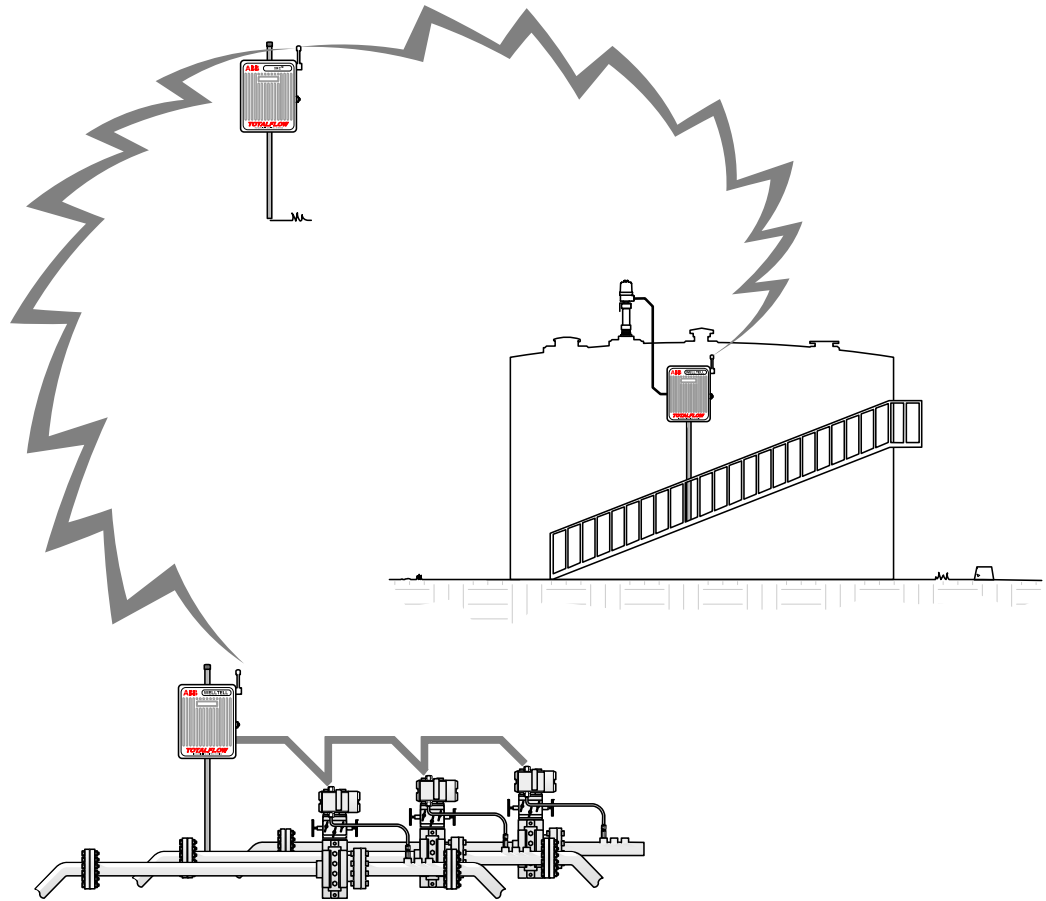# Totalflow® WellTell Wireless

User's Manual

TOTALFLOW
MEASUREMENT & CONTROL SYSTEMS

ABB

Intellectual Property & Copyright Notice

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Introduction

This manual is written to provide an experienced flow meter technician with the requirements necessary to install, setup and operate a Totalflow WellTell wireless product.

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 predefined styles and formatting provide help to adopt layout of the pages. Further description, see MS Word template user guide.

Chapter	Name	Description
1	System Description	Provides a description of the Totalflow, XRC^{G4} system components and specifications.
2	Mechanical Installation	Includes unpacking and detailed procedures for setup, installation and wiring.
3	WellTell Wireless Startup	Provides the user with detailed information required to setup and startup the system.
Appendix A	Radio Configuration and Test Protocols	Provides the user with information relative to implementation and test protocols.
Appendix B	PCCU Application Screens	Provides the user with information detailing information on PCCU screens.
Appendix C	4–20 MA Transmitter Specifications	Provides the user with detailed information about Totalflow's 4-20 MA requirements.
Appendix D	Definitions and Acronyms	Provides the user with information regarding the definition of acronyms and other Totalflow terms.

Getting Help

Totalflow takes pride in the ongoing support provided to customers. When a product is purchased, the user receives documentation which should answer any questions that arise; 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's 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 user's eye and draw 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 the user 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 the certification drawings shipped with this unit for specific guidelines. Extra copies of the certification drawings, referenced on the unit's name tag, can be obtained, free of charge, by contacting Totalflow Technical Support at the number listed in the "Getting Help" section.

Safety Guidelines

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

Safety First

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

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

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

WARNING 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 enclosure cover(s) in a hazardous location must follow guidelines stipulated in the Certification Drawings shipped with this unit.

- If unit is installed or to be installed in a hazardous location, technician must follow the guidelines stipulated in the Certification Drawings shipped with this unit.

- Access to unit via 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.

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

Equipment Markings

Protective ground (earth) terminal.

Grounding the Product

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

Operating Voltage

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

Danger From Loss of Ground

A grounding conductor may or may not be required depending on the hazardous classification. If required, any interruption of the grounding conductor inside or outside the equipment or loose connection of the grounding conductor can result

in a dangerous unit. Intentional interruption of the grounding conductor is not permitted.

Safe Equipment

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

Fuse Replacement

Fuses used on the WellTell wireless barrier product electronic boards are surface mounted, and not field repairable. WellTell I.S. boards must be returned to the factory for repair in order to maintain Intrinsic Safety Certification.

Positive temperature coefficient (PTC) devices are used for output and input circuit protection. These devices are self resetting when overload is removed.

If a known problem exists, the board should be sent in for repair or replacement.

1.0 SYSTEM DESCRIPTION

1.1 Overview

This section describes the Totalflow WellTell wireless product and discusses the advantages of using the WellTell wireless product. Chapter 1 also discusses the various system components (Host and Client) and how they are related. Product specification is also covered.

The Totalflow WellTell wireless product's main purpose is to replace expensive cable with robust and inexpensive radio links. Cable trenching presents several obvious drawbacks related to expense, inconvenience, maintainability and safety. Spread-spectrum radio technologies have made it possible to install low-cost, easily maintainable RF links between many of the system components. Trenching can be minimized, and in some instances, done away with entirely.

FYI — Setting up an application with the WellTell wireless product is no different than setting up the same application with cabling. The only thing that the user needs to watch out for is that they select the right registers. These registers can be found in the PCCU32 tree-view under I/O Subsystem.

The Totalflow WellTell wireless product is divided into Host (WellTell-X) and Client (WellTell-IO and WellTell-IS). Host and Client can be thought of as being the two ends of an RF link that replaces a length of cable. The Host, or master, will connect to an XFC/XRC/NGC platform via an existing COMM port. There are two types of Clients: a Wireless I/O (WellTell-IO) and a Wireless Barrier (WellTell-IS).

A single WellTell-X can support multiple remote Clients. A single XFC/XRC could have several WellTell-IO or WellTell-IS connected. The limiting factor is bandwidth through the WellTell-X as it tries to update values at a one second polling rate.

While a single WellTell-X can support multiple Clients, the COMM port supporting the WellTell-X host can only support one protocol. If the user has multiple Clients on a single Host, they must all be communicating using the same protocol.

The WellTell-IO supports two protocols: Modbus ASCII and Modbus RTU. The WellTell-IS is protocol independent. The WellTell-IS can support any of the protocols available in the Totalflow meters; however, all devices connected to the WellTell-IS must use the same protocol. As just mentioned, the COMM port supporting the WellTell-X can only use one protocol at a time.

1.1.1 WellTell-X (Host)

The WellTell-X is generally installed at an XFC (Flow Computer), XRC (RTU) or NGC equipment enclosure. The WellTell-X serves as the master.

1.1.2 WellTell-IS (Barrier Client)

The WellTell-IS is a simple protocol transport incorporating an RS-485 compatible Intrinsically safe (IS) barrier (i.e., LevelMaster applications or other RS-485 applications) as indicated by certification drawings provided with unit.

The WellTell-IS has a wide range of uses. One common application is providing an RF link to the LevelMaster products. The WellTell-IS can be mounted in Class I, Division 2, Group CD hazardous locations near or on top of the storage tank. The barrier output is connected via cable to the LevelMaster sensor board.

Installation must be according to certification drawings and national electrical code (NFPA 70). The WellTell-IS also has an on board solar panel compatible charging circuit to maintain the charge on a 12VDC lead-acid battery. LevelMaster protocol can be run over the wireless link between an XFC/XRC and the WellTell-IS to access LevelMaster data. The WellTell-IS will shut off power to the J6 port if it is not receiving data from the host to extend battery life.

1.1.3 WellTell-IO (I/O Client)

The WellTell-IO is a wireless Modbus transport offering the following I/O:

- 4 ea. DI/DOs
- 4 ea. AIs (0-5V or 4-20 mA)
- 2 ea. 100ohm RTD inputs
- 1 ea. AO (4-20 mA)

The WellTell-IO gives the operator the option of having extra I/O capacity and the ability to locate it some distance away from their XFC/XRC, all without having to trench and install cable. The WellTell-IO does not maintain any historical or calibration data. The WellTell-IO has an on board battery charger to maintain the charge on a 12VDC lead-acid battery.

The WellTell-IO has a simple I/O scanner that updates fixed Modbus registers.

1.1.4 WellTell Wireless Utility

The WellTell Wireless Utility (WWU) program is used to set up and configure Totalflow's WellTell wireless product. WWU is a program that runs on a laptop and allows the user to set up and configure the internal radios used by the WellTell Host and Clients.

1.2 WellTell Wireless Product General Specifications

	Specification
Certification	Class I, Division 2, Groups C & D hazardous area classification
Humidity	0–95% Non-Condensing
Mounting	Wall or pipe
Operating Temp.	-40° F to 140° F (-40 to 60°C)

1.2.1 Dimensions

Enclosure	Width	Height	Depth
6450	9.15" (23.24 cm)	10.23" (25.98 cm)	9.38" (23.83 cm)
6453	12.36" (31.39 cm)	14.88" (37.80 cm)	10.28" (26.11 cm)
6753	14.51" (36.47 cm)	18.88" (47.95 cm)	13.22" (33.58 cm)

1.2.2 Installed Depth

Enclosure	Pipe Mounted	Wall Mounted
6450	10.88" (27.64 cm)	10.13" (25.73 cm)
6453	11.78" (29.92 cm)	11.03" (28.02 cm)
6753	14.72" (37.39 cm)	13.97" (35.48 cm)

1.2.3 Enclosure

Enclosure	Weight (w/o battery)	Max Battery Capacity
6450	5.9 lbs (2.20k)	26 AH
6453	8.86 lbs. (3.31k)	26 AH
6753	29.0 lbs. (13.17k)	42 AH

1.3 AeroComm AC4490 1X1 Transceiver Specifications

Specifications	
Date Rates	Serial data rates up to 115.2Kbps
Power Consumption (Tx/Rx)	80/28mA
Channels	48
Frequency Band	902-928MHz
Output Power	0– 10mW
RF Range	Up to 1 mile
Oper. Temp. Range	-40 to +60°C

1.4 WellTell-X– 2102009 Board Specifications

DISPLAY SIDE

COMPONENT SIDE
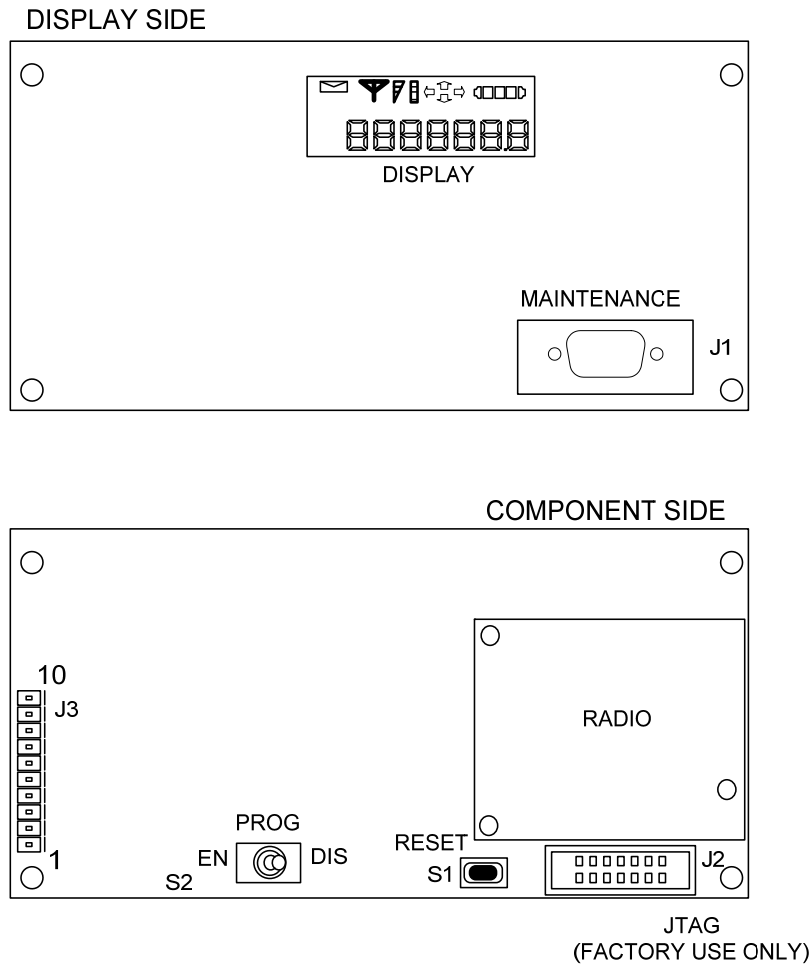
Figure 1–1 WellTell-X Assembly

Table 1—1 WellTell-X Specifications

Specifications	
Power	Power (+12VDC) is brought into the WellTell-X through connector J3.
Maintenance Connector (J1)	The maintenance connector (J1) supports downloading of a new Flash to the processor as well as radio setup.
Comm Ports (J3)	RS-485 communication is connected via J3. See J3 pin outs in the section, "WellTell-X Pin Outs".
Programming Switch (S2)	The programming switch, when enabled, permits downloading of a new Flash.
Reset Switch (S1)	Pressing the reset switch simply resets the processor (i.e., program counter goes to zero).
Available RAM	2KB on board the microprocessor.
Available FLASH	60KB on board the microprocessor.

Specifications	
Display	• Shows onboard data routing information. • Shows battery strength. • Shows signal strength. • SLEEP mode indication. • Displays data activity on various ports. • Displays network configuration information.
Power Management (Sleep Mode)	In an effort to minimize power consumption, the WellTell wireless product incorporates a Sleep mode. Sleep mode is entered whenever the battery voltage drops below the Sleep threshold. When the battery voltage drops below this level, the radio is powered down and the remaining hardware is placed in a low power mode. Sleep mode cannot be entered, regardless of battery voltage, if a device is connected to the maintenance port or Override mode is active. There are two situations that will take the unit out of Sleep mode: 1) the battery voltage is restored to a level above the Wake threshold; 2) a device is connected to the maintenance port.

1.5   WellTell-IS– 2102005 Board Specifications

Figure 1–2 WellTell-IS Assembly

Table 1—2 WellTell-IS Specifications

Specifications	
Battery (J4)	Power (+12VDC) is brought into the WellTell-IS through connector J4.
Charger (J5)	Charger connector could be a solar panel or an AC charger.
PCCU Connector (J3)	Supports radio setup software WellTell Wireless Utility (WWU). Also supports pass through communication mode for the LevelMaster.
Maintenance Connector (J1)	Supports everything the PCCU connector supports (see above). In addition, the maintenance connector supports some handshaking to allow downloading of a new Flash to processor.
JTAG Connector (J2)	Factory use only.
Programming Switch (S2)	The programming switch, when enabled, permits downloading of new Flash.
Available RAM	2KB on board the microprocessor.
Available FLASH	60KB on board the microprocessor.
XBT1 (only available in the -002)	Lithium cell provides power for the processor and its internal real-time clock. If main power is lost, the main processor will recognize this power loss and enter a low power mode (turns off radio, goes into idle loop and drops processor speed to 32KHz). The lithium cell allows the processor (and its real-time clock) to continue running in low power mode. This allows any programmed polling window to be preserved between the Host and the Client.
Lithium Enable/Disable (J10)	This jumper disables/enables the lithium backup.
RS-485 Termination (J9)	Disabled: if first or intermediate unit of several devices on 485 bus. Enabled: if first and only unit, or last of several units on 485 bus.
I. S. Barrier	The WellTell-IS provides intrinsically safe power and RS-485 (Bus + and Bus -) communication.
Display	• Shows onboard data routing information. • Shows battery strength. • Shows signal strength. • SLEEP mode indication. • Displays data activity on various ports. • Displays network configuration information.
Power Management (Sleep Mode)	In an effort to minimize power consumption, the WellTell wireless product incorporates a Sleep mode. Sleep mode is entered whenever the battery voltage drops below the Sleep threshold. When the battery voltage drops below this level, the radio is powered down and the remaining hardware is placed in a low power mode. Sleep mode cannot be entered, regardless of battery voltage, if a device is connected to the maintenance port or Override mode is active. There are two situations that will take the unit out of Sleep mode: 1) the battery voltage is restored to a level above the Wake threshold; 2) a device is connected to the maintenance port.

1.6 WellTell-IO– 2102007 Board Specifications
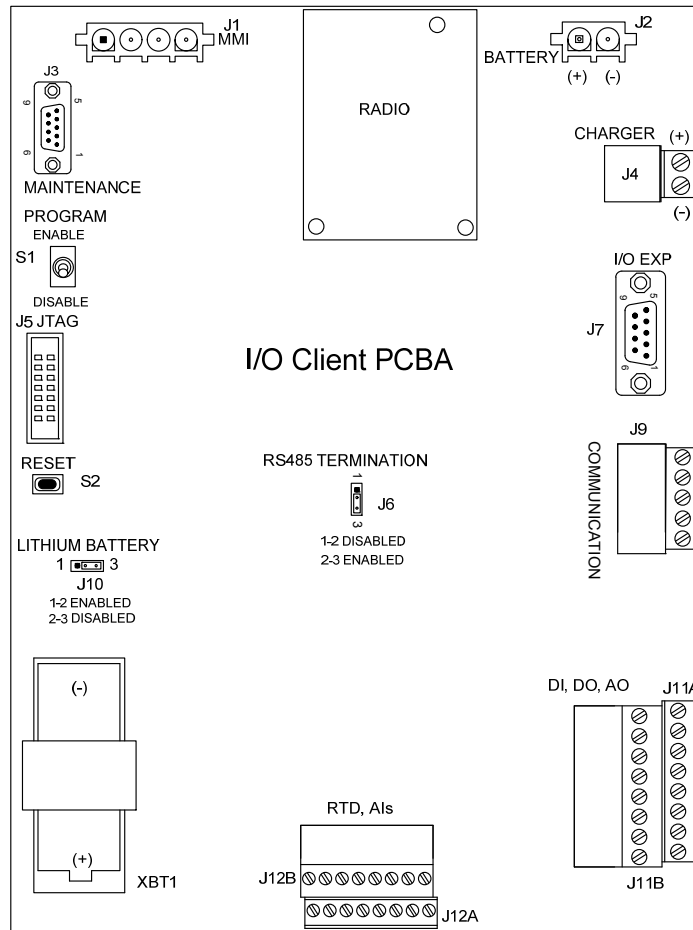
Figure 1–3 WellTell-IO Assembly

Table 1—3 WellTell-IO Specifications

Specifications	
Modbus Register Mapping	All the I/O associated with the WellTell-IO (i.e. DI, DO, AI, etc.) is mapped to fixed Modbus registers.
External Power (J9)	Power available for external 12VDC devices: • J9-1 VBAT (12VDC-2.5A) • J9-2 SWVBAT (12VDC-2.5A) • J9-5 GND
RS-485 Communication	J9-3 BUS + J9-4 BUS -
RS-485 Termination (J6)	Disabled: if first or intermediate unit of several devices on 485 bus. Enabled: if first and only unit, or last of several units on 485 bus.
Battery (J2)	Power (+12VDC) is brought into the WellTell-IO through connector J2.
Charger (J4)	Charger connector could be a solar panel or an AC charger.
Memory	32K Flash. This Flash can be used to store any historical data that might be collected at a later time.

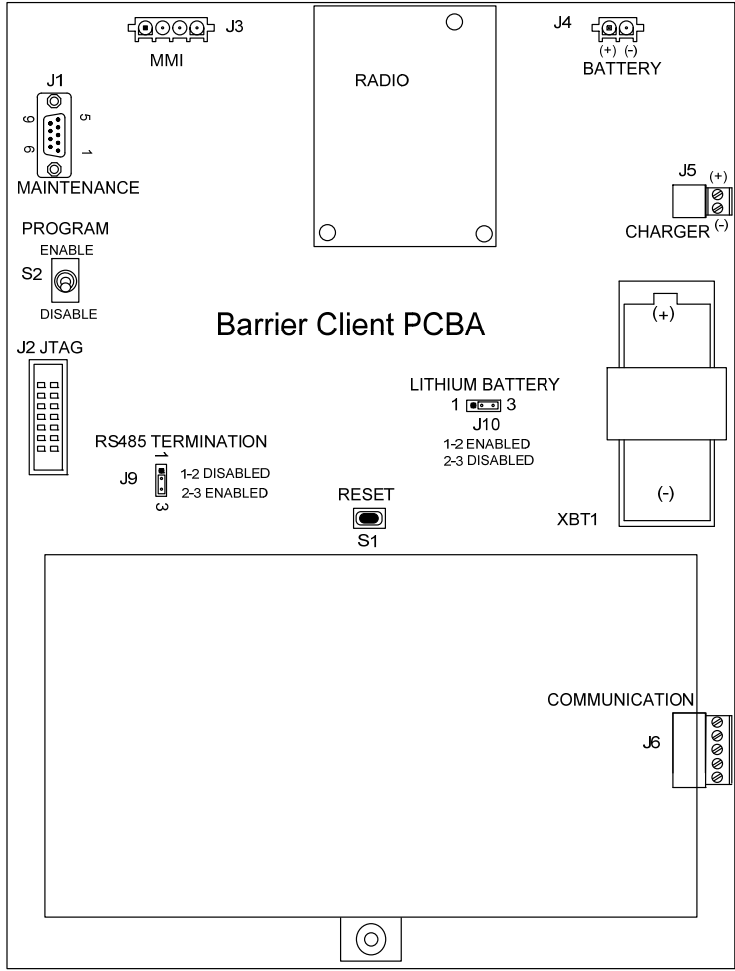| Specifications	
PCCU Connector (J1)	Supports radio setup software WellTell Wireless Utility (WWU).
Maintenance Connector (J3)	Supports everything the PCCU Connector supports (see above). In addition, the maintenance connector supports some handshaking to allow downloading of new Flash to processor.
JTAG connector (J5)	Factory use only.
Programming Switch (S1)	The programming switch, when enabled, permits downloading of new Flash.
Reset Switch (S2)	Pressing the reset switch simply resets the processor (i.e., program counter goes to zero).
Available RAM	2 KB on board the microprocessor.
Available FLASH	60 KB on board the microprocessor.
Display	See information under "Functions of WellTell Wireless Product".
XBT1 (only in the -002 model)	Lithium cell provides power for the processor and its internal real-time clock. If main power is lost, the main processor will recognize this power loss and enter a low power mode (turns off radio, goes into idle loop and drops processor speed to 32 KHz). The lithium cell allows the processor (and its real-time clock) to continue running in low power mode. This allows any programmed polling window to be preserved between the Host and the Client.
J10 Lithium	This jumper disables/enables the lithium backup.
I/O Function Support	The WellTell-IO supports an assortment of on board I/O: • 4ea. DI/DO (programmable as DI or DO) • 4ea. AI (programmable as 0-5 VDC or 0-20 mA) • 2ea. 100 Ohm RTD inputs • 1ea. AO (4-20 mA)
I/O Expansion (J7)	I2C bus connection (same as on X-series meters). This connector provides power and communications to any TFIO modules that have been added to the configuration.
Display	• Shows onboard data routing information. • Shows battery strength. • Shows signal strength. • SLEEP mode indication. • Displays data activity on 1 various port. • Displays network configuration information.
Power Management (Sleep Mode)	In an effort to minimize power consumption, the WellTell wireless product incorporates a Sleep mode. Sleep mode is entered whenever the battery voltage drops below the Sleep threshold. When the battery voltage drops below this level, the radio is powered down and the remaining hardware is placed in a low power mode. Sleep mode cannot be entered, regardless of battery voltage, if a device is connected to the maintenance port or Override mode is active. There are two situations that will take the unit out of Sleep mode: 1) the battery voltage is restored to a level above the Wake threshold; 2) a device is connected to the maintenance port.

