System Reference Manual
2-3-9000-744, Rev G
September 2014

700XA Gas Chromatograph

Applies to the Rosemount® Analytical 700XA Gas Chromatograph and the Danalyzer™ 700XA Gas Chromatograph

ROSEMOUNT® Analytical

EMERSON™ Process Management

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Contents

Appendices and reference

1 Introduction

This section describes the contents and purpose of the *700XA Gas Chromatograph System Reference Manual*, a description of the Model 700XA system, an explanation of the theory of operation, and a glossary of chromatograph terminology.

Use this section to get acquainted with the basic engineering of the 700XA.

1.1 Description of manual

The *700XA Gas Chromatograph System Reference Manual* (P/N 3-9000-744) consists of installation, operations, maintenance, and troubleshooting procedures.

1.2 System description

The 700XA is a high-speed gas chromatograph (GC) system that is engineered to meet specific field application requirements based on typical hydrocarbon stream composition and anticipated concentration of the selected components. In its standard configuration, the 700XA gas chromatograph can handle up to eight streams: seven for sample streams and one calibration stream.

The 700XA system consists of two major parts: the analyzer assembly and the electronics assembly. Depending upon the particular GC, there may also be a third, optional, assembly called the sample conditioning system (SCS).

The 700XA's electronics and hardware are housed in an explosion-proof enclosure that meets the approval guidelines of various certification agencies for use in hazardous environments. See the certification tag on the GC for specific details about agency approvals.

1.2.1 Analyzer assembly

The analyzer assembly includes the columns, TCDs/FIDs, a preamplifier, a preamplifier power supply, stream switching valves, analytical valves and solenoids. Additionally, the 700XA can be equipped with a liquid sample injection valve or a methanator.

For more information, see *Section 2.1.2*.

1.2.2 Electronics assembly

The electronics assembly includes the electronics and ports necessary for signal processing, instrument control, data storage, personal computer (PC) interface, and telecommunications. This assembly allows the user to use MON2020 to control the GC. Refer to *Section 2.2.2* for more details.

The GC-to-PC interface provides the user with the greatest capability, ease-of-use, and flexibility. MON2020 can be used to edit applications, monitor operations, calibrate streams, and display analysis chromatograms and reports, which can then be stored as files on the PC's hard drive or printed from a printer connected to the PC.

⚠ WARNING!

Do not use a PC or a printer in a hazardous area. Serial ports and Modbus communication links are provided to connect the unit to the PC and to connect to other computers and printers in a safe area. Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

1.2.3 Sample conditioning system (SCS)

The optional sample conditioning system is located between the process stream and the sample inlet, which is often mounted below the GC. The standard SCS configuration includes a stream switching system and filters.

1.3 Functional description

A sample of the gas to be analyzed is taken from the process stream by a sample probe installed in the process line. The sample passes through a sample line to the SCS where it is filtered or otherwise conditioned. After conditioning, the sample flows to the Analyzer Assembly for separation and detection of the gas components.

The chromatographic separation of the sample gas into its components is accomplished in the following manner. A precise volume of sample gas is injected into one of the analytical columns. The column contains a stationary phase (packing) that is either an active solid or an inert solid support that is coated with a liquid phase (absorption partitioning). The sample gas is moved through the column by means of a mobile phase (carrier gas). The selective retardation of the components takes place in the column, causing each component to move through the column at a different rate. This separates the sample into its constituent gases and vapors.

A detector located at the outlet of the analytical column senses the elution of components from the column and produces electrical outputs proportional to the concentration of each component.

Note

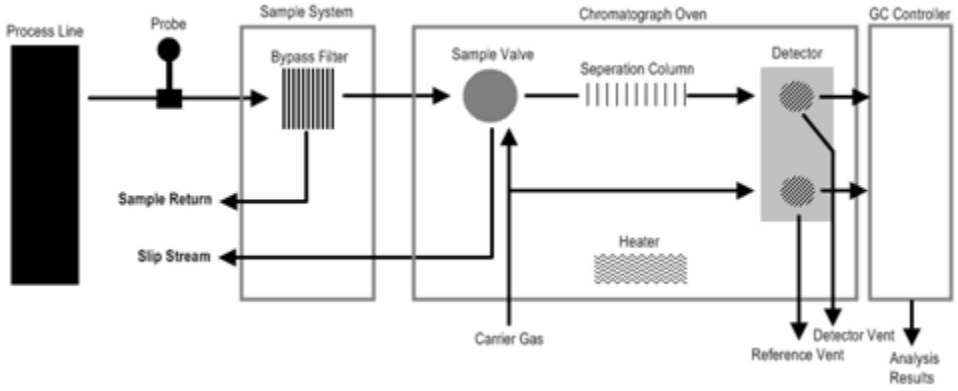
For additional information, see *Section 1.4*.

Output from the electronic assembly is normally displayed on a remotely located PC or a printer. Connection between the GC and the PC can be accomplished via a direct serial line, an optional ethernet cable, or via a Modbus-compatible communication interface.

Several chromatograms may be displayed via MON2020, with separate color schemes, allowing the user to compare present and past data.

In most cases it is essential to use MON2020 to configure and troubleshoot the GC. The PC may be remotely connected via ethernet, telephone, radio or satellite communications. Once installed and configured, the GC can operate independently for long periods of time.

Figure 1-1: Gas chromatography process model



1.4 Software description

The GC uses three distinct types of software. This enables total flexibility in defining the calculation sequence, printed report content, format, type and amount of data for viewing, control and/or transmission to another computer or controller assembly. The three types are:

- Embedded GC firmware
- Application configuration software
- Maintenance and operations software (MON2020)

The BOS and the Application configuration software are installed when the 700XA is shipped. The application configuration is tailored to the customer's process and shipped on a CD-ROM. Note that the hardware and software are tested together as a unit before the equipment leaves the factory. MON2020 communicates with the GC and can be used to initiate site system setup (i.e., operational parameters, application modifications, and maintenance).

1.4.1 Embedded GC firmware

The GC's embedded firmware supervises operation of the 700XA through its internal microprocessor-based controller; all direct hardware interface is via this control software. It consists of a multi-tasking program that controls separate tasks in system operation, as well as hardware self-testing, user application downloading, start-up, and communications. Once configured, the 700XA can operate as a stand alone unit.

1.4.2 MON2020

MON2020 is a Windows-based program that allows the user to maintain, operate, and troubleshoot a gas chromatograph. Individual GC functions that can be initiated or controlled by MON2020 include, but are not limited to, the following:

- Valve activations
- Timing adjustments
- Stream sequences
- Calibrations
- Baseline runs
- Analyses
- Halt operation
- Stream/detector/heater assignments
- Stream/component table assignments
- Stream/calculation assignments
- Diagnostics
- Alarm and event processing
- Event sequence changes
- Component table adjustments
- Calculation adjustments
- Alarm parameters adjustments
- Analog scale adjustments
- LOI variable assignments (optional)
- Foundation Fieldbus variable assignments (optional)

Reports and logs that can be produced, depending upon the GC application in use, include, but are not limited to, the following:

- Configuration report
- Parameter list
- Analysis chromatogram
- Chromatogram comparison
- Alarm log (unacknowledged and active alarms)
- Event log
- Various analysis reports

For a complete list of the GC functions, reports, and logs available through MON2020, consult the software manual (P/N 2-3-9000-745).

MON2020 provides operator control of the 700XA, monitors analysis results, and inspects and edits various parameters that affect 700XA operation. It also controls display and printout of the chromatograms and reports, and it stops and starts automatic analysis cycling or calibration runs.

After the equipment/software has been installed and the operation stabilized, automatic operation can be initiated via an ethernet network.

1.5 Theory of operation

The following sections discuss the theory of operation for the GC, the engineering principles and the concepts used.

Note

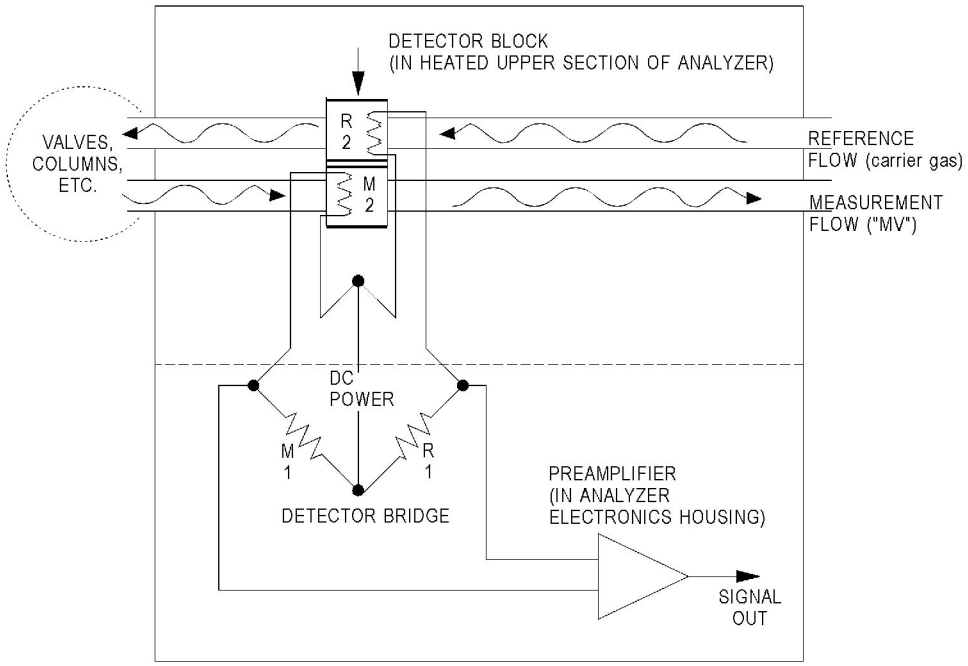
See *Section 1.7* for definitions of the terminology used in the following explanations.

1.5.1 Thermal conductivity detector

One of the detectors available on the 700XA is a thermal conductivity detector (TCD) that consists of a balanced bridge network with heat sensitive thermistors in each leg of the bridge. Each thermistor is enclosed in a separate chamber of the detector block.

One thermistor is designated the reference element and the other thermistor is designated the measurement element. See *Figure 1-2* for a schematic diagram of the thermal conductivity detector.

Figure 1-2: Analyzer assembly with TCD bridge



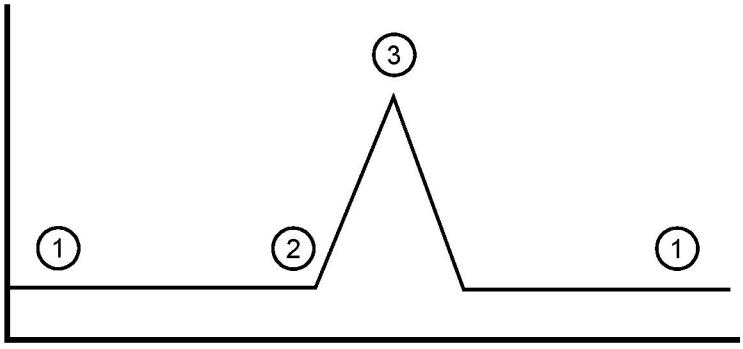
In the quiescent condition, prior to injecting a sample, both legs of the bridge are exposed to pure carrier gas. In this condition, the bridge is balanced and the bridge output is electrically nulled.

The analysis begins when the sample valve injects a fixed volume of sample into the column. The continuous flow of carrier gas moves the sample through the column. As successive components elute from the column, the temperature of the measurement element changes.

The temperature change unbalances the bridge and produces an electrical output proportional to the component concentration.

The differential signal developed between the two thermistors is amplified by the preamplifier. *Figure 1-3* illustrates the change in detector electrical output during elution of a component.

Figure 1-3: Detector output during component elution



1. Detector bridge balanced.
2. Component begins to elute from column and is measured by thermistor.
3. Peak concentration of component.

In addition to amplifying the differential signal developed between the two thermistors, the preamplifier supplies drive current to the detector bridge.

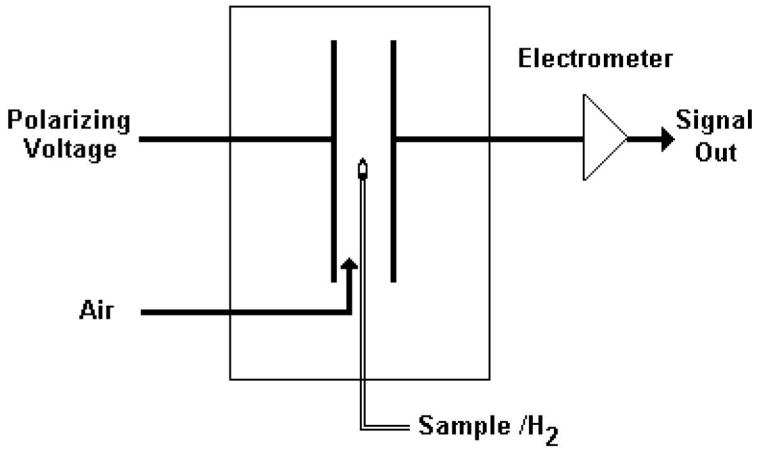
The signal is proportional to the concentration of a component detected in the gas sample. The preamplifier provides four different gain channels as well as compensation for baseline drift.

The signals from the preamplifier are sent to the electronic assembly for computation, recording on a printer, or viewing on a PC monitor with MON2020.

1.5.2 Flame ionization detector

The other detector available for the 700XA is the flame ionization detector (FID). The FID requires a polarization voltage and its output is connected to the input to a high impedance amplifier that is called an electrometer. The burner uses a mixture of hydrogen and air to maintain the flame. The sample of gas to be measured is also injected into the burner. See *Figure 1-4* for a schematic diagram of the FID.

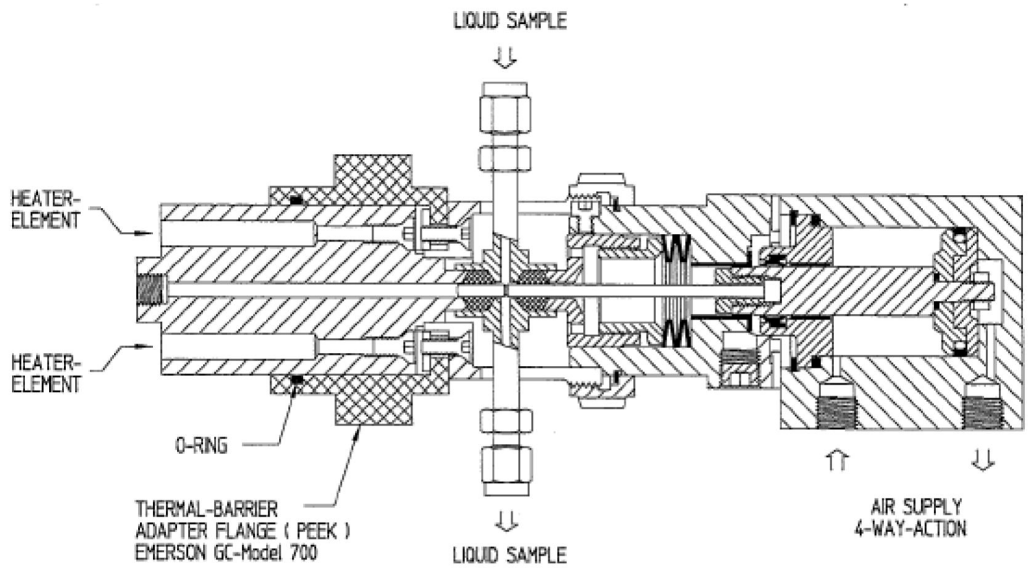
Figure 1-4: Analyzer assembly with FID detector bridge



1.5.3 Liquid sample injection valve

The optional liquid sample injection valve (LSIV) converts a liquid sample into a gas sample for GC analysis.

Figure 1-5: LSIV cross section



The LSIV penetrates the wall of the lower compartment and is held in place by a retaining ring. The mounting arrangement is designed to ensure integrity of the flameproof enclosure.

The outermost end houses an air-operated piston. Air at 60 PSI is directed by a solenoid valve to either advance the stem to inject the sample or to retract the stem.

The next section houses sample input connections and stem sealing components. There are two 1/8-inch O.D. tubing ports in this section; one port is for sample input, the other is the exhaust for sample flow.

Within the enclosure cavity are the flash chamber components surrounded with insulating covers. At working temperatures, the surfaces of these covers become very hot to the touch.

The tip of the cylindrical flash chamber is the port where flashed sample is taken to the oven system.

The port near the outer diameter of the end of the heated flash chamber block is the input for carrier gas.

The flash chamber block is stainless steel and is surrounded by an insulating mounting adapter. It houses the heater and an RTD.

1.5.4 Methanator

After all other components have been separated from the sample, carbon monoxide and carbon dioxide, which are normally present in quantities too small to be detected by the GC, can be sent through the optional methanator, where the two gases are combined with hydrogen to make methane in a heat-generated catalytic reaction. The methanator is also known as a methanizer or a catalytic converter.

1.5.5 Data acquisition

Every second, exactly 50 equally spaced data samples are taken (i.e., one data sample every 20 milliseconds) for analysis by the controller assembly.

As a part of the data acquisition process, groups of incoming data samples are averaged together before the result is stored for processing. Non-overlapping groups of *N* samples are averaged and stored, and thus reduce the effective incoming data rate to 40/*N* samples per second. For example, if *N* = 5, then a total of 40/5 or 8 (averaged) data samples are stored every second.

The value for the variable *N* is determined by the selection of a Peak Width parameter (*PW*). The relationship is

$$N = PW$$

where *PW* is given in seconds. Allowable values of *N* are 1 to 63; this range corresponds to *PW* values of 2 to 63 seconds.

The variable *N* is known as the integration factor. This term is used because *N* determines how many points are averaged, or integrated, to form a single value. The integration of data upon input, before storing, serves two purposes:

- The statistical noise on the input signal is reduced by the square root of *N*. In the case of *N* = 4, a noise reduction of two would be realized.
- The integration factor controls the bandwidth of the chromatograph signal. It is necessary to match the bandwidth of the input signal to that of the analysis algorithms in the controller assembly. This prevents small, short-duration perturbations from being recognized as true peaks by the program. It is therefore important to choose a Peak Width that corresponds to the narrowest peak in the group under consideration.

1.5.6 Peak detection

For normal area or peak height concentration evaluation, the determination of a peak's start point and end point is automatic. The manual determination of start and end points is used only for area calculations in the Forced Integration mode. Automatic determination of peak onset or start is initiated whenever Integrate Inhibit is turned off. Analysis is started in a region of signal quiescence and stability, such that the signal level and activity can be considered as baseline values.

Note

The controller assembly software assumes that a region of signal quiescence and stability will exist.

Having initiated a peak search by turning Integrate Inhibit off, the controller assembly performs a point by point examination of the signal slope. This is achieved by using a digital slope detection filter, a combination low pass filter and differentiator. The output is continually compared to a user-defined system constant called Slope Sensitivity. A default value of 8 is assumed if no entry is made. Lower values make peak onset detection more sensitive, and higher values make detection less sensitive. Higher values (20 to 100) would be appropriate for noisy signals, e.g. high amplifier gain.

Onset is defined where the detector output exceeds the baseline constant, but peak termination is defined where the detector output is less than the same constant.

Sequences of fused peaks are also automatically handled. This is done by testing each termination point to see if the region immediately following it satisfies the criteria of a baseline. A baseline region must have a slope detector value less than the magnitude of the baseline constant for a number of sequential points. When a baseline region is found, this terminates a sequence of peaks.

A zero reference line for peak height and area determination is established by extending a line from the point of the onset of the peak sequence to the point of the termination. The values of these two points are found by averaging the four integrated points just prior to the onset point and just after the termination points, respectively.

The zero reference line will, in general, be non-horizontal, and thus compensates for any linear drift in the system from the time the peak sequence starts until it ends.

In a single peak situation, peak area is the area of the component peak between the curve and the zero reference line. The peak height is the distance from the zero reference line to the maximum point on the component curve. The value and location of the maximum point is determined from quadratic interpolation through the three highest points at the peak of the discrete valued curve stored in the controller assembly.

For fused peak sequences, this interpolation technique is used both for peaks, as well as, valleys (minimum points). In the latter case, lines are dropped from the interpolated valley points to the zero reference line to partition the fused peak areas into individual peaks.

The use of quadratic interpolation improves both area and height calculation accuracy and eliminates the effects of variations in the integration factor on these calculations.

For calibration, the controller assembly may average several analyses of the calibration stream.

1.6 Basic analysis computations

Two basic analysis algorithms are included in the controller assembly:

- Area Analysis – calculates area under component peak
- Peak Height Analysis – measures height of component peak

Note

For additional information about other calculations performed, see the MON2020 user manual.

1.6.1 Concentration analysis - response factor

Concentration calculations require a unique response factor for each component in an analysis. These response factors may be manually entered by an operator or determined automatically by the system through calibration procedures (with a calibration gas mixture that has known concentrations).

The response factor calculation, using the external standard, is:

$$ARF_n = \frac{Area_n}{Cal_n} \quad \text{or} \quad HRF_n = \frac{Ht_n}{Cal_n}$$

where

ARF_n	area response factor for component “n” in area per mole percent
$Area_n$	area associated with component “n” in calibration gas
Cal_n	amount of component “n” in mole percent in calibration gas
Ht_n	peak height associated with component “n” mole percent in calibration gas
HRF_n	peak height response factor for component “n”

Calculated response factors are stored by the controller assembly for use in the concentration calculations, and are printed out in the configuration and calibration reports.

Average response factor is calculated as follows:

$$RFAVG_n = \frac{\sum_{i=1}^{k} RF_i}{k}$$

where

$RFAVG_n$	area or height average response factor for component “n”
RF_i	area or height average response factor for component “n” from the calibration run
k	number of calibration runs used to calculate the response factors

The percent deviation of new *RF* averages from old *RF* average is calculated in the following manner:

$$deviation = \left[\frac{RF_{new} - RF_{old}}{RF_{old}} \times 100 \right]$$

where the absolute value of percent deviation has been previously entered by the operator.

1.6.2 Concentration calculation - mole percentage (without normalization)

Once response factors have been determined by the controller assembly or entered by the operator, component concentrations are determined for each analysis by using the following equations:

$$CONC_n = \frac{Area_n}{ARF_n} \quad \text{or} \quad CONC_n = \frac{Ht_n}{HRF_n}$$

where

ARF_n	Area response factor for component “n” in area per mole percent.
$Area_n$	Area associated with component “n” in unknown sample.
$CONC_n$	Concentration of component “n” in mole percent.
Ht_n	Peak height associated with component “n” mole percent in unknown sample.
HRF_n	Peak height response factor for component “n”.

Component concentrations may be input through analog inputs 1 to 4 or may be fixed. If a fixed value is used, the calibration for that component is the mole percent that will be used for all analyses.

1.6.3 Concentration calculation in mole percentage (with normalization)

The normalized concentration calculation is:

$$CONCN_n = \frac{CONC_n}{\sum_{i=1}^{k} CONC_i} \times 100$$

where

$CONCN_n$	Normalized concentration of component “n” in percent of total gas concentration.
$CONC_i$	Non-normalized concentration of component “n” in mole percent for each “k” component.
$CONC_n$	Non-normalized concentration of component “n” in mole percent.
k	Number of components to be included in the normalization.

Note

The average concentration of each component will also be calculated when data averaging is requested.

1.7 Glossary

Auto Zero Automatic zeroing of the TCD preamplifier can be configured to take place at any time during the analysis if the component is not eluting or the baseline is steady.The FID will auto zero at each new analysis run

	and can be configured to auto zero anytime during the analysis if the component is not eluting or the baseline is steady. The TCD is only auto zeroed at the start of a new analysis.
Baseline	Signal output when there is only carrier gas going across the detectors. In a chromatogram you should only see Baseline when running an analysis without injecting a sample.
Carrier gas	The gas used to push the sample through the system during an analysis. In C6+ analysis we use Ultra Pure (zero grade) Carrier Gas for the carrier. This gas is 99.995 percent pure.
Chromatogram	A permanent record of the detector output. A chromatogram is obtained from a PC interfaced with the detector output through the controller assembly. A typical chromatogram displays all component peaks, and gain changes. It may be viewed in color as it is processed on a PC VGA display. Tick marks recorded on the chromatogram by the controller assembly indicate where timed events take place.
Component	Any one of several different gases that may appear in a sample mixture. For example, natural gas usually contains the following components: nitrogen, carbon dioxide, methane, ethane, propane, isobutane, normal butane, isopentane, normal pentane, and hexanes plus.
CTS	Clear to send.
DCD	Data carrier detect.
DSR	Data set ready.
DTR	Data terminal ready.
FID	Flame ionization detector. The optional FID may be used in place of a TCD for the detection of trace compounds. The FID requires a polarization voltage and its output is connected to the input to a high impedance amplifier, an electrometer. The sample of gas to be measured is injected into the burner with a mixture of hydrogen and air to maintain the flame.
LSIV	Liquid sample injection valve. The optional LSIV is used to convert a liquid sample to a gas sample by vaporizing the liquid in a heated chamber, then analyzing the flashed sample.
Methanator	The optional methanator, also known as a catalytic converter, transforms otherwise undetectable carbon dioxide and/or carbon monoxide into methane by adding hydrogen and heat to the sample.
Response factor	Correction factor for each component as determined by the following calibration: $RF = \frac{RawArea}{Calibration \quad Concentration}$
Retention time	Time, in seconds, that elapses between the start of analysis and the sensing of the maximum concentration of each component by the detector.
RI	Ring indicator.
RLSD	Received line signal detect. A digital simulation of a carrier detect.
RTS	Request to send.

RxD, RD, or S_{in}	Receive data, or signal in.
TCD	Thermal conductivity detector. A detector that uses the thermal conductivity of the different gas components to produce an unbalanced signal across the bridge of the preamplifier. The higher the temperature, the lower the resistance on the detectors.
TxD, TD, or S_{out}	Transmit data, or signal out.

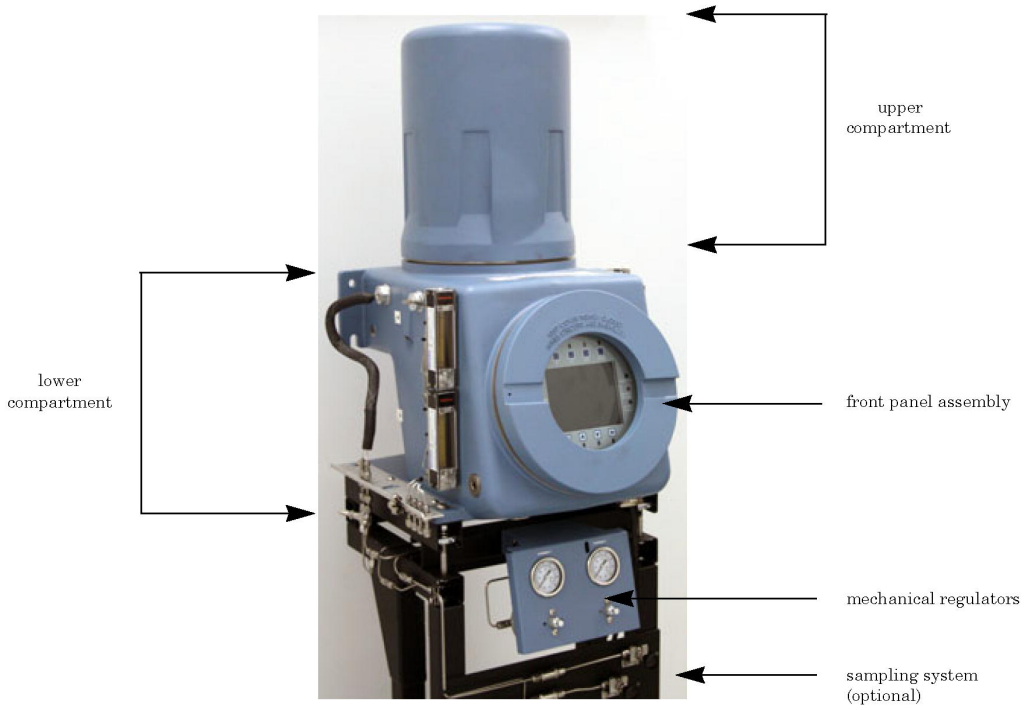
2 Equipment description and specifications

Use the following sections to reference the 700XA equipment description or specifications.

2.1 Equipment description

The 700XA consists of a copper-free aluminum explosion-proof chamber, and a front panel assembly. The chamber is divided into two compartments that together house the GC's major components. This unit is designed for hazardous locations.

Figure 2-1: 700XA gas chromatograph



2.1.1 Front panel assembly

The front panel assembly is located on the front section of the lower enclosure and consists of a removable, explosion-proof panel that shields either a switch panel or a local operator interface (LOI).

The switch panel

The switch panel contains a network of on/off switches that allow you to manually control the GC's stream and analytical valves.

Figure 2-2: 8-stream switch panel (left) and 18-stream switch panel (right)

There are two types of switch panels: 8-stream and 18-stream. The 8- stream switch panel is the standard panel, and is used when the GC has only one heater/solenoid board installed; if two heater/solenoid boards are installed, then the 18-stream switch panel is used.

Figure 2-3: Valve switch from switch panel set to "OFF"

A valve has the following three operational modes:

- **AUTO** - The valve turns on and off according to the Timed Events table that is accessible through MON2020. To set a valve to AUTO mode, set its switch on the switch panel to the "up" position.

- **OFF** - The valve turns off and remains off until the operational mode is changed. To set a valve to OFF mode, set its switch on the switch panel to the “center” position—that is, the switch is neither flipped “up” nor “down”.
- **ON** - The valve turns on and remains on until the operational mode is changed. To set a valve to ON mode, set its switch on the switch panel to the “down” position.

Figure 2-4: Status LEDs (Top of switch panel)

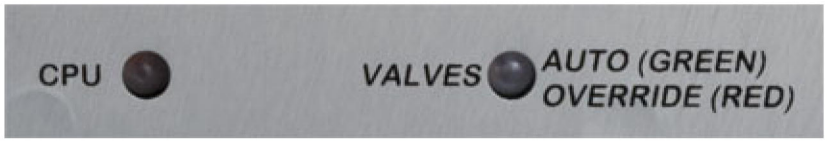
The switch panels also contain the following status lights that allow you to monitor the GC’s condition:

- **Working** - Turns green when the GC is in analysis mode.
- **Unack. Alarm** - Turns yellow if there is an unacknowledged alarm.
- **Active Alarm** - Turns red if there is an active alarm.

Figure 2-5: FID/FPD Status LED

- **FID/FPD** - The 18-stream switch panel contains a FID or FPD status LED that can indicate the following:
  - A green light means the flame has ignited.
  - A flashing yellow light means an attempt is being made to ignite the flame.
  - A red light means the flame as gone out or that the FID or FPD is over-temperature.

Figure 2-6: Status LEDs (Bottom of switch panel)



- **CPU** - Green light blinks continuously while the GC is running.
- **Valves** - Turns green if the valves are functioning automatically; turns red if the valves' automatic settings have been overridden.

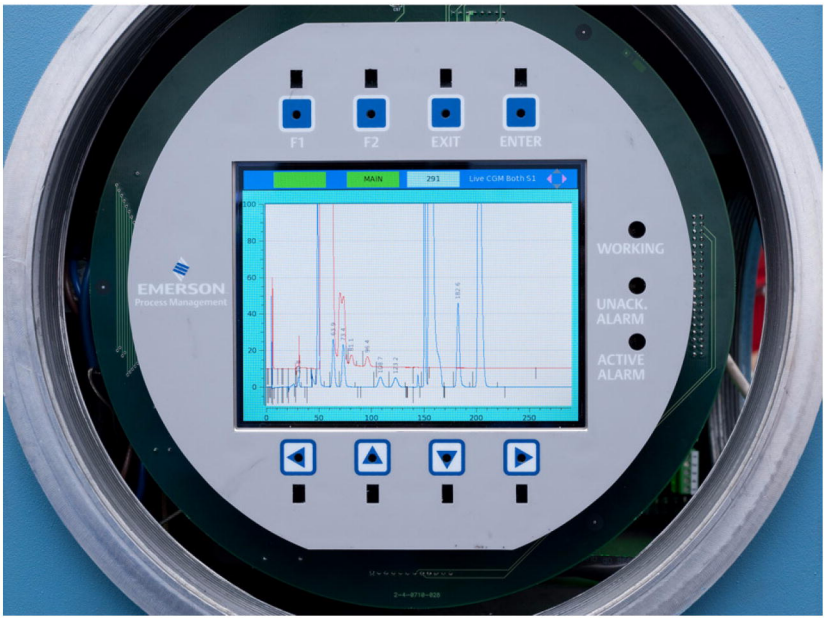
Note

During GC start up, all LEDs turn on for approximately ten seconds.

The local operator interface

The optional local operator interface (LOI) gives you more in-depth control over the GC's functions than does the switch panel. It has a high resolution color display that is touch key activated and allows you to operate a 700XA GC without a laptop or a PC.

Figure 2-7: The local operator interface



The LOI includes the following features:

- Color LCD with VGA (640 x 480 pixels) resolution.
- ASCII text and graphics modes.
- Adjustable auto-backlighting.

- 8 infrared-activated touch screen keys that eliminate the requirement for a magnetic pen.
- Complete GC status, control and diagnostics, including full chromatogram display.

See *Appendix A* for more information about operating the LOI.

2.1.2 Upper compartment

The upper compartment contains the following components:

- **Valves**. There are two types of XA valves: 6-port and 10-port. A 700XA can have a maximum of four XA valves consisting of any combination of the two types.
- **Column module**. Either capillary or micro-packed.
- **Thermal conductivity detector (TCD)**. The 700XA has a minimum of one TCD and a maximum of two TCDs.
- **Two heating elements**: a “top hat” heater and a column heater.
- **One temperature switch for each heating element**. The switch turns off its heating element if the heating element reaches 257° F (160° C).
- **Pressure switch**. The pressure switch activates when the carrier pressure falls below a predetermined set point. When activated, the switch triggers a general alarm that displays on the front panel or LOI and in MON2020.
- **Flame ionization detector (FID)**. The optional FID, which detects trace levels of hydrocarbons, can be used in place of one TCD.
- **Flame photometric detector (FPD)**. The optional FPD, which detects trace levels of sulphur compounds, can be used in place of a TCD. Installed as a "side car" component. For more information, refer to the *FPD for Gas Chromatographs Hardware Reference Manual*.
- **Methanator**. The methanator, or catalytic converter, is an optional component that converts otherwise undetectable carbon dioxide and/or carbon monoxide into methane by adding hydrogen and heat to the sample.
- **Liquid sample injection valve (LSIV)**. The optional LSIV is used to vaporize a liquid sample, thereby expanding the GC’s capability to measure liquids.

2.1.3 Lower compartment

The lower compartment consists of the following components:

- **Backplane**. The backplane is the GC’s central printed circuit board (PCB). Its main function is as a connection point for the GC’s specialized plug-in PCBs. The backplane also hosts connections for analog outputs and analog inputs, serial ports and an Ethernet port.
- **Card cage**. The card cage holds the specialized PCBs that plug into the backplane. The following PCBs are housed in the card cage:
  - Preamp board
  - CPU board
  - Base I/O board

- Heater/Solenoid board

The card cage also has four additional slots for the following optional PCBs:

- A second preamp board
- A second heater/solenoid board
- Two optional communications boards

⚠ WARNING!

The explosion-proof housing should not be opened when the unit is exposed to an explosive environment. If access to the explosion-proof housing is required, take precautions to ensure that an explosive environment is not present. Failure to do so may result in injury or death to personnel or cause damage to the equipment.

- **Optional AC/DC power supply**.

⚠ WARNING!

See power supply label prior to connection. Check the unit power design to determine if it is equipped for AC or DC power. Applying 110/220 VAC to a DC power input unit will severely damage the unit. Failure to do so may result in injury or death to personnel or cause damage to the equipment.

Note

The 700XA CSA-certified unit is equipped with 3/4-inch NPT-thread adapters.

2.1.4 Mechanical pressure regulators

Figure 2-8: The mechanical pressure regulators

The mechanical pressure regulators and gauges are used to set and monitor the pressure of the carrier gas flow through the GC's columns, as well as the pressure of the FID air and fuel (H_2).

The regulators and gauges are located beneath the GC.

2.2 Equipment specifications

2.2.1 Utilities

Use the following table to determine the utility specifications.

Type	Specification
Unit dimensions	• Basic unit envelope W - 15.2” (387 mm) H - 41.5” (1054 mm) D - 19.2” (488 mm) • Wall mount W - 18.2” (463 mm) H - 41.5” (1054 mm) D - 19.2” (488 mm) • Pole mount W - 18.2” (463 mm) H - 41.5” (1054 mm) D - 25.0” (635 mm) • Floor mount W - 18.2” (463 mm) H - 58.0” (1470 mm) D - 19.2” (488 mm) **Note** Allow 14” (360 mm additional) clearance for removal of dome.
Unit weight	• Wall mount - 110 lbs (59 kg) • Pole mount - 135 lbs (61 kg) • Floor mount - 180 lbs (82 kg)
Tubing	• 316 stainless steel • 316 stainless steel and Kapton® in contact with sample • Sulfinert® steel (optional)

Type	Specification
Mounting	• Floor mount • Pole mount: - 2” (60.3 mm) - 3” (89.0 mm) - 4” (114.3 mm) • Direct wall mount
Power	• 24V DC standard (21-30 V DC operating voltage range); MAX 150 watts • (optional) 100-120/240 V AC; 50-60 Hz **Note** Voltage range includes line voltage variations.
Instrument air	Not required; optional for valve actuation, minimum pressure of 90 psig
Environment	• Hazardous area certified: -20° C to 60° C (-4° F to 140° F) • 0 to 95% RH (non-condensing) • Indoor/outdoor • Pollution - degree 2 (The unit can withstand some non conductive environmental pollutants e.g., humidity.)
Approvals	CE 0518 Ex II 2G c SA us FOR USE IN HAZARDOUS LOCATIONS: • For Canada: Class I, Zone 1, EX d IIC T6, Enclosure Type 4 Class I, Division 1, Group B, C and D. • For USA: Class I, Zone 1, EX d IIC T6, Enclosure Type 4 Class I, Division 1, Group B, C and D.

2.2.2 Electronic hardware

Use the following table to determine the electronic hardware specifications:

Type	Specification
Rating	Division 1; no purge required
Communication ports	3 configurable Modbus ports that support RS-232/422/485 protocols; 2 optional ports in expansion slots; 9-pin RS-232 port. **Note** The maximum number of simultaneous Modbus TCP/IP connections from Modbus Master is 10.
Optional modem	56K Baud Telephone

Type	Specification
Analog inputs	2 connectors on the backplane, isolated
Standard analog outputs	6 connectors on the backplane, isolated
Optional analog outputs	8 connectors on optional expansion boards, isolated
Discrete digital inputs	5 connectors on the backplane
Discrete digital outputs	5 relay “Form C” contacts on Phoenix connectors on the backplane. Relay contact rating 24 VDC nominal @ 1 Amp
Solenoid Driver board	Maximum current output: Channels 1 - 8: Maximum rating is 17 W. Each channel can drive 2.12 W or 88.4 mA at 24 VDC. Channel 9 - 12: Maximum rating is 17 W. Each channel can drive 4.24 W or 176.8 mA at 24 VDC.
Transient protection	Over-voltage category II

2.2.3 Airless analytical oven

The following table lists the specifications for the oven assembly.

Type	Specification
Valves	6-port and 10-port XA valves; piston-operated diaphragms with pneumatic actuation
Columns	Max of 90 ft (27.4 m) of micro-packed columns; 1/16-inch (1.6-mm) outside diameter or 300 ft (91.4 m) of capillary columns
Solenoid actuation	• 24 VDC • Max 120 psi
Temperature control	• 24 VDC • 2 heaters • 2 optional heaters • Max oven operating temperature of 150° C (302° F)

2.2.4 Software

The following table lists the specifications for the GC’s software.

Type	Specification
Software	Windows-based MON2020.

Type	Specification
Firmware	Embedded firmware. Can be upgrade with MON2020.
Methods	4 Timed Event tables and 4 Component Data tables assignable to each stream.
Peak Integration	• Fixed time or auto slope and peak identification. • Update retention time upon calibration or during analysis.

2.2.5 Corrosion protection

Type	Specification
Enclosure Material	Copper-free and aluminum-coated with industrial grade powder coat suitable for high humidity and salt-laden environments.
Process Wetted Materials	Stainless steel; if the function of an item excludes the use of stainless steel, such as the glass rotameter tubes, materials that are resistant to corrosion are used.
Electronics	All electronic circuit boards are tropicalized with a clear conformal coating.

2.2.6 Archived Data Storage Capabilities

Type	Maximum Number of Records	Remarks
Analysis Results	31744	88 days with 4 minute cycle time
Final Calibration Results	370	1 year of Final Calibration results
Calibration Results	100	
Final Validation Results	370	1 year of Final Validation results
Validation Results	100	
Analysis Chromatograms	1703	Approximately 4.5 days assuming 4 minute cycle time
Final Calibration Chromatograms	370	1 year of Final Calibration Chromatograms*
Final Validation Chromatograms	370	1 year of Final Validation Chromatograms*
Protected Chromatograms	100	User -selectable
Hourly Averages (Up to 250** variables)	2400	100 days

Type	Maximum Number of Records	Remarks
Daily Averages (Up to 250**variables)	365	1 Year
Weekly Averages (Up to 250** variables)	58	1 Year
Monthly Averages (Up to 250** variables)	12	1 Year
Variable Averages (Up to 250** variables)	2360	
Every run (Up to 250** variables)	2360	
Alarm Logs	1000	
Event Logs	1000	

* The GC can store final calibration or final validation chromatograms for up to a year, provided that no more than one calibration or validation is run per day, and the cycle time is less than 15 minutes. If the cycle time exceeds 15 minutes, the oldest final calibration or validation chromatograms will be deleted to make room for newer ones.

** You can have a total of up to 250 averages of all types, including Hourly, 24 Hour, Weekly, Monthly, Variable and Every Run averages.

3 Installation and setup

This section provides instructions for installing and commissioning the 700XA.

Installing a 700XA involves the following steps:

1. Observing precautions and warnings.
2. Planning site location and mounting arrangement.
3. Obtaining supplies and tools.
4. Mounting the unit.
5. Installing GC wiring.
6. Installing GC sample and gas lines.
7. Purging carrier gas lines.
8. Purging calibration lines.
9. Performing leak checks.
10. Starting up GC system.

3.1 Precautions and warnings

⚠ WARNING!

Install and operate all equipment as designed and comply with all safety requirements. The seller does not accept any responsibility for installations of the GC, or any attached equipment, in which the installation or operation thereof has been performed in a manner that is negligent and/or non-compliant with applicable safety requirements.

⚠ WARNING!

If the unit is not operated in a manner recommended by the manufacturer, the overall safety could be impaired.

⚠ WARNING!

The unit is intended to be connected to supply mains by qualified personnel in accordance with local and national codes.

⚠ WARNING!

A suitable APPROVED switch and fuse or a circuit breaker shall be provided to facilitate the disconnection of mains power.

⚠ WARNING!

The unit is required to be used in a well ventilated area.

⚠ WARNING!

All gas connections must be properly leak tested at installation.

⚠ WARNING!

No user replaceable part inside except a few parts that are only allowed to be accessed by trained service personnel.

⚠ WARNING!

Observe and comply with all precautionary signs posted on the GC. Failure to do so may result in injury or death to personnel or cause damage to the equipment

⚠ WARNING!

If you plan to place the GC in a sealed shelter, always vent the GC to atmosphere with ¼-inch tubing or larger. This will prevent the build up of H2 and sample gas.

⚠ WARNING!

Exit ports may discharge dangerous levels of toxic vapors; use proper protection and a suitable exhaust device.

⚠ CAUTION!

Waste electrical and electronic products must not be disposed of with household waste. Please recycle where facilities exist. Check with your local authority or retailer for recycling advice.

Note

The 700XA is CSA-certified and ATEX-certified. See the certification tag on the GC for specific details about its agency approvals.

The following special conditions for safe use must be met:

Note

When installed, the equipment shall pass an electrical strength test of (1000 + 2 Un) V, rms applied for at least 10 seconds up to a maximum of 60 seconds.

Note
When the vapor regulators and flow switches are fitted they must be suitably certified with the ratings **Ex d IIC Gb T5/T6/T4** and for a minimum ambient temperature range **Ta = -20°C to +60°C**.

Note
Where right angle bend cable adaptors are used they shall be appropriately certified and shall interface with enclosures via appropriate certified barrier glands.

3.1.1 Installation considerations

Consider the following before installing the GC:

1. Anchor the GC solidly before performing electrical connections.

   Several options for mounting the unit are covered in this section. The GC is heavy and the potential for damage to equipment or personnel is high.
2. Ensure that the connections to the enclosure meet local standards.
3. Use approved seals: either cable glands or conduit seals.

   a. Install conduit seals within three inches of the enclosure.

   b. Seal unused openings with approved blanks (plugs).

      Threads for these openings are M32 x 1.5.
4. Remove any packing materials before powering up the unit.
5. Do not power up an open unit unless the surrounding area is certified non-hazardous.
6. Printers and most laptop computers cannot be used in hazardous areas.

3.2 XA mounting arrangements

The 700XA can be installed in one of the following mounting arrangements:

- Wall mount
- Pole mount
- Floor mount

When putting a unit into its final position, be careful to avoid damaging any of the external components or their attachments. Due to the size, weight, and shape of the GC, at least two people are required to safely mount the unit. Also, make sure you understand the installation procedure before handling the unit, and collect the appropriate tools beforehand.

3.2.1 Wall mount

The simplest mounting arrangement is the wall mount. If 'Wall Mount' is specified on the sales order, the unit will be shipped with a wall mount installation kit. Four locations on the mounting ears are available for support.

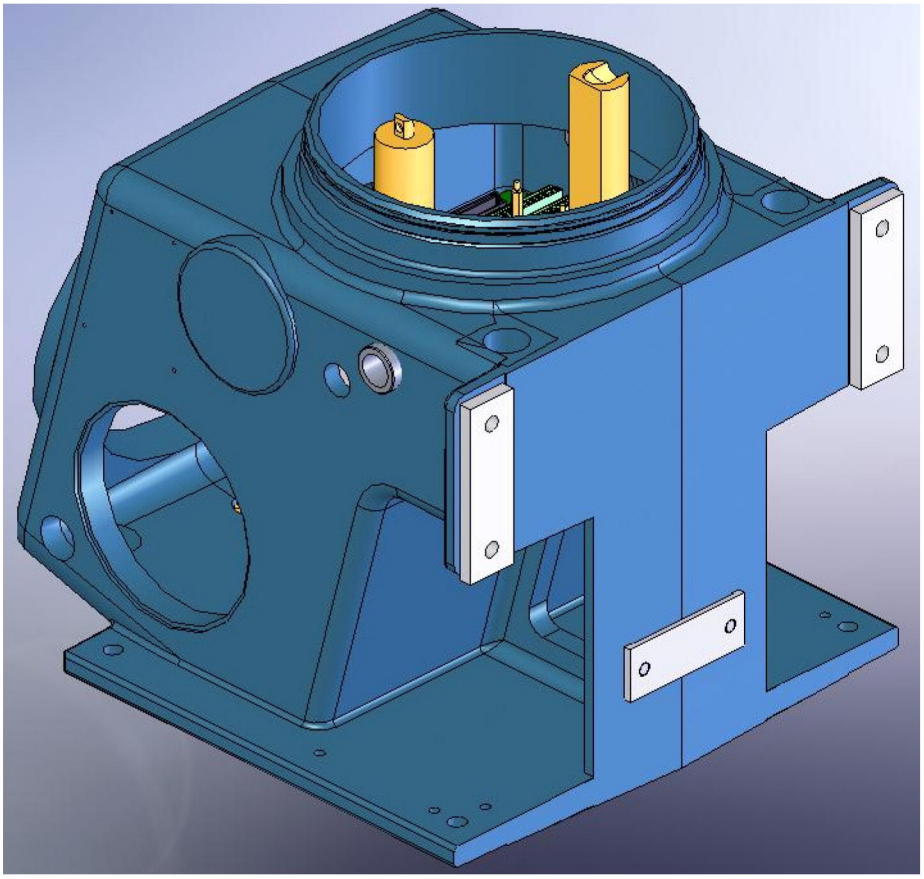
1. The unit is most easily mounted if a pair of 7/16-inch dia. (10 mm dia.) bolts with washers are pre-installed on the wall from which to hang the unit before installing the final pair of bolts.

   The first pair of bolts should be approximately 41.625 inches (1055 mm) off the ground, and 13.625 inches (346 mm) apart. Each bolt should have 5/8-inches (16 mm) of bare length projecting. A second pair of holes 3.56 inches (90.5 mm) above the first will be required.

⚠ CAUTION!

Until all bolts are tight, the unit should be supported to prevent unforeseen accidents.

