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OPERATING INSTRUCTIONS FOR

Model 2120XL

Trace Nitrogen in Argon Analyzer

P/N M84744
10-01-14

DANGER
This instrument is for analyzing nitrogen in argon only. Do not introduce any flammable or toxic gases into this instrument. Hazardous voltages exist on certain components internally which may be lethal. Disconnect power before servicing. Only authorized personnel should conduct maintenance and/or servicing. Before conducting any maintenance or servicing, consult with authorized supervisor/manager.

DECLARATION OF CONFORMITY

APPLICATION OF COUNCIL	:	**89/336/EEC**
STANDARDS TO WHICH CONFORMITY IS DECLARED	:	**EN55011** **EN50082-2**
MANUFACTURER'S NAME	:	**TELEDYNE ANALYTICAL INSTRUMENTS**
MANUFACTURER'S ADDRESS	:	**16830 Chestnut Street** **City of Industry, CA 91748** **U.S.A.**
TYPE OF EQUIPMENT	:	**Trace Nitrogen Analyzer**
EQUIPMENT CLASS	:	**ISM Class A Group 1**
MODEL NUMBER	:	**2120XL**

I, THE UNDERSIGNED, HEREBY DECLARE THAT THE EQUIPMENT SPECIFIED ABOVE CONFORMS TO THE ABOVE STANDARD(S) PER 89/336/EEC.

SIGNATURE: Stephen Broy / cf

FULL NAME: Stephen Broy

POSITION: Director of Engineering

DATE: 4/18/13

PLACE: City of Industry, CA

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Warranty

This equipment is sold subject to the mutual agreement that it is warranted by us free from defects of material and of construction, and that our liability shall be limited to replacing or repairing at our factory (without charge, except for transportation), or at customer plant at our option, any material or construction in which defects become apparent within one year from the date of shipment, except in cases where quotations or acknowledgements provide for a shorter period. Components manufactured by others bear the warranty of their manufacturer. This warranty does not cover defects caused by wear, accident, misuse, neglect or repairs other than those performed by Teledyne or an authorized service center. We assume no liability for direct or indirect damages of any kind and the purchaser by the acceptance of the equipment will assume all liability for any damage which may result from its use or misuse.

We reserve the right to employ any suitable material in the manufacture of our apparatus, and to make any alterations in the dimensions, shape or weight of any parts, in so far as such alterations do not adversely affect our warranty.

Important Notice

This instrument provides measurement readings to its user, and serves as a tool by which valuable data can be gathered. The information provided by the instrument may assist the user in eliminating potential hazards caused by his process; however, it is essential that all personnel involved in the use of the instrument or its interface, with the process being measured, be properly trained in the process itself, as well as all instrumentation related to it.

The safety of personnel is ultimately the responsibility of those who control process conditions. While this instrument may be able to provide early warning of imminent danger, it has no control over process conditions, and it can be misused. In particular, any alarm or control systems installed must be tested and understood, both as to how they operate and as to how they can be defeated. Any safeguards required such as locks, labels, or redundancy, must be provided by the user or specifically requested of Teledyne at the time the order is placed.

Therefore, the purchaser must be aware of the hazardous process conditions. The purchaser is responsible for the training of personnel, for providing hazard warning methods and instrumentation per the appropriate standards, and for ensuring that hazard warning devices and instrumentation are maintained and operated properly.

Teledyne Analytical Instruments, the manufacturer of this instrument, cannot accept responsibility for conditions beyond its knowledge and control. No statement expressed or implied by this document or any information disseminated by the manufacturer or its agents, is to be construed as a warranty of adequate safety control under the user's process conditions.

Specific Model Information

This instrument relies on the known spectrum emitted from a plasma discharge from a distinct gas mixture of variable composition at or near atmospheric pressure. This instrument cannot be used for analysis on any gas or gas mixture other than nitrogen in argon or a mixture specified at the time of purchase. Specific filters carefully chosen and tested at the factory have been installed for the particular gas mixture. Using this instrument to analyze any other gas mixture will result in serious error. Consult the factory for additional information for gas analysis not specified at the time of purchase.

Instrument Serial Number: _____

- Instrument Range: _____
- Calibrated for: _____
- Background Gas: _____
- Zero Gas: _____
- Span Gas: _____

Safety Messages

Your safety and the safety of others is very important. We have provided many important safety messages in this manual. Please read these messages carefully.

A safety message alerts you to potential hazards that could hurt you or others. Each safety message is associated with a safety alert symbol. These symbols are found in the manual and inside the instrument. The definition of these symbols is described below:

GENERAL WARNING/CAUTION: Refer to the instructions for details on the specific danger. These cautions warn of specific procedures which if not followed could cause bodily Injury and/or damage the instrument.

CAUTION: HOT SURFACE WARNING: This warning is specific to heated components within the instrument. Failure to heed the warning could result in serious burns to skin and underlying tissue.

WARNING: ELECTRICAL SHOCK HAZARD: Dangerous voltages appear within this instrument. This warning is specific to an electrical hazard existing at or nearby the component or procedure under discussion. Failure to heed this warning could result in injury and/or death from electrocution.

Technician Symbol: All operations marked with this symbol are to be performed by qualified maintenance personnel only.

NOTE:

Additional information and comments regarding a specific component or procedure are highlighted in the form of a note.

No Symbol

CAUTION: **THE ANALYZER SHOULD ONLY BE USED ONLY FOR THE PURPOSE AND IN THE MANNER DESCRIBED IN THIS MANUAL.**

IF YOU USE THE ANALYZER IN A MANNER OTHER THAN THAT FOR WHICH IT WAS INTENDED, UNPREDICTABLE BEHAVIOR COULD RESULT POSSIBLY ACCOMPANIED WITH HAZARDOUS CONSEQUENCES.

This manual provides information designed to guide you through the installation, calibration operation and maintenance of your new analyzer. Please read this manual and keep it available.

Occasionally, some instruments are customized for a particular application or features and/or options added per customer requests. Please check the front of this manual for any additional information in the form of an Addendum which discusses specific information, procedures, cautions and warnings that may be peculiar to your instrument.

Manuals do get lost. Additional manuals can be obtained from Teledyne at the address given in the Appendix. Some of our manuals are available in electronic form via the internet. Please visit our website at: www.teledyne-ai.com.

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DANGER
COMBUSTIBLE GAS USAGE WARNING

This is a general purpose instrument designed for use in a non-hazardous area. It is the customer's responsibility to ensure safety especially when combustible gases are present since the potential of gas leaks always exist.

Never introduce gases other than argon into the analyzer. If explosive, flammable or corrosive gases or gas mixtures are allowed to flow into the analyzer, fire or explosion can result.

Sample gas introduced must be at or very close to atmospheric pressure or damage to the detector will result.

To avoid serious injury, read all precautionary labels attached to equipment, cylinders, containers, and boxes prior to start-up.

Labels attached in appropriate areas of the analyzer warn you of inherent hazards associated with the system. For personal safety, read the labels and perform directed precautions before handling the equipment.

The customer should ensure that the principles of operating this equipment are well understood by the user. Misuse of this product in any manner, tampering with its components, or unauthorized substitution of any component may adversely affect the safety of this instrument.

Since the use of this instrument is beyond the control of Teledyne Analytical Instruments, referred as TAI, no responsibility by TAI, its affiliates, and agents for damage or injury from misuse or neglect of this equipment is implied or assumed.

Introduction

1.1 Overview

This manual describes installation, operation and maintenance for the Model 2120XL Trace Nitrogen in Argon Gas Analyzer. Section 1 describes the analyzer in general terms and provides additional safety information pertinent to the proper operation of the instrument.

The Teledyne Model 2120XL Trace Nitrogen in Argon Gas Analyzer is a robust analytical tool for measuring trace amounts of nitrogen in argon. Using precise optical filtering, single line emission characteristic of nitrogen is produced with an intensity proportional to the nitrogen concentration.

The Model 2120XL has three user programmable analysis ranges extending from 0-1 ppm to 0-100 ppm with corresponding analog output signals that are proportional to the concentration on the selected range. The nitrogen concentration is displayed on the front panel and the analog output signals are available at the rear panel. Digital communication is achieved with a standard RS-232 serial port.

The system is easy to operate with all controls and indicators accessible from the front panel. Digital flow control, two adjustable concentration alarms, system alarm, self-diagnostics are just a few of the many features included on the standard Model 2120XL instrument.

1.2 Typical Applications

The Model 2120XL Trace Nitrogen in Argon Gas Analyzer is used in a wide range of applications including:

- Air separation plants
- Argon Purification Plants
- Specialty Gas Laboratories
- Specialty Steel Manufacturing
- Gas Management/Monitoring Systems

- Quality Control for Truck Fills & Gas Cylinders
- Process Control
- New Line Certification
- Chemical Plants
- Welding Gas Management
- Semiconductor Manufacturing

1.3 Features

The Model 2120XL comes equipped with the following standard features:

- A 2-line alphanumeric vacuum fluorescent display (VFD) screen, driven by microprocessor electronics that continuously prompts and informs the operator.
- High resolution, accurate readings of nitrogen content from low ppm levels through 100 ppm in argon. Large, bright, meter readout.
- Advanced high frequency plasma generator produces stable electroluminescent discharge with minimal heating yielding a spectral emission characteristic of the gas mixture.
- Custom low-noise optical filter for precise narrow band selection and low optical interference.
- Amplified optics circuit for stable nitrogen detection at low ppb level.
- Microprocessor based electronics: 8-bit CMOS microprocessor with 32 kB RAM and 128 kB ROM.
- Three user definable output ranges (from 0-1 ppm through 0-100 ppm) allow best match to users process and equipment.
- Auto Ranging allows analyzer to automatically select the proper preset range for a given measurement. Manual override allows the user to lock onto a specific range of interest.
- Two adjustable concentration alarms and a system failure alarm.

- Extensive self-diagnostic testing, at startup and on demand, with continuous power-supply monitoring.
- Two way RFI protection.
- RS-232 serial digital port for use with a computer or other digital communication device.
- Four analog outputs: two for measurement (0–1 VDC and isolated 4–20 mA DC) and two for range identification.
- Convenient and versatile, steel, flush-panel or rack-mountable case with slide-out electronics drawer.

1.4 Front Panel

Operator controls and displays are located on the front panel as shown in Figure 1-1.

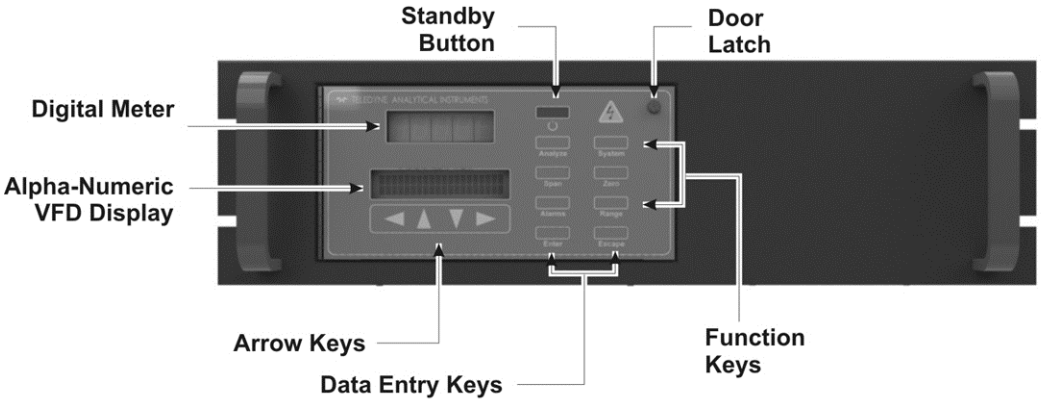

Figure 1-1 Model 2120XL Front Panel

The standard 2120XL Nitrogen in Argon Analyzer is panel mounted designed for easy installation in a standard 19" instrument rack. All user controls and displays accessible from the front panel.

The front panel has thirteen buttons for operating the analyzer, a digital meter, and an alphanumeric vacuum fluorescent (VFD) display.

Function Keys:
Six touch-sensitive membrane switches are used to change the specific function performed by the analyzer:

Analyze	Perform analysis for nitrogen content in an argon gas mixture.
System	Perform system-related tasks (described in detail in Chapter 4, Operation.).
Span	Span calibrate the analyzer.
Zero	Zero calibrate the analyzer.
Alarms	Set the alarm setpoints and attributes.
Range	Set up the 3 user definable ranges for the instrument.

Data Entry Keys:
Six touch-sensitive membrane switches are used to input data to the instrument via the alphanumeric VFD display:

◄►	Select between functions currently displayed on the VFD screen.
▲▼	Increment or decrement values of functions currently displayed.
Enter	Advances VFD display to the next screen in a series or returns to the Analyze screen if none remain.
Escape	Backs VFD display to the previous screen in a series or returns to the Analyze screen if none remain also used to abort an entry.

Digital Meter Display:
The meter display is a Light Emitting Diode (LED) device that produces large, bright, 7-segment numbers that are legible in any lighting. It produces a continuous readout from 0-10,000 ppm. It is accurate across all analysis ranges without the discontinuity inherent in analog range switching.

Alphanumeric Interface Screen:
The VFD screen is an easy-to-use interface from operator to analyzer. It displays values, options, and messages that give the operator immediate feedback.

Standby Button:
The Standby turns off the display and outputs, but circuitry is still operating.