1.7 WellTell Wireless Product LCD Standard Displays

The LCD display has two rows of displayed data. The top row contains all annunciator symbols. The bottom row has both annunciators and alpha/numeric information (see Figure 1–4).
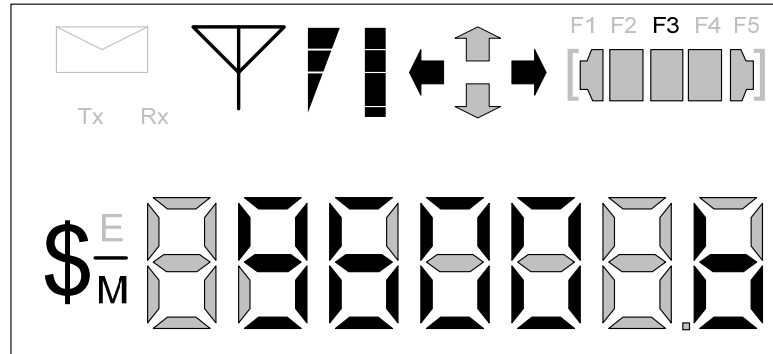
Figure 1–4 Standard Display

Table 1—4 Standard Display Descriptions

Display	Description
Standard Displays (Annunciators)	
Envelope	Indicates "Snoop" mode (i.e., processor is 'snooping' the data stream).
Tx/Rx	Indicates activity on the processor's UART port.
Antenna	The Host Server annunciator is always on. The Client is only on when the Client is 'synced' to a Host.
Signal Strength	A three section "progress bar" indicating incoming signal strength between the Host and the Client.
Battery Strength	A four section "progress bar" indicating remaining battery power.
Arrows	Next are four arrows. An up and down arrow and a left and right arrow. These arrows describe the routing matrix of the WellTell wireless product. This routing matrix connects the microprocessor (also referred to as the maintenance port) to either the radio or to the RS-485 device port. In Pass Through mode the device port is connected directly to the radio while the Microprocessor can be enabled to "Snoop" data from either the device port or the radio. More on this topic can be found in the WWU Help files. - When the UP arrow is on, this states that the microprocessor can snoop the device port. If the UP arrow is not on, the microprocessor can snoop the radio. Snoop is only operational in Pass Through mode (i.e., the Left and Right arrows are lit). - When the DOWN arrow is on, this states that the microprocessor is being connected in the routing matrix. - The RIGHT arrow being on depicts the radio being connected in the routing matrix. - LEFT arrow being on depicts device port (RS-485) being connected in the routing matrix. An example of the routing matrix might be having the Device Port (RS-485) connected directly to the Radio (Pass Through mode). In this configuration, the LEFT and RIGHT arrows would both be on.
F1-F5 Annunciators	F1 I. S. Barrier Client indicator F2 I/O Client indicator F3 Host Server indictor

Display	Description
	F4 Reserved for future use F5 Test mode indicator
[ ] Right and Left Brackets	Indicates activity on the maintenance (processor) port.
$	Always active on the Host and inactive on the Clients.
M	Activates whenever a cable is connected to the maintenance port.
_	The 'dash' or 'underscore' is the system heartbeat. It blinks off and on continuously. The blinking slows whenever the radio is dead or not connected.
Description of Standard Displays (Alpha/Numeric Portion)

Display	Description	
SLEEP		When power drops below 10.5 VDC, the Host server detects the low voltage and enters a "SLEEP" mode.
b	Ex: 9600 b	Baud rate displayed in numeric section.
n	Ex: n 1	Network ID displayed in numeric section.
ch	Ex: ch 2	Channel displayed in numeric section.
b	Ex: b 12.3	Battery voltage displayed in numeric section.
t	Ex: t 72.1	Temperature displayed in numeric section.
I/O and Barrier Client (Not Applicable to the Host Server)	
c	Ex: c 0	Charger voltage.
L	Ex: L .5	Lithium cell voltage.
Barrier Clients Only (Not Applicable to the Host Server or the I/O Client)	
o	Ex: o .0	Overload voltage.
i	Ex: i .0	Intrinsically safe voltage.
S	Ex: S 4.5	Supply voltage supervisory.

2.0 MECHANICAL INSTALLATION

2.1 Overview

This section provides the user with the information for installation and setup. By the time the section is finished, the user has the WellTell wireless product unpacked, installed, field wired and ready for operation. For safe and trouble free installation, follow all instructions and advisories.

FYI Read through this section before beginning the installation, and plan the installation. Also before beginning, refer to the wiring diagrams delivered with the new WellTell wireless product.

2.2 Unpacking and Inspection

2.2.1 Unpacking

The WellTell wireless product is shipped in a specially designed shipping carton which contains the unit, mounting brackets, parts list, wiring and interconnect diagrams. The solar panel and the battery pack with applicable hardware are shipped in a separate carton. Carefully remove the items from each carton.

2.2.2 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 unit exterior for dents, chipped paint, etc.
- Inspect the LCD window for damage.
- Open the housing by first removing the bolt and releasing the latch/latches.
- Visually inspect the digital PC board, cables and connectors for damage.

2.2.3 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.

2.3 WellTell Client Pipe Mount Mechanical Installation

If installing directly to the meter run, use this procedure. Before beginning, review the procedure and the materials required for installation. See Figure 2–1 through Figure 2–3 for installation dimensions.

2.3.1 Optionally Supplied Materials

- Two U-bolts plus fastening hardware.
- Enclosure mounting brackets and fastening hardware.

2.3.2 Materials Not Supplied

- One pipe saddle.
- One 40-inch, 2-inch pipe.

FYI   Optional equipment may be ordered from Totalflow.
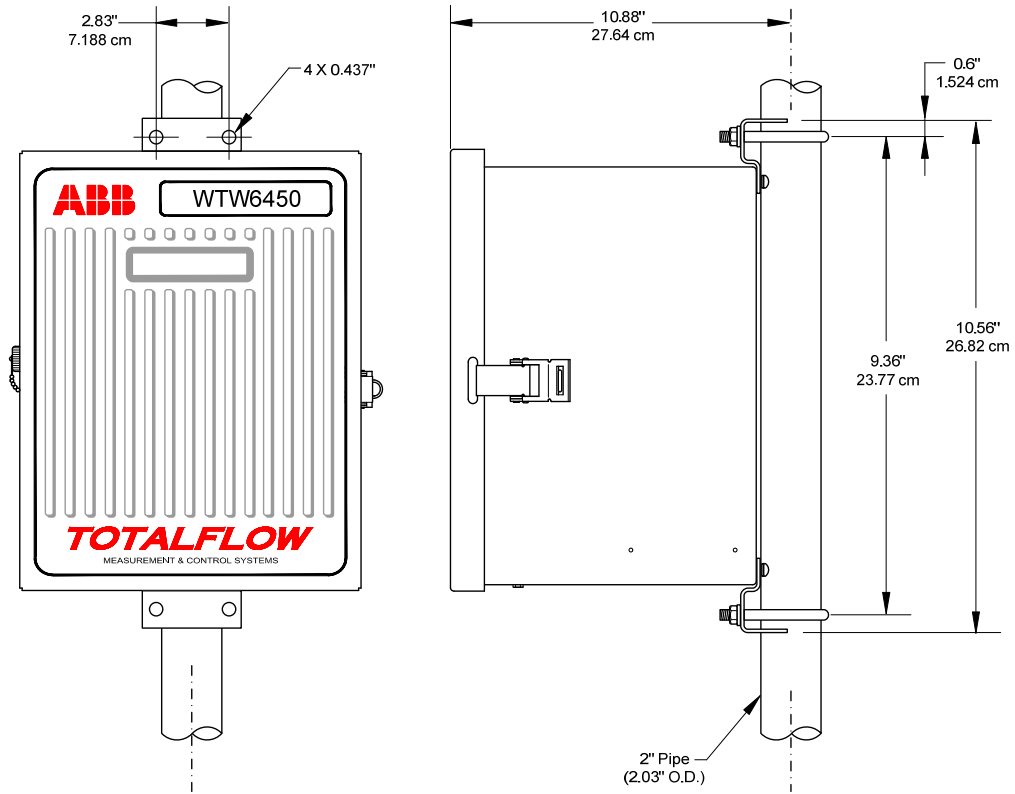
Figure 2–1 6450 Enclosure–Pipe Mounted
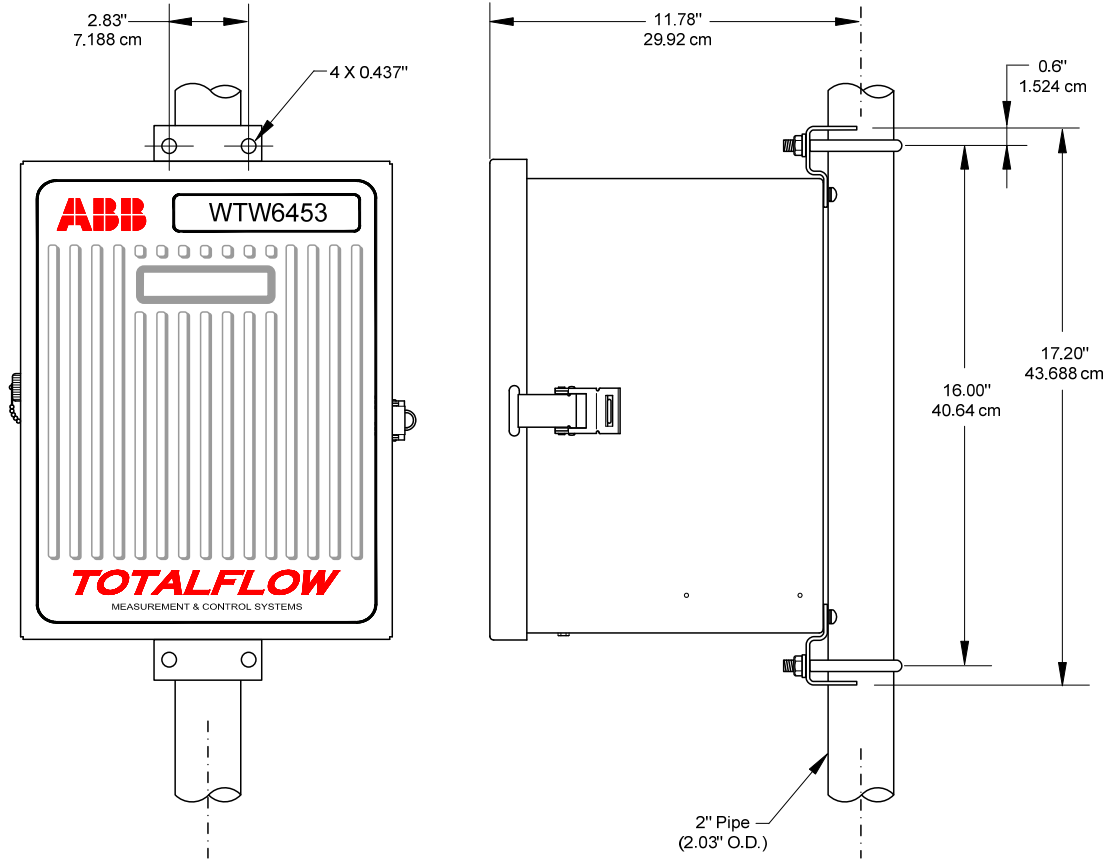
Figure 2–2 6453 Enclosure–Pipe Mounted
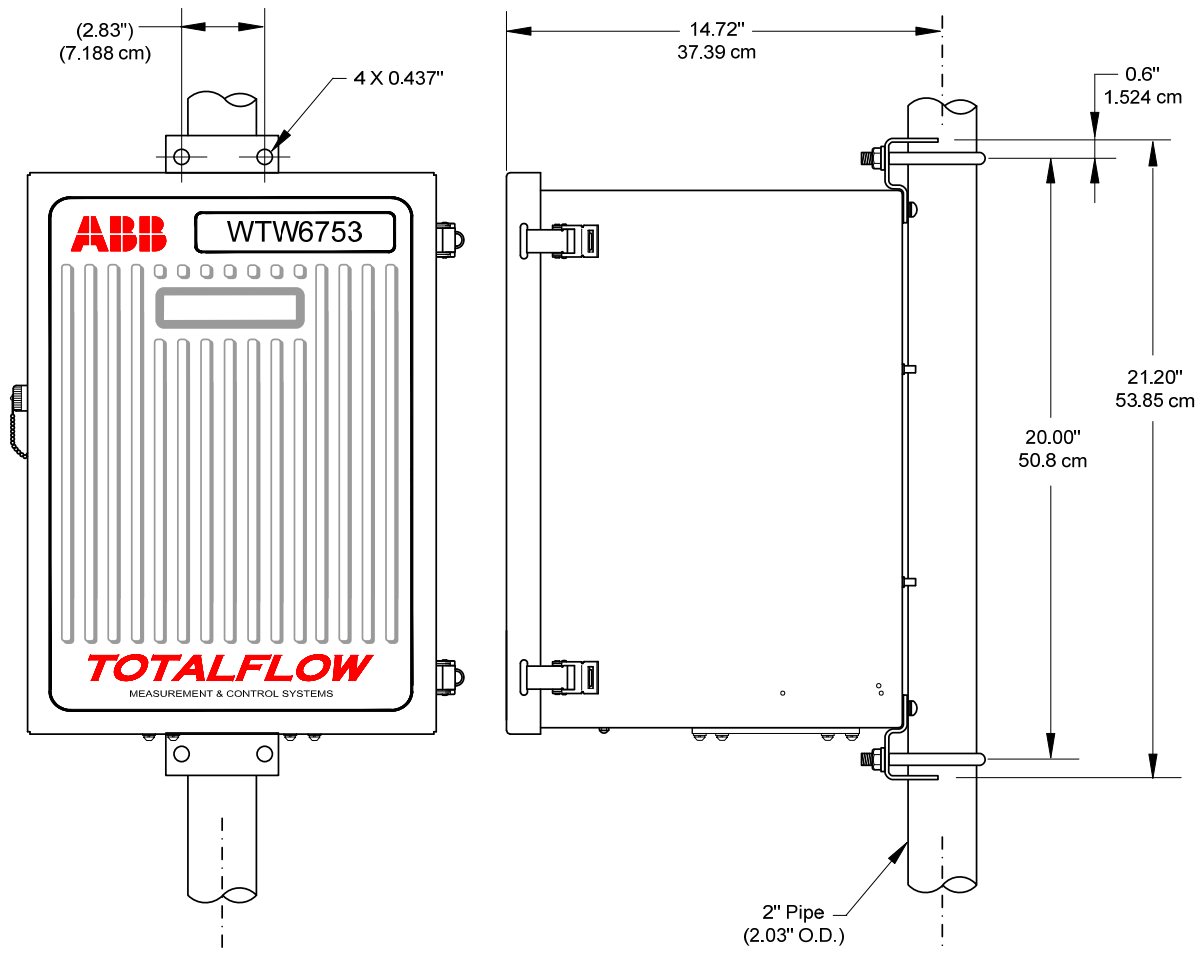
Figure 2–3 6753 Enclosure–Pipe Mounted

2.3.3   Instructions

FYI   The following procedures are to be followed when installing a WellTell wireless product client on a 2" mounting pipe. To install the WellTell wireless product client, it is recommended that two people perform the installation. One to hold the unit in position and the other to install and tighten in a manner consistent with the user's company policy.

1)   Position pipe saddle on meter run (see Figure 2–4). Select a location that allows easy user access and is close to the equipment.

2)   Temporarily attach saddle on meter run pipe using U-bolt and associated hardware.

3)   Screw 2" by 40" mounting pipe into saddle. Place level against pipe and vertically align. Adjust pipe, mounted in saddle, until vertical alignment is achieved.

4)   After vertical alignment, securely tighten 2" by 40" pipe in the saddle and then securely tighten saddle mounting bolts. Be certain pipe is securely installed in saddle.

5) Attach mounting bracket to back of enclosure using screw with a flat and split washer.

6) Situate the enclosure in position on the 2" mounting pipe, and secure in place with two U-bolts, flat washers, lock washers and two 9/16" bolts, as shown in Figure 2–5.
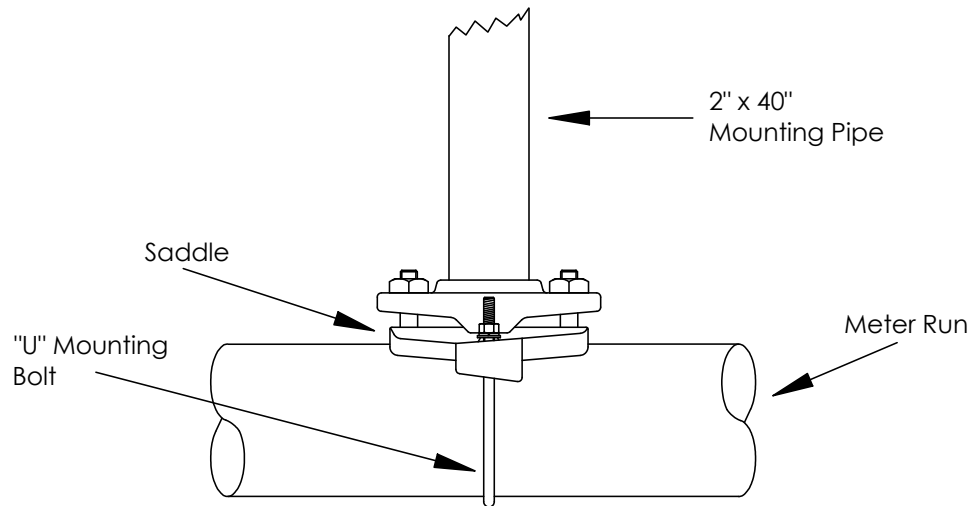
Figure 2–4 Typical Pipe Saddle Installation
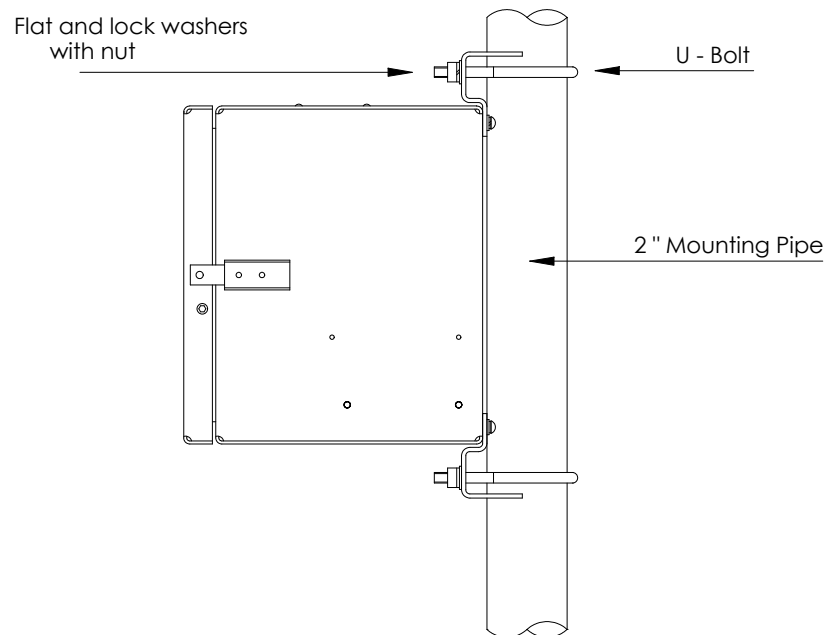
Figure 2–5 Pipe Mounted Enclosure

2.4 WellTell Client Wall Mount Mechanical Installation

If installing to a wall near the meter run or inside a meter shed, use this procedure. Before beginning, review the procedure and the materials required for installation. Refer to the outline drawing for mounting dimension requirements.

2.4.1 Optionally Supplied Materials

- Two U-bolts w/ fastening hardware (not used for wall mounts).

- Enclosure mounting brackets and fastening hardware.

2.4.2 Materials Not Supplied

- Four lag bolts or appropriate material to attach to wall.

CAUTION

If the WellTell wireless product enclosure is to be wall mounted, the wall itself should have sufficient strength to support the hanging weight of the unit.

There should be no obstruction(s) that would prevent the WellTell wireless product door from being opened to access interior installed components or to interfere with installation of the solar panel or other charging power sources.

2.4.3 Instructions

1) Refer to the Figure 2–6 through Figure 2–8 WellTell wireless product outline drawings, and drill mounting holes in wall supports.

2) Install mounting brackets on back of product enclosure.

3) Lift and align WellTell wireless product wall mounting brackets with mounting holes drilled in wall.

4) Insert 1/4" x 1/4" diameter machine bolts through WellTell wireless product mounting brackets into wall. Securely tighten all bolts to secure unit to wall.
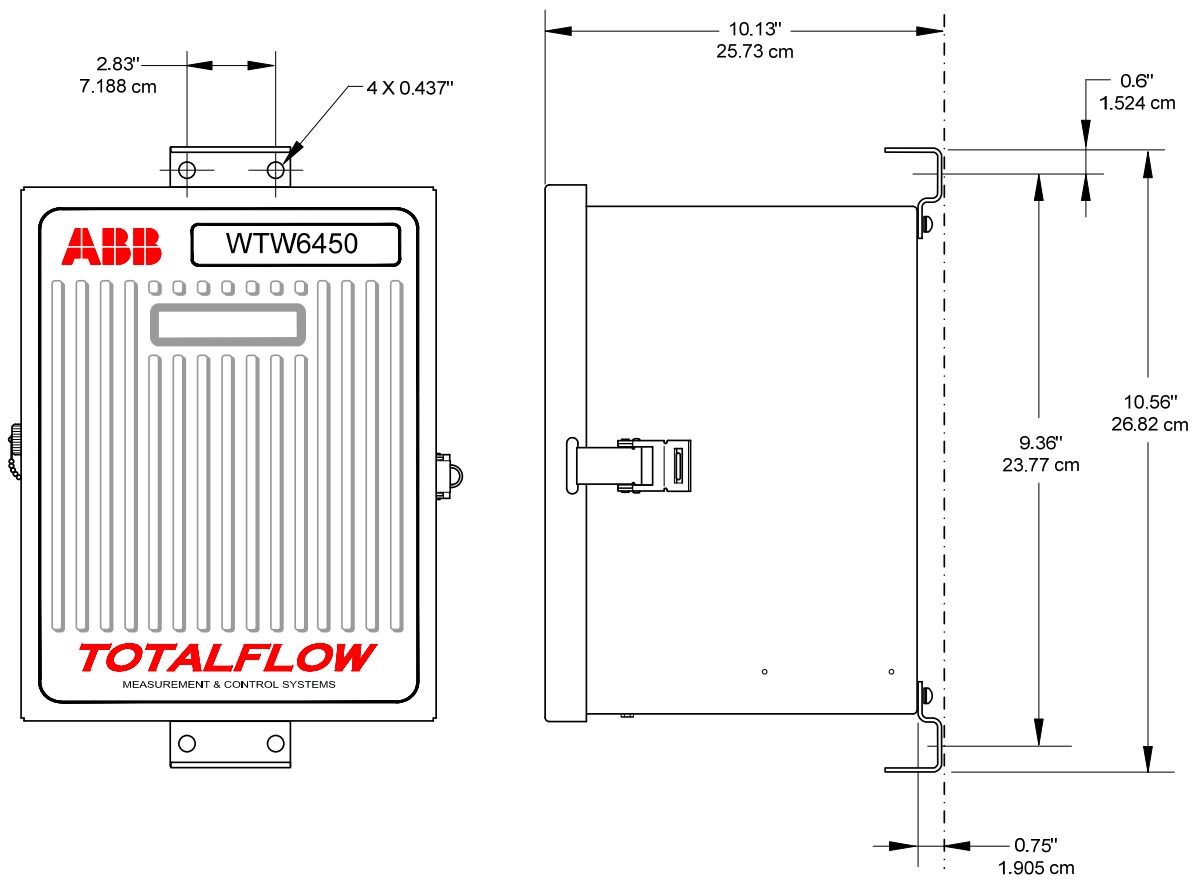
Figure 2–6 6450 Enclosure–Wall Mounted
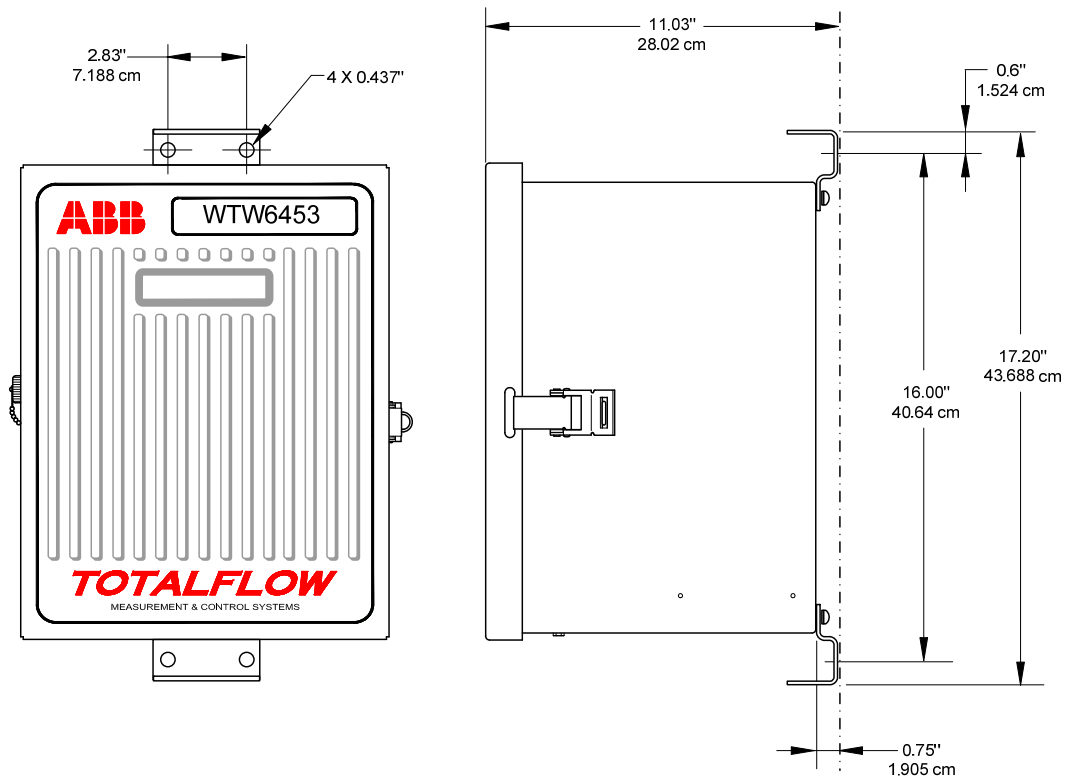
Figure 2–7 6453 Enclosure–Wall Mounted
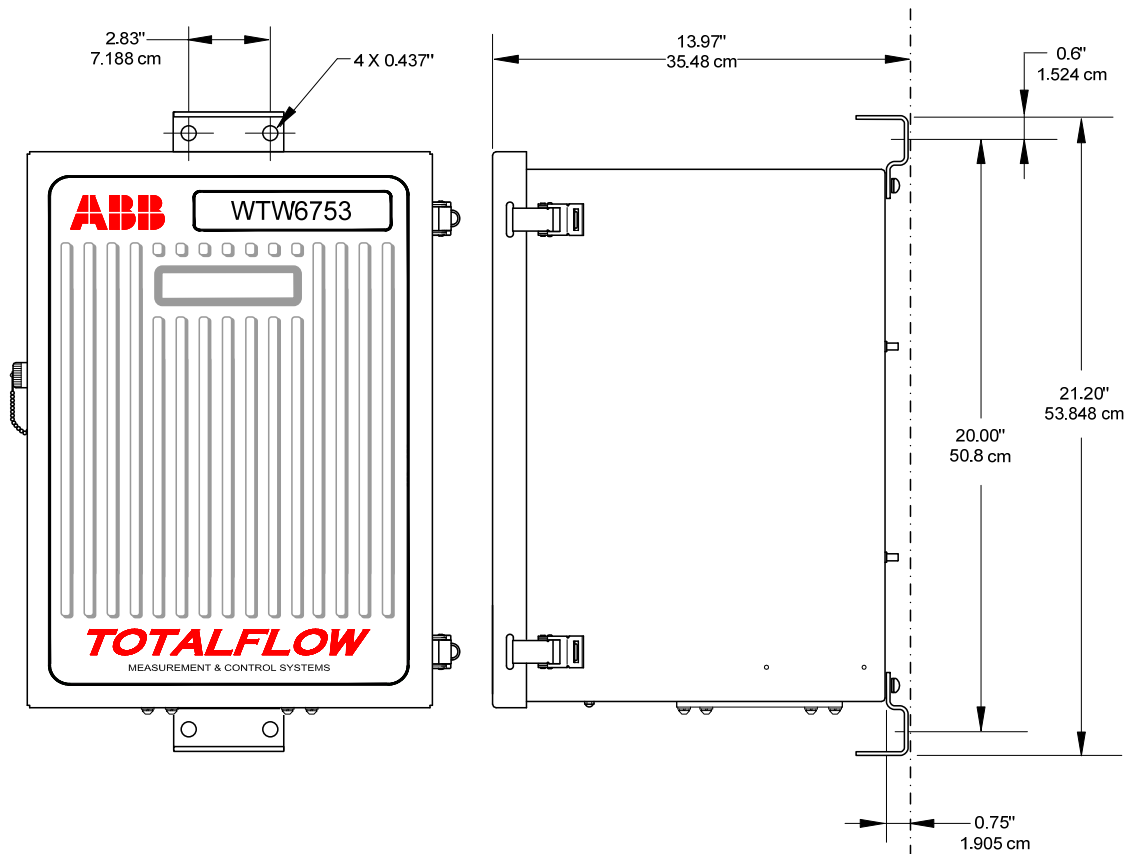
Figure 2–8 6753 Enclosure–Wall Mounted

2.5 Solar Panel Installation

The solar panel is designed for outdoor mounting on a 2" extension pipe installed on the upper end of the 40" mounting pipe, as shown in Figure 2–9. Solar panel must be mounted within 12 feet of the WellTell wireless product (other cable lengths available). For wall mounting, it can be mounted on top or side of the meter house.

