

2103217– rev. AC

# NGC8200 Dual Unit

User's Manual



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# INTRODUCTION

This manual is written to provide an experienced chromatography technician with the requirements necessary to install, setup and operate the Totalflow® Model NGC8200 Dual Unit Natural Gas Chromatograph.

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

## Chapter Descriptions

This manual provides the following information:

	Chapter	Description
1	System Description	Provides a description of the Totalflow NGC system components and specifications.
2	Installation	Includes unpacking and detailed procedures for setup and installation.
3	Start-up	Provides the user with a tutorial on how to get a newly installed NGC system up and running.
4	Maintenance	Provides Procedures on how to remove and replace major modules,
5	Troubleshooting	Provides a troubleshooting chart and procedures on how to correct most problems.
6	C9+ application	Provides specific information about the C9+ application.
<b>Appendix a</b>	Modbus Registers	Modbus Register List
<b>Appendix B</b>	Definitions and acronyms	Totalflow definitions and acronyms
<b>Appendix C</b>	Drawings	A place for the user to keep the drawings supplied with system.

## Getting Help

Totalflow takes pride in the ongoing support provided to customers. When purchasing a product, the user receives documentation which should answer their questions; however, Totalflow Technical Support provides an 800 number as an added source of information.

If requiring assistance, call:

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

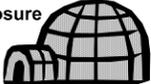
### Before Calling

- Know the Totalflow model and serial number. Serial numbers can be found on a plate located on each unit.
- Be prepared to give the customer service representative a detailed description of the problem.

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

## Key Symbols

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

Symbol	Description
<b>FYI</b> 	Intended to draw attention to useful information or to clarify a statement made earlier.
<b>TIP</b> 	Intended to draw attention to a fact that may be useful or helpful in understanding a concept.
<b>ACCESS</b> 	Intended to draw attention to information regarding security access to equipment and software Security features.
<b>CAUTION</b> 	Intended to draw attention to a statement that might keep the user from making a mistake, keep them from destroying equipment or parts or keep them from creating a situation that could cause personal injury if caution is not used. Please refer to the Safety Practices and Precaution section for additional information.
<b>WARNING</b> 	Intended to draw attention to a statement regarding the likelihood of personal injury or fatality that could result from improper access or techniques used while working in hazardous locations. Please refer to the Safety Practices and Precaution section for additional information.
<b>Environmental Enclosure</b> 	Indicates procedures that are only valid if system design includes the Environmental Enclosure (ENC82).

## Safety Practices and Precautions

This manual contains information and warnings which have to be followed by the user to ensure safe operation and to retain the product in a safe condition. Installation, maintenance and repairs should only be performed by a trained and qualified technician. Please refer to certification drawings shipped with this unit for specific guidelines. Extra copies of the certification drawings, referenced on the unit name tag, can be obtained, free of charge, by contacting Totalflow technical support at the number listed in the Getting Help section.

### Safety Guidelines

- DO NOT open or remove covers, including the PCCU local communications cover, unless the area is known to be non-hazardous, including the internal volume of the enclosure.
- DO NOT open the equipment to perform any adjustments, measurements, maintenance, parts replacement or repairs until all external power supplies have been disconnected.
- Installation and maintenance must be performed by person(s) qualified for the type and area of installation, according to national and local codes.

- 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.

## Safety First

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



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



**STOP.** Do not proceed without first verifying that a hazardous condition does not exist. This task may not be undertaken until proper protection has been accomplished, or the hazardous condition has been removed. Personal injury or fatality could result. Examples of these warnings include:

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

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

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

## Equipment Markings



Protective ground (earth) terminal.

## Grounding the Product

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

## Operating Voltage

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

## **Danger From Loss of Ground**

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

## **Safe Equipment**

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

## **Compliance**

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

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



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

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

## 1.0 SYSTEM DESCRIPTION

### 1.1 System Overview

This chapter introduces the user to the Totalflow® model NGC8200 Dual Unit natural gas chromatograph. The dual unit NGC differs slightly in that it has an auxiliary unit connected to the main unit. The auxiliary unit looks like the main unit but handles the additional component analysis duties such as C9+, O<sub>2</sub>N<sub>2</sub> and H<sub>2</sub>S applications; therefore, its column arrangement is slightly different.

The NGC is designed to continually analyze natural gas streams, on-site, determine composition, calorific value, and store the analysis information. It is designed for natural gas streams, 800 to 1500 Btu/scf (29.8 to 55.9 Mega joules/meter<sup>3</sup>) with less than 100 PPM H<sub>2</sub>S.

The unit is a fully functional gas chromatograph for pipeline quality natural gas and is designed to analyze natural gas streams that is dry of both hydrocarbon liquids and water. The unit can collect and retain analysis information for one to four independent sample streams. Applicable installations include: transmission, distribution, custody transfer with metrology quality results, production, gas gathering and end user gas markets.

#### 1.1.1 Framework

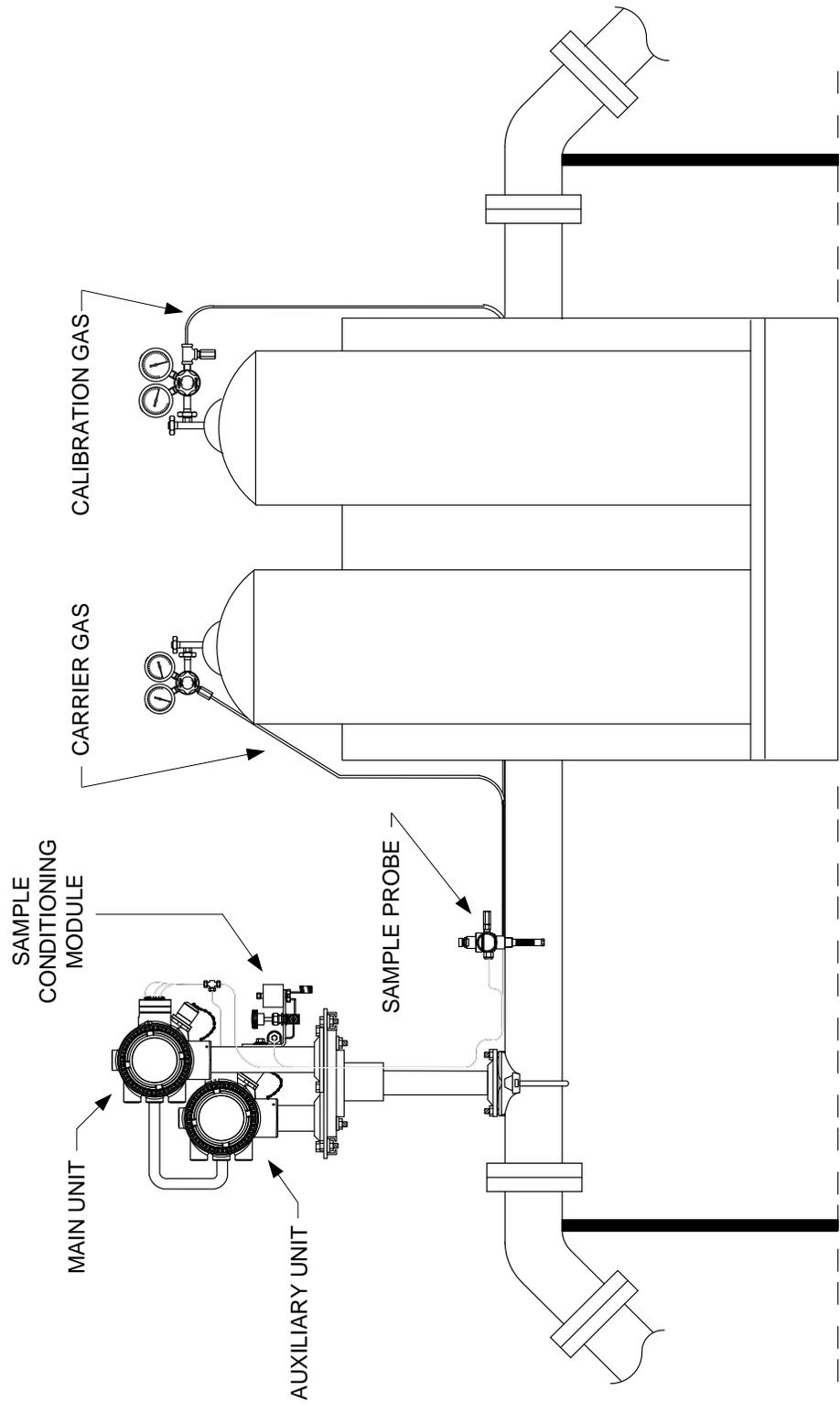
Based on ABB Totalflow XSeries technology, the NGC features a common platform that combines the expandable framework of the XSeries equipment with the capabilities of a remote gas chromatograph. This expandability allows the NGC to run other applications such as AGA-3 and AGA-7 while simultaneously performing stream analysis. This new platform is designed for operation on Windows CE real time operating system.

#### 1.1.2 Calibration

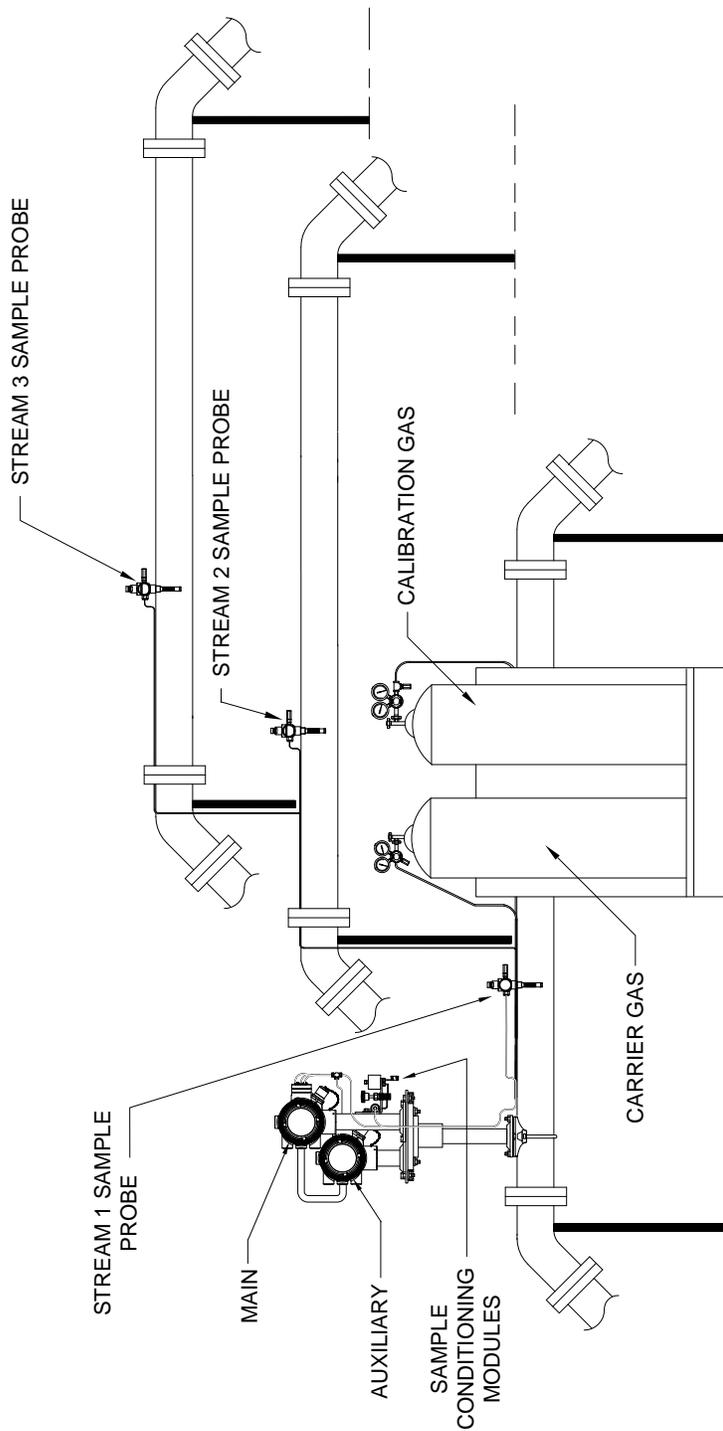
Once installed, the unit can immediately calculate the calorific value of natural gas. Although the unit is factory calibrated, due to some applications, the user may want to calibrate the unit using a calibration blend more representative of their specific stream makeup.

#### 1.1.3 Typical Installation

This unit will require minimal installation time and is fully configured and calibrated at the factory. A typical single stream pipeline installation would include a sample probe, optional sample conditioning module and carrier and calibration gas (see Figure 1–1). A multiple stream pipeline installation would include an installation where multiple sample probes may be connected to the NGC (see Figure 1–2).



**Figure 1-1 Typical Single Stream Installation**



**Figure 1-2 Typical Multi-stream Installation**

**FYI**



For clarity, the unit is shown mounted on the outside meter run. For sample line length consideration, the unit should be mounted on middle pipe run.

## 1.2 Processing a Sample

A natural gas sample is extracted from the pipeline, processed for particulate removal and phase integrity by the sample conditioning system (optional as required), transported to the NGC and injected onto the chromatographic columns where component separation occurs.

The NGC analyzes each sample, utilizing established chromatographic techniques. The resulting information consists of mole percent values for each component. These values are used to perform energy calculations. Calculated values include gas compressibility, real relative density, Btu/CV value, liquid GPM, Wobbe index, methane number and several other optional calculated values. Gas compressibility selections include NX-19, AGA-8 Detail, single virial summation factor, ISO summation factor and none (a factor of one is used).

The processed sample is then vented with the carrier gas and results are stored in memory and communicated to other devices as needed. All of these values as well as composition are available on various Modbus communication protocols.

### 1.2.1 Hydrocarbons

To further define the natural gas components, Table 1—1 gives additional details for each hydrocarbon. Among the more informative columns, key information includes the boiling point of the component. The boiling point of each component correlates to the order each component will exit the column.

**Table 1—1 Hydrocarbons**

Molecular Formula	Common abbreviation	Component	Boiling Point (8C)
C1H4	C1	Methane	-161.6
C2H4	C2=	Ethylene	-103.75
C2H6	C2	Ethane	-88.65
C3H6	C3=	Propylene	-47.65
C3H8	C3	Propane	-42.05
C4H10	IC4	Isobutane	-11.65
C4H8	C4=	Butylene	-6.95
C4H10	C4	Butane	-.45
C5H12	NeoC5	Neopentane	9.85
C5H12	IC5	Isopentane	27.85
C5H12	C5	Pentane	34.85
C6H14	C6	Hexane	68.85
C7H16	C7	Heptane	97.85
C8H18	C8	Octane	125.55
C9H20	C9	Nonane	150.95
C10H22	C10	Decane	173.95

### 1.3 Hardware System Specifications

**Table 1—2 System Specifications**

	12 VDC		24 VDC		
	No Aux. Heater	W/Aux. Heater	No Aux. Heater	W/Aux. Heater	
Supply Voltage	10.5–16 VDC	10.5–16 VDC	21–28 VDC	21–28 VDC	
Recommend AC Power Supply	14.5 V	14.5 V	25 V	25 V	
Maximum Instantaneous Current <sup>1</sup>	8 Amp	16.4 Amp	4.4 Amp	10.4 Amp	
Avg. Power Consumption After Startup <sup>2</sup>	Up to 14 Watts	Up to 106 Watts	Up to 14 Watts	Up to 128 Watts	
Environmental Temperature	Storage		-22°F to +140°F (-30° to 60°C)		
	Normal Operation		0°F to +131°F (-18°C to 55°C)		
	W/Cold Weather Enclosure		-40°F to +131°F (-40° to 55°C)		
Repeatability	6 0.125 Btu @ 1,000 Btu (60.0125%) ambient; 60.25 Btu @ 1,000 Btu (60.025%) over temp. range of 0–131°F (-18° to 55°C)				
Helium Carrier	Consumption rate: 24 ml/minute typical to 40 ml/minute maximum.				
Medium	800 to 1500 Btu per standard cubic foot (29.8 to 44.6 megajoules/meter <sup>3</sup> ) with less than 100 PPM H <sub>2</sub> S				
Analysis Time	Approx. 5 minutes; interval between cycles is adjustable.				
Calibration/Validation Streams	Up to 2 dedicated (reduces sample stream for each dedicated calibration streams). Must use dedicated stream(s) for auto-cal feature.				
Sample Streams	Up to 4 (with manual calibration streams).				
Construction	NEMA/Type 4X (IP56) Aluminum Alloy With White Polyester Powder coating. Explosion Proof. See Specification Sheet for certifications.				
Installation Time	Requires 2-3 hours for installation. Minimum 8 hours run time for repeatability.				
Mounting	Pipe run, free-standing pipe, shelf and ENC82.				
8200 Dimensions		Width	Height	Depth	Weight
	US	22.58"	22.5"	17.1"	60 lbs.
	Metric	573.53 mm	571.5 mm	434.34 mm	27.22 kg

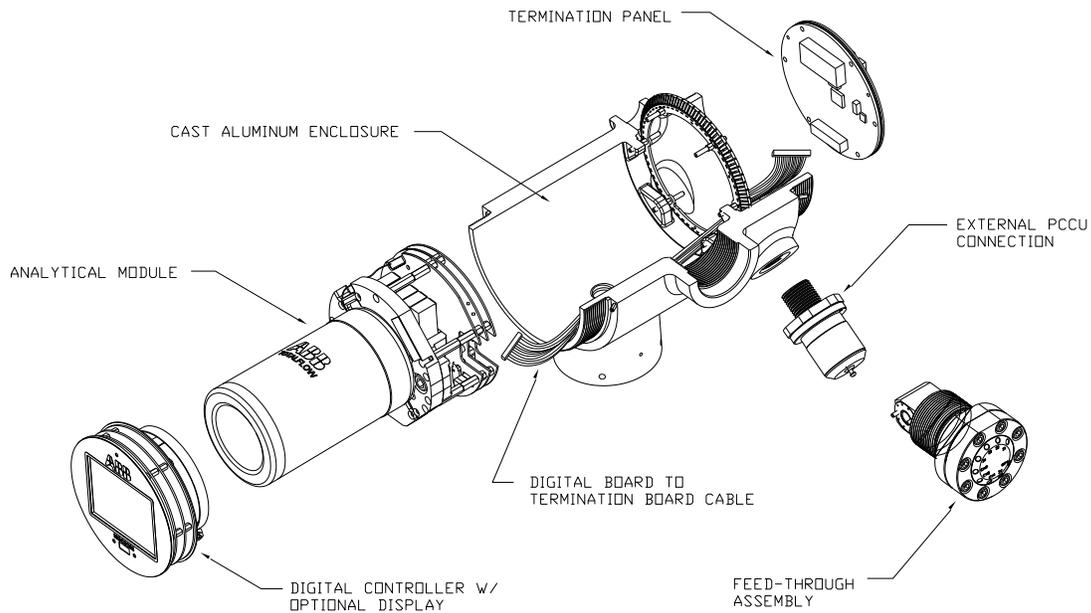
<sup>1</sup> Usually experienced at startup. Use this for power supply sizing requirements (includes approx., 20% buffer and is calculated for maximum allowable power supply voltages).

<sup>2</sup> At Recommended AC power supply voltage. Highly temperature dependent with feed-through heater operating continuously. Usually occurs at only the coldest ambient operating temperature, i.e., 0°F (-18°C).

### 1.3.1 NGC8200 Standard Hardware Features

The Totalflow NGC8200 Dual Unit features dual cast aluminum enclosures. Installation, start-up and troubleshooting times have been greatly reduced due to the following user friendly hardware features in each enclosure. The following items apply to both the main and auxiliary units:

- Enclosures, compact design
- Cast aluminum housing with six exterior Hubs
- Powder coating
- Weatherproof construction
- Modular design (see Figure 1–3)
- Digital controller assembly
- Analytical module with compact design and single bolt replacement
- Feed-through assembly with flame path arrestors
- Termination panel
- State of the art electronics
- 32-bit digital controlling electronics (i.e. no analog control loops)
- Low power operation
- Dual digital carrier pressure regulation
- Digital temperature control
- Digital detector electronics
- Low EMI/RFI design
- Operates on Windows CE
  - Auto-start with diagnostics
  - Factory calibrated



**Figure 1–3 Modular Design NGC8200**

### 1.3.2 Recommended Spare Parts

Totalflow has provided a recommended spares list for the NGC8200 product line. Consideration was given to the cost of the repair time and the cost of stocking repair parts. The NGC8200's modular design is uniquely suited to quick repair times. All the modules are easily replaced in a short time. A more comprehensive discussion of recommended spare parts can be found in Chapter 4-Maintenance.

### 1.3.3 Cast Aluminum Enclosure

The custom designed explosion proof enclosures consists of a cylindrical shaped cast aluminum housing, powder coated, with front and rear end caps for access to internal components. Figure 1-4 through Figure 1-7 show the outline dimensions of the NGC. The dimensions apply to both the main and auxiliary units with the exception that the auxiliary unit does not have an explosion proof MMI connector. The MMI hub will be plugged.

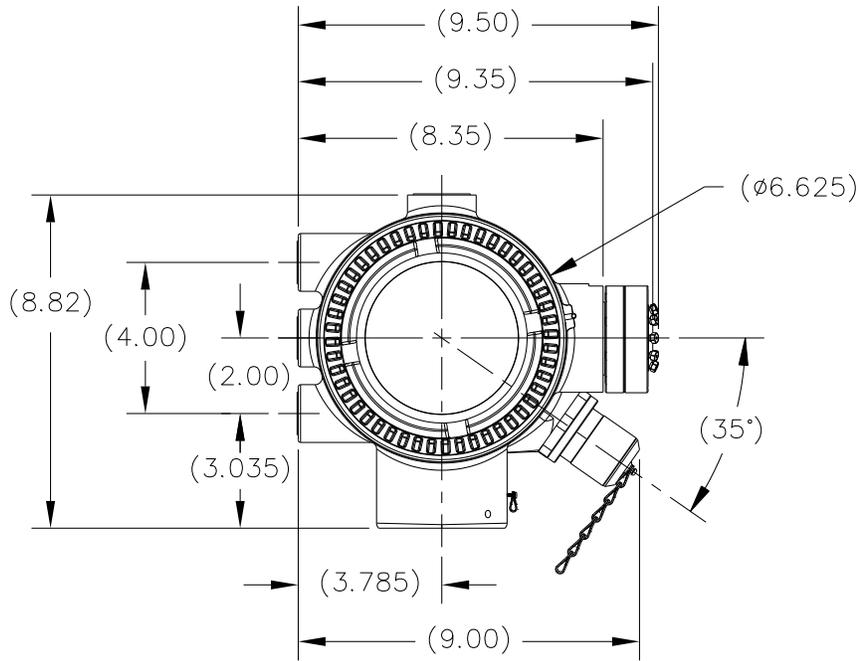
The end caps have precision engineered threading and are susceptible to damage if treated roughly. Enclosure and all fittings, including feed-through, MMI connection and breather, are tested to Nema/Type 4X. Unauthorized removal of the end caps are protected with a 1/16" hex socket set screw on each end cap.

The dual enclosures are mounted on a plate which in turn is typically mounted inside a cold weather enclosure (ENC82). The individual units may be directionally positioned using 1/8" hex socket set screws, located in the neck of each enclosure.

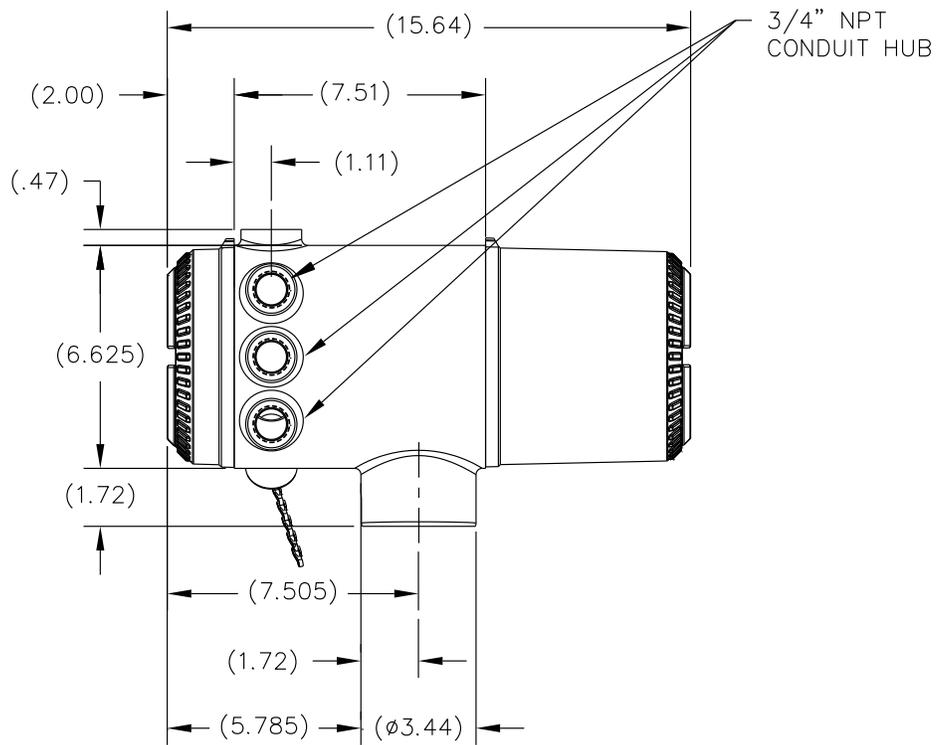
#### 1.3.3.1 Exterior Hubs

Each enclosure features six exterior hubs:

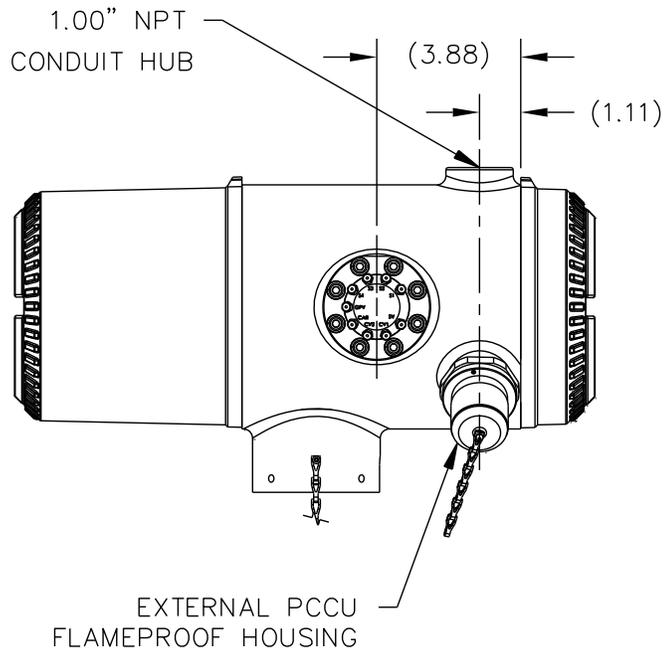
- Gas feed-through assembly
- Explosion proof local MMI port (main unit only)
- 4 miscellaneous hubs, including:
  - Communication hub
  - Power hub
  - Digital input/output wire hub
  - Undefined hub



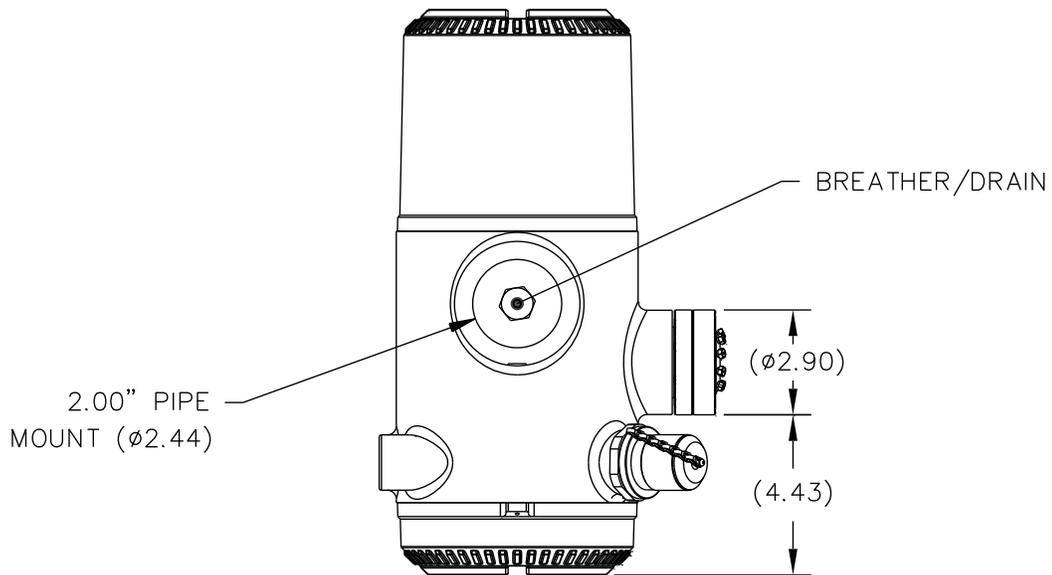
**Figure 1-4 NGC8200 Enclosure**



**Figure 1-5 NGC8200 Enclosure Left Side**



**Figure 1-6 NGC8200 Enclosure Right Side**



**Figure 1-7 NGC8200 Enclosure Underside**

### 1.3.4 Feed-Through Assembly

Sample streams can be connected directly to the feed-through assembly of the main and auxiliary units (see Figure 1-8) or through an optionally installed sample conditioning system. Either method requires tubing tees to branch off to each unit. The feed-through assembly on each unit also serves as the connection for carrier gas and calibration streams and contains the vents for sample and column gases. The feed-through assembly comes in three configurations:

- Without auxiliary heater

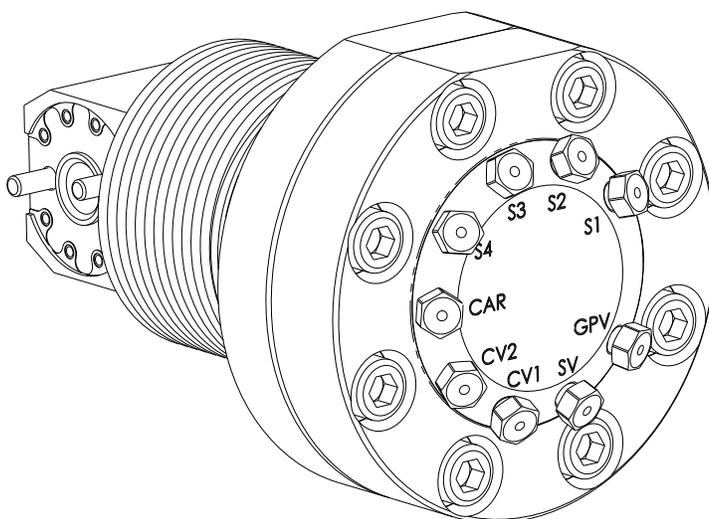
- With 12 VDC auxiliary heater
- With 24 VDC auxiliary heater

Assemblies with an auxiliary heater have a temperature sensor cable which connects to the analytical module and is replaceable. Please note that this cable will also come in two configurations: 12 VDC and 24 VDC.

#### 1.3.4.1 Inlets

All inlets have an internal, replaceable, 0.5 micron filters. Available inlets are:

- 1–4 sample stream inputs, calibration blend streams
  - 1–3 sample streams with 1 dedicated auto cal stream, or
  - 1–2 sample streams with 1–2 dedicated auto cal streams, or
  - 1–4 sample streams with 1–2 manual calibration streams.
- 1 carrier input stream



**Figure 1–8 NGC Feed-through assembly**



The 0.5 micron filters should NOT be considered as a replacement for the primary filtering system. Optional sample conditioning modules are designed for this purpose.

#### 1.3.4.2 Vents

Feed-through assembly vents do not have filters but will require vent tubing to be attached and routed accordingly on both the main and auxiliary units. These are:

- 2 column vents (CV1 and CV2)
- 1 sample vent (SV)
- 1 gauge port vent (GPV)

#### 1.3.5 Analytical Module

The modular design of the analytical module is enhanced by the single bolt removal feature. This module may also be broken down into the GC module, manifold assembly and analytical processor assembly. The GC module also features single bolt removal.

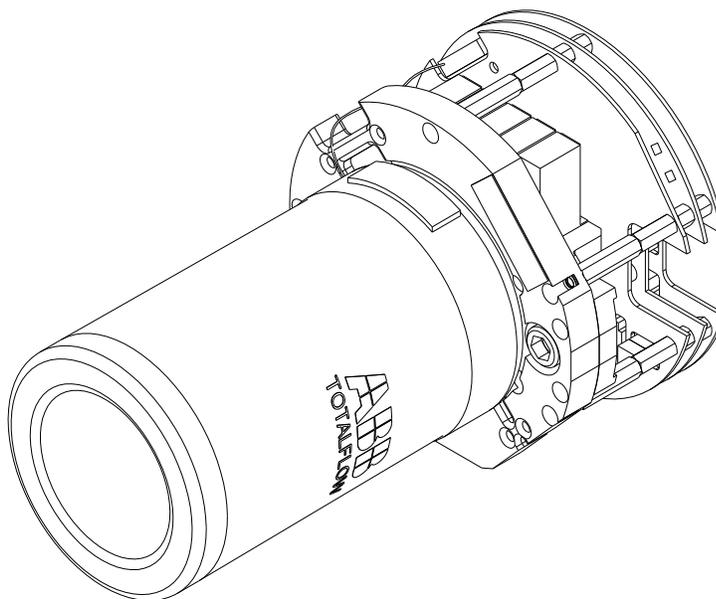
The analytical module comes in two voltage configurations: 12 VDC and 24 VDC.

**CAUTION**  Due to the fact that the column trains are different between the main and auxiliary unit, the analytical modules are not interchangeable.

Figure 1–9 shows the analytical module assembly removed from the enclosure.

#### 1.3.5.1 Features

- High-speed serial interface to digital controller board
- 32-bit digital signal processor
- FLASH memory
- Analog to digital conversion circuits
- Digital oven temperature controller
- Digital auxiliary heater controller (optional reed-through heater)
- Dual digital pressure regulators
- Sample pressure sensor
- Pressure sensors (100 PSI max.)
- Thermal conductivity detectors
- System level voltage monitoring
- Analytical processor board level temperature sensor
- LED board status indicators



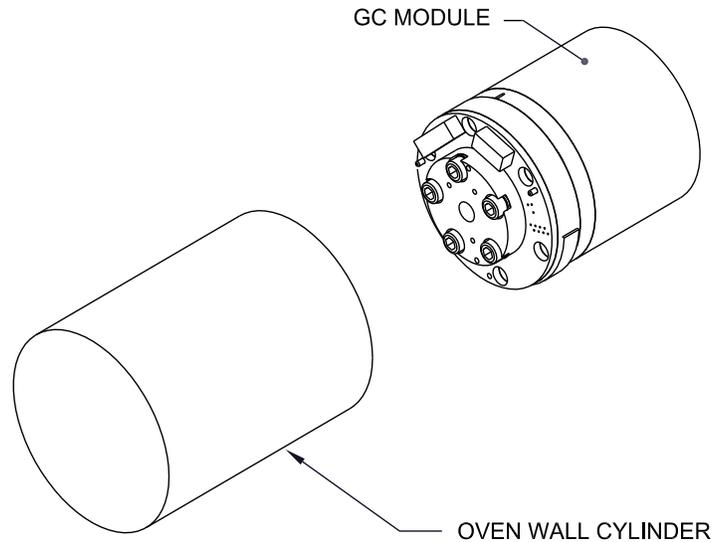
**Figure 1–9 Analytical Module**

#### 1.3.5.2 GC Module

The GC module is comprised of three parts: columns, GC valve and GC module circuit board. The GC valve controls the flow of carrier and sample gas to the columns which perform the component separation of the gas. The GC module circuit board contains the sensors for the carrier pressure regulators, the sample pressure sensor and the thermal conductivity detectors (TCD's) which detect the gas components as they elute from the columns. It also contains an EEPROM or

FLASH memory for storage of calibration and characterization information of the module and its sensors.

Figure 1–10 shows the GC module with the oven wall removed.

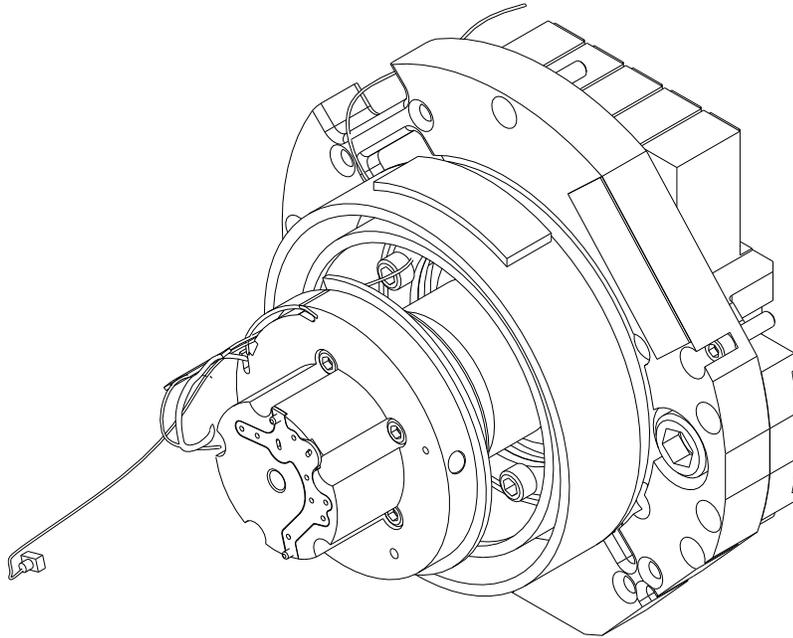


**Figure 1–10 GC Module Assembly**

### **1.3.5.3 Manifold Assembly**

The manifold assembly is comprised of the manifold plate, heater, stream select valves, sample shut-off valve, pilot valve, column pressure regulators and various cables to other major components. The manifold plate and heater maintain constant temperature of the oven which houses the GC module and columns. The cables complete the information chain from the GC module to the analytical processor and the digital controller assembly.

Figure 1–11 shows the manifold assembly. This assembly is not field replaceable.



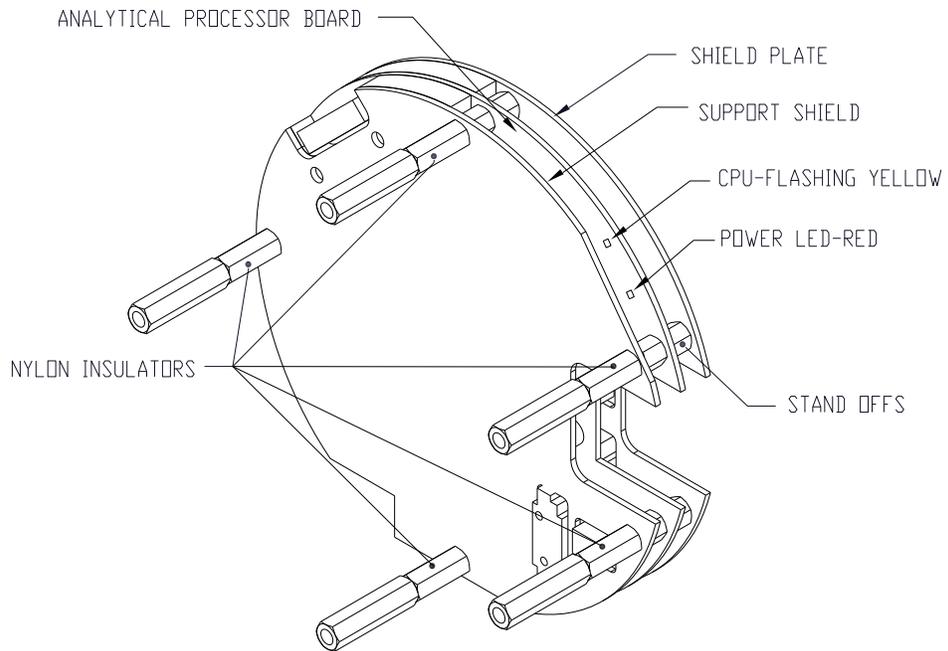
**Figure 1–11 Manifold Assembly**

#### **1.3.5.4 Analytical Processor Assembly**

The analytical processor board contained in the main and auxiliary units provide real-time system control and measurement of the analytical processes within the individual units. It does this by interfacing with all of the sensors in the GC module (and optional feed-through temperature sensor) as well as controlling the carrier pressure regulator valves, sample stream valves, the pilot valve and the heaters. The data generated by the analytical processor is passed to the digital controller board via a high speed serial interface. The main unit requests any information that it needs from the auxiliary unit via a communication link between the two units.

The analytical processor in each unit also has two status LEDs used for troubleshooting. The red LED indicates that the board is powered on. If the board is remotely powered down by the digital controller or has no power, this LED will be off. The yellow LED indicates that the analytical processor's CPU has booted its program successfully and is controlling its processes as directed by the digital controller. This LED should be flashing at a high speed (between 20-40Hz). If this LED is off or is on solid with no flashing, the software in the analytical processor is not running properly.

Figure 1–12 shows the analytical processor assembly. The analytical processor assembly is not field replaceable.



**Figure 1–12 Analytical Processor Assembly**

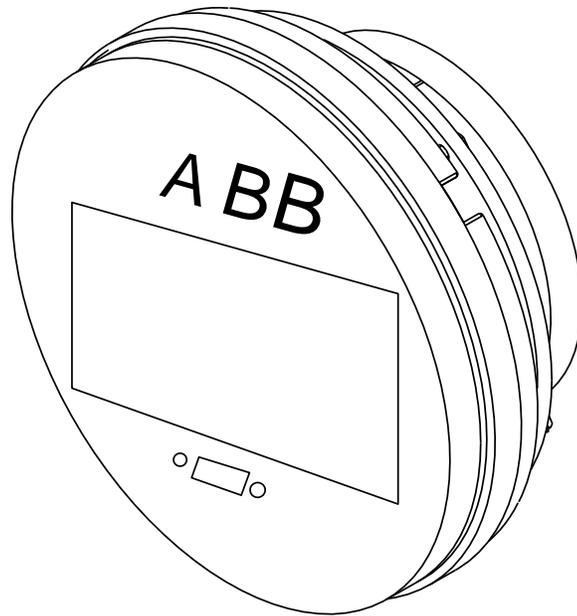
### 1.3.6 Digital Controller Assembly with VGA Display

This assembly located in the main and auxiliary units (see Figure 1–13) contains the digital electronic board, mounting assembly and VGA display. The VGA display is not optional for the auxiliary unit.

The digital controller board provides control parameters to the analytical processor board, stores and processes the data sent from the analytical processor board. The digital controller also processes communication with other devices.

The digital electronic board features:

- 16 MB pseudo static ram (application), lithium battery backed
- 32 MB NAND FLASH memory (boot/application/storage)
- 4 MB static CMOS memory (storage)
- 1 secure digital card socket, with up to 4 GB removable storage optional)



**Figure 1–13 Digital Controller Assembly with Optional Display**

The display board provides a ¼ panel VGA monochromatic display to monitor the process and results. The displayed data will include information from the auxiliary unit. The display is divided up via six magnetic switches to allow navigation through the various screens of data and to control the processes (hold, run and calibrate).

The VGA display features:

- ¼ panel VGA display circuit board
- 2 LED status indicators, user programmable
- User interface, with Hall-Effect magnet navigation for monitoring NGC operation

Figure 1–14 shows the typical flow of information accessible through the display.

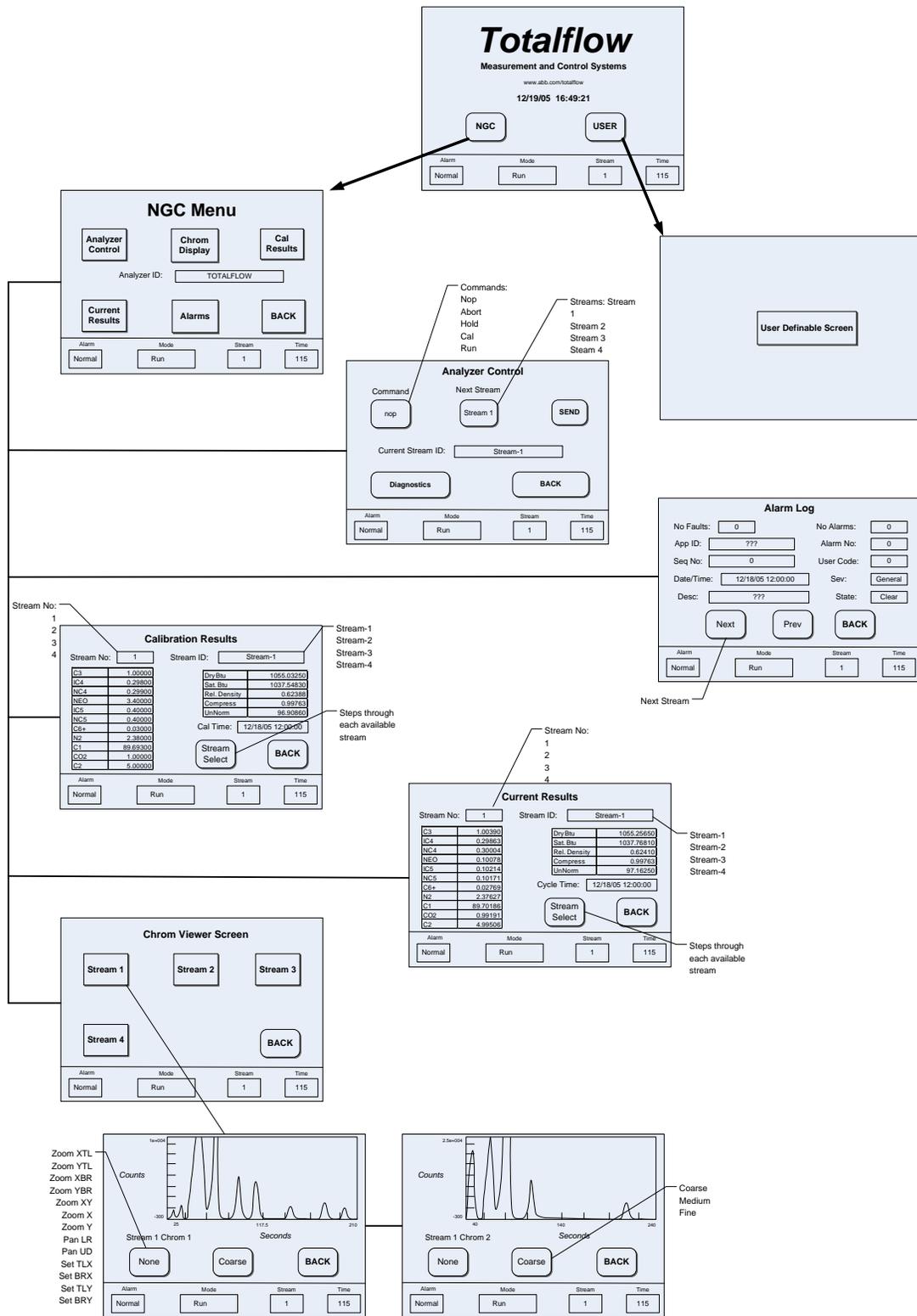


Figure 1-14 Optional NGC VGA Display Screens

### 1.3.7 Termination Panel

The NGC termination panel acts as a connection to the outside world. Both the main and auxiliary units contain a termination panel; however, all user connections are made only to the main unit. The termination panel features transient protection, a voltage regulator for digital controller, positive temperature coefficient fuses (PTC) and many other safeguards to protect the remainder of the system from electrical damage. All outside communications and I/O are channeled through this board. It is designed to be a low cost, field replaceable maintenance solution and is designed to operate on either 12 VDC or 24 VDC.

#### 1.3.7.1 Features

- Transient protection
- EMI/RFI protection
- PTC fuses
- Voltage regulator for digital controller
- Dedicated local serial data interface (dedicated communications between main and auxiliary units)
- 2 LED status indicators (software programmable)
- 1 power monitor status indicator
- 1 5VDC LED status indicator
- 2 DIs and 2 DOs connected to digital controller
- 2 remote serial ports (RS232/RS422/RS485 software selectable)
- Optional Ethernet interface with 3 LED status indicators
- Optional USB host and client interface

**FYI**



Communications ports and I/O are not available for use on the auxiliary unit.

#### 1.3.7.2 Local Interface

This local PC interface requires PCCU32 version 6.0 or higher, a laptop PC and a MMI cable (either USB or serial RS-232). The software operates within the full range of Windows® 95,98, 2000, NT and XP utilities. Maintenance functions can be performed by personnel with little or no knowledge of gas chromatography. See the online help files for more information.

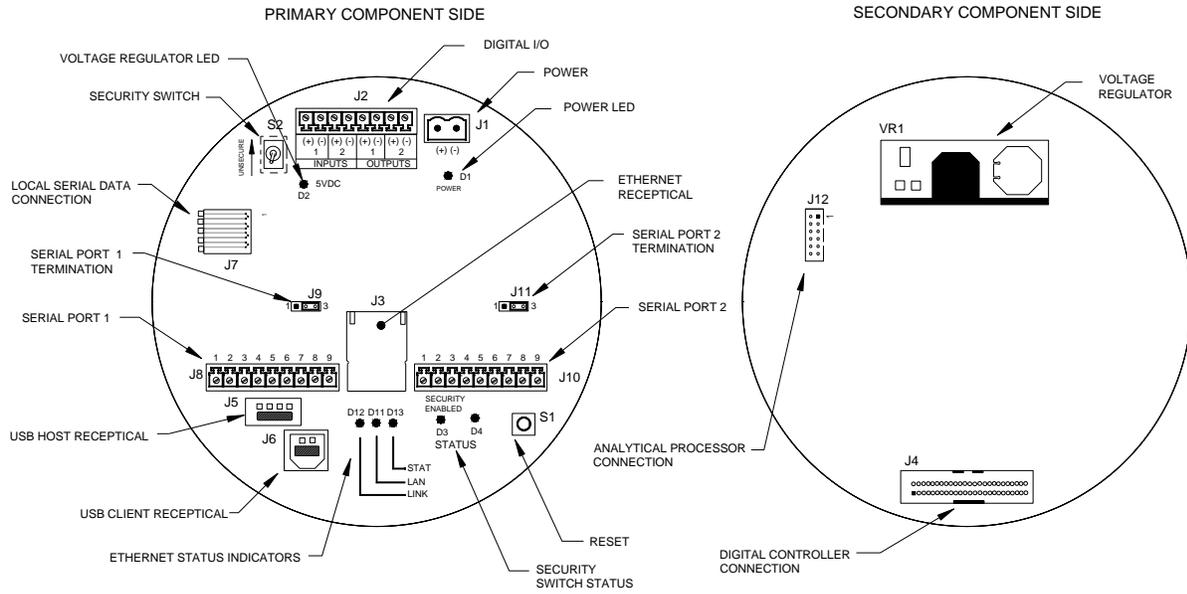


Figure 1-15 Termination Panel

## 1.4 Grounding the NGC

The NGC must be properly grounded. The NGC has a grounding lug on the mounting neck of the enclosure. This lug should be tied to a good earth ground with no smaller than #12 AWG wire. The NGC cannot be connected to any pipeline where cathodic protection exists. If the system uses cathodic protection, the NGC must be mounted on a section of pipe that has been electrically isolated from the cathodic currents (see Figure 1-16).

### 1.4.1 Power Supply

The power supply for the NGC should have an isolated output (i.e., the negative side of the 12 VDC output should not be electrically connected to chassis or earth ground). In many instances, the power supply will be located with a radio. If the radio is connected to the NGC via RS232/485/422, the communications should share the power ground. The communication shield should only be connected at the NGC end. The other end should be left to float (left unconnected).

### 1.4.2 Sample Probe

If the sample probe is mounted to a section of pipe where cathodic currents may exist, the user will have to put isolators in their sample tubing between the sample probe and the NGC. Any time that the sample probe is on a section of pipe other than the one where the NGC is directly mounted, tubing isolators should be employed. It is very important that probe ground and the NGC ground be at the same potential. If this cannot be ensured, tubing isolators must be used.

### 1.4.3 Other Considerations

If other devices are to be powered from the same isolated power supply that is powering the NGC, be careful to avoid any ground loops. The various devices should be connected in a star configuration. It is also important that any additional powered devices be able to handle a fairly wide range of input voltages as the NGC's heater will draw about 4 amps (if the auxiliary heater is installed it might be

as much as 8 amps). This load (4-8 amps) being drawn across any considerable length of cable can result in a substantial voltage drop

**FYI**



Please refer to Cable Length Power Specifications table.

The resulting lower input voltage to the additional device could effect its operation. Input voltage excursions will fluctuate with the toggling of the NGC's heater(s). The heater(s) will be turning on and off in an effort to maintain a very constant internal temperature for the NGC's GC module.

In an office or lab environment be sure to have a good earth ground to the NGC. In an office situation, it is easy to not have the NGC well grounded. Often, the third pin (ground) on the power cable is missing or has been removed. Improper grounding can lead to erratic behavior. If the unit is not properly grounded, the user could have as much as 60 VAC (half line voltage) on the case of their equipment due to capacitive coupling within the power supply. To power up the NGC in an office/lab environment, make sure to have an AC ground and jumper the AC and DC output grounds on the power supply as per Table 1—4 or Table 1—5.

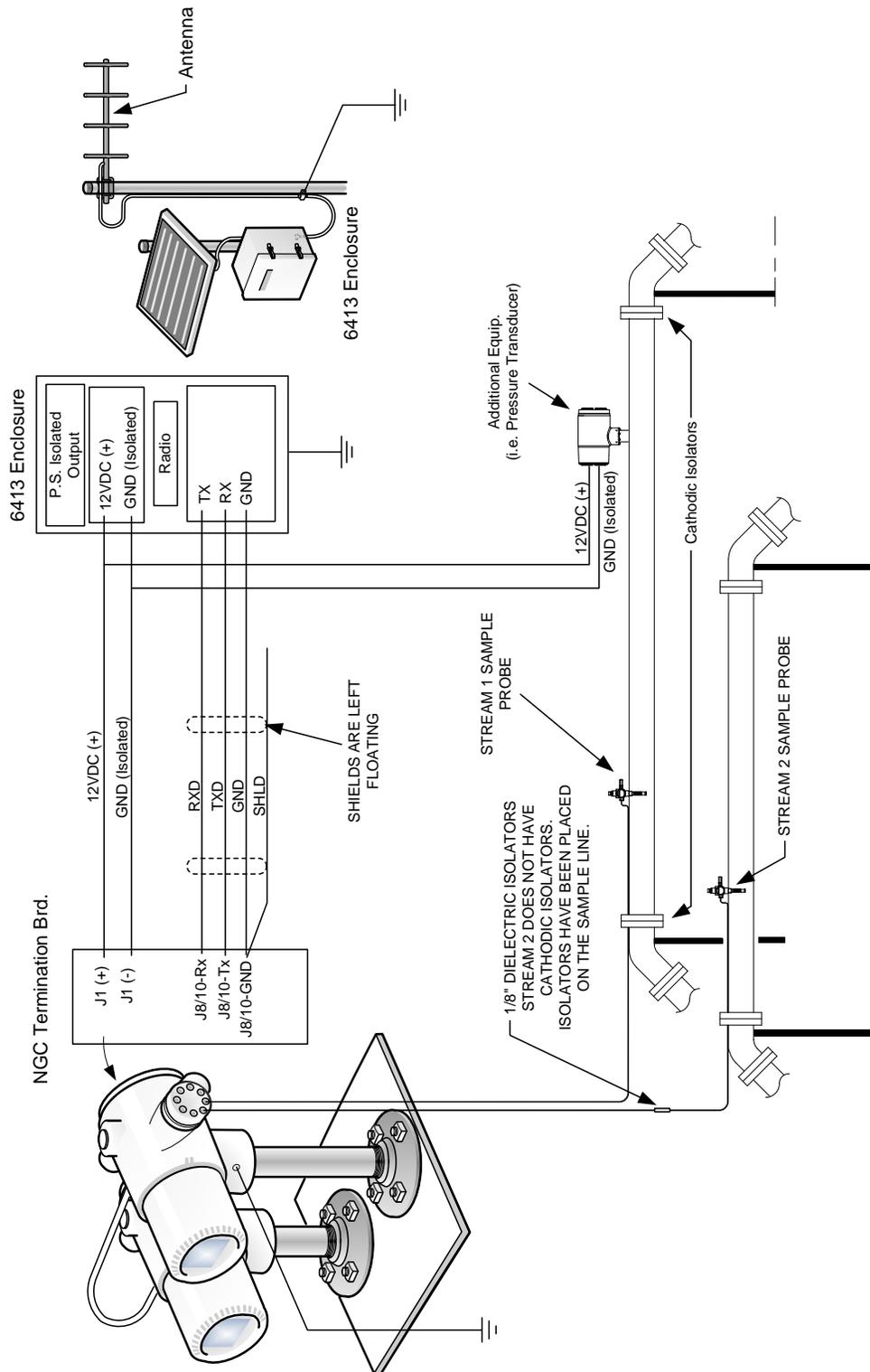


Figure 1-16 NGC Grounding Considerations

## 1.5 Calibration/Validation Stream

On the NGC feed-through assembly, one or two of the sample streams may be used for a calibration gas input. Totalflow recommends a metal diaphragm regulator set to  $15 \pm 2$  PSIG input. Recommended calibration gas component concentrations for use with auto peak find may be found in Table 1—3 (C6+ applications only).

**Table 1—3 Calibration Gas Blend Recommended Components**

Component Name	Abbreviation	Mol %	Component Name	Abbreviation	Mol %
Nitrogen	N2	2.500	Normal Butane	NC4	0.300
Methane	C1	89.570	Neo Pentane	Neo C5	0.100
Carbon Dioxide	CO2	1.000	Iso Pentane	IC5	0.100
Ethane	C2	5.000	Normal Pentane	NC5	0.100
Propane	C3	1.000	Hexanes and Heavier	C6+	0.030
Iso Butane	IC4	0.300			

## 1.6 Operating Voltages and Cable Lengths

The NGC is designed for connection to a 12 VDC or 24 VDC power source. The 12 volt power source must provide a minimum of 10.5 VDC to a maximum of 16 VDC at 4 amps minimum and the 24 Volt must provide a minimum of 21 VDC to a maximum of 28 VDC at 2.2 amps. Configurations with the auxiliary feed-through heater will increase requirements.

Adequate wire size is a function of the distance between the NGC and the DC power supply. When running wiring from the power source to the NGC, consideration must be given to the voltage dropped between the power source and the NGC. Smaller wire gauges have greater resistance, and therefore, a greater voltage drop across the wiring. The following tables (see Table 1—4 and Table 1—5) document multiple cable sizes and corresponding maximum cable lengths for DC and AC installations with and without the auxiliary feed-through assembly heater.

Additional devices connected to the NGC and requiring power (XMs, radios, etc.) must be factored into this calculation. Refer to their technical specifications for the requirements of each, or call Totalflow for help computing cable requirements for additional loads.

**FYI**



For non-standard applications or additional questions, call Totalflow customer service at:

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

**Table 1—4 12 VDC Battery Power Supply System Maximum Cable Lengths**

**(No external devices connected to NGC, 12 VDC Battery Power Supply Only)**

Model/ Option	Min. Batt Voltage (V)	Units	10 AWG <sup>3</sup>	12 AWG	14 AWG	16 AWG	6mm <sup>2</sup> <sup>3</sup>	4mm <sup>2</sup> <sup>3</sup>	2.5mm <sup>2</sup>	1.5mm <sup>2</sup>
12V NGC w/o Feed Through Heater	12.00	(ft)	39.14	24.72	15.5	9.72	45.01	30.08	18.71	11.45
		(m)	11.93	7.54	4.72	2.96	13.72	9.17	5.9	3.5
12V NGC with Feed Through Heater	12.00	(ft)	19.37	12.23	7.66	4.81	22.27	14.89	9.25	5.67
		(m)	5.90	3.73	2.33	1.47	6.79	4.54	2.82	1.73

**Table 1—5 AC Power Supply System Maximum Cable Lengths**

**(No external devices connected to NGC, AC Power Supply Only)**

Model /Option	Recommended PS Voltage (V)	Units	10 AWG <sup>3</sup>	12 AWG	14 AWG	16 AWG	6mm <sup>2</sup> <sup>3</sup>	4mm <sup>2</sup> <sup>3</sup>	2.5mm <sup>2</sup>	1.5mm <sup>2</sup>
12V NGC w/o Feed Through Heater	14.50	(ft)	234.84	148.32	92.91	58.30	270.1	180.51	112.25	68.77
		(m)	71.58	45.20	28.31	17.77	82.32	55.02	34.22	20.96
12V NGC with Feed Through Heater	14.50	(ft)	116.22	73.40	45.98	28.86	133.67	89.33	55.56	34.03
		(m)	35.42	22.37	14.01	8.80	40.74	27.23	16.94	10.37
24V NGC w/o Feed Through Heater	25.00	(ft)	404.76	255.64	160.12	100.49	465.54	311.13	193.5	118.53
		(m)	123.37	77.92	48.81	30.63	141.90	94.84	58.98	36.13
24V NGC with Feed Through Heater	25.00	(ft)	168.49	106.41	66.66	41.83	193.79	129.52	80.55	49.34
		(m)	51.35	32.43	20.31	12.75	59.06	39.48	24.55	15.04

<sup>3</sup> This wire size may require splicing in 12 AWG or 2.5mm<sup>2</sup> or smaller wires at each end of the cable to be able to fit screw terminals.

## 1.7 Sample Transport Tubing Design

Information in this section enables the user to design the sample transport tubing connected between the TCR sample probe and installed NGC. Minimizing transport “lagtime” and maintaining a single vapor phase sample are important factors to consider when selecting transport tubing.

Lag Time is the time required to purge out one volume of transport tubing and the volume of the sample conditioning system.

### 1.7.1 Tube Quality

Use only good quality, clean stainless steel chromatographic grade transport tubing for carrier, calibration gas and sample lines. Use of poor quality stainless steel tubing will give unsatisfactory results.



**DO NOT** use any type of plastic, Teflon or Teflon lined braided steel tubing.

Transport tubing must be chromatographically clean. Tubing should be free of hydrocarbon contamination and particle free. During cutting, fitting and deburring, the technician should insure that no particles are allowed to remain in the tubing.

### 1.7.2 Calculation

Sample transport lag time estimated calculations do not consider the volume of the sample conditioning system; however, the following equation can be used as a quick method to estimate lag time because normal transport tubing volume is much greater than sample conditioning system tubing volume.

$$\text{Lag Time} = \frac{(\text{Volume [cc] per Foot of Tubing}) \times (\text{Feet of Tubing})}{\text{Actual Sample Flow Rate (cc/min.)}}$$

For a detailed method of calculating Lag time, see the next section, Calculating Lag Time.

### 1.7.3 Analysis Time

If analysis results are used for process control or custody transfer, it is important to minimize the amount of the time sample spends in transit from the TCR sample probe to NGC. To arrive at the total cycle time between representative samples, sample transit time must be added to the NGC cycle time.

### 1.7.4 Transit Volume

The total volume of sample gas in transit is calculated by multiplying volume per foot of sample transport tubing by the total length of tubing. To assist in making these calculations, refer to Table 1—6 for the internal volume of commonly used sample transport tubing.

**Table 1—6 Internal Volume of Commonly Used Sample Transport Tubing**

Tube Outside Diameter (in.)	Tube Wall Thickness (in.)	Volume per Foot (cc)
1/8	0.02	1
1/4	0.035	5
3/8	0.035	15

Tube Outside Diameter (in.)	Tube Wall Thickness (in.)	Volume per Foot (cc)
1/2	0.035	25

### 1.7.5 Gas Volume in Transit Tubing

Gases are compressible and the volume of gas in transport tubing for standard conditions (atmospheric pressure and 70°F [21.1°C]) is a function of gas pressure and temperature within tubing.

Ideal gas equation:  $PV = nRT$

Where:

P = Pressure      V = Volume  
T = Temperature    R = Universal Gas Constant  
n = Number of moles in sample transport tubing.

“n” is used to calculate the number of moles of gas sample contained in a certain volume of sample transport tubing.

### 1.7.6 Mole

Mole is a fundamental unit that describes the number of chemical molecules. One mole always represents one Avogadro’s number  $6.02 \times 10^{23}$  of molecules. Number of moles can be determined by the calculation formula  $n = PV/RT$ .

Because sample and transport tubing volume and temperature are usually constant, the number of sample moles in transit is a function of pressure in sample transport tubing. Reducing gas sample pressure reduces mass of gas in sample transport tubing. This is referred to as “line peak”. Once transport volume is known for standard conditions, transport lag time can be determined.

### 1.7.7 Maintaining Phase

When designing sample transport tubing, phase of sample must be maintained. Gases containing high concentrations of high boiling components can cause problems when they condense on the inside of the transport tubing surface. To prevent condensation from occurring, heat trace transport tubing using electrical power, steam or hot glycol. This prevents components from condensing on transport tubing walls and prevents any water within the tubing from freezing and blocking sample flow.

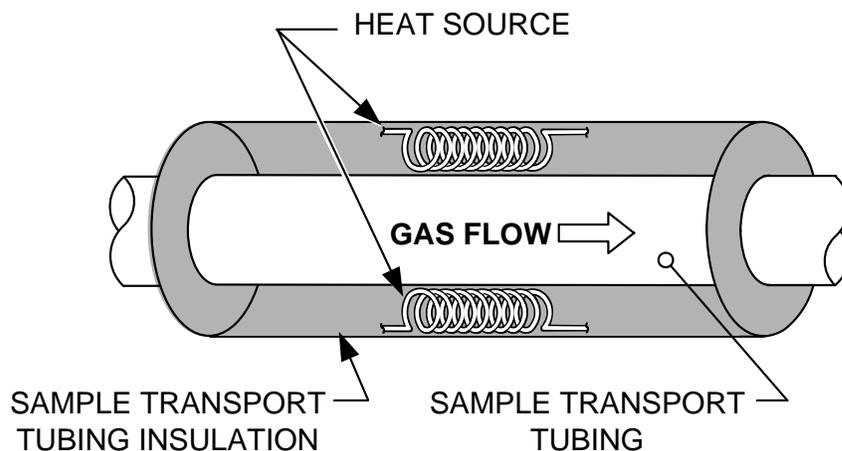
### 1.7.8 Heat Tracing Sample Lines

If there is a possibility that the vapor sample could condense in the sample transport line, heat tracing the sample line should be considered. This could occur at ambient temperatures or when a liquid has to be kept warm for transporting or to keep it from freezing (see Figure 1–17).

To determine heat tracing temperature, a dew point calculation can be performed, based on the worst case sample composition and transport pressure.



Heat tracing should conform to requirements of national and local codes.



**Figure 1–17 Heat Tracing Sample Line**

### 1.7.9 Tube Corrosion

When designing transport tubing, the effect that corrosion has on tubing must be considered. For hydrocarbon service, stainless steel transport tubing, type 316SS, is recommended.

For selection of transport tubing for different types of service, the customer should refer to reference information applicable to material applications for corrosive environments.

### 1.7.10 Tube Preparation

In the course of installing (cutting and fitting) the tubing at an installation, it is important to dress the ends of any cut tubing, and to insure that in the cutting and deburring process no particles are allowed to remain inside the tubing.

## 1.8 Calculating Lag Time

The following calculations assume that all pressure drops occur across the valves HV-1, HV-2 and HV-6 and that the rotameters, RM-1, RM-2 and RM-3, are measuring flow at atmospheric pressure (see Figure 1–18).

**FYI**



Figure 1–18 is for reference purposes only, but it is typical of a sample conditioning module with liquid separator and liquid shutoff. It is included for reference only. Refer to the documentation provided with the unit.

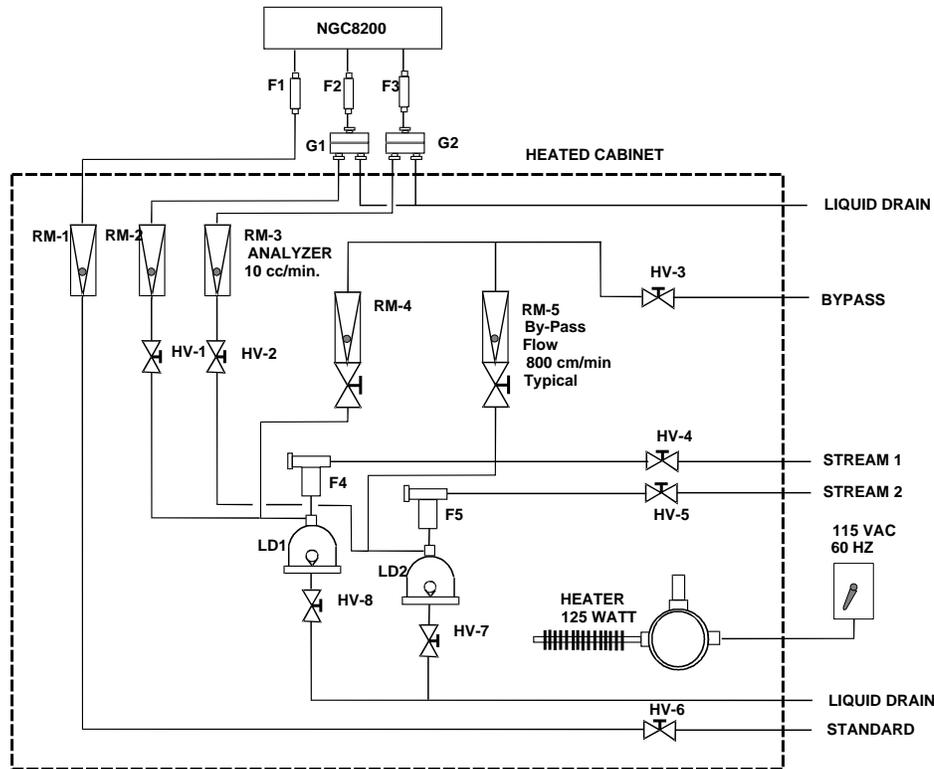


Figure 1-18 Typical Sample Installation Diagram

### 1.8.1 Calculations

Lag time calculation qualifying factors are as follows:

- The sample for calculation contains mostly methane gas that flows through 100 feet of ¼-inch stainless steel tubing with a wall thickness of 0.020-inch. Sample temperature is 80°F (26.7°C) and pressure is 15 PSIG (29.7 PSIA). Bypass rotameter in sample conditioning system reads 50% of full scale and is calibrated with air to 1180 cc/min at full scale. Air density is 0.075 lbs/cu. ft.
- To compute transport tubing lag time, perform the calculation below:

### 1.8.2 Calculating Using Actual Pressure

Calculating lag time using actual pressure:

$$t = \frac{VL}{F_s} \left[ \frac{P + 15}{15} \right] \times \left[ \frac{530}{T + 460} \right] \times \left[ \frac{1}{Z_p} \right]$$

Where:

T= Purge Time  
V= Tubing Volume, cc/ft.  
P= Actual Pressure, PSIG  
Zp= Compressibility at P Pressure

L= Line Length, ft.  
Fs = Standard Flow, cc/min.  
T= Actual Temperature, 8F

**TIP**

In this step, the lowest possible pressure should be used. This minimizes transport tubing lag time to reduce line or molecule peak. Care should be taken to insure that enough pressure is available to keep the sample flowing throughout the analysis system.

## 1.9 NGC Standard Software Features

Totalflow's onboard and host software work together to provide many key features that enable the user to access, control and share data. The user-friendly interface allows multi-faceted report and communication capabilities without compromising the integrity of the system or the data.

- Modular software design-application based plug-in software modules.
- Audit quality historical data
- Operational alarms
- Tri-level software security system
- Multiple calculation options
- Selectable engineering units (future)
- Analysis reporting
- Communication protocol selection
- Web enabled data collection

### 1.9.1 Audit Quality Data

Totalflow's software design creates a historically accurate file system that uses date and time stamped events to create an audit quality data structure.

The unit can collect, analyze and retain (default) stream data for the last 480 analysis cycles, retain the last 35 days of daily stream averages, the last 480 diagnostics reports, the last 480 alarms and the last 480 events. Additionally, user can also reconfigure it.

### 1.9.2 Security System

Users implementing PCCU version 7.6.0 or higher have access to three types of security:

- Hardware security (bi-level)
- PCCU enforced security (bi-level)
- Role Based Access Control (multi-level)

Both the Hardware and PCCU security are legacy systems. The hardware security consists of the security switch located on the termination panel; set to *on* or *off*. The PCCU security system forces the user to log on as either an administrator or a user.

Role Based Access Control (RBAC) is a new feature within PCCU that is designed to allow an administrator to designate roles and control access levels to various applications and processes in Totalflow G4 devices.

Beginning with a set of default roles, it is possible to duplicate, rename and delete these items to create a working list of access roles which are relevant to the user's company hierarchy. From this role list, it is then possible to create and customize user accounts with various roles. The user is also given the ability to take the newly created configuration and save it in the form of a security file to their PC.

This security file can then be sent to a G4 device, where it is then implemented. It is important to note that RBAC can override the Hardware security switch.

See the Help files in the host software package for more information.

### 1.9.3 Compressibility Options

User selectable measurement calculations may be defined individually per stream and include:

- AGA-5
- AGA-8 detail
- ISO summation factor
- Single virial summation factor
- None (a factor of one is used)
- NX-19

### 1.9.4 Calculation Options

During stream setup, the user may select from several calculation files. Selection of a suitable file will automatically set up other factors such as concentration/Btu basis and saturated gas treatment (see Table 1—7). For additional information, please refer to the PCCU help files.

**Table 1—7 Calculation File Settings**

Calculation File	Agency	Document	Temp1	Temp2	Comp.	Constants
gost-30319-aga8	GOST	30319	20		AGA8	
gpa-2172-96-aga8-2145-03a-fts	GPA	2172-1996			AGA8	2145-03a
iso-6976-1995-15-15	ISO	6976-1995	15	15	ISO Sum Factor	
iso-6976-1995-15	ISO	6976-1995	15		None	
iso-6976-1995-20-20	ISO	6976-1995	20	20	ISO Sum Factor	
iso-6976-1995-20	ISO	6976-1995	20		None	

### 1.9.5 Engineering Units

User selectable engineering units may be defined individually, per measurement stream. These include most metric system units as well as standard US units. Access to this capability requires instantiation of the unit conversion application and may be applied to data reporting and visual readings on the VGA screen. For additional information, please see the host software help files.

### 1.9.6 Supported Protocols

The NGC hardware and software supports several communication protocols:

- Totalflow Local
- Totalflow Remote
- Modbus Slave (ASCII)
- Modbus Slave (RTU)
- Modbus Host (ASCII)
- Modbus Host (RTU)
- Totalflow TCP

- Modbus TCP Server
- Modbus TCP Client
- LevelMaster

Supported protocols operate at 1200, 2400, 4800, 9600, 19200, 38400, 57,600 and 115200 baud rates.

## 1.10 PCCU Local Communication Options

Local communications with the NGC requires the use of PCCU32 software, running on a PC and typically using an MMI cable. The MMI cable is a USB cable connected between the PC and the MMI connector on the outside of the main enclosure.

When operating the NGC in a network environment, using Ethernet is an excellent and practical solution.

For example, the following chart (See Table 1—8) compares communication times between the different available options for several common operational tasks:

**Table 1—8 Communication Option Comparison**

Communication	Operational Task <sup>4</sup>		
	Data Collection-Single Stream	Save Files	Restore Files
Serial: 38,400 Baud	10 Seconds	2.5 Minutes	2.5 Minutes
Serial: 115,200 Baud <sup>5</sup>	4 Seconds	1.1 Minutes	1.1 Minutes
USB	3 Seconds	1.5 Minutes	1.5 Minutes
Ethernet	3 Seconds	1.5 Minutes	1.5 Minutes

## 1.11 NGC Start-up Diagnostics

The Totalflow Dual NGC Unit has an extensive set of built-in tests which are performed each time the unit is started. The tests will run concurrently on the main and auxiliary units. This start-up testing may be disabled, but Totalflow recommends that it be left enabled. These diagnostics consist of four areas of testing:

- Carrier pressure regulator test
- Oven temperature test
- Processor control test
- Stream test

These start-up tests may also be performed on a regular schedule but is not recommended. Please see the PCCU help files for more information on scheduling diagnostics.

### 1.11.1 Carrier Pressure Regulator Tests

This test compares the actual column pressure to the column pressure setpoint. A failure of this test indicates that the carrier pressure is not meeting or exceeding the expected level of pressure.

<sup>4</sup> Operational task speed directly correlates to PC Processor speed.

<sup>5</sup> Personal computer operating on Windows XP Operating System or newer.

### **1.11.2 Oven Temperature Test**

This test compares the actual oven temperature to the oven temperature setpoint. A failure of this test indicates that the oven is not maintaining the required temperature.

### **1.11.3 Processor Control Test**

This test contains three test areas: column 1 carrier pressure, column 2 carrier pressure and oven temperature. In each area, the test measures the effort required to maintain the required value. From those measurements, the test develops a standard deviation and makes a comparison. The failure of any of these comparisons indicates an erratic deviation exists. This means the processor is not able to control the function.

### **1.11.4 Stream Test**

This test will measure the various pressures for each available stream. Failure of a stream indicates an inability to meet certain criteria.

During the initial start-up, all streams will be disabled. During the stream test, streams with input pressure will be re-enabled, tested and either passed or failed. Streams with no initial input pressure will fail.

## **1.12 Historical Data**

The NGC compiles historical data that can be used for custody transfer needs, verifies NGC operation over time and provides a limited data backup for communication link reliability. Data retained by the NGC can be collected via a remote communication link or by a laptop PC operator interface.

### **1.12.1 Retaining Data**

The user can configure how much data is retained by the NGC via the operator interface. The default configuration is as follows:

### **1.12.2 Analysis Cycles**

The last 480 analysis cycles (default):

- Normalized components
- Un-normalized components
- Ideal Btu/CV
- Real Btu/CV (wet (inferior CV) and dry (superior CV))
- Relative density (specific gravity)
- Density
- GPM
- Wobbe index [dry Btu (superior CV)]
- Alarms

### **1.12.3 Stream Averages**

- Last 840 hour averages
- Last 35 daily averages
- Last monthly average

### 1.12.4 Diagnostic Reports

The last 480 analysis cycles:

- Selected peak times
- Selected peak areas
- Ideal Btu/CV
- Carrier regulator pressure
- Oven temperature
- Enclosure temperature
- Sample pressure
- Detector noise values
- Detector balance values

### 1.12.5 Audit Logs

- Last 100 alarms
- Last 100 events

## 1.13 TCR Sample Probe (Optional Equipment)

The temperature compensated regulator (TCR) sample probe is used to capture natural gas from the pipeline for NGC analysis. The probe can be mounted horizontally from the side of the pipe or mounted on top of the pipe as shown below.

TCR sample probe is specifically selected for operation with the NGC. The design of the probe prevents icing without the need for electrical power.

Check Table 1—9 to insure that the correct sample probe is available for the installation. The length of sample probe is dependent on the diameter of the customer's meter run.

Totalflow recommends that a temperature compensated regulator be installed with the NGC. Refer to Figure 1—19.

