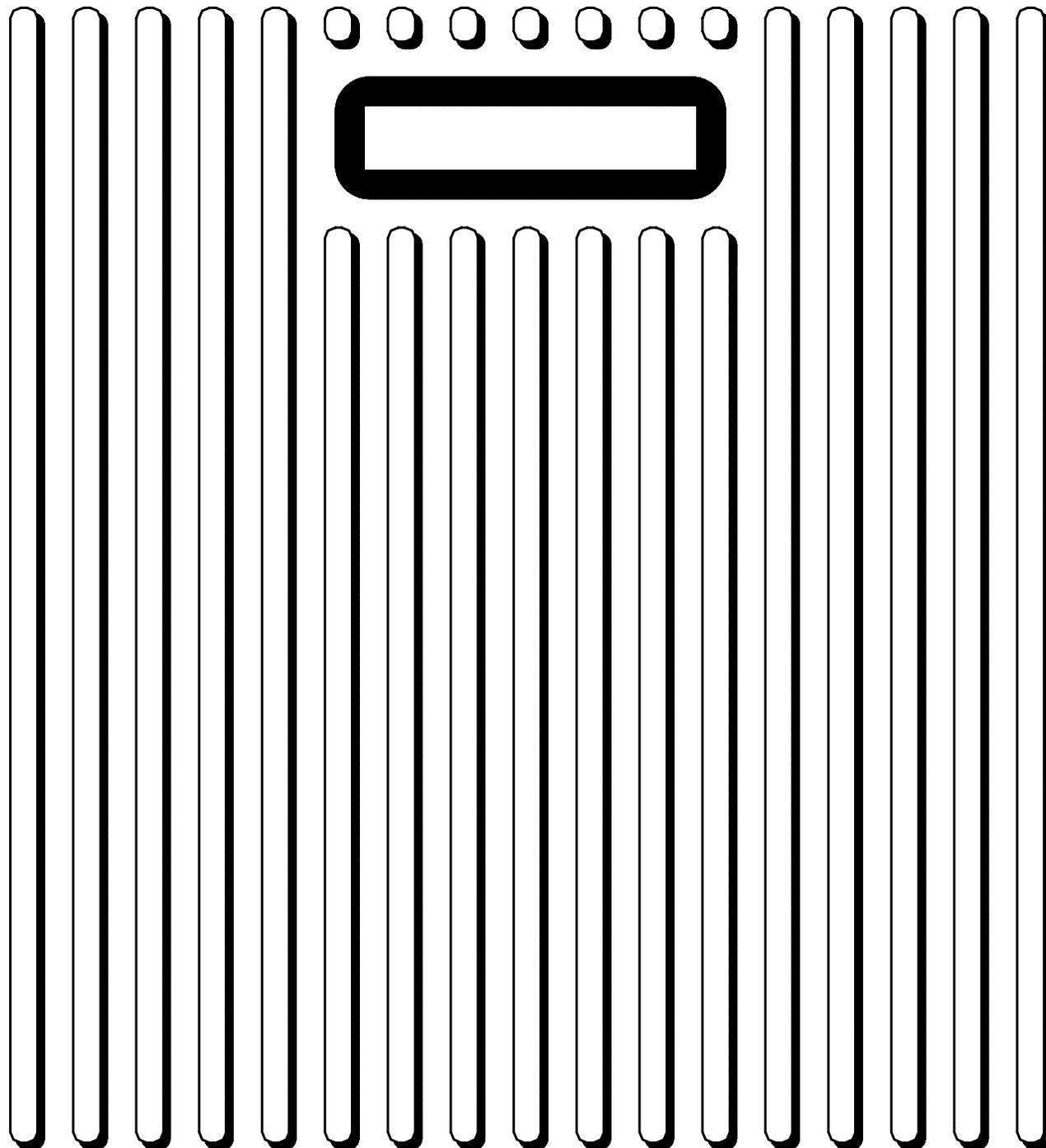


**ABB**

**X Series Remote Controller  
User's Manual**



***TOTALFLOW***

MEASUREMENT & CONTROL SYSTEMS



**TOTALFLOW<sup>®</sup>**  
**X Series Remote Controller**  
**User's Manual**

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# Introduction

## About the Manual

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This manual is written to provide an experienced RTU technician with the requirements necessary to install, setup and operate a Totalflow X Series Remote Controller (XRC).

### 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 XRC system components, specifications, and description of XRC operational methods.
2. Installation	Includes unpacking and detailed procedures for setup and installation.
3. XRC Operation	Provides you with a tutorial on how to get a newly installed XRC system up and running.
4. Input/Output	Provides you with detail instructions for wiring the modular I/O.
5. Maintenance	Provides instructions on how to remove and replace major modules.
6. Troubleshooting	Provides a description of the XRC front panel error messages and provides a troubleshooting chart on how to correct most problems.
7. Terms and Definitions	Provides quick access to the majority of terms and abbreviations, as well as their definitions.
8. Drawings	Provides a place to put drawings that accompany a unit.

## Key Symbols

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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.
- Caution**  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.
- TIP**  Intended to draw your attention to a fact that may be useful or helpful.

## Getting Help

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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 a 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 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.

### Terms as 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.

## Safety Practices and Precautions, Continued

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### **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 safely, it should be taken out of operation and secured against unintentional usage.

### **Fuse Replacement**

Fuses used on XRC electronic boards are surface mount and field repair should not be attempted. Most fuses automatically reset themselves, but if a known 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.

# Chapter 1

## System Description

### Overview

---

This Chapter introduces you to the Totalflow® X Series Remote Controllers (XRC). The X Series are a low power, microprocessor based units designed to meet a wide range of automation, monitor, control, alarming and measurement applications. Three models are available: Models XRC 6490, XRC 6790 and XRC 6890.

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

Each model is packaged in an enclosure that can accommodate the Main Electronic Board (XRC-195 Board), a variety of batteries and remote communications devices, and additional I/O Modules. The XRC 6490 can accommodate up to 3 I/O Modules, the XRC 6790 can accommodate up to 6 I/O Modules and the XRC 6890 can accommodate up to 14 I/O modules

The XRC-195 board offers the following input and output points:

- 5 analog inputs
- 4 digital or 2 digital and 2 high speed pulse inputs (Selectable De-bounce enable/disable)
- 4 digital outputs
- 2 Remote Communication Ports (RS232 or485)
- I/O Interface for TFIO Interface Modules (discussed in detail in Chapter 4, Input/Output)

This system is made up of a NEMA 4X enclosure, which can house battery, power supply, remote communications equipment, a XRC-195 board and Liquid Crystal Display.

### Highlights

This Chapter covers the following topics:

Topic	See Page
XRC General Specifications	1-3
XRC-195 Specifications	1-3
XRC Equipment	1-9
Functions of the XRC	1-14
Status and Alarm Conditions	1-15

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*Continued on Next Page*

## Overview, Continued

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**FYI**



The XRC is powered by a battery system, which can be charged using; either solar panel, 24Vdc or 120/240 VAC chargers. It is optimized for extremely low power consumption and is primarily designed for remote operation in harsh environments.

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

This system can be programmed for advanced control or shutdown logic using the IEC 1131 Control Language. An extensive applications library is available from Totalflow Projects Engineering as needed, or new application programs can be developed for you by Totalflow.

It is also possible for experienced IEC 1131 programmers in your company, or other companies, to design application programs for any XRC device.

## XRC General Specifications

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<b>Certification</b>	Designed to meet Class 1, Division 2, Groups C & D, and CSA hazardous area classification.
<b>Dimensions</b>	<b>Model XRC 6490</b> – 11.52 in. W x 14.81 in. H x 10.269 in. D (292.61 mm x 376.17 mm x 260.83 mm) <b>Model XRC 6790</b> – 15.10 in. W x 18.80 in. H x 13.38 in. D (383.54 mm x 477.52 mm x 339.85 mm) <b>Model XRC 6890</b> – 20.09 in. W x 28.91 in. H x 15.52 in. D (510.29 mm x 734.31 mm x 394.21 mm)
<b>Installed Depth</b>	<b>XRC 6490</b> – Pipe Mount – 12.75 in. (323.85 mm) Wall Mount – 11.00 in. (279.40 mm) <b>XRC 6790</b> – Pipe Mount – 15.75 in. (400.05 mm) Wall Mount – 14.00 in. (355.60 mm) <b>XRC 6890</b> – Pipe Mount – 18.01 in. (457.45mm) Wall Mount – 16.26 in. (413.00 mm)
<b>Weight</b>	<b>XRC 6490</b> – 8.86 lbs. (3.31 kg) with out battery <b>XRC 6790</b> – 29.0 lbs. (13.167 kg) with out battery <b>XRC 6890</b> – 45.5 lbs. (16.98 kg) with out battery
<b>Mounting</b>	Wall or pipe
<b>Operating Temp.</b>	-40° F to 140° F

## XRC-195 Board Specifications

---

<b>Analog Inputs</b>	5 ( $\pm 10V20mA$ individually selectable)
<b>Digital/Pulse Inputs</b>	4 Digital or 2 digital and 2 pulse inputs (Selectable De-bounce enable/disable)
<b>Digital Outputs</b>	4 Open Drain Outputs (2.5 Amp PTC, with 1500 W Transient protection)
<b>Power</b>	Battery 12 VDC
<b>Charger</b>	Solar or 16-18 VDC
<b>Memory</b>	<ul style="list-style-type: none"><li>• Data stored in 512K SRAM. RAM memory has lithium backup battery.</li><li>• Applications programs stored in 512K Flash.</li><li>• Flash loader stored in 512 K PROM</li><li>• Registry and Configuration files stored in 16K E<sup>2</sup>PROM</li></ul>
<b>Comm. Ports</b>	3 Ports Available:           1 - dedicated - PCCU 2 - RS232 or RS485 via Plug-In Modules
<b>I/O Module Interface</b>	Dedicated I <sup>2</sup> C Serial I/O Bus
<b>Keypad Interface</b>	Dedicated Interface for Optional Keypad Equipment
<b>LCD Interface</b>	Dedicated Interface for Liquid Crystal Display (LCD)
<b>Security Switch</b>	On/Off Bi-level on-board Security (See Chapter 3 for details)
<b>Scan Rate</b>	1 time per second

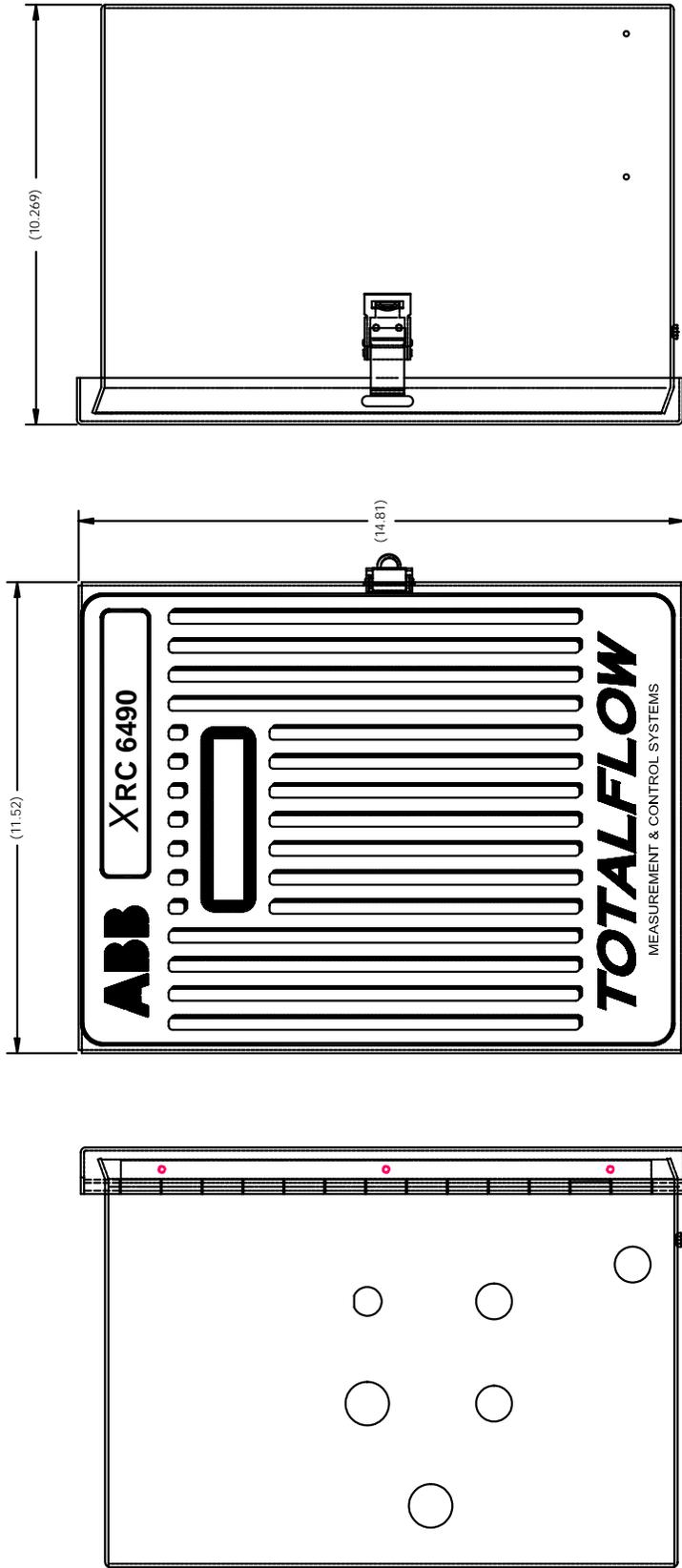


Figure 1-1 Model XRC 6490

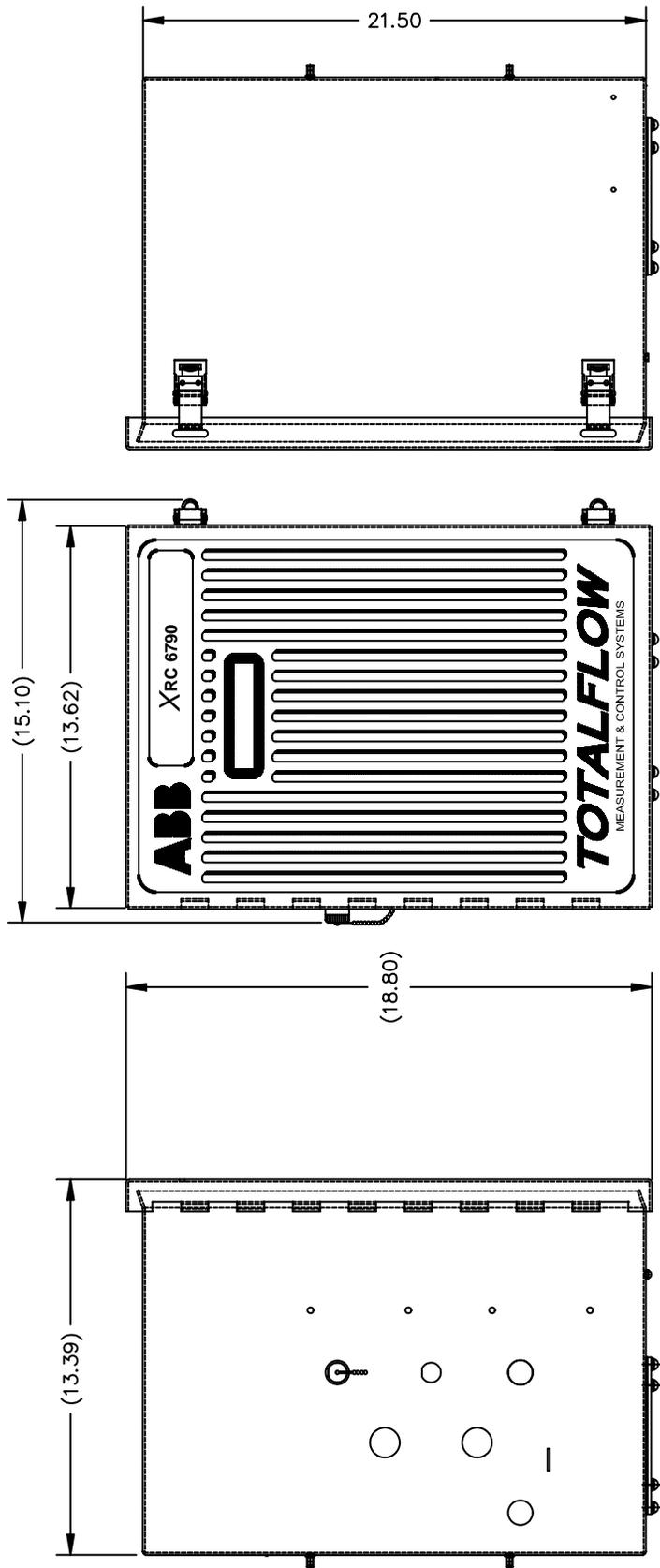


Figure 1-2 Model XRC 6790

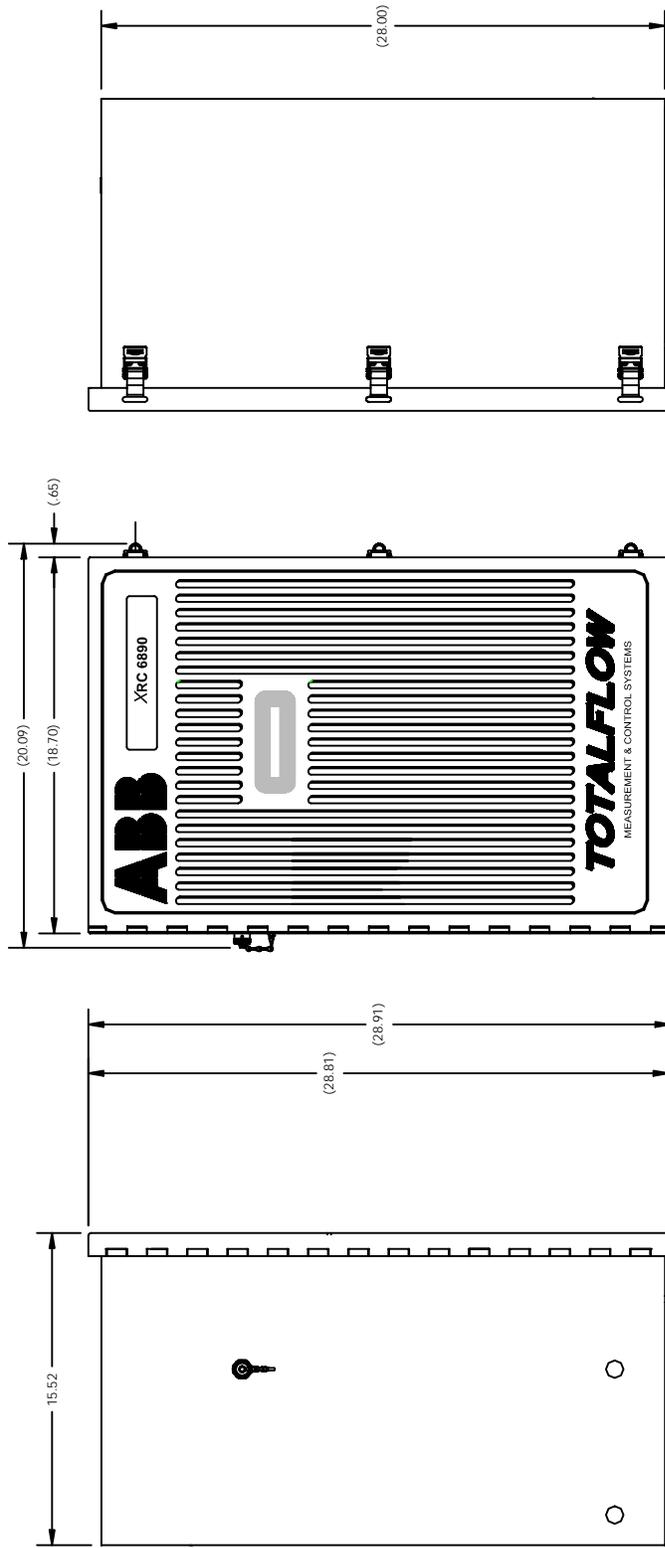
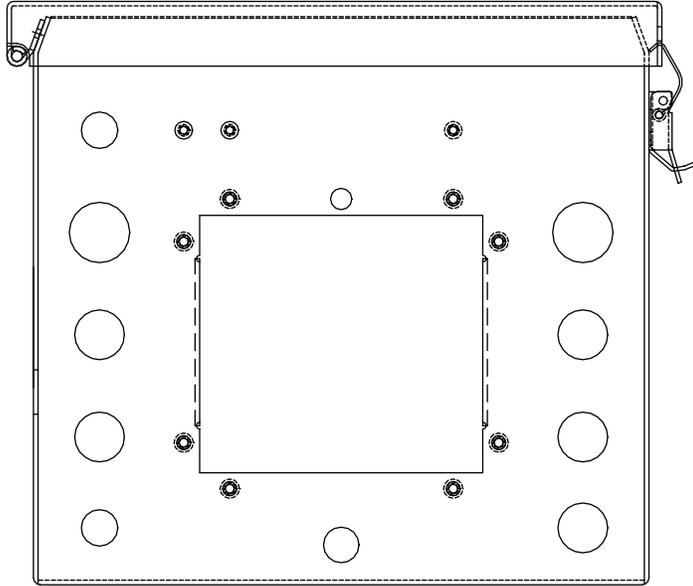
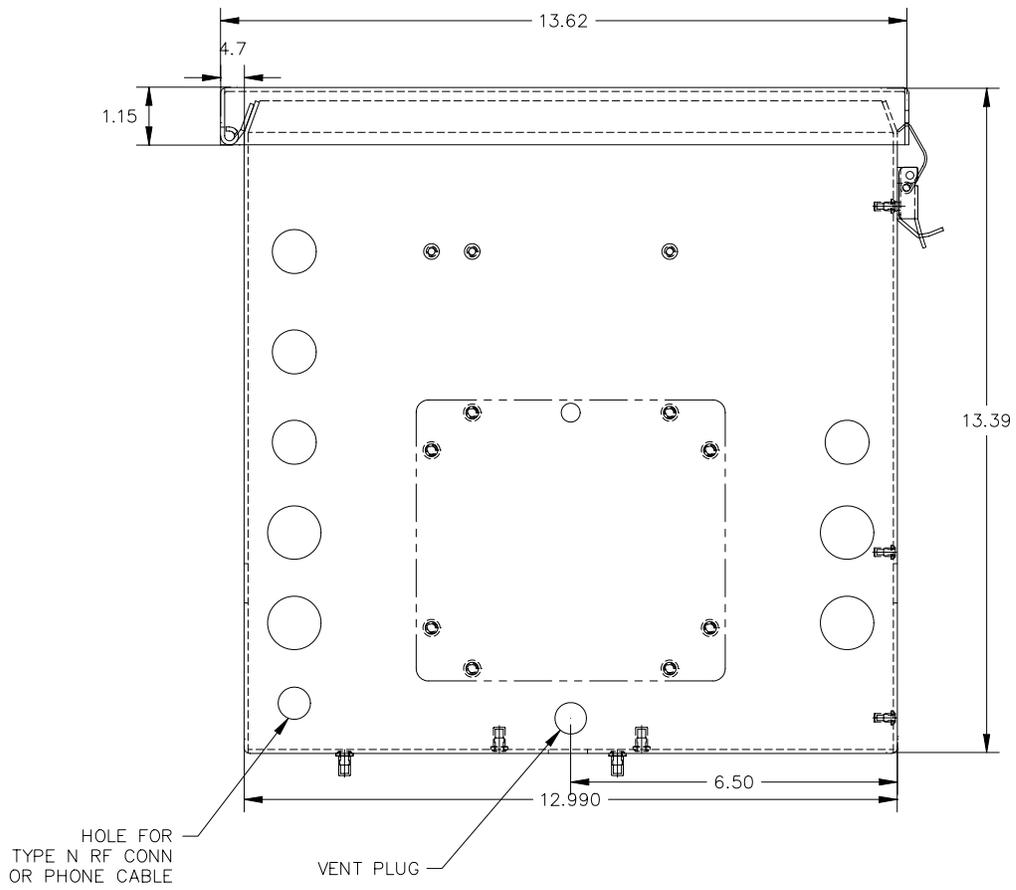


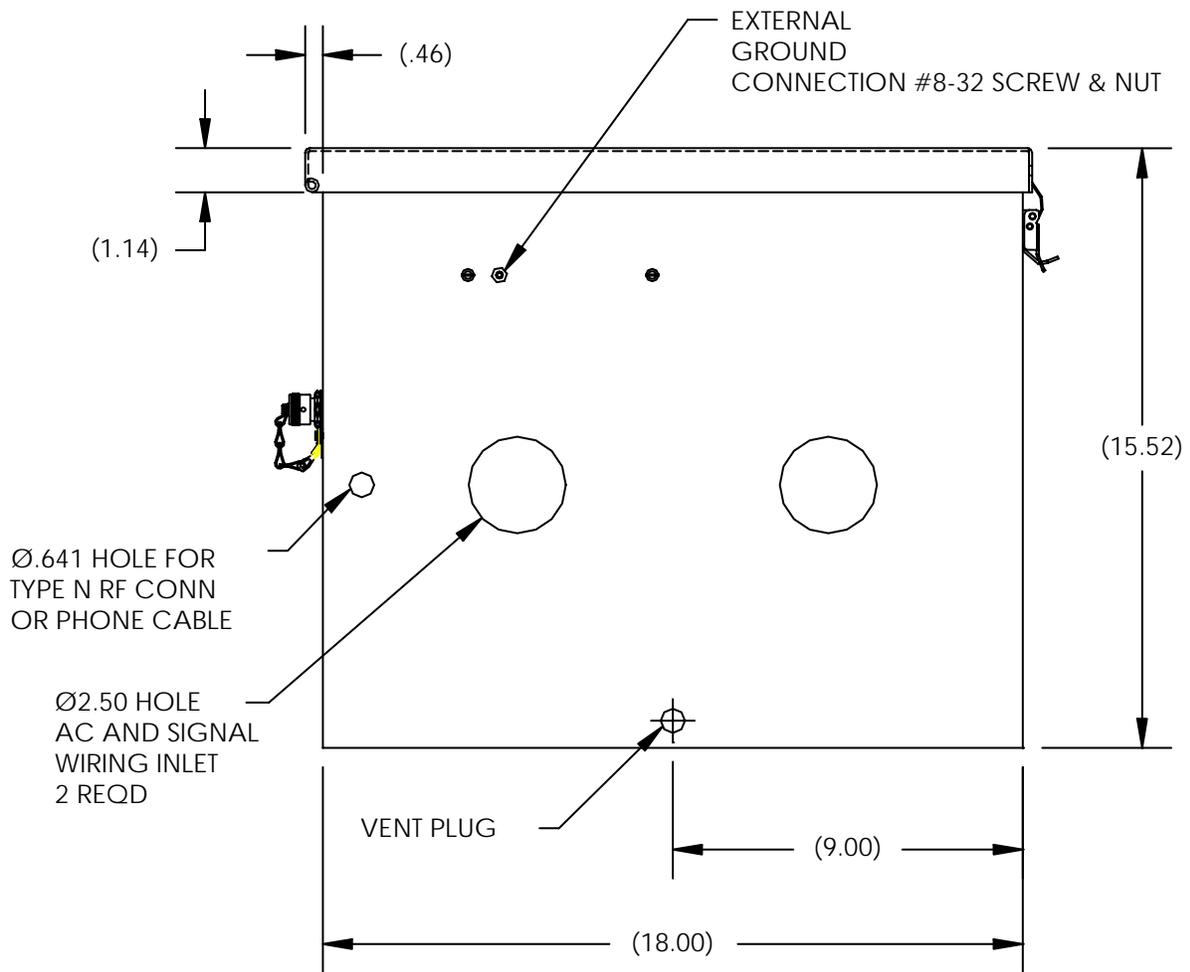
Figure 1-3 Model XRC 6890



**Figure 1-4 Bottom of Model XRC 6490**



**Figure 1-5 Bottom of Model XRC 6790**



**Figure 1-6 Bottom of Model XRC 6890**

## XRC Equipment

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The following drawings of system components reflect the layout of all the major functional parts when mounted in a XRC device. This system houses an internal main battery. In the 6490 and 6790, it is located behind the swing out plate. In the 6890, one or two batteries are located in the bottom compartment of the case and have no cover plate.

A removable communications enclosure can be provided that has been pre-drilled for mounting of many popular communications devices such as radios, cellular phones, modems, etc.

This enclosure meets NEMA 4X ratings and is designed for mounting in harsh environments (cold, hot, wet and salty).