CAUTION | Do not connect solar panel power cable to the WellTell wireless product unless main battery pack has been connected.

FYI | If installation procedures are required for mounting the solar panel on the top or side of the meter house, the user should contact Totalflow's service department.

2.5.1 Procedure

The standard solar panel must be mounted within 12 feet of the WellTell wireless product. For solar panel mounting, the following materials are required:

2.5.1.1 Materials Supplied

- One solar panel
- Two U-Bolts and fastening hardware
- Solar panel cable (Standard is 12', other lengths are available)

- Solar panel mounting bracket (if not already attached to Solar Panel)

2.5.1.2   Materials Not Supplied

- Cable ties
- One 9-inch extension of 2-inch pipe or other suitable length of pipe, threaded on one end
- One 2-inch coupling

CAUTION Exercise caution when installing solar panel so as not to damage it. When mounted, the solar panel faces up from the horizon at a 50° angle.
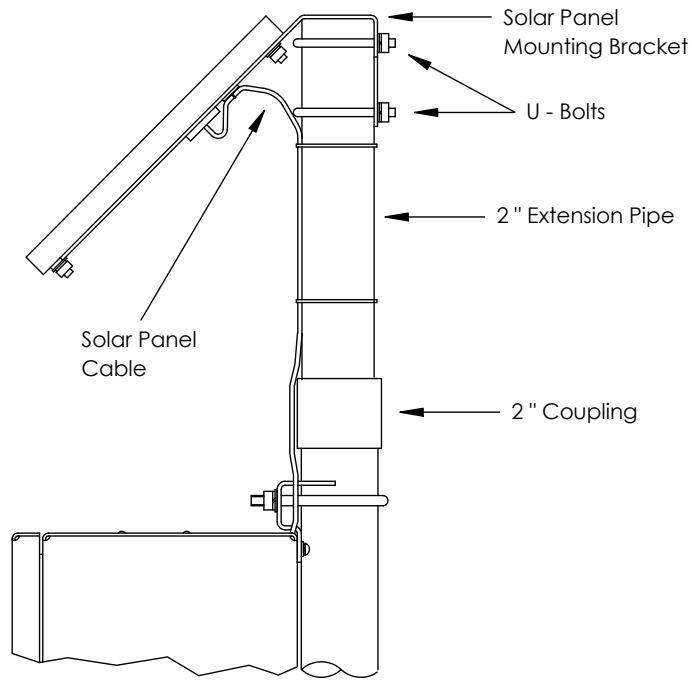
Figure 2–9 Typical Solar Panel Installation

2.5.2   Instructions

1) Attach 2" pipe coupling to top end of the 40" mounting pipe. Securely tighten.

2) Install 2" pipe extension into coupling, and securely tighten.

3) Check solar panel using digital voltmeter to verify polarity and output voltage. Voltage will vary depending on amount of sun, angle to sun, etc.

4) Install solar panel on mounting bracket, if required, with provided hardware. Install solar panel cable, if required.

CAUTION DO NOT connect other end of solar panel cable to WellTell wireless product until instructed to do so.

5) Attach solar panel mounting plate to top end of 2" extension pipe with U-bolts and associated mounting hardware. Do not tighten U-bolts until solar panel has been correctly orientated.

6) For northern hemispheres, position solar panel facing south. For southern hemispheres, position solar panel facing north. For optimum charging, solar panel should not be in shadows for the majority of the day. Panel should be kept clean for maximum charging.

CAUTION Do not connect solar panel power cable to the WellTell wireless product unless main battery pack has been connected.

WARNING Installation in classified hazardous locations must follow instructions given on the certification drawing listed on the product nameplate and all national and local electrical codes.

7) The solar panel power cable is connected to the WellTell wireless product digital board charger terminals. Insert solar panel power cable through an access hole on side of case. Allow enough power cable to extend into the WellTell wireless product enclosure for cable connection to charger +/- termination. Pay attention to the polarity. It is clearly marked on the board.

8) Before making connections to terminal block, trim wire ends back 1/4", and remove associated terminal block (charger) from digital board.

9) Loosen terminal block securing screws, insert wire then retighten. Connect solar panel (+) lead to + terminal and (-) wire to - terminal. Verify main battery pack is connected, and then reinstall terminal block with wires attached to charger connector.

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

2.6 WellTell-IO Wiring Instructions

This section discusses the I/O on the WellTell-IO. I/O specifications, wiring and pin outs are also covered (see Figure 2–10 and Figure 2–11).

As mentioned earlier, the WellTell-IO supports several varieties of I/O. Four digital inputs and outputs are available, as well as four analog inputs (programmable for 0-5V or 4-20 mA), two 100Ω RTD input and an analog output (4-20 mA).

WARNING All devices connected to the WellTell-I/O terminals must be wired according to the certification drawing referenced on the product nametag and national and local electrical codes.
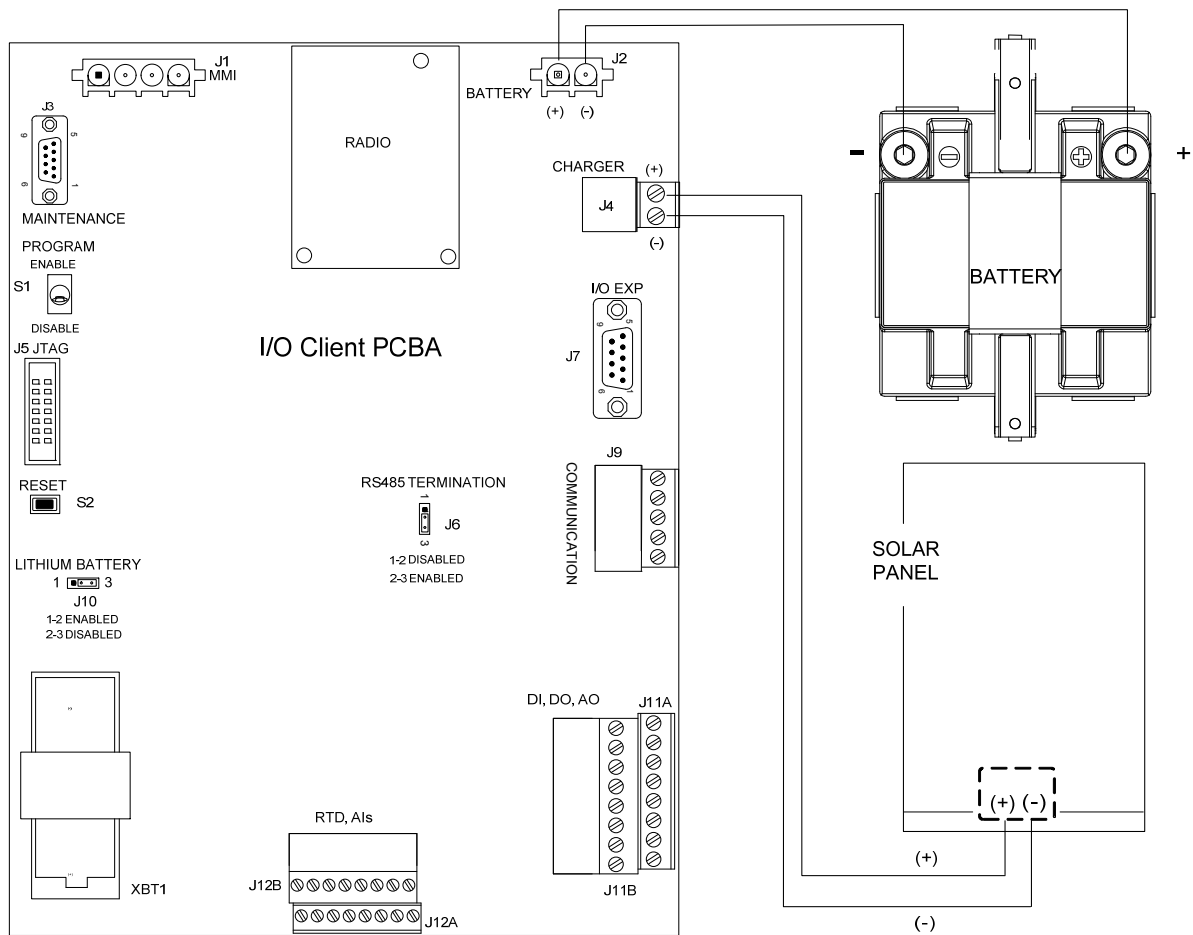
Figure 2–10 WellTell-IO Client Power
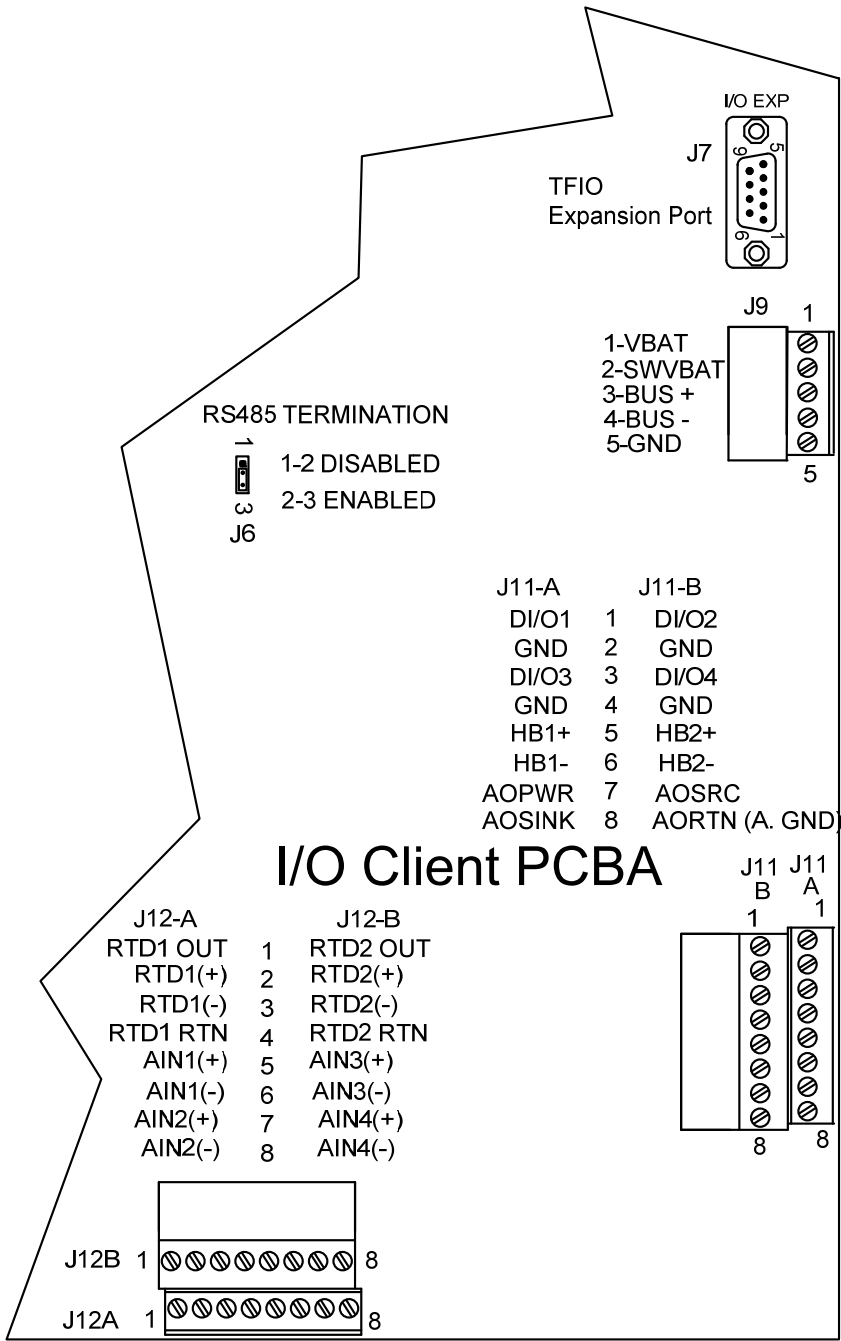
Figure 2–11 Pin Outs for the WellTell-IO

2.6.1   Analog Output (4-20 mA)

The WellTell-IO supports one analog output (AO).This point can be configured to either sink or source 4-20 mA signal using either an internal or external power source.

Table 2—1 Analog Output Specifications

Specifications	
Electrical (each point)	Maximum allowable voltage range on VDC source. I sink or I source: 26.5 VDC(VDC common is essentially System Ground).
Power Source	Maximum External: 26.5 VDC Minimum Load Resistance: 0 Ohms (Internal/External Power) Maximum Load Resistance: 350 Ohms (Internal Power) Maximum Load Resistance R_{MAX}: (VDC External - 4) X 50 (Calculated)
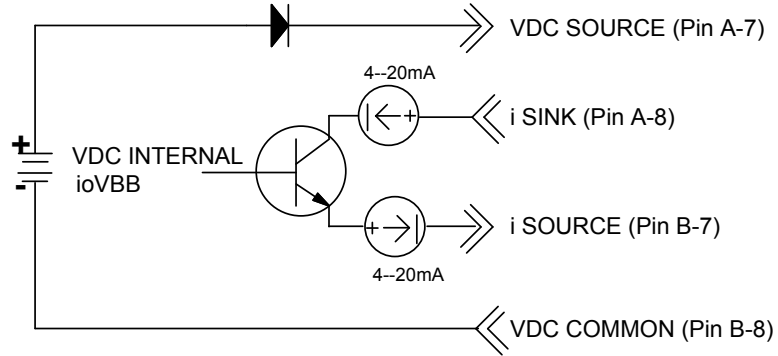
Figure 2–12 Analog Output Typical Point Schematic

2.6.2   Analog Output Examples

POWER SUPPLY: WIRELESS I/O CLIENT CURRENT SINK MODE
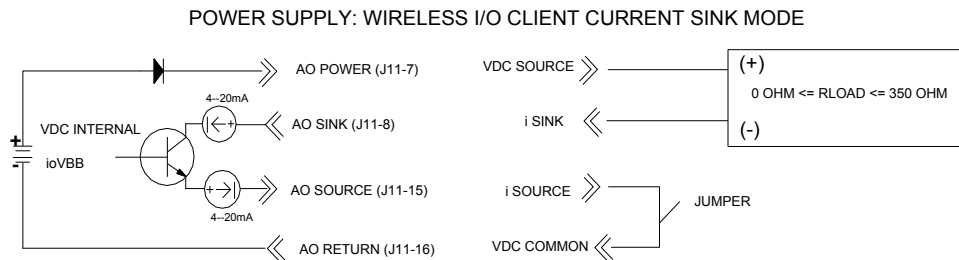
Figure 2–13 Analog Output Current Sink Mode Power Supply Point Connections

POWER SUPPLY: WIRELESS I/O CLIENT CURRENT SOURCE MODE
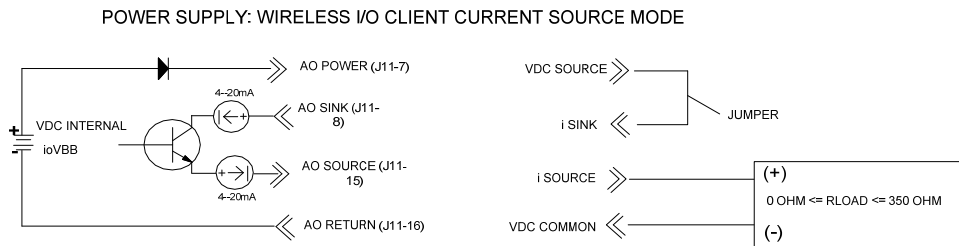
Figure 2–14 Analog Output Current Source Mode Power Supply Power Connections

CAUTION It is recommended to use a 50 mA fuse (maximum) in series with power supply to protect circuitry.

POWER SUPPLY: EXTERNAL CURRENT SINK MODE
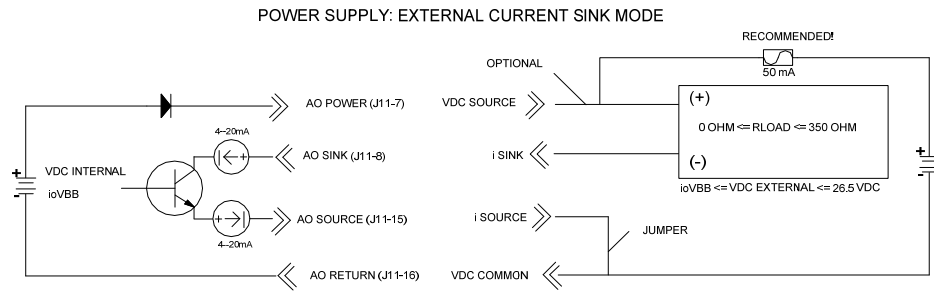
Figure 2–15 Analog Output External Current Sink Mode Power Supply Power Connections

POWER SUPPLY: EXTERNAL CURRENT SOURCE MODE
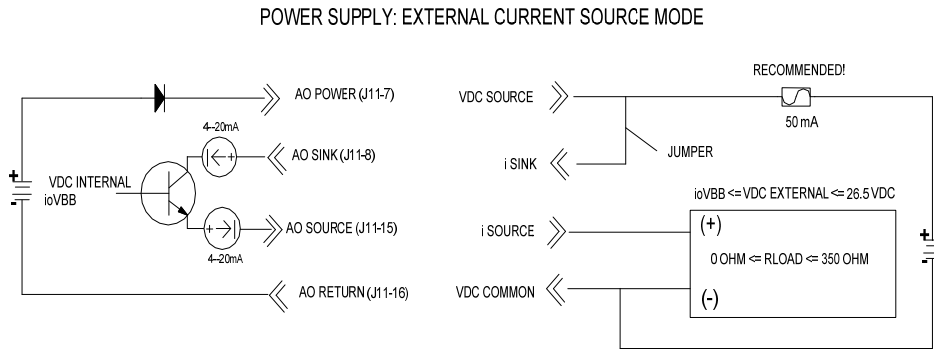
Figure 2–16 Analog Output External Current Source Mode Power Supply Power Connections

2.6.3   Analog Input (Type II)

The WellTell-IO supports four analog inputs (AI). Each point can be configured to be a 0-10 VDC voltage input or a 4-20 mA current input.

FYI If intending to use a 4-20 mA transmitter on the analog input, please refer to Appendix C. Manufacturer's specifications can be extremely misleading. Often, a manufacturer's specification claims to operate from 10 to 30 VDC. They are NOT always clear that this 10-30 VDC must be applied across the 4-20 mA transmitter ONLY (and NOT across the transmitter/load resistor series combination). Again, please refer to the explanation in the appendix.

Table 2—2 Analog Input (Type II) Specifications

Specifications	
Electrical (each point)	<u>Input Mode:</u> <u>Range:</u> Voltage Mode: 0-10V Current Mode: 0-20 mA
Typical Input Impedance	Voltage Mode: 91.24K Ohms Current Mode: 249.3 Ohms
Maximum Allowable	Continuous Input Current: 22.8 mA
Maximum Voltage	Maximum Input (before soft over-range): 10.7V
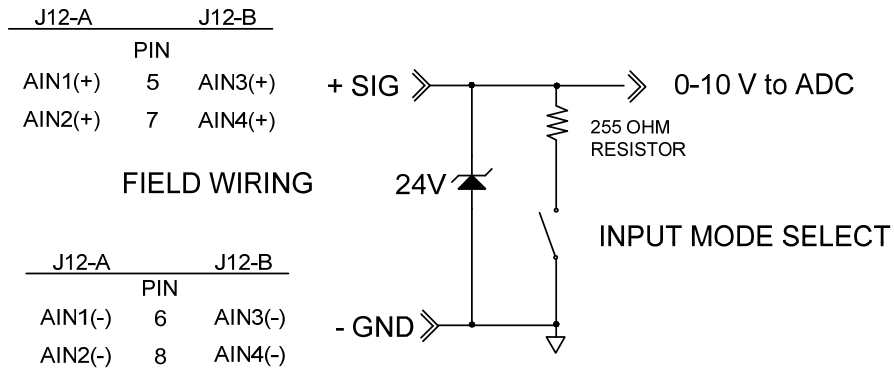
Figure 2–17 Analog Input Typical Point Schematic

2.6.3.1   Analog Input Examples
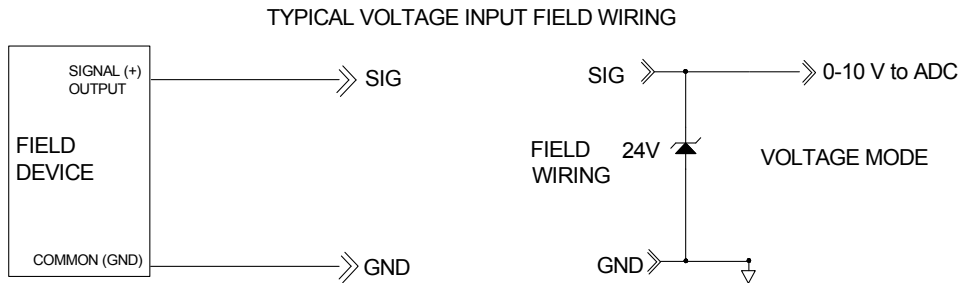
Figure 2–18 Analog Input Typical Voltage Input Field Wiring Point Connections
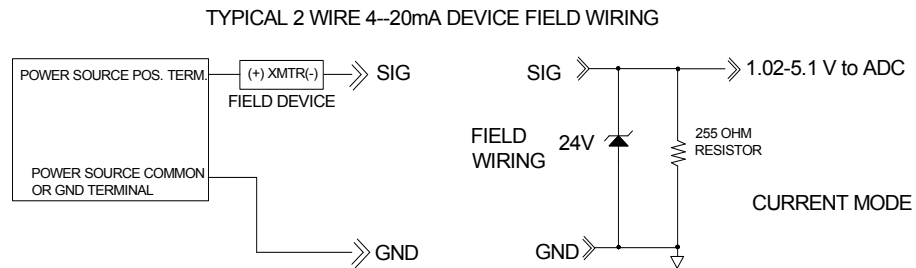
Figure 2–19 Analog Input Typical 2 Wire 4-20 mA Device Field Wiring Point Connections

2.6.4 Digital I/0

The WellTell-IO supports 4-point digital I/O. Each point can be configured to be either an input and/or output. All points are always inputs; however, if the output is activated, the input will be held steady state. The module also maintains a 16-bit (module 65536) accumulator for each input.