CAUTION: **THE POWER CABLE MUST BE UNPLUGGED TO FULLY DISCONNECT POWER FROM THE INSTRUMENT. WHEN CHASSIS IS EXPOSED OR WHEN ACCESS DOOR IS OPEN AND POWER CABLE IS CONNECTED, USE EXTRA CARE TO AVOID CONTACT WITH LIVE ELECTRICAL CIRCUITS .**

Access Door:
For access to internal components of the analyzer, the front panel swings open when the latch in the upper right corner of the panel is pressed all the way in with a narrow gauge tool. Accessing the main circuit board requires unfastening rear panel screws and sliding the unit out of the case.

1.5 Rear Panel

The rear panel, shown in Figure 1-2, contains the gas and electrical connectors for external inlets and outlets. Some of those depicted are optional and may not appear on your instrument. The connectors are described briefly here and in detail in Chapter 3 *Installation*.

Power Connection	Universal AC power source.
Digital I/O	*Analog Outputs:* 0–1 VDC nitrogen concentration plus 0-1 VDC range ID, and isolated 4–20 mA DC nitrogen concentration plus 4-20 mA DC range ID. *Alarm Signals:* 2 concentration alarms and 1 system alarm. *Remote Span/Zero* Digital inputs allow external control of analyzer calibration.

	Calibration Contact Notifies external equipment that instrument is being calibrated and readings are not monitoring sample.
	Range ID Contacts Four separate, dedicated, range relay contacts. Low, Medium, High, Cal (not used).
RS-232 Port	Serial digital concentration signal output and control input.
Gas Inlet and Outlet	One inlet and one vent.
Purge Connections	Inlet and outlet connections for purging the analyzer.
Instrument Air	Used for driving optional auto calibration valves.

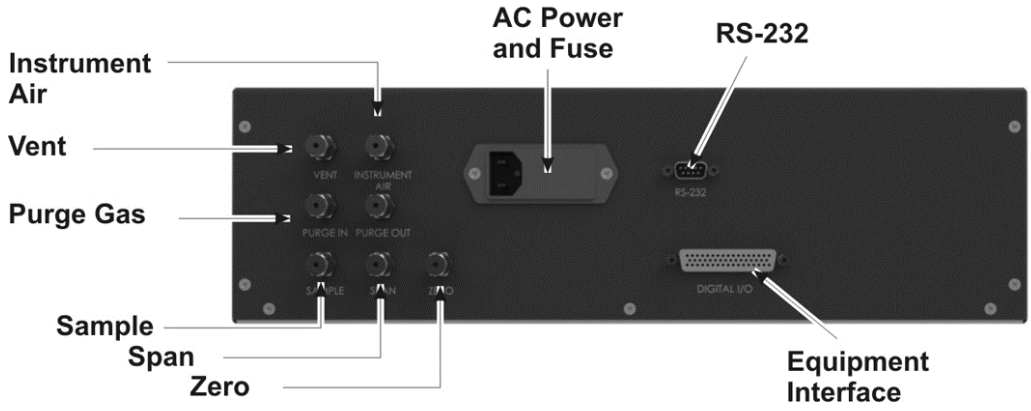

Figure 1-2: Model 2120XL Rear Panel

1.6 Internal Components

The internal components can be accessed by removing the top cover of the analyzer. Figure 1-3 shows an inside view of the analyzer

and identifies specific components of the analyzer. See also Figure 1-4 for internal components inside the card cage.

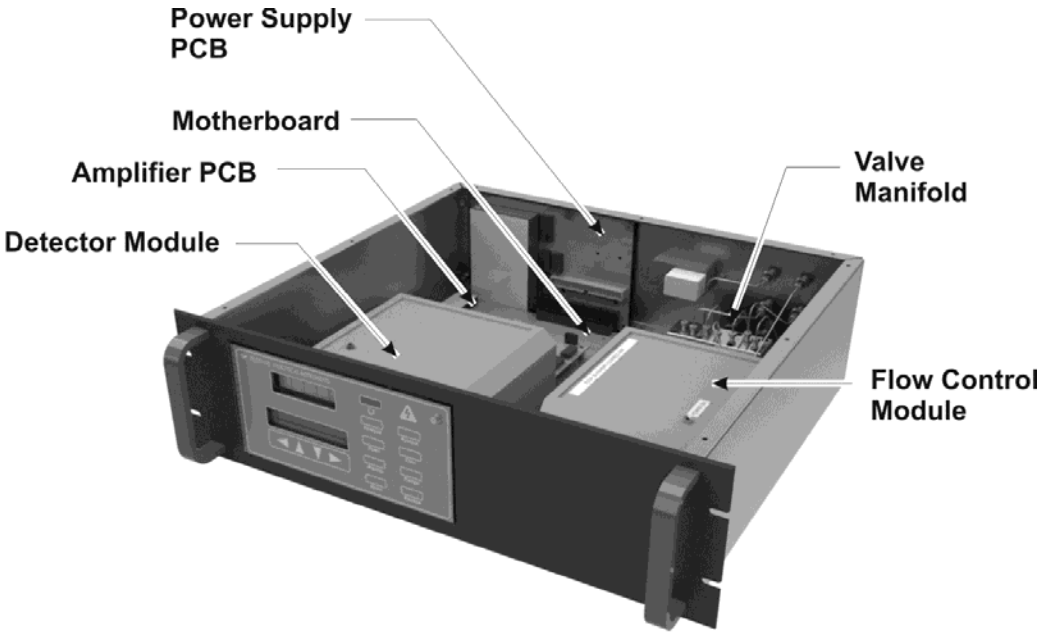

Figure 1-3: Internal Component Identification

WARNING: **HIGH VOLTAGE. ELECTROCUTION HAZARD. UNPLUG THE ANALYZER BEFORE REMOVING THE COVER. THE OUTPUT OF THE HIGH-VOLTAGE TRANSFORMER AND THE ANALYTICAL CELL ELECTRODES CAN APPROACH VOLTAGES OF 10,000 VAC. THE ANALYZER SHOULD BE SERVICED ONLY BY A QUALIFIED SERVICE TECHNICIAN.**

1.7 Additional Safety Information

Note: The material provided in this section contains information to promote safety in the operation and maintenance of this equipment. It is not intended to supersede, replicate, or replace any safety documentation or procedures provided from or established by official safety sources.

Do NOT operate the Model 2120XL Trace Nitrogen in Argon Gas Analyzer until you read and understand the operating, maintenance, and safety instructions included in this manual.

Anyone involved with the operation of this equipment including plant engineering, operations, and management, must understand the potential hazards involved, and know and observe all required safety precautions.

Your safety and the safety of equipment, nearby facilities, and personnel require a proper safety attitude and emphasis on safe work procedures. This is the essence of any good safety program. If at any time you identify safety deficiencies, immediately correct them and bring them to the attention of management.

Before an accident can be prevented, it must be anticipated. Use pre-job discussions with your coworkers and supervisors to identify hazards and the means to avoid them. At your facility, various gases may exist in liquid and/or gaseous states. Familiarize yourself with the hazards associated with each gas found at your facility.

Read and understand the Material Safety Data Sheets (MSDS) for the materials used with this equipment. All personnel who work in the vicinity of this equipment should read, understand, and follow all safety information contained in the MSDSs, in addition to following all government and facility safety regulations.

CAUTION: 

NEVER INTRODUCE GASES OTHER THAN ARGON INTO THE ANALYZER. IF EXPLOSIVE, FLAMMABLE, OR CORROSIVE GASES OR GAS MIXTURES ARE ALLOWED TO FLOW INTO THE ANALYZER, FIRE OR EXPLOSION CAN RESULT. THIS ANALYZER IS NOT DESIGNED TO BE USED IN HAZARDOUS AREAS.

1.7.1 Detector Cautions

The Model 2120XL uses a detection technique based on spectroscopic emission. The detector is a thin-walled pure quartz cell located in an electromagnetic field created by a specific high intensity plasma generator. This electromagnetic field creates a plasma that emits light at different wavelengths. A filter for the nitrogen is used to avoid any interference and get the best performance.

Since the cell is made of thin quartz, this analyzer must be used at atmospheric pressure to avoid cell damage. **Any back pressure in the detector will cause damage and require replacement of the module. Make sure the vent is at atmospheric pressure and without restrictions or blockage.**

1.7.2 Basic Safety Requirements

The following safety guidelines apply at all times when working with the Model 2120XL analyzer:

- **Prevent electrical shock** — Unplug and remove the AC power cord from the rear panel before opening and working on the analyzer. Use tools designed for work on electrical equipment.
- **Prevent injury** — Always wear safety glasses and appropriate safety protection. Ensure that all tools and instruments used during installation and maintenance are in good condition. Be aware that high-velocity gas may be released at vents and safety relief valves.
- **Follow posted precautions** — Read all precautionary labels attached to the equipment. Be sure to read all cylinder labels and warnings. Comply with all precautions before handling the equipment.

Situations may develop for which no written procedures exist. Think carefully before acting. Know the function of each valve and switch, and its effect on the equipment. Carefully review all operating procedures before starting up this equipment to ensure knowledge and understanding.

1.7.3 Precautionary Labels

WARNING: TO AVOID SERIOUS INJURY, READ ALL CAUTION LABELS ATTACHED TO EQUIPMENT, CYLINDERS, CONTAINERS, AND BOXES PRIOR TO START-UP.

Labels attached in appropriate areas of the analyzer warn you of inherent hazards associated with the system. For personal safety, read the labels and perform directed instructions before handling the equipment.

1.7.4 Summary of Known Hazards

This equipment is designed to minimize your exposure to the process gases and other known hazards. Read and thoroughly understand all safety aspects of this system and its operation before operating or maintaining the equipment.

1.7.4.1 ELECTROCUTION

WARNING: 

DO NOT OPERATE THE ANALYZER WITHOUT THE COVER SECURED IN PLACE. THE OUTPUT OF THE HIGH-VOLTAGE TRANSFORMER AND THE ANALYTICAL CELL ELECTRODES CAN APPROACH VOLTAGES OF 6,000 VAC OR HIGHER. TO GUARD AGAINST ELECTRICAL SHOCK AND POSSIBLE ELECTROCUTION, THE ANALYZER SHOULD BE SERVICED ONLY BY A QUALIFIED SERVICE TECHNICIAN.

Adherence to the following guidelines helps guard against electrical shock:

- For safety and proper performance, this analyzer must be connected to a properly grounded three-wire source of electrical power.
- Tampering or unauthorized substitution of components may adversely affect the safety of this instrument. Use only factory-approved components for repair.
- Before checking or replacing any chassis component, turn off the power and remove the AC power cord from the rear panel.

1.7.4.2 PRESSURE

WARNING: 

MISHANDLING OF GAS CYLINDERS COULD RESULT IN DEATH, SERIOUS INJURY, OR PROPERTY DAMAGE. HANDLE AND STORE GAS CYLINDERS WITH EXTREME CARE AND IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

Sudden or uncontrolled release of pressurized gas can cause serious injury. The hazards of high pressure can be avoided through careful inspection and handling of cylinders and equipment with proper

regulation. Read and understand the MSDSs for the process gases used before operating this analyzer. More detailed information on the precautions and safe practices to follow when handling cylinders can be found in the CGA pamphlet P-1, *Safe Handling of Compressed Gases in Cylinders.*

1.7.4.3 PURGING

CAUTION:

EQUIPMENT DAMAGE MAY RESULT IF THE ANALYTICAL CELL IN THIS UNIT IS EXPOSED TO PRESSURE ABOVE ATMOSPHERIC PRESSURE. THE CELL MAY BREAK OR SHATTER. TO PREVENT THIS, ALWAYS KEEP THE VENT AT ATMOSPHERIC PRESSURE.

DO NOT EXCEED 20 PSIG (138 KPA) AT THE SAMPLE INLET.

DO NOT BLOCK THE VENT.

Follow applicable safety precautions to ensure that an oxygen-deficient atmosphere is not created in the work area. Use low parts per million (ppm) nitrogen in argon gas with proper regulation to avoid contaminating the sampling system.

1.7.4.4 SAFE REPAIR PROCEDURES

Any repair work must be performed by a qualified service technician. Use only factory-approved components for repair.

Analyzer manifold purging as well as subsequent repair work must be performed by experienced personnel.

Ventilate working area to prevent any leaking supply gas from accumulating. Vent all gases to the outside.

Vent all pressure relief valves out of enclosed areas. Piping must be properly sized to allow safety devices to operate according to specifications.

De-pressurize supply gas piping before working on it.

1.7.4.5 GENERAL PRECAUTIONS FOR HANDLING AND STORING HIGH PRESSURE GAS CYLINDERS

Compressed gases have properties that can cause serious accidents, injuries, and even death if proper precautions and safety practices are

not followed. Therefore, during handling and use of these gases, be certain to use applicable safety precautions described by your local compressed gas supplier, the Compressed Gas Association, and/or OSHA regulations.

