.247.40	Rolling Average Compressibility
7497	7993	51.247.41	Rolling Average Superior Wobbe
7498	7995	51.247.47	Rolling Average Total Un-Normalized Mole
7499	7997	51.247.48	Rolling Average Total GPM
7500	7999	51.247.50	Rolling Average Ideal BTU
7501	8001	51.247.46	Rolling Average Density Normal
7502	8003	51.248.44	24 Hour Average for BTU - Dry
7503	8005	51.248.39	24 Hour Average for BTU - Sat
7504	8007	51.248.51	24 Hour Average for Specific Gravity
7505	8009	51.248.40	24 Hour Average for Compressibility
7506	8011	51.248.41	24 Hour Average for Superior Wobbe
7507	8013	51.248.47	24 Hour Average for Total Un-Normalized Mole
7508	8015	51.248.48	24 Hour Average for Total GPM
7509	8017	51.248.50	24 Hour Average for Ideal BTU
7510	8019	51.248.46	24 Hour Average for Density Normal
7511	8021	51.249.44	Previous 24 Hour Average for BTU - Dry
7512	8023	51.249.39	Previous 24 Hour Average for BTU - Sat
7513	8025	51.249.51	Previous 24 Hour Average for Specific Gravity
7514	8027	51.249.40	Previous 24 Hour Average for Compressibility
7515	8029	51.249.41	Previous 24 Hour Average for Superior Wobbe

7516	8031	51.249.47	Previous 24 Hour Average for Total Un-Normalized Mole
7517	8033	51.249.48	Previous 24 Hour Average for Total GPM
7518	8035	51.249.50	Previous 24 Hour Average for Ideal BTU
7519	8037	51.249.46	Previous 24 Hour Average for Density Normal
7520-7600	N/A	51.202.7	(N/A)
Registers 7600-7799 are for stream #2			
7601	8201	51.215.0	Mole % - Component #1(C3)
7602	8203	51.215.1	Mole % - Component #2(IC4)
7603	8205	51.215.2	Mole % - Component #3(NC4)
7604	8207	51.215.3	Mole % - Component #4(Neo C5)
7605	8209	51.215.4	Mole % - Component #5(IC5)
7606	8211	51.215.5	Mole % - Component #6(NC5)
7607	8213	51.215.6	Mole % - Component #7(C6+)
7608	8215	51.215.7	Mole % - Component #8(N2)
7609	8217	51.215.8	Mole % - Component #9(C1)
7610	8219	51.215.9	Mole % - Component #10(C02)
7611	8221	51.215.10	Mole % - Component #11(C2)
7612	8223	51.215.11	Mole % - Component #12(C6s)
7613	8225	51.215.12	Mole % - Component #13(C7s)
7614	8227	51.215.13	Mole % - Component #14(C8s)
7615	8229	51.215.14	Mole % - Component #15(C9s)
7616	8231	51.215.15	Mole % - Component #16(spare)
7617	8233	51.216.0	GPM % - Component #1
7618	8235	51.216.1	GPM % - Component #2
7619	8237	51.216.2	GPM % - Component #3
7620	8239	51.216.3	GPM % - Component #4
7621	8241	51.216.4	GPM % - Component #5
7622	8243	51.216.5	GPM % - Component #6
7623	8245	51.216.6	GPM % - Component #7
7624	8247	51.216.7	GPM % - Component #8
7625	8249	51.216.8	GPM % - Component #9
7626	8251	51.216.9	GPM % - Component #10
7627	8253	51.216.10	GPM % - Component #11
7628	8255	51.216.11	GPM % - Component #12
7629	8257	51.216.12	GPM % - Component #13
7630	8259	51.216.13	GPM % - Component #14
7631	8261	51.216.14	GPM % - Component #15

7632	8263	51.216.15	GPM % - Component #16
7633	8265	51.214.0	BTU - Dry
7634	8267	51.214.1	BTU - Saturated
7635	8269	51.214.2	Specific Gravity
7636	8271	51.214.3	Compressibility
7637	8273	51.214.4	WOBBE Index
7638	8275	51.214.5	Total UN-normalized mole
7639	8277	51.214.11	Total GPM
7640	8279	51.214.6	Ideal BTU
7641	8281	51.214.7	Density Normal
7642	8283	51.214.8	Inferior WOBBE
7643	8285	51.214.9	Methane Number
7644	8287	51.214.10	Speed of Sound
7645	8289	51.236.0	Rolling Average #1
7646	8291	51.236.1	Rolling Average #2
7647	8293	51.236.2	Rolling Average #3
7648	8295	51.236.3	Rolling Average #4
7649	8297	51.236.4	Rolling Average #5
7650	8299	51.236.5	Rolling Average #6
7651	8301	51.236.6	Rolling Average #7
7652	8303	51.236.7	Rolling Average #8
7653	8305	51.236.8	Rolling Average #9
7654	8307	51.236.9	Rolling Average #10
7655	8309	51.236.10	Rolling Average #11
7656	8311	51.236.11	Rolling Average #12
7657	8313	51.236.12	Rolling Average #13
7658	8315	51.236.13	Rolling Average #14
7659	8317	51.236.14	Rolling Average #15
7660	8319	51.236.15	Rolling Average #16
7661	8321	51.217.0	24 Hour Average for Component #1
7662	8323	51.217.1	24 Hour Average for Component #2
7663	8325	51.217.2	24 Hour Average for Component #3
7664	8327	51.217.3	24 Hour Average for Component #4
7665	8329	51.217.4	24 Hour Average for Component #5
7666	8331	51.217.5	24 Hour Average for Component #6
7667	8333	51.217.6	24 Hour Average for Component #7

7668	8335	51.217.7	24 Hour Average for Component #8
7669	8337	51.217.8	24 Hour Average for Component #9
7670	8339	51.217.9	24 Hour Average for Component #10
7671	8341	51.217.10	24 Hour Average for Component #11
7672	8343	51.217.11	24 Hour Average for Component #12
7673	8345	51.217.12	24 Hour Average for Component #13
7674	8347	51.217.13	24 Hour Average for Component #14
7675	8349	51.217.14	24 Hour Average for Component #15
7676	8351	51.217.15	24 Hour Average for Component #16
7677	8353	51.218.0	Previous 24 Hour Average for Component #1
7678	8355	51.218.1	Previous 24 Hour Average for Component #2
7679	8357	51.218.2	Previous 24 Hour Average for Component #3
7680	8359	51.218.3	Previous 24 Hour Average for Component #4
7681	8361	51.218.4	Previous 24 Hour Average for Component #5
7682	8363	51.218.5	Previous 24 Hour Average for Component #6
7683	8365	51.218.6	Previous 24 Hour Average for Component #7
7684	8367	51.218.7	Previous 24 Hour Average for Component #8
7685	8369	51.218.8	Previous 24 Hour Average for Component #9
7686	8371	51.218.9	Previous 24 Hour Average for Component #10
7687	8373	51.218.10	Previous 24 Hour Average for Component #11
7688	8375	51.218.11	Previous 24 Hour Average for Component #12
7689	8377	51.218.12	Previous 24 Hour Average for Component #13
7690	8379	51.218.13	Previous 24 Hour Average for Component #14
7691	8381	51.218.14	Previous 24 Hour Average for Component #15
7692	8383	51.218.15	Previous 24 Hour Average for Component #16
7693	8385	51.247.144	Rolling Average BTU - Dry
7694	8387	51.247.139	Rolling Average BTU - Sat
7695	8389	51.247.151	Rolling Average Specific Gravity
7696	8391	51.247.140	Rolling Average Compressibility
7697	8393	51.247.141	Rolling Average Superior Wobbe
7698	8395	51.247.147	Rolling Average Total Un-Normalized Mole
7699	8397	51.247.148	Rolling Average Total GPM
7700	8399	51.247.150	Rolling Average Ideal BTU
7701	8401	51.247.146	Rolling Average Density Normal
7702	8403	51.248.144	24 Hour Average for BTU - Dry
7703	8405	51.248.139	24 Hour Average for BTU - Sat
7704	8407	51.248.151	24 Hour Average for Specific Gravity
7705	8409	51.248.140	24 Hour Average for Compressibility
7706	8411	51.248.141	24 Hour Average for Superior Wobbe
7707	8413	51.248.147	24 Hour Average for Total Un-Normalized Mole
7708	8415	51.248.148	24 Hour Average for Total GPM

7709	8417	51.248.150	24 Hour Average for Ideal BTU
7710	8419	51.248.146	24 Hour Average for Density Normal
7711	8421	51.249.144	Previous 24 Hour Average for BTU - Dry
7712	8423	51.249.139	Previous 24 Hour Average for BTU - Sat
7713	8425	51.249.151	Previous 24 Hour Average for Specific Gravity
7714	8427	51.249.140	Previous 24 Hour Average for Compressibility
7715	8429	51.249.141	Previous 24 Hour Average for Superior Wobbe
7716	8431	51.249.147	Previous 24 Hour Average for Total Un-Normalized Mole
7717	8433	51.249.148	Previous 24 Hour Average for Total GPM
7718	8435	51.249.150	Previous 24 Hour Average for Ideal BTU
7719	8437	51.249.146	Previous 24 Hour Average for Density Normal
7720-7800	N/A	51.202.7	(N/A)
Registers 7800-7999 are for stream #3			
7801	8601	51.220.0	Mole % - Component #1(C3)
7802	8603	51.220.1	Mole % - Component #2(IC4)
7803	8605	51.220.2	Mole % - Component #3(NC4)
7804	8607	51.220.3	Mole % - Component #4(Neo C5)
7805	8609	51.220.4	Mole % - Component #5(IC5)
7806	8611	51.220.5	Mole % - Component #6(NC5)
7807	8613	51.220.6	Mole % - Component #7(C6+)
7808	8615	51.220.7	Mole % - Component #8(N2)
7809	8617	51.220.8	Mole % - Component #9(C1)
7810	8619	51.220.9	Mole % - Component #10(C02)
7811	8621	51.220.10	Mole % - Component #11(C2)
7812	8623	51.220.11	Mole % - Component #12(C6s)
7813	8625	51.220.12	Mole % - Component #13(C7s)
7814	8627	51.220.13	Mole % - Component #14(C8s)
7815	8629	51.220.14	Mole % - Component #15(C9s)
7816	8631	51.220.15	Mole % - Component #16(spare)
7817	8633	51.221.0	GPM % - Component #1
7818	8635	51.221.1	GPM % - Component #2
7819	8637	51.221.2	GPM % - Component #3
7820	8639	51.221.3	GPM % - Component #4
7821	8641	51.221.4	GPM % - Component #5
7822	8643	51.221.5	GPM % - Component #6
7823	8645	51.221.6	GPM % - Component #7
7824	8647	51.221.7	GPM % - Component #8

7825	8649	51.221.8	GPM % - Component #9
7826	8651	51.221.9	GPM % - Component #10
7827	8653	51.221.10	GPM % - Component #11
7828	8655	51.221.11	GPM % - Component #12
7829	8657	51.221.12	GPM % - Component #13
7830	8659	51.221.13	GPM % - Component #14
7831	8661	51.221.14	GPM % - Component #15
7832	8663	51.221.15	GPM % - Component #16
7833	8665	51.219.0	BTU - Dry
7834	8667	51.219.1	BTU - Saturated
7835	8669	51.219.2	Specific Gravity
7836	8671	51.219.3	Compressibility
7837	8673	51.219.4	WOBBE Index
7838	8675	51.219.5	Total UN-normalized mole
7839	8677	51.219.11	Total GPM
7840	8679	51.219.6	Ideal BTU
7841	8681	51.219.7	Density Normal
7842	8683	51.219.8	Inferior WOBBE
7843	8685	51.219.9	Methane Number
7844	8687	51.219.10	Speed of Sound
7845	8689	51.237.0	Rolling Average #1
7846	8691	51.237.1	Rolling Average #2
7847	8693	51.237.2	Rolling Average #3
7848	8695	51.237.3	Rolling Average #4
7849	8697	51.237.4	Rolling Average #5
7850	8699	51.237.5	Rolling Average #6
7851	8701	51.237.6	Rolling Average #7
7852	8703	51.237.7	Rolling Average #8
7853	8705	51.237.8	Rolling Average #9
7854	8707	51.237.9	Rolling Average #10
7855	8709	51.237.10	Rolling Average #11
7856	8711	51.237.11	Rolling Average #12
7857	8713	51.237.12	Rolling Average #13
7858	8715	51.237.13	Rolling Average #14
7859	8717	51.237.14	Rolling Average #15
7860	8719	51.237.15	Rolling Average #16

7861	8721	51.222.0	24 Hour Average for Component #1
7862	8723	51.222.1	24 Hour Average for Component #2
7863	8725	51.222.2	24 Hour Average for Component #3
7864	8727	51.222.3	24 Hour Average for Component #4
7865	8729	51.222.4	24 Hour Average for Component #5
7866	8731	51.222.5	24 Hour Average for Component #6
7867	8733	51.222.6	24 Hour Average for Component #7
7868	8735	51.222.7	24 Hour Average for Component #8
7869	8737	51.222.8	24 Hour Average for Component #9
7870	8739	51.222.9	24 Hour Average for Component #10
7871	8741	51.222.10	24 Hour Average for Component #11
7872	8743	51.222.11	24 Hour Average for Component #12
7873	8745	51.222.12	24 Hour Average for Component #13
7874	8747	51.222.13	24 Hour Average for Component #14
7875	8749	51.222.14	24 Hour Average for Component #15
7876	8751	51.222.15	24 Hour Average for Component #16
7877	8753	51.223.0	Previous 24 Hour Average for Component #1
7878	8755	51.223.1	Previous 24 Hour Average for Component #2
7879	8757	51.223.2	Previous 24 Hour Average for Component #3
7880	8759	51.223.3	Previous 24 Hour Average for Component #4
7881	8761	51.223.4	Previous 24 Hour Average for Component #5
7882	8763	51.223.5	Previous 24 Hour Average for Component #6
7883	8765	51.223.6	Previous 24 Hour Average for Component #7
7884	8767	51.223.7	Previous 24 Hour Average for Component #8
7885	8769	51.223.8	Previous 24 Hour Average for Component #9
7886	8771	51.223.9	Previous 24 Hour Average for Component #10
7887	8773	51.223.10	Previous 24 Hour Average for Component #11
7888	8775	51.223.11	Previous 24 Hour Average for Component #12
7889	8777	51.223.12	Previous 24 Hour Average for Component #13
7890	8779	51.223.13	Previous 24 Hour Average for Component #14
7891	8781	51.223.14	Previous 24 Hour Average for Component #15
7892	8783	51.223.15	Previous 24 Hour Average for Component #16
7893	8785	51.247.244	Rolling Average BTU - Dry
7894	8787	51.247.239	Rolling Average BTU - Sat
7895	8789	51.247.251	Rolling Average Specific Gravity
7896	8791	51.247.240	Rolling Average Compressibility
7897	8793	51.247.241	Rolling Average Superior Wobbe

7898	8795	51.247.247	Rolling Average Total Un-Normalized Mole
7899	8797	51.247.248	Rolling Average Total GPM
7900	8799	51.247.250	Rolling Average Ideal BTU
7901	8801	51.247.246	Rolling Average Density Normal
7902	8803	51.248.244	24 Hour Average for BTU - Dry
7903	8805	51.248.239	24 Hour Average for BTU - Sat
7904	8807	51.248.251	24 Hour Average for Specific Gravity
7905	8809	51.248.240	24 Hour Average for Compressibility
7906	8811	51.248.241	24 Hour Average for Superior Wobbe
7907	8813	51.248.247	24 Hour Average for Total Un-Normalized Mole
7908	8815	51.248.248	24 Hour Average for Total GPM
7909	8817	51.248.250	24 Hour Average for Ideal BTU
7910	8819	51.248.246	24 Hour Average for Density Normal
7911	8821	51.249.244	Previous 24 Hour Average for BTU - Dry
7912	8823	51.249.239	Previous 24 Hour Average for BTU - Sat
7913	8825	51.249.251	Previous 24 Hour Average for Specific Gravity
7914	8827	51.249.240	Previous 24 Hour Average for Compressibility
7915	8829	51.249.241	Previous 24 Hour Average for Superior Wobbe
7916	8831	51.249.247	Previous 24 Hour Average for Total Un-Normalized Mole
7917	8833	51.249.248	Previous 24 Hour Average for Total GPM
7918	8835	51.249.250	Previous 24 Hour Average for Ideal BTU
7919	8837	51.249.246	Previous 24 Hour Average for Density Normal
7920-8000	N/A	51.202.7	(N/A)
Registers 8000-8199 are for stream #4			
8001	9001	51.225.0	Mole % - Component #1(C3)
8002	9003	51.225.1	Mole % - Component #2(IC4)
8003	9005	51.225.2	Mole % - Component #3(NC4)
8004	9007	51.225.3	Mole % - Component #4(Neo C5)
8005	9009	51.225.4	Mole % - Component #5(IC5)
8006	9011	51.225.5	Mole % - Component #6(NC5)
8007	9013	51.225.6	Mole % - Component #7(C6+)
8008	9015	51.225.7	Mole % - Component #8(N2)
8009	9017	51.225.8	Mole % - Component #9(C1)
8010	9019	51.225.9	Mole % - Component #10(C02)
8011	9021	51.225.10	Mole % - Component #11(C2)
8012	9023	51.225.11	Mole % - Component #12(C6s)
8013	9025	51.225.12	Mole % - Component #13(C7s)

8014	9027	51.225.13	Mole % - Component #14(C8s)
8015	9029	51.225.14	Mole % - Component #15(C9s)
8016	9031	51.225.15	Mole % - Component #16(spare)
8017	9033	51.226.0	GPM % - Component #1
8018	9035	51.226.1	GPM % - Component #2
8019	9037	51.226.2	GPM % - Component #3
8020	9039	51.226.3	GPM % - Component #4
8021	9041	51.226.4	GPM % - Component #5
8022	9043	51.226.5	GPM % - Component #6
8023	9045	51.226.6	GPM % - Component #7
8024	9047	51.226.7	GPM % - Component #8
8025	9049	51.226.8	GPM % - Component #9
8026	9051	51.226.9	GPM % - Component #10
8027	9053	51.226.10	GPM % - Component #11
8028	9055	51.226.11	GPM % - Component #12
8029	9057	51.226.12	GPM % - Component #13
8030	9059	51.226.13	GPM % - Component #14
8031	9061	51.226.14	GPM % - Component #15
8032	9063	51.226.15	GPM % - Component #16
8033	9065	51.224.0	BTU - Dry
8034	9067	51.224.1	BTU - Saturated
8035	9069	51.224.2	Specific Gravity
8036	9071	51.224.3	Compressibility
8037	9073	51.224.4	WOBBE Index
8038	9075	51.224.5	Total UN-normalized mole
8039	9077	51.224.11	Total GPM
8040	9079	51.214.6	Ideal BTU
8041	9081	51.214.7	Density Normal
8042	9083	51.214.8	Inferior WOBBE
8043	9085	51.214.9	Methane Number
8044	9087	51.214.10	Speed of Sound
8045	9089	51.238.0	Rolling Average #1
8046	9091	51.238.1	Rolling Average #2
8047	9093	51.238.2	Rolling Average #3
8048	9095	51.238.3	Rolling Average #4
8049	9097	51.238.4	Rolling Average #5