Table 2—3 Combo Digital I/O Specifications

Specifications	Description/Settings
Electrical (each point)	Open circuit voltage: 5 VDC (Internally pulled up to 5 VDC Nom.) Short circuit leakage current: -430uA typical Input capacitance: 1000pF typical Maximum allowable voltage range on input: -0.5 VDC to 26.5 VDC.
Digital Input	Dry Contact or voltage type. Minimum contact resistance to activate input 15KΩ. Maximum voltage to activate the input: 2.0V (referenced to GND terminal.) Minimum voltage to deactivate the input: 3.0V (referenced to GND terminal.)
Digital Output	Open Drain FET type. RDS(ON): 0.060Ω Typical. Maximum continuous sink current: 2A @ 24VDC
Pulse Input	Maximum input frequency: 2850Hz @ 50% duty cycle. Minimum high or low period: 175uS

2.6.4.1 Digital I/O Wiring Requirements

When digital outputs are used to sink current, the sum total sink current for all points and modules should not exceed 5A total. If more than 5A are required, separate ground wires from module output ground to power source ground terminal (bus bar) are required. Failure to do so may cause erratic system operation. Sufficient gauge wire should be used to handle total load current.

Use shielded pair or twisted pair conductors to reduce the possibility of erroneous transitions on the inputs in high EMI/RFI environments (ground the shield at field device).
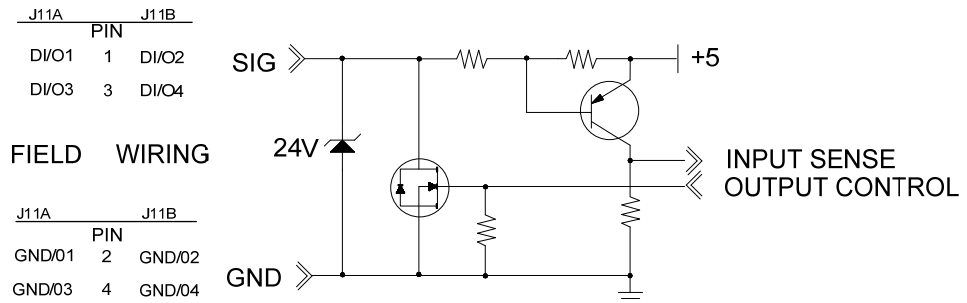
Figure 2–20 Digital I/O Typical Point Schematic

2.6.4.2   Digital I/O Example Connections
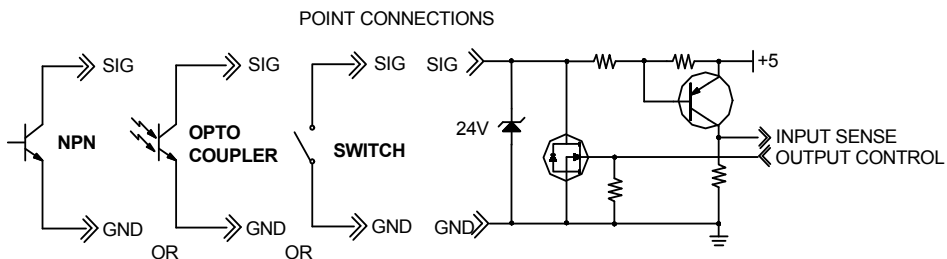
POINT CONNECTIONS

Figure 2–21 Digital I/O Point Connections

TYPICAL VOLTAGE INPUT FIELD
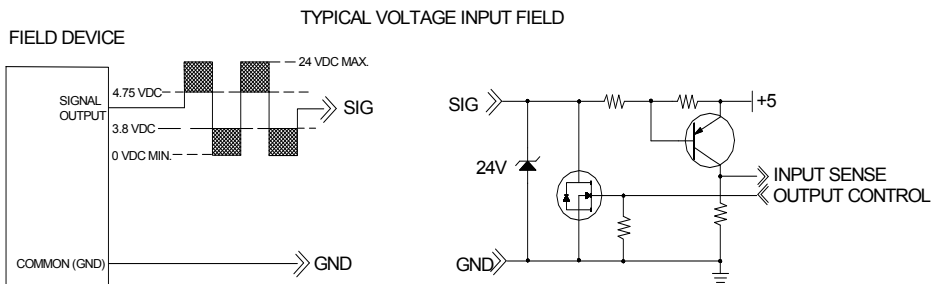
Figure 2–22 Digital I/O Typical Voltage Input Field

TYPICAL OUTPUT FIELD WIRING
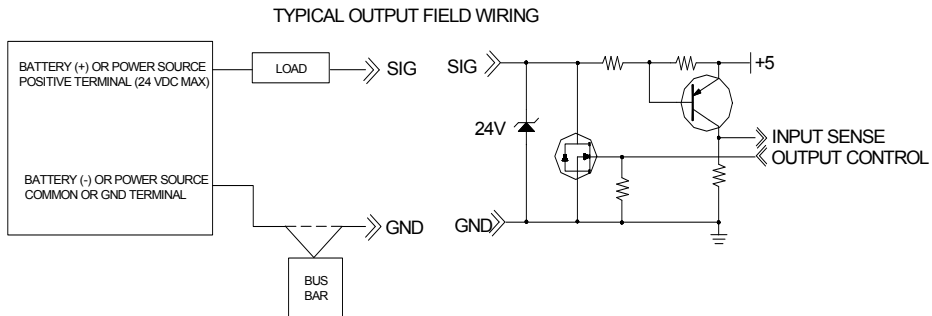
Figure 2–23 Digital I/O Typical Output Field Wiring

2.6.5   2-Point 100Ω Platinum RTD Input

The WellTell-IO supports a configurable 2-point RTD input. The inputs are designed to monitor temperatures using industry standard 4-wire 100Ω Platinum RTD probes with a T. C. of 0.00385Ω/Ω/°C. For proper operation, the installation instructions must be strictly adhered to.

Table 2—4 RTD Input Specifications

Specifications	Description/Settings	
Electrical (each point[1])	**Input Mode:** **Range:** 4-Wire 100Ω Platinum: -200 to 850°C (-328 to 1562°F) Alpha = 0.00385 (Measurement range of electronics)	
Accuracy	± 0.25°C (± .5°F)	
Points	RTD1 (point 1)	
	J12A-1	RTD1 OUT
	J12A-2	RTD1 (+)
	J12A-3	RTD1 (-)
	J12A-4	RTD1 RTN
	RTD2 (point 2)	
	J12B-9	RTD2 OUT
	J12B-10	RTD2 (+)
	J12B-11	RTD2 (-)
	J12B-12	RTD2 RTN

2.6.5.1 RTD Input Wiring

4-Wire RTD - Take care to not damage the insulation of the RTD wire when installing, and take precautions against later damage from vibration, abrasion or liquids in conduits. In addition, it is essential that the following practices be adhered to:

- Never run RTD wire in the same conduit as ignition wire or other high-energy wiring such as AC line power.
- Keep secondary wires to spark plugs and other high voltage wiring at least eight inches away from a RTD and extension wiring.

Testing RTD leads - If it becomes necessary to check RTD to terminal strip wiring with an ohmmeter or other checker, first unplug the RTD connector at the module. This prevents possible damage to the device's sensitive low voltage detection circuitry.

2.7 WellTell-IS Client (LevelMaster) Wiring Instructions

This section discusses the WellTell-IS Client. Wiring and pin out specifications are covered. The WellTell-IS is a simple protocol transport incorporating an RS-485 intrinsically safe (IS) barrier (i.e., LevelMaster applications or other RS-485 applications as indicated by certification drawings provided with this unit).

This WellTell RS-485 Barrier Client has a wide range of uses. One common application is providing an RF link to the LevelMaster products. The WellTell-IS can be mounted in Class I, Division 2, Group CD Hazardous location near or on top of the storage tank. The barrier output is connected via cable to the LevelMaster sensor board. Installation must be according to certification drawings and National Electrical Code (NFPA 70). The WellTell-IS also has an on board, solar panel compatible charging circuit to maintain the charge on a 12VDC lead-acid battery. LevelMaster protocol can be run over the wireless link between an XFC/XRC and the WellTell-IS to access LevelMaster data. The WellTell-IS will shut off power to the J6 port, if it is not receiving data from the host, to extend battery life.

---

[1] Not inclusive of RTD specifications
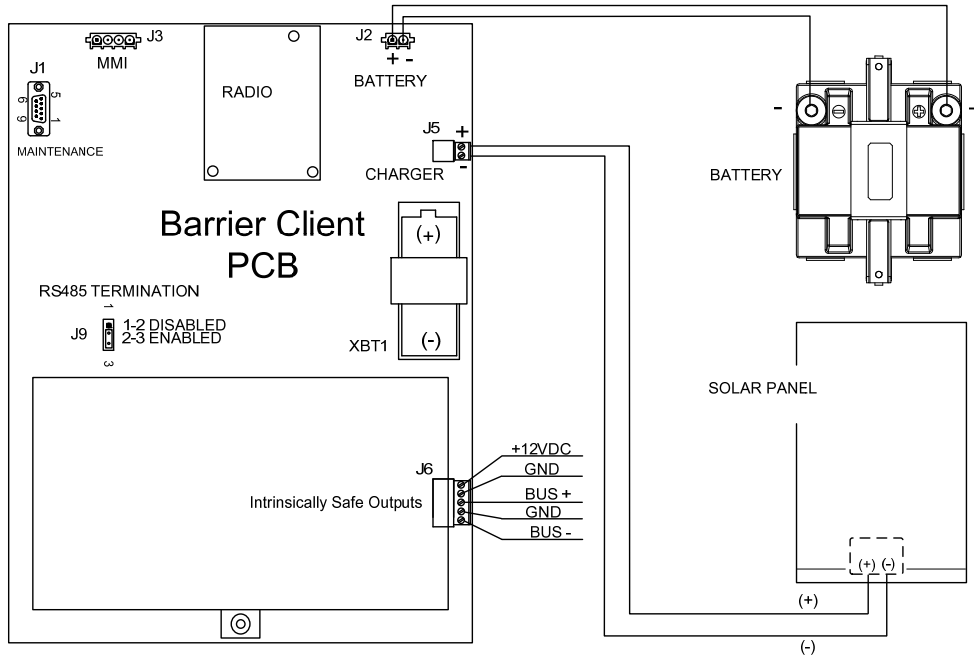
Figure 2–24 WellTell-IS Power

2.7.1 WellTell-IS Pin Outs

This WellTell-IS Client can support as many as four LevelMasters. The intrinsically safe outputs provide +12VDC power and ground as well as RS-485 bus (+) and bus (-).
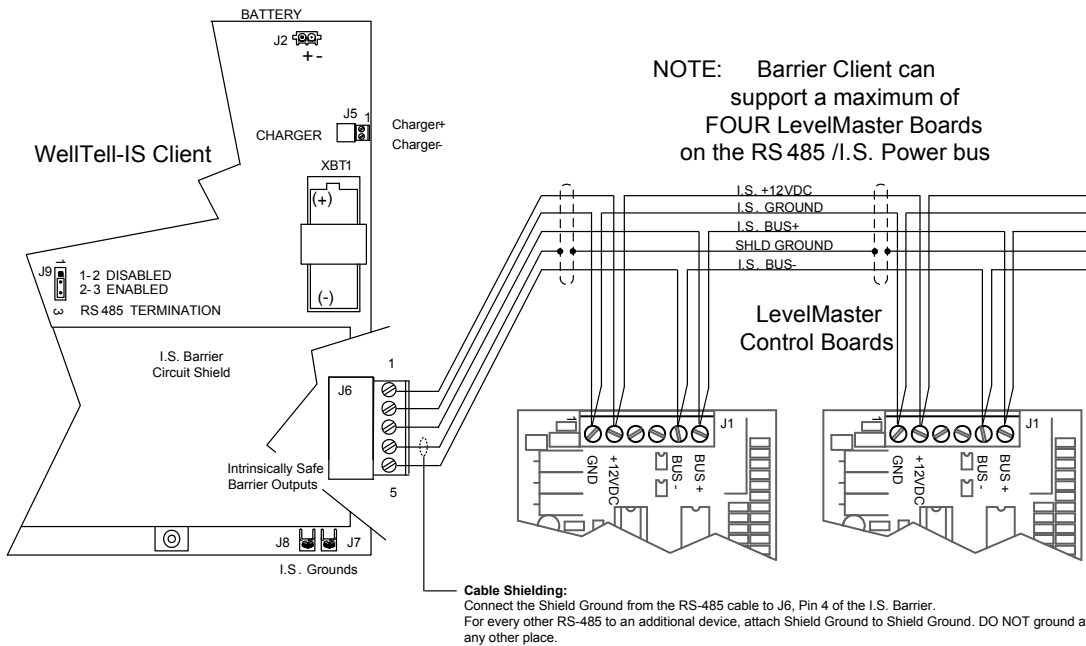
Figure 2–25 WellTell-IS Pin Outs for LevelMaster

WARNING Intrinsically safe wiring must be separated from incendiary wiring per the National Electrical Code (NFPA 70).

2.8   WellTell-X Mechanical Installation

The WellTell-X is generally installed at a flow computer (XFC) or RTU (XRC) site. It is designed to be installed in a 6400 or 6700 Totalflow enclosure. At the top of the 6400/6700 enclosure is an area where communication devices (radios, modems, etc.) are installed. This area is referred to as the communication compartment (see Figure 2–26).The WellTell-X comes pre-mounted on a special communication bracket. This bracket allows for additional communication equipment to be secured on the top of the communication tray and slid into the communication compartment.

2.8.1   Supplied Materials

- WellTell-X Host radio assembly

2.8.2   Optionally Supplied Materials

- Antenna

WARNING Installation in classified hazardous locations must follow instructions given on the certification drawing listed on the product nameplate and all national and local electrical codes.

2.8.3   Instructions

1) Communication equipment, in addition to the host radio, should be mounted to top of communication tray prior to installation.

2) Holding tray in the upright position as shown in Figure 2–26, line up mounting flanges with guides inside the communication compartment (see Figure 2–27).

3) Slide tray into compartment, being careful that antenna and communication wires exit compartment via the cable cutout on the communication shelf.

4) Tighten retractable screws to secure tray to shelf.

5) Figure 2–27 shows the installed WellTell-X host radio. Wiring instructions follow next in this chapter.

Mounting Flange   Mounting Flange

View A

Retractable Screw   Retractable Screw

View B

View B

View A
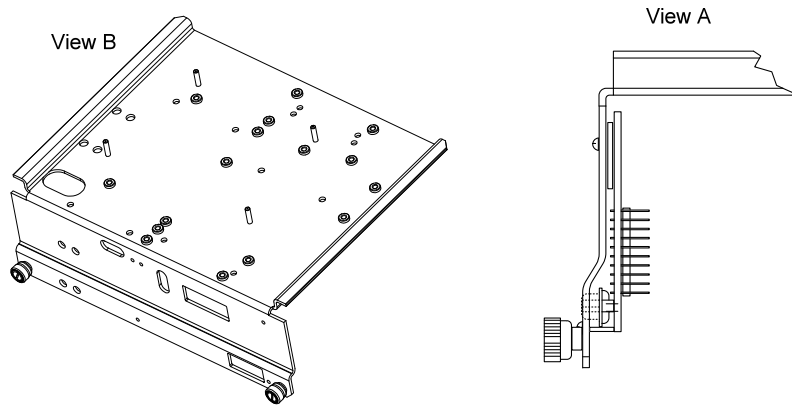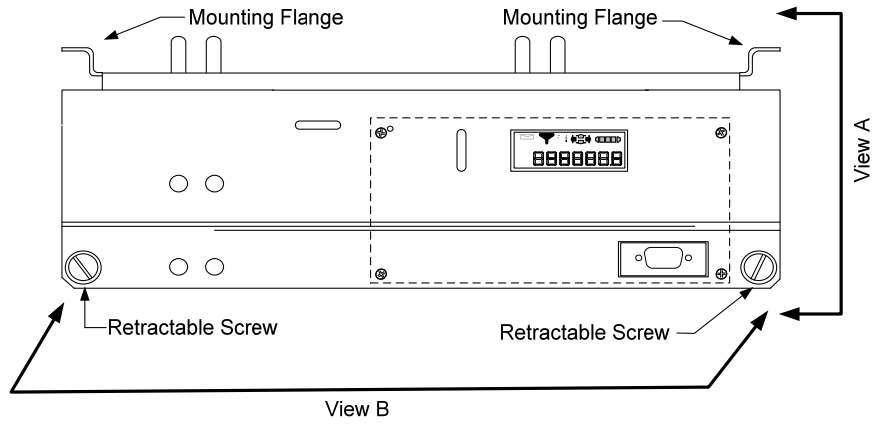
Figure 2–26 WellTell-X Host Communication Tray
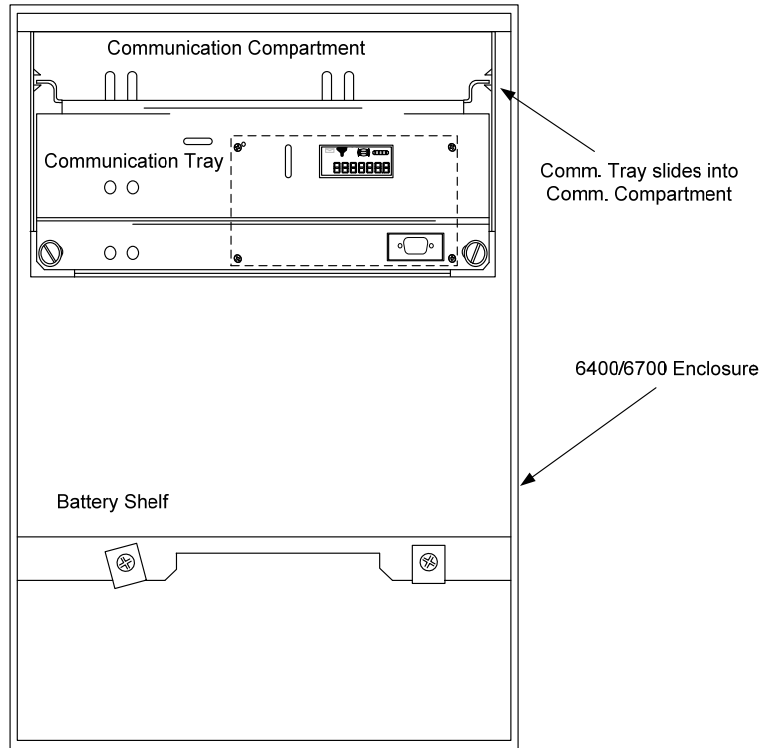
Figure 2–27 6400/6700 Communication Compartment

2.9 WellTell-X Wiring Instructions

This section discusses the WellTell-X pin outs. The WellTell-X is generally installed at an XFC (Flow Computer), XRC (RTU) or NGC. The WellTell-X serves as the master radio in the WellTell wireless product system.

2.9.1   WellTell-X Pin Outs

The WellTell-X is located in the communications tray of the XRC/XFC (See chapter on Mechanical Installation). The WellTell-X should be wired to an available communications port. The communication port (COM1, COM2, etc.) should be configured and wired for RS-485. VBATT (13.8 VDC) and GND should also be connected to provide power to the WellTell-X.

If the system was not configured at the Totalflow factory, the user needs to wire the WellTell-X into the meter enclosure (see Figure 2–28). Generally, factory default would be to connect the WellTell-X to COM2. This assumes that the user may have a remote collection system already connected to COM1. However, if COM1 is available, the user can connect the WellTell-X to COM1.
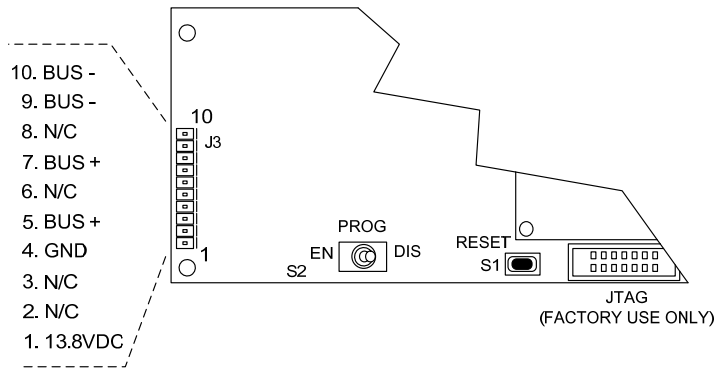
Figure 2–28 WellTell-X Pin Outs

2.9.1.1   Connecting WellTell-X to XFC or XRC

WARNING — Installation in classified hazardous locations must use factory provided cable.

1) Disconnect power to meter.

2) Wire WellTell-X to appropriate COM port using instructions in Figure 2–29 or Figure 2–30.

3) Ensure that RS-485 communications module is installed and communication jumper is properly installed.

4) Remove corresponding plug from bottom of enclosure.

5) Remove nut and lock washer from host radio antenna cable.

6) Insert threaded antenna connector through hole.

7) Place lock washer then nut on threaded end of connector. Tighten nut until snug.

8) Following instructions supplied with antenna, attach antenna to cable connector.
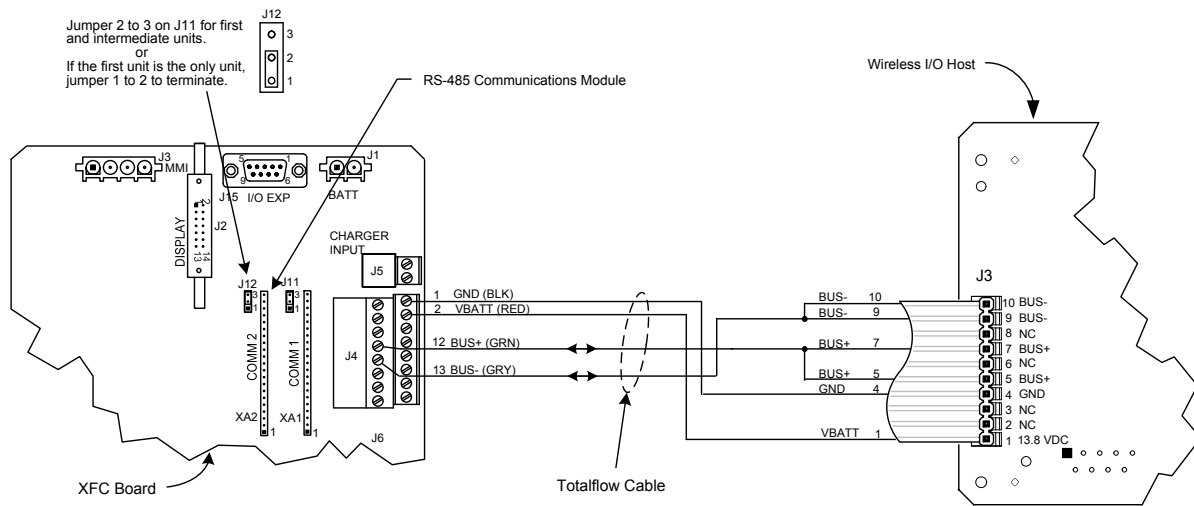
Figure 2–29 WellTell-X to XFC COM2
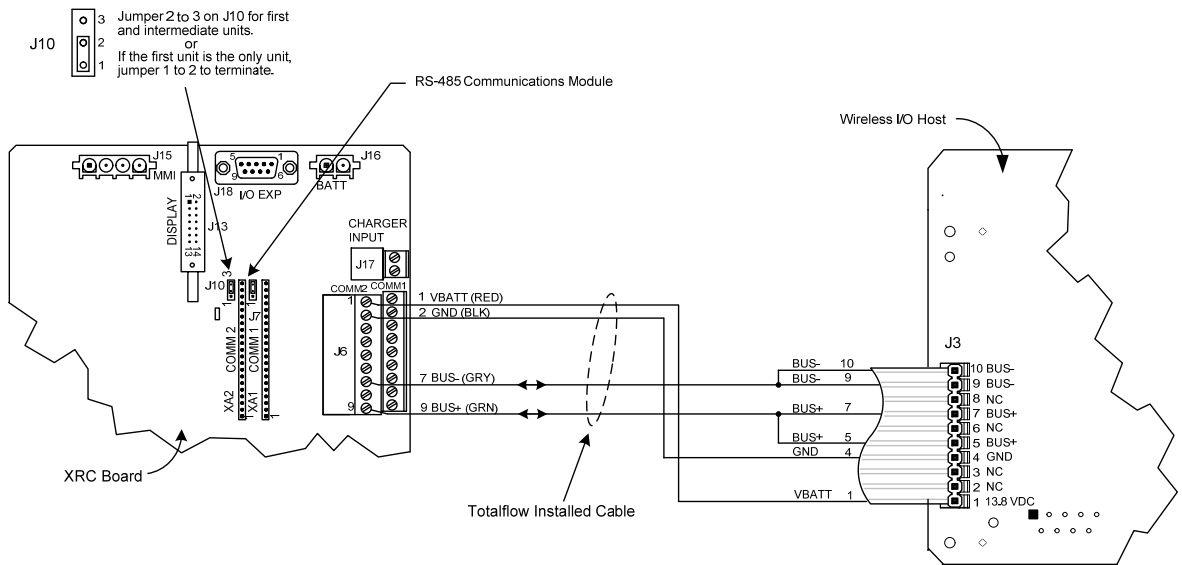
Figure 2–30 WellTell-X to XRC COM2

9) Restore power to meter.