With the exception of the size of the cases all models use identical components. These are the components of the XRC:

- Enclosure
- XRC-195 Board
- Power Supply & Communication Compartments
- Charger
- Modular I/O: Valve Control Interface Module, Analog Output (4-20mA) Module, Analog Input Module, Communication Interface Module and Combo Digital Module.
  - ◆ 6490 holds up to 3
  - ◆ 6790 holds up to 6
  - ◆ 6890 holds up to 14

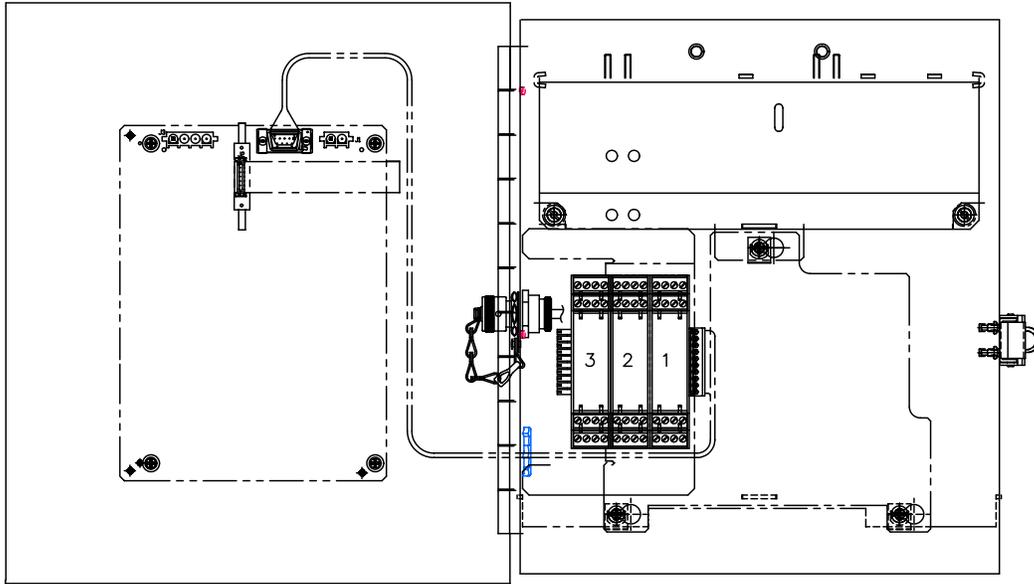
**Enclosures:** The enclosure consists of hinged-door box. The door provides a watertight, corrosion resistant seal between the outside elements and the XRC components. It is designed to meet Class I, Division 2, Groups C&D and is NEMA 4X rated. Opening the door's latch(s) allows access to electronics, battery, radio and modular components. This door may be locked for security purposes.

All models of the XRC provide an upper compartment to house a remote communication device; transceiver, cellular phone, etc.

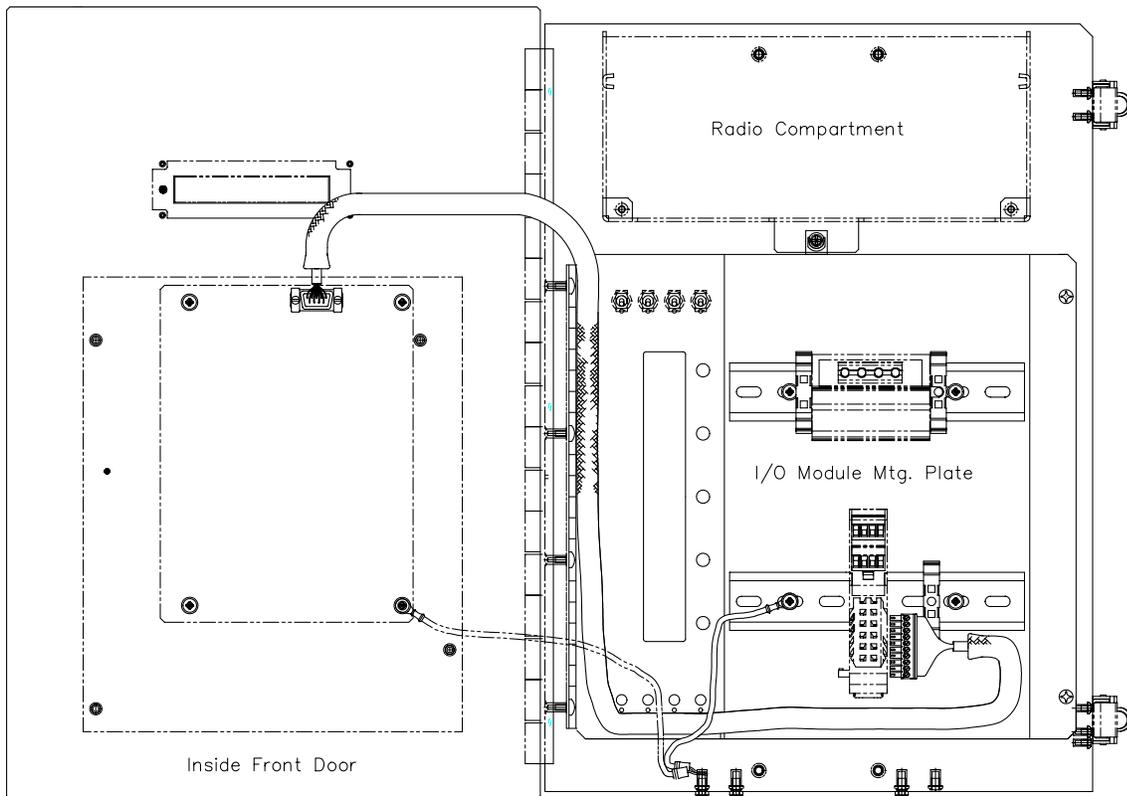
- **XRC 6490:** The battery sets in a central compartment directly behind the battery plate.
- **XRC 6790:** The battery sets in a central compartment directly behind a hinged cover plate holding the DIN rail and installed modular components.
- **XRC 6890:** The battery sets on the floor of the main compartment and houses the various optional battery packs that are available for the XRC; from one 8 ampere hours up two 70 ampere hour batteries.

**XRC-195 Board** The XRC-195 board is mounted on the inside of the door. All XRC on board input and output connections are made with snap-in connector terminals mounted directly on the board. The board uses a low power processor running at 11.0592 MHz with 512 K SRAM and 512 K PROM and 16K E<sup>2</sup>PROM. Other circuitry processes the inputs from the on board I/O and provides the interface to the LCD as well as the PCCU and optional key pad. Remote communications are handled by the RS232 and RS485 communication modules that plug directly into the board. The following XRC-195 Board drawing shows all the major functional parts and their locations when mounted.

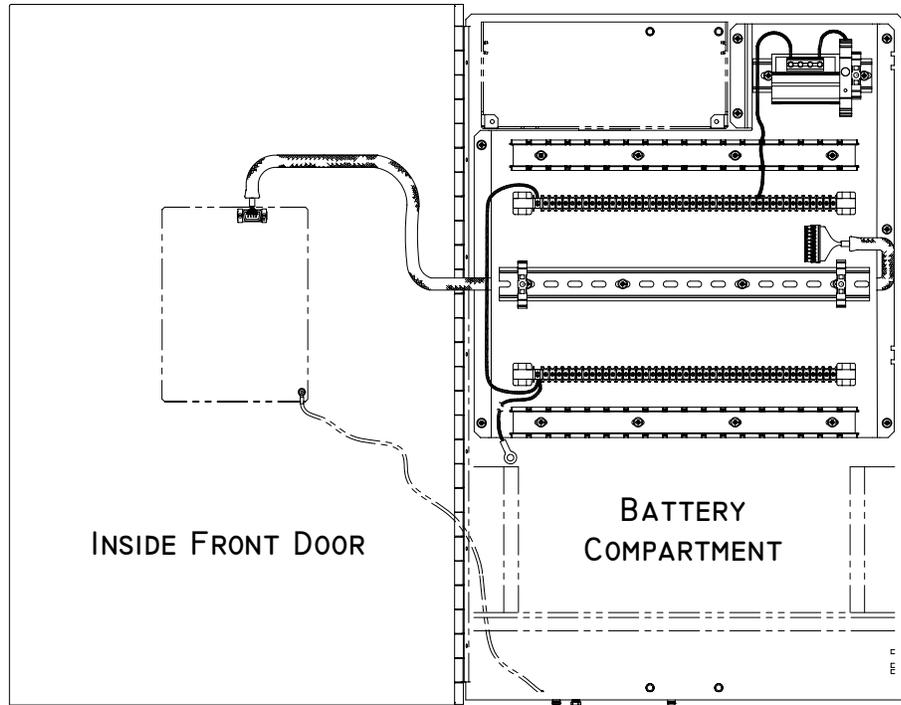
**Solar Panel** The XRC is configurable for a 10-Watt, 20-Watt or 30-Watt solar panel. The panel is designed for mounting on a 2-inch extension pipe above the XRC, on top of or a the side of a meter house.



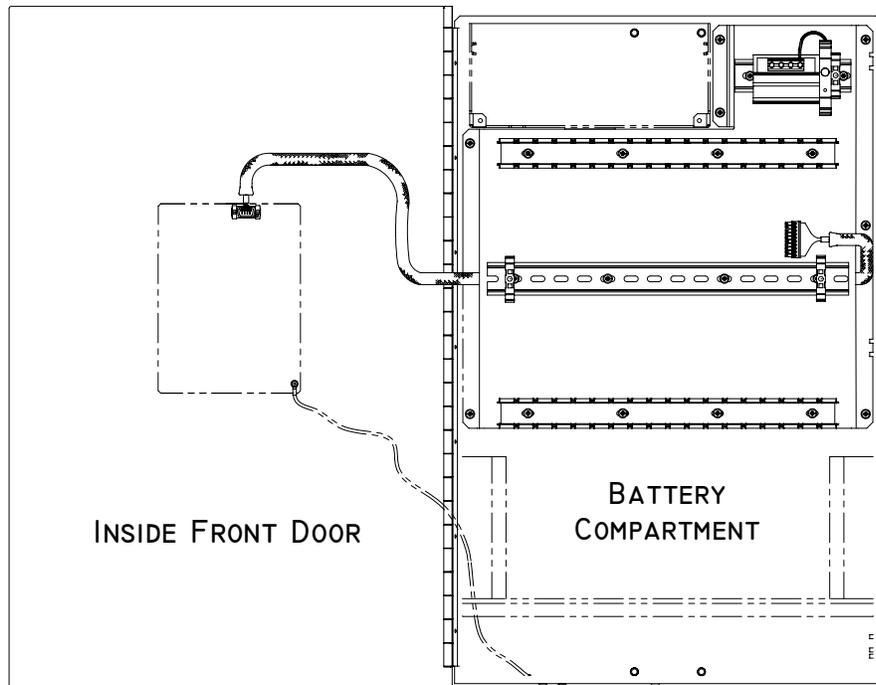
**Figure 1-7 XRC 6490 Inside View with I/O Modules Installed**



**Figure 1-8 XRC 6790 Inside View with I/O Modules Installed**



**Figure 1-9 XRC 6890 Inside View with Busbar**



**Figure 1-10 XRC 6890 Inside View without Busbar**



**Table 1-1 XRC-195 Board Identifications-Complete View**

<b>ID Number</b>	<b>Description</b>
1	Battery Connection
2	I/O Module Interface
3	LCD Display Interface
4	PCCU Interface
5	SRAM (Lithium backed)
6	Flash Program Memory
7	Prom Loader and Utilities Memory
8	Factory Maintenance Interface
9	Keypad Connector
10	Security Switch
11	Lithium Battery
12	Battery Cover
13	Battery Mounting Bracket
14	Memory Backup Enable/Disable
15	Analog Input Connectors
16	Analog Input Type Selection Jumper Pins
17	Auxiliary Power Output Connectors
18	DeBounce Enable/Disable
19	B Upper Pulse Inputs and Digital Outputs Connectors
20	A Lower Pulse Inputs and Digital Outputs Connectors
21	Remote Comm 2: Connectors
22	Remote Comm 1: Connectors
23	Remote Comm 2: Module Plug-in
24	Remote Comm 1: Module Plug-in
25	External Charger (Solar Panel) Connectors

## Functions of the XRC

---

Primary functions of the XRC reflect a design that is practical and efficient. The XRC is simple to use and easy to learn. It allows you to perform the following with minimum effort, maximum speed and greater accuracy.

### Capabilities

- Monitoring of the operational limits to insure detection and reporting of malfunctions or abnormal site conditions
- Remote Communications
- Realtime measurement and control
- Acceptance and storage of system parameters from PCCU32 4.3 or greater
- Storage of data records
- Storage of operational events
- Expandable I/O count to support most customer applications
- Multiple enclosure sizes provided to fit specific I/O requirements
- Custom IEC 1131 Applications to fit specific customer requirements

### Additional Features

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

- Programmable bi-level security system prevents unauthorized communication and configuration of the XRC (See Chapter 3)
- Internal crystal controlled clock providing a highly stable time base for the system
- Optional battery packs to extend operation for longer periods without power
- Three available charging sources -
  - External solar panel (standard)
  - External AC power
  - External 24/12 VDC power
- LCD (liquid crystal display) programmable to allow monitoring of operations (for example, displays flow rate, volumes, etc.)
- Rugged, aluminum, powder coated, NEMA 4X enclosure, lockable to prevent internal access
- Optional ability to allow rapid data collection over several communication links.
- Additional I/O for valve control, pressure, level monitoring, remote communication, etc.
- Optional Keypad

### XRC Display Function

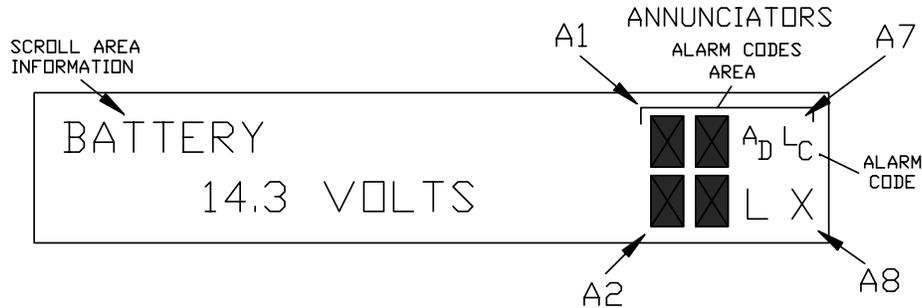
During the operation of the XRC the front panel LCD continuously scrolls through the operating parameters. Your system will come with a group of standard system displays, however any parameter with a Register Address can be displayed.

See "Program Display" in Chapter 3 for more details.

## Status and Alarm Conditions

One of the primary functions of the XRC is for monitoring operational conditions; therefore, the XRC indicates when an unusual or “alarm” condition is occurring. For how to use the display to troubleshoot, refer to Chapter 6; Troubleshooting.

Using new technology adaptable for multi-tube devices, the status and alarm code locations are programmable. This allows the user to program each annunciator to reflect different application or tube types. The single tube device will come with a standard display pre-programmed, but changeable.



**Figure 1-12 Liquid Crystal Display and Indicators**

**Table 1-2 Status and Alarm Description**

Indicator	Description
<b>I/O Sub-System</b>	
L <sub>L</sub>	<i>Low Lithium Battery Alarm:</i> When L <sub>L</sub> (low lithium) is displayed, lithium battery voltage is below 2.5 Vdc. A new lithium battery measures approximately 3.6 Vdc.
L <sub>C</sub>	<i>Low Charger:</i> Displayed if XRC battery charging voltage is (+)0.4 Vdc or is less than or equal to battery voltage.
A <sub>D</sub>	<i>A to D Failure:</i> Displayed if A to D Converter Absolute Differential Pressure, Absolute Static Pressure or temperature readings exceed maximum counts or are less than minimum counts.
<b>Communications Protocols</b>	
→	<i>Transmitting Data:</i>
←	<i>Receiving Data:</i>
!	<i>Nak. Negative Acknowledgement w/packet list.</i>
+	<i>Ack. Positive Acknowledge of receipt of request.</i>
⏏	<i>Waiting for Ack. Waiting for response after transmission.</i>
⏏	<i>ID Recognized.</i>

*Continued on Next Page*

## Status and Alarms Description, Continued

Table 1-2 Status and Alarm Description, Continued

Annunciator	Description
<b>Communications Protocols, Cont.</b>	
†	<i>Listen Cycle.</i> 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	<i>MODBUS ASCII:</i> Modbus ASCII protocol selected on this port.
m	<i>MODBUS RTU:</i> Modbus RTU protocol selected on this port. Same options available as above.
L	<i>Local Protocol.</i> Displayed when PCCU part is active and running TOTALFLOW Local Protocol.
¥	<i>Packet Protocol.</i> The Totalflow Packet Protocol selected on this port.
S	<i>Square D Protocol:</i> Square D protocol is running on this port. Same options available as above.
<b>Valve Control</b>	
V	Displayed when Valve Control option is on an Expanded I/O board (plug-in RTU). Other Valve Control symbols do not apply.
┌	Valve Control option installed. Valve is in full open position.
└	Valve Control option installed. Valve is in full closed position.
↑	Valve Control option installed. Valve is opening (open signal is being sent to valve actuator).
↓	Valve Control option installed. Valve is closing. (close signal is being sent to valve actuator).
Ö	Valve Control option installed. Valve controller override conditions met (DP/SP override set point or Low Battery).
L <sub>L</sub>	Valve Control option installed. Local Lock-out is initiated.
<b>Measurement Application</b>	
B <sub>F</sub>	Back Flow Condition. Visible only when DP variable displayed.
Z	Zero Flow Condition: Visible only when Flow Rate displayed.
H	<i>Hold.</i> Displayed when HOLD flag is active. Also displayed when HOLD flag is active for the following: 1. PCCU is being calibrated or 2. A to D Converter cannot be read.
A	<i>Alarm Condition.</i> Need to view alarm. You may need to compare application limits to current values to determine where the alarm condition is present.
<b>Display Application</b>	
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.



# 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 XRC 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 XRC. You may store these in the back of this manual under the tab Wiring Diagrams.

Installation procedures, presented within this Chapter, are applicable to all XRC Models.

## Highlights

This Chapter covers the following topics:

Topics	See Page
Unpacking & Inspection	2-2
Pipe Mount Installation	2-2
Wall Mount Installation	2-8
Battery Pack Installation	2-12
Solar Pan Installation	2-14
AC Charging Unit Installation	2-18

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## Unpacking & Inspection

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<b>Unpacking</b>	<p>The XRC is 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.</p> <p>Carefully remove the items from each carton.</p>
<b>Inspection</b>	<ul style="list-style-type: none"><li>• Inspect the shipping carton for damage. If the shipping carton is damaged, keep it until the contents have been inspected for damage.</li><li>• Inspect the unit exterior for dents, chipped paint, etc.</li><li>• Inspect the LCD window for breakage.</li><li>• Open the housing by first removing the bolt and releasing the latch/latches.</li><li>• Visually inspect the Digital PC Board, cables, and connectors for damage.</li></ul>
<b>Damaged Components</b>	<p>If any components has 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.</p>

## 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.

<b>Materials Supplied</b>	<ul style="list-style-type: none"><li>• Two U-bolts plus fastening hardware</li><li>• XRC mounting brackets</li></ul>
<b>Material Not Supplied</b>	<ul style="list-style-type: none"><li>• One pipe Saddle</li><li>• One 40-inch, 2-inch pipe</li></ul>

**FYI**



Optional equipment may be ordered from Totalflow.

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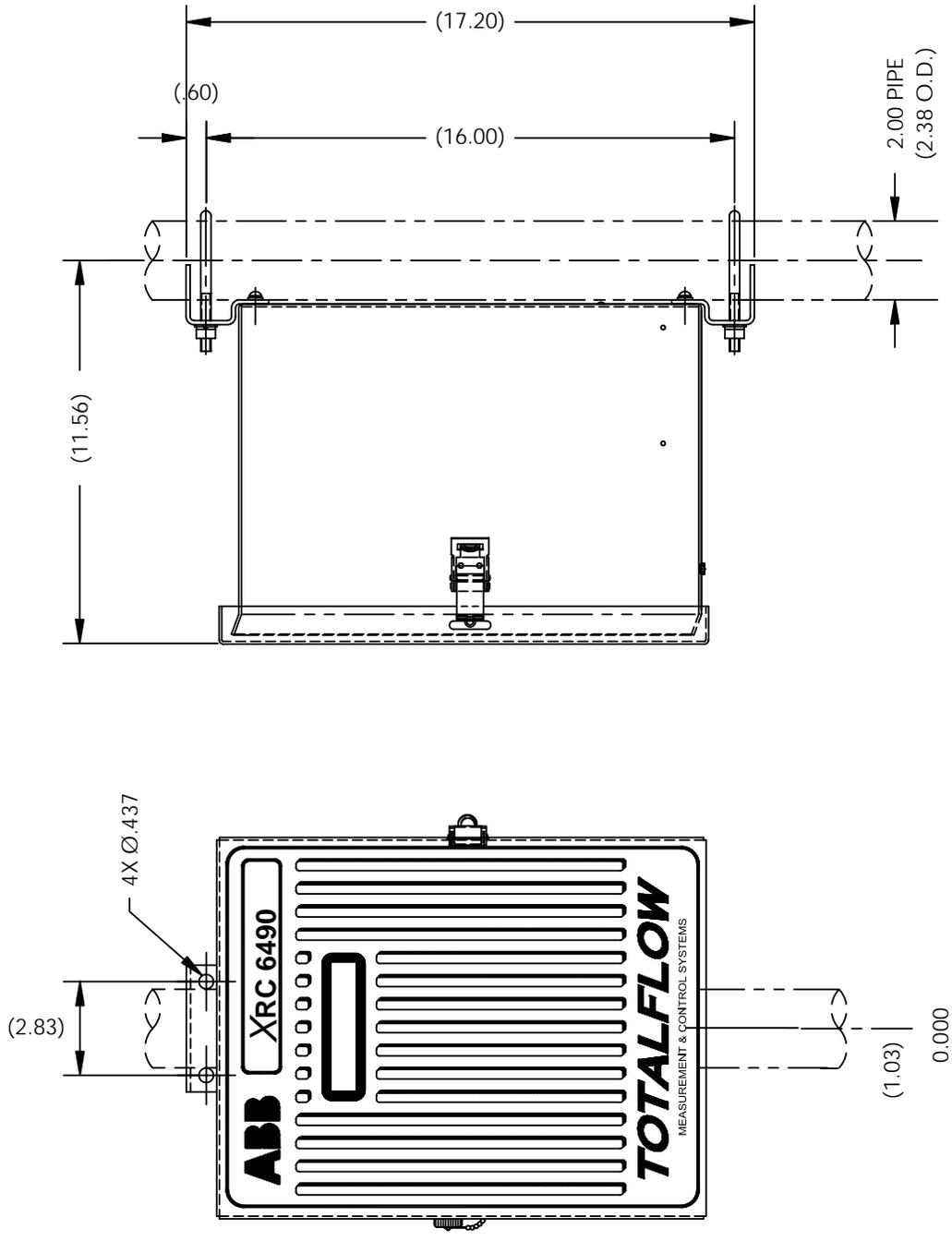


Figure 2-1 Model XRC 6490, Pipe Mounted

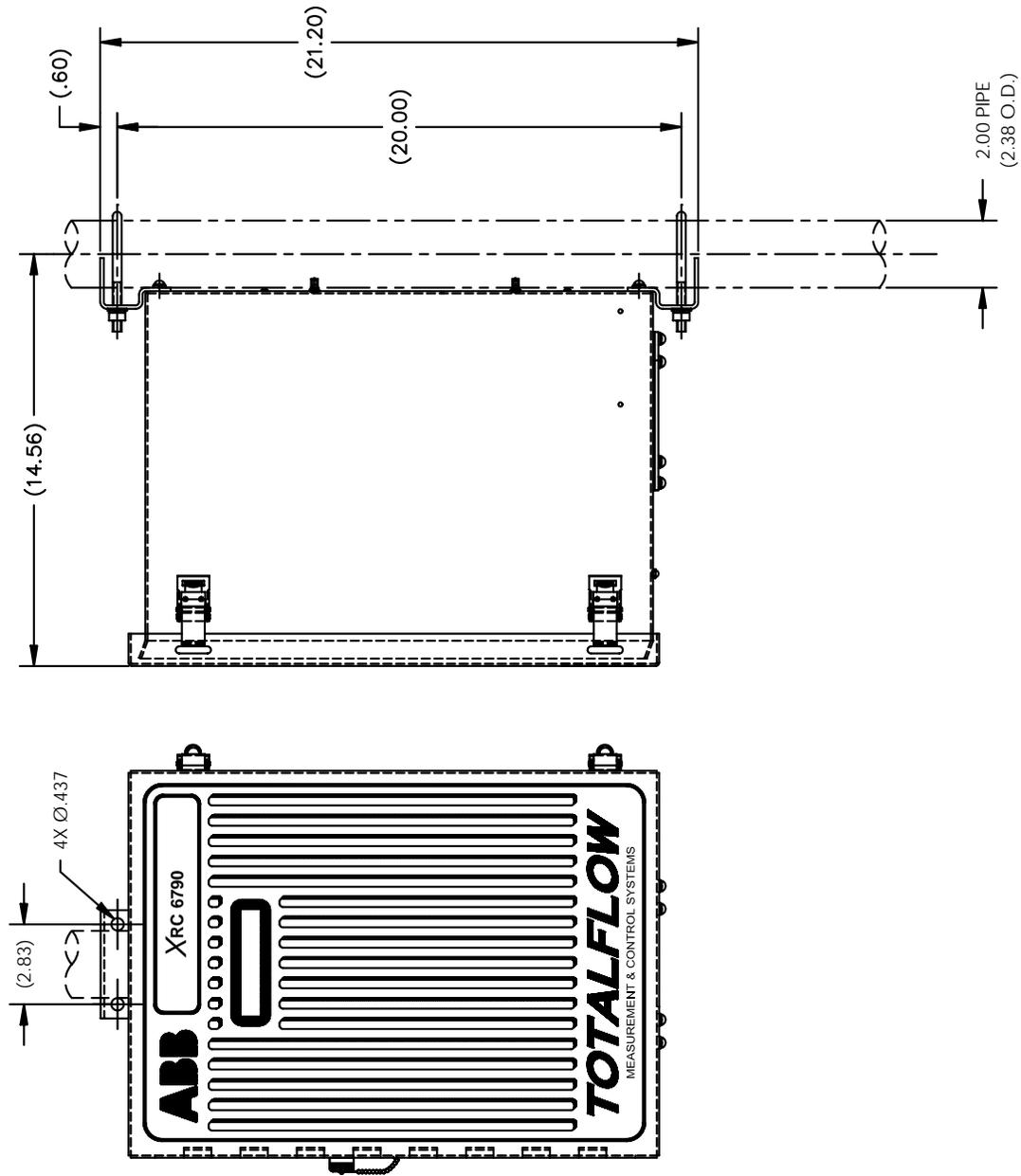


Figure 2-2 Model XRC 6790, Pipe Mounted

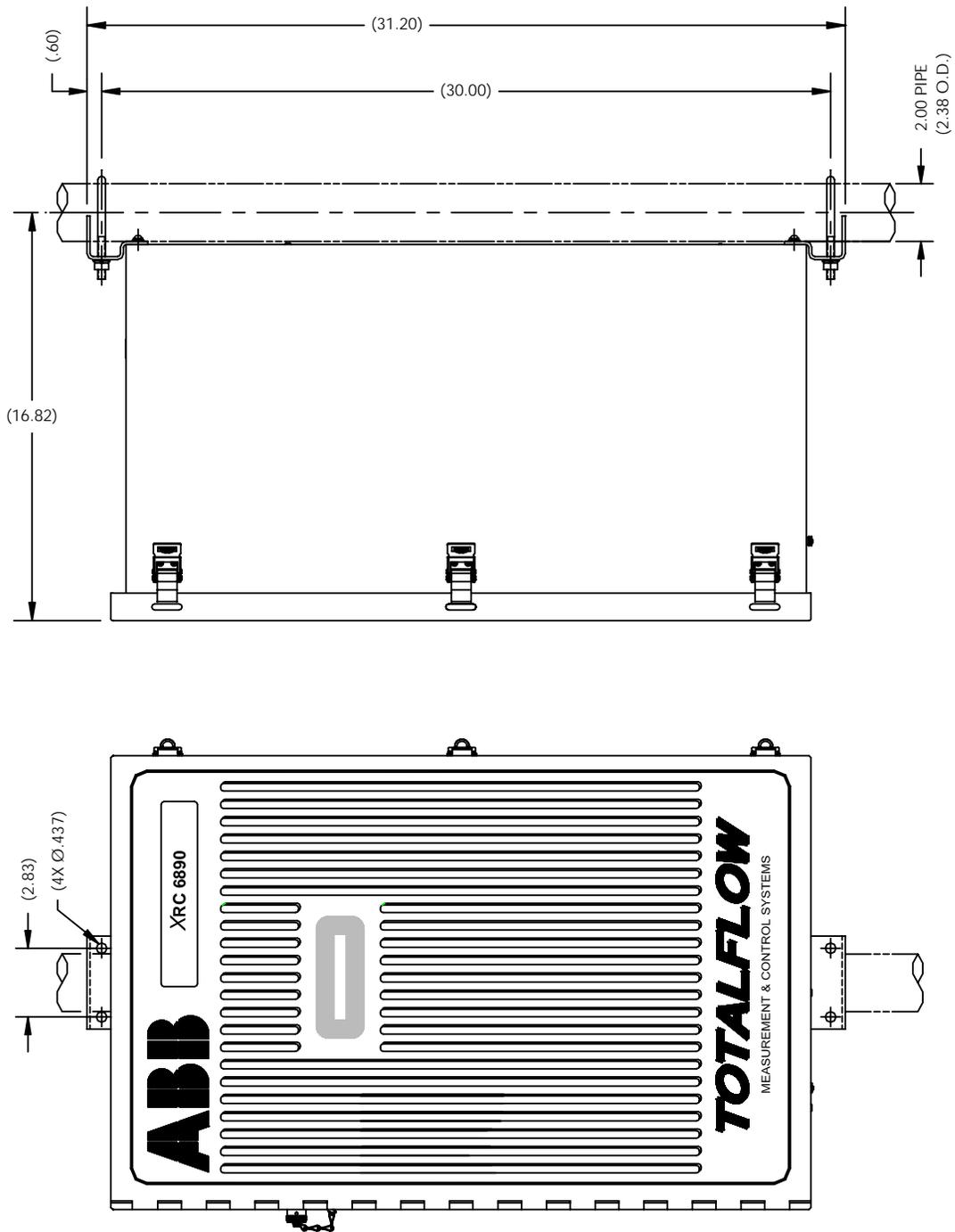


Figure 2-3 Model XRC 6890, Pipe Mounted

## Pipe Mount Installation, Continued

### Instructions

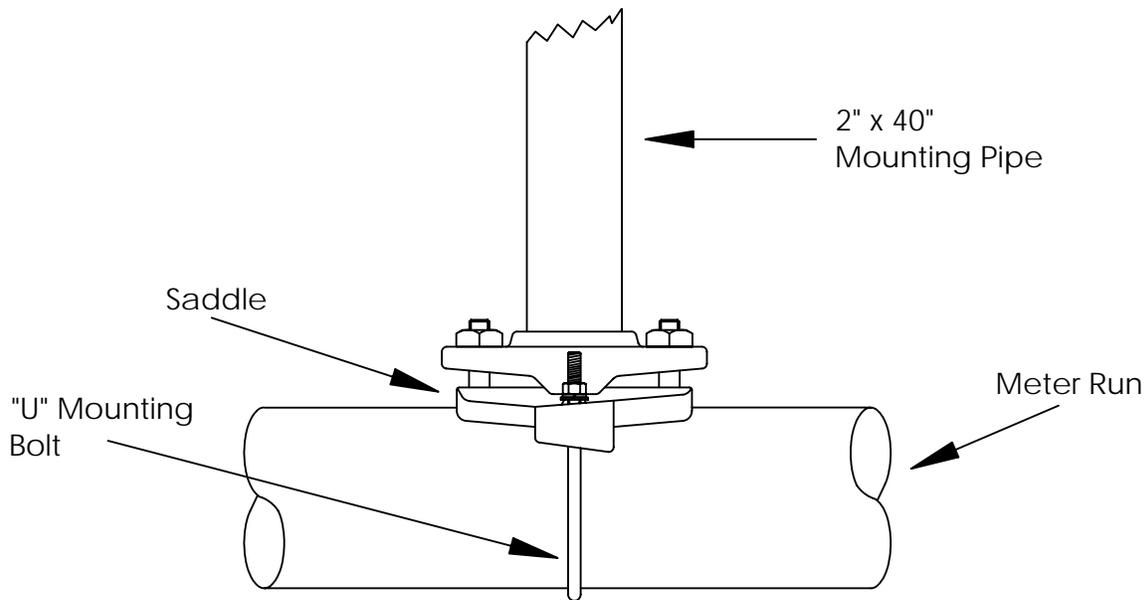
Step	Procedure
1.	Position pipe saddle on meter run. See Figure 2-3. Select a location that allows easy user access and is close to equipment.
2.	Temporarily attach Saddle on meter run pipe using U-bolt and associated hardware.
3.	Screw 2" by 40" mounting pipe into Saddle. Place level against pipe and vertically align. Adjust pipe, mounted in saddle, until vertical alignment is achieved.
4.	After vertical alignment, securely tighten 2" by 40" pipe in 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 an XRC on 2" mounting pipe. To install the XRC, it is recommended that two people perform 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.