Figure 3-1: Wall mount

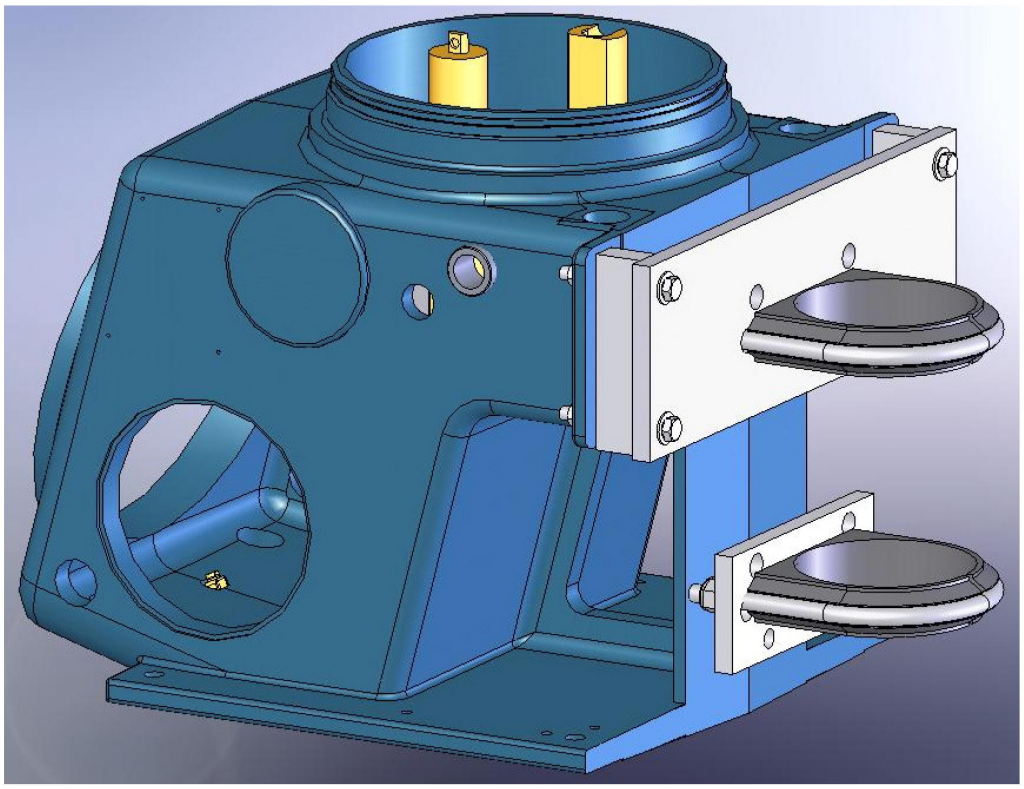


2. Maneuver the GC so that the notches in the mounting ears can be placed over the bolts on the wall and then place the washers over the bolts.
3. Install the second pair of bolts with washers and then tighten all the bolts.

3.2.2 Pole mount

The pole mount arrangement uses an additional plate and spacers to allow the necessary clearance for nuts. All hardware will be provided if 'Pole Mount' is specified on the sales order.

Figure 3-2: Pole mount



1. Use the u-bolt to firmly install the large plate on the pole about 44 inches (1120 mm) above the ground.
2. Install the long bolts and spacers.
3. Place nuts and washers on the lower bolts.
4. Install the small plate just tightly enough to hold its position, with the small plate's u-bolt about 6.875 inches (174.625 mm) below the large plate's U-bolt.
5. Hold the matching spacer in place with the bolts installed loosely.
6. Orient the unit so that the notches in the mounting ears can be placed over the lower bolts on the plate and then add the washers and nuts.

7. Place the nuts with washers on the upper bolts and then tighten all bolts.

⚠ WARNING!

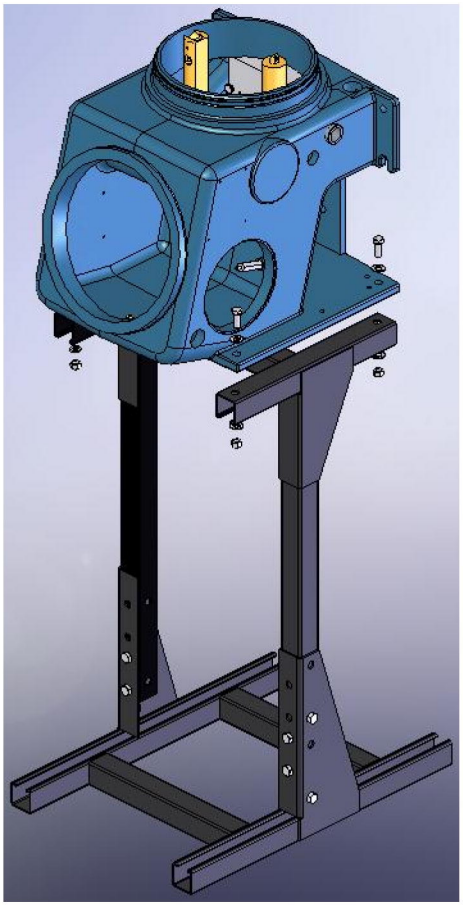
Until all bolts are tight, the unit should be supported to prevent unforeseen accidents.

8. Adjust the lower bracket to align the bolts with the plate. Tighten the bolts.

3.2.3 Floor mount

If 'Floor Mount' is specified in the sales order, the arrangement comes pre-assembled with the GC. The arrangement includes an additional support stand that is intended to be anchored to a floor or an instrument pad. The base rails have holes that are 13.625 inches (346 mm) apart, side to side, and 16.75 inches (425.5 mm) apart front to back. The holes are ½-inch in diameter and will accept up to 7/16-inch (or 10 mm) bolts.

Figure 3-3: Floor mount



3.3 Gas chromatograph wiring

3.3.1 Power source wiring

Follow these precautions when installing power source wiring:

- All wiring, as well as circuit breaker or power disconnect switch locations, must conform to the CEC or NEC; all local, state, or other jurisdictions; and company standards and practices.
- Provide single-phase, three-wire power at 120 or 240 VAC, 50-60 Hertz.

Note

If you do not have a single phase, three-wire AC power source, you must purchase an isolation transformer. Refer to Drawing #CE19492E1 at the back of the manual for more information.

- Locate in a safe area.
- Provide the GC and any optionally installed devices with one 15-amp circuit breaker for protection.

⚠ CAUTION!

15 amps is the maximum current for 14 AWG (wire).

- Ensure that the 24 VDC input power is compliant with the Separated Extra-Low Voltage (SELV) standard by suitable electrical separation from other circuits.
- Use multi-stranded copper conductor wire according to the following recommendations:
  - For power feed distances up to 250 feet (76 meters), use 14 AWG (American Wire Gauge) (18 Metric Wire Gauge), stranded.
  - For power feed distances 250 to 500 feet (76 to 152 meters), use 12 AWG (25 Metric Wire Gauge), stranded.
  - For power feed distances 500 to 1000 feet (152 to 305 meters), use 10 AWG (30 Metric Wire Gauge), stranded.
  - Cable entries are M32 in accordance with ISO 965.

3.3.2 Signal wiring

Follow these general precautions for field wiring digital and analog input/output (I/O) lines:

- Metal conduit or cable (according to local code) used for process signal wiring must be grounded at conduit support points because intermittent grounding helps prevent the induction of magnetic loops between the conduit and cable shielding.

- All process signal wiring should be of a single, continuous length between field devices and the GC. If, however, the length of the conduit runs require that multiple wiring pulls be made, the individual conductors must be interconnected with suitable terminal blocks.
- Use suitable lubrication for wire pulls in conduit to prevent wire stress.
- Use separate conduits for AC voltage and DC voltage circuits.
- Do not place digital or analog I/O lines in the same conduit as AC power circuits.
- Use only shielded cable for digital I/O line connections.
  - Ground the shield at only one end.
  - Shield-drain wires must not be more than two AWG sizes smaller than the conductors for the cable.
- When inductive loads (relay coils) are driven by digital output lines, the inductive transients must be diode-clamped directly at the coil.
- Any auxiliary equipment wired to the GC must have its signal common isolated from earth/chassis ground.

⚠ WARNING!

Any loop of extra cable left for service purposes inside the GC purged housing must not be placed near the conduit entry for AC power. This applies to all digital and analog I/O lines connecting to the GC. If the above precaution is not followed, the data and control signals to and from the GC can be adversely affected.

3.3.3 Electrical and signal ground

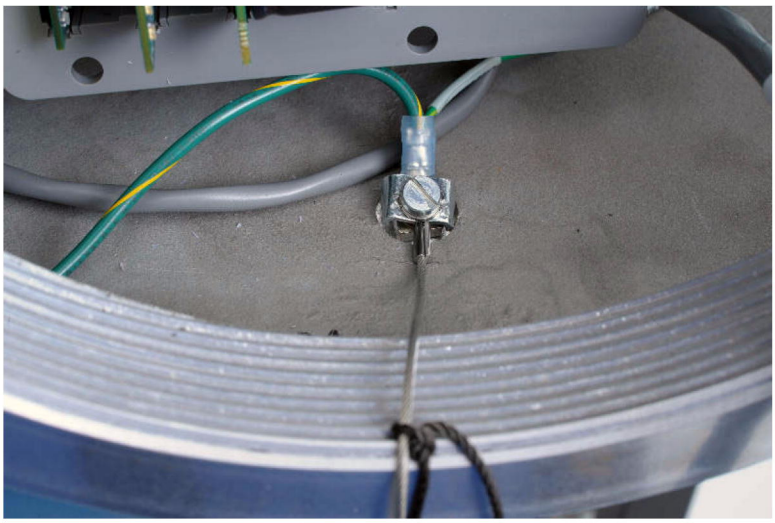
Follow these general precautions for grounding electrical and signal lines:

- For shielded signal conducting cables, shield-drain wires must not be more than two AWG sizes smaller than the conductors for the cable. Shielding is grounded at only one end.
- Metal conduit used for process signal wiring must be grounded at conduit support points (intermittent grounding of conduit helps prevent induction of magnetic loops between the conduit and cable shielding).
- A single-point ground must be connected to a copper-clad, 10-foot long, 3/4-inch diameter steel rod, which is buried, full-length, vertically into the soil as close to the equipment as is practical.

Note

The grounding rod is not furnished.

Figure 3-4: Interior ground lug, lower enclosure



- Resistance between the copper-clad steel ground rod and the earth ground must not exceed 25 Ohms.
- On ATEX-certified units, the external ground lug must be connected to the customer's protective ground system via 9 AWG (6mm^2) ground wire. After the connection is made, apply a non-acidic grease to the surface of the external ground lug to prevent corrosion.
- The equipment-grounding conductors used between the GC and the copper-clad steel ground rod must be sized according to your local regulations, the following specifications apply in the US.

Length	Wire
15 ft. (4.6 m) or less	8 AWG, stranded, insulated copper
15 to 30 ft. (4.6 to 9.1 m)	6 AWG, stranded, insulated copper
30 to 100 ft. (9.1 to 30.5 m)	4 AWG, stranded, insulated copper

- All interior enclosure equipment-grounding conductors must be protected by metal conduit.
- External equipment that is connected to the GC should be powered via isolation transformers to minimize the ground loops caused by the internally shared safety and chassis grounds.

3.3.4 Electrical conduit

Follow these general precautions for conduit installation:

- Conduit cutoffs must be cut at a 90-degree angle. Cutoffs must be made by a cold cutting tool, hacksaw, or by some other approved means that does not deform the conduit ends or leave sharp edges.

- All conduit fitting-threads, including factory-cut threads, must be coated with a metal-bearing conducting grease prior to assembly.
- Temporarily cap the ends of all conduit runs immediately after installation to prevent accumulation of water, dirt, or other contaminants. If necessary, swab out conduits prior to installing the conductors.
- Install drain fittings at the lowest point in the conduit run; install seals at the point of entry to the GC explosion-proof housing to prevent vapor passage and accumulation of moisture.
- Use liquid-tight conduit fittings for conduits exposed to moisture.

When a conduit is installed in hazardous areas, follow these general precautions for conduit installation:

- All conduit runs must have a fitting, which contains explosion-proof sealing (potting) located within three inches from the conduit entrance to the explosion-proof housing.
- The conduit installation must be vapor tight, with threaded hub fittings, sealed conduit joints and gaskets on covers, or other approved vapor-tight conduit fittings.

⚠ WARNING!

Observe all precautionary signs posted on the equipment. Consult your company's policies and procedures and other applicable documents to determine wiring and installation practices that are appropriate for hazardous areas. Failure to do so may result in injury or death to personnel or cause damage to the equipment.

3.3.5 Sample system requirements

Observe the following guidelines for installing GC sample systems:

Line Length	If possible, avoid long sample lines. In case of a long sample line, flow velocity can be increased by decreasing downstream pressure and using by-pass flow via a speed loop. **⚠ CAUTION!** **Stream switching requires a sample pressure of 20 psig.**
Sample Line Tubing Material	• Use Silco tubing for H_2S streams; for all other applications use stainless steel tubing. • Ensure tubing is clean and free of grease.

Dryers and Filters	Use small sizes to minimize time lag and prevent back diffusion. • Install a minimum of one filter to remove solid particles. Most applications require fine-element filters upstream of the GC. The GC includes a 2-micron filter. • Do use ceramic or porous metallic type filters. Do not use cork or felt filters. **Note** Install the probe/regulator first, immediately followed by the coalescing filter and then the membrane filter. See *Appendix B* for a recommended natural gas installation.
Pressure Regulators and Flow Controllers	• Use stainless steel wetted materials. • Should be rated for sample pressure and temperature.
Pipe Threads and Dressings	Use Teflon tape. Do not use pipe thread compounds or pipe dope.
Valving	• Install a block valve downstream of sample takeoff point for maintenance and shutdown. • The block valve should be a needle valve or cock valve type, of proper material and packing, and rated for process line pressure.

3.4 Preparation

Your GC was started and inspected before it left the factory. Program parameters were installed and documented in the GC Config Report furnished with your gas chromatograph.

3.4.1 Site selection

Install the GC as close as possible to the sample system but allow for adequate access space for maintenance tasks and adjustments. Allow a minimum of 14 inches (36 cm) in front for enclosure opening and access. Allow a minimum of 14 inches (36 cm) above the top of the dome enclosure for dome removal and access.

Ensure that exposure to radio frequency (RF) interference is minimal.

3.4.2 Unpacking the unit

1. Unpack the equipment:
   - 700XA
   - CD-ROM containing software and manuals.

Note
The serial number for MON2020 is located on the back of its CD-ROM case.

2. If your GC is configured with an FID, remove the vent plug from the FID outlet.

   The vent plug has a tag attached to it that reads “REMOVE VENT PLUGS PRIOR TO OPERATION”. Failure to remove the cap could result in a performance failure or in damage to the detector.

Installation and startup should proceed only if all required materials are on hand and free from obvious defects.

If any parts or assemblies appear to have been damaged in shipment, first file a claim with the carrier. Next, complete a full report describing the nature and extent of the damage and forward this report immediately to your Emerson Process Management representative. Include the GC's model number in the report. Disposition instructions will be provided as soon as possible. If you have any questions regarding the claim process, contact your Emerson Process Management representative for assistance.

3.4.3 Required tools and components

You will need the following tools and components to install the 700XA:

- Zero grade carrier gas:
  - 99.995% pure
  - Less than 5 ppm water
  - Less than 0.5 ppm hydrocarbons
- High pressure dual-stage regulator for the carrier gas cylinder:
  - High side up to 3000 psig
  - Gauge (psig)
  - Low side capable of controlling pressure up to 150 psig
- Calibration standard gas with correct number of components and concentrations.
- Dual-stage regulator for the calibration gas cylinder with a low pressure side capable of controlling pressure up to 30 psig.
- Sample probe regulator (fixture for procuring the stream, or sample gas for chromatographic analysis).
- Coalescing filter.
- Membrane filter.
- Eighth-inch stainless steel tubing:
  - For connecting calibration gas to the GC
  - For connecting carrier gas to the GC.
  - For connecting stream gas to the GC.
- Heat tracing, as required, for sample transport and calibration lines.
- Miscellaneous tube fittings, tubing benders, and tubing cutter.

- 14 AWG (American Wire Gauge), 18 MWG (Metric Wire Gauge) or larger electrical wiring and conduit to provide 120 or 240 volts AC, single phase, 50 to 60 Hertz, from an appropriate circuit breaker and power disconnect switch. See guidelines in *Section 3.3*.
- Digital volt-ohm meter with probe-type leads.
- Flow measuring device.
- Open-end wrenches sized 1/4-inch, 5/16-inch, 7/16-inch, 1/2-inch, 9/16-inch and 5/8-inch.
- Torque wrench.

3.4.4 Supporting tools and components

⚠ WARNING!

Do not use a PC or a printer in a hazardous area. Serial port and Modbus communications links are provided to connect the unit to the PC and to connect to other computers and printers in a safe area. Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

Supporting tools and components include:

- Use a Windows-based PC and either a direct or remote communications connection to interface with the GC. See the MON2020 user manual for more information on specific PC requirements.
- The GC comes with an ethernet port on the back plane factory-wired with an RJ-45 connector. Refer to *Section 3.5.8* for more information.

3.5 Installation

Note

CPU boards are switched off before shipping to preserve the board's battery. Before installing into the GC, be sure to switch the CPU board on.

3.5.1 DC power supply

⚠ WARNING!

Ensure that the 24 VDC input power source is switched OFF before connecting the wires. Also, ensure that the 24 VDC input power is SELV compliant by suitable electrical separation from other circuits. Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

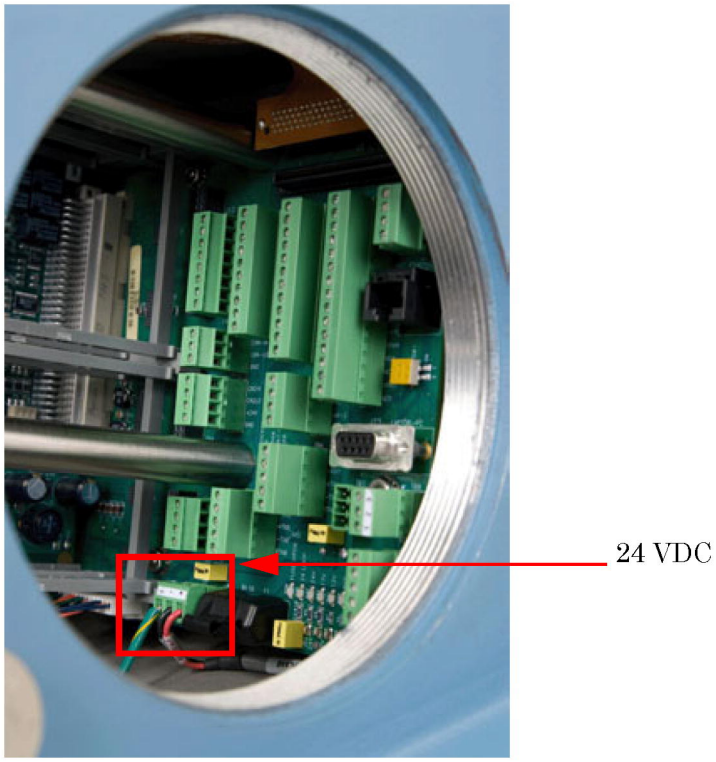
⚠ CAUTION!

Check the unit prior to wiring to determine if it is equipped for DC power. Failure to observe this precaution may damage equipment.

To connect a 24 VDC power source to the GC, do the following:

1. Locate the plug-together termination block inside the electronics enclosure.

Figure 3-5: 24 VDC power connection on the back plane



2. Bring the two leads in through one of the two possible entries on the lower compartment. Connect to the termination plug provided with the unit. See *Appendix F*, drawing #DE- 20993.

Figure 3-6: Location of entries for wiring on the under side of the lower enclosure

Use the following table for the DC power wiring details:

Attribute	Wire Color
+ (positive)	red
– (negative)	black

Note

Do not disconnect the factory-installed ground wire.

3. The backplane board that connects to the 24 VDC is protected from lead reversal by the use of blocking diodes.

   If the red (+) and black (-) leads are inadvertently reversed, no damage will occur; however, the system will not have power.

4. Connect the DC power leads to the power disconnect switch that should be properly fused. The recommended fuse size is 8 amps.

3.5.2 Optional AC/DC power converter

⚠ WARNING!

Check the unit prior to wiring to determine if it is equipped for optional AC power. Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

To connect a 120 or 240 VAC power source to the GC, do the following:

1. Locate the plug-together termination block inside the electronics enclosure, atop the power supply and adjacent to the card cage.

Figure 3-7: AC/DC termination block

⚠ WARNING!

Do not connect the AC power leads without first ensuring that AC power source is switched OFF. Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

⚠ CAUTION!

Do not apply electrical power to the GC until all interconnections and external signal connections have been verified, and proper grounds have been made. Failure to observe this precaution may cause damage to equipment.

AC wiring is usually colored as:

Label	Wire Color
Hot (**H**)	brown or black
Neutral (**N**)	blue or white
Ground (**G**)	green with yellow tracer or green

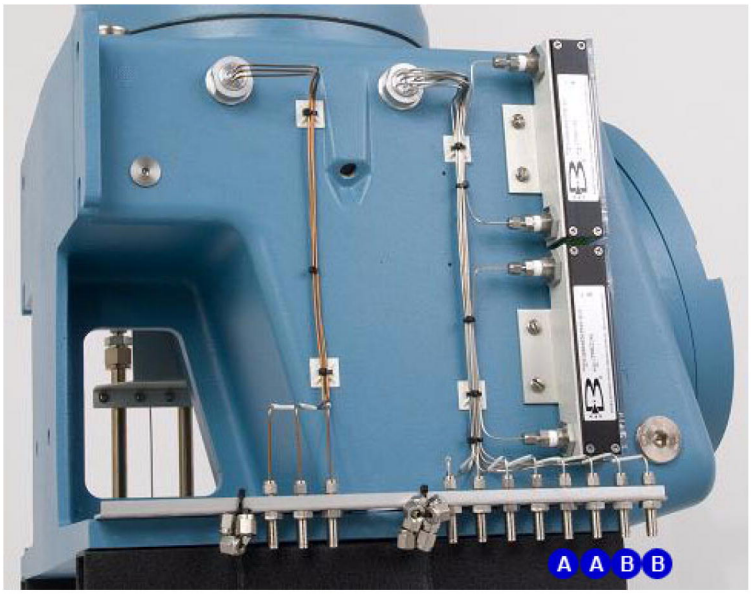
2. Bring the power leads in through the left entry on the bottom of the enclosure.
3. If necessary at remote locations, connect the GC chassis ground wire to an external copper ground rod. See *Section 3.3.3* regarding electrical and signal grounding.

3.5.3 Connect the sample and other gas lines

To install GC sample and gas lines, do the following:

1. Remove the plug from the 1/16-inch sample vent tubing marked “SV1” that is located on the flow panel assembly. Depending on your GC’s configuration, there may also be a second sample vent marked “SV2”. If so, remove its plug as well.

Figure 3-8: Sample vent (A) and measure vent (B) lines



- If desired, connect the sample vent lines to an external, ambient pressure vent. If the vent line is terminated in an area exposed to wind, protect the exposed vent with a metal shield.
- Use ¼-inch or 3/8-inch tubing for vent lines longer than 10 feet.

At this stage in the installation the GC measure vent lines (marked “MV1” and “MV2”) should remain plugged until the GC has been checked for leaks. For regular operation, however, the MV lines must be unplugged.

Note

Do not discard the vent line plugs. They are useful at any time when leak-checking the GC and its sample or gas line connections.

2. Connect the carrier gas to the GC. The carrier gas inlet is labeled “Carrier In” and is a 1/8-inch T-fitting.

⚠ WARNING!

Do not turn on sample gas until you have completely checked the carrier lines for leaks. Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

- Use stainless steel tubing to conduct carrier gas.

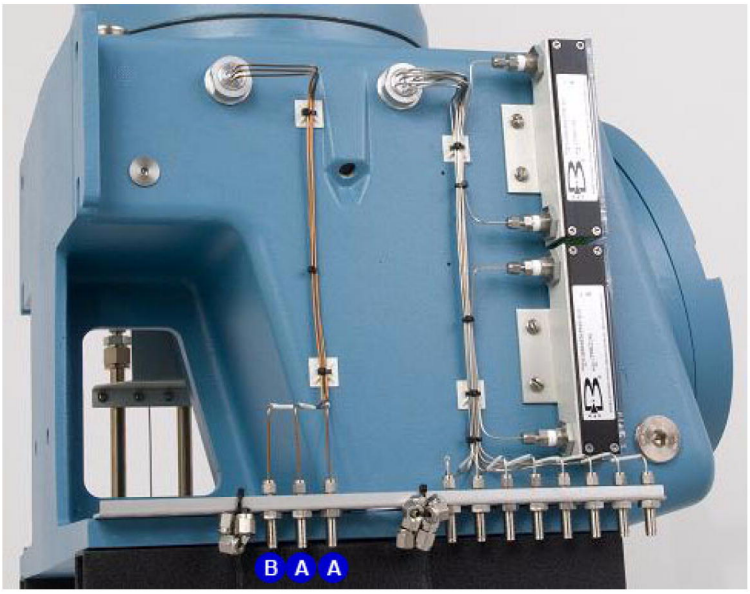
- Use a dual-stage regulator with high-side capacity of 3000 psig and low-side capacity of 150 psig.
- See *Appendix B* for a description of a dual-cylinder carrier gas manifold (P/N 3-5000-050) with these features: carrier gas is fed from two bottles; when one bottle is nearly empty (100 psig), the other bottle becomes the primary supply; and each bottle can be disconnected for refilling without interrupting GC operation.

3. Connect calibration standard gas to the GC.

When installing the calibration standard gas line, ensure that the correct tubing connection is made.

- Use 1/8-inch stainless steel tubing to connect calibration standard gas unless the application requires treated tubing.
- Use a dual-stage regulator with low-side capacity of up to 30 psig.

Figure 3-9: Sample stream inlets (A) and calibration gas inlet (B)



4. Connect sample gas stream(s) to the GC.

- Use 1/8-inch stainless steel tubing, as appropriate, to connect calibration standard gas.
- Unless stated otherwise in the product documentation, ensure that the pressure of the calibration and sample line is regulated at 20 psig.

5. After all lines have been installed, proceed with leak-checking the carrier and sample lines. See *Section 3.6*.

3.5.4 Maximum effective distance by communication protocol type

The table below lists the maximum distance at which the indicated protocol can transmit data without losing effectiveness. If longer runs are required, the use of a repeater or other type of extender will be necessary to maintain the protocol's efficiency.

Communication protocol	Maximum Distance
RS-232	50ft (15.24m)
RS-422/RS-485	4000ft (1219.2m)
Ethernet (Cat5)	300ft (91.44m)

3.5.5 RS-485 serial port terminals

To ensure correct communication with all hosts, place a 120-ohm terminating resistor across the GC serial port terminals on the RS-485 link. On a multi-dropped link, install the terminating resistor on the last controller link only.

3.5.6 Installing and connecting to an analog modem card

The 700XA has two slots—I/O Slot A and I/O Slot B—in the card cage for installing an analog modem.

Note

MON2020 only recognizes Microsoft Windows-compatible modems that have all relevant drivers installed correctly.

Note

Analog modems will only work with PSTN phone lines. Analog modems will not work with VOIP networks.

The following four LEDs are provided on the modem for troubleshooting:

- **RI** (Ring Indicator) - This LED flashes when it senses a **"**ring**"**. This LED should only flash once per connection because the modem automatically answers on the first ring.
- **CD** (Carrier Detect) - This LED glows green while connected to MON2020.
- **RX** (Receive) - This LED flashes while the GC receives data from MON2020.
- **TX** (Transmit) - This LED flashes while the GC sends data to MON2020.

Installing the analog modem

To install an analog modem, do the following:

1. Start MON2020 and connect to the GC.
2. Select **I/O Cards...** from the **Tools** menu. The *I/O Cards* window displays.
3. Change the **Card Type** for the appropriate I/O slot to **Communication Module - Modem**.
4. Click **Save**. MON2020 displays the following message:

   The GC must be rebooted for the ROC Card changes to take effect
5. Click **OK** to dismiss the message.
6. Click **OK** to close the *I/O Cards* window.
7. Disconnect from the GC.
8. Turn off the GC.
9. Insert the analog modem card into the appropriate I/O slot in the GC's card cage. Make certain that the I/O slot matches that from *Step 3*.
10. Tighten the card's screws to secure the modem in the slot.
11. Insert a telephone cable into the modem card's RJ-11 socket.
12. Start the GC.
13. Return to MON2020 and connect to the GC via its Ethernet connection.
14. Select **Communication...** from the **Application** menu. The *Communication* window displays. The appropriate I/O slot should be listed in the first column (*Label*).
15. Set the **Baud Rate** for the analog modem card to **57600**.
16. Make note of the I/O slot's Modbus Id.
17. Click **Save**.
18. Click **OK** to close the *Communication* window.
19. Disconnect from the GC.

3.5.7 Connecting to the GC via the analog modem

To connect to a GC via its analog modem, do the following:

1. Start MON2020 and select **GC Directory...** from the **File** menu. The *GC Directory* window displays.
2. Select **Add** from the *GC Directory* window's **File** menu. A row is added to the bottom of the directory table.
3. Replace "GC Name" with a more appropriate identifier for the GC to which you will be connecting.

   Note
   You can also enter more information about the GC in the *Short Desc* field.
4. Select the **Modem** check box.
5. Click the **Modem...** button. The *Modem Connection Properties for DialUp* window displays.

6. Make sure that the Comm Address matches the Modbus Id from the *Communication* window.
7. Select the appropriate modem from the **Modem** drop-down list. The *Edit Telephone Number* dialog box displays.
8. Enter the modem's telephone number and click **OK**. The *Modem Properties* window displays.
9. Click **OK** to close the *Modem Properties* window.
10. Click the *GC Directory* window's **Save** button.
11. Click the *GC Directory* window's **OK** button to close the window.
12. Select **Connect...** from the **Chromatograph** menu. The *Connect to GC* window displays.
13. Click the **Modem** button for the appropriate GC. The *Login* dialog box displays.
14. Enter the appropriate user name and password and click **OK**. MON2020 will connect to the GC via the modem connection.

3.5.8 Connecting directly to a PC using the GC's Ethernet port

The GC's DHCP server feature and its Ethernet port on the backplane at J22 allow you to connect directly to the GC. This is a useful feature for GCs that are not connected to a local area network; all that is needed is a PC—typically a notebook computer—and a CAT5 Ethernet cable.

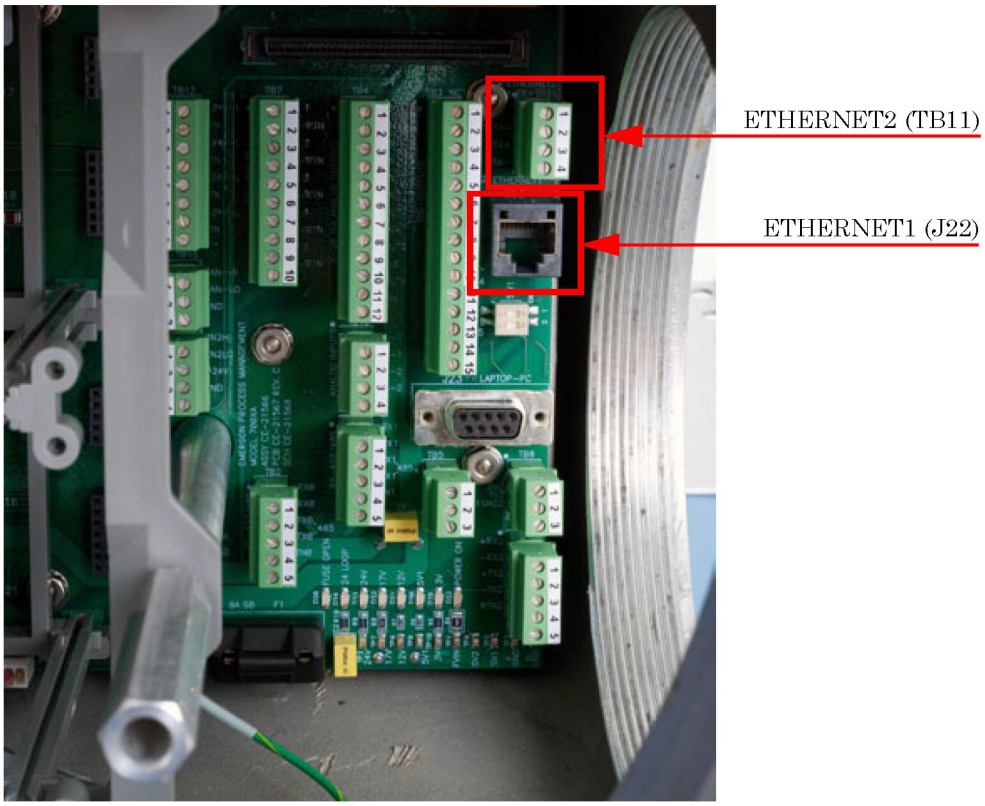
Note

The PC must have an Ethernet network interface card (NIC) that supports the automatic medium-dependent interface crossover (Auto-MDIX) technology and either an Ethernet cable of at least CAT5 or an Ethernet Crossover Cable of at least CAT5.

Note

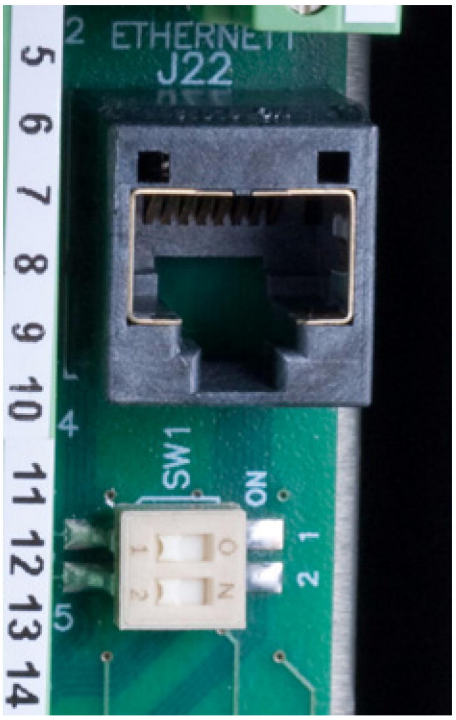
The GC can be connected (or remain connected) to the local network on TB11 on the backplane while the DHCP feature is being used.

Figure 3-10: Ethernet ports on the backplane



1. Plug one end of the Ethernet cable into the PC's Ethernet port and the other end into the GC's RJ45 socket on J22 on the backplane.
2. Locate the set of switches at SW1, directly beneath the Ethernet port on the back plane. Flip the switch that is labelled "1" to ON. This starts the GC's DHCP server feature. The server typically takes approximately 20 seconds to initialize and start up.

Figure 3-11: SW1 switches on the back plane



Note

Make sure the SW1 switch is set to off (1) before connecting the GC to your local network; else, the GC will disrupt the local network's functioning.

3. Wait for 20 seconds and then do the following to ensure that the server has provided an IP address to the PC:

   a. From the PC, go to **Start** → **Control Panel** → **Network Connections**.

   b. The *Network Connections* window lists all Dial-up and LAN / High-Speed Internet connections installed on the PC. In the list of LAN / High Speed Internet connections, find the icon that corresponds to the PC-to-GC connection and check the status that displays beneath the "Local Area Connection". It should show the status as "Connected". The PC is now capable of connecting to the GC. See *Using MON2020 to connect to the GC*.

1. If the status is "Disconnected", it may be that the PC is not configured to accept IP addresses; therefore, do the following:

4. Right-click on the icon and select **Properties**. The *Local Area Connection Properties* window displays.

5. Scroll to the bottom of the *Connection* list box and select **Internet Protocol (TCP/IP)**.

6. Click **Properties**. The *Internet Protocol (TCP/IP) Properties* window displays.

7. To configure the PC to accept IP addresses issued from the GC, select the **Obtain an IP address automatically** and **Obtain DNS server address automatically** check boxes.
8. Click **OK** to save the changes and to close the *Internet Protocol (TCP/IP) Properties* window.
9. Click **OK** to close the *Local Area Connection Properties* window.
10. Return to the *Network Connections* window and confirm that the appropriate icon's status reads "Connected". If the icon still reads "Disconnected" refer to *Section 3.5.9*.

Note

If you power cycle the GC, then you will lose connectivity. After the GC initializes completely, refer to *Section 3.5.9* to learn how to "repair" the connection.

Using MON2020 to connect to the GC

To connect to the GC, do the following:

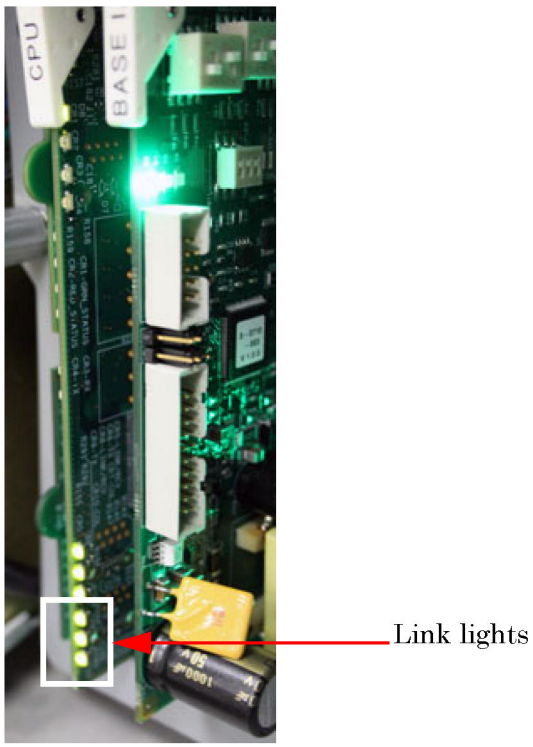
1. Start MON2020. After starting, the *Connect to GC* window displays.
2. Locate **Direct-DHCP** under the *GC Name* column. This GC directory is created automatically when MON2020 is installed. It can be renamed but the IP address that it references—192.168.135.100— should not be changed.
3. Click the associated **Ethernet** button. MON2020 prompts you to enter a user name and password, after which you will be connected to the GC.

3.5.9 Troubleshooting DHCP connectivity issues

Use the following tips to troubleshoot server connectivity issues:

1. Ensure that the GC is up and running. If equipped with an front panel, check the "CPU" LED on the front panel; a green light means that the GC is operational. If equipped with an LOI, ensure that the LOI is communicating with the GC.
2. Check that the SW1 switch is ON.
3. Check the following connections:
   a. If you are using a Ethernet straight cable, ensure that you the PC has an Ethernet network interface card with auto-MDIX.
   b. If your Ethernet network interface card does not support auto-MDIX, ensure that you are using an Ethernet crossover patch cable.
   c. Check to see if the CPU board's link lights are on. The three lights are located on the front bottom edge of the card. If link lights are off, then check your connections.

Figure 3-12: CPU board link lights

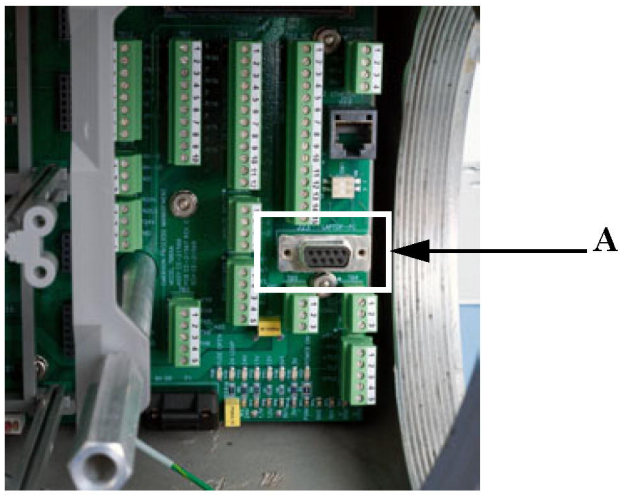


4. Do the following to ensure that your network adapter is enabled:
   a. Go to **Start** → **Control Panel** → **Network Connections**.
   b. Check the status of the *Local Area Connection* icon. If the status appears as **Disabled**, right-click on the icon and select **Enable** from the context menu.
5. Do the following to try to repair the network connection:
   a. Go to **Start** → **Control Panel** → **Network Connections**.
   b. Right-click on the *Local Area Connection* icon and select **Repair** from the context menu.

3.5.10 Connecting directly to a PC using the GC's serial port

The GC's serial port at J23 on the back plane allows a PC with the same type of port to connect directly to the GC. This is a useful feature for a GC that is located in an area without internet access; all that is needed is a PC running Windows XP Service Pack 3, Windows Vista, or Windows 7—typically a notebook computer—and a straight through serial cable.

Figure 3-13: J23 serial port on the backplane (A)



To set up the PC for the direct connection, do the following:

1. Do the following to install the **Daniel Direct Connect** modem driver onto the PC:
   a. Navigate to **Start** → **Control Panel** and double-click the **Phones and Modem Options** icon. The *Phones and Modem Options* dialog displays.
   b. Select the *Modem* tab and click **Add...**. The *Add Hardware Wizard* displays.
   c. Select the **Don't detect my modem; I will select it from a list** check box and then click **Next**.
   d. Click **Have Disk**. The *Install from Disk* dialog appears.
   e. Click **Browse** and the *Browse* dialog displays.
   f. Navigate to the MON2020 install directory (typically C:\Program Files\Emerson Process Management\MON2020) and select **Daniel Direct Connection.inf**.
   g. Click **Open**. You will be returned to the *Install from Disk* dialog.
   h. Click **OK**. You will be returned to the *Add Hardware Wizard*.
   i. Click **Next**.
   j. Select an available serial port and click **Next**. The *Hardware Installation* dialog displays.
   k. Click **Continue Anyway**. After the modem driver is installed, you will be returned to the *Add Hardware Wizard*.
   l. Click **Finish**. You will be returned to the *Phones and Modems* dialog. The **Daniel Direct Connect** modem should be listed in the Modem column.
2. Start MON2020 and do the following to create a GC connection for the **Daniel Direct Connection** modem:
   a. Select **GC Directory** from the **File** menu. The *GC Directory* window displays.
   b. Select **Add** from the *GC Directory* window's **File** menu. A *New GC* row will be added to the bottom of the table.

c. Select the **New GC** text and type in a new name for the GC connection.

Note
You can enter optional but helpful information about the connection in the Short Desc column.

d. Select the new GC's **Direct** check box.

e. Click the **Direct** button located at the bottom of the *GC Directory* window. The *Direct Connection Properties* window displays.

f. Select **Daniel Direct Connection (COM*n*)** from the *Port* drop-down window.

Note
The letter *n* stands for the COM number.

g. Select **57600** from the *Baud Rate* drop-down window.

h. Click **OK** to save the settings. You will be returned to the *GC Directory* window.

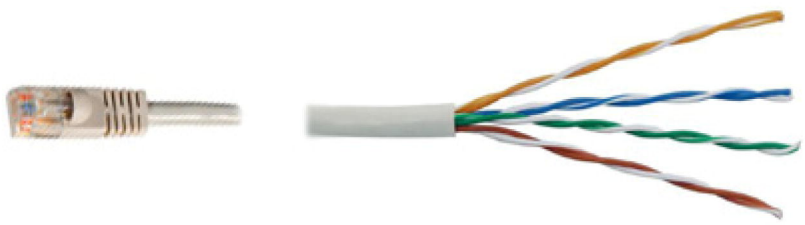
i. Click **OK** to save the new GC connection and to close the *GC Directory* window.

3. Connect one end of the direct connect cable to the GC's serial port at J23 on the back plane.
4. Connect the other end of the direct connect cable to the PC's corresponding serial port.
5. Select **Connect...** from the **Chromatograph** menu. The *Connect to GC* window displays.
6. Click **Direct** to connect to the GC using the serial cable connection.

3.5.11 Connecting directly to a PC using the GC's wired Ethernet terminal

The 700XA has a wired Ethernet terminal at TB11 on the backplane that you can connect to with a static IP address. All that is needed is a PC—typically a notebook computer—and a 2-Twisted Pair CAT 5 Ethernet cable with one of its plugs cut off to expose the wires.

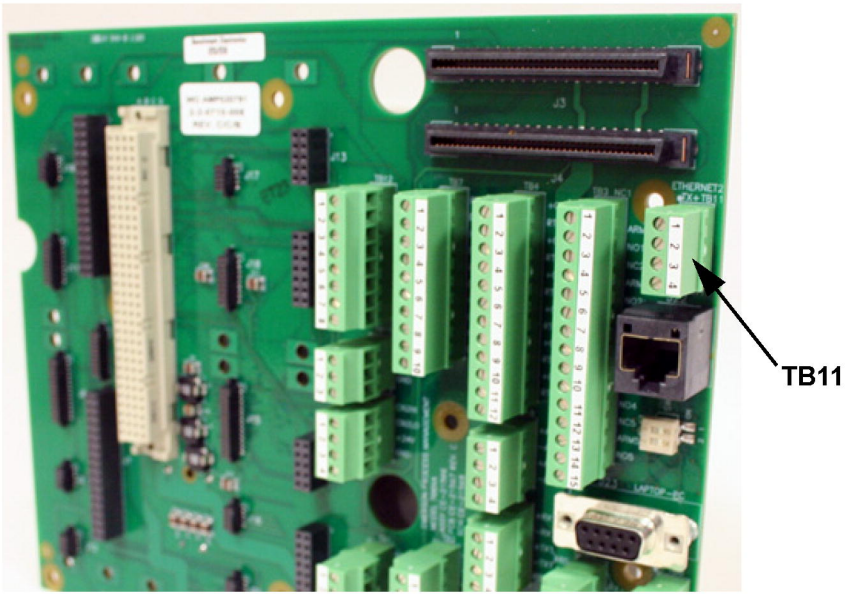
Figure 3-14: Crimped CAT 5 cable



Note

The GC can be connected (or remain connected) to the local network on TB11 on the back plane while the DHCP feature is being used.

Figure 3-15: Wired Ethernet terminal block on the backplane



Use the following schematics as a guide to wiring the GC via its Phoenix connector at TB11. *Figure 3-16* shows the traditional wiring scheme; *Figure 3-17* shows how to wire a CAT5e cable if you cut off its RJ-45 plug.

Figure 3-16: Field wiring to TB11

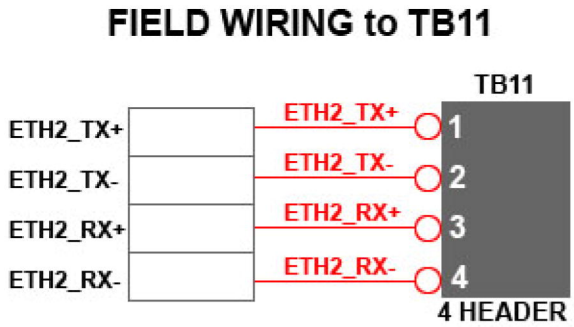
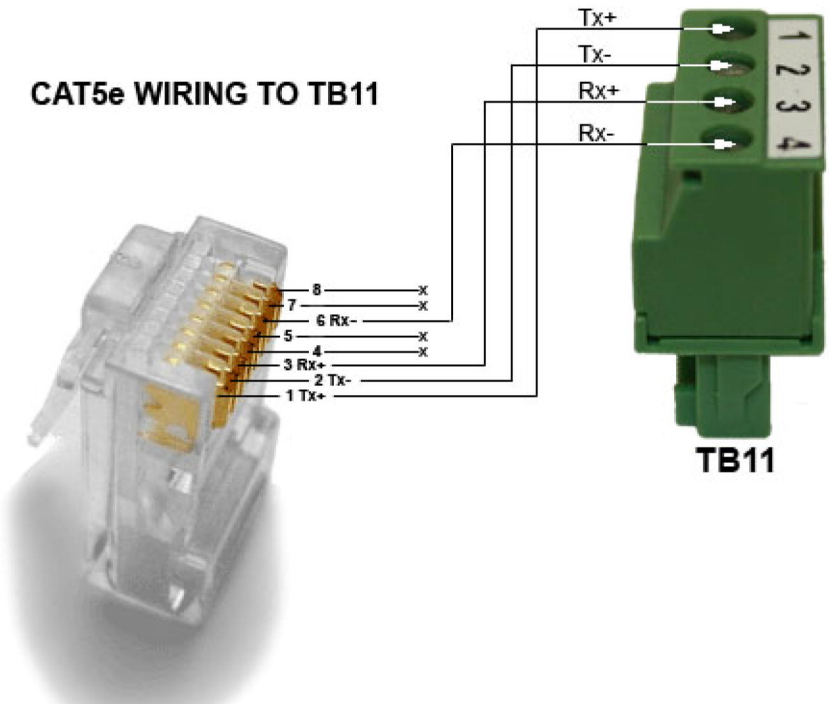


Figure 3-17: CAT5e wiring to TB11



Once you have wired the cable to the Ethernet terminal, plug the other end into a PC or a wall jack. See *Section 3.5.12* to continue configuring the GC.

3.5.12 Assigning a static IP address to the GC

To configure the GC with a static IP address, do the following:

1. Start MON2020 and log on to GC using a direct Ethernet connection. For more information, refer to *Section 3.5.8*.
2. Select **Ethernet ports...** from the **Applications** menu. The *Ethernet Ports* window displays.
3. Depending upon the Ethernet port to which you want to assign a static IP address, do the following:

   a. The Ethernet port at TB11: Enter the appropriate values in the **Ethernet 2 IP Address**, the **Ethernet 2 Subnet**, and the **Default Gateway** fields.

