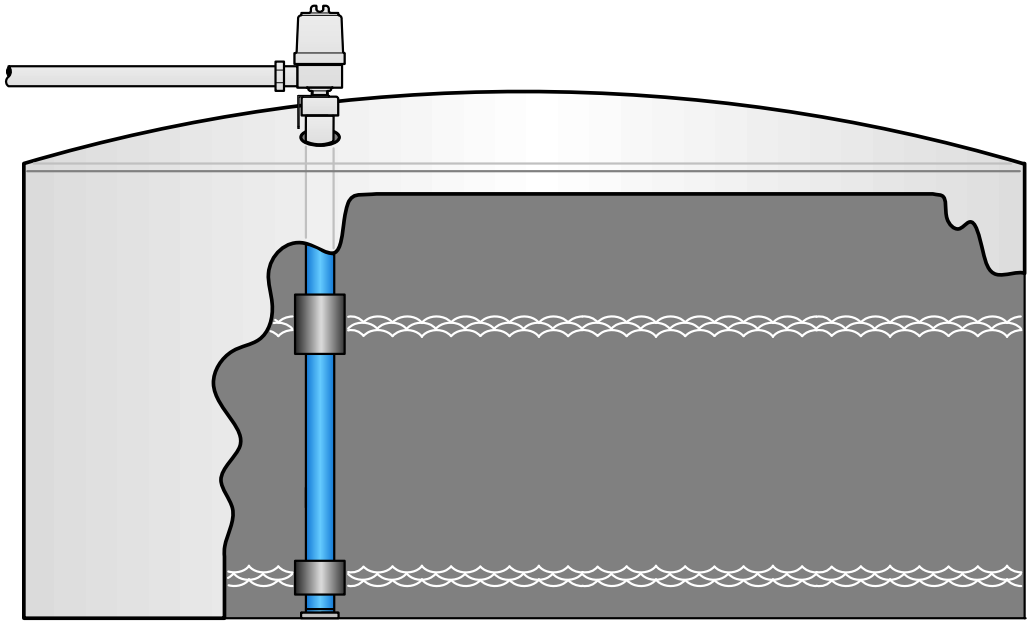
2018374-001– rev. AF

Totalflow® 7100 LevelMaster

User's Manual



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Inquiries regarding this manual should be addressed to ABB Inc., Totalflow Products, Technical Communications, 7051 Industrial Blvd., Bartlesville, Oklahoma 74006, U.S.A.

TABLE OF CONTENTS

TABLE OF FIGURES

LIST OF TABLES

Blank Page

Introduction

This manual is written to provide an experienced technician with the requirements necessary to install, setup and operate a Totalflow® Model 7100 LevelMaster.

Organization & Style

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

The following information is provided within the manual:

Chapter	Name	Description
1	System Description	Provides a description of the Totalflow 7100 system components, specifications and a brief summary of how it works.
2	Installation	Includes unpacking and detailed procedures for setup and installation.
3	Setup and Operations	Provides detailed procedures on setting up the LevelMaster using the MasterLink software and PCCU32 versions as well as operating instructions.
4	Maintenance and Troubleshooting	Provides instructions on removing and replacing major modules, moving the unit from one tank to the next and troubleshooting installations and communications.
5	Definitions and Acronyms	Provides quick access to the majority of terms, acronyms and abbreviations, along with their definitions.
6	Drawings	Provides a place to put drawings that accompany a unit.

Getting Help

Totalflow takes pride in the on going support that is provided to customers. When purchasing a product, the user receives documentation which should answer all 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.

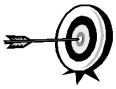
- Note any alarms or messages as they appear.
- Prepare a written description of problem.
- Know the software version, board and optional part numbers.

Key Symbols

The following symbols are used frequently in the manual. These are intended to catch the eye and draw the user's attention to important information.

FYI 

Intended to draw attention to useful information or to clarify a statement made earlier.

TIP 

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

CAUTION 

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

WARNING 

Intended to draw 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 Precaution" section for additional information.

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 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 identified as conditions or practices that could result in equipment damage, personal injury or loss of life will be 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 accomplished, or the hazardous condition has been removed. Personal injury or fatality could result. Examples of these warnings include:

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

DANGER 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 safety, it should be taken out of operation and secured against unintentional usage.

1.0 SYSTEM DESCRIPTION

1.1 Overview

The Totalflow® LevelMaster is an Intelligent Digital Level Sensor and is designed for custody transfer accuracy in demanding level measurement applications, including, but not limited to, oil, gas, water, wastewater, flood warning and chemical applications. See Figure 1–1 Typical LevelMaster Oil and Water Tank Installation for a typical tank installation.

The LevelMaster uses simple ASCII protocol for communications and, therefore, can be interfaced to basically any host system. When used in conjunction with an remote terminal unit (RTU) or Totalflow's XSeries remote controller (XRC), a wide range of data gathering and site automation applications are available.

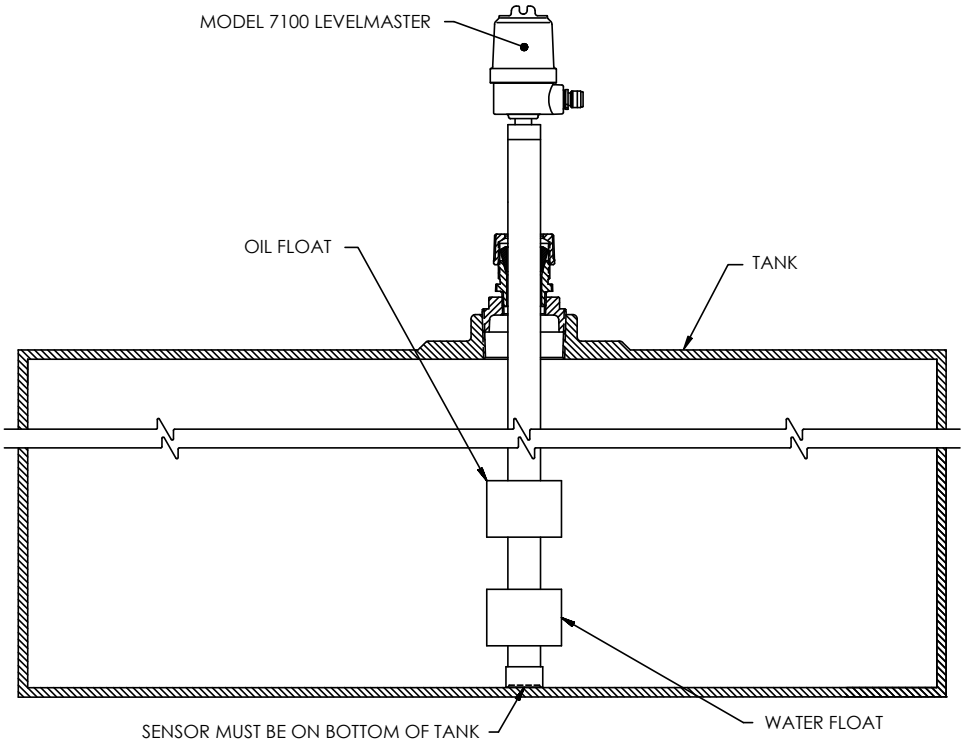


Figure 1–1 Typical LevelMaster Oil and Water Tank Installation

The LevelMaster consists of a sensor tube that sits on the bottom and extends through the top of the vessel. A reducer bushing and compression fitting can be provided for tanks with standard 3" or 4" diameter tank top ports. The LevelMaster can be adapted to basically any type of vessel. The sensor tube can be any length from 2 to 25 feet. A small round junction box with a screw-on cover sets atop the sensor tube. The junction box houses a small electronics board and is the termination point for the power and communication wiring.

1.1.1 Floats

Level(s) are sensed by one or two floats that slide up and down the sensor tube. Two floats are used when the vessel contains fluids with two different densities such as oil and water. Each float will accurately measure the level of its respective

fluid over the full vertical range of the sensor tube with a relative accuracy to the nearest ± 0.1 inch (2.5 mm); optional ± 0.05 inch (1.27mm).

1.1.2 Sensor

The sensor casing is manufactured with different materials, based on the corrosiveness of the fluid. These fluids include, but are not limited to, culinary water, oils, solvents, acids and chemicals. Floats have an outer material that can withstand most solvents and chemicals, plus other float materials are being considered.

1.1.3 Temperature

Temperature is also provided along with the fluid level readings. A standard configuration includes one temperature sensor located 12 inches (304.8 mm) from the bottom of the sensor tube reading accurately to within 1°F(0.6°C).

1.1.4 Data Gathering

Retrieving the information from the LevelMaster can be accomplished in many ways. Since the LevelMaster uses simple ASCII protocol, the user can use third party RTUs, PLCs or a PC. When connected to Totalflow's flow computer or RTU, host applications such as WinCCU32, TDS32 and PCCU32 become viable data gathering and reporting tools. See Figure 1–2.

Special Windows® based laptop software (MasterLink) has been developed specifically for setup and calibration of the LevelMaster after installation. MasterLink not only does the setup but also allows the user to see live readings of the levels and temperature. Another excellent feature is the capability of collecting data over time. This is accomplished by specifying how often to poll for the data. Each time the data is polled, an entry is written to a disk file that can be viewed by any text editor such as Notepad® or WordPad®.

1.1.5 RS-485

The LevelMaster uses RS-485 hardware protocol and standard ASCII software protocol to communicate to the outside world at speeds from 1200 to 9600 bps. RS-485 allows multiple LevelMasters to be daisy-chained together. The RS-485 is generally limited to 4000 feet when using locally provided external power. Similarly, if the LevelMaster is using externally supplied power routed through the RS-485 cable, the limitation is set to 500 feet.

See the heading, *Hazardous Location Installations*, for additional information and limitations regarding RS-485 cabling in hazardous areas.

1.1.6 Optional High Level Auxiliary Switch

The high level auxiliary switch is an option that can be ordered with the LevelMaster and works as an auxiliary shutdown switch. The switch is a float type switch that can be normally open or normally closed and is configurable in the field. The high level switch option comes in three configurations: 12, 16 and 24 inch. See *Chapter 2 - Optional High Level Auxiliary Switch* for more information.

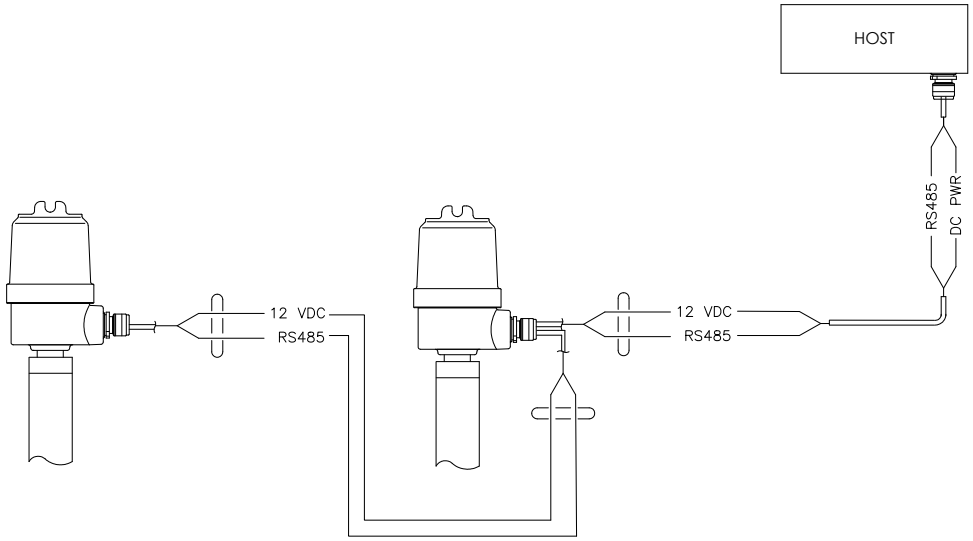


Figure 1–2 Typical LevelMaster Configuration

1.2 Hazardous Location Installations

LevelMaster units are CSA approved for installations in hazardous locations when connected through Totalflow certified barrier boards, in accordance with the Totalflow certification drawings (see Figure 1–3). See *Chapter 2 - Wiring* for additional information.

- 2100336-001 - Class 1, Division 1, Group D when connected through Totalflow certified barrier boards, in accordance with Totalflow drawing 2018387-CD. One barrier board supports up to four level sensors, with a maximum distance of 500 ft.
- 2100336-002 - Class 1, Division 1, Group C, D when connected through Totalflow certified barrier boards, in accordance with Totalflow drawing 2018387-CD. One barrier board supports up to one level sensor, with a maximum distance of 500 ft.

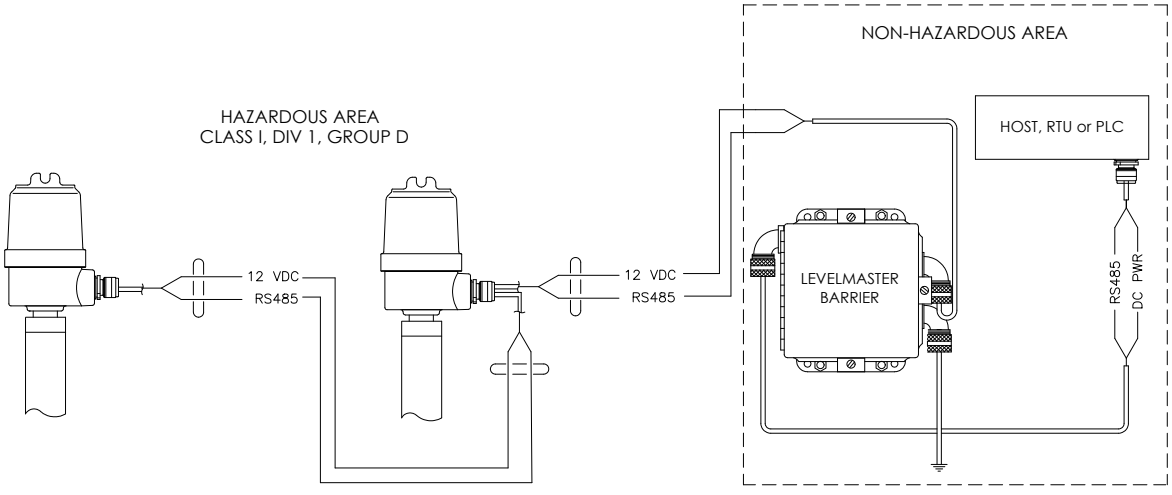


Figure 1–3 LevelMaster Group D Hazardous Location Installation

1.3 General Specifications

Environmental/Safety		
Operating Temperature	Non-submerged	-20°F to 185°F (-29°C to +85°C)
	Submerged floats	26°F to 185°F (-3°C to +85°C)
CSA Approved for Intrinsically Safe Operation	Class 1, Div 1, Group D	4 level sensors max / barrier
	Class 1, Div 1, Group C & D	3 level sensors max / barrier

Measurement	
Range (Depth)	2-25 feet (0.6 to 7.6 meters) in 1 foot (0.31 meters) increments
Relative Level Accuracy	+ 0.1 inches (2.5mm) Optional: + 0.05 inches (1.25mm)
Level Resolution	+ 0.01 inches (0.25mm)
Level Repeatability	+ 0.05 inches (1.25mm)
Temperature Sensor Accuracy	+ 1.8°F (1.0°C)
Temperature Sensor Range	0°F to 185°F (-17.7°C to 85°C)
Pressure	Non-pressurized tanks: Single or Dual Floats
	Up to 200 psig (standard) : Single Float Only
Single Surface Float Specific Gravity (at 68F)	0.41 (3 inch diameter), 0.60 (2.85 inch diameter)
Oil Float Specific Gravity (at 68F)	0.47
Water Float Specific Gravity (at 68F)	0.91
Emulsion Float Specific Gravity (at 68F)	0.75

Materials and Dimensions	
Casing Material	Fiberglass or Stainless Steel (pressurized tanks)
Casing Outer Diameter	1.95 inches (48.5mm)
Float Outer Diameter	3.17 inches (80.5mm) (2.85 inch single float on request)
Reducer Bushing and Compression Fitting	Fits standard 3 and 4 inch (10.16mm) tank port
Temperature Sensor Location	12 inches (300mm) from bottom (other locations possible)

Communications		Power	
		Supply Voltage	9-18 VDC
Output	Standard digital serial half duplex RS485, ASCII protocol	Current	40 mA transmitting; 1 mA standby
Speed	1200 or 9600 bps	Power Cycling	Available for optimal power management

1.4 Software Features

Within PCCU and WinCCU programs, after the user has initiated the LevelMaster application, they are then presented with a multitude of options that can be applied to their individual LevelMaster.

The following list presents the user with several supported software features of the LevelMaster application:

- Supports data collection and display for up to eight LevelMaster tank level instruments. (See *Data Collection*)
- Supports gross volume calculation for up to eight tanks using tank strapping table inputs. (See *Calculating Tank Volumes*)
- Supports up to 16 limit control blocks. (See *Limit Control Blocks*)
- Supports up to 16 virtual digital outputs for each of the two hardware digital outputs. (See Virtual Digital Outputs)
- Supports “Push to Read” display that allows selected data to be viewed on the LCD display using the optional “Push to Read” button. (See *Push-To-Read Display Control*)

- Supports Totalflow proprietary local protocols – PCCU32 and Terminal. The software supports PCCU32 and Terminal protocols over the local communications port. PCCU32 Revisions 4.1 and higher are supported.
- Supports Totalflow proprietary remote protocol – WinCCU remote host console. The software supports single host X-frame protocol. This protocol allows the Totalflow application, array and register access from the remote host console or TDS32, WinCCU applications.
- Supports the Totalflow configurable trend system. The software supports Totalflow trend configuration and collection. Trend files may be configured or collected using the PCCU32 or WinCCU programs.
- The software supports RAMS configurable alarms, alarm by exception and alarm cry-out. Alarms may be configured using PCCU32 or WinCCU programs.
- Supports selectable tank data display and storage units. The software supports selectable engineering units for collected levels, temperature and volume data. Units may be selected using PCCU32, WinCCU or Modbus protocol.
- Supports power duty cycling. This option is used for power conservation. It allows the software to switch the power on and off to the LevelMasters via a digital output contained in the software. (See *Tank System Setup*)

1.5 Host Controller Configurations

The LevelMaster can be operated in a stand-alone configuration wherein it attaches directly to the LevelMaster unit. Conversely, it can also be used as one of the many host controller configurations. This manual will detail those operations and provide basic information regarding these options.

1.6 Totalflow Host PROMs

When Totalflow equipment is used as the host for the LevelMaster, a special PROM is needed for the host that includes the information needed to operate and communicate with the unit. Table 1—1 contains a listing of each host model and its available proms, along with listings of the various supported features.

Table 1—1 Totalflow PROM Configurations

Totalflow					LEVELMASTER FEATURES						FCU FEATURES			
Model	**Prom Number**	**Prom Pick**	**Gas Orifice Gas Turbine**		**No.. Tanks**	**No. Push to Read**	**Comm Retry**	**Pass Through**	**Last Poll Time**	**HiHi/LoLo Valve Control**	**Configured**	**Cryout**	**DI/DO**	**AI/AO**
6400	**2017472-009**	7EEC	GO	Trend	4	1[1]	3	0	No	1	Host C	No	2/2	2/0
	2100314-002		GO	Trend, Selectable Units	4	1[1]	3	0	No	1	Host C	No	2/2	2/0
6700	**2017473-005**	7HDY	GO	Trend	4	1[1]	3	0	No	1	Host C	No	2/2	2/0
	2100252-004	7HFU	GO	ExpIO, Trend, AIU Detail	4	1[1]	0	0	No	0	Template	No	10/10	9/4
6790	C000111-002	(BLM)	N/A	All LACT features, custody transfer	2	0	0	0	No	0	Host C	No	8/8	7/4
	2100277-002	7DP	N/A	Trend, Custom Displays, Control, Alarm	8	8	3	0	No	8	Template	No	8/8	7/4
LMC	**2100352-003**	7LC	N/A	Trend, Alarms, Controls	8	1[1]	3	0	Yes	1	PCCU Entry	No	2/2	0/0
XFC	**2100826-011**		GO/GT	Everything	16[2]	1	Var	1	Yes	16	PCCU Entry	Yes	2/2[3]	2/0[3]
XRC	**2100805-011**		GO/GT	Everything	16[2]	1	Var	1	Yes	16	PCCU Entry	Yes	4/4[3]	5/0[3]

[1] Hold button down as display scrolls thru tanks. Releasing button causes last poll displayed while unit polls tank for new values. Displays for 30 seconds, then times out.

[2] 16 per application. Multiple applications available.

[3] On board IO count. 3 to 14 Modules (8AI, 4AO, RS485 Comm, RS232 Comm. & 1AO-6DI/DO-2 source DO combo modules available).

2.0 INSTALLATION

This chapter will lead the user through the unpacking, assembling, installing and wiring of the LevelMaster. For safe and trouble free installation, follow all instructions and advisories.

Although the LevelMaster is easy to install, there is no one procedure that will fit all situations. For example, if the length ordered fits a standard size tank such as 11, 16 or 25 foot, most of the LevelMaster is pre-assembled at the factory. Use the procedure entitled *Installing a Pre-Assembled Unit*.

TIP 

Read through this chapter before installation and establish an installation strategy. Also, before beginning the actual installation, refer to any instructions, drawings or wiring diagrams that are included with the LevelMaster. The detail part of any assembly will typically use the documentation that accompanies the unit. If a discrepancy exists between this manual and documentation that accompanies the unit, the unit's documentation will take precedence.

2.1 Unpacking and Inspection

2.1.1 Unpacking

The model 7100 LevelMaster product is shipped in a specially designed shipping carton which contains the sensor unit, electronics board with enclosure, mounting components, parts list, wiring and interconnect diagrams. If an intrinsically safe barrier is provided, it and its associated hardware are shipped in a separate carton.

Carefully remove the items from each carton.

2.1.2 Initial Inspection

Inspect the shipping carton for damage. If the shipping carton is damaged, keep it until the contents have been inspected for damage.

- Inspect the exterior of the individual components for dents, chipped paint, etc.
- Inspect the sensor wiring harness for damage or breakage.
- Open the electronics enclosure by removing its cap (see Figure 2–1).
- Visually inspect the Digital PC Board and cables for damage.
- Compare the contents to the parts list below.

2.1.3 Damaged Components

If any components have been damaged or if there are noticeable defects, notify a Totalflow representative. Keep all shipping materials for the carrier's inspection. Totalflow will arrange for immediate repair or replacement; see *Getting Help*, located in the introduction to this manual.

2.1.4 Parts List

The following parts list is for the convenience of those who receive their LevelMaster in a kit form. Some parts may be connected to or installed in other

parts but should be accounted for before starting the assembly process. Use Figure 2-1 for assistance when verifying parts list.

- Sensor Assembly – Goes inside the casing and will be basically the same length as the assembled casing. Has a ribbon cable coming out one end and is terminated with a 16-pin connector.
- Electronics Enclosure – Approximately 3 ½" diameter x 6" long with a screw-on cover. Houses the electronics board.
- Electronics Board – Approximately 2 ½" x 4". May be shipped inside the Electronics Enclosure.
- Float Kit – Composed of 1 or 2 floats. Floats are 3" diameter. Two floats are required for an oil and water application.
- Plug – The plug is epoxied into the bottom of the bottom casing joint.
- Top Cap – The top cap is an aluminum bushing that screws on to the top of the casing, leaving a 3/4" NPT threaded female opening.
- Nipple – ¾" pipe nipple. This goes between the top cap bushing and the electronics enclosure.

2.1.5 Optional Parts List

- Installation Clamps – Aids in the assembly and installation of the LevelMasters received as a kit.
- Tank Port Bushing – 3" NPT male x 2" NPT female reducer bushing or 4" NPT male x 2" NPT female reducer bushing, depending on the tank port opening size.
- Cord Connector – 2" NPT male cord connector. This screws into the tank port bushing.
- Barrier – Electrical barrier required if the LevelMaster is to be installed in a Division 1 or 2 hazardous area.
- High Level Switch – A float type switch that can be ordered in a 12, 16 or 24-inch version which is the distance below the tank port bushing. Available for 4" tank port bushing only.
- RS-232/RS-485 Converter – Allows a laptop computer to interface with the RS-485 protocol of the LevelMaster. Required when using the MasterLink setup software.

2.1.6 Typical Tank Installation

The following drawing is provided to show the major parts as well as how the assembled unit should look. This is a typical oil and water application that requires two floats. Many applications will measure only one medium and will use only one float.

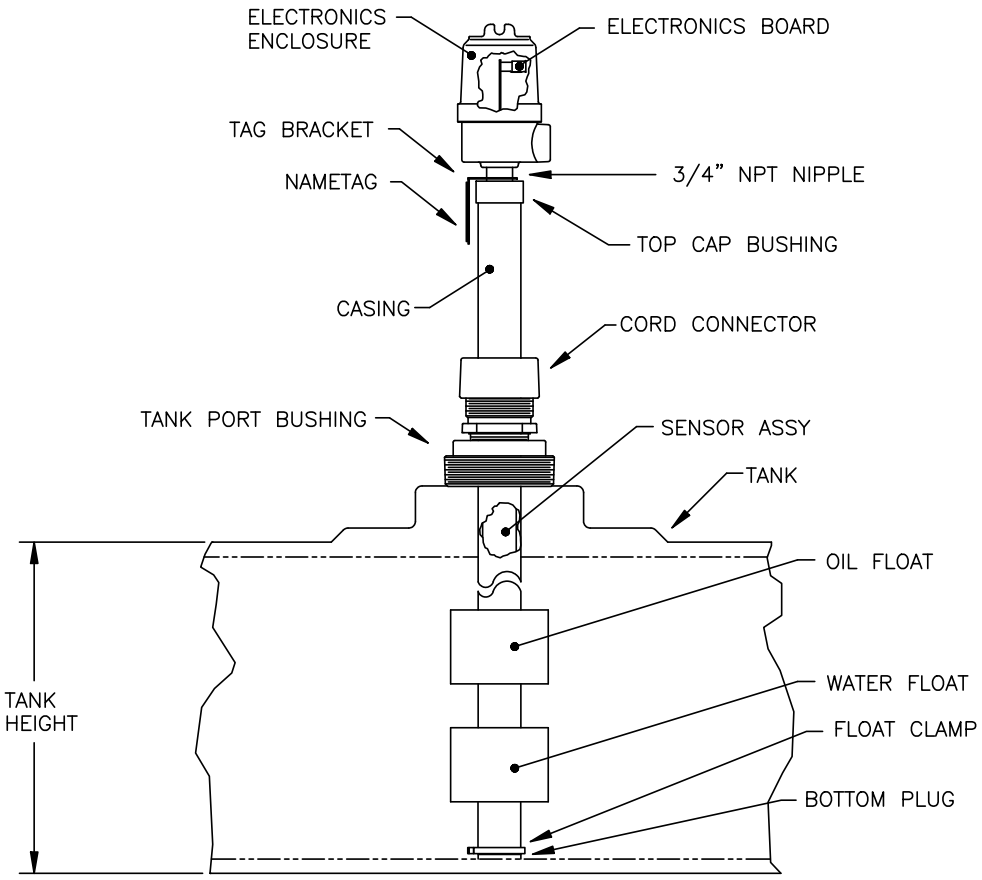


Figure 2–1 LevelMaster Components

2.2 Pre-Assembled Casing Installation Procedure

The following installation assumes the LevelMaster is being installed through a standard 3" or 4" tank port opening. Refer to Figure 2–1 LevelMaster Components for the overall picture of the completed assembly. The following procedures are for both a general purpose installation and for a high pressure installation. Please assume that the instructions are for both, unless otherwise noted.

2.2.1 Supplied Materials

- A completed assembly including casing, sensor assembly, electronics enclosure with electronics board, top cap and bottom plug.
- Float Assembly – One or two floats plus float clamp.
- Mounting Kit – (Optional) Tank port bushing, cord connector.
- Barrier – (Optional) Required for Division 1 & 2 hazardous locations.
- High Level Switch Assembly – (Optional)

FYI 

The cord connector, tank port bushing, floats and float clamp are typically not installed on the LevelMaster for shipping. Install these components while the unit is lying on wooden blocks on the ground.

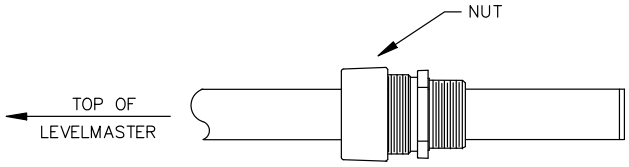
1) Prepare the tank for installation of the sensor, prior to beginning assembly:

- Remove bull plug from the top of the tank.

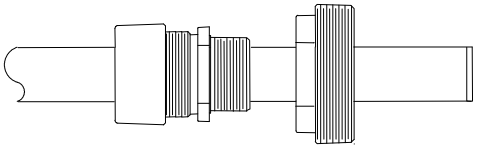
- Clean the threads on the tank opening.

2) If performing a general purpose installation, slide the cord connector onto the bottom of the LevelMaster casing, as shown below. The user may need to loosen the nut on the cord connector so it slides freely onto the casing.

3) If performing a high pressure installation, please skip to the *Component Assembly* procedure, step 1.



4) Slide the tank port bushing onto the bottom of the LevelMaster casing, as shown below. This is typically a 4” male x 2” female reducer bushing.



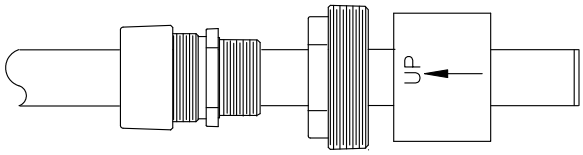
5) If the user has purchased the optional high level auxiliary switch, proceed to the *High Level Auxiliary Switch Installation* procedure; otherwise, move to the *Component Assembly* procedure.

2.2.2 Component Assembly

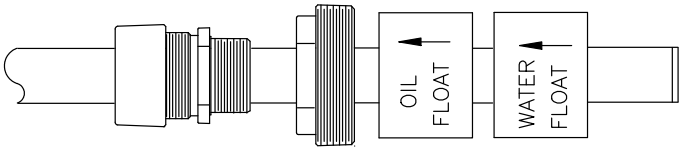
At this point, the user will have completed the preparation of the casing and installed the high level auxiliary switch assembly, if purchased. Install these components while the unit is lying on wooden blocks on the ground.

1) Slide the float(s) onto the bottom of the LevelMaster casing, as show below.

A) Units with one float – The label on the side of the float will only have an arrow that needs to point toward the top of the LevelMaster.



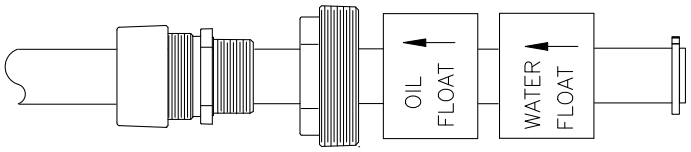
B) Units with two floats – The float labeled OIL will go on first with its arrow pointing toward the top of the LevelMaster. The float labeled WATER goes on next with its arrow pointing toward the top of the LevelMaster.



2) Slide the float clamp onto the bottom of the LevelMaster casing, as shown below. Use a screw driver to tighten the clamp onto the casing, just above

the bottom plug. Quite of bit of force may be required to lock the clamp on tight.

If installing a high pressure unit, skip to the *Tank Insertion of Pre-Assembled LevelMaster Unit* procedure, step 2.



2.2.3 Tank Insertion of Pre-Assembled LevelMaster Unit

At this point, the user will have completed the preparation of the casing and installed the high level auxiliary switch assembly, if purchased, and assembled the float(s).

TIP This portion of the installation typically requires at least two people, as the length and weight of the LevelMaster become an issue. A unit with fiberglass casing is quite a bit lighter but will flex a lot more when held up vertically in the air. The ideal situation incorporates the use of a crane. The following procedure assumes no crane.

CAUTION Failure to follow these procedures may cause damage to the unit or cause personal injury.

1) Slide the cord connector all the way to the bottom of the casing. Loosen the connector so that the casing will slide through.

Skip to step 2B if performing a high pressure installation.

2) In a general purpose installation, slide the float(s) and tank port bushing all the way to the bottom of the casing. Ensure that they do not slide down when the unit is raised vertically. For a high pressure installation, see step 3; otherwise, continue to step 4.

