2100726-001 (AF)

TOTALFLOW®

*X*Series Flow Computer

User's Manual

TOTALFLOW
MEASUREMENT & CONTROL SYSTEMS

ABB

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Introduction

About the Manual

This manual is written to provide an experienced flow meter technician with the requirements necessary to install, setup and operate a Totalflow X Series Series Flow Computer System.

Organization & Style

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

Highlights

This manual provides the following information:

Chapter	Description
1. System Description	Provides a description of the Totalflow, X Series system components, specifications, and description of flow computer computation methods.
2. Installation	Includes unpacking and detailed procedures for setup and installation.
3. XFC Startup	Provides you with a tutorial on how to get a newly installed XFC system up and running.
4. Maintenance	Provides instructions on how to remove and replace major modules.
5. Troubleshooting	Provides a description of the XFC front panel error messages and provides a troubleshooting chart on how to correct most problems.
6. Definitions and Acronyms	Provides quick access to the majority of terms and acronyms, as well as their definitions.
7. Drawings	Provides a place to put drawings that accompany a unit.

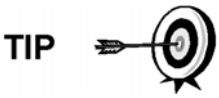
Key Symbols

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

FYI 

Intended to draw your attention to a statement that might clarify a point made earlier.

Intended to draw your attention to a statement that might keep you from making a mistake, keep you from destroying equipment or parts, or keep you from personal injury.



Intended to draw your attention to a fact that may be useful or helpful.

Getting Help

At Totalflow, we take pride in the on going support we provide our customers. When you purchase a product, you receive documentation which should answer your questions; however, your Totalflow technical support provides you an 800 number as an added source of information.

If you require assistance, call:

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

Before You Call

Know your Totalflow's serial number. Serial numbers can be found on the escutcheon plate located on the side of each unit.

Be prepared to give the customer service representative a detailed description of the problem.

Note any alarms or messages as they appear on the PCCU or front panel LCD.

Prepare a written description of problem.

Know your software version, board and AMU part numbers.

Safety Practices and Precautions

This manual contains information and warnings which have to be followed by the user to ensure safe operation and to retain the product in a safe condition.

Safety First

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

Symbols in This Manual

This symbol indicates where applicable safety, cautionary or other information is to be found.

Continued on Next Page

Terms Marked on Equipment

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

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

Symbols Marked on Equipment

 Protective ground (earth) terminal

Grounding the Product

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

Correct Operating Voltage

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

Danger Arising From Loss of Ground

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

Safe Equipment

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

Fuse Replacement

Fuses used on Model X Series electronic boards are surface mount and field repair should not be attempted. Most fuses automatically reset themselves, but if a know problem exists, the board should be sent in for repair or replacement.

Safety Guidelines

DO NOT open the equipment to perform any adjustments, measurements, maintenance, parts replacement or repairs until all external power supplies have been disconnected.

Only a properly trained technician should work on any equipment with power still applied.

When opening covers or removing parts, exercise extreme care "live parts or connections can be exposed".

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

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Chapter 1
System Description

Overview

This Chapter introduces you to the Totalflow® X Series Flow Computers (XFC). The X Series are low power, microprocessor based units designed to meet a wide range of measurement, automation, monitor, control and alarming applications for remote oil and gas systems of many kinds. Six models of the X Series are available: Models XFC 6410, XFC 6413 and XFC 6713 are differential (Orifice) meters. Models XFC 6411, XFC 6414 and XFC 6714 are pulse (Linear) meters.

The models XFC 6410 and XFC 6411 are packaged in a small enclosure and are designed for only the XFC-195 Board (main electronic 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, if needed. See Figures 1–1 and 1–2.

The models XFC 6413 and XFC 6414 are packaged in an enclosure that can accommodate the XFC-195 Board, a variety of remote communications devices, batteries, and up to 3 additional I/O modules. These I/O modules generally provide 8 I/O points per module. See Figures 1–3 and 1–4.

The models XFC 6713 and XFC 6714 that are packaged in an enclosure that can accommodate the XFC-195 Board, a variety of remote communications options, batteries, and up to 6 additional I/O modules. See Figures 1–5 and 1–6.

All of the X Series Flow Computers feature single or multi-tube capability, up to 5 per unit (8 tubes per unit in special cases) with custody transfer measurement features. These flow computers are also quite flexible and allow you to increase productivity and improve asset utilization. See Table 1–1 for the XFC Family Genealogy.

The letters XFC stand for Expandable Flow Computer. As their name implies, they are expandable to meet your needs, while maintaining backward compatibility with legacy Totalflow systems.

Highlights

This Chapter covers the following topics:

Continued on Next Page

FYI

The XFC maintains a history of alarms as well as average differential pressure (DP), average static pressure (SP), average flowing temperature (Tf), accumulated volume and energy. Additionally, for Differential Meters an average extension is maintained while for Pulse (linear) Meters an uncorrected volume accumulator is maintained.

The Orifice (differential) XFC can be programmed to calculate flow rates and volumes in accordance with either AGA 3-85, AGA 3-92, or additional flow calculations methods available on request such as; ISO5167, Liquid, Vcone, FloNozzle, etc.

The Pulse (linear) XFC can be programmed to calculate flow rates and volumes in accordance with AGA 7.

Supercompressibility calculations can be performed in accordance with either NX-19 or AGA 8-92, gross or detail.

Capabilities

The XFC defaults to retention of daily and log period records for 40 days and retention of 200 events. These defaults can be extended, limited only by the file space on the device.

All models may be used in conjunction with the handheld FS/2 and/or a laptop computer running PCCU32 software. The FS/2 can do the basic setup parameters, but PCCU32 is required for many of the advanced features of the X Series devices.

Models XFC 6410 and XFC 6411 perform the basic functions and include additional I/O as provided on the Main Electronic Board (XFC-195).

Models XFC 6413 and XFC 6414 perform these same basic functions and additionally have the option for three TFIO modules.

Models XFC 6713 and XFC 6714 perform these same basic functions and additionally have the option for six TFIO modules.

Table 1–1 XFC Family Genealogy

XFC Model	XFC-195 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

XFC General Specifications

Dimensions

XFC 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

XFC 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)

XFC 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 Part No. 2101101-001

Linear Flow Computer Part No. 2101102-001

XFC-195 Board

Power	Battery 12 VDC
External Power	SWVBAT: 1 fused with 2.5 amp PTC VBAT: 1 fused with 2.5 amp PTC
Charger	Solar or 16-18 VDC
Memory	• Data stored in 512K SRAM. RAM memory has lithium backup battery. • Applications programs stored in 512K Flash. • Flash loader stored in 512K PROM • Registry and Configuration files stored in 16/32K E^2PROM • Transducer factory calibration data stored in separate E^2PROM
Comm Ports	3 Ports Available: 1 - dedicated - PCCU 2 - RS232 or RS485 (via plug-in modules)
Microprocessor	High integration microcontroller with 20 bit address bus (1M), operating at 11 MHz
Analog Inputs	2 (0-5 VDC)
Digital Inputs	2 (State Change or Pulse to 10 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^2C Serial I/O Bus for TFIO Modules
Keypad Interface	Dedicated interface for Optional Keypad Equipment
LCD Interface	Dedicated interface for Liquid Crystal Display (LCD)
Security Switch	On/Off Bi-level on-board Security (See Chapter 3 for details)
I/O Scan Rate	1 time per second
Time Base Stability	± 7.5 ppm (parts per million)
Pulse Input Bandwidth	Up to 20 KHz (Linear flow meter only)

Analog Measurement Unit (AMU) or IMV Specifications

Multivariable Unit

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 1 Hz, 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	± 1°F (0.56°C) over operating range

Static Pressure

Accuracy	• Includes the effects of linearity, hysteresis and repeatability • Standard Accuracy: <= ±0.2% of URL (Upper Range Limit) • Optional Accuracy: <= ±0.05% URL
Ambient Temp. Effect	• ± 0.15% of URL (per 160°F, 71°C) • ± 0.125% of Reading
Stability	± 0.1% of URL for 12 months

Differential Pressure (Differentical Flow Computers only)

Accuracy	• Includes the effects of linearity, hysteresis and repeatability • Standard Accuracy: <= ±0.2% of URL (Upper Range Limit) • Optional Accuracy: <= ±0.05% URL
Ambient Temp. Effect	• ± 0.15% of URL (per 160°F, 71°C) • ± 0.125% of Reading
Stability	± 0.1% of URL for 12 months
Static Pressure Effect	DP Zero per 1500 psi: ± 0.03% of Calibrated Span DP Span per 1500 psi: ± 0.05% of URL

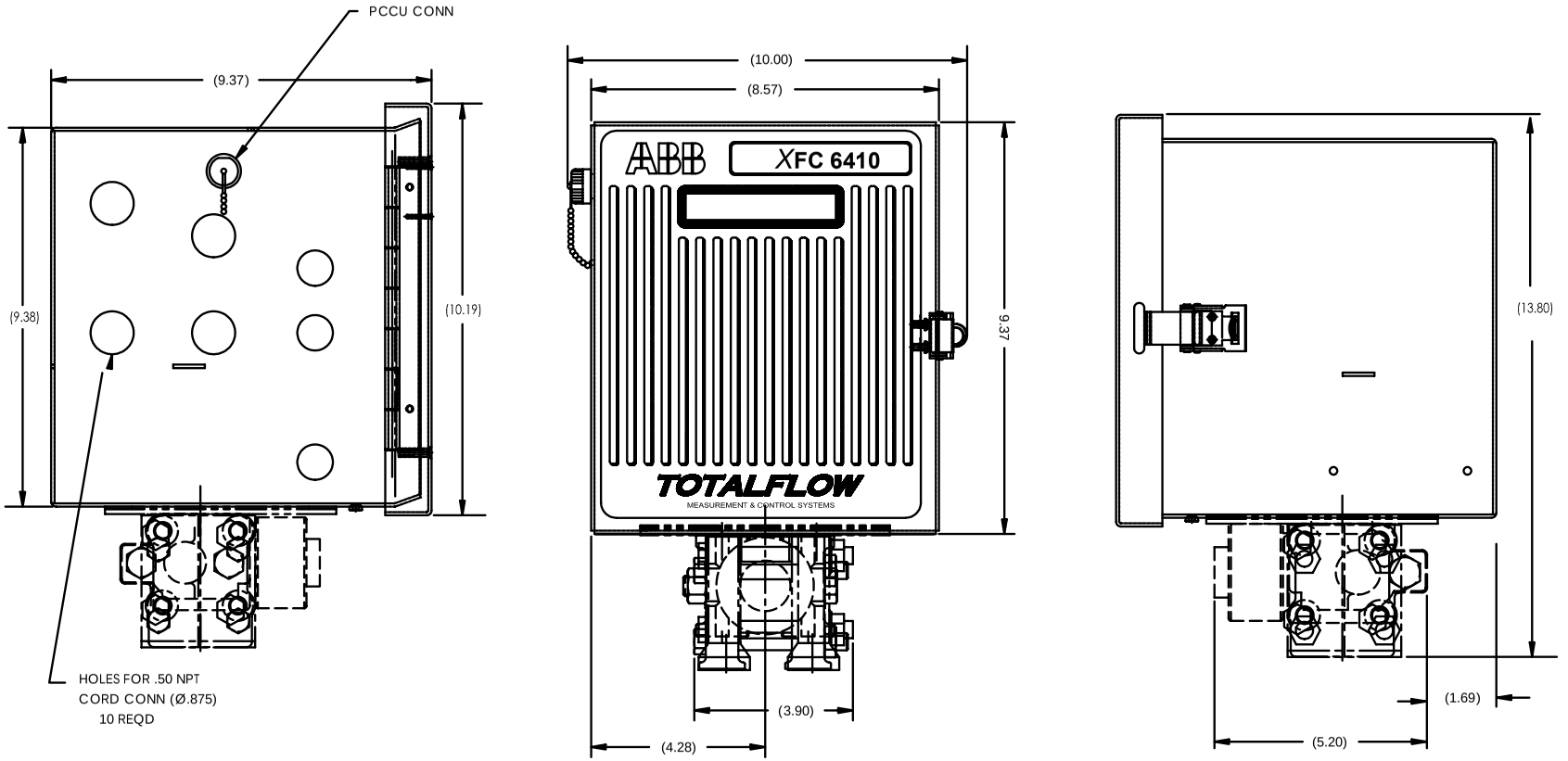


Figure 1–1 XFC Model 6410, Orifice Meter

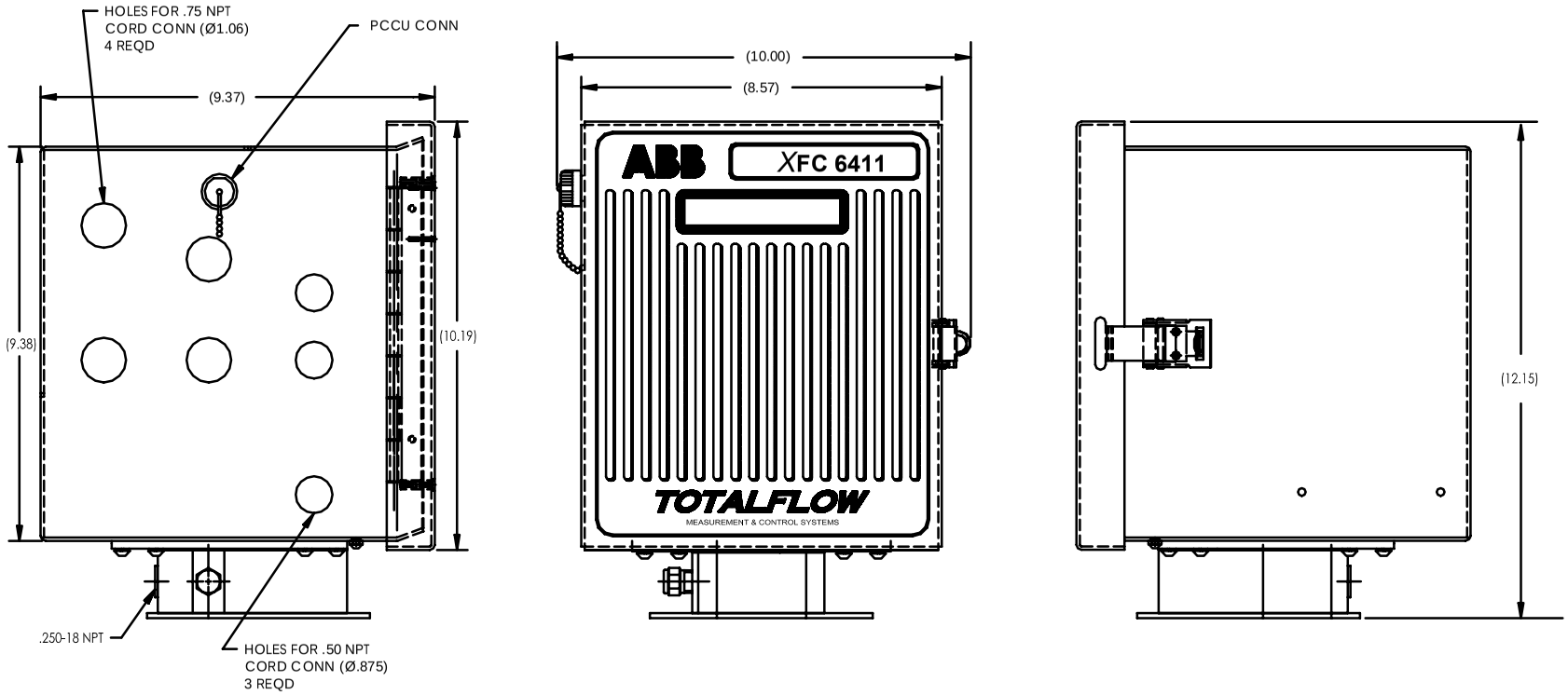


Figure 1–2 XFC Model 6411, Pulse Meter

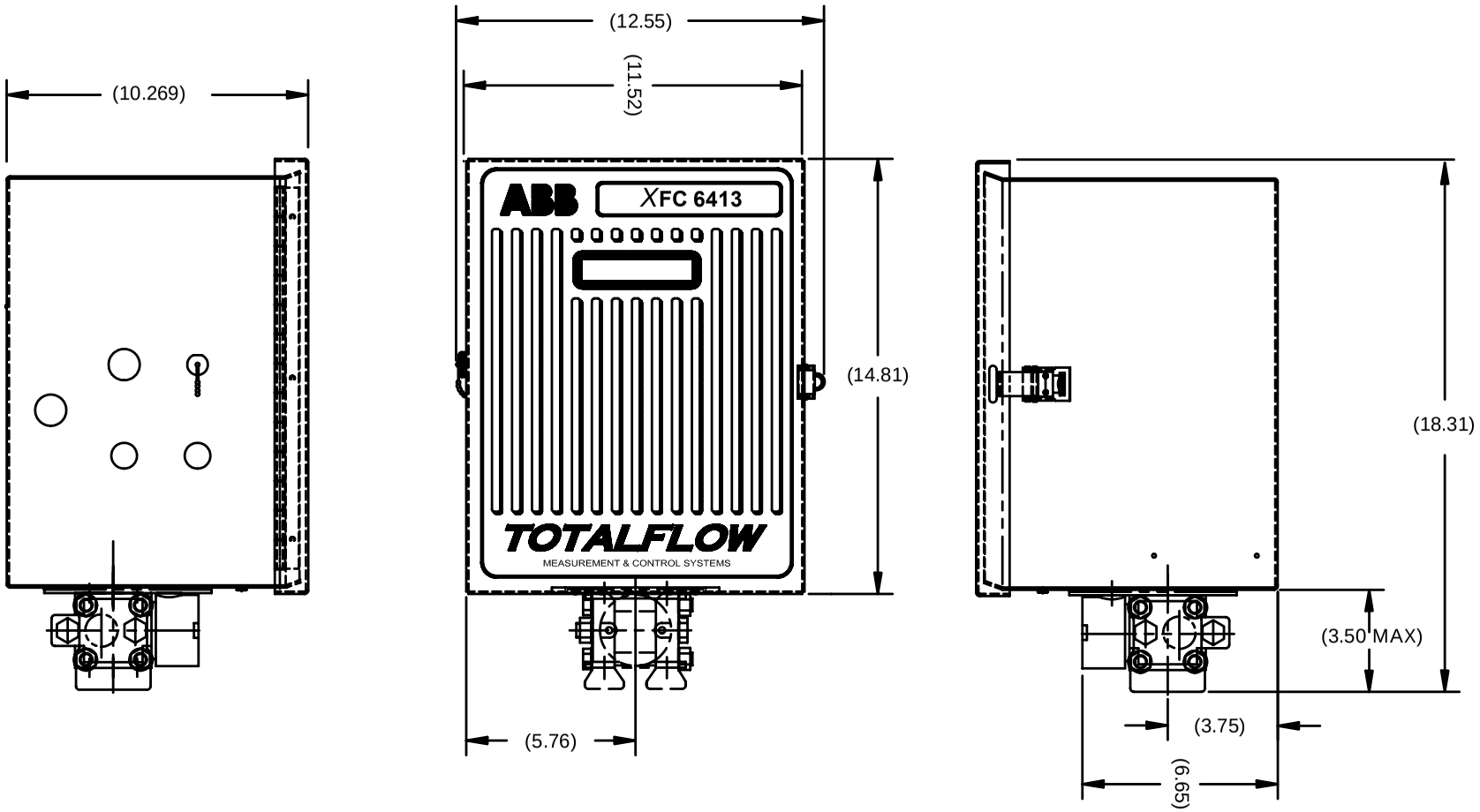


Figure 1–3 XFC Model 6413 Orifice Meter

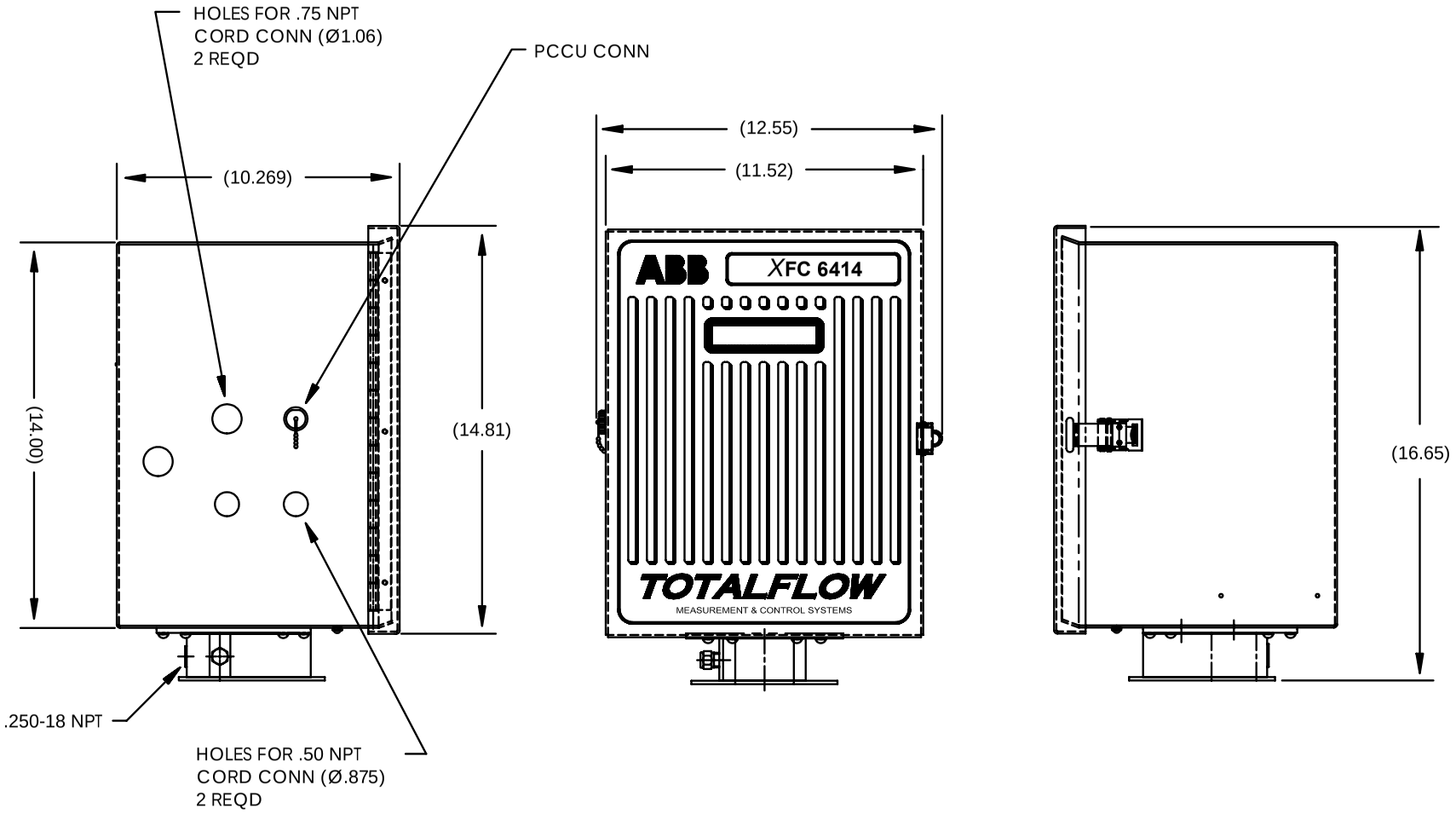


Figure 1–4 XFC Model 6414, Pulse Meter

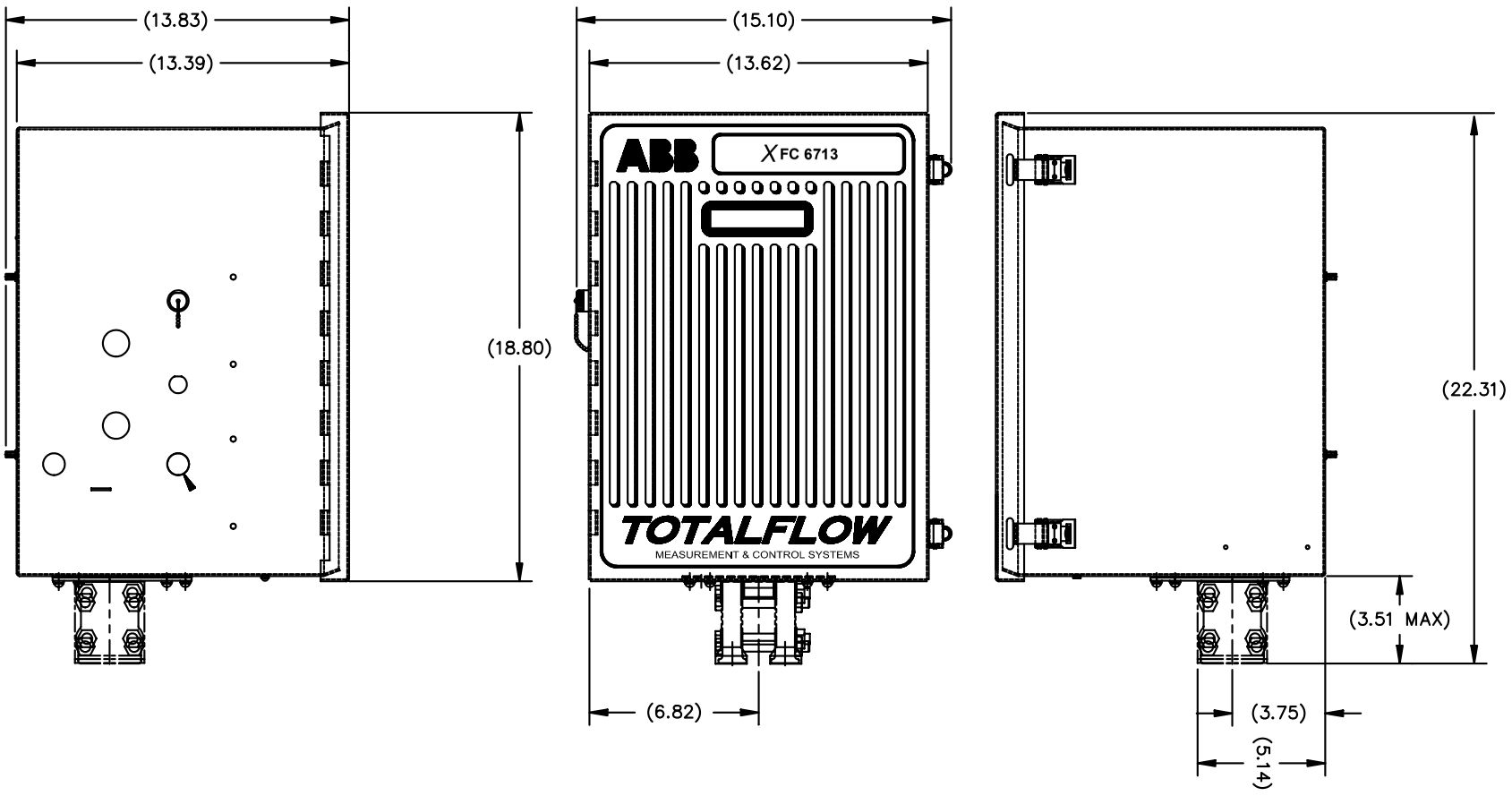


Figure 1–5 XFC Model 6713, Orifice Meter

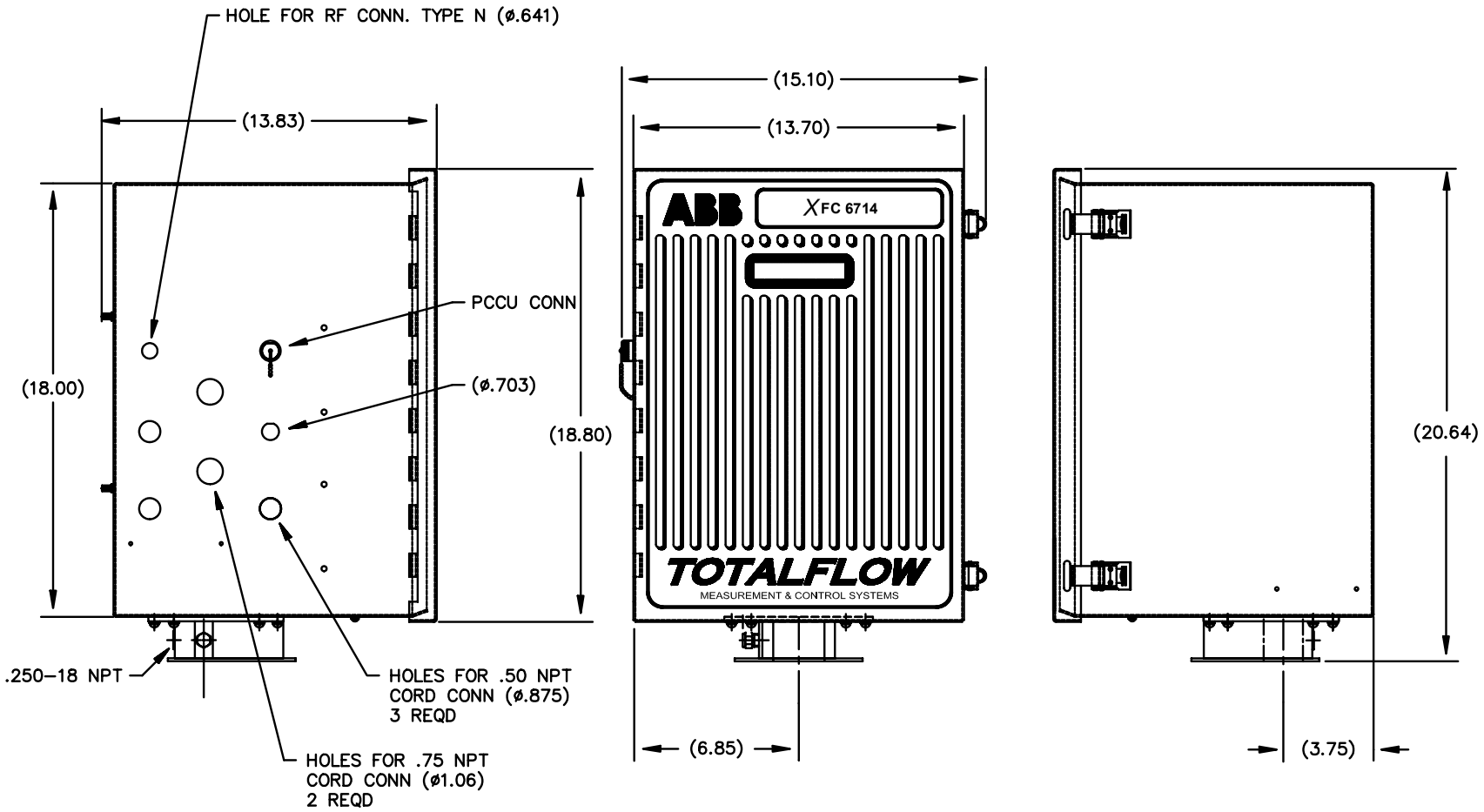
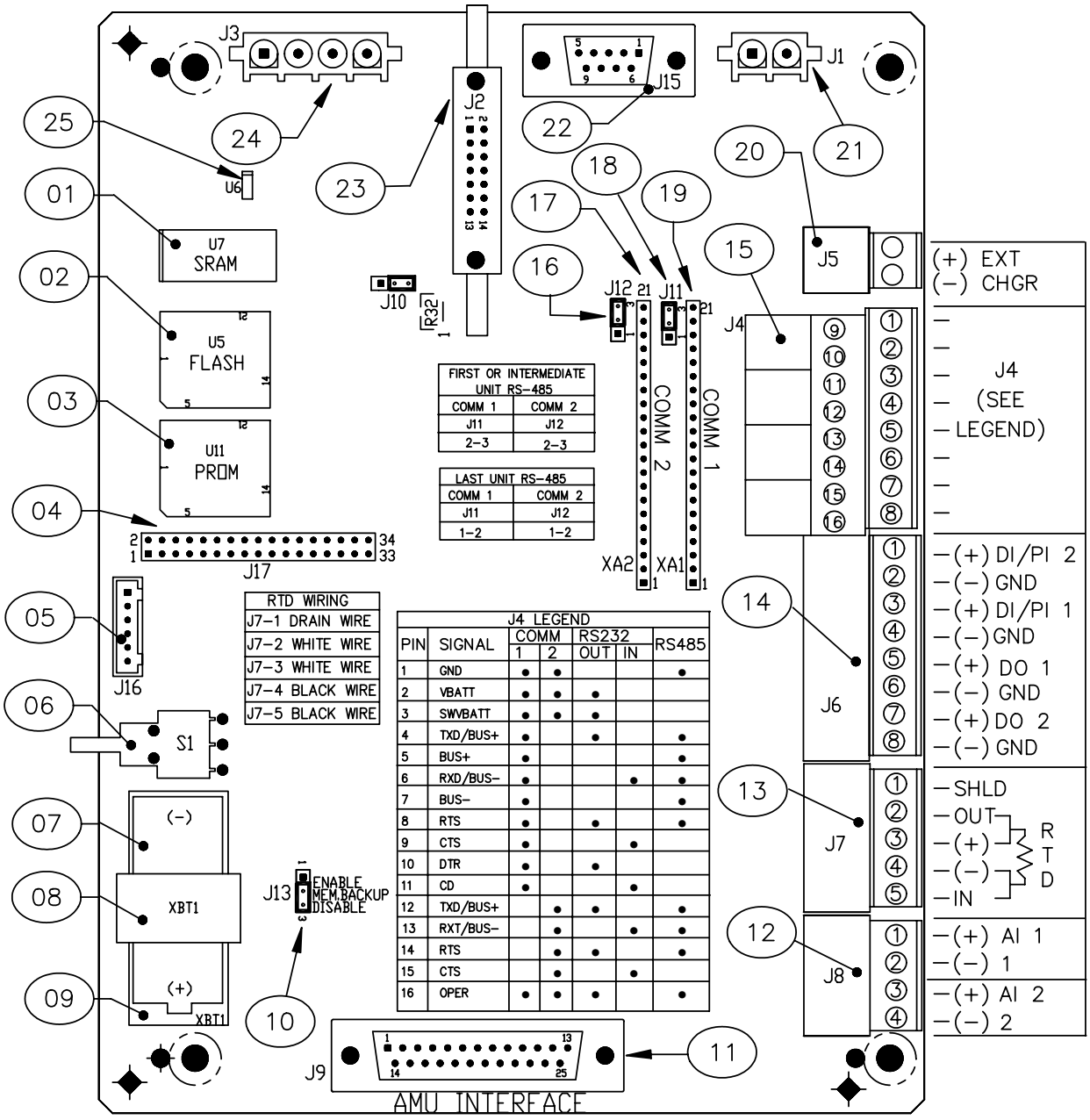


Figure 1–6 XFC Model 6714, Pulse Meter



FIRST OR INTERMEDIATE UNIT RS-485	
COMM 1	COMM 2
J11	J12
2-3	2-3

LAST UNIT RS-485	
COMM 1	COMM 2
J11	J12
1-2	1-2

RTD WIRING
J7-1 DRAIN WIRE
J7-2 WHITE WIRE
J7-3 WHITE WIRE
J7-4 BLACK WIRE
J7-5 BLACK WIRE

J4 LEGEND						
		COMM		RS232		RS485
PIN	SIGNAL	1	2	OUT	IN	
1	GND	•	•			•
2	VBATT	•	•	•		
3	SWVBATT	•	•	•		
4	TXD/BUS+	•		•		•
5	BUS+	•				•
6	RXD/BUS−	•			•	•
7	BUS−	•				•
8	RTS	•		•		•
9	CTS	•			•	
10	DTR	•		•		
11	CD	•			•	
12	TXD/BUS+		•	•		•
13	RXT/BUS−		•		•	•
14	RTS		•	•		•
15	CTS		•		•	
16	OPER	•	•	•		•

Figure 1–7 XFC-195 Board, Complete Overview

Table 1–2 XFC-195 Board Identifications, Complete Overview

ID Number	Description
1	RDRIVE: SRAM (Lithium backed)
2	Flash Program Memory
3	Prom Loader and Utilities Memory
4	Factory Maintenance Interface
5	Keypad Connector
6	Security Switch
7	Lithium Battery
8	Battery Cover
9	Battery Mounting Bracket
10	Memory Backup Enable/Disable
11	AMU Interface
12	Analog Input Connectors
13	RTD Connectors
14	Pulse Input and Digital Output Connectors
15	Remote Communications Connectors
16	Remote Comm 2: RS-485 Termination Jumper
17	Remote Comm 2: Module Plug-in
18	Remote Comm 1: RS-485 Termination Jumper
19	Remote Comm 1: Module Plug-in
20	External Charger
21	Battery Connection
22	I/O Module Interface
23	LCD Display Interface
24	PCCU Interface
25	SDRIVE: 16/32 K E^2Prom for Registry and Configuration Files

XFC Flow Computer Hardware

The Totalflow® X Series Flow Computer Models XFC 6410, XFC 6411, XFC 6413, XFC 6414, XFC 6713 and XFC 6714 are housed in a lightweight two-compartment aluminum case. With the exception of the size of the cases the X Series Models use identical components, which are:

- Enclosure
- XFC-195 Board (See Figure1–7)
- Analog Measuring Unit (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

Enclosure

The enclosure consists of hinged-door box. The door provides a watertight, corrosion resistant seal between the outside elements and the XFC components. It is NEMA 4X rated. Opening the door's latch(s) allows access to electronics, battery and Analog Measurement Unit (AMU/IMV) components.

XFC-195 Board

The XFC-195 Board is mounted on the inside of the door. All XFC input and output connections are made with Phoenix style snap-in connector terminals mounted directly on the board. The XFC-195 Board uses a low power processor running at 11.0592 MHz with Data stored in 512K SRAM. RAM memory has lithium backup battery. The applications programs stored in 512K Flash, the flash loader stored in 512 K PROM, and Registry and Configuration files stored in 16K E^2PROM. Other circuitry processes the inputs from the Analog Measuring Unit and provides interfaces to the LCD and the PCCU. Remote communications are handled by the RS232 and RS485 communication modules that plug directly into the XFC-195 Board. See Figure 1–7.

Analog Measurement Unit (AMU)

The AMU contains circuitry for processing all analog measurements and provides the primary measurement capability for the XFC. The unit is designed to provide EMI/RFI protection of the low level signals, and to protect the circuitry from other environmental effects. The AMU contains a single circuit board which contains the analog to digital converter and analog conditioning circuitry necessary for the AMUs, the RTD and two general purpose Analog Inputs.

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

FYI

For the purpose of clarity, the AMU acts as a multivariable transducer (includes a Static Pressure cell, a Differential cell and RTD input) and an AMU. In this manual, we reference the AMU when speaking generally. In the Input/Output chapter, we will discuss the AMU as a separate entity.

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XFC Flow Computer Hardware, Continued

Battery Compartment	The battery compartment houses the various optional battery packs that are available for the XFC; from 8 ampere hours up to 26 ampere hours. Installation of the battery requires only removing the battery plate, placing the battery in place, and connecting the battery cable to the XFC-195 Board. This is discussed in detail in Chapter 5-Maintenance.
Communication Compartment	Models XFC 6413 and XFC 6414, provide an enclosure to house a remote communication device; transceiver, cellular phone, etc.
Modular I/O	The hardware functionality of the X Series flow computers can be extended by using modular I/O packaged in DIN mount enclosures.
Solar Panel	The XFC can be configured for a 10-Watt, 20-Watt or 30-Watt solar panel. The panel is designed to be mounted on 2-inch extension pipe above XFC or mounted to the meter house.
Resistive Temperature Detector (RTD)	An optional 100-ohm platinum RTD measures 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.

Functions of the XFC

Functions of the XFC reflect a design that is practical, straight-forward and efficient. The XFC is simple to use and easy to learn - and it saves time usually spent on calculations and report preparation. The XFC allows you to perform the following with minimum effort, maximum speed and greater accuracy.

Complete log period flow and operational records reported (hourly, default) including -

- 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

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XFC Capabilities

The records and statistics generated are due to the following capabilities of the XFC:

- Calculation of flow rates, volume and coefficients per AGA-3, AGA-8 supercompressibility standards
- Calculation of flow extension $\sqrt{\frac{Dp * Sp}{Tf}}$ once per second
- Extrapolation of flow accumulation during AMU calibration
- Selection of all coefficients for calculation; 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 the PCCU or remote communications protocols.
- Storage of data records and operational events determined by user (based on available SRAM)

Additional Features

Additional features of the Totalflow System enabling its flexibility include the following:

- Programmable differential pressure zero cutoff
- Two digital outputs
- Programmable bi-level security codes to prevent unauthorized communication and configuration of the XFC.
- Two state inputs configurable as either digital inputs or high speed pulse accumulator inputs.
- Automatic temperature compensation of electronic measurement circuitry
- Automatic internal calibration of the RTD, with programmable bias adjustment
- Quick, simple calibration procedures for AMU with steps outlined.
- Real time clock providing a highly stable time base for the system
- Battery operation period is determined by the size of battery, location of unit and power consumption for communications and I/O. Totalflow Project Engineers can configure your requirements and select the appropriate battery. Battery packs to extend operation for longer periods without power are available.
- Three available charging sources -
  External solar panel (standard)
  External AC/DC power
  External 24/12 VDC power

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Functions of the XFC, Continued

Additional Features, Cont.

- LCD (liquid crystal display) programmable to allow monitoring of the XFC operations and any variable that has a Register (for example, displays voltage level of batteries in XFC)
- Rugged, aluminum, powder coated, NEMA 4X enclosure, lockable to prevent internal access.
- Optional ability to allow rapid data collection over several communication links.
- 3 Comm ports are available on the XFC-195 Board: dedicated Local and Remote Comm 1 and Comm 2
- Additional I/O for communications, control, monitoring and alarming functions, such as valve control, plunger lift, pressure, level monitoring, remote communication ports, etc.

On-board Input/Output (XFC-195 Board)

Totalflow's X Series Flow Computers continue to be backward compatible with the same base I/O as earlier models but enhanced to include:

- AMU Interface: 1 SP, 1 DP, 1TF
- External Charger
- 2 User A/I's
- 2 User D/O's
- 2 User D/I's or 2 User High Speed P/I's
- 2 RS232 or 485 Comm Ports
- Interface for TFIO Modules

The Main Electronic Board (XFC-195 Board) is an enhanced replacement for previous versions of the FCU Main Electronic Board (see Figure4–1). In the next few pages, you will see the specifications for Digital/Pulse Input, Digital Output and Analog Input. To see a complete overview of the XFC-195 Board, see Figure1–7.

Communication Ports

You have the ability to program up to two communication ports on the XFC-195 Board. Normally COMM 0 is the local port required for reading the XFC with a laptop computer running PCCU32. COMM 1 and COMM 2 can be configured for any combination of RS 232 or RS 485. See Figure 4–1 for On-Board Communication Ports.

Digital Input

The Totalflow XFC provides two digital/pulse inputs as a means to monitor external equipment.

When connecting or disconnecting any wires to the XFC-195 Board, you should remove all power sources and make sure that you are grounded properly.

Digital Input

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. "OFF" is defined as an open contact. Selectable de-bounce may be enabled or disabled within PCCU32. See the Help Files for additional information.