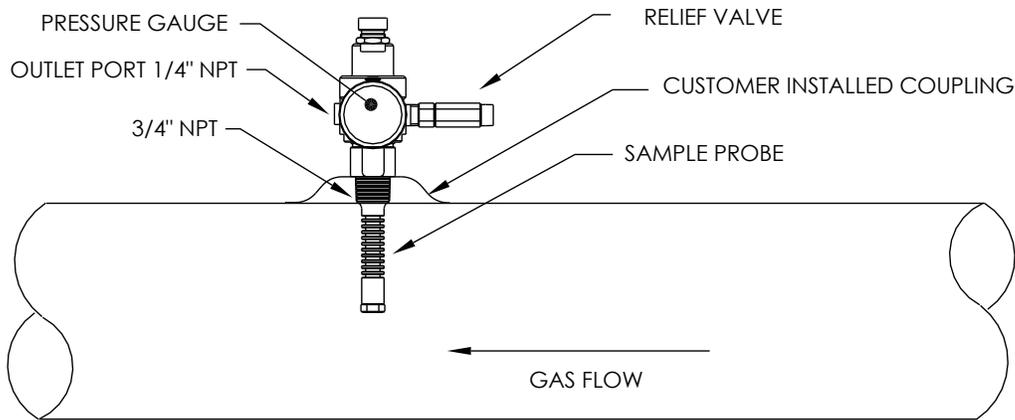
**FYI**



Please read the installation instructions in Chapter 2 to develop a pipeline installation plan prior to actual installation.

**Table 1—9 Optional Temperature Compensated Regulator (TCR)**

Length (inches)	Description
4	Temperature compensated sample probe/regulator/relief valve
8	Temperature compensated sample probe/regulator/relief valve



**Figure 1–19 Temperature Compensated Regulator With Sample Probe**

### 1.13.1 Location

- Locate the pipeline coupling on the meter run in close proximity to the NGC. This allows the sample line from the sample probe to the chromatograph to be as short as possible.
- The coupling should be mounted so that the probe can be installed on the top (recommended) or side of the pipe.
- Sample probe should not be mounted at the ends of headers, dead “T’s”, large volume accumulators or other spots where gas is likely to be stagnant.
- Installation should allow the probe to penetrate the center 1/3 of the pipe. This allows sufficient heat transfer with the flowing gas sample. Sample probe inlet should be high enough to avoid sampling of liquids at the bottom of the pipe.
- Sample probe, must be installed where probe has access to the fastest flow of gas within the pipe.
- Sample probe should be mounted a minimum of five pipe diameters from any device which could cause aerosols or significant pressure drops.

### 1.13.2 Other Considerations

- TCR sample probe line pressure should be as close to 1-atmosphere as possible to reduce sample transport lag times due to “Line pack”. Sample pressure at the NGC should be  $15 \pm 2$  PSIG ( $103 \pm 14$  KPa).
- To maintain this pressure at the NGC filters, it may be necessary to increase sample probe pressure to a value greater than 15 PSIG. Pressure is dependent on the sample transport tubing length between the sample probe and chromatograph.
- Be sure to use tubing electrical isolators on the sample tubing when connected to pipelines that are not isolated from cathodic protection.

## 1.14 ENC82 Environmental Enclosure (Optional Equipment)

In colder climates (ambient temperatures 0°F to -40°F), the environmental enclosure (ENC82) allows mounting of the NGC directly on the pipe. This insulated, weatherproof enclosure has brackets for the NGC and a small start

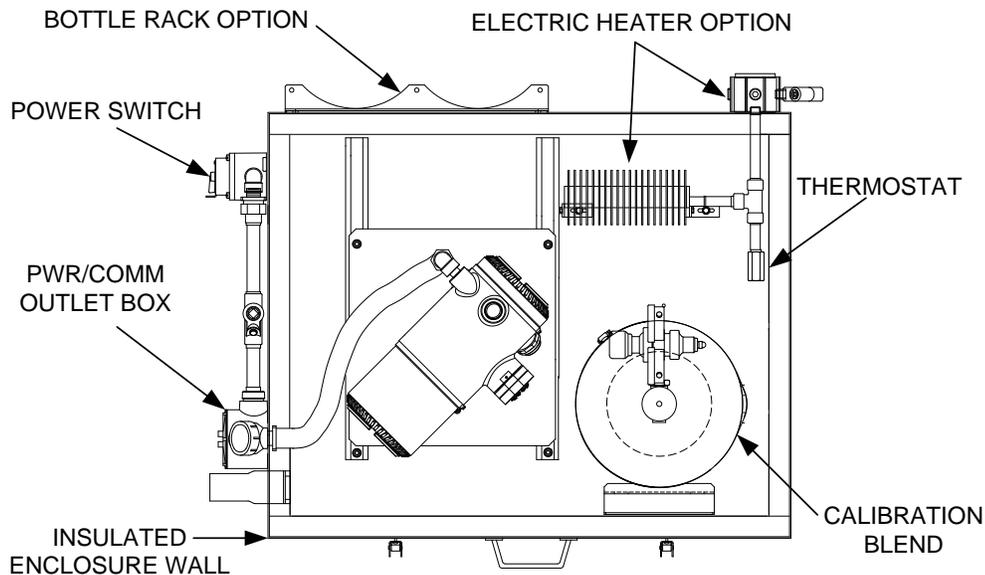
up/calibration bottle. Having the calibration bottle in the heated enclosure ensures a much more stable and consistent calibration.

#### 1.14.1 Standard Features

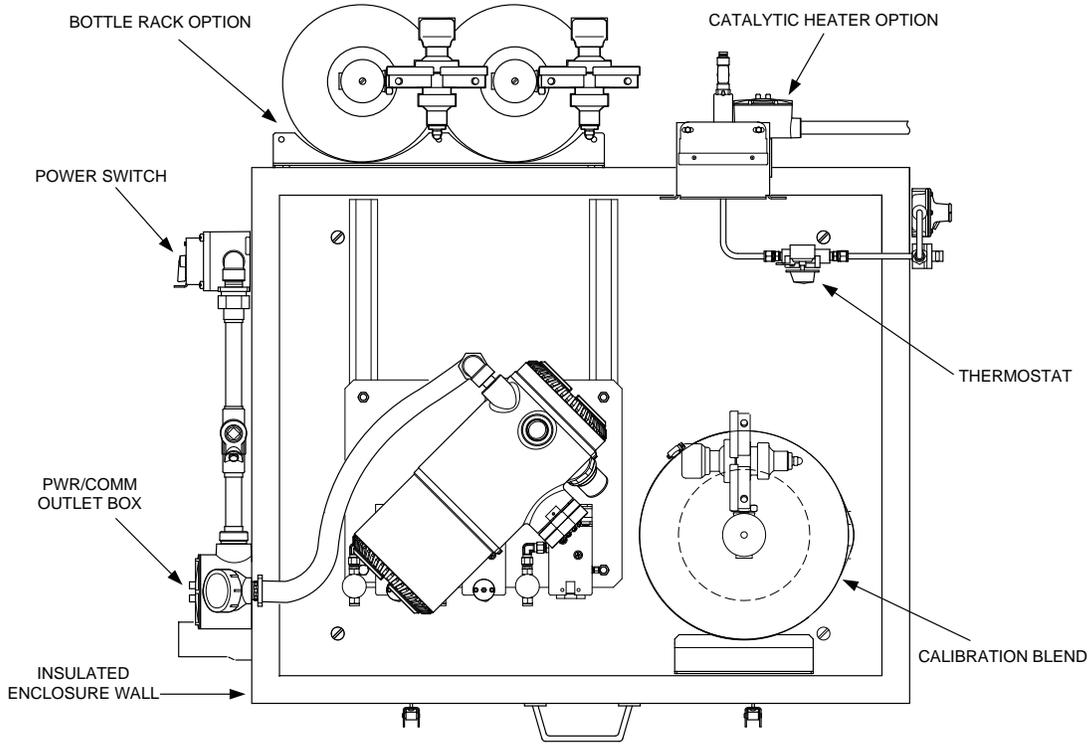
- Available with either an electric or catalytic heater option.
  - The catalytic heater is a 1500 Btu/hour input, includes a standard filter/drain kit.
  - The electric heater option features 120VAC/400W heater and thermostat.
- Sample conditioning system.
- Heated line entry.
- Rigid conduit.
- Mounts either as a free standing unit or pipe mounted unit.
  - Large enclosure may be pipe mounted on 4" through 12" pipe.
  - Small enclosure may be pipe mounted on 2" through 5" pipe.

##### 1.14.1.1 Enclosure

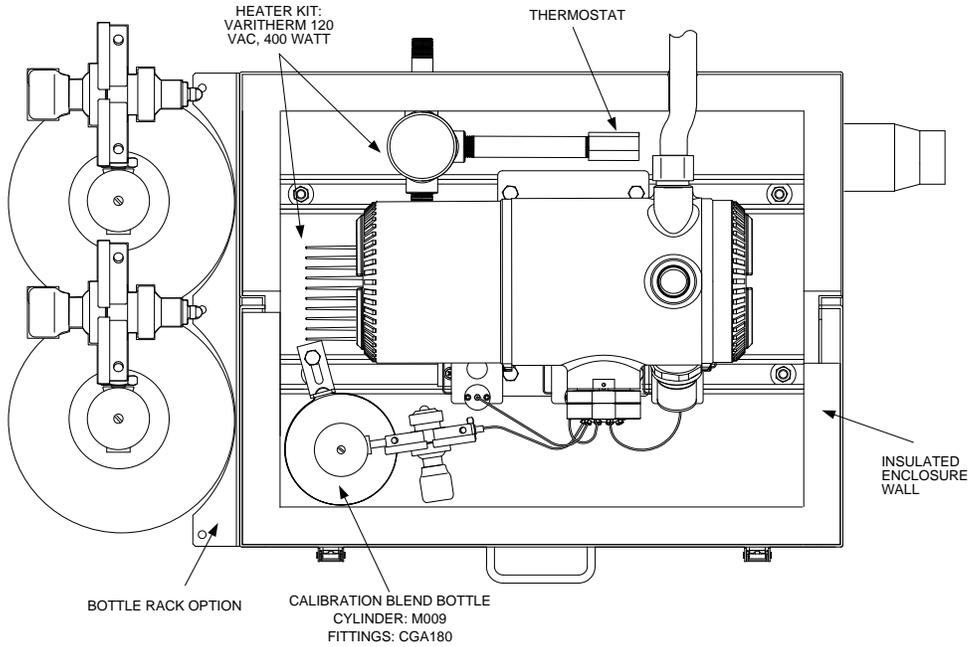
The heater and enclosure is designed to maintain a 40°F inside temperature when outside temperature is -40°F. Two enclosures are available for installation depending upon site requirements. The large enclosure (ENC82L) will hold a single or dual unit NGC and features a large foot print (38" w x 31" d x 30.5" h) (see Figure 1-20 and Figure 1-21). The small enclosure (ENC82S) is designed for a single NGC unit and features a smaller foot print (24" w x 19" d x 21" h) (see Figure 1-22 and Figure 1-23).



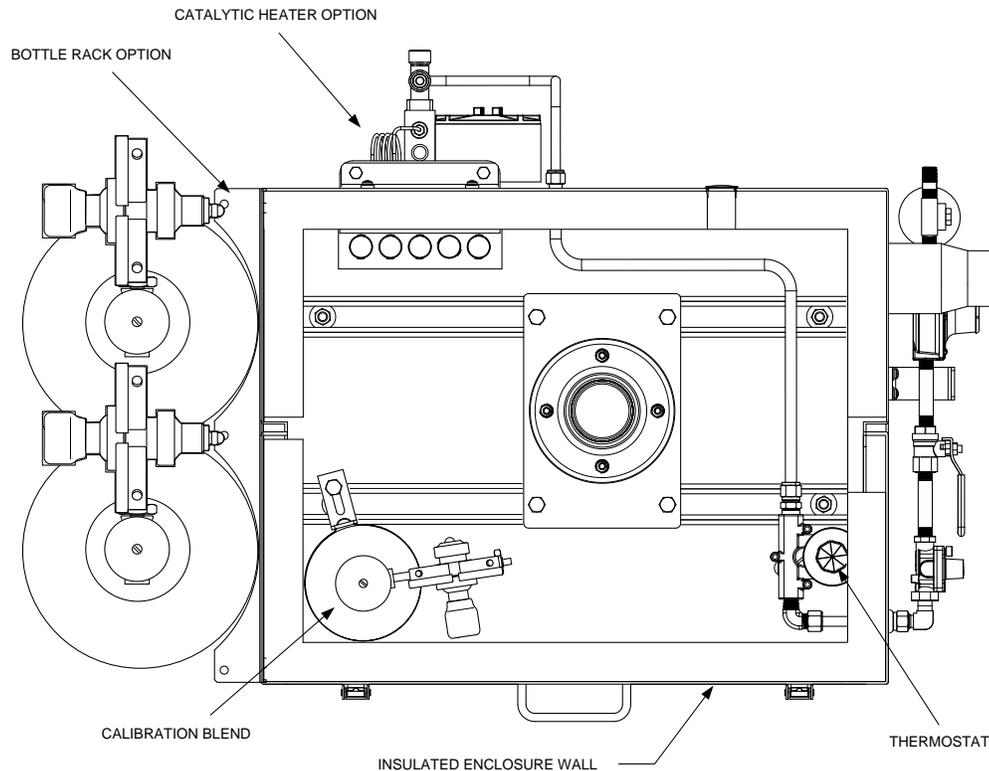
**Figure 1-20 ENC82L Environmental Enclosure with Electric Heater**



**Figure 1-21 ENC82L Environmental Enclosure with Catalytic Heater**



**Figure 1-22 ENC82S Environmental Enclosure with Electric Heater**



**Figure 1–23 ENC82S Environmental Enclosure with Catalytic Heater**

#### 1.14.1.2 Mounting Options

The ENC82 may be mounted directly on the pipe run, with or without the sample probe enclosed. Optional support leg(s) are available for added support when mounted on the pipe run.

Optionally, a free-standing kit may be used to mount the enclosure next to the process line.

#### 1.14.2 Optional Features

The following is a list of optional features:

- Calibration blend.
- DC power switch (large enclosure only).
- Dual bottle rack.

### 1.15 Sample Conditioning Modules (Optional Equipment)

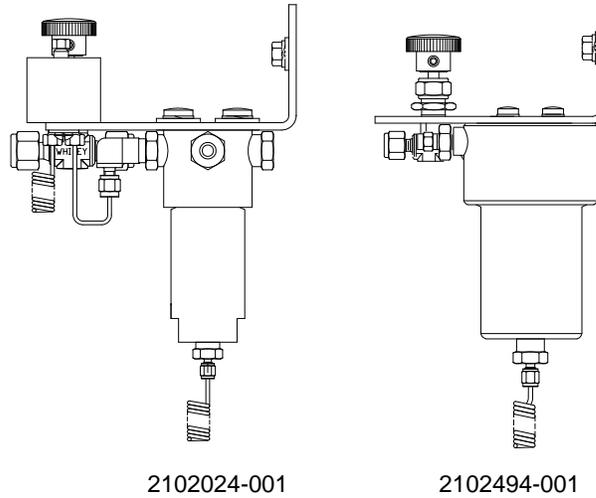
For some NGC installations, it may be necessary to install an optional sample conditioning module to compensate for non-ideal natural gas samples. These optional modules are pre-engineered to provide various levels of protection and bypass flows (see Figure 1–24). All of the sample conditioning modules include a level of particulate protection.

For installations where the gas is ideal and the sample probe is located less than 10' from the NGC, no sample conditioning module is required.

### 1.15.1 Gas Types

The user can select from one of four sample conditioning modules for installations where gas samples do not meet the ideal clean and dry conditions. The following definitions define what is meant by the condition of natural gas to be sampled.

- Clean gas is defined as having no particles larger than one micron and no more than one milligram of solids per cubic meter of gas.
- Dry gas is defined as having no more than seven pounds of water per million cubic feet of gas. Gas has less than 0.1 PPM of liquid at the coldest ambient condition expected at the coldest point in the system. The liquid can be water, oil, synthetic lubrication, glycol, condensed sample or any other non vapor contaminate.
- Stable gas is a vapor containing less than 0.1 PPM of liquid when vapor is cooled to 18.3°F (10°C) below the coldest ambient temperature possible at any point in the system.



**Figure 1–24 Available Sample Conditioning Modules**

**Table 1—10 Sample Conditioning Module Descriptions**

Part Number	Description
2102024-001	<p>Designed for sample point distances greater than 10' (3m) and less than 150' (50m) with known particulate and liquid contamination. For stable gas samples containing pipe scale and other solid contaminates and possibly minor amounts of liquid contamination. System features:</p> <ul style="list-style-type: none"> <li>• Particulate/coalescing filter</li> <li>• Liquid/vapor separator</li> </ul>
2102494-001	<p>Designed for sample point distance greater than 50' (15m) and less than 150' (50m). The sample gas is known to contain particulate and liquid contamination with a good probability of line flooding in upset conditions, enough at times to overflow the coalescer (a+ avenger) filter. Also has a Genie membrane for liquid rejection and a Genie liquid shut off to be used when liquid carry over would harm the chromatograph if it was introduced as a sample. This model contains a liquid shut off to protect the GC. The liquid shut off resets itself when liquids are no longer present.</p>

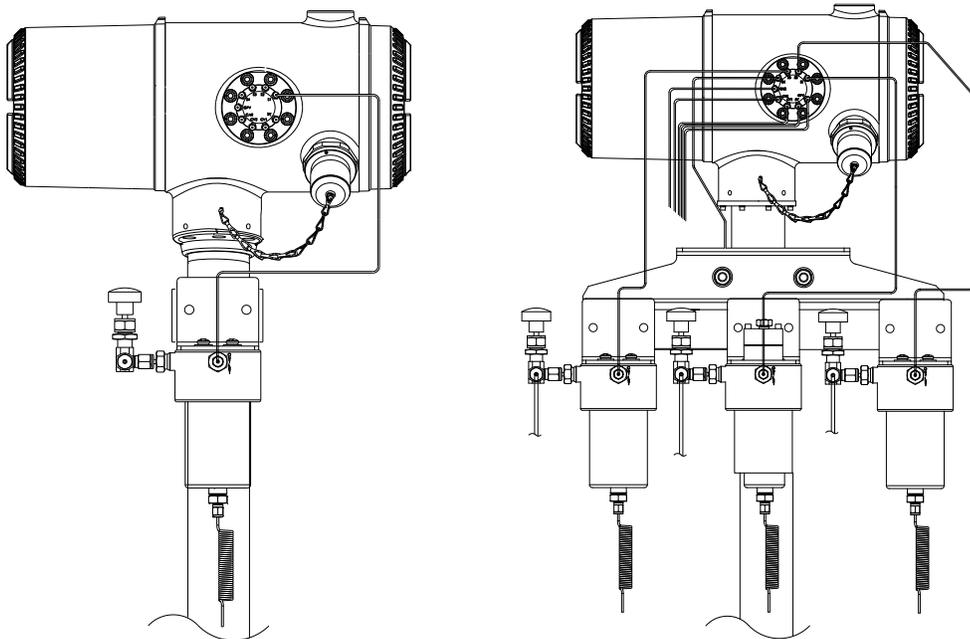
Part Number	Description
	<ul style="list-style-type: none"> <li>• Particulate/coalescing filter</li> <li>• Liquid/vapor separator</li> </ul>

### 1.15.2 Mounting Brackets

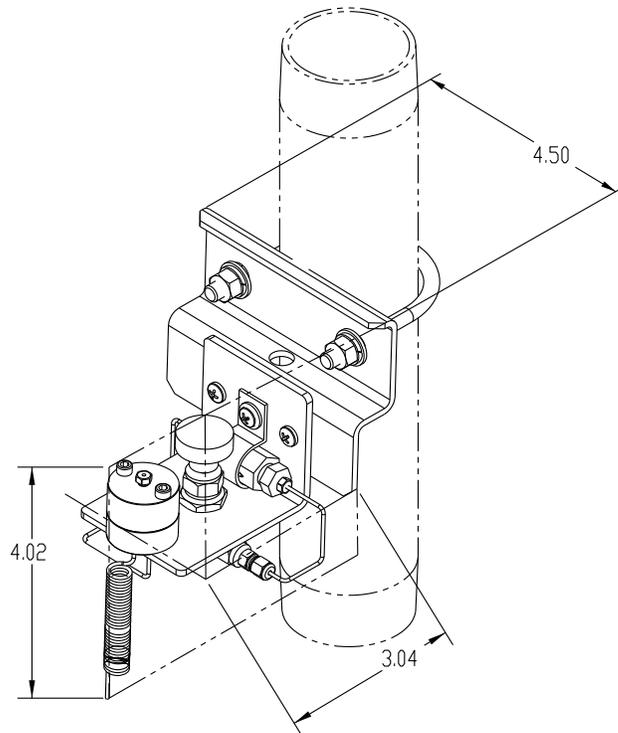
Two sample conditioning system mounting brackets are available, a single stream bracket or a multiple stream bracket (Figure 1–25) for up to three modules.

See Figure 1–26 and Figure 1–27 for installed dimensions.

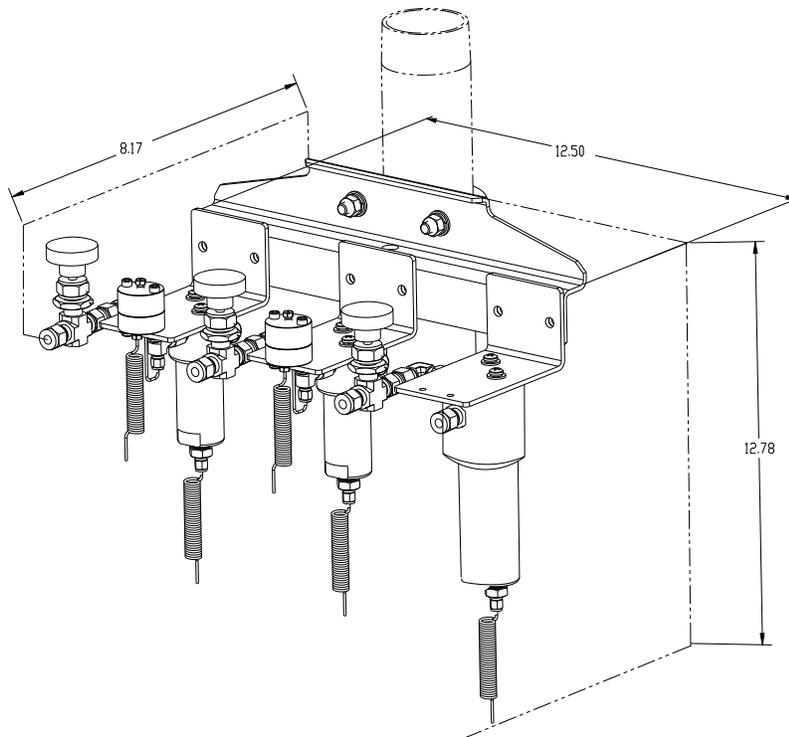
**FYI**  For simplicity, the auxiliary enclosure is not shown. The output tubing from the sample conditioning modules will typically go to a tubing tee and then go to the main and auxiliary enclosures.



**Figure 1–25 Single and Multiple Stream Sample Conditioning Assemblies**



**Figure 1–26 Single Stream Conditioning Module Dimensions**



**Figure 1–27 Multiple Stream Conditioning Module Dimensions**

## 1.16 Security Seal (Optional Equipment)

For some installations, it may be desirable to attach a security seal on the enclosure's front and rear end caps. To accommodate the seal, please note the holes located in the tab located on each end cap (See Figure 1–28).

### 1.16.1 Customer Supplied Materials

- 1 ea. security wire seal
- Seal press

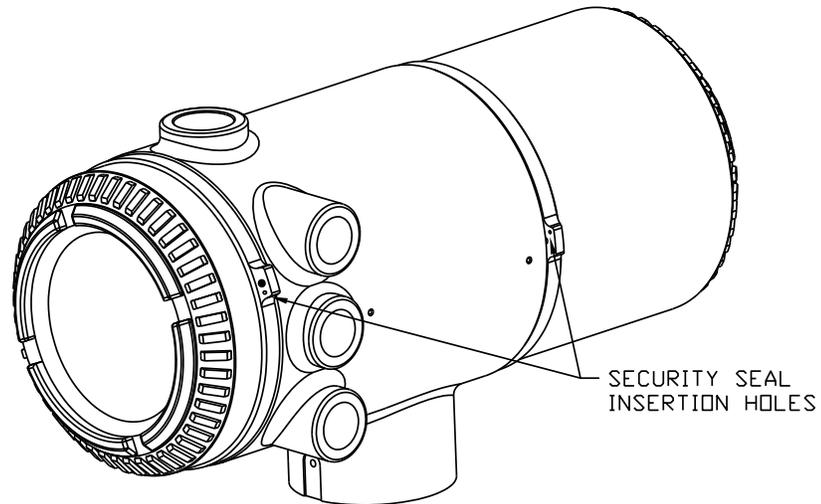


Figure 1–28 NGC End Cap Tabs for Security Seal

### 1.16.2 Instructions

- 1) Insert the security wire through the holes located on the end cap tabs.
- 2) Bring the ends together, and insert through the holes in the security seal (see Figure 1–29).
- 3) Use the seal press to compress the seal into the wire. Ensure that the wire is firmly captured inside the seal.

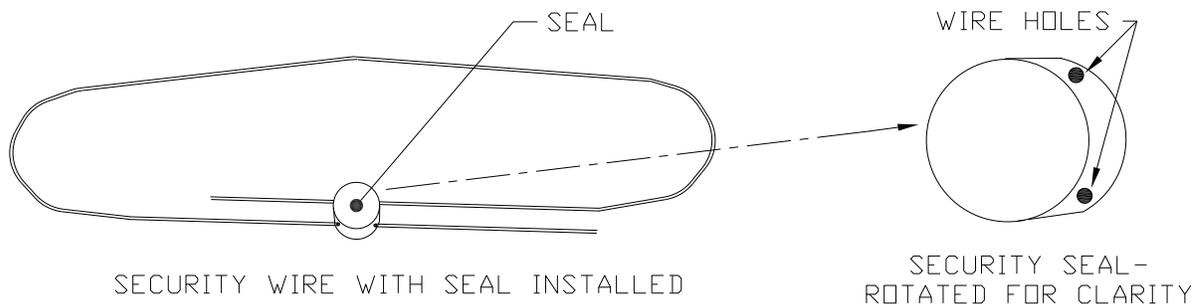


Figure 1–29 Security Wire with Seal

## 1.17 Optional Equipment Enclosure (Optional Equipment)

If an optional enclosure is used, it may be configured to include the dual power supply and other options, including, but not limited to, communication equipment and additional I/O.

Three enclosures are commonly used for the Dual NGC unit installations: the 6200 and 6700 optional equipment enclosures.

The 6200 installation will be for AC to DC sites. This enclosure does not allow for additional I/O or communications.

The 6700 enclosure supports AC to DC sites requiring communication equipment and/or additional I/O. Following local codes for installation, these units would normally be located in a division 2 or general purpose area. The units may be mounted on a 2" pipe or mounted on a flat surface such as a wall.

The 6800 enclosure supports battery backed<sup>6</sup> operation for the NGC via solar power or a UPS system, AC to DC power or DC to DC power and communication equipment.

### 1.17.1 6200 Optional Equipment Enclosure

The 6200 can accommodate the following equipment:

- 110/240 Volt to 12 VDC (2 each)
- 110/240 Volt to 24 VDC (2 each)

### 1.17.2 6700 Optional Equipment Enclosure

The 6700 enclosure can accommodate the following:

- Communication Kit
- 120 VAC / 240 VAC 12 VDC power supply (2 each)
- 24 VDC/12 VDC DC to DC converter (2 each)

### 1.17.3 6800 Optional Equipment Enclosure

The 6800 enclosure can accommodate the following:

- Communication Kit
- Solar Panel Power Option
  - 2 ea. 110 AH Batteries
- 115/230 VAC UPS Power Option (24 VDC Systems Only)
  - 2 ea. 40–110 AH Batteries

## 1.18 Power Supply Options (Optional Equipment)

### 1.18.1 Dual Power Supply Options (Optional Equipment)

Power supply options available for the NGC are as follows:

- 110/240 VAC to 12 VDC (2 each)
- 110/240 VAC to 24 VDC (2 each)
- 110/240 VAC to 12 and 24 VDC (1 each)
- 110/240 VAC to 24 VDC-EX (2 each)

---

<sup>6</sup> Autonomy measured in hours.

## 2.0 INSTALLATION

### 2.1 Overview

This chapter provides information for field installation of the NGC and optional equipment. After completing the procedures within this chapter, the NGC will be ready for start-up.



The installation instructions in this chapter are to be performed only when the area is known to be non-hazardous.



It is highly recommended that the user thoroughly read this chapter to establish an installation plan. Also, before beginning, refer to the wiring diagrams delivered with the new NGC. Store these under the tab “Drawings” in the back of this manual.

#### 2.1.1 What this Means



Installation instructions that feature this icon are applicable **ONLY** when the installation involves an Environmental Enclosure (ENC82). All other instructions may or may not be applicable.



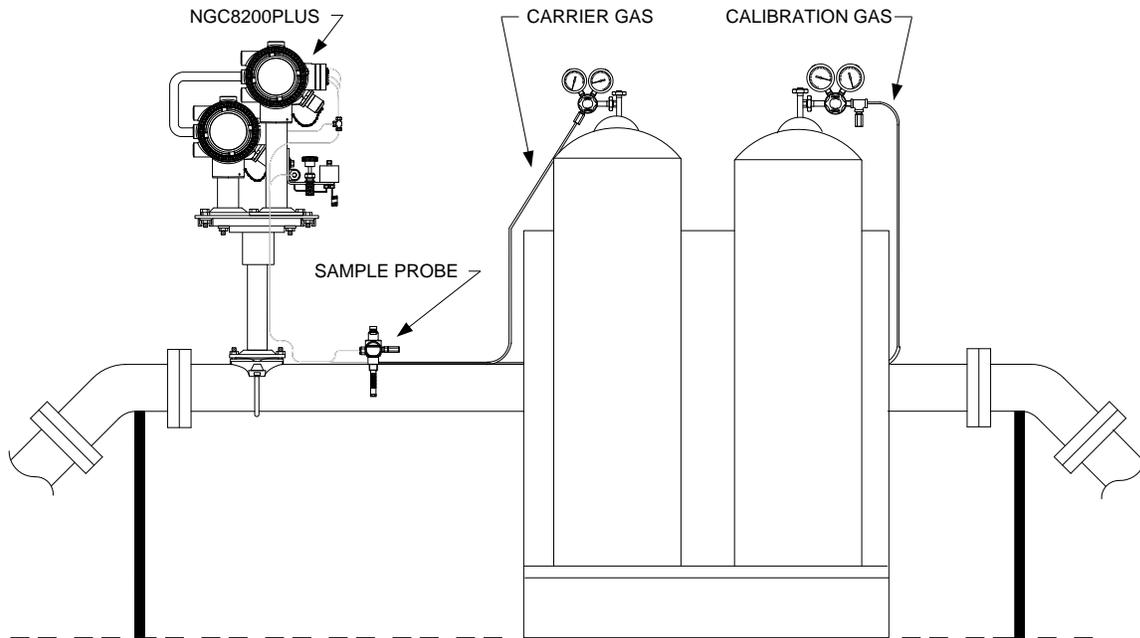
The following procedures, unless otherwise stated, are applicable to all NGC units. The NGC is designed to be pipe mounted (see Figure 2–1). Optionally, a shelf mounting kit (see Figure 2–2) may be purchased for use in mounting the unit on a wall, inside or outside of a building or a mounting plate for use in the optional ENCLOSURE (see Figure 2–3).

#### 2.1.2 Organization

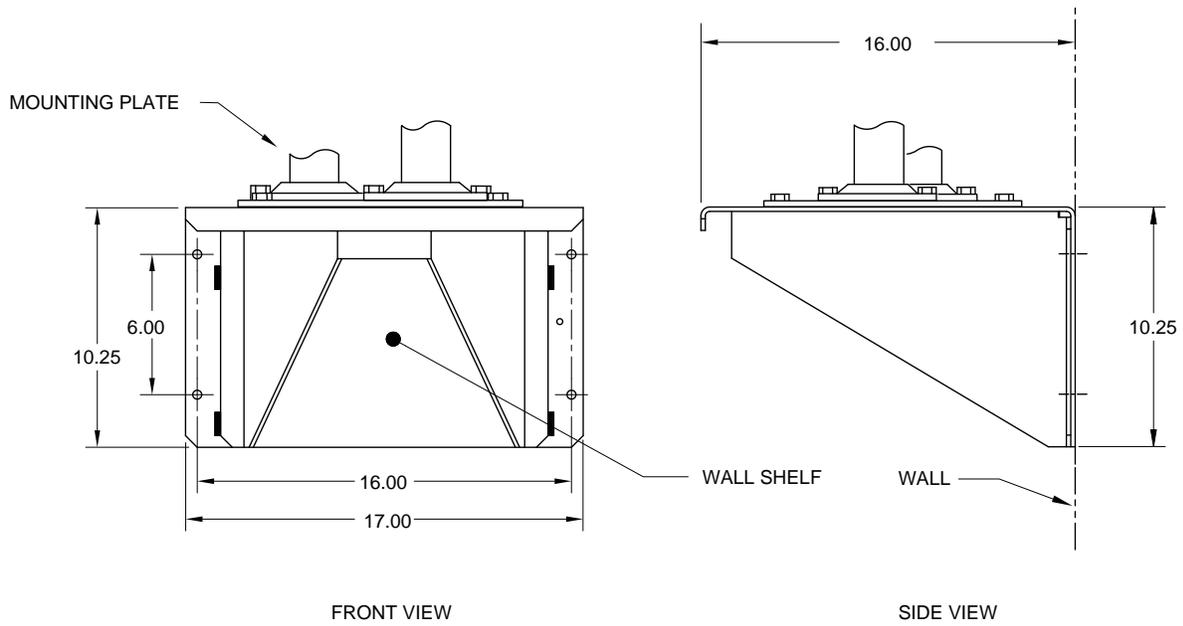
The following instruction sections are organized in the suggested installation order. Not all installation instructions will apply to the user’s situation. For example, some procedures may vary when the installation does not require certain equipment.



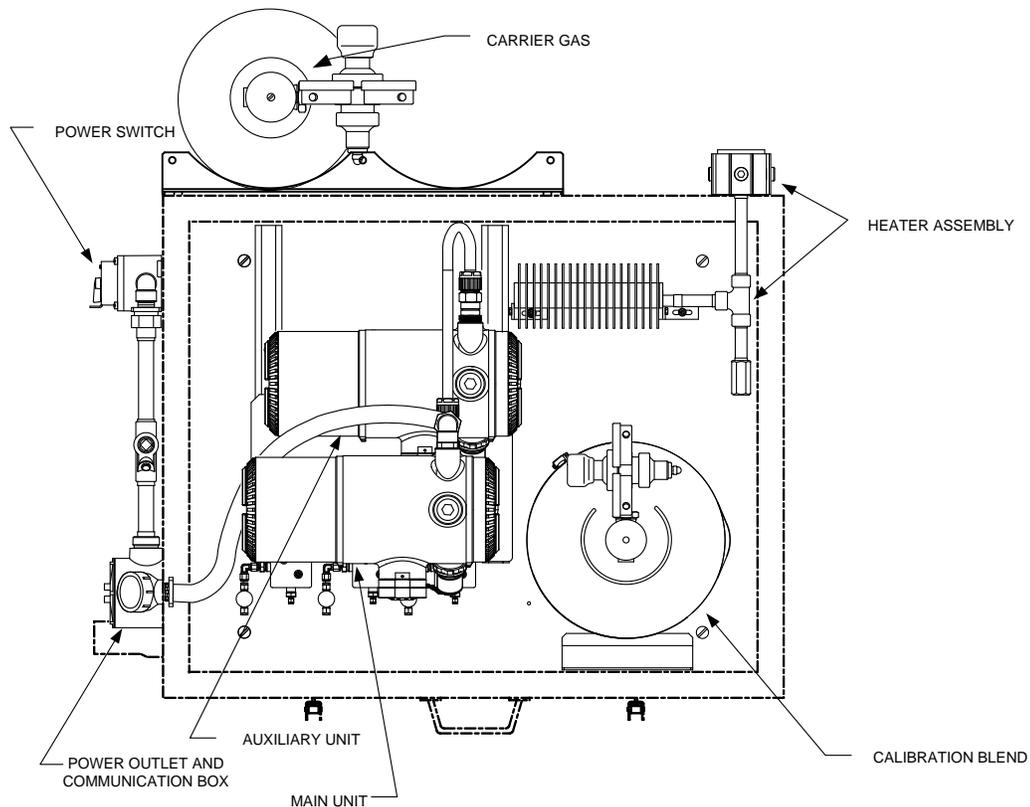
Please note that, where applicable, “typical” instructions are first, and variations or “specialized” instructions follow.



**Figure 2-1 Basic Meter Run Installation**



**Figure 2-2 Typical Wall Shelf Mount Installation**



**Figure 2-3 Typical Environmental Enclosure with Electric Heater**

### 2.1.3 Locating Area for Installation

The NGC is designed for mounting on main gas lines, 2-inch to 12-inch pipe sizes. Each type of installation is described within this chapter.

Be certain the installation site is clean and free of foreign debris that could effect NGC operation.

The NGC should be located as close as possible to the sample probe installation point. This prevents the need for high gas flow rates through sample lines to assure the analysis accuracy of the current sample.

If there is more than one stream being analyzed, locate the NGC in a central location to all sample probe points.

### 2.1.4 Installation

The NGC 8200 is a weatherproof device designed for installation “on the pipe” near to the sampling point. While the 8200 can be mounted outside, it is imperative that the temperatures stay above the dew point temperatures of the various components. It is recommended that the 8200 be mounted in a small house or heated enclosure. Options are available for wall mount, pipeline mount (2”-12” pipe sizes) and pole mount. A Environmental Enclosure (ENC82) is also available if ambient conditions are below either the sampled gas dew point or the operational specifications of the unit.

The vent manifold is designed to accommodate 1/16<sup>th</sup>-inch vent lines. Vent lines should not be longer than ten feet (3 meters). If vent lines must extend further, a

1/16 to 1/4 inch adaptor should be used to increase the diameter of the vent line beyond the ten foot limit.

The following information should help to determine the procedures to follow, depending upon the type of installation: meter run mount, stand alone, shelf Mount located on a building wall or ENC82 mounting for inclement climates.

### **2.1.5 Pipe Mount**

When mounting the unit directly on a meter run, the following installation procedures may be applicable:

- Sample Probe Installation
- Pipe Saddle Installation
- NGC Installation
- Sample Conditioning Module Installation
- Sample Line Connections
- Carrier/Calibration Bottle Rack Installation on Meter Run
- Carrier Gas Regulator with Low Pressure Switch Installation
- Calibration Gas Regulator - Low Pressure Switch Installation
- Carrier Gas and Calibration Gas Connections
- Vent Line Connections
- Optional Equipment Enclosure Installation
- 110/240 VAC to 12/24 VDC Power Supply Option
- DC Power Installation

### **2.1.6 Stand Alone**

When mounting the unit on a free-standing pipe, the following installation procedures may be applicable:

- Sample Probe Installation
- Stand alone Installation
- NGC Installation
- Sample Conditioning Module Installation
- Sample Line Connections
- Carrier/Calibration Bottle Rack Installation on Meter Run
- Carrier Gas Regulator with Low Pressure Switch Installation
- Calibration Gas Regulator with Low Pressure Switch Installation
- Carrier Gas and Calibration Gas Connections
- Vent Line Connections
- Optional Equipment Enclosure Installation
- 110/240 VAC to 12/24 VDC Power Supply Option
- DC Power Installation

### 2.1.7 Wall Shelf

When mounting the unit on a shelf located on a building wall, the following installation procedures may be applicable:

- Sample Probe Installation
- Shelf Installation
- NGC installation
- Sample Conditioning Module Installation
- Sample Line Connections
- Carrier/Calibration Bottle Rack Installation on Meter Run
- Carrier Gas Regulator with Low Pressure Switch Installation
- Calibration Gas Regulator with Low Pressure Switch Installation
- Carrier Gas and Calibration Gas Connections
- Vent Line Connections
- Optional Equipment Enclosure Installation
- 110/240 VAC to 12/24 VDC Power Supply Option
- DC Power Installation

### 2.1.8 Environmental Enclosure

When mounting the unit inside of the enclosure, the following installation procedures may be applicable. Please note that the enclosure has several mounting options: free standing, meter run and meter run with support leg(s).

- Sample Probe Installation
- Freestanding ENC82 Installation Kit
- Pipe Mounted ENC82 Mounting Kit
- Optional ENC82 Support Leg Kit Installation
- NGC Installation
- Sample Conditioning Module Installation
- Sample Line(s) to NGC inside of ENC82
- ENC82 Optional Pwr/Comm Outlet Box assembly
- ENC82 Carrier Gas Bottle Rack Installation
- Carrier Gas Regulator with Low Pressure Switch Installation
- ENC82 Calibration Gas Bottle Installation
- Calibration Gas Regulator with Low Pressure Switch Installation
- Carrier Gas and Calibration Gas Connections
- Vent Line Connections
- ENC82 Optional Catalytic Heater Installation
- ENC82 Optional Electric Heater Installation
- Optional Equipment Enclosure Installation
- 110/240 VAC to 12/24 VDC Power Supply Option
- DC Power Installation



The NGC is certified for installation in classified hazardous locations. The heater and fittings in the ENC82 may not have the same ratings. All components of the installation, including accessories and fittings, must be approved for the classification rating of the area of installation.

## 2.2 Unpacking & Inspection

### 2.2.1 Shipping Carton

Ensure that there is no external damage to the shipping container. If there is significant visible external damage, contact the user's receiving group, and report the damage to the trucking company for a freight damage claim.

### 2.2.2 Unpacking

The NGC is shipped in a specially designed shipping carton which contains both enclosures, mounting brackets, and wiring and interconnect diagrams. Optional equipment is shipped in a separate carton.

Carefully remove all internal and external packing material. Carefully remove all items from the box.

### 2.2.3 Bill of Lading

After removing the protective shipping cover from the NGC, compare shipped contents with those listed on the bill of lading. All items should match those on the bill of lading.

### 2.2.4 Inspection

Examine internal NGC components for evidence of damage.

Points of inspection are:

- Visually inspect exterior of the unit for dents, chipped paint, scratches, damaged threads or broken glass plate, etc.
- Physically inspect rear interior mounted circuit boards, cables and interior mounted circuit boards, for loose cables, boards, display and mounting screws, etc.
- If applicable, inspect calibration/carrier gas bottles to be certain they are correct for the installation.

### 2.2.5 Damaged Components

If there is any damage or if there are noticeable defects, notify the local Totalflow representative. Keep all shipping materials as evidence of damage for the carrier's inspection. Totalflow will arrange for immediate repair or replacement.

Telephone:

USA: (800) 442-3097 toll free or International: 1-918-338-4880

## 2.3 Sample Probe Installation

If a sample probe has previously been installed, the user may skip these instructions.



**TIP**

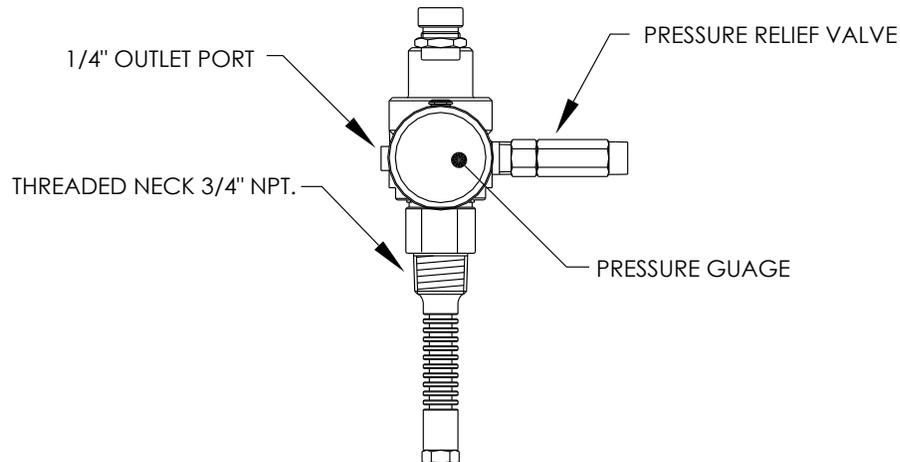
Sample probe pipe coupling should be located on the top of the meter run but may be horizontal on the side of the pipe.

### 2.3.1 Materials

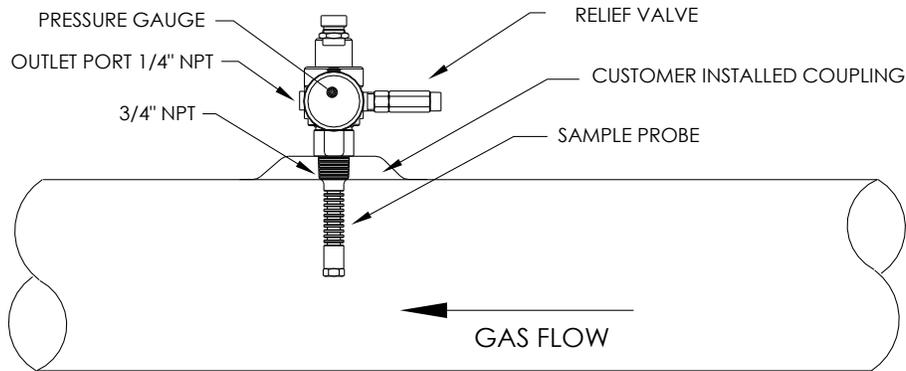
- $\frac{3}{4}$ " NPT pipe coupling (previously installed)
- Sample probe (configuration to be determined by the technician, based on installation and local codes.)
- Teflon tape or customer supplied pipe dope (suitable for chromatography)

### 2.3.2 Instructions

- 1) Shut down meter run and isolate from gas source. Be sure to use proper lockout and tagging procedures.
- 2) Bleed off gas from meter run.
- 3) Ensure installed mounting coupling is free from dirt and debris.
- 4) Ensure sample probe threads are free from dirt and debris.
- 5) Using Teflon tape or pipe dope, wrap or cover NPT threads of sample probe (see Figure 2-4).
- 6) Insert gas probe into pipeline coupling (see Figure 2-5).
- 7) Using the correct tool, tighten probe. Securely tighten so there is no gas leakage. **DO NOT OVER TIGHTEN.**
- 8) Install shut-off valve on secondary side of sample probe if desired.



**Figure 2-4 Sample Probe**



**Figure 2-5 Sample Probe Insertion**

## 2.4 Stand Alone Installation

If installing an NGC using the pipe saddle mounting kit, use this procedure to install the pipe saddle. Before beginning, review the procedure and the materials required for installation.

### 2.4.1 Material Not Supplied

- One 2" pipe with flange
- One 2" pipe coupling
- One 2" mounting pipe (Installed). Length dependant upon final overall NGC desired height.

**FYI**



Optional equipment may be ordered from Totalflow.

### 2.4.2 Instructions

- 1) Select a location to install mounting pipe that allows easy user access and is close to the sample probe. Lines should be as short as possible.
- 2) Install mounting pipe, being careful to ensure pipe is vertically aligned.
- 3) Screw 2" pipe coupling onto top of mounting pipe.
- 4) Screw optional mounting flange pipe into top of pipe coupling.

**FYI**



Continue to the NGC Installation instructions.

Method of installation must be consistent with customer's company policy.

## 2.5 Freestanding ENC82 Installation



If the installation includes a freestanding ENC82, follow these instructions; otherwise, move to the next section.

### 2.5.1 Materials

- 4 ea.  $\frac{1}{2}$ -13 x  $1 \frac{1}{4}$  SST bolt
- 4 ea.  $\frac{1}{2}$  SST flat washer
- 4 ea.  $\frac{1}{2}$ " SST split washer
- 1 ea. stand

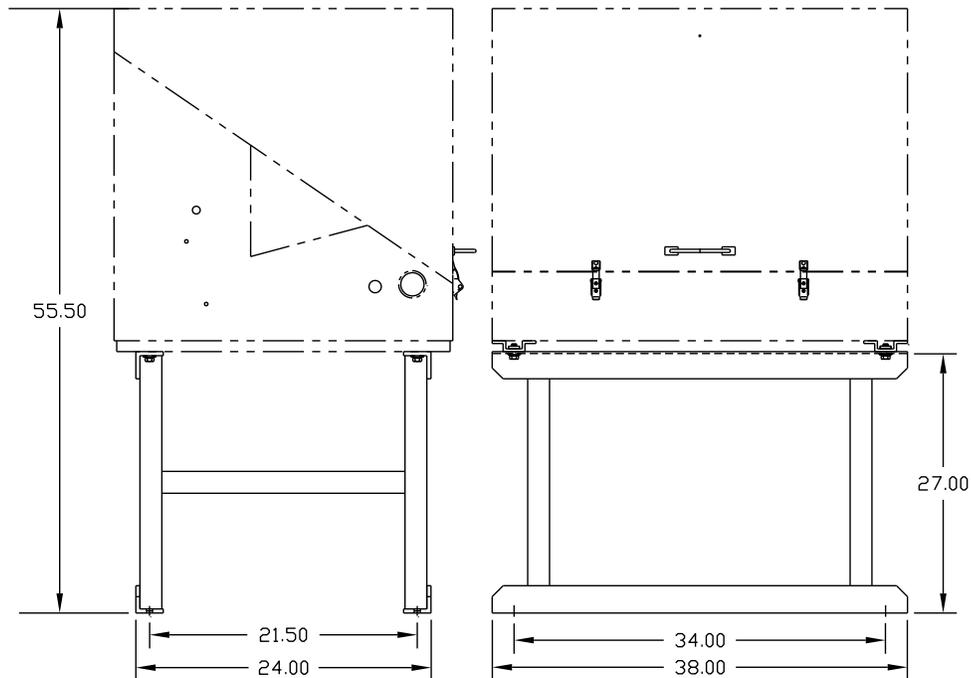
**FYI**



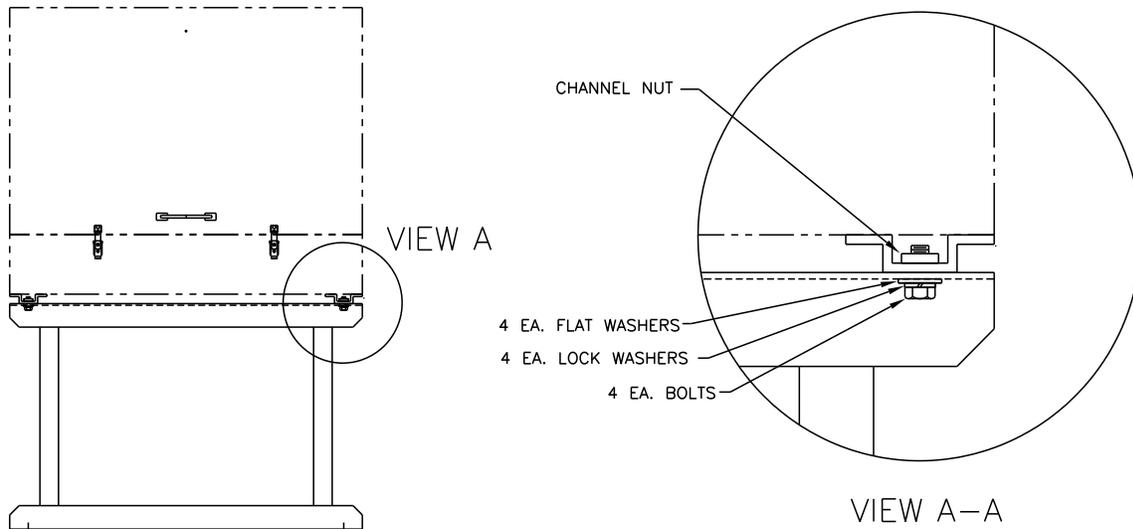
The following steps will typically require two people.

### 2.5.2 Instructions

- 1) The stand is made symmetrical. As a result, the top and bottom are identical. Locate stand base on a flat, stable, surface.
- 2) Set enclosure on top of stand, oriented as shown in Figure 2-6.
- 3) Place a split washer then a flat washer on one of the  $1 \frac{1}{4}$ " bolts, and insert through bolt hole, located in the angle iron into the outermost corner of the enclosure (see Figure 2-7).
- 4) Move channel nut into position so that bolt will screw into nut. Screw bolt into nut, but do not tighten.



**Figure 2-6 Typical ENC82 Stand Mount Installation**



**Figure 2-7 ENC82 Mounting Hardware**

- 5) Repeat for all other corners.
- 6) Position enclosure on stand, centered front to back as desired, and tighten all bolts.
- 7) Foot plate mounting holes are pre-drilled for mounting to a pad. Hardware to be supplied by the customer.

## 2.6 Pipe Mounted ENC82 Mounting Kit



If the installation includes a pipe mounted ENC82, follow these instructions as well as the optional support leg instructions if applicable; otherwise, continue to the next applicable set of instructions.

### 2.6.1 Materials

- 4 ea. 1/2" -13 x 1 1/4 SST bolt
- 4 ea. 1/2" SST flat washer
- 4 ea. 1/2" SST split washer
- 2 ea. 2 1/2" x 1/4" 43" steel angle Iron

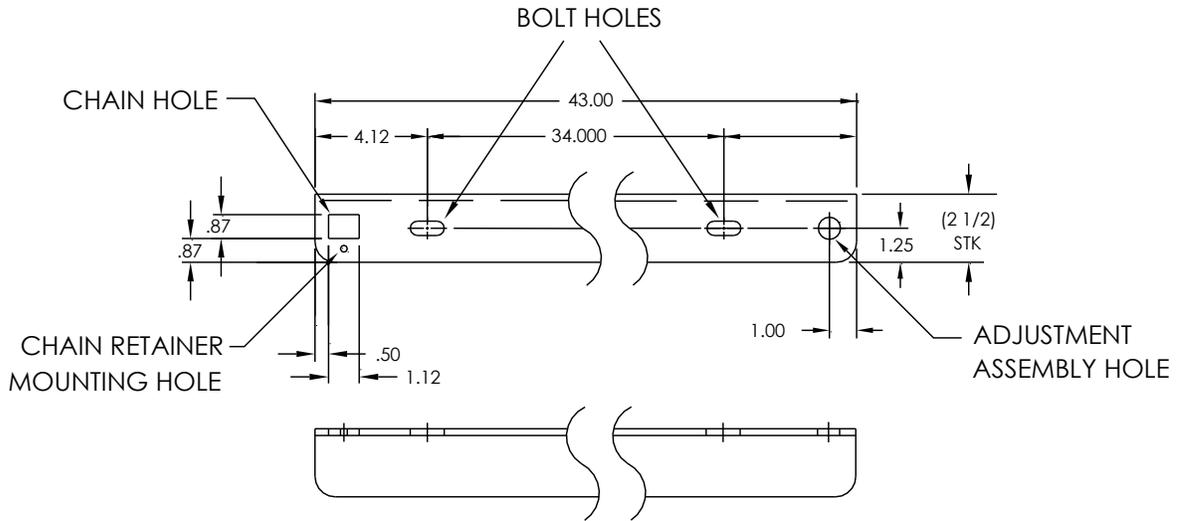
### FYI



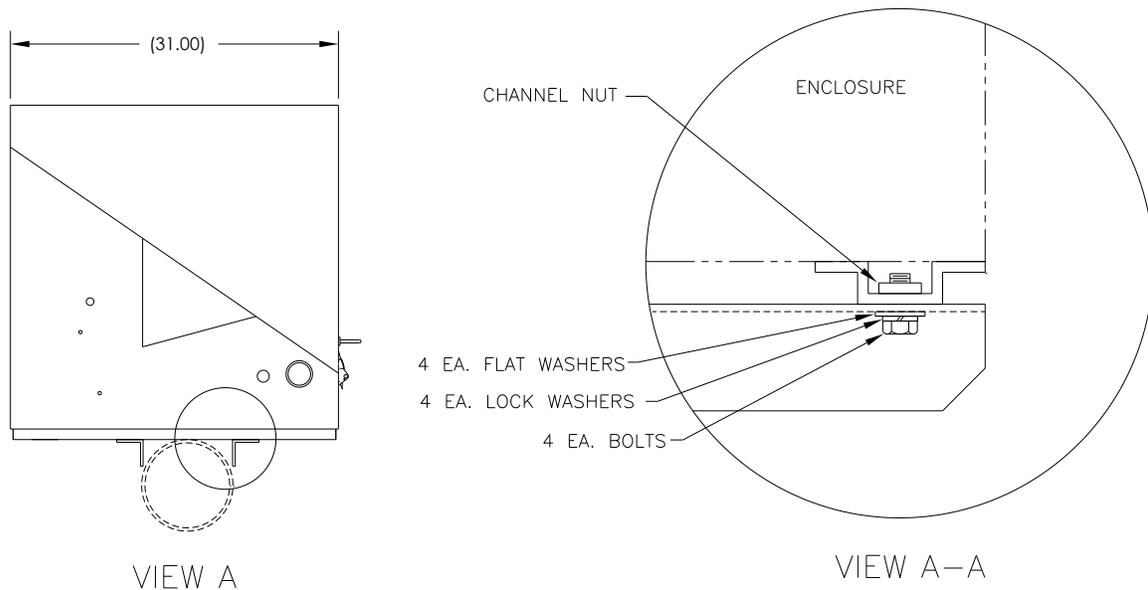
May be used in conjunction with optional support leg kit. See the Support Leg installation procedures next in this chapter.

### 2.6.2 Instructions

- 1) Set two pieces of angle iron (see Figure 2-8) on bottom of upside down enclosure. Be sure the side with the holes is facing the bottom of the enclosure and the solid sides of the angle iron are facing each other. Angle iron should be spaced so that the diameter of the pipe will fit in between.
- 2) Place a split washer then a flat washer on one of the 1 1/4" bolts (see Figure 2-9).

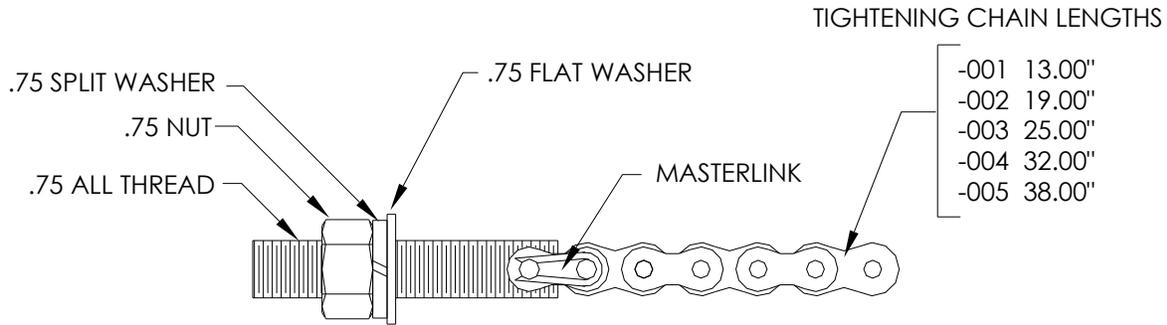


**Figure 2-8 Mounting Brackets**



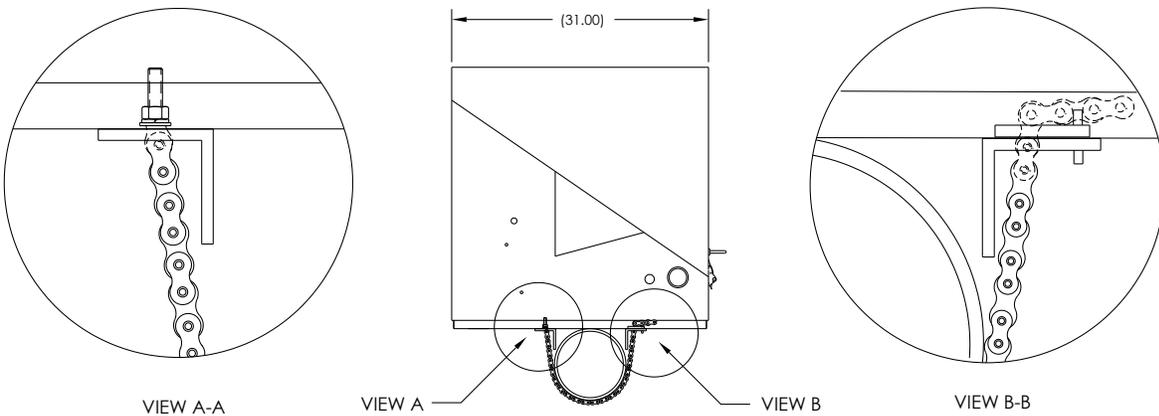
**Figure 2-9 Mounting Hardware Installation**

- 3) Insert the bolt through one of the slotted holes, located in the angle iron, into the outermost corner of the enclosure. Move channel nut into position so that bolt will screw into nut.
- 4) Screw bolt into nut, but leave loose for later adjustment.
- 5) Install other bolt, split washer and flat washer into other slotted hole.
- 6) Repeat for other angle iron. Final tightening of bolts is done after unit is mounted on pipe to allow for left to right and front to back positioning.
- 7) Remove nut and washers from adjustment assembly if necessary (see Figure 2-10).

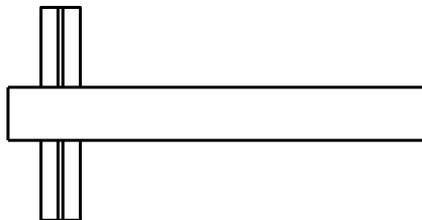


**Figure 2-10 Adjustment Assembly**

- 8) Insert all-thread through round hole on adjustment side of angle iron.
- 9) Place the flat washer, split washer and nut on all-thread.
- 10) Screw nut onto all-thread until top of nut is level with top of all-thread. Final tightening may be done after mounting chain is in place.
- 11) Set enclosure on top of pipe in between the angle iron mounting brackets. Keep unit steady on top of pipe.
- 12) Wrap mounting chain underneath pipe (see Figure 2-11). Feed chain up through square retainer hole of angle iron, and pull up until most of the slack has been taken out of mounting chain.
- 13) Feed long flat end of chain retainer (see Figure 2-12) through middle of a chain link, then move retainer lock into position where round peg fits into small round mounting hole.



**Figure 2-11 Pipe Mount installation**



**Figure 2-12 Chain Retainer Lock**

- 14) Adjust enclosure into final position on the pipe, and tighten nut on all-thread (adjustment assembly) until unit is securely in place.
- 15) Adjust enclosure position on angle iron, if necessary, then tighten bolts until secure.

## 2.7 Optional ENC82 Support Leg installation



If the installation includes a pipe mounted ENC82 and requires an optional support leg or two, follow these instructions; otherwise, continue to the next applicable set of instructions.

### 2.7.1 Materials

- 2 ea. 1/2"-13 x 1 1/4" SST bolt
- 2 ea. 1/2" SST flat washer
- 2 ea. 1/2" SST split washer
- 1 ea. pre-assembled adjustable height support leg

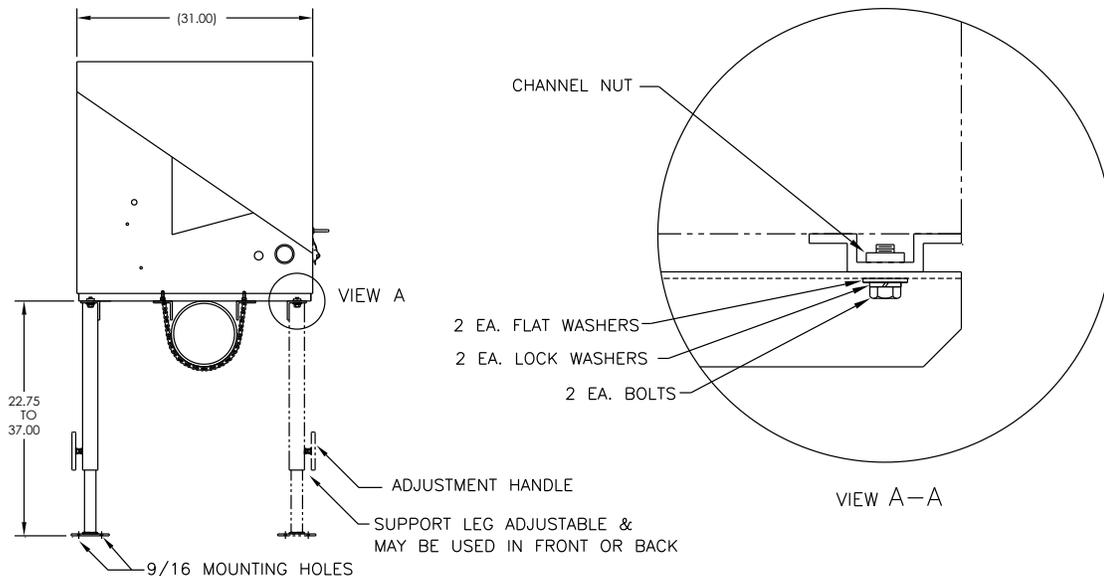
**FYI**



Must use with pipe mounting kit.

### 2.7.2 Instructions

- 16) Set support leg underneath front or rear (or both if using two kits) of the pipe mounted enclosure. Orient so that the leg brace is horizontal with the front of enclosure (see Figure 2-13).
- 17) Place split washer then flat washer on one of the 1 1/4" bolts.
- 18) Insert bolt through hole, located in the angle iron, into the outermost corner of the enclosure. Move channel nut into position so that bolt will screw into nut.



**Figure 2-13 Optional Support Leg Overview**

- 19) Screw bolt into nut, but leave loose for later adjustment. Repeat for other corner.
- 20) If installing two support legs, repeat for other angle iron. Final tightening of bolts may be done after support leg(s) are in desired position on a flat stable surface.
- 21) Loosen adjustment handle and drop leg foot down and retighten adjustment handle.
- 22) Foot plate mounting holes are pre-drilled for mounting to a pad. Hardware to be supplied by customer.

## 2.8 Pipe Saddle Installation

If installing an NGC using the pipe saddle mounting kit, use this procedure to install the pipe saddle. Before beginning, review the procedure and the materials required for installation. The optional pipe with flange may be used in installations requiring additional stability.

### 2.8.1 Material Not Supplied

- 1 ea. pipe saddle
- 1 ea. 2" mounting pipe. Length dependant upon final overall NGC desired height.
- 1 ea. 2" pipe coupling (optional)

FYI



Optional equipment may be ordered from Totalflow.

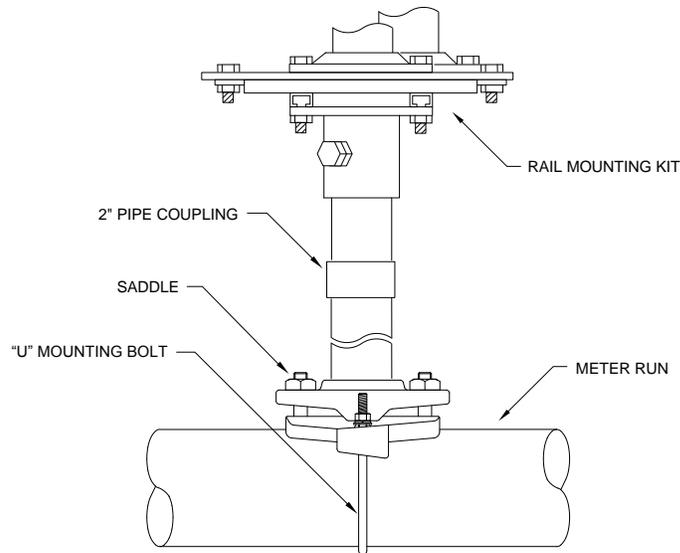
### 2.8.2 Instructions

- 23) Position pipe saddle on meter run. Select a location that allows easy user access and is close to the sample probe. Lines should be as short as possible.
- 24) Temporarily attach saddle on meter run pipe, using U-bolt and associated hardware (see Figure 2–14).
- 25) Screw one end of the 2" pipe into saddle flange on pipe saddle until "wrench tight". Place level against pipe, and vertically align. Adjust the saddle until vertical alignment is achieved.
- 26) After vertical alignment, securely tighten saddle mounting bolts.
- 27) Slide the rail mounting kit over the top of the pipe, and tighten the two locking bolts and run the nuts down until they are tight. (See Figure 2-16)

FYI



Continue to the "NGC Installation" instructions. Method of installation must be consistent with customer's company policy.



**Figure 2–14 Typical Pipe Saddle Installation**

## 2.9 Shelf Installation

If the installation calls for the NGC shelf mounting kit, use this procedure to mount the shelf; otherwise, continue to the next applicable instructions. Before beginning, review the procedure and the materials required for installation.

### 2.9.1 Materials

- 4 ea. ¼" x 20 1" SST hex head machine screws
- NGC mounting shelf with flanges
- 1 ea. 2" mounting pipe. Length dependant upon final overall NGC desired height.
- 1 ea. 2" pipe coupling (optional)

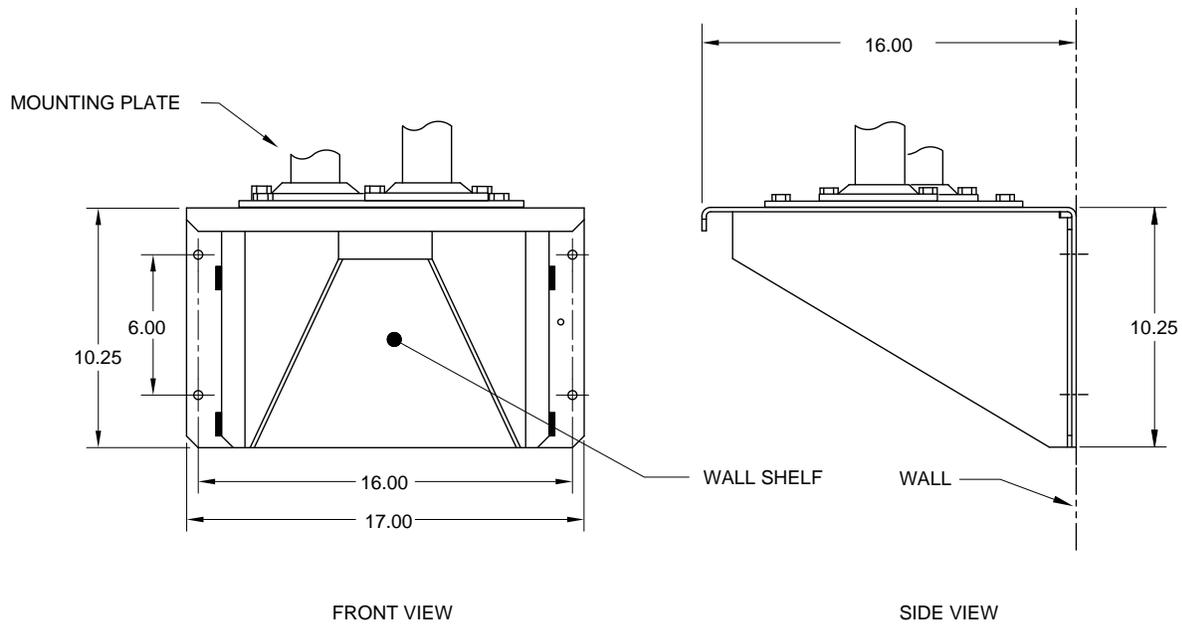
### 2.9.2 Instructions

- 28) Locate wall position where NGC is to be mounted. The shelf should be positioned high enough on the wall so all components are accessible to service personnel.
- 29) Shelf should be installed in close proximity to the installed sample probe.
- 30) Mount the shelf to the wall, being careful to keep level, using four ¼ x 20, 1-inch SST hex head machine screws in each of the four shelf mounting holes. Refer to Figure 2–15.
- 31) Screw one end of 2" mounting pipe into flange on mounting plate until "wrench tight".
- 32) If configuration includes the optional pipe with flange, screw 2" pipe coupling onto top of mounting pipe.
- 33) Screw optional mounting pipe with flange into top of pipe coupling.

**FYI**



Continue to the NGC Installation instructions. Method of installation must be consistent with customer's company policy.



**Figure 2–15 Shelf Installation**

## 2.10 NGC Installation

Once the mounting system has been installed, (either the saddle mounting kit, the shelf mounting kit, or the mounting plate located inside the ENC82) these instructions should be followed to install the NGC onto the mounting pipe.

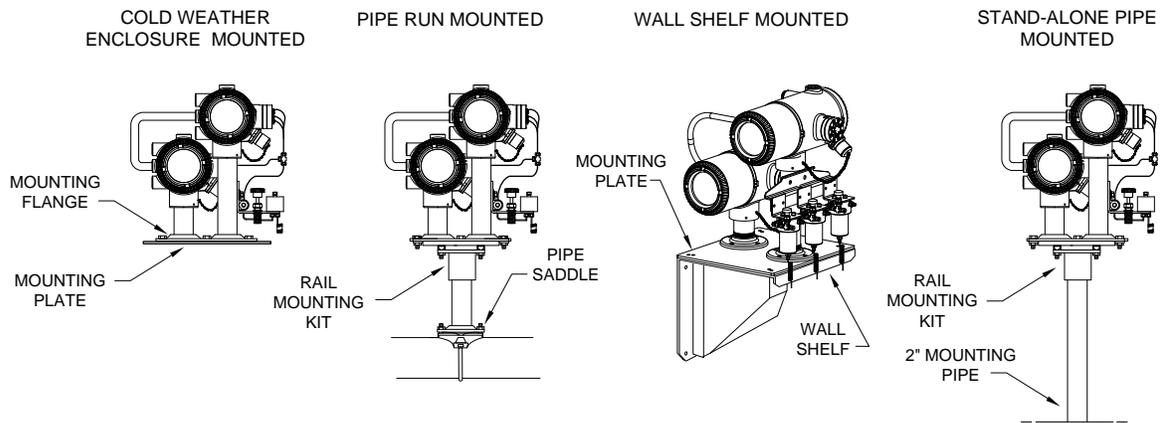
Before beginning, review the procedure and the materials required for installation.

### 2.10.1 Materials

- Installed mounting pipe
- NGC

### 2.10.2 Instructions

- 1) Position NGC on top of the two 2" pipes. The rail mounting kit can be turned to point in any direction.
- 2) For installation inside of a ENC82, the front of the unit will face left, with the feed-through assembly facing the front opening of the enclosure. This allows screen visibility, access to the feed-through assembly and termination panel located in the rear of the housing.
- 3) For shelf mounted units, the unit would be oriented with the feed-through assembly also facing forward. Sufficient clearance is required when mounted near an inside corner.
- 4) Otherwise, continue to the next step.
- 5) Secure in place by tightening the hex socket set screw, located in the neck of the unit, using a 1/8" hex wrench.



**Figure 2-16 NGC Mounting**

## 2.11 Sample Conditioning Module Installation

### 2.11.1 Materials

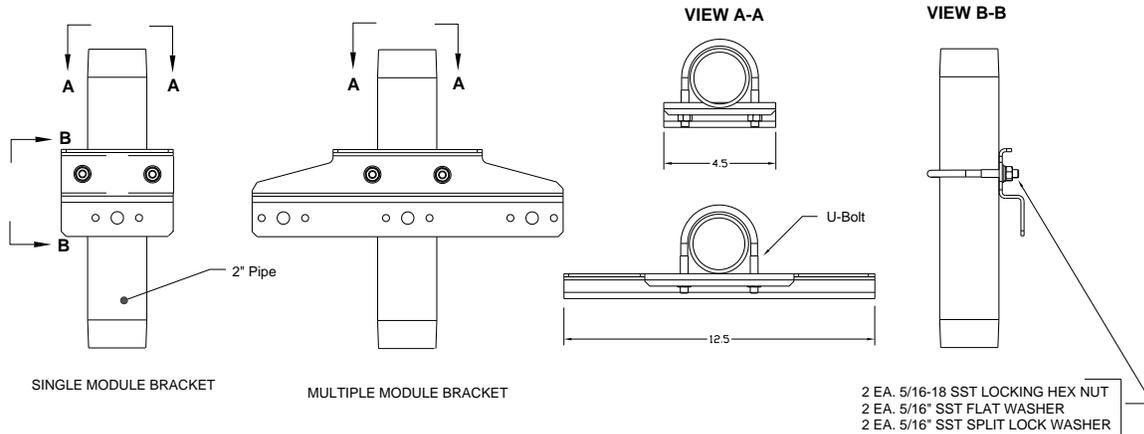
- Installed NGC
- Single or multiple module mounting kit (see Figure 2-17)
- 1 ea. .312 x 2.5 x 3.62 x 1.5 U-bolt
- 2 ea. 5/16" SST split washer
- 2 ea. 5/16" SST flat washer
- 2 ea. 5/16-18 SST lock nut
- Sample conditioning module(s) and hardware (see Figure 2-18)

### 2.11.2 Mounting Kits

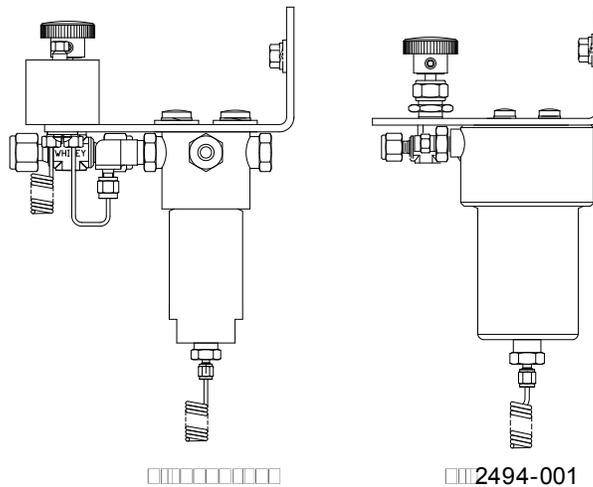
Both sample conditioning module mounting brackets are installed identically. The single module bracket will hold a single stream sample conditioning module, while the multiple module bracket will hold up to three sample conditioning modules.

### 2.11.3 Instructions

- 1) On sample conditioning module, align mounting holes to corresponding holes in bracket. Insert bolt through hole in bracket, from front to back, through mounting hole in module (see Figure 2-18). Place split washer then flat washer on bolt. Screw nut onto end of bolt, finger tight. Repeat for second mounting bolt. Tighten both nuts.
- 2) Repeat for all additional modules.
- 3) Straddle mounting pipe with U-bolt, and insert threaded ends through holes located in bracket so that bracket back fits flat against pipe and module mounting lip sets away from pipe (see Figure 2-17).
- 4) Place the flat washer then a split washer on end of U-bolt. Screw nut onto end of bolt, finger tight.
- 5) Repeat step 4 for other side of U-bolt.
- 6) Move bracket into position underneath NGC. Be careful to allow clearance for sample conditioning module(s).
- 7) Tighten both nuts.



**Figure 2-17 Sample System Mounting Kits**



**Figure 2-18 Sample Conditioning Module Bracket**

## 2.12 Sample Line Connections

Following the installation of the sample conditioning module(s), the sample tubing from the sample probe to the sample conditioning system and NGC feed-through assembly should be installed.