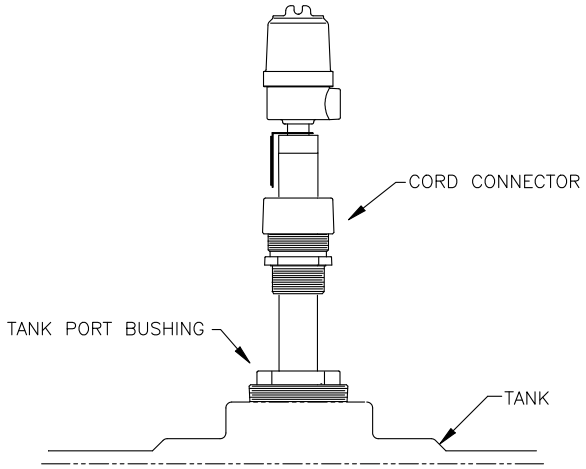
3) In a high pressure installation, slide the Float(s) all the way to the bottom of the casing. The tank port bushing is welded into place.

CAUTION If the tank has an operating agitator or mixer, the user should turn it off before attempting to insert the LevelMaster assembly. Leaving it in operation could cause harm to the equipment, if the LevelMaster is not inserted properly.

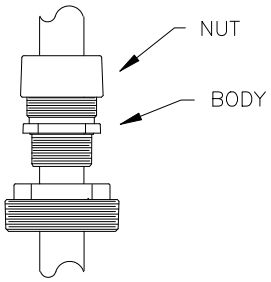
4) Once on top of the tank with the unit, carefully feed the casing and float(s) through the tank port opening. Lower slowly and allow the unit's weight to keep the unit vertical. If the bottom of the tank has sludge, the user may need to work the unit up and down a few times once the sludge has been reached to allow the unit to reach the bottom.

5) Screw the tank port bushing into the tank opening, and tighten. If the 24" version of the high level switch was purchased, make sure the tubing is assembled and the offset points away from the casing. Refer to Figure 2-2. (See step 5 of the 24" installation procedure in *Installing the High Level Auxiliary Switch*.)

If performing a high pressure installation, the user may skip to step 8 after screwing in the tank port bushing.



6) Slide the cord connector down and screw into the tank port bushing. Tighten using the lower part of the body.



7) Tighten the nut of the cord connector to form a rain tight seal around the casing.

8) Plumb the conduit or cable for the wiring into the ¾ inch hub on the side of the electronics enclosure. For division 1 & 2 hazardous areas, this would be conduit. For general purpose areas, this can be a cable with a cord connector.

TIP

If applicable, plumb conduit or cable into the conduit box for the high level switch. Terminate the wiring inside the conduit box using wire nuts. There are two wires coming from the switch representing the two sides of the switch. There are no polarity considerations.

Continue to the *Wiring* section, and follow the procedure for the relevant application.

After all mechanical and wiring is complete, see the *Operations* chapter for setup and calibration.

2.3 High Level Auxiliary Switch Installation

2.3.1 Overview

If the user purchased the high level auxiliary switch, perform this procedure.

If the user was directed here from the *Pre-Assembled Casing Installation – Preparation* section, this installation should be performed while the unit is lying on wooden blocks on the ground.

If wanting to…	Then use…	See Page
Install a 12” assembly	12” & 16” Installation Procedure	2-7
Install a 16” assembly	12” & 16” Installation Procedure	2-7
Install a 24” assembly	24” Installation Procedure	2-8

2.3.2 12” & 16” Installation Procedure

The following drawing shows this configuration as it would appear installed. The LevelMaster is typically shipped with the switch assembly installed in the tank port bushing.

1) Verify that the high level switch assembly is installed in the tank port bushing and looks similar to Figure 2–2.

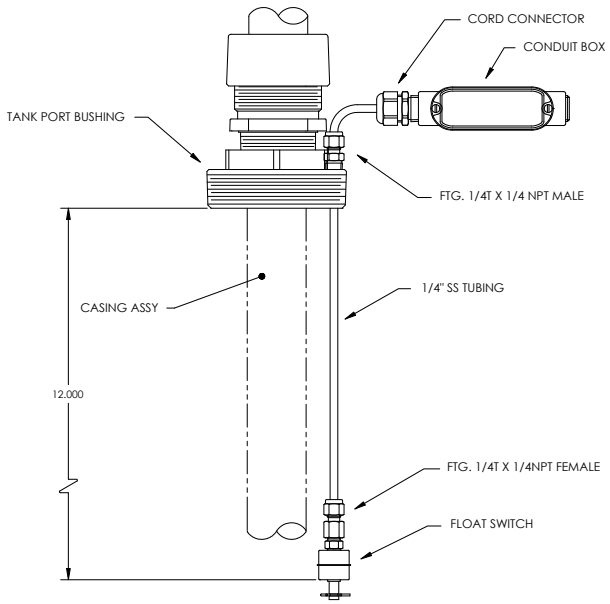
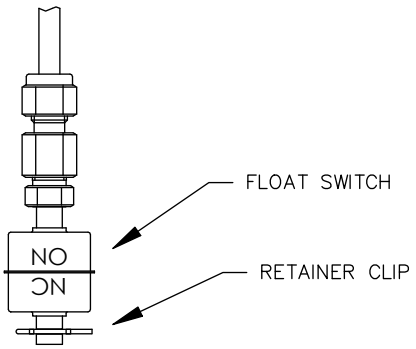
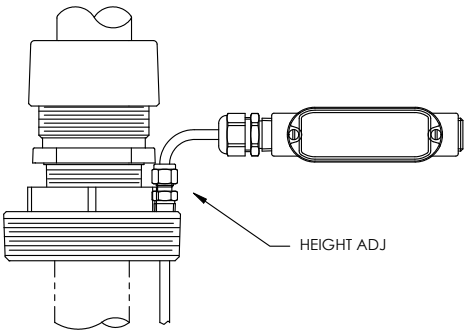


Figure 2–2 Overview of 12” and 16” High Level Auxiliary Switch Installation

2) Decide whether the switch needs to function as normally open (NO) or normally closed (NC). With the float switch down in its normal position, read the two character inscription above the center of the float. It will read either NO or NC. If not correct, pull the retainer clip off and turn the float over and re-install.



3) This prepares the high level switch assembly to a point that it can be put inside the tank. One consideration that can be done later is the height adjustment of the level switch. When the tubing is slid all the way down, the switch will actuate at approximately 12 inches below the bottom of the tank port bushing for the 12 inch switch and 16 inches below the bottom of the tank port bushing for the 16 inch switch. By loosening the nut on the fitting installed on the topside of the tank port bushing, the tubing can be pulled up, providing a range of approximately 9 inches.



2.3.3 24” Installation Procedure

The following drawing shows this configuration as it would appear installed. The LevelMaster is typically shipped with the switch assembly installed in the tank port bushing. Because of its length, the bottom offset portion of the tubing will be loose at the tube union and folded back onto the top portion and taped.

1) Verify that the Switch assembly is installed in the *Tank Port Bushing* and looks similar to Figure 2–3.

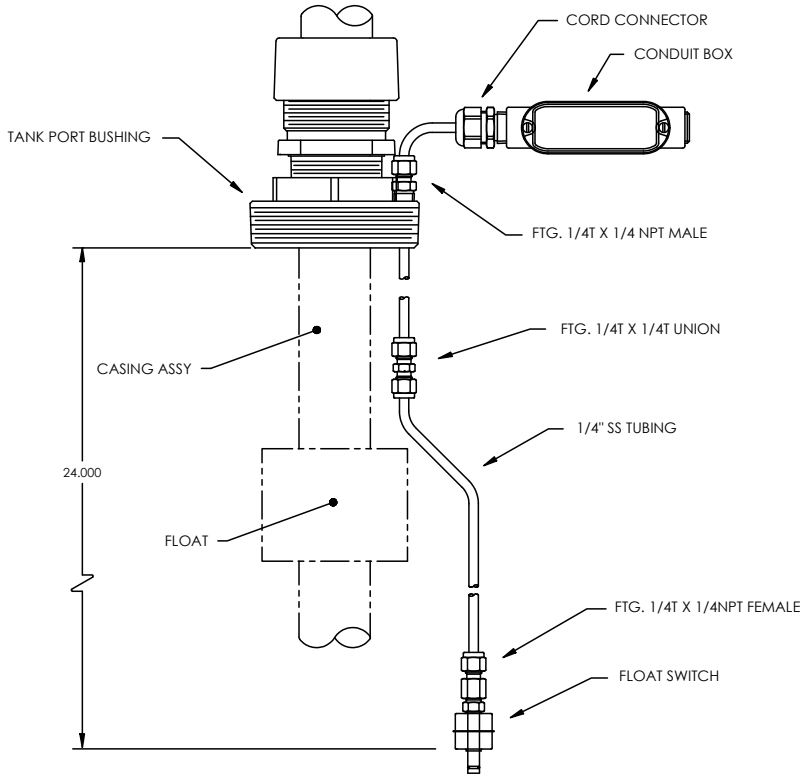
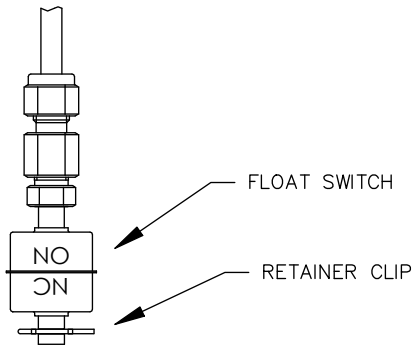


Figure 2–3 Overview of 24" High Level Auxiliary Switch Installation

2) Un-tape the bottom portion of the tubing from the top, and reinsert it into the ¼" tube union. The user may need to remove the cover on the conduit box, and pull the slack out of the wire.

3) Tighten the nut of the union. Keep in mind that the offset in the bottom portion of the tubing needs to point away from the center or what will be the casing. The user will probably want the conduit box to also point in the same direction.

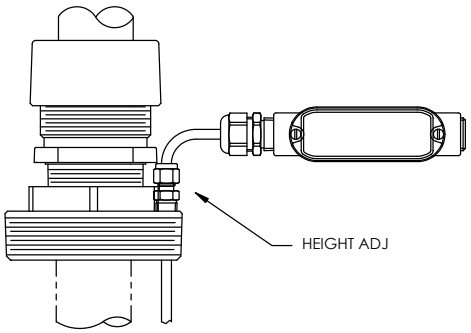
4) Decide whether the switch needs to function as normally open or normally closed. With the float switch down in its normal position, read the two character inscription above the center of the float. It will read either NO (normally open) or NC (normally closed). If not correct, pull the retainer clip off and turn the float over and re-install.



5) Make sure all fittings are tight except for the fitting on the top side of the tank port bushing. The user will need to rotate the high level switch unit so

that the “dog leg” is flush against the casing. After installation of the LevelMaster casing into the tank port, the user will need to rotate the “dog leg” away from the casing and then tighten the nut on top of the tank port bushing. This will allow the level floats to work properly. See Figure 2–2 Overview of 12” and 16” High Level Auxiliary Switch Installation.

If the user wants a float switch height other than the 24 inches, slide the tubing up to the correct height and then tighten the nut on top of the tank port bushing. There is approximately a 9-inch adjustable range. This, however, can be accomplished after installation, if desired.



6) If the user was directed here from the *Pre-Assembled Casing Installation Procedure - Preparation* section, return to that section and continue to the component assembly procedure.

2.4 General Wiring

The following section will discuss the electrical connections on the individual LevelMaster electronics board (see Figure 2–4) as well as overall wiring schemes. These schemes involve single or multiple LevelMasters in general purpose and hazardous areas.

2.4.1 Board Wiring

An outline of the LevelMaster electronics board (Figure 2-4) is shown below along with the pinouts of the connector. The connector can be unplugged from the board to aid in wiring.

Totalflow provides and recommends a cable specially designed for the RS-485. Additionally, it supports two 16 AWG wires for the power. RS-485 uses two wires, as shown below, by the TX(-) and TX(+) wires. Power wires go to the two terminals labeled as GND and +12 VDC.

Other than the wire for 12 VDC ground, do not connect any ground wire, shield from the cable or any other source to the board. The LevelMaster must float above ground potential.

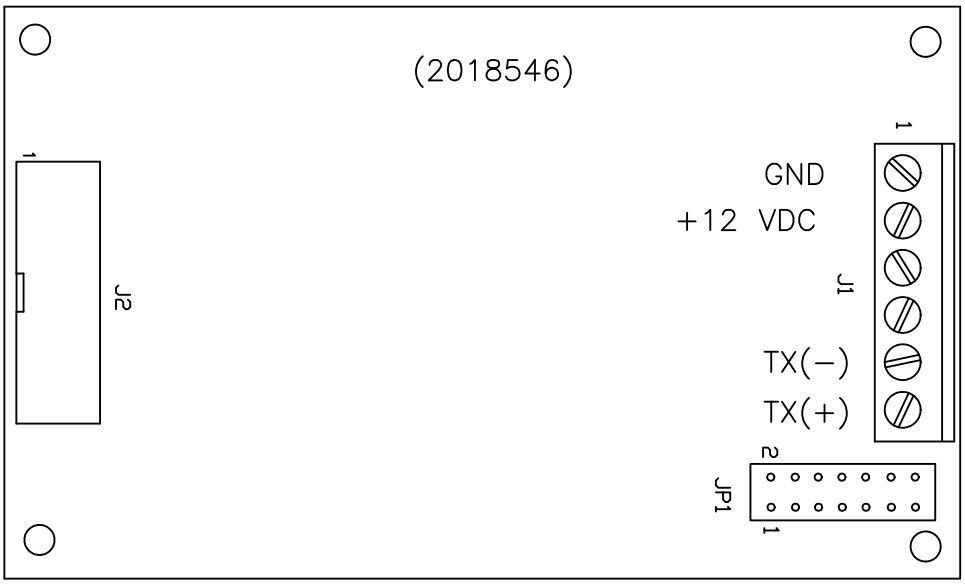


Figure 2–4 LevelMaster Electronics Board

The LevelMaster electronics board, as with any electronic board, is susceptible to damage by static electricity or improper handling. To prevent this from occurring, the user should wear a grounding strap.

CAUTION

A grounding strap is a conductive device used to make a connection between the person handling the board and a high quality ground point. Before handling the board, the user must install a ground strap on their body and then connect it to a grounded point. This discharges electrical static buildup from the body to ground, preventing static from discharging to the board.

2.4.2 Wiring Interconnect

The following is a typical RS-485 wiring interconnect between the LevelMaster and the various Totalflow models. The interconnect drawing shows the flow computer powering the LevelMaster, which may or may not be the case. See Figure 2–5.

	LEVEL MASTER		XFC, XFCG4, 6400 COMM 1		XFC, XFCG4, 6400 COMM 2		6700 RS485 MODULE		6700 RS485 CARD		LMC, XRC, XRCG4 COMM 1 or 2	
	A2J1		J4		J4		J4, J5, J6		J4		J6	
6	+T	4	BUS(+)	12	BUS(+)	4	BUS(+)	8	BUS(+)	8	BUS(+)	
5	−T	6	BUS(−)	13	BUS(−)	6	BUS(−)	6	BUS(−)	6	BUS(−)	
4	+R											
3	−R											
2	+V	2	VBATT	2	VBATT	1	VBATT	1	VBATT	1	VBATT	
1	−V	1	GND	1	GND	2	GND	2	GND	2	GND	

Figure 2–5 RS-485 General Purpose Wiring Interconnect

2.5 Daisy Chained

Figure 2–6 is a look at four LevelMasters daisy chained together. Additionally, all are connected to a host device. If the host is a Totalflow device, see the drawings on the following pages. Hardware protocol between the Totalflow and the LevelMaster will typically be RS-485 unless some type of converter or modem is placed in between.

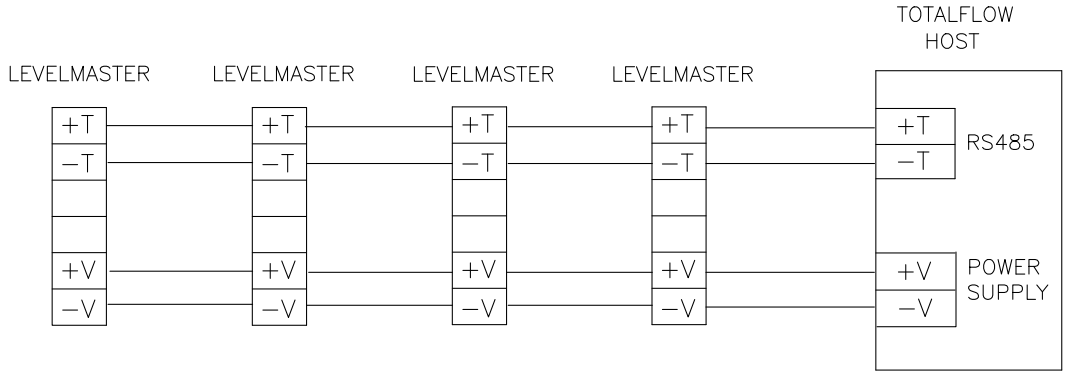


Figure 2–6 Daisy Chaining General Purpose Wiring Schematic

2.5.1 Jumpers

The electronics board has jumpers that need to be configured to complete the wiring process. The jumpers are for terminating the last board on an RS-485 bus. Therefore, the last board will be jumped differently than the first and intermediate boards. If the board is the only one on the bus, it is treated as the last board (see Figure 2–7).

Use the following figures to configure the jumpers. The bank of jumpers is labeled as JP1. Note that for the last board or only board, the three middle jumpers are used. If the board is the first or intermediate, jumpers 5, 6, 9, and 10 are used.

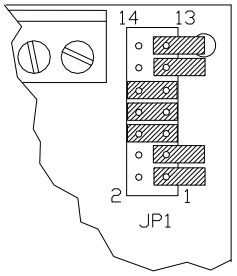
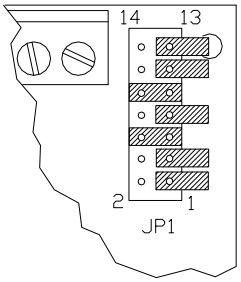
Last Board of Only Board		First or Intermediate Board	
Pin 13 Only Pin 11 Only Pin 9 & 10 (jumper) Pin 7 & 8 (jumper) Pin 5 & 6 (jumper) Pin 3 Only Pin 1 Only		Pin 13 Only Pin 11 Only Pin 9 & 10 (jumper) Pin 7 Only Pin 5 & 6 (jumper) Pin 3 Only Pin 1 Only	

Figure 2–7 RS-485 Termination J1 Wiring

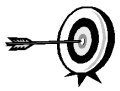
2.5.2 Wiring Limitations

For general purpose locations where the power is supplied locally, there is no barrier, and the cable is run directly to the host. The limitations are:

- Maximum cable length can be up to 4000 feet or
- Maximum of 10 LevelMasters.
- Both maximums are not allowed at the same time.

For general purpose locations where power is supplied via the RS-485 cable, there is no barrier, and the cable is run directly to the host. The limitations are:

- Maximum cable length can be up to 500 feet or
- Maximum of 4 LevelMasters.
- Both maximums are not allowed at the same time.

TIP 

When wiring from the LevelMaster to the host, do not cut off spare wires. Tape them securely back to the cable jacket as spares, in case of damage.

2.6 General Purpose Location Wiring

Non-hazardous wiring locations do not require the use of a barrier board. When wiring these locations, each host unit wires differently. Please refer to the figures for each host type. For the purpose of this section, units will not be daisy chained together. Please refer to the previous section for information regarding daisy chaining. Generally, the host computer uses Comm port 1 for remote communications for host software such as WinCCU. The second port may be used for communicating with the LevelMaster, with the exception of those host units having three communication ports. As always, the user needs to take into consideration how their equipment is configured.

2.6.1 No Host

The LevelMaster may be connected to a laptop computer for local communication using the MasterLink software. If located in a general purpose area, the laptop can be taken to the top of the tank and plugged directly into the LevelMaster's electronics board. This uses the optional converter cable powered by 2-9 volt batteries from the computer port, making a connection with either the optional

cable connector that mates directly into the communications connector on the electronics board (see Figure 2–8).For more information on setting up MasterLink, see *Chapter 3 - Setup*.

2.6.2 6400 FCU, XFC and XFCG4 Host

The Totalflow 6400 FCU and XSeries generation 3 and 4 computers can support the LevelMaster(s) as well perform their duties as a flow computer. Figure 2–9 shows the wiring to Comm port 1 and Figure 2–10 shows the LevelMaster wired to Comm port 2.

For more information on setting up the XFC, see *Chapter 3 - Setup*.

2.6.3 LMC7100, XRC, and XRCG4 Host

The Totalflow LevelMaster Controller (LMC) is a computer designed to store and display information collected from the LevelMaster. The LMC uses a modified version of the XRC electronic board therefore wiring instructions are identical. The XSeries Remote Controller boards, generation 3 and 4 additionally can support the LevelMaster.

If an installation does not require a barrier, the Levelmaster wiring can go directly to the LMC or XRC. As shown in Figure 2–11, the LevelMaster may be connected to either Comm 1 or Comm 2 (Figure 2–12).

For more information on the LMC or XRC see *Chapter 3, Setup*.

2.6.4 6700 FCU Host

The Totalflow 6700 series flow computers can support LevelMasters as well as their duties as a flow computer. Figure 2–13 shows the LevelMaster connected directly to the 6700 electronics board. For more information on setting up the 6700 FCU, see *Chapter 3 - Setup*.

The 6700 electronics board contains three communication ports which can be RS-232 or RS-485, depending on the communication module installed. Comm 1 (J4), Comm 2 (J5) and Comm 3 (J6) all wire up identically. The exception to this is if an RS-485 I/O interface card is plugged into the 50-pin I/O expansion slot. In this case, BUS (+) moves from terminal 4 to terminal 8.

2.6.5 6790 RTU Host

The Totalflow Model 6790 RTU has supporting firmware for the LevelMaster. The LevelMaster is typically connected to the satellite port of the RTU, which supports RS-485 communications. As shown in Figure 2–14, the LevelMaster can be wired directly to the RTU. For more information on setting up the 6790 RTU, see *Chapter 3 - Setup*.