1. Read the label on all cylinders BEFORE using to identify the cylinder contents. If the label is illegible, return the cylinder to the supplier. DO NOT ASSUME THE CONTENTS.
2. Secure cylinders in storage and in use to an immovable structure to prevent accidental falling or movement. Read the relevant safety codes.
3. Store or move cylinders ONLY in the vertical position. DO NOT move or transport cylinders with regulators attached.
4. Store cylinders in a well ventilated area away from heat or ignition sources.
5. When installing tubing, provide ONLY approved, adequate pressure reducing regulators and pressure relief devices to prevent over-pressurizing of tubing and equipment.
6. Never drop cylinders or permit them to strike each other violently.
7. Cylinders may be stored in the open but, in such cases, should be protected against extremes of weather and from damp ground (to prevent rusting) in areas where extreme temperatures are prevalent, store cylinders in the shade.
8. The valve protection cap should be left on each cylinder until cylinder has been secured against a wall or bench, or placed in a cylinder stand and is ready for use.
9. Avoid dragging, rolling or sliding cylinders even for a short distance. Move cylinders by using a suitable hand truck.
10. Never tamper with safety devices in valves or cylinders.
11. Do not store full and empty cylinders together. Serious suck-back can occur when an empty cylinder is attached to a pressurized system.
12. No part of a cylinder should be subjected to a temperature higher than 52°C (125°F). Do not permit flame to come in contact with any part of a compressed gas cylinder.

Operational Theory

2.1 The Analyzer

The Model 2120XL Trace Nitrogen in Argon Gas Analyzer is a rack mounting self-contained unit for measuring trace amounts of nitrogen in an argon gas stream.

A customer supplied sample system directs a stream of refined argon to the instrument at a pressure between 4 and 20 psig (14-138 kPa). The process stream enters at a constant flow rate and passes through a flow module containing a flow control valve and a mass flow transducer. A gas conditioning unit is installed to remove particulates from the incoming gas sample.

The gas is then fed to a quartz analytical cell where it is ionized in a plasma discharge. The high energy within the plasma results in constant collisions of ions and electrons and yields a characteristic emission spectra intimately associated with the gas comprising the plasma.

The specific line energy is identified for nitrogen and a custom blocking filter is selectively chosen and installed at the factory which is tuned to remove all but the narrow energy associated with the nitrogen emission peak. The light energy passing through the filter is focused on a photon detector also tuned to respond to that wavelength. This instrument can only be used for analyzing nitrogen in argon.

The photodetector produces a signal which is integrated and then amplified. The resulting signal is digitized and processed by a microprocessor and signal processing circuit. The results are displayed on the instrument display as parts per million (ppm). An additional digital to analog circuit transforms the signal back to analog form and produces an output signal, typically 4-20 mA DC that is proportional to the nitrogen concentration on the selected range.

The microprocessor circuit accepts input from the mass flow transducer as well as the user interface. The analyzer software interprets operator key presses and initiates the appropriate action as well as sending signals to the displays for prompting the user for input or data display.

After analysis, the gas is returned to the gas flow module. A signal is produced in the flow transducer that is used by the microprocessor to control the flow control valve. From the flow control module, the gas exits the analyzer at atmospheric pressure.

The superior accuracy of the Model 2120XL is achieved through enhanced coupling of the plasma to the process and an advanced plasma generator design. Through proper frequency and intensity control a uniform, precisely located, and highly stable plasma discharge is produced with minimum heat generation. The resulting emission spectra is clear and distinct.

The Model 2120XL is fitted with custom optical filtering and an optics system that is specifically designed to reduce interference. The desired spectral line used for analysis is sharp and focused on the detector.

The detector lifetime is enhanced using a "Duty Cycle Controlled System" by reducing the coating inside the cell. This also results in an increase in sensitivity.

2.2 Sample System

A suitable external sample system must be provided by the customer. The external sample system delivers calibration or sample gas to the analyzer at a suitable pressure.

The sample system may contain a molecular sieve type trap to reduce moisture levels in the sample gas. Moisture produces a well-known interference line in the spectrum close to that of nitrogen. It is necessary to use moisture-free sample gas or install an efficient moisture trap on the inlet.

Internally the Model 2120XL employs a flow control valve which provides proper flow through the analyzer when the inlet pressure is maintained between 4 to 20 psig. The proper flow rate should be maintained around 100 ccm.

CAUTION: **IT IS THE RESPONSIBILITY OF THE END USER TO PROVIDE A SUITABLE SAMPLE SYSTEM CAPABLE OF DELIVERING CLEAN, PARTICULATE-FREE ARGON THAT IS AIR AND MOISTURE FREE.**

EQUIPMENT DAMAGE MAY RESULT IF THE ANALYTICAL CELL IN THIS UNIT IS EXPOSED TO PRESSURE, CAUSING IT TO BREAK OR SHATTER. TO PREVENT THIS, NEVER EXCEED 20 PSIG (138 KPA) ON THE INPUT PORT AND ALWAYS MAINTAIN THE VENT AT ATMOSPHERIC PRESSURE.

DO NOT BLOCK THE VENT.

The external sample system should be capable of supplying clean, particulate-free and moisture-free sample gas that is also free of air and moisture. If air or moisture is ionized in the analytical cell, ozone emissions are possible. These same conditions apply to any calibration gases used.

Section 3.6.1 provides more information on a suitable sample system.

If air enters the sample system, it can be removed by purging the sample lines. Recalibration is not necessary.

Installation

Installation of the Model 2120XL Trace Nitrogen in Argon Analyzer can involve potentially hazardous procedures.

CAUTION:  **INSTALLATION SHOULD BE PERFORMED ONLY BY TRAINED AND QUALIFIED PERSONNEL WHO HAVE READ AND UNDERSTOOD THE INSTRUCTIONS IN THIS MANUAL.**

Installation of the Model 2120XL Trace Nitrogen in Argon Analyzer includes:

- Unpacking
- Choosing an Appropriate Location
- Mounting
- Electrical connections
- Gas connections
- Purging
- Calibration

3.1 Unpacking the Instrument

The analyzer is shipped with all the materials you need to install and prepare the system for operation. Carefully remove the analyzer from the shipping container and visually inspect it for damage. Maintain it in an upright position and avoid jarring. Ensure the power cord and calibration data sheets are included and that all components ordered have been supplied. Remove any plugs that may be installed on the gas tube fittings on the rear panel.

If any items are missing or the analyzer appears damaged, immediately report any damage to the shipping agent and notify Teledyne. Remove and discard caps from fittings; inspect the analyzer for loose fittings or connections.

3.2 Choosing a Location

Locate the Model 2120XL in a clean area free of:

- Excessive dust
- Mechanical vibrations
- Strong electric or electromagnetic fields
- Corrosive gases
- Moisture exceeding 90% relative humidity
- The use of walkie-talkies or cellular phones

Choose a location where sudden temperature changes in excess of 5°F (5°C) do not occur and where the temperature does not exceed the specified ambient temperature range. Avoid any location where the instrument would be exposed to direct sunlight or radiation from heaters.

CAUTION: THIS ANALYZER IS DESIGNED FOR USE IN A GENERAL PURPOSE AREA AND IS NOT RATED FOR USE IN HAZARDOUS AREAS.

3.3 Mounting

The Model 2120XL is a rack mountable unit intended for indoor use only. Space and materials required for mounting are:

- 8-3/4-inches (22.2 cm) of 19-inch rack space.
- Service access space behind and in front of the analyzer.
- Four mounting screws suited to the rack.

All operator controls are mounted on the control panel, which is hinged on the left edge and doubles as the door that provides access to components inside the controller module. The door latch is spring loaded and will swing open when the button in the center of the latch (upper right corner) is pressed all the way in with a narrow gauge tool (less than 0.18 inch wide). Allow clearance for the door to open in a 90-degree arc of radius 7.125 inches. See Figure 3-1.

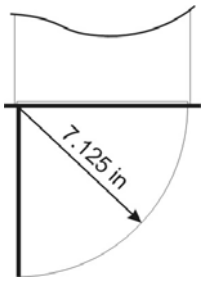

Figure 3-1: Required Front Door Clearance

3.4 Rear Panel Connections

Figure 3-2 shows the Model 2120XL rear panel. Up to 7 gas inlet and outlet ports are installed depending on whether the unit is supplied with an optional auto calibration module. In addition, the rear panel has provisions for power, communication, and a user interface connector that incorporates alarm, analog output, digital input/output, and relay connections that are used in interfacing peripheral equipment with the analyzer.

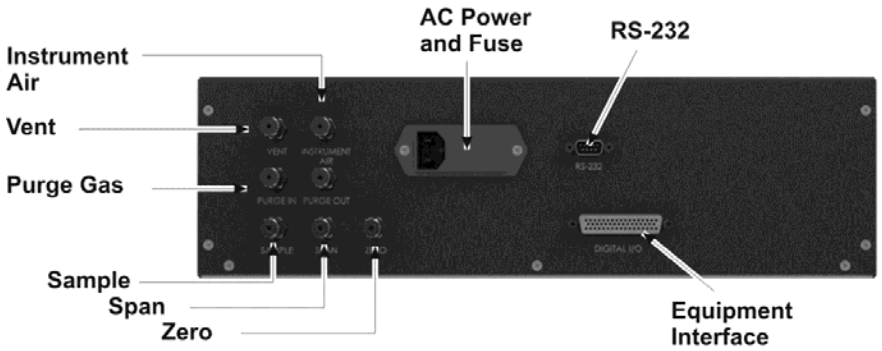

Figure 3-2: Rear Panel of the Model 2120XL

3.5 Electrical Connections

Electrical Connections are made at the rear of the instrument. See Figure 3-2.

For safe connections, no uninsulated wiring should be able to come in contact with fingers, tools or clothing during normal operation.

CAUTION: USE SHIELDED CABLES. ALSO, USE PLUGS THAT PROVIDE EXCELLENT EMI/RFI PROTECTION. THE PLUG CASE MUST BE CONNECTED TO THE CABLE SHIELD, AND IT MUST BE TIGHTLY FASTENED TO THE ANALYZER WITH ITS FASTENING SCREWS. ULTIMATELY, IT IS THE INSTALLER WHO ENSURES THAT THE CONNECTIONS PROVIDE ADEQUATE EMI/RFI SIELDING.

3.5.1 Primary Input Power

The power cord receptacle and fuse block are located in the same assembly. Insert the power cord into the power cord receptacle.

CAUTION: POWER IS APPLIED TO THE INSTRUMENT'S CIRCUITRY AS LONG AS THE INSTRUMENT IS CONNECTED TO THE POWER SOURCE. THESTANDBY SWITCH ON THE FRONT PANEL IS FOR SWITCHING POWER ON OR OFF TO THE DISPLAYS AND OUTPUTS ONLY.

The universal power supply requires an 85–250 VAC, 47-63 Hz power source.

Fuse Installation: The fuse block, at the right of the power cord receptacle, accepts US or European size fuses. A jumper replaces the fuse in whichever fuse receptacle is not used. Fuses are not installed at the factory. Be sure to install the proper fuse as part of installation. (See *Fuse Replacement* in Chapter 5, *Maintenance*.)

3.5.2 50-Pin Equipment Interface Connector

Figure 3-3 shows the pin layout of the Equipment Interface Connector. The arrangement is shown as seen when the viewer faces the rear panel of the analyzer. The pin numbers for each input/output function are given where each function is described in the paragraphs below.

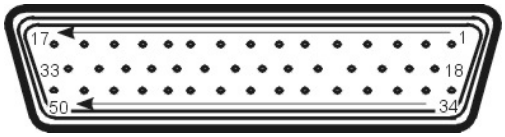

Figure 3-3: Equipment Interface Connector Pin Arrangement

Analog Outputs: There are four DC output signal pins—two pins per output. For polarity, see Table 3-1. The outputs are:

0–1 VDC % of Range:	Voltage rises linearly with increasing nitrogen, from 0 V at 0 ppm to 1 V at full scale ppm. (Full scale = 100% of programmable range.)
0–1 VDC Range ID:	0.25 V = Low Range, 0.5 V = Medium Range, 0.75 V = High Range, 1 V = 100ppm.
4–20 mA DC % Range:	Current increases linearly with increasing nitrogen, from 4 mA at 0 ppm to 20 mA at full scale ppm. (Full scale = 100% of programmable range.)
4–20 mA dc Range ID:	8 mA = Low Range, 12 mA = Medium Range, 16 mA = High Range, 20 mA = 100ppm.

Table 3-1: Analog Output Connections

Pin	Function
3	+ Range ID, 4-20 mA, floating
4	– Range ID, 4-20 mA, floating
5	+ % Range, 4-20 mA, floating
6	– % Range, 4-20 mA, floating
8	+ Range ID, 0-1 V dc
23	– Range ID, 0-1 V dc, negative ground
24	+ % Range, 0-1 V dc
7	– % Range, 0-1 V dc, negative ground

Alarm Relays: The nine alarm-circuit connector pins connect to the internal alarm relay contacts. Each set of three pins provides one set of Form C relay contacts. Each relay has both normally open and normally closed contact connections. The contact connections are shown in Table 3-2. They are capable of switching up to 3 amperes at 250 VAC into a resistive load. The connectors are:

- **Threshold Alarm 1:**
  - Can be configured as high (actuates when concentration is above threshold), or low (actuates when concentration is below threshold).
  - Can be configured as failsafe or non-failsafe.
  - Can be configured as latching or non-latching.
  - Can be configured out (defeated).
- **Threshold Alarm 2:**
  - Can be configured as high (actuates when concentration is above threshold), or low (actuates when concentration is below threshold).
  - Can be configured as failsafe or non-failsafe.
  - Can be configured as latching or non-latching.
  - Can be configured out (defeated).