**TIP**

If sample conditioning module and NGC are located inside a ENC82, review the following section, Sample Line Connections to NGC Inside of the ENC82, for information pertaining to this installation.

### 2.12.1 Materials

- 1/8" SST chromatography grade transport tubing (amount to be determined by technician based on distance from sample probe to sample conditioning module and number of sample streams)
- 2 ea. ferrule and nut (for each sample stream)
- 1 ea. 1/4" NPT to 1/8" reducer or other size as determined from sample probe output port (for each sample stream)

- 1 ea. sample conditioning module transport tubing (supplied with sample conditioning module)

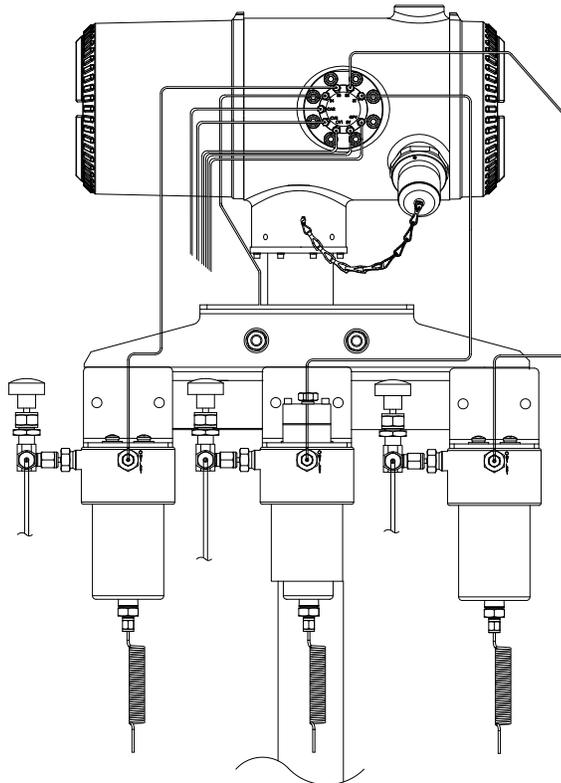
### 2.12.2 Instructions

**TIP**  Be certain the ends of the stainless steel tubing are open and not restricted.

- 1) Locate sample input fitting on the sample conditioning module (see Figure 2-19).
- 2) Locate the sample output fitting on the installed sample probe.
- 3) Measure and cut the SST tubing to the required length.
- 4) Make the necessary bends in tubing to ease installation of the ferrule and nut into sample conditioning module input port.

**FYI**  For simplicity, only the main enclosure is shown. The tubing from the sample conditioning modules will tee-off and go to both the main and auxiliary enclosures.

- 5) If necessary, install reducer into sample probe output fitting.
- 6) Install ferrule and nut onto one end of the sample tubing.
- 7) Insert tubing with ferrule into reducer/sample probe output fitting. Move nut down onto ferrule, screw onto fitting and tighten.



**Figure 2-19 Sample Conditioning Module Installation**

- 8) Install ferrule and nut onto other end of the sample tubing.

- 9) Insert ferrule into sample conditioning module input fitting. Move nut down onto ferrule, screw onto fitting and tighten.
- 10) Locate sample output fitting on sample conditioning module.
- 11) Locate sample input on NGC feed-through assembly, and remove sealing screw.
- 12) Make necessary bends in tubing to ease installation of the tubing into output fitting on sample conditioning module. Insert ferrule and Valco nut into input on NGC feed-through assembly.
- 13) Insert tubing with ferrule into output fitting on sample conditioning module. Move nut down onto ferrule, screw onto fitting and tighten.
- 14) Remove plastic caps from restrictor coils, sealing screws from feed-through column vents and sealing screw from sample vent lines.
- 15) Purge air from the transport tubing by opening the shut-off valve located on the sample probe.



**WARNING**

Be sure to follow the requirements of national and local codes when performing this purge.

- 16) Insert tubing with ferrule into corresponding input port located on the NGC feed-through assembly. Move Valco nut down onto ferrule, screw into port and tighten.
- 17) Repeat for each sample stream.



**CAUTION**

DO NOT over tighten. After securing tubing, check for gas leaks.

## 2.13 Sample Line(s) to NGC inside of ENC82



Environmental Enclosure

Sample line(s) being installed to a unit located inside the ENC82 require making minute changes to the instructions listed for their installation. The following information and steps should be noted during the installation.

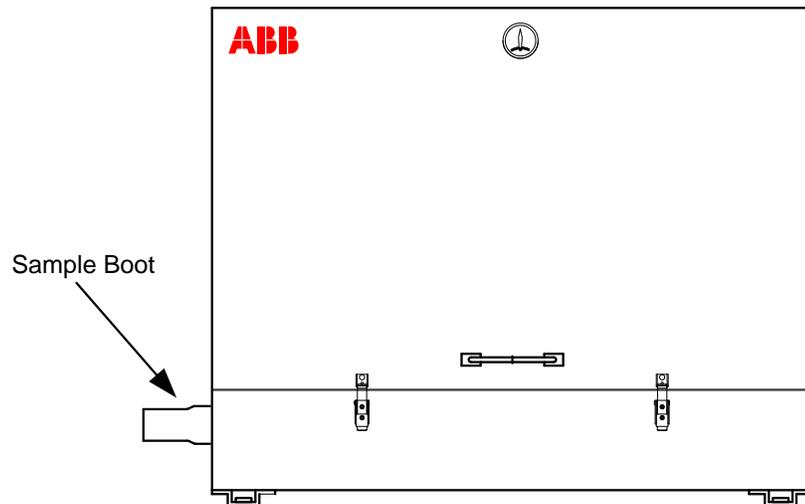
### 2.13.1 Materials

- Installed sample conditioning module for each stream.
- 1/8" SST chromatography grade transport tubing (amount to be determined by technician based on distance from sample probe to sample conditioning module and number of sample streams).
- 2 ea. ferrule and nut (for each sample stream)
- 1 ea. 1/4" NPT to 1/8" reducer or other size as determined from sample probe output port (for each sample stream)
- 1 ea. sample conditioning module transport tubing (supplied with sample conditioning module).
- 1/16" or larger vent tubing and materials for making connection to 1/16" purge coil to vent outside of enclosure (provided by customer for each stream)
- Heat trace materials provided by customer for each stream

### 2.13.2 Instructions

**TIP**  Be certain ends of stainless steel tubing are open and not restricted.

- 1) Locate sample input fitting on sample conditioning module (see Figure 2–20) and sample output fitting on installed sample probe..
- 2) Locate sample boot on side of environmental enclosure. Sample lines must feed through the sample boot located on the side of the enclosure.
- 3) Measure and cut SST tubing to required length. Feed sample tubing through sample boot.



**Figure 2–20 ENC82L–Environmental Enclosure Sample Boot**

- 4) If necessary, install reducer into sample probe output fitting.
- 5) Install ferrule and nut onto one end of the sample tubing.
- 6) Insert tubing with ferrule into reducer/sample probe output fitting. Move nut down onto ferrule, screw onto fitting and tighten.
- 7) Install ferrule and nut onto other end of the sample tubing.
- 8) Insert ferrule into sample conditioning module input fitting. Move nut down onto ferrule, screw onto fitting and tighten.
- 9) Locate sample output fitting on sample conditioning module.
- 10) Locate sample input on NGC feed-through assembly and remove sealing screw.

**CAUTION**  Leave sealing screw in any unused ports. If unused stream ports are not sealed, moisture can enter the manifold which can damage the instrument and void warranty.

- 11) Make necessary bends in tubing to ease installation of the tubing into output fitting on sample conditioning module, and ferrule and valco nut into input on NGC feed-through assembly.

- 12) Insert tubing with ferrule into output fitting on sample conditioning module. Move nut down onto ferrule, screw onto fitting and tighten.
- 13) Remove plastic caps from restrictor coils, sealing screws from Feed-through column vents and sealing screw from sample vent lines.
- 14) Purge air from the transport tubing by opening the shut-off valve located on the sample probe.



**WARNING**

Be sure to follow requirements of national and local codes when performing this purge.

- 15) Insert tubing with ferrule into corresponding input port located on the NGC feed-through assembly. Move valco nut down onto ferrule, screw into port and tighten.
- 16) Repeat for each additional sample stream.



**CAUTION**

DO NOT over tighten. After securing tubing, check for gas leaks.

- 17) Measure and cut vent tubing to sufficient length to guarantee purge coils vent outside of enclosure. Feed vent tubing through sample boot.
- 18) Make necessary bends in tubing to ease installation of tubing into the required fittings on the end of sample conditioning module purge coil.
- 19) Please follow Heat Trace Manufacturer's suggested installation instructions for applying Heat Trace equipment to additional sample streams.

## 2.14 ENC82 Optional Pwr/Comm Outlet Box Assembly

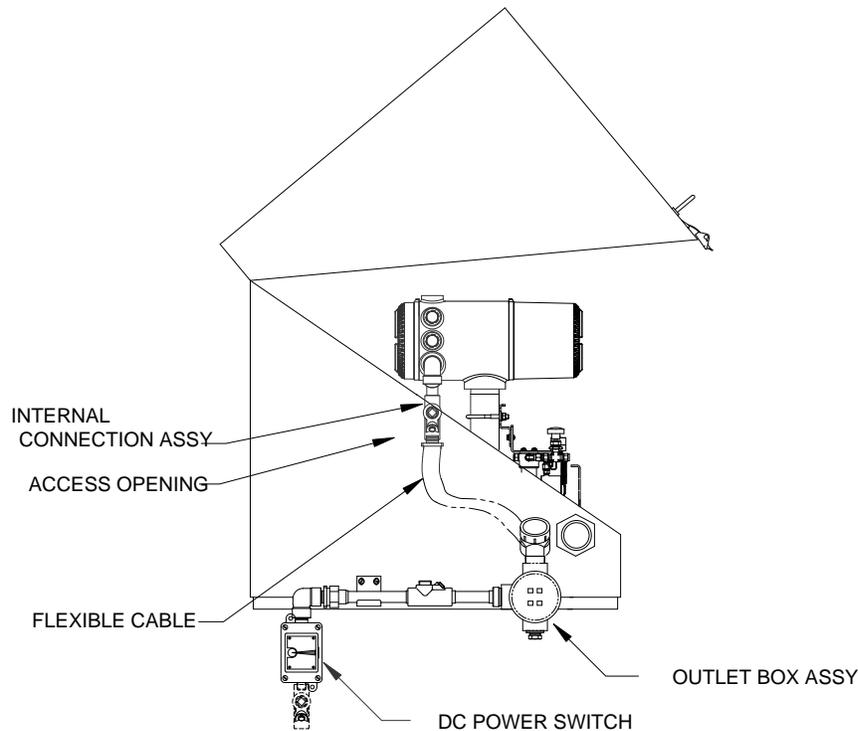


Environmental Enclosure

If installing the NGC inside a ENC82, use this procedure to install the optional RS-232/RS-485/RS-422 outlet box if required; otherwise, continue to the next applicable instructions. Before beginning, review the procedure and the materials required for installation (see Figure 2-22).

### 2.14.1 Materials

- 1 ea. outlet box assembly
- 1 ea. internal NGC connection assembly
- 1 ea. flexible cable assembly
- 1 ea. DC power switch box
- 1 ea. support bracket
- 2 ea. 10-32 x  $\frac{3}{4}$ " SS pan head screw, phillips
- 2 ea. #10 SST flat washer
- 2 ea. #20 SST split washer
- Materials for external wiring (to outlet box) not provided by Totalflow. Quantities and materials to be determined by the technician based on installation and local codes.

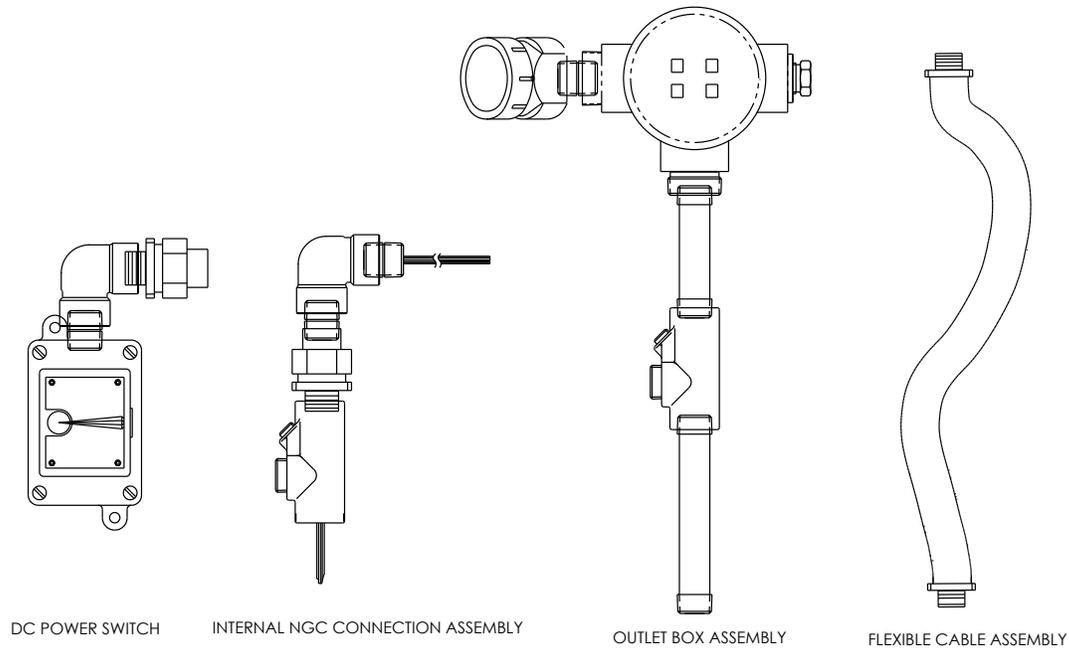


**Figure 2–21 ENC82 External Power/Communication Assembly**

#### 2.14.2 Instructions

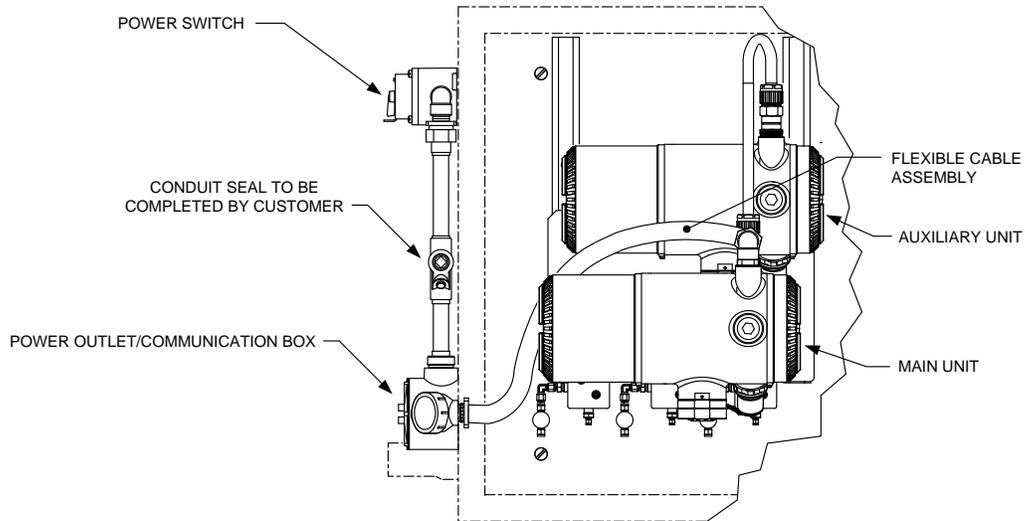
- 1) Gain access to rear termination panel of the main NGC by loosening the countersunk hex socket locking set screw in the rear end cap, using a 1/16" hex wrench, then unscrewing the end cap.
- 2) Remove hub plug from the bottom most access hub.
- 3) Beginning with the internal connection assembly (see Figure 2–22), feed the 13" wire bundle (elbow end of assembly) through open hub. Continue to pull wire past terminations until the nipple fitting is in position to screw into hub.
- 4) Moving assembly clockwise, screw nipple fitting into hub until assembly is tight and hanging straight down.
- 5) Feed other end of wire bundle through flexible cable assembly, beginning at end with sealing gasket, until threads meet conduit seal.
- 6) Rotate the flexible cable assembly clockwise, screwing threads into conduit seal until tight. For explosion proof installation, a minimum of five threads engaged are required.
- 7) Feed wires through the small hole located near the sample boot in the lower front of the ENC82 (see Figure 2–21).
- 8) Remove cover from outlet box assembly.

**TIP**  Remove elbow cap on outlet box assembly to facilitate feeding the wrapped wire around the elbow.

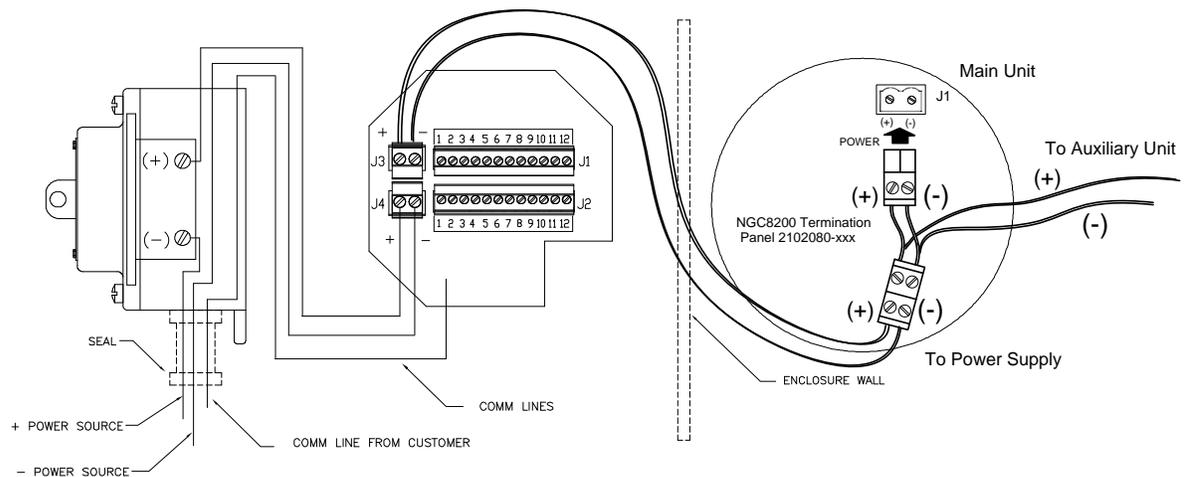


**Figure 2–22 Power Communication Outlet Box assembly**

- 9) Feed wires through outlet box elbow and out past the wiring panel, moving assembly up to the threaded end of the cable.
- 10) Begin threading the outlet box assembly onto end of flexible cable assembly, rotating entire outlet box assembly clockwise until tight and in a vertical position. For explosion proof installation, a minimum of five threads engaged are required.
- 11) Locate support bracket mounting holes on enclosure.
- 12) Place the split washer then a flat washer on end of each screw.
- 13) Insert screw through mounting bracket and into hole on side of enclosure.
- 14) Using a Phillips point screwdriver, start screw into hole, but do not tighten.
- 15) Repeat steps 13 through 15 for second screw.
- 16) Level bracket, and tighten screws until snug.
- 17) Move outlet box assembly down so that it rests on the mounting bracket (see Figure 2–23).
- 18) At the main NGC termination panel, trim and strip wire ends.
- 19) Remove power field termination J1 connector from termination panel.
- 20) Using the wiring instructions in Figure 2–24, install each wire into the correct terminal, and replace connector on board.



**Figure 2-23 Assembled Power/Communication Assembly**



**Figure 2-24 Power Wiring Diagram**

- 21) Trim and strip wire ends located in the external outlet box.
- 22) Remove power field termination J3 connector from outlet box panel.
- 23) Using the wiring instructions in Figure 2-24, install each wire into the correct terminal, and replace connector on board.
- 24) Remove DC power switch box cover.
- 25) Remove the switch mounting screws, and remove the switch.
- 26) Cut a 3' length of power (+) wire.

**TIP**

Optionally, communication wires may be run directly to the spare conduit hub located on the bottom of the outlet box assembly. Follow requirements of national and local codes.

For the purpose of this manual, it is assumed that communication wiring will be included with the power wiring in one conduit run.

- 27) Tape 3' power (+) wire, ground and communication wire ends together.
- 28) Feed through conduit hub located on the bottom of the DC power switch box, past cover opening, around elbow and out.
- 29) Continue pulling wire until approximately 2' of wire is extending out of the DC power switch box.

**CAUTION**

Be careful to not pull 3' power (+) wire past the DC power switch box opening.

- 30) Feed excess wire through 6" nipple fitting, conduit seal, 5" nipple fitting and out into outlet box opening. Pull sufficient wire to complete field wiring.
- 31) Remove power field termination J4 connector from outlet box panel.
- 32) Using the wiring instructions in Figure 2–24, install power (+) and power (-) wires into the correct terminal pins and replace connector on board.
- 33) Holding wires, slide DC power switch box up to 6" nipple fitting on end out outlet box assembly.
- 34) Slide conduit union onto end of nipple fitting, and screw on.
- 35) Loosen terminal screws on DC power switch.
- 36) Using the wiring instructions in Figure 2–24, wire power (+) to upper terminal screw and tighten.
- 37) Bring new power (+) wire into power switch enclosure, and pull short length out to allow wiring.
- 38) Using the wiring instructions in Figure 2–24, wire new power (+) length to bottom terminal screw and tighten.
- 39) Re-install DC power switch into box.
- 40) Using the wiring instructions in Figure 2–25 (RS-232), Figure 2–26 (RS-485) or Figure 2–27 (RS-422), make field connections to plug NGC termination panel com port(s) , re-insert into corresponding connector in termination panel.
- 41) Using the wiring instructions in Figure 2–25 (RS-232), Figure 2–26 (RS-485) or Figure 2–27 (RS-422), make field connections to plug J1, and re-insert into corresponding connector in outlet box.
- 42) Using the wiring instructions in Figure 2–24 (RS-232), Figure 2–26 (RS-485) or Figure 2–27 (RS-422), make field connections to plug J2, and re-insert into corresponding connector in outlet box.

**FYI**

Communication wiring terminations inside the power/communication outlet box assembly are pass-through connections. This means that J1-pin 1 is associated with J2-pin 1. As such, pin outs may be user defined and wiring instructions for this assembly are only suggestions.



External wiring and connections should be performed by person(s) qualified for the type and area of installation according to national and local codes.

- 43) Following instructions included with unit, complete seal between DC power switch and outlet box assembly.

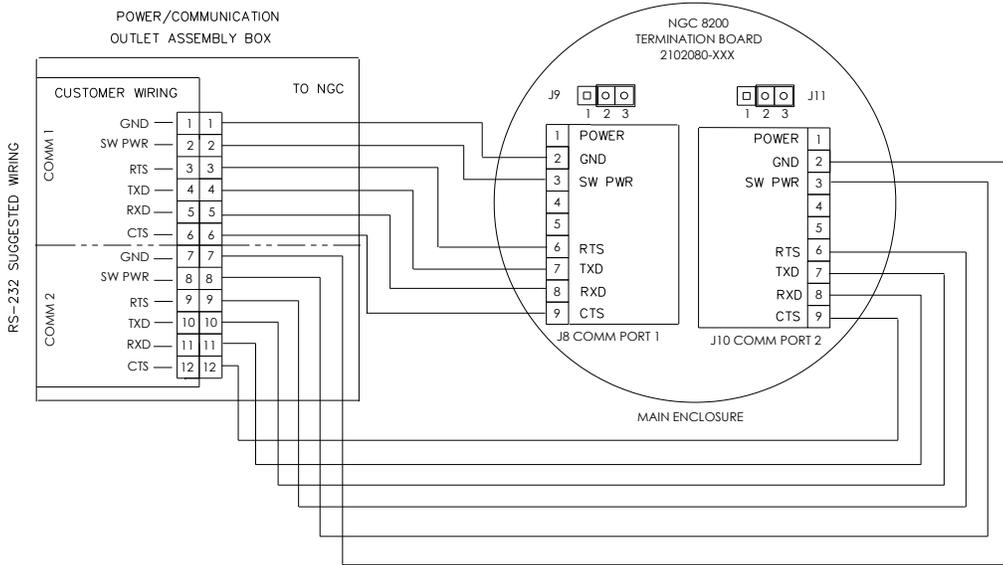


Figure 2-25 Suggested RS-232 Wiring Instructions

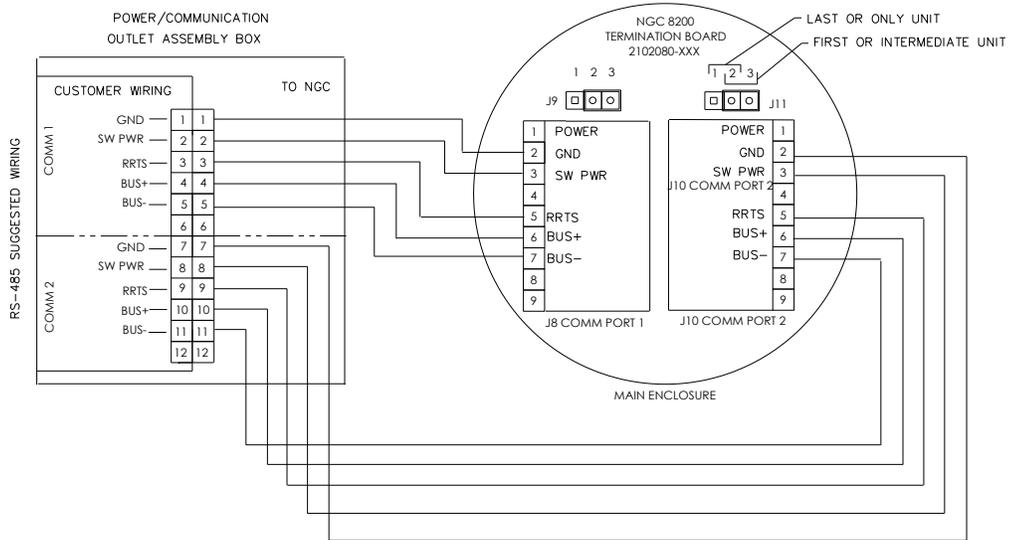
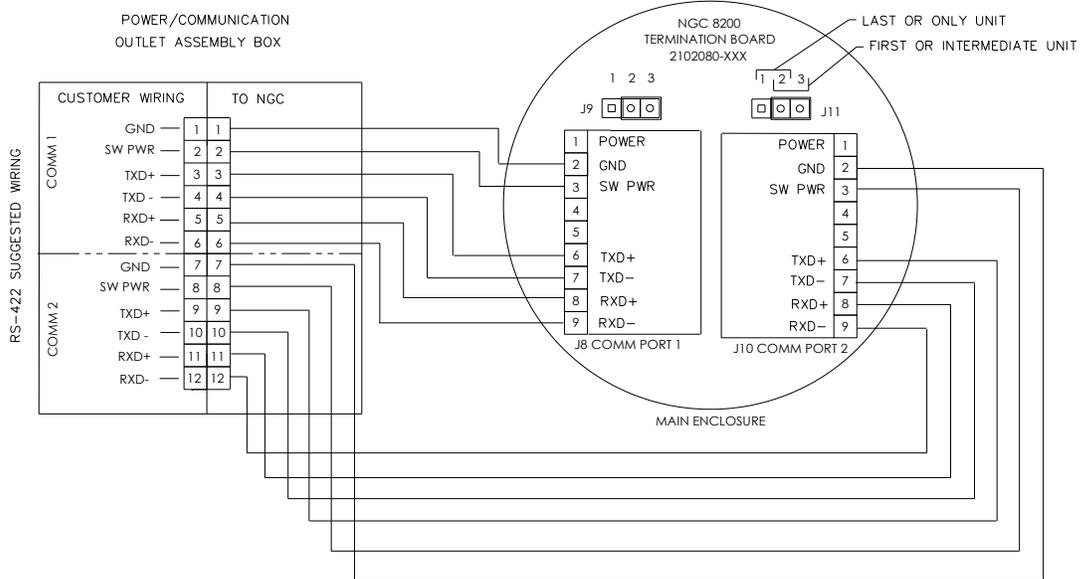


Figure 2-26 Suggested RS-485 Wiring Instructions



**Figure 2-27 Suggested RS-422 Wiring Instructions**

## 2.15 Carrier/Calibration Bottle Rack Installation on Meter Run

The carrier/calibration gas bottle rack is used to hold the carrier and calibration gas bottles on installations not using a ENC82. A gas regulator should be installed on each gas bottle (see Figure 2-28). This bottle rack is not available through Totalflow; therefore, the instructions are generalized.

### 2.15.1 Instructions

- 1) Position bottle rack in close proximity to NGC.
- 2) Secure rack to the pipe meter run with provided mounting hardware.
- 3) Install both carrier and calibration gas bottles in the rack.
- 4) Strap both bottles in rack to prevent their falling.

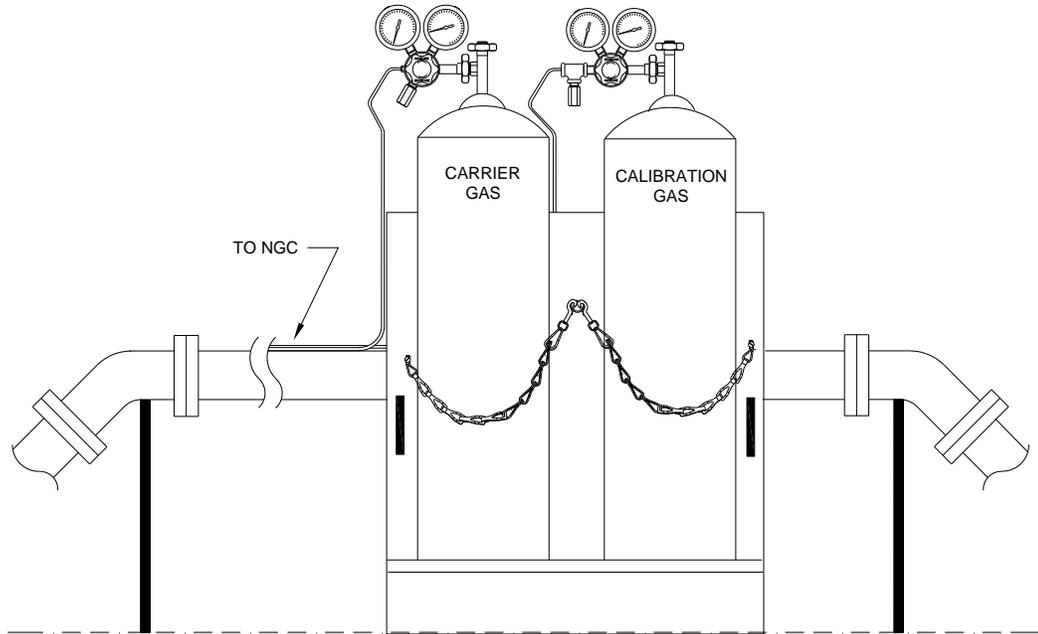


Figure 2–28 Carrier/Calibration Gas Bottle Rack Installation

## 2.16 ENC82 Carrier Gas Bottle Rack Installation



The carrier gas bottle rack is used to hold carrier gas bottles and is installed on the back of the ENC82. A gas regulator should be installed on each gas bottle (see Figure 2–29).

### 2.16.1 Materials

- 1 ea. bracket with chain assembly attached
- 2 ea. 3/8"-16 x 5/8 SST hex head bolt
- 2 ea. 3/8" SST split washers
- 2 ea. 3/8" SST flat washers

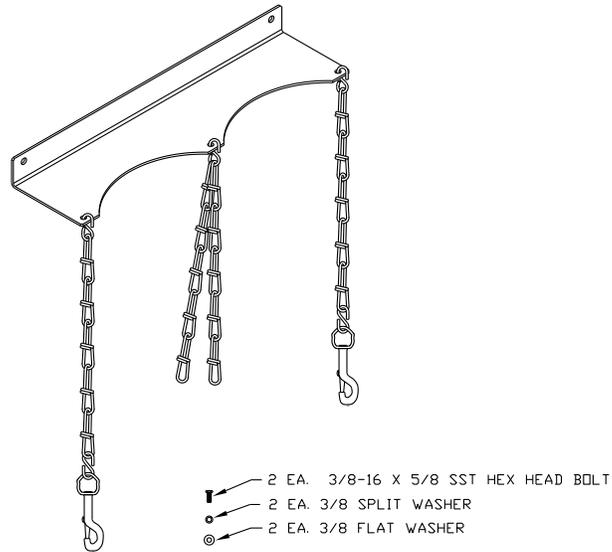
### 2.16.2 Instructions

- 1) Locate bracket holes on the rear of the large enclosure.
- 2) Place a split washer then a flat washer on one of the 5/8" bolts, and insert through bolt hole located in the bottle rack bracket into the corresponding hole located along the bottom edge of the enclosure, and tighten (see Figure 2–30).

**FYI**

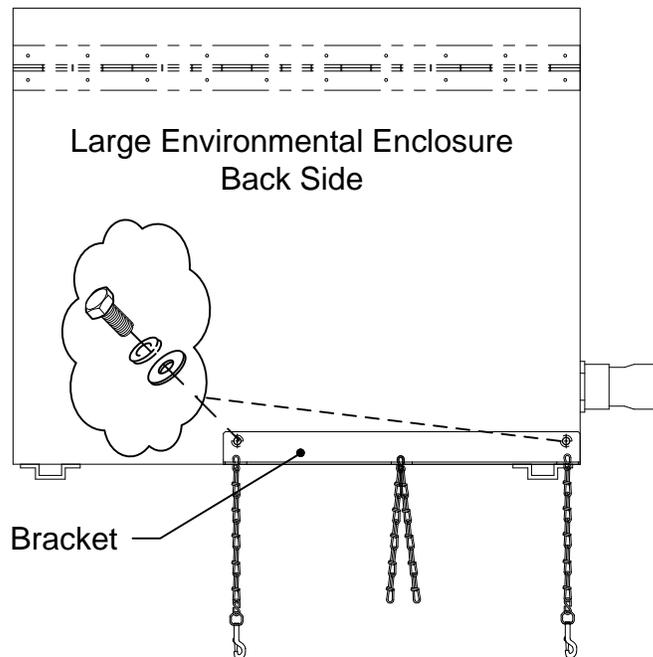


Enclosure hole contains a captive nut.



**Figure 2-29 Dual Bottle Rack Assembly**

- 3) Screw bolt into captive nut on large enclosure, tighten.
- 4) Repeat for second bolt.
- 5) Install carrier gas bottle in bottle rack.
- 6) Using chains, strap bottle(s) to rack by attaching bolt snap to one of the center chains.
- 7) Repeat step 5 if installing a second bottle.



**Figure 2-30 ENC82L-Dual Bottle Rack Installation**

## 2.17 Carrier Gas Regulator with Low Pressure Switch Installation

The following instructions are valid for all installations.

### 2.17.1 Materials

- Carrier regulator assembly with low pressure switch (see Figure 2–31)
- Installed carrier gas bottle

**FYI**



These instructions assume that the carrier gas bottle has previously been installed.

### 2.17.2 Instructions

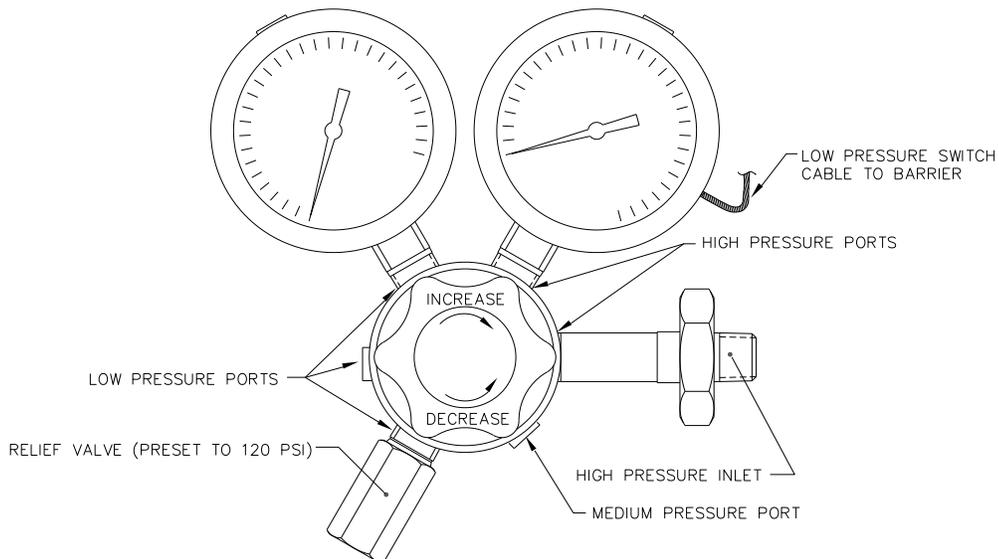
- 1) Remove protective cap from high pressure inlet, if required.
- 2) Insert ferrule on regulator high pressure inlet into carrier gas bottle outlet.
- 3) Screw nut onto thread and tighten.
- 4) Check for leaks.

**WARNING**

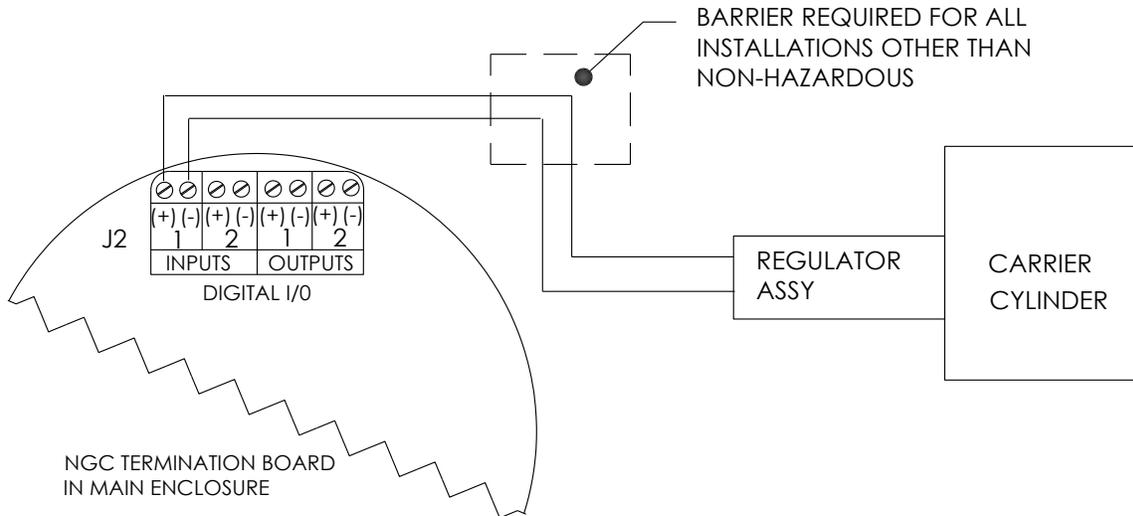


DO NOT connect low pressure switch directly to the NGC without a barrier.

- 5) Remove the J2 field wiring connector from the NGC termination panel located inside the rear of the main enclosure (see Figure 2–32).
- 6) Using a small flat blade screw driver, loosen DI1 pins 1 and 2.
- 7) Insert the red wire into the (+) terminal (pin 1).
- 8) Retighten pin 1.
- 9) Insert the black wire into the (-) terminal (pin 2).



**Figure 2–31 Carrier Gas Pressure Regulator with Relief Valve**



**Figure 2–32 Carrier Gas Low Pressure Switch Wiring Instructions**

- 10) Retighten pin 2.
- 11) Replace the termination connector in J2 board connector.

## 2.18 ENC82 Calibration Gas Bottle Installation



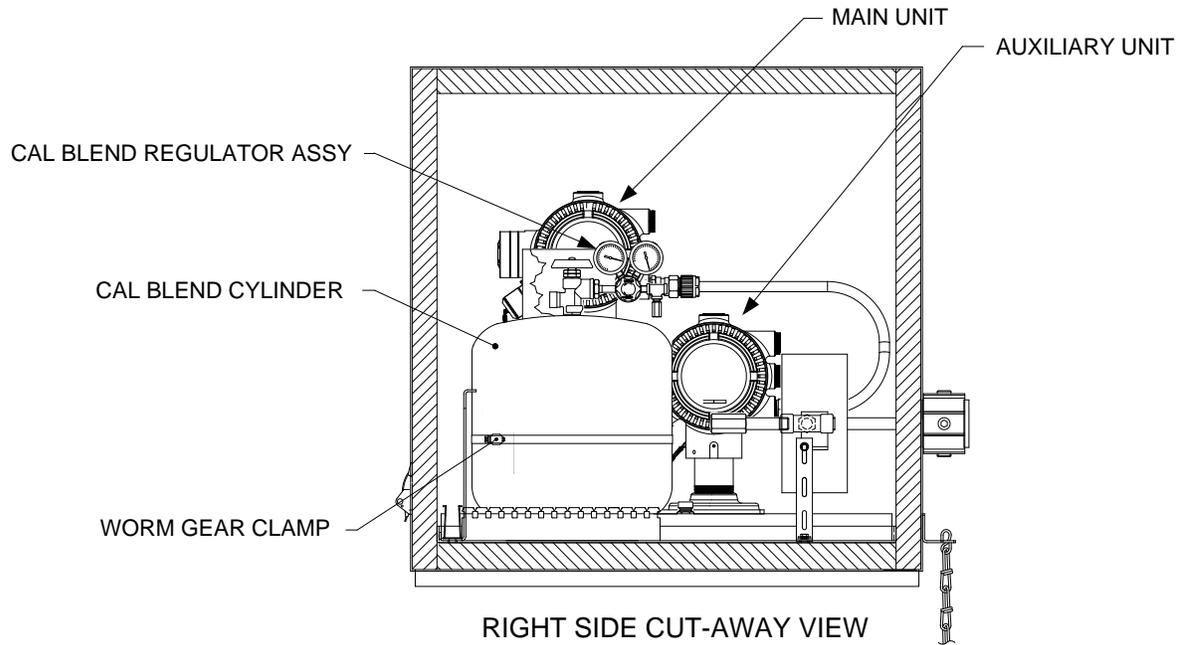
The calibration gas bottle mounting rack is used to hold the calibration gas bottle when located inside of the ENC82. A gas regulator should be installed on each gas bottle. Refer to Figure 2–33.

### 2.18.1 Materials

- Strapping material (shipped with ENC82)
- Calibration gas blend bottle

### 2.18.2 Instructions

- 1) Locate the bottle bracket in the right front area of the ENC82 (see Figure 2–33).
- 2) Set calibration bottle inside of enclosure, situated against the bottle bracket.
- 3) Thread strap through holes in bracket and around the bottle. Insert end of strap into worm gear.
- 4) Using a flat blade screw driver, turn screw on worm gear until strap is snug.



**Figure 2–33 Calibration Bottle Location**

## 2.19 Calibration Gas Regulator - Low Pressure Switch Installation

The following instructions are valid for all installations.

### 2.19.1 Materials

- Calibration blend regulator assembly (2017225-001) with low pressure switch (see Figure 2–34)
- Installed calibration gas bottle

**FYI**



These instructions assume that the carrier gas bottle has previously been installed.

### 2.19.2 Instructions

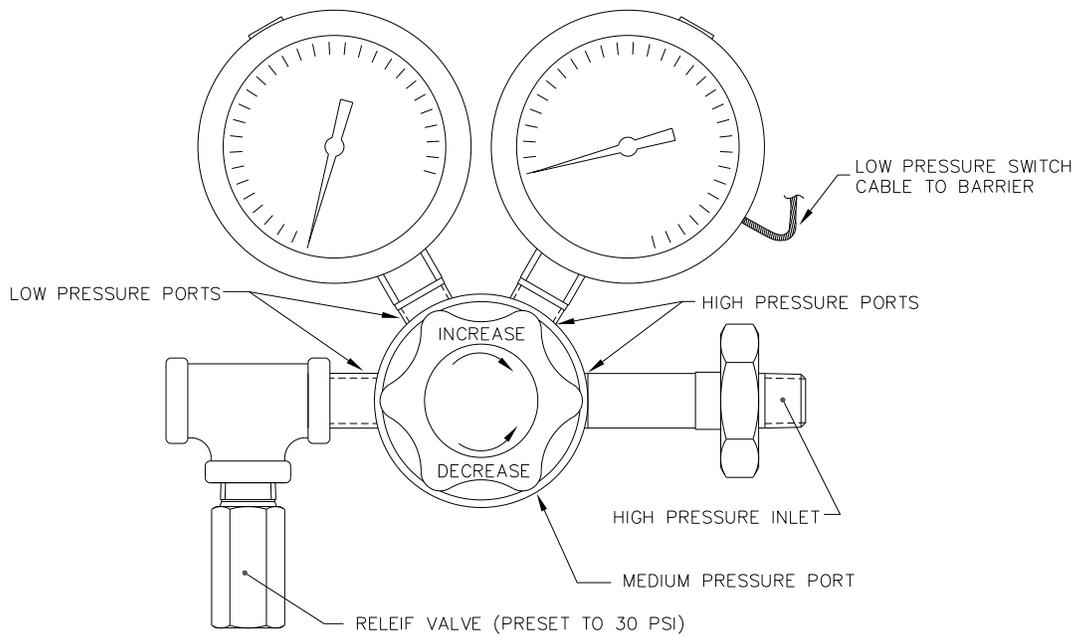
- 1) Remove protective cap from high pressure inlet, if required.
- 2) Insert ferrule on regulator high pressure inlet into calibration gas bottle outlet.
- 3) Screw nut onto thread and tighten.
- 4) Check for leaks.

**WARNING**

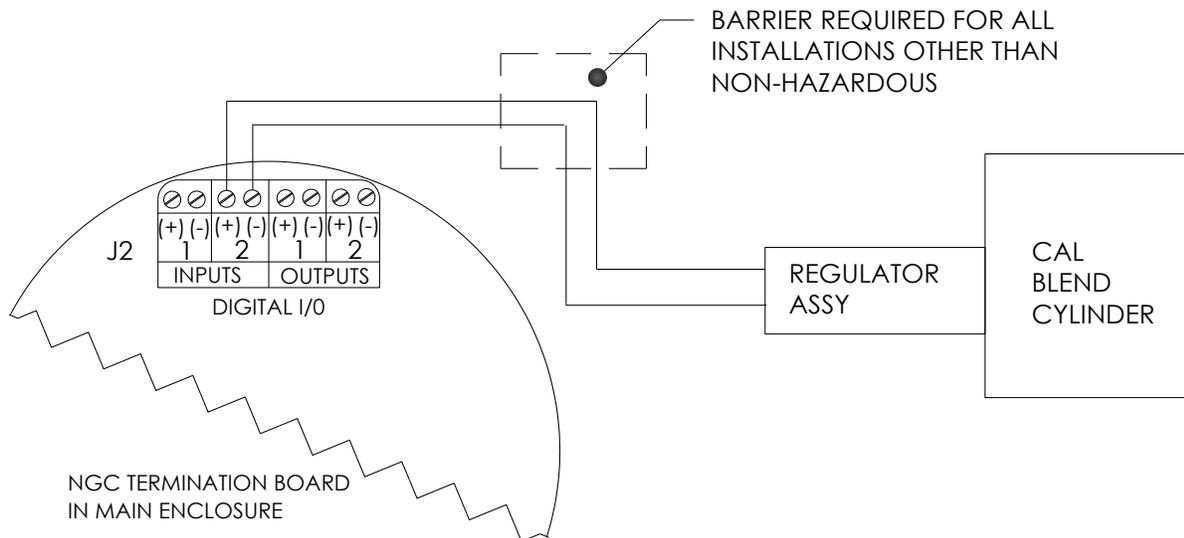


DO NOT connect low pressure switch directly to the NGC without a barrier.

- 5) Remove the J2 field wiring connector from the NGC termination panel located inside the rear of the main enclosure (see Figure 2–35).



**Figure 2-34 Calibration Gas Pressure Regulator with Relief Valve**



**Figure 2-35 Calibration Blend Low Pressure Switch Wiring Instruction**

- 6) Using a small flat blade screw driver, loosen DI2 pins 3 and 4.
- 7) Insert the red wire into the (+) terminal (pin 3).
- 8) Retighten pin 3.
- 9) Insert the black wire into the (-) terminal (pin 4).
- 10) Retighten pin 4.
- 11) Replace the termination connector in J2 board connector.

## 2.20 Carrier Gas and Calibration Gas Connections

The following procedures describe the steps for connecting the external carrier gas and calibration gas lines from the respective regulators to the feed-through assembly on the NGC. They are applicable for both a meter run and ENC82 installation.

### 2.20.1 Materials

- Installed carrier gas pressure regulator
- 1/16" SST chromatography grade transport tubing (amount to be determined by technician based on distance from carrier gas bottle regulator to sample input filter)
- Installed calibration gas pressure regulator
- 1/16" SST chromatography grade transport tubing (amount to be determined by technician based on distance from calibration gas bottle regulator to sample input filter)
- 4 ea. 1/16" ferrule and nut
- 2 ea. 1/4" NPT to 1/16" reducer or other size as determined from carrier/calibration gas regulator

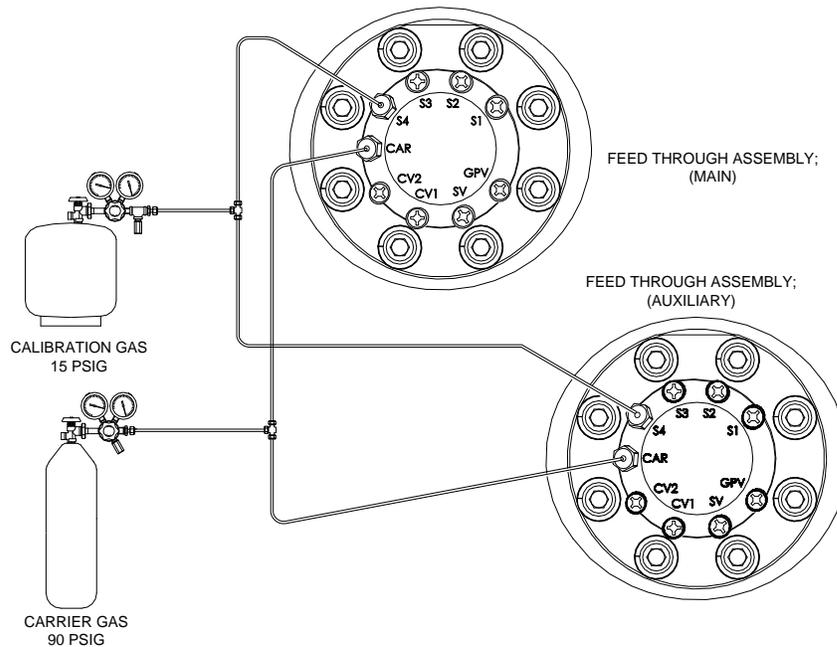
**FYI**



These instructions assume that the regulators and gas bottles have previously been installed.

### 2.20.2 Instructions

- 1) Locate the carrier gas input port (CAR) on NGC feed-through assembly on both main and auxiliary enclosures. Tubing should already be connected to the ports and then to a tee (See Figure 2–36).



**Figure 2–36 Carrier and Calibration Gas Connections**

- 2) Locate 1/4" low pressure output fitting on pressure regulator.

- 3) Measure and cut 1/16" SST tubing to reach between the carrier pressure regulator and the tee, mentioned above.
- 4) Install reducer into carrier gas regulator.
- 5) Insert tube with ferrule into reducer/pressure regulator output fitting. Move nut down onto ferrule, screw onto fitting and tighten.
- 6) Set carrier gas regulator pressure to 90 PSIG.
- 7) Purge air from the transport tubing by opening the shut-off valve, located on the carrier regulator, and then turn off.
- 8) Install tubing into the carrier tubing tee at the NGC. Remove cap and ferrules, and slide over tubing then insert tubing into tee and tighten cap.



**WARNING**

Be sure to follow requirements of national and local codes when performing this purge.

- 9) Determine input port for calibration gas on NGC feed-through assembly of the main and auxiliary enclosures (typically S4). Tubing should already be connected to the ports and then to a tee. (see Figure 2–36).
- 10) Locate 1/4" low pressure output fitting on the pressure regulator of the calibration gas bottle.
- 11) Install reducer into calibration gas regulator if required.
- 12) Measure and cut 1/16" SST tubing to reach between the calibration bottle pressure regulator and the tee, mentioned above.
- 13) Insert tube with ferrule into reducer/pressure regulator output fitting. Move nut down onto ferrule, screw onto fitting and tighten.
- 14) Set calibration gas pressure to 15 PSIG (103.4 kPa).
- 15) Purge air from the transport tubing by opening the shut-off valve slightly that is located on the regulator and then turn off.



**WARNING**

Be sure to follow requirements of national and local codes when performing this purge.

- 16) Install tubing into the calibration gas tubing tee at the NGC. Remove cap and ferrules, slide over tubing then insert tubing into tee and tighten cap.



**WARNING**

Leak test all gas connections when completed.

## 2.21 Vent Line Connections

The following procedure provides general steps for connecting the external vent lines from the respective output ports on the feed-through assembly. When the NGC is installed in a ENC82, sample vent line **MUST** vent outside of the ENC82. Other installations may only require short lines. Please follow requirements of national and local codes during this installation.

### 2.21.1 Materials

- 8 ea. 1/16" ferrule and nut
  - 8 ea. 1/16" SST vent tubing (supplied with NGC)
- or

- 8 ea. 1/16" SST tubing (amount to be determined by technician based on distance from NGC to external vent location).

### 2.21.2 Instructions

- 1) Locate gauge port vent (GPV), sample vent (SV), column vent 1 (CV1) and column vent 2 (CV2) ports on NGC feed-through assembly on both the main and auxiliary enclosures (see Figure 2–37). Remove sealing screws from vent ports.
- 2) Using supplied vent tubing (if sufficient length), place nut and ferrule onto short end of bent tubing. Insert tubing and ferrule into one of the vent ports with open end of tubing pointing down. Move Valco nut down onto ferrule, screw into port and tighten.

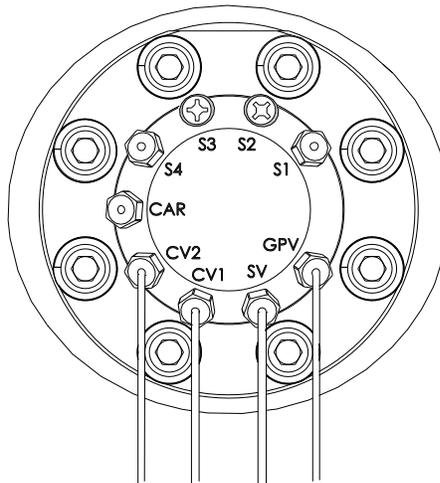
If vent tubing is not of sufficient length, measure and cut new tubing (not supplied by Totalflow). Make necessary bends to install tubing. Place nut and ferrule onto feed-through assembly end of tubing. Insert tubing and ferrule into one of the vent ports, and tighten. Move Valco nut down onto ferrule, screw into port and tighten. Do not tee vents together unless going into a larger tubing size.

- 3) Repeat step 2 for all other vents as listed in step 1.



All 4 vents **MUST** be open to atmospheric pressure without back pressure. Position vent tubing in a downward direction so that moisture does not accumulate in the tubing. If the vents must extend more than 10 ft. (or 3 meters), the diameter of the extended vent line should be increased to ¼ inch.

FEED THROUGH ASSEMBLY



VENT LINES

**Figure 2–37 Vent Line Connections on Feed-Through Assembly**

## 2.22 ENC82 Optional Catalytic Heater Installation



The following procedures describe the steps for installing a catalytic heater for the ENC82.



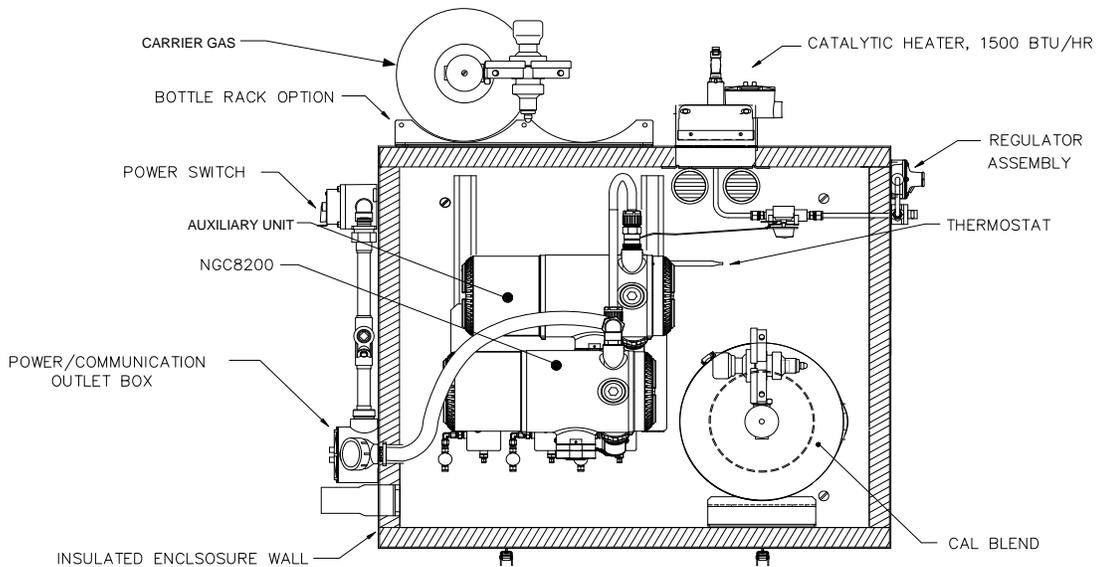
Verify the heater and fittings are approved for the classification rating of the area of installation.

### 2.22.1 Materials

- Catalytic heater (installed at factory)
- Thermostat assembly with temperature probe
- Regulator assembly w/ shut-off
- T assembly
- Tubing
- Filter/Drain Assembly
- Temperature probe mounting clip
- Teflon tape
- 1/4" male pipe connection from external gas source to catalytic heater. Materials for gas source is not provided by Totalflow. Quantities and materials to be determined by the technician based on installation and local codes.
- DC power source wiring. Materials for external power source for electrical preheat wiring are not provided by Totalflow. Quantities and materials to be determined by the technician based on installation and local codes.

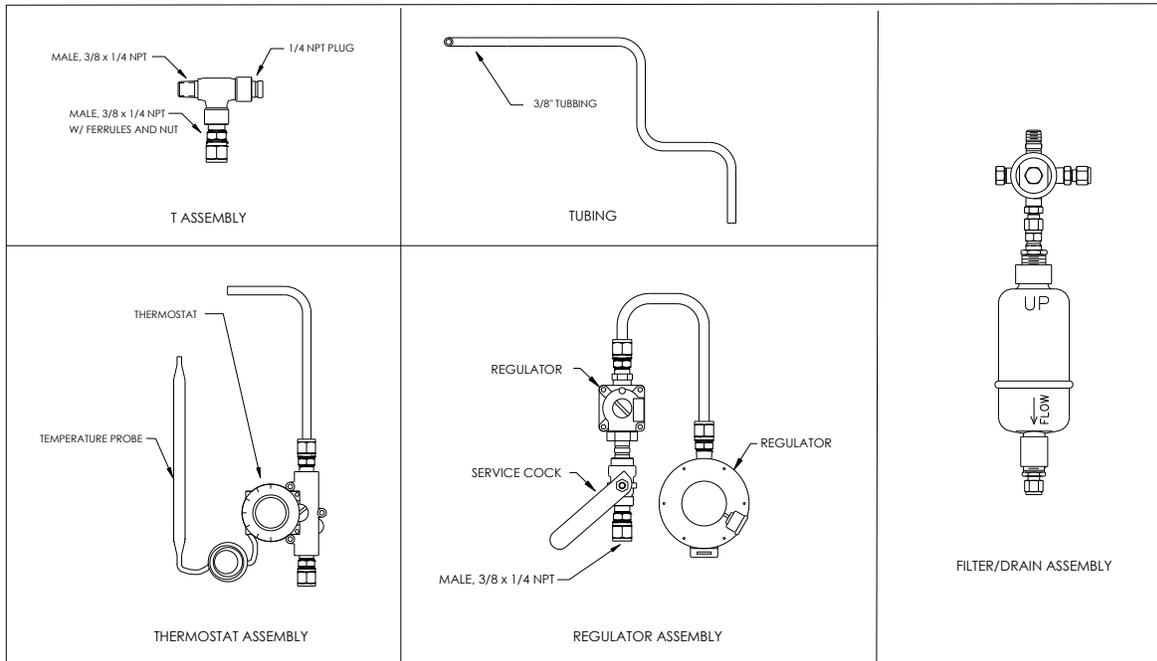
### 2.22.2 Instructions

- 1) Locate the installed catalytic heater on the rear of the ENC82 (see Figure 2-38).

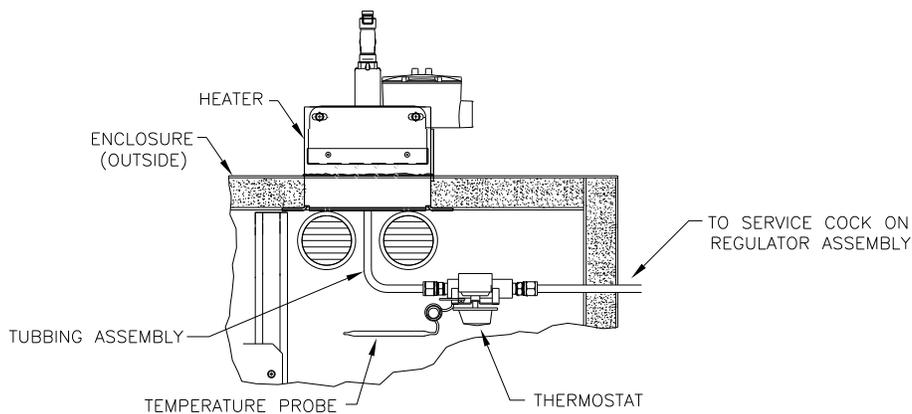


**Figure 2–38 Catalytic Heater Option in ENC82**

- 2) Remove protective end cap from catalytic heater input fitting if required.
- 3) Apply Teflon tape to threads on male end of T assembly (see Figure 2–39).
- 4) Screw threaded end of T assembly into  $\frac{1}{4}$ " female fitting, located on the factory installed catalytic heater, by turning entire assembly clockwise until tight (see Figure 2–40).
- 5) Remove ferrules and nut from male connector on the bottom of the T assembly.
- 6) From inside the ENC82, insert short bent end of  $\frac{3}{8}$ " tubing out through hole, located below catalytic heater, continue feeding tubing out until in position to insert into bottom of T assembly.



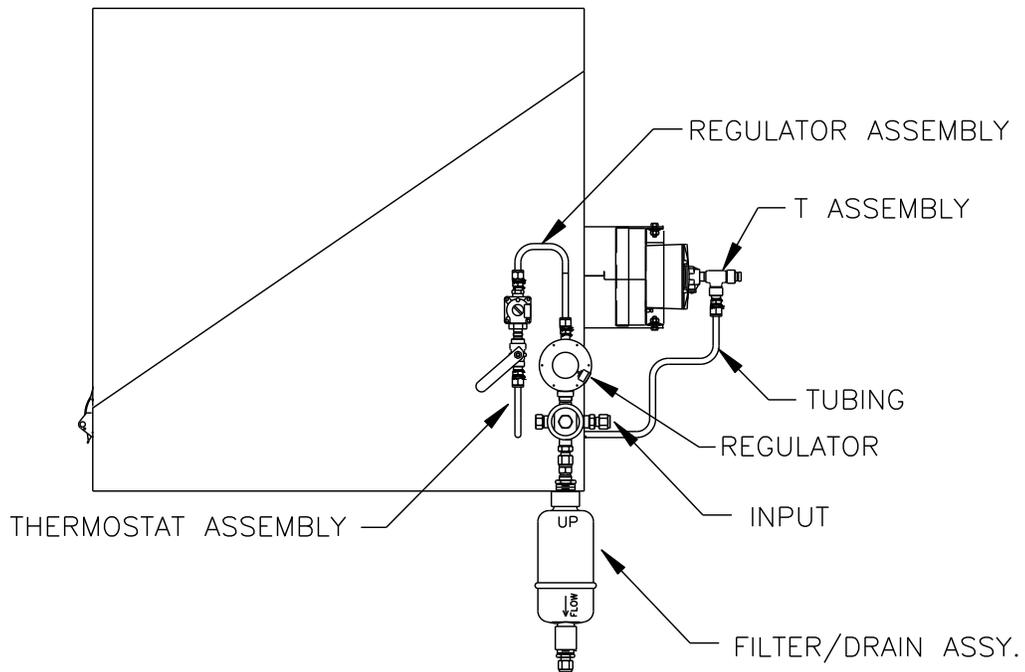
**Figure 2-39 Catalytic Heater Assemblies**



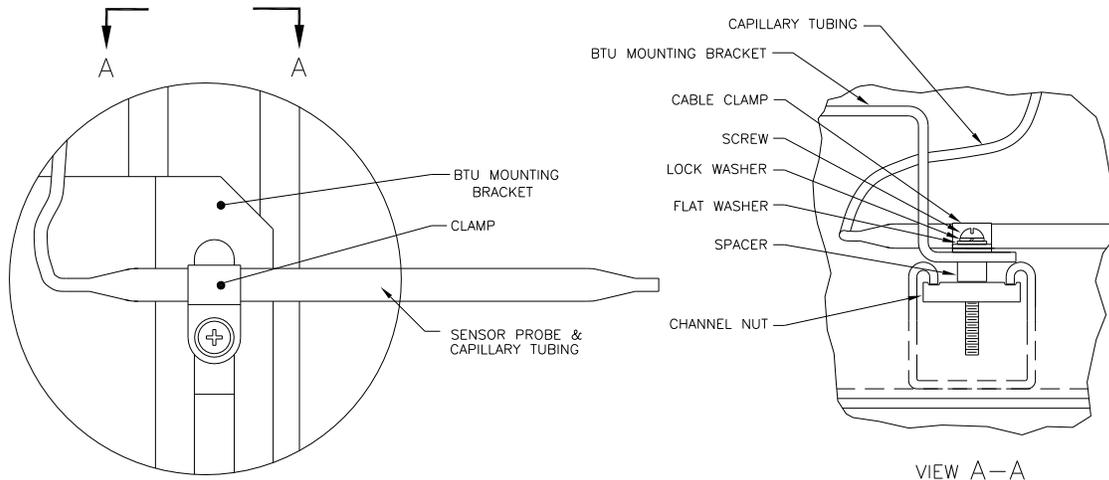
**Figure 2-40 Thermostat Assembly Installed**

- 7) Place nut, front ferrule and back ferrule onto outside end of tubing, and position so that the ferrules and nut screw onto the bottom of T assembly. Screw nut until tight.
- 8) Remove ferrules and nut from the thermostat end of the thermostat assembly. Apply Teflon tape.
- 9) From inside ENC82, insert tube end of thermostat assembly through exterior wall on the side of the ENC82 (see Figure 2-40).
- 10) Place nut, front ferrule and back ferrule onto end of 3/8" bent tubing (from T assembly beneath catalytic heater) inside of the ENC82. Position thermostat assembly so that the nut and ferrules screw onto the thermostat assembly.
- 11) Remove ferrules and nut from end of the regulator assembly closest to service cock.

- 12) Place nut, front ferrule and back ferrule onto end of thermostat assembly, protruding from ENC82.
- 13) Hold the regulator assembly with the curved tubing on top above the protruding tubing. Insert tubing into regulator assembly, slide ferrules and nut into place and tighten (see Figure 2-41).
- 14) Apply Teflon tape to port one nipple on filter/drain assembly.
- 15) Insert port one nipple on filter/drain assembly into output port on regulator and tighten nut.
- 16) Gently uncoil temperature probe capillary tubing from thermostat and insert through hole, located below the thermostatic gas valve. Be careful to not crimp or make sharp bends in capillary tubing (see Figure 2-42).
- 17) Remove mounting screw and washers from right rear NGC mounting bracket (see Figure 2-42).



**Figure 2-41 Regulator Assembly Installed**



**Figure 2-42 Temperature Probe Installation**

- 18) Insert screw with washers still in place through hole located on the mounting clip, and re-insert through mounting bracket into channel nut (see Figure 2-42).
- 19) Position probe underneath the mounting clip. Tighten screw into channel nut to hold probe in place.



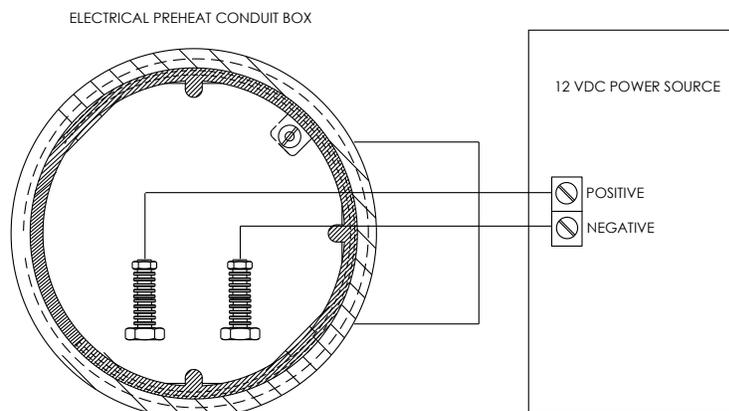
Technician responsible for installing gas supply must be qualified for the type and area of installation, according to national and local codes.

- 20) Using regulator manufacturer's instructions supplied with regulator, make external gas connections.



Installation must be performed by person(s) qualified for the type and area of installation, according to national and local codes.

- 21) Using the wiring instructions shown in Figure 2-43 and manufacturer's instructions enclosed with heater, make external connections.



**Figure 2-43 Electrical Pre-Heater Wiring Instructions**

## 2.23 ENC82 Optional Electric Heater Installation



Environmental  
Enclosure

The following procedures describe the steps for wiring an electric heater for the ENC82.



**WARNING**

Verify the heater and fittings are approved for the classification rating of the area of installation.

### 2.23.1 Materials

- Electric heater option (factory installed. See Figure 2–44)
- AC power source wiring. Materials for external power source for electric heater wiring not provided by Totalflow. Quantities and materials to be determined by the technician, based on installation and local codes.



**WARNING**

Installation must be performed by person(s) qualified for the type and area of installation, according to national and local codes.

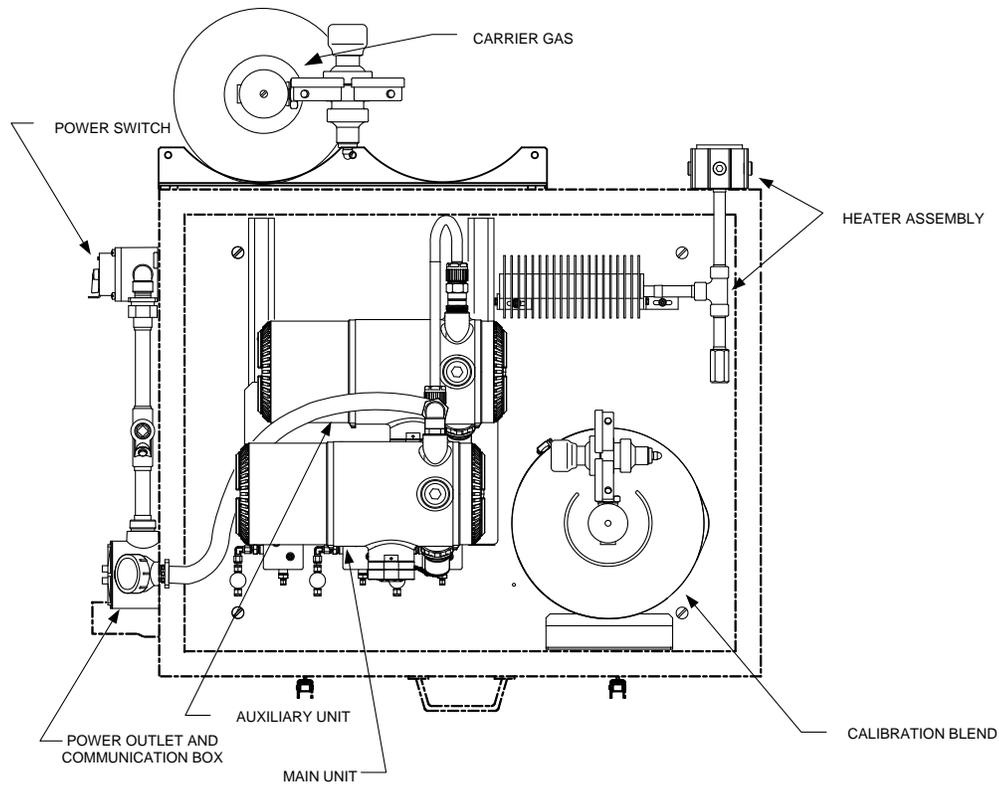


Figure 2–44 Electric Heater Installed in ENC82

### 2.23.2 Instructions

- 1) Using the wiring instructions shown in Figure 2–45 and the manufacturer's instructions enclosed with heater, make external connections.

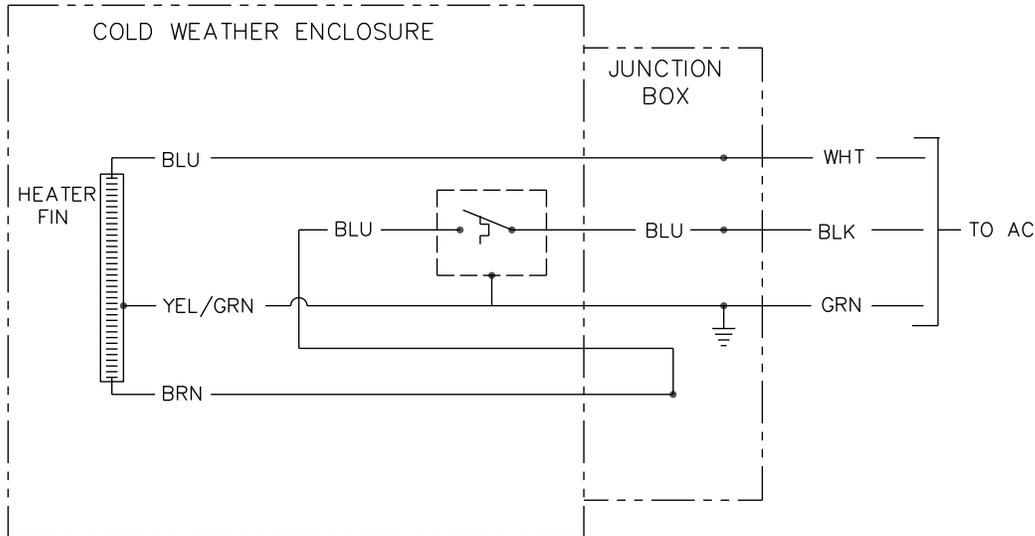


Figure 2–45 Electric Heater Option Wiring Instructions

## 2.24 Sealing Environmental Enclosure



The following procedures describe the steps for sealing the Environmental Enclosure.

When all sample and vent tubing has been installed and leak tested, sample boot must be sealed.

### 2.24.1 Customer Supplied Materials

- Aerosol insulating foam

### 2.24.2 Instructions

- 1) When all sample and vent connections are complete, apply aerosol insulating foam from inside the enclosure pointing toward the outside of boot, ensuring that the overspray falls outside the enclosure.

## 2.25 Optional Equipment Enclosure Installation

If the optional enclosure is used, it may be configured to include a dual power supply and other options, including but not limited to, communication equipment and additional I/O.

Two enclosures are commonly used for the Dual NGC unit installations: the 6200 and 6700 enclosures. The unit may be mounted on a 2" pipe or mounted on a flat surface such as a wall

Before beginning, review the procedures and the materials required for the installation; inspect all power cables where they terminate and the connector for breakage.



The optional equipment enclosure may be approved for classified hazardous locations or potentially explosive atmospheres. Verify the rating listed on the unit tag, and install per the referenced control drawing. Be sure to follow the requirements of national and local codes when installing the optional equipment enclosure.

### **2.25.1 Location**

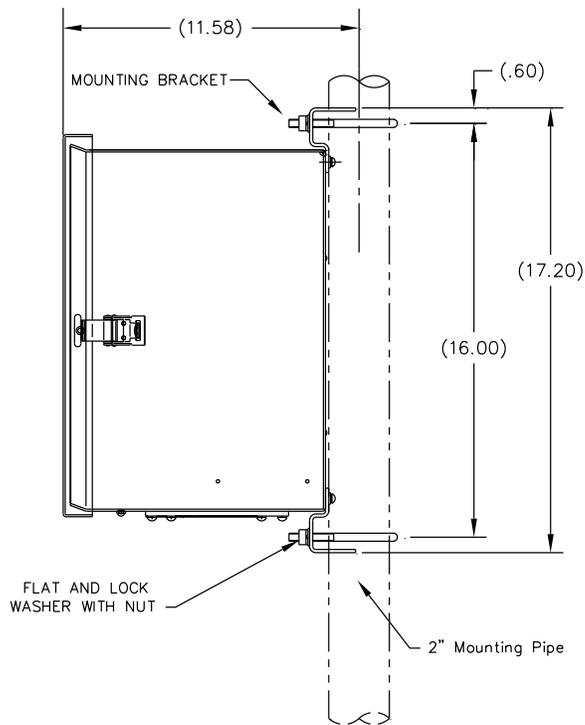
Mount the enclosure on a nearby wall, panel or pole. Make sure that the approved conduit can be installed between the power supply's enclosure and the NGC. Avoid obstructions.

### **2.25.2 Pipe Mount Instructions**

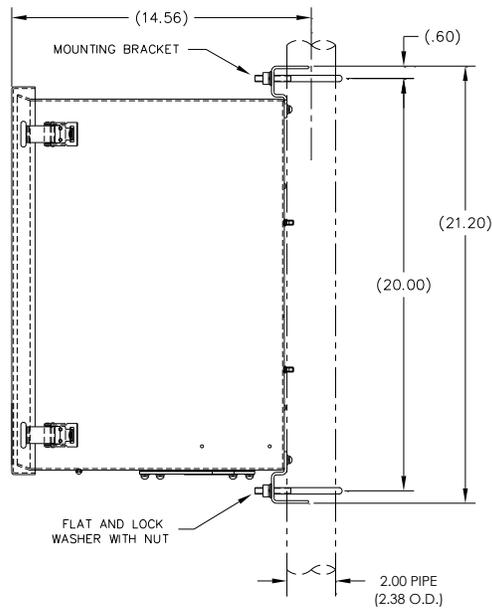
Enclosure mounting brackets and fastening hardware are supplied with unit. Customer must provide 2" pipe of suitable length (see Figure 2-46).

Instructions assume the mounting pipe has been previously installed. If not, refer to installation sections previously in this chapter for either free standing pipe installation or pipe saddle installation.

- 1)** When the unit is received, unpack and inspect all components for evidence of damage. Report damage to the shipping carrier and to Totalflow's service department.
- 2)** Using instructions supplied with the mounting kit, attach the bracket to the back of enclosure unit.
- 3)** Position the unit on the 2" mounting pipe, and secure in place with two U-bolts, split washers, flat washers and two bolts (see Figure 2-46 and Figure 2-47).



