2101510-002– rev. AE

NGC8206 Chromatograph

User's Manual

TOTALFLOW
MEASUREMENT & CONTROL SYSTEMS

ABB

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Inquiries regarding this manual should be addressed to ABB Inc., Totalflow Products, Technical Communications, 7051 Industrial Blvd., Bartlesville, Oklahoma 74006, U.S.A.

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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 NGC8206 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

The manual provides the following information:

Chapter	Name	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	Startup	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.
Appendix A	Modbus Register Tables	Provides a listing of all valid Modbus Registers.
Appendix B	Definitions & Acronyms	Provides quick access to the majority of terms and abbreviations, as well as their definitions.
Appendix C	Drawing	Provides a place to put drawings that accompany a unit.

Getting Help

At Totalflow, we take pride in the on going support we provide our 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:

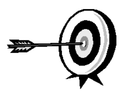
USA: (800) 442-3097 or International: 1-918-338-4880

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 problem.
- Know the software version, board and optional part numbers.

Key Symbols

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

FYI		Intended to draw attention to useful information or to clarify a statement made earlier.
TIP		Intended to draw attention to a fact that may be useful or helpful in understanding a concept.
ACCESS		Intended to draw your attention to information regarding security access to equipment and Software Security features.
CAUTION		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.
WARNING		Intended to draw attention to a statement regarding the likelihood of personal injury or fatality that could result from improper access or techniques used while working in hazardous locations. Please refer to the "Safety Practices and Precaution" section for additional information.
CWE		Indicates procedures that are only valid if system design includes a Cold Weather Enclosure.

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 the equipment to perform any adjustments, measurements, maintenance, parts replacement or repairs until all external power supplies have been disconnected.
- Only a properly trained technician should work on any equipment with power still applied.
- When opening covers or removing parts, exercise extreme care as live parts or connections can be exposed.
- Installation and maintenance must be performed by person(s) qualified for the type and area of installation according to national and local codes.
- Capacitors in the equipment can still be charged even after the unit has been disconnected from all power supplies.

Safety First

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

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

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

- Removal of enclosure cover(s) in a hazardous location must follow guidelines stipulated in the certification drawings shipped with this unit.
- If 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.

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

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

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 safety, it should be taken out of operation and secured against unintentional usage.

1.0 SYSTEM DESCRIPTION

1.1 System Overview

This chapter introduces the user to the Totalflow® Model NGC8206 Series Natural Gas Chromatograph (NGC). 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 Megajoules/meter^3) with less than 100 PPM H2S.

The unit is a fully functional gas chromatograph for "pipeline quality" natural gas and is 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.

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 doing stream analysis. This new platform is designed for operation on Windows CE Real Time Operating System.

1.1.2 Calibration

Once installed on the meter run, the unit can immediately calculate the calorific value of natural gas. The user can utilize their own calibration blend to adjust the unit to their company's standards or take advantage of various automatic operational features by using the recommended calibration gas.

1.1.3 Typical Installation

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

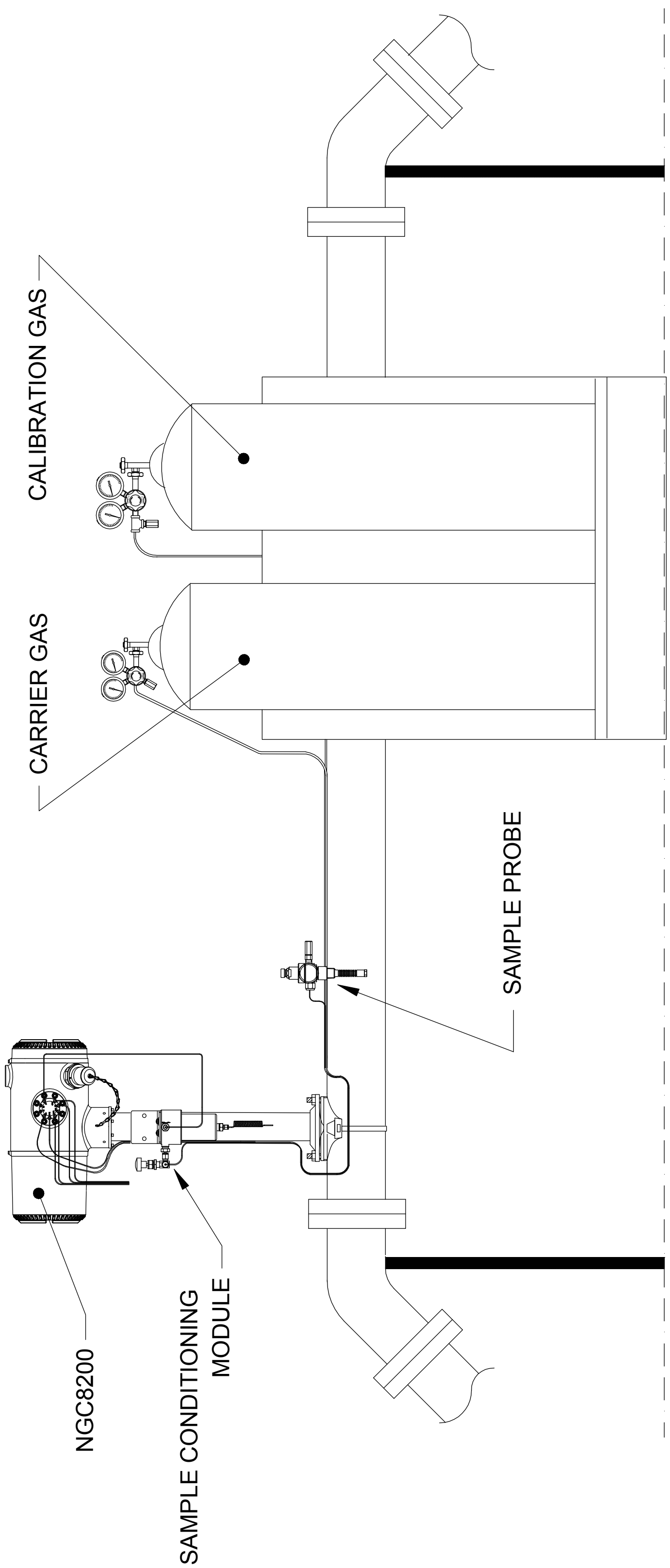
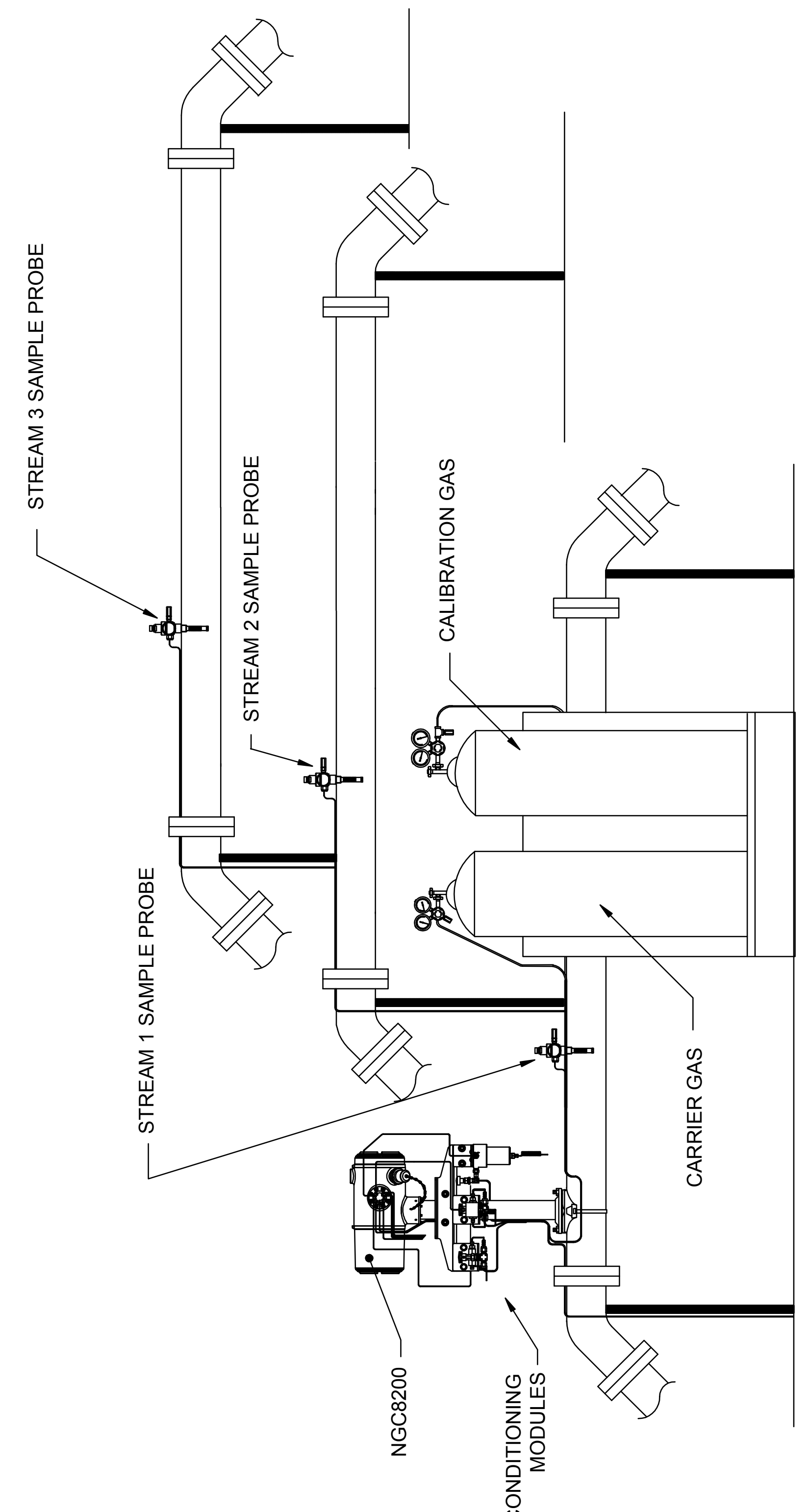


Figure 1–1 Typical Single Stream Installation



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

Figure 1–2 Typical Multi-Stream Installation

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 module (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 key information is 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
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
Recommended AC Power Supply	14.5V	14.5V	25V	25V
Maximum Instantaneous Current[1]	4 Amp	8.2 Amp	2.2Amp	5.2Amp
Avg. Power Consumption After Startup[2]	Up to 7 Watts	Up to 53 Watts	Up to 7 Watts	Up to 64 Watts
Environment 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	± 0.125 Btu @ 1,000 Btu (±0.0125%) ambient; ±0.25 Btu @ 1,000 Btu (±0.025%) over temp. range of 0–131°F (-18° to 55°C)			
Helium Carrier	Consumption rate: 12 ml/minute typical to 20 ml/minute maximum.			
Medium	800 to 1500 Btu per Standard Cubic Foot (29.8 to 44.6 megajoules/meter^3) with less than 100 PPM H2S			
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 Cold Weather Enclosure.			

8206 Dimension		*Width*	*Height*	*Depth*	*Weight*
	US	9.5“	8.82“	15.64“	29 lbs.
	Metric	241.3 mm	224.0 mm	397.3 mm	10.8 kg

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

2 At Recommended AC Power Supply Voltage. Highly temperature dependant, with Feed-through Heater operating continuously. Usually occurs at only the coldest ambient operating temperature, i.e. 0°F (-18°C).

1.3.1 NGC8206 Standard Hardware Features

The Totalflow® NGC (Natural Gas Chromatograph) features a rugged, field ready design. Installation, startup and troubleshooting times have been greatly reduced due to these user friendly hardware features:

- Enclosure – 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

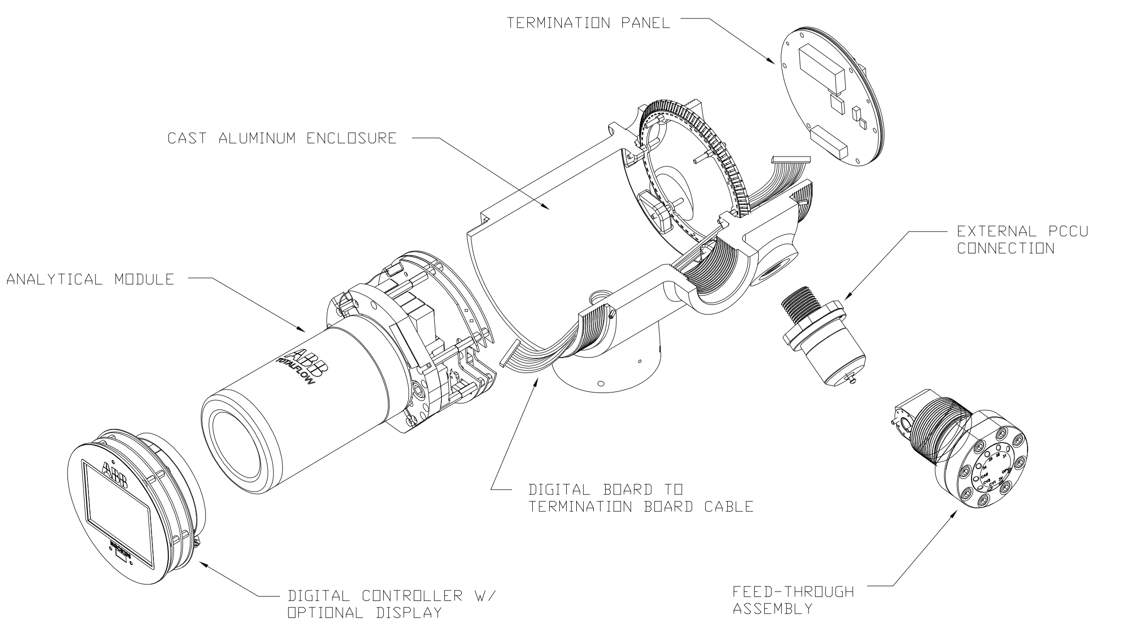

Figure 1–3 Modular Design NGC8206

1.3.2 Recommended Spare Parts

Totalflow has provided a recommended spares list for the NGC8206 product line. Consideration was given to the cost of the repair time and the cost of stocking repair parts. The NGC8206'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 enclosure 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 shows the outline dimensions of the NGC.

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.

This enclosure may be pipe mounted on meter run using a pipe saddle, stand alone pipe mounted, shelf mounted or optionally mounted in a cold weather enclosure. Unit may be directionally positioned using 1/8" hex socket set screws located in the neck of the enclosure.

1.3.3.1 Exterior Hubs

The unit enclosure features six exterior hubs:

- Gas feed-through assembly
- Explosion proof local MMI port
- Four miscellaneous hubs, including:
  - Communication hub
  - Power hub
  - Digital input/output wire hub
  - Undefined hub

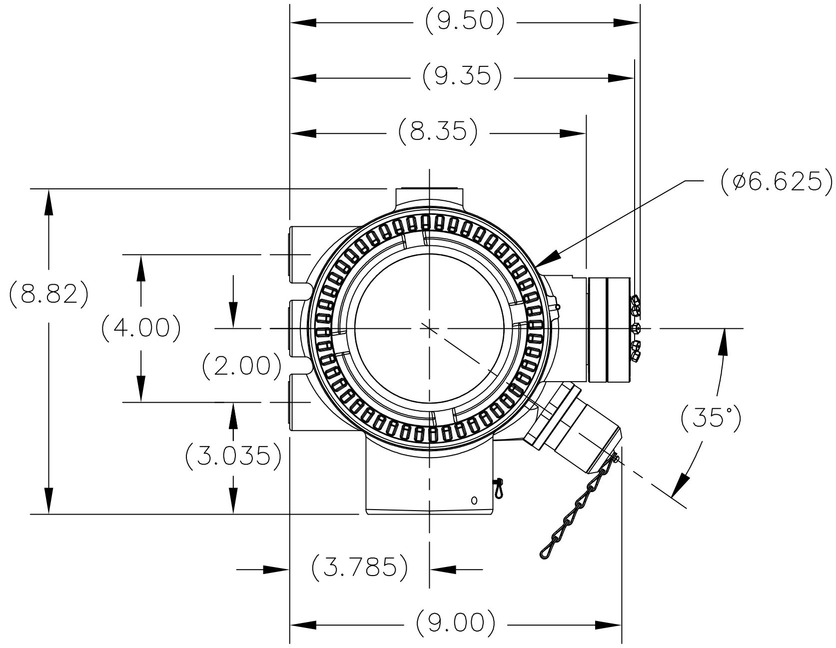

Figure 1–4 NGC8206 Enclosure

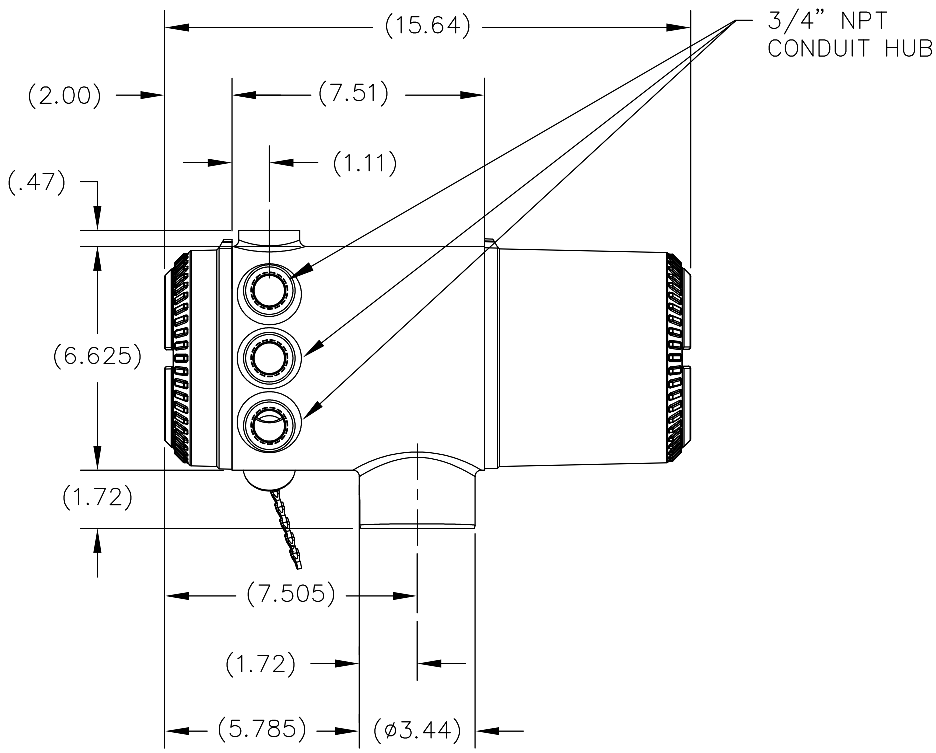

Figure 1–5 NGC8206 Enclosure Left Side

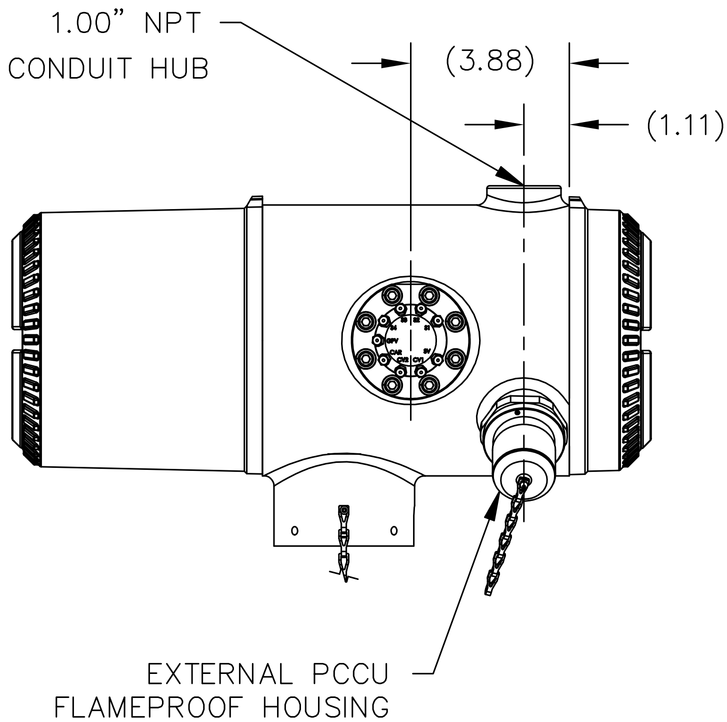

Figure 1–6 NGC8206 Enclosure Right Side

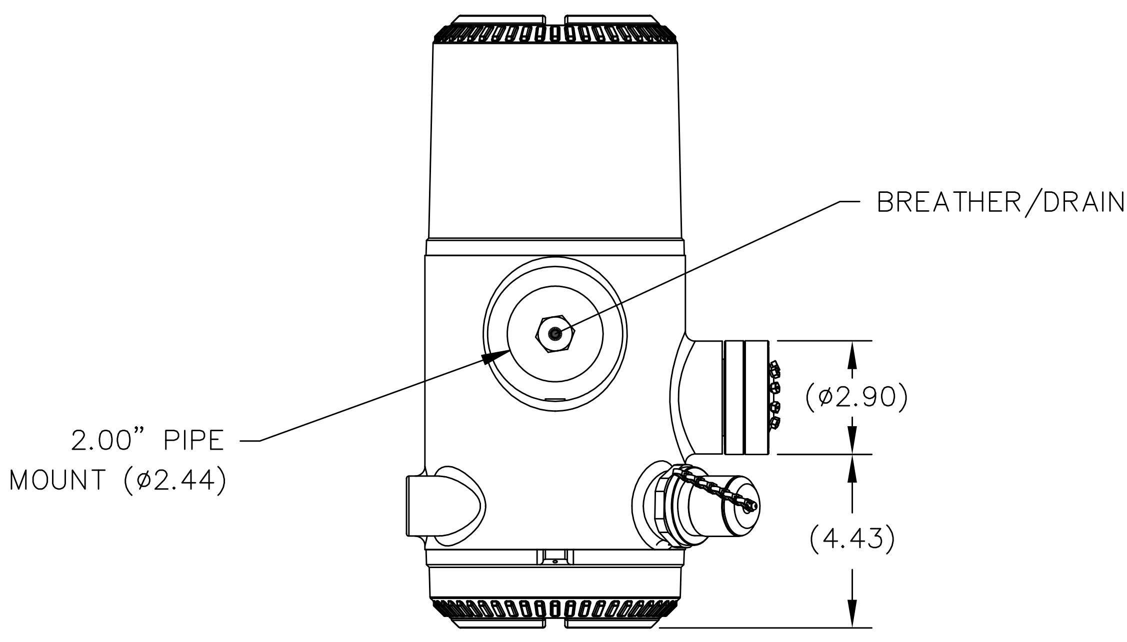

Figure 1–7 NGC8206 Enclosure Underside

1.3.4 Feed-through Assembly (2102026-xxx)

Independent sample streams are connected to the NGC directly to the feed-through assembly (see Figure 1–8), or through an optionally installed sample conditioning module. The feed-through assembly 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 the auxiliary heater feature a heater with a temperature sensor cable which makes connection to the analytical module and is replaceable. Please note that this cable comes 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.

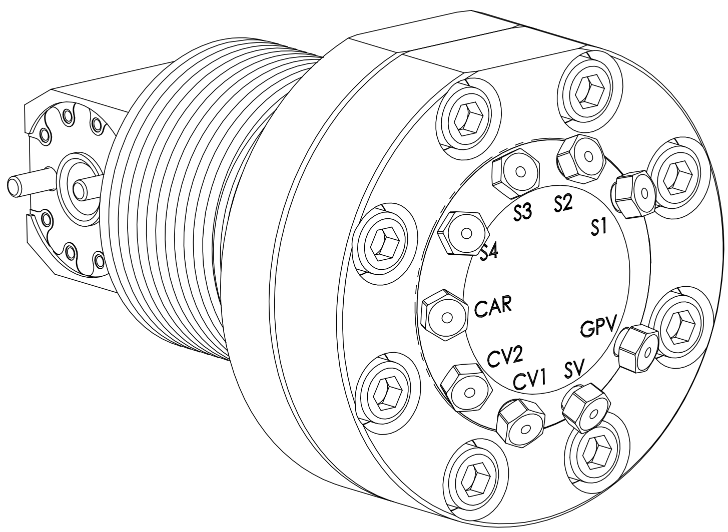

Figure 1–8 NGC Feed-through Assembly (2102026-xxx)

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 require vent tubing to be attached and routed accordingly. These are:

- 2 column vents (CV1 and CV2)
- 1 sample vent (S1, S2, S3 and S4)
- 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 assembly is comprised of the manifold and analytical processor. These parts are not field replaceable. The GC module is an important part of the analytical module, but is field replaceable. More discussion will follow.

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

Of the subassemblies that comprise the analytical module, GC module and manifold assembly come in two configurations: 12 VDC and 24 VDC.

In Figure 1–9 the user can see 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 feed-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

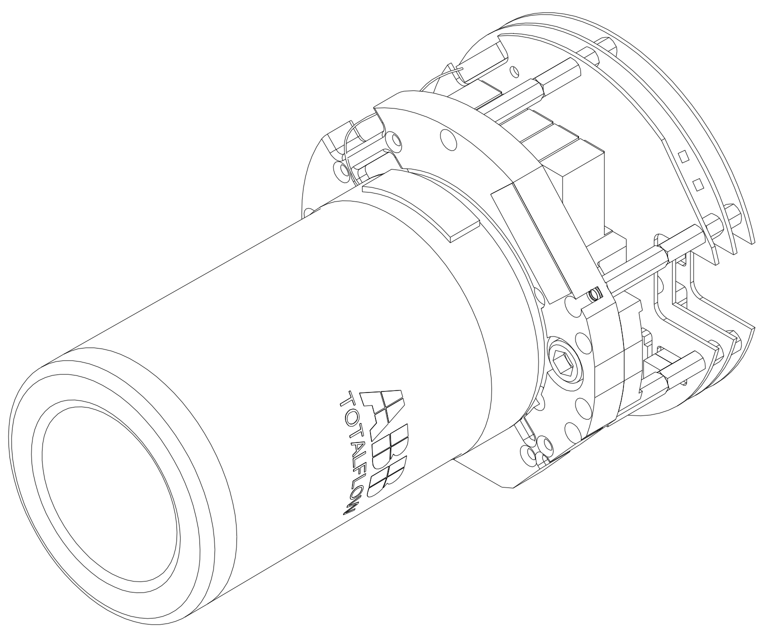

Figure 1–9 Analytical Module

1.3.5.2 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 valve controls the 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.

Figure 1–10 shows the manifold assembly. This is not a field replaceable part.

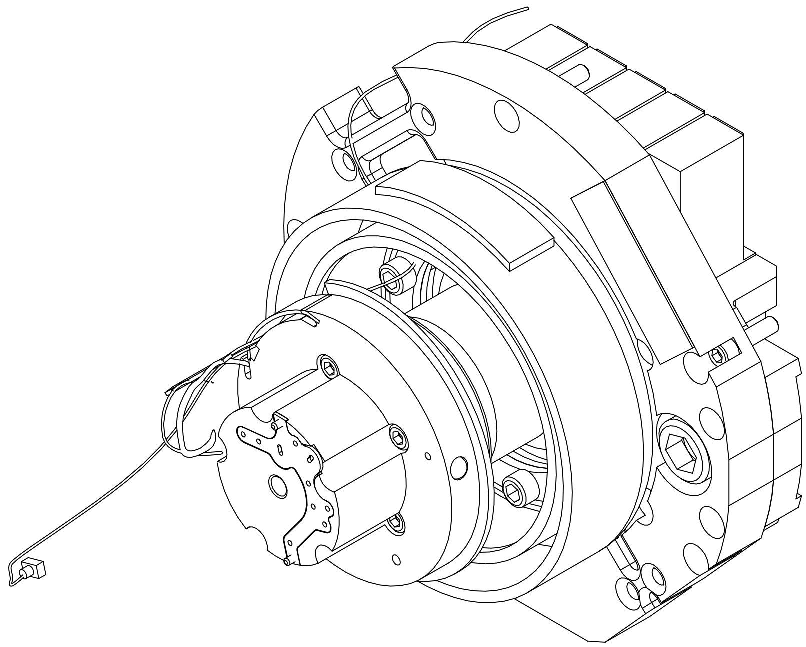

Figure 1–10 Manifold Assembly

1.3.5.3 Analytical Processor Assembly

The analytical processor board provides real-time system control and measurement of the analytical processes within the NGC. 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 analytical processor also has two status LED's 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 is 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, then the software in the analytical processor is not running properly.

Figure 1–11 shows the analytical processor assembly. This is not a field replaceable part.

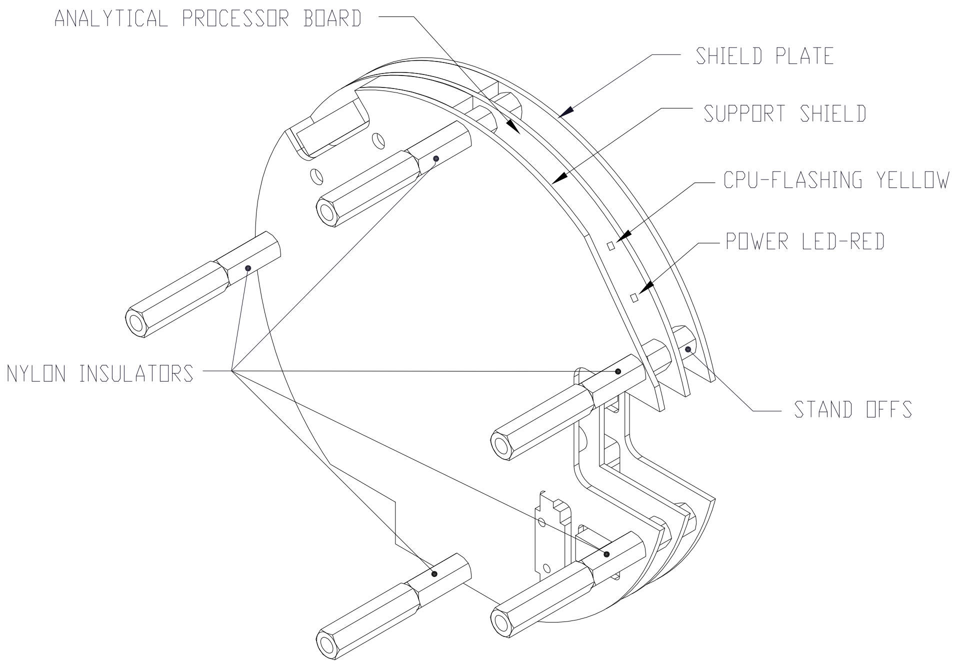

Figure 1–11 Analytical Processor Assembly

1.3.5.4 GC Module

The 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. Replacement is by single bold removal.

Figure 1–12 shows the GC module with the oven wall removed.

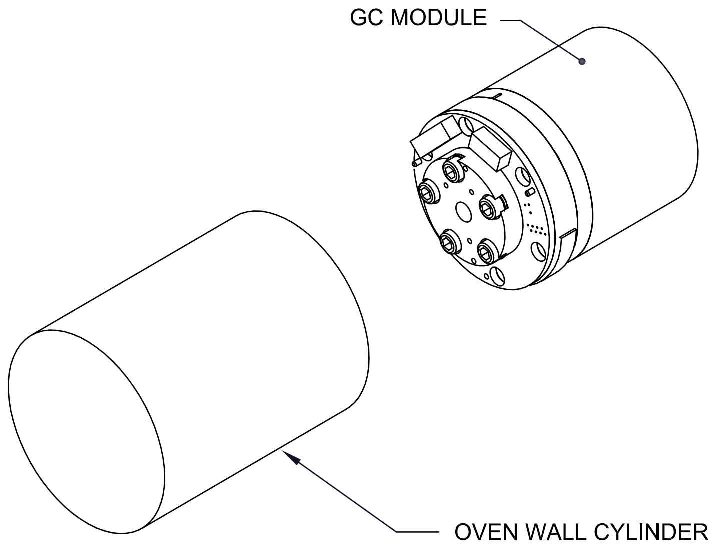

Figure 1–12 GC Module Assembly

1.3.6 Digital Controller Assembly

This assembly (see Figure 1–13) contains the digital electronic board, mounting assembly and, optionally, a VGA display.

The digital controller board provides control parameters to the analytical processor board and 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)

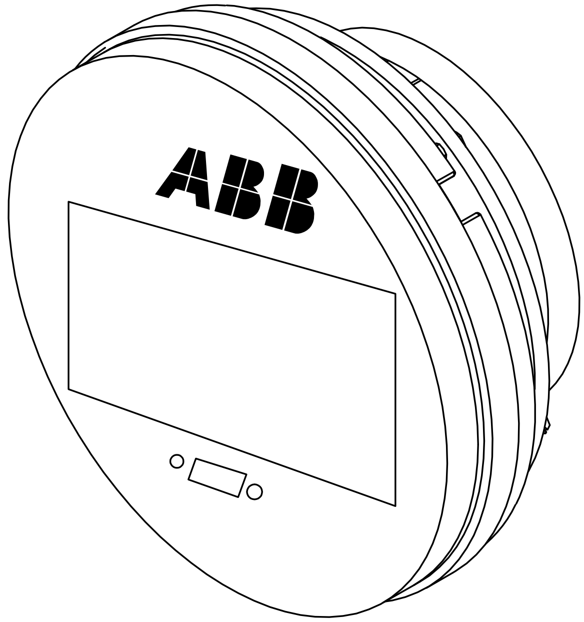

Figure 1–13 Digital Controller Assembly with Optional Display

1.3.7 Termination Panel

The NGC8206 termination panel acts as a connection to the outside world (see Figure 1–14). It features transient protection, a voltage regulator for 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 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 (up to 115200 bps)
- 2 LED status indicators (software programmable)
- 1 Power monitor status indicator
- 1 5 VDC LED status indicator
- 2 DI’s and 2 DO’s 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

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.

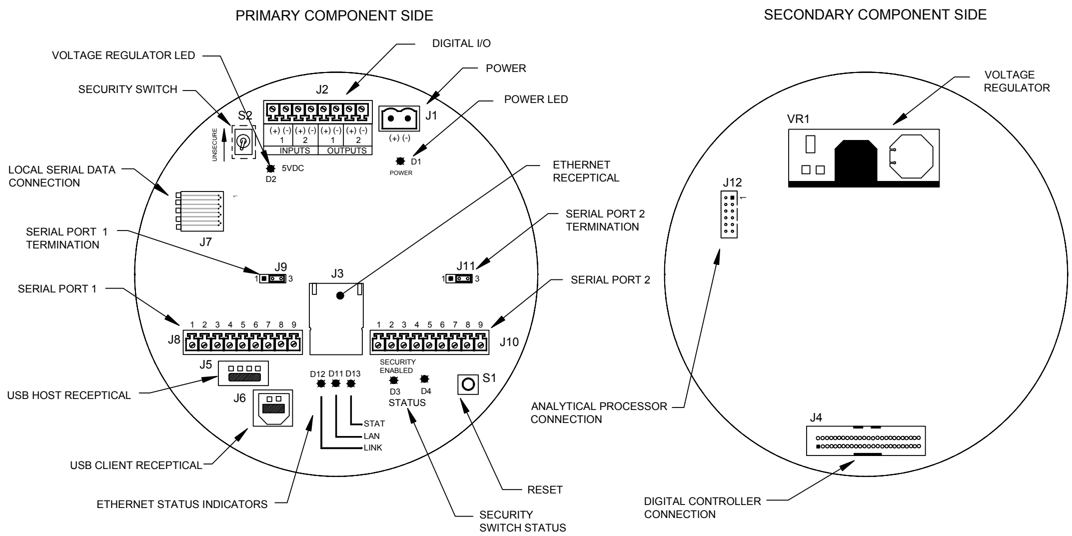

Figure 1–14 Termination Panel

1.4 Grounding the NGC

The NGC8206 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 #12AWG wire. The NGC8206 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 1–15).

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 is collocated with a radio. If the radio is connected to the NGC8206 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 needs to put isolators in the 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 insured, tubing isolators must be used.

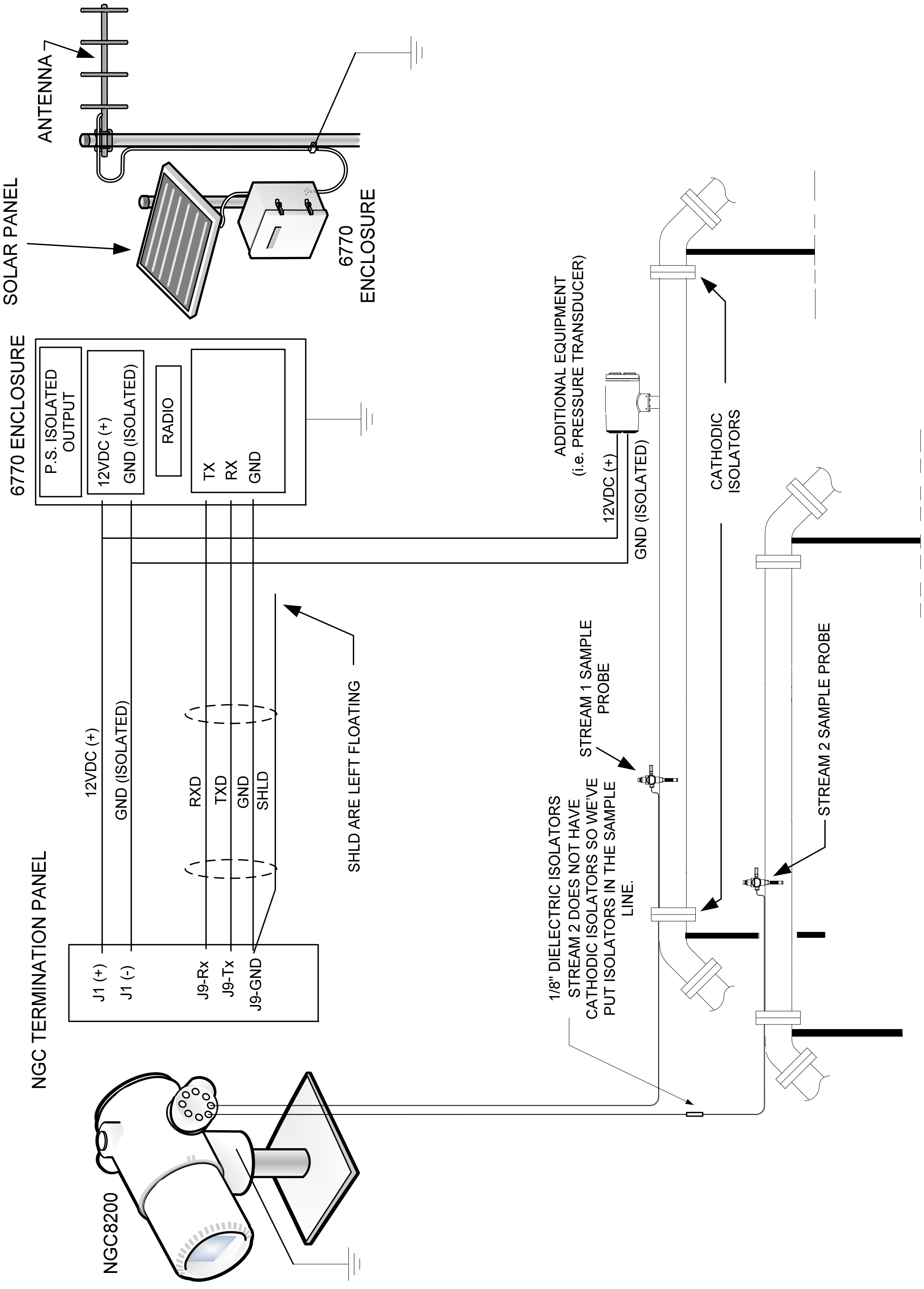

Figure 1–15 NGC Grounding Considerations

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

In an office environment, insure that a good earth ground is established to the NGC8206. 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. Be sure that the unit is properly grounded. If the unit is not properly grounded, the user could have as much as 60 VAC (half line voltage) on the case of the equipment due to capacitive coupling within the power supply.

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. It is recommend that a metal diaphragm regulator is set to 15 ± 2 PSIG input. The recommended calibration gas component concentrations for use with Auto Peak Find may be found in Table 1–3.

Table 1–3 Calibration Gas Blend Recommended Components

Component Name	Abbreviation	Mol %	Component Name	Abbreviation	Mol %
Nitrogen	N_2	2.500	Normal Butane	NC_4	0.300
Methane	C_1	89.570	Neo Pentane	Neo C_5	0.100
Carbon Dioxide	CO_2	1.000	Iso Pentane	IC_5	0.100
Ethane	C_2	5.000	Normal Pentane	NC_5	0.100
Propane	C_3	1.000	Hexanes and Heavier	C_6+	0.030
Iso Butane	IC_4	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. The configurations with the auxiliary feed-through heater increase the 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 (XMVs, 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 other questions exist, call Totalflow Customer Service at:

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

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

Model /Option	Min. Batt Voltage (V)	Units	10 AWG[1]	12 AWG	14 AWG	16 AWG	6 mm^2 [1]	4 mm^2 [1]	2.5 mm^2	1.5 mm^2
12 VDC NGC w/o Feed-through heater	12.00	(ft)	78.28	49.44	30.97	19.43	90.03	60.17	37.42	22.92
		(m)	23.86	15.07	9.44	5.92	27.44	18.34	11.41	6.99
12 VDC NGC with Feed-through heater	12.00	(ft)	38.74	24.47	15.32	9.62	44.55	29.78	18.52	11.34
		(m)	11.81	7.46	4.67	2.93	13.58	9.08	5.64	3.46

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 [1]	12 AWG	14 AWG	16 AWG	6 mm^2 [1]	4 mm^2 [1]	2.5 mm^2	1.5 mm^2
12 VDC NGC w/o Feed-through heater	14.50	(ft)	469.67	296.64	185.81	116.61	540.20	361.03	224.55	137.54
		(m)	143.16	90.41	56.63	35.54	164.65	110.04	68.44	41.92
12 VDC NGC with Feed-through heater	14.50	(ft)	232.43	146.80	91.95	57.71	267.33	178.66	111.12	68.06
		(m)	70.84	44.74	28.03	17.59	81.48	54.46	33.87	20.75
24 VDC NGC w/o Feed-through heater	25.00	(ft)	809.52	511.27	320.25	200.98	931.07	622.26	387.02	237.06
		(m)	246.74	155.84	97.61	61.26	283.79	189.67	117.96	72.26
24 VDC NGC with Feed-through heater	25.00	(ft)	336.97	212.83	133.31	83.66	387.57	259.03	161.10	98.68
		(m)	102.71	64.87	40.63	25.50	118.13	78.95	49.10	30.08

[1] This wire size may require splicing in 12AWG or 2.5mm^2 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 “lag time” 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 gives unsatisfactory results.

CAUTION 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.

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

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 time that the 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 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 total length of tubing. To assist in making these calculations, refer to Table 1–6 for 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
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 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 6.02x1023 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 the 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 uses electrical power, stream 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 vapor samples 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 1–16).

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.

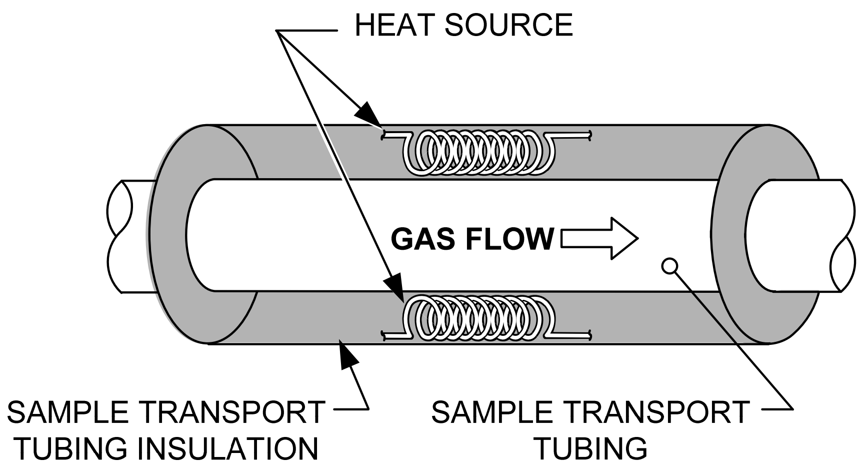

Figure 1–16 Heat Tracing Sample Line

1.7.9 Tube Corrosion

When designing transport tubing, the affect 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 user 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 that no particles are allowed to remain in 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 1–17).

FYI Figure 1–17 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.

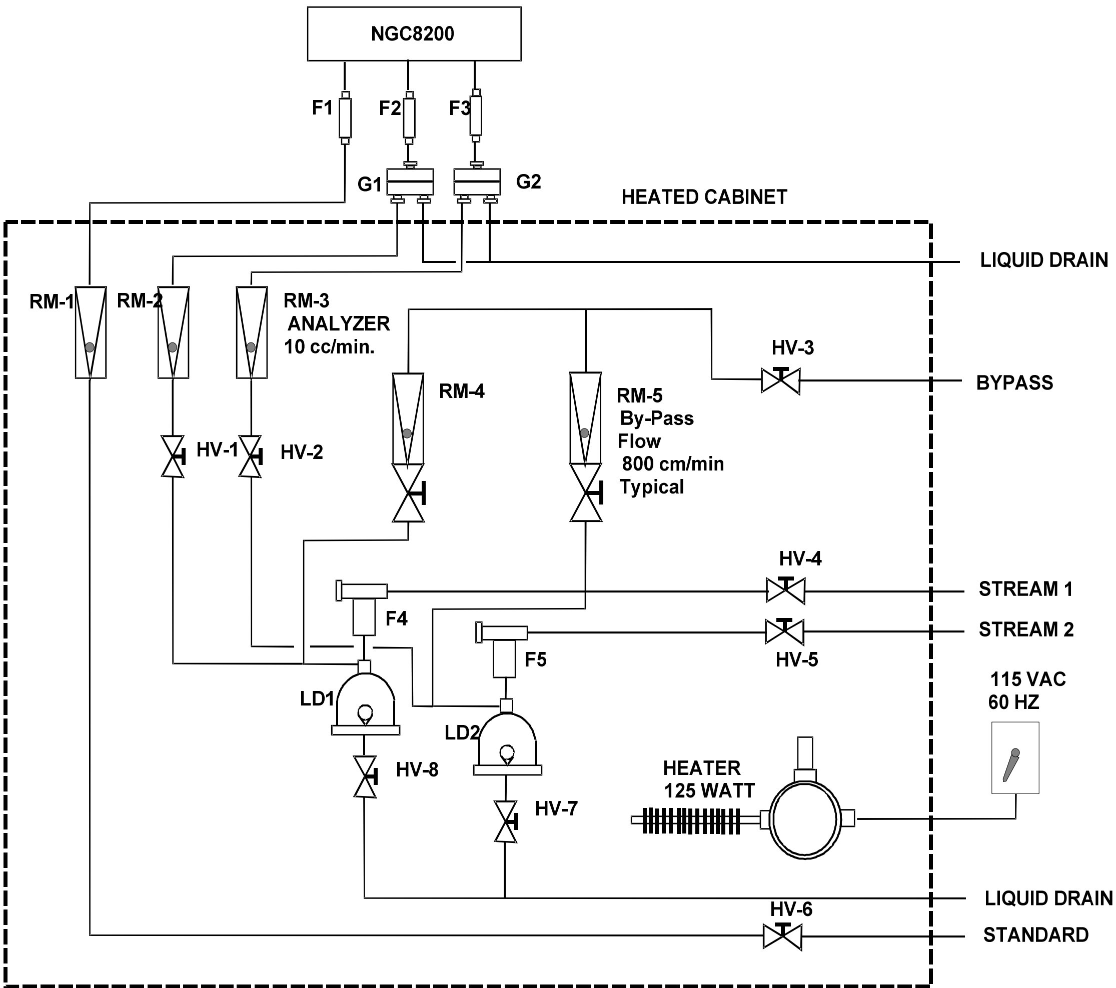

Figure 1–17 Typical Sample Installation Diagram

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 the 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	L	= Line Length, ft.
V	= Tubing Volume, cc/ft.	Fs	= Standard Flow, cc/min.
P	= Actual Pressure, PSIG	T	= Actual Temperature, °F
Zp	= Compressibility at P Pressure		

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 assure that enough pressure is available, to keep sample flowing throughout the analysis system.

1.9 NGC8206 Standard Software Features

Totalflow’s on-board 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 last 480 events. Additionally, this can be reconfigured by the user.

1.9.2 Tri-Level Security

The software security system is designed to have a password administrator who sets up the accounts and privileges for themselves as well as the other PCCU users. This privilege includes being able to instantiate applications and make changes to the functionality of the NGC. 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 automatically setup 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 support 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, 57600 and 115200 baud rates.

1.10 PCCU Local Communication Options

Local communication with the NGC requires the use of PCCU32 software running on a PC and an MMI (man machine interface) cable. Totalflow recommends using a USB cable for high speed local communication in a remote location. RS-232 serial communication with the NGC can also be a high speed application for users operating a PC with Windows XP Operating System or newer.

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

	Operational Task[1]		
Communication	**Data Coll. Single Stream**	**Save Files**	**Restore Files**
Serial: 38,400 Baud	10 Seconds	2.5 Minutes	2.5 Minutes
Serial: 115,200 Baud[2]	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 NGC8206 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.

1.11.1 Carrier Pressure Regulator Tests

This test compares the actual column pressure to the column pressure set point using carrier gas. A failure of this test indicates that the carrier pressure is not meeting or over exceeding the expected level of pressure.

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[1] Operational task speed directly correlates to PC Processor speed.

[2] 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 set point. 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, meaning the processor is not able to control the function.

1.11.4 Stream Test

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

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

1.12 Start-Up Wizard

The NGC8206 Start-up Wizard is designed to walk the technician through procedures required for setting up the unit. Following installation and connection to the NGC, the *Startup Wizard* begins automatically. This only happens the first time the user connects to the unit or upon start-up each time the user reconnects to the system until the unit setup is completed.

The wizard is designed to run concurrently with the NGC Diagnostics.

1.12.1 Wizard

The wizard steps through the process of entering information to get the NGC up and running: device set-up, stream set-up, calibration set-up, etc. Each screen has an associated Help screen that automatically displays when the user moves from screen to screen defining what information is required.

1.13 Historical Data

The NGC compiles historical data that can be used for custody transfer needs, verify NGC operation over time and provide 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.

1.13.1 Retaining Data

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

1.13.2 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
- Wobble Index [Dry Btu (Superior CV)]
- Alarms

1.13.3 Stream Averages

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

1.13.4 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

1.13.5 Audit Logs

- Last 100 alarms
- Last 100 events

1.14 TCR Sample Probe (Optional Equipment)

The temperature compensated regulator (TCR) sample probe is used to capture natural gas from the pipe line for NGC analysis. To capture the gas sample, it is recommended the TCR sample probe be mounted horizontally. It can be mounted vertically if this is more suitable to the customer's installation.

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

TIP It is the customer's responsibility to install and weld a 3/4 –inch female NPT standard pipeline coupling on the main meter run gas flow pipe. This coupling allows installation of the TCR sample probe.

Check Table 1–9 to ensure that the user has the correct sample probe for their installation. The length of the sample probe is dependent on the diameter of the customer's meter run.

ABB Totalflow recommends that a TCR be installed with the NGC. Refer to Figure 1–18.

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)	Part Number	Description
4	1461004-003	Temperature Compensated Sample Probe /Regulator/Relief Valve
8	1461004-004	Temperature Compensated Sample Probe /Regulator/Relief Valve

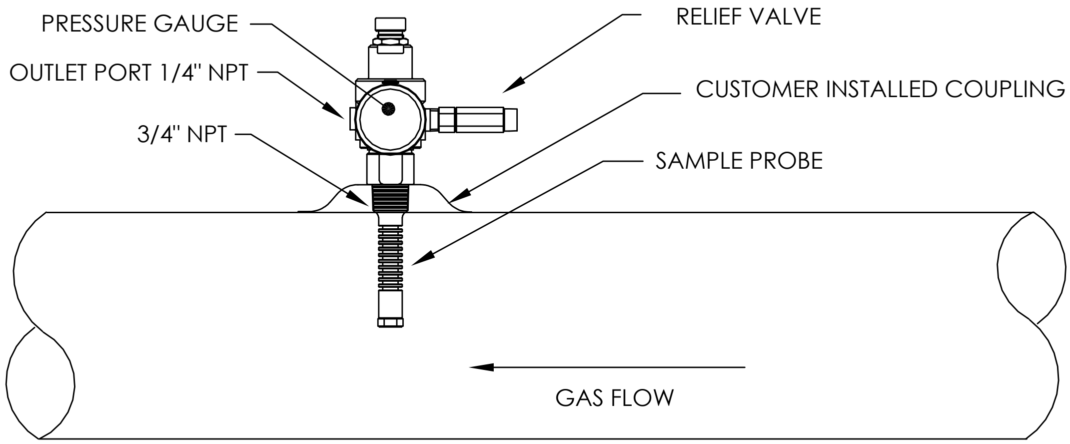


Figure 1–18 Temperature Compensated Regulator With Sample Probe

1.14.1 Location

- Locate the pipeline coupling on the gas meter run, in close proximity to the NGC. This allows the stainless steel sample line, from sample probe to Chromatograph, to be as short as possible.
- The coupling should be mounted so the probe can be installed horizontally or vertically on meter run pipe. This means the coupling should be mounted on either the top or the side of the meter run 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 main gas meter run. 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.
- The sample probe must be installed where probe has access to the fastest flow of gas within the pipe.
- The sample probe should be mounted a minimum of five pipe diameters from any device which could cause aerosols or significant pressure drops.

1.14.2 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 TCR sample probe pressure to a value greater than 15 PSIG. Pressure is dependent on sample transport tubing length between the TCR sample probe and analyzer.
- Be sure to use tubing electrical isolators on sample tubing when connected to pipelines that are not isolated from cathodic protection.

1.15 VGA Display (Optional Equipment)

The display board provides a ¼ panel, VGA monochromatic display to monitor the process and results. It also provides six magnetic switches to allow a user to navigate through various screens of data and control the processes (stop operation, start operation and calibrate).

If the NGC is configured with the front panel display, available screens and user defined screens may be navigated using the display magnet (Part No. 1801755-001).

The optional VGA display features:

- ¼ panel VGA display circuit board.
- 2 LED Status Indicators, User Programmable (default left LED- flashing light indicates a fault alarm, and a solid light indicates a warning alarm. Right LED-solid light indicates unit is NOT in auto run mode.)
- User interface, with hall-effect magnet navigation, for monitoring NGC8200 operation.

Figure 1–19 shows the flow of information accessible through the display.

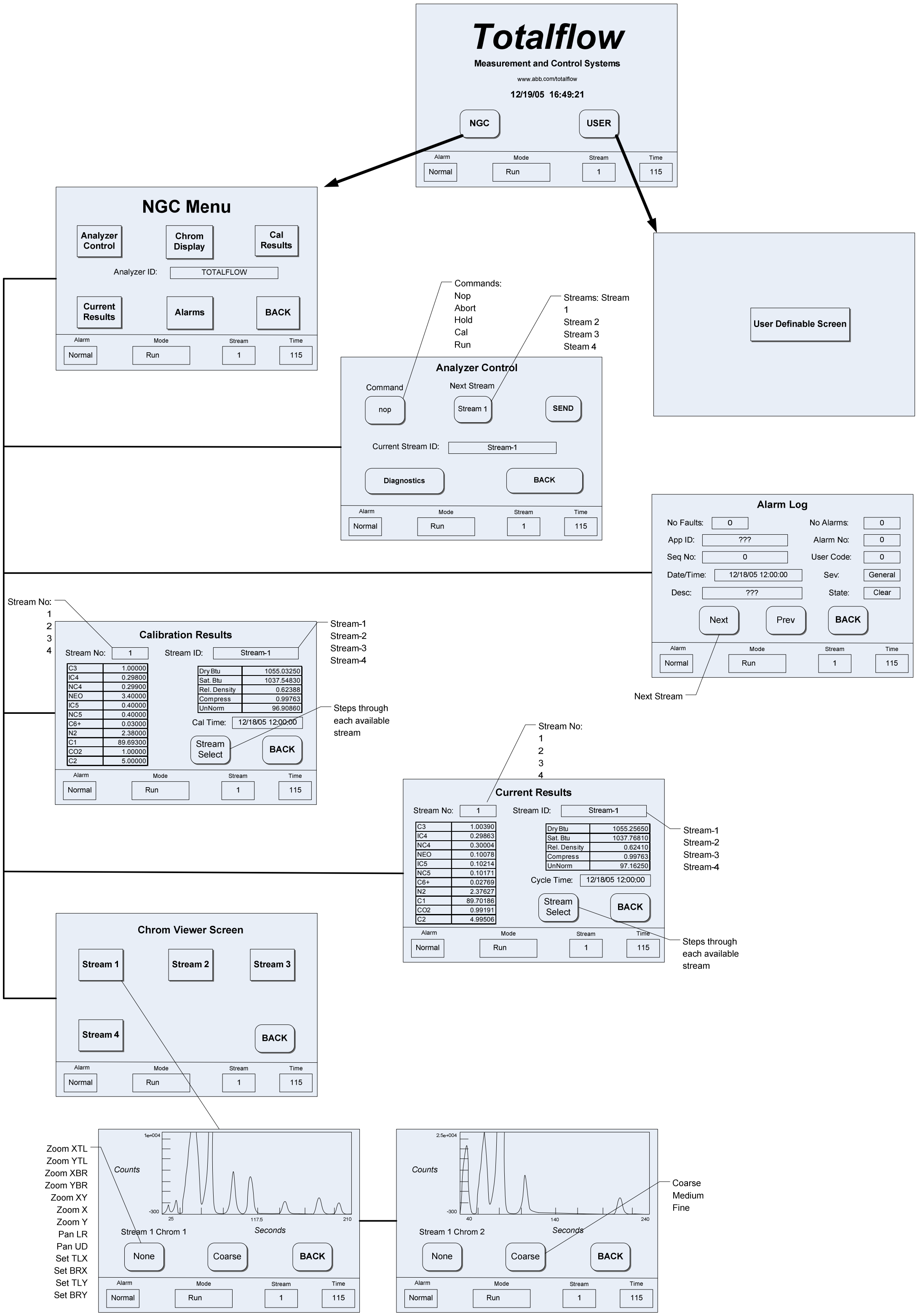


Figure 1–19 Optional NGC VGA Display Screen

1.16 Cold Weather Enclosure (Optional Equipment)

In colder climates (ambient temperatures 0°F to -40°F) this cold weather enclosure (CWE) allows mounting of the NGC directly on the pipe. This insulated weatherproof enclosure has brackets for the NGC, a small start up/calibration bottle and a removable plug that allows installation of the enclosure over the probe. This keeps the entire sampling system heated to prevent liquid condensation of the sample prior to analysis (see Figure 1–20). Having the calibration bottle in the heated enclosure ensures a much more stable and consistent calibration.

1.16.1 Enclosure

The heater and enclosure is designed to maintain a 40°F inside temperature when outside temperature is -40°F. The enclosure assembly is 31” x 31” x 31” (inside dimensions) and is made of polyurethane with hinged cover, access and precut holes.

1.16.2 Heater Options

Options for this enclosure include a choice of either a 400 watt 120 volt A/C heater (thermostat present at 50°F) or a 1500 Btu/hr. catalytic heater (thermostat preset at 50°F).

1.16.3 Mounting Options

The CWE 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 meter run.

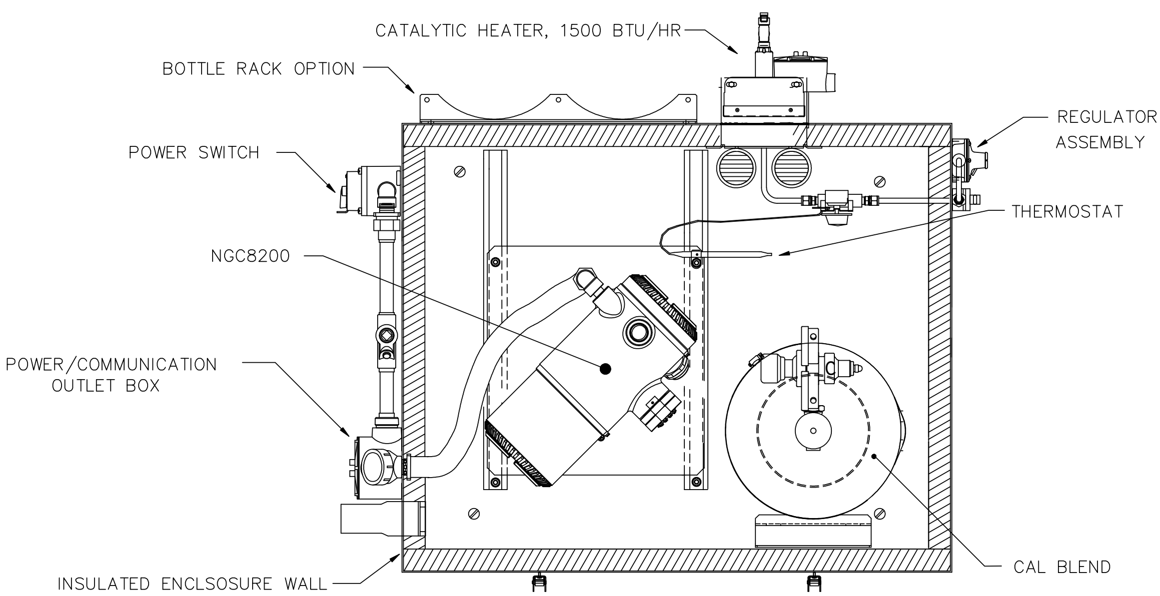


Figure 1–20 NGC8200 Cold Weather Enclosure Installation w/ Catalytic Heater

1.17 Sample Conditioning Modules (Optional Equipment)

For some NGC installations, it may be necessary to install an optional sample system 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 1–21). All of the sample conditioning modules include a level of particulate protection and come in two flow sizes: 50 CC and 450 CC per minute (see Table 1–10).

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

1.17.1 Gas Types

The user can select from one of four sample conditioning modules for installations whose 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.