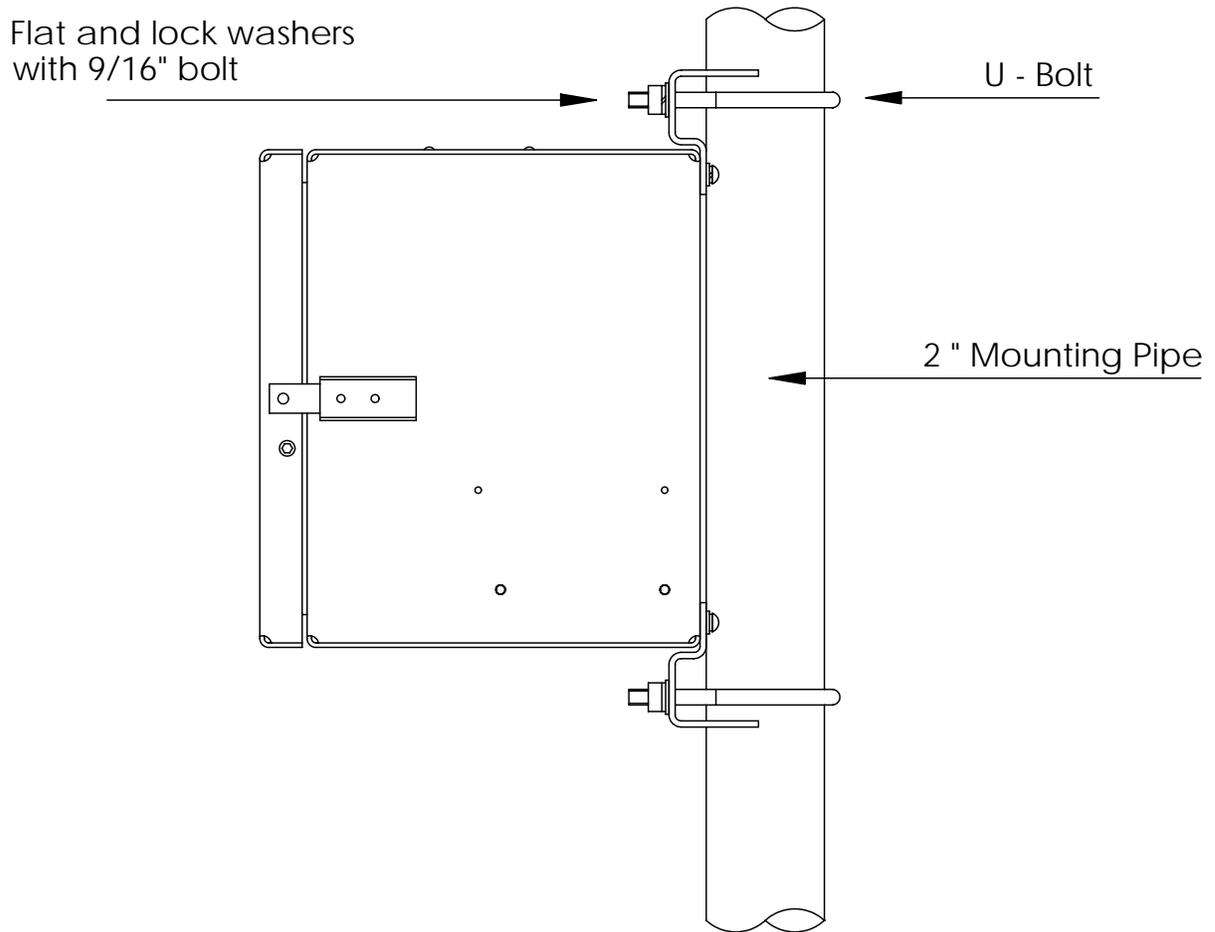
**Figure 2-4 Typical Pipe Saddle Installation**

*Continued on Next Page*

## Pipe Mount Installation, continued

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Step	Procedure
5.	Position the XRC in position on the 2" mounting pipe and secure in place with two U-bolts, flat washers, lock washers and two 9/16" bolts.



**Figure 2-5 XRC Pipe Mounting**

## 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 outline drawing for mounting dimensions requirements.

### Optionally Supplied Materials

- Two U-bolts w/ fastening hardware
- Enclosure mounting brackets

### Material Not Supplied

- Four 1/4" x 1/4" machine bolts
- #10 screws

### Caution



If the XRC 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 XRC door from being opened to access interior installed components or to interfere with installation of the solar panel or other charging power sources.

### Instructions

Step	Procedure
1.	Refer to Figures 2-5 or 2-6 XRC Outline Drawings, drill mounting holes in wall supports.
2.	Remove 2" mounting post brackets, from back of XRC, and install supplied wall mounting brackets.
3.	Lift and align XRC wall mounting brackets with mounting holes drilled in wall.
4.	Insert 1/4" x 1/4" diameter machine bolts through XRC mounting brackets into wall. Securely tighten all bolts to secure unit to wall.

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*Continued on Next Page*

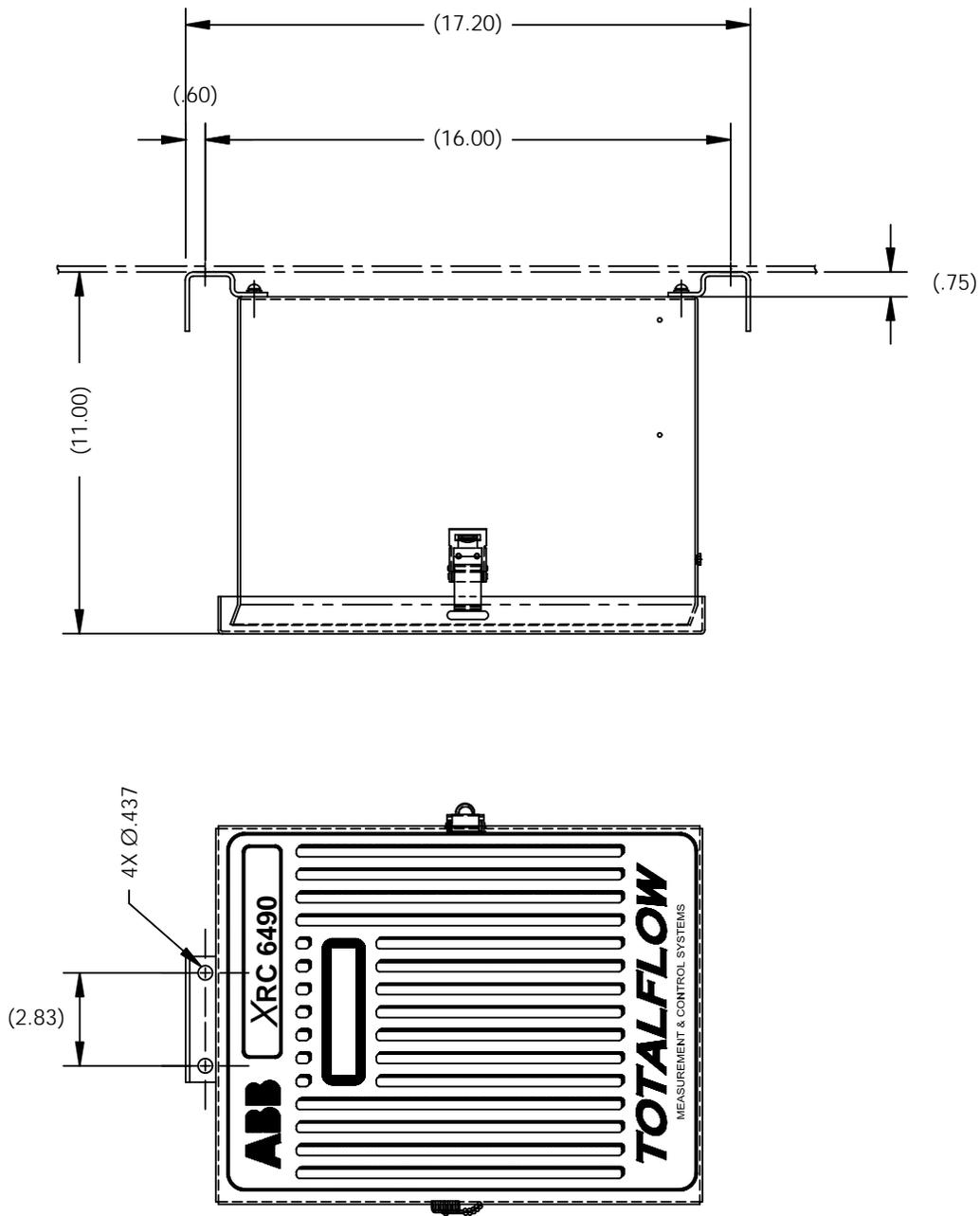


Figure 2-6 Model XRC 6490, Wall Mounted

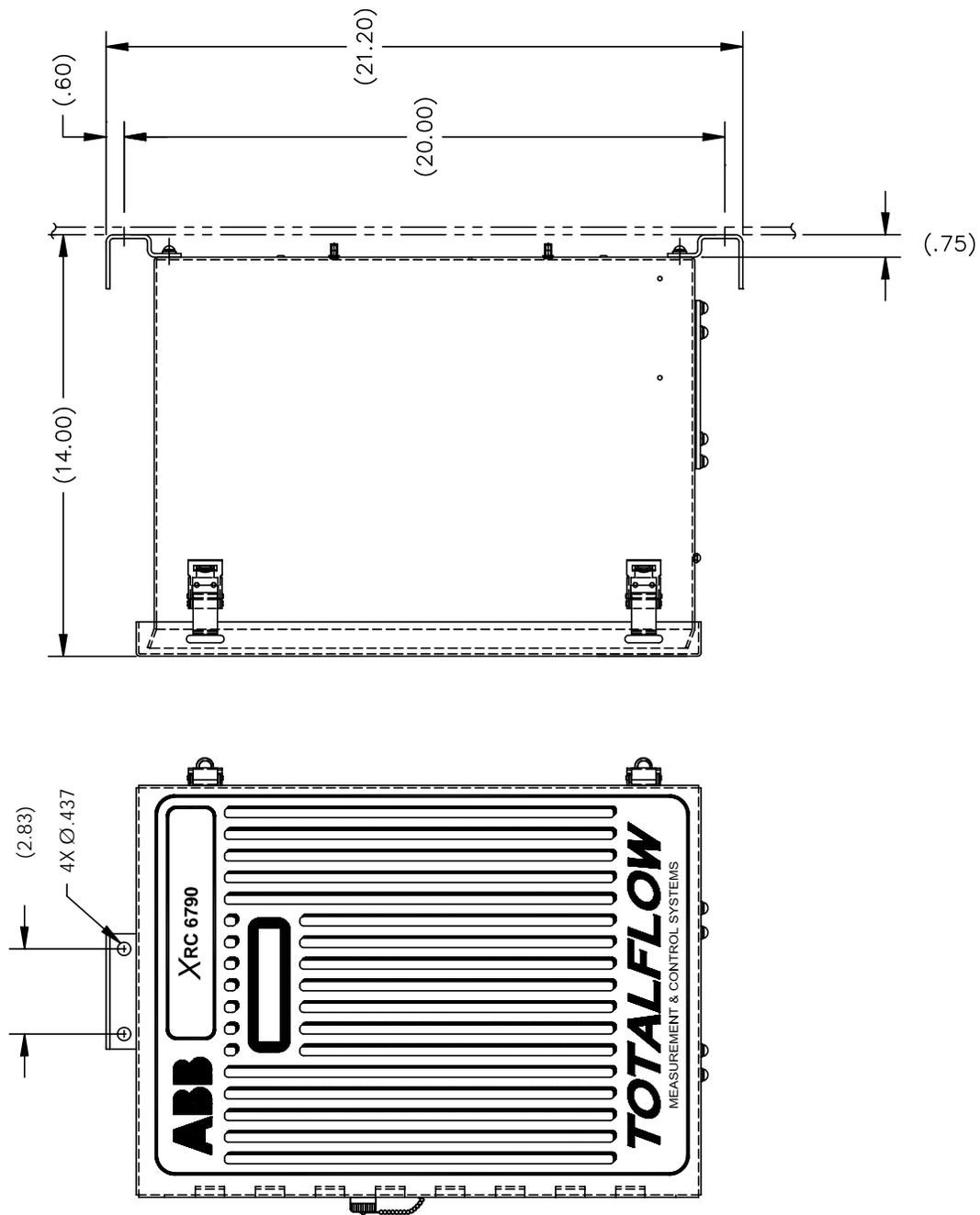


Figure 2-7 Model XRC 6790, Wall Mounted

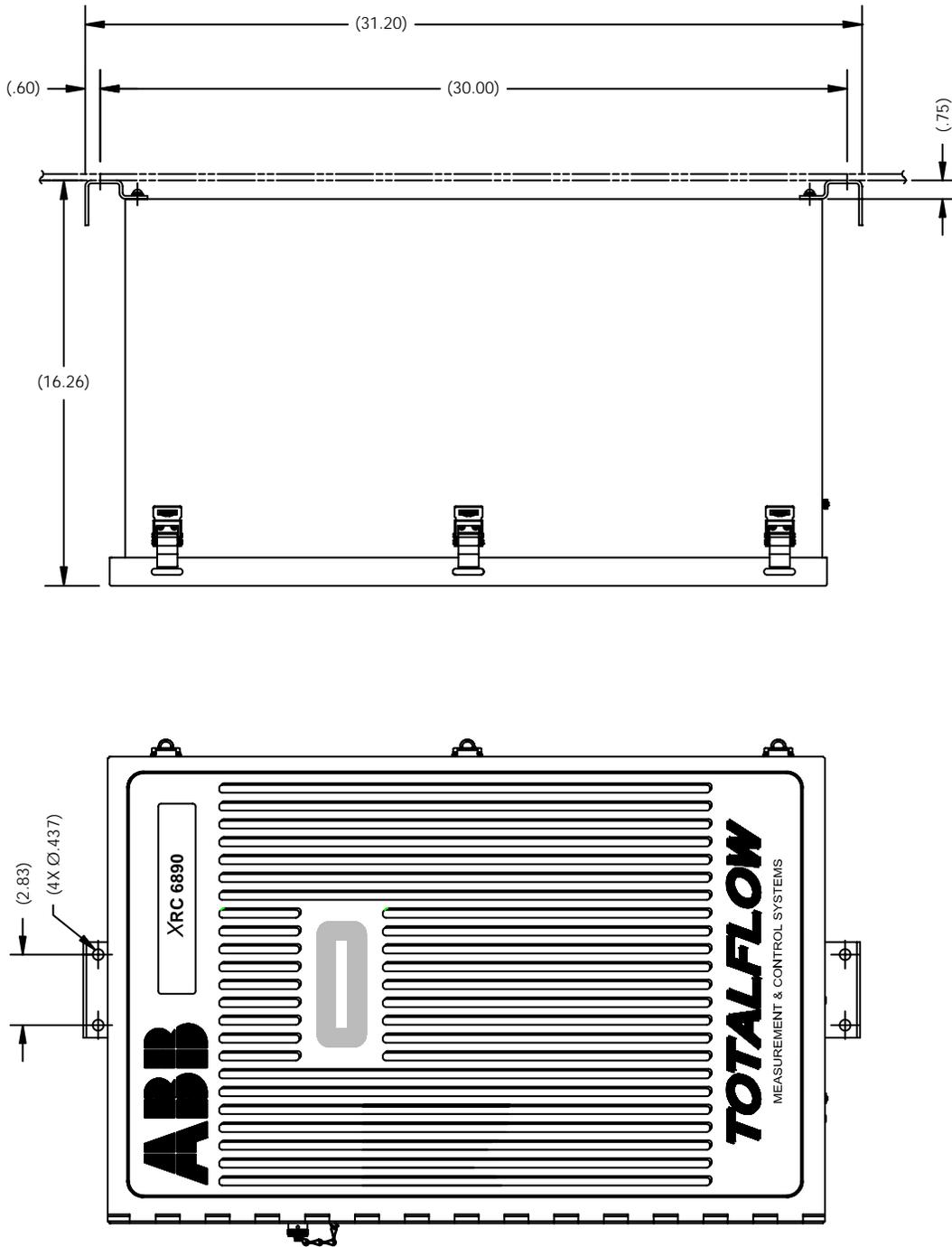


Figure 2-8 Model XRC 6890, Wall Mounted

## Battery Pack Installation

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

### Installation

In the following procedure, the common name for a component, its jumper number if available (Abbreviated J) or part is followed by a number in parentheses. For a complete overview of the XRC-195 Board, see Figure 1-11.

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

### Instructions

Step	Description
1.	Insert battery pack into lower compartment. Insert battery pack with its long dimension facing outward.
2.	Connect battery pack connector to Digital Board BATTERY CONN J16 (Figure 2-9 Item #1) connector, located in upper right corner of Board.
3.	Observe LCD, the display should be on and scrolling through the startup diagnostics sequence.

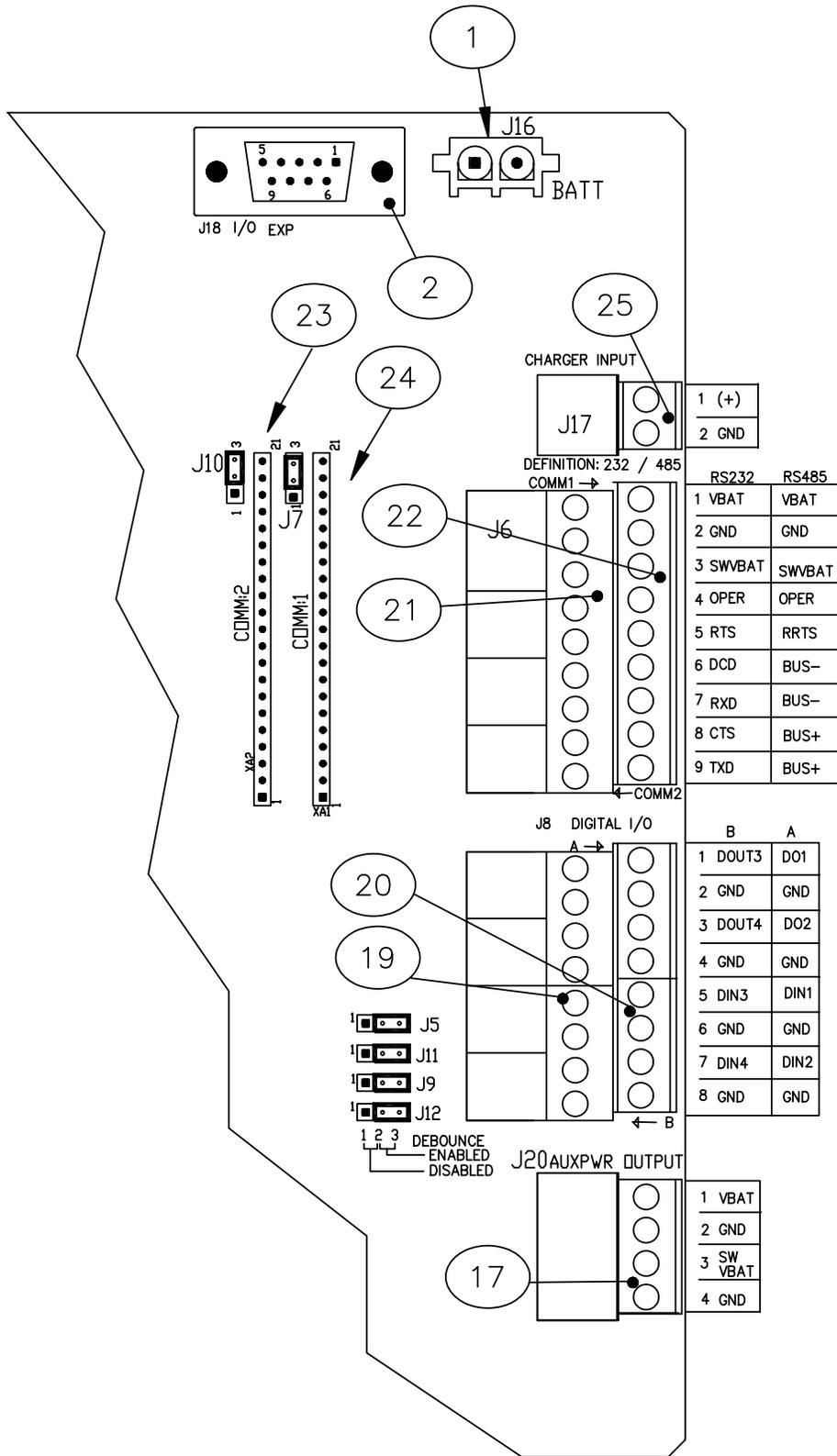


Figure 2-9 XRC-195 Board Cutout - Installation

**Table 2-1 XRC-195 Board Identifications-Installation**

<b>ID Number</b>	<b>Description</b>
1	Battery Connection
2	I/O Module Interface
17	Auxiliary Power Output Connectors
19	B Upper Pulse Inputs and Digital Outputs Connectors
20	A Lower Pulse Inputs and Digital Outputs Connectors
21	Remote Comm 2: Connectors
22	Remote Comm 1: Connectors
23	Remote Comm 2: Module Plug-in
24	Remote Comm 1: Module Plug-in
25	External Charger (Solar Panel) Connectors

## **Solar Panel Installation**

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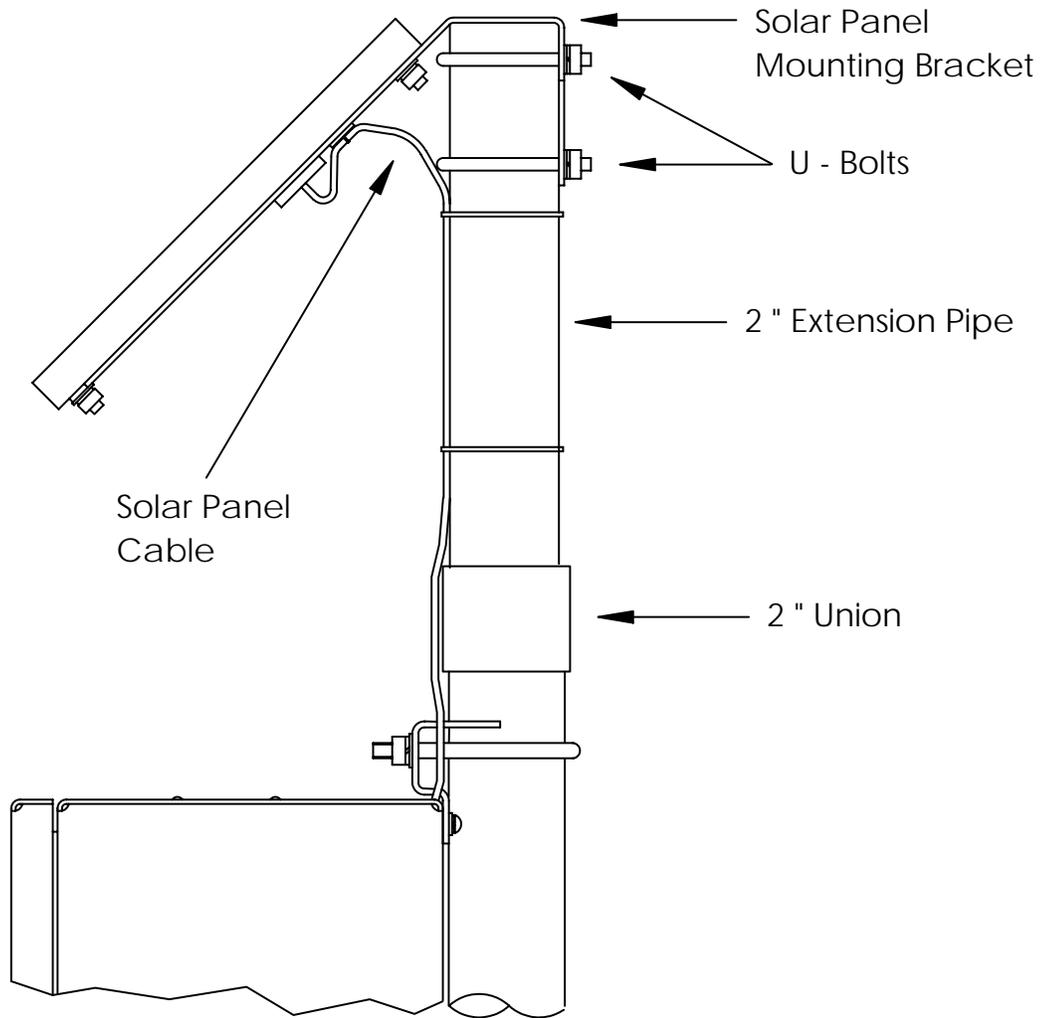
The Solar Panel is designed for outdoor mounting on a 2" extension pipe installed on upper end of XRC 40" mounting pipe. Solar panel must be mounted within 12 feet of XRC (other cable lengths available). For wall mounted XRC it can be mounted on top or side of meter house.



Do not connect solar panel power cable to the XRC unless main battery pack has been connected to J16 (Figure 2-9 Item #1). For a complete overview of the XRC-195 board, see Figure 1-11.



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.



**Figure 2-10 Typical Solar Panel Installation**

## Solar Panel Installation, Continued

---

### Procedure

Our standard solar panel must be mounted within 12 feet of XRC. For Solar Panel mounting, the following materials are required.

In the following procedure, the common name for a component, its jumper number if available (Abbreviated J) or part is followed by a number in parentheses. For a complete overview of the XRC-195 Board, see Figure 1-11.