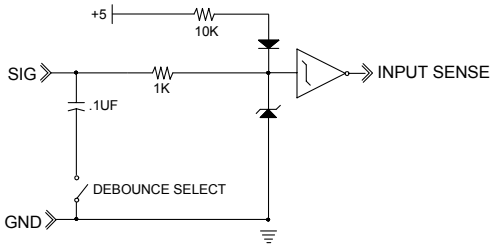
Electrical Specification (each point):

- Open circuit voltage: 5VDC (Internally pulled up to 5VDC Nom.)
- Short circuit leakage current: -395uA typical.
- Input capacitance: 0.1 ufd typical.
- Maximum allowable voltage range on input -0.5VDC to 15VDC.
- Maximum frequency input 100Hz @ 50% duty cycle with de-bounce enabled.
- Maximum frequency input 10KHz @ 50% duty cycle with de-bounce disabled.

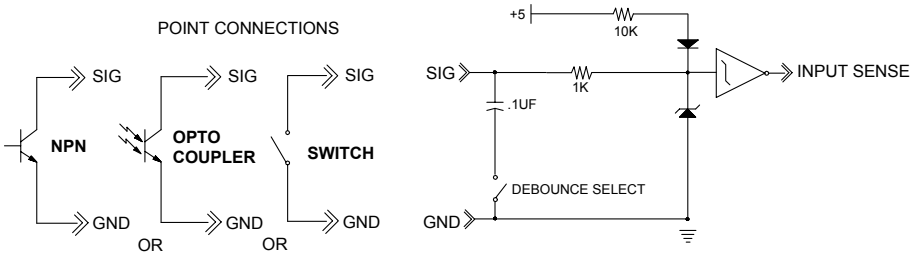
Input Specification

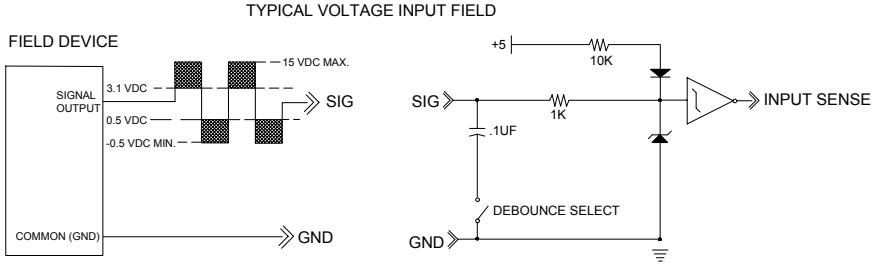
- Dry Contact, Open Collector or Active Voltage.
- Minimum contact resistance to activate input 1000Ω.
- Maximum voltage to deactivate the input: 3.1V (referenced to GND terminal.)
- Minimum voltage to activate the input: 0.5V (referenced to GND terminal.)
- Conductor pairs must be shielded to prevent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

Typical Point Schematic



Example Connections





Digital Output

The Totalflow XFC provides two digital (12V dc) outputs as a means to control external equipment.

When connecting or disconnecting any wires to the XFC-195 Board, you should remove all power sources and make sure that you are grounded properly.

Outputs

When the digital output is used as a measurement device; AGA3, AGA7 or Liquid Measurement, the following outputs can be set when the following conditions occur:

- Differential pressure over high limit
- Differential Pressure under low limit
- Static Pressure over high limit
- Static Pressure under low limit
- Low Charger voltage
- Remote Sense is On
- Volume Set point
- Flow Temperature Low
- Flow Temperature High
- Flow Rate Low
- Flow Rate High
- Trip on Digital Input
- Custom programmable by Totalflow or user programmable with IEC 1131 programming language.

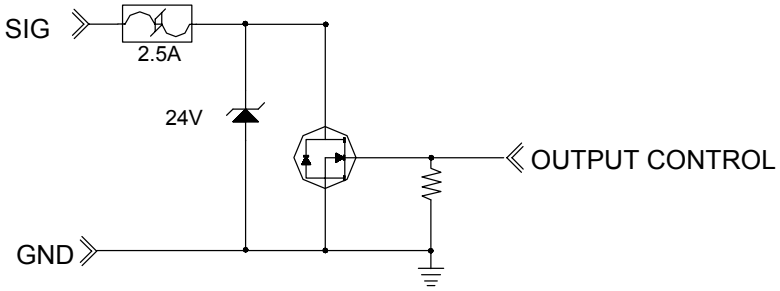
Electrical Specification (each point):

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

Input Specification

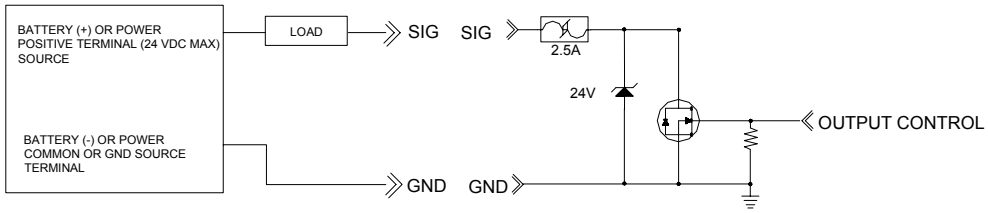
- Open Drain FET type
- "ON" Resistance: 0.1Ω Typical (Including PTC fuse resistance)
- Maximum pulse current: 3A for 5 seconds.
- Maximum continuous sink current: 2A.

Typical Point Schematic



Example Connections

TYPICAL SINK OUTPUT FIELD WIRING



Analog Input

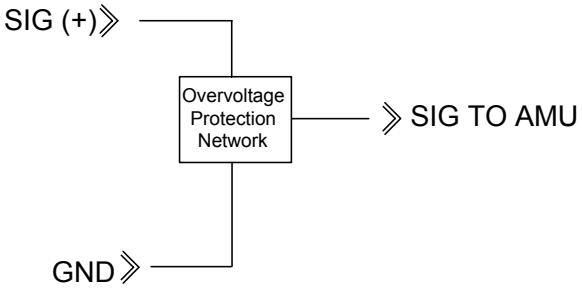
The Totalflow XFC provides two analog inputs as a means of receiving data represented by continuously varying voltage/current.

When connecting or disconnecting any wires to the XFC-195 Board, you should remove all power sources and make sure that you are grounded properly.

Electrical Specification (each point):

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

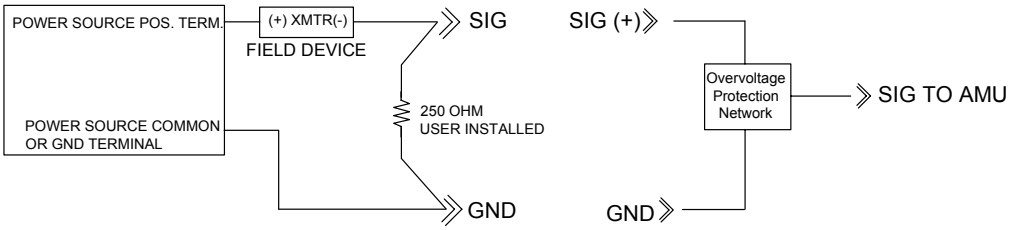
Typical Point Schematic



Example Connections

TYPICAL VOLTAGE ANALOG INPUT FIELD WIRING

TYPICAL 2 WIRE 4--20mA FIELD DEVICE WIRING



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

Log Period Data Entries

Log period data entries are made every 60 minutes by default. You may change this period to one of 6 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, thus requiring more storage space to hold a full day's data. The log period must never be less than the volume calculation period.

Volume Calculation Period Entries

Volume Calculation period entries are made every 60 minutes by default. You may change this period to one of 6 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. (ie. Top of the hour, top of the minute)

Changing XFC Clock

Changing XFC clock could affect the time when next log period entry is made. To protect integrity of accounting audit trail, XFC handles these types of clock changes as follows:

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).

Forward Clock Change Crossing an Hourly Boundary:

Forces an log period entry for part of hour that has accumulated since last hourly entry. FCU 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.

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. XFC 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.

FYI

A backward clock change uses two (2) daily flow 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.

Display Function

During operation, the front panel LCD continuously scrolls through the operating parameters. Table 1–3 shows 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 5 seconds); a setting of 0 seconds will set any display to off. See "Program Display" in Chapter 3 (and PCCU32 help files) for more details.

Table 1–3 Typical XFC 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

Sleep Mode

A unit will go into Sleep Mode 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. The unit can be awaken by simply connecting the PCCU to it and the unit will stay awake as long as the PCCU is connected. If the battery is below 10.9 volts when you disconnect, the unit will go back to sleep after 2 minutes. For more information in troubleshooting this mode, see chapter 5, Troubleshooting.

Status and Alarm Conditions

Since a primary function of the XFC is to provide complete volume and operational records; it is important to indicate unusual or “alarm” conditions as they occur. See Figure 1–8. This is supported on the LCD using annunciators, these are listed in Table 1–4 XFC Status and Alarm Description. Instructions for using the display as a troubleshooting aid can be found in Chapter 6-Troubleshooting.

Whenever an alarm is indicated the XFC records it in the appropriate log period flow record. These are automatically retrieved when data is collected.

In X Series flow computers the status and alarm code annunciators are programmable. This allows the user to program each annunciator to reflect custom status information for different application or tube types. As supplied from the factory, a typical single tube device will come with a standard display configuration, but can be modified. Consult the PCCU32 help files for more instruction on programming the display.

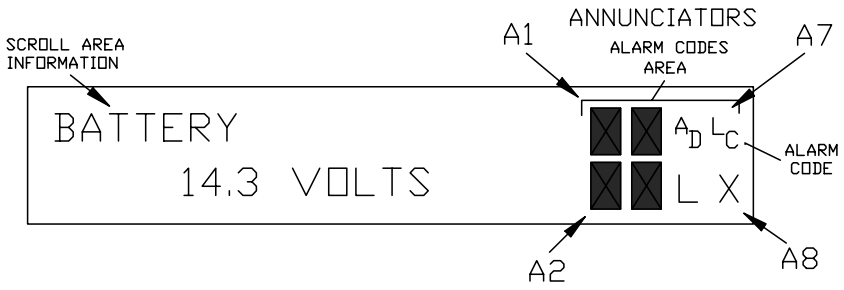


Figure 1–8 Liquid Crystal Display and Indicators

Table 1–4 XFC Status and Alarm Description

Indicator	Description
I/O Sub-System	
L_L	*Low Lithium Battery Alarm*: When L_L (low lithium) is displayed, lithium battery voltage is below 2.5 Vdc. A new lithium battery measures approximately 3.6 Vdc.
L_C	*Low Charger.* Displayed if XFC battery charging voltage is (+)0.4 Vdc or is less than or equal to 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 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.

Table Continued on Next Page

Table 1–4 XFC Status and Alarm Description, Continued

Indicator	Description
Communications Protocols	
→	*Transmitting Data*: Sending a response
←	*Receiving Data*: Processing request.
!	*Nak*. Negative Acknowledgement w/packet list.
+	*Ack*. Positive Acknowledge 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 listening cycle that occurs at 1, 2 or 4 second intervals.
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 PCCU part is active and running TOTALFLOW Local Protocol.
¥	*ID Recognized.* The ID has been recognized but is waiting for “Sync”.
R	*LevelMaster Protocol*: LevelMaster protocol is selected for the port assigned to this annunciator.
Measurement Application	
B_F	*Back Flow Condition.* Visible only when DP variable displayed.
Z	*Zero Flow Condition*: Visible only when Flow Rate displayed.
H	*Hold.* Displayed when PCCU has entered Calibration Mode on a Measurement Application in Hold mode.
A	*Alarm Condition.* Need to view alarm. You may need to compare application limits to current values to determine where the alarm condition is present.
A_D	*A to D Failure.* Displayed if A to D Converter Absolute Differential Pressure, Absolute Static Pressure or temperature readings exceed maximum counts or are less than minimum counts.

Table Continued on Next Page

Table 1–4 XFC Status and Alarm Description, Continued

Indicator	Description
Valve Control	
V	Displayed when Valve Control option is installed an 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).
Ö	Displayed when Valve Control option is installed. Valve controller override conditions met (DP/SP override set point or Low Battery).
L_L	Displayed when Valve Control option is installed. Local Lock-out is initiated.

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Chapter 2
Installation

Overview

This Chapter provides you with the information for installation and setup. By the time you finish this Chapter you will have the XFC unpacked, installed, field wired and ready for operation. For safe and trouble free installation follow all instructions and advisories.

FYI

Read through this Chapter before you begin the installation, to plan your installation. Also before you begin, refer to the wiring diagrams delivered with the new XFC. You may store these under the tab “Drawings” in the back of this manual.

Installation procedures, presented within this Chapter, are applicable to Models XFC 6410, XFC 6411, XFC 6413, XFC 6414, XFC 6713 and XFC 6714.

Highlights

This Chapter covers the following topics:

Continued on Next Page

Unpacking & Inspection

Unpacking

The XFC 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.

Inspection

- Carefully remove the items from each carton.
- 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 (XFC-195 Board), cables, and Analog Measurement Unit for damage.

Damaged Components

If any components have been damaged or if there are noticeable defects, notify your Totalflow representative. Keep all shipping materials for the carrier's inspection. Totalflow will arrange for immediate repair or replacement; see 'Getting Help', page x.

Meter Run Installation Overview

The following procedures, unless otherwise stated, are applicable to all X Series Flow Computers. The XFC can either be pipe, direct or wall mounted. Use the procedure that fits your installation.

See Figures 2–1 through 2–3 for a bottom view of each orifice model.

See Figures 2–4 through 2–6 for a bottom view of each pulse model.

FYI 

When the XFC is pipe or wall mounted it should be located as close as possible to the orifice fittings. This keeps the stainless steel gauge lines as short as applicable.

Instructions

If you want to...	THEN use...	For Procedure See Page
Install on meter run	Pipe Mounting Procedure	2-2
Install on wall	Wall Mounting Procedure	2-15
Direct Mount-Orifice	Direct Mounting Gas Orifice	2-22
Direct Mount-Pulse	Direct Mounting Pulse Meters	2-27

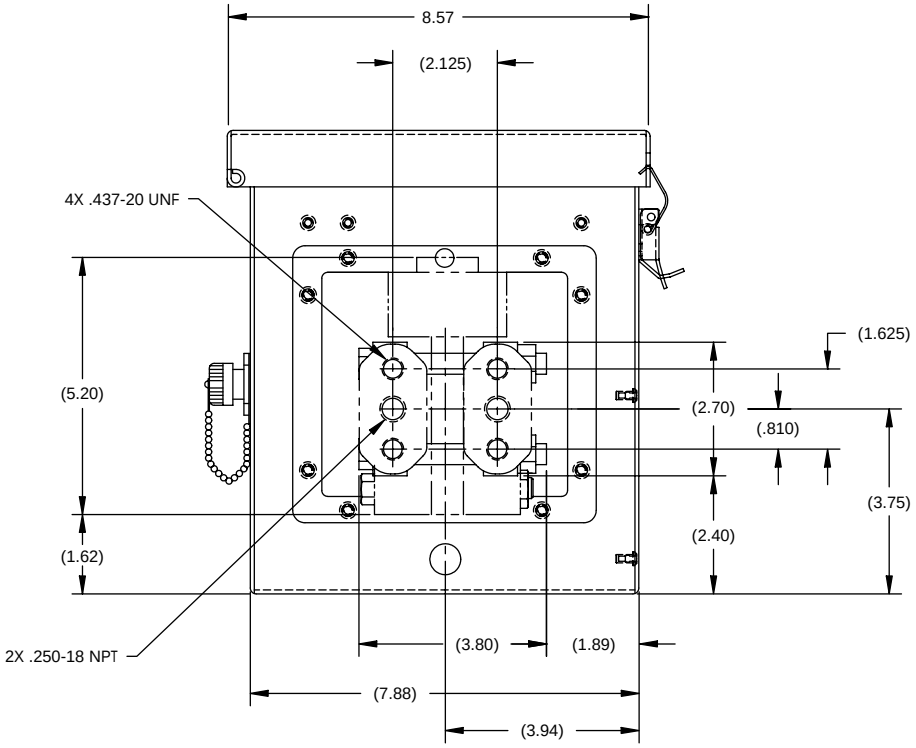

Figure 2–1 Bottom View Orifice Flow Computer XFC 6410

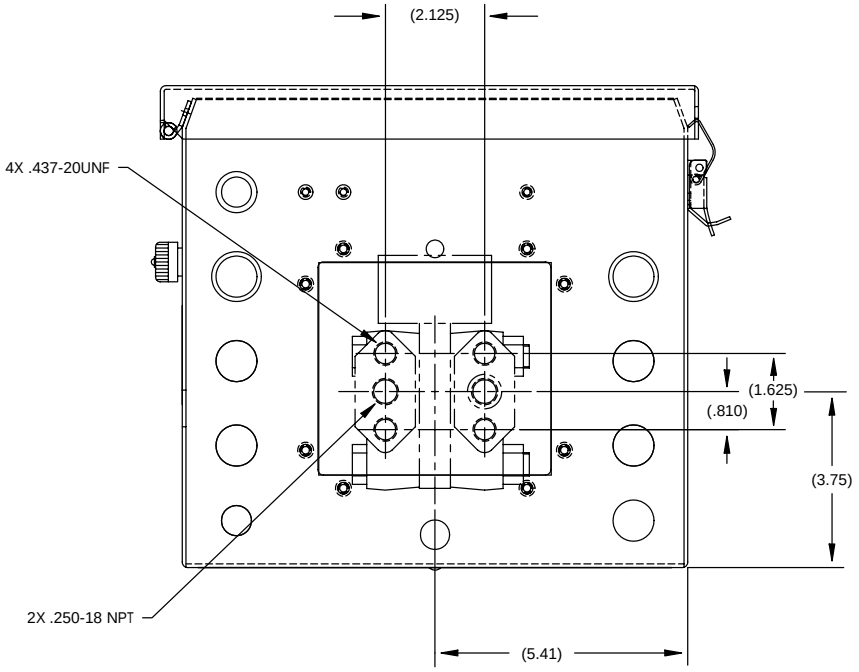

Figure 2–2 Bottom View Orifice Flow Computer XFC 6413

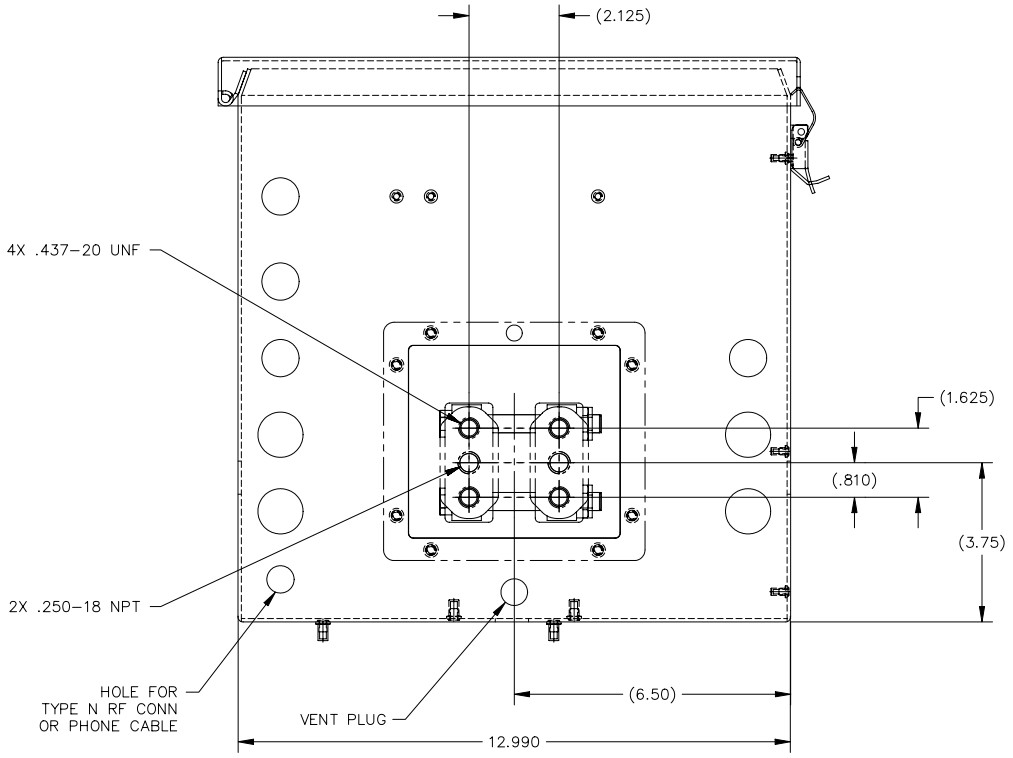

Figure 2–3 Bottom View Orifice Flow Computer XFC 6713

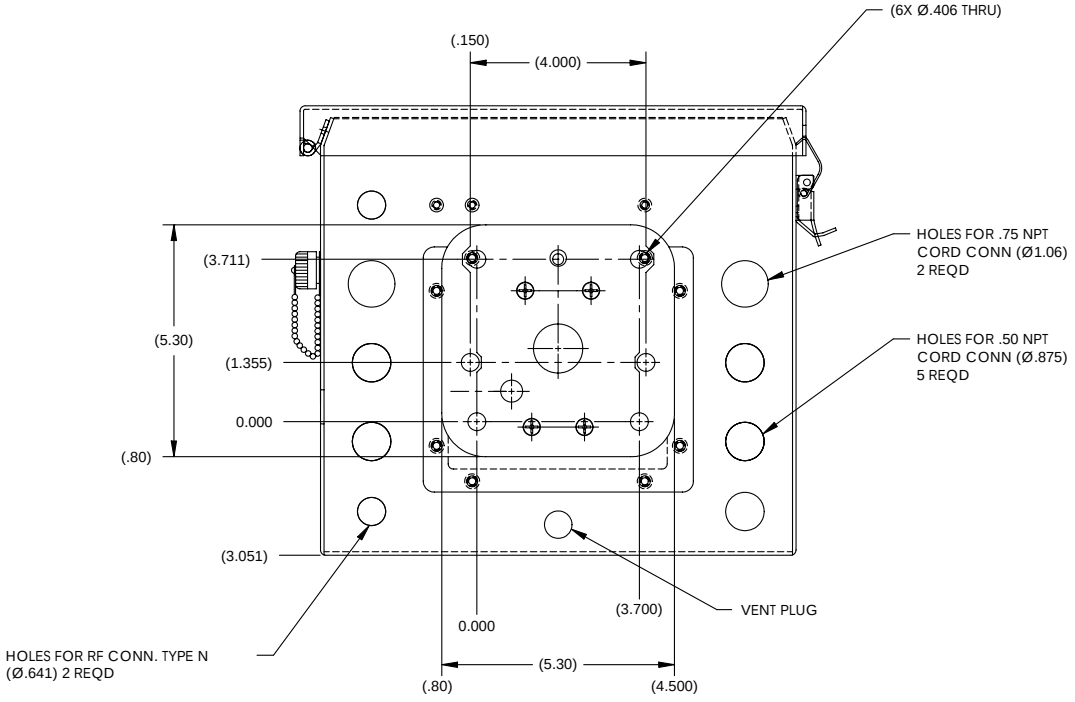

Figure 2–4 Bottom View Pulse Flow Computer XFC 6411

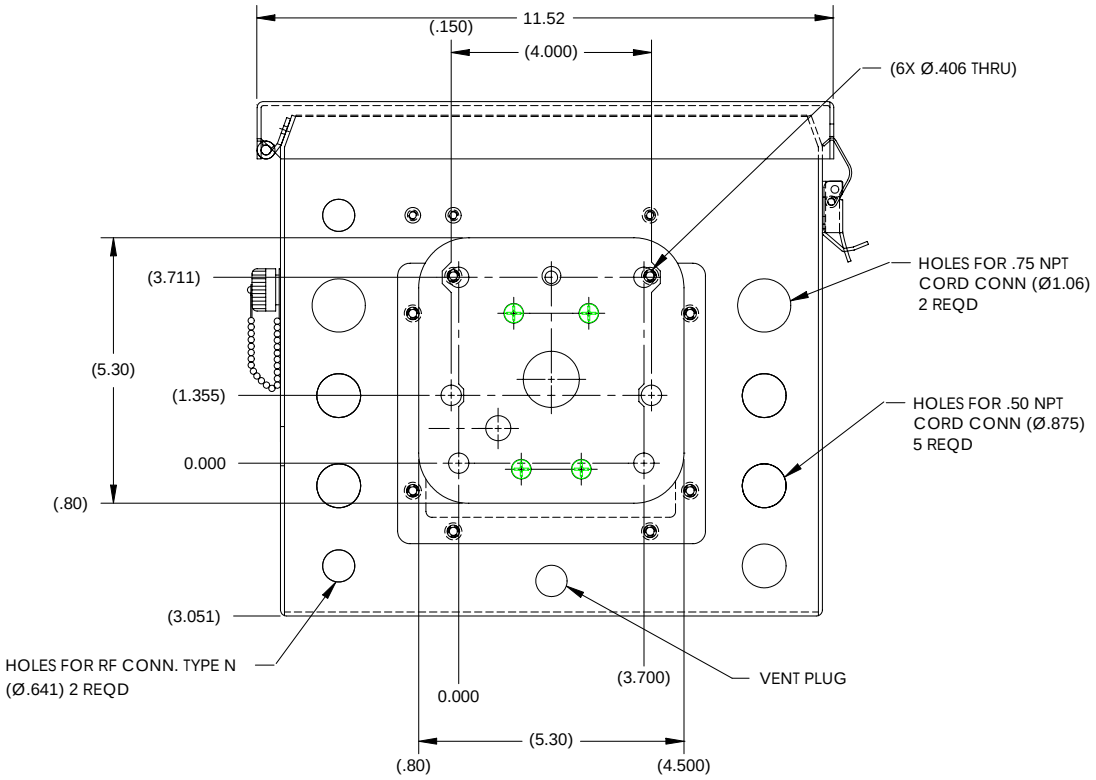

Figure 2–5 Bottom View Pulse Flow Computer XFC 6414

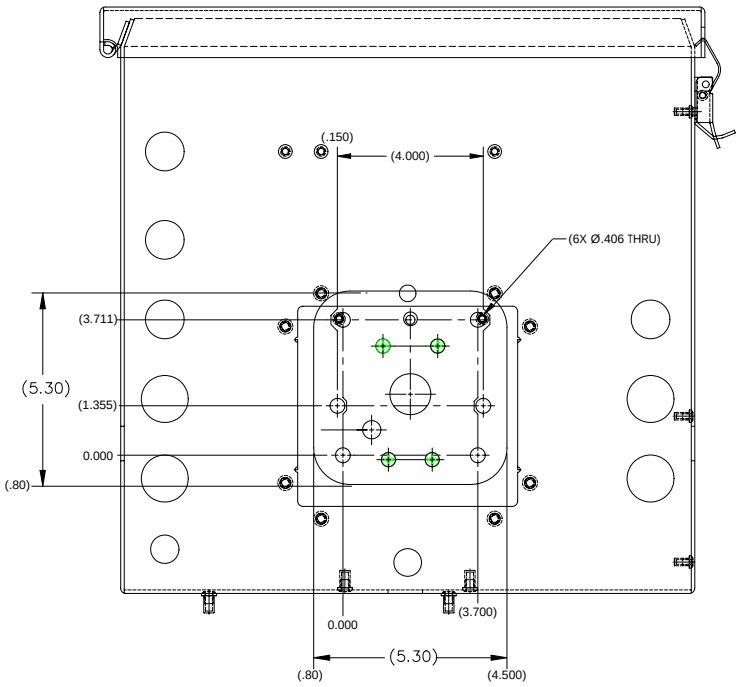

Figure 2–6 Bottom View Pulse Flow Computer XFC 6714

Pipe Mount Installation

If you are installing directly to the meter run use this procedure. Before you begin, review the procedure and the materials required for installation.

Materials Supplied

- Two U-bolts plus fastening hardware
- XFC mounting brackets

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

FYI Optional equipment may be ordered from Totalflow.

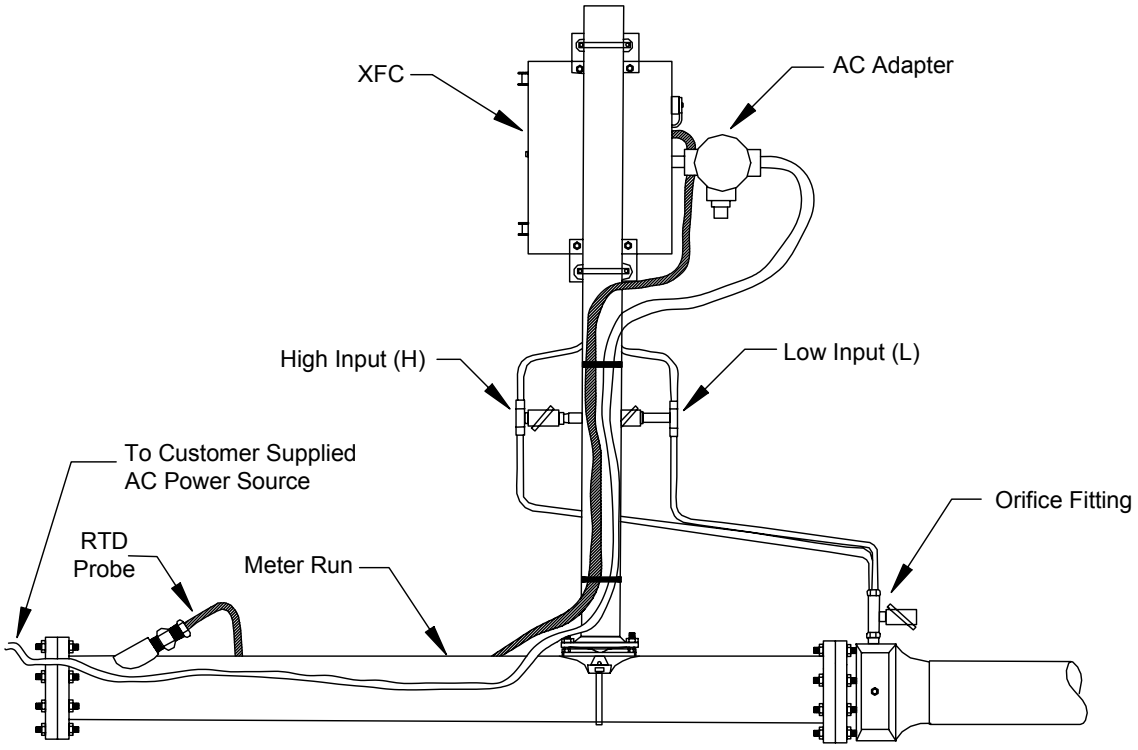

Figure 2–7 Typical Pipe Installation for Gas Orifice

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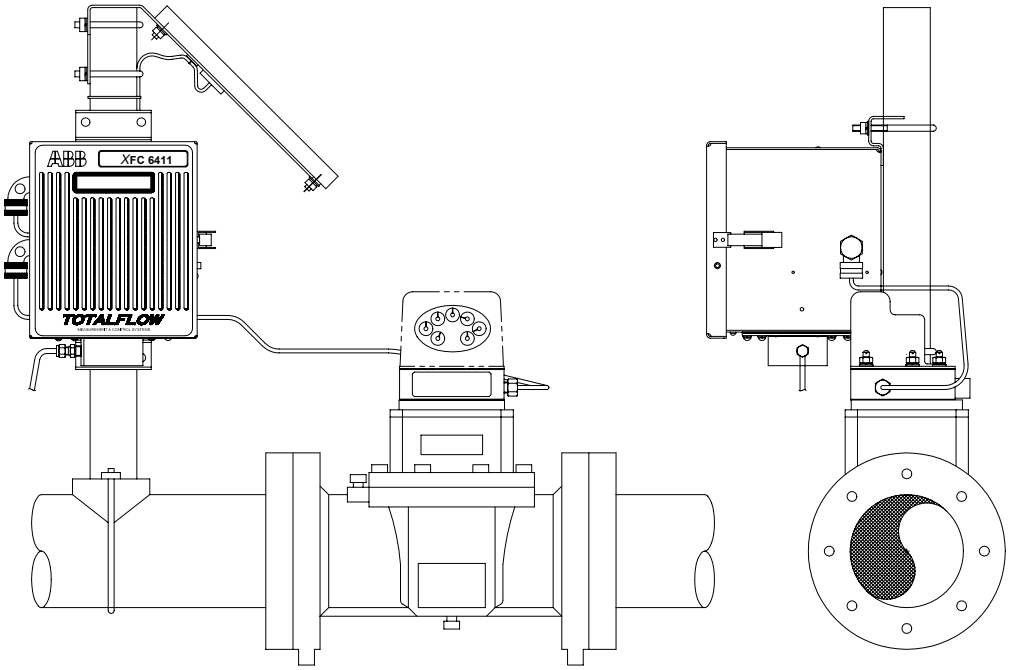

Figure 2–8 Typical Pipe Installation for Pulse Meter

Instructions

Step	Procedure
1.	Position pipe saddle on 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 Saddle on meter run pipe using U-bolt and associated hardware.
3.	Screw 2” by 40” mounting pipe into Saddle. Place level against pipe and vertically align. Adjust pipe, mounted in saddle, until vertical alignment is achieved.
4.	After vertical alignment, securely tighten 2” by 40” pipe in Saddle then securely tighten Saddle mounting bolts. Be certain pipe is securely installed in Saddle.

FYI

The following procedures are to be followed when installing XFC on 2” mounting pipe. To install XFC, it is recommended that two people make the installation. One to hold unit in position and the other to install and tighten mounting brackets.

Method of installation must be consistent with customers company policy.

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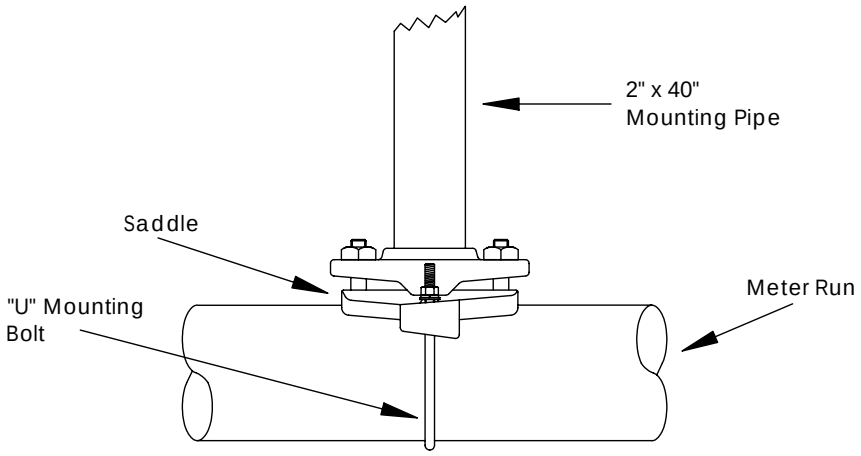

Figure 2–9 Typical Pipe Saddle Installation

Step	**Procedure,** Cont.
5.	Position XFC in position on 2” mounting pipe and secure in place with two U-bolts, flat washers, lock washers and two 9/16” bolts.

FYI

Orifice - Position XFC high enough on pipe to allow slope from externally mounted manifold to tap valves, refer to Figure 2–8.

Pulse – Position XFC high enough on pipe to allow slope from externally mounted static pressure tap valve. See Figure 2–9.

See Figures 2–11 through 2–16 for Pipe Mounted dimensions.