Table 3-2: Alarm Relay Contact Pins

Pin	Contact
45	Threshold Alarm 1, normally closed contact
28	Threshold Alarm 1, moving contact
46	Threshold Alarm 1, normally open contact
42	Threshold Alarm 2, normally closed contact
44	Threshold Alarm 2, moving contact
43	Threshold Alarm 2, normally open contact
36	System Alarm, normally closed contact
20	System Alarm, moving contact
37	System Alarm, normally open contact

Digital Remote Cal Inputs: Accept 0 V (off) or 24 VDC (on) inputs for remote control of calibration. (See *Remote Calibration Protocol* below.) See Table 3-3 for pin connections.

Zero: Floating input. 5 to 24 V input across the + and – pins puts the analyzer into the Zero mode. Either side may be grounded at the source of the signal. 0 to 1 volt across the terminals allows Zero mode to terminate when done. A synchronous signal must open and close the external zero valve appropriately. See Remote Probe Connector.

Span: Floating input. 5 to 24 V input across the + and – pins puts the analyzer into the Span mode. Either side may be grounded at the source of the signal. 0 to 1 volt across the terminals allows Span mode to terminate when done. A synchronous signal must open and close external span valve appropriately. See Figure 3-4 Remote Valve Connections.

Cal Contact: This relay contact is closed while analyzer is spanning and/or zeroing. (See *Remote Calibration Protocol* below.)

Table 3-3: Remote Calibration Connections

Pin	Function
9	+ Remote Zero
11	– Remote Zero
10	+ Remote Span
12	– Remote Span
40	Cal Contact
41	Cal Contact

Remote Calibration Protocol: To properly time the Digital Remote Cal Inputs to the Model 2120XL Analyzer, the customer's controller must monitor the Cal Relay Contact.

When the contact is OPEN, the analyzer is analyzing, the Remote Cal Inputs are being polled, and a zero or span command can be sent.

When the contact is CLOSED, the analyzer is already calibrating. It will ignore your request to calibrate, and it will not remember that request.

Once a zero or span command is sent, and acknowledged (contact closes), release it. If the command is continued until after the zero or span is complete, the calibration will repeat and the Cal Relay Contact (CRC) will close again.

For example:

1. Test the CRC. When the CRC is open, Send a zero command until the CRC closes (The CRC will quickly close.)
2. When the CRC closes, remove the zero command.
3. When CRC opens again, send a span command until the CRC closes. (The CRC will quickly close.)
4. When the CRC closes, remove the span command.

When CRC opens again, zero and span are done, and the sample is being analyzed.

Note: The Remote Valve connections (described below) provides signals to ensure that the zero and span gas valves will be controlled synchronously. If you have the Auto Caibration Option, it includes additional zero and span gas inputs—the 2120XL automatically regulates the zero, span and sample gas flow.

Range ID Relays: Four dedicated Range ID relay contacts. The first three ranges are assigned to relays in ascending order—Low range is assigned to Range 1 ID, Medium range is assigned to Range 2 ID, and High range is assigned to Range 3 ID. The fourth range is reserved for the Cal Range. Table 3-4 lists the pin connections.

Table 3-4: Range ID Relay Connections

Pin	Function
21	Range 1 ID Contact
38	Range 1 ID Contact
22	Range 2 ID Contact
39	Range 2 ID Contact
19	Range 3 ID Contact

18	Range 3 ID Contact
34	Range 4 ID Contact (not used)
35	Range 4 ID Contact (not used)

Network I/O: A serial digital input/output for local network protocol. At this printing, this port is not yet functional. It is to be used for future options to the instrument. Pins 13 (+) and 29 (–).

Remote Valve Connections: The Model 2120XL is a single-chassis instrument and does not have a Remote Probe. Instead, the Remote Probe connections are used as a method for directly controlling external sample/zero/span gas valves. See Figure 3-4.

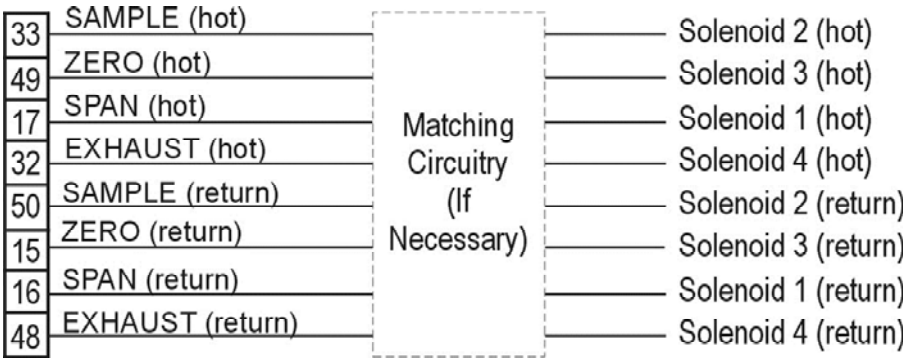

Figure 3-4: Remote Valve Connections

The voltage from these outputs is nominally 0 V for the OFF and 15 VDC for the ON conditions. The maximum combined current that can be pulled from these output lines is 100 mA. (If two lines are ON at the same time, each must be limited to 50 mA, etc.) If more current and/or a different voltage is required, use a relay, power amplifier, or other matching circuitry to provide the actual driving current.

In addition, each individual line has a series FET with a nominal ON resistance of 5 ohms (9 ohms worst case). This can limit the obtainable voltage, depending on the load impedance applied. See Figure 3-5.

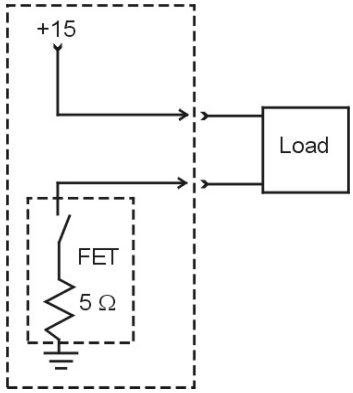

Figure 3-5: FET Series Resistance

3.5.3 RS-232 Port

The digital signal output is a standard, full duplex RS-232 serial communications port used to connect the analyzer to a computer, terminal, or other digital device. It requires a standard 9-pin D connector.

The output data is status information, in digital form, updated every two seconds. Status is reported in the following order:

- The concentration in ppm or percent
- The range in use (HI, MED, LO)
- The span of the range (0-100 ppm, etc)
- Which alarms—if any—are disabled (AL–x DISABLED)
- Which alarms—if any—are tripped (AL–x ON).

Each status output is followed by a carriage return and line feed.

Three input functions using RS-232 have been implemented to date. They are described in Table 3-5.

Table 3-5: Commands via RS-232 Input

Command	Description
as<enter>	Immediately starts an autospan.

az<enter>	Immediately starts an autozero.
st<enter>	Toggling input. Stops/Starts any status message output from the RS-232, until **st**<enter> is sent again.

The RS-232 protocol allows some flexibility in its implementation. Table 3-6 lists certain RS-232 values that are required by the Model 2120XL implementation.

Table 3-6: Required RS-232 Options

Parameter	Setting
Baud	9600
Byte	8 bits
Parity	none
Stop Bits	1
Message Interval	2 seconds. When CRC opens again, zero and span are done, and the sample is being analyzed.

3.6 Gas Connections

CAUTION: **THIS INSTRUMENT IS NOT DESIGNED TO HANDLE HAZARDOUS GASES.**

OZONE EMISSIONS CAN OCCUR IF AIR OR MOISTURE ARE IONIZED IN THE SAMPLING SYSTEM. THE SAMPLE PATH MUST BE RELATIVELY FREE OF AIR AND/OR MOISTURE BEFORE APPLYING THE IONIZING VOLTAGE.

KEEP THE MODEL 2120XL POWER OFF AND PURGE THE EXTERNAL TUBING. THEN APPLY POWER TO PURGE THE INTERNAL LINES. ANALYZER POWER IS NEEDED TO PURGE ANALYZER SINCE THE FLOW CONTROL MODULE NEEDS POWER TO OPERATE. MAKE SURE THAT THE VENT IS AT ATMOSPHERIC PRESSURE.

Note: Air leaking into the sampling system will cause erratic or unsatisfactory analyzer operation. Even if air is admitted into the system for only a few minutes, you must purge the regulator and the system for at least 1 hour before the readings stabilize. See Section 3.7.

Whenever a fitting on the sample system is opened, use a new ferrule and cone or new gasket depending on the type of fitting to secure a gas tight seal. Each fitting should be leak checked whenever a connection has been opened or disturbed in any manner.

All gas connections are made to the 1/8" tube fittings installed on the rear panel. See Figure 3-2. The connections include:

- Sample Gas In
- Exhaust Gas Out (Vent)
- Instrument Air (optional calibration valves)
- Purge Gas (optional calibration valves)
- Span Gas In (optional calibration valves)
- Zero Gas In (optional calibration valves)

CAUTION: **EQUIPMENT DAMAGE MAY RESULT IF THE ANALYTICAL CELL IN THIS UNIT IS EXPOSED TO PRESSURE, CAUSING IT TO BREAK OR SHATTER. TO PREVENT THIS, NEVER EXCEED 20 PSIG (138 KPA) ON THE INLET PORT AND ALWAYS MAINTAIN THE VENT AT ATMOSPHERIC PRESSURE.**

DO NOT BLOCK THE VENT. ANY BACKPRESSURE ON THE VENT WILL CAUSE DAMAGE TO THE ANALYTICAL CELL.

To connect the gas line:

1. Connect an unobstructed vent line to the 1/8" (0.32 cm) Swagelok fitting on the vent port on the rear of the analyzer.
2. Connect the purge gas input to the analyzer at the Purge Inlet.
3. On units equipped with the optional calibration valve, connect a source of instrument air to the unit. The air supply must be regulated to 65-70 psig.

CAUTION: AIR PRESSURE LESS THAN 65 PSIG WILL RESULT IN A FLOW RESTRICTION.

4. Connect the span and zero lines to the rear panel fittings supplied for this purpose. The span and zero gas inputs must be pressure regulated to the same pressure as the sample gas (4-20 psig).

Note: If this instrument is without the auto calibration option, there will be no rear panel fittings for zero and span gases. The customer must install a suitable valve switching manifold or tee the calibration gases with valves into the sample in line.

3.6.1 Typical Sample System

A suggested sample system is shown in Figure 3-6. This system allows you to switch the analyzer between zero or span calibration gases and the process gas streams quickly and efficiently without disconnecting the analyzer and introducing air in the system.

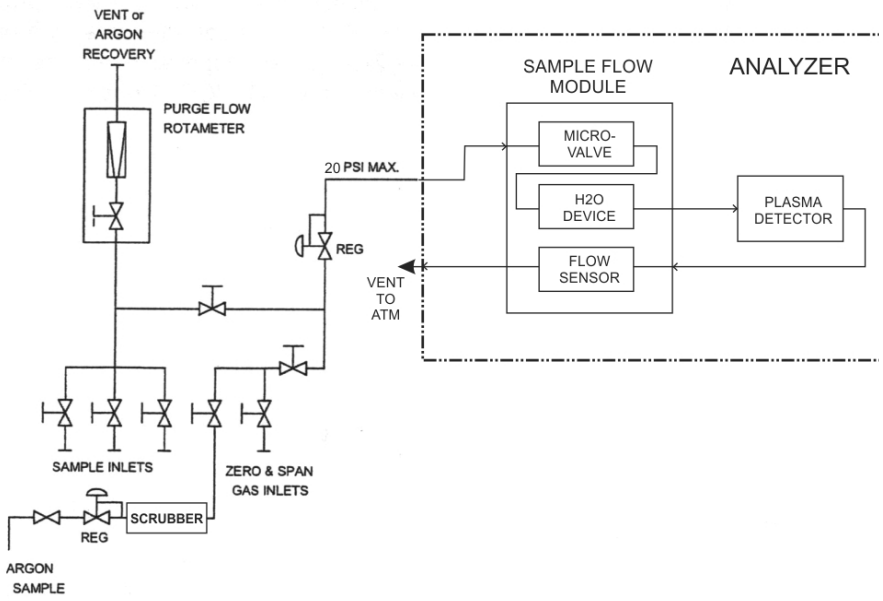

Figure 3-6: Suggested Sample System

The sample manifold system must be designed so that you can:

- Purge the sample line and pre-adjust the flow rate before admitting a sample to the analytical cell.
- Maintain a flow of argon through the analytical cell whenever ionization voltage is being applied.

The following guidelines are presented as an aid in constructing a suitable external sampling system for the Model 2120XL:

- Alter the geometry of the system in Figure 3-2, as necessary, to suit your specific needs and to maintain access to items on the rear panel. However, alterations should be adhered to schematically.
- Use 1/8-inch (0.32 cm) electro-polished stainless steel tubing for all parts of the manifold between the source and sample inlet connections of the analyzer. Although you can use 1/4-inch (0.64 cm) tubing, it is not recommended. The manifold should be a welded assembly wherever possible.
- Use only high-purity components with metal seals.
- Eliminate excess components.
- Minimize "dead spaces" in the sample lines.
- Use a 1/8 inch compression fitting for the analyzer inlet connection.
- Use a high-quality regulator or device to maintain a constant pressure to the zero, sample, and span inlet lines. Teledyne recommends using a high-purity regulator with the following specifications:
  - 2-stage tiered diaphragm
  - 100 psi outlet
  - 15 RA max
  - 5 ports
  - CGA 580 welded on inlet side
  - 1/8 M (1 port), 1/8 F (1 port)
  - 2 gauges

3.6.2 Gas Connections to the Instrument

CAUTION: EQUIPMENT DAMAGE MAY RESULT IF THE ANALYTICAL CELL IN THIS UNIT IS EXPOSED TO PRESSURE ABOVE ATMOSPHERIC, CAUSING IT TO BREAK OR SHATTER. TO PREVENT THIS, NEVER EXCEED 20 PSIG (138 KPA) ON THE INLET PORT. ALWAYS ENSURE THAT THE VENT IS AT ATMOSPHERIC PRESSURE.