### Materials Supplied

- One Solar Panel
- Two U-Bolts and fastening hardware
- Solar panel cable (Standard is 12', other lengths are available)
- Solar Panel Mounting Bracket (if not already attached to Solar Panel)

### 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 union.

### 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 union to top end of XRC 40" mounting pipe. Securely tighten.
2.	Install 2" pipe extension into union and securely tighten.
3.	Check solar panel polarity using digital voltmeter to insure proper connection is made.
4.	Install Solar Panel on mounting bracket, if required, with provided hardware. Install Solar Panel Cable if required.

### Caution



DO NOT connect other end of Solar Panel Cable to XRC until instructed to do so.

5.	Attach Solar Panel mounting plate to top end of 2" extension pipe with U-bolts and associated mounting hardware. Do not tighten U-bolts until Solar Panel has been correctly orientated.
6.	For northern hemispheres, position Solar Panel facing south. For southern hemispheres, position Solar Panel facing north. For optimum charging, solar panel should not be in shadows for the majority of the day. Panel should be kept clean for maximum charging.

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## Solar Panel Installation, Continued

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### Caution



Do not connect solar panel power cable to the XRC unless main battery pack has been connected to J16 (Figure 2-9 Item #1).

Step	Procedure
7.	The Solar Panel power cable is connected to XRC Digital Board EXT CHGR (J17) terminals (Figure 2-9 Item 25). Insert Solar Panel power cable through an access hole on side of case. Allow enough power cable to extend into XRC for cable connection to EXT CHGR +/- termination's on J17.
8.	Before making connections to terminal block, trim wire ends back 1/4" and remove associated terminal block (J17) from Digital Board.  Loosen terminal block securing screws, insert wire then retighten. Connect Solar Panel (+) lead to + terminal and (-) wire to - terminal. Reinstall terminal block with wires attached (J17).
9.	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

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The AC Power Charging Unit maintains a constant voltage charge on installed battery pack. There are many different types and styles. Each unit will come with wiring instructions. Generally, you should follow the steps listed below.

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

- 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.

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

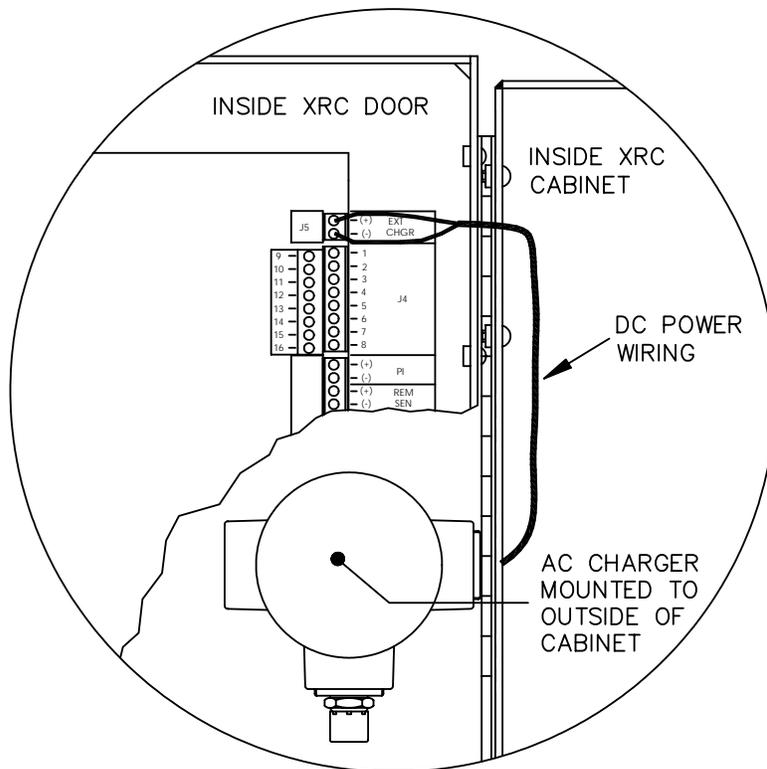
**Instructions** In the following procedure, the common name for a component, its jumper number if available (Abbreviated J) or part is followed by a number in parentheses. For a complete overview of the XRC-195 Board, see Figure 1-11.

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 XRC so that AC charging unit can be mounted without obstruction.
3.	Feed AC Charger DC power lines into XRC. Allow enough cable to extend into unit for connection to EXT CHGR +/- terminals J17 (Figure 2-9, Item# 25).
4.	Connect AC Battery Pack Charger to XRC using supplied sealing ring and nut.  To prevent moisture from entering XRC after installing AC Battery Pack Charger, be certain associated connector, at Charger 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 J17 terminal block (Figure 2-9, Item# 25) from Digital Board.  Loosen terminal block securing screws, insert black wire into plus (+) terminal (top) and white wire in negative (-) terminal (bottom). Retighten screws and reinstall terminal block with wires attached.

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## AC Charging Unit Installation, Continued

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 the AC Charger. Connect the ground wire to the green screw.
7.	Verify that the DC power wires are terminated properly inside the cabinet and verify that the main battery pack is plugged into J16 (Figure 2-9, Item# 1). Apply AC power to the AC Charger.
7.	Monitor DC charging voltage by observing the XRC display. LCD should indicate CHARGER 13.0 - 13.5 VOLTS.



**Figure 2-11 Mounting AC Charger**

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# Chapter 3 XRC Startup

## Overview

This Chapter generally describes the steps required get a newly installed XRC 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:

Topic	See Page
Laptop Computer running PCCU32	3-2
FS/2 Handheld PCCU	3-2
<b>Setting up the XRC</b>	3-3
Station ID	3-3
Device ID/Application ID	3-3
Location	3-3
Date/Time	3-4
Security System	3-4
<b>On-Board I/O Calibration</b>	3-5
Analog Inputs	3-5
Analog Output	3-8
Pulse and Digital Inputs	3-9
<b>Standard Displays</b>	3-10
Program Display	3-10
<b>Optional Equipment</b>	3-11
Key Pad	3-11

### FYI



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

### Options

The two equipment options for programming the XRC are the Windows based PCCU32 Software or 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 XRC. Many of the new features designed into the XRC cannot be accessed by the FS/2 due to its 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 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 9 pin connector on the side of the XRC. Once this physical connection has been made, you may begin the communicating through the software.

Also see Technical Bulletin #44 for "Terminal Mode" Connection.

## **FS/2 Handheld PCCU**

---

The FS/2 Portable Calibration & Collection Unit (PCCU) is a hand held device 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 XRC. 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 9 pin connector on the side of the XRC. Once this physical connection has been made, you may begin communication with the XRC through the program.

# Setting up the XRC

## Overview

---

Once physically connected to the XRC, you must then instruct the programming device software 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 XRC. 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 XRC 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	XXXXXXXXXXXXXXXXXXXXXXXXXX	24 digit alphanumeric

**FYI**



There are additional fields stored in WINCCU for uniquely identifying the 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 XRC.

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## Setting up the XRC, continued

### Date/Time

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The XRC date and time must be set correctly and should agree with the Collection Equipment if measurement tubes are instantiated.

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

### Security System

---

The Main Electronic Board (XRC-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 XRC 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 XRC. 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 XRC the Security Switch S1 on the XRC-195 Board must be OFF.

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

**Caution**  If the Security Switch S1 located on the XRC-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

# On Board I/O Calibration

## Overview

---

The calibration mode enables the calibration of the Analog Inputs, Analog Outputs and Pulse Inputs.

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

To exit the Hold mode:

1. Unplug DATA cable at XRC connector
2. Exit Calibration mode
3. Uncheck the "Hold" designator in PCCU32. Refer to the help files in PCCU32 for software instructions.

## Analog Inputs

---

**Overview** The Totalflow XRC comes standard with 5 analog inputs on the XRC-195 Board (See Figure 3-1, Items #15 & 16). As you enter calibration, the XRC enters the Hold Mode and displays the current values. To see a complete overview of the XRC-195 Board, see Figure 1-11.

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 or 4 - 20 ma to the AI terminals to be calibrated. Make sure the jumpers on the termination panel are in the 4 - 20 ma position if a 4 -20 ma source is used. This puts a 250 ohm resistor across the terminals to convert the 4 - 20 ma to 1 - 5 volts.
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 or 4 ma 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.

*Continued on Next Page*

## Analog Inputs, Continued

---

Calibration,  
Cont.

Step	Procedure
7	Move to the 100% Calibration Value.
8	Apply 5 volts or 20 ma 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 or 12 ma to the AI terminals.
12	Enter a value representing 50% and representing the desired engineering units.

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

**Table 3-1 XRC-195 Board Identifications-Callibration Points**

ID Number	Description
1	Battery Connection
15	Analog InputConnectors
16	Analog Input Type Selection Jumper Pins
17	Auxiliary Power Output Connectors
18	DeBounce Enable/Disable
19	B Upper Pulse Inputs and Digital Outputs Connectors
20	A Lower Pulse Inputs and Digital Outputs Connectors
21	Remote Comm 2: Connectors
22	Remote Comm 1: Connectors
23	Remote Comm 2: Module Plug-in
24	Remote Comm 1: Module Plug-in
25	External Charger (Solar Panel) Connectors

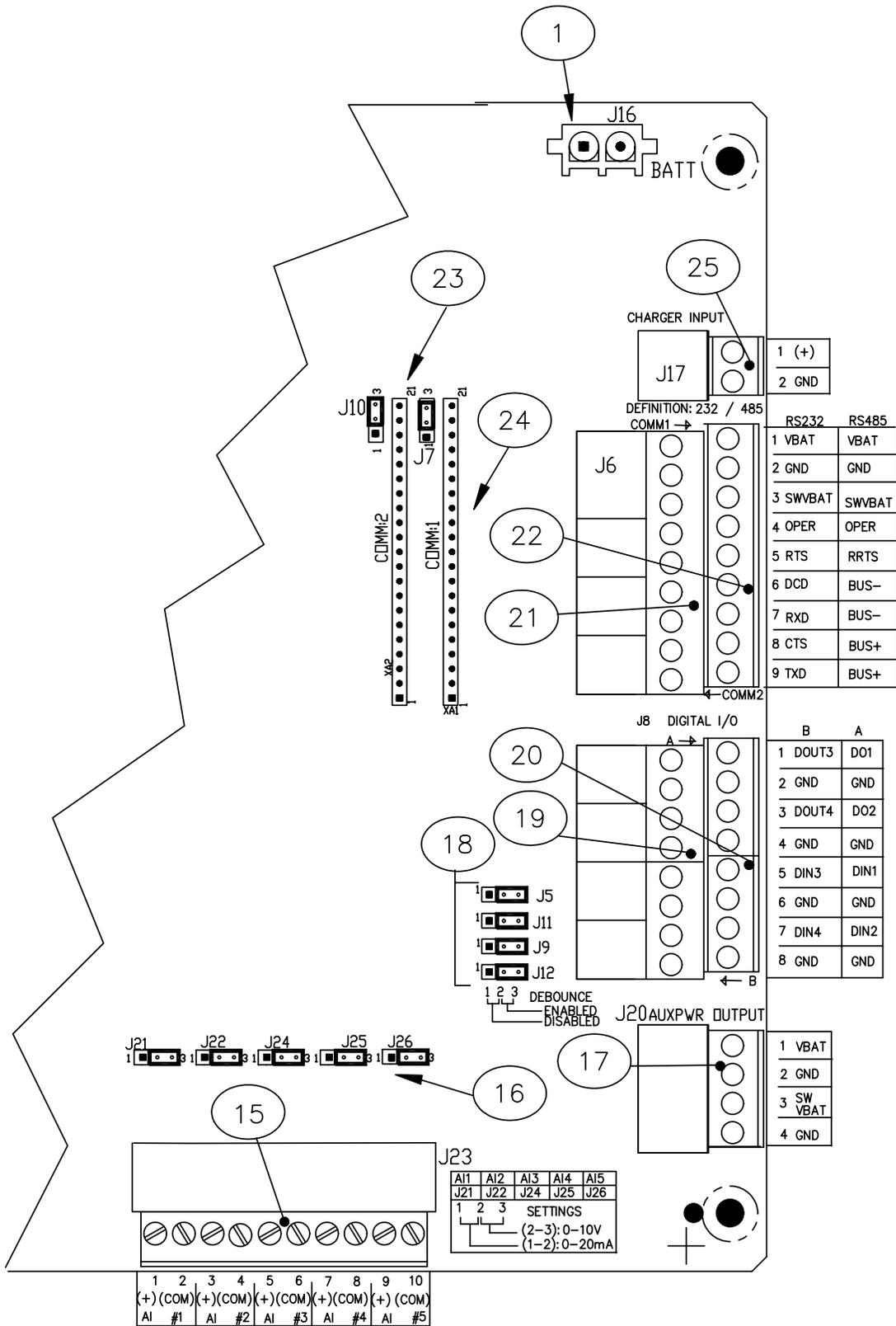


Figure 3-1 XRC-195 Board- Calibration Points

## Analog Outputs

---

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

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

## Pulse and Digital Inputs

---

### Overview

Totalflow XRC 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 XRC 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.

### Caution



Please take into consideration that these inputs may have the debounce enabled or disabled. This feature is discussed in detail in Chapter 4 in the On-Board Input/Output section. Look at Jumpers J5, J11, J9 and J12 on the XRC-195 Board.

## Standard Displays

### Program Display

---

The XRC comes with a factory set default to display the parameters shown below, scrolling continuously in a 5 second cycle time for each parameter on the XRC Liquid Crystal Display (LCD). 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.

**Table 3-2 XRC Displayed Items**

<b>Description</b>	<b>Format</b>	<b>Note</b>
DATE/TIME	MM/DD/YY HH:MM:SS	24 hour clock
BATTERY	NN.N VOLTS	Battery Voltage Volts
CHARGER	NN.N VOLTS	Charger Voltage
STATION ID	XXXXXXXXXX	10 Character alphanumeric identifier
DEVICE ID	XXXXXXXXXX	10 Character alphanumeric application or tube identifier

# Optional Equipment

## Key Pad

---

All X Series devices may be configured to include the optional Keypad located on the front cover of the unit. Keypad entry allows the user to monitor and change 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 access. You may either program all the display items for an application or individual display items within an application using PCCU32.
- Log On** Press the ENT button in the lower right hand corner of the keypad. See Figure 3-4.
- Security** When asked, enter the 4-digit security code.
- Viewing** Use the up and down arrow keys located in the upper right hand corner to scroll through the various instantiated applications (Multiple Tube Device).
- Selection** When you have located the item you wish to change/display, press the ENT button.
- Changing** After viewing the item for change, press the = key located in the lower right corner of the keypad. If entering a negative figure, press the +/- key to toggle the minus sign on or off. Enter the new figure. Press Enter.
- FYI**  You may change only those values that are not live.
- Validate** When setting up the XRC 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 configured the display application, 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.

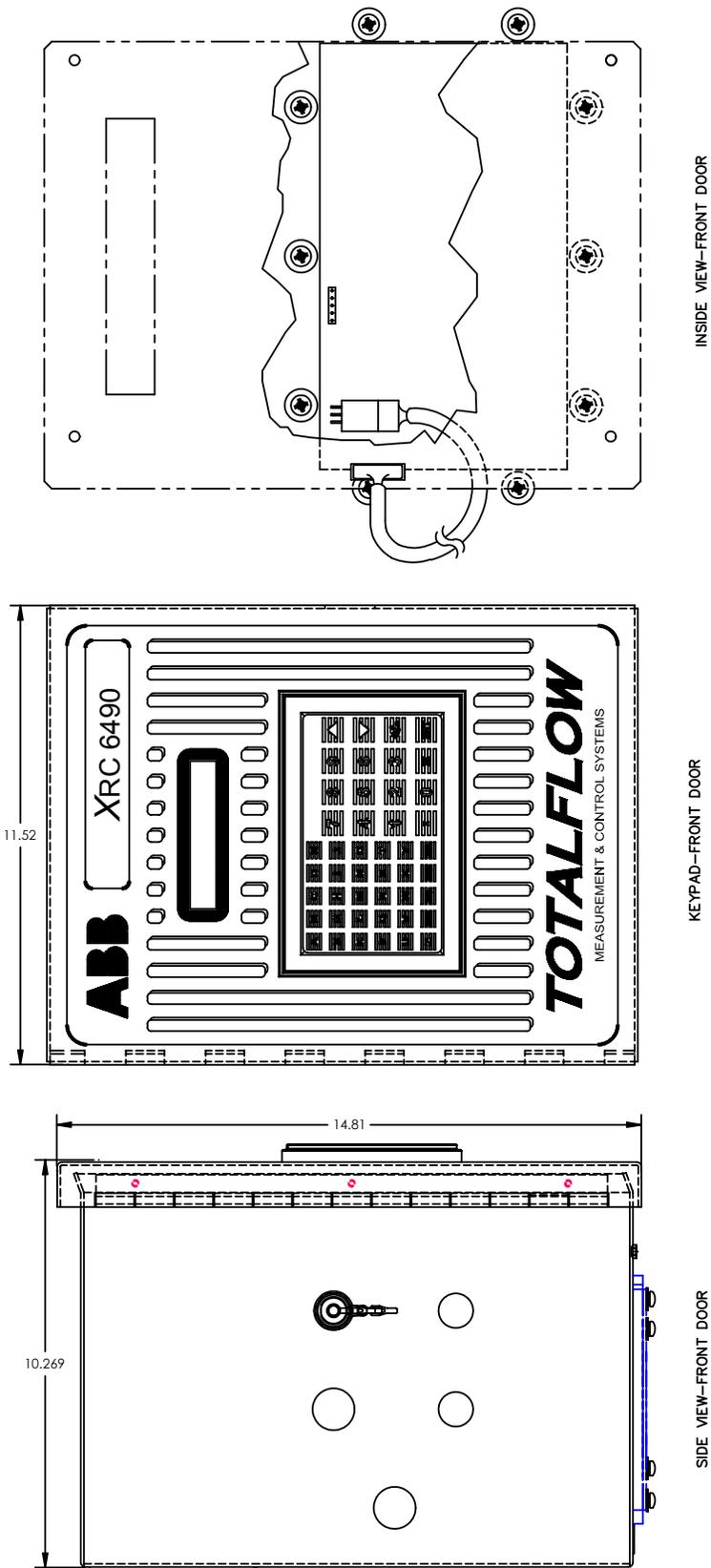


Figure 3-2 XRC 6490 with Optional Key Pad

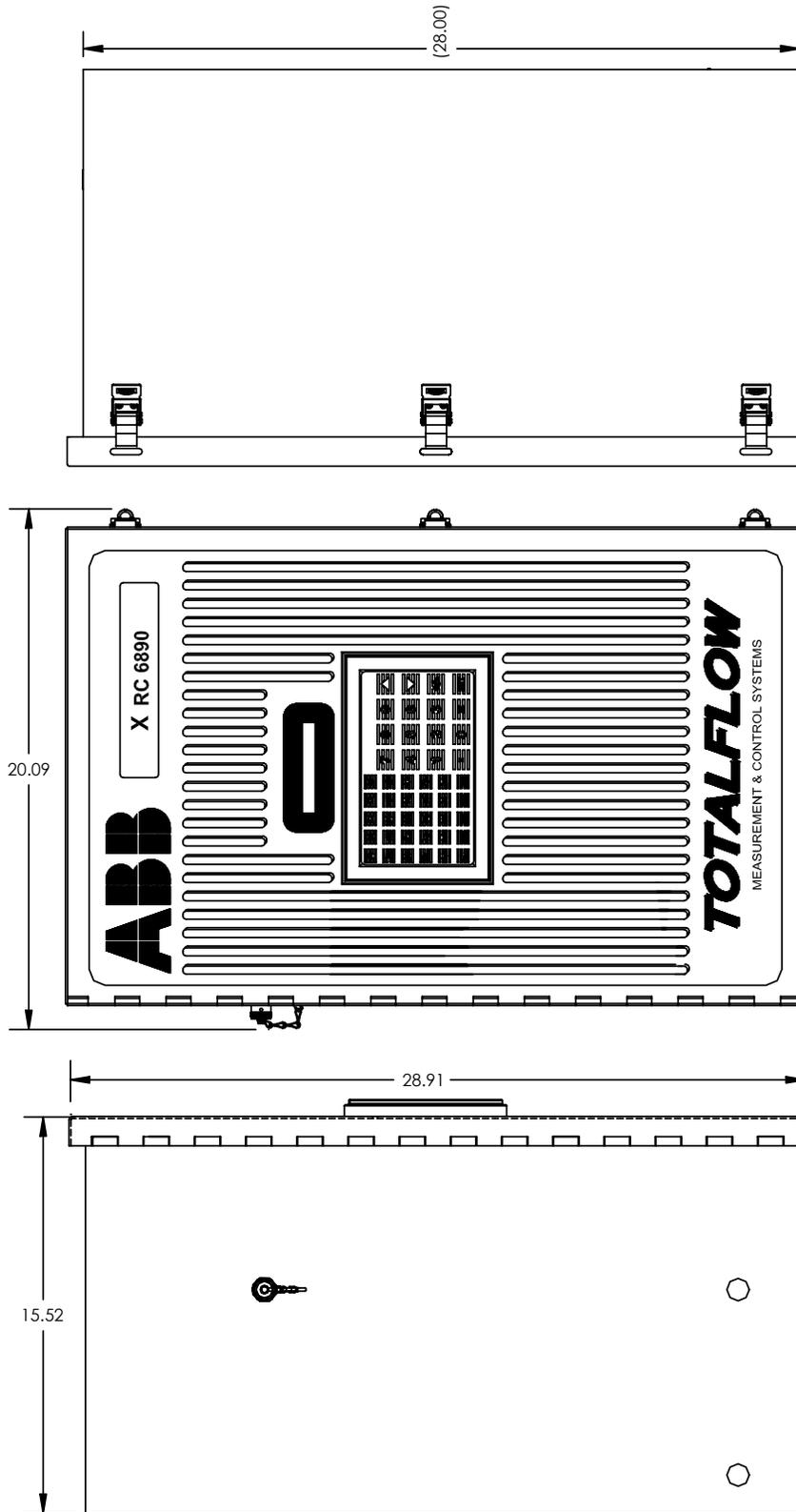


Figure 3-3 XRC 6890 with Optional Key Pad

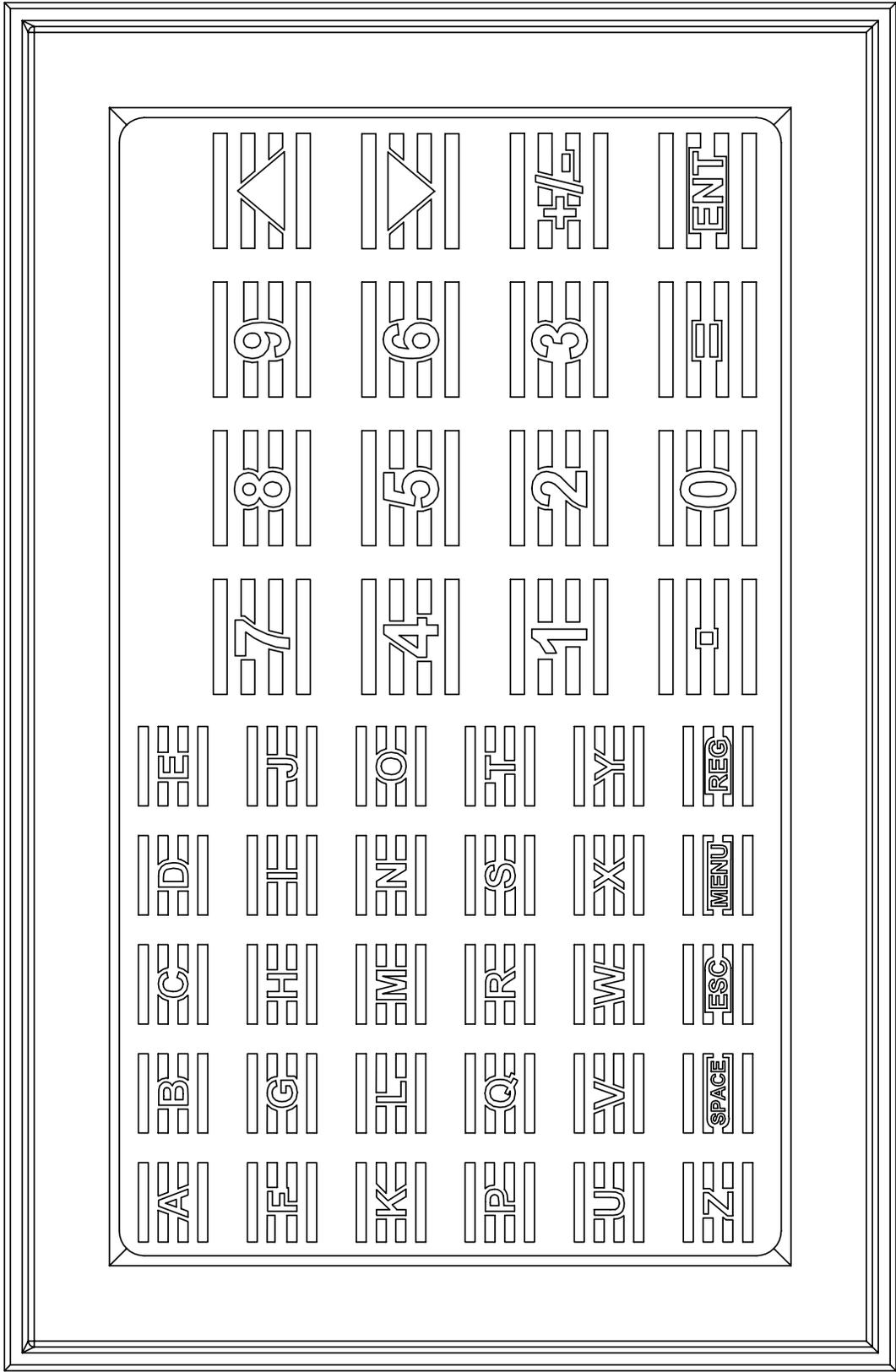


Figure 3-4 Optional Keypad

# Chapter 4 INPUT/OUTPUT

## Chapter Highlights

In this Chapter you will learn:

Topic	See Page
<b>On-Board Input/Output (XRC-195 Board)</b>	4-1
Communications Ports	4-1
Digital Inputs/Digital Outputs	4-4
Analog Inputs	4-7
<b>Totalflow Input/Output Modules</b>	4-8
TFIO Valve Control Interface Module	4-9
TFIO Analog Output (4-20mA) Module	4-15
TFIO Analog Input (Type II) Module	4-17
TFIO Communication Interface Module	4-19
TFIO Combo Digital Module	4-20
TFIO Register Maps	4-22

### **On-Board Input/Output (XRC-195 Board)**

---

Totalflow's XRC continues to be backward compatible with the same base I/O as earlier models but enhanced to include:

- 5 User AI's
- 4 User DO's
- 4 User DI's or 2 DI's and 2 High Speed PI's
- 2 RS232 or 485 Comm Ports
- Interface for TFIO Modules

The Main Electronic Board (XRC-195 Board) is an enhanced replacement for previous versions of the RTU Board. See Figure 4-1. 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 XRC-195 Board, see figure 1-11.

### **Communication Ports**

---

You have the ability to program up to two communication ports on the XRC-195 Board. Normally COMM 0 is the local port required for reading the XRC with a laptop computer running PCCU32 or the DOS based FS/2 device. COMM 1 and COMM 2 can be configured for any combination of RS 232 or RS 485. See Figure 4-1 for On-Board Communications Wiring Matrix and other I/O points.