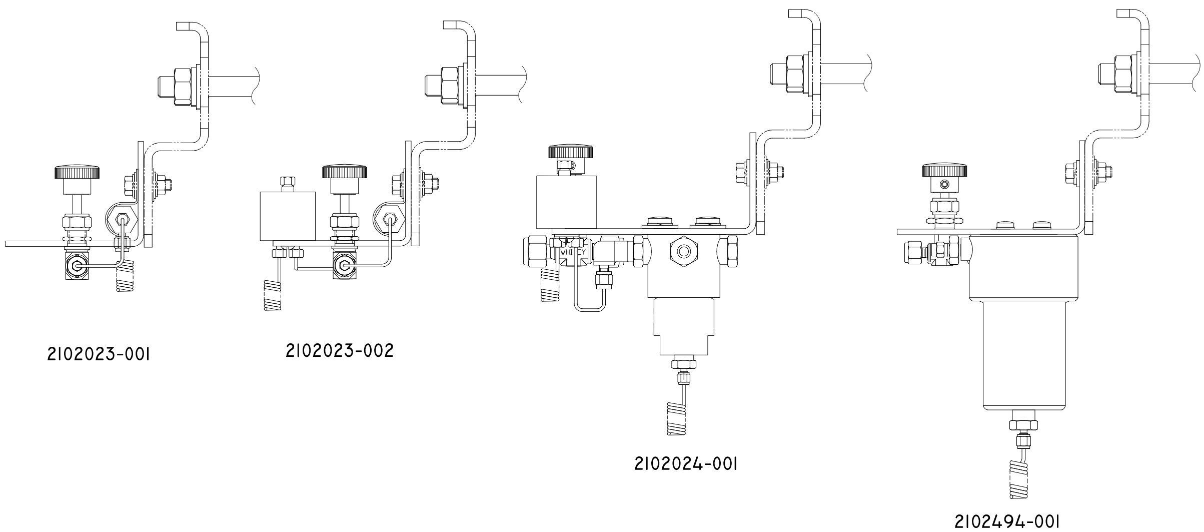


Figure 1–21 Available Sample Conditioning Modules

Table 1–10 Sample Conditioning Module Descriptions

Part Number	Description
2102023-001	Designed for clean, dry, stable gas, with minor amounts of particulate contamination, where the sample point is more than 10' (3m) and less than 50' (15m) from the NGC, and the customer guarantees that upset conditions, compressor failure or other problems never occur. It is also suitable where a high quality sampling system already exists. NGC bypass flow is expected to be 10 cc/min. System features: • 2 micron filter
2102023-002	Designed for clean, stable gas sample point distances greater than 10' (3m) and less than 50' (15m) and containing minor amounts of liquids such as glycol, compressor oil or water. This system also handles minor amounts of particulate contamination. System features: • 2 micron Filter • Liquid/Vapor Separator
2102024-001	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: • Particulate/Coalescing Filter • Liquid/Vapor Separator
2102494-001	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. • Particulate/Coalescing Filter • Liquid/Vapor Separator

1.17.2 Mounting Brackets

Two sample conditioning system mounting brackets are available: a single stream bracket (see Figure 1–22) or a multiple stream bracket (Figure 1–23) for up to three modules.

See Figure 1–24 and Figure 1–25 for installed dimensions.

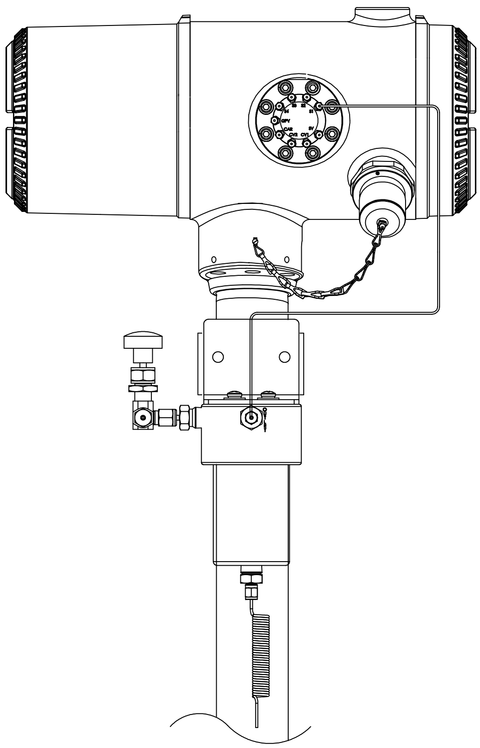


Figure 1–22 Single Stream Sample Conditioning Assembly

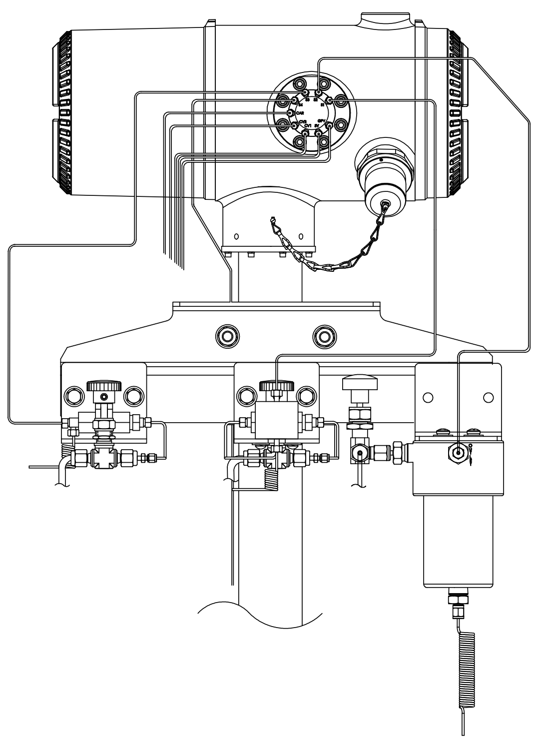


Figure 1–23 Multiple Stream Sample Conditioning Assembly

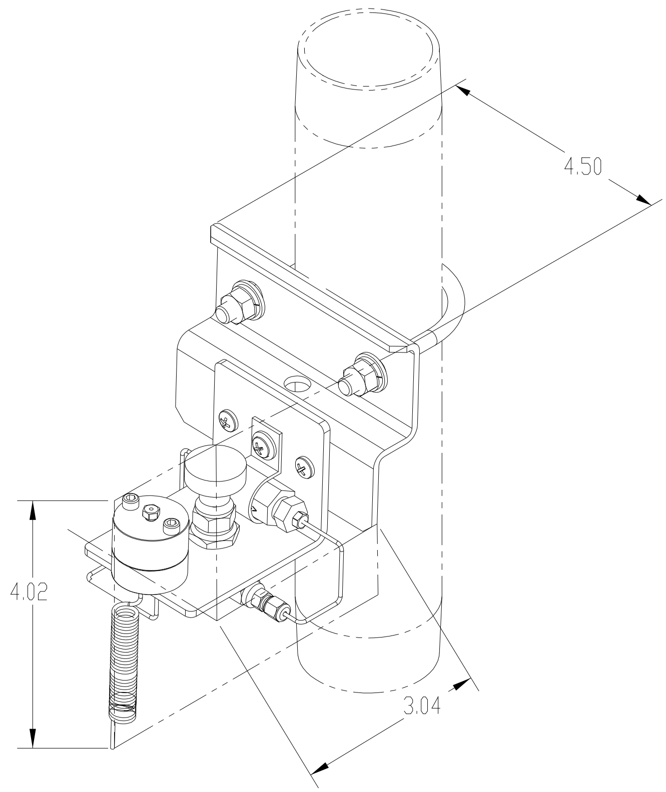


Figure 1–24 Single Stream Conditioning Module Dimensions

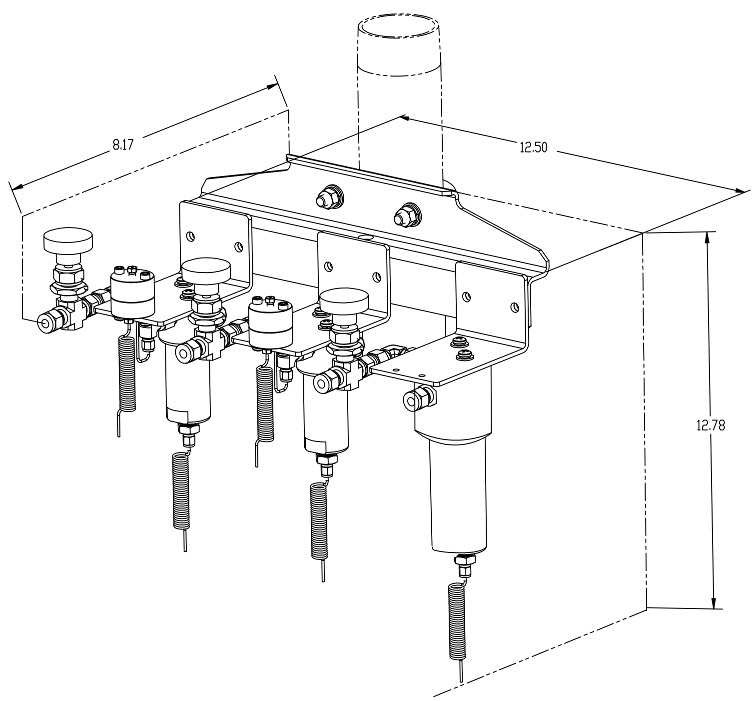


Figure 1–25 Multiple Stream Conditioning Module Dimensions

1.18 Security Seal (Optional Equipment)

For some NGC installations, it may be desirable to attach a Security Seal on the enclosure front and rear End Caps. To accommodate seal, please note the holes located in the tab located on each End Cap (See Figure 1–26).

1.18.1 Customer Supplied Materials

- 1 ea. Security Wire Seal
- Seal Press

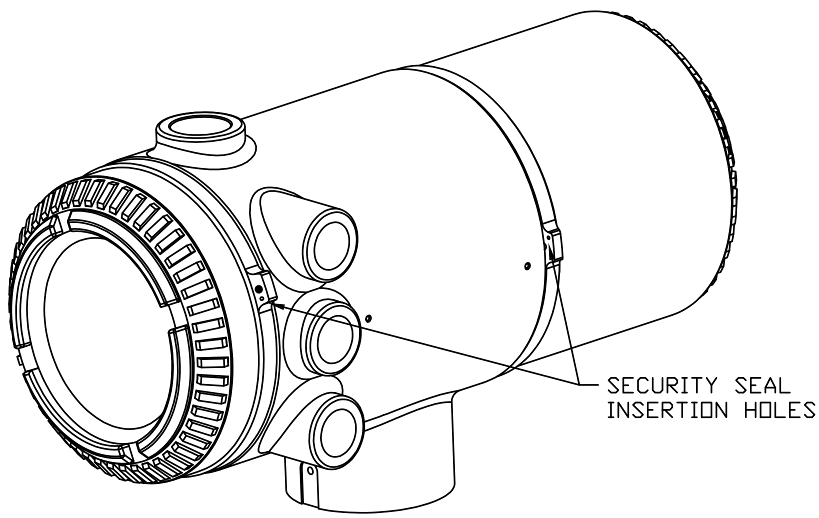


Figure 1–26 NGC End Cap Tabs for Security Seal

1.18.2 Instructions

1) Insert security wire through holes located on end cap tabs.

2) Bring ends together and insert through holes in security seal (see Figure 1–27).

3) Use seal press to compress seal into wire. Ensure that wire is firmly captured inside seal.

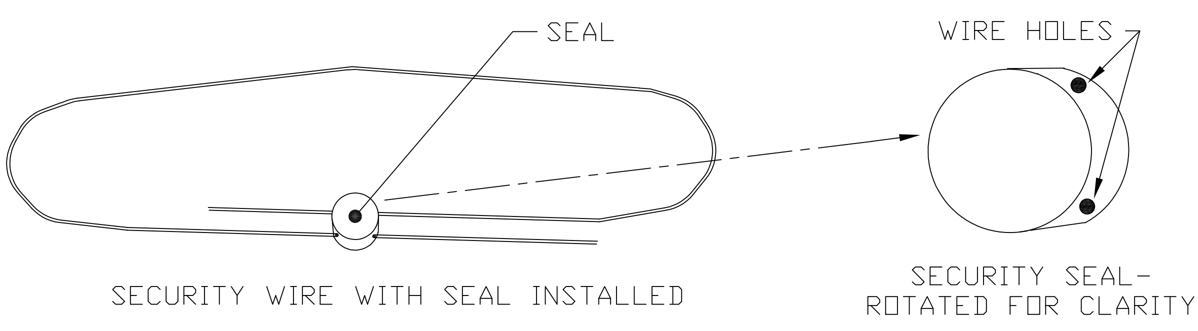


Figure 1–27 Security Wire w/ Seal

1.19 Optional Equipment Enclosure (Optional Equipment)

If optional enclosure is used, it may be configured to include other options, including, but not limited, to a battery pack to provide power to the NGC, communication equipment, solar power charger and additional I/O.

Three enclosures are commonly used for the NGC installations: the 6200, 6700 and the 6800 optional equipment enclosure.

The 6200 installation will be for AC to DC or DC sites requiring communication equipment. There is no battery backed option in this installation.

The 6700 enclosure supports AC to DC or DC sites requiring communication equipment. There is no batter back option in this installation.

The 6800 enclosure supports battery backed[3] operation for the NGC via solar power or a UPS system, AC to DC power or DC to DC power and communication equipment.

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.

1.19.1 6200 Optional Equipment Enclosure

The 6200 can accommodate the following equipment:

- Communication Kit
- 110/240 Volt to 12 VDC
- 110/240 Volt to 24 VDC

1.19.2 6700 Optional Equipment Enclosure

The 6700 enclosure can accommodate the following:

- Communication Kit
- 120 VAC / 240 VAC 12 VDC power supply
- 24 VDC/12 VDC DC to DC converter
- Communications shelf for radio/modem

1.19.3 6800 Optional Equipment Enclosure

The 6800 enclosure can accommodate the following:

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

1.20 Power Supply Options (Optional Equipment)

Power supply options available for the NGC8206 are as follows:

- 110/240 VAC to 12/24 VDC
- 115/230 VAC to 12 VDC (explosion proof)

[3] Autonomy measured in hours.

- 24 VDC to 12 VDC converter
- 24 VDC solar panel power option
- 115/230 VAC with UPS to 24 VDC

1.20.1 24 VDC Solar Panel Power Option

The solar panel power option employs a solar controller to maintain voltage on two 110 AH batteries:

- 14-day autonomy with standard 110 AH batteries without optional heater
- 5-day autonomy with standard 110 AH batteries with optional heater

Space is provided for communication equipment and fusing for auxiliary equipment. Auxiliary fusing supports a maximum of two 1 amp loads. The system disconnects batteries when the voltage drops below the minimum recharge level. Minimum configuration consists of dual 50W solar panels. System is designed to accommodate dual 110W solar panels as a maximum.

CAUTION Auxiliary fusing is not available when using the optional heater.

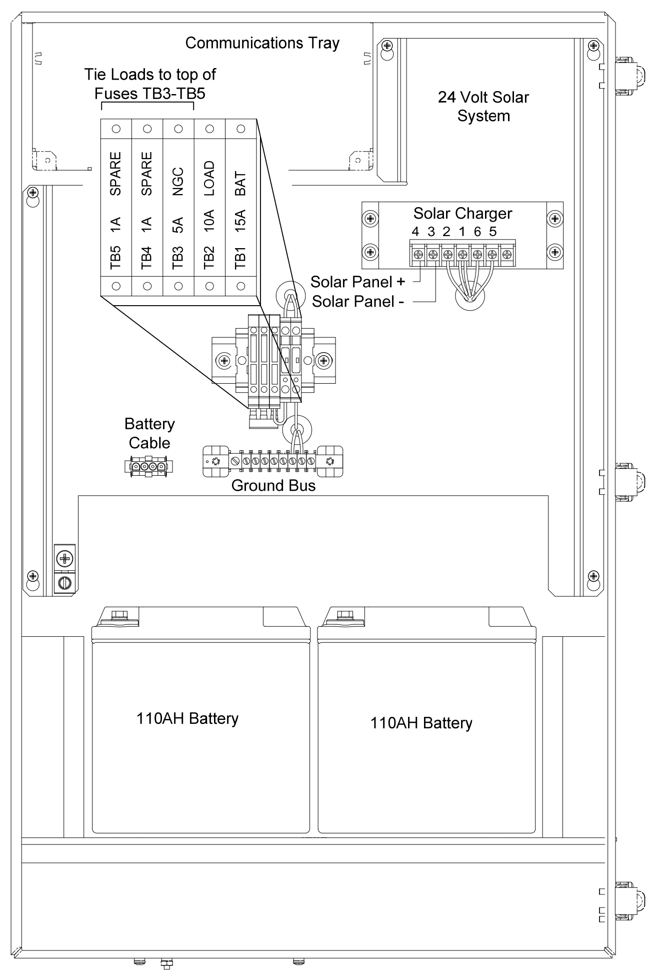


Figure 1–28 6800 Enclosure with 24 VDC Solar Panel Power Supply Option

1.20.2 115/230 VAC UPS Power Option (24VDC Systems Only)

This option assumes site availability of 115/230 VAC power. A UPS (Uninterruptible Power Supply) and two 50 AH batteries provide backup power for short power interruptions. 100 AH batteries are available for longer autonomy:

- 3-day autonomy with standard 50 AH batteries and no optional heater
- 36 hour autonomy with standard 50 AH batteries and optional heater

Space is provided for communication equipment and fusing for auxiliary equipment. Auxiliary fusing supports a maximum of three 1 amp loads. The system disconnects batteries when the voltage drops below the minimum recharge level.

CAUTION Auxiliary fusing is disabled when on UPS power.

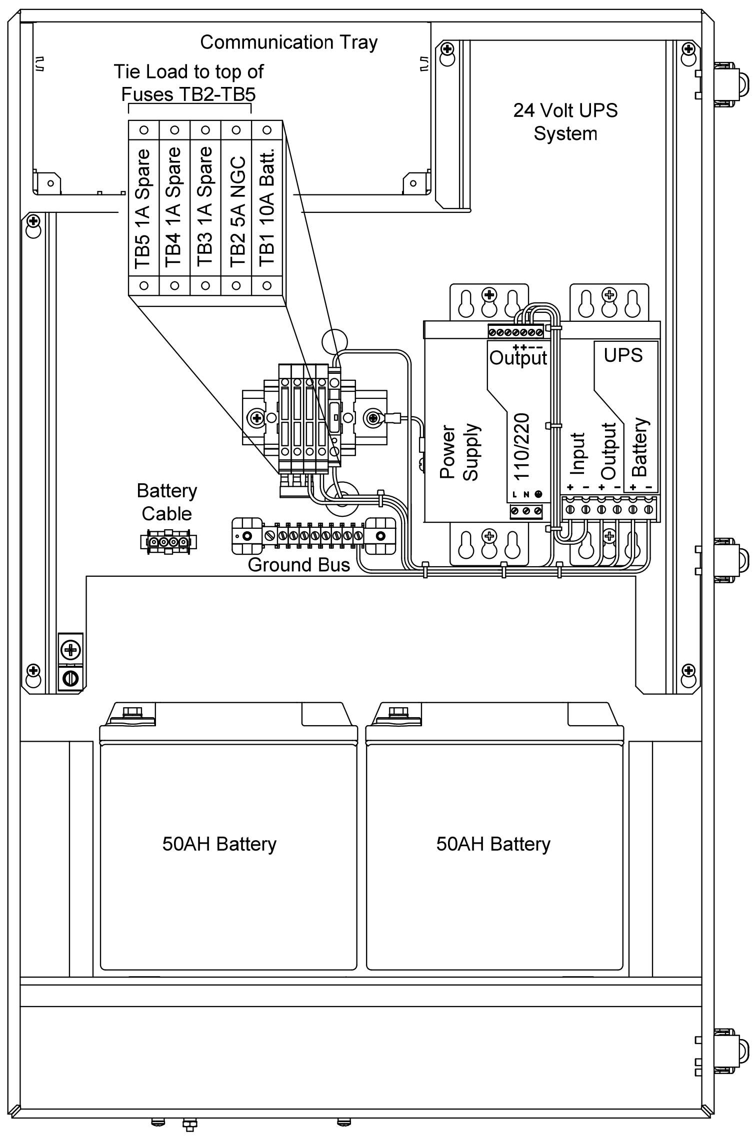


Figure 1–29 6800 Enclosure with 115/230 VAC UPS Power Option

1.20.3 Explosion Proof Power Supply (Optional Equipment)

For installations requiring an explosion proof power supply, Totalflow provides two power supplies (115 VAC and 230 VAC to 12 VDC) that meet these requirements and are housed in explosion proof enclosures.

1.20.3.1 Enclosure

The custom designed, explosion proof enclosure consists of a square shaped cast aluminum housing, powder coated, with top explosion proof threaded cap for access to internal components (see Figure 1–30).

The top cap has precision engineered threading and is susceptible to damage, if treated roughly. The top cap is water tight, corrosion resistant and NEMA 4X rated. Unauthorized removal of the cap is protected with a hex socket set screw on cap.

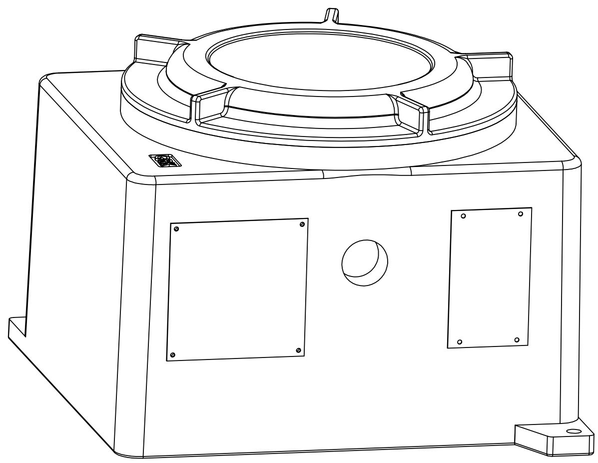


Figure 1–30 Explosion Proof AC Power Supply

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 is ready for start-up.

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

FYI It is highly recommended that the user thoroughly reads 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

CWE Installation instructions that feature this icon are applicable ONLY when the installation involves a cold weather enclosure (CWE). All other instructions may or may not be applicable.

FYI 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 cold weather 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.

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

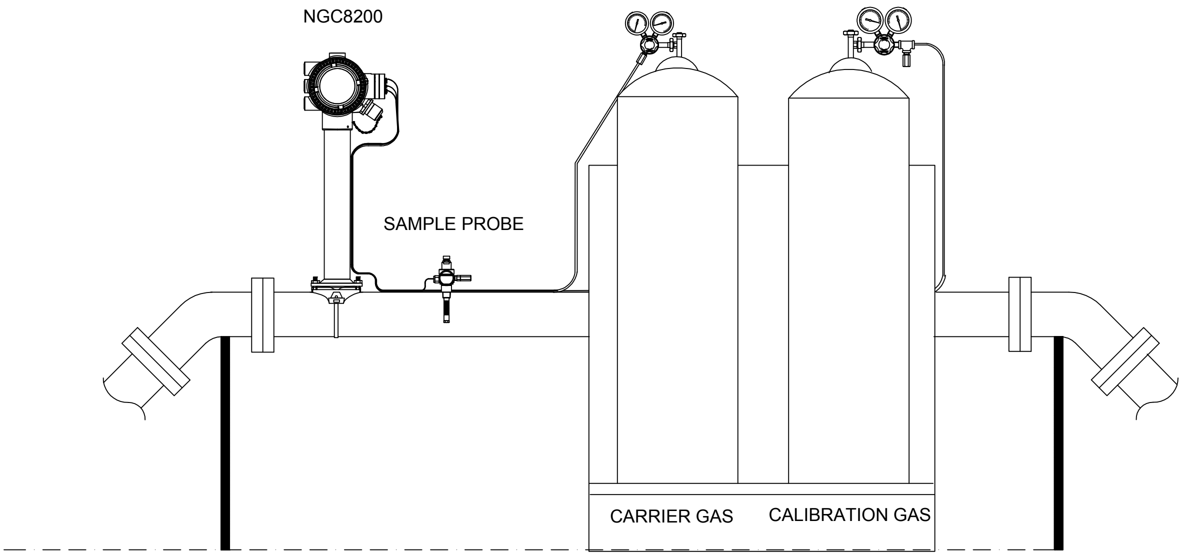


Figure 2–1 Basic Meter Run Installation

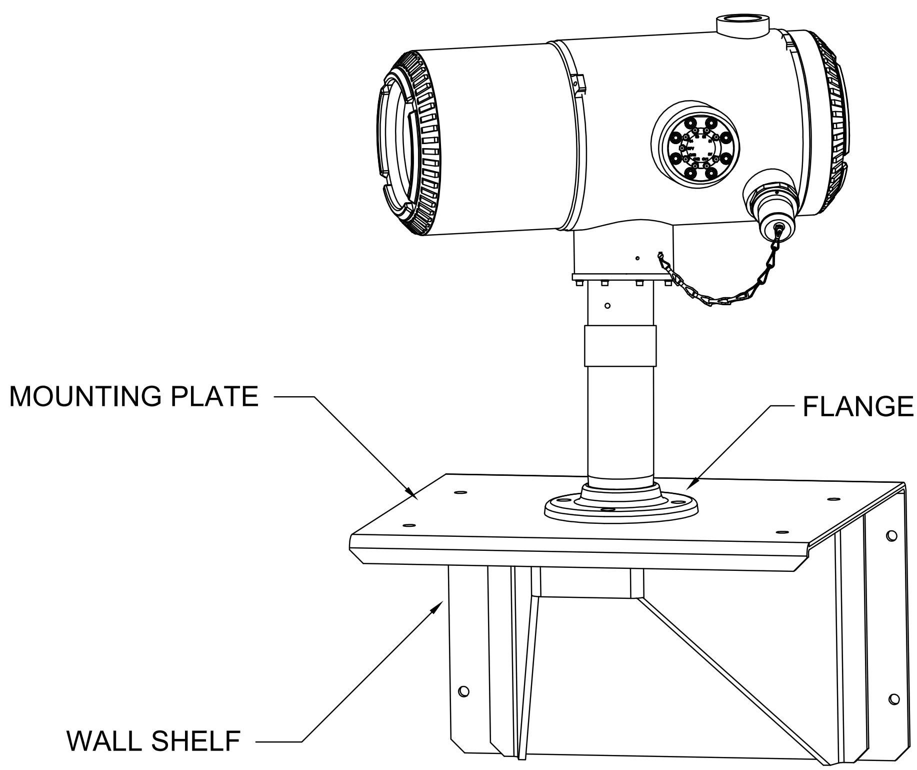


Figure 2–2 Typical Wall Shelf Mount Installation

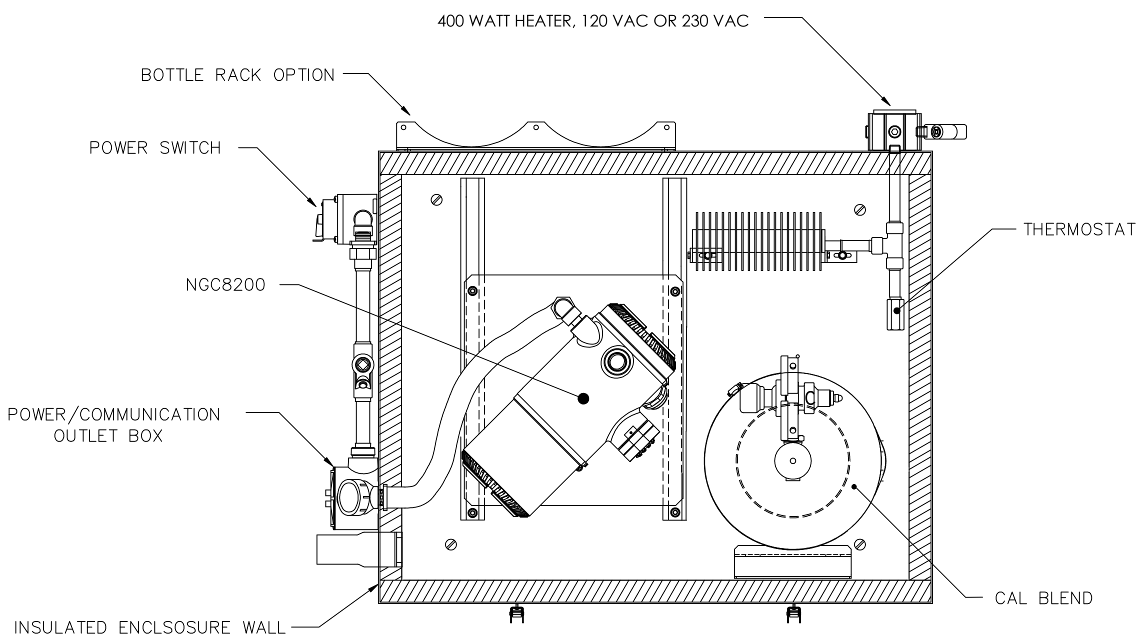


Figure 2–3 Typical Cold Weather Enclosure with Electrical Heater

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 affect 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 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 cold weather enclosure (CWE) 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 AC/DC explosion proof power supply installation
- Optional 115/230 VAC to 12 VDC Explosion Proof Power Supply Installation
- Optional equipment enclosure installation
- Optional 115/230 VAC UPS Power Supply (24 VDC Systems)
- Optional 110/240 to 12/24 VDC power supply installation
- Optional 24 VDC to 12 VDC power converter
- Optional equipment enclosure battery pack installation
- Optional solar panel installation
- Optional 24 VDC solar power supply
- 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 - Low Pressure Switch Installation
- Carrier Gas and Calibration Gas Connections
- Vent Line Connections
- Optional AC/DC explosion proof power supply installation
- Optional 115/230 VAC to 12 VDC Explosion Proof Power Supply Installation
- Optional equipment enclosure installation
- Optional 115/230 VAC UPS Power Supply (24 VDC Systems)
- Optional 110/240 to 12/24 VDC power supply installation
- Optional 24 VDC to 12 VDC power converter
- Optional equipment enclosure battery pack installation
- Optional solar panel installation
- Optional 24 VDC solar power supply
- 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 - Low Pressure Switch Installation
- Carrier Gas and Calibration Gas Connections
- Vent Line Connections
- Optional AC/DC explosion proof power supply installation
- Optional 115/230 VAC to 12 VDC Explosion Proof Power Supply Installation
- Optional equipment enclosure installation
- Optional 115/230 VAC UPS Power Supply (24 VDC Systems)
- Optional 110/240 to 12/24 VDC power supply installation
- Optional 24 VDC to 12 VDC power converter
- Optional equipment enclosure battery pack installation
- Optional solar panel installation
- Optional 24 VDC solar power supply
- DC Power Installation

2.1.8 Cold Weather Enclosure

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

- Sample Probe Installation
- Freestanding Cold Weather Enclosure Installation
- Pipe Mounted Cold Weather Enclosure Mounting Kit
- Optional Support Leg Kit installation
- Cold Weather Enclosure (CWE) Mounting Plate
- NGC Installation
- Sample Conditioning Module Installation
- Sample Line Connections
- Sample Line(s) to NGC inside of Cold Weather Enclosure
- CWE Optional Pwr/Comm Outlet Box Assembly
- CWE Carrier Gas Bottle Rack Installation
- Carrier Gas Regulator with Low Pressure Switch Installation
- CWE Calibration Gas Bottle Installation
- Calibration Gas Regulator - Low Pressure Switch Installation
- Carrier Gas and Calibration Gas Connections
- Vent Line Connections
- CWE Optional Catalytic Heater Installation
- CWE Optional Electric Heater Installation
- Optional AC/DC explosion proof power supply installation
- Optional 115/230 VAC to 12 VDC Explosion Proof Power Supply Installation
- Optional equipment enclosure installation
- Optional 115/230 VAC UPS Power Supply (24 VDC Systems)
- Optional 110/240 to 12/24 VDC power supply installation
- Optional 24 VDC to 12 VDC power converter
- Optional equipment enclosure battery pack installation
- Optional solar panel installation
- Optional 24 VDC solar power supply

- DC Power Installation

WARNING The NGC8200 is certified for installation in Classified Hazardous locations. The heater and fittings in the Cold Weather Enclosure 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 and 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 receiving group and report the damage to the trucking company for a freight damage claim.

2.2.2 Unpacking

The NGC is shipped in specially designed shipping cartons which contains the unit, mounting brackets, parts list 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 Bill of Lading.

2.2.4 Inspection

Examine internal NGC components for evidence of damage.

Points of inspection are:

- Visually inspect exterior of unit for dents, chipped paint, scratches, damaged threads or broken glass plate, etc.
- Physically inspect rear interior mounted circuit boards, cables and front 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 a local Totalflow representative. Keep all shipping materials as evidence of damage for 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 mounted vertical or horizontal.

If the sample probe is to be located inside the Cold Weather Enclosure, it MUST be a vertical mounting on a horizontal pipe and be installed on the meter run prior to seating the Cold Weather Enclosure on the meter run.

2.3.1 Materials

- ¾” 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.

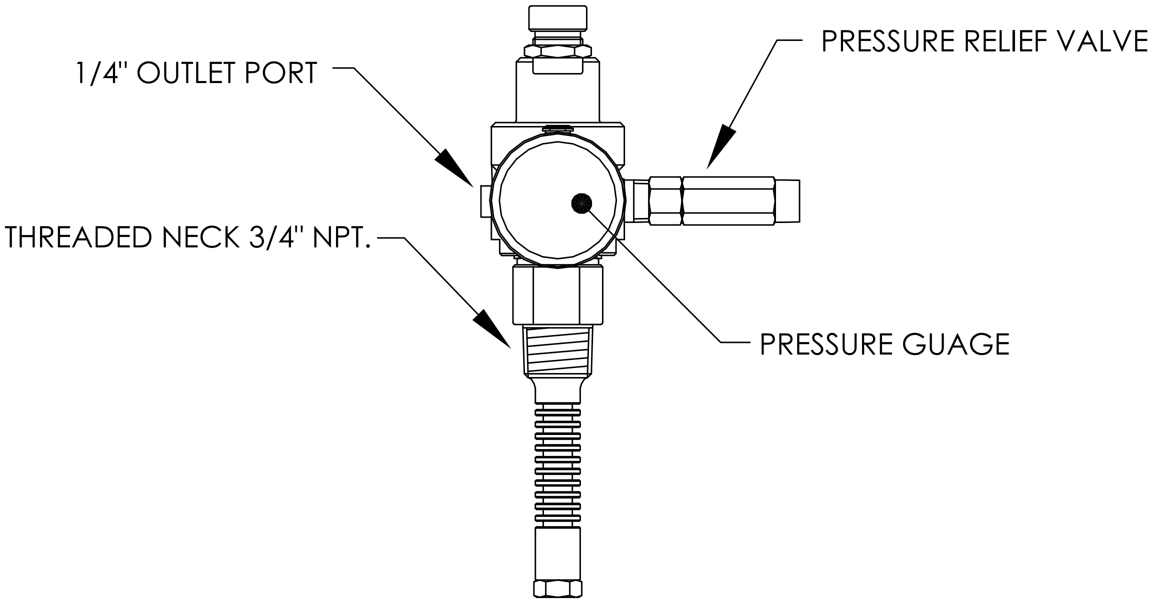


Figure 2–4 Sample Probe

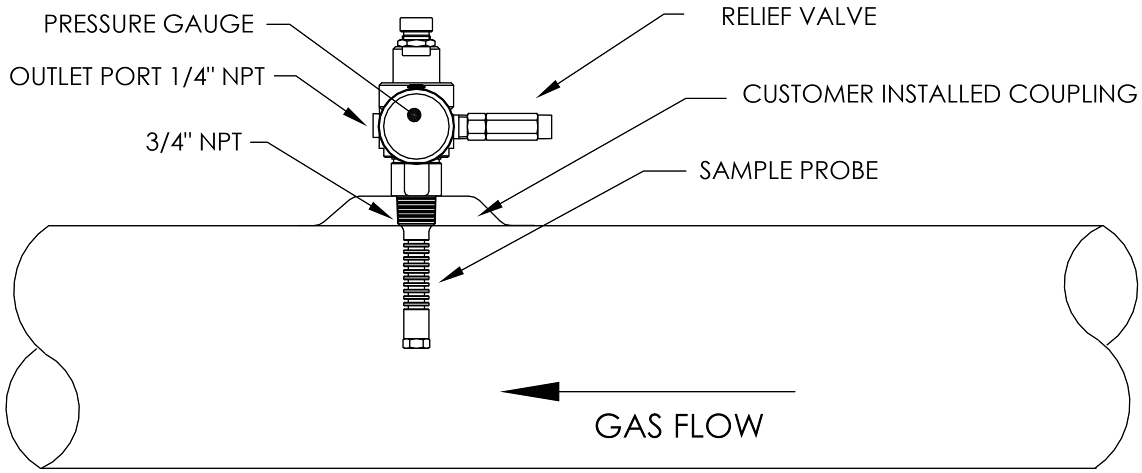


Figure 2–5 Sample Probe Insertion

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

or

- 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 the mounting pipe that allows easy user access and is close to the sample probe. Lines should be as short as possible.

2) Install a mounting pipe, being careful to ensure pipe is vertically aligned.

3) Screw 2” pipe coupling onto top of the 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 CWE Installation

CWE If the installation includes a freestanding cold weather enclosure, follow these instructions; otherwise, skip to the next section.

2.5.1 Materials

- 4 ea. ½-13 x 1 ¼ SST Bolt
- 4 ea. ½ SST Flat Washer
- 4 ea. ½” SST Split Washer
- 1 ea. Stand

FYI The following steps typically require two people.

2.5.2 Instructions

1) The stand is made to be symmetrical so that the top and bottom are identical. Locate the stand base on a flat, stable surface.

2) Set enclosure on top of the stand, oriented as shown in Figure 2–6.

3) Place a split washer and then a flat washer on one of the 1 ¼” bolts and insert through the 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 screws into the nut. Screw the bolt into the nut, but do not tighten.

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. The hardware needs to be supplied by the customer.

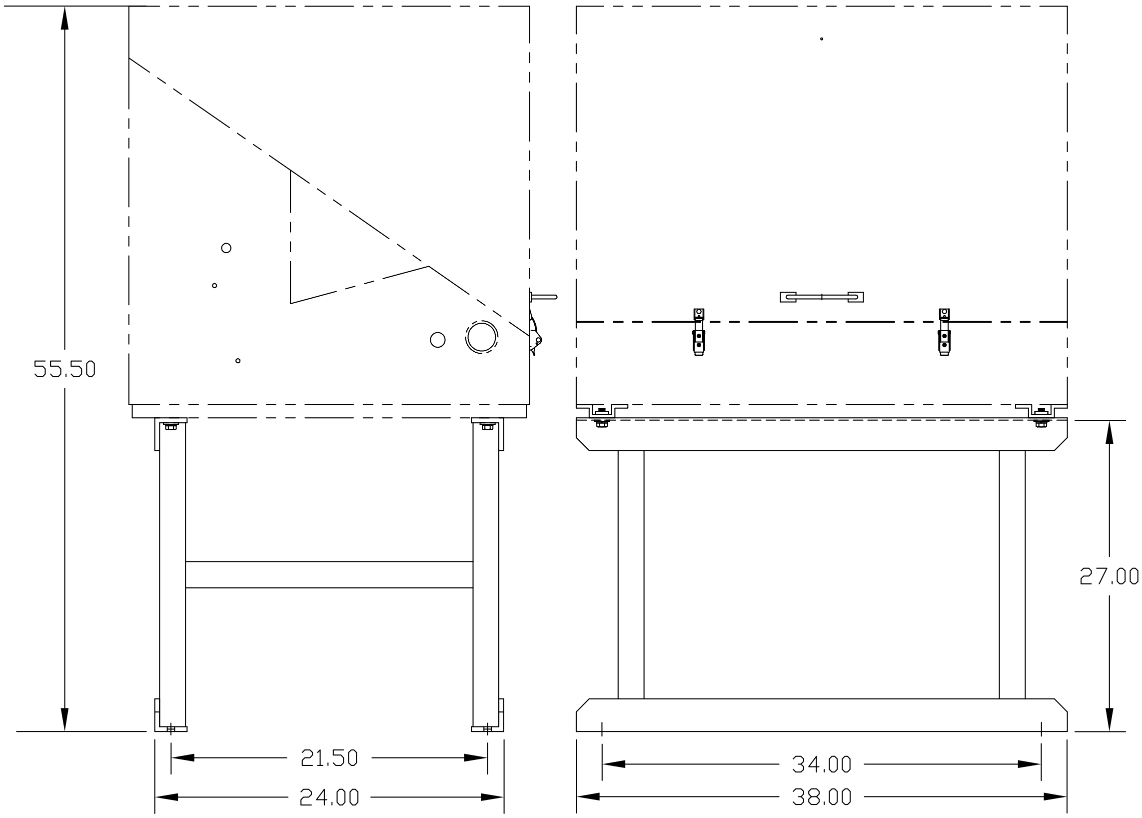


Figure 2–6 Typical CWE Stand Mount Installation

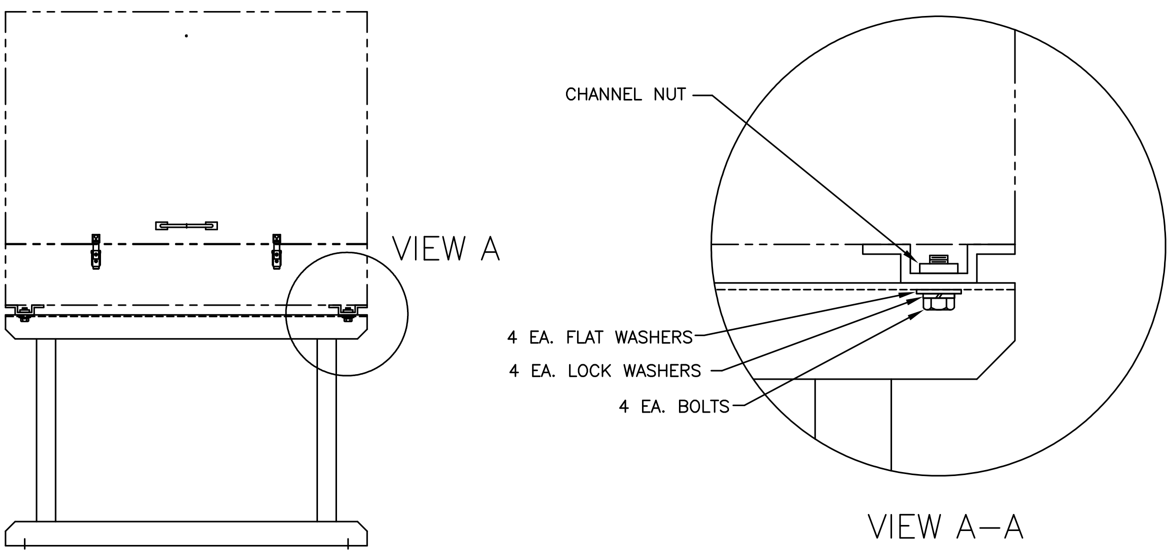
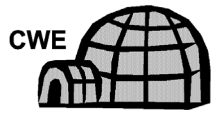


Figure 2–7 CWE Mounting Hardware

2.6 Pipe Mounted CWE Mounting Kit



If the installation includes a pipe mounted cold weather enclosure, 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. ½" -13 x 1 ¼ SST Bolt
- 4 ea. ½" SST Flat Washer
- 4 ea. ½" SST Split Washer
- 2 ea. 2 ½" x ¼" 43" Steel Angle Iron

FYI

May be used in conjunction with optional support leg kit. See support leg installation procedures featured in this chapter.

2.6.2 Instructions

1) Set two pieces of angle iron (see Figure 2–8) on the bottom of the upside down enclosure. Ensure that 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 fits in between.

2) Place a split washer and then a flat washer on one of the 1 ¼" bolts (see Figure 2–9).

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 the bolt screws into the nut.

4) Screw bolt into the nut but leave loose for later adjustment.

5) Install other bolt, split washer and flat washer into the other slotted hole.

6) Repeat for the other angle iron. Final tightening of bolts is done after the unit is mounted on the pipe to allow for left to right and front to back positioning.

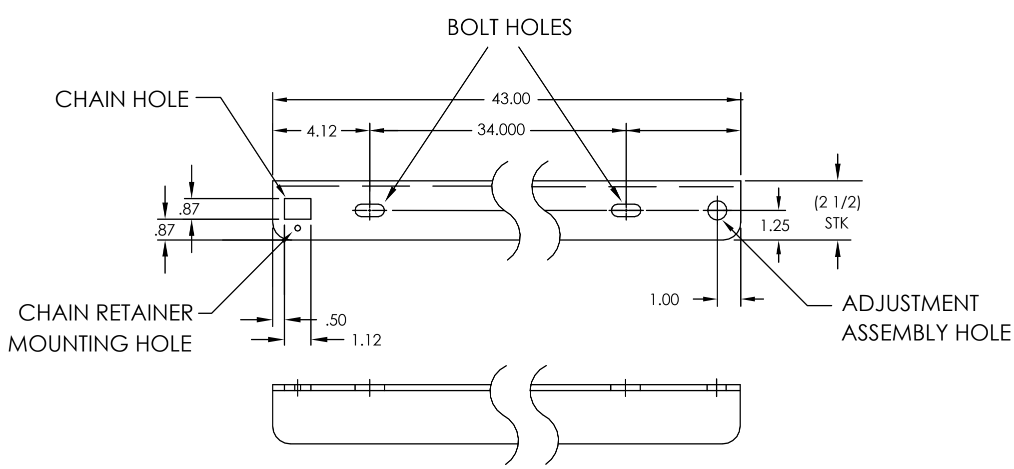


Figure 2–8 Mounting Brackets

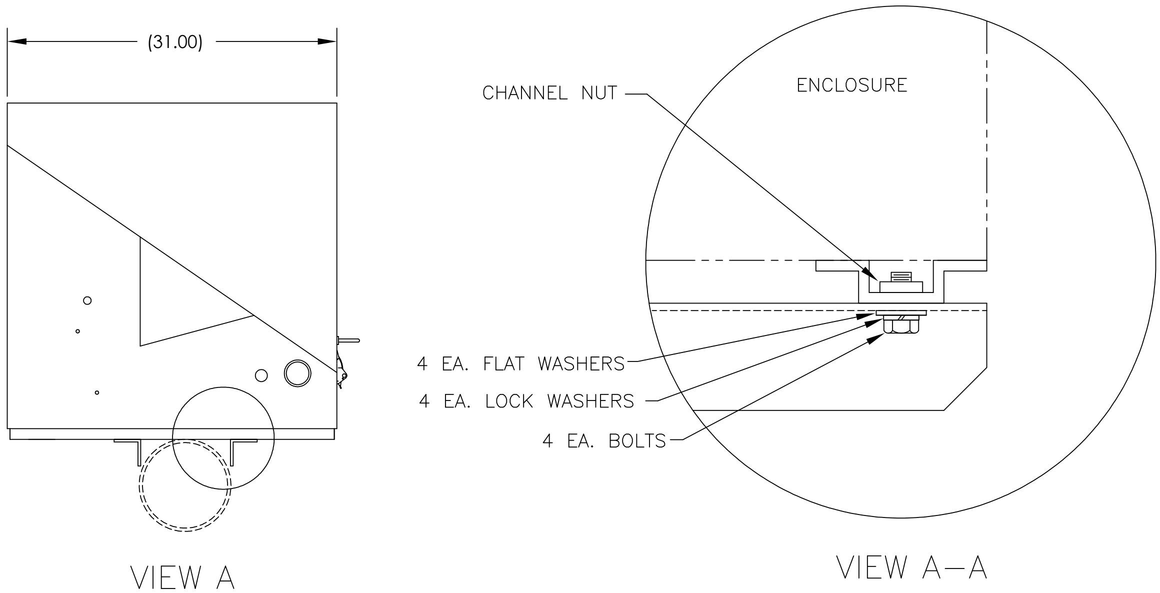


Figure 2–9 Mounting Hardware Installation

7) Remove nut and washers from the adjustment assembly, if necessary (see Figure 2–10).

8) Insert the all-thread through the round hole on the adjustment side of the angle iron.

9) Place the flat washer, split washer and nut on the all-thread.

10) Screw the nut onto the all-thread until the top of the nut is level with the top of the all-thread. Final tightening may be done after the mounting chain is in place.

FYI  Lift enclosure above meter run allowing enough clearance to clear pipe and installed sample probe, if applicable.

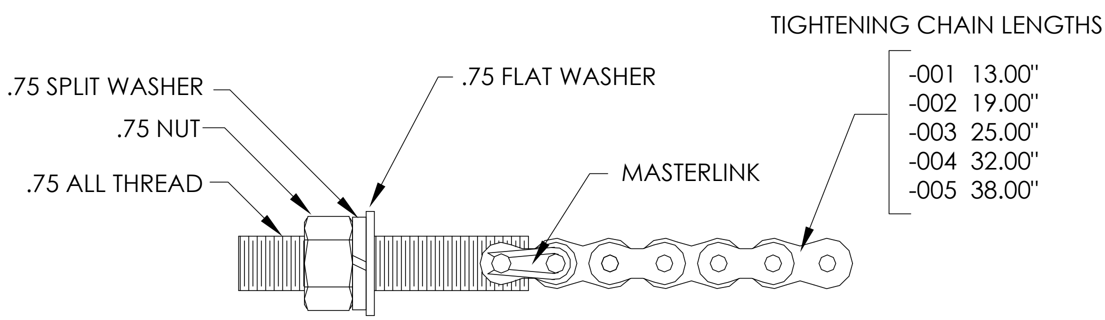


Figure 2–10 Adjustment Assembly

11) Set enclosure on top of the pipe in between the angle iron mounting brackets. Keep unit steady on top of the pipe.

12) Wrap mounting chain underneath pipe (see Figure 2–11). Feed chain up through the square retainer hole of the angle iron and pull up until most of the slack has been taken out of mounting chain.

13) Feed the long flat end of the chain retainer (see Figure 2–12) through the middle of a chain link, then move the retainer lock into position where round peg fits into small round mounting hole.

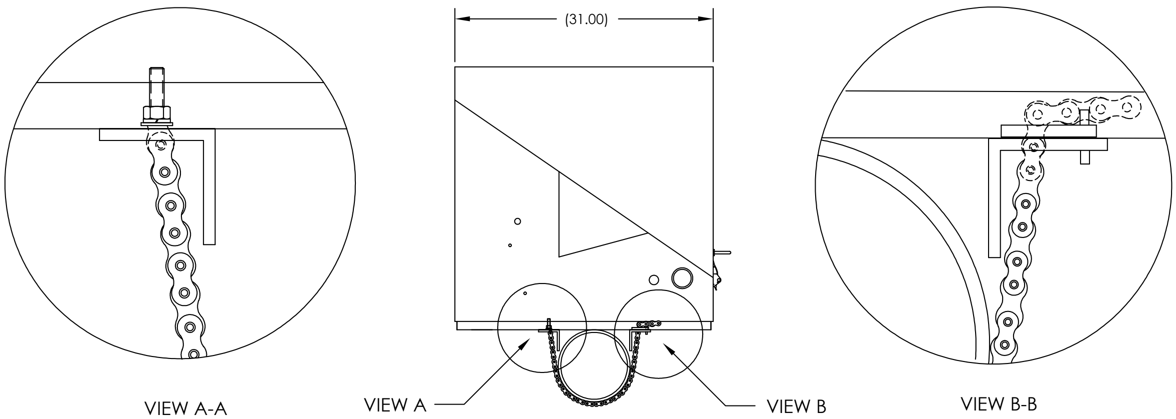


Figure 2–11 Pipe Mount Installation

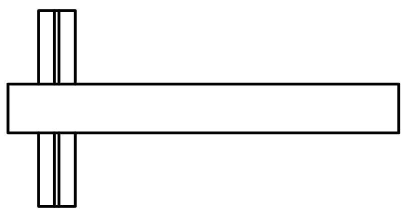
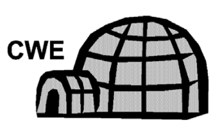


Figure 2–12 Chain Retainer Lock

14) Adjust enclosure into final position on the pipe and tighten the nut on the all-thread (adjustment assembly) until unit is securely in place.

15) If necessary, adjust the enclosure position on the angle iron, and tighten bolts until secure.

2.7 Optional Support Leg Installation



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

2.7.1 Materials

- 2 ea. ½”-13 x 1 ¼” SST Bolt
- 2 ea. ½” SST Flat Washer
- 2 ea. ½” SST Split Washer
- 1 ea. Pre-Assembled Adjustable Height Support Leg

FYI Must use with pipe mounting kit.

2.7.2 Instructions

1) Set support leg underneath front or rear (both, if using two kits) of the pipe mounted enclosure, oriented so that the leg brace is horizontal with the front of the enclosure (see Figure 2–13).

2) Place split washer and then the flat washer on one of the 1 ¼" bolts.

3) Insert bolt through the hole located in the angle iron into the outermost corner of the enclosure. Move channel nut into position so that the bolt screws into the nut.

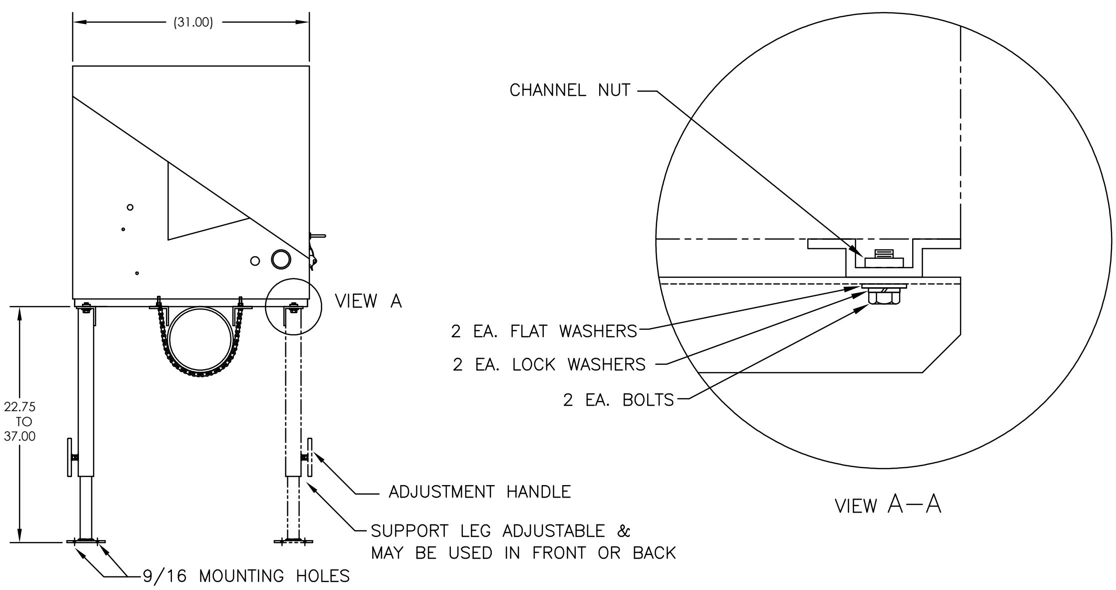


Figure 2–13 Optional Support Leg Overview

4) Screw the bolt into the nut, but leave loose for later adjustment. Repeat for the other corner.

5) If installing two support legs, repeat for the other angle iron. Final tightening of bolts may be done after the support leg(s) are in the desired positioned on a flat stable surface.

6) Loosen the adjustment handle and drop the leg foot down and retighten the adjustment handle.

7) Foot plate mounting holes are pre-drilled for mounting to a pad. The hardware needs to be supplied by the 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 with flange (Optional)
- 1 ea. 2” pipe coupling(Optional)

FYI Optional equipment may be ordered from Totalflow.

2.8.2 Instructions

1) Position pipe saddle on meter run. Select a location that allows easy user access and is close to the sample probe. Lines should be a short as possible.

2) Temporarily attach saddle on the meter run pipe using U-bolt and associated hardware (see Figure 2–14).

3) Screw one end of the 2” pipe into saddle flange on pipe saddle until “wrench tight”. Place level against pipe and vertically align, adjusting saddle until vertical alignment is achieved.

4) After vertical alignment, securely tighten saddle mounting bolts.

5) If the configuration includes the optional pipe with flange, screw the 2” pipe coupling onto the top of the mounting pipe.

6) Screw the optional mounting pipe with flange into the top of the pipe coupling.

FYI Continue to the “NGC Installation” instructions. Method of installation must be consistent with customer’s company policy.

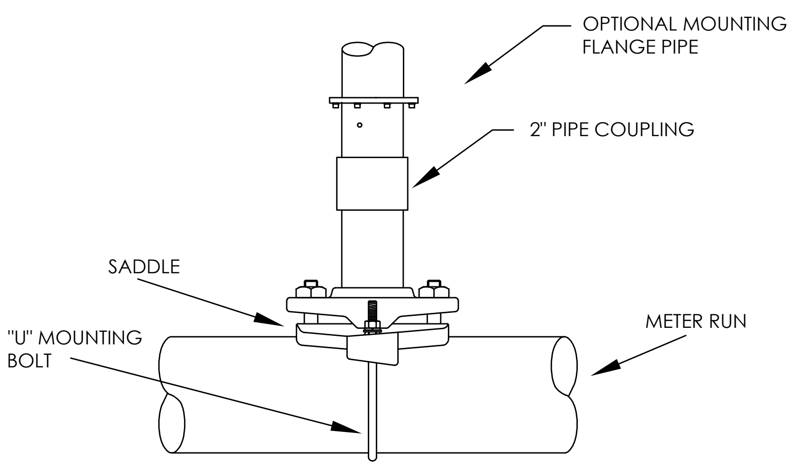


Figure 2–14 Typical Pipe Saddle Installation

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 flange
- 1 ea. 2” Mounting pipe. Length dependant upon final overall NGC desired height.
- 1 ea. 2” pipe with flange (Optional)
- 1 ea. 2” pipe coupling (Optional)

2.9.2 Instructions

1) Locate wall position where the NGC is to be mounted. The shelf should be positioned high enough on the wall so all components are accessible to service personnel. The shelf should be installed in close proximity to the installed sample probe.

2) 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.

3) Screw one end of the 2” mounting pipe into the flange on the mounting plate until “wrench tight”.

4) If the configuration includes the optional pipe with flange, screw the 2” pipe coupling onto the top of the mounting pipe.

5) Screw the optional mounting pipe with flange into the top of the pipe coupling.

FYI Continue to the “NGC Installation” instructions. The method of installation must be consistent with the customer’s company policy.

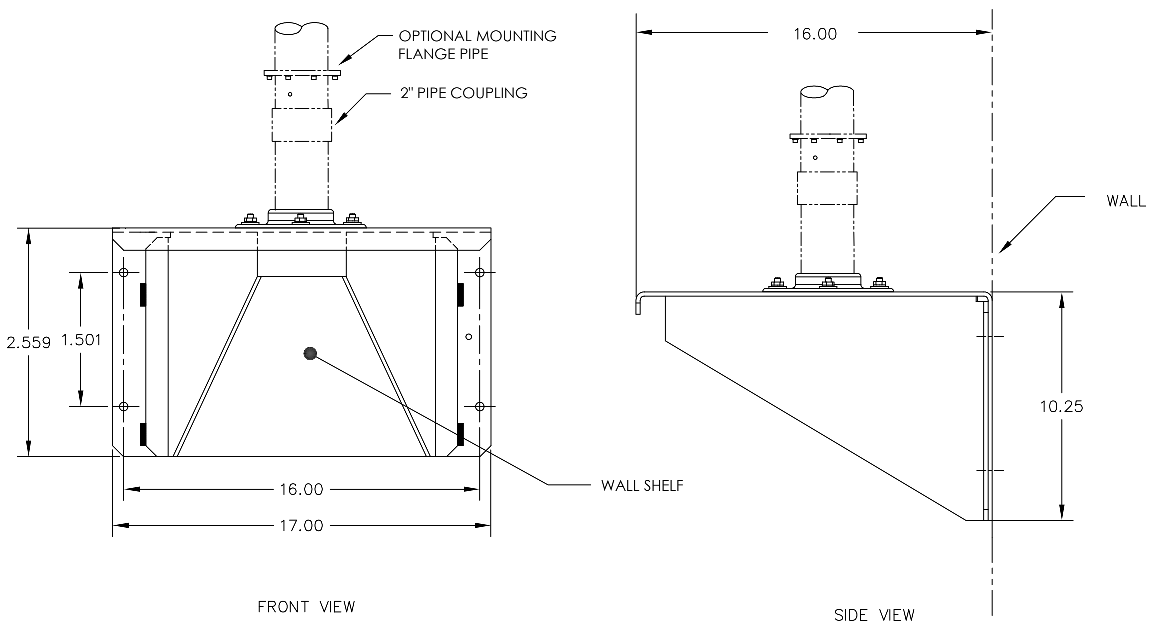


Figure 2–15 Shelf Installation

2.10 Cold Weather Enclosure (CWE) Mounting Plate

If installing an NGC inside a cold weather enclosure, use this procedure to install the mounting plate inside the enclosure; otherwise, continue to the next applicable instructions. Before beginning, review the procedure and the materials required for installation.

2.10.1 Materials

- Mounting plate with flange
- 2” pipe with flange
- 4 ea. 5/16” – 18 UNC X 1” Hex Head Screw
- 4 ea. 5/16” x .575 x .078 SST Split Washer
- 4 ea. 5/16” SST Flat Washer

2.10.2 Instructions

1) Place mounting plate (see Figure 2–16) inside of the cold weather enclosure, oriented so that each bolt hole is aligned with the mounting tracks (see Figure 2–17).
2) Move the channel spring nuts into position underneath slotted mounting holes.