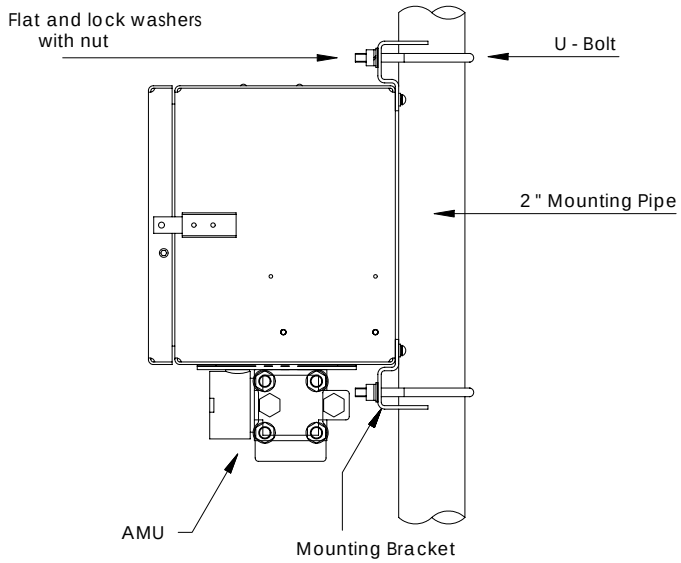

Figure 2–10 XFC Pipe Mounted

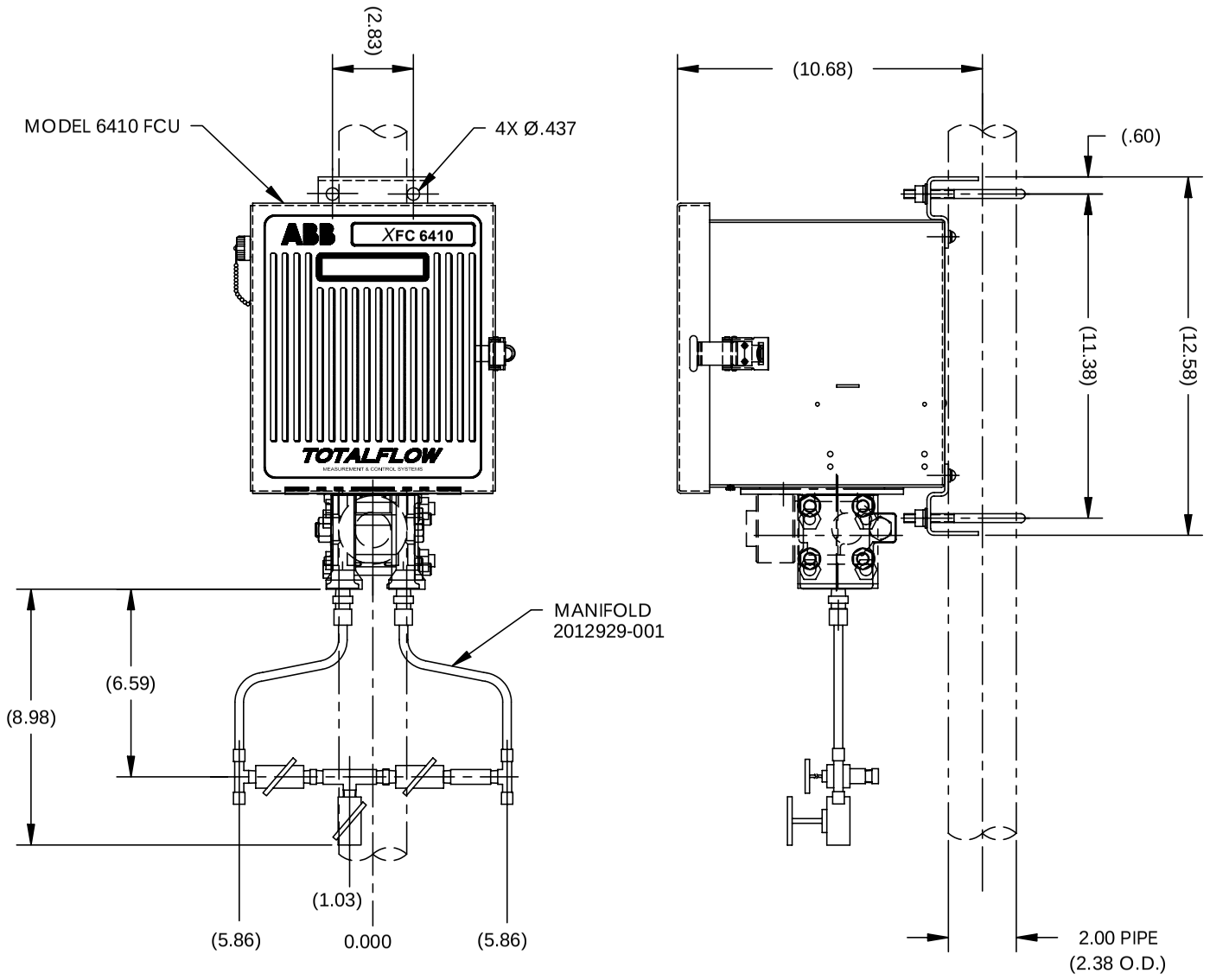

Figure 2–11 Model XFC 6410, Pipe Mounted W/Discrete Manifold

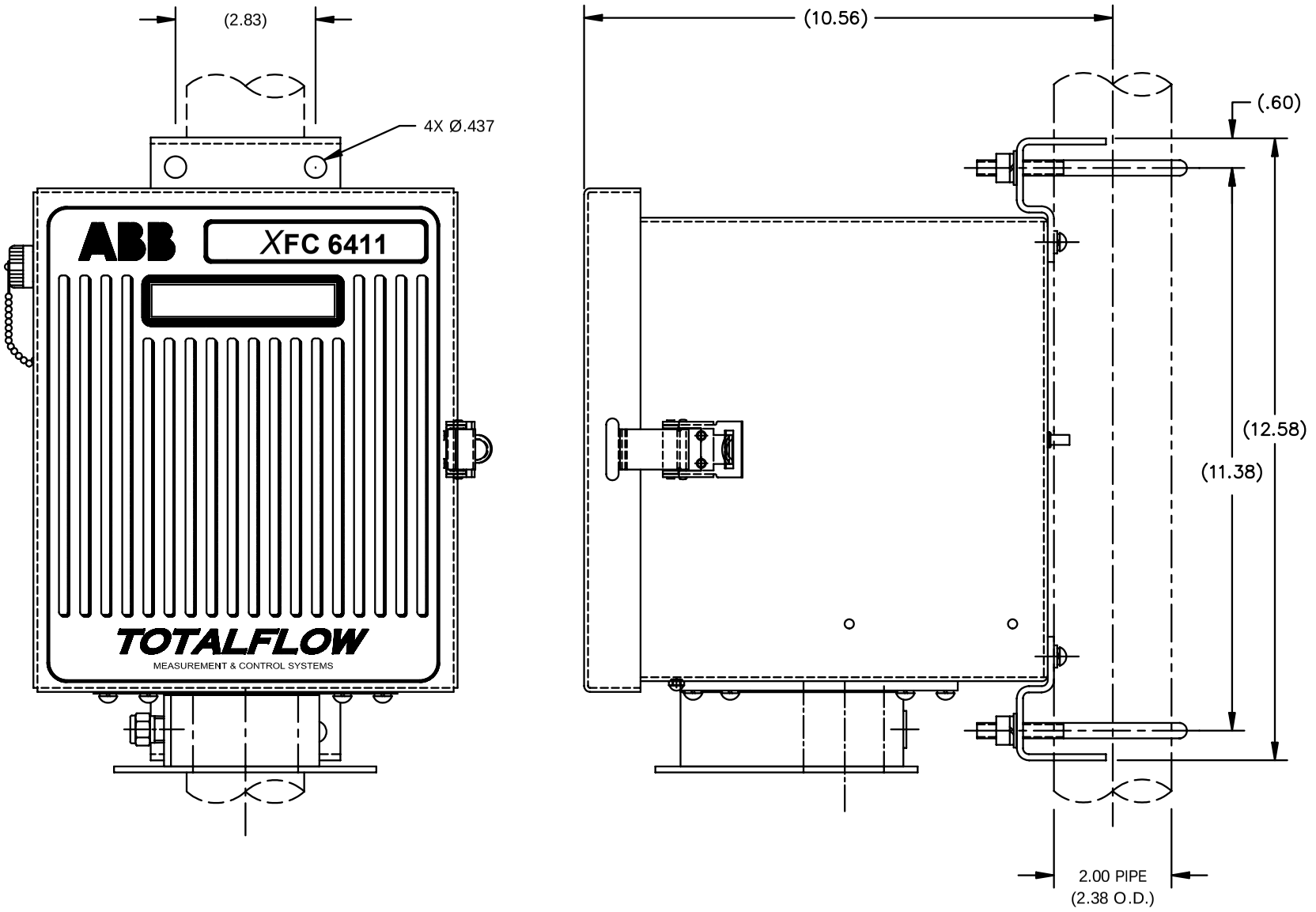

Figure 2–12 Model XFC 6411 Pipe Mounted

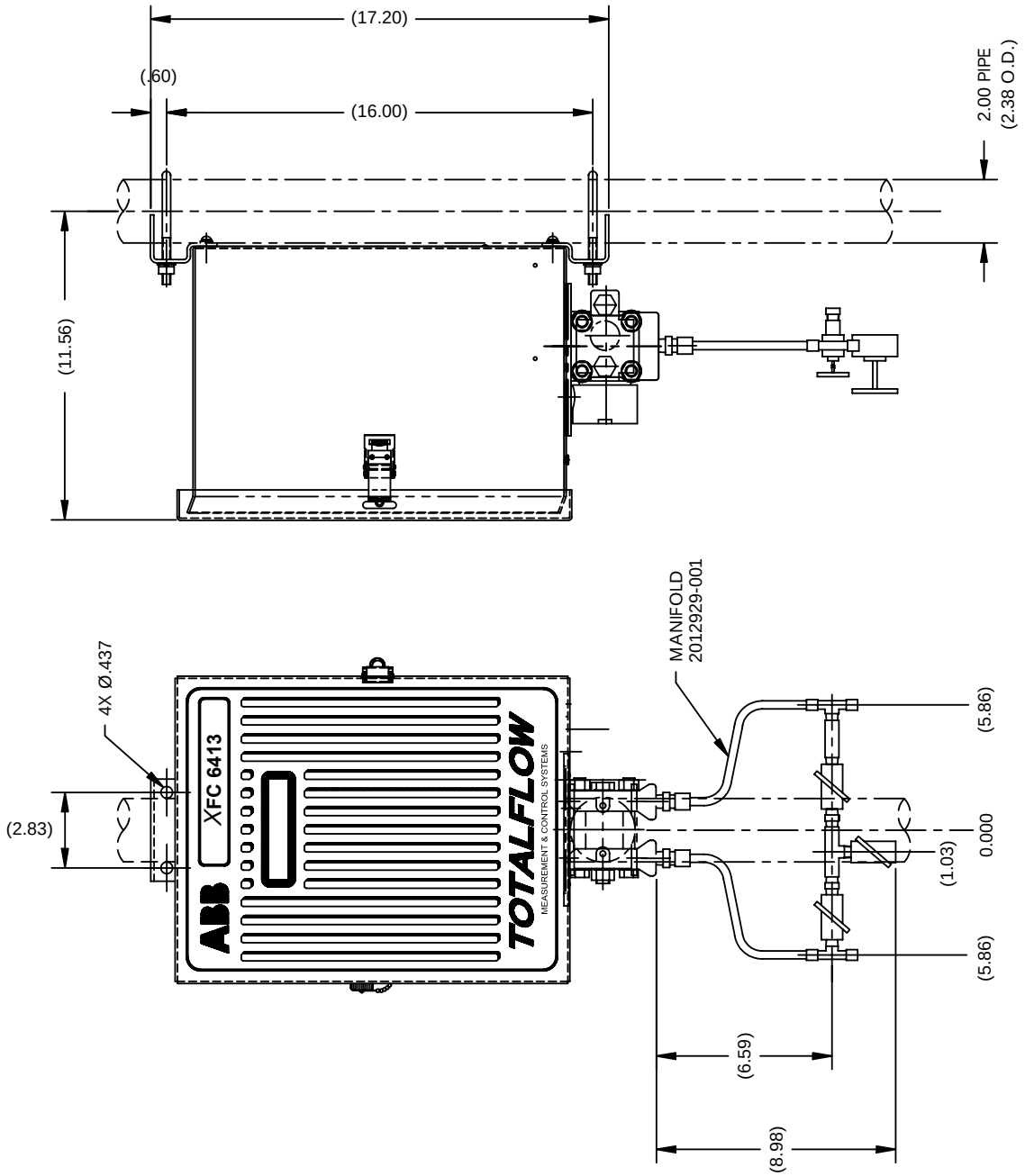

Figure 2–13 Model XFC 6413, Pipe Mounted W/Discrete Manifold

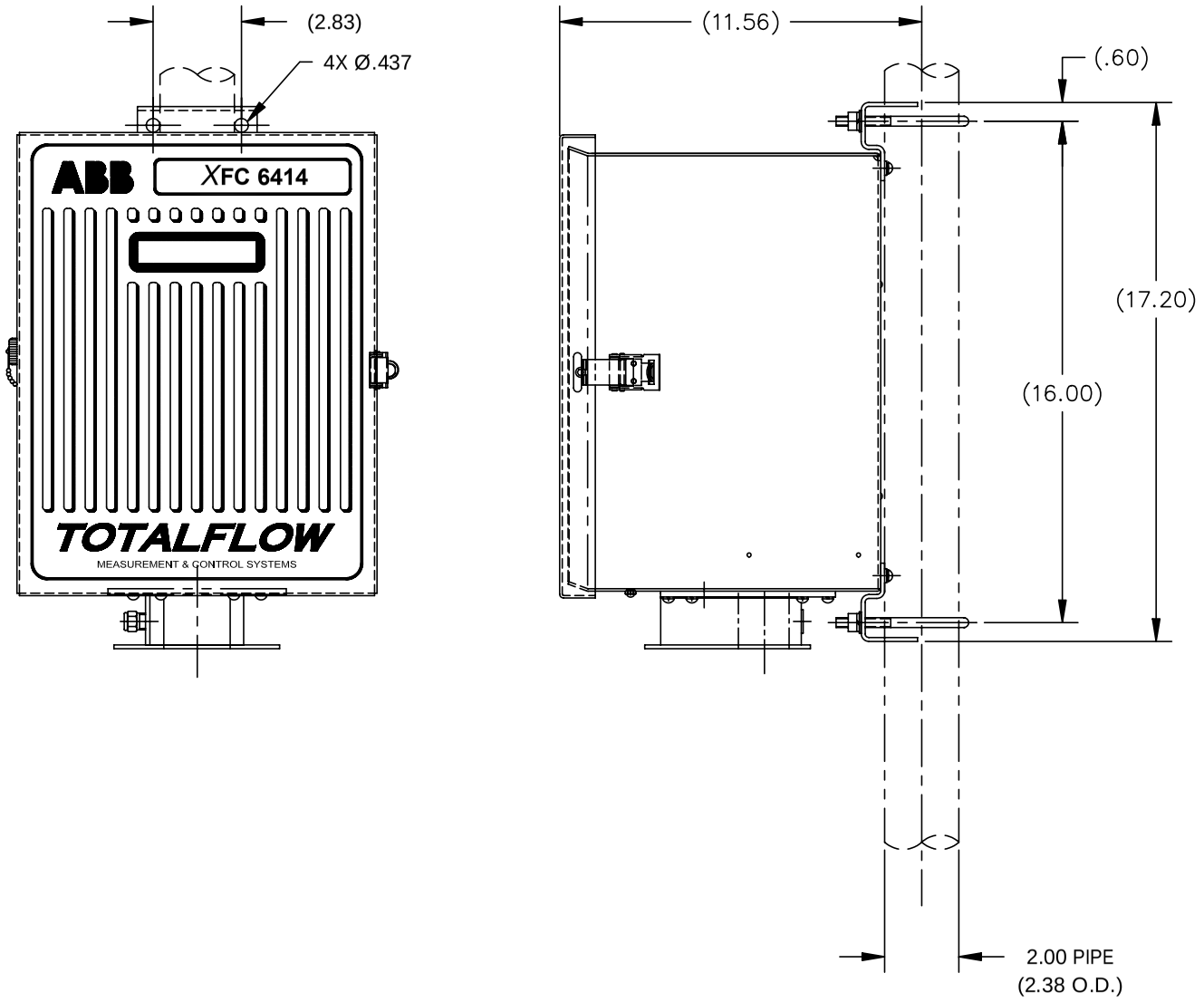

Figure 2–14 Model XFC 6414, Pipe Mounted

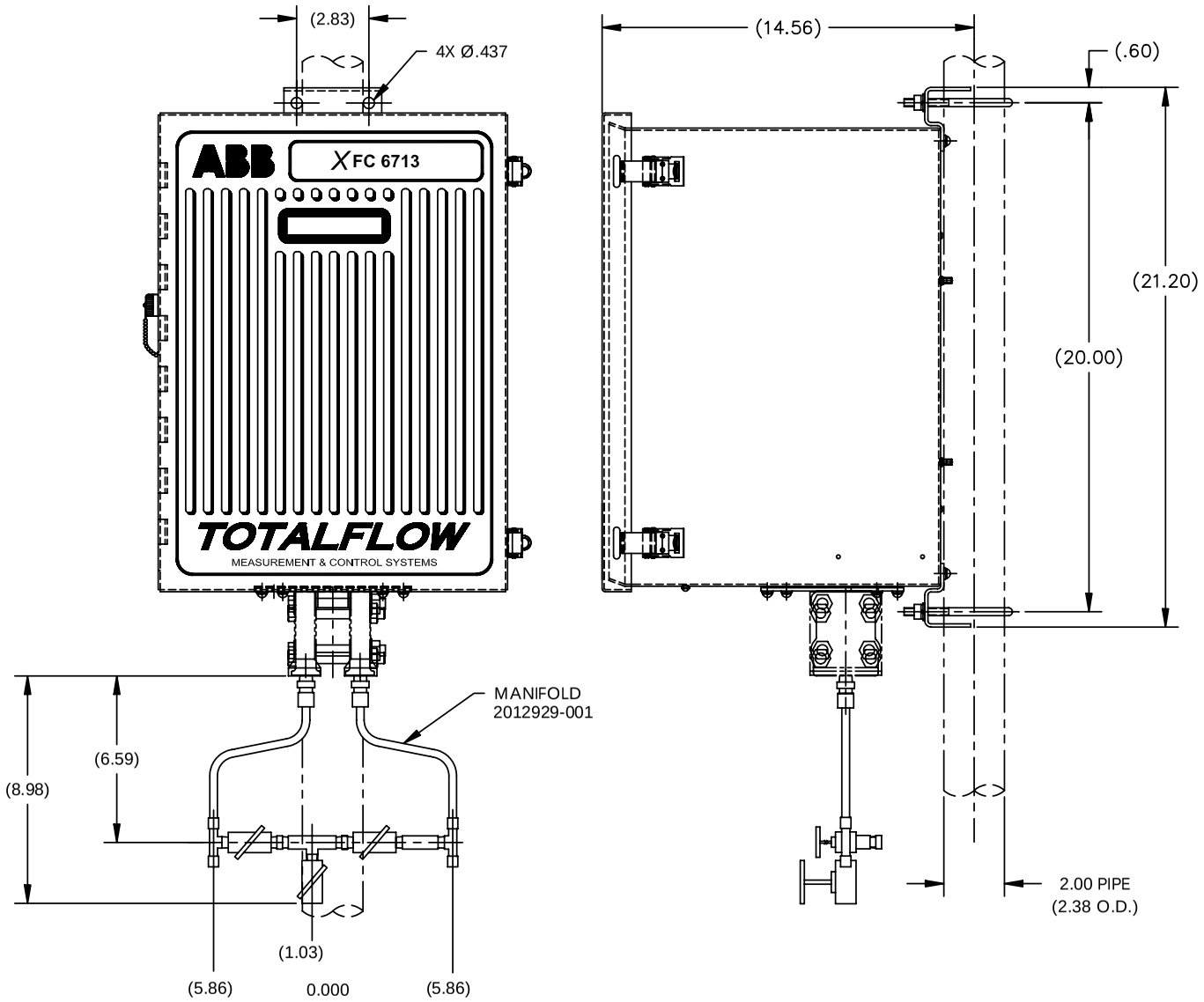

Figure 2–15 Model XFC 6713, Pipe Mounted

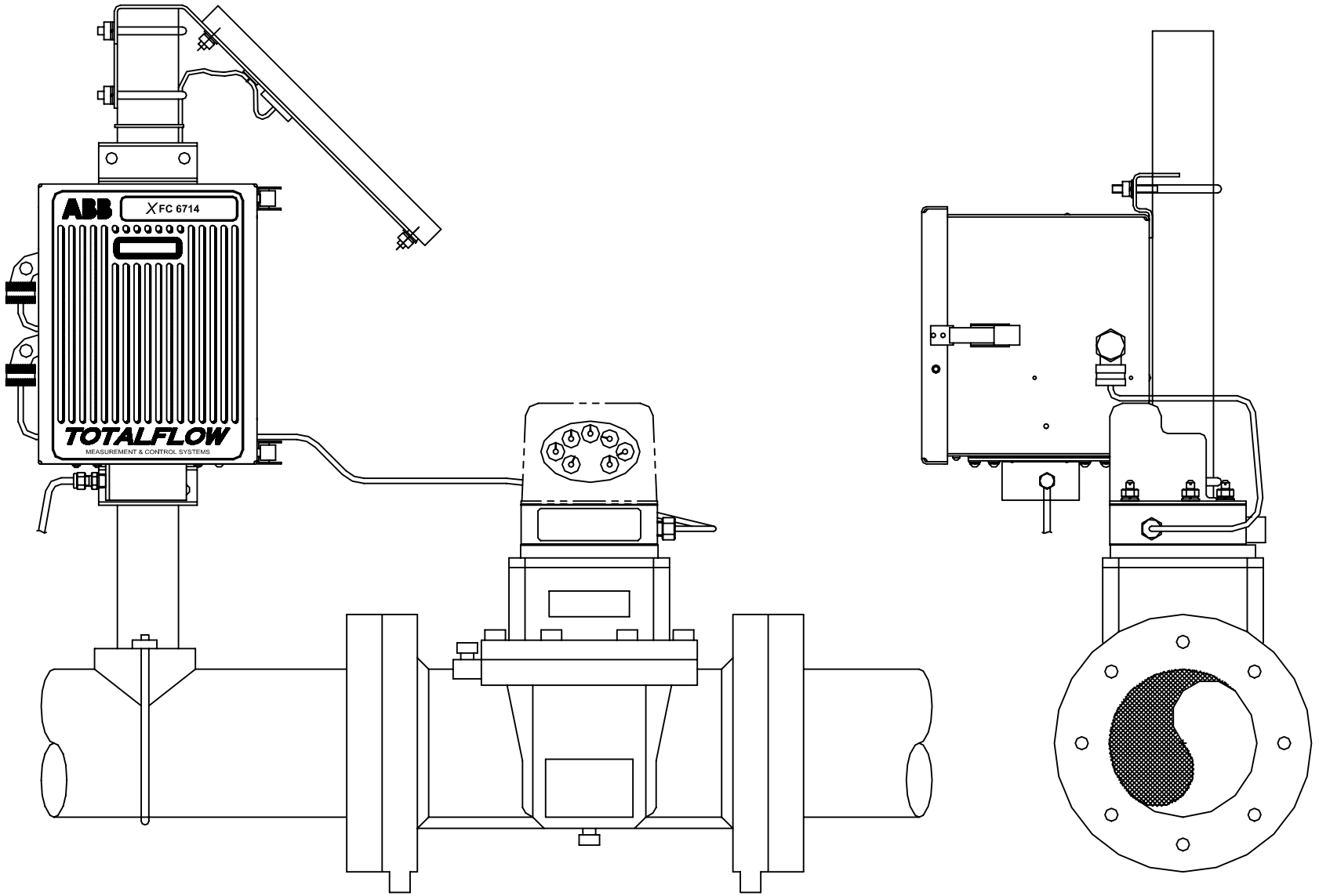

Figure 2–16 Model XFC 6714, Pipe Mounted

Wall Mount Installation

If you are installing to a wall near the meter run or inside a meter shed use this procedure. Before you begin, review the procedure and the materials required for installation. Refer to Figures 2–17 Through 2–22 for mounting dimensions requirements.

Optionally Supplied Materials

- XFC wall mounting brackets

Material 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

Caution

If XFC 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 XFC door from being opened to access interior installed components or to interfere with installation of the solar panel.

Instructions

Step	Procedure
1.	Refer to Figures 2–17 through 2–22 , drill mounting holes in wall supports.
2.	Install supplied wall mounting brackets on back of μFLO as shown in figures 2–17 through 2–22 .
3.	Lift and align XFC wall mounting brackets with mounting holes drilled in wall.
4.	Insert 1/4” x 1/4” diameter machine bolts through XFC mounting brackets into wall. Securely tighten all bolts to secure unit to wall.

FYI

Orifice - Position XFC high enough on wall to allow slope from externally mounted manifold to tap valves.

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

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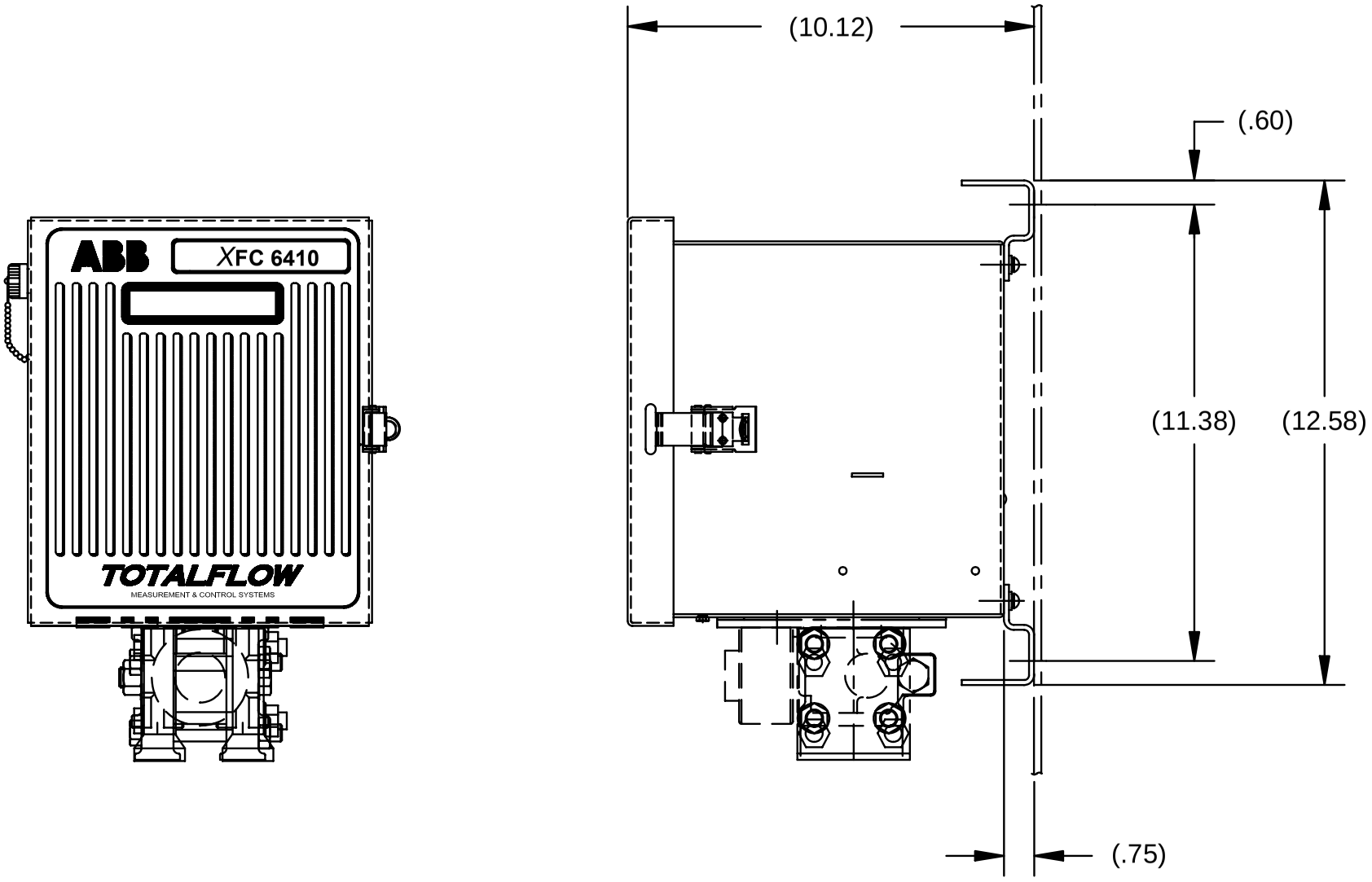


Figure 2–17 Model XFC 6410 Wall Mounted

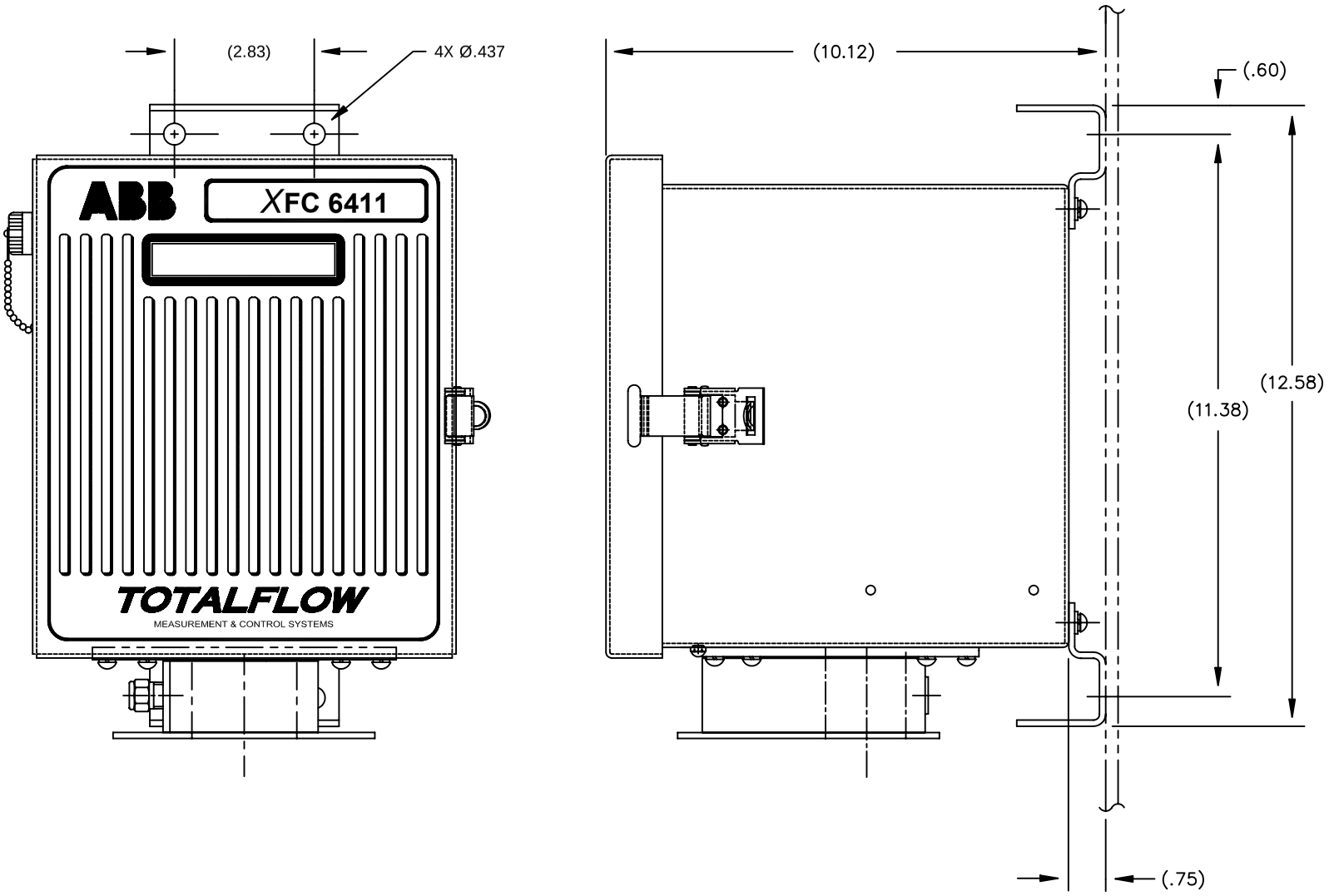


Figure 2–18 Model XFC 6411 Wall Mounted

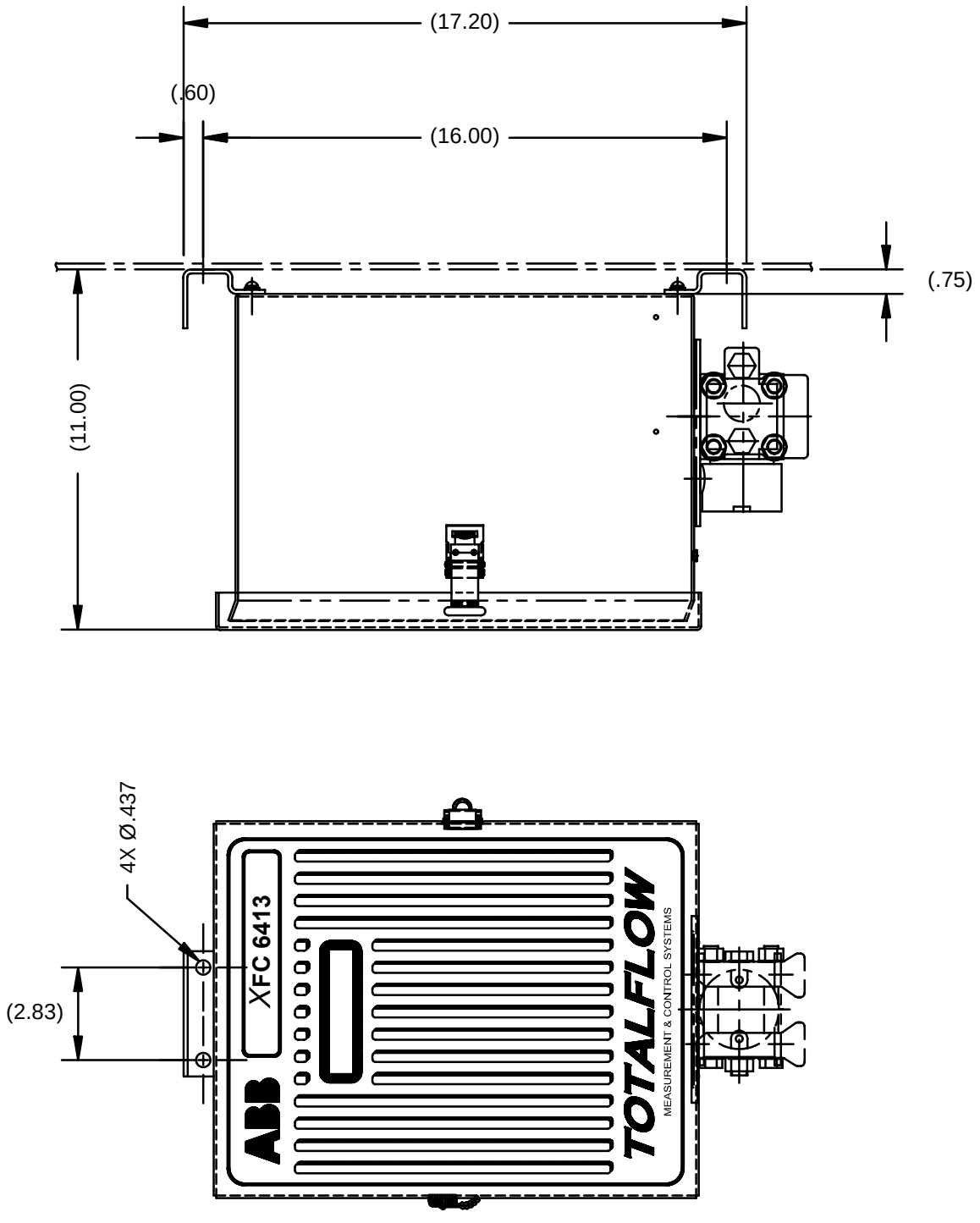


Figure 2–19 Model XFC 6413 Wall Mounted

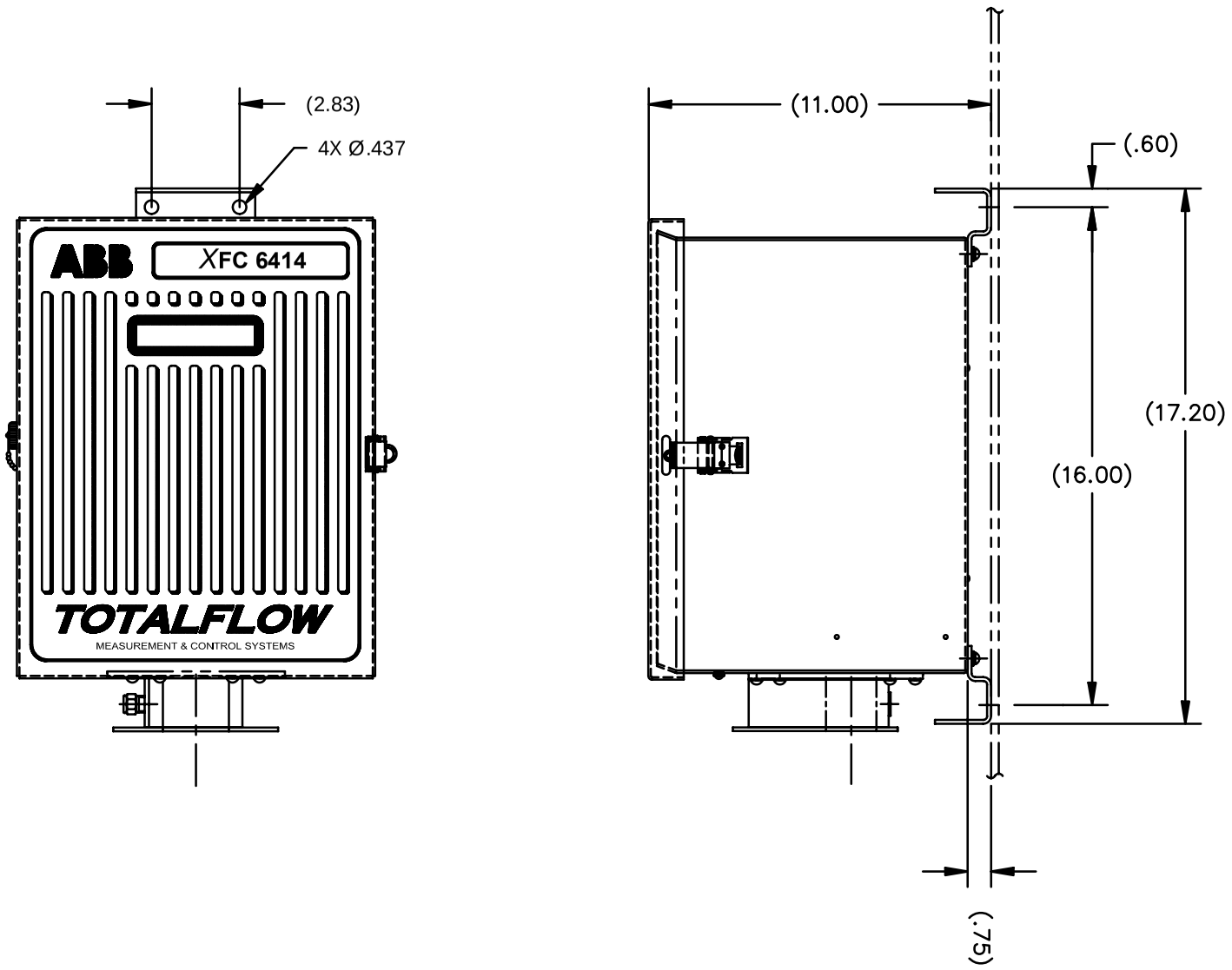


Figure 2–20 Model XFC 6414 Wall Mounted

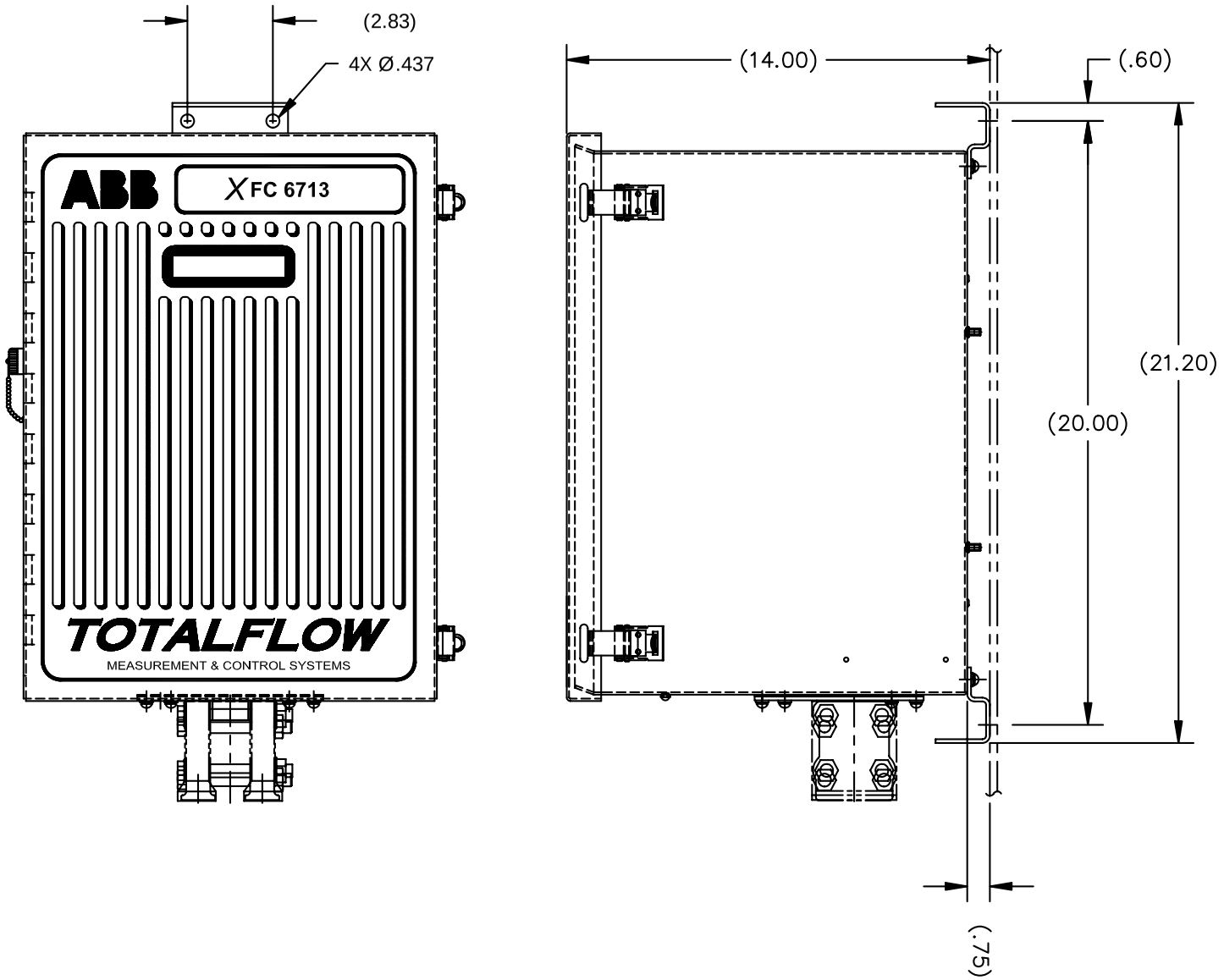


Figure 2–21 Model XFC 6713 Wall Mounted

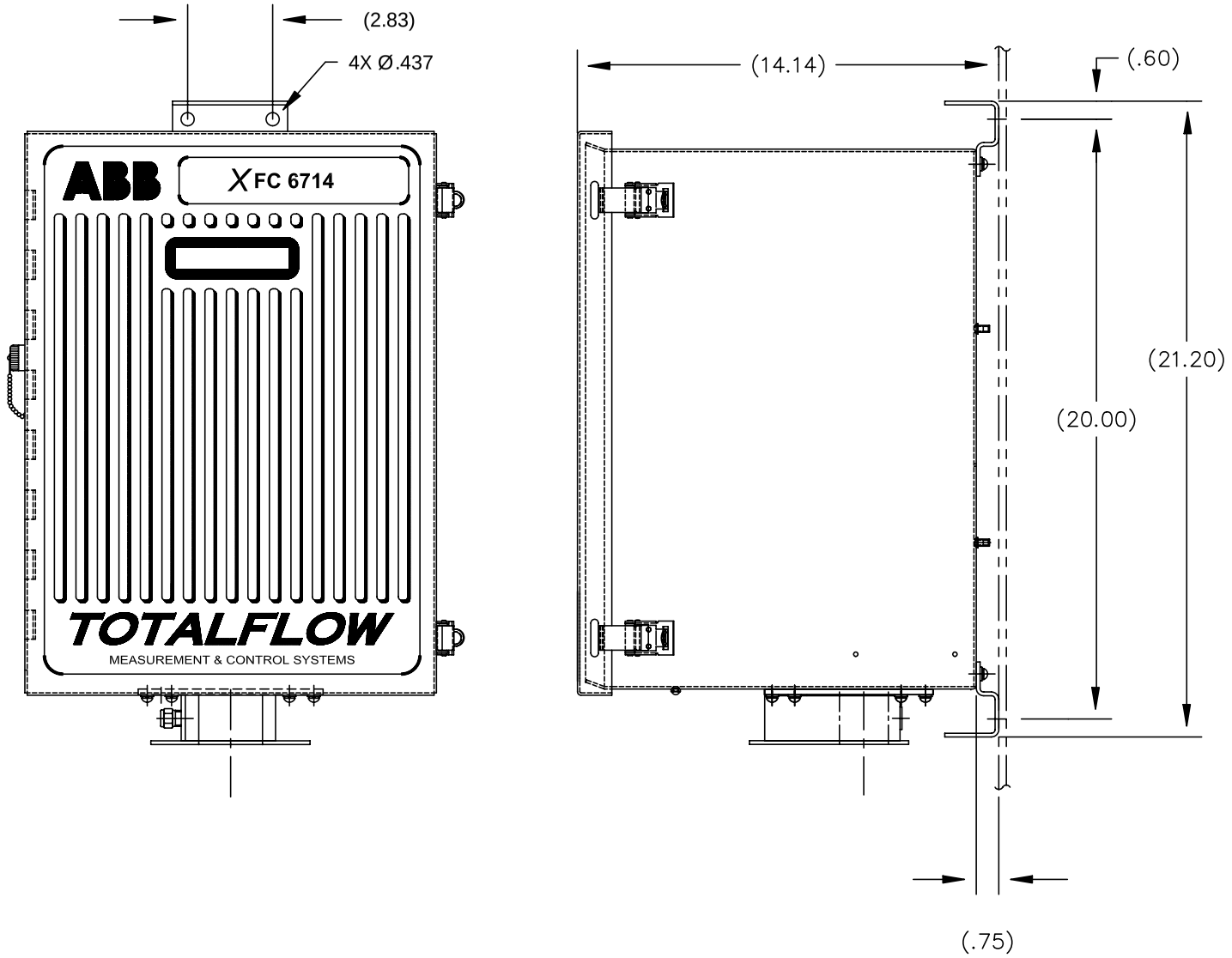


Figure 2–22 Model XFC 6714 Wall Mounted

Direct Mount Installation for Gas Orifice

If you are installing the XFC directly to an instrument manifold use this procedure. Before you begin, review the procedure and the Direct Mount Drawings, see figures 2–23 through 2–25 .

FYI  All required hardware for mounting to the XFC to the manifold is to be supplied by the customer.

Instructions

Step	Procedure
1.	Refer to Figures 2–23 through 2–25 , attach the AMU to the manifold. Before aligning with the manifold ensure that Teflon seal rings are in place around the two process ports.
2.	Using the four 7/16-inch bolts supplied with the manifold secure the AMU to the manifold.
3.	Refer to Figure 2–23 through 2–25 and complete installation.