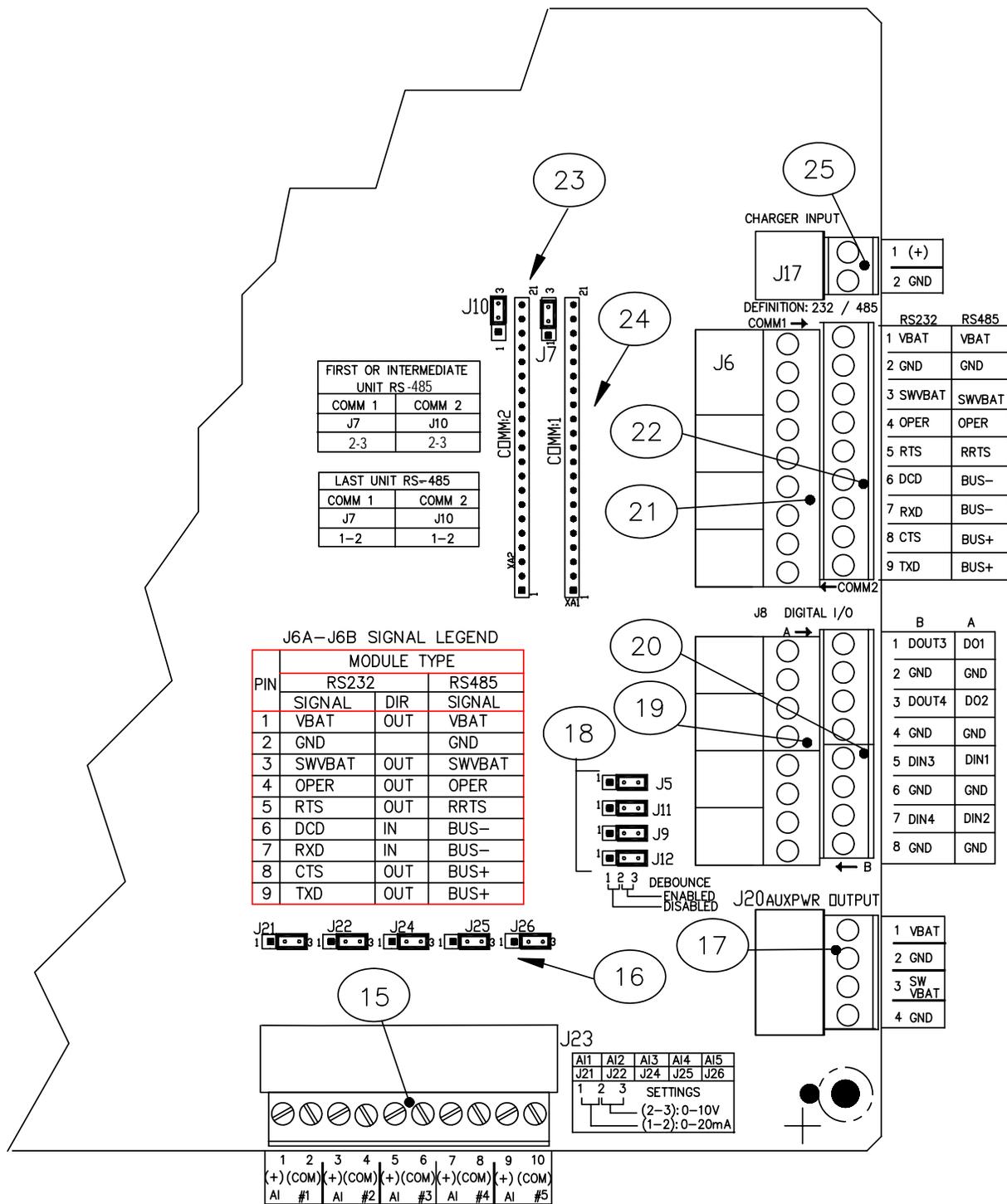


Figure 4-1 XRC-195 Board Cutout-I/O Points

**Table 4-1 XRC-195 Board Identifications-I/O Points**

<b>ID Number</b>	<b>Description</b>
15	Analog Input Connectors
16	Analog Input Type Selection Jumper Pins
17	Auxiliary Power Output Connectors
18	DeBounce Enable/Disable
19	B Upper Pulse Inputs and Digital Outputs Connectors
20	A Lower Pulse Inputs and Digital Outputs Connectors
21	Remote Comm 2: Connectors
22	Remote Comm 1: Connectors
23	Remote Comm 2: Module Plug-in
24	Remote Comm 1: Module Plug-in
25	External Charger (Solar Panel) Connectors

## Digital Inputs/Digital Outputs

---

The Totalflow XRC provides 4 digital inputs or 2 digital and 2 high speed pulse inputs and 4 digital (12V dc) outputs as a means to control external equipment with the XRC. See Figure 4-1, Items #19 and #20. For a complete overview of the XRC-195 Board, see Figure 1-11.

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

**Digital Inputs** The Digital Input reads an external contact. Below you will find the electrical and input specifications as well as information on enabling or disabling debounce.

### 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.

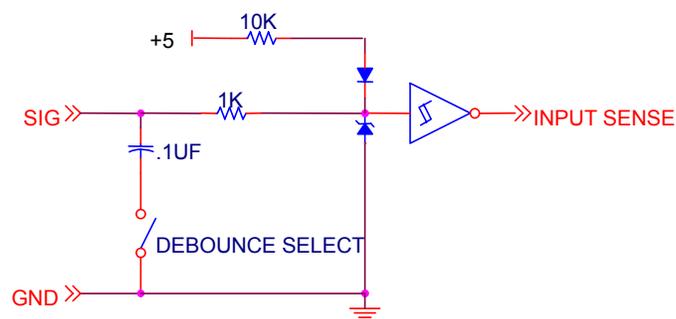
### Input Specification

- 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.

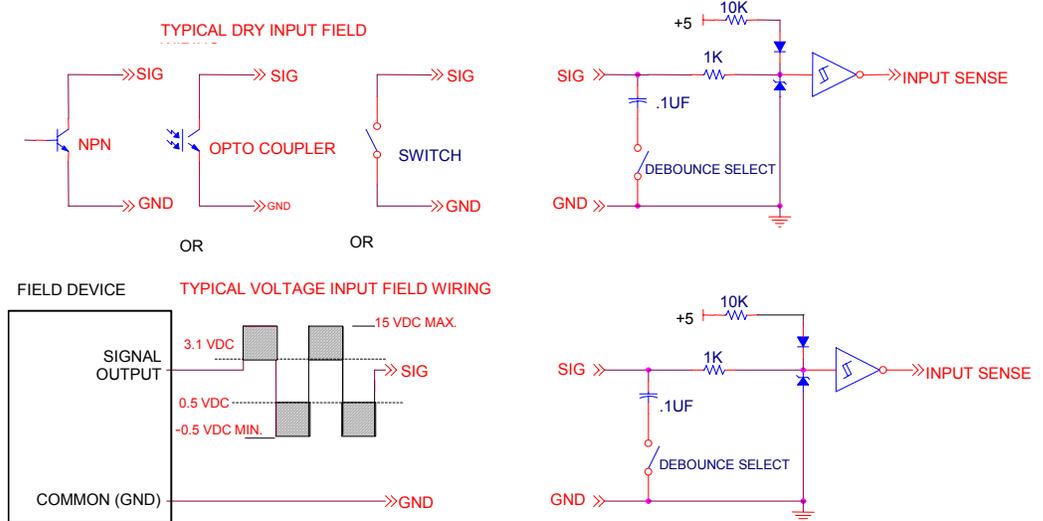
### Debounce

The XRC-195 Board includes Jumper Pins to enable or disable debounce. See Figure 4-1 #18 for the Jumpers. The inclusion of the Debounce capacitor when enabled allows the unit to ignore noise when manual switches are set. When disabled, the high speed pulses are received exactly as sent. If input is received as solid state, then debounce is not needed, it should be disabled.

### Typical Point Schematic



## Example Connections



## Digital 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
- Flowing Temperature Low
- Flowing Temperature High
- Flow Rate Low
- Flow Rate High
- Trip on Digital Input

Other Applications are:

- Custom programmable by Totalflow or user programmable with IEC 1131 programming language.
- 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.
- 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.

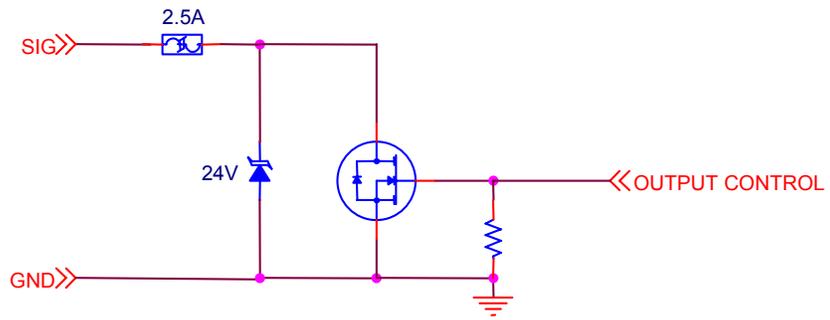
## Electrical Specification (each point):

## Input Specification

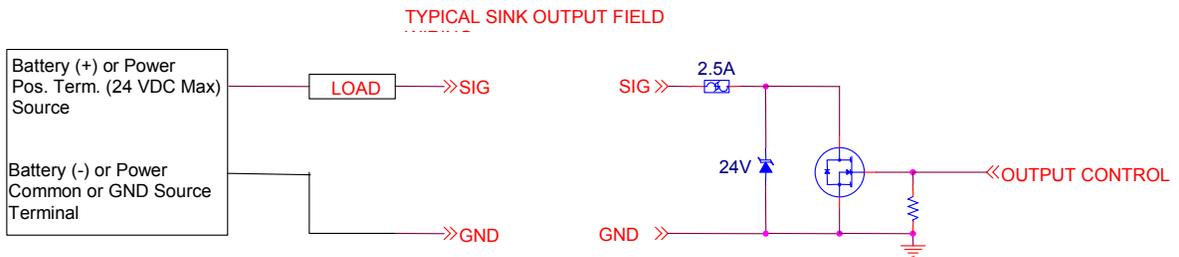
*Continued on Next Page*

# Digital Inputs/Digital Outputs, Cont.

## Typical Point Schematic



## Example Connections

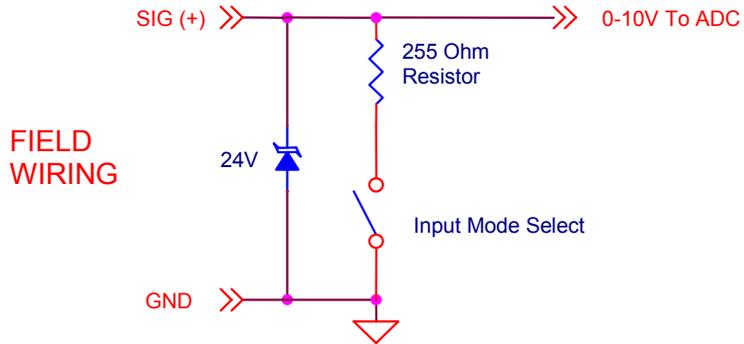


# Analog Inputs

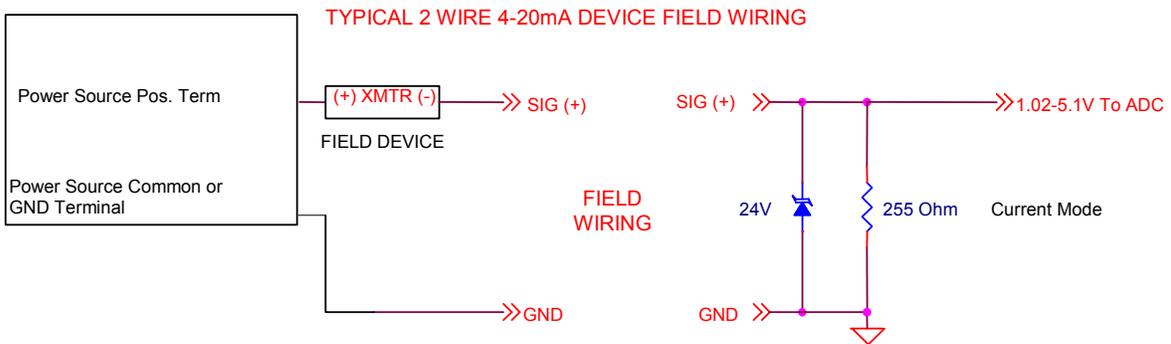
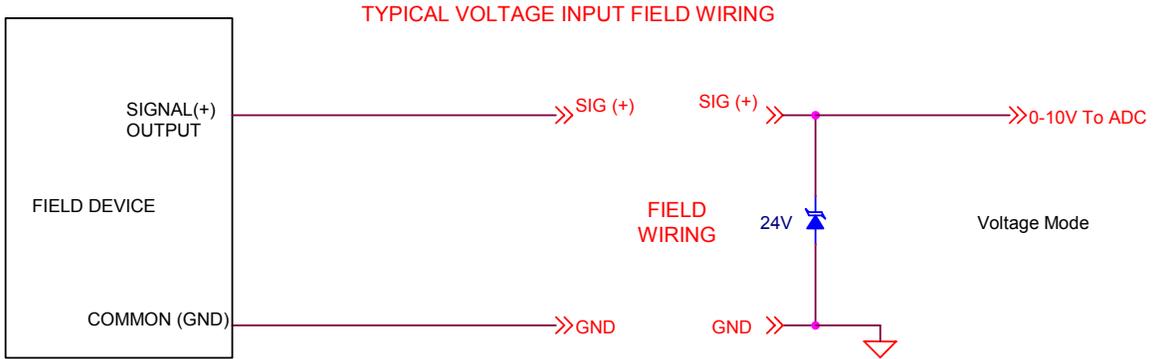
## Electrical Specification (each point):

- Voltage Mode: 0-10V
- Current Mode: 0-20mA
- Maximum Voltage mode input before soft over-range: 10.7V
- Maximum allowable continuous input current: 22.8mA
- Typical Input Impedance Voltage Mode: 91.24K Ohms
- Typical Input Impedance Current Mode: 249.3 Ohms

## Typical Point Schematic



## Example Connections



## Totalflow Input/Output Modules

---

Hardware functionality of XRC Series can be extended in a flexible and friendly way by adding modular I/O as needed. Totalflow I/O 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 XRC-195 Board by an I<sup>2</sup>C bus. On top of this bus, Totalflow has implemented an efficient I/O protocol to exchange information between the modules and the XRC-195 Board. The bus operates in a master/slave mode, with the Main Board acting as master.

The XRC 6490 supports up to 3 modules. The XRC 6790 supports up to 6 modules. The XRC 6890 supports up to 14 modules. For example, 3 analog input modules can be connected to the I<sup>2</sup>C bus. Since each module supports 8 analog inputs, then a total of 24 analog inputs can be added to the I<sup>2</sup>C 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 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 into 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.

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

All modules have 4 LED lights, a manual reset button and have a selectable address from 0 through 7. On the face plate of each Module (see Figure 4-2) you will see:

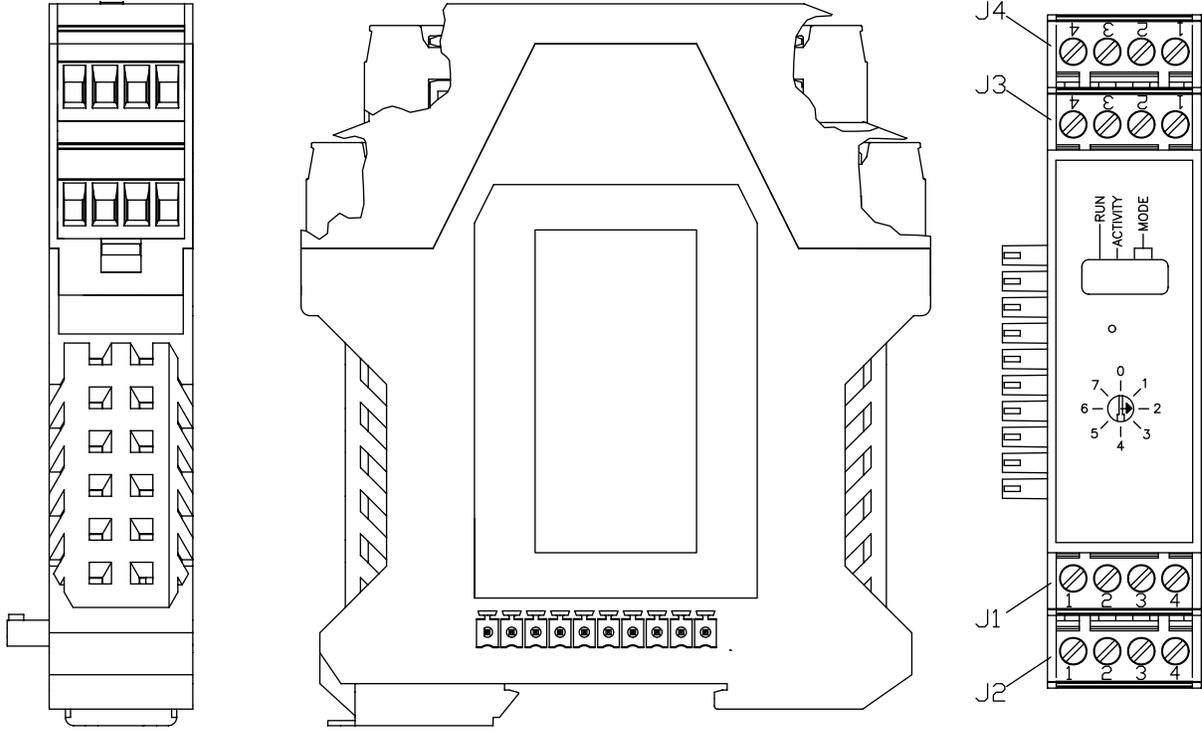
- Type of module (Name and Color Coded)
- LED Light Panel
- Reset Button Switch
- Module Address Selector

**LED Lights** The first light (RUN) is blinking when the Module is recognized by the XRC. The second light (ACTIVITY) toggles on or off with each communication from the XRC. The third and fourth lights (MODE) reflect one of two possible statuses of the module as shown on the bottom of the face plate. See Figure 4-2.

**Reset Button** The small hole on the front of the module is the reset button switch. You should reset the module anytime you change the address of the module. This constitutes a warm start of the program. To reset the module, use a fine point instrument, such as the end of a paper clip, inserted into the hole until the module resets.

**Address Selector** Each module of the same type must have a unique physical address, 0-7, selected prior to powering up the module. Different types of modules may share the same address. If you change the address of a module, you must do a reset.

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



**Figure 4-2 TFIO Module Housing**

## TFIO Valve Control Interface Module

---

The 2100412 TFIO Module is a software configurable Combination I/O Module specifically tailored for Valve Control applications.

The module incorporates six general purpose input/outputs. Two source mode digital outputs and one 4-20mA sink/source mode analog output are also provided.

### Specifications:

<b>Point Specifications</b>	<b>Electrical (ea. point):</b>	Open circuit voltage: 5VDC (Internally up to 5VDC Nom.)
		Short circuit leakage current: -430uA typical
		Input capacitance: 1000pF typical
		Maximum allowable voltage range on input -0.5VDC to 26.5VDC
	<b>Digital Input/Output:</b>	SIG Points 1,2,3,4,6,8 (6 and 8 have no ground)
	Input:	Dry Contact or voltage type
		Minimum contact resistance to activate input 15K $\Omega$
		Maximum voltage to activate the input: 2.0V (referenced to GND terminal.)
		Minimum voltage to deactivate the input: 3.0V (referenced to GND terminal.)
	Output (Sink):	Open Drain FET type
	RDS(ON): 0.060 $\Omega$ Typical	
	Maximum continuous sink current: 2A @ 24VDC	
<b>Digital Output (Source):</b>	Points 5 and 7	
	ioVBB supply @ 2A Max	
<b>Electrical (AO):</b>	Maximum allowable voltage range on VDC source, 1 sink or 1 source: 26.5 VDC.	
	Maximum External Power Source: 26.5VDC	
	Maximum load resistance (internal/external powered) 0 Ohms	
	Maximum load resistance (internally powered) 350 Ohms	
	Maximum load resistance RMAX (Calculated): (VDC External -4) x 50	

### Registers

See table 4-9 in the back of this section for the different arrays and registers used by the Valve Control Module. Note that the register numbers are listed for a Valve Control Module using address 0 (on the rotary switch).

# TFIO Valve Control Interface Module, Cont.

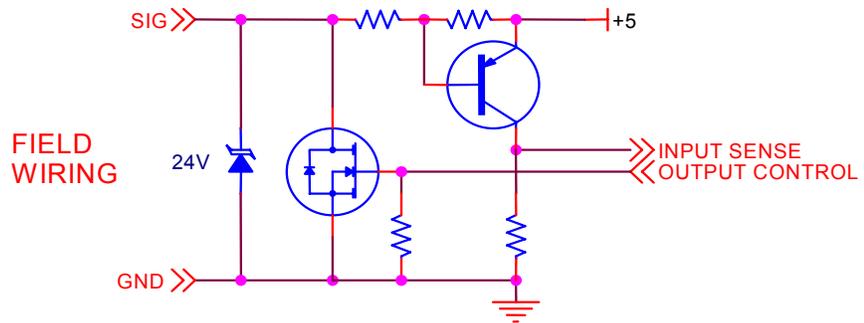
**Table 4-2 TFIO Valve Control Interface Module Pin Designation**

	J1	J2	J3	J4
1	POINT 1 SIG	AO VDC source	POINT 3 SIG	POINT 5 SIG
2	POINT 1 GND	AO I sink	POINT 3 GND	POINT 6 SIG
3	POINT 2 SIG	AO I source	POINT 4 SIG	POINT 7 SIG
4	POINT 2 GND	AO VDC common	POINT 4 GND	POINT 8 SIG



See Figure 4-2 for location of each terminal.

## Typical Point Schematic

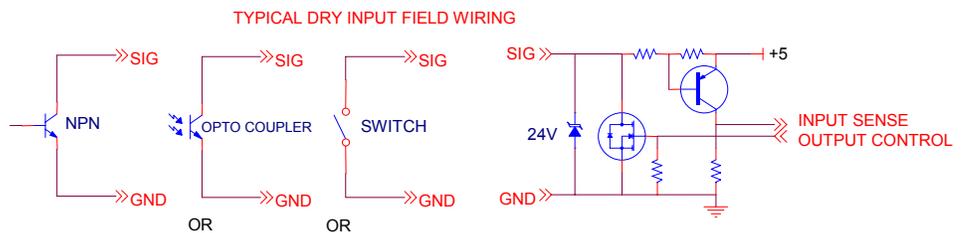


## Wiring Requirements

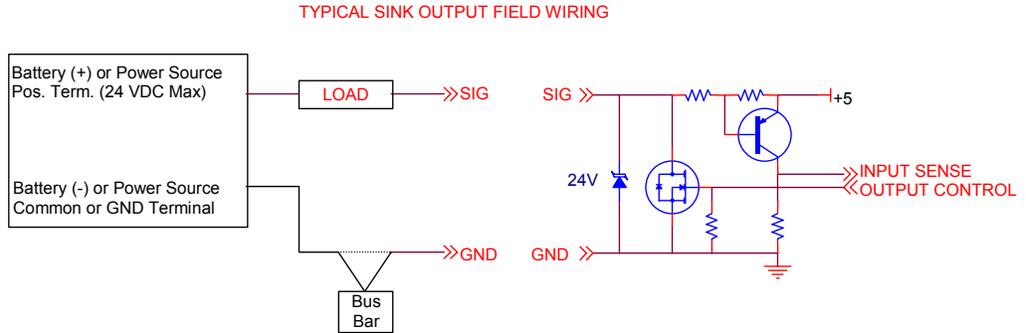
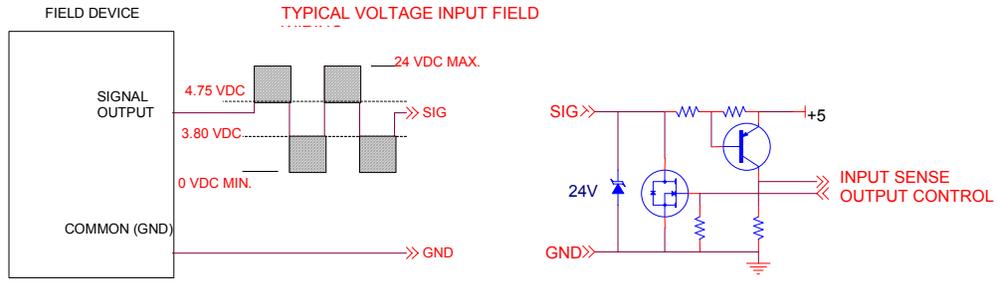
When digital outputs are used to sink current, the sum total sink current for all points and modules should not exceed 5A total. If more than 5A are required, separate ground wires from module output ground to power source ground terminal (bus bar) are required. Failure to do so may cause erratic system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

Use shielded pair or twisted pair conductors to reduce the possibility of erroneous transitions on the inputs in high EMI/RFI environments. (Ground the shield at field device)

## Example Point Connections



# Example Point Connections, Cont.



# Example Analog Output Point Connections:

## Power supplied by TFIO Module Current Sink Mode

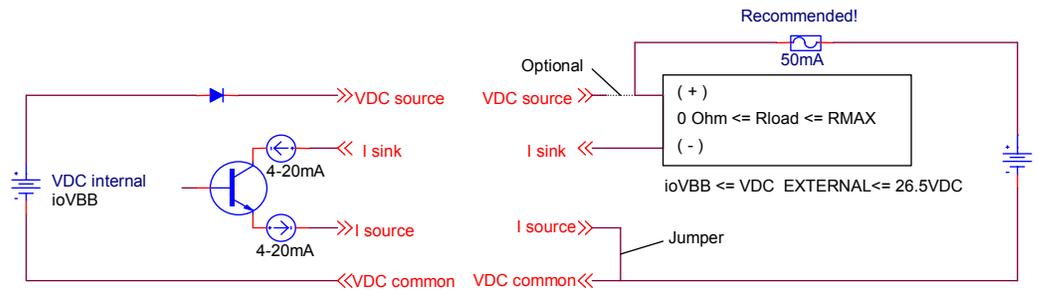


## Power supplied by TFIO Module Current Source Mode

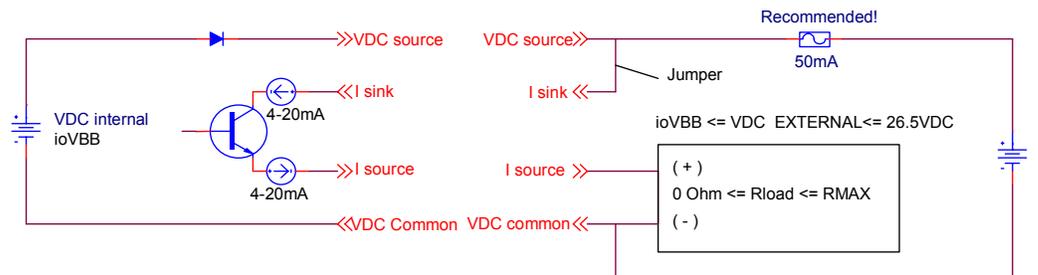


**Example  
Analog  
Output Point  
Connections,  
Cont. :**

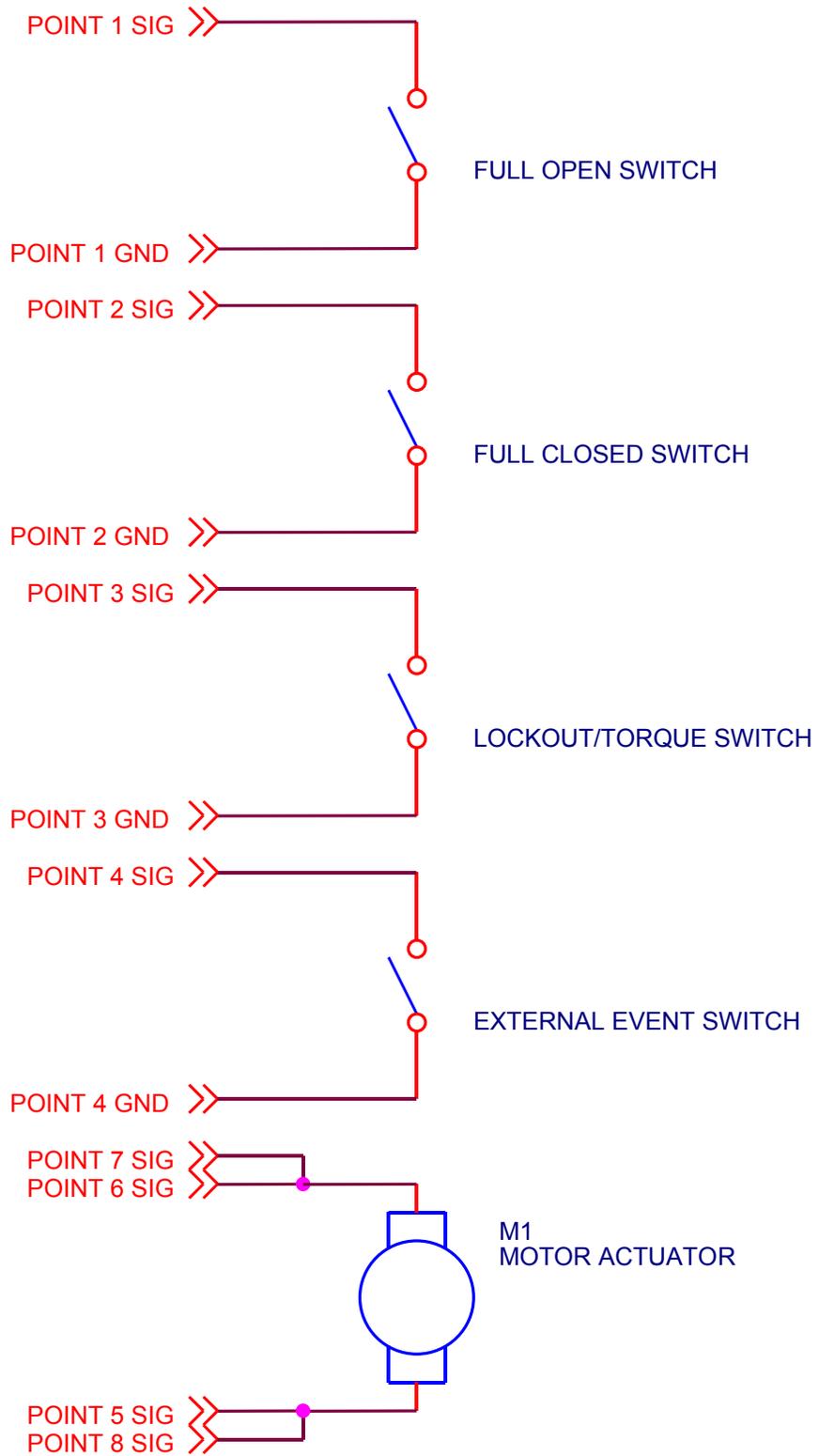
Power supplied externally, Current Sink Mode



Power supplied externally, Current Source Mode



# Valve Control Applications



## TFIO Analog Output (4-20mA) Module

The 2100415 TFIO Module is a configurable 4 point 4-20mA analog output module. Each point can be configured to either sink or source 4-20mA signal using either an internal or external power source.