**Figure 2-46 6200 Enclosure Pipe Mounting Installation**



**Figure 2-47 6700 Enclosure Pipe Mounting Installation**

### 2.25.3 Wall Mount

Before beginning, review the procedure and the materials required for installation. A typical installation should be similar to Figure 2-48 and Figure 2-49.

Enclosure mounting brackets and fastening hardware are supplied with the unit.

### 2.25.3.1 Wall Mount Instructions

- 1) When the unit is received, unpack and inspect all components for evidence of damage. Report damage to the shipping carrier and to ABB Totalflow's service department.
- 2) Using instructions supplied with the mounting kit, attach the bracket to the back of the enclosure unit.
- 3) Prepare the wall surface for mounting, and mount the enclosure to the wall.

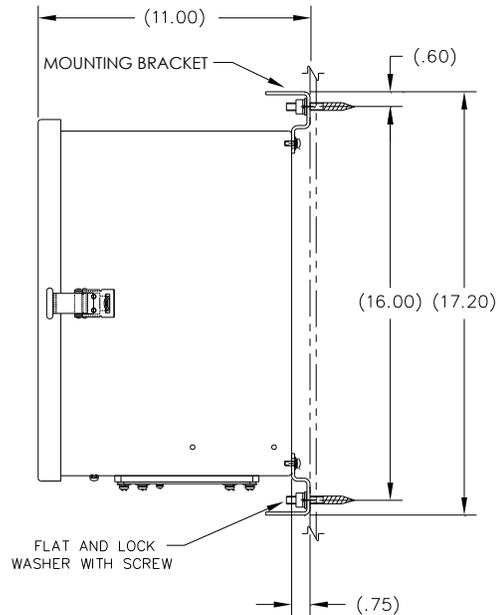


Figure 2-48 6200 Enclosure Wall Mounted Installation

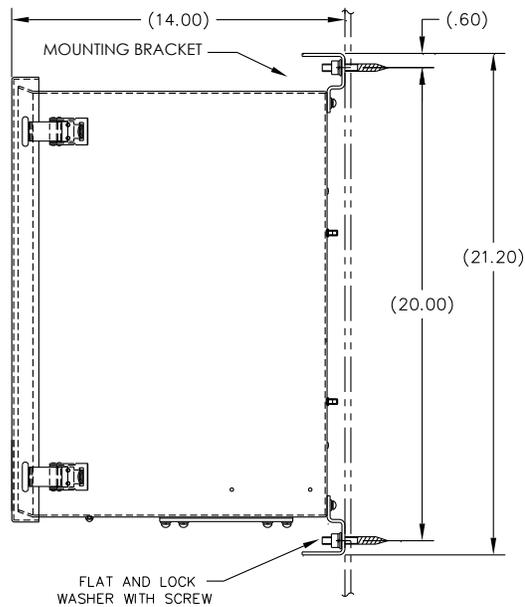


Figure 2-49 6700 Enclosure Wall Mounted Installation

### 2.25.3.2 Wall Mount Instructions

- 1) When the unit is received, unpack and inspect all components for evidence of damage. Report damage to the shipping carrier and to Totalflow's service department.
- 2) Using instructions supplied with the mounting kit, attach the bracket to the back of the enclosure unit.
- 3) Prepare the wall surface for mounting, and mount the enclosure to the wall.

## 2.26 110/240 VAC to 12/24 VDC Power Supply Wiring

The NGC is designed for either a 12 VDC or 24 VDC power source that must provide a minimum of 11.5 VDC to a maximum of 16 VDC at 8 amps minimum. Totalflow provides three AC/DC power supplies that meet the requirements for converting 120 VAC and 240 VAC to 12 VDC and 24 VDC.

Available power supply options for the Dual NGC Unit are:

- 110/240 VAC to 12 VDC (2 each)
- 110/240 VAC to 24 VDC (2 each)
- 110/240 VAC to 12 and 24 VDC (1 each)
- 110/240 VAC to 24 VDC-EX (2 each)

Wiring instructions follow.

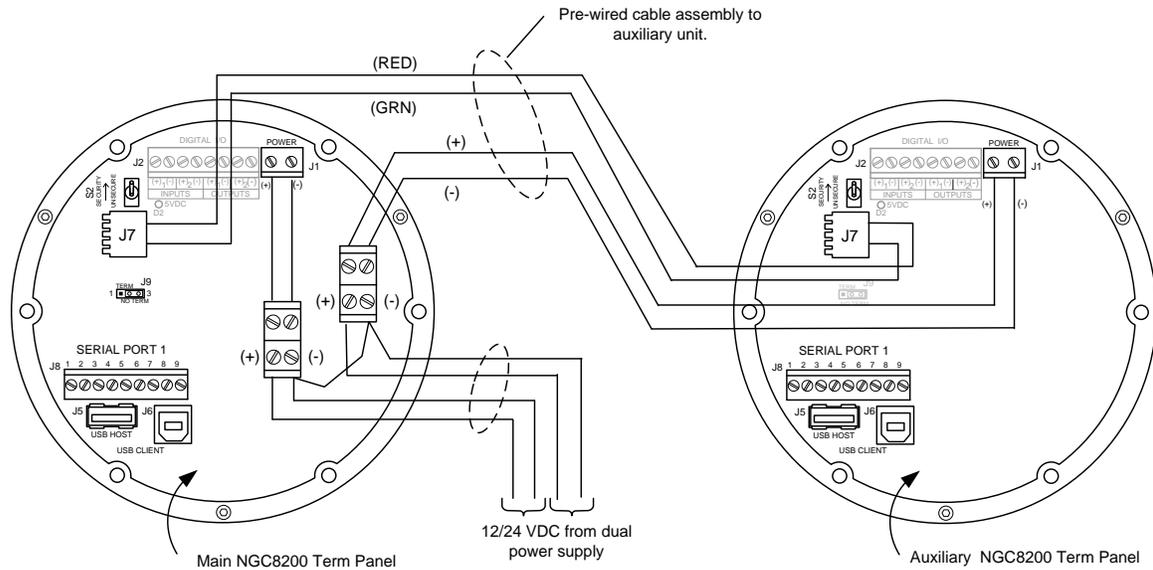


The AC/DC power supply may be approved for classified hazardous locations or potentially explosive atmospheres. Verify rating listed on the unit tag, and install per the referenced control drawing. Be sure to follow requirement of national and local codes when installing the power supply.

### 2.26.1 Instructions

If configured, the optional equipment enclosure should be installed using instructions previously in this chapter. The optional equipment enclosure should contain two installed AC power supplies.

- 1) Remove necessary plug from the side of the enclosure to install DC wiring and conduit to main NGC unit.
- 2) Remove necessary plug from the side of the enclosure to install AC wiring and conduit.
- 3) Pipe the conduit and associated DC wiring from the NGC into the power supply enclosure. See Table 1—4 in Chapter 1 for wire sizes.
- 4) Using wiring instructions in Figure 2–50, remove auxiliary power supply connector, and make field connections from 12 or 24 VDC power supply. **DO NOT RE-INSTALL CONNECTOR TO AUXILIARY POWER CABLE CONNECTOR.**
- 5) Remove J1 connector from NGC main unit termination panel. Using wiring instructions in Figure 2–50, make field connections from 12 or 24 VDC power supply. **DO NOT RE-INSTALL J1 CONNECTOR TO TERM PANEL.**
- 6) Pipe the conduit and associated AC wiring into the enclosure.



**Figure 2-50 Dual Power Supply Wiring to NGC Termination Panel**



Please review Grounding the NGC section in Chapter 1- System Description before making power connections.

- 7) Using wiring instructions in Figure 2-51, make field connections from 110 or 240 VAC power source to appropriate power supply.

## 2.27 DC Power Installation

These instructions assume that all external wiring has been completed to point where connections have been made to field termination panel, but the connector has not been plugged into the termination panel.

### 2.27.1 Instructions

- 1) Remove J1 Terminal from NGC Termination Panel.
- 2) Apply power:

If installation includes the ENCLOSURE Optional Pwr/Comm outlet box assembly:

- Apply power to switch, turn switch to “ON” position.

If installation includes the Optional Equipment Unit with the Optional AC Charger:

- Apply power to Charger regulator.

If installation includes a Solar panel connected to a Battery:

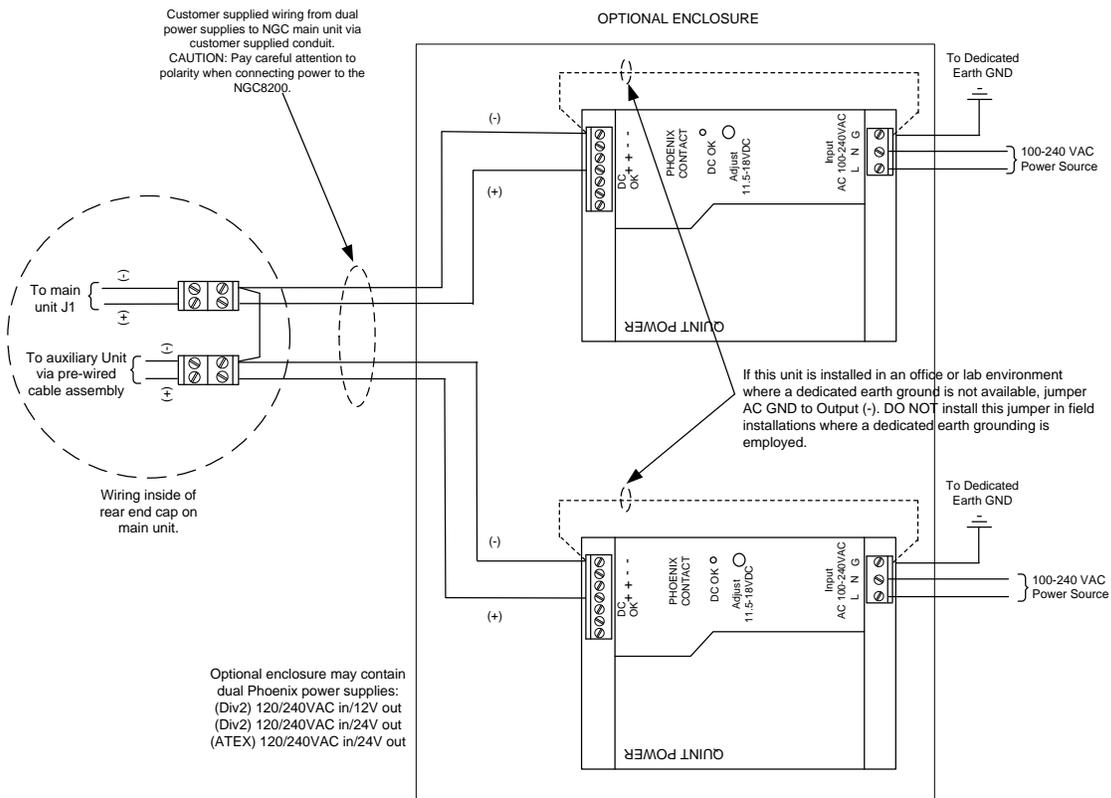
- Plug in Charger regulator battery connector.

- 3) Test power using a multi-meter connected to the power supply terminals of the auxiliary connector:

12 Volt unit: is between 12 and 16 volts (see Table 1—5).

24 Volt unit: is between 21 and 28 volts (see Table 1—5).

- 4) Test power using a Multi-Meter connected to J1 terminals of Phoenix connector to verify DC voltage:  
 12 Volt unit: is between 12 and 16 volts (see Table 1—5).  
 24 Volt unit: is between 21 and 28 volts (see Table 1—5).
- 5) If volts are within range, the power should be disconnected, Phoenix connector inserted into termination panel J1 connector and power re-applied. The VGA Screen will show “Totalflow Boot Loader” followed by navigational screen when functional.
- 6) Unit will begin start-up diagnostics and oven stabilization. This completes the hardware installation. Proceed to the “NGC8200 Dual Unit User’s Manual”, “Start-up “ section to begin unit setup and operation.



**Figure 2-51 Dual Phoenix Power Supply AC and DC Wiring**

## 2.28 Remote Communication Installation

As remote communication installation is specific to the communication transceiver, only basic information is supplied here. Additionally, wiring instructions should be shipped with the unit. Both communication ports (serial port 1 and 2) can function as RS-232, RS-422 or RS-485. Table 2—1 shows serial port pin outs and termination settings.

**FYI**  Communications are handled through the main unit only. No communications can be connected to the auxiliary unit.

**Table 2—1 Port 1 and Port 2 Pin-Outs/Terminations**

	<b>RS-232</b>	<b>RS-485</b>	<b>RS-422</b>
<b>PIN</b>	<b><u>PORT 1 (J8)</u></b>	<b><u>PORT 1 (J8)</u></b>	<b><u>PORT 1 (J8)</u></b>
1	Power Out	Power Out	Power Out
2	Ground	Ground	Ground
3	Switched Power Out	Switched Power Out	Switched Power Out
4	Operate	Operate	Operate
5	Not Used	RRTS	RTS
6	Request To Send	Bus +	Transmit Bus +
7	Transmit Data	Bus -	Transmit Bus -
8	Receive Data	No connection	Receive Bus +
9	Clear To Send (CTS)	No connection	Receive Bus -
<b>PIN</b>	<b><u>PORT 2 (J10)</u></b>	<b><u>PORT 2 (J10)</u></b>	<b><u>PORT 2 (J10)</u></b>
1	Power Out	Power Out	Power Out
2	Ground	Ground	Ground
3	Switched Power Out	Switched Power Out	Switched Power Out
4	Operate	Operate	Operate
5	Not Used	RRTS	RTS
6	Request To Send	Bus +	Transmit Bus +
7	Transmit Data	Bus -	Transmit Bus -
8	Receive Data	No connection	Receive Bus +
9	Clear To Send (CTS)	No connection	Receive Bus -
	<b><u>TERMINATIONS</u></b>	<b><u>PORT 1 (J9)</u></b>	<b><u>PORT 2 (J11)</u></b>
	First or Intermediate Unit (RS-485)	Pins 2–3	Pins 2–3
	Last or Only Unit (RS-485)	Pins 1–2	Pins 1–2
	RS-232	Pins 2–3	Pins 2–3

### 2.28.1 PCCU32 Communication Settings

To communicate remotely with the host, the NGC defaults to port 1, and the protocol defaults to Totalflow Remote. This protocol deals primarily with communications between the NGC and host (typically WinCCU). Port 2 is defaulted as an NGC interface and communicates via Modbus, functioning as a Modbus slave.

All communication parameters are found on the setup tabs for each instantiated communication application in PCCU32. Systems are shipped with default settings for communications but may need fine tuning. For additional information, please refer to the PCCU32 help files.



## 3.0 NGC START-UP

This chapter describes the minimum requirements to start-up a newly installed Dual NGC system. Specific details to further customize the NGC are discussed in the PCCU32 help files.



### WARNING

DO NOT open or remove covers, including the PCCU local communications cover, unless the area is known to be non-hazardous, including the internal volume of the enclosure.



### FYI

Before beginning, the user should complete the tasks outlined in the Chapter 2.0 - Installation.

## 3.1 PCCU32 Installation and Setup

Totalflow's PCCU32 6.03 (or later) software is required to communicate with the NGC. Previous versions of PCCU32 are not compatible with the Dual NGC.

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

The Totalflow NGC hardware is designed using Windows Mobile Technology CE operating system; therefore, communication between a personal computer and the NGC may be accomplished using a USB cable. When this method of communication is desired, Windows ActiveSync is required and supplied with PCCU32.

### 3.1.1 Software Installation Instructions

- 1) Insert PCCU32 disk into PC drive. If CD drive is set to auto play, the installation program should begin; otherwise, go to Start, Run and type in D:\Disk1\setup.exe. D being the CD drive designation.
- 2) Follow screen prompts during installation. When asked to install ActiveSync, the answer depends on whether the unit was shipped with a USB (default) or a round RS-232 military type connector as the local port connector. This is the connector on the outside of the unit with the round explosion proof cap. If USB, the user needs to check the Install ActiveSync box. If communicating via RS-232, simply click the Next button. If communicating with a PDA, the user already has ActiveSync installed, but this installation may contain a later version allowing for an upgrade. To verify the version, open ActiveSync, click Help and About Microsoft ActiveSync.
- 3) Another screen prompt will allow the user to select the correct port for communication: USB port for connecting via USB or serial port for connecting via RS-232. If the user has previously installed the PCCU software and selected a port and they are re-installing or upgrading, select Keep Current Port.
- 4) The installation puts a PCCU\_NGC folder on the Window's desktop with shortcuts. The shortcuts will be correct, assuming the install directory was not changed. If the install directory was changed, the shortcuts will have to be changed to the new directory path. If using a network, the NGC on the

Network shortcut will require a network ID or IP address. For a stand-alone desktop shortcut, right-click on the shortcut, select Create Shortcut and drag it to the desktop.

## 3.2 Ethernet Installation and Setup

Installation of an Dual NGC Unit in a network environment may be implemented using the following instructions. Some decisions may require input from the network administrator.

PCCU32 communication with the main unit of the Dual NGC Unit over an Ethernet connection requires the use of either a Hub, Switch or Router (see Figure 3–1). Ethernet (local) communication in a remote area may also be utilized but is not covered in these instructions as there are other high speed options for communicating locally.

PCCU32 makes use of the Windows DHCP Utility. Dynamic Host Configuration Protocol (DHCP) can randomly assign a unique IP address within the defined Subnet Mask. This utility also allows the user to define a more user friendly network ID. This ID must be unique within the Subnet Mask.

Disabling the DHCP requires that a unique IP address be assigned, generally by the network administrator.

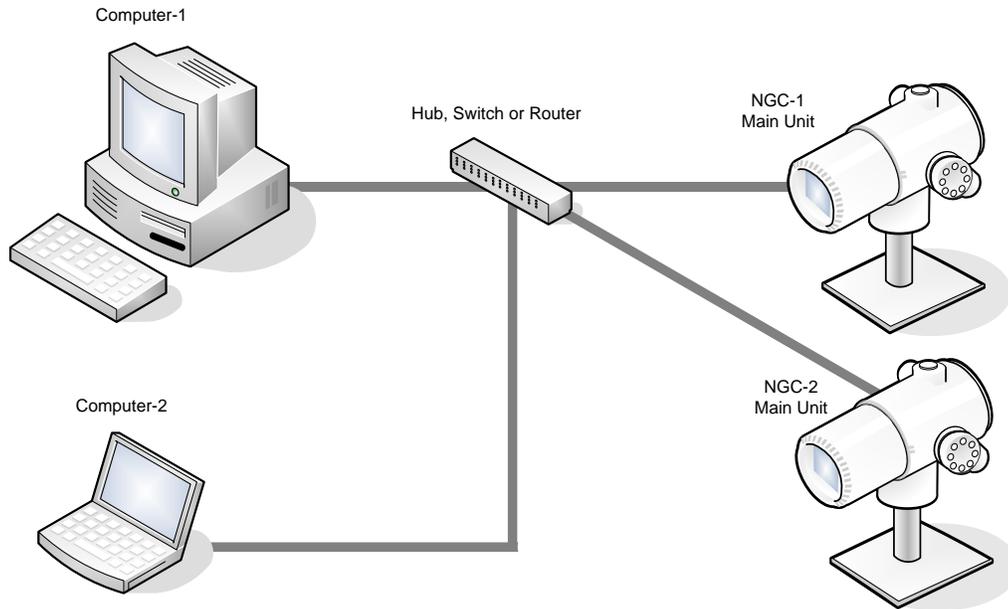
- 1) From the Analyzer Operation screen in PCCU, click on Show Tree View button in the upper left corner of screen.
- 2) Click on Communications to show the Communication Setup screen.
- 3) Select the Network tab.

### FYI



If using a Windows network, the user may wish to use the Network ID feature. Network ID's are limited to 15 alphanumeric digits with limited special characters. Please see Windows help files for more information on naming computers.

- 4) Enable or disable the DHCP. To disable DHCP and the assigned IP address, set the parameters to No, and continue to next Step; otherwise, select Yes, and skip to step 6.
- 5) Enter the IP address assigned by the network administrator and Subnet Mask, if different (default is 255.255.255.0).
- 6) When all desired changes have been made, select Send.
- 7) Reset NGC by pressing the Reset button, located on the termination panel, housed in the rear of the main enclosure.
- 8) Verify Ethernet communication: Select the Windows Start Menu, Run and then type CMD to open the command window.
- 9) At the prompt ">" type "ping" followed by a space. Then either type the Network ID or IP address, and press enter. A successful communication will show multiple replies for the unit.



**Figure 3–1 Ethernet Connections**

### 3.3 Connecting To The NGC's Local Port

The laptop computer connects to the local port via USB or RS-232, using one of two cables (See Figure 3–2).

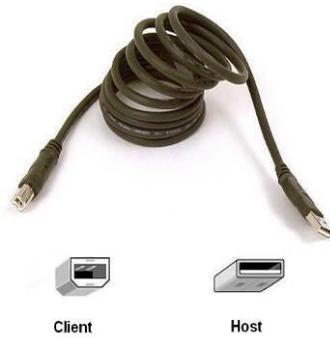
**FYI**



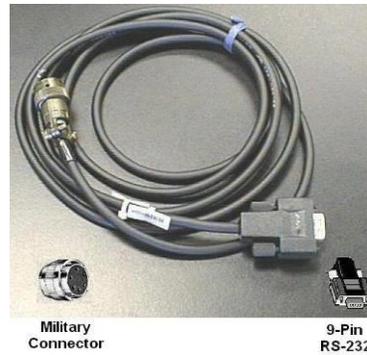
ActiveSync software is required to communicate when using USB. If ActiveSync was not installed during the PCCU32 installation, connecting the USB cable should trigger the ActiveSync installation to begin.

#### 3.3.1 Communicate

- 1) Connect the MMI cable to the designated port on the PC and to the local port located on the outside of the NGC's main unit. If unit is configured for the RS-232 MMI cable, connect to appropriate communication port on PC (default is COM1). If unit is configured for USB cable, connect host end of USB cable to any USB port on the PC.
- 2) Click the Windows Start button, select Programs, PCCU\_NGC (or correct program folder, if changed during installation) and then select PCCU32. This will display PCCU32's initial screen.



**USB Cable**  
P/N 1801800-xxx



**RS-232 Cable**  
P/N 2015240-xxx

**Figure 3–2 MMI Communication Cables**

- 3) Assuming the MMI cable is connected, click on the Connect icon (left-most icon at the top of the screen). If this unit had been previously set up, the Local Connect screen would appear with some labeled buttons.

**TIP**  If the invalid security code screen should appear, enter four zeros (0000) for the new code, and click OK. The NGC should have defaulted to 0000 on Start-up.

- 4) Again, if the unit has already been set up, the local connect screen displays two buttons: Entry Setup and Collect Historical Data. Clicking on the Entry Setup will take the user to the Analyzer Operation screen which has links to other operations. Daily operations should be performed from this screen. Historical data collection can also be performed from here by clicking on the Collect icon at the top of the screen.

**FYI**  If the user receives a communication error, click on the Setup icon along the top of the screen, and verify the PCCU comm port. If using USB, this should indicate USB. If not, click on the down arrow, and scroll down and select USB. If the user is using serial communications with the round connector on the NGC end, select the communications port being used (COM1, etc.). When finished, close the Setup screen, and click the Connect icon again.

### 3.4 NGC Diagnostics

Previously, in Chapter 2-Installation, the DC power circuit to the NGC was completed. Once power was applied to the unit, the NGC began the start up procedure:

- Unit cold started, loading start-up information into RAM memory
- Start-up diagnostics. If diagnostics are not successful, unit will return a system fault and cease start-up.

Start-up diagnostics consist of four areas of testing:

- Carrier Pressure Regulator Test
- Oven Temperature Test

- Processor Control Test
- Stream Test

As noted above, the Oven Temperature Test is one of the diagnostic tests run. To pass this test, the oven temperature in both units (main and auxiliary) must reach 60° C and somewhat stabilize. Additionally, part of the Processor Control Test is testing the amount of effort the oven controllers take to keep the ovens at the set point of 60° C. Based on ambient temperatures, this could take up to an hour.

During the initial start up, all streams are disabled. During the Stream Test, streams with input pressure will be re-enabled, tested and either passed or failed. Streams with no initial input pressure will fail and left disabled. Streams can always be re-enabled later if they will be used.

During the diagnostics or upon completion, the user may view the status of the diagnostic tests by clicking on the Diagnostics button in the Analyzer Operation screen. Part of the startup diagnostic takes the user to the Diagnostic screen. When the unit completes the startup diagnostics and has passed the appropriate tests, with the exception of streams with no pressure, the unit will go into Hold mode. Totalflow recommends that the unit be allowed to run at least eight hours to completely stabilize and then a calibration be performed. This is also spelled out in the start up.

### 3.5 NGC Start-up

After starting PCCU32 and clicking the Connect icon, the user will need to enter some start up information. The user will need to enter a unit ID, location and set the date and time. The user will also need to enter their calibration blend data.

When the user initially connects to the Dual NGC Unit, a Startup wizard will appear. This wizard and its associated help files can also be started, using the Wizard icon on the PCCU NGC toolbar. The wizard, as currently implemented, supports the NGC and does not support units analyzing components beyond C6+. While not specifically intended for use with the Dual NGC Unit analyzer, the wizard can be very helpful in walking the user through much of the required set up information. Toward the end of the wizard session, the user will be asked to verify analysis results. At this point, the user should close the Start Up wizard.

The following procedure is an outline to assist in going through the various start-up steps.

#### 3.5.1 Station Setup

- 1) Enter station ID (10 alphanumeric digits) and location (24 alphanumeric digits). See Table 3—1. The station ID should be a unique identifier from other NGC's the user may communicate with.
- 2) Verify date/time. If incorrect, set the device with the PCCU Date/Time to Yes.

**TIP**



Additional items in the station setup screen are not required for start-up. For more information regarding the setup of these items, see the topic on the start-up help displayed with each screen.

- 3) When all changes have been made, select Send, and move to the next screen.

**Table 3—1 Station Setup Screen Information**

Description	Value
Station ID	Assign unique identifier (10 alphanumeric digits).
Location	Enter information regarding meter location (24 alphanumeric digits).
Date/Time	Shows the current unit's date/time.
Set Device with PCCU Date/Time	Resets device's date and time to match PC.

**3.5.2 Stream Setup**

- 1) Enter stream ID and location, contract settings and calculation settings (see Table 3—2).
- 2) When all changes have been made, select Send, and move to the next screen.
- 3) Complete steps 4 and 5 for each sample stream.

**Table 3—2 Stream Setup Screens**

Setup Tab	Available Values	
Stream ID	Assign unique identifier (10 alphanumeric digits).	
Location	Enter information regarding meter location (24 alphanumeric digits).	
Calibration Stream	Stream #4 (default) Stream # 1, Stream #2, Stream #3 or Stream (any).	
<b>Contract Settings</b>	<b>Value</b>	<b>Available Units</b>
Contract Pressure	14.73 PSIA (default)	KPa, InH2O, Mbar, InHg, PSIA, Bar, mmHg, PSFA, MPA, Pa or kgcm2
Contract Temperature	60.00 F(default)	C, F, R or K
Relative Humidity	100.00 %(default)	Percent
Contract Hour	0 (default)	Hour (0-23)
<b>Calculation Settings</b>	<b>Value</b>	
Current Calculation File	GPA-2172-1996(AGA8), ISO-6976-1995, etc. <sup>7</sup>	
Sum IC5 & NeoC5	No (default), Yes.	
C6+ Index Split Mode <sup>8</sup>	Default-User defined with C6+ Reported, 47.466% C6 35.340% C7 17.194% C8, 50% C6 50% C7 0% C8, 50% C6 25% C7 25% C8, 57.143% C6 28.572% C7 14.285% C8, User defined C6+ Not Reported.	
C6, C7, C8, C9, C10`	Used to enter split percentages if desired.	

<sup>7</sup> File selection automatically sets the remainder of items on this screen. See PCCU help files for more information.

<sup>8</sup> Note that making a selection in this field (other than User Defined) will override any values in the C6+ Split Percent area of the Stream Setup screen.

### 3.5.3 Calibration Setup

- 1) Verify that each process stream is setup to use the correct calibration stream (Stream 4 default).
- 2) Change calibration cycles average and purge cycles, if required. Default calibration cycles average is 3 and purge cycles is 2.
- 3) Make changes to the concentrations in the % BLEND column, insuring that the total mole % equals 100%.



Caution should be used when entering component blend percentages to carefully match the components labeled on the calibration bottle. Mistakes will cause incorrect values.

If the total mole % does not equal 100% exactly, add or subtract the remainder to or from methane (C1) to force the total to 100%.

- 4) When finished and total mole % equals 100.00 %, move to the next screen.
- 5) When all desired changes have been made, select Send and move to the next screen.

### 3.5.4 Diagnostics

- 1) As discussed earlier, diagnostics began when power was applied to the unit. The user cannot proceed beyond the Diagnostics screen until diagnostics have passed. When completed, move to the next screen.
- 2) To change the run order of process streams, change values beside sequence numbers. In this same screen, streams may be disabled or enabled.

During the initial start-up, all streams will be disabled. During the Stream Test, streams with input pressure will be re-enabled, tested and either passed or failed. Streams with no initial input pressure will fail.

**FYI**



To enable or disable streams after completion of diagnostics, select Stream Sequence from the Analyzer Operation screen. Totalflow recommends that the Diagnostic Stream Test be preformed on streams enabled after initial diagnostics. Select the Help button for additional information.

- 3) When all desired changes have been made, select Send, and move to the next screen.

### 3.5.5 Update Configuration

- 1) Totalflow recommends that the user save the unit configuration file following setup. Change the value beside save configuration data to Now to save configuration.
- 2) Select Send, and move to the next screen.

### 3.5.6 Analyze Calibration Stream

- 1) Prior to running sample streams, the NGC should run the calibration stream (default Stream 4). Select stream 4 on the left side of the screen. The button beside stream 4 should illuminate, the cycle clock will begin and the user should see animated gas running on the calibration stream.
- 2) Allow stream to process for 2 or 3 cycles (approximately 10 to 15 minutes). During final cycle, change Next Mode to Hold. When unit completes the current cycle, it will enter Hold mode.
- 3) Verify analysis results.
- 4) Compare normalized % for each component to component and percent listed on the calibration blend bottle. Component percentages should be relatively similar.
- 5) Verify C3, C4 and C5 on Chrom-1.
- 6) Verify that the appropriate components are visible and labeled. For the standard C6+ application, the user should see C6+, C3, iC4, nC4, neoC5, iC5 and nC5. The second peak from left that looks like two peaks is a composite peak of C2- and is not used in calculations.
- 7) Verify light components on Chrom-2.
- 8) Verify that the appropriate components are visible and labeled. The user should see N2, C1, CO2 and C2. The first peak on the left is a composite peak of C3+ and is not used in calculations.
- 9) Verify the heavy components on Chrom-3.
- 10) Verify that the appropriate components are visible and labeled. For the standard C9+ application, the user should see C9, C6, C7 and C8. The second peak from left that looks like two peaks is a composite peak and is not used in calculations.
- 11) Select Run on the left side of the screen to begin the first process stream in the sequence. The buttons beside run should turn blue, the cycle clock will begin and the user should see animated gas running on the process stream.

### 3.5.7 Start-up Completion

- 1) The unit should continue to cycle through all enabled streams performing analysis and producing data.
- 2) Totalflow recommends that the unit be allowed to run at least eight hours before calibration to allow the unit to stabilize.
- 3) The user has now completed the start-up procedure and is ready to calibrate the NGC.

## 3.6 Calibrating the NGC

The NGC is factory calibrated and should not require a calibration be performed immediately. It is recommended that the unit operate for a period of eight continuous hours before a field calibration.

At that time, a field calibration should be performed. This will allow adjustments due to the location's barometric pressure and other factors to be taken into consideration.

A calibration cycle includes purge cycles and multiple calibration cycles for averaging. The system defaults to stream 4 (cal stream), 2 purge cycles and 3 calibration cycles. When the calibration is complete, a thorough examination of the results should follow.



Allow the NGC to run for a minimum of eight hours before a field calibration is performed.

### 3.6.1 Instructions

- 1) From the Analyzer Operation screen, select Cal.
- 2) When the current cycle completes, the unit should begin a calibration on the designated calibration stream (stream 4 default).
- 3) When the calibration is complete, the unit should move to the designated Next mode. View results on the Analyzer Operation screen. The calibration stream's unnormalized total should be 6.5% (between 99.5% and 100.5%).



If values exceed these parameters, proceed to the Troubleshooting section of this manual.

- 4) Carefully examine the calibration stream's Chrom-1, Chrom-2 and Chrom-3 by clicking on the  button. Look for unlabeled peaks and base line anomalies. Figure 3–3 and Figure 3–4 should be used as a guide.



If errors exist, proceed to the Troubleshooting section of this manual.

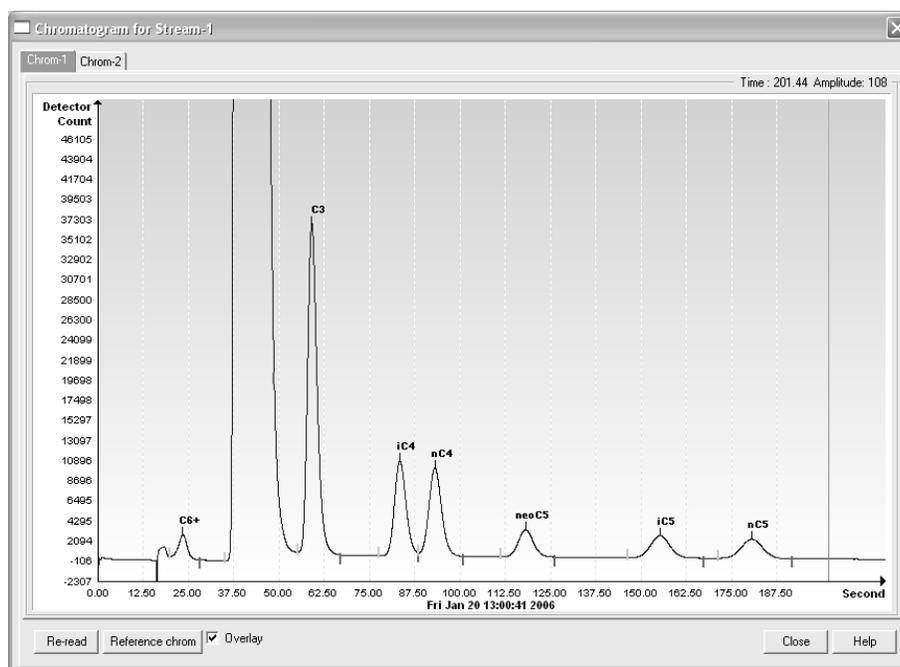


Figure 3–3 Typical Chromatograph for Chrom-1 (C3, C4 and C5)

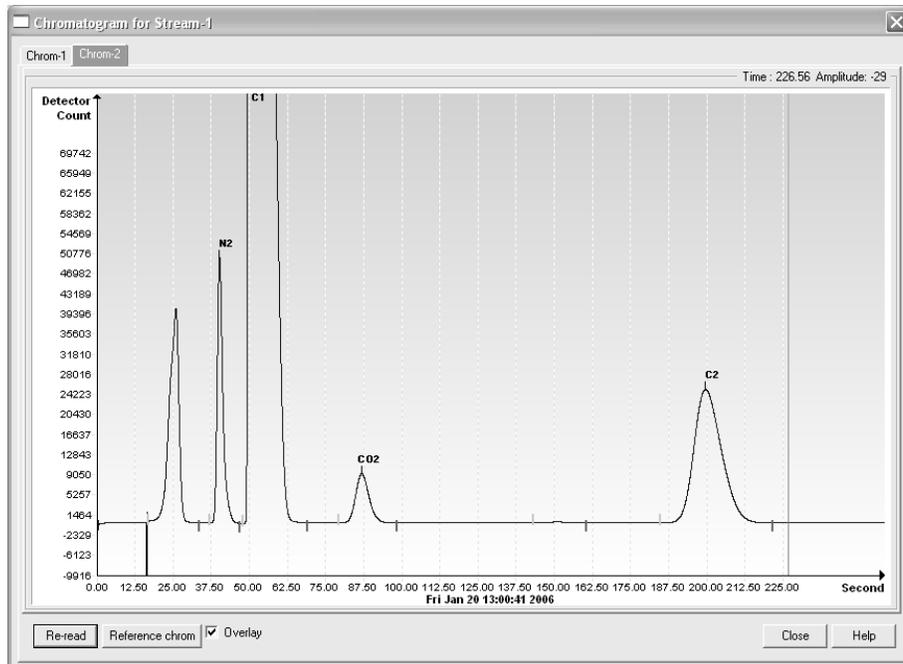


Figure 3–4 Typical Chromatograph for Chrom-2 (Lights)

## 3.7 Security System Setup

### 3.7.1 Hardware Security

The NGC board has a bi-level security system built in. For the purpose of this manual, this is referred to as hardware security. The security switch, located on the termination panel of the NGC, must be switched down for the hardware security system to be functional. The switch must be switched up to change the device's security code. Security codes are checked via remote communication, whether the switch is on or off.

### 3.7.2 PCCU Security

When the NGC is accessed through the PCCU32 or WINCCU host software packages, either remotely or locally, there is a second level of security included. This is referred to as the software security.

The security switch, located on the termination panel of the NGC, must be switched on for the hardware security system to be functional. The switch must be switched off to change the device's security code. Security codes are checked via remote communication, whether the switch is on or off.

When setup as designed, each user "logs on" to the system with a unique user name (up to 25 alphanumeric digits) and a 4-digit alphanumeric password, before connecting to the unit.

The software security system is designed to have two levels of user access:

- Reading data files - read only access (User)
- Sending application and configurations - read/write access (Admin)

By default, user access is restricted from modifying the application table or from downloading files to the device's TfData and TfCold drives but has all other user

type privileges. These default privileges can be edited by the administrator and consist of 4-digit alphanumeric pass codes, level 1 and level 2.



The NGC does not send an error message when trying to write an operation where the proper hardware security code does not exist; it simply does not accept value changes.

### 3.7.3 Role Based Access Control (RBAC)

The RBAC system is effective in PCCU versions 7.16.0 or higher. RBAC adds a third level of security to the NGC, superseding the hardware security system.

While available for setup, RBAC is not operational on delivery of new systems. This allows the customer to define any specific roles beyond the basic 4 defined roles:

- Basic
- Advanced
- Expert
- Administrator

Administrators can develop additional roles, setup and assign specific users a role, and define application access independently for each user. Levels of access for each application are:

- Yes or no
- Read, Write, or Read/Write

Users accessing the device or changing the security settings will automatically generate a record to a security log.

Once roles and access have been defined, the \*.RBA file can be saved to a computer and then downloaded into additional devices.

Additional information may be found in the PCCU Help files.

## 3.8 Alarm Definitions

The user has the ability to define the threshold for the NGC alarm parameters. The NGC provides 124 standard alarms. Of these, a number of alarms are defaulted to enabled (see Table 3—3). Many of these are considered system alarms, and the user is cautioned not to make changes to the logic. A multitude of additional alarms are available and user configurable.



User may define alarms, beyond defaults, for each process stream.

**Table 3—3 Defaulted Alarm Definitions**

Alarm Description	Logic Type	Threshold default	Severity
Pressure Regulator 1	GT	0	Fault
Pressure Regulator 2	GT	0	Fault
Sample Pressure	GT	0	Fault
Oven Temperature Error	GT	0	System Fault
No Stream Valve Selected	GT	0	System Fault

<b>Alarm Description</b>	<b>Logic Type</b>	<b>Threshold default</b>	<b>Severity</b>
Digital-analog Bd Comm Error	GT	0	System Fault
Calculation Error	GT	0	Fault
Calibration Un-Normalized Total	GT	0	Fault
Stream Sequence Error	GT	0	Fault
Calibration CV Percent Error	GT	0	Fault
RF Pct Error	GT	0	Fault
Analog Bd ambient Temp	GT	0	Warning
Analog Power Supply	GT	0	Warning
Out of Carrier Gas (DI1)	LT	1	System Fault
Out of Cal Gas (DI2)	LT	1	System Fault
GCM Chrom Process	GT	0	System Fault
Bad Bead	GT	0	Fault
Sample Flow Detect	GT	0	Fault
CPU Loading	GT	85	Warning
System Memory Available	LT	500000	Warning
Ram File Available	LT	1000000	Warning
FLASH File Available	LT	1000000	Warning
Missing Peak-Cal Not Used	GT	0.0000	Warning
Stream Un-Normalized Total	GT	0.000	Warning

## 4.0 MAINTENANCE

### 4.1 Overview

This chapter provides the user with maintenance information and instructions on how to remove and install NGC components.

It is recommended the user develop regularly scheduled daily, weekly or monthly maintenance programs. By establishing such programs, NGC downtime will be reduced, and the system will operate at optimum analytical efficiency. The majority of scheduled maintenance involves the quality of the gas prior to entering the chromatograph. This primarily involves cleaning or replacing filters in the sample system modules.



**TIP**

Unless otherwise noted, all procedures in this chapter pertaining to replacement of parts will relate to both the main and auxiliary units.



**WARNING**

DO NOT open or remove covers, including the PCCU local communications cover, unless the area is known to be non-hazardous. This includes the internal volume of the enclosure.

#### 4.1.1 Help

If technical assistance is required during performance of maintenance functions or if returning parts, the user should contact the ABB Totalflow Customer Service department at the following phone number:

USA: (800) 442-3097 or International: 1-918-338-4880

#### 4.1.2 Maintaining Cleanliness

It is important that an inspection time period be established to examine the unit for internal and external cleanliness and damage.

Because an NGC installation is primarily exposed to external environmental conditions, it is important that it be regularly inspected for cleanliness, both externally and internally. Even though the NGC is tightly sealed against moisture and foreign contamination, it is recommended that the internal components be examined for moisture and/or contamination. If contamination is found, the system should be shut down and cleaned. If such contamination is not removed, it could render the NGC inoperable.

#### 4.1.3 How to Use This Chapter

It is recommended that the user develop a regularly scheduled maintenance program. By establishing a maintenance program, NGC 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.

#### 4.1.4 Returning Part(s) for Repair

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

Part shipments must be prepaid by the customer. Any part not covered by original system warranty will be shipped to the customer, F.O.B.

**TIP**



When removing the front or rear end caps, the user's hands can become coated with a black thread lubricant. If they do, wash hands before performing maintenance functions, using Go-Jo or equivalent type hand cleanser. Lubricant **MUST NOT** come in contact with components. **DO NOT** wipe lubricant on clothing as it cannot be removed easily.

If the enclosure needs more thread lubricant, use Vaseline.

## 4.2 Field Tool Kit

Recommended NGC maintenance tools are presented in the following table and are included in the optional field tool kit

**Table 4—1 Tool Requirements**

Qty	-001	-002	Part Number	Description
1	●	●	2102304-001	Bag, ABB Nylon 11" x 6" Tool
1	●		1800683-01	Cutter, 1/16" Tubing
1	●	●	1801690-001	Extractor Tool, IC 8-24 Pin
1	●	●	T10790	Hex Key, Set 1/16-5/16 (12 Pcs)
1	●	●	T10440	Screwdriver, 3/32 x 2" Standard
1	●	●	T10601	Stripper, Wire
1	●	●	1801821-001	Tool, Ball Driver, 10.3" Long, 5/16"
1	●	●	1801822-001	Tools, nut Driver, 6" Shank, 1/4"
1	●		1801820-001	Wrench, 10" adjustable
1	●	●	T10805	Wrench, 3/8 x 7/16 Open End
1	●	●	T10800	Wrench, 1/4 x 5/16 Open End
1	●	●	1801819-001	Wrench, 6" adjustable

## 4.3 Spare Part Components

The information in this section presents the user with the components and parts that are accessible for removal and installation. Replacement components will be covered first in this chapter followed by instructions for replacing spare parts.

### 4.3.1 Replacement Components

The following is a list of components that may be replaced:

- Analytical Module (12 or 24 VDC) with or without GC Module
- GC Module
- Digital Controller assembly with or without display
- Termination Panel
- Feed-Through Assembly with or without preheat (12 or 24 VDC)

### 4.3.2 Replacement Parts

The following is a list of parts that may be replaced:

- Lithium Battery
- Frit Filters
- Analytical Processor to Termination Panel cable
- Termination Panel to Digital Controller cable
- Feed-Through O-ring
- Feed-Through Interface Gasket
- Feed-Through Manifold Gasket
- Feed-Through Heater (12 or 24 VDC)
- GC Module Temperature Sensor

## 4.4 Visual Inspection

The NGC should be given an external visual examination at an established time interval. Visual checks maintain optimum system operation and accuracy of natural gas sample analysis.

### 4.4.1 Inspection

During the visual inspection, components should be examined for the following conditions:

- Pipe or wall mounting: Unit must be in vertical position and mounting brackets tightened on pipe. Wall mounting bracket must be securely affixed to mounting wall.
- Carrier gas bottle mounting rack: Mounting rack should be tilted backward slightly to keep bottles from falling forward.
- Bottles within mounting rack: Bottles must be securely strapped in mounting rack.
- Bottle regulators: Must be tightened securely and checked for leaks.
- Pipe mounted sample probe: Must be securely mounted in pipe meter run using an approved probe adapter.
- Stainless steel tubing connected between sample probe and NGC: Must not be bent or closed off. Connections must be tight. Such conditions impede sample flow to NGC.
- Tightness of front and rear end caps: Hand tightening gently is adequate.
- Input/output termination's, external power or signal cable runs: All input/output cable, power and signal conduit running to Div 2 or non-hazardous areas must be sealed, per NEC codes.

## 4.5 Backing up Configuration Files

Before beginning any maintenance on the NGC, the user should collect the data and back up all configuration files to their laptop's hard drive or a floppy disk. This safeguards data and allows the user to re-start the unit without the addition of re-configuring the NGC should any problem arise.

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

### 4.5.1 Instructions

- 1) Collect data from the unit.
- 2) While in PCCU, use the Save and Restore Utility found under File Utilities in the Operate drop-down menu or by clicking the Save and Restore Utility icon on the toolbar.
- 3) In the Save and Restore window, click the Save Station Files button.
- 4) When the Save Station Files window displays, verify the default name and path for the files. Click OK. This will save the TFDData files to the PC.
- 5) When finished saving the station files, a new window will offer the option to restore the station files to the TFCold drive. If Yes is selected, the station files will be downloaded to that drive.

**FYI**



It may not always be desirable to restore the station files to TFCold. Some problems addressed in the Troubleshooting section may require a selective restore. For more information, see the Troubleshooting chapter and PCCU help files.

## 4.6 Restore Configuration Files

Following various maintenance procedures, or when configuration files need to be downloaded to the flow computer, the Restore function will accomplish this.

If prior to performing maintenance and Save Configuration Files were used, these files were downloaded to the laptop's hard drive or on a floppy disk. The Restore function uploads these files into the NGC's TFCold drive. This safeguards the data and allows the user to re-start the unit without the addition of re-configuring the NGC, should any problem arise.

### 4.6.1 Instructions

- 1) While in PCCU, use the Save and Restore Utility found under File Utilities in the Operate drop-down menu. The user can also click the Save and Restore Utility icon on the toolbar.
- 2) In the Save and Restore window, click the Restore Station Files button.
- 3) When the Restore Station files window displays, verify the default name and path for the files. Click OK. This will restore the files to the TFCold drive.
- 4) Verify the unit is functioning properly.

## FYI



It may not always be desirable to restore the station files to TFCold. Some problems addressed in the Troubleshooting section may require a selective restore. For more information, see the Troubleshooting chapter and PCCU help files.

## 4.7 Reset Procedures

On occasion, it may be necessary to reset the unit. There are two types of reset procedures: warm and cold.

### 4.7.1 Warm Start Instructions

A warm start occurs when the main power is removed, then re-applied while memory backup is enabled. This does not clear the data stored in RAM. The warm start will only reset the NGC microprocessor and not disturb any data that has been stored in RAM. A warm start can be used when a power or communication interruption caused the NGC microprocessor to lock-up. Since both the main and auxiliary units have their own microprocessor, they could be reset independently of each other, but that is typically not necessary.

- 1) Collect data from the unit.
- 2) Using the Lithium Battery Status instructions, verify the battery status is OK before proceeding.
- 3) If the unit is functional, place it in Hold mode.
- 4) Gain access to the rear termination panel of the main NGC enclosure by loosening the countersunk hex socket locking set screw in the rear end cap. Use a 1/16" hex wrench, and then unscrew the end cap.

## CAUTION



As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components voiding any warranty.

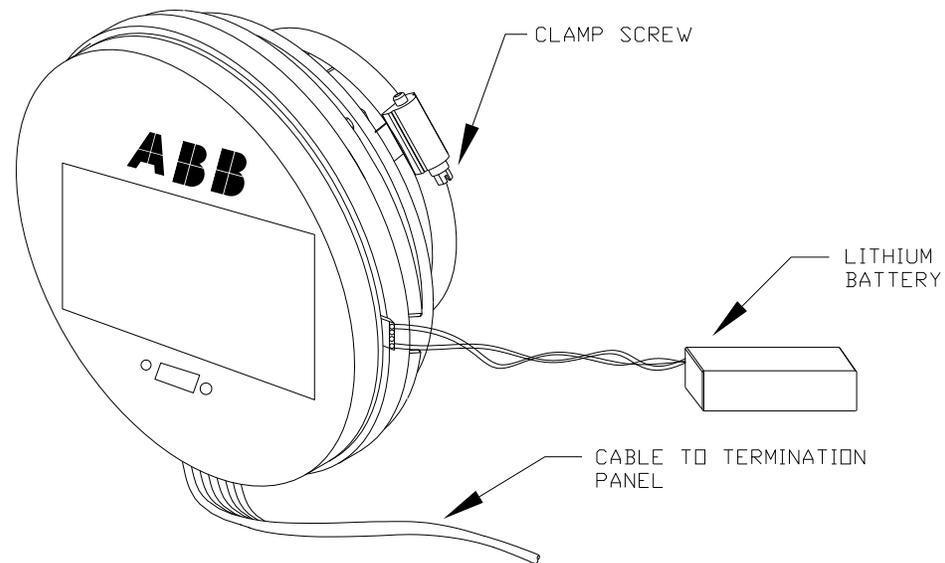
- 5) To warm start the unit, depress the S1 reset switch on the termination panel. This will warm start the main unit only but will typically correct any lockup problem. To warm start both the main and auxiliary units, disconnect the power wiring just before it splits off to the main and auxiliary units and then reconnect.
- 6) Disconnecting the power wiring, as discussed above, will remove power from both the main and auxiliary units.

### 4.7.2 Cold Start Instructions

A cold start clears all the data that is stored in RAM as well as resetting all entered variables to their factory default values. Discretionary use of this procedure is advised.

- 1) On the Analyzer Operation screen, click the Hold button. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 2) Gain access to the digital controller assembly of the main NGC enclosure by loosening the countersunk hex socket locking set screw in the front end cap. Use a 1/16" hex wrench, then unscrew the end cap.

- 3) Gain access to rear termination panel of NGC by loosening the countersunk hex socket locking set screw in the rear end cap using a 1/16" hex wrench, then unscrewing the end cap.
- 4) Unplug the lithium battery connector from the J5 receptacle on the digital controller board (see Figure 4–1).
- 5) Push the reset button located on the termination panel in the rear of the enclosure.
- 6) Initially, the Boot Loader screen will appear on the front display.
- 7) When the Navigation screen displays, restore the lithium battery connection on the digital controller board.



**Figure 4–1 Digital Controller Complete assembly**

## 4.8 Restore Factory Defaults

Occasionally, it may be necessary to restore factory defaults. If critical configuration data is accidentally changed or erroneous results have been produced, the unit may require a reset to factory defaults. Inadvertently changing setup data, including critical local communication protocols settings, may require the user to revert all setup information (configuration data) to factory settings. This includes the following items:

- Communication port settings
- Calibration gas concentrations
- Instantiated applications
- NGC setup information
- Start-up wizard re-initialized
- Electronic pressure settings
- All application parameters including display changes

This procedure will require the user to delete both the TFDData folder (current setup data being used to operate the NGC) and TFCold folder (non-volatile backup of the setup data).



**CAUTION**

This procedure should not be a normal operation. It should only be used when all other setup and troubleshooting options have been exhausted or used, when a Totalflow technical specialist recommends this procedure. If questions exist, call Totalflow support at (800) 442-3097, option 2.

#### 4.8.1 Instructions

- 1) On the Analyzer Operation screen, click Hold under Next mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.
- 2) Collect data from the unit.
- 3) Shutdown PCCU32.



**TIP**

The system may not allow the deletion of active files when the NGC is in normal operation (running from FLASH); therefore, the user should force the unit into Boot Loader mode.

- 4) Force the NGC's operating system into Boot Loader mode.
- 5) Press the Reset button on the NGC's termination panel. Wait about eight seconds until the Initializing System screen appears.
- 6) Press the Reset button a second time. The unit should now be in Boot Loader mode. The screen will revert to the TOTALFLOW display screen.
- 7) Right-click on the Activesync icon located in the system tray on the PC. From the pop-up screen, select Explore.
- 8) In the new window, highlight the TFData folder under mobile devices.
- 9) Right-click, and select Delete. The folder should disappear.
- 10) Open the FLASH folder by double-clicking.
- 11) Highlight the tfCold folder. Right-click, and select Delete. The folder should disappear.
- 12) Press the Reset button on the termination panel. This action should cause the FLASH, factory, and tfCold information saved at the factory to be copied into a new TFData folder. This will restore all factory settings. The unit has successfully been reset if the user sees the startup wizard when they reconnect with PCCU.

## 4.9 Changing NGC Clock

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

**FYI**



Examples are based on a 60-minute log period.

#### 4.9.1 Clock Change Not Crossing a Log Period Boundary

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

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

#### 4.9.2 Forward Clock Change Crossing a Log Period Boundary

Forces a log period entry for part of the log period that has accumulated since the last log period entry. NGC then advances to a new data flow record and begins maintaining the balance of the day's data in a newly defined boundary.

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

#### 4.9.3 Backward Clock Change Crossing a Log Period Boundary

Forces a log period entry for part of the log period that has accumulated since last log period entry. This is the same as for a forward clock change crossing an hourly boundary. NGC advances to a new day's data flow record and maintains the balance of the day's data in a new record.

Example: If the present time is 5:05 pm and the clock is changed to 4:55 pm of the same day, the log period record entry reflects only a five minute average accumulation (5:00 to 5:05). A new flow record is then written, and this log period is based on a five minute accumulation (4:55 to 5:00).

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

**FYI**



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

### 4.10 Lithium Battery Status

Prior to some maintenance procedures, especially when a cold start is not desirable or feasible, the user should verify that the lithium battery status is OK.

If directed to these instructions from another set of instructions, please return to them when the status has been verified.

#### 4.10.1 Instructions

- 1) While in the PCCU Analyzer Operation screen, select Station Setup from the icons across the top of the screen.
- 2) View the lithium battery status.
- 3) If the lithium battery status value reads OK, the power may be removed from the unit without causing a cold start.
- 4) If the lithium battery status reads Low Voltage or Not Connected, the lithium battery needs to be connected or replaced prior to removing power from the unit. See instructions later in the chapter, Replacing the Lithium Battery.

## 4.11 Replacing Calibration or Carrier Gas Bottle(s)

When calibration or carrier gas bottle(s) require replacement, please use the following instructions.

### 4.11.1 Instructions

- 1) On the Analyzer Operation screen, click Hold under Next mode. When the unit completes the current cycle and enters hold, the user may continue to the next step.
- 2) Turn off the calibration and/or carrier gas at the bottle.
- 3) Remove the regulator from the bottle.
- 4) Exchange the bottle with the full bottle.
- 5) Re-Install the regulator into the bottle. Verify that the pressure regulator is set correctly to either 15 PSIG for calibration gas or 90 PSIG for carrier gas. Open the shut-off valve on the regulator.
- 6) At the NGC feed-through assembly, loosen the nut and ferrule from the corresponding inlet. Allow air to purge from the line.



#### **WARNING**

Be sure to follow the requirements of the national and local codes when performing this purge.

- 7) Re-insert the ferrule and nut into the correct inlet and tighten.
- 8) Leak test the connections at the bottle regulator and feed-through assembly.
- 9) In PCCU, with unit still in hold, run two single cycles. Inspect the chromatograms to determine if the unit is processing correctly. If the chroms are OK, return the unit to normal operation.

## 4.12 Removing Digital Controller Assembly

This section presents the procedures for removal and installation of the digital controller assembly and mounting bracket. If directed here from another procedure, return there when disassembly is complete. Note that the auxiliary enclosure does not have a VGA display board.



#### **CAUTION**

As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components, voiding any warranty.

### 4.12.1 Instructions

- 1) On the Analyzer Operation screen, click Hold under Next mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 2) Gain access to the digital controller assembly by loosening the countersunk hex socket locking set screw in the front end cap. Use a 1/16" hex wrench, and unscrew the end cap.
- 3) Using a flat blade screwdriver, loosen screw in mounting clamp (see Figure 4-1).
- 4) Unplug the ground cable from the digital controller assembly.

- 5) Slide assembly off of the thermal flask. Be careful to not unplug the flat ribbon cable connecting the digital controller assembly to the termination panel or the lithium battery.



DO NOT remove the lithium battery or termination panel cable at this time. Removing the lithium battery will cause a cold start, and that may not be desirable. When replacing the lithium battery, the termination panel cable must remain connected to power the digital controller assembly; otherwise, the unit will cold start. The user will receive specific instructions during each procedure if either cable should be unplugged.

- 6) To reassemble, perform steps 3–5 in reverse order. Be careful to align the display screen horizontally before tightening the screw.

### 4.13 Replacing Digital Controller Complete assembly

Access to the digital controller board is gained by removing the front mounted digital controller assembly from the analytical module. Note that the auxiliary enclosure does not have a VGA display board.



As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components, voiding any warranty.

#### 4.13.1 Instructions

- 1) On the analyzer operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 2) Collect data from the unit.
- 3) Back up the configuration files, following the instructions detailed previously in this chapter entitled, Backing Up Configuration Files.
- 4) Turn off all sample streams, calibration gas and carrier gas.
- 5) Turn off the main power supply, or disconnect the power wiring on the termination board. Disconnecting the wiring in the main enclosure just before it splits will power off both the main and auxiliary units. Additionally, pulling the connector on J1 of either of the units will disconnect power to that unit only.



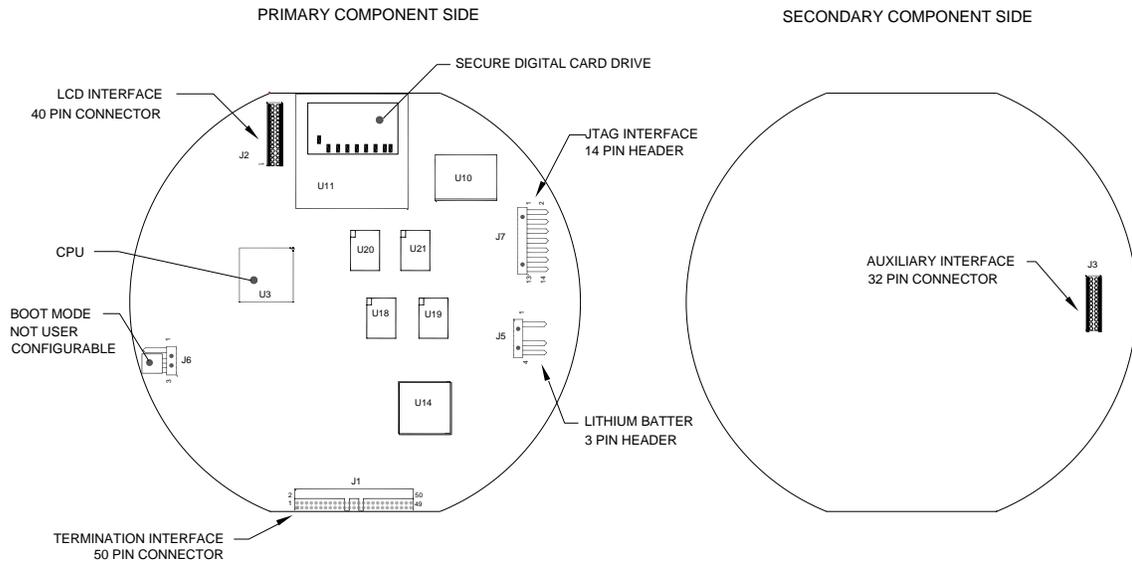
As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components, voiding any warranty.

- 6) Following the instructions detailed in this chapter entitled, Digital Controller Assembly Mounting Bracket, remove the assembly.
- 7) Unplug the termination panel to the digital controller assembly flat ribbon cable, leaving the lithium battery connected.
- 8) To reassemble using the replacement assembly, perform steps 6–7 in reverse order. Be careful to align the display screen before tightening. Check the lithium battery plug for proper installation on the connector.



Please note that the termination panel to digital controller ribbon cable pin 1 wire is NOT red. On the digital controller board, the red edge (pin 1) of the cable should plug onto pin 50, the right side of plug. The plug is “keyed”. Do not force plug into connector.

- 9) Re-plug the ground cable onto the new assembly.
- 10) Once assembled, apply power to the NGC (Step 5).



**Figure 4-2 Digital Controller Board**

- 11) Adjust contrast potentiometer, R18, for optimum display. To adjust v display contrast, use an extra small phillips point screwdriver to turn potentiometer R18 clockwise for more contrast or counter clockwise for less.
- 12) Restore the configuration files following the instructions detailed previously in this chapter entitled, Restore Configuration Files.
- 13) Reinstall front and rear end caps.



For purposes of returning this assembly to Totalflow Service for warranty or repair, please contact Totalflow Customer Service for an RA number. Please keep the lithium battery connected to the digital controller board for return.



Please note that since power was removed from this unit, the NGC will perform start-up diagnostics and stabilize. If the user has disabled the start-up diagnostics, they should be enabled and power cycled to the unit. If power has been withheld from the unit for an unknown or lengthy period of time, a complete start-up should be performed.

For more information on enabling the diagnostics in PCCU, click the Diagnostics button and then the Help button.

## 4.14 Replacing Analytical Module

This section presents the procedures for removal and installation of the analytical module and can apply to both the main and auxiliary units. The analytical module is a completely self-contained unit inside the NGC. Read through all procedural steps before beginning disassembly.

Verify before beginning the procedure that the module is appropriately rated for the system voltage. Compare module voltage to the ID tag located on the side of the enclosure.



When the analytical module is removed, the module should be placed on a clean dirt free work surface. Care should be taken that gas ports are free from lint or dust particles. Totalflow strongly suggests that the GC replacement module be kept in a sealed, static-free envelope until the last possible moment before installation.

It is important that the bottom surface of the module be placed on a clean, lint free cloth to prevent components from being scratched, damaged or contaminated.

### 4.14.1 Instructions

- 1) On the Analyzer Operation screen, click Hold under Next mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 2) Collect data from the unit.
- 3) Back up configuration files following the instructions detailed previously in this chapter entitled, Backing Up Configuration Files.
- 4) Using Lithium Battery Status instructions, verify the battery status is OK before proceeding.
- 5) Turn off all sample streams, calibration gas and carrier gas.
- 6) Disconnect or remove power from NGC unit externally, or remove the J1 connector from termination panel.

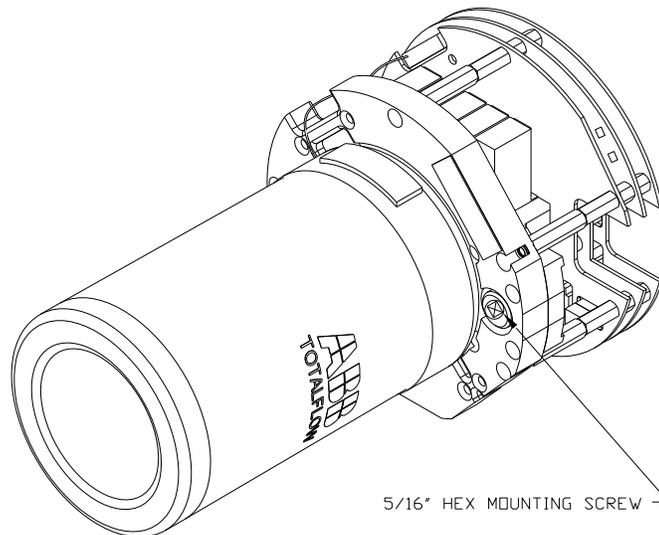


As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components, voiding any warranty.

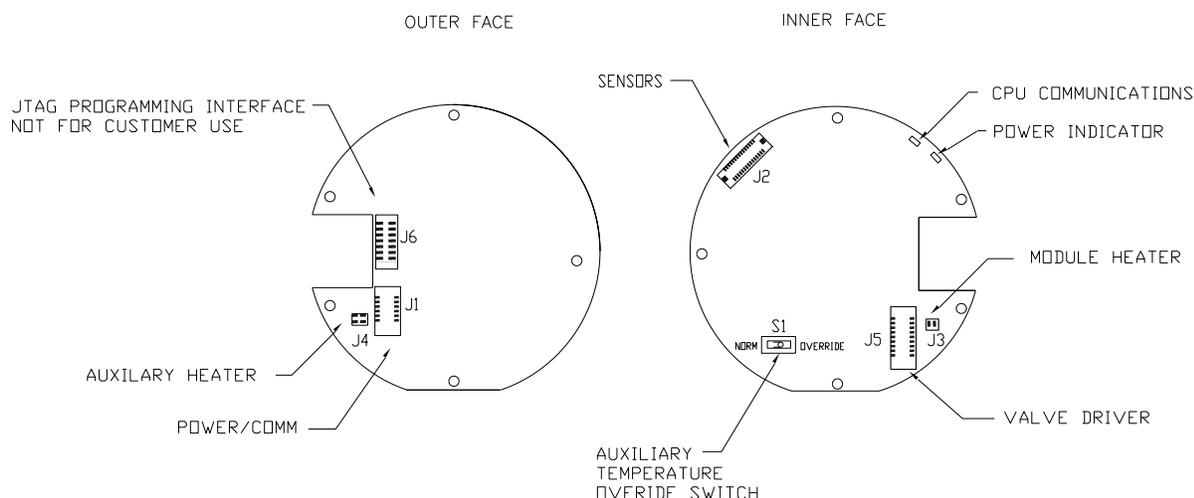
- 7) Gain access to the digital controller assembly by loosening the countersunk hex socket locking set screw in the front end cap, using a 1/16" hex wrench. Unscrew the end cap.
- 8) Following the instructions detailed previously in this chapter entitled, Digital Controller Assembly Mounting Bracket, remove the assembly. If weather/circumstances permit, the digital controller assembly may be suspended by the cables to eliminate stress on cable connections. The user may skip to step 10.
- 9) Carefully unplug the cable to the termination panel, leaving the lithium battery plugged in. Set the digital controller assembly aside on a clean, lint-free surface.
- 10) Using a 5/16" hex wrench, loosen the mounting screw (see Figure 4-3), holding the analytical module in place until the module can be slowly lifted

from the enclosure. Take care to not pull or stress wires attached to the rear of the assembly.

- 11) Detach the analytical module rear face jumper, J1 and J4, if the auxiliary heater is installed (see Figure 4–4).
- 12) Set the module on a clean, lint-free surface.
- 13) Verify that the gasket on the feed-through assembly manifold interface is in place, in good condition and free from metal filings or other contamination. If the gasket has fallen off inside the enclosure or stuck to the GC module, replace onto the feed-through manifold interface ensuring that the gasket does NOT cover the gas portholes.
- 14) Verify the S1 auxiliary heater switch is set to the correct position. If using the auxiliary feed-through heater, set position to Normal.
- 15) Insert mounting screw into the analytical module.
- 16) Holding the analytical module at the opening of the enclosure, reconnect jumper J1 and J4 if the auxiliary heater is installed (see Figure 4–4).



**Figure 4–3 Analytical Module**



**Figure 4–4 Analytical Processor Board**

- 17) Carefully insert the module into the enclosure, rotating the module to ensure rear components clear the manifold interface on the inside area of the feed-through assembly. Feed-through manifold interface and analytical module are keyed to ensure proper alignment.
- 18) When the analytical module is in place, tighten the mounting screw.
- 19) Reassemble the digital controller assembly, using instructions previously covered in this chapter.
- 20) Plug the termination panel to digital controller ribbon cable into digital controller assembly.



Please note that the termination panel to digital controller ribbon cable pin 1 wire is NOT red. On the digital controller board, the red edge (pin 1) of the cable should plug onto pin 50, the right side of plug. Plug is “keyed”. Do not force plug into connector.

- 21) Insert the lithium battery pack into the enclosure between enclosure and the thermal flask.
- 22) Turn on all sample streams, calibration gas and carrier gas.
- 23) Once the unit is reassembled, apply power to the NGC (Step 6).
- 24) Follow the Cold Start procedure in Chapter 4-Maintenance.
- 25) Reinstall front and rear end caps.



For purposes of returning this assembly to Totalflow Service for warranty or repair, please contact Totalflow Customer Service for an RA number.

**FYI**



Please note that since power was removed from this unit, the NGC will perform start-up diagnostics and stabilize. If the user has disabled the start-up diagnostics, they should be enabled and power cycled to the unit. If power has been withheld from unit for an unknown or lengthy period of time, a complete start-up should be performed.

For more information on enabling the diagnostics in PCCU, click the Diagnostics button and then the Help button.

## 4.15 Replacing GC Module

This section presents the procedures for the removal and installation of the GC module and can be applied to both the main and auxiliary units. The GC module is a completely self-contained unit and is part of the analytical module. Read through all procedural steps before removing the assembly.

Verify before beginning the procedure that the replacement module is appropriately rated for the system voltage. Compare module voltage to the ID tag located on the side of the enclosure.

When the GC module is removed, it is important that the bottom surface of the module be placed on a clean, lint free cloth to prevent its base from being scratched or damaged and gas sample flow line openings free of foreign contaminants.

**CAUTION**



If the GC module is not being immediately replaced, put the thermal flask back in place to prevent the mandrel from being scratched or damaged and gas sample flow line openings free of foreign contaminants. Also, be careful with the miniature D type connector pins.

### 4.15.1 Instructions

- 1) On the Analyzer Operation screen, click Hold under Next mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 2) Collect data from the unit.
- 3) Back up the configuration files, following the instructions detailed previously in this chapter entitled, Backing Up Configuration Files.
- 4) Using Lithium Battery Status instructions, verify the battery status is OK before proceeding.
- 5) Turn off all sample streams, calibration gas and carrier gas.
- 6) Disconnect or remove power from the NGC unit externally, or remove the J1 connector from the termination panel.

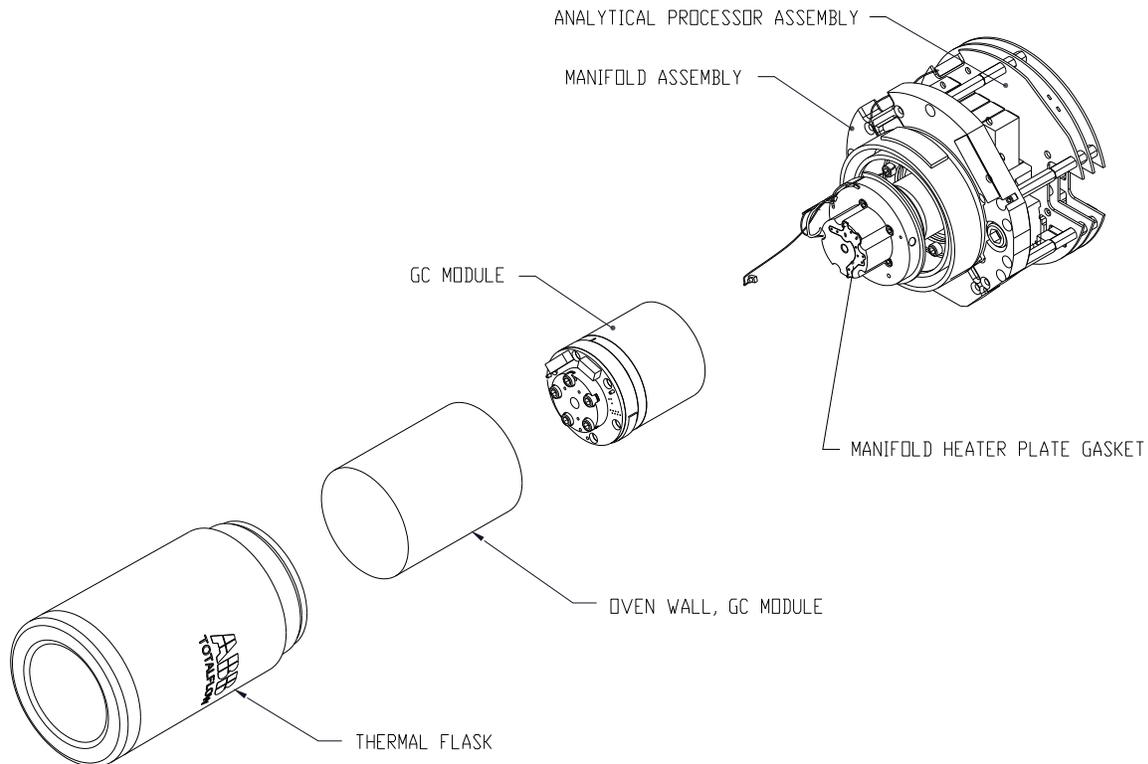
**CAUTION**



As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components, voiding any warranty.

- 7) Gain access to the digital controller assembly by loosening the countersunk hex socket locking set screw in the front end cap, using a 1/16" hex wrench. Unscrew the end cap.

- 8) Following the instructions detailed previously in this chapter entitled, Digital Controller Assembly Mounting Bracket, remove the assembly. If weather/circumstances permit, the digital controller assembly may be suspended by the cables to eliminate stress on cable connections. The user may skip to step 10.
- 9) Carefully unplug the cable to the termination panel, leaving the lithium battery plugged in. Set the digital controller assembly aside on a clean, lint-free surface.
- 10) Unscrew thermal flask counterclockwise (see Figure 4–5). When loose, lift the flask from the unit. Set aside.
- 11) Unscrew oven wall counterclockwise (oven wall may be hot). When loose, lift cylinder from the GC module. Set aside.
- 12) Using the extraction tool, remove the cable connectors from jumpers J1, J2 and J3. DO NOT pull connectors from the board by the wires.
- 13) Using a 9/64" hex wrench, loosen the mounting screw inside the center of the assembly. When loose, lift the assembly from the manifold assembly. Set aside on a clean, lint-free surface.



**Figure 4–5 GC Module, Exploded View**

- 14) Verify that manifold heater plate gasket is in place and in good condition.

- 15) Carefully insert the replacement module onto the manifold assembly, rotating the module to ensure key holes line up and the module rests on the base. Unit should not turn once it is seated correctly.
- 16) When GC module is in place, tighten mounting screw.
- 17) Carefully restore cable connectors to jumpers J1, J2 and J3. Be careful to not press against the wires attached to the connector head.
- 18) Replace oven wall onto the GC module. Be careful to not pinch or bind any of the cables. When fully on, turn oven wall clockwise to tighten.
- 19) Replace the thermal flask over GC module. When flask reaches mounting bracket, turn clockwise to tighten.
- 20) Reassemble the digital controller assembly, using instructions previously covered in this chapter.
- 21) Plug the termination panel to the digital controller ribbon cable into the digital controller assembly, if disconnected.



Please note that the termination panel to the digital controller ribbon cable pin 1 wire is NOT red. On the digital controller board, the red edge (pin 1) of the cable should plug onto pin 50, the right side of plug. Plug is “keyed”. Do not force plug into connector.

- 22) Insert the lithium battery pack into the enclosure between the enclosure and thermal flask.
- 23) Turn on all sample streams, calibration gas and carrier gas.
- 24) Once the unit is reassembled, apply power to the NGC (Step 6).



For the purposes of returning this assembly to Totalflow Service for warranty or repair, please contact Totalflow Customer Service for an RA number.

- 25) Follow the Cold Start procedure in Chapter 4-Maintenance.
- 26) Reinstall front and rear end caps.



Please note that since power was removed from this unit, the NGC will perform start-up diagnostics and stabilize. If the user has disabled the start-up diagnostics, they should be enabled and power cycled to unit. If the power has been withheld from the unit for an unknown or lengthy period of time, a complete start-up should be performed.

For more information on enabling the diagnostics in PCCU, click the Diagnostics button and then the Help button.

## 4.16 Replacing Termination Panel

This section presents the procedures for removal and installation of the power termination panel and can be applied to both the main and auxiliary units. This panel is located in rear of the NGC. Read through all procedural steps before removing the assembly.

### 4.16.1 Instructions

- 1) On the Analyzer Operation screen, click Hold under Next mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 2) Collect data from the unit.
- 3) Back up the configuration files, following the instructions detailed previously in this chapter entitled, Backing Up Configuration Files.
- 4) Using the Lithium Battery Status instructions, verify battery status is OK before proceeding.
- 5) Gain access to the rear termination panel of the NGC by loosening the countersunk hex socket locking set screw in the rear end cap, using a 1/16" hex wrench. Unscrew the end cap.

**CAUTION**  As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components, voiding any warranty.

- 6) Disconnect or remove power from NGC unit externally or remove J1 connector from termination panel (see Figure 4–6).
- 7) Disconnect all connectors from board; J2 digital I/O, J8 and J10 serial ports, J3 Ethernet and J6 USB client connectors. Move wires out of the way.

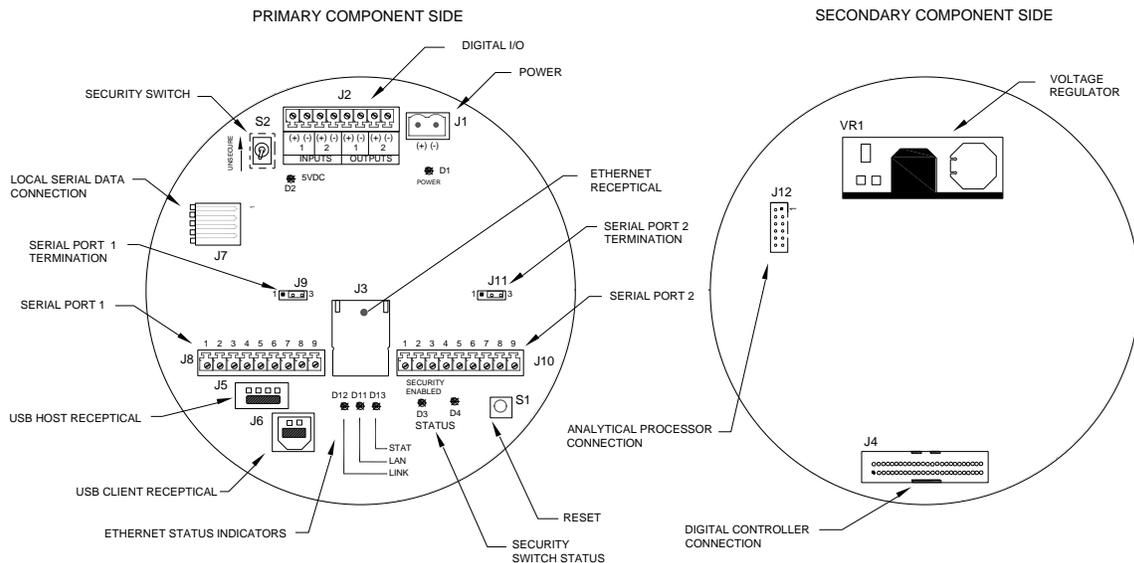


Figure 4–6 Termination Panel

- 8) Using a 5/16" nut driver, loosen and remove the six nuts holding the termination panel in place.
- 9) Lift the clear, protective overlay out.
- 10) Lift the termination panel out. Be careful of the wires fed into the enclosure through the hubs and cables connected to the back. **DO NOT REMOVE EMI GASKET.**
- 11) Carefully unplug the ribbon cable to the digital controller from the back of the termination panel, J4, and analytical processor J12. Set panel aside.