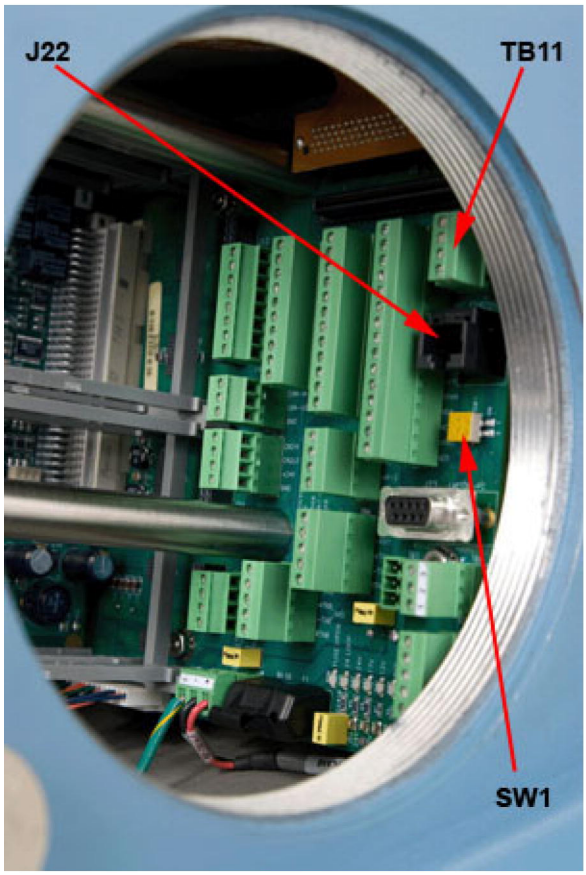
   b. The RJ-45 Ethernet port at J22: Enter the appropriate values in the **Ethernet 1 IP Address**, the **Ethernet 1 Subnet**, and the **Default Gateway** fields.

   Note
   IP, Subnet, and Gateway addresses can usually be obtained from a member of your IT staff.

4. Click **OK**.

5. Log off the GC.
6. Access the backplane, which is located in the GC's lower enclosure.

Figure 3-18: Port locations on the backplane



7. If you are setting up a static IP address for the Ethernet port at J22, and you also intend to connect to your company's local area network, do the following:

   a. Locate the set of dip switches, labeled 1 and 2, at SW1 on the backplane. SW1 is located directly beneath the Ethernet port at J22.

   b. Move dip switch **1** to its left position. This disables the DHCP server.

1. To connect to the GC, do the following:
8. Start MON2020 and select **GC Directory...** from the **File** menu. The *GC Directory* window displays.
9. Select **Add** from the *GC Directory* window's **File** menu. A **New GC** profile will be added to the end of table.

Note

You can also rename the GC's profile as well as add a short description.

10. Select the new profile and click **Ethernet...** Enter the GC's static IP address in the **IP address** field.
11. Click **OK**. The *Ethernet Connection Properties for New GC* window closes.
12. Click **Save** on the *GC Directory* window.
13. Click **OK** to close the *GC Directory* window.
14. Select **Connect...** from the **Chromatograph** menu or click the  icon. The *Connect to GC* window displays.
15. The newly created GC profile should be listed in the table. Locate it and click the **Ethernet** button that is associated with it. The *Login* window displays.
16. Enter a **User Name** and **User Pin** and click **OK**.

3.5.13 Discrete digital I/O wiring

The GC's back plane has five discrete outputs and five discrete inputs. Refer to the MON2020 user manual to learn how to configure the digital outputs.

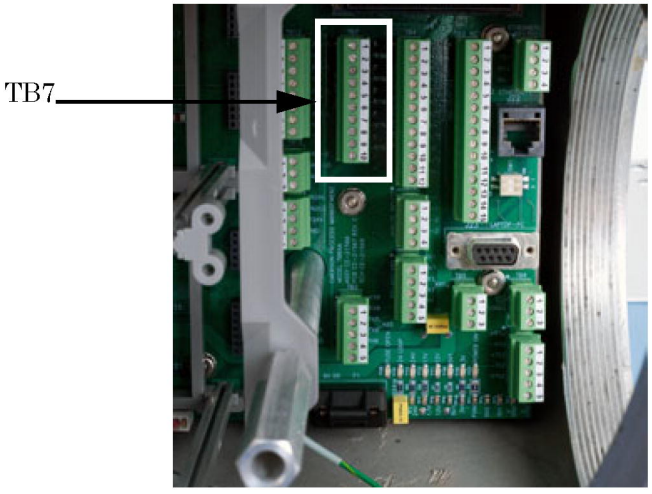
Discrete digital inputs

To connect digital signal input lines to the GC, do the following:

1. Access the back plane.

   The discrete inputs are located on TB7.

Figure 3-19: TB7 on the backplane



Note

The discrete digital input terminals on the backplane are selp-powered. Devices connected to the digital input will be powered by the GC's dedicated isolated 24V power supply.

Note
The discrete digital input terminals are optically isolated from the GC's other circuitry.

2. Route digital I/O lines appropriately, especially in the case of the explosion-proof enclosure.

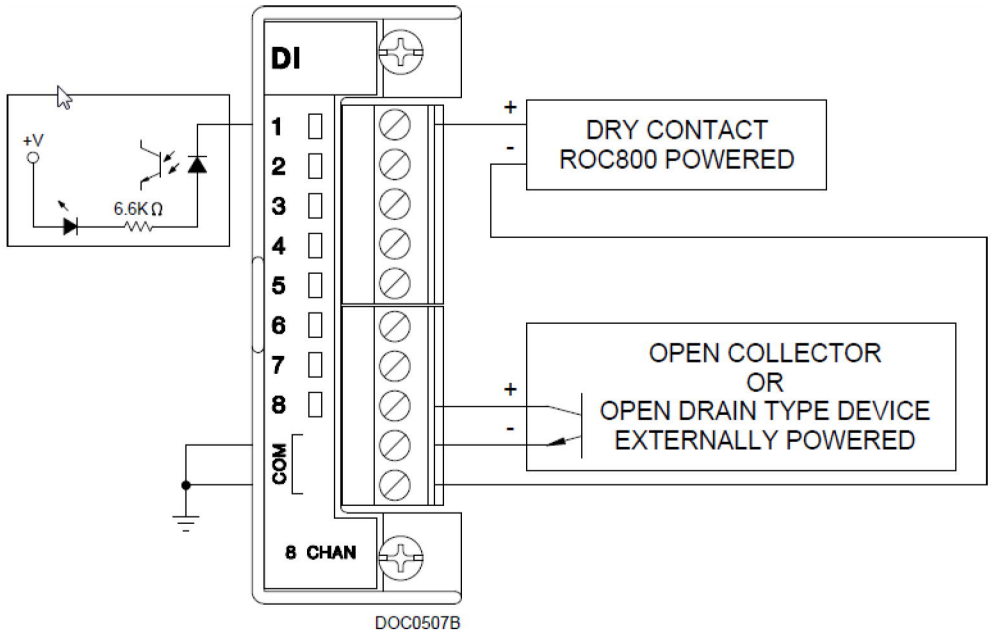
   There are connections for five digital inputs and five digital output lines, as indicated in the following table:

Table 3-1: Discrete Digital Inputs

TB7	Function
Pin 1	F_DIG_IN1
Pin 2	DIG_GND
Pin 3	F_DIG_IN2
Pin 4	DIG_GND
Pin 5	F_DIG_IN3
Pin 6	DIG_GND
Pin 7	F_DIG_IN4
Pin 8	DIG_GND
Pin 9	F_DIG_IN5
Pin 10	DIG_GND

Typical field wiring of a ROC800 DI module

Figure 3-20: Typical wiring



Terminal	Label	Definition
1	1	CH 1 Positive
2	2	CH 2 Positive
3	3	CH 3 Positive
4	4	CH 4 Positive
5	5	CH 5 Positive
6	6	CH 6 Positive
7	7	CH 7 Positive
8	8	CH 8 Positive
9	COM	Common
10	COM	Common

To connect the ROC800 DI module to a field device, do the following:

1. Expose the end of the wire to a maximum length of ¼ inch (6.3mm).

Note

Twisted-pair cables are recommended for I/O signal wiring. The module's terminal blocks accept wire sizes between 12 and 22 AWG. A minimum of bare wire should be exposed to prevent short circuits. Allow some slack when making connections to prevent strain.

2. Insert the exposed end into the clamp beneath the termination screw.
3. Tighten the screw.

Discrete digital outputs

The discrete outputs are located on TB3, which is a 15-pin Phoenix connector, and have five Form-C relays on the back plane. All contact outputs have a rating of 1A @30 VDC.

Figure 3-21: TB3 on the backplane

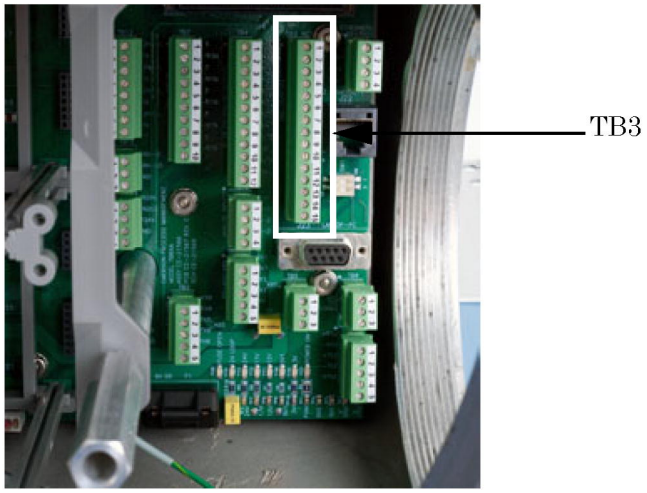


Table 3-2 lists the discrete digital output function for each pin on the TB3 connector.

Table 3-2: Discrete Digital Outputs

TB3	Function
Pin 1	DIG_OUT NC1
Pin 2	DIG_OUT ARM1
Pin 3	DIG_OUT NO1
Pin 4	DIG_OUT NC2
Pin 5	DIG_OUT ARM2
Pin 6	DIG_OUT NO2
Pin 7	DIG_OUT NC3
Pin 8	DIG_OUT ARM3
Pin 9	DIG_OUT NO3

Table 3-2: Discrete Digital Outputs *(continued)*

TB3	Function
Pin 10	DIG_OUT NC4
Pin 11	DIG_OUT ARM4
Pin 12	DIG_OUT NO4
Pin 13	DIG_OUT NC5
Pin 14	DIG_OUT ARM5
Pin 15	DIG_OUT NO5

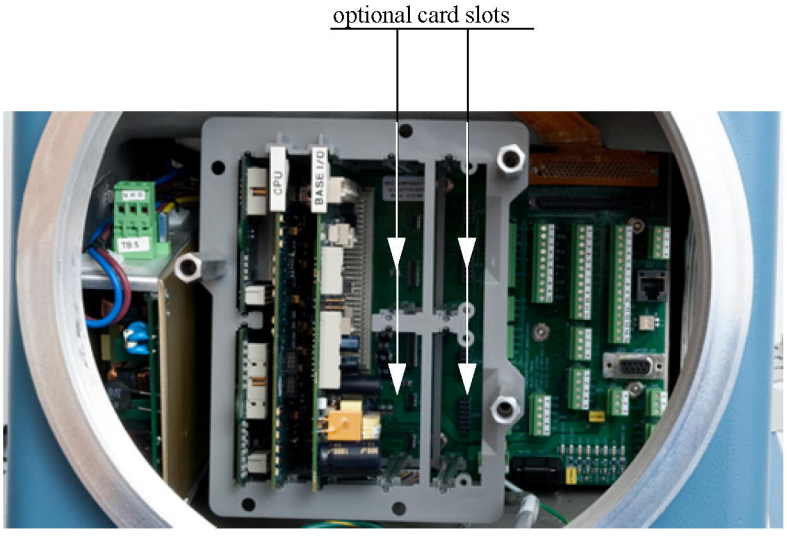
Note

Form-C relays are single-pole double-throw (SPDT) relays that have three positions: normally closed (**NC**); an intermediate position, also called the "make-before-break" position (**ARM**); and normally open (**NO**).

Optional discrete digital inputs

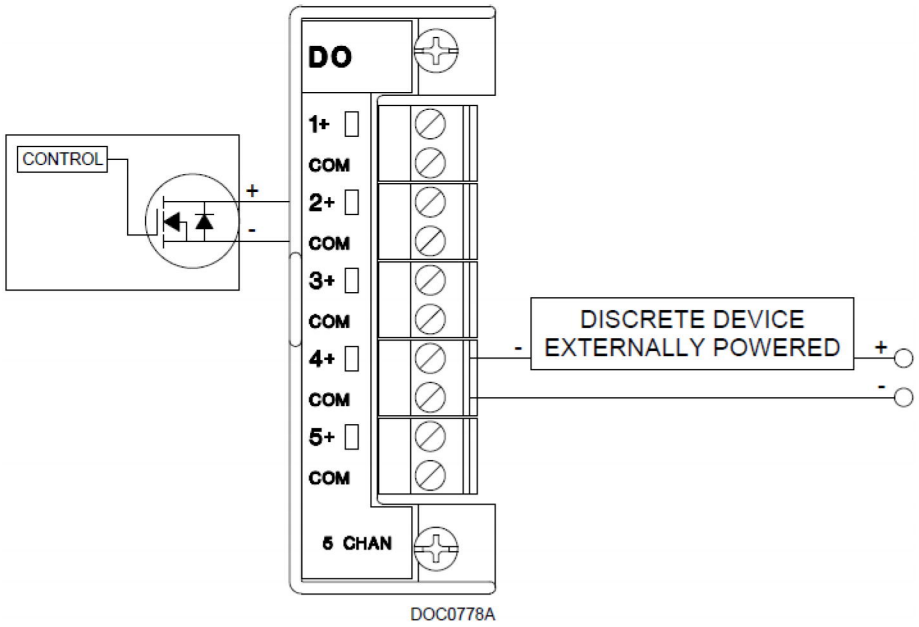
When plugged into one of the optional card slots on the card cage, the ROC800 DI card provides eight additional discrete digital inputs. The discrete digital inputs can monitor the status of relays, open-collector or open-drain type solid-state switches, and other two-state devices. For more information, see "ROC800-Series Discrete Input Module" at Emerson Process Management's ROC 800-Series web site.

Figure 3-22: Optional card slots



Typical field wiring of a ROC800 DO module

Figure 3-23: Typical wiring



Terminal	Label	Definition
1	1+	Positive discrete output
2	COM	Discrete output return
3	2+	Positive discrete output
4	COM	Discrete output return
5	3+	Positive discrete output
6	COM	Discrete output return
7	4+	Positive discrete output
8	COM	Discrete output return
9	5+	Positive discrete output
10	COM	Discrete output return

To connect the ROC800 DO module to a field device, do the following:

1. Expose the end of the wire to a maximum length of ¼ inch (6.3mm).

Note

Twisted-pair cables are recommended for I/O signal wiring. The module's terminal blocks accept wire sizes between 12 and 22 AWG. A minimum of bare wire should be exposed to prevent short circuits. Allow some slack when making connections to prevent strain.

2. Insert the exposed end into the clamp beneath the termination screw.
3. Tighten the screw.

3.5.14 Analog input wiring

All 700XAs have at least two analog inputs. An additional four analog inputs are available with a ROC800 AI-16 card that can be installed into one of the optional slots in the card cage.

Analog inputs on the blackplane

There are two analog input connections on the backplane at TB10.

Figure 3-24: TB10 on the black plane

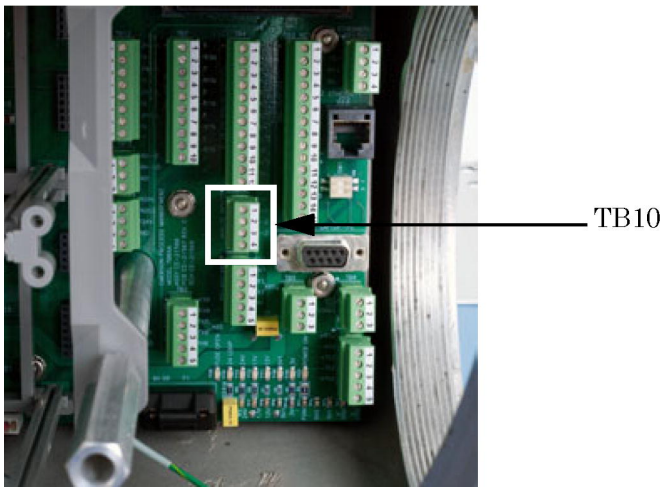


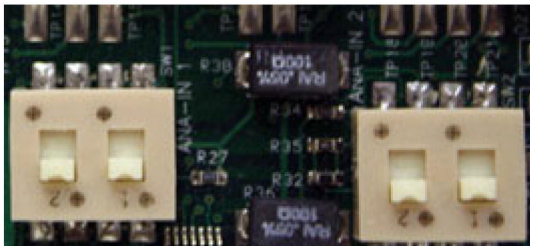
Table 3-3: Analog Inputs

TB10	Function
Pin 1	+AI_1
Pin 2	-AI_1
Pin 3	+AI_2
Pin 4	-AI_2

Factory settings for analog input switches

Figure 3-25 shows the factory settings for the analog input switches that are located on the Base I/O board. These analog inputs are set to accept a current (4-20 mA) source.

Figure 3-25: Factory settings for analog input switches



Note

To set an analog input to accept a voltage (0-10 VDC) source, flip the appropriate switch in the opposite direction from that shown in *Figure 3-25*.

Selecting the input type for an analog input

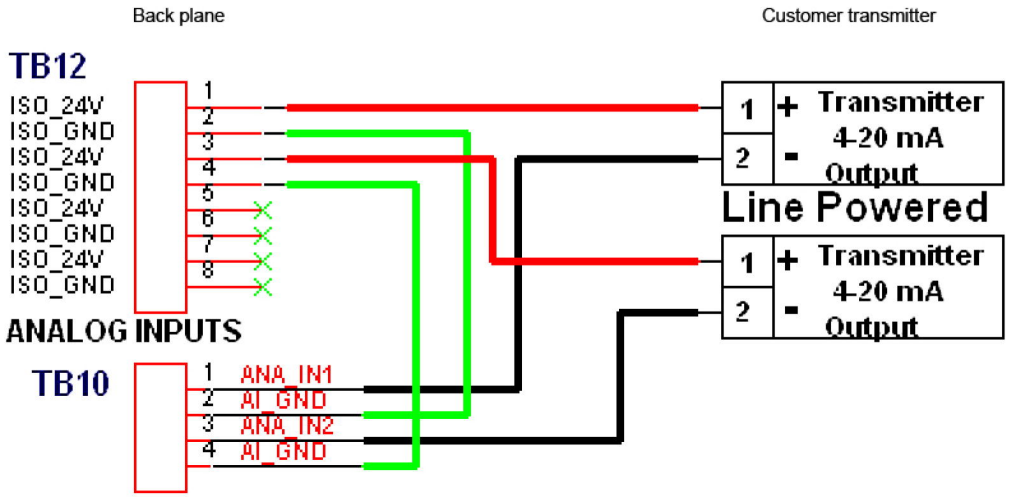
An analog input can be set to either voltage (0-10V) or current (4-20 mA) by flipping the appropriate switches on the Base I/O board.

1. Turn off the GC.
2. Locate and remove the Base I/O board, which is in the card cage in the GC's lower enclosure.
3. To set analog input #1 to current, locate **SW1** on the Base I/O board and push the switches up, toward the card ejector; to set the analog input to voltage, push the switches down, away from the card ejector.
4. To set analog input #2 to current, locate **SW2** on the Base I/O board and push the switches up, toward the card ejector; to set the analog input to voltage, push the switches down, away from the card ejector.
5. Replace the Base I/O board in the card cage.
6. Start up the GC.
7. Start MON2020 and connect to the GC.
8. Select **Analog Inputs** from the **Hardware** menu. The *Analog Inputs* window displays.
9. To set the analog input to current, select **mA** from the *mA/Volts* drop-down list for the appropriate analog input; to set the analog input to voltage, select **Volts** from the *mA/Volts* drop-down list for the appropriate analog input.
10. Click **Save** to save the changes and keep the window open, or click **OK** to save the changes and close the window.

Typical wiring for line-powered transmitters

The following drawing shows the most common wiring plan for supplying power to two 4-20 mA transmitters, such as pressure sensor transmitters.

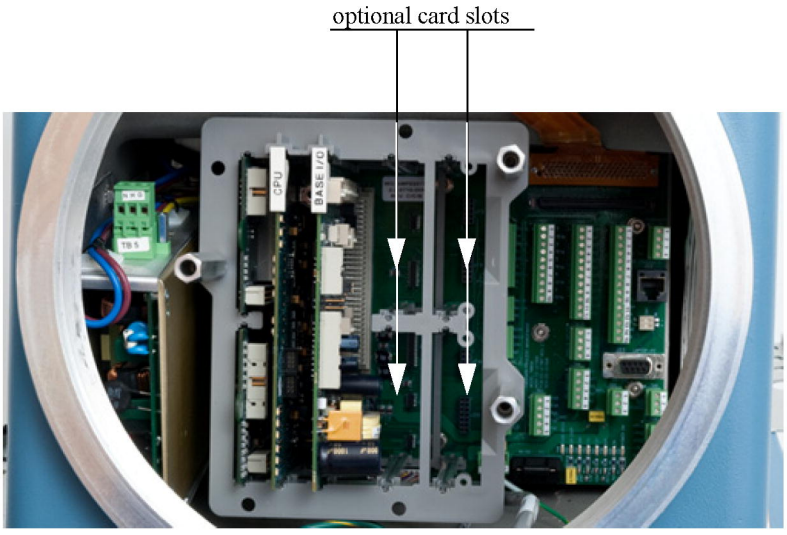
Figure 3-26: Typical wiring for line-powered transmitters



Optional analog inputs

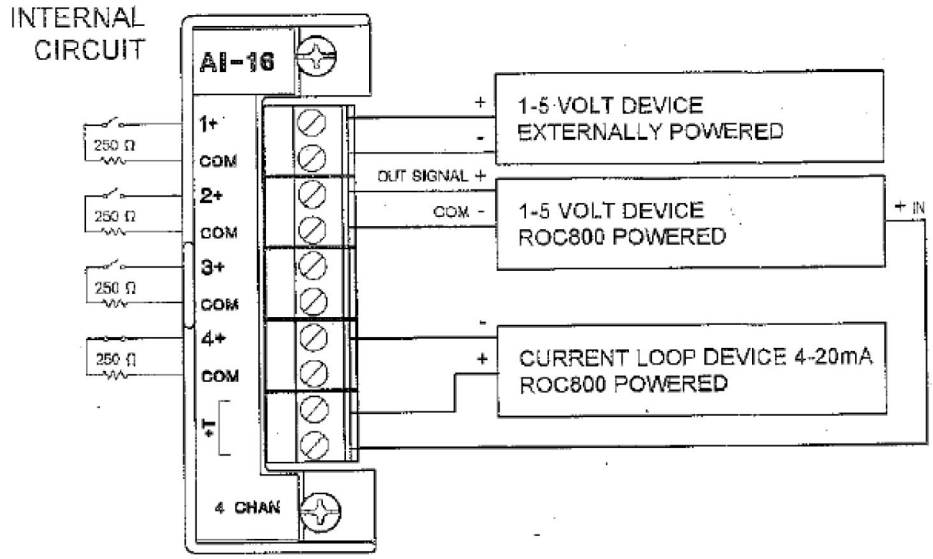
When plugged into one of the optional card slots on the card cage, the ROC800 AI-16 card provides four additional analog inputs. The AI channels are scalable, but are typically used to measure either a 4-20 mA analog signal or a 1-5 V dc signal. If required, the low end of the AI module's analog signal can be calibrated to zero. For more information, see "Analog Input Modules (ROC800-Series)" at Emerson Process Management's ROC 800-Series web site.

Figure 3-27: Optional card slots



Typical field wiring of a ROC800 AI-16 module

Figure 3-28: Typical wiring



To connect the ROC800 AI-16 module to a device, do the following:

⚠ CAUTION!

Failure to exercise proper electrostatic discharge precautions—such as wearing a grounded wrist strap—may reset the processor or damage electronic components, resulting in interrupted operations. Ground loops may be induced by tying commons from various modules together.

1. Expose the end of the wire to a maximum length of ¼ inch (6.3mm).

Note

Twisted-pair cables are recommended for I/O signal wiring. The module's terminal blocks accept wire sizes between 12 and 22 AWG. A minimum of bare wire should be exposed to prevent short circuits. Allow some slack when making connections to prevent strain.

2. Insert the exposed end into the clamp beneath the termination screw.
3. Tighten the screw.

There are two dip switches on the terminal block side of the module that can be used to set a 250 Ω resistor in or out of circuit for each analog input.

To put an analog input's resistor *in circuit*, flip the appropriate dip switch to "I"; to put an analog input's resistor *out of circuit*, flip the appropriate dip switch to "V".

Calibrating a ROC800 AI-16 module

To calibrate the ROC800 AI-16 module you must have a PC with the ROCLINK 800 Configuration program installed and open.

1. Select the **Configure** → **I/O** → **RTD Points** → **Calibration** tab.
2. Select an **Analog Input**.
3. Click **Update** to request one value update from the input.
4. Click **Freeze** to stop the values of the input from being updated during calibration.

Note
If you are calibrating a temperature input, disconnect the RTD sensor and connect a decade box or comparable equipment to the RTD terminals of the ROC card.

5. Click **Calibrate**.
6. Enter a value for **Set Zero** after stabilization.
7. Enter a value for **Set Span** after stabilization.
8. Enter values for up to three **Midpoints** one at a time or click **Done** if you are not configuring Midpoints.
9. Click **OK** to close the main calibration window and unfreeze the associated inputs. To calibrate the inputs for another analog input, return to *Step 1*.

3.5.15 Analog output wiring

All 700XAs have at least six analog outputs. An additional four analog inputs are available with a ROC800 AO card that can be installed into one of the optional slots in the card cage.

Analog outputs on the backplane

There are six analog output connections on the backplane at TB4.

Figure 3-29: TB4 on the black plane

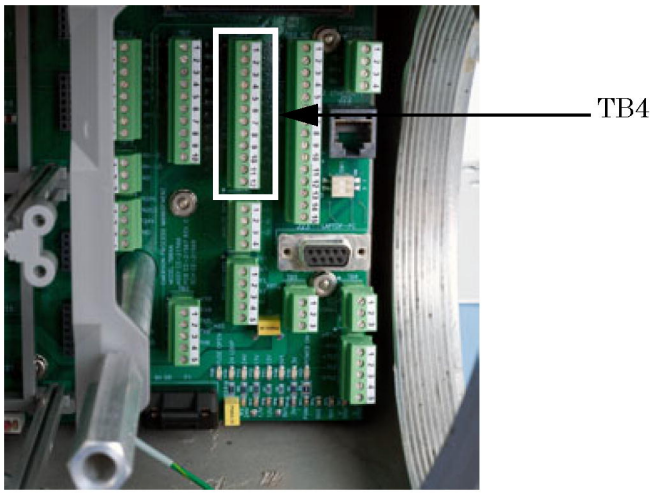


Table 3-4: Analog Outputs

TB4	Function
Pin 1	+ Loop1
Pin 2	Loop_RTN1
Pin 3	+ Loop 2
Pin 4	Loop_RTN2
Pin 5	+ Loop 3
Pin 6	Loop_RTN3
Pin 7	+ Loop 4
Pin 8	Loop_RTN4
Pin 9	+ Loop 5
Pin 10	Loop_RTN5
Pin 11	+ Loop 6
Pin 12	Loop_RTN6

Factory settings for analog output switches

This drawing shows how to wire up to six devices to the analog outputs that are located on the back plane. It also shows how to wire up to two analog inputs.

Figure 3-30: Wiring for six analog outputs

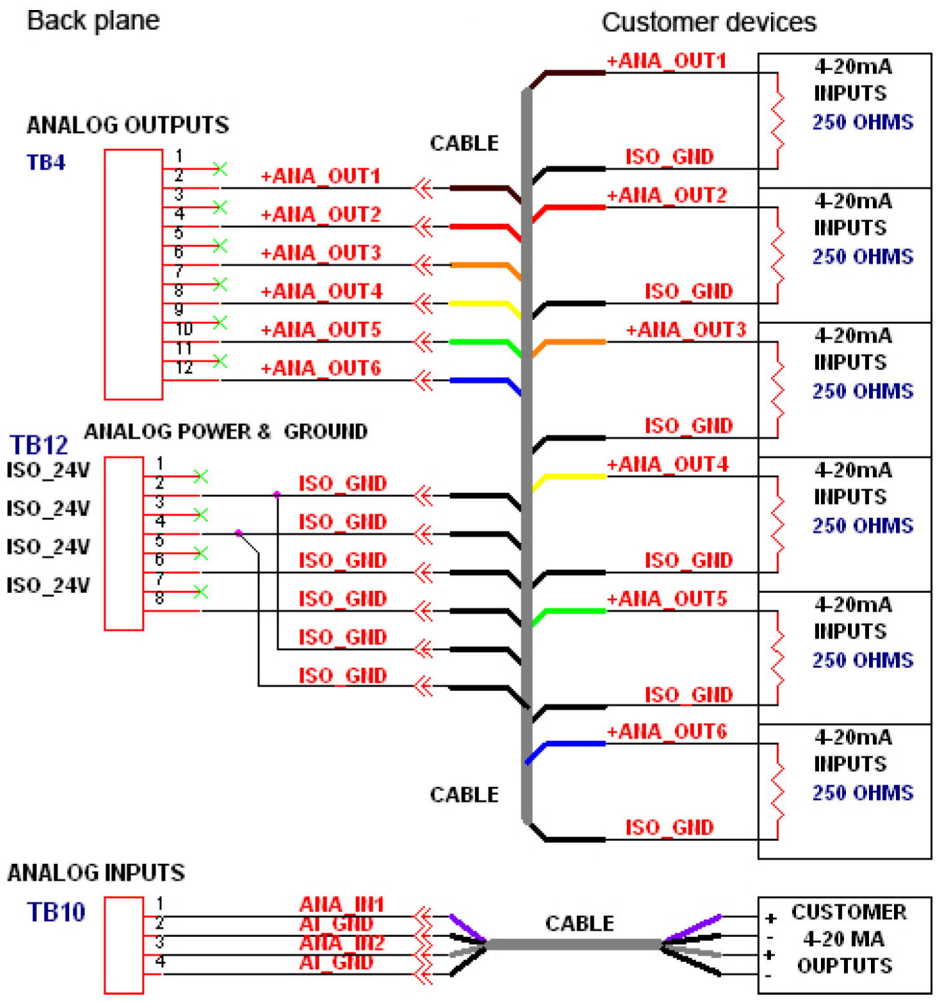
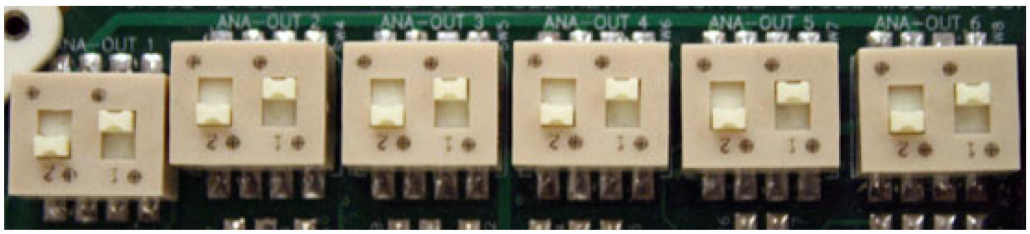


Figure 3-31 shows the factory settings for the analog output switches that are located on the Base I/O board.

Figure 3-31: Factory settings for analog output switches



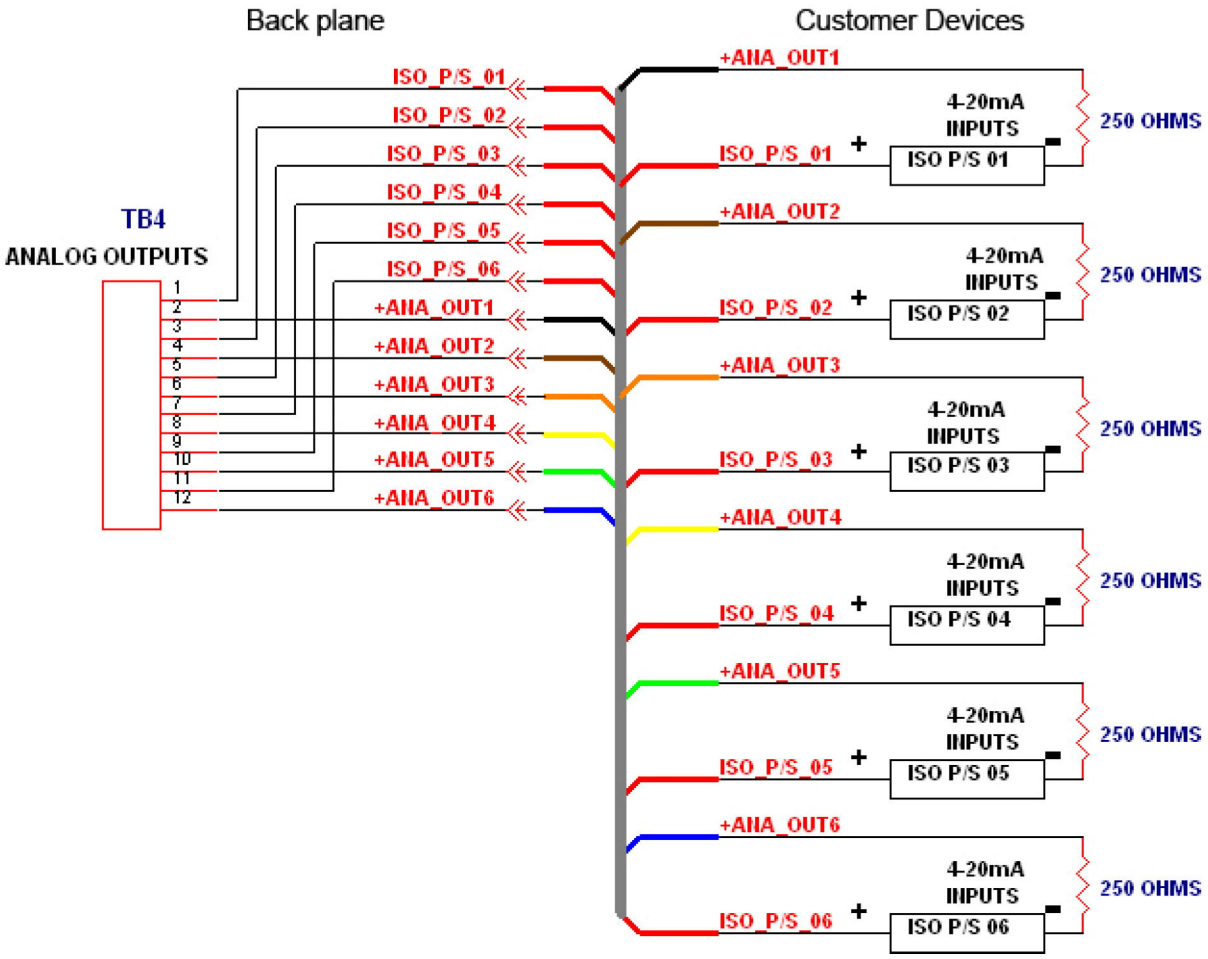
Wiring and switch settings for customer-powered analog outputs

It is possible to furnish power to each analog output while maintaining isolation between channels.

Consult the following diagrams before wiring a customer-powered device:

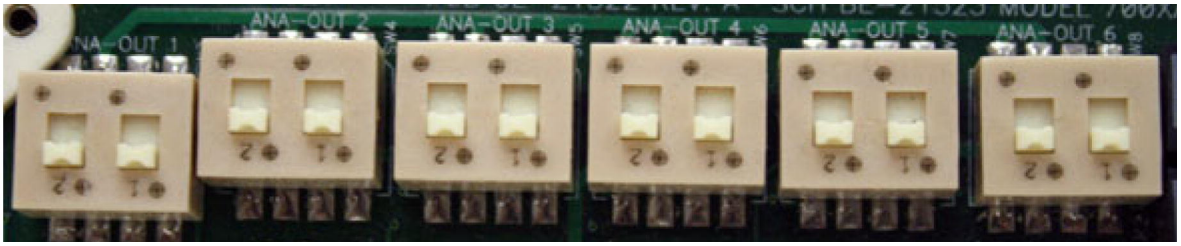
1. This drawing shows the wiring that is necessary to provide power to each analog output while maintaining isolation between channels.

Figure 3-32: Wiring for customer-powered analog outputs



2. This drawing shows the settings for the analog output switches, located on the Base I/O board, that are necessary to provide power to each analog output while maintaining isolation between channels.

Figure 3-33: Settings for analog output switches

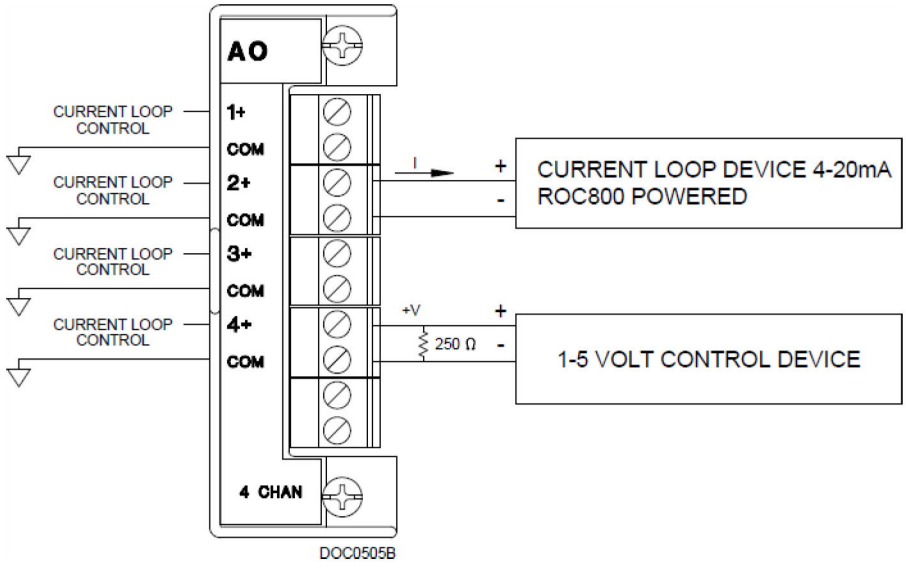


Optional analog outputs

When plugged into one of the optional card slots on the card cage, the ROC800 AO card provides four additional analog outputs. Each channel provides a 4 to 20 mA current signal for controlling analog current loop devices. For more information, see “ROC800-Series Analog Output Module” at Emerson Process Management’s ROC 800-Series web site.

Typical field wiring of a ROC800 AO module

Figure 3-34: Typical wiring



Terminal	Label	Definition
1	1+	Positive analog output
2	COM	Analog output return
3	2+	Positive analog output
4	COM	Analog output return
5	3+	Positive analog output

Terminal	Label	Definition
6	COM	Analog output return
7	4+	Positive analog output
8	COM	Analog output return
9	N/A	Not used
10	N/a	Not used

To connect the ROC800 AO module to a field device, do the following:

1. Expose the end of the wire to a maximum length of ¼ inch (6.3mm).

Note
Twisted-pair cables are recommended for I/O signal wiring. The module's terminal blocks accept wire sizes between 12 and 22 AWG. A minimum of bare wire should be exposed to prevent short circuits. Allow some slack when making connections to prevent strain.

2. Insert the exposed end into the clamp beneath the termination screw.
3. Tighten the screw.

3.6 Leak checking and purging for first calibration

Verify that all electrical connections are correct and safe, and then turn the unit on.

3.6.1 Checking the GC for leaks

To perform a leak check, do the following:

1. Plug all vents.
2. Make sure the setting of the carrier gas cylinder gauge is 115 psig and/or the valve actuation pressure is between 110 and 120 psig.
3. Check all fittings at the pressure gauge flow panel and at the carrier gas cylinder gauge with a leak detector. Correct any leaks detected.
4. Turn the carrier gas cylinder shut-off valve clockwise to close. Observe the carrier gas pressure for ten minutes to check for a drop in carrier pressure. The drop should be less than 200 psig on the high side of the gauge. If the carrier gas is lost at a faster rate, check for leaks between the carrier gas bottle and the analyzer.
5. Use the LOI or MON2020 to actuate the valves on and off and observe the pressure with the valves in different positions than in *Step 4*. When the valves are switched, some pressure change is normal because of carrier loss. Momentarily open cylinder valve to restore pressure if necessary.
6. If the pressure does not hold relatively constant, check all valve fittings for tightness.

7. Repeat *Step 5* again. If leaks persist, check the valve ports with a commercial gas leak detector. Do not use a liquid leak detector such as Snoop® on the valves or components in the oven.

3.6.2 Purging carrier gas lines

Purging carrier and calibration gas lines requires power and a PC connected to the GC.

Note

Tubing should be clean and dry internally. During installation, the tubing should have been blown free of internal moisture, dust, or other contaminants.

To purge the carrier gas lines, do the following:

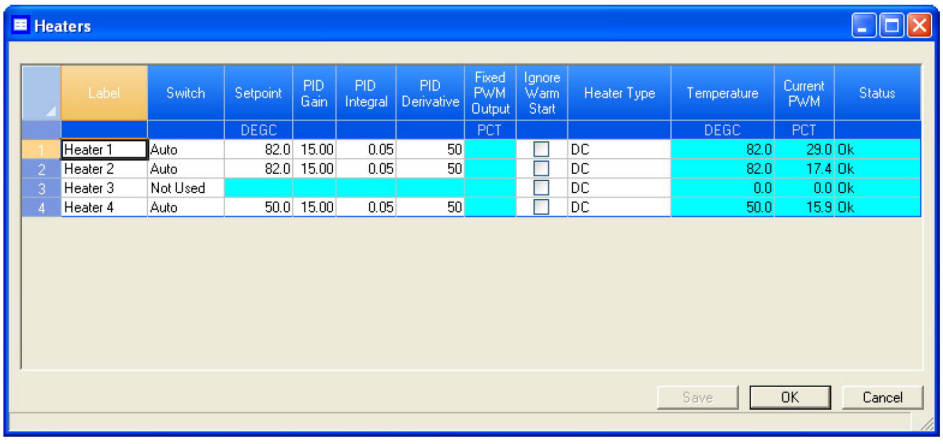
1. Ensure that the measure vent line plugs have been removed, and the vent lines are open.
2. Ensure that the carrier gas bottle valve is open.
3. Set the “GC side” of the carrier gas to 120 psig.
4. Turn on the GC and the PC.
5. Start MON2020 and connect to the GC.

Note

Consult the *MON2020 Software for Gas Chromatograph* manual for information about connecting to a GC.

6. Select *Hardware* → *Heaters*. The *Heaters* window displays. The temperature values for the heaters should indicate that the unit is warming up.

Figure 3-35: The Heaters window



7. Allow the GC system temperature to stabilize and the carrier gas lines to become fully purged with carrier gas, which usually takes about an hour.

8. Select **Control** → **Auto Sequence**.

   For more information about this function, refer to the *MON2020 Software for Gas Chromatographs* manual.

Note

A purging period of 4 to 8 hours (or overnight) is recommended, during which no changes should be made to the settings described in *Step 1* through *Step 7*.

3.6.3 Purging calibration gas lines

To purge the calibration gas lines, do the following:

1. Ensure that the carrier gas lines have been fully purged and that the sample vent plugs have been removed.
2. Close the calibration gas bottle valve.
3. Fully open the block valve associated with the calibration gas feed. The block valve is located on the lower right-hand corner of the front panel. Refer to the *MON2020 Software for Gas Chromatographs* manual for instructions on selecting streams.
4. Open the calibration gas bottle valve.
5. Increase the outlet pressure to 40 psig, plus or minus five percent, at the calibration gas bottle regulator.
6. Close the calibration gas bottle valve.
7. Let both gauges on the calibration gas bottle valve bleed down to 0 psig.
8. Repeat *Step 4* through *Step 7*, five times.
9. Open the calibration gas bottle valve.

3.7 System startup

To perform system start-up, do the following:

1. For system startup, run an analysis of the calibration gas.

   a. If equipped with a stream switching board or LOI, ensure that the calibration stream is set to AUTO.

      Unless stated otherwise in the product documentation, ensure that the pressure of the calibration and sample line is regulated at 3 to 30 psig (15 psig is recommended).

   b. Use MON2020 to run a single stream analysis on the calibration stream. Once proper operation of the GC is verified, halt the analysis by selecting Control → Halt. Refer to the *MON2020 Software for Gas Chromatographs* manual for more information.

2. Select *Control* → *Auto Sequence* to start auto sequencing of the line gas stream(s). Refer to the *MON2020 Software for Gas Chromatographs* manual for more information. The GC will begin the Auto Sequence analysis.

4 Operation and maintenance

4.1 Warning and precautions

⚠ WARNING!

Observe all precautionary signs posted on the 700XA. Failure to do so can result in injury or death to personnel or cause damage to the equipment.

⚠ CAUTION!

Turn off GC before removing a card from the card cage assembly. Failure to do so can result in damage to the card.

4.2 Start a two-point calibration

The 2-Point Calibration process calculates an *exponential power fit* that the GC uses to accurately analyze a sample stream with a Flame Photometric Detector (FPD). The 2-Point Calibration process requires two calibration gases that will be used to generate the data for the exponential power fit calculation. While both calibration gases should have the same components, one of the calibrations gases, called the *low calibration gas (LCG)* should have a lower concentration of the components than the other calibration gas, which is called the *high calibration gas (HCG)*. The GC can then compute the coefficients for the 2 Pt exponential power fit by doing a single-level calibration on these individual LC and HC streams.

1. Start MON2020 and press **F6** to open the Component Data screen.
2. Change the **Calib Type** for the target component to **2 pt Calib**.
3. For the target component, select the CDT that is associated with the LCG from the **2 Pt Calib Low CDT** drop-down list.
4. For the target component, select the CDT that is associated with the HCG from the **2 Pt Calib High CDT** drop-down list.
5. Run a **Single Stream** analysis on the stream associated with the LCG until the readings stabilize.
6. Run a **Forced Calibration** on the stream associated with the LCG.
7. Run a **Normal Calibration** on the stream associated with the LCG.
8. Run a **Single Stream** analysis on the stream associated with the HCG until the readings stabilize.
9. Run a **Forced Calibration** on the stream associated with the HCG.
10. Run a **Normal Calibration** on the stream associated with the HCG.

The GC is ready to analyze the sample or validation stream using the **2 Pt Exp** and the **Resp Factor** that were calculated during the LCG and HCG runs.

4.3 Troubleshooting and repair concept

The most efficient method for maintaining and repairing the 700XA is a component-replacement concept that allows you to return the system to operation as quickly as possible. Sources of trouble, such as printed-circuit assemblies, valves, etc., are identified during troubleshooting test procedures and are replaced at the lowest level practical with units in known working order. The defective components are then either repaired in the field or returned to Measurement Services for repair or replacement.

4.4 Routine maintenance

The 700XA will perform accurately for long periods with very little attention (except for maintaining the carrier gas cylinders). A bimonthly record of certain parameters will assist greatly in assuring that your 700XA is operating to specifications. The maintenance checklist should be filled out bimonthly, dated, and kept on file for access by maintenance technicians as necessary. This gives you a historical record of the operation of your 700XA, enables a maintenance technician to schedule replacement of gas cylinders at a convenient time, and allows quick troubleshooting and repair when it becomes necessary.

A chromatogram, a configuration report, and a raw data report should also be made and filed with the checklist, furnishing a positive dated record of the 700XA. The chromatogram and reports can also be compared to the chromatograms and reports run during the troubleshooting process.

4.4.1 Maintenance checklist

Print the sample maintenance checklist on the following page as necessary for your files. If you have a problem, please complete the checklist first and have the results available, as well as the sales order number, when calling your Emerson Process Management representative for technical assistance. The sales order number can be found on the nameplate located on the right side wall of the GC. The chromatograms and reports archived when your GC left the factory are filed by this number.

Note

To find the default measurements for the parameters on the checklist, use MON2020 to view the GC's Parameter List.

MAINTENANCE CHECKLIST

Date Performed: _____ Sales Order Number: _____

System Parameters	As Found	As Left
Carrier Gas Cylinder		
Cylinder Pressure Reading (High)	_____ psig	_____ psig
Cylinder Pressure Outlet Reading	_____ psig	_____ psig
Cylinder Pressure Panel Regulator	_____ psig	_____ psig
Sample System		
Sample Line Pressure(s)	(1)_____ psig	_____ psig
	(2)_____ psig	_____ psig
	(3)_____ psig	_____ psig
	(4)_____ psig	_____ psig
	(5)_____ psig	_____ psig
Sample Flows	(1)___ cc/min	___ cc/min
Sample Vent 1 (SV1)	(2)___ cc/min	___ cc/min
Sample Vent 2 (SV2)	(3)___ cc/min	___ cc/min
	(4)___ cc/min	___ cc/min
	(5)___ cc/min	___ cc/min
Calibration Gas		
High Pressure Reading	_____ psig	_____ psig
Outlet Pressure Reading	_____ psig	_____ psig
Flow	___ cc/min	___ cc/min

4.4.2 Routine maintenance procedures

- To give yourself a basis for comparison in the future, complete the maintenance checklist at least two times each month. Place the sales order number, date, and time on the form and file it.
- Save a chromatogram of the operating GC on the PC with MON2020. Print configuration, calibration, and raw data reports and file them with MON2020.
- Check the printer paper (if used) to ensure that a sufficient supply of paper remains. Check carrier and calibration gas supplies.

Service programs

Measurement Services offers maintenance service programs that are tailored to fit specific requirements. Contracts for service and repair can be arranged by contacting Measurement Services at the address or telephone number on the Customer Repair Report at the back of this manual.

4.4.3 Precautions for handling PC assemblies

Printed circuit assemblies contain CMOS integrated circuits, which can be damaged if the assemblies are not properly handled. The following precautions must be observed when working with the assemblies:

- Do not install or remove the printed circuit assemblies while power is applied to the units.
- Keep electrical components and assemblies in their protective (conductive) carriers or wrapping until ready for use.
- Use the protective carrier as a glove when installing or removing printed circuit assemblies.
- Maintain contact with a grounded surface to prevent static discharge when installing or removing printed circuit assemblies.