8050	9099	51.238.5	Rolling Average #6
8051	9101	51.238.6	Rolling Average #7
8052	9103	51.238.7	Rolling Average #8
8053	9105	51.238.8	Rolling Average #9
8054	9107	51.238.9	Rolling Average #10
8055	9109	51.238.10	Rolling Average #11
8056	9111	51.238.11	Rolling Average #12
8057	9113	51.238.12	Rolling Average #13
8058	9115	51.238.13	Rolling Average #14
8059	9117	51.238.14	Rolling Average #15
8060	9119	51.238.15	Rolling Average #16
8061	9121	51.227.0	24 Hour Average for Component #1
8062	9123	51.227.1	24 Hour Average for Component #2
8063	9125	51.227.2	24 Hour Average for Component #3
8064	9127	51.227.3	24 Hour Average for Component #4
8065	9129	51.227.4	24 Hour Average for Component #5
8066	9131	51.227.5	24 Hour Average for Component #6
8067	9133	51.227.6	24 Hour Average for Component #7
8068	9135	51.227.7	24 Hour Average for Component #8
8069	9137	51.227.8	24 Hour Average for Component #9
8070	9139	51.227.9	24 Hour Average for Component #10
8071	9141	51.227.10	24 Hour Average for Component #11
8072	9143	51.227.11	24 Hour Average for Component #12
8073	9145	51.227.12	24 Hour Average for Component #13
8074	9147	51.227.13	24 Hour Average for Component #14
8075	9149	51.227.14	24 Hour Average for Component #15
8076	9151	51.227.15	24 Hour Average for Component #16
8077	9153	51.228.0	Previous 24 Hour Average for Component #1
8078	9155	51.228.1	Previous 24 Hour Average for Component #2
8079	9157	51.228.2	Previous 24 Hour Average for Component #3
8080	9159	51.228.3	Previous 24 Hour Average for Component #4
8081	9161	51.228.4	Previous 24 Hour Average for Component #5
8082	9163	51.228.5	Previous 24 Hour Average for Component #6
8083	9165	51.228.6	Previous 24 Hour Average for Component #7
8084	9167	51.228.7	Previous 24 Hour Average for Component #8
8085	9169	51.228.8	Previous 24 Hour Average for Component #9
8086	9171	51.228.9	Previous 24 Hour Average for Component #10

8087	9173	51.228.10	Previous 24 Hour Average for Component #11
8088	9175	51.228.11	Previous 24 Hour Average for Component #12
8089	9177	51.228.12	Previous 24 Hour Average for Component #13
8090	9179	51.228.13	Previous 24 Hour Average for Component #14
8091	9181	51.228.14	Previous 24 Hour Average for Component #15
8092	9183	51.228.15	Previous 24 Hour Average for Component #16
8093	9185	51.247.344	Rolling Average BTU - Dry
8094	9187	51.247.339	Rolling Average BTU - Sat
8095	9189	51.247.351	Rolling Average Specific Gravity
8096	9191	51.247.340	Rolling Average Compressibility
8097	9193	51.247.341	Rolling Average Superior Wobbe
8098	9195	51.247.347	Rolling Average Total Un-Normalized Mole
8099	9197	51.247.348	Rolling Average Total GPM
8100	9199	51.247.350	Rolling Average Ideal BTU
8101	9201	51.247.346	Rolling Average Density Normal
8102	9203	51.248.344	24 Hour Average for BTU - Dry
8103	9205	51.248.339	24 Hour Average for BTU - Sat
8104	9207	51.248.351	24 Hour Average for Specific Gravity
8105	9209	51.248.340	24 Hour Average for Compressibility
8106	9211	51.248.341	24 Hour Average for Superior Wobbe
8107	9213	51.248.347	24 Hour Average for Total Un-Normalized Mole
8108	9215	51.248.348	24 Hour Average for Total GPM
8109	9217	51.248.350	24 Hour Average for Ideal BTU
8110	9219	51.248.346	24 Hour Average for Density Normal
8111	9221	51.249.344	Previous 24 Hour Average for BTU - Dry
8112	9223	51.249.339	Previous 24 Hour Average for BTU - Sat
8113	9225	51.249.351	Previous 24 Hour Average for Specific Gravity
8114	9227	51.249.340	Previous 24 Hour Average for Compressibility
8115	9229	51.249.341	Previous 24 Hour Average for Superior Wobbe
8116	9231	51.249.347	Previous 24 Hour Average for Total Un-Normalized Mole
8117	9233	51.249.348	Previous 24 Hour Average for Total GPM
8118	9235	51.249.350	Previous 24 Hour Average for Ideal BTU
8119	9237	51.249.346	Previous 24 Hour Average for Density Normal
8120-8199	N/A	51.202.7	(N/A)

Page Break

APPENDIX B TOTALFLOW DEFINITIONS AND ACRONYMS

TERM	DEFINITION
μ	Greek letter for "mu". Often used in math and engineering as the symbol for "micro". Pronounced as a long u.
μ FLO IMV	μFLO's measurement and operational features are housed in this single unit assembly. The main electronic board (μFLO-195 Board), communication connection, power, SP, DP and Temperature readings are all housed in this unit.
μ FLO-2100767 Board	Main Electronic Board used in the μFLO Computers. It is housed on an integrated assembly and includes the IMV. It operates at 195 MHz while drawing minimal power.
μ Sec	Micro Second.
μFLO 6200	This Totalflow flow computer is housed in a small lightweight enclosure. It's main feature is its low power, microprocessor based units designed to meet a wide range of measurement, monitor and alarming applications for remote gas systems, while being a cost effective alternative.
*.CSV file	See Comma Separated Values (I.E. spreadsheet format).
*.INI file	See Initialization File.
A/D	Analog-to-digital.
ABB Inc.	Asea, Brown & Boveri, parent company of Totalflow
Absolute Pressure	Gauge pressure plus barometric pressure. Totalflow devices use Static Pressure (SP) for flow calculations.
Absolute Zero	The zero point on the absolute temperature scale. It is equal to -273.16 degrees C, or 0 degrees K (Kelvin), or -459.69 degrees F, or 0 degrees R (Rankine).
Absorber	A tower or column that provides contact between natural gas being processed and a liquid solvent.
Absorption	The process of removing vapors from a stream of natural gas by passing the natural gas through liquids or chemicals which have a natural attraction to the vapors to be removed from the stream.
Absorption Factor	A factor which is an indication of the tendency for a given gas phase component to be transferred to the liquid solvent. It is generally expressed as A=L/KV where L and V are the moles of liquid and vapor, and K is the average value of the vapor-liquid equilibrium constant for the component of concern.
Absorption Oil	A hydrocarbon liquid used to absorb and recover components from the natural gas being processed.
AC	See Alternating Current.
Accuracy	How closely a measured value agrees with the correct value. Usually expressed as ± percent of full scale output or reading.
Acid Gas	See Gas, Acid.
ACK	See Acknowledgment.
Acknowledgment	This refers to a response over a remote communication device to a request such as a PING. Basically, saying, "I'm here, and I saw your request!"
ACM	See Analyzer Control Module.
Acoustics	The degree of sound. The nature, cause, and phenomena of the vibrations of elastic bodies; which vibrations create compressional waves or wave fronts which are transmitted through various media, such as air, water, wood, steel, etc.
Active Analog Output	Analog Output to a host providing power to the host.

TERM	DEFINITION
Active Mode	An operational mode used by the LevelMaster for measuring dual float levels by applying a signal to the primary windings, reading the voltage level on the secondary windings and using an algorithm to determine the oil and water levels.
Adapter	A mechanism or device for attaching non-mating parts.
ADC	See Analog-to-Digital Converter.
Address	A unique memory designation for location of data or the identity of a peripheral device; allows each device on a single communications line to respond to its own message.
Adiabatic Expansion	The expansion of a gas, vapor, or liquid stream from a higher pressure to a lower pressure in which there is no heat transfer between the gas, vapor, or liquid and the surroundings.
Adsorption	The process of removing natural gas liquids from a stream of natural gas by passing the natural gas through granular solids which have a natural attraction to the liquids to be removed from the stream.
Aerial	A length of wire designed to transmit or receive radio waves. (See also Antenna)
Aerosol Liquids	Minute liquid particles suspended in gas. Aerosols will behave like a fluid and can be transported by pipes and pumping. When aerosols contact each other they coalesce into droplets. Aerosols may be present in gas, or may be generated by glow shearing off the skim inside of a pipeline.
AGA	American Gas Association. Trade group representing natural gas distributors and pipelines.
AGA-10	American Gas Association Report No. 10, Speed of Sound in Natural Gas and Other Related Hydrocarbon Gases. Method for calculation of the speed of sound in gases.
AGA-3	American Gas Association Report No. 3, Orifice Metering of Natural Gas. Method for calculating gas volume across an Orifice Plate. This method requires two pressure readings, Differential Pressure (DP) and Static Pressure (SP).
AGA-5	American Gas Association Report No. 5, Fuel Gas Energy Metering. Methods (Volume, Mass or Energy) for calculating BTUs without knowing the composition of the gas.
AGA-7	American Gas Association Report No. 7, Measurement of Gas by Turbine Meters. Method for calculating gas volume using a Pulse Meter. This method requires one pressure reading, Static Pressure (SP).
AGA-8	American Gas Association Report No. 8, Compressibility Factor of Natural Gas and Related Hydrocarbon Gases. Method for calculating the Super Compressibility Factor, Fpv.
AGA-9	American Gas Association Report No. 9, Measurement of Gas by Multipath Ultrasonic Meters. Method for calculating gas based on transit-times.
AGC	Automatic Gain Control
AH	See Ampere-Hour.
AI	Analog Input
AIU	Analyzer Interface Unit.
Alkane	The simplest homologous series of saturated aliphatic hydrocarbons, consisting of methane, ethane, propane, butane; also know as olefins. Unsaturated hydrocarbons that contain one or more carbon-carbon double bonds.
Alkanolamine	See Amine.
Alkynes	Unsaturated hydrocarbons that contain one or more carbon-carbon triple bonds.

TERM	DEFINITION
Alphanumeric	A character set that contains both letters and digits.
Alternating Current	An electric current whose direction changes with a frequency independent of circuit components.
Aluminum Powder Coating	Totalflow aluminum enclosures have a baked-on Powder Coating designed to our specifications to ensure paint adhesion, weather resistance and durability.
Ambient Compensation	The design of an instrument such that changes in ambient temperature do not affect the readings of the instrument.
Ambient Conditions	The conditions around the transducer (pressure, temperature, etc.).
Ambient Pressure	Pressure of the air surrounding a transducer.
Ambient Temperature	The average or mean temperature of the surrounding air which comes in contact with the equipment and instruments under test.
Amine (Alkanolamine)	Any of several liquid compounds containing amino nitrogen generally used in water solution to remove, by reversible chemical reaction, hydrogen sulfide and/or carbon dioxide from gas and liquid hydrocarbon streams.
Ammeter	An instrument used to measure current.
Amp	See Ampere.
Ampere	The unit of electrical current. Also milliamp (one thousandth of an amp) and micro amp (one millionth of an amp). One amp corresponds to the flow of about 6×10^{18} electrons per second.
Ampere-Hour	The quantity of electricity measured in ampere-hours (Ah) which may be delivered by a cell or battery under specified conditions. A current of one ampere flowing for one hour.
Ampere-Hour Efficiency	The ratio of the output of a secondary cell or battery, measured in ampere-hours, to the input required to restore the initial state of charge, under specified conditions.
Amplifier	A device which draws power from a source other than the input signal and which produces as an output an enlarged reproduction of the essential features of its input.
Amplitude	The highest value reached by voltage, current or power during a complete cycle.
Amplitude Modulation	Where audio signals increase and decrease the amplitude of the "carrier wave".
Amplitude Span	The Y-axis range of a graphic display of data in either the time or frequency domain. Usually a log display (dB) but can also be linear.
AMU	See Analog Measurement Unit.
AMU/IMV	Generic reference to the Measurement unit. See Analog Measurement Unit and Integral Multivariable Transducer for more definition.
Analog	A system in which data is represented as a continuously varying voltage/current.
Analog Input	Data received as varying voltage/current.
Analog Measurement Unit	A transducer for converting energy from one form to another. (e.g. Static and Differential pressure to electrical signals)
Analog Output	A voltage or current signal that is a continuous function of the measured parameter. Data that is transmitted as varying voltage/current.
Analog Trigger	A trigger that occurs at a user-selected point on an incoming analog signal. Triggering can be set to occur at a specific level on either an increasing or a decreasing signal (positive or negative slope).
Analog-to-Digital Converter	An electronic device, often an integrated circuit, that converts an analog voltage to a number.

TERM	DEFINITION
Analytical Module	The primary component of the NGC's modular design is the analytical module. This module comes in a 12VDC or a 24VDC configuration and contains the GC module, Analytical Processing system and manifold. Replacement of this component is enhanced by the single bolt removal feature. This module may also be broken down into the GC module, manifold assembly and analytical processor assembly.
Analytical Module	Totalflow Analytical module assembly contains the GC module, Manifold and Analytical Processor. The modular design features Single Bolt removal.
Analytical Processor Assembly	The Analytical Processor board interfaces with the analog circuits to monitor temperatures, and pressures, and also control the processes. The data generated by the Analytical Processor is passed to the Digital Controller board.
Analyzer Control Module	Consists of various electronic components used for analysis.
Anemometer	An instrument for measuring and/or indicating the velocity of air flow.
Annealed	Toughen (steel or glass) by a process of gradually heating and cooling,
Annunciator	Display of a status on a screen.
ANSI	American National Standards Institute.
Antenna	A length of wire or similar that radiates (such as a transmitting antenna) or absorbs (such as a radio antenna) radio waves. The two basic types are: Yagi (directional) or Omni (bi-directional).
AO	Analog Output
AP	See Absolute Pressure.
API 14.3	American Petroleum Institute Report No. 14.3 addresses the 1992 equation regarding the AGA-3 method for calculating gas volume across an Orifice Plate.
API 21.1	American Petroleum Institute Report No. 21.1 addresses the equation regarding AGA-8 Fpv or Supercompressibility Factor and the energy content of the gas.
API Gravity	An arbitrary scale expressing the relative density of liquid petroleum products. The scale is calibrated in degrees API. The formula is: $DegAPI = \left[\frac{141.5}{\gamma(60°F / 60°F)}\right] - 131.5$ where γ =relative density.
Archive	A file containing historical records in a compressed format for more efficient long term storage and transfer. Totalflow archive records are non-editable, meaning that when they are stored they may not be changed. These records are used during an audit of data.
Artificial Drives	Techniques for producing oil after depletion or in lieu of natural drives; includes water flooding, natural gas re-injection, inert gas injection, flue gas injection and in-situ combustion.
Artificial Lift	Any of the techniques, other than natural drives, for bringing oil to the surface.
ASCII	American Standard Code for Information Interchange. A very popular standard method of encoding alphanumeric characters into 7 or 8 binary bits.
ASME	American Society of Mechanical Engineers.
ASTM	American Society for Testing and Materials (ASTM International).
ASTM D 3588	ASTM International Standard Practice for calculating heat value, compressibility factor and relative density of gaseous fuels.
Asynchronous	A communications protocol where information can be transmitted at an arbitrary, unsynchronized point in time, without synchronization to a reference time or "clock".
ATC	Automatic temperature compensation.

TERM	DEFINITION
ATEX	Term used for European Union's New Approach Directive 94/9/EC which concerns equipment and protective systems intended for use in potentially explosive atmospheres.
Atmosphere (one)	A unit of pressure; the pressure that will support a column of mercury 760 mm high at 0 °C.
Atmospheric Pressure	The pressure exerted on the earth by the earth's atmosphere (air and water vapor). A pressure of 760 mm of mercury, 29.92 inches of mercury, or 14.696 pounds per square inch absolute is used as a (scientific) standard for some measurements. Atmospheric pressure may also refer to the absolute ambient pressure at any given location.
Audio Frequency	Generally in the range 20 Hz to 20 KHz.
Audit	To examine or verify data for accuracy. Totalflow's DB1 and DB2 records may be edited to generate a more accurate representation of data information.
Audit Trail	Using the Long Term Archive files to justify changes made to records that more accurately reflects the correct data. Peripheral information used to edit data is recorded without exception, to justify the accuracy of the edited data records.
Automatic Frequency Control	Similar to Automatic Fine Tune (AFT). A circuit that keeps a receiver in tune with the wanted transmission.
AWG	American Wire Gage.
AWG	Acronym for American Wire Gauge.
Back Pressure	Pressure against which a fluid is flowing. May be composed of friction in pipes, restrictions in pipes, valves, pressure in vessels to which fluid is flowing, hydrostatic head, or other resistance to fluid flow.
Backflush	Technique used in chromatography to reverse direction of the flow after the lighter components have been measured, allowing the heavier components to remain in the column until measured, shortening the length of the column.
Background Acquisition	Data is acquired by a DAQ system while another program or processing routine is running without apparent interruption.
Background Noise	The total noise floor from all sources of interference in a measurement system, independent of the presence of a data signal.
Backup	A system, device, file or facility that can be used as an alternative in case of a malfunction or loss of data.
Bandwidth	The range of frequencies available for signaling; the difference between the highest and lowest frequencies of a band expressed in Hertz.
Bar	Bar is equal to 1 atmosphere of pressure. I.e. .987 Standard atmospheric pressure or 14.5 lbs./psia.
Barometer	An instrument which measures atmospheric pressure.
Barrel	A unit of liquid volume measurement in the petroleum industry that equals 42 U.S. gallons (.159 cubic meters) for petroleum or natural gas liquid products, measured at 60 degrees Fahrenheit and at an equilibrium vapor pressure.
Base Pressure	The pressure used as a standard in determining gas volume. Volumes are measured at operating pressures and then corrected to base pressure volume. Base pressure is normally defined in any gas measurement contract. The standard value for natural gas in the United States is 14.73 psia, established by the American National Standards Institute as standard Z-132.1 in 1969.
Basic Sediment and Water	Waste that collects in the bottom of vessels and tanks containing petroleum or petroleum products.
Battery	Two or more electrochemical cells electrically interconnected in an appropriate series/parallel arrangement to provide the required operating voltage and current levels.

TERM	DEFINITION
Baud	Unit of signaling speed. The speed in baud is the number of discrete conditions or events per second. If each event represents only one bit condition, baud rate equals bits per second (bps).
Baud Rate	Serial communications data transmission rate expressed in bits per second (b/s).
Bbl	See Barrel.
Bcf	Abbreviation for one billion standard cubic feet or one thousand MMcf or one million Mcf.
BG Mix	A liquefied hydrocarbon product composed primarily of butanes and natural gasoline.
Bias	Term used when calibrating. Amounts to offset the actual measurement taken. On a LevelMaster, it refers to adjusting the measurement of the float level to agree with a calibrated measurement. On an RTD (Resistant Thermal Detector), it refers to adjusting the measurement of the temperature to agree with a calibrated temperature. This figure maybe either a positive or negative figure.
BIAS Current	A very low-level DC current generated by the panel meter and superimposed on the signal. This current may introduce a measurable offset across a very high source impedance.
Binary Number	System based on the number 2. The binary digits are 0 and 1.
Binary-Coded Decimal	A code for representing decimal digits in a binary format.
BIOS	Basic Input/Output System. A program, usually stored in ROM, which provides the fundamental services required for the operation of the computer. These services range from peripheral control to updating the time of day.
Bipolar	A signal range that includes both positive and negative values.
Bipolar Transistor	The most common form of transistor.
Bit	Binary Digit - the smallest unit of binary data. One binary digit, either 0 or 1. See also byte.
Bits Per Second	Unit of data transmission rate.
Blue Dot Technology	Technological changes to the DC and ACM modules, decreasing noise by changing ground. Allows amplification of the results, gains resolution.
Board	Common name used to identify the Main Electronic Board. Also called Motherboard, Engine Card and Circuit Board.
Boiling Point	The temperature at which a substance in the liquid phase transforms to the gaseous phase; commonly refers to the boiling point of water which is 100°C (212°F) at sea level.
Bootstrap Loader	Abbreviated BSL. Software enabling user to communicate with the PCBA for the purpose of programming the FLASH memory in the microcontroller.
Bounce	Bouncing is the tendency of any two metal contacts in an electronic device to generate multiple signals as the contacts close or open. When you press a key on your computer keyboard, you expect a single contact to be recorded by your computer. In fact, however, there is an initial contact, a slight bounce or lightening up of the contact, then another contact as the bounce ends, yet another bounce back, and so forth. A similar effect takes place when a switch made using a metal contact is opened.
BP Mix	A liquefied hydrocarbon product composed primarily of butanes and propane.
BPS	See Bits Per Second.
Bridge	Generally a short-circuit on a PC board caused by solder joining two adjacent tracks.
Bridge Resistance	See Input impedance and Output impedance.