Continued on Next Page

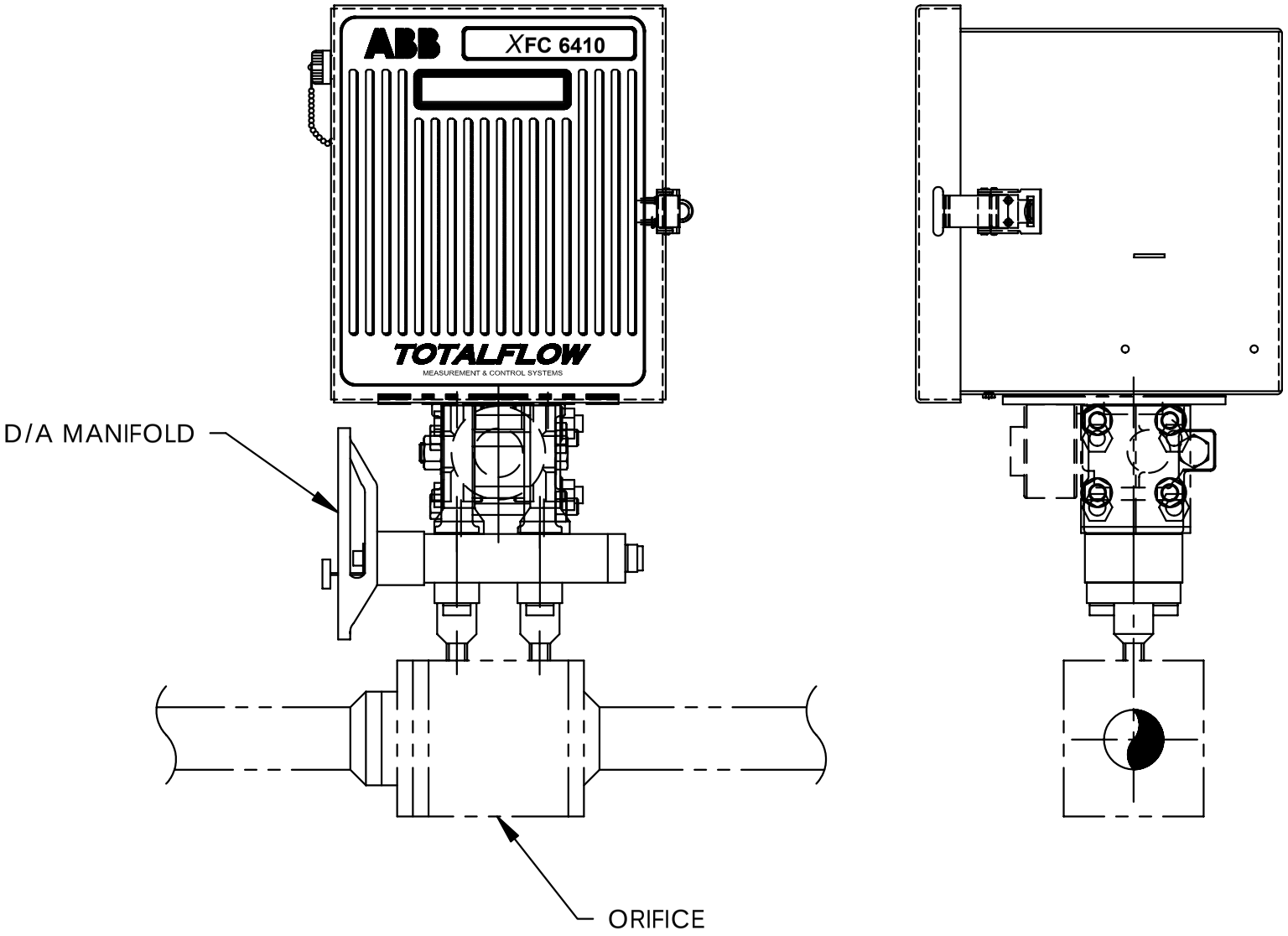


Figure 2–23 Model XFC 6410, Direct Mounted with D/A Manifold

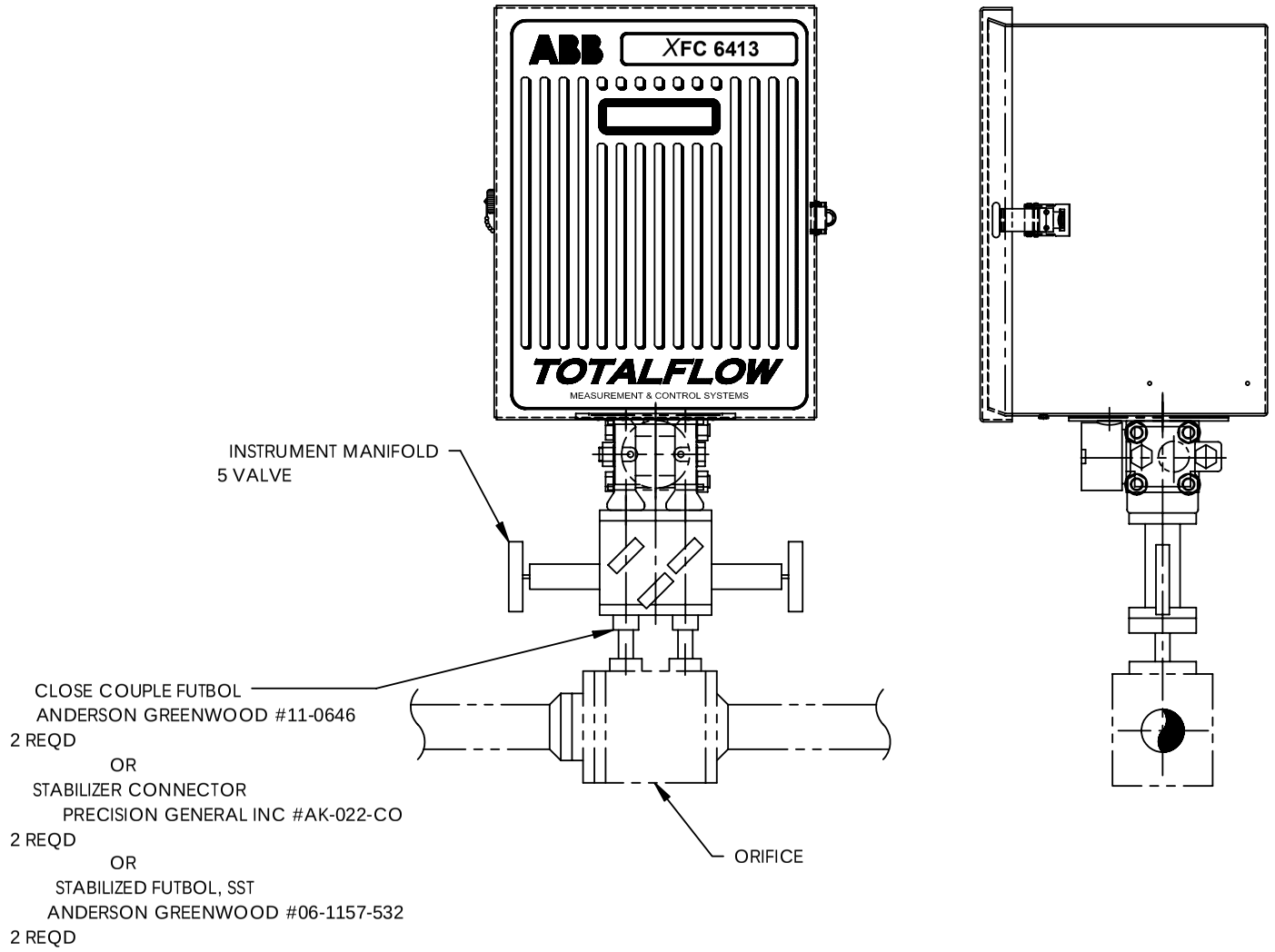


Figure 2–24 Model XFC 6413 Direct Mounted, Instrument Manifold

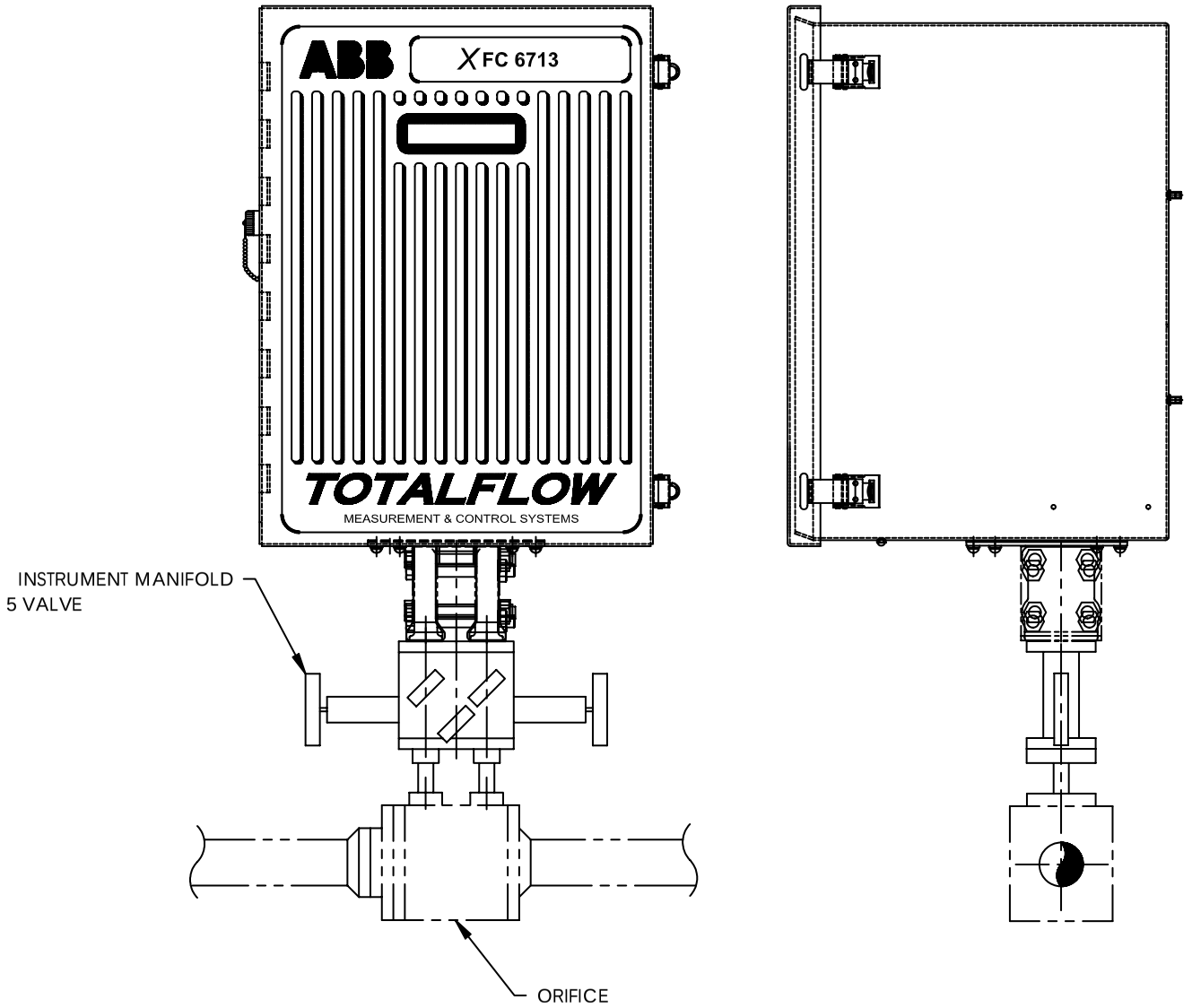


Figure 2–25 Model XFC 6713 Direct Mounted

Manifold Input Lines

The following instructions will provide procedural steps to install the manifold. The meter run manifold high (H) and low (L) pressures terminate in XFC H and L Differential Port cells. Differential Port cells are located on bottom of XFC. See Figure 2–26 .

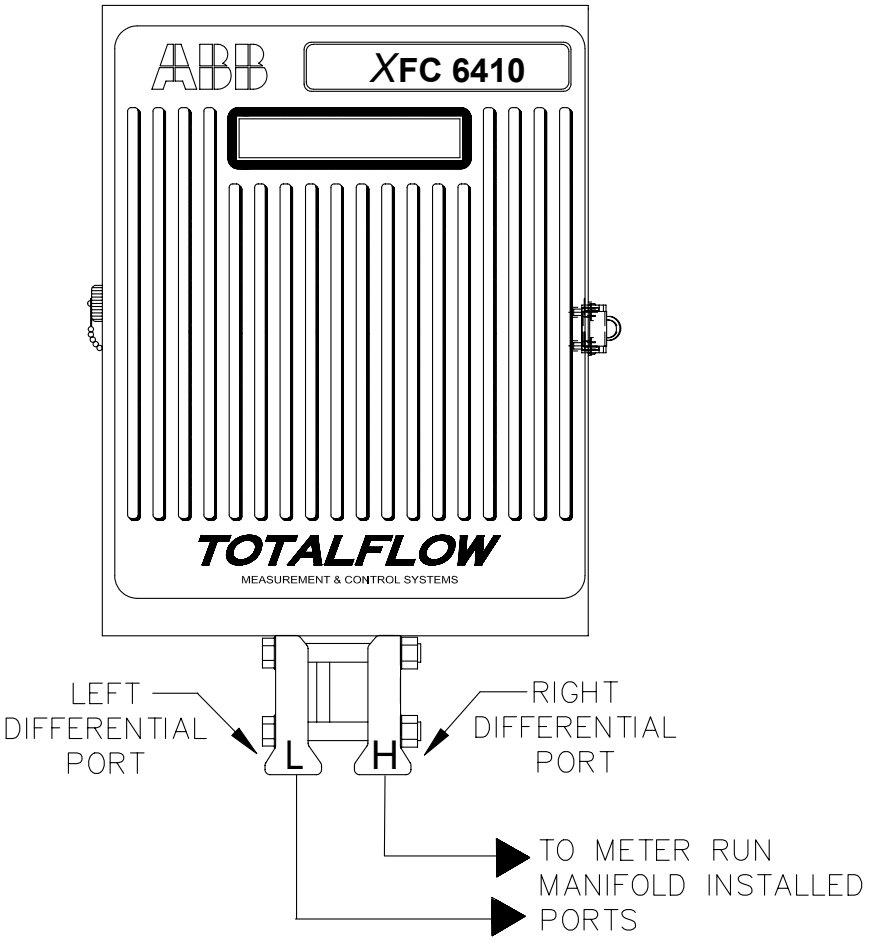


Figure 2–26 Flow Computer

Installation

Installation is customers responsibility.

The hardware required to connect to meter run to install manifold to XFC Differential Ports is as follows:

Customer Provided Materials

- Stainless steel tubing
- Tubing fittings

Caution

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

Continued on Next Page

Manifold Input Lines, Continued

Instructions

Step	Procedure
1.	Install isolation valves on meter run (if using 5 or 3 way manifolds).
2.	Install manifold and tubing to meter run and XFC. (Note: Manifold to XFC fittings not supplied with XFC).
3.	Leak check all connections.

TIP  Leaks in the tubing or manifold will introduce errors when calibrating AMUs.

Direct Mount Installation for Pulse Meter

If you are installing the XFC directly to a meter use this procedure. Before you begin, review the procedure and the Direct Mount Outline Drawings; see Figures 2–27 through 2–29 .

FYI  All required hardware for mounting to the XFC to the meter is supplied by Totalflow, as ordered.

Instructions

Step	Procedure
1.	Refer to Figures 2–27 through 2–29 XFC Outline Drawings, attach the FCU to the meter. Before aligning with the manifold ensure that all seals are in place around the mounting hardware.
2.	Using the four 3/8-inch bolts supplied with the XFC secure the XFC to the meter.
3.	Refer to Figure 2–27 , 2–28 or 2–29 and complete installation.

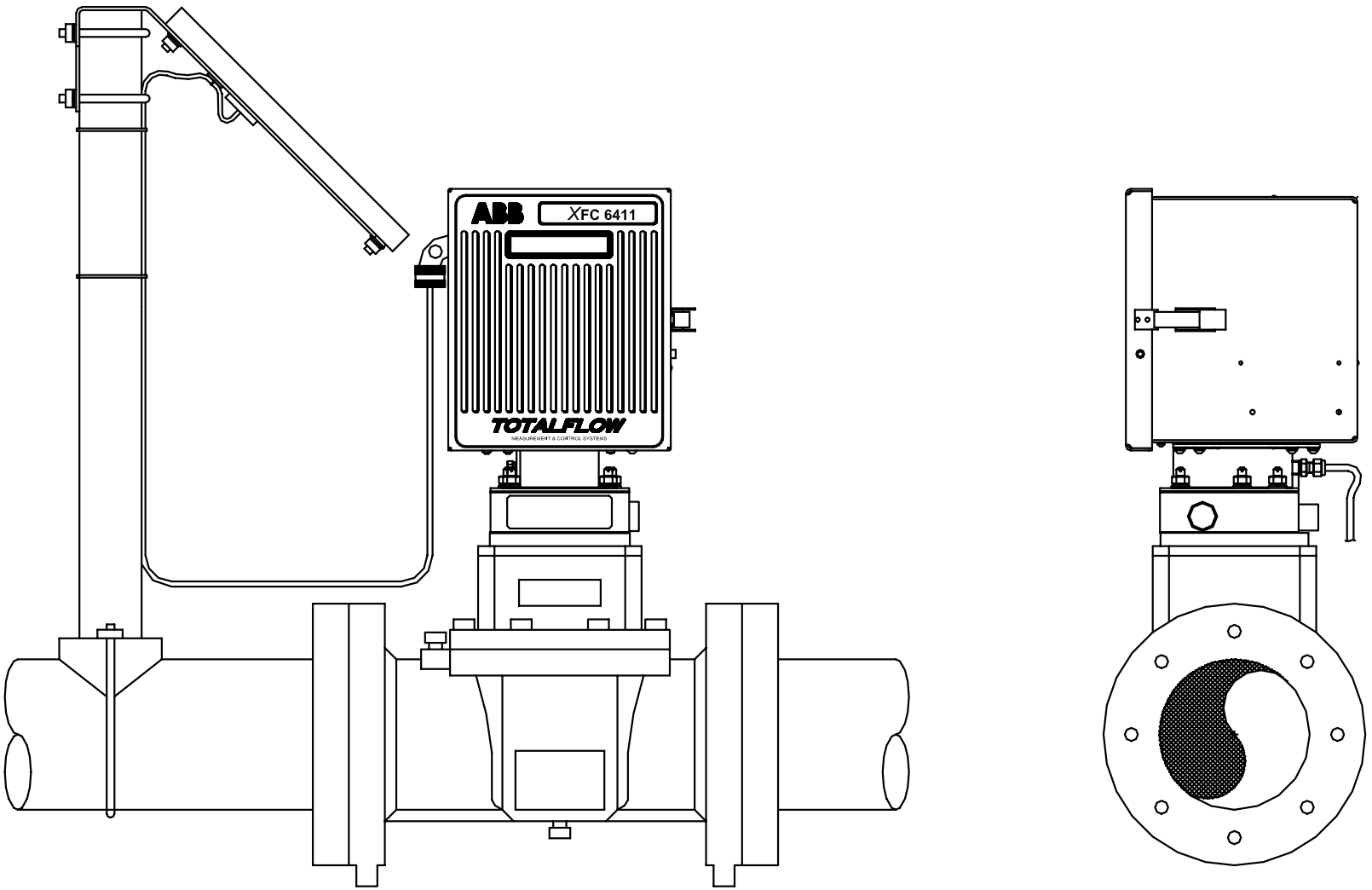


Figure 2–27 Model XFC 6411 Direct Mounted

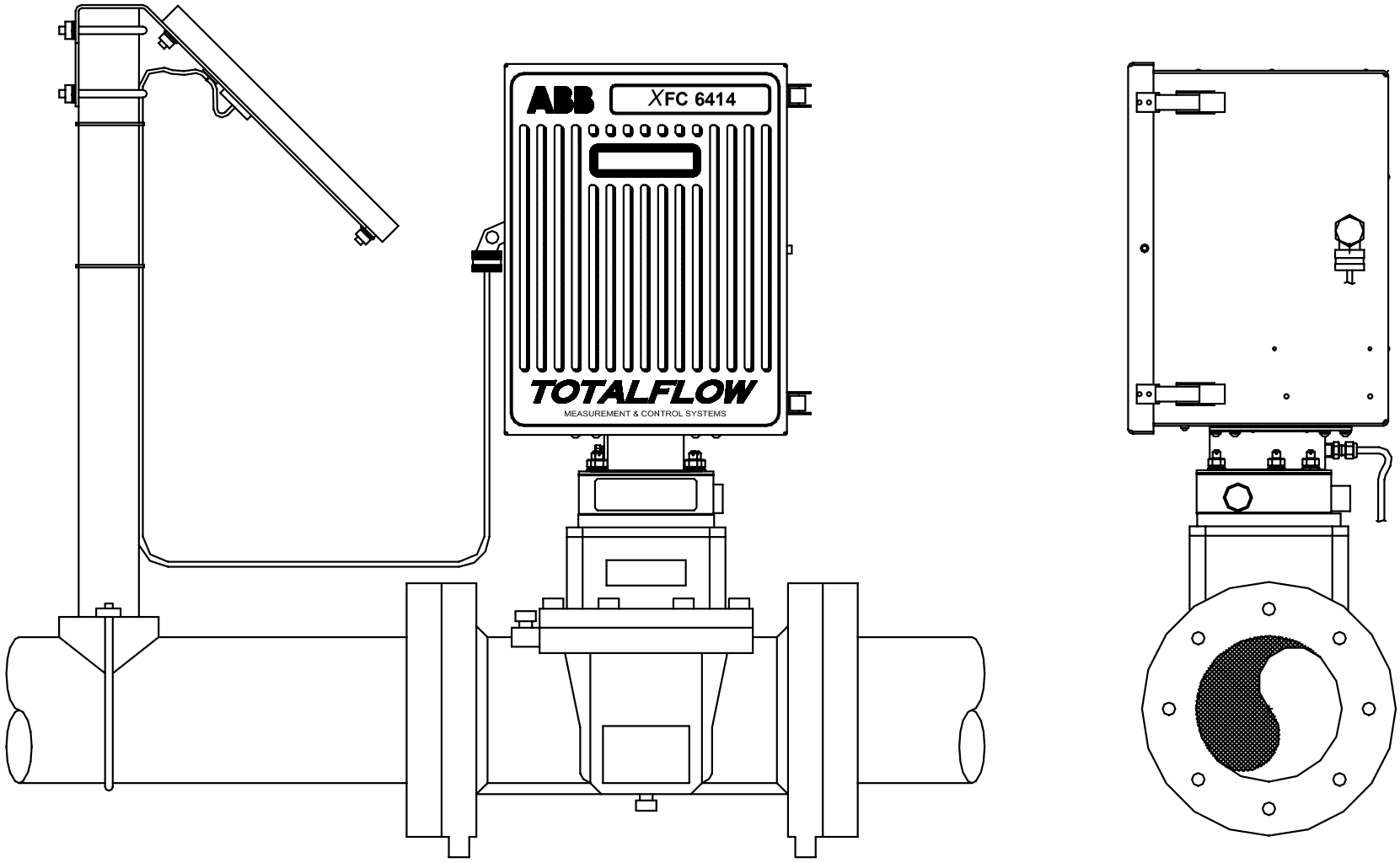


Figure 2–28 Model XFC 6414 Direct Mounted

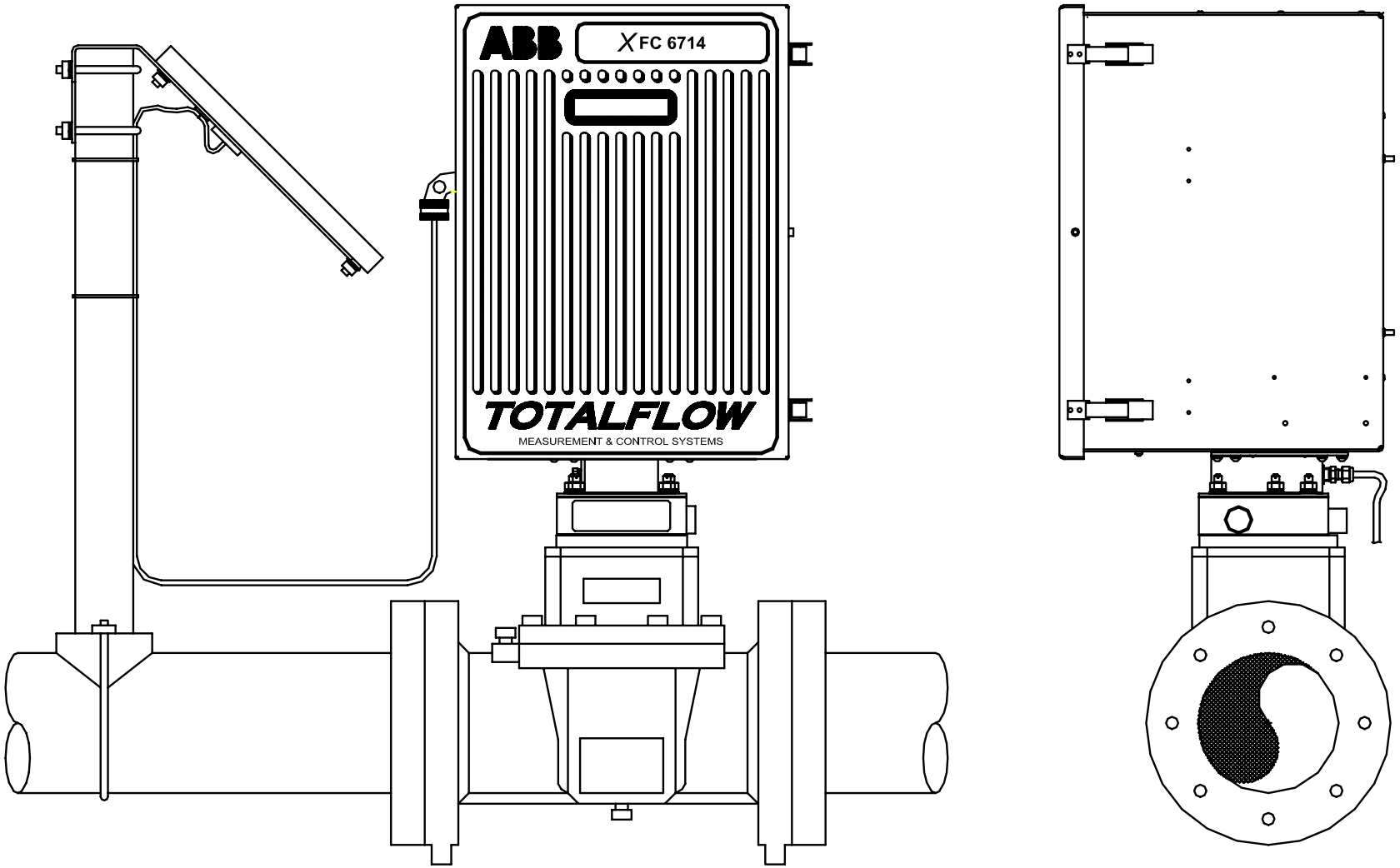


Figure 2–29 Model XFC 6714 Direct Mounted

Static Pressure Input Line

Description

The following instructions will provide procedural steps to install the static pressure input line. The static pressure input line terminates in either the rear or side pressure ports on the XFC mounting block located on the bottom of the XFC. See Figure 2–30 .

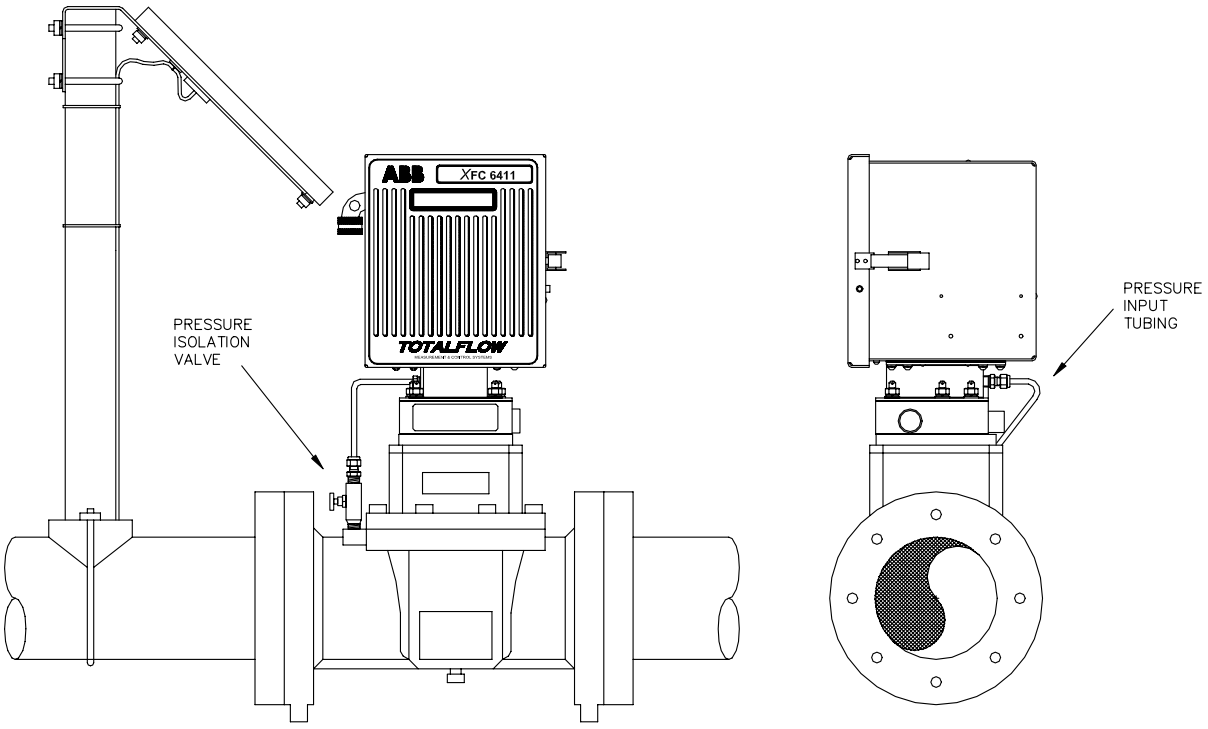


Figure 2–30 XFC Static Pressure Input Line

Installation

The hardware required to connect the FCU static pressure line to the FCU static pressure port is as follows. Installation is customers responsibility.

Customer Provided Materials

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

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

Continued on Next Page

Static Pressure Input Line, Continued

Instructions

Step	Procedure
1.	Install static pressure isolation valve on meter run.
2.	Install static pressure tubing to static pressure isolation valve and XFC static pressure input port connection. (Note: Valve to XFC fittings not supplied with XFC).
3.	Leak check all connections. Leaks in the tubing or connections will introduce errors when calibrating transducers.
4.	Mount XFC to direct mount manifold.
5.	Leak check all tubing connections before calibrating.

TIP Leaks in the static pressure connections and tubing will introduce errors in transducer readings.

RTD Probe Installation

The RTD measures flowing gas temperature. Procedures, presented in this Chapter, enable the user to install the RTD into the meter run.

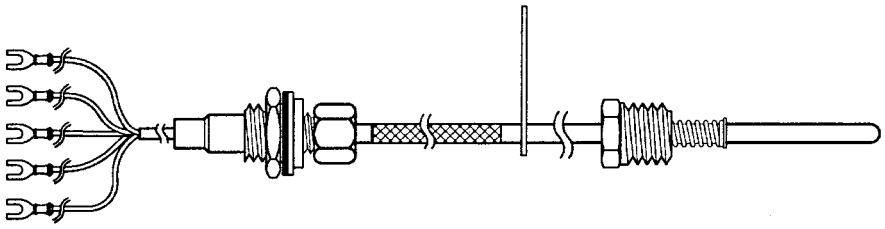


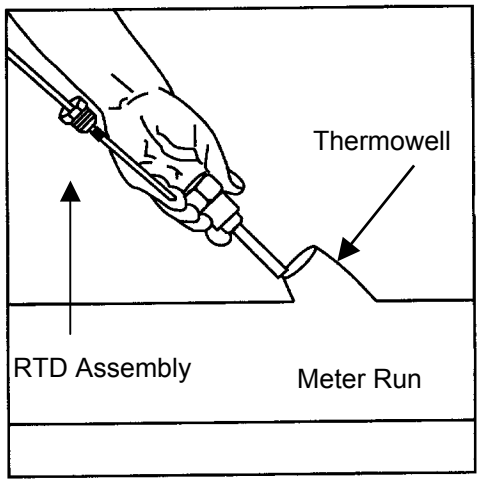
Figure 2–31 RTD Probe Wiring

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

Continued on Next Page

Instructions

Step	Procedure
1.	Install thermowell into meter run. 

FYI

To prevent moisture from entering XFC after installing RTD cord connector, be certain associated connector, at XFC, has a metal backed sealing “O” ring and metal locking nut attached.

Power should be removed from XFC before performing any field wiring.

2.	Using snap ring pliers, adjust probe length so that it is spring loaded against bottom of thermowell.
3.	Remove nut from water tight cord connector. On XFC, remove hole plug from unit and insert wires through the hole. Allow enough RTD cable to extend into XFC for connecting wires to RTD termination Block J7 (Figure 2–32 Item 13).
4.	Secure RTD Probe cable using supplied sealing ring and nut.
5.	Connect RTD probe to XFC RTD connector as follows. Before making connections to terminal block, remove spade lugs if attached and trim wire ends back 1/4” and remove associated terminal block from XFC-195 Board. See overlay on battery plate. Loosen terminal block securing screws, insert wire then retighten. Reinstall terminal block with wires attached. See 2–31 .
6.	Following connection of RTD thermowell, secure cable to meter run pipe with plastic tie wraps. Do Not wrap cable around meter run pipe.

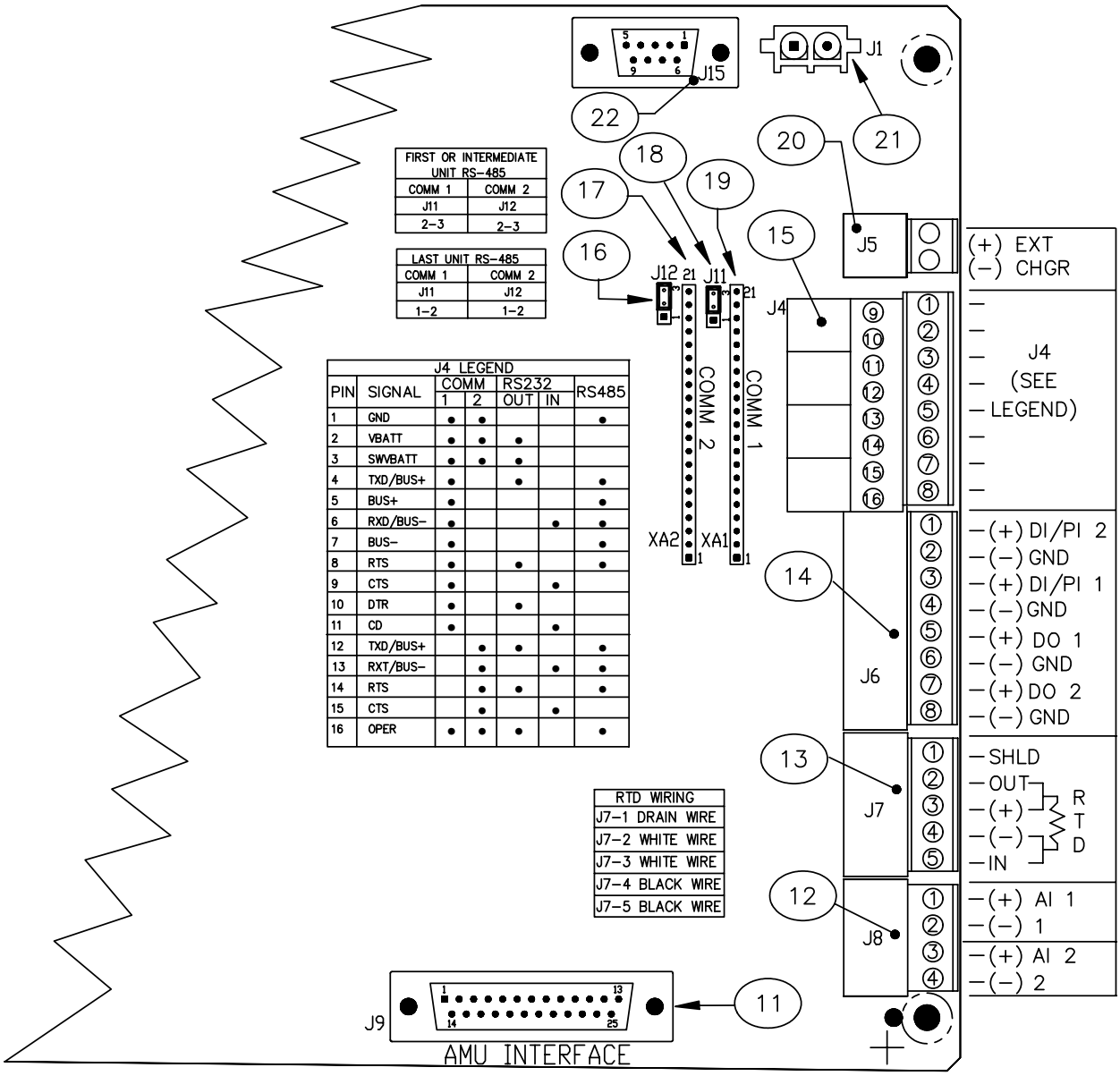


Figure 2–32 XFC-195 Board Cutout-Installation

Table 2–1 XFC-195 Board Identifications-Installation

ID Number	Description
11	AMU Interface
12	Analog Input Connectors
13	RTD Connectors
14	Pulse Input and Digital Output Connectors
15	Remote Communications Connectors
16	Remote Comm 2: RS-485 Termination Jumper
17	Remote Comm 2: Module Plug-in
18	Remote Comm 1: RS-485 Termination Jumper
19	Remote Comm 1: Module Plug-in
20	External Charger
21	Battery Connection
22	I/O Module Interface

Battery Pack Installation

A battery pack provides the XFC with it's operating power. The battery is packed and shipped separately. The battery is not installed in XFC when shipped. Before installation, inspect power cables, where they terminate on battery pack, and connector for breakage.

Installation

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

Instructions

Step	Description
1.	Remove XFC battery cover plate and insert battery pack into compartment. Insert battery pack with its long dimension facing outward. When cover plate is reinstalled, it should fit snugly against the battery pack. The screws can be loosened to accommodate larger battery.
2.	Connect battery pack connector to XFC-195 Board BATTERY CONN J1 (Figure 2–32 , Item 21) connector, located in upper right corner of Board.
3.	Observe LCD, the display should be on and scrolling through the startup diagnostics sequence.

Solar Panel Installation

The Solar Panel is designed for outdoor mounting on a 2” extension pipe installed on upper end of XFC 40” mounting pipe. Solar panel must be mounted within 12 feet of XFC (other lengths available). For wall mounted XFC it can be mounted on top or side of meter house.

CAUTION Do not connect solar panel power cable to the XFC unless main battery pack has been connected to J1 (Figure 2–32 , Item 21). Refer to previous section on Battery Pack Installation.

FYI If installation procedures are required for mounting Solar Panel on top or side of meter house, customer should contact Totalflow's Service Department; see page x, Getting Help.

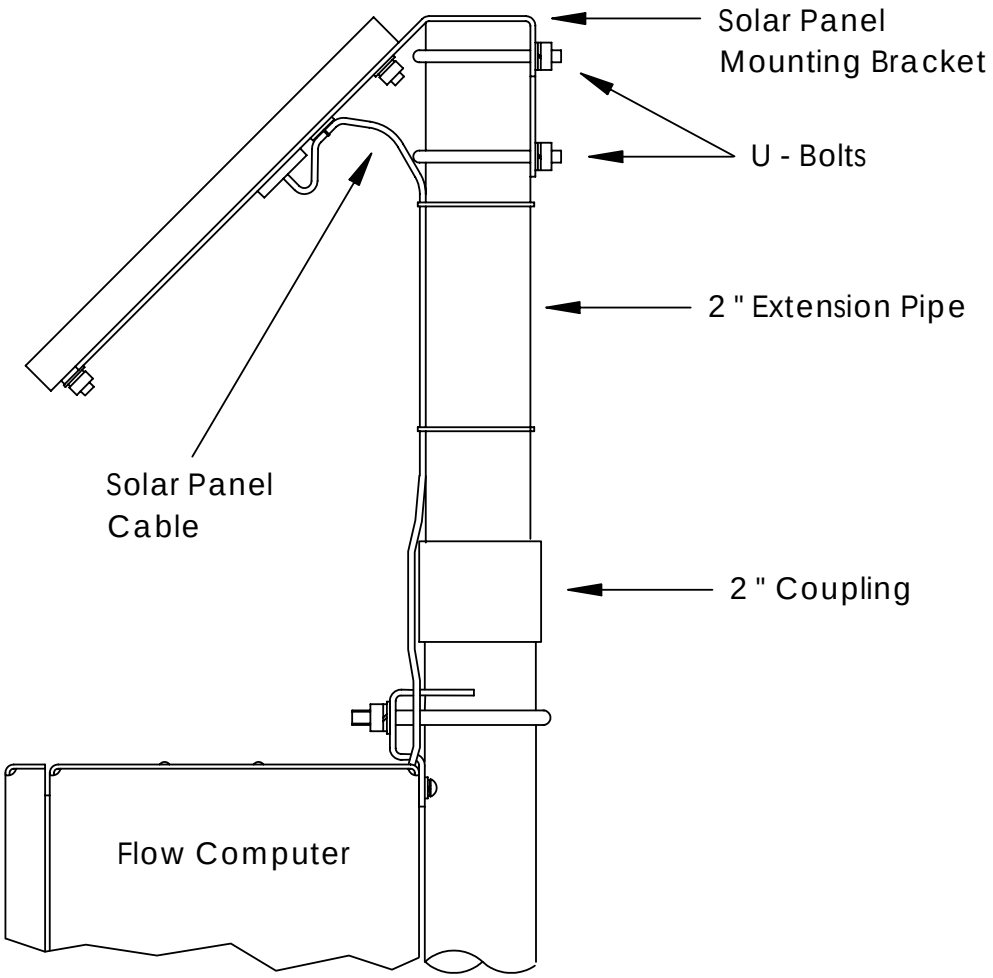


Figure 2–33 Typical Solar Panel Installation

Solar Panel Installation, Continued

Procedure

Our standard solar panel must be mounted within 12 feet of XFC. For Solar Panel mounting, the following materials are required. See Figure 2–33 .

Materials Supplied

- One Solar Panel
- Two U-Bolts and fastening hardware
- Solar panel cable (if not already attached)
- Solar Panel Mounting Bracket (if not already attached to Solar Panel)

Material not Supplied

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

FYI

Exercise caution when installing Solar Panel, so as not to damage it. When mounted, Solar Panel will face up from horizon at 50° angle.

Instructions

Step	Procedure
1.	Attach 2” pipe Coupling to top end of XFC 40” mounting pipe. Securely tighten.
2.	Install 2” pipe extension into Coupling and securely tighten.
3.	Check solar panel using digital voltmeter to verify polarity and output voltage. Voltage will vary depending on amount of sun, angle to sun, etc
4.	Install Solar Panel on mounting bracket, if required, with provided hardware. Install Solar Panel Cable if required.
5.	Attach Solar Panel mounting plate to top end of 2” extension pipe with U-bolts and associated mounting hardware. Do not tighten U-bolts until Solar Panel has been correctly orientated.
6.	For northern hemispheres, position Solar Panel facing south. For southern hemispheres, position Solar Panel facing north. For optimum charging, solar panel should not be in shadows for the majority of the day. Panel should be kept clean for maximum charging.
7.	DO NOT connect other end of cable to XFC until instructed to do so.
8.	Insert Solar Panel power cable through an access hole on side of case. Allow enough power cable to extend into XFC for cable connection to EXT CHGR +/- termination’s on J5 (Figure 2–32 Item 20); see overlay on battery plate.

Continued on Next Page

Step	**Procedure,** Cont.
9.	Before making connections to terminal block, trim wire ends back 1/4" and remove associated terminal block from XFC-195 Board. Loosen terminal block securing screws, insert wire then retighten. Connect Solar Panel (+) lead to + terminal and (-) wire to - terminal. Verify main battery pack is connected and then reinstall terminal block with wires attached.
10.	Following connection of Solar Panel power cable, secure cable to 2" extension and mounting pipe cable with plastic tie-wraps provided.

AC Charging Unit Installation

The AC Power Charging Unit maintains a constant voltage charge on installed battery pack. See Figure 2–34 .

Installation The following hardware is required to mount the AC power charging unit to XFC.

Materials Supplied
- AC Charging Unit
- Coupling nipple

Materials Not Supplied
- Plastic cable ties
- AC wiring, conduit (rigid or flexible)

FYI  To maintain system certification, all wiring must comply with NEC 501 code and applicable ABB certification drawings.

To prevent injury only a licensed electrician should install AC power wiring to customer supplied primary AC power source.

Instructions

Step	Procedure
1.	The AC Charging Unit is shipped separately. When unit is received, unpack and inspect all components for evidence of damage. Report damage to shipping carrier and to Totalflow's Service Department.
2.	Remove one of the plugs from the side of XFC so that AC charging unit can be mounted without obstruction; see Figure 2–34 .
3.	Feed AC Charger DC power lines into XFC. Allow enough cable to extend into unit for connection to EXT CHGR +/- terminals.

Continued on Next Page

Instructions (Continued)

Step	**Procedure,** Cont.
4.	Connect AC Battery Pack Charger unit to XFC using supplied sealing ring and nut. To prevent moisture from entering XFC after installing AC Battery Pack Charger unit, be certain associated connector, at Charger unit has a metal backed sealing “O” ring and metal locking nut attached.
5.	Before connecting Charger wiring, trim wire ends back 1/4” and remove associated EXT CHGR terminal block J5 (Figure 2–32 Item 20) from XFC-195 Board. Loosen terminal block securing screws, insert red wire into plus (+) terminal (top) and black wire in negative (-) terminal (bottom). Retighten screws and reinstall terminal block with wires attached.
6.	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. Connect the 120 V hot and neutral or the two hot wires for 240 V to TB1 of the AC Charger. Connect the ground wire to the green screw T1.
7.	Verify that the DC power wires are terminated properly inside the flow computer cabinet and verify that the main battery pack is plugged into J1 (Figure 2–32 Item 21). Apply AC power to the AC Charger.
8.	Monitor DC charging voltage by observing the XFC display. LCD should indicate CHARGER 13.0 - 13.5 VOLTS.