Note

CPU boards are switched off before shipping to preserve the board's battery. Before installing into the GC, be sure to switch the CPU board on.

4.4.4 General troubleshooting

This section contains general troubleshooting information for the 700XA. The information is arranged as appropriate either by major subsystems or by major functions of the instrument. Refer to *Hardware alarms* for frequent causes of hardware alarms.

Note

Correct ALL alarms before re-calibration.

Hardware alarms

Use the following table to identify the alarm and possible cause and solution for the problem.

Alarm Name	Possible Causes/Solution
LTLOI Failure	No switch panel detected or connected. Recommended actions: 1. Power the GC down completely. 2. Check that the board is seated in the correct slot of the back-plane board. 3. Power up the GC. 4. If message appears again, replace Switch Panel Board.
Maintenance Mode	A technician has put the GC into maintenance mode for servic-ing. To disable maintenance mode, unclick the **Maintenance Mode** check box in the *System* dialog.
Power Failure	The GC has experienced a re-start since alarms were last cleared, caused by power failure. The GC automatically starts in warm start mode. During warm start mode, the GC does the following: 1. Waits for the heaters to stabilize. 2. Purges the sample loop. 3. Actuates the valves for two cycles. After completing these actions, the GC switches to auto-se-quence mode.
User Calculation Failure	One or more errors were detected while parsing a user-defined calculations. This usually happens when a user-defined calcula-tion attempts to use a system variable that does not exist. Recommended action: Fix the calculation that is referring to the undefined system variable.
FF Board Comm Failure	Foundation Fieldbus board not detected. Recommended actions: 1. Power the GC down completely. 2. Check that the Foundation Fieldbus module cable is properly seated in the correct slot on the backplane board. 3. Check that the board is securely plugged into the Foundation Fieldbus module. 4. Check that the Foundation Fieldbus module is receiving pow-er. 5. Power up the GC. 6. If the alarm appears again, replace the Foundation Fieldbus board.

Alarm Name	Possible Causes/Solution
Low Battery Voltage	A low battery voltage has been detected on the CPU board. Replace the CPU board immediately to avoid losing GC configuration data. Recommended actions: 1. Save the GC Configuration to a PC. 2. Save any Chromatograms and/or Results to a PC. 3. Power down the GC. 4. Replace the CPU Board. 5. Restore Configuration back to the GC.
Preamp Board 1 Comm Failure	Preamp board not detected. Recommended actions: 1. Power the GC down completely. 2. Check that the board is properly seated in the correct slot (SLOT 1) on the backplane. 3. Power up the GC. 4. If message appears again, replace the preamp board.
Preamp Board 2 Comm Failure	Preamp board not detected. Recommended actions: 1. Power the GC down completely. 2. Check that the board is properly seated in the correct slot (SLOT 3) on the backplane. 3. Power up the GC. 4. If message appears again, replace the preamp board.
Heater Solenoid Board 1 Comm Failure	Heater/Solenoid board not detected. Recommended actions: 1. Power the GC down completely. 2. Check that the board is properly seated in the correct slot (SLOT 2) on the backplane. 3. Power up the GC. 4. If message appears again, replace the heater/solenoid board.
Heater Solenoid Board 2 Comm Failure	Heater/Solenoid board not detected. Recommended actions: 1. Power the GC down completely. 2. Check that the board is properly seated in the correct slot (SLOT 4) on the backplane. 3. Power up the GC. 4. If message appears again, replace the heater/solenoid board.
BaseIO Board Comm Failure	Base I/O (Multifunction I/O) board not detected. Recommended actions: 1. Power the GC down completely. 2. Check that the board is properly seated in the correct slot (SLOT 5) on the backplane. 3. Power up the GC. 4. If message appears again, replace the Base IO board.

Alarm Name	Possible Causes/Solution
Stream Skipped	One or more streams in the stream sequence cannot be analyzed because their “Usage” option is set to “Unused”. Recommended actions: Use MON2020 to do one of the following: Remove the unused stream(s) from the stream sequence. Change the Usage option of the stream(s) in the Streams dialog to something other than “Unused”.
GC Idle	The GC has been placed in Idle mode and is not running an analysis.
Warm Start Failed	The GC failed to achieve desired operating condition after power up. Unable to regulate heater zone temperature(s). Recommended actions: 1. Check heater settings in MON2020 or the LOI. 2. Check that the carrier gas cylinder pressure is 10 psi (or greater) above the mechanical regulator set point. 3. Confirm that carrier cylinder has flow to the GC. 4. Check for leaks in the carrier gas sample path. 5. Confirm that RTDs are not open. 6. If necessary, replace RTD(s), heater(s) and/or regulator(s).
Heater 1 Out Of Range Heater 2 Out Of Range Heater 3 Out Of Range Heater 4 Out Of Range Heater 5 Out Of Range Heater 6 Out Of Range Heater 7 Out Of Range Heater 8 Out Of Range	The GC failed to regulate heater zone temperatures for the indicated heater to within preset limits. Recommended actions: 1. Check temperatures within the GC, using MON2020 or the LOI. Be aware that the GC may generate this alarm during start up or if the set point has been changed. 2. Check wiring, looking for splits or loose connections at the termination board (for both the heaters and the RTDs). 3. If necessary, replace the defective heater and/or RTD.
Flame Out	The FID flame will not light or has extinguished. Recommended actions: 1. Use the front switch panel or the LOI or MON2020 to ignite the FID. 2. If unable to sustain the flame, confirm that both fuel and air cylinders are connected and contain sufficient pressure. 3. Confirm that fuel and air set points are set to achieve factory-desired mixture. 4. Confirm that there is no blockage at the FID outlet - such as a cap or ice. 5. Check that the wiring connections are secure for the FID, both on the FID cap and at the termination board. 6. If necessary, replace the FID module.

Alarm Name	Possible Causes/Solution
Flame Over Temperature	The FID flame temperature is above safe limits set at the factory and the FID flame has been extinguished, the fuel supply valve closed, and automatic analyses halted. Recommended actions: 1. Confirm that both fuel and air cylinders are connected and contain sufficient volume. 2. Confirm that fuel and air set points are set to achieve desired mixture. 3. Use the front switch panel or the LOI or MON2020 to ignite the FID.
Detector 1 Scaling Factor Failure	The GC detected an excess scaling factor deviation for Detector #1. Recommended action: Replace the preamp board located in SLOT 1 on the backplane.
Detector 2 Scaling Factor Failure	The GC detected an excess scaling factor deviation for Detector #2. Recommended action: Replace the preamp board located in SLOT 1 on the backplane.
Detector 3 Scaling Factor Failure	The GC detected an excess scaling factor deviation for Detector #3. Recommended action: Replace the preamp board located in SLOT 3 on the backplane.
Detector 4 Scaling Factor Failure	The GC detected an excess scaling factor deviation for Detector #4. Recommended action: Replace the preamp board located in SLOT 3 on the backplane.

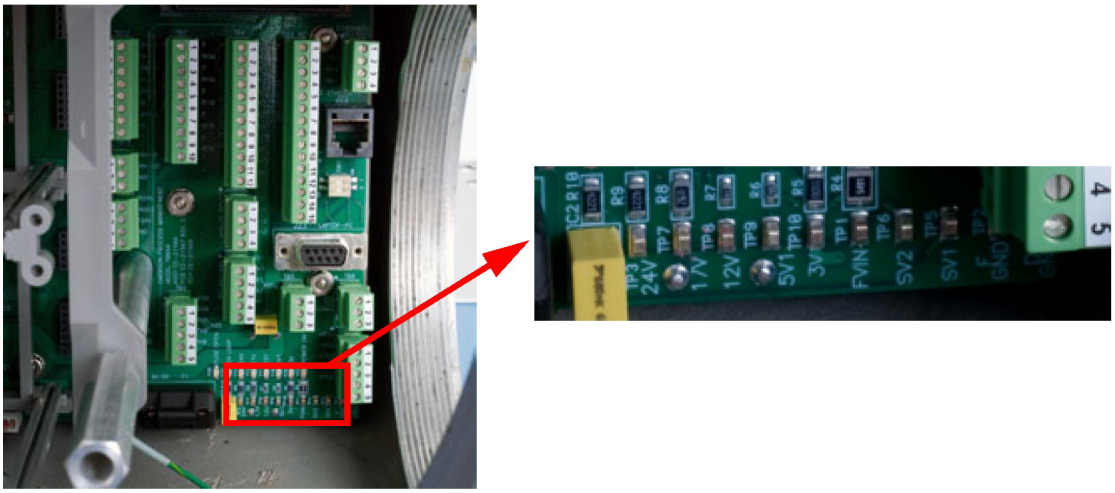
Alarm Name	Possible Causes/Solution
No sample flow 1 (Applies to the optional sample flow switch.)	There is no sample flow in the GC. Recommended actions: Check sample gas rotometer in the sample conditioning system for flow and do one of the following: If no gas flow or no rotometer is present, do the following: 1. Confirm that there is gas flow at the sample point location. 2. Check that the sample valves in the sample conditioning system are open. 3. Check that the bypass return vent path is free of obstruction. 4. Confirm that the sample line is connected from the sample point to the GC's sample conditioning system and is free of obstructions. 5. Close the valve at the sample tap, remove pressure from the line and check the filters at the probe or the sample conditioning system or both. If they are filled with liquids or particulates, replace the filtering elements. If automatic stream selection valves are present, confirm that they are operating properly. If a slight sample gas flow is present at the rotometer in the sample conditioning system, drain or replace all filters. If flow is observed in the rotometer, replace the sample flow switch because it might have failed.
No sample flow 2	Refer to "No sample flow 1".
Low Carrier Pressure 1	Input carrier pressure for detector 1 is below the preset limit. Recommended action: Check that the carrier cylinder pressure is 10 psi (or greater) above the mechanical regulator set point. If input carrier pressure is low, check the carrier cylinder pressure. Replace carrier gas cylinder if required.
Low Carrier Pressure 2	Input carrier pressure for detector 2 is below the preset limit. Recommended action: Check that the carrier cylinder pressure is 10 psi (or greater) above the mechanical regulator set point. If input carrier pressure is low, check the carrier cylinder pressure. Replace carrier gas cylinder if required.
Analog Input 1 High Signal Analog Input 2 High Signal Analog Input 3 High Signal Analog Input 4 High Signal Analog Input 5 High Signal Analog Input 6 High Signal Analog Input 7 High Signal Analog Input 8 High Signal Analog Input 9 High Signal Analog Input 10 High Signal	Measured value for the indicated analog input is greater than the user-defined full scale range.

Alarm Name	Possible Causes/Solution
Analog Input 1 Low Signal Analog Input 2 Low Signal Analog Input 3 Low Signal Analog Input 4 Low Signal Analog Input 5 Low Signal Analog Input 6 Low Signal Analog Input 7 Low Signal Analog Input 8 Low Signal Analog Input 9 Low Signal Analog Input 10 Low Signal	Measured value for the indicated analog input is lower than the user-defined full scale range.
Analog Output 1 High Signal Analog Output 2 High Signal Analog Output 3 High Signal Analog Output 4 High Signal Analog Output 5 High Signal Analog Output 6 High Signal Analog Output 7 High Signal Analog Output 8 High Signal Analog Output 9 High Signal Analog Output 10 High Signal Analog Output 11 High Signal Analog Output 12 High Signal Analog Output 13 High Signal Analog Output 14 High Signal	Measured value for the indicated analog output is greater than the user-defined full scale range.
Analog Output 1 Low Signal Analog Output 2 Low Signal Analog Output 3 Low Signal Analog Output 4 Low Signal Analog Output 5 Low Signal Analog Output 6 Low Signal Analog Output 7 Low Signal Analog Output 8 Low Signal Analog Output 9 Low Signal Analog Output 10 Low Signal Analog Output 11 Low Signal Analog Output 12 Low Signal Analog Output 13 Low Signal Analog Output 14 Low Signal	Measured value for the indicated analog output is lower than the user-defined zero range.

Alarm Name	Possible Causes/Solution
Stream 1 Validation Failure Stream 2 Validation Failure Stream 3 Validation Failure Stream 4 Validation Failure Stream 5 Validation Failure Stream 6 Validation Failure Stream 7 Validation Failure Stream 8 Validation Failure Stream 9 Validation Failure Stream 10 Validation Failure Stream 11 Validation Failure Stream 12 Validation Failure Stream 13 Validation Failure Stream 14 Validation Failure Stream 15 Validation Failure Stream 16 Validation Failure Stream 17 Validation Failure Stream 18 Validation Failure Stream 19 Validation Failure Stream 20 Validation Failure	The most recent validation sequence for the indicated stream failed. Recommended actions: 1. Check that the validation gas cylinder isolation valves are open. 2. Check that the validation gas regulators are set properly. 3. If the validation gas regulator is below the set point, replace the gas bottle with a full one. 4. If the gas used for validation is the same as the gas that is used for calibration, ensure that the cylinder gas composition value listed on the cylinder's tag or on the certificate of analysis received from the supplier matches the value displayed in MON2020's Component Data table. 5. Re-run the validation sequence. 6. If still unsuccessful contact your Emerson Process Management representative.
Stream 1 RF Deviation Stream 2 RF Deviation Stream 3 RF Deviation Stream 4 RF Deviation Stream 5 RF Deviation Stream 6 RF Deviation Stream 7 RF Deviation Stream 8 RF Deviation Stream 9 RF Deviation Stream 10 RF Deviation Stream 11 RF Deviation Stream 12 RF Deviation Stream 13 RF Deviation Stream 14 RF Deviation Stream 15 RF Deviation Stream 16 RF Deviation Stream 17 RF Deviation Stream 18 RF Deviation Stream 19 RF Deviation Stream 20 RF Deviation	The most recent calibration sequence failed. Recommended actions: 1. Check that the calibration gas cylinder isolation valves are open. 2. Check that the calibration gas regulators are set properly and that the cylinder is not below the set point. If the cylinder is below the set point, replace it with a full cylinder. 3. Verify that the calibration cylinder gas composition value listed on the cylinder tag or on the certificate of analysis received from supplier matches the calibration cylinder gas composition value displayed in MON2020's Component Data table. If there is a mismatch, edit the Component Data table to reflect the correct value. Re-run the calibration sequence. 4. If still unsuccessful contact your Emerson Process Management representative.

Test points

Figure 4-1: Lower enclosure showing test points on the back plane



The backplane has a set of test points that allow you to measure the voltage output of the Base I/O card. Each test point is labeled with a voltage value that, when measured with a voltmeter, should give a measurement equal to what is displayed on the label. A reading that does not match this label may indicate a faulty Base I/O card. Try swapping out the suspect card with a different one, and take another measurement. To get a measurement for a test point, touch the voltmeter's negative probe to the D GND test point, and touch the voltmeter's positive probe to the desired test point.

The following test points are associated with the following GC components:

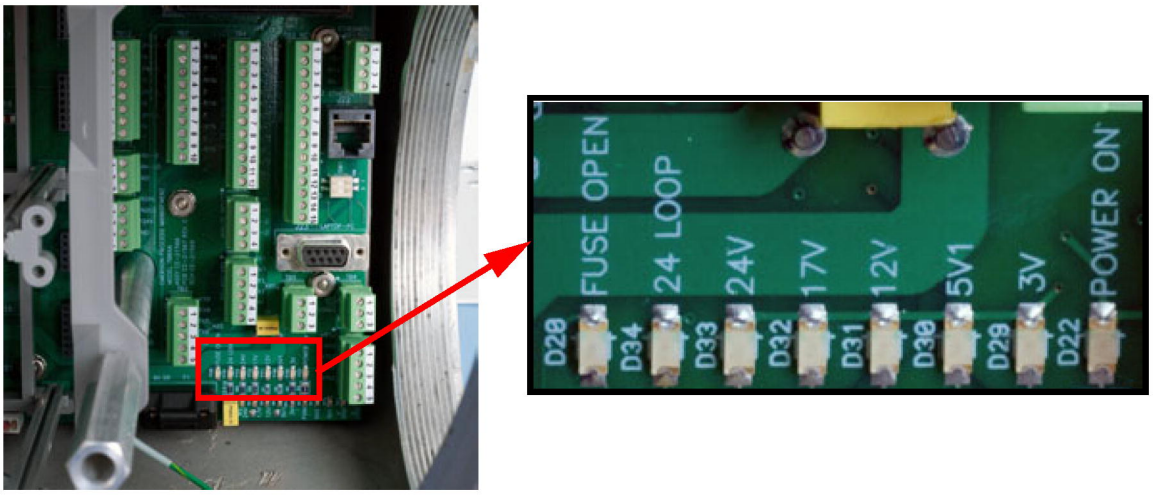
Test Point	GC Component	Tolerances
24V (Regulated)	GC power	±2.4V
17V	Preamp (Input for the bridge circuit)	±0.5V
12V	Optional I/O cards	±0.6V
5V1	System chips	±0.25V
3.3V	System chips	±0.15V
FVIN, F GND	Field voltage input and ground	±0V - 3V (21v - 30v)
SV1, SV2	Solenoid voltages that drive the heater/solenoid card	±2.4V

The input voltage range for DC/DC power supply is between 21 and 30 volts. The input range for AC/DC power supply is 90 - 264 volts (auto-ranging).

Voltage LEDs

A set of LEDs can be found above the test points. These LEDs are a quick way to visually inspect the voltage status of some of the GC's electrical components.

Figure 4-2: Voltage LEDs



The following LEDs are associated with the following GC components:

LED	GC Component
FUSE OPEN	Glows red when the fuse has blown or been removed; otherwise, it is not lit.
24 LOOP (Power)	Glows green when the current loop for the analog outputs is functioning properly; otherwise, it is not lit.
24V (Regulated)	Glows green when the GC power is functioning properly; otherwise, it is not lit.
17V (Input for the preamp)	Glows green when the Preamp is functioning properly; otherwise, it is not lit.
12V (Input for the I/O cards)	Glows green when the optional ROC expansion card is functioning properly; otherwise, it is not lit.
5V1	Glows green when the System chips are functioning properly; otherwise, it is not lit.
3V	Glows green when the System chips are functioning properly; otherwise, it is not lit.
POWER ON	Glows green when the GC is on; otherwise, it is not lit.

Temperature

Use MON2020 to monitor the temperature of the detector(s) and columns to determine if the GC is thermally stable.

When connected to the GC via MON2020, select **Heaters...** from the **Hardware** menu to access this function. The *Heaters* window displays.

When viewing the *Heater* window, the typical heater configuration is as follows:

- **Heater 1** is the analytical block heater.
- **Heater 2** is the “high hat” heater.

The *Temperature* column on the *Heaters* window displays the current temperature; the *Current PWM* column displays the percentage of power being used to run the heater.

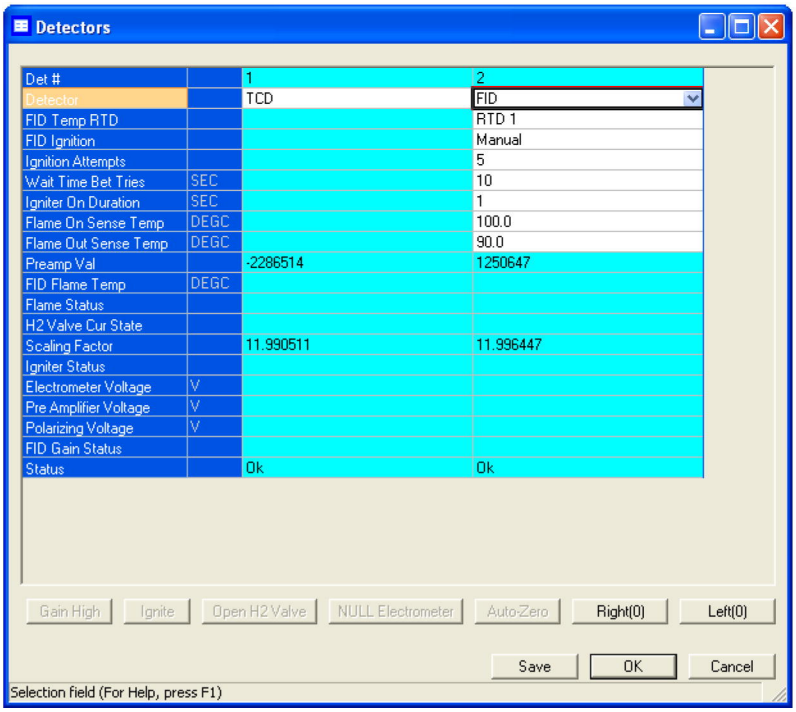
The settings and values shown in the *Heaters* window and described in the table below are preset at the factory and are based on the specific customer application. These values should not be changed unless recommended by Application Engineering, Customer Service personnel, or as part of a factory application requirement.

Function	Typical Setting
Detector(s) or analytical block temperature	80 °C (176 °F)
Oven temperature	80 °C (176 °F)
Spare Or, Methanator Or, LSIV	N/A 300 °C (572 °F) 150 °C (302 °F)

FID configuration

When connected to the GC via MON2020, select **Detectors** from the **Hardware** menu to access the *Detectors* dialog. Refer to the MON2020 user manual for additional configuration details.

Figure 4-3: The Detectors window



Configure the following fields from the *Detectors* dialog:

- FID Ignition - manual or automatic
- Ignition Attempts
- Wait Time Between Tries
- Igniter ON duration
- Flame ON Sense Temperature
- Flame OUT Sense Temperature
- Electrometer Voltage

Note

If the FID does not show up in the Detectors window, disconnect from MON2020 and turn off the GC. Inspect the S1 switch, which is located on the half-moon-shaped wire terminal board. The switch should be set to "ON".

4.4.5 Checking the GC for leaks

Leak checking should be a standard component of any maintenance protocol. See *Section 3.6.1*.

Plugged lines, columns, and valves

If the lines, columns, or valves are plugged, check the gas flow at valve ports. For a reference, use the flow diagram in the drawing package, and remember these points about flow diagrams:

- Port-to-port flow paths are indicated by solid or dashed lines.
- A dashed line indicates flow direction when the valve is ON, that is, energized.
- A solid line indicates flow direction when the valve is OFF, i.e., not energized.

4.4.6 Valves

Only minimal repair and maintenance is required by the customer (e.g., replacing the diaphragms).

Required tools for valve maintenance

The tools required for performing repair and general maintenance on the XA valve assemblies are:

- Torque wrench, scaled in foot-pounds
- 1/2” socket for 10-port valves
- 7/16” socket for 6-port valves
- 1/4” open-ended wrench
- 5/16” open-ended wrench
- 5/32” allen wrench

Valve replacement parts

Replacement parts required for each XA valves consist of the following parts:

- Diaphragm Kit 6-port XA Valve (P/N 2-4-0710-248)
- Diaphragm Kit 10-port XA Valve (P/N 2-4-0710-171)

Figure 4-4: XA valves

Valve overhaul

Note
Replacement factory-built XA valves are available. Call your Emerson Process Management representative for more information.

Use the following procedure to overhaul a valve:

1. If you are overhauling a 6-port valve, refer to drawing #CE-22015; If you are overhauling a 10-port valve, refer to drawing #CE-22016. Both drawings are available in *Appendix F*.
2. Shut off the carrier and sample gas streams entering the unit.
3. Remove the top hat heater from the oven system.
4. If the faulty valve is not easily accessible, loosen the thumb screw and tilt the oven on its side.
5. Disconnect tubing and fittings that attach to the valve from other locations.
6. Use an allen wrench to remove the two baseplate bolts on the valve to be replaced or serviced. The valve can now be removed from the GC.
7. Loosen the valve's torque bolt.

Figure 4-5: The torque bolt

8. Holding the lower piston plate, pull the valve straight off the block. The alignment pins may stick slightly.
9. Remove and discard the old valve diaphragms and gaskets.
10. Clean the sealing surface as required using a non-lint-forming cloth and isopropyl alcohol. Blow the sealing surface with clean, dry instrument air or carrier gas. Dirt including dust and lint can cause troublesome leakage.

Note

Do not use an oil-based cleaner on the valve.

11. Replace the old diaphragms and gaskets, in the same order, with the new ones supplied.
12. Reinstall the valve using the following steps:
    a. Align the pins with holes in the block and push the valve assembly into place.
    b. Tighten the valve's torque bolt. The 6-port valve requires 20 ft/lb of torque; the 10-port valve requires 30 ft/lb of torque.
    c. Return the valve to the assembly.
    d. Reconnect all fittings and tubing.

Removing and replacing solenoids

Both the oven system solenoids and the stream switching solenoids can be replaced by using the following procedure.

⚠ WARNING!

Disconnect all electrical power to the unit and ensure the area is free of explosive gases. Failure to follow this warning may result in injury or death to personal or cause damage to the equipment.

1. Remove the thermal cover from the upper enclosure.
2. Loosen the ultem thumb screw and tilt the oven on its side to gain access to the solenoids that are located on the underside of the ultem.
3. Loosen the screws holding the solenoid in place and remove the solenoid.
4. To replace the solenoid, reverse the procedure for removing them. Be sure to place a small amount of silicone grease on the target device (pneumatic block, 4-way stream block, etc.) where the solenoid is to be placed to ensure a tight seal.

4.4.7 Detector maintenance

When a TCD fails to perform normally it should be replaced. Signs that a TCD may be faulty include, but are not limited to, the following:

- A chromatogram with a wandering or drifting baseline;
- A chromatogram with a noisy baseline;
- A chromatogram with a no peaks;
- No chromatogram.

A test for a faulty TCD involves measuring the resistance of each filament using a voltmeter. A set of thermistors should give the same voltmeter reading; therefore, if a thermistor reading is significantly different from the reading of its mate, the pair should be replaced, otherwise the TCD bridge will be unbalanced, noisy and drifty.

Required tools for TCD maintenance

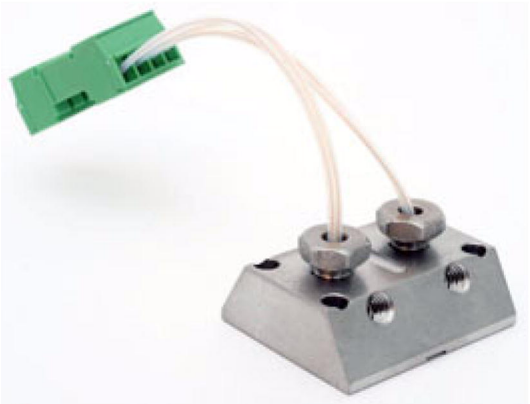
A flat-head screwdriver is required for removing and replacing TCDs.

TCD replacement parts

The following parts are required to replacing one TCD:

- Thermistor seal (P/N 6-5000-084)
- Thermistor set (P/N 6-1611-083)

Figure 4-6: TCD with block



Replacing a TCD

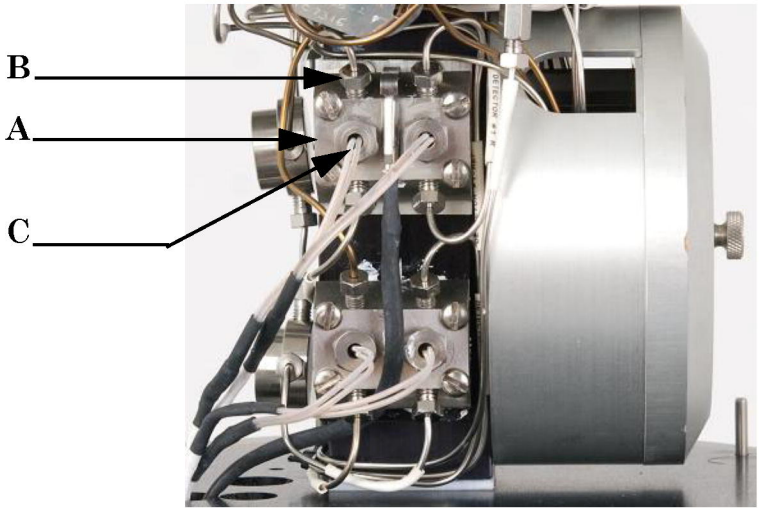
Use the following procedure to remove a TCD assembly from the GC for repair or replacement:

⚠ WARNING!

Disconnect all electrical power to the unit and ensure the area is free of explosive gases. Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

1. Disconnect all power to the unit.
2. If you have not already done so, remove the explosion-proof dome and the thermal cover.
3. Unscrew and remove the TCDs from the TCD block and the gas connectors. Be careful not to damage the teflon washer that is placed between the TCD and the TCD block.

Figure 4-7: Components of a TCD block



A. TCD block
B. Gas connector
C. TCD

4. To replace the TCD, reverse the steps taken to remove it.

Note
The block screws should be tightened with a torque wrench to 20 inch-ounce.

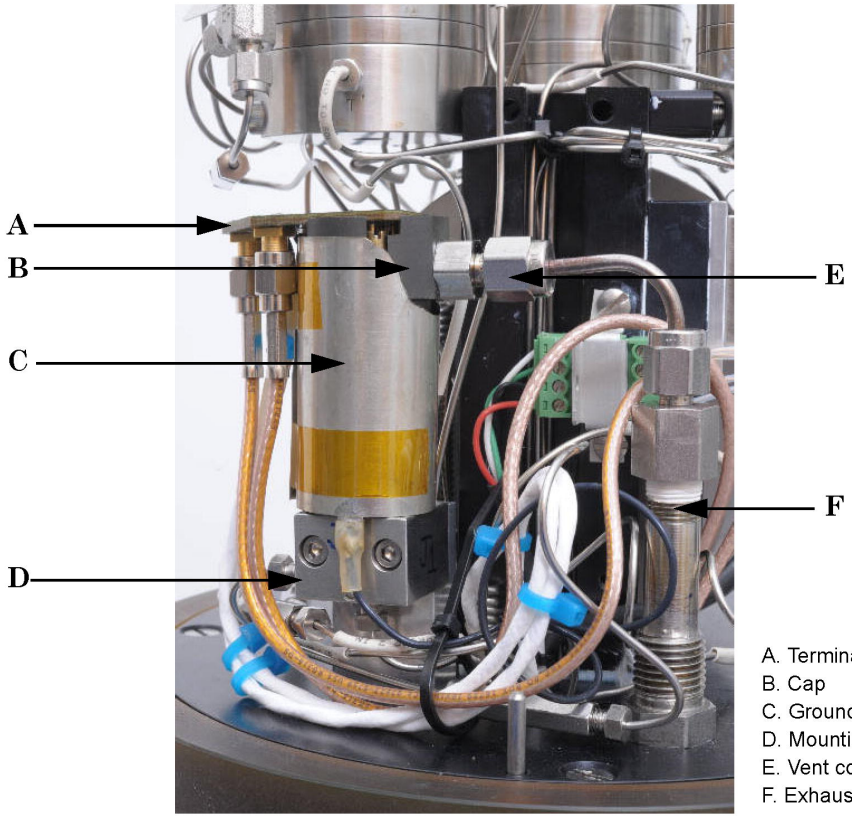
4.4.8 Removing the FID

The FID has no replaceable parts. Damage such as a broken RTD or igniter coil will require that the unit be removed and replaced.

⚠ WARNING!

Disconnect all electrical power to the unit and ensure the area is free of explosive gases. Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

Figure 4-8: The FID



A. Termination board
B. Cap
C. Ground shield cover
D. Mounting bracket
E. Vent connector
F. Exhaust tube

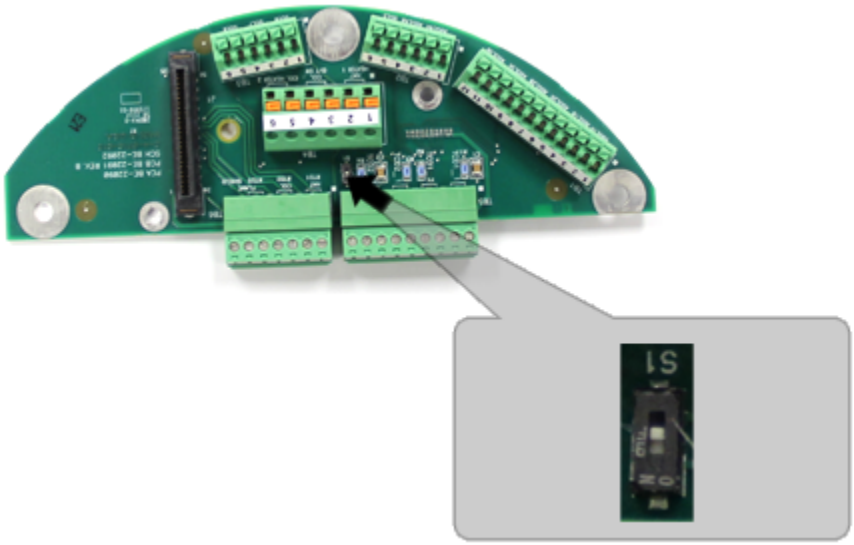
Use the following procedure to remove an FID from the GC:

1. Disconnect all power to the unit.

   Allow at least 10 minutes for the components to cool-down.

2. Locate the FID switch, which is on the half-moon-shaped wire terminal board, and flip it to the "off" position.

Figure 4-9: The location of the FID switch



3. Remove the explosion proof dome and the thermal hood.
4. Remove the screw connecting the termination board to the FID cap.
5. Remove the two screws from the mounting bracket.
6. Unscrew and remove the vent connector.

Note
Use a backing wrench on the bolt fronting the FID cap when removing the vent connector.

To replace the FID, reverse the steps taken to remove the device. The final step should be to flip the FID switch to the "ON" position.

4.4.9 LSIV maintenance

The following procedures detail how to remove and install an LSIV, as well as how to replace an LSIV's seals.

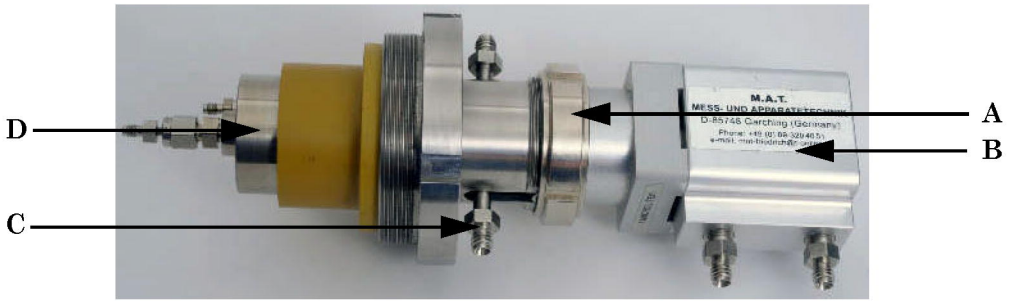
Installing a MAT LSIV

The LSIV can be maintained while attached to the enclosure. However, the user may find it easier to perform maintenance with the LSIV removed from the upper enclosure.

⚠ CAUTION!

This unit operates at high temperature. Allow a cool-down period of at least 10 minutes after shut-down and handle the unit carefully. Failure to follow this precaution may result in injury or death to personnel.

Figure 4-10: MAT LSIV components



A. Union coupling
B. Actuation section
C. Liquid sample connector
D. Thermal barrier adapter

Note

For a detailed view of the MAT LSIV's components, see *Figure 4-14*.

To install the MAT LSIV, do the following:

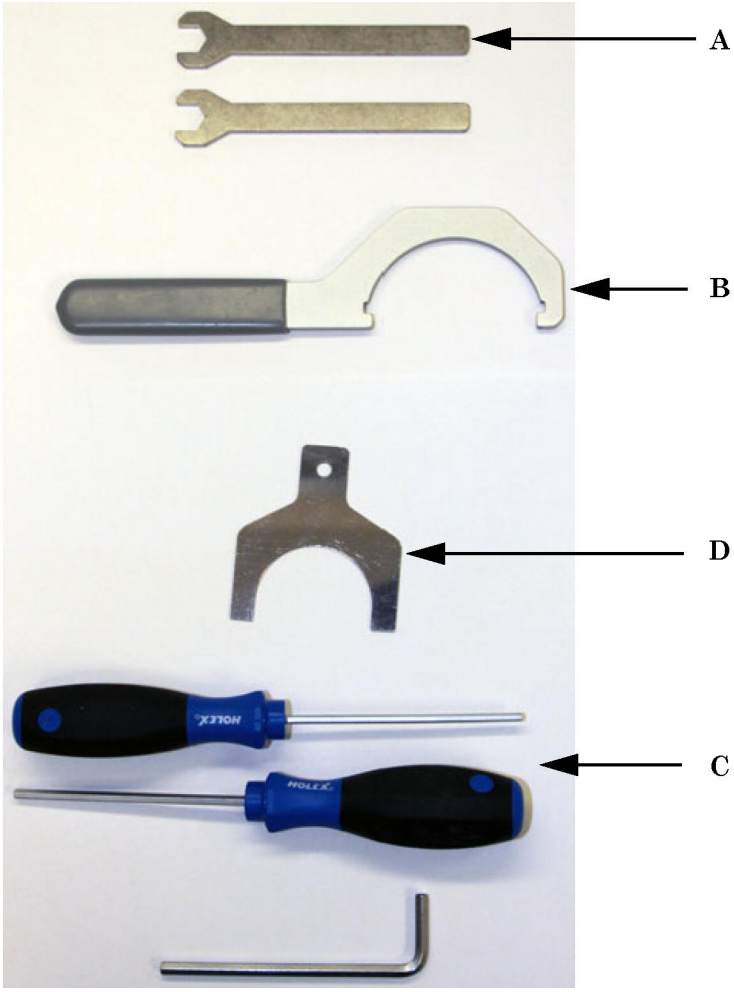
1. Install new MAT valve by doing the following:
   a. Attach the retaining ring from step 6c above to the MAT LSIV.
   b. Slide the MAT LSIV into the mounting hole in GC. Refer to Drawing #DE-20990 in *Appendix F*.
   c. Tighten the retaining ring by twisting it clockwise to secure the MAT LSIV to the GC.
2. Connect the following internal GC gas lines to the MAT LSIV:
   a. Connect the carrier gas line to the MAT LSIV.
   b. Connect the sample gas line to the MAT LSIV.
3. Place the insulation sleeve around the flash chamber as shown in Drawing #DE-20990.
4. Connect the following external GC gas lines to the MAT LSIV:
   a. Liquid Sample IN
   b. Liquid Sample Out
   c. Air Actuator Inject
   d. Air Actuator Retract
5. Install air solenoid items. Refer to Drawing #DE-20990.
6. Perform a standard system leak test.
7. Restart the sample flow. The GC can now be returned to service.

Required tools

Although for the most part it is possible to remove or disassemble the LSIV with traditional tools such as a wrench or pliers, the following tools should have been delivered with your LSIV-mounted gas chromatograph:

- Two 10-mm wrenches (A)
- Union coupling wrench (B)
- Two 3-mm Allen wrenches (C)
- Union coupling spacer (D)

Figure 4-11: The LSIV tools

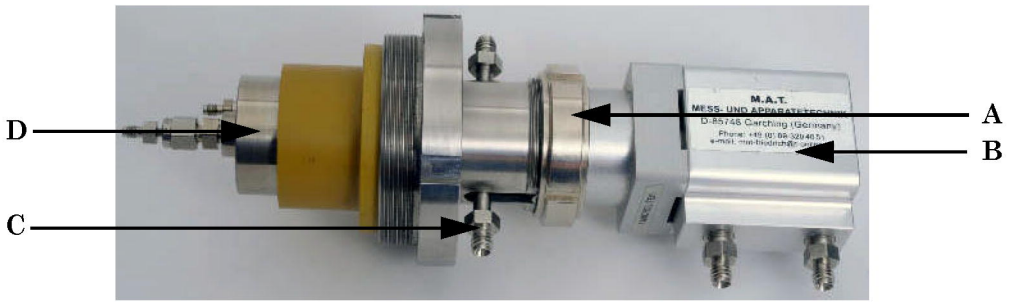


The LSIV can be maintained while attached to the enclosure. However, the user may find it easier to perform maintenance with the LSIV removed from the upper enclosure.

⚠ CAUTION!

This unit operates at high temperature. Allow a cool-down period of at least 10 minutes after shut-down and handle the unit carefully. Failure to follow this precaution may result in injury or death to personnel.

Figure 4-12: MAT LSIV components



A. Union coupling
B. Actuation section
C. Liquid sample connector
D. Thermal barrier adapter

Note

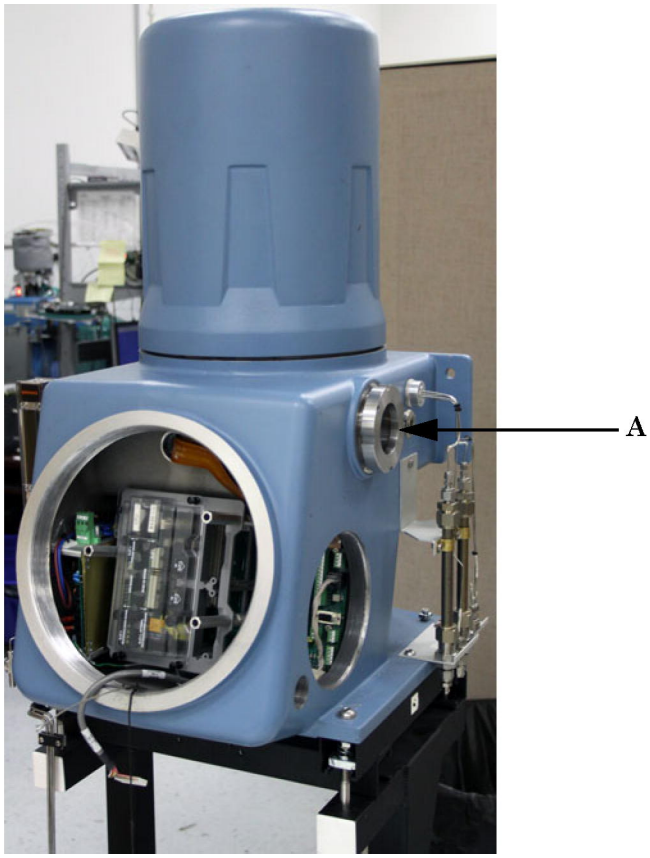
For a detailed view of the MAT LSIV's components, see *Figure 4-14*.

Removing the MAT LSIV

Inside the GC's upper compartment there are two insulation covers (they open like clam shells that slide off of the end of the LSIV) to be removed.

1. Disconnect the carrier and sample tubing from the LSIV.
2. Remove the heater and RTD from the heater block.
3. Disconnect sample and air tubing from the outer portions of the LSIV.
4. Unscrew the retaining ring, using a pin spanner wrench or other tool. With the retaining ring loose, the LSIV assembly is free to be pulled out of the upper enclosure.

Figure 4-13: 700XA after LSIV (A) has been removed



Replacing LSIV seals

Due to the possible damage caused by the presence of solids in the sample stream, combined with the regular, repeated motion of the injection valve stem, LSIV seals may require annual replacement.

Note

Specific application conditions should dictate the frequency of the seals replacement and you should monitor analytical performance to determine appropriate replacement intervals.

Note

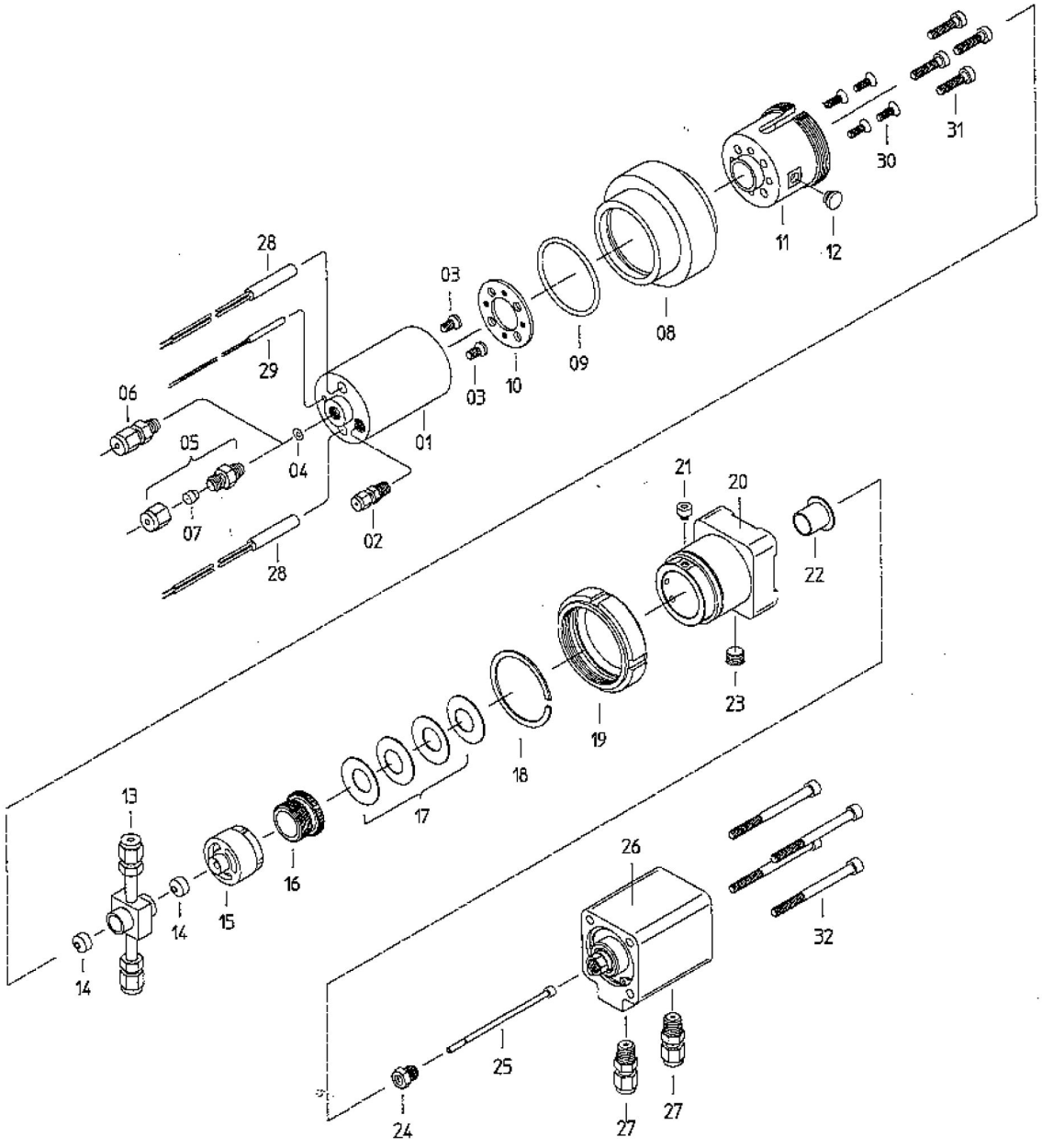
ID numbers listed in parenthesis refer to “LSIV - Exploded View” in *Figure 4-14*.

1. Halt sample flow and allow time for the LSIV to cool.
2. Remove the actuation portion (ID No. 26) of the valve by unscrewing the union coupling (ID No. 19) from the heater section (ID No. 11), which should remain attached to the GC. A union coupling wrench has been provided for this purpose.

This will expose the sample flow chamber and the old seals that ride the metering rod (ID No. 25), which should be treated with great care to prevent bending or scratching.

3. Pull the sample flow chamber assembly (ID No. 13) off the metering rod. Remove the two seals (ID No. 14). This may requiring pushing from the opposite side using a rod smaller than 1/8-inch diameter.
4. Place new seals on the sample flow chamber assembly. Press the chamber and seals back over the metering rod.
5. Place the actuation section in position on the heater section's headpiece.
6. Use the union coupling spacer to ensure that the union coupling is properly aligned with the heater section's headpiece.
7. Use the union coupling wrench to retighten the union coupling over the heater section.
8. Restart the sample flow. The GC can now be returned to service.

Figure 4-14: LSIV - exploded view



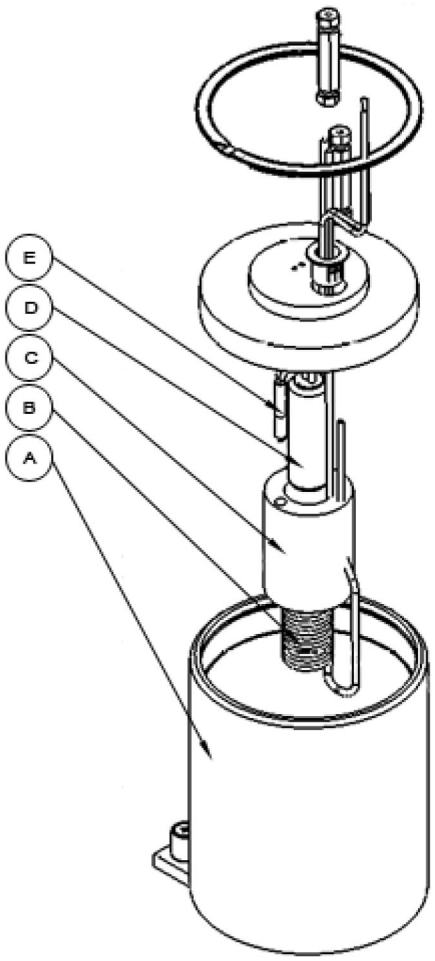
4.4.10 Methanator maintenance

The optional methanator, which is a catalytic converter, converts otherwise undetectable CO_2 and/or CO into methane by adding hydrogen and heat to the sample. The methanator requires little maintenance.

Note

Be sure to insulate the methanator assembly to prevent heat loss.

Figure 4-15: Methanator assembly



A. Case
B. Catalytic Column
C. Tube
D. Heater
E. RTD (temperature detector)

The RTD is replaceable. When replacing it, take care to anchor the RTD cable to the tubing to prevent loosening over time.