TERM	DEFINITION
British Thermal Unit	Energy required to raise one pound of water one degree Fahrenheit. One pound of water at 32 F° requires the transfer of 144 BTUs to freeze into solid ice.
Browser	Software which formats Web pages for viewing; the Web client
BS&W	See Basic Sediment and Water.
BSL	See Bootstrap Loader.
Btu	See British Thermal Unit.
Btu Factor	A numerical representation of the heating value of natural gas which may be calculated or presented to indicate varying relationships (e.g., the number of Btu contained in one standard cubic foot or the number of MMBtu contained in one Mcf of gas. The factor for a given relationship will vary depending upon whether the gas is "dry" or "saturated".
Btu Method	A method of allocating costs between different operations or between different products based upon the heat content of products produced in the various operations or of the various produced products.
Btu per Cubic Foot	A measure of the heat available or released when one cubic foot of gas is burned.
Btu, Dry	Heating value contained in cubic foot of natural gas measured and calculated free of moisture content. Contractually, dry may be defined as less than or equal to seven pounds of water per Mcf.
Btu, Saturated	The number of Btu's contained in a cubic foot of natural gas fully saturated with water under actual delivery pressure, temperature and gravity conditions. See BTU, DRY.
Btu/CV	Used to express the heating content of gas. See British Thermal Units or Calorific Value.
BtuMMI	Refers to the interface program or software that operates the Btu Analyzer.
Buffer	(1) A temporary storage device used to compensate for a difference in data rate and data flow between two devices (typically a computer and a printer); also called a spooler; (2) An amplifier to increase the drive capability, current or distance, of an analog or digital signal.
Burst Pressure	The maximum pressure applied to a transducer sensing element or case without causing leakage.
BUS	A data path shared by many devices (e.g., multipoint line) with one or more conductors for transmitting signals, data, or power.
Bus Master	A type of controller with the ability to read and write to devices on the computer bus.
Busbar	A heavy, rigid conductor used for high voltage feeders.
Butane (C4H10)	A saturated hydrocarbon (Alkane) with four carbon atoms in its molecule (C_4H_{10}). A gas at atmospheric pressure and normal temperature, but easily liquefied by pressure. Generally stored and delivered in liquefied form and used as a fuel in gaseous form, obtained by processing natural gas as produced and also from a process in petroleum refining. Contains approximately 3,260 Btu per cubic foot.
Butane, Normal	see Normal Butane.
Butylene (C4H8)	A saturated hydrocarbon (Alkane) with four carbon atoms in its molecule (C_4H_8). A gas at room temperature and pressure, but easily liquefied by lowering the temperature or raising the pressure. This gas is colorless, has a distinct odor, and is highly flammable. Although not naturally present in petroleum in high percentages, they can be produced from petrochemicals or by catalytic cracking of petroleum.

TERM	DEFINITION
Byte	A group of binary digits that combine to make a word. Generally 8 bits. Half byte is called a nibble. Large computers use 16 bits and 32 bits. Also used to denote the amount of memory required to store one byte of data.
C10H22	The molecular formula for Decane.
C1H4	The molecular formula for Methane.
C2H4	The molecular formula for Ethylene.
C2H6	The molecular formula for Ethane.
C3H6	The molecular formula for Propylene.
C3H8	The molecular formula for Propane.
C4H10	The molecular formula for Butane.
C4H8C	The molecular formula for Butylene.
C5+	A standard abbreviation for Pentanes Plus (IC5, NC5 and C6+).
C5H12	The molecular formula for Pentane.
C6+	A standard abbreviation for Hexane Plus.
C6H14	The molecular formula for Hexane.
C7H16	The molecular formula for Heptane.
C8H18	The molecular formula for Octane.
C9H20	The molecular formula for Nonane.
Cache Memory	Fast memory used to improve the performance of a CPU. Instructions that will soon be executed are placed in cache memory shortly before they are needed. This process speeds up the operation of the CPU.
Calibrate	To ascertain, usually by comparison with a standard, the locations at which scale or chart graduations should be placed to correspond to a series of values of the quantity which the instrument is to measure, receive or transmit. Also, to adjust the output of a device, to bring it to a desired value, within a specified tolerance for a particular value of the input. Also, to ascertain the error in the output of a device by checking it against a standard.
Calorie	The quantity of thermal energy required to raise one gram of water 1°C at 15°C.
Calorimeter	An apparatus which is used to determine the heating value of a combustible material.
Capacitor	An electronic component that stores electrical charge.
Capacity	The total number of ampere-hours (or watt-hours) that can be withdrawn from a cell/battery under specified conditions of discharge.
CAR	Carrier Gas (located on NGC series Feed-Through Assembly).
Carbon	Base of all hydrocarbons and is capable of combining with hydrogen in many proportions, resulting in numberless hydrocarbon compounds. The carbon content of a hydrocarbon determines, to a degree, the hydrocarbon's burning characteristics and qualities.
Carbon Dioxide	Colorless, odorless and slightly acid-tasting gas, consisting of one atom of carbon joined to two atoms of oxygen. C02. Produced by combustion or oxidation of materials containing carbon. Commonly referred to as dry ice when in its solid form.
Carrier Gas	Totalflow recommends that Helium be used as a carrier gas. Carrier gas is used in the “Mobile Phase” of chromatography, pushing the sample gas through the columns (“Stationary Phase”). Because Helium has no heating value, it does not affect the Btu values.
Casinghead Gas	Natural gas that is produced from oil wells along with crude oil.

TERM	DEFINITION
Catalyst	A substance that speeds up a chemical reaction without being consumed itself in the reaction. A substance that alters (usually increases) the rate at which a reaction occurs.
Catalytic	The process of altering, accelerating or instigating a chemical reaction.
Cathode	An electrode through which current leaves any nonmetallic conductor. An electrolytic cathode is an electrode at which positive ions are discharged, or negative ions are formed, or at which other reducing reactions occur. The negative electrode of a galvanic cell; of an electrolytic capacitor.
Cavitation	The boiling of a liquid caused by a decrease in pressure rather than an increase in temperature.
CC	Cubic Centimeters. Measurement unit for measuring volume or capacity in one hundredth of a meter.
CC	Acronym for Cubic Centimeter.
C-Code	C language (IEC supported programming language)
CCU	See DosCCU, WINCCU, PCCU or WEBCCU.
CCV	See Closed Circuit Voltage.
Cd	Coefficient of Discharge factor.
CDPD	Cellular Digital Packet Data
CE	European Community Certification Bureau.
Cell	The basic electrochemical unit used to generate or store electrical energy.
Celsius (centigrade)	A temperature scale defined by 0°C at the ice point and 100°C at boiling point of water at sea level.
CENELEC	European Committee for Electro-technical Standardization. Also known as the European Standards Organization.
Centimeter	Acronym c. Metric measurement equal to .3937 inch.
Central Processing Unit	The central part of a computer system that performs operations on data. In a personal computer the CPU is typically a single microprocessor integrated circuit.
Ceramic Insulation	High-temperature compositions of metal oxides used to insulate a pair of thermocouple wires The most common are Alumina (Al2O3), Beryllium (BeO), and Magnesia (MgO). Their application depends upon temperature and type of thermocouple. High-purity alumina is required for platinum alloy thermocouples. Ceramic insulators are available as single and multihole tubes or as beads.
Certification	The process of submitting equipment to specific tests to determine that the equipment meets the specifications or safety standards.
Cf	A standard abbreviation for Cubic foot.
CFG	Configuration File. When saving new configuration files, the file is saved as a *.cfg file.
CFM	The volumetric flow rate of a liquid or gas in cubic feet per minute.
Character	A letter, digit or other symbol that is used as the representation of data. A connected sequence of characters is called a character string.
Characteristics	Detailed information pertaining to its description. The XFC stores this information in the PROM chip. A feature or quality that makes somebody or something recognizable.
Charge	The conversion of electrical energy, provided in the form of a current from an external source, into chemical energy within a cell or battery.
Chip	Another name for integrated circuit or the piece of silicon on which semiconductors are created.

TERM	DEFINITION
Chromatograph	An instrument used in chemical analysis, to determine the make-up of various substances, and often used to determine the Btu content of natural gas. Chromatography- A method of separating gas compounds by allowing it to seep through an adsorbent so that each compound is adsorbed in a separate layer.
CIM	Communication Interface module. Totalflow's version is called TFIO Communication Interface module.
Circuit	1. The complete path between two terminals over which one-way or two-way communications may be provided. 2. An electronic path between two or more points, capable of providing a number of channels. 3. A number of conductors connected together for the purpose of carrying an electrical current. 4. An electronic closed-loop path among two or more points used for signal transfer. 5. A number of electrical components, such as resistors, inductances, capacitors, transistors, and power sources connected together in one or more closed loops.
Circuit board	Sometimes abbreviated PCB. Printed circuit boards are also called cards. A thin plate on which chips and other electronic components are placed. They fall into the following categories: Motherboard: Typically, the mother board contains the CPU, memory and basic controllers for the system. Sometimes call the system board or main board. Expansion board: Any board that plugs into one of the computer's expansion slots, including controller boards, LAN cards, and video adapters. Daughter Card: Any board that attaches directly to another board. Controller board: A special type of expansion board that contains a controller for a peripheral device. Network Interface Card (NIC): An expansion board that enables a PC to be connected to a local-area network (LAN). Video Adapter: An expansion board that contains a controller for a graphics monitor.
Class 1, Division 1	Class 1 refers to the presence of flammable gases, vapors or liquids. Division 1 indicates an area where ignitable concentrations of flammable gases, vapors or liquids can exist all of the time or some of the time under normal operating conditions.
Class 1, Division 2	Class 1 refers to the presence of flammable gases, vapors or liquids. Division 2 indicates an area where ignitable concentrations of flammable gases, vapors or liquids are not likely to exist under normal operating conditions.
Class 1, Zone 0	Class 1 refers to the presence of flammable gases, vapors or liquids. Zone 0 refers to a place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapor or mist is present continuously or for long periods or frequently.
Class 1, Zone 1	Class 1 refers to the presence of flammable gases, vapors or liquids. Zone 1 refers to a place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapor or mist is likely to occur in normal operation occasionally.
Class 1, Zone 2	Class 1 refers to the presence of flammable gases, vapors or liquids. Zone 2 refers to a place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapor or mist is not likely to occur in normal operation.
Clean Gas	Gas that has no particles larger than one micron and no more than one milligram of solids per cubic meter.
Clear	To restore a device to a prescribed initial state, usually the zero state.
Clock	The source(s) of timing signals for sequencing electronic events (e.g. synchronous data transfer).

TERM	DEFINITION
Closed Circuit Voltage	The difference in potential between the terminals of a cell/battery when it is discharging (on- load condition).
CM	Acronym for Cubic Meter.
Cm	Acronym for Centimeter.
CMM	Acronym for Cubic Meter per Minute.
CMOS	See Complimentary Metal-Oxide-Semiconductor.
CNG	See Compressed Natural Gas
CO_2	A standard abbreviation for Carbon Dioxide.
Coalbed Methane	A methane-rich, sulfur-free natural gas contained within underground coal beds.
Coefficient of expansion	The ratio of the change in length or volume of a body to the original length or volume for a unit change in temperature.
Coil	A conductor wound in a series of turns.
Cold Start	A rebooting technique which will clear all operational errors, loose all data files, but will not damage configuration files if stored on the SDRIVE or tfCold chip.
Cold Weather Enclosure	Totalflow insulated and heated enclosure designed to house either the NGC8200 or Btu 8000/8100 Chromatographs in inclement climates.
Collector	The semiconductor region in a bipolar junction transistor through which a flow of charge carriers leaves the base region.
Column	Hardware component used in gas chromatography to separate components into measurable units.
Combustible	Classification of liquid substances that will burn on the basis of flash points. A combustible liquid means any liquid having a flash point at or above 37.8°C (100°F) but below 93.3°C (200°F), except any mixture having components with flash points of 93.3°C (200°F) or higher, the total of which makes up 99 percent or more of the total volume of the mixture.
Comma Separated Values	These file types are importable records used by spreadsheet programs to display and manipulate data.
Communication	Transmission and reception of data among data processing equipment and related peripherals.
Communication Port	Comm. Port (abbreviation) refers to the host computer's physical communication's port being used to communicate with the equipment. Used by Totalflow when discussing local or remote communication with various equipment including the XFC, FCU, XRC, RTU and LevelMaster etc.
Compensation	An addition of specific materials or devices to counteract a known error.
Complimentary Metal-Oxide-Semiconductor	Family of logic devices that uses p-type and n-type channel devices on the same integrated circuit. It has the advantage of offering medium speed and very low power requirements.
Component	(1) A small object or program that performs a specific function and is designed in such a way to easily operate with other components and applications. Increasingly, the term is being used interchangeably with applet. (2) A part of a device.
Compressed Gas	A gas or mixture of gases having, in a container an absolute pressure exceeding 40 psi at 21.1°C (70°F). A gas or mixture having in a container, an absolute pressure exceeding 104 psi at 54.4°C (130°F) regardless of the pressure at (21.1°C (70°F). A liquid having a vapor pressure exceeding 40 psi at 37.8°C (70°F) as determined by ASTM D-323-72.

TERM	DEFINITION
Compressed Natural Gas	Natural gas in high-pressure surface containers that is highly compressed (though not to the point of liquefaction). CNG is used extensively as a transportation fuel for automobiles, trucks and buses in some parts of the world. Small amounts of natural gas are also transported overland in high-pressure containers.
Compressibility	The property of a material which permits it to decrease in volume when subjected to an increase in pressure. In gas-measurement usage, the compressibility factor "Z" is the deviation from the ideal Boyle and Charles' law behavior. See SUPERCOMPRESSIBILITY FACTOR.
Compressibility Factor	See Supercompressibility Factor.
Compressibility Factor	A factor usually expressed as “z” which gives the ratio of the actual volume of gas at a given temperature and pressure to the volume of gas when calculated by the ideal gas law without any consideration of the compressibility factor.
Concentration	Amount of solute per unit volume or mass of solvent or of solution.
Concurrent	Performing more than one task at a time.
Condensate	1) The liquid formed by the condensation of a vapor or gas; specifically, the hydrocarbon liquid separated from natural gas because of changes in temperature and pressure when the gas from the reservoir was delivered to the surface separators. 2) A term used to describe light liquid hydrocarbons separated from crude oil after production and sold separately.
Condensation	Liquefaction of vapor.
Condensed Phases	The liquid and solid phases; phases in which particles interact strongly.
Condensed States	The solid and liquid states.
Conduction	The conveying of electrical energy or heat through or by means of a conductor.
Configuration No.	The Configuration number is a suffix of the serial number which defines the characteristics of the unit.
Console Mode	A local user interface typically used with custom applications that are not supported through any other mechanism. Also referred to as Printer Console Mode.
Contact	Current carrying part of a switch, relay or connector.
Conversion Time	The time required, in an analog input or output system, from the moment a channel is interrogated (such as with a read instruction) to the moment that accurate data is available. This could include switching time, settling time, acquisition time, A/D conversion time, etc.
Coprocessor	Another computer processor unit that operates in conjunction with the standard CPU. Can be used to enhance execution speed. For example, the 8087 is designed to perform floating point arithmetic.
COR	See Corrected Runtime.
Corrected Runtime	Correction to signal made to decrease/increase “ZERO phase” and eliminate the shift between RT and COR for increased accuracy.
Cos	See Cosine.
Cosine	The sine of the complement of an arc or angle.
Counterclockwise	Movement in the direct opposite to the rotation of the hands of a clock.
Counts	The number of time intervals counted by the dual-slope A/D converter and displayed as the reading of the panel meter, before addition of the decimal point.
CPS	Cycles per second; the rate or number of periodic events in one second, expressed in Hertz (Hz).
CPU	See Central Processing Unit.
CPUC	California Public Utilities Commission

TERM	DEFINITION
CRC	See Cyclic Redundancy Check.
Cryogenic Plant	A gas processing plant which is capable of producing natural gas liquids products, including ethane, at very low operating temperatures.
CSA	CSA International: Formerly Canadian Standards Association. Canadian certification agency.
CTS	Communication abbreviation for Clear To Send.
Cubic	Three-dimensional shape with six equal sides. Used in measuring volume.
Cubic Centimeter	Acronym CC. Metric volume equal to a 1 Centimeter to the 3^{rd} power.
Cubic Foot	The most common unit of measurement of gas volume in the US. It is the amount of gas required to fill a volume of one cubic foot under stated conditions of temperature, pressure, and water vapor.
Cubic Foot Metered	The quantity of gas that occupies one cubic foot under pressure and temperature conditions in the meter.
Cubic Foot, Standard	That quantity of gas which under a pressure of 14.73 psia and at a temperature of 60 degrees occupies a volume of one cubic foot without adjustment for water vapor content.
Cubic Meter	Acronym CM. Metric volume equal to 35.31467 Cubic Feet.
Cubic Meter Per Minute	Acronym CMM. Metric flow rate equal to 35.31467 Cubic Feet per Minute.
Cumulative Capacity	The total number of ampere-hours (or watt hours) that can be withdrawn from a cell/battery under specified conditions of discharge over a predetermined number of cycles or the cycle life.
Current	Current is measured in amps (milliamps and micro amps). It is the passage of electrons. Conventional current flows from positive to negative. Electrons flow from negative to positive - called "electron flow".
Cursor	Dots used to indicate the location of the next character or symbol to be entered.
Custody Transfer	The legal and commercial transfer of a commodity such as natural gas, LNG, etc. from one party to another.
Custody Transfer Transaction	The Custody Transfer Transaction is the hand-off of the physical commodity from one operator to another.
Cut-Off Voltage	The cell/battery voltage at which the discharge is terminated.
CV	Calorific Value. European value of heating content.
CV1	Column 1 Vent (located on NGC8200 series Feed-Through Assembly).
CV2	Column 2 Vent (located on NGC8200 series Feed-Through Assembly).
CWE	Cold Weather Enclosure.
Cycle	One complete sequence of events. One complete alteration of an AC current or Volt. The discharge and subsequent charge of a rechargeable cell/battery is called a cycle.
Cycle Life	The number of cycles under specified conditions which were available from a rechargeable cell/battery before it fails to meet specified criteria as to performance.
Cycle Time	The time usually expressed in seconds for a controller to complete one on/off cycle.
Cyclic Redundancy Check	An ongoing verification of the validity of transmitted and received data providing assurance that the message conforms to a pre-agreed upon convention of communications.
D/A	See Digital-to-analog.
D/I	See Digital Input.
D/O	See Digital Output.