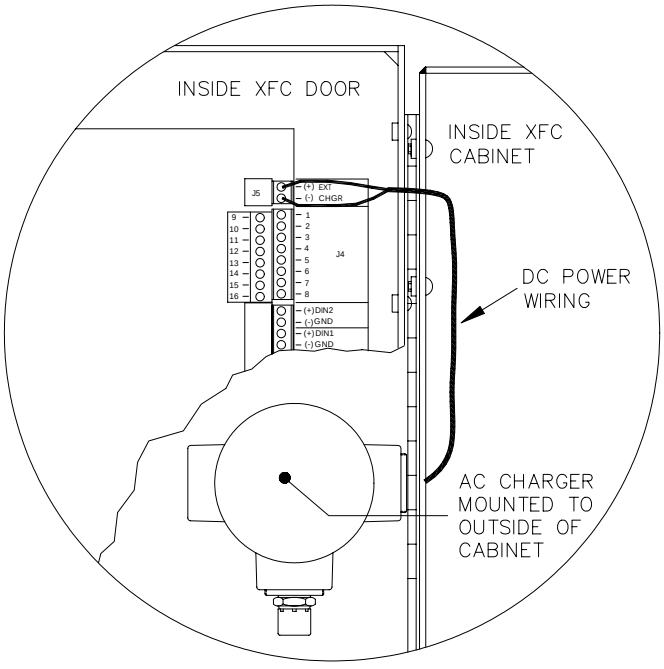


Figure 2–34 Mounting AC Charger

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Chapter 3
XFC Startup

This Chapter generally describes the steps required get a newly installed XFC system up and running. Specific information required to complete each step (depending on your equipment choice) is discussed in the PCCU32 help files, or the Operations manual for the FS/2 Portable Calibration and Collection Unit.

Highlights

In this Chapter you will learn about:

Continued on Next Page

Overview, Continued

FYI

Before you begin you should complete the tasks outlined in the Chapter 2.0, Installation.

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.

Options

The two equipment options for programming the XFC are the Windows based PCCU32 Software and the DOS based FS/2 device, these are discussed in more detail below.

Laptop Computer running PCCU32

PCCU32 Software running in a laptop Windows environment offers you the most capabilities for programming the XFC. Many of the new features designed into the XFC cannot be accessed by the FS/2 due to it's limited capabilities. The Windows environment features user friendly help files and easy to follow menus. Having help files readily accessible to the user is comparable to having a virtual teacher on location. Easy to follow menus and icons, step the user through many required choices.

The laptop computer connects via the cable directly to the connector on the side of the XFC.

Once this physical connection has been made, you may begin the communicating through the software.

FS/2 Handheld PCCU

The FS/2 Portable Calibration & Collection Unit (PCCU) is a hand held devices running the DOS version of PCCU. This equipment allows the user to perform only the most basic of operations and program the minimal features of the XFC. Because the device functions in the DOS environment, help files, icons and drop down menus are not available. Therefore this device is more limited.

The FS/2 PCCU connects via the cable directly to the connector on the side of the XFC.

Once this physical connection has been made, you may begin communication with the XFC through the program.

Prior to making the physical connection, you must instantiate the FS/2 application for the unit to recognize the connection. This requires a laptop computer. Once instantiated and the physical connection has been made, you may begin communication with the XFC through the program.

Setting up the XFC

Overview

Once physically connected to the XFC, you must then instruct the software of the programming device to connect. At this time, the software will actually read the device default values programmed at the factory. These preset values are based on the type of product you 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 (depending on your equipment choice) is discussed in the PCCU32 help files, or the Operations manual for the FS/2 Portable Calibration and Collection Unit.

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 XFC. 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

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 from that of others and will be the same as the Station ID.

Description	**Format**	**Note**
Device/Application ID	XXXXXXXXXX	10 digit alphanumeric

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	xxxxxxxxxxxxxxxxxxxxxxxx	24 digit alphanumeric

FYI 

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 XFC.

Date/Time

The XFC 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

Security System

The XFC-195 Board has a bi-level security system built in. For the purpose of this manual, we will refer to this as the Hardware Security. When the XFC is accessed through PCCU32 or WINCCU Host software packages, this will have a third level of security included. We will refer to this as the Software Security.

The Software Security System is designed to have a Password Administrator who sets up the accounts and privileges for himself as well as the other PCCU users. This privilege includes being able to instantiate applications and make changes to the functionality of the XFC. See the help files in the host software package for more information.

The Hardware Security System is designed to have two levels of user access, Application Editing and Downloading Files to a device. User access by default is restricted from modifying and downloading the Application Table or from downloading files to the device's R: and S: drives, but has all other user type privileges. These default privileges can be edited by the Administrator.

In order to program a user code into the XFC the Security Switch S1 on the XFC-195 Board must be OFF.

Also note that XFC does not send an error message when you have breeched the security level, it simply does not accept value changes.

If the Security Switch S1 located on the XFC-195 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.

Description	Format	Note
Security Code	XXXX	4 digit numeric

Contract Hour

You can program the XFC to begin the contract day based on your contract or company standards. When a XFC first powers up the contract is preset to begin at midnight.

FYI 

Midnight is 00 o'clock. If any value entered is greater than 23, you will record an error message and the XFC forces the value to 00 (midnight).

Log Period

Log period is the specified length of time between writing the calculated accumulated volume to record. You may record volumes as often as every minute and as seldom as every hour. The default is 60 minutes. The XFC 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

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

Calculation Method

When the XFC is powered up Initaially, the calculation method must be set. You have the option of setting the calculation method to AGA-3 1985, AGA-3 1992, AGA-7 or liquid. Once you have determined the calculation type, you may toggle specific factors on or off depending upon their availability.

TIP 

Calculation type, and many of the factors involved with setting up the calculations, are usually dictated by your sales contract or by company policy.

Continued on Next Page

Table 3–1 Configurable Calculation 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

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

* NOTE: Faux and Fw are not AGA factors.

1. Faux is a user set multiplier to compensate for liquids in the gas stream, defaults to 1.
2. Fw is a factor which compensates for water vapor in the gas stream and its affect on volume measurements.

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

Super Compressibility Calculation (Fpv)

When the XFC is powered up Initaially, the calculation method must be set. You have the option of changing the formula method to any of several other choices, see Table 3–2. Once you have determined the calculation to use, you may toggle specific parameters on or off depending upon whether you would like to use fixed or live analysis data.

TIP  Many decisions involved with setting up the Fpv are dictated by your sales contract or based on company policy.

Continued on Next Page

Table 3–2 Fpv Analysis Data

			Configurable		
Parameter	**Default Value**	**Units**	***All Others**	**NX19 Fixed FtFp**	**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	1000.0000	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.

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 3–3 for the list of constants.

Table 3–3 Gas Orifice Constants

			Configurable	
Parameter	**Default Value**	**Units**	**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

Alarm Limits

You have the ability to set XFC Alarm Limits for the parameters listed in Table 3–4. There are many purposes for setting these limits. ie. Controlling well output, or sending digital signals.

Table 3–4 Alarm Limits

			Configurable	
Parameter	**Default Value**	**Units**	**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

Reset Volume

When you Reset the volume accumulator the XFC 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.

TIP 

Since the XFC 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 XFC 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).

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Startup XFC

Put XFC On Line

To avoid a calibration shift, carefully follow these instructions.

Instructions

Open both bypass valves and close the vent to atmosphere valve, this stabilizes the pressure on both sides of the cell. Then begin to SLOWLY open the high side orifice tap valve from the meter run. Then SLOWLY open the low side valve. Once both the high and low sides are completely open, you may close both bypass valves.

Calibrating the XFC

Following installation and configuration of the XFC, the technician should perform calibration checks and possibly a calibration to ensure that measurements are accurate. The calibration technique used is usually determined by company policy and/or a contract.

Detailed instructions for performing calibration checks and calibrations may be found in Chapter 5, Maintenance.

Setup RTD

Although the RTD (Resistive Temperature Detector) temperature is accurately self-calibrating, you can match it to another reference source. This is accomplished by entering temperature bias, which shifts the RTD probe curve either positive or negative.

Setting XFC Temperature Calculation

The XFC 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.

TIP 

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.

Volume Reset

Since the XFC 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 XFC 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).

Description

When you reset the volume accumulator the XFC 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.

XFC Standard Displays

Program Display

The single tube XFC 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 3–5 XFC 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 PRESSURE	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

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Optional Equipment

Key Pad

The X Series models may be configured to include the optional Keypad located on the front cover of the unit. Keypad entry allows the user to monitor programmed display items without using additional equipment. See Figures 3–2 and 3–3.

FYI  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.

Log On Press the ENT button in the lower right hand corner of the keypad. See Figure 3–4.

Security When ask, 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).

Selectin 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.

FYI  You may change only those values that are not live from this screen.

Validate When setting up the XFC 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 and “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.

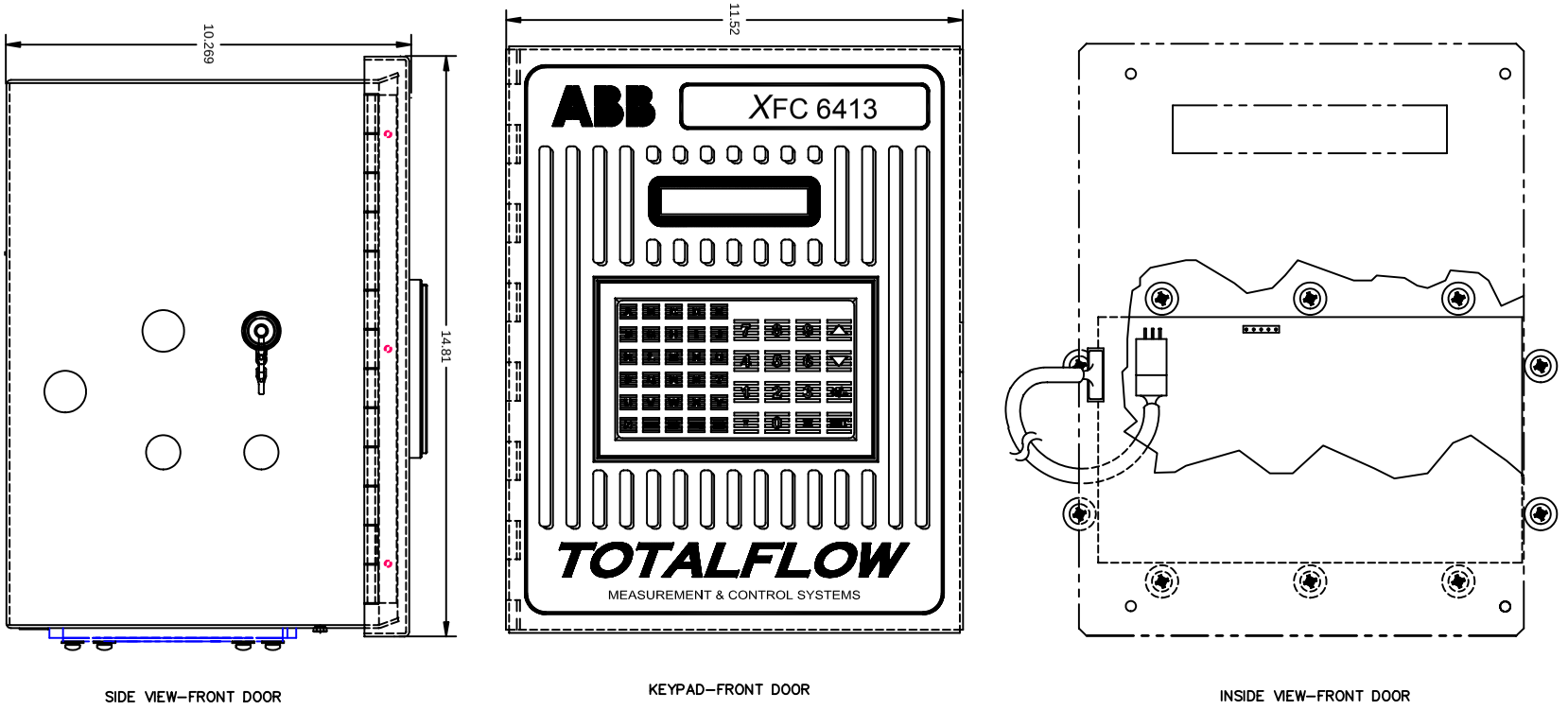


Figure 3–1 XFC 6413 with Optional Key Pad

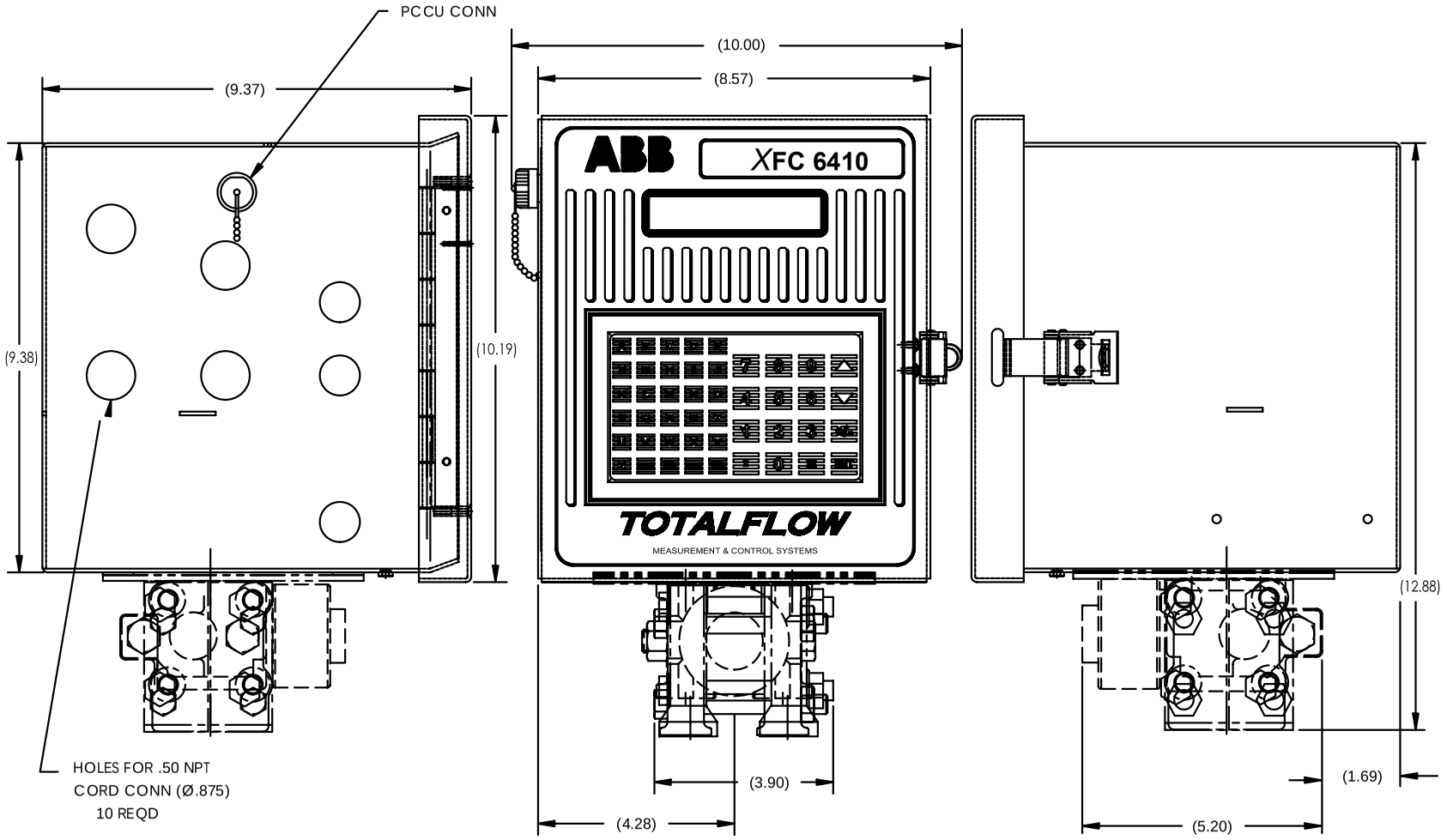


Figure 3–2 XFC 6410 with Optional Key Pad

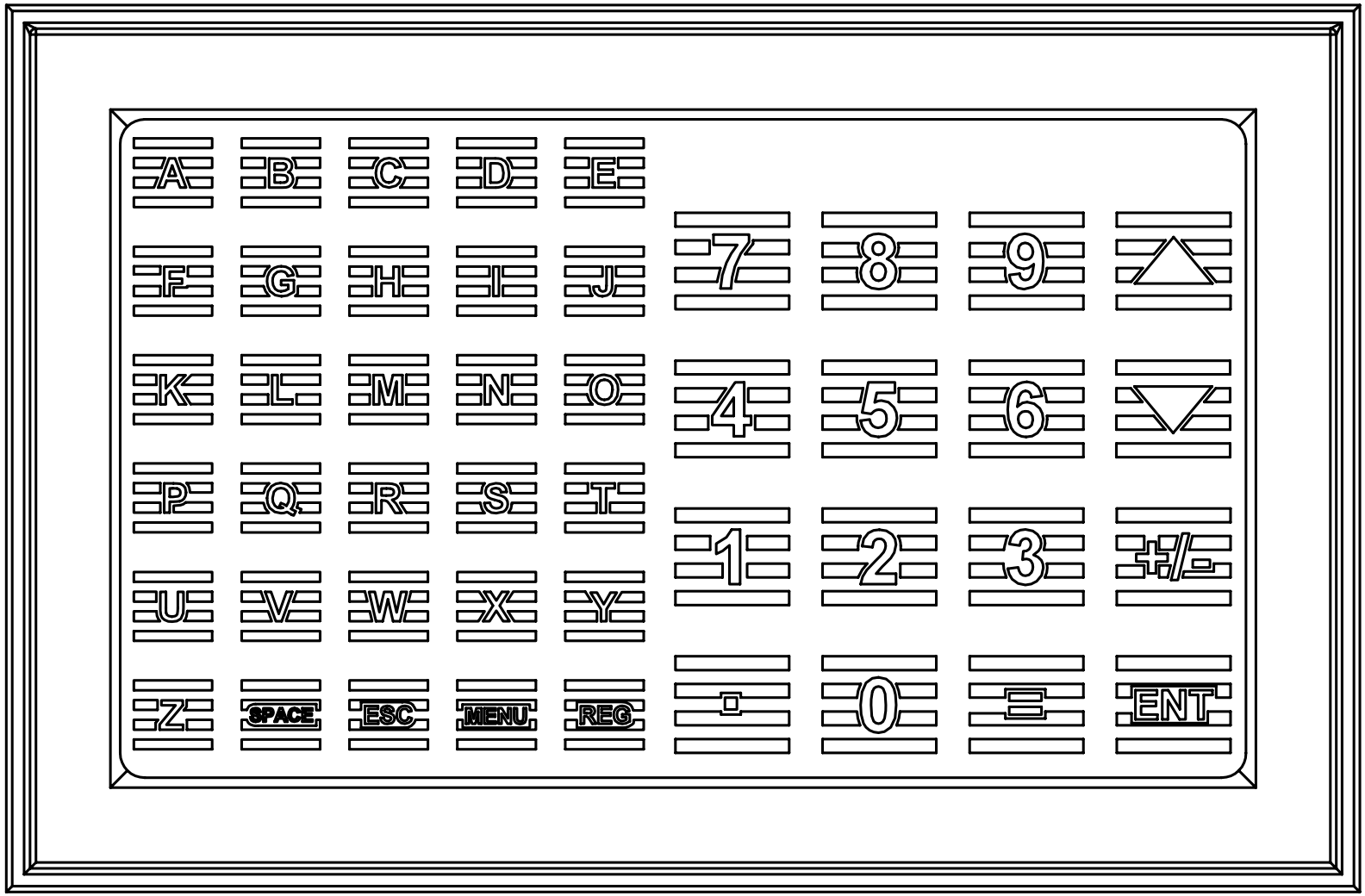


Figure 3–3 Optional Keypad

Totalflow Input/Output Modules Overview

In addition to Totalflow's enhanced on-board input/output capabilities, the hardware functionality of XFC Series can be extended in a flexible and friendly way by adding modular I/O as needed (see Figure3–4). Totalflow I/O (TFIO) modules are designed to accommodate low power, harsh environment 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 XFC-195 Board by an I^2C bus. On top of this bus, Totalflow has implemented an efficient I/O protocol to exchange information between the modules and the XFC-195 Board. The bus operates in a master/slave mode, with the Main Board acting as master.

The XFC 6413 and XFC 6414 (as shown in Figure3–5) systems support up to 3 modules. For example, 3 analog input modules can be connected to the I^2C bus. Since each module supports 8 analog inputs, then a total of 24 analog inputs can be added to the I^2C bus. Each module has capacity for up to 16 field terminations. Thus, for many modules 8 points are supported, since 2 terminations are generally required for each point. The XFC 6713 and XFC 6714 (as shown in Figure3–6) systems support up to 6 modules.

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 and moving the module into position directly beside and snapped to the next module. Likewise, in removing a module, it must first be separated from the module on either side, then removed from the DIN rail.

For additional information, please refer to the TFIO Module User's Manual (Part No.2101226-001).

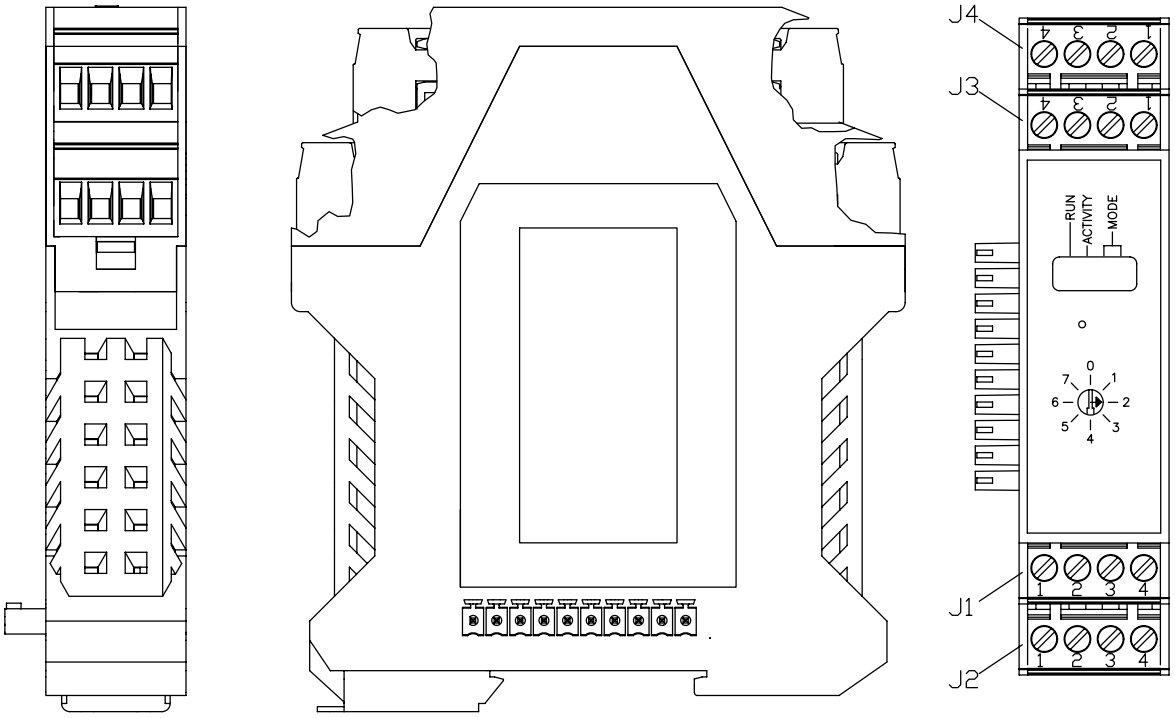


Figure 3–4 TFIO Module Housing

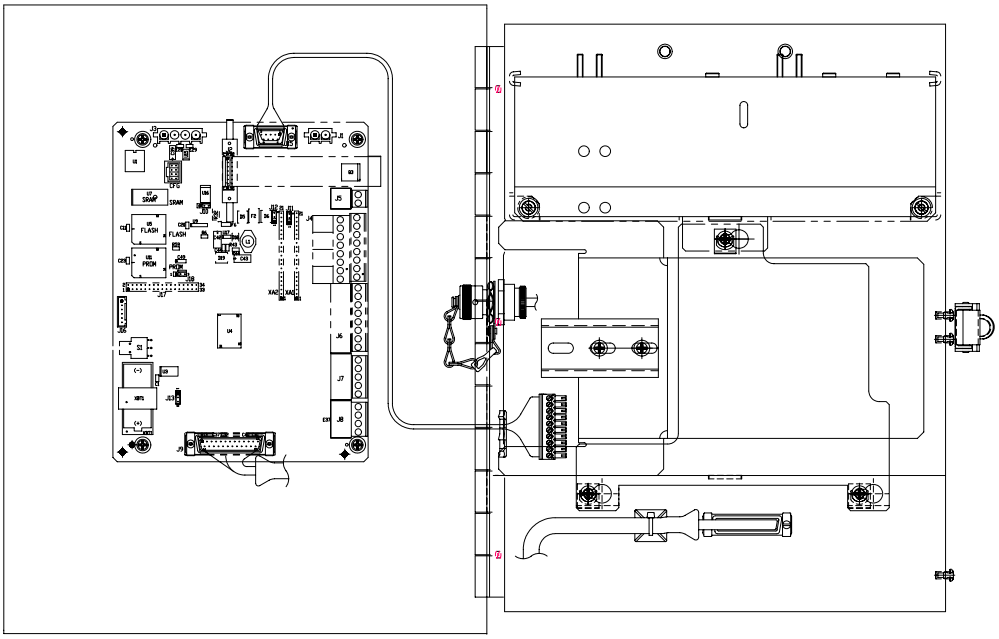


Figure 3–5 XFC 6413/6414 Inside View

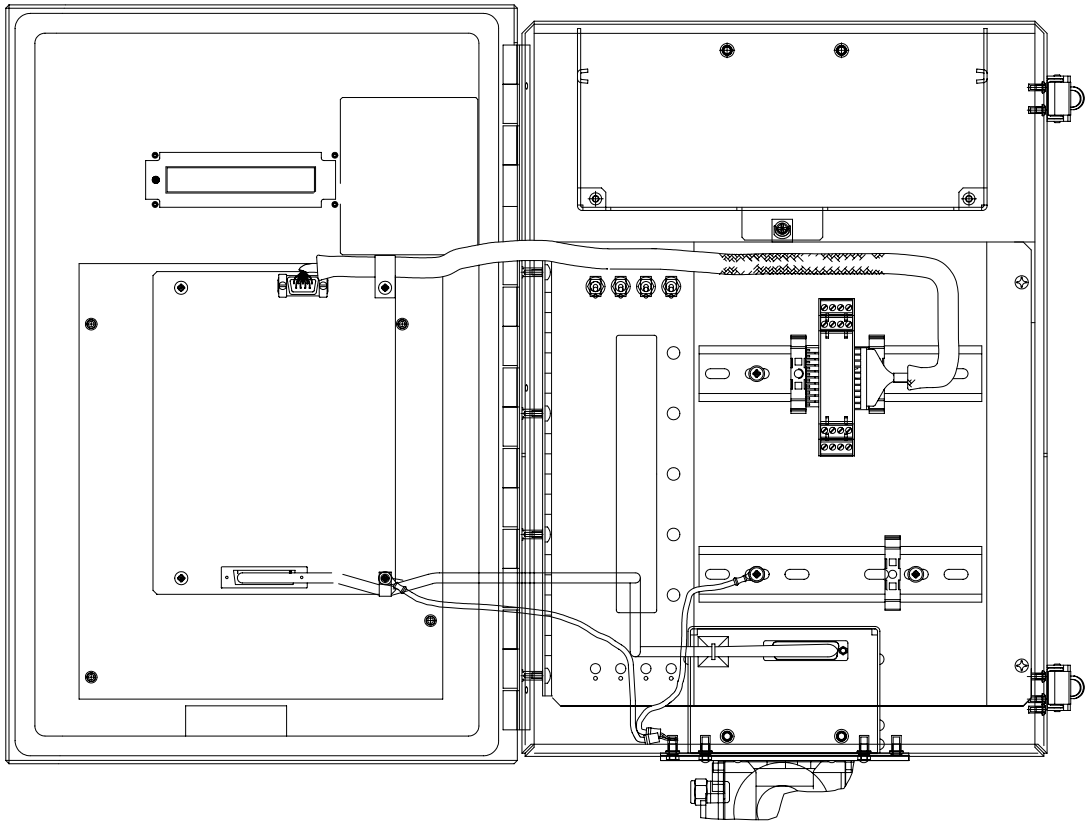


Figure 3–6 XFC 6713/6714 Inside View

Chapter 4
Maintenance

Overview

This Chapter provides you with standard Maintenance information and instructions on how to remove and install components of the XFC.

Highlights

In this Chapter you will learn how to:

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

Continued on Next Page

Overview, Continued

How to Use This Chapter

We recommend that you develop a regularly scheduled maintenance program. By establishing a maintenance program, XFC downtime can be minimized.

Record all items within this Chapter, in the maintenance practice procedures. Practical experience permits updating this schedule over a period of time. This results in many maintenance items being handled on a routine basis before potential problem(s) result in a failure.

Cleanliness

Because an XFC installation is primarily exposed to external environmental conditions, it is important that it be regularly inspected for cleanliness, both externally and internally. Foreign contaminants can cause damage to interior mounted components rendering XFC inoperable.

Front Mounted LCD

The user is informed of operational problems and operational limit violations by observing the alarm codes on the right side of the LCD display. XFC alarm troubleshooting procedures are presented in the Troubleshooting Chapter.

Returning Part(s) for Repair

If a TOTALFLOW component is to be returned to Totalflow for repair, securely wrap it in protective anti-static packaging. Before returning a component, call us 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.

Backing up Configuration Files

Before you begin any maintenance on your XFC, you should collect the data and back up all configuration files to your laptop's hard drive or a floppy disk. This “Upload” safeguards your data and allows you to re-start the unit without the hassle of re-configuring the XFC should any problem arise.

Although there are “Save” buttons in the Entry Mode screens which allows the user to backup “Entry” mode data items, a complete system backup is only accomplished by using the “Save and Restore Utility”. When using this utility to backup files, the user should also “download” the files to the S: drive in case of a “Cold” start.

- While in PCCU, use the Save and Restore Utility found under File Utilities in the Operate drop down menu.

Changing XFC Clock

When any measurement applications are instantiated on the XFC, changing the clock could affect the time when log period entries are made. To protect integrity of accounting audit trails, the XFC handles these types of clock changes as follows:

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).

Forward Clock Change Crossing an Hourly Boundary:

Forces an log period entry for part of hour that has accumulated since last hourly entry. XFC 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.

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. XFC 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.

FYI

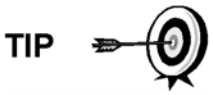
A backward clock change uses two (2) records to maintain data integrity. This assures that previously recorded data is not overwritten.

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.

Replacing XFC Battery Pack

This Chapter presents the procedures for removal and installation of XFC battery pack. To access the battery pack, open XFC door. Battery pack is located behind a front mounted keeper plate. On the XFC 6713/6714 models, the Battery is located directly behind a hinged plate on which the I/O module DIN rails are mounted. You will need to remove the two screws located on upper and lower right side on these models.

When removing battery pack, DO NOT remove Lithium battery from XFC-195 Board. This prevents any data stored in Board RAM, from being lost.



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.

Procedure

In the following procedure, the common name for a component or it's 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.

Step	Procedure
1.	Make sure the J13 (Figure 4–1, Item 10) memory backup jumper covers the top two pins. This enables the memory backup.
2.	Either make sure "L_L" battery alarm is not being displayed on XFC or measure lithium battery and make sure it is > 3.0V.
3.	Disconnect the battery charger from XFC-195 Board terminals EXT CHGR +/- J5 (Figure 4–1, Item 20).
4.	Before removing battery pack, disconnect the Battery Cable from the XFC-195 Board connector J1 (Figure 4–1, Item 21).
5.	Remove battery compartment cover (Figure 4–2 or 4–3, Item 18), which secures battery pack in its mounting location, by slightly loosening the three mounting screws. It is not necessary to remove screws.
6.	Remove battery pack from battery compartment.
7.	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. Reinstall keeper plate (Figure 4–2 or 4–3, Item 18) and tighten the three keeper plate mounting screws. Or close hinged plate and insert and tighten the upper and lower plate keeper.
8.	Reconnect battery pack cable to XFC-195 Board connector J1 (Figure 4–1, Item 21).
9.	Reconnect battery charger to XFC-195 Board terminals EXT CHGR +/- terminals J5 (Figure 4–1, Item 20).
10.	After closing XFC door, check door mounted LCD for normal operational readings.

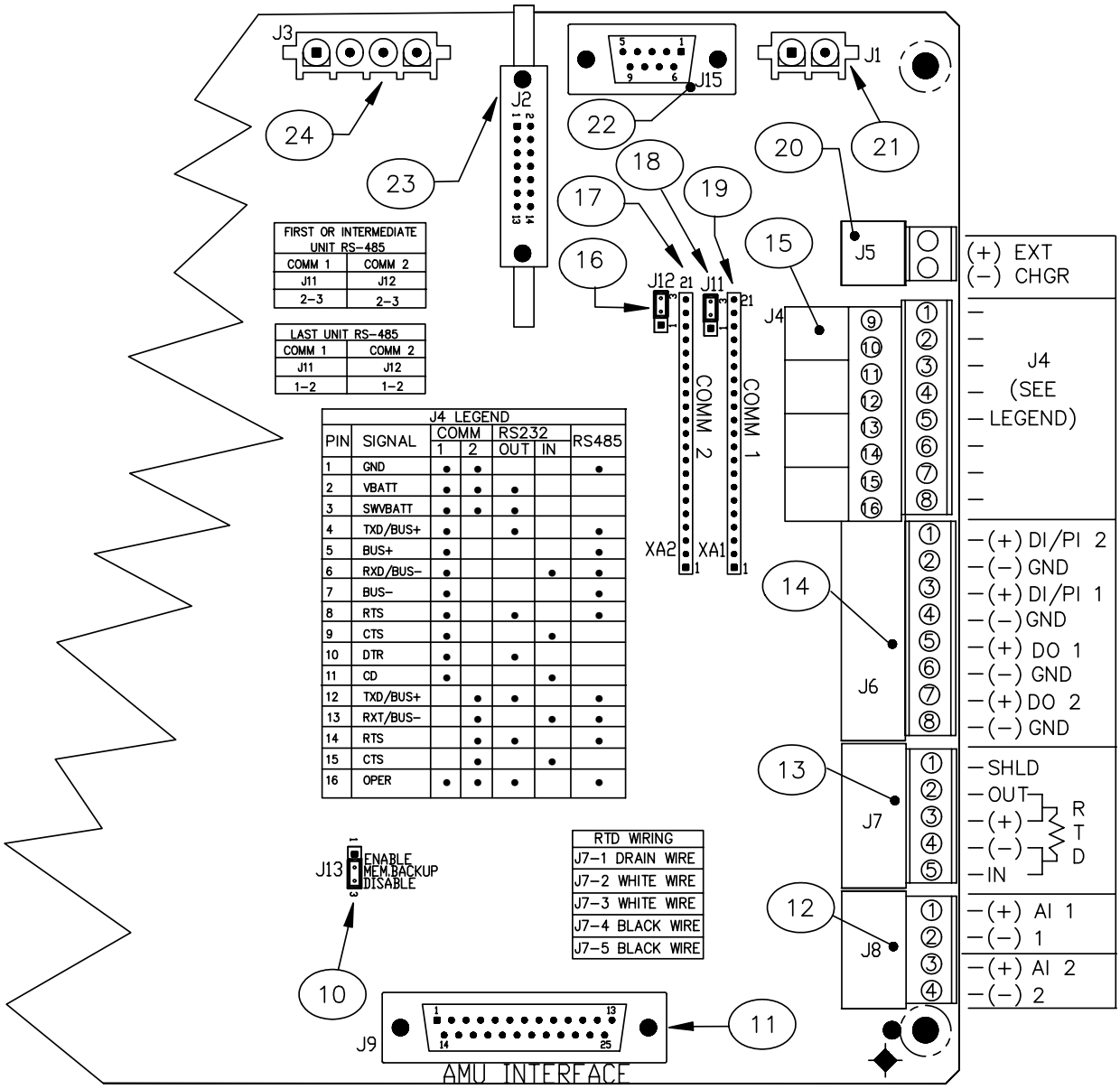


Figure 4–1 XFC-195 Board Cutout-Maintenance

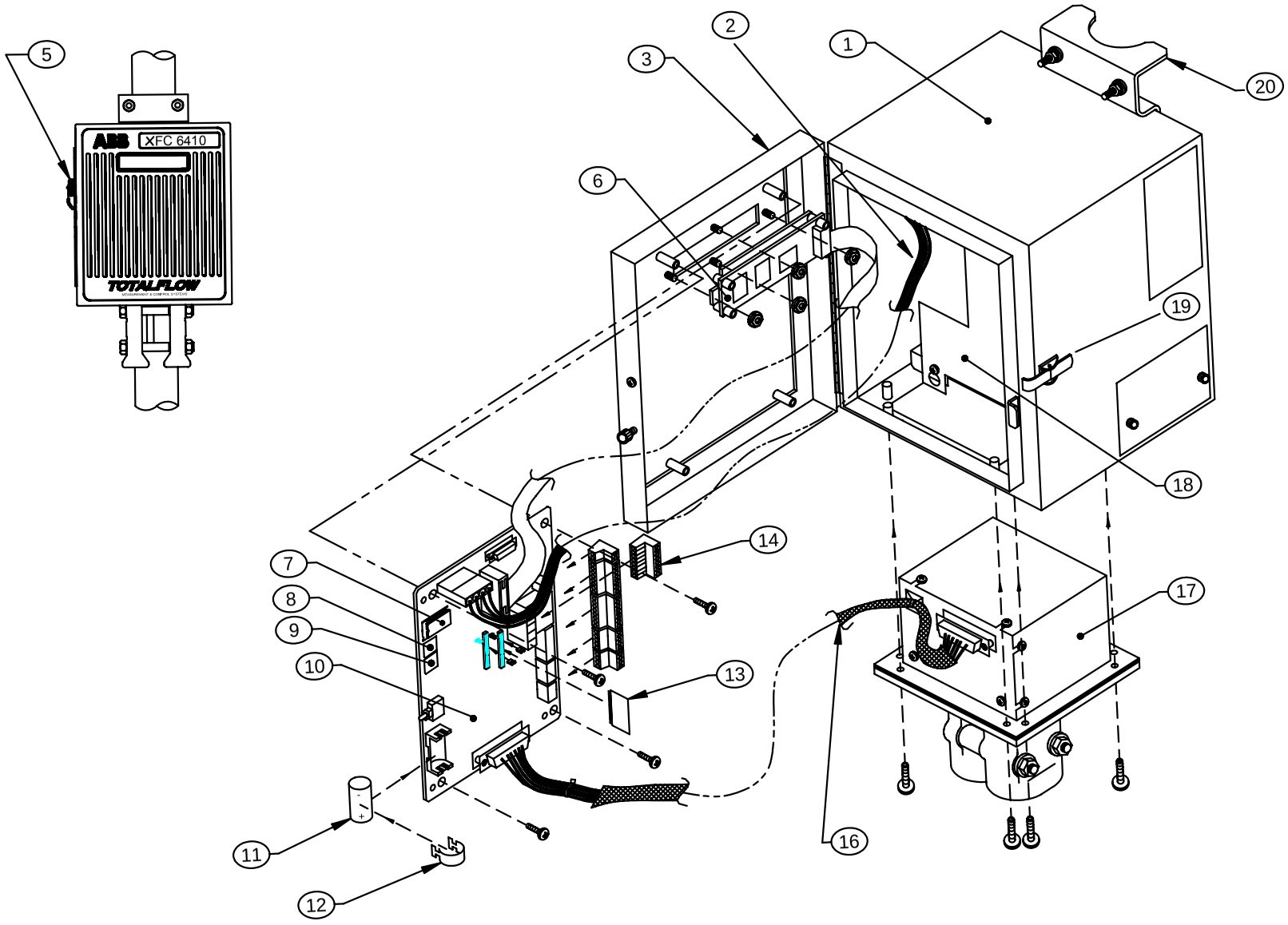


Figure 4–2 XFC 6410 Component/Cable Locations

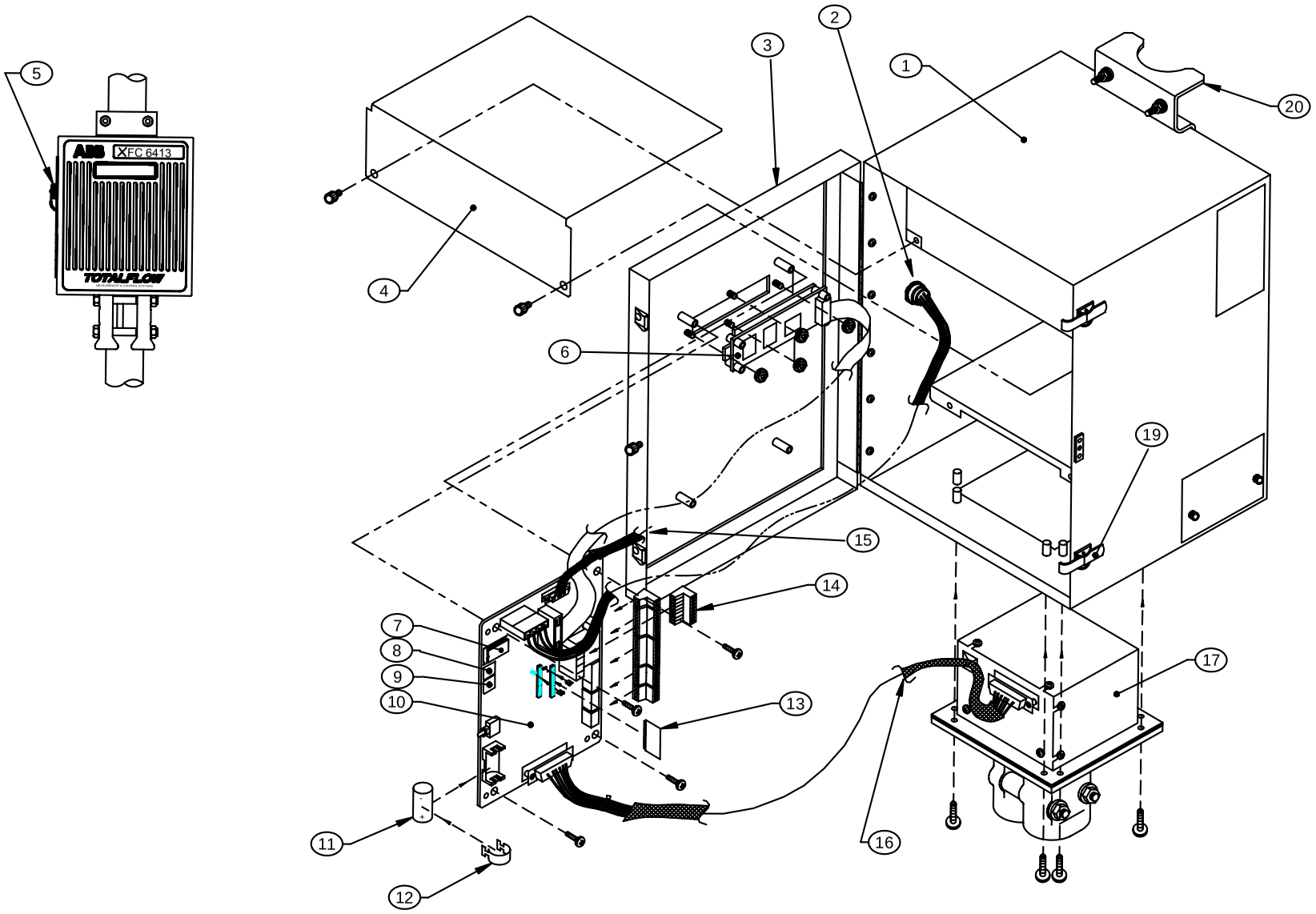


Figure 4–3 XFC 6413 Component/Cable Locations

Table 4–1 XFC-195 Board Identifications, Maintenance

ID Number	Description
10	Memory Backup Enable/Disable
11	AMU Interface
12	Analog Input Connectors
13	RTD Connectors
14	Pulse Input and Digital Output Connectors
15	Remote Communications Connectors
16	Remote Comm 2: RS-485 Termination Jumper
17	Remote Comm 2: Module Plug-in
18	Remote Comm 1: RS-485 Termination Jumper
19	Remote Comm 1: Module Plug-in
20	External Charger
21	Battery Connection
22	I/O Module Interface
23	LCD Display Interface
24	PCCU Interface

Table 4–2 XFC 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	Sram
8	Flash
9	Prom
10	XFC-195 Board
11	Lithium Battery
12	Battery Cover
13	Communication Module
14	Phoenix Connector Plug Module
15	TFIO Module Interface Cable (6413/6414 only)
16	AMU Interface Cable (Not on Pulse Models)
17	AMU (Not on Pulse Models)
18	Battery/Compartment Cover
19	Door Latch
20	Pipe Mounting Bracket

Replacing the Main Electronic Board (XFC-195)

The X Series Main Electronic Board (XFC-195 Board) is mounted to the backside of XFC access door. It is mounted, to the door, on standoffs. Refer to Figure 4–2 or 4–3. On Models XFC 6713 and XFC 6714, the XFC-195 Board is mounted below the LCD Screen

The XFC-195 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.

