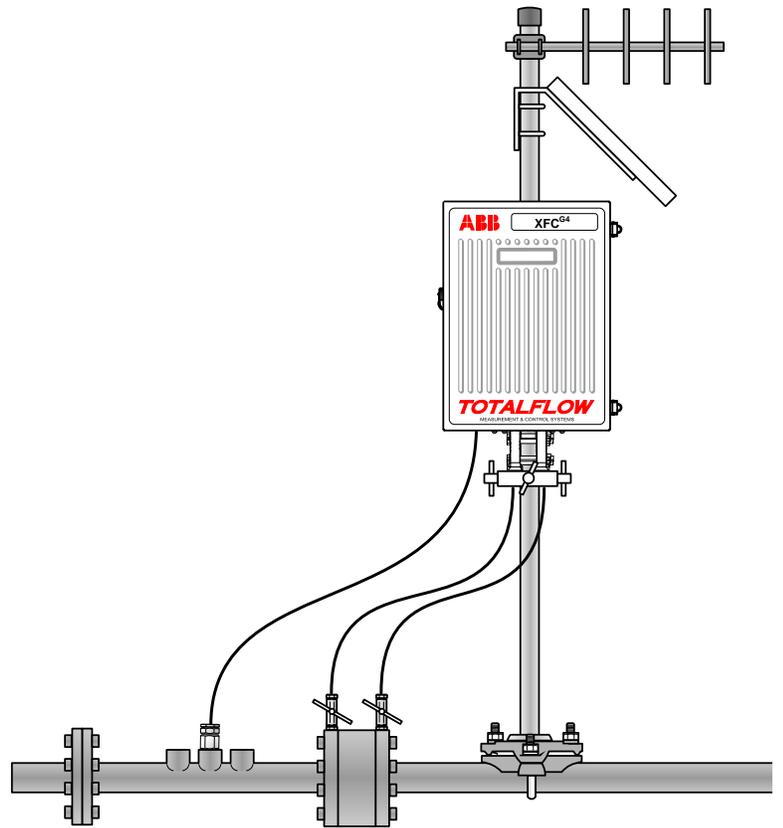


XSeriesG4 products

Flow computer

An engineering milestone in development of remote, low power, measurement and control devices



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Typographical conventions

Element	Convention	Example
Cross-reference to a figure or table in the document	Hyperlink the figure or table label and number. If the figure or table is not immediately following the cross-reference, add the page number where it is located.	See Figure 2 or See Table 3 (page 12).
Cross-reference to a specific section in the document	Hyperlink both the section number and title, with the section title in italics	Go to section 2.1, <i>Device setup</i> .
Greater than character (>)	Indicates that the following item is an additional menu selection.	Use the key pad to locate and select Calibrate > Diff. Press. Sensor > Calibration Units > Edit .
Menu item names in instructions	Bold text and the capitalization of names agrees with the names as displayed on the HMI menu.	Use the right soft key to enter the Main Menu .
Programs, including utility and accessory programs	Title capitalization	Microsoft Word
URL	All lowercase for a fully specified URL. If necessary, break long URLs before a forward slash or break a long URL before it begins	http://www.microsoft.com/ seattle.sidewalk.com
User input	Lowercase, unless case sensitive. Bold or italic, depending on element. If the user input string contains placeholder text, use italics for that text.	Type Name tag

Additional publications

Additional free publications for the device are available for download from the [ABB Library Download Center](#):

XFCG4 (Com2) ABB267/269 and ABB266 User Drawing	2102118
XFCG4 EX (Com2) ABB267/269 and ABB266 User Drawing	2102117
XRCG4 (Com2) IMV25 and ABB266 User Drawing	2105116
XFCG4 (Com2) IMV25 and ABB266 User Drawing	2105115
XRCG3 (Com1) ABB267/269 and ABB266 User Drawing	2105114
XRCG4 (Com2) ABB267/269 and ABB266 User Drawing	2105113
TFIO Comm Interface Module (2100421) to XMV MODBUS w/ RTD	2102345
XMV Pipe Mount Bracket	2104265

1 Health and safety

1.1 General information and notes for the reader

Read these instructions carefully prior to installation and commissioning. For reasons of clarity, these instructions do not contain all details about every type or version of the product, and therefore, do not take into account every conceivable assembly, operating, or maintenance scenario. For further information, or if specific problems arise which are not addressed in the instructions, please ask the manufacturer. The content of these instructions is neither part of, nor provided for changing a previous or existing agreement, promise, or legal relationship. All obligations to ABB result from the respective sales contract, which also contains the full and solely valid warranty clauses. These are neither limited to, nor extended by the content of these instructions.

Observe warning signs on the packaging and on the device.

1.2 Safety / warning symbols, note symbols



DANGER – Serious damage to health / risk to life. This symbol, in conjunction with the signal word "DANGER", indicates an imminent danger. Failure to observe this safety information will result in death or severe injury. The text may state the hazard, how to avoid the hazard, and what the result would be if not followed.



DANGER – Serious damage to health / risk to life. This symbol, in conjunction with the signal word "DANGER", indicates an imminent electrical hazard. Failure to observe this safety information will result in death or severe injury. The text may state the hazard, how to avoid the hazard, and what the result would be if not followed.



WARNING – Bodily injury. This symbol, in conjunction with the signal word "WARNING", indicates a potentially dangerous situation. Failure to observe this safety information may result in severe injury. The text may state the hazard, how to avoid the hazard, and what the result would be if not followed.



WARNING – Bodily injury. This symbol, in conjunction with the signal word "WARNING", indicates a potential electrical hazard. Failure to observe this safety information may result in death or severe injury. The text may state the hazard, how to avoid the hazard, and what the result would be if not followed.



CAUTION – Minor injuries. This symbol, in conjunction with the signal word "CAUTION", indicates a potentially dangerous situation. Failure to observe this safety information may result in minor or moderate injury.



CAUTION – Equipment / Property damage. This symbol, in conjunction with the signal word "CAUTION", indicates a potentially dangerous situation. Failure to observe this safety information may result in property damage. The symbol may also be used for minor injury warnings. The text may state the hazard, what to do or not do to avoid the hazard, and what the result would be if not followed.



NOTICE – Property damage. This symbol indicates a potentially damaging situation. Failure to observe this safety information may result in damage to or destruction of the product and / or other system components.



IMPORTANT NOTE: This symbol indicates operator tips, particularly useful information, or important information about the product or its further uses. The signal word "IMPORTANT NOTE" does not indicate a dangerous or harmful situation.

Although "WARNING" hazards are related to personal injury and "NOTICE" hazards are associated with equipment or property damage, it must be understood that under certain operating conditions, operating damaged equipment can result in degraded system / process performance leading to serious or life-threatening injuries. Therefore, compliance with all "WARNING" or "NOTICE" hazards is required at all times.

Only qualified and authorized specialists are to be employed for the assembly, electrical connection, commissioning, and maintenance of the transmitter, since they have the appropriate experience and the necessary qualifications for such work, e.g.:

- Training, instruction, and authorization to operate and maintain devices or systems according to safety engineering standards for electrical circuits, high pressures, and corrosive media
- Training or instruction in accordance with safety engineering standards regarding the maintenance and use of adequate safety systems



WARNING – Bodily injury. For electrical connections, use sufficiently insulated tools, according to the EN 60900 standard.

Follow the applicable standards, regulations, and recommendations for installation, including:

- The construction and operation of electrical installations. For example, the regulation for technical working materials (safety guidelines for tools)
- Explosion protection, if transmitters with explosion protection are installed

The device can be operated at high levels of pressure and with corrosive media. Serious injury and/or considerable material damage can result if the transmitter is handled incorrectly. Ensure compliance with the regulations applicable in the country of use when working with transmitters.

1.3 Potential safety hazards

Pressurized natural gas is present in the measurement pipeline. Because of this, a possibility exists for natural gas to escape from the pipeline or tubing during installation or calibration, or following damage to the pipeline or tubing. Only properly trained and authorized personnel should work in hazardous locations.

Totalflow equipment operates on 9 - 30 Vdc. However, optional equipment may convert power from Vac to Vdc. Follow your company's policies and procedures when installing any electrical and/or measurement equipment.

Always wear Personal Protective Equipment (PPE) per your company's policies and procedures.

2 Compliance

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

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



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

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

3 System Description

3.1 Overview

This chapter serves as an introduction to the Totalflow Fourth Generation Flow Computers (XFC^{G4}). The XSeries are low power, microprocessor-based units designed to meet a wide range of measurement, automation, monitor, control and alarm applications for remote oil and gas systems. Six models of the XSeries are available: Models XFC^{G4} 6410, XFC^{G4} 6413 and XFC^{G4} 6713 are differential (orifice) meters. Models XFC^{G4} 6411, XFC^{G4} 6414 and XFC^{G4} 6714 are pulse (linear) meters.

The letters XFC stand for Expandable Flow Computer. As the name implies, the flow computers are expandable to meet a wide range of user needs while maintaining backward compatibility with legacy Totalflow systems.

For users that are familiar with the XSeries flow computers, the XFC^{G4} offers easily recognizable features while expanding on its core functionality. This expansion includes a new CPU engine card and the adoption of 32-bit technology to enhance speed and memory. Additionally, the XFC^{G4} is able to run more applications than previous XSeries units with more AGA tube applications and more Plunger Lift applications.

For connectivity purposes, the XFC^{G4} supports the familiar military connector (serial communication) PCCU cable. Additionally, USB and Ethernet connectivity are also available. The only other visual difference is the addition of an SD Card slot, the SD card slot is not used.

3.1.1 Hardware

The models XFC^{G4} 6410 and XFC^{G4} 6411 are packaged in a small enclosure and are only designed for the XFC^{G4} board and a variety of batteries. When using these flow computers, communication devices can be installed in a separate enclosure such as the model 6470.

The models XFC^{G4} 6413 and XFC^{G4} 6414 are packaged in an enclosure that can accommodate the XFC^{G4} board, a variety of remote communications devices, batteries and up to three additional I/O modules. The I/O modules generally provide eight I/O points per module.

The models XFC^{G4} 6713 and XFC^{G4} 6714 are packaged in an enclosure that can accommodate the XFC^{G4} board, a variety of remote communications options, batteries and up to six additional I/O modules.

3.1.2 Functionality

The XFC^{G4} system has built-in, pre-engineered applications for data collection, trending and long term data storage. The XFC^{G4} can be used for oil and gas production, transmission and distribution site monitoring and control, water and waste system monitoring and control, etc.

All of the XSeries feature single or multi-tube capabilities with custody transfer measurement features. These flow computers are engineered to be flexible and will enable the user to increase productivity and improve asset utilization (see Table 1 for the XSeries family genealogy).

The XFC^{G4} defaults to the retention of daily and log period records over a 40 day period. Additionally, it defaults to the retention of 200 events. These defaults can be extended and are limited only by the file space on the device.

Models XFC^{G4} 6410/11 perform these basic functions and include additional I/O, as provided on the main electronic board (XFC^{G4}).

Models XFC^{G4} 6413/14 perform these same basic functions and have the option for three TFIO modules.

Models XFC^{G4} 6713/14 perform these same basic functions and have the option for six TFIO modules.

IMPORTANT NOTE: The XFC^{G4} maintains a history of alarms as well as average differential pressure (DP), average static pressure (SP), average flowing temperature (Tf), accumulated volume and energy.

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For the differential meters, an average extension is maintained. For pulse (linear) meters, an uncorrected volume accumulator is maintained.

The differential (orifice) flow computer can be programmed to calculate flow rates and volumes in accordance with either AGA-3-85, AGA-3-92 or additional flow calculations methods that are available on request. These include ISO-5167, Liquid, Vcone, FloNozzle, etc.

The linear (pulse) flow computer can be programmed to calculate flow rates and volumes in accordance with AGA-7.

Super compressibility calculations can be performed in accordance with either NX-19 or AGA 8-92 (gross or detail).

Table 1 XFC^{G4} Family Genealogy

XFC ^{G4} Model	XFC ^{G4} Board	Orifice Meter	Pulse Meter	Max. Battery Capacity	Communication Equipment	Max. TFIO Modules
6410	•	•		26AH	N/A	N/A
6411	•		•	26AH	N/A	N/A
6413	•	•		26AH	Yes	3
6414	•		•	26AH	Yes	3
6713	•	•		42AH	Yes	6
6714	•		•	42AH	Yes	6

3.1.3 XFCG4 General Specifications

Dimensions

Model	Width	Height	Depth
6410	10.00" (254.00mm)	13.80" (350.72mm)	9.37" (237.99mm)
6411	10.00" (254.00mm)	12.15" (308.56mm)	9.37" (237.99mm)
6413	12.55" (318.77mm)	18.31" (465.07mm)	10.27" (260.86mm)
6414	12.55" (318.77mm)	16.65" (422.91mm)	10.27" (260.86mm)
6713	15.10" (383.54mm)	22.31" (566.67mm)	13.83" (351.28mm)
6714	15.10" (383.54mm)	20.64" (524.26mm)	13.83" (351.28mm)

Installed Depth

Model	Pipe Mounted	Wall Mounted
6410/6411	10.68" (271.27mm)	10.12" (257.05mm)
6413/6414	11.58" (294.13mm)	11.02" (279.91mm)
6713/6714	14.56" (369.82mm)	14.00" (355.60mm)

Weight (w/o Battery)

Model	Pounds	Kilograms
6410	13.5	5.04
6411	11.5	4.29
6413	17.9	6.68
6414	15.9	5.93
6713	29.0	10.82
6714	27.0	10.08

Humidity

0-95% non-condensing

Mounting

Wall, pipe or direct

Oper. Temp.

-40°F to 185°F (-40°C to 85°C)

Certifications & EMC Req.

Please see Product Data Sheets:
Differential Flow Computer

3.2 XSeriesG4 Flow Computer Hardware

All of the Totalflow XFC^{G4} models are housed in a lightweight, two-compartment aluminum case. With the exception of the size of the cases, the XSeries models use identical components:

- Enclosure
- XFC^{G4} Board
- External Integral Multi-Variable (XIMV) (6410, 6413, 6713 only)
- Battery Compartment
- Communication Compartments (6413, 6414, 6713 and 6714 only)
- Liquid Crystal Display (LCD)
- Charger or Solar Panel
- Resistive Temperature Detector (RTD)
- Optional Modular I/O
- Optional Keypad

3.2.1 XFC^{G4} Board

The XFC^{G4} board is mounted on the inside of the door. All XFC^{G4} input and output connections are made with Phoenix-style snap-in connector terminals mounted directly on the board. Other circuitry processes the inputs from the External Integral Multivariable (XIMV) and provides interfaces to the Liquid Crystal Display (LCD) and the PCCU. Remote communications are handled by the RS-232 and RS-485 communication modules that plug directly into the XFC^{G4} board. The XFC^{G4} board offers the following input and output points:

- XIMV Communication
- 2 Digital or 2 High Speed Pulse Inputs (Selectable De-bounce Enable/Disable)
- 2 Digital Outputs
- 2 Analog Inputs
- 2 Remote Communication Ports (RS-232 or RS-485)
- I/O Interface for TFIO Interface Modules

3.2.2 CPU Engine Card

The CPU engine card plugs into the XFC^{G4} board. All processor and memory components reside on the CPU engine card. The engine card uses a low power processor running at 192MHz with 16M SRAM, 32M Flash and 256 bytes of serial EEPROM. A lithium backup battery is located on the main circuit board. Application programs and configuration files are stored in non-volatile Flash.



Caution- Loss of data: Unplugging the engine card disconnects it from the lithium cell backup, and SRAM (historical flow data) is cleared.

3.2.3 Communication Compartment

A removable communications enclosure can be provided that has been pre-drilled for mounting of many popular communications devices such as radios, cellular phones, modems, etc. Models XFC^{G4} 6413 and 6414 provide an enclosure to house a remote communication device, transceiver, cellular phone, etc.

3.2.4 Battery Compartment

The battery compartment houses the various optional battery packs that are available for the XFC^{G4}. These range from eight (8) ampere hours up to 26 ampere hours. Installation of the battery requires removing the battery plate, placing the battery in place and connecting the battery cable to the circuit board, see section 5 Maintenance, page 89.

3.2.5 Solar Panel

The flow computer can be configured for a 10-Watt, 20-Watt or 30-Watt solar panel. The panel is designed to be mounted on a 2-inch extension pipe above the flow computer, on top of or to the side of a meter house.

3.2.6 Resistive Temperature Detector (RTD)

An optional 100Ω platinum RTD measures the real-time flowing temperature of the gas. The standard RTD is provided with a 10-foot cable. Other lengths of cable are available upon request.

3.2.7 Additional Features

Additional features of the Totalflow system that enhance its flexibility include:

- Programmable bi-level security system prevents unauthorized communication and configuration of the flow computer.
- Internal crystal-controlled clock provides a highly stable time base for the system.
- Optional battery packs extend operation for longer periods without power.
- Three available charging sources:
 - External solar panel (standard)
 - External ac power
 - External 24/12Vdc power
- LCD-programmable to allow monitoring of operations (for example, displays flow rate, volumes, etc.).
- Rugged, aluminum, powder-coated NEMA 4X enclosure. Lockable to prevent internal access.
- Optional ability to allow rapid data collection over several communication links.
- Additional I/O for valve control, pressure, level monitoring, remote communication, etc.
- Optional keypad.

3.3 Standard Enclosures

The standard enclosure consists of a hinged-door box in varying sizes for the XFC^{G4} devices (see Figure 1 through Figure 6). The door provides a watertight, corrosion-resistant seal between the outside elements and the flow computer components. It is designed to meet Class I, Division 2, Groups C and D and is NEMA 4X rated. It is designed for mounting in harsh environments (cold, hot, wet and salty). Opening the door latches allows access to electronics, battery, radio, XIMV and modular components. This door may be locked for security purposes.

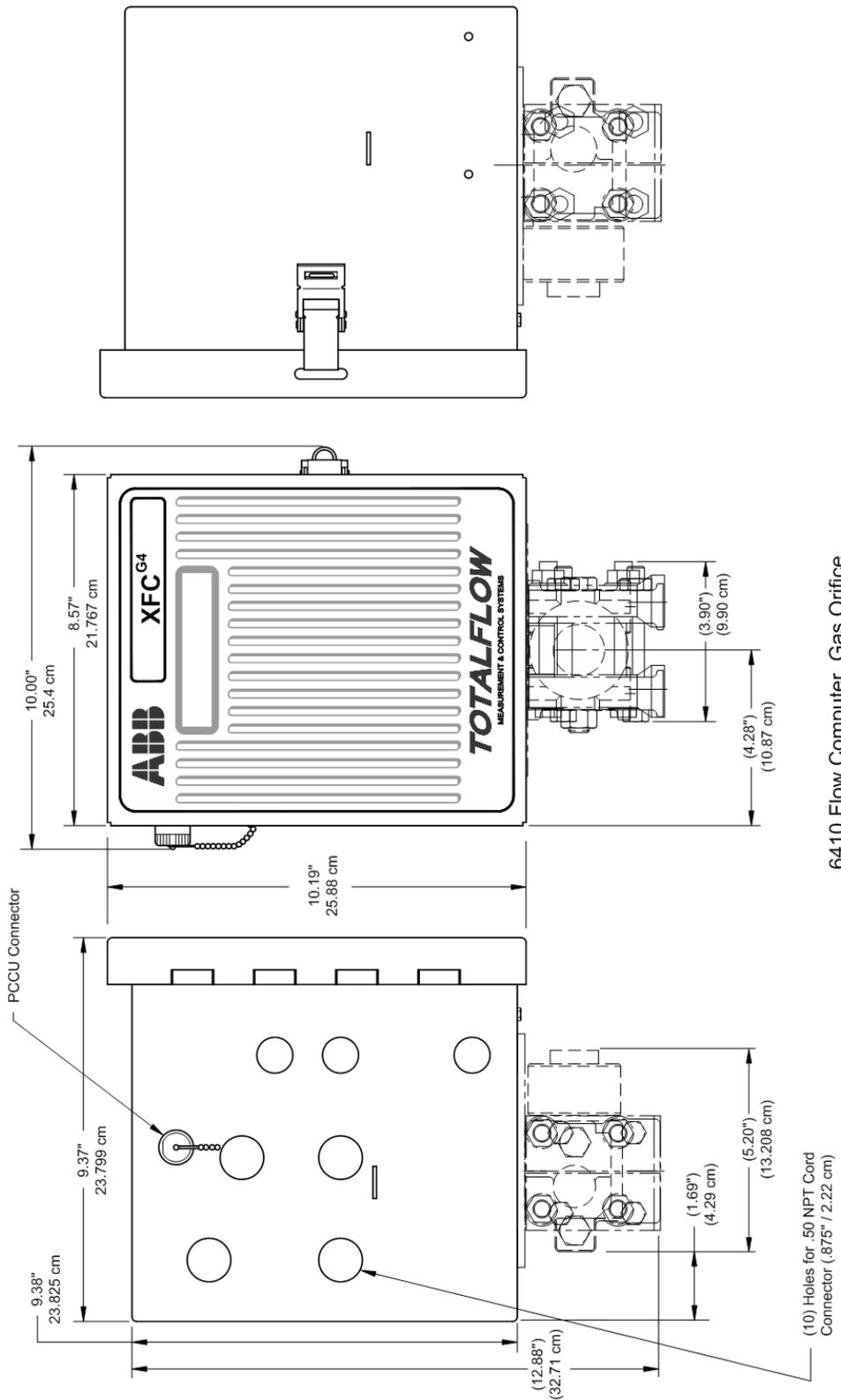
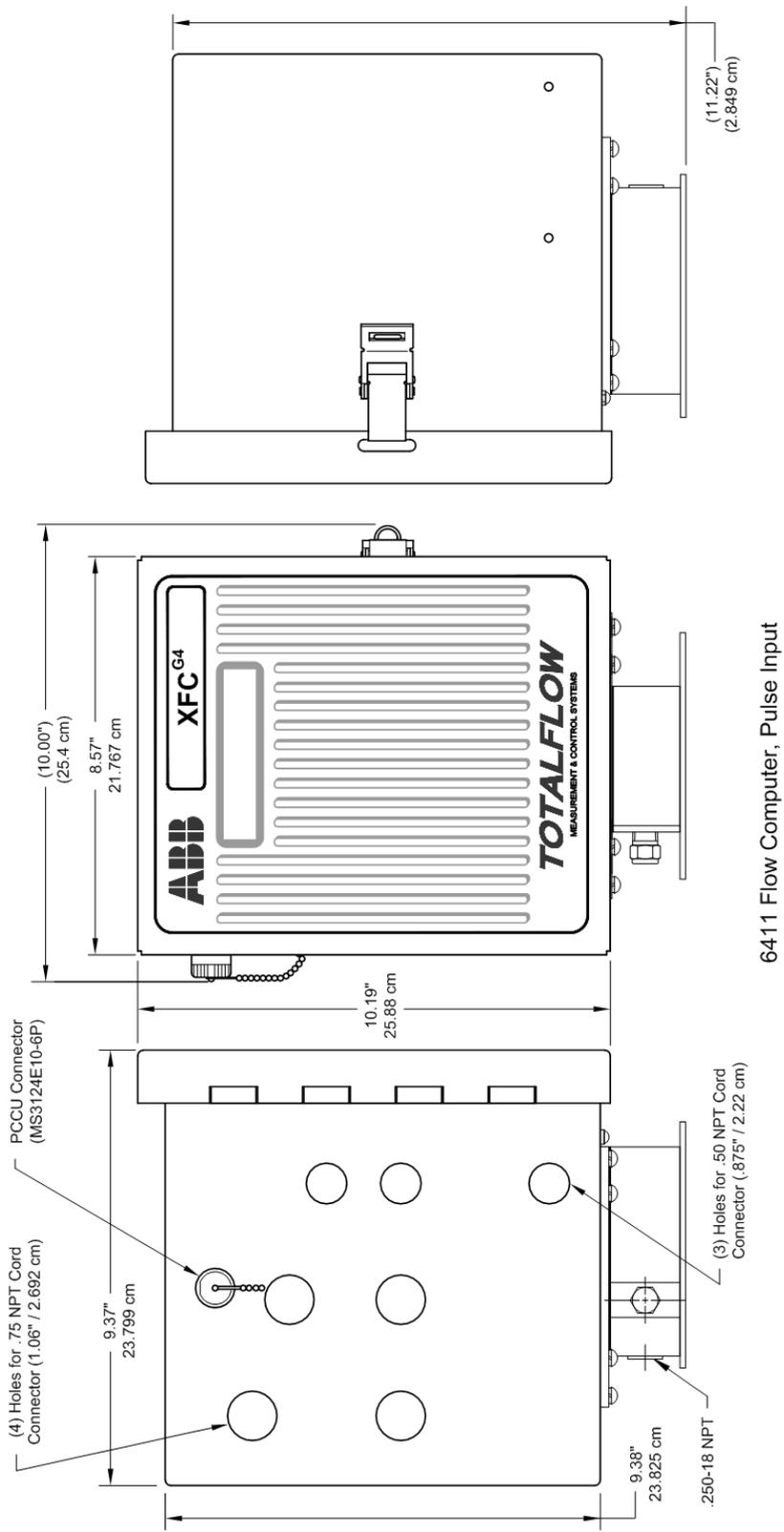


Figure 1 XFC^{G4} Model 6410, Orifice Meter



6411 Flow Computer, Pulse Input

Figure 2 XFC^{G4} Model 6411, Pulse Meter

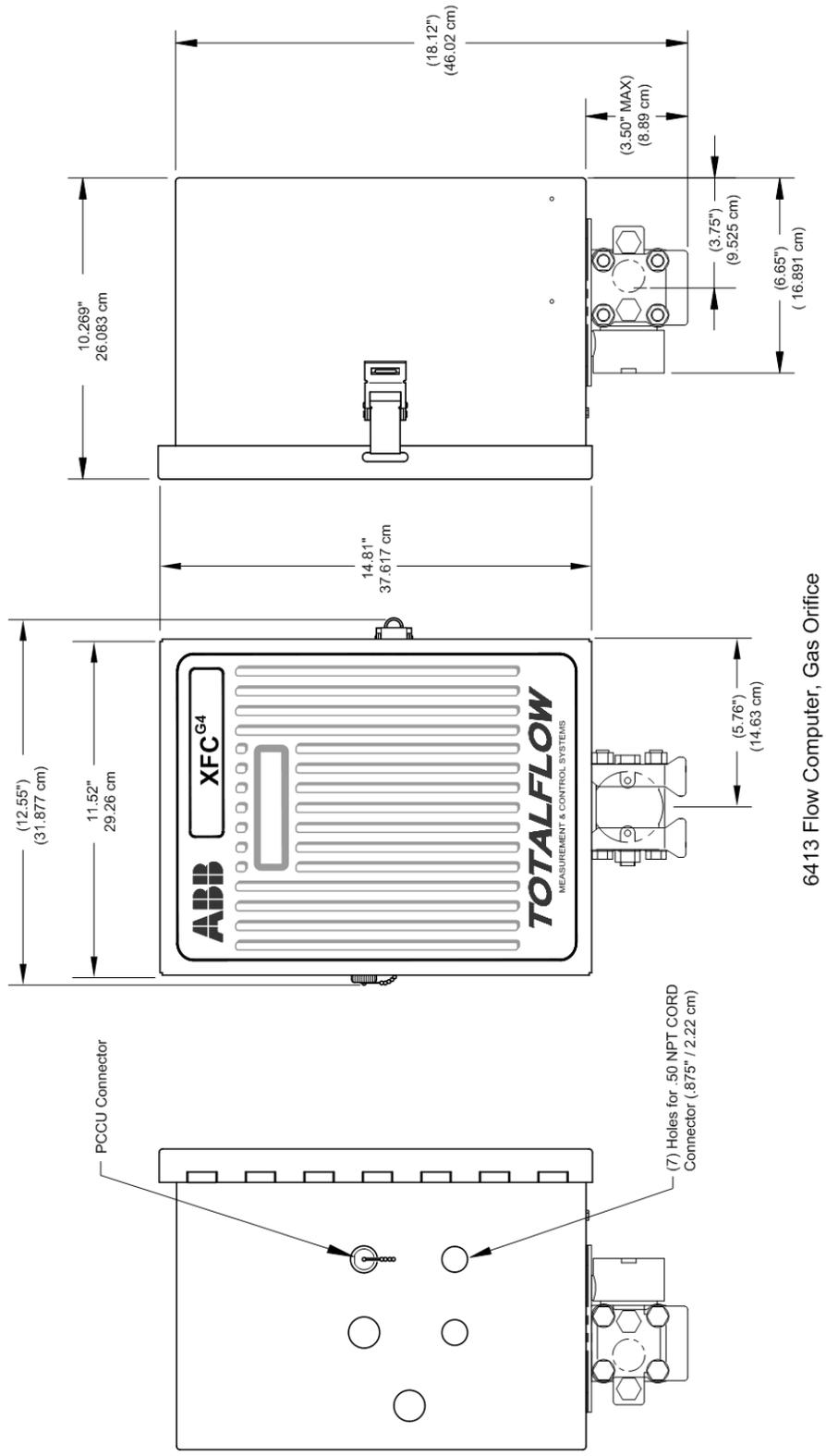
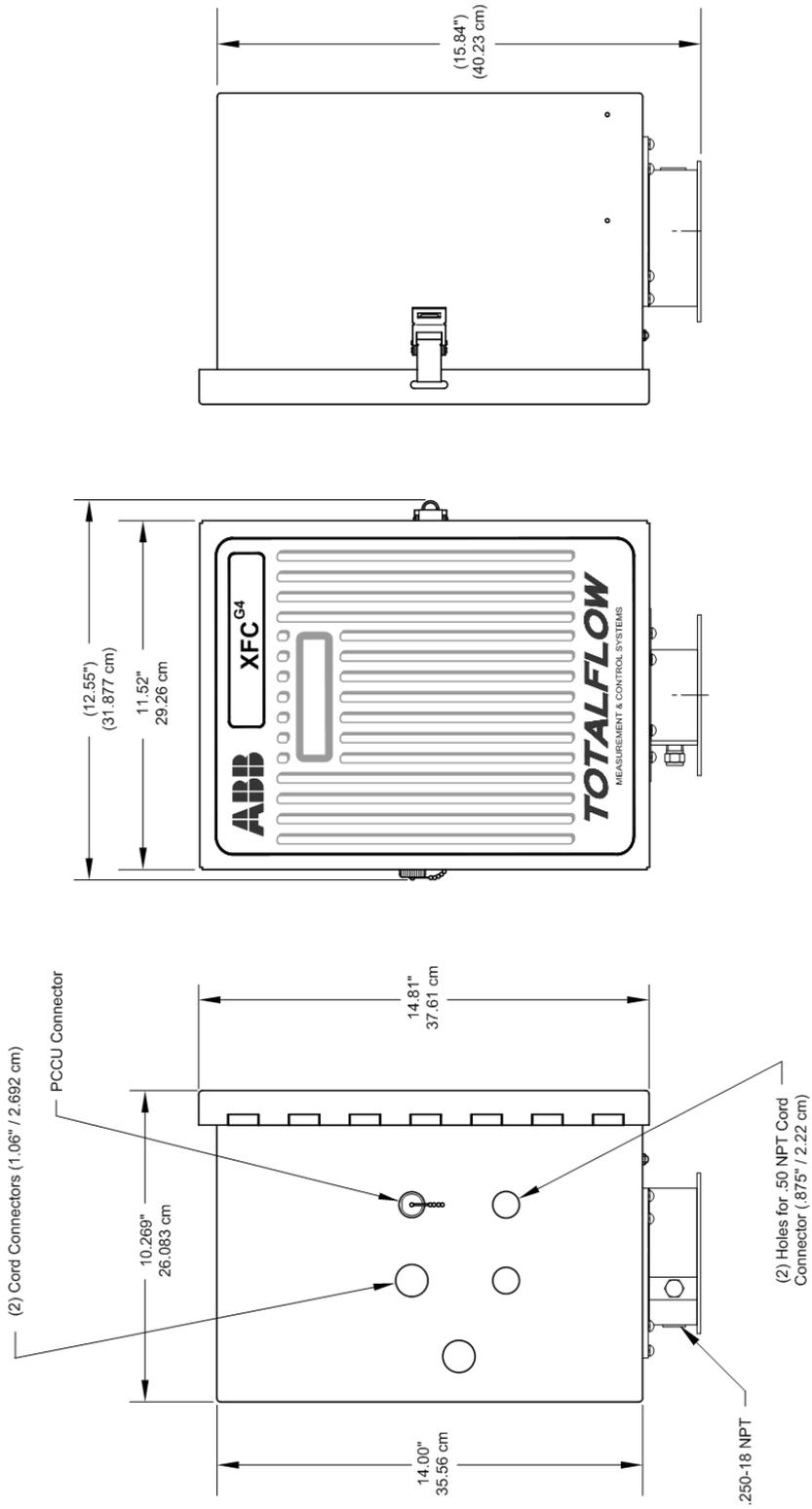
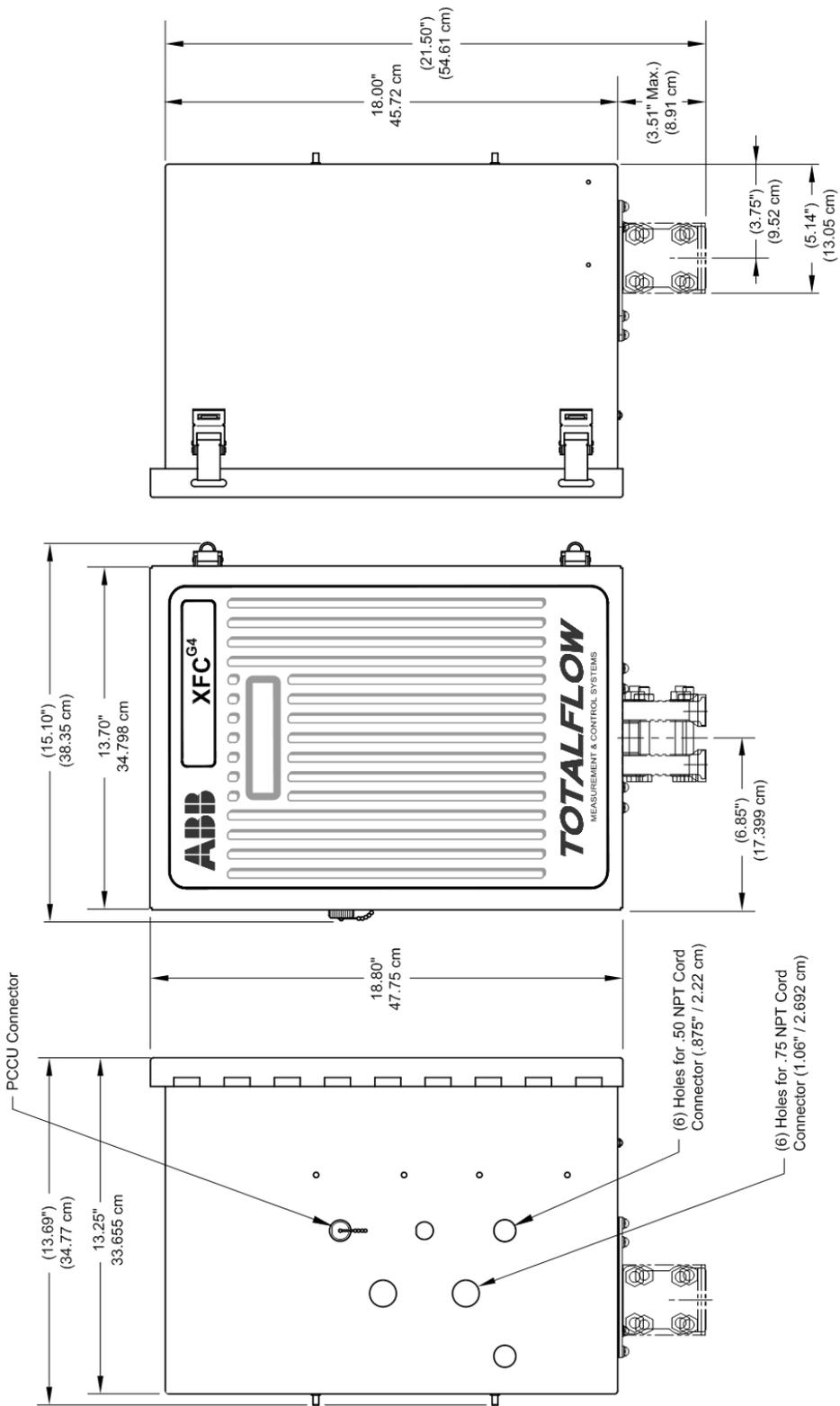


Figure 3 XFC^{G4} Model 6413, Orifice Meter



6414 Flow Computer, Pulse Input

Figure 4 XFC^{G4} Model 6414, Pulse Meter



6713 Flow Computer, Gas Orifice

Figure 5 XFC^{G4} Model 6713, Orifice Meter

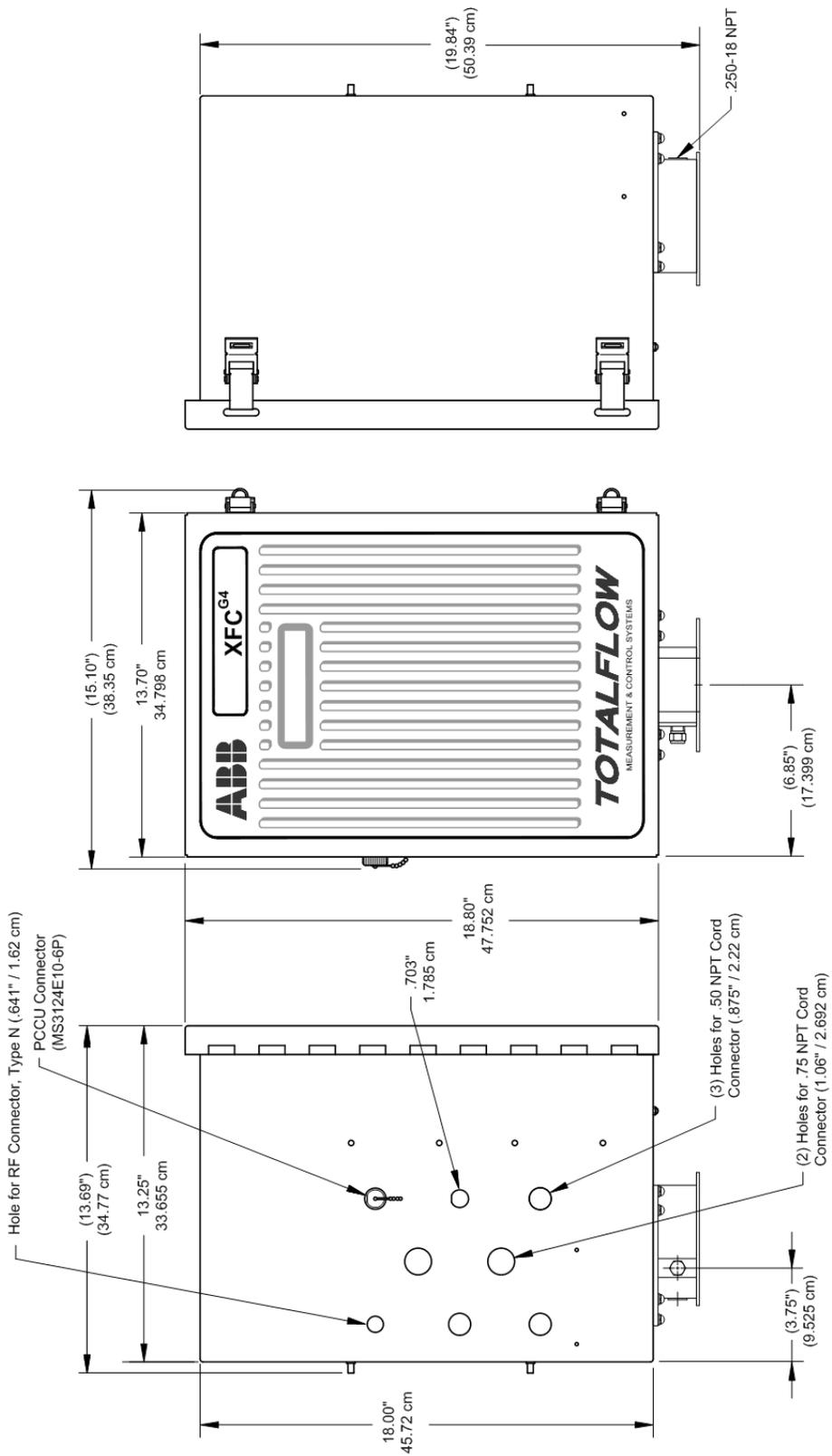


Figure 6 XFC^{G4} Model 6714, Pulse Meter

6714 Flow Computer, Pulse Input

3.4 XFCG4 Board Specifications

The XFC^{G4} board is designed as a general purpose circuit panel that mounts in all XSeries enclosures (see Table 2).

Table 2 XFC^{G4} board specifications

Component	Description
Power	Battery 12Vdc
External Power	SWVBAT: 1 fused with 2.5 amp PTC VBAT: 1 fused with 2.5 amp PTC
Charger	Solar or 15 Vdc (30 Watts Max.)
Memory	<ul style="list-style-type: none"> – Application (Totalflow.exe) runs out of 16M SRAM. RAM memory has lithium backup battery. – Application and configuration files permanently stored in 32M Flash. – Registry (MAC address, etc.) is stored in 256byte EEPROM – SD Card optional (128M/512M/1G)
Comm. Ports	6 Ports Available <ul style="list-style-type: none"> – Dedicated PCCU/MMI – RS232 or RS485 via Plug-In Modules – USB (Host & Client) NOTE: A special cable is required, and the user must check with Totalflow for a list of drivers to support Client peripherals <ul style="list-style-type: none"> – Ethernet
Analog Inputs	2 (0-5 Vdc)
Digital Inputs/Pulse Inputs	2 (State Change or Pulse to 20 kHz) operating at a 50% duty cycle with (Selectable De-bounce enabled 100 Hz)
Digital Outputs	2 FETs, sink = 2.5 Amp Max. Open Drain PTC, with 1500 W Transient protection
I/O Module Interface	Dedicated I ² C Serial I/O Bus for TFIO modules
Keypad Interface	Dedicated interface for Optional Keypad equipment
LCD Interface	Dedicated interface for the LCD
Security Switch	On/Off bi-level onboard security (See Chapter 3 for details)
I/O Scan Rate	1 time per second
Time Base Stability	± 7.5 ppm (parts per million)

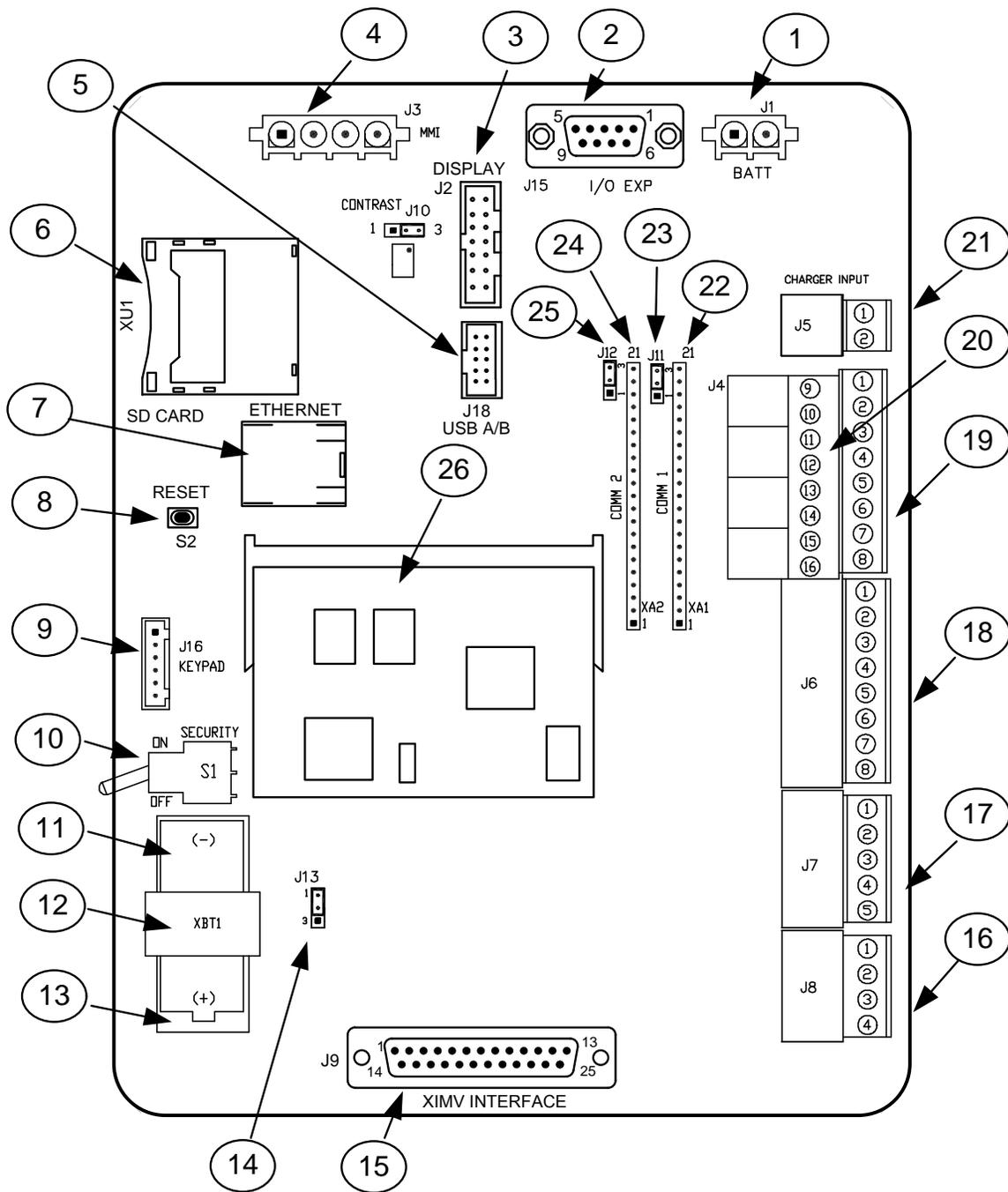


Figure 7 XFC Board

Table 3 XFC Board Identification

ID Number	Description	ID Number	Description
1	Battery Connection	14	Memory Backup Enable/Disable
2	I/O Module Interface	15	XIMV Interface
3	LCD Display Interface	16	Analog Input Connectors
4	PCCU Interface	17	RTD Connectors
5	USB Extension Port	18	Pulse Input and Digital Output Connectors
6	SD Card	19	Remote Communications Connector Comm 1
7	Ethernet Connector	20	Remote Communications Connector Comm 2
8	Reset Button (Warm Start)	21	External Charger
9	Keypad Connector	22	Remote Comm 1: Module Plug-in
10	Security Switch	23	Remote Comm 1: RS-485 Termination Jumper
11	Lithium Battery	24	Remote Comm 2: Module Plug-in
12	Battery Cover	25	Remote Comm 2: RS-485 Termination Jumper
13	Battery Mounting Bracket	26	CPU Engine Card

3.5 External Integral Multi-Variable (XIMV)

The External Integral Multi-Variable (XIMV) contains circuitry for processing all analog measurements and provides the primary measurement capability for the flow computer. The unit is designed to provide EMI/RFI protection of the low level signals and to protect the circuitry from other environmental effects. The XIMV contains a single circuit board which contains the analog to digital converter and analog conditioning circuitry necessary for the XIMVs, the RTD and two general purpose analog inputs (see Table 4).

Because the XIMV is characterized over temperature at the factory, the unit is not field repairable. All repairs should be performed at an authorized Totalflow service center or returned to the factory. The XIMV is characterized over temperature so that any changes occurring in the XIMV or in the electronics can be compensated.

Item	Description
Temperature Limits	Compensated -20 to 140°F (-29 to 60°C) Operational -40 to 185°F (-40 to 85°C) Storage -40 to 185°F (-40 to 85°C)
Analog to Digital Resolution	18-bit maximum resolution (0.00038% FS) 18-bit nominal resolution (0.0015% FS)
Vibration Performance	1.5 INW per G (2G maximum) at 1Hz, decreasing to zero at 1KHz in straight line mode.
Mounting Specification	Change from perpendicular (front to back/around X-axis) will be ≤ 1.5 INW (Can be corrected with calibration)
Temperature	
Operating Range	-80°F to 230°F (-62°C to 110°C)
Accuracy	$\pm 1^\circ\text{F}$ (0.56°C) over operating range
Static Pressure	
Accuracy	Includes the effects of linearity, hysteresis and repeatability Standard Accuracy: $\leq \pm 0.2\%$ of URL (Upper Range Limit) Optional Accuracy: $\leq \pm 0.05\%$ URL
Ambient Temp. Effect	$\pm 0.15\%$ of URL (per 160°F, 71°C) $\pm 0.125\%$ of Reading
Stability	$\pm 0.1\%$ of URL for 12 months
Differential Pressure (Differential Flow Computers Only)	
Accuracy	Includes the effects of linearity, hysteresis and repeatability

Item	Description
	Standard Accuracy: $\leq \pm 0.2\%$ of URL (Upper Range Limit) Optional Accuracy: $\leq \pm 0.05\%$ URL
Ambient Temp. Effect	$\pm 0.15\%$ of URL (per 160°F, 71°C) $\pm 0.125\%$ of Reading
Stability	$\pm 0.1\%$ of URL for 12 months
Static Pressure Effect	DP Zero per 1500 PSI: $\pm 0.03\%$ of calibrated span DP Span per 1500 PSI: $\pm 0.05\%$ of URL

The XIMV is a direct replacement for the AMU. The XIMV always measures static pressure on the high side. The XIMV can be ordered from the factory with the XIMV unit rotated on the meter enclosure; however, this is only offered as an aid to the mechanical installation process. Static pressure is still measured on the high pressure side.



IMPORTANT NOTE: For the purpose of clarity, the XIMV is a multi-variable transducer (includes a static pressure cell, a differential cell and a RTD input). The XIMV's new technology offers higher accuracy, better linearity and better overall performance over the older AMU.

Table 4 External Integral Multivariable (XIMV) Specifications

3.6 XSeries On-board Input/Output

Totalflow's XSeries flow computers are backward compatible with the same base I/O as earlier models but enhanced to include:

- XIMV Interface: 1 SP, 1 DP, 1 TF
- 1 Dedicated Local Communication Port
- 2 User A/Is
- 2 User D/Os
- 2 User D/Is or 2 User High Speed P/Is
- 2 RS-232 or RS-485 Comm Ports
- Interface for TFIO Modules

The main electronic panel is an enhanced replacement for the previous versions of the FCU main electronic panel. The following sections will display the specifications for the digital/pulse inputs, the digital output and the analog input. For a complete overview of the circuit board, see Figure 8.

3.6.1 Communication Ports

The user has the ability to program up to two onboard communication ports on the flow computer board. Normally, COMM 0 is the local port required for reading the flow computer with a laptop computer running PCCU32 (version 7.05.5 or greater). COMM 1 and COMM 2 can be configured for any combination of RS-232 or RS-485.

3.6.2 Digital Input

The flow computer provides two digital/pulse inputs as a means to monitor external equipment.



IMPORTANT NOTE: When connecting or disconnecting any wires to the flow computer board, the user should remove all power sources and insure they are properly grounded.

The digital input reads an external contact. This is primarily used as a status input to read external equipment. This contact must be closed to be considered on. The on condition is recorded in the log period alarms and can trigger the action of the flow computer's digital voltage (12 Vdc) output is off is defined as an open contact. Selectable de-bounce may be enabled or disabled within PCCU32. See the software help files for additional information.

3.6.2.1 Electrical Specification (Each Point)

- Open circuit voltage: 5 Vdc (Internally pulled up to 5 Vdc Nom.).

- Short circuit leakage current: -395 uA typical.
- Input capacitance: 0.1 ufd typical.
- Maximum allowable voltage range on input: -0.5Vdc to 15Vdc.
- Maximum frequency input: 100 KHz @ 50% duty cycle with de-bounce enabled.
- Maximum frequency input: 20 KHz @ 50% duty cycle with de-bounce disabled.

3.6.2.2 Input Specification

- Dry Contact (form A): Open Collector or Active Voltage.
- Minimum contact resistance to activate input: 1000 Ω .
- Voltage threshold to deactivate the input: 3.1 V (referenced to GND terminal.).
- Voltage threshold to activate the input: 0.5 V (referenced to GND terminal.).
- Conductor pairs must be shielded to prevent spurious signals.

3.6.2.3 Typical Point Schematic

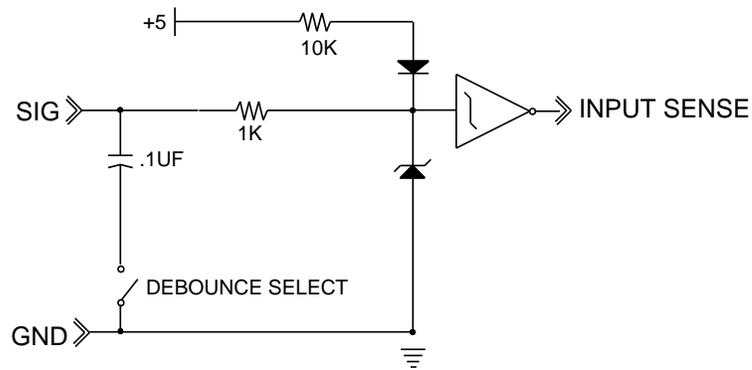


Figure 8 Typical Point Schematic

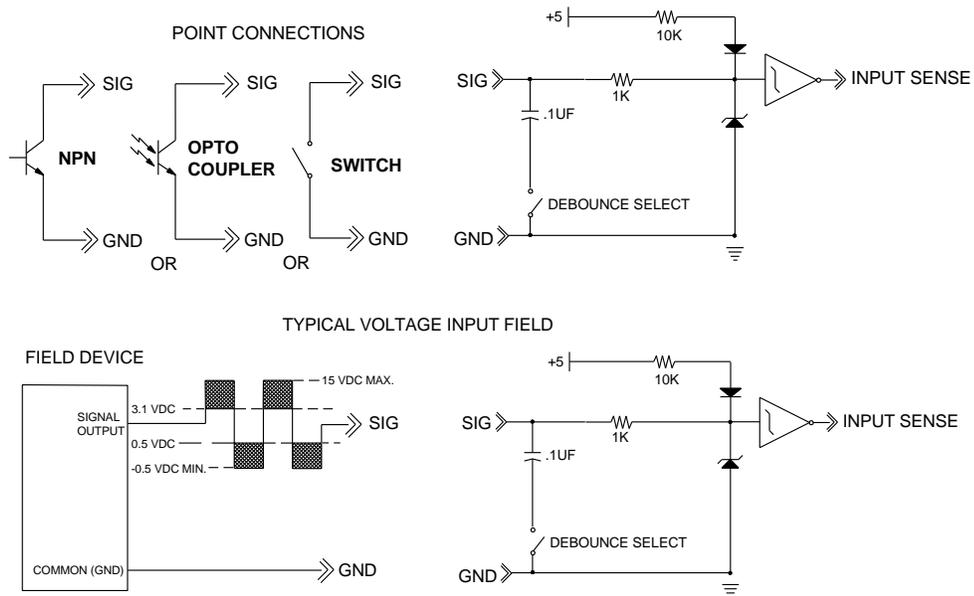


Figure 9 Example Connections

3.6.3 Digital Output

The Totalflow XFC^{G4} provides two digital (12 Vdc) outputs as a means to control external equipment.