TERM	DEFINITION
DAC	See Digital to Analog Converter.
DACU	Data Acquisition Control Unit.
Data Acquisition	Gathering information from sources such as sensors and AMUs in an accurate, timely and organized manner. Modern systems convert this information to digital data, which can be stored and processed by a computer.
Data Collect	Physically, locally or remotely, retrieving data stored with a Totalflow unit. This data is typically stored in records located in a data base format.
DB	See Decibel.
DB1	Acronym for Data Base 1. This refers to the previous data base structure used to store data in Totalflow products.
DB2	Acronym for Data Base 2. This refers to the current data base structure used to store data in Totalflow products.
DC	See Direct Current
DCD	Communication abbreviation for Data Carrier Detect
DCS/PLC	Distribution Control System/Programmable Logic Controller
DDE	See Digital Data Exchange. Also called Dynamic Data Exchange. May refer to Totalflow's DDE Server TDS32.
Dead Weight Tester	Portable pressure tester used to check calibration and to calibrate AMU's utilizing a system of calibrated weights.
De-bounce	De-bouncing is any kind of hardware device or software that ensures that only a single signal will be acted upon for a single opening or closing of a contact. When you press a key on your computer keyboard, you expect a single contact to be recorded by your computer. In fact, however, there is an initial contact, a slight bounce or lightening up of the contact, then another contact as the bounce ends, yet another bounce back, and so forth. A similar effect takes place when a switch made using a metal contact is opened. The usual solution is a de-bouncing device or software that ensures that only one digital signal can be registered within the space of a given time (usually milliseconds)
Decane (C10H22)	A hydrocarbon (Alkane) flammable colorless liquid with ten carbon atoms.
Decibel	A logarithmic measure of the ratio of two signal levels. A practical unit of gain.
Decimal	A numbering system based on 10.
Default	A value assigned or an action taken automatically unless another is specified.
Degree	An incremental value in the temperature scale, i.e., there are 100 degrees between the ice point and the boiling point of water in the Celsius scale and 180°F between the same two points in the Fahrenheit scale.
Delivery Point	Point at which gas leaves a transporter's system completing a sale or transportation service transaction between the pipeline company and a sale or transportation service customer.
Demand Day	That 24-hour period specified by a supplier-user contract for purposes of determining the purchaser's daily quantity of gas used (e.g., 8 AM to 8 AM, etc.). This term is primarily used in pipeline-distribution company agreements. It is similar to, and usually coincides with, the distribution company "Contract Day".
Demand Load	The rate of flow of gas required by a consumer or a group of consumers, often an average over a specified short time interval (cf/hr or Mcf/hr). Demand is the cause; load is the effect.
Demand Meters	A device which indicates or records the instantaneous, maximum or integrated (over a specified period) demand.
Demand, Average	The demand on a system or any of its parts over an interval of time, determined by dividing the total volume in therms by the number of units of time in the interval.

TERM	DEFINITION
Density	Mass per unit Volume: D=MV
Desaturization	Doesn't cause the composition of the gas to change, enabling a more representative sample of gas.
Detector Bead	See Thermal Conductivity Detector.
Deviation	The difference between the value of the controlled variable and the value at which it is being controlled.
Dew Point	The temperature at any given pressure at which liquid initially condenses from a gas or vapor. It is specifically applied to the temperature at which water vapor starts to condense from a gas mixture (water dew point) or at which hydrocarbons start to condense (hydrocarbon dew point).
Dewar	A glass or metal container made like a vacuum bottle that is used especially for storing liquefied gases. Also called "Dewar flask".
DG	Display Group. When display group files are created
Diaphragm	A bellows inside a displacement type gas meter. Also, a membrane separating two different pressure areas within a control valve or regulator.
Differential	For an on/off controller, it refers to the temperature difference between the temperature at which the controller turns heat off and the temperature at which the heat is turned back on. It is expressed in degrees.
Differential Input	A signal-input circuit where SIG LO and SIG HI are electrically floating with respect to ANALOG GND (METER GND, which is normally tied to DIG GND). This allows the measurement of the voltage difference between two signals tied to the same ground and provides superior common-mode noise rejection.
Differential Pressure	The pressure difference between two points in a system. For example, the difference in pressure between the upstream and downstream taps of an orifice plate, used to measure volume passing through the orifice.
Digit	A measure of the display span of a panel meter. By convention, a full digit can assume any value from 0 through 9, a 1/2-digit will display a 1 and overload at 2, a 3/4-digit will display digits up to 3 and overload at 4, etc. For example, a meter with a display span of ±3999 counts is said to be a 3-3/4 digit meter.
Digital	A signal which has distinct states, either on or off (0 or 1). Digital computers process data as binary information having either true of false states.
Digital Controller Assembly	The Digital Controller Assembly contains the Digital Electronic Board, Mounting Assembly and optionally a VGA Display. The Digital Controller board provides control parameters to the Analytical Processor board, stores and processes the data sent from the Analytical Processor board. The Digital Controller also processes communication with other devices.
Digital Controller Assy.	The NGC8200's digital controller assembly provides control parameters to the analytical processor board, stores and processes the data sent from the analytical processor board. The digital controller also processes communication with other devices. This assembly may also contain an optional VGA display.
Digital Data	Information transmitted in a coded form (from a computer), represented by discrete signal elements.
Digital Data Exchange or Dynamic Data Exchange	A Microsoft data exchange format generally used to transfer data from one program to another. It is a very simple format to use and Totalflow customers often use TDS to acquire data from Totalflow devices and then transfer the data to an Excel spreadsheet using DDE. The Totalflow Driver, TDS32, supports DDE and its network version, NetDDE.
Digital Electronics	The branch of electronics dealing with information in binary form.
Digital Input	Refers to the signal received in binary format.
Digital Output	Refers to the signal emitted in binary format. An output signal which represents the size of an input in the form of a series of discrete quantities.

TERM	DEFINITION
Digital to Analog Conversion	The process of translating discrete data into a continuously varying signal. Common uses are to present the output of a digital computer as a graphic display or as a test stimulus.
Digital-to-Analog Converter	An electronic device, often an integrated circuit, that converts a digital number into a corresponding analog voltage or current.
DIN	Deutsches Institut für Normung. German Institute for Standardization set of standards recognized throughout the world.
DIN Rail	Rail on which modules are mounted. Allows modules to snap on and slide right and left.
Diode	A semiconductor that allows current to flow in one direction only.
DIP Switches	A bank of switches typically used in setting the hardware configuration and base address of an option card.
Direct Current	A current that does not change in direction and is substantially constant in value.
Direct Memory Access	A method by which information can be transferred from the computer memory to a device on the bus without using the processor.
Discharge	The conversion of chemical energy of a cell/battery into electrical energy and withdrawal of the electrical energy into a load.
Discharge Rate	The rate, usually expressed in amperes, at which electrical current is taken from the cell/battery.
Discrete Manifold	Also called Tubing Manifold. Used in instances when the XFC is not mounted directly on the Orifice, usually pipe mount or wall mount.
Distillates	The distillate or middle range of petroleum liquids produced during the processing of crude oil. Products include diesel fuel, heating oil, kerosene and turbine fuel for airplanes.
Distillation	The first stage in the refining process in which crude oil is heated and unfinished petroleum products are initially separated.
Distribution	The act or process of distributing gas from the city gas or plant that portion of utility plant used for the purpose of delivering gas from the city gate or plant to the consumers, or to expenses relating to the operating and maintenance of distribution plant.
Distribution Company	Gas Company which obtains the major portion of its gas operating revenues from the operation of a retail gas distribution system, and which operates no transmission system other than incidental connections within its own system or to the system of another company. For purposes of A.G.A. statistics, a distribution company obtains at least 90 percent of its gas operating revenues from sales to ultimate customers, and classifies at least 90 percent of mains (other than service pipe) as distribution. Compare INTEGRATED COMPANY; TRANSMISSION COMPANY, GAS.
Dkt	Abbreviation for Dekatherm, equivalent to one MMBtu.
DMM	Digital Multi-Meter.
DN	Inside diameter standard.
DOS	Disk Operating System.
DOS CCU	Refers to the DOS version of the Calibration and Collection Unit. Also known as FS/2, hand held or Dog Bone.
DOT Matrix	A group of dots/pixels forming a character or symbol, usually five dots across and seven dots down.
DOT/Pixel	An active element that forms a character or symbol when combined in a matrix.
Download	This refers to a Totalflow procedure in which any file(s) located on a laptop PC or storage device, may be copied to the on-board memory of a Totalflow Host device for purposes of restoring, configuration or repair.

TERM	DEFINITION
Downstream	The oil industry term used to refer to all petroleum activities from the processing of refining crude oil into petroleum products to the distribution, marketing, and shipping of the products. Also see Upstream.
Downstream Pipeline	The pipeline receiving natural gas at a pipeline inter-connect point.
DP	See Differential Pressure.
DRAM	See Dynamic Random Access memory.
Drift	A change of a reading or a set point value over long periods due to several factors including change in ambient temperature, time, and line voltage.
Drip Gasoline	Hydrocarbon liquid that separates in a pipeline transporting gas from the well casing, lease separation, or other facilities and drains into equipment from which the liquid can be removed.
Driver (Hardware)	An electronic circuit that provides input to another electronic circuit.
Driver (Software)	A program that exercises a system or system component by simulating the activity of a higher level component.
Drivers	Software that controls a specific hardware device, such as interface boards, PLCs, RTUs, and other I/O devices.
Droplet Liquids	Large liquid particles
Dry Contact	Contacts which neither break nor make a circuit. 0 Ohms.
Dry Gas	Has no more than seven pounds of water per million cubic feet of gas. Gas has less than 0.1 PPM of liquid at the coldest ambient condition expected at the coldest point in the system. The liquid can be water, oil, synthetic lubrication, glycol, condensed sample or any other non vapor contaminate.
DSP	Digital Signal Processor.
Dual Element Sensor	A sensor assembly with two independent sensing elements.
Dual-Access Memory	Memory that can be sequentially accessed by more than one controller or processor but not simultaneously accessed. Also known as shared memory.
Duplex	The ability to both send and receive data simultaneously over the same communications line.
Duplex Wire	A pair of wires insulated from each other and with an outer jacket of insulation around the inner insulated pair.
Duty Cycle	The total time to one on/off cycle. Usually refers to the on/off cycle time of a temperature controller.
DVI	The Port Manager and communication engine of the SCADAvantage System. This software can multiplex among several communication formats and thus supporting several vendor's equipment over a single radio frequency. It "pushes" new data to the SCADA database, saving time and network resources by not transmitting redundant data. The DVI includes the Totalflow WinCPC code and thus supports all Totalflow software and functions – including WinCCU, TDS, PCCU, Report by exception, cryout, etc.
Dynamic Random Access memory	This is the most common form of computer memory It needs to be continually refreshed in order to properly hold data, thus the term "dynamic."
E^2Prom	See Electrically Erasable Programmable Read-Only Memory. Also called EEPROM.
Earth	Can mean a connection to the earth itself or the negative lead to the chassis or any point to zero voltage.
EC	European Community.
Echo	To reflect received data to the sender. i.e., depressed on a keyboard are usually echoed as characters displayed on the screen.
Edit	Making changes to information, data or configuration files.

TERM	DEFINITION
EEPROM	See Electrically Erasable Programmable Read-Only Memory. The PROM can be erased by electricity.
EFI	Electromechanical Frequency Interface.
EFM	See Electronic Flow Measurement.
EFR	Enhance Feature Release.
Electrical Interference	Electrical noise induced upon the signal wires that obscures the wanted information signal.
Electrically Erasable Programmable Read-Only Memory	ROM that can be erased with an electrical signal and reprogrammed. Also referred to as the S Drive. It is a persistent drive that will not loose its memory unless manually reprogrammed. Also called E^2Prom. Totalflow's XFC and XRC have a Serial EEPROM on board, which generally holds registry, application configuration and warranty information (non-volatile).
Electrode	The site, area, or location at which electrochemical processes take place.
Electromagnetic Compatibility	Term used for European Union's New Approach Directive 2004/108/EC, which means the device or system is able to function in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.
Electromagnetic Interference	Any electromagnetic disturbance that interrupts, obstructs, or otherwise degrades or limits the effective performance of electronics/electrical equipment. It can be induced intentionally, as in some forms of electronic warfare, or unintentionally, as a result of spurious emissions and responses, intermodulation products, and the like.
Electronic Flow Measurement	Historically, flow measurement was tracked using a chart recording technology. Developments in the field of electronics allowed for electronic measurement devices to overtake the chart recording market. This field continues to develop into peripheral markets, making the "Flow Meter" a valuable asset with multi-tasking "Control" capabilities. Totalflow's answer to this developing market is the XSeries equipment.
EMC	See Electromagnetic Compatibility
EMI	See Electromagnetic Interference.
Emitter	One terminal of a transistor.
EN	Euro Norm (European Standard)
Enagas	Spain's Certification Board
ENC82	Totalflow's environmental enclosure for the analytical product line. This enclosure comes in two sizes, ENC82S (small) and ENC82L (large).
Encoder	A device that converts linear or rotary displacement into digital or pulse signals. The most popular type of encoder is the optical encoder, which uses a rotating disk with alternating opaque areas, a light source, and a photodetector.
Environmental Conditions	All conditions in which a transducer may be exposed during shipping, storage, handling, and operation.
EP Mix	A liquefiable hydrocarbon product consisting primarily of ethane and propane.
EPROM	See Erasable Programmable Read-Only Memory. The PROM can be erased by ultraviolet light or electricity.
Erasable Programmable Read-Only Memory	ROM that can be erased using Ultraviolet Light. The EPROM maybe re-programmed by removing the EPROM from the circuit and using special equipment to write to it.
Ethane (C2H6)	A colorless hydrocarbon gas of slight odor having a gross heating value of 1,773 Btu per cubic foot and a specific gravity of 1.0488. It is a normal constituent of natural gas.

TERM	DEFINITION
Ethylene (C2H4)	A colorless unsaturated hydrocarbon gas of slight odor having a gross heating value of 1,604 Btu per cubic foot and a specific gravity of 0.9740. It is usually present in manufactured gas, constituting one of its elements and is very flammable.
EU	European Union. Formerly known as the European Community (EC). Members of this union are replacing individual national regulations of member countries with a series of Directives. These Directives are legislative instruments which oblige member states to introduce them into their existing laws. These directives harmonize a variety of existing practices, preserve the different legal traditions and settle constraints for further developments.
Event	Important incident: an occurrence, especially one that is particularly significant.
Event File	Stored records specifying a notable change. The XFC stores up to 200 records, containing: Time, Day, Description, Old Value, New Value.
Events	Signals or interrupts generated by a device to notify another device of an asynchronous event. The contents of events are device-dependent.
Ex	Potential Explosive.
EXIMV	Explosion Proof Integral Multivariable Transducer.
Expansion Board	A plug-in circuit board that adds features or capabilities beyond those basic to a computer, such as a data acquisition system expansion board.
Expansion Factor	Correction factor for the change in density between two pressure measurement areas in a constricted flow.
Expansion Slots	The spaces provided in a computer for expansion boards than enhance the basic operation of the computer.
Explosion-proof Enclosure	Explosion Proof Enclosure for Class 1 Division 1 locations. An enclosure that can withstand an explosion of gases within it and prevent the explosion of gases surrounding it due to sparks, flashes or the explosion of the container itself, and maintain an external temperature which will not ignite the surrounding gases.
Extended Binary Coded Decimal Interchange Code	EBCDIC. An eight-bit character code used primarily in IBM equipment. The code allows for 256 different bit patterns.
External Multivariable Transducer	Multivariable Transducer located outside of the flow computer enclosure. Used in multi-tube configurations and on systems where the actual flow computer is located at a distance from the flowing tube.
External Transducer	DP/SP Transducer located outside the enclosure. All electronics are located inside the enclosure and communicate via a ribbon cable.
F.O.B.	Abbreviation of free on board with the cost of delivery to a port and loading onto a ship included.
Fa	Orifice Thermal Expansion factor.
Fahrenheit	A temperature scale defined by 32° at the ice point and 212° at the boiling point of water at sea level.
Faux	Full Well Stream Factor.
Fb	Basic Orifice factor.
FBD	Function Block Diagram (IEC supported programming language)
FCC	Federal Communications Commission.
FCU	Flow computer unit
Feed Points	Connections between gas feeder lines and distribution networks.
Feedback	Occurs when some or all of the output of the device (such as an amplifier) is taken back to the input. This may be accidental (such as the acoustic feedback from a speaker to microphone) or intentional , to reduce distortion.

TERM	DEFINITION
Feeder (Main)	A gas main or supply line that delivers gas from a city gate station or other source of supply to the distribution networks.
Feed-Through Assembly	The Feed-Through Assembly also serves as the connection for sample streams, carrier gas and calibration streams, and contains the vents for sample and column gases.
Feed-through Assy.	Independent process streams are connected to the NGC8200 directly through the feed-through assembly or through an optionally installed sample conditioning system. The feed-through assembly also serves as the connection for carrier gas and calibration streams and contains the vents for sample and column gases.
FET	Field-effect transistor. Transistor with electric field controlling output: a transistor, with three or more electrodes, in which the output current is controlled by a variable electric field.
Fg	Specific Gravity factor.
Field Pressure	The pressure of natural gas as it is found in the underground formations from which it is produced.
File	A set of related records or data treated as a unit.
Film Liquids	Aerosols liquids who have contacted each other and become adhered to the inside of the pipeline.
Firmware	A computer program or software stored permanently in PROM or ROM or semi-permanently in EPROM.
Firmware Version	This refers to the version of firmware contained in the equipment.
Fixed-Point	A format for processing or storing numbers as digital integers.
Flag	Any of various types of indicators used for identification of a condition or event; for example, a character that signals the termination of a transmission.
Flameproof Enclosure “d”	Enclosure which can withstand the pressure developed during an internal explosion of an explosive mixture, and which prevents the transmission of the explosion to the explosive atmosphere surrounding the enclosure.
Flammable	A liquid as defined by NFPD and DOT as having a flash point below 37.8°C (100°F).
Flange	For pipe, a metal collar drilled with bolt holes and attached to the pipe with its flat surface at right angles to the pipe axis so that it can be securely bolted to a mating flange on a valve, another pipe section, etc.
FLASH	Re-programmable memory onboard an XFC/XRC, similar to an EPROM, except that it can be programmed while in circuit using a Boot Loader Program to write to it. Generally used for the operating system and application code space (non-volatile).
Flash ADC	An Analog to Digital Converter whose output code is determined in a single step by a bank of comparators and encoding logic.
Flash Point	The temperature at which a liquid will yield enough flammable vapor to ignite. There are various recognized industrial testing methods; therefore the method used must be stated.
Flash Vapors	Gas vapors released from a stream of natural gas liquids as a result of an increase in temperature or a decrease in pressure.
Flow	Travel of liquids or gases in response to a force (i.e., pressure or gravity).
Flow Computer, XSeries	A device placed on location to measure SP, DP and temperature (to calculate flow) of gases or liquids being transferred, for remote unattended operation.
Flow Formulas	In the gas industry, formulas used to determine gas flow rates or pressure drops in pipelines, regulators, valves, meters, etc.
Flow Rate	Actual speed or velocity of fluid movement .