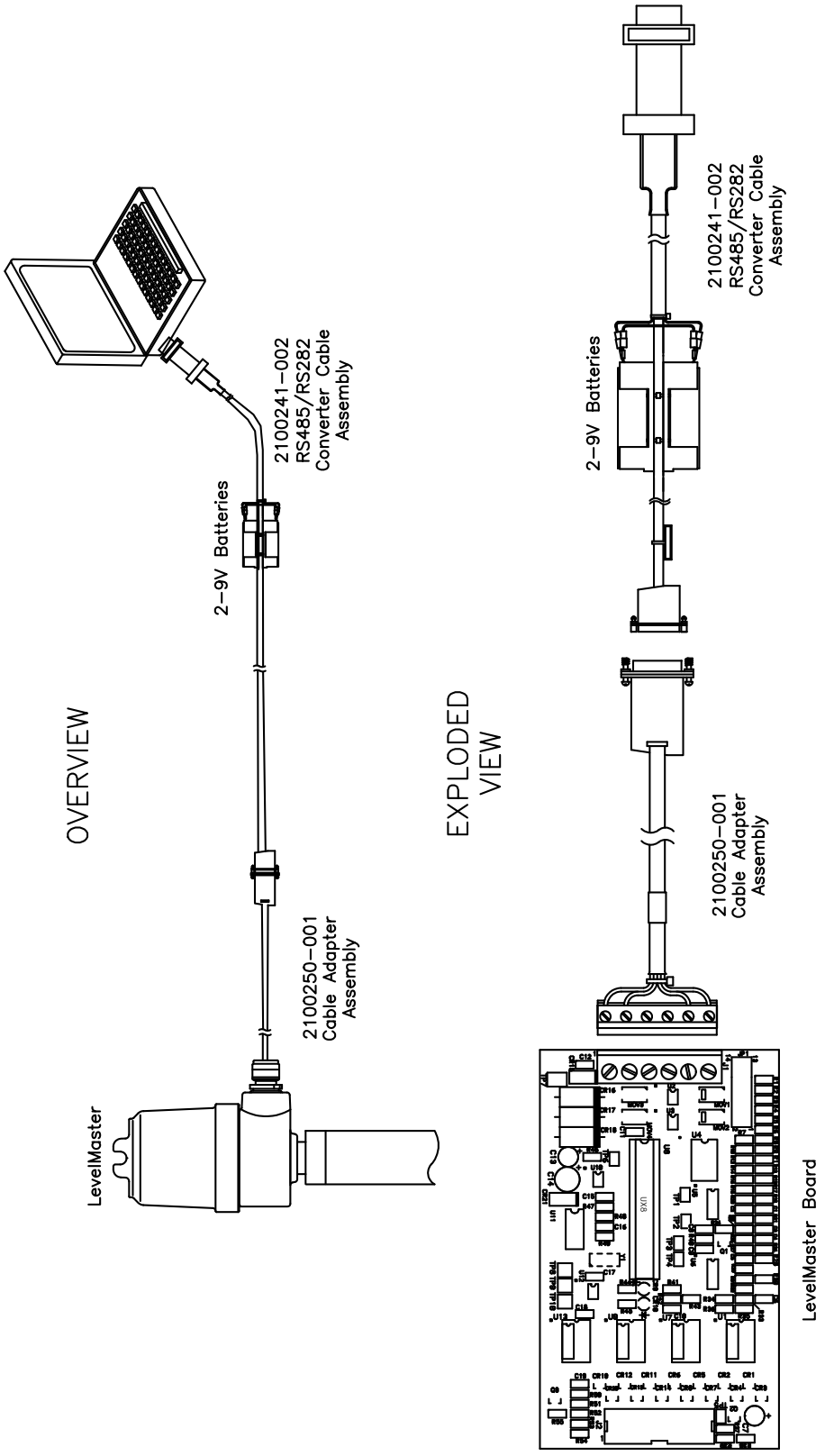


Figure 2–8 LevelMaster to Laptop Computer

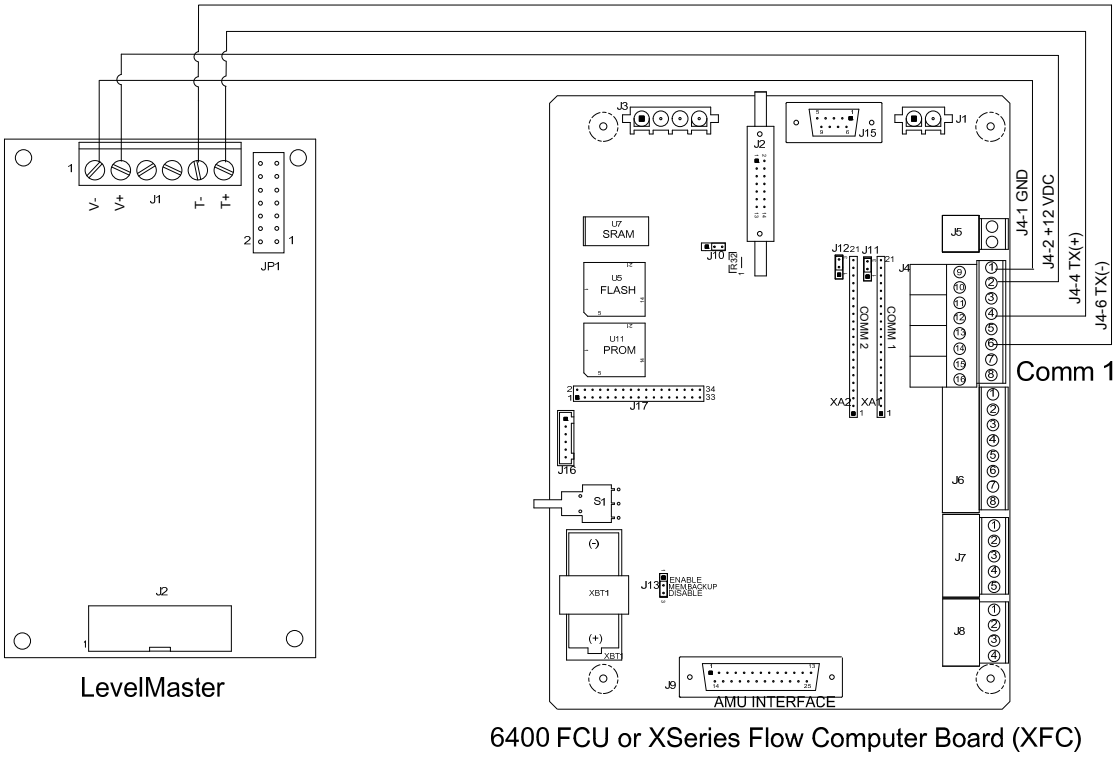


Figure 2–9 LM to 6400, XFC or XFCG4 Comm 1 General Purpose Wiring

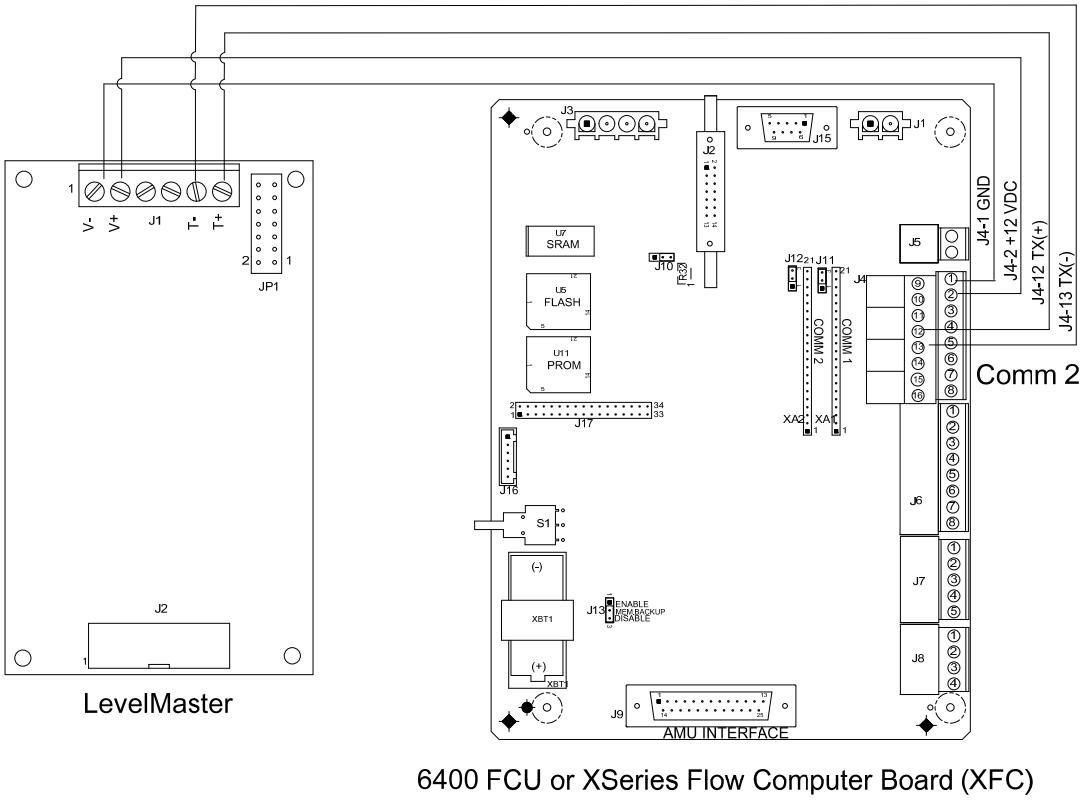


Figure 2–10 LM to 6400, XFC or XFCG4 Comm 1 Comm 2 General Purpose Wiring

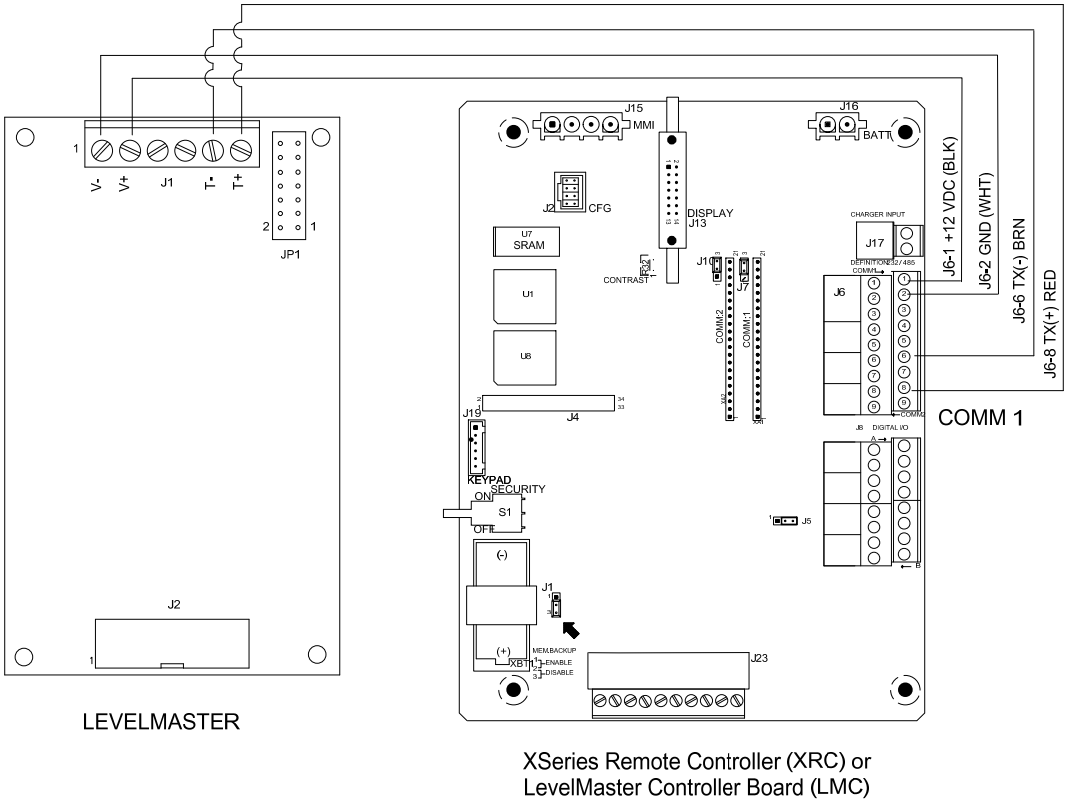


Figure 2–11 LM to LMC7100, XRC, or XRCG4 Comm 1 General Purpose Wiring

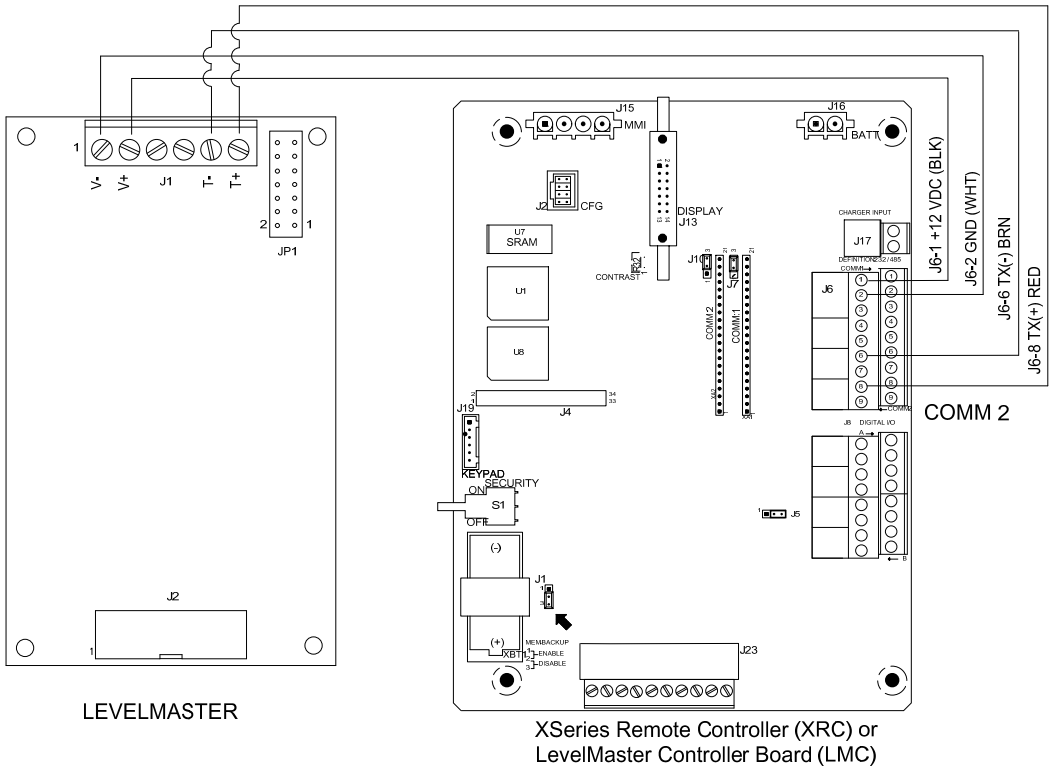


Figure 2–12 LM to LMC7100, XRC, or XRCG4 Comm 2 General Purpose Wiring

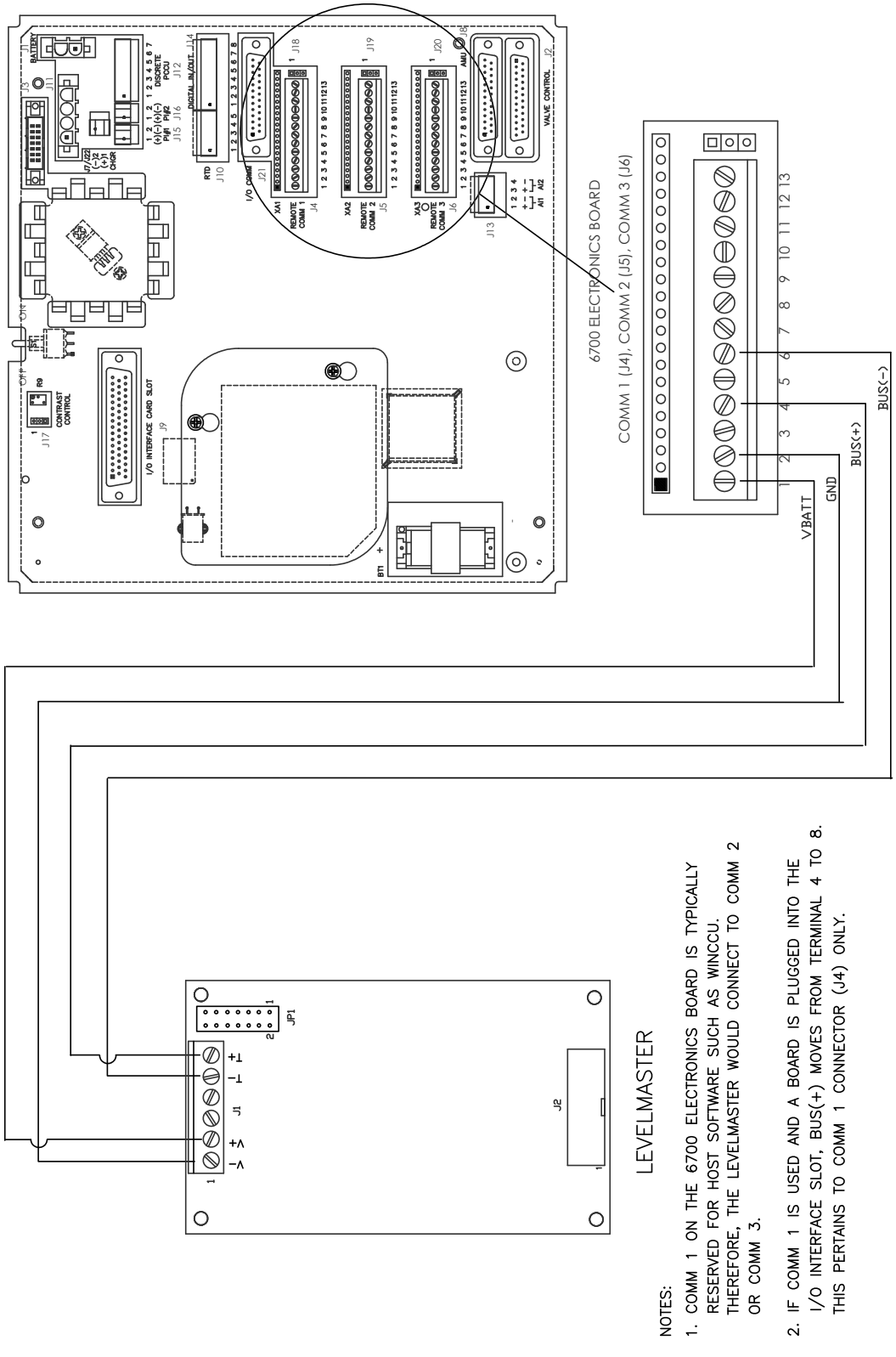


Figure 2–13 6700 FCU General Purpose Wiring

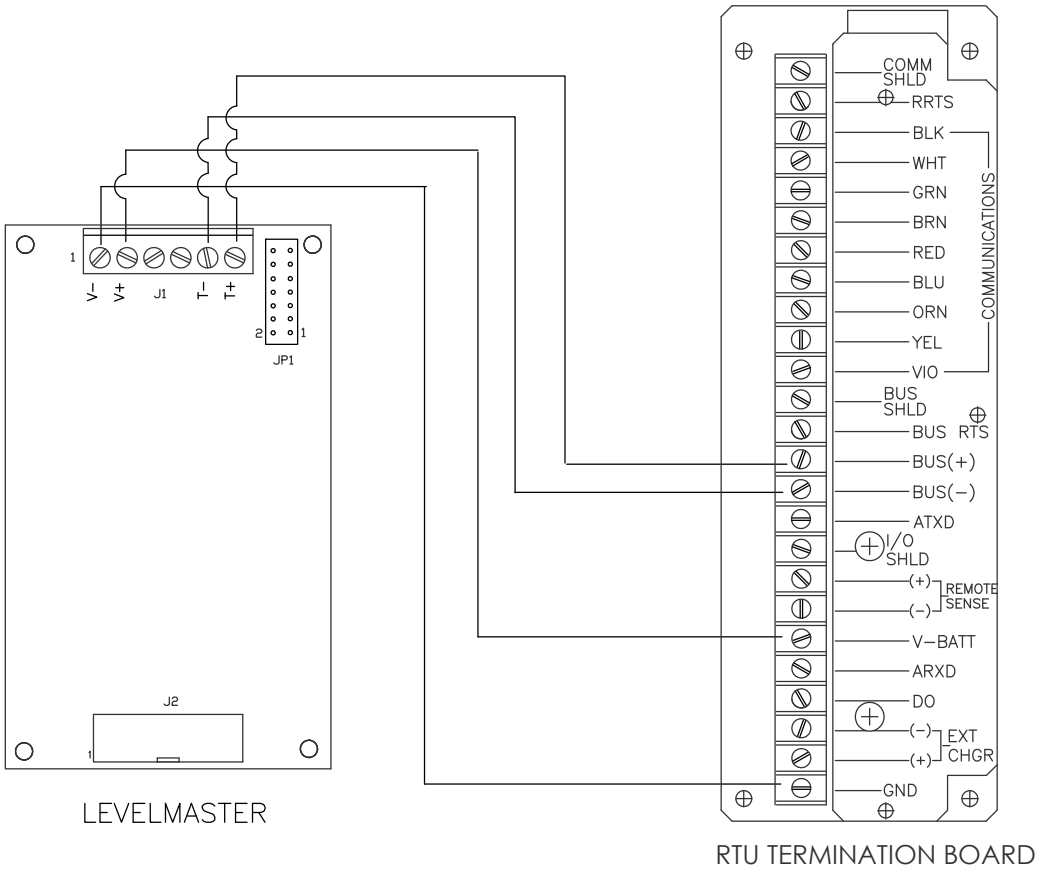


Figure 2–14 6790 RTU General Purpose Wiring

2.7 Hazardous Location Wiring

The LevelMaster is CSA certified for hazardous locations when installed per controlling document 2018387-CD. This requires the wiring to go through the Totalflow barrier that is located in a safe area.

Figure 2–15 is a look at two LevelMasters that are daisy chained together, connected to a barrier and then a PLC or RTU host device. If the host is a Totalflow device, see the related section in this chapter for the drawings for the corresponding Totalflow device. Hardware protocol between the Totalflow and the LevelMaster will typically be RS-485, unless some type of converter or modem is placed in between.

2.7.1 Limitations

Hazardous area certification restrictions limit the number of LevelMasters and length of cable that can be fed by the barrier. Those limitations are:

- Maximum of 500 ft. of cable from the barrier to the last LevelMaster.
- Maximum of four LevelMasters for Group D Locations.
- Maximum of one LevelMaster for Group C, D Locations.

Therefore, if the user has only one barrier, the maximum number of LevelMasters that they can have in a Group D location is four. If the user has multiple barriers, the power and RS-485 wiring to the LevelMasters can be split up.

See Figure 2–16 for a drawing of the Totalflow barrier board and Figure 2–17 for a drawing of the LevelMaster board wired to a barrier.

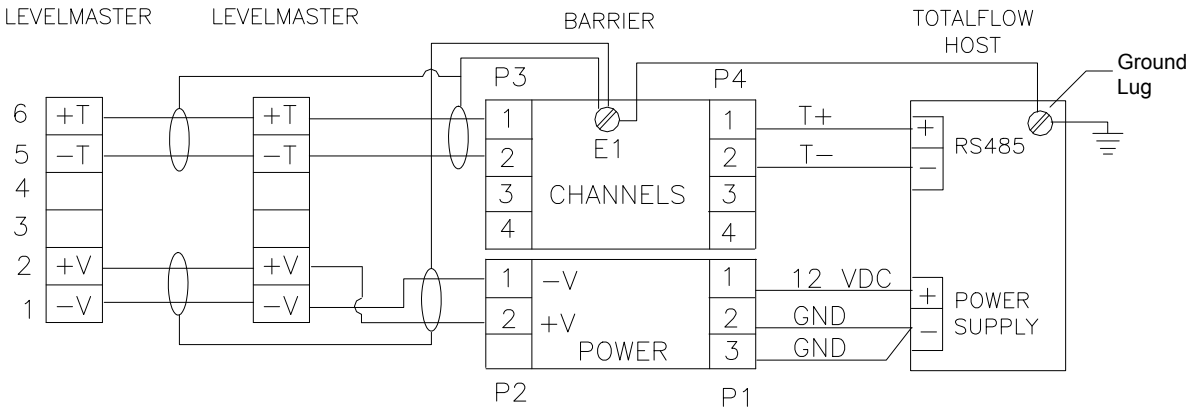


Figure 2–15 LevelMaster Wiring Schematic, Class 1 Division 1, Group D

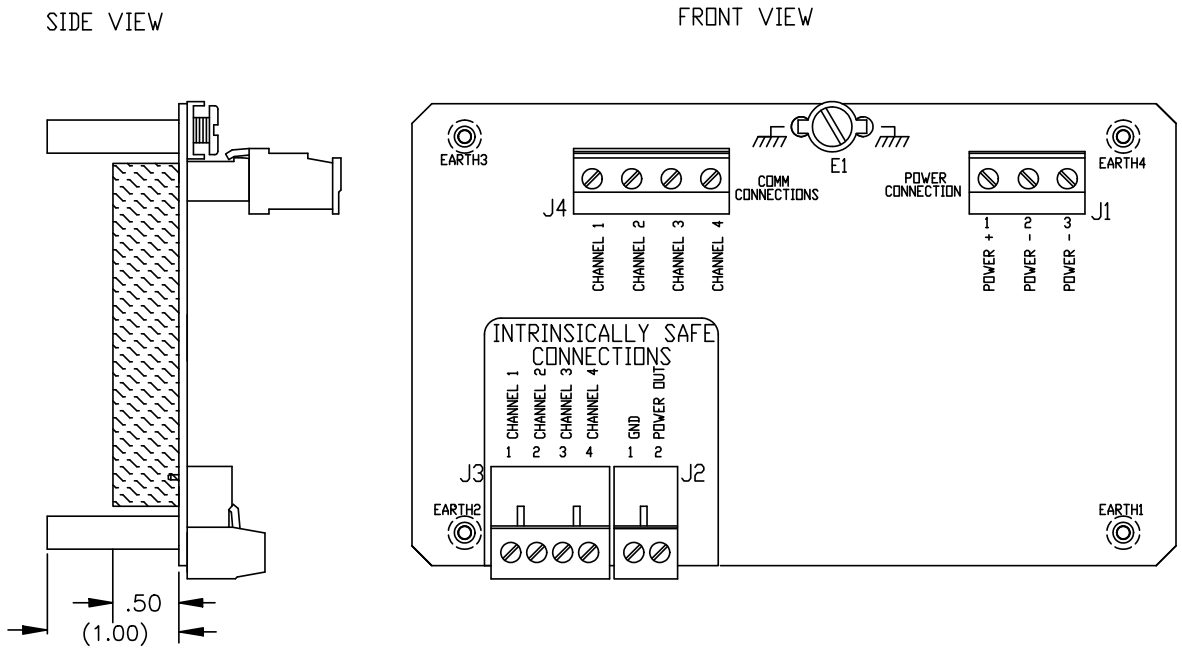


Figure 2–16 Totalflow CSA Certified Barrier Board

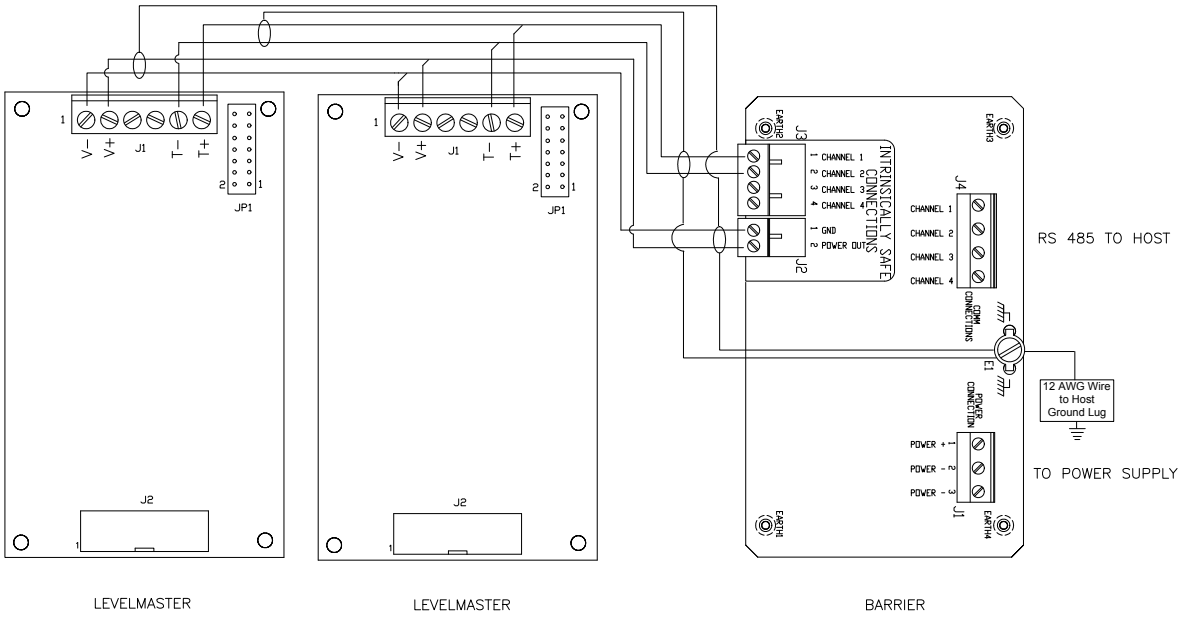
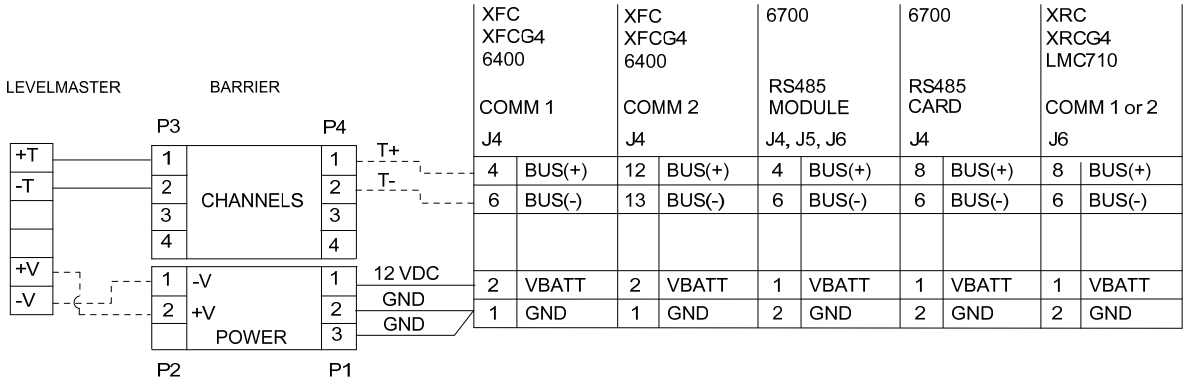


Figure 2–17 LevelMaster to Barrier Diagram, Class 1, Division 1, Group D

2.7.2 Wiring Interconnect

The following is typical RS-485 wiring interconnect between the LevelMaster, barrier and the various Totalflow models. The interconnect drawing shows the flow computer powering the LevelMaster, which may or may not be the case. See Figure 2–18.



XFC XFCG4 6400 COMM 1 J4		XFC XFCG4 6400 COMM 2 J4		6700 RS485 MODULE J4, J5, J6		6700 RS485 CARD J4		XRC XRCG4 LMC710 COMM 1 or 2 J6	
4	BUS(+)	12	BUS(+)	4	BUS(+)	8	BUS(+)	8	BUS(+)
6	BUS(-)	13	BUS(-)	6	BUS(-)	6	BUS(-)	6	BUS(-)
2	VBATT	2	VBATT	1	VBATT	1	VBATT	1	VBATT
1	GND	1	GND	2	GND	2	GND	2	GND

Figure 2–18 LevelMaster Wiring Schematic, Class 1 Division 1, Group C, D

2.7.3 No Host

The LevelMaster may be connected to a laptop computer for local communication using the MasterLink software. If located in a hazardous area, the user may be using the optional cable with alligator clips making their connection beyond the barrier board in the area classified as non-hazardous. For more information on the setting up MasterLink, see *Chapter 3 - Setup*.

2.7.4 6400, XFC, or XFCG4 Host

The Totalflow 6400 FCU or XSeries flow computers, generation 3 and 4, can support the LevelMaster(s) as well as perform their duties as a flow computer. Figure 2–19 shows the wiring to the XFC Comm 1 port, and Figure 2–20 shows the wiring to the XFC Comm 2 port. Both figures reflect the LevelMaster wired through a barrier board for hazardous location installations.

For more information on setting up the XFC, see *Chapter 3 - Setup*.

2.7.5 LMC7100, XRC, or XRCG4 Host

LevelMaster Controller (LMC) or XSeries Remote Controller (XRC) a Totalflow computer designed to store and display information collected from the LevelMaster. The LMC uses a modified version of the XRC electronic board therefore wiring instructions are identical. The XSeries Remote Controller boards, generation 3 and 4 additionally can support the LevelMaster.

As shown in, the LevelMaster may be connected to either Comm 1 (see Figure 2–21) or Comm 2 (see Figure 2–). Both figures reflect the LevelMaster wired through a barrier board for hazardous location installations. The wiring for both ports supports RS-485 communications.

For more information on the LMC or XRC see *Chapter 3, Setup*.

2.7.6 6700 FCU Host

The Totalflow 6700 series flow computers can support LevelMasters as well as perform their duties as a flow computer. Figure 2–22 shows the LevelMaster connected to the 6700 electronics board through the Totalflow barrier. For more information on setting up the 6700, see *Chapter 3 - Setup*.

The 6700 electronics board contains three communication ports which can be RS-232 or RS-485 depending on the communication's module installed. Comm 1 (J4), Comm 2 (J5) and Comm 3 (J6) all wire up identically except that if an RS-485 I/O interface card is plugged into the 50-pin I/O expansion slot, BUS (+) moves from terminal 4 to terminal 8. The LevelMaster is typically connected to Comm 2 or Comm 3, leaving Comm 1 for host software such as WinCCU.

2.7.7 6790 RTU Host

The Totalflow Model 6790 RTU has supporting firmware for the LevelMaster. The LevelMaster is typically connected to the satellite port of the RTU which supports RS-485 communications. If the installation site does not require a barrier as shown below (See Figure 2–23), the LevelMaster can be wired directly to the RTU. For more information on setting up the 6790 RTU, see *Chapter 3 - Setup*.