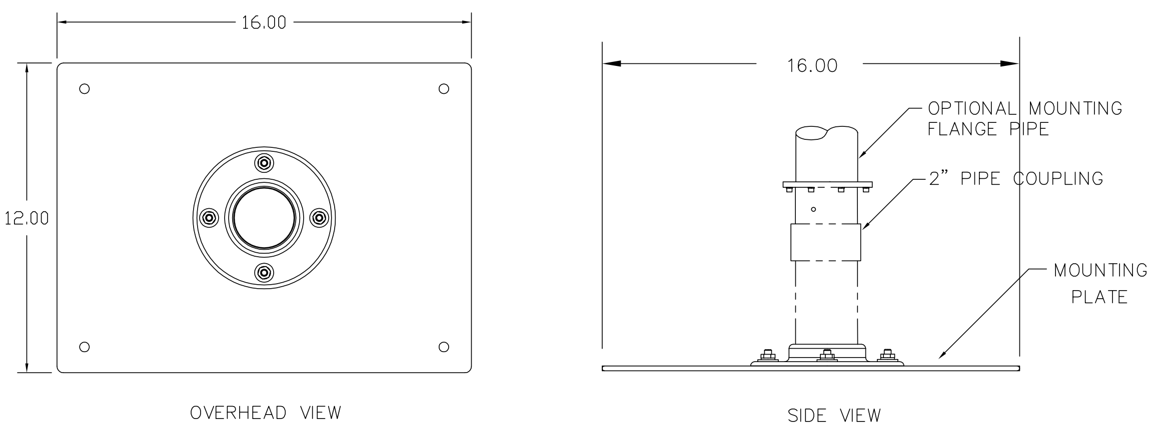


Figure 2–16 NGC Mounting Plate

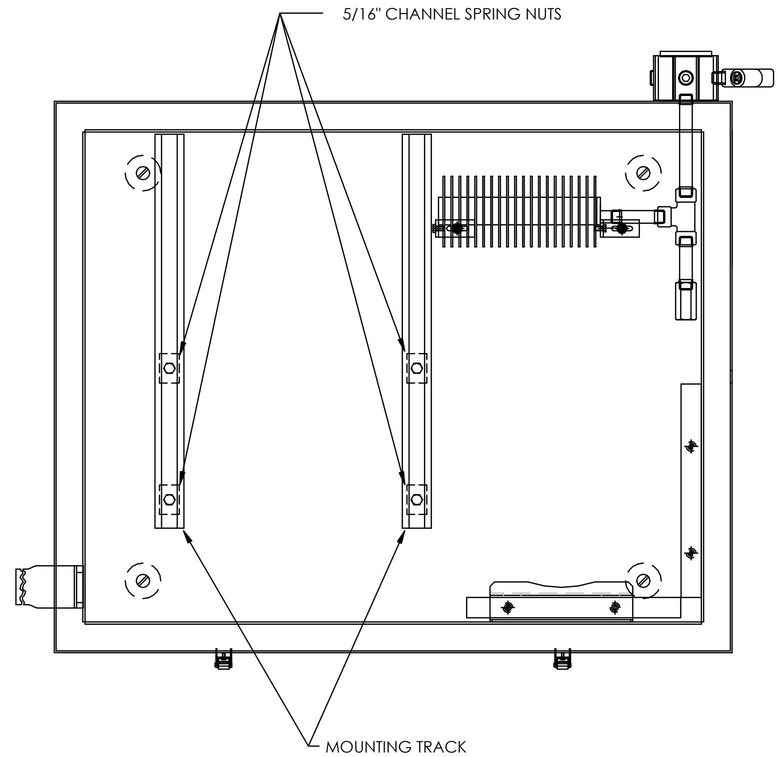


Figure 2–17 Cold Weather Enclosure Interior

3) Place the split washer and then the flat washer on one of the 5/16" screws. Insert the screw through one of the four holes on the mounting base and into the corresponding channel nut. Do not tighten until the unit is in final position.

4) Repeat for the other three screw/channel nuts.

5) Screw the 2" pipe into flange on mounting plate until "wrench tight".

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

2.11 NGC Installation

Once the mounting system has been installed, regardless of the type used, these instructions should be followed to install the NGC onto the mounting pipe.

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

2.11.1 Materials

- Installed Mounting pipe
- 4 ea. 5/16" hex socket screws (Optional for use with mounting pipe with flange kit)
- NGC

2.11.2 Instructions

1) Position the NGC on top of the 2” pipe stand (see Figure 2–18), in close approximation to correct orientation.

2) If the installation has the optional mounting pipe with flange, ensure the screw holes in the upper flange align with the holes located in the NGC neck bottom (see Figure 2–19).

- For installation inside of a cold weather enclosure, the front display of the unit would normally 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 the termination panel located in the rear of the housing.
- For the 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.
- Otherwise, continue to the next step.

3) Secure in place by tightening the hex socket set screw, located in the neck of the unit, using a 1/8” hex wrench.

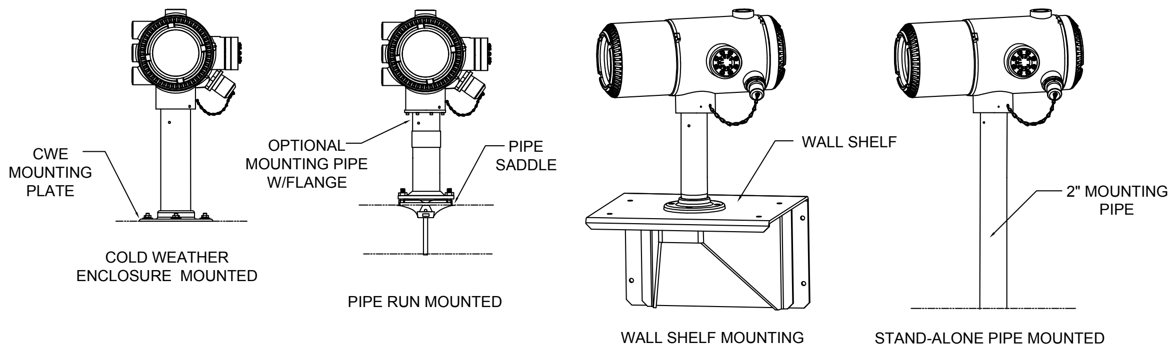


Figure 2–18 NGC Mounting

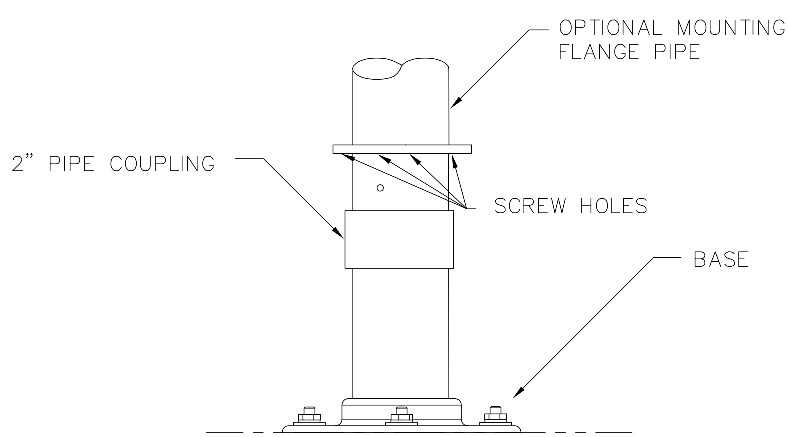


Figure 2–19 NGC Optional Mounting Flange Pipe

4) If the installation has the optional mounting flange pipe, insert the hex socket screw through the hole in the welded flange into the neck bottom of unit and tighten using ¼” hex wrench. Repeat for all screws.

5) If the installation has the optional mounting flange pipe, small adjustments may be made to orientation. Apply additional pressure to the mounting pipe with a pipe wrench and then tighten the mounting pipe into shelf mounted flange or pipe saddle flange.

Otherwise, loosen the hex socket set screw, rotate unit and retighten.

FYI When positioning the unit, the user should take into consideration the mounting of the sample conditioning system, conduit locations and access to the rear end cap of the unit.

2.12 Sample Conditioning Module Installation

2.12.1 Materials

- Installed NGC
- Single or multiple module mounting kit
- 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

2.12.2 Mounting Kits

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

2.12.3 Instructions

1) On sample conditioning module, align the mounting holes to the corresponding holes in the bracket. Insert the bolt through the hole in the bracket, from front to back through the mounting hole in the module (see Figure 2–20). Place the split washer and then the flat washer on the bolt. Screw the nut onto the end of the bolt until finger tight. Repeat for the second mounting bolt. Tighten both nuts.
2) Repeat for all additional modules.
3) Straddle the mounting pipe with the U-bolt and insert the threaded ends through the holes located in the bracket so that the bracket back fits flat against the pipe, and the module mounting lip sets away from the pipe (see Figure 2–21).
4) Place the flat washer, then a split washer on the end of the U-bolt. Screw the nut onto the end of the bolt and finger tighten.
5) Repeat step 4 for the other side of the U-bolt.
6) Move bracket into position underneath the NGC, being careful to allow clearance for the sample conditioning module(s).
7) Tighten both nuts.

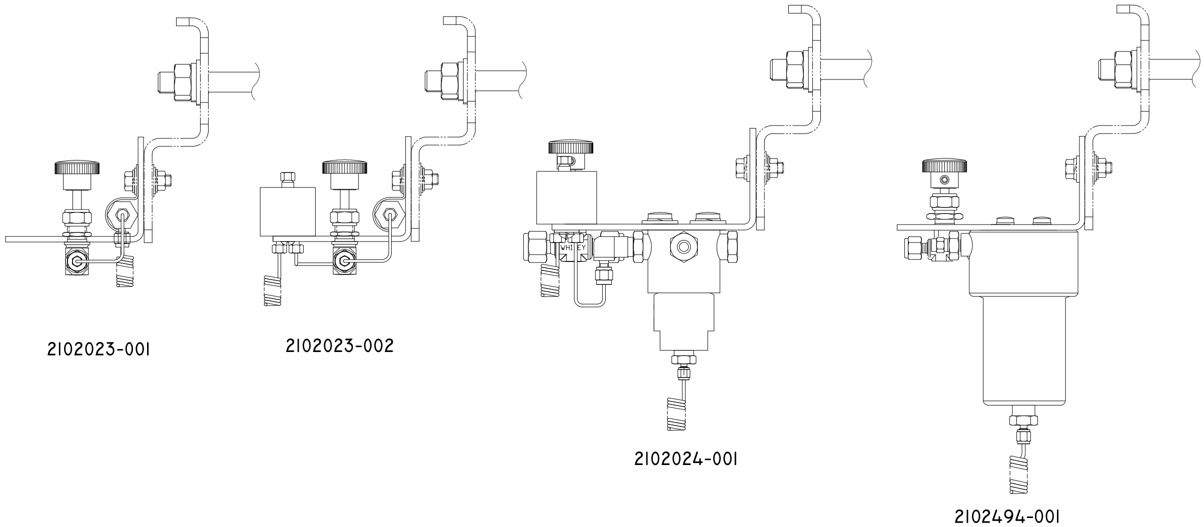


Figure 2–20 Sample Conditioning Module Bracket

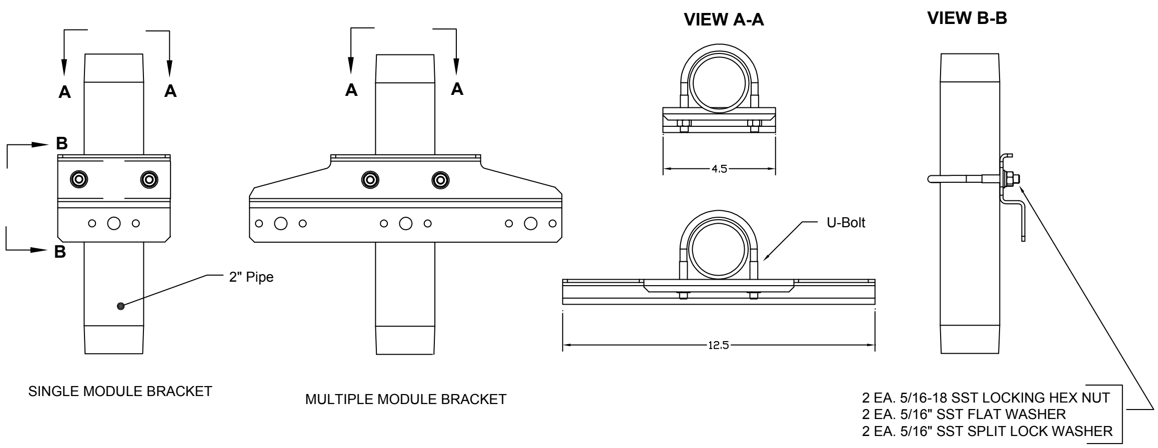


Figure 2–21 Sample System Mounting Kits

2.13 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.

2.13.1 Materials

- 1/8” SST chromatography grade transport tubing. Length of tubing to be determined by the technician based on the distance from the sample probe to the sample conditioning module and the number of sample streams.
- 2 ea. ferrule and nut (for each sample stream)
- 1 ea. ¼” NPT to 1/8” reducer or other size as determined from the sample probe output port (for each sample stream)
- 1 ea. sample conditioning module transport tubing (supplied with sample conditioning module).

2.13.2 Instructions

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

1) Locate the sample input fitting on the sample conditioning module (see Figure 2–22).

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 the tubing to ease installation of the ferrule and nut into the sample conditioning module input port.

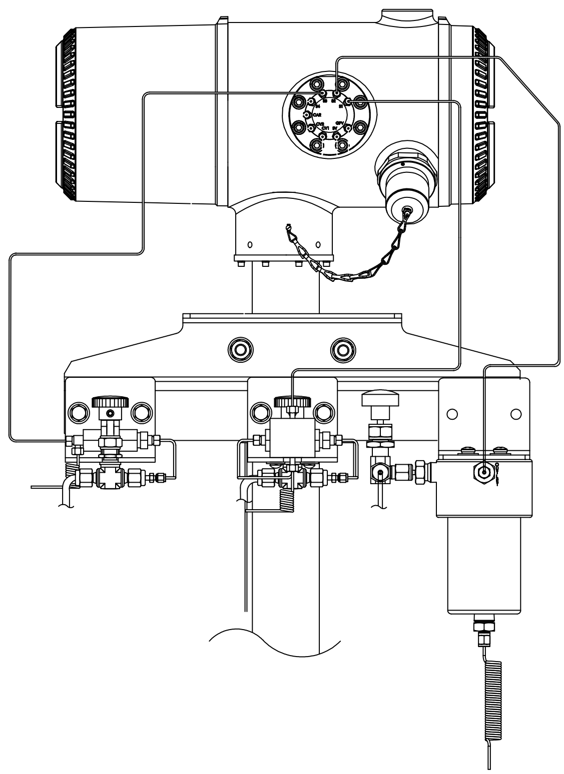


Figure 2–22 Sample Conditioning Module Installation

TIP If sample conditioning module and NGC are located inside a CWE, review the following section “Sample Line(s) to NGC inside of Cold Weather Enclosure” for information pertaining to this installation.

FYI Tube, ferrule and nut should always enter connection at a right angle.

5) If necessary, install the reducer into the sample probe output fitting.

6) Install the ferrule and nut onto one end of the sample tubing.

7) Insert the tubing with the ferrule into the reducer/sample probe output fitting. Move the nut down onto the ferrule, screw onto fitting and tighten.

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

9) Insert the ferrule into the sample conditioning module input fitting. Move the nut down onto the ferrule, screw onto fitting and tighten.

10) Locate the sample output fitting on the sample conditioning module.

11) Locate the sample input on the NGC feed-through assembly and remove the 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.

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

13) Insert the tubing with the ferrule into the output fitting on the sample conditioning module. Move the nut down onto the ferrule, screw onto fitting and tighten.

14) Remove the plastic caps from the restrictor coils, the sealing screws from the feed-through column vents and the sealing screw from the sample vent lines.

15) Purge the 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.

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

17) Repeat for each sample stream.

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

2.14 Sample Line(s) to NGC Inside of Cold Weather Enclosure

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

2.14.1 Materials

- Heat Trace Materials provided by customer for each additional stream
- Aerosol Insulating Foam (supplied with enclosure)

2.14.2 Instructions

1) Please follow the heat trace manufacturer's suggested installation instructions for applying heat trace equipment to additional sample streams.

2) Locate the sample boot on the side of the cold weather enclosure (see Figure 2–23).

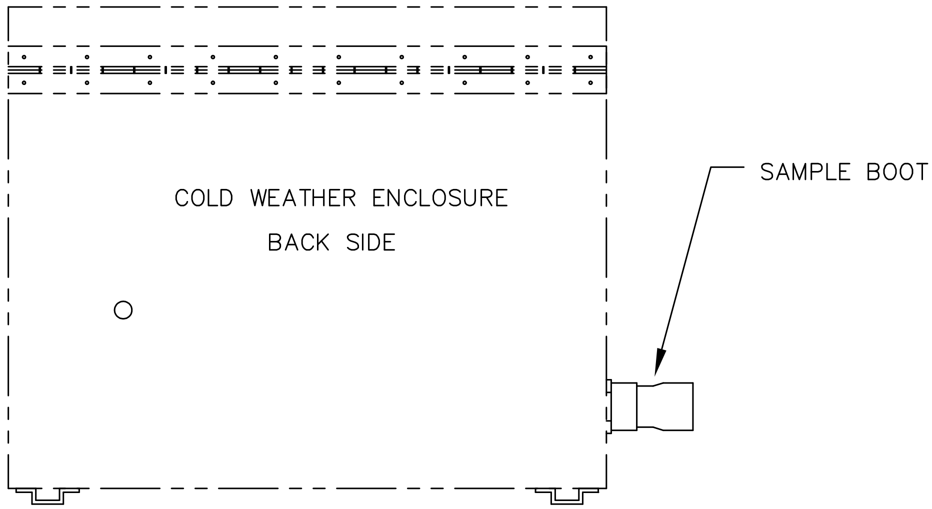


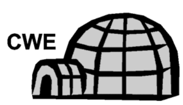
Figure 2–23 Sample Boot

3) Using instructions covered previously under “Sample Line Connections”, run the sample line from the sample probe through the sample boot to the sample conditioning module located below the NGC.

4) Repeat for each additional sample stream.

5) When the sample line 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.

2.15 CWE Optional Pwr/Comm Outlet Box Assembly



If installing the NGC inside a cold weather enclosure, 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.

2.15.1 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 ¾” 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.

2.15.2 Instructions

1) Remove the left side access plate, if so equipped, from the enclosure (see Figure 2–24).
2) 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 and then unscrewing the end cap.
3) Remove the hub plug from the bottom most access hub.
4) Beginning with the internal connection assembly (see Figure 2–25), feed the 13" wire bundle (elbow end of assembly) through the open hub. Continue to pull wire past terminations until the nipple fitting is in position to screw into the hub.
5) Moving the assembly clockwise, screw the nipple fitting into the hub until the assembly is tight and hanging straight down.
6) Feed the other end of the wire bundle through the flexible cable assembly, beginning at the end with the sealing gasket, until threads meet the conduit seal.
7) Rotate the flexible cable assembly clockwise, screwing threads into the conduit seal until tight. For explosion proof installation, a minimum of five threads engaged are required.
8) Feed the wires through the small hole located near the sample boot in the lower front of the CWE.

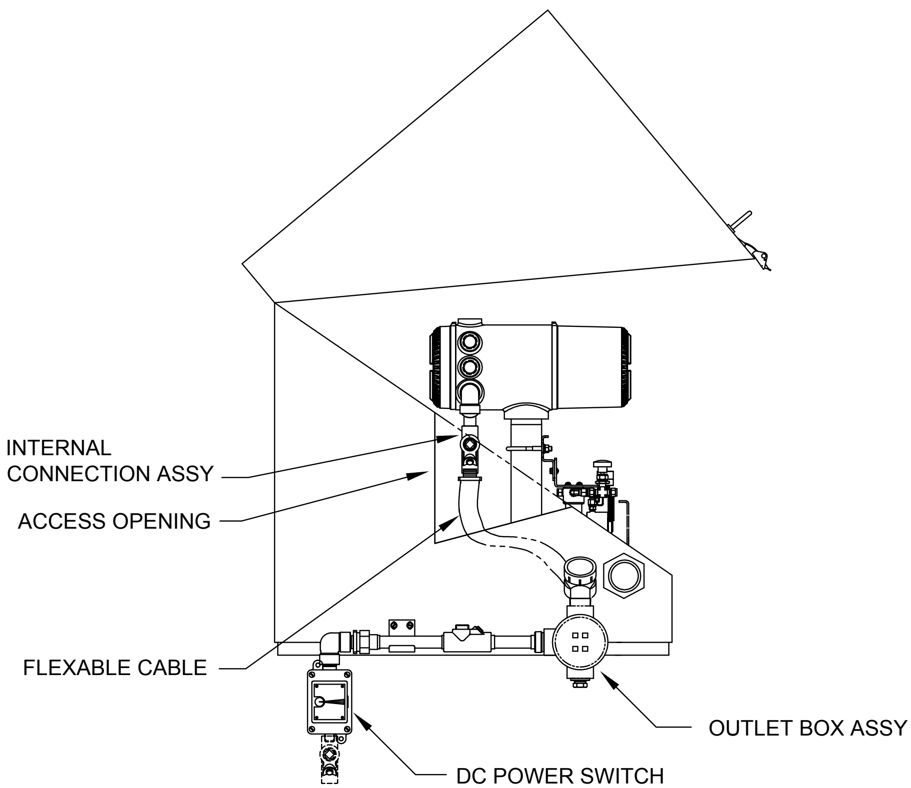


Figure 2–24 CWE Access Panel Removed

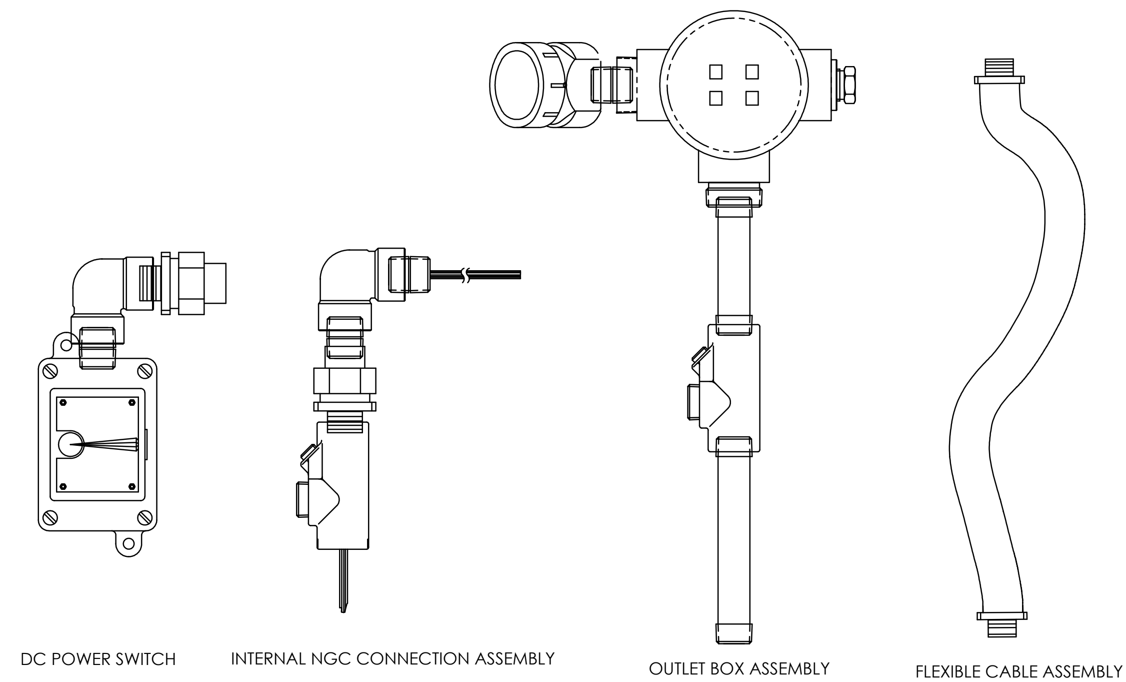


Figure 2–25 Power Communications Outlet Box Assembly

9) Remove the cover from the outlet box assembly.

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

10) Feed wires through the outlet box elbow and out past the wiring panel, moving assembly up to the threaded end of the cable.

11) Begin threading the outlet box assembly onto the end of the flexible cable assembly, rotating the entire outlet box assembly clockwise until tight and in a vertical position. For explosion proof installation, a minimum of five threads engaged are required.

12) Locate the support bracket mounting holes on enclosure.

13) Place the split washer, then a flat washer on the end of each screw.

14) Insert the screw through the mounting bracket and into the hole on the side of the enclosure.

15) Using a Phillips point screwdriver, start the screw into the hole, but do not tighten.

16) Repeat Steps 13 through 15 for the second screw.

17) Level the bracket and then tighten screws until snug.

18) Move the outlet box assembly down so that it rests on the mounting bracket (see Figure 2–26).

19) At the NGC termination panel, trim and strip wire ends.

20) Remove the power field termination J1 connector from the termination panel.

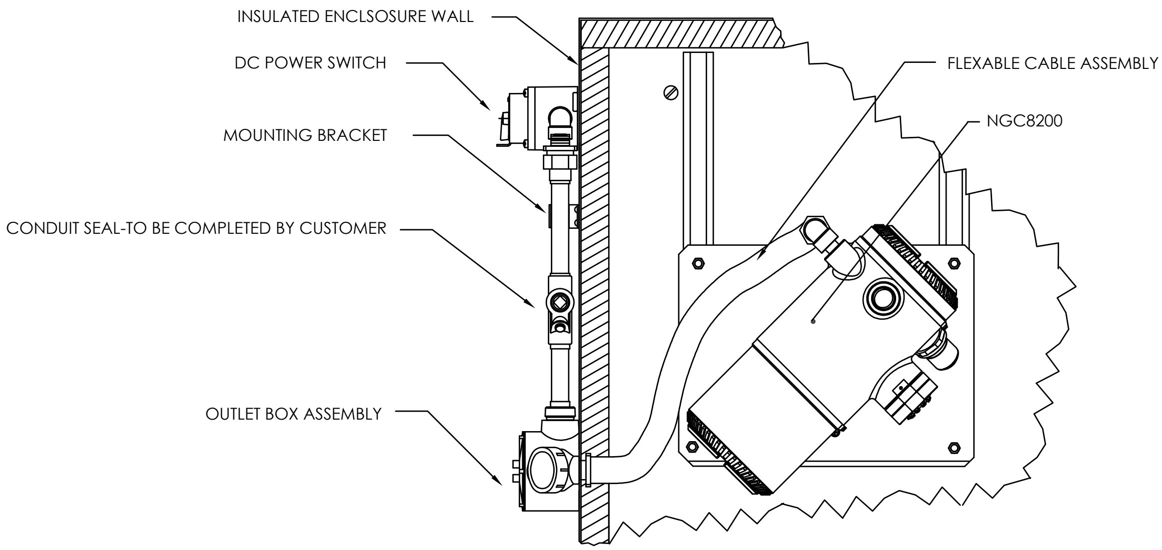


Figure 2–26 Assembled Power/Communication Assembly

21) Using the wiring instructions in Figure 2–27, install each wire into the correct terminal and replace the connector on board.

22) Trim and strip the wire ends located in the external outlet box.

23) Remove the power field termination J3 connector from the outlet box panel.

24) Using the wiring instructions in Figure 2–27, install each wire into the correct terminal and replace the connector on board.

25) Remove the DC power switch box cover.

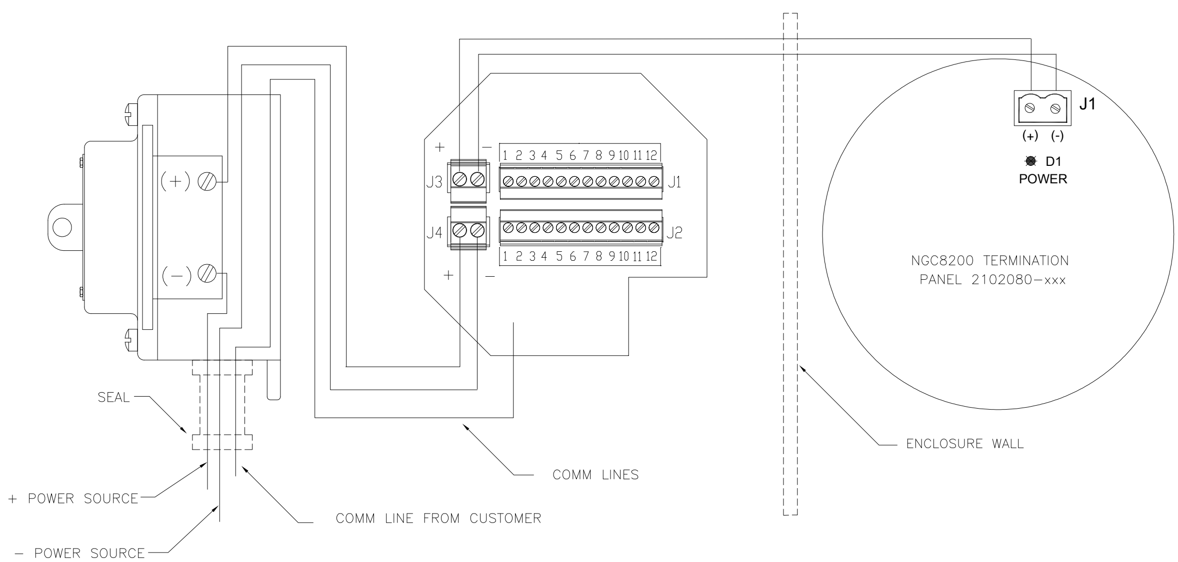


Figure 2–27 Power Wiring Diagram

26) Remove the switch mounting screws and remove the switch.

27) Cut a 3’ length of power (+) wire.

TIP

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

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

28) Tape the 3’ power (+) wire, ground and communication wire ends together.

29) Feed-through the conduit hub located on the bottom of the DC power switch box, past the cover opening, around the elbow and out.

30) Continue pulling wire until approximately 2’ of the wire is extending out of the DC power switch.

CAUTION

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

31) Feed excess wire through the 6” nipple fitting, conduit seal, 5” nipple fitting and out into the outlet box opening. Pull sufficient wire to complete the field wiring.

32) Remove the power field termination J4 connector from the outlet box panel.

33) Using the wiring instructions in Figure 2–27, install the power (+) and power (-) wires into the correct terminal pins and replace the connector on the board.

34) Holding the wires, slide the DC power switch box up to the 6” nipple fitting on the end out outlet box assembly.

35) Slide the conduit union onto the end of the nipple fitting and screw on.

36) Loosen the terminal screws on the DC power switch.

37) Using the wiring instructions in Figure 2–27, wire the power (+) to the upper terminal screw and tighten.

38) Bring the new power (+) wire into the power switch enclosure and pull the short length out to allow for wiring.

39) Using the wiring instructions in Figure 2–27, wire the new power (+) length to the bottom terminal screw and tighten.

40) Using the wiring instructions in Figure 2–27, wire the new power (+) length to the bottom terminal screw and tighten.

41) Using the wiring instructions in Figure 2–28 (RS-232), Figure 2–29 (RS-485) or Figure 2–30(RS-422), make field connections to plug the NGC termination panel com port(s) and re-insert into the corresponding connector in the termination panel.

42) Using the wiring instructions Figure 2–28 (RS-232), Figure 2–29 (RS-485) or Figure 2–30(RS-422), make the field connections to plug J1 and re-insert into the corresponding connector in the outlet box.

43) Using the wiring instructions in Figure 2–28 (RS-232), Figure 2–29 (RS-485) or Figure 2–30(RS-422), make the field connections to plug J2 and re-insert into the corresponding connector in the outlet box.

FYI Communication wiring terminations inside the power/communication outlet box assembly are pass-through connections, meaning 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.

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

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

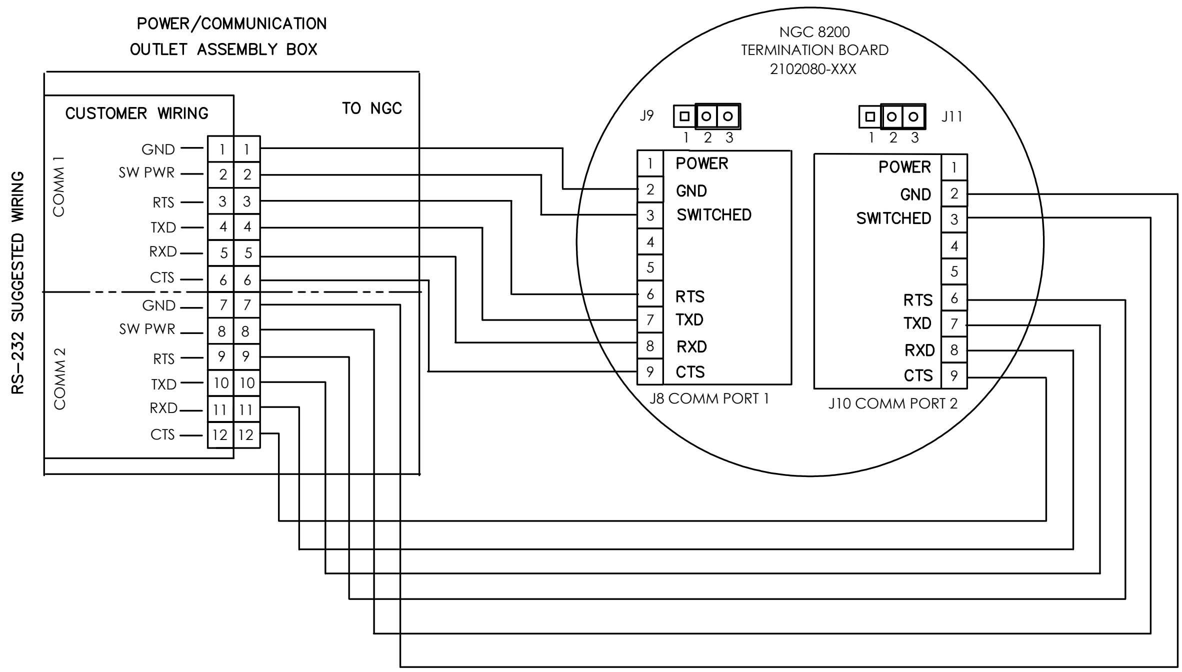


Figure 2–28 Suggested RS-232 Wiring Instructions

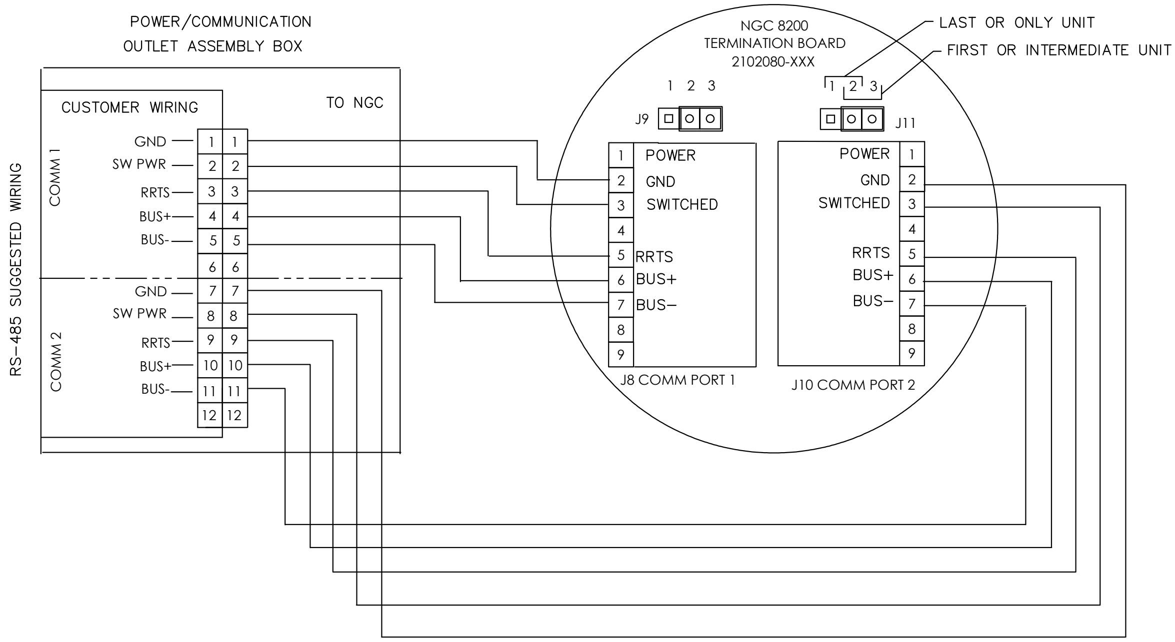


Figure 2–29 Suggested RS-485 Wiring Instructions

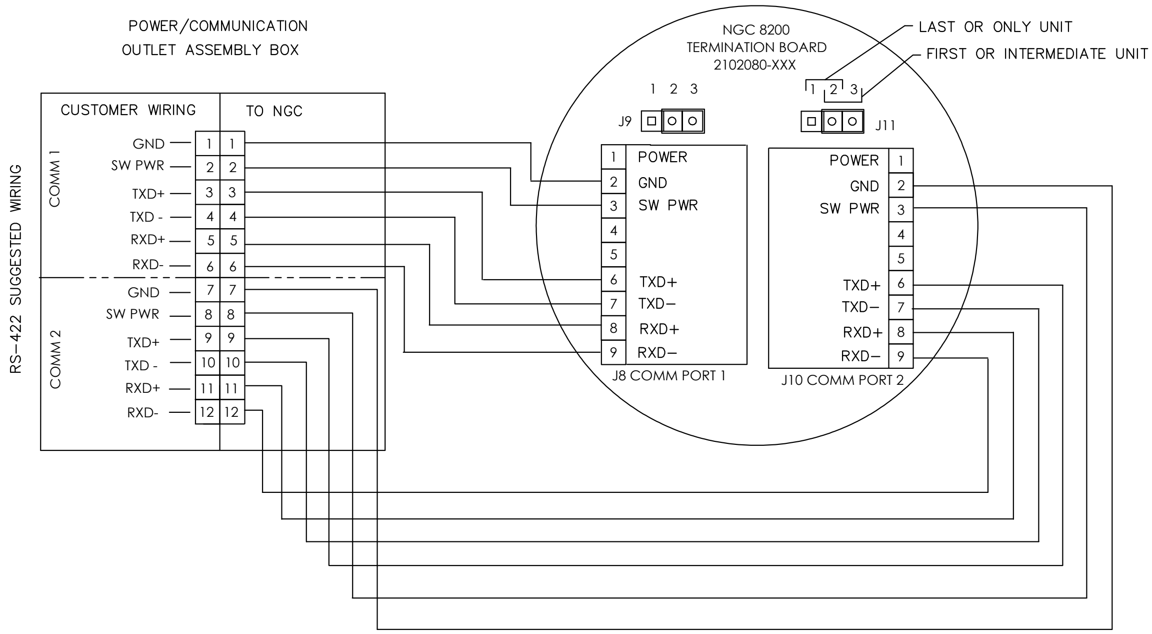


Figure 2–30 Suggested RS-422 Wiring Instructions

2.16 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 cold weather enclosure. A gas regulator should be installed on each gas bottle (see Figure 2–31). This bottle rack is not available through Totalflow; therefore, the instructions are generalized.

2.16.1 Instructions

1) Position the bottle rack in close proximity to the NGC.

2) Secure the rack to the pipe meter run with the provided mounting hardware.

3) Install both the carrier and calibration gas bottles in the rack.

4) Strap both bottles in the rack to prevent their falling.

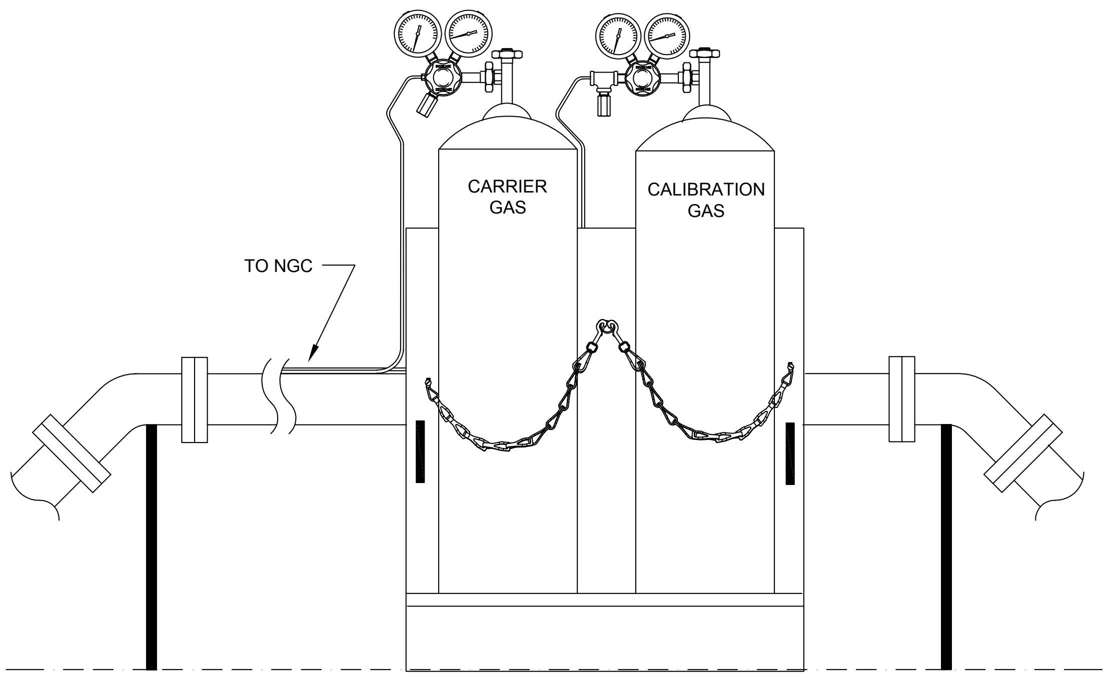


Figure 2–31 Carrier/Calibration Gas Bottle Rack Installation

2.17 CWE 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 cold weather enclosure (see Figure 2–32). A gas regulator should be installed on each gas bottle.

2.17.1 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

2.17.2 Instructions

1) Place a split washer and then a flat washer on one of the 5/8” bolts. Insert the combination through the bolt hole located in the bottle rack bracket and into the corresponding hole located along the bottom edge of the enclosure and tighten (see Figure 2–33).

FYI Enclosure hole contains a captive nut.

2) Repeat for the second bolt.

3) Install the carrier gas bottle in the bottle rack.

4) Using chains, strap the bottle(s) to the rack by attaching the bolt snap to one of the center chains.

5) Repeat step 4, if installing a second bottle.

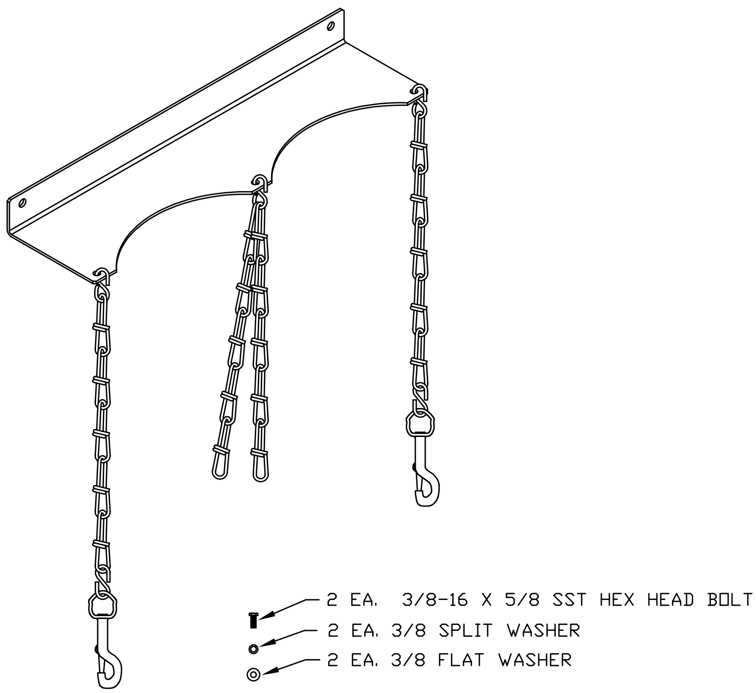


Figure 2–32 Dual Bottle Rack Assembly

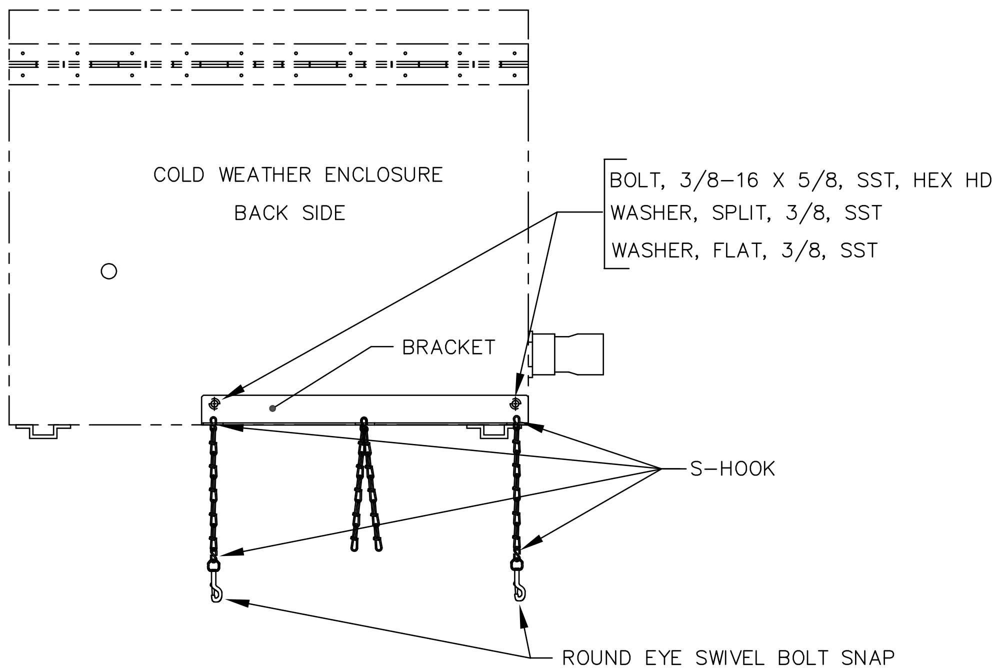


Figure 2–33 Dual Bottle Rack Installation

2.18 Carrier Gas Regulator with Low Pressure Switch Installation

The following instructions are valid for all installations.

2.18.1 Materials

- Carrier regulator assembly with low pressure switch (see Figure 2–34)
- Installed carrier gas bottle

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

2.18.2 Instructions

1) Remove protective cap from the high pressure inlet, if required.

2) Insert the ferrule on the regulator high pressure inlet into the calibration gas bottle outlet.

3) Screw the nut onto the thread and tighten.

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

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

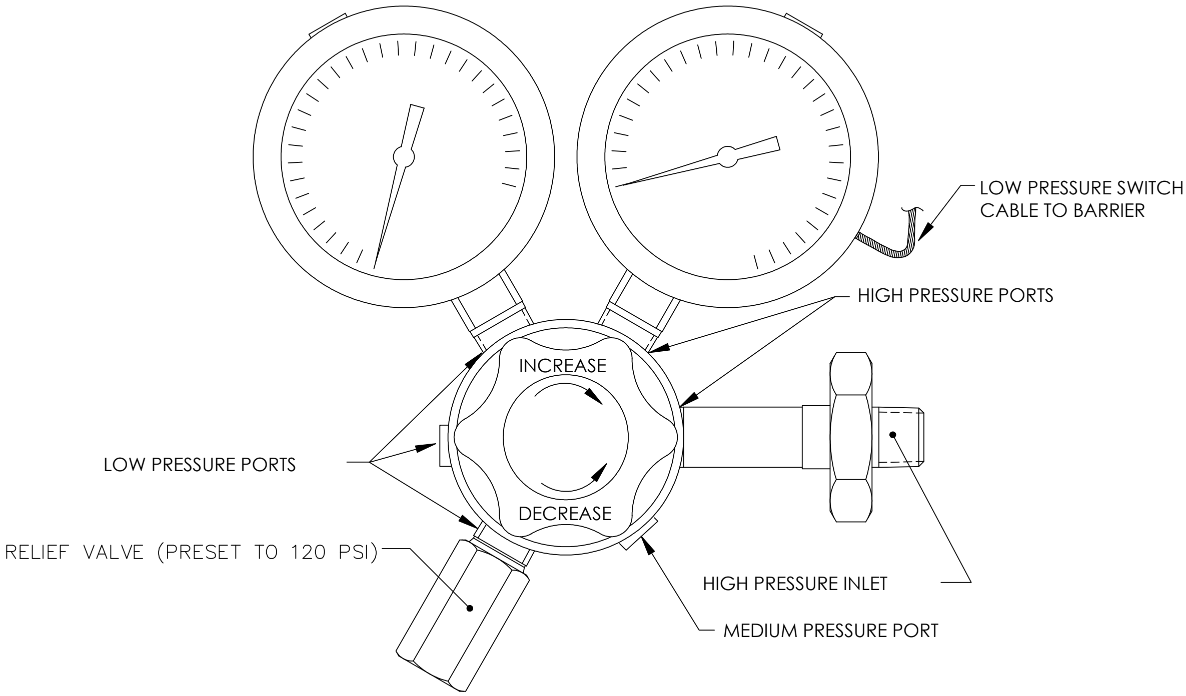


Figure 2–34 Carrier Gas Pressure Regulator with Relief Valve

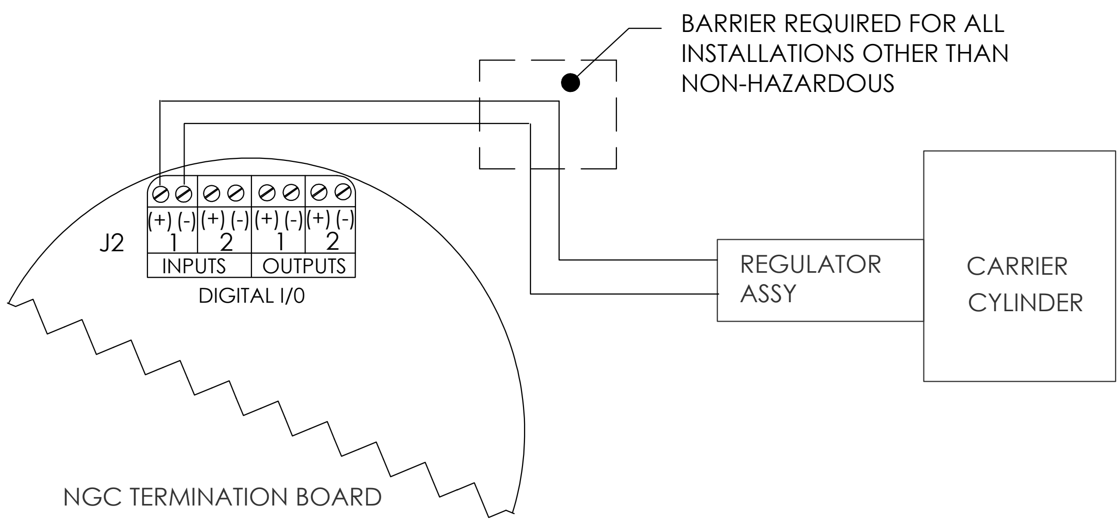


Figure 2–35 Carrier Gas Low Pressure Switch Wiring Instruction

5) Using a small flat blade screw driver, loosen DI2 pins 3 and 4.

6) Insert the red wire into the (+) terminal (pin 3).

7) Retighten pin 3.

8) Insert the black wire into the (-) terminal (pin 4).

9) Retighten pin 4.

10) Replace the termination connector in the J2 board connector.

2.19 CWE Calibration Gas Bottle Installation

The Calibration Gas Bottle mounting Rack is used to hold the Calibration Gas Bottle when located inside of the Cold Weather Enclosure. A gas regulator should be installed on each gas bottle. Refer to Figure 2–36.

2.19.1 Materials

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

2.19.2 Instructions

1) Locate the bottle bracket in the right front area of the Cold Weather Enclosure (see Figure 2–36).

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.

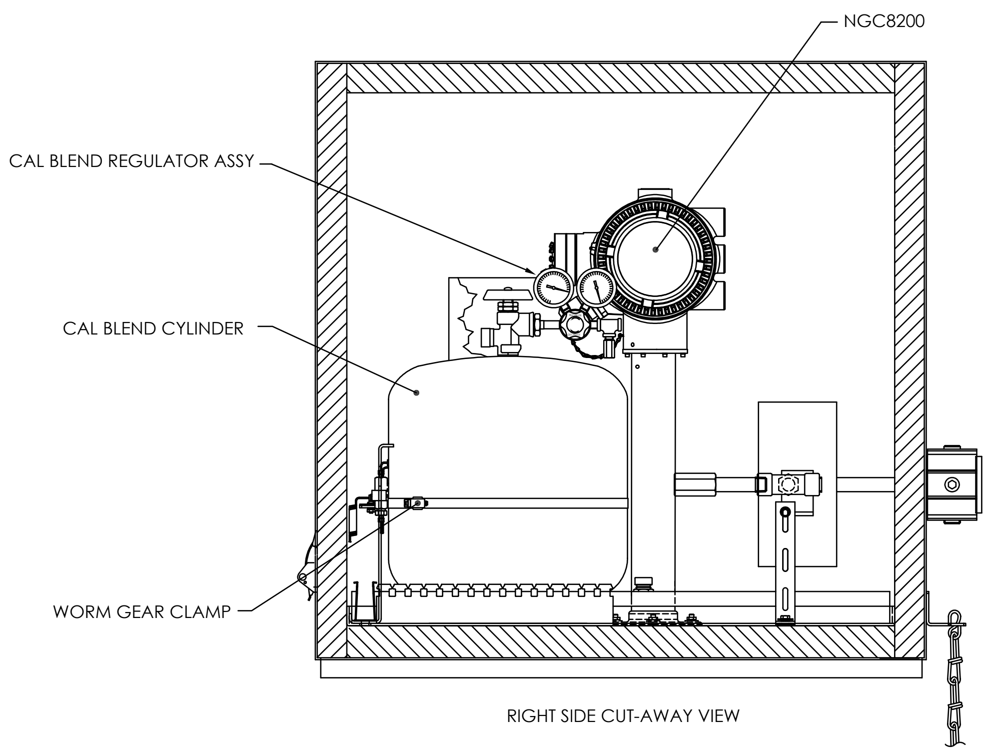


Figure 2–36 Calibration Bottle Location

2.20 Calibration Gas Regulator - Low Pressure Switch Installation

The following instructions are valid for all installations.

2.20.1 Materials

- Calibration blend regulator assembly with low pressure switch (see Figure 2–37)
- Installed calibration gas bottle

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

2.20.2 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.

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

4) Remove J2 field wiring connector from NGC termination panel located inside the rear of the enclosure (see Figure 2–38).

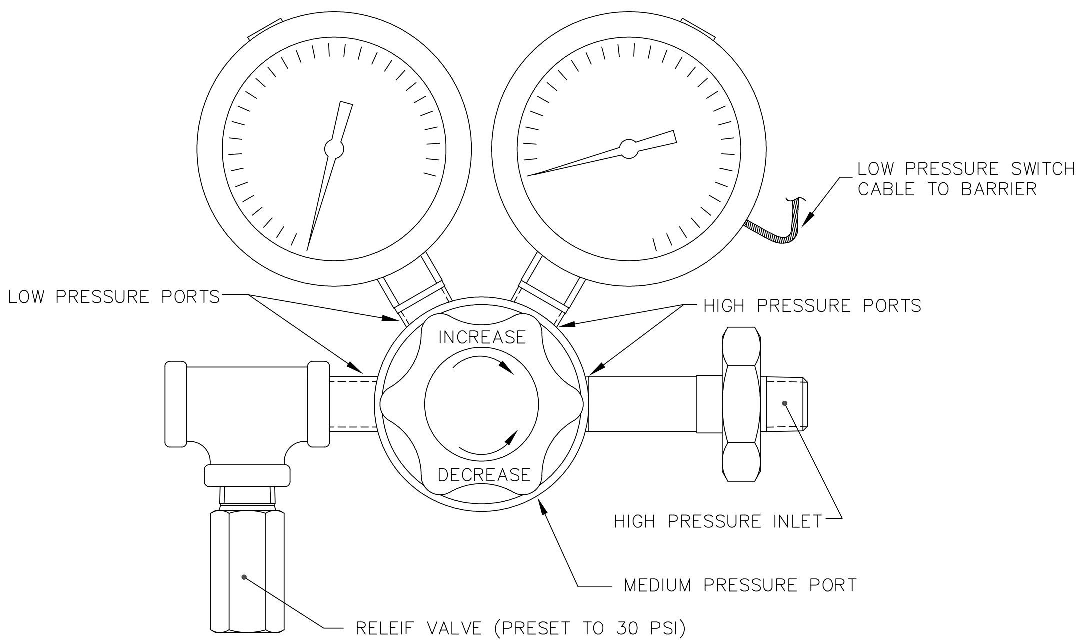


Figure 2–37 Calibration Gas Pressure Regulator with Relief Valve

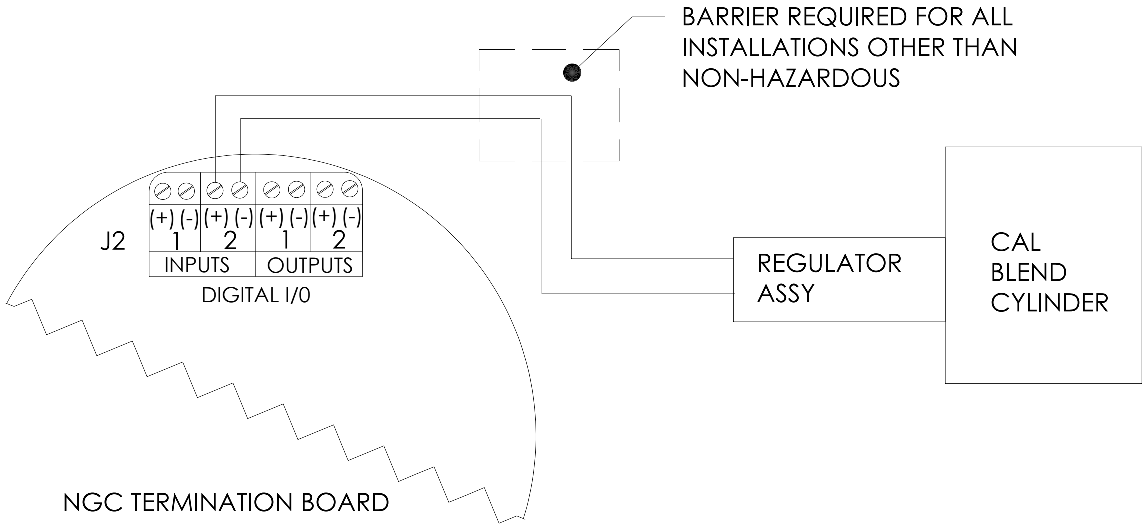


Figure 2–38 Calibration Blend Low Pressure Switch Wiring Instruction

5) Using a small flat blade screw driver, loosen DI2 pins 3 and 4.

6) Insert the red wire into the (+) terminal (pin 3).

7) Retighten pin 3.

8) Insert the black wire into the (-) terminal (pin 4).

9) Retighten pin 4.

10) Replace the termination connector in J2 board connector.

2.21 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 a cold weather enclosure installation.

2.21.1 Materials

- Installed carrier gas pressure regulator
- 1/16” SST chromatography grade transport tubing (Amount to be determined by the technician based on the distance from carrier gas bottle regulator to the sample input filter).
- Installed calibration gas pressure regulator
- 1/16” SST chromatography grade transport tubing (Amount to be determined by the technician based on the distance from the calibration gas bottle regulator to the sample input filter).
- 4 ea. 1/16” ferrule and nut
- 2 ea. ¼” NPT to 1/16” reducer or other size as determined from the carrier/calibration gas regulator.

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

2.21.2 Instructions

1) Locate the carrier gas input port (CAR) on the NGC feed-through assembly (see Figure 2–39).
2) Locate the ¼” low pressure output fitting on the installed pressure regulator.
3) Measure and cut the 1/16” SST tubing to the required length.
4) Make the necessary bends in the tubing to ease the installation of the tubing into the NGC and pressure regulator.

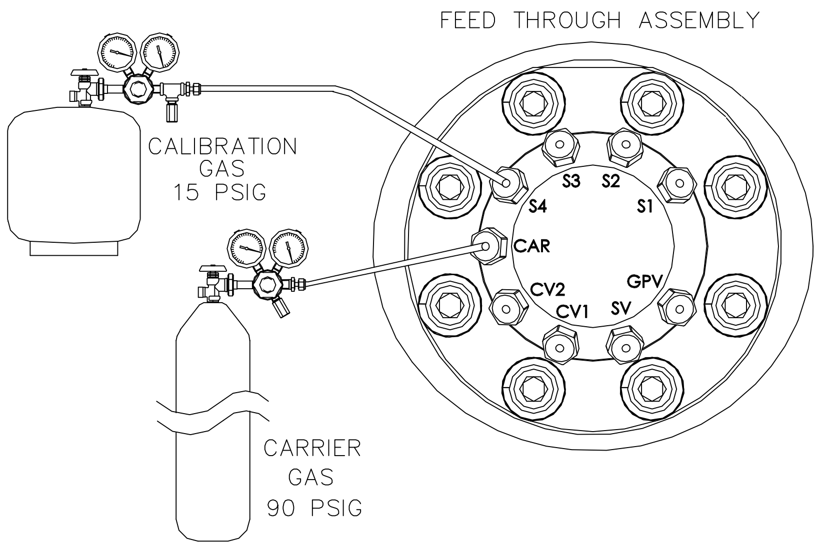


Figure 2–39 Carrier and Calibration Gas Connections

TIP Tube, ferrule and nut should always enter the connection at a right angle.

5) Install the reducer into the carrier gas regulator.
6) Insert the tube with the ferrule into the reducer/pressure regulator output fitting. Move the nut down onto the ferrule, screw onto fitting and tighten.
7) Carrier gas pressure should be set at 90 PSIG.
8) Locate the carrier gas input (CAR) on the NGC feed-through assembly and remove the 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.

9) Purge the air from the transport tubing by opening the shut-off valve located on the regulator.

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

10) Insert the tube with the ferrule into the carrier gas input port (CAR) on the feed-through assembly. Move the Valco nut down onto the ferrule, screw into port and tighten.

11) Determine the input port for the calibration gas (typically S4) on the NGC feed-through assembly (see Figure 2-43) and remove the sealing screw.

12) Locate the ¼” low pressure output fitting on the installed pressure regulator on the calibration gas bottle.