TERM	DEFINITION
Flowmeter	A device used for measuring the flow or quantity of a moving fluid.
Fluids	Substances that flow freely; gases and liquids.
FM	Factory Mutual Research Corporation. An organization which sets industrial safety standards.
FM Approved	An instrument that meets a specific set of specifications established by Factory Mutual Research Corporation.
Font	The style of lettering used to display information.
Footprint	The surface space required for an object.
Fpb	Pressure Base factor.
FPM	Flow velocity in feet per minute.
FPS	Flow velocity in feet per second.
Fpv	See Supercompressibility Factor.
Fr	Reynolds Number factor.
Fractionation	The process of separating a steam of natural gas liquids into its separate components.
Freezing Point	The temperature at which the substance goes from the liquid phase to the solid phase.
Frequency	The number of cycles per second for any periodic waveform - measured in cycles per second - now called Hertz. The number of repeating corresponding points on a wave that pass a given observation point per unit time.
Frequency Modulation	Modulation where the frequency of the sine wave carrier alters with the amplitude of the modulating signal.
Frequency Output	An output in the form of frequency which varies as a function of the applied input.
Frit Filter	A small fine filter used primarily on the NGC8200 product line in the feed-through assembly as a last stage gas filter. This filter is not designed to replace an appropriate sample conditioning system.
FRP	Fiberglass Reinforced Polyurethane. A non-flexible material used for LevelMaster sensors.
FS/2	Ruggadized handheld computer device for programming and collecting data from an XFC. Also referred to a Husky or Dog Bone.
FT^3	A standard abbreviation for Cubic Foot.
Ftb	Temperature Base factor.
Ftf	Flowing Temperature factor.
Fuel Oils	The heavy distillates from the oil refining process that are used primarily for heating, for fueling industrial processes, for fueling locomotives and ships, and for fueling power generation systems.
Full Bridge	Wheatstone bridge configuration utilizing four active elements or strain gauges.
Full Duplex	Simultaneous, two-way (transmit and receive), transmission.
Function	A set of software instructions executed by a single line of code that may have input and/or output parameters and returns a value when executed.
Fuse	A short length of wire that will easily burn out when excessive current flows.
Fw	Water Vapor factor.
G	The symbol used for giga or gigabyte.
G4	Totalflow's new Generation 4 extendable XFC equipment featuring technology that is expandable and flexible for ever changing needs.
Gain	The factor by which a signal is amplified, sometimes expressed in dB.

TERM	DEFINITION
Gain Accuracy	A measure of deviation of the gain of an amplifier from the ideal gain.
Gal	An abbreviation for one gallon.
Gas	That state of matter which has neither independent shape nor volume. It expands to fill the entire container in which it is held. It is one of the three forms of matter, the other two being solid and liquid.
Gas Chromatograph	An analytical instrument that separates mixtures of gas into identifiable components by means of chromatography.
Gas Chromatograph Module	Software module used in conjunction with PCCU32 and WINCCU to interact with Btu Chromatograph equipment and software.
Gas Chromatograph Module Coefficient	A co-efficient generated by the factory allowing user to start calibration on location without having a calibration gas available.
Gas Chromatography	Preferred method for determining the Btu value of natural gas.
Gas Field	A district or area from which natural gas is produced.
Gas Injection	An enhanced recovery technique in which natural gas is injected under pressure into a producing reservoir through an injection well to drive oil to the well bore and the surface.
Gas Processing	The separation of components by absorption, adsorption, refrigeration or cryogenics from a stream of natural gas for the purpose of making salable liquid products and for treating the residue gas to meet required specifications.
Gas, Acid	The hydrogen sulfide and/or carbon dioxide contained in, or extracted from, gas or other streams.
Gas, Associated	Gas produced in association with oil, or from a gas cap overlying and in contact with the crude oil in the reservoir. In general, most states restrict associated gas production since its indiscriminate production could reduce the ultimate oil recovery. Also, since some wells producing associated gas cannot be shut-in without also shutting-in the oil production, natural gas pipelines are generally required to take associated gas produced from oil wells on a priority basis.
Gas, C1	See Methane.
Gas, C2	See Ethane.
Gas, C3	See Propane.
Gas, C5+	Pentanes Plus (IC5, NeoC5, NC5 and C6+)
Gas, C6+	Hexanes Plus (C6, C7, C8, C9, C10, C11, etc.).
Gas, CO2	See Carbon Dioxide.
Gas, Dry	Gas whose water content has been reduced by a dehydration process. Gas containing little or no hydrocarbons commercially recoverable as liquid product. Specified small quantities of liquids are permitted by varying statutory definitions in certain states.
Gas, IC4	See Iso-Butane.
Gas, IC5	See Iso-Pentane.
Gas, Liquefied Petroleum (LPG)	A gas containing certain specific hydrocarbons which are gaseous under normal atmospheric conditions but can be liquefied under moderate pressure at normal temperatures. Propane and butane are the principal examples.
Gas, Manufactured	A gas obtained by destructive distillation of coal, or by the thermal decomposition of oil, or by the reaction of steam passing through a bed of heated coal or coke, or catalyst beds. Examples are coal gases, coke oven gases, producer gas, blast furnace gas, blue (water) gas, and carbureted water gas. Btu content varies widely.
Gas, Natural	A naturally occurring mixture of hydrocarbon and non-hydrocarbon gases found in porous geologic formations beneath the earth's surface, often in association with petroleum. The principal constituent is methane.

TERM	DEFINITION
Gas, NC4	See Normal Butane.
Gas, NC5	See Normal Pentane.
Gas, NeoC5	See Neo-Pentane.
Gas, Non-associated	Free natural gas not in contact with, nor dissolved in, crude oil in the reservoir.
Gas, Oil	A gas resulting from the thermal decomposition of petroleum oils, composed mainly of volatile hydrocarbons and hydrogen. The true heating value of oil gas may vary between 800 and 1600 Btu per cubic foot depending on operating conditions and feedstock properties.
Gas, Sour	Gas found in its natural state, containing such amounts of compounds of sulfur as to make it impractical to use, without purifying, because of its corrosive effect on piping and equipment.
Gas, Sweet	Gas found in its natural state, containing such small amounts of compounds of sulfur that it can be used without purifying, with no deleterious effect on piping and equipment.
Gas, Unconventional	Gas that can not be economically produced using current technology.
Gas, Wet	Wet natural gas is unprocessed natural gas or partially processed natural gas produced from strata containing condensable hydrocarbons. The term is subject to varying legal definitions as specified by certain state statutes.
Gate Station	Generally a location at which gas changes ownership, from one party to another, neither of which is the ultimate consumer. It should be noted, however, that the gas may change from one system to another at this point without changing ownership. Also referred to as city gate station, town border station, or delivery point.
Gathering	The act of operating extensive low-pressure gas lines which aggregate the production of several separate gas wells into one larger receipt point into an interstate pipeline.
Gathering Agreement	Agreement between a producer and a gathering system operator specifying the terms and conditions for entry of the producer's gas into the gathering system.
Gathering Line	A pipeline, usually of small diameter, used in gathering gas from the field to a central point.
Gathering Station	A compressor station at which gas is gathered from wells by means of suction because pressure is not sufficient to produce the desired rate of flow into a transmission or distribution system.
Gathering System	The gathering pipelines plus any pumps, tanks, or additional equipment used to move oil or gas from the wellhead to the main pipeline for delivery to a processing facility or consumer.
Gauge Factor	A measure of the ratio of the relative change of resistance to the relative change in length of a piezoresistive strain gage.
Gauge Pressure	Absolute pressure minus local atmospheric pressure.
Gauge, Pressure	Instrument for measuring the relative pressure of a fluid. Types include gauge, absolute, and differential.
Gauging Tape Measurements	This refers to a manual method of measuring the level of a liquid in a tank. These measurements may be used to calibrate float levels.
GC	See Gas Chromatograph.

TERM	DEFINITION
GC Module	The NGC8200's GC module is comprised of three parts: columns, chromatographic valve and GC module circuit board. The valve controls the flow of gas within the system. The columns perform the separation of the gas into component parts for analysis. The GC module circuit board contains the sensors for the carrier pressure regulators, the sample pressure sensor and the thermal conductivity detectors (TCD's) which detect the different gas components as they leave the GC columns. It also contains an EEPROM or FLASH memory for storage of calibration and characterization information of the module and its sensors.
GC Module Assembly	The GC module is comprised of 3 parts; Columns, Valves and Electronic Interface. The Valves control flow of gas within the system. The Columns perform the separation of the gas into component parts for analysis. The Electronic Interface contains pressure and temperature sensors to monitor and detect the different gas components as they leave the GC Columns.
GCM	See Gas Chromatograph Module
GCM	See Gas Chromatograph Module Coefficient.
GCN	Gravity, Carbon Dioxide and Nitrogen compounds. Used in NX-19 GCN Supercompressibility Factor.
GCNM	Gravity, Carbon Dioxide, Nitrogen and Methane compounds. Used in NX-19 GCNM Supercompressibility Factor.
GDF	Gasde of France
Gj	An abbreviation for gigajoule, equivalent to one thousand mega joules or one billion joules.
GND	See Ground.
GOST	Russian Government Standards for Importation.
GPA 2145-03	Gas Processors Association Physical Constants for Paraffin Hydrocarbons and other Components of Natural Gas
GPA 2172-96	Gas Processors Association Calculation of Gross Heating Value, Relative Density and Compressibility of Natural Gas Mixtures from Compositional Analysis.
GPM	Gallons of liquid per thousand cubic feet.
GPS 2261	See Gas Processors Standard 2261.
GPV	Gauge Port Vent. Refers to the NGC8200 Port designed to equalize the pressure inside of the explosion-proof enclosure.
GPV	Gauge Port Valve (located on NGC8200 series Feed-Through Assembly).
GRD	See Ground.
Gross Heating Value	The heating value measured in a calorimeter when the water produced during the combustion process is condensed to a liquid state. The heat of condensation of the water is included in the total measured heat.
Ground	1) An electronically neutral circuit having the same potential as the surrounding earth. Normally, a non-current carrying circuit intended for the safety purposes. A reference point for an electrical system. 2) A large conducting body (as the earth) used as a common return for an electric circuit and as an arbitrary zero of potential. 3) Reference point for an electrical system.
Grounding Strap	A grounding strap is a conductive device used to make connection between the person handling the board, and a high quality ground potential.
H2	The molecular formula for Hydrogen.
H2S	The molecular formula for Hydrogen Sulfide.
Half Duplex	Communication transmission in one direction at a time.

TERM	DEFINITION
Handshake	An interface procedure that is based on status/data signals that assure orderly data transfer as opposed to asynchronous exchange.
Handshaking	Exchange of predetermined signals between two devices establishing a connection. Usually part of a communications protocol.
Hardware	The physical components of a computer system, such as the circuit boards, plug-in boards, chassis, enclosures, peripherals, cables, and so on. It does not include data or computer programs.
Harmonic	A sinusoidal component of a waveform that is a whole multiple of the fundamental frequency. An oscillation that is an integral sub-multiple of the fundamental is called a sub-harmonic.
HART	Communication Interface.
Hazardous Area	Area in which an explosive gas atmosphere is present or may be expected to be present.
Heat	Thermal energy. Heat is expressed in units of calories or Btu's
Heat Capacity	The amount of heat required to raise the temperature of a body (of any mass) one degree Celsius.
Heat of Condensation	The amount of heat that must be removed from one gram of a vapor at its condensation point to condense the vapor with no change in temperature.
Heat of Vaporization	The amount of heat required to vaporize one gram of a liquid at its boiling point with no change in temperature. Usually expressed in J/g. The molar heat of vaporization is the amount of heat required to vaporize one mole of liquid at its boiling point with no change in temperature and usually expressed ion kJ/mol.
Heat Transfer	A form of energy that flows between two samples of matter because of their differences in temperature.
Heating Value	The amount of heat developed by the complete combustion of a unit quantity of a material. Heating values for natural gas are usually expressed as the Btu per Cf of gas at designated conditions (temperature and pressure) and either on the dry or water saturated basis.
Heavy Crude	Crude oil of 20-degree API gravity or less; often very thick and viscous.
Heavy Ends	The portion of a hydrocarbon mixture having the highest boiling point. Hexanes or heptanes and all heavier hydrocarbons are usually the heavy ends in a natural gas stream.
Heavy Hydrocarbons	More susceptible to increases in temperature and decreases in pressure, thus causing liquids to form.
Heptane (C7H16)	A saturated hydrocarbon (Alkane) with 7 carbon atoms in its molecule (C7H16). A liquid under normal conditions.
Hertz	Cycles per second. A measure of frequency or bandwidth.
Hexadecimal	A numbering system to the base 16, 0 through F.
Hexane (C6H14)	A saturated hydrocarbon (Alkane) with six carbon atoms in its molecule (C6H14). A liquid under normal conditions.
Hexane Plus or Heptane Plus	The portion of a hydrocarbon fluid mixture or the last component of a hydrocarbon analysis which contains the hexanes (or heptanes) and all hydrocarbons heavier than the hexanes (or heptanes).
Hierarchical	A method of organizing computer programs with a series of levels, each with further subdivisions, as in a pyramid or tree structure.
Hold	Meter HOLD is an external input which is used to stop the A/D process and freeze the display. BCD HOLD is an external input used to freeze the BCD output while allowing the A/D process to continue operation.
Host	The primary or controlling computer in a multiple part system.

TERM	DEFINITION
Host Console	Host Console via Local Port uses the PCCU cable between the computer and the device's Local PCCU port but running Remote Protocol. Host Console via Remote Port uses the remote protocol
Hub	A market or supply area pooling/delivery where gas supply transaction point occur that serve to facilitate the movement of gas between and among interstate pipelines. Transactions can include a change in title, a change in transporter, or other similar items.
HV	See Heating Value.
Hydrocarbon	A chemical compound composed solely of carbon and hydrogen. The compounds having a small number of carbon and hydrogen atoms in their molecules are usually gaseous; those with a larger number of atoms are liquid, and the compounds with the largest number of atoms are solid.
Hydrogen Sulfide	A flammable, very poisonous and corrosive gas with a markedly disagreeable odor, having the chemical formula of H_2S that is a contaminant in natural gas and natural gas liquids.
Hyper term	Terminal emulation program provided with Windows®.
Hysteresis	The maximum difference between output readings for the same measured point, one point obtained while increasing from zero and the other while decreasing from full scale. The points are taken on the same continuous cycle. The deviation is expressed as a percent of full scale.
I/O	See Input/Output.
I/O Address	A method that allows the CPU to distinguish between the different boards in a system. All boards must have different addresses.
I^2C	Inter-Integrated Circuit. Serial communications bus to I/O modules (developed by Phillips Semiconductor)
IAR	Maker and distributor of the Embedded Workbench, a compiler, assembler, linker development system for the Z80/64180 microprocessor family.
IC	See Integrated Circuit
IC4	A standard abbreviation for Isobutane.
IC5	A standard abbreviation for Isopentane.
Icon	A graphic functional symbol display. A graphic representation of a function or functions to be performed by the computer.
ID	Identification Number. You must assign an ID to the unit. Units are communicated to by this ID number, therefore the ID assigned in the software must agree with the hardware.
IEC	International Electrotechnical Commission. Developers of the IEC-61131-3 standard. Programming Language used by Totalflow for user applications in XSeries equipment.
$IECE_x$	The IEC scheme for certification to standards relating to equipment for use in explosive atmospheres.
IEEE	Institute of Electrical and Electronics Engineers
IIC	Inter-Integrated Circuit. Also see I^2C.
IL	Instruction List (IEC supported programming language)
Impedance	The total opposition to electrical flow (resistive plus reactive).
IMV	See Integral Multivariable Transducer.
Inch of Mercury	A pressure unit representing the pressure required to support a column of mercury one inch high at a specified temperature; 2.036 inches of mercury (at 32 degrees F and standard gravity of 32.174 ft/sec^2) is equal to a gauge pressure of one pound per square inch.

TERM	DEFINITION
Inch of Water	A pressure unit representing the pressure required to support a column of water one inch high. Usually reported as inches W.C. (water column) at a specified temperature; 27.707 inches of water (at 60o and standard gravity of 32.174 ft/sec2) is equal to a gauge pressure of one pound per square inch.
Industry Canada	Canadian Certification.
Inerts	Elements or compounds not acted upon chemically by the surrounding environment. Nitrogen and carbon dioxide are examples of inert components in natural gas. Inerts dilute the natural gas and since they do not burn or combust, have no heating value.
Initialization File	Generic file used to support the display of Totalflow application data in PCCU32.
Input	That part of a circuit that accepts a signal for processing.
Input Impedance	The resistance measured across the excitation terminals of a transducer.
Input Sense	To examine or determine the status of the input.
Input/Output	The transfer of data to/from a computer system involving communications channels, operator interface devices, and/or data acquisition and control interfaces.
Instantiate	Starting an instance of an object.
Instrument Manifold	Manifold type used when XFC is mounted directly on the Orifice.
Insulator	Any material that resists the flow of electrical current.
Integral Multivariable Transducer	A Multivariable Transducer that is an integral part of the flow computer, measuring DP and SP. This refers only to the transducer portion of the device and makes no assumption whether or not the circuitry is located as part of the unit, or if the circuitry is located on the Mother Board and attached via wiring. Also see Multivariable Transducer.
Integrated Circuit	A circuit component consisting of a piece of semiconductor material containing up to thousands of transistor and diodes. A chip.
Integrating ADC	An ADC whose output code represents the average value of the input voltage over a given time interval.
Interface (computer)	Usually refers to the hardware that provides communication between various items of equipment.
Interface (liquid)	The area between two liquids that are not easily mixed, i.e., oil and water.
Interference	A disturbance to the signal in any communications system.
Intrinsically Safe	An instrument which will not produce any spark or thermal effects under normal and specified fault conditions, that is capable of causing ignition of a specified gas mixture.
Inverter	A circuit in both analogue and digital systems that provides an output that is inverse to the input.
Inverter, DC to AC	Converts DC to AC at a high frequency.
ioINT	Interrupt signal from the I/O modules.
ioVBB	i/o Battery Voltage- Unregulated 13.8 volts. Host supplies 2.5 amps to the I/O modules.
ioVDD	Unregulated 5.6 volts from the host for I/O modules.
ISA	Instrument Society of America.
ISO	International Standards Organization.
ISO 5167	International Standards Organization Report No. 5167, Measurement of Fluid Flow by Means of Pressure Differential Devices.
ISO 6976-95	International Standards Organization Report No. 6976-95, Calculation of Calorific Values, Density, Relative Density and Wobbe Index from Composition.