**CAUTION**



Please note that the termination panel to digital controller ribbon cable pin 1 wire is NOT red. On the termination panel, the red edge (pin 1) of cable should plug onto pin 50, the right side of plug. Plug is "keyed". Do not force plug into connector.

- 12) Holding the replacement panel at the opening of the enclosure, reconnect the ribbon cable to the digital controller into the back of the termination panel, J4, and the analytical processor cable into J12.
- 13) Insert termination panel into enclosure. Be careful to not pinch wires between mounting stud and panel.
- 14) Replace the clear, protective overlay into the enclosure on the mounting studs.
- 15) Replace the nuts to hold the termination panel in place.
- 16) Restore J2, J8, J10, J3 and J6 connections, if applicable.
- 17) Once the unit is reassembled, apply power to the NGC (Step 6).
- 18) Reinstall the front and rear end caps.

**TIP**



For the purpose of returning this assembly to Totalflow Service for warranty or repair, please contact Totalflow Customer Service for an RA number.

**FYI**



Please note that since power was removed from this unit, the NGC will perform start-up diagnostics and stabilize. If the user has disabled the start-up diagnostics, they should be enabled and power cycled to unit. If power has been withheld from the unit for an unknown or lengthy period of time, a complete start-up should be performed.

For more information on enabling the diagnostics in PCCU, click the Diagnostics button and then the Help button.

## 4.17 Replacing Feed-Through Assembly

This section presents the procedures for removal and installation of the feed-through assembly and can be applied to both the main and auxiliary units. This assembly is located on the side of the NGC. Read through all procedural steps before removing the assembly.

### 4.17.1 Instructions

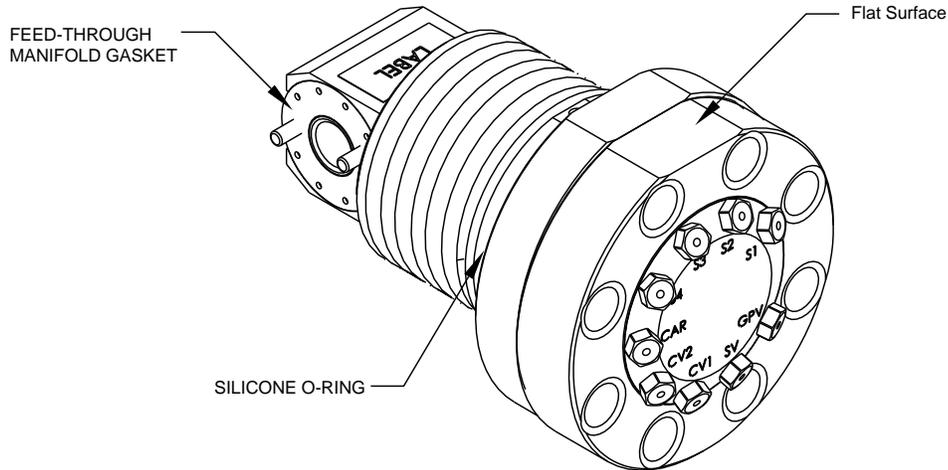
- 1) On the Analyzer Operation screen, click Hold under Next mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.

- 2) Collect data from unit.
- 3) Back up configuration files, following the instructions detailed previously in this chapter entitled, Backing Up Configuration Files.
- 4) Using the Lithium Battery Status instructions, verify the battery status is OK before proceeding.
- 5) Turn off all sample streams, calibration gas and carrier gas.
- 6) Disconnect or remove the power from the NGC unit externally, or remove the J1 connector from the termination panel.



As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components, voiding any warranty.

- 7) Gain access to the digital controller assembly by loosening the countersunk hex socket locking set screw in the front end cap, using a 1/16" hex wrench. Unscrew the end cap.
- 8) Following the instructions detailed previously in this chapter entitled, Digital Controller Assembly Mounting Bracket, remove the assembly (see Figure 4-1). If weather/circumstances permit, the digital controller assembly may be suspended by the cables to eliminate stress on cable connections. The user may move to step 10.
- 9) Carefully unplug the cable to the termination panel, leaving the lithium battery plugged in. Set the digital controller assembly aside on a clean, lint-free surface.
- 10) Using a 5/16" hex wrench, loosen the mounting screw holding the analytical module in place until the module can be slowly lifted from the enclosure. Take care to not pull wires attached to the rear of the assembly (see Figure 4-3).
- 11) Detach the analytical module rear face jumper, J1 and J4, if the auxiliary heater is installed.
- 12) Set module on a clean, lint-free surface.
- 13) Using a 1/4" open end wrench, loosen the Valco nut, and remove the input line. Repeat for all sample, carrier and calibration gas lines.
- 14) Using a 5/64" hex wrench, loosen the feed-through set screw.
- 15) Unscrew the feed-through assembly, turning by hand counterclockwise until free.
- 16) On the replacement assembly, install the manifold gasket supplied with new feed-through assembly (see Figure 4-7).



**Figure 4–7 Feed-Through Assembly**

- 17) Carefully apply the sealing thread lubricant to the threads on the feed-through assembly. Be extremely careful to not contaminate the feed-through manifold and gasket.
- 18) Insert the replacement feed-through assembly, and screw in clockwise until completely screwed in but not tight.
- 19) If the flat surface, when screwed all the way in, is over 180 degrees past the top, reverse the feed-through assembly counter clockwise until the flat surface is on top and horizontal.
- 20) If the flat surface, when screwed all the way in, is less than 180 degrees past the top, turn the assembly counter clockwise one full turn plus enough to bring the flat surface to where it is on top and horizontal.
- 21) Using a 5/64" hex wrench, tighten the feed-through set screw.
- 22) Insert the mounting screw into the analytical module.
- 23) Holding the analytical module at the opening of the enclosure, reconnect jumper J1 and J4, if auxiliary heater is installed (see Figure 4–5).
- 24) Carefully insert the module into the enclosure, rotating the module to ensure rear components clear the manifold interface on the inside area of the feed-through assembly. Feed-through manifold interface and analytical module are keyed to ensure proper alignment.
- 25) When the analytical module is in place, tighten the mounting screw.
- 26) Reassemble the digital controller assembly, using instructions previously covered in this chapter.
- 27) Plug the termination panel to digital controller ribbon cable into the digital controller assembly.

**CAUTION**



Please note that the termination panel to digital controller ribbon cable pin 1 wire is NOT red. On the digital controller board, the red edge (pin 1) of the cable should plug onto pin 50, the right side of plug. Plug is "keyed". Do not force plug into connector.

- 28) Insert lithium battery pack into enclosure between enclosure and thermal flask.

- 29) Once unit is reassembled, apply power to NGC (Step 6).
- 30) Reinstall front and rear end caps.

**FYI**



Please note that since power was removed from this unit, the NGC will perform start-up diagnostics and stabilize. If user has disabled the start-up diagnostics, they should be enabled and power cycled to unit. If power has been withheld from unit for an unknown or lengthy period of time, a complete “start-up” should be performed.

For more information on “enabling” the diagnostics in PCCU, click the diagnostics button and then the “Help” button.

## 4.18 Replacing Lithium Battery

This section presents the procedures for removal and installation of a new lithium battery. This procedure can apply to both the main and auxiliary units. The lithium battery is inside of the front end cap and is wedged between the thermal flask and the enclosure wall. Read through all procedural steps before removing the assembly.

### 4.18.1 Instructions

**CAUTION**



**DO NOT REMOVE POWER TO THE UNIT!** Loss of power to the unit will perform a cold start. All data and configuration files will be destroyed.

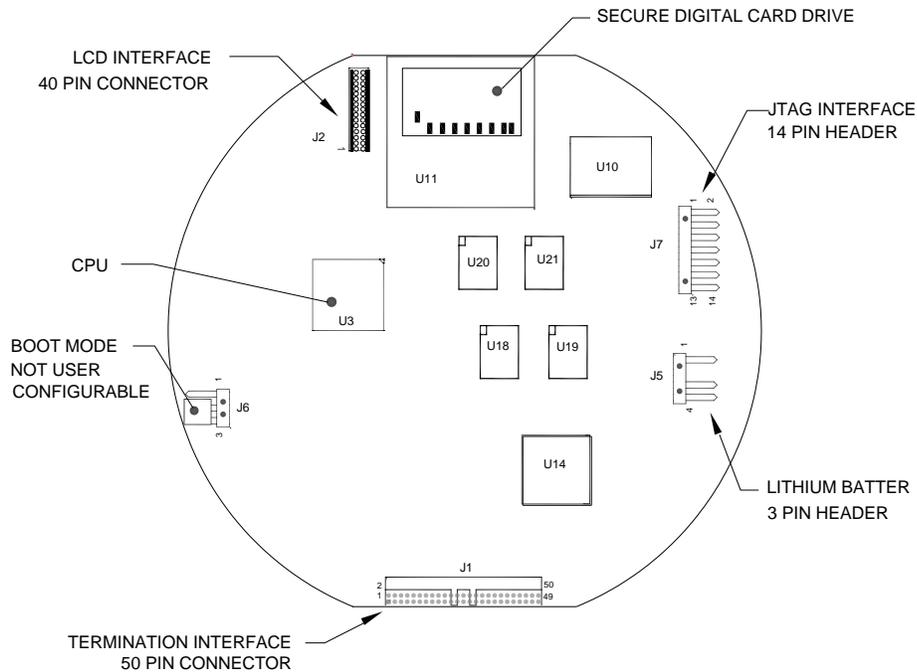
- 1) On the Analyzer Operation screen, click Hold under Next mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 2) Collect data from the unit.
- 3) Back up the configuration files, following the instructions detailed previously in this chapter entitled, Backing Up Configuration Files.

**CAUTION**



As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components, voiding any warranty.

- 4) Gain access to digital controller assembly by loosening the countersunk hex socket locking set screw in the front end cap using a 1/16” hex wrench, then unscrewing the end cap.
- 5) Unplug the lithium battery connector from the J5 receptacle on digital controller board (see Figure 4–8).
- 6) Plug in the replacement lithium battery to J5 on the digital controller board.
- 7) Insert the lithium battery pack into the enclosure between the enclosure and thermal flask.
- 8) Using the Lithium Battery Status instructions, verify the battery status is OK before proceeding.
- 9) Reinstall the front end cap.



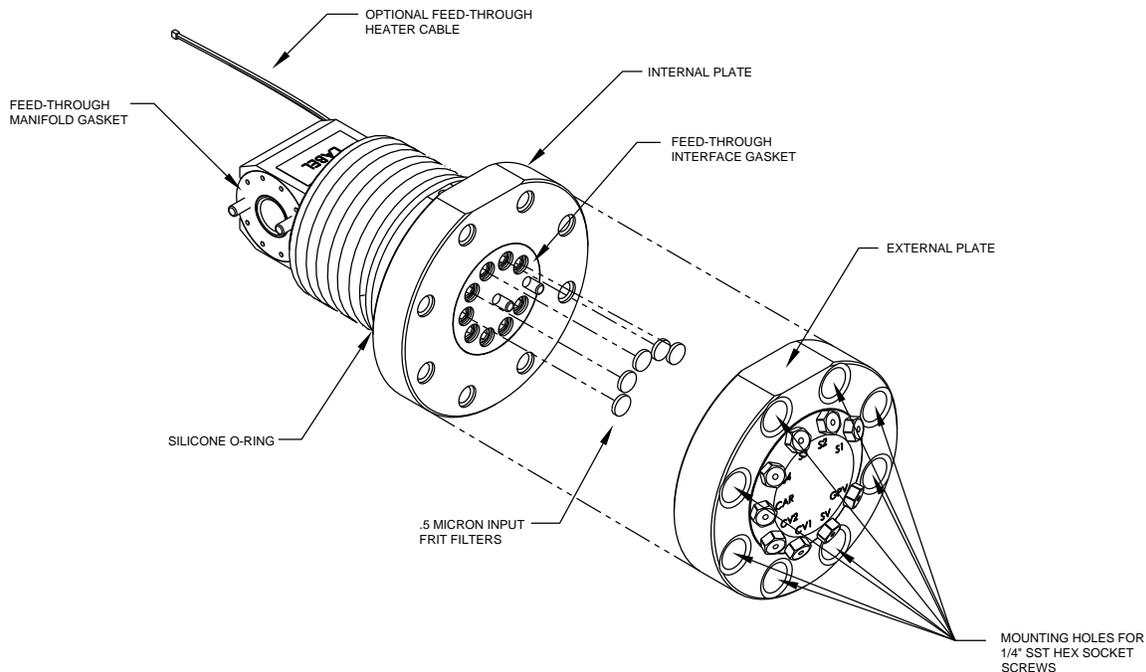
**Figure 4–8 Primary Component Side Digital Controller Board**

## 4.19 Replacing Frit Filters

Applies to both the main and auxiliary units. Several reasons exist for replacing the frit filters, from a scheduled maintenance procedure to decreased sample pressure due to clogged filters. When replacing the filters on a regularly scheduled maintenance plan, it will most likely not require that the sample lines be removed from the external plate. When replacing the filters as a troubleshooting result, the user should remove the sample input lines and use compressed air to clear the pathway. For the purpose of being thorough, these instructions contain steps for the worst case scenario.

### 4.19.1 Instructions

- 1) On the Analyzer Operation screen, click Hold under Next mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 2) Collect data from unit.
- 3) Back up the configuration files, following the instructions detailed previously in this chapter entitled, Backing Up Configuration Files.
- 4) Turn off all sample streams, calibration gas and carrier gas.
- 5) Using a 7/32" hex wrench, loosen and remove all 8–1/4" hex socket screws (see Figure 4–9).



**Figure 4–9 Feed-Through Assembly - Exploded View**

- 6) If space permits lift the external plate away from the internal plate, and view the frit filters. If space does not permit lifting the plate away enough to view the filters, the user must remove the sample input lines and the carrier and calibration gas lines.
- 7) If filters appear soiled, it will be necessary to remount the external plate and remove the input lines. To remove the input lines, continue to the next step; otherwise, skip to step 8.
- 8) Using a 1/4" open end wrench, loosen the Valco nut, and remove the input line. Repeat for all sample, carrier and calibration gas lines.
- 9) Remove the 8–1/4" hex socket mounting screws.
- 10) Remove the used filters from the filter sockets. Using an edged instrument, or possibly a fingernail, put pressure on the outermost edge of each filter to pop them out.
- 11) If replacing filters due to clogging, the user should also use compressed air to blow out the input holes in the external plate. It may also be necessary to wipe clean the gasket located on the internal plate; otherwise, skip to the next step.
- 12) Using the replacement filter, carefully lay the filter into the filter socket, applying uniform pressure to the filter. DO NOT use any pointed instrument to push the filter into place. Repeat for each input stream, carrier and calibration gas input. Vents do not require filters.
- 13) Reseat the external plate, aligning the mounting pins on the internal plate to the corresponding holes on the external plate.
- 14) Replace the 8–1/4" mounting screws, using a star pattern when tightening the screws.

- 15) If sample, carrier and calibration gas lines were removed, purge air from the transport tubing and reconnect to the corresponding ports.

**CAUTION**  DO NOT over tighten. After securing the tubing, check for gas leaks.

## 4.20 Replacing Feed-through Interface Gasket

Should the feed-through interface gasket require replacement (see Figure 4–9), follow these instructions. Typically, the user would change the gasket while performing another procedure, but for the purposes of this manual, the instructions will start and finish as a complete procedure.

### 4.20.1 Instructions

- 1) On the Analyzer Operation screen, click Hold under Next mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 2) Collect data from the unit.
- 3) Back up the configuration files, following the instructions detailed previously in this chapter entitled, Backing Up Configuration Files.
- 4) Turn off all sample streams, calibration gas and carrier gas.
- 5) Using a 7/32" hex wrench, loosen and remove all 8–1/4" hex socket screws.
- 6) If space permits, lift the external plate away from the internal plate, and remove the damaged gasket from the internal plate. If space does not permit lifting the plate away enough to replace the gasket, the user must remove the sample input lines and the carrier and calibration gas lines.
- 7) Remount the external plate, and remove the input lines. To remove the input lines, continue to the next step; otherwise, skip to step 8.
- 8) Using a 1/4" open end wrench, loosen the Valco nut, and remove the input line. Repeat for all sample, carrier and calibration gas lines.
- 9) Remove the 8–1/4" hex socket mounting screws.
- 10) Remove the damaged gasket from the internal plate.
- 11) Clean the gasket area on the internal plate, using a clean, dry, lint-free cloth, before placing a new gasket on the internal plate. The gasket is keyed to ensure that it is placed correctly. The gasket should not cover any holes in the internal plate.
- 12) Reseat the external plate, aligning the mounting pins on the internal plate to the corresponding holes on the external plate.
- 13) Replace the 8–1/4" mounting screws, using a star pattern when tightening the screws.
- 14) If sample, carrier and calibration gas lines were removed, purge air from the transport tubing, and reconnect to corresponding ports.

**CAUTION**  DO NOT over tighten. After securing the tubing, check for gas leaks.

## 4.21 Replacing Feed-Through Manifold Gasket

Should the feed-through manifold gasket require replacement (see Figure 4–9), follow these instructions. This procedure can apply to both the main and auxiliary units. Typically the user would change the gasket while performing another procedure, but for the purposes of this manual, the instructions will start and finish as a complete procedure.

### 4.21.1 Instructions

- 1) On the Analyzer Operation screen, click Hold under Next mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 2) Collect data from the unit.
- 3) Back up the configuration files, following the instructions detailed previously in this chapter entitled, Backing Up Configuration Files.
- 4) Using the Lithium Battery Status instructions, verify the battery status is OK before proceeding.
- 5) Turn off all sample streams, calibration gas and carrier gas.
- 6) Disconnect or remove power from the NGC unit externally, or remove the J1 connector from the termination panel.



As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components, voiding any warranty.

- 7) Gain access to the digital controller assembly by loosening the countersunk hex socket locking set screw in the front end cap, using a 1/16" hex wrench. Unscrew the end cap.
- 8) Following the instructions detailed previously in this chapter titled; Digital Controller Assembly Mounting Bracket, remove the assembly (see Figure 4–1). If weather/circumstances permit, the digital controller assembly may be suspended by the cables to eliminate stress on the cable connections, Move to step 10.
- 9) Carefully unplug the cable to the termination panel, leaving the lithium battery plugged in. Set the digital controller assembly aside on a clean, lint-free surface.
- 10) Using a 5/16" hex wrench, loosen the mounting screw holding the analytical module in place until the module can be slowly lifted from the enclosure. Take care to not pull wires attached to the rear of the assembly (see Figure 4–4).
- 11) Detach the analytical module rear face jumper, J1 and J4, if the auxiliary heater is installed.
- 12) Set the module on a clean, lint-free surface.
- 13) Replace the gasket on the feed-through assembly manifold interface, ensuring that the gasket does NOT cover the gas portholes.
- 14) Insert the mounting screw into the analytical module.
- 15) Holding the analytical module at the opening of the enclosure, reconnect jumper J1 and J4, if auxiliary heater is installed (see Figure 4–5).
- 16) Carefully insert the module into the enclosure, rotating the module to ensure rear components clear the manifold interface on the inside area of the feed-

through assembly. The feed-through manifold interface and analytical module are keyed to ensure proper alignment.

- 17) When the analytical module is in place, tighten the mounting screw.
- 18) Reassemble the digital controller assembly, using instructions previously covered in this chapter.
- 19) Plug the termination panel to the digital controller ribbon cable into the digital controller assembly.



Please note that the termination panel to digital controller ribbon cable pin 1 wire is NOT red. On the digital controller board, the red edge (pin 1) of the cable should plug onto pin 50, the right side of plug. Plug is “keyed”. Do not force plug into connector.

- 20) Insert the lithium battery pack into the enclosure between the enclosure and thermal flask.
- 21) Once the unit is reassembled, apply power to NGC (Step 6).
- 22) Reinstall the front and rear end caps.

FYI



Please note that since power was removed from this unit, the NGC will perform start-up diagnostics and stabilize. If the user has disabled the start-up diagnostics, they should be enabled and power cycled to unit. If power has been withheld from the unit for an unknown or lengthy period of time, a complete start-up should be performed.

For more information on enabling the diagnostics in PCCU, click the Diagnostics button and then the Help button.

## 4.22 Replacing Termination Panel to Digital Controller Cable

Should the termination panel to digital controller cable become damaged and require replacement, follow these instructions. This procedure can apply to both the main and auxiliary units. Typically, the user would change the cable while performing another procedure, but for the purposes of this manual, the instructions will start and finish as a complete procedure.

### 4.22.1 Instructions

- 1) On the Analyzer Operation screen, click Hold under Next mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 2) Collect data from the unit.
- 3) Back up the configuration files, following the instructions detailed previously in this chapter entitled, Backing Up Configuration Files.
- 4) Using the Lithium Battery Status instructions, verify the battery status is OK before proceeding.
- 5) Turn off all sample streams, calibration gas and carrier gas.
- 6) Disconnect or remove power from the NGC unit externally, or remove the J1 connector from termination panel.



As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components, voiding any warranty.

- 7) Gain access to the digital controller assembly by loosening the countersunk hex socket locking set screw in the front end cap, using a 1/16" hex wrench. Unscrew the end cap.
- 8) Following the instructions detailed previously in this chapter entitled, Digital Controller Assembly Mounting Bracket, remove the assembly (see Figure 4-1).
- 9) Carefully unplug the cable to the termination panel, leaving the lithium battery plugged in. Set the digital controller assembly aside on a clean, lint-free surface.
- 10) Using a 5/16" hex wrench, loosen the mounting screw holding the analytical module in place until module can be slowly lifted from the enclosure. Take care to not pull wires attached to the rear of the assembly (see Figure 4-4).
- 11) Detach the analytical module rear face jumper, J1 and J4, if auxiliary heater is installed.
- 12) Set the module on a clean, lint-free surface.
- 13) Reach into the enclosure through the front opening, and unplug the ribbon cable from the rear of the termination panel, J4.
- 14) On the replacement cable, verify orientation by viewing the keyed receptacle on the termination panel and cable. Insert plug into J4 connector.
- 15) Verify that the gasket on the feed-through assembly manifold interface is in place and in good condition. If the gasket has fallen off inside the enclosure or stuck to the GC module, replace onto the feed-through manifold interface, ensuring that the gasket does NOT cover the gas portholes.
- 16) Insert the mounting screw into the analytical module.
- 17) Holding the analytical module at the opening of the enclosure, reconnect jumper, J1 and J4, if auxiliary heater is installed.
- 18) Carefully insert the module into the enclosure, rotating the module to ensure rear components clear the manifold interface on the inside area of the feed-through assembly. The feed-through manifold interface and analytical module are keyed to ensure proper alignment.
- 19) When the analytical module is in place, tighten mounting screw.
- 20) Reassemble the digital controller assembly, using instructions previously covered in this chapter.
- 21) Plug the termination panel to the digital controller ribbon cable into the digital controller assembly.



Please note that the termination panel to digital controller ribbon cable pin 1 wire is NOT red. On digital controller board, the red edge (pin 1) of cable should plug onto pin 50, the right side of plug. Plug is "keyed", do not force plug into connector.

- 22) Insert the lithium battery pack into the enclosure between the enclosure and the thermal flask.
- 23) Once the unit is reassembled, apply power to the NGC (Step 6).

24) Reinstall the front and rear end caps.

FYI



Please note that since power was removed from this unit, the NGC will perform start-up diagnostics and stabilize. If the user has disabled the start-up diagnostics, they should be enabled and power cycled to unit. If power has been withheld from the unit for an unknown or lengthy period of time, a complete start-up should be performed.

For more information on enabling the diagnostics in PCCU, click the Diagnostics button and then the Help button.

## 4.23 Replacing Analytical Processor to Termination Panel Cable

Should the cable connecting the analytical processor to the termination panel require replacement, use the following instructions. This procedure can apply to both the main and auxiliary units.

### 4.23.1 Instructions

- 1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 2) Collect data from unit.
- 3) Back up the configuration files following the instructions detailed previously in this chapter entitled, Backing Up Configuration Files.
- 4) Using the Lithium Battery Status instructions, verify the battery status is OK before proceeding.
- 5) Disconnect or remove power from the NGC unit externally, or remove the J1 connector from the termination panel.

**CAUTION**



As with all electronic components, caution should be used when handling boards. Static electricity can potentially damage board components, voiding any warranty.

- 6) Following the instructions detailed previously in this chapter titled; Replacing Termination Panel, remove the panel and unplug the cable. Reaching into the enclosure, unplug the analytical processor to termination panel cable from the analytical processor assembly (see Figure 4–4).
- 7) Using the replacement cable, insert into the enclosure and plug into the power/communication connector, J1. Connect the cable to the back of the termination panel, J12 connector (see Figure 4–6).
- 8) Reinstall the termination panel.

**CAUTION**



Please note that the termination panel to digital controller ribbon cable pin 1 wire is NOT red. On the digital controller board, the red edge (pin 1) of cable should plug onto pin 50, the right side of plug. Plug is keyed. Do not force plug into connector.

- 9) Once the unit is reassembled, apply power to the NGC (Step 6).

**TIP**



For the purposes of returning this assembly to Totalflow Service for warranty or repair, please contact Totalflow Customer Service for an RA number.

**10) Reinstall the rear end cap.**

**FYI**



Please note that since power was removed from this unit, the NGC will perform start-up diagnostics and stabilize. If the user has disabled the start-up diagnostics, they should be enabled and power cycled to unit. If power has been withheld from the unit for an unknown or lengthy period of time, a complete start-up should be performed.

For more information on enabling the diagnostics in PCCU, click the Diagnostics button and then the Help button.

## 5.0 TROUBLESHOOTING

### 5.1 Overview

As an aid to troubleshooting the NGC8200 Dual Unit, this chapter will provide troubleshooting guidelines for the various subsystems of the NGC. Some of these procedures will differ slightly from other Totalflow products because the communications, power charger/source and other I/O are contained in a separate enclosure rather than within the NGC enclosure.

This chapter is roughly divided into sections grouped as: start-up diagnostic troubleshooting, troubleshooting alarms, alarm troubleshooting tests, power troubleshooting and troubleshooting communications.

Some of the procedures are based on tests performed on the NGC termination panel, and others are based on tests performed on components located in a separate enclosure. The user will determine which of these procedures correspond to their particular unit. If using equipment other than the Totalflow OEU, the user will need to refer to the manufacturer's procedures for troubleshooting their equipment.

Since the NGC is comprised of a main and auxiliary unit, the user will have to make some decisions as to which unit might be the source of the problem. Generally problems involving the heavier components (i.e. C7, C8 and C9+) will be associated with the auxiliary unit. Columns 1 and 2 refer to the main unit, while column 3 refers to the auxiliary unit. The main and auxiliary units are mechanically and electrically identical except for the auxiliary unit not having a display. All assembly and disassembly instructions are identical for the two units.



DO NOT open or remove covers, including the PCCU local communications cover, unless the area is known to be non-hazardous, including the internal volume of the enclosure.

#### 5.1.1 Troubleshooting Support

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

USA: (800) 442-3097 or International: 001-918-338-4880

#### 5.1.2 Getting Started

Using Figure 5-1, determine which section the user most likely needs to begin, and skip to that section.

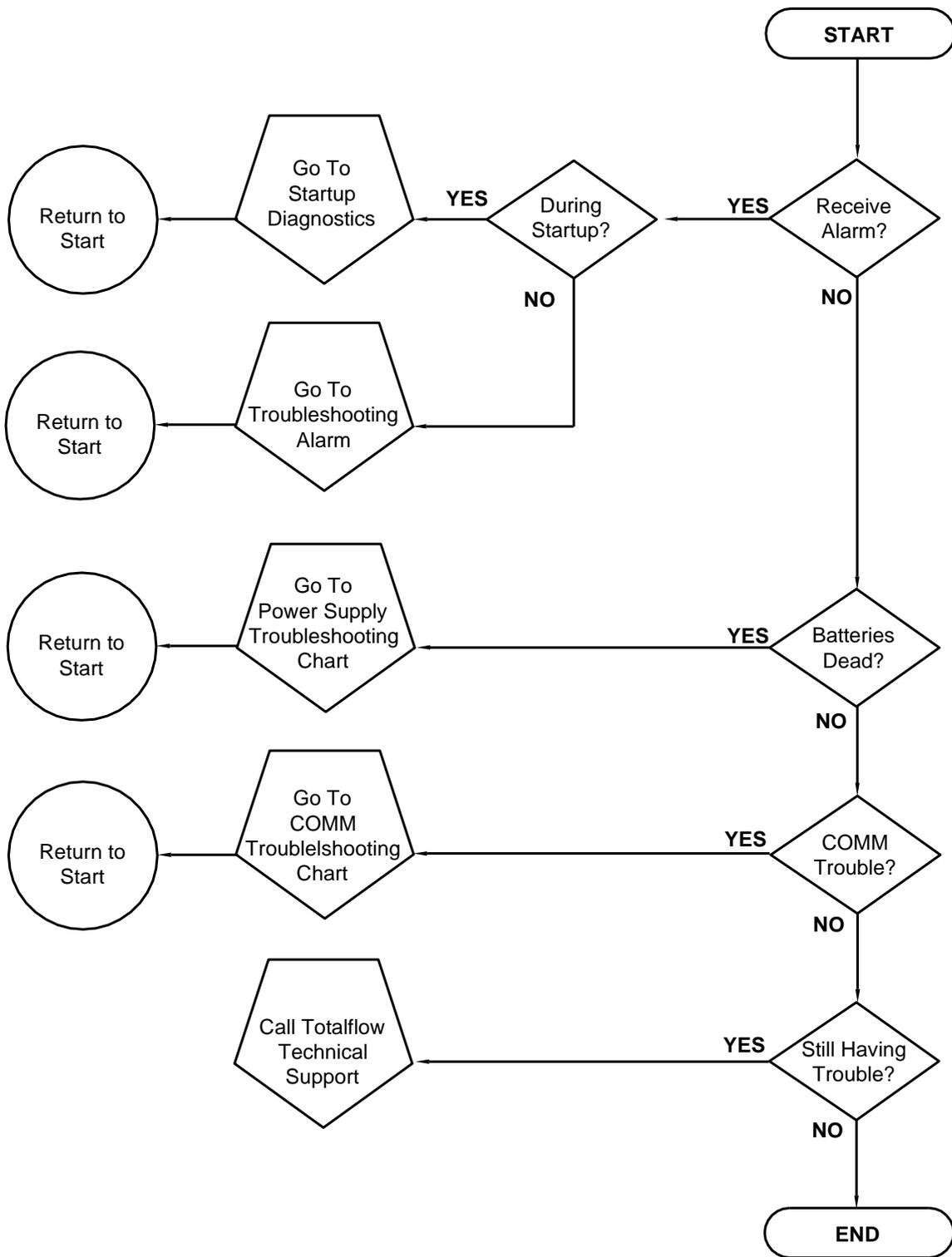


Figure 5-1 Troubleshooting Flowchart

## 5.2 Start-Up Diagnostic Troubleshooting

This section focuses on determining what has caused an alarm during start-up diagnostics. The Totalflow NGC has an extensive built-in list of tests which are performed each time the unit is started. This start-up testing may be disabled, but Totalflow recommends that it be left enabled.

These diagnostics consist of four areas of testing:

- Carrier Pressure Regulator Test
- Oven Temperature Test
- Processor control Test
- Stream Test

These start-up tests may also be performed on a regular schedule. Please see the PCCU help files for more information on scheduling diagnostics.

**FYI**



Totalflow has endeavored to perform extensive testing on each NGC prior to shipment, and each unit is factory calibrated using this standard calibration blend.

**TIP**



During the stream test, streams with no gas pressure will fail, and they will be disabled in the stream sequence. To enable these streams, please click on the Stream Setup button on the Analyzer Operation screen.

### 5.2.1 Status

The following descriptive status and definitions are standard for all start-up diagnostics. Additionally, each test group will have status results that will narrow down the possibilities for troubleshooting.

<b>Idle</b>	No tests are running.
<b>In Progress</b>	Test(s) are in progress.
<b>Passed</b>	Basic and/or additional tests, if required, passed.
<b>Failed</b>	The basic test failed, plus additional, more in depth, tests were run and also failed.
<b>aborted</b>	Tests were aborted by the user using the abort command.

### 5.2.2 Carrier Pressure Regulator Test

If the Col 1, Col 2 or Col 3 Carrier Pressure Test failed, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### 5.2.2.1 Description

These alarms are indicative of low carrier pressure. The causes range from a closed carrier bottle regulator to a blockage inside the GC module.

### 5.2.2.2 Status

The following descriptive status and definitions are applicable for only the Carrier Pressure Regulator Test and are in addition to those defined for all start-up diagnostics.

<b>Low Reg Pressure</b>	Pressure is too low to continue the test. Possible causes are the carrier bottle is low, the regulator on the carrier bottle needs to be turned up to 90 PSIG, carrier line from bottle to NGC is plugged, etc.
<b>Flow Blocked</b>	A blockage was sensed during one of the tests. The Flow Test was run in an attempt to dislodge the blockage but was not successful. See Flow Test below.
<b>Pressure Reg Test</b>	This is an additional test that is in progress because the basic test failed. A different status will be displayed after the test has finished.
<b>Flow Test</b>	The Flow Test is in Progress. The Flow Test is initiated when a blockage is sensed. The Flow Test will raise the pressure in an attempt to blow the plug out through the vent. If unsuccessful, the Flow Blocked status will be display
<b>Failed</b>	The additional tests can not prove with certainty, but either the GC module or the manifold assembly is bad.

### 5.2.2.3 Instructions

- 1) Verify the carrier gas bottle pressure regulator is open. If not, open the regulator on the carrier gas bottle; otherwise, continue to next step.
- 2) Verify the carrier gas bottle pressure regulator set point is 90 PSIG. If not, correct the set point to 90 PSIG (620.5 kPa or 6.2 bars); otherwise, continue to next step.
- 3) Perform the Column Vent Pressure Test procedure in this chapter for column vent 1 (main), column vent 2 (main) and column vent 1 (auxiliary). If either test failed, proceed to the next step.



Totalflow recommends that a replacement analytical module be installed at this point and additional steps be performed in a clean, lint free atmosphere. Because the customer does not have the required equipment to determine which specific module needs replaced, the final instructions are by process of elimination, beginning with the most likely module.

The Totalflow Repair Department offers a range of services for troubleshooting and repairing/replacing the non-functioning parts. For more information regarding the repair service, contact Customer Service:

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

- 4) Using the Replacing GC Module instructions in Chapter 4-Maintenance, replace the GC module.

### 5.2.3 Oven Temperature Test

If the Oven Wall Temperature Test failed, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### 5.2.3.1 Description

This alarm is indicative of a temperature condition. The causes range from an unplugged cable to a bad module heater.

#### 5.2.3.2 Instructions

- 1) Using the Replacing Temperature Sensor to GC Module Cable instructions in Chapter 4-Maintenance, verify that the cable is plugged in and in good repair. If the cable is unplugged or appears to be damaged, replace or plug-in cable; otherwise, continue to the next step.
- 2) Using the Replacing Analytical Module instructions in Chapter 4-Maintenance, replace the analytical module.

Totalflow recommends that a replacement analytical module be installed at this point and additional steps be performed in a clean, lint free atmosphere.



The Totalflow Repair Department offers a range of services for troubleshooting and repairing/replacing the non-functioning parts. For more information regarding the repair service, contact Customer Service:

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

### 5.2.4 Processor Control Test

If Col 1 (main), Col 2 (main) or Col 1 (auxiliary) Carrier Pressure Test failed or either of the Oven Wall Temperature tests failed, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### 5.2.4.1 Description

These alarms are indicative of a lack of ability to control a function. If the failure is either one or any of the Column Carrier Pressure Tests, it could be a missing or failed gasket. If the failure is in the Oven Wall Control Temperature Test, it could be something as easy as a missing GC module cover or analytical module thermal flask.

#### 5.2.4.2 Instructions

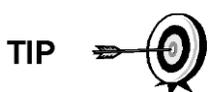
- 1) If the start-up diagnostics are being performed following disassembly or replacement of a module or spare part, insure that the unit is completely reassembled, including the thermal flask and both the front and rear end caps. Re-start the diagnostics. If the diagnostics again fail, repeat disassembly steps, and verify that all gaskets and connections are tight and correctly installed; otherwise continue to the next step.

- 2) If the start-up diagnostics are being performed from an initial startup, verify that the analytical module is not loose inside the enclosure.
- 3) Verify that the GC module is tight and that the cables are correctly installed and not damaged.
- 4) Reassemble the unit, and restart diagnostics. If the unit continues to fail, replace the entire analytical module, and return to Totalflow for warranty repair/replacement.

## 5.2.5 Stream Test

The Stream Flow diagnostics go through a series of tests, testing the stream pressure at different conditions, as listed below. Each column will display the pressure results after that part of the test has completed. The status column will reflect the current and final status of the tests.

The following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.



**TIP**

During the Stream Test, streams with no gas pressure will fail, and they will be disabled in the stream sequence. To enable these streams, please click on the Stream Setup button on the Analyzer Operation screen.

### 5.2.5.1 Status

The following descriptive status and definitions are applicable for only the Stream Test and are in addition to those defined for all start-up diagnostics. The tests are run sequentially.

<b>Failed Initial Pressure</b>	Failed the Initial Pressure Test.
<b>Failed Resting Pressure</b>	Failed the Resting Pressure Test.
<b>Failed No Pressure</b>	Failed the Maximum Pressure Test.
<b>Failed Holding Pressure</b>	Failed the Holding Pressure Test.
<b>Failed Flowing Pressure</b>	Failed the Flowing Pressure Test.
<b>Failed Ending Pressure</b>	Failed the Ending Pressure Test.
<b>Waiting</b>	This will be displayed by streams waiting to be tested.

### 5.2.5.2 Description

These alarms are indicative of a sample pressure problem. The causes range from a plugged frit filter to a bad GC module.

### 5.2.5.3 Instructions

- 1) Perform Sample Vent Pressure Test procedure, found in this chapter, for the sample vent. If the test failed, proceed to the next step.
- 2) Perform Feed-Through Assembly Blockage Test on the sample vent (SV). If the test fails, replace feed-through assembly with new or refurbished assembly; otherwise, continue to next step.



Totalflow recommends that a replacement analytical module be installed at this point and additional steps be performed in a clean, lint free atmosphere. Because the customer does not have the required equipment to determine which specific module needs replaced, the final instructions are by process of elimination, beginning with the most likely module.

The Totalflow Repair Department offers a range of services for troubleshooting and repairing/replacing the non-functioning parts. For more information regarding the repair service, contact Customer Service:

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

- 3) Using the Replacing GC Module instructions in Chapter 4 Maintenance, replace the GC module.

## 5.3 Troubleshooting alarms

This section focuses on determining what has caused an alarm following normal operation. The Totalflow NGC has an extensive, built-in list of alarms, some of which are user configurable. These alarms may be grouped into three areas: warning, fault and system fault. See Table 5—1 for a list of all enabled alarms. To view all the available alarms, select Setup under Stream 1 on the Analyzer Operation screen and select Alarm Definitions.

**FYI**



Additionally, Component High/Low Concentration, Component Peak Not Found and Component RF Limit Exceeded alarms are available but disabled. These alarms may be enabled by the user but are not included here for purposes of troubleshooting. Please see the PCCU32 help files for more information regarding these.

### 5.3.1 Operators

- GT = Greater Than
- LT = Less Than
- And = Including
- Or = Instead of
- GE = Greater Than or Equal To
- LE = Less Than or Equal To
- NAND = and Not
- Nor = Not Or
- Plus = In addition to
- Minus = Not Included or subtract from

### 5.3.2 Alarm Severity

#### 5.3.2.1 General

Indicates that an alarm exists, but that it is not critical to the operation of the unit. Use general when testing for some condition that the user thinks may occur from time to time and wants to know when it happens.

### 5.3.2.2 Warning

Indicates that an alarm exists. Typically, this is not critical but may indicate or provide unexpected results.

### 5.3.2.3 Fault

Indicates that a malfunction exists that may effect the operation of the unit and most likely will provide unexpected results. The fault will keep any effected streams from having their data updated; however, a fault would not stop a scheduled or manually initiated calibration from occurring. If the calibration corrects the alarm condition, the alarm will be cleared.

### 5.3.2.4 System Fault

This typically indicates that a maintenance problem exists. Analysis processing will still occur, depending on the problem; however, results will not be updated for any stream while this condition exists. Default system faults are already defined, and unless the user has a situation in which they want to stop all stream data from being updated, should not use this category of alarm.

**Table 5—1 Dual NGC Unit alarms**

Description	Enable	Type	Severity
Pressure Regulator 1	Yes	GT	Fault
Pressure Regulator 2	Yes	GT	Fault
Pressure Regulator 1 (auxiliary)	Yes	GT	Fault
Sample Pressure	Yes	GT	Fault
Oven (Main) Temperature Error	Yes	GT	System Fault
Oven (auxiliary) Temperature Error	Yes	GT	System Fault
No Stream Valve Selected	Yes	GT	System Fault
Digital-analog Bd Comm Error	Yes	GT	System Fault
Calculation Error	Yes	GT	Fault
Calibration Un-Normalized Total	Yes	GT	Fault
Stream Sequence Error	Yes	GT	Fault
Calibration CV Percent Error	Yes	GT	Fault
RF Pct Error	Yes	GT	Fault
Analog Bd (Main) ambient Temp	Yes	GT	Warning
Analog Bd (auxiliary) ambient Temp	Yes	GT	Warning
Analog Power Supply (Main)	Yes	GT	Warning
Analog Power Supply (auxiliary)	Yes	GT	Warning
Low Carrier Gas Bottle (DI1)	Yes	LT	Warning
Low Cal Gas Bottle (DI2)	Yes	LT	Warning
GCM 1 Chrom Process	Yes	GT	System Fault
GCM 2 Chrom Process	Yes	GT	System Fault
Bad Bead	Yes	GT	Fault
No Pilot Valve Change Detected	Yes	GT	Fault
Sample Flow Detect	Yes	GT	Fault
CPU Loading	Yes	GT	Warning

Description	Enable	Type	Severity
System Memory available	Yes	LT	Warning
Ram File available	Yes	LT	Warning
FLASH File available	Yes	LT	Warning
Missing Peak-Cal Not Used	Yes	GT	Warning
Stream Un-Normalized Total	Yes	GT	Warning

### 5.3.3 Pressure Regulator 1, 2 (Main and auxiliary Units) alarm

If Pressure Regulator 1 (main), Pressure Regulator 2 (main) or Pressure Regulator 1 (auxiliary) alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### 5.3.3.1 Description

These alarms are indicative of low or restricted carrier pressure. The causes range from an empty or low carrier bottle, restricted pressure or a blockage inside the GC module.

#### 5.3.3.2 Instructions

- 1) If the carrier bottle regulator includes an installed low pressure switch, investigate if Low Carrier Gas Bottle Warning is also present; otherwise, continue to the next step.
- 2) If Low Carrier Gas Bottle Warning is present, replace the carrier gas bottle; otherwise, continue to the next step.
- 3) Verify the carrier gas bottle pressure is above 90 PSIG. If pressure is below 90 PSIG, replace the carrier gas bottle; otherwise, continue to next step.
- 4) Verify the carrier gas bottle pressure regulator set point is 90 PSIG. If not, correct the set point to 90 PSIG; otherwise, continue to next step.
- 5) Verify column vents 1 (CV1), 2 (CV2) and 1 (CV1 of auxiliary unit), sample vent (SV) and gauge port vent (GPV) are open and unobstructed.
- 6) Check the sampling system for leaks and tubing restrictions. Repair leak or restriction, if found; otherwise, continue to next step.
- 7) Perform start-up diagnostics.
- 8) If the Carrier Pressure Regulator 1, 2 and 3 tests all pass, continue to next step.
- 9) Perform the Column Vent Pressure Test procedure, found in this chapter, for column vent 1 (main), column vent 2 (main) and column vent 1 (auxiliary unit). If any test failed, proceed to the next step.
- 10) Perform the Feed-through Assembly Blockage Test procedure, found in this chapter, on column vent 1 (CV1), column vent 2 (CV2) and column vent 1 (CV1) of the auxiliary unit. If the test fails, replace the feed-through assembly with the new or refurbished assembly; otherwise, continue to next step.

Totalflow recommends that a replacement analytical module be installed at this point and additional steps be performed in a clean, lint free atmosphere.

**CAUTION**



Because the customer does not have the required equipment to determine which specific module needs replaced, the final instructions are by process of elimination, beginning with the most likely module.

The Totalflow Repair Department offers a range of services for troubleshooting and repairing/replacing the non-functioning parts. For more information regarding the repair service, contact Customer Service:

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

- 11) Using the Replacing GC Module instructions in Chapter 4 Maintenance, replace the GC module. If the alarm does not clear, continue to the next step.
- 12) Using the Replacing Analytical Module instructions in Chapter 4-Maintenance, replace the analytical module assembly.

### 5.3.4 Sample Pressure Alarm

If the sample pressure alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### 5.3.4.1 Description

These alarms are indicative of low sample or calibration gas pressure. The causes range from an empty or low calibration gas bottle to a blockage inside the GC module.

#### 5.3.4.2 Instructions

- 1) If the calibration gas bottle regulator includes an installed low pressure switch, investigate if Lo Bottle Calibration Gas Warning is also present; otherwise, continue to next step.
- 2) If Lo Bottle Calibration Gas Warning is present, replace the calibration gas bottle; otherwise, continue to next step.
- 3) Verify the calibration gas bottle pressure is above 15 PSIG. If pressure is below 15 PSIG, replace the calibration gas bottle; otherwise, continue to the next step.
- 4) Verify calibration gas bottle pressure regulator set point is 15 PSIG. If not, correct the set point to 15 PSIG; otherwise, continue to next the step.
- 5) Verify the sample vent is open and unobstructed.
- 6) Perform the Sample Vent Pressure Test found in this chapter. If test failed, continue to the next step; otherwise, skip to step 7.
- 7) Perform Feed-through Assembly Blockage Test, found in this chapter, on the sample vent (SV). If test fails, replace the feed-through assembly; otherwise, continue to next step.

- 8) Check the sampling system for leaks and tubing restrictions. Repair leak or restriction, if found; otherwise, continue to the next step.
- 9) Perform start-up diagnostics.
- 10) If Stream Test fails, continue to the next step.
- 11) Following the Replacing Frit Filters instructions in Chapter 4-Maintenance, verify the filters are clean and free of obstructions. If needed, replace filters.

Totalflow recommends that a replacement analytical module be installed at this point and additional steps be performed in a clean, lint free atmosphere.



Because the customer does not have the required equipment to determine which specific module needs replaced, the final instructions are by process of elimination, beginning with the most likely module.

The Totalflow Repair Department offers a range of services for troubleshooting and repairing/replacing the non-functioning parts. For more information regarding the repair service, contact Customer Service:

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

- 12) Using the Replacing GC Module instructions in Chapter 4-Maintenance, replace the GC module. If alarm does not clear, continue to the next step.
- 13) Using the Replacing Analytical Module instructions in Chapter 4-Maintenance, replace the analytical module assembly.

### 5.3.5 Oven Temperature Error Alarm

If the Oven Wall Temperature (main) or Oven Wall Temperature (auxiliary unit) error alarm is in system fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### 5.3.5.1 Description

This alarm is indicative of an issue surrounding the ability to control the oven temperature. The causes range from an unplugged cable, to an inability to communicate with a sensor.

#### 5.3.5.2 Instructions

- 1) Verify that the auxiliary heater switch on analytical processor board coincides with the feed-through assembly configuration. If the feed-through assembly has an installed auxiliary heater, verify that the switch on board is set to normal. If no auxiliary heater is installed, the switch should be set to override.
- 2) Verify that the temperature sensor is plugged into the GC module.
- 3) Follow the Temperature Sensor Test Procedure found in this chapter. If the test fails, follow the Temperature Sensor to GC Module Assembly replacement instructions in Chapter 4-Maintenance; otherwise, continue to the next step.

- 4) Remaining options are not field repairable. Following the Replacing Analytical Module instructions in Chapter 4-Maintenance, replace module.



**TIP**

The information provided for troubleshooting this alarm is only intended to cover basic steps that can be performed in the field. On occasion, additional troubleshooting steps may be provided by Totalflow Technical Support in an effort to reduce down time. Additionally, it may be desirable to return a module to Totalflow for comprehensive testing and/or repair.

### 5.3.6 No Stream Valve Selected alarm

If the No Stream Valve Selected Alarm is in system fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### 5.3.6.1 Description

These alarms are indicative of an attempt to run a cycle with insufficient sample pressure. If the sample pressure is too low when diagnostics are run, it will disable all streams but continue to try to run chruns. Can also be caused if the digital and analytical board get out of synchronization.

#### 5.3.6.2 Instructions

- 1) Check the sampling system for leaks, tubing restrictions and incorrect pressure setting. Repair leak or restriction, or adjust pressure setting if found; otherwise, continue to the next step.
- 2) Place the NGC in Hold, allow ten minutes (approximately 2 cycles) to lapse and then run a single cycle. If the alarm reappears, continue to the next step.
- 3) Unit should still be in Hold. Manually enable all streams.
- 4) Perform start-up diagnostics.
- 5) If Stream Test fails, continue to the next step.
- 6) Perform warm start, using instructions in Chapter 4-Maintenance.



**TIP**

The information provided for troubleshooting this alarm is only intended to cover basic steps that can be performed in the field. On occasion, additional troubleshooting steps may be provided by Totalflow Technical Support, in an effort to reduce down time. Additionally, it may be desirable to return a module to Totalflow for comprehensive testing and/or repair.

### 5.3.7 Digital-analog Board Communication Error Alarm

If the Digital-Analog Board Communication Error Alarm is in system fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

### 5.3.7.1 Description

These alarms are indicative of a communication error between the digital board and the analytical processor board. Verify cable connectors are firmly and correctly connected to both the digital and analytical processor boards.

### 5.3.7.2 Instructions

- 1) In the alarm log, check the frequency of the error. If multiple errors exist, place the unit in Hold, and then launch a cycle.
- 2) If alarms continue to register, perform a warm start, using instructions in Chapter 4-Maintenance.
- 3) When the unit completes the start-up diagnostics without error, place the unit in Run mode.
- 4) Following 2-3 cycles, verify that no new alarms are registering.
- 5) If the alarms continue to register, call Totalflow Technical Support.



**TIP**

The information provided for troubleshooting this alarm is only intended to cover basic steps that can be performed in the field. On occasion, additional troubleshooting steps may be provided by Totalflow Technical Support in an effort to reduce down time. Additionally, it may be desirable to return a module to Totalflow for comprehensive testing and/or repair.

## 5.3.8 Calculation Error alarm

If the calculation error alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

### 5.3.8.1 Description

These alarms are indicative of AGA-8 compressibility calculation not functioning properly. Typically, this error would be caused by a gas sample being out of specification for AGA-8 but could indicate that the component's peak has shifted.

### 5.3.8.2 Instructions

- 1) Following the Calibrating the NGC instructions in Chapter 3-Startup, perform a calibration ensuring that the next mode is set to Hold.
- 2) When the unit enters Hold, select peak find.
- 3) Verify that the peaks are correctly labeled and integrated. If peaks are not correctly labeled and integrated, continue to the next step; otherwise, skip to step 4.
- 4) In the peak find screen, Run the Auto PF. This process will typically require 45 minutes to complete. When the cycle is complete, repeat step 3.
- 5) Under Next mode, select Run.
- 6) Allow the unit to run a minimum of an hour, then perform a calibration.

**TIP**



The information provided for troubleshooting this alarm is only intended to cover basic steps that can be performed in the field. On occasion, additional troubleshooting steps may be provided by Totalflow Technical Support in an effort to reduce down time. Additionally, it may be desirable to return a module to Totalflow for comprehensive testing and/or repair.

### **5.3.9 Calibration Un-Normalized Error Alarm**

If Calibration Unnormalized Error alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### **5.3.9.1 Description**

These alarms are indicative of a change to the Unnormalized Total of sufficient percentage to activate the alarm. This alarm will discontinue a scheduled calibration and will need to be disabled prior to calibrating the unit.

#### **5.3.9.2 Instructions**

- 1) On the Analyzer Operation screen, click Hold under Next mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 2) Verify the calibration blend concentrations to calibration blend concentrations listed on the Calibration Setup screen. If errors exist, make corrections, and send the setup when complete.
- 3) Under Stream Setup-Alarm Definitions, locate the Calibration Unnormalized Error Alarm, and set the Alarm Enable to No. Send change. Repeat for any additional streams with this alarm.
- 4) Following the Calibrating the NGC instructions in Chapter 3-Startup, perform a calibration, ensuring that the Next mode is set to Hold.
- 5) When unit enters Hold, select Peak Find.
- 6) Verify that peaks are correctly labeled and integrated. If the peaks are correctly labeled and integrated, return the unit to operation; otherwise, continue to the next step.
- 7) Select the Peak Find from the Analyzer Operation screen. Ensure that Automatic is check marked, then select Run Auto PF. This procedure will require approximately 45 minutes.
- 8) When the unit enters Hold, verify that the peaks are correctly labeled and integrated. If the peaks are correctly labeled and integrated, return the unit to operation; otherwise, contact Totalflow Technical Support.
- 9) Reset the alarm enable to Yes. Verify that the Alarm Threshold is a valid configuration. Typically, the Unnormalized Total should be within 6.50% (between 99.5 and 100.5).
- 10) Return the unit to regular operation.



**TIP**

The information provided for troubleshooting this alarm is only intended to cover basic steps that can be performed in the field. On occasion, additional troubleshooting steps may be provided by Totalflow Technical Support in an effort to reduce down time. Additionally, it may be desirable to return a module to Totalflow for comprehensive testing and/or repair.

### **5.3.10 Stream Sequence Error Alarm**

If the Stream Sequence Error Alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### **5.3.10.1 Description**

These alarms are indicative of a synchronization problem, following a manual data Post Process in Factory Mode.

#### **5.3.10.2 Instructions**

- 1) On the Analyzer Operation screen, click Hold under Next Mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 2) Following the Reset Procedure instructions in Chapter 4-Maintenance, perform a Warm Start.

### **5.3.11 Calibration CV Percent Error alarm**

If the Calibration CV Percent Error Alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### **5.3.11.1 Description**

These alarms are indicative of a change to the CV Percent of sufficient percentage to activate the alarm. This alarm will discontinue a scheduled calibration and will need to be disabled prior to calibrating the unit.

#### **5.3.11.2 Instructions**

- 1) On the Analyzer Operation screen, click Hold under Next mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 2) Verify the calibration blend concentrations to calibration blend concentrations listed on the Calibration Setup screen. If errors exist, make corrections, and send the setup when complete.
- 3) Under Stream Setup-Alarm Definitions, locate the Calibration CV Percent Error Alarm, and set the Alarm Enable to No. Send the change. Repeat for any additional streams with this alarm.
- 4) Following the Calibrating the NGC instructions in Chapter 3-Startup, perform a calibration, ensuring that the Next mode is set to Hold.
- 5) When the unit enters Hold, select Peak Find.

- 6) Verify that peaks are correctly labeled and integrated. If peaks are correctly labeled and integrated, return unit to operation.
- 7) Reset the Alarm Enable to Yes. Verify that the alarm threshold is a valid configuration.
- 8) Return the unit to regular operation.



The information provided for troubleshooting this alarm is only intended to cover basic steps that can be performed in the field. On occasion, additional troubleshooting steps may be provided by Totalflow Technical Support in an effort to reduce down time. Additionally, it may be desirable to return a module to Totalflow for comprehensive testing and/or repair.

### 5.3.12 Calibration RF Percent Error alarm

If the Response Factor (RF) Percent Error Alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### 5.3.12.1 Description

These alarms are indicative of a change to the Response Factor of a sufficient percentage to activate the alarm. This alarm will discontinue a scheduled calibration and will need to be disabled prior to calibrating the unit.

#### 5.3.12.2 Instructions

- 1) Verify Calibration Blend concentrations to calibration blend concentrations listed on the Calibration Setup screen. If errors exist, make corrections, and send the setup when complete.
- 2) On the Analyzer Operation screen, click Hold under Next mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 3) Under Stream Setup-Alarm Definitions, locate the RF Percent Error Alarm, and set the Alarm Enable to No. Send the change. Repeat for any additional streams with this alarm.
- 4) When the unit enters Hold, select Peak Find. Select Run Auto PF.
- 5) Verify that the peaks are correctly labeled and integrated. If the peaks are correctly labeled and integrated, return the unit to operation.
- 6) Allow the unit to cycle 3-4 times.
- 7) Following the Calibrating the NGC instructions in Chapter 3-Startup, perform a calibration, ensuring that the Next mode is set to Hold.
- 8) Reset the alarm enable to Yes. Verify that the alarm threshold is a valid configuration.
- 9) Return the unit to regular operation.

**TIP**



The information provided for troubleshooting this alarm is only intended to cover basic steps that can be performed in the field. On occasion, additional troubleshooting steps may be provided by Totalflow Technical Support in an effort to reduce down time. Additionally, it may be desirable to return a module to Totalflow for comprehensive testing and/or repair.

### 5.3.13 Enclosure Temperature Alarm

If the Enclosure Temperature alarm is in Warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### 5.3.13.1 Description

These alarms are indicative of either extremely high or low temperatures inside the enclosure. Causes could range from external temperatures being extremely high or low, to a bad temperature sensor on the analytical board.

#### 5.3.13.2 Instructions

- 1) Compare the outside temperature with the temperature reading on the Analyzer Operation screen Enclosure Temperature. Atmospheric temperature could be less than the enclosure temperature by as much as 20 degrees.
- 2) If the temperature differential seems reasonable, the unit may be operating out of range. This unit is designed to operate between 0°F and 120°F; otherwise, continue to the next step.
- 3) If the temperature differential does not seem reasonable, the analytical processor assembly may have a bad temperature sensor. As this alarm is only a warning, it will not effect the operation of the unit. The user may replace the analytical processor assembly at their leisure.

**FYI**



The Totalflow Repair Department offers a range of services for troubleshooting and repairing/replacing the non-functioning parts. For more information regarding the repair service, contact Customer Service:

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

### 5.3.14 Power Supply Alarm

If the Power Supply Alarm is in Warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### 5.3.14.1 Description

These alarms are indicative of the input voltage, either below 11 volts or above 16 volts. Causes may range from a power supply issue to a bad cable.

#### **5.3.14.2 Instructions**

- 1) Check the power supply to the termination panel, following instructions later in this chapter, Termination Panel Supply Voltage Test. If the test fails, restore the power supply to the proper working specifications; otherwise, continue to the next step.
- 2) Following the cable replacement instructions in Chapter 4-Maintenance, check the analytical processor to termination panel cable for damage. If the cable is damaged, replace; otherwise, continue to the next step.
- 3) Following the cable replacement instructions in Chapter 4-Maintenance, check the termination panel to digital controller cable for damage. If cable is damaged, replace; otherwise, contact Totalflow Technical Support for additional instructions.

#### **5.3.15 Low Carrier Gas Bottle (DI1) Alarm**

If the Low Carrier Gas Bottle (DI1) Alarm is in Warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

##### **5.3.15.1 Description**

These alarms are indicative of the carrier gas bottle pressure below the threshold.

##### **5.3.15.2 Instructions**

- 1) Verify that the carrier gas bottle regulator low pressure switch threshold is set around 90 PSIG. The alarm is switched when pressure drops below threshold.
- 2) If the threshold is above current bottle PSIG, replace carrier gas bottle.
- 3) If the threshold is below current bottle PSIG, verify regulator is functioning properly.

#### **5.3.16 Low Cal Gas Bottle (DI2) Alarm**

If the Lo Bottle Calibration Gas (DI2) Alarm is in Warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

##### **5.3.16.1 Description**

These alarms are indicative of calibration gas bottle pressure below the threshold.

##### **5.3.16.2 Instructions**

- 1) Verify that the calibration gas bottle regulator low pressure switch threshold is set around 15 PSIG. The alarm is switched when pressure drops below the threshold.
- 2) If the threshold is above current bottle PSIG, replace calibration gas bottle.
- 3) If the threshold is below current bottle PSIG, verify regulator is functioning properly.

### 5.3.17 GCM Processing Error Alarm

If the GCM Chrom Process alarm is in Warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### 5.3.17.1 Description

This alarm is indicative of an error that stops the GCM application from signaling the chrom application to process a chrom. The following internal errors could instigate this alarm: communication response error, polling error, sequence error and data error.

#### 5.3.17.2 Instructions

- 1) In the alarm log, check the frequency of the error. If multiple errors exist, place the unit in Hold, and then launch a cycle.
- 2) If the alarms continue to register, perform a warm start.
- 3) When unit completes the start-up diagnostics without error, place the unit in run.
- 4) Following 2-3 cycles, verify that no new alarms are registering.
- 5) If the alarms continue to register, call Totalflow Technical Support.



The information provided for troubleshooting this alarm is only intended to cover basic steps that can be performed in the field. On occasion, additional troubleshooting steps may be provided by Totalflow Technical Support in an effort to reduce down time. Additionally, it may be desirable to return a module to Totalflow for comprehensive testing and/or repair.

### 5.3.18 Bad Bead Alarm

If Bad Bead Alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### 5.3.18.1 Description

These alarms are indicative of problem with the GC module.

#### 5.3.18.2 Instructions

- 1) Following the GC Module Replacement instructions in Chapter 4-Maintenance, replace the GC module.

### 5.3.19 No Pilot Valve Change Detected Alarm

If the No Pilot Valve Change Detected Alarm is in Warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

### **5.3.19.1 Description**

These alarms are indicative of a pressure regulator problem on the manifold. During Backflush, a valve is changed, but no disturbance is registered.

### **5.3.19.2 Instructions**

- 1) Verify the carrier gas bottle pressure is above 90 PSIG. If pressure is below 90 PSIG, replace the carrier gas bottle; otherwise, continue to next step.
- 2) Verify the carrier gas bottle pressure regulator set point is 90 PSIG. If not, correct the set point to 90 PSIG; otherwise, continue to next step.
- 3) Following the Manifold Replacement instructions in Chapter 4-Maintenance, replace the manifold.

## **5.3.20 Sample Flow Detection Alarm**

If the Sample Flow Detection Alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

### **5.3.20.1 Description**

These alarms are indicative of a pressure issue: blocked vent tube, too short bleed cycle or stream test is in auto.

### **5.3.20.2 Instructions**

- 1) Inspect the vent tubes for blockage, including crimps in tubing, dirt or debris.
- 2) Following the instructions later in this chapter, perform Sample Pressure Test.
- 3) Verify sample the bleed time is set greater than 1 second.
- 4) Following the GC Module Replacement instructions in Chapter 4-Maintenance, replace the GC module.

## **5.3.21 CPU Loading Alarm**

If the CPU Loading Alarm is in Warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

### **5.3.21.1 Description**

These alarms are indicative of processor being overloaded. An occasional spike in the processor loading is to be expected. Multiple occurrences are not field repairable.

### **5.3.21.2 Instructions**

- 1) View the alarm history for multiple occurrences. If an occasional warning is registered, this is not a problem.
- 2) If multiple alarm occurrences exist, contact Totalflow Technical Support for additional help.

### 5.3.22 System Memory available Alarm

If the System Memory Available Alarm is in Warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### 5.3.22.1 Description

These alarms are indicative of the Task Memory resource becoming full. The recommended files size for Task Memory is 1 to 2 MB. This alarm may be received after adding additional applications.

#### 5.3.22.2 Instructions

- 1) View the alarm history for multiple occurrences. If an occasional warning is registered, this is not a problem.
- 2) View Resources from PCCU Entry screen to check available memory. If applicable, the available memory could be increased incrementally.

**FYI**



Please note that when increasing the available Memory, the available RAM File Space is reduced. Caution should be used.

- 3) Following the Reset Procedure instructions in Chapter 4-Maintenance, warm start the unit to defrag the system memory.
- 4) Reducing the number of instantiated applications may be required. Contact Totalflow Technical Support for assistance.

### 5.3.23 RAM File Available Alarm

If the RAM File Available Alarm is in Warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### 5.3.23.1 Description

These alarms are indicative of the TFDData File resource becoming full. The recommended files size for TFDData is 2 to 3 MB. This alarm may be received after changing the log period frequency, adding applications or setting up additional trend files.

#### 5.3.23.2 Instructions

- 1) View the alarm history for multiple occurrences. If an occasional warning is registered, this is not a problem.
- 2) View Resources from the PCCU Entry screen to check available RAM file space. If applicable, the RAM file space could be increased incrementally.

**FYI**



Please note that when increasing the RAM file space, the available memory file space is reduced. Caution should be used.

- 3) Following the Reset Procedure instructions in Chapter 4-Maintenance, warm start the unit to defrag the system memory.

- 4) Reducing the number of instantiated applications, trend files or lengthening the log periods may be required. Contact Totalflow Technical Support for assistance.

#### **5.3.24 FLASH File Available Alarm**

If the FLASH File Available Alarm is in Warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

##### **5.3.24.1 Description**

These alarms are indicative of a shortage of file space in the 32 MB FLASH. Typically, this space is not user accessible; however, instantiating too many applications may cause an alarm.

##### **5.3.24.2 Instructions**

- 1) View the alarm history for multiple occurrences. If an occasional warning is registered, this is not a problem.
- 2) Please contact Totalflow Technical Support for assistance.

#### **5.3.25 Missing Peak-Calibration Not Used**

If Missing Peak-Calibration Not Used is in Warning status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

##### **5.3.25.1 Description**

These alarms are indicative of a missing peak during a calibration cycle and calibration will not be used.

##### **5.3.25.2 Instructions**

- 1) Verify the calibration blend concentrations to calibration blend concentrations listed on the Calibration Setup screen. If errors exist, make corrections, and send the setup, when complete.
- 2) On the Analyzer Operation screen, click Hold under Next mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 3) When the unit enters Hold, select Peak Find. Select Run Auto PF.
- 4) Verify that the peaks are correctly labeled and integrated. If the peaks are correctly labeled and integrated, return the unit to operation.
- 5) Allow the unit to cycle 3-4 times.
- 6) Following the Calibrating the NGC instructions in Chapter 3-Startup, perform a calibration. Ensure that the Next mode is set to Hold.
- 7) When unit the enters Hold, verify that the peaks are correctly labeled and integrated. If the peaks are correctly labeled and integrated, return unit to operation; otherwise, continue to the next step.

- 8) Select Peak Find from the Analyzer Operation screen. Ensure that automatic is check marked, then select Run Auto PF. This procedure will require approximately 45 minutes.
- 9) When the unit enters Hold, verify that the peaks are correctly labeled and integrated. If the peaks are correctly labeled and integrated, return the unit to operation; otherwise, contact Totalflow Technical Support.

### 5.3.26 Stream Unnormalized Total

If the Stream Unnormalized Total is in Warning status (default), the following procedure will step the user through the troubleshooting process. If the severity of the alarm is set to fault, the new stream data is not allowed to update. On occasion, these instructions may detour the user to other procedures, and when complete, they should return to these procedures to continue.

#### 5.3.26.1 Description

These alarms are indicative of a change to the Process Stream Unnormalized Total of Sufficient Percentage to activate the alarm.

#### 5.3.26.2 Instructions

- 1) Verify that alarm threshold is a valid configuration. Typically, the Unnormalized Total should be within 6.50% (between 99.5 and 100.5).
- 2) Verify the calibration blend concentrations to calibration blend concentrations listed on the Calibration Setup screen. If errors exist, make corrections, and send the setup when complete.
- 3) On the Analyzer operation screen, click Hold under Next mode. When the unit completes the current cycle and enters Hold, the user may continue to the next step.
- 4) When the unit enters Hold, select Peak Find. Select Run Auto PF. Ensure that Automatic is check marked, then select Run Auto PF. This procedure will require approximately 45 minutes.
- 5) Verify that the peaks are correctly labeled and integrated. If the peaks are correctly labeled and integrated, return the unit to operation; otherwise, continue to the next step.
- 6) Allow unit to cycle 3-4 times.
- 7) Follow the Calibrating the NGC instructions in Chapter 3-Startup, perform a calibration.

## 5.4 Alarm Troubleshooting Tests

### 5.4.1 Sample Vent Pressure Test

#### 5.4.1.1 Instructions

- 1) Attach Flowmeter to SV.

**FYI**



This test can be run on both the main and auxiliary units.

- 2) From the Analyzer Operation screen, click on Diagnostics.
- 3) Select the Manual Operation tab.

- 4) Under Manual Control, open the sample shutoff valve.
- 5) When opened, the SV should measure a spike to 15 sccm. Close the valve when done reading.
- 6) If the SV does not spike to 15 sccm, the test has failed.
- 7) Return to Troubleshooting instructions.

## 5.4.2 Column Vent Pressure Test

### 5.4.2.1 Instructions

- 1) Attach the Flowmeter to CV1.

**FYI**



This test can be run on both the main and auxiliary units.

- 2) From the Analyzer Operation screen, click on Diagnostics.
- 3) Select the Manual Operation tab.
- 4) Under Manual Control, open Stream 1 Valve.
- 5) When opened, CV1 should measure between 3–12 sccm. Close the valve when done reading.
- 6) If the CV1 measures within range, continue to the next step. If CV1 does not measure within range, the test has failed. Return to the Troubleshooting Alarms instructions.
- 7) Attach the Flowmeter to CV2.
- 8) Open the Stream 1 Valve.
- 9) When opened, the CV2 should measure between 3–12 sccm. Close the valve when done reading.
- 10) If the CV2 does not measure within the range, the test has failed. Return to the Troubleshooting Alarms instructions.

## 5.4.3 Sample Pressure Test

### 5.4.3.1 Instructions

- 1) Place the unit in Hold.
- 2) From the Analyzer Operation screen, click on Diagnostics.
- 3) Select the Manual Operation tab, and select Monitor.
- 4) Read the sample pressure from the current reading.
- 5) Under Manual Control, open Stream 1 Valve or stream reflecting alarm.
- 6) Under Manual Control, close the sample shutoff valve.
- 7) The sample pressure reading under current should increase.
- 8) Under Manual Control, open the sample shutoff valve.
- 9) The sample pressure reading under current should decrease rapidly.
- 10) If the pressure decreases slowly, return to the Troubleshooting Alarm instructions. The test has failed.

## 5.4.4 Feed-Through Assembly Blockage Test

### 5.4.4.1 Instructions

- 1) Remove the feed-through assembly from the NGC, following the Feed-Through Assembly instructions in Chapter 4-Maintenance.

**FYI**



This test can be run on both the main and auxiliary units.

- 2) If testing from the Pressure Regulator 1 or 2 Alarm, continue to steps 3 and 4.
- 3) If testing from the Stream Test in the start-up diagnostics or from the Sample Pressure Alarm, skip to step 5.
- 4) Attach the pressure source to the CV1, and activate. If flow through assembly is impeded, the test has failed. Return to Troubleshooting Alarms instructions; otherwise, continue to the next step.
- 5) Attach the pressure source to the CV2, and activate. If the flow through assembly is impeded, the test has failed. Return to the Column Vent Pressure Test.
- 6) Attach the pressure source to the SV, and activate. If the flow through assembly is impeded, the test has failed. Return to the Troubleshooting Alarms instructions.

## 5.4.5 Temperature Sensor Test

### 5.4.5.1 Instructions

- 1) Following Replacing Temperature Sensor to GC Module cable instructions in Chapter 4-Maintenance, unplug the sensor from the GC module.

**FYI**



This test can be run on both the main and auxiliary units.

- 2) Connect the digital multimeter (DMM). Set to read resistance, positive lead to pin 1 and negative lead to pin 2.
- 3) The meter should indicate a resistance reading between approximately 10 K ohms and 1 M ohms. Resistance value is dependent on the temperature of the gas chromatograph oven and ambient temperature; therefore, any reading in this range should indicate a functioning temperature sensor.

## 5.4.6 Abnormal Calibration Gas Depletion

### 5.4.6.1 Description

If the calibration (and/or carrier) gas has depleted significantly quicker than expected, there may one or more issues.

### 5.4.6.2 Instructions

- 4) If the NGC has been running normally but consuming too much calibration (and/or carrier) gas, carefully leak test the gas bottle regulator, tubing and connections to the NGC.

- 5) If the unit is a new start-up installation, check and tighten the analytical module mounting bolt. The module may have been loosened due to vibration during shipping.
- 6) If the unit has been disassembled recently, re-check and tighten all assemblies, including the analytical module mounting bolt.
- 7) If the NGC has been powered down for any significant length of time, the calibration (also carrier and sample) gas should be shut off. Some valves may be left in an open or partially open state, allowing gas to continue flowing.

## 5.5 Power Troubleshooting

This section focuses on determining what has caused the NGC to lose power. Generally, loss of power can be attributed to only the power supply system; however, if the power supply system is used for powering a transceiver or other peripheral equipment, a problem with that equipment may drain the battery and cause the NGC to lose power. Notice that the Power Troubleshooting Flowchart (see Figure 5–2) takes the user through several tests but also directs the user to the Communication Troubleshooting Flowchart located further in this chapter.

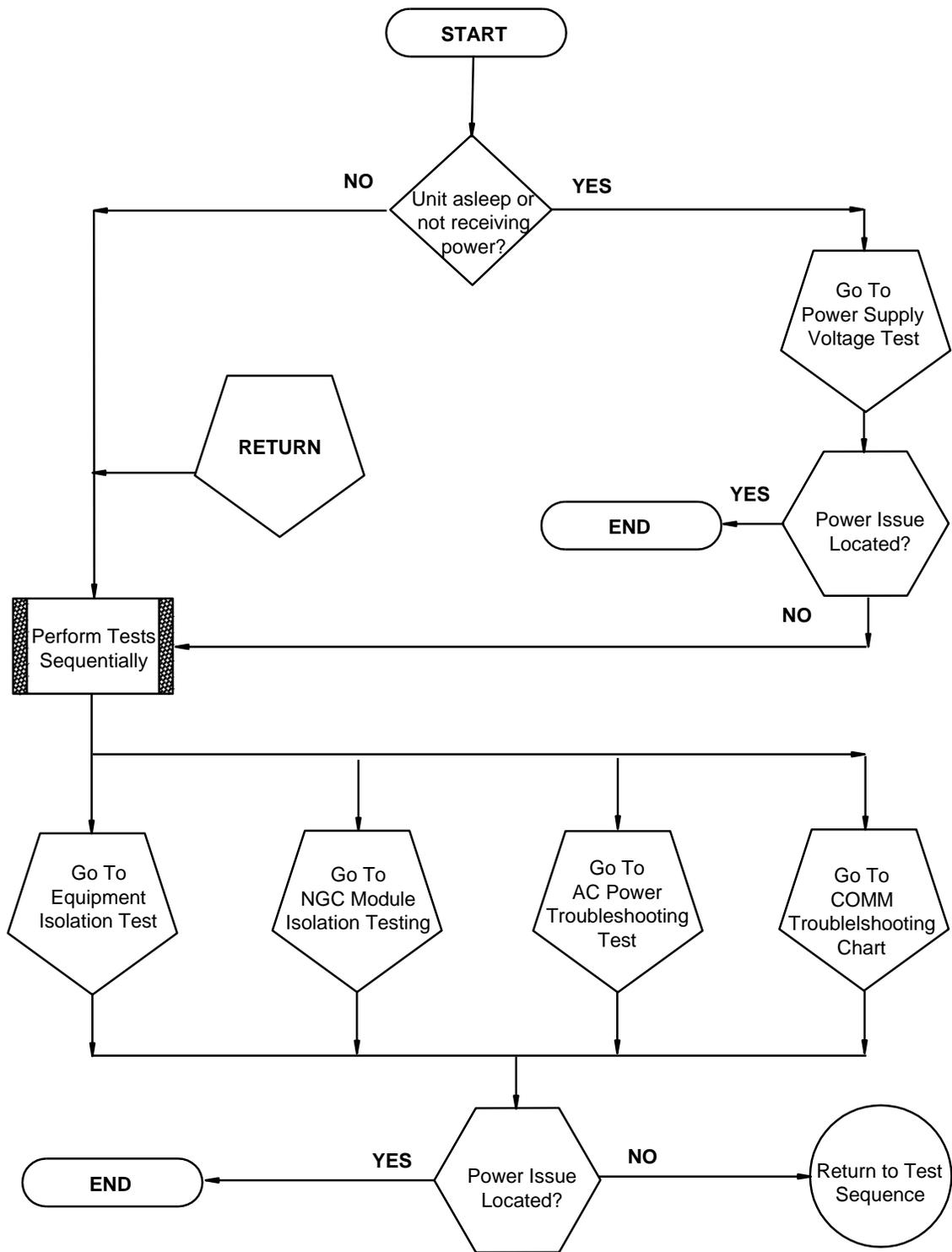


Figure 5-2 Power Troubleshooting Flowchart

## 5.5.1 Power Supply Voltage Test



**TIP**

This test assumes a power supply that is in good working order and that has previously been tested and qualified to power an NGC. If the power supply is under suspicion, it is recommended that it be replaced with a known good power supply before conducting these tests.

### 5.5.1.1 Instructions

- 1) Check that the power supply voltage setting, the power supply current rating and the cables used for the installation meet the recommended requirements (see System Specifications in Chapter 1).
- 2) If this is a new installation and external equipment is being powered from the NGC termination panel, call Totalflow Technical Support for help in evaluating the cable and power supply installation requirements.
- 3) Correct and retest, as necessary.
- 4) Check for a poor cable connection in the cable between the NGC and the power source. Verify all field wiring screw terminals are tight.
- 5) Correct and retest, as necessary.
- 6) Verify that there are no other devices that may drop an excessive voltage across them in the power supply circuit (to the NGC) like a fuse, diode, or a barrier device, etc.
- 7) Correct and retest, as necessary.
- 8) Disconnect the power supply cable at the NGC (main unit) termination panel, J1.
- 9) Measure the power supply cable voltage at the connector, and compare with the table recommendations (see Table 1—4 and Table 1—5).
- 10) If the power supply voltage does not meet recommendations, check the cabling and other loads on the power supply. Also, check the power supply output voltage setting.
- 11) Correct and retest, as necessary.
- 12) Reconnect the power supply cable to the NGC (main unit) termination panel, J1.

## 5.5.2 Equipment Isolation Test

This test isolates peripheral equipment from the equation to verify that the excessive current is not being drawn from the power source thus reducing the amount of power supplied to the NGC.

This procedure assumes that the previous Power Supply Voltage Test was performed and that no errors were found.