### Specifications:

<b>Point Specifications</b>	<p><b>Electrical (each point):</b> Maximum allowable voltage range on VDC source, I sink or I source: 26.5VDC(VDC common is essentially System Ground).</p> <p><b>Maximum External Power Source:</b> 26.5VDC</p> <p><b>Minimum load resistance (internal / external powered):</b> 0 Ohms</p> <p><b>Maximum load resistance (internally powered):</b> 350 Ohms</p> <p><b>Maximum load resistance R<sub>MAX</sub> (Calculated):</b> (VDC External - 4) X 50</p>
<b>Registers</b>	See table 4-10 in the back of this section for the different arrays and registers used by this Module.

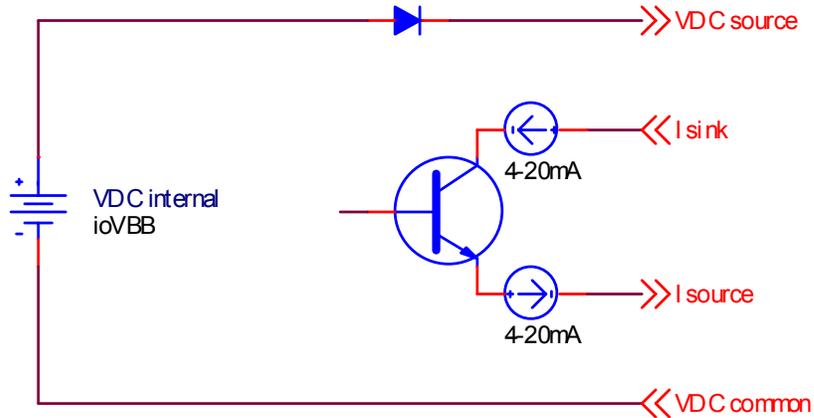
**Table 4-3 TFIO Analog Output (4-20mA) Module Pin Designation**

	J1	J2	J3	J4
1	AO1 VDC source	AO2 VDC source	AO3 VDC source	AO4 VDC source
2	AO1 Isink	AO2 Isink	AO3 Isink	AO4 Isink
3	AO1 Isource	AO2 Isource	AO3 Isource	AO4 Isource
4	AO1 VDC common	AO2 VDC common	AO3 VDC common	AO4 VDC common

**TIP** See Figure 4-2 for location of each terminal.

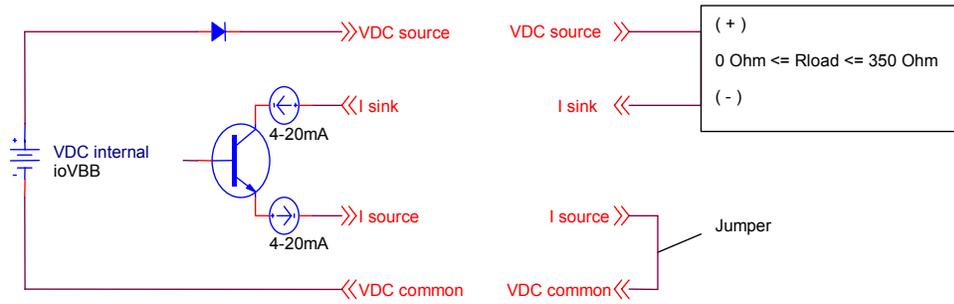


### Typical Point Schematic

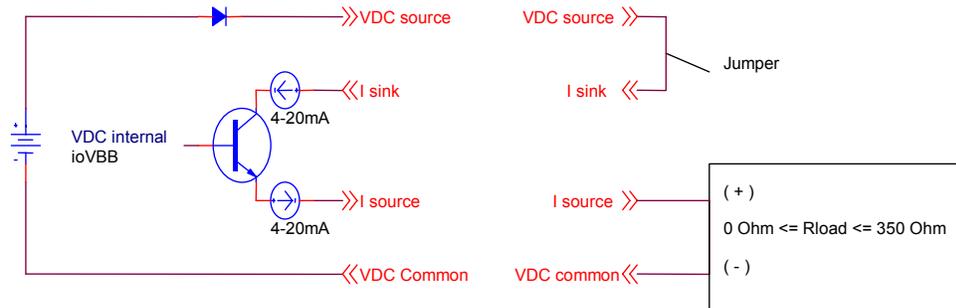


# Example Point Connections

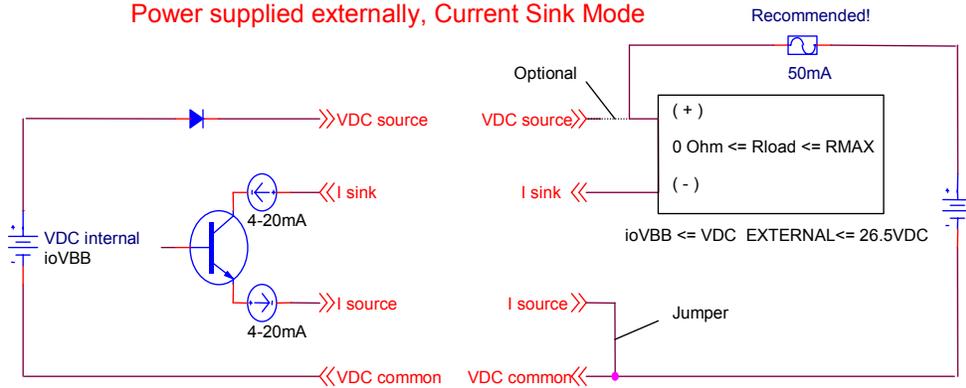
## Power supplied by TFIO Module Current Sink Mode



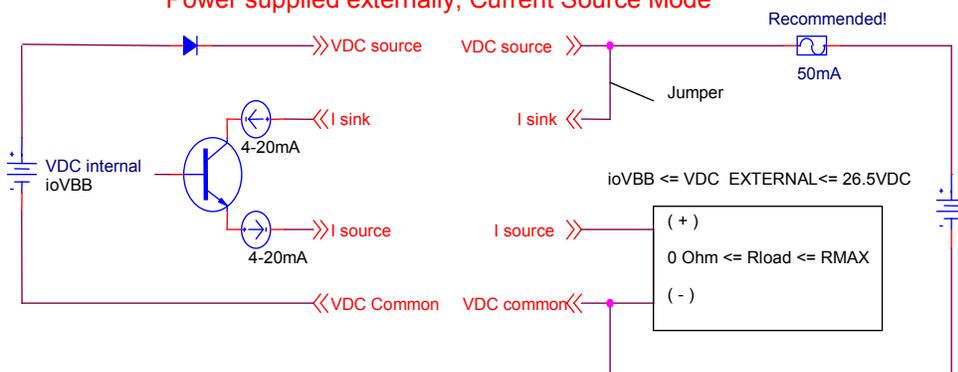
## Power supplied by TFIO Module Current Source Mode



## Power supplied externally, Current Sink Mode



## Power supplied externally, Current Source Mode



## TFIO Analog Input (Type II) Module

The 2100418 TFIO Module is a configurable 8-point Analog Input module. Each point can be configured to be a 0-10V voltage input or a 0-20mA current input.

### Specifications:

<b>Point Specifications</b>	<b>Electrical (each point):</b>	Input Mode:	Range:
		Voltage Mode:	0-10V
		Current Mode:	0-20mA
	<b>Maximum Voltage mode input before soft over-range:</b>		10.7V
	<b>Maximum allowable continuous input current:</b>		22.8mA
	<b>Typical Input Impedance Voltage Mode:</b>		91.24K Ohms
	<b>Typical Input Impedance Current Mode:</b>		249.3 Ohms

**Registers** See table 4-11 in the back of this section for the different arrays and registers used by this Module.

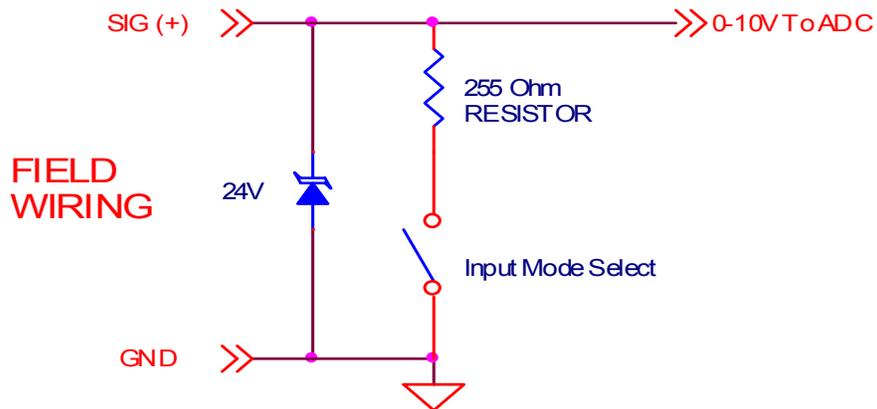
**Table 4-4 TFIO Analog Input (Type II) Module Pin Designation**

	J1	J2	J3	J4
<b>1</b>	AI1 (+)	AI3 (+)	AI5 (+)	AI7 (+)
<b>2</b>	AI1 (GND)	AI3 (GND)	AI5 (GND)	AI7 (GND)
<b>3</b>	AI2 (+)	AI4 (+)	AI6 (+)	AI8 (+)
<b>4</b>	AI2 (GND)	AI4 (GND)	AI6 (GND)	AI8 (GND)

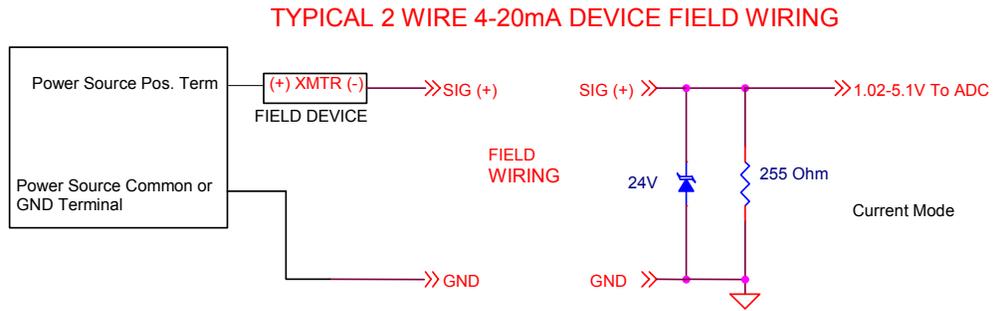
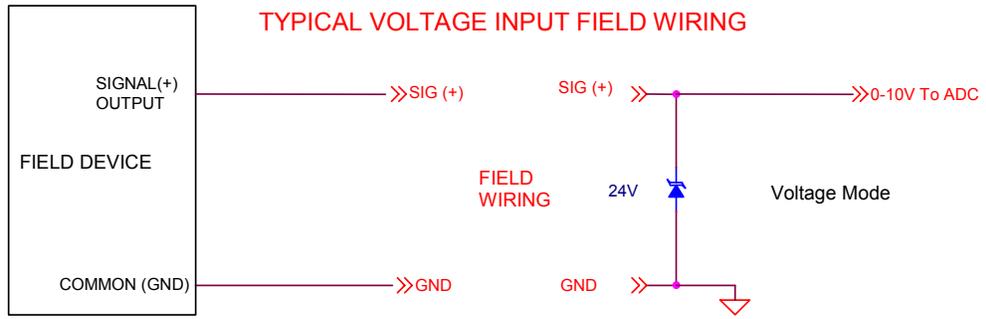


See Figure 4-2 for location of each terminal.

### Typical Point Schematic



# Example Connections





## TFIO Combo Digital Module

The 2100543 TFIO Module is a configurable 8 point digital I/O module. Each point can be configured to be either an input and/or output. All points are always inputs; however, if the output is activated the input will be held steady state. The module also maintains a 16-bit (modulo 65536) accumulator for each input, thus each input can be used as a pulse accumulator.

### Specifications:

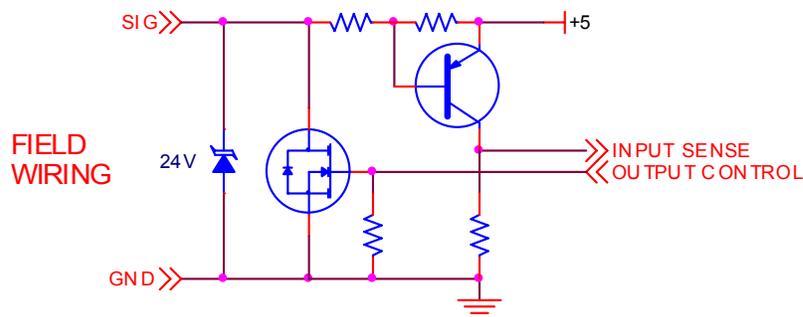
<b>Point Specifications</b>	<b>Electrical (each point):</b>	Open circuit voltage: 5VDC (Internally pulled up to 5VDC Nom.) Short circuit leakage current: -430uA typical. Input capacitance: 1000pF typical. Maximum allowable voltage range on input -0.5VDC to 26.5VDC.
	<b>Digital Input:</b>	Dry Contact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

**Table 4-7 TFIO Combo Digital Module Pin Designations**

	J1	J2	J3	J4
1	POINT 1 SIG	POINT 3 SIG	POINT 5 SIG	POINT 7 SIG
2	POINT 1 GND	POINT 3 GND	POINT 5 GND	POINT 7 GND
3	POINT 2 SIG	POINT 4 SIG	POINT 6 SIG	POINT 8 SIG
4	POINT 2 GND	POINT 4 GND	POINT 6 GND	POINT 8 GND

**TIP**  See Figure 4-2 for location of each terminal.

### Typical Point Schematic



## Registers

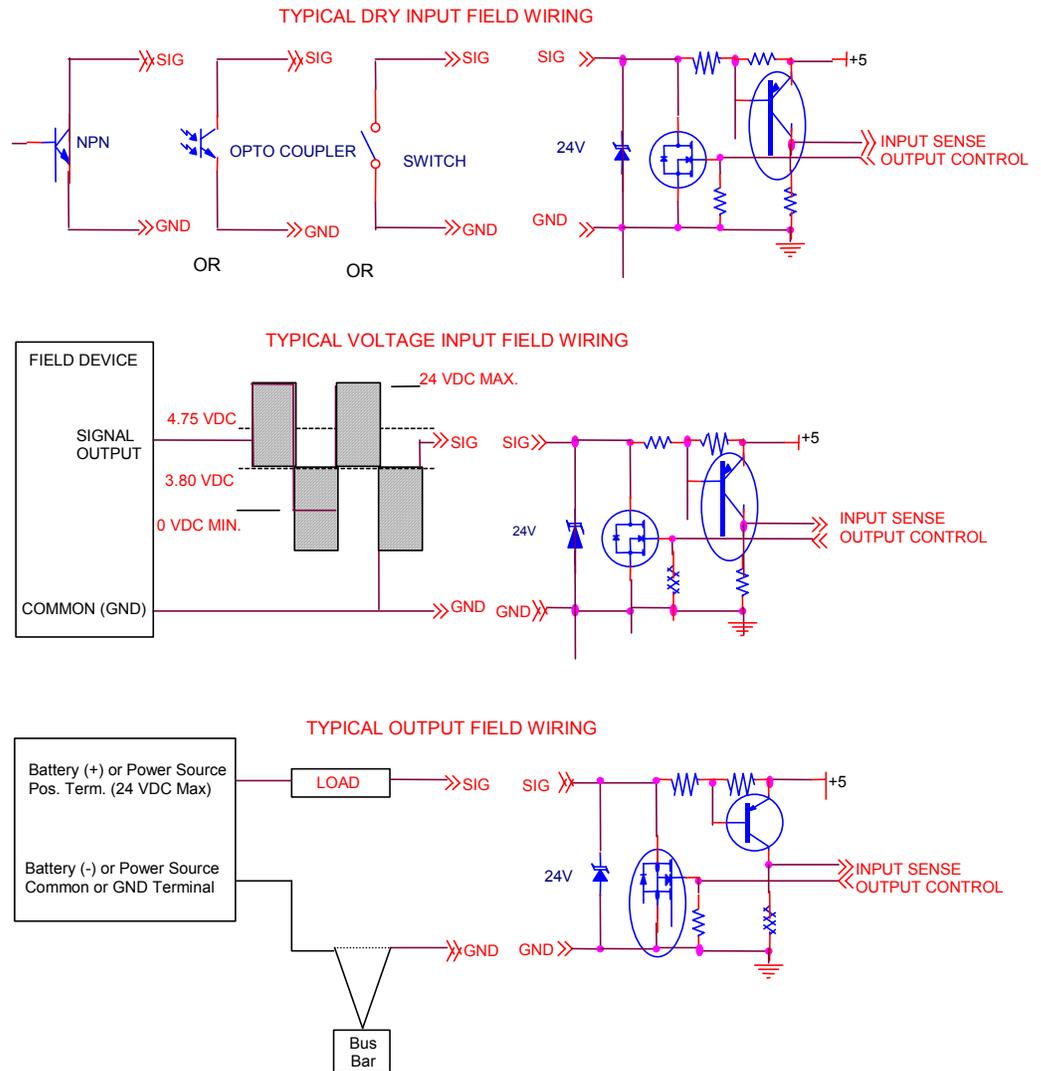
See table 4-13 in the back of this section for the different arrays and registers used by this Module.

## Wiring Requirements

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

Use shielded pair or twisted pair conductors to reduce the possibility of erroneous transitions on the inputs in high EMI/RFI environments. (Ground the shield at field device)

## Example Connections



## TFIO Register Maps

---

This Section describes the basic information needed to locate the registers for the various modules when needed for programming. You may locate the register number in PCCU32 very simply, but for the purposes of programming, you will need to follow the algorithm shown in the example below.

This register map is based on the use of RegisterSet ( ) and RegisterGet ( ) access routines. RegisterSet will write the desired VALUE to the appropriate REGISTER. RegisterGet will retrieve VALUE from the appropriate REGISTER. All the TFIO Modules are accessed through the I/O Scanner application.

RegisterSet and RegisterGet take the following form:

- RegisterSet (APPLICATION, ARRAY, REGISTER, written VALUE);
- RegisterGet (APPLICATION, ARRAY, REGISTER, read VALUE);

Each module, and its associated registers, will have unique array and register values. The ARRAY depends upon the type of data being expected in VALUE and the REGISTER selects a specific register or data point (Module 3, DI point 4). Each module type (Quad AO, Valve Control, etc.) can have an address between 0 and 7. This address is selected using the eight position rotary switch on the module's front panel. The module's address determines the REGISTER group.

**Table 4-8 Module Address Registers**

<u>Module Address</u>	<u>Registers</u>
0	0...
1	4096...
2	8192...
3	12288...
4	16384...
5	20480...
6	24576...
7	28672...

Knowing the module address (0-7 on front panel rotary switch) and the REGISTER INDEX (from the Register Map) is sufficient to determine the appropriate REGISTER.

REGISTER = (Module Address << 12) | Specific Data Point

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*Continued on Next Page*

**Example**

You want to read DI2 on my TFIO Combo Digital Module. The Combo Module I'm interested in has its address switch (Module Address) set to '4'. How do I determine the arguments for the RegisterGet command to retrieve DI2's VALUE on Combo Module 4?

**Solution**

First, you need to remember that all the TFIO Modules are accessed through the I/O Subsystem. In my system you know that my I/O Subsystem was setup as Application 2. Find this by using PCCU32 and going into ENTRY mode. Opening TOTALFLOW, I selected the Applications tab. It shows Application 2 to be the I/O Subsystem.

**From this: APPLICATION = 2**

Secondly, you'll need the ARRAY number. This is found in the TFIO Combo Digital Register Map by finding "Read DI current state (0=inactive, 1=active)" in Table 4-13. This will determine the ARRAY number (i.e. 66).

**From this: ARRAY = 66**

Lastly, you need to determine the REGISTER. Locate DI2's REGISTER INDEX by going to the Combo Digital Module Array and Register Map, Table 4-13. You find DI2's REGISTER INDEX to be 6. From the REGISTER INDEX and the Module Address we use the equation to determine the REGISTER number.

**REGISTER = (Module Address << 12) | REGISTER INDEX**

Using binary numbering notation:

Module Address = 4      Binary Notation      0000 0000 0000 0100

Shift 12 bits LEFT=4096      0100 0000 0000 0000

REGISTER INDEX = 6      0000 0000 0000 0110

ORing the shifted Module Address

With the REGISTER INDEX renders:      0100 0000 0000 0110

Converting this binary representation to decimal 0100 0000 0000 0110 = 16390

*Or more simply:*

4096 (12 bit module address shift)

x 4 (Module Address)

16384 + 6 (Register Index from Table 4-13)

**From this: REGISTER = 16390**

**Answer**

RegisterGet (2, 66, 16390, VALUE)

**Table 4-9 TFIO Valve Control Module Array and Register Map**

<b>Array No.</b>	<b>Register Index</b>	<b>Description</b>
192		DO Active time (in msec). Write a value to this register to 'turn on' the specified DO for the value of time written to the register.
	0	DO 8
	1	DO 7
	2	DO 6
	3	DO 5
	4	DO 4
	5	DO 3
	6	DO 2
	7	DO 1
	A read from the following registers will wait to return a value until the timer terminates. The value returned is be the remaining time if the DO terminated before the time expired.	
	8	DO 8 residual
	9	DO 7 residual
	10	DO 6 residual
	11	DO 5 residual
	12	DO 4 residual
	13	DO 3 residual
	14	DO 2 residual
	15	DO 1 residual
	The following registers contain the residual time after the DO has terminated.	
	16	DO 8 residual
	17	DO 7 residual
	18	DO 6 residual
	19	DO 5 residual
	20	DO 4 residual
	21	DO 3 residual
	22	DO 2 residual
	23	DO 1 residual
193	DO Override DI assignment	
	0	DO 8 – defaults to DI 1 or 7 for VC app
	1	DO 7 – defaults to DI 2 or 6 for VC app
	2	DO 6 – defaults to DI 2 or 6 for VC app
	3	DO 5 – defaults to DI 1 or 7 for VC app
	4	DO 4 – defaults to None or 255
	5	DO 3 – defaults to None or 255
	6	DO 2 – defaults to None or 255
	7	DO 1 – defaults to None or 255

**Table 4-9 TFIO Valve Control Module Array and Register Map, Cont.**

<b>Array No.</b>	<b>Register Index</b>	<b>Description</b>
194	Configure DO Active state	
	0	DO 8 – defaults to 1 or Close
	1	DO 7 – defaults to 1 or Close
	2	DO 6 – defaults to 1 or Close
	3	DO 5 – defaults to 1 or Close
	4	DO 4 – defaults to 1 or Close
	5	DO 3 – defaults to 1 or Close
	6	DO 2 – defaults to 1 or Close
	7	DO 1 – defaults to 1 or Close
195	Set AO value	
	0	Set value of AO to percent of full scale
	1	Set value of AO to user units
196	Read DO current state (0=inactive, 1=active)	
	0	DO 8
	1	DO 7
	2	DO 6
	3	DO 5
	4	DO 4
	5	DO 3
	6	DO 2
	7	DO 1
197	Read DI current state (0=inactive, 1=active)	
	0	DI 8
	1	DI 7
	2	DI 6
	3	DI 5
	4	DI 4
	5	DI 3
	6	DI 2
	7	DI 1
198	Calibration registers for AO	
	0	AOS_OutMin_I – this value determines the lower cal point
	1	AOS_Actual_Imin – value from ext. DVM used for cal
	2	AOS_Unints_min – Lower limit in user units
	3	AOS_OutMax_I – this value determines the upper cal point
	4	AOS_Actual_Imax – value from ext. DVM used for cal
	5	AOS_Unints_max – Upper limit in user units
	6	AOS_Units_Bias – Est. Bias level for user units
	7	AOS_Reset_val – Restores factory defaults for calibration
	15	AOS_FINISHCAL – Non-zero value indicates cal complete

**Table 4-9 TFIO Valve Control Module Array and Register Map, Cont.**

<b>Array No.</b>	<b>Register Index</b>	<b>Description</b>
199		Configure DI active state
	0	DI 8 – defaults to 1 or Normal Open
	1	DI 7 – defaults to 1 or Normal Open
	2	DI 6 – defaults to 1 or Normal Open
	3	DI 5 – defaults to 1 or Normal Open
	4	DI 4– defaults to 1 or Normal Open
	5	DI 3 – defaults to 1 or Normal Open
	6	DI 2 – defaults to 1 or Normal Open
	7	DI 1 – defaults to 1 or Normal Open
200		Write DO current state (0=inactive, 1=active)
	0	DO 8
	1	DO 7
	2	DO 6
	3	DO 5
	4	DO 4
	5	DO 3
	6	DO 2
	7	DO 1
201		AO Calibration Flags (calibration complete = 80)
	24	Cal Flags – Indicates progress through calibration procedure

**Table 4-10 TFIO Analog Output (4-20mA) Module Array and Register Map**

<b>Array No.</b>	<b>Register Index</b>	<b>Description</b>
81	Set AO value (0-4095)	
	0	AO 1 DAC (hex)
	1	AO 2 DAC (hex)
	2	AO 3 DAC (hex)
	3	AO 4 DAC (hex)
83	Set AO value to percent of full scale (0-100%)	
	0	AO 1
	1	AO 2
	2	AO 3
	3	AO 4
83	Set AO value to user units (4-20ma)	
	4	AO 1
	5	AO 2
	6	AO 3
	7	AO 4
86	Calibration registers for AO 1	
	0	AOS_OutMin_I – this value determines the lower cal point
	1	AOS_Actual_Imin – value from ext. DVM used for cal
	2	AOS_Unints_min – Lower limit in user units
	3	AOS_OutMax_I – this value determines the upper cal point
	4	AOS_Actual_Imax – value from ext. DVM used for cal
	5	AOS_Unints_max – Upper limit in user units
	6	AOS_Units_Bias – Est. Bias level for user units
	7	AOS_Reset_val – Restores factory defaults for calibration
	15	AOS_FINISHCAL – Non-zero value indicates cal complete
86	Calibration registers for AO 2	
	16	AOS_OutMin_I – this value determines the lower cal point
	17	AOS_Actual_Imin – value from ext. DVM used for cal
	18	AOS_Unints_min – Lower limit in user units
	19	AOS_OutMax_I – this value determines the upper cal point
	20	AOS_Actual_Imax – value from ext. DVM used for cal
	21	AOS_Unints_max – Upper limit in user units
	22	AOS_Units_Bias – Est. Bias level for user units
	23	AOS_Reset_val – Restores factory defaults for calibration
	31	AOS_FINISHCAL – Non-zero value indicates cal complete

**Table 4-10 TFIO Analog Output (4-20mA) Module Array and Register Map, Cont.**

<b>Array No.</b>	<b>Register Index</b>	<b>Description</b>
86	Calibration registers for AO 3	
	32	AOS_OutMin_I – this value determines the lower cal point
	33	AOS_Actual_Imin – value from ext. DVM used for cal
	34	AOS_Unints_min – Lower limit in user units
	35	AOS_OutMax_I – this value determines the upper cal point
	36	AOS_Actual_Imax – value from ext. DVM used for cal
	37	AOS_Unints_max – Upper limit in user units
	38	AOS_Units_Bias – Est. Bias level for user units
	39	AOS_Reset_val – Restores factory defaults for calibration
	47	AOS_FINISHCAL – Non-zero value indicates cal complete
86	Calibration registers for AO 4	
	48	AOS_OutMin_I – this value determines the lower cal point
	49	AOS_Actual_Imin – value from ext. DVM used for cal
	50	AOS_Unints_min – Lower limit in user units
	51	AOS_OutMax_I – this value determines the upper cal point
	52	AOS_Actual_Imax – value from ext. DVM used for cal
	53	AOS_Unints_max – Upper limit in user units
	54	AOS_Units_Bias – Est. Bias level for user units
	55	AOS_Reset_val – Restores factory defaults for calibration
	63	AOS_FINISHCAL – Non-zero value indicates cal complete
89	AO Calibration Flags (calibration complete = 80)	
	0	Cal Flags AO 1 – Indicates progress through calibration procedure
	1	Cal Flags AO 2 – Indicates progress through calibration procedure
	2	Cal Flags AO 3 – Indicates progress through calibration procedure
	3	Cal Flags AO 4 – Indicates progress through calibration procedure

**Table 4-11 TFIO Analog Input (Type II) Module Array and Register Map**

<b>Array No.</b>	<b>Register Index</b>	<b>Description</b>
112	Read AI current value (16-bit integer)	
	0	AI 1
	1	AI 2
	2	AI 3
	3	AI 4
	4	AI 5
	5	AI 6
	6	AI 7
	7	AI 8
	8	AD Zero
114	AI Configuration Registers (0=60Hz, 1=50Hz)	
	9	AI 1
	10	AI 2
	11	AI 3
	12	AI 4
	13	AI 5
	14	AI 6
	15	AI 7
	16	AI 8
114	AI Configuration Registers (0=0-10V, 1=4-20ma)	
	17	AI 1
	18	AI 2
	19	AI 3
	20	AI 4
	21	AI 5
	22	AI 6
	23	AI 7
	24	AI 8
115	Read AI current value (float)	
	0	AI 1
	1	AI 2
	2	AI 3
	3	AI 4
	4	AI 5
	5	AI 6
	6	AI 7
	7	AI 8
	8	AD Zero

**Table 4-12 TFIO Communication Interface Module Array and Register Map**

<b>Array No.</b>	<b>Register Index</b>	<b>Description</b>
0	Setup	
	2	Baud Rate 1200=0, 2400=1, 4800=2, 9600=3, 19200=4, 38400=5, 57600=6, 115200=7
	6	Protocol None=255, TFLocal=0, TFRemote=2, MB Slave (A)=1, MB Slave (R)=5, MB Host (A)=8, MB Host (R)=9, LevelMaster =7
	7	Listen Cycle (0,1, 2, 4)
	Advanced	
	1	Interface RS232=0, RS485=1, RS422=2, Modem=0x40
	3	Data Bits Bits5=5, Bits7=7, Bits8=8
	4	Parity None=0, Even=1, Odd=2
	5	Stop Bits Stops1=1, Stops2=2
	8	Wait for Host TMO (ms)
	15	Switched V-Batt/Oper (On=1)
	Schedule	
	9	Schedule Mode NoScedule=0, TODSchedule=1, CycleSchedule=2
	10	Except. Retry Limit
	Modem	
	16	Pager Enable (Enable=1)
	Modbus	
	11	Slave Addr.
	12	Register Format
	13	Retries
1	Advanced	
	0	Power Up Delay (ms)
	1	Xmit Key Delay (ms)
	2	Unkey Delay (ms)
	4	Inact. TMO (min)
	Modem	
	5	Connect TMO (sec)
	6	Disconnect TMO (sec)
	Modbus	
	3	Timeout (ms)
2	Schedule	
	0	Schedule Start Time (00:00:00)
	1	Schedule Stop Time (00:00:00)
	2	Schedule Cycle Int. (00:00:00)
	3	Schedule Cycle Dur. (00:00:00)
3	Modem	
	1	Dial String
	2	Init String
	Modbus	
	0	Directory

**Table 4-13 TFIO Combo Digital Module Array and Register Map**

<b>Array No.</b>	<b>Register Index</b>	<b>Description</b>
64	Read PI current value (16-bit integer)	
	0	PI 8
	1	PI 7
	2	PI 6
	3	PI 5
	4	PI 4
	5	PI 3
	6	PI 2
	7	PI 1
66	Write DO current state (0=inactive, 1=active)	
	0	DO 8
	1	DO 7
	2	DO 6
	3	DO 5
	4	DO 4
	5	DO 3
	6	DO 2
	7	DO 1
66	Read DI current state (0=inactive, 1=active)	
	0	DI 8
	1	DI 7
	2	DI 6
	3	DI 5
	4	DI 4
	5	DI 3
	6	DI 2
	7	DI 1

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# Chapter 5 Maintenance

## Overview

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

### Chapter Highlights

In this Chapter you will learn how to:

Topic	See Page
Back up Configuration Files	5-2
Changing Clock	5-2
Replace Battery Pack	5-3
Replace XRC-195 Board	5-9
Replace Liquid Crystal Display (LCD) Board	5-10

### 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

### How to Use This Chapter

We recommend that you develop regularly scheduled maintenance program. By establishing such a maintenance program XRC 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.