10) WellTell-X display activates (see Figure 2–31). As such, the antenna is on when the 'F3' is displayed, the '$' is on and the '_' is blinking.

The display cycles through several system parameters (baud rate, temperature, etc.).
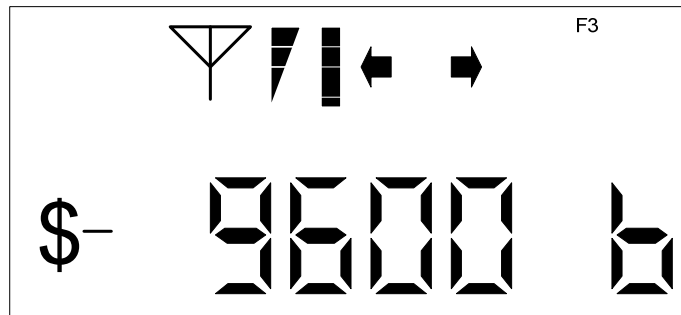
Figure 2–31 WellTell-X Display

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3.0 WELLTELL WIRELESS STARTUP

This section discusses setting up the WellTell Host and Clients. Two programs (supplied by Totalflow) are necessary to properly configure the Wireless system: Portable Configuration and Calibration Unit (PCCU) and WellTell Wireless Utility (WWU).

PCCU is a Windows® program designed to interface with the Totalflow flow computer or RTU. The Totalflow flow computer must be properly configured to work with the WellTell wireless product.

WWU is a Windows program designed to configure the AeroComm® radios used in the WellTell wireless product. The AeroComm radio is properly configured from the factory. The factory default values will most likely work with little or no changes. Before changing the radio's settings, be sure to read the "Setting Up WWU" section. Changing parameters that are unfamiliar could result in unpredictable operation.

3.1 Setting Up PCCU for WellTell-IO (G3)

To use the WellTell-IO, some configuration is required at the WellTell-X (XFC/XRC). PCCU32 is used to configure the meter to communicate with the WellTell-IO. The basic steps are as follows (see Figure 3–1):

1) Instantiate the wireless application:

- Click on the meter ID within the tree-view, and click the Application tab.
- Find an application slot that is spared out, and select Wireless.

2) Set up a COMM port to communicate with the WellTell-X:

- Select COMM port for the WellTell.
- Click on the Communication App in the tree-view, and go to the Setup tab.
- Set protocol for modbus ASCII or RTU.
- Set baud rate to 9600.
- Set register format to 32-bit Totalflow.
- Go to the Advanced tab.
- Set interface to RS-485.
- Data bits to 8, parity to none and stop bits to 1.
- Establish how many WellTell I/O devices are in the system.
- Click on the wireless remote IO, and go to the Configure tab.
- Enter the number of wireless I/O devices in the system.
- Configure and calibrate the appropriate I/O.
- Point any applications using wireless I/O to the appropriate registers.
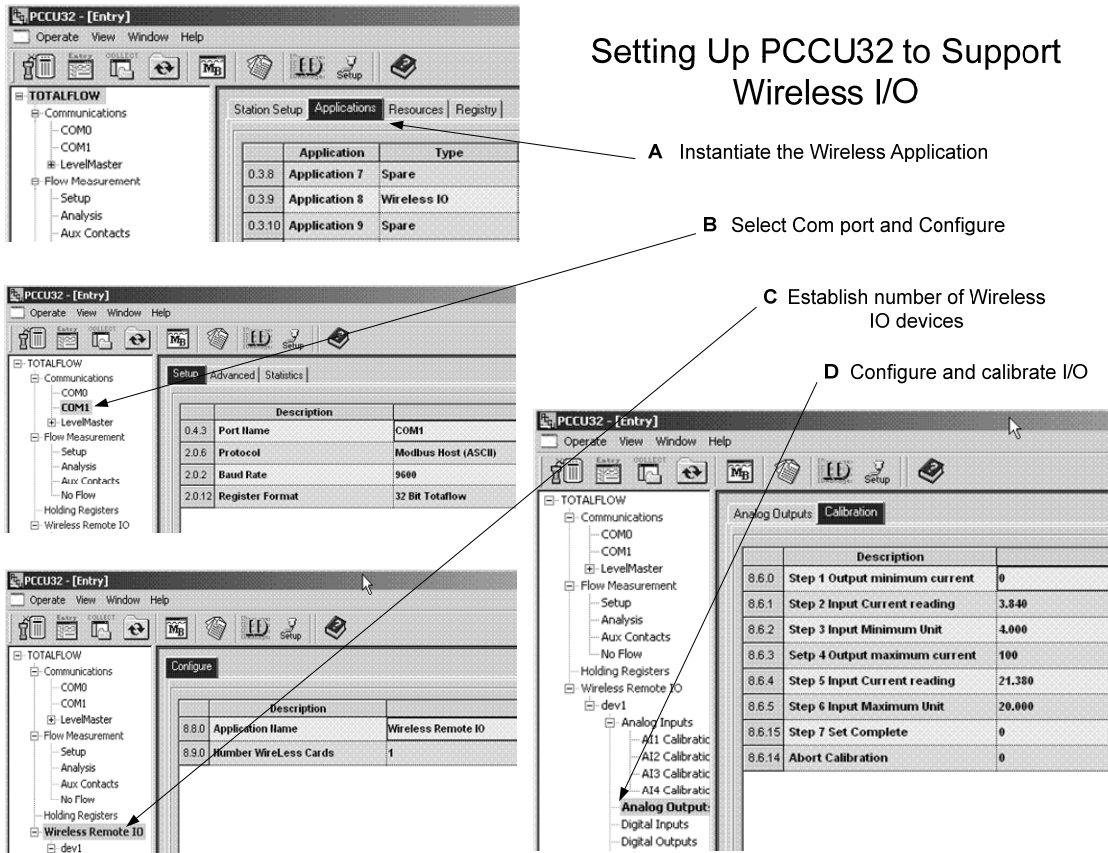
Figure 3–1 PCCU32 Setup for WellTell-IO (G3)

3.2 Setting Up PCCU for WellTell-IO (G4)

To use the WellTell-IO, some configuration is required at the WellTell-X host (XFC/XRC). PCCU32 is used to configure the meter to communicate with the WellTell-IO. The configuration for the WellTell-IO will only occur in certain instances such as adding a WellTell Wireless to existing XFCs or XRCs or more than one existing IO client.

The basic steps are as follows:

1) Instantiate the wireless application in PCCU (see Figure 3–2):

- Click on the meter ID in the tree-view. Click the Applications tab.

- Move to application slot 56. Select Wireless Remote I/O.

- Click the Send button to instantiate the application.

Figure 3–2 Application Tab

Within the G4, the user will need to establish the comm port or CIM module that will connect the WellTell I/O Interface (see Figure 3–3).

2) Move to the Communications menu in the tree-view, and click on it. By default, the user will move to the Communications Ports tab:

- In the Communications Ports tab, locate the Wireless I/O Interface.
- If establishing a comm port, type in the comm port number within the Port number field. The syntax needs to be exact. For example: COM2:. It should be noted that the comm port cannot be shared by other applications.
- If all of the onboard comm ports are in use and the user is setting up a TFIO module, type in CIM0:.

3) The newly instantiated Wireless I/O Interface application will display as a sub-menu under the Communications heading:

- Click the + button next to the Wireless I/O Interface application. After the application expands, click on Communications. By default, the user will move to the Setup tab.
- Establish the number of WellTell I/O devices that are in the system.
- Set Scan Enable to Enabled.
- Set the port type. By default, this is set to Serial. If using something other than the onboard comm ports such as a TFIO module, select TFIO CIM from the drop-down selection.
- If the Port field is blank, manually type in the comm port specified in the Communications Ports tab for the application. The user must type in the comm port syntax exactly. For example: COM2:.
- Set the protocol for RTU.
- Set the interface to RS-485.
- Set the baud rate to 9600.
- Set the Data bits to 8, parity to none and stop bits to 1.
- Click the Send button.
- Click on the Wireless 1 sub-menu. Move to the Client Setup tab.
- The Modbus Address field defaults to 32. The user needs to ensure that the Modbus Address matches the one being used by the remote client.

FYI

If the user happens to have multiple Wireless devices, the default Modbus Address will be incremented by one for each subsequent device. For example, the Wireless 1 will be set to default at 32, Wireless 2 device will be set to 33, etc.

It should be noted that regardless of the number of devices that the user has, the IO client radio will need to be configured to match its corresponding Modbus Address.

- Scan Enable needs to be set to Enabled.

```
□ TOTALFLOW
  ⊟ Communications
       Totalflow - TCP
       Totalflow - USB
       MMI Serial - COM0
       TF Remote - COM1
       Spare - COM2
    ⊞ LevelMaster
    ⊟ XMV Interface
         Communications
         XMV 1
    ⊞ Therms Slave
    ⊞ Therms Master
    ⊟ Wireless I/O Interface
         Communications
         Wireless 1
  ⊞ I/O Interface
  ⊞ Display
     Holding Registers
  ⊞ Operations
  ⊞ Trend System
  ⊞ Valve Control
     Pad Controller
     Pulse Accumulator
```

Setup | Statistics | Packet Log

	Description	
0.4.57	Device/APP ID	Wireless I/O Interface
56.255.0	Number of Wireless	1
	--- Communication Setup ---	
56.0.25	Scan Enable	Enabled
56.0.22	Port Type	Serial
56.3.3	Port	COM2:
56.0.6	Protocol	Modbus Host (RTU)
56.0.12	Register Format	32 Bit Totaflow
56.0.1	Interface	Rs485
56.0.2	Baud Rate	9600
56.0.3	Data Bits	8
56.0.4	Parity	None
56.0.5	Stop Bits	1
56.1.1	Xmit Key Delay (milliseconds)	20
56.1.2	Unkey Delay (milliseconds)	10
56.1.10	Response Delay (milliseconds)	0
56.1.3	Timeout (milliseconds)	1000
56.0.13	Retries	0
56.0.17	Trailing Pad	None
56.0.24	Keep TCP Connection Open	No

Figure 3–3 Setup Tab

Figure 3–4 Client Setup Tab

3.2.1 Configuring the XMV to Operate with the WellTell Wireless-IO

The following instructions will detail the necessary steps to configure the XMV device to operate with a WellTell Wireless device.

1) Instantiate the wireless application:

- Click on the meter ID in the tree-view. Click the Applications tab.

- Move to application slot 41. Select XMV Interface from the drop-down.

- Click the Send button to instantiate the application.

2) The XMV Interface sub-menu will display under the Communications menu. Click the + button to expand the XMV Interface menu, and click on Communications. By default, the user will move to the Setup tab.

FYI The user needs to move into Expert mode to perform the following steps.

3) In the Setup tab (see Figure 3–5), set the Port to 'None'.

4) Next, within the same tab, locate the Alternate Port field, and set the value to the port number that is being used by the Wireless IO. In the above example, the com port being used is COM2:. As such, the user needs to type in COM2:.

5) Click the Send button.

Figure 3–5 XMV Communications Setup Tab

3.3   Setting Up PCCU for WellTell-IS

There is not a set up procedure for the WellTell-IS like there is for the WellTell-IO. The WellTell-IS is basically a protocol transport. Whatever protocol is passed to the WellTell-X at the meter (XFC/XRC) is simply relayed to the WellTell-IS and sent to any device(s) connected to the barrier. The output of the WellTell-IS supports RS-485.

A common implementation of the WellTell-IS is the LevelMaster application. However, no special setup is required beyond the physical wiring of the WellTell-IS to an appropriate COMM port (see Figure 3–6). The LevelMaster application is instantiated and configured like any other LevelMaster application (see Figure 3–7 or Figure 3–8). The WellTell-IS simply provides a wireless RF connection to the LevelMaster rather than the more expensive and labor intensive cabling. The selected COMM port is set to the protocol expected by the end device. In this example, the LevelMaster protocol is already selected.

Hosting Device

Com2 to Host Radio

2100759-004

NOTE: See larger detailed figures

Remote Wireless Barrier Client

Barrier supporting two Level Master sticks

Intrinsically Safe
Barrier Outputs
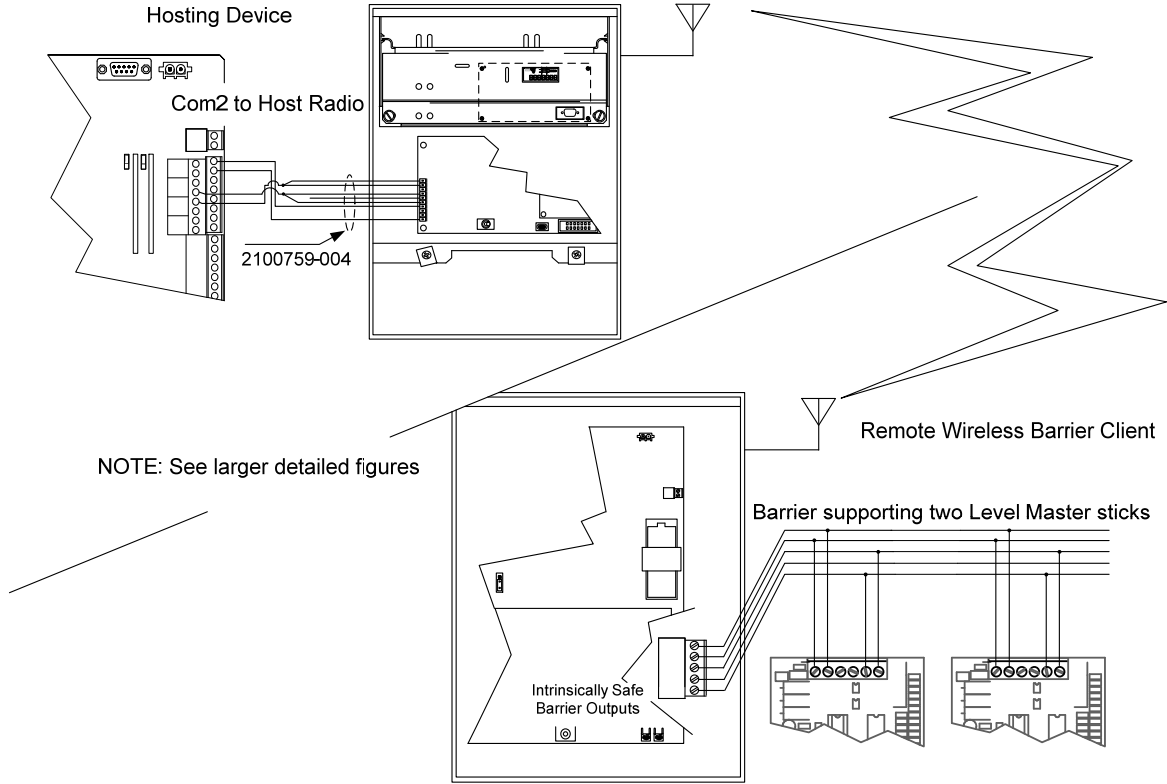
Figure 3–6 Communication Setup for LevelMaster

Typical Communications Setup
For LevelMaster Application

C   Typical status data for successful communications

B   Setup Advanced tab as shown

A   Setup LevelMaster on Comm2
Select LevelMaster protocol
And 9600 Baud

Figure 3–7 Communication Setup for LevelMaster in PCCU (G3)

A - Move to the Communications tab. Set the Spare – COM 2 to None and the LevelMaster port to COM2:

B – Move to the LevelMaster Communications tab and setup as shown

Figure 3–8 Communication Setup for LevelMaster in PCCU (G4)

3.4   Setting Up WellTell Wireless Utility

The WellTell Wireless Utility (WWU) program is used to set up and configure Totalflow's WellTell wireless product. WWU is a program that runs on a laptop and allows the user to set up and configure the internal radios used by the WellTell Host and Clients. The program also provides a Flash Loader to download new versions of software to the WellTell Host or Client. The program communicates between the laptop's serial port and the Host or Client's maintenance or PCCU port. A typical 9-pin to 9-pin cable (female DB9 to male DB9) can be used between the laptop and the maintenance connector. The Host and both Clients can be connected to the laptop through the 9-pin to 9-pin cable. For convenience, the PCCU cable (2015240-xxx) can be used to connect to the PCCU port (military connector) on the Clients. The Host units do not support the PCCU cable (i.e., they do not have the military connector associated with them); however, using the PCCU cable will not permit Flash downloading. Flash downloads can only be accomplished through the maintenance ports of the Host or Client using the 9-pin to 9-pin serial cables.

FYI When using Flash Loader to download new software to the host or client, ensure that the physical Program switch is set to Enable on the WellTell board. The switch is located next to the DB9 connector.

To install WWU on a computer, run the 'setup.exe', and follow the prompting of the Install Wizard.

WWU supports two levels of access: Restricted Use and Admin (lower left of the System Config tab). Restricted Use gives the user access to the basic setup parameters that are most often used (i.e., Network ID, RF Channel, etc.). Lesser used parameters (i.e., Encryption Key, Range Refresh, etc.) are grayed out. Normal setup does not require Admin permissions. These lesser used parameters

can be accessed through Admin. Admin is achieved by entering the password. The factory default password is '0000'.

3.4.1   Configuring the WellTell Wireless Product with WWU

Much of the following information can be found in the WWU help files.

The main capabilities of this program include:

- Configuring both the radio and the non-radio information of a WellTell device.
- Downloading a new product program to a WellTell device.

Additional capabilities include:

- Saving/loading configuration information to/from a file.
- Viewing a hex dump of a radio's EEPROM contents.
- Displaying WellTell device status and in-range server information.
- Monitoring/logging communication between this program and the WellTell device.
- Snooping on WellTell device communication lines.
- Overriding normal WellTell device product connections with specialized connections to its maintenance port.
- Launching programs to be used with a WellTell device while it is in override mode.
- Testing communication links.

There are six major tabs within the WWU program:

- System Configuration
- Radio Configuration
- Network View
- PC Port
- Flash Loader
- PIC Loader
- Test

Each of these tabs displays a Windows dialog box that identifies lesser functions.

3.4.1.1   System Configuration Tab

This dialog box is used to modify all WellTell device configuration information, except for the radio transceiver configuration information that is handled within the Radio Configuration tab. Product, part number and revision are displayed at the top of the page. This information is updated when the operator connects to the WellTell wireless product through the maintenance port. The routing matrix describes the current routing between the RS-485 port, the maintenance port and the radio. If the routing matrix is grayed out and inaccessible to the operator, Admin access has not been given to the operator. Admin functionality is password protected (see Overview).
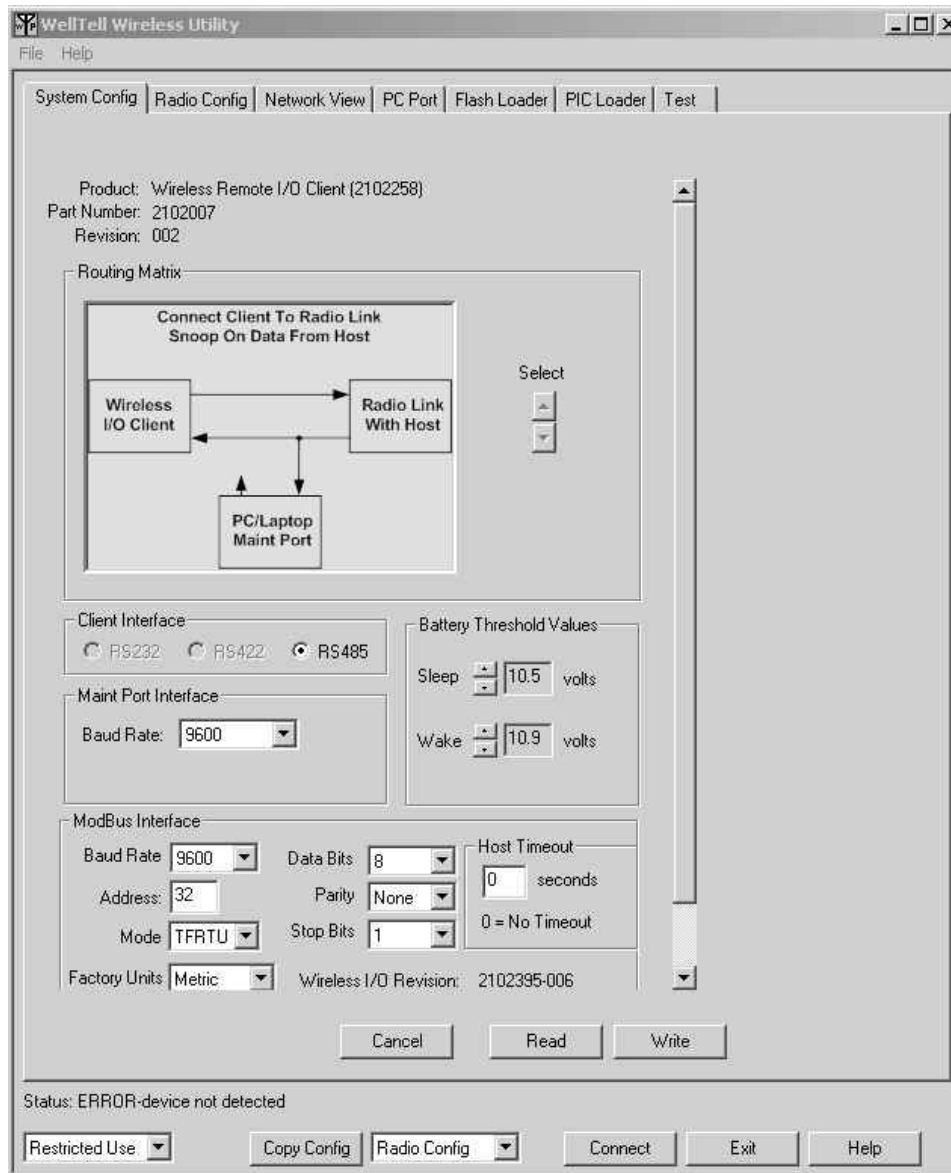
Figure 3–9 WWU System Config Tab

To configure a WellTell device, first read it (Read button), make changes to the configuration controls that are presented in the main body of this tab and then write the information to the WellTell device (Write button). This helps to avoid the problem of writing the wrong information to the WellTell device when switching back and forth between different devices. The Cancel button causes all configuration control values/settings to revert back to the state that was last read from or written to a WellTell device. The Copy Config button allows the user to copy the System Configuration, the Radio Configuration or both configurations to multiple units.

Table 3—1 Routing Matrix for WWU

Routing Matrix	
Depending on what the user is linked to (either a Wireless Client or Wireless Host), the routing matrix will reflect this difference, i.e., the text captions will denote that the user is hooked up to a Wireless Client . For the purpose of this document, it is assumed that the user is hooked to a Wireless Client.	
Disconnect Client from Radio Link **Snoop on Data From Client**	This specifies that the user has disconnected the client from the radio, i.e., no longer communicating between the client and the radio. The current Snoop selection is now looking for information from the client.
Disconnect Client from Radio Link **Snoop on Data From Host**	This specifies that the user has disconnected the client from the radio, i.e., no longer communicating between the client and the radio. The current Snoop selection is now looking for information from the host.
Connect Client to Radio Link **Snoop on Data from Client**	This specifies that the user has connected the client to the radio and has the ability to communicate. The current Snoop selection is now looking for information from the client.
Connect Client to Radio Link **Snoop on Data from Host**	This specifies that the user has connected the client to the radio and has the ability to communicate. The current Snoop selection is now looking for information from the host.
Override Radio Link **Connect Maint Port to Client**	Gives the user the ability to override the radio link, allowing the user to connect to the Client using the Maintenance port.
Override Client **Connect Maint Port to Radio Link**	Gives the user the ability to override the client, allowing the user to connect to the radio using the Maintenance port.

Table 3—2 Interface

Interface	Description
Client	
RS-232	Unsupported
RS-422	Unsupported
RS-485	The device port is currently an RS-485 interface.
Maintenance Port	
Baud Rate	Baud rates can be selected from 1.2KB to 115.2KB. Current hardware only supports 9600 baud.
Battery Threshold Values	
Sleep	If the supply voltage drops below the user set sleep threshold, the board will transition into sleep mode. This is done to conserve power.
Wake	If the supply voltage increases above the user-defined threshold, the board will transition back into wake mode.
Host Timeout	
The Host Timeout enhancement is implemented with the following components: • PIC Client Program • PCCU • G4 Wireless Application • WellTell Wireless Utility The WellTell Wireless Utility is used to set the host timeout value in the I/O client. The I/O client applies default I/O states if it times out waiting to receive communication from the host.	

Interface	Description
	The default I/O states are the same as the power up initial states. PCCU is used to set these values. The host timeout value needs to be greater than the scan interval; however, a host timeout value of zero disables the I/O client timeout feature.
Modbus	
	This section will only display for Wireless I/O Client and not the IS Client or the X Host.
Baud Rate	Baud rates can be selected from 1.2KB to 115.2KB.
Address	In Modbus protocol, the user can address different devices by putting in the correct address of that device.
Data Bits	This is a communication setting.
Parity	This is a communication setting.
Mode	The WellTell-IO supports two Modbus protocols: Modbus ASCII and Modbus RTU.
Stop Bits	This is a communication setting.
Factory Units	Configuring the board to either return metric or English units.

3.4.1.2 Radio Configuration Tab

The Radio Configuration tab is used to modify the radio transceiver configuration. The radio should have been properly configured at the factory. The following screen shots show typical default values for the various parameters. Care should be exercised when changing these parameters.