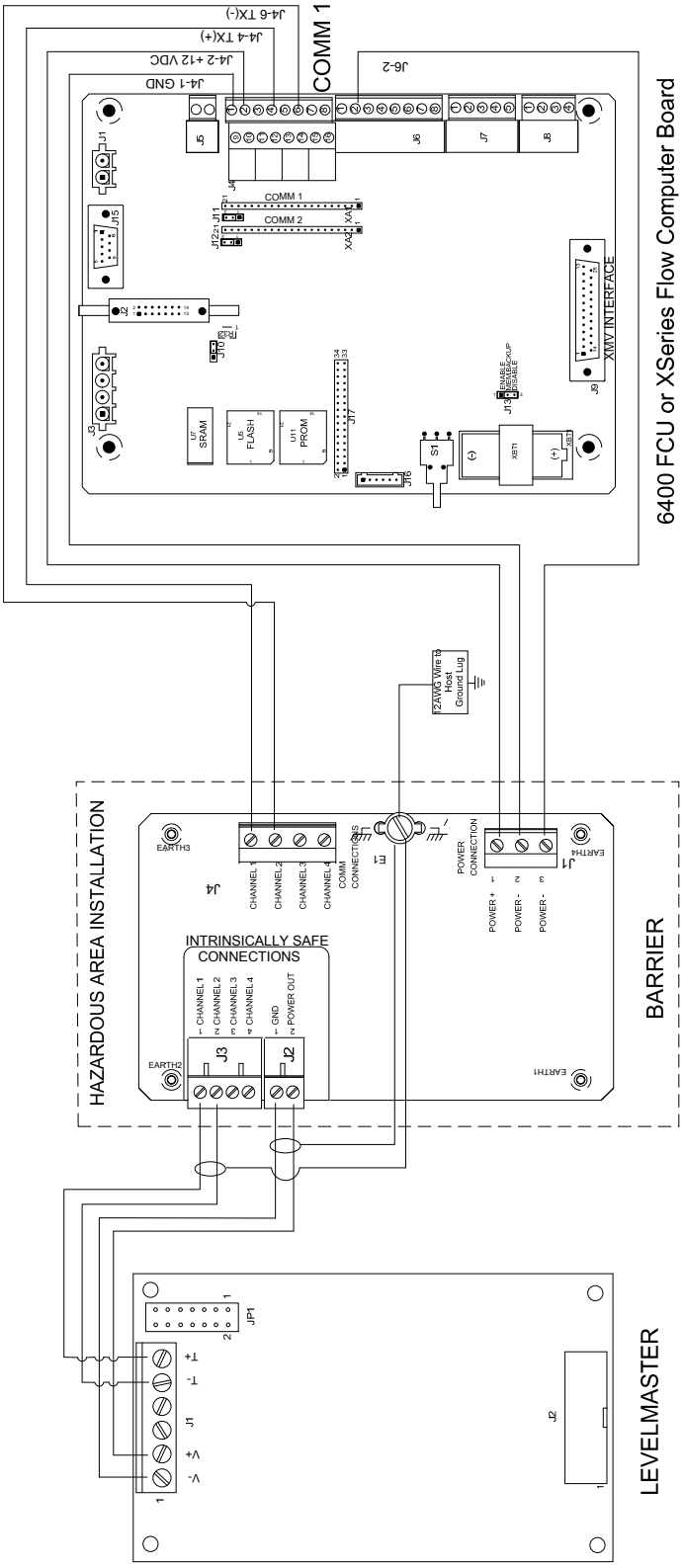


Figure 2–19 6400, XFC, or XFCG4 Comm 1 Hazardous Location Wiring

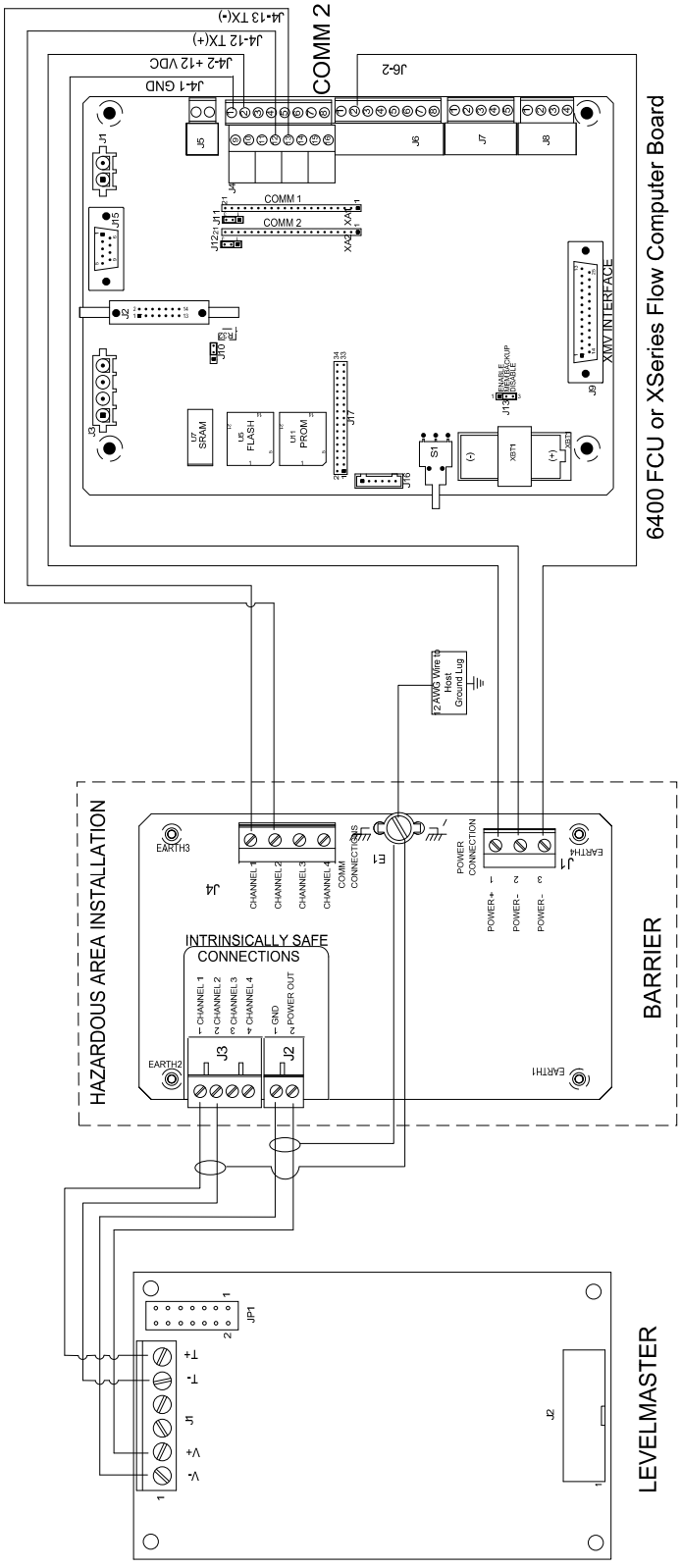


Figure 2–20 6400, XFC, or XFCG4 Comm 2 Hazardous Location Wiring

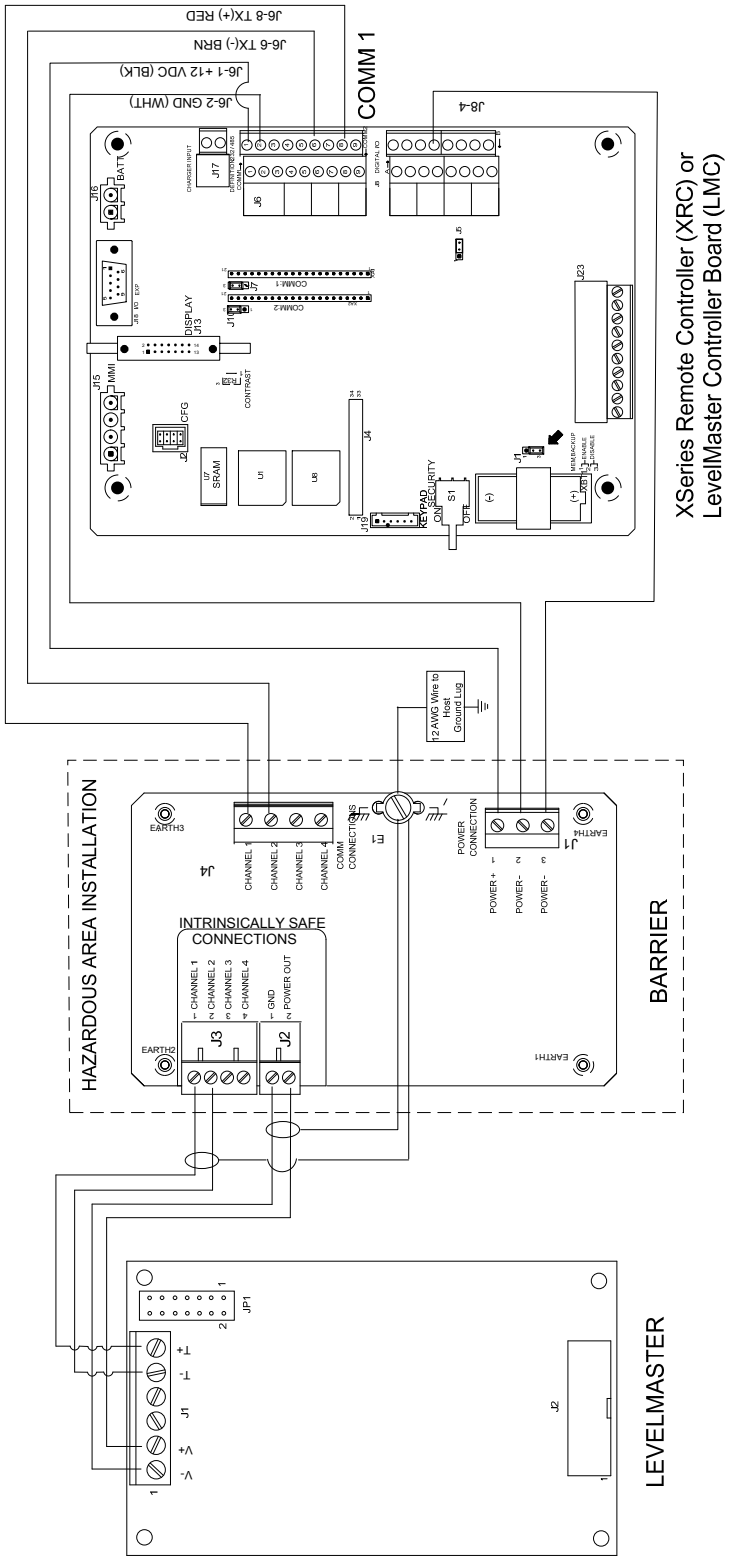


Figure 2–21 LMC, XRC, or XRCG4 COMM 1 Hazardous Location Wiring

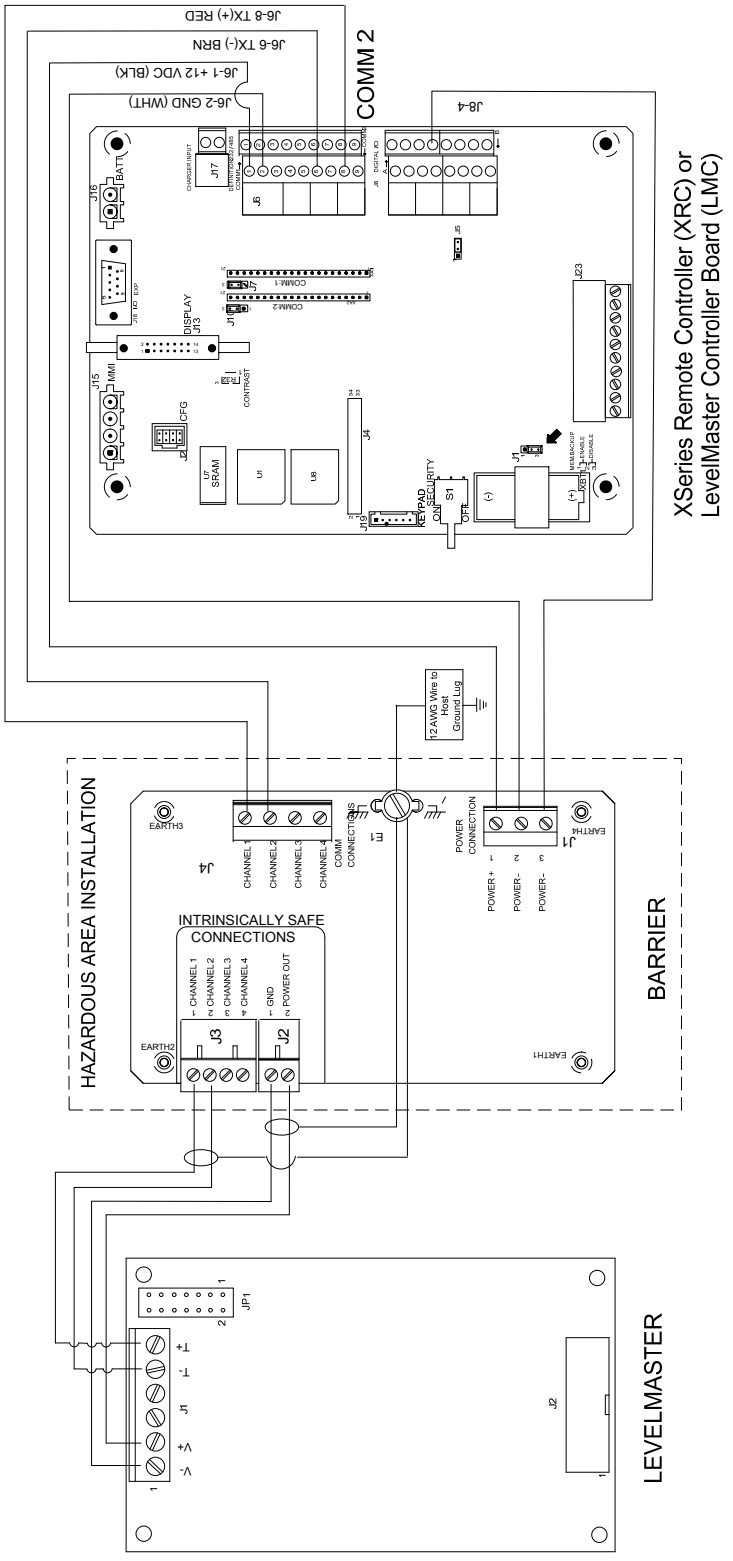
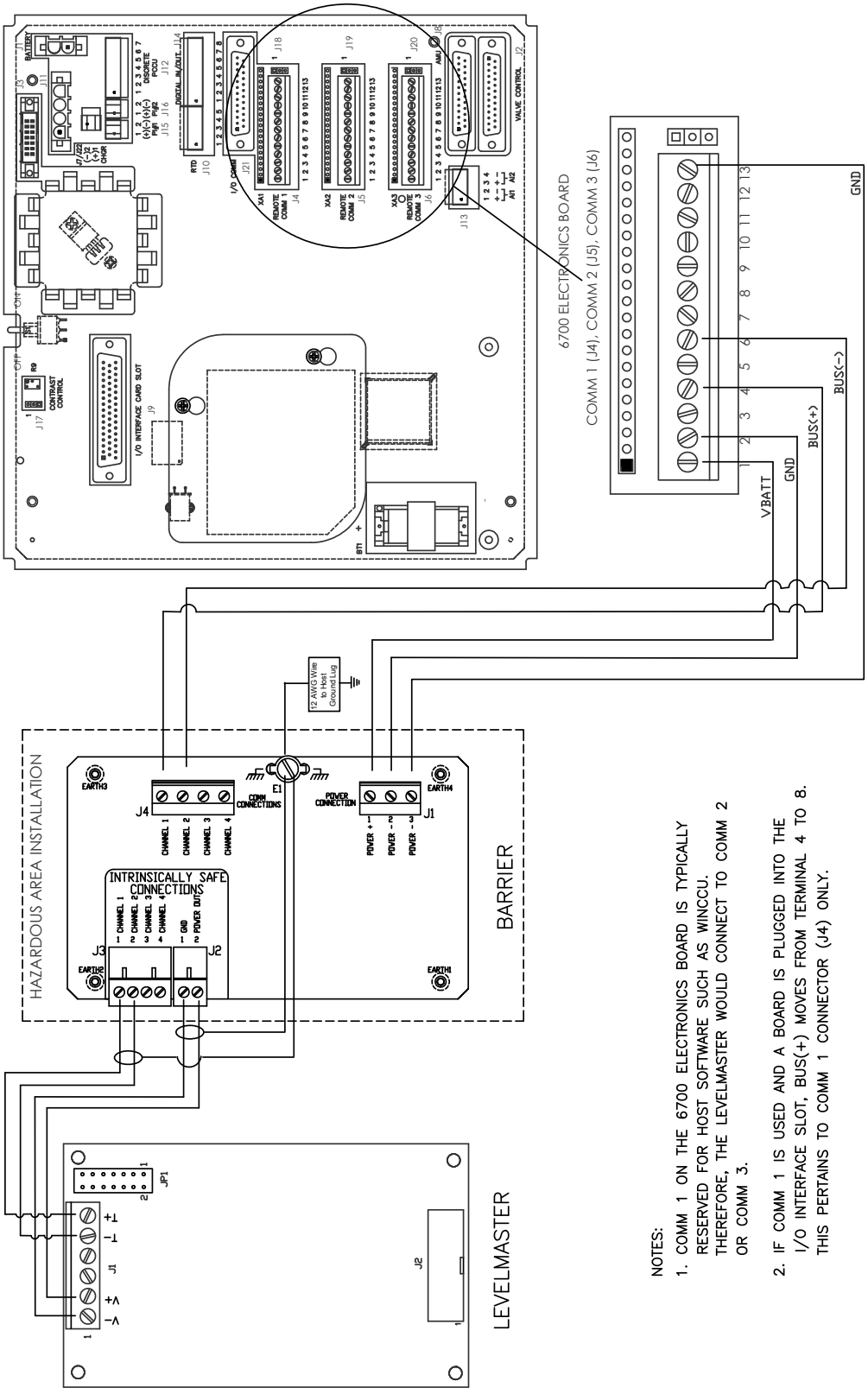


Figure 2– LMC, XRC, or XRCG4 COMM 2 Hazardous Location Wiring



NOTES:

1. COMM 1 ON THE 6700 ELECTRONICS BOARD IS TYPICALLY RESERVED FOR HOST SOFTWARE SUCH AS WINCCU. THEREFORE, THE LEVELMASTER WOULD CONNECT TO COMM 2 OR COMM 3.
2. IF COMM 1 IS USED AND A BOARD IS PLUGGED INTO THE I/O INTERFACE SLOT, BUS(+) MOVES FROM TERMINAL 4 TO 8. THIS PERTAINS TO COMM 1 CONNECTOR (J4) ONLY.

Figure 2–22 6700 FCU Hazardous Location Wiring

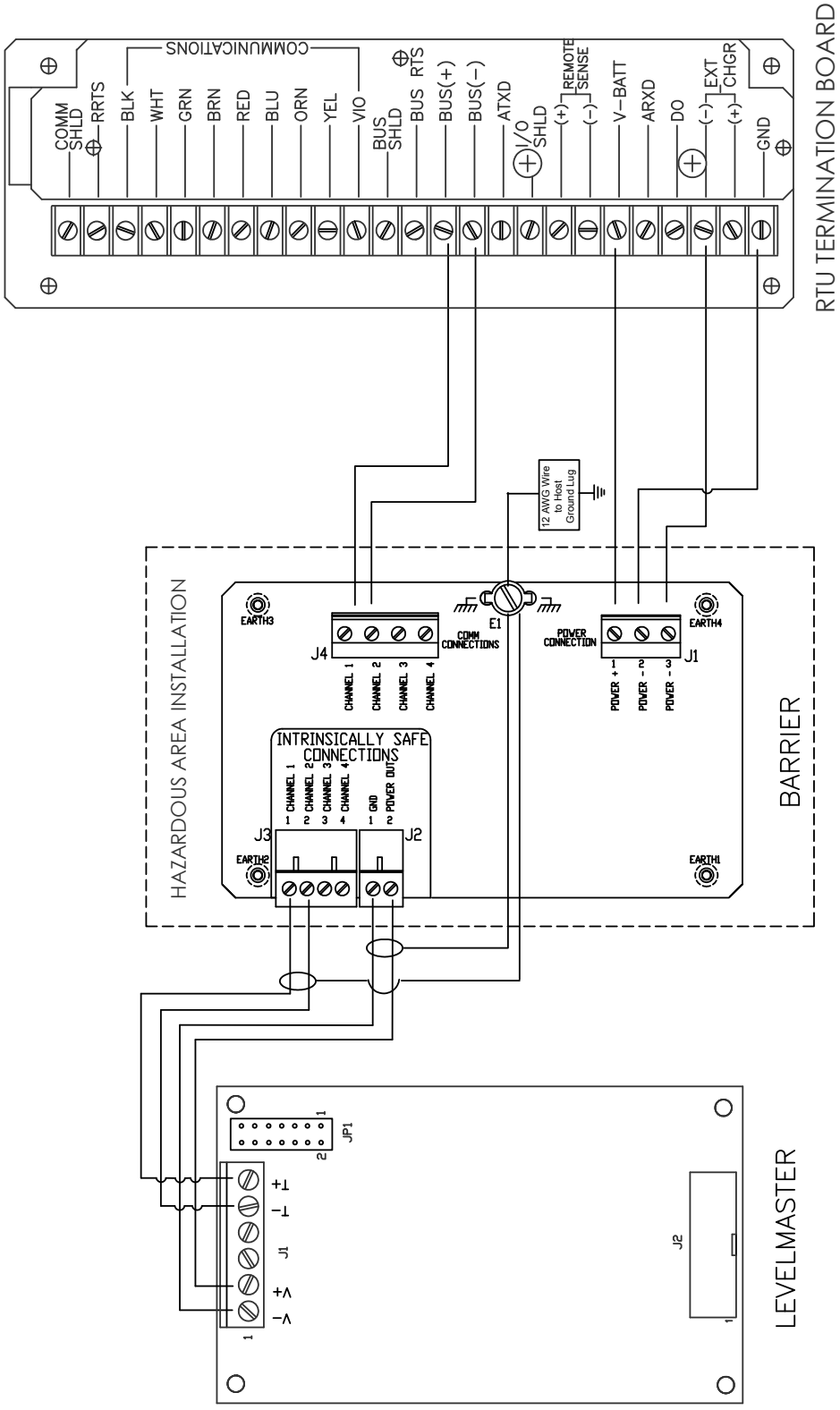


Figure 2–23 RTU Hazardous Location Wiring

3.0 SOFTWARE SETUP

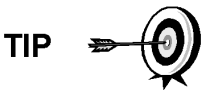
3.1 Overview

This chapter provides information on how to set up a LevelMaster. The Setup section is broken down based on the software the user will be using with the LevelMaster and the equipment used. Setup information is included for interfacing the LevelMaster with a laptop computer using MasterLink, PCCU version 4.14 and earlier using the console mode, PCCU32 version 4.14 and earlier with Tank Gauge Upgrade installed and PCCU32 version 4.30 and later.

Initially, MasterLink should be used to assign the ID to the LevelMaster prior to continuing with the host software. Using the chart below, determine which set of instructions need to be used, and proceed to that page.

The LevelMaster should be installed and power applied at this point. The LevelMaster is functional after power is applied.

Not all features are addressed in this chapter. The intent of this chapter is to discuss typical items that would be used when programming the communication and operations of the LevelMaster. For additional information about items that are displayed on PCCU32 screens, use the Help button on those individual screens.



To determine the version of PCCU32 software that is being used, click on the *Help* menu on the program bar at the top of the screen. Move down to About *PCCU32* and select it. This will open the screen which lists the version and serial number.

If the software is…	And the hardware is…	Use the following instructions
MasterLink	LevelMaster only	MasterLink Setup
PCCU32 4.14 or earlier	6400 or 6700 FCU	Console Mode Flow Computer Setup
	6790 RTU	Console Mode RTU Setup
PCCU32 4.14 or earlier with Tank Gauge Upgrade	6400 or 6700 FCU	Tank Gauge Upgrade Setup
PCCU32 4.30–6.xx	XFC	XSeries Setup
	XRC	XSeries Setup
PCCU32 7.0 or later	XFCG4	XSeries G4 Setup
	XRCG4	XSeries G4 Setup

3.2 MasterLink Setup

As a preparation for setting up the LevelMaster for use with a Totalflow host, MasterLink should be used to assign an ID number to each unit. As this communicates directly with the LevelMaster electronics board, this ID is stored in an EEPROM located on this board.

When the equipment configuration does not contain a host unit such as a Totalflow XFC or flow computer, MasterLink is the primary tool used for setup and calibration. MasterLink is a Windows-based program designed specifically for that purpose.

The following procedure assumes the LevelMaster is installed and power is applied. The procedure will describe how to use the MasterLink software package to enter the required setup and calibration information. For additional information when using MasterLink, click on the *Help* menu item on the main screen. Additionally, most of the individual screens have a *Help* button providing information for that screen

3.2.1 Tools Required

- Laptop computer
- MasterLink software package
- RS-485 to RS-232 converter. The LevelMaster is RS-485 only and will need to be converted to RS-232 to communicate with the laptop computer. A converter with cable and connectors is available from Totalflow:
    - Cable with connector that mates to the communications connector on the LevelMaster electronics board.

  or

    - Cable with alligator clips to connect to wires or screw terminals.

3.2.2 Instructions

1) Connect the RS-485/RS232 converter cable to the communication ports of the laptop computer and to the LevelMaster communication connector.

2) Power up the laptop computer.

3) Start the MasterLink software program.

4) From the *Comm. Port* window, use the down arrow to select the communications port of the laptop that is being used.

5) From the *Baud Rate* window, use the down arrow to select 1200 or 9600 baud. The LevelMaster should default to 9600 when first powered up. The rate in the window tells the software what baud rate to use and must match the LevelMaster's baud rate.

6) If no names exist or a new location is to be used, right click inside the screen (white area) and select *Add New Location*. Enter up to 25 characters for a location.

7) To add a LevelMaster to an existing (or just created) location, click on the appropriate location name on the screen and then right click, and select *Add New LevelMaster*. After the user has added the new LevelMaster, make sure the location is highlighted.

8) Click on the *Setup LevelMaster* button.

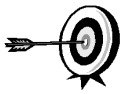
9) *One Unit:* Check the selection that says, "*I have only one LevelMaster connected to communication port and I want to set it up*" and then click the *Setup LevelMaster* button.

10) Daisy Chain Multiple Units: If the user has more than one unit on the RS-485 bus, existing units should have their own IDs already assigned. The new unit will default to 1 for an ID. Therefore, check the selection that says,

"I know the ID of the LevelMaster that I want to setup", enter 1 for the ID and select the Setup LevelMaster button.

11) The user will see a *Monitor* screen and a communication attempt will be made with the LevelMaster.

12) If communications are not established, the *Monitor* screen will remain, and the communications errors will appear at the bottom of the screen. If this happens, close the screen, change to the other baud rate and start with step 8 again. If still no success, verify the wiring per the wiring section in Chapter 2.

TIP 

When communication is established, the *Monitor* screen will then appear and, after a short delay, temperature and tank level readings should appear. This screen is for information only and is an indication to the user that communications are working. The only user entry here is a check box to cause the screen to be continuously updated.

13) One *Unit:* A screen will appear asking if the user would like to add this LevelMaster to their list. Click the *Yes* button. Another screen will appear asking the user to enter a name for the LevelMaster. Enter up 15 characters for a name and click *OK*. This name will only be used for the location file, which the user can view later.

14) *Multiple Units:* Skip to step 11.

15) Click on the *Setup* tab and enter an ID from 1 to 99 for the LevelMaster. Make sure each unit has its own individual ID, especially units on the same RS-485 bus. Click *Set New ID*. The user will be notified when that is complete; click *OK*. The user is the asked *"Would you like to update the new ID to your list?"* Click *Yes*.

16) The user can change the baud rate if desired. The *Set Baud Rate* button will indicate the opposite baud rate that is currently being used. The baud rate change will only take affect after the LevelMaster has been powered off and back on. A new unit defaults to 9600 baud and is recommended unless communications is not reliable.

17) Click the *Hardware Change* button.

18) Select the option that says "*I Just Moved the LevelMaster to a New Tank".* This causes the LevelMaster to run a program which establishes new offset voltages based on its new surroundings.

19) Click the *Next* button.

20) Read the message and then click the *Next* button. Follow the instructions.

21) Click *OK* when done

TIP 

If unit will be operated by a Totalflow host, do not calibrate the floats, also referred to as Level Bias, in MasterLink during the initial setup. Performing the calibration through the Totalflow host provides an audit trail.

22) Although the LevelMaster is a highly accurate device, there can be subtle errors such as the fluids gravity being slightly different than what the float was calibrated. This can cause the float to float either slightly higher or

lower in the fluid. Therefore, if the user has been manually gauging the levels and feels confident with the measurements, the user can enter those values here on the Setup tab. Entering the tank levels generates a calibration offset within the LevelMaster.

23) If the user will not be using a separate Totalflow host to operate with the LevelMaster, continue with this step; otherwise, skip to Step 19.

24) To enter the levels, enter the measured value for the upper or only level in the *Tank Level 1* window, and click the *Set Tank Level 1* button. The user will need to acknowledge a screen that says when it is done.

25) If the LevelMaster has two floats, enter the value for the lower level in the *Tank Level 2* window, and click the *Set Tank Level 2* button. The user will again need to acknowledge a screen that says when it is done.

The user can now click on the *Monitor* tab, check the *Continuous Monitor* box and wait for an update. The new reading(s) should agree with the entered value(s).

26) If any changes have been made since the last setup file save, click on the *Upload/Download* tab. This screen allows the user to save all the parameters within the LevelMaster to a file. Either use the default path and name, or enter a new path and name. Upon completion, click the *Read and Save Data to File* button. The default name is the base serial number of the LevelMaster.

27) Click the *Close* button to return to the main MasterLink screen.

28) If the user has several locations, (e.g. large tank batteries or fields), they may want to create different location files. This allows the user to group certain tanks or locations in different files. To name the displayed location file, select *Location* from the file menu along the top of the screen and then select *Save Location File*. Enter a file name, and click the *Save* button. If the user never names a location file, all information will always go into the same default file named *FirstSetup*. The last location file viewed will, by default, be displayed when the program is started again. To open a different file, click *Location* from the file menu and select *Open Location File*. Click on the appropriate file name and then click open.

While the user can now read basic tank levels at this point, they should proceed to the *Calibration* section of this chapter to set up the tank for volume.

3.3 Console Mode Flow Computer Setup

Totalflow's Model 6400 and 6700 flow computers can be set up to provide support for the LevelMaster using PCCU32 version 4.14 or older. The flow computer would be connected to the LevelMaster via RS-485 protocol. The FCU will poll the LevelMaster at user programmable intervals and store the current level(s) and temperature data into registers known as Application, Array, Registers (App, Array, Reg). This data is available to Totalflow software packages WinCCU32 and PCCU32.

Set up for the LevelMaster data in the flow computer is done using the Console mode found in PCCU32. An alternate method is to use a terminal emulator such as HyperTerm found in Windows. When using HyperTerm in Windows, the user

will need to enter the protocol information shown below and then type "*CONS*" to get into the Console mode.

The following procedure assumes that the LevelMaster has been physically installed and wired to the FCU board, per the instructions in Chapter 2 and that the FCU is already installed and operating. For more information on the FCU, please see the User Manual for the corresponding Totalflow model.

3.3.1 Tools Required

- Laptop computer
- PCCU32 version 4.14 or older
- 9 pin computer cable terminated with military connector, available in 8, 25 and 50 foot lengths

3.3.2 Instructions

1) Connect the computer to the local communications port on the side of the FCU enclosure.

2) Open the PCCU32 software.

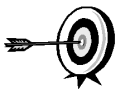
TIP 

The icon or tool bar is located directly below the program bar on the PCCU32 screen. By moving the mouse pointer over each icon and pausing, a help label will identify the command assigned to that icon. See the PCCU32 help files for more information.

By viewing the status bar across the bottom of the PCCU32 screen, the user will see the status of their connection and their login name.

3) Make the software connection to the FCU by clicking the *Connect to Totalflow* icon and then the *Entry* button.

4) Locate *Operate* on the program bar. Open the pull-down menu and select *Console Mode.*

TIP 

The first time the *Console Mode* screen appears, it may be too small to show all of the information required. Hold the mouse pointer over one of the corners until the diagonal double ended arrow displays. Click and drag the window to the desired height and width. The user may also accomplish this by dragging the side and the bottom of the screen separately until it is large enough. Microsoft Windows remembers the screen size for the next time that the window is opened. The user can change it at any time.

5) The initial screen may appear similar to the screen shown in Figure 3–1. Differences may be in the version of the prom and may reflect other capabilities than shown here. See Table 3—1 for Console Mode, Local Commands to use in editing the setup screens.

For the purpose of this procedure, it is assumed that the user's screen is identical to this one. If it is not, the user will need to locate the proper group number and enter it instead of the numbers used here.

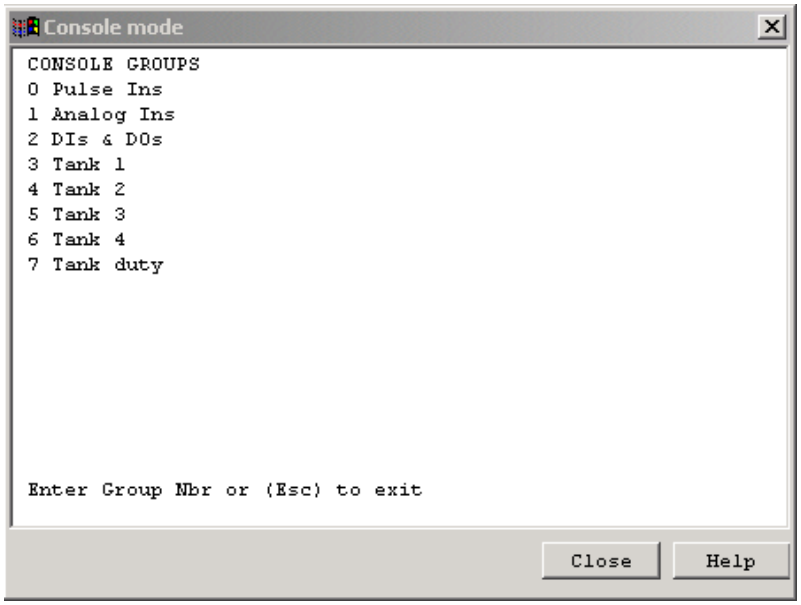


Figure 3–1 Console Mode, Initial Screen

Table 3—1 Console Mode, Local Commands

Command	Description
CONS	FCU or RTU starts up its Local Console Task and begins controlling the Local Console Display.
>	Position of prompt.
*****	Indicates the item beside it can be changed.
U	Move cursor up.
D	Move cursor down.
R	Refreshes the display.
M	Monitor mode. The display updates every 5 seconds. Any key will exit monitor mode.
Y	Cycle display. The display will scroll and update every 5 seconds. Any key will exit monitor mode.
E or *	Exits the current screen if the user is in a 2nd level screen making modifications. If the user is in a 1st level screen, it does nothing.
ESC	Exit the Local Console Task.
C	Change selected value:
	When **Changing Numeric Values**, clears the current value and accepts entry of a new value. Entry of the new value is accepted by pressing the [ENTER] key. If the [ENTER] key is pressed before any other keys, the change process is terminated and the old value retained.
	Changing Fixed Selections such as enable, disable, etc. Pressing the 'C' key cycles through the selections, and pressing the [Enter] key causes the existing selection to be accepted. If the [ENTER] key is pressed before the second 'C' key is pressed, the change process terminates and the old state retained.

6) The FCU supports up to four LevelMasters. These are numbered 3 through 7 (as shown in Figure 3–1 Console Mode, Initial Screen). When the group number is entered, it will return all information linked with that group. To setup the first tank, press the number *3* on the keyboard.

7) On Figure 3–2, the labels shown on the user's particular software version may not necessarily be the same as the example screen shown here.

See Table 3—2 for Console Mode Tank Setup Parameters.

FYI

The items marked with an asterisk (*) are items that can be modified, whereas the other items are information only. The cursor position is represented by the (>) sign. Move the cursor up with the "*U*" key or down with the "*D*" key and then type "*C*" to change the item. When the desired changes have been made, press the *Enter* key on the keyboard. This will save the change and return the user to the editing mode. See Table 3—1 Console Mode for a complete list of local commands.

Items such as *ScanEna*, *Units*, and *Level Cnt* have selections that are selectable by repeatedly pressing "*C*". Items such as *Unit No*., *Rd Timeout*, and *Rd Freq*. require the user to enter a value.

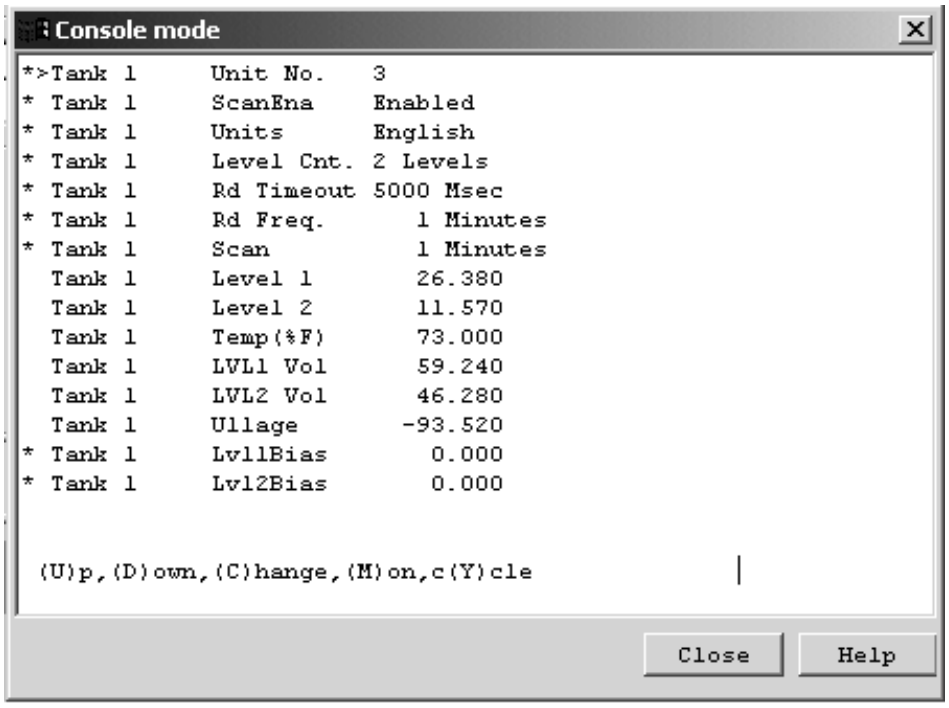


Figure 3–2 Console Mode, Tank 1 Setup

Table 3—2 Console Mode Tank Setup Parameters

Item	Description
Unit No.	ID of the LevelMaster.
ScanEna	Enables or disables scanning of the LevelMaster.
Units	English or SI • English – Levels in inches & temperature in degrees F. • SI – Levels in centimeters & temperature in degrees C.
Level Cnt.	1 or 2 for the number of levels being measured in the tank.
Rd Timeout	Amount of time to allow for data to be returned from the LevelMaster. A timeout causes a minus 1 (-1) to be entered for the data, and a communication error is logged.
Rd Freq.	Time in minutes between data requests.
Scan	Starts with the Rd Freq. Time and counts down to the next data request.
Level 1	Value of Level 1.
Level 2	Value of Level 2.
Temp	Temperature value of fluid.
LVL1 Vol	Volume calculated by using Level 1 value and corresponding strapping table setup by user.
LVL2 Vol	Volume calculated by using Level 2 value and corresponding strapping table setup by user.
Ullage	Unused vertical space left in tank.
Lvl1Bias*	Value added (positive number) or subtracted (negative number) from value read from LevelMaster to provide Level 1 value.
Lvl2Bias*	Value added (positive number) or subtracted (negative number) from value read from LevelMaster to provide Level 2 value.
Do not calibrate the floats, also referred to as Level Bias, in MasterLink during the initial setup, if unit will be operated by a Totalflow Host. Performing the calibration through the Totalflow Host provides an audit trail.	