13) Measure and cut the 1/16” SST tubing to the required length.

14) Make the necessary bends in the tubing to ease the installation of the ferrule and tubing into the NGC and pressure regulator.

TIP Tube, ferrule and nut should always enter connection at a right angle.

15) Install the reducer into the calibration gas regulator, if required.

16) Insert the tube with the ferrule into the reducer/pressure regulator output fitting. Move the nut down onto the ferrule, screw onto fitting and tighten.

17) Calibration gas pressure should be set at 15 PSIG.

18) Purge the air from the transport tubing by opening the shut-off valve located on the regulator.

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

19) Insert the tube with the ferrule into the calibration gas input port (S4) on the feed-through assembly. Move the Valco nut down onto the ferrule, screw into port and tighten.

WARNING Leak test ALL gas connections when completed.

2.22 Vent Lines 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 CWE, the sample vent line MUST vent outside of the CWE. Other installations may only require short lines. Please follow the requirements of national and local codes during this installation.

2.22.1 Materials

- 4 ea. 1/16” ferrule and nut
- 4 ea. 1/16” SST vent tubing (supplied with NGC) or
- 4 ea. 1/16” SST tubing (Amount to be determined by the technician based on the distance from the NGC to the external vent location).

2.22.2 Instructions

1) Locate the gauge port vent (GPV), sample vent (SV)), column vent 1 (CV1) and column vent 2 (CV2) ports on the NGC feed-through assembly (see Figure 2–40). Remove the sealing screws for the vent ports.

2) Using the supplied vent tubing (if sufficient length) and ferrule, place the nut and ferrule onto the short end of the bent tubing. Insert the tubing and ferrule into one of the vent ports, with the open end of the tubing pointing down. Move the Valco nut down onto the ferrule, screw into the port and tighten.

   If vent tubing is not of sufficient length, measure and cut new tubing (not supplied by Totalflow). Make the necessary bends to install the tubing. Place the nut and ferrule onto the corresponding end of the tubing. Insert the tubing and ferrule into one of the vent ports, being careful to keep tubing horizontal, with the open end of the tubing pointing down. Move Valco nut down onto the ferrule, screw into port and tighten.

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

CAUTION All four vents MUST be open to atmospheric pressure without back pressure. Position the vent tubing in a downward direction so that moisture does not accumulate in the tubing.

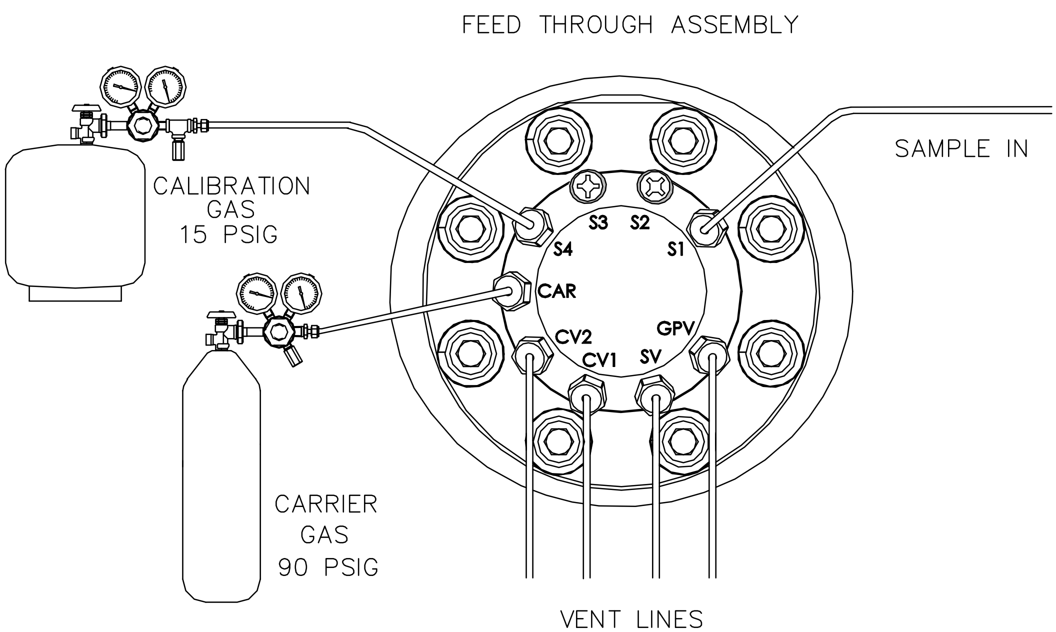


Figure 2–40 Vent Line Connections on Feed-through Assembly

2.23 CWE Optional Catalytic Heater Installation

CWE The following procedures describe the steps for installing a catalytic heater for the cold weather enclosure.

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

2.23.1 Materials

- Catalytic heater (installed at factory)
- Thermostat assembly with temperature probe
- Regulator assembly w/ shut-off
- T assembly
- Tubing
- Temperature probe mounting clip
- Teflon tape
- ¼” Male pipe connection from external gas source to catalytic heater. Materials for the gas source are 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.

2.23.2 Instructions

1) Locate the installed catalytic heater on the rear of the cold weather enclosure (see Figure 2–41).

2) Remove the protective end cap from the catalytic heater input fitting, if required.

3) Apply Teflon tape to the threads on the male end of the T assembly (see Figure 2–42).

4) Screw the threaded end of the T assembly into the ¼” female fitting, located on the factory installed catalytic heater, by turning the entire assembly clockwise until tight (see Figure 2–43).

5) Remove the ferrules and nut from the male connector on the bottom of the T assembly.

6) From inside the CWE, insert the short bent end of the 3/8” tubing out through the hole located below the catalytic heater, and continue feeding the tubing out until it is in position to insert into the bottom of the T assembly.

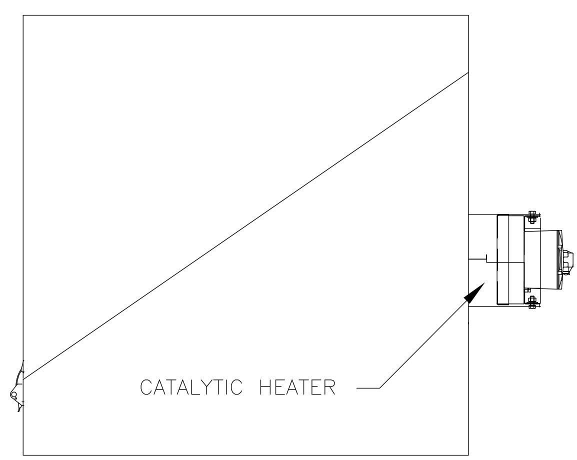


Figure 2–41 Catalytic Heater Option in Cold Weather Enclosure

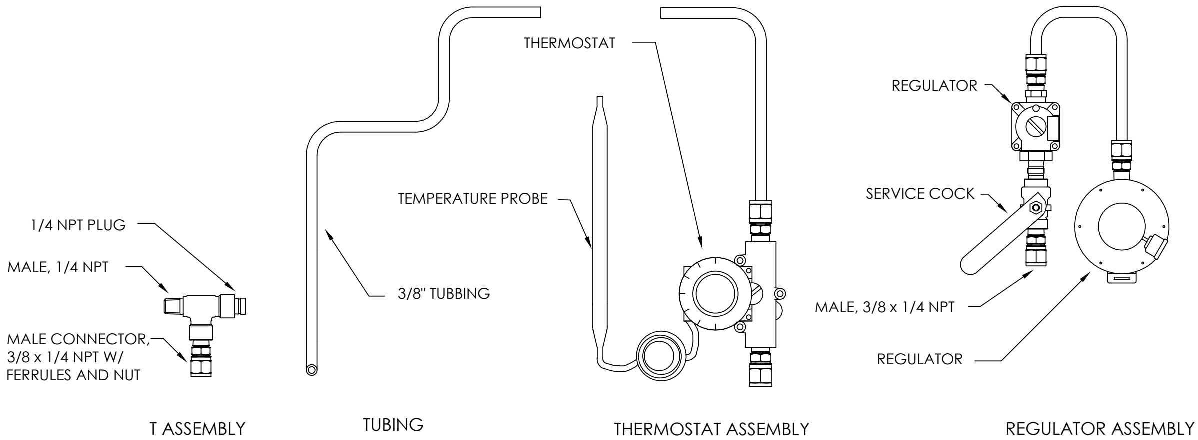


Figure 2–42 Catalytic Heater Assembly

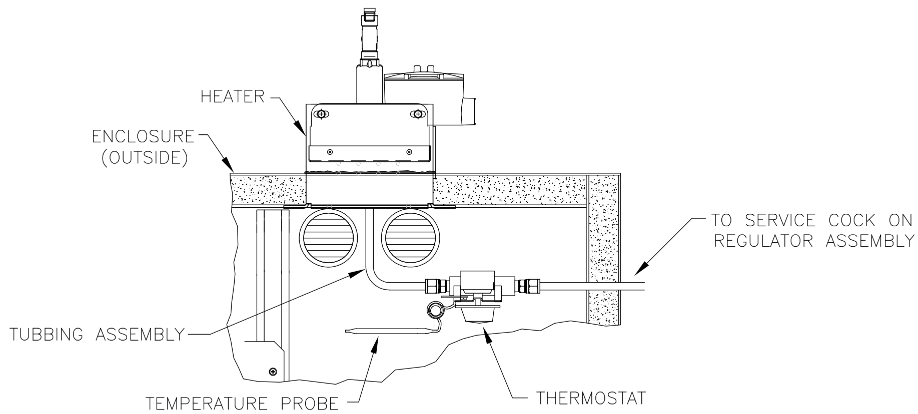


Figure 2–43 Thermostat Assembly Installed

7) Place the nut, front ferrule and back ferrule onto the outside end of the tubing and position so that the ferrules and nut screw onto the bottom of the T assembly. Screw nut until tight.

8) Remove ferrules and nut from the thermostat end of the thermostat assembly.

9) From inside CWE, insert the tube end of the thermostat assembly through the exterior wall on the side of the CWE (see Figure 2–44).

10) Place the nut, front ferrule and back ferrule onto the end of the 3/8" bent tubing (from the T assembly beneath the catalytic heater) inside of the CWE. Position the thermostat assembly so that the nut and ferrules screw onto the thermostat assembly.

11) Remove the ferrules and nut from the end of the regulator assembly closest to the service cock.

12) Place the nut, front ferrule and back ferrule onto the end of the thermostat assembly protruding from the CWE.

13) Hold the regulator assembly with the curved tubing on top, above the protruding tubing. Insert the tubing into the regulator assembly, slide the ferrules and nut into place and tighten.

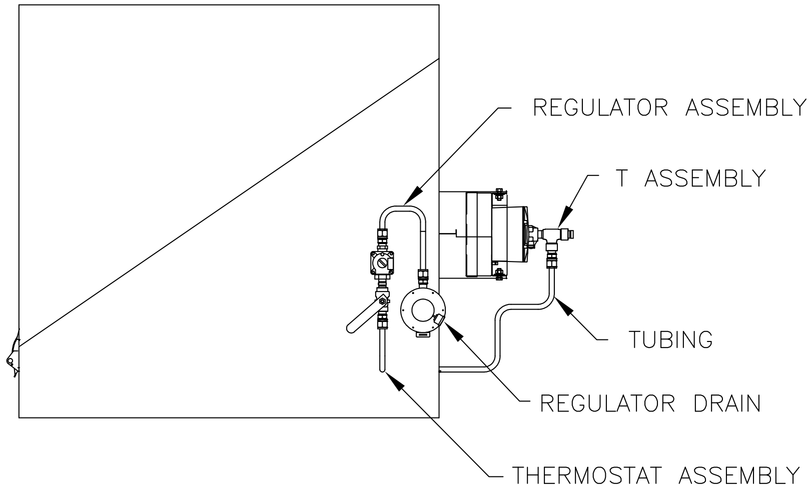


Figure 2–44 Regulator Assembly Installed

14) Gently uncoil the temperature probe capillary tubing from the thermostat and insert through the hole located below the thermostatic gas valve, being careful to not crimp or make sharp bends in the capillary tubing.

15) Remove the mounting screw and washers from the right rear NGC mounting bracket (see Figure 2–45).

16) Insert the screw with washers still in place through the hole located on the mounting clip, and re-insert through the mounting bracket into the channel nut..

17) Position the probe underneath the mounting clip. Tighten the screw into the channel nut to hold the probe in place.

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

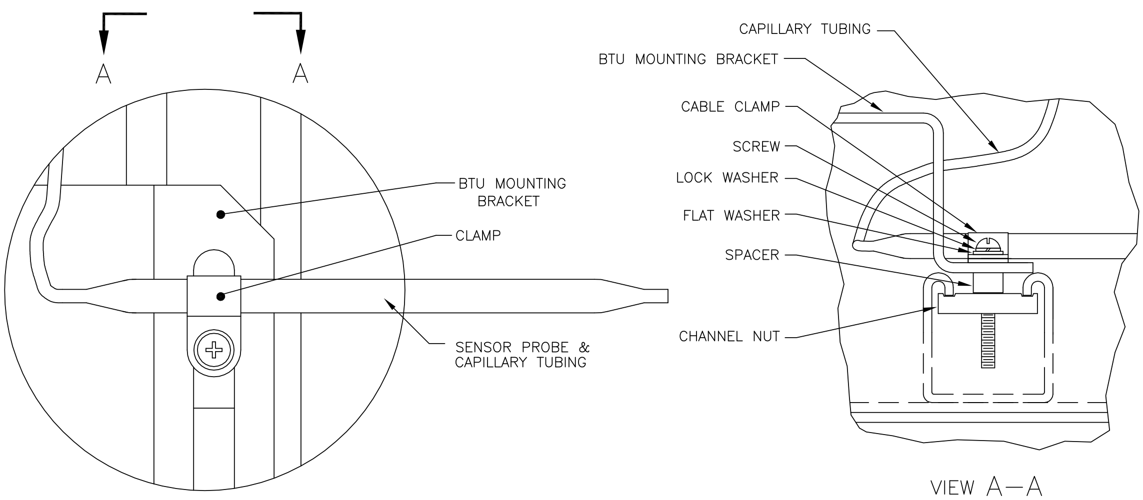


Figure 2–45 Temperature Probe Installation

18) Using the regulator manufacturer’s instructions supplied with the regulator, make the external gas connections.

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

19) Using the wiring instructions shown in Figure 2–46 and the manufacturer’s instructions enclosed with the heater, make external connections.

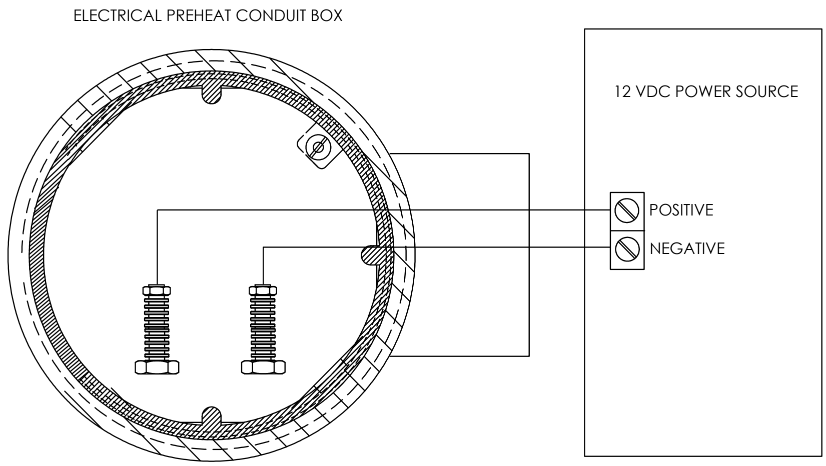
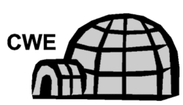


Figure 2–46 Electrical Pre-Heater Wiring Instructions

2.24 CWE Optional Electric Heater Installation



The following procedures describe the steps for wiring an electric heater for the cold weather enclosure.

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

2.24.1 Materials

- Electric heater Option (Factory Installed, see Figure 2–47)
- AC Power source wiring. Materials for external Power source for Electric heater wiring not provided by Totalflow.

WARNING

Quantities and materials to be determined by the technician based on installation and local codes.

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

2.24.2 Instructions

1) Using the wiring instructions shown in Figure 2–48 and the manufacturer's instructions enclosed with the heater, make external connections.

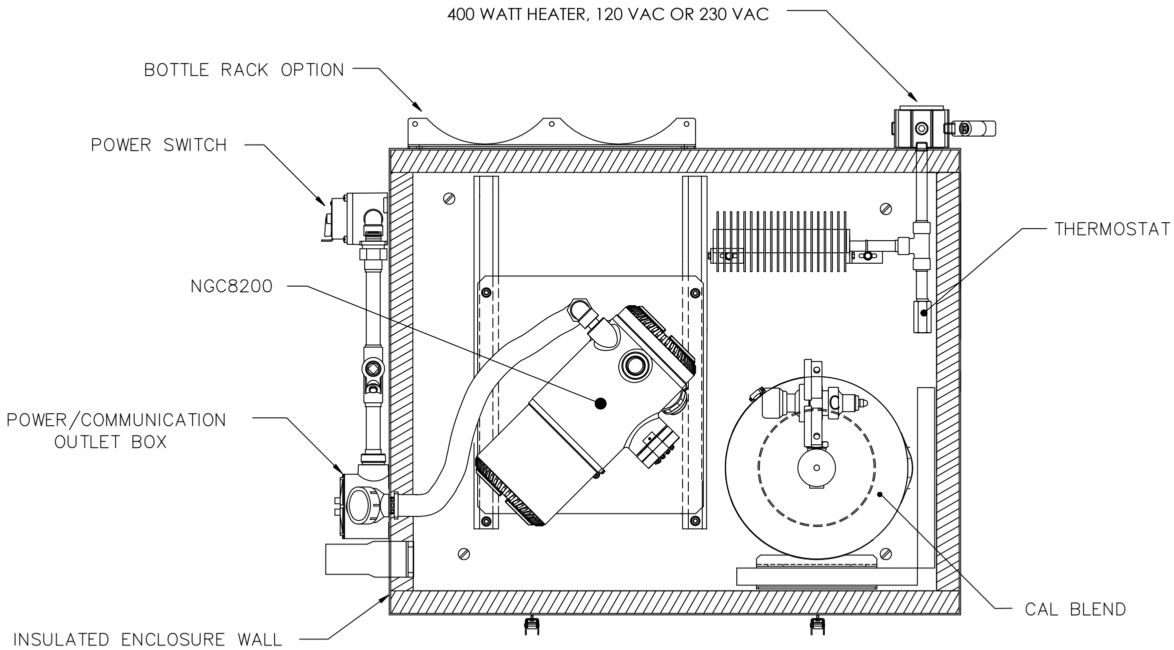


Figure 2–47 Electrical Heater Installed in CWE

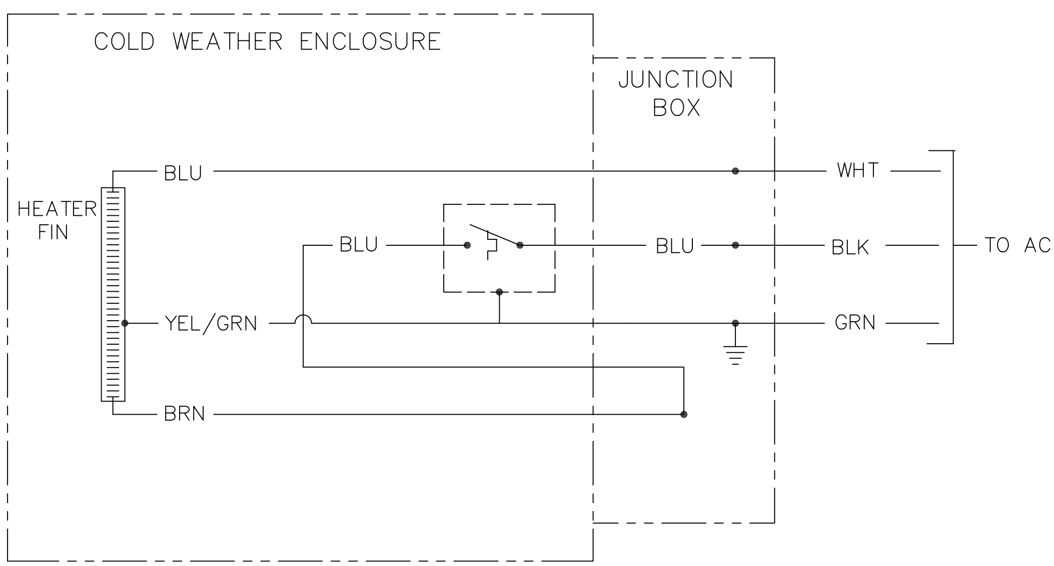


Figure 2–48 Electric Heater Option Wiring Instructions

2.25 Optional Equipment Enclosure Installation

If the optional enclosure is used, it may be configured to include other options, including, but not limited to, a battery pack to provide reserve power to the NGC, communication equipment, solar power charger and additional I/O.

Three enclosures are commonly used for the NGC8201 installations: the 6200, 6700 and 6800 enclosure. The unit may be mounted on a 2” pipe or mounted on a flat surface such as a wall

If configured, the battery and solar panel are packed and shipped separately from the Optional Equipment Enclosure.

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

WARNING 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 6200 Optional Equipment Enclosure

The 6200 can accommodate the following equipment:

- Power Supply Kit for 6200
- 120 VAC/12 VDC Power Supply
- 240 VAC/12 VDC Power Supply

The 6200 installation will be for AC and 24 VDC sites. There is no battery backed option in this installation.

2.25.2 6700 Optional Equipment Enclosure

The 6700 Optional Equipment Enclosure can accommodate the following:

- Power Supply Kit
  - 120 VAC/12 VDC Power Supply
  - 240 VAC/12 VDC Power Supply
  - 24 VDC/12 VDC DC to DC converter 2015440-005)
- Solar Panel Charger
- XFC/XRC Electronic Board
  - XFC/XRC Onboard Battery Charger will be used
- Battery Options
  - 1 each 26/30 AH Battery
- Communications Shelf for Radio/Modem

The 6700 enclosure supports battery backed operation for the NGC. The XFC/XRC electronic board provides a battery charger/regulator for the system.

2.25.3 6800 Enclosure

The 6800 enclosure can accommodate the following :

- Solar Panel Power Option (24 VDC Systems Only)

- 115/230 VAC UPS Power Option (24 VDC Systems Only)

2.25.4 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.

2.25.5 Pipe Mount Instructions

Enclosure mounting brackets and fastening hardware are supplied with unit. Customer must provide 2" pipe of suitable length (see Figure 2–49).

If a charging source, such as a solar panel is desired, this procedure may be adapted to mount the solar panel on the upper portion of the pipe.

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 2–49, Figure 2–50 and Figure 2–51).

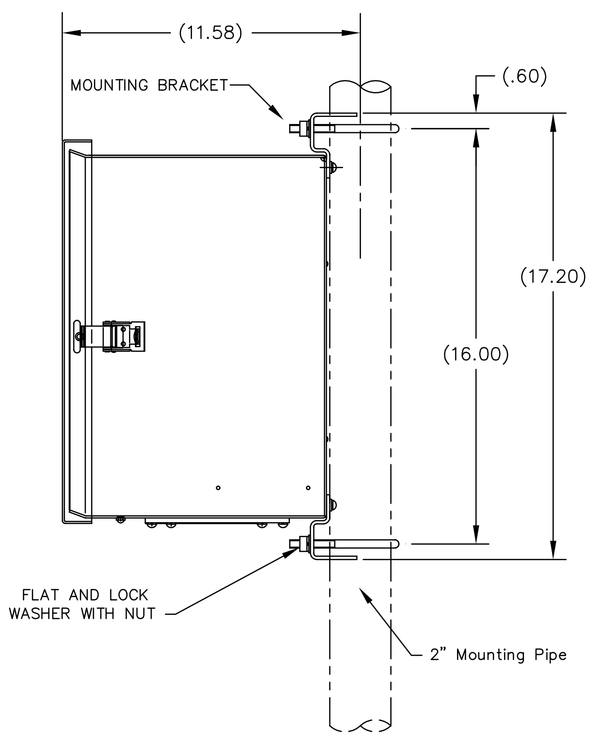


Figure 2–49 6200 Enclosure Pipe Mounting Installation

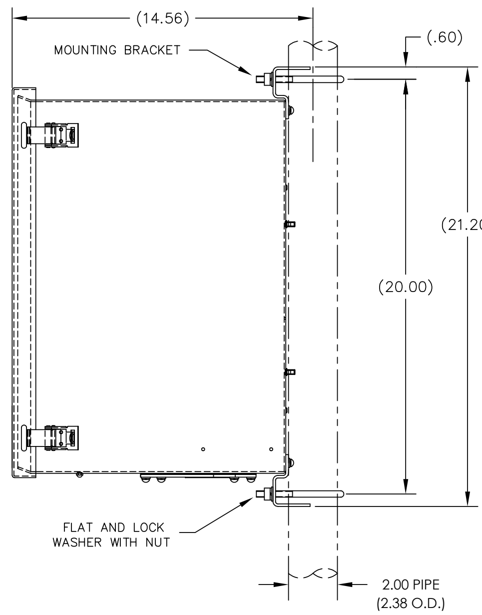


Figure 2–50 6700 Enclosure Pipe Mounting Installation

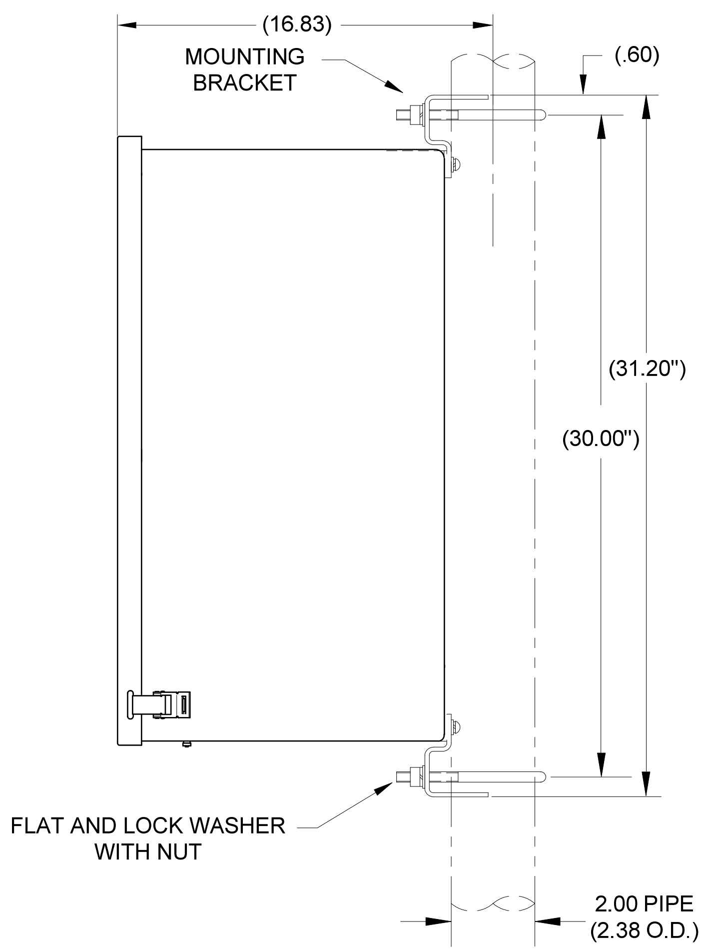


Figure 2–51 6800 Enclosure Pipe Mounting Installation

2.25.6 Wall Mount

Before beginning, review the procedure and the materials required for installation. A typical installation should be similar to Figure 2–52, Figure 2–53 and Figure 2–54.

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

2.25.6.1 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.

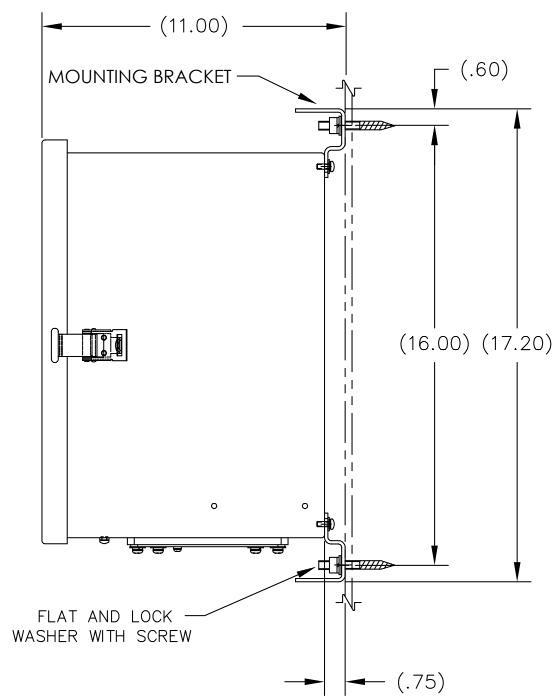


Figure 2–52 6200 Enclosure Wall Mounted Installation

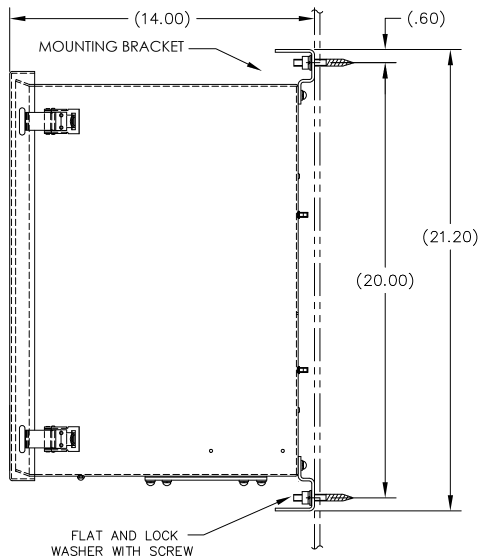


Figure 2–53 6700 Enclosure Wall Mounted Installation

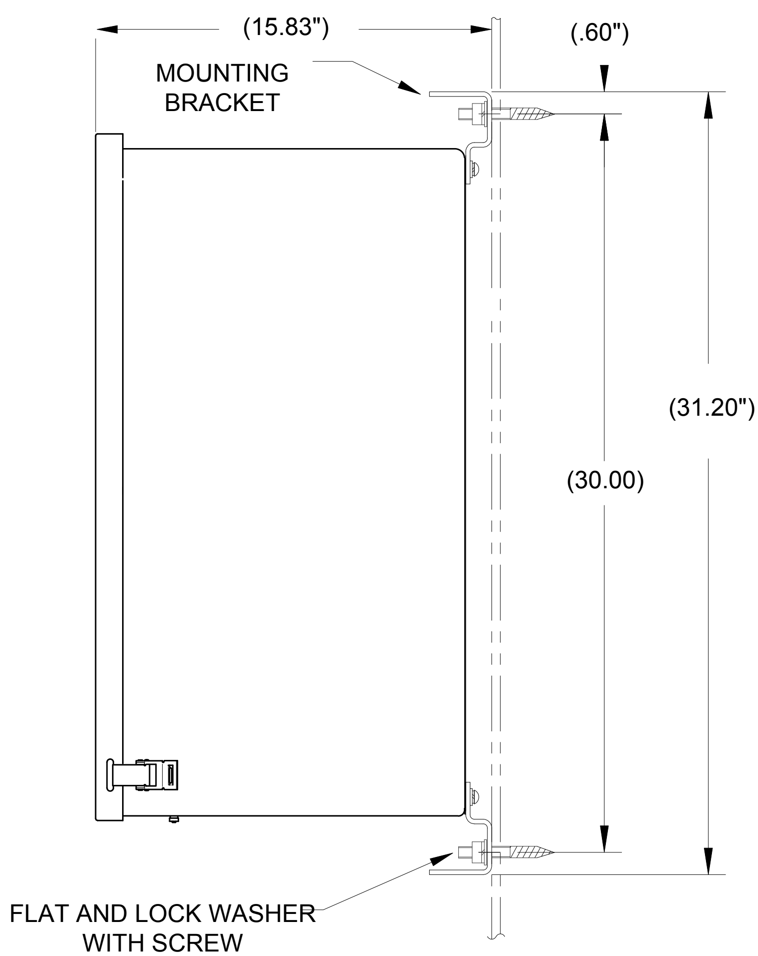


Figure 2–54 6800 Enclosure Wall Mounted Installation

2.25.6.2 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.

2.26 115/230 VAC UPS Power Supply (24 VDC Systems)

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

WARNING This power supply 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 power supply.

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

2.26.1 Instructions

1) If configured, the optional equipment unit should contain an installed power supply. The optional equipment enclosure should be installed using instructions shown previously in this chapter.
2) Remove the necessary plugs from the side of the enclosure to install the rigid conduit.
3) Pipe the conduit and associated AC wiring into the enclosure.

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

4) Using wiring instructions in Figure 2–55, make the field connections from the 115 VAC hot and neutral or the two hot wires for 230 VAC as shown in the wiring instructions.
5) 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.
6) Remove the J1 connector from the NGC termination panel. Using the wiring instructions in Figure 2–55, make field connections from the power supply wire as shown to J1 connector (+) pin and connect the ground wire to J1 connector (-) pin. DO NOT re-insert the J1 connector to the termination board.
7) Proceed to the battery pack installation instructions later in this chapter.
8) Go to DC power installation later in this chapter.

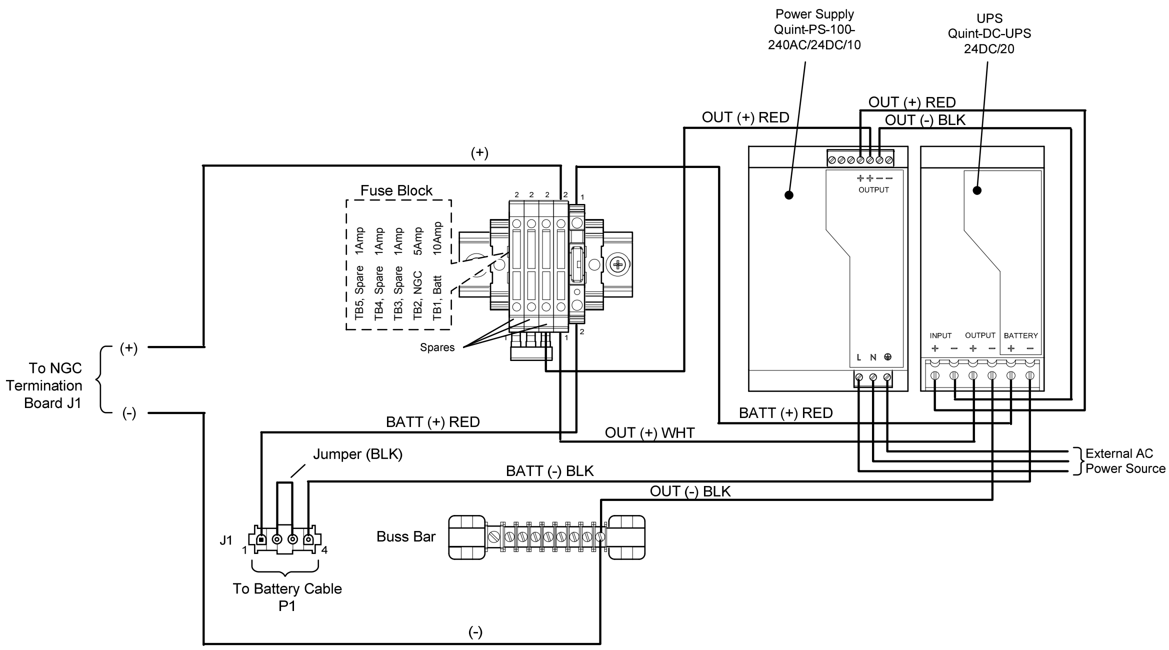


Figure 2–55 115/230 VAC UPS Power Supply Option

2.27 115/230 VAC to 12 VDC Explosion Proof Power Supply Installation

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

WARNING The AC/DC power supply 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 power supply.

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

2.27.1 Customer Supplied Materials

- Plastic cable ties
- AC wiring. Please refer to the cable recommendation chart in Chapter 1 (see Table 1–5 AC Power Supply System Maximum Cable Lengths).
- Explosion proof conduit with fittings and poured seals or approved explosion proof/flame Proof Flexible Cable with Fittings according to the requirements of the national and local codes.

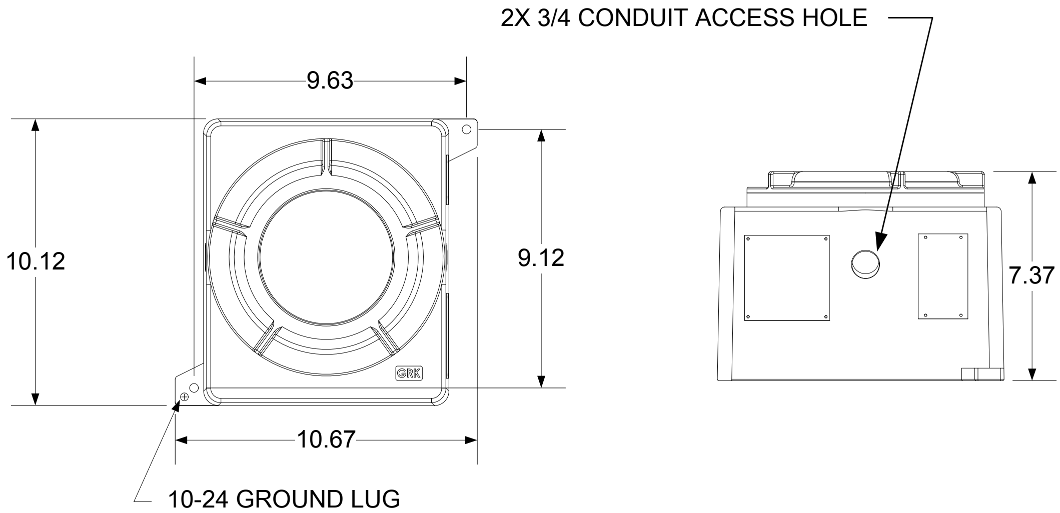


Figure 2–56 Explosion Proof AC Power Supply Top/Front Dimensions

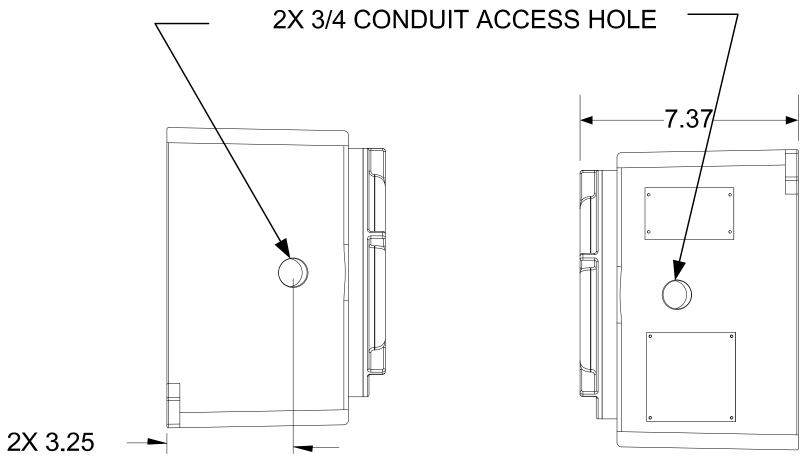


Figure 2–57 Explosion Proof AC Power Supply Side Dimensions

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

2.27.2 Instructions

1) The AC power supply is shipped separately. 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) Mount the explosion proof enclosure on a nearby wall or panel. Make sure that the rigid explosion proof conduit or appropriate flexible conduit can be installed between the power supply's explosion proof enclosure and the NGC. Avoid obstructions.

3) Remove the necessary plugs from the side of the explosion proof enclosure to install the rigid conduit.

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

4) Pipe the conduit and associated AC wiring from the external power source into the AC power supply enclosure.

5) Using the wiring instructions in Figure 2–58, make field connections from the 115 VAC hot and neutral or the two hot wires for 230 VAC to TB1 terminal 5A and terminal 6A on the power supply.

6) 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.

7) Remove the J1 connector from the NGC termination panel. Using the wiring instructions in Figure 2–58 make field connections from the power supply wire from F1 terminal B to J1 connector (+) pin and connect the ground wire TB1 terminal 1A to J1 connector (-) pin. DO NOT re-insert J1 connector to the termination board.

8) Go to the DC power installation later in this chapter.

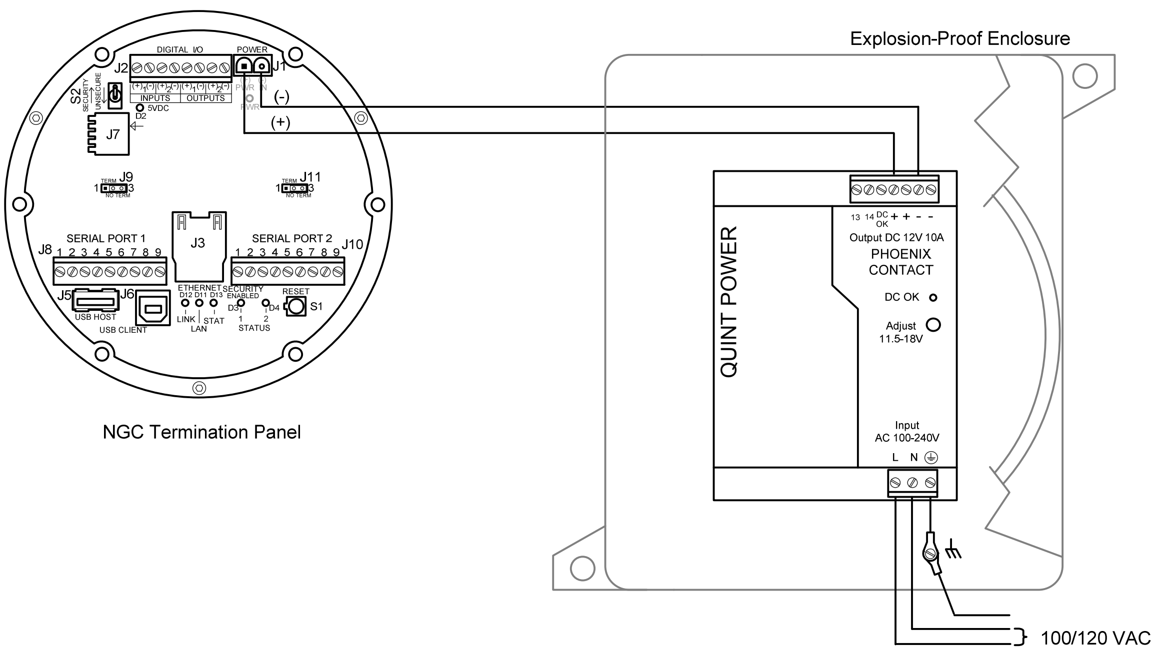


Figure 2–58 Explosion Proof AC Power Supply Wiring Instructions

2.28 110/240 VAC to 12/24 VDC Power Supply Installation

WARNING The power supply 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 the national and local codes when installing the power supply.

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

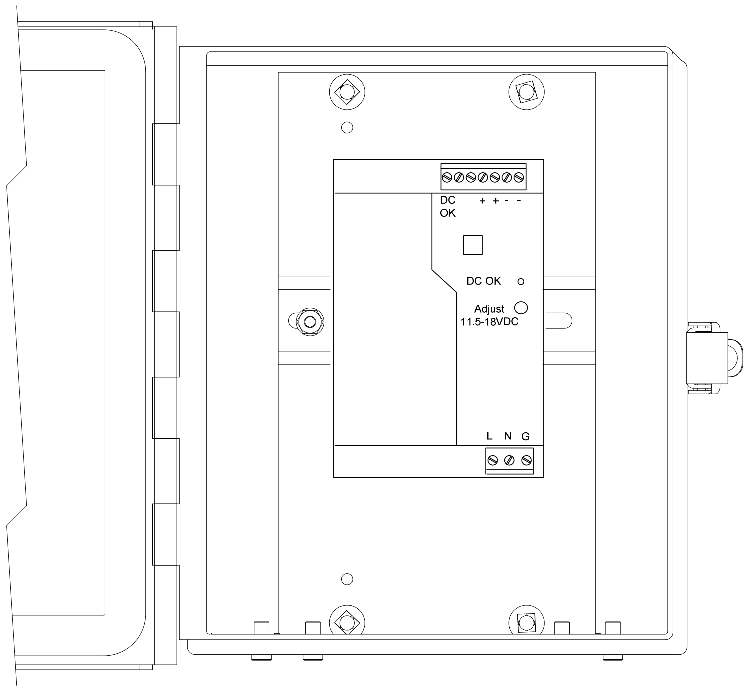


Figure 2–59 6200 Optional Equipment Enclosure with Power Supply

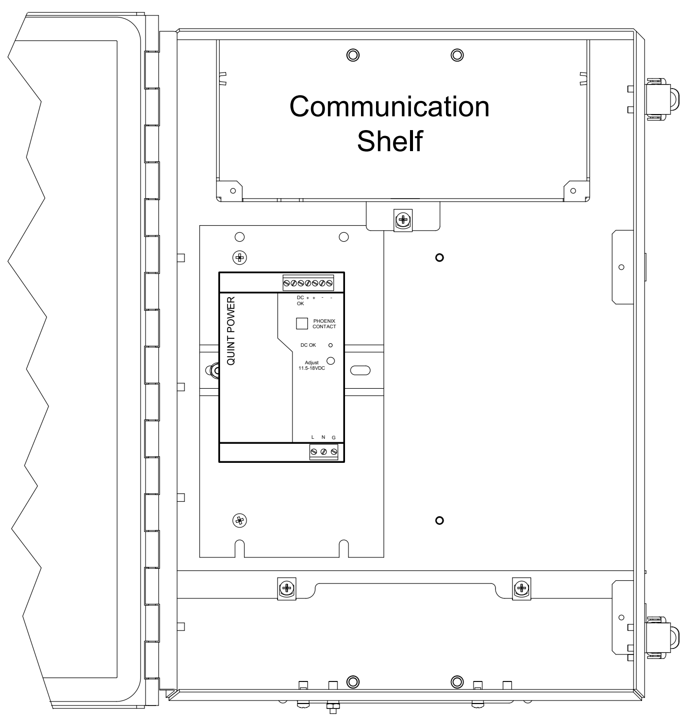


Figure 2–60 6700 Optional Equipment Enclosure with Power Supply

WARNING The AC/DC power supply 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 power supply.

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

2.28.1 Instructions

1) If configured, the optional equipment unit should contain an installed AC power supply. The Optional Equipment Enclosure should be installed using instructions shown previously in this chapter.
2) Remove the necessary plugs from the side of the enclosure to install the rigid conduit.
3) Pipe the conduit and associated AC wiring into the enclosure.

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

4) Using wiring instructions in Figure 2–61, make the field connections from the 115 VAC hot and neutral or the two hot wires for 230 VAC to TB1 terminal 5A and terminal 6A on the power supply.
5) 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.
6) Remove the J1 connector from the NGC termination panel. Using the wiring instructions in Figure 2–61, make field connections from the power supply wire from F1 terminal B to J1 connector (+) pin and connect the ground wire TB1 terminal 1A to J1 connector (-) pin. DO NOT re-insert the J1 connector to the termination board.
7) Go to DC power installation later in this chapter.

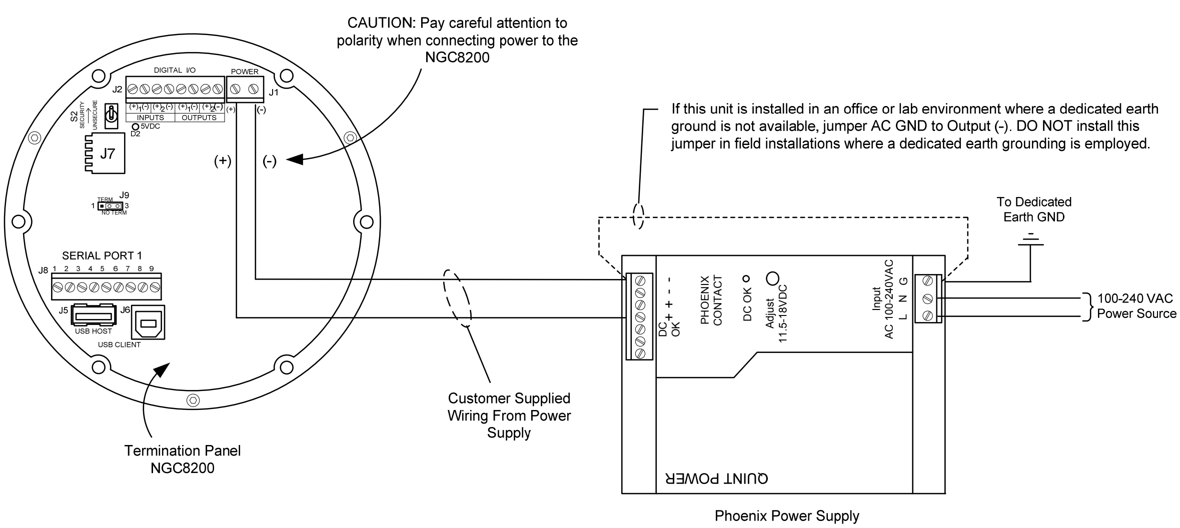


Figure 2–61 AC/DC Converter Wiring Instructions

2.29 24 VDC to 12 VDC Power Converter

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

WARNING The DC/DC power converter 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 power converter.

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

2.29.1 Instructions

1) If configured, the optional equipment enclosure should contain an installed converter. Enclosure should be installed using instructions shown previously in this chapter.

2) Remove the necessary plugs from the side of the enclosure to install the rigid conduit.

3) Pipe the conduit and associated DC wiring into the enclosure.

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

4) Using the wiring instructions in Figure 2–62, make field connections from the 24 VDC(+) and (-) source to TB1 terminal 11A (+) and terminal 12A (-) on the power supply.

5) 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.

6) Remove the J1 connector from the NGC termination panel. Using the wiring instructions in Figure 2–62 make the field connections from the power supply wire from the TB1 terminal 7A to the J1 connector (+) pin and connect the ground wire from TB1 Terminal 8A to the J1 connector (-) pin. DO NOT re-insert the J1 connector to the termination board.

7) Go to the DC power installation later in this chapter.

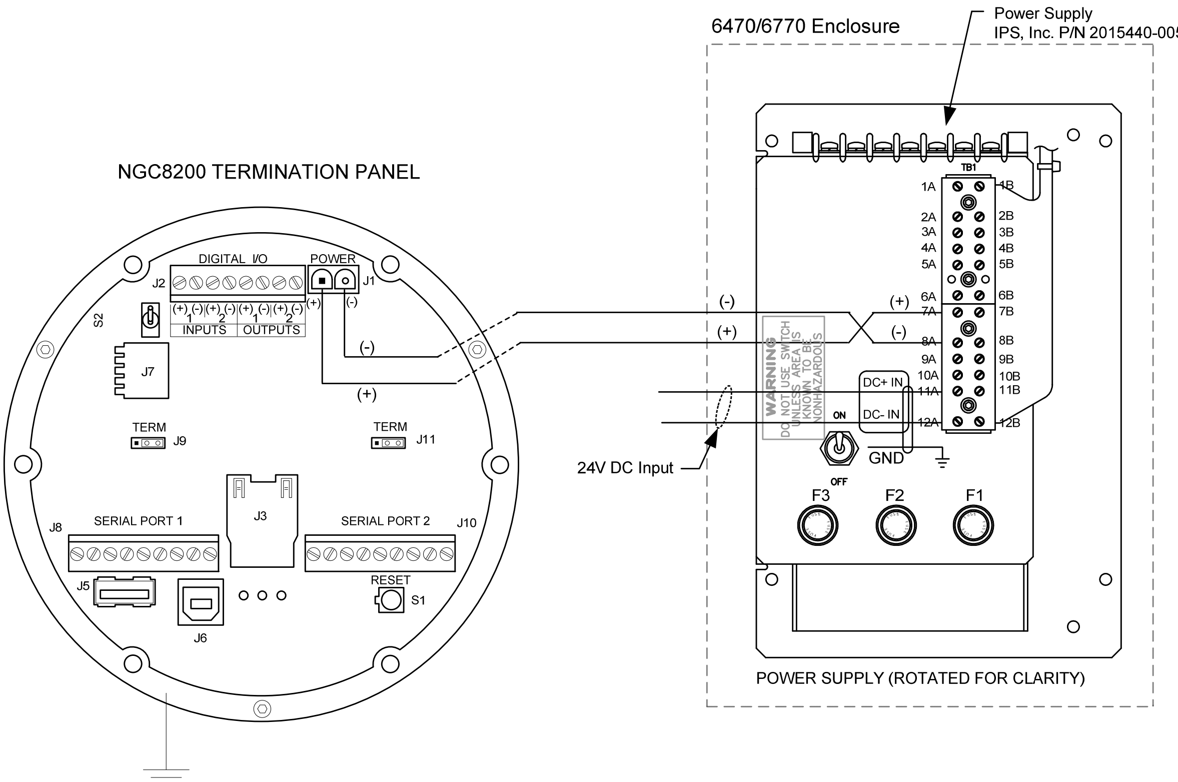


Figure 2–62 24 VDC/12 VDC Power Supply Converter

2.30 Battery Pack Installation

FYI

To extend the life of the battery pack, fully charge the battery prior to installation. Systems using solar panels may not fully charge the battery. Charging the battery quickly removes the oxide buildup and improves the life of the battery.

CAUTION

DO NOT over charge the battery pack.

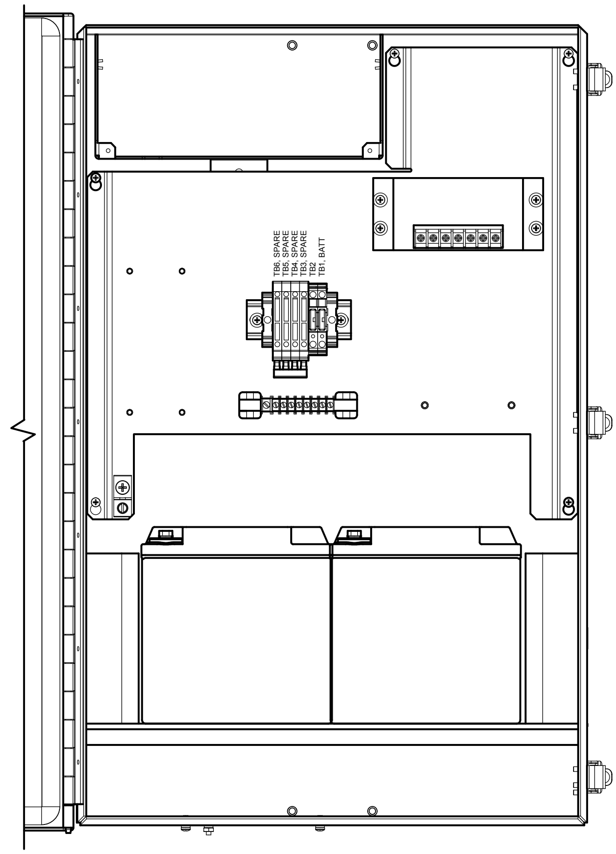


Figure 2–63 Optional 6800 Enclosure with Battery Pack

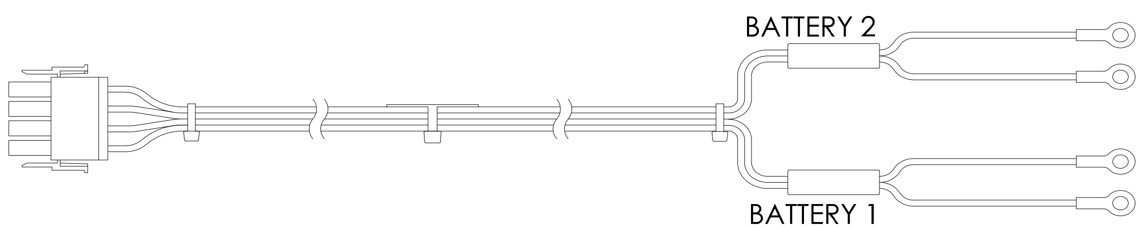


Figure 2–64 24 VDC Dual Battery Pack Cable

2.30.1 Instructions

1) Insert the battery(s) into the battery compartment with the terminals facing up (see Figure 2–63).

2) For the 24 VDC solar power system or the 24 VDC UPS power system, a dual battery cable is provided with unit (see Figure 2–64).

- Connect the battery 1 red wire lug to battery 1 positive terminal.
- Connect the battery 1 black wire lug to battery 1 negative terminal.
- Connect the battery 2 red wire lug to battery 2 positive terminal.
- Connect the battery 2 black wire lug to battery 2 negative terminal.

3) For AC charging systems containing one or two batteries (see Figure 2–65), connect battery cable to prewired power supply cable(s).

4) If system calls for a solar panel charging system, proceed to instructions for solar panel later in this chapter.

5) Go to the DC power installation later in this chapter.

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

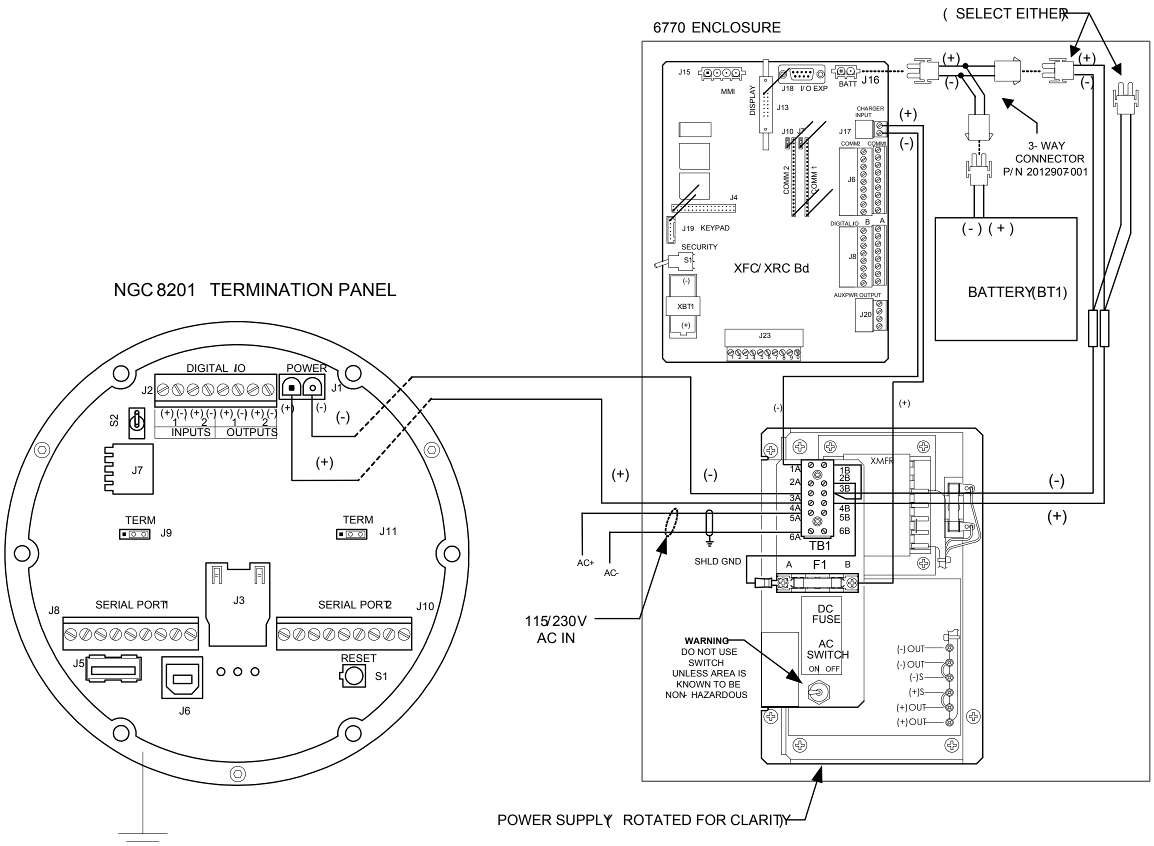


Figure 2–65 Battery Pack with AC Power Supply Wiring Instructions

2.31 Solar Panel Installation

The solar panel is designed for outdoor mounting on a 2” extension pipe located near the optional equipment enclosure (see Figure 2–66). Solar panel must be mounted within 12 feet of unit (other cable lengths available). For wall mounted units, it can be mounted on top or side of meter house.

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

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

2.31.1 Materials Supplied

- Two solar panels
- U-Bolts and fastening hardware
- Solar panel cables (Standard is 12’, other lengths are available)
- Solar panel mounting brackets (if not already attached to solar panel)

2.31.2 Material not Supplied

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

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

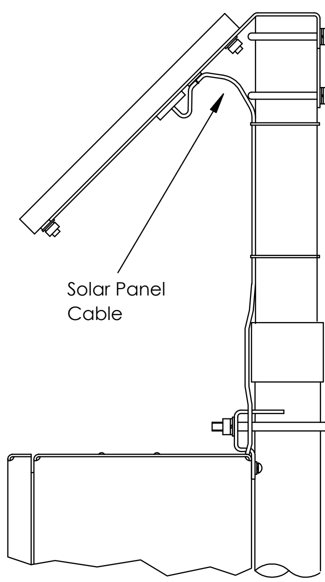


Figure 2–66 Typical Solar Panel Installation

2.31.3 Instructions

1) Attach 2” pipe coupling to top end of enclosure mounting pipe. Securely tighten.

2) Install 2” pipe extension into coupling and securely tighten.

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

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

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

5) Attach solar panel mounting plates to top end of 2" extension pipe with U-bolts and associated mounting hardware. Do not tighten U-bolts until solar panels are correctly positioned.

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

2.32 Solar Power Pack

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

WARNING The power supply 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 the national and local codes when installing the power supply.

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

2.32.1 Instructions

1) If configured, the optional equipment enclosure should contain an installed power supply. The enclosure should be installed using instructions detailed previously in this chapter.

2) Remove plug from access hole in equipment enclosure. Insert solar panel power cable through an access hole on side of case. Allow enough power cable for field wiring to solar charger connector pins 3 and 4.

CAUTION Please review the Grounding the NGC8206 section in Chapter 1-System Description before making power connections.