Important Note: When connecting or disconnecting any wires to the flow computer board, all power sources should be removed, and insure that the equipment is properly grounded.

When the digital output is used as a measurement device, AGA-3, AGA-7 or liquid measurement, the outputs can be set when the following conditions occur:

- Differential pressure over high limit
- Volume set point
- Differential pressure under low limit
- Flow temperature low
- Static pressure over high limit
- Flow temperature high
- Static pressure under low limit
- Flow rate low
- Low charger voltage
- Flow rate high
- Remote sense is on
- Trip on digital input
- Custom programmable by Totalflow or user-programmable with IEC 1131 programming language

3.6.3.1 Electrical Specification (Each Point)

- Open circuit voltage: 0 Vdc
- Short circuit leakage current: 0 uA typical
- Output capacitance: 1000 pF typical
- Maximum allowable voltage range on output: 0.5 Vdc to 26.5 Vdc

3.6.3.2 Input Specification

- Open drain FET type
- "ON" resistance (Including PTC fuse resistance): 0.1 Ω typical
- Maximum pulse current: 3 A for 5 seconds
- Maximum continuous sink current: 2 A

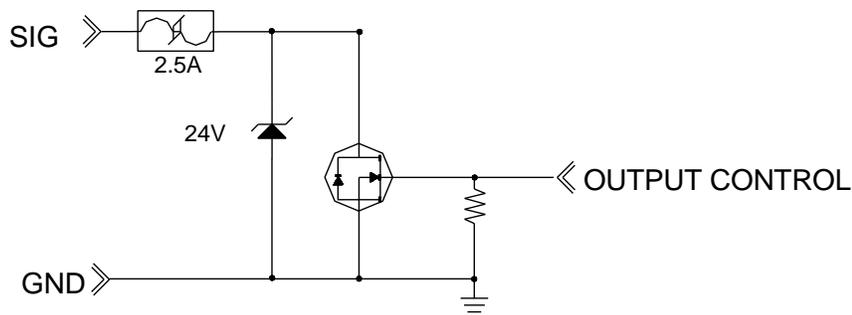


Figure 10 Typical Point Schematic

TYPICAL SINK OUTPUT FIELD WIRING

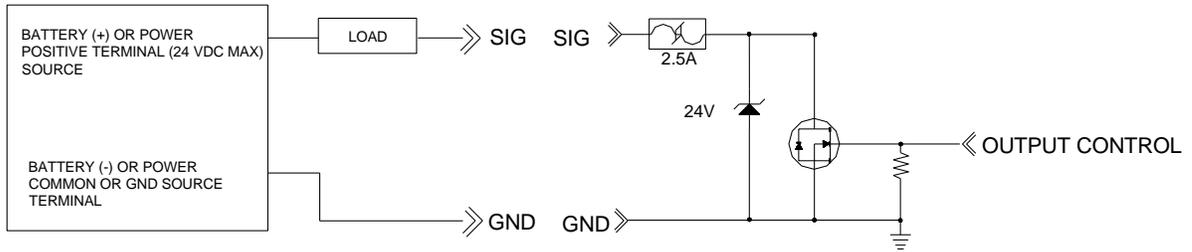


Figure 11 Example Connections

3.6.4 Analog Input

The Totalflow XFC^{G4} provides two analog inputs as a means of receiving data, represented by continuously varying voltage/current.

3.6.4.1 Electrical Specification (each point)

- Open circuit voltage: 0 Vdc
- Short circuit leakage current: 0 uA typical
- Input impedance: 21 KΩ typical (0-7.5 V)
- Measurable input voltage range: -0.5 V to 7.5 V
- Maximum voltage on input: 30 Vdc

3.6.4.2 4-20mA Transmitter

If 4-20mA is used for a transmitter on the analog input, see section, Appendix A, page 143. Manufacturer's specifications can be extremely misleading. Often, a manufacturer's specification will claim to operate from 10 to 30Vdc. They are not always clear that this 10-30Vdc must be applied across the 4-20mA transmitter only (and not across the transmitter/load resistor series combination).

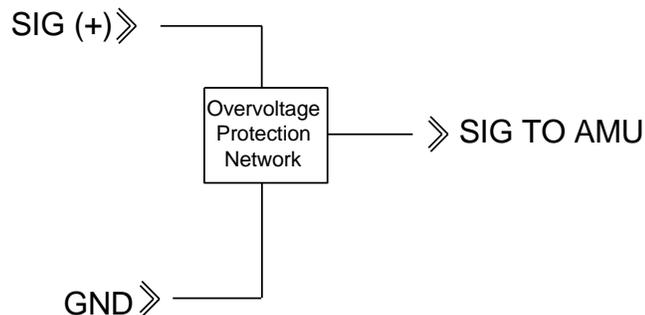


Figure 12 Typical Point Schematic

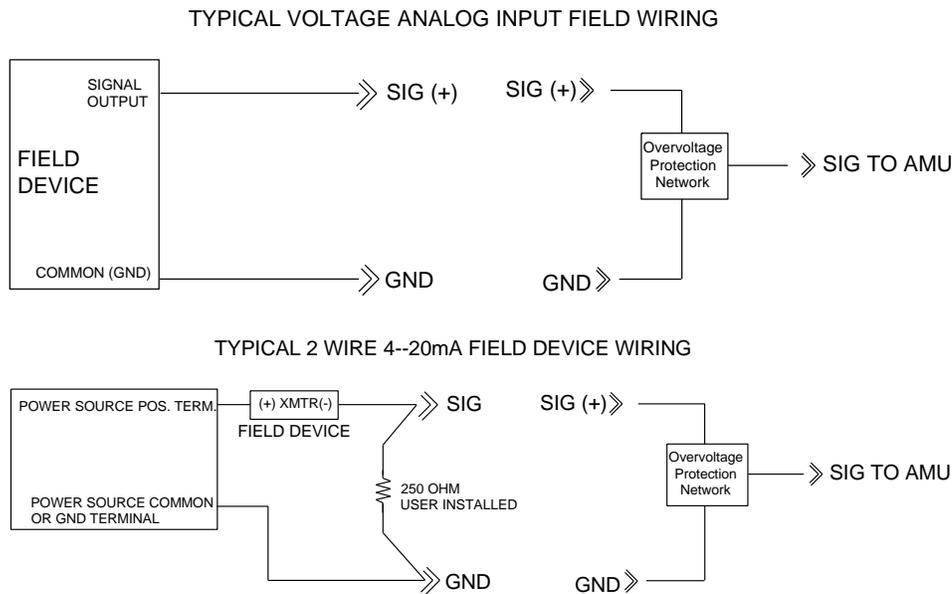


Figure 13 Example Connections

3.7 Functions of the XFCG4

The functions of the flow computer reflect a design that is practical, straight-forward and efficient. This improved functionality insures that the flow computer is easy to use and learn. The flow computer enables the user to perform the following with a minimum of effort and greater speed and accuracy.

3.7.1 Records

Complete log period flow and operational records reported (hourly-default) include:

- Average static pressure
- Average differential pressure
- Average flowing temperature
- Corrected volume total
- Corrected energy total
- Operating status and alarms
- Complete daily flow records, including -
 - Average static pressure
 - Average differential pressure
 - Average flowing temperature
 - Average extension
 - Corrected volume total
 - Corrected energy total
 - Operating status and alarms
- Complete daily operation statistics, including –
 - Percent flowing time
 - Percent back flow time
 - Percent out of limits (programmable) on SP, DP, Tf and flow rate
 - Minimum and maximum values for SP, DP, Tf and flow rate

3.7.2 XFCG4 Capabilities

The generated records and statistics are possible due to the following capabilities of the XFC^{G4}:

- Calculation of flow rates volume and coefficients per AGA-3, AGA-8 Supercompressibility standards.
- Calculation of flow extension for the AGA3-92 is $\sqrt{\frac{Dp * Sp}{Tf + 459.67}}$, once per second.
- The flow extension reported for the log period is: $\sqrt{\frac{Dp * Sp}{Tf + 459.67}} / 3600 * \text{flow time in seconds}$
- Calculation of the flow extension for the AGA3-85 equation is $\sqrt{Dp * Sp}$, once per second.
- Extrapolation of flow accumulation during XIMV calibration.
- Selection of all coefficients for calculation; the calculation of dynamic factors (dependent upon DP, SP and Tf) using averages based on one second samples.
- Sample set of most recent calculations allowing subsequent verification.
- Monitoring of the operational limits, minimums and maximums to insure detection and reporting of malfunctions or abnormal site conditions.
- Acceptance and storage of system constants from PCCU32 or remote communication protocols.
- Storage of data records and operational events determined by user (based on available SRAM).

3.7.3 Additional Features

Additional features of the Totalflow system that highlight its flexibility include the following:

- Programmable differential pressure no-flow cutoff.
- Programmable bi-level security codes to prevent unauthorized communication and configuration of the XFC^{G4} or user-configurable Role Based Security Access (RBAC).
- Internal 100Ω platinum RTD resistance curve fit with user-programmable single point offset or 3/5-point user-calibration of the RTD input.
- Quick, simple calibration procedure for the transducer.
- Real-time clock providing a highly stable time base for the system.
- Proper battery and solar sizing is determined by geographic location of the unit and total power consumption of the system. Totalflow project engineers can select the appropriate battery and solar requirements for the user's specific application. Larger capacity batteries are available to increase autonomy, if required.
- Three available power sources:
 - External solar panel (standard)
 - External ac or ac to dc power
 - External 24 or 12Vdc power
- Liquid crystal display (LCD) programmable to allow monitoring of the flow computer operations and can display any variable that has a register (for example, display current static pressure).
- Six available serial port communications are available on the flow computer:
 - 1 dedicated – PCCU (Local Configuration port)
 - 2 RS-232 or RS-485 (Board Insertion Modules) with baud rates up to 115,200
 - 1 USB 1.1 Host port – optional
 - 1 USB 1.1 Device port (may be used as a high speed Local Configuration port)
 - 1 10 Base-T Ethernet port (may be used as a high speed Local port or Network port)
- USB, Ethernet or RS-232 serial may be ordered as local, externally accessible Local Communication Interface port

3.7.4 Log Period Records

Each record has entries that contain the following information:

- Average SP (Static Pressure)
- Average DP (Differential pressure)
- Average FT (Flow Temperature)
- Calculated Volume

3.7.4.1 Log Period Data Entries

Log period data entries are made every 60 minutes, by default. The period may be changed to one of six other choices (1,2,5,10,20,30,60). Choosing a log period of less than 60 minutes will result in additional records being logged. As such, this requires more storage space to hold a full day's data. The log period must never be less than the volume calculation period.

3.7.4.2 Volume Calculation Period Entries

Volume calculation period entries are made every 60 minutes, by default. The user may change this period to one of six other choices (1,2,5,10,20,30,60). The volume calculation period should never be greater than the log period and should be evenly divisible into the log period.

Volume calculations are completed following the top of the current period (i.e., top of the hour, top of the minute).

3.8 Display Function

During operation of the flow computer, the front panel LCD continuously scrolls through the operating parameters. Table 5 shows the typical displayed parameters; however, any parameter with a register address can be displayed. The duration that the parameter is displayed can vary from 1 to 255 seconds (default is five seconds); a setting of zero (0) seconds will set any display to off. See Program Display in Chapter 3 (and PCCU32 help files) for more details.

Table 5 Typical XFC^{G4} Display Options

Display	Description
DATE/TIME MM/DD/YY HH:MM:SS	Current Date and Time 24 hour clock
YEST DP LO NN PERCENT	Yesterday's Percent DP Low Limit Percent time below DP Low Set Point
YEST DP HI NN PERCENT	Yesterday's Percent DP High Limit Percent time below DP High Set Point
FLOWRATE NNNNNN.N SCF/HR	Current Flow Rate Programmable SCF or MCF or MMCF
ACCUM VOL NNNNNN.NN MCF	Total Accumulated Volume Programmable SCF or MCF or MMCF
BATTERY NN.N VOLTS	Battery Voltage Volts
DIFF PRESS NNN.N IN. H2O	Differential Pressure Inches H2O
PRESSURE NNN.N PSIA	Static Pressure Absolute PSIA
FLOW TEMP NN.N DEG. F	Flowing Temperature °F
YEST VOL NNNN.N MCF	Yesterday's Volume Programmable SCFM or MCF or MMCF
PERIOD VOL NNNN.N SCF	Previous Period Volume Last volume calculation period volume
CHARGER NN.N VOLTS	Charger Voltage
M_FLOWRATE NNNNNN.N SCF/HR	Minute Average Flow Rate

3.9 Display Annunciators

One of the primary functions of the flow computer is to provide complete volume and operational records. As such, it is important to indicate unusual or alarm conditions as they occur (see Figure 14). This is supported on the LCD using annunciators (see Table 6). Instructions for using the display as a troubleshooting aid can be found in Chapter 6 -Troubleshooting. Whenever an alarm is indicated, the flow computer records it in the appropriate log period flow record. These are automatically retrieved when data is collected.

Using technology adaptable for multi-tube devices, the status and alarm code locations are programmable. Each annunciator may be programmed to reflect different application or tube types. The single tube device will come with a standard display preprogrammed but can be changed (see Table 6). Consult the PCCU32 help files for more instructions on programming the display.

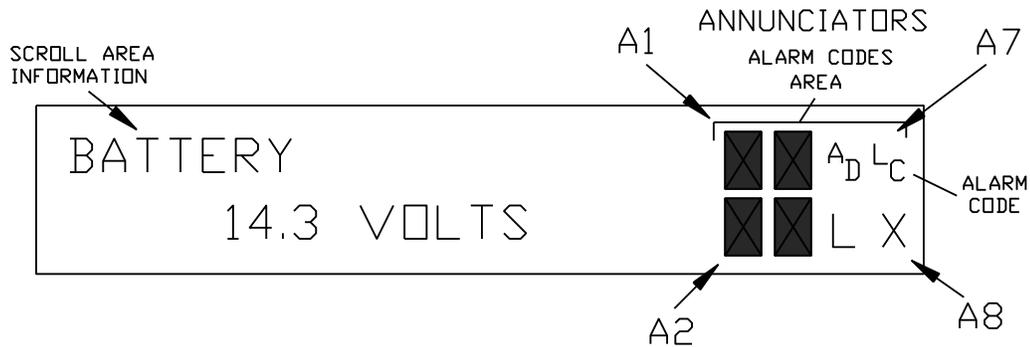


Figure 14 Liquid Crystal Display and Indicators

Table 6 XFC^{G4} Status and Alarm Description

Indicator	Description
System	
LL	Low Lithium Battery Alarm: When LL (low lithium) is displayed, the lithium battery voltage is below 2.5 Vdc. A new lithium battery measures approximately 3.6 Vdc.
LC	Low Charger: When LC (low charger) is displayed the μ FLO ^{G5} battery charging voltage is (+) 0.4 Vdc or is less than or equal to the battery voltage.
Display Application	
1	A number represents the Display Group number currently being displayed.
↑	The displayed item's value is above the Data High Limit value that is specified on the display Item Setup screen.
↓	The displayed item's value is below the Data Low Limit value specified on the display Item Setup screen.
Communications Protocols	
→	Transmitting Data: Sending a response
←	Receiving Data: Processing request
!	Nak: Negative acknowledgement with packet list
+	Ack: Positive acknowledgement of receipt of request
⏸	Waiting for Ack: Waiting for response after transmission
?	Exception Alarm Processing
ƒ	ID Recognized: Recognized and receiving request
⚡	Listen Cycle: Flashes if this remote port is active and running Totalflow Remote Protocol. Flashes in sync with the listening cycle that occurs at 1, 2 or 4 second intervals. When the baud rate is faster than 2400, then the flashing symbol may not be visible. The annunciator will remain on listening cycle if the listen cycle is set to zero.
M	MODBUS® ASCII: MODBUS® ASCII protocol is selected for the port assigned to this annunciator.
m	MODBUS® RTU: MODBUS® RTU protocol is selected for the port assigned to this annunciator.
L	Local Protocol: Displayed when the PCCU32 port is active and running Totalflow Local Protocol

Indicator	Description
¥	ID Recognized: The ID has been recognized but is waiting for sync.
n	Ethernet Protocol: Displayed when the Totalflow/TCP port is active.
Measurement Application	
BF	Back Flow Condition: Visible only when DP variable is displayed
Z	Zero Flow Condition: Visible only when the flow rate is displayed
H	Hold: Displayed when PCCU32 has entered hold
A	Alarm Condition: Need to view alarm. Compare application limits to the current values to determine where the alarm condition is present.
AD	A to D Failure: Displayed if the A to D converter's absolute differential pressure, absolute static pressure, or temperature readings exceed the maximum counts or are less than the minimum counts
Valve Control	
V	Displayed when Valve Control option is installed and no other valve control symbols are valid.
=	Displayed when Valve Control option is installed. Process value (PV) is within the user set dead band. No control action required.
┌	Displayed when Valve Control option is installed. Valve is in full open position.
└	Displayed when Valve Control option is installed. Valve is in full closed position.
↑	Displayed when Valve Control option is installed. Valve is opening (open signal is being sent to valve actuator).
↓	Displayed when Valve Control option is installed. Valve is closing (close signal is being sent to valve actuator).
⊗	Displayed when Valve Control option is installed. Valve controller override conditions met (DP/SP override set point or low battery).
LL	Displayed when Valve Control option is installed. Local lock-out is initiated.

3.10 XFCG4 Application Licensing

The fourth generation (G4) flow computers offers unrivaled power and flexibility. The G4 flow computer can support far more applications than the third generation (G3) devices. Various applications require that Totalflow pay a royalty to third party vendors. As such, Totalflow has developed a credit system for handling application loads beyond what would be required for a typical G3 meter run. Application credits are required to enable many of the applications. From the factory, the G4 unit has four general credits installed. Several system configurations are possible with these four general credits:

- AGA-3 with Valve Control and Trending (uses 3 general credits)
- Two AGA-3 (or AGA-7) tubes with Trending (uses 3 general credits)
- AGA-3 with Valve Control and Plunger Lift (uses 3 general credits)

Applications have been divided into categories: Standard, General, IEC, CO2 and HCDP (hydrocarbon dew point). Other application categories may be created in the future.

Standard applications typically support general applications as well as the basic operation of the flow computer. Standard applications do not require any credits to be instantiated.

Standard applications include:

- System Application
- Communications
- I/O Subsystem
- Therms Master
- Therms Slave
- Analysis Trend System
- LevelMaster
- Operations

- XMV Interface
- Holding Registers
- Units Conversion
- Host Interface
- Displays

General applications typically provide some type of measurement, control, logging and/or archival function. General applications include:

- LMV Interface (future)
- NGC Client
- AGA-3 Measurement
- AGA-7 Measurement
- Trend System
- Alarm System
- Pulse Accumulator
- Valve Control
- Safety
- Plunger
- Oil Custody Transfer Measurement

IEC applications are generally custom applications provided by Totalflow at the customer's request. They might include special control and/or measurement algorithms required by the customer. Multiple IEC applications can be instantiated with a single IEC credit.

CO2 (NIST) applications each require a CO2 (NIST) credit.

HCDP applications will each require an HCDP credit.

3.10.1 Credit Key (USB)

The flow computer comes with four general credits installed in the unit. If the system configuration requires more application credits, they can be purchased from Totalflow.

Credits (Standard, General, IEC, CO2 and HCDP) are maintained on the credit key. Credits can be purchased and kept on the USB credit key. The credit key is a secure USB Flash drive (i.e., thumb drive). It cannot be written to or read by any program other than PCCU32 7.0 or later. Credits can be added to the credit key via phone call to Technical Support. Again, these credits are used to run the various applications available in the product line.

Credits can be transferred between the laptop and the flow computer. If a flow computer has extra credits (more than required to be fully licensed), the extra credits can be downloaded to the credit key and used on other G4 flow computers.



IMPORTANT NOTE: If any G4 controller is running an unlicensed application, that fact is reflected in any reports generated from that unlicensed meter. The meter will also log the fact that it is unlicensed in the Event Log at the top of each contract day. Unlicensed applications will cause the meter to connect more slowly.

3.11 Laptop Computer Running PCCU32

PCCU32 software running in a laptop Windows environment offers the user the most capabilities for programming the flow computer. The Windows environment features user friendly help files and easy to follow menus.

If configured with the USB option, the laptop computer connects via the cable directly to the connector on the side of the flow computer.



IMPORTANT NOTE: Connecting to a G4 meter with PCCU32 will require version 7.05.5 or later.

Making a local connection to the meter may be accomplished one of two ways. Traditionally, local connections have been made using the RS-232 PCCU cable with the round military connector on one end and a serial port connector on the other. The second method involves the local connection being made using a USB cable.

3.12 Local PCCU Connections

3.12.1 RS-232 Serial PCCU Cable (Round Military Connector)

The local connection (serial military connector) requires an RS-232 serial port on the host computer (generally a laptop). A PCCU cable is required to connect the host computer to the meter's round military connector. Connecting the PCCU cable to the meter will cause an annunciator in the LCD to display an upper case letter "L" for local connect.

i

IMPORTANT NOTE: The flow computer must be ordered to include serial communication capability. A change over kit may be purchased to adapt the flow computer to USB capability.

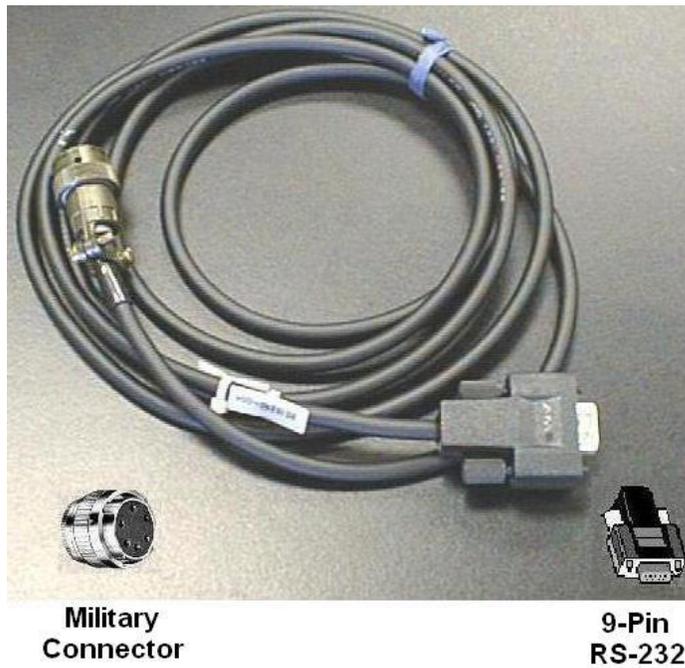


Figure 15 RS-232 Local Communication Cable

3.12.2 PCCU32 USB Connection

The local USB connection requires the use of a USB cable connected to the host computer (generally a laptop). A USB PCCU cable is required to connect the host computer to the flow computer's client connector. Connecting the PCCU cable to the flow computer will cause an annunciator in the LCD to display an upper case letter "L" for local connect.

i

IMPORTANT NOTE: The flow computer must be ordered to include USB communication capability. A change over kit may be purchased to adapt the flow computer for serial communication capability.

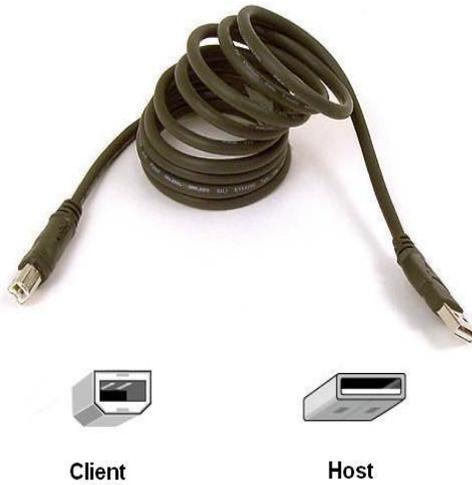


Figure 16 USB Local Communication Cable P/N 1801800-xxx

3.13 Network Connectivity (Dynamic IP w/Router)

When operating the flow computer in a network environment, using an Ethernet is a practical solution. PCCU32 communication with the meter over an Ethernet connection (TCP/IP) requires the use of a hub, switch or router along with appropriate cabling (see

Figure 18). Ethernet (local) communication in a remote area may also be used.



Figure 17 Ethernet Communication Cable P/N 1681011-xxx

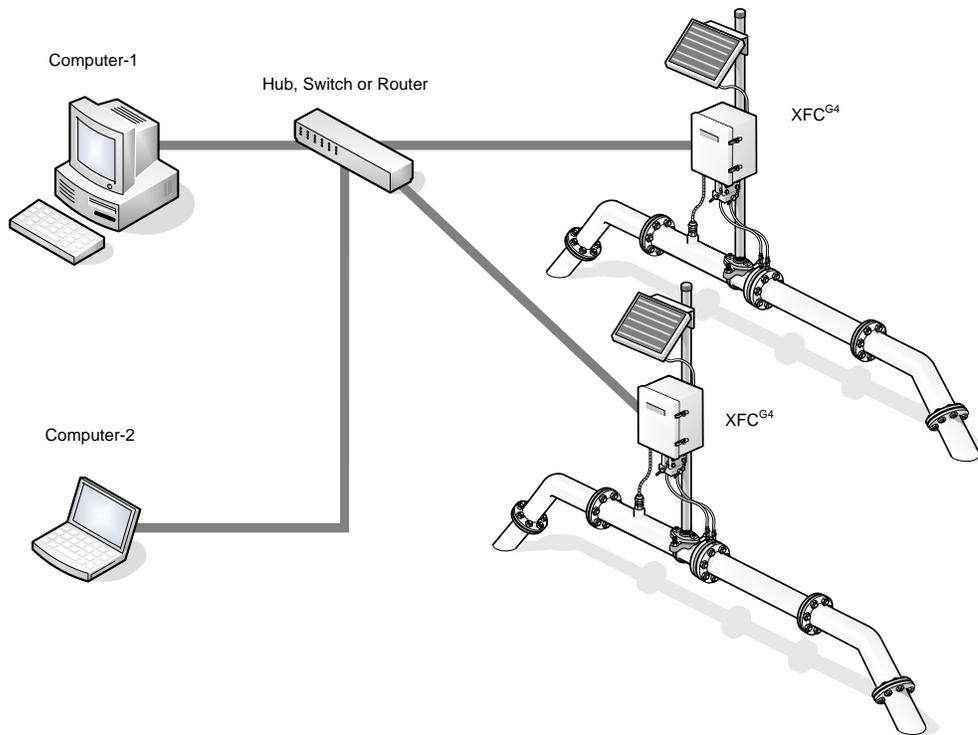


Figure 18 Ethernet Connectivity Diagram

3.14 Optional Key Pad

The XSeries models may be configured to include the optional keypad (see Figure 19) located on the front cover of the unit. Keypad entry allows the user to monitor programmed display items without using additional equipment. See Figure 20 through Figure 21 for outline dimensions.



IMPORTANT NOTE: To view the various display items, the items must be preprogrammed for keypad entry. All the display items may be programmed for an application or individually display items within the application using PCCU32.

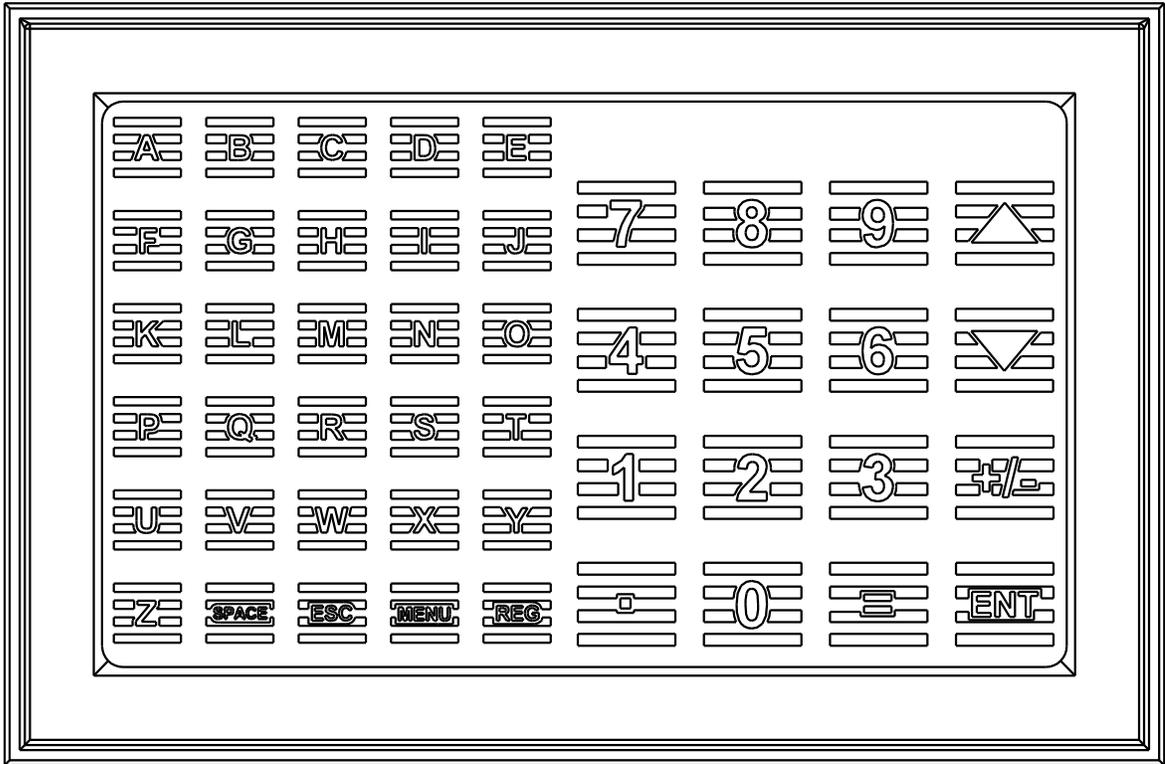


Figure 19 Optional Keypad

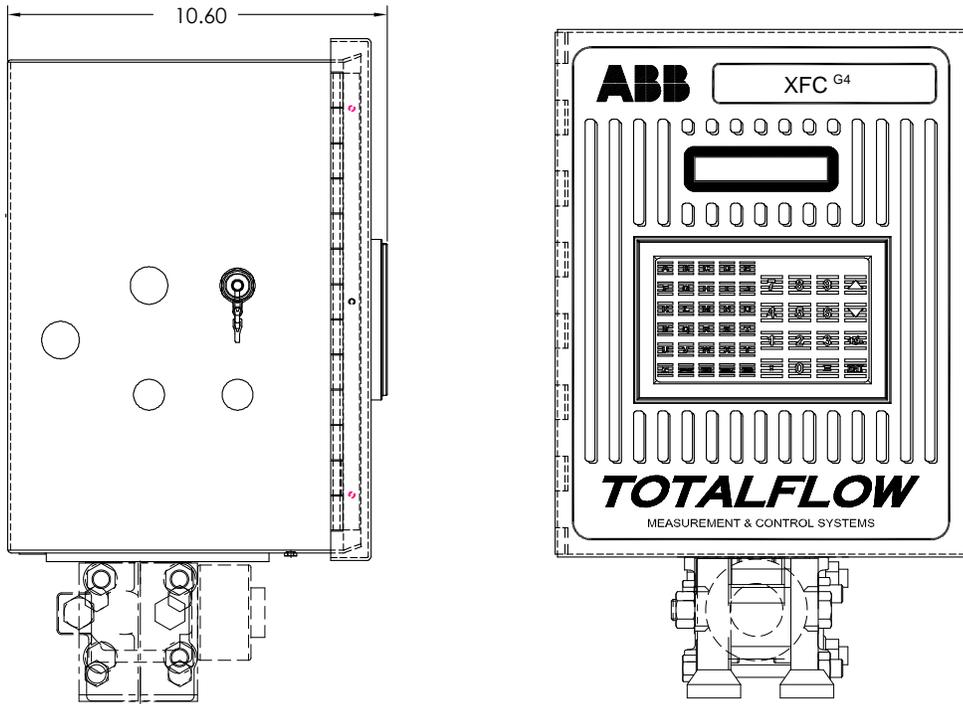


Figure 20 XFC^{G4} 6413 with Optional Key Pad

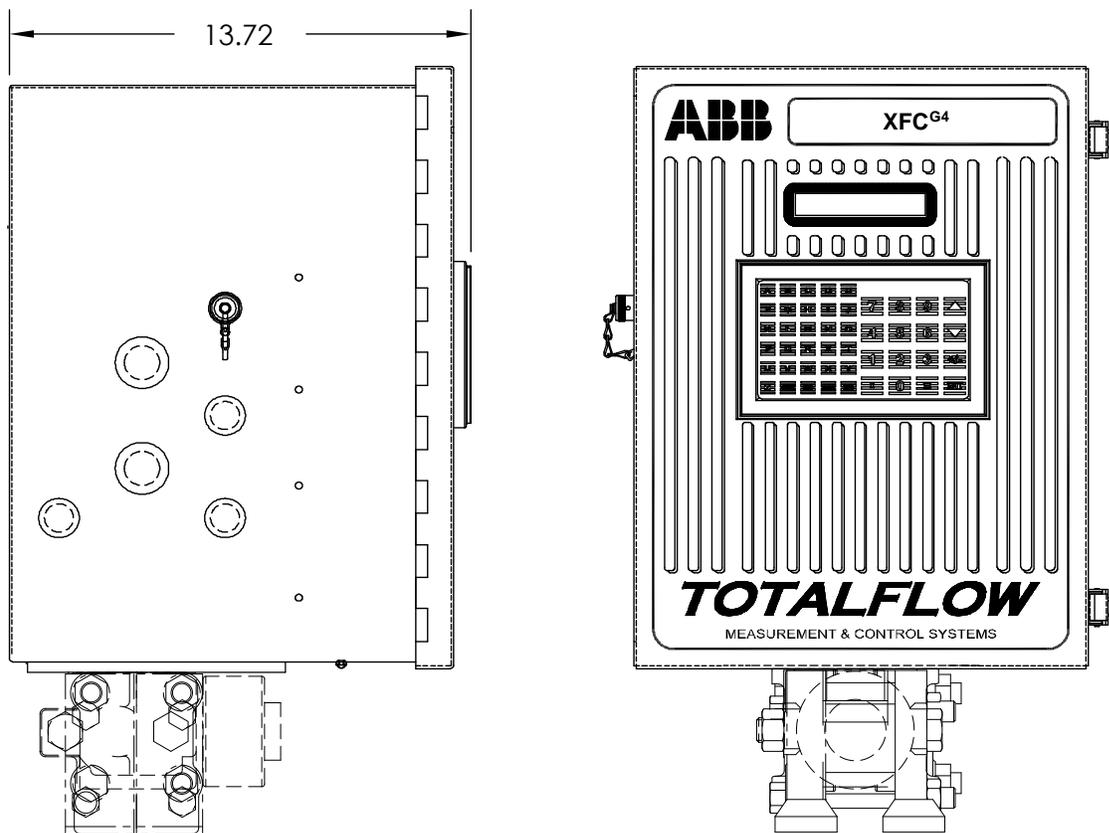


Figure 21 XFC^{G4} 6713 with Optional Key Pad

3.15 Optional Totalflow Input/Output Modules

The hardware functionality of the XSeries flow computers can be extended by using modular I/O packaged in DIN mount enclosures.

In addition to Totalflow's enhanced on-board input/output capabilities, the hardware functionality of the flow computer series can be extended in a flexible way by adding modular I/O, as needed (see Figure 22). Totalflow I/O (TFIO) modules are designed to accommodate low power, harsh environments and economical cost requirements. The system automatically recognizes the module types and configures the I/O Scanner subsystem accordingly.

The modules are interfaced to the flow computer board by an I²C bus. On top of this bus, Totalflow has implemented an efficient I/O protocol to exchange information between the modules and the circuit board. The bus operates in a master or slave mode with the main board acting as master.

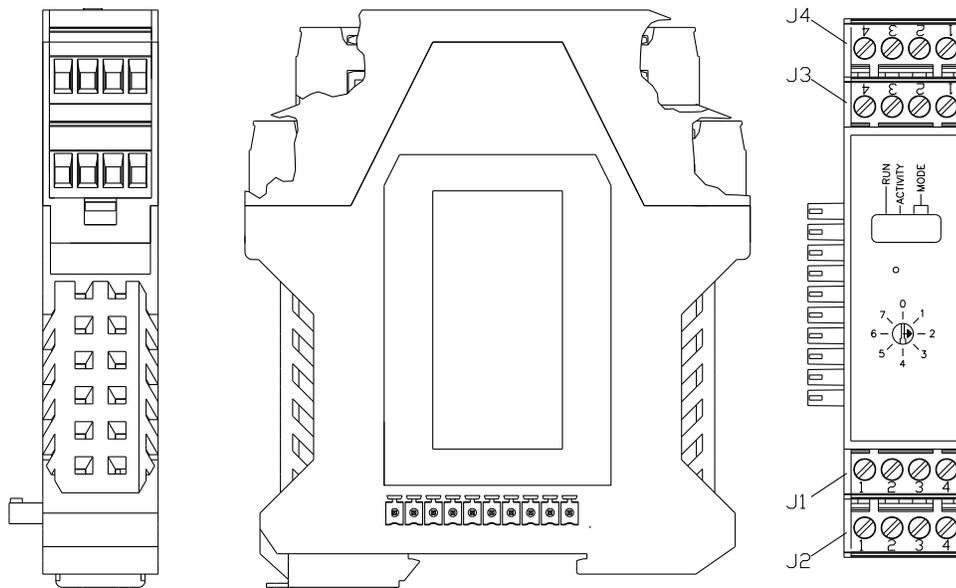


Figure 22 TFIO Module Housing

3.15.1 TFIO Module Specifications

The flow computer 6413 and flow computer 6414 (as shown in Figure 23) systems support up to three modules. For example, three analog input modules can be connected to the I²C bus. Since each module supports eight analog inputs, a total of 24 analog inputs can be added to the I²C bus. Each module has the capacity for up to 16 field terminations. For many modules, eight points are supported, since two terminations are generally required for each point. The flow computer 6713 and flow computer 6714 (as shown in Figure 24) systems support up to six modules.

Current design criteria dictates that module capacity must also be limited by the panel's ability to provide power to the modules. The following table indicates the maximum load capabilities.

Table 7 TFIO Module Loading

	XFC (G3)	XRC (G3)	XFCG4	XRCG4
# of Modules	9	22	9	22

All modules are designed to meet Class 1, Division 2, Group C and D Certification.

3.15.2 TFIO Module Hardware

The I/O module hardware is packaged in DIN mount enclosures that employ Phoenix contact technology for field wiring. The modules also interconnect with each other to provide the necessary power and interface signals along their bus. Installation consists of snapping the Phoenix connector onto the DIN rail, moving the module into position directly beside the corresponding module and then snapping it to that module. Likewise, in removing a module, it must first be separated from the module on either side and then removed from the DIN rail.

All modules have four LED lights, a manual reset button and a selectable address from 0 through 7. On the face plate of each module is:

- Type of module (name and color coded)
- LED light panel
- Reset button switch
- Module address selector

For additional information, please refer to the TFIO Module User's Manual.

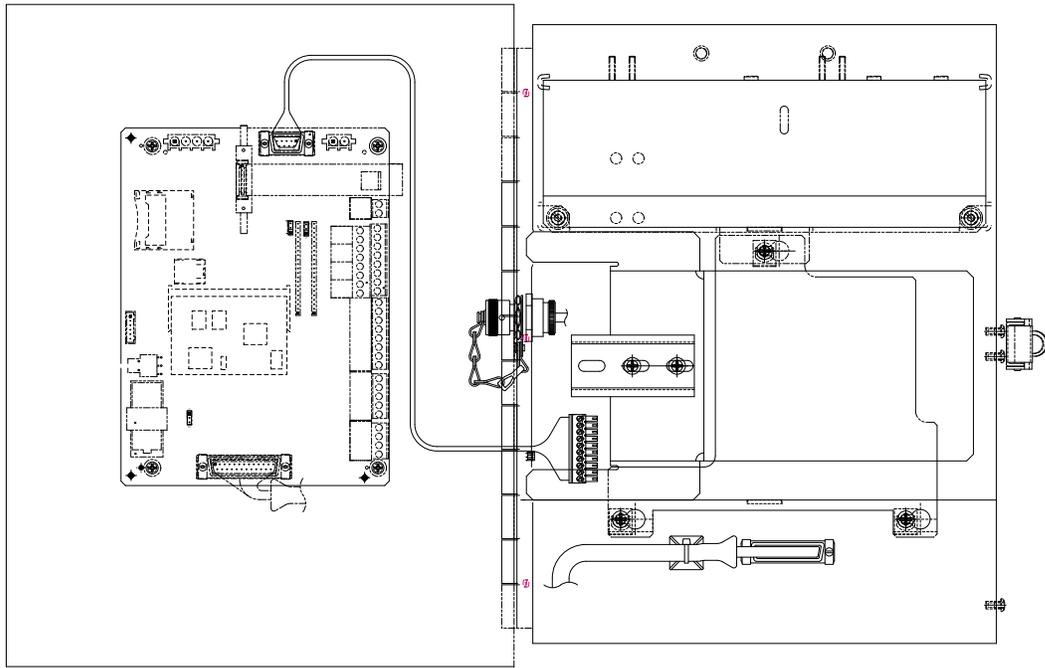


Figure 23 XFC^{G4} 6413/6414 Inside View with Module Mounting Rail

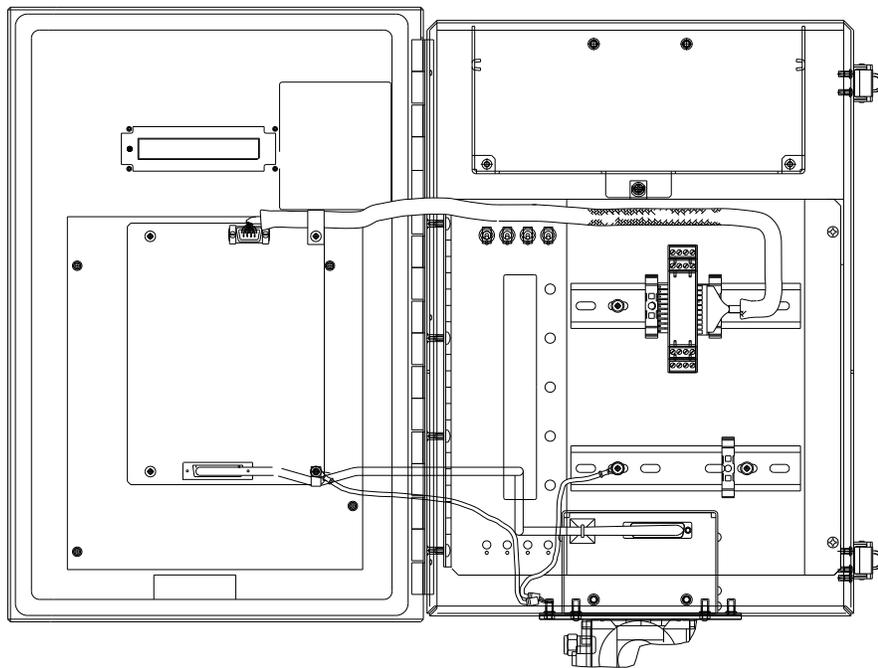


Figure 24 XFC^{G4} 6713/6714 Inside View with Module Mounting Rail

4 Installation

This chapter provides information for installation and setup of a flow computer. By the time this chapter is finished, the flow computer will have been unpacked, installed, field wired and ready for operation. For a safe and trouble free installation, follow all instructions and advisories.

i

IMPORTANT NOTE: Read through this chapter before beginning the installation. Additionally, before beginning, refer to the wiring diagrams delivered with the new flow computer. The user can store these under the Drawing tab in the back of this manual.

Installation procedures presented within this chapter are applicable to models XFC^{G4} 6410, 6411, 6413, 6414, 6713 and 6714.

4.1 Unpacking and Inspection

4.1.1 Unpacking

The flow computer and RTD are shipped in a specially designed shipping carton which contains the unit, mounting brackets, parts list and 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.

4.1.2 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's exterior for dents, chipped paint, etc.
- Inspect the LCD window for breakage.
- Open the housing by first removing the bolt and releasing the latch/latches.
- Visually inspect the main electronic board (flow computer panel), cables and XIMV unit for damage.

4.1.3 Damaged Components

If any components have been damaged, or if there are noticeable defects, notify a Totalflow representative. Keep all shipping materials for the carrier's inspection. Totalflow will arrange for immediate repair or replacement. See the Getting Help section in the beginning of the manual.

4.2 Installation Overview

The following procedures, unless otherwise indicated, are applicable to all XSeries flow computers. The flow computer can either be pipe, direct or wall mounted. Follow the procedure that best suits the installation. Figure 25 displays a typical gas orifice pipe mount installation. Figure 26 displays a typical pulse meter installation.

See Figure 27 through Figure 29 for a bottom view of each orifice model.

See Figure 30 through Figure 32 for a bottom view of each pulse model.