DO NOT REMOVE THE FLOW CONTROL ORIFICE FROM THE SAMPLE INLET OF THE ANALYZER.

DO NOT BLOCK THE VENT.

To connect the gas line:

1. Connect an unobstructed vent line to the 1/8-in Swagelok fitting on the vent port on the rear of the analyzer.
2. Connect the inlet line from the sample manifold system, regulated to 4 to 20 psig (41 kPa), to the 1/8-in Input port fitting on the rear of the analyzer.

3.7 Purging

The Model 2120XL is equipped with a flow control module installed in the analyzer sample inlet to regulate flow and pressure to the analytical cell. A maximum inlet pressure of 20 psig (138 kPa) is allowable.

CAUTION: OZONE EMISSIONS ARE POSSIBLE IF AIR OR MOISTURE IS IONIZED IN THE SAMPLING SYSTEM. THE SAMPLE PATH MUST BE RELATIVELY FREE OF AIR AND/OR MOISTURE BEFORE APPLYING THE IONIZING VOLTAGE.

KEEP THE MODEL 2120XL POWER OFF AND PURGE THE EXTERNAL TUBING. THEN APPLY POWER TO PURGE THE INTERNAL LINES. ANALYZER POWER IS NEEDED TO PURGE ANALYZER SINCE THE FLOW CONTROL MODULE NEEDS POWER TO OPERATE.

When installing a new analyzer or starting up an analyzer that has been idle for a period of time, the sampling system should be purged for several hours to cleanse it of contaminants and water vapor.

Although high-purity sample gas may be used to purge the analyzer, argon with a minimum purity of 99.999% is recommended.

The exact purge method depends on the sample manifold design and construction. In general, each sample inlet line must be thoroughly purged. Sufficient purge time becomes critical when sample lines longer than 10 feet (3 m) are used.

To purge the analyzer (see Figure 3-2):

Note: Do not purge long lines through the analytical cell. First, purge them through the purge flow rotameter; then transfer flow to the analyzer cell as suggested in step 6, below. This eliminates the possibility of contaminating the analytical cell and having to purge for an extended period to reach equilibrium.

1. Close all valves on the sample manifold.
2. Open the valve on sample inlet line to be purged and any shut-off valve that may be installed.
3. Connect purge gas to the sample inlet line.
4. Use a flowmeter on the purge gas and adjust flow rate to 1 cfh (0.475 slpm) at no more than 7 psig (76 kPa) and purge for at least one hour.
5. Close the sample inlet valve, and then repeat steps 2 through 4 to purge any other sample inlet lines.
6. After the last sample line and the zero and span gas inlet lines have been purged, close the purge flowmeter valve, open the valve controlling flow through the analytical cell, and purge the analyzer with the sample flow set at 1 cfh (0.475 slpm). Purge the analyzer for a minimum of 6 hours.
7. If cylinder argon is used as a purge gas, reconnect the sample gas to sample manifold inlet.
8. After purging, a calibration should be performed.

3.8 Calibration

The Model 2120XL was calibrated at the factory in accordance with the calibration data shipped with your instrument. Prior to using the instrument for analysis the calibration must be checked using the factory settings supplied. If the settings do not match, the instrument should be recalibrated prior to using for the first time.

Calibration procedures require an understanding of how to operate the instrument which is discussed in Section 4 of this manual. Refer to Section 4.5.2 for calibration procedures after reading the entire section on operating the instrument (Section 4).

3.9 Installation Checklist

After installing the system, and prior to powering up the system, verify the following items:

1. Each gas line has been purged for at least 1 hour prior to connection to the analyzer inlets.
2. There are no leaks at the sample inlet gas connection to the instrument.
3. There are no leaks between the span gas cylinder and the analyzer span gas inlet port when span gas is flowing to the analyzer.
4. There are no leaks between the zero gas source and the analyzer zero gas inlet port when zero gas is flowing to the analyzer.
5. The vent tube connection has no leaks, has an unobstructed path to atmosphere, and is at least 1/8-in (0.32-cm) OD.
6. All electrical connections have been made properly and the Power Entry module is set for the appropriate power from your facility.

Operation

This section describes the operation and calibration procedures for the Model 2120XL Trace Nitrogen in Argon Analyzer. Operation of the analyzer involves potentially hazardous procedures. Only trained and qualified personnel who have read and understood the instructions in this manual should operate this equipment.

CAUTION: 

DO NOT OPERATE THIS ANALYZER UNTIL YOU HAVE READ AND UNDERSTOOD THE INSTRUCTIONS IN THIS MANUAL. PAY PARTICULAR ATTENTION TO ALL CAUTIONS AND WARNINGS.

NEVER INTRODUCE GASES OTHER THAN ARGON INTO THE ANALYZER IF EXPLOSIVE, FLAMMABLE, OR CORROSIVE GASES OR GAS MIXTURES ARE ALLOWED TO FLOW INTO THE ANALYZER, FIRE OR EXPLOSION CAN RESULT.

THIS ANALYZER IS NOT DESIGNED FOR USE IN HAZARDOUS AREAS.

EQUIPMENT DAMAGE MAY RESULT IF THE ANALYTICAL CELL IN THIS UNIT IS EXPOSED TO PRESSURE, CAUSING IT TO BREAK OR SHATTER. TO PREVENT THIS, NEVER EXCEED 20 PSIG (38 KPA) ON THE INLET PORT AND ALWAYS MAINTAIN THE VENT AT ATMOSPHERIC PRESSURE.

DO NOT REMOVE THE FLOW CONTROL ORIFICE FROM THE SAMPLE INLET OF THE ANALYZER.

DO NOT BLOCK VENT.

Note: Maintain flow of sample gas through the analyzer when it is not in use. This procedure is highly recommended in areas of high humidity. Take care to keep the inside of the instrument dry.

4.1 Powering Up the Analyzer

CAUTION: **OZONE EMISSIONS ARE POSSIBLE IF AIR OR MOISTURE ARE IONIZED IN THE SAMPLING SYSTEM. THE SAMPLE PATH MUST BE RELATIVELY FREE OF AIR AND/OR MOISTURE BEFORE APPLYING THE IONIZING VOLTAGE.**

KEEP THE POWER OFF UNTIL THE ANALYZER IS FULLY PURGED.

1. Purge the analyzer and sampling system using the procedure described in Section 3.7.
2. Connect the power cord to the proper power source for your analyzer. The analyzer will begin its power up sequence

CAUTION: **EQUIPMENT DAMAGE MAY RESULT IF THE ANALYTICAL CELL IN THIS UNIT IS EXPOSED TO EXCESSIVE PRESSURE, CAUSING IT TO BREAK OR SHATTER.**

3. Observe the display while allowing the instrument to warm up and the readings stabilize. Drift occurs until internal temperatures stabilize and the analytical cell is completely purged. A persistent drift indicates an improperly purged system or an air leak into the system.

4.2 Zero and Span Calibration

The Model 2120XL is designed to provide a linear response over the 0-100 ppm concentration range for nitrogen in argon. Therefore, a two-point (zero and span) calibration is sufficient to define the calibration curve for this analyzer.

Prior to shipment, the analyzer was calibrated and linearized at the factory in accordance with the calibration data shipped with your analyzer. Use these settings to verify that the unit is in calibration, or re-calibrate the analyzer as outlined in Section 4.5.2. Recalibrations are required periodically. The user can also redefine the linearization curve for this instrument. Refer to Section 4.5.1.12.

4.3 Setup and Operation General Information

Once the analyzer has been installed, it can be configured for your application. To do this you will:

- Set system parameters:
  - Establish a security password, if desired, requiring Operator to log in.
  - Establish and start an automatic calibration cycle, if desired.
- Calibrate the instrument.
- Define the three user selectable analysis ranges. Then choose auto ranging or select a fixed range of analysis, as required.
- Set alarm setpoints, and modes of alarm operation (latching, failsafe, etc).

Before you configure your Model 2120XL Analyzer these default values are in effect:

Ranges: LO = 1 ppm, MED = 10 ppm, HI = 100 ppm.

Auto Ranging: ON

Alarm Relays: Defeated, 100 and 200 ppb, HI, Not failsafe, Not latching.

Zero: Auto, every 0 days at 0 hours.

Span: Auto, at 000008.00 ppm, every 0 days at 0 hours.

If you choose not to use password protection, the default password is automatically displayed on the password screen when you start up, and you simply press ENTER for access to all functions of the analyzer.

4.4 Using the Data Entry and Function Buttons

Data Entry Buttons: The ◄►arrow buttons select options from the menu currently being displayed on the VFD screen. The selected option blinks.

When the selected option includes a modifiable item, the ▲/▼ arrow buttons can be used to increment or decrement that modifiable item.

The ENTER button is used to accept any new entries on the VFD screen. The ESCAPE button is used to abort any new entries on the

VFD screen that are not yet accepted by use of the ENTER key or to move backwards through previous screens.

The VFD screen text that accompanies each operation is reproduced, at the appropriate point in the procedure, in a **Arial Narrow Bold** type style. The various operational modes are printed in *CAPITALIZED ITALICS*.

Figure 4-1 shows the hierarchy of functions available to the operator via the screen menus.

Any function can be selected at any time by pressing the appropriate key (unless password restrictions apply).

Each of these functions is described in greater detail in the following procedures.

4.5 Analyzer Functions

Analyzer functions are accessed from front panel keys.

There are six selectable functions plus the ENTER and ESCAPE keys. They are:

1. **Analyze:** This is the main operational screen of the analyzer and displays the current concentration plus an error indication if any error exists.
2. **System:** This function contains nine sub functions that are used to user to set up the instrument for your application.
3. **Span:** Contains sub functions used for span calibration.
4. **Zero:** Contains sub functions used for zero calibration.
5. **Alarms:** Contains sub functions used to configure the concentration alarms.
6. **Range:** Allows the user to set the upper bound of the instrument range.

In the following section, Section 4.5.1, each screen display is described with information on how to access and modify the various items within each screen.

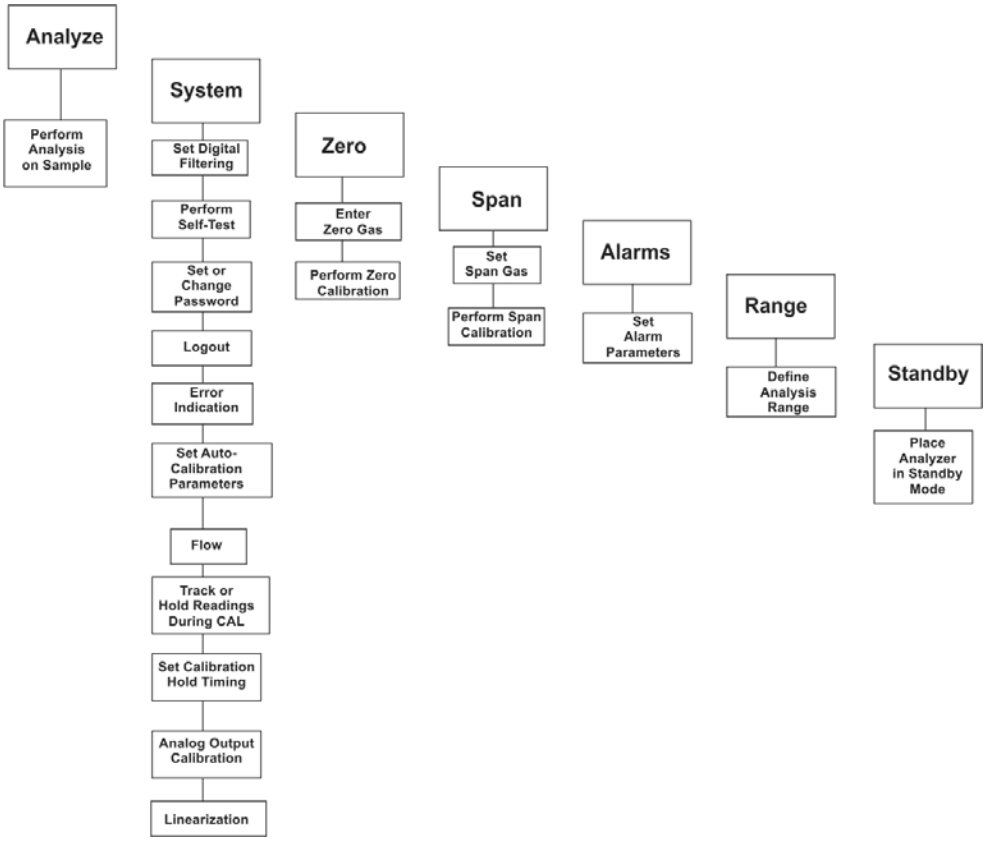

Figure 4-1: Hierarchy of Functions and Sub Functions

4.5.1 System Menu

Dig_filt Self-test

Pwd Logout Err More

.