3) Pipe the conduit and associated DC wiring from the NGC8206 into the power supply enclosure. See Table 1–4 in Chapter 1 for wire sizes.

4) Field wire solar panel cables to solar charger inside the enclosure. Using the wiring instructions in Figure 2–67, make the field connections.
   - Loosen terminal block securing screws, insert wire then retighten. Connect solar panel (+) lead to pin 4 and (-) wire to pin 3 terminal. Verify main battery pack is connected.

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

6) Go to the DC Power Installation section later in this chapter.

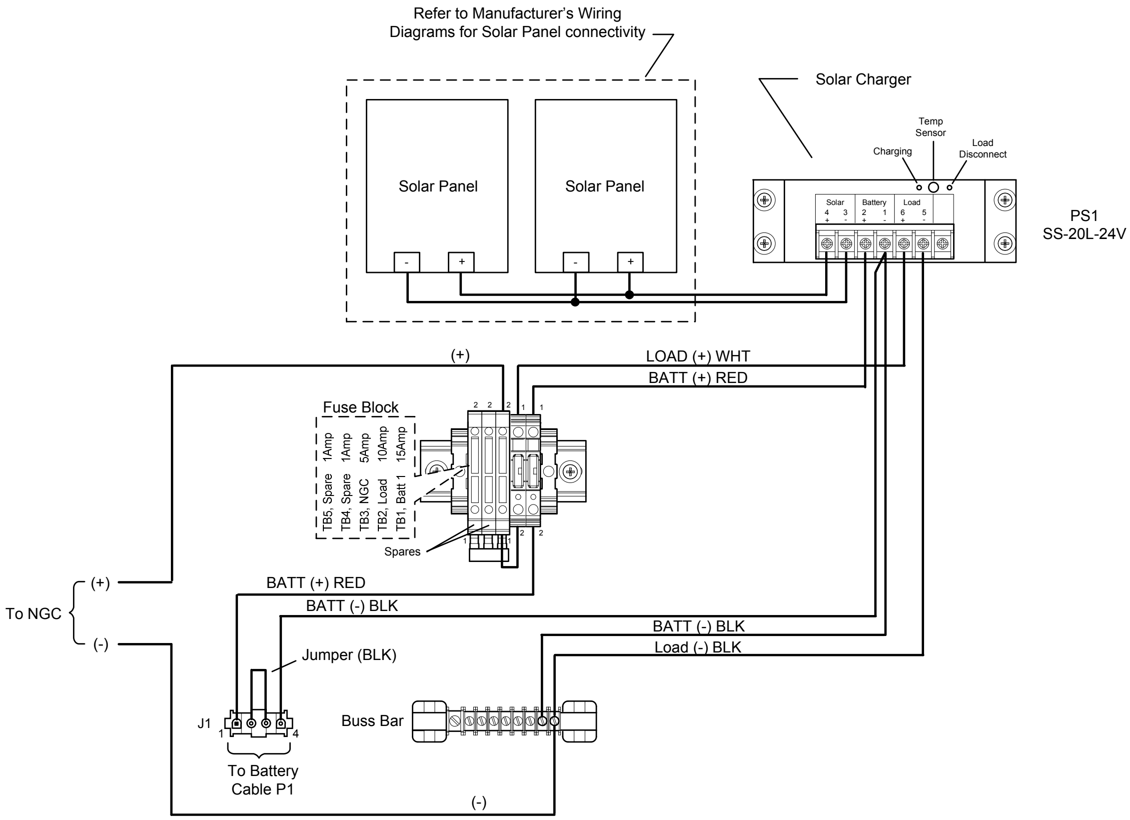
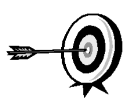


Figure 2–67 24 VDC Solar Panel Power Supply

2.33 DC Power Installation

TIP 

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

2.33.1 Instructions

1) If the installation includes the optional power switch:

- Apply power to switch; turn switch to "ON" position.

2) If the installation includes the optional equipment enclosure with the optional power supply:

- Apply power to power supply.

3) If the installation includes a solar panel connected to a battery:

- Plug in the charger regulator battery connector.

4) Test power using a multi-meter connected to the J1 terminals of the phoenix connector:

- 12 Volt System: voltage is between 11.5 and 16.0 volts (see Table 1–4).
- 24 Volt System: voltage is between 21.0 and 28.0 volts (see Table 1–5).

If volts are within range, the power should be disconnected, the phoenix connector inserted into the termination panel J1 connector and power re-applied.

During Startup operations, the unit will require:

- 12 Volt System: 11.5 volts minimum.
- 24 Volt System: 21.0 volts minimum.

5) If the NGC8200 has the optional VGA screen, the unit will show “Totalflow Boot Loader” followed by the navigational screen, when functional.

6) Unit will begin *Start-up Diagnostics* and oven stabilization. This completes the hardware installation. Proceed to the next chapter, *Start-up*, to begin unit setup and operation.

2.34 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.

Table 2–1 Port 1 and Port 2 Pin-Outs/Terminations

	RS-232	**RS-485**	**RS-422**
PIN	**PORT 1 (J8)**	**PORT 1 (J8)**	**PORT 1 (J8)**
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 -
PIN	**PORT 2 (J10)**	**PORT 2 (J10)**	**PORT 2 (J10)**
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 -
TERMINATIONS		**PORT 1 (J9)**	**PORT 2 (J11)**
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

3.0 NGC8206 STARTUP

This chapter describes the minimum requirements to start up a newly installed 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, complete the tasks outlined in Chapter 2 - Installation.

3.1 PCCU32 Installation and Setup

Totalflow's® PCCU32 6.0 (or later) software is required to communicate with the NGC8200. Previous versions of PCCU32 are not compatible with the NGC8200.

PCCU32 software running in a laptop Windows desktop environment offers the most capabilities for programming the NGC. The Windows environment features user friendly help files and easy to follow menus that enable the user to step through many required choices.

The Totalflow NGC8200 hardware is designed using Windows Mobile technology CE operating system; therefore, communication between a personal computer and the NGC8200 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 the PCCU32 disk into the PC drive. If the CD drive is set to auto play, the installation program should begin; otherwise, click the Windows' *Start* button, and select *Run*. Within the Run dialog box, type the following: *D:\Disk1\setup.exe*. D stands as 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 place a check in the *install ActiveSync* box. If communicating via RS-232, simply click the *Next* button. If communicating with a PDA, *ActiveSync* is already installed, but this installation may contain a later version allowing for a upgrade. To verify the version, open ActiveSync, and click the *Help* icon. Within the help file, select *About Microsoft ActiveSync*.

3) Another screen prompt will allows for the selection of the correct port for communication: USB port for connecting via USB and serial port for connecting via RS-232. If the PCCU software was previously installed and the user selected a port and they are re-installing or upgrading, select *Keep Current Port*.

4) The installation puts a PCCU folder on the Window's desktop with shortcuts. The shortcuts are 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 standalone desktop shortcut, right-click on the shortcut, select *Create Shortcut* from the pop-up menu, and drag it to the desktop.

3.2 Ethernet Installation and Setup

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

PCCU32 communication with the NGC over an Ethernet connection (TCP/IP) requires the use of a hub, switch or router (see Figure 3–1). Ethernet (local) communication in a remote area may also be utilized.

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; however, a new IP address may be automatically assigned to the NGC ,if the NGC's power is cycled. For this reason, it may be preferable to disable the DHCP.

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

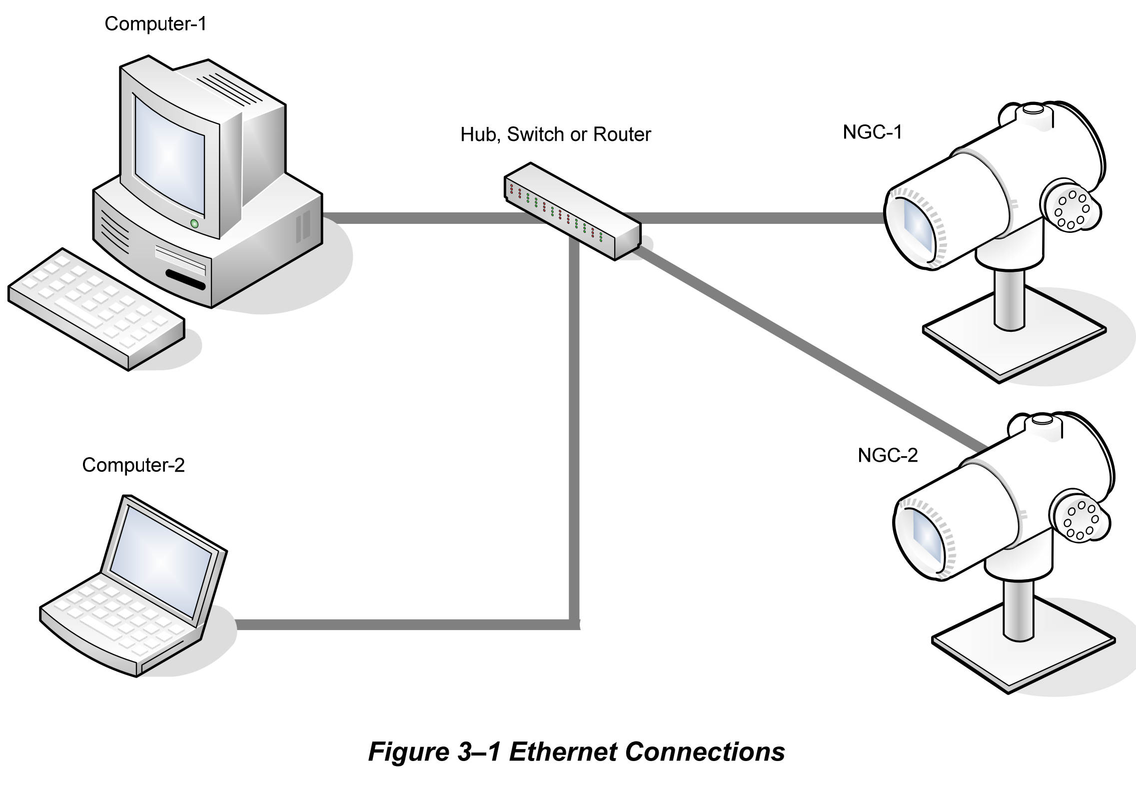


Figure 3–1 Ethernet Connections

3.2.1 TCP/IP Network Connection

Materials Required:

- Ethernet Straight through Cable (see Figure 3–2).
- Hub, Switch or Router and Associated Wiring to NGC (see Figure 3–1).

3.2.1.1 Instructions

1) Acquire TCP/IP Network Settings:

- Click the Windows *Start* button. From the pop-up menu, select *Run*.
- In the Run dialog box, type the program name "*CMD*"..
- Press *OK*.
- At the command prompt, type *ipconfig /all* (space after …ipconfig).
- Record the PC and LAN settings displayed for later use.

2) Make local connection to the NGC using either the USB or RS-232 cable to do initial setup of the parameters.

3) From the *Analyzer Operation* screen in PCCU, click on *Show Tree View* button in the upper left corner of the screen.

4) Click on *Communications* to show the communication setup screen.

5) Select the *Network* tab.

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

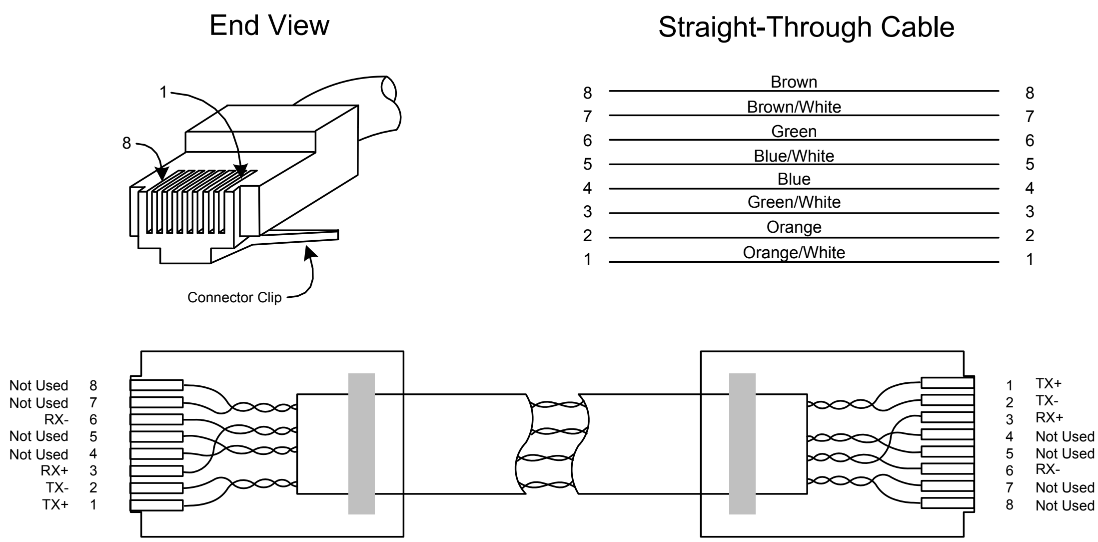


Figure 3–2 Ethernet Cable-Typical

6) Enable or disable the dynamic host configuration protocol (DHCP). To disable the DHCP and assigned IP address, set to *No* and continue to the next step; otherwise, select *Yes* and skip to step 6.

7) Enter the IP address assigned by the network administrator and subnet mask, if different (default is 255.255.255.0).

8) When all desired changes have been made, select *Send.*

9) Reset the NGC by pressing the *Reset* button located on the termination panel housed in the rear of NGC enclosure.

10) Verify the Ethernet communication:

- Change to TCP/IP network cable.
- From the Windows Start Menu, select **Run**. From the Run dialog box, type *CMD* to open the Command window.

11) At prompt “>” type “*ping*” followed by a space, then either the network ID or IP address, and press *enter*. A successful communication will show multiple replies for the unit.

3.2.2 TCP/IP Local Connection

Material Required:

- Ethernet Cross-Over Cable (see Figure 3–3).

3.2.2.1 Instructions

1) Make local connection to the NGC using either a USB or RS-232 cable to do the initial setup of the parameters.

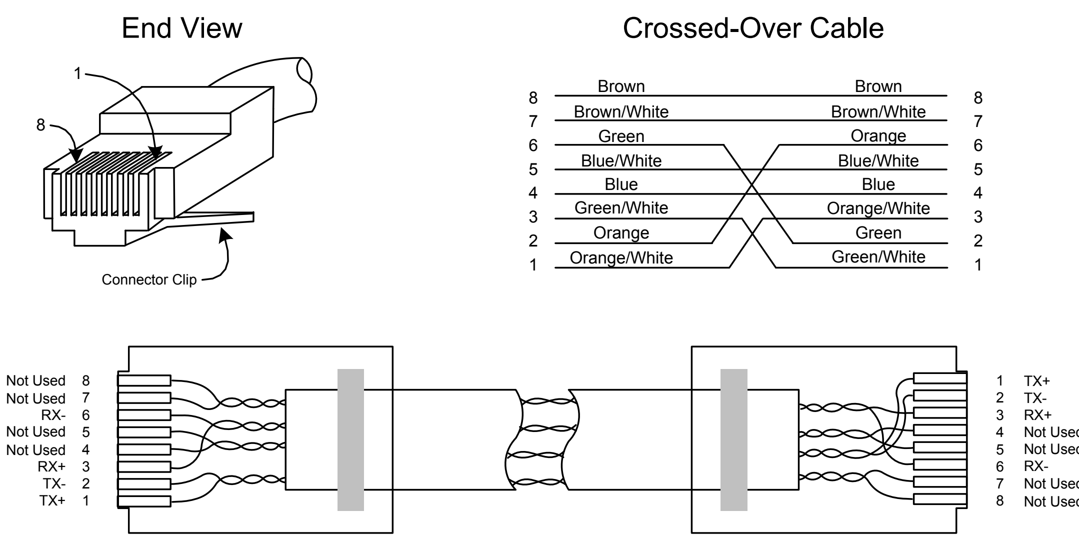


Figure 3–3 Ethernet Cable-Cross-Over

2) From the *Analyzer Operation* screen in PCCU, click on *Show Tree View* button in the upper left corner of screen.

3) Click on *Communications* to show the communication setup screen.

4) Select the *Network* tab. Enable DHCP. Send changes, and record a new IP address for later use.

5) Exit PCCU, and disconnect the local communication cable.

6) Connect the Ethernet cross-over cable between the PC and NGC.

7) Open PCCU software. Click on *Operate* on the menu bar. Navigate through the drop-down list to *Setup*. From the fly-out menu, select *System Setup*.

8) Under *Communications*, set the PCCU com port to TCP, and enter the IP address previously noted in the network ID or IP box. Close the *System Setup* screen.

9) Verify the TCP/IP communications by clicking the *Entry* button on the main screen (upper most left button).

FYI

If receiving a “Communication Link Failed” error message, investigate the following possible causes:

Verify a crossover Ethernet is being used and not a straight through Ethernet cable.

If using a network hub or network, verify the firewall is not blocking the IP address.

If the laptop is connected to a network, verify a virtual private network (VPN) is not being used to access a corporate network. The VPN may need to be disconnected before a local Ethernet connection is possible.

3.3 Connecting to NGC8206’s Local Port

The laptop computer connects to the local port via USB or RS-232 using one of two cables (See Figure 3–4).

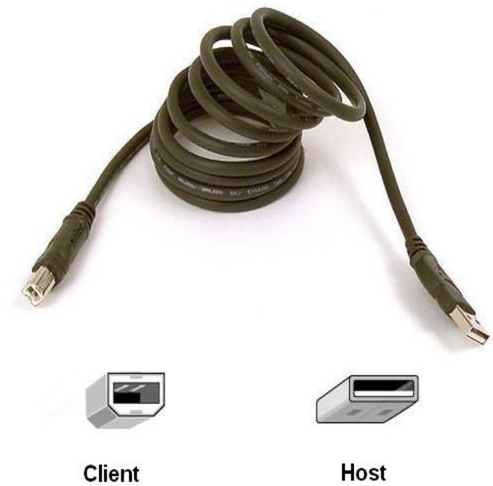
FYI

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

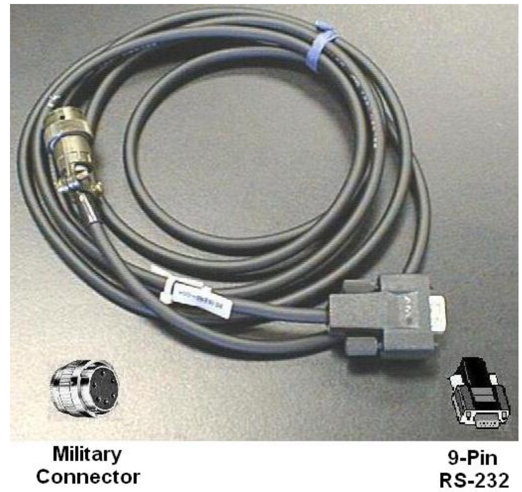
3.3.1 Communicate Instructions

1) Connect the MMI cable to the designated port on the PC and to the local port located on the outside of the NGC. If the unit is configured for the RS-232 MMI cable, connect to the appropriate communication port on the PC (default is COM1). If the unit is configured for a USB cable, connect the host end of the USB cable to any USB port on the PC.

2) Although shortcuts were previously discussed, the following is the traditional method of connection. Click on the Windows *Start* button. From the menu, *Programs* and then *PCCU* (or correct program folder if changed during installation). From the fly-out menu, select *PCCU32*. This will display PCCU32’s initial screen.



USB Cable
P/N 180 1800-xxx



RS-232 Cable
P/N 2015240-xxx

Figure 3–4 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. However, since going on the assumption that we are setting up the unit for the first time, the *NGC Startup Wizard* will appear. If so, see *NGC Startup* on the next page.

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 *Entry Setup* will takes 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 a communication error is received, click on the Setup icon along the top of the screen, and verify the PCCU com port. If using USB, this should indicate USB; if not, click on the down arrow and scroll through the available selections, and select USB. If the serial communications with the round connector on the NGC end is used, 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 run. If diagnostics are not successful, unit will return a system fault and cease start-up.
- Start-up diagnostics consists 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 must reach 60° C and somewhat stabilize. Additionally, part of the processor control test is testing the amount of effort the oven controller takes to keep the oven at its set point of 60° C. Based on ambient temperatures, this could take up to an hour. During this time, the user can be entering information via the Startup Wizard.

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 are 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 on 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 is performed. This is also spelled out in the Startup Wizard.

3.5 NGC Start-Up Wizard

After starting PCCU32 and clicking the *Connect* icon as discussed earlier, the NGC Startup Wizard begins automatically. This will only happen the first time the user connects to the unit or each time they reconnect to the unit and have not completed the Startup Wizard.

The wizard walks the user through the process of entering all the necessary information to get the NGC up and running. Each screen has an associated help screen that automatically displays when moving from screen to screen.

Step through all the screens in the Startup Wizard, filling in the required information. The unit may be concurrently running the startup diagnostics as the user is entering data into the Startup Wizard. One of the steps in the Startup Wizard is displaying the *Diagnostics* screen to see the results. If the diagnostics are still in progress, the Startup Wizard will not allow the user to continue until they finish.

The following procedure is only an outline, and specific steps are discussed in the Wizard help file.

3.5.1 Station Setup Instructions

1) Enter the *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 the date and time; if incorrect, *Set 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 desired changes have been made, select *Send* and then *Next* to 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 current unit Date/Time
Set Device with PCCU Date/Time	Resets device Date and time to match PC

3.5.2 Stream Setup Instructions

1) Enter the Stream ID, Location, Contract Settings and Calculation Settings (see Table 3–2).

2) When all *the* desired changes have been made, select *Send* and then *Next* to move to the next screen.

3) Complete steps 1 and 2 for each sample stream.

TIP During the stream setup, please note that each time Next is selected, the user should see the Stream ID, located on the first line of each screen, change value. The user must move through all four streams even if the unit is a single stream unit.

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)
Contract Settings	**Value**	**Available Units**
Contract Pressure	14.73 PSIA (default)	KPa, InH20, 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)
Calculation Settings		**Value**
Current Calculation File		GPA-2172-1996(AGA8), ISO-6976-1995, etc.[1]
Sum IC5 & NeoC5		No (default), Yes
C6+ Index Split Mode[2]		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.

3.5.3 Calibration Setup Instructions

1) Verify that each process stream is set up to use the correct calibration stream (Stream 4 Default).

2) To make changes to the calibration stream for each process stream, use the *Back* button to return to the setup for the stream and make changes.

3) Change *Calibration Cycles Average* and *Purge Cycles*, if required. Default *Calibration Cycles Average* is 3 and *Purge Cycles* is 2.

4) Make changes to the concentrations in the *% BLEND* column insuring that the *Total Mole %* equals 100%.

CAUTION

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%.

[1] File selection automatically sets the remainder of items on this screen. See PCCU Help files for more information.

[2] 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.

5) When finished and *Total Mole %* equals 100.00 %, select *Next* to move to the next screen.

6) When all desired changes have been made, select *Send* and then *Next* to 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, select *Next* to 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.

FYI

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

To enable or disable steams 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 then *Next* to 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 then *Next* to move to the next screen.

3.5.6 Analyze Calibration Stream

1) Prior to running the 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 the stream to process for two or three cycles (approximately 10 to 15 minutes). During the final cycle, change the next mode to *Hold*. When unit completes the current cycle, it will enter hold mode.

3) Select *Next* to 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.

TIP

There will not be any comparisons for C6+ individual components. There may be values in the Normalized column for hexane thru Decane, but this is based on the C6+ configuration entered in Stream Setup. For comparison purposes, use the components called heavies.

5) Select *Next* to verify heavy components 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 2nd peak from left that looks like two peaks is a composite peak of C2- and is not used in calculations.

7) Select *Next* to 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 1st peak on the left is a composite peak of C3+ and is not used in calculations.

9) Select *Next* to begin the process stream analysis. 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 unit to stabilize.

3) Select *Close* to complete the Start-up Wizard and return to PCCU's *Local Analyzer Operation* screen. If completed satisfactorily, the Start-up Wizard should not re-appear when connecting to unit. However, should the user like to review or make changes, they may re-enter the Wizard by selecting *NGC Start-up Wizard* from the Help drop-down menu.

3.6 Calibrating the NGC

The NGC is factory calibrated and should not require that a calibration be performed immediately. It is recommended 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. System defaults to stream 4 (cal stream), two purge cycles and three calibration cycles. When calibration is complete a thorough examination of the results should follow.

CAUTION

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 cal 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.
4) The calibration stream's UnNormalized total should be 6.5% (between 99.5% and 100.5%).

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

5) Carefully examine the calibration stream's Chrom-1 and Chrom-2 by clicking on the button. Look for unlabeled peaks and base line anomalies. Figure 3–5 and Figure 3–6 should be used as a guide.

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

6) Once the unit is running smoothly and is producing good chroms and all the peaks are labeled and eluting correctly, perform a save and restore procedure to update tfCold.

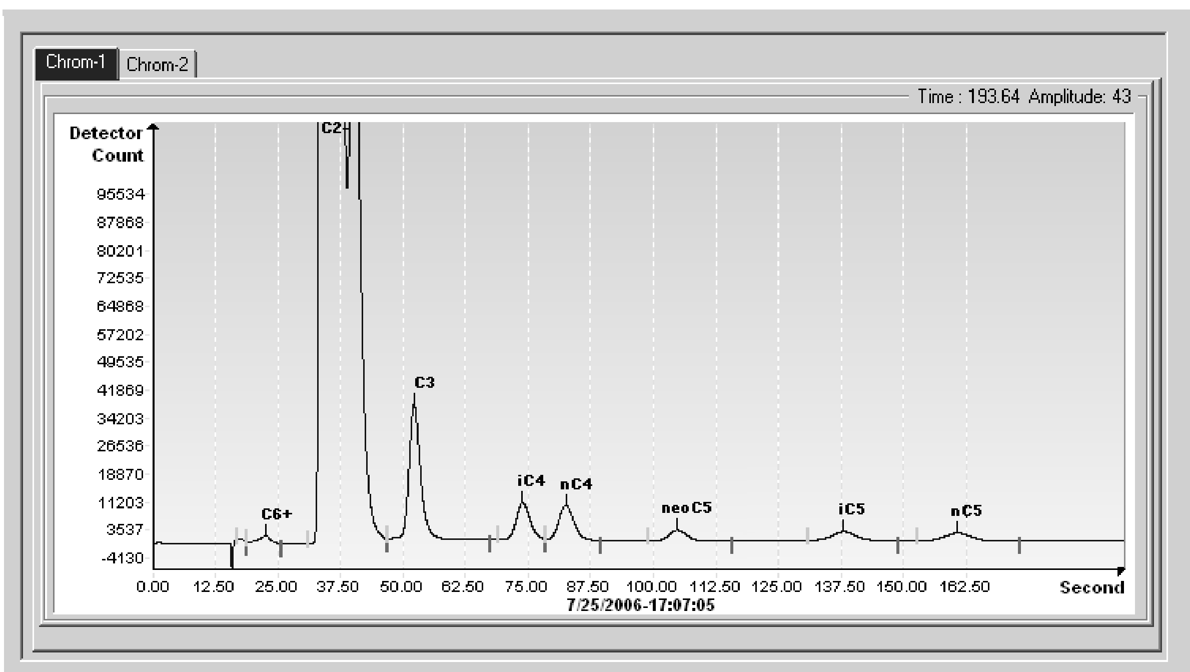


Figure 3–5 Typical Chromatograph for Chrom-1 (Heavies)

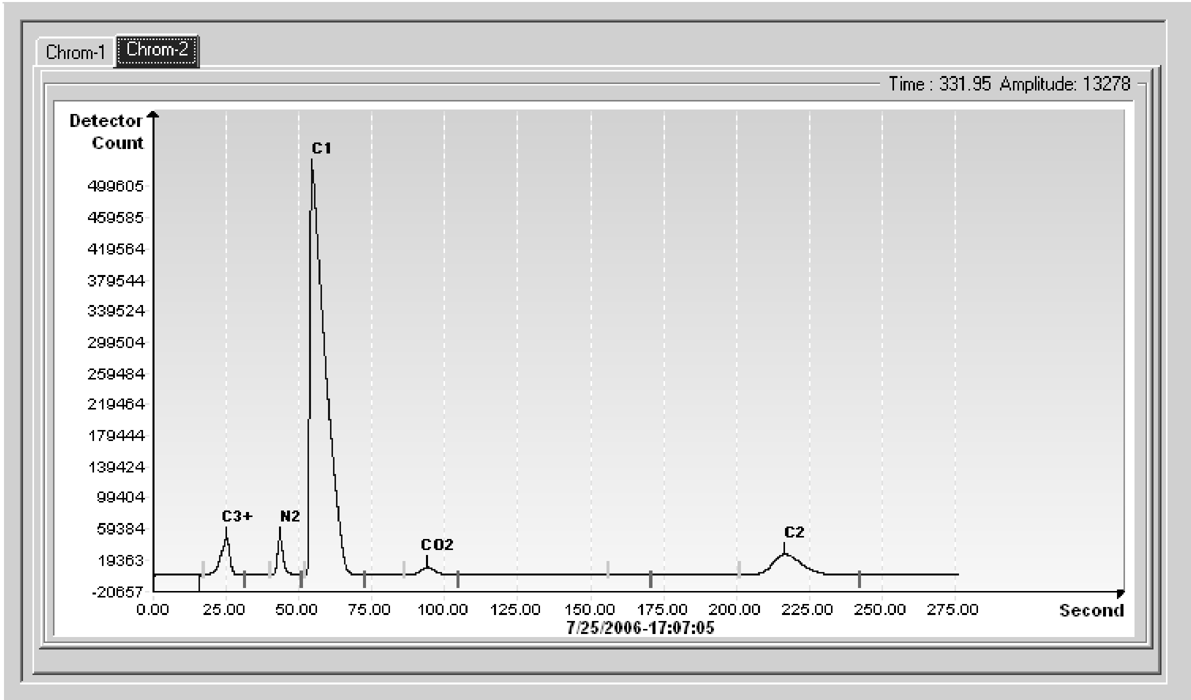


Figure 3–6 Typical Chromatograph for Chrom-2 (Lights)

3.7 Security System

The NGC Board has a bi-level security system built in. For the purpose of this manual, this is referred to as hardware security. When the NGC is accessed through PCCU32 or WINCCU Host software packages, either remotely or locally, there is a third 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 down for the hardware security system to be functional. The switch must be switched up to change the devices security code. Security codes are checked via remote communication whether the switch is on or off.

3.7.1 Security Code

The setup, as designed, has each user “log on” to the system with a unique user name (up to 25 alphanumeric digits) and 4-digit alpha-numeric password before connecting to the unit.

3.7.2 Hardware Security

The hardware security system is designed to have two levels of user access: 1) reading data files, read only access, and 2) sending application and configurations, read/write access.

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.

3.7.3 Software Security

The tri-level software security system is designed for the password administrator to set up the accounts and privileges for themselves as well as all other host software users. These privileges include being able to instantiate applications and make changes to the functionality of the NGC.

A second level of user access includes application editing and downloading files to a device. User access by default is restricted from modifying and downloading the application table or from downloading files to the device's TFData and TFCold drives but has all other user type privileges.

These default privileges can be edited by the administrator and consist of a user name (up to 25 alphanumeric digits) and a password (up to 25 alphanumeric digits).These are separate privileges and may be given individually or totally. See the help files in the host software package for more information.

TIP The NGC does not send an error message when the user tries to write an operation but does not have the proper hardware security code; it simply does not accept value changes.

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.

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

Table 3–3 Defaulted Alarm Definitions

Alarm Descriptions	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
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

Alarm Descriptions	Logic Type	Threshold Default	Severity
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

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4.0 MAINTENANCE

4.1 Overview

This chapter provides the user with maintenance information and instructions on how to remove and install NGC components. Performance of the recommended procedures maintains the unit in optimum operating condition, reduces system downtime and ensures accuracy of natural gas sample analysis.

It is recommended that 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. Perform all the recommended procedures as presented within this chapter. If through use additional procedures are developed, they should be included with those in existence.

Practical experience permits updating the maintenance procedures and associated schedules over time. This results in many procedures being performed on a routine basis before potential problem(s) result in a failure.

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.

4.1.1 Help

If technical assistance is required during performance of maintenance functions or if returning parts, the user should contact 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 for authorization number (RA). Affix this number to the outside of the return package.

Parts 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 the user removes the front or rear end caps, their hands can become coated with a black thread lubricant. If this happens, wash your hands before performing maintenance functions, using Go-Jo or an equivalent type hand cleanser. The lubricant MUST NOT come in contact with components. DO NOT wipe lubricant on clothing as it cannot be removed easily.

If enclosure needs more thread lubricant, use Vaseline.

4.2 Spare Part Components

The information in this section presents the user with the components (see Figure 4–1) 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.

4.2.1 Replacement Components

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

- Analytical module (12 or 24 VDC) with or without GC module (see Figure 4–2)
- GC module
- Digital controller assembly with display
- Termination panel
- Feed-through assembly without preheat (see Figure 4–3)
- Feed-through assembly with preheat (12 or 24 VDC)

4.2.2 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

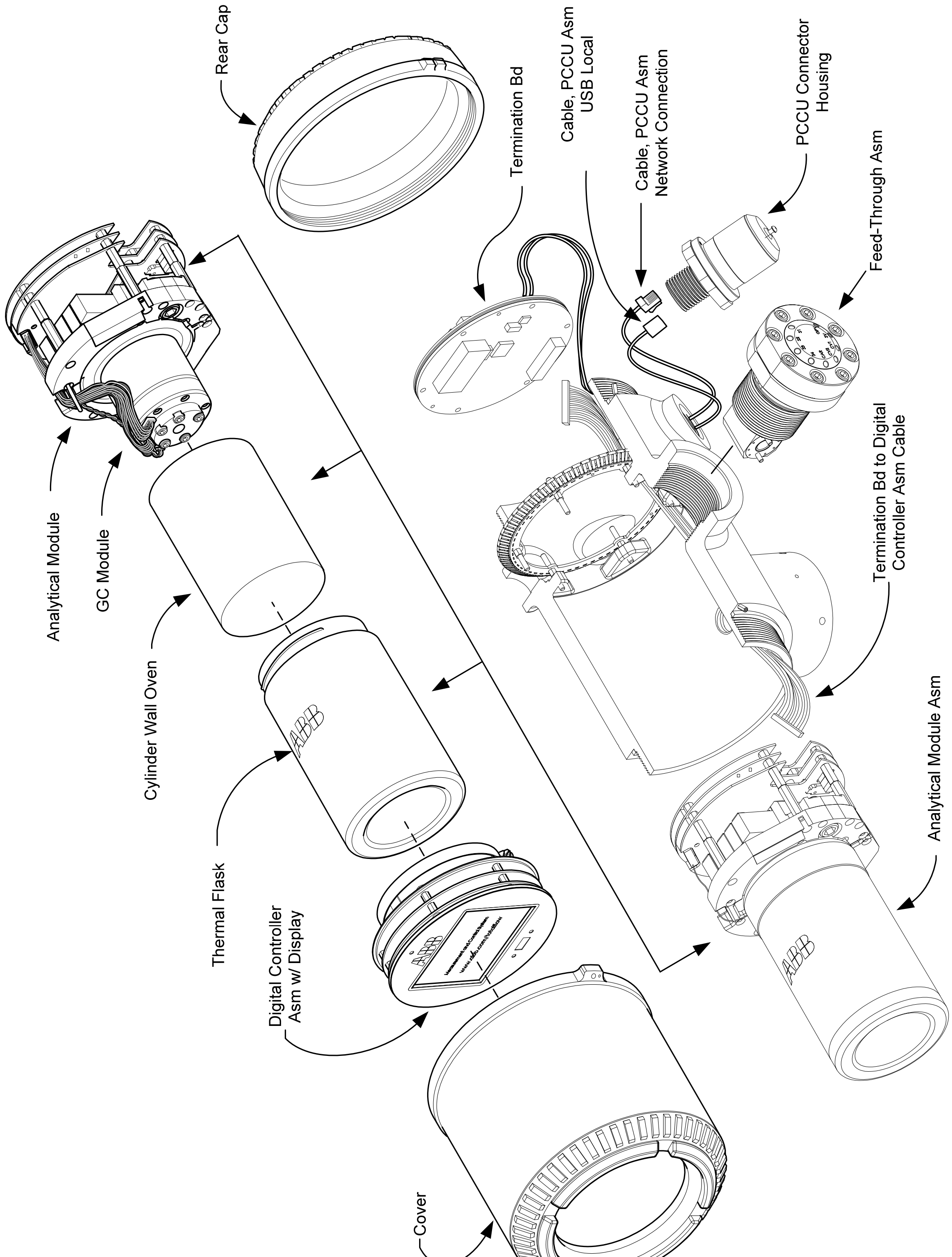

Figure 4–1 NGC8206 Overall View

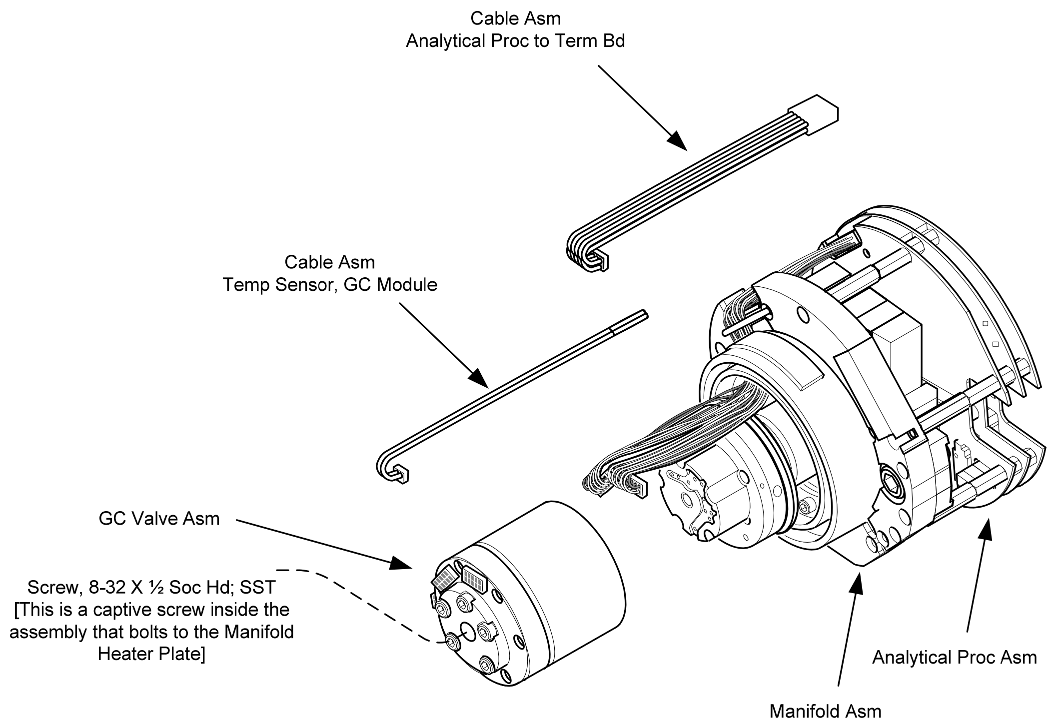

Figure 4–2 Analytical Module, Exploded

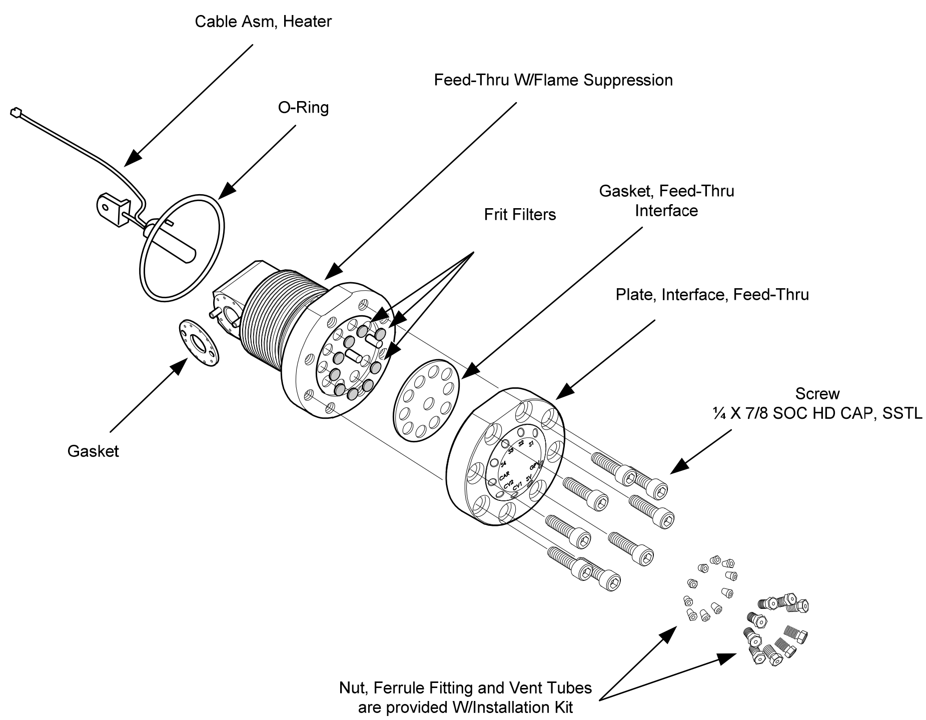

Figure 4–3 Feed Through Assembly, Exploded

4.2.3 Repair Time

ABB Totalflow has provided a recommended spares list for the NGC8206 product line. Consideration was given to the cost of the repair time and the cost of stocking the repair parts. The NGC8206's modular design is uniquely suited for quick repair times. All the modules are easily replaced in a short time. Below are listed four categories of repair times and the spares required to achieve those various repair times. Repair days are in work days not calendar days.

Table 4–1 Repair Time vs. Down Time

Repair Time	Requirements
No down time	If the application cannot allow for any down time, the user will need to consider having two units up and running. When one fails the user can simply switch to the backup unit and send the failed unit in for repair.
In less than 8 hours	If the user is required to have a down time of less than eight hours, the user will have to stock replacement parts on site. The repair parts required would depend on the variety of applications at the site. This would be a typical scenario, if the user has multiple units or applications at a single site.
In less than 48 hours	This category is for applications where the parts would be stocked at the factory. Over night delivery of the part would allow for repair the next day. This might be typical for a fixed application that could tolerate a 48 hour repair time.
In less than 120 hours	This category is suited for any application or mix of applications. Within five working days, the site can receive shipment of stocked or built-to-order parts.

4.2.4 Recommended Spares

Recommended spares are provided for each of these categories, depending upon whether there is a single or multiple unit at the site(s) and whether the applications are fixed applications (stocked at the factory). The user will need to balance the cost of the spares with the cost of the repair time. With the variety of options available, the user can manage the repair time for the units, as needed.

4.2.5 Customer Service

Customer service can be called out and may have the stocked applications available for replacement (depending upon usage by the individual on service calls). The scheduling for a call out is typically a week. As a result, maintenance contracts may need to be considered, if service personnel are needed in a more timely fashion. Phone support from the factory is available to help with diagnosis of the problem. Alarms from the unit are also a key to quick diagnosis and repair of any failure.

Table 4–2 Recommended Spare Parts

Part Description	Stock Application	
	1	>1
12 VDC Analytical Module Assy. w/o GC Module		1
12 VDC Analytical Module Assy. With GC Module	1	
24 VDC Analytical Module Assy. w/o GC Module		1
24 VDC Analytical Module Assy. With GC Module	1	
Cable between the Analog Processor and the Termination Board	1	1
Digital Controller Board & Display, Completed Assy.	1	1 per application
Digital Controller Board Assembly (Auxiliary unit with no display)	1	1 per application
Filter Frit for Feed-through Assembly	2	2
GC Module tested and characterized		1 per application
MMI Port RS-232	1	1
Ribbon Cable for connection between the Digital Controller and Termination Panel	1	1
Termination Panel	1	
USB Local MMI Port	1	1

4.3 Field Tool Kit

The recommended NGC maintenance tools are presented in Table 4–3 and are included in the optional field tool kit.

Table 4–3 Tool Requirements

Qty	-001	-002	Part Number	Description
1	●	●	2102304-001	Bag, ABB Nylon 11” x 6” Tool
1	●		1800683-001	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, ¼”
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

4.4 Visual Inspection

The NGC should be given an external visual examination on an established time period. 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: The unit must be in a vertical position and the mounting brackets tightened on the pipe. The wall mounting bracket must be securely affixed to the mounting wall.
- Carrier gas bottle mounting rack: The mounting rack should be tilted backward slightly to keep the bottles from falling forward.
- Bottles within mounting rack: The bottles must be securely strapped in the mounting rack.
- Bottle regulators: These must be tightened securely and checked for leaks.
- Pipe mounted sample probe: These must be securely mounted in the pipe meter run using an approved probe adapter.
- Stainless steel tubing connected between sample probe and NGC: These must not be bent or closed off. The connections must be tight. Such conditions impede the 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 runs to Div 2 or non-hazardous areas must be sealed per NEC codes.

4.5 Backing Up Configuration Files (Save)

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 the data and allows for a re-start of the unit without the problems of re-configuring the NGC should anything arise.

Although there are save buttons in the *Entry Mode* screens which allows the user to back up entry mode data items, a complete system backup is only accomplished by using the Save and Restore Utility. When using this utility to backup files, the user should also download the files to the 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* button on the toolbar.

3) In the *Save and Restore* window, click the *Save Station Files* button.

4) When the *Save Station Files* window appears, verify the default name and path for the files. Click *OK*. This will save the "TFData" 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 the user selects ‘Yes’, 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

The *Restore* function enables the user to follow various maintenance procedures or download configuration files to the flow computer.

If prior to performing maintenance, the *Save Configuration Files* was used, these files were downloaded to the user’s laptop 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 for a re-start of the unit without the problems of re-configuring the NGC should anything 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 or by clicking the *Save and Restore Utility* button on the toolbar.
2) In the *Save and Restore* window, click the *Restore Station Files* button.
3) When the Restore Station Files window appears, verify the default name and path for the files. Click *OK.* This will restore the files to the “TFCold” drive.
4) Perform a cold start following the instructions in the Reset Procedures section and 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 or cold.

4.7.1 Warm Start Instructions

A warm start occurs when the main power is removed and 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.

1) Collect data from the unit.
2) Using *Lithium Battery Status* instructions, verify the battery status is “OK” before proceeding.

3) Gain access to the rear termination panel on the NGC by loosening the countersunk hex socket locking set screw in the rear end cap using a 1/16" hex wrench and then unscrewing 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.

4) To warm start the unit, depress the S1 reset switch on the termination panel.

   Or, to remove the NGC from service, disconnect the power connector J1 from the board.

5) To place NGC in service, return the power connection J1 to the termination panel.

4.7.2 Cold Start 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.

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

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

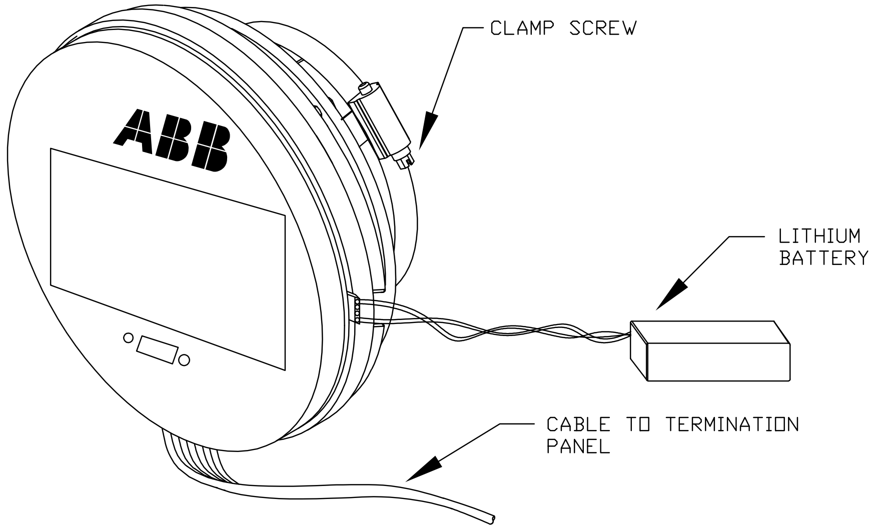

Figure 4–4 Digital Controller Complete Assembly

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 “TFData” 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) Shut-down 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 unit into "Boot Loader" mode.

4) Force the NGC's operating system into "Boot Loader".

5) a) Press the *Reset* button on the NGC's termination panel.

b) Wait about eight seconds until the *Initializing System* screen appears.

6) c) Press the *Reset* button a second time.

d) 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\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 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 the user is directed to these instructions from another set of instructions, please return to them when the status has been verified.

4.9.1 Instructions

1) While in the PCCU *Analyzer Operation s*creen, select *Station Setup* from the buttons across the top of the screen.

2) Select the value beside lithium battery status.

3) If *Lithium Battery Status* value reads "OK", then power may be removed from the unit without causing a "cold start".

4) If *Lithium Battery Status* reads "Low Voltage or Not Connected", then the lithium battery should be connected or replaced prior to removing power from the unit. See instructions later in the chapter, "*Replacing the Lithium Battery*".

4.10 Changing NGC Clock

When measurement streams are instantiated on the PGC, changing the clock could affect the time when log period entries are made. To protect 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.

4.10.1 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 p.m. and the clock is changed to 4:05 p.m. of the same day, the daily flow record is the same. The entry reflects the accumulation over a 70 minute time period (15 minutes plus 55 minutes).

4.10.2 Forward Clock Change Crossing a Log Period Boundary

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

4.10.3 Backward Clock Change Crossing a Log Period Boundary

This forces a log period entry for part of the log period that has accumulated since the 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 p.m. and the clock is changed to 4:55 p.m. of the same day, the log period record entry reflects only a 5 minute average accumulation (5:00 to 5:05). Then a new flow record is written and this log period is based on a 5 minute accumulation (4:55 to 5:00).

FYI

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

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

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 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, allowing 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 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 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 the user has been directed here from another procedure, return back to the corresponding procedure when disassembly is complete.

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 using a 1/16” hex wrench then unscrewing the end cap.

3) Using a flat blade screwdriver, loosen the screw in the mounting clamp.

4) Unplug the ground cable from the digital controller assembly.

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

CAUTION DO NOT remove the NGC board mounted lithium battery or the 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, being careful to align the display screen horizontally before tightening screw.

4.13 Replacing Digital Controller Complete Assembly

Access to the digital controller assembly is gained by removing the front mounted digital controller assembly from the analytical module.

CAUTION 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) Disconnect or remove the 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 in this chapter entitled, *Removing Digital Controller Assembly*, remove assembly.

7) Unplug the termination panel to digital controller assembly flat ribbon cable, leaving the lithium battery connected.

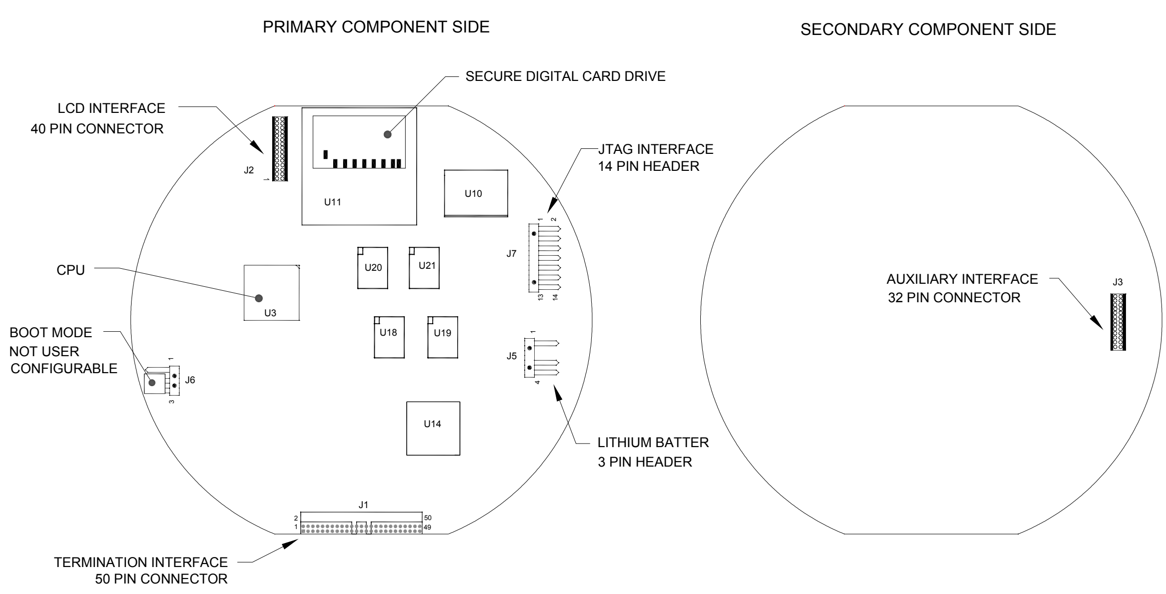

Figure 4–5 Digital Controller Board

8) To reassemble using the replacement assembly, perform steps 6–7 in reverse order, being careful to align the display screen before tightening. Check the lithium battery plug for proper installation on the connector.

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. The plug is "keyed"; do not force the plug into the connector.

9) Re-plug the ground cable onto the new assembly.

10) Once assembled, apply power to the NGC (Step 5).

11) Adjust the contrast potentiometer R18 for optimum display. To adjust the display contrast, use an extra small Phillips point screwdriver to turn the 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.

CAUTION

For the 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.

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 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.

4.14 Replacing Analytical Module

This section presents the procedures for removal and installation of the analytical module. The module is a completely self-contained unit and is part of the NGC8200. Read through all procedural steps before beginning disassembly.

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

CAUTION

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 be 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.

TIP

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

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 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 the 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 then unscrewing 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 the cable connections. 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 4–6) holding the analytical module in place until the module can be slowly lifted from the enclosure, taking care to not pull or stress wires attached to the rear of the assembly.

11) Detach the analytical module rear face jack J1 and J4, if the auxiliary heater is installed (see Figure 4–7).

12) Set 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 the position to *Normal*.

15) Insert the mounting screw into the analytical module.

16) Holding the new analytical module at the opening of the enclosure, reconnect jack J1 and J4, if the auxiliary heater is installed (see Figure 4–7).

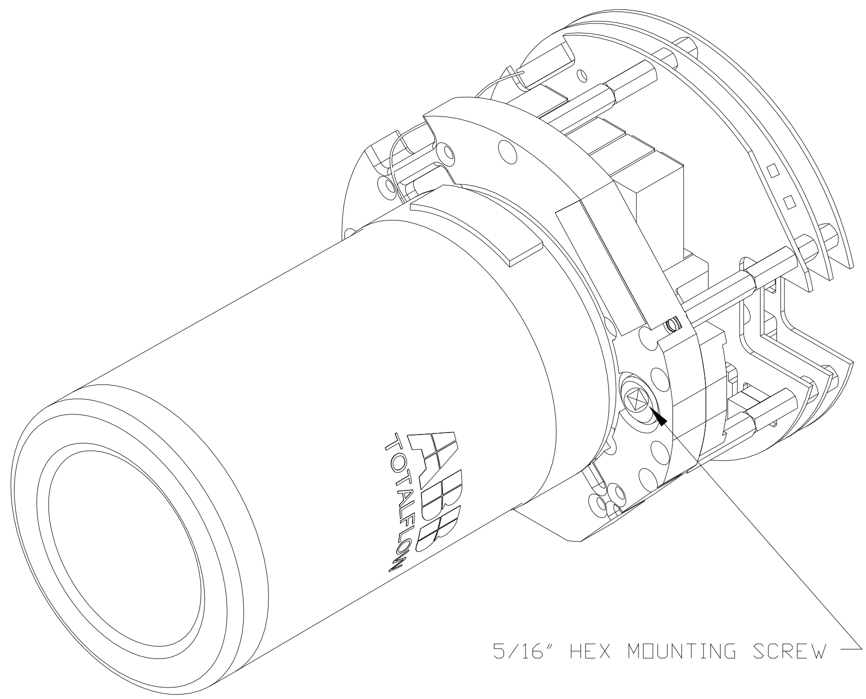

Figure 4–6 Analytical Module

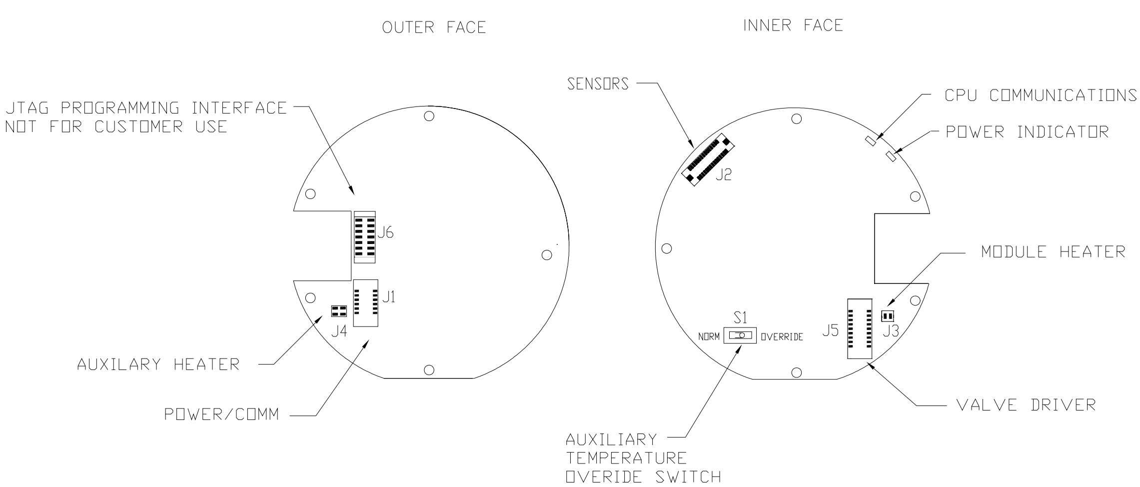

Figure 4–7 Analytical Processor Board

17) Carefully insert the module into the enclosure, rotating the module to ensure the rear components clear the manifold interface on the inside area of the feed-through assembly. The feed-through manifold interface and the 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 the 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. The plug is “keyed”; do not force the plug into the connector.

21) Insert the lithium battery pack into the enclosure between the 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 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 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.

4.15 Replacing GC Module

This section presents the procedures for the removal and installation of the GC module. The 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 module is appropriately rated for the system voltage. Compare the module voltage to the ID tag located on the side of the enclosure.

CAUTION

When the GC module is removed, the module should be placed on a clean, dirt free work surface. 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 the gas sample flow line openings be free of foreign contaminants.

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 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.

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 then unscrewing 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. If so, move to step 10.

9) Carefully unplug the cable to the termination panel, leaving the lithium battery plugged in, and set the digital controller assembly aside on a clean, lint-free surface.

10) Unscrew the thermal flask counterclockwise (see Figure 4–8). When loose, lift the flask from the unit. Set aside.

11) Unscrew the oven wall counterclockwise (oven wall may be hot). When loose, lift the cylinder from the GC module. Set aside.

12) Using the extraction tool, remove the cable connectors from J1, J2 and J3 jacks. DO NOT pull the connectors from the board by 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.

14) Verify that the 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 that the key holes line up and the module rests on the base. The unit should not turn once it is seated correctly.

16) When the GC module is in place, tighten the mounting screw.

17) Carefully restore the cable connectors to J1, J2 and J3 jacks, being careful to not press against the wires attached to the connector head.

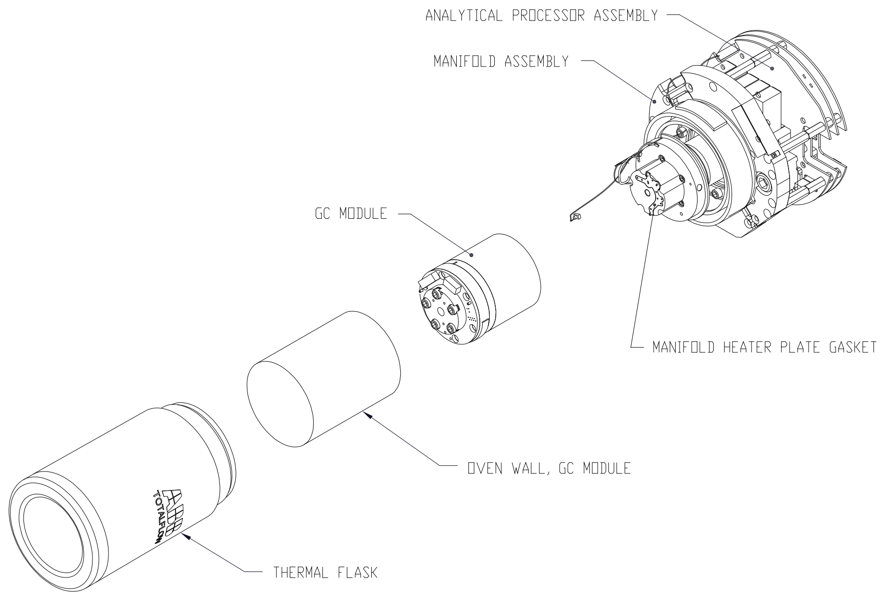

Figure 4–8 GC Module, Exploded View

18) Replace the oven wall onto the GC module, being careful to not pinch or bind any of the cables. When fully on, turn the oven wall clockwise to tighten.

19) Replace the thermal flask over the GC module. When the flask reaches the 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 and then into the digital controller assembly, if disconnected.

CAUTION 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 the plug. Plug is "keyed"; do not force plug into the connector.

22) Insert the lithium battery pack into the enclosure between the enclosure and the 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).

TIP 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 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 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.

4.16 Replacing Termination Panel

This section presents the procedures for removal and installation of the power termination panel. This panel is located in the 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 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) 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, and then unscrewing 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 the NGC unit externally, or remove the J1 connector from the termination panel (see Figure 4–9).

7) Disconnect all connectors from board J2 digital I/O, J8 and J10 serial ports, J3 Ethernet and J6 USB client connectors. Move the wires out of the way.

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, being careful of the wires fed into the enclosure through the hubs and the 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 the analytical processor J12. Set panel aside.

CAUTION

Please note that the termination panel to the 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 the plug. The plug is “keyed”; do not force plug into the connector.