TERM	DEFINITION
Isobutane (C4H10)	A hydrocarbon of the same chemical formula as butane but different molecular structure, resulting in different physical properties, notably lower boiling point. Gross heating value 3261 Btu/cu. ft. gas.
Isokenetic Sampling	Laboratory technique where gas sample is tested after removing liquids, therefore not allowing the atomized liquid to return to the gaseous state, changing the sample accuracy.
Isolation	The reduction of the capacity of a system to respond to an external force by use of resilient isolating materials.
Isopentane (C5H12)	A hydrocarbon of the paraffin series having a chemical formula of C5H12 and having its carbon atoms branched.
IUPAC	Acronym for International Union of Pure and Applied Chemistry. It is an international non-governmental organization devoted to the advancement of chemistry. It is most well known as the recognized authority in developing standards for the naming of the chemical elements and their compounds
Joule	The basic unit of thermal energy.
Joule-Thompson Effect	The change in gas temperature which occurs when the gas is expanded at constant enthalpy from a higher pressure to a lower pressure. The effect for most gases at normal pressure, except hydrogen and helium, is a cooling of the gas creating condensation.
K	Kilo. 1) In referring to computers, a "kilo" is 1024 or 2 to the 10th power (Note that it is actually slightly more than an even 1000.). 2) the standard metric prefix for 1,000, or 10^3, used with units of measure such as volts, hertz, and meters.
Kbytes/s	A unit for data transfer that means 1,000 or 10^3 bytes/s.
Kerosene	An oily liquid obtained in the distilling of gasoline in a temperature range from 174-288 degree C. A hydrocarbon of specific gravity of 0.747 to 0.775. Used as fuel for some internal combustion engines, heating equipment, and illuminating purposes. A heavy grade known as range oil is used for cooking and heating.
KHz	Electronic abbreviation for Kilohertz.
kilobyte	1024 bytes.
Kilowatt	Equivalent to 1000 watts.
kilowatt-hour	A unit of energy when one kilowatt of power is expended for one hour. Example A radiator bar is usually rated at 1,000 watts and this switched on for one hour consumes one kilowatt-hour of electricity.
KPa	Kilopascal-Measure of Pressure
kw	See Kilowatt.
kwh	See Kilowatt-hour.
LACT	Lease Automatic Custody Transfer.
Lag	1) A time delay between the output of a signal and the response of the instrument to which the signal is sent. 2) A time relationship between two waveforms where a fixed reference point on one wave occurs after the same point of the reference wave.
Latent Heat of Vaporization	Represents the amount of heat required to vaporize a liquid. In the instance of natural gas, the equation appears: 1 Btu = heat to change. This is the most likely scenario for causing gas to liquefy.
LCD	Liquid Crystal Display.
LD	Ladder Diagram (IEC supported programming language)
LED	Light Emitting Diodes.
LevelMaster	Intelligent Digital Level Sensor and is designed for custody transfer accuracy in demanding level measurement applications in tanks. LevelMaster is the name of the Totalflow’s Tank Gauging System.

TERM	DEFINITION
Life	For rechargeable batteries, the duration of satisfactory performance, measured in years (float life) or in the number of charge/discharge cycles (cycle life).
Life Cycle	The minimum number of pressure cycles the transducer can endure and still remain within a specified tolerance.
Light Crude	Crude oil with a high API gravity due to the presence of a high proportion of light hydrocarbon fractions.
Light Ends	The portion of a liquid hydrocarbon mixture having the lowest boiling points which are easily evaporated.
Light Hydrocarbons	The low molecular weight hydrocarbons such as methane, ethane, propane and butanes. More Volatile.
Linearity	The maximum deviation of the calibration curve from a straight line between zero and full scale, expressed as a percent of full scale output and measured on increasing measurement only.
Liquefiable Hydrocarbons	The components of natural gas that may be recovered as liquid products.
Liquefied Natural Gas	Natural gas which has been liquefied by reducing its temperature to minus 260 degrees Fahrenheit at atmospheric pressure. It remains a liquid at -116 degrees Fahrenheit and 673 psig. In volume, it occupies 1/600 of that of the vapor at standard conditions. Natural gasoline and liquefied petroleum gases fall in this category.
Liquefied Petroleum Gas	A gas containing certain specific hydrocarbons which are gaseous under normal atmospheric conditions, but can be liquefied under moderate pressure at normal temperatures. Propane and butane are the principal examples.
Liquid Crystal Display	A reflective display that requires very low power for operation.
LNG	See Liquefied Natural Gas.
Load (electrical)	A load is an energy consuming device. The device can be an actual device such as a bulb of a flash light, radio, cassette player, motor, etc., a resistor or a constant current load.
Load (units)	The amount of gas delivered or required at any specified point or points on a system; load originates primarily at the gas consuming equipment of the customers. Also, to load a pressure regulator is to set the regulator to maintain a given pressure as the rate of gas flow through the regulator varies. Compare DEMAND.
Location File	This is a file containing the configuration of the Location or site and the LevelMasters assigned to the Location. You may have a file that contains everything or a file for each Location name. The information from the file is displayed on the main MasterLink screen in the form of a tree structure. See the Main Screen topic for more information.
Location Name	Location Name is the top of the hierarchy tree of a Location File. Included in the Location Name is the LevelMaster's name, ID, S/N, Sensor File and Configuration no.
Log Period	In a XFC, the specified length between writing the calculated accumulated volume to record. You may record volumes as often as every minute and as seldom as every hour. More frequent recording reduces the number of days of records possible between collection.
Long Term	For Totalflow's purpose, the application of this term refers to storing data over a period of time that is greater than a minimal time. Such as data collected weekly versus data collected weekly but stored indefinitely.
LPG	See Liquefied Petroleum Gas.
LSB	Least Significant Byte
M	Mega, the prefix for 1,048,576, or 2^{20}, when used with byte to quantify data or computer memory. Also 1000, as in MCF or 1000 Cubic Ft.

TERM	DEFINITION
Manifold	The conduit of an appliance which supplies gas to the individual burners. Also, a pipe to which two or more outlet pipes are connected.
Manifold Assembly	The Manifold Assembly is comprised of the Manifold Plate, Heater, Valves, and various Cables to other major components. The Manifold Plate and Heater maintain constant temperature for the GC module and Columns. The Valves control Stream processing, Carrier and Calibrations gases. The Cables complete the information chain from the GC module to the Analytical Processor and the Digital Controller Assembly.
Man-Machine Interface	Software program that converts machine instructions and commands into a user interface.
Manometer	A two-armed barometer.
Manual Reset	The switch in a limit controller that manually resets the controller after the limit has been exceeded.
MasterLink	MasterLink is the name of the software program used to communicate with the LevelMaster for purposes of doing setup, calibration, troubleshooting, generating site files, monitoring levels and collecting data.
Mbytes/s	A unit for data transfer that means 1 million or 10^6 bytes/s.
Mcf	The quantity of natural gas occupying a volume of 1000 cubic feet at a temperature of 60° Fahrenheit and at a pressure of 14.73 psia.
Mean Temperature	The average of the maximum and minimum temperature of a process equilibrium.
Measurement Unit Assembly	μFLO's measurement and operational features are housed in this single unit assembly. The main electronic board (μFLO-195 Board), communication connection, power, SP, DP and Temperature readings are all housed in this unit.
Mega	Multiplier indicating that a quantity should be multiplied by 1,000,000.
Melting Point	The temperature at which a substance transforms from a solid phase to a liquid phase.
Membrane	The pH-sensitive glass bulb is the membrane across which the potential difference due to the formation of double layers with ion-exchange properties on the two swollen glass surfaces is developed. The membrane makes contact with and separates the internal element and filling solution from the sample solution.
Memory	Electronic devices that enable a computer to store and recall information. In its broadest sense, memory refers to any hardware capable of serving that end, e.g., disk, tape, or semiconductor storage.
Menu	The list of available functions for selection by the operator, usually displayed on the computer screen once a program has been entered.
MEPAFLOW	SICK Engineering's Menu-based Measurement and Parameterization Software for the TotalSonic system (MMI).
Mercaptans	Compounds of carbon, hydrogen and sulfur found in sour crude and gas; the lower mercaptans have a strong, repulsive odor and are used, among other things, to odorize natural gas.
Meter	Acronym M. Metric measurement equal to 1.09361 yards.
Meter Manifold	Gas piping between gas service line and meter. Also, gas piping supplying two or more meters.
Meter, Orifice	A meter using the differential pressure across an orifice plate as a basis for determining volume flowing through the meter. Ordinarily, the differential pressure is charted.
Meter, PD	See Meter, Positive Displacement.

TERM	DEFINITION
Meter, Positive Displacement	An instrument which measures volume on the basis of filling and discharging gas in a chamber.
Meter, Turbine	1) Pulse meter. 2)A velocity measuring device in which the flow is parallel to the rotor axis and the speed of rotation is proportional to the rate of flow. The volume of gas measured is determined by the revolutions of the rotor and converting them to a continuously totalized volumetric reading.
Methane (C1H4)	A hydrocarbon (Alkane) with the lightest molecule. A gas under normal conditions. The first of the paraffin series of hydrocarbons. The chief constituent of natural gas. Pure methane is odorless and has a heating value of 1012 Btu per cubic foot. Typically mixed with a sulfur compound to aid in leak detection.
microFlo Computer	See μFLO.
Microprocessor	This term is commonly used to describe the CPU. More specifically, it refers to the part of the CPU that actually does the work, since many CPUs now contain L1 and L2 caches on-chip.
Milli	One thousandth e.g. one milli-watt - 1mW. one milli-amp - 1mA. one milli-volt - 1mV.
Millimeter	Acronym mm. Metric measurement equal to .03937 inch.
MIPS	Million instructions per second. The unit for expressing the speed of processor machine code instructions.
Mj	Abbreviation for mega joule, equivalent to one million joules.
Mm	Acronym for Millimeter.
MMBtu	A thermal unit of energy equal to 1,000,000 Btu's, that is, the equivalent of 1,000 cubic feet of gas having a heating content of 1,000 BTUs per cubic foot, as provided by contract measurement terms.
MMcf	A million cubic feet. See CUBIC FOOT. (1,000,000 CF)
MMI	See Man-Machine Interface.
Modbus®	Messaging structure developed and used to establish master-slave/client-server communication between intelligent devices. Generic protocol supported by most process automation vendors.
Modem	Modulator-Demodulator. A device used to convert serial digital data from a transmitting terminal to a signal suitable for transmission over a common carrier, or to reconvert the transmitted signal to digital data for acceptance by a receiving terminal.
Module	Typically a board assembly and its associated mechanical parts, front panel, optional shields, and so on. A module contains everything required to occupy one or more slots in a mainframe.
Mol%	See Mole Percent.
Mole Percent	The number of moles of a component of a mixture divided by the total number of moles in the mixture.
MRB	Modbus® Request Block. When requesting storage space after adding a new Modbus® application, the file is saved as a *.mrb file.
MRM	Modbus® register map. When requesting storage space after adding a new Modbus® register, the file is saved as a *.mrm file.
MS	Milliseconds. One-thousandth of a second.
MSB	Most Significant Byte
Mueller Bridge	A high-accuracy bridge configuration used to measure three-wire RTD thermometers.
Multiplex	A technique which allows different input (or output) signals to use the same lines at different times, controlled by an external signal. Multiplexing is used to save on wiring and I/O ports.

TERM	DEFINITION
Multi-tasking	A property of an operating system in which several processes can be run simultaneously.
Multi-tube Sites	Locations where many flow tubes are all within a prescribed distance allowing one flow meter with multitube capabilities, such as the XSeries product line, to monitor and maintain flow records for each tube in one flow computer.
Multivariable Transducer	Transducer supplying more than 1 variable. Totalflow uses this term to encompass units that read Static Pressure, Differential Pressure. Historically these units were coined AMU for Analog Measurement Unit. As a result of advanced technology, the unit no longer functions as only an analog measurement unit. Therefore the newer terminology, Multivariable Transducer, more aptly describes the functionality of this design. The abbreviation IMV refers to the Integral version of the multivariable. The abbreviation XIMV, refers to the XSeries IMV version of the multivariable, which contains the circuitry as part of the unit and the abbreviation IMVX, refers to the Explosion Proof IMV, where the required circuitry resides on the Main Processor Board. See each instance for additional explanation.
MW	Acronym for Molecular Weight.
N2	A standard abbreviation for Nitrogen.
NAK	See Negative Acknowledgement
NAMUR	Normenarbeitsgemeinschaft für Mess- und Regeltechnik in der chemischen Industrie (Standards study group for measurement and process control technology in the chemical industry).
Natural Gas	See Gas, Natural.
Natural Gas Distillate	Material removed from natural gas at the "heavy end" portion; that is, aliphatic compounds ranging from C4 to C8 (butanes and heavier).
Natural Gas Liquids	The hydrocarbon components: propane, butanes, and pentanes (also referred to as condensate), or a combination of them that are subject to recovery from raw gas liquids by processing in field separators, scrubbers, gas processing and reprocessing plants, or cycling plants. The propane and butane components are often referred to as liquefied petroleum gases or LPG.
Natural Gasoline	A mixture of hydrocarbons, mostly pentanes and heavier, extracted from natural gas, which meets vapor pressure and other specifications.
NBS	National Bureau of Standards.
NC	See Normally Closed.
NC4	A standard abbreviation for Normal Butane.
NC5	A standard abbreviation for Normal Pentane.
NEC	National Electrical Codes
Negative Acknowledgment	This refers to a response over a remote communication device, such as a PING. Basically, saying, "I don’t acknowledge your request!" This is the opposite of ACK. NAK is a slang term that means that you disagree or do not acknowledge something.
NEMA	National Electrical Manufacturers Association.
NEMA, Type 3R	A standard from the National Electrical Manufacturers Association. Enclosure constructed for indoor/outdoor use to provide protection against falling dirt, rain, sleet and snow and remain undamaged by external formation of ice.
NEMA, Type 4	A standard from the National Electrical Manufacturers Association. Enclosure constructed for indoor/outdoor use to provide protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, and hose-directed water and remain undamaged by external formation of ice.
NEMA, Type 4X	A standard from the National Electrical Manufacturers Association. Enclosure constructed as for Type 4 with protection against corrosion.

TERM	DEFINITION
NeoC4	A standard abbreviation for Neobutane.
NeoC5	A standard abbreviation for Neopentane.
Network	A group of computers that are connected to each other by communications lines to share information and resources.
Newton Meter	Torque measurement unit equal to 8.84 Inch Pounds.
NGC	Natural Gas Chromatograph
NGC Termination Panel	The NGC Termination Panel acts as a connection to the outside world. It features Transient Protection, a built-in voltage regulator, Positive Temperature Co-efficient Fuses (PTC) and many other safeguards to protect the remainder of the system from electrical damage. All outside communications and I/O are channeled through this board. It is designed to be a low cost, field replaceable maintenance solution and is designed to operate on either 12V or 24V.
NGC8201	Totalflow NGC8201 Gas Chromatograph for Process Gas Chromatography. The NGC is designed to continually analyze process gas streams, on-site, determine composition, calorific value, and store the analysis information. The unit can collect and retain analysis information for one to four independent sample streams.
NGC8206	Totalflow NGC Gas Chromatograph, with C6+. The NGC is designed to continually analyze natural gas streams, on-site, determine composition, calorific value, and store the analysis information. It is designed for natural gas streams, 800 to 1500 Btu/scf (29.8 to 55.9 Mega joules/meter^3) with less than 100 PPM H2S. The unit is a fully functional gas chromatograph for “Pipeline Quality” natural gas, designed to analyze natural gas streams, dry of both hydrocarbon liquids and water. The unit can collect and retain analysis information for one to four independent sample streams. Applicable installations include: Transmission, Distribution, Custody Transfer with Metrology quality results, Production, Gas Gathering and End User Gas Markets.
NGL	See Natural Gas Liquids.
NGL	A standard abbreviation for Natural Gas Liquids.
Nm	Abbreviation for Newton Meter. Metric Torque measurement.
NO	See Normally Open.
Noise	An undesirable electrical signal. Noise comes from external sources such as the AC power line, motors, generators, transformers, fluorescent lights, soldering irons, CRT displays, computers, electrical storms, welders, radio transmitters, and internal sources such as semiconductors, resistors, and capacitors. Unwanted disturbances superimposed upon a useful signal that tends to obscure its information content.
Nonane (C9H20)	A hydrocarbon (Alkane) flammable colorless liquid with nine carbon atoms.
Non-hazardous area	Area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions.
Non-Persistent	Refers to data that is no longer available after a Warm Start.
Normal Butane	An aliphatic compound of the paraffin series having the chemical formula of C4H10 and having all of its carbon atoms joined in a straight chain.
Normal Pentane	A hydrocarbon of the paraffin series having a chemical formula of C5H12 and having all its carbon atoms joined in a straight chain.

TERM	DEFINITION
Normalization of Component Mole Percentages	The exact amount of sample which is injected onto the columns of the chromatograph must be a very reproducible volume in order to give consistent values for the resulting calculated Btu. The calculation controls the volume, temperature and pressure of the sample to be injected by a very simple means. A few seconds before the sample is actually injected, the flow of sample through the sample valve injection loop is stopped by automatically shutting the sample shut-off valve. This allows the pressure of the sample in the sample loop to bleed down to atmospheric pressure. Since the temperature is controlled and the size of sample loop does not vary then the only change possible in sample size is related to variations in atmospheric pressure. Atmospheric pressure does vary with the weather and in order to compensate for this or any other slight sample size change, the mole percentages of each component are adjusted to equal a total of 100% through a calculation called normalization. The values in mole percents are determined by the chromatographic analysis and then totaled to a value that is near 100%, which is called the unnormalized total. The unnormalized total is divided by 100% and the resulting factor is then multiplied by the mole% value for each component. This calculation will adjust each component's mole% in the correct manner as to result in a new total of exactly 100%. The calculation also checks to see if the unnormalized total is out of a specified range for alarm purposes. This is an overall performance check to determine if the chromatograph has some problem or has drifted out of calibration.
Normally Closed	Designation which states that the contacts of a switch or relay are closed or connected when at rest. When activated, the contacts open or separated.
Normally Open	Designation which states that the contacts of a switch or relay are normally open or not connected. When activated the contacts close or become connected.
Norsok	Norwegian Certification Bureau
NPN	Negative-Positive-Negative (Transistor).
NPT	National Pipe Thread.
NRTL	Nationally Recognized Testing Laboratory.
Null	A condition, such as balance, which results in a minimum absolute value of output.
NX-19	American Gas Association Report referring to a specific method to calculate the Supercompressibility factor.
O2	A standard abbreviation for oxygen.
Octane (C8H18)	A hydrocarbon (Alkane) flammable colorless liquid with eight carbon atoms. Is the 100 point on the Octane Rating Scale.
OCV	See Open Circuit Voltage.
ODBC	See Open Database Connectivity.
OEU	Optional Equipment Unit.
Offset	The difference in temperature between the set point and the actual process temperature. Also, referred to as droop.
OHM	The unit of resistance usually shown as the symbol "R". One thousand ohms is written "k" and one million ohms is written "M". Resistance is measured with a multimeter, set to the "ohms range".
Ohmmeter	An instrument used to measure electrical resistance.

TERM	DEFINITION
OLE	Object Linking and Embedding. A set of system services that provides a means for applications to interact and interoperate. Based on the underlying Component Object Model, OLE is object-enabling system software. Through OLE Automation, an application can dynamically identify and use the services of other applications, to build powerful solutions using packaged software. OLE also makes it possible to create compound documents consisting of multiple sources of information from different applications.
Ole for Process Control	This is a data interchange format and supporting software. Typically, vendors (such as ABB) write OPC server drivers which can talk to their devices. SCADA system vendors (again like ABB) write OPC clients that can gather data from OPC Servers. The idea is to provide a universal way to collect data into a SCADA system regardless of the equipment vendor. This standard was developed and is maintained by the OPC Foundation. The Totalflow Driver, TDS32, supports OPC.
Ole for Process Control Database	A programming interface to databases. Supports the OLEDB interface.
OLEDB	See Ole for Process Control Database.
Olefins	Basic chemicals made from oil or natural gas liquids feedstocks; commonly used to manufacture plastics and gasoline. Examples are ethylene and propylene.
OOP	Object-Oriented Programming. The XFC/XRC architecture incorporates an object-oriented approach.
OPC	See Ole for Process Control.
Open Circuit	A complete break in a metal conductor path.
Open Circuit Voltage	The difference in potential between the terminals of a cell/battery when the circuit is open (no-load condition).
Open Collector	A single NPN transistor with the base connected to the logic driving circuitry and with the emitter grounded. The collector is the output pin of the gate.
Open Database Connectivity	A widely accepted application-programming interface (API) for database access. It is based on the Call-Level Interface (CLI) specifications from X/Open and ISO/IEC for database APIs and uses Structured Query Language (SQL) as its database access language. Using ODBC, you can create database applications with access to any database for which your end-user has an ODBC driver. This allows access for authorized users to databases over any network, including the Internet. The SCADA system provides an ODBC driver, making the database accessible to authorized users anywhere on a corporate network, or even over the Internet if the network is properly configured.
Operating System	Base-level software that controls a computer, runs programs, interacts with users, and communicates with installed hardware or peripheral devices.
Optional Equipment Unit	Totalflow enclosure designed to house optional power and communication devices.
Orifice Meter	Device to record differential pressure measurement which uses a steel plate with a calibrated hole or orifice to generate a drop in pressure between the two sides of the plate. Also the primary element of the meter run.
Orifice Plate	A plate of non-corrosive material which can be fastened between flanges or in a special fitting perpendicular to the axis of flow and having a concentric circular hole. The primary use is for the measurement of gas flow.