8) The primary parameters that will need to be set are:

- Unit No. 3
- ScanEna Enabled
- Level Cnt. 2 Levels
- Rd Freq. 2 Minutes
- Rd Timeout 5000 Milliseconds

Use the commands shown in Table 3—1 Console Mode to make these changes.

9) After the user has made the appropriate changes, press the *e* key or the * key on the keyboard to move back to the first level screen.

10) If the user is not using solar or battery power to operate the host and LevelMaster, enter the *Tank Duty* screen and set the cycle opt to *Off*. Press the *ESC* key.

If the user will be using the tank duty option, please see the *Operations* section, *Duty Cycling Power*.

FYI

The user has now performed the initial setup of the LevelMaster. Because the LevelMaster communicates with the FCU through RS-485 protocol, the user will need to set up a communication port dedicated to the LevelMaster.

11) Locate the *Communication* tab, and click on it.

12) Determine the communication port that will be set up for the LevelMaster.

13) Update the values for the port based on the desired parameters. See Table 3—3 for communication parameters used here.

14) After the user has made the modifications, click on the *Send Data* button on the lower portion of that screen. This does not require the unit to reconnect.

Table 3—3 Communications Port Parameters

Item	Description
Baud Rate:	1200 or 9600 - The LevelMaster can communicate at either baud rate but defaults to 1200 at startup.
Listen Cycle	4
Parity:	Even
Data Bits:	7
Stop Bits:	1
Power Up Delay	80 (milliseconds) is the default value and will typically work; however, adjustments may be required for more consistent communications.
Xmit Key Delay:	420 (milliseconds) is the default value and will typically work; however, adjustments may be required for more consistent communications.
Unkey Delay:	40 (milliseconds) is the default value and will typically work; however, adjustments may be required for more consistent communications.
Protocol:	Tank Gauge – This selection will only be available in PCCU32 if it has been updated with PCCU32 Service Pack 2. Available from Totalflow's web site (www.Totalflow.com). To Set via Term mode: Com1 – RPP=7, Com2 – APP=7, Com3 – BPP=7
Interface Type:	RS-485
CCU Download Wait	7 (seconds)
Comm Buffer Size	4k
Modbus Register Format	32 Bit Bias By 1
Modbus Char. Timeout	0 (milliseconds)
Inactive time-out	0 (minute)

FYI

The user has now performed the basic communication setup for the LevelMaster. Now the user needs to program the display to scroll these values.

15) Locate the *Program Display* tab, and click on it.

16) Click in the *Value* column next to the list of displays, and a drop-down menu of the available displays will appear.

17) Click on the tank number and desired display item. It may appear similar to this:

TNK1LVL1

This will set up Tank 1, Level 1 to display. Press the *Tab* key on the keyboard. This will return all associated values for this display item.

18) Change the value for the display interval to at least five (seconds). The default was set to zero which turns the display item off.

19) Click on the *Send Data* button on the lower portion of that screen. This does not require the unit to reconnect.

20) Repeat steps 15 through 19 for each display item the user would like to modify.

While the user can now read basic tank levels at this point, they should proceed to the *Calibration* section of this chapter to setup the bias, if needed.

FYI

The user has now performed the basic setup of the LevelMaster. The final step is to save all the configuration files to the hard drive.

21) Ensure that the device configuration files are backed up, and click on the *Save* button. This procedure will take a few minutes. After the information has been collected, the *Device Configuration File Save* screen will appear and ask for the location to save the file. The destination directory may be something like this:

C:/PCCU32/Devconfi/_FCU-6410.fcu

See the PCCU32 help files for more information.

TIP

When the FCU is warm booted, it will automatically load these configuration files at startup.

3.4 Console Mode RTU Setup

Totalflow's Model 6790 RTU provides support for the LevelMaster through PCCU32 version 4.14 or older. The RTU will poll the LevelMaster via RS-485 protocol and, at programmable intervals, store the current level(s) and temperature data into registers known as Application, Array, Registers (App, Array, Reg). The data is then available to the RTU for processing. This data is also available in Totalflow software packages WinCCU32, PCCU32 and TDS32.

Setup for the LevelMaster data in the RTU is done using the Console mode found in PCCU32. An alternate method is to use a terminal emulator such as HyperTerm found in Windows. When using HyperTerm in Windows, the user will need to enter the protocol information shown below and then type "*CONS*" to get into the Console mode.

FYI

Most RTU systems are custom designed to fit specific user needs; thus, the firmware deals with user applications. Each RTU will be accompanied by its own custom documentation detailing those applications and their setup; therefore, these instructions are general in nature. Please refer to the user's guide provided with the RTU. If the user has a project with specific requirements, get in touch with the local Totalflow sales person or call Totalflow at (800) 442-3097 and ask for a Projects person.

3.4.1 Tools Required

- Laptop computer
- PCCU32 version 4.14 or older
- 9 pin Computer Cable terminated with military connector, available in 8, 25 and 50 foot lengths.

3.4.2 Instructions

1) Connect the computer to the local communications port on the side of the RTU enclosure.

2) Open the PCCU32 software.

TIP

The icon or tool bar is located directly below the program bar on the PCCU32 screen. By moving the mouse pointer over each icon and pausing, a help label will identify the command assigned to that icon. See the PCCU32 help files for more information.

By viewing the status bar across the bottom of the PCCU32 screen, the user will see the status of the connection and their login name.

3) Make the software connection to the RTU by clicking the *Connect to Totalflow* icon and then the *Entry* button.

4) Locate *Operate* on the program bar. Open the pull-down menu, and select *Console Mode*.

TIP

The first time the *Console Mode* screen appears, it may be too small to show all of the information required. Hold the mouse pointer over one of the corners until the diagonal double ended arrow appears. Click and drag the window until it is the desired height and width. The user may also accomplish this by dragging the side and the bottom of the screen separately until it is large enough. Microsoft Windows remembers the screen size for the next time that the window is opened. The user may change it at any time.

5) The initial screen may appear similar to the screen shown in Figure 3–3 Console Mode, Initial Screen. Differences may be in the version of the prom and may reflect other capabilities than what is shown here.

Information is divided into groups, and, since each RTU is typically customized, the number of groups and their labels will vary from job to job. For the purpose of this procedure, it is assumed that the user's screen is

identical to this one. If it is not, the user will need to locate the proper group number and enter it instead of the numbers used here.

6) Enter the group's number to look at its data. In the example shown in Figure 3–3 Console Mode, Initial Screen there are two tank data groups labeled Tank1Data and Tank2Data. To see the setup configuration for Tank 1 (T1 Cfg), the user would enter a *6* for group 6 and the setup information labeled *T1 Cfg* would be displayed. See Figure 3–4 Console Mode, Tank 1 Setup.

The labels shown on the user's particular software version may not necessarily be the same as the example screen shown here.

FYI

The items marked with an asterisk (*) are items that can be modified, whereas the other items are information only. The cursor position is represented by the (>) sign. Move the cursor up with the "*U*" key or down with the "*D*" key and then type "*C*" to change the item. When desired changes have been made, press the *Enter* key on the keyboard. This will save the change and return the user to the editing mode. See Table 3—1 Console Mode, Local Commands, in the previous section, for a complete list of local commands.

Items such as *Gauge Type*, *Units*, and *Level Cnt* have selections that are selectable by repeatedly pressing "*C*". For items such as *Unit no.*, *read tout* and *Frequency*, simply enter a value.

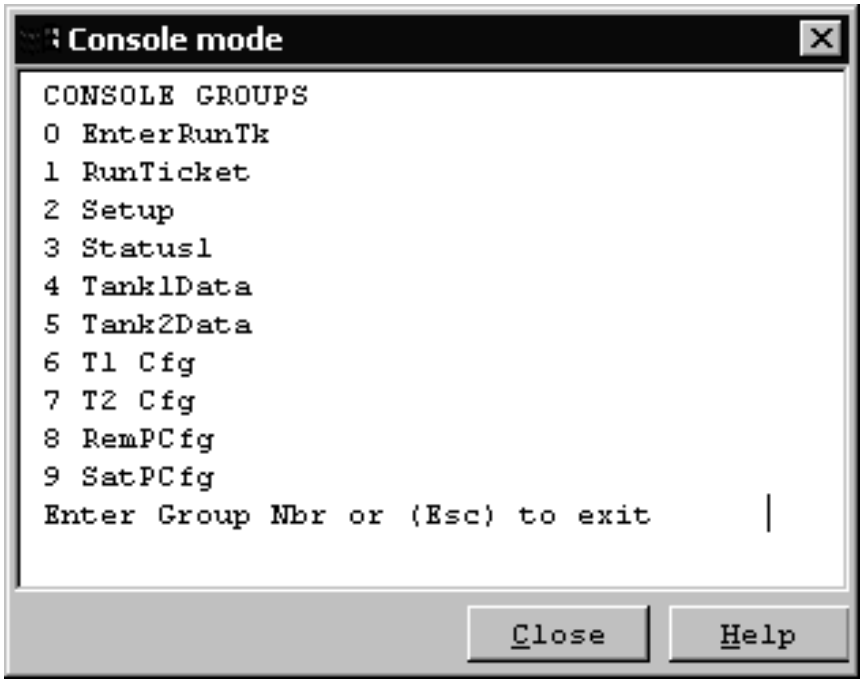


Figure 3–3 Console Mode, Initial Screen

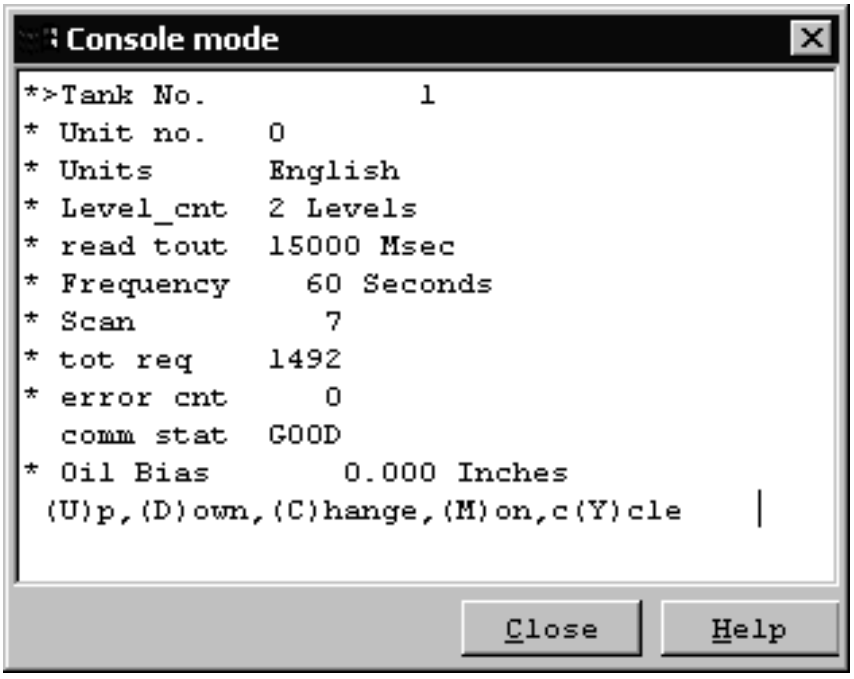


Figure 3–4 Console Mode, Tank 1 Setup

7) Of the items shown in Figure 3–4 Console Mode, Tank 1 Setup and listed in Table 3—4 Console Mode, Tank Setup Parameters, the primary parameters that will need to be set are:

- Unit no. 0
- Level_cnt 2 Levels
- Frequency 60 Seconds
- Read tout 15000 Msec
- Scan 7

To start scanning in the above screen example, the user would set *Scan* to a positive number. By default it would be a –1. Other jobs may simply indicate *Off*, and the user would change to *On* to start scanning.

An option that is also available on the RTU is the capability to turn the LevelMaster's power on when requesting its data and then turn the power off. This is for power conservation and is normally used on units that are solar powered.

8) Repeat steps 6 and 7 for each tank being set up.

9) After the user has made the appropriate changes, press the '*e'* key or the '*****' key on the keyboard to move back to the first level screen.

Table 3—4 Console Mode, Tank Setup Parameters

Item	Description
Tank No.	The number of this tank configuration.
Unit No.	ID of the LevelMaster
Units	English or SI English – Levels in inches & temperature in degrees F. SI – Levels in centimeters & temperature in degrees C.
Level_Cnt.	1 or 2 for the number of levels being measured in the tank.
Read Tout	Read Time Out. Amount of time to allow for data to be returned from the LevelMaster. A timeout causes a minus 1 (-1) to be entered for the data, and a communication error is logged.
Frequency	Time in minutes between data requests. Read Frequency
Scan	Starts with the Read Frequency. Time and counts down to the next data request.
Tot Req.	Total of requests for data.
Error Cnt	Total of errors received.
Comm Stat	Status of communications.
Oil Bias	Value added (positive number) or subtracted (negative number) from value read from LevelMaster to provide oil level.

FYI 

The user has now performed the initial setup of the LevelMaster. Because the LevelMaster communicates with the RTU through RS-485 protocol, the user will need to set up a communication port dedicated to the LevelMaster.

10) Select the *Satellite Port Configuration* **(***SatPCfg***)** group by entering the number ***9*****.** See Figure 3–5 Console Mode, Satellite Port Setup.

11) Figure 3–5 Console Mode, Satellite Port Setup shows the typical setup to communicate with the LevelMaster. See Table 3—5 RTU Communication Port Parameters for the communication port parameters.

TIP 

The LevelMaster's baud rate can be changed using the MasterLink software. The LevelMaster will have to be powered off and back on for the new baud rate to take affect.

FYI 

The user has now performed the basic communication setup for the LevelMaster. The RTU will be pre-configured with several standard displays. Because most all RTU systems are custom designed, the user may need to program additional displays for scrolling these values.

12) Locate the *Program Display* tab, and click on it.

13) Click in the *Value* column next to *List of Displays* and a drop-down menu of the available displays will appear.

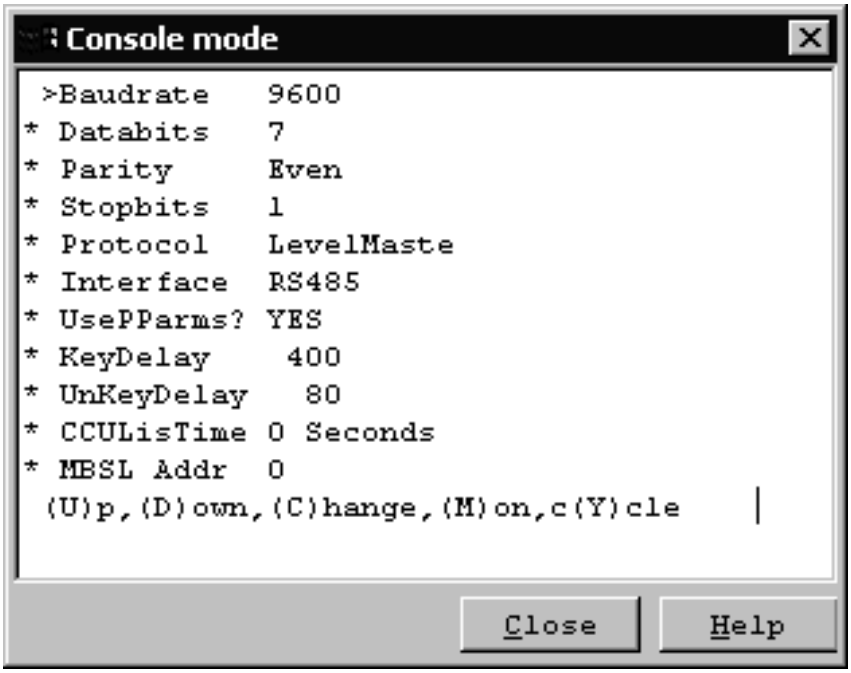


Figure 3–5 Console Mode, Satellite Port Setup

Table 3—5 RTU Communication Port Parameters

Item	Description
Baud Rate:	1200 or 9600 - The LevelMaster can communicate at either baud rate but defaults to 1200 at startup.
Data Bits:	7
Parity:	Even
Stop Bits:	1
Protocol	LevelMaster
Interface	RS-485
Use PParms?	YES. This uses the port parameters for port initialization.
KeyDelay:	400 (milliseconds) is the value to power up prior to starting data transmission.
Unkey Delay:	80 (milliseconds) is the value to hold power after data transmission ends.
CCULisTime	0 (seconds). The time for Totalflow CCU Link establishment.
MBSL Addr	0 Modbus Slave Address.

14) Click on the display item to update. It may appear similar to this:

TANK 1 OIL

This will modify the display for Tank 1, Oil Level. Press the *Tab* key on the keyboard. This will return all associated values for this display item.

15) Change the value for the display interval to at least five (seconds) to display this item, or set to zero which turns the display item off.

16) Click on the *Send* button on the lower portion of that screen. This does not require the unit to reconnect.

17) Repeat steps 14 through 16 for each display item needing to be modified.

While the user can now read and display tank level information at this point, they should proceed to the Calibration section of this chapter to set up the bias.

FYI

The user has now performed the basic setup of the LevelMaster. The final step is to save all the configuration files to the hard drive.

18) Ensure that the device configuration files are backed up, and click on the *Save* button. This procedure will take a few minutes. After the information has been collected, the *Device Configuration File* save screen will appear and ask for the location to save the file. The destination directory may be something like this:

C:/PCCU32/Devconfi/_RTU-6790.rtu

See the PCCU32 help Files for more information.

FYI

The user has now performed the basic setup of the LevelMaster. The final step is to save all the configuration files to the hard drive.

3.5 Tank Gauge Upgrade Setup

Totalflow's Tank Gauge Software Upgrade makes setup for the LevelMaster, using PCCU32, more user friendly. This upgrade integrates the *Console* screens directly into the PCCU32 *Entry* screen. This makes using the Console mode obsolete. If the user owns a version of PCCU32 4.14 or a prior version, they may request a free copy from Totalflow, or download a free copy of from Totalflow's web page.

The flow computer stores the current level(s) and temperature data into registers known as Application, Array, Registers (App, Array, Reg).

The following procedure assumes that the LevelMaster has been physically installed and wired to the FCU board, per the instructions in Chapter 2 and that the FCU is already installed and operating. For more information on the FCU, please see the user's manual for the corresponding Totalflow model.

3.5.1 Tools Required

- Laptop computer.
- PCCU32 version 4.14 or earlier with Tank Gauge Software Upgrade installed.
- 9 pin computer cable terminated with military connector, available in 8, 25 and 50 foot lengths.

3.5.2 Instructions

1) Connect the computer to the local communications port on the side of the FCU enclosure.

2) Open the PCCU32 software.

TIP 

The icon or tool bar is located directly below the program bar on the PCCU32 screen. By moving the mouse pointer over each icon and pausing, a help label will identify the command assigned to that icon. See the PCCU32 help files for more information.

By viewing the status bar across the bottom of the PCCU32 screen, the user will see the status of their connection and the login name.

3) Make the software connection to the FCU by clicking the *Connect to Totalflow* icon and then the *Entry* button.

TIP 

If wondering if the Tank Gauge Software Upgrade has been installed, view Figure 3–6 PCCU32 Software without the Tank Gauge Software Upgrade and Figure 3–7 PCCU32 Software with the Tank Gauge Software Upgrade. While the screen may not be identical, the user will notice that the *Entry* screen will now show tabs reflecting setup and output information for up to four tanks.

FYI 

Because the LevelMaster communicates with the FCU through RS-485 protocol, the user will need to set up a communication port dedicated to the LevelMaster. This procedure assumes that the wiring has already been completed.

4) Locate the *Communication* tab and click on it.

5) Determine the communication port that the user wired for the setup of the LevelMaster.

6) Update the values for the port based on the desired parameters. See Table 3—6 Communication Port Parameters for communication parameters used here.

7) After the user has made the necessary modifications, click on the *Send* button on the lower portion of that screen. This does not require the unit to reconnect.

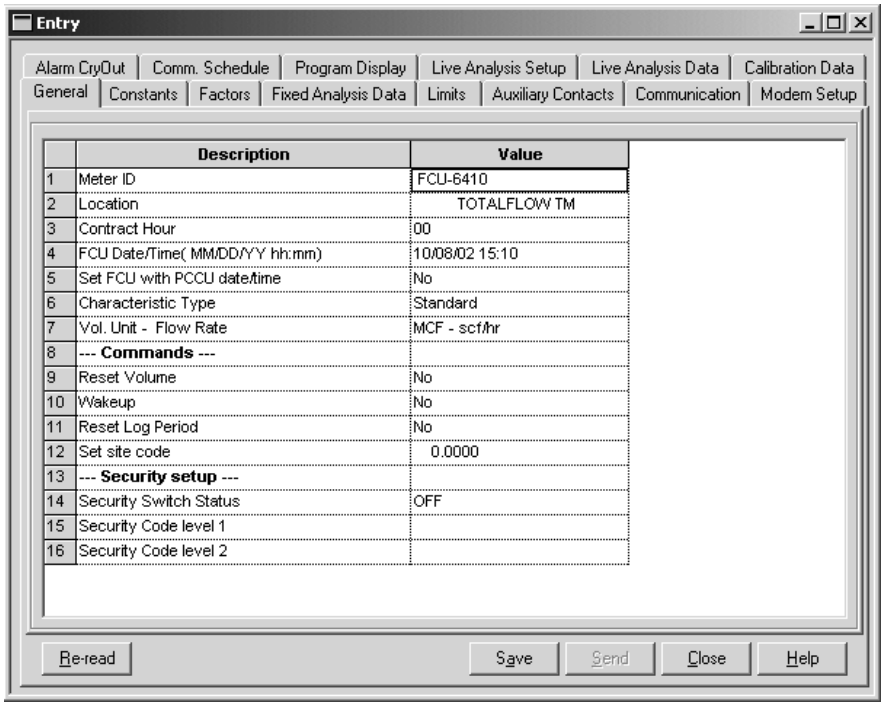


Figure 3–6 PCCU32 Software without the Tank Gauge Software Upgrade

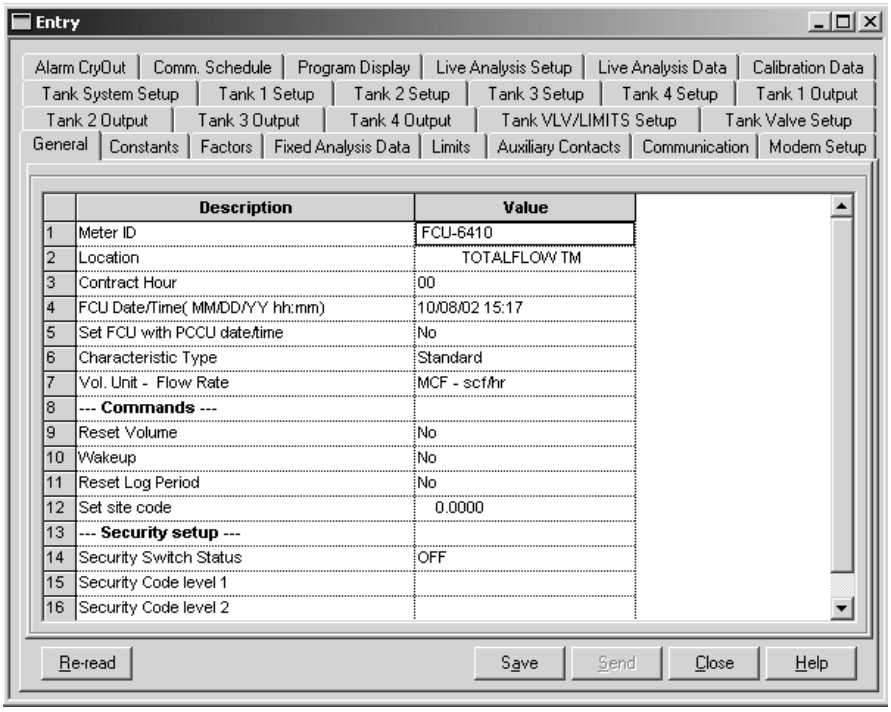


Figure 3–7 PCCU32 Software with the Tank Gauge Software Upgrade

Table 3—6 Communication Port Parameters

Item	Description
Baud Rate:	1200 or 9600 - The LevelMaster can communicate at either baud rate but defaults to 1200 at startup.
Listen Cycle	4
Parity:	Even
Data Bits:	7
Stop Bits:	1
Power Up Delay	80 (milliseconds) is the default value and will typically work; however, adjustments may be required for more consistent communications.
Xmit Key Delay:	420 (milliseconds) is the default value and will typically work; however, adjustments may be required for more consistent communications.
Unkey Delay:	40 (milliseconds) is the default value and will typically work; however, adjustments may be required for more consistent communications.
Protocol:	Tank Gauge – This selection will only be available in PCCU32 if it has been updated with PCCU32 Service Pack 2. Available from Totalflow's web site (www.Totalflow.com). To Set via Term mode: Com1 – RPP=7, Com2 – APP=7, Com3 – BPP=7
Interface Type:	RS-485
CCU Download Wait	7 (seconds)
Comm Buffer Size	4k
Modbus Register Format	32 Bit Bias By 1
Modbus Char. Timeout	0 (milliseconds)
Inactive time-out	0 (minute)

FYI 

Now that the user has setup and established communications, they will configure the system and set up the individual tanks.

8) Locate the tab labeled *Tank System Setup*. Click on it. Under this tab, the user will set up the FCU for power cycling.

9) If the user is not using solar or battery power to operate the FCU, set the *Tank Read Now* to *Enable* and the *Duty Cycle Option* to *Disable*.

FYI 

Each LevelMaster draws about 7 Ma of current when idle and draws 45 Ma when polling. To conserve the 7 Ma of current when idle, use the *Duty Cycling Power* option to define a digital output for powering up the electronic board. If the user needs the *Duty Cycle Option*, see the Operations section in this chapter and the sub-heading Duty Cycling Power.

10) Click on the *Send* button on the lower portion of that screen. This does not require the unit to reconnect.

11) Locate the tab labeled *Tank 1 Setup*. Click on it. Under this tab, the user will setup their first tank unit.

12) Change the value on the line labeled *Tank Unit Number* to match the ID number that was assigned to that particular tank.

13) Change the value on the line labeled *Tank Units* for metric or English measurement.

14) Change the value on the line labeled *Number of Floats* to match the number of floats on this LevelMaster.

15) Change the value on the line labeled *Tank Comm Timeout* to the milliseconds desired before a time out error is issued. Suggested value: 5000

16) Change the value on the line labeled *Tank Scan Time* to scan frequency desired.

17) Change the value on the line labeled *Tank Scan Enable* to *Enable*.

18) After these basic values have been entered, the user may enter a bias level for each float, if needed. This should be a positive or negative number in inches based on the difference between the measurements and the measurements reflected in PCCU32.

19) If desired, the user may enter strapping points, strap heights and a volume factor for each point. This will ensure accurate quantities are measured.

20) Click on the *Send* button on the lower portion of that screen. This does not require the unit to reconnect.

21) Repeat Steps 11 through 20 for each tank being set up.

22) Locate the tab labeled *Tank 1 Output*. Click on it. Under this tab, the user will see the first tank unit information. Click on 2, 3 and 4 to view tank information respectively.

FYI 

The user has now performed the basic setup and communication setup for the LevelMaster. Now the user needs to program the display to scroll these values.

23) Locate the *Program Display* tab, and click on it. The program will need to read the list of displays. This may take a few minutes.

24) Click in the *Value* column next to *List of Displays*, and a drop-down menu of the available displays will appear.

25) Click on the tank number and desired display item. It may appear similar to this:

TNK1LVL1

This will set up *Tank 1, Level 1* to display. Press the *Tab* key on the keyboard. This will return all associated values for this display item.

26) Change the value for the *Display Interval* to at least five (seconds). The default was set to zero which turns the display item off.

27) Click on the *Send* button on the lower portion of that screen. This does not require the unit to reconnect.

28) Repeat steps 24 through 27 for each display item the user would like to modify.

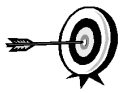
FYI 

The user has now performed the basic setup of the LevelMaster. The final step is to save all the configuration files to the hard drive.

29) Ensure that the device configuration files are backed up, and click on the *Save* button. This procedure will take a few minutes. After the information has been collected, the *Device Configuration File* save screen will appear and ask for the location to save the file. The destination directory may be something like this:

C:/PCCU32/_FCU-6410_.fcu

See the PCCU32 help files for more information.

TIP 

When the FCU is warm booted, it will automatically load these configuration files at startup.

3.6 XSeries Setup

Totalflow's XSeries System (XFC or XRC) can be setup to provide support for the LevelMaster. Each will poll the LevelMaster at user programmable intervals and store the current level(s) and temperature data into registers known as Application, Array, Registers (App, Array, Reg). This data is available in Totalflow software packages, WinCCU32 and PCCU32.

The XFC and XRC are connected to the LevelMaster via RS-485 protocol. Set up for the LevelMaster data in the XFC or XRC is done using the following procedure. This procedure assumes that there are no other LevelMaster applications already instantiated.

To instantiate the LevelMaster application, the user needs to have administrative access in the security system. See the online help files for PCCU32 for more information.

3.6.1 Tools Required

- Laptop computer
- PCCU32 version 4.30 to 6.xx.
- 9 or 25 Pin PCCU cable terminated with military connector, available in 8, 25 and 50 foot lengths.

3.6.2 Instructions

3.6.2.1 Instantiating the LevelMaster Application

1) Connect the computer to the local communications port on the side of the XFC or XRC enclosure.

2) Open the PCCU32 software.

TIP 

By moving the mouse pointer over each icon and pausing, a help label will identify the command assigned to that icon.

The icon or tool bar is located directly below the program bar on the PCCU32 screen. As these icons are user-selectable, the user may toggle off icons that they will not be using. See the PCCU32 help files for more information.

3) Locate *Operate* on the program bar. Open the pull down menu and move down to *Security*. From the cascading menu, select *Login*.

4) Enter the user name and password for Administrative access. Click *Enter*.

FYI  By viewing the status bar across the bottom of the PCCU32 screen, the user will see the status of the connection and their login name.

5) Make the software connection to the XFC or XRC by clicking the *Connect to Totalflow* icon and then the *Entry* button, or go directly to the *Entry* screen by clicking the *Entry* icon.

6) Click on the *Station ID* in the tree-view *Entry* screen. If the user has multiple stations, select the location being set up in the tree-view so that it is highlighted.

7) Click on the *Applications* tab next to the *Station Setup* tab.

TIP  This procedure assumes that the basic applications used by the XFC or XRC are already instantiated. See the PCCU32 help files for more information on setting up the XFC or XRC and instantiating applications.

8) Move down to the first application that reads *Spare*. The Application number is normally slot 51 through 55. Click on the word *Spare*. This will open a pull down menu.

9) Locate the *LevelMaster* application, and select it. The user will need the application number for a later step, so mark it down. As stated above, the slot number is generally Application 51 through 55.

10) Click on the *Send* button on the lower portion of that screen. This will download the new application information to the XFC. This requires the unit to reconnect automatically. A screen will appear. Select *OK*.

3.6.2.2 LevelMaster Setup

1) Expand the Communications entry in the tree-view by clicking the + sign. The user will be able to see that a LevelMaster entry is now displayed.

2) Click on the LevelMaster caption. By default, the user will move to the Setup tab.

3) Within the Setup tab, the user may change the value of the Device/APP ID. Any name change will be reflected in the tree-view.

4) Next, enter the number of tanks that will be effected. Upon completion, click the Send button.

3.6.2.3 LevelMaster Communications Port Setup

The following information will detail the steps necessary to establish the communications port for the LevelMaster

1) Towards the top of the tree-view, click on the Communications caption.

2) Click on the Communications Ports tab. The user will see all of the communication ports and their designated assignments.

3) The user needs to decide which communication port that they want to assign to the LevelMaster. For the sake of these instructions, it is assumed that the user selects Com 2.