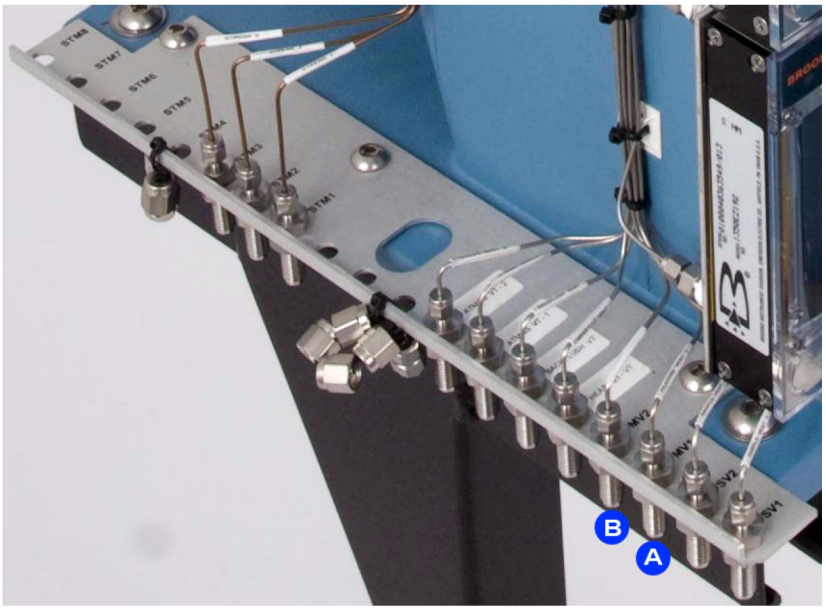
To replace the RTD, consult drawing #CE-22210, which is available at the back of this manual.

4.4.11 Measure vent flow

You will need an accurate flow meter for this measurement.

To measure the measure vent flow, do the following:

Figure 4-16: Measure flow vents



1. Consult the documentation the Parameter List that was provided with the GC to learn the appropriate flow rate.
2. Attach a flow meter to the vent output on the right side of the GC that is labelled “MV1”. The flow should match the value displayed in the Parameter List.
3. Attach a flow meter to the vent that is labelled “MV2”. The flow should match the value displayed in the Parameter List.

4.4.12 Electrical components

The GC is designed to operate for long periods of time without the need for preventive or regularly scheduled maintenance. It was designed with an explosion-proof enclosure that is dust-proof, water-proof, and flame-proof.

⚠ WARNING!

Disconnect all electrical power to the unit and ensure the area is free of explosive gases. Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

Prior to opening the GC, use MON2020 to ensure that there are no configuration or parameter errors.

To access the card cage, do the following:

1. Ensure electrical power is disconnected from the unit and the environment is safe.
2. Unscrew and remove the front panel.

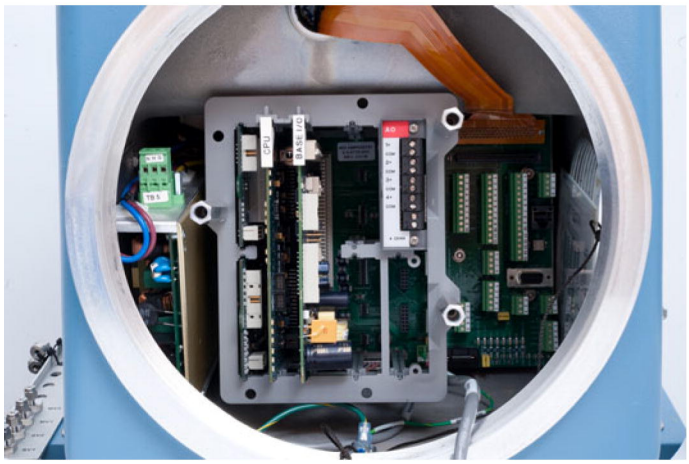
Figure 4-17: Remove the front panel

3. Unscrew and remove the switch panel or LOI.

Figure 4-18: Remove the switch panel or LOI

The PCBs are located in the card cage.

Figure 4-19: PCBs in the card cage



4. Note the location and direction of any board removed. Release the catch(es) and remove/replace the circuit board(s) as necessary.

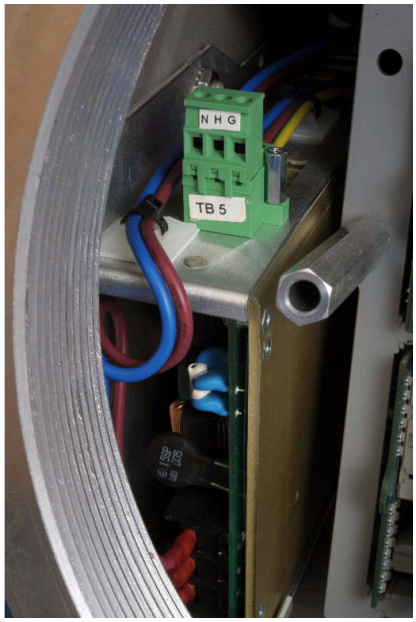
Replacing AC/DC power supply

The AC/DC power supply is mounted on the left wall of the lower enclosure adjacent to the card cage and is accessible by removing the front panel and the switch panel or LOI from the lower enclosure.

⚠ WARNING!

Disconnect all electrical power to the unit and ensure the area is free of explosive gases. Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

Figure 4-20: AC/DC power supply located in lower compartment



A Cross point #2 Phillips screw driver is required to remove and replace the AC/DC power supply.

To remove and replace an AC/DC power supply, do the following:

1. Remove power to the GC.
2. Unscrew and remove the front panel.

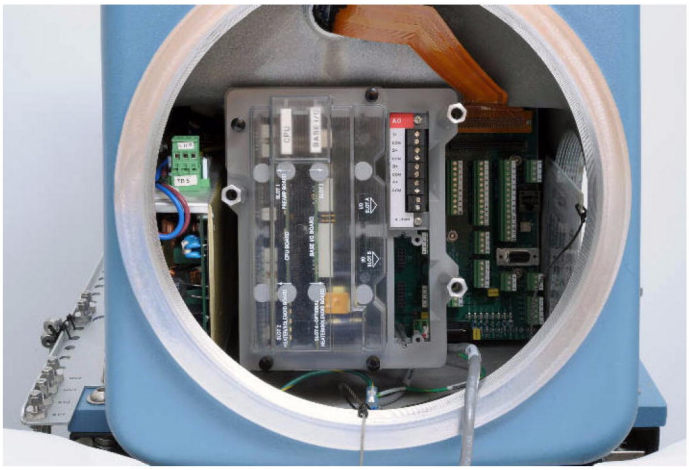
Figure 4-21: Remove the front panel

3. Unscrew and remove the switch panel or LOI to allow access to the card cage.

Figure 4-22: Remove the switch panel or LOI

4. If present, remove the clear cover from the card cage.

Figure 4-23: The card cage



5. Unplug all the cards in the card cage but do not remove them.
6. Unscrew the three switch panel connector posts. Remove the washers as well.
7. Lift the card cage with the boards and remove from the lower enclosure.
8. Unscrew and remove the post closest to the power supply.
9. Unplug the connector at the top of the power supply on the left.
10. Unplug the low voltage cable connected along the lower edge of the backplane.
11. Disconnect the ground lead from the power supply at the chassis ground immediately inside the lower enclosure opening.

12. Remove the nut just above the power supply. The power supply may now be twisted free of the attaching stud and lifted from its cradle. Remove the power supply carefully to avoid damage due to wire interferences.
13. Maneuver the new power supply into the cradle, ensuring that the wires are free to be connected.

Reverse this procedure to install a new power supply.

4.4.13 Factory settings for jumpers and switches

The following table shows the factory settings for the jumpers and switches that are located on the various circuit boards that are located in the electrical enclosure.

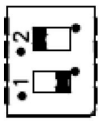
Legend	
	Not set. Jumper shunt is installed on one pin only.
	Set. Jumper shunt is installed on both pins.
	Set. This jumper has three pins and the jumper shunt is installed on pins 2 and 3.
	The dark areas (▉) indicate the position of the switch actuators.

Figure 4-24: Preamp board factory jumper setting

Figure 4-25: Heater/Solenoid board factory jumper setting

Figure 4-26: Base I/O board factory jumper and switch settings

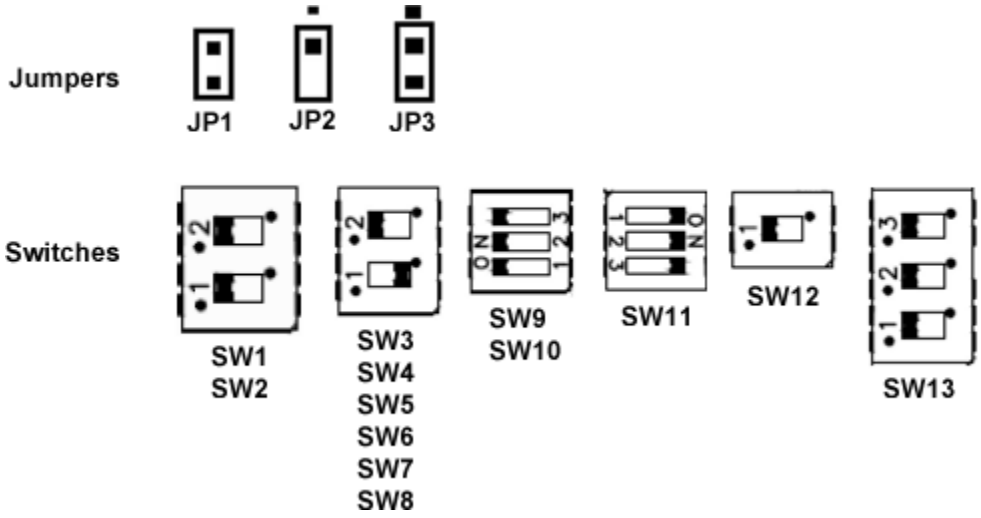


Figure 4-27: Backplane factory switch setting

4.4.14 Communications

The 700XA has four serial communications ports: Port 0, Port 1, Port 2, and Port 3, which is a dedicated PC-to-GC port. The mode for each of the first three ports can be set to RS232, RS422, or RS485. These port configurations are normally specified by the customer at the time of order and then set at the factory, but they can be changed at any time with MON2020.

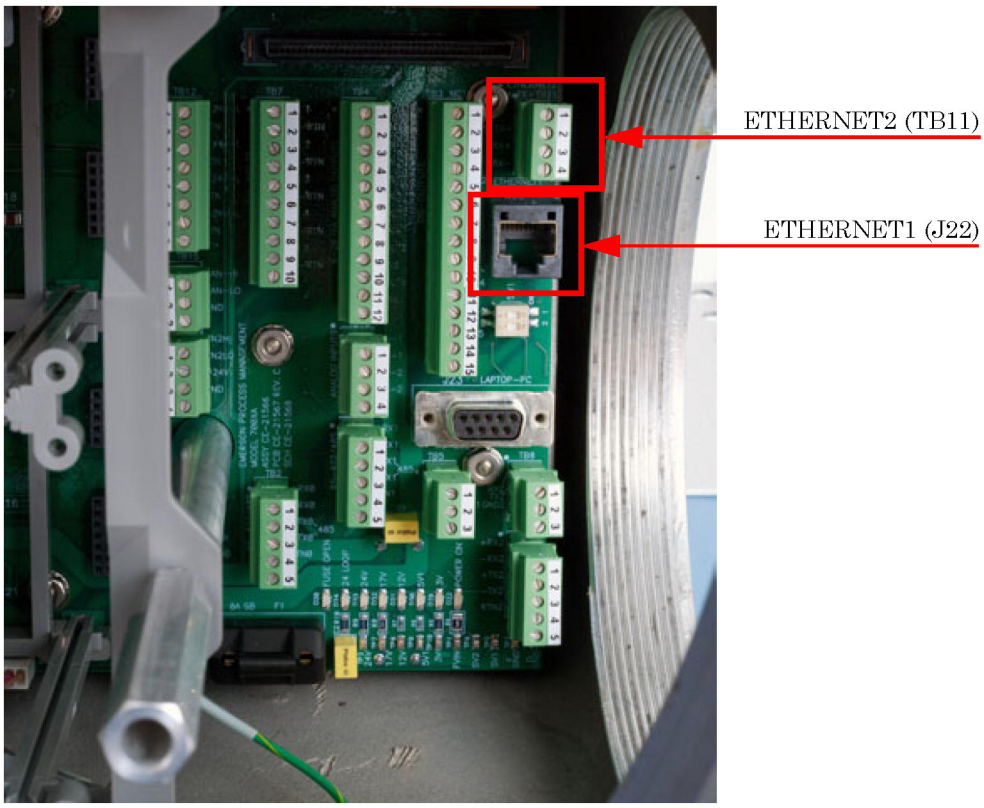
Note

The backplane has two switches located at SW1. The first switch is used for starting the DHCP server. See *Section 3.5.8* for more information. The second switch is reserved for future use.

The backplane has two Ethernet ports:

Name	Location	Connector Type
ETHERNET1	J22	RJ45 (DHCP-enabled)
ETHERNET2	TB11	4-wire terminal block

Figure 4-28: Ethernet ports on the backplane



Maximum distance by communication type

Communication Type	Maximum Length
RS-232	50 feet
RS-422/RS-485	4000 feet
Ethernet (CAT5)	300 feet

Changing the line drivers

The following table lists the relevant traits of the GC's serial ports.

Port Name	Port Mode	Terminal Block Location on the back plane	Communication Modes Supported
Port 0	RS232	TB1	Modbus ASCII/RTU
	RS422, RS485	TB2	
Port 1	RS232	TB5	Modbus ASCII/RTU
	RS422, RS485	TB6	
Port 2	RS232	TB8	Modbus ASCII/RTU
	RS422, RS485	TB9	
Port 3 (DB9 connector)	RS232	J23 (LAPTOP-PC)	Modbus ASCII/RTU Direct Connection through MON2020

Note

Port 3 can be used to set up a direct-to-PC connection.

The factory setting for each port is RS-232. To change the setting of a serial port, do the following:

1. Start MON2020 and connect to the GC.
2. Select **Communication...** from the **Applications** menu. The *Communication* window displays.
3. Select the appropriate mode from the *Port* drop-down list for the appropriate serial port. The options are **RS232** or **RS485 or RS422**.
4. Click **OK**.
5. Close MON2020.
6. Turn off the GC.
7. Locate and remove the Base I/O board, which is located in the card cage in the GC's lower enclosure.
8. Consult the following figures, which show the correct switch settings for each mode. The first column lists the port number; the first row lists the communications mode. The table cell at which the desired port and the desired mode intersect contains the appropriate switch settings for that configuration.

   Port 0 corresponds with channel "1" on each switch; Port 1 corresponds with channel "2" on each switch; Port 2 corresponds with channel "3" on each switch.

Figure 4-29: RS-232

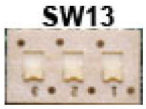


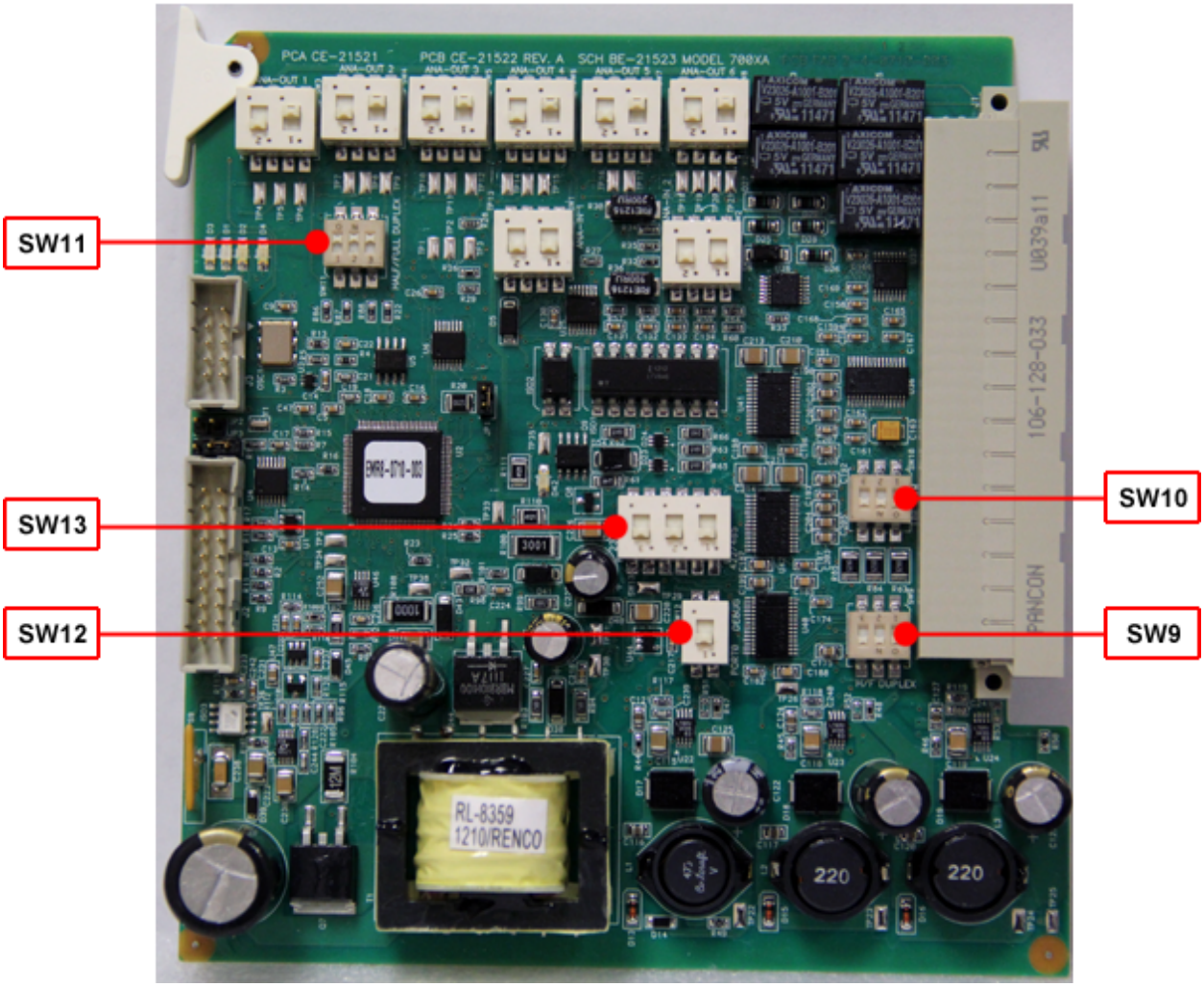
Figure 4-30: RS-422 (Full Duplex/4-Wire)

Figure 4-31: RS-485 (Half Duplex/2-Wire)

Therefore, if you want to set Port 1 to RS-232 mode, you would set channel “2” on SW13 to the down position.

9. To learn the location of a switch on the Base I/O board, consult *Figure 4-32*:

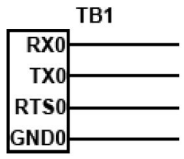
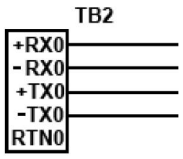
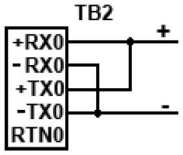
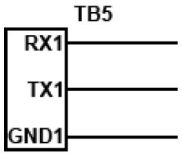
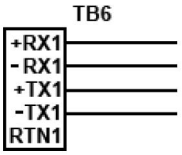
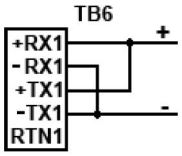
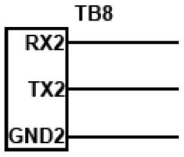
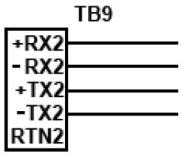
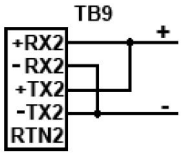
Figure 4-32: Serial port switches on the Base I/O board



10. Make sure that SW12 is set to the down position or Port 0 will not function.

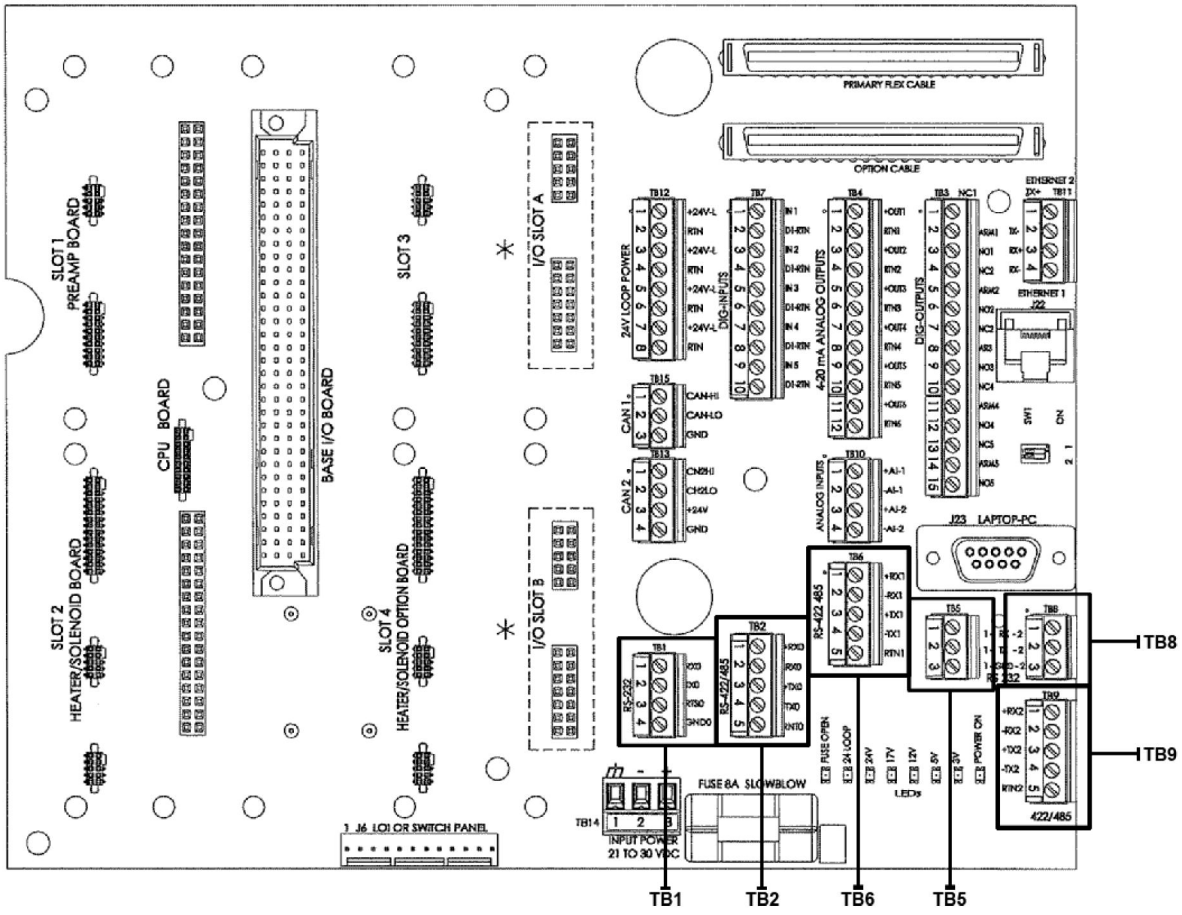
> **Note**
> Ordinarily SW12 should never be adjusted. It is used by the factory for testing purposes. If it was somehow set to the top, be sure to return it to its factory-set position, which is the down position.

11. To enable line termination for a serial port, set the appropriate port switch on SW10 to the bottom position.
12. Replace the Base I/O board in the card cage.
13. Consult the following table, which shows the correct termination block wiring for each mode and port. The first column lists the port number; the first row lists the communications mode. The table cell at which the desired port and the desired mode intersect contains the appropriate wiring for that configuration.

	RS-232	RS-422 (Full Duplex/4-Wire)	RS-485 (Half Duplex/2-Wire)
Port 0			
Port 1			
Port 2			

14. Access the backplane and consult the following graphic to locate the appropriate terminal blocks:

Figure 4-33: Terminal block locations on the backplane



15. Once the appropriate termination blocks are wired correctly, you can start up the GC.

Optional RS-232 serial ports

It is possible to install an optional RS-232 board in one or both of the expansion I/O slots provided on the GC's card cage in the electronics enclosure.

This extra port can be used for Modbus ASCII/RTU communications or to connect directly to a computer installed with MON2020.

To install an optional RS-232 board, do the following:

1. Start MON2020 and connect to the GC.
2. Select **I/O Cards...** from the **Tools** menu. The *I/O Cards* window displays.
3. Identify the appropriate card slot under the *Label* column and then select **Communications module - RS232** from the appropriate *Card Type* drop-down list.
4. Click **OK**.

5. Turn off the GC.
6. Install the RS-232 board into the appropriate I/O card slot in the GC's card cage.
7. Start the GC.

Optional RS-485/RS-422 serial ports

It is possible to install an optional RS-485 board in one or both of the expansion I/O slots provided on the GC's card cage in the electronics enclosure. This card can be configured in RS-422 (4-wire) or RS-485 (2-wire) mode. RS-485 mode is the standard setting; to configure the card for RS-422 mode, see
Configuring the optional RS-485 serial port to function as an RS-422 serial port.

This extra port can be used for Modbus ASCII/RTU communications or to connect directly to a computer installed with MON2020. When used to connect to MON2020, the following limitations apply:

- Limited bandwidth.
- Supported on Windows XP® only—port won't work with Windows Vista® or Windows 7®.
- Must uncheck the **Use PPP protocol for serial connection (use SLIP if unchecked)** check box on the *Program Settings* window in MON2020.

Installing an optional RS-485/RS-422 serial port card

To install an optional RS-485/RS-422 serial port card, do the following:

1. Start MON2020 and connect to the GC.
2. Select **I/O Cards...** from the **Tools** menu. The *I/O Cards* window displays.
3. Identify the appropriate card slot under the *Label* column and then select **Communications module - RS422/485** from the appropriate *Card Type* drop-down list.
4. Click **OK**.
5. Turn off the GC.
6. Install the RS-485/RS-422 serial port card into the appropriate expansion slot in the GC's card cage.
7. Start the GC.

Configuring the optional RS-485 serial port to function as an RS-422 serial port

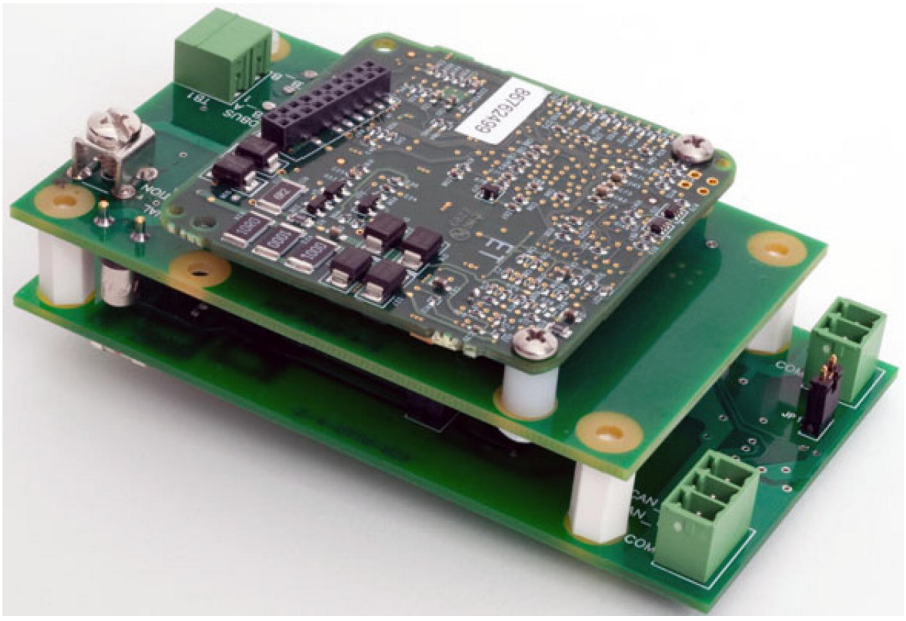
Use the following table to learn the correct jumper settings for configuring the optional RS-485 serial port to function as an RS-422 serial port:

Jumpers	RS-485 (Half Duplex/2-Wire)	RS-422 (Full Duplex/4-Wire)
J3	Half	Full
J5	Half	Full

	Termination IN	Termination OUT
J4	In	Out
J6	In	Out
	TB1 Wire Terminals	
	RS-485 (Half Duplex/2-Wire)	RS-422 (Full Duplex/4-Wire)
A	RxTx+	Rx+
B	RxTx-	Rx-
Y	NC	Tx+
Z	NC	Tx-

4.4.15 Installing or replacing a FOUNDATION fieldbus module

Figure 4-34: The FOUNDATION fieldbus module



The FOUNDATION fieldbus module should be mounted adjoining the card cage. It is held in place by the LOI post tips that attach to the LOI posts.

Mounting the FOUNDATION fieldbus module requires the following items:

- A FOUNDATION fieldbus module
- A FOUNDATION fieldbus assembly bracket
- Two screws
- Two flat washers
- A FOUNDATION fieldbus cable assembly

Removing a FOUNDATION fieldbus module

Note

Be sure to properly ground yourself before performing this procedure.

To remove the module, do the following:

1. Unscrew the two LOI post tips. The FOUNDATION fieldbus module can now be detached from the card cage.
2. Remove the two screws that attach the FOUNDATION fieldbus assembly bracket to the FOUNDATION fieldbus module.

Installing a FOUNDATION fieldbus module

⚠ CAUTION!

Be sure to properly ground yourself before performing this procedure.

Note

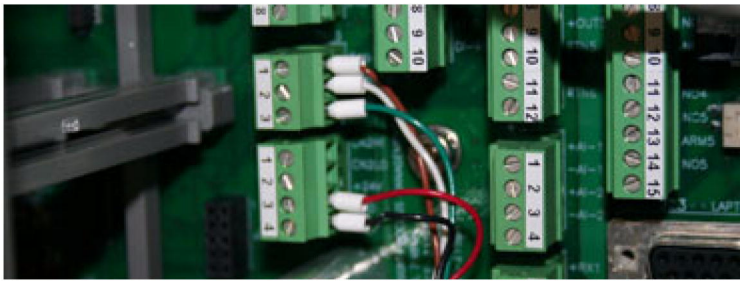
The GC draws 21 mA from the FOUNDATION fieldbus.

To install a FOUNDATION fieldbus module, do the following:

1. Attach the FOUNDATION fieldbus assembly bracket to the FOUNDATION fieldbus module by aligning the two holes in the FOUNDATION fieldbus assembly bracket with the two holes at the bottom of the FOUNDATION fieldbus module and screwing in the two thumb screws.
2. Attach the FOUNDATION fieldbus assembly bracket to the card cage by aligning the FOUNDATION fieldbus assembly bracket's second set of holes with the LOI post tip holes in the card cage.
3. Screw in the LOI post tips.
4. Use the following wiring chart to connect the FOUNDATION fieldbus cable assembly to the backplane:

Backplane terminal block	Post Number	Wire
TB15	1	Brown
	2	White
	3	Green
TB13	3	Red
	4	Black

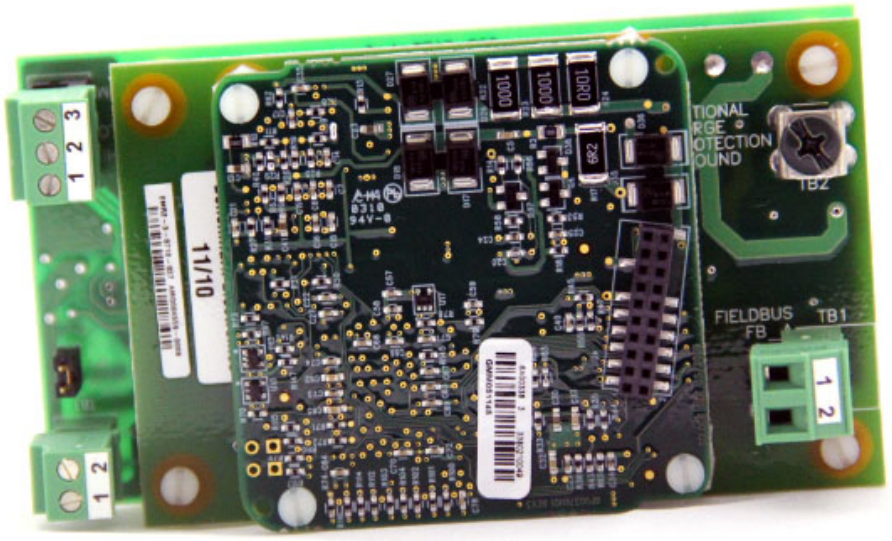
Figure 4-35: FOUNDATION fieldbus wiring on the backplane



Connecting the GC's FOUNDATION fieldbus module to a Fieldbus segment

The FOUNDATION fieldbus module has a terminal at TB1 on the carrier board, which is the middle card in the stack. This terminal can be used to connect to a fieldbus segment.

Figure 4-36: Carrier board showing connector at TB1



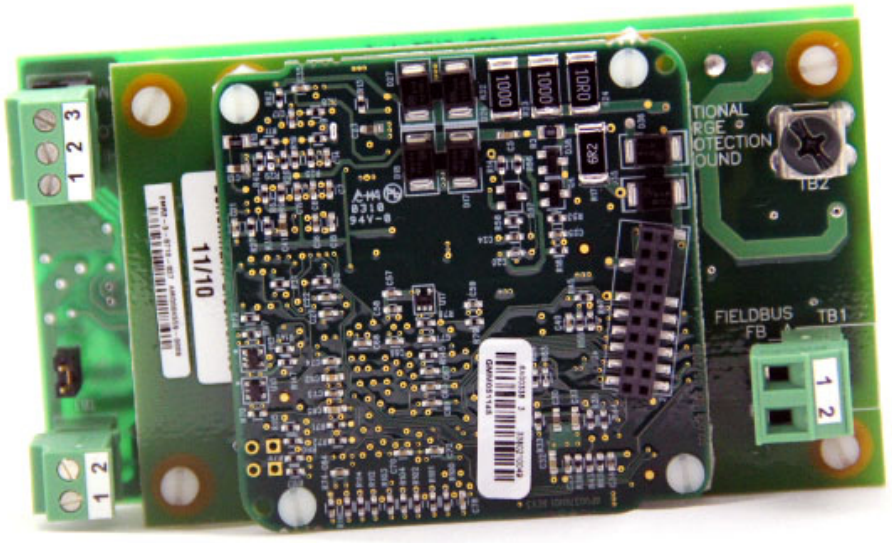
To connect to a fieldbus segment, do the following:

1. Attach one end of a wire to **1** on the TB1 terminal and to the positive (+) terminal on the fieldbus segment.
2. Attach one end of a wire to **2** on the TB1 terminal and to the negative (-) terminal on the fieldbus segment.

Connecting the optional ground wire

If you wish to provide the Foundation Fieldbus module with surge protection, there is a ground lug at TB2 on the module's carrier board, which is the middle card in the stack. One end of the ground wire should be attached to this lug nut, and the other end should be attached to the frame of the GC.

Figure 4-37: Carrier board showing ground lug at TB2



⚠ CAUTION!

The Foundation Fieldbus module is designed to be intrinsically safe; however, attaching a ground wire will nullify this feature.

Foundation Fieldbus jumper settings

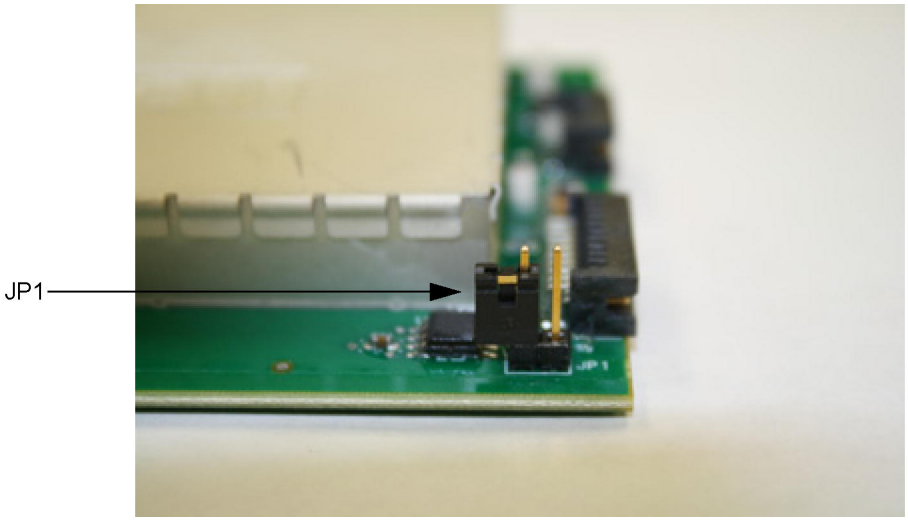
In order for the Foundation Fieldbus module to work correctly, you must set several jumpers that are spread across a number of circuit boards. The following table summarizes the jumper settings for the Foundation Fieldbus.

Board	Jumper	Set?
Preamplifier	JP1	No
Heater Solenoid Driver(s)	JP1	No
Base I/O	JP1	Yes
	JP2	No
	JP3	Yes (Pins 2 and 3)
CPU	S3	No
	S4	No

Board	Jumper	Set?
LOI	J1	Yes

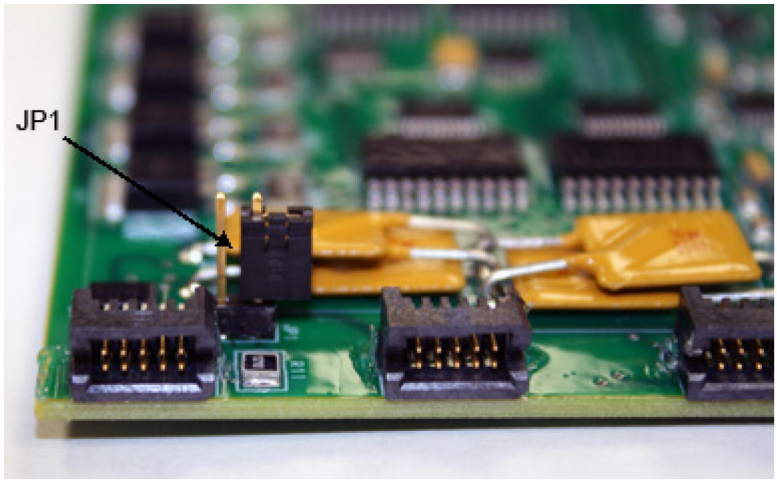
For more details, consult the following drawings:

Figure 4-38: Preamplifier board



JP1 on the preamplifier board should **not** be set. The preamplifier board is located in slot 1 of the card cage.

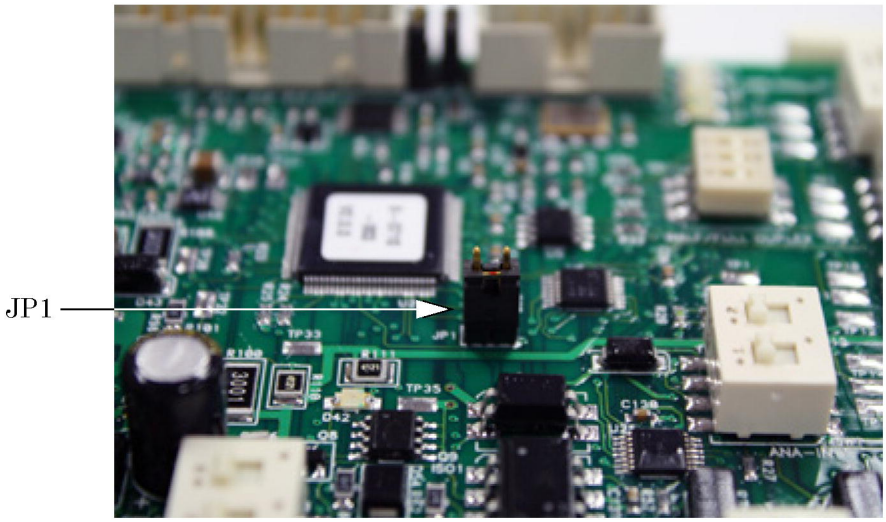
Figure 4-39: Heater/solenoid driver board



JP1 on the heater/solenoid driver board should **not** be set. The heater/solenoid driver board is located in slot 2 of the card cage. If there is an additional heater/solenoid driver board, it will be located in slot 4, and its JP1 jumper also should **not** be set.

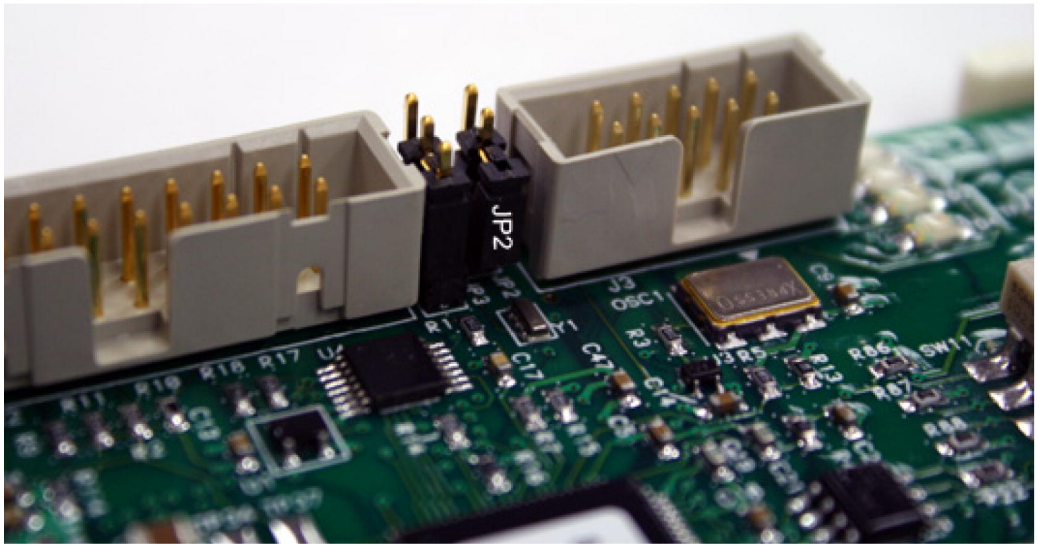
The Base I/O board, which is located in slot 3 of the card cage, has three jumpers that affect the performance of the Foundation Fieldbus.

Figure 4-40: JP1 on the Base I/O board



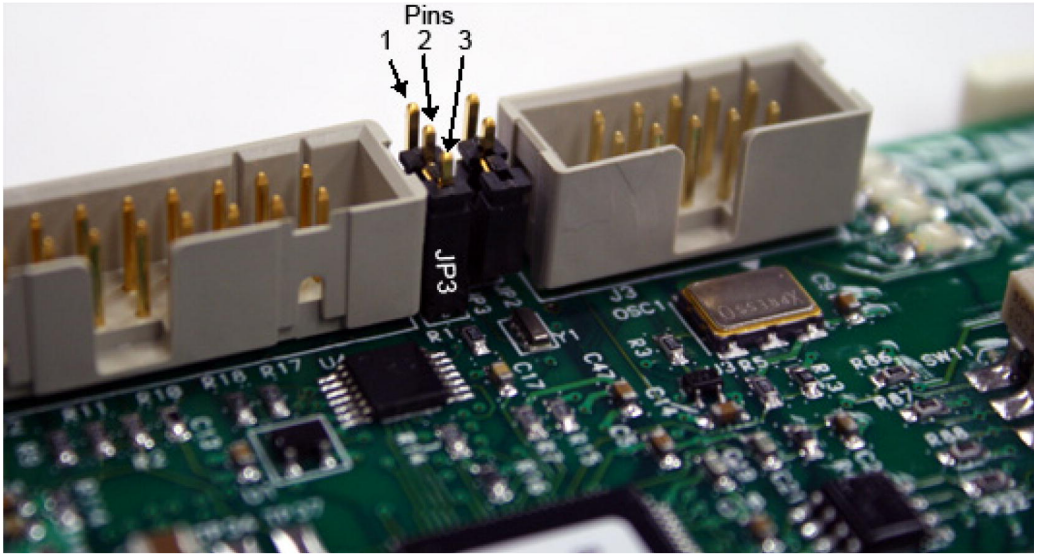
JP1 on the Base I/O board **should** be set.

Figure 4-41: JP2 on the Base I/O board



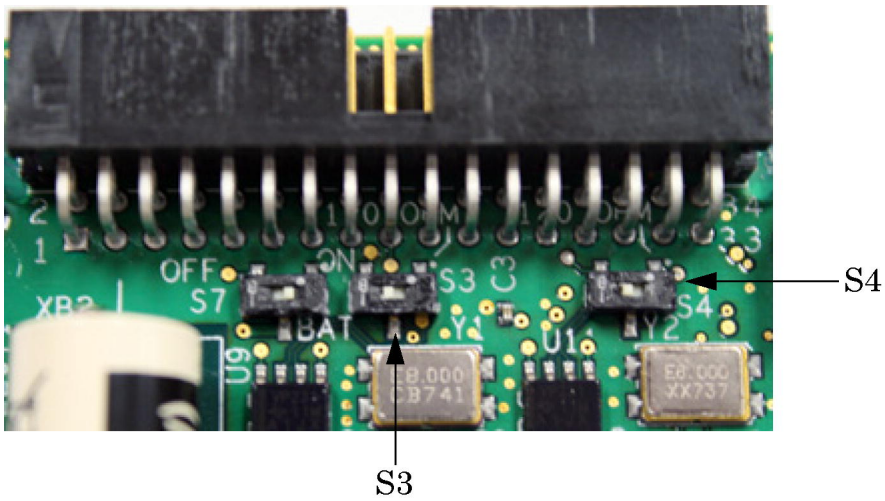
JP2 on the Base I/O board should **not** be set.

Figure 4-42: JP3 on the Base I/O board



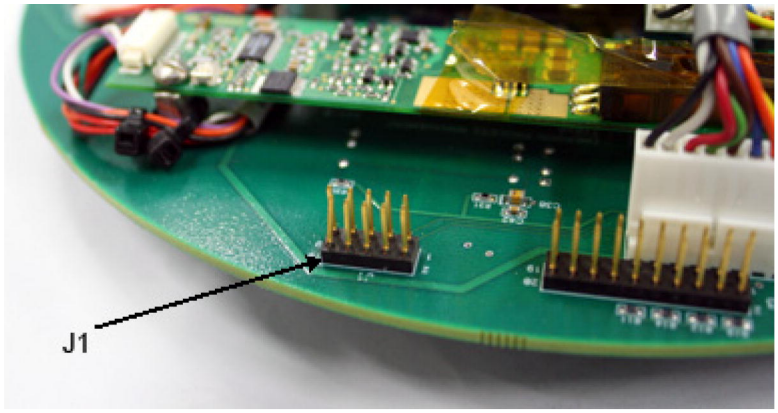
JP3 on the Base I/O board has three pins, and the jumper **should** be set on pins 2 and 3.

Figure 4-43: CPU board



S3 and S4 on the CPU board should be switched to **OFF**, which is the left-most position while holding the board right-side up.

Figure 4-44: LOI board



The J1 jumper is located on the back of the LOI, at the top while holding the LOI right-side up. It **should** be set.

4.4.16 Analog inputs and outputs

The analog outputs can be calibrated or adjusted with MON2020. However, these outputs should be measured with a calibrated digital meter upon initial installation at zero scale and full scale. Then the span can be set with MON2020 so that it represents values from zero to 100 percent of the user-defined units in use.

Nominally, calibration is made within a range of 4-20 milliamperes (mA) output from each analog channel. However, zero scale calibrations can be set with 0 mA output, and full scale calibration can be set with up to 22.5 mA output. If there is reason to suspect that the span on any particular channel might be off after a period of time and heavy use, then the analog output for that channel should be recalibrated.

Analog output adjustment

The initial analog output adjustments are set at the factory, before shipment, at standard values (4-20 mA). It may be necessary to check and/or adjust these values depending on output cabling/impedance. The adjustment may require two persons if the units are some distance apart. It requires a calibrated digital meter to check the zero and full scale values at the receiving end. The scale or span value can then be adjusted with MON2020.

It is possible to calibrate the analog outputs using different engineering units, volts and percentages.

4.4.17 Discrete digital inputs and outputs

For instructions on connecting digital inputs and outputs to the GC's field termination boards, see *Section 3.5.13* for more details.

4.4.18 Recommended spare parts

See *Appendix C* for the lists of recommended spare parts. The quantities listed in the tables represent the number of spares to cover most contingencies for up to five GCs or for more than 5 GCs or critical installations.

Emerson Process Management, however, offers service contracts that make maintaining an inventory of spare parts for the GC unnecessary. Details regarding service contracts can be obtained by contacting your Emerson Process Management representative.

4.4.19 Upgrading the embedded software

The Base Operating System performs functions similar to operating systems such as DOS or Windows® or Linux®. BOS provides the basic resources and interfaces to run the user's tasks. Unlike DOS or Windows® or Linux®, BOS is an embedded, real-time, multi-tasking, and preemptive operating system. There is no direct user-level interface to it. If a BOS upgrade is required for your system, refer to the MON2020 users manual for additional information.