### 5.5.2.1 Instructions

- 1) While the NGC is operating, verify that the voltage at the NGC termination panel (main unit) is between 11.5-16 VDC (for 12 VDC systems) or 22 VDC to 28 VDC (for 24 VDC systems).

The NGC uses Pulse Width Modulation technology to drive its heaters and valves. Due to this feature, a DMM may not show the voltage present at the NGC termination panel accurately; however, in no case, even under load, should the DMM indicate a voltage less than 11.5 VDC (or 22 VDC for 24 VDC system), if the proper cables are used. It may be necessary to have a digital volt meter capable of capturing fast transients (less than 1 ms in duration).



For example: While using a DMM with fast transient capture capability, set the DMM to capture the minimum voltage (sometimes this is a Min/Max measurement), using its fast transient capability, and then let it monitor the NGC while operating for a few minutes. This should provide a good indication of the minimum voltage appearing at the NGC terminals.

- 2) Is voltage within limits? If No, continue to the next step. If yes, no physical problem is found.
- 3) Is external equipment such as a radio or other device being powered from the NGC termination panel? If No, return to Figure 5–2 Power Troubleshooting Flowchart, and continue the test sequence. If Yes, continue to next step.
- 4) Disconnect the peripheral equipment from NGC.
- 5) While the NGC is operating, verify that the voltage at the NGC termination panel (main unit) is between 11.5-16 VDC (for 12 VDC systems) or 22 VDC to 28 VDC (for 24 VDC systems).
- 6) Is voltage within limits? If No, return to Figure 5–2 Power Troubleshooting Flowchart, and continue the test sequence. If Yes, external equipment is drawing excessive current. Check the equipment and related wiring. Correct and retest, if necessary.

### 5.5.3 NGC Module Isolation Test

This test isolates the NGC modules to pinpoint equipment failure.

This procedure assumes that the previous Power Supply Voltage Test and Equipment Isolation Test were performed and that no errors were found.

#### 5.5.3.1 Instructions

- 1) With power still supplied to the termination panel, J1 connector (main unit), disconnect the power supply cable at the termination panel.
- 2) Using instructions in Chapter 4-Digital Controller Assembly Mounting Bracket, remove the digital controller, and disconnect the termination panel to digital controller cable.
- 3) Using instructions in Chapter 4-Replacing Analytical Module, remove the analytical module.
- 4) With power still disconnected from the NGC, measure the voltage at the J1 connector screw terminals. Record the value as power supply voltage (open circuit).
- 5) Reconnect the power supply cable at the NGC termination panel, J1.

- 6) Measure the voltage at the termination panel, J1 connector screw terminals. The voltage should be within 0.1V of power supply voltage (open circuit). I.e., only 0.1V drop max., between the PS and the NGC.
- 7) If the voltage drop is greater than 0.1V, replace the termination panel, using instructions in Chapter 4-Replacing Termination Panel, and return to step 6. If the voltage drop is greater than 0.1V again, call Totalflow Technical Support, following instructions in the Introduction-Getting Help.
- 8) If the drop is less than 0.1V, check the termination panel to analytical processor cable for pinched or exposed insulation. Also, check the feed-through auxiliary heater cable for similar damage.
- 9) Was damaged cable found? If Yes, replace appropriate cable, using instructions in Chapter 4.
- 10) If No, use instructions in Chapter 4-Replacing Analytical Module. Replace the module. Skip to step 10.
- 11) Reinstall the analytical module.
- 12) Reinstall the digital controller assembly
- 13) If disconnected during a procedure, reconnect the J1 power supply connector to the termination panel. It may require 10-60 seconds for the processors in the NGC to fully boot and for the NGC to start drawing normal to full power; however, under normal operation, the NGC should never, at any time, draw current beyond its rated values.
- 14) Return to the Equipment Isolation Test

#### 5.5.4 AC Power Supply Troubleshooting Test

If the system setup includes an AC charger/power supply connected to the optional equipment enclosure and is not supplying the required voltage to the NGC unit, the user may need to test the AC charger/power supply. The following instructions contain the steps required to do so.

##### 5.5.4.1 Instructions

- 1) Check the input AC voltage to the enclosure power supply. Be certain the primary AC voltage is correct.
- 2) If the primary input AC voltage level is correct and there is no DC output from the power supply, replace the AC charger/power supply.

## 5.6 Troubleshooting Communications

These troubleshooting procedures are applicable to an NGC with an installed radio in the optional equipment enclosure. Use Figure 5–3 as an aid for troubleshooting communication problems. All communications are the responsibility of the main unit. The three basic types of radio communications that can be used between the NGC and a radio receiver are:

- RS-232 communications (see Table 5—2 for pin configurations)
- RS-485 communications (see Table 5—3 for pin configurations)
- RS-422 communications (available, but not detailed)

The radio/modem may be powered one of two ways: Always On or Switched. The user's specific system set up will determine what steps they need to power the radio/modem.

When switching power to a radio with Inhibit (SLEEP) mode, the serial port 1 or 2 switched power line, will go to the radio's Inhibit (SLEEP) Mode input. Power out will go to the radio's power input.

### **5.6.1 Communication**

Troubleshooting the communications for this unit requires that equipment in two areas be tested: the NGC comm ports and the external communication device. This is discussed in more detail in the Communications Overview section.

Other communication troubleshooting information is shared in the following categories:

- RS-232 communications
- RS-485 communications
- RS-422 communications

### **5.6.2 Setting Up Communication**

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

- Verify field wiring terminations on the NGC termination panel (main unit).
- Verify field wiring from the NGC unit to the termination strip inside the OEU enclosure.
- Verify field wiring from the termination strip to the radio.
- Check the NGC identifier (ID). Log the ID for future reference.
- Log the NGC access security code, baud rate, listen cycle, protocol and interface for future reference.

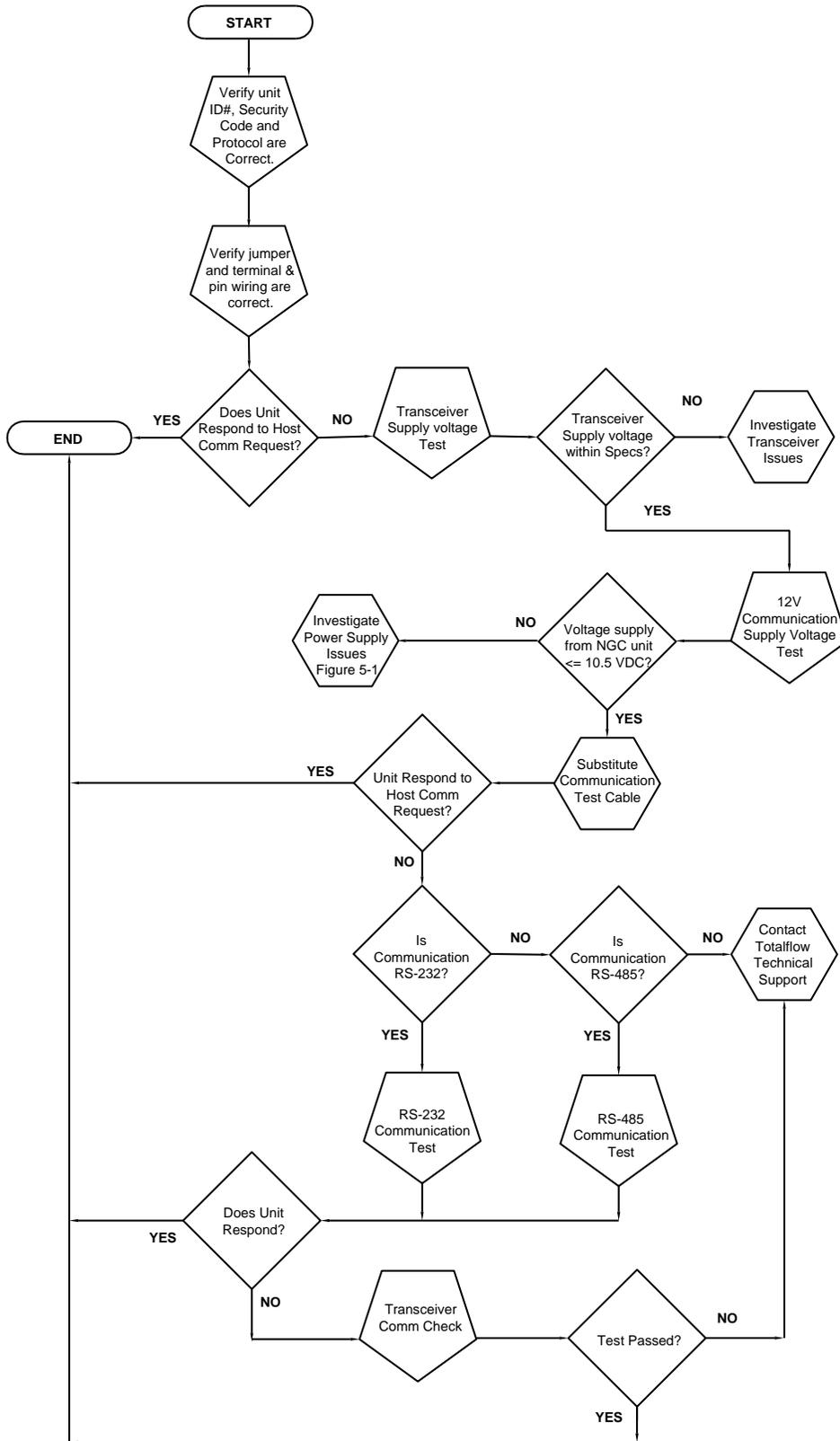


Figure 5-3 Communication Troubleshooting Flowchart

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

**FYI**



- When communication equipment is powered/switched on, NGC displays the communication icon after it recognizes the NGC ID and is responding.
- Check the baud rate of NGC transmission and LISTEN time settings. The baud rate and time settings can be changed by entering the Station Setup screen from the Analyzer Operation screen. Default settings are 1200 baud and the listening time is four seconds and the communications interface is turned off.
- The minimum power required for operating remote communications is 11.9 VDC (default) or as set by user. Should the power fall below this level, remote communications will be terminated.
- Test remote communications, using RS-232 troubleshooting cable (2011781-xxx). Use RS-232 to RS-485 communication converter (1800255-xxx) in conjunction with RS-232 troubleshooting cable to test RS-485 remote communications.

### 5.6.3 Transceiver Supply Voltage Test

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

**FYI**



If the transceiver is not receiving sufficient voltage, investigate power supply issues. These may involve wiring irregularities at either the AC charger/power supply, XFC/XRC board (6770 only) or at the power relay, if using relay for switching power to radio.

### 5.6.4 12 VDC Communication Supply Voltage Test

#### 5.6.4.1 Instructions

If the transceiver does not feature a SLEEP mode and power is supplied through an optional relay, begin with step 1-Relay Supply Voltage Test.

If the transceiver features a SLEEP mode or is continuously powered, begin with step 2.

- 1) If the transceiver does not feature a SLEEP mode and receives power through an optional relay, activate serial port 1 or 2 switched power out (pin 3), and using a digital multimeter (DMM) set to volts DC, measure the voltage at the relay between relay coil terminals.

If voltage reads the same as supplied voltage (12 VDC) and transceiver is still not receiving power, the relay may be incorrectly wired (use normally open contacts) or relay may be bad.

If the relay is not receiving power, continue to step 2.

- 2) If the transceiver features a SLEEP mode or is continuously powered, using a digital multimeter (DMM) set to volts DC, measure the voltage at the next supply junction. Verify wiring is firmly connected; otherwise, continue to the charger relay and measure voltage between:

Power (+) and Ground (-).

- 3) Voltage should be greater than or equal to 11.9 VDC for this unit. If voltage is less than 11.9, return to the test sequence outlined in the Power Troubleshooting Flowchart (see Figure 5–2).

### 5.6.5 Transceiver Check

#### 5.6.5.1 Instructions

- 1) If available, use a wattmeter to check the transceiver output power. Refer to manufacturer’s documentation for measuring instructions.
- 2) If available, use two (2) hand-held transceivers, and verify the communication path between the master and remote sites. Voice activated interface can be used, if available.
- 3) Verify that the transceiver is set to the correct frequency. Refer to the manufacturer’s documentation for checking frequency instructions.
- 4) If a directional antenna is used, verify the orientation to the antenna to the master site.

**FYI**



If a communication problem still exists, and the unit has passed the Transceiver Check Test, contact Totalflow Customer Service for additional help.

### 5.6.6 RS-232 Communication Test

The following RS-232 Serial Communication Test procedure is directed from Figure 5–3 and will assist the user in what may be the possible cause for the indicated error message.

Before performing this test, please verify that the field wiring is correct (see Table 5–2).

**Table 5—2 RS-232 Field Wiring on NGC Termination Panel (Main unit)**

	Description	Description
PIN	Jumper 8–Port 1	Jumper 10–Port 2
1	Power Out	Power Out
2	Ground	Ground
3	Switched Power Out	Switched Power Out
4	Operate	Operate
5	Not Used	Not Used
6	Request to Send	Request to Send

	Description	Description
7	Transmit Data	Transmit Data
8	Receive Data	Receive Data
9	Clear to Send	Clear to Send



**TIP**

When troubleshooting RS-232 mode, verify the termination settings of serial port 1, J9, and serial port 2, J11, on the termination panel (main unit) have pins 2 and 3 jumpered.

### 5.6.6.1 Instructions

Voltage on the following steps may be hard to see using a digital multimeter. If available, an oscilloscope will provide a more accurate reading. To verify, the host software must be continuously polling the NGC.



**TIP**

Generally speaking, these tests performed on the terminal board will only verify incorrect or damaged wiring. If all previous testing passed and all wiring, jumper and terminations have been verified as correct, the board will need to be replaced. Contact Totalflow Customer Service. See Getting Help in the introduction of this manual for instructions.

- 1) Using an oscilloscope, measure the receiving data voltage on the termination panel, J8 or J10 (main unit), between:

Port 1, J8—pin 2 (Ground) and pin 8 (Receive data) or

Port 2, J10—pin 2 (Ground) and pin 8 (Receive data).

When the unit is receiving data from the host, the voltage should vary between -5 VDC and +5VDC. This would indicate that the unit is receiving data; continue to step 2. If the unit is not receiving data, investigate the wiring issues (see Table 5—2).

- 2) Using an oscilloscope, measure the Request to Send voltage on the termination panel, J8 or J10 (main unit), between:

Port 1, J8—pin 2 (Ground) and pin 6 (Request to Send) or

Port 2, J10—pin 2 (Ground) and pin 6 (Request to Send).

When the unit is communicating to the host, the voltage should be +5VDC and remain +5VDC until the XFC transmit stops. This would indicate that the unit is transmitting data; continue to step 3. If the unit is not receiving data, investigate the wiring issues (see Table 5—2).

- 3) Using an oscilloscope, measure transmit data voltage on the termination panel, J8 or J10 (main unit), between:

Port 1, J8—pin 2 (Ground) and pin 7 (Transmit data) or

Port 2, J10—pin 2 (Ground) and pin 7 (Transmit data).

When the unit is transmitting to the host, the voltage should vary between -5 VDC and +5VDC. This would indicate that the unit is transmitting data. If the unit is still not responding, continue to next test as directed in Figure 5—3.

### 5.6.7 RS-485 Communications

The following RS-485 Serial Communication Test procedure is directed from Figure 5–3 and will assist the user in what may be the possible cause for indicated error message.

Before performing this test, please verify that the field wiring is correct (see Table 5–2).



**TIP**

When troubleshooting RS-485 mode, verify the termination settings of port 1, J9, and port 2, J11, on the termination panel (main unit) are correctly jumpered (see Table 5–3).

**Table 5–3 RS-485 Terminations (Main Unit)**

Serial Comm Port	1	2
Jumper	J9	J11
First or Intermediate Unit	Pins 2–3	Pins 2–3
Last or Only Unit	Pins 1–2	Pins 1–2

### 5.6.8 RS-485 Communication Test

Before performing this test on the termination panel (main unit) located inside the rear end cap, please verify that the wiring is correct (see Table 5–4).

**Table 5–4 RS-485 Field Wiring on NGC Termination Panel (Main Unit)**

	Description	Description
PIN	J8–Port 1	J10–Port 2
1	Power	Power
2	Ground	Ground
3	Switched Power Out	Switched Power Out
4	Operate	Operate
5	Remote Request to Send	Remote Request to Send
6	Transmit Bus (+)	Transmit Bus (+)
7	Transmit Bus (-)	Transmit Bus (-)
8	Receive Bus (+) (RS-422)	Receive Bus (+) (RS-422)
9	Receive Bus (-) (RS-422)	Receive Bus (-) (RS-422)

### 5.6.8.1 Instructions

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

**FYI**



Generally speaking, these tests performed on the termination panel (main unit) will only verify incorrect or damaged wiring. If all previous testing passed and all wiring, jumper and terminations have been verified as correct, the termination panel may need to be replaced but does not typically fail. Contact Totalflow Customer Service. See Getting Help in the introduction of this manual for instructions.

- 1) Using an oscilloscope, measure line driver voltage on termination panel J8 or J10 (main unit) between:

Port 1, J8–pin 7 (BUS-) and pin 6 (BUS+) or

Port 2, J10–pin 7 (BUS-) and pin 6 (BUS+).

When the unit is receiving data from the host, voltage should vary between +5 VDC and 0 VDC. This would indicate that the unit is receiving data.

- 2) Using an oscilloscope, measure Remote Request to Send voltage on termination panel, J8 or J10 (main unit):

Port 1, J8–pin 2 (Ground) and pin 5 (RRTS)

Port 2, J10–pin 2 (Ground) and pin 5 (RRTS)

When the unit is transmitting data, the voltage should vary between +5 VDC and 0 VDC. This would indicate that the RRTS is working correctly.

- 3) If any inaccuracy exists, investigate wiring errors or damaged wires.

**FYI**



If a communication problem still exists and the unit has passed the tests in steps 1 and 2, additional testing will be required.



## 6.0 MODEL 8209 (C9+ APPLICATION)

### 6.1 Overview

The purpose of this document is to supplement the basic manual, (NGC8200 Dual unit). The Model 8209 is simply a pairing of the main unit (C6+) with an auxiliary unit (C9+). The auxiliary unit provides a third column to deal with C6, C7, C8 and C9+. The user will do all local and remote communication through the main unit. The user would have little reason to deal directly with the auxiliary unit. The auxiliary unit looks identical to the main unit except that the auxiliary unit has no LCD display. The two units (main and auxiliary) communicate with one another through an explosion proof cable.

The scope of this document is to cover any pertinent differences between the more common NGC8206 (C6+ unit) and the NGC 8209 (C9+ unit). While the two units share a great deal of commonality, there are several differences that the user should be aware of.

Most of the differences revolve around the following issues:

- Installation
- Power supply
- Setup
- Diagnostics
- PCCU NGC interface

#### 6.1.1 What is the NGC8209?

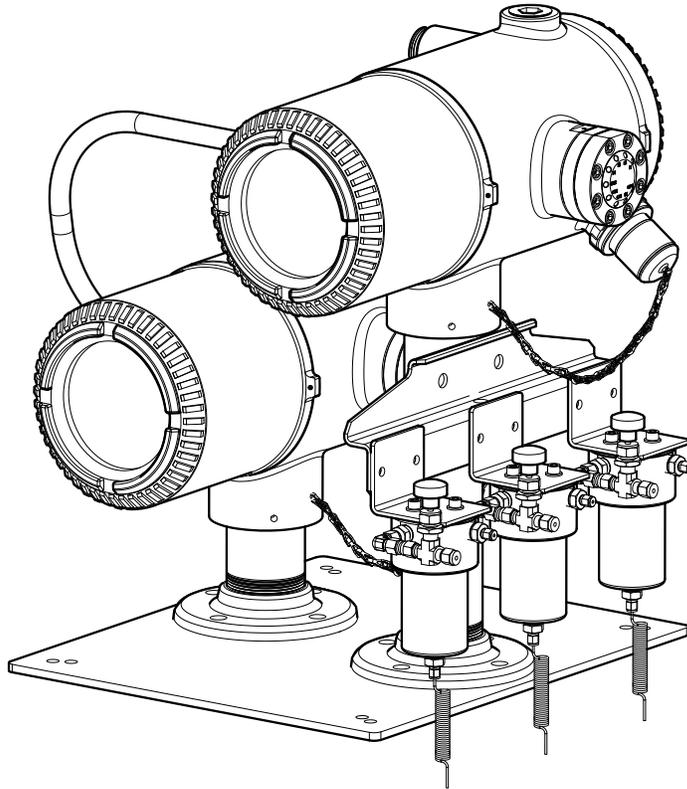
The C9+ NGC, or NGC8209 (Natural Gas Chromatograph) performs on-site gas analysis and heating value computation using an extended analysis. Using normal on-line chromatograph techniques, N2 through C6 + analysis is done and the C6+ fraction is simultaneously separated and quantified so that more of the heavy hydrocarbons are analyzed.

The state-of-the-art, built-in 32-bit digital controller, the three electronic carrier pressure regulators, oven-mounted sensors and other low-noise electronics provide unparalleled sensitivity and months between calibrations. This revolutionary new GC is the third generation of Totalflow's highly integrated manifold technology that started with the Model 8000. The new design is more compact, more reliable and more precise. The unit provides custody transfer/metrology quality chromatography for heating value and composition measurement. It is truly a lower cost unit to buy, install and operate.

#### 6.1.2 Extended analysis

The NGC8209 will rely on the modularity of the XSeries software to integrate a second GC unit into the analysis of the natural gas from the NGC8209. The main unit will do the normal C6+ analysis and contain the main controller. The auxiliary unit will support a single column train which will make the split of the C6's, C7's, C8's and C9+. This extended analysis data will then be sent digitally to the main controller in the main unit (C6+ GC). The software will then substitute this carbon split information for the C6+ fraction and then normalize the analysis and make the calculations needed. The main unit will also control the stream switching and the timing for the sample. The sample will be split and supply both the analysis units simultaneously.

All set up and configuration will be done on the main unit and the auxiliary unit will receive its functions from the main. As a whole, the dual unit will appear to operate as one chromatograph.



**Figure 6–1 Main and auxiliary Units NGC8209**

## 6.2 Theory of Operation

A natural gas sample is extracted from a flowing pipeline, transported to the analyzer, processed for particle removal and phase integrity and injected onto the chromatographic columns where component separation and peak detection occurs.

### 6.2.1 N2 to C9+

The NGC 8209 analyzes each sample utilizing established chromatographic techniques. The resulting information consists of mole percent values for the following:

- Air (contains N<sub>2</sub>, CO and O<sub>2</sub>)
- C1
- CO<sub>2</sub>
- C2
- C3
- IC4
- NC4
- NeoC5
- IC5

- NC5
- C6's
- C7's
- C8's
- C9+

### 6.2.2 Calculated Values

Using process chromatographic techniques, the columns are back flushed so that the NGC 8209 measures a C3+, C6+ and a C9+ peak. Calculated values include:

- Gas compressibility per AGA 8
- Real Relative density (Specific Gravity)
- Btu/CV Value
- GPM (gallons of liquid per thousand cubic feet)
- Wobbe Index
- Methane Number
- Optional calculations can include: AGA 10 speed of sound, (Hydrocarbon dew Point, Vapor pressure: to be developed)

## 6.3 Features

Modular design includes features listed in Chapter 1-System Description, plus:

- Two analytical modules, one for N2 through C6+ and one for the C6 through C9+
- Modular software – application based plug in software modules
- Dual 10 port valves have no moving metal parts in each analysis unit.

## 6.4 Calibration Procedure<sup>9</sup>

When the user receives the NGC8209, they will need to run a calibration cycle. A component peak find will have been performed at the factory prior to shipping. The user should not need to perform a peak find on a new unit from the factory. But the used will need to run the calibration cycle.

To achieve the greatest accuracy in the calibration results, the user should use a calibration blend similar to the process streams they are running. Totalflow suggests taking a sample of the process stream gas and having it analyzed in a local laboratory. However, in dealing with the heavier components (i.e. C6, C7, C8 and C9), it is necessary to exercise extreme caution in how the user takes a spot sample of their process stream. It is recommended to pay close attention to the procedures outlined in GPA-2166.

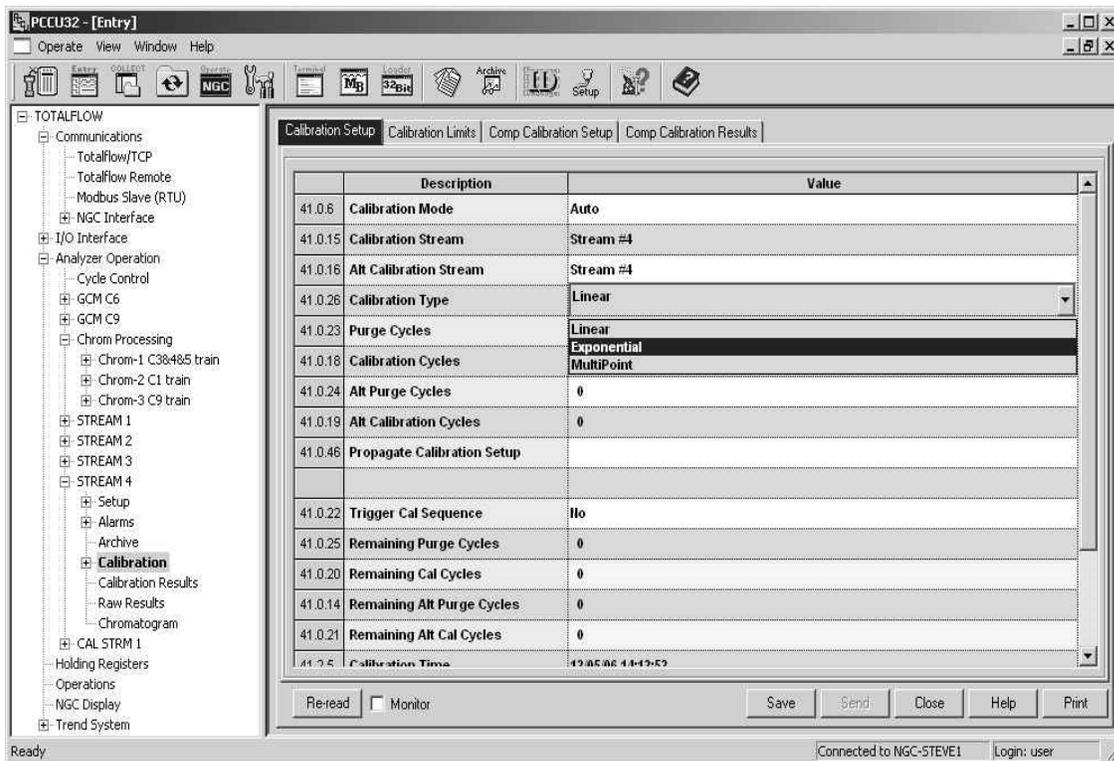
- 1) It is recommended that the C9+ unit be calibrated using the exponential algorithm. This algorithm can be selected in Calibration Setup under the user's calibration stream (generally defaulted to Stream #4). Change Calibration Type to exponential (see Figure 6–2).
- 2) To run a calibration cycle, it is best to select Analyzer Operation in the tree-view. This will display the operation screen in the right-hand pane.

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<sup>9</sup> To access these screens, the user will have to go to Expert View.

- 3) Click on the Cal button. Calibration will be displayed as Next mode and when the current cycle completes, calibration will be displayed as Current mode (see Figure 6–3).
- 4) When the calibration is complete, the unit should move to the designated next mode. View results on the Analyzer Operation screen.
- 5) The calibration process will run through the appropriate number of run cycles (defaults to 4), and return to the Run sequence.

**TIP**  For more information regarding the use of PCCU NGC, please refer to the PCCU NGC help screens.



**Figure 6–2 Calibration Setup**

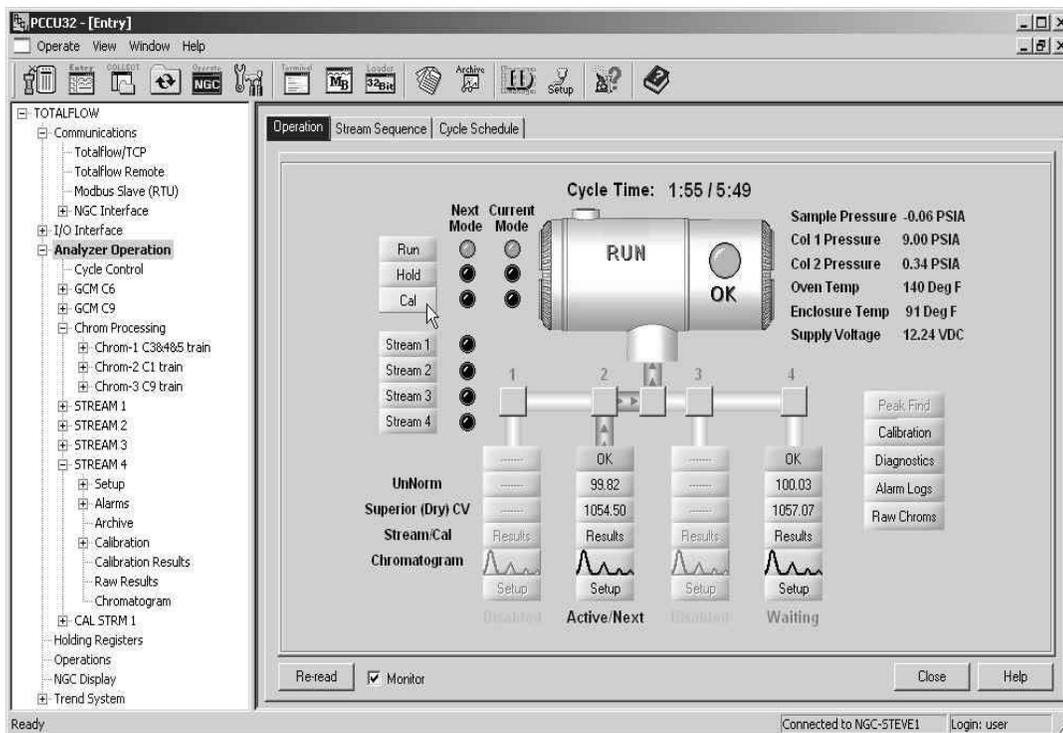


Figure 6–3 Analyzer Operation

## 6.5 C9+ applications

There are several differences between the screens the user would see when connected to a standard NGC8206 (C6+ unit) or an NGC8209 (C9+ unit). The NGC8209 will have a second GCM interface application instantiated (application 31) as well as a third chrom processor application (application 34). These applications support the auxiliary unit and gather the C9+ data and chromatograms (see Figure 6–4).

### 6.5.1 Third Chrom

Another difference will be the addition of a third chromatogram (see Figure 6–5). This third chromatogram is a graphical representation of the third column separation. In Figure 6–5, note the three chromatograms in the tree-view under Chrom Processing. The additional C9+ components (C6, C7, C8 and C9+) can be viewed in the new chromatogram.

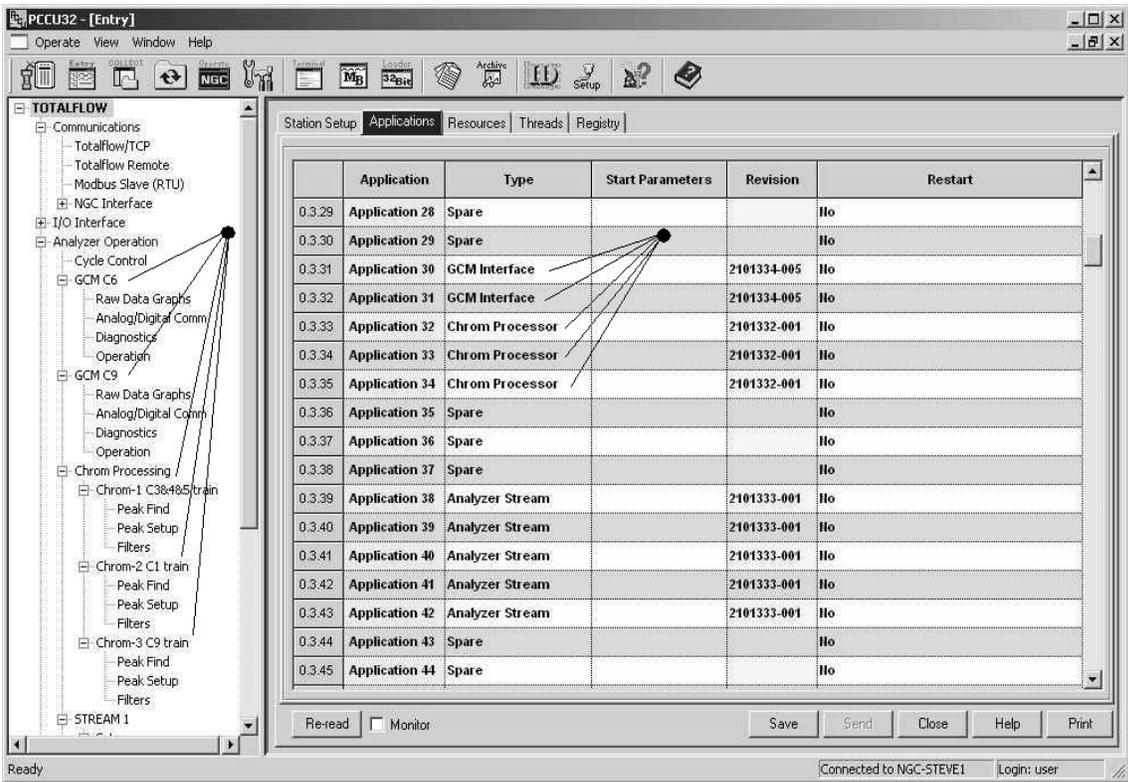


Figure 6-4 NGC8209 applications

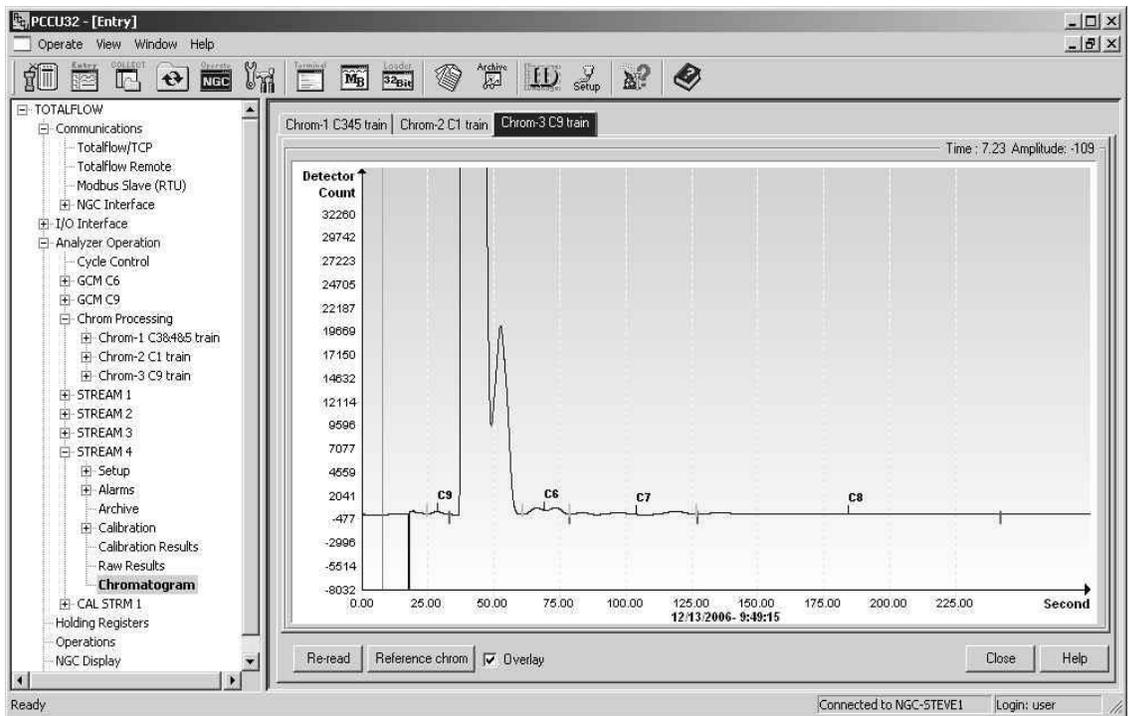


Figure 6-5 C9+ Chromatogram (Chrom 3)

## 6.6 NGC8209 Certifications

- NEC & CEC Class I, Div. 1, Groups C and D, T6
- CFR 47, Part 15
- **CE**:
  - - ATEX  $\text{Ex d, IIB+H}_2$  T6; Class 1, Zone 1
  - - EMC - EMI/RFI:
    - - EN 55022, EN 61000-6-1, EN 61000-4-2, 4-3, 4-4, 4-6, 4-8
    - - CISPR 22-2004

## 6.7 NGC8209 Specifications

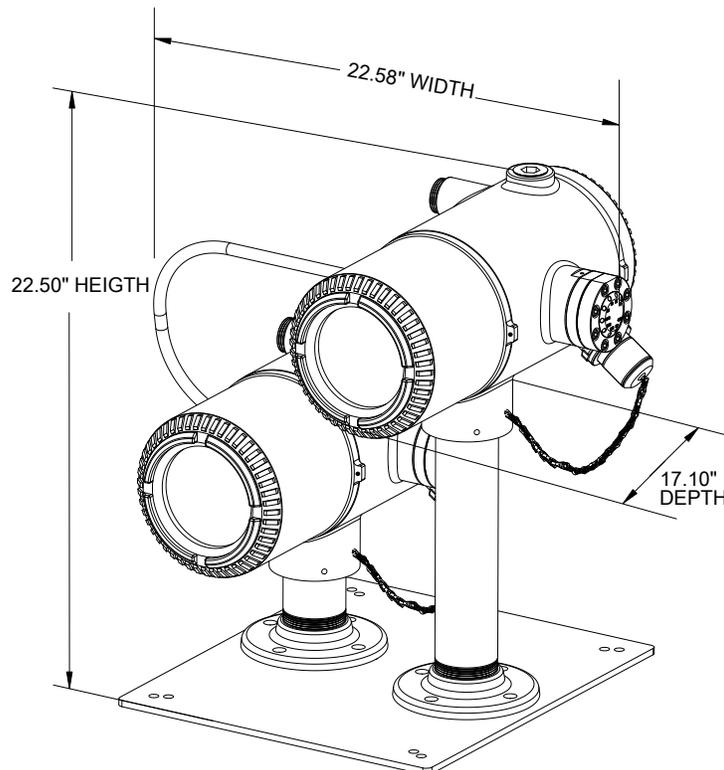


Figure 6–6 NGC8209

	<b>Description</b>
Medium:	Designed for Pipeline-Quality Natural Gas. 800 to 1500 Btu per standard cubic foot (29.8 to 55.9 megajoules/meter <sup>3</sup> ) <sup>1</sup> with less than 100 PPM H <sub>2</sub> S
Carrier Gas:	Helium (consumption rate <40 cc/minute during analysis cycle)
analysis Time:	approximately five (5) minutes; cycles may be scheduled by user
Repeatability:	±0.5 Btu @ 1,000 Btu (±0.05%) at a fixed temperature
Temperature Range:	0 to 131°F (-18 to 55°C)
Temperature Range (Storage):	-22°F to +140°F (-30°C to 60°C)
Supply Voltage:	10.5 to 16 volts DC (16 to 28 VDC as an option)
Power Consumption	Nominal operation @ 0°F (-18°C) = 14 Watts; (1.3 a)
Start up:	less than 8 amps (120 Watts @ 15 VDC)
Linearity:	Meet or exceeds GPA 2261-99
Streams	Up to four streams (Manual calibration required with 4 sample streams).
Calibration	Single auto calibration stream and 3 sample streams, or 2 auto calibration streams and 2 sample streams.
Communications supported:	<ul style="list-style-type: none"> <li>• Two serial digital ports, software selectable for RS232, RS485, or RS422</li> <li>• One Man-Machine Interface (RS232 or USB)</li> <li>• Optional USB hub (host and client) and Ethernet ports</li> </ul>
Protocols Supported:	<ul style="list-style-type: none"> <li>• Totalflow Remote / local MMI</li> <li>• Totalflow / TCP</li> <li>• Modbus / TCP Server</li> <li>• Modbus / TCP Client</li> <li>• Modbus ASCII or RTU (Modicon, WordSwap, or Danalyzer)</li> <li>• DSFG (future)</li> </ul>
Dimensions:	17.1" depth x 22.58" wide x 22.5" tall
Weight:	approximately 50 lb. (22 Kg)
Shipping Weight:	94 lb. (45 Kg).
Weatherproof Construction:	NEMA/Type-4/IP 56, (certification pending) aluminum alloy with white polyester powder coating.

## 6.8 C9+ Additional Registers

Register	Description	Modbus Map
38.4.66	Stream 1 Result Dew Point 1	9500
38.4.67	Stream 1 Result Dew Point 2	9501
38.4.68	Stream 1 Result Dew Point 3	9502
38.4.69	Stream 1 Result Dew Point 4	9503
38.4.130	Stream 1 Pressure 1 Used For Calc	9504
38.4.131	Stream 1 Pressure 2 Used For Calc	9505
38.4.132	Stream 1 Pressure 3 Used For Calc	9506
38.4.133	Stream 1 Pressure 4 Used For Calc	9507
39.4.66	Stream 2 Result Dew Point 1	9508
39.4.67	Stream 2 Result Dew Point 2	9509
39.4.68	Stream 2 Result Dew Point 3	9510
39.4.69	Stream 2 Result Dew Point 4	9511
39.4.130	Stream 2 Pressure 1 Used For Calc	9512
39.4.131	Stream 2 Pressure 2 Used For Calc	9513
39.4.132	Stream 2 Pressure 3 Used For Calc	9514
39.4.133	Stream 2 Pressure 4 Used For Calc	9515
40.4.66	Stream 3 Result Dew Point 1	9516
40.4.67	Stream 3 Result Dew Point 2	9517
40.4.68	Stream 3 Result Dew Point 3	9518
40.4.69	Stream 3 Result Dew Point 4	9519
40.4.130	Stream 3 Pressure 1 Used For Calc	9520
40.4.131	Stream 3 Pressure 2 Used For Calc	9521
40.4.132	Stream 3 Pressure 3 Used For Calc	9522
40.4.133	Stream 3 Pressure 4 Used For Calc	9523
41.4.66	Stream 4 Result Dew Point 1	9524
41.4.67	Stream 4 Result Dew Point 2	9525
41.4.68	Stream 4 Result Dew Point 3	9526
41.4.69	Stream 4 Result Dew Point 4	9527
41.4.130	Stream 4 Pressure 1 Used For Calc	9528
41.4.131	Stream 4 Pressure 2 Used For Calc	9529
41.4.132	Stream 4 Pressure 3 Used For Calc	9530
41.4.133	Stream 4 Pressure 4 Used For Calc	9531
38.7.16	Stream 1 Result Nonane+	9532
38.7.17	Stream 1 Result Nonane	9533
38.7.18	Stream 1 Result Decane	9534
38.7.19	Stream 1 Result Undecane	9535
38.7.20	Stream 1 Result Dodecane	9536
39.7.16	Stream 2 Result Nonane+	9537
39.7.17	Stream 2 Result Nonane	9538
39.7.18	Stream 2 Result Decane	9539
39.7.19	Stream 2 Result Undecane	9540
39.7.20	Stream 2 Result Dodecane	9541
40.7.16	Stream 3 Result Nonane+	9542
40.7.17	Stream 3 Result Nonane	9543

<b>Register</b>	<b>Description</b>	<b>Modbus Map</b>
40.7.18	Stream 3 Result Decane	9544
40.7.19	Stream 3 Result Undecane	9545
40.7.20	Stream 3 Result Dodecane	9546
41.7.16	Stream 4 Result Nonane+	9547
41.7.17	Stream 4 Result Nonane	9548
41.7.18	Stream 4 Result Decane	9549
41.7.19	Stream 4 Result Undecane	9550
41.7.20	Stream 4 Result Dodecane	9551
38.4.62	Stream 1 Input Pressure 1 (Write)	9552
38.4.63	Stream 1 Input Pressure 2 (Write)	9553
38.4.64	Stream 1 Input Pressure 3 (Write)	9554
38.4.65	Stream 1 Input Pressure 4 (Write)	9555
39.4.62	Stream 2 Input Pressure 1 (Write)	9556
39.4.63	Stream 2 Input Pressure 2 (Write)	9557
39.4.64	Stream 2 Input Pressure 3 (Write)	9558
39.4.65	Stream 2 Input Pressure 4 (Write)	9559
40.4.62	Stream 3 Input Pressure 1 (Write)	9560
40.4.63	Stream 3 Input Pressure 2 (Write)	9561
40.4.64	Stream 3 Input Pressure 3 (Write)	9562
40.4.65	Stream 3 Input Pressure 4 (Write)	9563
41.4.62	Stream 4 Input Pressure 1 (Write)	9564
41.4.63	Stream 4 Input Pressure 2 (Write)	9565
41.4.64	Stream 4 Input Pressure 3 (Write)	9566
41.4.65	Stream 4 Input Pressure 4 (Write)	9567

# APPENDIX A POWER SUPPLY SPECIFICATIONS

## A.1 12 VDC Power Supply Specifications

Power Supply, Primary Switch Mode for Universal Use – QUINT 12 V DC/10 A

### 3. Technical Data



QUINT 12 V DC/10 A

	7	solid (mm <sup>2</sup> )	flexible (mm <sup>2</sup> )	AWG	torque [Nm]	torque [lb in.]
Input		0.2 - 2.5	0.2 - 2.5	25 - 14	0.5 - 0.6	4.4 - 5.3
Output		0.2 - 2.5	0.2 - 2.5	25 - 14	0.5 - 0.6	4.4 - 5.3
Signal		0.2 - 2.5	0.2 - 2.5	25 - 14	0.5 - 0.6	4.4 - 5.3

1 AC



Description
<b>Power Supply</b> Primary switch mode for universal use

Type	Order No.	Ess. Pkt.
QUINT-P8-100-240AC/12DC/10	28 38 81 1	1

#### Technical Data

**Input Data (1)**  
 Nominal input voltage  
 Input voltage range  
 Frequency  
 Current consumption (for nominal values)  
 Inrush current limiting I<sub>R</sub> (+25°C [+77°F])  
 Mains buffering for a nominal load (typical)  
 Switch-on time after applying the mains voltage  
 Transient surge voltage protection  
 Input fuse, internal  
 Recommended fuse

100 - 240 V AC (wide range input)  
 85 - 264 V AC      90 - 350 V DC  
 45 - 65 Hz      0 Hz  
 1.5 A (120 V AC)/0.6 A (230 V AC), approximately  
 15 A, approximately/1 A<sup>2</sup>s, approximately  
 50 ms  
 < 1 s  
 Varistor  
 6.3 AT (device protection)  
 Circuit breaker 10 A or 16 A  
 Characteristic B (EN 60 898)  
 < 3.5 mA

#### Discharge current for PE

< 3.5 mA

**Output Data (2)**  
 Nominal output voltage U<sub>N</sub>/tolerance  
 Setting range for the output voltage  
 Output current (continuous) during convection cooling  
 and nominal values POWER BOOST I<sub>BOOST</sub> -25°C to +40°C (-13°F to +104°F)  
 Nominal output current I<sub>N</sub> -25°C to +60°C (-13°F to +140°F)  
**Derating**  
 Short-circuit current limit  
 Startup of capacitive loads  
 System deviation on:  
     Load change static 10 - 90%  
     Load change dynamic 10 - 90%  
     Input voltage change ±10%  
 Maximum power loss  
 Efficiency  
 Response time U<sub>OUT</sub> (10% - 90%)  
 Residual ripple/switching peaks (20 MHz)  
 Can be connected in parallel  
 Internal surge voltage protection

12 V DC ±1%  
 11.5 - 18.0 V DC  
 16 A (U<sub>OUT</sub> = 18 V DC)  
 10 A (U<sub>OUT</sub> = 18 V DC)  
 From -60°C (-140°F), 2.5% per Kelvin  
 I<sub>BOOST</sub> = 16 A, approximately  
 Unlimited  
 < 1%, typical  
 < 4%, typical  
 < 0.1%, typical  
 4 W/22 W, approximately  
 > 84% (for 230 V AC and nominal values)  
 < 2 ms, typical  
 < 100 mV<sub>pp</sub> (for nominal values)  
 To increase redundancy and power  
 Yes, limited to 25 V DC, approximately  
 25 V DC

**Signal Output Data**  
 DC OK (active) (3)  
 (U<sub>OUT</sub> > 0.9 x U<sub>N</sub> = high signal)  
 DC OK (electrically isolated) (4)  
 (U<sub>OUT</sub> > 0.9 x U<sub>N</sub> = contact closed)  
 LED (6) (U<sub>OUT</sub> < 0.9 x U<sub>N</sub> = LED flashing)

+12 V DC signal (with regard to the device weight)  
 40 mA, maximum  
 80 V AC/DC, maximum; 1 A, maximum  
 Green LED

Power Supply, Primary Switch Mode for Universal Use – QUINT 12 V DC/10 A

<b>General Data</b>		
Insulation voltage:	Input/output Input/PE Output/PE	4 kV AC (type test)/2 kV AC (routine test) 3.5 kV AC (type test)/2 kV AC (routine test) 500 V DC (routine test)
Approval package		 EN 60 204 (Surge Voltage Category III)
Electrical equipment of machines		EN 61 558-2-17
Safety transformers for switched-mode power supply units		EN 60950/VDE 0805,
Electrical safety (of IT equipment)		UL/C-UL Recognized UL 60 950 II
Industrial control equipment		UL/C-UL Listed UL 508 
Equipping high voltage installations with electronic equipment		EN 50 178 (VDE 0160)
Safety extra-low voltage		PELV (EN 60 204) SELV (EN 60 950) VDE 0100-410 DIN 57100-410
Safe isolation		DIN VDE 0106-101
Protection against electric shock		According to EN 61000-9-2
Protection against dangerous shock currents, basic requirements for safe isolation in electrical equipment		On horizontal NS 35 DIN rail according to EN 50022
Limitation of harmonic line currents		a 5 cm (1.969 in.)
Mounting position		0 cm
Can be mounted with spacing	- Vertical Horizontal	IP 20
Degree of protection		1, with PE connection
Class of protection		> 500 000 h according to IEC 1709 (SN 29 500)
MTBF		AluNox (Al/Mg), closed
Housing version		Default upon delivery: Rotated 90°:
Dimensions (W x H x D) + DIN rail		(85 x 130 x 125 mm [3.345 x 5.118 x 4.921 in.])/(122 x 130 x 98 mm [4.803 x 5.118 x 3.465 in.])
Weight		1.3 kg, approximately
<b>Climatic Data</b>		
Ambient temperature	Operation Storage	-25°C to +70°C (-13°F to +158°F) (> +60°C [+140°F] derating) -40°C to +85°C (-40°F to +185°F)
Humidity		Up to 95% at +25°C (+77°F), no condensation
Vibration	according to IEC 68-2-6	< 15 Hz, amplitude ±2.5 mm/15 Hz - 150 Hz, 2.8 g, 90 minutes
Shock	according to IEC 68-2-27	In resonant frequency
Degree of pollution		80 g all space directions
Climatic category		2 (according to EN 50 178) 3K3 (according to EN 60 721)

**CE**  
Conforms to the EMC Directive 89/336/EEC and the Low Voltage Directive 73/23/EEC

EMC (Electromagnetic Compatibility)			Requirements	
Noise Immunity According to EN 61000-6-2:			EN 61 000-6-2	QUINT-P8-100-240AC/12DC/10
Electrostatic discharge (ESD)	EN 61000-4-2 <sup>1)</sup>	Housing Contact discharge: Air discharge:	4 kV 8 kV	Level 4 8 kV 15 kV
Electromagnetic HF field	EN 61000-4-3 <sup>2)</sup>	Housing Frequency: Field strength:	80 - 1000 MHz 10 V/m	Level 3 80 - 1000 MHz/1.4 - 2.0 GHz 10 V/m
Fast transients (burst)	EN 61000-4-4 <sup>3)</sup>	Input: Output: Signal:	2 kV asymmetrical <sup>4)</sup> 2 kV asymmetrical <sup>4)</sup> 1 kV asymmetrical <sup>4)</sup>	4 kV (Level 4) 2 kV (Level 3) 1 kV (Level 2)
Surge current loads	EN 61000-4-5 <sup>3)</sup>	Input: Output: Signal:	2 kV asymmetrical <sup>4)</sup> 1 kV symmetrical <sup>4)</sup> 0.5 kV asymmetrical <sup>4)</sup> 0.5 kV symmetrical <sup>4)</sup> 1 kV asymmetrical <sup>4)</sup>	4 kV (Level 4) 2 kV (Level 4) 0.5 kV (Level 1) 0.5 kV (Level 1) 1 kV (Level 2)
Conducted Interference	EN 61000-4-6 <sup>2)</sup>	I/O/S: Frequency: U <sub>C</sub> :	0.15 - 80 MHz 10 V	Level 3 0.15 - 80 MHz 10 V
Voltage dips	EN 61000-4-11 <sup>3)</sup>	Input:	30% reduction of the input voltage for 0.5 periods	See input data: Mains buffering > 20 ms
Simulation of radiophone	EN 50204	Frequency: Field strength:	Not required	900 MHz/1800 MHz 20 V/m
<b>Noise Emission According to EN 60081-2:</b>				
Radio Interference	EN 55011		Class A <sup>4)</sup>	EN 55011 (EN 55022) Class B <sup>5)</sup>
Radio Interference	EN 55011		Class A <sup>4)</sup>	EN 55011 (EN 55022) Class B <sup>5)</sup>

EN 55011 corresponds to CISPR11/EN 55022 corresponds to CISPR22  
EN 61000 corresponds to IEC 1000

<sup>1)</sup>Criterion A: Normal operating characteristics within the specified limits.

<sup>2)</sup>Criterion B: Temporary adverse effects on the operating characteristics that the device corrects independently.

<sup>4)</sup>Symmetrical: Cable to cable  
<sup>5)</sup>Asymmetrical: Cable to ground

<sup>4)</sup>Class A: Industrial application  
<sup>5)</sup>Class B: Industrial and domestic applications

## A.2 24 VDC Power Supply Specifications

QUINT-PS-100-240AC/24DC/10

### Ordering Data

#### Product

Description	Type	Order No.	Pcs./Pkt.
Single-phase primary-switched power supply unit	QUINT-PS-100-240AC/24DC/10	29 98 60 4	1

#### Accessories

Description	Type	Order No.	Pcs./Pkt.
Assembly adapter for QUINT POWER 10 A on S7 300 rails	QUINT-PS-ADAPTERS7/2	29 98 20 6	1

### Technical Data

#### Input Data

Nominal input voltage range	100...240 V AC
Input voltage range	85...264 V AC, 90...350 V DC
Frequency range	45...65 Hz (0 Hz at DC input)
Current consumption	2.34 A (at 120 V AC (nominal load)), approximately 1.2 A (at 230 V AC (nominal load)), approximately
Inrush current surge	< 15 A (typical), inrush current limiting <sup>22</sup> (25°C): < 1.5 A/s
Mains buffering (for nominal load)	> 50 ms (at 120 V AC), > 50 ms (at 230 V AC)
Typical switch-on time	< 1 s
Protective circuit	Transient surge protection varistor
Input fuse	6.3 A (slow-blow, internal)
Recommended backup fuse	Circuit breaker 10 A or 16 A, Characteristic B
Discharge current to PE	< 3.5 mA
Connection method	COMBICON screw/plug-in connection
Stripping length	7 mm

#### Output Data

Nominal output voltage	24 V DC $\pm$ 1%
Setting range for the output voltage	22.5...28.5 V DC
Output current	10 A (-25...+60°C) 15 A (with POWER BOOST, -25...+40°C)
Derating	Above +60°C: 2.5% per Kelvin
Current limit	$I_{BOOST} = 15$ A (for short circuit), approximately
Maximum capacitive load	Unlimited
System deviation	< 1% (static load change 10...90%) < 2% (dynamic load change 10...90%) < 0.1% (input voltage change $\pm$ 10%)
Power dissipation	
Maximum nominal load	24 W
Maximum no load	2 W
Efficiency	> 91% for 230 V AC and nominal values
Rise time	< 2 ms ( $U_{OUT}$ (10...90%))
Residual ripple/switching peaks (20 MHz)	< 100 mV <sub>pp</sub> (for nominal values)
Parallel connection	Yes, to create redundant systems and increase efficiency
Internal surge protection	Yes, limited to 35 V DC, approximately
Resistance to return supply	85 V DC
Connection method	COMBICON screw/plug-in connection
Stripping length	7 mm

#### DC OK Signal Output, Active

Type of output	Transistor output, $U_{OUT} > 0.9 \times U_N$ : High signal
Continuous current	40 mA, maximum
Output voltage	+24 V DC (signal)

DC OK Signal Output, Floating	
Type of output	Relay contact, $U_{out} > 0.9 \times U_N$ ; Contact closed
Continuous current	1 A, maximum
Maximum switching voltage	30 V AC/DC, maximum
General Data	
Insulation voltage	
Input/output	4 kV AC (type test)/2 kV AC (routine test)
Input/PE	3.5 kV AC (type test)/2 kV AC (routine test)
Insulation voltage output/PE	500 V DC (routine test)
Mounting position	On horizontal NS 35 DIN rail according to EN 60715
Degree of protection	IP20
Protection class	I, with PE connection
MTEF	$> 500,000$ h according to IEC 61709 (SN 29500)
Housing version	AluNox (AlMg1), closed
Weight	1,900 kg
Dimensions (width x height x depth)	85 mm x 130 mm x 125 mm
Dimensions (width x height x depth) for alternative assembly	122 mm x 130 mm x 88 mm
Status Indicators	
DC OK status indicator	Green LED ( $U_{out} < 0.9 \times U_N$ ; LED flashes)
Climatic Data	
Ambient temperature (operation)	-25...+70°C (> 60°C derating)
Ambient temperature (storage/transport)	-40...+85°C
Maximum permissible humidity (operation)	95% (at +25°C, no condensation)
Vibration (operation)	$< 15$ Hz, amplitude $\pm 2.5$ mm according to IEC 60068-2-6 15...150 Hz, 2.9g, 90 minutes
Shock	30g in all space directions, according to IEC 60068-2-27
Pollution degree	2 according to EN 50178
Climatic class	3K3 according to EN 60721
Certification/Standards	
Electrical equipment of machines	EN 60204 (Surge Voltage Category III)
Safety transformers for switched-mode power supply units	EN 61558-2-17
Electrical safety (of IT equipment)	EN 60950/VDE 0805 (SELV) CB Scheme 
Industrial control equipment	UL/C-UL Recognized UL 60650  UL/C-UL Listed UL 508 
Electrical equipment for potentially explosive areas	UL/C-UL Recognized UL 1604, Class I, Division 2, Groups A, B, C, D
Shipbuilding	Germanischer Lloyd  , ABS
Electronic equipment for use in electrical power installations	EN 50178 (VDE 0160)
Safety extra-low voltage	PELV (EN 60204), SELV (EN 60950)
Safe Isolation	DIN VDE 0100-410
Protection against electric shock	DIN 57100-410
Protection against electric shock, basic requirements for safe isolation in electrical equipment	DIN VDE 0106-101
Limitation of harmonic line currents	According to EN 61000-3-2
Device safety	 (tested safety)

**Conformance With EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC**

<b>Noise Immunity Test According to EN 61000-6-2<sup>1</sup></b>			
Electrostatic discharge (ESD)	EN 61000-4-2	Criterion B <sup>2</sup>	Housing Level 4 Air discharge 15 kV Contact discharge 8 kV
Electromagnetic HF field	EN 61000-4-3	Criterion A <sup>3</sup>	Housing Level 3 Frequency range 80...1000 MHz/1.4...2.0 GHz Field strength 10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion B <sup>2</sup>	Input 4 kV (Inst. Class 4, asymmetrical: Cable to ground) 2 kV (Inst. Class 4, symmetrical: Cable to cable) Output 0.5 kV (Level 1, asymmetrical: Cable to ground) 0.5 kV (Level 1, symmetrical: Cable to cable) Signal 1 kV (Level 1, asymmetrical: Cable to ground)
Surge current load (surge)	EN 61000-4-5	Criterion B <sup>2</sup>	Input 4 kV (Level 4, asymmetrical) Output 2 kV (Level 3, asymmetrical) Signal 1 kV (Level 2, asymmetrical)
Conducted Interference	EN 61000-4-6	Criterion A <sup>3</sup>	Input/output/signal Level 3, asymmetrical Frequency range 0.15...80 MHz Voltage 10 V
Voltage dips	EN 61000-4-11	Criterion B	Input Mains buffering > 20 ms

**Noise Emission Test According to EN 61000-6-3**

Noise emission of housing	EN 55011 (EN 55022) <sup>4</sup>	Class B	Industrial and domestic applications
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<sup>1</sup> EN 61000 corresponds to IEC 61000

<sup>2</sup> Criterion B: Temporary adverse effects on the operating behavior, which the device corrects automatically.

<sup>3</sup> Criterion A: Normal operating behavior within the specified limits.

<sup>4</sup> EN 55011 corresponds to CISPR11/EN 55022 corresponds to CISPR22

## A.3 24 VDC EX Power Supply Specifications

1-Phase Power Supply, Primary Switch Mode for Use in Potentially Explosive Areas – QUINT 24 V DC/10A/EX

### 3. Technical Data



QUINT 24 V DC/10 A/EX

γ	solid	flexible	AWG	torque
	[mm <sup>2</sup> ]			[Nm] [lb in.]
Input	0.2 - 2.5	0.2 - 2.5	25 - 14	0.5 - 0.6 4.4 - 5.3
Output	0.2 - 2.5	0.2 - 2.5	25 - 14	0.5 - 0.6 4.4 - 5.3
signal	0.2 - 2.5	0.2 - 2.5	25 - 14	0.5 - 0.6 4.4 - 5.3

Description
Power supply Primary switch mode for potentially explosive areas

Technical Data
<b>Input Data (1)</b>
Nominal input voltage
Input voltage range
Frequency
Current consumption (for nominal values)
Inrush current limiting (P <sub>in</sub> +25°C [+77°F])
Mains buffering for a nominal load (typical)
switch-on time after applying the mains voltage
Transient surge voltage protection
Input fuse, internal
Recommended fuse
Discharge current for PE
<b>Output Data (2)</b>
Nominal output voltage U <sub>N</sub> , tolerance
setting range for the output voltage
Output current (continuous) during convection cooling and nominal values POWER BOOST I <sub>BOOST</sub> -25°C to +40°C (-13°F to +104°F)
Nominal output current I <sub>N</sub> -25°C to +60°C (-13°F to +140°F)
short-circuit current limit
startup of capacitive loads
system deviation on:
Load change static 10 - 90%
Load change dynamic 10 - 90%
input voltage change ±10%
No load/nominal load
Maximum power dissipation
Efficiency
Response time U <sub>OUT</sub> (10% - 90%)
Residual ripple/switching peaks (20 MHz)
Can be connected in parallel
Internal surge voltage protection
Resistance to return supply
<b>Signal Output Data</b>
DC OK (active) (3)
(U <sub>DC OK</sub> > 0.9 x U <sub>N</sub> = high signal)
DC OK (electrically isolated) (4)
(U <sub>DC OK</sub> > 0.9 x U <sub>N</sub> = contact closed)
LED (5) (U <sub>DC OK</sub> < 0.9 x U <sub>N</sub> = LED flashing)

1 AC CB, CE, RoHS, REACH

Type	Order No.	DCS PKT.
QUINT-PS-100-240AC/24DC/10/EX	28 38 88 8	1

100 - 240 V AC (wide range input)
85 - 264 V AC
90 - 250 V DC
45 - 65 Hz
0 Hz
2.8 A (120 V AC)/1.2 A (230 V AC), approximately
15 A, approximately/1.5 A <sup>2</sup> , approximately
> 40 ms (120 V AC)/> 40 ms (230 V AC)
< 1 s
Varistor
6.3 AT (device protection)
Circuit breaker 10 A or 16 A
Characteristic B (EN 60 898)
< 3.5 mA
24 V DC ±1%
22.5 - 28.5 V DC
15 A (U <sub>DC OK</sub> = 24 V DC)
10 A (U <sub>DC OK</sub> = 24 V DC)
I <sub>BOOST</sub> = 15 A, approximately
Unlimited
< 1%, typical
< 2%, typical
< 0.1%, typical
4 W/33 W, approximately
> 88% (for 230 V AC and nominal values)
< 2 ms, typical
< 100 mV <sub>pp</sub> (for nominal values)
To increase redundancy and power
Yes, limited to 35 V DC, approximately
35 V DC
+24 V DC signal (with regard to the device weight)
40 mA, maximum
30 V AC/DC, maximum; 1 A, maximum, ohmic load
Green LED

**1-Phase Power Supply, Primary Switch Mode for Use in Potentially Explosive Areas – QUINT 24 V DC/10A/EX**

<b>General Data</b>		
Insulation voltage:	Input/output Input/PE Output/PE	4 kV AC (type test)/2 kV AC (routine test) 3.5 kV AC (type test)/2 kV AC (routine test) 700 V DC (routine test)
Approval package		 EN 60 204 (Surge Voltage Category III) EN 61 558-2-17 EN 60950/VDE 0805, UL/C-UL Recognized UL 60 950  UL/C-UL Listed UL 508  Germanischer Lloyd  
Electrical equipment of machines Safety transformers for switched-mode power supply units Electrical safety (of IT equipment) Industrial control equipment shipbuilding Equipping high voltage installations with electronic equipment safety extra-low voltage		EN 50 178 (VDE 0160) PELV (EN 60 204) SELV (EN 60 950) VDE 0100-410 DIN 57100-410
Safe Isolation Protection against electric shock Protection against dangerous shock currents, basic requirements for safe isolation in electrical equipment Limitation of harmonic line currents Conformance mark according to EN 50021 Electrical equipment for explosion-protected areas Mounting position Can be mounted with spacing Degree of protection Class of protection MTBF Housing version Dimensions (W x H x D) + DIN rail		DIN VDE 0106-101 According to EN 61000-3-2  II 3G EEX nAC IIC T4 TÜV 03 ATEX 2047X UL/C-UL Recognized UL 1604 Class I, Division 2, Groups A, B, C, D On horizontal R <sub>s</sub> 35 DIN rail according to EN 50022 Vertical with ≥ 5 cm (1.969 in.), horizontal 0 cm IP 20 1, with PE connection > 500 000 h according to IEC 1709 (S/N 29 500) AluNox (AlMg1), closed Default upon delivery: Rotated 90°: (85 x 130 x 125 mm) 122 x 130 x 88 mm (3.346 x 5.118 x 4.921 in.) (4.803 x 5.118 x 3.465 in.) 1.3 kg, approximately
Weight		
<b>Climatic Data</b>		
Ambient temperature	Operation storage	-25°C to +60°C/+40°C (-13°F to +140°F/104°F) -40°C to +85°C (-40°F to +185°F)
Humidity		Up to 100% at +25°C (+77°F), condensation permitted
Vibration	according to IEC 68-2-6	< 15 Hz, amplitude ±2.5 mm/15 Hz - 150 Hz, 2.3 g, 90 minutes
Shock	according to IEC 68-2-27	30 g all space directions
Degree of pollution		2 (according to EN 50 178)
Climatic category		3K3 (according to EN 60 721)

**CE**  
Conforms to the EMC Directive 89/336/EEC and the Low Voltage Directive 73/23/EEC

EMC (Electromagnetic Compatibility)		Requirements	QUINT-P8-100-240AC/24DC/10/EX
Noise Immunity According to EN 61000-6-2:		EN 61 000-6-2	EX
Electrostatic discharge (ESD)	EN 61000-4-2 <sup>2)</sup> Housing Contact discharge: Air discharge:	4 kV 8 kV 15 kV	Level 4 8 kV 15 kV
Electromagnetic HF field	EN 61000-4-3 <sup>2)</sup> Housing Frequency: Field strength:	80 - 1000 MHz 10 V/m	Level 3 80 - 1000 MHz/1.4 - 2.0 GHz 10 V/m
Fast transients (burst)	EN 61000-4-4 <sup>3)</sup> Input: Output: Signal:	2 kV asymmetrical <sup>4)</sup> 2 kV asymmetrical <sup>4)</sup> 1 kV asymmetrical <sup>4)</sup>	4 kV (Level 4) 2 kV (Level 3) 1 kV (Level 2)
Surge current loads	EN 61000-4-5 <sup>3)</sup> Input: Output: Signal:	2 kV asymmetrical <sup>4)</sup> 1 kV symmetrical <sup>4)</sup> 0.5 kV asymmetrical <sup>4)</sup> 0.5 kV symmetrical <sup>4)</sup> 1 kV asymmetrical <sup>4)</sup>	4 kV (Level 4) 2 kV (Level 4) 0.5 kV (Level 1) 0.5 kV (Level 1) 1 kV (Level 2)
Conducted interference	EN 61000-4-6 <sup>2)</sup> I/Os: Frequency: U <sub>0</sub> :	0.15 - 80 MHz 10 V	Level 3 0.15 - 80 MHz 10 V
Voltage dips	EN 61000-4-11 <sup>3)</sup> Input:	30% reduction of the input voltage for 0.5 periods	see input data: Mains buffering >20 ms
Simulation of radiophone	EN 50204 Frequency: Field strength:	Not required	900 MHz/1800 MHz 20 V/m
Noise Emission According to EN 60081-2:			
Radio interference	EN 55011	Class A <sup>6)</sup>	EN 55011 (EN 55022) Class B <sup>7)</sup>
Radio Interference	EN 55011	Class A <sup>6)</sup>	EN 55011 (EN 55022) Class B <sup>7)</sup>

EN 55011 corresponds to CISPR11/EN 55022 corresponds to CISPR22  
EN 61000 corresponds to IEC 1000

<sup>2)</sup>Criterion A: Normal operating characteristics within the specified limits.  
<sup>3)</sup>Criterion B: Temporary adverse effects on the operating characteristics that the device corrects independently.