TERM	DEFINITION
ORing	Boolean algebra logical function. Described as the addition or summing of switches or inputs, in the case of Boolean elements, the 0 and 1 represent two possible states of a premise or hypothesis: True or False, On or Off. When adding Boolean elements not real numbers, you will find these results: 1 or 1 = 1 1 or 0 = 1 0 or 1 = 1 0 or 0 = 0
O-Ring	A flat ring made of rubber or plastic, used as a gasket.
Output	That part of a circuit where the processed signal is available.
Output Impedance	The resistance as measured on the output terminals of a pressure transducer.
Output Noise	The RMS, peak-to-peak (as specified) ac component of a transducer's dc output in the absence of a measurand variation.
P/I	See Pulse Input.
Parameter	(1) Characteristic. For example, *specifying parameters* means defining the characteristics of something. In general, parameters are used to customize a program. For example, file names, page lengths, and font specifications could all be considered parameters. (2) In programming, the term *parameter* is synonymous with argument, a value that is passed to a routine.
Parity	A technique for testing transmitting data. Typically, a binary digit is added to the data to make the sum of all the digits of the binary data either always even (even parity) or always odd (odd parity).
Parts per Million	Acronym PPM.
Passive Analog Output	Analog Output to a host that is powered by an outside source.
PCCU	Portable Collection and Calibration Unit.
PCCU32	Windows® version of PCCU communications software to process, archive and collect data from the Totalflow equipment. Generally run from a laptop.
Peak Area	The retention time the element takes to exit the column. This is used in calculating the amount of each component in the sample or Mole %.
Pentane (C5H12)	A saturated hydrocarbon (Alkane) with five carbon atoms in its molecule (C5H12). A liquid under normal conditions.
Pentane, Normal	See Normal Pentane.
Pentanes Plus	A hydrocarbon mixture consisting mostly of normal pentane and heavier components.
Peripheral	The input/output and data storage devices attached to a computer such as disk drives, printers, keyboards, displays, data acquisition systems, etc.
Persistent	Refers to data that remains available after a Warm Start.
PEX	A flexible material used for LevelMaster sensors.
PGC	Process Gas Chromatograph
Phase	A time based relationship between a periodic function and a reference. In electricity, it is expressed in angular degrees to describe the voltage or current relationship of two alternating waveforms.
Phenol	Hydrocarbon derivative containing an [OH] group bound to an aromatic ring.
Physical Change	A change in which a substance changes from one physical state to another but no substances with different composition are formed. Example Gas to Liquid - Solid.

TERM	DEFINITION
PID	Proportional, Integral, Derivative. A three mode control action where the controller has time proportioning, integral (auto reset) and derivative rate action. These three parameters form the PID calculation. The proportional value determines the reaction to the current error; the integral value determines the reaction based on the sum of recent errors and the derivative value determines the reaction based on the rate at which the error has been changing. The weighted sum of these three actions is used to adjust the process via a control element such as the position of a control valve or the power supply of a heating element.
Piezoceramic	A ceramic material that has piezoelectric properties similar to those of some natural crystals.
Pipeline Condensate	Liquid hydrocarbons that have condensed from gas to liquid as a result of changes in pressure and temperature as gas flows in a pipeline. Pipeline condensate only remains as a liquid under high-pressure conditions and would vaporize at atmospheric pressure.
Plant Products	All liquid hydrocarbons and other products (including sulfur and excluding residue gas) recovered in a gas processing plant.
PLC	See Programmable logic controller
Plunger Lift	A technique used to optimize gas production. A Steel plunger is inserted into the production tubing in the well. The flow is turned off and this shut-in causes plunger to fall allowing fluid to collect above plunger. Different techniques are used to decide how long to shut in and flow the well.
Polarity	In electricity, the quality of having two oppositely charged poles, one positive one negative.
Polling	A snapshot view of the readings taken by the Totalflow equipment.
Port	A communications connection on a computer or a remote controller. A place of access to a device or network, used for input/output of digital and analog signals.
Positive Temperature Co-efficient	An increase in resistance due to an increase in temperature.
Positive Temperature Co-efficient Fuse	Opens circuit when high current condition occurs. Closes when condition no longer exists. Replaces typical fuses, which require replacement when blown.
POU	Program Organization Unit. This is Softing’s term for an ‘independent programming unit’. Programs, functions, etc.
Power Supply	A separate unit or part of a circuit that supplies power to the rest of the circuit or to a system.
PPM	Acronym for parts per million.
Pressure Base	The contractual, regulatory or standard ambient pressure at which natural gas is measured or sampled expressed in psia (pounds per square inch absolute).
Pressure Differential	Difference in pressure between any two points in a continuous system.
Pressure Markers	Pressure testing at different levels of pressure. Used for comparison purposes.
Pressure, Absolute	See PSIA.
Pressure, Atmospheric	See Atmospheric Pressure.
Pressure, Gas	In the natural gas industry pressure is measured by the force applied to a designated area. PSI and OSI refer to how much pressure (pound or ounce) is applied to one square inch. Inches Water Column (In.W.C.) is also used to express gas pressure and is measured using a manometer for lower pressure readings. 1 PSIG=27.21 Inches Water Column.
Pressure, Gauge	See PSIG.
Primary Cell (or Battery)	A cell or battery which is not intended to be recharged and is discarded when the cell or battery has delivered all its electrical energy.

TERM	DEFINITION
PRM	Acronym for Pressure Regulator Module.
Probe	A generic term that is used to describe many types of temperature sensors.
Process Gas	Gas use for which alternate fuels are not technically feasible, such as in applications requiring precise temperature controls and precise flame characteristics.
Program	A list of instructions that a computer follows to perform a task.
Programmable Logic Controller	A highly reliable special-purpose computer used in industrial monitoring and control applications. PLCs typically have proprietary programming and networking protocols, and special-purpose digital and analog I/O ports.
Programmable Read Only Memory	Computer memory in which data can be written to. ROM is used for storing programs (e.g. operating systems) and characteristic files on a permanent basis. (non-volatile)
Programmed I/O	The standard method a CPU uses to access an I/O device-- each byte of data is read or written by the CPU.
PROM	See Programmable Read Only Memory
Propane (C3H8)	A saturated hydrocarbon (Alkane) gas, the molecule of which is composed of three carbon and eight hydrogen atoms. Propane is present in most natural gas and is the first product refined from crude petroleum. It has many industrial uses and may be used for heating and lighting. Contains approximately 2,500 Btu per cubic foot.
Proportional, Integral, Derivative	PID Controllers are designed to eliminate the need for continuous operator attention. An example would be the cruise control in a car or a house thermostat. These controllers are used to automatically adjust some variable to hold the measurement (or process variable) at the set-point. The set-point is where you would like the measurement to be. Error is defined as the difference between set-point and measurement.
Propylene (C3H6)	A saturated hydrocarbon (Alkane) gas, the molecule of which is composed of three carbon and six hydrogen atoms. At room temperature and pressure, propylene is a gas. It is colorless, highly flammable, and has a odor similar to garlic. It is found in coal gas and can be synthesized by cracking petroleum. The main use of propylene is as a monomer, mostly for the production of polypropylene.
Protocol	A formal set of conventions governing the formatting and relative timing of message exchange between two communicating systems.
PSI	Pounds per Square Inch.
PSIA	Pounds per Square Inch Absolute. Absolute pressure uses a perfect vacuum as the zero point. A perfect vacuum is 0 PSIA. PSIA=PSIG + Atmospheric Pressure.
PSID	Pounds per square inch differential. Pressure difference between two points.
PSIG	Pounds per Square Inch Gauge. Gauge pressure uses the actual atmospheric pressure as the zero point.
PSIS	Pounds per square inch standard. Pressure referenced to a standard atmosphere.
PTB	Physikalisch Technische Bundesanstalt (Federal Physical Technical Office) or Technical Institute for Certification.
PTC	See Positive Temperature Co-efficient Fuse.
Pulse Input	Any digital input to a meter (usually a turbine) that is used to measure pulses over a time period. This calculates volume and flow rate for each period of time.
Pulse Mode	An operational mode used by the LevelMaster for measuring single float levels by transmitting a pulse to the primary windings, reading the voltage level on both the primary and secondary windings and using a calculation whereby one is subtracted from another to determine the single fluid level.

TERM	DEFINITION
Pulse Output	Any digital output that is used to measure pulses over a period of time. Frequency of Pulses in a predetermined time frame represents a value to be used in calculating volume and flow rate.
Radio Frequency	RF for short. That part of the spectrum from approx. 50kHz to gigahertz.
Radio Frequency Interference	Electromagnetic radiation which is emitted by electrical circuits carrying rapidly changing signals, as a by-product of their normal operation, and which causes unwanted signals (interference or noise) to be induced in other circuits.
RAM	See Random Access Memory.
RAM Disk	A lithium backed storage chip. Also see Random Access Memory.
RAMS	Acronym for Remote Alarms Monitoring System.
Random Access Memory	Onboard read/write volatile memory, generally used for application variables and the file system. Data stored is lost if power is removed (volatile).
Range	Those values over which a transducer is intended to measure, specified by its upper and lower limits.
Rangeability	The ratio of the maximum flowrate to the minimum flowrate of a meter.
Rated Capacity	The number of ampere-hours a cell/battery can deliver under specific conditions (rate of discharge, cut-off voltage, temperature).
Raw Gas	Natural gas that has not been processed.
Raw Mix Liquids	A mixture of natural gas liquids that has not been fractionated or separated into its various components.
RBUS	Communication abbreviation for Results Bus.
RCV	Communication abbreviation for Received.
RD	Acronym for Relative Density.
RDrive	Refers to Totalflow's SRam Drive (solid state memory chip) located on the main board, used to store data and configuration files. The RDrive is a lithium backed, volatile memory chip and is not affected by a warm start. Generation 3 only.
Read Only Memory	Computer memory in which data can be routinely read but written to only once using special means when the ROM is manufactured. ROM is used for storing data or programs (e.g. operating systems) on a permanent basis.
Real Time	Data acted upon immediately instead of being accumulated and processed at a later time.
Real Time Data Base	The SCADA system has an in-memory RTDB for the data it collects from various devices. Real-time generally means that the data is acquired often enough that the user can make operational changes to the process while it is still useful to do so. On a factory floor, this can be in milliseconds. For remote devices which may require a couple of hours of drive time to reach, real-time can be thought of in tens of minutes or even hours. The data base can meet either of these requirements.
Real Time Operating System	Any operating system where interrupts are guaranteed to be handled within a certain specified maximum time, thereby making it suitable for control of hardware in embedded systems and other time-critical applications. RTOS is not a specific product but a class of operating system.
Recharge/Charge	The conversion of electrical energy, provided in the form of a current from an external source (charger), into chemical energy within a cell/battery.
Recommended Standard 232	This is the standard interface for full-duplex data communication conducted with two way independent channels. It employs unbalanced signaling and refers to point-to-point communications between one driver and one receiver in a 4-wire bus system. The RS-232 (single-ended) transmits at a relatively slow data rate (up to 20K bits per second) and short distances (up to 50 Ft. @ the maximum data rate).

TERM	DEFINITION
Recommended Standard 422	This is the standard interface for half-duplex communications conducted with a dual-state driver. It employs balanced signaling and refers to multi-drop communications between one driver and up to ten receivers, known as “straight-through” cabling in a 4-wire bus system. The RS-422 (Differential) transmits a much faster data rate (up to 100K bits per second) and longer distances (up to 4000 Ft. @ the maximum data rate).
Recommended Standard 485	This is the standard interface for half-duplex communications conducted in the tri-state or common mode. It employs balanced signaling and refers to true multi-point communications between up to 32 drivers and 32 receivers, in 2-wire bus system. The RS-485 (Differential) transmits a much faster data rate (up to 100K bits per second) and longer distances (up to 4000 Ft. @ the maximum data rate). It also supports more nodes per line because it uses lower impedance drivers and receivers.
Record	A collection of unrelated information that is treated as a single unit.
Register	A storage device with a specific capacity, such as a bit, byte or word.
Relay	Electromechanical device containing a coil and set of contacts. The contacts close when the coil is activated.
Remote	Not hard-wired; communicating via switched lines, such as telephone lines. Usually refers to peripheral devices that are located a site away from the CPU.
Remote Controller, XSeries.	Totalflow’s XSeries remote controller is a low power, microprocessor based unit designed to meet a wide range of automation, monitor, control, alarming and measurement applications.
Remote Terminal Unit	An industrial data collection device similar to a PLC, designed for location at a remote site, that communicates data to a host system by using telemetry (such as radio, dial-up telephone, or leased lines).
Repeatability	The ability of a transducer to reproduce output readings when the same measurement value is applied to it consecutively, under the same conditions, and in the same direction. Repeatability is expressed as the maximum difference between output readings.
Residue Gas	The portion of natural gas remaining in a gaseous state after recovery of certain components through gas processing.
Resistance	The measure of the ability of a material to pass a current.
Resistance Temperature Characteristic	A relationship between a thermistors resistance and the temperature.
Resistant Thermal Detector	A metallic probe that measures temperature based upon its coefficient of resistivity.
Resistor	Passive component with a known resistance. The value of resistance is usually shown by a set of colored bands on the body of the component.
Resolution	The smallest significant number to which a measurement can be determined. For example, a converter with 12-bit resolution can resolve 1 part in 4096.
Response Factor	A calculated value determined by analyzing a known substance under precise conditions (temperature, pressure, carrier flow rate) which equals the area of the peak divided by the weight or volume of the injected substance. This calculated value is then used as a response multiplier or offset for analyzing a “sample” of this same substance from another source. In the case of Natural gas, each component will have its own Response Factor.
Response Time	1) The length of time required for the output of a transducer to rise to a specified percentage of its final value as a result of a step change of input. 2) The time required by a sensor to reach 63.2% of a step change in temperature under a specified set of conditions. Five time constants are required for the sensor to stabilize at 600 of the step change value.

TERM	DEFINITION
Restore	This refers to a Totalflow procedure in which all the Station or Configuration files are restored to the SDRIVE or tfCold chip from the file located on the laptop. This process is very helpful prior to doing a Cold Start when you want to continue using the Configuration and Station files.
Reynolds Number	The ratio of inertial and viscous forces in a fluid defined by the formula Re = rVD/μ, where: r = Density of fluid, μ = Viscosity in centipoise (CP), V = Velocity, and D = Inside diameter of pipe.
RFI	See Radio Frequency Interference.
Ribbon Cable	A flat cable in which the conductors are side by side rather than in a bundle.
Rich Gas	Natural gas which, based on its content of liquefiable hydrocarbons, is suitable for processing in a gas plant for recovery of plant products.
ROM	See Read Only Memory
RRTS	Communication abbreviation for Remote Ready To Send.
RS-232	See Recommended Standard 232.
RS-422	See Recommended Standard 422.
RS-485	See Recommended Standard 485.
RT	See Runtime.
RTD	See Resistant Temperature Detector.
RTDB	See Real Time Data Base.
RTOS	See Real Time Operating System.
RTS	Communication abbreviation for Ready To Send.
RTU	See Remote Terminal Unit
Runtime	The time required for an acoustic signal to travel from point A to point B. This measurement is used in calculating the speed of Sound, gas velocity and volume in the TotalSonic Meter.
RXD	Communication abbreviation for Receive Data.
S/N	Serial Number. The whole Serial Number is made up of a prefix of 5 digits and the suffix, a 10 digit configuration number.
S1	Sample Line 1 (located on NGC8200 series Feed-Through Assembly).
S2	Sample Line 2 (located on NGC8200 series Feed-Through Assembly).
S3	Sample Line 3 (located on NGC8200 series Feed-Through Assembly).
S4	Sample Line 4 (located on NGC8200 series Feed-Through Assembly).
Saddle	A fitted plate held in place by clamps, straps, heat fusion, or welding over a hole punched or drilled in a gas main to which a branch line or service line connection is made. The saddle also may serve as a reinforcing member for repair.
Sample Loop	A tube with a given volume used in conjunction with a valve for measuring and holding the sample gas before pushing it into the chromatograph column.
Saturated BTU	The heating value of natural gas that is saturated with water vapor.
Saturated Hydrocarbons	Hydrocarbons that contain only single bonds. They are also called Alkanes or paraffin hydrocarbons.
Save	This refers to a Totalflow procedure in which all the Station or Configuration files are copied from the RDRIVE or the SDRIVE or tfCold chip, to a file created on a laptop.
Savitsky-Golay Smoothing	Digital Signal Smoothing. A special class of a digital signal processing filter. Specifically determines the coefficients that are used for signal processing.
SCADA	See Supervisory Control and Data Acquisition

TERM	DEFINITION
Scf	Abbreviation for one standard cubic foot, a measurement of a gas volume at a contractual, regulatory or standard specified temperature and pressure.
Schematic	Another name for a circuit diagram.
SCM	Acronym for Sample Conditioning module.
Scroll	To move all or part of the screen material up to down, left or right, to allow new information to appear.
SD Card	Secure Digital Card.
SDRIVE	Totalflow's Serial E^2 PROM solid state memory chip, located on the main board (volatile memory, affected by a cold start), used to store configuration or station files.
Selectable Units	Selectable measurement units for various international and specialized application needs.
Self-Calibrating	A property of a DAQ board that has an extremely stable onboard reference and calibrates its own A/D and D/A circuits without manual adjustments by the user.
Semiconductor	Material that is nether a conductor nor insulator. Its properties can be altered by a control voltage.
Sensing Element	That part of the transducer which reacts directly in response to the input.
Sensor	A device that responds to a physical stimulus (heat, light, sound, pressure, motion, flow, and so on), and produces a corresponding electrical signal.
Sensor File	The Sensor File contains all the setup/calibration information of the unit. The Sensor File is a (.dat) file and by default is named after the base serial number proceeded by an "s", such as s00108.dat. Although the name can be overwritten, it is recommended that the default name be kept.
Serial I/O	A common form of data transmission, in which the bits of each character are sent one at a time over the line.
Serial Port	A communications interface that uses one data line to transfer data bits sequentially. On the IBM PC the serial port refers to a standard asynchronous serial interface which uses the 8250/16450/16550 family of UARTs.
Service Life	The period of useful life (usually in hours or minutes) of a primary cell/battery before a predetermined cut-off voltage is reached.
Set Point	The temperature at which a controller is set to control a system.
Set-Point	A "level" or control point in a feedback system.
SFC	Sequential Function Chart (IEC supported programming language)
SG	Acronym for Specific Gravity.
Short Circuit	A connection of comparatively low resistance accidentally or intentionally made between points on a circuit between which the resistance is normally much greater. Also called a "bridge" or "short" such as when solder from two tracks touch on a PC board.
Shrinkage	The reduction in volume and/or heating value of a natural gas stream due to extraction or removal of some of its components.
SIG	See Signal.
Signal	Any communication between message-based devices consisting of a write to a signal register.
Signal Generator	A circuit that produces a variable and controllable signal.
Signed Integer	Can represent a number half the size of a "unsigned integer", including a negative number.
Sink	Device such as a load that consumes power or conducts away heat.