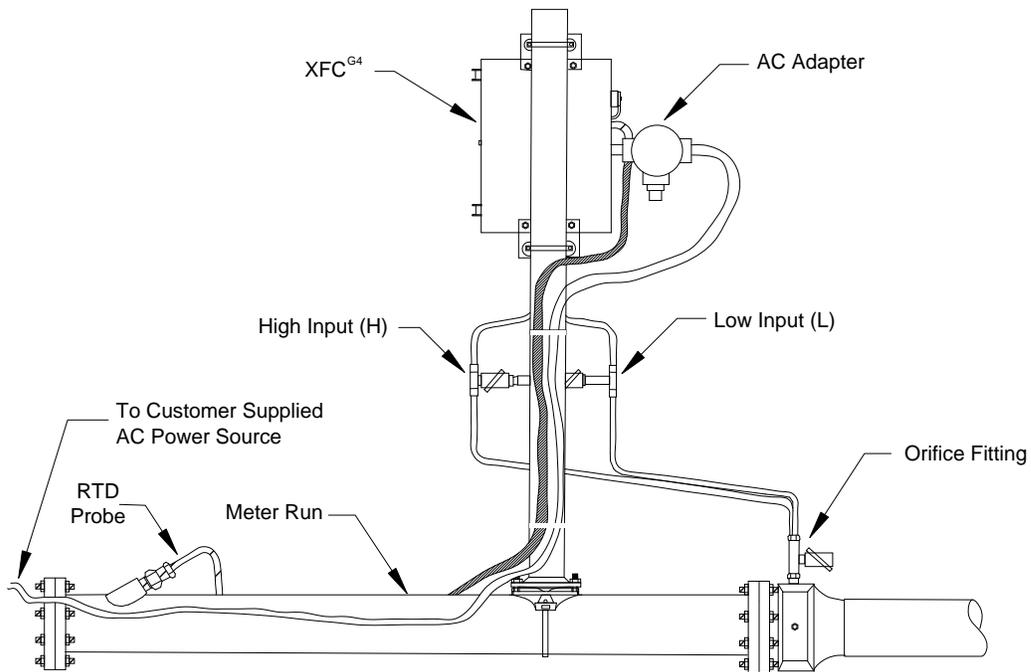


Figure 25 Typical Pipe Installation for Gas Orifice

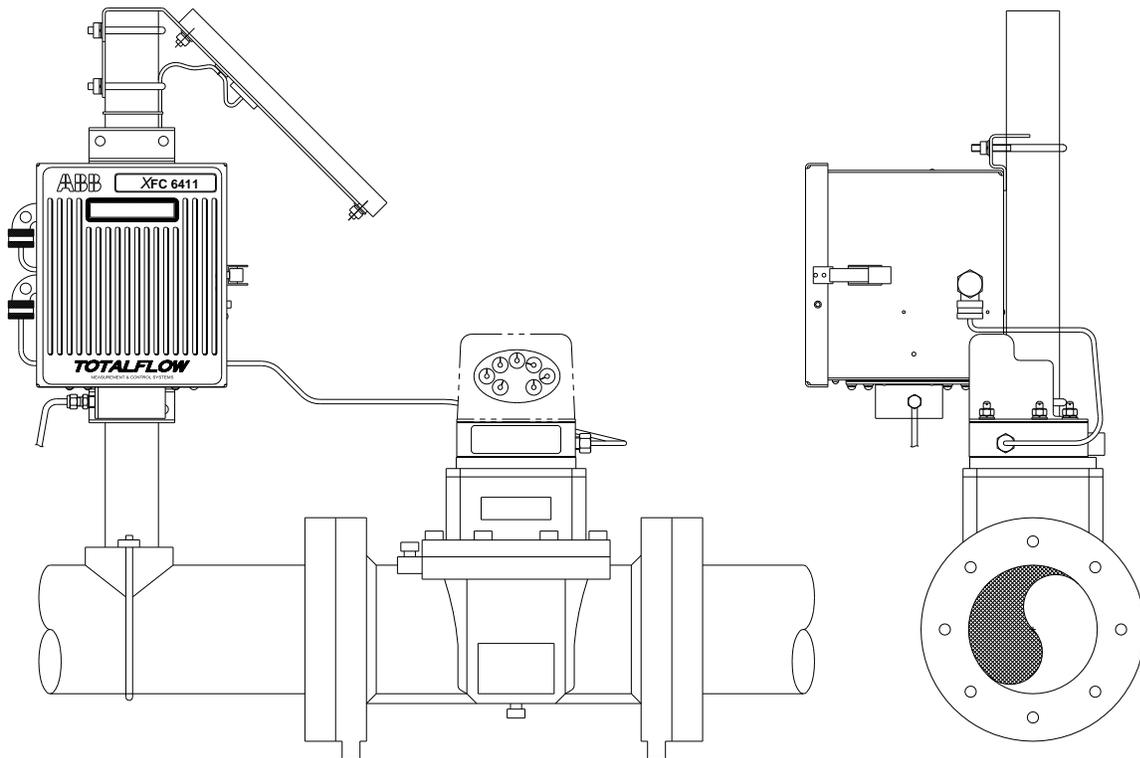


Figure 26 Typical Pipe Installation for Pulse Meter

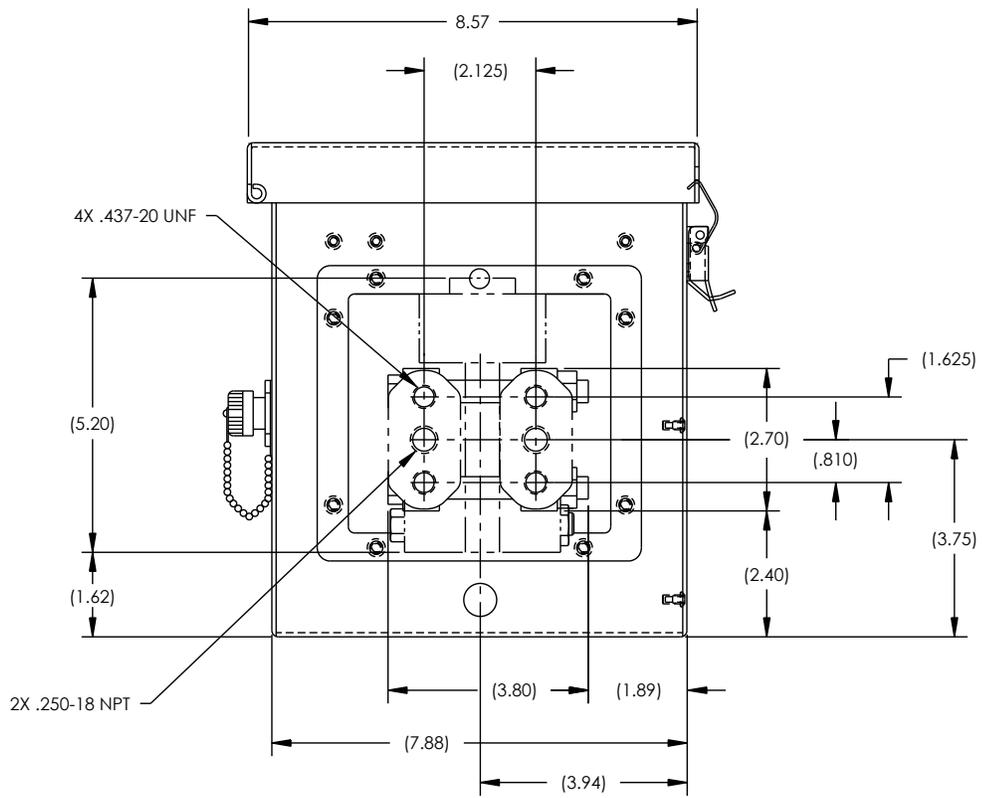


Figure 27 Bottom View Orifice Flow Computer XFC^{G4} 6410

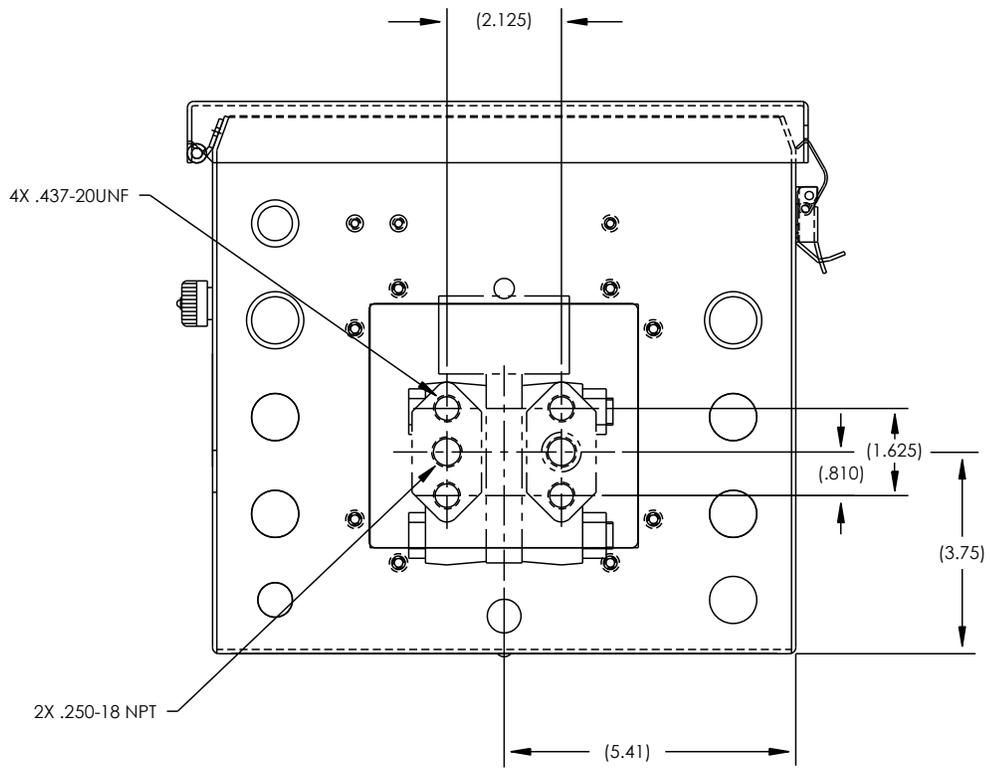


Figure 28 Bottom View Orifice Flow Computer XFC^{G4} 6413

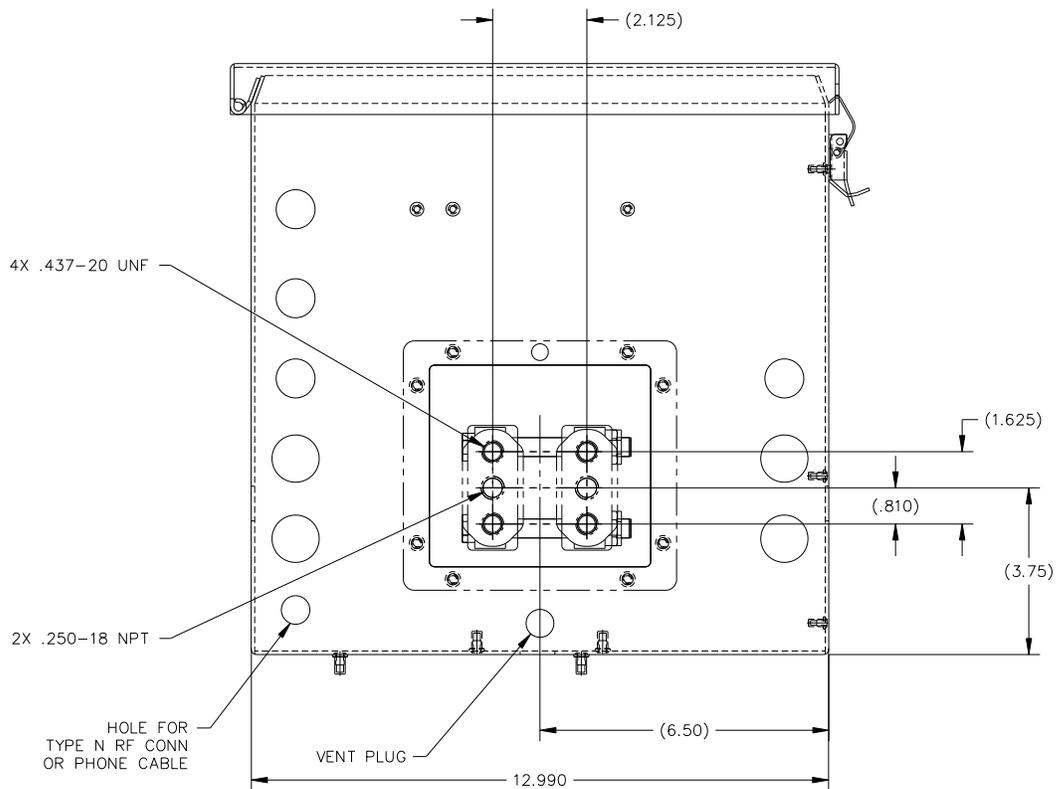


Figure 29 Bottom View Orifice Flow Computer XFC^{G4} 6713

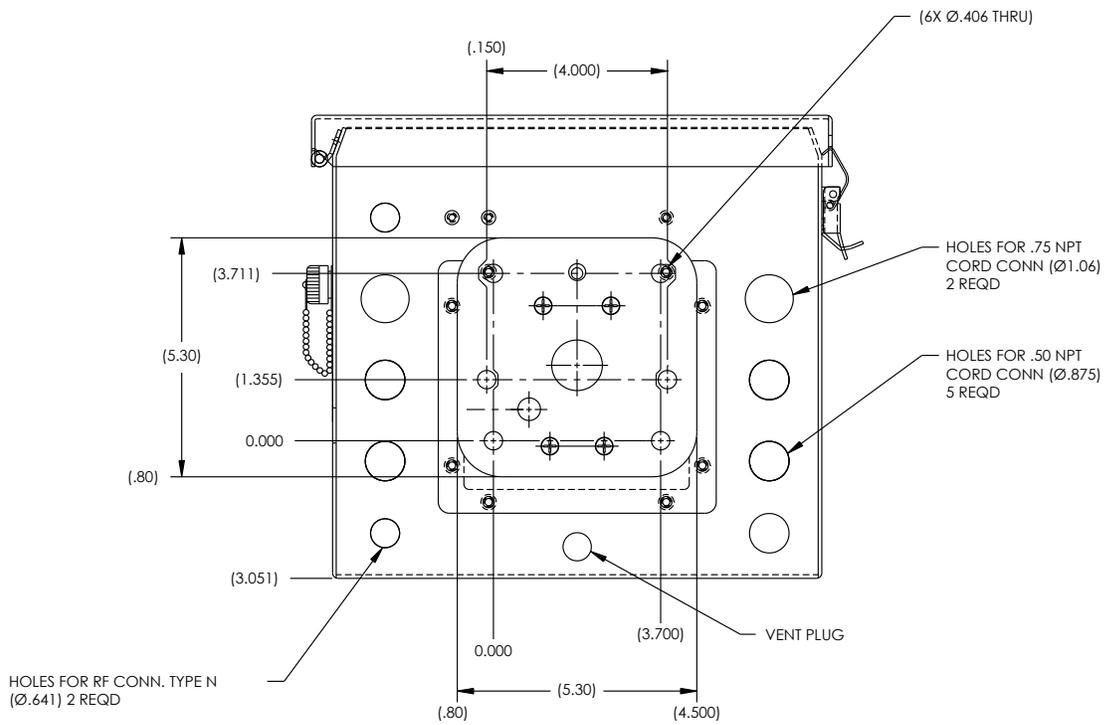


Figure 30 Bottom View Pulse Flow Computer XFC^{G4} 6411

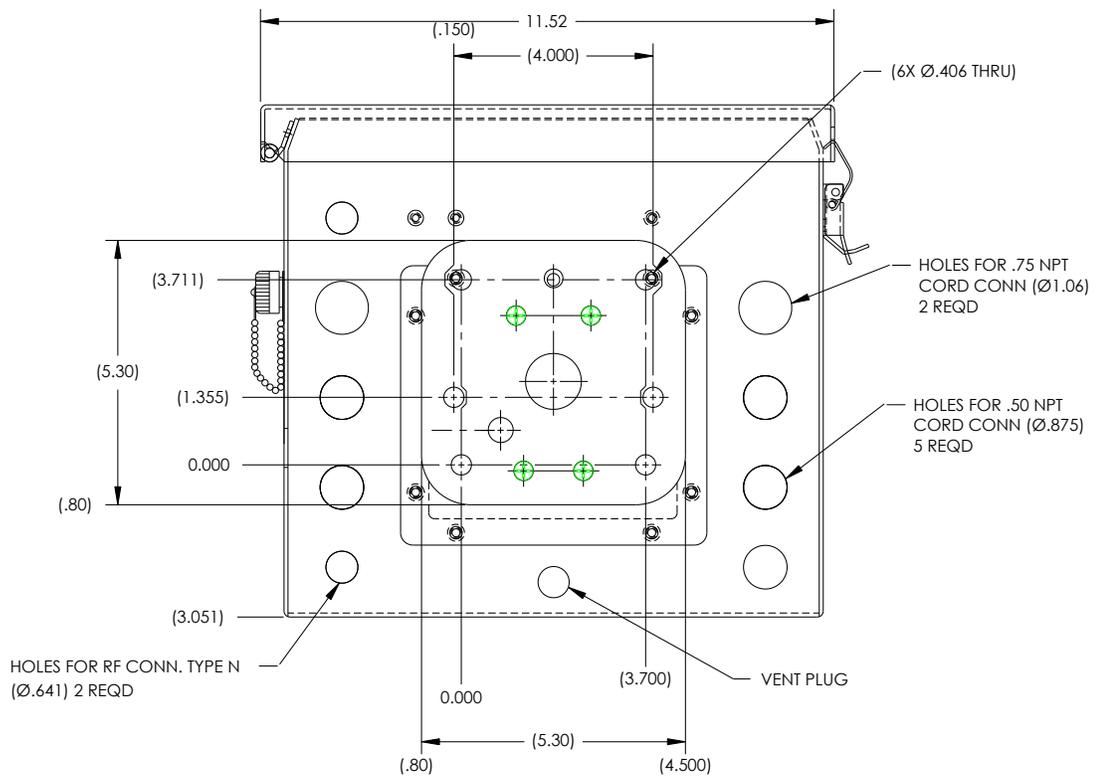


Figure 31 Bottom View Pulse Flow Computer XFC^{G4} 6414

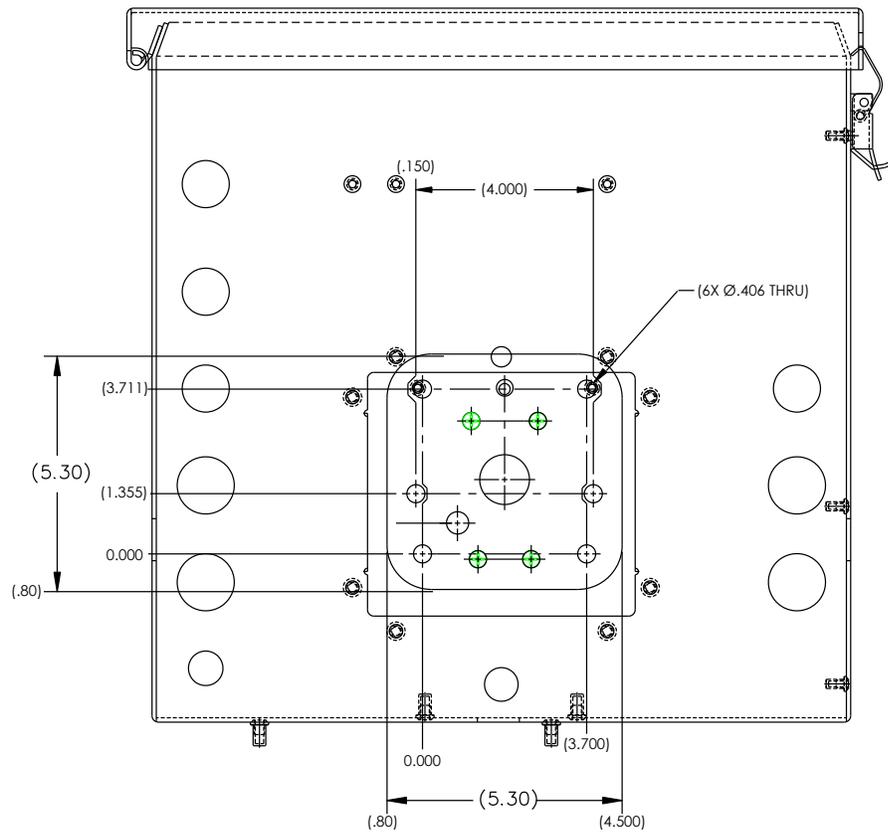


Figure 32 Bottom View Pulse Flow Computer XFC^{G4} 6714

4.3 Pipe Mount Installation

If installing directly to the meter run, use the following procedure. Before beginning, review the procedure and the materials required for installation.

Materials:

- Two U-bolts plus fastening hardware
- Flow computer mounting brackets

4.3.1 Material Not Supplied

- One pipe saddle
- One 2" x 40" pipe
- Standard 3 or 5 valve manifold or static pressure tap valve
- Stainless steel tubing

Tools needed:

- 5/16" combination wrench or socket with drive.

To pipe mount the flow computer enclosure:

-
- **IMPORTANT NOTE:** To install the flow computer, it is recommended that two people perform the installation. One to hold the unit in position and the other to install and tighten the mounting brackets.
- 1** The method of installation must be consistent with company policy or contract specifications.
-

1. Position the pipe saddle on the meter run. Select a location that allows easy user access and is close to the lines. Lines should be as short as possible.
2. Temporarily attach the saddle on the meter run pipe using the U-bolt and associated hardware.
3. Screw the 2" by 40" mounting pipe into the saddle.
4. Place a level against the pipe, and vertically align.
5. Adjust the pipe, mounted in the saddle, until vertical alignment is achieved.
6. Securely tighten the 2" by 40" pipe in the saddle after vertical alignment, then securely tighten the saddle mounting bolts.

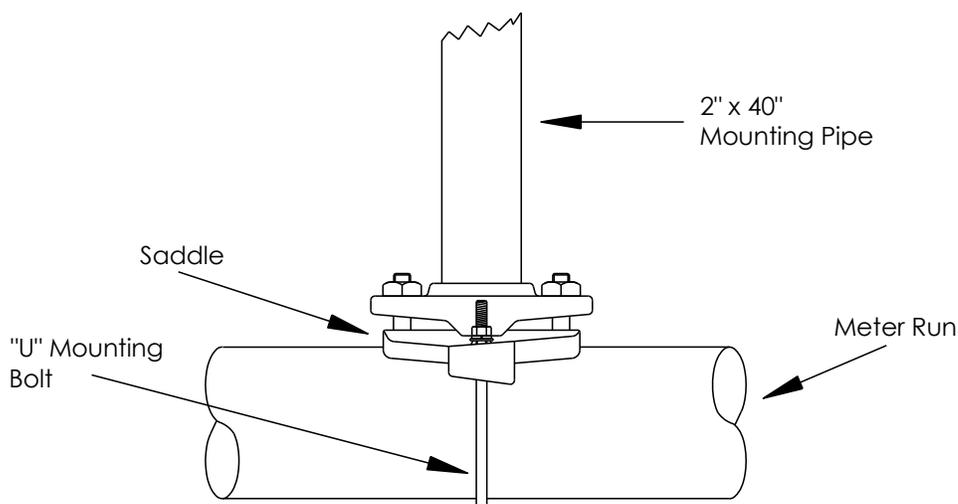


Figure 33 Typical Pipe Saddle Installation

7. Position the flow computer on the 2" mounting pipe, and secure in place with two U-bolts, flat washers, lock washers and two 9/16" bolts.

The flow computer enclosure is now pipe mounted.

i

IMPORTANT NOTE: Orifice - Position the flow computer high enough on the pipe to allow slope from the externally mounted manifold to the tap valves.

Pulse – Position the flow computer high enough on the pipe to allow slope from the externally mounted static pressure tap valve.

See Figure 35 through Figure 38 for pipe mounted dimensions.

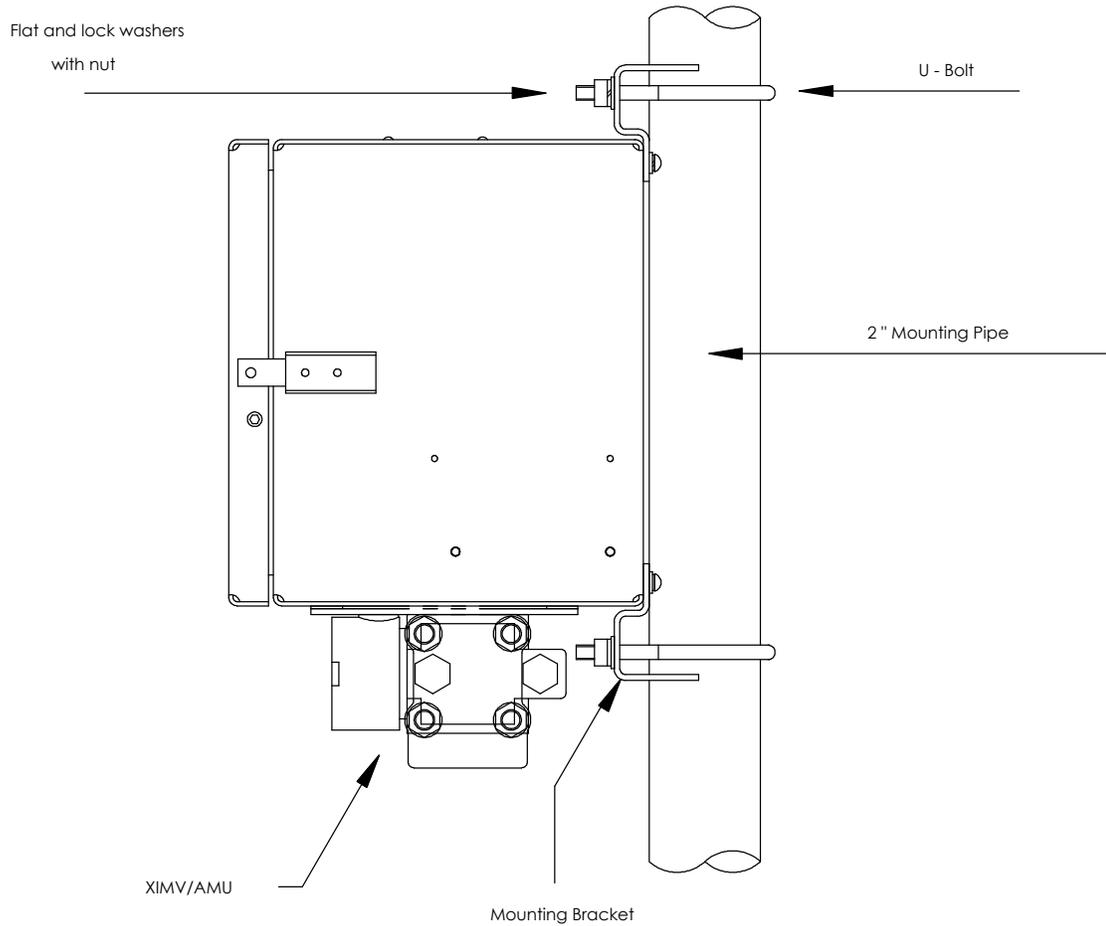


Figure 34 XFC^{G4} Pipe Mounted

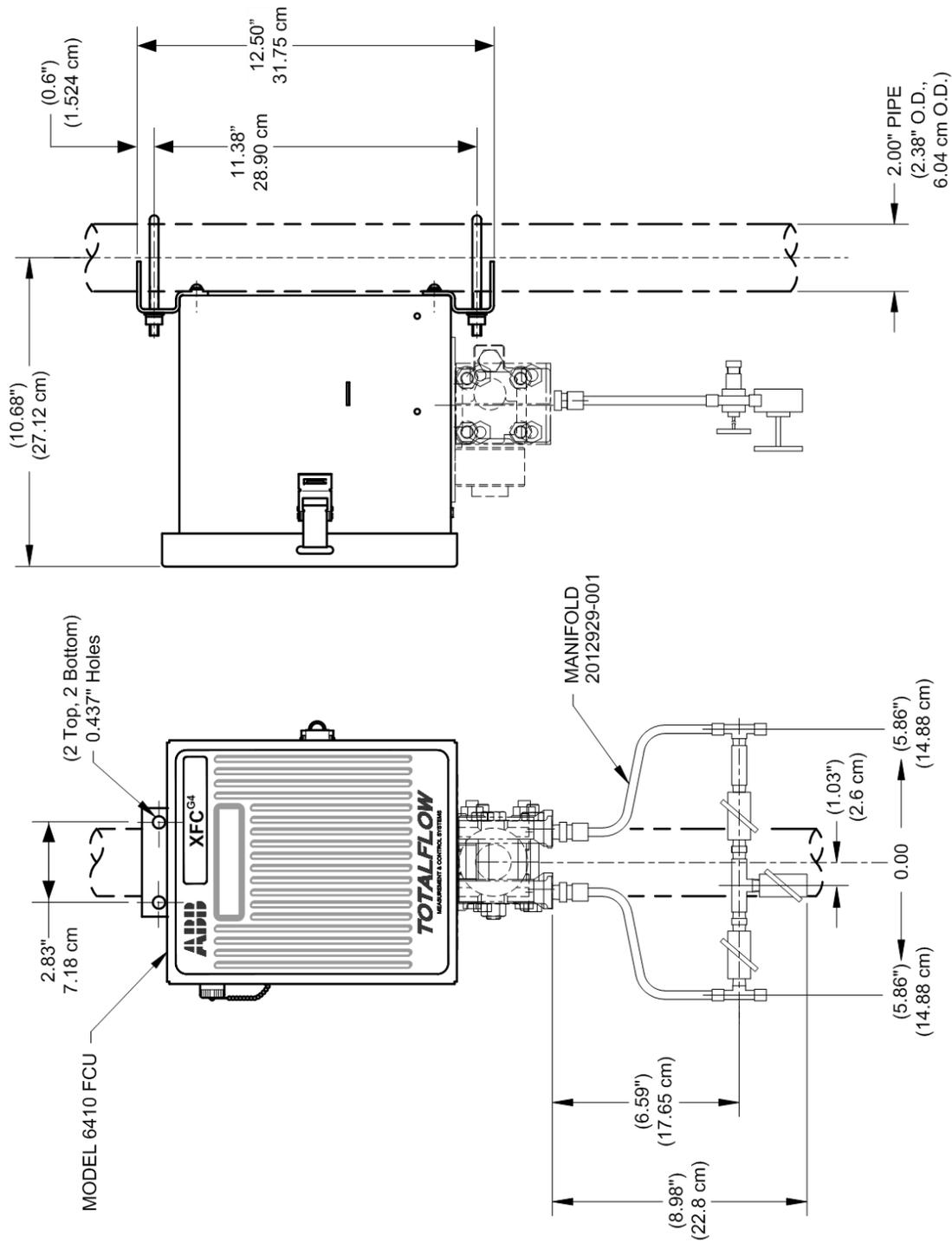


Figure 35 Model XFC^{G4} 6410, Pipe Mounted W/Discreet Manifold

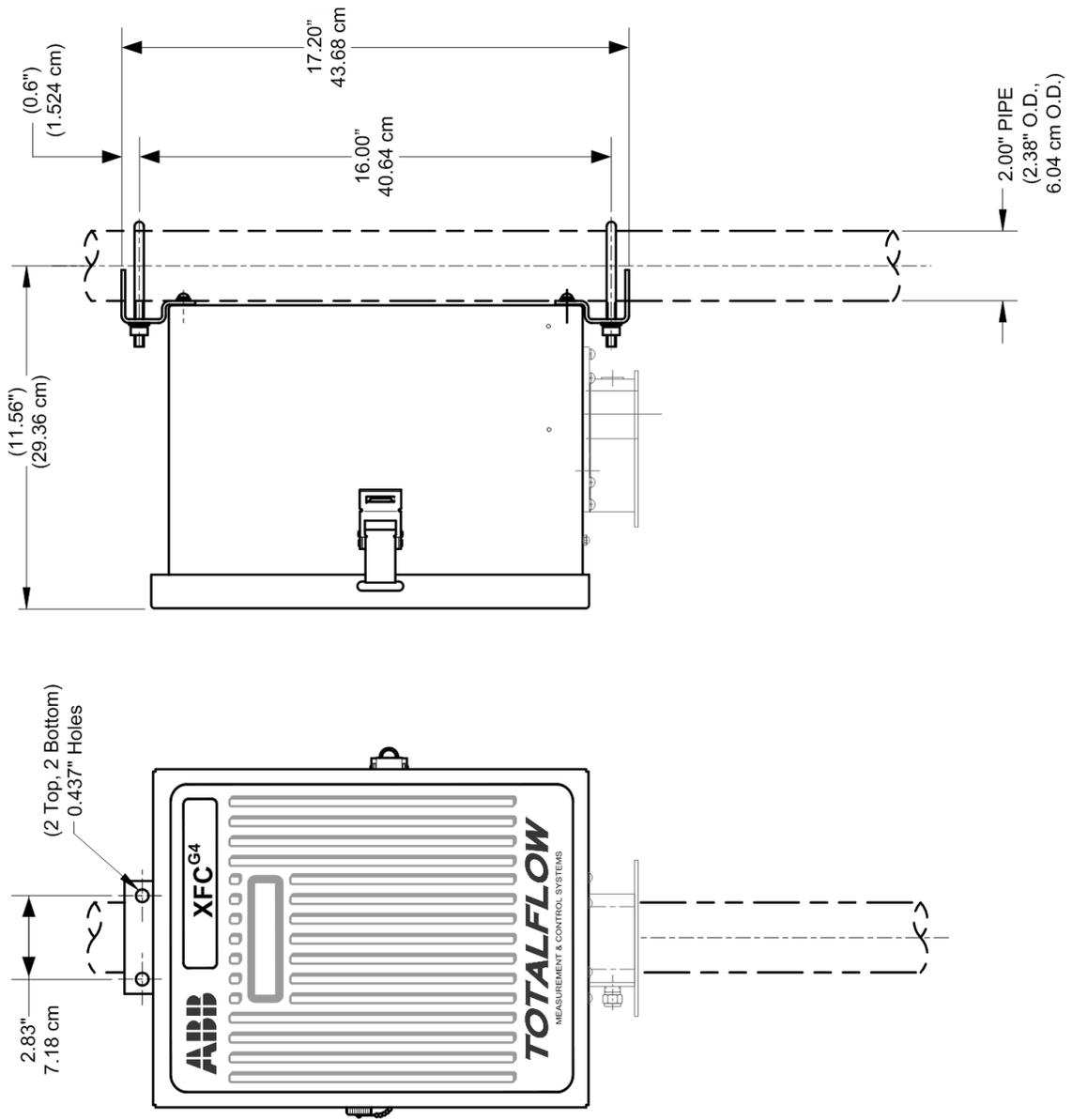


Figure 36 Model XFC^{G4} 6414, Pipe Mounted

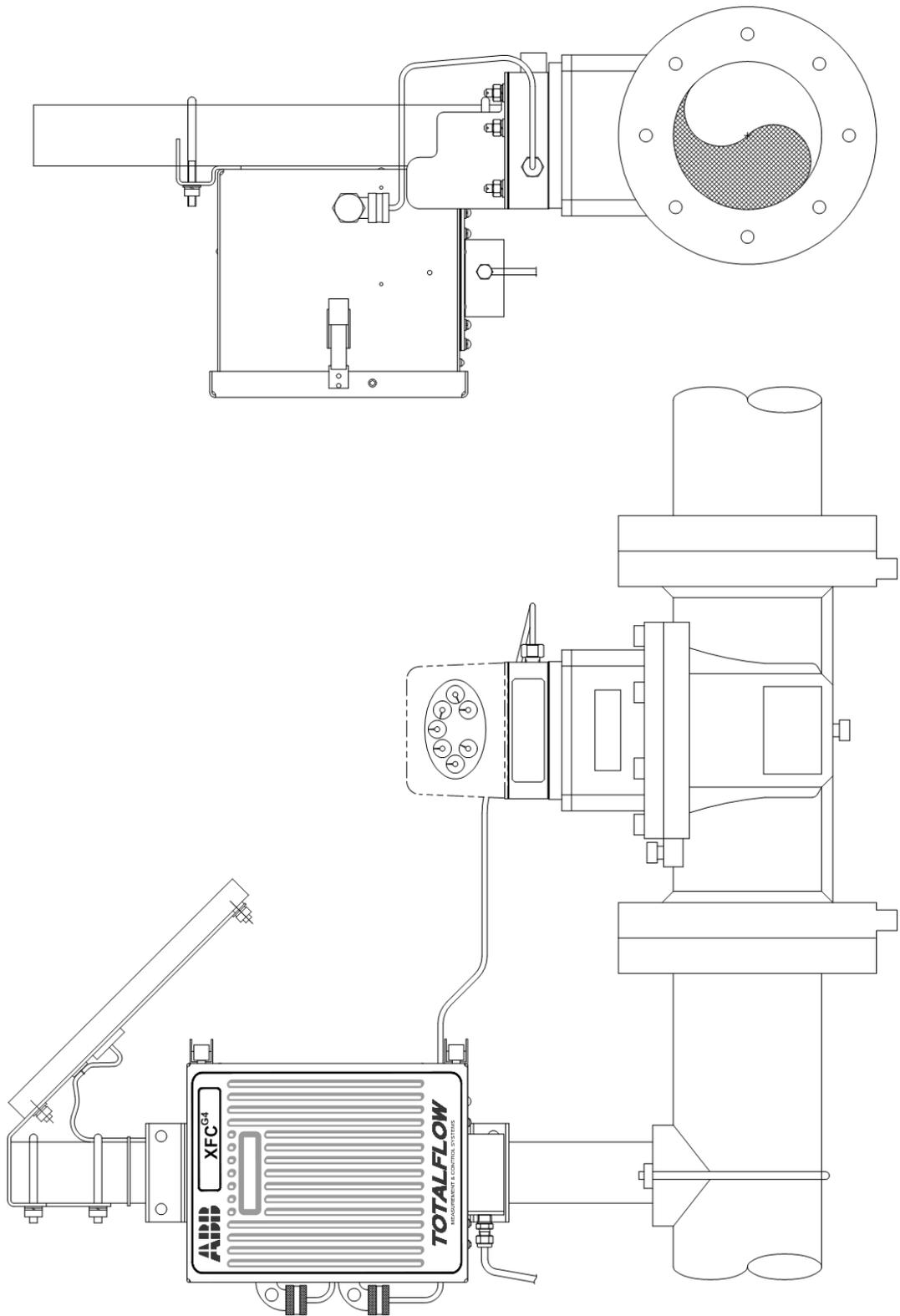


Figure 38 Model XFC^{G4} 6714, Pipe Mounted

4.4 Wall Mount Installation

If the flow computer is mounted to a wall near the meter run or inside a meter shed, use the following procedure. Before beginning, review the procedure and the materials required for installation. Refer to Figure 39 through Figure 44 for mounting dimension requirements.

4.4.1 Optionally Supplied Materials

- Flow computer wall mounting brackets

4.4.2 Materials Not Supplied

- Four 1/4" x 1/4" machine bolts
- Standard 3 or 5 valve manifold or static pressure tap valve
- 3/8-inch stainless steel tubing
- 1/4" x 3/8" tubing fittings

Tools needed

- 3/8" combination wrench x 2
- Hand drill
- 1/4" drill bit

i

IMPORTANT NOTE: If the flow computer 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 flow computer door from being opened to access interior installed components or to interfere with the installation of the solar panel.

4.4.3 Step-by-Step Instructions

To perform a wall mount installation:

1. Drill the mounting holes in the wall supports.
2. Install the supplied wall mounting brackets on the back of the flow computer.
3. Lift and align the flow computer wall mounting brackets with the mounting holes drilled in the wall.
4. Insert the 1/4" x 1/4" machine bolts through the flow computer mounting brackets and into the wall.
5. Securely tighten all bolts to secure the unit to the wall.

i

IMPORTANT NOTE: Orifice - Position the flow computer high enough on the wall to allow slope from the externally mounted manifold to the tap valves.

Pulse – Position the flow computer high enough on the wall to allow slope from the externally mounted static pressure tap valve.

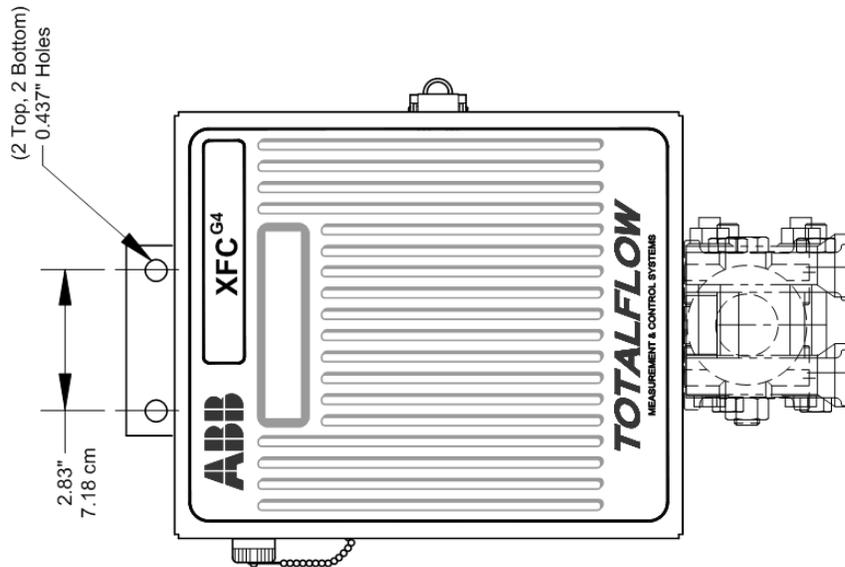
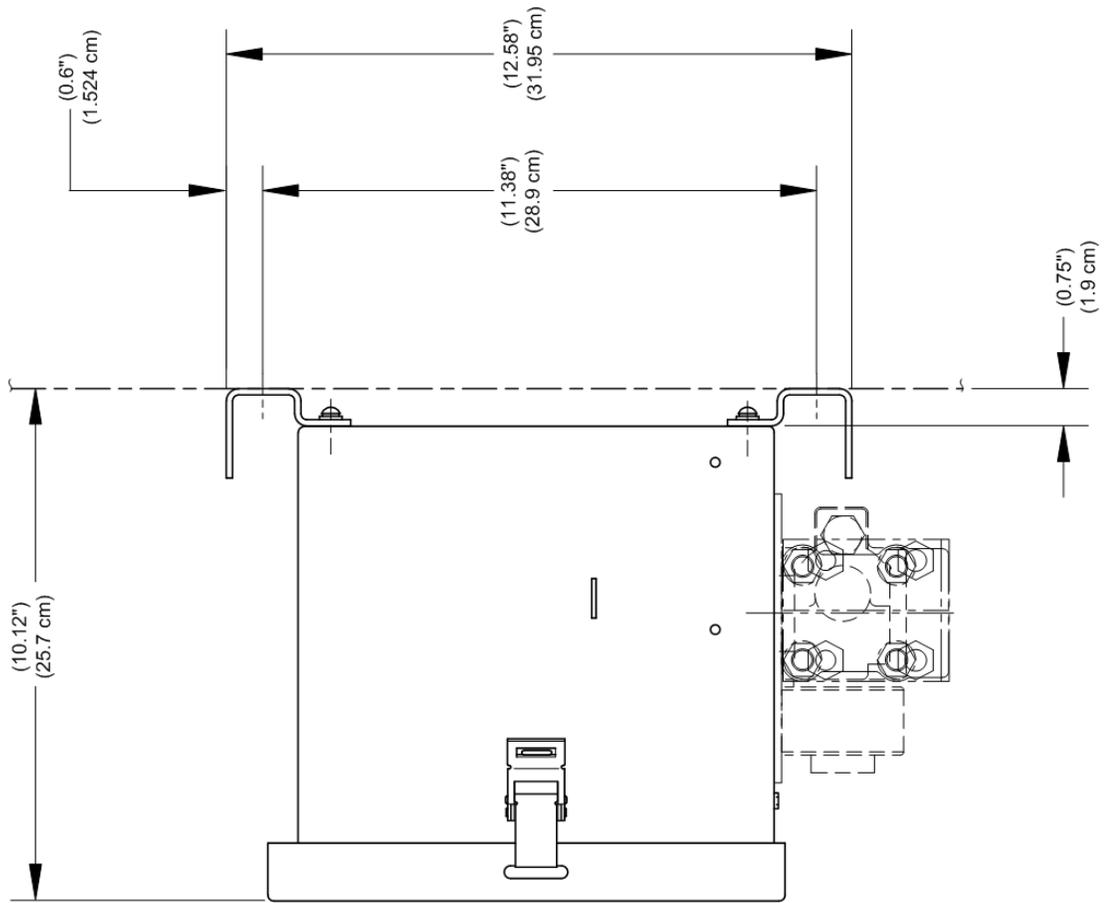


Figure 39 Model XFC^{G4} 6410 Wall Mounted

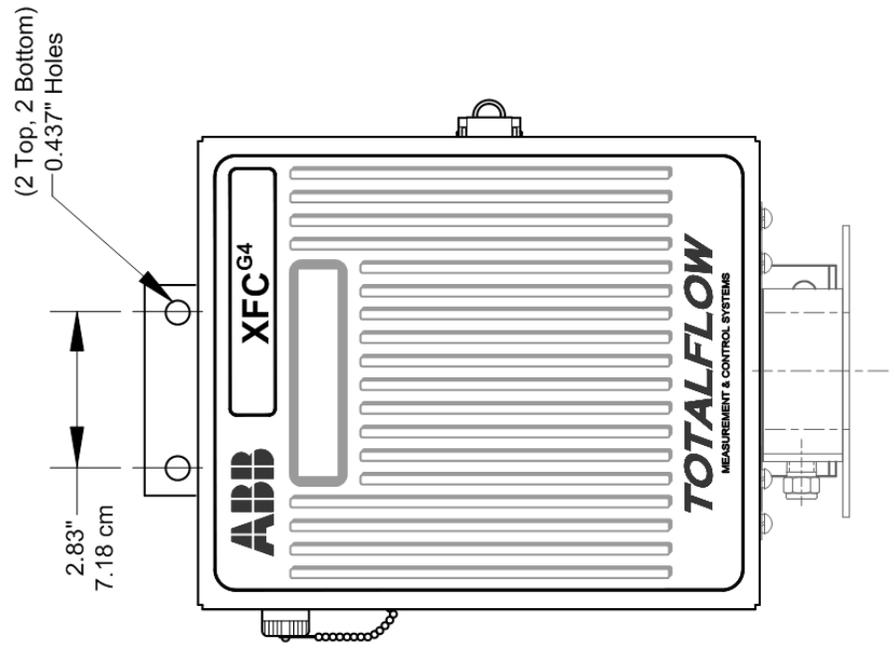
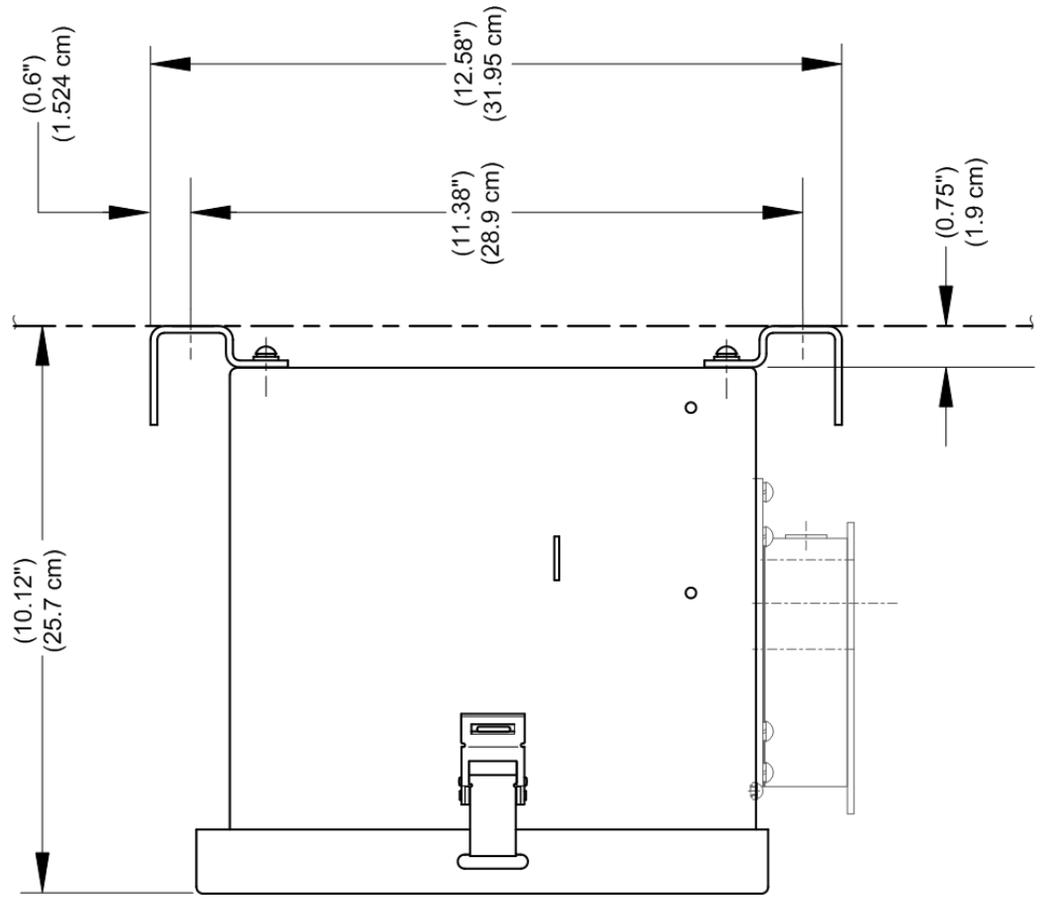


Figure 40 Model XFC^{G4} 6411 Wall Mounted

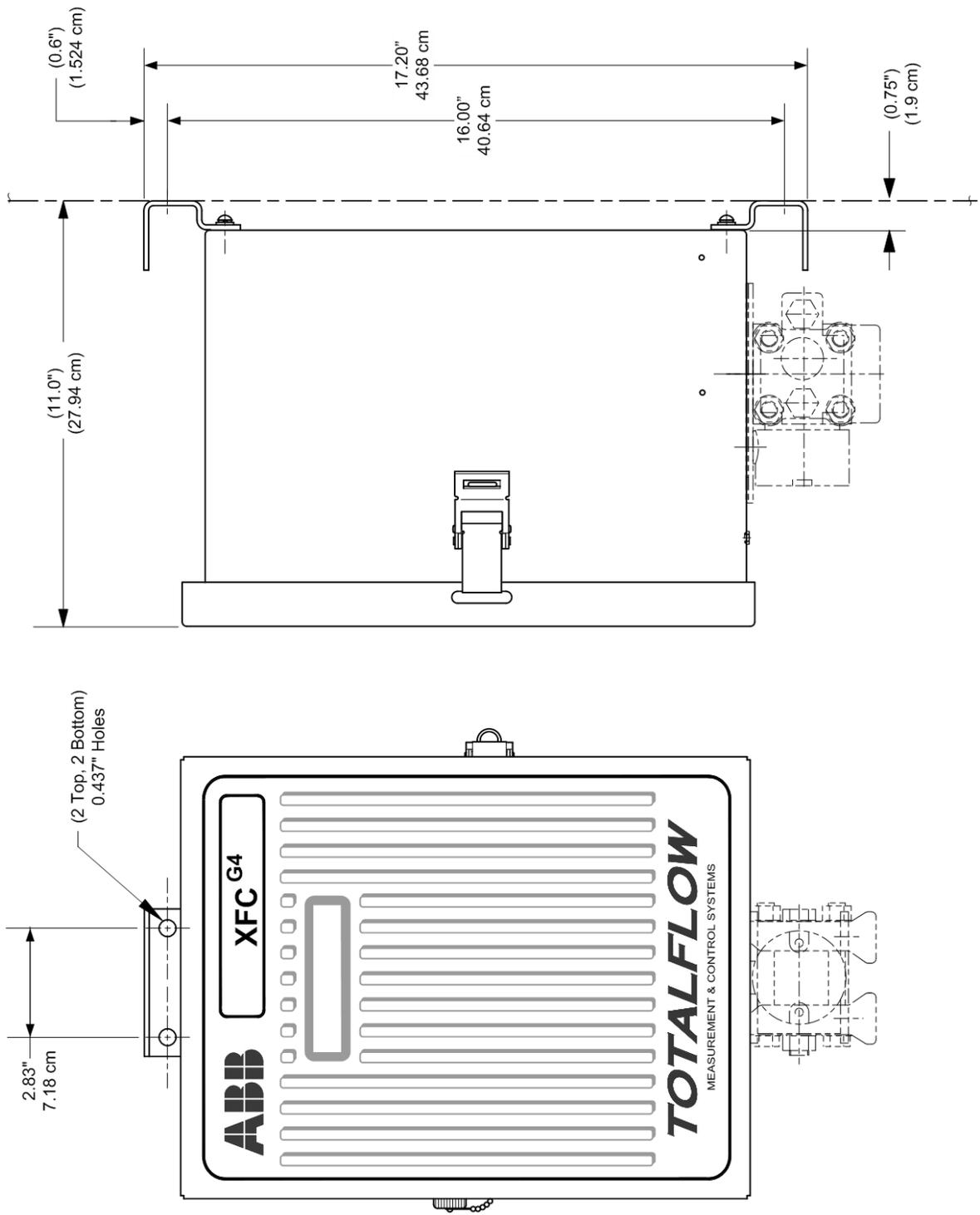


Figure 41 Model XFC^{G4} 6413 Wall Mounted

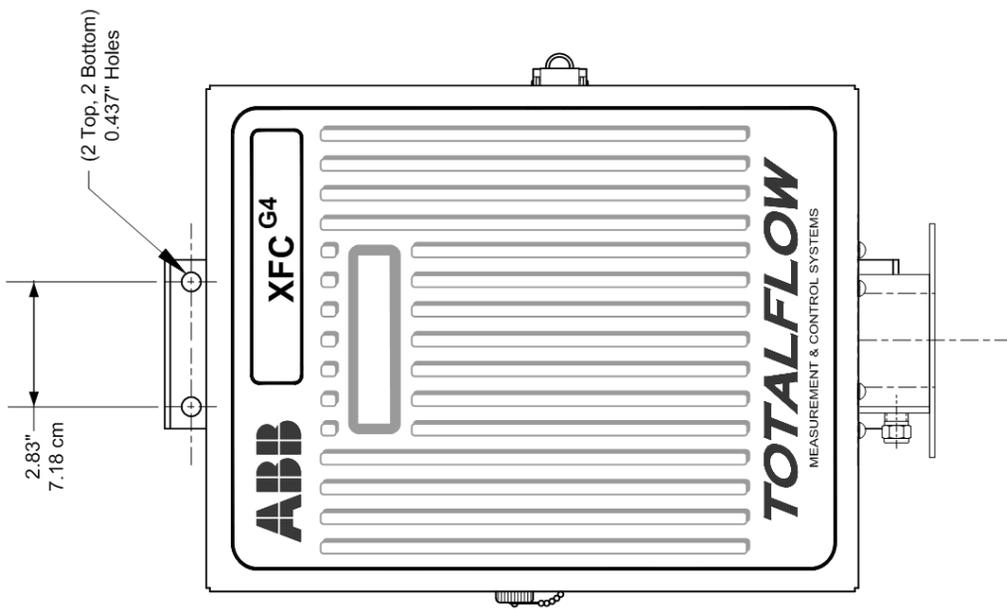
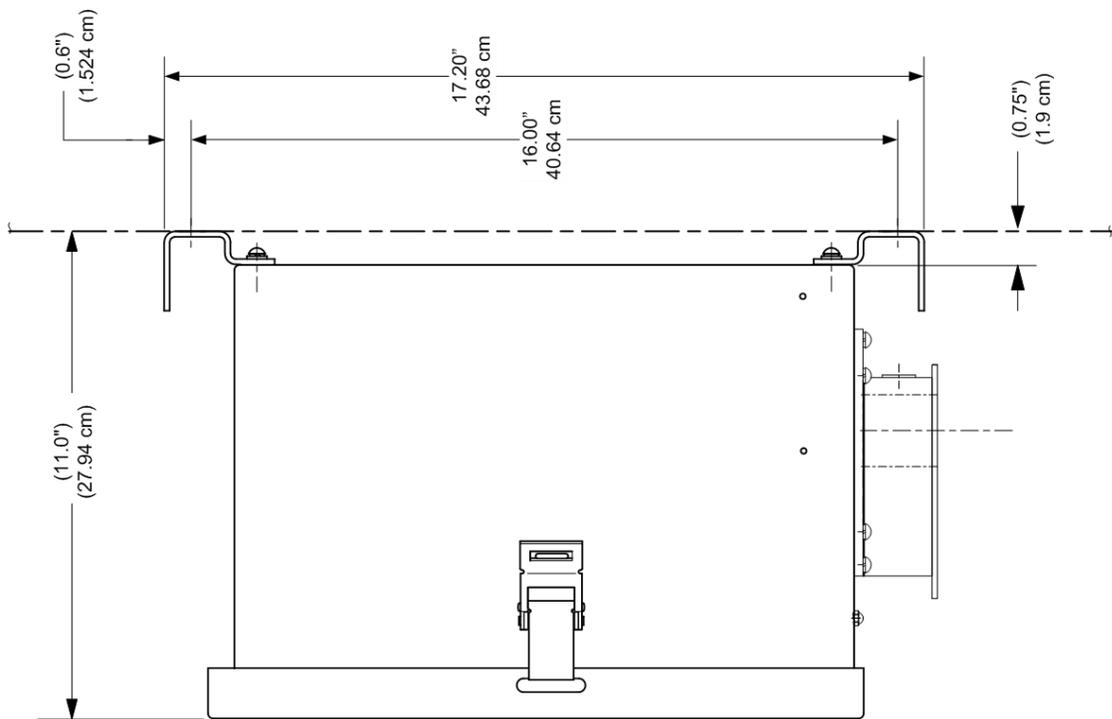
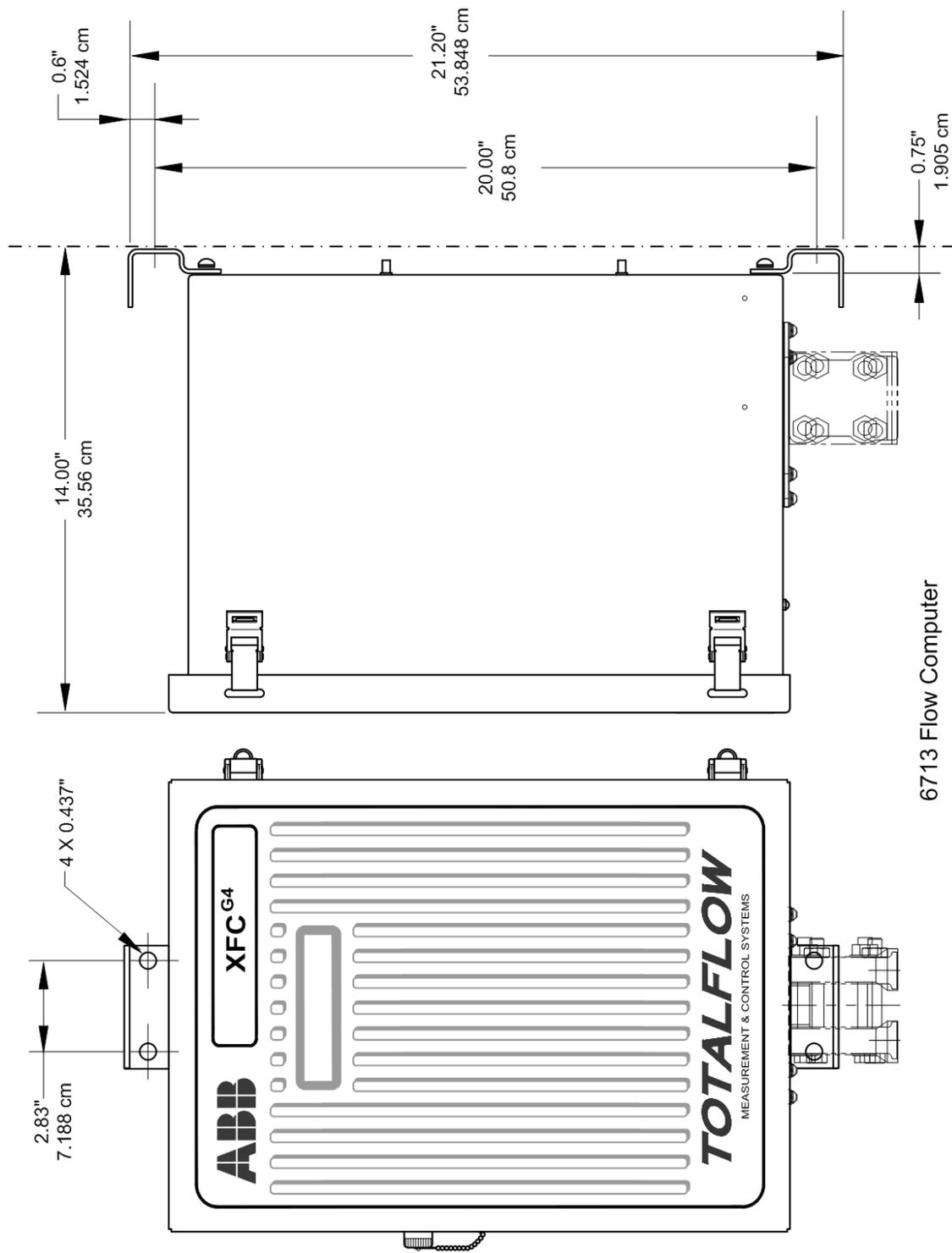
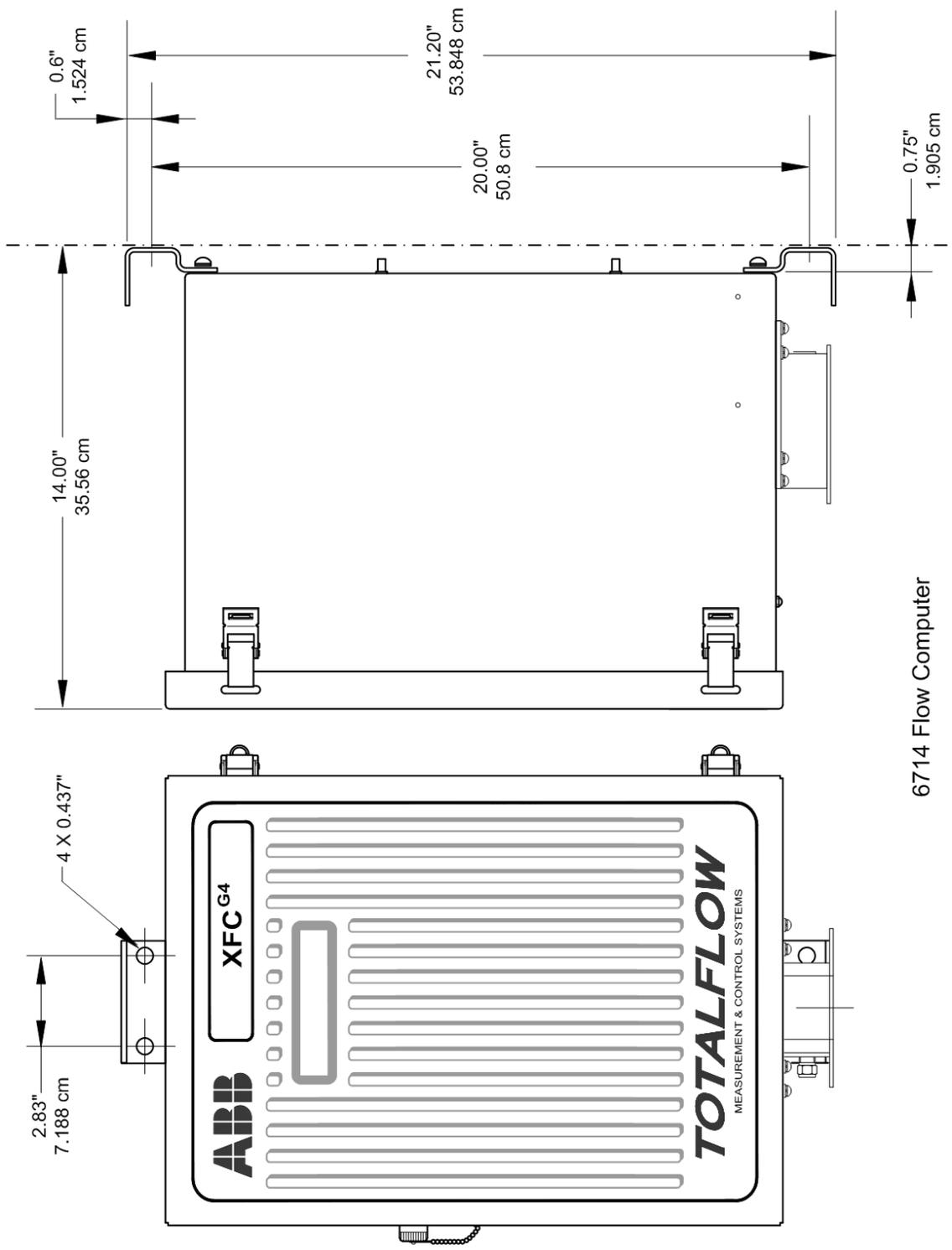


Figure 42 Model XFC^{G4} 6414 Wall Mounted



6713 Flow Computer

Figure 43 Model XFC^{G4} 6713 Wall Mounted



6714 Flow Computer

Figure 44 Model XFC^{G4} 6714 Wall Mounted

4.5 Direct Mount Installation for Gas Orifice

If installing the flow computer directly to an instrument manifold, use the following procedure. Before beginning, review the procedure and the direct mount drawings. See Figure 2–23 through Figure 2–25.