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 XFC-195 Board, be certain any historical flow data has been saved to an external storage medium. Failure to do so could result in data loss when XFC-195 Board is removed.

Procedure

In the following procedure, the common name for a component or it's 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.

Step	Procedure
1.	Back up configuration files following the instructions listed previously in this chapter titled: Backing Up Configuration Files.
2.	Before XFC-195 Board removal, disconnect the following associated connectors in this order. • If used, disconnect external charging source J5(Figure 4–1, Item 20). • Disconnect battery pack connector J1(Figure 4–1, Item 21). • Slide, to the right; green terminal strips J4, J6, J7 and J8 (Figure 4–1, Item 12–15) from their associated XFC-195 Board connector. DO NOT lift connectors upward. Tape an identifier to each connector so it will be correctly reinserted into the same Board mounting connector during reinstallation of XFC-195 Board. • Disconnect PCCU Port connector J3 (Figure 4–1, Item 24). • AMU Port connector J9 (Figure 4–1, Item 11). • XFC LCD port connector J2 (Figure 4–1, Item 23). • Remove cable from J15 (Figure 4–1, Item 22) if External I/O Modules are installed.
3.	Remove four mounting screws and lock washers securing XFC-195 Board (Figure 4–2 or 4–3, Item 10) to door mounted standoffs.

FYI

When removing the XFC-195 Board, grasp its outer edges. This prevents damage to circuitry and components.

Continued on Next Page

Replacing the Main Electronic Board (XFC-195), Continued

Step	Procedure, Cont.
4.	Replace and secure XFC-195 Board on four standoffs and secure in place using four screws and lock washers. DO NOT over tighten screws. Doing so could cause damage to Board or associated circuitry.
5.	Reinstall connectors, removed in Step 1, to their associated Board mounted connectors in the following order. • AMU Connector J9 (Figure 4–1, Item 11) • LCD Connector (Figure 4–1, Item 23) • PCCU Connector J3 (Figure 4–1, Item 24) • RTD J7 (Figure 4–1, Item 13) • I/O Module Cable J15 (Figure 4–1, Item 22) • Battery Pack J1 (Figure 4–1, Item 21) • Communications J4 (Figure 4–1, Item 15) • On-Board I/O J6 and J8 (Figure 4–1, Item 12 & 14) • Charger Last (Figure 4–1, Item 20)
6.	If you desire to restore the Configuration Files follow the instructions found in the PCCU32 Help Files.

Replacing Liquid Crystal Display (LCD) Board

The LCD Board is mounted on the backside of hinged doors behind the XFC-195 Board. To access and remove Display Board, perform the following procedures.

Procedure

In the following procedure, the common name for a component or it's 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.

DO NOT remove the XFC-195 Board mounted Lithium battery since it provides power to RAM. It is recommended that historical flow data be downloaded before accessing and removing LCD Board to prevent potential loss of stored data.

Step	Procedure
1.	Make sure the J13 (Figure 4–1, Item 10) memory backup jumper covers the top two pins. This enables the memory backup.
2.	Back up configuration files following the instructions listed previously in this chapter titled: Backing Up Configuration Files.
3.	To access the LCD Board, open the TOTALFLOW unit door. Board is located behind XFC-195 Board on all Models except the XFC 6713 and XFC 6714.
4.	Disconnect the external charging unit J5 (Figure 4–1, Item 20) from the XFC-195 Board.
5.	Disconnect the Battery Pack connector J1 (Figure 4–1, Item 21) from the board mounted connector.

Continued on Next Page

Replacing Liquid Crystal Display (LCD) Board, Continued

Step	Procedure, Cont.
6.	Disconnect LCD Board cable connector from XFC-195 Board Display Port connector J2 (Figure 4–1, Item 23). If you are replacing the LCD Board on either the XFC 6713 or XFC 6714, proceed to step 9.
7.	Remove four XFC-195 Board mounting screws and lock washers. DO NOT let screws and lock washer fall onto Board circuitry.
8.	Move Board away from door then support it so its circuitry does not come in contact with any metal surface.
9.	Using a 3/16" nut driver, remove four Display Board hexagonal mounting standoffs. Lift Board from door mounted standoffs. If Board is being returned to Totalflow for service, it is recommended that attached ribbon cable be left connected and returned with Display Board.
10.	To reinstall Display Board, perform procedures 1 to 9 in reverse order. DO NOT over tighten screws. Once Display Board is reinstalled, apply power to XFC and verify information displayed on LCD is correct. Adjust contrast potentiometer (R32) for optimum display.

TIP 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.

Replacing AMU

CAUTION Under no circumstances shall the XFC AMU cover be removed. Removal of this cover, and entry into interior of AMU, **voids AMU warranty**. If the AMU requires servicing, the entire assembly, including cable, must be removed from XFC, securely packaged for shipping and returned to Totalflow.

Procedure

In the following procedure, the common name for a component or it's 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.

Step	Procedure
1.	Make sure the J13 (Figure 4–1, Item 10) memory backup jumper covers the top two pins. This enables the memory backup.
2.	Using meter run installed Manifold high/low control valves, equalize pressure to AMU. See Figure 4–4.
3.	Using XFC high/low tap valves, close off both lines. These two valves connect Meter Run high/low output lines to XFC.

Continued on Next Page

Step	**Procedure,** Cont.
4.	Vent manifold to atmosphere using vent valve.
5.	Completely disconnect high/low Manifold lines from AMU.
6.	If used, disconnect external battery charger connected to J5 (Figure 4–1, Item 20).
7.	Disconnect battery pack from J1 (Figure 4–1, Item 21).
8.	**Do not disconnect AMU cable with power connected.** Disconnect XFC AMU cable J9 (Figure 4–1, Item 11) from XFC-195 Board. Cable is secured to XFC-195 Board with a Board mounting screws which must be removed. See Figure 4–2 or 4–3.
9.	Loosen XFC 2” mounting post clamps and rotate XFC a sufficient distance to allow removal of AMU. Clearance of approximately 7” is required for removal. After rotation, tighten clamps to hold XFC in place before removing AMU.

When rotating XFC, be careful not to place twisting stress on attached cables.

10.	Using a Phillips screwdriver, remove eight mounting screws, washers and lock washers securing AMU to XFC cabinet. Access mounting hardware from underside of XFC.
11.	Tilt AMU slightly upwards, then remove unit. A weather sealing gasket is affixed to top side of AMU mounting flange.

During reinstallation of AMU, weather sealing gasket must be reinstalled between the AMU and bottom of XFC to keep out moisture and dust.

12.	To install AMU, perform steps 2 to 11 in reverse order. When installing AMU, the eight mounting screws should be securely tightened to keep our external environmental elements.

Before placing AMU back into operation, the XFC MUST be calibrated. Refer to Calibration Procedure; Chapter 3 for detailed procedures.

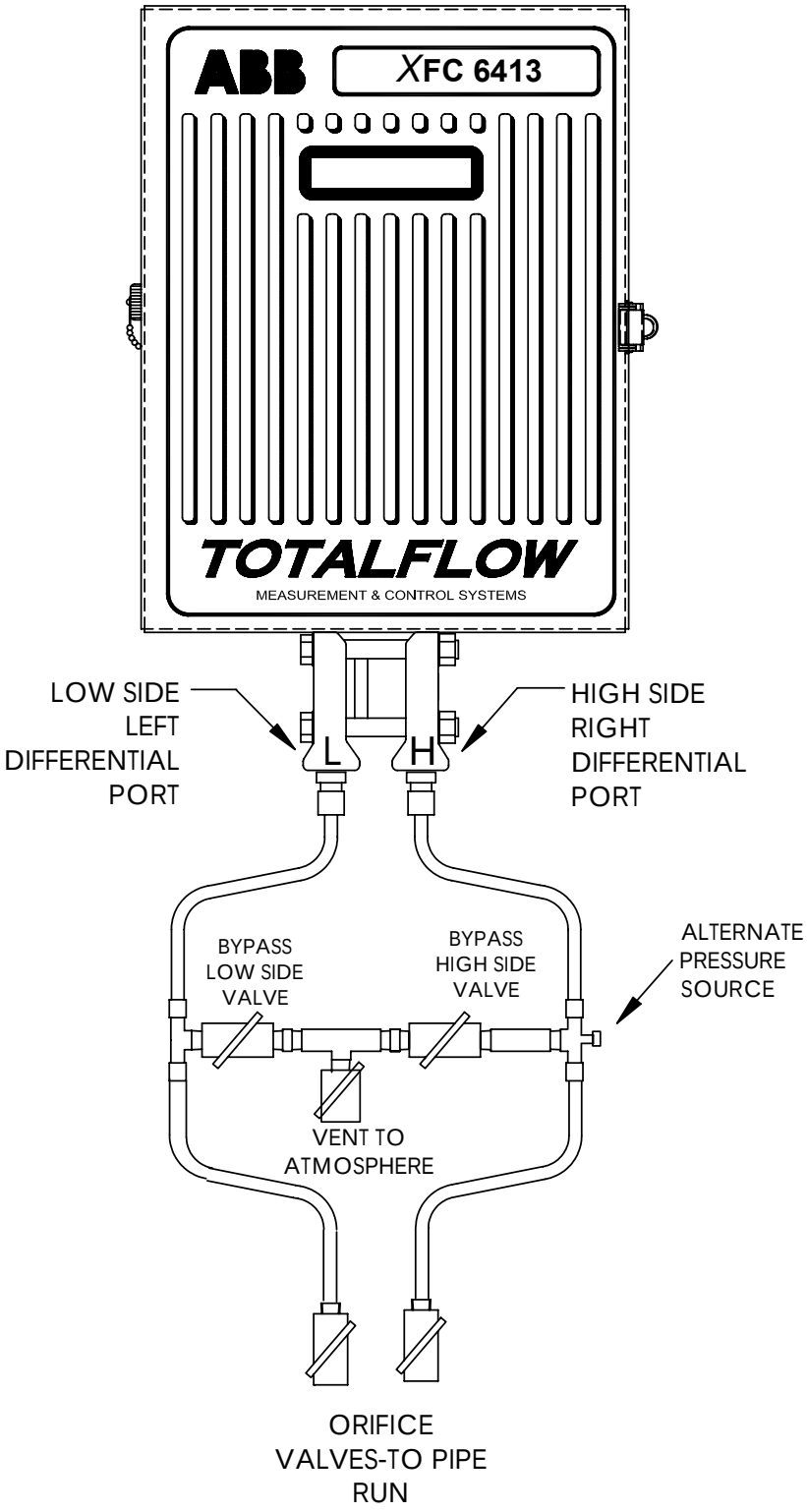


Figure 4–4 Flow Computer with Discrete Manifold

Calibration Overview

The calibration mode allows you to calibrate, check and zero the static and differential pressure. In addition, this mode allows you to set the (bias) for the Resistance Temperature Detector (RTD). During the initial calibration, the parameters shown in Table 4–3 will need to be configured.

Table 4–3 Calibration Configurable Parameters

Parameter	Default Value	Units
Fixed Temperature	60.0000	Degrees F
RTD installed	No	
Temperature Base (Tb)	60.0000	Degrees F

Required Test Equipment

The following test equipment is required to calibrate the XFC AMU/IMV :

- PCCU (either laptop with PCCU32 software or FS/2
- 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

FYI

If a method other than the 'compressed nitrogen / deadweight tester' method is used to calibrate Static Pressure cell, you 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.

Hold Mode

When calibrating the AMU or setting up a fixed temperature, the PCCU will instruct the XFC to ignore live values for the flow calculations for the period of time the XFC is being calibrated. This prevents real time XFC flow calculations from being affected during the calibration. During this time the XFC 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. Unplug DATA cable at XFC connector

TIP

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.

Checking Static Pressure (SP)

The XFC allows you to check the Static Pressure Calibration and log the pressure marker check points. You should perform this check prior to and directly following the calibration.

During normal operation of the XFC, the display provides continuous SP readouts. However during this procedure the XFC is placed in a temporary hold mode.

You can enter as many SP pressure markers as you desire. Recording too many markers could cause the XFC to overwrite existing older events. Only the last five checks are used by the WINCCU editor for calibration adjustment. Enter a low, mid-low, mid, mid-high and high value.

FYI 

During this procedure, you 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.

Calibrating Static Pressure (SP)

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

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

FYI 

The XFC uses an absolute Static Pressure (SP) Cell. Absolute pressure measures the pressure referenced to a vacuum or sealed chamber. This is different than a guage cell which measures the pressure referenced to the atmosphere.

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

Since the static pressure cell is an absolute device, it always measures the true pressure relative to a vaccum or sealed chamber. Thus 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.

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.

Checking Differential Pressure (DP)

As discussed above under “Checking Static Pressure (SP) Calibration”, it is recommended that checks of the Differential Pressure (DP) be done prior to and directly following calibration.

You can enter as many DP pressure markers as you desire. Recording too many markers may cause the XFC to overwrite existing older events. Only the last five checks are used by the WINCCU editor for calibration adjustment. Enter a low, mid-low, mid, mid-high and high value.

FYI 

During this procedure, you 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.

Calibrating Differential Pressure (DP)

A three or five point pressure method is used to calibrate the XFC Differential Pressure cell. These different pressures are applied to the cell from a known traceable source with resultant pressure values entered into the XFC 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 re-calibrate the DP.

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

On-Board I/O Calibration Overview

The calibration mode enables the calibration of the Analog Inputs, Analog Outputs (TFIO Module) and Pulse Inputs.

Hold Mode

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

To exit the Hold mode:

1. Exit Calibration mode
2. Unplug DATA cable at XFC connector

Calibrating On-Board Analog Input

Overview

The Totalflow XFC comes standard with 2 analog inputs on the XFC-195 Board. As you enter calibration, the XFC 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.

Calibration

Step	Procedure
1.	Connect an accurate power source capable of 1 - 5 volts to the AI terminals to be calibrated.
2.	In Calibration Control for the AI you are calibrating, select either 3 Point or 5 Point for number of calibration points. 3 Point for low, 50% and 100% values and 5 Point for low, 25%, 50%, 75% and 100% values.
3.	In the Current Value box, check the Update button. This causes the AI to look for it's source at the terminals instead of a Test Value.
4.	Begin the calibration starting with the first selection, Low Calculation Point.
5.	Apply 1 volt to the AI terminals.
6.	Enter a value (typically zero) representing the Low Cal Point and representing the desired engineering units. Click the OK button.

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.

7.	Move to the 100% Calibration Value.
8.	Apply 5 volts to the AI terminals.
9.	Enter a value representing full range and representing the desired engineering units. Click the OK button.
10.	If 3 Point calibration was selected, move to the 50% Calibration Value.
11.	Apply 3 volts to the AI terminals.
12.	Enter a value representing 50% and representing the desired engineering units.

Note: If Preforming a 5 point calibration, you will need to add additional steps for the 25% and 75% Calculation points.

Calibrating On-Board Pulse and Digital Inputs

Overview

Totalflow XFC 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 XFC 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. Generally you need to complete the following procedure.

Calibration

Step	Procedure
1.	Click on the K-Factor button, enter a value and click the OK button. Input pulses are multiplied by the K-Factor. To have a one to one pulse count, use a factor of 1.

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.

Calibrating TFIO Module Analog Outputs

Overview

The following procedure is for calibrating Analog Outputs contained on the XFC TFIO Analog Output Modules. As you enter the calibration screen and have selected the A/O that you would like to calibrate, the XFC 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. Generally you need to complete the following procedures.

Calibration

Step	Procedure
1.	Connect a meter capable of reading 4 - 20 ma signal to the analog output terminals to be calibrated.
2.	Click on the Low Cal button and verify that the meter's reading has stabilized at approximately 4 ma.
3.	Enter the meter's reading in the Enter Measured Value window and click the OK button.
4.	Click on the High Cal button and verify that the meter's reading has stabilized at approximately 20 ma.
5.	Enter the meter's reading in the Enter Measured Value window and click the OK button.
6.	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)

How to Change Orifice Plate

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

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

Step	Procedure
1.	Take meter run out of service.
2.	Replace the orifice plate.
3.	If you would like to record a Volume Calculation, go to the Entry screen, select the measurement tube, and move to the Commands tab. Change the value for the Reset Log Period to Yes. This forces a new record to be written based on the old orifice plate size. If you would also like to simultaneously zero the accumulated volume, you may use the Reset Volume command instead. While seemingly unnecessary, 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.	In PCCU, enter the new orifice plate diameter.
5.	Return meter to service.

Leaving Run In-Service Procedure (Senior Fitting)

Step	Procedure
1.	Place XFC in HOLD, by entering the calibration mode, so constant SP, DP and Temperature values are used, while the orifice plate is being changed.
2.	Replace the orifice plate.
3.	Exit the Calibration mode, releasing the Hold of the SP, DP and Temperature.
4.	If you would like to record a Volume Calculation, go to the Entry screen, select the measurement tube, and move to the Commands tab. Change the value for the Reset Log Period to Yes. This forces a new record to be written based on the old orifice plate size. If you would also like to simultaneously zero the accumulated volume, you may use the Reset Volume command instead. While seemingly unnecessary, 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.
5.	In PCCU, enter the new orifice plate diameter.

FYI  At top of next Volume Calculation Period, the XFC will do calculations based on new orifice plate diameter for the part of the period after the log was reset.

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), you may conclude that the SP or the DP pressures are out of alignment exactly the same amount at each pressure marker (linear shift). When this occurs, you may either re-calibrate the XFC or you may set the Transducer to zero. The preferred method is to re-calibrate the XFC. This maintains the XFC records in a manner that is 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.

Using the Zero Transducer capability assumes that the shift is Linear, meaning that at different levels of pressure that the AMU is off by exactly the same amount. If this is not the case, you need to re-calibrate the AMU instead.

Static Pressure

The SP can be zeroed without re-calibrating. If the SP shifts, user can enter a new barometric pressure value. This shifts the SP AMU curve. After the HOLD state begins, select Zero Transducer.

Differential Pressure

The DP can be zeroed without re-calibrating. If DP shifts, user can enter a new zero (0). This shifts the DP curve. After the HOLD state begins, select Zero.

Replacing Static Pressure Transducer

Under no circumstances shall the XFC 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 XFC, securely packaged for shipping and returned to Totalflow.

Procedure

In the following procedure, the common name for a component or it's 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.

Step	Procedure
1.	Make sure the J13 (Figure 4–1, Item 10) memory backup jumper covers the top two pins. This enables the memory backup.
2.	Using user installed static pressure transducer impulse line isolation valve, close and isolate static pressure to transducer. See Figure 4–5.
3.	Using user installed static pressure transducer calibration three way valve, close and isolate pressure to transducer and open test port to vent static pressure from transducer.
4.	Remove static pressure impulse line connections from transducer.
5.	If used, disconnect external battery charger connected to J5 (Figure 4–1, Item 20).
6.	Disconnect battery pack from J1 (Figure 4–1, Item 21).

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Step	**Procedure,** Cont.
7.	**Do not disconnect cable with power connected.** Disconnect XFC Transducer cable from XFC-195 Board (Figure 4–1, Item 11). Cable is secured to XFC-195 Board with a Board mounting screw which must be removed.
8.	Remove cable from Static Pressure Transducer connector.
9.	Loosen FCU 2” mounting post clamps and rotate XFC a sufficient distance to allow removal of Static Pressure Transducer. Clearance of approximately 7” is required for removal. After rotation, tighten clamps to hold XFC in place before removing Static Pressure Transducer.

CAUTION

When rotating XFC, be careful not to place twisting stress on attached cables.

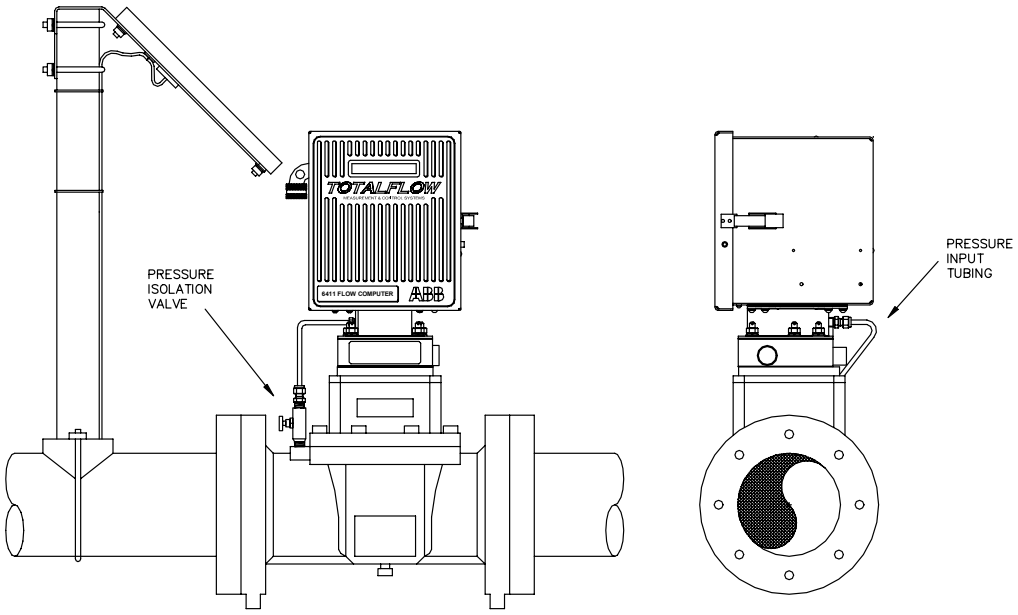

Figure 4–5 Flow Computer with Pulse Meter

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Step	**Procedure,** Cont.
10.	Using a Phillips screwdriver, remove eight mounting screws, washers and lock washers securing Static Pressure Transducer to XFC cabinet. Access mounting hardware from underside of XFC.
11.	Tilt Static Pressure Transducer slightly upwards then remove unit. A weather sealing gasket is affixed to top side of Static Pressure Transducer mounting flange.

FYI 

During reinstallation of Transducer, weather sealing gasket must be reinstalled between the Transducer and bottom of XFC to keep out moisture and dust.

12.	To install Static Pressure Transducer, perform steps 2 to 11 in reverse order. When installing the Transducer, the eight mounting screws should be securely tightened to keep external environmental elements from entering FCU interior.

TIP 

Before placing Static Pressure Transducer back into operation, the XFC MUST be calibrated. Refer to Calibration Procedure, in this chapter for detailed procedures.

Chapter 5
Troubleshooting

Overview

This Chapter contains troubleshooting tables to correct most XFC alarm code condition(s). The alarm codes flag you that an operational problem exists, and are visible on the front door LCD.

The Troubleshooting Tables are designed to match an alarm code with its probable cause(s) and the corrective procedure(s). Besides these tables, this Chapter contains procedures for setup and troubleshooting with an installed radio communication unit.

See Table 5–1 and Figure 5–1 for XFC-195 Board Troubleshooting Component locations.

Highlights This Chapter covers the following topics:

Table 5–1 XFC-195 Board Identifiers, Troubleshooting

ID Number	Description
10	Memory Backup Enable/Disable
11	AMU Interface
12	Analog Input Connectors
13	RTD Connectors
14	Pulse Input and Digital Output Connectors
15	Remote Communications Connectors
16	Remote Comm 2: RS-485 Termination Jumper
17	Remote Comm 2: Module Plug-in
18	Remote Comm 1: RS-485 Termination Jumper
19	Remote Comm 1: Module Plug-in
20	External Charger
21	Battery Connection
22	I/O Module Interface

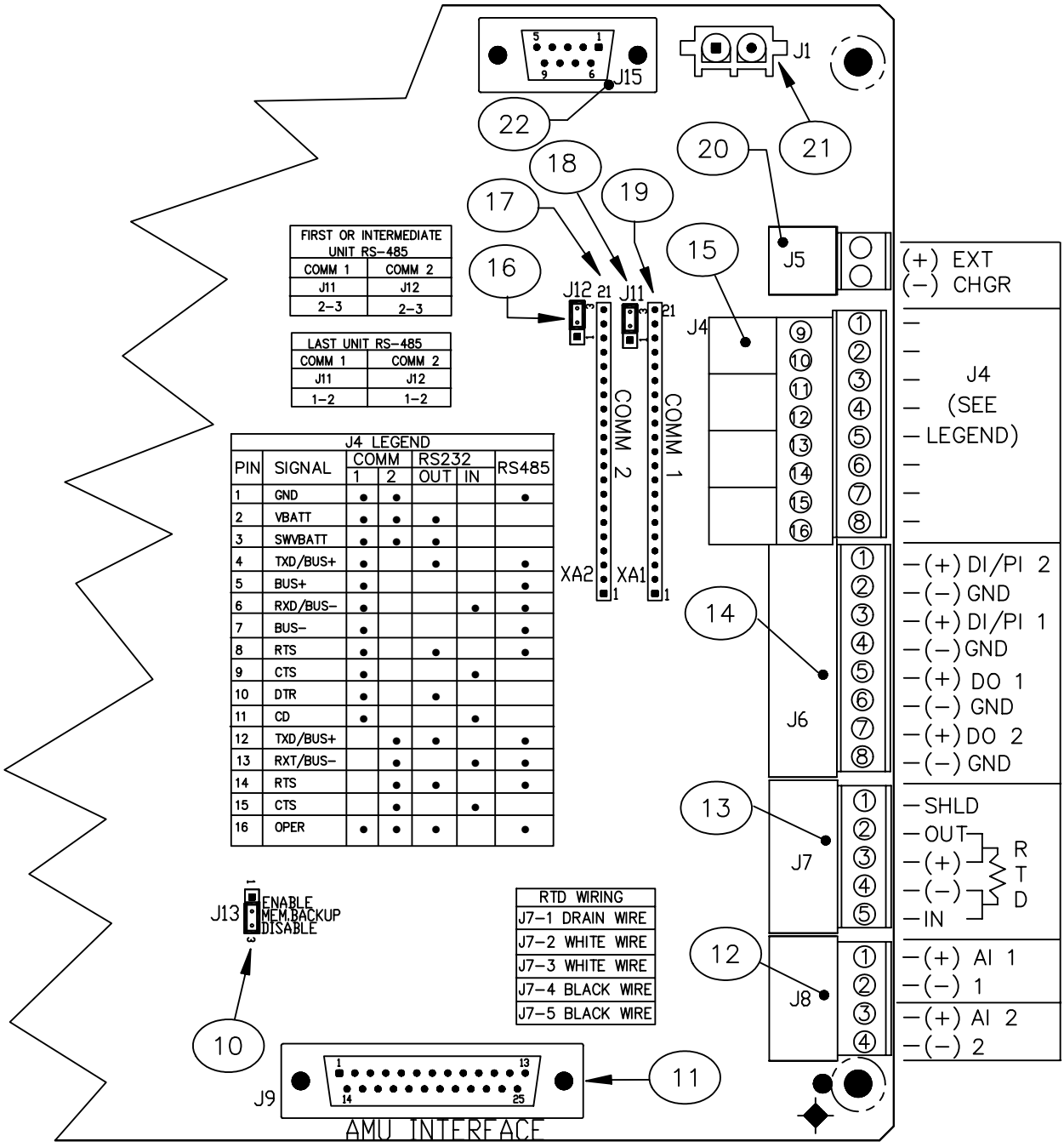

Figure 5–1 XFC-195 Board Cutout-Troubleshooting

Reset Procedures

The XFC 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.

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. A cold start should be used for new XFC 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.

Cold Start Procedures (Hardware)

In the following procedure, the common name for a component or it's 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.

Step	Procedure
1.	If an external charging source is connected, it must be disconnected. Slide external charger terminal block J5 (Figure 5–1, Item 20) from the XFC-195 Board.
2.	Disconnect battery pack connector from XFC-195 Board BAT CONN connector J1 (Figure 5–1, Item 21).
3.	Disable Memory Backup J13 (Figure 5–1, Item 10), by moving the pin jumper to pins 2 and 3.
4.	To return to service reconnect 12 Vdc battery pack connector to XFC-195 Board BAT CONN connector J1 (Figure 5–1, Item 21) and observe LCD .
5.	If removed, reconnect external charging source to EXT CHGR connector J5 (Figure 5–1, Item 20).
6.	Enter all necessary parameters or send a saved setup file and calibrate XFC. See chapter 3.0, XFC Startup.
7.	When XFC has been cold started, the 24 hour clock will be reset to 00:00:00.
8.	Enable Memory Backup J13 (Figure 5–1, Item 10), by moving the pin jumper to pins 1 and 2.

Cold Start Procedures (Software)

Step	Procedure
1.	Using PCCU, in the terminal mode, type this command exactly as shown: boot=COLD

Continued on Next Page

Reset Procedures, Continued

Warm Start

A warm start occurs when the charging source and main power is removed, then re-applied while memory backup is enabled. This does not clear the data stored in RAM. The warm start will only reset the XFC microprocessor and not disturb any data that has been stored in RAM. A warm start should be used when taking an XFC out service to perform maintenance or troubleshooting. A warm start can be used when a power or communication interruption caused the XFC microprocessor to lock-up.

Warm Start Procedures

In the following procedure, the common name for a component or it's 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.

Step	Procedure
1.	If an external charging source is connected, it must be disconnected. Slide external charger terminal block J5 (Figure 5–1, Item 20) from the XFC-195 Board.
2.	Enable Memory Backup J13 (Figure 5–1, Item 10), by moving the pin jumper to pins 1 and 2.
3.	Disconnect battery pack connector from XFC-195 Board BAT CONN connector J1 (Figure 5–1, Item 21). The XFC is now out of service.
4.	To place XFC in service, connect battery pack connector J1 (Figure 5–1, Item 21).
5.	Connect the EXT CHGR terminal block J5 (Figure 5–1, Item 20).

Visual Alarm Codes

After the XFC completes recording hourly flow and operational records the LCD will show any alarm conditions that have occurred. Also, the date, hour and type of alarm conditions are stored in the XFC memory. An alarm can be a word, character, letter or symbol. The entire list of Status and Alarm codes may be found in Chapter 1, Table 1–2. For the purpose of troubleshooting, only those codes considered to be as alarms are discussed here. A description of each XFC alarm code, is described in Table 5–2.

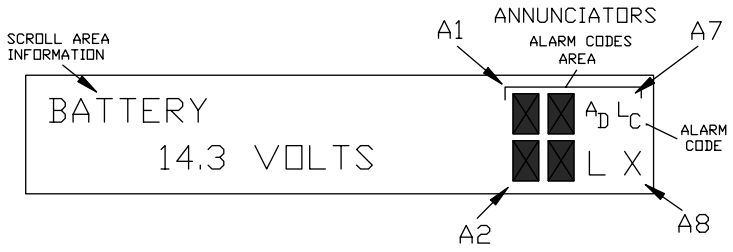

Figure 5–2 Liquid Crystal Display and Indicators

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Visual Alarm Codes, continued

Table 5–2 Visual Alarm Codes

Annunciator	Description
$^{L}_{L}$	*Low Lithium Battery Alarm*: When $^{L}_{L}$ (low lithium) is displayed, lithium battery voltage is below 2.5 Vdc. A new lithium battery measures approximately 3.6 Vdc.
$^{L}_{C}$	*Low Charger.* Displayed if XFC battery charging voltage is less than 0.4 Vdc above the battery voltage.
$^{A}_{D}$	*A to D Failure.* Displayed if A to D Converter Absolute Differential Pressure, Absolute Static Pressure or temperature readings exceed maximum counts or are less than minimum counts.

System Troubleshooting

System indicated alarm conditions and their probable cause, including SLEEP mode, and procedure(s) for correcting the problem, are presented below in Table 5–3.

Table 5–3 Troubleshooting

Indicator	Probable Cause	Procedure
In the following procedure, the common name for a component or it's 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.		
SLEEP	Battery Voltage Below 10.9 VDC	Make a local connection with the XFC. This wakes up the unit so that you may check all alarm conditions and determine the problem. 1. Check battery pack cable. It must make a good secure electrical connection with the main board BAT CONN connector J1(Figure 5–1, Item 21). 2. Check battery pack cable is securely connected to battery. 3. If battery pack cable is securely connected on both ends, check battery pack voltage. If voltage is low, replace with another battery pack.
L_C	Charging Source Below 0.4 Vdc Plus Battery Pack Voltage	Check battery pack charging source with PCCU Monitor Mode. This is for either Solar or externally connected charging sources.

Table Continued on Next Page

Table 5–3 Troubleshooting, Continued

Indicator	Probable Cause	Procedure
$^{L}_{C}$	Solar Power Charging Unit	In low sun light conditions, the display normally shows LC. 1. Check solar panel angle and direction. In northern hemisphere, panel should face due south and in southern hemisphere, due north. 2. Check solar panel for any physical damage or obstructions to sunlight. Sunlight obstruction prevents solar panel from receiving enough sunlight to charge installed battery pack. 3. Solar panel should be positioned so it receives the most sunlight. Do not place it in a shaded area. 4. Check solar panel wiring to be certain it is correctly connected to associated XFC-195 Board termination block J5 (Figure 5–1, Item 20). 5. Solar panel should be checked under load, using a diagnostic test kit. 6. If solar panel wiring is correct, sunlight is not obstructed and voltage does not increase above 0.4 VDC under bright sunlight, replace Solar Panel.
$^{L}_{C}$	AC Power Unit	1. Check AC charger wiring to XFC termination block connector J5 (Figure 5–1, Item 20). Be certain wiring is correct. 2. Check input AC voltage to external AC charging unit. Be certain primary AC voltage is correct. 3. If input primary AC voltage level is correct, wiring to XFC XFC-195 Board terminal is correct and there is no DC output from the charger, replace charger fuse. 4. If fuse is not faulty or there is no charger DC output voltage after replacing fuse, replace AC charging unit.
$^{A}_{D}$	A/D Converter is Over or Under Range	This alarm condition can be caused by differential pressure, static pressure or the temperature being out of measurement range. 1. Check SP, DP and temperature to determine which measurement channel is causing the alarm. In the PCCU Entry screen, enter the Monitor mode by clicking on the I/O subsystem.

Table Continued on Next Page

Table 5–3 Troubleshooting, Continued

Indicator	Probable Cause	Procedure
$^{A}_{D}$	Temperature Measurement Causing Alarm	A faulty RTD Probe, or loose wiring connection(s), can cause an AD alarm code. 1. Check RTD wiring on XFC-195 Board terminal connector J7 (Figure 5–1, Item 13). 2. To determine if problem is with the RTD Probe or main board, disconnect RTD wiring connector from main board connector J7 (Figure 5–1, Item 13) and perform either of the following two procedures: A) Substituting RTD Probe with Resistor: These procedures are performed on the main board. 1. Connect a 100-ohm resistor across connector J7 (Figure 5–1, Item 13) RTD OUT terminals 3 and 4. 2. Connect a jumper wire from J7 (Figure 5–1, Item 13) terminals 2 and 3. 3. Connect a jumper wire from J7 (Figure 5–1, Item 13) terminals 4 and 5. 4. The XFC LCD should read approximately 32°F with the 100 ohm resistor connected. 5. If temperature is approximately 32°F and AD error goes away, RTD probe is faulty and should be replaced. If temperature is not 32°F, XFC-195 Board or AMU is faulty and should be replaced. B) RTD Probe Resistive Impedance Check: 1. Immerse RTD Probe in ice bath. 2. Perform a continuity check between any two similar colored wires. Measured resistance should be 1-ohm or less. 3. Perform a continuity check between any two dissimilarity colored wires. Measured resistance should be approximately 100 ohms. 4. Perform a continuity between RTD shield and any other wire. Measured resistance should be in the megohm range.

Communications Troubleshooting

These troubleshooting procedures are applicable only to a XFC with an installed radio communication unit. The two basic types of radio communications that can be used between the XFC and a radio receiver, are:

RS-232 Communications: Communication is accomplished using an RS-232 Module, installed in the XFC-195 Board.

RS-485 Communications: Communication is accomplished using an RS-485 Module, installed in the XFC-195 Board.

Before removal or installation of either the above communication interface modules, it is important that you disconnect XFC external battery charger and main XFC battery pack cable connectors from XFC-195 Board. Refer to Figure 5–1.

Setting Up Communication

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

1. Verify RS-232 or RS485 Interface Modules, cables, associated XFC-195 Board MODULE RS-485 or RS-232 connector and radio are correctly installed.
2. Check XFC identifier (ID). Log the ID for future reference.
3. Log XFC access security code, baud rate, listen cycle, protocol and interface for future reference.

FYI

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

1. When communication equipment is powered on, XFC displays the → after it recognizes the XFC ID and is responding.
2. Check baud rate of XFC transmission and LISTEN time settings. The baud rate and time settings can be changed when PCCU is in ENTRY mode. Default settings are 1200 baud and listening time is 4 seconds and communications interface is turned off.

TIP

To check for wiring shorts or opens with two or more wire connections, use a multimeter set on continuity (resistance). Check two wires at a time from one device to another and back. If black and white wires are to be tested, disconnect both wires at both ends, set one probe on black, and the other on white. The meter should read OL or OFL (over range) if no shorts. Jumper the two wires at the other end. The meter should read allow resistance if no opens. This method requires only one end of the wiring to be tested, no matter how far the devices are apart.

Troubleshooting RS-232 Serial Communications

The following RS-232 Serial Communication troubleshooting procedures will assist the user in what may be the possible cause for indicated error message. Refer to Table 5–4.

FYI

Voltage may be difficult to see using a digital voltmeter. It can be seen using an oscilloscope.

Verify voltage by continuously polling XFC from CCU.

Table 5–4 Troubleshooting RS-232 Serial Communications

Error Condition	Check	Procedure
In the following procedure, the common name for a component or it's 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.		
Not Responding	Battery Voltage	Verify battery pack voltage is greater than 11.5 Vdc.
	ID Number /Security Code	Verify ID number and security code are correct.
	Wiring	Verify XFC-195 Board wiring to radio transceiver is correct.
	SWVBATT Supply Voltage	Using a digital voltmeter, measure transceiver SWVBATT DC supply voltage between the following XFC-195 Board J4 (Figure 5–1, Item 15) connector terminals. Voltage should be greater than 11.5 Vdc. J4–1 (GND [BLK]) and J4–3 (SWVBATT [WHT]) The SWVBATT voltage should pulse once every four (4) seconds for a time duration of approximately 350 milliseconds (Baud rate dependent 350 ms @ 1200 Baud). Voltage must be at least 11.5 Vdc.
	Receiving Data (RXD+) Voltage	Using an oscilloscope or digital voltmeter, connect it to XFC-195 Board J4 (Figure 5–1, Item 15) connector across the following terminals. J4–1 (GND [BLK]) and J4–6 (RXD+ [BRN]) When communication data is being transmitted from CCU to XFC, voltage should vary between +5 Vdc and -5 Vdc.
	Request To Send (RTS) Voltage	Using an oscilloscope or digital voltmeter, connect measuring device to XFC-195 Board J4 (Figure 5–1, Item 15) green connector across the following terminals. When XFC is sending communication data to CCU, voltage should be +5 Vdc. J4–1 (GND) and J4–8 (RTS) COM1 J4–1 (GND) and J4–14 (RTS) COM2

Table Continued on Next Page

Table 5–4 Troubleshooting RS-232 Serial Communications, Continued

Error Condition	Check	Procedure
Not Responding, Continued	Transmitting Data (TXD+) Voltage	Using an oscilloscope or digital voltmeter, connect measuring device to XFC-195 Board J4 (Figure 5–1, Item 15) green connector across the following terminals. When communication data is being transmitted from the XFC, voltage should vary between +5 Vdc and -5 Vdc. J4–1 (GND) and J4–4 (TXD+) COM 1 J4–1 (GND) and J4–12 (TXD+) COM2
	Problem(s) Still Exists	1. Using two (2) hand-held transceivers, check communication path between Master and Remote sites. If available, voice activated interface can be used. 3. Using a wattmeter, check transceiver output power. Refer to manufacturer's documentation for measuring instructions. 4. Verify that transceiver is on correct frequency. Refer to manufacturer's documentation for checking frequency instructions. 5. Verify orientation of antenna if directional.

Troubleshooting RS-485 Communications

The following RS-485 Communications troubleshooting procedures will assist the user in what may be the possible cause for indicated error message. Refer to Table 5–5. In the following procedure, the common name for a component or it's jumper number if available (abbreviated J) or part is followed by a number in parentheses. Refer to Figure 5–1 for location of XFC-195 Board connections.

FYI 

Voltage may be difficult to see using a digital voltmeter. It can be seen using an oscilloscope.

Verify voltage by continuously polling XFC from CCU.

Table 5–5 Troubleshooting RS-485 Communications

Error Condition	Check	Procedure
In the following procedure, the common name for a component or it's 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.		
Not Responding	Battery Voltage	Verify battery pack voltage is at least 11.5 Vdc.
	Board to Radio TXD+ Wiring	Verify wiring from UCI Board to Radio Transceiver Assembly is correct. Verify UCI Board jumper settings are correct.
	Board to UCI Wiring	Verify that XFC-195 Board wiring, to optional UCI (Universal Communications Interface) Board or Radio Modem Assembly, is correct.
	ID Number /Security Code	Verify that ID number and security code are correct.
	Modem to Radio TXD+ Wiring	Verify wiring from Radio Modem Assembly to Radio Transceiver Assembly is correct.