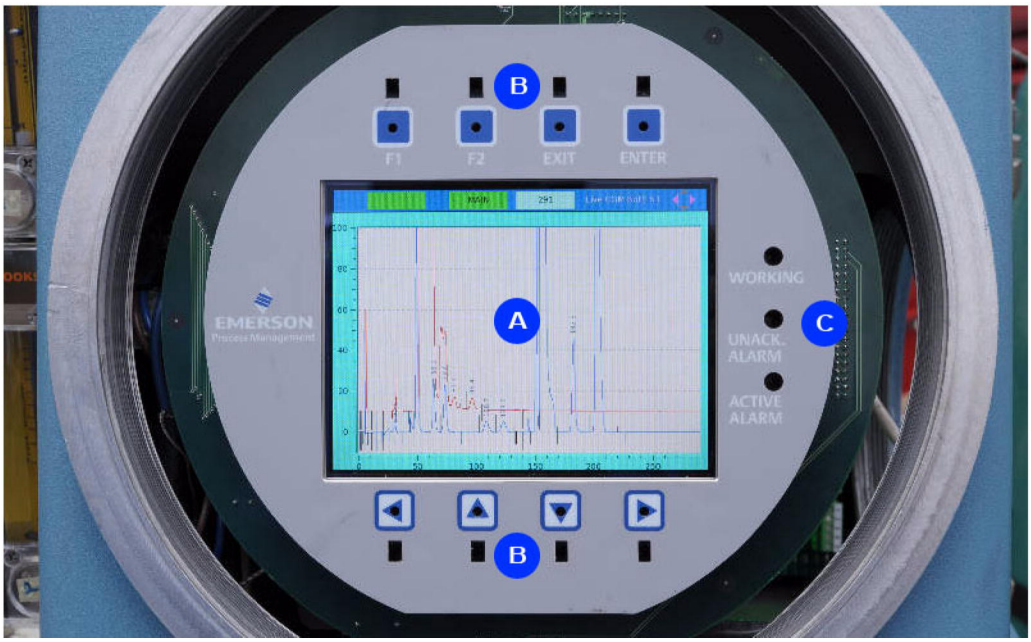
The GC's applications use the tools provided by BOS to perform the desired gas chromatograph functions for the user. There are different applications to facilitate different gas chromatographic needs. To load a new application or to upgrade an existing application, refer to the MON2020 users manual for details.

Appendix A
Local operator interface

A.1 Interface components for displaying and entering data

The local operator interface (LOI) has multiple components that you can use to interact with the unit.

Figure A-1: The LOI



A. LCD screen
B. Keypads
C. LED indicators

A.1.1 Light emitting diode indicators

There are three light emitting diode (LED) status indicators on the LOI that show the overall status of the gas chromatograph. These LEDs are positioned to the right of the display screen. Each LED, when lit, indicates a specific condition.

	The GC is currently running an analysis.
	The GC has at least one unacknowledged alarm.
	The GC has an out-of-tolerance or alarm condition that requires an operator action.

A.1.2 LCD screen

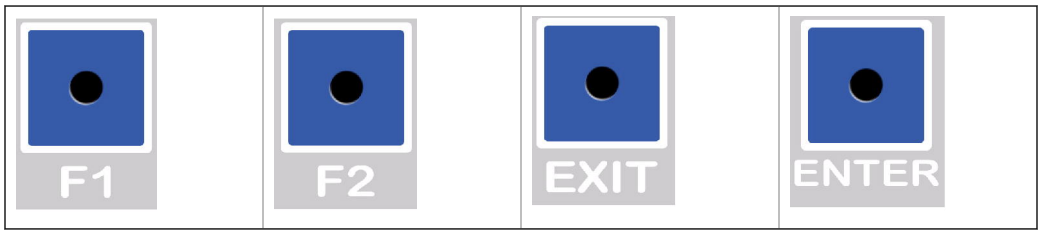
The LCD screen measures 111.4mm by 83.5 mm and is capable of 640 by 4800 VGA pixel resolution, supporting both text and full graphics. The backlighting, boost, and brightness are all under software control. The boost and brightness levels are user-adjustable.

A.1.3 Keypad

The keypad consists of eight infrared keys. See *Section A.2.3* for more information.

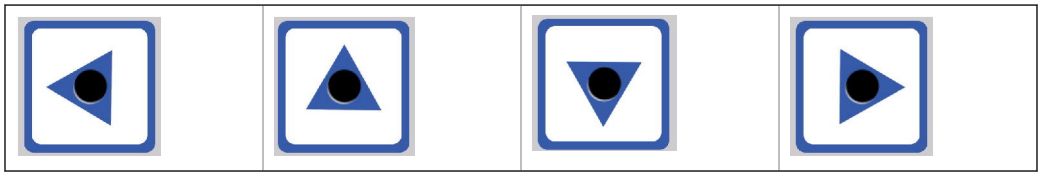
The command keys

The four keys located above the LCD screen are “command” keys.



The arrow keys

The four keys below the LCD screen are arrow keys that allow you to navigate within the screen by scrolling or moving the cursor from field to field. These keys function in the same way as a computer keyboard’s arrow keys.



Pressing a key

A key is “pressed” by placing a finger on the glass over the associated key hole and then removing the finger. Holding a finger over the key hole will cause that key to repeat until the finger is removed.

A.2 Using the local operator interface

A.2.1 Start up

Upon starting the GC, the LOI automatically runs in Status Display mode, in which it scrolls through a predefined series of screens, displaying each screen for approximately 30 seconds.

Status	Displays information about the operational state of the analyzer, including a scrolling list of up to 25 user-selectable parameters that can be defined or modified using the MON 2000 application. **Note** There may be more than one *Status* screen, depending upon the GC’s mode of operation.
Live Chromato-gram	Displays the chromatogram for the current analysis in real time. **Note** There may be more than one *Live Chromatogram* screen, depending upon the GC’s mode of operation. **Note** This screen does not display if the GC is not currently analyzing a sample.
Active Alarms	Lists active alarms, if any.
Heater	Displays information about the PID temperature control loops.
Valves	Displays the settings and states of the stream and analyzer valves.

In Status Display mode, you can manually scroll to the next screen using the RIGHT arrow key, or to the previous screen using the LEFT arrow key. You can pause automatic scrolling at any time by pressing the EXIT key, and you can resume automatic scrolling by pressing either the LEFT or the RIGHT arrow key. Automatic scrolling resumes after ten minutes of keypad inactivity.

Pressing F1 when “MOVE” is displayed in the green box below it takes the focus inside the screen so that you can navigate through the controls of the screen using the LEFT, RIGHT, UP and DOWN keys. Pressing EXIT returns the focus to the top level—that is, outside of the screen. Pressing LEFT or RIGHT at the top level resumes automatic scrolling in addition to moving to the previous or next screen.

At any time while in Status Display mode, you can press ENTER or F2 to enter the Main Menu. Use the EXIT key to leave the Main Menu and return the LOI to Status Display mode. If you log onto the GC from the Main Menu to perform operations or edit data, when you exit the menu you will automatically be logged off the LOI.

A.2.2 Navigating menus

At any time while in Status Display mode, you can press ENTER or F2 to enter the Main Menu.

Use the UP and DOWN arrow keys to navigate between fields or controls within each drop down menu. Pressing the DOWN arrow key while focus is on the last field of a drop down menu moves the focus to the first field on a screen. Alternatively, pressing the UP arrow key while focus is on the first field of the drop down menu causes the focus to move to the last field.

Use the ENTER key from the *Main Menu* to activate submenus and individual menu items.

Press EXIT to leave the Main Menu and return the LOI to Status Display mode, if no menu is dropped down. If a menu is dropped down then pressing EXIT closes that menu.

If you log onto the GC from the Main Menu to perform operations or edit data, when you exit the menu you will automatically be logged off the LOI.

The *Main Menu* allows you access to all of the available LOI screens.; however, you must be logged on to make changes. If you are not logged on and you attempt to edit a field, the *Login* screen will appear first.

After a period of fifteen minutes of inactivity, you will be automatically logged off.

A.2.3 Navigating the screen

LOI screens have several functions. They can display data for review; they can display data for editing; and they can be used to initiate activities.

Within any given screen, the function of the ENTER key depends upon the context. It can be used to validate and save changes or to initiate an action.

If a validation error is found after pressing ENTER, an “Invalid Entry” message displays. Press ENTER again to close the message and then re-enter your data.

Pressing EXIT closes the currently open screen. If you have made changes to the screen, the LOI will display a confirmation message asking if you want to save your changes. Use the arrow keys to select the appropriate button and press ENTER. If you select **No**, your changes will be discarded and the Main Menu will display; if you select **Cancel**, the message window will close and you will be returned to the current screen; if you select **Yes**, your changes will be validated and saved and then you will be returned to the Main Menu.

The F1 and F2 keys are context dependent. A one-word description of the function of each of these keys displays in a green prompt box directly under the key in the title bar of the top-level full-sized screen.

In some cases, F1 acts as a toggle between scrolling either a line or a page at a time. When this is true, the currently selected option (LN or PG) displays with a green background and black text, while the non-selected option displays with a black background and green text. The table below lists the possible functions of the F1 key:

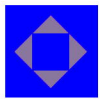
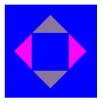
MOVE	Press F1 to move the cursor around within the boundary of the screen.
EDIT	Press F1 to open the edit dialog for the field that contains the cursor. The type of dialog that displays depends upon the type of field to be edited. See *Section A.2.4* and *Section A.2.5* for more information.
SELECT	Press F1 to select the field to be edited.
BACKSP	Press F1 to delete the character to the left of the cursor.
LN PG	Press F1 to scroll line by line within a screen.
LN PG	Press F1 to scroll page by page within a screen.

Note

Throughout this appendix, when referring to the F1 key, the key's current valid function will be indicated in parenthesis—for instance, F1 (MOVE) or F1 (SELECT).

The F2 key, when "MAIN" is displayed in the prompt box, closes all screens and goes back to the Main Menu.

There is a navigation icon in the upper right corner of the screen that indicates which navigation keys are active for the currently displayed screen.

			
None	Left	Up	Right
			
Down	Left/Right	Up/Down	All

When you press a key, a green square will flash in the upper left corner if the key is valid; if the key is not valid, a red box will flash in the upper left corder.

A.2.4 Editing numeric fields

When the focus is on an editable field, pressing F1 (EDIT) will display the Edit Dialog containing the field's original text.

Use the LEFT and RIGHT arrow keys to move through the individual characters within the field and to select the character to be changed. Use the UP and DOWN arrows keys to select the value of each digit. The possible values are 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, "-" (minus), "." (period), and "E".

The "-" value is available for signed numbers.

The "." and the "E" values are available for floating-point numbers, except for retention times and timed event values.

The following rules apply when entering a floating-point value:

- More than one "E" is not allowed.
- More than one "." is not allowed.
- If the previous position is an "E" then a "." and a 0 is not allowed.
- A "-" is allowed only after an "E" or at the first position only.
- If the previous position is "." then an "E" is not allowed.
- If the first character is a "-" and the current index is 1 then a "." is not allowed.
- If the previous position is a "-" then a 0 is not allowed.
- If the next character is an "E" then a "." is not allowed at the previous location.

The DOWN arrow key moves backward in the list from the current value of the selected digit.

The UP arrow key moves forward in the list from the current value of the selected digit.

The F1 (BACKSP) key acts as a backspace and deletes the digit immediately to the left of the current position.

The ENTER key validates and saves the entry, then closes the Edit Dialog. The new entry will display in the field.

The EXIT key cancels any changes that were entered and closes the Edit Dialog, restoring the previous value to the field.

A.2.5 Editing non-numeric fields

The function of the keys when editing non-numeric data is context-dependant.

Editing alphanumeric fields

Alphanumeric fields take numbers (0 - 9) and letters (a - z, A - Z).

Selecting check boxes

Press F1 (SELECT) to select or clear a check box.

Figure A-2: Selecting a check box

Clicking buttons

Press F1 (EXECUTE) to click the button and execute the command.

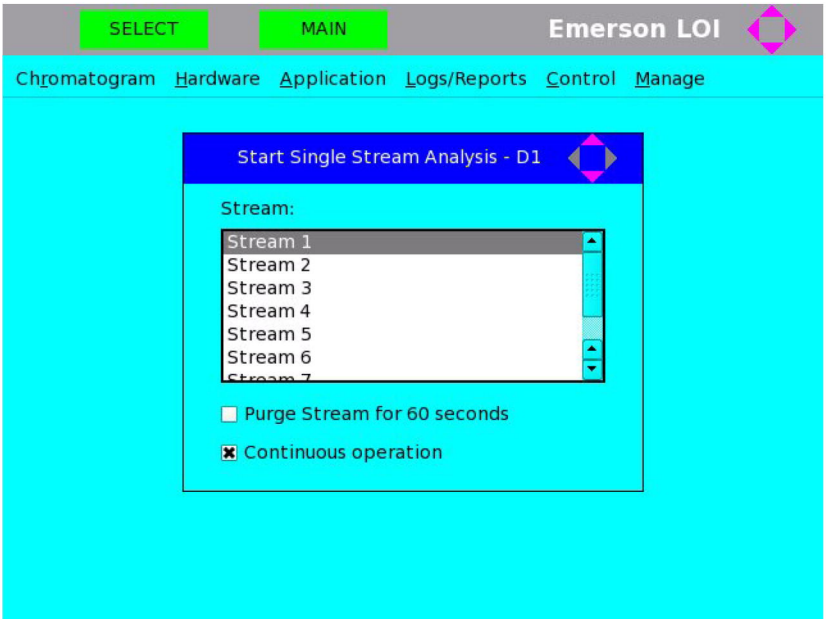
Selecting radio buttons

1. Press F1 (SELECT) to select a group of radio buttons.
2. Use the UP and DOWN arrow keys to move through the various radio buttons within the group.
3. Press ENTER to accept the current selection or press EXIT to abort any changes and to restore the previous selection.

Selecting an item from a list box

1. Press F1 (SELECT) while focused on the list box to switch it to edit mode.

Figure A-3: Selecting a list box



2. Use the UP and DOWN arrows keys to move between the values within the list box.
3. Press ENTER to accept the current selection or press EXIT to abort the new selection and the list box will revert to the previous selection.

Selecting an item from a combo box

1. Press F1 (SELECT) while focused on the combo field and a Combo Dialog opens and displays a list of available selections.

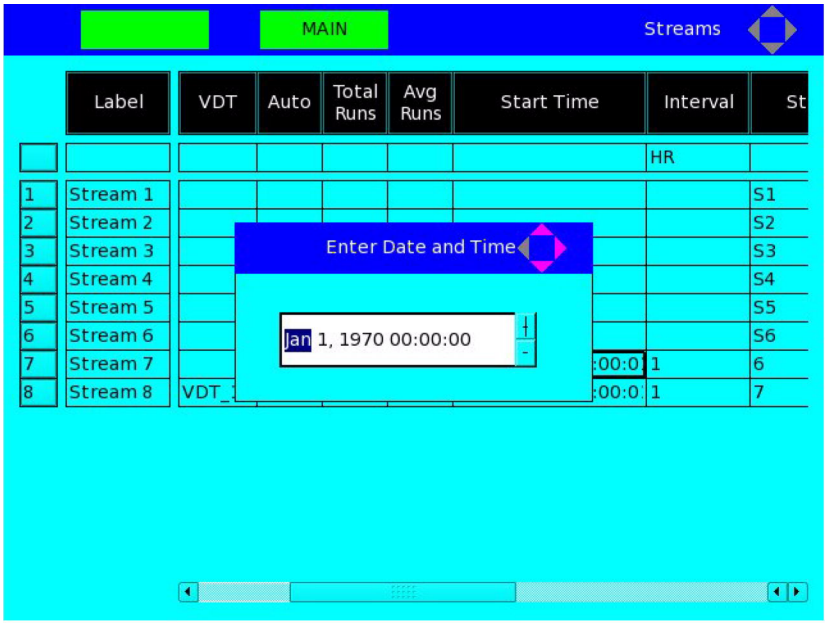
Figure A-4: Selecting a combo box

2. Use the UP and DOWN arrow keys to move between the selections.
3. Press ENTER to select the desired value or press EXIT to restore the combo box's initial value.

Entering a date and time

1. Press F1 (SELECT) while focused on the Date and Time field and the Enter the Date and Time dialog displays. By default, the focus is set on the "Month" unit.

Figure A-5: Entering a date and time



2. Use the UP and DOWN arrow keys to change the value of the unit—that is, to go from January to February, or from 1 to 2.
3. Use the LEFT and RIGHT arrow keys to change units—that is, to go from months to years or hours to minutes.

Note

If the focus is on the left most section, the LEFT arrow key will be inactive and similarly if the focus is on the right most section, the RIGHT arrow key will be inactive.

4. Press ENTER to save the change or press EXIT to discard the change and restore the original value.

Setting the time

1. Press F1 (SELECT) while focused on the *Time* field and the *Enter the Time* dialog displays. By default, the focus is set on the “Hour” unit.
2. Use the UP and DOWN arrow keys to change the value of the unit.
3. Use the LEFT and RIGHT arrow keys to change units—to go from hours to minutes, for example.

Note

If the focus is on the left most section, the LEFT arrow key will be inactive and similarly if the focus is on the right most section, the RIGHT arrow key will be inactive.

4. Press ENTER to save the change or press EXIT to discard the change and restore the original value.

A.3 Screen navigation and interaction tutorial

This tutorial, which guides you through the procedure for editing data on a screen, will incorporate all of the preceding information to demonstrate the typical method of navigating and interacting with the LOI. You will learn how to perform the following actions:

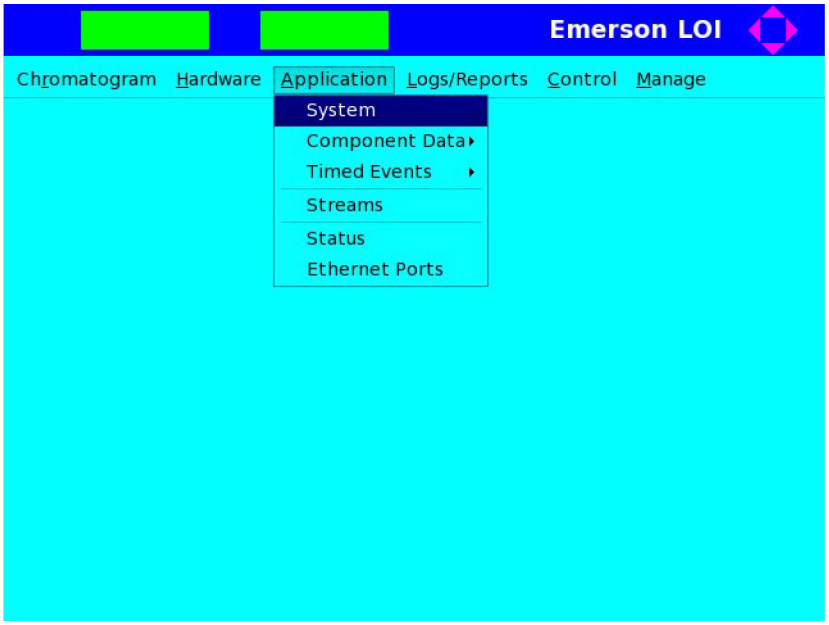
- Opening and closing screens
- Navigating through tables
- Selecting fields for editing
- Saving data

1. From the *Main Menu*, click the RIGHT arrow key enough times to navigate to the *Application* menu. The *System* submenu, since it is the first item in the list, is already selected.

Note

In this instance, the term “click” means to tap the glass on the spot directly above the arrow’s keyhole.

Figure A-6: Navigate to the Application menu



Note

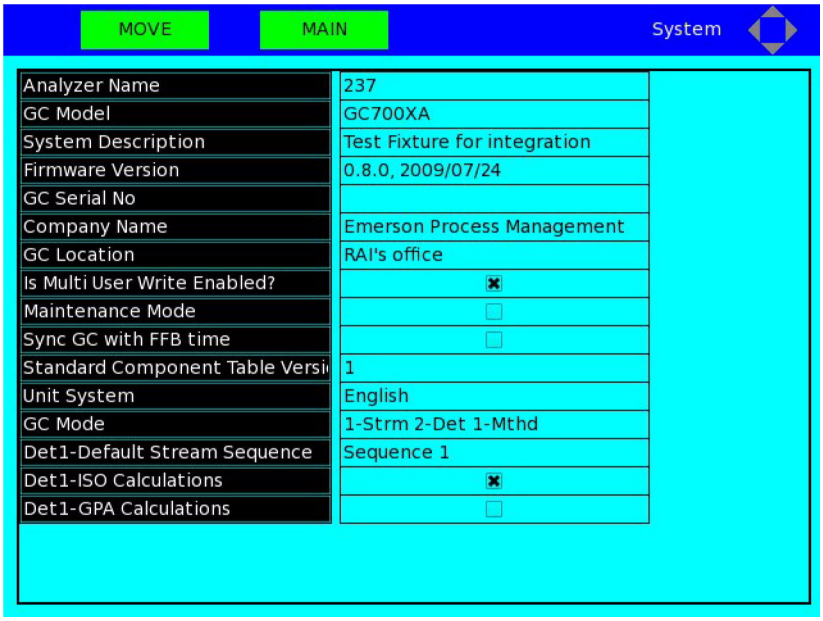
Notice the navigation icon in the upper right corner, which indicates that all four arrow keys are active. This allows you to navigate to all of the menu items and sub menu items.

Note

Notice that the green prompt boxes are empty. This means that the F1 and F2 keys are inactive from the *Main Menu*.

2. Click ENTER. The *System* screen displays.

Figure A-7: The System screen

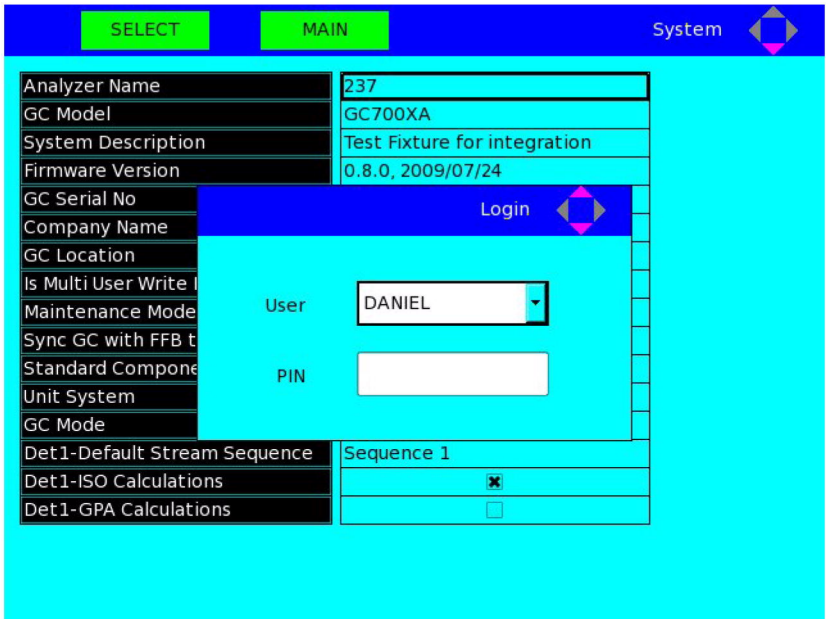


Note

Notice the navigation icon in the upper right corner, which indicates that no arrow keys are active.

3. Notice that the green prompt boxes now display function keywords. “MAIN” means that if you click the F2 key, the LOI will close the current screen and return you to the *Main Menu*. “MOVE” means that if you click the F1 key, you will be allow to use the arrow keys to navigate within the *System* screen. Click F1. The LOI switches to Edit mode.
4. Notice that the navigation icon in the upper right corner of the screen indicates that the down arrow is active. Click the down arrow once. Now the navigation icon indicates that both the up and down arrows are active. Click the up arrow once to return to the previous cell. The navigation icon again indicates that only the down arrow is active.
5. Notice that the green F1 prompt box reads “EDIT”. Click F1.
6. You must be logged in to the GC to make a change to any screen. If you try to edit a field before logging in—as you just did—the LOI displays the *Login* dialog to prompt you to log in.

Figure A-8: You must log in to the GC before editing a screen



Note

Notice that there is also a navigation icon on the *Login* dialog.

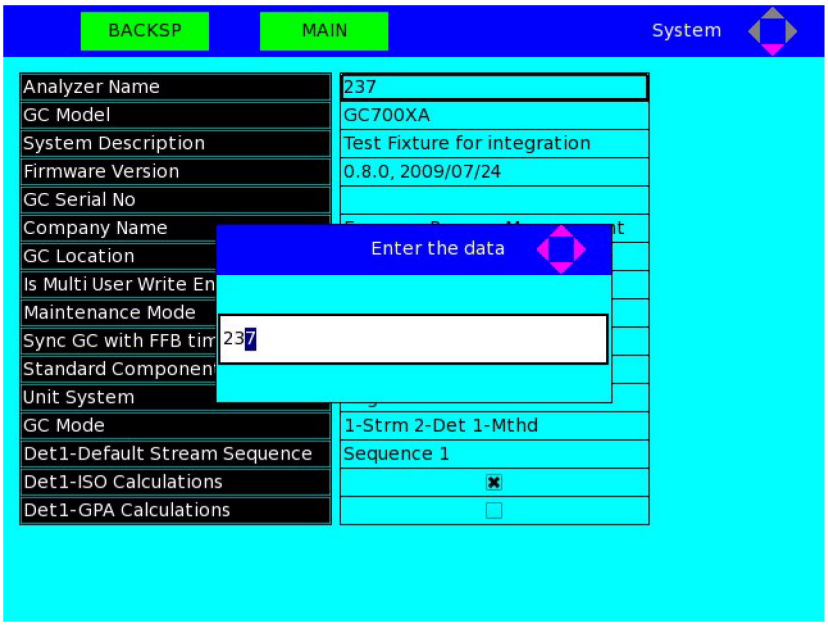
7. Click F1 (SELECT) and navigate up or down the list to highlight your user name.

Note

For the remainder of this tutorial, when referring to the F1 key, the key's current valid function will be indicated in parenthesis—for instance, F1 (MOVE) or F1 (SELECT).

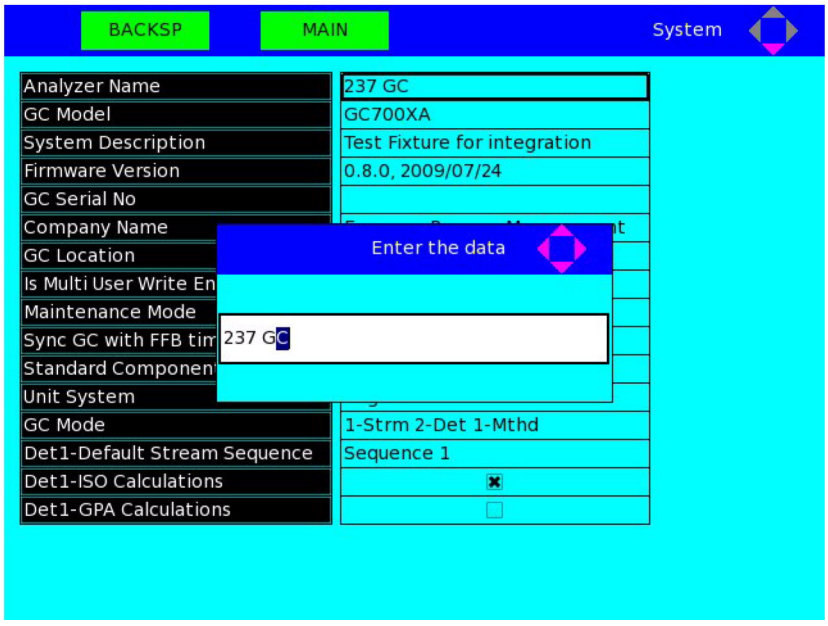
8. Click ENTER.
9. Navigate to the *Pin* field, press F1 (EDIT), and enter your password.
10. Click ENTER twice.
11. Now that your are logged in, you can edit the fields on the screen. Click F1 (EDIT). The *Enter the data* dialog displays.

Figure A-9: The Enter the data dialog allows you to edit the selected field



12. To delete a character, press F1 (BACKSP). To enter new data, use the UP and DOWN arrows to cycle through the available characters, and use the RIGHT arrow key to add a new character to the field.
13. When you are finished entering data, press ENTER to validate and save the new information. To discard the information, press EXIT.

Figure A-10: The field now holds new data

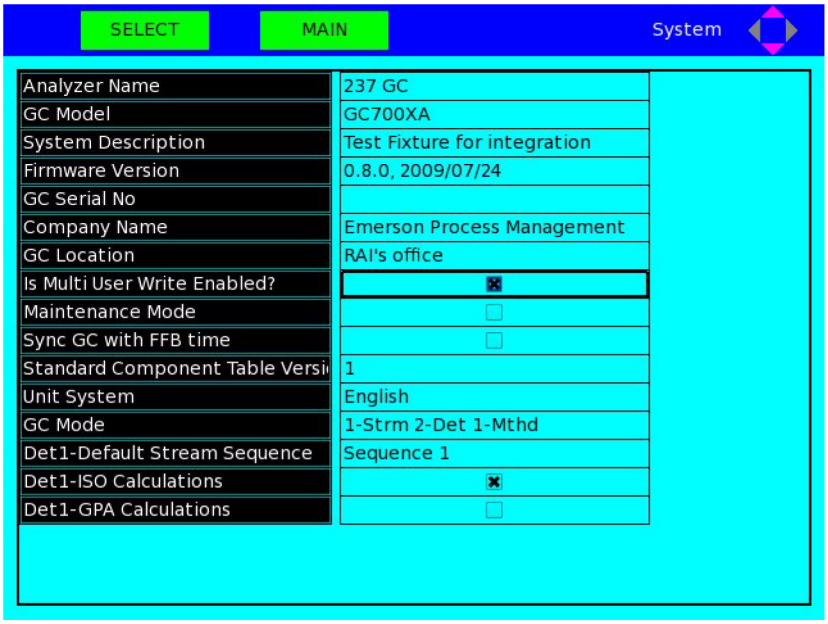


Note

If a validation error is found after pressing ENTER, an “Invalid Entry” message displays. Press ENTER to close the message and then re-enter your data.

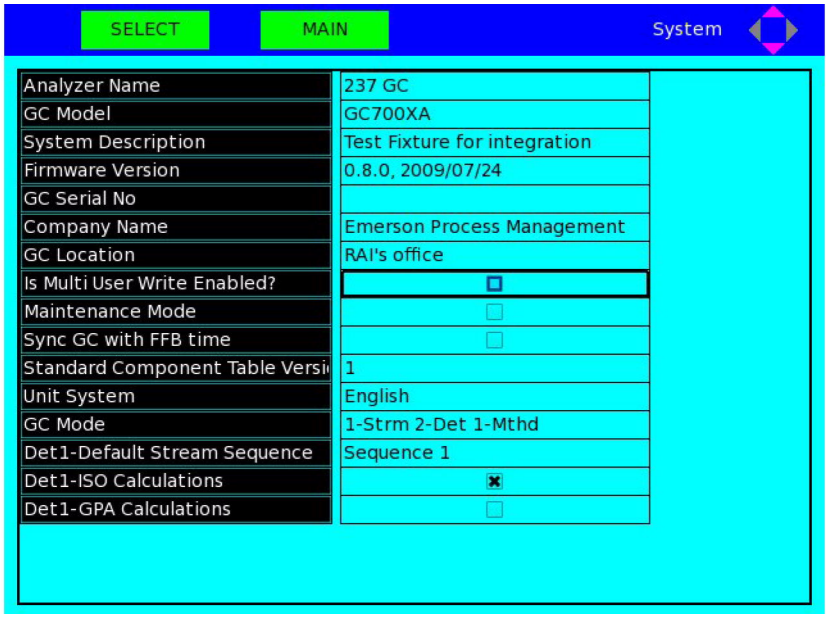
14. Use the down arrow to move to the *Is Multi User Write Enabled?* check box.

Figure A-11: The Is Multi User Write Enabled? check box



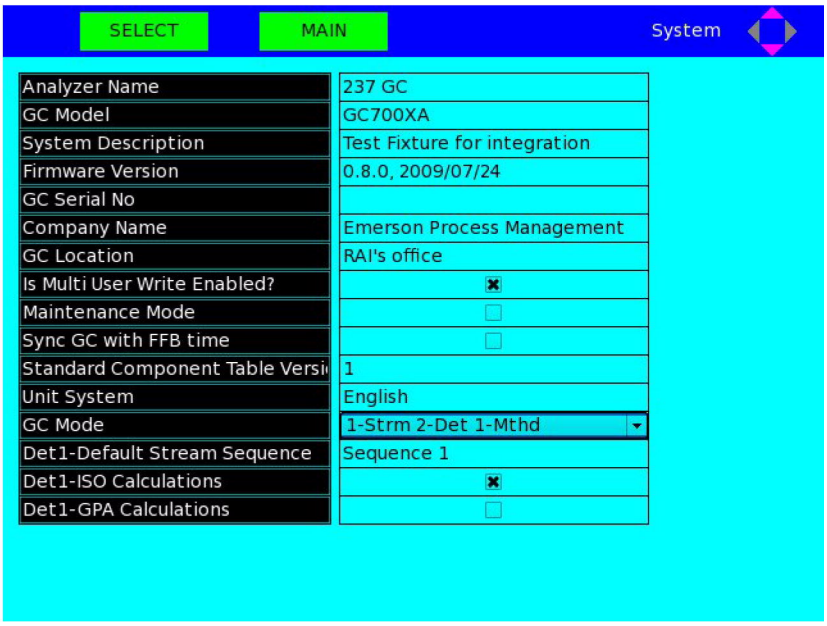
15. Press F1 (SELECT). This clears the check box.

Figure A-12: The Is Multi User Write Enabled? check box, no longer checked



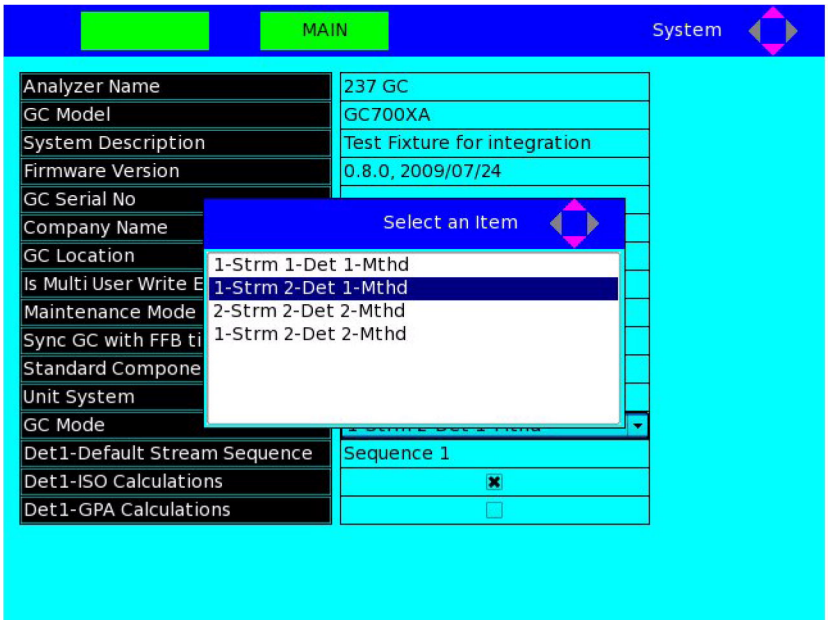
16. Click F1 (SELECT) again to re-select the check box.
17. Navigate to the GC Mode field.

Figure A-13: The GC Mode field



18. Press F1 (SELECT). The *Select an Item* combo box displays.

Figure A-14: The Select an Item combo box



19. Use the DOWN arrow to scroll down to the last item in the combo box. Press ENTER.
20. Press ENTER a second time to save all the changes that were made to the table.

Note
If you neglect to press ENTER at this point, all of your changes will be lost.

21. Press F2 (MAIN) to return to the *Main Menu*.

This concludes the tutorial.

A.4 The LOI screens

The Main Menu has six top-level submenus: Chromatogram, Hardware, Applications, Control, Logs/Reports, and Manage.

The table below lists the submenus and commands that are available from the Main Menu.

Submenu	Command	Subcommands	Reference
Chromato-gram			
	View		
		Chromatogram Settings	*Figure A-16*
		Live Chromatogram View Screen (Status Mode)	*Figure A-17*

Submenu	Command	Subcommands	Reference
		Live Chromatogram Screen (Advanced Mode)	*Figure A-18*
		Archived Chromatogram Screen (Advanced Mode)	*Figure A-19*
		Live & Archived Chromatogram Viewer Options Menu	*Figure A-20*
		CGM Scaling Screen	*Figure A-21*
		Chromatogram CDT Table	*Figure A-22*
		Chromatogram TEV Table	*Figure A-23*
		Chromatogram Raw Data Table	*Figure A-24*
Hardware			
	Heaters		*Figure A-25*
	Valves		*Figure A-27*
	Electronic Pressure Ctrl		*Figure A-28*
	Detectors		*Figure A-29*
	Discrete Inputs		*Figure A-30*
	Discrete Outputs		*Figure A-31*
	Analog Inputs		*Figure A-32*
	Analog Outputs		*Figure A-33*
	Installed Hardware		*Figure A-34*
Application			
	System		*Figure A-36*
	Component Data		*Figure A-37*
		CDT 1	
		CDT 2	
		CDT 3	
		CDT 4	
	Timed Events		*Figure A-38*
		TEV 1	
		TEV 2	
		TEV 3	
		TEV 4	
	Streams		*Figure A-42*
	Status		*Figure A-43*
		DET1	
		DET2	
	Ethernet Ports		*Figure A-44*

Submenu	Command	Subcommands	Reference
Logs/Reports			
	Maintenance Log		*Figure A-46*
	Event Log		*Figure A-47*
	Alarm Log		*Figure A-48*
	Unack Alarms		*Figure A-49*
	Active Alarms		*Figure A-50*
	Report Display		*Figure A-51*
Control			
	Auto Sequence		*Figure A-53*
	Single Stream		*Figure A-54*
	Halt		*Figure A-55*
	Calibration		*Figure A-56*
	Validation		*Figure A-57*
	Stop Now		*Figure A-58*
Manage			
	LOI Settings		*Figure A-60*
	Change PIN		*Figure A-61*
	Diagnostics		*Figure A-62*
	Log out		no screen

Refer to the *MON2020 Software for Gas Chromatographs User Manual* for detailed information regarding the commands listed in the table above.

A.4.1 The Chromatogram menu

The *Chromatogram* menu enables you to view live and archived chromatograms and their associated CDT and TEV tables, as well as to edit the display properties if the chromatogram screens.

Refer to the “Using the chromatograph functions” section of the *MON2020 Software for Gas Chromatographs User Manual* for detailed information regarding the Chromatogram menu screens.

Figure A-15: The Chromatogram menu

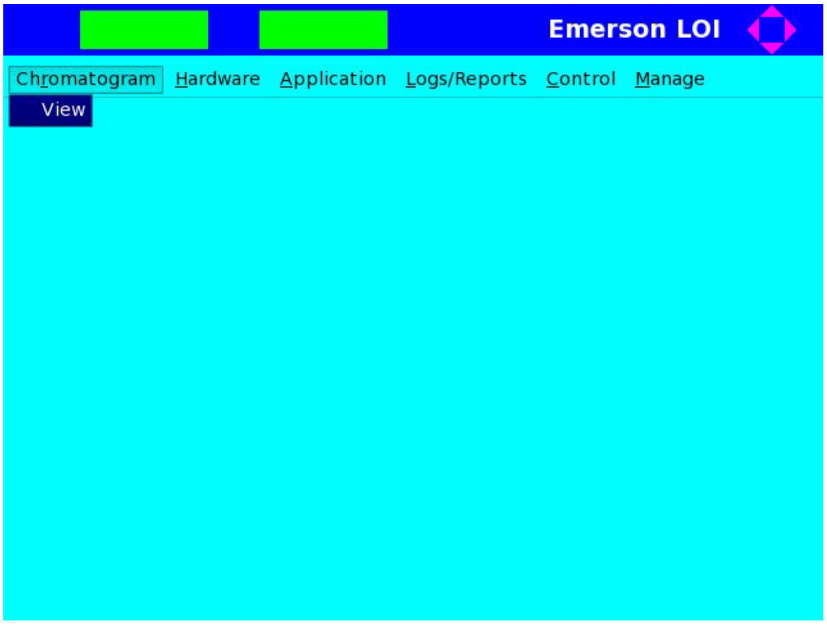


Figure A-16: The Chromatogram Settings screen

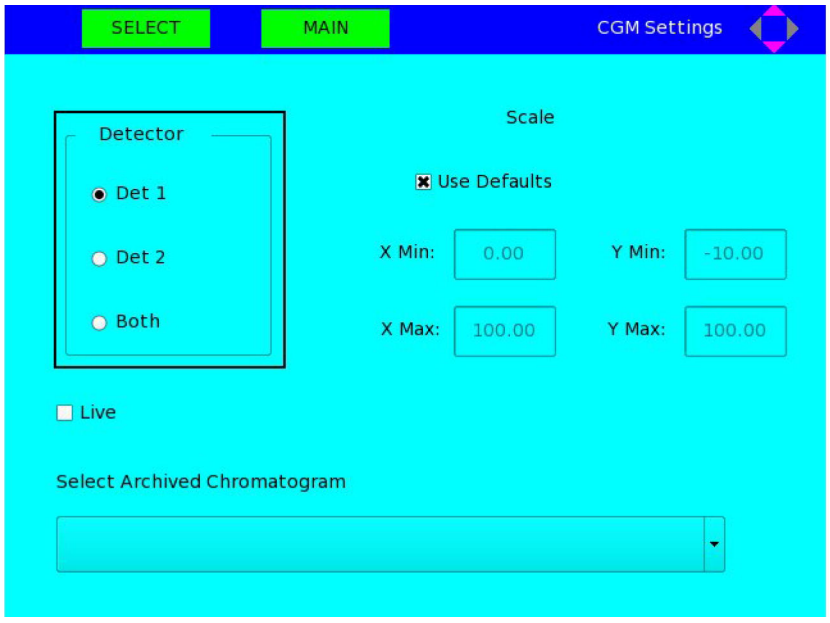
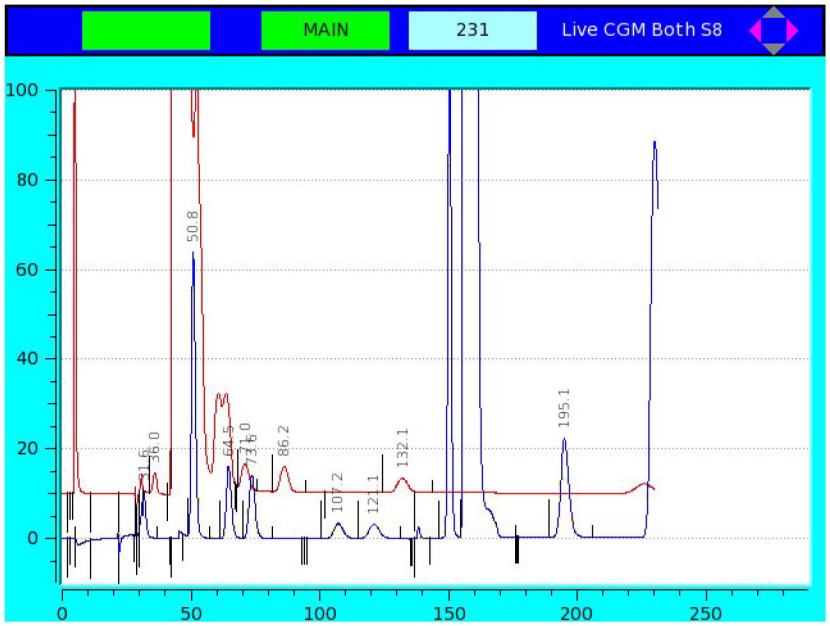


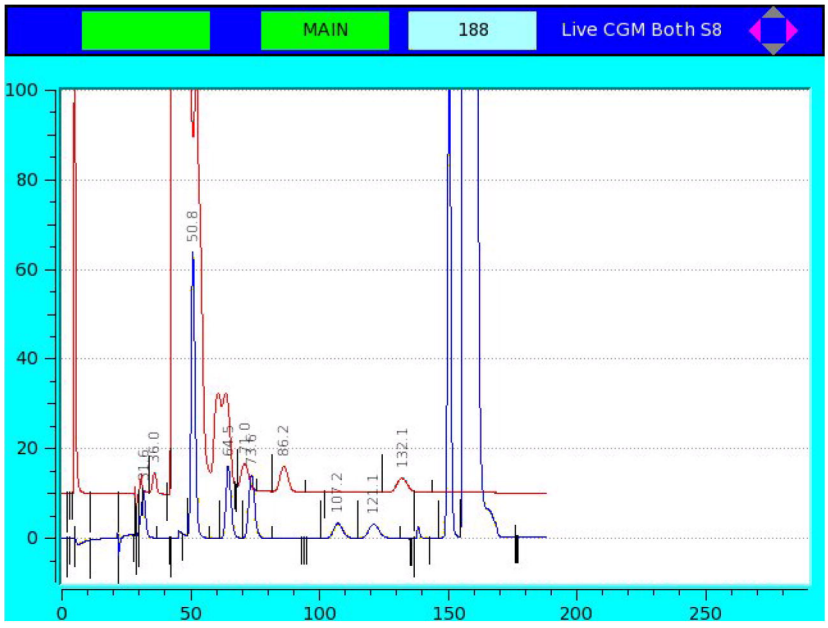
Figure A-17: The Live Chromatogram View (Status Mode) screen



Note

The blue box displays the current analysis time.

Figure A-18: The Live Chromatogram View (Advanced Mode) screen



Note

The blue box displays the current analysis time.

Figure A-19: The Archived Chromatogram (Advanced Mode) screen

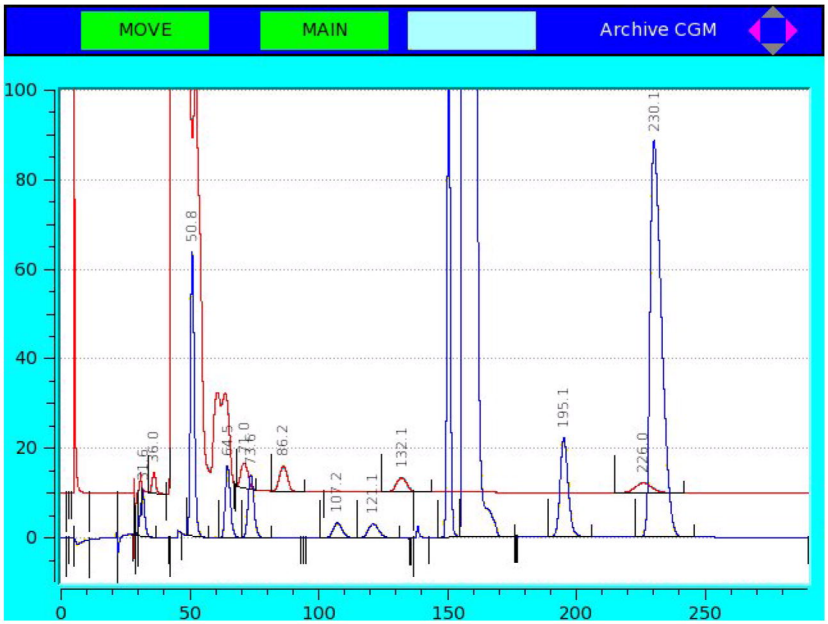
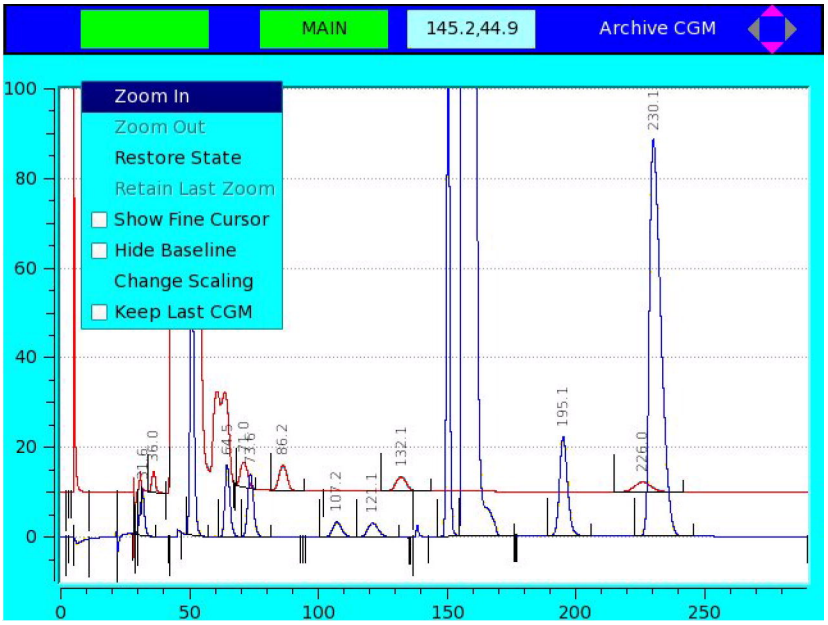


Figure A-20: The Live & Archived Chromatogram Viewer Options screen



Note

The blue box displays the cursor's x- (analysis time) and y- (amplitude) coordinates.