IMPORTANT NOTE: All required hardware for mounting the flow computer to the manifold is to be supplied by the customer.

4.5.1 Step-by-Step Instructions

Tools needed

— 7/16" combination wrench or socket with drive.

To perform a direct mount installation:

1. Attach the XIMV to the manifold, to Figure 45 through Figure 47.
2. Ensure that the Teflon seal rings are in place around the two process ports, before aligning with the manifold.
3. Secure the XIMV to the manifold, using the four 7/16-inch bolts supplied with the manifold.
4. Refer to Figure 45 through Figure 47, and complete the installation.

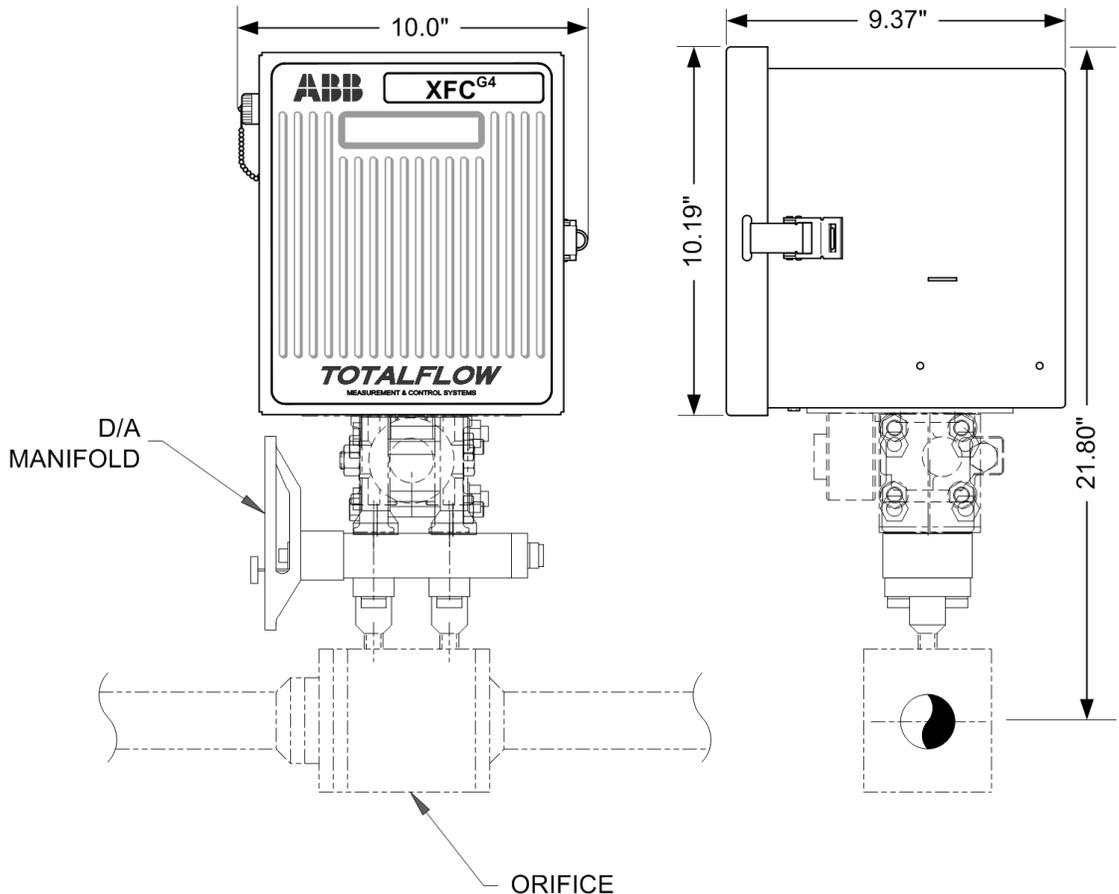


Figure 45 Model XFC^{G4} 6410, Direct Mounted with D/A Manifold (for illustrative purposes only)

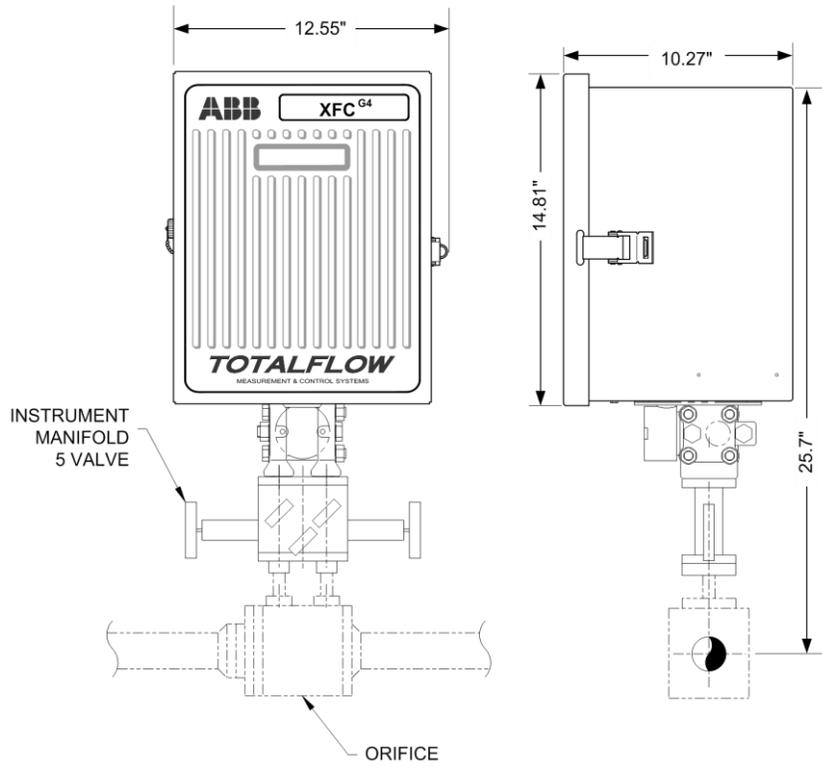


Figure 46 Model XFC^{G4} 6413 Direct Mounted, Instrument Manifold

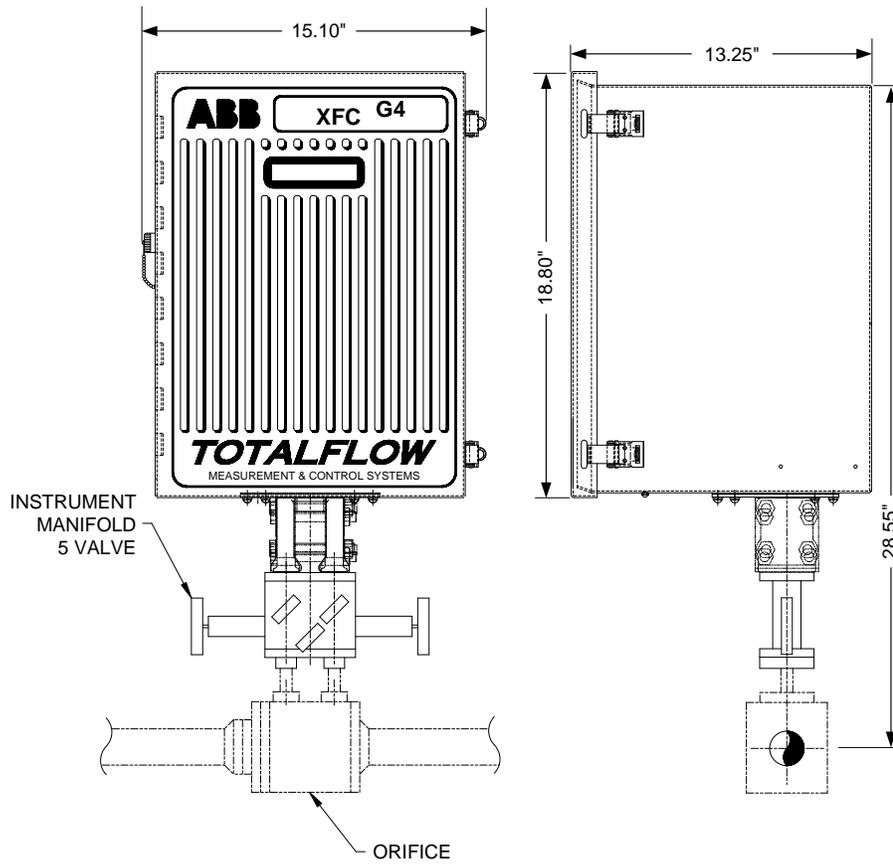


Figure 47 Model XFC^{G4} 6713 Direct Mounted

4.6 Manifold Input Lines

The following procedure will provide the user with the necessary steps to install the manifold. The meter run manifold high (H) and low (L) pressures terminate in flow computer H and L differential port cells. Differential port cells are located on the bottom of the flow computer (see Figure 48).

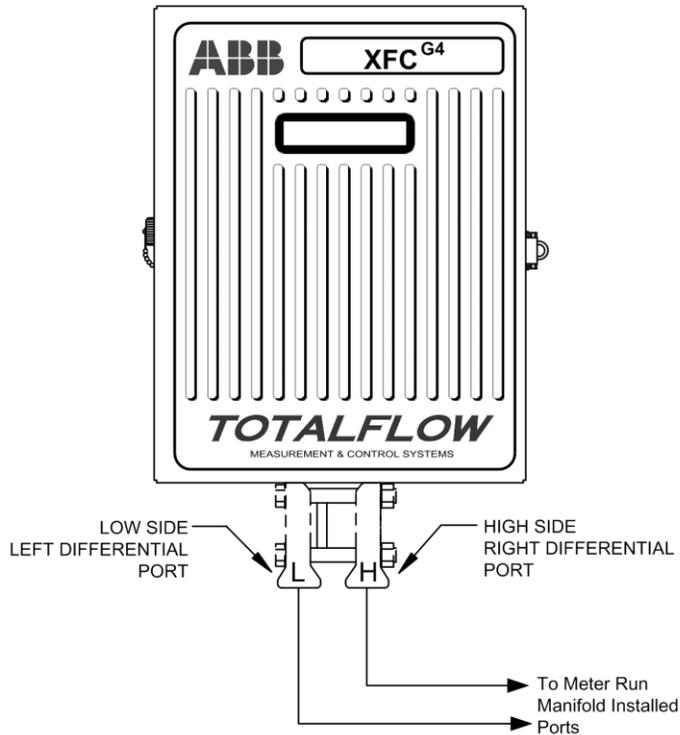


Figure 48 Transducer Low and High Side Ports

Materials (not supplied)

- Stainless steel tubing
- Tubing fittings



NOTICE-Property damage: A backup wrench should always be used when working with stainless steel tubing and valves. This prevents the fitting from turning or putting tension on the stainless steel tubing.

4.6.1 Step-by-Step Instructions

Tools needed

- Combination wrench x2
- Tubing cutter

To install the manifold input lines:

1. Install the isolation valves on the meter run (if using 3 or 5 way manifolds).
 2. Install the manifold and tubing to the meter run and the flow computer.
-



IMPORTANT NOTE: The manifold to the flow computer fittings are not supplied with the flow computer.

3. Leak check all connections.

The manifold input lines are now installed.



IMPORTANT NOTE: Leaks in the tubing or manifold will introduce errors when calibrating XIMVs.

4.7 Direct Mount Installation for Pulse Meter

If installing the flow computer directly to a meter, use the following procedure. Before beginning, review the procedure and the Direct Mount drawings (see Figure 49 through Figure 51).



IMPORTANT NOTE: All required hardware for mounting the flow computer to the meter is supplied by Totalflow, as ordered.

4.7.1 Step-by-Step Instructions

Tools needed

- 3/8" combination wrench or socket with drive

To perform a direct mount installation for a pulse meter:

1. Attach the flow computer to the pulse meter. Before aligning with the manifold, ensure that all seals are in place around the mounting hardware.
2. Secure the flow computer to the meter, using the four 3/8-inch bolts supplied with the XFC^{G4}.

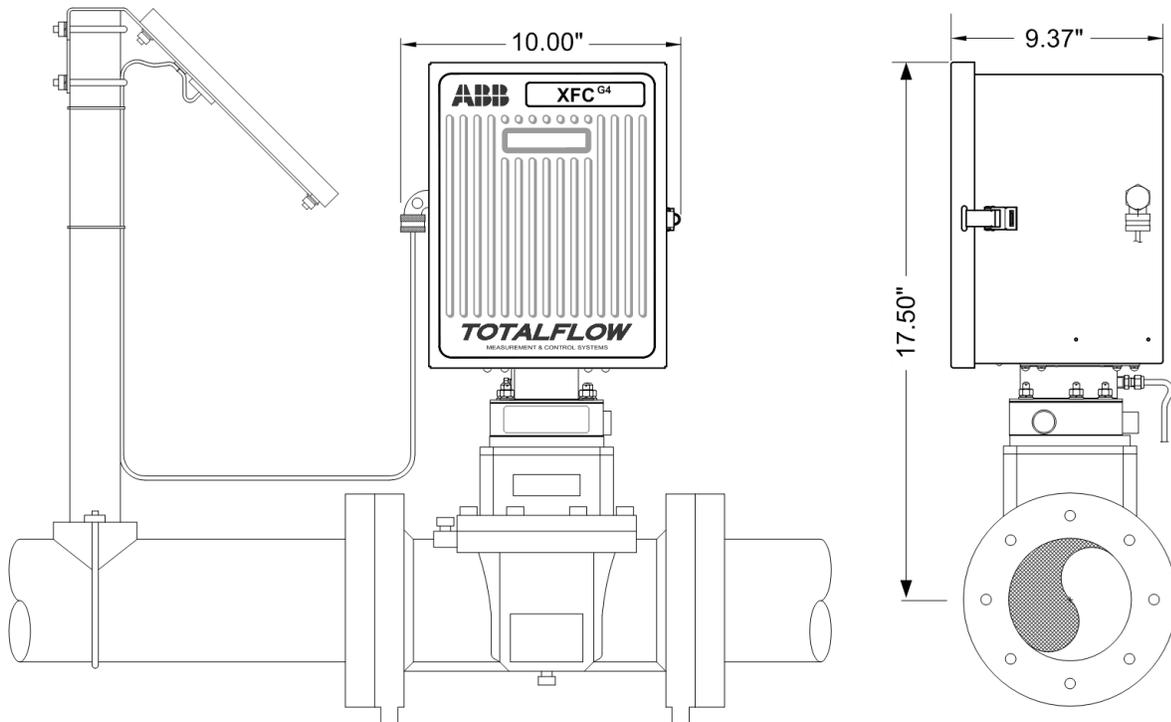


Figure 49 Model XFC^{G4} 6411 Direct Mounted

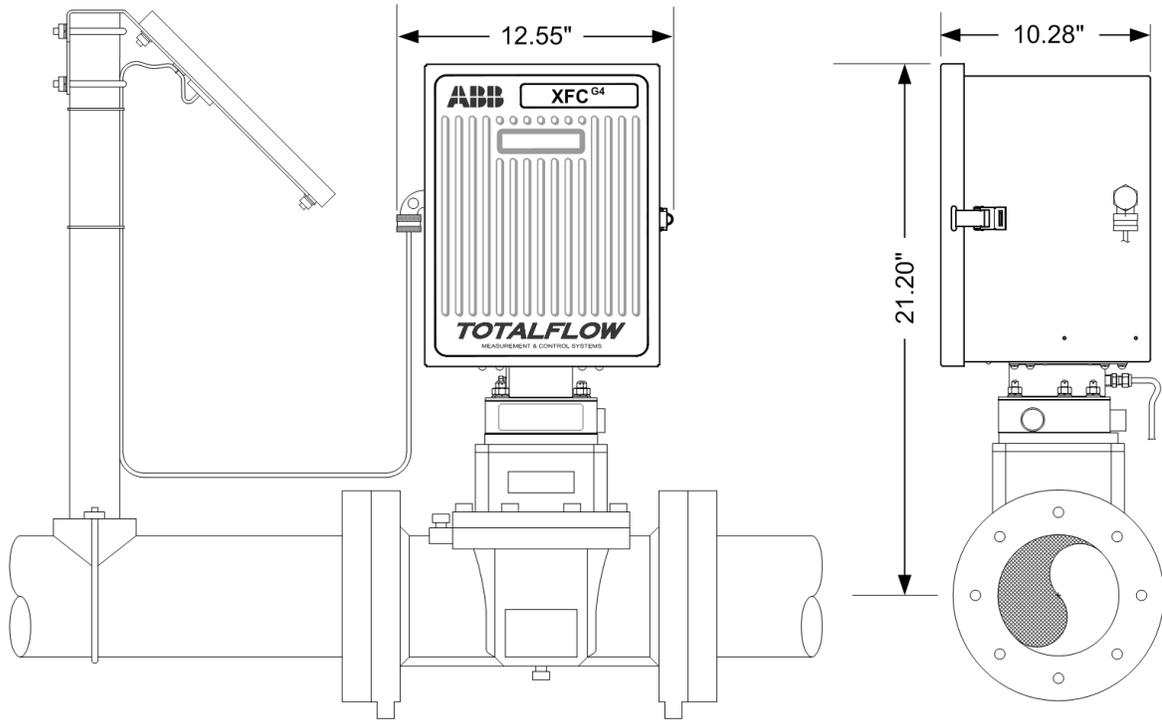


Figure 50 Model XFC^{G4} 6414 Direct Mounted

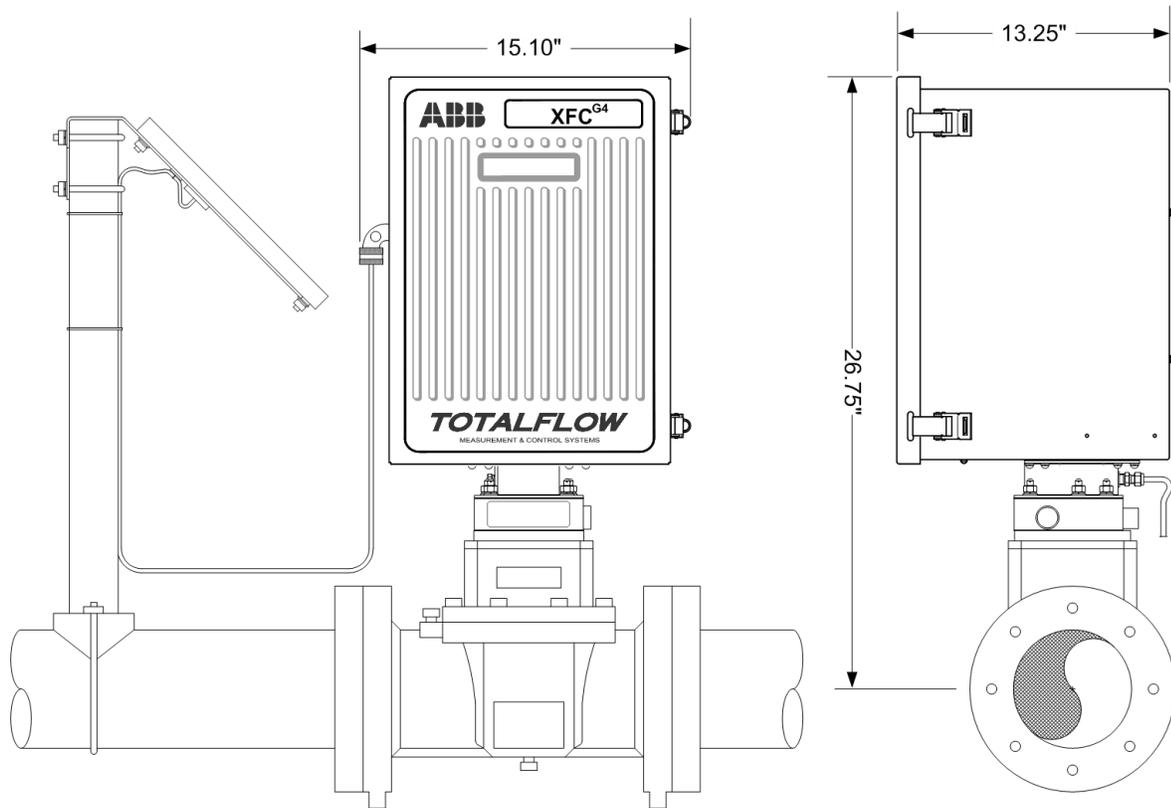


Figure 51 Model XFC^{G4} 6714 Direct Mounted

4.8 Static Pressure Input Line

4.8.1 Description

The following procedure will provide the instructions necessary to install the static pressure input line. The static pressure input line terminates in either the rear or side pressure ports on the flow computer mounting block. The block is located on the bottom of the flow computer (see Figure 52). Installation is the customer's responsibility.

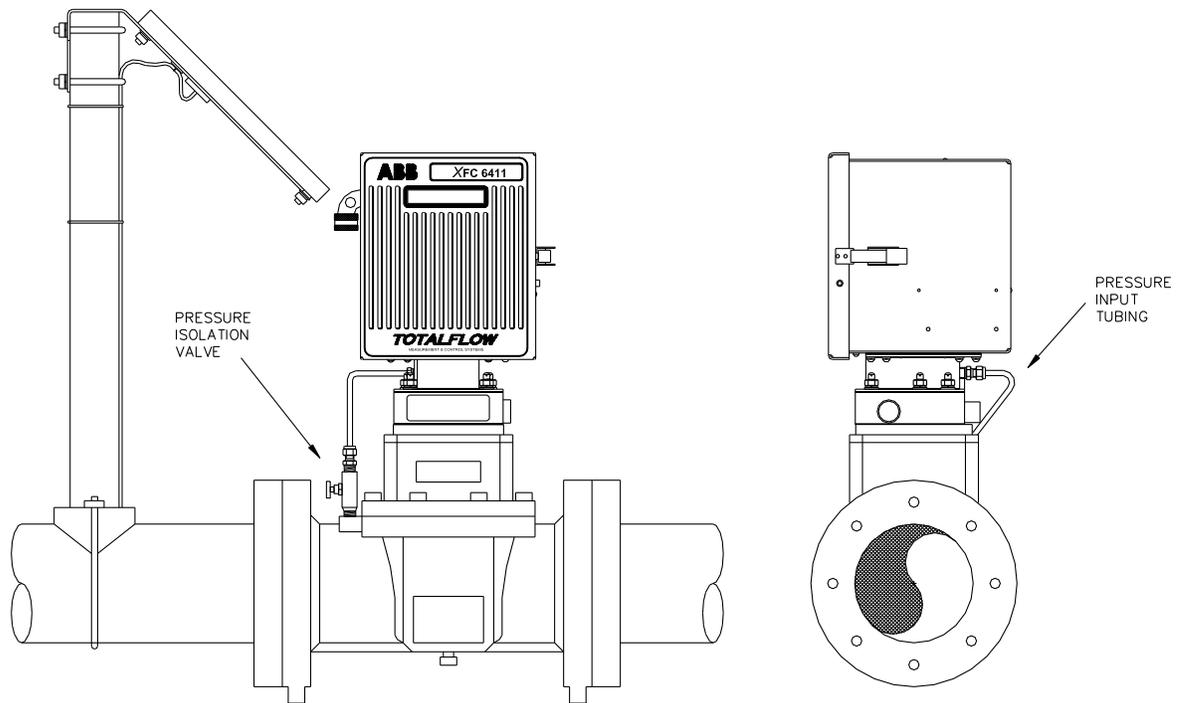


Figure 52 XFC^{G4} Static Pressure Input Line

Materials(not supplied)

- Stainless steel tubing
- Static pressure isolation/shut off valve
- Tubing fittings



NOTICE-Equipment damage: A backup wrench should always be used when working with stainless steel tubing and valves. This prevents the fitting from turning and/or putting tension on the stainless steel tubing.

4.8.2 Step-by-Step Instructions

Tools needed

- Combination wrench
- Tubing cutter

To install the static pressure input lines:

1. Install the static pressure isolation valve on the meter run.
2. Connect the static pressure tubing to the static pressure isolation valve and the flow computer static pressure input port connection.



IMPORTANT NOTE: The valve to the flow computer fittings are not supplied with the flow computer.

3. Leak check all connections.

i

IMPORTANT NOTE: Leaks in the tubing or connections will introduce errors when calibrating transducers.

4. Mount the flow computer to the direct mount manifold using the instructions in section 4.5, *Direct Mount Installation for Gas Orifice*.
5. Leak check all tubing connections before calibrating.

The static pressure input lines are installed.

i

IMPORTANT NOTE: Leaks in the static pressure connections and tubing will introduce errors in transducer readings.

4.9 Battery Pack Installation

A battery pack provides the flow computer with its operating power. The battery is packed and shipped separately. Before installation, inspect the power cables where they terminate on the battery pack and the connectors for breakage.

The battery pack is mounted behind the removable metal battery plate cover. The plate is adjustable for various sized batteries.

4.9.1 Step-by-Step Instructions

To install the battery pack:

1. Remove battery pack cover.
2. Insert the battery pack into the lower compartment, with the long dimension facing outward.
3. Connect the battery pack connector to the digital board battery connection J1 connector (see Figure 53).
4. Replace battery pack cover.
5. Observe the LCD, the display should be on and scrolling through the startup diagnostics sequence.

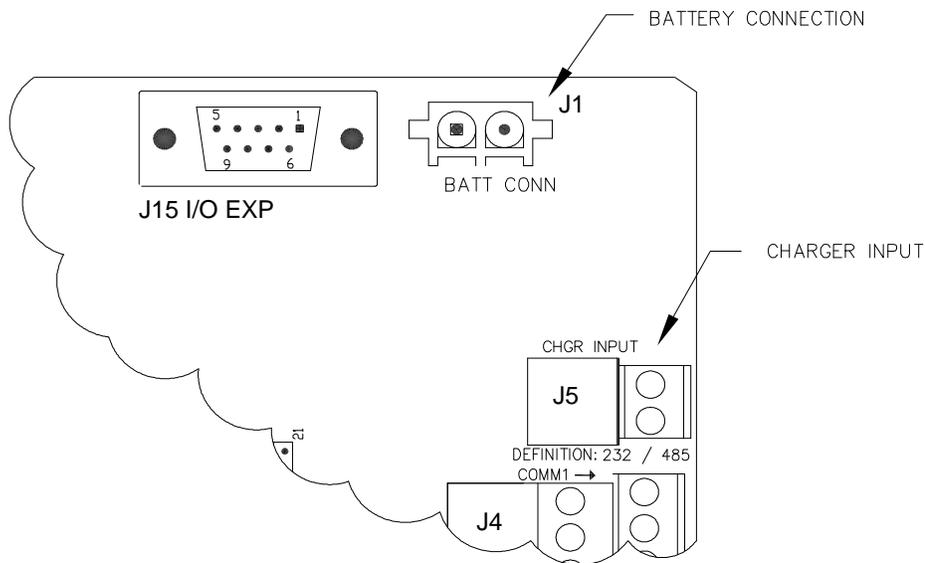


Figure 53 XFC^{G4} Board Battery and Charger Input Connections

The battery pack is now installed.

4.10 Solar Panel Installation

The solar panel is designed for outdoor mounting on a 2" extension pipe. This is installed on the upper end of the flow computer 40" mounting pipe, as shown in Figure 54. The solar panel must be mounted within 12 feet of the flow computer (other cable lengths available). For a wall mounted flow computer, it can be mounted on the top or the side of the meter house.



NOTICE- Equipment damage: Do not connect the solar panel power cable to the flow computer unless the main battery pack has been connected to J1 (see Figure 53).

If installation procedures are required for mounting the solar panel on the top or the side of the meter house, the customer should contact Totalflow's Service Department; see the Getting Help section in the Introduction chapter of this manual.

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)

Materials (not supplied)

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



NOTICE- Equipment damage: Exercise caution when installing the solar panel so as not to damage it. When mounted, the solar panel will face up from the horizon at a 50° angle.

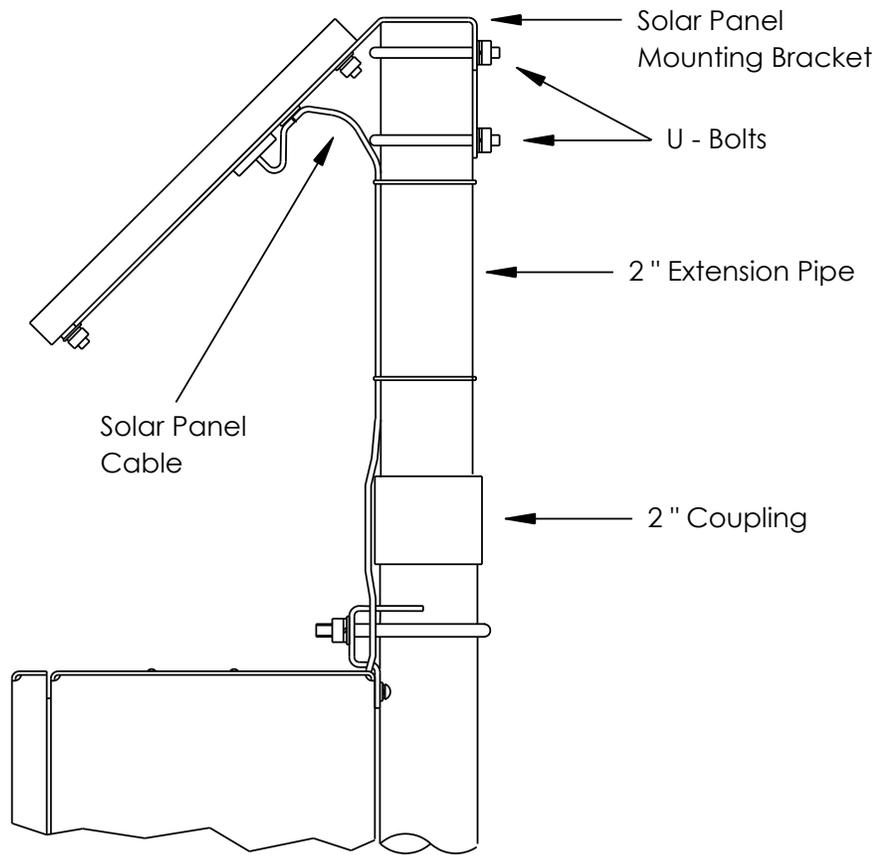


Figure 54 Typical Solar Panel Installation

4.10.1 Step-by-Step Instructions

To install the solar panel:

1. Attach the 2" pipe coupling to the top end of the flow computer 40" mounting pipe. Securely tighten.
2. Attach the 2" pipe extension into the coupling, and securely tighten.
3. Check the solar panel using a Multi Meter to verify polarity and output voltage. Voltage will vary depending on the amount of sun, angle to sun, etc.
4. Install the solar panel on the mounting bracket with the provided hardware, if required.



NOTICE- Equipment damage: Do not connect the other end of the solar panel cable to the flow computer until instructed to do so.

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



IMPORTANT NOTE: For northern hemispheres, position the solar panel facing south. For southern hemispheres, position the solar panel facing north. For optimum charging, the solar panel should not be in the shadows for the majority of the day. The panel should be kept clean for maximum charging.

6. Remove the CHGR Input terminal block (J5) from the digital board.

7. Insert the solar panel power cable through an access hole on the side of the case. Allow enough power cable for field wiring to the CHGR Input +/- terminations on J5.
8. Trim the wire ends back 1/4", before making connections to the terminal block.
9. Loosen the terminal block securing screws, insert the wire then retighten.
10. Connect the solar panel (+) lead to the (+) terminal and the (-) wire to the (-) terminal.
11. Verify the main battery pack is connected.
12. Reinstall the terminal block with wires attached.
13. Secure the solar panel power cable to the 2' extension pipe and mounting pipe cable with plastic tie-wraps.

The solar panel is now installed.

4.11 RTD Probe Installation

The standard RTD measures flowing gas temperature and should only be located in DIV 2 or general purpose areas, following local codes. The following procedure will enable the user to install the RTD into the meter run.

Optionally Supplied Materials

- RTD probe with 10' of cable. Optional lengths are 15', 25', 30', 40' and 50'
- One (1) thermowell with 3/4" npt threads. Optional threads are 1/2" and 1"
- Nylon tie wraps

Materials (Not Supplied):

- Customer must specify thermowell "U" length
- Teflon tape

4.11.1 Step-by-Step Instructions

Tools needed

- Flat blade screwdriver
- Wire stripper
- 12" crescent wrench
- Snap ring pliers

To install the RTD probe:

1. Install the thermowell into the meter run (see Figure 55).



NOTICE- Equipment damage: Power should be removed from the flow computer before performing any field wiring.

2. Adjust the probe length, using the snap ring pliers, so that it is spring loaded against the bottom of the thermowell.
3. Screw the probe connector into the thermowell.

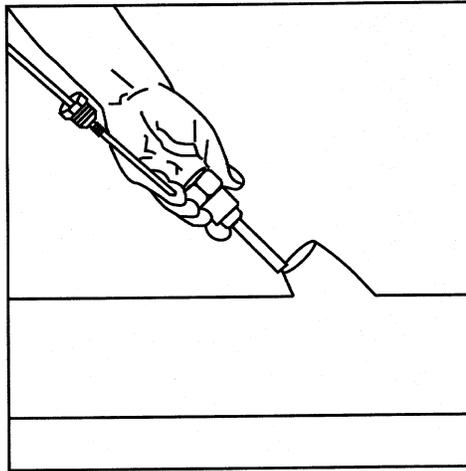


Figure 55 RTD Installation into thermowell

4. Remove the nut from the water tight cord connector. Leave the nylon sealing ring in place.
5. Remove the hole plug from the flow computer, and insert the wires through the hole. Allow enough RTD cable to extend into the flow computer for connecting wires to the RTD termination block, J7.
6. Secure the RTD probe cable using the supplied sealing ring and nut.

1 **IMPORTANT NOTE:** To prevent moisture from entering the flow computer after installing the RTD cord connector, be certain that the associated connector at the flow computer has a metal backed sealing “O” ring and metal locking nut attached.

7. Remove the spade lugs, if attached, from the RTD probe wire.
8. Trim the wire ends back 1/4”.
9. Remove the associated terminal block from the flow computer panel (J7).
10. Loosen the terminal block securing screws.
11. Insert the wire and then retighten (see Figure 57).
12. Reinstall the terminal block with the wires attached.
13. Secure the cable to the meter run pipe with nylon tie wraps. Do not wrap cable around meter run pipe.

The RTD probe is now installed.

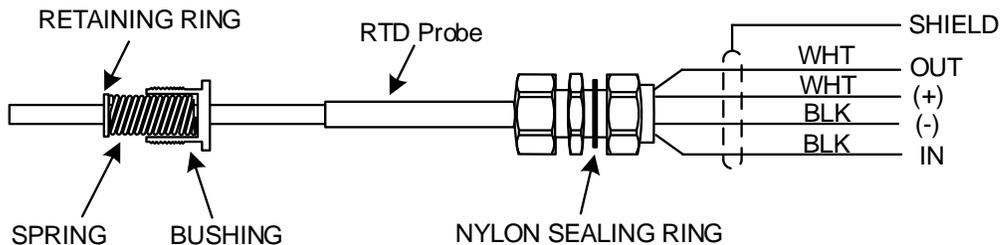


Figure 56 RTD Probe Wiring

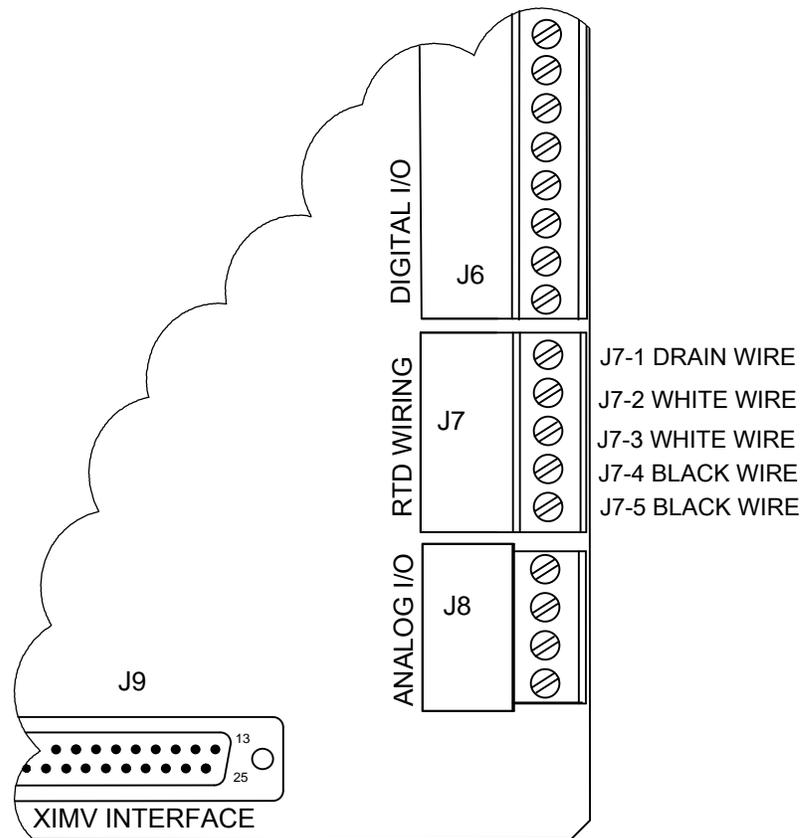


Figure 57 RTD Input Connections

4.12 AC Charging Unit Installation

The ac power charging unit maintains a constant voltage charge on the installed battery pack.

Materials (supplied):

The following hardware is required to mount the ac power charging unit to the flow computer.

- ac charging unit
- Coupling nipple

Additional Materials (not supplied):

- Plastic cable ties or zip ties
- ac wiring, conduit (rigid or flexible)



WARNING- Bodily injury: To maintain system certification, all wiring must comply with NEC 501 code and applicable ABB certification drawings.



WARNING- Bodily injury: To prevent injury, only a licensed electrician should install ac power wiring to the customer supplied primary ac power source.

4.12.1 Step-by-Step Instructions

Tools needed

- 12" crescent wrench
- Flat blade screwdriver

To install the ac charging unit:

1. Remove one of the plugs from the side of the flow computer so that the ac charging unit can be mounted without obstruction (see Figure 58).
2. Feed the ac charger dc power lines into the flow computer. Allow enough cable to extend into the unit for connection to the EXT CHGR +/- terminals.
3. Connect the ac charger unit to the flow computer using the supplied sealing ring and nut (see Figure 59).



CAUTION – Equipment / Property damage: To prevent moisture from entering the flow computer enclosure after installing the AC battery pack charger unit, be certain that the associated connector at the charger unit has a metal backed sealing “O” ring and metal locking nut attached.

-
4. Trim the wire ends back 1/4”, before connecting the charger wiring.
 5. Remove the associated EXT CHGR terminal block J5 (see Figure 53) from the flow computer board.
 6. Loosen the terminal block securing screws.
 7. Insert the red wire into the plus (+) terminal (top) and the black wire into the negative (-) terminal (bottom).
 8. Retighten the screws, and reinstall the terminal block with the wires attached.
 9. Plumb the conduit and associated ac wiring into the ac charger conduit box. The ac charger is rated at either 120 Vac 60 Hz or 240 Vac 50 Hz.
 10. Connect the 120 Vac hot and neutral or the two hot wires for 240 V to TB1 of the ac charger.
 11. Connect the ground wire to the green screw T1 (see Figure 60).
 12. Verify that the DC power wires are terminated properly inside the flow computer cabinet.
 13. Verify that the main battery pack is plugged into J1 (see Figure 53).
 14. Apply ac power to the ac charger.
 15. Monitor dc charging voltage by observing the flow computer display. LCD should indicate CHARGER 13.0 - 13.5 Vdc.

The ac charging unit is now installed.

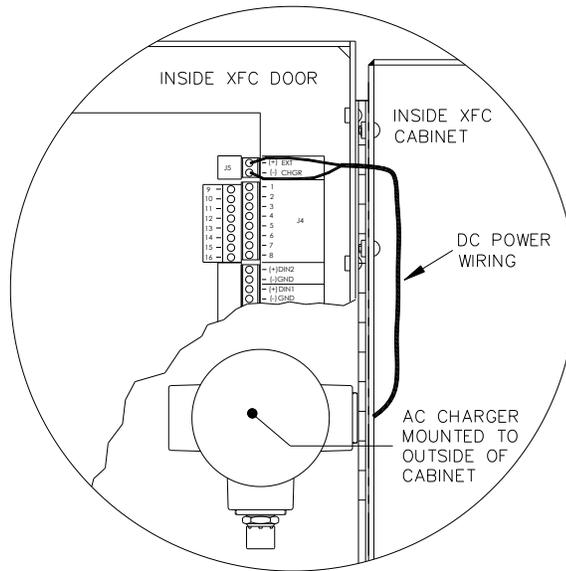


Figure 58 Mounting AC Charger

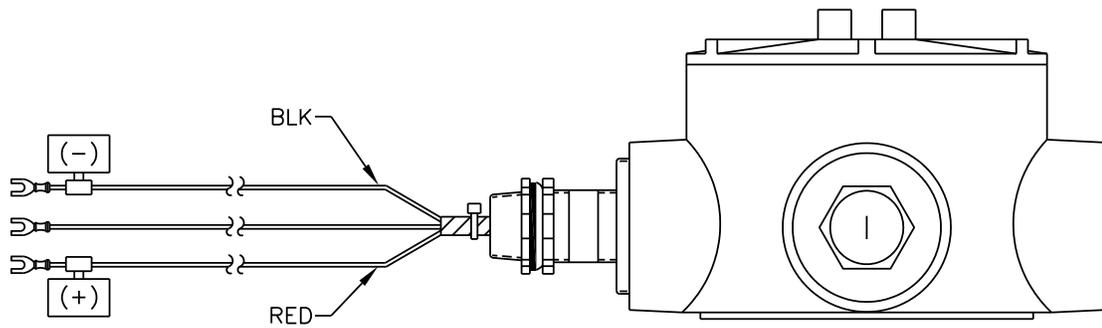


Figure 59 DC Wiring Instructions

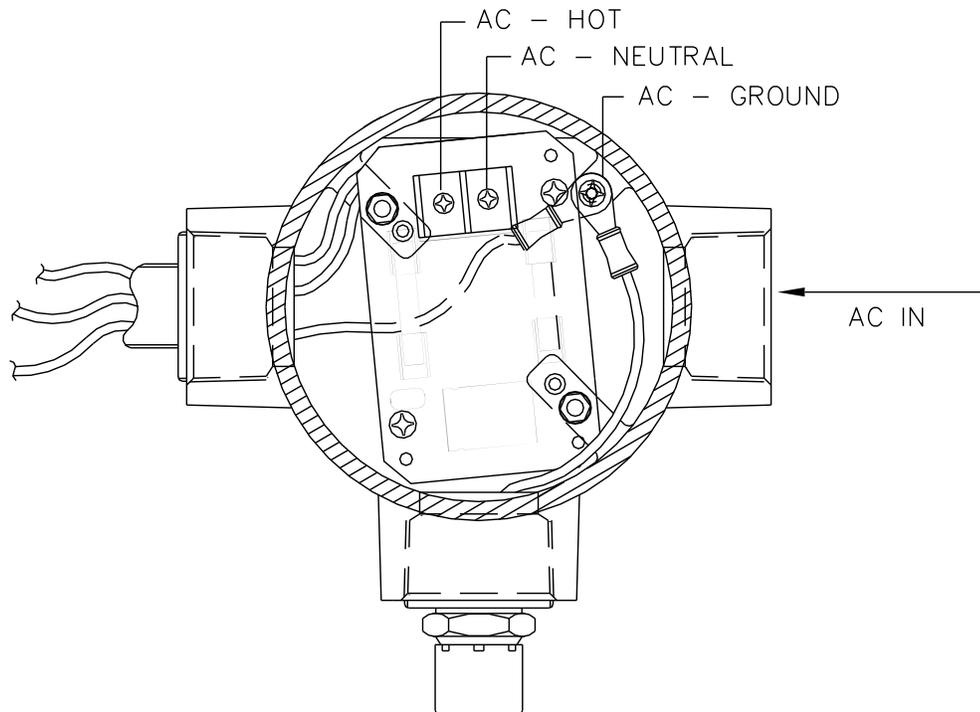


Figure 60 AC Wiring Instructions

4.13 XFCG4 Communication, Jumper Settings and Field Wiring

The flow computer main electronic board may require some basic setup and wiring.

The standard flow computer enclosure allows the user access to the main electronic board for configuration of jumpers, communication modules and switches. All user wiring is wired directly to this board.

4.13.1 Communication Wiring

You have the ability to program up to two communication ports on the flow computer board. COMM 0 is the local port required for reading the flow computer with a laptop computer running PCCU32. COMM 1 and COMM 2 can be configured for any combination of RS 232 or RS 485. For on-board communications wiring inside the standard flow computer enclosure, see Figure 61.

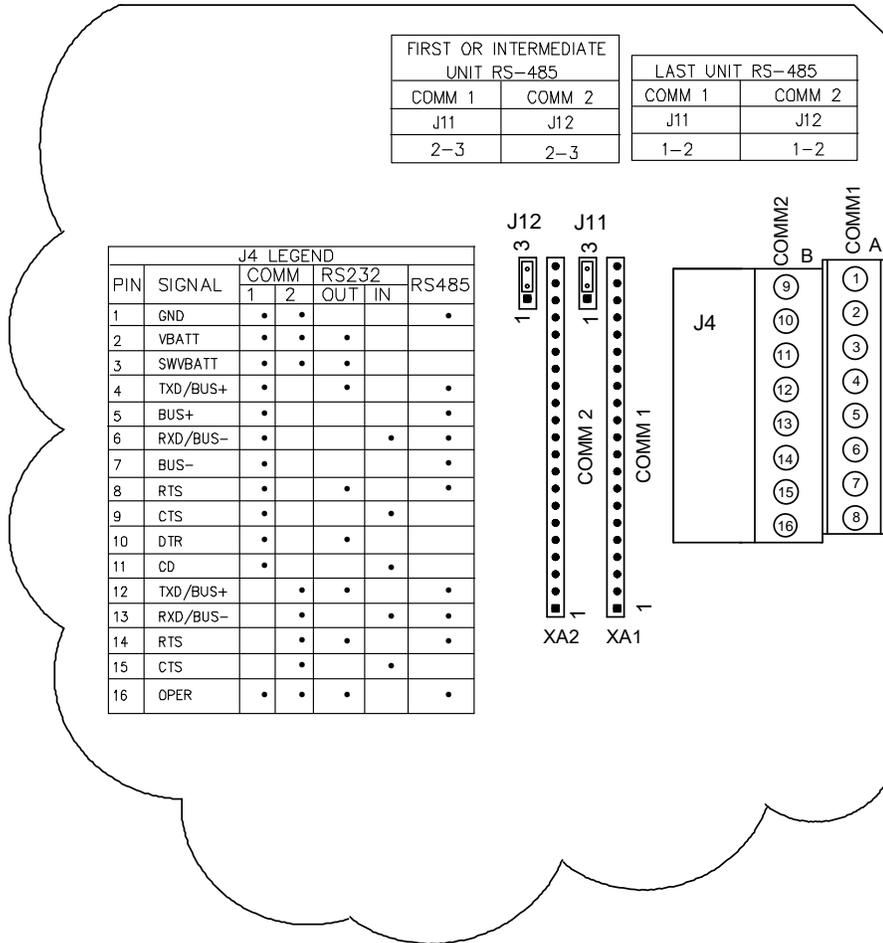


Figure 61 XFC^{G4} Standard Communication Wiring



CAUTION- Equipment damage: The flow computer board, as with any electronic board, is susceptible to damage by static electricity or improper handling. To prevent this from occurring, user should wear a grounding strap.

Remove power to unit prior to changing jumper settings or field wiring to on-board I/O.

4.13.2 Communication Modules

If the flow computer is configured for remote communications, XA1 and/or XA2 will contain a 21 pin communication module specific to either RS-232, RS-422 or RS-485. If using the RS-485 communication module, J11 and/or J12 jumpers will require termination on the last or only unit.

4.13.3 Board Configuration

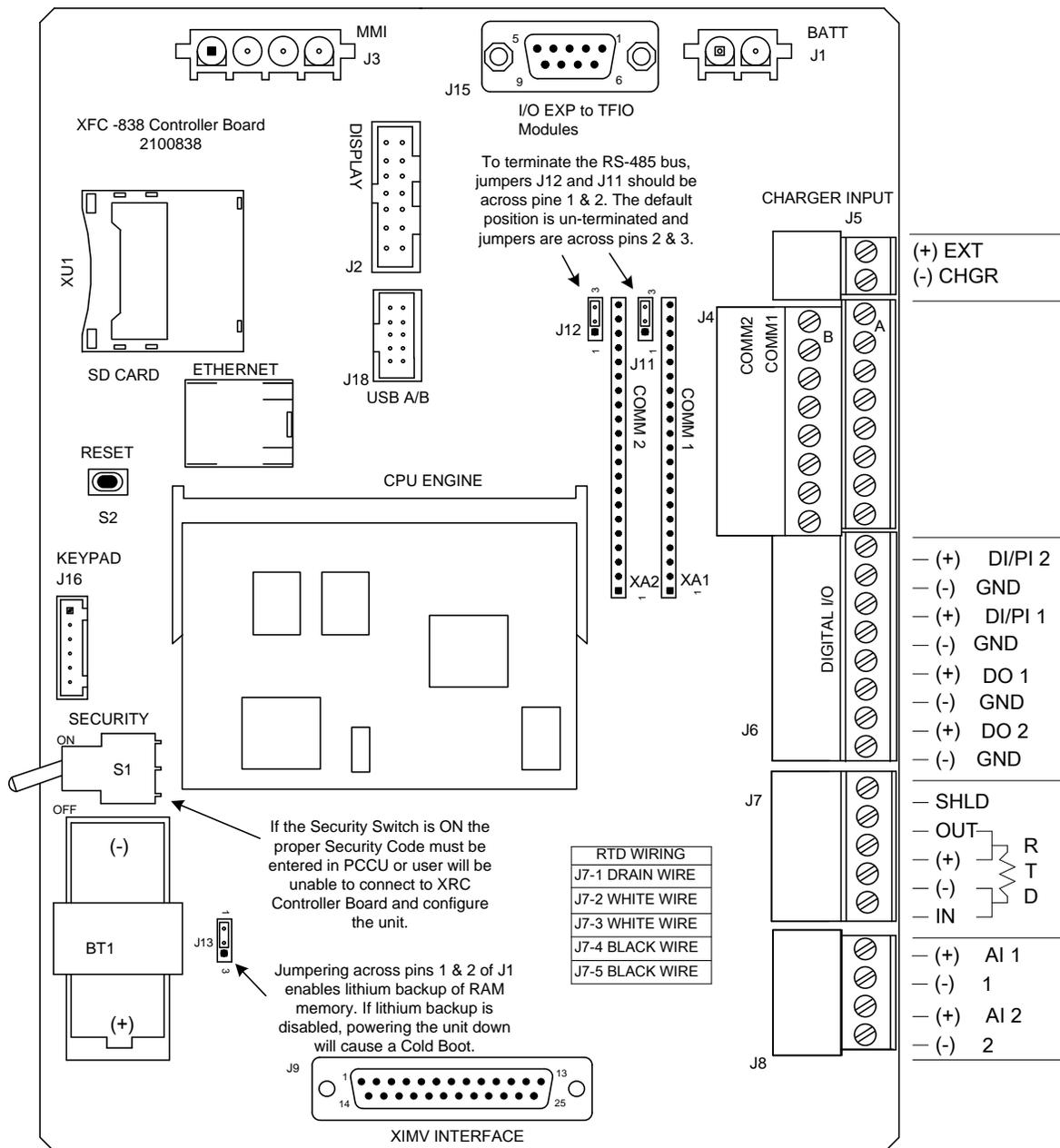
Table 2–2 is a brief description of each configurable point on the flow computer main electronic board and its function. The board diagram shows the location of these items (see Figure 62).

4.13.4 Other Field Wiring

For other wiring connections directly on the flow computer main electronic board, use Table 8 and Figure 62.

Table 8 XFC^{G4} On-Board Jumper Settings

Jumper No.	Description
J11 & J12	RS-485 Termination: When multiple flow computers are daisy-chained together on a single RS-485 bus, the bus must be properly terminated. When the flow computer is the <i>last</i> or <i>only</i> unit on the bus, the jumper should be across pins 1 & 2. If the unit is <i>first</i> or <i>intermediate</i> the jumper should be across pins 2 & 3.
J13	Lithium Battery Backup: J13 enables and disables memory backup via the lithium cell. A jumper across pins 1 & 2 enables RAM memory backup. If the jumper is removed (or across pins 2 & 3) the lithium cell is NOT enabled for memory backup. Should power be lost or disconnected while the lithium cell is NOT enabled, the flow computer main processor board will execute a <i>Cold Boot</i> and all historical data WILL be lost.
S1	Security Switch: If the security switch is ON and a local connection is made to the unit via PCCU, the proper security code must be entered. If the proper security code is not setup in PCCU the operator will be unable to configure the flow computer. If the security switch is turned , OFF the user will be able to configure the flow computer without secure access.