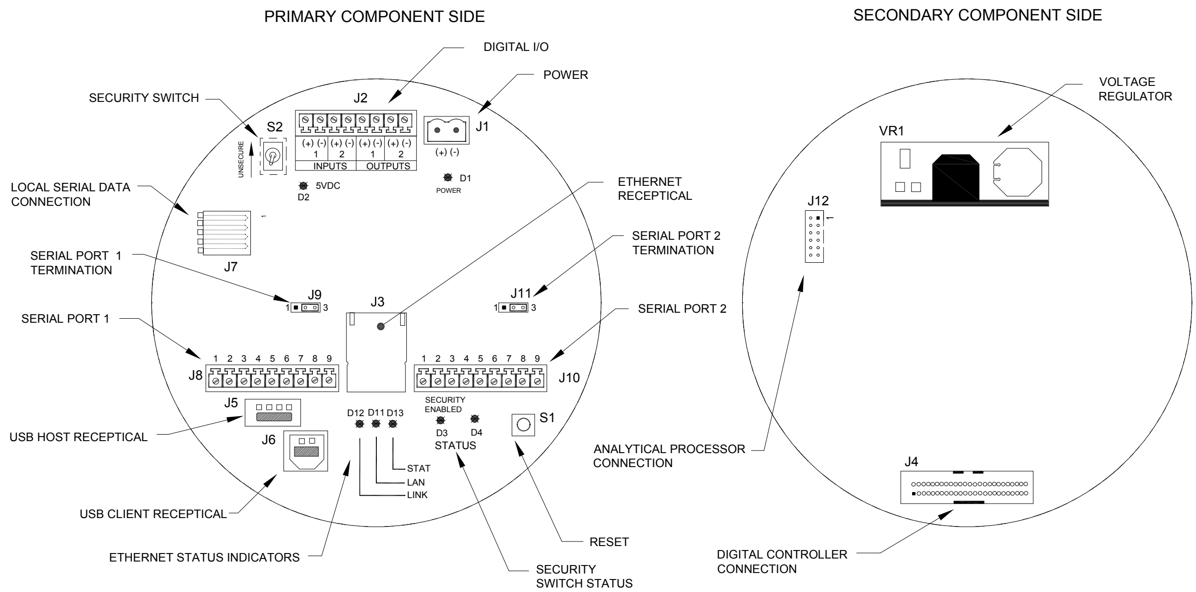

Figure 4–9 Termination Panel

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 the termination panel into the enclosure being careful to not pinch the wires between the mounting stud and the 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 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 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.

4.17 Replacing Feed-through Assembly

This section presents the procedures for the removal and installation of the feed-through assembly. This assembly is located on the side of the NGC. Read through all the procedural steps before removing the assembly.

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

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 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 the 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, then unscrewing 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 the cable connections. If this is the case, 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, taking care to not pull the wires attached to the rear of the assembly.

11) Detach the analytical module rear face jack J1 and J4, if the auxiliary heater is installed.

12) Set the module on a clean, lint-free surface.

13) Using a ¼" open end wrench, loosen the Valco nut and remove the input line. Repeat for all the 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 o-ring and manifold gasket supplied with new feed-through assembly (see Figure 4–10).

17) Carefully apply the sealing thread lubricant to the threads on the feed-through assembly, being extremely careful to not contaminate the feed-through manifold and gasket.

18) Verify the O-ring and feed-through manifold gasket are in place and not damaged (see Figure 4–10).

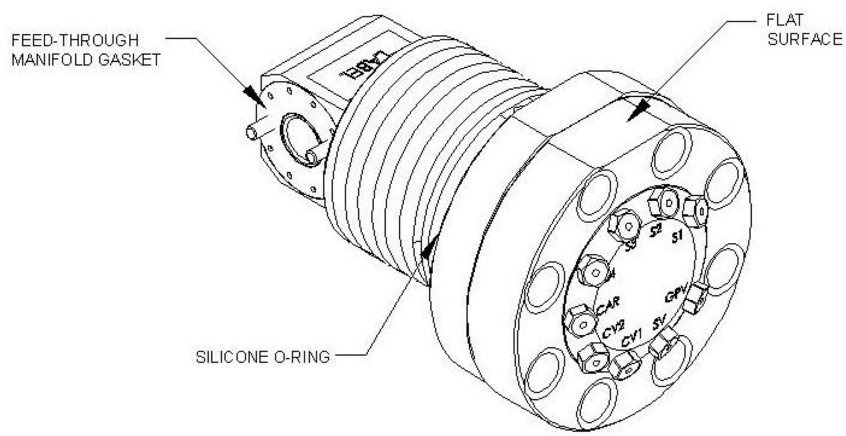

Figure 4–10 Feed-Through Assembly

19) Insert the replacement feed-through assembly through the opening and screw in clockwise until completely screwed in but not tight.

20) Reverse the direction, unscrewing the feed-through assembly counter clockwise a minimum of 1/2 rotation but no more than 1 1/2 rotations, stopping when the flat edge is exactly 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 jack J1 and J4, if the auxiliary heater is installed (see Figure 4–7).

24) Carefully insert the module into the enclosure, rotating the module to ensure the 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.

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 the digital controller ribbon cable and 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. The plug is "keyed"; do not force the plug into the connector.

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

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

30) Reinstall the front and rear end caps.

FYI

Please note that since the 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 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.

4.18 Replacing Lithium Battery

This section presents the procedures for the removal and installation of a new lithium battery. 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 the boards. Static electricity can potentially damage board components, voiding any warranty.

4) 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 and then unscrewing the end cap.

5) Unplug the lithium battery connector from the J5 receptacle on the digital controller board (see Figure 4–11).

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 the thermal flask.

8) Using *Lithium Battery Status* instructions, verify that the battery status is ok before proceeding.

9) Reinstall the front end cap.

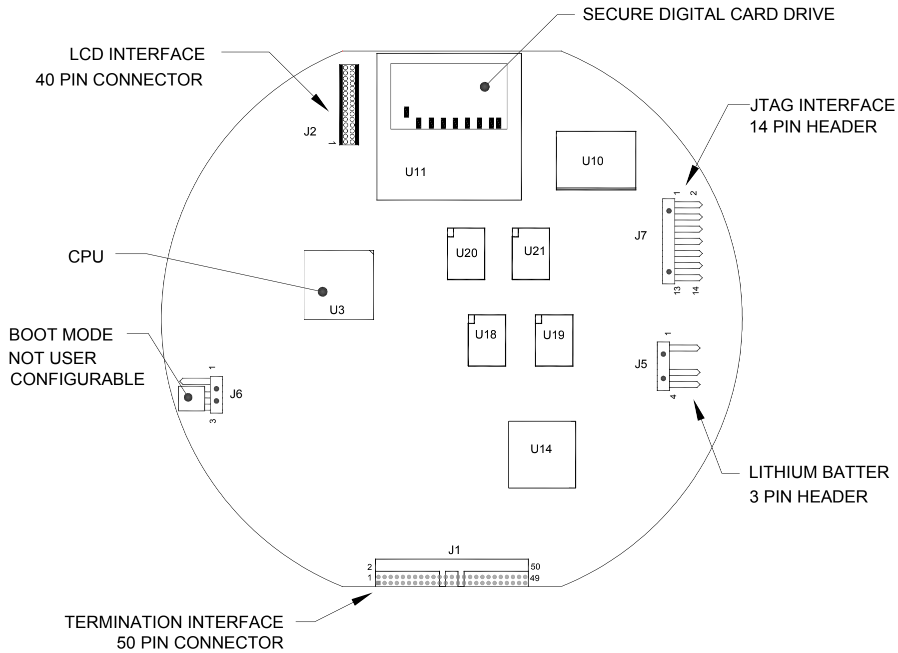

Figure 4–11 Primary Component Side Digital Controller Board

4.19 Replacing Frit Filters

Several reasons exist for replacing the frit filters from a scheduled maintenance procedure to decrease 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 measure, the user should remove the sample input lines and use compressed air to clear the pathway. For the purposes of this manual, 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 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 the sample streams, calibration gas and carrier gas.

5) Using a 7/32” hex wrench, loosen and remove all 8–¼” hex socket screws (see Figure 4–12).

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 the 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, move to step 8.

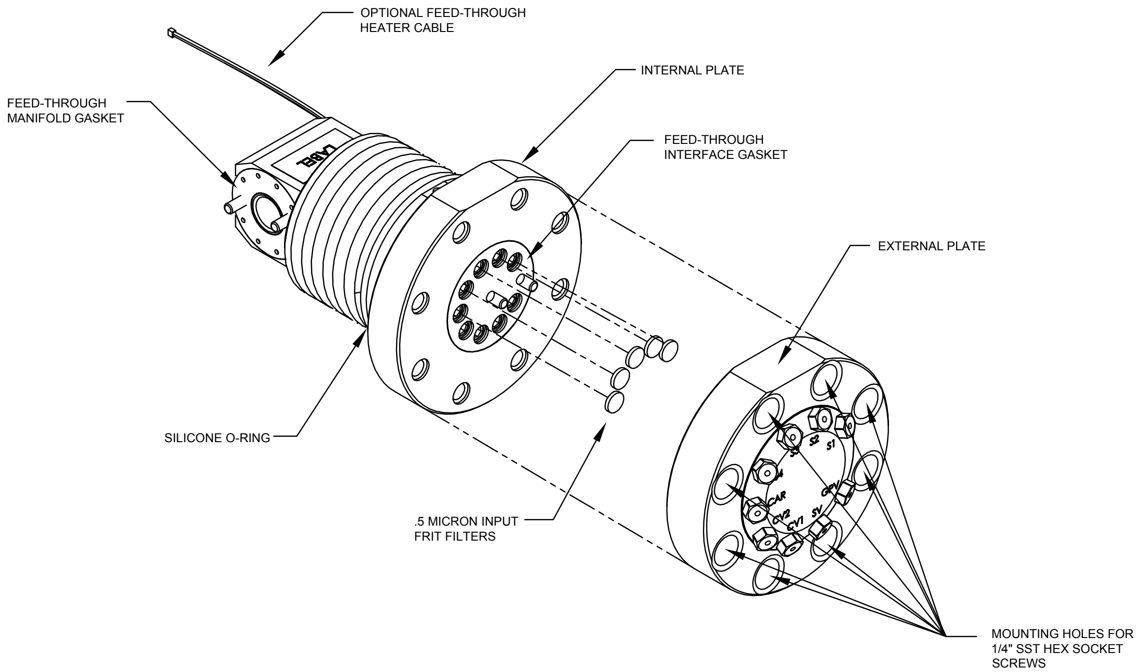

Figure 4–12 Feed-through Assembly, Exploded View

8) Using a ¼” open end wrench, loosen the Valco nut, and remove the input line. Repeat for all sample, carrier and calibration gas lines.

9) Remove the 8–¼” hex socket mounting screws.

10) Remove the used filters from the filter sockets. Using an edged instrument or 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, move 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 8–¼” mounting screws, using a star pattern when tightening the screws.

15) If the sample, carrier and calibration gas lines were removed, purge the 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 4–12), 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 the sample streams, calibration gas and carrier gas.

5) Using a 7/32” hex wrench, loosen and remove all 8–¼” 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 ¼” open end wrench, loosen the Valco nut and remove the input line. Repeat for all sample, carrier and calibration gas lines.

9) Remove the 8–¼” 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 the 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 8–¼” mounting screws, using a star pattern when tightening the screws.

14) If the 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.

4.21 Replacing Feed-through Manifold Gasket

Should the feed-through manifold gasket require replacement (see Figure 4–12), 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.

4.21.1 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 the 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.

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 then unscrewing the end cap.
8) Following the instructions detailed previously in this chapter entitled, *Digital Controller Assembly Mounting Bracket*, remove assembly. If weather/circumstances permit, the digital controller assembly may be suspended by the cables to eliminate stress on cable connections. If this is the case, move to step 10.
9) Carefully unplug the cable to the termination panel, leaving the lithium battery plugged in, and 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, taking care to not pull the wires attached to the rear of the assembly.
11) Detach analytical module rear face jack J1 and J4 if 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 port holes.
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 the auxiliary heater is installed (see Figure 4–7).
16) Carefully insert the module into the enclosure, rotating the module to ensure the rear components clear the manifold interface on the inside area of the feed-through assembly. The feed-through manifold interface and the 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.

CAUTION 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. The plug is keyed; do not force the plug into the connector.

20) Insert the lithium battery pack into the enclosure, between the enclosure and the thermal flask.

21) Once the unit is reassembled, apply power to the NGC8201 (Step 6).

22) Reinstall the front and rear end caps.

FYI Please note that since power was removed from this unit, the NGC8201 will perform startup diagnostics and stabilize. If the user has disabled the startup diagnostics, it should be enabled and power cycled to the unit. If the power has been withheld from the unit for an unknown or lengthy period of time, a complete startup 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. 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 the 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.

CAUTION As with all electronic components, caution should be used when handling the 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 and then unscrewing the end cap.

8) Following the instructions detailed previously in this chapter entitled, Removing Digital Controller Assembly, remove the assembly (see *Figure* 4–4). If weather/circumstances permit, the digital controller assembly may be suspended by the cables to eliminate stress on the cable connections; the user may skip to step 10.

9) Carefully unplug the cable to the termination panel, leaving the lithium battery plugged in, and 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, taking care to not pull the wires attached to the rear of the assembly (see Figure 4–7).

11) Detach the analytical module rear face jack J1 and J4, if the 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 the orientation by viewing the keyed receptacle on the termination panel and cable. Insert the plug into the 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 is 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 jack J1 and J4, if the auxiliary heater is installed (see Figure 4–6).

18) Carefully insert the module into the enclosure, rotating the module to ensure that the 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 the proper alignment.

19) When the analytical module is in place, tighten the mounting screw.

20) Reassemble the digital controller assembly using the instructions previously covered in this chapter.

21) Plug the termination panel into the digital controller ribbon cable and then 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 the plug. The plug is “keyed”; do not force plug into connector.

22) Insert the lithium battery pack is 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 the 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 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.

4.23 Replacing Analytical Processor to Termination Panel Cable

Should the cable connecting the analytical processor to the termination panel require replacement, use the following instructions.

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 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) Disconnect or remove the power from the NGC unit externally, or remove the J1 connector from the termination panel.

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

6) Following the instructions detailed previously in this chapter entitled, *Replacing Termination Panel*, remove the panel and unplug the cable. Reaching into the enclosure, unplug the analytical processor to the termination panel cable from the analytical processor assembly (see Figure 4–7).

7) Using the replacement cable, insert it 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 4–9).

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 the cable should plug onto pin 50, the right side of the plug. The 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 the 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.

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5.0 TROUBLESHOOTING

5.1 Overview

As an aid to troubleshooting the NGC, 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.

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 enclosure, the user will need to refer to the manufacturer's procedures for troubleshooting their equipment.

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.

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 most likely needed to begin and skip to that section.

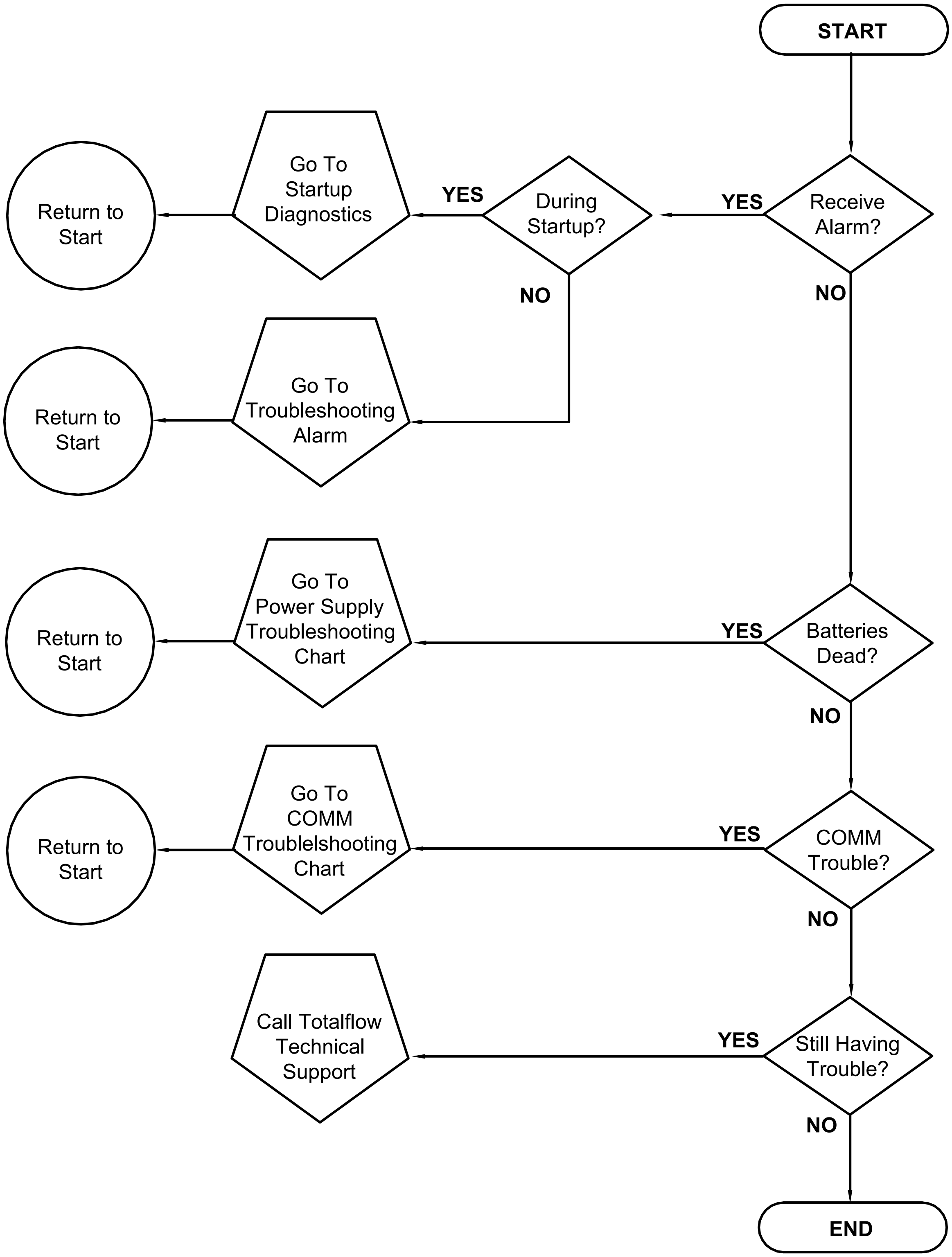

Figure 5–1 Troubleshooting Flowchart

5.2 Start-Up Diagnostic Troubleshooting

This section focuses on determining what has caused an alarm during start-up diagnostics. The Totalflow® NGC8200 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 4 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 NGC8200 prior to shipment, and each unit is factory calibrated using our 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 description 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.

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

5.2.2 Carrier Pressure Regulator Test

If Col 1 or Col 2 carrier pressure test failed, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour to other procedures, and, when complete, the user 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.

Status	Description
Low Reg Pressure	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 the bottle to the NGC is plugged, etc.
Flow Blocked	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.
Pressure Reg Test	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.
Flow Test	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
Failed	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 the 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 the next step.

3) Perform the column vent pressure test procedure in this chapter for both column vent 1 and column vent 2. If either test failed, proceed to the next step.

4) Using the *Replacing Analytical Module Assembly* instructions in *Chapter 4 - Maintenance*, replace the analytical module assembly.

CAUTION

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

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

5.2.3 Oven Temperature Test

If the oven 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) Verify that the cable is plugged in and in good repair. If the cable is unplugged, plug-in the cable.

Otherwise, continue to the next step.

2) Verify that the analytical processor to GC module cable is plugged in and in good repair. If the cable is unplugged , reinstall plug. If cable appears to be damaged, continue to the next step.

3) Using the *Replacing Analytical Module Assembly* instructions in *Chapter 4-Maintenance*, replace the analytical module assembly.

CAUTION

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: 1-918-338-4880

5.2.4 Processor Control Test

If Col 1 or Col 2 carrier pressure test failed, or the oven temperature test failed, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour to other procedures, and when complete, the user 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 both of the column carrier pressure tests, it could be a missing or failed gasket. If the failure is in the oven 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 the disassembly/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, and re-start the diagnostics. If 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.

Status	Description
Failed Initial Pressure	Failed the Initial Pressure test.
Failed Resting Pressure	Failed the Resting Pressure test.
Failed No Pressure	Failed the Maximum Pressure test.
Failed Holding Pressure	Failed the Holding Pressure test.
Failed Flowing Pressure	Failed the Flowing Pressure test.
Failed Ending Pressure	Failed the Ending Pressure test.
Waiting	This will be displayed by streams waiting to be tested. The tests are run sequentially.

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 the sample vent pressure test procedure, found in this chapter, for the sample vent. If the test failed, proceed to the next step.

2) Perform the feed-through assembly blockage test on the sample vent (SV). If the test fails, replace the feed-through assembly with new or refurbished assembly.

Otherwise, continue to the next step.

CAUTION

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: 1-918-338-4880

3) Using the *Analytical Module Assembly* instructions in *Chapter 4-Maintenance*, replace the analytical module assembly.

4) 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® NGC8200 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 the purposes of troubleshooting. Please see the PCCU32 help files for more information regarding these.

Table 5–1 NGC8200 Alarms

Description	Enable	Type	Severity
Pressure Regulator 1	Yes	GT	Fault
Pressure Regulator 2	Yes	GT	Fault
Sample Pressure	Yes	GT	Fault
Oven 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 Ambient Temp	Yes	GT	Warning
Analog Power Supply	Yes	GT	Warning
Low Carrier Gas Bottle (DI1)	Yes	LT	Warning
Low Cal Gas Bottle (DI2)	Yes	LT	Warning
GCM 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
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

5.3.1 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

Table 5–2 Alarm Severity

Type	Definition
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 may occur from time to time and want to know when it happens.
Warning	Indicates that an alarm exists, but typically is not critical but may indicate or provide unexpected results.
Fault	Indicates that a malfunction exists that may affect the operation of the unit and most likely will provide unexpected results. The fault will keep any affected streams from having their data updated. However, a fault would not stop a scheduled or manually initiated calibration from occurring, and, if the calibration corrects the alarm condition, the alarm will be cleared.
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 he/she wants to stop all stream data from being updated, should not use this category of alarm.

5.3.3 Pressure Regulator 1 or 2 Alarm

If the pressure regulator 1 or pressure regulator 2 alarm is in fault status, the following procedure will step the user through the troubleshooting process. On occasion, these instructions may detour to other procedures, and, when complete, the user 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 to 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 the low carrier gas bottle warning is also present; otherwise, continue to next step.

If the low carrier gas bottle warning is present, replace the carrier gas bottle; otherwise, continue to the next step.

2) Verify the carrier gas bottle pressure is above 90 PSIG. If the pressure is below 90 PSIG, replace the carrier gas bottle.

Otherwise, continue to the next step.

3) Verify the carrier gas bottle pressure regulator set point is 90 PSIG. If not, correct the set point to 90 PSIG.

Otherwise, continue to the next step.

4) Verify the column vent 1 (CV1) and 2 (CV2), sample vent (SV) and gauge port vent (GPV) are open and unobstructed.

5) Check the sampling system for leaks and tubing restrictions. Repair the leak or restriction, if found. Otherwise, continue to the next step.

6) Perform start-up diagnostics.

7) If the carrier pressure regulator 1 and 2 tests both pass, continue to the next step.

8) Perform *Column Vent Pressure Test* procedure, found in this chapter, for both column vent 1 and column vent 2. If either test failed, proceed to the next step.

9) Perform *Feed-through Assembly Blockage Test* procedure, found in this chapter, on column vent 1 (CV1) and column vent 2 (CV2). If the test fails, replace the feed-through assembly with a new or refurbished assembly.

Otherwise, continue to the next step.

CAUTION

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: 1-918-338-4880

10) Using the *Replacing Analytical Module* instructions in *Chapter-4 Maintenance*, replace the analytical module assembly.

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

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 to other procedures, and, when complete, should return the user 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 the lo bottle calibration gas warning is also present; otherwise, continue to next step.

If the lo bottle calibration gas warning is present, replace the calibration gas bottle; otherwise, continue to the next step.

2) Verify the calibration gas bottle pressure is above 15 PSIG. If the pressure is below 15 PSIG, replace the calibration gas bottle. Otherwise, continue to next step.

3) Verify the calibration gas bottle pressure regulator set point is 15 PSIG. If not, correct the set point to 15 PSIG. Otherwise, continue to next step.

4) Verify the sample vent is open and unobstructed.

5) Perform *Sample Vent Pressure Test*, found in this chapter. If the test failed, continue to the next step; otherwise, skip to step 7.

6) Perform the *Feed-through Assembly Blockage Test* found in this chapter, on the sample vent (SV). If the test fails, replace the feed-through assembly.

Otherwise, continue to next step.

7) Check the sampling system for leaks and tubing restrictions. Repair the leak or restriction, if found. Otherwise, continue to next step.

8) Perform start-up diagnostics. If the stream test fails, continue to the next step.

9) Follow *Replacing Frit Filters* instructions in *Chapter 4-Maintenance*, verify filters are clean and free of obstructions. If needed, replace filters.

CAUTION

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: 1-918-338-4880

10) Using the *Analytical Module Assembly* instructions in *Chapter 4-Maintenance*, replace the analytical module assembly.

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

5.3.5 Oven Temperature Error Alarm

If the oven temperature 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 the 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. Using the *Analytical Module Assembly* instructions in *Chapter 4-Maintenance*, replace the analytical module assembly.

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

If 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 and run chroms. This can also be caused if the digital and analytical board moves out of synchronization.

5.3.6.2 Instructions

1) Check the sampling system for leaks, tubing restrictions and incorrect pressure settings. Repair the leak or restriction, or adjust the pressure setting, if found; otherwise, continue to next step.

2) Place the NGC in hold, allow ten minutes (approximately two cycles) to lapse and then run a single cycle. If the alarm reappears, continue to the next step.

3) The unit should still be in hold. Manually enable all streams.

4) Perform start-up diagnostics.

If the stream test fails, continue to the next step.

5) Perform a warm start.

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 the 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 the alarms continue to register, perform a warm start.

3) When the 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.

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 the 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 *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 the peaks are not correctly labeled and integrated, continue to the next step.

   Otherwise, skip to step 5.
4) In the *Peak Find* screen, *Run 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 and 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 the calibration un-normalized 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 un-normalized 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 an error exists, make corrections and send the setup when complete.
3) Under *Stream Setup*, *Alarm Definitions*, locate the calibration un-normalized error alarm and set 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 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.

7) Select *Peak Find* from the *Analyzer Operation* screen. Ensure that *Automatic* is check marked and 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 un-normalized total should be within ±.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 *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 the 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 *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 the peaks are correctly labeled and integrated. If the peaks are correctly labeled and integrated, return the 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.

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.

5.3.12 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, the user should return to these procedures to continue.

5.3.12.1 Description

These alarms are indicative of a change to the response factor 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.

5.3.12.2 Instructions

1) Verify the calibration blend concentrations to calibration blend concentrations listed on the *Calibration Setup* screen. If the 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 *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 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.

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.

2) 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 module, as needed.

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: 1-918-338-4880

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 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 Instruction

1) Check the power supply to termination panel, following instructions later in this chapter, *Termination Panel Supply Voltage Test*. If the test fails, restore the power supply to 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 the 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 the threshold.

2) If the threshold is above the current bottle PSIG, replace the carrier gas bottle.

3) If the threshold is below the current bottle PSIG, verify the regulator is functioning properly.

4) Perform the *Abnormal Calibration Gas Depletion* procedure, found in this chapter. If the procedure fails to locate the problem, contact Totalflow technical support following the procedure in the *Introduction* section of this manual.

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 the 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 the pressure drops below the threshold.

2) If the threshold is above the current bottle PSIG, replace the calibration gas bottle.

3) If the threshold is below the current bottle PSIG, verify the regulator is functioning properly.

4) Perform the *Abnormal Calibration Gas Depletion* procedure, found in this chapter. If the procedure fails to locate the problem, contact Totalflow technical support following the procedure in the *Introduction* section of this manual.

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 the 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.

If alarms continue to register, call Totalflow technical support.

5.3.18 Bad Bead Alarm

If the 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 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 the 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 the pressure is below 90 PSIG, replace the carrier gas bottle.

Otherwise, continue to the 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 the 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 such as a blocked vent tube, too short bleed cycle, stream test is in auto, etc.

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 the sample pressure test.

3) Verify the sample bleed time is set greater than one 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 the processor being overloaded. An occasional spike in 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 getting full. The recommended files size for the 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 the resources from the PCCU *Entry* screen to check the 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 TFData file resource becoming full. The recommended files size for TFData 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 the resources from the PCCU *Entry* screen to check the 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 the 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 the 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* from the *Analyzer Operation* screen. Ensure that *Automatic* is check marked and then select *Run Auto PF*. This procedure will require approximately 45 minutes.

4) Verify that peaks are correctly labeled and integrated. Refer to Figure 3–5 and Figure 3–6 for comparison. On chrom 1, NC5 peak should elute around 160 seconds. On chrom 2, C2 peak should elute at approximately 220 seconds. If peaks are correctly labeled and integrated, return the unit to operation, and continue to the next step; otherwise, contact Totalflow technical support.

5) Allow the unit to cycle 3-4 times.

6) Following the *Calibrating the NGC* instructions in *Chapter 3-Startup*, perform a calibration ensuring that the *Next Mode* is set to *Hold*.

7) When the unit enters hold, verify that peaks are correctly labeled and integrated. If peaks are correctly labeled and integrated, return the unit to operation.

8) If peaks are not correctly labeled and integrated, contact Totalflow technical support for assistance.

5.3.26 Stream Un-Normalized Total

If the stream un-normalized 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 un-normalized total of the sufficient percentage to activate the alarm.

5.3.26.2 Instructions

1) Verify that the 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 the 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 and then select *Run Auto PF*. This procedure will require approximately 45 minutes.
5) Verify that peaks are correctly labeled and integrated. If 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 the sample valve.
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 flowmeter to *CV1*.
2) From the *Analyzer Operation* screen, click on *Diagnostics*.
3) Select the *Manual Operation* tab.
4) Under *Manual Control*, open the stream 1 valve.
5) When opened, the *CV1* should measure between 3–12 sccm. Close the valve when done reading.
6) If the CV1 measures within this range, continue to the next step. If CV1 does not measure within the range, the test has failed. Return to troubleshooting alarm instructions.
7) Attach flowmeter to *CV2*.
8) Open the stream 1 valve.
9) When opened, *CV2* should measure between 3–12 sccm. Close the valve when done reading.

10) If *CV2* does not measure within this range, the test has failed. Return to troubleshooting alarm instructions.

5.4.3 Sample Pressure Test

5.4.3.1 Instructions

1) Place 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, close the sample shutoff valve and return to the troubleshooting alarm instructions. The test has failed.

5.4.4 Feed-through Assembly Blockage Test

1) Remove the feed-through assembly from the NGC following *Feed-through Assembly* instructions in *Chapter 4-Maintenance*.
2) If testing from the pressure regulator 1 or 2 alarms, continue to steps 3 and 4.

   If testing from the stream test in the start-up diagnostics or from the sample pressure alarm, skip to step 5.
3) Attach the pressure source to CV1 and activate. If the flow through assembly is impeded, the test has failed. Return to troubleshooting alarm instructions; otherwise, continue to next step.
4) Attach the pressure source to CV2 and activate. If the flow through assembly is impeded, the test has failed. Return to the column vent pressure test.
5) Attach the pressure source to SV and activate. If the flow through assembly is impeded, the test has failed. Return to the troubleshooting alarm instructions.

5.4.5 Temperature Sensor Test

5.4.5.1 Instructions

1) Unplug the sensor from the GC module.
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. The 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 sooner than expected, there may one or more issues.

5.4.6.2 Instructions

1) 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.

2) If the unit is new start-up installation, check and tighten the analytical module mounting bolt. The module may have been loosened due to vibration during shipping.

3) If the unit has been disassembled recently, re-check and tighten all assemblies including the analytical module mounting bolt.

4) 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

5.5.1 Overview

This section focuses on determining what has caused the NGC to lose power. Generally, the 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 them to the communication troubleshooting flowchart located further in this chapter.

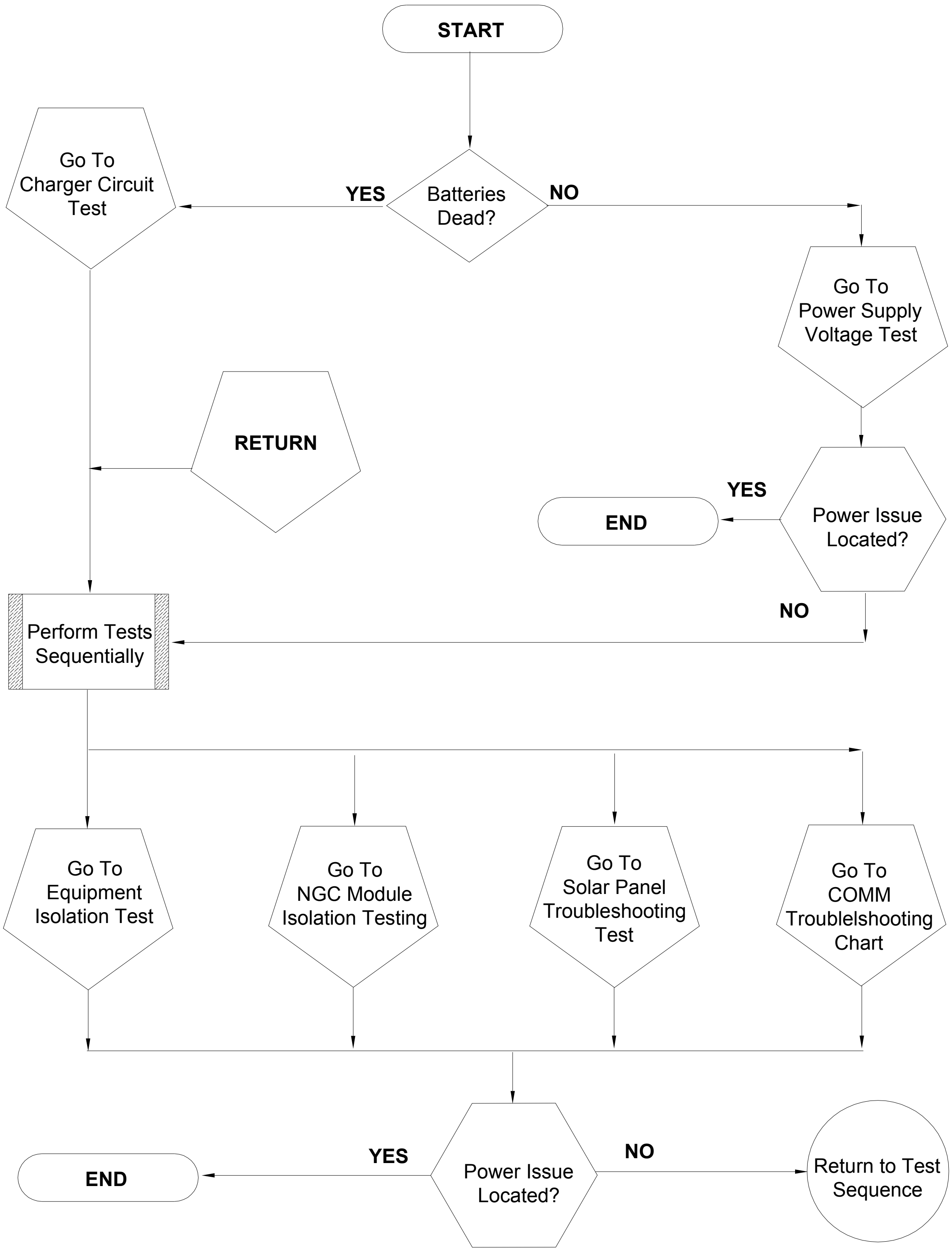

Figure 5–2 Power Troubleshooting Flowchart

5.5.2 Power Supply Voltage Test

TIP

This test assumes a power supply is in good working order and 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.

5.5.2.1 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).

If this is a new installation and the 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.

Correct and retest as necessary.

2) Check for a poor cable connection in the cable between the NGC and the power source. Verify all field wiring screw terminals are tight.

Correct and retest as necessary.

3) 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.

Correct and retest as necessary.

4) Disconnect the power supply cable at the NGC termination panel J1.

5) Measure the power supply cable voltage at the connector and compare with the table recommendations (see Table 1–4 and Table 1–5).

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.

Correct and retest as necessary.

6) Reconnect the power supply cable to the NGC termination panel J1.

5.5.3 Equipment Isolation Test

This test isolates the peripheral equipment from the equation to verify that 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.

5.5.3.1 Instructions

1) While the NGC is operating, verify that the voltage at the NGC termination panel is between 11.5 VDC-16 VDC (for 12 VDC systems) or 22 VDC to 28 VDC (for 24 VDC systems).

TIP

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 the voltage within limits? If no, continue to the next step. If yes, no physical problem is found.

3) Is the external equipment, such as a radio or other device, being powered from the NGC termination panel? If no, return to Figure 5–2 and continue the test sequence. If yes, continue to the next step.

4) Disconnect the peripheral equipment from the NGC.

5) While the NGC is operating, verify that the voltage at the NGC termination panel is between 11.5 VDC-16 VDC (for 12 VDC systems) or 22 VDC to 28 VDC (for 24 VDC systems).

6) Is the voltage within limits? If no, return to Figure 5–2 and continue the test sequence. If yes, the external equipment is drawing excessive current. Check the equipment and related wiring. Correct and retest, if necessary.

5.5.4 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 was performed and that no errors were found.

5.5.4.1 Instructions

1) With power still supplied to the termination panel J1 connector, 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 the 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 voltage at the termination panel J1 connector screw terminals. Voltage should be within 0.1 VDC of the power supply voltage (open circuit).

i.e., only 0.1 VDC 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 again greater than 0.1V, call Totalflow technical support, following the instructions in the *Introduction* to this manual, *Getting Help*.

If the drop is less than 0.1V, check the termination panel to the analytical processor cable for pinched or exposed insulation. Also, check the feed-through auxiliary heater cable for similar damage.

8) Was the damaged cable found? If yes, replace the appropriate cable using instructions in chapter 4.

If no, use instructions in *Chapter 4- Replacing Analytical Module,* and replace the module. Skip to step 10.

9) Reinstall the analytical module.

10) Reinstall the digital controller assembly.

11) 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 anytime, draw current beyond its rated values.

12) Return to the equipment isolation test.

5.5.5 Charger Circuit Test

If the system setup includes a battery pack, solar panel or AC charger/power supply connected to the optional equipment enclosure, and the unit's battery is not staying charged, the user will need to test the battery pack, AC charger/power supply or the solar panel.

The following instructions contain the steps required to perform the circuit testing.

5.5.5.1 Things to Consider

The following list points to other troubleshooting procedures that the user may want to consider as well:

- Solar Panel Troubleshooting Test
- AC Charger/Power Supply Troubleshooting Test

5.5.5.2 Instructions

1) Begin by disconnecting power from the AC charger/power supply, located in the optional enclosure.

2) Replace the battery with a known good battery using the *Battery Pack Replacement* procedure located in *Chapter 4-Maintenance*.

3) Reconnect the power to the charger/supply. If the battery pack is charged through an AC charger, skip to step 5; otherwise, continue to step 4.

4) Measure the solar panel charging voltage at the charger regulator using a DMM connecting the (+) and (-) leads to the (+) and (-) solar panel wires.

Loaded voltage should be greater than or equal to the specification listed in Table 5–3. If the voltage is within range, the battery was bad.

If the loaded voltage is not above the minimum, perform the solar panel troubleshooting test found later in this chapter.

5) If the unit uses an AC charger, perform the AC charger/power supply troubleshooting test found later in this chapter.

6) If all other testing to this point has not located the error, return to Figure 5–2 power troubleshooting flowchart and continue.

Table 5–3 Specifications for Solar Panels

Panel	Max	Volts @P_{Max}	Open Circuit	Load Resistance	Loaded Voltage
50	54W	17.4V	21.7V	5 Ω 100W	16–18 VDC
85	87W	17.4V	21.7V	5 Ω 100W	16–18 VDC

5.5.6 Solar Panel Troubleshooting Test

If the system setup includes a solar panel connected to the optional equipment enclosure, and it is not supplying the required voltage and current to the NGC unit, the user may need to test the solar panel.

The following instructions contain the steps required to do so.

5.5.6.1 Things to Consider

The following list points to other troubleshooting procedures that the user may want to consider as well:

- Power Consumption Test (Remote Equipment)
- AC Charger/Power Supply Troubleshooting Test

5.5.6.2 Required Equipment

- Digital Multimeter with 0-20 VDC range.
- Required resistors for testing specific panels listed in Table 5–3.

FYI In continuous low sun light conditions, the unit may not supply the required voltage. The solar panel should be positioned so it receives the most sunlight. Do not place it in a shaded area.

5.5.6.3 Instructions

1) Measure the solar panel voltage at the controller assembly using a DMM connecting the (+) and (-) leads to the (+) and (-) solar panel wires. The loaded voltage should be greater than or equal to the specifications listed in Table 5–3. If the solar panel is not above the minimum, replace the solar panel, and continue to step 2.

2) Check the solar panel angle and direction. In the northern hemisphere, the panel should face due south and in the southern hemisphere, due north.

3) Check the solar panel for any physical damage or obstructions to sunlight. Sunlight obstruction prevents the solar panel from receiving enough sunlight to charge the installed battery pack. Clear any debris from the cell face of the panel.

4) Check the solar panel wiring to be certain it is correctly connected to the associated termination pins located in the enclosure (see Figure 5–3).
5) Disconnect the solar panel from the field device.
6) Set the DMM range to read over 20 VDC.
7) Determine if the open circuit voltage is greater than or equal to the specifications listed in Table 5–3 by clipping the positive lead of the DMM to the positive wire and clipping the negative lead of the DMM to the negative wire. If the solar panel is not above the minimum, continue to the next step.
8) Using the selected resistor from Table 5–3 for the solar panel wattage, attach the selected resistor between the two solar panel wires.

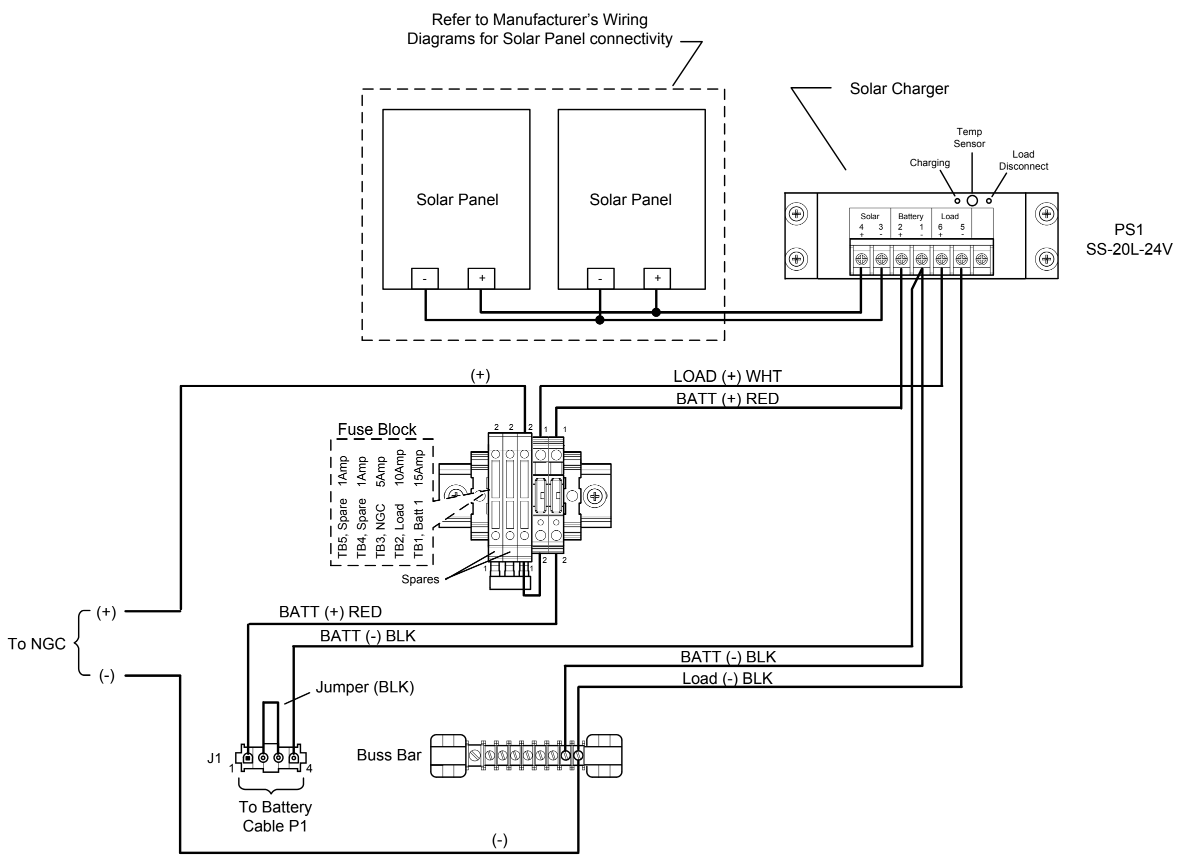

Figure 5–3 Solar Panel Wiring Instructions

9) Clip the positive lead of the DMM to the one side of the test resistor.
10) Clip the negative lead of the DMM to the other side of the test resistor.
11) Determine if the loaded voltage is greater than or equal to the specifications listed in Table 5–3. If the solar panel is not above the minimum, replace the solar panel and return to step 3.

5.5.7 AC Charger/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.

5.5.7.1 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 F1 charger fuse (see Figure 5–4).
3) If the fuse is not faulty or there is no charger DC output voltage after replacing the fuse, replace the AC charger/power supply.

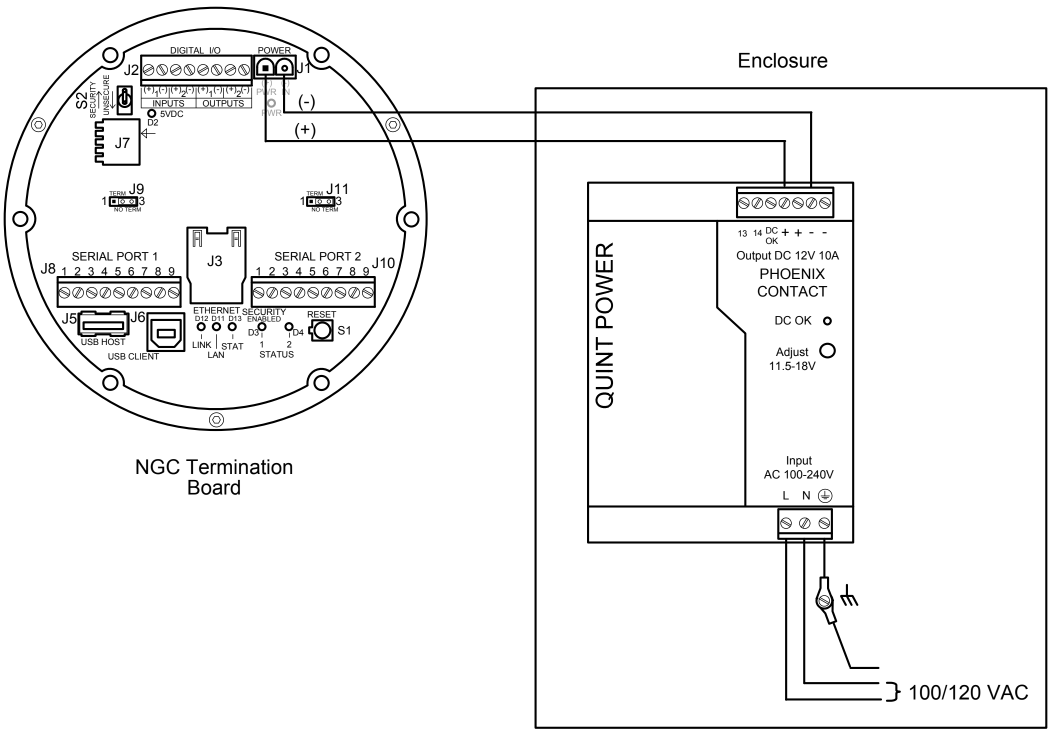

Figure 5–4 AC Charger/Power Supply Wiring

5.6 Troubleshooting Communications

These troubleshooting procedures are applicable to an NGC8200 with an installed radio in the optional equipment enclosure. Use Figure 5–5 as an aid for troubleshooting communication problems. The three basic types of radio communications that can be used between the NGC and a radio receiver are:

- RS-232 Communications (see Table 5–4 for pin Configurations)
- RS-485 Communications (see Table 5–6 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 specific system set up will determine what steps are needed to power the radio/modem.

When switching the power to a radio with inhibit (SLEEP) mode, the serial port 1 or 2 switched power line will go to the radios inhibit (SLEEP) mode input. Power out will go to the radios 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:

- RS232 Communications
- RS485 Communications
- RS422 Communications

5.6.2 Setting Up Communication

After the 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.
- Verify field wiring from the NGC unit to the termination strip inside the enclosure.
- Verify the 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.

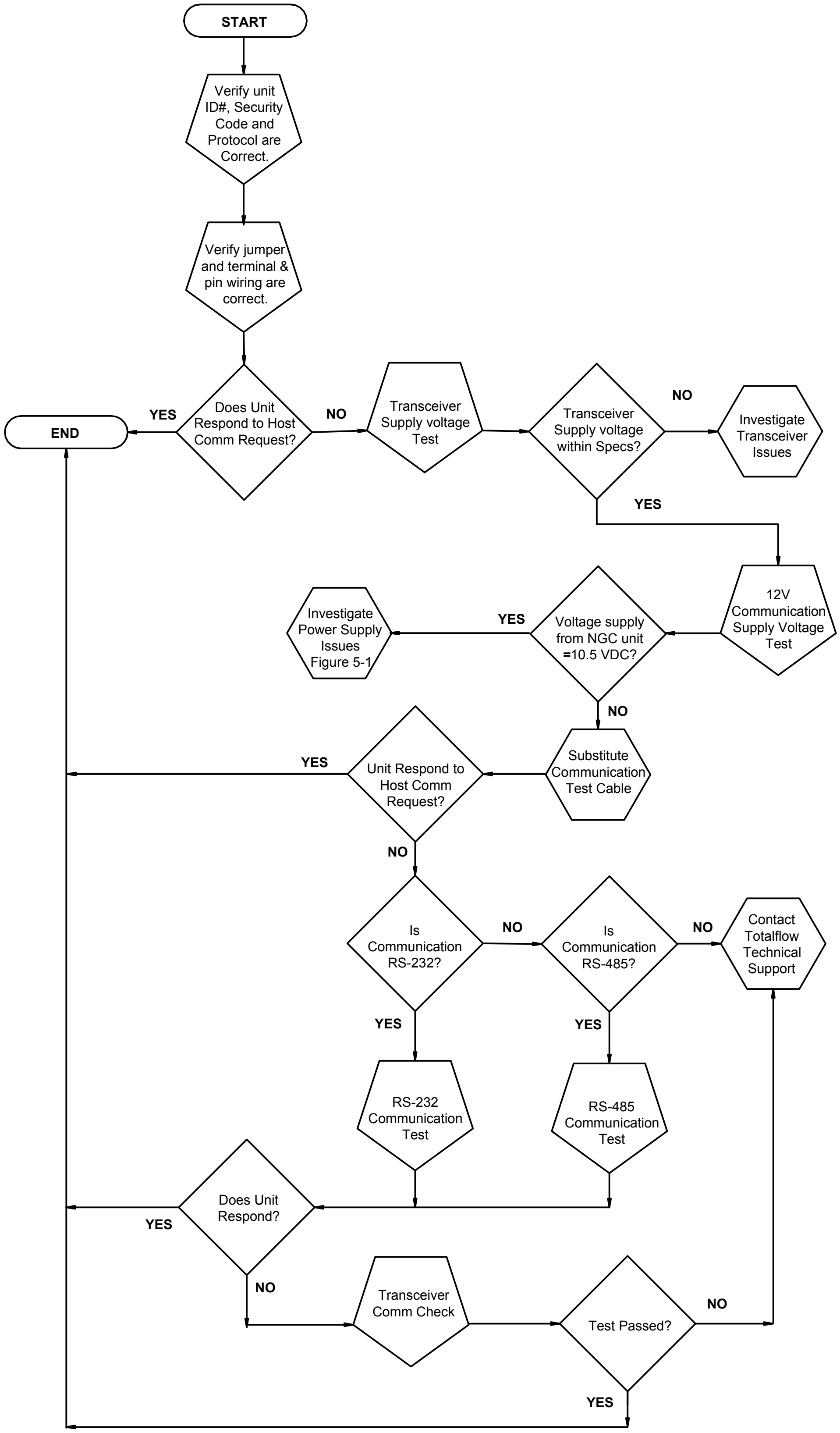

Figure 5–5 Communication Troubleshooting Flowchart

FYI

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

When the communication equipment is powered/switched on, the NGC displays the communication icon after it recognizes the NGC ID and is responding.

Check the baud rate of the NGC transmission and the 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 with the communications interface turned off.

The minimum power required for operating the 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 the remote communications using RS-232 troubleshooting cable. Use the RS-232 to RS-485 communication converter in conjunction with the RS-232 troubleshooting cable to test the RS-485 remote communications.

5.6.3 Transceiver Supply Voltage Test

Using the 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 optional equipment enclosure wiring voltage test.

FYI

If the transceiver is not receiving sufficient voltage, investigate the power supply issues. These may involve wiring irregularities at the AC charger/power supply, XFC/XRC board or at the power relay if using the relay for switching power to the 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 the voltage reads the same as the supplied voltage (12 VDC) and the transceiver is still not receiving power, the relay may be incorrectly wired (use normally open contacts), or the 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 each power supply wiring junction. Verify the wiring is firmly connected and measure the voltage between:

Power (+) and Ground (-).

The voltage should be greater than or equal to 11.9 VDC for this unit. If the 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 the 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 5–5 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 5–4).

Table 5–4 RS-232 Field Wiring on NGC Termination Panel

	Description	**Description**
PIN	**Jack 8–Port 1**	**Jack 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
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 the serial port 1 J9 and serial port 2 J11 on the termination panel have pins 2 and 3 jumpered.

5.6.6.1 Instructions

TIP 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.

Generally speaking, these tests performed on the terminal board will only verify incorrect or damaged wiring. If all previous testing passed and all wiring, jack 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 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 +5 VDC. 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 5–4).

2) Using an oscilloscope, measure the request to send voltage on the termination panel J8 or J10 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 with the host, the voltage should be +5 VDC and remain +5 VDC 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 5–4).

3) Using an oscilloscope, measure the transmit data voltage on the termination panel J8 or J10 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 +5 VDC. This would indicate that the unit is transmitting data. If the unit is still not responding, continue to the next test as directed in Figure 5–5.

5.6.7 RS-485 Communications

The following RS-485 serial communication test procedure is directed from Figure 5–5 and will assist the user in what may be the possible cause for the indicated error message.

TIP When troubleshooting RS-485 mode, verify the termination settings of port 1 J9 and port 2 J11 on the termination panel are correctly jumpered (see Table 5–5).

Table 5–5 RS-485 Terminations

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 located inside the rear end cap, please verify that the wiring is correct (see Table 5–6).

Table 5–6 RS-485 Field Wiring on NGC Termination Panel

	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 will only verify incorrect or damaged wiring. If all previous testing passed and all wiring, jack and terminations have been verified 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 the line driver voltage on the termination panel J8 or J10 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, the voltage should vary between +5 VDC and 0 VDC. This would indicate that the unit is receiving data.

2) Using an oscilloscope, measure the remote request to send voltage on the termination panel J8 or J10:

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 the 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.

APPENDIX A MODBUS REGISTERS

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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)

Modbus Reg # 32-bit	16-bit	Input Reg	Description
3037	3037	51.201.4	Current Day (1-31) (15.1.9)
3038	3038	51.201.5	Current Year (0-99) (15.1.10)
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

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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)
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

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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
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)

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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)
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

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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
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)

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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)
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)

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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)
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

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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
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

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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
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
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)

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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
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

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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
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

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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)
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

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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
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

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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
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)

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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
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

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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
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

Modbus Reg # 32-bit	16-bit	Input Reg	Description
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 B TOTALFLOW® DEFINITIONS AND ACRONYMS

TERM	DEFINITION
μ	Greek letter for “mu”. Often used in math and engineering as the symbol for “micro”. Pronounced as a long u.
μ FLO IMV	μFLO’s measurement and operational features are housed in this single unit assembly. The main electronic board (μFLO-195 Board), communication connection, power, SP, DP and Temperature readings are all housed in this unit.
μ FLO-2100767 Board	Main Electronic Board used in the μFLO Computers. It is housed on an integrated assembly and includes the IMV. It operates at 195 MHz while drawing minimal power.
μ Sec	Micro Second.
μFLO 6200	This Totalflow Flow Computer is housed in a small lightweight enclosure. It’s main feature is it’s low power, microprocessor based units designed to meet a wide range of measurement, monitor and alarming applications for remote gas systems, while being a cost effective alternative.
*.CSV file	See Comma Separated Values (I.E. spreadsheet format).
*.INI file	See Initialization File.
A/D	Analog-to-digital.
ABB Inc.	Asea, Brown & Boveri, parent company of Totalflow
Absolute Pressure	Gauge pressure plus barometric pressure. Totalflow devices use Static Pressure (SP) for flow calculations.
Absolute Zero	The zero point on the absolute temperature scale. It is equal to -273.16 degrees C, or 0 degrees K (Kelvin), or -459.69 degrees F, or 0 degrees R (Rankine).
Absorber	A tower or column that provides contact between natural gas being processed and a liquid solvent.
Absorption	The process of removing vapors from a stream of natural gas by passing the natural gas through liquids or chemicals which have a natural attraction to the vapors to be removed from the stream.
Absorption Factor	A factor which is an indication of the tendency for a given gas phase component to be transferred to the liquid solvent. It is generally expressed as A=L/KV where L and V are the moles of liquid and vapor, and K is the average value of the vapor-liquid equilibrium constant for the component of concern.
Absorption Oil	A hydrocarbon liquid used to absorb and recover components from the natural gas being processed.
AC	See Alternating Current.
Accuracy	How closely a measured value agrees with the correct value. Usually expressed as ± percent of full scale output or reading.
Acid Gas	See Gas, Acid.

TERM	DEFINITION
ACK	See Acknowledgment.
Acknowledgment	This refers to a response over a remote communication device to a request such as a PING. Basically, saying, "I'm here, and I saw your request!"
ACM	See Analyzer Control Module.
Acoustics	The degree of sound. The nature, cause, and phenomena of the vibrations of elastic bodies; which vibrations create compressional waves or wave fronts which are transmitted through various media, such as air, water, wood, steel, etc.
Active Analog Output	Analog Output to a host providing power to the host.
Active Mode	An operational mode used by the LevelMaster for measuring dual float levels by applying a signal to the primary windings, reading the voltage level on the secondary windings and using an algorithm to determine the oil and water levels.
Adapter	A mechanism or device for attaching non-mating parts.
ADC	See Analog-to-Digital Converter.
Address	A unique memory designation for location of data or the identity of a peripheral device; allows each device on a single communications line to respond to its own message.
Adiabatic Expansion	The expansion of a gas, vapor, or liquid stream from a higher pressure to a lower pressure in which there is no heat transfer between the gas, vapor, or liquid and the surroundings.
Adsorption	The process of removing natural gas liquids from a stream of natural gas by passing the natural gas through granular solids which have a natural attraction to the liquids to be removed from the stream.
Aerial	A length of wire designed to transmit or receive radio waves. (See also Antenna)
Aerosol Liquids	Minute liquid particles suspended in gas. Aerosols will behave like a fluid and can be transported by pipes and pumping. When aerosols contact each other they coalesce into droplets. Aerosols may be present in gas, or may be generated by glow shearing off the skim inside of a pipeline.
AGA	American Gas Association. Trade group representing natural gas distributors and pipelines.
AGA-10	American Gas Association Report No. 10, Speed of Sound in Natural Gas and Other Related Hydrocarbon Gases. Method for calculation of the speed of sound in gases.
AGA-3	American Gas Association Report No. 3, Orifice Metering of Natural Gas. Method for calculating gas volume across an Orifice Plate. This method requires two pressure readings, Differential Pressure (DP) and Static Pressure (SP).

TERM	DEFINITION
AGA-5	American Gas Association Report No. 5, Fuel Gas Energy Metering. Methods (Volume, Mass or Energy) for calculating BTUs without knowing the composition of the gas.
AGA-7	American Gas Association Report No. 7, Measurement of Gas by Turbine Meters. Method for calculating gas volume using a Pulse Meter. This method requires one pressure reading, Static Pressure (SP).
AGA-8	American Gas Association Report No. 8, Compressibility Factor of Natural Gas and Related Hydrocarbon Gases. Method for calculating the Super Compressibility Factor, Fpv.
AGA-9	American Gas Association Report No. 9, Measurement of Gas by Multipath Ultrasonic Meters. Method for calculating gas based on transit-times.
AGC	Automatic Gain Control
AH	See Ampere-Hour.
AI	Analog Input
AIU	Analyzer Interface Unit.
Alkane	The simplest homologous series of saturated aliphatic hydrocarbons, consisting of methane, ethane, propane, butane; also know as olefins. Unsaturated hydrocarbons that contain one or more carbon-carbon double bonds.
Alkanolamine	See Amine.
Alkynes	Unsaturated hydrocarbons that contain one or more carbon-carbon triple bonds.
Alphanumeric	A character set that contains both letters and digits.
Alternating Current	An electric current whose direction changes with a frequency independent of circuit components.
Aluminum Powder Coating	Totalflow aluminum enclosures have a baked-on Powder Coating designed to our specifications to ensure paint adhesion, weather resistance and durability.
Ambient Compensation	The design of an instrument such that changes in ambient temperature do not affect the readings of the instrument.
Ambient Conditions	The conditions around the transducer (pressure, temperature, etc.).
Ambient Pressure	Pressure of the air surrounding a transducer.
Ambient Temperature	The average or mean temperature of the surrounding air which comes in contact with the equipment and instruments under test.
Amine (Alkanolamine)	Any of several liquid compounds containing amino nitrogen generally used in water solution to remove, by reversible chemical reaction, hydrogen sulfide and/or carbon dioxide from gas and liquid hydrocarbon streams.
Ammeter	An instrument used to measure current.