FYI 

Power to transceiver can be provided from an external power supply. This allows XFC to switch external power to transceiver. Switching is accomplished using a 12VDC switch line connected to J4–3 (WHT). Refer to Measuring SWVBATT Transceiver Supply Switch Voltage. If this option is used, J4–2 (V-BATT) is not used.

	V-BATT Supply Voltage	Using a digital voltmeter, measure transceiver V-BATT power supply voltage between the following XFC-195 Board J4 (Figure 5–1, Item 15) connector terminals. Switched voltage should be greater than 11.5 Vdc. J4–1 (GND [BLK]) and J4–2 (V-BATT)
	Line Driver voltage	Using an oscilloscope or digital voltmeter, connect it to XFC-195 Board J4 (Figure 5–1, Item 15) connector between the following terminals. Voltage should vary between +5 Vdc and 0 Vdc when communication data is being transmitted from CCU to XFC. J4–4 (BUS+) and J4–6 (BUS-) COM1 J4–12 (BUS+) and J4–13 (BUS-) COM2

Table Continued on Next Page

Table 5–5 Troubleshooting RS-485 Communications, Continued

Error Condition	Check	Procedure
Not Responding, Continued	Request to Send (RTS) Voltage	Using an oscilloscope or digital voltmeter, connect it to XFC-195 Board J4 (Figure 5–1, Item 15) connector between the following terminals. Voltage should be +5 Vdc when sending data to CCU. 0V when not transmitting. J4–1 (GRD) and J4–8 (RTS) COM1 J4–1 (GRD) and J4–14 (RTS) COM2 When RTS is high, transmitter must be keyed and transmitting data.
	Problem(s) Still Exist	2. Using two hand-held transceivers, check communication path between Master and Remote sites. If available, voice activated interface can be used. 6. Using a wattmeter, check transceiver output power. Refer to wattmeter manufacturers documentation for operating instructions. 7. Verify that transceiver is on correct frequency. Refer to transceiver manufacturer's documentation for procedures to check frequency. 8. Verify transceiver settings.

Chapter 6
Totalflow® Definitions and Acronyms

TERM	DEFINITION
μ	Greek letter for “mu”. Often used in math and engineering as the symbol for “micro”. Pronounced as a long u.
μ FLO	Totalflow’s Micro Flow Computer is a low power, microprocessor based units designed to meet a wide range of measurement, monitor and alarming applications for remote gas systems, while being a cost effective alternative.
μ FLO IMV	μFLO’s measurement and operational features are housed in this single unit assembly. The main electronic board (μFLO-195 Board), communication connection, power, SP, DP and Temperature readings are all housed in this unit.
μ FLO-2100767 Board	Main Electronic Board used in the µFLO Computers. It is housed on the IMV and operates at 195 MHz while drawing minimal power.
μ Sec	Micro Second.
*.CSV file	See Comma Separated Values.
*.INI file	See Initialization File.
A/D	Analog-to-digital.
ABB Inc.	Asea, Brown & Boveri, parent company of Totalflow
Absolute Pressure	Gauge pressure plus barometric pressure. Absolute pressure is used by most Totalflow devices for flow calculations.
Absolute Zero	The zero point on the absolute temperature scale. It is equal to -273.16 degrees C, or 0 degrees K (Kelvin), or -459.69 degrees F, or 0 degrees R (Rankine).
AC	See Alternating Current.
ACK	See Acknowledgment
Acknowledgment	This refers to a response over a remote communication device to a request such as a PING. Basically, saying, "I'm here, and I saw your request!"
ACM	See Analyzer Control Module.
Active Analog Output	Analog Output to a host providing power to the host.
Active Mode	An operational mode used by the LevelMaster for measuring dual float levels by applying a signal to the primary windings, reading the voltage level on the secondary windings and using an algorithm to determine the oil and water levels.
ADC	See Analog-to-Digital Converter.
Address	A unique memory designation for location of data or the identity of a peripheral device; allows each device on a single communications line to respond to its own message.
Aerial	A length of wire designed to transmit or receive radio waves. (See also Antenna)
Aerosol Liquids	Minute liquid paraticles suspended in gas. Aerosols will behave like a fluid and can be transported by pipes and pumping. When aerosols contact each other they coalesce into droplets. Aerosols may be present in gas, or may be generated by glow shearing off the skim inside of a pipeline.
AGA	American Gas Association. Trade group representing natural gas distributors and pipelines.
AGA-3	American Gas Association Report No. 3, method of calculating gas volume across an Orifice Plate.
AGA-5	American Gas Association Report No. 5, methods (Volume, Mass or Energy) for calculating BTUs without knowing the composition of the gas.

TERM	DEFINITION
AGA-7	American Gas Association Report No. 7, method of calculating gas volume using a Pulse Meter.
AGA-8	American Gas Association Report No. 8, method of calculating the Super Compressibility Factor, Fpv.
AGC	Automatic Gain Control
AH	See Ampere-Hour.
AI	Analog Input
Alkane	The simplest homologous series of saturated aliphatic hydrocarbons, consisting of methane, ethane, propane, butane; also know as olefins.
Alternating Current	An electric current whose direction changes with a frequency independent of circuit components.
Aluminum Powder Coating	Totalflow aluminum enclosures have a baked-on Powder Coating designed to our specifications to ensure paint adhesion, weather resistance and durability.
Amp	See Ampere.
Ampere	The unit of electrical current. Also milliamp (one thousandth of an amp) and microamp (one millionth of an amp). One amp corresponds to the flow of about 6 x 10^{18} electrons per second.
Ampere-Hour	The quantity of electricity measured in ampere-hours (Ah) which may be delivered by a cell or battery under specified conditions. A current of one ampere flowing for one hour.
Ampere-Hour Efficiency	The ratio of the output of a secondary cell or battery, measured in ampere-hours, to the input required to restore the initial state of charge, under specified conditions.
Amplitude	The highest value reached by voltage, current or power during a complete cycle.
Amplitude Modulation	Where audio signals increase and decrease the amplitude of the "carrier wave".
AMU	See Analog Measurement Unit.
AMU/IMV	Generic reference to the Measurement unit. See (Integral) Multivariable Transducer for more definition.
Analog	A system in which data is represented as a continuously varying voltage/current.
Analog Input	Data received as varying voltage/current.
Analog Measurement Unit	A device for converting energy from one form to another. (e.g. Static and Differential pressure to electrical signals)
Analog Output	Data is transmitted as varying voltage/current.
Analog Trigger	A trigger that occurs at a user-selected point on an incoming analog signal. Triggering can be set to occur at a specific level on either an increasing or a decreasing signal (positive or negative slope).
Analog-to-Digital Converter	An electronic device, often an integrated circuit, that converts an analog voltage to a number.
Analyzer Control Module	Consists of various electronic components used for analysis.
Annunciator	Display of a status on a screen.
ANSI	American National Standards Institute.
Antenna	A length of wire or similar that radiates (such as a transmitting antenna) or absorbs (such as a radio antenna) radio waves. The two basic types are: Yagi (directional) or Omni (bi-directional).
AO	Analog Output
AP	See Absolute Pressure.
API 14.3	American Petroleum Institute Report No. 14.3 addresses the 1992 equation regarding the AGA-3 method for calculating gas volume across an Orifice Plate.

TERM	DEFINITION
API 21.1	American Petroleum Institute Report No. 21.1 addresses the equation regarding AGA-8 Fpv or Supercompressibility Factor and the energy content of the gas.
Archive	A file containing historical records in a compressed format for more efficient long term storage and transfer. Totalflow archive records are non-editable, meaning that when they are stored they may not be changed. These records are used during an audit of data.
ASCII	American Standard Code for Information Interchange. A very popular standard method of encoding alphanumeric characters into 7 or 8 binary bits.
Asynchronous	A communications protocol where information can be transmitted at an arbitrary, unsynchronized point in time, without synchronization to a reference time or "clock".
ATEX	Certification Directive for Explosive Atmospheres.
Atmospheric Pressure	The pressure due to the weight of the atmosphere (air and water vapor) on the earth's surface. The average atmospheric pressure at sea level (for scientific purposes) has been defined at 14.696 pounds per square inch absolute.
Audio Frequency	Generally in the range 20 Hz to 20 KHz.
Audit	To examine or verify data for accuracy. Totalflow's DB1 and DB2 records may be edited to generate a more accurate representation of data information.
Audit Trail	Using the Long Term Archive files to justify changes made to records that more accurately reflects the correct data. Peripheral information used to edit data is recorded without exception, to justify the accuracy of the edited data records.
Automatic Frequency Control	Similar to Automatic Fine Tune (AFT). A circuit that keeps a receiver in tune with the wanted transmission.
Back Pressure	Pressure against which a fluid is flowing. May be composed of friction in pipes, restrictions in pipes, valves, pressure in vessels to which fluid is flowing, hydrostatic head, or other resistance to fluid flow.
Backflush	
Background Acquisition	Data is acquired by a DAQ system while another program or processing routine is running without apparent interruption.
Bandwidth	The range of frequencies available for signaling; the difference between the highest and lowest frequencies of a band expressed in Hertz.
Barometer	An instrument which measures atmospheric pressure.
Barrel	The unit of volume measurement used for petroleum and it's products; 1 barrel = 42 US gallons.
Base Pressure	The pressure used as a standard in determining gas volume. Volumes are measured at operating pressures and then corrected to base pressure volume. Base pressure is normally defined in any gas measurement contract. The standard value for natural gas in the United States is 14.73 psia, established by the American National Standards Institute as standard Z-132.1 in 1969.
Battery	Two or more electrochemical cells electrically interconnected in an appropriate series/parallel arrangement to provide the required operating voltage and current levels.
Baud	Unit of signaling speed. The speed in baud is the number of discrete conditions or events per second. If each event represents only one bit condition, baud rate equals bits per second (bps).
Baud Rate	Serial communications data transmission rate expressed in bits per second (b/s).
Bias	Term used when calibrating. Amounts to offset the actual measurement taken. On a LevelMaster, it refers to adjusting the measurement of the float level to agree with a calibrated measurement. On an RTD (Resistant Thermal Detector), it refers to adjusting the measurement of the temperature to agree with a calibrated temperature. This figure maybe either a positive or negative figure.

TERM	DEFINITION
BIAS Current	A very low-level DC current generated by the panel meter and superimposed on the signal. This current may introduce a measurable offset across a very high source impedance.
Binary Number	System based on the number 2. The binary digits are 0 and 1.
Binary-Coded Decimal	A code for representing decimal digits in a binary format.
BIOS	Basic Input/Output System. A program, usually stored in ROM, which provides the fundamental services required for the operation of the computer. These services range from peripheral control to updating the time of day.
Bipolar	A signal range that includes both positive and negative values.
Bipolar Transistor	The most common form of transistor.
Bit	Binary Digit - the smallest unit of binary data. One binary digit, either 0 or 1. See also byte.
Bits Per Second	Unit of data transmission rate.
Blue Dot Technology	Technological changes to the DC and ACM Modules, decreasing noise by changing ground. Allows amplification of the results, gains resolution.
Board	Common name used to identify the Main Electronic Board. Also called Motherboard, Engine Card and Circuit Board.
Bottom Solids and Water	Refers to materials that settle to the bottom of an oil tank, including the heavy water.
Bounce	Bouncing is the tendency of any two metal contacts in an electronic device to generate multiple signals as the contacts close or open. When you press a key on your computer keyboard, you expect a single contact to be recorded by your computer. In fact, however, there is an initial contact, a slight bounce or lightening up of the contact, then another contact as the bounce ends, yet another bounce back, and so forth. A similar effect takes place when a switch made using a metal contact is opened.
BPS	See Bits Per Second.
Bridge	Generally a short-circuit on a PC board caused by solder joining two adjacent tracks.
British Thermal Unit	Energy required to raise one pound of water one degree Fahrenheit. One pound of water at 32 F° requires the transfer of 144 BTUs to freeze into solid ice.
Browser	Software which formats Web pages for viewing; the Web client
BS&W	See Bottom Solids (or sediment) and Water.
BTU	See British Thermal Unit.
Btu Method	A method of allocating costs between different operations or between different products based upon the heat content of products produced in the various operations or of the various produced products.
Btu per Cubic Foot	A measure of the heat available or released when one cubic foot of gas is burned.
Btu, Dry	Heating value contained in cubic foot of natural gas measured and calculated free of moisture content. Contractually, dry may be defined as less than or equal to seven pounds of water per Mcf.
Btu, Saturated	The number of Btu's contained in a cubic foot of natural gas fully saturated with water under actual delivery pressure, temperature and gravity conditions. See BTU, DRY.
Btu/CV	Used to express the heating content of gas. See British Thermal Units or Calorific Value.
BtuMMI	Refers to the interface program or software that operates the Btu Analyzer.

TERM	DEFINITION
Buffer	(1) A temporary storage device used to compensate for a difference in data rate and data flow between two devices (typically a computer and a printer); also called a spooler; (2) An amplifier to increase the drive capability, current or distance, of an analog or digital signal.
BUS	A data path shared by many devices (e.g., multipoint line) with one or more conductors for transmitting signals, data, or power.
Bus Master	A type of controller with the ability to read and write to devices on the computer bus.
Busbar	A heavy, rigid conductor used for high voltage feeders.
Butane (C4H10)	A saturated hydrocarbon (alkane) with four carbon atoms in it's molecule (C_4H_{10}). A gas at atmospheric pressure and normal temperature, but easily liquefied by pressure. Generally stored and delivered in liquefied form and used as a fuel in gaseous form, obtained by processing natural gas as produced and also from a process in petroleum refining. Contains approximately 3,260 Btu per cubic foot.
Byte	A group of binary digits that combine to make a word. Generally 8 bits. Half byte is called a nibble. Large computers use 16 bits and 32 bits. Also used to denote the amount of memory required to store one byte of data.
Cache Memory	Fast memory used to improve the performance of a CPU. Instructions that will soon be executed are placed in cache memory shortly before they are needed. This process speeds up the operation of the CPU.
Calibrate	To ascertain, usually by comparison with a standard, the locations at which scale or chart graduations should be placed to correspond to a series of values of the quantity which the instrument is to measure, receive or transmit. Also, to adjust the output of a device, to bring it to a desired value, within a specified tolerance for a particular value of the input. Also, to ascertain the error in the output of a device by checking it against a standard.
Capacitor	An electronic component that stores electrical charge.
Capacity	The total number of ampere-hours (or watt-hours) that can be withdrawn from a cell/battery under specified conditions of discharge.
Carbon	Base of all hydrocarbons and is capable of combining with hydrogen in many proportions, resulting in numberless hydrocarbon compounds.
Carbon Dioxide	Colorless, odorless and slightly acid-tasting gas, consisting of one atom of carbon joined to two atoms of oxygen. C02. Produced by combustion or oxidation of materials containing carbon.
Carrier Gas	
Catalytic	The process of altering, accelerating or instigating a chemical reaction.
Cathode	An electrode through which current leaves any nonmetallic conductor. An electrolytic cathode is an electrode at which positive ions are discharged, or negative ions are formed, or at which other reducing reactions occur. The negative electrode of a galvanic cell; of an electrolytic capacitor.
C-Code	C language (IEC supported programming language)
CCU	See Dos CCU, WINCCU or PCCU.
CCV	See Closed Circuit Voltage.
Cd	Coefficient of Discharge factor.
CE	European Community Certification Bureau.
Cell	The basic electrochemical unit used to generate or store electrical energy.
Cenelec	European Committee for Electro-technical Standardization. Also known as the European Standards Organization.
Central Processing Unit	The central part of a computer system that performs operations on data. In a personal computer the CPU is typically a single microprocessor integrated circuit.

TERM	DEFINITION
Certification	The process of submitting equipment to specific tests to determine that the equipment meets the specifications or safety standards.
CFG	Configuration File. When saving new configuration files, the file is saved as a *.cfg file.
Characteristics	Detailed information pertaining to it's description. The XFC stores this information in the PROM chip. A feature or quality that makes somebody or something recognizable.
Charge	The conversion of electrical energy, provided in the form of a current from an external source, into chemical energy within a cell or battery.
Chip	Another name for integrated circuit or the piece of silicon on which semiconductors are created.
Chromatograph	An instrument used in chemical analysis, to determine the make-up of various substances, and often used to determine the Btu content of natural gas. Chromatography- A method of separating gas compounds by allowing it to seep through an adsorbent so that each compound is adsorbed in a separate layer.
CIM	Communication Interface Module. Totalflow's version is called TFIO Communication Interface Module.
Circuit	1. The complete path between two terminals over which one-way or two-way communications may be provided. 2. An electronic path between two or more points, capable of providing a number of channels. 3. A number of conductors connected together for the purpose of carrying an electrical current. 4. An electronic closed-loop path among two or more points used for signal transfer. 5. A number of electrical components, such as resistors, inductances, capacitors, transistors, and power sources connected together in one or more closed loops.
Circuit board	Sometimes abbreviated PCB. Printed circuit boards are also called cards. A thin plate on which chips and other electronic components are placed. They fall into the following categories: Motherboard: Typically, the mother board contains the CPU, memory and basic controllers for the system. Sometimes call the system board or main board. Expansion board: Any board that plugs into one of the computer's expansion slots, including controller boards, LAN cards, and video adapters. Daughter Card: Any board that attaches directly to another board. Controller board: A special type of expansion board that contains a controller for a peripheral device. Network Interface Card (NIC): An expansion board that enables a PC to be connected to a local-area network (LAN). Video Adapter: An expansion board that contains a controller for a graphics monitor.
Class 1, Division 1	Class 1 refers to the presence of hazardous gas. Division 1 refers to the conditions at the location: meaning that there is not sufficient airflow around the equipment to dissipate any gases that are accumulating in the vicinity. i.e. An enclosed space.
Class 1, Division 2	Class 1 refers to the presence of hazardous gas. Division 2 refers to the conditions at the location: meaning that there is sufficient airflow around the equipment to dissipate any gases that are accumulating in the vicinity.
Clock	The source(s) of timing signals for sequencing electronic events (e.g. synchronous data transfer).
Closed Circuit Voltage	The difference in potential between the terminals of a cell/battery when it is discharging (on- load condition).
CMOS	See Complimentary Metal-Oxide-Semiconductor.
CNG	See Compressed Natural Gas
Coil	A conductor wound in a series of turns.

TERM	DEFINITION
Cold Start	A rebooting technique which will clear all operational errors, loose all data files, but will not damage configuration files if stored on the SDRIVE.
Collector	The semiconductor region in a bipolar junction transistor through which a flow of charge carriers leaves the base region.
Comma Separated Values	These file types are importable records used by spreadsheet programs to display and manipulate data.
Communication Port	Comm. Port (abbreviation) refers to the host computer's physical communication's port being used to communicate with the equipment. Used by Totalflow when discussing local or remote communication with various equipment including the XFC, FCU, XRC, RTU and LevelMaster etc.
Complimentary Metal-Oxide-Semiconductor	Family of logic devices that uses p-type and n-type channel devices on the same integrated circuit. It has the advantage of offering medium speed and very low power requirements.
Component	(1) A small object or program that performs a specific function and is designed in such a way to easily operate with other components and applications. Increasingly, the term is being used interchangeably with applet. (2) A part of a device.
Compressed Natural Gas	Natural gas in high-pressure surface containers that is highly compressed (though not to the point of liquefaction). CNG is used extensively as a transportation fuel for automobiles, trucks and buses in some parts of the world. Small amounts of natural gas are also transported overland in high-pressure containers.
Compressibility	The property of a material which permits it to decrease in volume when subjected to an increase in pressure. In gas-measurement usage, the compressibility factor "Z" is the deviation from the ideal Boyle and Charles' law behavior. See SUPERCOMPRESSIBILITY FACTOR.
Compressibility Factor	See Supercompressibility Factor.
Concurrent	Performing more than one task at a time.
Configuration No.	The Configuration number is a 10 digit suffix of the serial number which defines the characteristics of the unit.
Console Mode	A local user interface typically used with custom applications that are not supported through any other mechanism. Also referred to as Printer Console Mode.
Contact	Current carrying part of a switch, relay or connector.
Conversion Time	The time required, in an analog input or output system, from the moment a channel is interrogated (such as with a read instruction) to the moment that accurate data is available. This could include switching time, settling time, acquisition time, A/D conversion time, etc.
Coprocessor	Another computer processor unit that operates in conjunction with the standard CPU. Can be used to enhance execution speed. For example, the 8087 is designed to perform floating point arithmetic.
Cosine	The sine of the complement of an arc or angle.
CPU	See Central Processing Unit.
CPUC	California Public Utilities Commission
CRC	See Cyclic Redundancy Check.
CRC	Cycling Redundancy Character
CSA	Canadian Standards Association. Canadian certification agency.
CTS	Communication abbreviation for Clear To Send.
Cubic Foot	The most common unit of measurement of gas volume in the US. It is the amount of gas required to fill a volume of one cubic foot under stated conditions of temperature, pressure, and water vapor.
Cubic Foot Metered	The quantity of gas that occupies one cubic foot under pressure and temperature conditions in the meter.

TERM	DEFINITION
Cubic Foot, Standard	That quantity of gas which under a pressure of 14.73 psia and at a temperature of 60 degrees occupies a volume of one cubic foot without adjustment for water vapor content.
Cumulative Capacity	The total number of ampere-hours (or watt hours) that can be withdrawn from a cell/battery under specified conditions of discharge over a predetermined number of cycles or the cycle life.
Current	Current is measured in amps (milliamps and microamps). It is the passage of electrons. Conventional current flows from positive to negative. Electrons flow from negative to positive - called "electron flow".
Cursor	Dots used to indicate the location of the next character or symbol to be entered.
Custody Transfer	The legal and commercial transfer of a commodity such as natural gas, LNG, etc. from one party to another.
Custody Transfer Transaction	The Custody Transfer Transaction is the hand-off of the physical commodity from one operator to another.
Cut-Off Voltage	The cell/battery voltage at which the discharge is terminated.
CV	Calorific Value. European value of heating content.
Cycle	One complete sequence of events. One complete alteration of an AC current or Volt. The discharge and subsequent charge of a rechargeable cell/battery is called a cycle.
Cycle Life	The number of cycles under specified conditions which were available from a rechargeable cell/battery before it fails to meet specified criteria as to performance.
Cyclic Redundancy Check	An ongoing verification of the validity of transmitted and received data providing assurance that the message conforms to a pre-agreed upon convention of communications.
D/A	See Digital-to-analog.
D/I	See Digital Input.
D/O	See Digital Output.
DAC	See Digital to Analog Converter.
Data Acquisition	Gathering information from sources such as sensors and AMUs in an accurate, timely and organized manner. Modern systems convert this information to digital data, which can be stored and processed by a computer.
Data Collect	Physically, locally or remotely, retrieving data stored with a Totalflow unit. This data is typically stored in records located in a data base format.
DB1	Acronym for Data Base 1. This refers to the previous data base structure used to store data in Totalflow products.
DB2	Acronym for Data Base 2. This refers to the current data base structure used to store data in Totalflow products.
DC	See Direct Current
DCD	Communication abbreviation for Data Carrier Detect
DCS/PLC	Distribution Control System/Programmable Logic Controller
DDE	See Digital Data Exchange. Also called Dynamic Data Exchange. May refer to Totalflow's DDE Server TDS32.
Dead Weight Tester	Portable pressure tester used to check calibration and to calibrate AMU's utilizing a system of calibrated weights.

TERM	DEFINITION
De-bounce	De-bouncing is any kind of hardware device or software that ensures that only a single signal will be acted upon for a single opening or closing of a contact. When you press a key on your computer keyboard, you expect a single contact to be recorded by your computer. In fact, however, there is an initial contact, a slight bounce or lightening up of the contact, then another contact as the bounce ends, yet another bounce back, and so forth. A similar effect takes place when a switch made using a metal contact is opened. The usual solution is a de-bouncing device or software that ensures that only one digital signal can be registered within the space of a given time (usually milliseconds)
Decibel	A logarithmic measure of the ratio of two signal levels. A practical unit of gain.
Decimal	A numbering system based on 10.
Default	A value assigned or an action taken automatically unless another is specified.
Delivery Point	Point at which gas leaves a transporter's system completing a sale or transportation service transaction between the pipeline company and a sale or transportation service customer.
Demand Day	That 24-hour period specified by a supplier-user contract for purposes of determining the purchaser's daily quantity of gas used (e.g., 8 AM to 8 AM, etc.). This term is primarily used in pipeline-distribution company agreements. It is similar to, and usually coincides with, the distribution company "Contract Day".
Demand Load	The rate of flow of gas required by a consumer or a group of consumers, often an average over a specified short time interval (cf/hr or Mcf/hr). Demand is the cause; load is the effect.
Demand Meters	A device which indicates or records the instantaneous, maximum or integrated (over a specified period) demand.
Demand, Average	The demand on a system or any of its parts over an interval of time, determined by dividing the total volume in therms by the number of units of time in the interval.
Desaturization	Doesn’t cause the composition of the gas to change, enabling a more representative sample of gas.
Detector Bead	
DG	Display Group. When display group files are created
Diaphragm	A bellows inside a displacement type gas meter. Also, a membrane separating two different pressure areas within a control valve or regulator.
Differential Pressure	The pressure difference between two points in a system. For example, the difference in pressure between the upstream and downstream taps of an orifice plate, used to measure volume passing through the orifice.
Digital	A signal which has distinct states, either on or off (0 or 1). Digital computers process data as binary information having either true of false states.
Digital Data	Information transmitted in a coded form (from a computer), represented by discrete signal elements.
Digital Data Exchange or Dynamic Data Exchange	A Microsoft data exchange format generally used to transfer data from one program to another. It is a very simple format to use and Totalflow customers often use TDS to acquire data from Totalflow devices and then transfer the data to an Excel spreadsheet using DDE. The Totalflow Driver, TDS32, supports DDE and its network version, NetDDE.
Digital Electronics	The branch of electronics dealing with information in binary form.
Digital Input	Refers to the signal received in binary format.
Digital Output	Refers to the signal emitted in binary format.
Digital to Analog Conversion	The process of translating discrete data into a continuously varying signal. Common uses are to present the output of a digital computer as a graphic display or as a test stimulus.

TERM	DEFINITION
Digital-to-Analog Converter	An electronic device, often an integrated circuit, that converts a digital number into a corresponding analog voltage or current.
DIN	Deutsches Institut für Normung. German Institute for Standardization.
DIN Rail	Rail on which modules are mounted. Allows modules to snap on and slide right and left.
Diode	A semiconductor that allows current to flow in one direction only.
DIP Switches	A bank of switches typically used in setting the hardware configuration and base address of an option card.
Direct Current	A current that does not change in direction.
Direct Memory Access	A method by which information can be transferred from the computer memory to a device on the bus without using the processor.
Discharge	The conversion of chemical energy of a cell/battery into electrical energy and withdrawal of the electrical energy into a load.
Discharge Rate	The rate, usually expressed in amperes, at which electrical current is taken from the cell/battery.
Discrete Manifold	Also called Tubing Manifold. Used in instances when the XFC is not mounted directly on the Orifice, usually pipe mount or wall mount.
Distribution	The act or process of distributing gas from the city gas or plant that portion of utility plant used for the purpose of delivering gas from the city gate or plant to the consumers, or to expenses relating to the operating and maintenance of distribution plant.
Distribution Company	Gas Company which obtains the major portion of its gas operating revenues from the operation of a retail gas distribution system, and which operates no transmission system other than incidental connections within its own system or to the system of another company. For purposes of A.G.A. statistics, a distribution company obtains at least 90 percent of its gas operating revenues from sales to ultimate customers, and classifies at least 90 percent of mains (other than service pipe) as distribution. Compare INTEGRATED COMPANY; TRANSMISSION COMPANY, GAS.
DN	Inside diameter standard.
DOS	Disk Operating System.
DOS CCU	Refers to the DOS version of the Calibration and Collection Unit. Also known as FS/2, hand held or Dog Bone.
DOT Matrix	A group of dots/pixels forming a character or symbol, usually five dots across and seven dots down.
DOT/Pixel	An active element that forms a character or symbol when combined in a matrix.
Download	This refers to a Totalflow procedure in which any file(s) located on a laptop PC or storage device, may be copied to the on-board memory of a Totalflow Host device for purposes of restoring, configuration or repair.
Downstream	Any point in the direction of flow of a liquid or gas from the reference point. Compare UPSTREAM.
Downstream Pipeline	The pipeline receiving natural gas at a pipeline inter-connect point.
DP	See Differential Pressure.
DRAM	See Dynamic Random Access memory.
Driver (Hardware)	An electronic circuit that provides input to another electronic circuit.
Driver (Software)	A program that exercises a system or system component by simulating the activity of a higher level component.
Drivers	Software that controls a specific hardware device, such as interface boards, PLCs, RTUs, and other I/O devices.

TERM	DEFINITION
Droplet Liquids	Large liquid particles
Dry Contact	Contacts which neither break nor make a circuit. 0 Ohms.
DSP	Digital Signal Processor.
Dual-Access Memory	Memory that can be sequentially accessed by more than one controller or processor but not simultaneously accessed. Also known as shared memory.
Duplex	The ability to both send and receive data simultaneously over the same communications line.
DVI	The Port Manager and communication engine of the iVision SCADA System. This software can multiplex among several communication formats and thus supporting several vendor's equipment over a single radio frequency. It "pushes" new data to the iVision database, saving time and network resources by not transmitting redundant data. The DVI includes the Totalflow WinCPC code and thus supports all Totalflow software and functions – including WinCCU, TDS, PCCU, Report by exception, cryout, etc.
Dynamic Random Access memory	This is the most common form of computer memory It needs to be continually refreshed in order to properly hold data, thus the term "dynamic."
E^2Prom	See Electrically Erasable Programmable Read-Only Memory. Also called EEPROM.
Earth	Can mean a connection to the earth itself or the negative lead to the chassis or any point to zero voltage.
EC	European Community.
Edit	Making changes to information, data or configuration files.
EEPROM	See Electrically Erasable Programmable Read-Only Memory.
EFI	Electromechanical Frequency Interface.
EFM	See Electronic Flow Measurment.
EFR	Enhance Feature Release.
Electrically Erasable Programmable Read-Only Memory	ROM that can be erased with an electrical signal and reprogrammed. Also referred to as the S Drive. It is a persistent drive that will not loose it's memory unless manually reprogrammed. Also called E^2Prom. Totalflow's XFC and XRC have a Serial EEPROM on board, which generally holds registry, application configuration and warranty information (non-volatile).
Electrode	The site, area, or location at which electrochemical processes take place.
Electromagnetic Compatibility	IEEE Standards for Electromagnetic Compatibility.
Electromagnetic Interference	Any electromagnetic disturbance that interrupts, obstructs, or otherwise degrades or limits the effective performance of electronics/electrical equipment. It can be induced intentionally, as in some forms of electronic warfare, or unintentionally, as a result of spurious emissions and responses, intermodulation products, and the like.
Electronic Flow Measurment	Historically, flow measurment was tracked using a chart recording technology. Developments in the field of electronics allowed for electronic measurement devices to overtake the chart recording market. This field continues to develop into peripheral markets, making the "Flow Meter" a valuable asset with multi-tasking "Control" capabilities. Totalflow's answer to this developing market is the XSeries equipment.
EMC	See Electromagnetic Compatibility
EMI	See Electromagnetic Interference.
Emitter	One terminal of a transistor.
EN	Euro Norm (European Standard)
Enagas	Spain's Certification Board

TERM	DEFINITION
Encoder	A device that converts linear or rotary displacement into digital or pulse signals. The most popular type of encoder is the optical encoder, which uses a rotating disk with alternating opaque areas, a light source, and a photodetector.
Environmental Conditions	All conditions in which a transducer may be exposed during shipping, storage, handling, and operation.
EPROM	See Erasable Programmable Read-Only Memory.
Erasable Programmable Read-Only Memory	ROM that can be erased using Ultraviolet Light. The EPROM maybe re-programmed by removing the EPROM from the circuit and using special equipment to write to it.
Ethane (C2H6)	A colorless hydrocarbon gas of slight odor having a gross heating value of 1,773 Btu per cubic foot and a specific gravity of 1.0488. It is a normal constituent of natural gas.
Ethylene (C2H4)	A colorless hydrocarbon gas of slight odor having a gross heating value of 1,604 Btu per cubic foot and a specific gravity of 0.9740. It is usually present in manufactured gas, constituting one of its elements.
EU	European Union. Formerly known as the European Community (EC). Members of this union are replacing individual national regulations of member countries with a series of Directives. These Directives are legislative instruments which oblige member states to introduce them into their existing laws. These directives harmonize a variety of existing practices, preserve the different legal traditions and settle constraints for further developments.
Event	Important incident: an occurrence, especially one that is particularly significant.
Event File	Stored records specifying a notable change. The XFC stores up to 200 records, containing: Time, Day, Description, Old Value, New Value.
Events	Signals or interrupts generated by a device to notify another device of an asynchronous event. The contents of events are device-dependent.
Ex	Potential Explosive.
Exp Enclosure	Explosion Proof Enclosure for Class 1 Division 1 locations
Expansion Board	A plug-in circuit board that adds features or capabilities beyond those basic to a computer, such as a data acquisition system expansion board.
Expansion Slots	The spaces provided in a computer for expansion boards than enhance the basic operation of the computer.
Extended Binary Coded Decimal Interchange Code	EBCDIC. An eight-bit character code used primarily in IBM equipment. The code allows for 256 different bit patterns.
External Multivariable Transducer	Multivariable Transducer located outside of the Flow Computer enclosure. Used in multi-tube configurations and on systems where the actual Flow Computer is located at a distance from the flowing tube.
F.O.B.	Abbreviation of free on board with the cost of delivery to a port and loading onto a ship included.
Fa	Orifice Thermal Expansion factor.
Faux	Full Well Stream Factor.
Fb	Basic Orifice factor.
FBD	Function Block Diagram (IEC supported programming language)
FCC	Federal Communications Commission.
FCU	Flow computer unit
Feed Points	Connections between gas feeder lines and distribution networks.
Feedback	Occurs when some or all of the output of the device (such as an amplifier) is taken back to the input. This may be accidental (such as the acoustic feedback from a speaker to microphone) or intentional , to reduce distortion.

TERM	DEFINITION
Feeder (Main)	A gas main or supply line that delivers gas from a city gate station or other source of supply to the distribution networks.
FET	Field-effect transistor. Transistor with electric field controlling output: a transistor, with three or more electrodes, in which the output current is controlled by a variable electric field.
Fg	Specific Gravity factor.
Field Pressure	The pressure of natural gas as it is found in the underground formations from which it is produced.
Film Liquids	Aerosols liquids who have contacted each other and become adhered to the inside of the pipeline.
Firmware	A computer program or software stored permanently in PROM or ROM or semi-permanently in EPROM.
Firmware Version	This refers to the version of firmware contained in the equipment.
Fixed-Point	A format for processing or storing numbers as digital integers.
Flange	For pipe, a metal collar drilled with bolt holes and attached to the pipe with its flat surface at right angles to the pipe axis so that it can be securely bolted to a mating flange on a valve, another pipe section, etc.
FLASH	Re-programmable memory onboard an XFC/XRC, similar to an EPROM, except that it can be programmed while in circuit using a Boot Loader Program to write to it. Generally used for the operating system and application code space (non-volatile).
Flash ADC	An Analog to Digital Converter whose output code is determined in a single step by a bank of comparators and encoding logic.
Flow Computer, X Series	A device placed on location to measure SP, DP and temperature (to calculate flow) of gases or liquids being transferred, for remote unattended operation.
Flow Formulas	In the gas industry, formulas used to determine gas flow rates or pressure drops in pipelines, regulators, valves, meters, etc.
Font	The style of lettering used to display information.
Footprint	The surface space required for an object.
Fpb	Pressure Base factor.
Fpv	See Supercompressibility Factor.
Fr	Reynolds Number factor.
Frequency	The number of cycles per second for any periodic waveform - measured in cycles per second - now called Hertz.
Frequency Modulation	Modulation where the frequency of the sinewave carrier alters with the amplitude of the modulating signal.
FRP	Fiberglass Reinforced Polyurethane. A non-flexible material used for LevelMaster sensors.
FS/2	Ruggadized handheld computer device for programming and collecting data from an XFC. Also referred to a Husky or Dog Bone.
Ftb	Temperature Base factor.
Ftf	Flowing Temperature factor.
Full Duplex	Simultaneous, two-way (transmit and receive), transmission.
Function	A set of software instructions executed by a single line of code that may have input and/or output parameters and returns a value when executed.
Fuse	A short length of wire that will easily burn out when excessive current flows.
Fw	Water Vapor factor.
G	The symbol used for giga or gigabyte.

TERM	DEFINITION
Gain	The factor by which a signal is amplified, sometimes expressed in dB.
Gain Accuracy	A measure of deviation of the gain of an amplifier from the ideal gain.
Gas	That state of matter which has neither independent shape nor volume. It expands to fill the entire container in which it is held. It is one of the three forms of matter, the other two being solid and liquid.
Gas Chromatograph	An analytical instrument that separates mixtures of gas into identifiable components by means of chromatography.
Gas Chromatograph Module	Software module used in conjunction with PCCU32 and WINCCU to interact with Btu Chromatograph equipment and software.
Gas Chromatograph Module Coefficient	A co-efficient generated by the factory allowing user to start calibration on location without having a calibration gas available.
Gas Field	A district or area from which natural gas is produced.
Gas, Associated	Gas produced in association with oil, or from a gas cap overlying and in contact with the crude oil in the reservoir. In general, most states restrict associated gas production since its indiscriminate production could reduce the ultimate oil recovery. Also, since some wells producing associated gas cannot be shut-in without also shutting-in the oil production, natural gas pipelines are generally required to take associated gas produced from oil wells on a priority basis.
Gas, C1	Methane.
Gas, C2	Ethane.
Gas, C3	Propane.
Gas, C6+	Hexanes Plus (C6, C7, C8, C9, C10, C11, etc.).
Gas, CO2	Carbon Dioxide.
Gas, Dry	Gas whose water content has been reduced by a dehydration process. Gas containing little or no hydrocarbons commercially recoverable as liquid product. Specified small quantities of liquids are permitted by varying statutory definitions in certain states.
Gas, IC4	Iso-Butane.
Gas, IC5	Iso-Pentane.
Gas, Liquefied Petroleum (LPG)	A gas containing certain specific hydrocarbons which are gaseous under normal atmospheric conditions but can be liquefied under moderate pressure at normal temperatures. Propane and butane are the principal examples.
Gas, Low Btu	Gas with a heating value of less than 250 Btu's per cubic foot. Typically heating values fall between 120 and 180 Btu's per cubic foot.
Gas, Manufactured	A gas obtained by destructive distillation of coal, or by the thermal decomposition of oil, or by the reaction of steam passing through a bed of heated coal or coke, or catalyst beds. Examples are coal gases, coke oven gases, producer gas, blast furnace gas, blue (water) gas, and carbureted water gas. Btu content varies widely.
Gas, Natural	A naturally occurring mixture of hydrocarbon and nonhydrocarbon gases found in porous geologic formations beneath the earth's surface, often in association with petroleum. The principal constituent is methane.
Gas, NC4	Normal Butane.
Gas, NC5	Normal Pentane.
Gas, NeoC5	Neo-Pentane.
Gas, Non-associated	Free natural gas not in contact with, nor dissolved in, crude oil in the reservoir.
Gas, Oil	A gas resulting from the thermal decomposition of petroleum oils, composed mainly of volatile hydrocarbons and hydrogen. The true heating value of oil gas may vary between 800 and 1600 Btu per cubic foot depending on operating conditions and feedstock properties.

TERM	DEFINITION
Gas, Sour	Gas found in its natural state, containing such amounts of compounds of sulfur as to make it impractical to use, without purifying, because of its corrosive effect on piping and equipment.
Gas, Sweet	Gas found in its natural state, containing such small amounts of compounds of sulfur that it can be used without purifying, with no deleterious effect on piping and equipment.
Gas, Unconventional	Gas that can not be economically produced using current technology.
Gas, Wet	Wet natural gas is unprocessed natural gas or partially processed natural gas produced from strata containing condensable hydrocarbons. The term is subject to varying legal definitions as specified by certain state statutes.
Gate Station	Generally a location at which gas changes ownership, from one party to another, neither of which is the ultimate consumer. It should be noted, however, that the gas may change from one system to another at this point without changing ownership. Also referred to as city gate station, town border station, or delivery point.
Gathering	The act of operating extensive low-pressure gas lines which aggregate the production of several separate gas wells into one larger receipt point into an interstate pipeline.
Gathering Agreement	Agreement between a producer and a gathering system operator specifying the terms and conditions for entry of the producer's gas into the gathering system.
Gathering Line	A pipeline, usually of small diameter, used in gathering gas from the field to a central point.
Gathering Station	A compressor station at which gas is gathered from wells by means of suction because pressure is not sufficient to produce the desired rate of flow into a transmission or distribution system.
Gathering System	The gathering pipelines plus any pumps, tanks, or additional equipment used to move oil or gas from the wellhead to the main pipeline for delivery to a processing facility or consumer.
Gauge, Pressure	Instrument for measuring the relative pressure of a fluid. Types include gauge, absolute, and differential.
Gauging Tape Measurements	This refers to a manual method of measuring the level of a liquid in a tank. These measurements may be used to calibrate float levels.
GC	See Gas Chromatograph.
GCM	See Gas Chromatograph Module
GCMC	See Gas Chromatograph Module Coefficient.
GCN	Gravity, Carbon Dioxide and Nitrogen compounds. Used in NX-19 GCN Supercompressibility Factor.
GCNM	Gravity, Carbon Dioxide, Nitrogen and Methane compounds. Used in NX-19 GCNM Supercompressibility Factor.
GDF	Gasde of France
GND	See Ground.
GOST	Russian Certification
GPA 2145	Gas Processors Association standard for values of gas components.
GPM	Gallons of liquid per million cubic feet.
GPS 2261	See Gas Processors Standard 2261.
GRD	See Ground.
Ground	1) An electronically neutral circuit having the same potential as the surrounding earth. Normally, a non-current carrying circuit intended for the safety purposes. A reference point for an electrical system. 2) A large conducting body (as the earth) used as a common return for an electric circuit and as an arbitrary zero of potential.