5 XFCG4 Startup

5.1 Overview

This chapter generally describes the steps required get a newly installed flow computer system up and running. Specific information required to complete each step (depending on your equipment choice) is discussed in the PCCU32 help files.

-
- **IMPORTANT NOTE:** Before you begin you should complete the tasks outlined in the Chapter 2.0, Installation.
- i** All references in older materials to AP, absolute pressure, have been converted to SP, static pressure. This reflects the difference of including barometric pressure during calibration.
-

5.2 PCCU32 Installation and Setup

Totalflow's® PCCU32 7.05.5 (or later) software is required to communicate with XSeries G4 equipment. Previous versions of PCCU32 are not compatible.

PCCU32 software running in a laptop Windows® environment offers you the most capabilities for programming. The Windows environment features user friendly help files and easy to follow menus. Having help files readily accessible is comparable to having a virtual teacher on location. Easy to follow menus and icons step the user through many required choices.

5.2.1 Step by Step Instructions

To install and setup PCCU:

1. Insert PCCU32 disk into PC drive. If CD drive is set to AutoPlay, the installation program should begin: otherwise, click **Start > Run** and type in "D:\Disk1\setup.exe". D is the CD drive designation.
2. Follow screen prompts during installation.
3. Complete information and enter serial number at the prompt will asking for user information, carefully entering both numbers and dashes.
4. Click **Next** to continue.
5. Click **finish** when the operation is complete. A new Totalflow PCCU32 window will appear. This contains the shortcuts created in the start menu. The PCCU32 shortcut may be copied to the desktop if desired.

-
- **IMPORTANT NOTE:** For a standalone desktop shortcut, right-click on the shortcut, select **Create Shortcut** and drag it to the desktop.
-

5.3 Establishing Initial Local Communication

As discussed previously, local communication may be established in different ways: RS-232 MMI cable or USB cable. The flow computer may be configured for one or the other or both. TCP/IP is available but is designed for use over a network setup.

5.3.1 Connecting To Local Port using RS-232 Cable

If the flow computer is configured to include the local RS-232 Communication port, the connection is made using the RS-232 cable, connecting the laptop computer to the local port on the meter. This port is located on the side of a standard enclosure, or on the front panel of the panel mount enclosure.

-
- **IMPORTANT NOTE:** If using a PC or laptop without RS-232 interfaces (serial ports), use a serial-to-USB converter on the RS-232 (MMI) cable and connect to a USB port on the PC. The Digi® Edgeport®/1 converter is recommended and can be purchased from ABB (part number 1801382-001). Contact technical support to order or for more details.
-

To connect to the local port via an RS-232 cable:

1. Connect the MMI cable to a serial port on your PC and to the RS-232 local port located on the unit.
2. Click on the Windows **Start** button.

3. Select **Programs>Totalflow PCCU32** (or correct program folder if changed during installation) and then select **PCCU32**. The PCCU32 initial screen displays.
4. Click **Setup** on the top menu bar. The System Setup window displays the **Setup** tab (Figure 63).

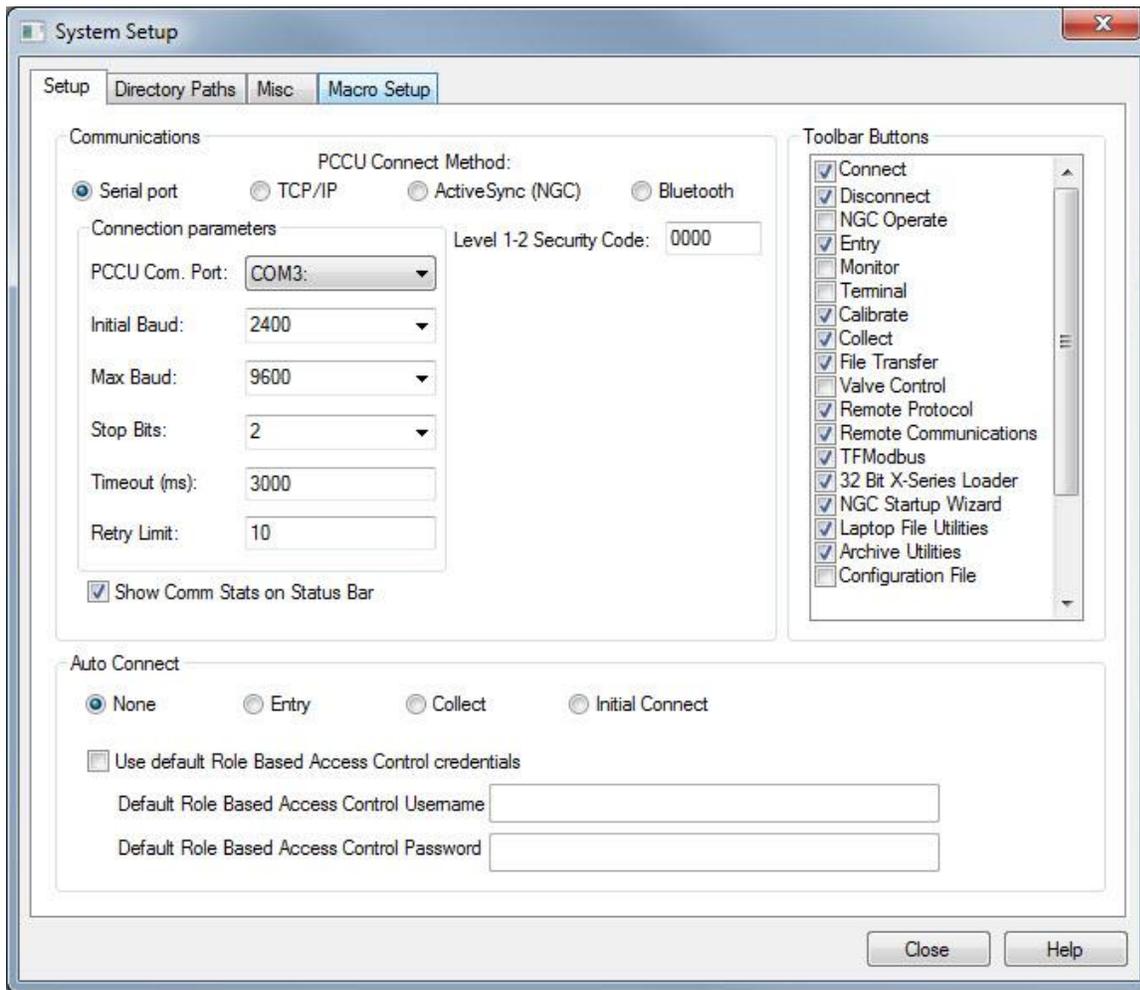


Figure 63 Setup for local communication

5. Under Communications, select **Serial port**.
6. Under Connection parameters, expand the **PCCU Com. Port** drop down list to select the Com port designated for the RS-232 communication on the PC.
7. Click **Close** to exit setup and return to the PCCU main screen.
8. Click the **Entry** icon on the top menu bar. For other screen options, click on the **Connect** Icon instead (left-most icon at the top of the screen). The *Local Connect* screen displays other screen options in addition to the **Entry** screen. When the selected screen displays, you have connected successfully to the device.

1

IMPORTANT NOTE: If the Invalid security code screen should appear, enter four zeros (0000) for the new code and click OK. The flow comp should have defaulted to 0000 on Start-up.

If the meter has been given a security code, make sure that you have entered that code in PCCU32 System Setup screen (see Figure 63). However, if your meter has been cold started, the security code will be reset to factory default and historical data will be lost.

5.3.2 Connecting To Local USB Port

If the flow computer is configured to include the local USB communication port, the connection is made using the USB cable. This connects the laptop computer to the local port on the meter. This port is located on the side of a standard enclosure, or on the front panel of the panel mount enclosure.

To connect to the USB port:

1. Connect the USB cable to a USB port on your PC and to the USB port on the unit.



IMPORTANT NOTE: If connecting directly to the USB port on the board, you need to purchase the Y adapter cable (part number 1803009-001). To order contact ABB.

2. Click on the Windows **Start** button.
3. Select **Programs>Totalflow PCCU32** (or correct program folder if changed during installation) and then select *PCCU32*. This will display PCCU32s initial screen.
4. Click **Setup** on the top menu bar. The System Setup window displays the **Setup** tab (Figure 63: *Setup for local communication*).
5. Under Communications, select **Serial port**.
6. Under Connection parameters, expand the **PCCU Com. Port** drop down list to select the Com port designated for the USB port on the PC.
7. Click **Close** to exit setup and return to the PCCU main screen.
8. Click the **Entry** icon on the top menu bar. For other screen options, click on the **Connect** Icon instead (left-most icon at the top of the screen). The *Local Connect* screen displays other screen options in addition to the **Entry** screen. When the selected screen displays, you have connected successfully to the device.

5.4 Setup of the XFC for Ethernet communication

The XFC's factory configuration has the Ethernet port disabled. To setup the XFC for Ethernet connection, you must first connect locally using either the RS-232 or USB cable as described in section 5.3, *Establishing Initial Local Communication*. Using this local connection, enable and setup Ethernet based on the required scenario:

- Connection of the XFC to a host (PC or laptop) for local communication for configuration or monitoring purposes
- Connection of the XFC to a network for remote communication and management. Connections are established using the default factory- defined TCP port (9999). The XFC factory configuration comes with the communication instance for this type of connection already instantiated.
- Connection to the XFC to a network for remote communication and management. Connections are established using a user-defined TCP port (not the default 9999). The XFC factory configuration does not come with the communication instance for this type of connection. The instance must be added, enabled, and configured with user-preferences.



IMPORTANT NOTE: A TCP port is a logical port defined by the TCP/IP protocol to support several connections on a single physical Ethernet port. Customers can add additional communication instances to handle non-default ports and other protocols over the Ethernet port.

5.4.1 Enable Ethernet for local point-to-point connection with a host

This procedure assumes the following:

- The local connection to the XFC through the Ethernet port is temporary and for monitoring or configuration purposes.
- The XFC has its default factory Network configuration intact.
- The PC or laptop has Windows 7 as its operating system.



IMPORTANT NOTE: The local connection can use private IP addressing for the point-to-point communication between the XFC and the PC or laptop. The XFC has a default private network IP address already assigned from the factory (169.254.0.11). The PC or laptop must be configured to obtain its own IP address automatically. When

setup for automatic addressing, when the laptop connects to the enabled XFC Ethernet port, it automatically configures a compatible IP address.

For additional details on the IP addressing setup for the PC or laptop click **Help** from the Network screen.

To enable and setup the Ethernet port:

1. Establish a local connection to the **Entry** screen as described in section 5.3, *Establishing Initial Local Communication*.
2. Connect the XFC Ethernet port to the PC or laptop Ethernet port with a crossover Ethernet cable.
3. Select **Communications**> **Network** tab from the navigation tree. The Network screen displays with options to configure the Ethernet port or Network Adaptor (Figure 64).
4. In the Network ID value field type the Network ID.
5. Set **Network Adaptor** to **Enable**.

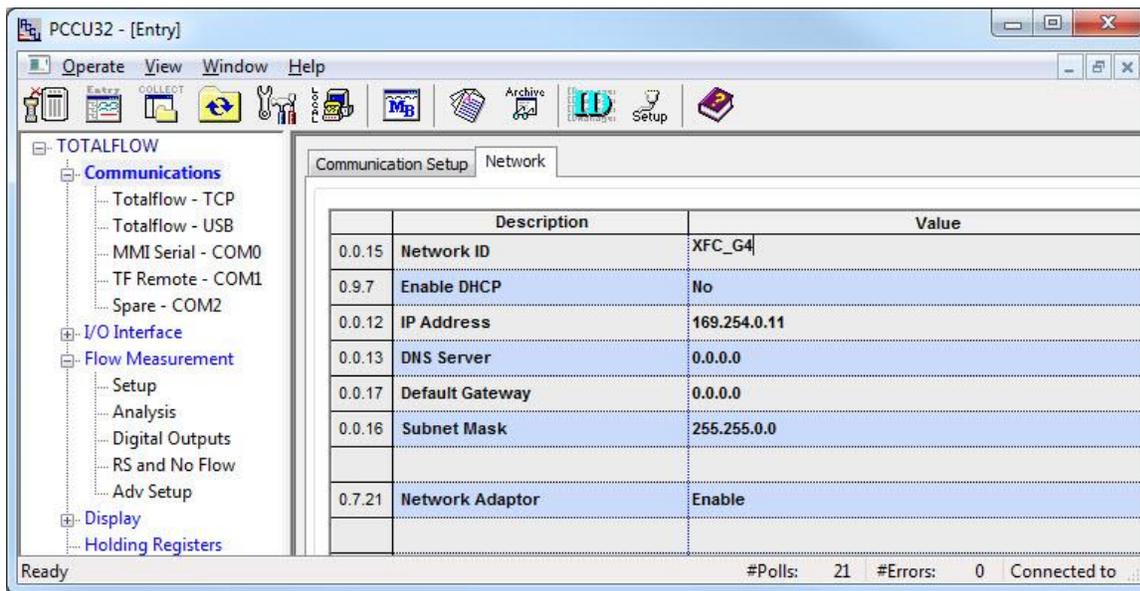


Figure 64 Network Setup: ID

6. Click **Send**.
7. Click **OK** to confirm changes.
8. On the navigation tree, select **Communications** > **Totalflow/TCP**>**Setup** tab to view or change additional port parameters (Figure 65). The default protocol enabled on the port is **Totalflow/TCP**.

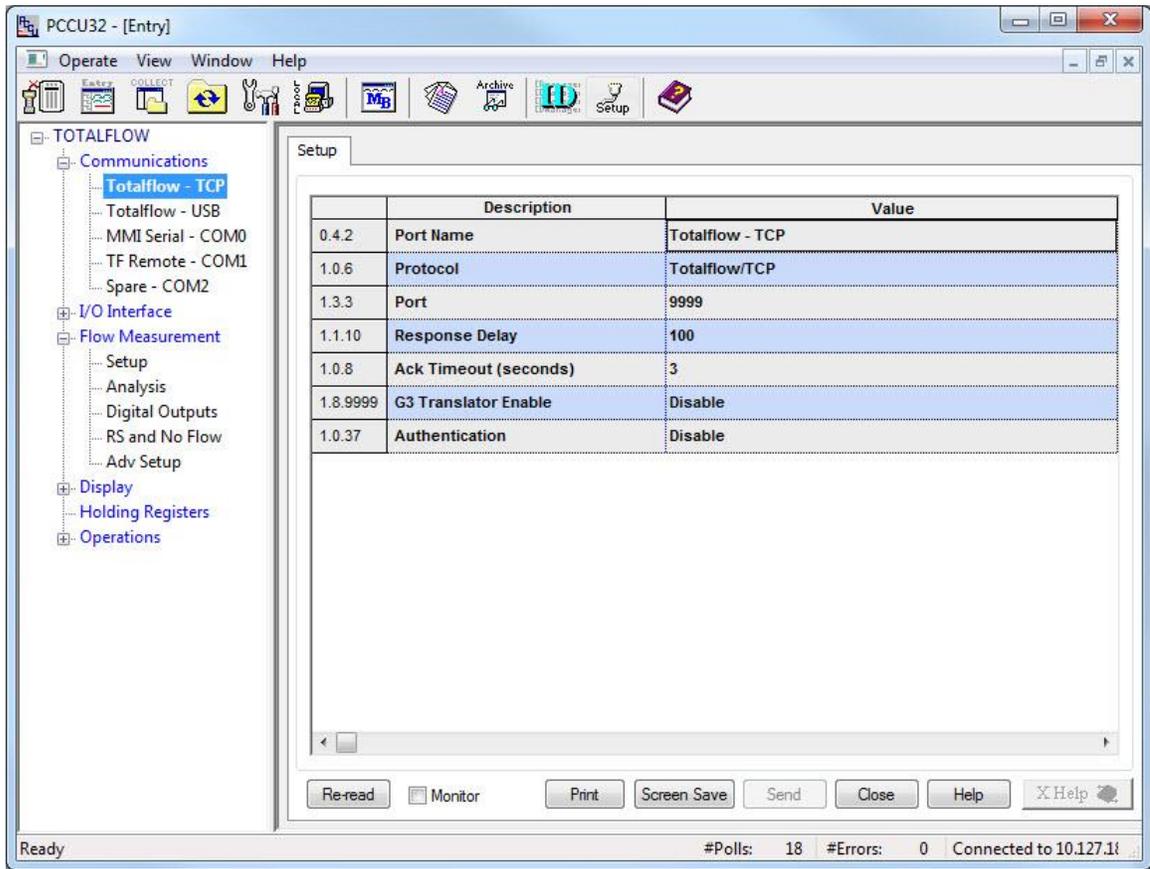


Figure 65 Communication Setup: Totalflow /TCP Protocol

9. Click **Send** to save changes.
10. Open the door to the flow computer.
11. Press the Reset button on the board. This restarts the XFC with the Ethernet port enabled. The current PCCU connection to the XFC over the serial or USB port may terminate as the XFC resets.
12. When the XFC completes its startup sequence, connect to the XFC using Ethernet as described in section 5.4.2, *Establish local point-to-point connection over Ethernet*.

5.4.2 Establish local point-to-point connection over Ethernet

To establish an Ethernet connection:

1. Make sure the Ethernet cable is connected to both the XFC and laptop Ethernet ports.
2. Restart PCCU.
3. Click **Setup** from the toolbar. The **Setup** screen for communication displays (Figure 66).
4. Under Communications, select **TCP/IP** as the PCCU connect method.
5. In the Network ID field type either the Network ID or the IP address of the device (169.254.0.11).
6. Click **Close** to exit setup and return to the PCCU main screen.

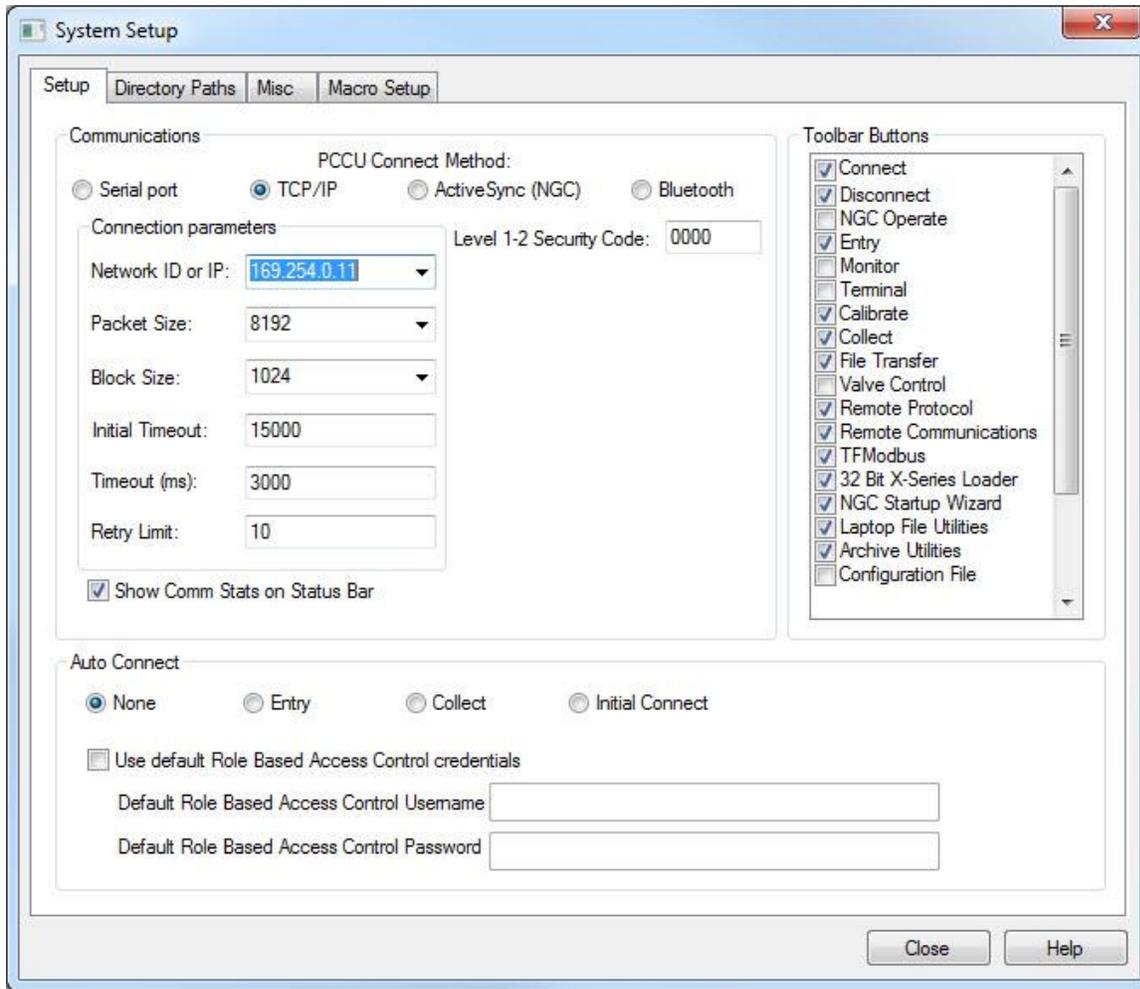


Figure 66 Setup TCP/IP communication over Ethernet

7. Click **Entry** from the toolbar. When the Entry screen displays, the connection over Ethernet is successful.
8. Click **Close** to exit connection or continue to use the Ethernet connection for further configuration of the XFC.

5.4.3 Enable and configure Ethernet for network connection with hosts

Connecting the XFC to a network requires the configuration of valid IP parameters, such as the IP address, gateway and subnet mask. IP parameter configuration is either manual (static addressing) or automatic (dynamic addressing):

- For manual configuration, obtain IP parameters (static addresses) from your IT administrator and type the values in the required fields. Static addresses are permanent and remain in the device unless configuration is changed. The IP address must be unique (reserved for the device).
- For automatic configuration, enable DHCP. The XFC auto-populates the values in the required fields. This addressing mechanism requires that the network connection is active and that a DHCP server on the corporate network is active. If the flow computer is unable to connect to a DHCP server, it will not be able to configure its IP address and hosts will not be able to connect to the XFC.

To enable and configure Ethernet:

1. Establish a local connection to the **Entry** screen as described in section 5.3, *Establishing Initial Local Communication*.
2. Connect the XFC Ethernet port to the network equipment (switch) with the Ethernet cable.
3. Select **Communications**> **Network** tab from the navigation tree. The Network screen displays with options to configure the Ethernet port or Network Adaptor.
4. In the Network ID field, type a name that helps to identify the device uniquely (Figure 67).
5. Set **Network Adaptor** to **Enable** (Figure 67).

6. Configure the IP parameters. Select one of the options based on your addressing method.
 - a. If using DHCP for dynamic addressing, set **Enable DHCP** to Yes (Figure 67). Leave the additional default IP configuration intact as it will auto-configure after Ethernet is activated.

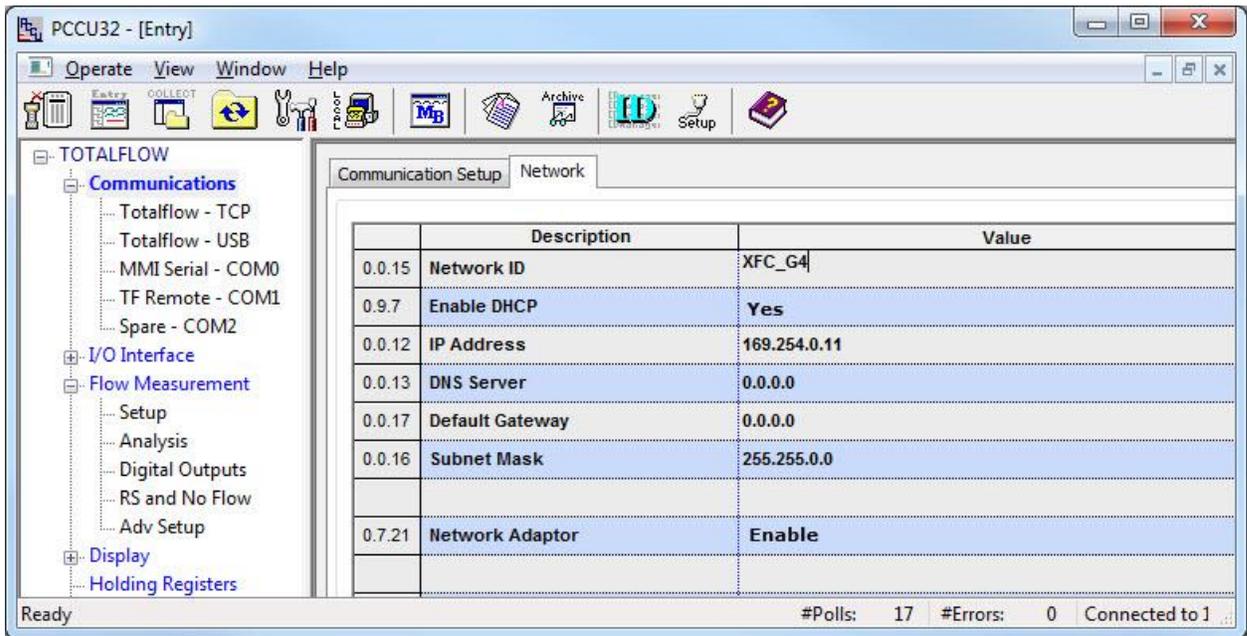


Figure 67 Network tab: Configure to use DHCP for addressing

- b. If using static addresses, make sure to set **Enable DHCP** to **No** (Figure 68). Type the IP Address, Subnet Mask, and Default Gateway, provided by the IT administrator.

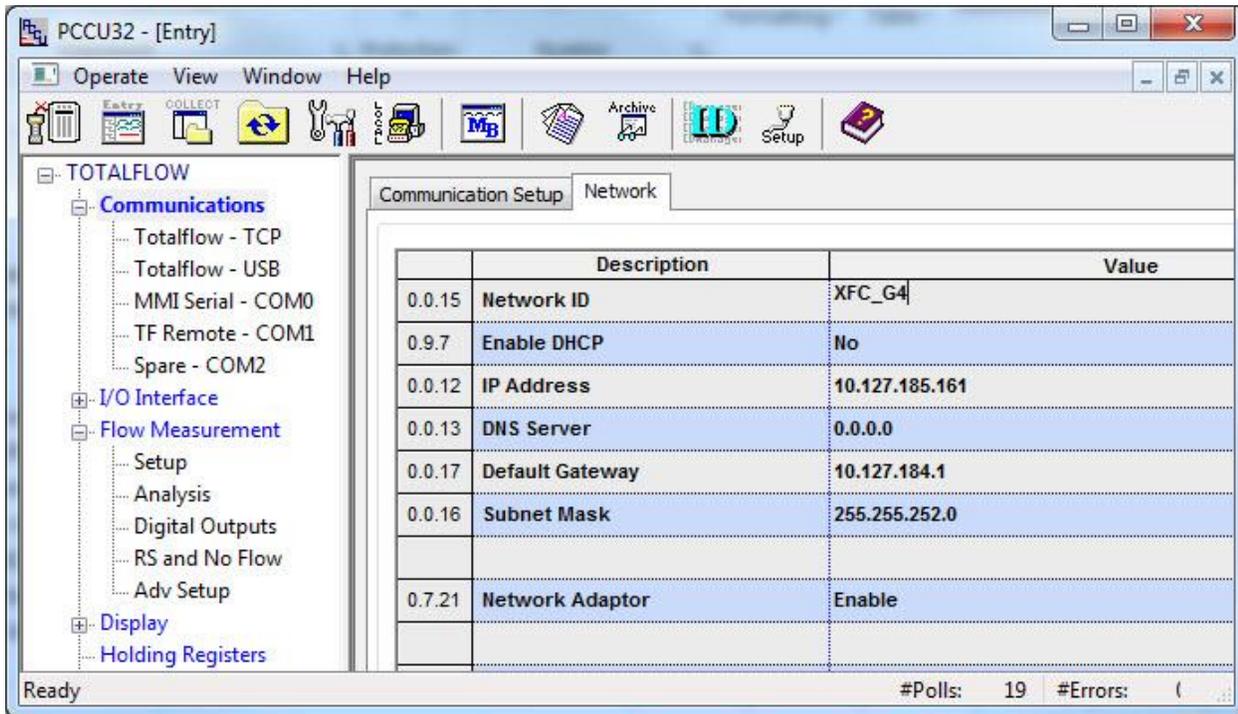


Figure 68 Network Tab: Configure static IP address

7. Click **Send** to save configuration.
8. Click **OK** to confirm the changes.
9. Open the door to the flow computer.
10. Press the Reset button on the board. This restarts the XFC with the Ethernet port enabled. The current PCCU connection to the device will terminate as the XFC restarts.
11. When the XFC completes its startup sequence, restart PCCU and select the **Entry** icon to connect again.
12. If DHCP is enabled verify that the IP parameters display (the fields should have auto-populated). Take note of the IP address assigned to the XFC.
13. If the parameters do not display, the XFC was not able to obtain the parameters from the DHCP server:
 - a. Verify that the Ethernet cable is plugged correctly to the network equipment.
 - b. Ensure that the connection to the corporate network is active.
 - c. Contact the IT administrator to verify that the DHCP server on the corporate network is running and available.
 - d. If unable to use DHCP, obtain IP addresses and configure the XFC manually.
14. Click **Close** to terminate the connection over the serial or USB port.
15. Connect to the XFC over the network as described next in section 5.4.4, *Establish network connection over Ethernet*.

5.4.4 Establish network connection over Ethernet (using default TCP port)

This procedure assumes that the host (PC or laptop) has a valid IP configuration, is connected to the corporate network, and the connection is established remotely.

i

IMPORTANT NOTE: If establishing this connection on site (able to connect both the XFC and the PC to a local Ethernet switch), make sure that the laptop has a compatible IP configuration. Both, the IP address of the PC and the XFC must be on the same IP subnet for communication to work.

For additional details on the IP addressing setup for the PC or laptop, click **Help** from the **Network** screen.

To establish a network connection:

1. Make sure the XFC is connected to the network equipment (switch).
2. Start PCCU.
3. Click **Setup** from the toolbar. The **Setup** screen for communication displays (Figure 66).
4. Under Communications, select **TCP/IP** as the PCCU connect method.
5. In the Network ID field type either the Network ID or the IP address of the device. Use the static address manually configured or the address obtained by DHCP.
6. Click **Close** to exit setup and return to the PCCU main screen.

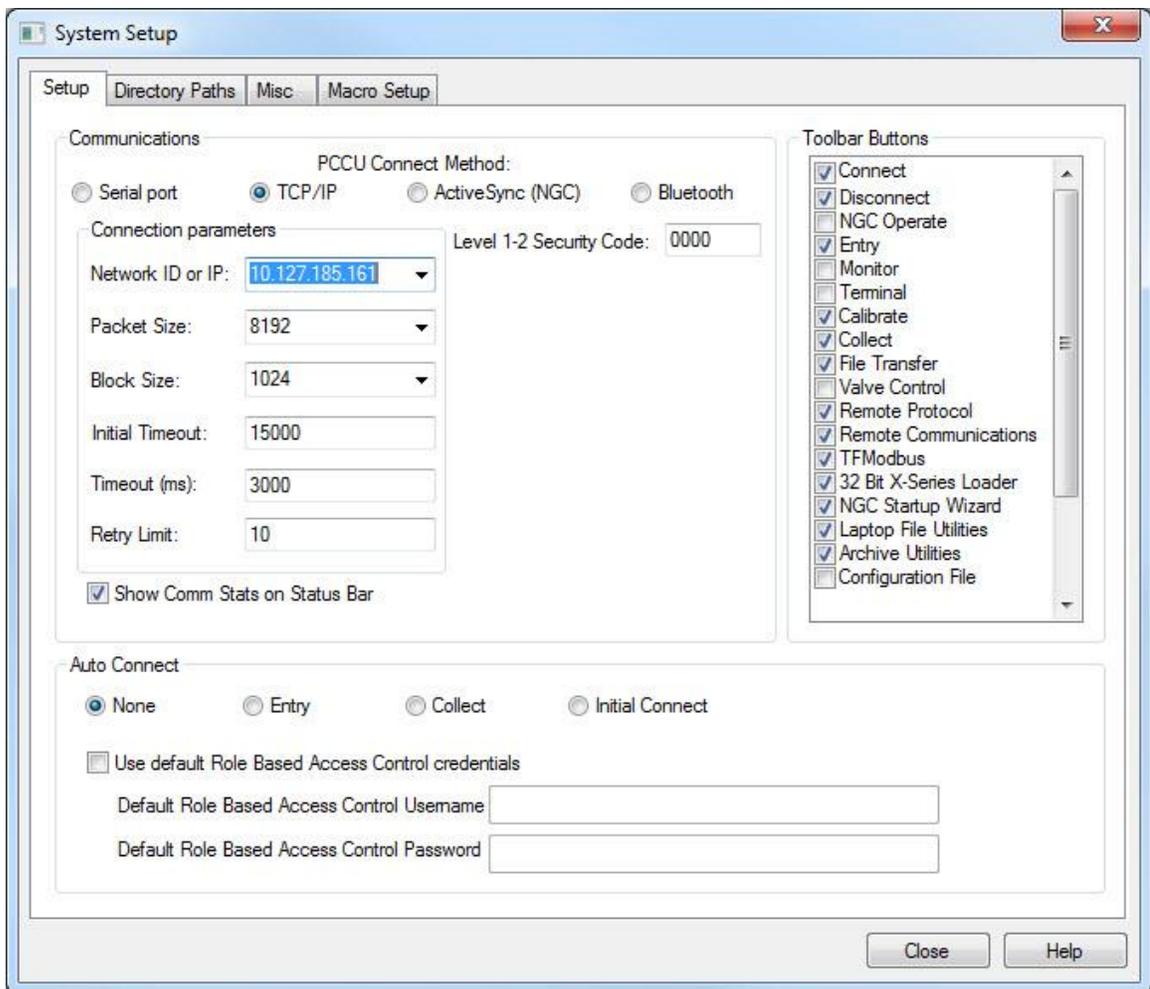


Figure 69 Setup of network connection over Ethernet

7. Click **Entry** from the toolbar. When the Entry screen displays, the Ethernet connection over the network is successful.

5.4.5 Add and configure additional communication instances for Ethernet

The default Ethernet port configuration supports connections on TCP port 9999. This port value is read-only. To support connections using another TCP port, add a new communication instance for Ethernet and configure the desired port number.

5.4.5.1 Add communication instance

1. Establish local communication as described in section 5.3, *Establishing Initial Local Communication*.
2. On the navigation tree, select the station name (top node on the tree, default name TOTALFLOW).
3. Click the **Application and Licensing** tab.
4. Click **Add App**. The Add New Application dialog box displays.
5. In the **Applications to add** drop down list, select **Communications**.
6. Click **OK**.
7. Verify that Communications show in the application list.
8. Click **Send**.
9. Verify that the communication application displays in the navigation tree. The communication application instance displays a generic name and it displays at the bottom of the communication applications. Configure the protocol, change the name and configure the TCP port next.

5.4.5.2 Configure the new communication instance

1. On the navigation tree, select the new communication instance. The **Setup** tab displays.
2. Select the **Protocol** value field and select **Totalflow/TCP** from the drop down list.
3. Click **Send**.
4. On the navigation tree, verify that the communication instance name changes to **Totalflow/TCP**.
5. Select the instance, the lower **Totalflow/TCP**. The **Setup** tab displays.
6. In the Port Name value field, type a name to uniquely identify the port or communication instance. For example to identify the TPC port, use TCP 9998. The port will not be confused with the default Totalflow/TCP.
7. In the Port value field, type the TCP port number. For example 9998.
8. Click **Send**.
9. At the warning, click **Yes** to confirm and save changes.
10. Click **Re-read** to verify that the user-defined name of the communication instance displays on the navigation tree (in this example the instance displays as TCP 9998). Make sure the configuration on the setup tab is correct.

5.4.6 Establish a network connection over Ethernet (using non-default TCP port)

This procedure assumes that the host (PC or laptop) has a valid IP configuration, is connected to the corporate network, and the connection is established remotely.



IMPORTANT NOTE: If establishing this connection on site (able to connect both the XFC and the PC to a local Ethernet switch), make sure that the laptop has a compatible IP configuration. Both, the IP address of the PC and the XFC must be on the same IP subnet for communication to work.

For additional details on the IP addressing setup for the PC or laptop, click **Help** from the **Network** screen.



IMPORTANT NOTE: If the XFC is connected to a router or cell modem at the site, enable port forwarding on the router/cell modem. Ensure that the TCP port number configured in the XFC is also configured in the router. The connection will be established through the router/modem. Contact technical support for more details.

To establish a network connection:

1. Make sure the XFC is connected to the network equipment (switch).
2. Start PCCU.
3. Click **Setup** from the toolbar. The **Setup** screen for communication displays.

4. Under Communications, select **TCP/IP** as the PCCU connect method.
5. In the Network ID field type. Configure one of the following:
 - a. The IP address of the XFC and the TCP port for the connection (in the following format: xxx.xxx.xxx.xxx/TCP port number). See Figure 70.
 - b. The IP address of the onsite router/cell modem and the TCP port for the connection (in the following format: xxx.xxx.xxx.xxx/TCP port number).

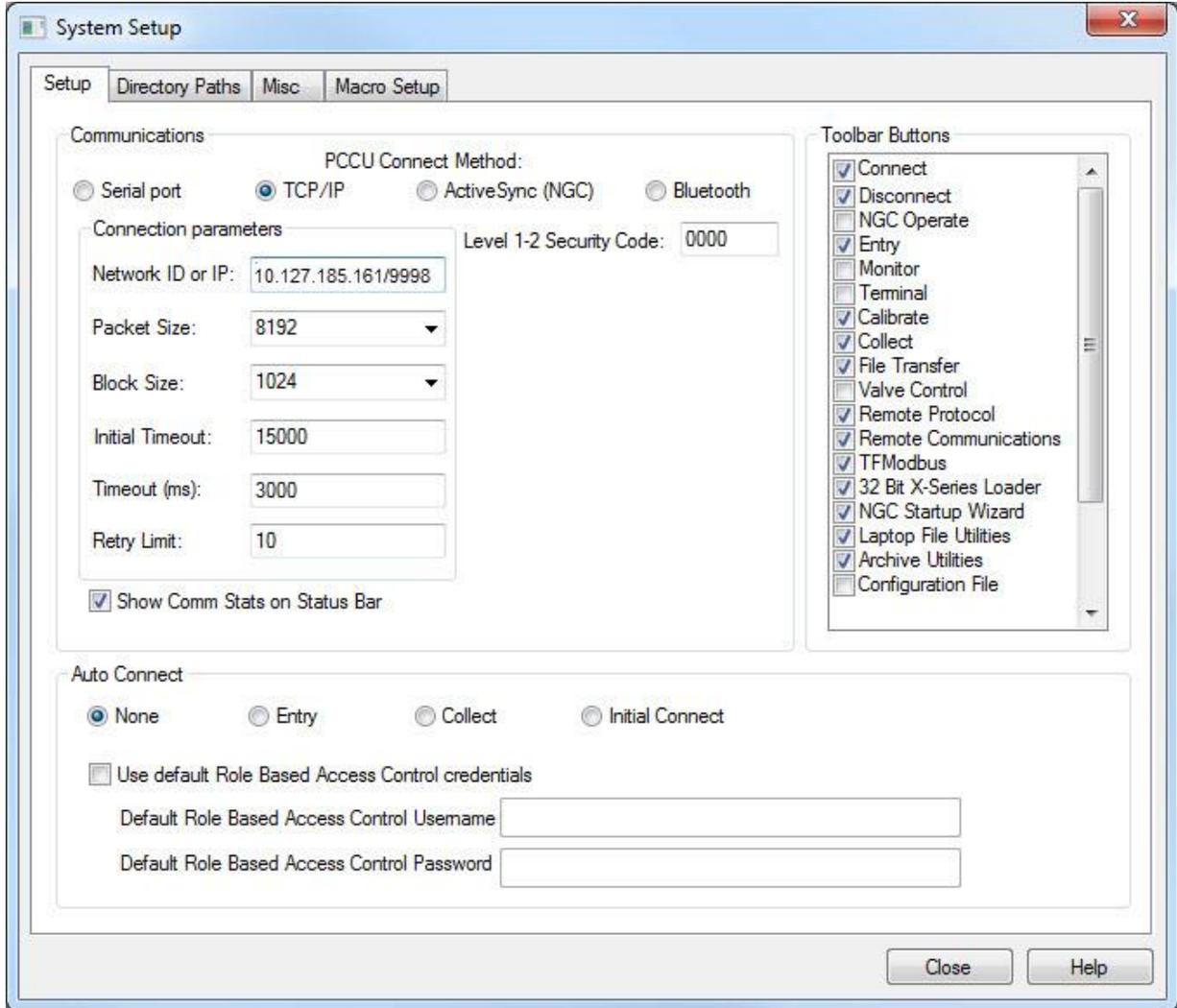


Figure 70: Connection setup over Ethernet using non-default TCP port

6. Click **Close** to exit setup and return to the PCCU main screen.
7. Click **Entry** from the toolbar. When the Entry screen displays, the Ethernet connection over the network is successful.

5.5 Setting up the XFCG4

Once physically connected to the flow computer, the software must be instructed by the programming device to connect. The software will read the device default values programmed at the factory. These preset values are based on the type of product ordered and programmed for the most widely used configuration.

Depending on the programming device you are using, the following are the minimum required entries. Specific information required to complete each step is discussed in the PCCU32 help files.

5.5.1 Station ID

The station identifier code should uniquely identify one station from that of others. If running a multiple tube station, the station ID is the same for all tubes on that flow computer. If left blank on a single tube device, it will be the same as the device ID.

Description	Format	Note
Station ID	XXXXXXXXXX	10 digit alphanumeric

5.5.2 Device ID/Application ID

The device identifier should uniquely identify each tube/application on a multi-tube device. On a single tube installation, the identifier code should uniquely identify one XFC^{G4} from that of others and will be the same as the Station ID.

Description	Format	Note
Device/Application ID	XXXXXXXXXX	10 digit alphanumeric

5.5.3 Location

In WINCCU, the host software, the location field can hold up to 24 alphanumeric characters to describe its location. An example would be the county name or road number.

Description	Format	Note
Location	xxxxxxxxxxxxxxxxxxxxxxxxxx	24 digit alphanumeric

There are additional fields stored in WINCCU for uniquely identifying the meter including fields for entering the lease holder, producer, operator and buyer. These fields reside on the host computer in the ID Manager, not in the flow computer.

5.5.4 Date/Time

The flow computer date and time must be set correctly and should agree with the Collection Equipment.

Description	Format	Note
Date	MM/DD/YY	Must enter 2 digits each
Time	HH:MM:SS	24 hour clock

5.5.5 Bi-Level Security System

Data and configuration security in the XSeries meters (XFC, XRC and uFlo) is spread across three elements; the flow meter, PCCU32 and WinCCU32.

The flow meters (XFC, XRC or uFlo) have a security switch (S1) on the electronic boards. Password security is bi-level; read only (security code level 1) or read/write (security code level 2). To establish meter security the security switch must be in the OFF position, and locally connect with PCCU32.

5.5.5.1 Meter Security

To set meter security:

To establish meter security, the security switch must be in the OFF position and locally connected with PCCU32.

1. Open the door to the flow computer.
2. Ensure the security switch is in the OFF position.
3. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
4. Open PCCU.

5. Select the **Entry** button from the toolbar.
6. Select the **Station ID** from the tree.
7. Enter a four digit number for level 1 and level 2 security codes, in the **Station Setup** tab. (see Figure 71).
8. Click **Send**.

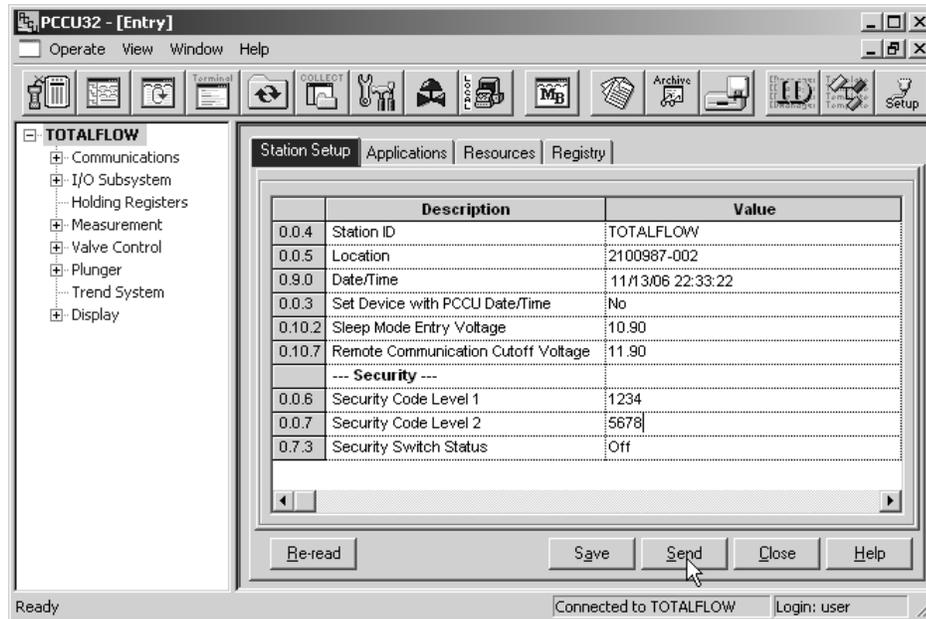


Figure 71 Meter Setup and Security Screen

The security code is now configured.

i

IMPORTANT NOTE: Turning the security switch (S1) ON will activate the security codes. The level 1 code (example above-‘1234’) will allow data and configuration values to be read, but not altered. The level 2 code (example above- ‘5678’) will allow full access to read and to write.

These security codes must be entered into PCCU32 and WinCCU32 to provide appropriate access to the meters. However, WinCCU32 will always need the proper security code, regardless of the position of the security switch (S1). Turning the security switch OFF does not allow unprotected access by a WinCCU32 operator. Modbus access to the meters is not protected by the security codes.

5.5.5.2 PCCU32 Security

PCCU32 will require the appropriate security code be entered. To enter the security code go to System Setup in PCCU32. In the example (see Figure 72) the operator was provided with *read only* access to the meter.

Security code level 1 (below example) of ‘1234’ will provide read only access to the meter. Had a security code of ‘5678’ been entered the operator would have had full read/write access to the meter.

i

IMPORTANT NOTE: If the security level is breached, the meter will give no indication. Any data the operator attempted to change will simply remain unchanged.

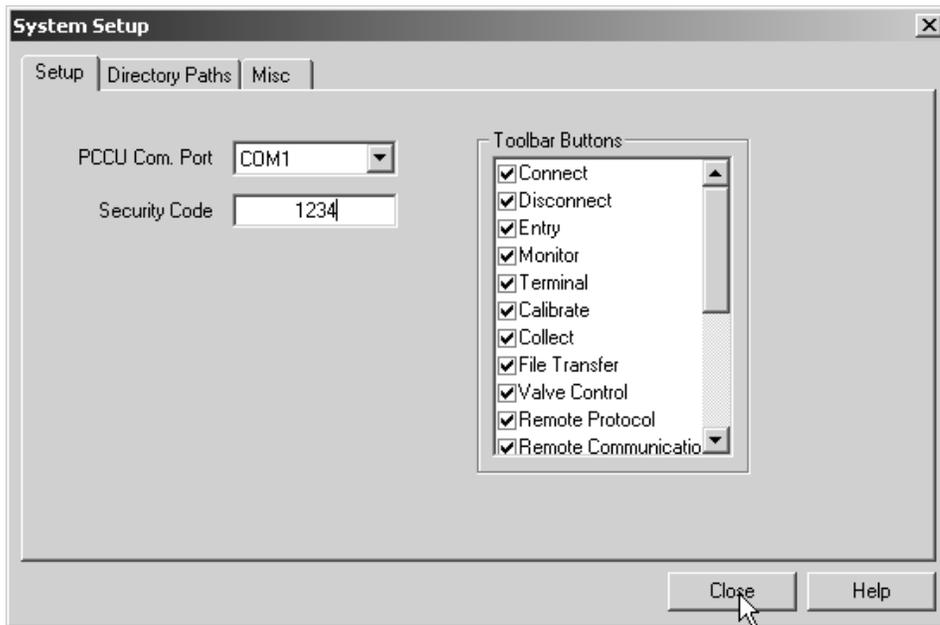


Figure 72 PCCU32 Security Code Setup

5.5.5.3 WinCCU32 Security

WinCCU32 will also require appropriate security codes (see Figure 73). Highlight the appropriate meter, and click **Edit ID**.

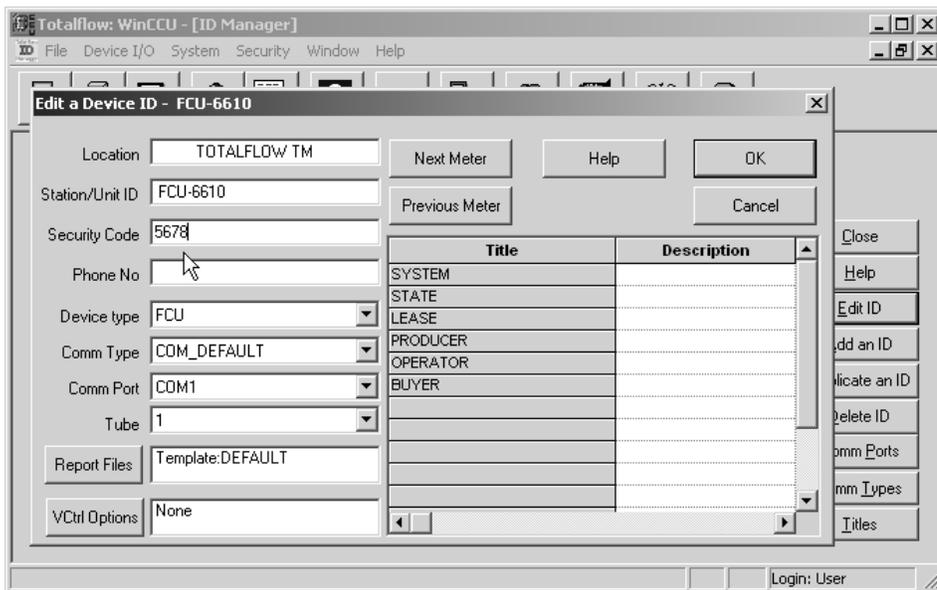


Figure 73 WinCCU32 Security Code Entry in Meter I.D.

By entering a security code level 2 (previous example) of '5678'. This gives the WinCCU32 operator full read/write access to the meter.

IMPORTANT NOTE: Modbus access to the meters is not protected by the security codes.



If the Security Switch S1 located on the flow computer board is in the OFF position, no security code has to be entered to access the operating parameters even if there is one programmed into the device.

5.6 Application Licensing Credit Key

5.6.1 Credit key driver Installation

To install the credit key driver:

1. Plug the USB credit key into an available USB port.
2. The Windows® operating system will recognize the credit key as new hardware and attempt to install the appropriate driver with the Found New Hardware Wizard.
3. Click **Next**
4. Point the wizard to the PCCU32 directory.
5. Select **Browse**, in the Files Needed screen, and locate the driver *usbkey.sys* in the PCCU32 directory.
6. Click on **OK**, once the driver has been located. Software driver installation will commence.
7. Click **Finish** when installation is complete.

The USB credit key is now installed.



IMPORTANT NOTE: If the credit key is inserted in a different USB port on the computer, it will need to be installed for that new USB port. The credit key must be installed on each available USB port if the same USB port is not used each time the credit key is used.

5.6.2 Access and view the credit key with PCCU32 7.0 (or later)

To access and view the credit key you must use PCCU32 7.0 (or later). The credit key is a secure device and only accessible through PCCU32. To view credits on the credit key:

To access and view the credit key:

1. Install the credit key in an available USB port. For more information about installing the credit key, see section 4.5.1 Credit key driver installation, page 78.
2. Open PCCU32
3. Disconnect from the flow computer, if connected.
4. Click **Operate > File Utilities > Credit Key License Utility**.



IMPORTANT NOTE: To open the Credit Key License Utility, the PC cannot be connected to the flow computer.

5. Click **Load** to view available credits on USB Key (see Figure 74), when the Credit Key Status and Update Utility screen opens.

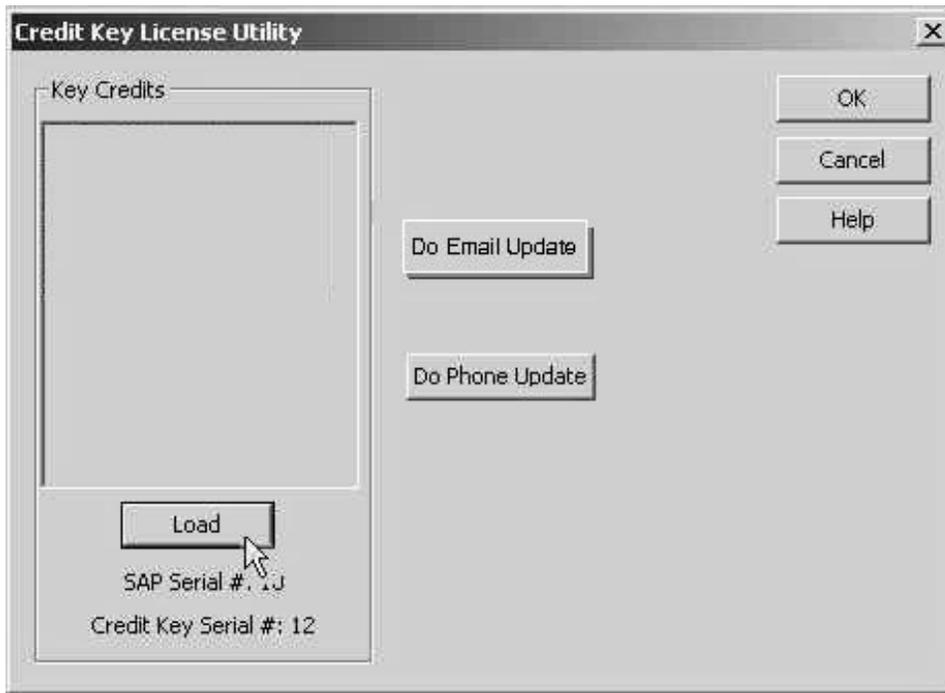


Figure 74 Loading Credit Key Status

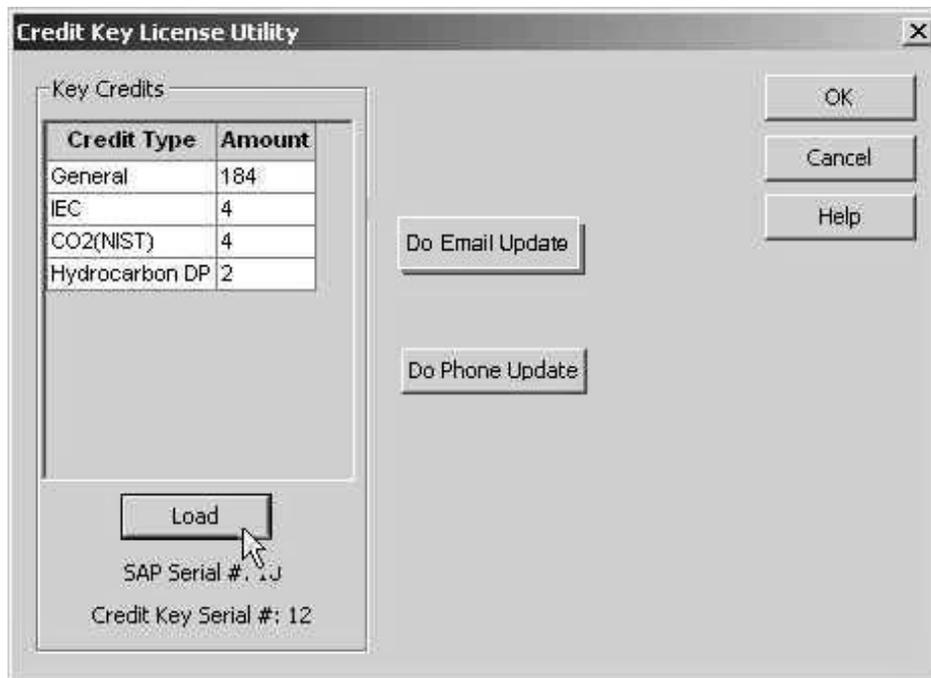


Figure 75 Credit Key Status

5.6.3 Adding Credits to the Credit Key by Telephone

You may have ordered the credit key from Totalflow with a specified number of the various credits; however, you may need to add more or different credits in the future.