First, read the radio before modifying its configuration. The controls on this tab will update to reflect the current configuration state of the radio, each time the user reads the radio. Make changes to the controls on this dialog by loading a new set of configuration parameters from a file (Load) and/or by manually modifying individual controls. Modify the radio configuration using the Write button.
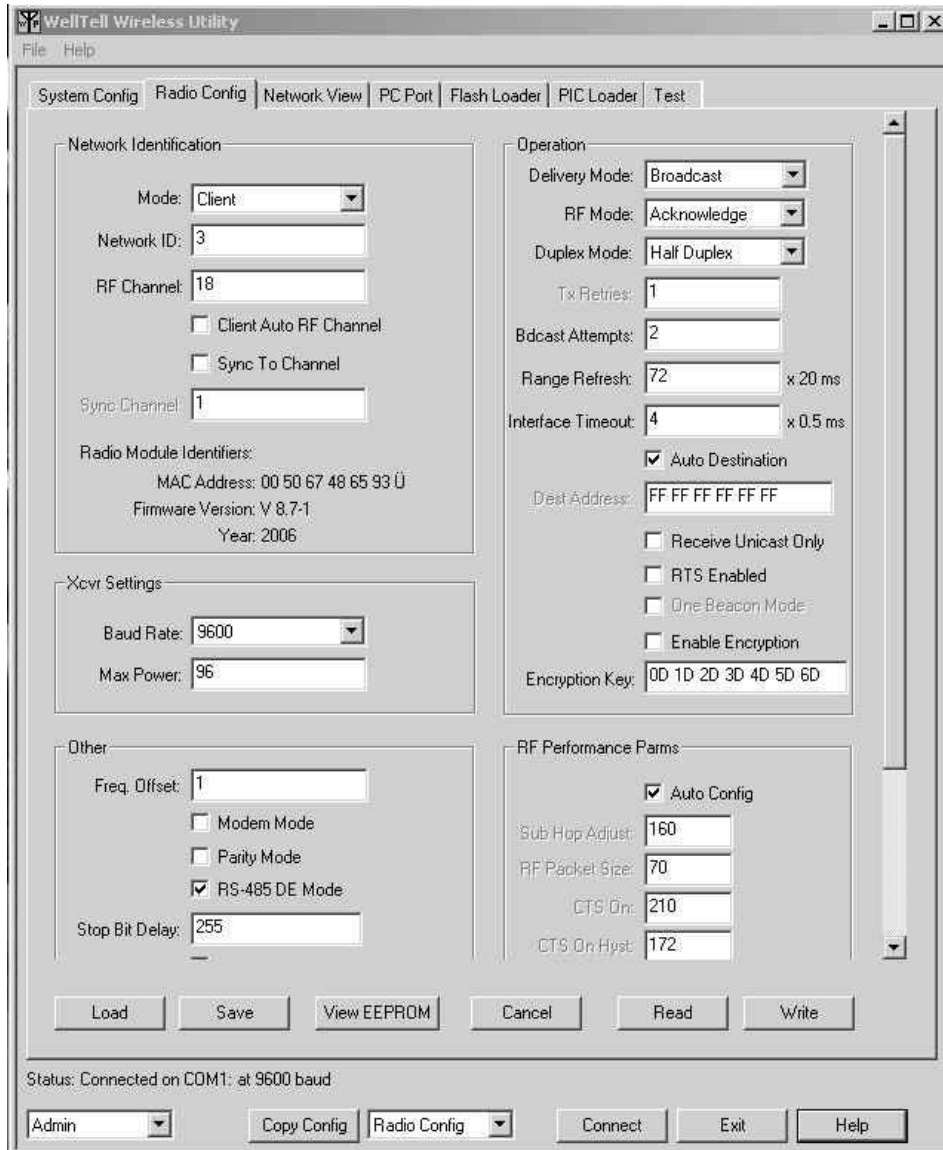
Figure 3–10 Radio Config Tab

The Save button can be used to save the values that are currently displayed on this dialog to a file. Additionally, this will also save the Modbus interface parameters that were established in the System Config tab, if this was the Wireless I/O client. The Cancel button causes all control values/settings to revert back to the current radio configuration state.

The View EEPROM button is used to pop-up a hexadecimal dump display of the radio EEPROM contents.

If, during setup, any of the parameters are displayed in red, the user has entered an invalid value.

Table 3—3 Radio Configuration Settings

Specification	Description/Setting
Network Identification	
Mode	(Host/Client): The Host controls the system timing by sending out regular beacons (transparent to the transceiver host) that contain system timing information. This timing information synchronizes the client radios to the Host. Each network should consist of one and only one Host. There should never be two Hosts (servers) on the same channel number in the same coverage area, as the interference between the two Hosts will severely hinder RF communications. Even though units are programmed as Host servers and Clients, servers can communicate with Clients, and Clients can communicate with the Host server and all other Clients.
Network ID	Network ID is similar to a password character or network number and makes network eavesdropping more difficult. A receiving radio will not go in range of or communicate with another radio on a different network ID.
RF Channel Number	The channel number must be the same on the Host and Client units. RF Channel numbers can range between 00 and 55. For a more in depth explanation, please refer to the WWU contextual Help.
Client Auto RF Channel	Enabling Auto RF Channel in the Client will allow the Client to synchronize with the first Host Server they detect. For a more in-depth explanation, please refer to the WWU contextual Help.
Sync to Channel	Enabled to prevent "cross-talk" interference between co-located networks. For a more in-depth explanation, please refer to the WWU contextual Help.
Sync Channel	Channel number between 00-55 to synchronize to in an effort to avoid "cross-talk".
Transceiver Settings	
Baud Rate	This value determines the baud rate used for transceiver communication. Baud Rate values of 14400 and 28800 are not currently supported.
Max Power	Max Power provides a means for controlling the RF transmit output power of the radio. Output power and current consumption can vary by as much as 10% per radio. Please refer to the MaxPower table below.

Power			
MaxPower	**Transmit Current (mA)**	**Transmit Power Output (dBm)**	
0	47	-20	
1	50	-10	
2	50.5	-3	
3	52	1	
4	55	4	
5	58.5	7	
6	63.5	9	
7	69	10.5	
8	76	12	
9	83	13.5	
10	90.5	14.5	
11	97.5	15.5	
12	105	16.5	
13	111.5	17	

Specification	Description/Setting		
14	118	17.5	
15	123.5	18	
30	140.5	19	
96	156	20	
Operation			
Delivery Mode	In Broadcast Mode, the RF packet is broadcast out to all eligible receivers on the network. In Addressed Mode, RF packets are only received by the transceiver specified by the destination address. If addressed packets are desired, the destination address should be programmed with the MAC ID of the destination transceiver. To simplify EEPROM programming, Auto Destination can be enabled in Clients which allows the Client to automatically set its destination address to the address of the Host server.		
RF Mode	All radios located on the same network must use the same RF Mode. **Acknowledge Mode:** In Acknowledge mode, the transceiver uses Transmit Retries or Broadcast Attempts to increase the odds of successfully delivering the packet to the intended receiver(s). If the transceiver is unable to send the packet to the intended receiver without errors, the intended receiver will not send the packet to the OEM host. **Stream Mode:** In Stream mode, the transceiver sends each RF packet out once. There are no retries on the packet. Whether or not the packet contains errors, the receiver will send the packet to the OEM Host.		
Duplex Mode	In Half Duplex mode, the AC4490/AC4486 sends a packet out over the RF when it can. This can cause packets sent at the same time by a Host server and a Client to collide with each other over the RF. To prevent this, Full Duplex mode can be enabled. This mode restricts Clients to transmitting on odd numbered frequency "bins" and the Host server to transmitting on even frequency bins. Though the RF hardware is still technically half duplex, it makes the transceiver seem full duplex. This can cause overall throughputs to be cut in half. Note: All transceivers on the same network must have the same setting for Full Duplex. Full Duplex mode is incompatible with Stream RF mode.		
Tx Retries	In Addressed Acknowledge Mode, Transmit Retries is used to increase the odds of successful delivery to the intended receiver. Transparent to the OEM Host, the sending transceiver will send the RF packet to the intended receiver. If the receiver detects a packet error, it tells the sender to retry the packet. This goes on until the packet is successfully received or the transmitter exhausts all of its retries. The received packet is only sent to the OEM Host if it is received free of errors.		
Broadcast Attempts	In Broadcast Acknowledge mode, broadcast attempts are used to increase the odds of successful delivery to the intended receiver(s). Transparent to the OEM Host, the sending transceiver will send the RF packet to the intended receiver(s). If the receiver detects a packet error, it throws out the packet. This will go on until the packet is successfully received or the transmitter exhausts all of its attempts. Once the receiver successfully receives the packet, it throws out any duplicates caused by further broadcast attempts. The received packet is only sent to the OEM Host if it is received free of errors.		
Range Refresh	This byte specifies the maximum amount of time a transceiver reports In Range without having heard a beacon (320ms per increment).		
Interface Timeout	Interface timeout, in conjunction with RF packet size, determines when a buffer of data is sent out over the RF as a complete RF packet, based on whichever condition occurs first. For a more in-depth explanation, please refer to the WWU contextual Help.		
Auto Destination	When enabled in Clients, this allows the Client to automatically set its destination address to that of the Host server.		
Destination	The destination address is simply the MAC (IEEE) address of the intended receiver on the		

Specification	Description/Setting
Address	network. In Addressed Delivery mode, the RF packet is sent out to the intended receiver, designated by the destination address. In Acknowledge mode, transmit retries is used to increase the odds of successful delivery. In Stream mode, the packet is just sent out once over the RF to the intended receiver.
Receive Unicast Only	Please refer to the WWU contextual Help.
RTS Enabled	With RTS Mode disabled, the transceiver will send any (valid) received packet to the OEM Host as soon as the packet is verified. With RTS Mode enabled, the OEM Host can keep the transceiver from sending it a packet by disabling RTS (logic high). Once RTS is enabled (logic low), the transceiver can send packets to the OEM Host. Note: Leaving RTS disabled for too long can cause lost data, once the transceiver's receive buffer fills up.
One Beacon Mode	The beacon, which is sent by the Host Server and contains system timing information, takes approximately 1ms to send. With One Beacon mode disabled, the Host Server will send a beacon once every hop. Enabling One Beacon mode causes the beacon to only be sent once per complete hop cycle. Using this feature can make initial synchronization take slightly longer and can make communications more difficult, if operating on the fringe, but can increase net throughput. All transceivers on the same network must use the same settings for One Beacon mode. Please refer to the One Beacon mode table below.
Enable Encryption	Data Encryption Standard (DES)– Encryption is the process of encoding an information bit stream to secure the data content. The DES algorithm is a common, simple and well-established encryption routine. An encryption key of 56-bits is used to encrypt the packet. The receiver must use the exact same key to decrypt the packet; otherwise, garbled data is produced.
Encryption Key	The encryption key is used to encode the information bit stream to secure the data content. The DES algorithm is a common, simple and well-established encryption routine. An encryption key of 56-bits (7 bytes) is used to encrypt the packet. The receiver must use the exact same key to decrypt the packet; otherwise, garbled data is produced.

One Beacon Mode Settings

Address	One Beacon Enabled	One Beacon Disabled	
45h	Set bit 7	Clear bit 7	
3Ch	18h	28h	
3Dh	Ch. 10-2Fh: C8h	18h	
All others: 68h	All others: 68h	All others: 68h	

Other

Freq. Offset	Frequency Offset is a radio protocol parameter used in conjunction with RF channel number.
Modem Mode	Full modem handshaking is supported by the transceivers when enabled in EEPROM. Modem mode is incompatible with RS-485 DE mode. Because Command/Data performs an alternate function when this mode is enabled, CC on-the-fly commands cannot be used and Configuration mode is entered by forcing 9600 baud through the 9600_BAUD pin. Therefore, Modem mode, though enabled in EEPROM, is ignored when 9600 baud is forced.
Parity Mode	The serial interface data rate is programmable by the Host. This is the rate the Host and transceiver communicate over the serial bus. Possible values range from 1200 bps to 115,200 bps. Note: Enabling Parity mode cuts throughput in half and the Interface Buffer size in half.
RS-485 DE Mode	RS-485 DE Control– When enabled in EEPROM, the transceiver will use the GO0 pin to control the DE pin on external RS-485 circuitry. If enabled, when the transceiver has data to send to the host, it asserts GO0 Low, sends the data to the host and takes GO0 High.

Specification	Description/Setting
Stop Bit Delay	For systems using the RS-485 interface or Parity mode, the serial stop bit might come too early (especially at slower interface baud rates). Stop Bit Delay controls the width of the last bit before the stop bit occurs. FFh = Disable Stop Bit Delay (12us) 00h = (256 * 1.6us) + 12us 1– FEh = (value * 1.6us) + 12us.
Protocol Status/ Acknowledge	(Implemented in v6.3 of the firmware and later) When enabled in EEPROM, GO0 and GO1 will perform the functions of protocol status and received acknowledgment. For a more in-depth explanation, please refer to the WWU contextual Help.
Receive API	(Implemented in v6.3 of the firmware and later) Receive API can be enabled to determine the sender of a message. This causes the radio to append a header to the received message detailing the length of the data packet and the sending radio's MAC address. The received packet will use the following format: |83h|PDL|Sender's MAC|PD For a more in-depth explanation, please refer to the WWU contextual Help.
RF Performance Parameters	
Auto Config	Please refer to the WWU contextual Help
Sub Hop Adjust	Sub Hop Adjust is a protocol parameter and should only be modified when directed to do so by an AeroComm representative.
RF Packet Size	RF packet size, in conjunction with interface timeout, determines when a buffer of data will be sent out over the RF as a complete RF packet, based on whichever condition occurs first. For a more in-depth explanation please refer to the WWU contextual Help.
CTS On	CTS On, in conjunction with CTS On Hysteresis, controls the operation of CTS. The AC4490 has a maximum interface buffer size of 256 bytes. If the buffer fills up and more bytes are sent to the transceiver before the buffer can be emptied, data corruption occurs. Therefore, CTS On specifies the amount of bytes that must be in the buffer for CTS to be disabled. This is used to prevent buffer overrun and subsequent data corruption. Even while CTS is disabled, the OEM host can still send data to the transceiver, but it should do so carefully. Once CTS is disabled, it remains disabled until the buffer is reduced to the size specified by CTS On Hysteresis.
CTS On Hysteresis	CTS On Hysteresis, in conjunction with CTS On, controls the operation of CTS. The AC4490 has a maximum interface buffer size of 256 bytes. If the buffer fills up and more bytes are sent to the transceiver before the buffer can be emptied, data corruption occurs. Therefore, CTS On specifies the amount of bytes that must be in the buffer for CTS to be disabled. This is used to prevent buffer overrun and subsequent data corruption. Even while CTS is disabled, the OEM host can still send data to the transceiver, but it should do so carefully. Once CTS is disabled, it remains disabled until the buffer is reduced to the size specified by CTS On Hysteresis.

The non-configurable information on this dialog page includes:

- MAC Address - This identifies the radio transceiver.
- Firmware Version - This identifies the radio transceiver.
- Year - This identifies the radio transceiver.

3.4.1.3 Network View Tab

This dialog displays network information.

A function is provided that will find and list all host servers within range of this device.
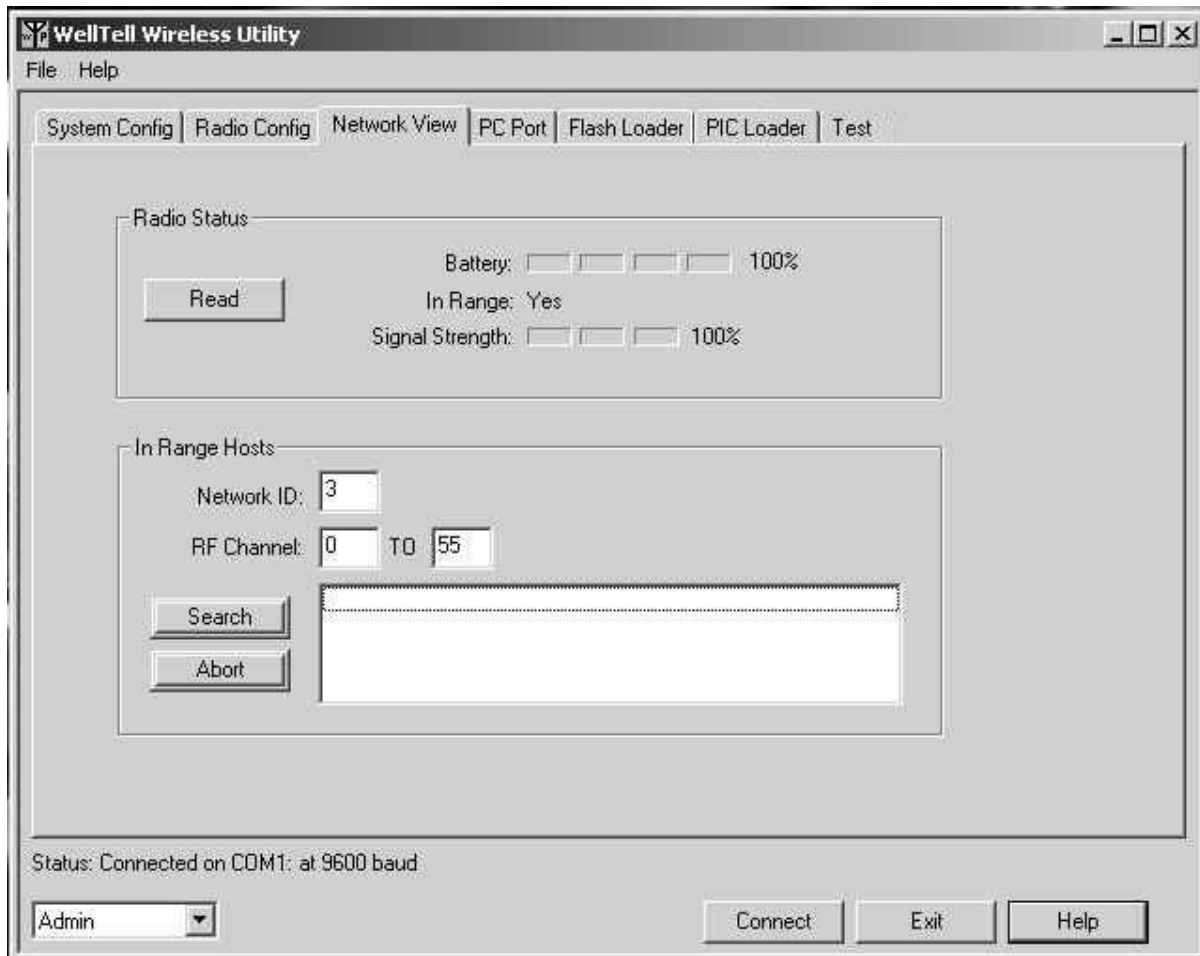
Figure 3–11 Network View Tab

Table 3—4 Network View Settings

Specification	Description/Setting
Radio Status	
Read Button	This set of controls includes a Read button to read status from the WellTell device radio and the following controls which display the status that is returned.
Battery	Shows the battery charge level that is currently being displayed on the WellTell device LCD display.
In Range	In Range - Displays Yes or No to indicate if this device has synchronized with a Host Server that is on the same network ID and RF channel as the current radio configuration parameters of this Wireless device.
Signal Strength	Signal Strength - Shows the current signal strength that is currently being displayed on the WellTell device LCD display.
In Range Hosts	
Network I.D.	This control is used to enter the network ID that is to be searched.
RF Channel	These controls are used to enter the start and end channels of a range of channels to be searched.
Search	This set of controls are used to find Host Servers that are in range of this WellTell device. This button is used to start a search for in-range servers.

Specification	Description/Setting
Abort	This button is used to abort a search that is in progress.

3.4.1.4 PC Port Tab

This dialog provides both communication setup and data logging capability for the port that is connected to the WellTell device.
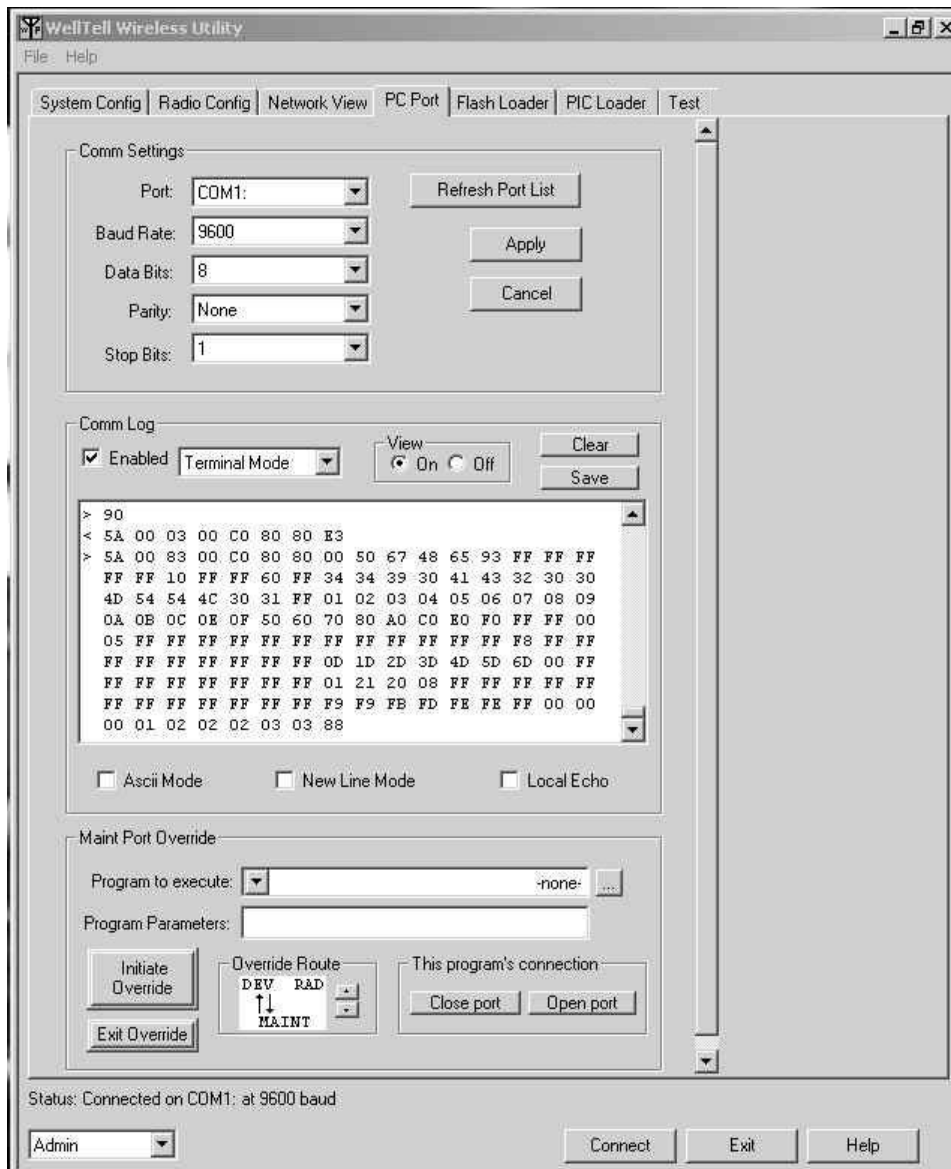
Figure 3–12 PC Port Tab

The Comm Settings are used to configure the serial port that is connected to the WellTell device. All selections are applied when the Apply button is clicked. The Cancel button will reset all selections to their original values.

Table 3—5 PC Port Settings

Specification	Description/Setting
Comm Settings	
Port	This selects the Comm Port to use on the PC.
Baud Rate	This sets the baud rate on the PC communication port.
Data Bits	Selects the number of data bits in the data word: 7/8
Parity	Selects parity: Odd, Even or None
Stop Bits	Selects the number of stop bits: 1/2
Apply	Applies above parameters to the PC's communications port.
Cancel	Resets all above parameters to their default values.
Refresh Port List	Rebuilds the list of available com ports.

The Comm Log window displays data communication for the selected port.

Table 3—6 Comm Log Setting

Specification	Description/Setting
Enabled	This check box is used to turn data logging capability on/off. Logged data includes commands sent out, responses to those commands and input that is being monitored via the Monitor mode or Terminal mode capabilities described below.
Commands	This mode logs commands sent to and responses received from the WellTell device. Commands sent out are preceded with a '<' character and responses are preceded with a '>' character.
Monitor Mode	This mode will watch and display input coming from the WellTell device via the maintenance port. It can also be used to enter data that will be sent to the WellTell device via the maintenance port. The Monitor mode uses a special format that allows all data to be seen.
Terminal Mode	This mode operates similar to a dumb terminal connected to the WellTell device via the maintenance port.
View On/Off	This turns the Comm Log window display on/off. View Off allows the program to better keep up with a data stream that is being monitored. The data will still be added to the log when in this mode and can be viewed when the View is turned back on.
Clear	This button is used to clear the contents of the log.
Save	This button is used to save the log to a file.
Ascii Mode	This mode will display characters when recognized as such. Non-character data will continue to be displayed in hex dump format. Note that this has no effect on the operation of Terminal Mode.
New Line Mode	This mode will begin a new line following each <cr> and <lf>. This mode applies only to monitored input.
Local Echo	This mode applies to data entered in Monitor and Terminal mode. It will echo characters to the window as they are typed in.

The WellTell device can be placed into a mode of operation that overrides its current configuration by connecting the maintenance port directly, according to a user-selectable route. The current Comm Settings selections are used to initialize the port parameters. This allows an application to communicate directly via the

maintenance port connection to a device that the maintenance port is routed to. The radio is disabled when in this mode.

The WellTell device remains in this state while a maintenance port cable is connected.

The WellTell device automatically exits from this mode 30 seconds after disconnecting the physical cable from the maintenance port.