<sup>4)</sup>symmetrical: Cable to cable  
<sup>5)</sup>asymmetrical: Cable to ground  
<sup>6)</sup>Class A: Industrial application  
<sup>7)</sup>Class B: Industrial and domestic applications



## APPENDIX B MODBUS REGISTERS

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
Component Index for Stream			
3001	3001	51.200.0	Component Table #1 Component Index #1(C3)
3002	3002	51.200.1	Component Table #1 Component Index #2(IC4)
3003	3003	51.200.2	Component Table #1 Component Index #3(NC4)
3004	3004	51.200.3	Component Table #1 Component Index #4(Neo C5)
3005	3005	51.200.4	Component Table #1 Component Index #5(IC5)
3006	3006	51.200.5	Component Table #1 Component Index #6(NC5)
3007	3007	51.200.6	Component Table #1 Component Index #7(C6+)
3008	3008	51.200.7	Component Table #1 Component Index #8(N2)
3009	3009	51.200.8	Component Table #1 Component Index #9(C1)
3010	3010	51.200.9	Component Table #1 Component Index #10(CO2)
3011	3011	51.200.10	Component Table #1 Component Index #11(C2)
3012	3012	51.200.11	Component Table #1 Component Index #12(C6s)
3013	3013	51.200.12	Component Table #1 Component Index #13(C7s)
3014	3014	51.200.13	Component Table #1 Component Index #14(C8s)
3015	3015	51.200.14	Component Table #1 Component Index #15(C9s)
3016	3016	51.200.15	Component Table #1 Component Index #16(Spare)
3017	3017	51.200.0	Component Table #2 Component Index #1
3018	3018	51.200.1	Component Table #2 Component Index #2
3019	3019	51.200.2	Component Table #2 Component Index #3
3020	3020	51.200.3	Component Table #2 Component Index #4
3021	3021	51.200.4	Component Table #2 Component Index #5
3022	3022	51.200.5	Component Table #2 Component Index #6
3023	3023	51.200.6	Component Table #2 Component Index #7
3024	3024	51.200.7	Component Table #2 Component Index #8
3025	3025	51.200.8	Component Table #2 Component Index #9
3026	3026	51.200.9	Component Table #2 Component Index #10
3027	3027	51.200.10	Component Table #2 Component Index #11
3028	3028	51.200.11	Component Table #2 Component Index #12
3029	3029	51.200.12	Component Table #2 Component Index #13
3030	3030	51.200.13	Component Table #2 Component Index #14
3031	3031	51.200.14	Component Table #2 Component Index #15
3032	3032	51.200.15	Component Table #2 Component Index #16
3033	3033	51.201.1	Analysis Time (in1/30ths of 1 second) (N/A)
3034	3034	51.201.0	Current Stream Number(15.0.28)
3035	3035	51.201.1	Mask of streams associated with Component Table 41 (N/A)
3036	3036	51.201.3	Current Month (1-12) (15.1.8)
3037	3037	51.201.4	Current Day (1-31) (15.1.9)
3038	3038	51.201.5	Current Year (0-99) (15.1.10)

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
3039	3039	51.201.6	Current Hour (0-24) (15.1.11)
3040	3040	51.201.7	Current Minutes (0-59) (15.1.12)
3041	3041	51.201.8	Cycle Start Month (1-12) (15.1.13)
3042	3042	51.201.9	Cycle Start Day (1-31) (15.1.14)
3043	3043	51.201.10	Cycle Start Year (0-99) (15.1.15)
3044	3044	51.201.11	Cycle Start Hour (0-24) (15.1.16)
3045	3045	51.201.12	Cycle Start Minutes (0-59) (15.1.17)
3046	3046	51.201.42	Bit Flags Transmitter
3047	3047	51.201.43	Bit Flags Transmitter
3048	3048	51.201.1	Bit Flags Stream #1 Low (N/A)
3049	3049	51.201.1	Bit Flags Stream #1 High (N/A)
3050	3050	51.201.1	Bit Flags Stream #2 Low (N/A)
3051	3051	51.201.1	Bit Flags Stream #2 High (N/A)
3052	3052	51.201.1	Bit Flags Stream #3 Low (N/A)
3053	3053	51.201.1	Bit Flags Stream #3 High (N/A)
3054	3054	51.201.1	Bit Flags Stream #4 Low (N/A)
3055	3055	51.201.1	Bit Flags Stream #4 High (N/A)
3056	3056	51.201.1	Bit Flags Stream #5 Low (N/A)
3057	3057	51.201.1	Bit Flags Stream #5 High (N/A)
Int16 for Stream			
3058	3058	51.201.2	New Data Flag(15.1.7)
3059	3059	51.201.13	Cal/Analysis Flag(15.1.18)
3060	3060	51.201.32	Read the Current State (19.1.0)
3061	3061	51.201.33	Read the Next State (19.1.0)
3062	3062	51.201.1	Auto Calibration During Start-up (N/A)
3063	3063	51.201.22	Alternate Purge Cycles (15.0.24)
3064	3064	51.201.23	Alternate Calibration Cycles (15.0.19)
3065	3065	51.201.24	Number of Purge Cycles (15.0.23)
3066	3066	51.201.25	Number of Calibration Cycles (15.0.18)
3067	3067	51.201.1	Low Carrier Mode (N/A)
3068	3068	51.201.1	Low Power Mode (N/A)
3069	3069	51.201.1	Pre-Purge Selection (Future)
3070	3070	51.201.1	Normal Status (N/A)
3071	3071	51.201.1	Fault Status (N/A)
3072	3072	51.201.26	Carrier Bottle Low (DI1) (11.0.0)
3073	3073	51.201.27	Calibration Bottle Low (DI2) (11.0)
3074	3074	51.201.1	Manual Update Response Factors (N/A)
3075	3075	51.201.1	Auto Update Response Factors (N/A)
3076	3076	51.201.1	Disable Stream Switching (N/A)

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
3077	3077	51.201.1	Transmitter Current Warning (N/A)
3078	3078	51.201.1	Transmitter Current Fault (N/A)
3079	3079	51.201.1	Transmitter Initial Warning (N/A)
3080	3080	51.201.1	Transmitter Initial Fault (N/A)
3081	3081	51.201.18	Stream #1 Current Warning (15.128.1)
3082	3082	51.201.19	Stream #2 Current Warning (16.128.1)
3083	3083	51.201.20	Stream #3 Current Warning (17.128.1)
3084	3084	51.201.21	Stream #4 Current Warning (18.128.1)
3085	3085	51.201.14	Stream #1 Current Fault (15.128.0)
3086	3086	51.201.15	Stream #2 Current Fault (16.128.0)
3087	3087	51.201.16	Stream #3 Current Fault (17.128.0)
3088	3088	51.201.17	Stream #4 Current Fault (18.128.0)
3089	3089	51.201.38	Stream #1 Initial Warning (15.128.3)
3090	3090	51.201.39	Stream #2 Initial Warning (16.128.3)
3091	3091	51.201.40	Stream #3 Initial Warning (17.128.3)
3092	3092	51.201.41	Stream #4 Initial Warning (18.128.3)
3093	3093	51.201.34	Stream #1 Initial Fault (15.128.2)
3094	3094	51.201.35	Stream #2 Initial Fault (16.128.2)
3095	3095	51.201.36	Stream #3 Initial Fault (17.128.2)
3096	3096	51.201.37	Stream #4 Initial Fault (18.128.2)
3097	3097	51.201.28	Stream #1 Skip Flag (19.0.7)
3098	3098	51.201.29	Stream #2 Skip Flag (19.0.8)
3099	3099	51.201.30	Stream #3 Skip Flag (19.0.9)
3100	3100	51.201.31	Stream #4 Skip Flag (19.0.10)
5001	5001	51.208.2	Cycle Clock (19.2.2)
5002	5003	51.208.1	Cycle Time (19.2.1)
5003	5005	51.208.0	Detector 0 (N/A)
5004	5007	51.208.0	Detector 1 (N/A)
5005	5009	51.208.0	Detector 2 (N/A)
5006	5011	51.208.0	Detector 3 (N/A)
Mole % for Stream			
7001	7001	51.203.0	Mole % - Component #1
7002	7003	51.203.1	Mole % - Component #2
7003	7005	51.203.2	Mole % - Component #3
7004	7007	51.203.3	Mole % - Component #4
7005	7009	51.203.4	Mole % - Component #5
7006	7011	51.203.5	Mole % - Component #6
7007	7013	51.203.6	Mole % - Component #7
7008	7015	51.203.7	Mole % - Component #8

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
7009	7017	51.203.8	Mole % - Component #9
7010	7019	51.203.9	Mole % - Component #10
7011	7021	51.203.10	Mole % - Component #11
7012	7023	51.203.11	Mole % - Component #12
7013	7025	51.203.12	Mole % - Component #13
7014	7027	51.203.13	Mole % - Component #14
7015	7029	51.203.14	Mole % - Component #15
7016	7031	51.203.15	Mole % - Component #16
GPM % for Stream			
7017	7033	51.204.0	GPM % - Component #1
7018	7035	51.204.1	GPM % - Component #2
7019	7037	51.204.2	GPM % - Component #3
7020	7039	51.204.3	GPM % - Component #4
7021	7041	51.204.4	GPM % - Component #5
7022	7043	51.204.5	GPM % - Component #6
7023	7045	51.204.6	GPM % - Component #7
7024	7047	51.204.7	GPM % - Component #8
7025	7049	51.204.8	GPM % - Component #9
7026	7051	51.204.9	GPM % - Component #10
7027	7053	51.204.10	GPM % - Component #11
7028	7055	51.204.11	GPM % - Component #12
7029	7057	51.204.12	GPM % - Component #13
7030	7059	51.204.13	GPM % - Component #14
7031	7061	51.204.14	GPM % - Component #15
7032	7063	51.204.15	GPM % - Component #16
Floats for Stream			
7033	7065	51.202.0	BTU - Dry(15.4.5)
7034	7067	51.202.1	BTU - Saturated(15.4.6)
7035	7069	51.202.2	Specific Gravity(15.4.9)
7036	7071	51.202.3	Compressibility(15.4.11)
7037	7073	51.202.4	WOBBE Index(15.4.7)
7038	7075	51.202.6	Total UN-normalized mole(15.4.12)
7039	7077	51.202.13	Total GPM (15.4.13)
7040	7079	51.202.8	Ideal BTU (15.4.4)
7041	7081	51.202.9	Density Normal (15.4.10)
7042	7083	51.202.10	Inferior WOBBE (15.4.8)
7043	7085	51.202.11	Methane Number (15.4.27)

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
7044	7087	51.202.12	Speed of Sound (15.4.54)
7045	7089	51.241.0	Rolling Average #1
7046	7091	51.241.1	Rolling Average #2
7047	7093	51.241.2	Rolling Average #3
7048	7095	51.241.3	Rolling Average #4
7049	7097	51.241.4	Rolling Average #5
7050	7099	51.241.5	Rolling Average #6
7051	7101	51.241.6	Rolling Average #7
7052	7103	51.241.7	Rolling Average #8
7053	7105	51.241.8	Rolling Average #9
7054	7107	51.241.9	Rolling Average #10
7055	7109	51.241.10	Rolling Average #11
7056	7111	51.241.11	Rolling Average #12
7057	7113	51.241.12	Rolling Average #13
7058	7115	51.241.13	Rolling Average #14
7059	7117	51.241.14	Rolling Average #15
7060	7119	51.241.15	Rolling Average #16
7061	7121	51.206.0	24 Hour Average for Component #1
7062	7123	51.206.1	24 Hour Average for Component #2
7063	7125	51.206.2	24 Hour Average for Component #3
7064	7127	51.206.3	24 Hour Average for Component #4
7065	7129	51.206.4	24 Hour Average for Component #5
7066	7131	51.206.5	24 Hour Average for Component #6
7067	7133	51.206.6	24 Hour Average for Component #7
7068	7135	51.206.7	24 Hour Average for Component #8
7069	7137	51.206.8	24 Hour Average for Component #9
7070	7139	51.206.9	24 Hour Average for Component #10
7071	7141	51.206.10	24 Hour Average for Component #11
7072	7143	51.206.11	24 Hour Average for Component #12
7073	7145	51.206.12	24 Hour Average for Component #13
7074	7147	51.206.13	24 Hour Average for Component #14
7075	7149	51.206.14	24 Hour Average for Component #15
7076	7151	51.206.15	24 Hour Average for Component #16
7077	7153	51.207.0	Previous 24 Hour Average for Component #1
7078	7155	51.207.1	Previous 24 Hour Average for Component #2
7079	7157	51.207.2	Previous 24 Hour Average for Component #3
7080	7159	51.207.3	Previous 24 Hour Average for Component #4
7081	7161	51.207.4	Previous 24 Hour Average for Component #5
7082	7163	51.207.5	Previous 24 Hour Average for Component #6

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
7083	7165	51.207.6	Previous 24 Hour Average for Component #7
7084	7167	51.207.7	Previous 24 Hour Average for Component #8
7085	7169	51.207.8	Previous 24 Hour Average for Component #9
7086	7171	51.207.9	Previous 24 Hour Average for Component #10
7087	7173	51.207.10	Previous 24 Hour Average for Component #11
7088	7175	51.207.11	Previous 24 Hour Average for Component #12
7089	7177	51.207.12	Previous 24 Hour Average for Component #13
7090	7179	51.207.13	Previous 24 Hour Average for Component #14
7091	7181	51.207.14	Previous 24 Hour Average for Component #15
7092	7183	51.207.15	Previous 24 Hour Average for Component #16
Floating Point Register Group - Transmitter			
7200	7200	51.202.7	Ground Reference (N/A)
7201	7202	51.202.18	Power (12.247.9)
7202	7204	51.202.19	Mandrel Temp (12.247.7)
7203	7206	51.202.20	Column 1 Pressure (12.247.5)
7204	7208	51.202.21	Column 2 Pressure (12.247.6)
7205	7210	51.202.7	Analog Input #6 - Spare (N/A)
7206	7212	51.202.7	Ambient Temp (N/A)
7207	7214	51.202.7	Voltage Reference (N/A)
7208	7216	51.202.7	(N/A)
7209	7218	51.233.0	Calibration Standard - Component #1 (15.31.0)
7210	7220	51.233.1	Calibration Standard - Component #2 (15.31.1)
7211	7222	51.233.2	Calibration Standard - Component #3 (15.31.2)
7212	7224	51.233.3	Calibration Standard - Component #4 (15.31.3)
7213	7226	51.233.4	Calibration Standard - Component #5 (15.31.4)
7214	7228	51.233.5	Calibration Standard - Component #6 (15.31.5)
7215	7230	51.233.6	Calibration Standard - Component #7 (15.31.6)
7216	7232	51.233.7	Calibration Standard - Component #8 (15.31.7)
7217	7234	51.233.8	Calibration Standard - Component #9 (15.31.8)
7218	7236	51.233.9	Calibration Standard - Component #10 (15.31.9)
7219	7238	51.233.10	Calibration Standard - Component #11 (15.31.10)
7220	7240	51.233.11	Calibration Standard - Component #12 (15.31.11)
7221	7242	51.233.12	Calibration Standard - Component #13 (15.31.12)
7222	7244	51.233.13	Calibration Standard - Component #14 (15.31.13)
7223	7246	51.233.14	Calibration Standard - Component #15 (15.31.14)
7224	7248	51.233.15	Calibration Standard - Component #16 (15.31.15)
7225	7250	51.205.0	Response Factor - Component #1 (15.5.0)
7226	7252	51.205.1	Response Factor - Component #2 (15.5.1)
7227	7254	51.205.2	Response Factor - Component #3 (15.5.2)
7228	7256	51.205.3	Response Factor - Component #4 (15.5.3)

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
7229	7258	51.205.4	Response Factor - Component #5 (15.5.4)
7230	7260	51.205.5	Response Factor - Component #6 (15.5.5)
7231	7262	51.205.6	Response Factor - Component #7 (15.5.6)
7232	7264	51.205.7	Response Factor - Component #8 (15.5.7)
7233	7266	51.205.8	Response Factor - Component #9 (15.5.8)
7234	7268	51.205.9	Response Factor - Component #10 (15.5.9)
7235	7270	51.205.10	Response Factor - Component #11 (15.5.10)
7236	7272	51.205.11	Response Factor - Component #12 (15.5.11)
7237	7274	51.205.12	Response Factor - Component #13 (15.5.12)
7238	7276	51.205.13	Response Factor - Component #14 (15.5.13)
7239	7278	51.205.14	Response Factor - Component #15 (15.5.14)
7240	7280	51.205.15	Response Factor - Component #16 (15.5.15)
7241	7282	51.239.0	Alt Calibration Standard - Component #1 (15.40.0)
7242	7284	51.239.1	Alt Calibration Standard - Component #2 (15.40.1)
7243	7286	51.239.2	Alt Calibration Standard - Component #3 (15.40.2)
7244	7288	51.239.3	Alt Calibration Standard - Component #4 (15.40.3)
7245	7290	51.239.4	Alt Calibration Standard - Component #5 (15.40.4)
7246	7292	51.239.5	Alt Calibration Standard - Component #6 (15.40.5)
7247	7294	51.239.6	Alt Calibration Standard - Component #7 (15.40.6)
7248	7296	51.239.7	Alt Calibration Standard - Component #8 (15.40.7)
7249	7298	51.239.8	Alt Calibration Standard - Component #9 (15.40.8)
7250	7300	51.239.9	Alt Calibration Standard - Component #10 (15.40.9)
7251	7302	51.239.10	Alt Calibration Standard - Component #11 (15.40.10)
7252	7304	51.239.11	Alt Calibration Standard - Component #12 (15.40.11)
7253	7306	51.239.12	Alt Calibration Standard - Component #13 (15.40.12)
7254	7308	51.239.13	Alt Calibration Standard - Component #14 (15.40.13)
7255	7310	51.239.14	Alt Calibration Standard - Component #15 (15.40.14)
7256	7312	51.239.15	Alt Calibration Standard - Component #16 (15.40.15)
7257	7314	51.240.0	Alt Response Factor - Component #1 (15.43.0)
7258	7316	51.240.1	Alt Response Factor - Component #2 (15.43.1)
7259	7318	51.240.2	Alt Response Factor - Component #3 (15.43.2)
7260	7320	51.240.3	Alt Response Factor - Component #4 (15.43.3)
7261	7322	51.240.4	Alt Response Factor - Component #5 (15.43.4)
7262	7324	51.240.5	Alt Response Factor - Component #6 (15.43.5)
7263	7326	51.240.6	Alt Response Factor - Component #7 (15.43.6)
7264	7328	51.240.7	Alt Response Factor - Component #8 (15.43.7)
7265	7330	51.240.8	Alt Response Factor - Component #9 (15.43.8)
7266	7332	51.240.9	Alt Response Factor - Component #10 (15.43.9)
7267	7334	51.240.10	Alt Response Factor - Component #11 (15.43.10)
7268	7336	51.240.11	Alt Response Factor - Component #12 (15.43.11)
7269	7338	51.240.12	Alt Response Factor - Component #13 (15.43.12)

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
7270	7340	51.240.13	Alt Response Factor - Component #14 (15.43.13)
7271	7342	51.240.14	Alt Response Factor - Component #15 (15.43.14)
7272	7344	51.240.15	Alt Response Factor - Component #16 (15.43.15)
7273	7346	51.202.14	Detector 0 value (12.247.0)
7274	7348	51.202.15	Detector 1 value (12.247.1)
7275	7350	51.202.16	Detector 2 value (12.247.2)
7276	7352	51.202.17	Detector 3 value (12.247.3)
Registers 7400-7599 are for stream #1			
7401	7401	51.210.0	Mole % - Component #1(C3)
7402	7403	51.210.1	Mole % - Component #2(IC4)
7403	7405	51.210.2	Mole % - Component #3(NC4)
7404	7407	51.210.3	Mole % - Component #4(Neo C5)
7405	7409	51.210.4	Mole % - Component #5(IC5)
7406	7411	51.210.5	Mole % - Component #6(NC5)
7407	7413	51.210.6	Mole % - Component #7(C6+)
7408	7415	51.210.7	Mole % - Component #8(N2)
7409	7417	51.210.8	Mole % - Component #9(C1)
7410	7419	51.210.9	Mole % - Component #10(C02)
7411	7421	51.210.10	Mole % - Component #11(C2)
7412	7423	51.210.11	Mole % - Component #12(C6s)
7413	7425	51.210.12	Mole % - Component #13(C7s)
7414	7427	51.210.13	Mole % - Component #14(C8)
7415	7429	51.210.14	Mole % - Component #15(C9)
7416	7431	51.210.15	Mole % - Component #16(spare)
7417	7433	51.211.0	GPM % - Component #1
7418	7435	51.211.1	GPM % - Component #2
7419	7437	51.211.2	GPM % - Component #3
7420	7439	51.211.3	GPM % - Component #4
7421	7441	51.211.4	GPM % - Component #5
7422	7443	51.211.5	GPM % - Component #6
7423	7445	51.211.6	GPM % - Component #7
7424	7447	51.211.7	GPM % - Component #8
7425	7449	51.211.8	GPM % - Component #9
7426	7451	51.211.9	GPM % - Component #10
7427	7453	51.211.10	GPM % - Component #11
7428	7455	51.211.11	GPM % - Component #12
7429	7457	51.211.12	GPM % - Component #13
7430	7459	51.211.13	GPM % - Component #14
7431	7461	51.211.14	GPM % - Component #15

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
7432	7463	51.211.15	GPM % - Component #16
7433	7465	51.209.0	BTU - Dry
7434	7467	51.209.1	BTU - Saturated
7435	7469	51.209.2	Specific Gravity
7436	7471	51.209.3	Compressibility
7437	7473	51.209.4	WOBBE Index
7438	7475	51.209.5	Total UN-normalized mole
7439	7477	51.209.11	Total GPM
7440	7479	51.209.6	Ideal BTU
7441	7481	51.209.7	Density Normal
7442	7483	51.209.8	Inferior WOBBE
7443	7485	51.209.9	Methane Number
7444	7487	51.209.10	Speed of Sound
7445	7489	51.235.0	Rolling Average #1
7446	7491	51.235.1	Rolling Average #2
7447	7493	51.235.2	Rolling Average #3
7448	7495	51.235.3	Rolling Average #4
7449	7497	51.235.4	Rolling Average #5
7450	7499	51.235.5	Rolling Average #6
7451	7501	51.235.6	Rolling Average #7
7452	7503	51.235.7	Rolling Average #8
7453	7505	51.235.8	Rolling Average #9
7454	7507	51.235.9	Rolling Average #10
7455	7509	51.235.10	Rolling Average #11
7456	7511	51.235.11	Rolling Average #12
7457	7513	51.235.12	Rolling Average #13
7458	7515	51.235.13	Rolling Average #14
7459	7517	51.235.14	Rolling Average #15
7460	7519	51.235.15	Rolling Average #16
7461	7521	51.212.0	24 Hour Average for Component #1
7462	7523	51.212.1	24 Hour Average for Component #2
7463	7525	51.212.2	24 Hour Average for Component #3
7464	7527	51.212.3	24 Hour Average for Component #4
7465	7529	51.212.4	24 Hour Average for Component #5
7466	7531	51.212.5	24 Hour Average for Component #6
7467	7533	51.212.6	24 Hour Average for Component #7
7468	7535	51.212.7	24 Hour Average for Component #8

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
7469	7537	51.212.8	24 Hour Average for Component #9
7470	7539	51.212.9	24 Hour Average for Component #10
7471	7541	51.212.10	24 Hour Average for Component #11
7472	7543	51.212.11	24 Hour Average for Component #12
7473	7545	51.212.12	24 Hour Average for Component #13
7474	7547	51.212.13	24 Hour Average for Component #14
7475	7549	51.212.14	24 Hour Average for Component #15
7476	7551	51.212.15	24 Hour Average for Component #16
7477	7553	51.213.0	Previous 24 Hour Average for Component #1
7478	7555	51.213.1	Previous 24 Hour Average for Component #2
7479	7557	51.213.2	Previous 24 Hour Average for Component #3
7480	7559	51.213.3	Previous 24 Hour Average for Component #4
7481	7561	51.213.4	Previous 24 Hour Average for Component #5
7482	7563	51.213.5	Previous 24 Hour Average for Component #6
7483	7565	51.213.6	Previous 24 Hour Average for Component #7
7484	7567	51.213.7	Previous 24 Hour Average for Component #8
7485	7569	51.213.8	Previous 24 Hour Average for Component #9
7486	7571	51.213.9	Previous 24 Hour Average for Component #10
7487	7573	51.213.10	Previous 24 Hour Average for Component #11
7488	7575	51.213.11	Previous 24 Hour Average for Component #12
7489	7577	51.213.12	Previous 24 Hour Average for Component #13
7490	7579	51.213.13	Previous 24 Hour Average for Component #14
7491	7581	51.213.14	Previous 24 Hour Average for Component #15
7492	7583	51.213.15	Previous 24 Hour Average for Component #16
7493	7985	51.247.44	Rolling Average BTU – Dry
7494	7987	51.247.39	Rolling Average BTU-Sat
7495	7989	51.247.51	Rolling Average Specific Gravity
7496	7991	51.247.40	Rolling Average Compressibility
7497	7993	51.247.41	Rolling Average Superior Wobbe
7498	7995	51.247.47	Rolling Average Total Un-Normalized Mole %
7499	7997	51.247.48	Rolling Average Total GPM
7500	7999	51.247.50	Rolling Average Ideal BTU
7501	8001	51.247.46	Rolling Average Density Normal
7502	8003	51.248.44	24 Hr Average for BTU – Dry
7503	8005	51.248.39	24 Hr Average for BTU – Sat
7504	8007	51.248.51	24 Hr Average for Specific Gravity
7505	8009	51.248.40	24 Hr Average for Compressibility
7506	8011	51.248.41	24 Hr Average for Superior Wobbe
7507	8013	51.248.47	24 Hr Average for Total Un-Normalized Mole %
7508	8015	51.248.48	24 Hr Average for Total GPM
7509	8017	51.248.50	24 Hr Average for BTU

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
7510	8019	51.248.46	24 Hr Average for Density Normal
7511	8021	51.249.44	Previous 24 Hr Average for BTU – Dry
7512	8023	51.249.39	Previous 24 Hr Average for BTU - Sat
7513	8025	51.249.51	Previous 24 Hr Average for Specific Gravity
7514	8027	51.249.40	Previous 24 Hr Average for Compressibility
7515	8029	51.249.41	Previous 24 Hr Average for Superior Wobbe
7516	8031	51.249.47	Previous 24 Hr Average for Total Un-Normalized Mole %
7517	8033	51.249.48	Previous 24 Hr Average for Total GPM
7518	8035	51.249.50	Previous 24 Hr Average for BTU
7519	8037	51.249.46	Previous 24 Hr Average for Density Normal
7520-7600	N/A	51.249.46	
Registers 7600-7799 are for stream #2			
7601	7601	51.215.0	Mole % - Component #1(C3)
7602	7603	51.215.1	Mole % - Component #2(IC4)
7603	7605	51.215.2	Mole % - Component #3(NC4)
7604	7607	51.215.3	Mole % - Component #4(Neo C5)
7605	7609	51.215.4	Mole % - Component #5(IC5)
7606	7611	51.215.5	Mole % - Component #6(NC5)
7607	7613	51.215.6	Mole % - Component #7(C6+)
7608	7615	51.215.7	Mole % - Component #8(N2)
7609	7617	51.215.8	Mole % - Component #9(C1)
7610	7619	51.215.9	Mole % - Component #10(C02)
7611	7621	51.215.10	Mole % - Component #11(C2)
7612	7623	51.215.11	Mole % - Component #12(C6s)
7613	7625	51.215.12	Mole % - Component #13(C7s)
7614	7627	51.215.13	Mole % - Component #14(C8s)
7615	7629	51.215.14	Mole % - Component #15(C9s)
7616	7631	51.215.15	Mole % - Component #16(spare)
7617	7633	51.216.0	GPM % - Component #1
7618	7635	51.216.1	GPM % - Component #2
7619	7637	51.216.2	GPM % - Component #3
7620	7639	51.216.3	GPM % - Component #4
7621	7641	51.216.4	GPM % - Component #5
7622	7643	51.216.5	GPM % - Component #6
7623	7645	51.216.6	GPM % - Component #7
7624	7647	51.216.7	GPM % - Component #8
7625	7649	51.216.8	GPM % - Component #9
7626	7651	51.216.9	GPM % - Component #10
7627	7653	51.216.10	GPM % - Component #11
7628	7655	51.216.11	GPM % - Component #12

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
7629	7657	51.216.12	GPM % - Component #13
7630	7659	51.216.13	GPM % - Component #14
7631	7661	51.216.14	GPM % - Component #15
7632	7663	51.216.15	GPM % - Component #16
7633	7665	51.214.0	BTU - Dry
7634	7667	51.214.1	BTU - Saturated
7635	7669	51.214.2	Specific Gravity
7636	7671	51.214.3	Compressibility
7637	7673	51.214.4	WOBBE Index
7638	7675	51.214.5	Total UN-normalized mole
7639	7677	51.214.11	Total GPM
7640	7679	51.214.6	Ideal BTU
7641	7681	51.214.7	Density Normal
7642	7683	51.214.8	Inferior WOBBE
7643	7685	51.214.9	Methane Number
7644	7687	51.214.10	Speed of Sound
7645	7689	51.236.0	Rolling Average #1
7646	7691	51.236.1	Rolling Average #2
7647	7693	51.236.2	Rolling Average #3
7648	7695	51.236.3	Rolling Average #4
7649	7697	51.236.4	Rolling Average #5
7650	7699	51.236.5	Rolling Average #6
7651	7701	51.236.6	Rolling Average #7
7652	7703	51.236.7	Rolling Average #8
7653	7705	51.236.8	Rolling Average #9
7654	7707	51.236.9	Rolling Average #10
7655	7709	51.236.10	Rolling Average #11
7656	7711	51.236.11	Rolling Average #12
7657	7713	51.236.12	Rolling Average #13
7658	7715	51.236.13	Rolling Average #14
7659	7717	51.236.14	Rolling Average #15
7660	7719	51.236.15	Rolling Average #16
7661	7721	51.217.0	24 Hour Average for Component #1
7662	7723	51.217.1	24 Hour Average for Component #2
7663	7725	51.217.2	24 Hour Average for Component #3
7664	7727	51.217.3	24 Hour Average for Component #4
7665	7729	51.217.4	24 Hour Average for Component #5
7666	7731	51.217.5	24 Hour Average for Component #6

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
7667	7733	51.217.6	24 Hour Average for Component #7
7668	7735	51.217.7	24 Hour Average for Component #8
7669	7737	51.217.8	24 Hour Average for Component #9
7670	7739	51.217.9	24 Hour Average for Component #10
7671	7741	51.217.10	24 Hour Average for Component #11
7672	7743	51.217.11	24 Hour Average for Component #12
7673	7745	51.217.12	24 Hour Average for Component #13
7674	7747	51.217.13	24 Hour Average for Component #14
7675	7749	51.217.14	24 Hour Average for Component #15
7676	7751	51.217.15	24 Hour Average for Component #16
7677	7753	51.218.0	Previous 24 Hour Average for Component #1
7677	7755	51.218.1	Previous 24 Hour Average for Component #2
7678	7757	51.218.2	Previous 24 Hour Average for Component #3
7679	7759	51.218.3	Previous 24 Hour Average for Component #4
7680	7761	51.218.4	Previous 24 Hour Average for Component #5
7681	7763	51.218.5	Previous 24 Hour Average for Component #6
7682	7765	51.218.6	Previous 24 Hour Average for Component #7
7683	7767	51.218.7	Previous 24 Hour Average for Component #8
7684	7769	51.218.8	Previous 24 Hour Average for Component #9
7685	7771	51.218.9	Previous 24 Hour Average for Component #10
7686	7773	51.218.10	Previous 24 Hour Average for Component #11
7687	7775	51.218.11	Previous 24 Hour Average for Component #12
7689	7777	51.218.12	Previous 24 Hour Average for Component #13
7690	7779	51.218.13	Previous 24 Hour Average for Component #14
7691	7781	51.218.14	Previous 24 Hour Average for Component #15
7692	7783	51.218.15	Previous 24 Hour Average for Component #16
Registers 7800-7999 are for stream #3			
7801	7801	51.220.0	Mole % - Component #1(C3)
7802	7803	51.220.1	Mole % - Component #2(IC4)
7803	7805	51.220.2	Mole % - Component #3(NC4)
7804	7807	51.220.3	Mole % - Component #4(Neo C5)
7805	7809	51.220.4	Mole % - Component #5(IC5)
7806	7811	51.220.5	Mole % - Component #6(NC5)
7807	7813	51.220.6	Mole % - Component #7(C6+)
7808	7815	51.220.7	Mole % - Component #8(N2)
7809	7817	51.220.8	Mole % - Component #9(C1)
7810	7819	51.220.9	Mole % - Component #10(C02)
7811	7821	51.220.10	Mole % - Component #11(C2)
7812	7823	51.220.11	Mole % - Component #12(C6s)
7813	7825	51.220.12	Mole % - Component #13(C7s)

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
7814	7827	51.220.13	Mole % - Component #14(C8s)
7815	7829	51.220.14	Mole % - Component #15(C9s)
7816	7831	51.220.15	Mole % - Component #16(spare)
7817	7833	51.221.0	GPM % - Component #1
7818	7835	51.221.1	GPM % - Component #2
7819	7837	51.221.2	GPM % - Component #3
7820	7839	51.221.3	GPM % - Component #4
7821	7841	51.221.4	GPM % - Component #5
7822	7843	51.221.5	GPM % - Component #6
7823	7845	51.221.6	GPM % - Component #7
7824	7847	51.221.7	GPM % - Component #8
7825	7849	51.221.8	GPM % - Component #9
7826	7851	51.221.9	GPM % - Component #10
7827	7853	51.221.10	GPM % - Component #11
7828	7855	51.221.11	GPM % - Component #12
7829	7857	51.221.12	GPM % - Component #13
7830	7859	51.221.13	GPM % - Component #14
7831	7861	51.221.14	GPM % - Component #15
7832	7863	51.221.15	GPM % - Component #16
7833	7865	51.219.0	BTU - Dry
7834	7867	51.219.1	BTU - Saturated
7835	7869	51.219.2	Specific Gravity
7836	7871	51.219.3	Compressibility
7837	7873	51.219.4	WOBBE Index
7838	7875	51.219.5	Total UN-normalized mole
7839	7877	51.219.11	Total GPM
7840	7879	51.219.6	Ideal BTU
7841	7881	51.219.7	Density Normal
7842	7883	51.219.8	Inferior WOBBE
7843	7885	51.219.9	Methane Number
7844	7887	51.219.10	Speed of Sound
7845	7889	51.237.0	Rolling Average #1
7846	7891	51.237.1	Rolling Average #2
7847	7893	51.237.2	Rolling Average #3
7848	7895	51.237.3	Rolling Average #4
7849	7897	51.237.4	Rolling Average #5
7850	7899	51.237.5	Rolling Average #6
7851	7901	51.237.6	Rolling Average #7
7852	7903	51.237.7	Rolling Average #8

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
7853	7905	51.237.8	Rolling Average #9
7854	7907	51.237.9	Rolling Average #10
7855	7909	51.237.10	Rolling Average #11
7856	7911	51.237.11	Rolling Average #12
7857	7913	51.237.12	Rolling Average #13
7858	7915	51.237.13	Rolling Average #14
7859	7917	51.237.14	Rolling Average #15
7860	7919	51.237.15	Rolling Average #16
7861	7921	51.222.0	24 Hour Average for Component #1
7862	7923	51.222.1	24 Hour Average for Component #2
7863	7925	51.222.2	24 Hour Average for Component #3
7864	7927	51.222.3	24 Hour Average for Component #4
7865	7929	51.222.4	24 Hour Average for Component #5
7866	7931	51.222.5	24 Hour Average for Component #6
7867	7933	51.222.6	24 Hour Average for Component #7
7868	7935	51.222.7	24 Hour Average for Component #8
7869	7937	51.222.8	24 Hour Average for Component #9
7870	7939	51.222.9	24 Hour Average for Component #10
7871	7941	51.222.10	24 Hour Average for Component #11
7872	7943	51.222.11	24 Hour Average for Component #12
7873	7945	51.222.12	24 Hour Average for Component #13
7874	7947	51.222.13	24 Hour Average for Component #14
7875	7949	51.222.14	24 Hour Average for Component #15
7876	7951	51.222.15	24 Hour Average for Component #16
7877	7953	51.223.0	Previous 24 Hour Average for Component #1
7878	7955	51.223.1	Previous 24 Hour Average for Component #2
7879	7957	51.223.2	Previous 24 Hour Average for Component #3
7880	7959	51.223.3	Previous 24 Hour Average for Component #4
7881	7961	51.223.4	Previous 24 Hour Average for Component #5
7882	7963	51.223.5	Previous 24 Hour Average for Component #6
7883	7965	51.223.6	Previous 24 Hour Average for Component #7
7884	7967	51.223.7	Previous 24 Hour Average for Component #8
7885	7969	51.223.8	Previous 24 Hour Average for Component #9
7886	7971	51.223.9	Previous 24 Hour Average for Component #10
7887	7973	51.223.10	Previous 24 Hour Average for Component #11
7888	7975	51.223.11	Previous 24 Hour Average for Component #12
7889	7977	51.223.12	Previous 24 Hour Average for Component #13
7890	7979	51.223.13	Previous 24 Hour Average for Component #14
7891	7981	51.223.14	Previous 24 Hour Average for Component #15
7892	7983	51.223.15	Previous 24 Hour Average for Component #16

Modbus Reg # 32-bit	16-bit	Input Reg	Description
Registers 8000-8199 are for stream #4			
8001	8001	51.225.0	Mole % - Component #1(C3)
8002	8003	51.225.1	Mole % - Component #2(IC4)
8003	8005	51.225.2	Mole % - Component #3(NC4)
8004	8007	51.225.3	Mole % - Component #4(Neo C5)
8005	8009	51.225.4	Mole % - Component #5(IC5)
8006	8011	51.225.5	Mole % - Component #6(NC5)
8007	8013	51.225.6	Mole % - Component #7(C6+)
8008	8015	51.225.7	Mole % - Component #8(N2)
8009	8017	51.225.8	Mole % - Component #9(C1)
8010	8019	51.225.9	Mole % - Component #10(C02)
8011	8021	51.225.10	Mole % - Component #11(C2)
8012	8023	51.225.11	Mole % - Component #12(C6s)
8013	8025	51.225.12	Mole % - Component #13(C7s)
8014	8027	51.225.13	Mole % - Component #14(C8s)
8015	8029	51.225.14	Mole % - Component #15(C9s)
8016	8031	51.225.15	Mole % - Component #16(spare)
8017	8033	51.226.0	GPM % - Component #1
8018	8035	51.226.1	GPM % - Component #2
8019	8037	51.226.2	GPM % - Component #3
8020	8039	51.226.3	GPM % - Component #4
8021	8041	51.226.4	GPM % - Component #5
8022	8043	51.226.5	GPM % - Component #6
8023	8045	51.226.6	GPM % - Component #7
8024	8047	51.226.7	GPM % - Component #8
8025	8049	51.226.8	GPM % - Component #9
8026	8051	51.226.9	GPM % - Component #10
8027	8053	51.226.10	GPM % - Component #11
8028	8055	51.226.11	GPM % - Component #12
8029	8057	51.226.12	GPM % - Component #13
8030	8059	51.226.13	GPM % - Component #14
8031	8061	51.226.14	GPM % - Component #15
8032	8063	51.226.15	GPM % - Component #16
8033	8065	51.224.0	BTU - Dry
8034	8067	51.224.1	BTU - Saturated
8035	8069	51.224.2	Specific Gravity
8036	8071	51.224.3	Compressibility
8037	8073	51.224.4	WOBBE Index
8038	8075	51.224.5	Total UN-normalized mole

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
8039	8077	51.224.11	Total GPM
8040	8079	51.214.6	Ideal BTU
8041	8081	51.214.7	Density Normal
8042	8083	51.214.8	Inferior WOBBE
8043	8085	51.214.9	Methane Number
8044	8087	51.214.10	Speed of Sound
8045	8089	51.238.0	Rolling Average #1
8046	8091	51.238.1	Rolling Average #2
8047	8093	51.238.2	Rolling Average #3
8048	8095	51.238.3	Rolling Average #4
8049	8097	51.238.4	Rolling Average #5
8050	8099	51.238.5	Rolling Average #6
8051	8101	51.238.6	Rolling Average #7
8052	8103	51.238.7	Rolling Average #8
8053	8105	51.238.8	Rolling Average #9
8054	8107	51.238.9	Rolling Average #10
8055	8109	51.238.10	Rolling Average #11
8056	8111	51.238.11	Rolling Average #12
8057	8113	51.238.12	Rolling Average #13
8058	8115	51.238.13	Rolling Average #14
8059	8117	51.238.14	Rolling Average #15
8060	8119	51.238.15	Rolling Average #16
8061	8121	51.227.0	24 Hour Average for Component #1
8062	8123	51.227.1	24 Hour Average for Component #2
8063	8125	51.227.2	24 Hour Average for Component #3
8064	8127	51.227.3	24 Hour Average for Component #4
8065	8129	51.227.4	24 Hour Average for Component #5
8066	8131	51.227.5	24 Hour Average for Component #6
8067	8133	51.227.6	24 Hour Average for Component #7
8068	8135	51.227.7	24 Hour Average for Component #8
8069	8137	51.227.8	24 Hour Average for Component #9
8070	8139	51.227.9	24 Hour Average for Component #10
8071	8141	51.227.10	24 Hour Average for Component #11
8072	8143	51.227.11	24 Hour Average for Component #12
8073	8145	51.227.12	24 Hour Average for Component #13
8074	8147	51.227.13	24 Hour Average for Component #14
8075	8149	51.227.14	24 Hour Average for Component #15
8076	8151	51.227.15	24 Hour Average for Component #16
8077	8153	51.228.0	Previous 24 Hour Average for Component #1

Modbus Reg #		Input Reg	Description
32-bit	16-bit		
8078	8155	51.228.1	Previous 24 Hour Average for Component #2
8079	8157	51.228.2	Previous 24 Hour Average for Component #3
8080	8159	51.228.3	Previous 24 Hour Average for Component #4
8081	8161	51.228.4	Previous 24 Hour Average for Component #5
8082	8163	51.228.5	Previous 24 Hour Average for Component #6
8083	8165	51.228.6	Previous 24 Hour Average for Component #7
8084	8167	51.228.7	Previous 24 Hour Average for Component #8
8085	8169	51.228.8	Previous 24 Hour Average for Component #9
8086	8171	51.228.9	Previous 24 Hour Average for Component #10
8087	8173	51.228.10	Previous 24 Hour Average for Component #11
8088	8175	51.228.11	Previous 24 Hour Average for Component #12
8089	8177	51.228.12	Previous 24 Hour Average for Component #13
8090	8179	51.228.13	Previous 24 Hour Average for Component #14
8091	8181	51.228.14	Previous 24 Hour Average for Component #15
8092	8183	51.228.15	Previous 24 Hour Average for Component #16

## APPENDIX C DEFINITIONS AND ACRONYMS

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 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-2100767 Board	Main Electronic Board used in the $\mu$ FLO Computers. It is housed on an integrated assembly and includes the IMV. It operates at 195 MHz while drawing minimal power.
$\mu$ Sec	Micro Second.
$\mu$ FLO 6200	This Totalflow Flow Computer is housed in a small lightweight enclosure. It’s main feature is it’s low power, microprocessor based units designed to meet a wide range of measurement, monitor and alarming applications for remote gas systems, while being a cost effective alternative.
*.CSV file	See Comma Separated Values (I.E. spreadsheet format).
*.INI file	See Initialization File.
A/D	Analog-to-digital.
ABB Inc.	Asea, Brown & Boveri, parent company of Totalflow
Absolute Pressure	Gauge pressure plus barometric pressure. Totalflow devices use Static Pressure (SP) for flow calculations.
Absolute Zero	The zero point on the absolute temperature scale. It is equal to -273.16 degrees C, or 0 degrees K (Kelvin), or -459.69 degrees F, or 0 degrees R (Rankine).
Absorber	A tower or column that provides contact between natural gas being processed and a liquid solvent.
Absorption	The process of removing vapors from a stream of natural gas by passing the natural gas through liquids or chemicals which have a natural attraction to the vapors to be removed from the stream.
Absorption Factor	A factor which is an indication of the tendency for a given gas phase component to be transferred to the liquid solvent. It is generally expressed as $A=L/KV$ where L and V are the moles of liquid and vapor, and K is the average value of the vapor-liquid equilibrium constant for the component of concern.
Absorption Oil	A hydrocarbon liquid used to absorb and recover components from the natural gas being processed.
AC	See Alternating Current.
Accuracy	How closely a measured value agrees with the correct value. Usually expressed as $\pm$ percent of full scale output or reading.
Acid Gas	See Gas, Acid.
ACK	See Acknowledgment.

TERM	DEFINITION
Acknowledgment	This refers to a response over a remote communication device to a request such as a PING. Basically, saying, "I'm here, and I saw your request!"
ACM	See Analyzer Control Module.
Acoustics	The degree of sound. The nature, cause, and phenomena of the vibrations of elastic bodies; which vibrations create compressional waves or wave fronts which are transmitted through various media, such as air, water, wood, steel, etc.
Active Analog Output	Analog Output to a host providing power to the host.
Active Mode	An operational mode used by the LevelMaster for measuring dual float levels by applying a signal to the primary windings, reading the voltage level on the secondary windings and using an algorithm to determine the oil and water levels.
Adapter	A mechanism or device for attaching non-mating parts.
ADC	See Analog-to-Digital Converter.
Address	A unique memory designation for location of data or the identity of a peripheral device; allows each device on a single communications line to respond to its own message.
Adiabatic Expansion	The expansion of a gas, vapor, or liquid stream from a higher pressure to a lower pressure in which there is no heat transfer between the gas, vapor, or liquid and the surroundings.
Adsorption	The process of removing natural gas liquids from a stream of natural gas by passing the natural gas through granular solids which have a natural attraction to the liquids to be removed from the stream.
Aerial	A length of wire designed to transmit or receive radio waves. (See also Antenna)
Aerosol Liquids	Minute liquid particles suspended in gas. Aerosols will behave like a fluid and can be transported by pipes and pumping. When aerosols contact each other they coalesce into droplets. Aerosols may be present in gas, or may be generated by glow shearing off the skim inside of a pipeline.
AGA	American Gas Association. Trade group representing natural gas distributors and pipelines.
AGA-10	American Gas Association Report No. 10, Speed of Sound in Natural Gas and Other Related Hydrocarbon Gases. Method for calculation of the speed of sound in gases.
AGA-3	American Gas Association Report No. 3, Orifice Metering of Natural Gas. Method for calculating gas volume across an Orifice Plate. This method requires two pressure readings, Differential Pressure (DP) and Static Pressure (SP).
AGA-5	American Gas Association Report No. 5, Fuel Gas Energy Metering. Methods (Volume, Mass or Energy) for calculating BTUs without knowing the composition of the gas.

TERM	DEFINITION
AGA-7	American Gas Association Report No. 7, Measurement of Gas by Turbine Meters. Method for calculating gas volume using a Pulse Meter. This method requires one pressure reading, Static Pressure (SP).
AGA-8	American Gas Association Report No. 8, Compressibility Factor of Natural Gas and Related Hydrocarbon Gases. Method for calculating the Super Compressibility Factor, Fpv.
AGA-9	American Gas Association Report No. 9, Measurement of Gas by Multipath Ultrasonic Meters. Method for calculating gas based on transit-times.
AGC	Automatic Gain Control
AH	See Ampere-Hour.
AI	Analog Input
AIU	Analyzer Interface Unit.
Alkane	The simplest homologous series of saturated aliphatic hydrocarbons, consisting of methane, ethane, propane, butane; also know as olefins. Unsaturated hydrocarbons that contain one or more carbon-carbon double bonds.
Alkanolamine	See Amine.
Alkynes	Unsaturated hydrocarbons that contain one or more carbon-carbon triple bonds.
Alphanumeric	A character set that contains both letters and digits.
Alternating Current	An electric current whose direction changes with a frequency independent of circuit components.
Aluminum Powder Coating	Totalflow aluminum enclosures have a baked-on Powder Coating designed to our specifications to ensure paint adhesion, weather resistance and durability.
Ambient Compensation	The design of an instrument such that changes in ambient temperature do not affect the readings of the instrument.
Ambient Conditions	The conditions around the transducer (pressure, temperature, etc.).
Ambient Pressure	Pressure of the air surrounding a transducer.
Ambient Temperature	The average or mean temperature of the surrounding air which comes in contact with the equipment and instruments under test.
Amine (Alkanolamine)	Any of several liquid compounds containing amino nitrogen generally used in water solution to remove, by reversible chemical reaction, hydrogen sulfide and/or carbon dioxide from gas and liquid hydrocarbon streams.
Ammeter	An instrument used to measure current.
Amp	See Ampere.
Ampere	The unit of electrical current. Also milliamp (one thousandth of an amp) and micro amp (one millionth of an amp). One amp corresponds to the flow of about $6 \times 10^{18}$ electrons per second.

TERM	DEFINITION
Ampere-Hour	The quantity of electricity measured in ampere-hours (Ah) which may be delivered by a cell or battery under specified conditions. A current of one ampere flowing for one hour.
Ampere-Hour Efficiency	The ratio of the output of a secondary cell or battery, measured in ampere-hours, to the input required to restore the initial state of charge, under specified conditions.
Amplifier	A device which draws power from a source other than the input signal and which produces as an output an enlarged reproduction of the essential features of its input.
Amplitude	The highest value reached by voltage, current or power during a complete cycle.
Amplitude Modulation	Where audio signals increase and decrease the amplitude of the "carrier wave".
Amplitude Span	The Y-axis range of a graphic display of data in either the time or frequency domain. Usually a log display (dB) but can also be linear.
AMU	See Analog Measurement Unit.
AMU/IMV	Generic reference to the Measurement unit. See Analog Measurement Unit and Integral Multivariable Transducer for more definition.
Analog	A system in which data is represented as a continuously varying voltage/current.
Analog Input	Data received as varying voltage/current.
Analog Measurement Unit	A transducer for converting energy from one form to another. (e.g. Static and Differential pressure to electrical signals)
Analog Output	A voltage or current signal that is a continuous function of the measured parameter. Data that is transmitted as varying voltage/current.
Analog Trigger	A trigger that occurs at a user-selected point on an incoming analog signal. Triggering can be set to occur at a specific level on either an increasing or a decreasing signal (positive or negative slope).
Analog-to-Digital Converter	An electronic device, often an integrated circuit, that converts an analog voltage to a number.
Analytical Module	The primary component of the NGC's modular design is the analytical module. This module comes in a 12VDC or a 24VDC configuration and contains the GC Module, Analytical Processing system and manifold. Replacement of this component is enhanced by the single bolt removal feature. This module may also be broken down into the GC module, manifold assembly and analytical processor assembly.
Analytical Module	Totalflow Analytical Module assembly contains the GC Module, Manifold and Analytical Processor. The modular design features Single Bolt removal.
Analytical Processor Assembly	The Analytical Processor board interfaces with the analog circuits to monitor temperatures, and pressures, and also control the processes. The data generated by the Analytical Processor is passed to the Digital Controller board.

TERM	DEFINITION
Analyzer Control Module	Consists of various electronic components used for analysis.
Anemometer	An instrument for measuring and/or indicating the velocity of air flow.
Annealed	Toughen (steel or glass) by a process of gradually heating and cooling,
Annunciator	Display of a status on a screen.
ANSI	American National Standards Institute.
Antenna	A length of wire or similar that radiates (such as a transmitting antenna) or absorbs (such as a radio antenna) radio waves. The two basic types are: Yagi (directional) or Omni (bi-directional).
AO	Analog Output
AP	See Absolute Pressure.
API 14.3	American Petroleum Institute Report No. 14.3 addresses the 1992 equation regarding the AGA-3 method for calculating gas volume across an Orifice Plate.
API 21.1	American Petroleum Institute Report No. 21.1 addresses the equation regarding AGA-8 Fpv or Supercompressibility Factor and the energy content of the gas.
API Gravity	An arbitrary scale expressing the relative density of liquid petroleum products. The scale is calibrated in degrees API. The formula is: $DegAPI = \left[ \frac{141.5}{\gamma(60^{\circ}F / 60^{\circ}F)} \right] - 131.5$ where $\gamma$ =relative density.
Archive	A file containing historical records in a compressed format for more efficient long term storage and transfer. Totalflow archive records are non-editable, meaning that when they are stored they may not be changed. These records are used during an audit of data.
Artificial Drives	Techniques for producing oil after depletion or in lieu of natural drives; includes water flooding, natural gas re-injection, inert gas injection, flue gas injection and in-situ combustion.
Artificial Lift	Any of the techniques, other than natural drives, for bringing oil to the surface.
ASCII	American Standard Code for Information Interchange. A very popular standard method of encoding alphanumeric characters into 7 or 8 binary bits.
ASME	American Society of Mechanical Engineers.
ASTM	American Society for Testing and Materials (ASTM International).
ASTM D 3588	ASTM International Standard Practice for calculating heat value, compressibility factor and relative density of gaseous fuels.
Asynchronous	A communications protocol where information can be transmitted at an arbitrary, unsynchronized point in time, without synchronization to a reference time or "clock".
ATC	Automatic temperature compensation.

TERM	DEFINITION
ATEX	Term used for European Union's New Approach Directive 94/9/EC which concerns equipment and protective systems intended for use in potentially explosive atmospheres.
Atmosphere (one)	A unit of pressure; the pressure that will support a column of mercury 760 mm high at 0 °C.
Atmospheric Pressure	The pressure exerted on the earth by the earth's atmosphere (air and water vapor). A pressure of 760 mm of mercury, 29.92 inches of mercury, or 14.696 pounds per square inch absolute is used as a (scientific) standard for some measurements. Atmospheric pressure may also refer to the absolute ambient pressure at any given location.
Audio Frequency	Generally in the range 20 Hz to 20 KHz.
Audit	To examine or verify data for accuracy. Totalflow's DB1 and DB2 records may be edited to generate a more accurate representation of data information.
Audit Trail	Using the Long Term Archive files to justify changes made to records that more accurately reflects the correct data. Peripheral information used to edit data is recorded without exception, to justify the accuracy of the edited data records.
Automatic Frequency Control	Similar to Automatic Fine Tune (AFT). A circuit that keeps a receiver in tune with the wanted transmission.
AWG	American Wire Gage.
AWG	Acronym for American Wire Gauge.
Back Pressure	Pressure against which a fluid is flowing. May be composed of friction in pipes, restrictions in pipes, valves, pressure in vessels to which fluid is flowing, hydrostatic head, or other resistance to fluid flow.
Backflush	Technique used in chromatography to reverse direction of the flow after the lighter components have been measured, allowing the heavier components to remain in the column until measured, shortening the length of the column.
Background Acquisition	Data is acquired by a DAQ system while another program or processing routine is running without apparent interruption.
Background Noise	The total noise floor from all sources of interference in a measurement system, independent of the presence of a data signal.
Backup	A system, device, file or facility that can be used as an alternative in case of a malfunction or loss of data.
Bandwidth	The range of frequencies available for signaling; the difference between the highest and lowest frequencies of a band expressed in Hertz.
Bar	Bar is equal to 1 atmosphere of pressure. I.e. .987 Standard atmospheric pressure or 14.5 lbs./psia.
Barometer	An instrument which measures atmospheric pressure.
Barrel	A unit of liquid volume measurement in the petroleum industry that equals 42 U.S. gallons (.159 cubic meters) for petroleum or natural gas liquid products, measured at 60 degrees Fahrenheit and at an equilibrium vapor pressure.

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.
Basic Sediment and Water	Waste that collects in the bottom of vessels and tanks containing petroleum or petroleum products.
Battery	Two or more electrochemical cells electrically interconnected in an appropriate series/parallel arrangement to provide the required operating voltage and current levels.
Baud	Unit of signaling speed. The speed in baud is the number of discrete conditions or events per second. If each event represents only one bit condition, baud rate equals bits per second (bps).
Baud Rate	Serial communications data transmission rate expressed in bits per second (b/s).
Bbl	See Barrel.
Bcf	Abbreviation for one billion standard cubic feet or one thousand MMcf or one million Mcf.
BG Mix	A liquefied hydrocarbon product composed primarily of butanes and natural gasoline.
Bias	Term used when calibrating. Amounts to offset the actual measurement taken. On a LevelMaster, it refers to adjusting the measurement of the float level to agree with a calibrated measurement. On an RTD (Resistant Thermal Detector), it refers to adjusting the measurement of the temperature to agree with a calibrated temperature. This figure maybe either a positive or negative figure.
BIAS Current	A very low-level DC current generated by the panel meter and superimposed on the signal. This current may introduce a measurable offset across a very high source impedance.
Binary Number	System based on the number 2. The binary digits are 0 and 1.
Binary-Coded Decimal	A code for representing decimal digits in a binary format.
BIOS	Basic Input/Output System. A program, usually stored in ROM, which provides the fundamental services required for the operation of the computer. These services range from peripheral control to updating the time of day.
Bipolar	A signal range that includes both positive and negative values.
Bipolar Transistor	The most common form of transistor.
Bit	Binary Digit - the smallest unit of binary data. One binary digit, either 0 or 1. See also byte.
Bits Per Second	Unit of data transmission rate.
Blue Dot Technology	Technological changes to the DC and ACM Modules, decreasing noise by changing ground. Allows amplification of the results, gains resolution.

TERM	DEFINITION
Board	Common name used to identify the Main Electronic Board. Also called Motherboard, Engine Card and Circuit Board.
Boiling Point	The temperature at which a substance in the liquid phase transforms to the gaseous phase; commonly refers to the boiling point of water which is 100°C (212°F) at sea level.
Bootstrap Loader	Abbreviated BSL. Software enabling user to communicate with the PCBA for the purpose of programming the FLASH memory in the microcontroller.
Bounce	Bouncing is the tendency of any two metal contacts in an electronic device to generate multiple signals as the contacts close or open. When you press a key on your computer keyboard, you expect a single contact to be recorded by your computer. In fact, however, there is an initial contact, a slight bounce or lightening up of the contact, then another contact as the bounce ends, yet another bounce back, and so forth. A similar effect takes place when a switch made using a metal contact is opened.
BP Mix	A liquefied hydrocarbon product composed primarily of butanes and propane.
BPS	See Bits Per Second.
Bridge	Generally a short-circuit on a PC board caused by solder joining two adjacent tracks.
Bridge Resistance	See Input impedance and Output impedance.
British Thermal Unit	Energy required to raise one pound of water one degree Fahrenheit. One pound of water at 32 F° requires the transfer of 144 BTUs to freeze into solid ice.
Browser	Software which formats Web pages for viewing; the Web client
BS&W	See Basic Sediment and Water.
BSL	See Bootstrap Loader.
Btu	See British Thermal Unit.
Btu Factor	A numerical representation of the heating value of natural gas which may be calculated or presented to indicate varying relationships (e.g., the number of Btu contained in one standard cubic foot or the number of MMBtu contained in one Mcf of gas. The factor for a given relationship will vary depending upon whether the gas is “dry” or “saturated”.
Btu Method	A method of allocating costs between different operations or between different products based upon the heat content of products produced in the various operations or of the various produced products.
Btu per Cubic Foot	A measure of the heat available or released when one cubic foot of gas is burned.
Btu, Dry	Heating value contained in cubic foot of natural gas measured and calculated free of moisture content. Contractually, dry may be defined as less than or equal to seven pounds of water per Mcf.

TERM	DEFINITION
Btu, Saturated	The number of Btu's contained in a cubic foot of natural gas fully saturated with water under actual delivery pressure, temperature and gravity conditions. See BTU, DRY.
Btu/CV	Used to express the heating content of gas. See British Thermal Units or Calorific Value.
BtuMMI	Refers to the interface program or software that operates the Btu Analyzer.
Buffer	(1) A temporary storage device used to compensate for a difference in data rate and data flow between two devices (typically a computer and a printer); also called a spooler; (2) An amplifier to increase the drive capability, current or distance, of an analog or digital signal.
Burst Pressure	The maximum pressure applied to a transducer sensing element or case without causing leakage.
BUS	A data path shared by many devices (e.g., multipoint line) with one or more conductors for transmitting signals, data, or power.
Bus Master	A type of controller with the ability to read and write to devices on the computer bus.
Busbar	A heavy, rigid conductor used for high voltage feeders.
Butane (C <sub>4</sub> H <sub>10</sub> )	A saturated hydrocarbon (Alkane) with four carbon atoms in it's 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.
Butane, Normal	see Normal Butane.
Butylene (C <sub>4</sub> H <sub>8</sub> )	A saturated hydrocarbon (Alkane) with four carbon atoms in it's molecule (C <sub>4</sub> H <sub>8</sub> ). A gas at room temperature and pressure, but easily liquefied by lowering the temperature or raising the pressure. This gas is colorless, has a distinct odor, and is highly flammable. Although not naturally present in petroleum in high percentages, they can be produced from petrochemicals or by catalytic cracking of petroleum.
Byte	A group of binary digits that combine to make a word. Generally 8 bits. Half byte is called a nibble. Large computers use 16 bits and 32 bits. Also used to denote the amount of memory required to store one byte of data.
C <sub>10</sub> H <sub>22</sub>	The molecular formula for Decane.
C <sub>1</sub> H <sub>4</sub>	The molecular formula for Methane.
C <sub>2</sub> H <sub>4</sub>	The molecular formula for Ethylene.
C <sub>2</sub> H <sub>6</sub>	The molecular formula for Ethane.
C <sub>3</sub> H <sub>6</sub>	The molecular formula for Propylene.
C <sub>3</sub> H <sub>8</sub>	The molecular formula for Propane.
C <sub>4</sub> H <sub>10</sub>	The molecular formula for Butane.
C <sub>4</sub> H <sub>8</sub> C	The molecular formula for Butylene.

TERM	DEFINITION
C5+	A standard abbreviation for Pentanes Plus (IC5, NC5 and C6+).
C5H12	The molecular formula for Pentane.
C6+	A standard abbreviation for Hexane Plus.
C6H14	The molecular formula for Hexane.
C7H16	The molecular formula for Heptane.
C8H18	The molecular formula for Octane.
C9H20	The molecular formula for Nonane.
Cache Memory	Fast memory used to improve the performance of a CPU. Instructions that will soon be executed are placed in cache memory shortly before they are needed. This process speeds up the operation of the CPU.
Calibrate	To ascertain, usually by comparison with a standard, the locations at which scale or chart graduations should be placed to correspond to a series of values of the quantity which the instrument is to measure, receive or transmit. Also, to adjust the output of a device, to bring it to a desired value, within a specified tolerance for a particular value of the input. Also, to ascertain the error in the output of a device by checking it against a standard.
Calorie	The quantity of thermal energy required to raise one gram of water 1°C at 15°C.
Calorimeter	An apparatus which is used to determine the heating value of a combustible material.
Capacitor	An electronic component that stores electrical charge.
Capacity	The total number of ampere-hours (or watt-hours) that can be withdrawn from a cell/battery under specified conditions of discharge.
CAR	Carrier Gas (located on NGC series Feed-Through Assembly).
Carbon	Base of all hydrocarbons and is capable of combining with hydrogen in many proportions, resulting in numberless hydrocarbon compounds. The carbon content of a hydrocarbon determines, to a degree, the hydrocarbon's burning characteristics and qualities.
Carbon Dioxide	Colorless, odorless and slightly acid-tasting gas, consisting of one atom of carbon joined to two atoms of oxygen. CO <sub>2</sub> . Produced by combustion or oxidation of materials containing carbon. Commonly referred to as dry ice when in its solid form.
Carrier Gas	Totalflow recommends that Helium be used as a carrier gas. Carrier gas is used in the "Mobile Phase" of chromatography, pushing the sample gas through the columns ("Stationary Phase"). Because Helium has no heating value, it does not affect the Btu values.
Casinghead Gas	Natural gas that is produced from oil wells along with crude oil.
Catalyst	A substance that speeds up a chemical reaction without being consumed itself in the reaction. A substance that alters (usually increases) the rate at which a reaction occurs.
Catalytic	The process of altering, accelerating or instigating a chemical reaction.

TERM	DEFINITION
Cathode	An electrode through which current leaves any nonmetallic conductor. An electrolytic cathode is an electrode at which positive ions are discharged, or negative ions are formed, or at which other reducing reactions occur. The negative electrode of a galvanic cell; of an electrolytic capacitor.
Cavitation	The boiling of a liquid caused by a decrease in pressure rather than an increase in temperature.
CC	Cubic Centimeters. Measurement unit for measuring volume or capacity in one hundredth of a meter.
CC	Acronym for Cubic Centimeter.
C-Code	C language (IEC supported programming language)
CCU	See DosCCU, WINCCU, PCCU or WEBCCU.
CCV	See Closed Circuit Voltage.
Cd	Coefficient of Discharge factor.
CDPD	Cellular Digital Packet Data
CE	European Community Certification Bureau.
Cell	The basic electrochemical unit used to generate or store electrical energy.
Celsius (centigrade)	A temperature scale defined by 0°C at the ice point and 100°C at boiling point of water at sea level.
CENELEC	European Committee for Electro-technical Standardization. Also known as the European Standards Organization.
Centimeter	Acronym c. Metric measurement equal to .3937 inch.
Central Processing Unit	The central part of a computer system that performs operations on data. In a personal computer the CPU is typically a single microprocessor integrated circuit.
Ceramic Insulation	High-temperature compositions of metal oxides used to insulate a pair of thermocouple wires The most common are Alumina (Al <sub>2</sub> O <sub>3</sub> ), Beryllium (BeO), and Magnesia (MgO). Their application depends upon temperature and type of thermocouple. High-purity alumina is required for platinum alloy thermocouples. Ceramic insulators are available as single and multihole tubes or as beads.
Certification	The process of submitting equipment to specific tests to determine that the equipment meets the specifications or safety standards.
Cf	A standard abbreviation for Cubic foot.
CFG	Configuration File. When saving new configuration files, the file is saved as a *.cfg file.
CFM	The volumetric flow rate of a liquid or gas in cubic feet per minute.
Character	A letter, digit or other symbol that is used as the representation of data. A connected sequence of characters is called a character string.

TERM	DEFINITION
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> <p>Motherboard: Typically, the mother board contains the CPU, memory and basic controllers for the system. Sometimes call the system board or main board.</p> <p>Expansion board: Any board that plugs into one of the computer's expansion slots, including controller boards, LAN cards, and video adapters.</p> <p>Daughter Card: Any board that attaches directly to another board.</p> <p>Controller board: A special type of expansion board that contains a controller for a peripheral device.</p> <p>Network Interface Card (NIC): An expansion board that enables a PC to be connected to a local-area network (LAN).</p> <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 flammable gases, vapors or liquids. Division 1 indicates an area where ignitable concentrations of flammable gases, vapors or liquids can exist all of the time or some of the time under normal operating conditions.
Class 1, Division 2	Class 1 refers to the presence of flammable gases, vapors or liquids. Division 2 indicates an area where ignitable concentrations of flammable gases, vapors or liquids are not likely to exist under normal operating conditions.

TERM	DEFINITION
Class 1, Zone 0	Class 1 refers to the presence of flammable gases, vapors or liquids. Zone 0 refers to a place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapor or mist is present continuously or for long periods or frequently.
Class 1, Zone 1	Class 1 refers to the presence of flammable gases, vapors or liquids. Zone 1 refers to a place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapor or mist is likely to occur in normal operation occasionally.
Class 1, Zone 2	Class 1 refers to the presence of flammable gases, vapors or liquids. Zone 2 refers to a place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapor or mist is not likely to occur in normal operation.
Clean Gas	Gas that has no particles larger than one micron and no more than one milligram of solids per cubic meter.
Clear	To restore a device to a prescribed initial state, usually the zero state.
Clock	The source(s) of timing signals for sequencing electronic events (e.g. synchronous data transfer).
Closed Circuit Voltage	The difference in potential between the terminals of a cell/battery when it is discharging (on- load condition).
CM	Acronym for Cubic Meter.
Cm	Acronym for Centimeter.
CMM	Acronym for Cubic Meter per Minute.
CMOS	See Complimentary Metal-Oxide-Semiconductor.
CNG	See Compressed Natural Gas
CO <sub>2</sub>	A standard abbreviation for Carbon Dioxide.
Coalbed Methane	A methane-rich, sulfur-free natural gas contained within underground coal beds.
Coefficient of expansion	The ratio of the change in length or volume of a body to the original length or volume for a unit change in temperature.
Coil	A conductor wound in a series of turns.
Cold Start	A rebooting technique which will clear all operational errors, loose all data files, but will not damage configuration files if stored on the SDRIVE.
Cold Weather Enclosure	Totalflow insulated and heated enclosure designed to house either the NGC or Btu 8000/8100 Chromatographs in inclement climates.
Collector	The semiconductor region in a bipolar junction transistor through which a flow of charge carriers leaves the base region.
Column	Hardware component used in gas chromatography to separate components into measurable units.

TERM	DEFINITION
Combustible	Classification of liquid substances that will burn on the basis of flash points. A combustible liquid means any liquid having a flash point at or above 37.8°C (100°F) but below 93.3°C (200°F), except any mixture having components with flash points of 93.3°C (200°F) or higher, the total of which makes up 99 percent or more of the total volume of the mixture.
Comma Separated Values	These file types are importable records used by spreadsheet programs to display and manipulate data.
Communication	Transmission and reception of data among data processing equipment and related peripherals.
Communication Port	Comm. Port (abbreviation) refers to the host computer's physical communication's port being used to communicate with the equipment. Used by Totalflow when discussing local or remote communication with various equipment including the XFC, FCU, XRC, RTU and LevelMaster etc.
Compensation	An addition of specific materials or devices to counteract a known error.
Complimentary Metal-Oxide-Semiconductor	Family of logic devices that uses p-type and n-type channel devices on the same integrated circuit. It has the advantage of offering medium speed and very low power requirements.
Component	(1) A small object or program that performs a specific function and is designed in such a way to easily operate with other components and applications. Increasingly, the term is being used interchangeably with applet. (2) A part of a device.
Compressed Gas	A gas or mixture of gases having, in a container an absolute pressure exceeding 40 psi at 21.1°C (70°F). A gas or mixture having in a container, an absolute pressure exceeding 104 psi at 54.4°C (130°F) regardless of the pressure at (21.1°C (70°F)). A liquid having a vapor pressure exceeding 40 psi at 37.8°C (70°F) as determined by ASTM D-323-72.
Compressed Natural Gas	Natural gas in high-pressure surface containers that is highly compressed (though not to the point of liquefaction). CNG is used extensively as a transportation fuel for automobiles, trucks and buses in some parts of the world. Small amounts of natural gas are also transported overland in high-pressure containers.
Compressibility	The property of a material which permits it to decrease in volume when subjected to an increase in pressure. In gas-measurement usage, the compressibility factor "Z" is the deviation from the ideal Boyle and Charles' law behavior. See SUPERCOMPRESSIBILITY FACTOR.
Compressibility Factor	See Supercompressibility Factor.
Compressibility Factor	A factor usually expressed as "z" which gives the ratio of the actual volume of gas at a given temperature and pressure to the volume of gas when calculated by the ideal gas law without any consideration of the compressibility factor.
Concentration	Amount of solute per unit volume or mass of solvent or of solution.
Concurrent	Performing more than one task at a time.

TERM	DEFINITION
Condensate	1) The liquid formed by the condensation of a vapor or gas; specifically, the hydrocarbon liquid separated from natural gas because of changes in temperature and pressure when the gas from the reservoir was delivered to the surface separators. 2) A term used to describe light liquid hydrocarbons separated from crude oil after production and sold separately.
Condensation	Liquefaction of vapor.
Condensed Phases	The liquid and solid phases; phases in which particles interact strongly.
Condensed States	The solid and liquid states.
Conduction	The conveying of electrical energy or heat through or by means of a conductor.
Configuration No.	The Configuration number is a suffix of the serial number which defines the characteristics of the unit.
Console Mode	A local user interface typically used with custom applications that are not supported through any other mechanism. Also referred to as Printer Console Mode.
Contact	Current carrying part of a switch, relay or connector.
Conversion Time	The time required, in an analog input or output system, from the moment a channel is interrogated (such as with a read instruction) to the moment that accurate data is available. This could include switching time, settling time, acquisition time, A/D conversion time, etc.
Coprocessor	Another computer processor unit that operates in conjunction with the standard CPU. Can be used to enhance execution speed. For example, the 8087 is designed to perform floating point arithmetic.
COR	See Corrected Runtime.
Corrected Runtime	Correction to signal made to decrease/increase "ZERO phase" and eliminate the shift between RT and COR for increased accuracy.
Cos	See Cosine.
Cosine	The sine of the complement of an arc or angle.
Counterclockwise	Movement in the direct opposite to the rotation of the hands of a clock.
Counts	The number of time intervals counted by the dual-slope A/D converter and displayed as the reading of the panel meter, before addition of the decimal point.
CPS	Cycles per second; the rate or number of periodic events in one second, expressed in Hertz (Hz).
CPU	See Central Processing Unit.
CPUC	California Public Utilities Commission
CRC	See Cyclic Redundancy Check.
Cryogenic Plant	A gas processing plant which is capable of producing natural gas liquids products, including ethane, at very low operating temperatures.
CSA	CSA International: Formerly Canadian Standards Association. Canadian certification agency.

TERM	DEFINITION
CTS	Communication abbreviation for Clear To Send.
Cubic	Three-dimensional shape with six equal sides. Used in measuring volume.
Cubic Centimeter	Acronym CC. Metric volume equal to a 1 Centimeter to the 3 <sup>rd</sup> power.
Cubic Foot	The most common unit of measurement of gas volume in the US. It is the amount of gas required to fill a volume of one cubic foot under stated conditions of temperature, pressure, and water vapor.
Cubic Foot Metered	The quantity of gas that occupies one cubic foot under pressure and temperature conditions in the meter.
Cubic Foot, Standard	That quantity of gas which under a pressure of 14.73 psia and at a temperature of 60 degrees occupies a volume of one cubic foot without adjustment for water vapor content.
Cubic Meter	Acronym CM. Metric volume equal to 35.31467 Cubic Feet.
Cubic Meter Per Minute	Acronym CMM. Metric flow rate equal to 35.31467 Cubic Feet per Minute.
Cumulative Capacity	The total number of ampere-hours (or watt hours) that can be withdrawn from a cell/battery under specified conditions of discharge over a predetermined number of cycles or the cycle life.
Current	Current is measured in amps (milliamps and micro amps). It is the passage of electrons. Conventional current flows from positive to negative. Electrons flow from negative to positive - called "electron flow".
Cursor	Dots used to indicate the location of the next character or symbol to be entered.
Custody Transfer	The legal and commercial transfer of a commodity such as natural gas, LNG, etc. from one party to another.
Custody Transfer Transaction	The Custody Transfer Transaction is the hand-off of the physical commodity from one operator to another.
Cut-Off Voltage	The cell/battery voltage at which the discharge is terminated.
CV	Calorific Value. European value of heating content.
CV1	Column 1 Vent (located on NGC series Feed-Through Assembly).
CV2	Column 2 Vent (located on NGC series Feed-Through Assembly).
CWE	Cold Weather Enclosure.
Cycle	One complete sequence of events. One complete alteration of an AC current or Volt. The discharge and subsequent charge of a rechargeable cell/battery is called a cycle.
Cycle Life	The number of cycles under specified conditions which were available from a rechargeable cell/battery before it fails to meet specified criteria as to performance.
Cycle Time	The time usually expressed in seconds for a controller to complete one on/off cycle.

TERM	DEFINITION
Cyclic Redundancy Check	An ongoing verification of the validity of transmitted and received data providing assurance that the message conforms to a pre-agreed upon convention of communications.
D/A	See Digital-to-analog.
D/I	See Digital Input.
D/O	See Digital Output.
DAC	See Digital to Analog Converter.
DACU	Data Acquisition Control Unit.
Data Acquisition	Gathering information from sources such as sensors and AMUs in an accurate, timely and organized manner. Modern systems convert this information to digital data, which can be stored and processed by a computer.
Data Collect	Physically, locally or remotely, retrieving data stored with a Totalflow unit. This data is typically stored in records located in a data base format.
DB	See Decibel.
DB1	Acronym for Data Base 1. This refers to the previous data base structure used to store data in Totalflow products.
DB2	Acronym for Data Base 2. This refers to the current data base structure used to store data in Totalflow products.
DC	See Direct Current
DCD	Communication abbreviation for Data Carrier Detect
DCS/PLC	Distribution Control System/Programmable Logic Controller
DDE	See Digital Data Exchange. Also called Dynamic Data Exchange. May refer to Totalflow's DDE Server TDS32.
Dead Weight Tester	Portable pressure tester used to check calibration and to calibrate AMU's utilizing a system of calibrated weights.
De-bounce	De-bouncing is any kind of hardware device or software that ensures that only a single signal will be acted upon for a single opening or closing of a contact. When you press a key on your computer keyboard, you expect a single contact to be recorded by your computer. In fact, however, there is an initial contact, a slight bounce or lightening up of the contact, then another contact as the bounce ends, yet another bounce back, and so forth. A similar effect takes place when a switch made using a metal contact is opened. The usual solution is a de-bouncing device or software that ensures that only one digital signal can be registered within the space of a given time (usually milliseconds)
Decane (C <sub>10</sub> H <sub>22</sub> )	A hydrocarbon (Alkane) flammable colorless liquid with ten carbon atoms.
Decibel	A logarithmic measure of the ratio of two signal levels. A practical unit of gain.
Decimal	A numbering system based on 10.

TERM	DEFINITION
Default	A value assigned or an action taken automatically unless another is specified.
Degree	An incremental value in the temperature scale, i.e., there are 100 degrees between the ice point and the boiling point of water in the Celsius scale and 180°F between the same two points in the Fahrenheit scale.
Delivery Point	Point at which gas leaves a transporter's system completing a sale or transportation service transaction between the pipeline company and a sale or transportation service customer.
Demand Day	That 24-hour period specified by a supplier-user contract for purposes of determining the purchaser's daily quantity of gas used (e.g., 8 AM to 8 AM, etc.). This term is primarily used in pipeline-distribution company agreements. It is similar to, and usually coincides with, the distribution company "Contract Day".
Demand Load	The rate of flow of gas required by a consumer or a group of consumers, often an average over a specified short time interval (cf/hr or Mcf/hr). Demand is the cause; load is the effect.
Demand Meters	A device which indicates or records the instantaneous, maximum or integrated (over a specified period) demand.
Demand, Average	The demand on a system or any of its parts over an interval of time, determined by dividing the total volume in therms by the number of units of time in the interval.
Density	Mass per unit Volume: $D=MV$
Desaturation	Doesn't cause the composition of the gas to change, enabling a more representative sample of gas.
Detector Bead	See Thermal Conductivity Detector.
Deviation	The difference between the value of the controlled variable and the value at which it is being controlled.
Dew Point	The temperature at any given pressure at which liquid initially condenses from a gas or vapor. It is specifically applied to the temperature at which water vapor starts to condense from a gas mixture (water dew point) or at which hydrocarbons start to condense (hydrocarbon dew point).
Dewar	A glass or metal container made like a vacuum bottle that is used especially for storing liquefied gases. Also called "Dewar flask".
DG	Display Group. When display group files are created
Diaphragm	A bellows inside a displacement type gas meter. Also, a membrane separating two different pressure areas within a control valve or regulator.
Differential	For an on/off controller, it refers to the temperature difference between the temperature at which the controller turns heat off and the temperature at which the heat is turned back on. It is expressed in degrees.

TERM	DEFINITION
Differential Input	A signal-input circuit where SIG LO and SIG HI are electrically floating with respect to ANALOG GND (METER GND, which is normally tied to DIG GND). This allows the measurement of the voltage difference between two signals tied to the same ground and provides superior common-mode noise rejection.
Differential Pressure	The pressure difference between two points in a system. For example, the difference in pressure between the upstream and downstream taps of an orifice plate, used to measure volume passing through the orifice.
Digit	A measure of the display span of a panel meter. By convention, a full digit can assume any value from 0 through 9, a 1/2-digit will display a 1 and overload at 2, a 3/4-digit will display digits up to 3 and overload at 4, etc. For example, a meter with a display span of $\pm 3999$ counts is said to be a 3-3/4 digit meter.
Digital	A signal which has distinct states, either on or off (0 or 1). Digital computers process data as binary information having either true or false states.
Digital Controller Assembly	The Digital Controller Assembly contains the Digital Electronic Board, Mounting Assembly and optionally a VGA Display. The Digital Controller board provides control parameters to the Analytical Processor board, stores and processes the data sent from the Analytical Processor board. The Digital Controller also processes communication with other devices.
Digital Controller Assy.	The NGC's digital controller assembly provides control parameters to the analytical processor board, stores and processes the data sent from the analytical processor board. The digital controller also processes communication with other devices. This assembly also contains a VGA display.
Digital Data	Information transmitted in a coded form (from a computer), represented by discrete signal elements.
Digital Data Exchange or Dynamic Data Exchange	A Microsoft data exchange format generally used to transfer data from one program to another. It is a very simple format to use and Totalflow customers often use TDS to acquire data from Totalflow devices and then transfer the data to an Excel spreadsheet using DDE. The Totalflow Driver, TDS32, supports DDE and its network version, NetDDE.
Digital Electronics	The branch of electronics dealing with information in binary form.
Digital Input	Refers to the signal received in binary format.
Digital Output	Refers to the signal emitted in binary format. An output signal which represents the size of an input in the form of a series of discrete quantities.
Digital to Analog Conversion	The process of translating discrete data into a continuously varying signal. Common uses are to present the output of a digital computer as a graphic display or as a test stimulus.
Digital-to-Analog Converter	An electronic device, often an integrated circuit, that converts a digital number into a corresponding analog voltage or current.

TERM	DEFINITION
DIN	Deutsches Institut für Normung. German Institute for Standardization set of standards recognized throughout the world.
DIN Rail	Rail on which modules are mounted. Allows modules to snap on and slide right and left.
Diode	A semiconductor that allows current to flow in one direction only.
DIP Switches	A bank of switches typically used in setting the hardware configuration and base address of an option card.
Direct Current	A current that does not change in direction and is substantially constant in value.
Direct Memory Access	A method by which information can be transferred from the computer memory to a device on the bus without using the processor.
Discharge	The conversion of chemical energy of a cell/battery into electrical energy and withdrawal of the electrical energy into a load.
Discharge Rate	The rate, usually expressed in amperes, at which electrical current is taken from the cell/battery.
Discrete Manifold	Also called Tubing Manifold. Used in instances when the XFC is not mounted directly on the Orifice, usually pipe mount or wall mount.
Distillates	The distillate or middle range of petroleum liquids produced during the processing of crude oil. Products include diesel fuel, heating oil, kerosene and turbine fuel for airplanes.
Distillation	The first stage in the refining process in which crude oil is heated and unfinished petroleum products are initially separated.
Distribution	The act or process of distributing gas from the city gas or plant that portion of utility plant used for the purpose of delivering gas from the city gate or plant to the consumers, or to expenses relating to the operating and maintenance of distribution plant.
Distribution Company	Gas Company which obtains the major portion of its gas operating revenues from the operation of a retail gas distribution system, and which operates no transmission system other than incidental connections within its own system or to the system of another company. For purposes of A.G.A. statistics, a distribution company obtains at least 90 percent of its gas operating revenues from sales to ultimate customers, and classifies at least 90 percent of mains (other than service pipe) as distribution. Compare INTEGRATED COMPANY; TRANSMISSION COMPANY, GAS.
Dkt	Abbreviation for Dekatherm, equivalent to one MMBtu.
DMM	Digital Multi-Meter.
DN	Inside diameter standard.
DOS	Disk Operating System.
DOS CCU	Refers to the DOS version of the Calibration and Collection Unit. Also known as FS/2, hand held or Dog Bone.
DOT Matrix	A group of dots/pixels forming a character or symbol, usually five dots across and seven dots down.

TERM	DEFINITION
DOT/Pixel	An active element that forms a character or symbol when combined in a matrix.
Download	This refers to a Totalflow procedure in which any file(s) located on a laptop PC or storage device, may be copied to the on-board memory of a Totalflow Host device for purposes of restoring, configuration or repair.
Downstream	The oil industry term used to refer to all petroleum activities from the processing of refining crude oil into petroleum products to the distribution, marketing, and shipping of the products. Also see Upstream.
Downstream Pipeline	The pipeline receiving natural gas at a pipeline inter-connect point.
DP	See Differential Pressure.
DRAM	See Dynamic Random Access memory.
Drift	A change of a reading or a set point value over long periods due to several factors including change in ambient temperature, time, and line voltage.
Drip Gasoline	Hydrocarbon liquid that separates in a pipeline transporting gas from the well casing, lease separation, or other facilities and drains into equipment from which the liquid can be removed.
Driver (Hardware)	An electronic circuit that provides input to another electronic circuit.
Driver (Software)	A program that exercises a system or system component by simulating the activity of a higher level component.
Drivers	Software that controls a specific hardware device, such as interface boards, PLCs, RTUs, and other I/O devices.
Droplet Liquids	Large liquid particles
Dry Contact	Contacts which neither break nor make a circuit. 0 Ohms.
Dry Gas	Has no more than seven pounds of water per million cubic feet of gas. Gas has less than 0.1 PPM of liquid at the coldest ambient condition expected at the coldest point in the system. The liquid can be water, oil, synthetic lubrication, glycol, condensed sample or any other non vapor contaminate.
DSP	Digital Signal Processor.
Dual Element Sensor	A sensor assembly with two independent sensing elements.
Dual-Access Memory	Memory that can be sequentially accessed by more than one controller or processor but not simultaneously accessed. Also known as shared memory.
Duplex	The ability to both send and receive data simultaneously over the same communications line.
Duplex Wire	A pair of wires insulated from each other and with an outer jacket of insulation around the inner insulated pair.
Duty Cycle	The total time to one on/off cycle. Usually refers to the on/off cycle time of a temperature controller.

TERM	DEFINITION
DVI	The Port Manager and communication engine of the SCADA Advantage System. This software can multiplex among several communication formats and thus supporting several vendor's equipment over a single radio frequency. It "pushes" new data to the SCADA database, saving time and network resources by not transmitting redundant data. The DVI includes the Totalflow WinCPC code and thus supports all Totalflow software and functions – including WinCCU, TDS, PCCU, Report by exception, cryout, etc.
Dynamic Random Access memory	This is the most common form of computer memory It needs to be continually refreshed in order to properly hold data, thus the term "dynamic."
E <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.
EC	European Community.
Echo	To reflect received data to the sender. i.e. depressed on a keyboard are usually echoed as characters displayed on the screen.
Edit	Making changes to information, data or configuration files.
EEPROM	See Electrically Erasable Programmable Read-Only Memory. The PROM can be erased by electricity.
EFI	Electromechanical Frequency Interface.
EFM	See Electronic Flow Measurement.
EFR	Enhance Feature Release.
Electrical Interference	Electrical noise induced upon the signal wires that obscures the wanted information signal.
Electrically Erasable Programmable Read-Only Memory	ROM that can be erased with an electrical signal and reprogrammed. Also referred to as the S Drive. It is a persistent drive that will not lose its memory unless manually reprogrammed. Also called E <sup>2</sup> Prom. Totalflow's XFC and XRC have a Serial EEPROM on board, which generally holds registry, application configuration and warranty information (non-volatile).
Electrode	The site, area, or location at which electrochemical processes take place.
Electromagnetic Compatibility	Term used for European Union's New Approach Directive 2004/108/EC, which means the device or system is able to function in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.
Electromagnetic Interference	Any electromagnetic disturbance that interrupts, obstructs, or otherwise degrades or limits the effective performance of electronics/electrical equipment. It can be induced intentionally, as in some forms of electronic warfare, or unintentionally, as a result of spurious emissions and responses, intermodulation products, and the like.