To add credits to the credit key by telephone:

1. Open PCCU32 do not connect to the unit.
2. Click **Operate > File Utilities > Credit Key License Utility**.

3. Insert the credit key into an available USB port.
4. Select **Do Phone Update** (see Figure 76).
5. Ensure that the credit key is plugged in.
6. Call Totalflow Order Entry.
7. Click **OK** when you have connected with an Order Entry clerk.
8. The clerk will ask for the five (5) encrypted codes that appear directly beneath the **Do Phone Update**. Read them from top to bottom (see Figure 77).

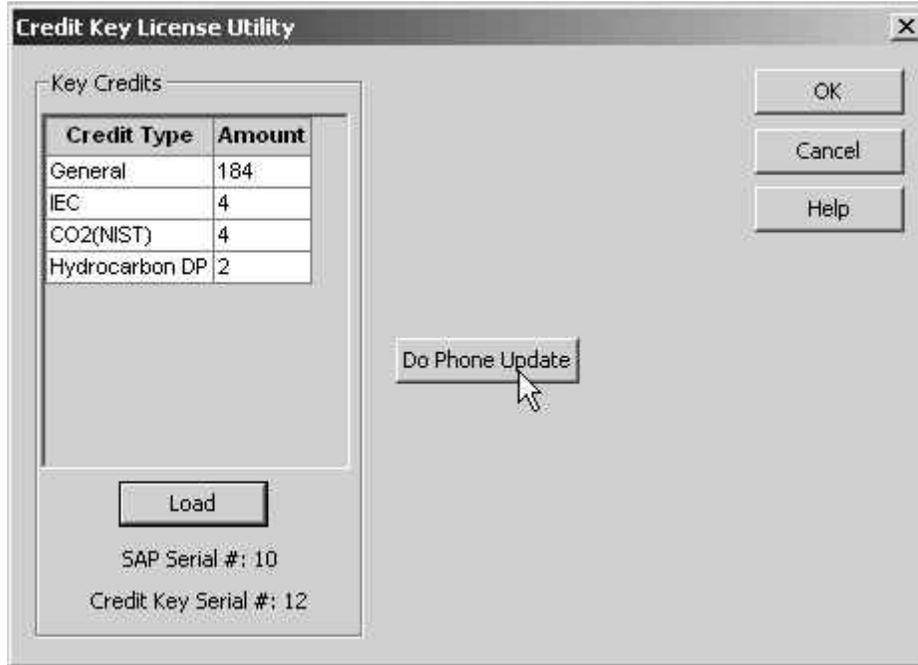


Figure 76 Credit Key Telephone Update

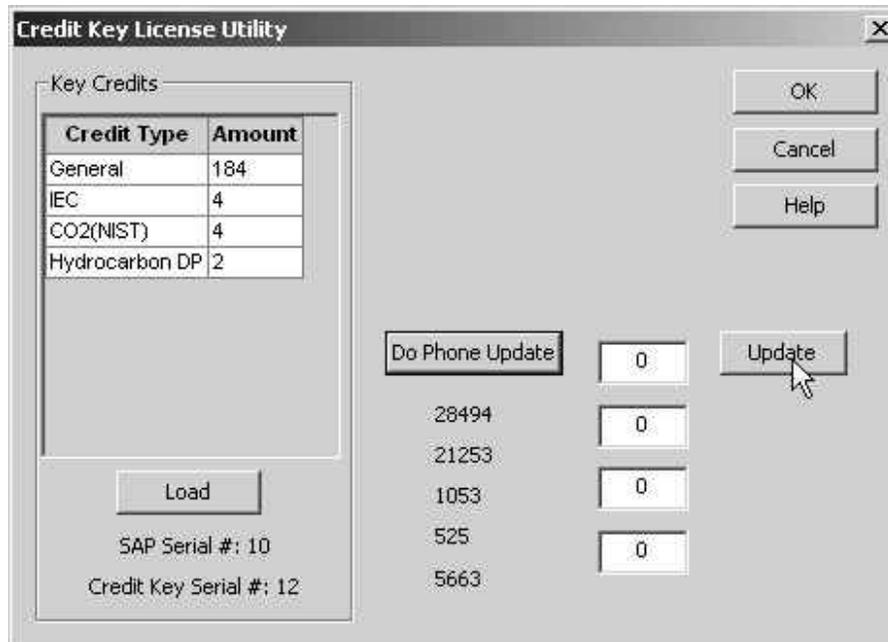


Figure 77 Application Credit Entry Screen

9. Enter the four codes, given by the clerk, in the fields to the immediate right.
10. Click the **Update** button, three more codes will be displayed directly beneath the **Do Phone Update** button (see Figure 78).
11. Read the three codes back to the clerk when prompted to verify the credits have been properly written.
12. Click **Update**, when finished.

The credit key now has added credits.

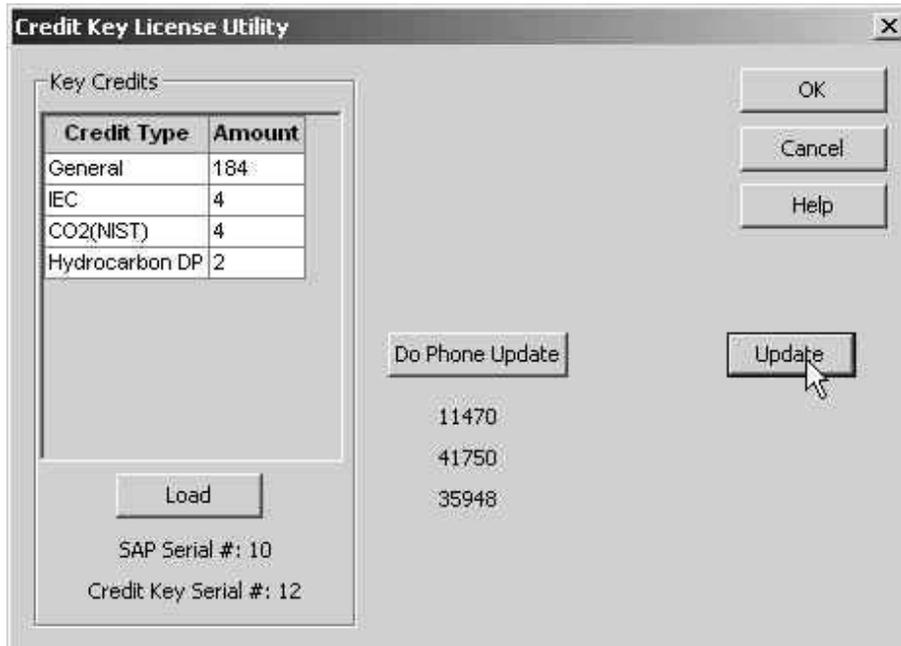


Figure 78 Application Credit Verification Codes

5.6.4 Transferring Credits to the G4 Controller from Credit Key

Credits can be transferred to the device (G4). The user selects the type of credit and the amount of those credits to be transferred.



IMPORTANT NOTE: If a flow computer has a surplus of credits, these credits can be transferred to the credit key to be used on other meters. See Section 4.5.5, *Transferring Credits to the Credit Key from G4 Device*, page 82.

To transfer application credits to the flow computer from the credit key:

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU.
3. Click on the **Entry** button from the toolbar.
4. Select **Station ID>Application Licensing** tab.
5. Install the credit key in an available USB port.
6. Click **Load** to view available credits.

i

IMPORTANT NOTE: This Application Licensing tab allows for viewing of the licensing status of the flow computer as well as the available credits on the credit key. The left pane shows the type and amount of the available credits on the credit key. The upper-right pane is for information only. It shows the various applications available and the type and amount of credit necessary to run the application. The standard credits (and four general credits) come free with the purchase of the flow computer. The lower-right pane displays the licensing status of the flow computer. It shows what credits are in the machine, what credits are being used and any surplus or deficit of credits. A surplus of credits is highlighted in green. A deficit of credits is highlighted in red.

7. Select **Transfer to Device**, located in the center of the screen (see Figure 79).
8. Select the Type of credit using the drop down menu, in the center of the screen.
9. Select the number of credits to transfer, in the amount box.
10. Click **Transfer**.

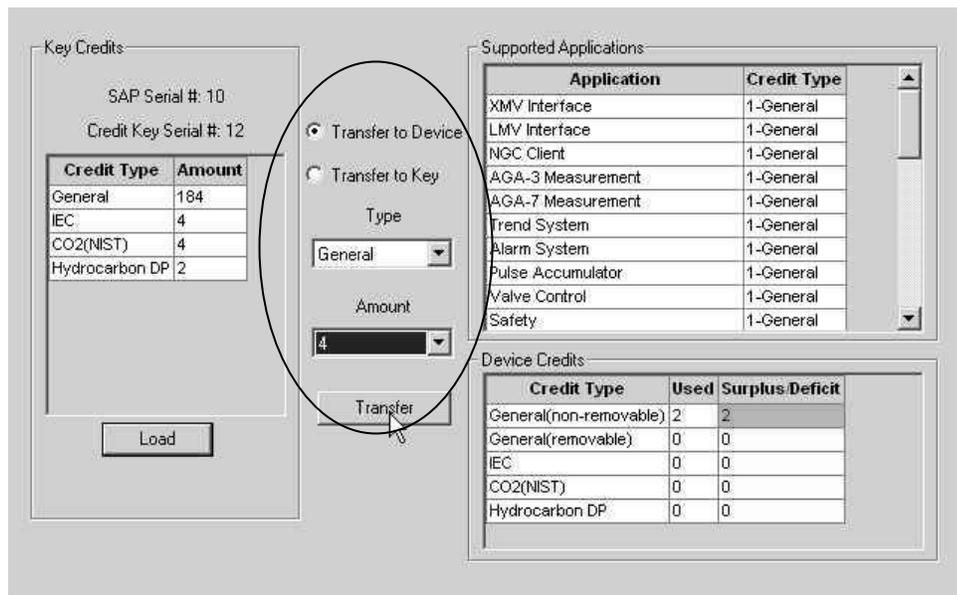


Figure 79 Transfer to Device Application Credit Selections

11. Transferred credits should now show up on the lower right-hand side (see Figure 80).

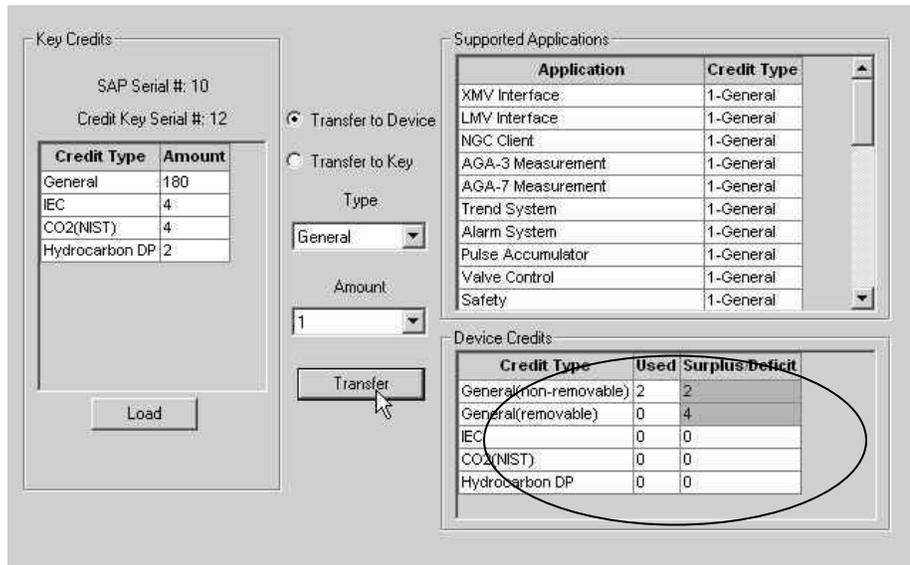


Figure 80 Transferred to Device Application Credits

The application credits are now transferred to the flow computer.

5.6.5 Transferring Credits to the Credit Key from G4 Device

Excess credits (credits beyond what would be required to be fully licensed) can be taken from the flow computer and returned to the credit key to be used on other flow computers. The user determines the type of credit and the amount of those credits to be transferred.

i

IMPORTANT NOTE: If the flow computer has a surplus of credits, these credits can be transferred to the credit key to be used on other flow computers.

If a flow computer requires additional credits, these credits can be transferred from the credit key. See section 4.5.4, *Transferring Credits to the G4 Device from Credit Key* page 81.

To transfer application credits to the flow computer:

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU.
3. Click on the **Entry** button from the toolbar
4. Select **Station ID>Application Licensing** tab.
5. Install the credit key in an available USB port.
6. Click **Load** to view available credits.

i

IMPORTANT NOTE: This screen allows for the licensing status of the flow computer as well as the available credits on the credit key. The left pane shows the type and amount of the available credits on your credit key. The upper-right pane is for information only. It shows the various applications available and the type/amount of credit necessary to run the application. The standard credits (and four general credits) come free with the purchase of the flow computer. The lower-right pane displays the licensing status of the flow computer. It shows what credits are in the machine, what credits are being used and any surplus or deficit of credits. A surplus of credits is highlighted in green. A deficit of credits is highlighted in red.

7. Select **Transfer to Key**, located in the center of the screen (see Figure 81).
8. Select the Type using the drop down menu.
9. Select the number of credits to transfer.

10. Click **Transfer**.

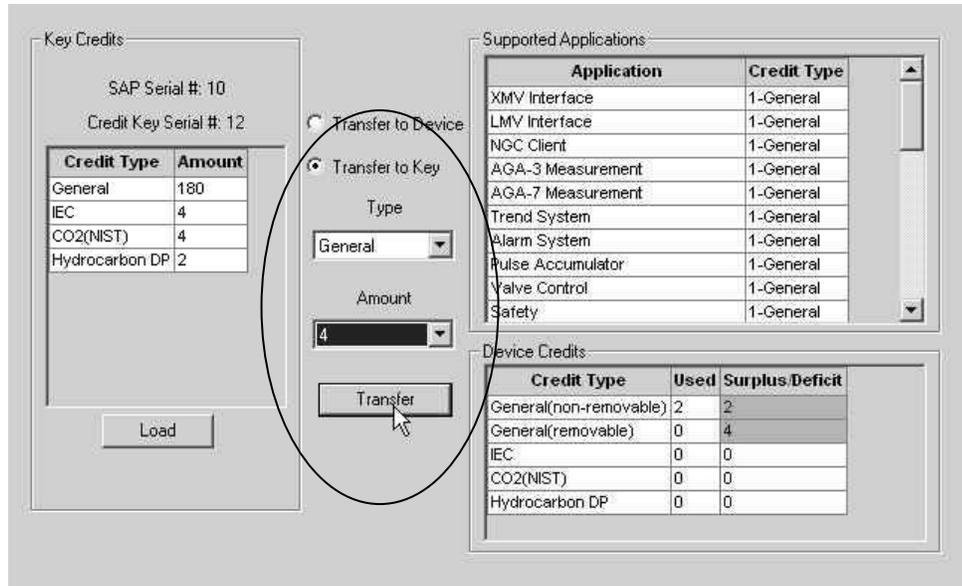


Figure 81 Transfer to Credit Key Application Credit Selections

11. The transferred credits should now show up on the left side of the screen (see 82).

The credit keys have now been transferred.

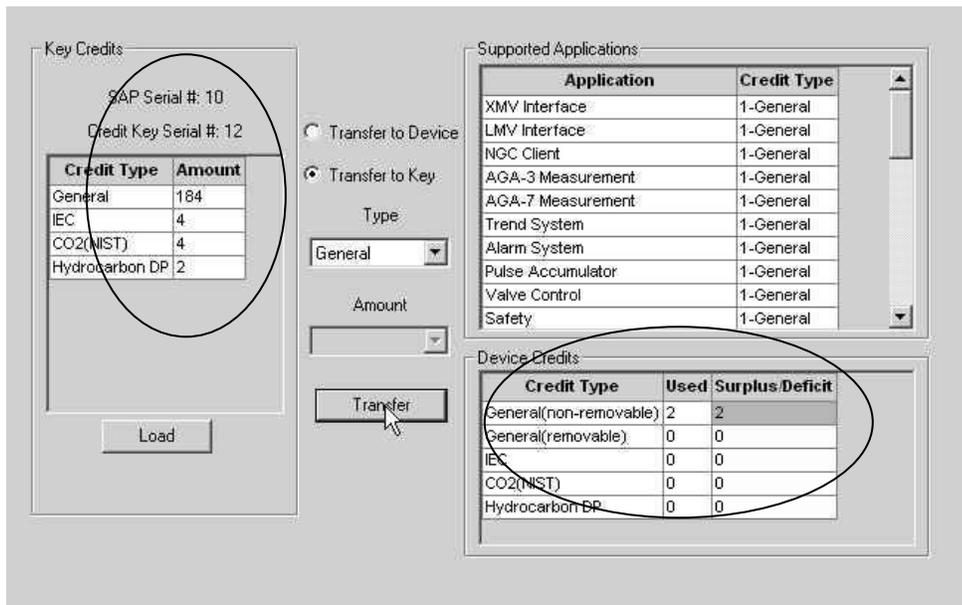


Figure 82 Transferred to Credit Key Application Credits

5.7 XFCG4 Configuration

5.7.1 Contract Hour

A flow computer can be programmed to begin the contract day based on contract or company standards. When a flow computer first powers up the contract is preset to begin at midnight.

i **IMPORTANT NOTE:** Midnight is 00 o'clock. If any value entered is greater than 23, the FLOW COMPUTER forces the value to 00 (midnight).

5.7.2 Log Period

Log period is the specified length of time between writing the calculated accumulated volume to record. Volumes may be recorded as often as every minute and as seldom as every hour. The default is 60 minutes. The flow computer can normally store 960 log periods (40 days x 24 logs). A 5 minute log period will consume available memory in 8 days.

Description	Options
Log Period	1,2,5,10,20,30,60

5.7.3 Volume Calculation Period

Volume Calculation Period is the specified length of time between volume calculations. The Volume Calculation Period must be equally divisible into the Log Period. The default is 60 minutes.

Description	Options
Volume Calculation Period	1,2,5,10,20,30,60

5.7.4 Calculated Method

When the flow computer is powered up initially, the calculation method must be set. The calculation method may be set to AGA-3 1985, AGA-3 1992, AGA-7 or liquid. Once the calculation type has been determined, it is possible to toggle specific factors on or off depending upon their availability (see Table 9).

i **IMPORTANT NOTE:** Calculation types, and many of the factors involved with setting up the calculations, are usually dictated by the sales contract or by company policy.

Table 9 Configurable Calculations Factors

Calculation Parameter	Configurable	
	AGA-3 1985	AGA-3 1992
Fpb (Pressure Base Factor)	Yes	N/A
Ftb (Temperature Base Factor)	Yes	N/A
Fg (Specific Gravity Factor)	Yes	N/A
Fb (Orifice Factor)	Yes	N/A
Ftf (Flowing Temperature Factor)	Yes	N/A
Y (Expansion Factor)	Yes	Yes
Fr (Reynolds Number)	Yes	N/A
Fa (Orifice Thermal Expansion Factor)	Yes	N/A
**Fpv (Supercompressibility Factor)	Yes	Yes
*Fw (Water Vapor Factor)	Yes	Yes
*Faux (Full Well Stream Factor)	Yes	Yes

Cd (Coefficient of Discharge)	N/A	Yes
Fp (for Fpv method = NX19 Fixed)	Yes	Yes
Ft (for Fpv method = NX19 Fixed)	Yes	Yes

* Faux and Fw are not AGA factors. Faux is a user set multiplier to compensate for liquids in the gas stream, defaults to Fw is a factor which compensates for water vapor in the gas stream and its effect on volume measurements.

** NX19 GCN, NX19 GCNM, AGA-8 1992 Gross and AGA-8 1992 Detail.

A complete description can be found in the AGA Report No. 3.

5.7.5 Super Compressibility Calculation (Fpv)

When the flow computer is powered up initially, the calculation method must be set. You have the option of changing the formula method to any of several other choices, (see Table 10). Once the calculation type has been determined, you may toggle the specific parameters may be toggled on or off depending upon whether using a fixed or live analysis data.



IMPORTANT NOTE: Calculation types, and many of the factors involved with setting up the calculations, are usually dictated by the sales contract or by company policy.

Table 10 Fpv Analysis Data

Parameter	Default Value	Units	Configurable		
			*All Others	NX19 Fixed Ft/Fp	AGA-8 1992 Detail
Fp (for Fpv method NX19 Fixed)	1.000		No	Yes	No
Ft (for Fpv method NX19 Fixed)	1.000		No	Yes	No
**Heating value	1000.00	BTU/SCF	Yes	Yes	Yes
Argon	0.0000	mol %	No	No	Yes
Carbon dioxide CO2	0.0000	mol %	Yes	Yes	Yes
Carbon Monoxide	0.0000	mol %	No	No	Yes
Ethane	0.0000	mol %	No	No	Yes
H2S	0.0000	mol %	No	No	Yes
Helium	0.0000	mol %	No	No	Yes
Hydrogen	0.0000	mol %	No	No	Yes
iButane	0.0000	mol %	No	No	Yes
iPentane	0.0000	mol %	No	No	Yes
Methane	100.000	mol %	Yes	No	Yes
nButane	0.0000	mol %	No	No	Yes
nDecane	0.0000	mol %	No	No	Yes
nHeptane	0.0000	mol %	No	No	Yes
nHexane	0.0000	mol %	No	No	Yes
nitrogen N2	0.0000	mol %	Yes	Yes	Yes
nNonane	0.0000	mol %	No	No	Yes
nOctane	0.0000	mol %	No	No	Yes
nPentane	0.0000	mol %	No	No	Yes
Oxygen	0.0000	mol %	No	No	Yes
Propane	0.0000	mol %	No	No	Yes

Water H2O	0.0000	mol %	No	No	Yes
Specific Gravity	0.6000	N/A	Yes	Yes	Yes

* NX19 GCN, NX19 GCNM, AGA-8 1992 Gross

** Enter the Heating Value in Btu per SCF. Not used in volume calculations. Only used for calculating MMBTU for reports.

5.7.6 Constants

On a single tube gas orifice meter, there are certain constants or parameters that may need to be entered or changed from the default values. Please see Table 11 for the list of constants.

Table 11 Gas Orifice Constants

Parameter	Default Value	Units	Configurable	
			AGA-3 1985	AGA-3 1992
Auxiliary Factor (Faux)	1.0		Yes	Yes
Barometric Pressure		PSIA	Yes	Yes
DP zero cutoff	0.0000	inches H2O	Yes	Yes
Meter Factor (Fb Basic Orifice Factor)	210.2300		Yes	N/A
Orifice Coefficient of Expansion	9.2500	Inches per Deg. F	No	Yes
Orifice diameter	1.0000		Yes	Yes
Orifice Material	Stainless		Yes	No
Pipe Coefficient of Expansion	6.2000	Inches per Deg. F	N/A	Yes
Pipe diameter	2.0670		Yes	Yes
Pressure Base (Contract)	14.7300	PSIA	Yes	Yes
Specific Heat Ratio	1.3000		Yes	Yes
Tap Location	Downstream		Yes	Yes
Tap Type	Flange Taps		Yes	No
Temperature Base (Tb)	60.0000	Degrees F	Yes	Yes
Viscosity	0.0103	Centipoise	Yes	Yes
Z of air at base condition	0.9996		N/A	Yes
Fixed Cd	.6		N/A	Yes

5.7.7 Alarm Limits

The user has the ability to set the flow computer Alarm Limits for the parameters listed in Table 12. There are many purposes for setting these limits. i.e., controlling well output, or sending digital signals.

Table 12 Alarm Limits

Parameter	Default Value	Units	Configurable	
			AGA-3 1985	AGA-3 1992
DP High Limit	2047.9688	In H2O	Yes	Yes
DP Low Limit	0	In H2O	Yes	Yes
Flow Rate High Limit	1,000,000	SCF/Hr	Yes	Yes
Flow Rate Low Limit	0	SCF/Hr	Yes	Yes
RTD High Limit	420	Degrees F	Yes	Yes
RTD Low Limit	0	Degrees F	Yes	Yes

SP High Limit	2047.9688	PSIA	Yes	Yes
SP Low Limit	0	PSIA	Yes	Yes

5.7.8 Reset Volume

When the volume accumulator is reset the flow computer will:

- Store time, date and previous accumulated partial calc periods volume into the historical record file
- Zero the remaining partial calc periods accumulations.
- Complete all computations for the present flow file daily record.
- Begin a new flow file daily record.
- Zero total volume accumulator and log the event with an accumulator value before zeroing out accumulator.

i **IMPORTANT NOTE:** Since the flow computer volume calculations are made each vol calc period, any changes you make during the period would affect the volume calculations (such as changing the orifice plate size) and be introduced into the calculations. To avoid introduced errors, it is recommended that Reset Volume command be used. This command forces the flow computer to perform volume calculations for the elapsed time since a previous volume calculation was made. A new partial period volume is added to the volume accumulator, which is logged as an event before it is reset to zero (0).

5.8 Startup the flow computer

5.8.1 Put the flow computer on-line

To put the flow computer on-line:

i **IMPORTANT NOTE:** To avoid a calibration shift, carefully follow these instructions.

1. Open both bypass valves
2. Close the vent to the atmosphere valve. This stabilizes the pressure on both sides of the cell.
3. Slowly open the high side orifice tap valve from the meter run.
4. Slowly open the low side valve.
5. Close both bypass valves once both the high and low sides are completely open.

The flow computer is on-line.

5.8.2 Setting flow computer temperature calculation

The flow computer temperature calculations can be set to the following conditions:

- Selection of Fixed Temperature Used in Calculations—causes fixed temperature to be used in flow calculations.
- Selection of Fixed Temperature and RTD Installed—will record RTD temperature while using fixed temperature in calculations.
- Selection of RTD Installed and not use Fixed Temperature—measures and uses RTD temperature in calculations. However, if a temperature error occurs such as an A/D error, the Fixed Temperature will be used for calculations.

i **IMPORTANT NOTE:** Selecting RTD Installed only, does not force the unit to use the flowing temperature in its calculations. You must turn off the Fixed Temperature selection.

5.8.3 Volume reset

Since the flow computer volume calculations are made each vol calc period, any changes you make during the period would affect the volume calculations (such as changing the orifice plate size) and be introduced into the calculations. To avoid

introduced errors, it is recommended that Reset Volume command be used. This command forces the flow computer to perform volume calculations for the elapsed time since a previous volume calculation was made. A new partial period volume is added to the volume accumulator, which is logged as an event before it is reset to zero (0).

5.8.3.1 Description

When the volume accumulator is reset the flow computer will:

- Store time, date and previous accumulated partial calc period volume into the historical record file.
- Zero the remaining partial calc period accumulation.
- Complete all computations for the present flow file daily record.
- Begin a new flow file daily record.
- Zero total volume accumulator and log the event with an accumulator value before zeroing out accumulator.

5.9 XFCG4 Standard Displays

5.9.1 Program Display

The single tube flow computer comes from the factory with a set default displays as shown below. By default, each display item remains on the display for 5 seconds. You have the ability to change this default to zero (item not displayed) or any value from 1 to 255 seconds. You are also able to change the engineering units, and data format for display purposes. Further instructions on programming the display system can be found in the PCCU32 Help Files. All display items and item groups are programmable and may be displayed by user defined parameters.

Table 13 XFC^{G4} Displayed Items

Description	Format	Note
DATE/TIME	MM/DD/YY HH:MM:SS	24 hour clock
YEST DP LO	NN PERCENT	Yesterday's Percent DP Low Limit Percent time below DP Low Set Point
YEST DP HI	NN PERCENT	Yesterday's Percent DP High Limit Percent time below DP High Set Point
FLOWRATE	NNNNNN.N SCF/HR	Current Flow Rate Programmable SCF or MCF or MMCF
ACCUM VOL	NNNNNN.NN MCF	Total Accumulated Volume Programmable SCF or MCF or MMCF
BATTERY	NN.N VOLTS	Battery Voltage Volts
DIFF. PRESS.	NNN.N IN. H2O	Differential Pressure Inches H2O
STATIC PRESS.	NNN.N PSIA	Static Pressure Static PSIA
FLOW TEMP	NN.N DEG. F	Flowing Temperature °F
YEST VOL	NNNN.N MCF	Yesterday's Volume Programmable MCF or MMCF
PERIOD VOL	NNNN.N SCF	Previous Period Volume Last volume calculation period volume
CHARGER	NN.N VOLTS	Charger Voltage
STATION ID	XXXXXXXXXX	10 Character alphanumeric identifier
DEVICE ID	XXXXXXXXXX	10 Character alphanumeric application or tube identifier

5.10 Key Pad

The XSeries models may be configured to include the optional keypad (see Figure 83) located on the front cover of the unit. The keypad entry allows the user to monitor programmed display items without using additional equipment (see Table 14).



IMPORTANT NOTE: For you to be able to view various display items, those items must be pre-programmed for keypad entry. You may either program all the display items for an application or individual display items within the application using PCCU32.

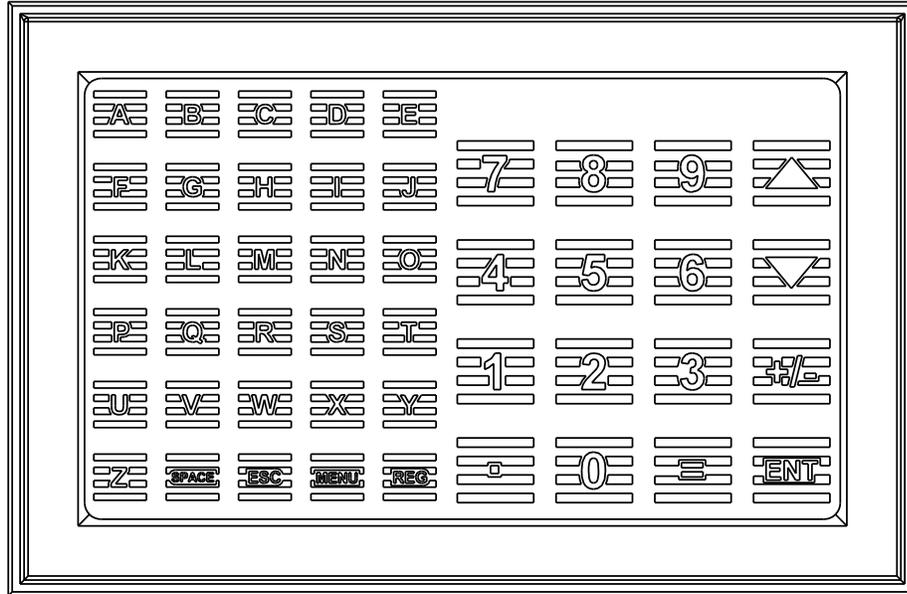


Figure 83 Optional Keypad (P/N 2100652-xxx)

Table 14 Optional Keypad Commands

Command	Description
Log On	Press the ENT button in the lower right hand corner of the keypad.
Security	When prompted, enter the 4-digit security code.
Viewing	Use the up and down arrow keys located in the upper right hand corner to scroll through the various instantiated applications (Multiple Tube Device).
Selection	When you have located the item you wish to change/display, press the ENT button.
Changing	After viewing the item for change, press the = key located in the lower right corner of the keypad. If entering a negative figure, press the ± key to toggle the minus sign on or off. Enter the new figure. Press Enter . NOTE: You may only change those values that are not live from this screen.
Validate	When setting up the XFC ^{G4} Display items, you may also set Data Limits so that when you change a programmed value, it must be valid between the high and low limit; otherwise it will return an invalid code. This is called Validate Keypad Entry and must be set to yes to be active.
Time Out	Based on how you have programmed the display setup, you may set the Scroll Lock Timeout . After the programmed time has elapsed, it will return to regular operation. This includes exiting the security system. To re-enter the keypad program, you will need to re-enter your security code.
SPACE	Pressing this button will have the effect of leaving a blank space(s) between characters during data entry.
MENU	Pressing the MENU button and then the group number and item number will take you directly to the specified screen.
REG	Pressing the REG button and then entering the application.array.index of the register you would like displayed will take you directly to the specified register.
ESC	To exit the program, press the ESC key in the lower left corner once for each level you are viewing. When the screen begins to scroll again, you have exited the program completely.

6 Service and maintenance

This Chapter provides standard maintenance information and instructions on how to remove and install components of the flow computer.

It is recommend that a regularly scheduled maintenance program is established. Establishing a maintenance program can help minimize downtime.

6.1.1 Cleanliness

Because a flow computer installation is primarily exposed to external environmental conditions, it is important that the equipment be regularly inspected for cleanliness, both externally and internally, as damage may occur. Foreign contaminants can cause damage to interior mounted components rendering flow computer inoperable.

6.2 Data preservation

Prior to performing maintenance on the flow computer, preserving and protecting data is very important. Data that should be preserved includes:

- Measurement data
- Alarm and event records
- Station configuration files
- Calibration data

The following subsections provide instructions for ensuring that all data is protected and preserved.

6.2.1 Data collection



IMPORTANT NOTE: Collected data includes the measurement data, the alarm and event codes. For more details click **Help** on the **Collect** screen.

To collect data:

1. Establish local communication with the XFC on the preferred port. See section 5.3, *Establishing Initial Local Communication* or 5.4.2, *Establish local point-to-point connection over Ethernet*.
2. Click the Collect icon on the PCCU toolbar.
3. On the navigation tree, select all the desired measurement application instances in the device. If collecting all data, select all check boxes.
4. Select the desired output types for the data. Data collected can be stored in files saved in the laptop used to perform the collection,
5. Select the desired time range. For the data for the entire collection capacity select **All Data**.
6. Click **Collect**.

6.2.2 Back up configuration files (save)



IMPORTANT NOTE: Backup configuration files include both configuration and calibration data.

Although there are multiple reasons to backup station configuration files, this procedure will focus on preserving the configuration files and calibration data for the purpose of restoring the flow computer following maintenance and troubleshooting procedures.

To safeguard the station and calibration data, back up files to a laptop hard drive or disk before performing any maintenance procedure. You can use backup files to restore the station and calibration data, allowing the flow computer to restart without the need for reconfiguration.

There are several methods for file backup. This section describes the configuration file backup and the update of the startup (cold) configuration from the **Save and restore** utility. Make sure to collect the XFC data as described in section 6.2.1, *Data collection*.

To backup configuration files:

1. Start PCCU. The main PCCU screen displays.
2. On the main PCCU screen, on the top menu, select **Operate > File Utilities> Save and Restore Utility** or click the **Save and Restore Utility** icon on the toolbar.
3. Click **Save Station Files** at the bottom of the screen. The Save Station files dialog box displays.
4. In the Save to field, verify or define the location (path) to save the backup file. Take note of the file location for later retrieval. The default path stores the backup files in the StationFiles directory under the PCCU installation directory. The backup file default name is the station ID with the .xfc extension.
5. Click **OK**.
6. Wait for the backup to complete. Progress status messages display at the bottom of the screen.
7. When the upload complete message displays, select **Yes** to restore (copy) the warm configuration to tfCold.



IMPORTANT NOTE: It is recommended that the startup (cold) configuration is updated with the running (warm) configuration to ensure that the XFC has the most up-to-date configuration should it experience a cold start.

8. Wait for the tfCold update to complete. Progress status messages display at the bottom of the screen.
9. Verify that the update is complete by expanding tfCold on the navigation tree. Compare the contents of tfCold with tfData and ensure the configuration files now show in tfCold.

6.2.3 Restoring configuration files (Restore)

The Restore function sends the backup file to the flow computer to restore operation, if the configuration is lost or corrupted. This procedure assumes that a configuration file backup exists (see section 6.2.2, *Back up configuration files (save)*).

To restore configuration and calibration data files:

1. Start PCCU. The main PCCU screen displays.
2. On the main PCCU screen, on the top menu, select **Operate > File Utilities> Save and Restore Utility** or click the **Save and Restore Utility** icon on the toolbar. The Save and Restore screen displays.
3. Click **Restore Station Files** at the bottom of the screen. The Restore Station Files dialog box displays.
4. Define or verify the file path where the backup file is located. If there are several backup files, make sure to select the desired one.
5. Click **OK**.
6. Wait for the restore to complete. Progress status messages display at the bottom of the screen.
7. Perform a cold-start (cold boot) to load the restored data. Select the cold start method in section 6.4, *Performing a Cold Boot*, page 111.
8. When the XFC completes its boot sequence, verify the unit is functioning properly.

6.3 Performing a Warm Boot

A warm boot is the result of cycling the power off the board without disconnecting, or disabling the lithium battery. No data should be lost. A warm boot can be initiated from a hardware or software standpoint. The following will take the user through both methods.

6.3.1 Hardware Warm Boot

6.3.1.1 Method 1

To perform the first warm boot method:

1. Open the door to the unit.
2. Locate the Reset button, directly below the Ethernet plug connector on the left-hand side of the board (Figure 84).

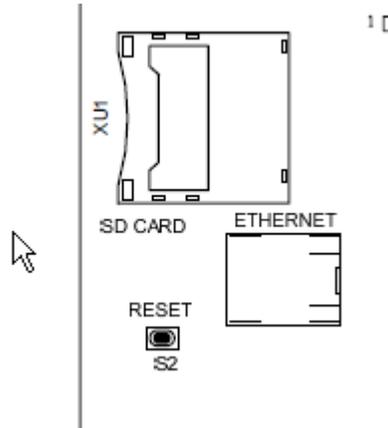


Figure 84: Electronic reset button S2

3. Press the Reset button for approximately five seconds. The unit will warm boot.

6.3.1.2 Method 2

To perform the second warm boot method:

1. Open the door to the unit.
2. Ensure that there is voltage on the battery and that the lithium battery jumper is enabled.



NOTICE – Loss of Data. If lithium battery voltage is insufficient and/or the battery jumper is in the disabled position, do not attempt a Warm Boot. Continuing with this process without both conditions being met will result in a Cold Boot and all historical data will be lost.

3. Remove power to the board and then reconnect. This will initiate a warm boot.

6.3.2 Software Warm Boot

6.3.2.1 Method 1

To perform the first software warm boot method:

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU.
3. Select **Entry Mode** at the Totalflow splash screen.
4. Click the **32-Bit Loader** icon on the toolbar.
5. Select the **Reload** button.
6. Ensure that all of the checkmarks have been removed from the software options.
7. Check the boxes in the options list beside **Shutdown Flash** and **Start Flash**.

8. Select the appropriate connection type from the available drop-down menu, in the lower left hand portion of the screen.
9. Click the **Start** button to begin.



IMPORTANT NOTE: There is a chance that the user will see a PCCU32 dialog box display that informs them that the Target Device Loader is not working. The user will need to follow the dialog box instructions to warm boot the system.

6.3.2.2 Method 2

To perform the second warm boot method:

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable
2. Select **Entry** mode within PCCU.
3. Click the **Terminal** icon on the PCCU toolbar.
4. Move cursor to the terminal prompt (->)
5. Type in the following: "BOOT=WARM".
6. Press Enter on the keyboard to initiate the warm boot.

The flow computer has been warm booted.

6.4 Performing a Cold Boot

A cold boot occurs when power is removed from the board, including the lithium battery backup. A cold boot can be initiated from a hardware or software standpoint. The following will take the user through both methods.



NOTICE – Loss of data. A cold boot will cause a loss of all historical data, and any changes made that have not yet been saved to TFCold.

6.4.1 Hardware Cold Boot

To perform a hardware cold boot:

1. Open the door to the flow computer.
2. Locate the enable/disable jumper for the lithium backup battery. Located on the lower left-hand side of the board (Figure 85).

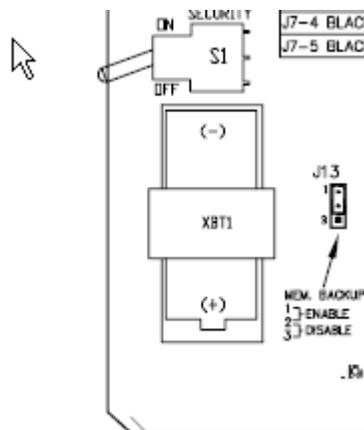


Figure 85: Memory backup enable/disable

3. Move the jumper to the 2-3 position.

4. Locate the reset button on the upper left-hand side of the board (Figure 84).
5. Press the reset button for approximately 5 seconds. The flow computer will cold boot.

6.4.2 Software Cold Boot

6.4.2.1 Method 1: Cold boot from the loader

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable
2. Open PCCU. The user needs to ensure that they are not in **Entry** Mode and are at the Totalflow splash screen.
3. Click the **32-Bit Loader** icon on the toolbar.
4. Select the **Reload** button.
5. Select the appropriate connection type from the available drop-down menu, in the lower left hand portion of the screen.
6. Ensure that all the checkmarks are removed from the software options.
7. Place a checkmark by **Shutdown Flash**, **Delete tfData** and **Start Flash**. A prompt will display that warns that a cold boot is occurring.
8. Click **Yes** to initiate the cold boot.



IMPORTANT NOTE: There is a chance that the user will see a PCCU32 dialog box display that informs them that the Target Device Loader is not working. The user will need to follow the dialog box instructions to warm boot the system.

6.4.2.2 Method 2: Cold boot from the terminal screen

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable
2. Select **Entry** mode within PCCU.
3. Click the **Terminal** icon on the PCCU toolbar.
4. Move the cursor to the terminal prompt (->).
5. Type in the following: `BOOT=COLD`.
6. Press Enter on the keyboard to initiate the cold boot.

6.5 Changing XFCG4 Clock

Changing the flow computer clock when measurement applications are instantiated, could affect the time stamps of log period entries. To protect integrity of accounting audit trails, the flow computer handles clock changes as follows:

6.5.1 Clock change not crossing an hour boundary

When next log period entry is made, clock is not altered.

Example: If present time is 4:15 p.m. and clock is changed to 4:05 p.m. of the same day, the daily flow record is the same. Entry reflects averages accumulated over a 70 minute time period (15 minutes plus 55 minutes).

6.5.2 Forward clock change crossing an hourly boundary

Forces a log period entry for part of hour that has accumulated since last hourly entry. XFC^{G4} then advances to newly defined data flow record boundary and begins maintaining balance of days' data in newly defined boundary.

Example: If present time is 4:55 p.m. and clock is changed to 5:05 p.m. of the same day, the entry reflects only a 55 minute average accumulation. Then a new flow record is written and this period is also based on a 55 minute accumulation.

6.5.3 Backward clock change crossing an hourly boundary

Hourly entry is made for part of hour that has accumulated since making last hourly entry. This is same as for a Forward Clock Change Crossing an Hourly Boundary. The flow computer advances to a new day's data flow record and maintains balance of day's data in new record.

Example: If present time is 5:05 p.m. and clock is changed to 4:55 p.m. of the same day, the log period record entry reflects only a 5 minute average accumulation. Then a new flow record is written and this log period is based on a 60 minute accumulation.



IMPORTANT NOTE: A backward clock change uses two (2) records to maintain data integrity. This assures that previously recorded data is not overwritten.

If it is necessary to make small backward time changes, less than one (1) hour, user should wait until current hour has progressed far enough to make change that does not cross an hour boundary.

6.6 Replacing the lithium battery

This section presents the procedures for replacing the onboard lithium battery which maintains the SRAM memory. Replacing the lithium battery should only be done while the flow computer is fully powered by the battery pack or charging system. SRAM memory stores historical flow data.

To replace the lithium battery:



NOTICE – Loss of data. Do not remove power to unit. Loss of power to unit will perform a Cold Start when lithium battery is removed. All historical data and any changes to the configuration that have not yet been saved to TfCold will be lost.

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU.
3. Collect the Data from the unit as described in section 6.2.1, *Data collection* (page 108).
4. Back up configuration files as described in section 6.2.2, *Back up configuration files (save)* in page 108.6.2.2
5. Open the XFC enclosure door.
6. Remove the lithium battery cover from the battery bracket by inserting the blade of a slotted screwdriver between the cover and the side of the bracket.
7. Grasp the battery on each side and pull from the bracket. The positive end of the battery is at the bottom end of the bracket.
8. Insert the new lithium battery into the bracket with the positive end of the battery down.
9. Reinsert the battery cover.

6.7 Replacing XFCG4 Battery Pack

This section presents the procedures for removal and installation of the battery pack. To access the battery pack, open the door. Battery pack is located behind a front mounted keeper plate. On the XFC^{G4} 6713/6714 models, the Battery is located directly behind a hinged plate on which the I/O module DIN rails are mounted if applicable.



IMPORTANT NOTE: To extend the life of the battery pack, fully charge the battery prior to installation. A system using solar panels may not fully charge the battery. Also a fast charge, which the solar panel can't provide, improves the life of the battery.

To recharge a battery, a quick charge will remove the buildup in the battery much more effectively than a “trickle charge”. A battery slowly drained by low light conditions on a solar charged system or setting in storage for instance, will be less likely to recover than a battery pack that was quickly discharged from a short for instance. Store batteries in a cool environment for less drainage.

6.7.1 Step by Step Instructions

In the following procedure, the common name for a component or its jumper number if available (abbreviated J) or part is followed by a number in parentheses. This refers to the call out item number referenced on each drawing.

To replace the flow computer battery pack:

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU.
3. Collect the data from the unit as described in section 6.2.1, *Data collection* (page 108).
4. Back up configuration files as described in section 6.2.2, *Back up configuration files (save)* in page 108.6.2.2
5. Ensure the J13 memory backup jumper covers the top two pins (Figure 86). This enables the memory backup.
6. Verify "LL" battery alarm is not being displayed on the LCD
7. Measure the lithium battery with a Multi Meter ensuring it is > 3.0V.

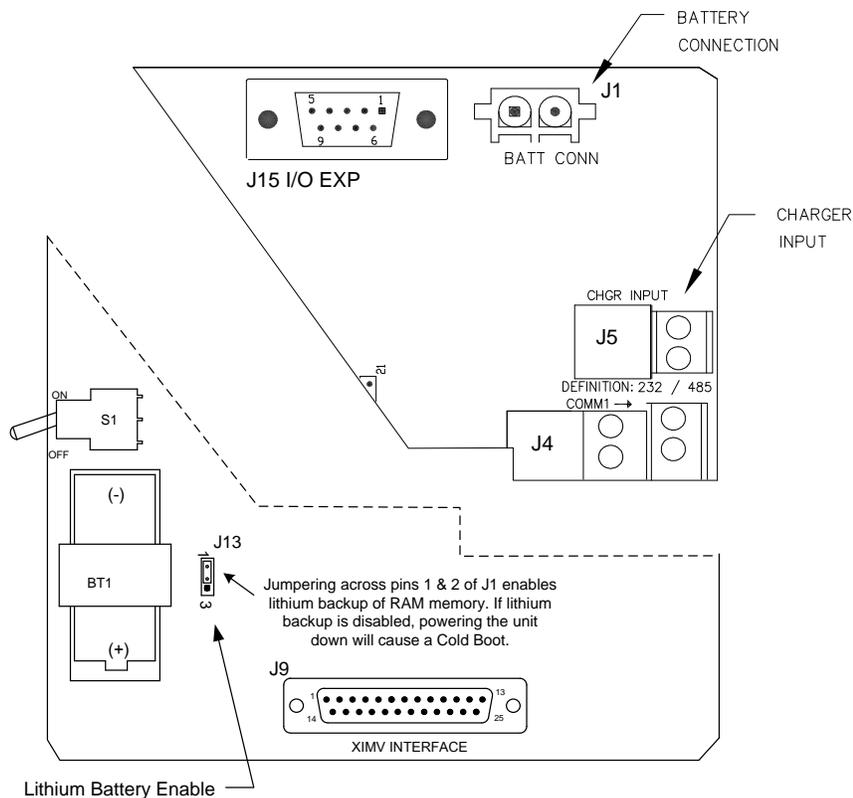


Figure 86: XFC^{G4} Electronic Board Maintenance Connections

! **NOTICE – Loss of data.** When removing the battery, do not remove, or disable the lithium battery from the board. This will prevent any historical data from being lost.

8. Disconnect the battery charger from the XFC^{G4} panel terminals EXT CHGR +/- J5.
9. Disconnect the Battery Cable from the XFC^{G4} panel connector J1, before removing the battery pack.
10. Loosen the three mounting screws. Note: It is not necessary to completely remove the screws.
11. Remove the battery compartment cover (Figure 87: item 18).

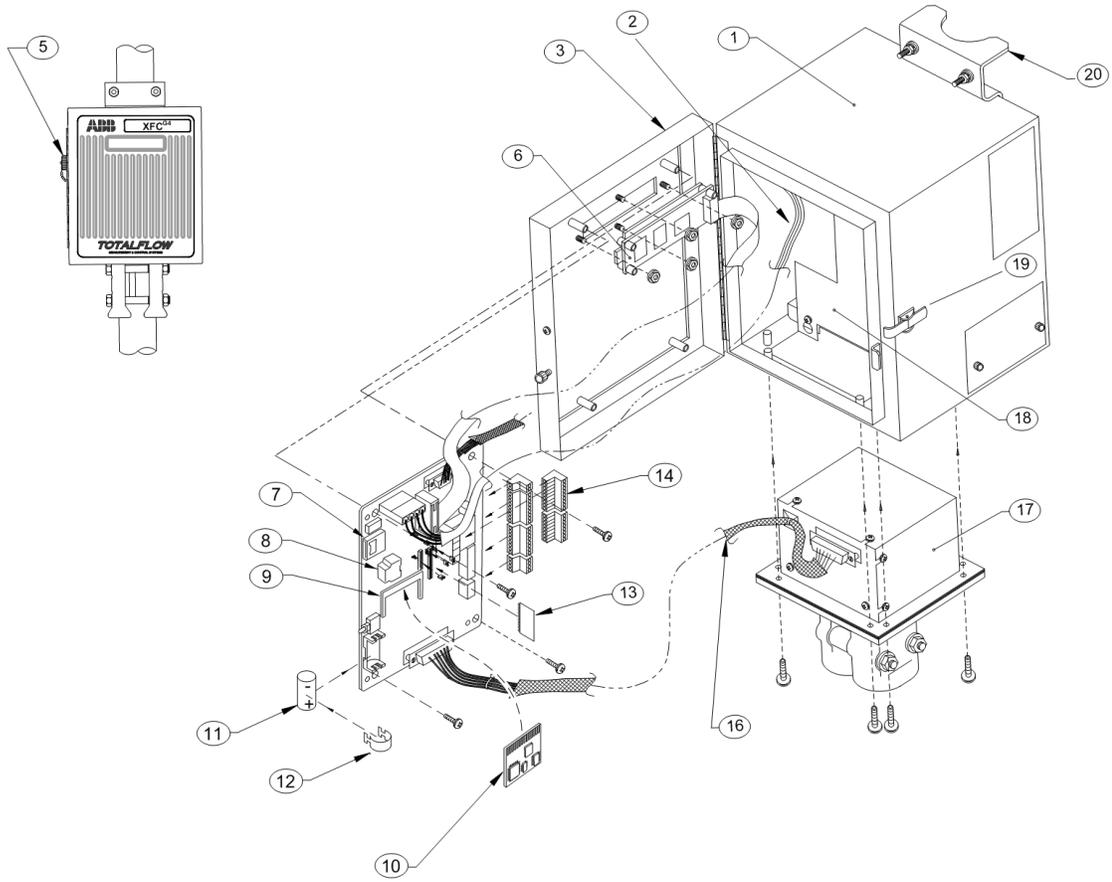


Figure 87: XFC^{G4} 6410 Component/Cable Locations

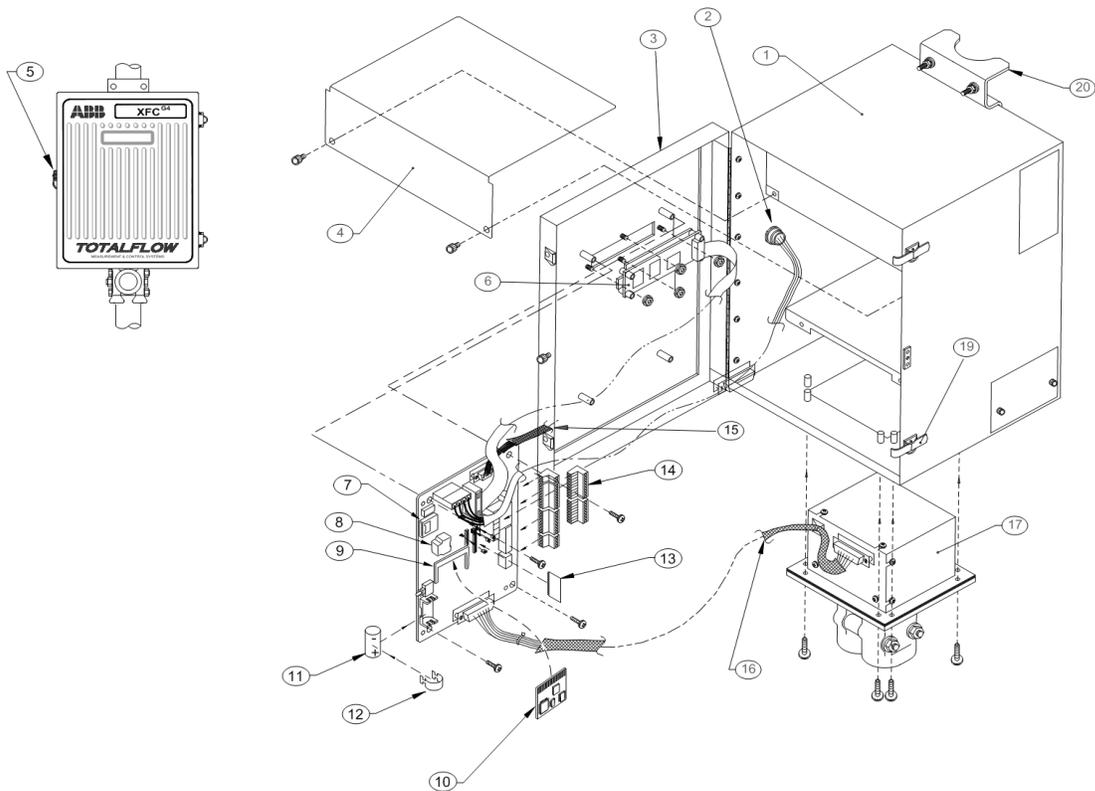


Figure 88 XFC^{G4} 6413 Component/Cable Locations

Table 15: XFC^{G4} 6410 and 6413 Component Identifications

ID Number	Description
1	Enclosure
2	PCCU Internal Cable
3	Door
4	Radio Compartment Cover (6413/6414 only)
5	External PCCU Connector
6	LCD Display
7	SD Card
8	Ethernet Connector
9	CPU Engine Card Connector
10	CPU Engine Card
11	Lithium Battery
12	Battery Cover
13	Communication Module
14	Phoenix Connector Plug Module
15	TFIO Module Interface Cable (6413/6414 only)
16	XIMV Interface Cable (not on pulse models)
17	XIMV (not on pulse models)
18	Battery/Compartment Cover
19	Door Latch
20	Pipe Mounting Bracket

12. Remove battery pack from battery compartment.

13. Insert new battery pack into battery compartment. Battery pack must be positioned so its longest dimension fits snugly against keeper plate when plate is installed.
14. Reinstall the keeper plate and tighten the three keeper plate mounting screws. Or close the hinged plate and insert and tighten the upper and lower plate keeper.
15. Reconnect the battery pack cable to the flow computer panel connector J1 (Figure 86, *XFCG4 Electronic Board Maintenance Connections*, page 114).
16. Reconnect the battery charger to the flow computer panel terminals EXT CHGR +/- terminals J5 (Figure 86, *XFCG4 Electronic Board Maintenance Connections*, page 114).
17. Close the flow computer door
18. Check the door mounted LCD for normal operational readings.