### Maintaining Cleanliness of XRC

Because an XRC 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 XRC 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. XRC 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.

Part 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

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

There are two methods for "uploading" configuration files:

- While in the Entry Mode in PCCU32, click on the 'save' button located on the bottom of the window. This will open a tree view menu. Mark all files to back up. Marking the uppermost box will backup all configuration files. To select specific files, mark only those boxes. When completed it will ask you to direct the backup files to the directory on your hard drive or diskette.
- While in PCCU, use the Save and Restore Utility found under File Utilities in the Operate drop down menu.

## Changing XRC Clock

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When any AGA applications are instantiated on the XRC, changing the clock could affect the time when log period entries are made. To protect integrity of accounting audit trails, the XRC 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. XRC 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. XRC 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 XRC Battery Pack

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This Chapter presents the procedures for removal and installation of XRC battery pack. To access battery pack, open XRC door. Battery pack is located behind front mounted keeper plate (model 6490 only). See Figure 5-2 and 5-3. See Figure 5-1 for XRC Board Identifications. For a complete overview of the XRC-195 Board, see Figure 1-11.

### Caution



When removing battery pack, DO NOT remove the Lithium battery from the Main Electronic Board (XRC-195 Board). This prevents any data stored in Board RAM, from being lost.

### Procedures

In the following procedure, the common name for a component, its jumper number if available (Abbreviated J) or part is followed by a number in parentheses.

Step	Procedure
1.	Make sure the J1 (Figure 5-1, Item 14) memory backup jumper covers the top two pins too enable the memory backup.
2.	Either make sure "LL" battery alarm is not being displayed on XRC LCD or measure lithium battery and make sure it is > 3.0V.
3.	Disconnect the battery charger from XRC-195 Board terminals EXT CHGR +/- J17 (Figure 5-1, Item 25).
4.	Before removing battery pack, disconnect the Battery Cable from the XRC-195 Board connector J16 (Figure 5-1, Item 1).
5.	Remove keeper plate (Figure 5-2, Item 16) (6490 only), 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 5-2, Item 16) (6490 only) and tighten the keeper plate mounting screws.
8.	Reconnect battery pack cable to XRC-195 Board (Figure 5-1, Item 1) connector J16.
9.	Reconnect battery charger to XRC-195 Board terminals EXT CHGR +/- terminals J17 (Figure 5-1, Item 25).
10.	After closing XRC door, check door mounted LCD for normal operational readings.

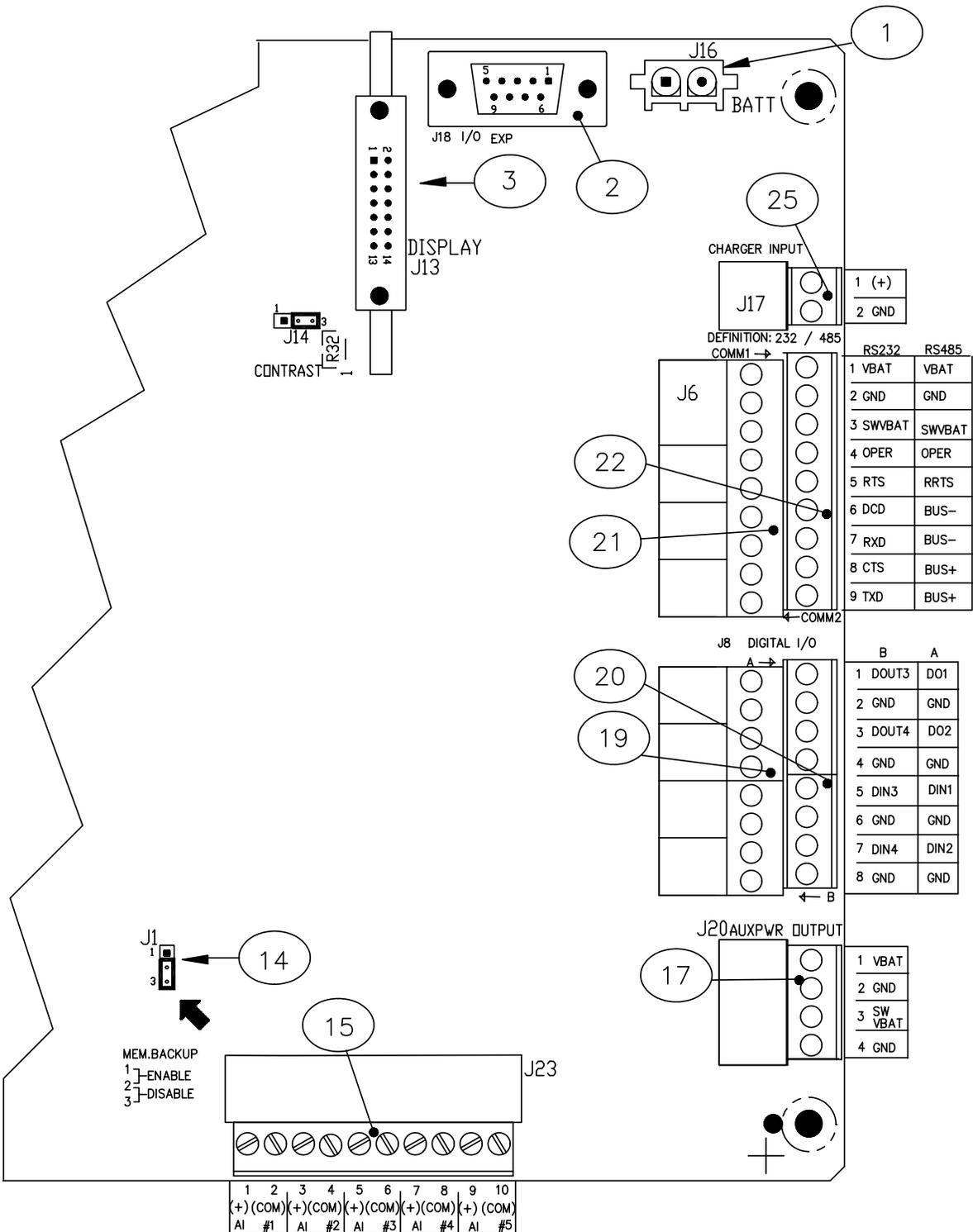


Figure 5-1 XRC-195 Board-Maintenance

**Table 5-1 XRC-195 Board Identifications- Maintenance**

<b>ID Number</b>	<b>Description</b>
1	Battery Connection
2	I/O Module Interface
3	LCD Display Interface
14	Memory Backup Enable/Disable
15	Analog Input Connectors
17	Auxiliary Power Output Connectors
19	B Upper Pulse Inputs and Digital Outputs Connectors
20	A Lower Pulse Inputs and Digital Outputs Connectors
21	Remote Comm 2: Connectors
22	Remote Comm 1: Connectors
25	External Charger (Solar Panel) Connectors

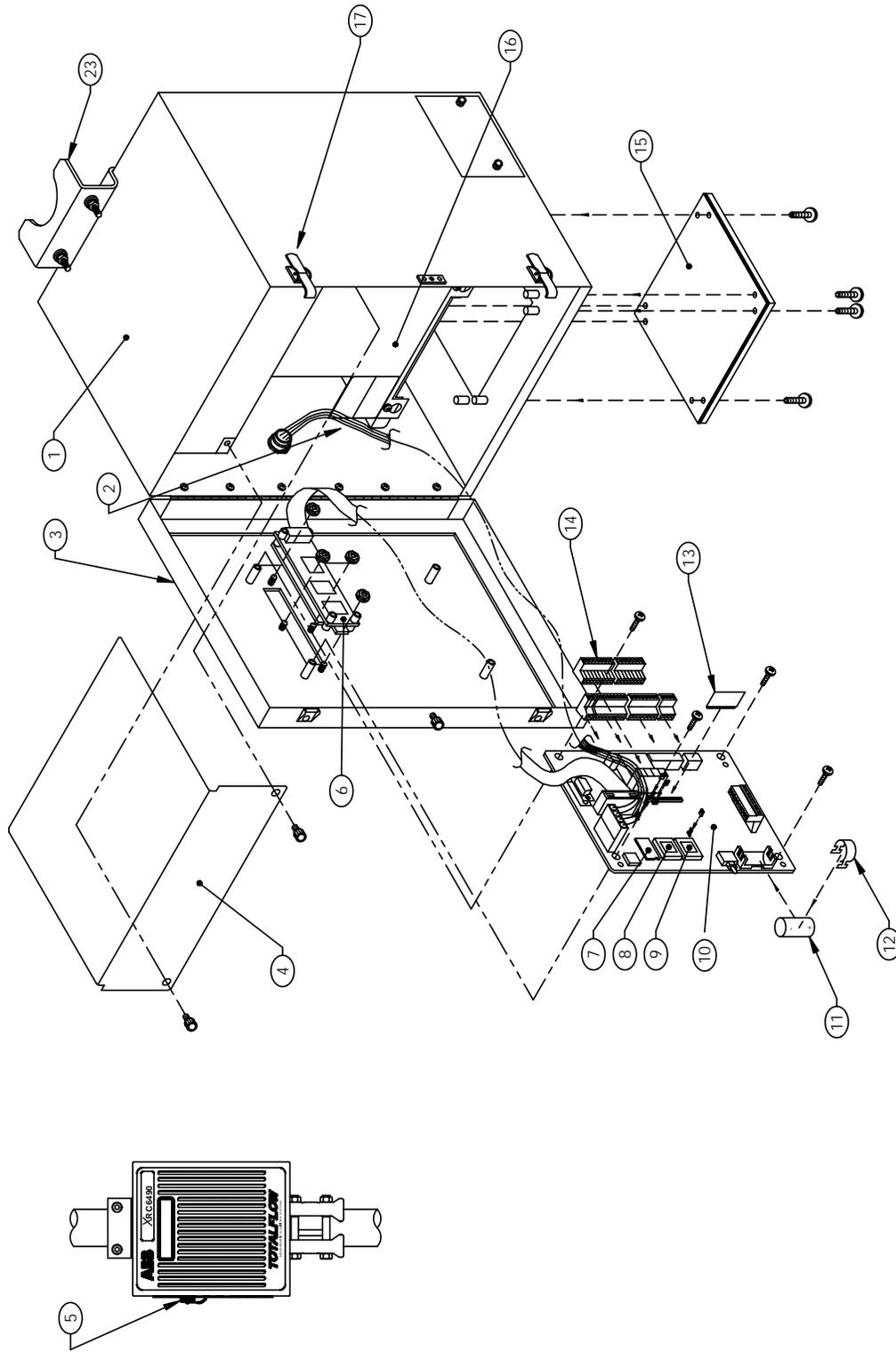


Figure 5-2 XRC 6490 Component/Cable Locations (see Table 5-2)

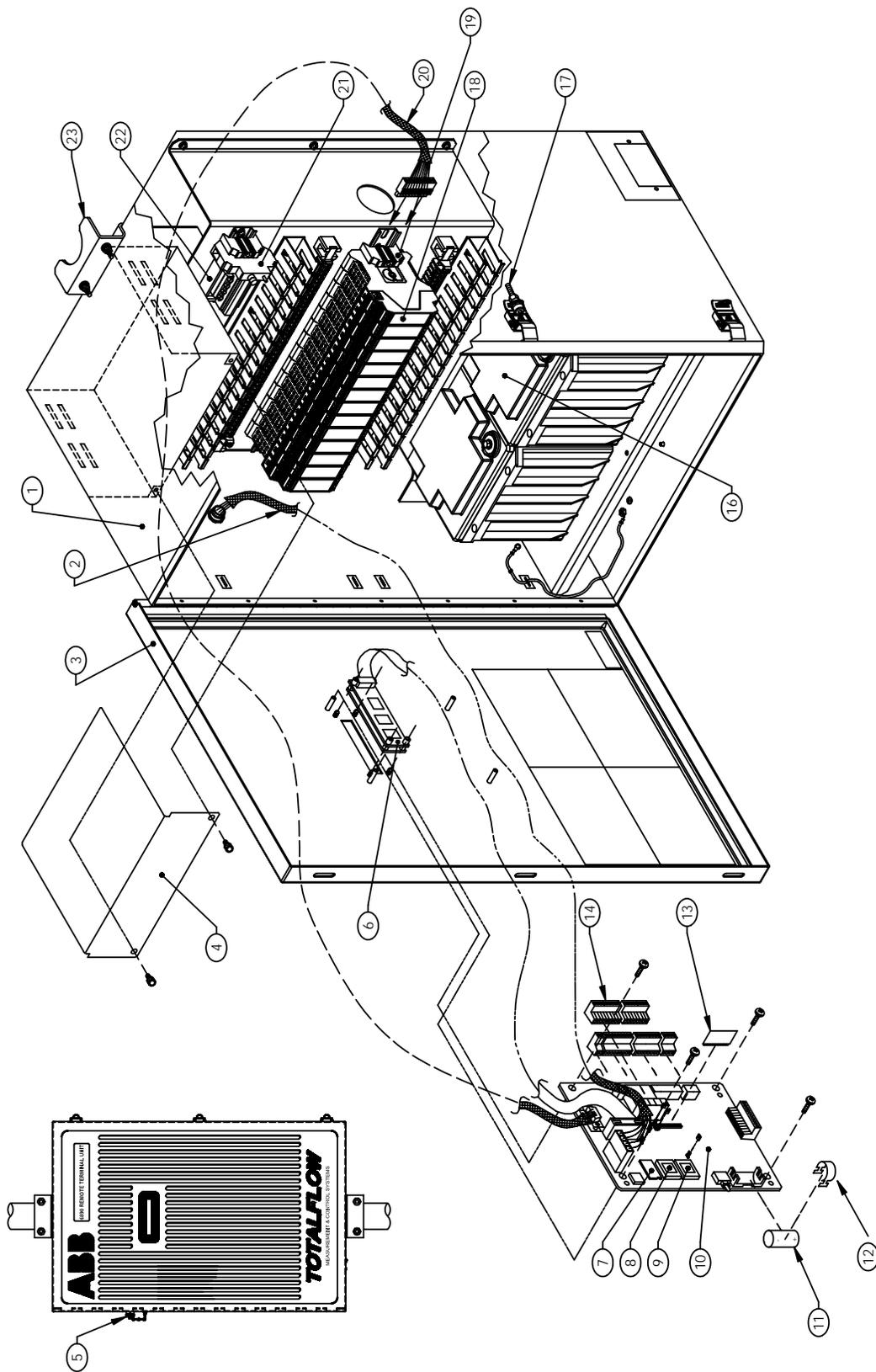


Figure 5-3 XRC 6890 Component/Cable Locations (see Table 5-2)

**Table 5-2 XRC 6490 and 6890 Component Identifications**

<b>ID No.</b>	<b>Description</b>
1	Enclosure
2	PCCU Internal Cable
3	Door
4	Radio Compartment Cover
5	External PCCU Connector
6	LCD Display
7	Sram
8	Flash
9	Prom
10	XRC-195 Board
11	Lithium Battery
12	Battery Cover
13	Communication Module
14	Phoenix Connector Plug Module
15	Conversion Plate (6490 only)
16	Battery/Compartment Cover
17	Door Latch
18	I/O Module (shown 6890 only)
19	I/O Module End Cap (shown 6890 only)
20	TFIO Interface Module Cable (shown 6890 only)
21	Main Electronic Breaker (shown 6890 only)
22	Terminal Block (shown 6890 only)
23	Pipe Mounting Bracket

## Replacing XRC-195 Board

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The XRC-195 Board is mounted to the backside of access door. It is mounted, to the door, on standoffs. Refer to Figure 5-2 or 5-3.

### Caution



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

### Procedures

In the following procedure, the common name for a component, its jumper number if available (Abbreviated J) or part is followed by a number in parentheses.

Step	Procedure
1.	<p>Before XRC-195 Board (Figure 5-2 or 5-3, Item 10) removal, disconnect the following associated connectors in this order.</p> <ul style="list-style-type: none"><li>• If used, disconnect external charging source J17 (Figure 5-1, Item 25).</li><li>• Disconnect battery pack connector J16 (Figure 5-1, Item 1).</li><li>• Slide, to the right; green terminal strips J6-COMM 2 (Figure 5-1, Item 21), J6-COMM 1 (Figure 5-1, Item 22), J8-A (Figure 5-1, Item 20), J8-B (Figure 5-1, Item 19), J20 (Figure 5-1, Item 17) and J23 (Figure 5-1, Item 15) from its associated XRC-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 XRC-195 Board.</li><li>• Disconnect PCCU Port connector J15 (Figure 5-1, Item 4).</li><li>• LCD Interface connector J13 (Figure 5-1, Item 3).</li><li>• Remove cable from J18 (Figure 5-1, Item 2) if External I/O Modules are installed.</li></ul>
2.	<p>Remove four mounting screws and lock washers securing the XRC-195 Board to door mounted standoffs.</p>

### FYI



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

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*Continued on Next Page*

## Replacing XRC-195 Board, Continued

Step	Procedure
3.	Replace and secure XRC-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.
4.	Reinstall connectors, removed in Step 1, to their associated Board mounted connectors in the following order. <ul style="list-style-type: none"> <li>• LCD Connector J13 (Figure 5-1, Item 3)</li> <li>• PCCU Connector J15 (Figure 5-1, Item 4)</li> <li>• I/O Module Cable J18 (Figure 5-1, Item 2)</li> <li>• Battery Pack J16 (Figure 5-1, Item 1)</li> <li>• Communications J6-COMM 2 (Figure 5-1, Item 21), J6-COMM 1 (Figure 5-1, Item 22)</li> <li>• On board I/O J8-A (Figure 5-1, Item 19), J8-B (Figure 5-1, Item 20), J23 (Figure 5-1, Item 15) and J20 (Figure 5-1, Item 17)</li> <li>• Charger Last J17 (Figure 5-1, Item 25)</li> </ul>

## Replacing Liquid Crystal Display (LCD) Board

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

**Procedures** In the following procedure, the common name for a component, its jumper number if available (Abbreviated J) or part is followed by a number in parentheses.

Step	Procedure
1.	To access the LCD Board, open the TOTALFLOW unit door (Figure 5-2 or 5-3, Item 3). Board is located behind XRC-195 Board (Figure 5-2 or 5-3, Item 6).
2.	Disconnect the external charging unit J17 (Figure 5-1, Item 25) from the XRC-195 Board.
3.	Disconnect the Battery Pack connector J16 (Figure 5-1, Item 1) from the board mounted connector.

### Caution



DO NOT remove the 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.

4.	Disconnect LCD Board cable connector from XRC-195 Board Display Interface connector J13 (Figure 5-1, Item 3). If working on a 6790, skip to step 7.
5.	Remove four XRC-195 Board mounting screws and lock washers. DO NOT let screws and lock washer fall onto Board circuitry.

*Continued on Next Page*

## Replacing Liquid Crystal Display (LCD) Board, continued

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6.	Move Board away from door then support it so its circuitry does not come in contact with any metal surface.
7.	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.

**TIP**



To adjust display contrast, use an extra small screw driver to turn potentiometer R32 completely clockwise. Complete to step 8, then move screw back counter clockwise until screen is readable.

8.	To reinstall Display Board, perform procedures 1 to 7 in reverse order. DO NOT over tighten screws. Once Display Board is reinstalled, apply power to XRC, adjust contrast potentiometer (R32) for optimum display, and verify information displayed on LCD is correct.
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# Chapter 6 Troubleshooting

## Overview

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

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 an XRC s with an installed radio communication unit.

### Chapter Highlights

This Chapter covers the following topics:

Preview Topic	See Page
Reset Procedures	6-2
Visual Alarm Codes	6-5
Troubleshooting	6-6
Communications Overview	6-8
RS-232 Serial Communication	6-9
RS-485 Communications	6-11
Wake-Up	6-13

## Reset Procedures

---

The XRC 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 XRC 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, its jumper number if available (Abbreviated J) or part is followed by a number in parentheses. To see a complete overview of the XRC-195 Board, see Figure 1-11.

Step	Procedure
1.	If an external charging source is connected, it must be disconnected. Slide external battery pack charger EXT CHGR +/- terminal block J17 (Figure 6-1, Item 25) from the XRC-195 Board green terminal block.
2.	Disconnect battery pack connector from XRC-195 Board BAT CONN connector J16 (Figure 6-1, Item 1).
3.	Disable Memory Backup J1 (Figure 6-1, Item 14), by moving the pin jumper to pins 2 and 3.
4.	To return to service reconnect 12 Vdc battery pack connector to XRC-195 Board BAT CONN connector J16 (Figure 6-1, Item 1) and observe LCD .
5.	If removed, reconnect external battery pack charging source to EXT CHGR connector J17 (Figure 6-1, Item 25).
6.	Enter all necessary parameters or send a saved setup file. See chapter 3.0, XRC Operation.
7.	When XRC has been cold started, the 24 hour clock will be reset to 00:00:00.
8.	Enable Memory Backup J1 (Figure 6-1, Item 14), 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

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*Continued on the Next Page*

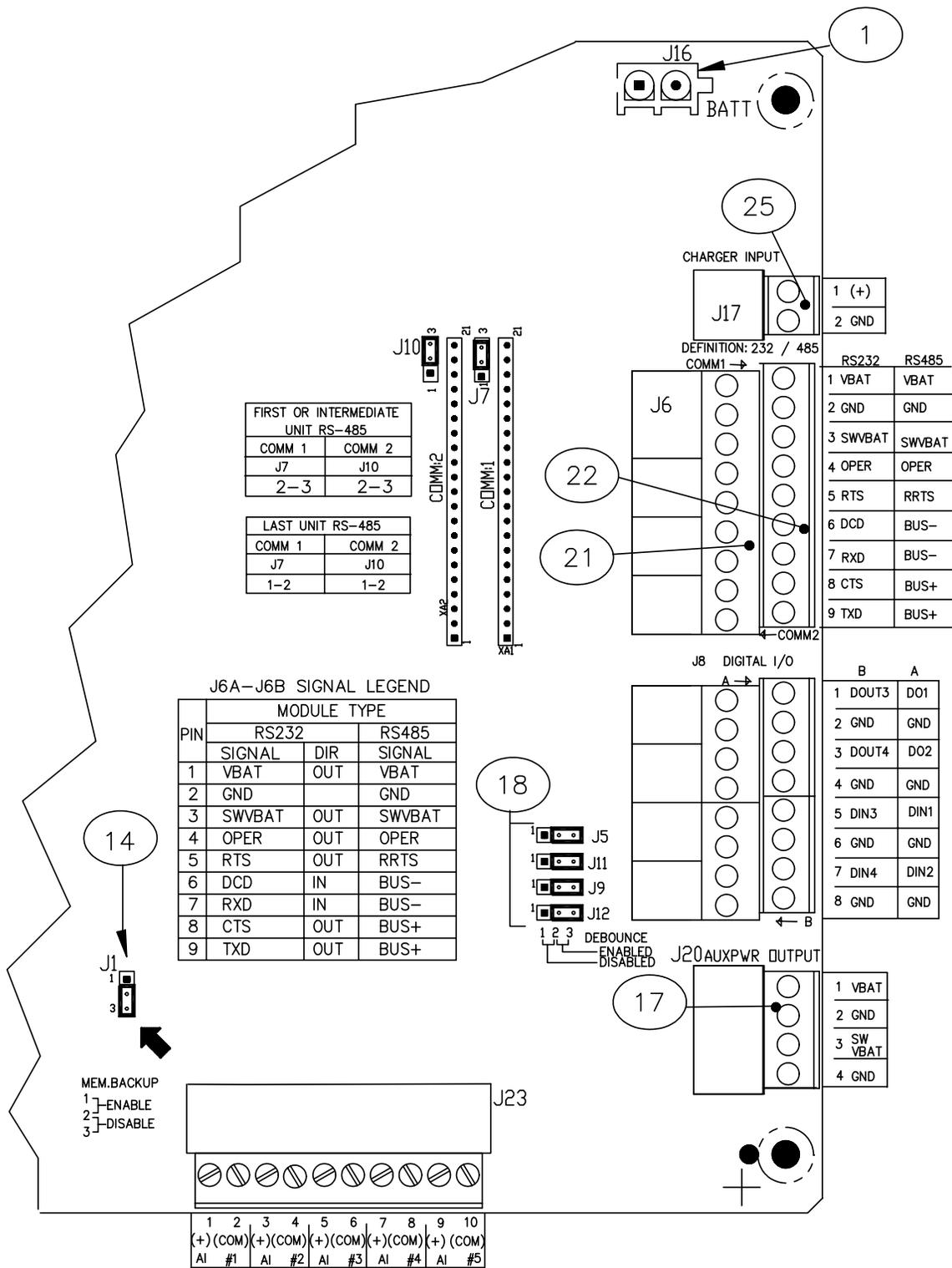


Figure 6-1 XRC-195 Board Cutout- Troubleshooting

**Table 6-1 XRC-195 Board Identifications-Troubleshooting**

<b>ID Number</b>	<b>Description</b>
1	Battery Connection
14	Memory Backup Enable/Disable
17	Auxiliary Power Output Connectors
18	DeBounce Enable/Disable
21	Remote Comm 2: Connectors
22	Remote Comm 1: Connectors
25	External Charger (Solar Panel) Connectors

## **Reset Procedures, Continued**

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

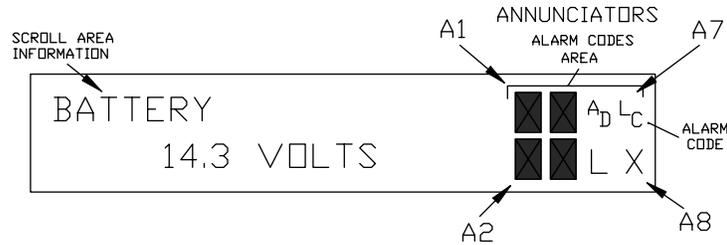
**Warm Start Procedures** In the following procedure, the common name for a component, its jumper number if available (Abbreviated J) or part is followed by a number in parentheses.