TERM	DEFINITION
Skip Days	Extra Daily records for recording events that require the start of a new day. i.e., Volume Reset, Backward Time change over the hour, and Contract Hour change.
SNAM	Italy's Certification Board
SNR	Signal to Noise Ratio.
SoftCONTROL	Softing's IEC compiler environment
Softing	Maker and distributor of the IEC compiler softCONTROL
Software	The non-physical parts of a computer system that include computer programs such as the operating system, high-level languages, applications programs, etc.
Solar cell	A cell that produces current under sunlight.
Solenoid	A coil of wire that is long compared to its diameter, through which a current will flow and produce a magnetic flux to push or pull a rod (called an armature).
SOS	See Speed of Sound.
Sour Gas	Natural gas that has a high concentration of H_2S.
Source	Device that provides signal power or energy to a load.
SP	See Static Pressure
Span	The difference between the upper and lower limits of a range expressed in the same units as the range.
Specific Gravity	The ratio of the mass of a solid or liquid to the mass of an equal volume of distilled water at 4°C (39°F) or of a gas to an equal volume of air or hydrogen under prescribed conditions of temperature and pressure. Also called *relative density*.
Speed of Gas	Rate at which gas travels through the pipeline. Used in flow calculations in the TotalSonic Meter. Calculations follow AGA 9 Report.
Speed of Sound	Rate at which sound travels through the medium. Used in flow calculations in the TotalSonic Meter. Calculations follow AGA 10 Report.
SPU	Signal Processing Unit (measurement transducer).
SQL	See Structured Query Language.
SRAM	See Static Random Access Memory
SSM	Acronym for Stream Selector module.
ST	Structured Text (IEC supported programming language)
Stability	The quality of an instrument or sensor to maintain a consistent output when a constant input is applied.
Stable Gas	Is a vapor containing less than 0.1 PPM of liquid when vapor is cooled to 18.3°F (10°C) below the coldest ambient temperature possible at any point in the system.
Static Pressure	Equals PSIA or PSIG. Referenced to atmospheric pressure versus absolute pressure in a vacuum. It is defined as the pressure exerted by a non-moving liquid or gas. In the case of a gas well this would be the natural PSI of the gas inside of the well.
Static Random Access Memory	The place in your computer that programs reside when running. You can access any part of the memory, and it can easily be overwritten with new values. SRAM is much more expensive and physically larger than DRAM but much faster.
Status Output	Any digital output that uses "On" or "Off" conditions to determine the status of the assigned description. Changing from one to the other represents a change in the condition.
STP	Standard Temperature and Pressure

TERM	DEFINITION
Structured Query Language	IBM developed this language in the 60's as a way of accessing data from a relational database. It has a very simple syntax for simple functions but can become complex for sophisticated applications. This language is standardized by international standards bodies, and is almost universal in application. Almost all databases support SQL. The RTDB supports SQL and this makes it extremely flexible within a corporate network. Authorized users throughout the organization can write SQL statements to acquire data from this database that they need for Marketing, Accounting, Engineering, or other functions.
Sulfur	A pale, yellow, non-metallic chemical element that may be found in a gas stream and which needs to be removed or reduced from the gas stream for corrosion control or health or safety reasons.
Supercompressibility Factor	A factor used to account for the following effect: Boyle's law for gases states that the specific weight of a gas is directly proportional to the absolute pressure, the temperature remaining constant. All gases deviate from this law by varying amounts, and within the range of conditions ordinarily encountered in the natural gas industry, the actual specific weight under the higher pressure is usually greater than the theoretical. The factor used to reflect this deviation from the ideal gas law in gas measurement with an orifice meter is called the "Supercompressibility factor Fpv". The factor is used to calculate corrected from volumes at standard temperatures and pressures. The factor is of increasing importance at high pressures and low temperatures.
Supervisory Control and Data Acquisition	A common PC function in process control applications, where programmable logic controllers (PLCs) perform control functions but are monitored and supervised by a PC.
Surge	A sudden change (usually an increase) in the voltage on a power line. A surge is similar to a spike, but is of longer duration.
SV	Sample Vent (located on NGC8200 series Feed-Through Assembly).
SW VBATT	Switched Battery Voltage. Cycles power to equipment to save power.
Switch	An electrical device for connecting and disconnecting power to a circuit, having two states, on (closed) or off (open). Ideally having zero impedance when closed and infinite impedance when open.
Synchronous	(1) Hardware - A property of an event that is synchronized to a reference clock. (2) Software - A property of a function that begins an operation and returns only when the operation is complete.
Syntax	Comparable to the grammar of a human language, syntax is the set of rules used for forming statements in a particular programming language.
System Noise	A measure of the amount of noise seen by an analog circuit or an ADC when the analog inputs are grounded.
TankMaster	Totalflow Control System for LevelMaster Tank Units.
Tap	To cut threads in a round hole so that other fittings or equipment can be screwed into the hole. Also to make an opening in a vessel or pipe.
TBUS	Communication abbreviation for Transmit Bus.
TCD	See Thermal Conductivity Detector.
TCP/IP	TCP/IP – This is the basic communication format for the Internet, and for much of what happens on a corporate network. Virtually all networked PCs and other computers have an "IP address" having the format xxx.xxx.xxx.xxx (xxx can range from 0 to 255 in most cases). You can see the IP address of your PC by going to the start menu, selecting run, and entering cmd. A "DOS Box" will be displayed on your screen. Type ipconfig to get the IP address. When you enter a URL (e.g., www.totalflow.com) in a browser, a DNS server (on the network) resolves this into an IP address and directs your request to the machine with that address.
TCR	Temperature Compensated Regulator.

TERM	DEFINITION
TDS32	Totalflow DDE Server that allows Microsoft Windows® applications with DDE capabilities to communicate with Totalflow's equipment. For example data can be retrieved and placed in an Excel spreadsheet.
Temperature Coefficient	An experimental number used to modify the calibration of a device (Totalflow transducer) to account for changes in environmental temperature.
Temperature Error	The maximum change in output, at any measured value within the specified range, when the transducer temperature is changed from room temperature to specified temperature extremes.
Temperature Range, Compensated	The range of ambient temperatures within which all tolerances specified for Thermal Zero Shift and Thermal Sensitivity Shift are applicable (temperature error).
Temperature, Ambient	The temperature of the air, atmosphere or other fluid that completely surrounds the apparatus, equipment or the work piece under consideration. For devices which do not generate heat, this temperature is the same as the temperature of the medium at the point of device location when the device is not present. For devices which do generate heat, this temperature is the temperature of the medium surrounding the device when the device is present and generating heat. Allowable ambient-temperature limits are based on the assumption that the device in question is not exposed to significant radiant-energy sources such as sunlight or heated surfaces.
Temperature, Flowing	Temperature of the flowing fluid. Usually gas and measured by an RTD.
Terminal Mode	Man-Machine interface tool used as and engineering interface with equipment.
Termination	Placement of a connector on a cable.
Termination Panel	The NGC's termination panel acts as a connection to the outside world. It features transient protection, a voltage regulator for the digital controller, positive temperature co-efficient fuses (PTC) and many other safeguards to protect the remainder of the system from electrical damage. All outside communications and I/O are channeled through this board. It is designed to be a low cost, field replaceable maintenance solution and is designed to operate on either 12V or 24V.
Termination Panel	A circuit board with screw terminals or other connector system that allows convenient connection of field signals to a data acquisition or communication system.
TF Loader Packages	In PCCU32, the 32-Bit XSeries Loader is the program that allows for the downloading of specific files to an NGC, XFC, XRC or µFLO XSeries device. The 32-Bit XSeries Loader application allows packages containing a combination of Flash, WinCE OS (nk.bin), ISaGraf Runtime, Blackfin Firmware (NGC) and configuration files to be downloaded to XFCs, XRCs, NGCs or µFLO machine types. These same packages can be downloaded to other machines of the same type to expedite configurations for machines having the same purpose. With the creation of these packages, the user is then prevented from accidentally loading incompatible packages to the wrong device.
TF.NET	Totalflow network used to access web data.
tfCold	Totalflow's Serial E^2 PROM solid state memory chip, located on the main board (volatile memory, affected by a cold start), used to store configuration or station files.
tfData	Refers to Totalflow's SRam Drive (solid state memory chip) located on the main board, used to store data and configuration files. The tfData drive is a lithium backed, volatile memory chip and is not affected by a warm start.
TFIO Module	Totalflow Input/Output module (i.e., quad AO)

TERM	DEFINITION
Thermal Conductivity Detector	Universal detector that shows a response to all compounds. An electrical component that changes resistance based on the components ability to conduct heat. In chromatography, two TCDs are used, 1)as a reference detector and 2) as the sensor detector. The reference detector is exposed to only the carrier gas and the Sensor detector is exposed to the sample.
Thermistor	A temperature-sensing element composed of sintered semiconductor material which exhibits a large change in resistance proportional to a small change in temperature. Thermistors usually have negative temperature coefficients.
Thermistor Bead	See Thermal Conductivity Detector.
Thermocouple	A temperature sensor created by joining two dissimilar metals. The junction produces a small voltage as a function of the temperature.
Thermowell	A closed-end tube designed to protect temperature sensors from harsh environments, high pressure, and flows. They can be installed into a system by pipe thread or welded flange and are usually made of corrosion-resistant metal or ceramic material depending upon the application.
Therms Master	Totalflow application for Gas Analyzer.
Tolerance	The allowable percentage variation of any component from that stated on its body.
Totalflow	Product line of ABB Inc. Maker and distributor of the XSeries flow computers (XFC) and remote controllers (XRC).
TotalSonic MMI	TotalSonic’s Man Machine Interface software program. May also be called MEPAFLOW 600.
Transducer	A device for converting energy from one form to another, specifically the measurement of pressure differential in natural gas gate stations. I.e. Pressure to voltage or current.
Transfer Rate	The rate, measured in bytes/s, at which data is moved from source to destination after software initialization and set up operations; the maximum rate at which the hardware can operate.
Transient	An abrupt change in voltage, of short duration (e.g. a brief pulse caused by the operation of a switch).
Transistor	A three leaded device (Collector, Base, Emitter) used for amplifying or switching. Also called a bi-polar transistor to distinguish it from Field Effect Transistor etc.
Transmitter	A device that converts audio, video or coded signals into modulated radio frequency signals which can be propagated by electromagnetic waves (radio waves).
Tranzorb	Transient Voltage Suppression device.
TRB	Tank Request Block Editor. When requesting storage space after adding a LevelMaster application, the file is saved as a *.trb file.
Tube	Cylinder for transporting or storing liquids: any long hollow cylinder used to transport or store liquids.
Tuned Radio Frequency	An amplitude modulated (AM) receiver with one or more stages of radio frequency before the detector.
TXD	Communication abbreviation for Transmit Data.
UDINT	Unsigned Double Integer
UL	Underwriters Laboratories, Inc. An independent laboratory that establishes standards for commercial and industrial products.
Union	A form of pipe fitting where two extension pipes are joined at a separable coupling.

TERM	DEFINITION
Universal Serial Bus	An external peripheral interface standard for communication between a computer and external peripherals over a cable using biserial transmission. It supports both isochronous and asynchronous data transfers.
Unnormalized Total	Is a calculation of the Peak Area divided by the Response Factor for each component, then summed by each component.
Unsigned Integer	Can represent a number twice the size of a “signed integer”, but cannot represent a large negative number.
Upload	This refers to a Totalflow procedure in which any file(s) located in the on-board memory of a Totalflow Host is copied to a file created on a laptop PC.
UPS	Un-interruptible power supply. A power conditioning unit placed between the commercial power service and the protected device. The UPS uses line power to charge batteries, which, in the case of a power failure, can drive electronic circuitry to produce the appropriate AC requirements for some time period.
Upstream	Oil and natural gas exploration and production activities; plus gas gathering, processing and marketing operations.
Upstream Pipeline	The first pipeline to transport natural gas en route to an inter-connect point for delivery to another pipeline. See DOWNSTREAM PIPELINE.
USB	Acronym for Universal Serial Bus.
USB Client	Generally refers to the peripheral device (slave or client) that is driven by a computer (Master or Host). Examples are a printer and digital camera.
USB Host	Generally refers to the computer device (Master or Host) that drives a peripheral piece of equipment (slave or client). An example is a Laptop or Desktop Computer.
USX	Provider of the RTOS used by the XSeries product line
VAC	Volts of alternating current.
Vacuum	A pressure less than atmospheric pressure, measured either from the base of zero pressure or from the base of atmospheric pressure (PSIA).
Valve	A mechanical device for controlling the flow of fluids and gases; types such as gate, ball, globe, needle, and plug valves are used.
Valve Control	This feature provides automatic feedback control of Differential Pressure (DP), Static Pressure (SP), and Flow Rate for the purpose of positioning a flow valve to maintain a desired value of DP, SP, or Flow Rate.
Vapor Pressure	The pressure exerted by a liquid when confined in a specified tank or test apparatus.
VAS32	Totalflow’s Voice Alarm System. A software program that receives and transmits alarm notifications via cell, telephone or pager systems.
VBATT	Battery Voltage. The voltage output from the battery source.
VCI	Valve Control Interface.
VDC	Volts of direct current.
VDE	Verband der Elektrotechnik Elektronik Informationstechnik [Association for Electrical, Electronic & Information Technologies]
Velocity	The time rate of change of displacement; dx/dt.
Vent	A normally sealed mechanism which allows for the controlled escape of gases from within a cell.
VGA	Video Graphic Array.
Virtual Memory	A method of making disk storage appear like RAM memory to the CPU, thus allowing programs that need more RAM memory than is installed to run in the system. This technique is slow compared to "real" memory.
Viscosity	The inherent resistance of a substance to flow.

TERM	DEFINITION
VOG	Velocity of Gas.
Volatile Memory	A storage medium that loses all data when power is removed.
Volt	The unit of voltage or potential difference.. One thousand volts = 1kV.
Voltage	Electrical pressure, the force, which causes current to flow through a conductor. Voltage must be expressed as a difference of potential between two points since it is a relational term. Connecting both voltmeter leads to the same point will show no voltage present although the voltage between that point and ground may be hundred or thousands of volts.
Voltmeter	A meter for reading voltage. It is one of the ranges in a multimeter.
Volume Calculation Period	The specified length between reading and calculating volume data.
Volume Flow Rate	Calculated using the area of the full closed conduit and the average fluid velocity in the form, Q = V x A, to arrive at the total volume quantity of flow. Q = volumetric flowrate, V = average fluid velocity, and A = cross sectional area of the pipe.
VOS	Velocity of Sound.
Warm Start	A rebooting technique which will clear most operational errors, without damaging either the data or configuration files. This causes the equipment to boot from the RDRIVE or tfData, which is a solid state memory chip.
Watt	Symbol W. The unit of power. One watt is the product of one volt and one amp. Power (W) = Current (I) X Energy (E). (E = Volts)
Wavelength	The distance between two points of corresponding phase in consecutive cycles
Web Page	All the text, graphics, and sound visible with a single access to a Web site; what you see when you request a particular URL.
Web Server	The hardware and software required to make Web pages available for delivery to others on networks connected with yours.
Web Site	A collection of electronic "pages" of information on a Web server
Well, Development	A well drilled in order to obtain production of gas or oil known to exist.
Well, Disposal	A deep well in which to inject waste chemicals, etc., such as a well to dispose of salt brine from the solution mining of salt dome gas storage caverns.
Well, Exploratory	A well drilled to a previously untested geologic structure to determine the presence of oil or gas.
Well, Gas	A well which produces at surface conditions the contents of a gas reservoir; legal definitions vary among the states.
Well, Marginal	A well which is producing oil or gas at such a low rate that it may not pay for the drilling.
Well, Stripper	Non-associated gas well capable of producing no more than 90 Mcf/day at its maximum rate of flow.
Well, Wildcat	An exploratory well being drilled in unproven territory, that is, in a horizon from which there is no production in the general area.
Wellhead	The assembly of fittings, valves, and controls located at the surface and connected to the flow lines, tubing, and Casing of the well so as to control the flow from the reservoir.
WellTell Wireless	Product line designed to communicate RS-485 without the use of cabling. Group consists of the wireless host (WellTell-X), wireless IS client (WellTell-IS) and wireless IO client (WellTell-IO).
WellTell-IO	Client communication device designed with extra on-board IO.
WellTell-IS	Client communication device designed with an intrinsically safe barrier.
WellTell-X	Host communication device for WTW product line.
Wheatstone Bridge	Circuit design using two TCDs to measure components in chromatography.

TERM	DEFINITION
WINCCU	Windows® Central Collection Unit. Windows® version of software to process, archive and manipulate data collected from the Totalflow products.
Window	In computer graphics, a defined area in a system not bounded by any limits; unlimited "space" in graphics.
Witness	In the field, where hydrocarbons are changing hands and actual cash register transactions being performed, it is not uncommon for one party or the other to request / require a representative or company employee be present during calibrations and or routine maintenance. Often this arrangement is contractually linked.
Wobbe Index	Calculated from the energy content, or a higher heating value of the gas, and the relative density of the gas (Btu/$RD^{1/2}$).
Wobbe Number	A number proportional to the heat input to a burner at constant pressure. In British practice, it is the gross heating value of a gas divided by the square root of its gravity. Widely used in Europe, together with a measured or calculated flame speed, to determine interchangeability of fuel gases.
Working Voltage	The highest voltage that should be applied to a product in normal use, normally well under the breakdown voltage for safety margin. See also Breakdown Voltage.
World Wide Web	An Internet service facilitating access to electronic information - also known as the Web, WWW, or W3.
Write	To record data in a storage device or on a data medium.
WTW	Acronym for WellTell Wireless products.
WTW	WellTell Wireless product line. See WellTell Wireless.
XDCR	See External Transducer.
XFC	See flow computer, XSeries.
XFC G4	Totalflow’s new Generation 4 extendable XFC equipment featuring technology that is expandable and flexible for ever changing needs.
XFC-195 Board	The main electronic board used in XSeries flow computers. The XFC-195 Board mounts on the inside of the enclosure’s front door.
XFC6200EX	Totalflow’s Class 1 Div 1 flow computer. This Totalflow flow computer is housed in an explosion proof housing and has similar operational features as the μFLO, with additional capabilities.
XIMV	See XSeries Integral Multivariable Transducer.
XMV	See Multivariable Transducer.
XRC	XSeries remote controller. Also see remote controller, XSeries.
XRC G4	Totalflow’s new Generation 4 extendable XRC equipment featuring technology that is expandable and flexible for ever changing needs.
XSeries	Totalflow’s new extendable equipment series featuring technology that is expandable and flexible for ever changing needs.
XSeries Integral Multivariable	Abbreviated XIMV. A smart Multivariable Transducer that is an integral part of the XSeries flow computer, measuring Static Pressure (SP), Differential Pressure (DP) and Flowing Temperature (Tf). This refers to both the transducer portion of the device and the circuitry required to supply measurements to the Main Processor Board, which is housed in a factory sealed unit. See Multivariable Transducer for more information.
Y	Expansion factor.
Zero Gas	Gas at atmospheric pressure.
Zero Offset	The difference expressed in degrees between true zero and an indication given by a measuring instrument.

APPENDIX C PROJECTS AND DRAWINGS

For the convenience of customers, site specific information will be included in the “projects” section; site schematics, site communication schemes, special enclosures.

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