Table 3—7 Maintenance Port Override

Specification	Description/Setting
Program to Execute	This control identifies a program to automatically execute when the Initiate Override button is pressed. It is possible to clear this field to avoid automatic execution of a program, if None is selected.
Program Parameters	This control is used to provide command line parameters for the program to execute.
Initiate Override	This button places the WellTell device into the override state. The port is closed by this application to allow some other application to gain access to it.
Exit Override	This button sends a break to the WellTell device that causes the Wireless device to exit Override mode.
Override Route	This selects the maintenance port connection route.
Close Port	This button causes this application to close the port. This is necessary in order to make the port available to a different program for override connection purposes.
Open Port	This button attempts to open the port for use by this application. If the Wireless device is still in Override mode, then the "Comm Log" terminal can then be used to communicate directly with the remote port device.

CAUTION

If in Override mode and the port is closed or not in use, the WellTell device will exit override mode after 30 seconds, automatically. To cause it to exit Override mode immediately, press the Exit Override button.

The port must be open to resume normal WellTell configuration capabilities.

3.4.1.5   Flash Loader Tab

This dialog is used to load a product's program into the WellTell device. The program is loaded using the COM port that is currently selected on the PC Port tab dialog.
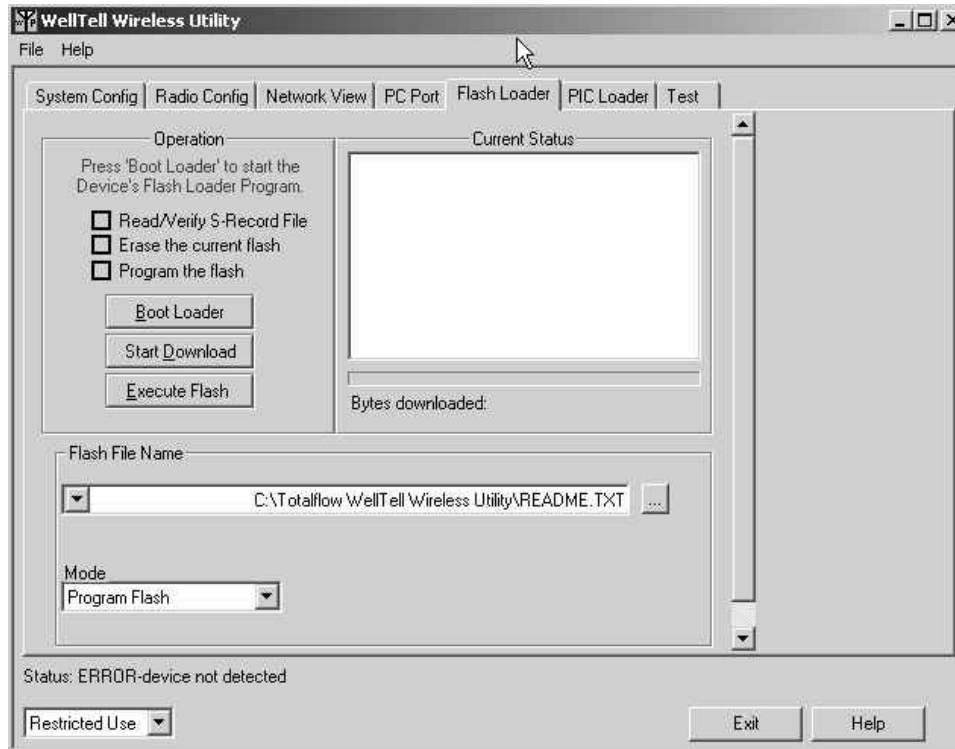
Figure 3–13 Flash Loader Tab

Flash Loading Procedure:

1) Select Program Flash Mode.

2) Select the appropriate Flash file name (name of program to download).

3) Click the Boot Loader button to activate the Boot Loader program.

4) Click the Start Download button to download the program.

5) Select Verify Flash mode.

6) Click the Start Verify button to verify successful download.

7) Click the Execute Flash button to start the WellTell program.

FYI — Note that the Execute Flash button can be used at any time to reset the WellTell device. The WellTell device also resets automatically upon entry to and exit from this dialog page.

CAUTION — Flash Loader operation requires proper cabling that includes the DTR and RTS signals. Additionally, the Program switch on the WellTell board needs to be set to Enabled.

3.4.1.6 PIC Loader

The PIC Loader is an enhancement that allows the PIC to be programmed in the field with a 1.7.1 version of the I/O client program.
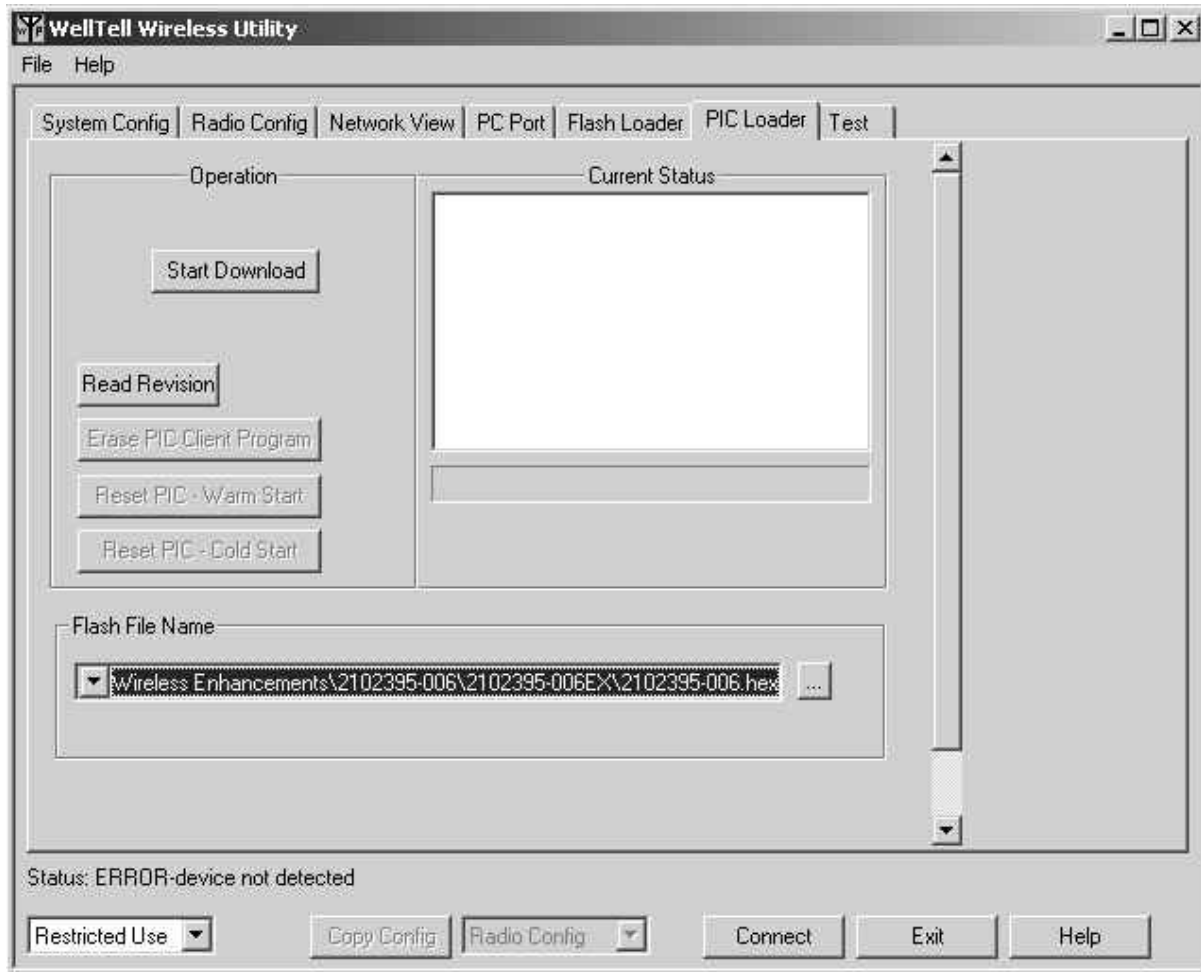
Figure 3–14 PIC Loader

The PIC boot loader is now responsible for loading the PIC Wireless I/O client flash product. Previously, the software was flashed using the MPLAB software and the MPLAB puck. This software and hardware is now used to flash the boot loader to the PIC. The WellTell Wireless Utility sends a command to the PIC client to enter the boot loader and then communicates with the boot loader to download a user-selected version of the PIC client product. It should be noted that the PIC client program may not be there. If this occurs, the boot loader will already be executing.

The boot loader stays programmed in the PIC. It can only be replaced using a hardware programmer (such as the MPLAB scenario above).

The boot loader executes from a power-up and then executes the PIC client firmware, if it has been loaded to the PIC; otherwise, the boot loader continues to execute until the client program is downloaded.

The current I/O states of the client will remain constant while the new PIC client program is being downloaded. Once downloaded, the new PIC client program will begin executing, which may cause a momentary glitch in the I/O states until the program restores the I/O states that are currently stored in the PIC's eeprom.

3.4.1.7   Test Tab

This dialog can be used to test the WellTell device and radio communication links.

This group of controls can be used to test radio communication links. A port can be set up to send test patterns to and/or a port can be set up to receive test patterns on. A test is restarted (using the current input control information) each time the Start button is clicked. The test stops when the Stop button is clicked or the user moves to a different tab.
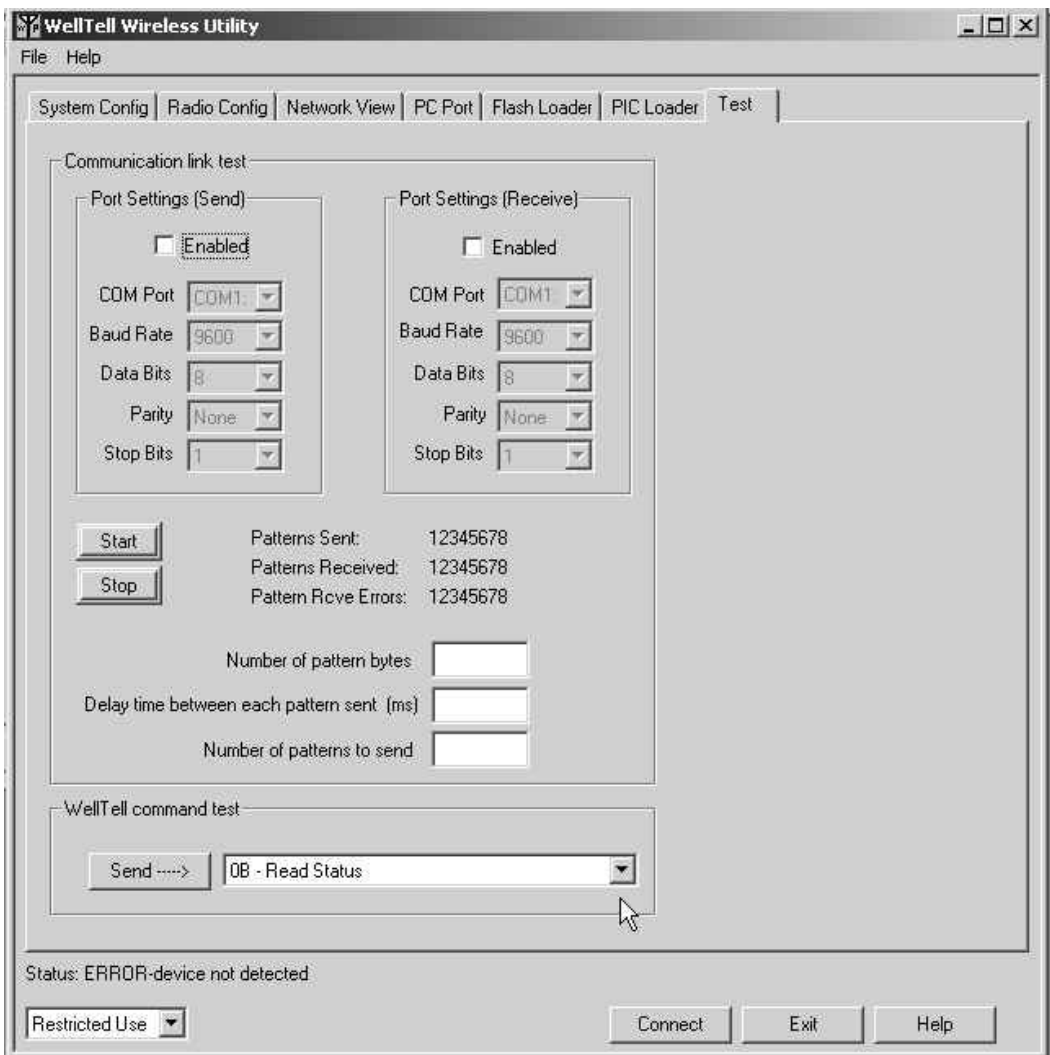
Figure 3–15 Test Tab

Table 3—8 Test Settings

Specification	Description/Settings
Communication Link Test	
Port Settings (Send)	This group of controls defines the port to send patterns out on.
Port Settings (Receive)	This group of controls defines the port to receive patterns on.
Start Button	Input controls are read, and a new test is started each time this button is clicked.

Specification	Description/Settings
Stop Button	This button stops a test that is active.
Number of pattern bytes	The number of bytes in a single test pattern (min of 4, max of 256).
Delay time between each pattern sent (ms)	When sending the pattern more than one time, this value specifies how long to delay before sending the pattern again. This value can be zero (no delay).
Number of patterns to send	The number of byte patterns to send. A value of zero indicates that the pattern is sent over and over until manually stopped.
Command Test	
These controls are used to test sending a command to a WellTell device. Pressing the Send button sends the command that is currently selected in the control next to it. The command and response communication can then be viewed using the Comm Log display on the PC Port tab dialog.	

3.5   WellTell I/O Calibration Utility

The WellTell I/O Calibration utility is a application that is designed to simplify the process of calibrating a wireless I/O client locally. The process is initiated when the user travels to the site of the wireless I/O client, connects a laptop to the client via a MMI cable and then runs the WellTell I/O Calibration utility to perform the calibration. The calibration information is then stored within the wireless I/O client.

FYI   After the user has entered in all of the calibration information within the WellTell I/O Calibration utility, they will need to use PCCU in order to retrieve the calibration information.

When the user switches from one tab to the next, the utility will re-read and display the values for the selected tab.

To install the calibration utility on a computer, run the "setup.exe" and follow the prompting of the Install Wizard.

3.5.1   Calibrate AI

The WellTell I/O board contains four onboard analog inputs. The settings available to the user in the Calibrate AI tab enables them to establish the parameters for the analog inputs.

For additional information on how to calibrate the AO, please refer to the application's help files.

FYI   When the user is calibrating information of the Calibrate AI tab (or any other tab in the WellTell I/O Calibration utility) if they happen to move off the tab prior to calibration completion, all information is lost. A subsequent return to the tab will mean that the user has to restart the calibration sequence.
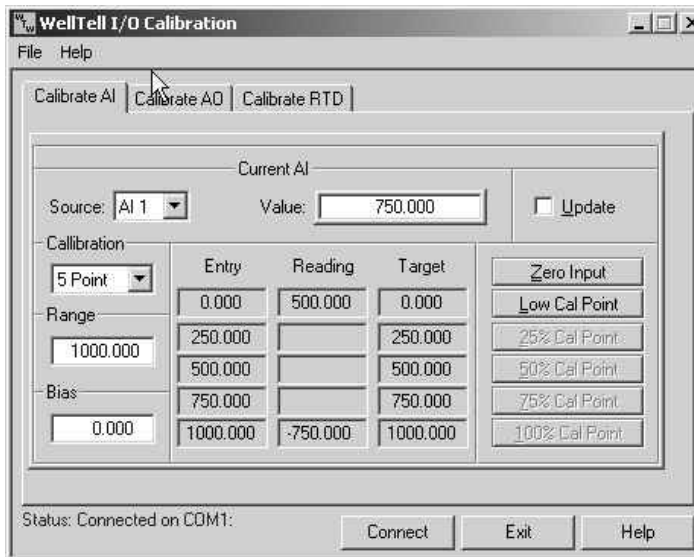
Figure 3–16 Calibrate AI Tab

Table 3—9 AI Current AI Calibration Screen

Specification	Description/Setting
Source	Within this drop-down field, the user can establish which AI they will be configuring (A1– A4).
Value	This information field displays the current value of the selected input.
Update	Upon being checked, this will insure that the user receives the current value every second.
Calibration	Within this drop-down field, the user can select whether to initiate a 2, 3 or 5-point calibration. It should be noted that if a 2-point calibration is selected, there are two target values and two Cal Point buttons. If the user selects a 3-point calibration, there will be three target values and three Cal Point buttons. Finally, if the user selects 5-point calibration, there will be five target values and five Cal Point buttons.
Range	This field enables the user to establish a calibration range value. The range can be anything and represent any unit (percent, volts, etc.). The Target values are updated to reflect the new calibration range.
Bias	This input value will either be added to or subtracted from (negative value) the analog input's value.
Zero Input	During the process of setting up analog input markers, the user may conclude that the inputs are out of alignment exactly the same amount at each AI marker (linear shift). When this occurs, the user may either re-calibrate the wireless I/O or may set the AI to zero. The preferred method is to recalibrate the wireless I/O. By using the Zero Input function, all references to previous AI markers are non-existent, eliminating the ability to adjust based on previous markers.
Low Cal Point	The Low Cal Point button enables the user to apply the unit amount for the low calibration point.
XX% Cal Point	Based on the point calibration that the user has selected, these individual fields represent the five possible calibration points. If 2-point calibration is selected, then only two of the Cal Point fields will display and so forth. Those not in use will not be available to the user.

3.5.2 Calibrate AO

The Calibrate AO tab enables the user to establish the calibration for the wireless I/O client's analog outputs. The user is presented with three fields: Eng. Units, %FS and mA. The user can enter in a value within any one of these fields, and it is then sent to the wireless I/O client where a conversion is made for the other two values. All three values are re-read from the client and displayed for the user. This is generally for information only and will not set the client's AO value.

For additional information on how to calibrate the AO, please refer to the application's help files.
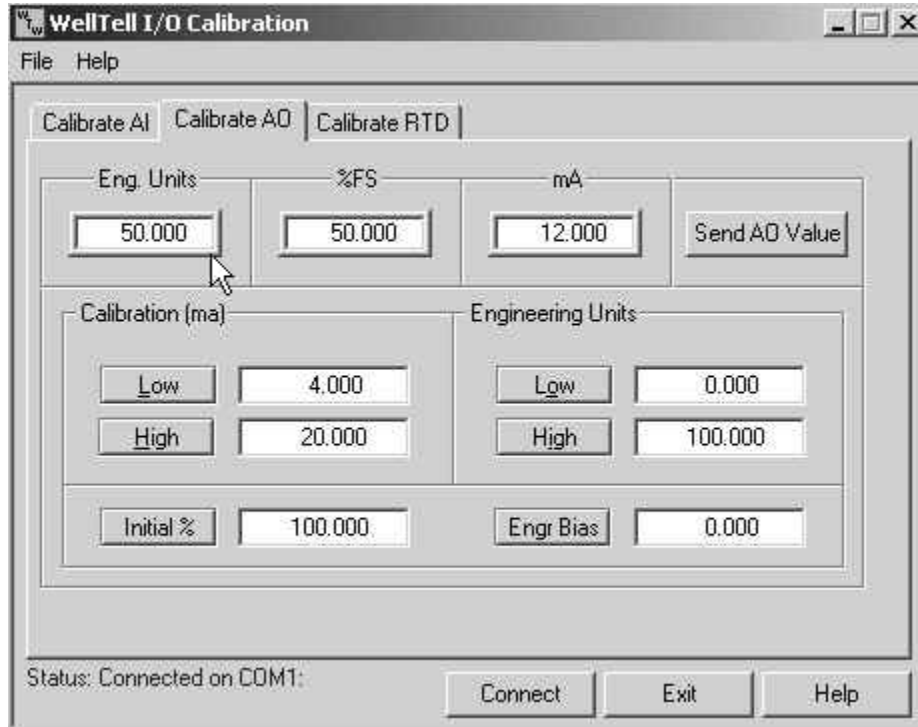
Figure 3–17 Calibrate AO Tab

Table 3—10 Calibrate AO Screen

Specification	Description/Setting
Engineering Units	
Eng. Units	The user can enter a value that represents the engineering units scaled across the 4-20 mA range. This is generally 0 (low) through 100 (high).
%FS	This value field allows the user to enter a percentage amount as it relates to a 4-20 mA range. For example, entering 50 in this field will return an output of 12 mA.
mA	This value field represents the milliamp range of 4-20 mA. Depending on what value the user places in this field (4-20), the Eng. Unit and %FS fields will reflect the conversion values.
Send AO Value	This button is pushed to set the AO to the display values (Eng Units, %FS and mA).
Calibration (mA)	
Low	After the user has connected a meter to the module, the user can enter the reading as displayed by the meter.

Specification	Description/Setting
High	After the user has connected a meter to the module, the user can enter the reading as displayed by the meter.
Engineering Units	
Low	This field enables the user to enter units representing engineering units that are scaled across the 4-20 mA range. This field value represents zero or the low end of the range.
High	This field enables the user to enter units representing engineering units that are scaled across the 4-20 mA range. This field value represents full scale or the high end of the range.
Other	
Initial %	This field allows the user to enter a percentage value of the full scale that is a value that the AO will output after a loss of power to the electronic board.
Engr Bias	This field allows the user to enter a bias value in Engineering Units. The bias offsets the low end of the range by the bias amount.

3.5.3 Calibrate RTD

The WellTell I/O Calibration utility allows the user to calibrate the two resistant temperature detector (RTD) inputs. The RTD is responsible for measuring the real-time flowing temperature of the gas.

For additional information on how to calibrate the RTDs, please refer to the application's help files.
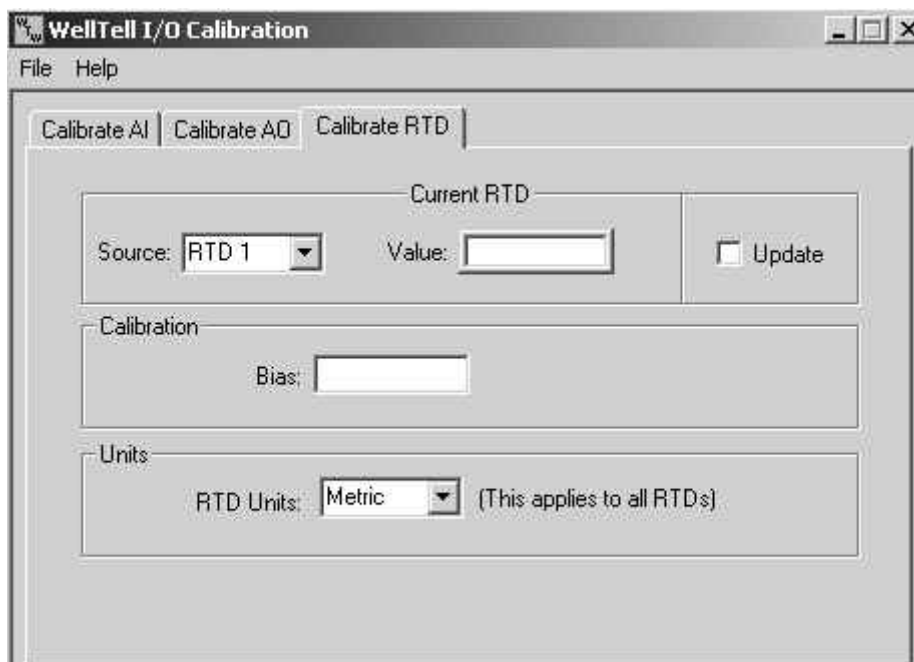
Figure 3–18 Calibrate RTD Tab

Table 3—11 Calibrate RTD Screen

Specification	Description
Current RTD	
Source	This drop-down selection enables the user to select the RTD that is being calibrated.

Specification	Description
Value	This information field shows the value of the RTD.
Update	Once selected by the user, this enables the user to see the current RTD value in one second intervals.
Calibration	
Bias	This user input field shifts the RTD probe curve, either positive or negative. The user can adjust the measurement of the temperature to agree with the calibrated temperature.
Units	
RTD Units	This field enables the user to set the units of measure for RTD components in either Metric or English.

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APPENDIX A   RADIO CONFIGURATION AND TEST PROTOCOL

The objective of this section is to provide information relative to implementing the interface between the WellTell Wireless Utility (WWU) and an embedded wireless board.

A.1   Communication

A.1.1   Synchronization

Before sending a command to the wireless board, the configuration host sends a synchronization character (SYNC = 0x80). This character is sent to determine whether the wireless board is connected and ready to receive commands. The synchronization character is not part of the data frame which is defined later.

After receiving a SYNC from the host, and if the wireless board is in a ready state, it will respond with an acknowledgement (DATA_ACK = 0x90).

After receiving the ACK, the host is now ready to send a command, if it wants to.

A DATA_NAK (0xA0) is returned from the wireless board, if it receives an incorrect data frame or if it could not complete the required operation.

There are two categories of commands sent to the wireless board from the host:

- System Configuration and Status

- Radio Configuration and Status

A.1.2   Data Frames

The data frame follows a preceding synchronization sequence as previously described.

A.1.3   Commands

Table A–1 Typical System Commands

Command	Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = high byte	Data	LRC
Typical System	0x5A	Xx	LLHH	xxxxxx………	Yy
Typical Radio[2]	0x5A	0x00	LLHH	xxxxxx………	Yy
Typical Response	0x5A	0x00	LLHH	xxxxxx………	Yy

A.2   Boot Loading

The bootstrap loader (BSL) enables a user to communicate with the embedded wireless board through the WWU software for the purpose of programming the Flash memory in the MSP430 microcontroller. The BSL uses the maintenance communication port to set up and program the microcontroller. It issues a specific entry sequence to the communication port device pins and then follows that with a sequence of commands to initiate the desired functions. The boot loading session

---

[2] Radio command embedded in the data section.

is exited by continuing operation at a defined user program address or by the reset condition.