4) Locate the Spare – Com 2 field. Click into the adjacent Port column field, and delete the COM2 designation. Type in the following: **NONE**.

5) Click the Send button.

6) Next, locate the LevelMaster field within the same tab. Once located, click into the adjacent Port column field. Type in the following: **COM2:**

7) Click the Send button. This will assign comm port 2 to the LevelMaster.

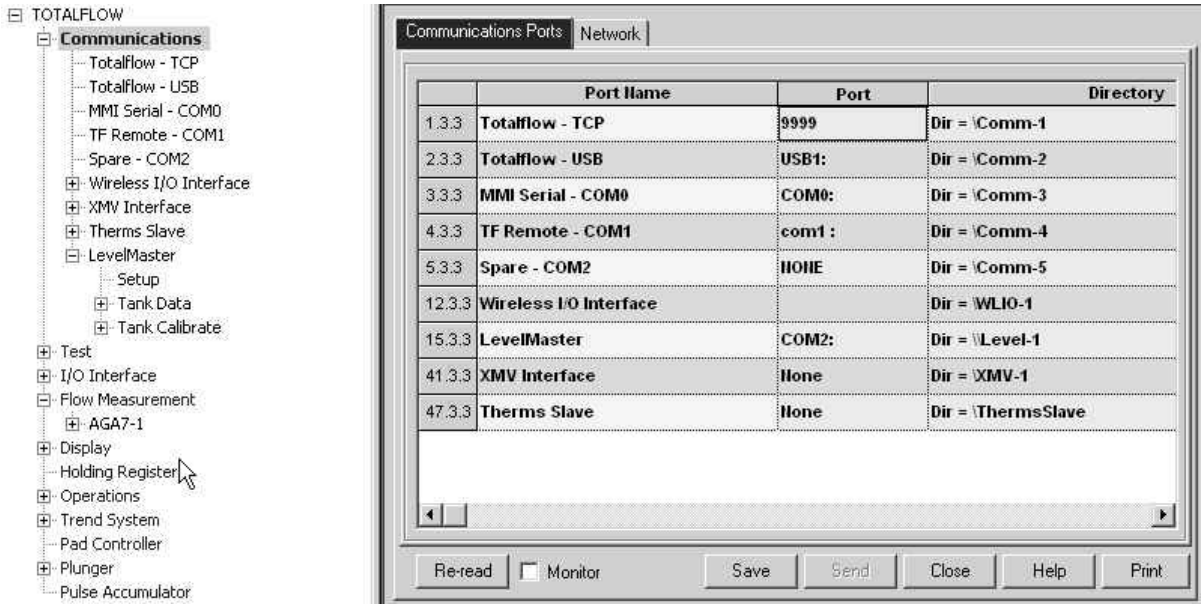


Figure 3–8 Communication Tab

8) Move to the LevelMaster application in the tree-view. Expand the LevelMaster by clicking the + sign.

9) Next, click on Setup, and move to the Communications tab.

10) Locate the Serial Port field. Verify that the port number, entered in step 6, is already displayed in the adjacent Value field. If not, type in **COM2:**.

FYI

Based on the configuration files that were loaded onto the board, the remaining field default values should be sufficient to begin operation.

Additionally, if the user is setting up a CIM connection, select TFIO CIM from the Port Type drop-down menu.

3.6.2.4 LevelMaster Request Block Editor

After the LevelMaster has been set up, the user needs to set the LevelMaster Request Block Editor.

1) Locate *Operate* on the program bar. Open the pull-down menu and move down to *File Utilities*. From the cascading menu, select *LevelMaster Request Block Editor*.

2) The LevelMaster Request Block Editor screen will appear.

- Modify *Application*. Enter the number of the application that was instantiated in step 9.
- Select the tank number associated with the *Tank Application* instantiated in step 14.
- Set the correct number of sensors for this tank.
- Modify the ID to match the unit ID.
- Set the interval to the time desired between data requests.

3) Locate *File* on the program bar of the *LevelMaster Request Block Editor* screen and select *Save As*.

4) The user will need to save this file to their computer files in PCCU32 on the computer. The path may be something like this:

C:/PCCU32/LMBlockRequest/TankReq1.TRB

Please note the location, as the user will be uploading these files to the *R Drive* later.

5) Repeat steps 21 through 23 for each tank installed. The user will need to rename the file for each tank set up in step 23. When finished, close the editor. It would be best to append the file name with the ID number of each tank, i.e.,

C:/PCCU32/LMBlockRequest/TankReq2.TRB

6) Locate *Operate* on the program bar. Open the pull-down menu and move down to *File Utilities*. From the cascading menu, select *File Transfer*.

7) Under the *R***:** drive, open *COM-1* by clicking on it. Open *Level* by clicking on it. Click on the *Download* button on the bottom of the *File Transfer* screen. Return to the location on the computer where the user stored the *LevelMaster Request Block* files created in steps 23 and 24.

8) Click on the *TankReq1.TRB* file, and click on *Open*. Repeat this step for each tank set up in steps 23 and 24. When finished downloading all files, click *Close*.

9) In the tree-view *Entry* screen, open the *LevelMaster* applications by clicking on the *"+"* next to the *LevelMaster Device ID*. To view each tank, select the tank, and click the *Re-read* button on the bottom of the screen.

3.6.2.5 LevelMaster Display and Annuciator Setup

1) In the tree view *Entry* Screen, click on *Display***.** Under the *Setup* tab, the user may setup display groups, etc. Click on the *Annunciators* tab. Determine which unassigned annunciator to reflect the status of the communication port that the user has dedicated to the LevelMaster. By setting this up, the user will be able to view the *LevelMaster Protocol* "R" and *Receive* functions "←" as the XFC or XRC polls the LevelMaster for Information.

For more information on setting up displays, see the PCCU32 help files.

2) In the tree view *Entry* screen, open the *LevelMaster* applications by clicking on the ***"+"*** next to the *LevelMaster Device ID*. To view each tank, select the tank and click the *Re-read* button on the bottom of the screen.

3) Record the register number in the left hand shaded column for each item the user would like to build a display for. Do this for each tank that the user wishes to display information on.

4) In the tree view *Entry* screen, open the *Display* application by clicking on the ***"+"*** next to the *Display*. Click on the *Display Group* that the user would like to add the information to, or create a *New Display Group*. To create a *New Display Group*, see the PCCU32 help files.

5) In the *Setup* screen, the user may rename the *Group Description* and modify the *Number of Displays*. Click on the *Send* button on the lower portion of that screen. This will download the new application information to the XFC. This requires the unit to reconnect automatically. A screen will appear. Select *OK*.

6) Return to the *Display Group*. Click on the first *Spare*. This will open the *Item Setup* screen for this item.

7) Modify the first display item by entering the *Name of Display Item* and entering the *Register* number recorded in step 30. Change the *Display Interval* to a minimum of five seconds. This may be changed to any length from 0 to 255. Entering 0 turns the display off. To modify any other values, see the PCCU32 help files for more information.

8) Click on the *Send* button on the lower portion of that screen. This does not require the unit to reconnect.

9) Once the user has moved to a level of the tree-view *Entry* Screen above the *Display Group* level, the LCD screen located on the front of the unit should begin scrolling.

CAUTION 

While the user can now read basic tank levels at this point, they should proceed to the Calibration section of this chapter to setup the tank for volume.

FYI 

The user has now performed the basic setup of the LevelMaster. The final step is to save all the configuration files to the S Drive for memory backup on the XFC or XRC-195 board static ram chip.

10) Ensure that the *Enable Memory Backup* pins located on the XFC or XRC-195 board are set correctly. See the XFC or XRC user's manual or the PCCU32 help files for more information.

11) Locate *Operate* on the program bar. Open the pull-down menu, and move down to *File Utilities*. From the cascading menu, select the *Save and Restore Utility*.

12) Click on *Save Station Files*. On the new screen, the user will need to indicate the location where they wish to store this copy of the station configuration files. The destination **d**irectory may be something like this:

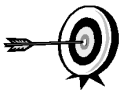
C:/PCCU32/Station Files/Station Name/

Check mark the *All Setup or Configuration Files* box. Do not change either the *Extension List* or the *From* location.

Click *OK*. This may take a few minutes to complete. If the user has preformed this at a prior time, it may state that the files already exist and

ask if the user would like to *OverwriteIMerge* or *Rename* the existing file to a backup file.

13) When completed, the *Upload Completed***!** screen will appear. It will ask if the user would also like to copy the files to the *S Drive*. The user should answer *Yes*. The user will see the same screen displayed as in step 39. The user will notice that the *Destination Directory* is now *Source Directory* and it is the location where they saved the station **f**iles on their computers hard drive. The *From* location is now *Download To*, and the location is *S***:**. Do not change this. Click *OK*. When the *Download Completed* screen appears, click *OK*.

TIP  When the XFC or XRC is cold booted, it will automatically load these configuration files at startup.

FYI  The user may desire to program the *Push-to-Read* feature. This feature allows the user to receive immediate readings from the LevelMaster. See the Operations section of this chapter, Push-To-Read instructions.

3.7 XSeries G4 Setup

Totalflow's XSeries System G4 (XFC or XRC) can be setup to provide support for the LevelMaster. Each will poll the LevelMaster at user programmable intervals and store the current level(s) and temperature data into registers known as Application, Array, Registers (App, Array, Reg). This data is available in Totalflow software packages, WinCCU32 and PCCU32.

The XFC and XRC are connected to the LevelMaster via RS-485 protocol. Set up for the LevelMaster data in the XFC or XRC is done using the following procedure. This procedure assumes that there are no other LevelMaster applications already instantiated.

To instantiate the LevelMaster application, the user needs to have administrative access in the security system. See the online help files for PCCU32 for more information.

3.7.1 Tools Required

- Laptop computer
- PCCU32 version 7.0 or later.
- 9 or 25 Pin PCCU cable terminated with military connector, available in 8, 25 and 50 foot lengths.

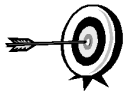
3.7.2 Instructions

3.7.2.1 Instantiating the LevelMaster Application

1) Connect the computer to the local communications port on the side of the XFCG4 or XRCG4 enclosure.

2) Open the PCCU32 software.

By moving the mouse pointer over each icon and pausing, a help label will identify the command assigned to that icon.

TIP 

The icon or tool bar is located directly below the program bar on the PCCU32 screen. As these icons are user-selectable, the user may toggle off icons that they will not be using. See the PCCU32 help files for more information.

3) Locate *Operate* on the program bar. Open the pull down menu and move down to *Security*. From the cascading menu, select *Login*.

4) Enter the user name and password for Administrative access. Click *Enter*.

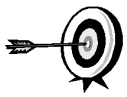
FYI 

By viewing the status bar across the bottom of the PCCU32 screen, the user will see the status of the connection and their login name.

5) Make the software connection to the XFCG4 or XRCG4 by clicking the *Connect to Totalflow* icon and then the *Entry* button, or go directly to the *Entry* screen by clicking the *Entry* icon.

6) Click on the *Station ID* in the tree-view *Entry* screen. If the user has multiple stations, select the location being set up in the tree-view so that it is highlighted.

7) Click on the *Applications* tab next to the *Station Setup* tab.

TIP 

This procedure assumes that the basic applications used by the XFC or XRC are already instantiated. See the PCCU32 help files for more information on setting up the XFC or XRC and instantiating applications.

8) Move down to the first application that reads *Spare*. The Application number is normally slot 51 through 55. Click on the word *Spare*. This will open a pull down menu.

9) Locate the *LevelMaster* application, and select it. The user will need the application number for a later step, so mark it down. As stated above, the slot number is generally Application 51 through 55.

10) Click on the *Send* button on the lower portion of that screen. This will download the new application information to the XFC. This requires the unit to reconnect automatically. A screen will appear. Select *OK*.

3.7.2.2 LevelMaster Setup

The following information will detail the steps necessary to setup the number of tanks and establish the communications port for the LevelMaster.

TIP 

Installation and setup of the Xseries G4 units has been simplified. In PCCU 32 7.xx, the LevelMaster Communication setup is now part of the LevelMaster application.

1) Expand the Communications entry in the tree-view by clicking the + sign. The user will be able to see that a LevelMaster entry is now displayed.

2) Expand the LevelMaster entry in the tree-view by clicking the + sign. Click Setup entry under LevelMaster.

3) Within the Setup tab, the user may change the value of the Device/APP ID. Any name change will be reflected in the tree-view (see Figure 3–9).

4) Next, enter the number of tanks that will be effected. Upon completion, click the Send button. In this case we are only setting up one tank.

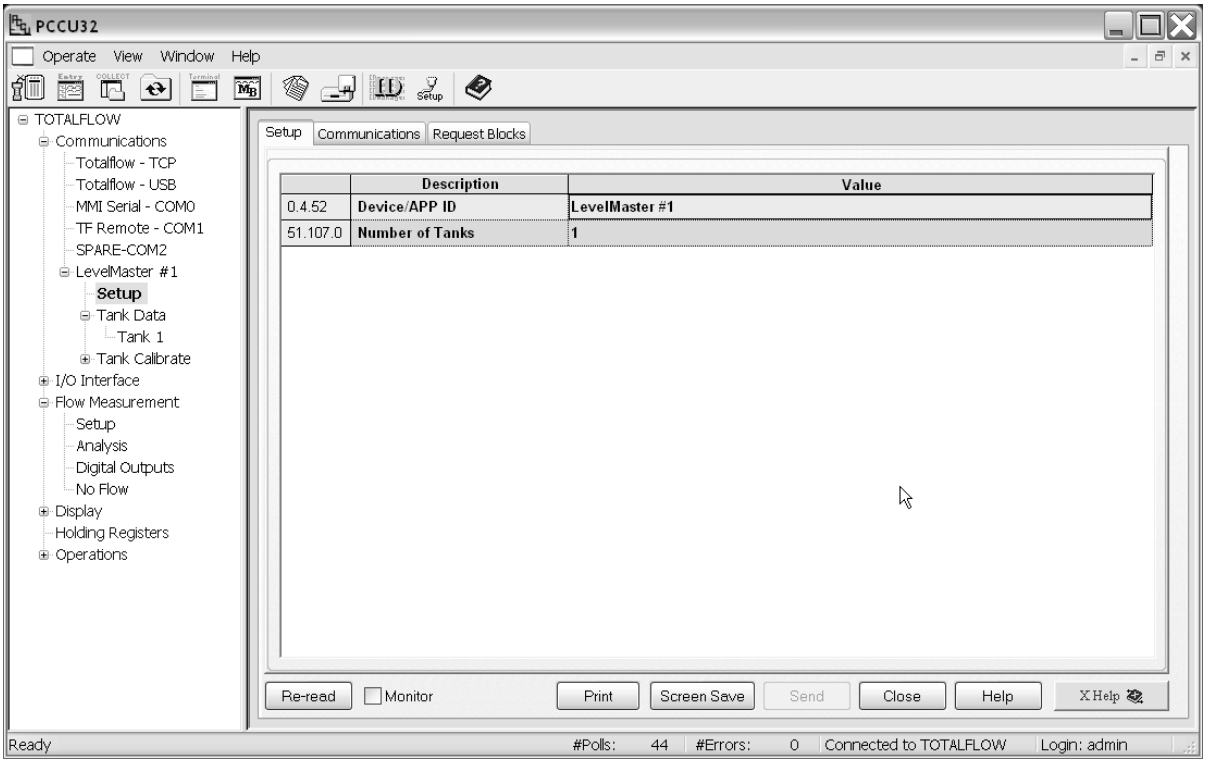


Figure 3–9 G4 LevelMaster Setup Screen

5) Move to the Communications tab under the LevelMaster Setup screen (see Figure 3–10). The user needs to decide which communication port that they want to assign to the LevelMaster. For the purpose of these instructions, it is assumed that the user selects Com 2. Under Value, next to the Serial Port, type **COM2:** Click the Send button, this will assign comm port 2 to the LevelMaster.

FYI

Based on the configuration files that were loaded onto the board, the remaining field default values should be sufficient to begin operation.

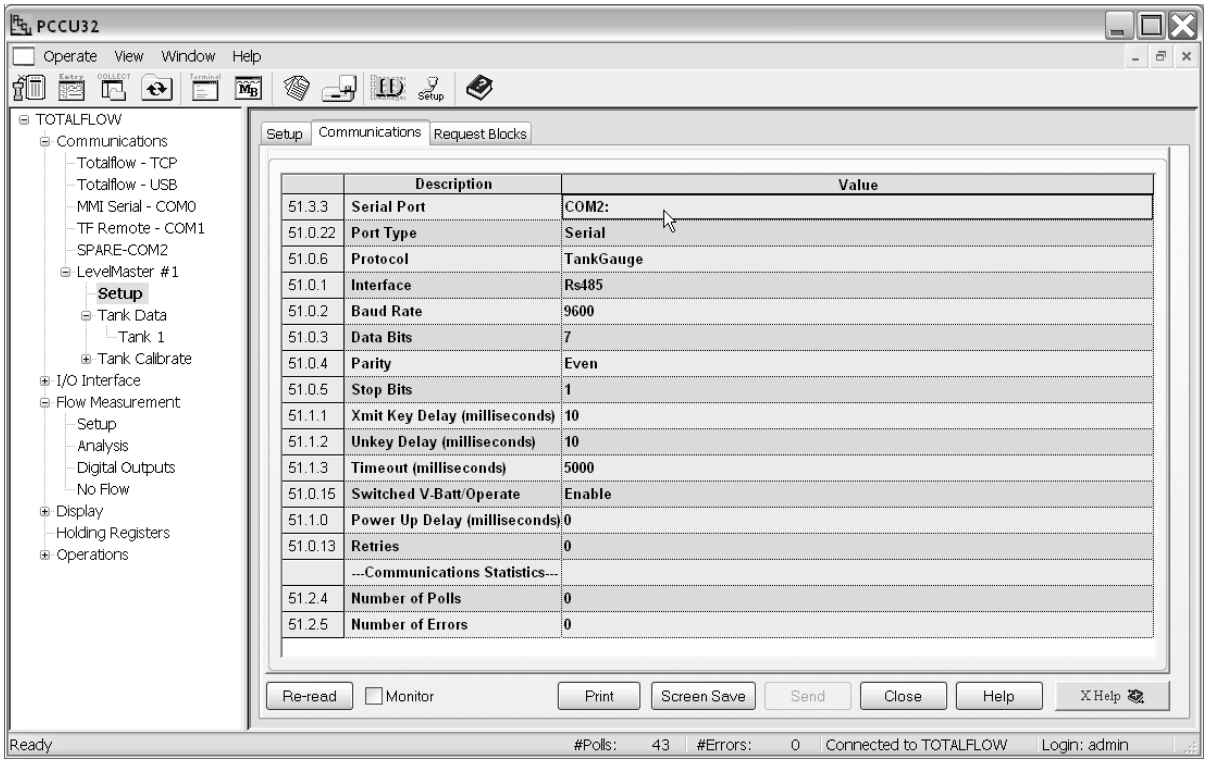


Figure 3–10 G4 LevelMaster Communication Tab

3.7.2.3 LevelMaster Request Block Editor

After the LevelMaster has been set up, the user needs to set the LevelMaster Request Block Editor.

1) Move to the Request Blocks tab under the LevelMaster Setup screen (see Figure 3–11).

2) Select *Add* and enter a tank name. Repeating instances will require a new individual name. Click *OK*.

3) Complete the following:

- *Auto Configuration*
  - Modify Application if required to reflect the application slot instanstantiated previously. In this instance, set Application number to **51**.
  - Select the first tank number associated with the *Tank Application*. In this instance, set Tank Number to **1**. Additional tanks will increment this number. In repeating instances for multiple tanks, change the tank number and ID for each new tank.
  - Set the correct number of sensors for this tank. In this instance, we are setting up a **Dual Level** sensor.
- *Registers*
  - Modify the ID to match the unit ID. In this instance, set ID to **1**. Additional tanks will increment this ID number.
  - Set the interval to the time desired between data requests. Typically, this is set to poll every **15** minutes.

4) Click Send.

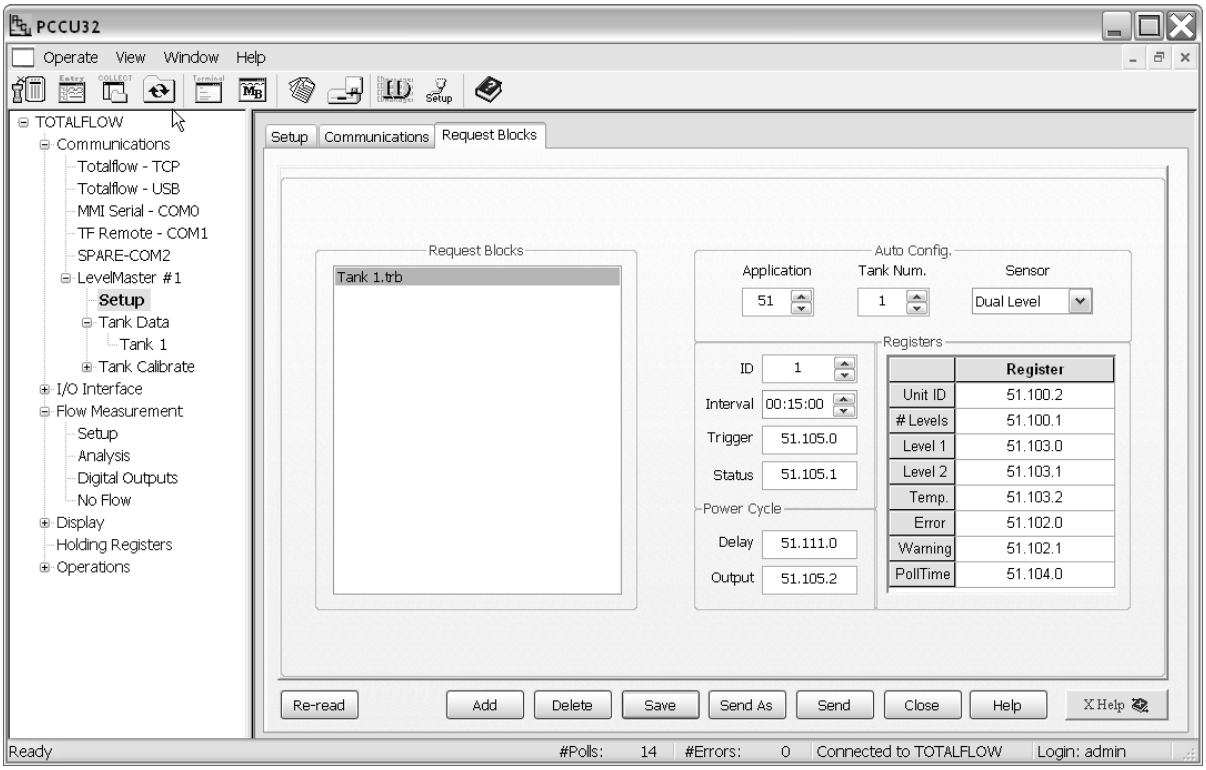


Figure 3–11 G4 LevelMaster Request Block

5) After adding each tank, the user will need to save this file to their computer files in PCCU32 on the computer. Click Save.

6) In the Save Request File screen, the path may be something like this:

C:/PCCU32/LMBlockRequest/TankReq1.TRB

It may be necessary to create the LMBlockRequest folder shown in this example. In repeating instances, append the file name with the tank number. ie. Change *1* to *2*, etc.

7) Repeat steps 2 through 6 if setting up more than one tank. The user will need to rename the file for each tank set up in step 2.

8) Click the folder icon located in the upper left quadrant in Figure 3–11 or locate *Operate* on the program bar, open the pull-down menu and move down to *File Utilities*. From the cascading menu, select *File Transfer*.

9) Select *tfData* on the tree view, by clicking on it. Click on the *Save Station Files* button on the bottom of the *Save and Restore* screen (see Figure 3–12). Click *OK*.

10) On the Save Options screen, ensure that the *Delete all existing files and save* selection is selected. Click *OK*.

11) When completed, a new screen will appear asking you to *Restore Station Files*. Select *Yes*.

12) Back at the Restore Station Files option screen, check mark *Empty tfcold: before restoring station files* (see Figure 3–13). Click OK.

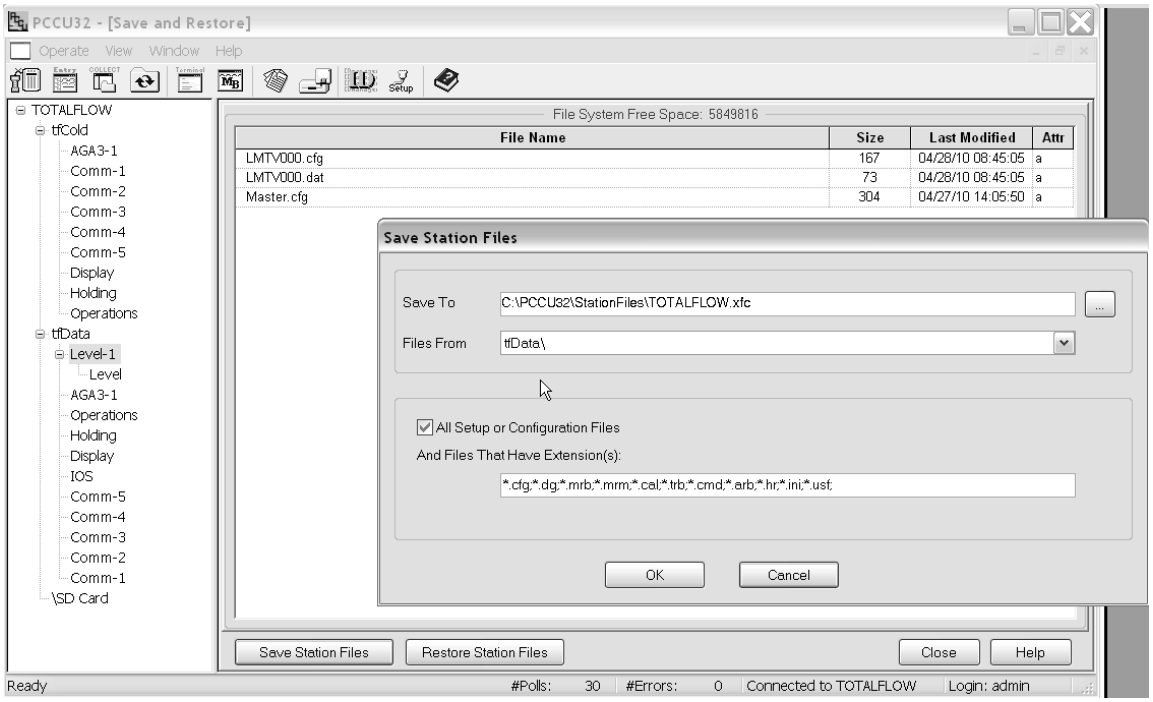


Figure 3–12 PCCU32 Save and Restore Screen, Save Station Files

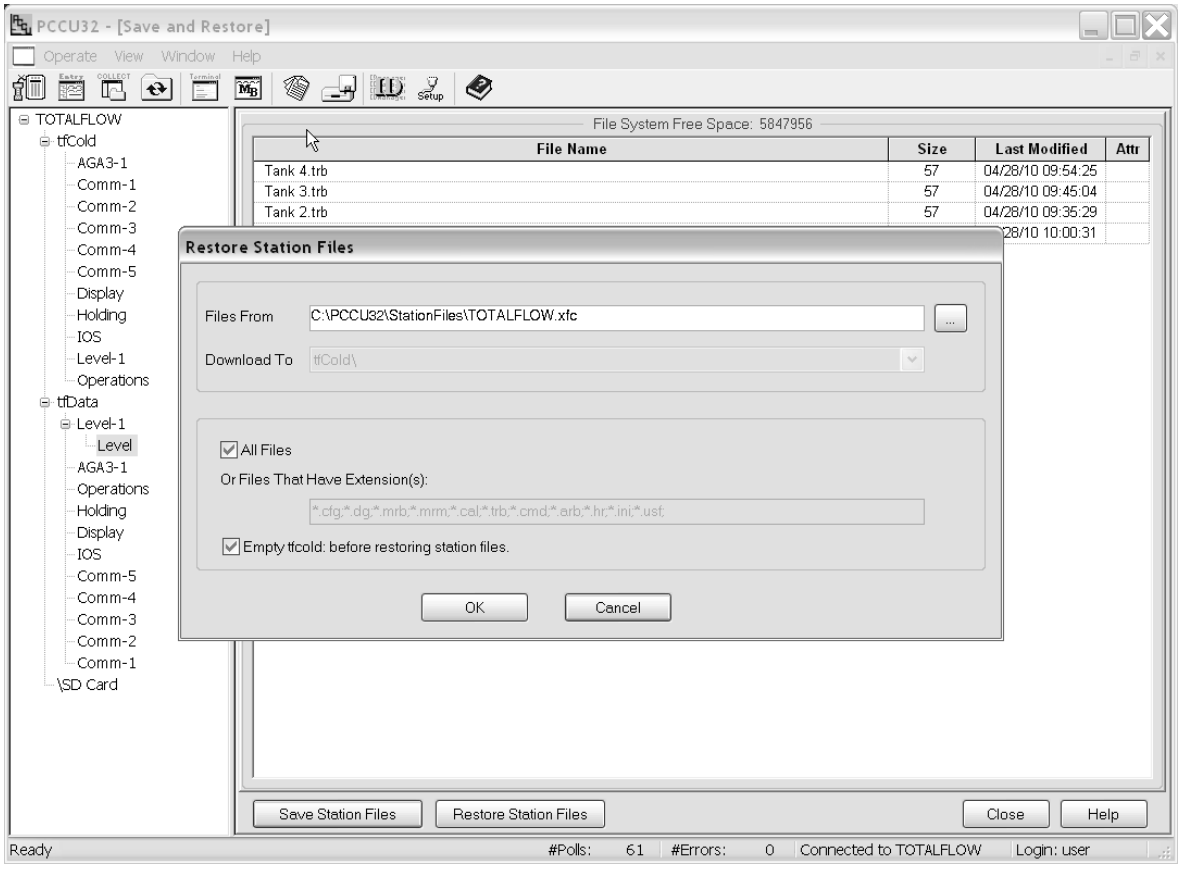


Figure 3–13 PCCU32 Save and Restore Screen, Restore Station Files

3.7.2.4 LevelMaster Display and Annuciator Setup

1) In the tree view *Entry* Screen, click on *Display***.** Under the *Setup* tab, the user may setup display groups, etc. Click on the *Annunciators* tab. Determine which unassigned annunciator to reflect the status of the communication port that the user has dedicated to the LevelMaster. By setting this up, the user will be able to view the *LevelMaster Protocol* "R" and *Receive* functions "←" as the XFC or XRC polls the LevelMaster for Information.

For more information on setting up displays, see the PCCU32 help files.

2) In the tree view *Entry* screen, open the *LevelMaster* applications by clicking on the ***"+"*** next to the *LevelMaster Device ID*. To view each tank, select the tank and click the *Re-read* button on the bottom of the screen.

3) Record the register number in the left hand shaded column for each item the user would like to build a display for. Do this for each tank that the user wishes to display information on.

4) In the tree view *Entry* screen, open the *Display* application by clicking on the ***"+"*** next to the *Display*. Click on the *Display Group* that the user would like to add the information to, or create a *New Display Group*. To create a *New Display Group*, see the PCCU32 help files.

5) In the *Setup* screen, the user may rename the *Group Description* and modify the *Number of Displays*. Click on the *Send* button on the lower portion of that screen. This will download the new application information to the XFC. This requires the unit to reconnect automatically. A screen will appear. Select *OK*.

6) Return to the *Display Group*. Click on the first *Spare*. This will open the *Item Setup* screen for this item.

7) Modify the first display item by entering the *Name of Display Item* and entering the *Register* number recorded in step 30. Change the *Display Interval* to a minimum of five seconds. This may be changed to any length from 0 to 255. Entering 0 turns the display off. To modify any other values, see the PCCU32 help files for more information.

8) Click on the *Send* button on the lower portion of that screen. This does not require the unit to reconnect.

9) Once the user has moved to a level of the tree-view *Entry* Screen above the *Display Group* level, the LCD screen located on the front of the unit should begin scrolling.

CAUTION 

While the user can now read basic tank levels at this point, they should proceed to the Calibration section of this chapter to setup the tank for volume.