TERM	DEFINITION
Grounding Strap	A grounding strap is a conductive device used to make connection between the person handling the board, and a high quality ground potential.
Half Duplex	Communication transmission in one direction at a time.
Handshaking	Exchange of predetermined signals between two devices establishing a connection. Usually part of a communications protocol.
Hardware	The physical components of a computer system, such as the circuit boards, plug-in boards, chassis, enclosures, peripherals, cables, and so on. It does not include data or computer programs.
Harmonic	A sinusoidal component of a waveform that is a whole multiple of the fundamental frequency. An oscillation that is an integral sub-multiple of the fundamental is called a sub-harmonic.
HART	Communication Interface.
Hazardous Area Classification	Any area likely to have an explosive combination of oxygen and fuel.
Heating Value	The amount of heat developed by the complete combustion of a unit quantity of a material.
Heavy Hydrocarbons	More subseptable to increases in temperature and decreases in pressure, thus causing liquids to form.
Hertz	Cycles per second. A measure of frequency or bandwidth.
Hexadecimal	A numbering system to the base 16, 0 through F.
Hexanes	A saturated hydrocarbon (alkane) with two carbon atoms in it's molecule (C_2H_6). A liquid under normal conditions.
Hierarchical	A method of organizing computer programs with a series of levels, each with further subdivisions, as in a pyramid or tree structure.
High Btu Gas	A term used to designate fuel gases having heating values of pipeline specification, i.e., greater than about 900 Btu's per standard cubic foot.
Host Console	Host Console via Local Port uses the PCCU cable between the computer and the device's Local PCCU port but running Remote Protocol. Host Console via Remote Port uses the remote protocol
Hub	A market or supply area pooling/delivery where gas supply transaction point occur that serve to facilitate the movement of gas between and among interstate pipelines. Transactions can include a change in title, a change in transporter, or other similar items.
HV	See Heating Value.
Hydrocarbon	A chemical compound composed solely of carbon and hydrogen. The compounds having a small number of carbon and hydrogen atoms in their molecules are usually gaseous; those with a larger number of atoms are liquid, and the compounds with the largest number of atoms are solid.
Hyperterm	Terminal emulation program provided with Windows.
Hysteresis	The maximum difference between output readings for the same measured point, one point obtained while increasing from zero and the other while decreasing from full scale. The points are taken on the same continuous cycle. The deviation is expressed as a percent of full scale.
I/O	See Input/Output.
I/O Address	A method that allows the CPU to distinguish between the different boards in a system. All boards must have different addresses.
I^2C	Serial communications channel to I/O modules (developed by Phillips Semiconductor)
IAR	Maker and distributor of the Embedded Workbench, a compiler, assembler, linker development system for the Z80/64180 microprocessor family.

TERM	DEFINITION
IC	See Integrated Circuit
ID	Identification Number. You must assign an ID to the unit. Units are communicated to by this ID number, therefore the ID assigned in the software must agree with the hardware.
IEC	International Electro-technical Commission. Developers of the IEC-61131-3 standard. Programming Language used by Totalflow for user applications in X Series equipment.
IEEE	Institute of Electrical and Electronics Engineers
IL	Instruction List (IEC supported programming language)
IMV	See Integral Multivariable Transducer.
Inch of Mercury	A pressure unit representing the pressure required to support a column of mercury one inch high at a specified temperature; 2.036 inches of mercury (at 32 degrees F and standard gravity of 32.174 ft/sec2) is equal to a gauge pressure of one pound per square inch.
Inch of Water	A pressure unit representing the pressure required to support a column of water one inch high. Usually reported as inches W.C. (water column) at a specified temperature; 27.707 inches of water (at 60o and standard gravity of 32.174 ft/sec2) is equal to a gauge pressure of one pound per square inch.
Industry Canada	Canadian Certification.
Inert	A material not acted upon chemically by the surrounding environment. Nitrogen and carbon dioxide are examples of inert constituents of natural gases; they dilute the gas and do not burn, and thus add no heating value.
Initialization File	Generic file used to support the display of Totalflow application data in PCCU32.
Input	That part of a circuit that accepts a signal for processing.
Input Sense	To examine or determine the status of the input.
Input/Output	The transfer of data to/from a computer system involving communications channels, operator interface devices, and/or data acquisition and control interfaces.
Instantiate	Starting an instance of an object.
Instrument Manifold	Manifold type used when XFC is mounted directly on the Orifice.
Insulator	Any material that resists the flow of electrical current.
Integral Multivariable Transducer	A Multivariable Transducer that is a part of the flow computer enclosure. Also see Multivariable Transducer.
Integrated Circuit	A circuit component consisting of a piece of semiconductor material containing up to thousands of transistor and diodes. A chip.
Integrating ADC	An ADC whose output code represents the average value of the input voltage over a given time interval.
Interface (computer)	Usually refers to the hardware that provides communication between various items of equipment.
Interface (liquid)	The area between two liquids that are not easily mixed, i.e. oil and water.
Interference	A disturbance to the signal in any communications system.
Inverter	A circuit in both analogue and digital systems that provides an output that is inverse to the input.
Inverter, DC to AC	Converts DC to AC at a high frequency.
ioINT	Interrupt signal from the I/O modules.
ioVBB	i/o Battery Voltage- Unregulated 13.8 volts. Host supplies 2.5 amps to the I/O modules.
ioVDD	Unregulated 5.6 volts from the host for I/O modules.
ISO	International Standards Organization.

TERM	DEFINITION
Isobutane (C4H10)	A hydrocarbon of the same chemical formula as butane but different molecular structure, resulting in different physical properties, notably lower boiling point. Gross heating value 3261 Btu/cu. ft. gas.
Isokenetic Sampling	Laboratory technique where gas sample is tested after removing liquids, therefore not allowing the atomized liquid to to return to the gaseous state, changing the sample accuracy.
IVision	SCADA system designed for oil and gas applications
Joule-Thompson Effect	Created by reducing the gas pressure by constriction, causing the gas to cool, creating condensation.
K	Kilo. 1) In referring to computers, a "kilo" is 1024 or 2 to the 10th power (Note that it is actually slightly more than an even 1000.). 2) the standard metric prefix for 1,000, or 10^3, used with units of measure such as volts, hertz, and meters.
kbytes/s	A unit for data transfer that means 1,000 or 10^3 bytes/s.
Kerosene	An oily liquid obtained in the distilling of gasoline in a temperature range from 174-288 degree C. A hydrocarbon of specific gravity of 0.747 to 0.775. Used as fuel for some internal combustion engines, heating equipment, and illuminating purposes. A heavy grade known as range oil is used for cooking and heating.
KHz	Electronic abbreviation for Kilohertz.
Kilobyte	1024 bytes.
Kilowatt-hour kWh	A unit of energy when one kilowatt of power is expended for one hour. Example A radiator bar is usually rated at 1,000 watts and this switched on for one hour consumes one kilowatt-hour of electricity.
KPa	Kilopascal-Measure of Pressure
LACT	Lease Automatic Custody Transfer.
Latent Heat of Vaporization	Represents the amount of heat required to vaporize a liquid. In the instance of natural gas, the equation appears: 1 Btu = heat to change. This is the most likely scenario for causing gas to liquefy.
LCD	Liquid Crystal Display.
LD	Ladder Diagram (IEC supported programming language)
LED	Light Emitting Diodes.
LevelMaster	Intelligent Digital Level Sensor and is designed for custody transfer accuracy in demanding level measurement applications in tanks. LevelMaster is the name of the Totalflow's Tank Gauging System.
Life	For rechargeable batteries, the duration of satisfactory performance, measured in years (float life) or in the number of charge/discharge cycles (cycle life).
Light Hydrocarbons	More volitile.
Linearity	The maximum deviation of the calibration curve from a straight line between zero and full scale, expressed as a percent of full scale output and measured on increasing measurement only.
Liquefied Natural Gas	Natural gas which has been liquefied by reducing its temperature to minus 260 degrees Fahrenheit at atmospheric pressure. It remains a liquid at -116 degrees Fahrenheit and 673 psig. In volume, it occupies 1/600 of that of the vapor at standard conditions.
Liquefied Petroleum Gas	A gas containing certain specific hydrocarbons which are gaseous under normal atmospheric conditions, but can be liquefied under moderate pressure at normal temperatures. Propane and butane are the principal examples.
Liquid Crystal Display	A reflective display that requires very low power for operation.
Liquids, Natural Gas	Those liquid hydrocarbon mixtures which are gaseous at reservoir temperatures and pressures but are recoverable by condensation or absorption. Natural gasoline and liquefied petroleum gases fall in this category.

TERM	DEFINITION
Load (electrical)	A load is an energy consuming device. The device can be an actual device such as a bulb of a flash light, radio, cassette player, motor, etc., a resistor or a constant current load.
Load (units)	The amount of gas delivered or required at any specified point or points on a system; load originates primarily at the gas consuming equipment of the customers. Also, to load a pressure regulator is to set the regulator to maintain a given pressure as the rate of gas flow through the regulator varies. Compare DEMAND.
Location File	This is a file containing the configuration of the Location or site and the LevelMasters assigned to the Location. You may have a file that contains everything or a file for each Location name. The information from the file is displayed on the main MasterLink screen in the form of a tree structure. See the Main Screen topic for more information.
Location Name	Location Name is the top of the hierarchy tree of a Location File. Included in the Location Name is the LevelMaster's name, ID, S/N, Sensor File and Configuration no.
Log Period	In a XFC, the specified length between writing the calculated accumulated volume to record. You may record volumes as often as every minute and as seldom as every hour. More frequent recording reduces the number of days of records possible between collection.
Long Term	For Totalflow's purpose, the application of this term refers to storing data over a period of time that is greater than a minimal time. Such as data collected weekly versus data collected weekly but stored indefinitely.
LSB	Least Significant Byte
M	Mega, the prefix for 1,048,576, or 2^{20}, when used with byte to quantify data or computer memory. Also 1000, as in MCF or 1000 Cubic Ft.
Manifold	The conduit of an appliance which supplies gas to the individual burners. Also, a pipe to which two or more outlet pipes are connected.
Man-Machine Interface	Software program that converts machine instructions and commands into a user interface.
MasterLink	MasterLink is the name of the software program used to communicate with the LevelMaster for purposes of doing setup, calibration, troubleshooting, generating site files, monitoring levels and collecting data.
Mbytes/s	A unit for data transfer that means 1 million or 10^6 bytes/s.
Mcf	The quantity of natural gas occupying a volume of 1000 cubic feet at a temperature of 60° Fahrenheit and at a pressure of 14.73 psia.
Measurement Unit Assembly	μFLO's measurement and operational features are housed in this single unit assembly. The main electronic board (μFLO-195 Board), communication connection, power, SP, DP and Temperature readings are all housed in this unit.
Mega	Multiplier indicating that a quantity should be multiplied by 1,000,000.
Memory	Electronic devices that enable a computer to store and recall information. In its broadest sense, memory refers to any hardware capable of serving that end, e.g., disk, tape, or semiconductor storage.
Menu	The list of available functions for selection by the operator, usually displayed on the computer screen once a program has been entered.
MEPAFLOW	SICK Engineering's Menu-based Measurement and Parameterization Software for the TotalSonic system (MMI).
Meter Manifold	Gas piping between gas service line and meter. Also, gas piping supplying two or more meters.
Meter, Orifice	A meter using the differential pressure across an orifice plate as a basis for determining volume flowing through the meter. Ordinarily, the differential pressure is charted.

TERM	DEFINITION
Meter, PD	See Meter, Positive Displacement.
Meter, Positive Displacement	An instrument which measures volume on the basis of filling and discharging gas in a chamber.
Meter, Turbine	1) Pulse meter. 2)A velocity measuring device in which the flow is parallel to the rotor axis and the speed of rotation is proportional to the rate of flow. The volume of gas measured is determined by the revolutions of the rotor and converting them to a continuously totalized volumetric reading.
Methane (CH4)	A hydrocarbon (alkane)with the lightest molecule. A gas under normal conditions. The first of the paraffin series of hydrocarbons. The chief constituent of natural gas. Pure methane has a heating value of 1012 Btu per cubic foot.
Micro Flow Computer	See μFLO.
Microprocessor	This term is commonly used to describe the CPU. More specifically, it refers to the part of the CPU that actually does the work, since many CPUs now contain L1 and L2 caches on-chip.
Milli	One thousandth e.g. one milli-watt - 1mW. one milli-amp - 1mA. one milli-volt -1mV.
MIPS	Million instructions per second. The unit for expressing the speed of processor machine code instructions.
MMBtu	A thermal unit of energy equal to 1,000,000 Btu's, that is, the equivalent of 1,000 cubic feet of gas having a heating content of 1,000 BTUs per cubic foot, as provided by contract measurement terms.
MMcf	A million cubic feet. See CUBIC FOOT. (1,000,000 CF)
MMI	See Man-Machine Interface.
Modbus	Messaging structure developed and used to establish master-slave/client-server communication between intelligent devices. Generic protocol supported by most process automation vendors.
Modem	Modulator-Demodulator. A device used to convert serial digital data from a transmitting terminal to a signal suitable for transmission over a common carrier, or to reconvert the transmitted signal to digital data for acceptance by a receiving terminal.
Module	Typically a board assembly and its associated mechanical parts, front panel, optional shields, and so on. A module contains everything required to occupy one or more slots in a mainframe.
Mole Percent	
MRB	Modbus Request Block. When requesting storage space after adding a new Modbus application, the file is saved as a *.mrb file.
MRM	Modbus Register Map. When requesting storage space after adding a new Modbus register, the file is saved as a *.mrm file.
MS	Milliseconds. One-thousandth of a second.
MSB	Most Significant Byte
Multi-tasking	A property of an operating system in which several processes can be run simultaneously.
Multi-tube Sites	Locations where many flow tubes are all within a prescribed distance allowing one flow meter with multitube capabilities, such as the XSeries product line, to monitor and maintain flow records for each tube in one Flow Computer.

TERM	DEFINITION
Multivariable Transducer	Transducer supplying more than 1 variable. Totalflow uses this term to encompass units that read Static Pressure, Differential Pressure and Temperature. Historically these units were coined AMU for Analog Measurement Unit. As a result of advanced technology, the unit no longer functions as only an analog measurement unit. Therefore the newer terminology, Multivariable Transducer, more aptly describes the functionality of this design. The abbreviation MVX, refers to the External version of the multivariable. The abbreviation IMV refers to the Integral version of the multivariable.
MV	Acronym for Molecular Weight.
MV	See Multivariable Transducer.
MVX	See Multivariable Transducer.
N.C.	See Normally Closed.
N.O.	See Normally Open.
N2	Nitrogen
NAK	See Negative Acknowledgement
NAMUR	Normenarbeitsgemeinschaft für Mess- und Regeltechnik in der chemischen Industrie (Standards study group for measurement and process control technology in the chemical industry).
Natural Gas Distillate	Material removed from natural gas at the "heavy end" portion; that is, aliphatic compounds ranging from C4 to C8 (butanes and heavier).
Natural Gas Liquids	The hydrocarbon components: propane, butanes, and pentanes (also referred to as condensate), or a combination of them that are subject to recovery from raw gas liquids by processing in field separators, scrubbers, gas processing and reprocessing plants, or cycling plants. The propane and butane components are often referred to as liquefied petroleum gases or LPG.
Negative Acknowledgment	This refers to a response over a remote communication device, such as a PING. Basically, saying, "I don't acknowledge your request!" This is the opposite of ACK. NAK is a slang term that means that you disagree or do not acknowledge something.
NEMA	National Electrical Manufacturers Association.
Newton Meter	Torque measurement unit equal to 8.84 Inch Pounds.
Nm	Abbreviation for Newton Meter. Metric Torque measurement.
Noise	An undesirable electrical signal. Noise comes from external sources such as the AC power line, motors, generators, transformers, fluorescent lights, soldering irons, CRT displays, computers, electrical storms, welders, radio transmitters, and internal sources such as semiconductors, resistors, and capacitors. Unwanted disturbances superimposed upon a useful signal that tends to obscure its information content.
Non-Persistent	Refers to data that is no longer available after a Warm Start.
Normally Closed	Designation which states that the contacts of a switch or relay are closed or connected when at rest. When activated, the contacts open or separated.
Normally Open	Designation which states that the contacts of a switch or relay are normally open or not connected. When activated the contacts close or become connected.
Norsok	Norwegian Certification Bureau
NPN	Negative-Positive-Negative (Transisitor).
NPT	National Pipe Thread.
NRTL	Nationally Recognized Testing Laboratory.
NX-19	American Gas Association Report referring to a specific method to calculate the Supercompressibility factor.
OCV	See Open Circuit Voltage.

TERM	DEFINITION
ODBC	See Open Database Connectivity.
OHM	The unit of resistance usually shown as the symbol "R". One thousand ohms is written "k" and one million ohms is written "M". Resistance is measured with a multimeter, set to the "ohms range".
OLE	Object Linking and Embedding. A set of system services that provides a means for applications to interact and interoperate. Based on the underlying Component Object Model, OLE is object-enabling system software. Through OLE Automation, an application can dynamically identify and use the services of other applications, to build powerful solutions using packaged software. OLE also makes it possible to create compound documents consisting of multiple sources of information from different applications.
Ole for Process Control	This is a data interchange format and supporting software. Typically, vendors (such as ABB) write OPC server drivers which can talk to their devices. SCADA system vendors (again like ABB) write OPC clients that can gather data from OPC Servers. The idea is to provide a universal way to collect data into a SCADA system regardless of the equipment vendor. This standard was developed and is maintained by the OPC Foundation. The Totalflow Driver, TDS32, supports OPC.
Ole for Process Control Database	A programming interface to databases. IVision supports the OLEDB interface.
OLEDB	See Ole for Process Control Database.
OOP	Object-Oriented Programming. The XFC/XRC architecture incorporates an object-oriented approach.
OPC	See Ole for Process Control.
Open Circuit	A complete break in a metal conductor path.
Open Circuit Voltage	The difference in potential between the terminals of a cell/battery when the circuit is open (no-load condition).
Open Collector	A single NPN transistor with the base connected to the logic driving circuitry and with the emitter grounded. The collector is the output pin of the gate.
Open Database Connectivity	A widely accepted application-programming interface (API) for database access. It is based on the Call-Level Interface (CLI) specifications from X/Open and ISO/IEC for database APIs and uses Structured Query Language (SQL) as its database access language. Using ODBC, you can create database applications with access to any database for which your end-user has an ODBC driver. This allows access for authorized users to databases over any network, including the Internet. The iVision SCADA system provides an ODBC driver, making the database accessible to authorized users anywhere on a corporate network, or even over the Internet if the network is properly configured.
Operating System	Base-level software that controls a computer, runs programs, interacts with users, and communicates with installed hardware or peripheral devices.
Orifice Meter	Device to record differential pressure measurement which uses a steel plate with a calibrated hole or orifice to generate a drop in pressure between the two sides of the plate. Also the primary element of the meter run.
Orifice Plate	A plate of non-corrosive material which can be fastened between flanges or in a special fitting perpendicular to the axis of flow and having a concentric circular hole. The primary use is for the measurement of gas flow.
ORing	Boolean algebra logical function. Described as the addition or summing of switches or inputs, in the case of boolean elements, the 0 and 1 represent two possible states of a premis or hypothesis: True or False, On or Off. When adding boolean elements not real numbers, you will find these results: 1 or 1 = 1 1 or 0 = 1 0 or 1 = 1 0 or 0 = 0

TERM	DEFINITION
O-Ring	A flat ring made of rubber or plastic, used as a gasket.
Output	That part of a circuit where the processed signal is available.
P/I	See Pulse Input.
Parameter	(1) Characteristic. For example, *specifying parameters* means defining the characteristics of something. In general, parameters are used to customize a program. For example, file names, page lengths, and font specifications could all be considered parameters. (2) In programming, the term *parameter* is synonymous with argument, a value that is passed to a routine.
Passive Analog Output	Analog Output to a host that is powered by an outside source.
PCCU	Portable Collection and Calibration Unit.
PCCU32	Windows version of PCCU communications software to process, archive and collect data from the Totalflow equipment. Generally run from a laptop.
Peak Area	
Peak High	
Pentane (C5H12)	A saturated hydrocarbon (alkane) with five carbon atoms in it's molecule (C_5H_{12}). A liquid under normal conditions.
Peripheral	The input/output and data storage devices attached to a computer such as disk drives, printers, keyboards, displays, data acquisition systems, etc.
Persistent	Refers to data that remains available after a Warm Start.
PEX	A flexible material used for LevelMaster sensors.
PID	See Proportional, Integral, Derivative.
Piezoceramic	A ceramic material that has piezoelectric properties similar to those of some natural crystals.
PLC	See Programmable logic controller
Plunger Lift	A technique used to optimize gas production. A Steel plunger is inserted into the production tubing in the well. The flow is turned off and this shut-in causes plunger to fall allowing fluid to collect above plunger. Different techniques are used to decide how long to shut in and flow the well.
Polling	A snapshot view of the readings taken by the Totalflow equipment.
Porportional, Integral, Derivative	PID Controllers are designed to eliminate the need for continuous operator attention. An example would be the cruise control in a car or a house thermostat. These controllers are used to automatically adjust some variable to hold the measurement (or process variable) at the set-point. The set-point is where you would like the measurement to be. Error is defined as the difference between set-point and measurement.
Port	A communications connection on a computer or a remote controller. A place of access to a device or network, used for input/output of digital and analog signals.
Positive Temperature Co-efficient fuse	Opens circuit when high current condition occurs. Closes when condition no longer exists. Replaces typical fuses, which require replacement when blown.
POU	Program Organization Unit. This is Softing's term for an 'independent programming unit'. Programs, functions, etc.
Pressure Differential	Difference in pressure between any two points in a continuous system.
Pressure Markers	Pressure testing at different levels of pressure. Used for comparison purposes.
Pressure, Absolute	See PSIA.
Pressure, Atmospheric	See Atmospheric Pressure.

TERM	DEFINITION
Pressure, Gas	In the natural gas industry pressure is measured by the force applied to a designated area. PSI and OSI refer to how much pressure (pound or ounce) is applied to one square inch. Inches Water Column (In.W.C.) is also used to express gas pressure and is measured using a manometer for lower pressure readings. 1 PSIG=27.21 Inches Water Column.
Pressure, Gauge	See PSIG.
Primary Cell (or Battery)	A cell or battery which is not intended to be recharged and is discarded when the cell or battery has delivered all its electrical energy.
PRM	Acronym for Pressure Regulator Module.
Process Gas	Gas use for which alternate fuels are not technically feasible, such as in applications requiring precise temperature controls and precise flame characteristics.
Programmable Logic Controller	A highly reliable special-purpose computer used in industrial monitoring and control applications. PLCs typically have proprietary programming and networking protocols, and special-purpose digital and analog I/O ports.
Programmable Read Only Memory	Computer memory in which data can be written to. ROM is used for storing programs (e.g. operating systems) and characteristic files on a permanent basis. (non-volatile)
Programmed I/O	The standard method a CPU uses to access an I/O device-- each byte of data is read or written by the CPU.
PROM	See Programmable Read Only Memory
Propane (C3H8)	A saturated hydrocarbon (alkane) gas, the molecule of which is composed of three carbon and eight hydrogen atoms. Propane is present in most natural gas and is the first product refined from crude petroleum. It has many industrial uses and may be used for heating and lighting. Contains approximately 2,500 Btu per cubic foot.
Protocol	A formal set of conventions governing the formatting and relative timing of message exchange between two communicating systems.
PSI	Pounds per Square Inch.
PSIA	Pounds per Square Inch Absolute. Absolute pressure uses a perfect vacuum as the zero point. A perfect vacuum is 0 PSIA. PSIA=PSIG + Atmospheric Pressure.
PSIG	Pounds per Square Inch Gauge. Gauge pressure uses the actual atmospheric pressure as the zero point.
PTB	Physikalisch Technische Bundesanstalt (Federal Physical Technical Office) or Technical Institute for Certification.
PTC	See Positive Temperature Co-efficient Fuse.
Pulse Input	Any digital input to a meter (usually a turbine) that is used to measure pulses over a time period. This calculates volume and flow rate for each period of time.
Pulse Mode	An operational mode used by the LevelMaster for measuring single float levels by transmitting a pulse to the primary windings, reading the voltage level on both the primary and secondary windings and using a calculation whereby one is subtracted from another to determine the single fluid level.
Pulse Output	Any digital output that is used to measure pulses over a period of time. Frequency of Pulses in a predetermined time frame represents a value to be used in calculating volume and flow rate.
Radio Frequency	RF for short. That part of the spectrum from approx. 50kHz to gigahertz.
Radio Frequency Interference	Electromagnetic radiation which is emitted by electrical circuits carrying rapidly changing signals, as a by-product of their normal operation, and which causes unwanted signals (interference or noise) to be induced in other circuits.
RAM	See Random Access Memory.

TERM	DEFINITION
RAM Disk	A lithium backed storage chip. Also see Random Access Memory.
Random Access Memory	Onboard read/write volatile memory, generally used for application variables and the file system. Data stored is lost if power is removed (volatile).
Rated Capacity	The number of ampere-hours a cell/battery can deliver under specific conditions (rate of discharge, cut-off voltage, temperature).
RBUS	Communication abbreviation for Results Bus.
RCV	Communication abbreviation for Received.
RD	Acronym for Relative Density.
RDrive	Refers to Totalflow's SRam Drive (solid state memory chip) located on the main board, used to store data and configuration files. The RDrive is a lithium backed, volatile memory chip and is not affected by a warm start.
Read Only Memory	Computer memory in which data can be routinely read but written to only once using special means when the ROM is manufactured. ROM is used for storing data or programs (e.g. operating systems) on a permanent basis.
Real Time	Data acted upon immediately instead of being accumulated and processed at a later time.
Real Time Data Base	The iVision SCADA system has an in-memory RTDB for the data it collects from various devices. Real-time generally means that the data is acquired often enough that the user can make operational changes to the process while it is still useful to do so. On a factory floor, this can be in milliseconds. For remote devices which may require a couple of hours of drive time to reach, real-time can be thought of in tens of minutes or even hours. The iVision data base can meet either of these requirements.
Real Time Operating System	Any operating system where interrupts are guaranteed to be handled within a certain specified maximum time, thereby making it suitable for control of hardware in embedded systems and other time-critical applications. RTOS is not a specific product but a class of operating system.
Recharge/Charge	The conversion of electrical energy, provided in the form of a current from an external source (charger), into chemical energy within a cell/battery.
Recommended Standard 232	This is the standard interface for full-duplex data communication conducted with two way independent channels. It employs unbalanced signaling and refers to point-to-point communications between one driver and one receiver in a 4-wire bus system. The RS-232 (single-ended) transmits at a relatively slow data rate (up to 20K bits per second) and short distances (up to 50 Ft. @ the maximum data rate).
Recommended Standard 422	This is the standard interface for half-duplex communications conducted with a dual-state driver. It employs balanced signaling and refers to multi-drop communications between one driver and up to ten receivers, known as "straight-through" cabling in a 4-wire bus system. The RS-422 (Differential) transmits a much faster data rate (up to 100K bits per second) and longer distances (up to 4000 Ft. @ the maximum data rate).
Recommended Standard 485	This is the standard interface for half-duplex communications conducted in the tri-state or common mode. It employs balanced signaling and refers to true multi-point communications between up to 32 drivers and 32 receivers, in 2-wire bus system. The RS-485 (Differential) transmits a much faster data rate (up to 100K bits per second) and longer distances (up to 4000 Ft. @ the maximum data rate). It also supports more nodes per line because it uses lower impedance drivers and receivers.
Relay	Electromechanical device containing a coil and set of contacts. The contacts close when the coil is activated.
Remote Controller, X Series.	Totalflow's X series Remote Controller is a low power, microprocessor based unit designed to meet a wide range of automation, monitor, control, alarming and measurement applications.

TERM	DEFINITION
Remote Terminal Unit	An industrial data collection device similar to a PLC, designed for location at a remote site, that communicates data to a host system by using telemetry (such as radio, dial-up telephone, or leased lines).
Resistance	The measure of the ability of a material to pass a current.
Resistant Thermal Detector	A metallic probe that measures temperature based upon its coefficient of resistivity.
Resistor	Passive component with a known resistance. The value of resistance is usually shown by a set of colored bands on the body of the component.
Resolution	The smallest significant number to which a measurement can be determined. For example, a converter with 12-bit resolution can resolve 1 part in 4096.
Restore	This refers to a Totalflow procedure in which all the Station or Configuration files are restored to the SDRIVE from the file located on the laptop. This process is very helpful prior to doing a Cold Start when you want to continue using the Configuration and Station files.
RFI	See Radio Frequency Interference.
Ribbon Cable	A flat cable in which the conductors are side by side rather than in a bundle.
ROM	See Read Only Memory
RRTS	Communication abbreviation for Remote Ready To Send.
RS-232	See Recommended Standard 232.
RS-422	See Recommended Standard 422.
RS-485	See Recommended Standard 485.
RTD	See Resistant Thermal Device.
RTDB	See Real Time Data Base.
RTOS	See Real Time Operating System.
RTS	Communication abbreviation for Ready To Send.
RTU	See Remote Terminal Unit
RXD	Communication abbreviation for Receive Data.
S/N	Serial Number. The whole Serial Number is made up of a prefix of 5 digits and the suffix, a 10 digit configuration number.
Saddle	A fitted plate held in place by clamps, straps, heat fusion, or welding over a hole punched or drilled in a gas main to which a branch line or service line connection is made. The saddle also may serve as a reinforcing member for repair.
Sample Loop	
Save	This refers to a Totalflow procedure in which all the Station or Configuration files are copied from the RDRIVE or the SDRIVE, to a file created on a laptop.
Savitsky-Golay Smoothing	Digital Signal Smoothing. A special class of a digital signal processing filter. Specifically determines the coefficients that are used for signal processing.
SCADA	See Supervisory Control and Data Acquisition
Schematic	Another name for a circuit diagram.
SCM	Acronym for Sample Conditioning Module.
SDRIVE	Totalflow's Serial E^2 PROM solid state memory chip, located on the Main Board (volatile memory, affected by a cold start), used to store configuration or station files.
Selectable Units	Selectable measurement units for various international and specialized application needs.
Self-Calibrating	A property of a DAQ board that has an extremely stable onboard reference and calibrates its own A/D and D/A circuits without manual adjustments by the user.

TERM	DEFINITION
Semiconductor	Material that is nether a conductor nor insulator. Its properties can be altered by a control voltage.
Sensor	A device that responds to a physical stimulus (heat, light, sound, pressure, motion, flow, and so on), and produces a corresponding electrical signal.
Sensor File	The Sensor File contains all the setup/calibration information of the unit. The Sensor File is a (.dat) file and by default is named after the base serial number proceeded by an "s", such as s00108.dat. Although the name can be overwritten, it is recommended that the default name be kept.
Serial I/O	A common form of data transmission, in which the bits of each character are sent one at a time over the line.
Serial Port	A communications interface that uses one data line to transfer data bits sequentially. On the IBM PC the serial port refers to a standard asynchronous serial interface which uses the 8250/16450/16550 family of UART's.
Service Life	The period of useful life (usually in hours or minutes) of a primary cell/battery before a predetermined cut-off voltage is reached.
Set-Point	A "level" or control point in a feedback system.
SFC	Sequential Function Chart (IEC supported programming language)
SG	Acronym for Specific Gravity.
Short Circuit	A connection of comparatively low resistance accidentally or intentionally made between points on a circuit between which the resistance is normally much greater. Also called a "bridge" or "short" such as when solder from two tracks touch on a PC board.
SIG	See Signal.
Signal	Any communication between message-based devices consisting of a write to a signal register.
Signal Generator	A circuit that produces a variable and controllable signal.
Signed Integer	Can represent a number half the size of a “unsigned integer”, including a negative number.
Sink	Device such as a load that consumes power or conducts away heat.
Skip Days	Extra Daily records for recording events that require the start of a new day. i.e. Volume Reset, Backward Time change over the hour, and Contract Hour change.
SNAM	Italy’s Certification Board
SNR	Signal to Noise Ratio.
SoftCONTROL	Softing’s IEC compiler environment
Softing	Maker and distributor of the IEC compiler softCONTROL
Software	The non-physical parts of a computer system that include computer programs such as the operating system, high-level languages, applications programs, etc.
Solar cell	A cell that produces current under sunlight.
Solenoid	A coil of wire that is long compared to its diameter, through which a current will flow and produce a magnetic flux to push or pull a rod (called an armature).
SOS	See Speed of Sound.
Source	Device that provides signal power or energy to a load.
SP	See Static Pressure
Specific Gravity	The ratio of the mass of a solid or liquid to the mass of an equal volume of distilled water at 4°C (39°F) or of a gas to an equal volume of air or hydrogen under prescribed conditions of temperature and pressure. Also called *relative density*.
Speed of Sound	Rate at which sound travels through the medium. Used in flow calculations in the TotalSonic Meter.

TERM	DEFINITION
SPU	Signal Processing Unit (measurement transducer).
SQL	See Structured Query Language.
SRAM	See Static Random Access Memory
SSM	Acronym for Stream Selector Module.
ST	Structured Text (IEC supported programming language)
Static Pressure	Equals PSIA or PSIG. Referenced to atmospheric pressure versus absolute pressure in a vacuum. It is defined as the pressure exerted by a non-moving liquid or gas. In the case of a gas well this would be the natural PSI of the gas inside of the well.
Static Random Access Memory	The place in your computer that programs reside when running. You can access any part of the memory, and it can easily be overwritten with new values. SRAM is much more expensive and physically larger than DRAM but much faster.
Status Output	Any digital output that uses “On” or “Off” conditions to determine the status of the assigned description. Changing from one to the other represents a change in the condition.
STP	Standard Temperature and Pressure
Stream	
Structured Query Language	IBM developed this language in the 60’s as a way of accessing data from a relational database. It has a very simple syntax for simple functions but can become complex for sophisticated applications. This language is standardized by international standards bodies, and is almost universal in application. Almost all databases support SQL. The iVision RTDB supports SQL and this makes it extremely flexible within a corporate network. Authorized users throughout the organization can write SQL statements to acquire data from this database that they need for Marketing, Accounting, Engineering, or other functions.
Supercompressibility Factor	A factor used to account for the following effect: Boyle's law for gases states that the specific weight of a gas is directly proportional to the absolute pressure, the temperature remaining constant. All gases deviate from this law by varying amounts, and within the range of conditions ordinarily encountered in the natural gas industry, the actual specific weight under the higher pressure is usually greater than the theoretical. The factor used to reflect this deviation from the ideal gas law in gas measurement with an orifice meter is called the "Supercompressibility factor Fpv". The factor is used to calculate corrected from volumes at standard temperatures and pressures. The factor is of increasing importance at high pressures and low temperatures.
Supervisory Control and Data Acquisition	A common PC function in process control applications, where programmable logic controllers (PLCs) perform control functions but are monitored and supervised by a PC.
Surge	A sudden change (usually an increase) in the voltage on a power line. A surge is similar to a spike, but is of longer duration.
SW VBATT	Switched Battery Voltage. Cycles power to equipment to save power.
Switch	An electrical device for connecting and disconnecting power to a circuit, having two states, on (closed) or off (open). Ideally having zero impedance when closed and infinite impedance when open.
Synchronous	(1) Hardware - A property of an event that is synchronized to a reference clock. (2) Software - A property of a function that begins an operation and returns only when the operation is complete.
Syntax	Comparable to the grammar of a human language, syntax is the set of rules used for forming statements in a particular programming language.
System Noise	A measure of the amount of noise seen by an analog circuit or an ADC when the analog inputs are grounded.

TERM	DEFINITION
TankMaster	Totalflow Control System for LevelMaster Tank Units.
Tap	To cut threads in a round hole so that other fittings or equipment can be screwed into the hole. Also to make an opening in a vessel or pipe.
TBUS	Communication abbreviation for Transmit Bus.
TCP/IP	TCP/IP – This is the basic communication format for the Internet, and for much of what happens on a corporate network. Virtually all networked PCs and other computers have an “IP address” having the format xxx.xxx.xxx.xxx (xxx can range from 0 to 255 in most cases). You can see the ip address of your PC by going to the start menu, selecting run, and entering cmd. A “DOS Box” will be displayed on your screen. Type ipconfig to get the ip address. When you enter a URL (e.g., www.totalflow.com) in a browser, a DNS server (on the network) resolves this into an IP address and directs your request to the machine with that address.
TDS32	Totalflow DDE Server that allows Microsoft Windows applications with DDE capabilities to communicate with Totalflow’s equipment. For example data can be retrieved and placed in an Excel spreadsheet.
Temperature Coefficient	An experimental number used to modify the calibration of a device (Totalflow transducer) to account for changes in environmental temperature.
Temperature, Ambient	The temperature of the air, atmosphere or other fluid that completely surrounds the apparatus, equipment or the work piece under consideration. For devices which do not generate heat, this temperature is the same as the temperature of the medium at the point of device location when the device is not present. For devices which do generate heat, this temperature is the temperature of the medium surrounding the device when the device is present and generating heat. Allowable ambient-temperature limits are based on the assumption that the device in question is not exposed to significant radiant-energy sources such as sunlight or heated surfaces.
Temperature, Flowing	Temperature of the flowing fluid. Usually gas and measured by an RTD.
Terminal Mode	Man-Machine interface tool used as and engineering interface with equipment.
Termination	Placement of a connector on a cable.
Termination Panel	A circuit board with screw terminals or other connector system that allows convenient connection of field signals to a data acquisition or communication system.
TF.NET	Totalflow network used to access iVision/web data.
TFIO Module	Totalflow Input/Output module (i.e. quad AO)
Thermocouple	A temperature sensor created by joining two dissimilar metals. The junction produces a small voltage as a function of the temperature.
Thermowell	A closed-end tube designed to protect temperature sensors from harsh environments, high pressure, and flows. They can be installed into a system by pipe thread or welded flange and are usually made of corrosion-resistant metal or ceramic material depending upon the application.
Therms Master	Totalflow application for Gas Analyzer.
Tolerance	The allowable percentage variation of any component from that stated on its body.
Totalflow	Product line of ABB Inc. Maker and distributor of the X Series Flow Computers (XFC) and Remote Controllers (XRC).
TotalSonic MMI	TotalSonic’s Man Machine Interface software program. May also be called MEPAFLOW 600.
Transducer	A device for converting energy from one form to another, specifically the measurement of pressure differential in natural gas gate stations. I.e. Pressure to voltage or current.
Transfer Rate	The rate, measured in bytes/s, at which data is moved from source to destination after software initialization and set up operations; the maximum rate at which the hardware can operate.

TERM	DEFINITION
Transient	An abrupt change in voltage, of short duration (e.g. a brief pulse caused by the operation of a switch).
Transistor	A three leaded device (Collector, Base, Emitter) used for amplifying or switching. Also called a bi-polar transistor to distinguish it from Field Effect Transistor etc.
Transmitter	A device that converts audio, video or coded signals into modulated radio frequency signals which can be propagated by electromagnetic waves (radio waves).
Tranzorb	Transient Voltage Suppression device.
TRB	Tank Request Block Editor. When requesting storage space after adding a LevelMaster application, the file is saved as a *.trb file.
Tube	Cylinder for transporting or storing liquids: any long hollow cylinder used to transport or store liquids.
Tuned Radio Frequency	An amplitude modulated (AM) receiver with one or more stages of radio frequency before the detector.
TXD	Communication abbreviation for Transmit Data.
UDINT	Unsigned Double Integer
Unsigned Integer	Can represent a number twice the size of a “signed integer”, but cannot represent a large negative number.
Upload	This refers to a Totalflow procedure in which any file(s) located in the on-board memory of a Totalflow Host is copied to a file created on a laptop PC.
UPS	Un-interruptible power supply. A power conditioning unit placed between the commercial power service and the protected device. The UPS uses line power to charge batteries, which, in the case of a power failure, can drive electronic circuitry to produce the appropriate AC requirements for some time period.
Upstream	From a reference point, any point located nearer the origin of flow, that is, before the reference point is reached.
Upstream Pipeline	The first pipeline to transport natural gas en route to an inter-connect point for delivery to another pipeline. See DOWNSTREAM PIPELINE.
USX	Provider of the RTOS used by the X Series product line
VAC	Volts of alternating current.
Vacuum	A pressure less than atmospheric pressure, measured either from the base of zero pressure or from the base of atmospheric pressure (PSIA).
Valve	A mechanical device for controlling the flow of fluids and gases; types such as gate, ball, globe, needle, and plug valves are used.
Valve Control	This feature provides automatic feedback control of Differential Pressure (DP), Static Pressure (SP), and Flow Rate for the purpose of positioning a flow valve to maintain a desired value of DP, SP, or Flow Rate.
VAS32	Totalflow’s Voice Alarm System. A software program that receives and transmits alarm notifications via cell, telephone or pager systems.
VBATT	Battery Voltage. The voltage output from the battery source.
VDC	Volts of direct current.
VDE	Verband der Elektrotechnik Elektronik Informationstechnik [Association for Electrical, Electronic & Information Technologies]
Vent	A normally sealed mechanism which allows for the controlled escape of gases from within a cell.
Virtual Memory	A method of making disk storage appear like RAM memory to the CPU, thus allowing programs that need more RAM memory than is installed to run in the system. This technique is slow compared to "real" memory.
VOG	Velocity of Gas.

TERM	DEFINITION
Volatile Memory	A storage medium that loses all data when power is removed.
Volt	The unit of voltage or potential difference.. One thousand volts = 1kV.
Voltage	Electrical pressure, the force, which causes current to flow through a conductor. Voltage must be expressed as a difference of potential between two points since it is a relational term. Connecting both voltmeter leads to the same point will show no voltage present although the voltage between that point and ground may be hundred or thousands of volts.
Voltmeter	A meter for reading voltage. It is one of the ranges in a multimeter.
Volume Calculation Period	The specified length between reading and calculating volume data.
VOS	Velocity of Sound.
Warm Start	A rebooting technique which will clear most operational errors, without damaging either the data or configuration files. This causes the equipment to boot from the RDRIVE, which is a solid state memory chip.
Watt	Symbol W. The unit of power. One watt is the product of one volt and one amp. Power (W) = Current (I) X Energy (E). (E = Volts)
Wavelength	The distance between two points of corresponding phase in consecutive cycles
Web Page	All the text, graphics, and sound visible with a single access to a Web site; what you see when you request a particular URL.
Web Server	The hardware and software required to make Web pages available for delivery to others on networks connected with yours.
Web Site	A collection of electronic "pages" of information on a Web server
Well, Development	A well drilled in order to obtain production of gas or oil known to exist.
Well, Disposal	A deep well in which to inject waste chemicals, etc., such as a well to dispose of salt brine from the solution mining of salt dome gas storage caverns.
Well, Exploratory	A well drilled to a previously untested geologic structure to determine the presence of oil or gas.
Well, Gas	A well which produces at surface conditions the contents of a gas reservoir; legal definitions vary among the states.
Well, Marginal	A well which is producing oil or gas at such a low rate that it may not pay for the drilling.
Well, Stripper	Non-associated gas well capable of producing no more than 90 Mcf/day at its maximum rate of flow.
Well, Wildcat	An exploratory well being drilled in unproven territory, that is, in a horizon from which there is no production in the general area.
Wellhead	The assembly of fittings, valves, and controls located at the surface and connected to the flow lines, tubing, and Casing of the well so as to control the flow from the reservoir.
WINCCU	Windows Central Collection Unit. Windows version of software to process, archive and manipulate data collected from the Totalflow products.
Witness	In the field, where hydrocarbons are changing hands and actual cash register transactions being performed, it is not uncommon for one party or the other to request / require a representative or company employee be present during calibrations and or routine maintenance. Often this arrangement is contractually linked.
Wobbe Index	Calculated from the energy content, or a higher heating value of the gas, and the relative density of the gas ($Btu/RD^{1/2}$).
Working Voltage	The highest voltage that should be applied to a product in normal use, normally well under the breakdown voltage for safety margin. See also Breakdown Voltage.

TERM	DEFINITION
World Wide Web	An Internet service facilitating access to electronic information - also known as the Web, WWW, or W3.
X Series	Totalflow's new extendable equipment series featuring technology that is expandable and flexible for ever changing needs.
XFC	See Flow Computer, X Series.
XFC-195 Board	The main electronic board used in X Series flow computers. The XFC-195 Board mounts on the inside of the enclosure's front door.
XIMV	Integral Multivariable Transducer
XMV	External Multivariable Transducer.
XRC	See Remote Controller, X Series.
XRC	X Series Remote Controller. Also see Remote Controller, X Series.
Y	Expansion factor
Zero Gas	Gas at atmospheric pressure.

Chapter 7
Drawing & Diagrams

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

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

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