TERM	DEFINITION
Electronic Flow Measurement	Historically, flow measurement was tracked using a chart recording technology. Developments in the field of electronics allowed for electronic measurement devices to overtake the chart recording market. This field continues to develop into peripheral markets, making the "Flow Meter" a valuable asset with multi-tasking "Control" capabilities. Totalflow's answer to this developing market is the XSeries equipment.
EMC	See Electromagnetic Compatibility
EMI	See Electromagnetic Interference.
Emitter	One terminal of a transistor.
EN	Euro Norm (European Standard)
Enagas	Spain's Certification Board
Encoder	A device that converts linear or rotary displacement into digital or pulse signals. The most popular type of encoder is the optical encoder, which uses a rotating disk with alternating opaque areas, a light source, and a photodetector.
Environmental Conditions	All conditions in which a transducer may be exposed during shipping, storage, handling, and operation.
EP Mix	A liquefiable hydrocarbon product consisting primarily of ethane and propane.
EPROM	See Erasable Programmable Read-Only Memory. The PROM can be erased by ultraviolet light or electricity.
Erasable Programmable Read-Only Memory	ROM that can be erased using Ultraviolet Light. The EPROM maybe re-programmed by removing the EPROM from the circuit and using special equipment to write to it.
Ethane (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 unsaturated hydrocarbon gas of slight odor having a gross heating value of 1,604 Btu per cubic foot and a specific gravity of 0.9740. It is usually present in manufactured gas, constituting one of its elements and is very flammable.
EU	European Union. Formerly known as the European Community (EC). Members of this union are replacing individual national regulations of member countries with a series of Directives. These Directives are legislative instruments which oblige member states to introduce them into their existing laws. These directives harmonize a variety of existing practices, preserve the different legal traditions and settle constraints for further developments.
Event	Important incident: an occurrence, especially one that is particularly significant.
Event File	Stored records specifying a notable change. The XFC stores up to 200 records, containing: Time, Day, Description, Old Value, New Value.
Events	Signals or interrupts generated by a device to notify another device of an asynchronous event. The contents of events are device-dependent.

TERM	DEFINITION
Ex	Potential Explosive.
EXIMV	Explosion Proof Integral Multivariable Transducer.
Expansion Board	A plug-in circuit board that adds features or capabilities beyond those basic to a computer, such as a data acquisition system expansion board.
Expansion Factor	Correction factor for the change in density between two pressure measurement areas in a constricted flow.
Expansion Slots	The spaces provided in a computer for expansion boards than enhance the basic operation of the computer.
Explosion-proof Enclosure	Explosion Proof Enclosure for Class 1 Division 1 locations. An enclosure that can withstand an explosion of gases within it and prevent the explosion of gases surrounding it due to sparks, flashes or the explosion of the container itself, and maintain an external temperature which will not ignite the surrounding gases.
Extended Binary Coded Decimal Interchange Code	EBCDIC. An eight-bit character code used primarily in IBM equipment. The code allows for 256 different bit patterns.
External Multivariable Transducer	Multivariable Transducer located outside of the Flow Computer enclosure. Used in multi-tube configurations and on systems where the actual Flow Computer is located at a distance from the flowing tube.
External Transducer	DP/SP Transducer located outside the enclosure. All electronics are located inside the enclosure and communicate via a ribbon cable.
F.O.B.	Abbreviation of free on board with the cost of delivery to a port and loading onto a ship included.
Fa	Orifice Thermal Expansion factor.
Fahrenheit	A temperature scale defined by 32° at the ice point and 212° at the boiling point of water at sea level.
Faux	Full Well Stream Factor.
Fb	Basic Orifice factor.
FBD	Function Block Diagram (IEC supported programming language)
FCC	Federal Communications Commission.
FCU	Flow computer unit
Feed Points	Connections between gas feeder lines and distribution networks.
Feedback	Occurs when some or all of the output of the device (such as an amplifier) is taken back to the input. This may be accidental (such as the acoustic feedback from a speaker to microphone) or intentional , to reduce distortion.
Feeder (Main)	A gas main or supply line that delivers gas from a city gate station or other source of supply to the distribution networks.
Feed-Through Assembly	The Feed-Through Assembly also serves as the connection for sample streams, carrier gas and calibration streams, and contains the vents for sample and column gases.

TERM	DEFINITION
Feed-through Assy.	Independent process streams are connected to the NGC directly through the feed-through assembly or through an optionally installed sample conditioning system. The feed-through assembly also serves as the connection for carrier gas and calibration streams and contains the vents for sample and column gases.
FET	Field-effect transistor. Transistor with electric field controlling output: a transistor, with three or more electrodes, in which the output current is controlled by a variable electric field.
Fg	Specific Gravity factor.
Field Pressure	The pressure of natural gas as it is found in the underground formations from which it is produced.
File	A set of related records or data treated as a unit.
Film Liquids	Aerosols liquids who have contacted each other and become adhered to the inside of the pipeline.
Firmware	A computer program or software stored permanently in PROM or ROM or semi-permanently in EPROM.
Firmware Version	This refers to the version of firmware contained in the equipment.
Fixed-Point	A format for processing or storing numbers as digital integers.
Flag	Any of various types of indicators used for identification of a condition or event; for example, a character that signals the termination of a transmission.
Flameproof Enclosure "d"	Enclosure which can withstand the pressure developed during an internal explosion of an explosive mixture, and which prevents the transmission of the explosion to the explosive atmosphere surrounding the enclosure.
Flammable	A liquid as defined by NFPD and DOT as having a flash point below 37.8°C (100°F).
Flange	For pipe, a metal collar drilled with bolt holes and attached to the pipe with its flat surface at right angles to the pipe axis so that it can be securely bolted to a mating flange on a valve, another pipe section, etc.
FLASH	Re-programmable memory onboard an XFC/XRC, similar to an EPROM, except that it can be programmed while in circuit using a Boot Loader Program to write to it. Generally used for the operating system and application code space (non-volatile).
Flash ADC	An Analog to Digital Converter whose output code is determined in a single step by a bank of comparators and encoding logic.
Flash Point	The temperature at which a liquid will yield enough flammable vapor to ignite. There are various recognized industrial testing methods; therefore the method used must be stated.
Flash Vapors	Gas vapors released from a stream of natural gas liquids as a result of an increase in temperature or a decrease in pressure.
Flow	Travel of liquids or gases in response to a force (i.e. pressure or gravity).

TERM	DEFINITION
Flow Computer, XSeries	A device placed on location to measure SP, DP and temperature (to calculate flow) of gases or liquids being transferred, for remote unattended operation.
Flow Formulas	In the gas industry, formulas used to determine gas flow rates or pressure drops in pipelines, regulators, valves, meters, etc.
Flow Rate	Actual speed or velocity of fluid movement .
Flowmeter	A device used for measuring the flow or quantity of a moving fluid.
Fluids	Substances that flow freely; gases and liquids.
FM	Factory Mutual Research Corporation. An organization which sets industrial safety standards.
FM Approved	An instrument that meets a specific set of specifications established by Factory Mutual Research Corporation.
Font	The style of lettering used to display information.
Footprint	The surface space required for an object.
Fpb	Pressure Base factor.
FPM	Flow velocity in feet per minute.
FPS	Flow velocity in feet per second.
Fpv	See Supercompressibility Factor.
Fr	Reynolds Number factor.
Fractionation	The process of separating a steam of natural gas liquids into its separate components.
Freezing Point	The temperature at which the substance goes from the liquid phase to the solid phase.
Frequency	The number of cycles per second for any periodic waveform - measured in cycles per second - now called Hertz. The number of repeating corresponding points on a wave that pass a given observation point per unit time.
Frequency Modulation	Modulation where the frequency of the sine wave carrier alters with the amplitude of the modulating signal.
Frequency Output	An output in the form of frequency which varies as a function of the applied input.
Frit Filter	A small fine filter used primarily on the NGC product line in the feed-through assembly as a last stage gas filter. This filter is not designed to replace an appropriate sample conditioning system.
FRP	Fiberglass Reinforced Polyurethane. A non-flexible material used for LevelMaster sensors.
FS/2	Ruggedized handheld computer device for programming and collecting data from an XFC. Also referred to a Husky or Dog Bone.
FT <sup>3</sup>	A standard abbreviation for Cubic Foot.
Ftb	Temperature Base factor.

TERM	DEFINITION
Ftf	Flowing Temperature factor.
Fuel Oils	The heavy distillates from the oil refining process that are used primarily for heating, for fueling industrial processes, for fueling locomotives and ships, and for fueling power generation systems.
Full Bridge	Wheatstone bridge configuration utilizing four active elements or strain gauges.
Full Duplex	Simultaneous, two-way (transmit and receive), transmission.
Function	A set of software instructions executed by a single line of code that may have input and/or output parameters and returns a value when executed.
Fuse	A short length of wire that will easily burn out when excessive current flows.
Fw	Water Vapor factor.
G	The symbol used for giga or gigabyte.
Gain	The factor by which a signal is amplified, sometimes expressed in dB.
Gain Accuracy	A measure of deviation of the gain of an amplifier from the ideal gain.
Gal	An abbreviation for one gallon.
Gas	That state of matter which has neither independent shape nor volume. It expands to fill the entire container in which it is held. It is one of the three forms of matter, the other two being solid and liquid.
Gas Chromatograph	An analytical instrument that separates mixtures of gas into identifiable components by means of chromatography.
Gas Chromatograph Module	Software module used in conjunction with PCCU32 and WINCCU to interact with Btu Chromatograph equipment and software.
Gas Chromatograph Module Coefficient	A co-efficient generated by the factory allowing user to start calibration on location without having a calibration gas available.
Gas Chromatography	Preferred method for determining the Btu value of natural gas.
Gas Field	A district or area from which natural gas is produced.
Gas Injection	An enhanced recovery technique in which natural gas is injected under pressure into a producing reservoir through an injection well to drive oil to the well bore and the surface.
Gas Processing	The separation of components by absorption, adsorption, refrigeration or cryogenics from a stream of natural gas for the purpose of making salable liquid products and for treating the residue gas to meet required specifications.
Gas, Acid	The hydrogen sulfide and/or carbon dioxide contained in, or extracted from, gas or other streams.

TERM	DEFINITION
Gas, Associated	Gas produced in association with oil, or from a gas cap overlying and in contact with the crude oil in the reservoir. In general, most states restrict associated gas production since its indiscriminate production could reduce the ultimate oil recovery. Also, since some wells producing associated gas cannot be shut-in without also shutting-in the oil production, natural gas pipelines are generally required to take associated gas produced from oil wells on a priority basis.
Gas, C1	See Methane.
Gas, C2	See Ethane.
Gas, C3	See Propane.
Gas, C5+	Pentanes Plus (IC5, NeoC5, NC5 and C6+)
Gas, C6+	Hexanes Plus (C6, C7, C8, C9, C10, C11, etc.).
Gas, CO2	See Carbon Dioxide.
Gas, Dry	Gas whose water content has been reduced by a dehydration process. Gas containing little or no hydrocarbons commercially recoverable as liquid product. Specified small quantities of liquids are permitted by varying statutory definitions in certain states.
Gas, IC4	See Iso-Butane.
Gas, IC5	See Iso-Pentane.
Gas, Liquefied Petroleum (LPG)	A gas containing certain specific hydrocarbons which are gaseous under normal atmospheric conditions but can be liquefied under moderate pressure at normal temperatures. Propane and butane are the principal examples.
Gas, Manufactured	A gas obtained by destructive distillation of coal, or by the thermal decomposition of oil, or by the reaction of steam passing through a bed of heated coal or coke, or catalyst beds. Examples are coal gases, coke oven gases, producer gas, blast furnace gas, blue (water) gas, and carbureted water gas. Btu content varies widely.
Gas, Natural	A naturally occurring mixture of hydrocarbon and non-hydrocarbon gases found in porous geologic formations beneath the earth's surface, often in association with petroleum. The principal constituent is methane.
Gas, NC4	See Normal Butane.
Gas, NC5	See Normal Pentane.
Gas, NeoC5	See Neo-Pentane.
Gas, Non-associated	Free natural gas not in contact with, nor dissolved in, crude oil in the reservoir.
Gas, Oil	A gas resulting from the thermal decomposition of petroleum oils, composed mainly of volatile hydrocarbons and hydrogen. The true heating value of oil gas may vary between 800 and 1600 Btu per cubic foot depending on operating conditions and feedstock properties.
Gas, Sour	Gas found in its natural state, containing such amounts of compounds of sulfur as to make it impractical to use, without purifying, because of its corrosive effect on piping and equipment.

TERM	DEFINITION
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 Factor	A measure of the ratio of the relative change of resistance to the relative change in length of a piezoresistive strain gage.
Gauge Pressure	Absolute pressure minus local atmospheric pressure.
Gauge, Pressure	Instrument for measuring the relative pressure of a fluid. Types include gauge, absolute, and differential.
Gauging Tape Measurements	This refers to a manual method of measuring the level of a liquid in a tank. These measurements may be used to calibrate float levels.
GC	See Gas Chromatograph.
GC Module	The NGC's GC module is comprised of three parts: columns, chromatographic valve and GC module circuit board. The valve controls the flow of gas within the system. The columns perform the separation of the gas into component parts for analysis. The GC module circuit board contains the sensors for the carrier pressure regulators, the sample pressure sensor and the thermal conductivity detectors (TCD's) which detect the different gas components as they leave the GC columns. It also contains an EEPROM or FLASH memory for storage of calibration and characterization information of the module and its sensors.

TERM	DEFINITION
GC Module Assembly	The GC Module is comprised of 3 parts; Columns, Valves and Electronic Interface. The Valves control flow of gas within the system. The Columns perform the separation of the gas into component parts for analysis. The Electronic Interface contains pressure and temperature sensors to monitor and detect the different gas components as they leave the GC Columns.
GCM	See Gas Chromatograph Module
GCM	See Gas Chromatograph Module Coefficient.
GCN	Gravity, Carbon Dioxide and Nitrogen compounds. Used in NX-19 GCN Supercompressibility Factor.
GCNM	Gravity, Carbon Dioxide, Nitrogen and Methane compounds. Used in NX-19 GCNM Supercompressibility Factor.
GDF	Gasde of France
Gj	An abbreviation for gigajoule, equivalent to one thousand mega joules or one billion joules.
GND	See Ground.
GOST	Russian Government Standards for Importation.
GPA 2145-03	Gas Processors Association Physical Constants for Paraffin Hydrocarbons and other Components of Natural Gas
GPA 2172-96	Gas Processors Association Calculation of Gross Heating Value, Relative Density and Compressibility of Natural Gas Mixtures from Compositional Analysis.
GPM	Gallons of liquid per thousand cubic feet.
GPS 2261	See Gas Processors Standard 2261.
GPV	Gauge Port Vent. Refers to the NGC Port designed to equalize the pressure inside of the explosion-proof enclosure.
GPV	Gauge Port Valve (located on NGC series Feed-Through Assembly).
GRD	See Ground.
Gross Heating Value	The heating value measured in a calorimeter when the water produced during the combustion process is condensed to a liquid state. The heat of condensation of the water is included in the total measured heat.
Ground	1) An electronically neutral circuit having the same potential as the surrounding earth. Normally, a non-current carrying circuit intended for the safety purposes. A reference point for an electrical system. 2) A large conducting body (as the earth) used as a common return for an electric circuit and as an arbitrary zero of potential. 3) Reference point for an electrical system.
Grounding Strap	A grounding strap is a conductive device used to make connection between the person handling the board, and a high quality ground potential.
H2	The molecular formula for Hydrogen.
H2S	The molecular formula for Hydrogen Sulfide.

TERM	DEFINITION
Half Duplex	Communication transmission in one direction at a time.
Handshake	An interface procedure that is based on status/data signals that assure orderly data transfer as opposed to asynchronous exchange.
Handshaking	Exchange of predetermined signals between two devices establishing a connection. Usually part of a communications protocol.
Hardware	The physical components of a computer system, such as the circuit boards, plug-in boards, chassis, enclosures, peripherals, cables, and so on. It does not include data or computer programs.
Harmonic	A sinusoidal component of a waveform that is a whole multiple of the fundamental frequency. An oscillation that is an integral sub-multiple of the fundamental is called a sub-harmonic.
HART	Communication Interface.
Hazardous Area	Area in which an explosive gas atmosphere is present or may be expected to be present.
Heat	Thermal energy. Heat is expressed in units of calories or Btu's
Heat Capacity	The amount of heat required to raise the temperature of a body (of any mass) one degree Celsius.
Heat of Condensation	The amount of heat that must be removed from one gram of a vapor at it's condensation point to condense the vapor with no change in temperature.
Heat of Vaporization	The amount of heat required to vaporize one gram of a liquid at its boiling point with no change in temperature. Usually expressed in J/g. The molar heat of vaporization is the amount of heat required to vaporize one mole of liquid at its boiling point with no change in temperature and usually expressed ion kJ/mol.
Heat Transfer	A form of energy that flows between two samples of matter because of their differences in temperature.
Heating Value	The amount of heat developed by the complete combustion of a unit quantity of a material. Heating values for natural gas are usually expressed as the Btu per Cf of gas at designated conditions (temperature and pressure) and either on the dry or water saturated basis.
Heavy Crude	Crude oil of 20-degree API gravity or less; often very thick and viscous.
Heavy Ends	The portion of a hydrocarbon mixture having the highest boiling point. Hexanes or heptanes and all heavier hydrocarbons are usually the heavy ends in a natural gas stream.
Heavy Hydrocarbons	More susceptible to increases in temperature and decreases in pressure, thus causing liquids to form.
Heptane (C <sub>7</sub> H <sub>16</sub> )	A saturated hydrocarbon (Alkane) with 7 carbon atoms in it's molecule (C <sub>7</sub> H <sub>16</sub> ). A liquid under normal conditions.
Hertz	Cycles per second. A measure of frequency or bandwidth.
Hexadecimal	A numbering system to the base 16, 0 through F.

TERM	DEFINITION
Hexane (C <sub>6</sub> H <sub>14</sub> )	A saturated hydrocarbon (Alkane) with six carbon atoms in it's molecule (C <sub>6</sub> H <sub>14</sub> ). A liquid under normal conditions.
Hexane Plus or Heptane Plus	The portion of a hydrocarbon fluid mixture or the last component of a hydrocarbon analysis which contains the hexanes (or heptanes) and all hydrocarbons heavier than the hexanes (or heptanes).
Hierarchical	A method of organizing computer programs with a series of levels, each with further subdivisions, as in a pyramid or tree structure.
Hold	Meter HOLD is an external input which is used to stop the A/D process and freeze the display. BCD HOLD is an external input used to freeze the BCD output while allowing the A/D process to continue operation.
Host	The primary or controlling computer in a multiple part system.
Host Console	Host Console via Local Port uses the PCCU cable between the computer and the device's Local PCCU port but running Remote Protocol. Host Console via Remote Port uses the remote protocol
Hub	A market or supply area pooling/delivery where gas supply transaction point occur that serve to facilitate the movement of gas between and among interstate pipelines. Transactions can include a change in title, a change in transporter, or other similar items.
HV	See Heating Value.
Hydrocarbon	A chemical compound composed solely of carbon and hydrogen. The compounds having a small number of carbon and hydrogen atoms in their molecules are usually gaseous; those with a larger number of atoms are liquid, and the compounds with the largest number of atoms are solid.
Hydrogen Sulfide	A flammable, very poisonous and corrosive gas with a markedly disagreeable odor, having the chemical formula of H <sub>2</sub> S that is a contaminant in natural gas and natural gas liquids.
Hyper term	Terminal emulation program provided with Windows.
Hysteresis	The maximum difference between output readings for the same measured point, one point obtained while increasing from zero and the other while decreasing from full scale. The points are taken on the same continuous cycle. The deviation is expressed as a percent of full scale.
I/O	See Input/Output.
I/O Address	A method that allows the CPU to distinguish between the different boards in a system. All boards must have different addresses.
I <sup>2</sup> C	Inter-Integrated Circuit. Serial communications bus to I/O modules (developed by Phillips Semiconductor)
IAR	Maker and distributor of the Embedded Workbench, a compiler, assembler, linker development system for the Z80/64180 microprocessor family.
IC	See Integrated Circuit
IC4	A standard abbreviation for Isobutane.
IC5	A standard abbreviation for Isopentane.

TERM	DEFINITION
Icon	A graphic functional symbol display. A graphic representation of a function or functions to be performed by the computer.
ID	Identification Number. You must assign an ID to the unit. Units are communicated to by this ID number, therefore the ID assigned in the software must agree with the hardware.
IEC	International Electrotechnical Commission. Developers of the IEC-61131-3 standard. Programming Language used by Totalflow for user applications in XSeries equipment.
IECE <sub>x</sub>	The IEC scheme for certification to standards relating to equipment for use in explosive atmospheres.
IEEE	Institute of Electrical and Electronics Engineers
IIC	Inter-Integrated Circuit. Also see I <sup>2</sup> C.
IL	Instruction List (IEC supported programming language)
Impedance	The total opposition to electrical flow (resistive plus reactive).
IMV	See Integral Multivariable Transducer.
Inch of Mercury	A pressure unit representing the pressure required to support a column of mercury one inch high at a specified temperature; 2.036 inches of mercury (at 32 degrees F and standard gravity of 32.174 ft/sec <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.
Inerts	Elements or compounds not acted upon chemically by the surrounding environment. Nitrogen and carbon dioxide are examples of inert components in natural gas. Inerts dilute the natural gas and since they do not burn or combust, have no heating value.
Initialization File	Generic file used to support the display of Totalflow application data in PCCU32.
Input	That part of a circuit that accepts a signal for processing.
Input Impedance	The resistance measured across the excitation terminals of a transducer.
Input Sense	To examine or determine the status of the input.
Input/Output	The transfer of data to/from a computer system involving communications channels, operator interface devices, and/or data acquisition and control interfaces.
Instantiate	Starting an instance of an object.
Instrument Manifold	Manifold type used when XFC is mounted directly on the Orifice.
Insulator	Any material that resists the flow of electrical current.

TERM	DEFINITION
Integral Multivariable Transducer	A Multivariable Transducer that is an integral part of the flow computer, measuring DP and SP. This refers only to the transducer portion of the device and makes no assumption whether or not the circuitry is located as part of the unit, or if the circuitry is located on the Mother Board and attached via wiring. Also see Multivariable Transducer.
Integrated Circuit	A circuit component consisting of a piece of semiconductor material containing up to thousands of transistor and diodes. A chip.
Integrating ADC	An ADC whose output code represents the average value of the input voltage over a given time interval.
Interface (computer)	Usually refers to the hardware that provides communication between various items of equipment.
Interface (liquid)	The area between two liquids that are not easily mixed, i.e. oil and water.
Interference	A disturbance to the signal in any communications system.
Intrinsically Safe	An instrument which will not produce any spark or thermal effects under normal and specified fault conditions, that is capable of causing ignition of a specified gas mixture.
Inverter	A circuit in both analogue and digital systems that provides an output that is inverse to the input.
Inverter, DC to AC	Converts DC to AC at a high frequency.
ioINT	Interrupt signal from the I/O modules.
ioVBB	i/o Battery Voltage- Unregulated 13.8 volts. Host supplies 2.5 amps to the I/O modules.
ioVDD	Unregulated 5.6 volts from the host for I/O modules.
ISA	Instrument Society of America.
ISO	International Standards Organization.
ISO 5167	International Standards Organization Report No. 5167, Measurement of Fluid Flow by Means of Pressure Differential Devices.
ISO 6976-95	International Standards Organization Report No. 6976-95, Calculation of Calorific Values, Density, Relative Density and Wobbe Index from Composition.
Isobutane (C <sub>4</sub> H <sub>10</sub> )	A hydrocarbon of the same chemical formula as butane but different molecular structure, resulting in different physical properties, notably lower boiling point. Gross heating value 3261 Btu/cu. ft. gas.
Isokenetic Sampling	Laboratory technique where gas sample is tested after removing liquids, therefore not allowing the atomized liquid to return to the gaseous state, changing the sample accuracy.
Isolation	The reduction of the capacity of a system to respond to an external force by use of resilient isolating materials.
Isopentane (C <sub>5</sub> H <sub>12</sub> )	A hydrocarbon of the paraffin series having a chemical formula of C <sub>5</sub> H <sub>12</sub> and having its carbon atoms branched.

TERM	DEFINITION
IUPAC	Acronym for International Union of Pure and Applied Chemistry. It is an international non-governmental organization devoted to the advancement of chemistry. It is most well known as the recognized authority in developing standards for the naming of the chemical elements and their compounds
Joule	The basic unit of thermal energy.
Joule-Thompson Effect	The change in gas temperature which occurs when the gas is expanded at constant enthalpy from a higher pressure to a lower pressure. The effect for most gases at normal pressure, except hydrogen and helium, is a cooling of the gas creating condensation.
K	Kilo. 1) In referring to computers, a "kilo" is 1024 or 2 to the 10th power (Note that it is actually slightly more than an even 1000.). 2) the standard metric prefix for 1,000, or 10 <sup>3</sup> , used with units of measure such as volts, hertz, and meters.
Kbytes/s	A unit for data transfer that means 1,000 or 10 <sup>3</sup> bytes/s.
Kerosene	An oily liquid obtained in the distilling of gasoline in a temperature range from 174-288 degree C. A hydrocarbon of specific gravity of 0.747 to 0.775. Used as fuel for some internal combustion engines, heating equipment, and illuminating purposes. A heavy grade known as range oil is used for cooking and heating.
KHz	Electronic abbreviation for Kilohertz.
kilobyte	1024 bytes.
Kilowatt	Equivalent to 1000 watts.
kilowatt-hour	A unit of energy when one kilowatt of power is expended for one hour. Example A radiator bar is usually rated at 1,000 watts and this switched on for one hour consumes one kilowatt-hour of electricity.
KPa	Kilopascal-Measure of Pressure
kw	See Kilowatt.
kwh	See Kilowatt-hour.
LACT	Lease Automatic Custody Transfer.
Lag	1) A time delay between the output of a signal and the response of the instrument to which the signal is sent. 2) A time relationship between two waveforms where a fixed reference point on one wave occurs after the same point of the reference wave.
Latent Heat of Vaporization	Represents the amount of heat required to vaporize a liquid. In the instance of natural gas, the equation appears: 1 Btu = heat to change. This is the most likely scenario for causing gas to liquefy.
LCD	Liquid Crystal Display.
LD	Ladder Diagram (IEC supported programming language)
LED	Light Emitting Diodes.
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.

TERM	DEFINITION
Life	For rechargeable batteries, the duration of satisfactory performance, measured in years (float life) or in the number of charge/discharge cycles (cycle life).
Life Cycle	The minimum number of pressure cycles the transducer can endure and still remain within a specified tolerance.
Light Crude	Crude oil with a high API gravity due to the presence of a high proportion of light hydrocarbon fractions.
Light Ends	The portion of a liquid hydrocarbon mixture having the lowest boiling points which are easily evaporated.
Light Hydrocarbons	The low molecular weight hydrocarbons such as methane, ethane, propane and butanes. More Volatile.
Linearity	The maximum deviation of the calibration curve from a straight line between zero and full scale, expressed as a percent of full scale output and measured on increasing measurement only.
Liquefiable Hydrocarbons	The components of natural gas that may be recovered as liquid products.
Liquefied Natural Gas	Natural gas which has been liquefied by reducing its temperature to minus 260 degrees Fahrenheit at atmospheric pressure. It remains a liquid at -116 degrees Fahrenheit and 673 psig. In volume, it occupies 1/600 of that of the vapor at standard conditions. Natural gasoline and liquefied petroleum gases fall in this category.
Liquefied Petroleum Gas	A gas containing certain specific hydrocarbons which are gaseous under normal atmospheric conditions, but can be liquefied under moderate pressure at normal temperatures. Propane and butane are the principal examples.
Liquid Crystal Display	A reflective display that requires very low power for operation.
LNG	See Liquefied Natural Gas.
Load (electrical)	A load is an energy consuming device. The device can be an actual device such as a bulb of a flash light, radio, cassette player, motor, etc., a resistor or a constant current load.
Load (units)	The amount of gas delivered or required at any specified point or points on a system; load originates primarily at the gas consuming equipment of the customers. Also, to load a pressure regulator is to set the regulator to maintain a given pressure as the rate of gas flow through the regulator varies. Compare DEMAND.
Location File	This is a file containing the configuration of the Location or site and the LevelMasters assigned to the Location. You may have a file that contains everything or a file for each Location name. The information from the file is displayed on the main MasterLink screen in the form of a tree structure. See the Main Screen topic for more information.
Location Name	Location Name is the top of the hierarchy tree of a Location File. Included in the Location Name is the LevelMaster's name, ID, S/N, Sensor File and Configuration no.

TERM	DEFINITION
Log Period	In a XFC, the specified length between writing the calculated accumulated volume to record. You may record volumes as often as every minute and as seldom as every hour. More frequent recording reduces the number of days of records possible between collection.
Long Term	For Totalflow's purpose, the application of this term refers to storing data over a period of time that is greater than a minimal time. Such as data collected weekly versus data collected weekly but stored indefinitely.
LPG	See Liquefied Petroleum Gas.
LSB	Least Significant Byte
M	Mega, the prefix for 1,048,576, or $2^{20}$ , when used with byte to quantify data or computer memory. Also 1000, as in MCF or 1000 Cubic Ft.
Manifold	The conduit of an appliance which supplies gas to the individual burners. Also, a pipe to which two or more outlet pipes are connected.
Manifold Assembly	The Manifold Assembly is comprised of the Manifold Plate, Heater, Valves, and various Cables to other major components. The Manifold Plate and Heater maintain constant temperature for the GC Module and Columns. The Valves control Stream processing, Carrier and Calibrations gases. The Cables complete the information chain from the GC Module to the Analytical Processor and the Digital Controller Assembly.
Man-Machine Interface	Software program that converts machine instructions and commands into a user interface.
Manometer	A two-armed barometer.
Manual Reset	The switch in a limit controller that manually resets the controller after the limit has been exceeded.
MasterLink	MasterLink is the name of the software program used to communicate with the LevelMaster for purposes of doing setup, calibration, troubleshooting, generating site files, monitoring levels and collecting data.
Mbytes/s	A unit for data transfer that means 1 million or $10^6$ bytes/s.
Mcf	The quantity of natural gas occupying a volume of 1000 cubic feet at a temperature of 60° Fahrenheit and at a pressure of 14.73 psia.
Mean Temperature	The average of the maximum and minimum temperature of a process equilibrium.
Measurement Unit Assembly	$\mu$ 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.
Mega	Multiplier indicating that a quantity should be multiplied by 1,000,000.
Melting Point	The temperature at which a substance transforms from a solid phase to a liquid phase.

TERM	DEFINITION
Membrane	The pH-sensitive glass bulb is the membrane across which the potential difference due to the formation of double layers with ion-exchange properties on the two swollen glass surfaces is developed. The membrane makes contact with and separates the internal element and filling solution from the sample solution.
Memory	Electronic devices that enable a computer to store and recall information. In its broadest sense, memory refers to any hardware capable of serving that end, e.g., disk, tape, or semiconductor storage.
Menu	The list of available functions for selection by the operator, usually displayed on the computer screen once a program has been entered.
MEPAFLOW	SICK Engineering's Menu-based Measurement and Parameterization Software for the TotalSonic system (MMI).
Mercaptans	Compounds of carbon, hydrogen and sulfur found in sour crude and gas; the lower mercaptans have a strong, repulsive odor and are used, among other things, to odorize natural gas.
Meter	Acronym M. Metric measurement equal to 1.09361 yards.
Meter Manifold	Gas piping between gas service line and meter. Also, gas piping supplying two or more meters.
Meter, Orifice	A meter using the differential pressure across an orifice plate as a basis for determining volume flowing through the meter. Ordinarily, the differential pressure is charted.
Meter, PD	See Meter, Positive Displacement.
Meter, Positive Displacement	An instrument which measures volume on the basis of filling and discharging gas in a chamber.
Meter, Turbine	1) Pulse meter. 2) A velocity measuring device in which the flow is parallel to the rotor axis and the speed of rotation is proportional to the rate of flow. The volume of gas measured is determined by the revolutions of the rotor and converting them to a continuously totalized volumetric reading.
Methane (C1H4)	A hydrocarbon (Alkane) with the lightest molecule. A gas under normal conditions. The first of the paraffin series of hydrocarbons. The chief constituent of natural gas. Pure methane is odorless and has a heating value of 1012 Btu per cubic foot. Typically mixed with a sulfur compound to aid in leak detection.
microFlo Computer	See $\mu$ FLO.
Microprocessor	This term is commonly used to describe the CPU. More specifically, it refers to the part of the CPU that actually does the work, since many CPUs now contain L1 and L2 caches on-chip.
Milli	One thousandth e.g. one milli-watt - 1mW. one milli-amp - 1mA. one milli-volt - 1mV.
Millimeter	Acronym mm. Metric measurement equal to .03937 inch.
MIPS	Million instructions per second. The unit for expressing the speed of processor machine code instructions.
Mj	Abbreviation for mega joule, equivalent to one million joules.

TERM	DEFINITION
Mm	Acronym for Millimeter.
MMBtu	A thermal unit of energy equal to 1,000,000 Btu's, that is, the equivalent of 1,000 cubic feet of gas having a heating content of 1,000 BTUs per cubic foot, as provided by contract measurement terms.
MMcf	A million cubic feet. See CUBIC FOOT. (1,000,000 CF)
MMI	See Man-Machine Interface.
Modbus	Messaging structure developed and used to establish master-slave/client-server communication between intelligent devices. Generic protocol supported by most process automation vendors.
Modem	Modulator-Demodulator. A device used to convert serial digital data from a transmitting terminal to a signal suitable for transmission over a common carrier, or to reconvert the transmitted signal to digital data for acceptance by a receiving terminal.
Module	Typically a board assembly and its associated mechanical parts, front panel, optional shields, and so on. A module contains everything required to occupy one or more slots in a mainframe.
Mol%	See Mole Percent.
Mole Percent	The number of moles of a component of a mixture divided by the total number of moles in the mixture.
MRB	Modbus Request Block. When requesting storage space after adding a new Modbus application, the file is saved as a *.mrb file.
MRM	Modbus Register Map. When requesting storage space after adding a new Modbus register, the file is saved as a *.mrm file.
MS	Milliseconds. One-thousandth of a second.
MSB	Most Significant Byte
Mueller Bridge	A high-accuracy bridge configuration used to measure three-wire RTD thermometers.
Multiplex	A technique which allows different input (or output) signals to use the same lines at different times, controlled by an external signal. Multiplexing is used to save on wiring and I/O ports.
Multi-tasking	A property of an operating system in which several processes can be run simultaneously.
Multi-tube Sites	Locations where many flow tubes are all within a prescribed distance allowing one flow meter with multitube capabilities, such as the XSeries product line, to monitor and maintain flow records for each tube in one Flow Computer.

TERM	DEFINITION
Multivariable Transducer	Transducer supplying more than 1 variable. Totalflow uses this term to encompass units that read Static Pressure, Differential Pressure. Historically these units were coined AMU for Analog Measurement Unit. As a result of advanced technology, the unit no longer functions as only an analog measurement unit. Therefore the newer terminology, Multivariable Transducer, more aptly describes the functionality of this design. The abbreviation IMV refers to the Integral version of the multivariable. The abbreviation XIMV, refers to the XSeries IMV version of the multivariable, which contains the circuitry as part of the unit and the abbreviation IMVX, refers to the Explosion Proof IMV, where the required circuitry resides on the Main Processor Board. See each instance for additional explanation.
MW	Acronym for Molecular Weight.
N2	A standard abbreviation for Nitrogen.
NAK	See Negative Acknowledgement
NAMUR	Normenarbeitsgemeinschaft für Mess- und Regeltechnik in der chemischen Industrie (Standards study group for measurement and process control technology in the chemical industry).
Natural Gas	See Gas, Natural.
Natural Gas Distillate	Material removed from natural gas at the "heavy end" portion; that is, aliphatic compounds ranging from C4 to C8 (butanes and heavier).
Natural Gas Liquids	The hydrocarbon components: propane, butanes, and pentanes (also referred to as condensate), or a combination of them that are subject to recovery from raw gas liquids by processing in field separators, scrubbers, gas processing and reprocessing plants, or cycling plants. The propane and butane components are often referred to as liquefied petroleum gases or LPG.
Natural Gasoline	A mixture of hydrocarbons, mostly pentanes and heavier, extracted from natural gas, which meets vapor pressure and other specifications.
NBS	National Bureau of Standards.
NC	See Normally Closed.
NC4	A standard abbreviation for Normal Butane.
NC5	A standard abbreviation for Normal Pentane.
NEC	National Electrical Codes
Negative Acknowledgment	This refers to a response over a remote communication device, such as a PING. Basically, saying, "I don't acknowledge your request!" This is the opposite of ACK. NAK is a slang term that means that you disagree or do not acknowledge something.
NEMA	National Electrical Manufacturers Association.
NEMA, Type 3R	A standard from the National Electrical Manufacturers Association. Enclosure constructed for indoor/outdoor use to provide protection against falling dirt, rain, sleet and snow and remain undamaged by external formation of ice.

TERM	DEFINITION
NEMA, Type 4	A standard from the National Electrical Manufacturers Association. Enclosure constructed for indoor/outdoor use to provide protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, and hose-directed water and remain undamaged by external formation of ice.
NEMA, Type 4X	A standard from the National Electrical Manufacturers Association. Enclosure constructed as for Type 4 with protection against corrosion.
NeoC4	A standard abbreviation for Neobutane.
NeoC5	A standard abbreviation for Neopentane.
Network	A group of computers that are connected to each other by communications lines to share information and resources.
Newton Meter	Torque measurement unit equal to 8.84 Inch Pounds.
NGC	Natural Gas Chromatograph
NGC Termination Panel	The NGC8200 Termination Panel acts as a connection to the outside world. It features Transient Protection, a built-in voltage regulator, Positive Temperature Co-efficient Fuses (PTC) and many other safeguards to protect the remainder of the system from electrical damage. All outside communications and I/O are channeled through this board. It is designed to be a low cost, field replaceable maintenance solution and is designed to operate on either 12V or 24V.
NGC8201	Totalflow NGC8201 Gas Chromatograph for Process Gas Chromatography. The NGC is designed to continually analyze process gas streams, on-site, determine composition, calorific value, and store the analysis information.  The unit can collect and retain analysis information for one to four independent sample streams.
NGC8206	Totalflow NGC8200 Gas Chromatograph, with C6+. The NGC is designed to continually analyze natural gas streams, on-site, determine composition, calorific value, and store the analysis information. It is designed for natural gas streams, 800 to 1500 Btu/scf (29.8 to 55.9 Mega joules/meter <sup>3</sup> ) with less than 100 PPM H <sub>2</sub> S.  The unit is a fully functional gas chromatograph for "Pipeline Quality" natural gas, designed to analyze natural gas streams, dry of both hydrocarbon liquids and water. The unit can collect and retain analysis information for one to four independent sample streams. Applicable installations include: Transmission, Distribution, Custody Transfer with Metrology quality results, Production, Gas Gathering and End User Gas Markets.
NGL	See Natural Gas Liquids.
NGL	A standard abbreviation for Natural Gas Liquids.
Nm	Abbreviation for Newton Meter. Metric Torque measurement.
NO	See Normally Open.

TERM	DEFINITION
Noise	An undesirable electrical signal. Noise comes from external sources such as the AC power line, motors, generators, transformers, fluorescent lights, soldering irons, CRT displays, computers, electrical storms, welders, radio transmitters, and internal sources such as semiconductors, resistors, and capacitors. Unwanted disturbances superimposed upon a useful signal that tends to obscure its information content.
Nonane (C <sub>9</sub> H <sub>20</sub> )	A hydrocarbon (Alkane) flammable colorless liquid with nine carbon atoms.
Non-hazardous area	Area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions.
Non-Persistent	Refers to data that is no longer available after a Warm Start.
Normal Butane	An aliphatic compound of the paraffin series having the chemical formula of C <sub>4</sub> H <sub>10</sub> and having all of its carbon atoms joined in a straight chain.
Normal Pentane	A hydrocarbon of the paraffin series having a chemical formula of C <sub>5</sub> H <sub>12</sub> and having all its carbon atoms joined in a straight chain.
Normalization of Component Mole Percentages	<p>The exact amount of sample which is injected onto the columns of the chromatograph must be a very reproducible volume in order to give consistent values for the resulting calculated Btu. The calculation controls the volume, temperature and pressure of the sample to be injected by a very simple means. A few seconds before the sample is actually injected, the flow of sample through the sample valve injection loop is stopped by automatically shutting the sample shut-off valve. This allows the pressure of the sample in the sample loop to bleed down to atmospheric pressure. Since the temperature is controlled and the size of sample loop does not vary then the only change possible in sample size is related to variations in atmospheric pressure. Atmospheric pressure does vary with the weather and in order to compensate for this or any other slight sample size change, the mole percentages of each component are adjusted to equal a total of 100% through a calculation called normalization.</p> <p>The values in mole percents are determined by the chromatographic analysis and then totaled to a value that is near 100%, which is called the unnormalized total. The unnormalized total is divided by 100% and the resulting factor is then multiplied by the mole% value for each component. This calculation will adjust each component's mole% in the correct manner as to result in a new total of exactly 100%. The calculation also checks to see if the unnormalized total is out of a specified range for alarm purposes. This is an overall performance check to determine if the chromatograph has some problem or has drifted out of calibration.</p>
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

TERM	DEFINITION
NPN	Negative-Positive-Negative (Transistor).
NPT	National Pipe Thread.
NRTL	Nationally Recognized Testing Laboratory.
Null	A condition, such as balance, which results in a minimum absolute value of output.
NX-19	American Gas Association Report referring to a specific method to calculate the Supercompressibility factor.
O2	A standard abbreviation for oxygen.
Octane (C8H18)	A hydrocarbon (Alkane) flammable colorless liquid with eight carbon atoms. Is the 100 point on the Octane Rating Scale.
OCV	See Open Circuit Voltage.
ODBC	See Open Database Connectivity.
OEU	Optional Equipment Unit.
Offset	The difference in temperature between the set point and the actual process temperature. Also, referred to as droop.
OHM	The unit of resistance usually shown as the symbol "R". One thousand ohms is written "k" and one million ohms is written "M". Resistance is measured with a multimeter, set to the "ohms range".
Ohmmeter	An instrument used to measure electrical resistance.
OLE	Object Linking and Embedding. A set of system services that provides a means for applications to interact and interoperate. Based on the underlying Component Object Model, OLE is object-enabling system software. Through OLE Automation, an application can dynamically identify and use the services of other applications, to build powerful solutions using packaged software. OLE also makes it possible to create compound documents consisting of multiple sources of information from different applications.
Ole for Process Control	This is a data interchange format and supporting software. Typically, vendors (such as ABB) write OPC server drivers which can talk to their devices. SCADA system vendors (again like ABB) write OPC clients that can gather data from OPC Servers. The idea is to provide a universal way to collect data into a SCADA system regardless of the equipment vendor. This standard was developed and is maintained by the OPC Foundation. The Totalflow Driver, TDS32, supports OPC.
Ole for Process Control Database	A programming interface to databases. Supports the OLEDB interface.
OLEDB	See Ole for Process Control Database.
Olefins	Basic chemicals made from oil or natural gas liquids feedstocks; commonly used to manufacture plastics and gasoline. Examples are ethylene and propylene.
OOP	Object-Oriented Programming. The XFC/XRC architecture incorporates an object-oriented approach.
OPC	See Ole for Process Control.

TERM	DEFINITION
Open Circuit	A complete break in a metal conductor path.
Open Circuit Voltage	The difference in potential between the terminals of a cell/battery when the circuit is open (no-load condition).
Open Collector	A single NPN transistor with the base connected to the logic driving circuitry and with the emitter grounded. The collector is the output pin of the gate.
Open Database Connectivity	A widely accepted application-programming interface (API) for database access. It is based on the Call-Level Interface (CLI) specifications from X/Open and ISO/IEC for database APIs and uses Structured Query Language (SQL) as its database access language. Using ODBC, you can create database applications with access to any database for which your end-user has an ODBC driver. This allows access for authorized users to databases over any network, including the Internet. The SCADA system provides an ODBC driver, making the database accessible to authorized users anywhere on a corporate network, or even over the Internet if the network is properly configured.
Operating System	Base-level software that controls a computer, runs programs, interacts with users, and communicates with installed hardware or peripheral devices.
Optional Equipment Unit	Totalflow enclosure designed to house optional power and communication devices.
Orifice Meter	Device to record differential pressure measurement which uses a steel plate with a calibrated hole or orifice to generate a drop in pressure between the two sides of the plate. Also the primary element of the meter run.
Orifice Plate	A plate of non-corrosive material which can be fastened between flanges or in a special fitting perpendicular to the axis of flow and having a concentric circular hole. The primary use is for the measurement of gas flow.
ORing	<p>Boolean algebra logical function. Described as the addition or summing of switches or inputs, in the case of Boolean elements, the 0 and 1 represent two possible states of a premise or hypothesis: True or False, On or Off. When adding Boolean elements not real numbers, you will find these results:</p> <p>1 or 1 = 1  1 or 0 = 1  0 or 1 = 1  0 or 0 = 0</p>
O-Ring	A flat ring made of rubber or plastic, used as a gasket.
Output	That part of a circuit where the processed signal is available.
Output Impedance	The resistance as measured on the output terminals of a pressure transducer.
Output Noise	The RMS, peak-to-peak (as specified) ac component of a transducer's dc output in the absence of a measurand variation.
P/I	See Pulse Input.

TERM	DEFINITION
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.
Parity	A technique for testing transmitting data. Typically, a binary digit is added to the data to make the sum of all the digits of the binary data either always even (even parity) or always odd (odd parity).
Parts per Million	Acronym PPM.
Passive Analog Output	Analog Output to a host that is powered by an outside source.
PCCU	Portable Collection and Calibration Unit.
PCCU32	Windows version of PCCU communications software to process, archive and collect data from the Totalflow equipment. Generally run from a laptop.
Peak Area	The retention time the element takes to exit the column. This is used in calculating the amount of each component in the sample or Mole %.
Pentane (C <sub>5</sub> H <sub>12</sub> )	A saturated hydrocarbon (Alkane) with five carbon atoms in it's molecule (C <sub>5</sub> H <sub>12</sub> ). A liquid under normal conditions.
Pentane, Normal	See Normal Pentane.
Pentanes Plus	A hydrocarbon mixture consisting mostly of normal pentane and heavier components.
Peripheral	The input/output and data storage devices attached to a computer such as disk drives, printers, keyboards, displays, data acquisition systems, etc.
Persistent	Refers to data that remains available after a Warm Start.
PEX	A flexible material used for LevelMaster sensors.
PGC	Process Gas Chromatograph
Phase	A time based relationship between a periodic function and a reference. In electricity, it is expressed in angular degrees to describe the voltage or current relationship of two alternating waveforms.
Phenol	Hydrocarbon derivative containing an [OH] group bound to an aromatic ring.
Physical Change	A change in which a substance changes from one physical state to another but no substances with different composition are formed. Example Gas to Liquid - Solid.
PID	Proportional, Integral, Derivative. A three mode control action where the controller has time proportioning, integral (auto reset) and derivative rate action.
Piezoceramic	A ceramic material that has piezoelectric properties similar to those of some natural crystals.

TERM	DEFINITION
Pipeline Condensate	Liquid hydrocarbons that have condensed from gas to liquid as a result of changes in pressure and temperature as gas flows in a pipeline. Pipeline condensate only remains as a liquid under high-pressure conditions and would vaporize at atmospheric pressure.
Plant Products	All liquid hydrocarbons and other products (including sulfur and excluding residue gas) recovered in a gas processing plant.
PLC	See Programmable logic controller
Plunger Lift	A technique used to optimize gas production. A Steel plunger is inserted into the production tubing in the well. The flow is turned off and this shut-in causes plunger to fall allowing fluid to collect above plunger. Different techniques are used to decide how long to shut in and flow the well.
Polarity	In electricity, the quality of having two oppositely charged poles, one positive one negative.
Polling	A snapshot view of the readings taken by the Totalflow equipment.
Port	A communications connection on a computer or a remote controller. A place of access to a device or network, used for input/output of digital and analog signals.
Positive Temperature Co-efficient	An increase in resistance due to an increase in temperature.
Positive Temperature Co-efficient Fuse	Opens circuit when high current condition occurs. Closes when condition no longer exists. Replaces typical fuses, which require replacement when blown.
POU	Program Organization Unit. This is Softing's term for an 'independent programming unit'. Programs, functions, etc.
Power Supply	A separate unit or part of a circuit that supplies power to the rest of the circuit or to a system.
PPM	Acronym for parts per million.
Pressure Base	The contractual, regulatory or standard ambient pressure at which natural gas is measured or sampled expressed in psia (pounds per square inch absolute).
Pressure Differential	Difference in pressure between any two points in a continuous system.
Pressure Markers	Pressure testing at different levels of pressure. Used for comparison purposes.
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.

TERM	DEFINITION
Primary Cell (or Battery)	A cell or battery which is not intended to be recharged and is discarded when the cell or battery has delivered all its electrical energy.
PRM	Acronym for Pressure Regulator Module.
Probe	A generic term that is used to describe many types of temperature sensors.
Process Gas	Gas use for which alternate fuels are not technically feasible, such as in applications requiring precise temperature controls and precise flame characteristics.
Program	A list of instructions that a computer follows to perform a task.
Programmable Logic Controller	A highly reliable special-purpose computer used in industrial monitoring and control applications. PLCs typically have proprietary programming and networking protocols, and special-purpose digital and analog I/O ports.
Programmable Read Only Memory	Computer memory in which data can be written to. ROM is used for storing programs (e.g. operating systems) and characteristic files on a permanent basis. (non-volatile)
Programmed I/O	The standard method a CPU uses to access an I/O device-- each byte of data is read or written by the CPU.
PROM	See Programmable Read Only Memory
Propane (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.
Proportional, Integral, Derivative	PID Controllers are designed to eliminate the need for continuous operator attention. An example would be the cruise control in a car or a house thermostat. These controllers are used to automatically adjust some variable to hold the measurement (or process variable) at the set-point. The set-point is where you would like the measurement to be. Error is defined as the difference between set-point and measurement.
Propylene (C <sub>3</sub> H <sub>6</sub> )	A saturated hydrocarbon (Alkane) gas, the molecule of which is composed of three carbon and six hydrogen atoms. At room temperature and pressure, propylene is a gas. It is colorless, highly flammable, and has a odor similar to garlic. It is found in coal gas and can be synthesized by cracking petroleum. The main use of propylene is as a monomer, mostly for the production of polypropylene.
Protocol	A formal set of conventions governing the formatting and relative timing of message exchange between two communicating systems.
PSI	Pounds per Square Inch.
PSIA	Pounds per Square Inch Absolute. Absolute pressure uses a perfect vacuum as the zero point. A perfect vacuum is 0 PSIA. PSIA=PSIG + Atmospheric Pressure.
PSID	Pounds per square inch differential. Pressure difference between two points.

TERM	DEFINITION
PSIG	Pounds per Square Inch Gauge. Gauge pressure uses the actual atmospheric pressure as the zero point.
PSIS	Pounds per square inch standard. Pressure referenced to a standard atmosphere.
PTB	Physikalisch Technische Bundesanstalt (Federal Physical Technical Office) or Technical Institute for Certification.
PTC	See Positive Temperature Co-efficient Fuse.
Pulse Input	Any digital input to a meter (usually a turbine) that is used to measure pulses over a time period. This calculates volume and flow rate for each period of time.
Pulse Mode	An operational mode used by the LevelMaster for measuring single float levels by transmitting a pulse to the primary windings, reading the voltage level on both the primary and secondary windings and using a calculation whereby one is subtracted from another to determine the single fluid level.
Pulse Output	Any digital output that is used to measure pulses over a period of time. Frequency of Pulses in a predetermined time frame represents a value to be used in calculating volume and flow rate.
Radio Frequency	RF for short. That part of the spectrum from approx. 50kHz to gigahertz.
Radio Frequency Interference	Electromagnetic radiation which is emitted by electrical circuits carrying rapidly changing signals, as a by-product of their normal operation, and which causes unwanted signals (interference or noise) to be induced in other circuits.
RAM	See Random Access Memory.
RAM Disk	A lithium backed storage chip. Also see Random Access Memory.
RAMS	Acronym for Remote Alarms Monitoring System.
Random Access Memory	Onboard read/write volatile memory, generally used for application variables and the file system. Data stored is lost if power is removed (volatile).
Range	Those values over which a transducer is intended to measure, specified by its upper and lower limits.
Rangeability	The ratio of the maximum flowrate to the minimum flowrate of a meter.
Rated Capacity	The number of ampere-hours a cell/battery can deliver under specific conditions (rate of discharge, cut-off voltage, temperature).
Raw Gas	Natural gas that has not been processed.
Raw Mix Liquids	A mixture of natural gas liquids that has not been fractionated or separated into its various components.
RBUS	Communication abbreviation for Results Bus.
RCV	Communication abbreviation for Received.
RD	Acronym for Relative Density.

TERM	DEFINITION
RDrive	Refers to Totalflow's SRam Drive (solid state memory chip) located on the main board, used to store data and configuration files. The RDrive is a lithium backed, volatile memory chip and is not affected by a warm start.
Read Only Memory	Computer memory in which data can be routinely read but written to only once using special means when the ROM is manufactured. ROM is used for storing data or programs (e.g. operating systems) on a permanent basis.
Real Time	Data acted upon immediately instead of being accumulated and processed at a later time.
Real Time Data Base	The SCADA system has an in-memory RTDB for the data it collects from various devices. Real-time generally means that the data is acquired often enough that the user can make operational changes to the process while it is still useful to do so. On a factory floor, this can be in milliseconds. For remote devices which may require a couple of hours of drive time to reach, real-time can be thought of in tens of minutes or even hours. The data base can meet either of these requirements.
Real Time Operating System	Any operating system where interrupts are guaranteed to be handled within a certain specified maximum time, thereby making it suitable for control of hardware in embedded systems and other time-critical applications. RTOS is not a specific product but a class of operating system.
Recharge/Charge	The conversion of electrical energy, provided in the form of a current from an external source (charger), into chemical energy within a cell/battery.
Recommended Standard 232	<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>

TERM	DEFINITION
Record	A collection of unrelated information that is treated as a single unit.
Register	A storage device with a specific capacity, such as a bit, byte or word.
Relay	Electromechanical device containing a coil and set of contacts. The contacts close when the coil is activated.
Remote	Not hard-wired; communicating via switched lines, such as telephone lines. Usually refers to peripheral devices that are located a site away from the CPU.
Remote Controller, XSeries.	Totalflow's XSeries Remote Controller is a low power, microprocessor based unit designed to meet a wide range of automation, monitor, control, alarming and measurement applications.
Remote Terminal Unit	An industrial data collection device similar to a PLC, designed for location at a remote site, that communicates data to a host system by using telemetry (such as radio, dial-up telephone, or leased lines).
Repeatability	The ability of a transducer to reproduce output readings when the same measurement value is applied to it consecutively, under the same conditions, and in the same direction. Repeatability is expressed as the maximum difference between output readings.
Residue Gas	The portion of natural gas remaining in a gaseous state after recovery of certain components through gas processing.
Resistance	The measure of the ability of a material to pass a current.
Resistance Temperature Characteristic	A relationship between a thermistors resistance and the temperature.
Resistant Thermal Detector	A metallic probe that measures temperature based upon its coefficient of resistivity.
Resistor	Passive component with a known resistance. The value of resistance is usually shown by a set of colored bands on the body of the component.
Resolution	The smallest significant number to which a measurement can be determined. For example, a converter with 12-bit resolution can resolve 1 part in 4096.
Response Factor	A calculated value determined by analyzing a known substance under precise conditions (temperature, pressure, carrier flow rate) which equals the area of the peak divided by the weight or volume of the injected substance. This calculated value is then used as a response multiplier or offset for analyzing a "sample" of this same substance from another source. In the case of Natural gas, each component will have it's own Response Factor.
Response Time	1) The length of time required for the output of a transducer to rise to a specified percentage of its final value as a result of a step change of input. 2) The time required by a sensor to reach 63.2% of a step change in temperature under a specified set of conditions. Five time constants are required for the sensor to stabilize at 600 of the step change value.
Restore	This refers to a Totalflow procedure in which all the Station or Configuration files are restored to the SDRIVE from the file located on the laptop. This process is very helpful prior to doing a Cold Start when you want to continue using the Configuration and Station files.

TERM	DEFINITION
Reynolds Number	The ratio of inertial and viscous forces in a fluid defined by the formula $Re = rVD/\mu$ , where: r = Density of fluid, $\mu$ = Viscosity in centipoise (CP), V = Velocity, and D = Inside diameter of pipe.
RFI	See Radio Frequency Interference.
Ribbon Cable	A flat cable in which the conductors are side by side rather than in a bundle.
Rich Gas	Natural gas which, based on its content of liquefiable hydrocarbons, is suitable for processing in a gas plant for recovery of plant products.
ROM	See Read Only Memory
RRTS	Communication abbreviation for Remote Ready To Send.
RS-232	See Recommended Standard 232.
RS-422	See Recommended Standard 422.
RS-485	See Recommended Standard 485.
RT	See Runtime.
RTD	See Resistant Temperature Detector.
RTDB	See Real Time Data Base.
RTOS	See Real Time Operating System.
RTS	Communication abbreviation for Ready To Send.
RTU	See Remote Terminal Unit
Runtime	The time required for an acoustic signal to travel from point A to point B. This measurement is used in calculating the speed of Sound, gas velocity and volume in the TotalSonic Meter.
RXD	Communication abbreviation for Receive Data.
S/N	Serial Number. The whole Serial Number is made up of a prefix of 5 digits and the suffix, a 10 digit configuration number.
S1	Sample Line 1 (located on NGC8200 series Feed-Through Assembly).
S2	Sample Line 2 (located on NGC8200 series Feed-Through Assembly).
S3	Sample Line 3 (located on NGC8200 series Feed-Through Assembly).
S4	Sample Line 4 (located on NGC8200 series Feed-Through Assembly).
Saddle	A fitted plate held in place by clamps, straps, heat fusion, or welding over a hole punched or drilled in a gas main to which a branch line or service line connection is made. The saddle also may serve as a reinforcing member for repair.
Sample Loop	A tube with a given volume used in conjunction with a valve for measuring and holding the sample gas before pushing it into the chromatograph column.
Saturated BTU	The heating value of natural gas that is saturated with water vapor.
Saturated Hydrocarbons	Hydrocarbons that contain only single bonds. They are also called Alkanes or paraffin hydrocarbons.

TERM	DEFINITION
Save	This refers to a Totalflow procedure in which all the Station or Configuration files are copied from the RDRIVE or the SDRIVE, to a file created on a laptop.
Savitsky-Golay Smoothing	Digital Signal Smoothing. A special class of a digital signal processing filter. Specifically determines the coefficients that are used for signal processing.
SCADA	See Supervisory Control and Data Acquisition
Scf	Abbreviation for one standard cubic foot, a measurement of a gas volume at a contractual, regulatory or standard specified temperature and pressure.
Schematic	Another name for a circuit diagram.
SCM	Acronym for Sample Conditioning Module.
Scroll	To move all or part of the screen material up to down, left or right, to allow new information to appear.
SD Card	Secure Digital Card.
SDRIVE	Totalflow's Serial E <sup>2</sup> PROM solid state memory chip, located on the Main Board (volatile memory, affected by a cold start), used to store configuration or station files.
Selectable Units	Selectable measurement units for various international and specialized application needs.
Self-Calibrating	A property of a DAQ board that has an extremely stable onboard reference and calibrates its own A/D and D/A circuits without manual adjustments by the user.
Semiconductor	Material that is neither a conductor nor insulator. Its properties can be altered by a control voltage.
Sensing Element	That part of the transducer which reacts directly in response to the input.
Sensor	A device that responds to a physical stimulus (heat, light, sound, pressure, motion, flow, and so on), and produces a corresponding electrical signal.
Sensor File	The Sensor File contains all the setup/calibration information of the unit. The Sensor File is a (.dat) file and by default is named after the base serial number proceeded by an "s", such as s00108.dat. Although the name can be overwritten, it is recommended that the default name be kept.
Serial I/O	A common form of data transmission, in which the bits of each character are sent one at a time over the line.
Serial Port	A communications interface that uses one data line to transfer data bits sequentially. On the IBM PC the serial port refers to a standard asynchronous serial interface which uses the 8250/16450/16550 family of UARTs.
Service Life	The period of useful life (usually in hours or minutes) of a primary cell/battery before a predetermined cut-off voltage is reached.
Set Point	The temperature at which a controller is set to control a system.

TERM	DEFINITION
Set-Point	A "level" or control point in a feedback system.
SFC	Sequential Function Chart (IEC supported programming language)
SG	Acronym for Specific Gravity.
Short Circuit	A connection of comparatively low resistance accidentally or intentionally made between points on a circuit between which the resistance is normally much greater. Also called a "bridge" or "short" such as when solder from two tracks touch on a PC board.
Shrinkage	The reduction in volume and/or heating value of a natural gas stream due to extraction or removal of some of its components.
SIG	See Signal.
Signal	Any communication between message-based devices consisting of a write to a signal register.
Signal Generator	A circuit that produces a variable and controllable signal.
Signed Integer	Can represent a number half the size of a "unsigned integer", including a negative number.
Sink	Device such as a load that consumes power or conducts away heat.
Skip Days	Extra Daily records for recording events that require the start of a new day. i.e. Volume Reset, Backward Time change over the hour, and Contract Hour change.
SNAM	Italy's Certification Board
SNR	Signal to Noise Ratio.
SoftCONTROL	Softing's IEC compiler environment
Softing	Maker and distributor of the IEC compiler softCONTROL
Software	The non-physical parts of a computer system that include computer programs such as the operating system, high-level languages, applications programs, etc.
Solar cell	A cell that produces current under sunlight.
Solenoid	A coil of wire that is long compared to its diameter, through which a current will flow and produce a magnetic flux to push or pull a rod (called an armature).
SOS	See Speed of Sound.
Sour Gas	Natural gas that has a high concentration of H <sub>2</sub> S.
Source	Device that provides signal power or energy to a load.
SP	See Static Pressure
Span	The difference between the upper and lower limits of a range expressed in the same units as the range.
Specific Gravity	The ratio of the mass of a solid or liquid to the mass of an equal volume of distilled water at 4°C (39°F) or of a gas to an equal volume of air or hydrogen under prescribed conditions of temperature and pressure. Also called <i>relative density</i> .

TERM	DEFINITION
Speed of Gas	Rate at which gas travels through the pipeline. Used in flow calculations in the TotalSonic Meter. Calculations follow AGA 9 Report.
Speed of Sound	Rate at which sound travels through the medium. Used in flow calculations in the TotalSonic Meter. Calculations follow AGA 10 Report.
SPU	Signal Processing Unit (measurement transducer).
SQL	See Structured Query Language.
SRAM	See Static Random Access Memory
SSM	Acronym for Stream Selector Module.
ST	Structured Text (IEC supported programming language)
Stability	The quality of an instrument or sensor to maintain a consistent output when a constant input is applied.
Stable Gas	Is a vapor containing less than 0.1 PPM of liquid when vapor is cooled to 18.3°F (10°C) below the coldest ambient temperature possible at any point in the system.
Static Pressure	Equals PSIA or PSIG. Referenced to atmospheric pressure versus absolute pressure in a vacuum. It is defined as the pressure exerted by a non-moving liquid or gas. In the case of a gas well this would be the natural PSI of the gas inside of the well.
Static Random Access Memory	The place in your computer that programs reside when running. You can access any part of the memory, and it can easily be overwritten with new values. SRAM is much more expensive and physically larger than DRAM but much faster.
Status Output	Any digital output that uses “On” or “Off” conditions to determine the status of the assigned description. Changing from one to the other represents a change in the condition.
STP	Standard Temperature and Pressure
Structured Query Language	IBM developed this language in the 60's as a way of accessing data from a relational database. It has a very simple syntax for simple functions but can become complex for sophisticated applications. This language is standardized by international standards bodies, and is almost universal in application. Almost all databases support SQL. The RTDB supports SQL and this makes it extremely flexible within a corporate network. Authorized users throughout the organization can write SQL statements to acquire data from this database that they need for Marketing, Accounting, Engineering, or other functions.
Sulfur	A pale, yellow, non-metallic chemical element that may be found in a gas stream and which needs to be removed or reduced from the gas stream for corrosion control or health or safety reasons.

TERM	DEFINITION
Supercompressibility Factor	A factor used to account for the following effect: Boyle's law for gases states that the specific weight of a gas is directly proportional to the absolute pressure, the temperature remaining constant. All gases deviate from this law by varying amounts, and within the range of conditions ordinarily encountered in the natural gas industry, the actual specific weight under the higher pressure is usually greater than the theoretical. The factor used to reflect this deviation from the ideal gas law in gas measurement with an orifice meter is called the "Supercompressibility factor Fpv". The factor is used to calculate corrected from volumes at standard temperatures and pressures. The factor is of increasing importance at high pressures and low temperatures.
Supervisory Control and Data Acquisition	A common PC function in process control applications, where programmable logic controllers (PLCs) perform control functions but are monitored and supervised by a PC.
Surge	A sudden change (usually an increase) in the voltage on a power line. A surge is similar to a spike, but is of longer duration.
SV	Sample Vent (located on NGC8200 series Feed-Through Assembly).
SW VBATT	Switched Battery Voltage. Cycles power to equipment to save power.
Switch	An electrical device for connecting and disconnecting power to a circuit, having two states, on (closed) or off (open). Ideally having zero impedance when closed and infinite impedance when open.
Synchronous	(1) Hardware - A property of an event that is synchronized to a reference clock. (2) Software - A property of a function that begins an operation and returns only when the operation is complete.
Syntax	Comparable to the grammar of a human language, syntax is the set of rules used for forming statements in a particular programming language.
System Noise	A measure of the amount of noise seen by an analog circuit or an ADC when the analog inputs are grounded.
TankMaster	Totalflow Control System for LevelMaster Tank Units.
Tap	To cut threads in a round hole so that other fittings or equipment can be screwed into the hole. Also to make an opening in a vessel or pipe.
TBUS	Communication abbreviation for Transmit Bus.
TCD	See Thermal Conductivity Detector.
TCP/IP	TCP/IP – This is the basic communication format for the Internet, and for much of what happens on a corporate network. Virtually all networked PCs and other computers have an "IP address" having the format xxx.xxx.xxx.xxx (xxx can range from 0 to 255 in most cases). You can see the IP address of your PC by going to the start menu, selecting run, and entering cmd. A "DOS Box" will be displayed on your screen. Type ipconfig to get the IP address. When you enter a URL (e.g., www.totalflow.com) in a browser, a DNS server (on the network) resolves this into an IP address and directs your request to the machine with that address.
TCR	Temperature Compensated Regulator.

TERM	DEFINITION
TDS32	Totalflow DDE Server that allows Microsoft Windows applications with DDE capabilities to communicate with Totalflow's equipment. For example data can be retrieved and placed in an Excel spreadsheet.
Temperature Coefficient	An experimental number used to modify the calibration of a device (Totalflow transducer) to account for changes in environmental temperature.
Temperature Error	The maximum change in output, at any measured value within the specified range, when the transducer temperature is changed from room temperature to specified temperature extremes.
Temperature Range, Compensated	The range of ambient temperatures within which all tolerances specified for Thermal Zero Shift and Thermal Sensitivity Shift are applicable (temperature error).
Temperature, Ambient	The temperature of the air, atmosphere or other fluid that completely surrounds the apparatus, equipment or the work piece under consideration. For devices which do not generate heat, this temperature is the same as the temperature of the medium at the point of device location when the device is not present. For devices which do generate heat, this temperature is the temperature of the medium surrounding the device when the device is present and generating heat. Allowable ambient-temperature limits are based on the assumption that the device in question is not exposed to significant radiant-energy sources such as sunlight or heated surfaces.
Temperature, Flowing	Temperature of the flowing fluid. Usually gas and measured by an RTD.
Terminal Mode	Man-Machine interface tool used as an engineering interface with equipment.
Termination	Placement of a connector on a cable.
Termination Panel	The NGC8200's termination panel acts as a connection to the outside world. It features transient protection, a voltage regulator for the digital controller, positive temperature co-efficient fuses (PTC) and many other safeguards to protect the remainder of the system from electrical damage. All outside communications and I/O are channeled through this board. It is designed to be a low cost, field replaceable maintenance solution and is designed to operate on either 12V or 24V.
Termination Panel	A circuit board with screw terminals or other connector system that allows convenient connection of field signals to a data acquisition or communication system.
TF Loader Packages	In PCCU32, the 32-Bit XSeries Loader is the program that allows for the downloading of specific files to an NGC, XFC, XRC or $\mu$ FLO XSeries device. The 32-Bit XSeries Loader application allows packages containing a combination of Flash, WinCE OS (nk.bin), ISaGraf Runtime, Blackfin Firmware (NGC) and configuration files to be downloaded to XFCs, XRCs, NGCs or $\mu$ FLO machine types. These same packages can be downloaded to other machines of the same type to expedite configurations for machines having the same purpose. With the creation of these packages, the user is then prevented from accidentally loading incompatible packages to the wrong device.
TF.NET	Totalflow network used to access web data.

TERM	DEFINITION
TFIO Module	Totalflow Input/Output module (i.e. quad AO)
Thermal Conductivity Detector	Universal detector that shows a response to all compounds. An electrical component that changes resistance based on the components ability to conduct heat. In chromatography, two TCDs are used, 1)as a reference detector and 2) as the sensor detector. The reference detector is exposed to only the carrier gas and the Sensor detector is exposed to the sample.
Thermistor	A temperature-sensing element composed of sintered semiconductor material which exhibits a large change in resistance proportional to a small change in temperature. Thermistors usually have negative temperature coefficients.
Thermistor Bead	See Thermal Conductivity Detector.
Thermocouple	A temperature sensor created by joining two dissimilar metals. The junction produces a small voltage as a function of the temperature.
Thermowell	A closed-end tube designed to protect temperature sensors from harsh environments, high pressure, and flows. They can be installed into a system by pipe thread or welded flange and are usually made of corrosion-resistant metal or ceramic material depending upon the application.
Therms Master	Totalflow application for Gas Analyzer.
Tolerance	The allowable percentage variation of any component from that stated on its body.
Totalflow	Product line of ABB Inc. Maker and distributor of the XSeries Flow Computers (XFC) and Remote Controllers (XRC).
TotalSonic MMI	TotalSonic's Man Machine Interface software program. May also be called MEPAFLOW 600.
Transducer	A device for converting energy from one form to another, specifically the measurement of pressure differential in natural gas gate stations. I.e. Pressure to voltage or current.
Transfer Rate	The rate, measured in bytes/s, at which data is moved from source to destination after software initialization and set up operations; the maximum rate at which the hardware can operate.
Transient	An abrupt change in voltage, of short duration (e.g. a brief pulse caused by the operation of a switch).
Transistor	A three leaded device (Collector, Base, Emitter) used for amplifying or switching. Also called a bi-polar transistor to distinguish it from Field Effect Transistor etc.
Transmitter	A device that converts audio, video or coded signals into modulated radio frequency signals which can be propagated by electromagnetic waves (radio waves).
Tranzorb	Transient Voltage Suppression device.
TRB	Tank Request Block Editor. When requesting storage space after adding a LevelMaster application, the file is saved as a *.trb file.

TERM	DEFINITION
Tube	Cylinder for transporting or storing liquids: any long hollow cylinder used to transport or store liquids.
Tuned Radio Frequency	An amplitude modulated (AM) receiver with one or more stages of radio frequency before the detector.
TXD	Communication abbreviation for Transmit Data.
UDINT	Unsigned Double Integer
UL	Underwriters Laboratories, Inc. An independent laboratory that establishes standards for commercial and industrial products.
Union	A form of pipe fitting where two extension pipes are joined at a separable coupling.
Universal Serial Bus	An external peripheral interface standard for communication between a computer and external peripherals over a cable using biserial transmission. It supports both isochronous and asynchronous data transfers.
Unnormalized Total	Is a calculation of the Peak Area divided by the Response Factor for each component, then summed by each component.
Unsigned Integer	Can represent a number twice the size of a “signed integer”, but cannot represent a large negative number.
Upload	This refers to a Totalflow procedure in which any file(s) located in the on-board memory of a Totalflow Host is copied to a file created on a laptop PC.
UPS	Un-interruptible power supply. A power conditioning unit placed between the commercial power service and the protected device. The UPS uses line power to charge batteries, which, in the case of a power failure, can drive electronic circuitry to produce the appropriate AC requirements for some time period.
Upstream	Oil and natural gas exploration and production activities; plus gas gathering, processing and marketing operations.
Upstream Pipeline	The first pipeline to transport natural gas en route to an inter-connect point for delivery to another pipeline. See DOWNSTREAM PIPELINE.
USB	Acronym for Universal Serial Bus.
USB Client	Generally refers to the peripheral device (Slave or Client) that is driven by a computer (Master or Host). Examples are a printer and digital camera.
USB Host	Generally refers to the computer device (Master or Host) that drives a peripheral piece of equipment (Slave or Client). An example is a Laptop or Desktop Computer.
USX	Provider of the RTOS used by the XSeries product line
VAC	Volts of alternating current.
Vacuum	A pressure less than atmospheric pressure, measured either from the base of zero pressure or from the base of atmospheric pressure (PSIA).
Valve	A mechanical device for controlling the flow of fluids and gases; types such as gate, ball, globe, needle, and plug valves are used.

TERM	DEFINITION
Valve Control	This feature provides automatic feedback control of Differential Pressure (DP), Static Pressure (SP), and Flow Rate for the purpose of positioning a flow valve to maintain a desired value of DP, SP, or Flow Rate.
Vapor Pressure	The pressure exerted by a liquid when confined in a specified tank or test apparatus.
VAS32	Totalflow's Voice Alarm System. A software program that receives and transmits alarm notifications via cell, telephone or pager systems.
VBATT	Battery Voltage. The voltage output from the battery source.
VCI	Valve Control Interface.
VDC	Volts of direct current.
VDE	Verband der Elektrotechnik Elektronik Informationstechnik [Association for Electrical, Electronic & Information Technologies]
Velocity	The time rate of change of displacement; dx/dt.
Vent	A normally sealed mechanism which allows for the controlled escape of gases from within a cell.
VGA	Video Graphic Array.
Virtual Memory	A method of making disk storage appear like RAM memory to the CPU, thus allowing programs that need more RAM memory than is installed to run in the system. This technique is slow compared to "real" memory.
Viscosity	The inherent resistance of a substance to flow.
VOG	Velocity of Gas.
Volatile Memory	A storage medium that loses all data when power is removed.
Volt	The unit of voltage or potential difference.. One thousand volts = 1kV.
Voltage	Electrical pressure, the force, which causes current to flow through a conductor. Voltage must be expressed as a difference of potential between two points since it is a relational term. Connecting both voltmeter leads to the same point will show no voltage present although the voltage between that point and ground may be hundred or thousands of volts.
Voltmeter	A meter for reading voltage. It is one of the ranges in a multimeter.
Volume Calculation Period	The specified length between reading and calculating volume data.
Volume Flow Rate	Calculated using the area of the full closed conduit and the average fluid velocity in the form, $Q = V \times A$ , to arrive at the total volume quantity of flow. Q = volumetric flowrate, V = average fluid velocity, and A = cross sectional area of the pipe.
VOS	Velocity of Sound.
Warm Start	A rebooting technique which will clear most operational errors, without damaging either the data or configuration files. This causes the equipment to boot from the Rdrive, which is a solid state memory chip.

TERM	DEFINITION
Watt	Symbol W. The unit of power. One watt is the product of one volt and one amp. Power (W) = Current (I) X Energy (E). (E = Volts)
Wavelength	The distance between two points of corresponding phase in consecutive cycles
Web Page	All the text, graphics, and sound visible with a single access to a Web site; what you see when you request a particular URL.
Web Server	The hardware and software required to make Web pages available for delivery to others on networks connected with yours.
Web Site	A collection of electronic "pages" of information on a Web server
Well, Development	A well drilled in order to obtain production of gas or oil known to exist.
Well, Disposal	A deep well in which to inject waste chemicals, etc., such as a well to dispose of salt brine from the solution mining of salt dome gas storage caverns.
Well, Exploratory	A well drilled to a previously untested geologic structure to determine the presence of oil or gas.
Well, Gas	A well which produces at surface conditions the contents of a gas reservoir; legal definitions vary among the states.
Well, Marginal	A well which is producing oil or gas at such a low rate that it may not pay for the drilling.
Well, Stripper	Non-associated gas well capable of producing no more than 90 Mcf/day at its maximum rate of flow.
Well, Wildcat	An exploratory well being drilled in unproven territory, that is, in a horizon from which there is no production in the general area.
Wellhead	The assembly of fittings, valves, and controls located at the surface and connected to the flow lines, tubing, and Casing of the well so as to control the flow from the reservoir.
WellTell Wireless	Product line designed to communicate RS-485 without the use of cabling. Group consists of the wireless host (WellTell-X), wireless IS client (WellTell-IS) and wireless IO client (WellTell-IO).
WellTell-IO	Client communication device designed with extra on-board IO.
WellTell-IS	Client communication device designed with an intrinsically safe barrier.
WellTell-X	Host communication device for WTW product line.
Wheatstone Bridge	Circuit design using two TCDs to measure components in chromatography.
WINCCU	Windows Central Collection Unit. Windows version of software to process, archive and manipulate data collected from the Totalflow products.
Window	In computer graphics, a defined area in a system not bounded by any limits; unlimited "space" in graphics.

TERM	DEFINITION
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> ).
Wobbe Number	A number proportional to the heat input to a burner at constant pressure. In British practice, it is the gross heating value of a gas divided by the square root of its gravity. Widely used in Europe, together with a measured or calculated flame speed, to determine interchangeability of fuel gases.
Working Voltage	The highest voltage that should be applied to a product in normal use, normally well under the breakdown voltage for safety margin. See also Breakdown Voltage.
World Wide Web	An Internet service facilitating access to electronic information - also known as the Web, WWW, or W3.
Write	To record data in a storage device or on a data medium.
WTW	WellTell Wireless product line. See WellTell Wireless.
XDCR	See External Transducer.
XFC	See Flow Computer, XSeries.
XFC G4	Totalflow's new Generation 4 extendable XFC equipment featuring technology that is expandable and flexible for ever changing needs.
XFC-195 Board	The main electronic board used in XSeries flow computers. The XFC-195 Board mounts on the inside of the enclosure's front door.
XFC6200EX	Totalflow's Class 1 Div 1 Flow Computer. This Totalflow Flow Computer is housed in an explosion proof housing and has similar operational features as the $\mu$ FLO, with additional capabilities.
XIMV	See XSeries Integral Multivariable Transducer.
XMV	See Multivariable Transducer.
XRC	XSeries Remote Controller. Also see Remote Controller, XSeries.
XRC G4	Totalflow's new Generation 4 extendable XRC equipment featuring technology that is expandable and flexible for ever changing needs.
XSeries	Totalflow's new extendable equipment series featuring technology that is expandable and flexible for ever changing needs.
XSeries Integral Multivariable	Abbreviated XIMV. A smart Multivariable Transducer that is an integral part of the XSeries Flow Computer, measuring Static Pressure (SP), Differential Pressure (DP) and Flowing Temperature (Tf). This refers to both the transducer portion of the device and the circuitry required to supply measurements to the Main Processor Board, which is housed in a factory sealed unit. See Multivariable Transducer for more information.
Y	Expansion factor.

<b>TERM</b>	<b>DEFINITION</b>
Zero Gas	Gas at atmospheric pressure.
Zero Offset	The difference expressed in degrees between true zero and an indication given by a measuring instrument.

## **APPENDIX D    DRAWINGS**

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

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