TERM	DEFINITION
Amp	See Ampere.
Ampere	The unit of electrical current. Also milliamp (one thousandth of an amp) and micro amp (one millionth of an amp). One amp corresponds to the flow of about 6 x 10^{18} electrons per second.
Ampere-Hour	The quantity of electricity measured in ampere-hours (Ah) which may be delivered by a cell or battery under specified conditions. A current of one ampere flowing for one hour.
Ampere-Hour Efficiency	The ratio of the output of a secondary cell or battery, measured in ampere-hours, to the input required to restore the initial state of charge, under specified conditions.
Amplifier	A device which draws power from a source other than the input signal and which produces as an output an enlarged reproduction of the essential features of its input.
Amplitude	The highest value reached by voltage, current or power during a complete cycle.
Amplitude Modulation	Where audio signals increase and decrease the amplitude of the "carrier wave".
Amplitude Span	The Y-axis range of a graphic display of data in either the time or frequency domain. Usually a log display (dB) but can also be linear.
AMU	See Analog Measurement Unit.
AMU/IMV	Generic reference to the Measurement unit. See Analog Measurement Unit and Integral Multivariable Transducer for more definition.
Analog	A system in which data is represented as a continuously varying voltage/current.
Analog Input	Data received as varying voltage/current.
Analog Measurement Unit	A transducer for converting energy from one form to another. (e.g. Static and Differential pressure to electrical signals)
Analog Output	A voltage or current signal that is a continuous function of the measured parameter. Data that is transmitted as varying voltage/current.
Analog Trigger	A trigger that occurs at a user-selected point on an incoming analog signal. Triggering can be set to occur at a specific level on either an increasing or a decreasing signal (positive or negative slope).
Analog-to-Digital Converter	An electronic device, often an integrated circuit, that converts an analog voltage to a number.
Analytical Module	The primary component of the NGC8200's modular design is the analytical module. This module comes in a 12VDC or a 24VDC configuration and contains the GC Module, Analytical Processing system and manifold. Replacement of this component is enhanced by the single bolt removal feature. This module may also be broken down into the GC module, manifold assembly and analytical processor assembly.

TERM	DEFINITION
Analytical Module	Totalflow Analytical Module assembly contains the GC Module, Manifold and Analytical Processor. The modular design features Single Bolt removal.
Analytical Processor Assembly	The Analytical Processor board interfaces with the analog circuits to monitor temperatures, and pressures, and also control the processes. The data generated by the Analytical Processor is passed to the Digital Controller board.
Analyzer Control Module	Consists of various electronic components used for analysis.
Anemometer	An instrument for measuring and/or indicating the velocity of air flow.
Annealed	Toughen (steel or glass) by a process of gradually heating and cooling,
Annunciator	Display of a status on a screen.
ANSI	American National Standards Institute.
Antenna	A length of wire or similar that radiates (such as a transmitting antenna) or absorbs (such as a radio antenna) radio waves. The two basic types are: Yagi (directional) or Omni (bi-directional).
AO	Analog Output
AP	See Absolute Pressure.
API 14.3	American Petroleum Institute Report No. 14.3 addresses the 1992 equation regarding the AGA-3 method for calculating gas volume across an Orifice Plate.
API 21.1	American Petroleum Institute Report No. 21.1 addresses the equation regarding AGA-8 Fpv or Supercompressibility Factor and the energy content of the gas.
API Gravity	An arbitrary scale expressing the relative density of liquid petroleum products. The scale is calibrated in degrees API. The formula is: $DegAPI = \left[\frac{141.5}{\gamma(60°F/60°F}\right] - 131.5$ where γ =relative density.
Archive	A file containing historical records in a compressed format for more efficient long term storage and transfer. Totalflow archive records are non-editable, meaning that when they are stored they may not be changed. These records are used during an audit of data.
Artificial Drives	Techniques for producing oil after depletion or in lieu of natural drives; includes water flooding, natural gas re-injection, inert gas injection, flue gas injection and in-situ combustion.
Artificial Lift	Any of the techniques, other than natural drives, for bringing oil to the surface.
ASCII	American Standard Code for Information Interchange. A very popular standard method of encoding alphanumeric characters into 7 or 8 binary bits.
ASME	American Society of Mechanical Engineers.

TERM	DEFINITION
ASTM	American Society for Testing and Materials (ASTM International).
ASTM D 3588	ASTM International Standard Practice for calculating heat value, compressibility factor and relative density of gaseous fuels.
Asynchronous	A communications protocol where information can be transmitted at an arbitrary, unsynchronized point in time, without synchronization to a reference time or "clock".
ATC	Automatic temperature compensation.
ATEX	Term used for European Union’s New Approach Directive 94/9/EC which concerns equipment and protective systems intended for use in potentially explosive atmospheres.
Atmosphere (one)	A unit of pressure; the pressure that will support a column of mercury 760 mm high at 0 °C.
Atmospheric Pressure	The pressure exerted on the earth by the earth’s atmosphere (air and water vapor). A pressure of 760 mm of mercury, 29.92 inches of mercury, or 14.696 pounds per square inch absolute is used as a (scientific) standard for some measurements. Atmospheric pressure may also refer to the absolute ambient pressure at any given location.
Audio Frequency	Generally in the range 20 Hz to 20 KHz.
Audit	To examine or verify data for accuracy. Totalflow’s DB1 and DB2 records may be edited to generate a more accurate representation of data information.
Audit Trail	Using the Long Term Archive files to justify changes made to records that more accurately reflects the correct data. Peripheral information used to edit data is recorded without exception, to justify the accuracy of the edited data records.
Automatic Frequency Control	Similar to Automatic Fine Tune (AFT). A circuit that keeps a receiver in tune with the wanted transmission.
AWG	American Wire Gage.
AWG	Acronym for American Wire Gauge.
Back Pressure	Pressure against which a fluid is flowing. May be composed of friction in pipes, restrictions in pipes, valves, pressure in vessels to which fluid is flowing, hydrostatic head, or other resistance to fluid flow.
Backflush	Technique used in chromatography to reverse direction of the flow after the lighter components have been measured, allowing the heavier components to remain in the column until measured, shortening the length of the column.
Background Acquisition	Data is acquired by a DAQ system while another program or processing routine is running without apparent interruption.
Background Noise	The total noise floor from all sources of interference in a measurement system, independent of the presence of a data signal.
Backup	A system, device, file or facility that can be used as an alternative in case of a malfunction or loss of data.

TERM	DEFINITION
Bandwidth	The range of frequencies available for signaling; the difference between the highest and lowest frequencies of a band expressed in Hertz.
Bar	Bar is equal to 1 atmosphere of pressure. I.e. .987 Standard atmospheric pressure or 14.5 lbs./psia.
Barometer	An instrument which measures atmospheric pressure.
Barrel	A unit of liquid volume measurement in the petroleum industry that equals 42 U.S. gallons (.159 cubic meters) for petroleum or natural gas liquid products, measured at 60 degrees Fahrenheit and at an equilibrium vapor pressure.
Base Pressure	The pressure used as a standard in determining gas volume. Volumes are measured at operating pressures and then corrected to base pressure volume. Base pressure is normally defined in any gas measurement contract. The standard value for natural gas in the United States is 14.73 psia, established by the American National Standards Institute as standard Z-132.1 in 1969.
Basic Sediment and Water	Waste that collects in the bottom of vessels and tanks containing petroleum or petroleum products.
Battery	Two or more electrochemical cells electrically interconnected in an appropriate series/parallel arrangement to provide the required operating voltage and current levels.
Baud	Unit of signaling speed. The speed in baud is the number of discrete conditions or events per second. If each event represents only one bit condition, baud rate equals bits per second (bps).
Baud Rate	Serial communications data transmission rate expressed in bits per second (b/s).
Bbl	See Barrel.
Bcf	Abbreviation for one billion standard cubic feet or one thousand MMcf or one million Mcf.
BG Mix	A liquefied hydrocarbon product composed primarily of butanes and natural gasoline.
Bias	Term used when calibrating. Amounts to offset the actual measurement taken. On a LevelMaster, it refers to adjusting the measurement of the float level to agree with a calibrated measurement. On an RTD (Resistant Thermal Detector), it refers to adjusting the measurement of the temperature to agree with a calibrated temperature. This figure maybe either a positive or negative figure.
BIAS Current	A very low-level DC current generated by the panel meter and superimposed on the signal. This current may introduce a measurable offset across a very high source impedance.
Binary Number	System based on the number 2. The binary digits are 0 and 1.
Binary-Coded Decimal	A code for representing decimal digits in a binary format.

TERM	DEFINITION
BIOS	Basic Input/Output System. A program, usually stored in ROM, which provides the fundamental services required for the operation of the computer. These services range from peripheral control to updating the time of day.
Bipolar	A signal range that includes both positive and negative values.
Bipolar Transistor	The most common form of transistor.
Bit	Binary Digit - the smallest unit of binary data. One binary digit, either 0 or 1. See also byte.
Bits Per Second	Unit of data transmission rate.
Blue Dot Technology	Technological changes to the DC and ACM Modules, decreasing noise by changing ground. Allows amplification of the results, gains resolution.
Board	Common name used to identify the Main Electronic Board. Also called Motherboard, Engine Card and Circuit Board.
Boiling Point	The temperature at which a substance in the liquid phase transforms to the gaseous phase; commonly refers to the boiling point of water which is 100°C (212°F) at sea level.
Bootstrap Loader	Abbreviated BSL. Software enabling user to communicate with the PCBA for the purpose of programming the FLASH memory in the microcontroller.
Bounce	Bouncing is the tendency of any two metal contacts in an electronic device to generate multiple signals as the contacts close or open. When you press a key on your computer keyboard, you expect a single contact to be recorded by your computer. In fact, however, there is an initial contact, a slight bounce or lightening up of the contact, then another contact as the bounce ends, yet another bounce back, and so forth. A similar effect takes place when a switch made using a metal contact is opened.
BP Mix	A liquefied hydrocarbon product composed primarily of butanes and propane.
BPS	See Bits Per Second.
Bridge	Generally a short-circuit on a PC board caused by solder joining two adjacent tracks.
Bridge Resistance	See Input impedance and Output impedance.
British Thermal Unit	Energy required to raise one pound of water one degree Fahrenheit. One pound of water at 32 F° requires the transfer of 144 BTUs to freeze into solid ice.
Browser	Software which formats Web pages for viewing; the Web client
BS&W	See Basic Sediment and Water.
BSL	See Bootstrap Loader.
Btu	See British Thermal Unit.

TERM	DEFINITION
Btu Factor	A numerical representation of the heating value of natural gas which may be calculated or presented to indicate varying relationships (e.g., the number of Btu contained in one standard cubic foot or the number of MMBtu contained in one Mcf of gas. The factor for a given relationship will vary depending upon whether the gas is “dry” or “saturated”.
Btu Method	A method of allocating costs between different operations or between different products based upon the heat content of products produced in the various operations or of the various produced products.
Btu per Cubic Foot	A measure of the heat available or released when one cubic foot of gas is burned.
Btu, Dry	Heating value contained in cubic foot of natural gas measured and calculated free of moisture content. Contractually, dry may be defined as less than or equal to seven pounds of water per Mcf.
Btu, Saturated	The number of Btu’s contained in a cubic foot of natural gas fully saturated with water under actual delivery pressure, temperature and gravity conditions. See BTU, DRY.
Btu/CV	Used to express the heating content of gas. See British Thermal Units or Calorific Value.
BtuMMI	Refers to the interface program or software that operates the Btu Analyzer.
Buffer	(1) A temporary storage device used to compensate for a difference in data rate and data flow between two devices (typically a computer and a printer); also called a spooler; (2) An amplifier to increase the drive capability, current or distance, of an analog or digital signal.
Burst Pressure	The maximum pressure applied to a transducer sensing element or case without causing leakage.
BUS	A data path shared by many devices (e.g., multipoint line) with one or more conductors for transmitting signals, data, or power.
Bus Master	A type of controller with the ability to read and write to devices on the computer bus.
Busbar	A heavy, rigid conductor used for high voltage feeders.
Butane (C4H10)	A saturated hydrocarbon (Alkane) with four carbon atoms in it’s molecule (C_4H_{10}). A gas at atmospheric pressure and normal temperature, but easily liquefied by pressure. Generally stored and delivered in liquefied form and used as a fuel in gaseous form, obtained by processing natural gas as produced and also from a process in petroleum refining. Contains approximately 3,260 Btu per cubic foot.
Butane, Normal	see Normal Butane.

TERM	DEFINITION
Butylene (C4H8)	A saturated hydrocarbon (Alkane) with four carbon atoms in it's molecule (C_4H_8). A gas at room temperature and pressure, but easily liquefied by lowering the temperature or raising the pressure. This gas is colorless, has a distinct odor, and is highly flammable. Although not naturally present in petroleum in high percentages, they can be produced from petrochemicals or by catalytic cracking of petroleum.
Byte	A group of binary digits that combine to make a word. Generally 8 bits. Half byte is called a nibble. Large computers use 16 bits and 32 bits. Also used to denote the amount of memory required to store one byte of data.
C10H22	The molecular formula for Decane.
C1H4	The molecular formula for Methane.
C2H4	The molecular formula for Ethylene.
C2H6	The molecular formula for Ethane.
C3H6	The molecular formula for Propylene.
C3H8	The molecular formula for Propane.
C4H10	The molecular formula for Butane.
C4H8C	The molecular formula for Butylene.
C5+	A standard abbreviation for Pentanes Plus (IC5, NC5 and C6+).
C5H12	The molecular formula for Pentane.
C6+	A standard abbreviation for Hexane Plus.
C6H14	The molecular formula for Hexane.
C7H16	The molecular formula for Heptane.
C8H18	The molecular formula for Octane.
C9H20	The molecular formula for Nonane.
Cache Memory	Fast memory used to improve the performance of a CPU. Instructions that will soon be executed are placed in cache memory shortly before they are needed. This process speeds up the operation of the CPU.
Calibrate	To ascertain, usually by comparison with a standard, the locations at which scale or chart graduations should be placed to correspond to a series of values of the quantity which the instrument is to measure, receive or transmit. Also, to adjust the output of a device, to bring it to a desired value, within a specified tolerance for a particular value of the input. Also, to ascertain the error in the output of a device by checking it against a standard.
Calorie	The quantity of thermal energy required to raise one gram of water 1°C at 15°C.
Calorimeter	An apparatus which is used to determine the heating value of a combustible material.
Capacitor	An electronic component that stores electrical charge.

TERM	DEFINITION
Capacity	The total number of ampere-hours (or watt-hours) that can be withdrawn from a cell/battery under specified conditions of discharge.
CAR	Carrier Gas (located on NGC8200 series Feed-Through Assembly).
Carbon	Base of all hydrocarbons and is capable of combining with hydrogen in many proportions, resulting in numberless hydrocarbon compounds. The carbon content of a hydrocarbon determines, to a degree, the hydrocarbon's burning characteristics and qualities.
Carbon Dioxide	Colorless, odorless and slightly acid-tasting gas, consisting of one atom of carbon joined to two atoms of oxygen. C02. Produced by combustion or oxidation of materials containing carbon. Commonly referred to as dry ice when in its solid form.
Carrier Gas	Totalflow recommends that Helium be used as a carrier gas. Carrier gas is used in the “Mobile Phase” of chromatography, pushing the sample gas through the columns (“Stationary Phase”). Because Helium has no heating value, it does not affect the Btu values.
Casinghead Gas	Natural gas that is produced from oil wells along with crude oil.
Catalyst	A substance that speeds up a chemical reaction without being consumed itself in the reaction. A substance that alters (usually increases) the rate at which a reaction occurs.
Catalytic	The process of altering, accelerating or instigating a chemical reaction.
Cathode	An electrode through which current leaves any nonmetallic conductor. An electrolytic cathode is an electrode at which positive ions are discharged, or negative ions are formed, or at which other reducing reactions occur. The negative electrode of a galvanic cell; of an electrolytic capacitor.
Cavitation	The boiling of a liquid caused by a decrease in pressure rather than an increase in temperature.
CC	Cubic Centimeters. Measurement unit for measuring volume or capacity in one hundredth of a meter.
CC	Acronym for Cubic Centimeter.
C-Code	C language (IEC supported programming language)
CCU	See DosCCU, WINCCU, PCCU or WEBCCU.
CCV	See Closed Circuit Voltage.
Cd	Coefficient of Discharge factor.
CDPD	Cellular Digital Packet Data
CE	European Community Certification Bureau.
Cell	The basic electrochemical unit used to generate or store electrical energy.
Celsius (centigrade)	A temperature scale defined by 0°C at the ice point and 100°C at boiling point of water at sea level.

TERM	DEFINITION
CENELEC	European Committee for Electro-technical Standardization. Also known as the European Standards Organization.
Centimeter	Acronym c. Metric measurement equal to .3937 inch.
Central Processing Unit	The central part of a computer system that performs operations on data. In a personal computer the CPU is typically a single microprocessor integrated circuit.
Ceramic Insulation	High-temperature compositions of metal oxides used to insulate a pair of thermocouple wires The most common are Alumina (Al_2O_3), Beryllium (BeO), and Magnesia (MgO). Their application depends upon temperature and type of thermocouple. High-purity alumina is required for platinum alloy thermocouples. Ceramic insulators are available as single and multihole tubes or as beads.
Certification	The process of submitting equipment to specific tests to determine that the equipment meets the specifications or safety standards.
Cf	A standard abbreviation for Cubic foot.
CFG	Configuration File. When saving new configuration files, the file is saved as a *.cfg file.
CFM	The volumetric flow rate of a liquid or gas in cubic feet per minute.
Character	A letter, digit or other symbol that is used as the representation of data. A connected sequence of characters is called a character string.
Characteristics	Detailed information pertaining to it's description. The XFC stores this information in the PROM chip. A feature or quality that makes somebody or something recognizable.
Charge	The conversion of electrical energy, provided in the form of a current from an external source, into chemical energy within a cell or battery.
Chip	Another name for integrated circuit or the piece of silicon on which semiconductors are created.
Chromatograph	An instrument used in chemical analysis, to determine the make-up of various substances, and often used to determine the Btu content of natural gas. Chromatography- A method of separating gas compounds by allowing it to seep through an adsorbent so that each compound is adsorbed in a separate layer.
CIM	Communication Interface Module. Totalflow's version is called TFIO Communication Interface Module.
Circuit	1. The complete path between two terminals over which one-way or two-way communications may be provided. 2. An electronic path between two or more points, capable of providing a number of channels. 3. A number of conductors connected together for the purpose of carrying an electrical current. 4. An electronic closed-loop path among two or more points used for signal transfer. 5. A number of electrical components, such as resistors, inductances, capacitors, transistors, and power sources connected together in one or more closed loops.

TERM	DEFINITION
Circuit board	Sometimes abbreviated PCB. Printed circuit boards are also called cards. A thin plate on which chips and other electronic components are placed. They fall into the following categories: Motherboard: Typically, the mother board contains the CPU, memory and basic controllers for the system. Sometimes call the system board or main board. Expansion board: Any board that plugs into one of the computer's expansion slots, including controller boards, LAN cards, and video adapters. Daughter Card: Any board that attaches directly to another board. Controller board: A special type of expansion board that contains a controller for a peripheral device. Network Interface Card (NIC): An expansion board that enables a PC to be connected to a local-area network (LAN). Video Adapter: An expansion board that contains a controller for a graphics monitor.
Class 1, Division 1	Class 1 refers to the presence of flammable gases, vapors or liquids. Division 1 indicates an area where ignitable concentrations of flammable gases, vapors or liquids can exist all of the time or some of the time under normal operating conditions.
Class 1, Division 2	Class 1 refers to the presence of flammable gases, vapors or liquids. Division 2 indicates an area where ignitable concentrations of flammable gases, vapors or liquids are not likely to exist under normal operating conditions.
Class 1, Zone 0	Class 1 refers to the presence of flammable gases, vapors or liquids. Zone 0 refers to a place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapor or mist is present continuously or for long periods or frequently.
Class 1, Zone 1	Class 1 refers to the presence of flammable gases, vapors or liquids. Zone 1 refers to a place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapor or mist is likely to occur in normal operation occasionally.
Class 1, Zone 2	Class 1 refers to the presence of flammable gases, vapors or liquids. Zone 2 refers to a place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapor or mist is not likely to occur in normal operation.
Clean Gas	Gas that has no particles larger than one micron and no more than one milligram of solids per cubic meter.
Clear	To restore a device to a prescribed initial state, usually the zero state.
Clock	The source(s) of timing signals for sequencing electronic events (e.g. synchronous data transfer).
Closed Circuit Voltage	The difference in potential between the terminals of a cell/battery when it is discharging (on- load condition).
CM	Acronym for Cubic Meter.

TERM	DEFINITION
Cm	Acronym for Centimeter.
CMM	Acronym for Cubic Meter per Minute.
CMOS	See Complimentary Metal-Oxide-Semiconductor.
CNG	See Compressed Natural Gas
CO_2	A standard abbreviation for Carbon Dioxide.
Coalbed Methane	A methane-rich, sulfur-free natural gas contained within underground coal beds.
Coefficient of expansion	The ratio of the change in length or volume of a body to the original length or volume for a unit change in temperature.
Coil	A conductor wound in a series of turns.
Cold Start	A rebooting technique which will clear all operational errors, loose all data files, but will not damage configuration files if stored on the SDRIVE.
Cold Weather Enclosure	Totalflow insulated and heated enclosure designed to house either the NGC8200 or Btu 8000/8100 Chromatographs in inclement climates.
Collector	The semiconductor region in a bipolar junction transistor through which a flow of charge carriers leaves the base region.
Column	Hardware component used in gas chromatography to separate components into measurable units.
Combustible	Classification of liquid substances that will burn on the basis of flash points. A combustible liquid means any liquid having a flash point at or above 37.8°C (100°F) but below 93.3°C (200°F), except any mixture having components with flash points of 93.3°C (200°F) or higher, the total of which makes up 99 percent or more of the total volume of the mixture.
Comma Separated Values	These file types are importable records used by spreadsheet programs to display and manipulate data.
Communication	Transmission and reception of data among data processing equipment and related peripherals.
Communication Port	Comm. Port (abbreviation) refers to the host computer's physical communication's port being used to communicate with the equipment. Used by Totalflow when discussing local or remote communication with various equipment including the XFC, FCU, XRC, RTU and LevelMaster etc.
Compensation	An addition of specific materials or devices to counteract a known error.
Complimentary Metal-Oxide-Semiconductor	Family of logic devices that uses p-type and n-type channel devices on the same integrated circuit. It has the advantage of offering medium speed and very low power requirements.
Component	(1) A small object or program that performs a specific function and is designed in such a way to easily operate with other components and applications. Increasingly, the term is being used interchangeably with applet. (2) A part of a device.

TERM	DEFINITION
Compressed Gas	A gas or mixture of gases having, in a container an absolute pressure exceeding 40 psi at 21.1°C (70°F). A gas or mixture having in a container, an absolute pressure exceeding 104 psi at 54.4°C (130°F) regardless of the pressure at (21.1°C (70°F). A liquid having a vapor pressure exceeding 40 psi at 37.8°C (70°F) as determined by ASTM D-323-72.
Compressed Natural Gas	Natural gas in high-pressure surface containers that is highly compressed (though not to the point of liquefaction). CNG is used extensively as a transportation fuel for automobiles, trucks and buses in some parts of the world. Small amounts of natural gas are also transported overland in high-pressure containers.
Compressibility	The property of a material which permits it to decrease in volume when subjected to an increase in pressure. In gas-measurement usage, the compressibility factor "Z" is the deviation from the ideal Boyle and Charles' law behavior. See SUPERCOMPRESSIBILITY FACTOR.
Compressibility Factor	See Supercompressibility Factor.
Compressibility Factor	A factor usually expressed as “z” which gives the ratio of the actual volume of gas at a given temperature and pressure to the volume of gas when calculated by the ideal gas law without any consideration of the compressibility factor.
Concentration	Amount of solute per unit volume or mass of solvent or of solution.
Concurrent	Performing more than one task at a time.
Condensate	1) The liquid formed by the condensation of a vapor or gas; specifically, the hydrocarbon liquid separated from natural gas because of changes in temperature and pressure when the gas from the reservoir was delivered to the surface separators. 2) A term used to describe light liquid hydrocarbons separated from crude oil after production and sold separately.
Condensation	Liquefaction of vapor.
Condensed Phases	The liquid and solid phases; phases in which particles interact strongly.
Condensed States	The solid and liquid states.
Conduction	The conveying of electrical energy or heat through or by means of a conductor.
Configuration No.	The Configuration number is a suffix of the serial number which defines the characteristics of the unit.
Console Mode	A local user interface typically used with custom applications that are not supported through any other mechanism. Also referred to as Printer Console Mode.
Contact	Current carrying part of a switch, relay or connector.
Conversion Time	The time required, in an analog input or output system, from the moment a channel is interrogated (such as with a read instruction) to the moment that accurate data is available. This could include switching time, settling time, acquisition time, A/D conversion time, etc.

TERM	DEFINITION
Coprocessor	Another computer processor unit that operates in conjunction with the standard CPU. Can be used to enhance execution speed. For example, the 8087 is designed to perform floating point arithmetic.
COR	See Corrected Runtime.
Corrected Runtime	Correction to signal made to decrease/increase “ZERO phase” and eliminate the shift between RT and COR for increased accuracy.
Cos	See Cosine.
Cosine	The sine of the complement of an arc or angle.
Counterclockwise	Movement in the direct opposite to the rotation of the hands of a clock.
Counts	The number of time intervals counted by the dual-slope A/D converter and displayed as the reading of the panel meter, before addition of the decimal point.
CPS	Cycles per second; the rate or number of periodic events in one second, expressed in Hertz (Hz).
CPU	See Central Processing Unit.
CPUC	California Public Utilities Commission
CRC	See Cyclic Redundancy Check.
Cryogenic Plant	A gas processing plant which is capable of producing natural gas liquids products, including ethane, at very low operating temperatures.
CSA	CSA International: Formerly Canadian Standards Association. Canadian certification agency.
CTS	Communication abbreviation for Clear To Send.
Cubic	Three-dimensional shape with six equal sides. Used in measuring volume.
Cubic Centimeter	Acronym CC. Metric volume equal to a 1 Centimeter to the 3^{rd} power.
Cubic Foot	The most common unit of measurement of gas volume in the US. It is the amount of gas required to fill a volume of one cubic foot under stated conditions of temperature, pressure, and water vapor.
Cubic Foot Metered	The quantity of gas that occupies one cubic foot under pressure and temperature conditions in the meter.
Cubic Foot, Standard	That quantity of gas which under a pressure of 14.73 psia and at a temperature of 60 degrees occupies a volume of one cubic foot without adjustment for water vapor content.
Cubic Meter	Acronym CM. Metric volume equal to 35.31467 Cubic Feet.
Cubic Meter Per Minute	Acronym CMM. Metric flow rate equal to 35.31467 Cubic Feet per Minute.
Cumulative Capacity	The total number of ampere-hours (or watt hours) that can be withdrawn from a cell/battery under specified conditions of discharge over a predetermined number of cycles or the cycle life.

TERM	DEFINITION
Current	Current is measured in amps (milliamps and micro amps). It is the passage of electrons. Conventional current flows from positive to negative. Electrons flow from negative to positive - called "electron flow".
Cursor	Dots used to indicate the location of the next character or symbol to be entered.
Custody Transfer	The legal and commercial transfer of a commodity such as natural gas, LNG, etc. from one party to another.
Custody Transfer Transaction	The Custody Transfer Transaction is the hand-off of the physical commodity from one operator to another.
Cut-Off Voltage	The cell/battery voltage at which the discharge is terminated.
CV	Calorific Value. European value of heating content.
CV1	Column 1 Vent (located on NGC8200 series Feed-Through Assembly).
CV2	Column 2 Vent (located on NGC8200 series Feed-Through Assembly).
CWE	Cold Weather Enclosure.
Cycle	One complete sequence of events. One complete alteration of an AC current or Volt. The discharge and subsequent charge of a rechargeable cell/battery is called a cycle.
Cycle Life	The number of cycles under specified conditions which were available from a rechargeable cell/battery before it fails to meet specified criteria as to performance.
Cycle Time	The time usually expressed in seconds for a controller to complete one on/off cycle.
Cyclic Redundancy Check	An ongoing verification of the validity of transmitted and received data providing assurance that the message conforms to a pre-agreed upon convention of communications.
D/A	See Digital-to-analog.
D/I	See Digital Input.
D/O	See Digital Output.
DAC	See Digital to Analog Converter.
DACU	Data Acquisition Control Unit.
Data Acquisition	Gathering information from sources such as sensors and AMUs in an accurate, timely and organized manner. Modern systems convert this information to digital data, which can be stored and processed by a computer.
Data Collect	Physically, locally or remotely, retrieving data stored with a Totalflow unit. This data is typically stored in records located in a data base format.
DB	See Decibel.

TERM	DEFINITION
DB1	Acronym for Data Base 1. This refers to the previous data base structure used to store data in Totalflow products.
DB2	Acronym for Data Base 2. This refers to the current data base structure used to store data in Totalflow products.
DC	See Direct Current
DCD	Communication abbreviation for Data Carrier Detect
DCS/PLC	Distribution Control System/Programmable Logic Controller
DDE	See Digital Data Exchange. Also called Dynamic Data Exchange. May refer to Totalflow's DDE Server TDS32.
Dead Weight Tester	Portable pressure tester used to check calibration and to calibrate AMU's utilizing a system of calibrated weights.
De-bounce	De-bouncing is any kind of hardware device or software that ensures that only a single signal will be acted upon for a single opening or closing of a contact. When you press a key on your computer keyboard, you expect a single contact to be recorded by your computer. In fact, however, there is an initial contact, a slight bounce or lightening up of the contact, then another contact as the bounce ends, yet another bounce back, and so forth. A similar effect takes place when a switch made using a metal contact is opened. The usual solution is a de-bouncing device or software that ensures that only one digital signal can be registered within the space of a given time (usually milliseconds)
Decane (C10H22)	A hydrocarbon (Alkane) flammable colorless liquid with ten carbon atoms.
Decibel	A logarithmic measure of the ratio of two signal levels. A practical unit of gain.
Decimal	A numbering system based on 10.
Default	A value assigned or an action taken automatically unless another is specified.
Degree	An incremental value in the temperature scale, i.e., there are 100 degrees between the ice point and the boiling point of water in the Celsius scale and 180°F between the same two points in the Fahrenheit scale.
Delivery Point	Point at which gas leaves a transporter's system completing a sale or transportation service transaction between the pipeline company and a sale or transportation service customer.
Demand Day	That 24-hour period specified by a supplier-user contract for purposes of determining the purchaser's daily quantity of gas used (e.g., 8 AM to 8 AM, etc.). This term is primarily used in pipeline-distribution company agreements. It is similar to, and usually coincides with, the distribution company "Contract Day".
Demand Load	The rate of flow of gas required by a consumer or a group of consumers, often an average over a specified short time interval (cf/hr or Mcf/hr). Demand is the cause; load is the effect.

TERM	DEFINITION
Demand Meters	A device which indicates or records the instantaneous, maximum or integrated (over a specified period) demand.
Demand, Average	The demand on a system or any of its parts over an interval of time, determined by dividing the total volume in therms by the number of units of time in the interval.
Density	Mass per unit Volume: D=MV
Desaturization	Doesn't cause the composition of the gas to change, enabling a more representative sample of gas.
Detector Bead	See Thermal Conductivity Detector.
Deviation	The difference between the value of the controlled variable and the value at which it is being controlled.
Dew Point	The temperature at any given pressure at which liquid initially condenses from a gas or vapor. It is specifically applied to the temperature at which water vapor starts to condense from a gas mixture (water dew point) or at which hydrocarbons start to condense (hydrocarbon dew point).
Dewar	A glass or metal container made like a vacuum bottle that is used especially for storing liquefied gases. Also called "Dewar flask".
DG	Display Group. When display group files are created
Diaphragm	A bellows inside a displacement type gas meter. Also, a membrane separating two different pressure areas within a control valve or regulator.
Differential	For an on/off controller, it refers to the temperature difference between the temperature at which the controller turns heat off and the temperature at which the heat is turned back on. It is expressed in degrees.
Differential Input	A signal-input circuit where SIG LO and SIG HI are electrically floating with respect to ANALOG GND (METER GND, which is normally tied to DIG GND). This allows the measurement of the voltage difference between two signals tied to the same ground and provides superior common-mode noise rejection.
Differential Pressure	The pressure difference between two points in a system. For example, the difference in pressure between the upstream and downstream taps of an orifice plate, used to measure volume passing through the orifice.
Digit	A measure of the display span of a panel meter. By convention, a full digit can assume any value from 0 through 9, a 1/2-digit will display a 1 and overload at 2, a 3/4-digit will display digits up to 3 and overload at 4, etc. For example, a meter with a display span of ±3999 counts is said to be a 3-3/4 digit meter.
Digital	A signal which has distinct states, either on or off (0 or 1). Digital computers process data as binary information having either true of false states.

TERM	DEFINITION
Digital Controller Assembly	The Digital Controller Assembly contains the Digital Electronic Board, Mounting Assembly and optionally a VGA Display. The Digital Controller board provides control parameters to the Analytical Processor board, stores and processes the data sent from the Analytical Processor board. The Digital Controller also processes communication with other devices.
Digital Controller Assy.	The NGC8200's digital controller assembly provides control parameters to the analytical processor board, stores and processes the data sent from the analytical processor board. The digital controller also processes communication with other devices. This assembly may also contain an optional VGA display.
Digital Data	Information transmitted in a coded form (from a computer), represented by discrete signal elements.
Digital Data Exchange or Dynamic Data Exchange	A Microsoft data exchange format generally used to transfer data from one program to another. It is a very simple format to use and Totalflow customers often use TDS to acquire data from Totalflow devices and then transfer the data to an Excel spreadsheet using DDE. The Totalflow Driver, TDS32, supports DDE and its network version, NetDDE.
Digital Electronics	The branch of electronics dealing with information in binary form.
Digital Input	Refers to the signal received in binary format.
Digital Output	Refers to the signal emitted in binary format. An output signal which represents the size of an input in the form of a series of discrete quantities.
Digital to Analog Conversion	The process of translating discrete data into a continuously varying signal. Common uses are to present the output of a digital computer as a graphic display or as a test stimulus.
Digital-to-Analog Converter	An electronic device, often an integrated circuit, that converts a digital number into a corresponding analog voltage or current.
DIN	Deutsches Institut für Normung. German Institute for Standardization set of standards recognized throughout the world.
DIN Rail	Rail on which modules are mounted. Allows modules to snap on and slide right and left.
Diode	A semiconductor that allows current to flow in one direction only.
DIP Switches	A bank of switches typically used in setting the hardware configuration and base address of an option card.
Direct Current	A current that does not change in direction and is substantially constant in value.
Direct Memory Access	A method by which information can be transferred from the computer memory to a device on the bus without using the processor.
Discharge	The conversion of chemical energy of a cell/battery into electrical energy and withdrawal of the electrical energy into a load.

TERM	DEFINITION
Discharge Rate	The rate, usually expressed in amperes, at which electrical current is taken from the cell/battery.
Discrete Manifold	Also called Tubing Manifold. Used in instances when the XFC is not mounted directly on the Orifice, usually pipe mount or wall mount.
Distillates	The distillate or middle range of petroleum liquids produced during the processing of crude oil. Products include diesel fuel, heating oil, kerosene and turbine fuel for airplanes.
Distillation	The first stage in the refining process in which crude oil is heated and unfinished petroleum products are initially separated.
Distribution	The act or process of distributing gas from the city gas or plant that portion of utility plant used for the purpose of delivering gas from the city gate or plant to the consumers, or to expenses relating to the operating and maintenance of distribution plant.
Distribution Company	Gas Company which obtains the major portion of its gas operating revenues from the operation of a retail gas distribution system, and which operates no transmission system other than incidental connections within its own system or to the system of another company. For purposes of A.G.A. statistics, a distribution company obtains at least 90 percent of its gas operating revenues from sales to ultimate customers, and classifies at least 90 percent of mains (other than service pipe) as distribution. Compare INTEGRATED COMPANY; TRANSMISSION COMPANY, GAS.
Dkt	Abbreviation for Dekatherm, equivalent to one MMBtu.
DMM	Digital Multi-Meter.
DN	Inside diameter standard.
DOS	Disk Operating System.
DOS CCU	Refers to the DOS version of the Calibration and Collection Unit. Also known as FS/2, hand held or Dog Bone.
DOT Matrix	A group of dots/pixels forming a character or symbol, usually five dots across and seven dots down.
DOT/Pixel	An active element that forms a character or symbol when combined in a matrix.
Download	This refers to a Totalflow procedure in which any file(s) located on a laptop PC or storage device, may be copied to the on-board memory of a Totalflow Host device for purposes of restoring, configuration or repair.
Downstream	The oil industry term used to refer to all petroleum activities from the processing of refining crude oil into petroleum products to the distribution, marketing, and shipping of the products. Also see Upstream.
Downstream Pipeline	The pipeline receiving natural gas at a pipeline inter-connect point.
DP	See Differential Pressure.
DRAM	See Dynamic Random Access memory.

TERM	DEFINITION
Drift	A change of a reading or a set point value over long periods due to several factors including change in ambient temperature, time, and line voltage.
Drip Gasoline	Hydrocarbon liquid that separates in a pipeline transporting gas from the well casing, lease separation, or other facilities and drains into equipment from which the liquid can be removed.
Driver (Hardware)	An electronic circuit that provides input to another electronic circuit.
Driver (Software)	A program that exercises a system or system component by simulating the activity of a higher level component.
Drivers	Software that controls a specific hardware device, such as interface boards, PLCs, RTUs, and other I/O devices.
Droplet Liquids	Large liquid particles
Dry Contact	Contacts which neither break nor make a circuit. 0 Ohms.
Dry Gas	Has no more than seven pounds of water per million cubic feet of gas. Gas has less than 0.1 PPM of liquid at the coldest ambient condition expected at the coldest point in the system. The liquid can be water, oil, synthetic lubrication, glycol, condensed sample or any other non vapor contaminate.
DSP	Digital Signal Processor.
Dual Element Sensor	A sensor assembly with two independent sensing elements.
Dual-Access Memory	Memory that can be sequentially accessed by more than one controller or processor but not simultaneously accessed. Also known as shared memory.
Duplex	The ability to both send and receive data simultaneously over the same communications line.
Duplex Wire	A pair of wires insulated from each other and with an outer jacket of insulation around the inner insulated pair.
Duty Cycle	The total time to one on/off cycle. Usually refers to the on/off cycle time of a temperature controller.
DVI	The Port Manager and communication engine of the SCADAvantage System. This software can multiplex among several communication formats and thus supporting several vendor’s equipment over a single radio frequency. It “pushes” new data to the SCADA database, saving time and network resources by not transmitting redundant data. The DVI includes the Totalflow WinCPC code and thus supports all Totalflow software and functions – including WinCCU, TDS, PCCU, Report by exception, cryout, etc.
Dynamic Random Access memory	This is the most common form of computer memory It needs to be continually refreshed in order to properly hold data, thus the term "dynamic."
E^2Prom	See Electrically Erasable Programmable Read-Only Memory. Also called EEPROM.

TERM	DEFINITION
Earth	Can mean a connection to the earth itself or the negative lead to the chassis or any point to zero voltage.
EC	European Community.
Echo	To reflect received data to the sender. i.e. depressed on a keyboard are usually echoed as characters displayed on the screen.
Edit	Making changes to information, data or configuration files.
EEPROM	See Electrically Erasable Programmable Read-Only Memory. The PROM can be erased by electricity.
EFI	Electromechanical Frequency Interface.
EFM	See Electronic Flow Measurement.
EFR	Enhance Feature Release.
Electrical Interference	Electrical noise induced upon the signal wires that obscures the wanted information signal.
Electrically Erasable Programmable Read-Only Memory	ROM that can be erased with an electrical signal and reprogrammed. Also referred to as the S Drive. It is a persistent drive that will not loose it's memory unless manually reprogrammed. Also called E^2Prom. Totalflow's XFC and XRC have a Serial EEPROM on board, which generally holds registry, application configuration and warranty information (non-volatile).
Electrode	The site, area, or location at which electrochemical processes take place.
Electromagnetic Compatibility	Term used for European Union's New Approach Directive 89/336/EEC which means the device or system is able to function in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.
Electromagnetic Interference	Any electromagnetic disturbance that interrupts, obstructs, or otherwise degrades or limits the effective performance of electronics/electrical equipment. It can be induced intentionally, as in some forms of electronic warfare, or unintentionally, as a result of spurious emissions and responses, intermodulation products, and the like.
Electronic Flow Measurement	Historically, flow measurement was tracked using a chart recording technology. Developments in the field of electronics allowed for electronic measurement devices to overtake the chart recording market. This field continues to develop into peripheral markets, making the "Flow Meter" a valuable asset with multi-tasking "Control" capabilities. Totalflow's answer to this developing market is the XSeries equipment.
EMC	See Electromagnetic Compatibility
EMI	See Electromagnetic Interference.
Emitter	One terminal of a transistor.
EN	Euro Norm (European Standard)
Enagas	Spain's Certification Board

TERM	DEFINITION
Encoder	A device that converts linear or rotary displacement into digital or pulse signals. The most popular type of encoder is the optical encoder, which uses a rotating disk with alternating opaque areas, a light source, and a photodetector.
Environmental Conditions	All conditions in which a transducer may be exposed during shipping, storage, handling, and operation.
EP Mix	A liquefiable hydrocarbon product consisting primarily of ethane and propane.
EPROM	See Erasable Programmable Read-Only Memory. The PROM can be erased by ultraviolet light or electricity.
Erasable Programmable Read-Only Memory	ROM that can be erased using Ultraviolet Light. The EPROM maybe re-programmed by removing the EPROM from the circuit and using special equipment to write to it.
Ethane (C2H6)	A colorless hydrocarbon gas of slight odor having a gross heating value of 1,773 Btu per cubic foot and a specific gravity of 1.0488. It is a normal constituent of natural gas.
Ethylene (C2H4)	A colorless unsaturated hydrocarbon gas of slight odor having a gross heating value of 1,604 Btu per cubic foot and a specific gravity of 0.9740. It is usually present in manufactured gas, constituting one of its elements and is very flammable.
EU	European Union. Formerly known as the European Community (EC). Members of this union are replacing individual national regulations of member countries with a series of Directives. These Directives are legislative instruments which oblige member states to introduce them into their existing laws. These directives harmonize a variety of existing practices, preserve the different legal traditions and settle constraints for further developments.
Event	Important incident: an occurrence, especially one that is particularly significant.
Event File	Stored records specifying a notable change. The XFC stores up to 200 records, containing: Time, Day, Description, Old Value, New Value.
Events	Signals or interrupts generated by a device to notify another device of an asynchronous event. The contents of events are device-dependent.
Ex	Potential Explosive.
EXIMV	Explosion Proof Integral Multivariable Transducer.
Expansion Board	A plug-in circuit board that adds features or capabilities beyond those basic to a computer, such as a data acquisition system expansion board.
Expansion Factor	Correction factor for the change in density between two pressure measurement areas in a constricted flow.
Expansion Slots	The spaces provided in a computer for expansion boards than enhance the basic operation of the computer.

TERM	DEFINITION
Explosion-proof Enclosure	Explosion Proof Enclosure for Class 1 Division 1 locations. An enclosure that can withstand an explosion of gases within it and prevent the explosion of gases surrounding it due to sparks, flashes or the explosion of the container itself, and maintain an external temperature which will not ignite the surrounding gases.
Extended Binary Coded Decimal Interchange Code	EBCDIC. An eight-bit character code used primarily in IBM equipment. The code allows for 256 different bit patterns.
External Multivariable Transducer	Multivariable Transducer located outside of the Flow Computer enclosure. Used in multi-tube configurations and on systems where the actual Flow Computer is located at a distance from the flowing tube.
External Transducer	DP/SP Transducer located outside the enclosure. All electronics are located inside the enclosure and communicate via a ribbon cable.
F.O.B.	Abbreviation of free on board with the cost of delivery to a port and loading onto a ship included.
Fa	Orifice Thermal Expansion factor.
Fahrenheit	A temperature scale defined by 32° at the ice point and 212° at the boiling point of water at sea level.
Faux	Full Well Stream Factor.
Fb	Basic Orifice factor.
FBD	Function Block Diagram (IEC supported programming language)
FCC	Federal Communications Commission.
FCU	Flow computer unit
Feed Points	Connections between gas feeder lines and distribution networks.
Feedback	Occurs when some or all of the output of the device (such as an amplifier) is taken back to the input. This may be accidental (such as the acoustic feedback from a speaker to microphone) or intentional , to reduce distortion.
Feeder (Main)	A gas main or supply line that delivers gas from a city gate station or other source of supply to the distribution networks.
Feed-Through Assembly	The Feed-Through Assembly also serves as the connection for sample streams, carrier gas and calibration streams, and contains the vents for sample and column gases.
Feed-through Assy.	Independent process streams are connected to the NGC8200 directly through the feed-through assembly or through an optionally installed sample conditioning system. The feed-through assembly also serves as the connection for carrier gas and calibration streams and contains the vents for sample and column gases.
FET	Field-effect transistor. Transistor with electric field controlling output: a transistor, with three or more electrodes, in which the output current is controlled by a variable electric field.
Fg	Specific Gravity factor.

TERM	DEFINITION
Field Pressure	The pressure of natural gas as it is found in the underground formations from which it is produced.
File	A set of related records or data treated as a unit.
Film Liquids	Aerosols liquids who have contacted each other and become adhered to the inside of the pipeline.
Firmware	A computer program or software stored permanently in PROM or ROM or semi-permanently in EPROM.
Firmware Version	This refers to the version of firmware contained in the equipment.
Fixed-Point	A format for processing or storing numbers as digital integers.
Flag	Any of various types of indicators used for identification of a condition or event; for example, a character that signals the termination of a transmission.
Flameproof Enclosure "d"	Enclosure which can withstand the pressure developed during an internal explosion of an explosive mixture, and which prevents the transmission of the explosion to the explosive atmosphere surrounding the enclosure.
Flammable	A liquid as defined by NFPD and DOT as having a flash point below 37.8°C (100°F).
Flange	For pipe, a metal collar drilled with bolt holes and attached to the pipe with its flat surface at right angles to the pipe axis so that it can be securely bolted to a mating flange on a valve, another pipe section, etc.
FLASH	Re-programmable memory onboard an XFC/XRC, similar to an EPROM, except that it can be programmed while in circuit using a Boot Loader Program to write to it. Generally used for the operating system and application code space (non-volatile).
Flash ADC	An Analog to Digital Converter whose output code is determined in a single step by a bank of comparators and encoding logic.
Flash Point	The temperature at which a liquid will yield enough flammable vapor to ignite. There are various recognized industrial testing methods; therefore the method used must be stated.
Flash Vapors	Gas vapors released from a stream of natural gas liquids as a result of an increase in temperature or a decrease in pressure.
Flow	Travel of liquids or gases in response to a force (i.e. pressure or gravity).
Flow Computer, XSeries	A device placed on location to measure SP, DP and temperature (to calculate flow) of gases or liquids being transferred, for remote unattended operation.
Flow Formulas	In the gas industry, formulas used to determine gas flow rates or pressure drops in pipelines, regulators, valves, meters, etc.
Flow Rate	Actual speed or velocity of fluid movement .
Flowmeter	A device used for measuring the flow or quantity of a moving fluid.

TERM	DEFINITION
Fluids	Substances that flow freely; gases and liquids.
FM	Factory Mutual Research Corporation. An organization which sets industrial safety standards.
FM Approved	An instrument that meets a specific set of specifications established by Factory Mutual Research Corporation.
Font	The style of lettering used to display information.
Footprint	The surface space required for an object.
Fpb	Pressure Base factor.
FPM	Flow velocity in feet per minute.
FPS	Flow velocity in feet per second.
Fpv	See Supercompressibility Factor.
Fr	Reynolds Number factor.
Fractionation	The process of separating a steam of natural gas liquids into its separate components.
Freezing Point	The temperature at which the substance goes from the liquid phase to the solid phase.
Frequency	The number of cycles per second for any periodic waveform - measured in cycles per second - now called Hertz. The number of repeating corresponding points on a wave that pass a given observation point per unit time.
Frequency Modulation	Modulation where the frequency of the sine wave carrier alters with the amplitude of the modulating signal.
Frequency Output	An output in the form of frequency which varies as a function of the applied input.
Frit Filter	A small fine filter used primarily on the NGC8200 product line in the feed-through assembly as a last stage gas filter. This filter is not designed to replace an appropriate sample conditioning system.
FRP	Fiberglass Reinforced Polyurethane. A non-flexible material used for LevelMaster sensors.
FS/2	Ruggadized handheld computer device for programming and collecting data from an XFC. Also referred to a Husky or Dog Bone.
FT^3	A standard abbreviation for Cubic Foot.
Ftb	Temperature Base factor.
Ftf	Flowing Temperature factor.
Fuel Oils	The heavy distillates from the oil refining process that are used primarily for heating, for fueling industrial processes, for fueling locomotives and ships, and for fueling power generation systems.
Full Bridge	Wheatstone bridge configuration utilizing four active elements or strain gauges.

TERM	DEFINITION
Full Duplex	Simultaneous, two-way (transmit and receive), transmission.
Function	A set of software instructions executed by a single line of code that may have input and/or output parameters and returns a value when executed.
Fuse	A short length of wire that will easily burn out when excessive current flows.
Fw	Water Vapor factor.
G	The symbol used for giga or gigabyte.
Gain	The factor by which a signal is amplified, sometimes expressed in dB.
Gain Accuracy	A measure of deviation of the gain of an amplifier from the ideal gain.
Gal	An abbreviation for one gallon.
Gas	That state of matter which has neither independent shape nor volume. It expands to fill the entire container in which it is held. It is one of the three forms of matter, the other two being solid and liquid.
Gas Chromatograph	An analytical instrument that separates mixtures of gas into identifiable components by means of chromatography.
Gas Chromatograph Module	Software module used in conjunction with PCCU32 and WINCCU to interact with Btu Chromatograph equipment and software.
Gas Chromatograph Module Coefficient	A co-efficient generated by the factory allowing user to start calibration on location without having a calibration gas available.
Gas Chromatography	Preferred method for determining the Btu value of natural gas.
Gas Field	A district or area from which natural gas is produced.
Gas Injection	An enhanced recovery technique in which natural gas is injected under pressure into a producing reservoir through an injection well to drive oil to the well bore and the surface.
Gas Processing	The separation of components by absorption, adsorption, refrigeration or cryogenics from a stream of natural gas for the purpose of making salable liquid products and for treating the residue gas to meet required specifications.
Gas, Acid	The hydrogen sulfide and/or carbon dioxide contained in, or extracted from, gas or other streams.
Gas, Associated	Gas produced in association with oil, or from a gas cap overlying and in contact with the crude oil in the reservoir. In general, most states restrict associated gas production since its indiscriminate production could reduce the ultimate oil recovery. Also, since some wells producing associated gas cannot be shut-in without also shutting-in the oil production, natural gas pipelines are generally required to take associated gas produced from oil wells on a priority basis.
Gas, C1	See Methane.
Gas, C2	See Ethane.
Gas, C3	See Propane.

TERM	DEFINITION
Gas, C5+	Pentanes Plus (IC5, NeoC5, NC5 and C6+)
Gas, C6+	Hexanes Plus (C6, C7, C8, C9, C10, C11, etc.).
Gas, CO2	See Carbon Dioxide.
Gas, Dry	Gas whose water content has been reduced by a dehydration process. Gas containing little or no hydrocarbons commercially recoverable as liquid product. Specified small quantities of liquids are permitted by varying statutory definitions in certain states.
Gas, IC4	See Iso-Butane.
Gas, IC5	See Iso-Pentane.
Gas, Liquefied Petroleum (LPG)	A gas containing certain specific hydrocarbons which are gaseous under normal atmospheric conditions but can be liquefied under moderate pressure at normal temperatures. Propane and butane are the principal examples.
Gas, Manufactured	A gas obtained by destructive distillation of coal, or by the thermal decomposition of oil, or by the reaction of steam passing through a bed of heated coal or coke, or catalyst beds. Examples are coal gases, coke oven gases, producer gas, blast furnace gas, blue (water) gas, and carbureted water gas. Btu content varies widely.
Gas, Natural	A naturally occurring mixture of hydrocarbon and non-hydrocarbon gases found in porous geologic formations beneath the earth's surface, often in association with petroleum. The principal constituent is methane.
Gas, NC4	See Normal Butane.
Gas, NC5	See Normal Pentane.
Gas, NeoC5	See Neo-Pentane.
Gas, Non-associated	Free natural gas not in contact with, nor dissolved in, crude oil in the reservoir.
Gas, Oil	A gas resulting from the thermal decomposition of petroleum oils, composed mainly of volatile hydrocarbons and hydrogen. The true heating value of oil gas may vary between 800 and 1600 Btu per cubic foot depending on operating conditions and feedstock properties.
Gas, Sour	Gas found in its natural state, containing such amounts of compounds of sulfur as to make it impractical to use, without purifying, because of its corrosive effect on piping and equipment.
Gas, Sweet	Gas found in its natural state, containing such small amounts of compounds of sulfur that it can be used without purifying, with no deleterious effect on piping and equipment.
Gas, Unconventional	Gas that can not be economically produced using current technology.
Gas, Wet	Wet natural gas is unprocessed natural gas or partially processed natural gas produced from strata containing condensable hydrocarbons. The term is subject to varying legal definitions as specified by certain state statutes.

TERM	DEFINITION
Gate Station	Generally a location at which gas changes ownership, from one party to another, neither of which is the ultimate consumer. It should be noted, however, that the gas may change from one system to another at this point without changing ownership. Also referred to as city gate station, town border station, or delivery point.
Gathering	The act of operating extensive low-pressure gas lines which aggregate the production of several separate gas wells into one larger receipt point into an interstate pipeline.
Gathering Agreement	Agreement between a producer and a gathering system operator specifying the terms and conditions for entry of the producer's gas into the gathering system.
Gathering Line	A pipeline, usually of small diameter, used in gathering gas from the field to a central point.
Gathering Station	A compressor station at which gas is gathered from wells by means of suction because pressure is not sufficient to produce the desired rate of flow into a transmission or distribution system.
Gathering System	The gathering pipelines plus any pumps, tanks, or additional equipment used to move oil or gas from the wellhead to the main pipeline for delivery to a processing facility or consumer.
Gauge Factor	A measure of the ratio of the relative change of resistance to the relative change in length of a piezoresistive strain gage.
Gauge Pressure	Absolute pressure minus local atmospheric pressure.
Gauge, Pressure	Instrument for measuring the relative pressure of a fluid. Types include gauge, absolute, and differential.
Gauging Tape Measurements	This refers to a manual method of measuring the level of a liquid in a tank. These measurements may be used to calibrate float levels.
GC	See Gas Chromatograph.
GC Module	The NGC8200's GC module is comprised of three parts: columns, chromatographic valve and GC module circuit board. The valve controls the flow of gas within the system. The columns perform the separation of the gas into component parts for analysis. The GC module circuit board contains the sensors for the carrier pressure regulators, the sample pressure sensor and the thermal conductivity detectors (TCD's) which detect the different gas components as they leave the GC columns. It also contains an EEPROM or FLASH memory for storage of calibration and characterization information of the module and its sensors.
GC Module Assembly	The GC Module is comprised of 3 parts; Columns, Valves and Electronic Interface. The Valves control flow of gas within the system. The Columns perform the separation of the gas into component parts for analysis. The Electronic Interface contains pressure and temperature sensors to monitor and detect the different gas components as they leave the GC Columns.
GCM	See Gas Chromatograph Module

TERM	DEFINITION
GCM	See Gas Chromatograph Module Coefficient.
GCN	Gravity, Carbon Dioxide and Nitrogen compounds. Used in NX-19 GCN Supercompressibility Factor.
GCNM	Gravity, Carbon Dioxide, Nitrogen and Methane compounds. Used in NX-19 GCNM Supercompressibility Factor.
GDF	Gasde of France
Gj	An abbreviation for gigajoule, equivalent to one thousand mega joules or one billion joules.
GND	See Ground.
GOST	Russian Government Standards for Importation.
GPA 2145-03	Gas Processors Association Physical Constants for Paraffin Hydrocarbons and other Components of Natural Gas
GPA 2172-96	Gas Processors Association Calculation of Gross Heating Value, Relative Density and Compressibility of Natural Gas Mixtures from Compositional Analysis.
GPM	Gallons of liquid per thousand cubic feet.
GPS 2261	See Gas Processors Standard 2261.
GPV	Gauge Port Vent. Refers to the NGC8200 Port designed to equalize the pressure inside of the explosion-proof enclosure.
GPV	Gauge Port Valve (located on NGC8200 series Feed-Through Assembly).
GRD	See Ground.
Gross Heating Value	The heating value measured in a calorimeter when the water produced during the combustion process is condensed to a liquid state. The heat of condensation of the water is included in the total measured heat.
Ground	1) An electronically neutral circuit having the same potential as the surrounding earth. Normally, a non-current carrying circuit intended for the safety purposes. A reference point for an electrical system. 2) A large conducting body (as the earth) used as a common return for an electric circuit and as an arbitrary zero of potential. 3) Reference point for an electrical system.
Grounding Strap	A grounding strap is a conductive device used to make connection between the person handling the board, and a high quality ground potential.
H2	The molecular formula for Hydrogen.
H2S	The molecular formula for Hydrogen Sulfide.
Half Duplex	Communication transmission in one direction at a time.
Handshake	An interface procedure that is based on status/data signals that assure orderly data transfer as opposed to asynchronous exchange.

TERM	DEFINITION
Handshaking	Exchange of predetermined signals between two devices establishing a connection. Usually part of a communications protocol.
Hardware	The physical components of a computer system, such as the circuit boards, plug-in boards, chassis, enclosures, peripherals, cables, and so on. It does not include data or computer programs.
Harmonic	A sinusoidal component of a waveform that is a whole multiple of the fundamental frequency. An oscillation that is an integral sub-multiple of the fundamental is called a sub-harmonic.
HART	Communication Interface.
Hazardous Area	Area in which an explosive gas atmosphere is present or may be expected to be present.
Heat	Thermal energy. Heat is expressed in units of calories or Btu's
Heat Capacity	The amount of heat required to raise the temperature of a body (of any mass) one degree Celsius.
Heat of Condensation	The amount of heat that must be removed from one gram of a vapor at it's condensation point to condense the vapor with no change in temperature.
Heat of Vaporization	The amount of heat required to vaporize one gram of a liquid at its boiling point with no change in temperature. Usually expressed in J/g. The molar heat of vaporization is the amount of heat required to vaporize one mole of liquid at its boiling point with no change in temperature and usually expressed ion kJ/mol.
Heat Transfer	A form of energy that flows between two samples of matter because of their differences in temperature.
Heating Value	The amount of heat developed by the complete combustion of a unit quantity of a material. Heating values for natural gas are usually expressed as the Btu per Cf of gas at designated conditions (temperature and pressure) and either on the dry or water saturated basis.
Heavy Crude	Crude oil of 20-degree API gravity or less; often very thick and viscous.
Heavy Ends	The portion of a hydrocarbon mixture having the highest boiling point. Hexanes or heptanes and all heavier hydrocarbons are usually the heavy ends in a natural gas stream.
Heavy Hydrocarbons	More susceptible to increases in temperature and decreases in pressure, thus causing liquids to form.
Heptane (C_7H_{16})	A saturated hydrocarbon (Alkane) with 7 carbon atoms in it's molecule (C_7H_{16}). A liquid under normal conditions.
Hertz	Cycles per second. A measure of frequency or bandwidth.
Hexadecimal	A numbering system to the base 16, 0 through F.
Hexane (C_6H_{14})	A saturated hydrocarbon (Alkane) with six carbon atoms in it's molecule (C_6H_{14}). A liquid under normal conditions.

TERM	DEFINITION
Hexane Plus or Heptane Plus	The portion of a hydrocarbon fluid mixture or the last component of a hydrocarbon analysis which contains the hexanes (or heptanes) and all hydrocarbons heavier than the hexanes (or heptanes).
Hierarchical	A method of organizing computer programs with a series of levels, each with further subdivisions, as in a pyramid or tree structure.
Hold	Meter HOLD is an external input which is used to stop the A/D process and freeze the display. BCD HOLD is an external input used to freeze the BCD output while allowing the A/D process to continue operation.
Host	The primary or controlling computer in a multiple part system.
Host Console	Host Console via Local Port uses the PCCU cable between the computer and the device's Local PCCU port but running Remote Protocol. Host Console via Remote Port uses the remote protocol
Hub	A market or supply area pooling/delivery where gas supply transaction point occur that serve to facilitate the movement of gas between and among interstate pipelines. Transactions can include a change in title, a change in transporter, or other similar items.
HV	See Heating Value.
Hydrocarbon	A chemical compound composed solely of carbon and hydrogen. The compounds having a small number of carbon and hydrogen atoms in their molecules are usually gaseous; those with a larger number of atoms are liquid, and the compounds with the largest number of atoms are solid.
Hydrogen Sulfide	A flammable, very poisonous and corrosive gas with a markedly disagreeable odor, having the chemical formula of H_2S that is a contaminant in natural gas and natural gas liquids.
Hyper term	Terminal emulation program provided with Windows.
Hysteresis	The maximum difference between output readings for the same measured point, one point obtained while increasing from zero and the other while decreasing from full scale. The points are taken on the same continuous cycle. The deviation is expressed as a percent of full scale.
I/O	See Input/Output.
I/O Address	A method that allows the CPU to distinguish between the different boards in a system. All boards must have different addresses.
I^2C	Inter-Integrated Circuit. Serial communications bus to I/O modules (developed by Phillips Semiconductor)
IAR	Maker and distributor of the Embedded Workbench, a compiler, assembler, linker development system for the Z80/64180 microprocessor family.
IC	See Integrated Circuit
IC4	A standard abbreviation for Isobutane.
IC5	A standard abbreviation for Isopentane.