<b>Step</b>	<b>Procedure</b>
1.	If an external charging source is connected, it must be disconnected. Slide external battery pack charger EXT CHGR +/- terminal block J17 (Figure 6-1, Item 25) from the XRC-195 Board green terminal block.
2.	Enable Memory Backup J1 (Figure 6-1, Item 14), by moving the pin jumper to pins 1 and 2.
2.	Disconnect battery pack connector from XRC-195 Board BAT CONN connector J16 (Figure 6-1, Item 1). The XRC is now out of service.
3.	To place XRC in service, connect battery pack connector J16 (Figure 6-1, Item 1).
4.	Connect the EXT CHGR +/- terminal block J17 (Figure 6-1, Item 25).

## Visual Alarm Codes

The entire list of Status and Alarm codes may be found in Chapter 1, Table 1-3. For the purpose of troubleshooting, only those codes considered to be as alarms are discussed here. A description of each XRC alarm code, is described in Table 6-1. An alarm can be a word, character, letter or symbol.

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



**Figure 6-2 Liquid Crystal Display and Indicators**

**Table 6-2 Visual Alarm Codes**

Annunciator	Description
<b>I/O Sub-System</b>	
L L	<i>Low Lithium Battery Alarm:</i> When L <sub>L</sub> (low lithium) is displayed, lithium battery voltage is below 2.5 Vdc. If battery voltage is above 2.5VDC, A1 appears shaded. A new lithium battery measures approximately 3.6 Vdc.
L C	<i>Low Charger.</i> Displayed if XRC battery charging voltage is less than (+)0.4 Vdc higher than battery voltage. If charging voltage is (+)0.4 Vdc greater than battery voltage then annunciator is shaded.
A D	<i>A to D Failure.</i> Displayed if A to D Converter Absolute Differential Pressure, Absolute Static Pressure or temperature readings exceed maximum counts or are less than minimum counts. If A to D Converter readings are within range, AD is shaded..

## Troubleshooting

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Alarm conditions and their probable cause, and procedure(s) for correcting the problem, are presented below in Table 6-3. In the following procedure, the common name for a component, its jumper number if available (Abbreviated J) or part is followed by a number in parentheses.

**Table 6-3 Troubleshooting Alarm Codes**

<b>Alarm Condition</b>	<b>Probable Cause</b>	<b>Procedure</b>
SLEEP	Battery Voltage Below 10.9 VDC	<ol style="list-style-type: none"> <li>1. Make a local connection with the XRC. This wakes up the unit so that you may check all alarm conditions and determine the problem.</li> <li>2. Check battery pack cable. It must make a good secure electrical connection with XRC-195 Board BAT CONN connector J16(Figure 6-1, Item 1).</li> <li>3. If battery pack cable is securely connected, check battery pack voltage. If voltage is low, replace with another battery pack.</li> </ol>
L C	Charging Source Below 0.4 Vdc Plus Battery Pack Voltage	Check battery pack charging source with PCCU. This is for either Solar or externally connected charging sources.
L C	Solar Power Charging Unit	<ol style="list-style-type: none"> <li>1. In low lighting conditions, the display normally shows LC.</li> <li>2. Check solar panel angle and direction. In northern hemisphere, panel should face due south and in southern hemisphere, due north.</li> <li>3. 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.  Solar panel should be positioned so it receives the most sunlight. Do not place it in a shaded area.</li> <li>4. Check solar panel wiring to be certain it is correctly connected to associated XRC-195 Board termination block J17 (Figure 6-1, Item 25).</li> <li>5. Solar panel should be checked under load, using a diagnostic test kit.</li> </ol> <p>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.</p>

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**Table 6-3 Troubleshooting Alarm Codes, continued**

<p>L C</p>	<p>AC Power Unit</p>	<ol style="list-style-type: none"> <li>1. Check AC charger wiring to XRC termination block connector J17 (Figure 6-1, Item 25). Be certain wiring is correct.</li> <li>2. Check input AC voltage to external AC charging unit. Be certain primary AC voltage is correct.</li> <li>3. If input primary AC voltage level is correct, wiring to XRC-195 Board terminal is correct and there is no DC output from the charger, replace charger fuse.</li> <li>4. If fuse is not faulty or there is no charger DC output voltage after replacing fuse, replace AC charging unit.</li> </ol>
<p>A D</p>	<p>A/D Converter on XRC-195 Board is Over or Under Range</p>	<p>This alarm condition can be caused by differential pressure, static pressure or the temperature being out of measurement range.</p> <ol style="list-style-type: none"> <li>1. Check SP, DP and temperature with PCCU operating in Monitor mode, to determine which measurement channel is causing the alarm.</li> </ol>
<p>A D</p>	<p>Differential or Static Pressure Causing Alarm</p>	<ol style="list-style-type: none"> <li>1. From PCCU enter CALIBRATION check mode. This forces XRC to monitor differential or static pressure.</li> <li>2. Vent meter, run installed Manifold, to atmospheric pressure. Check to see if alarm code AD disappears. If it does, it is an indication the AMU is being operated out of its pressure range.</li> <li>3. If AD alarm code does not disappear, replace AMU. Do not remove cover from AMU. Doing so voids warranty. Remove AMU as an entire assembly.</li> </ol>

## Communications Overview

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These troubleshooting procedures are applicable to a XRC with an installed radio communication unit.

The two basic types of radio communications that can be used between the XRC and a radio receiver, are:

RS-232 Communications: Communication is accomplished using an RS-232 Module (P/N-2015192-001), installed in the XRC-195 Board.

RS-485 Communications: Communication is accomplished using an RS-485 Module (P/N-2015193-001), installed in XRC-195 Board.

**Caution**  Before removal or installation of either the above communication interface modules, it is important that you disconnect XRC external battery charger and main XRC battery pack cable connectors from XRC-195 Board. Refer to Figure 6-1.

### Setting Up Communications

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

- Verify RS-232 or RS485 Interface Modules, cables, associated XRC-195 Board MODULE RS-485 or RS-232 connector and radio are correctly installed.
- Check XRC identifier (ID). Log the ID for future reference.
- Log XRC 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:

- If you have the Comm Port assigned to an annunciator, the XRC displays the → after it recognizes the XRC ID.
- Check baud rate of XRC transmission and timing. The baud rate and timing 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.

## 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 6-4. In the following procedures, the common name for a component, its Jumper Number if available (Abbreviated J) or part is followed by a number in parentheses.

**FYI**  Voltage may be difficult to see using a digital voltmeter. It can be seen using an oscilloscope.  
Verify voltage by continuously polling XRC from CCU.

**Table 6-4 Troubleshooting RS-232 Serial Communication**

Error Condition	Possible Cause
XRC Will Not Respond to Communication Message	<ul style="list-style-type: none"> <li>• Verify XRC-195 Board wiring to radio transceiver is correct.</li> <li>• Verify battery pack voltage is greater than 11.5 Vdc.</li> <li>• Verify XRC ID number and security code are correct.</li> </ul>
Procedure	Instructions
Measuring SWVBATT Transceiver Supply Voltage	<p>Check XRC transceiver SWVBATT supply voltage. Refer to the following Measuring SWVBATT Transceiver Supply voltage for procedures:</p> <p>Using a digital voltmeter, measure transceiver SWVBATT DC supply voltage between the following XRC-195 Board J20 (Figure 6-1, Item 17) connector terminals. Voltage should be greater than 11.5 Vdc.</p> <p style="padding-left: 40px;">Comm 1 (Item # 22) or Comm 2 (Item # 21)</p> <p style="padding-left: 80px;">J6-2 (GDN [BLK]) and J6-3 (SWVBATT [WHT])</p> <p>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.</p>
Measuring Receiving Data [RXD (+)] Voltage	<p>Using an oscilloscope or digital voltmeter, connect it to XRC-195 Board J20 (Figure 6-1, Item 17) connector across the following terminals.</p> <p style="padding-left: 40px;">Comm 1 (Item # 22) or Comm 2 (Item # 21)</p> <p style="padding-left: 80px;">J6-2(GND [BLK]) and J6-7 (RXD+ [BRN])</p> <p>When communication data is being transmitted from CCU to XRC, voltage should vary between +5 Vdc and -5 Vdc.</p>

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## RS-232 Serial Communications, continued

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**Table 6-4 Troubleshooting RS-232 Serial Communication, continued**

Procedure	Instructions
Measuring Request To Send (RTS) Voltage	<p>Using an oscilloscope or digital voltmeter, connect measuring device to XRC-195 Board J20 (Figure 6-1, Item 17) green connector across the following terminals. When XRC is sending communication data to CCU, voltage should be +5 Vdc.</p> <p style="text-align: center;">Comm 1 (Item # 22) or Comm 2 (Item # 21)</p> <p style="text-align: center;">J6-2 (GND) and J6-5(RTS)</p>
Measuring Transmitting Data (TXD+) Voltage	<p>Using an oscilloscope or digital voltmeter, connect measuring device to XRC-195 Board J20 (Figure 6-1, Item 17) green connector across the following terminals. When communication data is being transmitted from the XRC , voltage should vary between +5 Vdc and -5 Vdc.</p> <p style="text-align: center;">Comm 1 (Item # 22) or Comm 2 (Item # 21)</p> <p style="text-align: center;">J6-2 (GND) and J6-9 (TXD+)</p>
If Communication Problems Still Exists	<ul style="list-style-type: none"> <li>• Using two (2) hand-held transceivers, check communication path between Master and Remote sites. If available, voice activated interface can be used.</li> <li>• Using a wattmeter, check transceiver output power. Refer to manufacturer's documentation for measuring instructions.</li> <li>• Verify that transceiver is on correct frequency. Refer to manufacturer's documentation for checking frequency instructions.</li> <li>• Verify orientation of antenna if directional.</li> </ul>

## 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 6-5. In the following procedures, the common name for a component, its Jumper Number if available (Abbreviated J) or part is followed by a number in parentheses.

**Table 6-5 Troubleshooting RS-485 Communications**

<b>Error Message</b>	<b>Possible Cause</b>
XRC Will Not Respond To Communication Message	<ul style="list-style-type: none"> <li>• Verify that XRC-195 Board wiring, to optional universal Communications Interface (UCI) Board or Radio Modem Assembly, is correct.</li> <li>• Verify wiring from UCI Board to Radio Transceiver Assembly is correct. Verify UCI Board jumper settings are correct.</li> <li>• Verify wiring from Radio Modem Assembly to Radio Transceiver Assembly is correct.</li> <li>• Verify XRC battery pack voltage is at least 11.5 Vdc.</li> <li>• Verify that XRC ID number and security code are correct.</li> </ul>

<b>Procedure</b>	<b>Instructions</b>
Measuring SWVBATT Transceiver Supply Switch Voltage	<p>Using a digital voltmeter, measure transceiver SWVBATT DC supply voltage between the following XRC-195 Board J20 (Figure 6-1, Item 17) connector terminals. Switched voltage should be greater than 11.5 Vdc.</p> <p style="text-align: center;">Comm 1 (Item # 22) or Comm 2 (Item # 21)</p> <p style="text-align: center;">J6-2 (GND [BLK]) and J6-3 (SWVBATT [WHT])</p> <p>The transceiver SWVBATT measured DC voltage should pulse every four (4) seconds for a time duration of approximately 350 milliseconds. Voltage must be at least 11.5 Vdc. (Baud rate dependent 350 max = 1200 Baud.)</p> <p>Voltage may be difficult to measure because of the short 350 millisecond time duration.</p>
Measuring Battery Pack Voltage (V-BATT)	<p>Using a digital voltmeter, measure transceiver V-BATT power supply voltage between the following XRC-195 Board J20 (Figure 6-1, Item 17) connector terminals. Switched voltage should be greater than 11.5 Vdc.</p> <p style="text-align: center;">Comm 1 (Item # 22) or Comm 2 (Item # 21)</p> <p style="text-align: center;">J6-2 (GND [BLK]) and J6-1 (V-BATT)</p>

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## RS-485 Communications, Continued



Power to transceiver can be provided from an external power supply. This allows XRC to switch external power to transceiver. Switching is accomplished using a 12VDC switch line connected to J20-3 (WHT). Refer to Measuring SWVBATT Transceiver Supply Switch Voltage. If this option is used, J20-1 (V-BATT) is not used.

**Table 6-5 RS-485 Communications, continued**

Procedure	Instructions
Measuring RS-485 Line Driver voltage	<p>Using an oscilloscope or digital voltmeter, connect it to XRC-195 Board J20 (Figure 6-1, Item 17) connector between the following terminals. Voltage should vary between +5 Vdc and 0 Vdc when communication data is being transmitted from CCU to XRC.</p> <p>Comm 1 (Item # 22) or Comm 2 (Item # 21)</p> <p>J6-8 (BUS+) and J6-6 (BUS-)</p>



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

Verify voltage by continuously polling XRC from CCU.

Measuring Request to Send (RTS) Voltage	<p>Using an oscilloscope or digital voltmeter, connect it to XRC-195 Board J20 (Figure 6-1, Item 17) connector between the following terminals. Voltage should be +5 Vdc when sending data to CCU. 0V when not transmitting.</p> <p>Comm 1 (Item # 22) or Comm 2 (Item # 21)</p> <p>J6-2 (GRD) and J6-5 (RTS)</p> <p>When RTS is high, transmitter must be keyed and transmitting data.</p>
Communication Problem(s) Still Exit	<ul style="list-style-type: none"> <li>Using two hand-held transceivers, check communication path between Master and Remote sites. If available, voice activated interface can be used.</li> <li>Using a wattmeter, check transceiver output power. Refer to wattmeter manufacturers documentation for operating instructions.</li> <li>Verify that transceiver is on correct frequency. Refer to transceiver manufacturer's documentation for procedures to check frequency.</li> <li>Verify transceiver settings.</li> </ul>

## Wake-Up

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

If battery voltage is still below 10.9 VDC, when you disconnect locally, the XRC returns to SLEEP mode. If battery voltage is above 11VDC, XRC remains awake.

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

Upon wake-up, the XRC performs the following functions:

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

Step	Procedure
1.	Connect locally to the XRC. This should WAKE-UP the unit for you to determine the cause
2.	Check battery pack cable. It must make a good secure electrical connection with XRC-195 Board BAT CONN connector J1 (18).
3.	If battery pack cable is securely connected, check battery pack voltage. If voltage is low, replace with another battery pack.

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## Chapter 7 Terms and Definitions

Term	Definition
$\mu$	Greek letter for "mu". Often used in math and engineering as the symbol for "micro". Pronounced as a long u.
$\mu$ 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.
$\mu$ FLO IMV	$\mu$ FLO's measurement and operational features are housed in this single unit assembly. The main electronic board ( $\mu$ FLO-195 Board), communication connection, power, SP, DP and Temperature readings are all housed in this unit.
$\mu$ FLO-195 Board	Main Electronic Board used in the $\mu$ FLO Computers. It is housed in the MUA and operates at 195 MHz while drawing minimal power.
A/D	Analog-to-digital.
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 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)
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.

Term	Definition
AGA-5	American Gas Association Report No. 5, methods (Volume, Mass or Energy) for calculating BTUs without knowing the composition of the gas.
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.
AH	See Ampere-Hour.
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.
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 $6 \times 10^{18}$ 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 Measurement Unit	A device for converting energy from one form to another. (e.g. Static and Differential pressure to electrical signals)
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.

Term	Definition
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).
AP	See Absolute Pressure.
API 14.3	American Petroleum Institute Report No. 14.3 addresses the 1992 equation regarding the AGA-3 method for calculating gas volume across an Orifice Plate.
API 21.1	American Petroleum Institute Report No. 21.1 addresses the equation regarding AGA-8 Fpv or Supercompressibility Factor and the energy content of the gas.
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".
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.
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.
Audio Frequency	Generally in the range 20 Hz to 20 KHz.
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.
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.

Term	Definition
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.
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.
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.

Term	Definition
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.
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.

Term	Definition
Butane (C <sub>4</sub> H <sub>10</sub> )	A saturated hydrocarbon (alkane) with four carbon atoms in its molecule (C <sub>4</sub> H <sub>10</sub> ). 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. CO <sub>2</sub> . Produced by combustion or oxidation of materials containing carbon.
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.
CCU	See Dos CCU, WINCCU or PCCU.
CCV	See Closed Circuit Voltage.
Cd	Coefficient of Discharge factor.
CE	European 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.
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	<p>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:</p> <ul style="list-style-type: none"> <li>• Motherboard: Typically, the mother board contains the CPU, memory and basic controllers for the system. Sometimes call the system board or mainboard.</li> <li>• Expansion board: Any board that plugs into one of the computer's expansion slots, including controller boards, LAN cards, and video adapters.</li> <li>• Daughtercard: Any board that attaches directly to another board.</li> <li>• Controller board: A special type of expansion board that contains a controller for a peripheral device.</li> <li>• Network Interface Card (NIC): An expansion board that enables a PC to be connected to a local-area network (LAN).</li> </ul> <p>Video Adapter: An expansion board that contains a controller for a graphics monitor.</p>
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.

Term	Definition
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.
Collector	The semiconductor region in a bipolar junction transistor through which a flow of charge carriers leaves the base region.
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 and RTU 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.
Console Mode	A local user interface typically used with custom applications that are not supported through any other mechanism. Also referred to as Printer Console Mode.
Contact	Current carrying part of a switch, relay or connector.
Conversion Time	The time required, in an analog input or output system, from the moment a channel is interrogated (such as with a read instruction) to the moment that accurate data is available. This could include switching time, settling time, acquisition time, A/D conversion time, etc.

Term	Definition
Coproprocessor	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.
CSA	CSA International, Inc. is a 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.
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.

Term	Definition
DB1	Acronym for Data Base 1. This refers to the previous data base structure used to store data in Totalflow products.
DB2	Acronym for Data Base 2. This refers to the current data base structure used to store data in Totalflow products.
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.
DC	See Direct Current
DCD	Communication abbreviation for Data Carrier Detect
DCS/PLC	Distribution Control System/Programmable Logic Controller
DDE	See Digital Data Exchange. Also called Dynamic Data Exchange. May refer to Totalflow's DDE Server TDS32.
Dead Weight Tester	Portable pressure tester used to check calibration and to calibrate AMU's utilizing a system of calibrated weights.
De-bounce	De-bouncing is any kind of hardware device or software that ensures that only a single signal will be acted upon for a single opening or closing of a contact. When you press a key on your computer keyboard, you expect a single contact to be recorded by your computer. In fact, however, there is an initial contact, a slight bounce or lightening up of the contact, then another contact as the bounce ends, yet another bounce back, and so forth. A similar effect takes place when a switch made using a metal contact is opened. The usual solution is a de-bouncing device or software that ensures that only one digital signal can be registered within the space of a given time (usually milliseconds)
Decibel	A logarithmic measure of the ratio of two signal levels. A practical unit of gain.
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 "sendout day". Also contract day.

Term	Definition
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.
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 or 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.
Digital-to-Analog Converter	An electronic device, often an integrated circuit, that converts a digital number into a corresponding analog voltage or current.
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.

Term	Definition
Discharge Rate	The rate, usually expressed in amperes, at which electrical current is taken from the cell/battery.
Discrete Manifold	Also called Tubing Manifold. Used in instances when the XFC is not mounted directly on the Orifice, usually pipe mount or wall mount.
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.
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.
Down-Load	The copying of information from one computer to another.
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.
Dry Contact	Contacts which neither break nor make a circuit. 0 Ohms.
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.

Term	Definition
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 <sup>2</sup> Prom	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.
Edit	Making changes to information, data or configuration files.
EEPROM	See Electrically Erasable Programmable Read-Only Memory. Also called E <sup>2</sup> Prom.
EFI	Electromechanical Frequency Interface.
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.
Electrode	The site, area, or location at which electrochemical processes take place.
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.
EMI	See Electromagnetic Interference.
Emitter	One terminal of a transistor.
Enagas	Spain's Certification Board
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 (usually by ultraviolet light exposure) and reprogrammed.

Term	Definition
Ethane (C <sub>2</sub> H <sub>6</sub> )	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 (C <sub>2</sub> H <sub>4</sub> )	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.
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.
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.
FCC	Federal Communications Commission.
Feed Points	Connections between gas feeder lines and distribution networks.
Feedback	Occurs when some or all of the output of the device (such as an amplifier) is taken back to the input. This may be accidental (such as the acoustic feedback from a speaker to microphone) or intentional , to reduce distortion.
Feeder (Main)	A gas main or supply line that delivers gas from a city gate station or other source of supply to the distribution networks.
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.

Term	Definition
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 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	Ruggedized 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.
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.

Term	Definition
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.

<b>Term</b>	<b>Definition</b>
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.
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.
GC	See Gas Chromatograph.
GCM	See Gas Chromatograph Module

<b>Term</b>	<b>Definition</b>
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.
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.
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.
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 <sub>2</sub> H <sub>6</sub> ). 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.

Term	Definition
Host Console	Host Console via Local Port uses the PCCU cable between the computer and the device's Local PCCU port but running Remote Protocol. Host Console via Remote Port uses the remote protocol
Hub	A market or supply area pooling/delivery where gas supply transaction point occur that serve to facilitate the movement of gas between and among interstate pipelines. Transactions can include a change in title, a change in transporter, or other similar items.
HV	See Heating Value.
Hydrocarbon	A chemical compound composed solely of carbon and hydrogen. The compounds having a small number of carbon and hydrogen atoms in their molecules are usually gaseous; those with a larger number of atoms are liquid, and the compounds with the largest number of atoms are solid.
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.
IC	See Integrated Circuit
IEC	Programming Language used by Totalflow for user applications.
IMV	See Integrated Multivariable Transducer.
Inch of Mercury	A pressure unit representing the pressure required to support a column of mercury one inch high at a specified temperature; 2.036 inches of mercury (at 32 degrees F and standard gravity of 32.174 ft/sec <sup>2</sup> ) 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/sec <sup>2</sup> ) 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.
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.

<b>Term</b>	<b>Definition</b>
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.
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, ie. 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.
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.
IVision	SCADA system designed for oil and gas applications
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

Term	Definition
LACT	Lease Automatic Custody Transfer.
LCD	Liquid Crystal Display.
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).
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.
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.
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 Totalflows 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.
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.

Term	Definition
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 <sup>6</sup> 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.
Meter Manifold	Gas piping between gas service line and meter. Also, gas piping supplying two or more meters.
Meter, Orifice	A meter using the differential pressure across an orifice plate as a basis for determining volume flowing through the meter. Ordinarily, the differential pressure is charted.
Meter, PD	See Meter, Positive Displacement.
Meter, Positive Displacement	An instrument which measures volume on the basis of filling and discharging gas in a chamber.
Meter, Turbine	1) Pulse meter. 2)A velocity measuring device in which the flow is parallel to the rotor axis and the speed of rotation is proportional to the rate of flow. The volume of gas measured is determined by the revolutions of the rotor and converting them to a continuously totalized volumetric reading.
Methane (CH <sub>4</sub> )	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.

Term	Definition
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.
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.
Multitasking	A property of an operating system in which several processes can be run simultaneously.
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 (IMV), more aptly describes the functionality of this design.
MVX	See Multivariable Transducer.
MV	Acronym for Molecular Weight.
N.C.	See Normally Closed.
N.O.	See Normally Open.
N2	Nitrogen
NAK	See Negative Acknowledgement
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.

Term	Definition
Noise	An undesirable electrical signal. Noise comes from external sources such as the AC power line, motors, generators, transformers, fluorescent lights, soldering irons, CRT displays, computers, electrical storms, welders, radio transmitters, and internal sources such as semiconductors, resistors, and capacitors. Unwanted disturbances superimposed upon a useful signal that tends to obscure its information content.
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
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.
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.
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).

Term	Definition
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.
Output	That part of a circuit where the processed signal is available.
P/I	See Pulse Input.
Parameter	(1) Characteristic. For example, <i>specifying parameters</i> 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 <i>parameter</i> is synonymous with argument, a value that is passed to a routine.
PCCU	Portable Collection and Calibration Unit.
PCCU32	Windows version of PCCU software to process, archive and collect data from the Totalflow equipment.
Pentane (C <sub>5</sub> H <sub>12</sub> )	A saturated hydrocarbon (alkane) with five carbon atoms in its molecule (C <sub>5</sub> H <sub>12</sub> ). 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.
PEX	A flexible material used for LevelMaster sensors.
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.

Term	Definition
Polling	A snapshot view of the readings taken by the Totalflow equipment.
Port	A communications connection on a computer or a remote controller. A place of access to a device or network, used for input/output of digital and analog signals.
Positive Temperature Co-efficient fuse	Opens circuit when high current condition occurs. Closes when condition no longer exists. Replaces typical fuses, which require replacement when blown.
Pressure Differential	Difference in pressure between any two points in a continuous system.
Pressure Markers	Pressure testing at different levels of pressure. Used for comparison purposes.
Pressure, Absolute	See PSIA.
Pressure, Atmospheric	See Atmospheric Pressure.
Pressure, Gas	In the natural gas industry pressure is measured by the force applied to a designated area. PSI and OSI refer to how much pressure (pound or ounce) is applied to one square inch. Inches Water Column (In.W.C.) is also used to express gas pressure and is measured using a manometer for lower pressure readings. 1 PSIG=27.21 Inches Water Column.
Pressure, Gauge	See PSIG.
Primary Cell (or Battery)	A cell or battery which is not intended to be recharged and is discarded when the cell or battery has delivered all its electrical energy.
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 routinely read and written to. ROM is used for storing data or programs (e.g. operating systems) and characteristic files on a semi-permanent basis.
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 (C <sub>3</sub> H <sub>8</sub> )	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.

Term	Definition
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 (German for Physically Technical Federal Institution) or German Technical Institute for certification.
PTC	See Positive Temperature Co-efficient Fuse.
Pulse Input	An 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.
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. Also referred to as RAM Disk.
RAM Disk	A lithium backed storage chip. Also see Random Access Memory.
Random Access Memory	Semiconductor read/write volatile memory. Data stored is lost if power is removed.
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.
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 iVison 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 iVison data base can meet either of these requirements.

Term	Definition
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	<p>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.</p> <p>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).</p>
Recommended Standard 422	<p>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.</p> <p>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).</p>
Recommended Standard 485	<p>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.</p> <p>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.</p>
Relay	Electromechanical device containing a coil and set of contacts. The contacts close when the coil is activated.
RD	Acronym for Relative Density.
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.
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.
RFI	See Radio Frequency Interference.
Ribbon Cable	A flat cable in which the conductors are side by side rather than in a bundle.

Term	Definition
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.
RTS	Communication abbreviation for Ready To Send.
RTU	See Remote Terminal Unit
RXD	Communication abbreviation for Receive Data.
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.
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	Serial E <sup>2</sup> Prom.
Self-Calibrating	A property of a DAQ board that has an extremely stable onboard reference and calibrates its own A/D and D/A circuits without manual adjustments by the user.
Semiconductor	Material that is neither 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.
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.
SG	Acronym for Specific Gravity.

Term	Definition
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.
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. ie. Volume Reset, Backward Time change over the hour, and Contract Hour change.
SNAM	Italy's Certification Board
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).
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 <i>relative density</i> .
SQL	See Structured Query Language.
SRAM	See Static Random Access Memory
SSM	Acronym for Stream Selector Module.
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.
STP	Standard Temperature and Pressure

Term	Definition
Structured Query Language	IBM developed this language in the 60's as a way of accessing data from a relational database. It has a very simple syntax for simple functions but can become complex for sophisticated applications. This language is standardized by international standards bodies, and is almost universal in application. Almost all databases support SQL. The 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.
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.

Term	Definition
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 workpiece 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 an 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.
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.
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.

<b>Term</b>	<b>Definition</b>
Transfer Rate	The rate, measured in bytes/s, at which data is moved from source to destination after software initialization and set up operations; the maximum rate at which the hardware can operate.
Transient	An abrupt change in voltage, of short duration (e.g. a brief pulse caused by the operation of a switch).
Transistor	A three leaded device (Collector, Base, Emitter) used for amplifying or switching. Also called a bi-polar transistor to distinguish it from Field Effect Transistor etc.
Transmitter	A device that converts audio, video or coded signals into modulated radio frequency signals which can be propagated by electromagnetic waves (radio waves).
Tranzorb	Transient Voltage Suppression device.
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.
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.
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.
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.
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.

Term	Definition
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.
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 <b>Casing</b> 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 <sup>1/2</sup> ).

<b>Term</b>	<b>Definition</b>
Working Voltage	The highest voltage that should be applied to a product in normal use, normally well under the breakdown voltage for safety margin. See also Breakdown Voltage.
World Wide Web	An Internet service facilitating access to electronic information - also known as the Web, WWW, or W3.
X Series	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.
XMV	External Multivariable Transducer.
XRC	See Remote Controller, X Series.
Y	Expansion factor
Zero Gas	Gas at atmospheric pressure.

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## **Chapter 8 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 this Model 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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