.

Autocal Flow Hold

Calholdtimer More

.

Model Out-cal Lin

There are eleven sub functions within the *System* function as described below. Specific procedures for their use follow the descriptions.

- **Dig Filt:** The Model 2120XL includes a user adjustable digital filter. The filter has settings 1-10. Setting 1 is the least amount of filtering and 10 is the highest level of damping.
- **Self–Test:** The instrument performs a self-diagnostic test to check the integrity of the power supply, output boards and amplifiers.
- **PSWD:** Security can be established by choosing a 5 digit password (PSWD) from the standard ASCII character set. (See Installing or Changing a Password, below, for a table of ASCII characters available.)
- **Logout:** Logging out prevents an unauthorized tampering with analyzer settings.
- **More:** Select and enter More to get a new screen with additional sub functions listed.
- **Auto-Cal:** Used to define an automatic calibration sequence and/or start an Auto-Cal.
- **Flow:** Used to set the flow through the flow controller.
- **TRAK/HLD:** The operator sets whether the instrument analog outputs track the concentration change during calibration and sets a time delay for the concentration alarms after calibration
- **Cal Hold Timer:** Allows alarm suppression and analog output value hold times during calibration events for a user adjustable period.
- **Model:** Displays Manufacturer, Model, and Software Version of the instrument.
- **Out-Cal:** Analog output calibration allows the user to calibrate the 4 and 20 mA analog output values.
- **Lin:** Used to linearize the output of the controller.

To enter any of the system functions, use the ◄►arrow keys to move to the function and then use the ENTER key to engage that function.

4.5.1.1 DIGITAL FILTER

Upon entering the digital filter function, the following screen appears on the display:

Weight of Digital

Filter: 4

The current filter setting (4 in this case) will be flashing. It can be modified from 0 (no filtering) to 10 maximum filtering using the ▲/▼ keys. Pressing ENTER will accept the value and return to the *SYSTEM* menu.

The default setting should suffice for most applications. In some applications where speeding the response time with some trade off in noise is of value, the operator could decrease the number of the digital filter. In applications where the signal is noisy, switch to a higher number, however, the response time will decrease.

4.5.1.2 SELF-TEST

The system self-test is automatically initiated when the unit is powered up. It can also be activated by the user from the *SYSTEM* menu. To manually initiate a self-test, press the STSTEM key and navigate to Self-Test using the ◄►arrow keys. Press ENTER to engage the function and the following screen appears:

Perform System Test?

<ENT> Yes <ESC> No

Pressing ENTER will begin the Self-Test. A successions of diagnostic screens will follow:

RUNNING DIAGNOSTIC

Testing Preamp — 83

During preamp testing there is a countdown in the lower right corner of the screen. When the testing is complete, the results are displayed.

Power: ## Analog: ##

Preamp: ##

The module is functioning properly if it is followed by OK. If a problem is detected, a number will appear next to the heading and

indicates a problem in a specific area of the instrument. Refer to Chapter *5 Maintenance and Troubleshooting* for number-code information. The results screen alternates for a time with:

Press Any Key

To Continue...

Then the analyzer returns to the initial System screen.

4.5.1.3 PASSWORD PROTECTION

Security can be established by choosing a 3 digit password (PSWD) from the standard ASCII character set. (See Installing or Changing a Password, below, for a table of ASCII characters available.)

Once a unique password is assigned and activated, the operator MUST enter the UNIQUE password to gain access to set-up functions which alter the instrument's operation, such as setting the instrument span or zero setting, adjusting the alarm setpoints, or defining an analysis range.

After a password is assigned, the operator must log out to activate it. Until then, anyone can continue to operate the instrument without entering the new password.

Only one password can be defined. Before a unique password is assigned, the system assigns TAI by default. This allows access to anyone. After a unique password is assigned, to defeat the security, the password must be changed back to TAI.

If a password is assigned, then setting the following instrument parameters can be done only after the password is entered: **span** and **zero** settings, **alarm** setpoints, analysis **range** definitions, switching between **auto ranging** and manual override. In addition, all **System** functions such as setting up an **auto-cal**, **self-test** and assigning a new **password** etc. with the exception of **Track/Hold** and **Model** cannot be accessed without entering a password. However, the instrument can still be used for analysis without entering the password.

If you have decided not to employ password security, use the default password TAI. This password will be displayed automatically by

the microprocessor. The operator just presses the Enter key to be allowed total access to the instrument's features.

Note: If you use password security, it is advisable to keep a copy of the password in a separate, safe location.

4.5.1.3.1 Entering the Password

To install a new password or change a previously installed password, you must key in and ENTER the old password first. If the default password is in effect, pressing the ENTER button will enter the default TAI password for you.

Press *System* to enter the *System* mode.

Use the ◄► arrow keys to scroll the blinking over to PSWD, and press ENTER to select the password function. Either the default TAI password or AAA place holders for an existing password will appear on screen depending on whether or not a password has been previously installed.

Enter PWD: TAI

or

A A A

If you are not using password protection, press ENTER to accept TAI as the default password. If a password has been previously installed, enter the password using the ◄► arrow keys to scroll back and forth between letters, and the ▲/▼ arrow keys to change the letters to the proper password. Press ENTER to enter the password.

If the password is accepted, the screen will indicate that the password restrictions have been removed and you have clearance to proceed.

PSWD Restrictions

Removed

In a few seconds, you will be given the opportunity to change this password or keep it and go on.

Change Password?

<ENT>=Yes <ESC>=No

Press ESCAPE to move on, or proceed as in *Changing the Password*, below.

4.5.1.3.2 Installing or Changing the Password

If you want to install a password, or change an existing password, proceed as above in *Entering the Password*. When you are given the opportunity to change the password:

Change Password?

<ENT>=Yes <ESC>=No

Press ENTER to change the password (either the default TETAI or the previously assigned password), or press ESCAPE to keep the existing password and move on.

If you chose ENTER to change the password, the password assignment screen appears.

Enter New Pwd: T A I

or

Enter New Pwd: AAA

Enter the password using the ◄► arrow keys to move back and forth between the existing password letters, and the ▲/▼ arrow keys to change the letters to the new password. The full set of 94 characters available for password use are shown in the table below.

Characters Available for Password Definition:

A	B	C	D	E	F	G	H	I	J
K	L	M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z	[	¥	]	^
	`	a	b	c	d	e	f	g	h
i	j	k	l	m	n	o	p	q	r

s	t	u	v	w	x	y	z	{	|
}	~	!	"	#	$	%	&	'	(
)	*	+	'	-	.	/	0	1	2
3	4	5	6	7	8	9	:	;	<
=	>	?	@						

When you have finished typing the new password, press *Enter*. A verification screen appears. The screen will prompt you to retype your password for verification.

Confirm Pwd: ‘ A A A’

Retyping the password will confirm proper password is entered and the following screen will appear briefly:

New Pwd Accepted

and then return to the *System* menu.

Use the arrow keys to retype your password and press *Enter* when finished. Your password will be stored in the microprocessor and the system will immediately switch to the *Analyze* screen, and you now have access to all instrument functions.

If all alarms are defeated, the *Analyze* screen appears as:

0.0 $^{p}_{p}$m Anlz

Range: 0 — 100

If an alarm is tripped, the second line will change to show which alarm it is:

0.0 $^{p}_{p}$m Anlz

AL—1

Note: If you log off the system using the logout function in the system menu, you will now be required to re-enter the password to gain access to Span, Zero, Alarm, and Range functions.

4.5.1.4 LOGOUT

The Logout function provides a convenient means of leaving the analyzer in a password protected mode without having to shut the instrument off. By entering Logout, you effectively log off the instrument leaving the system protected against use until the password is reentered. To log out, press the *System* button to enter the *System* function.

Dig_filt Self-test

Pwd Logout Err More

Use the ◄► arrow keys to position the blinking over the Logout function, and press ENTER to Log out. The screen will display the message:

Protected Until

Password Reentered

4.5.1.5 ERR

During analysis, if the system detects a fault, and error signal is sent and shows a flashing 'E' in the right corner of the *Analyze* screen as follows:

N2 2.3 ppb E

Rng: 100.0pb 100.2 ccm

To obtain more information about the error, press SYSTEM and navigate to the *Err* function. Then pres ENTER to display the particular error screen. There are 14 possible error screens that may appear. The first line displays the particular fault while the second line informs the user to press ENTER to clear the error.

Note: The particular fault must be remedied before attempting to clear the error, otherwise the error indication will immediately regenerate on the Analyze screen.

The following notifications may appear on the Err screen first line:

- LED Display Error
- Flow Error

- Neg. Flow Adc Error
- Bad Adc Channel Sel.
- Bad Gain Selected
- Zero Fail
- Span Fail
- Sys Test - - 5V
- Sys Test - - 15V
- Sys Test - - Dac A
- Sys Test - - Dac B
- Sys Test - - Preamp 0.0V
- Sys Test - - Preamp 0.7V
- Sys Test - - Pre Gain Ck

See Section 5.5 for additional information on error screens.

4.5.1.6 AUTO CALIBRATION (AUTO CAL)

This menu allows the user to set a program for initiating a calibration cycle (zero and span) automatically at a time interval set by the user. It also is the screen used to turn the auto calibration function ON or OFF. To use the Auto Cal function, your instrument must be equipped with the optional auto calibration valve manifold.

Note: To use the Auto Cal function, the analyzer must be equipped with the Auto Cal option which includes a solenoid valve manifold for automatic switching of sample, zero or span gas.

When equipped with the Auto Cal option, the analyzer can cycle itself through a sequence of steps that automatically zero and span the instrument.

Note: Before setting up an AUTO-CAL, be sure you understand the Zero *and* Span *functions as described in Section 4.5.2, and follow the precautions given there.*

Note: If you require highly accurate AUTO-CAL timing, use external AUTO-CAL control where possible. The internal clock in the

Model 2120XL is accurate to 2-3 %. Accordingly, internally scheduled calibrations can vary 2-3 % per day.

To setup an Auto Cal cycle:

Choose *SYSTEM* from the function buttons. Use the ◄► arrow keys to position the blinking over the More function, and press ENTER. A second display of *System* functions will appear. Use the ◄► arrow keys again to position the blinking over the Auto Cal function, and press ENTER to enter the function. The following screen will appear:

Zero In 0d 0h Off

Span In 0d 0h Off

Press the ▲/▼ arrow keys to blink **ZERO** (or **SPAN**), then press ENTER again.

Note: You will be unable to set **OFF** *to* **ON** *if a zero interval is entered.*

A **Span Every ...** (or **Zero Every ...**) screen appears.

Zero schedule: OFF

Day: Ød Hour: Øh

Move the blinking highlight to the **Day** field , then use the ▲/▼ arrow keys to display the correct value for the day.

Once the correct day is displayed press ENTER to accept the value and to move to the start-time value. Use the ▲/▼ arrow keys to set a start-time value. Press ENTER again to accept the value.

To turn ON the **SPAN** and/or **ZERO** cycles (to activate the auto cal feature):

If a scheduled day and time has just been entered, press ESCAPE to return to the previous menu or press *SYSTEM* again and move to the **AUTO CAL** function with the ◄► keys and press ENTER again.

When the **ZERO/SPAN** values screen appears, use the ▲/▼ arrows to blink the **ZERO** (or **SPAN**) and press ENTER to go to the next screen. Use the ◄► arrows to select the **OFF/ON** field. Use the ▲/▼ arrows to set the **OFF/ON** field to **ON**. You can now turn these fields ON because there is a nonzero span interval defined.

If instrument is turned off, the next time the instrument is powered, the instrument will automatically perform a calibration cycle after 3 minutes of entering the sample mode if **AUTO CAL** functions were on prior to shut down.

4.5.1.7 FLOW

This function allows the user to set the flowrate through the flow control valve. The first line of the display indicates the current flow setting in ccm and can be manipulated using the ▲/▼ arrow keys. The second line of the display is a read-only item that displays the live sensor voltage within the flow control module.

To set or change the flow rate, press the *SYSTEM* key and use the ◄► arrow keys to position the blinking over the More function, and press ENTER. A second screen of system function will appear. Use the ◄► arrow keys to position the blinking over the Flow function, and press ENTER to enter the function. The following screen will appear:

Flow: 100.0 ccm

Sens Vout: 300.0 mV

The current flow rate (100) will be blinking and can be changed using the ▲/▼ arrow keys. Press ENTER when the proper flow rate is indicated on the display screen.

4.5.1.8 TRACKING DURING CALIBRATION

The user has the option of setting the preference as to whether the analog outputs track the display readings during calibration or not. The function can be toggled between Track or Hold in this function.

To set the preference, press the *SYSTEM* key and the first System menu will appear in the VFD display. Use the ◄► arrow keys to position the blinking over the More function, and press ENTER. A second screen of system function will appear. Use the ◄► arrow keys to position the blinking over the Track (or Hold) function, and toggle between Track or Hold using the ▲/▼ arrow keys. Press ENTER when the desired selection is indicated on the display screen.

If Hold is selected, the next function **Calholdtimer** sets the hold period.