TERM	DEFINITION
Icon	A graphic functional symbol display. A graphic representation of a function or functions to be performed by the computer.
ID	Identification Number. You must assign an ID to the unit. Units are communicated to by this ID number, therefore the ID assigned in the software must agree with the hardware.
IEC	International Electrotechnical Commission. Developers of the IEC-61131-3 standard. Programming Language used by Totalflow for user applications in XSeries equipment.
$IECE_x$	The IEC scheme for certification to standards relating to equipment for use in explosive atmospheres.
IEEE	Institute of Electrical and Electronics Engineers
IIC	Inter-Integrated Circuit. Also see I^2C.
IL	Instruction List (IEC supported programming language)
Impedance	The total opposition to electrical flow (resistive plus reactive).
IMV	See Integral Multivariable Transducer.
Inch of Mercury	A pressure unit representing the pressure required to support a column of mercury one inch high at a specified temperature; 2.036 inches of mercury (at 32 degrees F and standard gravity of 32.174 ft/sec^2) is equal to a gauge pressure of one pound per square inch.
Inch of Water	A pressure unit representing the pressure required to support a column of water one inch high. Usually reported as inches W.C. (water column) at a specified temperature; 27.707 inches of water (at 60o and standard gravity of 32.174 ft/sec2) is equal to a gauge pressure of one pound per square inch.
Industry Canada	Canadian Certification.
Inerts	Elements or compounds not acted upon chemically by the surrounding environment. Nitrogen and carbon dioxide are examples of inert components in natural gas. Inerts dilute the natural gas and since they do not burn or combust, have no heating value.
Initialization File	Generic file used to support the display of Totalflow application data in PCCU32.
Input	That part of a circuit that accepts a signal for processing.
Input Impedance	The resistance measured across the excitation terminals of a transducer.
Input Sense	To examine or determine the status of the input.
Input/Output	The transfer of data to/from a computer system involving communications channels, operator interface devices, and/or data acquisition and control interfaces.
Instantiate	Starting an instance of an object.
Instrument Manifold	Manifold type used when XFC is mounted directly on the Orifice.
Insulator	Any material that resists the flow of electrical current.

TERM	DEFINITION
Integral Multivariable Transducer	A Multivariable Transducer that is an integral part of the flow computer, measuring DP and SP. This refers only to the transducer portion of the device and makes no assumption whether or not the circuitry is located as part of the unit, or if the circuitry is located on the Mother Board and attached via wiring. Also see Multivariable Transducer.
Integrated Circuit	A circuit component consisting of a piece of semiconductor material containing up to thousands of transistor and diodes. A chip.
Integrating ADC	An ADC whose output code represents the average value of the input voltage over a given time interval.
Interface (computer)	Usually refers to the hardware that provides communication between various items of equipment.
Interface (liquid)	The area between two liquids that are not easily mixed, i.e. oil and water.
Interference	A disturbance to the signal in any communications system.
Intrinsically Safe	An instrument which will not produce any spark or thermal effects under normal and specified fault conditions, that is capable of causing ignition of a specified gas mixture.
Inverter	A circuit in both analogue and digital systems that provides an output that is inverse to the input.
Inverter, DC to AC	Converts DC to AC at a high frequency.
ioINT	Interrupt signal from the I/O modules.
ioVBB	i/o Battery Voltage- Unregulated 13.8 volts. Host supplies 2.5 amps to the I/O modules.
ioVDD	Unregulated 5.6 volts from the host for I/O modules.
ISA	Instrument Society of America.
ISO	International Standards Organization.
ISO 5167	International Standards Organization Report No. 5167, Measurement of Fluid Flow by Means of Pressure Differential Devices.
ISO 6976-95	International Standards Organization Report No. 6976-95, Calculation of Calorific Values, Density, Relative Density and Wobbe Index from Composition.
Isobutane (C4H10)	A hydrocarbon of the same chemical formula as butane but different molecular structure, resulting in different physical properties, notably lower boiling point. Gross heating value 3261 Btu/cu. ft. gas.
Isokenetic Sampling	Laboratory technique where gas sample is tested after removing liquids, therefore not allowing the atomized liquid to return to the gaseous state, changing the sample accuracy.
Isolation	The reduction of the capacity of a system to respond to an external force by use of resilient isolating materials.
Isopentane (C5H12)	A hydrocarbon of the paraffin series having a chemical formula of C5H12 and having its carbon atoms branched.

TERM	DEFINITION
IUPAC	Acronym for International Union of Pure and Applied Chemistry. It is an international non-governmental organization devoted to the advancement of chemistry. It is most well known as the recognized authority in developing standards for the naming of the chemical elements and their compounds
Joule	The basic unit of thermal energy.
Joule-Thompson Effect	The change in gas temperature which occurs when the gas is expanded at constant enthalpy from a higher pressure to a lower pressure. The effect for most gases at normal pressure, except hydrogen and helium, is a cooling of the gas creating condensation.
K	Kilo. 1) In referring to computers, a "kilo" is 1024 or 2 to the 10th power (Note that it is actually slightly more than an even 1000.). 2) the standard metric prefix for 1,000, or 10^3, used with units of measure such as volts, hertz, and meters.
Kbytes/s	A unit for data transfer that means 1,000 or 10^3 bytes/s.
Kerosene	An oily liquid obtained in the distilling of gasoline in a temperature range from 174-288 degree C. A hydrocarbon of specific gravity of 0.747 to 0.775. Used as fuel for some internal combustion engines, heating equipment, and illuminating purposes. A heavy grade known as range oil is used for cooking and heating.
KHz	Electronic abbreviation for Kilohertz.
kilobyte	1024 bytes.
Kilowatt	Equivalent to 1000 watts.
kilowatt-hour	A unit of energy when one kilowatt of power is expended for one hour. Example A radiator bar is usually rated at 1,000 watts and this switched on for one hour consumes one kilowatt-hour of electricity.
KPa	Kilopascal-Measure of Pressure
kw	See Kilowatt.
kwh	See Kilowatt-hour.
LACT	Lease Automatic Custody Transfer.
Lag	1) A time delay between the output of a signal and the response of the instrument to which the signal is sent. 2) A time relationship between two waveforms where a fixed reference point on one wave occurs after the same point of the reference wave.
Latent Heat of Vaporization	Represents the amount of heat required to vaporize a liquid. In the instance of natural gas, the equation appears: 1 Btu = heat to change. This is the most likely scenario for causing gas to liquefy.
LCD	Liquid Crystal Display.
LD	Ladder Diagram (IEC supported programming language)
LED	Light Emitting Diodes.

TERM	DEFINITION
LevelMaster	Intelligent Digital Level Sensor and is designed for custody transfer accuracy in demanding level measurement applications in tanks. LevelMaster is the name of the Totalflow's Tank Gauging System.
Life	For rechargeable batteries, the duration of satisfactory performance, measured in years (float life) or in the number of charge/discharge cycles (cycle life).
Life Cycle	The minimum number of pressure cycles the transducer can endure and still remain within a specified tolerance.
Light Crude	Crude oil with a high API gravity due to the presence of a high proportion of light hydrocarbon fractions.
Light Ends	The portion of a liquid hydrocarbon mixture having the lowest boiling points which are easily evaporated.
Light Hydrocarbons	The low molecular weight hydrocarbons such as methane, ethane, propane and butanes. More Volatile.
Linearity	The maximum deviation of the calibration curve from a straight line between zero and full scale, expressed as a percent of full scale output and measured on increasing measurement only.
Liquefiable Hydrocarbons	The components of natural gas that may be recovered as liquid products.
Liquefied Natural Gas	Natural gas which has been liquefied by reducing its temperature to minus 260 degrees Fahrenheit at atmospheric pressure. It remains a liquid at -116 degrees Fahrenheit and 673 psig. In volume, it occupies 1/600 of that of the vapor at standard conditions. Natural gasoline and liquefied petroleum gases fall in this category.
Liquefied Petroleum Gas	A gas containing certain specific hydrocarbons which are gaseous under normal atmospheric conditions, but can be liquefied under moderate pressure at normal temperatures. Propane and butane are the principal examples.
Liquid Crystal Display	A reflective display that requires very low power for operation.
LNG	See Liquefied Natural Gas.
Load (electrical)	A load is an energy consuming device. The device can be an actual device such as a bulb of a flash light, radio, cassette player, motor, etc., a resistor or a constant current load.
Load (units)	The amount of gas delivered or required at any specified point or points on a system; load originates primarily at the gas consuming equipment of the customers. Also, to load a pressure regulator is to set the regulator to maintain a given pressure as the rate of gas flow through the regulator varies. Compare DEMAND.
Location File	This is a file containing the configuration of the Location or site and the LevelMasters assigned to the Location. You may have a file that contains everything or a file for each Location name. The information from the file is displayed on the main MasterLink screen in the form of a tree structure. See the Main Screen topic for more information.

TERM	DEFINITION
Location Name	Location Name is the top of the hierarchy tree of a Location File. Included in the Location Name is the LevelMaster's name, ID, S/N, Sensor File and Configuration no.
Log Period	In a XFC, the specified length between writing the calculated accumulated volume to record. You may record volumes as often as every minute and as seldom as every hour. More frequent recording reduces the number of days of records possible between collection.
Long Term	For Totalflow's purpose, the application of this term refers to storing data over a period of time that is greater than a minimal time. Such as data collected weekly versus data collected weekly but stored indefinitely.
LPG	See Liquefied Petroleum Gas.
LSB	Least Significant Byte
M	Mega, the prefix for 1,048,576, or 2^{20}, when used with byte to quantify data or computer memory. Also 1000, as in MCF or 1000 Cubic Ft.
Manifold	The conduit of an appliance which supplies gas to the individual burners. Also, a pipe to which two or more outlet pipes are connected.
Manifold Assembly	The Manifold Assembly is comprised of the Manifold Plate, Heater, Valves, and various Cables to other major components. The Manifold Plate and Heater maintain constant temperature for the GC Module and Columns. The Valves control Stream processing, Carrier and Calibrations gases. The Cables complete the information chain from the GC Module to the Analytical Processor and the Digital Controller Assembly.
Man-Machine Interface	Software program that converts machine instructions and commands into a user interface.
Manometer	A two-armed barometer.
Manual Reset	The switch in a limit controller that manually resets the controller after the limit has been exceeded.
MasterLink	MasterLink is the name of the software program used to communicate with the LevelMaster for purposes of doing setup, calibration, troubleshooting, generating site files, monitoring levels and collecting data.
Mbytes/s	A unit for data transfer that means 1 million or 10^6 bytes/s.
Mcf	The quantity of natural gas occupying a volume of 1000 cubic feet at a temperature of 60° Fahrenheit and at a pressure of 14.73 psia.
Mean Temperature	The average of the maximum and minimum temperature of a process equilibrium.
Measurement Unit Assembly	μFLO's measurement and operational features are housed in this single unit assembly. The main electronic board (μFLO-195 Board), communication connection, power, SP, DP and Temperature readings are all housed in this unit.
Mega	Multiplier indicating that a quantity should be multiplied by 1,000,000.

TERM	DEFINITION
Melting Point	The temperature at which a substance transforms from a solid phase to a liquid phase.
Membrane	The pH-sensitive glass bulb is the membrane across which the potential difference due to the formation of double layers with ion-exchange properties on the two swollen glass surfaces is developed. The membrane makes contact with and separates the internal element and filling solution from the sample solution.
Memory	Electronic devices that enable a computer to store and recall information. In its broadest sense, memory refers to any hardware capable of serving that end, e.g., disk, tape, or semiconductor storage.
Menu	The list of available functions for selection by the operator, usually displayed on the computer screen once a program has been entered.
MEPAFLOW	SICK Engineering's Menu-based Measurement and Parameterization Software for the TotalSonic system (MMI).
Mercaptans	Compounds of carbon, hydrogen and sulfur found in sour crude and gas; the lower mercaptans have a strong, repulsive odor and are used, among other things, to odorize natural gas.
Meter	Acronym M. Metric measurement equal to 1.09361 yards.
Meter Manifold	Gas piping between gas service line and meter. Also, gas piping supplying two or more meters.
Meter, Orifice	A meter using the differential pressure across an orifice plate as a basis for determining volume flowing through the meter. Ordinarily, the differential pressure is charted.
Meter, PD	See Meter, Positive Displacement.
Meter, Positive Displacement	An instrument which measures volume on the basis of filling and discharging gas in a chamber.
Meter, Turbine	1) Pulse meter. 2)A velocity measuring device in which the flow is parallel to the rotor axis and the speed of rotation is proportional to the rate of flow. The volume of gas measured is determined by the revolutions of the rotor and converting them to a continuously totalized volumetric reading.
Methane (C1H4)	A hydrocarbon (Alkane) with the lightest molecule. A gas under normal conditions. The first of the paraffin series of hydrocarbons. The chief constituent of natural gas. Pure methane is odorless and has a heating value of 1012 Btu per cubic foot. Typically mixed with a sulfur compound to aid in leak detection.
microFlo Computer	See μFLO.
Microprocessor	This term is commonly used to describe the CPU. More specifically, it refers to the part of the CPU that actually does the work, since many CPUs now contain L1 and L2 caches on-chip.
Milli	One thousandth e.g. one milli-watt - 1mW. one milli-amp - 1mA. one milli-volt -1mV.
Millimeter	Acronym mm. Metric measurement equal to .03937 inch.

TERM	DEFINITION
MIPS	Million instructions per second. The unit for expressing the speed of processor machine code instructions.
Mj	Abbreviation for mega joule, equivalent to one million joules.
Mm	Acronym for Millimeter.
MMBtu	A thermal unit of energy equal to 1,000,000 Btu's, that is, the equivalent of 1,000 cubic feet of gas having a heating content of 1,000 BTUs per cubic foot, as provided by contract measurement terms.
MMcf	A million cubic feet. See CUBIC FOOT. (1,000,000 CF)
MMI	See Man-Machine Interface.
Modbus	Messaging structure developed and used to establish master-slave/client-server communication between intelligent devices. Generic protocol supported by most process automation vendors.
Modem	Modulator-Demodulator. A device used to convert serial digital data from a transmitting terminal to a signal suitable for transmission over a common carrier, or to reconvert the transmitted signal to digital data for acceptance by a receiving terminal.
Module	Typically a board assembly and its associated mechanical parts, front panel, optional shields, and so on. A module contains everything required to occupy one or more slots in a mainframe.
Mol%	See Mole Percent.
Mole Percent	The number of moles of a component of a mixture divided by the total number of moles in the mixture.
MRB	Modbus Request Block. When requesting storage space after adding a new Modbus application, the file is saved as a *.mrb file.
MRM	Modbus Register Map. When requesting storage space after adding a new Modbus register, the file is saved as a *.mrm file.
MS	Milliseconds. One-thousandth of a second.
MSB	Most Significant Byte
Mueller Bridge	A high-accuracy bridge configuration used to measure three-wire RTD thermometers.
Multiplex	A technique which allows different input (or output) signals to use the same lines at different times, controlled by an external signal. Multiplexing is used to save on wiring and I/O ports.
Multi-tasking	A property of an operating system in which several processes can be run simultaneously.
Multi-tube Sites	Locations where many flow tubes are all within a prescribed distance allowing one flow meter with multitube capabilities, such as the XSeries product line, to monitor and maintain flow records for each tube in one Flow Computer.

TERM	DEFINITION
Multivariable Transducer	Transducer supplying more than 1 variable. Totalflow uses this term to encompass units that read Static Pressure, Differential Pressure. Historically these units were coined AMU for Analog Measurement Unit. As a result of advanced technology, the unit no longer functions as only an analog measurement unit. Therefore the newer terminology, Multivariable Transducer, more aptly describes the functionality of this design. The abbreviation IMV refers to the Integral version of the multivariable. The abbreviation XIMV, refers to the XSeries IMV version of the multivariable, which contains the circuitry as part of the unit and the abbreviation IMVX, refers to the Explosion Proof IMV, where the required circuitry resides on the Main Processor Board. See each instance for additional explanation.
MW	Acronym for Molecular Weight.
N2	A standard abbreviation for Nitrogen.
NAK	See Negative Acknowledgement
NAMUR	Normenarbeitsgemeinschaft für Mess- und Regeltechnik in der chemischen Industrie (Standards study group for measurement and process control technology in the chemical industry).
Natural Gas	See Gas, Natural.
Natural Gas Distillate	Material removed from natural gas at the "heavy end" portion; that is, aliphatic compounds ranging from C4 to C8 (butanes and heavier).
Natural Gas Liquids	The hydrocarbon components: propane, butanes, and pentanes (also referred to as condensate), or a combination of them that are subject to recovery from raw gas liquids by processing in field separators, scrubbers, gas processing and reprocessing plants, or cycling plants. The propane and butane components are often referred to as liquefied petroleum gases or LPG.
Natural Gasoline	A mixture of hydrocarbons, mostly pentanes and heavier, extracted from natural gas, which meets vapor pressure and other specifications.
NBS	National Bureau of Standards.
NC	See Normally Closed.
NC4	A standard abbreviation for Normal Butane.
NC5	A standard abbreviation for Normal Pentane.
NEC	National Electrical Codes
Negative Acknowledgment	This refers to a response over a remote communication device, such as a PING. Basically, saying, "I don’t acknowledge your request!" This is the opposite of ACK. NAK is a slang term that means that you disagree or do not acknowledge something.
NEMA	National Electrical Manufacturers Association.
NEMA, Type 3R	A standard from the National Electrical Manufacturers Association. Enclosure constructed for indoor/outdoor use to provide protection against falling dirt, rain, sleet and snow and remain undamaged by external formation of ice.

TERM	DEFINITION
NEMA, Type 4	A standard from the National Electrical Manufacturers Association. Enclosure constructed for indoor/outdoor use to provide protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, and hose-directed water and remain undamaged by external formation of ice.
NEMA, Type 4X	A standard from the National Electrical Manufacturers Association. Enclosure constructed as for Type 4 with protection against corrosion.
NeoC4	A standard abbreviation for Neobutane.
NeoC5	A standard abbreviation for Neopentane.
Network	A group of computers that are connected to each other by communications lines to share information and resources.
Newton Meter	Torque measurement unit equal to 8.84 Inch Pounds.
NGC	Natural Gas Chromatograph
NGC Termination Panel	The NGC8200 Termination Panel acts as a connection to the outside world. It features Transient Protection, a built-in voltage regulator, Positive Temperature Co-efficient Fuses (PTC) and many other safeguards to protect the remainder of the system from electrical damage. All outside communications and I/O are channeled through this board. It is designed to be a low cost, field replaceable maintenance solution and is designed to operate on either 12V or 24V.
NGC8201	Totalflow NGC8201 Gas Chromatograph for Process Gas Chromatography. The NGC is designed to continually analyze process gas streams, on-site, determine composition, calorific value, and store the analysis information. The unit can collect and retain analysis information for one to four independent sample streams.
NGC8206	Totalflow NGC8200 Gas Chromatograph, with C6+. The NGC is designed to continually analyze natural gas streams, on-site, determine composition, calorific value, and store the analysis information. It is designed for natural gas streams, 800 to 1500 Btu/scf (29.8 to 55.9 Mega joules/meter^3) with less than 100 PPM H2S. The unit is a fully functional gas chromatograph for “Pipeline Quality” natural gas, designed to analyze natural gas streams, dry of both hydrocarbon liquids and water. The unit can collect and retain analysis information for one to four independent sample streams. Applicable installations include: Transmission, Distribution, Custody Transfer with Metrology quality results, Production, Gas Gathering and End User Gas Markets.
NGL	See Natural Gas Liquids.
NGL	A standard abbreviation for Natural Gas Liquids.
Nm	Abbreviation for Newton Meter. Metric Torque measurement.
NO	See Normally Open.

TERM	DEFINITION
Noise	An undesirable electrical signal. Noise comes from external sources such as the AC power line, motors, generators, transformers, fluorescent lights, soldering irons, CRT displays, computers, electrical storms, welders, radio transmitters, and internal sources such as semiconductors, resistors, and capacitors. Unwanted disturbances superimposed upon a useful signal that tends to obscure its information content.
Nonane (C9H20)	A hydrocarbon (Alkane) flammable colorless liquid with nine carbon atoms.
Non-hazardous area	Area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions.
Non-Persistent	Refers to data that is no longer available after a Warm Start.
Normal Butane	An aliphatic compound of the paraffin series having the chemical formula of C4H10 and having all of its carbon atoms joined in a straight chain.
Normal Pentane	A hydrocarbon of the paraffin series having a chemical formula of C5H12 and having all its carbon atoms joined in a straight chain.
Normalization of Component Mole Percentages	The exact amount of sample which is injected onto the columns of the chromatograph must be a very reproducible volume in order to give consistent values for the resulting calculated Btu. The calculation controls the volume, temperature and pressure of the sample to be injected by a very simple means. A few seconds before the sample is actually injected, the flow of sample through the sample valve injection loop is stopped by automatically shutting the sample shut-off valve. This allows the pressure of the sample in the sample loop to bleed down to atmospheric pressure. Since the temperature is controlled and the size of sample loop does not vary then the only change possible in sample size is related to variations in atmospheric pressure. Atmospheric pressure does vary with the weather and in order to compensate for this or any other slight sample size change, the mole percentages of each component are adjusted to equal a total of 100% through a calculation called normalization. The values in mole percents are determined by the chromatographic analysis and then totaled to a value that is near 100%, which is called the unnormalized total. The unnormalized total is divided by 100% and the resulting factor is then multiplied by the mole% value for each component. This calculation will adjust each component's mole% in the correct manner as to result in a new total of exactly 100%. The calculation also checks to see if the unnormalized total is out of a specified range for alarm purposes. This is an overall performance check to determine if the chromatograph has some problem or has drifted out of calibration.
Normally Closed	Designation which states that the contacts of a switch or relay are closed or connected when at rest. When activated, the contacts open or separated.

TERM	DEFINITION
Normally Open	Designation which states that the contacts of a switch or relay are normally open or not connected. When activated the contacts close or become connected.
Norsok	Norwegian Certification Bureau
NPN	Negative-Positive-Negative (Transistor).
NPT	National Pipe Thread.
NRTL	Nationally Recognized Testing Laboratory.
Null	A condition, such as balance, which results in a minimum absolute value of output.
NX-19	American Gas Association Report referring to a specific method to calculate the Supercompressibility factor.
O2	A standard abbreviation for oxygen.
Octane (C8H18)	A hydrocarbon (Alkane) flammable colorless liquid with eight carbon atoms. Is the 100 point on the Octane Rating Scale.
OCV	See Open Circuit Voltage.
ODBC	See Open Database Connectivity.
OEU	Optional Equipment Unit.
Offset	The difference in temperature between the set point and the actual process temperature. Also, referred to as droop.
OHM	The unit of resistance usually shown as the symbol "R". One thousand ohms is written "k" and one million ohms is written "M". Resistance is measured with a multimeter, set to the "ohms range".
Ohmmeter	An instrument used to measure electrical resistance.
OLE	Object Linking and Embedding. A set of system services that provides a means for applications to interact and interoperate. Based on the underlying Component Object Model, OLE is object-enabling system software. Through OLE Automation, an application can dynamically identify and use the services of other applications, to build powerful solutions using packaged software. OLE also makes it possible to create compound documents consisting of multiple sources of information from different applications.
Ole for Process Control	This is a data interchange format and supporting software. Typically, vendors (such as ABB) write OPC server drivers which can talk to their devices. SCADA system vendors (again like ABB) write OPC clients that can gather data from OPC Servers. The idea is to provide a universal way to collect data into a SCADA system regardless of the equipment vendor. This standard was developed and is maintained by the OPC Foundation. The Totalflow Driver, TDS32, supports OPC.
Ole for Process Control Database	A programming interface to databases. Supports the OLEDB interface.
OLEDB	See Ole for Process Control Database.

TERM	DEFINITION
Olefins	Basic chemicals made from oil or natural gas liquids feedstocks; commonly used to manufacture plastics and gasoline. Examples are ethylene and propylene.
OOP	Object-Oriented Programming. The XFC/XRC architecture incorporates an object-oriented approach.
OPC	See Ole for Process Control.
Open Circuit	A complete break in a metal conductor path.
Open Circuit Voltage	The difference in potential between the terminals of a cell/battery when the circuit is open (no-load condition).
Open Collector	A single NPN transistor with the base connected to the logic driving circuitry and with the emitter grounded. The collector is the output pin of the gate.
Open Database Connectivity	A widely accepted application-programming interface (API) for database access. It is based on the Call-Level Interface (CLI) specifications from X/Open and ISO/IEC for database APIs and uses Structured Query Language (SQL) as its database access language. Using ODBC, you can create database applications with access to any database for which your end-user has an ODBC driver. This allows access for authorized users to databases over any network, including the Internet. The SCADA system provides an ODBC driver, making the database accessible to authorized users anywhere on a corporate network, or even over the Internet if the network is properly configured.
Operating System	Base-level software that controls a computer, runs programs, interacts with users, and communicates with installed hardware or peripheral devices.
Optional Equipment Unit	Totalflow enclosure designed to house optional power and communication devices.
Orifice Meter	Device to record differential pressure measurement which uses a steel plate with a calibrated hole or orifice to generate a drop in pressure between the two sides of the plate. Also the primary element of the meter run.
Orifice Plate	A plate of non-corrosive material which can be fastened between flanges or in a special fitting perpendicular to the axis of flow and having a concentric circular hole. The primary use is for the measurement of gas flow.
ORing	Boolean algebra logical function. Described as the addition or summing of switches or inputs, in the case of Boolean elements, the 0 and 1 represent two possible states of a premise or hypothesis: True or False, On or Off. When adding Boolean elements not real numbers, you will find these results: 1 or 1 = 1 1 or 0 = 1 0 or 1 = 1 0 or 0 = 0
O-Ring	A flat ring made of rubber or plastic, used as a gasket.

TERM	DEFINITION
Output	That part of a circuit where the processed signal is available.
Output Impedance	The resistance as measured on the output terminals of a pressure transducer.
Output Noise	The RMS, peak-to-peak (as specified) ac component of a transducer's dc output in the absence of a measurand variation.
P/I	See Pulse Input.
Parameter	(1) Characteristic. For example, *specifying parameters* means defining the characteristics of something. In general, parameters are used to customize a program. For example, file names, page lengths, and font specifications could all be considered parameters. (2) In programming, the term *parameter* is synonymous with argument, a value that is passed to a routine.
Parity	A technique for testing transmitting data. Typically, a binary digit is added to the data to make the sum of all the digits of the binary data either always even (even parity) or always odd (odd parity).
Parts per Million	Acronym PPM.
Passive Analog Output	Analog Output to a host that is powered by an outside source.
PCCU	Portable Collection and Calibration Unit.
PCCU32	Windows version of PCCU communications software to process, archive and collect data from the Totalflow equipment. Generally run from a laptop.
Peak Area	The retention time the element takes to exit the column. This is used in calculating the amount of each component in the sample or Mole %.
Pentane (C_5H_{12})	A saturated hydrocarbon (Alkane) with five carbon atoms in it’s molecule (C_5H_{12}). A liquid under normal conditions.
Pentane, Normal	See Normal Pentane.
Pentanes Plus	A hydrocarbon mixture consisting mostly of normal pentane and heavier components.
Peripheral	The input/output and data storage devices attached to a computer such as disk drives, printers, keyboards, displays, data acquisition systems, etc.
Persistent	Refers to data that remains available after a Warm Start.
PEX	A flexible material used for LevelMaster sensors.
PGC	Process Gas Chromatograph
Phase	A time based relationship between a periodic function and a reference. In electricity, it is expressed in angular degrees to describe the voltage or current relationship of two alternating waveforms.
Phenol	Hydrocarbon derivative containing an [OH] group bound to an aromatic ring.

TERM	DEFINITION
Physical Change	A change in which a substance changes from one physical state to another but no substances with different composition are formed. Example Gas to Liquid - Solid.
PID	Proportional, Integral, Derivative. A three mode control action where the controller has time proportioning, integral (auto reset) and derivative rate action.
Piezoceramic	A ceramic material that has piezoelectric properties similar to those of some natural crystals.
Pipeline Condensate	Liquid hydrocarbons that have condensed from gas to liquid as a result of changes in pressure and temperature as gas flows in a pipeline. Pipeline condensate only remains as a liquid under high-pressure conditions and would vaporize at atmospheric pressure.
Plant Products	All liquid hydrocarbons and other products (including sulfur and excluding residue gas) recovered in a gas processing plant.
PLC	See Programmable logic controller
Plunger Lift	A technique used to optimize gas production. A Steel plunger is inserted into the production tubing in the well. The flow is turned off and this shut-in causes plunger to fall allowing fluid to collect above plunger. Different techniques are used to decide how long to shut in and flow the well.
Polarity	In electricity, the quality of having two oppositely charged poles, one positive one negative.
Polling	A snapshot view of the readings taken by the Totalflow equipment.
Port	A communications connection on a computer or a remote controller. A place of access to a device or network, used for input/output of digital and analog signals.
Positive Temperature Co-efficient	An increase in resistance due to an increase in temperature.
Positive Temperature Co-efficient Fuse	Opens circuit when high current condition occurs. Closes when condition no longer exists. Replaces typical fuses, which require replacement when blown.
POU	Program Organization Unit. This is Softing’s term for an ‘independent programming unit’. Programs, functions, etc.
Power Supply	A separate unit or part of a circuit that supplies power to the rest of the circuit or to a system.
PPM	Acronym for parts per million.
Pressure Base	The contractual, regulatory or standard ambient pressure at which natural gas is measured or sampled expressed in psia (pounds per square inch absolute).
Pressure Differential	Difference in pressure between any two points in a continuous system.
Pressure Markers	Pressure testing at different levels of pressure. Used for comparison purposes.

TERM	DEFINITION
Pressure, Absolute	See PSIA.
Pressure, Atmospheric	See Atmospheric Pressure.
Pressure, Gas	In the natural gas industry pressure is measured by the force applied to a designated area. PSI and OSI refer to how much pressure (pound or ounce) is applied to one square inch. Inches Water Column (In.W.C.) is also used to express gas pressure and is measured using a manometer for lower pressure readings. 1 PSIG=27.21 Inches Water Column.
Pressure, Gauge	See PSIG.
Primary Cell (or Battery)	A cell or battery which is not intended to be recharged and is discarded when the cell or battery has delivered all its electrical energy.
PRM	Acronym for Pressure Regulator Module.
Probe	A generic term that is used to describe many types of temperature sensors.
Process Gas	Gas use for which alternate fuels are not technically feasible, such as in applications requiring precise temperature controls and precise flame characteristics.
Program	A list of instructions that a computer follows to perform a task.
Programmable Logic Controller	A highly reliable special-purpose computer used in industrial monitoring and control applications. PLCs typically have proprietary programming and networking protocols, and special-purpose digital and analog I/O ports.
Programmable Read Only Memory	Computer memory in which data can be written to. ROM is used for storing programs (e.g. operating systems) and characteristic files on a permanent basis. (non-volatile)
Programmed I/O	The standard method a CPU uses to access an I/O device-- each byte of data is read or written by the CPU.
PROM	See Programmable Read Only Memory
Propane (C3H8)	A saturated hydrocarbon (Alkane) gas, the molecule of which is composed of three carbon and eight hydrogen atoms. Propane is present in most natural gas and is the first product refined from crude petroleum. It has many industrial uses and may be used for heating and lighting. Contains approximately 2,500 Btu per cubic foot.
Proportional, Integral, Derivative	PID Controllers are designed to eliminate the need for continuous operator attention. An example would be the cruise control in a car or a house thermostat. These controllers are used to automatically adjust some variable to hold the measurement (or process variable) at the set-point. The set-point is where you would like the measurement to be. Error is defined as the difference between set-point and measurement.
Propylene (C3H6)	A saturated hydrocarbon (Alkane) gas, the molecule of which is composed of three carbon and six hydrogen atoms. At room temperature and pressure, propylene is a gas. It is colorless, highly flammable, and has a odor similar to garlic. It is found in coal gas and can be synthesized by cracking petroleum. The main use of propylene is as a monomer, mostly for the production of polypropylene.

TERM	DEFINITION
Protocol	A formal set of conventions governing the formatting and relative timing of message exchange between two communicating systems.
PSI	Pounds per Square Inch.
PSIA	Pounds per Square Inch Absolute. Absolute pressure uses a perfect vacuum as the zero point. A perfect vacuum is 0 PSIA. PSIA=PSIG + Atmospheric Pressure.
PSID	Pounds per square inch differential. Pressure difference between two points.
PSIG	Pounds per Square Inch Gauge. Gauge pressure uses the actual atmospheric pressure as the zero point.
PSIS	Pounds per square inch standard. Pressure referenced to a standard atmosphere.
PTB	Physikalisch Technische Bundesanstalt (Federal Physical Technical Office) or Technical Institute for Certification.
PTC	See Positive Temperature Co-efficient Fuse.
Pulse Input	Any digital input to a meter (usually a turbine) that is used to measure pulses over a time period. This calculates volume and flow rate for each period of time.
Pulse Mode	An operational mode used by the LevelMaster for measuring single float levels by transmitting a pulse to the primary windings, reading the voltage level on both the primary and secondary windings and using a calculation whereby one is subtracted from another to determine the single fluid level.
Pulse Output	Any digital output that is used to measure pulses over a period of time. Frequency of Pulses in a predetermined time frame represents a value to be used in calculating volume and flow rate.
Radio Frequency	RF for short. That part of the spectrum from approx. 50kHz to gigahertz.
Radio Frequency Interference	Electromagnetic radiation which is emitted by electrical circuits carrying rapidly changing signals, as a by-product of their normal operation, and which causes unwanted signals (interference or noise) to be induced in other circuits.
RAM	See Random Access Memory.
RAM Disk	A lithium backed storage chip. Also see Random Access Memory.
RAMS	Acronym for Remote Alarms Monitoring System.
Random Access Memory	Onboard read/write volatile memory, generally used for application variables and the file system. Data stored is lost if power is removed (volatile).
Range	Those values over which a transducer is intended to measure, specified by its upper and lower limits.
Rangeability	The ratio of the maximum flowrate to the minimum flowrate of a meter.

TERM	DEFINITION
Rated Capacity	The number of ampere-hours a cell/battery can deliver under specific conditions (rate of discharge, cut-off voltage, temperature).
Raw Gas	Natural gas that has not been processed.
Raw Mix Liquids	A mixture of natural gas liquids that has not been fractionated or separated into its various components.
RBUS	Communication abbreviation for Results Bus.
RCV	Communication abbreviation for Received.
RD	Acronym for Relative Density.
RDrive	Refers to Totalflow's SRam Drive (solid state memory chip) located on the main board, used to store data and configuration files. The RDrive is a lithium backed, volatile memory chip and is not affected by a warm start.
Read Only Memory	Computer memory in which data can be routinely read but written to only once using special means when the ROM is manufactured. ROM is used for storing data or programs (e.g. operating systems) on a permanent basis.
Real Time	Data acted upon immediately instead of being accumulated and processed at a later time.
Real Time Data Base	The SCADA system has an in-memory RTDB for the data it collects from various devices. Real-time generally means that the data is acquired often enough that the user can make operational changes to the process while it is still useful to do so. On a factory floor, this can be in milliseconds. For remote devices which may require a couple of hours of drive time to reach, real-time can be thought of in tens of minutes or even hours. The data base can meet either of these requirements.
Real Time Operating System	Any operating system where interrupts are guaranteed to be handled within a certain specified maximum time, thereby making it suitable for control of hardware in embedded systems and other time-critical applications. RTOS is not a specific product but a class of operating system.
Recharge/Charge	The conversion of electrical energy, provided in the form of a current from an external source (charger), into chemical energy within a cell/battery.
Recommended Standard 232	This is the standard interface for full-duplex data communication conducted with two way independent channels. It employs unbalanced signaling and refers to point-to-point communications between one driver and one receiver in a 4-wire bus system. The RS-232 (single-ended) transmits at a relatively slow data rate (up to 20K bits per second) and short distances (up to 50 Ft. @ the maximum data rate).

TERM	DEFINITION
Recommended Standard 422	This is the standard interface for half-duplex communications conducted with a dual-state driver. It employs balanced signaling and refers to multi-drop communications between one driver and up to ten receivers, known as "straight-through" cabling in a 4-wire bus system. The RS-422 (Differential) transmits a much faster data rate (up to 100K bits per second) and longer distances (up to 4000 Ft. @ the maximum data rate).
Recommended Standard 485	This is the standard interface for half-duplex communications conducted in the tri-state or common mode. It employs balanced signaling and refers to true multi-point communications between up to 32 drivers and 32 receivers, in 2-wire bus system. The RS-485 (Differential) transmits a much faster data rate (up to 100K bits per second) and longer distances (up to 4000 Ft. @ the maximum data rate). It also supports more nodes per line because it uses lower impedance drivers and receivers.
Record	A collection of unrelated information that is treated as a single unit.
Register	A storage device with a specific capacity, such as a bit, byte or word.
Relay	Electromechanical device containing a coil and set of contacts. The contacts close when the coil is activated.
Remote	Not hard-wired; communicating via switched lines, such as telephone lines. Usually refers to peripheral devices that are located a site away from the CPU.
Remote Controller, XSeries.	Totalflow's XSeries Remote Controller is a low power, microprocessor based unit designed to meet a wide range of automation, monitor, control, alarming and measurement applications.
Remote Terminal Unit	An industrial data collection device similar to a PLC, designed for location at a remote site, that communicates data to a host system by using telemetry (such as radio, dial-up telephone, or leased lines).
Repeatability	The ability of a transducer to reproduce output readings when the same measurement value is applied to it consecutively, under the same conditions, and in the same direction. Repeatability is expressed as the maximum difference between output readings.
Residue Gas	The portion of natural gas remaining in a gaseous state after recovery of certain components through gas processing.
Resistance	The measure of the ability of a material to pass a current.
Resistance Temperature Characteristic	A relationship between a thermistors resistance and the temperature.
Resistant Thermal Detector	A metallic probe that measures temperature based upon its coefficient of resistivity.
Resistor	Passive component with a known resistance. The value of resistance is usually shown by a set of colored bands on the body of the component.
Resolution	The smallest significant number to which a measurement can be determined. For example, a converter with 12-bit resolution can resolve 1 part in 4096.

TERM	DEFINITION
Response Factor	A calculated value determined by analyzing a known substance under precise conditions (temperature, pressure, carrier flow rate) which equals the area of the peak divided by the weight or volume of the injected substance. This calculated value is then used as a response multiplier or offset for analyzing a "sample" of this same substance from another source. In the case of Natural gas, each component will have it's own Response Factor.
Response Time	1) The length of time required for the output of a transducer to rise to a specified percentage of its final value as a result of a step change of input. 2) The time required by a sensor to reach 63.2% of a step change in temperature under a specified set of conditions. Five time constants are required for the sensor to stabilize at 600 of the step change value.
Restore	This refers to a Totalflow procedure in which all the Station or Configuration files are restored to the SDRIVE from the file located on the laptop. This process is very helpful prior to doing a Cold Start when you want to continue using the Configuration and Station files.
Reynolds Number	The ratio of inertial and viscous forces in a fluid defined by the formula Re = rVD/μ, where: r = Density of fluid, μ = Viscosity in centipoise (CP), V = Velocity, and D = Inside diameter of pipe.
RFI	See Radio Frequency Interference.
Ribbon Cable	A flat cable in which the conductors are side by side rather than in a bundle.
Rich Gas	Natural gas which, based on its content of liquefiable hydrocarbons, is suitable for processing in a gas plant for recovery of plant products.
ROM	See Read Only Memory
RRTS	Communication abbreviation for Remote Ready To Send.
RS-232	See Recommended Standard 232.
RS-422	See Recommended Standard 422.
RS-485	See Recommended Standard 485.
RT	See Runtime.
RTD	See Resistant Temperature Detector.
RTDB	See Real Time Data Base.
RTOS	See Real Time Operating System.
RTS	Communication abbreviation for Ready To Send.
RTU	See Remote Terminal Unit
Runtime	The time required for an acoustic signal to travel from point A to point B. This measurement is used in calculating the speed of Sound, gas velocity and volume in the TotalSonic Meter.
RXD	Communication abbreviation for Receive Data.

TERM	DEFINITION
S/N	Serial Number. The whole Serial Number is made up of a prefix of 5 digits and the suffix, a 10 digit configuration number.
S1	Sample Line 1 (located on NGC8200 series Feed-Through Assembly).
S2	Sample Line 2 (located on NGC8200 series Feed-Through Assembly).
S3	Sample Line 3 (located on NGC8200 series Feed-Through Assembly).
S4	Sample Line 4 (located on NGC8200 series Feed-Through Assembly).
Saddle	A fitted plate held in place by clamps, straps, heat fusion, or welding over a hole punched or drilled in a gas main to which a branch line or service line connection is made. The saddle also may serve as a reinforcing member for repair.
Sample Loop	A tube with a given volume used in conjunction with a valve for measuring and holding the sample gas before pushing it into the chromatograph column.
Saturated BTU	The heating value of natural gas that is saturated with water vapor.
Saturated Hydrocarbons	Hydrocarbons that contain only single bonds. They are also called Alkanes or paraffin hydrocarbons.
Save	This refers to a Totalflow procedure in which all the Station or Configuration files are copied from the RDRIVE or the SDRIVE, to a file created on a laptop.
Savitsky-Golay Smoothing	Digital Signal Smoothing. A special class of a digital signal processing filter. Specifically determines the coefficients that are used for signal processing.
SCADA	See Supervisory Control and Data Acquisition
Scf	Abbreviation for one standard cubic foot, a measurement of a gas volume at a contractual, regulatory or standard specified temperature and pressure.
Schematic	Another name for a circuit diagram.
SCM	Acronym for Sample Conditioning Module.
Scroll	To move all or part of the screen material up to down, left or right, to allow new information to appear.
SD Card	Secure Digital Card.
SDRIVE	Totalflow's Serial E^2 PROM solid state memory chip, located on the Main Board (volatile memory, affected by a cold start), used to store configuration or station files.
Selectable Units	Selectable measurement units for various international and specialized application needs.
Self-Calibrating	A property of a DAQ board that has an extremely stable onboard reference and calibrates its own A/D and D/A circuits without manual adjustments by the user.
Semiconductor	Material that is nether a conductor nor insulator. Its properties can be altered by a control voltage.

TERM	DEFINITION
Sensing Element	That part of the transducer which reacts directly in response to the input.
Sensor	A device that responds to a physical stimulus (heat, light, sound, pressure, motion, flow, and so on), and produces a corresponding electrical signal.
Sensor File	The Sensor File contains all the setup/calibration information of the unit. The Sensor File is a (.dat) file and by default is named after the base serial number proceeded by an "s", such as s00108.dat. Although the name can be overwritten, it is recommended that the default name be kept.
Serial I/O	A common form of data transmission, in which the bits of each character are sent one at a time over the line.
Serial Port	A communications interface that uses one data line to transfer data bits sequentially. On the IBM PC the serial port refers to a standard asynchronous serial interface which uses the 8250/16450/16550 family of UARTs.
Service Life	The period of useful life (usually in hours or minutes) of a primary cell/battery before a predetermined cut-off voltage is reached.
Set Point	The temperature at which a controller is set to control a system.
Set-Point	A "level" or control point in a feedback system.
SFC	Sequential Function Chart (IEC supported programming language)
SG	Acronym for Specific Gravity.
Short Circuit	A connection of comparatively low resistance accidentally or intentionally made between points on a circuit between which the resistance is normally much greater. Also called a "bridge" or "short" such as when solder from two tracks touch on a PC board.
Shrinkage	The reduction in volume and/or heating value of a natural gas stream due to extraction or removal of some of its components.
SIG	See Signal.
Signal	Any communication between message-based devices consisting of a write to a signal register.
Signal Generator	A circuit that produces a variable and controllable signal.
Signed Integer	Can represent a number half the size of a “unsigned integer”, including a negative number.
Sink	Device such as a load that consumes power or conducts away heat.
Skip Days	Extra Daily records for recording events that require the start of a new day. i.e. Volume Reset, Backward Time change over the hour, and Contract Hour change.
SNAM	Italy’s Certification Board
SNR	Signal to Noise Ratio.
SoftCONTROL	Softing’s IEC compiler environment

TERM	DEFINITION
Softing	Maker and distributor of the IEC compiler softCONTROL
Software	The non-physical parts of a computer system that include computer programs such as the operating system, high-level languages, applications programs, etc.
Solar cell	A cell that produces current under sunlight.
Solenoid	A coil of wire that is long compared to its diameter, through which a current will flow and produce a magnetic flux to push or pull a rod (called an armature).
SOS	See Speed of Sound.
Sour Gas	Natural gas that has a high concentration of H2S.
Source	Device that provides signal power or energy to a load.
SP	See Static Pressure
Span	The difference between the upper and lower limits of a range expressed in the same units as the range.
Specific Gravity	The ratio of the mass of a solid or liquid to the mass of an equal volume of distilled water at 4°C (39°F) or of a gas to an equal volume of air or hydrogen under prescribed conditions of temperature and pressure. Also called *relative density*.
Speed of Gas	Rate at which gas travels through the pipeline. Used in flow calculations in the TotalSonic Meter. Calculations follow AGA 9 Report.
Speed of Sound	Rate at which sound travels through the medium. Used in flow calculations in the TotalSonic Meter. Calculations follow AGA 10 Report.
SPU	Signal Processing Unit (measurement transducer).
SQL	See Structured Query Language.
SRAM	See Static Random Access Memory
SSM	Acronym for Stream Selector Module.
ST	Structured Text (IEC supported programming language)
Stability	The quality of an instrument or sensor to maintain a consistent output when a constant input is applied.
Stable Gas	Is a vapor containing less than 0.1 PPM of liquid when vapor is cooled to 18.3°F (10°C) below the coldest ambient temperature possible at any point in the system.
Static Pressure	Equals PSIA or PSIG. Referenced to atmospheric pressure versus absolute pressure in a vacuum. It is defined as the pressure exerted by a non-moving liquid or gas. In the case of a gas well this would be the natural PSI of the gas inside of the well.
Static Random Access Memory	The place in your computer that programs reside when running. You can access any part of the memory, and it can easily be overwritten with new values. SRAM is much more expensive and physically larger than DRAM but much faster.

TERM	DEFINITION
Status Output	Any digital output that uses “On” or “Off” conditions to determine the status of the assigned description. Changing from one to the other represents a change in the condition.
STP	Standard Temperature and Pressure
Structured Query Language	IBM developed this language in the 60’s as a way of accessing data from a relational database. It has a very simple syntax for simple functions but can become complex for sophisticated applications. This language is standardized by international standards bodies, and is almost universal in application. Almost all databases support SQL. The RTDB supports SQL and this makes it extremely flexible within a corporate network. Authorized users throughout the organization can write SQL statements to acquire data from this database that they need for Marketing, Accounting, Engineering, or other functions.
Sulfur	A pale, yellow, non-metallic chemical element that may be found in a gas stream and which needs to be removed or reduced from the gas stream for corrosion control or health or safety reasons.
Supercompressibility Factor	A factor used to account for the following effect: Boyle's law for gases states that the specific weight of a gas is directly proportional to the absolute pressure, the temperature remaining constant. All gases deviate from this law by varying amounts, and within the range of conditions ordinarily encountered in the natural gas industry, the actual specific weight under the higher pressure is usually greater than the theoretical. The factor used to reflect this deviation from the ideal gas law in gas measurement with an orifice meter is called the "Supercompressibility factor Fpv". The factor is used to calculate corrected from volumes at standard temperatures and pressures. The factor is of increasing importance at high pressures and low temperatures.
Supervisory Control and Data Acquisition	A common PC function in process control applications, where programmable logic controllers (PLCs) perform control functions but are monitored and supervised by a PC.
Surge	A sudden change (usually an increase) in the voltage on a power line. A surge is similar to a spike, but is of longer duration.
SV	Sample Vent (located on NGC8200 series Feed-Through Assembly).
SW VBATT	Switched Battery Voltage. Cycles power to equipment to save power.
Switch	An electrical device for connecting and disconnecting power to a circuit, having two states, on (closed) or off (open). Ideally having zero impedance when closed and infinite impedance when open.
Synchronous	(1) Hardware - A property of an event that is synchronized to a reference clock. (2) Software - A property of a function that begins an operation and returns only when the operation is complete.
Syntax	Comparable to the grammar of a human language, syntax is the set of rules used for forming statements in a particular programming language.

TERM	DEFINITION
System Noise	A measure of the amount of noise seen by an analog circuit or an ADC when the analog inputs are grounded.
TankMaster	Totalflow Control System for LevelMaster Tank Units.
Tap	To cut threads in a round hole so that other fittings or equipment can be screwed into the hole. Also to make an opening in a vessel or pipe.
TBUS	Communication abbreviation for Transmit Bus.
TCD	See Thermal Conductivity Detector.
TCP/IP	TCP/IP – This is the basic communication format for the Internet, and for much of what happens on a corporate network. Virtually all networked PCs and other computers have an "IP address" having the format xxx.xxx.xxx.xxx (xxx can range from 0 to 255 in most cases). You can see the IP address of your PC by going to the start menu, selecting run, and entering cmd. A "DOS Box" will be displayed on your screen. Type ipconfig to get the IP address. When you enter a URL (e.g., www.totalflow.com) in a browser, a DNS server (on the network) resolves this into an IP address and directs your request to the machine with that address.
TCR	Temperature Compensated Regulator.
TDS32	Totalflow DDE Server that allows Microsoft Windows applications with DDE capabilities to communicate with Totalflow's equipment. For example data can be retrieved and placed in an Excel spreadsheet.
Temperature Coefficient	An experimental number used to modify the calibration of a device (Totalflow transducer) to account for changes in environmental temperature.
Temperature Error	The maximum change in output, at any measured value within the specified range, when the transducer temperature is changed from room temperature to specified temperature extremes.
Temperature Range, Compensated	The range of ambient temperatures within which all tolerances specified for Thermal Zero Shift and Thermal Sensitivity Shift are applicable (temperature error).
Temperature, Ambient	The temperature of the air, atmosphere or other fluid that completely surrounds the apparatus, equipment or the work piece under consideration. For devices which do not generate heat, this temperature is the same as the temperature of the medium at the point of device location when the device is not present. For devices which do generate heat, this temperature is the temperature of the medium surrounding the device when the device is present and generating heat. Allowable ambient-temperature limits are based on the assumption that the device in question is not exposed to significant radiant-energy sources such as sunlight or heated surfaces.
Temperature, Flowing	Temperature of the flowing fluid. Usually gas and measured by an RTD.
Terminal Mode	Man-Machine interface tool used as and engineering interface with equipment.
Termination	Placement of a connector on a cable.

TERM	DEFINITION
Termination Panel	The NGC8200's termination panel acts as a connection to the outside world. It features transient protection, a voltage regulator for the digital controller, positive temperature co-efficient fuses (PTC) and many other safeguards to protect the remainder of the system from electrical damage. All outside communications and I/O are channeled through this board. It is designed to be a low cost, field replaceable maintenance solution and is designed to operate on either 12V or 24V.
Termination Panel	A circuit board with screw terminals or other connector system that allows convenient connection of field signals to a data acquisition or communication system.
TF Loader Packages	In PCCU32, the 32-Bit XSeries Loader is the program that allows for the downloading of specific files to an NGC, XFC, XRC or μFLO XSeries device. The 32-Bit XSeries Loader application allows packages containing a combination of Flash, WinCE OS (nk.bin), ISaGraf Runtime, Blackfin Firmware (NGC) and configuration files to be downloaded to XFCs, XRCs, NGCs or μFLO machine types. These same packages can be downloaded to other machines of the same type to expedite configurations for machines having the same purpose. With the creation of these packages, the user is then prevented from accidentally loading incompatible packages to the wrong device.
TF.NET	Totalflow network used to access web data.
TFIO Module	Totalflow Input/Output module (i.e. quad AO)
Thermal Conductivity Detector	Universal detector that shows a response to all compounds. An electrical component that changes resistance based on the components ability to conduct heat. In chromatography, two TCDs are used, 1)as a reference detector and 2) as the sensor detector. The reference detector is exposed to only the carrier gas and the Sensor detector is exposed to the sample.
Thermistor	A temperature-sensing element composed of sintered semiconductor material which exhibits a large change in resistance proportional to a small change in temperature. Thermistors usually have negative temperature coefficients.
Thermistor Bead	See Thermal Conductivity Detector.
Thermocouple	A temperature sensor created by joining two dissimilar metals. The junction produces a small voltage as a function of the temperature.
Thermowell	A closed-end tube designed to protect temperature sensors from harsh environments, high pressure, and flows. They can be installed into a system by pipe thread or welded flange and are usually made of corrosion-resistant metal or ceramic material depending upon the application.
Therms Master	Totalflow application for Gas Analyzer.
Tolerance	The allowable percentage variation of any component from that stated on its body.

TERM	DEFINITION
Totalflow	Product line of ABB Inc. Maker and distributor of the XSeries Flow Computers (XFC) and Remote Controllers (XRC).
TotalSonic MMI	TotalSonic's Man Machine Interface software program. May also be called MEPAFLOW 600.
Transducer	A device for converting energy from one form to another, specifically the measurement of pressure differential in natural gas gate stations. I.e. Pressure to voltage or current.
Transfer Rate	The rate, measured in bytes/s, at which data is moved from source to destination after software initialization and set up operations; the maximum rate at which the hardware can operate.
Transient	An abrupt change in voltage, of short duration (e.g. a brief pulse caused by the operation of a switch).
Transistor	A three leaded device (Collector, Base, Emitter) used for amplifying or switching. Also called a bi-polar transistor to distinguish it from Field Effect Transistor etc.
Transmitter	A device that converts audio, video or coded signals into modulated radio frequency signals which can be propagated by electromagnetic waves (radio waves).
Tranzorb	Transient Voltage Suppression device.
TRB	Tank Request Block Editor. When requesting storage space after adding a LevelMaster application, the file is saved as a *.trb file.
Tube	Cylinder for transporting or storing liquids: any long hollow cylinder used to transport or store liquids.
Tuned Radio Frequency	An amplitude modulated (AM) receiver with one or more stages of radio frequency before the detector.
TXD	Communication abbreviation for Transmit Data.
UDINT	Unsigned Double Integer
UL	Underwriters Laboratories, Inc. An independent laboratory that establishes standards for commercial and industrial products.
Union	A form of pipe fitting where two extension pipes are joined at a separable coupling.
Universal Serial Bus	An external peripheral interface standard for communication between a computer and external peripherals over a cable using biserial transmission. It supports both isochronous and asynchronous data transfers.
Unnormalized Total	Is a calculation of the Peak Area divided by the Response Factor for each component, then summed by each component.
Unsigned Integer	Can represent a number twice the size of a "signed integer", but cannot represent a large negative number.
Upload	This refers to a Totalflow procedure in which any file(s) located in the on-board memory of a Totalflow Host is copied to a file created on a laptop PC.

TERM	DEFINITION
UPS	Un-interruptible power supply. A power conditioning unit placed between the commercial power service and the protected device. The UPS uses line power to charge batteries, which, in the case of a power failure, can drive electronic circuitry to produce the appropriate AC requirements for some time period.
Upstream	Oil and natural gas exploration and production activities; plus gas gathering, processing and marketing operations.
Upstream Pipeline	The first pipeline to transport natural gas en route to an inter-connect point for delivery to another pipeline. See DOWNSTREAM PIPELINE.
USB	Acronym for Universal Serial Bus.
USB Client	Generally refers to the peripheral device (Slave or Client) that is driven by a computer (Master or Host). Examples are a printer and digital camera.
USB Host	Generally refers to the computer device (Master or Host) that drives a peripheral piece of equipment (Slave or Client). An example is a Laptop or Desktop Computer.
USX	Provider of the RTOS used by the XSeries product line
VAC	Volts of alternating current.
Vacuum	A pressure less than atmospheric pressure, measured either from the base of zero pressure or from the base of atmospheric pressure (PSIA).
Valve	A mechanical device for controlling the flow of fluids and gases; types such as gate, ball, globe, needle, and plug valves are used.
Valve Control	This feature provides automatic feedback control of Differential Pressure (DP), Static Pressure (SP), and Flow Rate for the purpose of positioning a flow valve to maintain a desired value of DP, SP, or Flow Rate.
Vapor Pressure	The pressure exerted by a liquid when confined in a specified tank or test apparatus.
VAS32	Totalflow's Voice Alarm System. A software program that receives and transmits alarm notifications via cell, telephone or pager systems.
VBATT	Battery Voltage. The voltage output from the battery source.
VCI	Valve Control Interface.
VDC	Volts of direct current.
VDE	Verband der Elektrotechnik Elektronik Informationstechnik [Association for Electrical, Electronic & Information Technologies]
Velocity	The time rate of change of displacement; dx/dt.
Vent	A normally sealed mechanism which allows for the controlled escape of gases from within a cell.
VGA	Video Graphic Array.

TERM	DEFINITION
Virtual Memory	A method of making disk storage appear like RAM memory to the CPU, thus allowing programs that need more RAM memory than is installed to run in the system. This technique is slow compared to "real" memory.
Viscosity	The inherent resistance of a substance to flow.
VOG	Velocity of Gas.
Volatile Memory	A storage medium that loses all data when power is removed.
Volt	The unit of voltage or potential difference.. One thousand volts = 1kV.
Voltage	Electrical pressure, the force, which causes current to flow through a conductor. Voltage must be expressed as a difference of potential between two points since it is a relational term. Connecting both voltmeter leads to the same point will show no voltage present although the voltage between that point and ground may be hundred or thousands of volts.
Voltmeter	A meter for reading voltage. It is one of the ranges in a multimeter.
Volume Calculation Period	The specified length between reading and calculating volume data.
Volume Flow Rate	Calculated using the area of the full closed conduit and the average fluid velocity in the form, Q = V x A, to arrive at the total volume quantity of flow. Q = volumetric flowrate, V = average fluid velocity, and A = cross sectional area of the pipe.
VOS	Velocity of Sound.
Warm Start	A rebooting technique which will clear most operational errors, without damaging either the data or configuration files. This causes the equipment to boot from the Rdrive, which is a solid state memory chip.
Watt	Symbol W. The unit of power. One watt is the product of one volt and one amp. Power (W) = Current (I) X Energy (E). (E = Volts)
Wavelength	The distance between two points of corresponding phase in consecutive cycles
Web Page	All the text, graphics, and sound visible with a single access to a Web site; what you see when you request a particular URL.
Web Server	The hardware and software required to make Web pages available for delivery to others on networks connected with yours.
Web Site	A collection of electronic "pages" of information on a Web server
Well, Development	A well drilled in order to obtain production of gas or oil known to exist.
Well, Disposal	A deep well in which to inject waste chemicals, etc., such as a well to dispose of salt brine from the solution mining of salt dome gas storage caverns.
Well, Exploratory	A well drilled to a previously untested geologic structure to determine the presence of oil or gas.
Well, Gas	A well which produces at surface conditions the contents of a gas reservoir; legal definitions vary among the states.

TERM	DEFINITION
Well, Marginal	A well which is producing oil or gas at such a low rate that it may not pay for the drilling.
Well, Stripper	Non-associated gas well capable of producing no more than 90 Mcf/day at its maximum rate of flow.
Well, Wildcat	An exploratory well being drilled in unproven territory, that is, in a horizon from which there is no production in the general area.
Wellhead	The assembly of fittings, valves, and controls located at the surface and connected to the flow lines, tubing, and Casing of the well so as to control the flow from the reservoir.
WellTell Wireless	Product line designed to communicate RS-485 without the use of cabling. Group consists of the wireless host (WellTell-X), wireless IS client (WellTell-IS) and wireless IO client (WellTell-IO).
WellTell-IO	Client communication device designed with extra on-board IO.
WellTell-IS	Client communication device designed with an intrinsically safe barrier.
WellTell-X	Host communication device for WTW product line.
Wheatstone Bridge	Circuit design using two TCDs to measure components in chromatography.
WINCCU	Windows Central Collection Unit. Windows version of software to process, archive and manipulate data collected from the Totalflow products.
Window	In computer graphics, a defined area in a system not bounded by any limits; unlimited "space" in graphics.
Witness	In the field, where hydrocarbons are changing hands and actual cash register transactions being performed, it is not uncommon for one party or the other to request / require a representative or company employee be present during calibrations and or routine maintenance. Often this arrangement is contractually linked.
Wobbe Index	Calculated from the energy content, or a higher heating value of the gas, and the relative density of the gas ($Btu/RD^{1/2}$).
Wobbe Number	A number proportional to the heat input to a burner at constant pressure. In British practice, it is the gross heating value of a gas divided by the square root of its gravity. Widely used in Europe, together with a measured or calculated flame speed, to determine interchangeability of fuel gases.
Working Voltage	The highest voltage that should be applied to a product in normal use, normally well under the breakdown voltage for safety margin. See also Breakdown Voltage.
World Wide Web	An Internet service facilitating access to electronic information - also known as the Web, WWW, or W3.
Write	To record data in a storage device or on a data medium.
WTW	WellTell Wireless product line. See WellTell Wireless.
XDCR	See External Transducer.

TERM	DEFINITION
XFC	See Flow Computer, XSeries.
XFC G4	Totalflow’s new Generation 4 extendable XFC equipment featuring technology that is expandable and flexible for ever changing needs.
XFC-195 Board	The main electronic board used in XSeries flow computers. The XFC-195 Board mounts on the inside of the enclosure’s front door.
XFC6200EX	Totalflow’s Class 1 Div 1 Flow Computer. This Totalflow Flow Computer is housed in an explosion proof housing and has similar operational features as the μFLO, with additional capabilities.
XIMV	See XSeries Integral Multivariable Transducer.
XMV	See Multivariable Transducer.
XRC	XSeries Remote Controller. Also see Remote Controller, XSeries.
XRC G4	Totalflow’s new Generation 4 extendable XRC equipment featuring technology that is expandable and flexible for ever changing needs.
XSeries	Totalflow’s new extendable equipment series featuring technology that is expandable and flexible for ever changing needs.
XSeries Integral Multivariable	Abbreviated XIMV. A smart Multivariable Transducer that is an integral part of the XSeries Flow Computer, measuring Static Pressure (SP), Differential Pressure (DP) and Flowing Temperature (Tf). This refers to both the transducer portion of the device and the circuitry required to supply measurements to the Main Processor Board, which is housed in a factory sealed unit. See Multivariable Transducer for more information.
Y	Expansion factor.
Zero Gas	Gas at atmospheric pressure.
Zero Offset	The difference expressed in degrees between true zero and an indication given by a measuring instrument.

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APPENDIX C 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.

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