FYI 

The user has now performed the basic setup of the LevelMaster. The final step is to save all the configuration files to the S Drive for memory backup on the XFC or XRC-195 board static ram chip.

10) Ensure that the *Enable Memory Backup* pins located on the XFC or XRC-195 board are set correctly. See the XFC or XRC user's manual or the PCCU32 help files for more information.

11) Locate *Operate* on the program bar. Open the pull-down menu, and move down to *File Utilities*. From the cascading menu, select the *Save and Restore Utility*.

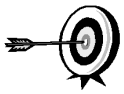
12) Click on *Save Station Files*. On the new screen, the user will need to indicate the location where they wish to store this copy of the station configuration files. The destination **d**irectory may be something like this:

C:/PCCU32/Station Files/Station Name/

Check mark the *All Setup or Configuration Files* box. Do not change either the *Extension List* or the *From* location.

Click *OK*. This may take a few minutes to complete. If the user has preformed this at a prior time, it may state that the files already exist and ask if the user would like to *Overwrite*/*Merge* or *Rename* the existing file to a backup file.

13) When completed, the *Upload Completed***!** screen will appear. It will ask if the user would also like to copy the files to the *S Drive*. The user should answer *Yes*. The user will see the same screen displayed as in step 39. The user will notice that the *Destination Directory* is now *Source Directory* and it is the location where they saved the station **f**iles on their computers hard drive. The *From* location is now *Download To*, and the location is *S***:**. Do not change this. Click *OK*. When the *Download Completed* screen appears, click *OK*.

TIP  When the XFC or XRC is cold booted, it will automatically load these configuration files at startup.

FYI  The user may desire to program the *Push-to-Read* feature. This feature allows the user to receive immediate readings from the LevelMaster. See the Operations section of this chapter, Push-To-Read instructions.

3.8 Volume Calculations Setup

Gross tank volumes are calculated using a formula whereby the host software computes the volume using tank levels and the strapping table for individual tanks. The user creates the strapping table by entering information for the selected tank and each individual section. For more information on strapping tables, see the section on strapping tables.

3.8.1 Strapping Tables

While the LevelMaster is factory calibrated for the user's particular tank, occasionally there are extenuating circumstances that may require the tank volume to be adjusted. These circumstances may be as simple as the tank skin bulging between the tank straps or more complicated issues dealing with external damage of the tank. These changes to the composition of the tank may introduce errors to the measurement calculations. To correct these types of errors, Totalflow included a feature in the software to make these corrections.

When MasterLink software is used to communicate locally and no host hardware unit is controlling the LevelMaster, there is no capability for developing a strapping table. However, the user may enter a new figure for each level, thus allowing for the adjustment of the density of the liquid which affects the float level. Details for adjusting the float levels is located in the section entitled, Float Calibration.

Host hardware, PCCU32, WinCCU Remote Host Console or Modbus may be used to configure strapping tables and view calculated gross values.

3.8.1.1 Table Factors

The following three items are used to create a strapping table and are used to calculate tank volumes. Strapping table inputs include:

- **No. of Tank Sections (10 max)** – Horizontal sections that the user divides the tank into, usually the actual straps around the tank, are used for section dividers. Because tanks may not be uniform from bottom to top, dividing each tank into sections allows the user to more accurately provide information for each section. If the tank is uniform, the user may enter only one section.
- **Section # Height** – Each section (1-10) of the tank has an entry for its height in inches from the bottom of the tank.
- **Section # Vol. Factor** – Each section (1-10) of the tank has an entry for its own volume factor per ¼ inch of height. By default, this would be barrels per ¼ inch. However, because the tank is broken into sections, the user may adjust individual volume factors based on the condition of each section. Therefore, a section which has sustained damage, either concave or convex, may be adjusted to allow for the missing or addition storage space.

For example, a twenty-foot tank may be divided into five, 48-inch calibration sections. Using default English units, enter the height at the top of each of the five sections and the barrels per quarter inch of tank volume within that section. The host software then calculates the gross volume for each of the tank sections and adds them together. Volume outputs may be viewed using any of the host software packages discussed in this chapter.

3.8.1.2 PCCU32

Tank Setup Screen: As the user sets up each tank in the *Tank Setup* screen, the lower portion of the screen allows the user to enter information to create a strapping table. The user will need to enter the number of tank sections and then complete the following information for each section *(x* being the section number):

- Section (X) height
- Section (X) volume per unit height

3.9 Float Calibration

While the LevelMaster is factory calibrated for the user's particular tank, occasionally there are extenuating circumstances that may require the floats to be calibrated. These circumstances may be as simple as a difference in the fluid gravity.

Calibrating the float is actually based on determining a new level factor and making a positive or negative adjustment to the level. This is called a bias. The user may determine the need to set a bias if they have been comparing the reading level of each float and comparing that to an actual measurement.

To further adjust the volumes due to an outside influence, namely a damaged section of the tank, a strapping table allows for a more accurate adjustment. This allows the user to make a correction based only on the area damaged, rather than an adjustment to the entire volume of the tank by setting a bias level.

3.9.1 MasterLink

When communicating directly with the LevelMaster from the user's laptop using MasterLink during the setup process, the user may enter a new value for each float in the *Setup* screen. Under the *Setup* tab for this tank, the user will see the section "*Enter Gauging Tape Measurements Here:*" For each tank level, the user may set a new level based upon the actual gauge level. (See Tip below.)

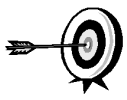
3.9.2 Console Mode

When setting up each tank using the Console mode, the user may set a bias for each level. This allows the user to adjust the reading of the float.

- Enter the *Tank Setup* screen. Here the user may enter only a positive or negative bias level for each float.

3.9.3 PCCU32

Tank Setup Screen: As the user sets up each tank in the *Tank Setup* screen, in the upper portion of the screen they may enter a positive or negative bias for each level.

TIP 

Do not calibrate the floats, also referred to as level bias, in MasterLink during the initial setup if the unit will be operated by a Totalflow host. Performing the calibration through the Totalflow host provides an audit trail.

3.10 Data Collection

Data collection from the LevelMaster may be accomplished in several ways. Because the LevelMaster communicates using RS-485, any host with RS-485 or converting hardware may communicate. The most basic method for data collection is communicating directly with the LevelMaster using MasterLink software on a laptop computer and a RS-232 converter. Totalflow equipment is specifically designed to communicate with the LevelMaster. They can also be configured using Modbus RTU or ASCII protocol.

Currently, the most efficient way to collect data from the LevelMaster is to use a Totalflow host device with trending capabilities.

3.10.1 Trending

PCCU32 versions 4.30 or later may be programmed to collect data by using the *Trending* application available with the *Advanced* version. Trending is a system whereby values stored in an App/Array/Reg location can be written to a file, printer or screen.

Advanced users may design their Trend function to use the *Push to Read* feature to poll on demand. The basic steps required to setup the Trend function for data collection may contain the following:

- Determine the information, order and App/Array Reg number of the stored values for the report.
- Using the *Trend File Editor*, create a new report and save to the hard drive.
- Upload the new file to the R drive, using the *File Transfer System*.
- Using the *Local Remote Protocol*, enter the Trend System, open the new report and upload it to the device.
- Collect the data.

3.11 Duty Cycling Power

Duty cycling allows the host device to turn on the LevelMaster's power, collect its data and then turn the power off. For systems operated using solar/battery power, each LevelMaster draws 1Ma power while idle and 40Ma during the read/collect function. The cycling is done via a digital output in the host software.

Setup is done in the host software and may be accomplished by setting the suggested parameters shown in Table 3—7 Duty Cycle Parameters. This feature is not required and can be enabled or disabled using the cycle option below. It is disabled by default.

Additional parameters located on some screens may not be used for enabling and scheduling power cycling, i.e., Push-to-Read, Read Now DI and Round To parameters. These may be used and set at various other times.

Table 3—7 Duty Cycle Parameters

Parameter	Description	Suggested
Cycle Option	Enables (On) or Disables (Off) the Duty Cycle option.	On or Enable
Read Now	Setting this flag to Yes causes the Host to initiate an immediate read from all the LevelMasters. The flag then returns to the No state. The Scan Time counter is zeroed so that the next scheduled Scan Time is from the time this read was initiated.	No
Power D/O	For the Duty Cycle option to work, the Host turns the power on and off via one of its digital outputs. This parameter assigns the Digital Output connected. See Figure 3-8 for connection information.	DO 1
Power Up Time	This is a delay time in milliseconds from when the Power DO is energized until the read request is sent to the LevelMaster. This allows the LevelMaster to stabilize after power-up before requesting data.	1000 ms
Rd Freq.	This is the frequency the flow computer will read data from the LevelMaster in minutes. If the Cycle opt is turned on, this Rd Freq. (scan time) overrides the Rd Freq., under the individual tank setups. If the Duty Cycle option is not enabled, the read frequency is established by the Scan Time in individual tank setups.	60 mins.
Rd Timeout	This is simply a counter that counts down to the next time data is requested from the LevelMaster. Based on Rd Freq. Above.	N/A

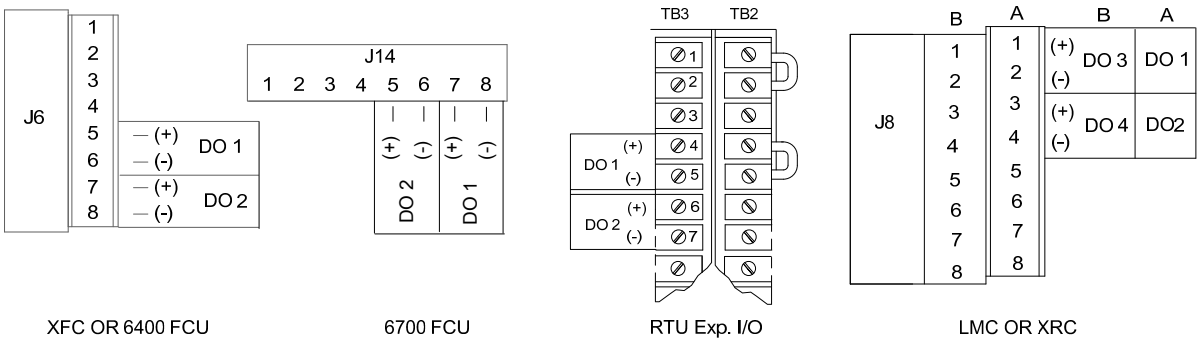


Figure 3–14 Host Hardware Digital Outputs

3.11.1 PCCU32 Ver. 4.14 or Earlier

Set parameters for duty cycling power by locating the *Tank System Setup* tab in the *Entry* screen. The user may need to make specific determinations based on how their system is configured and wired.

3.11.2 PCCU32 Ver 4.30 or Later

Set parameters for power duty cycling by locating the *Power Duty Cycling* on the tree menu and selecting it. The user may need to make specific determinations based on how their system is configured and wired.

3.11.3 Console Mode

Set parameters for power duty cycling by entering the Console mode and selecting *Tank Duty* (see Figure 3–15 Console Mode, Tank Duty Cycle Setup). The user may need to make specific determinations based on how their system is configured and wired.

Console mode commands may be located in Table 3—4 Console Mode, Tank Setup Parameters earlier in this manual.

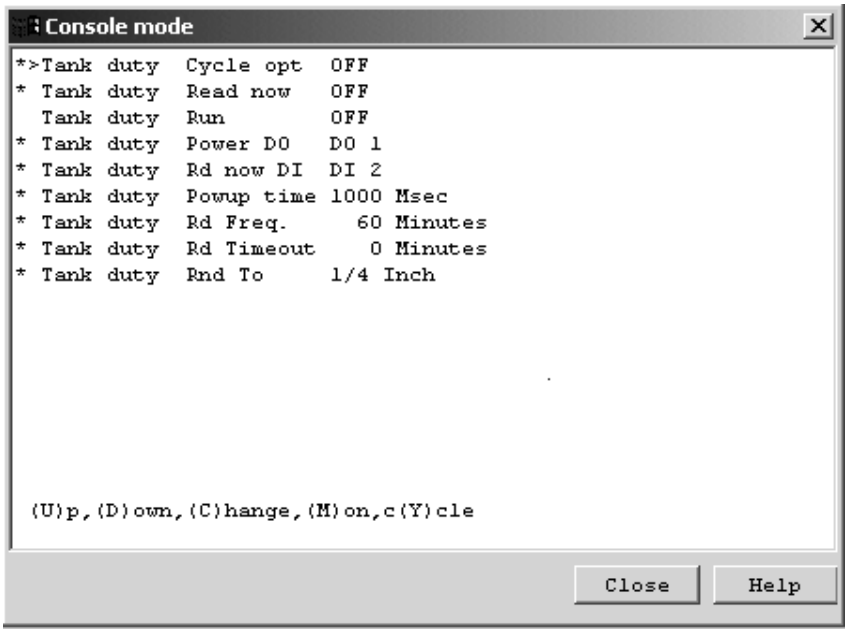


Figure 3–15 Console Mode, Tank Duty Cycle Setup

3.12 Push-to-Read

The *Push to Read* function is applicable for any LevelMaster where LevelMaster is powered through a Totalflow device such as a flow computer or RTU. Normal function of these control units consists of a scrolling display of information. Because these units normally control and collect data from multiple devices, the *Push to Read* function is particularly useful to force a communication with the LevelMaster and then display only those items programmed to display during the *Push to Read* operation. This is actually combining two separate but useful functions.

- Force poll one or more LevelMasters—Function before and after a sale.
- Switch display to LevelMaster readings—Goes directly to the information requested.

Depending on the equipment and software version is being used, the procedure will vary.

3.12.1 Wiring Push to Read Input Button

Locate the pulse or digital input + and – on the main electronic board as shown in Figure 3–16 Host Hardware Digital Inputs. Install the switch per the manufacturer's instructions in the enclosure, leaving enough wire to reach the location of the DI or PI. Remove power from the main electronic board, and wire the switch into the connector. The connector is removable from the board to aid in field wiring.

The following instructions for setting up the host software are grouped according to which method will be used for the host software.

If the software is…	And the hardware is…	Use the following instructions:
PCCU32 4.14 or Earlier	6400 or 6700 FCU	Console Mode
	6790 RTU	
PCCU32 4.14 or Earlier with Tank Gauge Upgrade	6400 or 6700 FCU	Tank Gauge Upgrade
PCCU32 4.30 or Later	XFC	X Series Setup
	XRC	
PCCU32 7.0 or later	XFCG4	XSeries G4 Setup
	XRCG4	XSeries G4 Setup

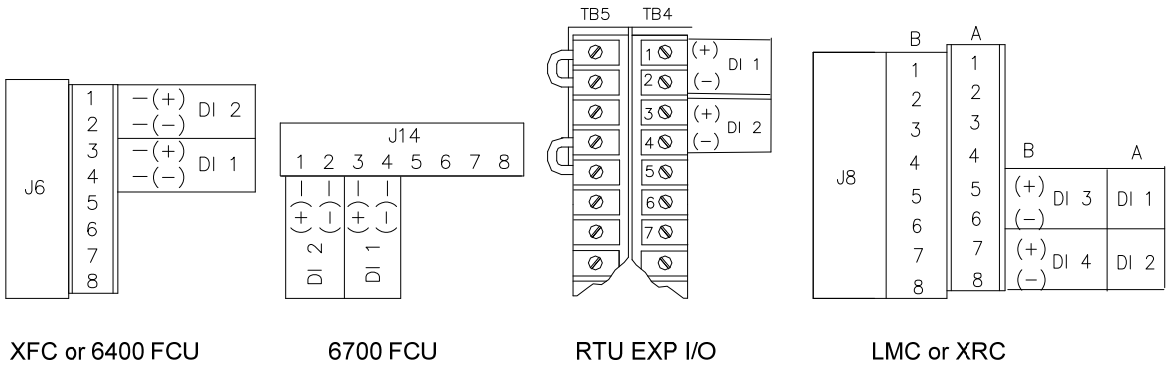


Figure 3–16 Host Hardware Digital Inputs

3.12.2 Console Mode

The following instructions are applicable for the 6400 and 6700 FCUs as well as the 6790 RTU, using PCCU32 version 4.14 or earlier without the Tank Gauge Upgrade installed. For the purpose of these instructions, it is assumed that the basic wiring has been completed and that the user has basic knowledge of the flow computer and PCCU32 software.

3.12.2.1 Instructions

1) Locate *Operate* on the program bar. Open the pull-down menu and select *Console Mode*.

2) After the *Console Mode* screen appears, locate the *Tank Duty* menu item, and enter the corresponding number to access the setup.

3) Move the > down to *Tank Duty Rd now DI*, by repeatedly pushing the *D* for down.

4) Once there, push the *C* key for change, and enter the new value.

5) The change information will appear at the bottom of that window. Use the *U* for up and *D* for down to display the different options available.

6) Once the user has found the correct option, press *Enter* to save the change.

7) Using Table 3—8 Push-To-Read Parameters, make sure all parameters are set as needed.

8) Click on the *Close* button and exit the Console mode.

FYI 

To operate the Push to Read switch, press the button and hold. The user can then scroll through the list of items to display. When the desired display is reached, release the button. After the view time has elapsed (approx. 30 seconds), the display will return to the normal display function.

TIP 

These changes have not been saved to the configuration file. The user may want to review the Save instructions and write a copy to their hard drive for later retrieval, if necessary.

CAUTION 

If using PCCU32 4.14 or older and have installed the Tank Gauge Software Upgrade, the user will see *Tank Read PB DI* under the *Tank System Setup* screen. The default value is DI0. If the user modified this value to the other option of DI1, the Push to Read feature will not work.

Table 3—8 Push-To-Read Parameters

Parameter	Description	Suggested
Push to Read Display Enable	Enables (On) or Disables (Off) the Push-to-Read option.	On or Enable
Display Select View Time (seconds)	Time that each item stays on the display while *Push to Read* button is held closed.	1
Selected Display View Time (seconds)	The amount of time that the displayed item will remain on the display when the button is released.	10
Rd now DI	This is the digital input to be used for the push button.	DI1 or DI2

3.12.3 XSeries Equipment

The following instructions are applicable for all XSeries equipment using PCCU32 version 4.3 or newer. These instructions assume that the user has basic knowledge of PCCU32 and their XSeries Equipment.

3.12.3.1 Procedure

1) Locate the *AppIArrayIReg* for the digital input that the user is wired to. Do this by opening the drop-down menu for *I/O Subsystem*, then *On Board*, and finally the *Digital Inputs*. The App/Array/Reg number may be similar to:

   7.2.4096

   This number depends upon the order in which the I/O subsystem was instantiated. The default instantiation for the I/O subsystem is application 7. It is simply an address where this information is stored.

2) From the program bar, select *Operate*, *File Utilities* and then *LevelMaster Request Block Editor*.

3) In the TRB Program bar, select *File/Open*.

4) Browse for the TRB file, created when originally programming the LevelMaster.

5) Modify the App/Array/Reg number listed in the *Trigger* window to the number that was located in step 4.

6) Save the file to the previous location, and close the *LevelMaster Request Block Editor***.** Then closes the editor.

7) From the program bar, select *Operate*, *File Utilities* and then *File Transfer*.

8) Under the *R* drive, select the Comm **p**ort the LevelMaster is running on.

9) Select the *Level* folder directly beneath the *Comm Port*.

10) Select *Download* from the bottom of this window, and locate the *TRB* file that was just recently modified from the hard drive. Select the file, and press the *Open* button.

11) This will replace the file on the *R* drive and update the last modified date and time for that file. Close the *File Transfer* screen.

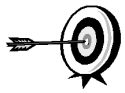
FYI 

The user has now completed the set up to force poll one or more LevelMasters. The next step is to program the display to scroll through the desired display items.

12) Click on *Display* in the tree menu.

13) On the *Setup* screen for display, change the value of the *Group Scroll Control* to the App/Array/Reg number located in step 4.

14) Update the value of the *Scroll Lock Timeout* to a pre-determined figure.

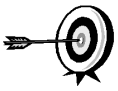
TIP 

The rule of thumb to follow when figuring the desired scroll lock timeout is to allot enough time for each item to be displayed for the allotted display interval (set up in the display screen for each item) and to allow the group of items to be displayed three times. Because the poll and the display are started simultaneously the first time the list scrolls through, it is the value already stored. The second time through should be the updated (Polled) numbers. The third time through will allow the user to make notes of the numbers that they missed the second time through. For example, the user may have ten items to display for five seconds each, multiplied by three times. The user would set the scroll lock timeout to 11/2 minutes.

15) Click *Send*.

FYI 

To operate the Push to Read switch, press release the button. The group display numbers will begin scrolling. Click the button again when the correct display group is showing. This group should begin to scroll through its list. If the user followed the Tip above, the list should scroll through three times and then return to the normal display.

TIP 

When the equipment is polling the LevelMaster, the user will see an arrow →. When not communicating, the user will see an *R*.

3.13 Remote User Interface (Host Console)

When access to a host via remote communication is required, this is accomplished by using a feature called *Remote User Interface* or *Host Console*. This interface is handled by either WinCCU or PCCU32, the firmware device template and a form of communication equipment, i.e., radio.

The process for using the device template with either WinCCU or PCCU32 is to import the template into WinCCU and/or PCCU32. It is then available for attaching to the device ID with the WinCCU ID Manager or, if using PCCU32, it is available for use with the ExIO/RTU device type. WinCCU32 and PCCU32 software use a mode called *Host Console* to interface with the register data in a format determined by template. The template is designed or edited using the *Device Template Editor*, which is a standard part of WinCCU32 and PCCU32.

3.13.1 Screens

The *Host Console* screens are used to view and change any necessary data. When using WinCCU, the host console may be started by either using the *Host Console* icon on the WinCCU task bar or by using the *Device I/O* pull-down menu and then selecting *Host Console*. When using PCCU32, the connection to the device must be established first and then the *Host Console* icon on the PCCU32 task bar may be used to begin the host console operation.

3.13.2 Polling

Another feature available in WinCCU32 and PCCU32 is the ability to poll for the App, Array, Reg data using the *Remote Communications* function. This requires that the desired data be setup in a custom report area of the template. A *Trending* function is also available with WinCCU32 and PCCU32 in which the user specifies the register locations and intervals to trend.

When the host console is started, a screen similar to Figure 3–17 Host Console Mode using a Device Template appears. The upper left box lists the areas that are contained in the device template, and the upper right box lists the groups of data that are contained in the highlighted area. The lower box lists the data items contained in the highlighted group.

TIP  For more information regarding Host Console, please see the help files provided with the software.

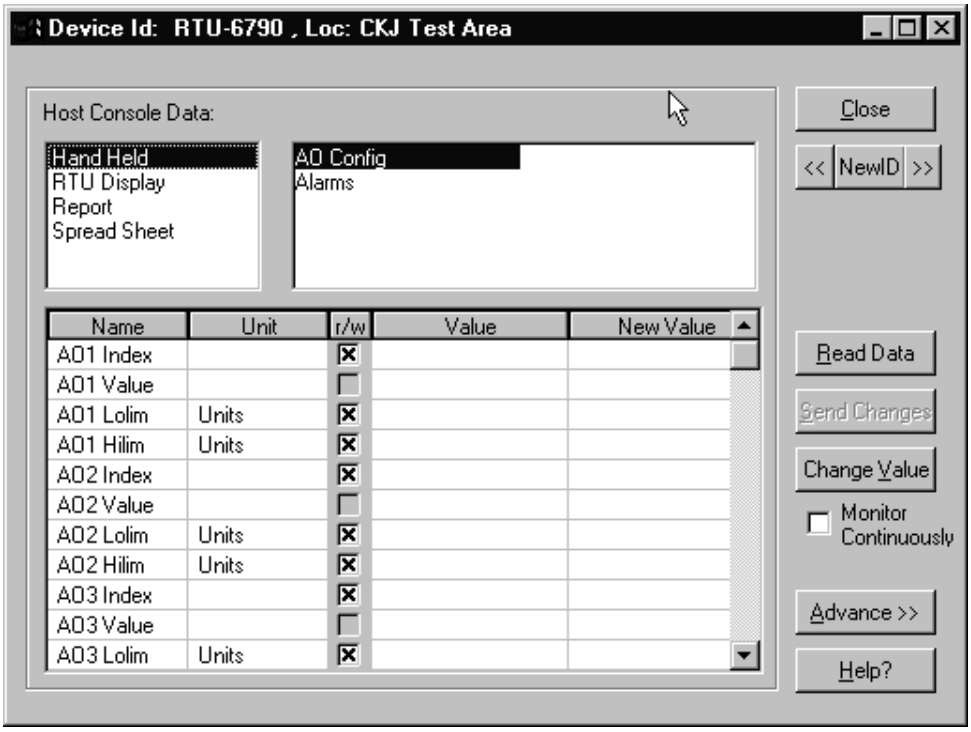


Figure 3–17 Host Console Mode using a Device Template

3.14 Communications Protocol

A simple ASCII protocol is supplied in each LevelMaster product for communication to any host system that understands this protocol (See Table 3—9 Protocol Explanation **(version 3.04 and forward)**). The LevelMaster protocol is a public domain, non-proprietary protocol and is available for any data acquisition and control application.

Table 3—9 Protocol Explanation *(version 3.04 and forward)*

Input Format	Description	Output Format
Unn? *ID Number (00 through 99)* *Command Code*	Return Distance, Temperature, Errors, and Warnings.	***Single Float Response:*** UnnD123.45F123EeeeeWwwwwCcccc *Checksum* *Warnings (NA)* *Errors (see next page)* *Temperature* *Distance (Float 1, Passive)* *Unit Number (00 through 99)* ***Dual Float Response:*** UnnD123.45D123.45EeeeeWwwwwCcccc *Distance (Float 0, Active)*
UnnED(0)(1)(2)(3)	Display EEPROM Memory	Displays 256 locations at a time.
UnnERxxx	Select EEPROM Memory Location	
UnnEWxxx	Write xxx data to Selected Memory Location	
UnnERxxxEWxxx	Select Memory Location xxx and Write xxx data.	
UnnF?	Return number of floats	UnnFxCcccc # of floats (0, 1, 2)
UnnFxROS *password* # of floats (0, 1, 2)	Program number of floats	UnnFOKCcccc *acknowledged successful upload*
U**N?	Return ID	UnnNxxCcccc *Unit number*
U00N01	Ex; changing ID number (00 to 01)	UnnNOKCcccc *acknowledged successful upload*

Input Format	Description	Output Format
UnnOL?	Return level offset	UnnOL+xxxxCcccc Offset # in hundreths of base units (in, mm, cm) Sign + or - Offset, Level
UnnOLxxxx	Program xxxx level offset positive	UnnOLOKCcccc *acknowledged successful upload*
UnnOL-xxxx	Program -xxxx level offset negative	UnnOLOKCcccc *acknowledged successful upload*
UnnT?	Return temperature sense or number	U01TxCcccc Temperature Sensor Number
UnnV	Return firmware revision	UnnVx.xxxCcccc Firmware Version No.

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4.0 MAINTENANCE & TROUBLESHOOTING

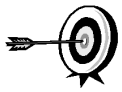
This chapter provides information on how to perform maintenance on the LevelMaster and troubleshoot problems.

The primary tool used to setup and check out the LevelMaster during maintenance is MasterLink, a Windows based software program designed specifically for the LevelMaster. The program would typically be loaded on a laptop computer and taken to the site. An RS-485/RS232 converter with cable can also be provided for interfacing the computer to the RS-485 communications of the LevelMaster

4.1 Replacing the Electronics Board

The following procedure assumes there is a setup (.dat) file available that can be downloaded to the replacement board. This file will have all the critical setup information, even if subsequent changes were not saved. The user should always read the setup information using the *Upload/Download* feature of MasterLink after making any type of changes. For additional information when using MasterLink, click on the *Help* menu item on the main screen. Additionally, most of the individual screens have a *Help* button providing information for that screen.

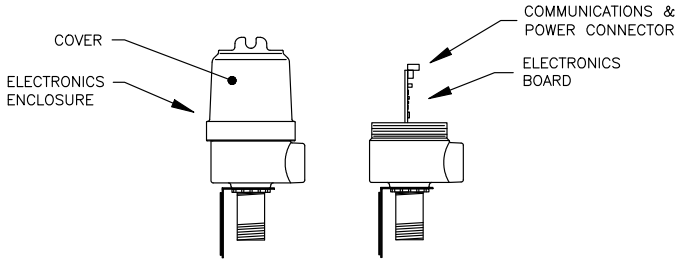
TIP



If a sensor board is replaced due to failure, the original calibration file for the sensor must be loaded into the replacement board. If the file is not available on-site, the user can contact ABB Totalflow and request a copy. When ordering a replacement board, if ABB is supplied with the LevelMaster serial number, the calibration file for that LevelMaster unit will be loaded into the board at the factory before shipment (there is no cost for this service).

1) Remove the power going to the LevelMaster.

2) Remove the cover from the electronics enclosure.



3) Unplug communications and power connector(s). This may be one connector or two, depending on the board.

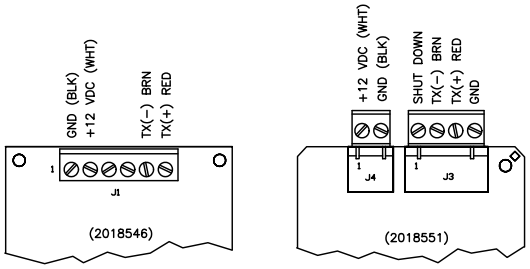
4) Hold the board by the edges, and pull it slowly out. Unplug the 16-pin connector at the bottom of the board.

5) Plug the connector into the electronics **b**oard. The connector is keyed so it will only plug in one way. Push some of the excess cable back down through the bottom of the assembly while sliding the electronics **b**oard back into position. Allow a small loop to fold back towards the top of the enclosure.

6) Brace the electronic board inside the housing by using the yellow fiberglass tab inserted into the enclosure. Bend it gently into a semicircle using the

thumb and forefinger, making sure the apex of the arch is placed against the board while the ends of the tab are braced to the inside of the housing.

7) Re-install the communications and power Connector(s). If the new board has two connectors and the old board has one, rewire as follows.



8) Screw the cover back on the electronics enclosure.

9) Reapply power to the LevelMaster.

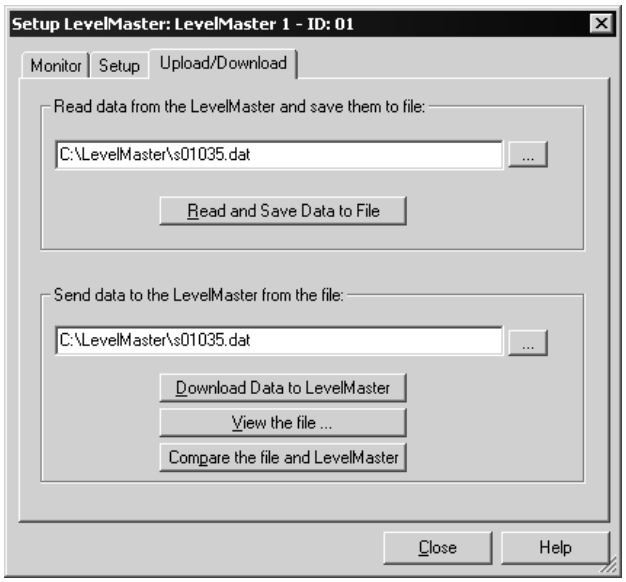
10) Connect the laptop using the RS-485/RS232 converter to the RS-485 bus in a safe area.

11) Start the MasterLink program, and select the LevelMaster from the main screen.

12) Click on the *Setup LevelMaster* button.

13) Click on the *Upload/Download* tab.

14) In the bottom half of the screen, click on the *Browse* button […] which is just to the right side of the *Send Data* window. Locate the setup file for the LevelMaster. Each LevelMaster should have its own setup file that was saved during the original installation. If not modified or saved as a different name, the default name will be the same as the 5-digit base serial number. To view the serial number, click on the *Monitor* tab.



15) After locating the file, select it and click the *Open* button. The file path and name should now display in the window.

16) Click on the *Download Data to LevelMaster* button. Another screen will appear during the download to inform the user when it is finished. Click *OK* to acknowledge, and close the screen.

17) The user should now be able to click on the *Monitor* tab and see the temperature and level data, using the newly downloaded setup information. This completes the electronics **b**oard replacement procedure.