6.8 Replacing the Main Electronic Board

The XSeries main electronic board is mounted to the backside of the flow computer access door on standoffs (Figure 87: or Figure 88). On models XFC^{G4} 6713 and XFC^{G4} 6714, the XFC^{G4} board is mounted below the LCD Screen.



CAUTION – Property damage. The flow computer board is susceptible to damage by static electricity or improper handling. To prevent this from occurring, a grounding strap should be worn.

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

Before removal of flow computer board, save historical flow data and configuration file to an external storage medium. Failure to do so could result in data loss when the board is removed.

To replace the circuit board:

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU
3. Collect the Data from the unit as described in section 6.2.1, *Data collection* (page 108).
4. Back up configuration files as described in section 6.2.2, *Back up configuration files (save)* in page 108.6.2.2
5. Verify “LL” battery alarm is not being displayed on the LCD.
6. Measure the lithium battery with a Multi Meter ensuring it is > 3.0V.
7. Disconnect the battery charger from terminals EXT CHGR +/- J5 (Figure 89, *XFCG4 Removable Board Connections for Maintenance*, page 119).
8. Disconnect the Battery Cable from panel connector J1.
9. Disconnect the communication connector(s) J3, J18 or J15 (Figure 89).
10. Disconnect the XIMV Port connector J9.
11. Disconnect the XFC^{G4} LCD port connector J2 (Figure 89).



NOTICE-Equipment Damage. DO NOT lift connectors upward, damage may result.

12. Slide, to the right, green terminal strips J4, J6, J7, and J8 (Figure 89) from their associated flow computer panel Connector.
13. Remove the cable from J15 (Figure 89). If optional TFIO modules are installed.



IMPORTANT NOTE: Pay particular attention to J4 and J6 connectors and label if necessary to insure correct installation when replacement board is in place.

14. Remove the cable from J16 (Figure 89). If the unit has the optional keypad.
15. Remove the four mounting screws and lock washers securing the flow computer panel (Figure 87: or Figure 88) to the door mounted standoffs.



CAUTION – Equipment Damage. When removing the flow computer board, grasp its outer edges. This prevents damage to circuitry and components.

16. Replace and secure the flow computer panel on the four standoffs and secure in place using four screws and lock washers. Do not over tighten the screws. Doing so could cause damage to the panel or associated circuitry.
17. Reinstall the connectors removed in Steps 5 through 11 in reverse order.

The circuit board is now reinstalled. If the replacement board does not include a new engine card, see section 6.9, *Replacing the CPU Engine Card*. If restoring the configuration files, see section 6.2.3, *Restoring configuration files (Restore)*, in page 109.

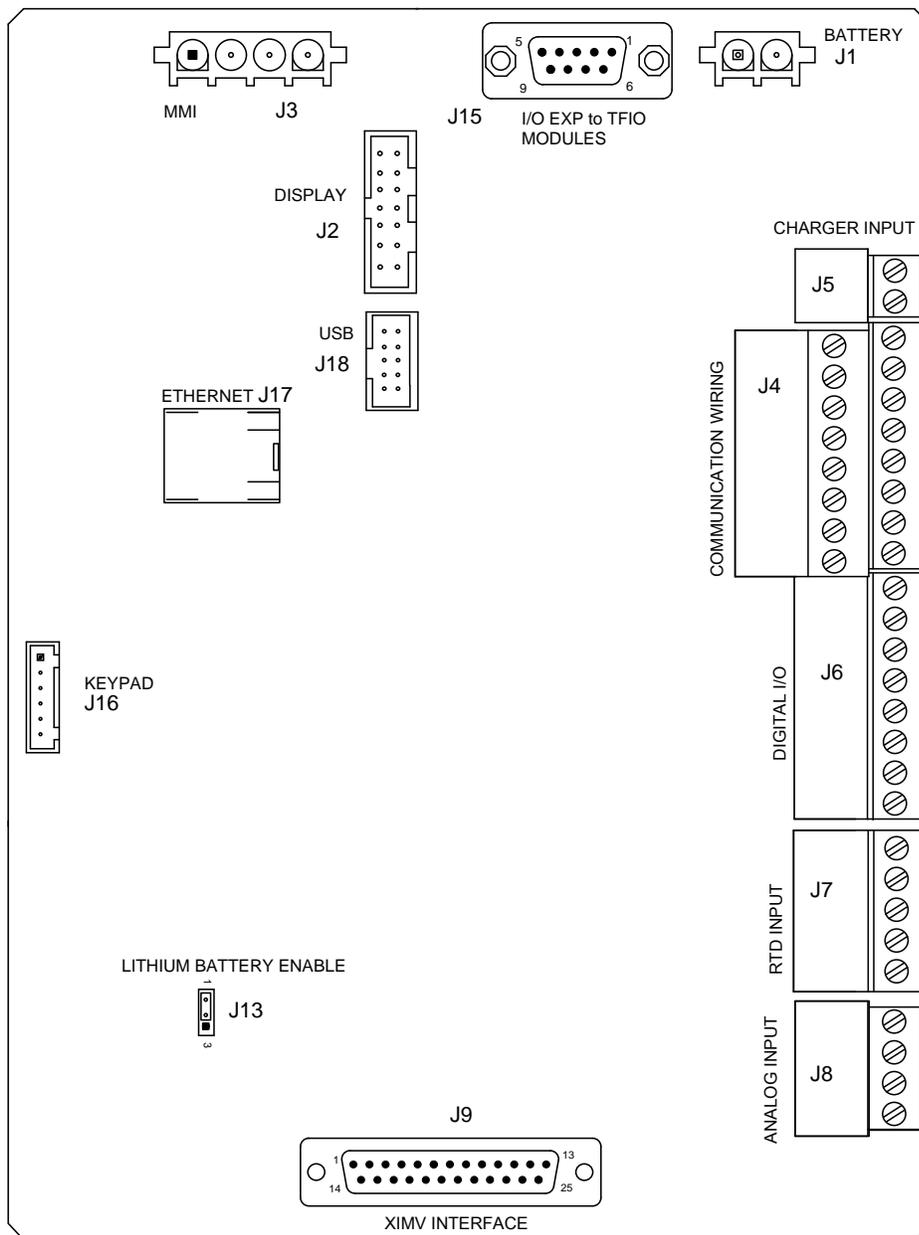


Figure 89: XFC^{G4} Removable Board Connections for Maintenance

6.9 Replacing the CPU Engine Card

One of the major differences in the XFC^{G4} is the incorporation of a 32-bit CPU engine card. This engine card holds the main processor, as well as the Flash, RAM and serial EEPROM. Should the engine card require replacing, perform the following procedure.

To replace the CPU Engine Card:



NOTICE – Loss of data. The engine card holds configuration data. The configuration is in non-volatile Flash, but it is always a good idea to keep a copy of your configuration files on your laptop. See section 6.2.2, *Back up configuration files (save)*, on page 108 and section 6.2.3, *Restoring configuration files (Restore)*, on page 109.

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU

3. Collect the data from the unit, see section 6.2.1, *Data collection*, on page 108.
4. Back up the configuration files see section 6.2.2, *Back up configuration files (save)*, on page 108.
5. Ensure the J13 (Figure 86) memory backup jumper covers the top two pins.
6. Verify "LL" battery alarm is not being displayed on the LCD.
7. Measure the lithium battery with a Multi Meter and ensure it is > 3.0V.
8. Disconnect the battery charger from the panel terminals EXT CHGR +/- J5 (Figure 86, *XFCG4 Electronic Board Maintenance Connections*, page 114).
9. Disconnect the Battery Cable from the panel connector J1 (Figure 86).



CAUTION – Equipment Damage. Gently spread the tabs with fingers. Do not use tools. Engine card damage may result.

10. Spread the connector fingers extending down from the CPU engine card connector. The engine card will spring up at a 30 degree angle from the main board.
11. Pull the engine card out (Figure 90).

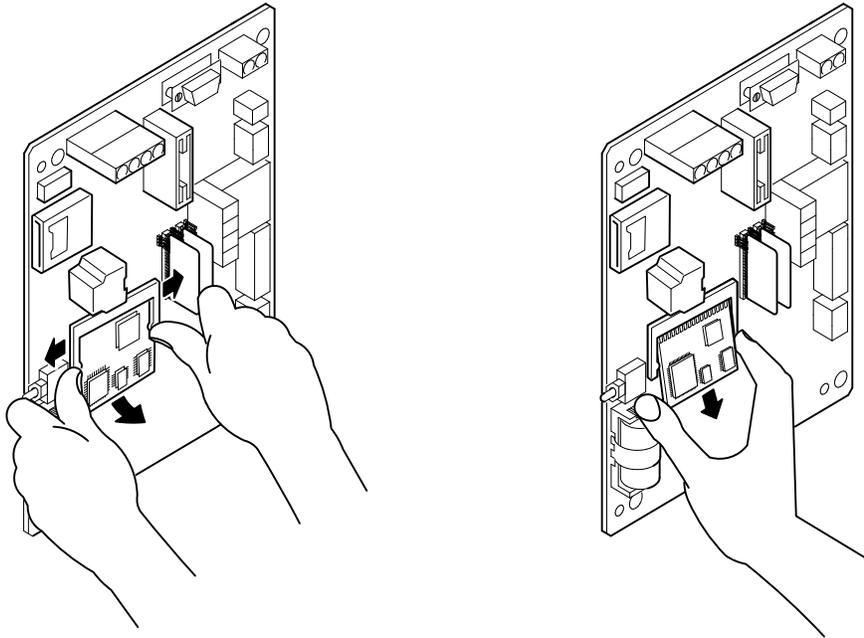


Figure 90: CPU Engine Card Removal

12. Insert the new engine card at a 30 degree angle (Figure 91).
13. Press the engine card in until the gold plated edge connector pins at the top of the engine card are no longer visible.
14. Press the engine card down toward the main panel until a click is heard.
15. Restore station files as described in section 6.2.3, *Restoring configuration files (Restore)*, on page 109.

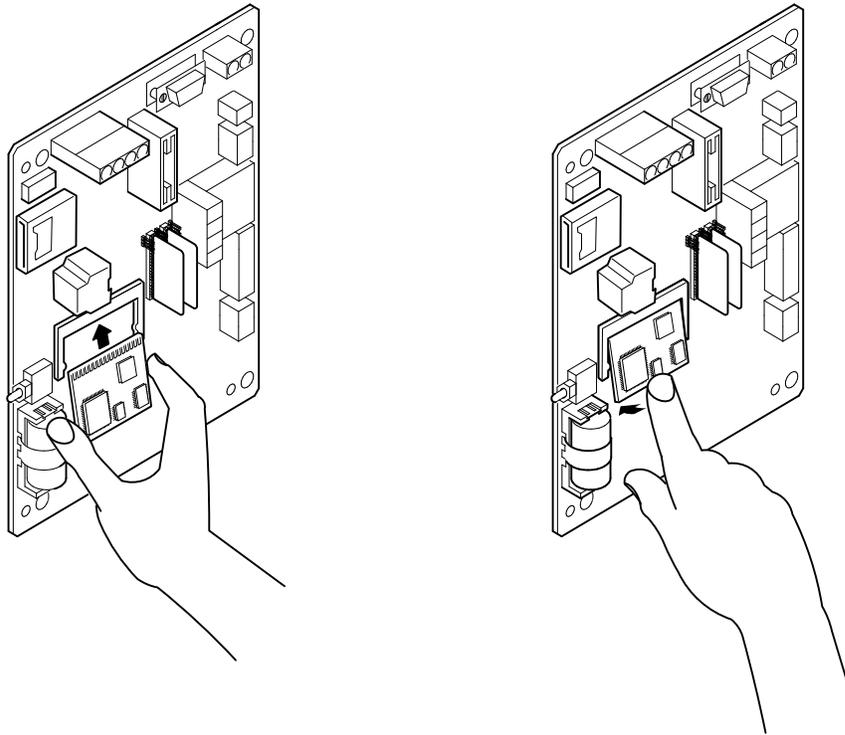


Figure 91: CPU Engine Card Replacement

6.10 Replacing Liquid Crystal Display (LCD) Board

The LCD board is mounted on the backside of hinged doors behind the flow computer board. To access and remove Display board, perform the following procedures.

Equipment needed:

- Phillips Head Screwdriver
- 3/16" Nut Driver

To replace the Liquid Crystal Display (LCD) board:



NOTICE – Loss of data. Do not remove the board mounted Lithium battery since it provides power to the RAM. It is recommended that historical flow data be downloaded before accessing and removing LCD board to prevent potential loss of stored data.

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU.
3. Collect the Data from the unit as described in section 6.2.1, *Data collection* (page 108).
4. Back up configuration files as described in section 6.2.2, *Back up configuration files (save)* in page 108.
5. Ensure the J13 (Figure 86) memory backup jumper covers the top two pins.
6. Verify "LL" battery alarm is not being displayed on the LCD or measure the lithium battery and make sure it is > 3.0V.
7. Disconnect the battery charger from the terminals EXT CHGR +/- J5 (Figure 86).
8. Disconnect the Battery Cable from the connector J1 (Figure 86).
9. Disconnect the LCD port connector J2 (Figure 89).
10. Disconnect the communication connector(s) J3, J15 or J18 (Figure 89).



IMPORTANT NOTE: If the unit is a 6713 or a 6714, removal of Electronic Board is not required, please skip to Step 16. Otherwise, continue to the next step.

11. Disconnect the XIMV Port connector J9 (Figure 89).
 12. Slide, to the right, green terminal strips J4, J6, J7, and J8 (Figure 89) from their associated connector. Do not lift connectors upward. Pay particular attention to the J4 and J6 connectors and label if necessary to ensure correct installation when the replacement panel is in place.
 13. Remove the cable from J15, if TFIO modules are installed (Figure 89).
 14. Remove the cable from J16, if the flow computer has the installed optional keypad (Figure 89).
 15. Remove the four mounting screws and lock washers, using a Phillips head screwdriver, securing the circuit board (Figure 87: or Figure 88) to the door mounted standoffs.
-



CAUTION – Property damage. When removing the circuit board, grasp its outer edges. This prevents damage to circuitry and components.

16. Place the electronic panel on a safe, clean non-metal surface.
 17. Remove the four display panel hexagon mounting standoffs, using a 3/16" nut driver.
 18. Lift the panel from the door mounted standoffs.
 19. Install the replacement screen and secure with standoffs.
-



CAUTION – Property damage. Do not to over-tighten nylon standoffs, has this will strip the threads inside.

20. Replace and secure the circuit board on the four standoffs and secure in place using the four screws and lock washers.
-



CAUTION – Property damage. Do not to over-tighten screws, circuit board damage may result.

21. Reinstall the connectors removed in Steps 9 through 13 in reverse order.
 22. Reconnect the LCD port connector J2 (Figure 89).
 23. Reconnect the battery cable to connector J1 (Figure 89).
 24. Reconnect the battery charger to EXT CHGR +/- J5 (Figure 89).
 25. Once the flow computer has powered up, it may be necessary to adjust the LCD contrast.
 26. If needed, restore the configuration as described in see section 6.2.3, *Restoring configuration files (Restore)*, page 109.
-



IMPORTANT NOTE: To adjust display contrast, use an extra small screw driver to turn potentiometer R32 completely clockwise, then move screw back counter clockwise until screen is readable.

6.11 Replacing XIMV



NOTICE – Warranty Violation. Under no circumstances shall the XIMV cover be removed. Removal of this cover, and entry into interior of XIMV, voids XIMV warranty. If the XIMV requires servicing, the entire assembly, including cable, must be removed from flow computer, securely packaged for shipping and returned to Totalflow.

Equipment needed:

- Flat blade screwdriver
- Crescent wrench

To replace the XIMV:

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
 2. Open PCCU
 3. Collect the Data from the unit as described in section 6.2.1, *Data collection* (page 108).
 4. Back up configuration files as described in section 6.2.2, *Back up configuration files (save)* in page 108.
 5. Ensure the J13 (Figure 89) memory backup jumper covers the top two pins.
 6. Verify “LL” battery alarm is not being displayed on the LCD display.
 7. Measure the lithium battery with a Multi Meter to ensure it is > 3.0V.
 8. Disconnect the battery charger from terminals EXT CHGR +/- J5 (Figure 89).
 9. Disconnect the Battery Cable from connector J1 (Figure 89).
 10. Equalize the pressure to the XIMV using the meter run installed Manifold high/low control valves, (Figure 92:).
 11. Close off both lines using the high/low tap valves. These two valves connect the meter run high/low output lines to the flow computer.
 12. Vent the manifold to atmosphere using the vent valve.
 13. Disconnect the high/low manifold lines from the XIMV.
-



CAUTION – Property damage. Do not disconnect the XIMV cable with power connected. Damage may result.

14. Disconnect the XIMV cable J9 (Figure 89) from the panel.
 15. Remove the screws holding the XIMV cable to the panel using a slotted screwdriver.
 16. Loosen the 2” mounting post clamps.
 17. Rotate the flow computer a sufficient distance to allow removal of the XIMV. Clearance of approximately 7” is required for removal.
 18. Tighten the clamps after rotation, to hold the flow computer in place before removing the XIMV.
-



CAUTION – Property damage. When rotating the flow computer, be careful not to place twisting stress on attached cables.

19. Access the mounting hardware from underside of the flow computer enclosure.
20. Remove the eight mounting screws, washers and lock washers securing the XIMV to the cabinet, using a Phillips screwdriver.
21. Tilt the XIMV slightly upwards.
22. Remove the unit.

23. Remove any remaining gasket that is adhered to the bottom of the cabinet.



IMPORTANT NOTE: Bottom of cabinet should be clean and free of any materials that may keep the new gasket from sealing during installation of replacement XIMV.

24. Perform steps 10 to 14 in reverse order.

25. Tighten securely the eight mounting screws.

26. Reconnect the power by performing steps 5 and 6 in reverse order.



IMPORTANT NOTE: Before placing unit back into operation, the flow computer must be calibrated as described in section 6.13, *Calibration*, page 126.

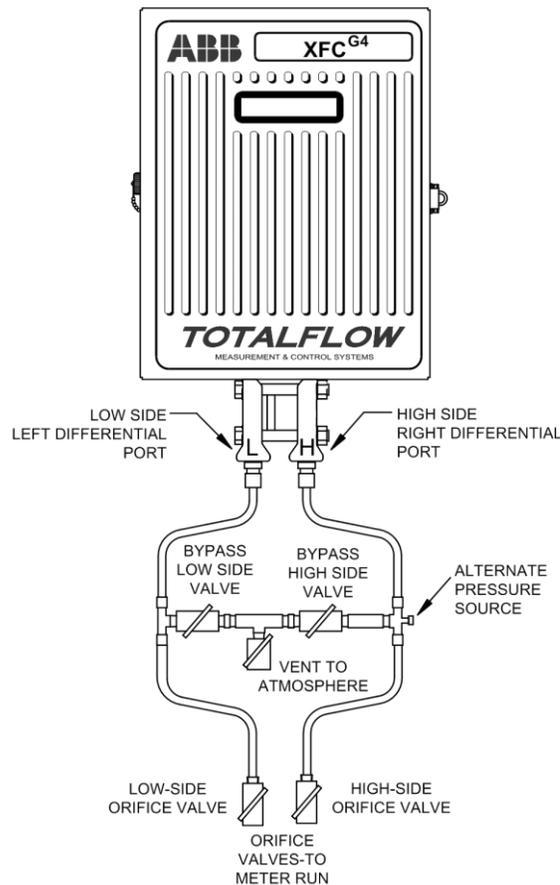


Figure 92: Flow Computer with Discrete Manifold

6.12 Replacing Static Pressure Transducer



IMPORTANT NOTE: Under no circumstances shall the XIMV static pressure transducer cover be removed. Removal of this cover, and entry into interior of static pressure transducer, voids the warranty. If the static pressure transducer requires servicing, the entire assembly, including cable, must be removed from the flow computer, securely packaged for shipping and returned to Totalflow.

Equipment needed:

- Multi Meter (MM)
- Crescent wrench

-Phillips head screwdriver

To replace the static pressure transducer:



DANGER – High pressure gas. Pressurized natural gas is present in the measurement pipeline and equipment. A possibility exists for natural gas to escape from the pipeline or tubing. Only properly trained and authorized personnel should work in hazardous locations.

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
 2. Open PCCU.
 3. Collect the Data from the unit as described in section 6.2.1, *Data collection* (page 108).
 4. Back up configuration files as described in section 6.2.2, *Back up configuration files (save)* in page 108.
 5. Ensure the J13 (Figure 89) memory backup jumper covers the top two pins.
 6. Verify “LL” battery alarm is not being displayed on the LCD display.
 7. Measure the lithium battery with a Multi Meter, ensure it is > 3.0V.
 8. Disconnect the battery charger from terminals EXT CHGR +/- J5 (Figure 89).
 9. Disconnect the Battery Cable from connector J1 (Figure 89).
 10. Close the user installed static pressure transducer impulse line isolation valve.
 11. Close and isolate the static pressure to transducer (Figure 93:).
 12. Close and isolate the pressure to transducer using the user installed static pressure transducer calibration three way valve.
 13. Open the test port to vent static pressure from the transducer.
 14. Remove the static pressure impulse line connections from the transducer.
-



CAUTION – Equipment damage. Do not disconnect XIMV cable with power connected. Damage may result.

15. Disconnect the transducer cable from the circuit board.
16. Remove the mounting screw from XIMV cable with a flat blade screwdriver.
17. Remove the cable from static pressure transducer connector. If not pipe mounted skip to step 21.
18. Loosen the pipe mounting bolts until the unit may be rotated.
19. Rotate a sufficient distance to allow removal of the static pressure transducer.
20. Tighten the clamps after rotation to hold the flow computer in place before removing the static pressure transducer.
21. Loosen the mounting bolts until unit can be lifted off of pulse box.

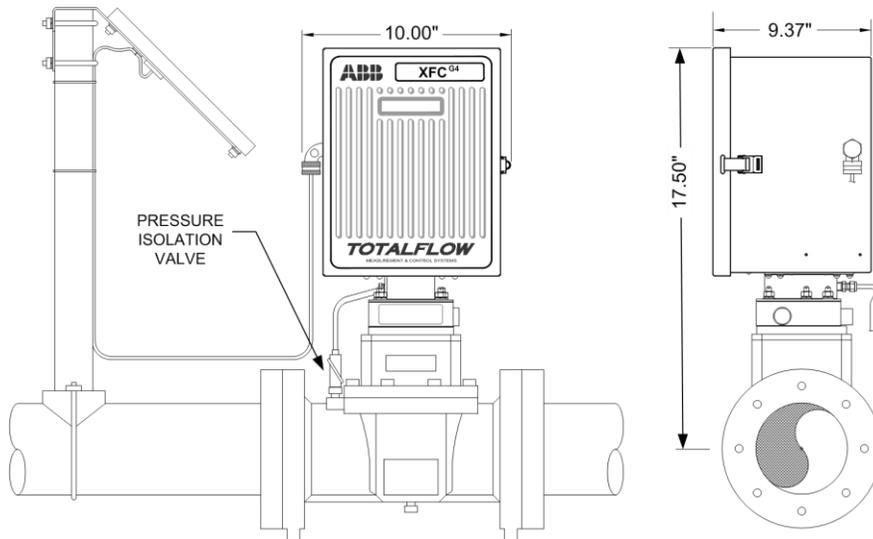


Figure 93: Direct Mount Pulse Meter with Static Pressure Transducer

22. Access mounting hardware from underside of the flow computer.
23. Remove eight mounting screws, using a Phillips head screwdriver, washers and lock washers securing static pressure transducer to the cabinet.
24. Tilt static pressure transducer slightly upwards then remove unit.

i **IMPORTANT NOTE:** A weather sealing gasket is affixed to top side of static pressure transducer mounting flange. During reinstallation of transducer, weather sealing gasket must be reinstalled between the transducer and bottom of the enclosure to keep out moisture and dust.

25. Perform steps 2 to 15 in reverse order to install replacement static pressure transducer.
26. Securely tighten the eight mounting screws.

The transducer is now installed.

i **IMPORTANT NOTE:** Before placing static pressure transducer back into operation, the flow computer must be calibrated as described in section 6.13, *Calibration*, page 109.

6.13 Calibration

The calibration mode allows the user to calibrate, check and zero the static and differential pressure. In addition, this mode allows the user to set the (bias) for the resistance temperature detector (RTD). During the initial calibration, the parameters shown in Table 16: will need to be configured.

Table 16: Calibration Configurable Parameters

Parameter	Default Value	Units
RTD Bias	0.00	Degrees F
RTD Installed	No	
Temperature Base (Tb)	60.000	Degrees F
Use Fixed Temperature (TF)	No	

6.13.1 Required Test Equipment

The following test equipment is required to calibrate the XFC^{G4} XIMV:

- PCCU32 version 7.05.5 or later
- Deadweight tester or equivalent calibration standard
- Test Gauge capable of dual range measurement (PSIG and Inches)
- Barometer or another means which can determine barometric pressure
- Nitrogen or compressed air source



IMPORTANT NOTE: If a method other than the 'compressed nitrogen/deadweight tester' method is used to calibrate static pressure cell, the user must ensure that the prescribed flange tap valves are blocked to prevent false differential pressure from being applied to DP cell. Also ensure that both high and low sides are pressured up during SP calibration.

6.13.2 Hold Mode

When calibrating the XIMV or setting up a fixed temperature, PCCU will instruct the flow computer to ignore live values for the flow calculations for the period of time the flow computer is being calibrated. This prevents real time flow calculations from being affected during the calibration. During this time the flow computer uses SP, DP and temperature captured at the time calibration mode was entered. (This is called the Hold mode.)

To exit the Hold mode:

1. Exit calibration mode.
2. Disconnect PCCU cable at the local connector.



IMPORTANT NOTE: Totalflow recommends performing a five point check before and after calibration. During normal operation, either cell could be knocked out of calibration (typically due to a slug of liquid). WinCCU, the host software, is capable of recalculating the volume based on the differences between the previous five point check and the current five point check.

After a secure audit trail is archived, WinCCU recalculates the flow volumes based on the previous and current markers, this allows more accurate results of the flow volume.

6.13.3 Static Pressure (SP) Calibration Checks

The XFC^{G4} allows for checking the static pressure calibration and log the pressure marker check points. The check should be performed prior to and directly following the calibration.

During normal operation the display provides continuous SP readouts. However during calibration flow computer is placed in a temporary hold mode.

A minimum of three SP markers should be set. The user may enter as many SP pressure markers as desired. Recording too many markers could cause the flow computer to overwrite existing older events. Only the last five checks are used by the WINCCU editor for calibration adjustment. Enter a 0%, 25%, 50%, 75% and 100% value.



Caution- Equipment damage. During this procedure, the user will pressure both sides of the cell by closing both the high and low side orifice valves, open the vent to atmosphere, then closing the atmosphere vent and opening both high and low bypass valves.

The resulting comparison pressure must not be greater than the static pressure cell's maximum pressure, or damage may occur.

Equipment needed:

- Calibration standard

To perform Static Pressure (SP) calibration checks:

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.

2. Open PCCU.
3. Select the **Calibration** button from the toolbar. The Flow Computer is now placed in Hold.
4. Select the desired measurement tube from the tree view in the left pane.
5. Select SP from the calibration drop down box to the left of the pressure marker table.
6. Select the SP type: Absolute or Gauge.

i **IMPORTANT NOTE:** Absolute will display values with Barometric Pressure added in plus entered values will need the Barometric Pressure added. Gauge will display values in Gauge Pressure plus entered values will need to be in Gauge Pressure.

7. Click on the Enter Pressure Check Value.
8. Select **Continuous** to update the Current Reading.
9. Verify that the vent valve is closed (Figure 92:).
10. Open both the high and low equalizer valves.
11. Close both the downstream and upstream tap valves.
12. Open the atmospheric vent valve.
13. Enter a pressure marker for atmospheric pressure (psia).
14. Enter zero if in Gauge Mode, or the Barometric Pressure (or contract value) if in the Absolute mode.
15. Click **OK**.
16. Close the atmospheric vent valve.
17. Click on the **Enter Pressure Check Value**.
18. Connect Calibration Standard to calibration test port.
19. Pressure to the next desired verification pressure.
20. Enter the pressure value from the calibration source, once the current reading stabilizes.

i **IMPORTANT NOTE:** Add the Barometric pressure if the pressure type is Absolute.

21. Click **OK**.
22. Repeat steps 11 through 14 for each pressure check value.
23. Determine if Calibration is required once all Static Pressure markers have been set.
24. Return the manifold to service before exiting Calibration mode if no Calibration is required, Static pressure calibration checks have been performed.

i **IMPORTANT NOTE:** For additional information regarding Static Pressure Calibration Checks, see PCCU Help Files.

6.13.4 Differential Pressure (DP) Calibration Checks

It is recommended that checks of the differential pressure (DP) be done prior to and directly following calibration.

A minimum of three Differential Pressure markers should be set, however the user may enter as many DP pressure markers as you desire. Recording too many markers may cause the flow computer to overwrite existing older events. Only the last five checks are used by the WinCCU editor for calibration adjustment. Enter a 0%, 25, 50%, 75% and a 100% value.

During normal operation the display provides continuous DP readouts. However during this procedure the flow computer is placed in a temporary hold mode.



IMPORTANT NOTE: During this procedure, the user will pressure the high side of the cell by closing both the high and low side orifice valves, open the vent to atmosphere and the low side bypass valve, and closing the high side bypass valve.

Equipment needed:

-Calibration standard

To perform the Differential Pressure (DP) calibration checks:

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable
2. Open PCCU.
3. Select the **Calibration** button from the toolbar. The Flow Computer is placed in hold.
4. Select the desired measurement tube from the tree view in the left pane.
5. Select DP from the calibration drop down box to the left of the pressure marker table.
6. Click on the **Enter Pressure Check Value** and select Continuous to update the Current Reading.
7. Verify that the vent valve is closed (Figure 92:).
8. Open both the high and low equalizer valves.
9. Close both the downstream and upstream tap valves.
10. Open the atmospheric vent valve.
11. Enter a pressure marker for differential pressure 0.0.
12. Click **OK**.
13. Close the high side equalizer valve
14. Connect the Calibration Standard to calibration test port.
15. Pressure to the next desired verification pressure.
16. Enter the pressure value from the calibration source once the current reading stabilizes.
17. Click **OK**.
18. Repeat steps 11 through 13 for each pressure check value.
19. Determine if calibration is required when all Differential Pressure markers have been set.
20. Return the manifold to service, if no calibration is required, before exiting calibration mode.

The differential pressure has been calibrated.



IMPORTANT NOTE: For additional information regarding Differential Pressure Calibration Checks, see PCCU Help Files.

6.13.5 Calibrating Static Pressure

A three or five point pressure method may be used to calibrate the static pressure cell. These different pressures are applied to the cell from a known traceable source with resultant pressure values entered using PCCU software.

When doing the following procedures wait for the display to stabilize. If the flow computer is not in the calibration mode the display will not necessarily match applied cell pressures.

Important Note: The flow computer uses an absolute static pressure (SP) Cell. Absolute pressure measures the pressure referenced to a vacuum or sealed chamber. This is different than a gauge cell which measures the pressure referenced to the atmosphere.

i

Since the static pressure cell is an absolute device, it always measures the true pressure relative to a vacuum or sealed chamber. When vented, it measures true barometric pressure.

For other points of calibration, add reading of PSI and barometric pressure to arrive at PSIA, then enter this reading.

6.13.5.1 Absolute vs. Gauge

It is recommended that the initial calibration point be at vented conditions. When doing so the barometric pressure reading (in psi) may be used as the initial point.

When operating in PCCU's Absolute Mode, other points of calibration are arrived at by adding the PSI reading and barometric pressure to arrive at PSIA, then enter this reading.

When operating in PCCU's Gauge Mode, readings may be entered as read, then a barometric pressure reading is entered.

i

IMPORTANT NOTE: To convert barometric pressure measured from inches of mercury to Barometric Pressure (psi), perform the following calculation:

Barometric pressure, in inches of mercury x .4912 or (÷ 2.036) equals Barometric Pressure in psi.

6.13.5.2 Calibrating Static Pressure (SP)

Equipment needed:

-Calibration standard

To calibrate Static Pressure (SP):

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU.
3. Select the **Calibration** button from the toolbar. The flow computer is placed in hold.
4. Select the desired measurement tube from the tree view in the left pane.
5. Select SP from the calibration drop down box to the left of the pressure marker table.
6. Select the 3 or 5 Point Calibration.
7. Set the Transducer SP Pressure Range in calibration window. This should match the range reading from the tag or label attached to the transducer.
8. Select the SP type: Absolute or Gauge.

i

IMPORTANT NOTES: Absolute will display values with Barometric Pressure added in plus entered values will need the Barometric Pressure added.

Gauge will display values in Gauge Pressure plus entered values will need to be in Gauge Pressure.

9. Enter the barometric in the bottom window before proceeding.
10. Verify that the vent valve is closed (Figure 92:).
11. Open both the high and low equalizer valves.
12. Close both the downstream and upstream tap valves.
13. Open the atmosphere vent valve.
14. Click on the **Low Cal Point** button.
15. Verify the Current Reading is Continuously updated. This should represent the lowest calibration point.

16. Click **OK** when the current reading stabilizes, or enter a different value.
17. Click **OK**.
18. Press enter when the previous reading was accepted, notice that the **100% Cal Point** button becomes highlighted.
19. Connect the Calibration Standard to calibration test port.
20. Close the atmosphere vent valve.
21. Pressure to 100% of the transducer range (100% of target value).
22. Click **OK** when the current reading stabilizes,
23. Accept the target value already showing in the window, or enter the pressure value from the calibration source.
24. Click **OK**.
25. Press Enter to select the next Calibration point.
26. Pressure the transducer to the next target value as shown in the calibration window.
27. Press Enter when the current reading stabilizes.
28. Accept the target value already showing in the window, or enter the pressure value from the calibration source.
29. Click **OK**.
30. Repeat steps 17 through 19 until all calibration points have been entered.
31. Return the manifold to service before exiting calibration mode.

The transducer is now calibrated. New calibration markers should be set. Exiting calibration mode will remove the flow computer from hold.

6.13.6 Calibrating Differential Pressure (DP)

A three or five point pressure method is used to calibrate the differential pressure cell. These different pressures are applied to the cell from a known traceable source with resultant pressure values entered using PCCU software.

During factory calibration, the differential pressure (DP) is set to zero to compensate for any leaks that may be detected. After field calibration of the unit, the correction made at the factory remains as is. This ensures that the readings received in the field are accurate. The user may not change the factory set shift. If readings appear incorrect, you may need to check for leaks and then recalibrate the DP.

When calibrating, wait for the readings to stabilize before entering the new values.

Equipment needed:

- Calibration standard

To calibrate Differential Pressure (DP):

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU
3. Select the **Calibration** button from the toolbar. The Flow Computer is placed in hold.
4. Select DP to begin Differential Pressure calibration.
5. Select the 3 or 5 Point Calibration.
6. Set the Transducer DP Pressure Range in calibration window before proceeding. This should match the range reading from the tag or label attached to the transducer. Target values based on the selected range will appear in the calibration table.
7. Verify that the vent valve is closed (Figure 92:).
8. Open both the high and low equalizer valves.
9. Close both the downstream and upstream tap valves.

10. Open the atmospheric vent valve.
11. Click on the **Low Cal Point** button.
12. Verify the Current Reading is continuously updated.
13. Click **OK** when the current reading stabilizes, or enter a different value.
14. Click **OK**.
15. Press enter when the previous reading was accepted, notice that the 100% Cal Point button becomes highlighted.
16. Press Enter to accept the value.
17. Connect the Calibration Standard to calibration test port.
18. Close the high side equalizer valve.
19. Pressure to 100% of the transducer range (100% of target value).
20. Click **OK** When the current reading stabilizes to accept the target value already showing in the window, or enter the pressure value from the calibration source.
21. Click **OK**.
22. Press Enter to select the next calibration point.
23. Pressure the transducer to the next target value as shown in the calibration window.
24. Click **OK** when the current reading stabilizes accept the target value already showing in the window, or enter the pressure value from the calibration source.
25. Click **OK**.
26. Repeat steps 16 through 18 until all calibration points have been entered.
27. Return the manifold to service before exiting calibration mode.

The transducer is now calibrated. New calibration markers should be set. Exiting calibration mode will remove the Flow Computer from hold.



IMPORTANT NOTE: For additional information regarding Differential Pressure Calibration Mode, see PCCU Help Files.

6.14 On-Board I/O Calibration Overview

The calibration mode enables the calibration of the analog inputs, analog outputs (TFIO Module) and pulse inputs.

6.14.1 Hold Mode

When calibrating, PCCU will instruct the flow computer to ignore live values for the period of time the flow computer is being calibrated. This prevents real time calculations from being affected during the calibration. During this time the flow computer uses the last known value at the time calibration mode was entered. (This is called the “HOLD” mode.)

To exit the Hold mode:

1. Exit the calibration mode.
2. Unplug the PCCU cable at local connector.

6.14.2 Calibrating On-Board Analog Input

The Totalflow XFC^{G4} comes standard with 2 analog inputs on the board. As you enter calibration, the flow computer enters the Hold Mode and displays the current values.

The Current Values section will display the current values continuously by checking the Update box. When different analog inputs are selected, their assigned register numbers are displayed on the top of the screen.

Follow the instructions in the PCCU32 Help files for specific software steps. Generally you need to complete the following procedures.



IMPORTANT NOTE: If using a 4-20mA transmitter on the analog input, please refer to Appendix D. Manufacturer's specifications can be extremely misleading. Often a manufacturer's specification will claim to operate from 10 to 30Vdc. They are not always clear that this 10-30Vdc must be applied across the 4-20mA transmitter only (and NOT across the transmitter/load resistor series combination).

Equipment needed:

- A certified power supply capable of 1-5Vdc

To calibrate the Analog Input (AI):

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU.
3. Connect the power supply to the AI terminals to be calibrated.
4. Select the **Calibration** button from the toolbar. The flow computer is placed in hold.
5. Select the appropriate AI to be calibrated from the tree.
6. Select either the 3 Point or the 5 Point for number of calibration points. 3 Point for 0%, 50% and 100% values and 5 Point for 0%, 25%, 50%, 75% and 100% values.
7. Check the **Update** button in the Current Value box.
8. Apply the 0% value to the AI terminals.
9. Enter the value (typically zero) representing the 0% value.
10. Click **OK**.



IMPORTANT NOTE: The current reading value on the pop up entry screens will be placed in the reading column and represent values from the previous calibration. User entered values will be displayed in the entry column.

11. Select from the menu the 100% Calibration Value.
12. Apply the 100% value to the AI terminals.
13. Enter the value representing 100% from the calibration standard.
14. Click **OK**.
15. Select from the menu the *50% Calibration Value*.
16. Apply the 50% value to the AI terminals.
17. Enter a value representing 50% from the calibration standard.
18. Click **Ok**.



IMPORTANT NOTE: If Performing a 5 point calibration, the user will need to add additional steps for the 25% and 75% Calculation points.

6.14.3 Calibrating On-Board Pulse and Digital Inputs

The XFC^{G4} comes standard with 2 high speed pulse inputs on board. These may also be used as digital inputs. The following procedure is for calibrating pulse inputs. As you enter the calibration screen and have selected the P/I that you would like to calibrate, the flow computer enters the Hold Mode and displays the current values and their register number.

The Current Values section will display the current values continuously by checking the Update box. When different digital inputs are selected, their assigned register numbers are displayed on the top of the screen.

Follow the instructions in the PCCU32 Help files for specific software steps. Generally the following procedure will need to be completed.

To set the K-Factor for digital and pulse inputs:

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU.
3. Skip to Step 11 if AGA-7 application is already instantiated.
4. Select the **Entry** button from the toolbar.
5. Click the **Station ID** at the top of tree.
6. Select the **Applications** tab from the open pane.
7. Click the **Add App** button at the bottom of the pane.
8. Select from the drop down menu **AGA-7 Measurement**. The application will populate in the tree.
9. Click **Flow Measurement > AGA7 > Setup**
10. Select the **Constants** tab from the open pane.
11. Click on the field to the right of **K-Factor**, enter the value and click **Send**.
12. Adjust the K-Factor type, if needed, in the row below the **K-Factor** field.



IMPORTANT NOTE: Input pulses are multiplied by the K-Factor. Two types of K-Factor exist: Pulse per Volume or Volume per Pulse, and may be changed in PCCU32. The K-Factor is supplied by the device manufacturer and may be noted on the body of the device.

Please take into consideration that these inputs may have the debounce enabled or disabled. This feature is discussed in the PCCU32 Help files and is also turned on or off within PCCU32.

13. Click **Send**.

6.15 Calibrating TFIO Module Analog Outputs

The following procedure is for calibrating analog outputs contained on the XFC^{G4} TFIO analog output Modules. As the calibration screen is entered select the desired A/O to be calibrated. The flow computer enters the Hold Mode and displays the current values and their register number.

The Current Values section will display the current values continuously by checking the **Update** box. When different analog inputs are selected, their assigned register numbers are displayed on the top of the screen. Follow the instructions in the PCCU32 Help files for specific software steps.



IMPORTANT NOTE: If using a 4-20mA transmitter on the analog input, please refer to Appendix D. Manufacturer's specifications can be extremely misleading. Often a manufacturer's specification will claim to operate from 10 to 30Vdc. They are not always clear that this 10-30Vdc must be applied across the 4-20mA transmitter only, and not across the transmitter/load resistor series combination.

Equipment needed:

- -Calibrated Multi Meter capable of measuring 4-20 mA

To calibrate the Analog Output (AO) on the TFIO module:

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU.
3. Select the **Calibration** button from the toolbar.
4. Connect the Multi Meter to the analog output terminals to be calibrated.

5. Click on the **Low Cal** button and verify that the meter's reading has stabilized at approximately 4 ma.
6. Enter the Multi Meter reading in the Enter Measured Value window.
7. Click **OK**.
8. Click on the **High Cal** button and verify that the meter's reading has stabilized at approximately 20 ma.
9. Enter the Multi Meter reading in the Enter Measured Value window.
10. Click **OK**.

The Analog Output is now calibrated.



IMPORTANT NOTE: To test the calibration, click on the appropriate AO button in the Current Values section and enter a value 0 - 100% and note the reading on the meter. (25% = 8 ma, 50% = 12ma, 75% = 16 ma, 100% = 20 ma)

6.16 How to Change Orifice Plate

Use one of the following procedures when changing an orifice plate.

6.16.1 Taking Meter Run Out-of-Service Procedure (Simplex Fitting)



DANGER – Serious damage to health / risk to life. Explosive gas and high pressure present. Work should only be performed by qualified individuals.

To replace the orifice plate on a flow computer using a Simplex Fitting:

1. Remove meter run from service.
2. Replace the orifice plates.
3. Skip to Step 11 if recording the Volume Calculation is not desired.



IMPORTANT NOTE: If the Volume Calculation Period is set to anything less than 60 minutes, Totalflow recommends performing either the Reset Log Period or the Reset Volume command to enhance the audit trail created by the event.

4. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
 5. Open PCCU.
 6. Select the **Entry** button from the toolbar.
 7. Select **Flow Measurement**.
 8. Select the **Commands** tab from the open pane.
 9. Change the value in the **Reset Log Period** field to Yes
 10. Click **Send**.
-



IMPORTANT NOTE: If the Log Period is reset a new record will be written based on the old orifice size. The accumulated volume may also be zeroed by using the Reset Volume command.

11. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
12. Open PCCU.
13. Select the **Entry** button from the toolbar.

14. Select **Flow Measurement > AGA-3 > Setup**
15. Select the **Constants** tab from the open pane.
16. Type in the new Orifice size in the **Orifice Diameter** field.
17. Click **Send**.
18. Return the flow computer to service.

The orifice plate size is now changed.

6.16.2 Leaving Meter Run In-Service Procedure (Senior Fitting)



DANGER – Serious damage to health / risk to life. Explosive gas and high pressure present. Work should only be performed by qualified individuals.

To replace the orifice plate on a flow computer using a Senior Fitting:

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU.
3. Select the **Calibration** button on the toolbar.
4. Place the flow computer in hold, by entering the calibration mode.
5. Replace the orifice plate.
6. Exit the calibration mode.
7. Skip to Step 13 if the Log Period Reset is not desired.
8. Select the **Entry** button from the toolbar.
9. Select **Flow Measurement**.
10. Select the **Commands** tab from the open pane.
11. Change the value in the **Reset Log Period** field to Yes
12. Click **Send**.



IMPORTANT NOTE: If the Log Period is reset a new record will be written based on the old orifice size. The accumulated volume may also be zeroed by using the Reset Volume command.

13. Select **Flow Measurement > AGA-3 > Setup**
14. Select the **Constants** tab from the open pane.
15. Type in new Orifice size in the **Orifice Diameter** field.
16. Click **Send**.
17. Return the flow computer to service.

The orifice plate size is now changed.



IMPORTANT NOTE: At top of next Volume Calculation Period, the flow computer will perform calculations based on new orifice plate diameter for the part of the period after the log was reset.

6.17 Zero Transducer

During the process of setting pressure markers to determine the need for a calibration of either the static pressure (SP) or the differential pressure (DP), it may be concluded that the SP or the DP pressures are out of alignment exactly the same amount at each pressure marker (linear shift). When this occurs, the flow computer may need to be recalibrated, or the transducer may need to be zeroed. The preferred method is to recalibrate the XIMV. This maintains the records in a manner that assures accountability and continuity when other measurement issues arise. By using the **Zero Transducer** command, all references to previous pressure markers are non-existent, eliminating the ability to adjust volumes based on previous markers.



NOTICE – Tained results. Using the zero transducer capability assumes that the shift is Linear, meaning that at different levels of pressure that the XIMV is off by exactly the same amount. If this is not the case, you need to recalibrate the XIMV instead.

6.17.1 Static Pressure

The SP can be zeroed without recalibrating. If the SP shifts, the user can enter a new barometric pressure value. This shifts the SP XIMV curve.

To zero the Static Pressure (SP):

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU.
3. Select the **Calibration** button from the toolbar.
4. Select the appropriate device in the tree.
5. Select the **Static Pressure** tab.
4. Select the **Zero Transducer** button.

The SP is now zeroed.

6.17.2 Differential Pressure

The DP can be zeroed without recalibrating. If DP shifts, the user can enter a new zero (0). This shifts the DP curve.

To zero the Differential Pressure (DP):

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU.
3. Select the **Calibration** button from the toolbar.
4. Select the appropriate device in the tree.
5. Select the **Diff. Pressure** tab.
4. Select the **Zero Transducer** button.

The DP is now zeroed.

7 Troubleshooting

As an aid to troubleshooting the flow computer, this chapter will provide troubleshooting guidelines for the various subsystems.

This chapter contains a troubleshooting flowchart (Figure 94:). As you follow the logic in this flowchart, you will be directed to specific test instructions that are found in this chapter or you may be directed to the Power Troubleshooting Flowchart (Figure 97:) or possibly the Communication Troubleshooting Flowchart (Figure 102:). In addition to these flowcharts, this chapter contains step by step procedures for troubleshooting a flow computer with or without an installed radio communication unit.

7.1.1 Troubleshooting Support

If troubleshooting instructions do not lead to a resolution and assistance is required, the user can contact the Totalflow Service Department.

7.1.2 Maintenance support

If installation, calibration and maintenance assistance is required, user can contact the Totalflow Service Department.

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

7.1.3 Returning Part(s) for Repair

If a component is to be returned to Totalflow for repair, securely wrap the product in protective anti-static packaging. Before returning a component, refer to the *Contact Us* section for a Return for Authorization Number (RA). Affix this number to the outside of return package.

Parts shipments must be prepaid by customer. Any part, not covered by original SYSTEM WARRANTY, will be shipped to customer, F.O.B.



IMPORTANT NOTE: Do not return equipment to ABB without prior written consent. Returns are subject to terms and conditions

7.1.4 Visual Alarm Codes

As noted in Chapter 1, the units LCD annunciator area shows many different status indicators related to device operations. This section contains info on those codes that reflect errors or provide information useful in troubleshooting. Alarm codes indicate that an operational problem exists.

The user is informed of operational problems and operational limit violations by observing the alarm codes on the right side of the LCD display.

7.1.5 SLEEP Mode

Totalflow units are designed to go into a low power mode, SLEEP, when an insufficient supply voltage is present for a period of time. At issue here is locating the reason for the SLEEP alarm, simply waking up the unit will not suffice; therefore, issues relating to the system's power supply should be investigated.

7.1.6 Solar Panel

When a solar panel is attached to the flow computer to provide a charging source for the battery, cleanliness and positioning play an important role, as do proper electrical and cabling techniques, see section 4.10, *Solar Panel Installation*, on page 71

Troubleshooting the communications for this unit requires that both pieces of equipment be tested: the XFC^{G4} Comm ports and the Communication device, see section 7.4.1, *Communications Overview*, on page 154.

Other communication troubleshooting information is shared in the following categories:

- RS-232 Communications
- RS485 Communications
- RS422 Communications

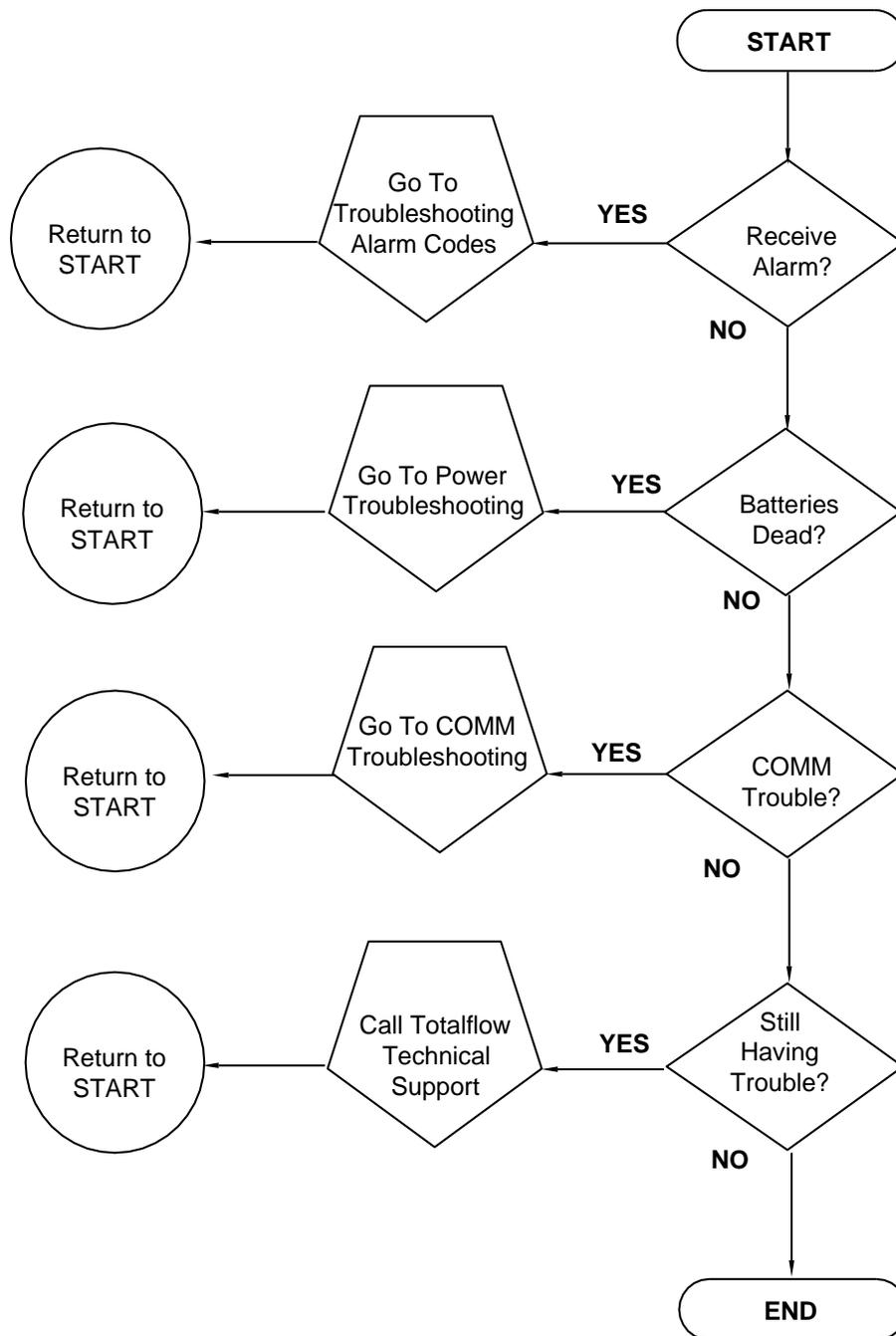


Figure 94: Troubleshooting Flowchart

7.2 Troubleshooting Visual Alarm Codes

When a visual indicator is present (Figure 95:) the following section will assist in determining the probable cause and steps required to correct the condition.