Figure A-21: The CGM Scaling screen

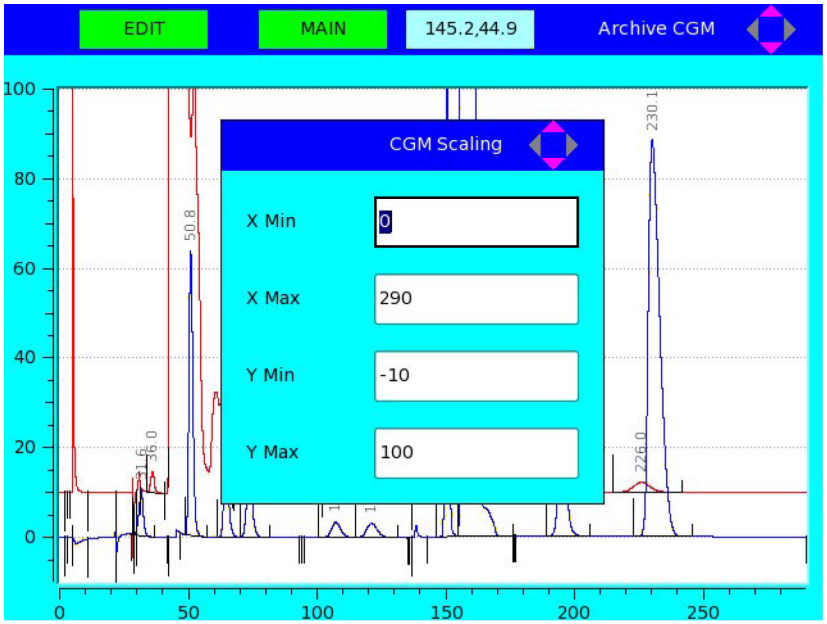
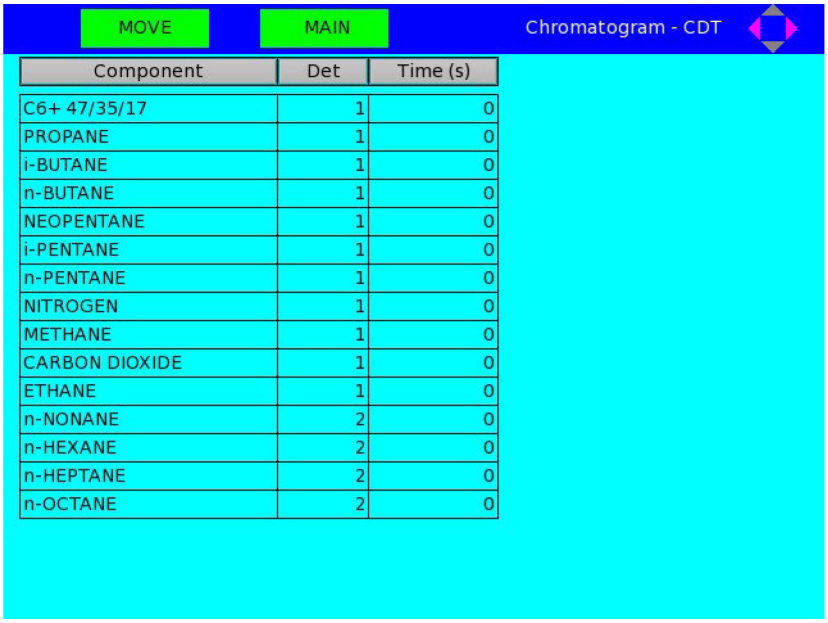
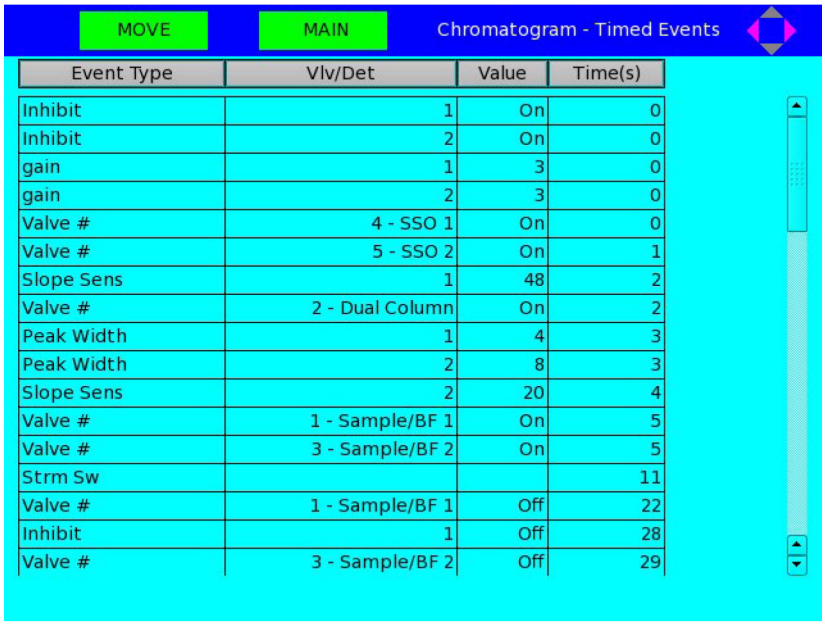


Figure A-22: The Chromatogram CDT Table screen



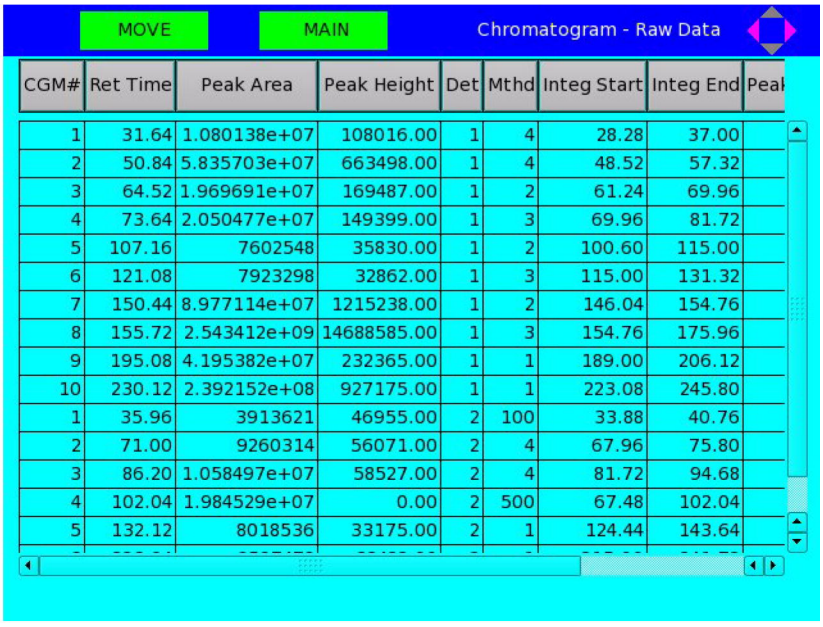
Component	Det	Time (s)
C6+ 47/35/17	1	0
PROPANE	1	0
i-BUTANE	1	0
n-BUTANE	1	0
NEOPENTANE	1	0
i-PENTANE	1	0
n-PENTANE	1	0
NITROGEN	1	0
METHANE	1	0
CARBON DIOXIDE	1	0
ETHANE	1	0
n-NONANE	2	0
n-HEXANE	2	0
n-HEPTANE	2	0
n-OCTANE	2	0

Figure A-23: The Chromatogram TEV Table screen



Event Type	Vlv/Det	Value	Time(s)
Inhibit	1	On	0
Inhibit	2	On	0
gain	1	3	0
gain	2	3	0
Valve #	4 - SSO 1	On	0
Valve #	5 - SSO 2	On	1
Slope Sens	1	48	2
Valve #	2 - Dual Column	On	2
Peak Width	1	4	3
Peak Width	2	8	3
Slope Sens	2	20	4
Valve #	1 - Sample/BF 1	On	5
Valve #	3 - Sample/BF 2	On	5
Strm Sw			11
Valve #	1 - Sample/BF 1	Off	22
Inhibit	1	Off	28
Valve #	3 - Sample/BF 2	Off	29

Figure A-24: The Chromatogram Raw Data Table screen



CGM#	Ret Time	Peak Area	Peak Height	Det	Mthd	Integ Start	Integ End	Peal
1	31.64	1.080138e+07	108016.00	1	4	28.28	37.00	
2	50.84	5.835703e+07	663498.00	1	4	48.52	57.32	
3	64.52	1.969691e+07	169487.00	1	2	61.24	69.96	
4	73.64	2.050477e+07	149399.00	1	3	69.96	81.72	
5	107.16	7602548	35830.00	1	2	100.60	115.00	
6	121.08	7923298	32862.00	1	3	115.00	131.32	
7	150.44	8.977114e+07	1215238.00	1	2	146.04	154.76	
8	155.72	2.543412e+09	14688585.00	1	3	154.76	175.96	
9	195.08	4.195382e+07	232365.00	1	1	189.00	206.12	
10	230.12	2.392152e+08	927175.00	1	1	223.08	245.80	
1	35.96	3913621	46955.00	2	100	33.88	40.76	
2	71.00	9260314	56071.00	2	4	67.96	75.80	
3	86.20	1.058497e+07	58527.00	2	4	81.72	94.68	
4	102.04	1.984529e+07	0.00	2	500	67.48	102.04	
5	132.12	8018536	33175.00	2	1	124.44	143.64	

A.4.2 The Hardware menu

The *Hardware* menu enables you to view and manage the GC's hardware components.

Refer to the “Using the hardware functions” section of the *MON2020 Software for Gas Chromatographs User Manual* for detailed information regarding the *Hardware* menu screens.

Figure A-25: The Hardware menu

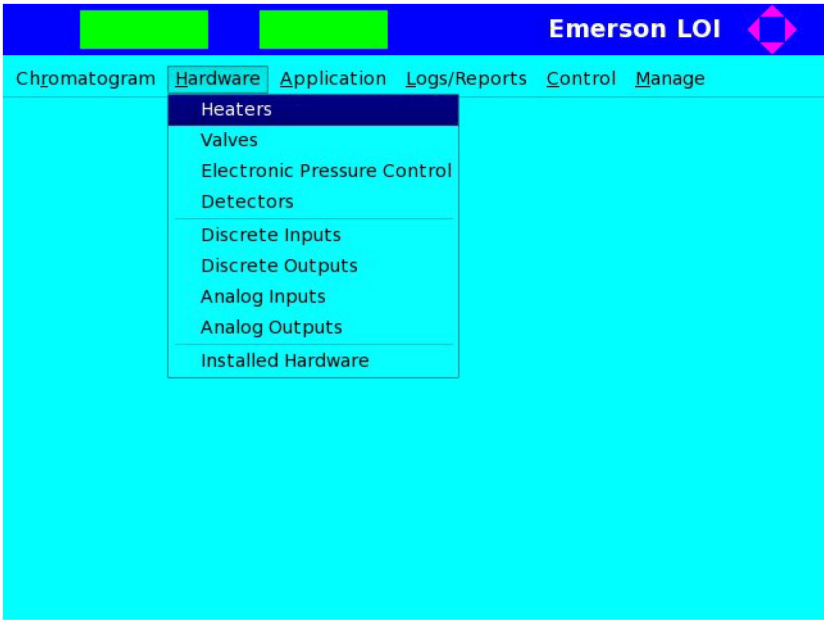


Figure A-26: The Heaters screen

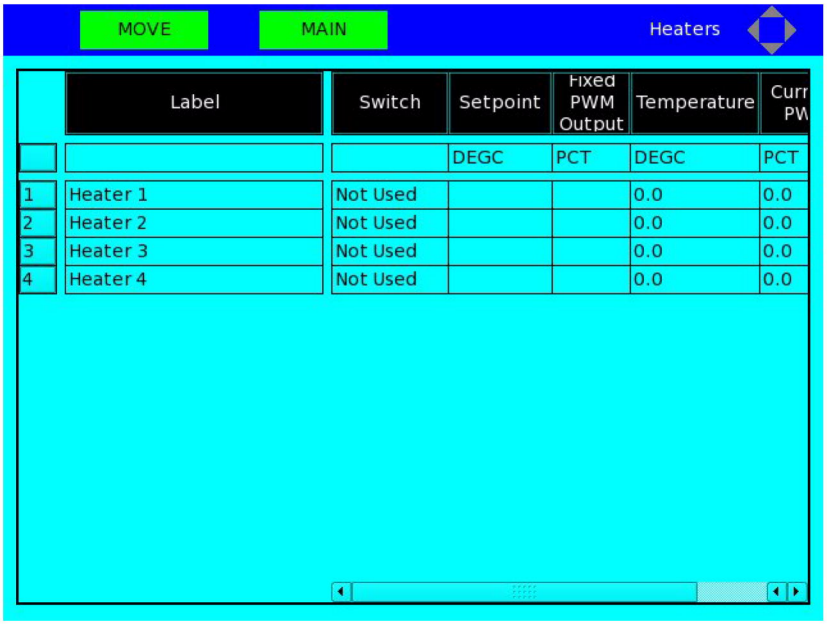
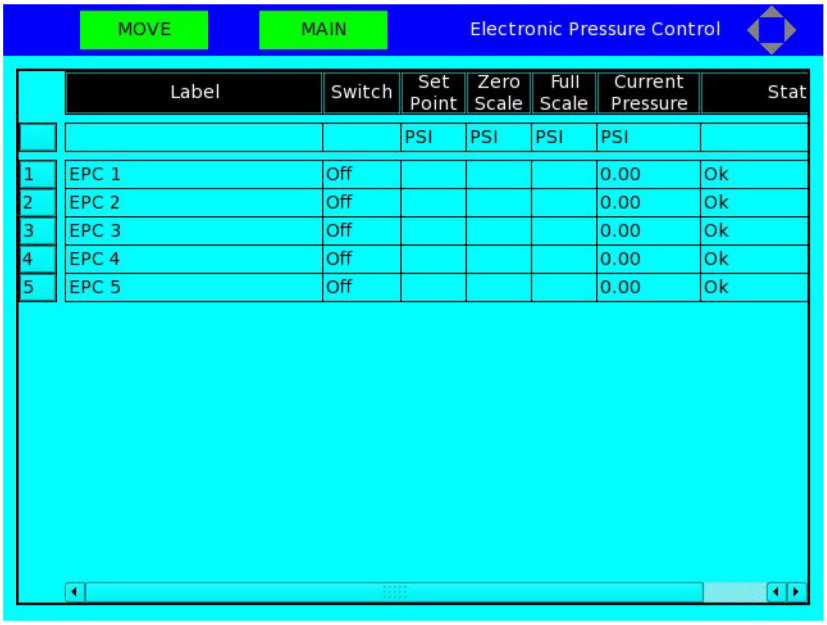


Figure A-27: The Valves screen

Note

The usage (Sample/BF1, Dual Column), mode (Auto, Off), and state (green = on, black = off, red = error) of each valve is displayed. See the "Configuring the valves" section of the *MON2020 Software for Gas Chromatographs User Manual* for more information.

Figure A-28: The EPC screen



	Label	Switch	Set Point	Zero Scale	Full Scale	Current Pressure	Stat
			PSI	PSI	PSI	PSI	
1	EPC 1	Off				0.00	Ok
2	EPC 2	Off				0.00	Ok
3	EPC 3	Off				0.00	Ok
4	EPC 4	Off				0.00	Ok
5	EPC 5	Off				0.00	Ok

Figure A-29: The Detectors screen

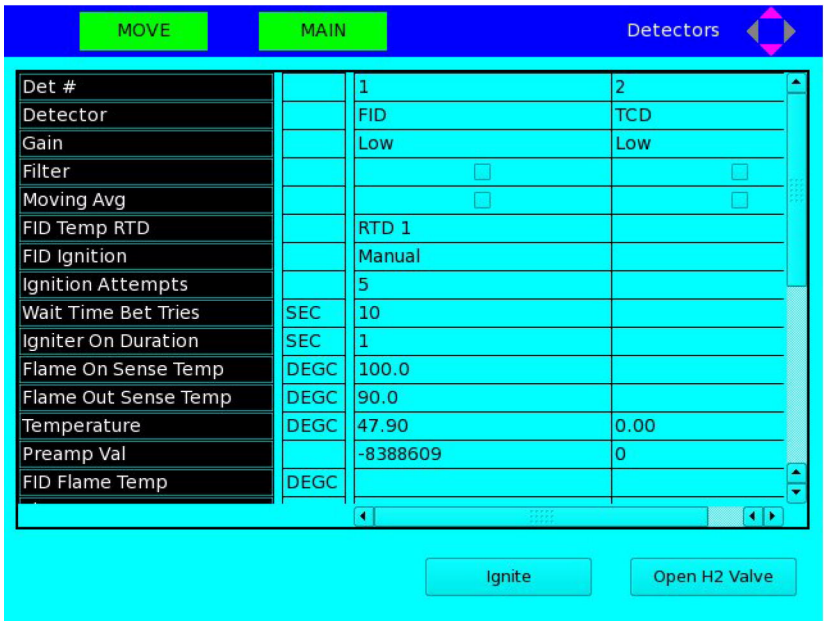


Figure A-30: The Discrete Inputs screen

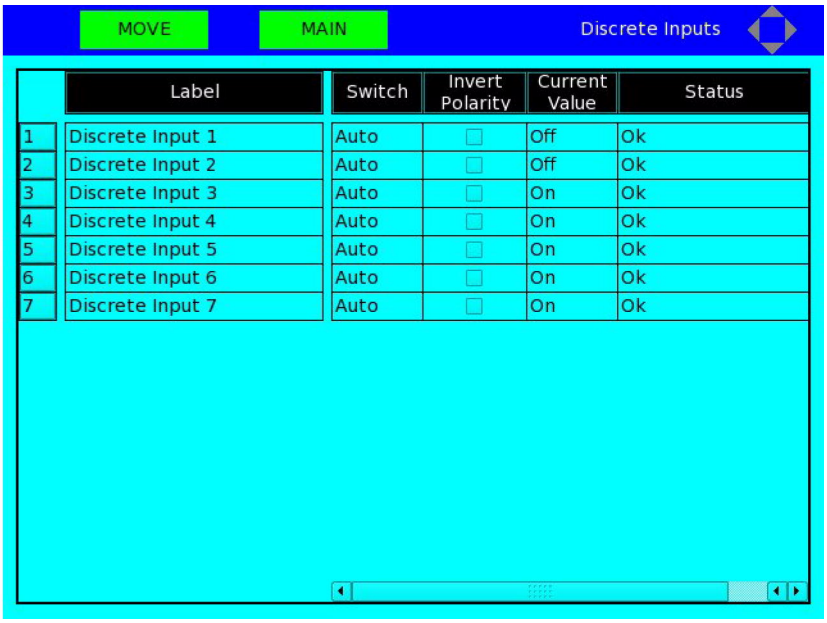
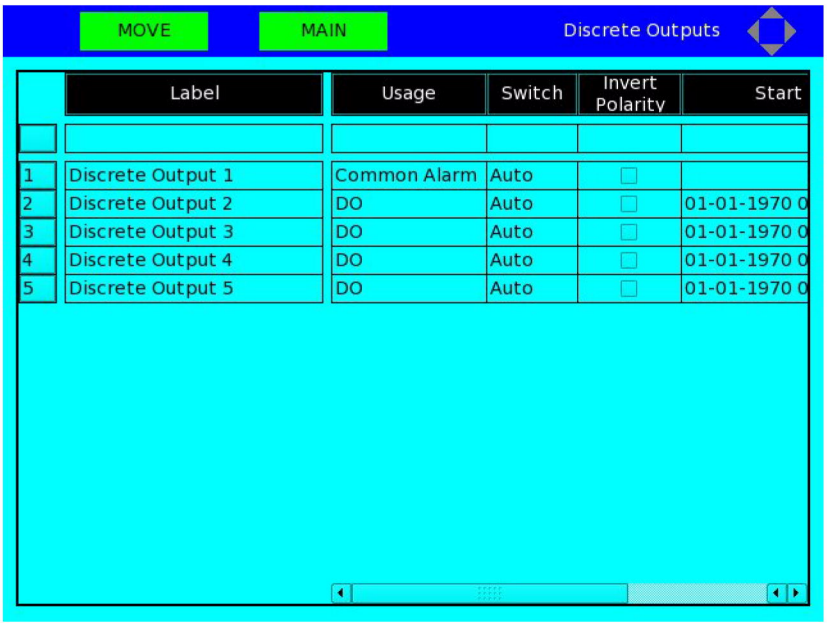
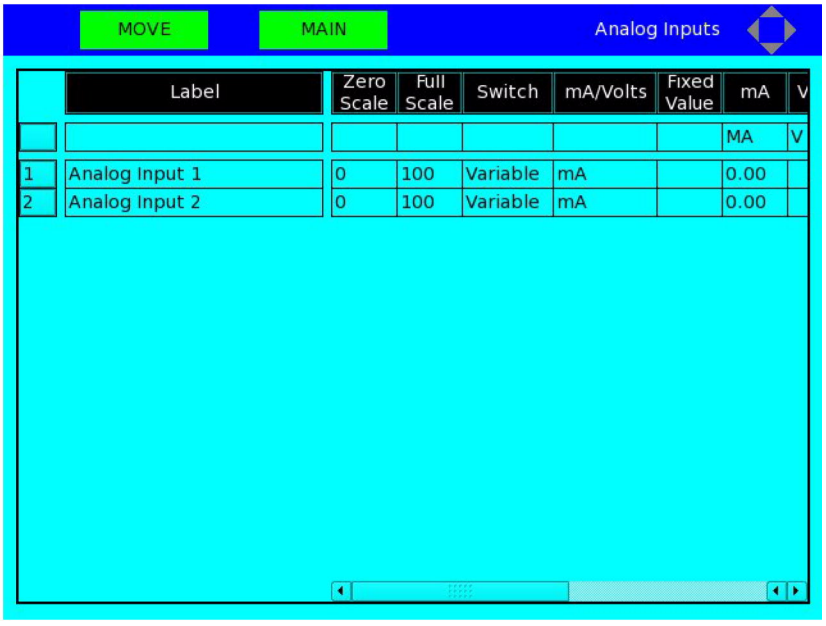


Figure A-31: The Discrete Outputs screen



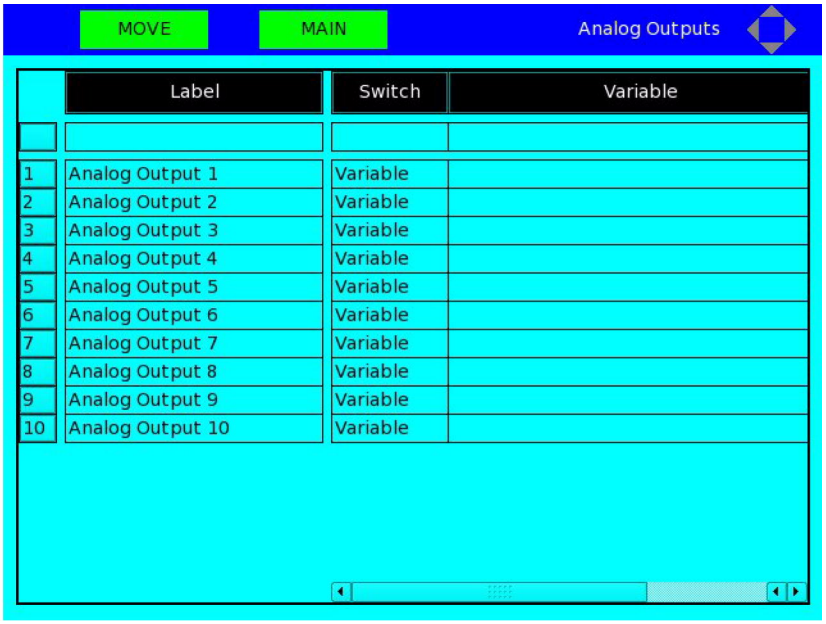
	Label	Usage	Switch	Invert Polarity	Start
1	Discrete Output 1	Common Alarm	Auto	☐	
2	Discrete Output 2	DO	Auto	☐	01-01-1970 0
3	Discrete Output 3	DO	Auto	☐	01-01-1970 0
4	Discrete Output 4	DO	Auto	☐	01-01-1970 0
5	Discrete Output 5	DO	Auto	☐	01-01-1970 0

Figure A-32: The Analog Inputs screen



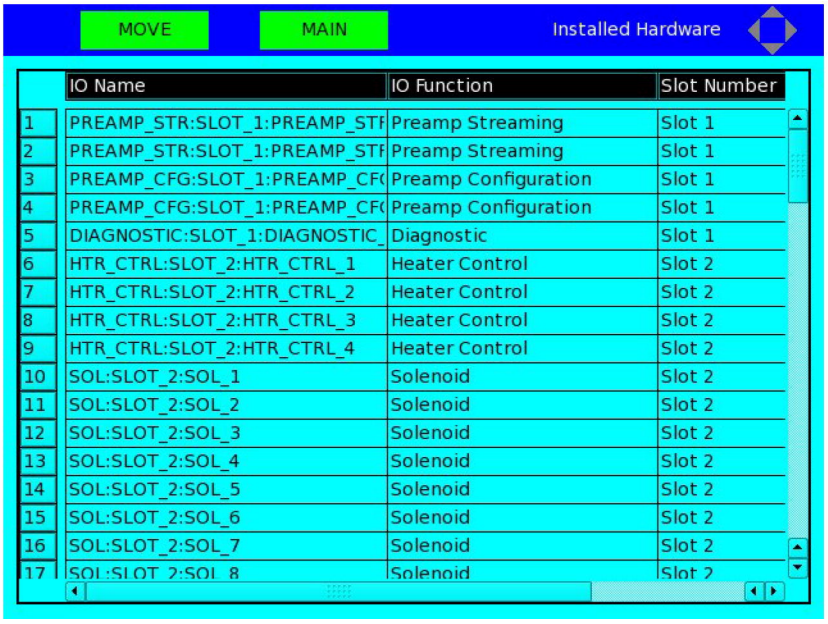
	Label	Zero Scale	Full Scale	Switch	mA/Volts	Fixed Value	mA	V
							MA	V
1	Analog Input 1	0	100	Variable	mA		0.00	
2	Analog Input 2	0	100	Variable	mA		0.00	

Figure A-33: The Analog Outputs screen



	Label	Switch	Variable
1	Analog Output 1	Variable	
2	Analog Output 2	Variable	
3	Analog Output 3	Variable	
4	Analog Output 4	Variable	
5	Analog Output 5	Variable	
6	Analog Output 6	Variable	
7	Analog Output 7	Variable	
8	Analog Output 8	Variable	
9	Analog Output 9	Variable	
10	Analog Output 10	Variable	

Figure A-34: The Installed Hardware screen



	IO Name	IO Function	Slot Number
1	PREAMP_STR:SLOT_1:PREAMP_STF	Preamp Streaming	Slot 1
2	PREAMP_STR:SLOT_1:PREAMP_STF	Preamp Streaming	Slot 1
3	PREAMP_CFG:SLOT_1:PREAMP_CF(	Preamp Configuration	Slot 1
4	PREAMP_CFG:SLOT_1:PREAMP_CF(	Preamp Configuration	Slot 1
5	DIAGNOSTIC:SLOT_1:DIAGNOSTIC_	Diagnostic	Slot 1
6	HTR_CTRL:SLOT_2:HTR_CTRL_1	Heater Control	Slot 2
7	HTR_CTRL:SLOT_2:HTR_CTRL_2	Heater Control	Slot 2
8	HTR_CTRL:SLOT_2:HTR_CTRL_3	Heater Control	Slot 2
9	HTR_CTRL:SLOT_2:HTR_CTRL_4	Heater Control	Slot 2
10	SOL:SLOT_2:SOL_1	Solenoid	Slot 2
11	SOL:SLOT_2:SOL_2	Solenoid	Slot 2
12	SOL:SLOT_2:SOL_3	Solenoid	Slot 2
13	SOL:SLOT_2:SOL_4	Solenoid	Slot 2
14	SOL:SLOT_2:SOL_5	Solenoid	Slot 2
15	SOL:SLOT_2:SOL_6	Solenoid	Slot 2
16	SOL:SLOT_2:SOL_7	Solenoid	Slot 2
17	SOL:SLOT_2:SOL_8	Solenoid	Slot 2

A.4.3 The Application menu

The *Application* menu allows you to view the CDT, TEV and streams tables for the GC. The *System*, *Status*, and *Ethernet Ports* screens are also accessible from this menu.

Refer to the “Using the application functions” section of the *MON2020 Software for Gas Chromatographs User Manual* for detailed information regarding the *Application* menu screens.

Figure A-35: The Application menu

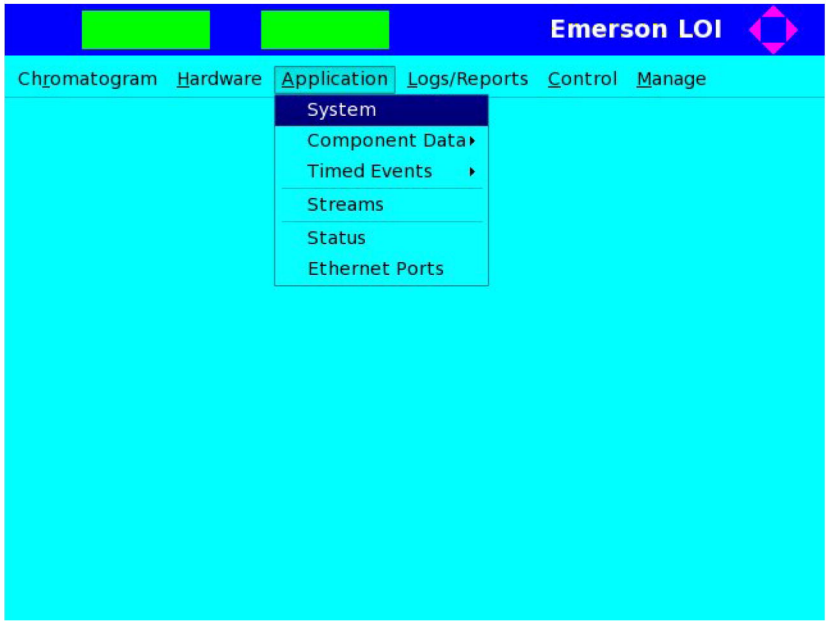


Figure A-36: The System screen

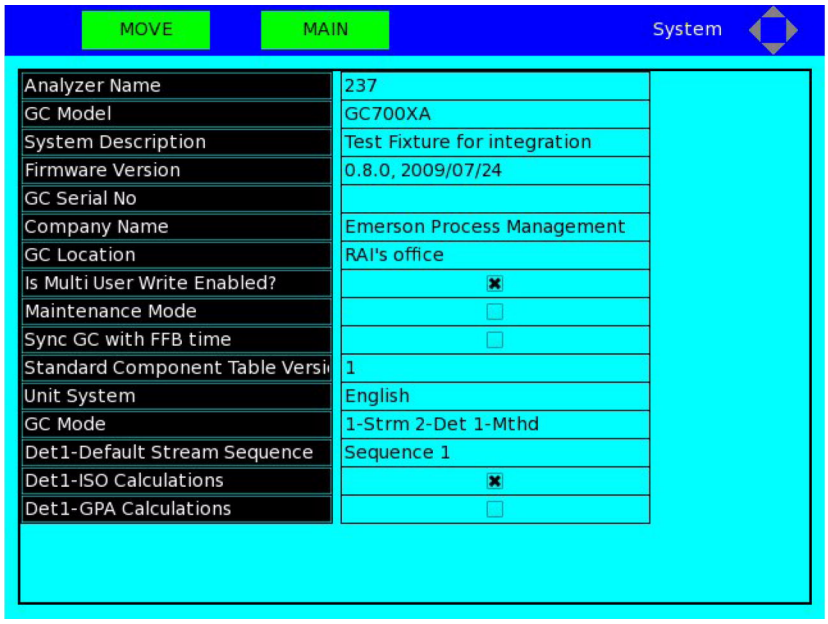
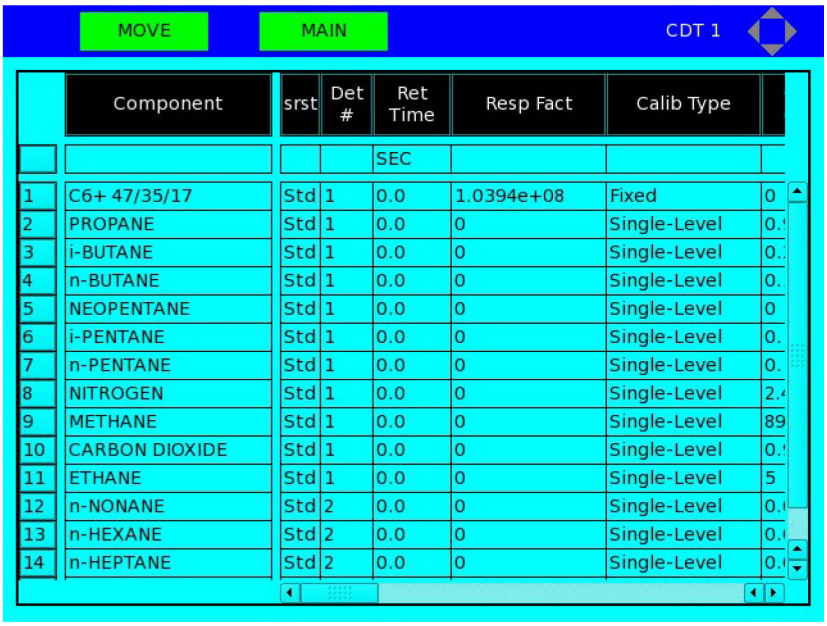
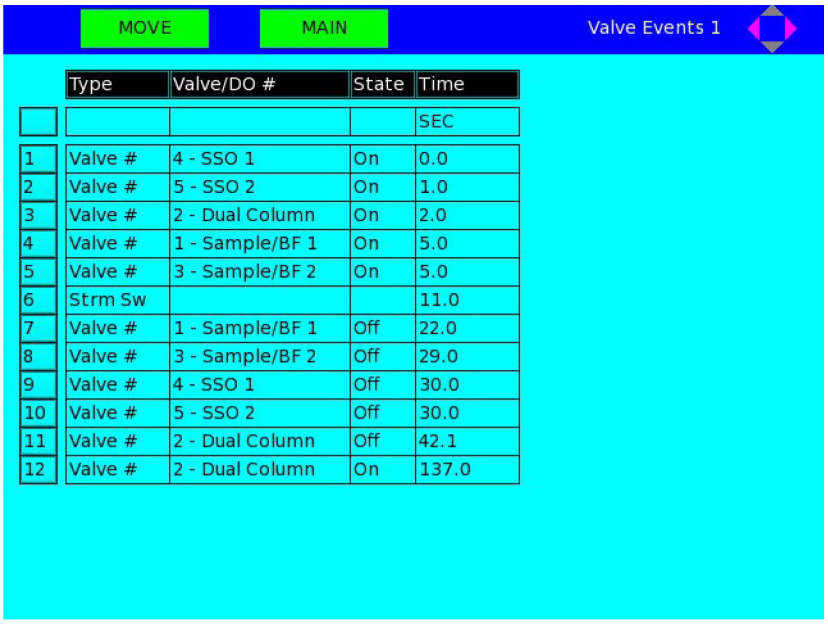


Figure A-37: The CDT screen



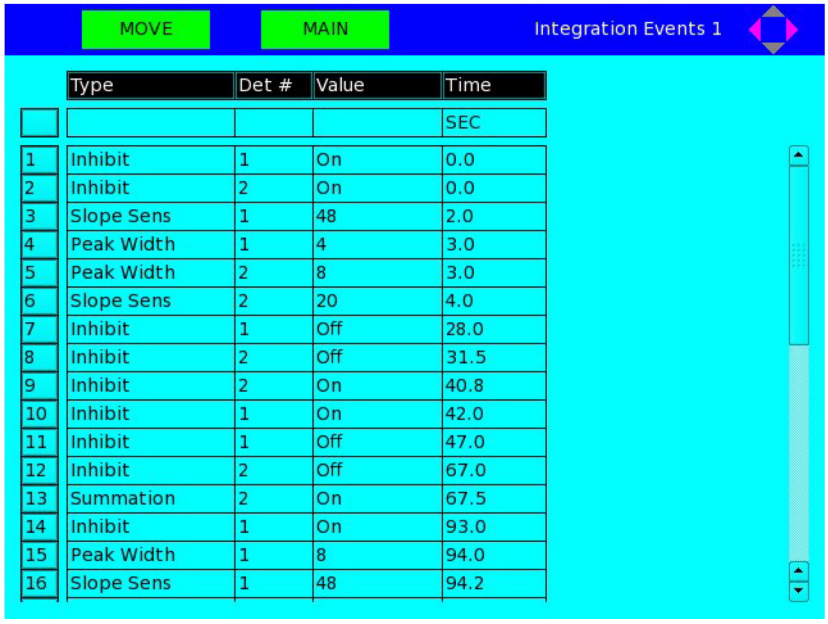
	Component	srst	Det #	Ret Time	Resp Fact	Calib Type	
				SEC			
1	C6+ 47/35/17	Std	1	0.0	1.0394e+08	Fixed	0
2	PROPANE	Std	1	0.0	0	Single-Level	0.
3	i-BUTANE	Std	1	0.0	0	Single-Level	0.
4	n-BUTANE	Std	1	0.0	0	Single-Level	0.
5	NEOPENTANE	Std	1	0.0	0	Single-Level	0
6	i-PENTANE	Std	1	0.0	0	Single-Level	0.
7	n-PENTANE	Std	1	0.0	0	Single-Level	0.
8	NITROGEN	Std	1	0.0	0	Single-Level	2.
9	METHANE	Std	1	0.0	0	Single-Level	89
10	CARBON DIOXIDE	Std	1	0.0	0	Single-Level	0.
11	ETHANE	Std	1	0.0	0	Single-Level	5
12	n-NONANE	Std	2	0.0	0	Single-Level	0.
13	n-HEXANE	Std	2	0.0	0	Single-Level	0.
14	n-HEPTANE	Std	2	0.0	0	Single-Level	0.

Figure A-38: The TEV - Valve Events screen



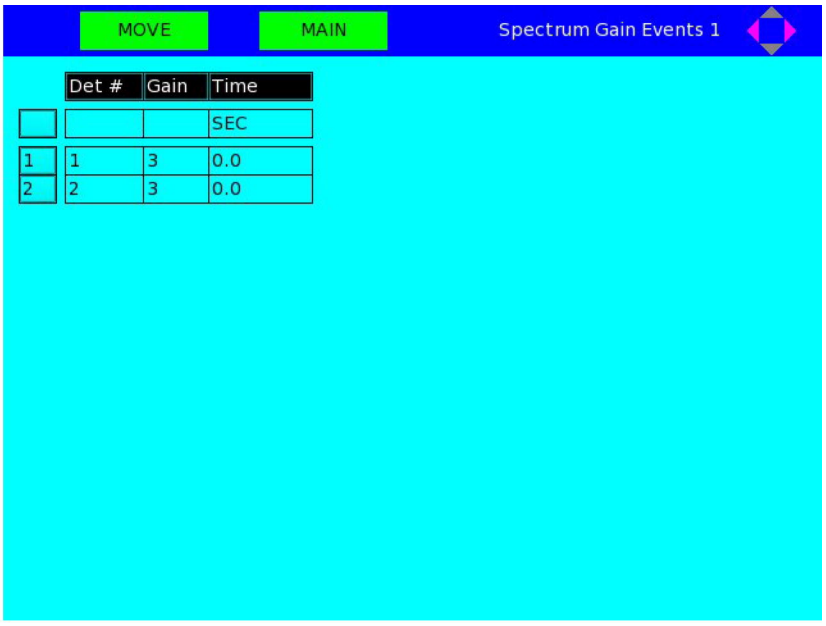
	Type	Valve/DO #	State	Time
				SEC
1	Valve #	4 - SSO 1	On	0.0
2	Valve #	5 - SSO 2	On	1.0
3	Valve #	2 - Dual Column	On	2.0
4	Valve #	1 - Sample/BF 1	On	5.0
5	Valve #	3 - Sample/BF 2	On	5.0
6	Strm Sw			11.0
7	Valve #	1 - Sample/BF 1	Off	22.0
8	Valve #	3 - Sample/BF 2	Off	29.0
9	Valve #	4 - SSO 1	Off	30.0
10	Valve #	5 - SSO 2	Off	30.0
11	Valve #	2 - Dual Column	Off	42.1
12	Valve #	2 - Dual Column	On	137.0

Figure A-39: The TEV - Integration Events screen



	Type	Det #	Value	Time
				SEC
1	Inhibit	1	On	0.0
2	Inhibit	2	On	0.0
3	Slope Sens	1	48	2.0
4	Peak Width	1	4	3.0
5	Peak Width	2	8	3.0
6	Slope Sens	2	20	4.0
7	Inhibit	1	Off	28.0
8	Inhibit	2	Off	31.5
9	Inhibit	2	On	40.8
10	Inhibit	1	On	42.0
11	Inhibit	1	Off	47.0
12	Inhibit	2	Off	67.0
13	Summation	2	On	67.5
14	Inhibit	1	On	93.0
15	Peak Width	1	8	94.0
16	Slope Sens	1	48	94.2

Figure A-40: The TEV - Spectrum Gain Events screen



	Det #	Gain	Time
			SEC
1	1	3	0.0
2	2	3	0.0

Figure A-41: The TEV - Analysis Time screen

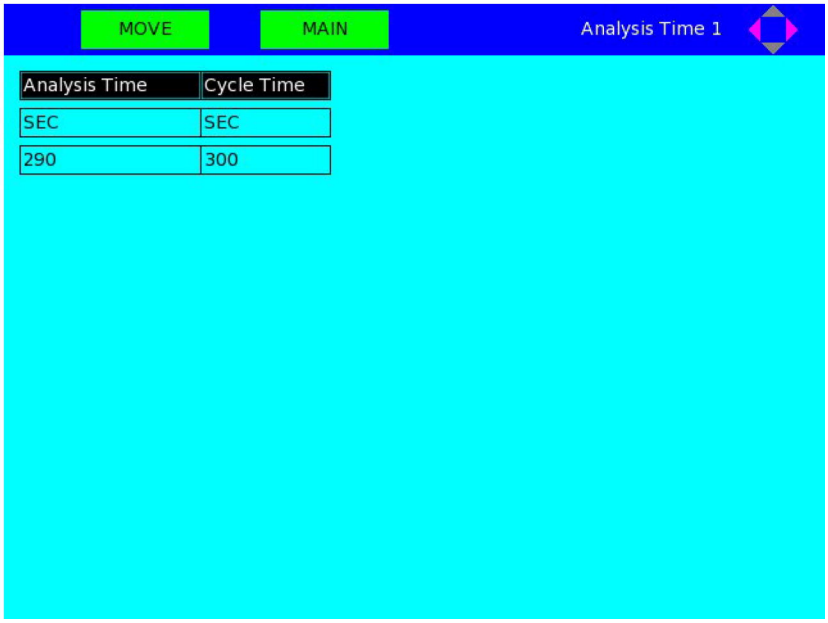


Figure A-42: The Streams screen

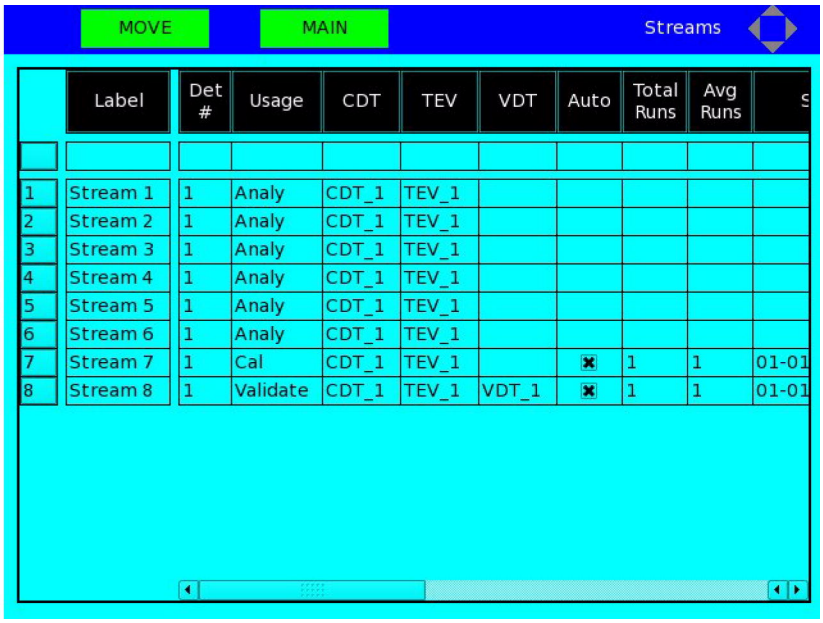


Figure A-43: The Status screen

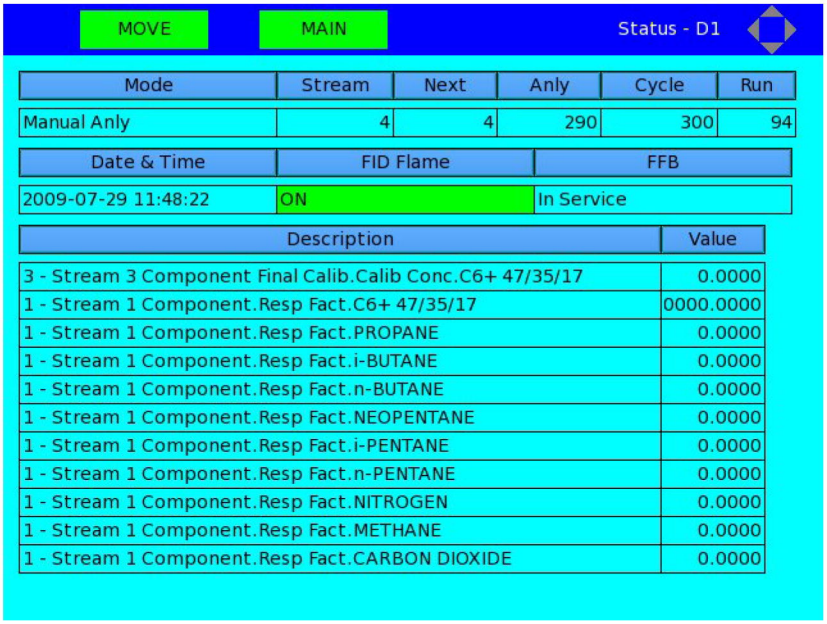
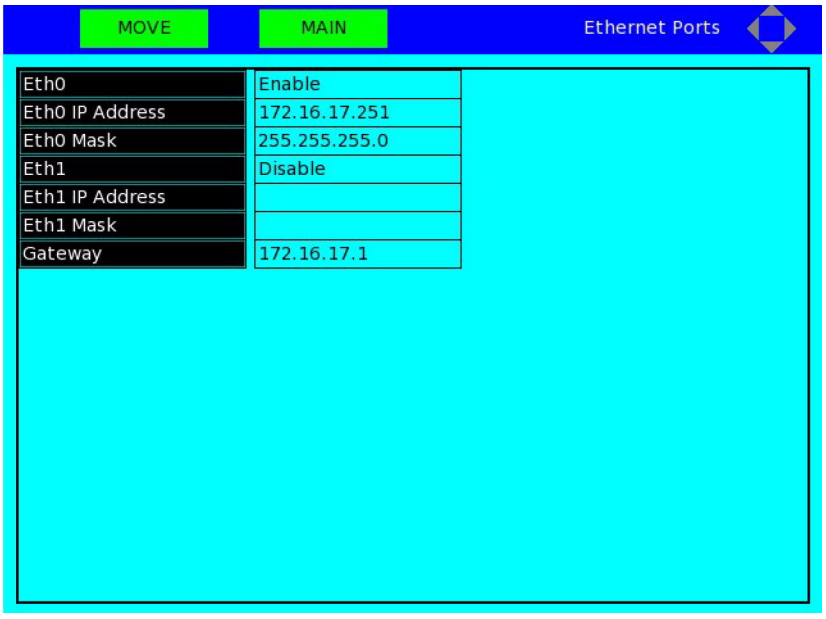


Figure A-44: The Ethernet Ports screen



A.4.4 The Logs/Reports menu

The *Logs/Reports* menu enables you to view the various reports that are available from the GC.

Refer to the “Logs/Reports” section of the *MON2020 Software for Gas Chromatographs User Manual* for detailed information regarding the *Logs/Reports* menu screens.