Applying an appropriate sequence to RTS and DTR pins forces the microcontroller to start program execution at the BSL Reset vector instead of the vector located at 0xFFFE. If the RTS pin is kept low while the DTR pin goes from low to high, the unit will go to the normal reset vector at 0xFFFE. The BSL program starts whenever the RTS pin has received a minimum of two positive transitions and if the RTS pin is high while the DTR pin goes from low to high.

After doing the sequence with RTS and DTR, the host sends a 0x80 over the port and, if the unit returns a 0x90, it is in BSL mode and ready to be loaded using data frames

A.3   Command Description

A.3.1   Command 0x00– Radio Command

Command	Description			
0x00	Radio Command			
0x01	Set Switches			
0x02	Read Switches			
0x03	Radio Command 9600 Baud			
0x04	Report Device Description			
0x05	Report Part Number			
0x06	Report Revision			
0x07	Read Device Interface Settings			
0x08	Write Device Interface Settings			
0x09	Communicate with Remote (over ride mode)			
0x0A	Set default baud rate for maintenance port			
0x0B	Read Board Status			
0x0C	Get PIC Info			
0x0D	Set PIC Info			
Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	Data	LRC
0x5A	0x00	LLHH	(Radio Command)	yy

The radio command data is sent directly to the AeroComm Radio.

A.3.2   Response 0x00

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	Data	LRC
0x5A	0x00	LLHH	XX	yy

XX: Routing Switch Setting:

- 00– Micro < ---- > Device

- 01– Micro < ---- > Radio

- 02– Device < ---- > Radio, Device ---- Micro, (pass thru)

- 03– Device < ---- > Radio, Radio ---- Micro, (pass thru)

A.3.3   Response 0x01

0x90

A.3.4   Command 0x02– Read Switches

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	Data	LRC
0x5A	0x02	0100	XX	yy

XX: Routing Switch Setting:

- 00– Micro < ---- > Device
- 01– Micro < ---- > Radio
- 02– Device < ---- > Radio, Device ----
- 03– Device < ---- > Radio, Radio ---- Micro, (pass thru)Micro, (pass thru)

A.3.5   Command 0x03– Radio Command (At 9600 Baud Only)

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	Data	LRC
0x5A	0x03	0000	(Radio Command)	yy

A.3.6   The Radio Command Data is Sent Directly to the AeroComm Radio

The command forces the radio to go to 9600 baud.

A.3.7   Response 0x03 (At 9600 Baud Only)

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	LRC
0x5A	0x04	0000	0xA2

A.3.8   Response 0x04

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	Data	LRC
0x5A	0x04	LLHH	Description	yy

Description (null-terminated ASCII)

Ex. Wireless RS-485 Barrier Client

A.3.9   Command 0x05– Report Part Number

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	LRC
0x5A	0x05	0000	0xA1

A.3.10 Response 0x05

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	Data	LRC
0x5A	0x05	0800	Part Number	yy

Part number (null-terminated ASCII)

Ex. 2102005

A.3.11 Command 0x06– Report Division

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	LRC
0x5A	0x06	0000	0xA0

A.3.12 Response 0x06

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	Data	LRC
0x5A	0x06	0400	Revision	yy

Revision (null-terminated ASCII)

Ex. 001

A.3.13 Command 0x07– Read Device Interface Settings

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	LRC
0x5A	0x07	0000	0x9F

A.3.14 Response 0x07

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	Data	LRC
0x5A	0x07	0100	XX	yy

XX:

00– RS232 (not supported by any of our current products)

01– RS-422 (not supported by any of our current products)

02– RS-485

A.3.15 Command 0x08– Write Device Interface Settings

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	Data	LRC
0x5A	0x08	0100	XX	yy

XX:

00– RS232 Note: not supported by any of our current products.

01– RS-422 Note: not supported by any of our current products.

02– RS-485

A.3.16 Response 0x08

0x90

A.3.17 Command 0x09– Communicate with Remote (Override Mode)

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	Data	LRC
0x5A	0x09	0100	XX	yy

XX = Baud Rate, Timeout Count, Break Enable, Routing

Baud Rate:
- 00– 1200
- 01– 2400
- 02– 4800
- 03– 9600
- 04– 19200
- 05– 38400
- 06– 57600
- 07– 115200

Timeout Count:
- 50 is roughly equivalent to 30 seconds.

Break Enable:
- 00– maintenance port break is ignored.
- 01– maintenance port break stops override mode.

Routing:
- 00– Micro < - - >Device
- 01– Micro < - - >Radio

A.3.18 Response 0x09

0x90

A.3.19 Command 0x0A– Set Default Baud Rate for Maintenance Port

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	Data	LRC
0x5A	0x0A	0100	XX	yy

XX = Baud Rate

Baud Rate:
- 00– 1200
- 01– 2400
- 02– 4800
- 03– 9600
- 04– 19200
- 05– 38400
- 06– 57600

- 07– 115200

A.3.20 Command 0x0B– Read Status of Board

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	LRC
0x5A	0x0B	0000	0x9B

A.3.21 Response 0x0B

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	Data	LRC
0x5A	0x0B	0100	XX	yy

XX = Board Status, XCVR Status, Product ID
- Board Status (1 byte)
- Bit 7– A0 (lowest bar of signal strength indicator) 0=off, 1=on
- Bit 6– A1 (middle bar of signal strength indicator) 0=off, 1=on
- Bit 5– A2 (top bar of signal strength indicator) 0=off, 1=on
-
- Bit 4– Antenna Symbol 0=off, 1=on
- Bit 3– BB (lowest battery level indicator)
- Bit 2– B1 (next higher battery level indicator)
- Bit 1– B2 (next higher battery level indicator)
- Bit 0– BT (top battery level indicator)

- XCVR Status (1 byte)
- 00 or 01– Radio On
- 0xFF or 0xFE– Radio Off

Produce ID:
- 01– Obsolete (Prototype Board)
- 02– Wireless RS-485 Barrier Client
- 03– Wireless Remote I/O Client
- 04– Wireless Host Server

A.3.22 Command 0x0C– Get PIC Info (Applies to Wireless I/O Client Only)

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	LRC
0x5A	0x0C	0000	0x9A

A.3.23 Response 0x0C

Frame Byte	Command	Data Length (LLHH) LL = lo byte, HH = hi byte	Data	LRC
0x5A	0x0C	0100	XX	yy

XX = Baud Rate, Num Bits, Parity, Mode, Stop Bits, Address and Type.

Baud Rate:

- 00– 1200
- 01– 2400
- 02– 4800
- 03– 9600
- 04– 19200
- 05– 38400
- 06– 57600
- 07– 115200

Num bits

- 00– 7 bits
- 01– 8 bits

Parity

- 00– None
- 01– Even
- 02– Odd

Mode

- 00– ASCII
- 01– RTU

Stop bits

- 00– 1 stop bit
- 01– 2 stop bits

Address

No extended I/O

- 01– 0xBF
- 0xC1- 0xCF (odd addresses)
- 0xD0- F7

Extended I/O

- 0xC0- 0xCE (even addresses)

Type

- 00– 32 bit Totalflow
- 01– 32 bit (not support by any of our current wireless products)
- 02– 16 bit Modicon
- 03– 16 bit word swapped

A.3.24 Response 0x0D

0x90

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APPENDIX B   PCCU APPLICATION SCREENS

The following information describes setting up PCCU32 to work with a WellTell wireless product. Several of the pertinent Windows dialog boxes are discussed. Calibration of analog inputs and analog outputs is targeted.

B.1 Wireless Remote I/O Screen

B.1.1 Wireless Remote IO Screen

B.1.1.1   Application Name

This is just the name of the application (determined by development group). This can be something similar to 'Wireless Remote IO'.

B.1.1.2   Number Wireless Cards

Here the user enters the number of Wireless Remote IO cards they have in their system.

B.1.2 User Descriptor (Just Beneath Wireless Remote IO in the App Tree)

B.1.2.1   Device Descriptor

Here, the user can gives each Wireless Remote IO card in the system a unique identifier. For example, if there are two Wireless Remote IO cards in separate locations, the user can identify each by that unique location (i.e., 'Location 1', 'Location 2').

B.1.2.2   Address

This is the Modbus of the Wireless Client card. It must match the Modbus address established when the user set up the Client card with the WWU program.

B.1.2.3   Status

This monitors the communications status.

B.1.2.4   Trigger

B.1.2.5   Remote Part

This is the Flash part number associated with the Wireless Client card.

B.1.2.6   Battery Voltage

This monitors the Wireless Client's battery voltage.

B.2 Analog Input Screen

FYI If intending to use a 4–20 mA transmitter on the analog input, please refer to Appendix C. Manufacturer's specifications can be extremely misleading. Often, a manufacturer's specification claims to operate from 10 to 30 VDC. They are NOT always clear that this 10–30 VDC must be applied across the 4–20 mA transmitter ONLY (and NOT across the transmitter/load resistor series combination). Again, please refer to the explanation in the appendix.

B.2.1 RTD 1 and 2

RTD 1 and 2 monitor the temperature in degrees Centigrade for the two RTD probes. RTD 1 and RTD 2 are physically connected to J12A and J12B, respectively.

B.2.2 AI 1 thru 4

AI-1 thru AI-4 return, in user defined units, the value associated with those analog inputs. The user defined units are identified during the calibration process.

B.2.3 Setup

Under the Setup tab, the user can select what type of Analog Input they require (voltage from 0–10 VDC or current from 4–20 mA).

B.3 Analog Input Calibration Screen

FYI If intending to use a 4–20 mA transmitter on the analog input, please refer to Appendix C. Manufacturer's specifications can be extremely misleading. Often, a manufacturer's specification claims to operate from 10 to 30 VDC. They are NOT always clear that this 10–30 VDC must be applied across the 4–20 mA transmitter ONLY (and NOT across the transmitter/load resistor series combination). Again, please refer to the explanation in the appendix.

This screen walks the user through the Calibration process for the Analog Inputs. The Analog Inputs can be calibrated for 0–10 VDC or 4–20 mA. In steps 1 to 5, the user is asked to enter values for 0, 100, 75, 50 and 25%. It is possible to do a 2, 3, 4 or 5-point calibration depending on which of these calibration values the user decides to enter. These values entered by the operator can be in any units.

B.3.1 Cal Mode

The Cal Mode can be Factory or Field. Generally, the unit is shipped with Factory calibration and is very close to what most users would find acceptable; however, the user is able to calibrate the unit to their specific application and generally get somewhat more accurate results. When the user goes through the calibration process, the Cal Mode is switched to Field.

B.3.2 Zero

1) 0% input
2) 100% input

3) 75% input

4) 50% input

5) 25% input

6) Bias offset

B.4 Analog Output Screen

B.4.1 Percent Full Scale 0–100%

The user is able to set the percent of full scale that they want to see on their 4–20 mA AO. For example, if the user range is 6 to 120 barrels of oil, setting the percent of full scale to 50% would represent 63 barrels of oil.

B.4.2 User Calibrated Range

The user can set their user units of output here. If the user range is from 6 to 120 barrels of oil and they enter 63, the Percent Full Scale should reflect 50%.

B.4.3 Status

This item reports the status of the communication link.

B.5 Analog Output Calibration Screen

This screen walks the user through a 4–20 mA Calibration process.

The Calibration process has seven steps.

1) Output minimum current

Connect an ampere meter to the AO. AOSRC (+) is on J11-15 and AORTN (-) is on J11-16. With the ampere meter connected, enter a 1 in Step 1, and click the Send button. The minimum current (probably about 3.84 mA) is output to the meter.

2) Input Current reading

Whatever the ampere meter reads (again, probably about 3.84 mA) should be entered in Step 2, and click on the Send button.

3) Input minimum unit

In Step 3, enter the low end value for the expected units range. If setting up the 4–20 mA AO to represent 6 to 120 barrels of oil, the user would enter a 6 in Step 3. In other words, 4 mA represents six barrels of oil.

4) Output maximum current

With the ampere meter still connected, enter a 1 in Step 4. This causes the AO to output the maximum possible milliamps (about 21.48 mA).

5) Input Current reading

Now, whatever the ampere meter reads (probably about 21.48 mA) should be entered in Step 5, and click the Send button.

6) Input Maximum Unit

Same as Step 3, but enter the high end of the expected unit's range. Again, if the expected unit's range for the 4–20 mA output is going to be 6 to 120 barrels of oil, the user will enter the 120 in Step 6. In other words, 20 mA represents 120 barrels of oil.

7) Set Complete

Entering a 1 and hitting Send completes the Calibration sequence.

B.5.1 Abort Calibration

Entering a 1 in Abort Calibration causes the calibration sequence to be ignored.

FYI The following discussion does NOT pertain to 1–5 VDC transmitters.

Totalflow flow meters employ a 250 ohm resistor to convert the 4–20 milliamp transmitter current loop to a 1–5 VDC signal. In some meters, this conversion is made by attaching a 250 ohm resistor across the 4–20 mA input pins (see Fig. A). Some meters use a small three-pin jumper to select an onboard 250 ohm resistor (see Fig. B), or not. Still, other meters employ an electronic switch to select the 250 ohm resistor (see Fig. C), or not. In the figures, VCC represents the voltage source used to power the transmitter. In many instances, VCC would be tied to the meter's VBAT.

With a solar powered system such as many Totalflow installations, available voltage to power the 4–20 transmitter can become an issue. Batteries in a battery backed solar installation can drop to 12 VDC or less. Some transmitters may not be able to drive 20 milliamps into a 250 ohm load with only 12 VDC applied to them. Fully charged batteries, connected to an operational battery charger, may be sitting at about 13.5–14 VDC.

Again, the 4–20 mA transmitter that the user chooses must be fully operational at voltages as low as VCC - 5 VDC. Again, VCC is the source voltage available at the site and 5 VDC represents the voltage dropped across the meter's 250 ohm resistor at maximum loop current (20 mA).

Totalflow can provide a 12 to 24 VDC converter (part # 2100358-001). This converter can be powered from the meter's VBAT. The converter's 24VDC output can then be used to power the 4–20 mA transmitter loop. In other words; VCC would now be 24 VDC. Subtracting the 5 volts dropped across the 250 ohm resistor would leave 19 VDC to power the transmitter.

FYI Another possible solution is to reduce the 250 ohm resistor to a smaller value, possibly 125 ohms. An under-powered transmitter could more easily drive 20 mA into the lesser resistance. Field calibrating the AI would negate any differences between the 250 ohm and the 125 ohm resistors. However, as the user reduces the size of the resistor, they lessen the overall resolution.

Example 1:

If the 4–20 mA transmitter can drive full range (20 mA through the 250 ohm resistor) the user has essentially converted a 4–20 mA current range into a 1–5 VDC voltage range. The analog to digital (A/D) converter used in Totalflow equipment expects a 1–5 VDC signal. During field calibration, the user might have the 4 mA of loop current represent 10bbls of fluid per hour and 20 mA represent 100bbls. The conversion to voltage (using the 250 ohm resistor) is as follows:

- 1VDC = 10bbls/hour
- 5 VDC = 100bbls/hour

Assuming that the A/D converter is ranged between 0 and 5 VDC and that the converter is resolving 15 bits, the user would expect to resolve about 150µVDC (or .0006mA). These numbers translate to about .003bbl (3 thousandths of a barrel or about one half fluid ounce).

Example 2:

If the 4–20 mA transmitter can NOT drive full range (20 mA through the 250 ohm resistor), the user may want to reduce the value of the resistor. For the example, it is dropped to 125 ohms (or half). A 4–20 mA current is now converted to a .5–2.5 VDC voltage range. Again, during field calibration, the user would have the 4 mA current represent 10bbls per hour and the 20 mA signal represent 100bbls per hour. The voltage conversion (using the 125 ohm resistor) is as follows:

- .5 VDC = 10bbls/hour
- 2.5 VDC = 1000bbls/hour

The A/D's full range is still 0–5 VDC; however, the user is only using about half of its range capability. Just like the resistor value, the ability to resolve barrels of fluid per hour has been cut in half. The overall accuracy remains unchanged, but the user can only resolve about .006bbl (6 thousandths of a barrel,or about one fluid ounce).
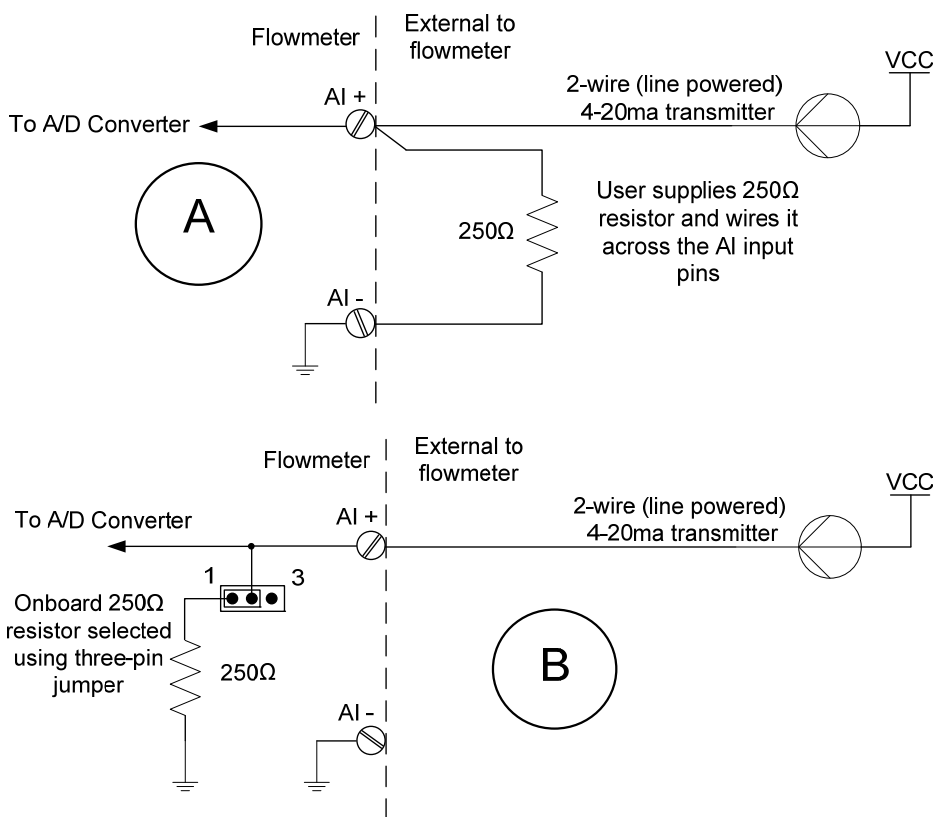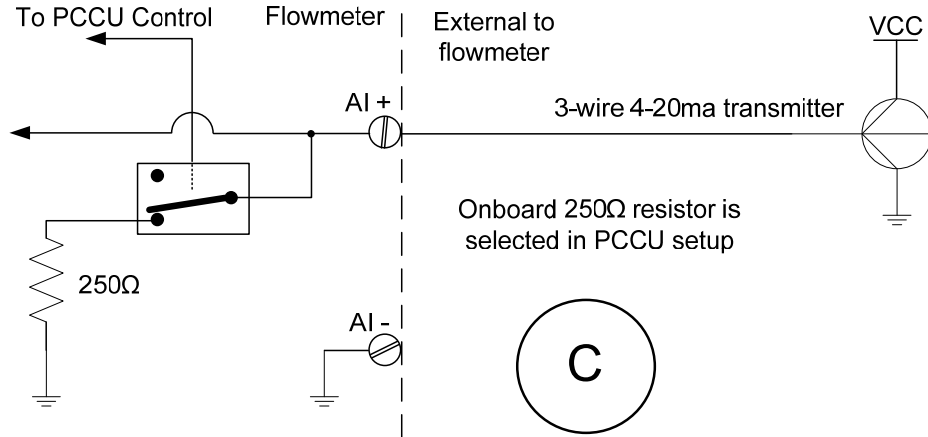
B.6 Conclusion

If the 4–20 mA transmitter the user is using cannot drive a full 20 mA through the 250 ohm resistor, reduce the resistive value. However, as the resistive value is reduced, resolution (not overall accuracy) is reduced proportionately. If the user drops the resistive value by half (250 ohms to 125 ohms), the resolution is also reduced by half.

To reduce the resistive value of an onboard resistor, add an external resistor across the analog input pins. This places the two resistors in parallel with one another. The parallel combination produces an equivalent resistance that is less than either of the two resistors alone. The value of this equivalent resistance is calculated as shown in the figure.

$$\text{Equivalent Resistance} = \frac{R1 \times R2}{R1 + R2} = \frac{250 \times 250}{250 + 250} = \frac{62500}{500} = 125 \text{ Ohms}$$
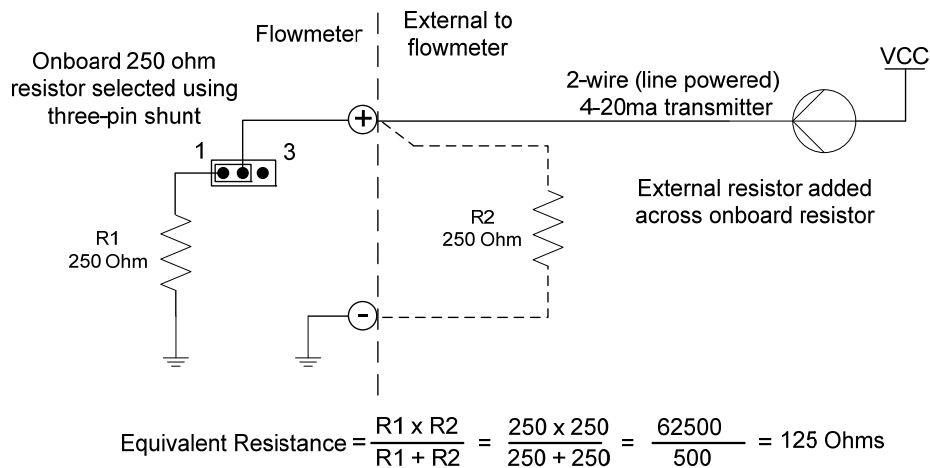
APPENDIX C   4–20 MA TRANSMITTER SPECIFICATIONS

4–20 milliamp transmitters are essentially variable constant current sources. They need to have sufficient voltage applied to them to ensure that they will be able to drive 20 milliamps into a 250 ohm load. Different transmitter technologies have different powering requirements.

Many 4–20 mA transmitters claim to be operational between 10 and 30 VDC. This can be somewhat misleading. If it is a two-wire (line powered) transmitter and it is sourcing the maximum loop current of 20 mA, 5 VDC is dropped across the 250 ohm resistor. Dropping 5 VDC across the load resistor only leaves 5 to 25 VDC (of the before mentioned 10 to 30 VDC) to operate the transmitter. There is a good chance that 5 VDC will NOT be enough to properly operate the transmitter at its maximum output of 20 milliamps.

Example: Voltage dropped across the load resistor at maximum loop current.

E = I x R = 20 mA x 250 ohms = 5 VDC

The below screenshot shows a 4–20 mA loop being powered by a 12 VDC source; possibly a solar panel with battery backup. If the battery has been discharged to 12 volts, then only 7 volts would remain to operate the transmitter. This may not be enough to fully operate the transmitter at higher loop currents.

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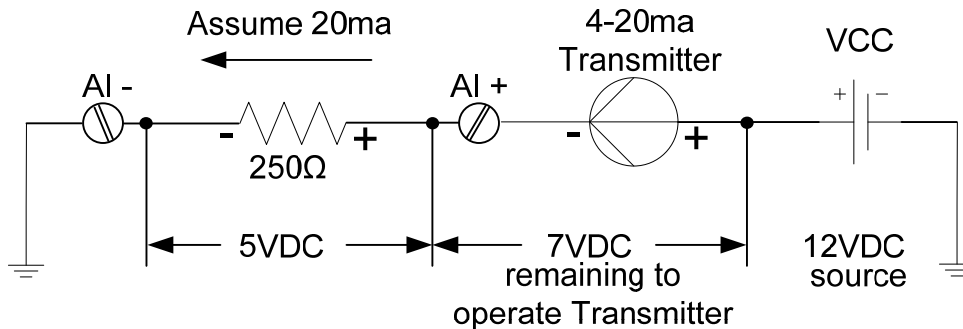
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APPENDIX D   TOTALFLOW DEFINITIONS AND ACRONYMS

TERM	DEFINITION
μ	Greek letter for "mu". Often used in math and engineering as the symbol for "micro". Pronounced as a long u.
μ FLO IMV	μFLO's measurement and operational features are housed in this single unit assembly. The main electronic board (μFLO-195 Board), communication connection, power, SP, DP and Temperature readings are all housed in this unit.
μ FLO-2100767 Board	Main Electronic Board used in the μFLO Computers. It is housed on an integrated assembly and includes the IMV. It operates at 195 MHz while drawing minimal power.
μ Sec	Micro Second.
μFLO 6200	This Totalflow Flow Computer is housed in a small lightweight enclosure. It's main feature is 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.

TERM	DEFINITION
Acid Gas	See Gas, Acid.
ACK	See Acknowledgment.
Acknowledgment	This refers to a response over a remote communication device to a request such as a PING. Basically, saying, "I'm here, and I saw your request!"
ACM	See Analyzer Control Module.
Acoustics	The degree of sound. The nature, cause, and phenomena of the vibrations of elastic bodies; which vibrations create compressional waves or wave fronts which are transmitted through various media, such as air, water, wood, steel, etc.
Active Analog Output	Analog Output to a host providing power to the host.
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 6×10^{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 (Al_2O_3), 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^{2}C.
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 $Re = rVD/\mu$, 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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