For the purpose of troubleshooting, only those codes considered alarms or codes used to assist troubleshooting are discussed here. The entire list of status and alarm codes may be found in Chapter 1. Table 17: contains a description of each alarm code. An alarm can be a word, character, letter or symbol.

An application can be assigned to an annunciator and any alarms or status codes associated with that application will be displayed.

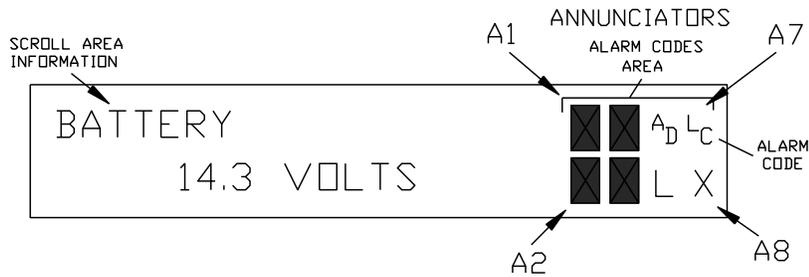


Figure 95: Liquid Crystal Display and Indicators

Table 17: Visual Alarm Codes

Indicator	Description
System	
LL	Low Lithium Battery Alarm: When LL (low lithium) is displayed, the lithium battery voltage is below 2.5 Vdc. A new lithium battery measures approximately 3.6 Vdc.
LC	Low Charger: When LC (low charger) is displayed the μ FLO ^{G5} battery charging voltage is (+) 0.4 Vdc or is less than or equal to the battery voltage.
Communication protocols	
→	Transmitting Data: Sending a response
←	Receiving Data: Processing request
!	Nak: Negative acknowledgement with packet list
+	Ack: Positive acknowledgement of receipt of request
⋮	Waiting for Ack: Waiting for response after transmission
?	Exception Alarm Processing
⌘	ID Recognized: Recognized and receiving request
⚡	Listen Cycle: Flashes if this remote port is active and running Totalflow Remote Protocol. Flashes in sync with the listening cycle that occurs at 1, 2 or 4 second intervals. When the baud rate is faster than 2400, then the flashing symbol may not be visible. The annunciator will remain on listening cycle if the listen cycle is set to zero.
M	MODBUS® ASCII: MODBUS® ASCII protocol is selected for the port assigned to this annunciator.
m	MODBUS® RTU: MODBUS® RTU protocol is selected for the port assigned to this annunciator.
L	Local Protocol: Displayed when the PCCU32 port is active and running Totalflow Local Protocol
¥	ID Recognized: The ID has been recognized but is waiting for sync.
n	Ethernet Protocol: Displayed when the Totalflow/TCP port is active.
Measurement applications	
BF	Back Flow Condition: Visible only when DP variable is displayed
Z	Zero Flow Condition: Visible only when the flow rate is displayed
H	Hold: Displayed when PCCU32 has entered hold
A	Alarm Condition: Need to view alarm. Compare application limits to the current values to determine where the alarm condition is present.
AD	A to D Failure: Displayed if the A to D converter's absolute differential pressure, absolute static pressure, or temperature readings exceed the maximum counts or are less than the minimum counts
Display applications	
1	A number represents the Display Group number currently being displayed.
↑	The displayed item's value is above the Data High Limit value that is specified on the display Item Setup screen.
↓	The displayed item's value is below the Data Low Limit value specified on the display Item Setup screen.

7.2.1 Troubleshooting a Blank LCD Screen

When the LCD is blank, this means that the unit has entered SLEEP mode. This generally indicates the battery voltage has dropped below 10.9 Vdc.

Equipment needed:

-Digital Multi Meter

To troubleshoot a blank LCD screen:

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable. This wakes up the unit so that the user may check all alarm conditions.
2. Check battery pack cable. It must make a good secure electrical connection with the main electronic board BATT CONN connector J1 (Figure 96:).
3. Check battery pack cable is securely connected.
4. Check battery pack voltage. If voltage is low, replace with another battery pack.
5. If voltage is still low, investigate power issues following the Power Troubleshooting Flow Chart (Figure 97:).

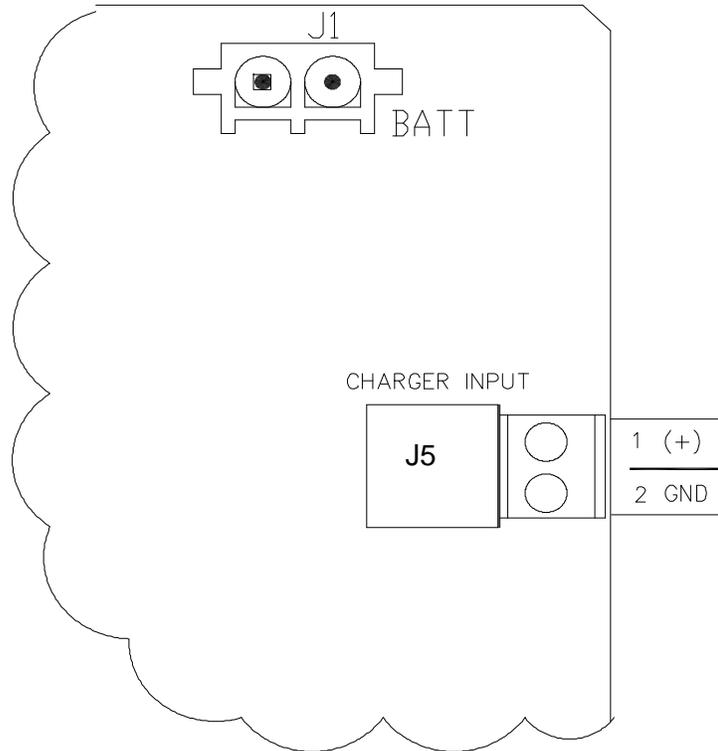


Figure 96: Battery Charger and Battery Pack Connections

7.2.2 Troubleshooting a Low Lithium Alarm (LL)

When the Low Lithium alarm appears, the lithium battery should be replaced immediately, see section 6.6, *Replacing the lithium battery*, page 113.



NOTICE – Loss of data. Failure to replace lithium battery could result in loss of data, following a power loss.

7.2.3 Troubleshooting a Low Charger Alarm (LC)

The Low Charger alarm is typically displayed if battery charging voltage is less than (+) 0.4 Vdc higher than battery voltage or low light conditions exist and system is charged using a solar power charger.

To troubleshoot a Low Charger Alarm (LC):

1. Check the battery pack cable. It must make a good secure electrical connection with the main electronic panel BATT CONN connector J1 (Figure 96:).
2. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
3. Open PCCU.
4. Select the **Entry** button from the toolbar
5. Select **I/O Subsystem > On-Board > Auxiliary I/O**. If the charger is less than +0.4 Vdc proceed to Power Troubleshooting section.

7.2.4 Troubleshooting a Analog to Digital Failure Alarm (AD)

The flow computer must have a measurement tube application running to receive this error. If A to D Converter readings are within range, AD is shaded. If the A to D Failure alarm code is present, or if the device is in the SLEEP mode, but is still receiving minimum voltage, it may be necessary to test the data link between the main electronic board and the transducer. Follow the instructions below to check transducer.

Probable causes of receiving the A to D Failure include:

- A/D Converter is over or under range (DP, SP or Tf)
- Loose wiring connections
- Faulty RTD probe

To troubleshoot an Analog to Digital Failure Alarm (AD):

1. Begin by collecting data from the flow computer, see section, 5.2.1 Data Collection, page 89.
2. View the event log in PCCU for codes:
 - -99 A/D converter could not be read
 - -100 A/D converter could be read again.
3. If the event code is found, follow guidelines for returning transducer to Totalflow for repair or replacement. If the event code is not found, continue to the next step.
4. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
5. Open PCCU.
6. Select the **Entry** button from the toolbar.
7. Select **I/O Interface**.
8. Select the **On-Board** tab from the open pane.
9. Check the SP, DP and temperature to determine which measurement channel is causing the alarm.
 - If alarm is caused by the SP or DP channel, equalize and vent manifold.
 - If alarm disappears: SP or DP cell is not ranged properly or manifold may have blockage.
 - If alarm is still present, replace transducer.
 - If alarm is caused by the temperature channel, skip to Step 9, otherwise go to next step.
10. Set the XIMV back to *Factory* calibration. If this corrects the alarm, recalibrate the XIMV to correct field calibration. If the alarm is not corrected, continue to next step.
11. Verify the Flow Computer is not displaying a LL (Low Lithium) alarm.
12. Perform a Warm start on the Flow Computer, see section 5.3 Performing a Warm Boot, page 90.

13. Restore power to flow computer. If A/D Failure alarm is not corrected, continue to the next step.
14. Perform the Save and Restore function, see section 5.2.2 *Backing up Configuration Files*, page 90.
15. Restore these files to the tfCold Drive, see section 5.2.3 *Restoring Configuration Files*, page 90.
16. Perform a Cold start on the Flow Computer, see section 5.4 *Performing a Cold Boot*, page 92. If problem is not corrected, continue to next step.
17. Check the RTD wiring at the XIMV.
18. Perform the following three procedures, see section(s) 6.2.5 *Resistive Temperature Detector (RTD) Continuity Test*, page 123, 6.2.6 *RTD Current Source (Resistive) Test*, page 123, 6.2.7 *RTD Impedance Test*, page 124.
 - RTD Continuity Test
 - RTD Resistive Test
 - RTD Impedance Test
19. Contact Totalflow to repair or replace the XIMV.

7.2.5 Resistive Temperature Detector (RTD) Continuity Test

Should the readings from the RTD be suspect, follow the instructions below to test the RTD probe.

Required Equipment:

- -Multi Meter (MM) w/ alligator clip leads

To perform a Resistive Temperature Detector (RTD) continuity test:

1. Begin by disconnecting the power and communications from the XIMV.
2. Disconnect the RTD from the XIMV.
3. Perform the continuity test on wires leading to the probe. Set the MM to 200 OHM or Continuity Audio.
4. Check continuity of first wire pair (typically red or black) by connecting one lead to each wire. Meter should read zero or close to zero.
5. If there is continuity, skip to Step 7.
6. Verify the wiring at RTD head is correct.
 - If the wiring at connection head is correct:
 - The RTD is defective.
 - Replace the probe.
7. Check the continuity of second wire pair (typically white) by connecting one lead to each wire. The meter should read zero or close to zero.
8. Check the continuity of each wire (first pair either red or black as identified in step 4) to the probe or the shield.
 - If there is continuity:
 - The RTD is defective.
 - Replace the probe.
9. Check the continuity of each second wire pair (white or as identified in step 7) to probe or shield.
 - If there is continuity:
 - The RTD is defective.
 - Replace the probe.
10. Check the continuity of each first wire pair (as identified in Step 4) to each second wire pair (as identified in Step 7).
 - If the Multi Meter does not read approximately 100 to 140 Ohms.
 - RTD is defective.
 - Replace the probe.
11. If the probe is still not functioning correctly, recheck wiring using supplied diagram. If no wiring error was found, see section 6.2.6 *RTD Current Source Test*, page 123.

7.2.6 RTD Current Source (Resistive) Test

If readings from the RTD are still suspect following the RTD Probe Continuity test, follow the instructions below to test the current source on the termination board to verify it is receiving power.

Required Equipment:

- Flow computer diagnostics kit (Part No. 2017373)
- Multi Meter (MM) w/ alligator clip leads

To perform an RTD current source (resistive) test:

1. Disconnect the power and communications from the main electronic panel.
2. Disconnect the RTD from the main electronic panel.
3. Set the MM to 200mVdc.
4. Select the RTD test resistance value by selecting the resistor test connector from FCU Diagnostic Kit, or make one using a resistor appropriate for your unit:
 - Substitute RTD probe wiring by connecting either a 100 OHM or 123 OHM resistor across connector terminals 3 and 4.
 - Connect a jumper wire between terminals 2 and 3.
 - Connect a jumper wire between terminals 4 and 5.
5. Clip the positive lead of the MM to the upper side of the RTD test resistor.
6. Clip the negative lead of the MM to the lower side of the RTD test resistor.
7. Supply power to the flow computer.
8. The measured value across the RTD test resistor should be either:
 - 100 OHM Resistor – Min. of 100mv to a maximum of 125mv
 - 123 OHM Resistor – Min. of 123mv to a maximum of 155mv
9. The RTD measurement temperature on the FCU display should read either:
 - 100 OHM Resistor – 31.0°F to 33.0°F
 - 123 OHM Resistor – 140.8°F to 142.8°F
10. If either of the measured values are outside of range:
 - Remove the power.
 - Replace the RTD (2011905-xxx).
11. Return the power and perform steps 9 and 10 again.
12. If either of the measured values are outside of range:
 - Remove the power.
 - Replace the main electronic panel (2102838-xxx).
13. Return power and perform steps 9 and 10.
14. If either of the measured values are outside of the range:
 - Remove the power.
 - Replace the XIMV.

7.2.7 RTD Impedance Test

If readings from the RTD are still suspect following the RTD Probe test, follow the instructions below to test the current source on the termination board to verify it is receiving power.

Required Equipment:

- Ice Bath
- Multi Meter

To perform an RTD impedance test:

1. Immerse the RTD Probe in ice bath.
2. Perform a continuity check between any two similarly colored wires. Measured resistance should be 1 OHM or less.
3. Perform a continuity check between any two dissimilar colored wires. Measured resistance should be approximately 100 Ohms.
4. Perform a continuity check between the shield wire and any other wires. Measured resistance should be in the Mohm range.
5. If any values are returned out of range. RTD Probe is defective:
 - Replace the RTD.

7.3 Power Troubleshooting

7.3.1 Overview

This section focuses on determining what has caused the flow computer to lose power. Generally, loss of power can be attributed to the power supply system. However, if the power supply system is used for powering a transceiver, or other peripheral equipment, a problem with that equipment may drain the battery and cause the flow computer to lose power.



IMPORTANT NOTE: Notice that the *Power Troubleshooting Flowchart* (Figure 97:) takes the user through several tests but also directs the user to the *Communication Troubleshooting Flowchart* located further in this chapter.

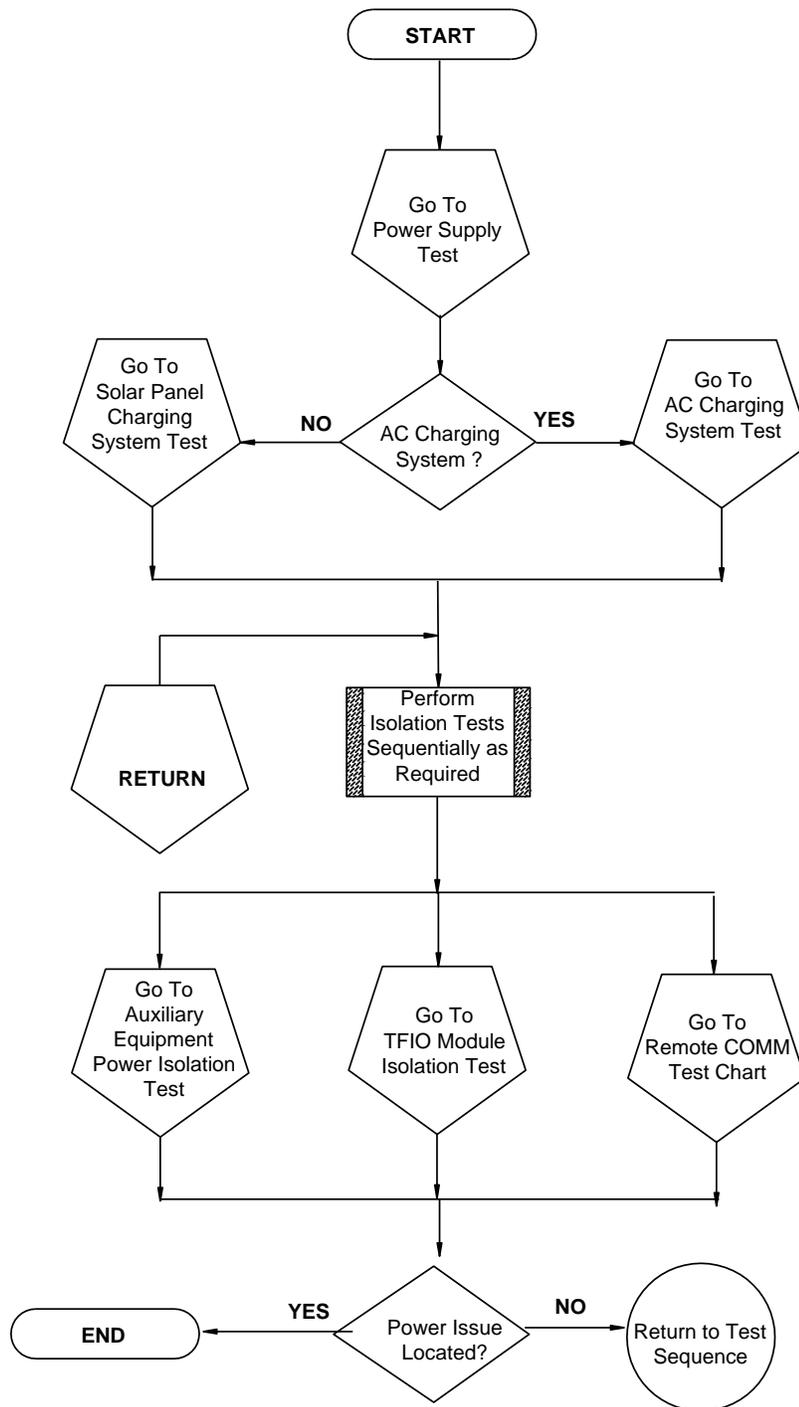


Figure 97: Power Troubleshooting Flowchart

7.3.2 Power Supply Test

Various equipment configurations will necessitate moving to one or more additional tests from this location.

i IMPORTANT NOTE: If this is a new installation and external equipment is being powered from the flow computer, call Totalflow Technical Support for help in evaluating your conductor and power supply installation requirements.

Tools needed

-Digital Multi Meter (MM)

To perform a power supply test:

1. Verify that the power supply voltage setting, the power supply current rating and the conductors are sized correctly (reference wire sizing chart).
 - Correct any discrepancies.
2. Check for a poor cable connection in the cable between the circuit board and the J1 battery pack and the J5 charging source (Figure 98:).
3. Verify all the field wiring screw terminals are tight.
3. Correct and retest, as necessary.
4. Verify that there are no other devices that may drop an excessive voltage across them in the power supply circuit.
5. Correct and retest, as necessary.
6. Disconnect the charging source cable at the panel J5 connector.
7. Replace the battery with a known good battery, see section, 3.9 *Battery Pack Installation*, page 56.
8. Reconnect the charging source cable to the panel J5 connector.
9. Measure the voltage at the charging source cable.
10. Measure the voltage at the battery pack.
11. Compare the voltage. If the charging source voltage is less than (+) 0.4 Vdc higher than the battery voltage, return to Figure 97: and continue.

7.3.3 Solar Panel Charging System Test

If your system setup includes a solar panel charger connected to the XFC^{G4} panel, and it is not supplying the required voltage to the flow computer.

Tools needed:

- Multi Meter (MM)
- Small slotted screwdriver

To perform a solar panel charging system test:

1. Check the solar panel angle and direction. In the northern hemisphere, the panel should face due south and in the southern hemisphere, due north.
2. Correct and retest, as necessary.
3. Check the solar panel for any physical damage or obstructions to sunlight.
4. Correct and retest, as necessary.
5. Check the solar panel wiring to be certain it is correctly connected to the associated J5 charger input termination block (Figure 98:).
6. Correct and retest, as necessary.

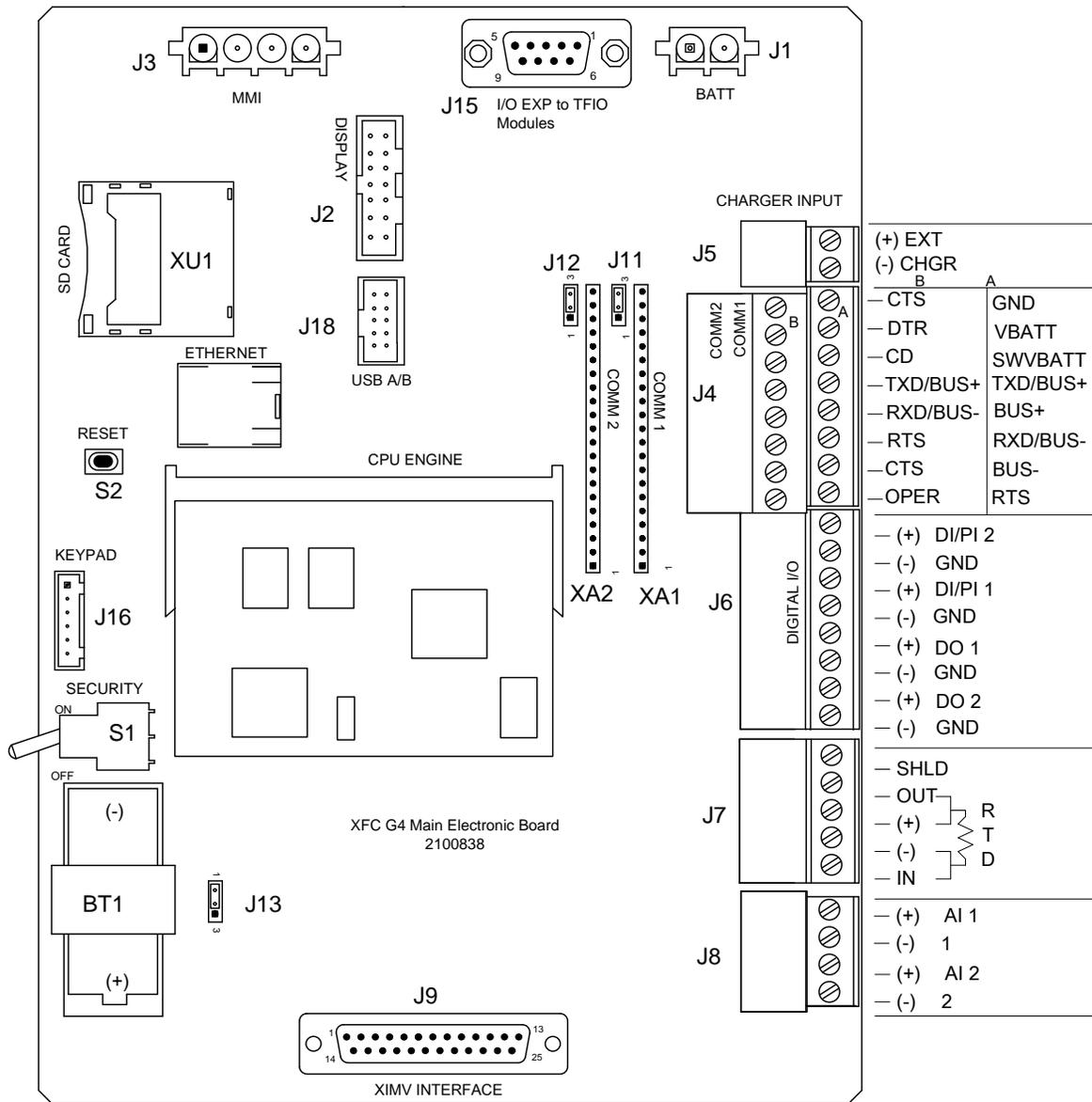


Figure 98: XFC^{G4} Main Electronic Board

7. Measure the solar panel voltage at the connector using a MM
8. Connect the (+) and (-) leads to the (+) and (-) solar panel wires. Loaded voltage should be greater than or equal to the specification listed in Table 18:
 - If the solar panel is not above minimum.
 - Replace the solar panel.
 - Retest.
9. Disconnect the solar panel from the circuit board.
10. Set the MM range to read over 20 Vdc.
11. Determine if the Open Circuit voltage is greater than or equal to the specification listed in Table 18:
 - Clip the positive lead of the MM to positive wire.
 - Clip the negative lead of the MM to negative wire.
 - If solar panel is not above the minimum voltage, continue to the next step.
12. Attach the selected resistor from Table 18: between the two solar panel wires.
13. Clip the positive lead of the MM to the one side of the test resistor.

14. Clip the negative lead of the MM to the other side of the test resistor.
15. Determine if the loaded voltage is greater than or equal to the specification listed in Table 18:..
 - If solar panel is not above the minimum.
 - Replace solar panel.
 - Retest.
16. Return to the Power Troubleshooting flowchart and continue testing, if the issue still exists.

Table 18: Specifications for Solar panels

Panel	Max	Volts @P _{Max}	Open Circuit	Load Resistance	Loaded Voltage
10	10W	16.8V	21V	30 Ω 25W	16–18Vdc
20	20W	16.8V	21V	15 Ω 25W	16–18Vdc
30	30W	16.8V	21V	10 Ω 40W	16–18Vdc

7.3.4 AC Charging System Test

If the system setup includes an ac charger connected to the flow computer, and it is not supplying the required voltage to the unit, it may be necessary to test the ac charger.

7.3.4.1 Step by Step Instructions

To perform a test on the ac charging system:

1. Verify that all the wiring is correct:
 - Check the dc wiring to the J17 charger input termination block connector (Figure 99:).
2. Verify the primary ac voltage input level is correct.
 - Check the input ac power supply voltage to the external ac charging unit.
3. Verify the dc output from the charger.
 - If there is no dc output from the charger, replace charger fuse (Figure 99:).
 - If the fuse is not faulty, or there is no charger dc output voltage after replacing the fuse, replace the ac charging unit.
4. If an issue still exists, return to the Power Troubleshooting flowchart and continue testing.

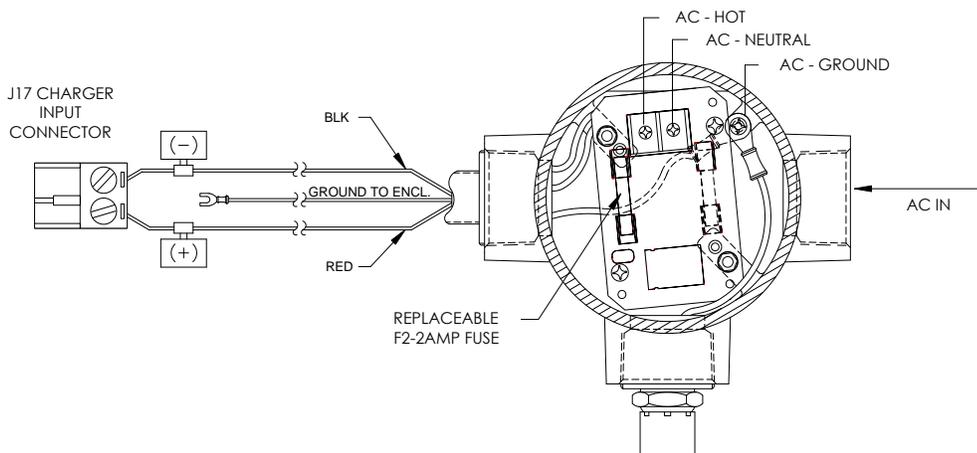


Figure 99: AC-DC Charger Wiring Instructions

7.3.5 Auxiliary Equipment Isolation Test

This test will need to be performed if your battery pack output voltage is not remaining consistent and no errors were found during the previous Power Supply, Solar Panel Charging System or AC Charging Circuit troubleshooting tests.

Tools needed:

- Multi Meter (MM)
- Small slotted screwdriver

To perform an auxiliary equipment isolation test:

1. Disconnect solar panel charger or AC charger from J5 charger input.
2. Disconnect the battery pack cable from the J1 connector.
3. Substitute the known good battery.
4. Disconnect any auxiliary equipment that draws power from the flow computer or the battery pack. This is not limited to, but should include, removing the J4 Communication connector if used.
5. Connect the current measurement troubleshooting cable (Part No. 2017350-xxx see Figure 100:), to the known good battery.
6. Reconnect the battery to the circuit board.

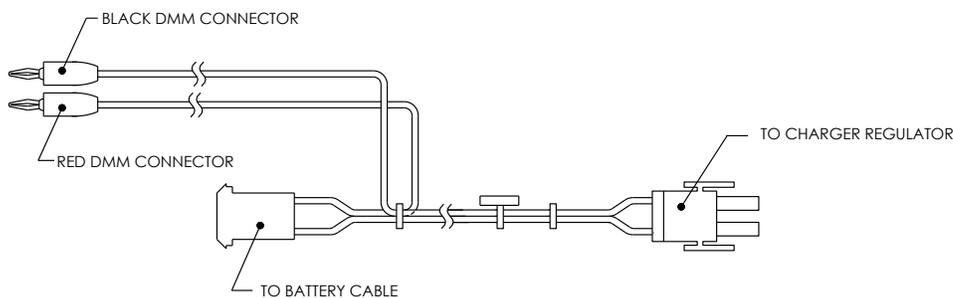


Figure 100: Current Measurement Troubleshooting Cable

7. Connect to the troubleshooting cable with a MM and measure the average current.
8. Disconnect the battery pack if equal to or greater than 80 mA at 12 Vdc.
9. Reconnect an auxiliary item.
10. If the average current is less than the specification, replace the main electronic panel using the instructions in section, 6.8, Replacing the Main Electronic Board, on page 117.
11. Reconnect the battery pack.
12. Measure the average current with a MM.
13. Disconnect the battery pack, if the average current is less than or equal to the equipment specification.
14. Reconnect an additional Auxiliary item.
15. Repeat Step 14 until all of the auxiliary items have been tested, or the equipment causing the power drain has been located.
16. Return to the Power Troubleshooting Flow Chart (Figure 97:), if power drain has not been located.

7.3.6 TFIO Module Isolation Test

If unit is configured to include TFIO modules, this test will need to be performed, if the flow computer battery pack output voltage is not remaining consistent and no errors were found during the previous Auxiliary Equipment Isolation Test.

Tools needed:

- Multi Meter (MM)
- Small slotted screwdriver

To perform a TFIO isolation test:

1. Disconnect the solar panel charger or the ac charger from the J5 charger input.
2. Disconnect the battery pack cable from the J1 connector.
3. Substitute the known good battery.
4. Disconnect the TFIO module cable from J15 I/O expansion connector, remote communications equipment and auxiliary equipment.
5. Connect the current measurement troubleshooting cable (Part No. 2017350-xxx see Figure 100:) to known good battery, and connect to the circuit board.
6. Measure the average current using a MM. If equal to or greater than 80 mA at 12 Vdc, disconnect the battery pack.
7. Reconnect the TFIO module cable with the one module connected.
8. Measure the average current using a MM.



IMPORTANT NOTE: Low Power TFIO modules generally do not draw over 0.30 ma at 12 Vdc.

9. Disconnect the battery pack if average current drops less than or equal to 0.30 mA.
10. Connect the one additional module.
11. Repeat this step for additional modules until all have been connected or equipment fault has been located.
12. Return to the Power Troubleshooting Flow Chart (Figure 97:) if power drain has not been located,

7.3.7 SLEEP Mode

The SLEEP mode is a safety feature which maintains the RAM but discontinues data measurement calculations and control functions. If the battery voltage falls below 11Vdc, the flow computer enters SLEEP mode. When the flow computer is in the SLEEP mode, the word SLEEP is displayed on the LCD.

If battery voltage is still below 10.9 Vdc, when the user disconnects locally, the flow computer returns to SLEEP mode. If battery voltage is above 11Vdc, the flow computer remains awake.

The flow computer has a real-time clock which maintains time and date during the SLEEP mode and writes an event record when entering and leaving the SLEEP mode.

Upon wake-up, the flow computer performs the following functions:

- Stores present calculation periods accumulations in historical record.
- Zeros present calculation periods accumulations.
- Ends current daily record and start new daily record.

Tools needed:

- -Multi Meter (MM)

To perform a check of battery voltage while flow computer is in sleep mode:

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Ensure the battery pack cable make a secure connection with the connector J1 (Figure 96:).
3. Check the battery pack voltage.
4. Replace with another battery pack if voltage is low.

7.3.8 Reset Procedures

The flow computer operating system can be reset through either a cold or warm start procedure. The decision to use these procedures should only be made by an experienced technician.

7.3.8.1 Cold Start

A cold start clears all the data that is stored in RAM as well as resetting all entered variables to their factory default values or to the values last written to the tfCold drive by the Save and Restore utility. A cold start should be used for new flow computer installations. This will ensure that all memory is clear and the operating program is at its default settings. Discretionary use of this procedure is advised.



NOTICE – Loss of data. If performed a cold start will delete all historical data.

7.3.8.2 Cold Start Procedures (Hardware)

To perform a hardware cold start:



IMPORTANT NOTE: Pressing the RESET button with the memory backup battery disabled performs a *Cold Start*. When the flow computer has been cold started, the 24-hour clock will be reset to 00:00:00.

1. Open the flow computer door.
2. Disconnect the external battery pack charger, CHGR INPUT +/- terminal block J5 (Figure 96:).
3. Disconnect the battery pack connector from the board BAT CONN connector J1 (Figure 96:).
4. Disable the memory backup, J13 (Figure 101:) by moving the pin jumper to pins 2 and 3.
5. Reconnect the 12Vdc battery pack connector to the board BAT CONN connector J1 (Figure 96:).
6. Observe LCD.
 - a. If the reset was the display will move through the startup screens and begin to scroll the cold start was successful.
 - b. If the display does not begin cycling or locks on one of the startup screens, contact technical support for additional instructions
7. Reconnect the external battery pack charging source to CHGR INPUT connector J5 (Figure 96:).
8. Enter all the necessary parameters or load a saved station file. See *Chapter 3, XFC^{G4} Startup*.
9. Enable the memory backup J13 (Figure 101:), by moving the pin jumper to pins 1 and 2.

The flow computer has been cold started.

7.3.8.3 Cold Start Procedure (Software)

Where the hardware restart requires physically disconnecting and reconnecting jumpers from the main electronic board, performing a software restart involves typing in a command in PCCU.

To perform software cold start:

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU.
3. Select the **Terminal** button from the toolbar.
4. Type the following command exactly as shown at the prompt: `BOOT=COLD`
5. Press the enter key.
6. Observe LCD.
 - a. If the reset was the display will move through the startup screens and begin to scroll, the cold start was successful.
 - b. If the display does not begin cycling or locks on one of the startup screens, contact technical support for additional instructions

The flow computer has now been cold started.

7.3.8.4 Warm Start

A warm start does not clear the data stored in RAM. The warm start will only reset the microprocessor and not disturb any data that has been stored in RAM. A warm start should be used when taking a unit out service to perform maintenance or troubleshooting. A warm start can be used when a power or communication interruption caused the microprocessor to lock-up.

Tools needed:

- Slotted screwdriver

7.3.8.5 Warm Start Procedures (Hardware)

To perform a warm start procedure (hardware):



IMPORTANT NOTE: Pressing the Reset button with the Memory Backup Enable jumper in the enabled position performs a warm start.

1. Disconnect any connected external charging source, if applicable.
2. Slide the external battery pack charger, CHGR INPUT +/- terminal block J5, (Figure 96:) from the circuit board green terminal block.
3. Move the memory backup jumper to pins 1 and 2 at J13 (Figure 101:).
4. Disconnect the battery pack connector from the circuit board BATT CONN connector J1 (Figure 96:).
5. Connect the battery pack connector J1 (Figure 96:).
6. Connect the CHGR INPUT +/- terminal block J5 (Figure 96:).
7. View the screen during startup to verify that the unit warm starts and begins cycling
 - a. If the display moves through the startup screens and begins cycling correctly, the warm start was successful.
 - b. If the display does not begin cycling correctly or locks on one of the startup screens, contact technical support for additional instructions

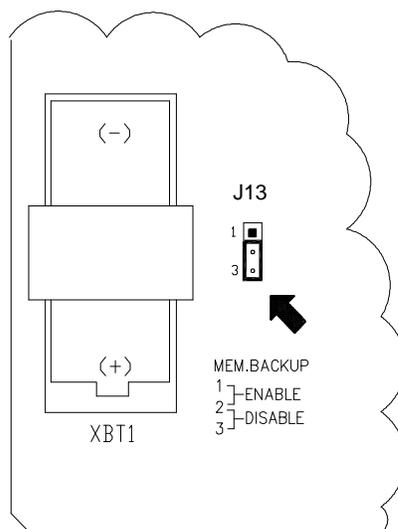


Figure 101: Lithium Battery Backup Enable/Disable

7.3.9 SLEEP Mode

A unit will go into Sleep mode, and display SLEEP on the LCD, if the main power source drops below 10.9 volts and stays there for a period of 2 minutes. Sleep Mode will preserve the unit's historical data that was collected prior to it going to sleep. The date/time will also be kept during the time the device is in Sleep Mode. An event record will be recorded in the System Log indicating when sleep mode is entered and exited. The unit can be awakened by simply connecting to the flow computer locally

with a PC. The unit will stay awake as long as the PC is connected. If the battery is below 10.9 volts when the user disconnects, the unit will go back to sleep after 2 minutes. If the battery voltage is above 11 Vdc, the flow computer will remain awake.

Upon wake-up, the flow computer performs the following functions:

- Stores present calculation periods accumulations in historical record.
- Zeros present calculation periods accumulations.
- Ends current daily record and start new daily record.

Tools needed:

- Multi meter (MM)
- Small slotted screwdriver

To remove the flow computer from sleep mode:

2. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Check battery pack cable. It must make a good secure electrical connection with the circuit board BAT CONN connector J16 (Figure 96:).
3. Check battery pack voltage with MM.
4. Replace with another battery pack if voltage is below 11 Vdc.

7.4 Troubleshooting Communications

7.4.1 Communications Overview

These troubleshooting procedures are applicable to all XSeries Flow Computers with an installed radio. Use Figure 102: as an aid for troubleshooting communication problems. The three basic types of radio communications that can be used are:

- RS-232 Communications, using a RS-232 module
- RS-485 Communications, using a RS-485 module
- RS-422 Communications (available, but not detailed)

The radio/modem may be powered one of two ways: always on or switched. Specific system set up will determine what steps are needed to power the radio/modem.

When switching power to a radio with Inhibit (SLEEP) mode, the COM 1 or COM 2 switched power line will go to the radios inhibit (SLEEP) mode input. The radio(s) will be energized.



CAUTION - Property Damage: Before removal or installation of either the above communication interface modules, it is important that the user disconnect any external battery charger and main battery pack cable connectors from the board. Refer to Figure 96:

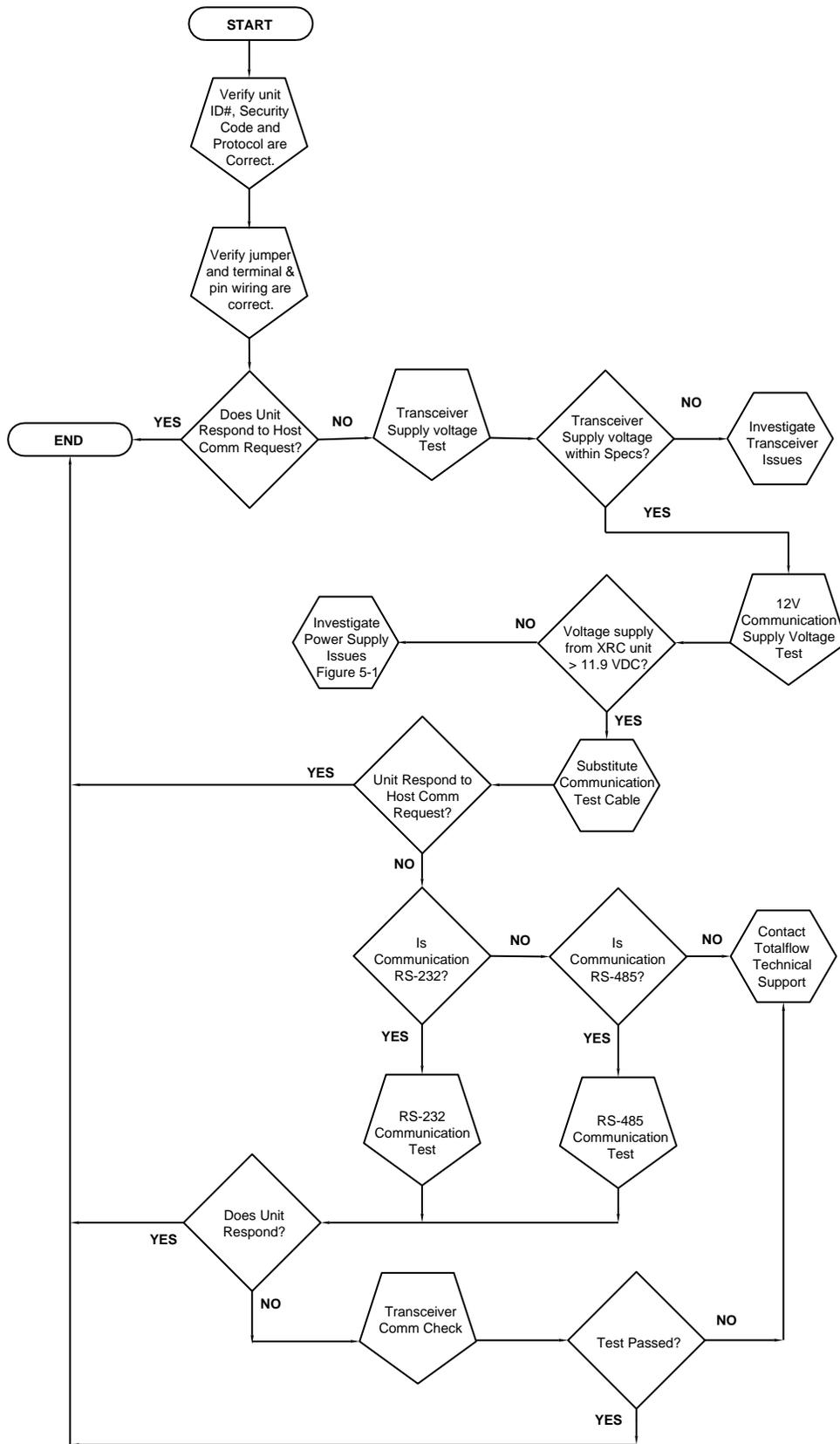


Figure 102: Communication Troubleshooting Flow Chart

7.4.1.1 Setting up communication

After installation of communication equipment and before placing the communication system into operation, the user should note the following:

- Verify RS-232 or RS485 interface modules and jumpers are installed or set correctly.
- Verify that radio cable or wiring is correctly installed at the radio.
- Verify field wiring terminations on the XFC^{G4} board.
- Check flow computer identifier (ID). Log the ID for future reference.
- Log the access security code, baud rate, listen cycle, protocol and interface for future reference.

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IMPORTANT NOTE: The following helpful hints aid the user after communication equipment has been installed and setup:

If the comm port assigned to an annunciator, the XFC^{G4} displays the → after it recognizes the XFC^{G4} ID.

Check baud rate, transmission and timing. The baud rate and timing settings can be changed within PCCU, in Entry mode. Default settings are 1200 baud, listening time is 4 seconds, and communications interface is turned off.

Minimum power required for operating remote communications is 11.9Vdc (default) or as set by user. Should the power fall below this level, remote communications will be terminated.

Test remote communications using RS-232 troubleshooting cable (2011781-xxx). Use RS-232 to RS-485 communication Converter (1800255-xxx) in conjunction with RS-232 troubleshooting cable to test RS-485 remote communications.

7.4.2 Transceiver Supply Voltage Test

Using wiring information and guidelines supplied by transceiver manufacturer, verify that transceiver is receiving manufacturer's suggested voltage. If unit is receiving sufficient voltage, continue to the 12V Communication Test.

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IMPORTANT NOTE: If transceiver is not receiving sufficient voltage, investigate power supply issues. These may involve wiring irregularities at either the AC charger/power supply system or the circuit board.

7.4.3 12V Communication Supply Voltage Test

Tools needed:

- Multi Meter (MM)
- Flat head tweaker screwdriver

To perform a 12V communication supply voltage test:

If transceiver features a SLEEP mode, or is continuously powered, proceed to step 6.

1. Connect the PC running PCCU32 to the flow computer with either an MMI cable (RS-232), a USB cable or an Ethernet cable.
2. Open PCCU.
3. Select **Entry** mode from the toolbar
4. If transceiver does not feature a SLEEP mode and power is supplied through an optional relay.
 - a. Select applicable communication application from the tree.
 - b. Select the **Advanced** tab from the open pane.
 - c. Select the **SwitchedV-Batt/Operate**
 - d. Set to **Enable**
 - e. Click **Send**.

- Measure voltage at J4 between: *pin-1 (GND) and pin-3 (SWVBAT)* using a MM set to volts DC. Voltage should be greater than 11.9Vdc. If voltage is equal to or less than 11.9, return to test sequence outlined in the Power Troubleshooting flowchart (Figure 97:).
- Measure voltage at J4 between: *pin-1 (GND) and pin-2 (VBAT)* using a MM set to volts DC. Voltage should be greater than 11.9Vdc for this unit. If voltage is equal to or less than 11.9, return to test sequence outlined in the Power Troubleshooting Flowchart (Figure 97:).

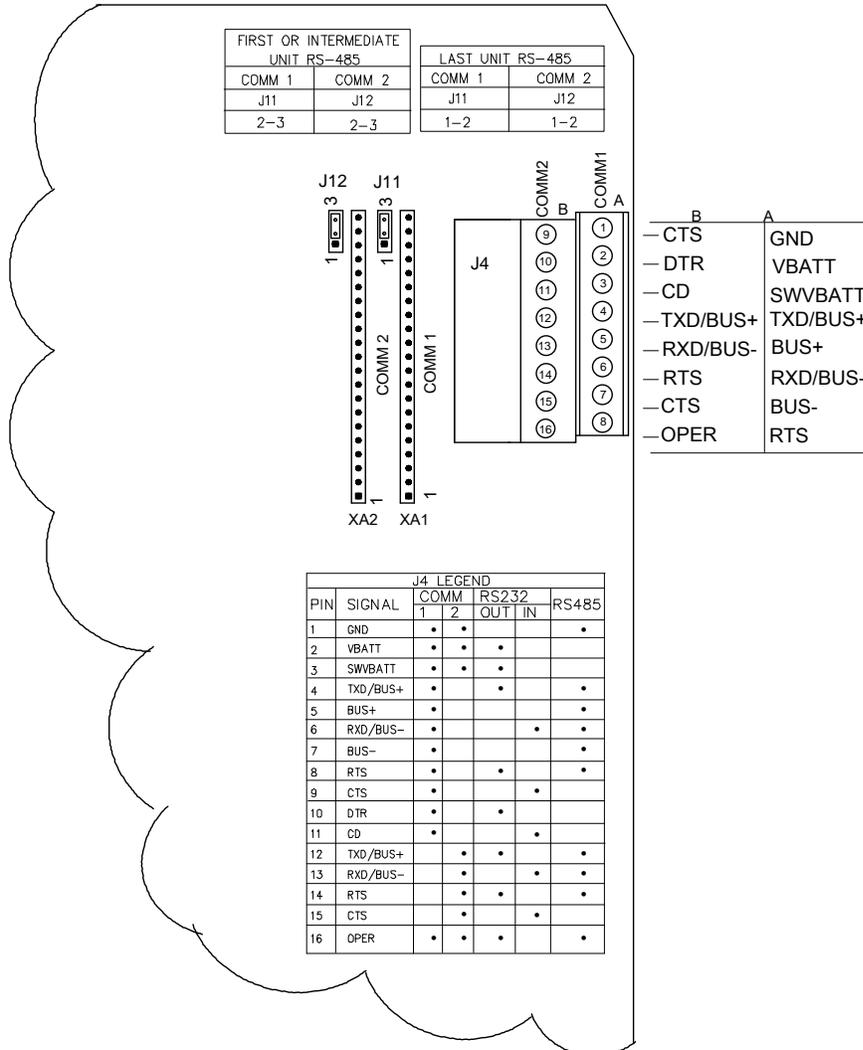


Figure 103: XFC^{G4} Communication Wiring

7.4.4 Transceiver Check

To perform a transceiver check:

- If available, use a wattmeter to check transceiver output power. Refer to manufacturer's documentation for measuring instructions.
- If available, use two hand-held transceivers, and verify communication path between master and remote sites. Voice-activated interface can be used, if available.
- Verify that transceiver is set to the correct frequency. Refer to manufacturer's documentation for checking frequency instructions.
- If a directional antenna is used, verify the orientation to the antenna to the master site.



IMPORTANT NOTE: If a communication problem still exists and the unit has passed the transceiver check test, contact Totalflow Technical Support for additional help.

7.4.5 RS-232 Communication Test

The following test procedure is directed from Figure 102: and will assist the user in what may be the possible cause for an indicated error message.

Before performing this test, please verify that the field wiring is correct (Table 19:).

Table 19: RS-232 Field Wiring on XFC^{G4} Electronic Board J4 A and B

PIN	Description
1	Ground
2	V Battery
3	Switched V Battery
4	TXD/BUS+
5	N/A
6	RXD/BUS-
7	N/A
8	RTS
9	CTS
10	DTR
11	CD
12	TXD/BUS+
13	RXD/BUS-
14	RTS
15	CTS
16	Operate

Tools needed:

- Oscilloscope



IMPORTANT NOTE: When troubleshooting RS-232 mode, verify termination settings of Comm 1-J11 and Comm 2-J12 on XFC^{G4} have pins 2 and 3 jumpered.

To perform an RS-232 test:



IMPORTANT NOTE: Voltage on the following steps may be hard to see using a digital multimeter. If available, an oscilloscope will provide a more accurate reading. To verify, the host software must be continuously polling the flow computer. Generally speaking, these tests performed on the termination board will only verify incorrect or damaged wiring. If all previous testing passed, and all wiring, jumper and terminations have been verified correct, the board will need to be replaced. Contact the office number listed on the back page of this guide.

1. Open enclosure.
2. Measure, Using an oscilloscope, receiving data (RXD) voltage on electronic board J4 between:
 - a. COMM 1, pin 1 (Ground) and COMM 1, pin 6 (Receive Data)
 - b. COMM 1, pin 1 (Ground) and COMM 2, pin 13 (Receive Data)



IMPORTANT NOTE: When the unit is receiving data from host, voltage should vary between -5Vdc and +5Vdc. This would indicate that the unit is receiving data, continue to step 3. If unit is not receiving data, investigate wiring issues (Table 19:).

3. Measure, using an oscilloscope, Request to Send (RTS) voltage on electronic board J4 between:
 - a. COMM 1, pin 1 (Ground) and COMM ,1 pin 8 (Request to Send)
 - b. COMM 1, pin 1 (Ground) and COMM 2, pin 14 (Request to Send)
-



IMPORTANT NOTE: When unit is communicating with the host, voltage should be +5Vdc and remain +5Vdc until the flow computer transmit stops. This would indicate that the unit is transmitting data. Continue to step 4. If unit is not receiving data, investigate wiring issues (Table 19:)

4. Using an oscilloscope, measure transmit data (TXD) voltage on electronic board J4 between:
 - a. COMM 1, pin 1 (Ground) and COMM 1 pin 4 (Transmit Data) or
 - b. COMM 1, pin 1 (Ground) and COMM 2, pin 12 (Transmit Data).
-



IMPORTANT NOTE: When the unit is transmitting to host, voltage should vary between -5 Vdc and +5Vdc. This would indicate that the unit is transmitting data. If unit is still not responding, continue to next test as directed in Figure 102:

7.4.6 RS-485 Communication Test

The following RS-485 Serial Communication Test procedure is directed from Figure 102: and will assist the user in what may be the possible cause for indicated error message.

Before performing this test, please verify that the field wiring (Table 20:) is correct.



IMPORTANT NOTE: When troubleshooting RS-485 mode, verify termination settings of COMM 1 J11 and COMM 2 J12 on XFC^{G4} board are correctly jumpered (Table 21:).

Table 20: RS-485 Field Wiring on XFC^{G4} Board J4 A and B

PIN	Description
1	Ground
2	VBattery
3	Switched VBattery
4	TXD/BUS+
5	BUS+
6	RXD/BUS-
7	BUS-
8	RTS
9	N/A
10	N/A
11	N/A
12	TXD/BUS+
13	RXD/BUS-
14	RTS
15	N/A
16	Operate

Table 21: RS-485 Terminations

Communication Port	1	2
Jumper	J11	J12
First or Intermediate Unit	pins 2–3	pins 2–3
Last or Only Unit	pins 1–2	pins 1–2

7.4.7 RS-485 Communication Test

Tools needed:

- Oscilloscope
- Flat head tweaker screwdriver

To perform an RS-485 communication test using an oscilloscope:

1 **IMPORTANT NOTE:** Voltage on the following steps may be hard to see using a multimeter. If available, an oscilloscope will provide a more accurate reading. To verify, the host software must be continuously polling the meter.

1. Open enclosure
2. Measure line driver voltage, using an oscilloscope, on the circuit board J4 between:
 - a. COMM 1, pin 7 (BUS-) and COMM 1, pin 5 (BUS+)
 - b. COMM 2, pin 13 (BUS-) and COMM2, pin 12 (BUS+)

1 **IMPORTANT NOTE:** When the unit is receiving data from host, voltage should vary between -5Vdc and 0Vdc. This would indicate that the unit is receiving data, continue to step 3. If unit is not receiving data, investigate wiring issues (Table 19:).

3. Using an oscilloscope, measure remote request J4 to send (RRTS) voltage J6 between:
 - a. COMM 1, pin 2 (Ground) and COMM 1, pin 8 (RTS) or
 - b. COMM 1, pin 2 (Ground) and COMM 2, pin 14 (RTS).

1 **IMPORTANT NOTE:** When the unit is receiving data from host, voltage should vary between +5Vdc and 0Vdc. This would indicate that the RRTS is receiving data. If unit is not receiving data, investigate wiring issues (Table 19:).

4. Call Totalflow Technical Support for additional help. If a communication problem still exists, and the unit has passed the tests in steps 1 and 2, additional testing will be required.



CAUTION – Equipment Damage: Before removal or installation of either the above communication interface modules, it is important that you disconnect the external battery charger and main battery pack cable connectors from the circuit board.

Customer support

We provide a comprehensive after sales service via a Worldwide Service Organization.

Contact one of the following offices for details on your nearest Service and Repair Centre.

Client warranty

Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification. Periodic checks must be made on the equipment's condition. In the event of a failure under warranty, the following documentation must be provided as substantiation:

- A listing evidencing process operation and alarm logs at time of failure.
- Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.

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