When HOLD is selected, the analog output (4-20 mA) and the range ID contacts will freeze on their last state before entering one of the calibration modes. When the instrument returns to the *Analyze* mode, either by a successful or an aborted calibration, there will be a three-minute delay before the analog outputs and the range ID contacts start tracking again.

The concentration alarms freeze on their last state before entering calibration regardless of selecting HOLD or TRACK. But, when HOLD is selected the concentration alarms will remain frozen for the time set in the Calholdtimer screen after the analyzer returns to the *Analyze* mode. See Section 4.5.1.9 *Calibration Hold Timer*.

4.5.1.9 CALIBRATION HOLD TIMER (CALHOLDTIMER)

This function sets the time period for the analog output hold as well as the time period for which the alarms will be suppressed during a calibration event.

To set the time period for a hold, press the *SYSTEM* key to display the first System menu. Use the ◄►arrow keys to position the blinking over the More function, and press ENTER. A second screen of system function will appear. Use the ◄►arrow keys to position the blinking over the Calholdtimer function, and press ENTER to advance to the Calholdtimer screen.

Calbrt hold: 1 min

Sample hold: 1 min

The time intervals can be set from 0 (off) to 100 minutes using the ▲/▼ arrow keys. Press ENTER when the desired value is displayed.

The factory default is three minutes, but the delay time is programmable. This preference is stored in non-volatile memory so that it is recovered if power is removed from the instrument.

4.5.1.10 THE MODEL SCREEN

The Model screen displays the manufacturer, model, and software version information for your analyzer.

To view the information in the Model function, press the *SYSTEM* key to display the first System menu. Use the ◄►arrow keys to position the blinking over the More function, and press ENTER. Repeat

the above to ENTER at More a second time. This will display a third screen of system functions as shown below.

Model Out-cal Lin

Use the ◄► arrow keys to position the blinking over the Model function, and press ENTER to display your specific Model information.

4.5.1.11 ANALOG OUTPUT CALIBRATION (OUT_CAL)

For enhanced accuracy, this function allows the user to calibrate the 4 to 20 mA analog output to remove any offsets inherent in the PCB. A DMM configured as a DC ammeter is needed. The DMM should be connected across the output terminals of the 4 to 20 mA output to monitor the output current. The range of adjustment is approximately +/- 10% of scale (+/- 1.6 mA).

If the analyzer is equipped with a secondary 0-1 VDC output, this function can be used to calibrate the 0 to 1 volt output as well by using a digital voltmeter on the 0-1 volt output.

To enter the 4 to 20 mA output adjust function:

Press the *SYSTEM* key to display the first *System* menu. Use the ◄► arrow keys to position the blinking over the More function, and press ENTER. Repeat the above to ENTER at More a second time. This will display a third screen of system functions as shown below.

Model Out-cal Lin

Use the ◄► arrow keys to position the blinking over the Out_cal function, and press ENTER. The following screen will appear:

Use UP/DOWN arrow to

Adjust 4 ma: 500

The current value associated with the 4 mA output will be blinking. Use the ▲/▼ arrow keys to adjust it up or down. When the desired value appears, Press ENTER to accept and save the value and the display automatically moves to the next line for adjusting the 20 mA setting.

Use UP/DOWN arrow to

Adjust 20 ma: 500

Repeat the process for adjusting the 20 mA output. Pressing ENTER will accept the value and return the display to the last *System* screen.

4.5.1.12 LINEARIZE (LIN)

With this function, the user has the capability of linearizing the output of the instrument by flowing prepared samples with known concentration across the analytical range. The linearization can be performed manually or automatically depending on the setting chosen in the linearization setup screen. Upon completion of the linearization sample introduction, the software performs linear approximation between data points.

The Model 2120XL can accept up to 11 linearization points. These are:

- Zero point (pure argon)
- 9 data points between zero and full span
- Full Span (85-100 ppm N_2 in Ar or 85-100% of the highest full range)

The linearization can be performed manually or automatically depending on the chosen setting.

To enter the linearization function:

Press the *SYSTEM* key to display the first *System* menu. Use the ◄► arrow keys to position the blinking over the More function, and press ENTER. Repeat the above to ENTER at More a second time. This will display a third screen of system functions as shown below.

Model Out-cal Lin

Use the ◄► arrow keys to position the blinking over the Lin function, and press ENTER. The following screen will appear:

Linearize

Manual Auto

4.5.1.12.2 Setup Sub Function

The Setup sub function allows the operator to choose between Manual or Automatic linearization. In manual mode the operator the operator enters the value of the prepared linearization sample as reported

by the analyzer's display. In Auto mode, this is done automatically by the software.

From the Linearizer (Lin) function screen, use the ◄► arrow keys to position the blinking over the Setup function, and press ENTER. The following screen appears:

Linearize

Manual **Auto**

To enter Manual or Auto Mode, use the ◄► arrow keys to position the blinking over the Manual or Auto and press ENTER. The following screen appears:

In 0.0ppb **1**

Out 0.0ppb **Accept**

where the number (1) in the right corner of the screen indicates the linearization sample number currently being entered. In this exampe, it is the first sample to be entered.

In MANUAL mode, the number adjacent to "**In**" is editable. It represents the unlinearized concentration of the sample gas as reported by the analyzer. In AUTO mode, this value is not editable but is entered automatically by the routine. The value for "**Out**" is editable in both Man and Auto modes. **Out** is entered by the user and represents the desired linearized value of the sample. For instance, feeding the analyzer a prepared linearizer sample gas whose concentration is known to be 10.0 ppm and the analyzer reports an unlinearized value of **13.6pm** adjacent to **In**, the user would correct this by entering **10.0pm** as the **Out** value.

If not done already, hook up the first linearization sample to the sample input of the analyzer and allow the gas to flow for a few minutes. Watch the display and when the concentration value is stable, enter the correct value for **Out** and then press ENTER to accept the value.

A confirmation screen will appear.

<ENT> Accept

<ESC> Reject

Pressing ENTER again will save the data into memory to be used for calculating the coefficients used in the best fit linearization

polynomial once all data has been entered. The screen will return to the AUTO/MAN screen with the upper right number incremented by 1.

If ESCAPE is pressed, the data will be rejected and the screen will return to the AUTO/MAN screen without incrementing the sample number in the right corner.

Repeat the above procedures for each prepared linearization sample making sure to adequately flush or purge the lines each time a new sample is connected. The linearization process must include a zero and full span value. Up to 11 data samples are to be entered.

When all 11 data points have been entered, change the **'Accept'** field to **'finish'** and press Enter to leave data entry mode.

Some Notes about Calibration: For the analyzer to preserve good linearity throughout the 0-100 ppm scale, users must try to calibrate near the top of the highest range (0-100 ppm). If calibration gas is low value, for example 10 ppm, to improve accuracy at that level, you can expect to have less accuracy when readings surge much higher than that.

4.5.2 The Zero and Span Functions

The Model 2120XL is designed to provide a linear response over the analysis range for nitrogen in argon. Therefore, once the linearization procedure has been performed as described in 4.5.1.12 , a two-point (zero and span) calibration is sufficient to define the calibration curve .

Prior to shipment, the analyzer was calibrated by the factory in accordance with the calibration data shipped with your analyzer. Use these settings to verify that the unit is in calibration, or re-calibrate the analyzer as outlined in this section.

4.5.2.1 BEFORE CALIBRATION

Note: To minimize consumption of zero and span gases, careful attention to the purging of the analyzer, as described in Chapter 3, is critical.

1. Ensure that the analyzer is fully purged and warmed up.
2. Check that the sample gas flow rate is correct. Default setting is 100 ccm See Section 2.2. Adjust the pressure

regulator on the sample inlet. **Do not exceed a maximum of 20 psig (138 kPa)**.

4.5.2.2 RECOMMENDED CALIBRATION GASES

Teledyne recommends the following gases be used for calibration:

Zero Gas:	N_2-free Ar
Span Gas:	
For 0-1 ppm range:	0.7-1.0 ppm N_2 in Ar
For 0-10 ppm range:	7-10 ppm N_2 in Ar
For 0-100 ppm range:	70 – 100 ppm N_2 in Ar (best for overall accuracy on all ranges)

The first calibration point is fixed by a zero gas. The most convenient source of nitrogen-free argon is through an activated molecular sieve scrubber cooled to liquid oxygen temperatures or a heated transition metal scrubber. A commercially available scrubber the Teledyne Part number S1748-120 (or S1748 -240 depending on AC voltage) is ideal for this. Alternatively, a zero gas cylinder with a low ppb nitrogen level can be used for zeroing in the low ppm range specified, as long as the N_2 concentration is known.

The second point is fixed by a certified span gas normally supplied in a high-pressure cylinder.

4.5.2.3 ZERO CAL

The ZERO button on the front panel is used to enter the zero calibration function. Zero calibration can be performed in either the automatic or manual mode. In the **automatic** mode, an internal algorithm compares consecutive readings from the sensor to determine when the output is within the acceptable range for zero. In the **manual** mode, the operator determines when the reading is within the acceptable range for zero. Make sure the zero gas is connected to the instrument. See Section 3.6 for gas connections.

After pressing the ZERO button, the mode selection screen appears:

Select Zero

Mode : Manual (Auto)

where Manual and Automatic can be toggled back and forth using the ▲/▼ arrow keys. Once the proper mode is displayed, press ENTER. The following screen appears:

Zero Offset **0.0ppb**

<ENT> to Begin

This screen allows the user to add a zero offset if desired. With the value adjacent to Zero Offset blinking, use the ▲/▼ arrow keys to enter any offset required. Press ENTER when finished.

4.5.2.3.1 Manual Zero

If manual zero mode was selected, the following screen appears:

N2: 1.2ppb **Zero**

<ENT> to Finish

In the Manual Mode, the user has the opportunity to decide when the zero settling is close enough to zero to be valid. When the value adjacent to **N2** is sufficiently close to zero and sufficiently stable, press ENTER to accept the zero reading.

After pressing ENTER two screens will appear that indicate that the zero level has been acquired and will report the live adc value for the two gains in the amplifier (G0 and G1) as well as the change (Δ).

Zero Acquired **G1/1**

Δ 1.2 **Val:-12345**

shortly followed by:

Zero Acquired **G0/1**

Δ-0.2 **Val:-12345**

4.5.2.3.2 Auto Mode Zero

If AUTO mode was selected from the Zero Mode Selection screen the following screen appears:

Zero Settling:	**0:58**

The time value displayed at the right count down to zero from the value currently held in Calholdtimer. See Section 4.5.1.9.

When the counter reaches zero, the display switches to display the gain on G1:

Zero Settling:	**G1/11**
Δ2.1	**Val:-12345**

where Δ Val:-12345 is a live display of the change in the adc.

Shortly the display will change to a second screen representing the gain on G2:

Zero Acquired	**G1/1**
Δ-3.6	**Val:-12345**

followed by:

Zero Acquired	**G01/1**
Δ 0.6	**Val:-12345**

where the Δ Val:-12345 is the live display of the change in the adc for G01.

When the countdown reaches zero, zero calibration is complete and the screen reverts to the Analyze mode screen.

4.5.2.4 SPAN CALIBRATION

The SPAN button on the front panel is used to enter the span calibration function. Span calibration can be performed in either the automatic or manual mode. In the **automatic** mode, an internal algorithm compares consecutive readings from the sensor to determine when the output is within the acceptable range for span. In the **manual** mode, the operator determines when the reading is are acceptably close to the actual span concentration. Make sure the span gas is connected to the instrument. See Section 3.6 for gas connections.

After pressing the SPAN button, the mode selection screen appears:

Select Span

Mode : Manual (Auto)

where Manual and Automatic can be toggled back and forth using the ▲/▼ arrow keys. Once the proper mode is displayed, press ENTER. The following screen appears:

Span 100.0ppm

<ENT> to begin Span

This screen allows the user to input the known concentration of the span gas used. Uuse the ▲/▼ arrow keys to enter the span gas concentration. Press ENTER when finished.

4.5.2.3.1 Manual Span

If manual span mode was selected, the following screen appears:

39.25 ppm

<ENT> to Finish

In the Manual Mode, the user has the opportunity to decide when the span settling is close enough to the actual concentration to be valid. When the value is sufficiently close to the known concentration and sufficiently stable, press ENTER to accept the span calibration.

4.5.2.3.2 Auto Mode Span

If AUTO mode was selected from the Span Mode Selection screen the following screen appears:

Span Settling: 0:58

The time value displayed at the right count down to zero from the value currently held in Calholdtimer. See Section 4.5.1.9.

When the counter reaches zero, the display switches to display the live adc change count.

N2: 123.0ppm

Δ 123 Span

where Δ 123.0 is a live display of the change in the adc.

When the change in adc value is reasonably small, the span calibration is complete and the screen reverts to the Analyze mode screen.

4.5.3 The Range Function

The Model 2120XL has three user programmable ranges extending from 0-1 ppm to 0-100 ppm. The Range function is used to set the three analysis ranges and to set whether the instrument functions on a fixed range (1, 2 or 3) or uses auto ranging.

To set the range properties for your instrument, press the RANGE button. The following screen appears:

R1: 1.00ppm R2: 10.00ppm

R3: 100.0ppm Rng: Auto

where either the 1.00, 10.00, 100.0, or Auto is blinking.

Use the ◄► arrow keys to position the blinking over the range value to be changed . Then use the ▲/▼ arrow keys to modify the range value. Continue with the ◄► arrow keys to position the blinking over the next range value to be changed and modify with the ▲/▼ arrow keys.