4.2 Replacing Floats

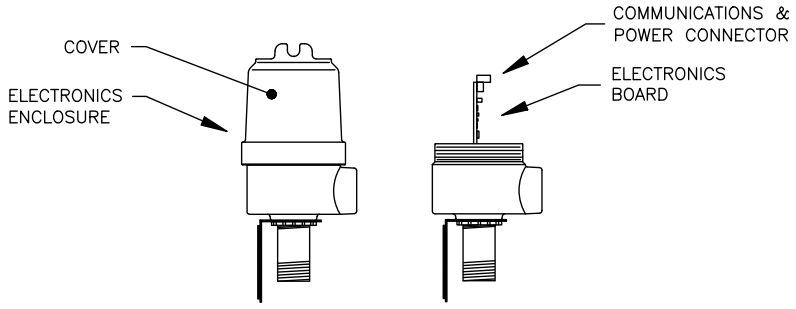
The following procedures will describe how to replace floats with the same type of floats or one type float with a different type float. There are two basic types of floats: passive and active. Units with one float usually will be passive but can be active whereas units with two floats must be active. Active floats can also be different as in the density, such as the floats used for oil and water.

Replacing floats will require that the LevelMaster be pulled out of the tank.

Changing floats generally requires test programs to be run on the LevelMaster and certain setup data be modified to support the new float. When replacing active float(s) with a passive float, two test programs must be run. This is all done by the MasterLink software program by selecting the correct float change from a list of options. For additional information when using MasterLink, click on the *Help* menu item on the main screen. Additionally, most individual screens have a *Help* button providing information particular to that screen.

1) Disconnect the power going to the LevelMaster.

2) Remove the cover from the electronics enclosure.

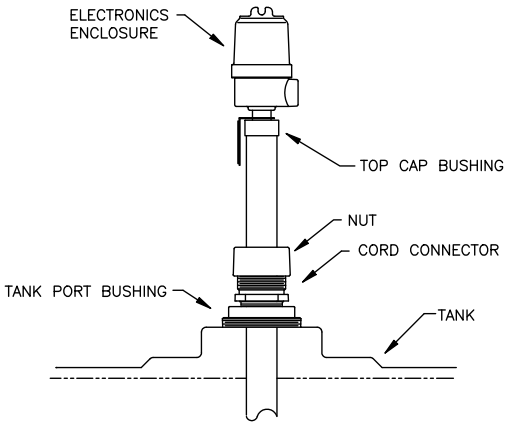


3) With a small screwdriver, remove the wiring from the communications and power connector. This may be one connector or two depending on the board. Make a note as to what wires went to what terminal number. See the *Wiring* section of the *Installation* chapter for more information.

4) Remove the cable or conduit from the electronics enclosure.

5) Replace the cover on the electronics enclosure.

6) Loosen the nut on the cord connector. Unscrew the tank port busing. There should be no cord connector on high pressure units.



7) Remove the LevelMaster from the tank, and lay it on the ground with blocks underneath.

8) Remove the float clamp from the bottom of the casing.

9) Slide the float**(s)** off the bottom of the casing.

10) Install the new float(s) except in the situation where the user is replacing active float(s) with a passive float. In that situation, wait until instructed to do so by the MasterLink program. When installing two floats, make sure they are in the correct order.

11) Connect the laptop using the RS-485/RS232 converter with the cable into the communications and power connector. This will also require the user to have a battery to power the LevelMaster. Two 9V batteries are included in later versions of the RS-485/RS232 converter to power the LevelMaster.

12) Start the MasterLink program, and select the LevelMaster from the main screen.

13) Click on the *Setup LevelMaster* button.

14) Click on the *Setup* tab.

15) Click on the *Hardware Change* button.

16) Click on the *Float Change* option that fits the particular float change.

17) Click the *Next* button, and follow all instructions.

18) When complete, click on the *Monitor* tab to verify the new readings. If the readings look correct, this concludes the setup portion.

19) Disconnect the laptop.

20) Plug the communications and power plug back into its connector, and replace the electronics **e**nclosure cover.

21) Make sure that the float clamp has been reinstalled.

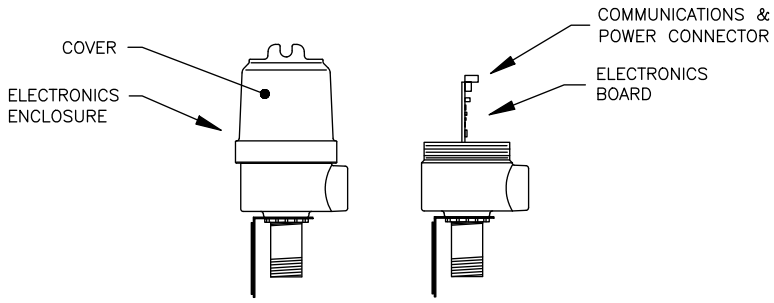
22) To reinstall, perform steps 6 through 1 in reverse.

4.3 Replacing the Sensor Assembly

The following procedure will instruct the user on how to change out the sensor assembly and then use the MasterLink software program to run the necessary test programs. For additional information when using MasterLink, click on the *Help* menu item on the main screen. Additionally, most of the individual screens have a *Help* button providing information for that screen.

1) Disconnect the power going to the LevelMaster.

2) Remove the cover from the electronics enclosure.

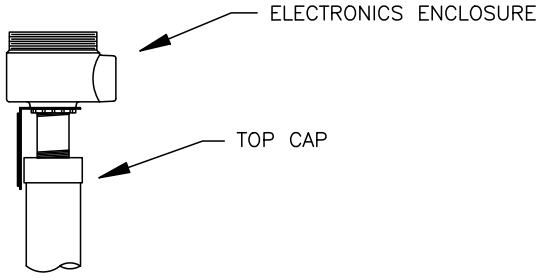


3) With a small screwdriver, remove the wiring from the communications and power connector. This may be one connector or two depending on the board. Make a note as to what wires went to what terminal number.

4) Remove the cable or conduit from the electronics enclosure.

5) Hold the electronics board by the edges and pull it slowly out. Unplug the 16-pin connector at the bottom of the board. Place the board in a safe place.

6) Remove the electronics enclosure down to and including the top cap. The user should be able to unscrew the whole assembly at the top cap. Either way, hold the sensor cable so that it does not twist when unscrewing the parts.



7) Remove the rectangular foam pad. This should be at the top of the casing, folded around the sensor. Save it to use with the new sensor assembly.

8) Take a hold of the cable tie that should be at the top of the sensor assembly. Use it to pull the assembly out far enough so that a hold can be established. Do not pull on the wire cable. Pull the assembly all the way out.

9) Insert the bottom of the new sensor assembly down through the top of the casing. Feed the assembly down until the end is within a few inches of the top of the casing and then use the cable tie to let the sensor down the rest of the way. The sensor assembly should bottom out, leaving the wire cable and connector sticking out of the top of the casing. Push the cable tie down out of the way.

10) Perform steps 7 through 2 in a reverse manner to reinstall.

11) Move to a safe area where the laptop computer and RS-485/RS232 converter can be connected to the RS-485 wiring.

12) Apply power to the LevelMaster.

13) Start the MasterLink program, and select the LevelMaster from the main screen.

14) Click on the *Setup LevelMaster* button.

15) Click on the *Setup* tab.

16) Click on the *Hardware Change* button.

17) Select the option "*I Just Installed a New Sensor Assembly*".

18) Click the *Next* button.

19) Read the message and then click the *Next* button.

20) The user should have received a new ***.dat*** file representing the setup data for the new sensor assembly. Enter its path and name, or use the *Browse* […] button to locate the file.

21) With the file in the window, click on the *Download Data to LevelMaster* button.

22) Click *OK* when finished.

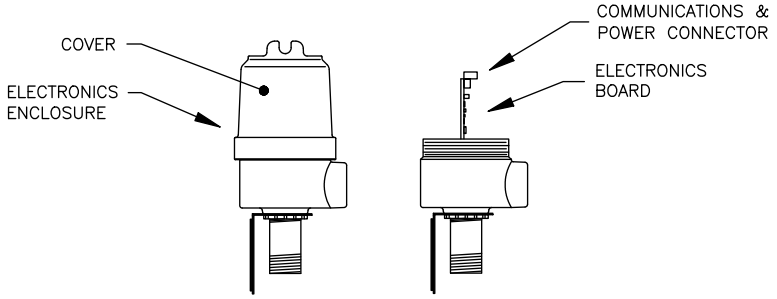
23) Select the *Monitor* tab to verify the temperature and tank level readings.

4.4 Moving a LevelMaster from One Tank to Another

The following procedure will describe how to prepare the LevelMaster for removal from a tank and installation in another tank. Use the MasterLink software package to run a test which will establish new offsets to match the LevelMaster to its new surroundings. For additional information when using MasterLink, click on the *Help* menu item on the main screen. Additionally, most of the individual screens have a *Help* button providing information for that screen.

1) Disconnect the power going to the LevelMaster.

2) Remove the cover from the electronics enclosure.

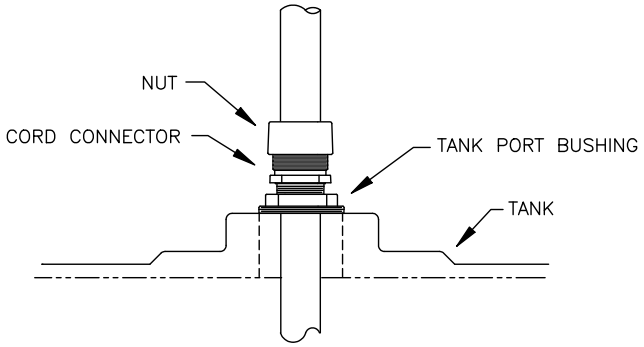


3) With a small screwdriver, remove the wiring from the communications and power connector. This may be one connector or two depending on the board. Make a note as to what wires went to what terminal number.

4) Remove the cable or conduit from the electronics enclosure.

5) Replace the cover of the electronics enclosure.

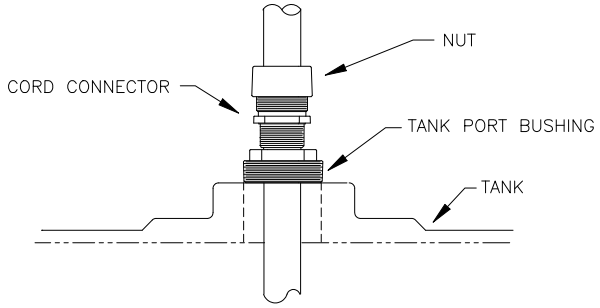
6) Loosen the nut on the on the cord connector. Unscrew the tank port busing and cord connector together. There is no cord connector on high pressure units.



7) The LevelMaster should now be ready to remove from the tank.

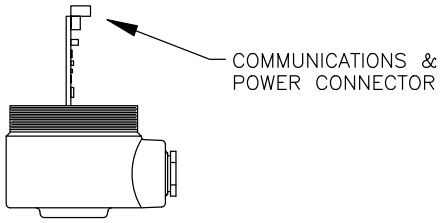
8) Lower the LevelMaster down through the hole in the new tank. Lower slowly, making sure the unit is vertical until it is resting on the bottom. If there is sludge in the bottom, the user may need to work the unit up and down a few times to reach the bottom.

9) Screw the tank port bushing into the tank port opening.



10) Tighten the nut on the cord connector. (Not applicable to high pressure units)

11) Plumb the cable or conduit into the electronics enclosure for the communications and power wiring. Connect the wiring to the communications and power connector.



12) See the *Wiring* section of the Installation chapter for wiring assistance.

13) Move to a safe area where the laptop computer and RS-485/RS232 converter can be connected to the RS-485 wiring.

14) Apply power to the LevelMaster.

15) Start the MasterLink program, and select the LevelMaster from the main screen.

16) Click on the *Setup LevelMaster* button.

17) Click on the *Setup* tab.

18) Click on the *Hardware Change* button.

19) Select the option that says *"I Just Moved the LevelMaster to a New Tank"*.

20) Click the *Next* button.

21) Read the message and then click the *Next* button. Follow the instructions

22) Click *OK* when done.

23) Select the *Monitor* tab to verify the temperature and tank level readings.

4.5 Troubleshooting a New Installation

In troubleshooting problems for a new installation, the user may naturally assume that the hardware worked properly when received, and that a mistake was incurred during the installation, setup or programming. This will differ slightly when troubleshooting an existing the location has already been functioning properly. So from this point, we first look at each area, beginning with the basics, power, wiring and then programming. The two main groups of startup problems are:

- Hardware
- Software

To help determine which type of problem(s) the user has and what to check, the following will help to narrow the problem.

Table 4—1 Troubleshooting New Installations

Error Condition	Check	Procedure
In the following procedure, specific wiring information is called by the common name for a component, followed by its jumper number (abbreviated J) and pin number. i.e., V-BATT, J4-1. If host hardware is a 6790 RTU, please locate the correct pins on the RTU termination board. If the host hardware is an XRC, please replace the J4 jumper number with the correct pins on the J6 jumper.		
Hardware Wiring	Board to T+ Wiring	Verify wiring from Host Hardware Board to LevelMaster Board (J1)Transceiver Assembly is correct. Verify Board jumper settings (JP1) are correct.
	Board to Barrier Wiring	Verify that host hardware board wiring to optional barrier board is correct.
	Barrier to Board Wiring	Verify that optional barrier board wiring to LevelMaster board is correct.
	Red Light on LM Board not Blinking during a Poll	Verify that T+ and T- Wires are not reversed.
	Compare Host voltage to LevelMaster voltage	If no voltage is received at the LevelMaster, the barrier may be blown. If the voltage received at the LevelMaster is greater than or less than the host voltage, the power side of the barrier may be blown. The newer CSA barriers exhibit a 1 volt drop from the host to the LevelMaster side. In older UL barriers, the ground may be fused and can show smaller or even greater voltage than the LevelMaster is providing. This is due to a "floating ground". The current (Ma) in these cases will be near zero. Continuity can be checked to trace parted

Error Condition	Check	Procedure
		power wire problems. Be sure to trace the wiring for polarity before supplying power.
	V-BATT Supply Voltage	Using a digital voltmeter, measure transceiver V-BATT power supply voltage between the following Host Hardware board J4 connector terminals. Switched voltage should be greater than 11.5 Vdc. J4-1 (GND [BLK]) and J4-2 (V-BATT)
FYI 	Power to transceiver can be provided from an external power supply. This allows the host to switch external power to the transceiver. Switching is accomplished using a 12VDC switch line connected to J4-3 (WHT). Refer to *Measuring SWVBATT Transceiver Supply Switch Voltage*. If this option is used, J4-2 (V-BATT) is not used.	
Hardware Wiring	Line Driver voltage	Using an oscilloscope or digital voltmeter, connect it to Host Hardware board J4 connector between the following terminals. Voltage should vary between +5 Vdc and 0 Vdc when communication data is being transmitted from CCU to XFC. J4-4 (BUS+) and J4-6 (BUS-)COM1 J4-12 (BUS+) and J4-13 (BUS-) COM2
	Request to Send (RTS) Voltage	Using an oscilloscope or digital voltmeter, connect it to XFC-195 board J4 connector between the following terminals. Voltage should be +5 Vdc when sending data to CCU. 0V when not transmitting. J4-1 (GRD) and J4-8 (RTS) COM1 J4-1 (GRD) and J4-14 (RTS) COM2 When RTS is high, transmitter must be keyed and transmitting data.
Is Host Hardware operating?	If no, check Battery Voltage	Verify battery pack voltage is at least 11.5 Vdc. See troubleshooting section of Host Hardware User's Manual.
FYI 	Power to the transceiver can be provided from an external power supply. This allows the host to switch the external power to the transceiver. Switching is accomplished using a 12VDC switch line connected to J4-3 (WHT). Refer to *Measuring SWVBATT Transceiver Supply Switch Voltage*. If this option is used, J4-2 (V-BATT) is not used.	
Annunciator Display	"R" (LevelMaster Protocol) not displayed	Protocol selected for the communication port may be incorrect. Configure the correct communication port.
	Wrong Position	Make sure the annunciator has the communications port displayed, not the LevelMaster
	Wrong Port Wired	Return to chapter 2 – Installation - Wiring section, locate and check wiring.
	No "R" is visible in the annunciators	Have not assigned the LevelMaster annunciator. Follow instructions for setting up the display.
Communication Port Configuration	During polling, the "R" is not replaced by an →	Depending on the baud rate, the user may not see both, but should see the "R" become at least one of these.

Error Condition	Check	Procedure
	and/or ←?	Make sure data parameters are set correctly for the unit. X Series unit? LevelMaster Request Block not downloaded to the Level subdirectory of the communications port. Older Unit? Check tank parameters: Tank Enabled? Duty Cycle off?
No float level, but temp. reads ok?	Check Power Source	Check the voltage of the power source; the sensor needs 8.5vdc to acquire a level reading. Temperature and communication requires only 5vdc. When using MasterLink and the LevelMaster test cable, the sensor is powered by the batteries on the cable. If the output voltage of the battery is below 8.5vdc, the sensor will not report a level; however, the sensor board will communicate with the MasterLink program, and a temperature will be reported

4.6 Troubleshooting Existing Installations

Troubleshooting techniques will vary slightly when the user has an installation that was previously working but now is not. In new installations, the user may naturally assume that the hardware worked properly when received and that a mistake was incurred during the installation, setup or programming. When the location has already been functioning properly, the user may assume that a catastrophic event has occurred to render it inoperable. From this point, first look at equipment failures caused by damage from an external source, i.e., a power surge caused by a storm.

The two main groups of problems are:

- Hardware
- Software

To help determine which types of problem(s) exist, here are some questions to narrow the problem down.

Table 4—2 Troubleshooting an Existing Installation

Error Condition	Check	Procedure
In the following procedure, specific wiring information is called by the common name for a component, followed by its jumper number (abbreviated J) and pin number. i.e., V-BATT, J4-1. If the host hardware is a 6790 RTU, please locate the correct pins on the RTU termination board. If the host hardware is an XRC, please replace the J4 jumper number with the correct pins on the J6 jumper.		
Is Host Hardware operating?	If no, check battery voltage	Verify battery pack voltage is at least 11.5 Vdc. See troubleshooting section of host hardware user's manual.
Check power	Check outbound voltage from Host Hardware	Using a digital voltmeter, measure transceiver V-BATT power supply voltage between the following Host Hardware board J4 connector terminals. Switched voltage should be greater than 11.5 Vdc. J4-1 (GND [BLK]) and J4-2 (V-BATT) See troubleshooting section of host hardware user's manual.
	Check inbound voltage at Barrier	Using a digital voltmeter, measure power supply voltage incoming from the host hardware on the RS-485 cable; at barrier, voltage

Error Condition	Check	Procedure
		should be greater than 11.5 Vdc. J1-2 (POWER -) and J1-1 (POWER +) Negative voltage indicates damage to RS-485 cable.
	Check outbound voltage at Barrier	Using a digital voltmeter, measure power voltage outbound from *Barrier* to LevelMaster; at barrier, voltage should be greater than 11.5 Vdc. J1-2 (POWER -) and J1-1 (POWER +) Negative voltage indicates damage to barrier. If the voltage received at the LevelMaster is greater than or less than the host voltage, the power side of the barrier can be blown. In older UL barriers, the ground may be fused and can show smaller or even greater voltage than the LevelMaster is providing. This is due to a “floating ground”. The current (Ma) in these cases will be near zero. Continuity can be checked to trace parted power wire problem. Be sure to trace the wiring for polarity before supplying power.
	Check inbound voltage at LevelMaster	Using a digital voltmeter, measure voltage incoming from host hardware on RS-485 cable; at LevelMaster, voltage should be greater than 11.5 Vdc. J1-1 (GND) and J1-2 (+12 VDC) Negative voltage indicates damage to RS-485 cable.
	Power received at LevelMaster	If power is received at LevelMaster board but board is still not functioning, this indicates the LevelMaster board is damaged.
Host Hardware LCD returned to Totalflow display	Software files	Most likely if the screen displays something similar to this: XSeries Flow Computer 2100xxx-xxx (COPYRIGHT) If this is the case, the system has cold started. This requires uploading configuration files from computer to host hardware. See user manual for host hardware and help files in host software.

4.7 Additional Troubleshooting

In addition to Table 4—1 Troubleshooting New Installations and Table 4—2 Troubleshooting an Existing Installation, Totalflow has built in additional tools for troubleshooting. Table 4—3 Error Messages (Ver. 5.015 – 5.018) discusses error messages that may be reflected in PCCU32 and MasterLink, along with information on locating the problem.

Another tool for troubleshooting is a tool provided in PCCU32 called *Tank Level Pass Through*. This feature allows the user to communicate directly with the LevelMaster, outside of the PCCU32 in Terminal mode. By using this feature, the user can communicate at a base level.

Table 4—3 Error Messages (Ver. 5.015 – 5.018)

Code	Level	Message	Troubleshooting Tip
0000	General	No errors	
0001	Float 0 (Oil)	Detection of broken primary coil.	Primary coil may be broken; use sensor test box to test primary winding.
0002	Float 0 (Oil)	No float, or float not recognized, or float battery dead, or float malfunction, or A to D Gain too low.	A to D gain may be too low; use test cable and the MasterLink program to increase the gain of the analog to digital converter. If this does not solve the problem, the top float may be malfunctioning. Remove sensor and replace float.
0003	Float 0 (Oil)	Float position out of range, float is not positioned in sensor range	The float is not positioned over the windings on the sensor; check that float is present on sensor or is not stuck at the top of the tank (casing), or if the tank is empty, the float may be at the very bottom of the casing and out of sensor range.
0004	Float 0 (Oil)	Analog to digital converter saturation (Gain too High), or sensor failure	Reading for the top float has saturated the analog to digital converter; reduce gain setting using the MasterLink program.
0005	Float 0 (Oil)	Level bias calculation error. Compensated value below 0” or above 655”, or wrong calibration file for this hardware (board/sensor).	Check the value entered for level offset for the top float, and assure it has been entered correctly.
0010	General	Broken primary coil.	Use LevelMaster, Sensor Test box to test primary coil.
0020	General	Measurement Error – Gain set too high or bad sensor element	Connect a laptop to the Sensor board, using test cable and using the MasterLink program, reduce the analog to digital gain. If reducing the gain does not eliminate the error condition, the sensor wiring may have failed. Use the sensor test box and test sensor primary and secondary windings. If neither of the above fixes the problem then the sensor PC board may be bad.
0030	General	Analog to digital converter saturation (Gain too High)	Reduce the analog to digital gain (after installation proximity of metal tank walls or other metal close to the sensor may increase sensor efficiency and gain may have to be reduced.
0100	Temp	No Temperature reading	If the level is reading correctly then the RTD may have failed, if so replace sensor.
0200	Temp	Calculated Temperature error value below 0 or above 255	Temperature is out of range.
1000	Float 1 (Water)	Detection of broken primary coil.	Primary coil may be broken use Sensor test box to test primary winding.
2000	Float 1 (Water)	No float, or float not recognized, or float battery dead, or float malfunction, or A to D Gain too low.	A to D gain may be too low, use test cable and the MasterLink program to increase the gain of the analog to digital converter. If this does not solve the problem, the bottom float may be malfunctioning; remove sensor and replace float.
2002	Float 1 (Water)	No Oil or Water float recognized (see code 2 and 2000)	
4000	Float 1	Analog to digital converter saturation	

Code	Level	Message	Troubleshooting Tip
	(Water)	(Gain too High), or sensor failure	
5000	Float 1 (Water)	Level bias calculation error. Compensated value below 0” or above 655”, or wrong calibration file for this hardware (board/sensor).	Check the value entered for level offset for the top float and assure it has been entered correctly.

4.7.1 Tank Level Pass Through

This feature allows the user to communicate directly with the LevelMaster, using the communications port. This feature, while accessed through PCCU32, operates outside of PCCU32 in the Terminal mode. By using this feature, the user can communicate at a base level and use the commands found in Table 4—4 Query Commands for TLPT to locate problems.

To begin using this feature, set the *Unkey Delay* to *1* in the communications port that is using LevelMaster protocol in PCCU32. Use the following procedure to enter the *Tank Level Pass Through* feature (TLPT). When finished with the queries, press the *ESC* key to exit.

1) Connect to an FCU/RTU

2) Click *OPERATE*.

3) Click *COMMUNICATIONS*.

4) Click *TERMINAL*.

5) Type *TLPT=1* (**T**ank **L**evel **P**ass **T**hrough Activate) for XSeries FCUs and RTUs

Type *TLPT=0* (**T**ank **L**evel **P**ass **T**hrough Activate) for 64XX and 67XX FCUs

6) Screen will return *LM>* (Now using LevelMaster protocol). Using the commands listed in Table 4—4 Query Commands for TLPT, press *return* after the query has been typed.

If no port is set to LevelMaster protocol, the following message will appear: *“No port protocol set to Level Master Interface”*.

7) The characters at the end are character return checks (CRC) to insure good communications. These start with “*C*” and can be ignored.

8) When finished using TLPT, use the *ESC* key to exit back to PCCU32.

Table 4—4 Query Commands for TLPT

Command	Description	Type Example	Read Example	Meaning Of Read
U**?	Return level(s), temperature, errors, warnings ANY ID Respond	U**?	U03D020.96D011.94F07 6E0000W000C5ac0	03 ID, 20.96” Oil, 11.94” Water, No Errors, CRC USE ONLY WITH 1 LM CONNECTED
Unn?	Return level(s), temperature, errors, warnings	U03?	U03D020.96D011.94F07 6E0000W000C5ac0	03 ID, 20.96” Oil, 11.94” Water, No Errors, CRC
U**N?	Return ID	U**N?	U03N03Cd746	03 ID, CRC

Command	Description	Type Example	Read Example	Meaning Of Read
UnnF?	Return # Floats	U03F?	U03F2C01f6	2 Floats, CRC
UnnOL?	Return Level Offset	U03OL?	U03OL+0079C0732	+.79 Offset, CRC
UnnV?	Return Firmware Version	U03V?	U03V5.018C09d3	5.108 Firmware, CRC
UnnEDn	Return EPROM Memory. 3 Blocks, enter 0,1,2, or 3	U03ED0	See Example 1 following table	All memory blocks. Used to check gain and others
U???	Return level(s), temperature, errors in TEST MODE, ANY ID	U???	See Example 2 following table	Shows raw values & other data, ie V0, V1 to check gain
Unn??	Return level(s), temperature, errors, warnings until power off	U03??	U03D020.96D011.94F07 6E0000W000C5ac0 (REPEATED)	Aid to trouble-shoot RS485 bus.
UnnNnn	Change ID	U03N00	U03N00NOKCOf11	ID change from 03 to 00, CRC
UnnFnROS	Change # floats	U03F1ROS	U03FOKC6f57	# Floats change OK, CRC

1.1.1.1 Example 1:

U03ED0

LM>U03ED0003 003 008 003 003 100 001 025 001 010 044 000 079 000 010 007
002 083 001 001 083 000 006 001 000 001 010 010 005 129 002 091
000 012 002 204 000 079 003 050 246 004 040 246 004 058 000 200
246 009 199 255 254 077 240 011 248 000 000 000 000 000 006 200
128 128 128 128 128 128 128 128 128 128 128 128 128 128 128 128
128 128 128 128 128 128 128 128 128 128 128 128 128 128 128 128
128 128 128 128 128 128 128 128 128 128 128 128 128 128 128 128
128 128 128 128 128 128 128 128 128 128 128 128 128 128 128 128
255 255 255 255 255 255 255 255 255 255 255 255 255 255 255 255
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255 255 255 255 255 255 255 255 255 255 255 255 255 255 255 255

1.1.1.2 Example 2:

U???

LM>_???V0=+00006 V1=-00708 V2=-00085 V3=-00802 AVG

V0=-06447 V1=+05155 V2=-06952 V3=-07166 PC00548 F0

V0=+07765 V1=+01656 V2=+04361 V3=+08909 PC00548 F1

V0=-06447 V1=+05155 V2=-06952 V3=-07166 5 7 S00557 L02285 021 F0

V0=+07765 V1=+01656 V2=+04361 V3=+08909 2 3 S00245 L01113 010 F1

R=10727 T1=10950 T2=10762 T3=10733 T4=10722 T5=10731

R=10728 T1=10955 T2=10760 T3=10733 T4=10722 T5=10731

R=10728 T1=10948 T2=10762 T3=10732 T4=10723 T5=10731

R=10727 T1=10950 T2=10763 T3=10736 T4=10722 T5=10730

R=10729 T1=10953 T2=10761 T3=10734 T4=10724 T5=10730

R=10728 T1=10955 T2=10763 T3=10734 T4=10722 T5=10728

R=10728 T1=10950 T2=10761 T3=10733 T4=10723 T5=10730

R=10728 T1=10950 T2=10765 T3=10733 T4=10726 T5=10730

R=10728 T1=10953 T2=10761 T3=10735 T4=10721 T5=10730

R=10727 T1=10953 T2=10763 T3=10735 T4=10723 T5=10731

DIST=022.93 TC=+000.00 F0

DIST=011.13 TC=+000.00 F1

U03D023.72D012.11F076E0000W0000Ca982

4.7.2 Testing tv azhe Sensor

The following information will take the user through the process of testing the LevelMaster sensor.

1) Remove the Killark conduit dome cover on the top of the LevelMaster sensor, and disconnect the green phoenix connector.

2) Remove the yellow fiberglass tension support and then lift the interface board out of the conduit housing.

3) Disconnect the ribbon cable.

4) Connect the sensor ribbon cable to the test box cable.

5) Set the ohmmeter to the 2K range and attach the leads to the test box.

6) Record the readings for future reference.

7) On the backside of the test box is a resistance table for different windings for each sensor. If the winding readings are +/- 5.0% of the resistance table on the backside of the test box, the sensor passes the test. If the test fails, the reading will normally be open or shorted wires. If this is the case, the sensor will need to be replaced.

8) Disconnect the ribbon cable from the test box cable, and reconnect the ribbon cable to the interface board.

9) Set the board in the conduit housing, and replace the yellow fiberglass tension support.

10) Reconnect the green phoenix connector.

11) Replace the Killark conduit dome cover.

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APPENDIX A 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 it’s 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.

TERM	DEFINITION
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.
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).

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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 x 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.
Analytical Module	The primary component of the NGC8200'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.

TERM	DEFINITION
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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 it’s 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.

TERM	DEFINITION
Butylene (C4H8)	A saturated hydrocarbon (Alkane) with four carbon atoms in it's 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.
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.

TERM	DEFINITION
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 NGC8200 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.
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.

TERM	DEFINITION
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 it's 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.
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.

TERM	DEFINITION
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).
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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
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 3rd 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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.

TERM	DEFINITION
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.
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 it's 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

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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 .
Flowmeter	A device used for measuring the flow or quantity of a moving fluid.

TERM	DEFINITION
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.

TERM	DEFINITION
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.
Gain	The factor by which a signal is amplified, sometimes expressed in dB.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.
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

TERM	DEFINITION
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.
Handshake	An interface procedure that is based on status/data signals that assure orderly data transfer as opposed to asynchronous exchange.

TERM	DEFINITION
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 it's 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 it’s 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 it’s molecule (C6H14). A liquid under normal conditions.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.

TERM	DEFINITION
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.
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 NGC8200 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 NGC8200 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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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 it's 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.

TERM	DEFINITION
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.
PID	Proportional, Integral, Derivative. A three mode control action where the controller has time proportioning, integral (auto reset) and derivative rate action.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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 it’s 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.
Restore	This refers to a Totalflow procedure in which all the Station or Configuration files are restored to the SDRIVE 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.

TERM	DEFINITION
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, 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
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.

TERM	DEFINITION
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.
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

TERM	DEFINITION
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 H2S.
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.

TERM	DEFINITION
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
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
Termination Panel	The NGC8200'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.
TFIO Module	Totalflow Input/Output module (i.e. quad AO)
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.

TERM	DEFINITION
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.
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.

TERM	DEFINITION
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.

TERM	DEFINITION
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.
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, 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.

TERM	DEFINITION
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.
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	WellTell Wireless product line. See WellTell Wireless.
XDCR	See External Transducer.

TERM	DEFINITION
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.

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APPENDIX B DRAWINGS SECTION

This section of the manual has been provided as a location for the user to place the drawings that accompanies the new Totalflow units.

Totalflow recommends that a complete set of all drawings that accompany a unit be placed in this section. This would ensure that the user have only drawings applicable to their units and drawings that are at the latest revision level.

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