Figure A-45: The Logs/Reports menu

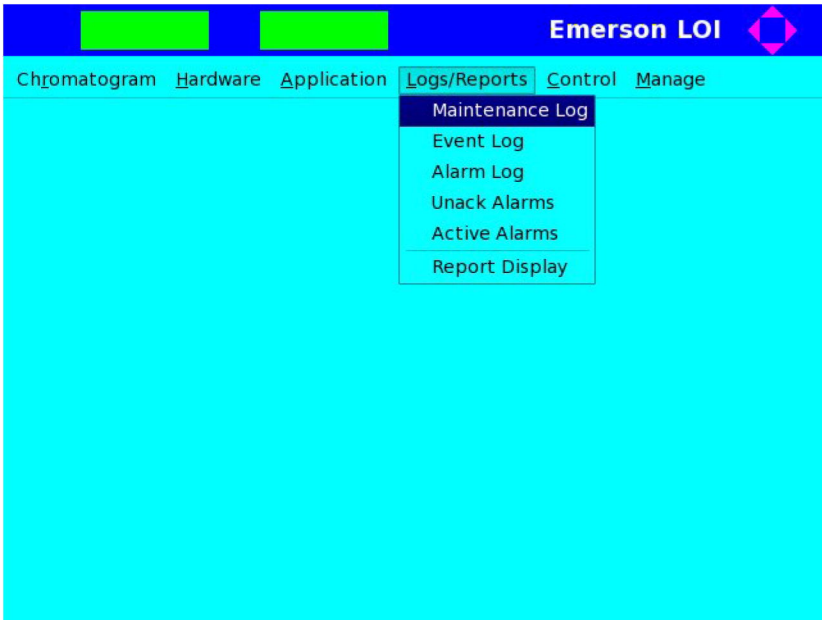


Figure A-46: The Maintenance Log screen

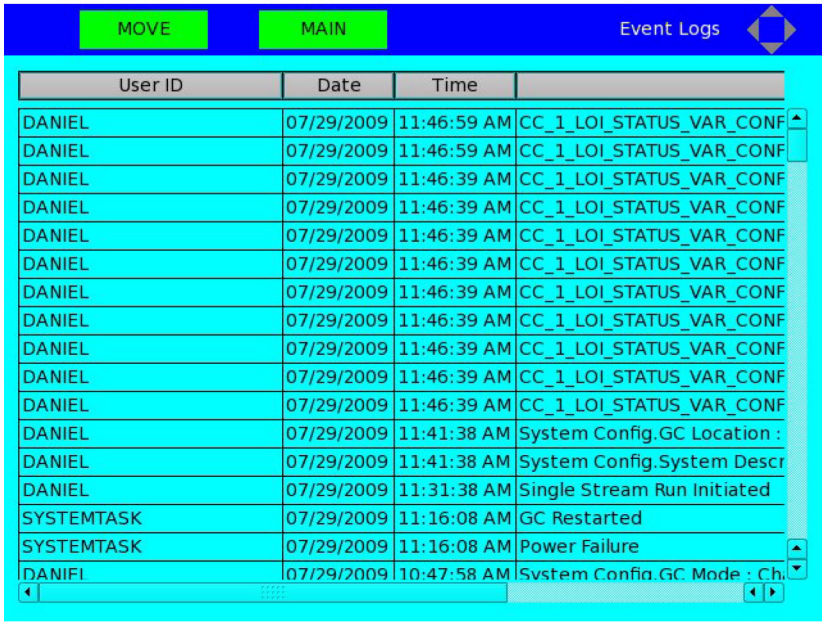
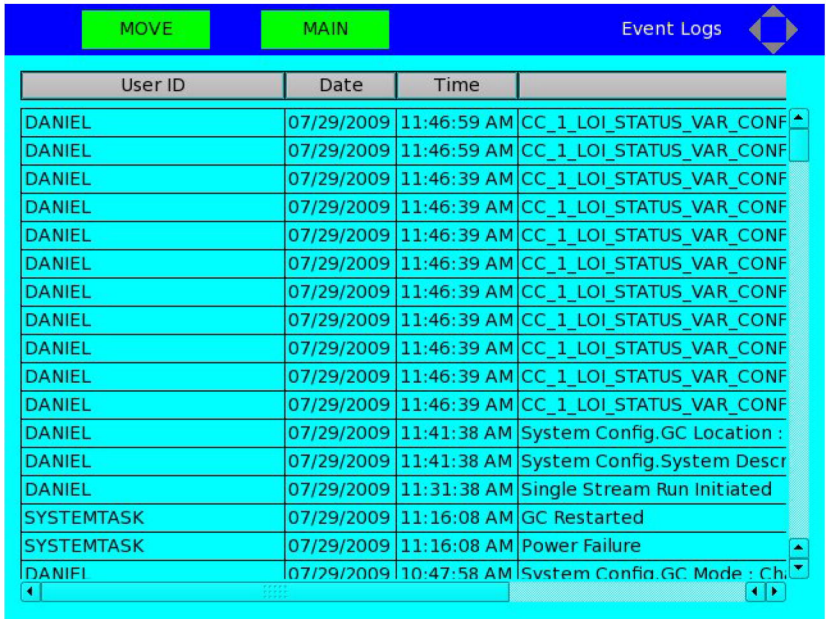
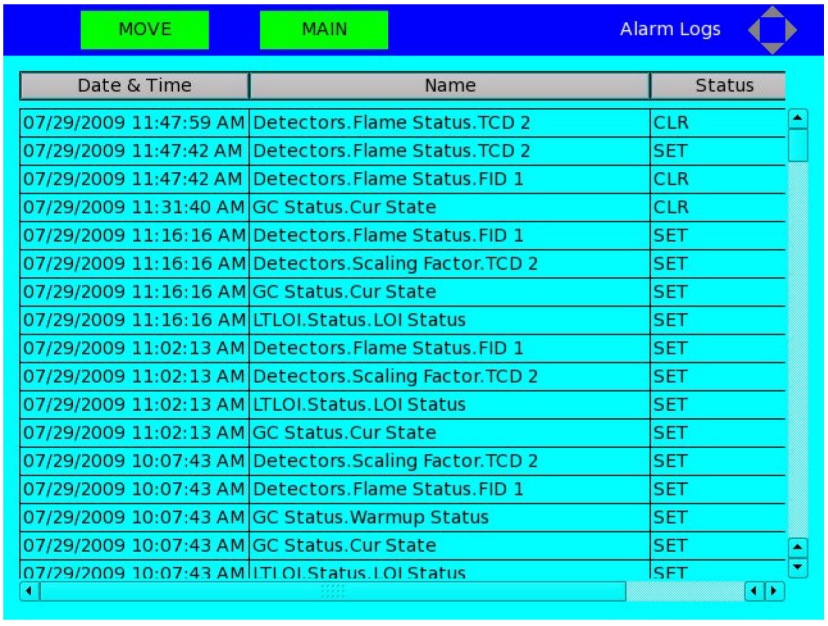


Figure A-47: The Event Log screen



User ID	Date	Time	
DANIEL	07/29/2009	11:46:59 AM	CC_1_LOI_STATUS_VAR_CONF
DANIEL	07/29/2009	11:46:59 AM	CC_1_LOI_STATUS_VAR_CONF
DANIEL	07/29/2009	11:46:39 AM	CC_1_LOI_STATUS_VAR_CONF
DANIEL	07/29/2009	11:46:39 AM	CC_1_LOI_STATUS_VAR_CONF
DANIEL	07/29/2009	11:46:39 AM	CC_1_LOI_STATUS_VAR_CONF
DANIEL	07/29/2009	11:46:39 AM	CC_1_LOI_STATUS_VAR_CONF
DANIEL	07/29/2009	11:46:39 AM	CC_1_LOI_STATUS_VAR_CONF
DANIEL	07/29/2009	11:46:39 AM	CC_1_LOI_STATUS_VAR_CONF
DANIEL	07/29/2009	11:46:39 AM	CC_1_LOI_STATUS_VAR_CONF
DANIEL	07/29/2009	11:46:39 AM	CC_1_LOI_STATUS_VAR_CONF
DANIEL	07/29/2009	11:46:39 AM	CC_1_LOI_STATUS_VAR_CONF
DANIEL	07/29/2009	11:41:38 AM	System Config.GC Location :
DANIEL	07/29/2009	11:41:38 AM	System Config.System Descr
DANIEL	07/29/2009	11:31:38 AM	Single Stream Run Initiated
SYSTEMTASK	07/29/2009	11:16:08 AM	GC Restarted
SYSTEMTASK	07/29/2009	11:16:08 AM	Power Failure
DANIEL	07/29/2009	10:47:58 AM	System Config.GC Mode : Ch

Figure A-48: The Alarm Log screen



Date & Time	Name	Status
07/29/2009 11:47:59 AM	Detectors.Flame Status.TCD 2	CLR
07/29/2009 11:47:42 AM	Detectors.Flame Status.TCD 2	SET
07/29/2009 11:47:42 AM	Detectors.Flame Status.FID 1	CLR
07/29/2009 11:31:40 AM	GC Status.Cur State	CLR
07/29/2009 11:16:16 AM	Detectors.Flame Status.FID 1	SET
07/29/2009 11:16:16 AM	Detectors.Scaling Factor.TCD 2	SET
07/29/2009 11:16:16 AM	GC Status.Cur State	SET
07/29/2009 11:16:16 AM	LTLOI.Status.LOI Status	SET
07/29/2009 11:02:13 AM	Detectors.Flame Status.FID 1	SET
07/29/2009 11:02:13 AM	Detectors.Scaling Factor.TCD 2	SET
07/29/2009 11:02:13 AM	LTLOI.Status.LOI Status	SET
07/29/2009 11:02:13 AM	GC Status.Cur State	SET
07/29/2009 10:07:43 AM	Detectors.Scaling Factor.TCD 2	SET
07/29/2009 10:07:43 AM	Detectors.Flame Status.FID 1	SET
07/29/2009 10:07:43 AM	GC Status.Warmup Status	SET
07/29/2009 10:07:43 AM	GC Status.Cur State	SET
07/29/2009 10:07:43 AM	LTLOI.Status.LOI Status	SET

Figure A-49: The Unack Alarms screen

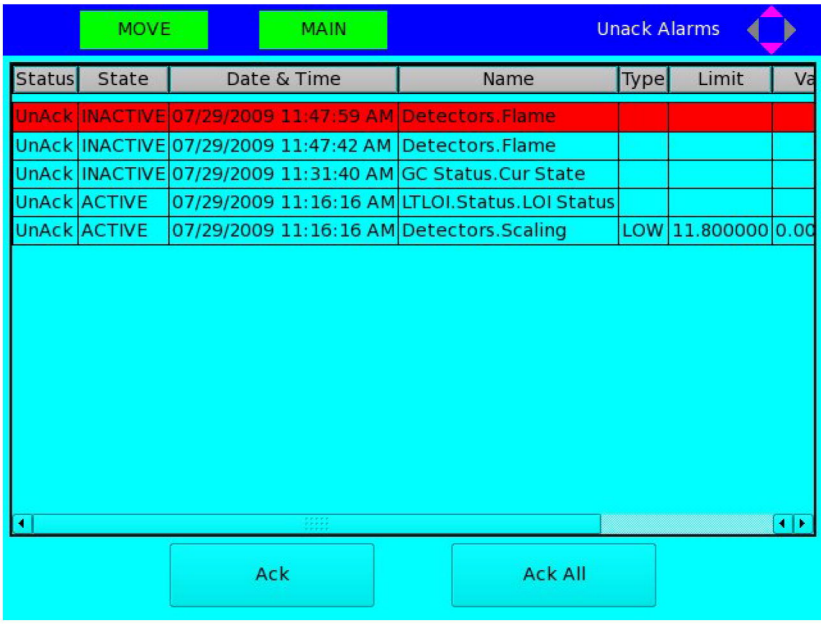


Figure A-50: The Active Alarms screen

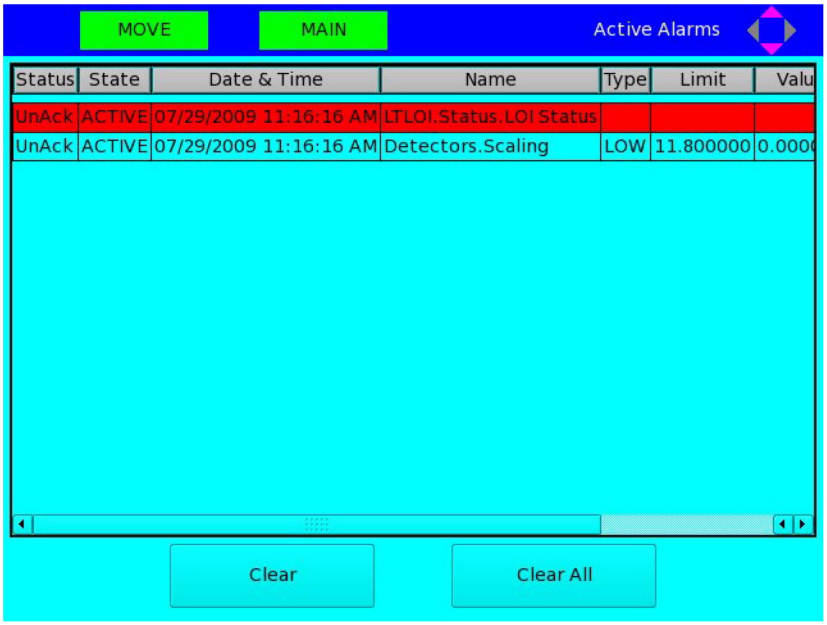
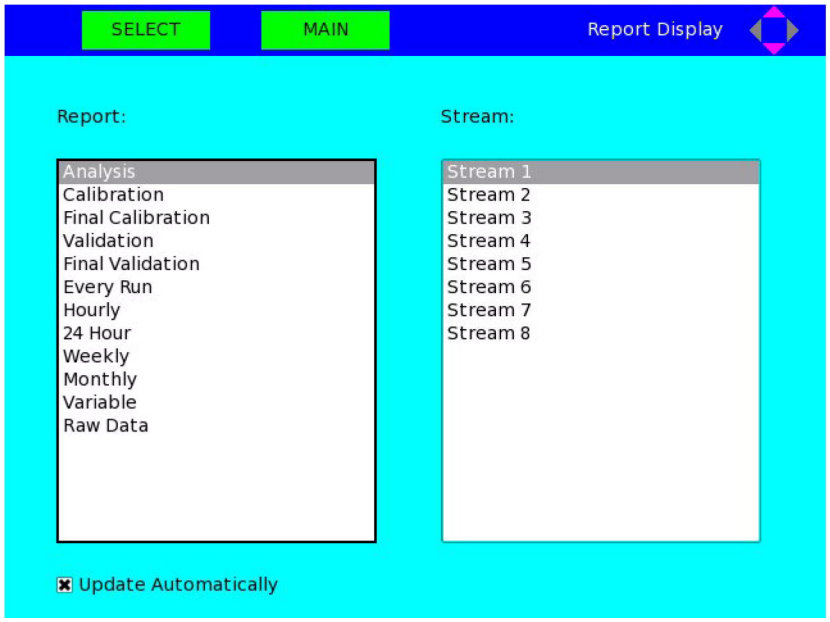


Figure A-51: The Report Display screen



A.4.5 The Control menu

The *Control* menu enables you to stop, calibrate, or place on automatic control a sample stream from the analyzer.

Refer to the “Control menu” section of the *MON2020 Software for Gas Chromatographs User Manual* for detailed information regarding the *Control* menu screens.

Figure A-52: The Control menu

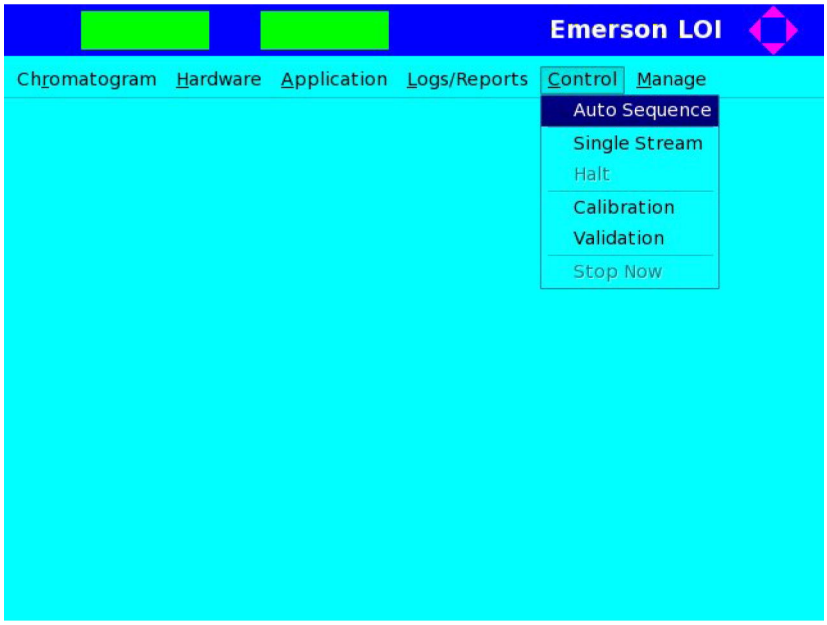


Figure A-53: The Auto Sequence screen

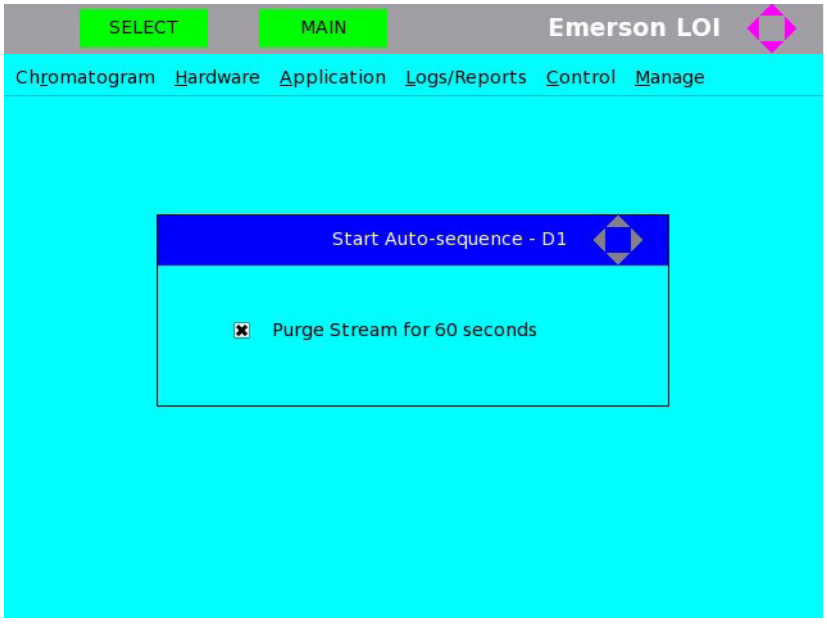


Figure A-54: The Single Stream screen

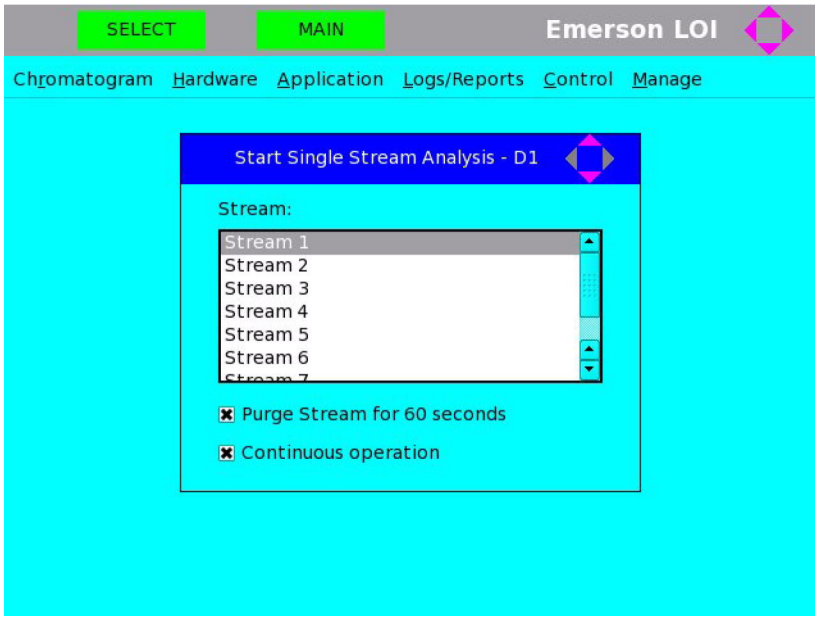


Figure A-55: The Halt screen

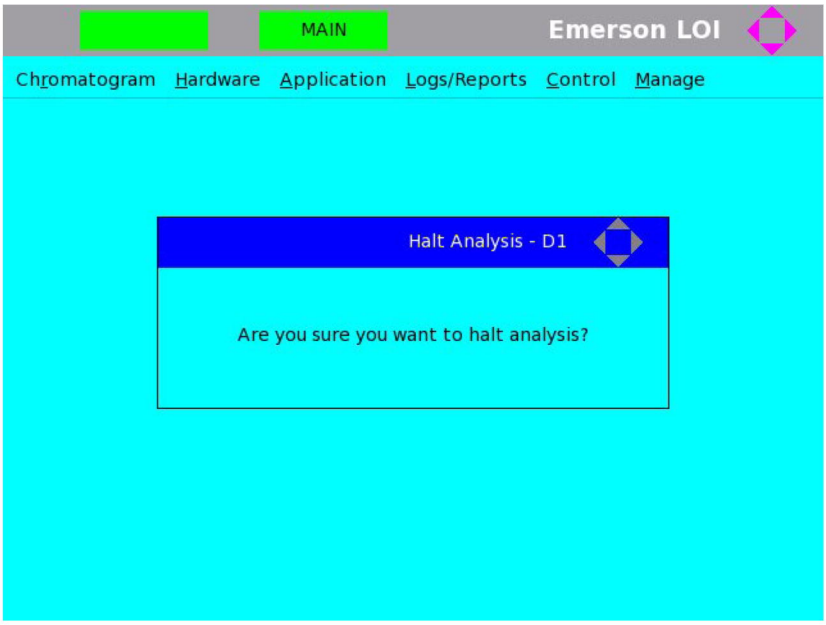


Figure A-56: The Calibration screen

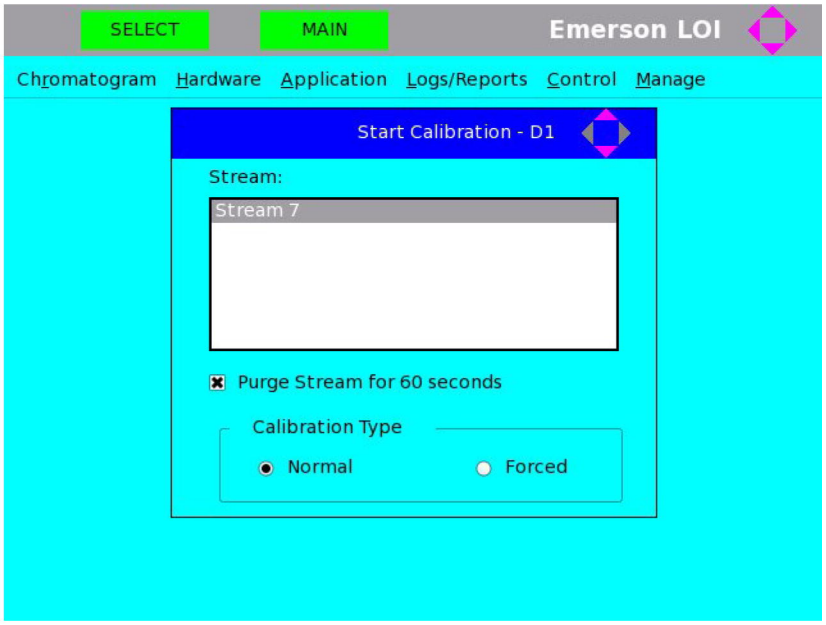


Figure A-57: The Validation screen

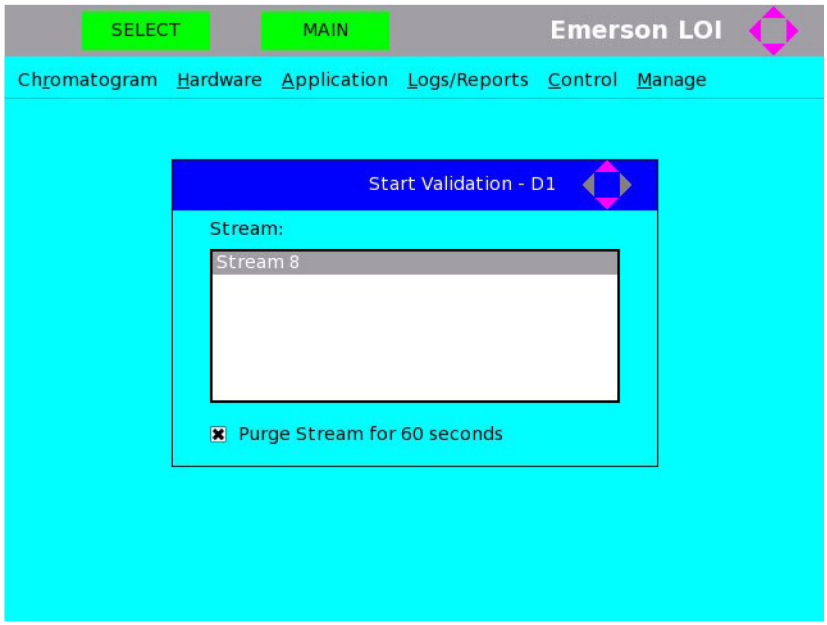
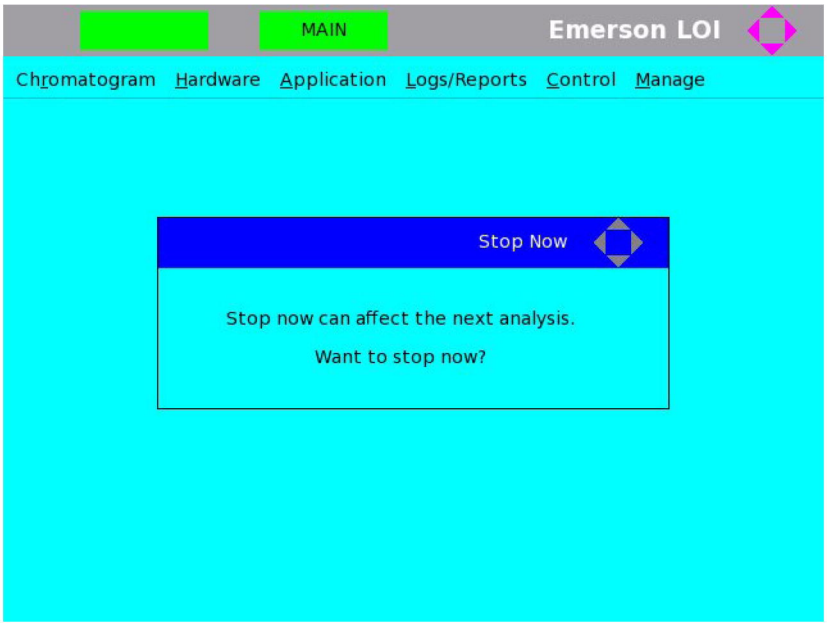


Figure A-58: The Stop Now screen



A.4.6 The Manage menu

The *Manage* menu enables you to change the LOI's settings, change a user's password, and log off of the GC to which you are connected.

Refer to the "Manage menu" section of the *MON2020 Software for Gas Chromatographs User Manual* for detailed information regarding the *Manage* menu screens.

Figure A-59: The Manage menu

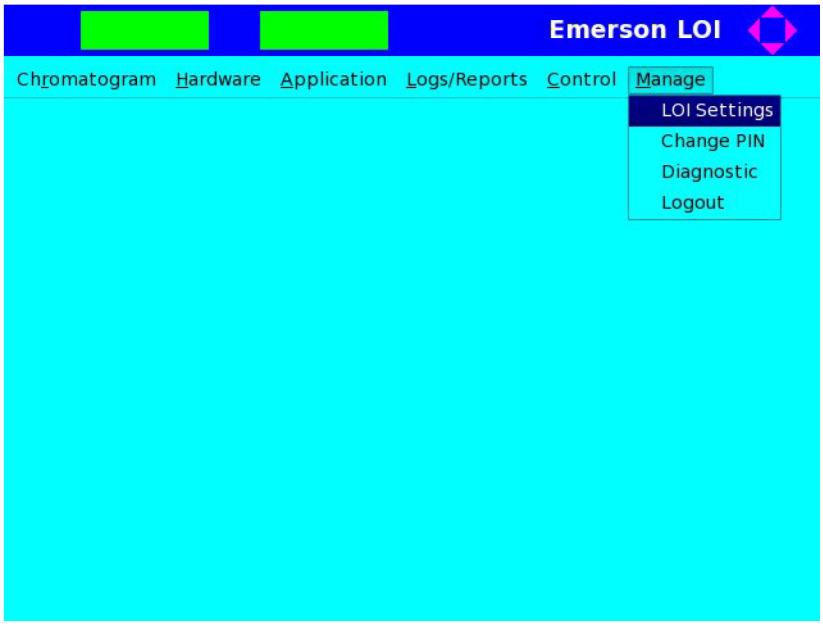


Figure A-60: The LOI Settings screen

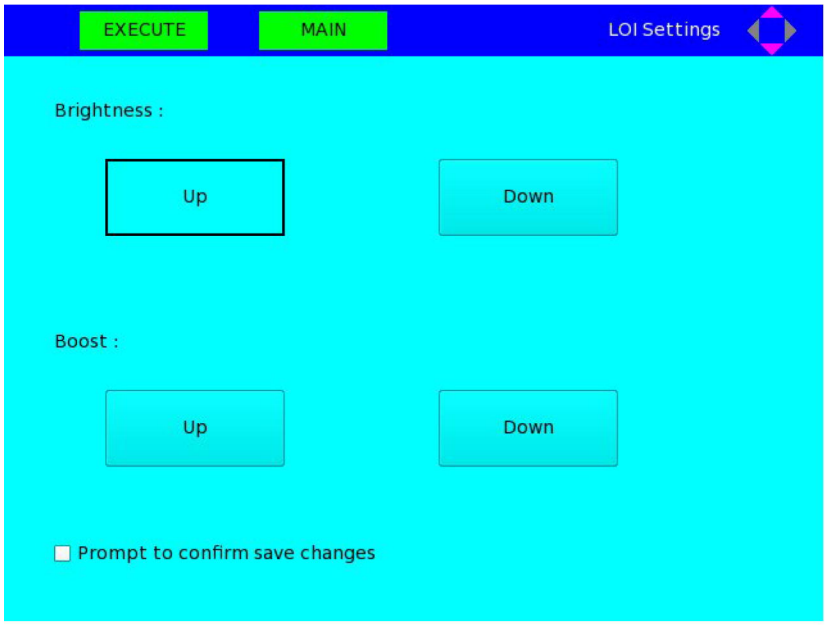


Figure A-61: The Create PIN screen

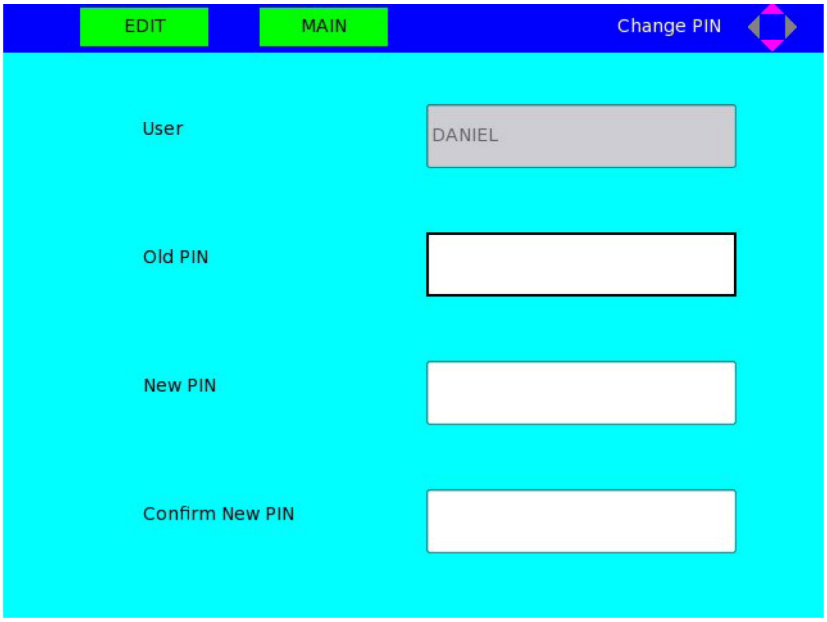
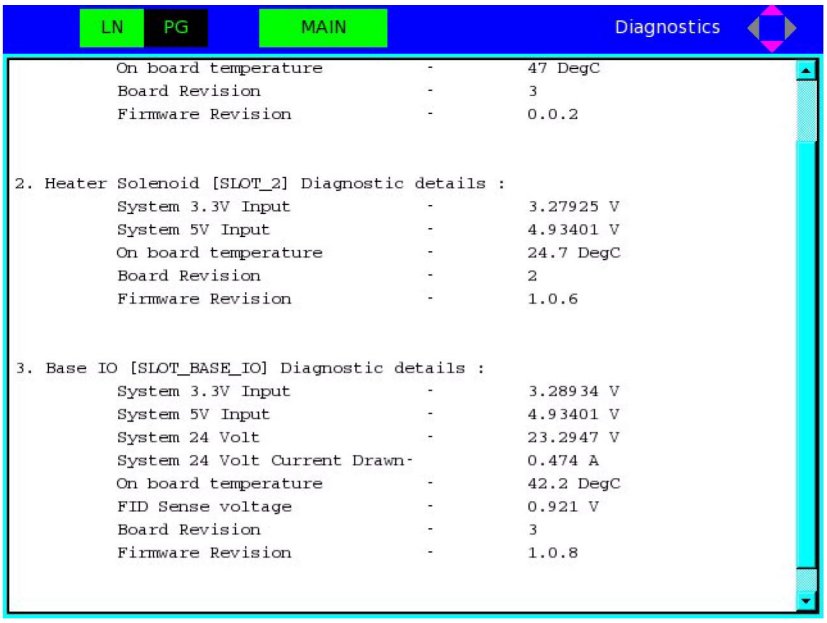


Figure A-62: The Diagnostic screen



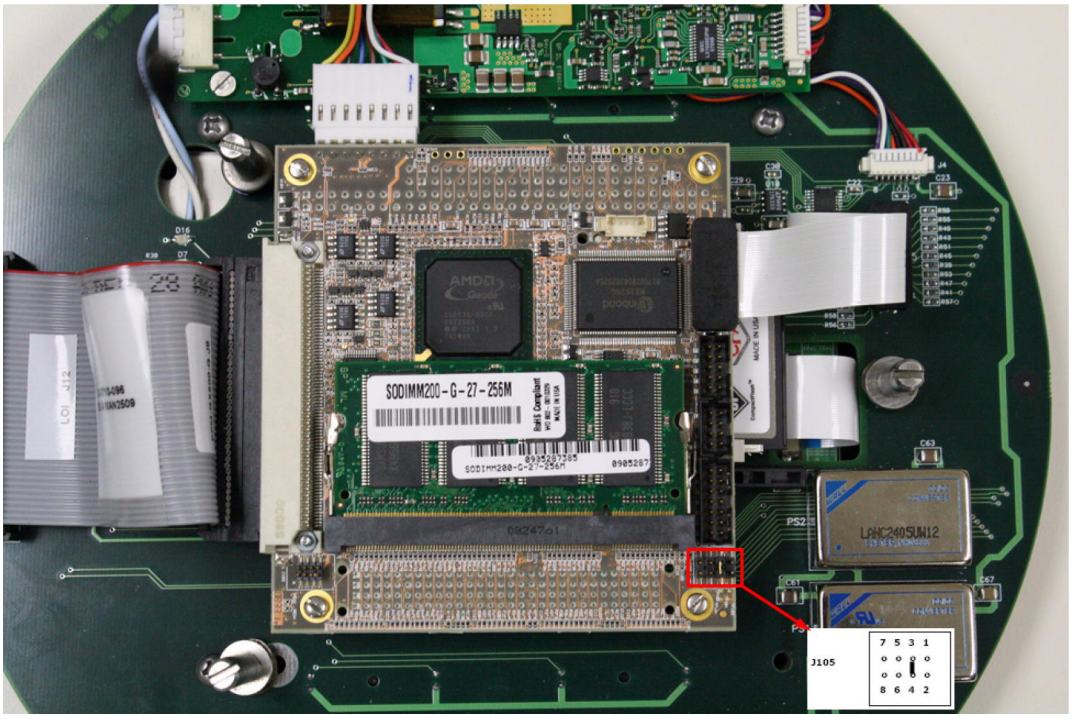
A.5 Troubleshooting a blank LOI screen

If the LOI is powered up but the LCD screen is blank, do the following:

1. Unscrew and remove the LOI from the GC.

2. Flip the LOI over to expose its motherboard and associated electronics.

Figure A-63: Jumpers at J105 on LOI motherboard



3. Check the jumpers located at J105 on the motherboard. These jumpers control the screen's power. To function properly, jumper pins 3 and 4 must be set; if they are not, set them.

If the screen is still blank, contact Customer Service at 1-888-801-1452 for assistance.

Appendix B
Carrier gas installation and maintenance

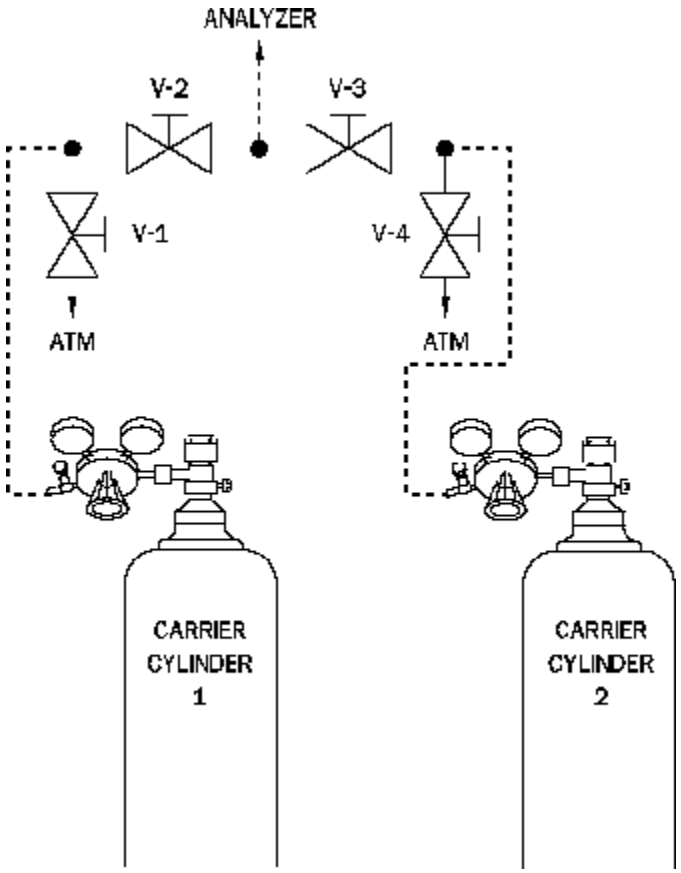
B.1 Carrier gas

This appendix provides a description of the optional carrier manifold (P/N 3-5000-050) that permits the connection of two carrier gas bottles, or cylinders, to a gas chromatograph (GC) system. The benefits of this manifold are as follows:

Note
The illustration and information in this appendix are adapted from drawing AE-10098.

- When one bottle is nearly empty (i.e., 100 psig remaining), the other bottle becomes the primary supply.
- Each bottle can be disconnected for refilling without interrupting GC operation.

Figure B-1: Manifold for two carrier gas bottles to GC system



V-1	Carrier cylinder 1	Bleed valve
V-2	Carrier cylinder 1	Block valve
V-3	Carrier cylinder 2	Block valve
V-4	Carrier cylinder 2	Bleed valve

B.2 Installation and line purging

To install and purge the dual-bottle carrier gas manifold, proceed as follows:

1. Install manifold as shown in *Figure B-1*. Close all valves and tighten all fittings. Run tubing to the GC, but do not connect.
2. Back off pressure regulator (counter clockwise) fully.
3. Open cylinder valve for Carrier Cylinder 1.

   The pressure indicator will read the cylinder pressure.
4. Open the shut-off valve attached to the carrier regulator.
5. Regulate pressure out of the cylinder to 20 psig, then close the cylinder valve.
6. Open V-1 (bleed valve) and let the carrier gas bleed to atmosphere until both gauges read 0 psig, then close V-1.
7. Repeat *Step 4* and *Step 5* twice to purge the line to V-2.
8. Purge the line to V-3 by repeating *Step 2* through *Step 6*; but this time, use bleed valve V-4 and Carrier Cylinder 2.
9. With valves 1-4 closed, open both cylinder valves and regulate both carriers to approximately 10 psig.
10. Open V-2 and V-3 simultaneously, then turn both cylinder valves off and let the carrier gasses bleed through the line to the GC until all gauges read 0 psig.
11. Repeat *Step 8* and *Step 9* twice to purge the line to the GC.
12. Close V-3, leave V-2 open.
13. Open the cylinder valve of Carrier Cylinder 1 and, with carrier gas flowing at 10 psig or below, connect the carrier line to the GC.
14. Slowly regulate Carrier Cylinder 1 to 110 psig.
15. Open V-3 and slowly regulate Carrier Cylinder 2 to 100 psig.

    By doing this, all but 100 pounds of Carrier Cylinder 1 will be used before any of Carrier Cylinder 2 is used. When Carrier Cylinder 1 gets to 100 pounds, replace the cylinder.
16. Leak-check all of the fittings carefully.
17. Let the GC run overnight before calibrating.

B.3 Replacing carrier cylinder

To replace one carrier cylinder without interrupting GC operation, proceed as follows:

1. Turn cylinder valve off.
2. Back off on cylinder pressure regulator until handle turns freely.
3. Remove cylinder.
4. Attach new cylinder to regulator and repeat Steps 3 through 7 of *Section B.2*, using appropriate bleed valve to purge line.
5. Leak-check the fitting.
6. Open the appropriate block valve to the analyzer (V-2 or V-3) and regulate outlet pressure to appropriate level. (See Steps 14 and 15 of *Section B.2*.)

B.4 Calibration gas

The calibration gas used for BTU analysis should be blended of gases specified as Primary Standards. Primary Standard gases are blended using weights that are traceable to the National Institute of Standards and Technology (N.I.S.T). For other applications, the calibration gas should be blended to the specifications detailed in the analyzer's Application Data Sheets.

The calibration gas should not have any component that could drop out at the coldest temperature to which the gas will be subjected. A typical blend for a temperature of zero degrees Fahrenheit is listed in the following table. No dropout will occur in this calibration gas if it is blended at a pressure below 250 psig.

Gas	Mole Percent
Nitrogen	2.5
Carbon Dioxide	0.5
Methane	Balance
Propane	1.0
Isobutane	0.3
N-butane	0.3
Neopentane	0.1
Isopentane	0.1
N-pentane	0.1
N-hexane	0.03

The sampling system should be carefully planned for the best chromatographic analyses.

Appendix C
Recommended spare parts

The following tables list the recommended spare parts that would allow you to maintain a single gas chromatograph.

C.1 Recommended spare parts for 700XA TCD analyzers

Quantity		Description	Part Number
1-5 GCs	**6 or more GCs or Critical Installations**		
1	1	KIT, FUSE, XA	2-3-0710-074
1	2	SOLENOID, 4 WAY, MAC, 24VDC	2-4-0710-224
Note 1	Note 1	SOLENOID, 3-WAY, 24VDC	2-4-0700-124
1	1	THERMISTOR SEALS, PACKAGE OF 10	2-3-0500-391
1 per valve	1 per valve	KIT DIAPHRAGM, 10-PORT XA	2-4-0710-171
1 per valve	1 per valve	KIT DIAPHRAGM, 6-PORT XA	2-4-0710-248
1	1	COLUMN SET	Note 2
1 per stream	1 per stream	FILTER ELEMENT 2 MICRON	2-4-5000-113
1 per stream	1 per stream	MEMBRANE KIT 120 FILTER	2-4-5000-938
0	1	PCA DETECTOR PREAMP	2-3-0710-001
0	1	PCA SOLENOID/HEATER DRIVER	2-3-0710-002
0	1	PCA BASE I/O	2-3-0710-003
0	1	PCA BACKPLANE	2-3-0710-005
0	1	PCA MAIN CPU	2-3-0710-007
0	Note 3	ASSEMBLY, POWER SUPPLY (AC)	2-3-0710-053
0	Note 4	PRESSURE SWITCH, CARRIER	2-4-0710-266
0	1 per detector	KIT, THERMISTORS (TCD)	Note 2

0	1 per carrier	CARRIER DRYER ASSEMBLY	2-3-0500-180

Note
If a GC has a stream internal switching assembly, then one spare is recommended.

Note
Application dependent. Please contact your Rosemount Analytical, Inc. representative and provide the GC's sales order number for recommended part number and description.

Note
If the GCs are powered with an AC line, then one spare is recommended.

Note
If the GCs have a pressure switch installed, then one spare is recommended.

C.2 Recommended spare parts for 700XA FID/TCD analyzers

Quantity		Description	Part Number
1-5 GCs	**6 or more GCs or Critical Installations**		
1	1	KIT, FUSE, XA	2-3-0710-074
1	2	SOLENOID, 4 WAY, MAC, 24VDC	2-4-0710-224
Note 1	Note 1	SOLENOID, 3-WAY, 24VDC	2-4-0700-124
1	1	THERMISTOR SEALS, PACKAGE OF 10	2-3-0500-391
1 per valve	1 per valve	KIT DIAPHRAGM, 10-PORT XA	2-4-0710-171
1 per valve	1 per valve	KIT DIAPHRAGM, 6-PORT XA	2-4-0710-248
1	1	COLUMN SET	Note 2
1 per stream	1 per stream	FILTER ELEMENT 2 MICRON	2-4-5000-113
1 per stream	1 per stream	MEMBRANE KIT 120 FILTER	2-4-5000-938
0	1	PCA DETECTOR PREAMP	2-3-0710-001

0	1	PCA SOLENOID/HEATER DRIVER	2-3-0710-002
0	1	PCA BASE I/O	2-3-0710-003
0	1	PCA BACKPLANE	2-3-0710-005
0	1	PCA MAIN CPU	2-3-0710-007
0	1	PCA FID ELECTROMETER	2-3-0710-014
0	Note 3	ASSEMBLY, POWER SUPPLY (AC)	2-3-0710-053
0	1	ASSEMBLY, MICROFID, XA	2-3-0710-077
0	Note 4	KIT, FIELD, METHANATOR REPLACEMENT	2-3-0710-700
0	Note 4	PRESSURE SWITCH, CARRIER	2-4-0710-266
0	1 per detector	KIT, THERMISTORS (TCD)	Note 2
0	1 per carrier	CARRIER DRYER ASSEMBLY	2-3-0500-180

Note
If a GC has a stream internal switching assembly, then one spare is recommended.

Note
Application dependent. Please contact your Rosemount Analytical, Inc. representative and provide the GC's sales order number for recommended part number and description.

Note
If the GCs are powered with an AC line, then one spare is recommended.

Note
If the GCs have this option installed, then one spare is recommended.

C.3 Recommended spare parts for 700XA FID analyzers

Quantity		Description	Part Number
1-5 GCs	**6 or more GCs or Critical Installations**		
1	1	KIT, FUSE, XA	2-3-0710-074
1	2	SOLENOID, 4 WAY, MAC, 24VDC	2-4-0710-224

Note 1	Note 1	SOLENOID, 3-WAY, 24VDC	2-4-0700-124
1 per valve	1 per valve	KIT DIAPHRAGM, 10-PORT XA	2-4-0710-171
1 per valve	1 per valve	KIT DIAPHRAGM, 6-PORT XA	2-4-0710-248
1	1	COLUMN SET	Note 2
1 per stream	1 per stream	FILTER ELEMENT 2 MICRON	2-4-5000-113
1 per stream	1 per stream	MEMBRANE KIT 120 FILTER	2-4-5000-938
0	1	PCA DETECTOR PREAMP	2-3-0710-001
0	1	PCA SOLENOID/HEATER DRIVER	2-3-0710-002
0	1	PCA BASE I/O	2-3-0710-003
0	1	PCA BACKPLANE	2-3-0710-005
0	1	PCA MAIN CPU	2-3-0710-007
0	1	PCA FID ELECTROMETER	2-3-0710-014
0	Note 3	ASSEMBLY, POWER SUPPLY (AC)	2-3-0710-053
0	1	ASSEMBLY, MICROFID, XA	2-3-0710-077
0	Note 4	KIT, FIELD, METHANATOR REPLACEMENT	2-3-0710-700
0	Note 4	PRESSURE SWITCH, CARRIER	2-4-0710-266
0	1 per carrier	CARRIER DRYER ASSEMBLY	2-3-0500-180

Note

If a GC has a stream internal switching assembly, then one spare is recommended.

Note

Application dependent. Please contact your Rosemount Analytical, Inc. representative and provide the GC's sales order number for recommended part number and description.

Note

If the GCs are powered with an AC line, then one spare is recommended.

Note

If the GCs have this option installed, then one spare is recommended.

Appendix D
Shipping and long-term storage recommendations

The following recommendations should be followed:

- For shipping purposes the gas chromatograph should be secured to a wooden pallet, maintained in a vertical position and enclosed in a wood framework with a cardboard skin.
- Auxiliary equipment such as sample probes may be stored in the packaging in which it was shipped. If this packaging material is no longer available, secure the equipment to prevent excessive shaking and protect the accessories in a water proof enclosure.
- The gas chromatograph should be stored in a sheltered environment that is temperature controlled between -30 °C (-22° F) and 70° C (158° F) to keep the gas chromatograph's protective coatings from deteriorating from exposure to rain or caustic or corrosive environments. Humidity in the sheltered environment should be non-condensing.
- The program stored in the remote or integral controller memory may be retained through battery back-up for at least two years. If lost for some reason, a custom program for downloading the appropriate GC application is included on the CD shipped with the system documentation.
- If the gas chromatograph has been in operation, the system should be purged with carrier gas before powering the gas chromatograph down. Allowing the gas chromatograph to perform a couple of analysis cycles without sample gas is an acceptable method of purging the system. Monitor the results and remove power after component values fall to "0" or after peaks are significantly reduced in size.
- After removing power from the GC, remove the purge gas and immediately cap all inlets and vents, including the carrier drier. These vents and inlets should be capped with the fittings that were in place when the GC shipped from the factory or with Swagelok caps (not provided). This will protect the columns and filters and should result in a trouble-free start up when the unit is returned to service.
- The sample conditioning system vents and inlets should also be capped with the fittings that were in place when the system shipped from the factory. Additionally, all vents should be closed.
- Any remaining openings—such as conduit entries—should also have appropriate plugs installed to prevent foreign material such as dust or water from entering the system.

Appendix E
Engineering drawings

E.1 List of engineering drawings

This addendum contains the following engineering drawings:

- BE-22175 Label Set Field Wiring Card 1 (Sheets 1, 2, and 3)
- DE-22050 Outline and Dimensional Pole, Wall and Floor Mounting Units, 700XA
- CE-22260 Assembly, 6 Port XA Valve, Model 700XA
- CE-22300 Assembly, 10 Port XA Valve, Model 700XA
- CE-19492 Transformer Assembly

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