Move the blinking to the field at the far right of the second line and set whether fixed analysis or auto-ranging is to be used. The field can be toggled between these values:

1	(Fixed range analysis on range 1)
2	(Fixed range analysis on range 2)
3	(Fixed range analysis on range 3)
Auto	Auto-ranging.

Press ENTER when the range properties have been correctly set. Use ESCAPE to return to the *Analyze* mode without altering the range settings.

Note: Range 1 must be set lower than range 2 and range two less than range 3. Only the upper bound of the range may be changed. The lower value will always remain at 0.

When auto-ranging is selected, the analyzer will automatically switch to the appropriate range based on the concentration of the sample gas under test.

4.5.4 The Alarms Function

The Model 2120XL is equipped with 2 fully adjustable concentration alarms and one non-adjustable system alarm. Each alarm has a relay with a set of form "C" contacts rated for 3 amperes resistive load at 250 VAC. Refer to Chapter 3, Installation and/or the Interconnection Diagram included at the back of this manual for relay connections.

The concentration alarms can be configured from the front panel as either high or low alarms by the operator. The alarm modes can be set as latching or non-latching, and either failsafe or non-failsafe, or, they can be defeated altogether. The setpoints for the alarms are also established using this function.

Decide how your alarms should be configured. The choice will depend upon your process. Consider the following four points:

1. Which if any of the alarms are to be high alarms and which if any are to be low alarms?
   Setting an alarm as HIGH triggers the alarm when the nitrogen concentration rises above the setpoint. Setting an alarm as LOW triggers the alarm when the nitrogen concentration falls below the setpoint.

   Decide whether you want the alarms to be set as:
   - Both high (high and high-high) alarms, or
   - One high and one low alarm, or
   - Both low (low and low-low) alarms.

2. Are either or both of the alarms to be configured as failsafe?
   In failsafe mode, the alarm relay de-energizes in an alarm condition. For non-failsafe operation, the relay is energized in an alarm condition. You can set either or both of the concentration alarms to operate in failsafe or non-failsafe mode.

3. Are either of the alarms to be latching?
   In latching mode, once the alarm or alarms trigger, they will remain in the alarm mode even if process conditions revert back to non-alarm conditions. This mode requires an alarm to be recognized before it can be reset. In the non-latching mode, the alarm status will terminate when process conditions revert to non- alarm conditions.
4. Are either of the alarms to be defeated?
   The defeat alarm mode is incorporated into the alarm circuit so that maintenance can be performed under conditions which would normally activate the alarms.
   The defeat function can also be used to reset a latched alarm. (See procedures, below.)

If you are using password protection, you will need to enter your password to access the alarm functions. Follow the instructions in Section 4.5.1.3 to enter your password. Once you have clearance to proceed, enter the Alarm function.

Press the ALARM button on the front panel to enter the Alarm function. Make sure that AL1 is blinking.

Sel Alarm to set

AL1 AL2

Set up alarm 1 by moving the blinking over to AL1 using the ◄► arrow keys. Then press ENTER to move to the next screen.

AL—100.0ppm High

Dft—Y Fs—N Ltch—N

Five parameters can be changed on this screen:

- Value of the alarm setpoint, AL–1 #### ppb/ppm (nitrogen)
- Out-of-range direction, HI or LO
- Defeated? Dft–**Y**/**N** (Yes/No)
- Failsafe? Fs–**Y**/**N** (Yes/No)

- Latching? Ltch–**Y**/**N** (Yes/No).

To define the setpoint, use the ◄► arrow keys to move the blinking over to AL–1 ####. Then use the ▲/▼ arrow keys to change the number. Holding down the key speeds up the incrementing or decrementing. (Remember, the setpoint units are ppm N_2.)

To set the other parameters use the ◄► arrow keys to move the blinking over to the desired parameter. Then use the ▲/▼ arrow keys to change the parameter.

Once the parameters for alarm 1 have been set, press *Alarms* again, and repeat this procedure for alarm 2 (AL2).

To reset a latched alarm, go to Dft– and then press either ▲ two times or ▼ two times to toggle Dft from Y and then back to N.

–OR –

Go to Ltch– and then press either ▲ two times or ▼ two times. (Toggle it to N and back to Y**.**)

4.6 The Analyze Function

Normally, all of the functions automatically switch back to the *Analyze* function when they have completed their assigned operations. Pressing the ESCAPE button in many cases also switches the analyzer back to the *Analyze* function. Alternatively, you can press the ANALYZE button at any time to return to analyzing your sample.

4.7 Signal Output

The standard Model 2120XL Analyzer is equipped with two 0–1 VDC analog output terminals accessible on the back panel (one concentration and one range ID), and two isolated 4–20 mA DC current outputs (one concentration and one range ID).

See *Rear Panel* in Chapter 3, *Installation*, for illustration.

The signal output for concentration is linear over the currently selected analysis range. For example, if the analyzer is set on range that was defined as 0–100 ppm N_2, then the output would be:

ppm N_2	Voltage Signal Output (VDC)	Current Signal Output (mA dc)
0	0.0	4.0

10	0.1	5.6
20	0.2	7.2
30	0.3	8.8
40	0.4	10.4
50	0.5	12.0
60	0.6	13.6
70	0.7	15.2
80	0.8	16.8
90	0.9	18.4
100	1.0	20.0

The analog output signal has a voltage which depends on the nitrogen concentration AND the currently activated analysis range. To relate the signal output to the actual concentration, it is necessary to know what range the instrument is currently on, especially when the analyzer is in the auto-ranging mode.

To provide an indication of the range, a second pair of analog output terminals are used. They generate a steady preset voltage (or current when using the current outputs) to represent a particular range. The following table gives the range ID output for each analysis range:

Range	Voltage (V)	Current (mA)
LO	0.25	8
MED	0.50	12
HI	0.75	16

Maintenance

CAUTION: **MAINTENANCE AND REPAIR OF THE MODEL 2120XL ANALYZER INVOLVE POTENTIALLY HAZARDOUS PROCEDURES. ONLY TRAINED AND QUALIFIED PERSONNEL WHO HAVE READ AND UNDERSTOOD THE INSTRUCTIONS IN THIS MANUAL SHOULD WORK ON THIS EQUIPMENT.**

5.1 Routine Maintenance

Aside from normal cleaning and checking for leaks at the gas connections, routine maintenance consists of recalibration and periodic inspection of essential analyzer parts. For calibration procedures, refer to Section 4.5.2. The periodic inspection of analyzer parts helps ensure continuing high performance and reduces malfunctions that could lead to analyzer downtime.

5.2 Routine Maintenance Schedule

Perform a routine calibration of the analyzer at least once every one to two weeks. Keep a log of the percentage zero and percentage span deviation settings. This ensures not only that accuracy is maintained; it also may help in troubleshooting the analyzer if these settings vary widely at each calibration or vary consistently up or down scale. If the readings are stable from calibration to calibration, then the frequency of routine calibrations can be decreased accordingly.

Check the sample flow rate at least every one to two weeks. Use the Flow function from the System menu to check and adjust the sample flow rate to approximately 100 ccm.

Check for excessive accumulation of dirt. In dusty locations, you may need to wipe or gently blow off dust from the various sections at least once a week. Any accumulation of dust or oil film hinders satisfactory operation.

On an annual basis, check the gas lines for signs of leaks.

Table 5-1 summarizes the recommended routine maintenance required for the Model 2120XL.

Table 5-1: Routine Maintenance Schedule

Maintenance Task	Time Schedule
Calibrate	Every 1-2 weeks
Check sample gas flow rate	Every 1-2 weeks
Check for excessive accumulation of dirt	Weekly
Check gas lines for leaks	Yearly

5.3 Fuse Replacement

1. Place small screwdriver in notch, and pry cover off, as shown in Figure 5-1.

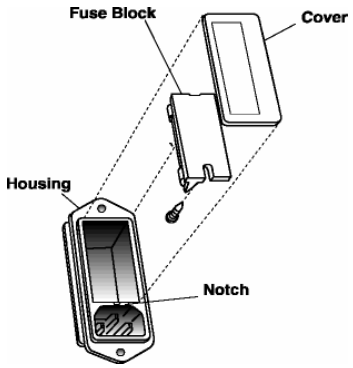

Figure 5-1: Removing Fuse Block from Housing

2. To change between American and European fuses, remove the single retaining screw, flip Fuse Block over 180 degrees, and replace screw.
3. Replace fuse as shown in Figure 5-2.
4. Reassemble Housing as shown in Figure 5-1.

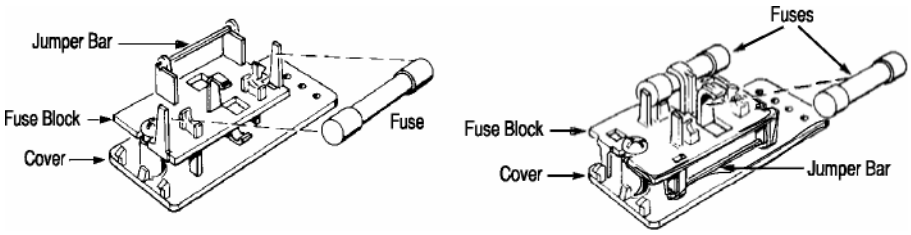

Figure 5-2: Installing Fuses

5.4 System Self Diagnostic Test

1. Press the System button to enter the system mode.
2. Use the ◄► arrow keys to move to More, and press Enter.
3. Use the ◄► arrow keys to move to Self-Test, and press Enter.

The following failure codes apply:

Power: Tests the sample 5V and 15V power supplies

0 OK
1 5 V Failure
2 15 V Failure
3 Both Failed

Analog: Set non-zero sample on analog output channel 1 (% of range) and channel 2 (Range ID) and sample response.

0 OK
1 Analog channel 1 (% of Range) is incorrect
2 Analog channel 1 (Range ID) is incorrect
3 Both channels are incorrect

Preamp: A) Tests the bypass sensor input.

B) Sets a zero level on preamp then tests response.

C) Sets a non-zero livel on preamp then tests response.

0 OK
1 Preamp is incorrect at zero level
2 Preamp is incorrect at non-zero level
3 Both zero and non-zero are incorrect

5.5 Error Screens

Additional errors are indicated by a flashing ‘E’ at the upper right corner of the analyzer display screen.

If 'E' is flashing in the upper right hand corner, the instrument has detected an error. Go to menu item 'Err' and press ENTER. If there are errors, they will be listed on the screen'.

Use the UP/DOWN to scroll through the errors. Press ENTER to dispatch the current error. If the error condition still persists, the flashing ‘E’ will return.

Any of the following errors will cause the system alarm to trigger. These are non-latching so when all alarms have been dispatched (if possible), the system alarm will be cease.

LED Display Error 0x0001

"LED Display Error "

This indicates a problem with the LED interface. Contact TAI

Flow Error 0x0002

"Flow Error "

Flow control system has problems and cannot control the flow. This may be a temporary self-correcting error. If it persists, contact TAI.

Negative Flow Error 0x0004

"Neg. Flow Adc Error "

The flow sensing system has a problem. This may be a temporary self-correcting error. If it persists, contact TAI.

Zero Fail 0x0020

"Zero Fail "

The auto-settled zero calibration could not be completed within 1/2 hour. This indicates most likely that the input signal is too noisy.

SysTest5V 0x0080

"Sys Test -- 5V "

The system test on the 5V power supply has found a problem.

SysTest15V 0x0100

"Sys Test -- 15V "

The system test on the 15V power supply has found a problem.

SysTest Analog 1 0x0200

"Sys Test DAC A "

The system test on analog channel 1 (% of range) is incorrect.

SysTest Analog 2 0x0400

"Sys Test DAC B "

The system test on analog channel 2 (Range ID) is incorrect

SysTestPreamp_0_0V 0x0800

"Sys Test Preamp 0.0V"

The system test on the preamp is incorrect at the zero level.

SysTestPreamp_0_7V 0x1000"Sys Test Preamp 0.7V"

The system test on the preamp is incorrect at the non-zero level

InvLinearErr 0x4000

"Linearization Error "

The dataset for linearization could not be processed. Most likely, two linearization outputs have been set for the same input.

5.6 Sensor Replacement

While it is possible to replace a sensor in the field, TAI recommends that the analyzer be shipped back to the factory for sensor replacement and requalification. If the sensor is replaced in the field, the customer must contact TAI Customer Service to obtain the required input data to linearize the new sensor.

Appendix

A.1 Specifications

Detector:	Plasma Emission Detector with Duty Controlled System
Measurement Ranges:	3 user programmable ranges from 0-1 ppm to 0-100 ppm.
Output:	4-20 mA and 0-1 vdc, concentration and Range ID
Sample Flowrate:	adjustable 15-200 sccm, 100 ccm default for optimal operation
Zero Cal. Gas:	Through Scrubber TAI P/N S1748
Span Cal. Gas:	70-100 ppm N_2 in Ar
Flow Accuracy:	0 to 200 sccm ± 1% full scale
Operating Temperature:	32-104°F (0-40°C)
Operating Pressure:	4-20 psig (27.6 – 138 kPa)
Power Required:	85-240 VAC 50/60 Hz, 60 W
Sample Connections:	1/8” tube fittings
Accuracy:	± 1% full scale (0-100 ppm)
Alarms:	Two programmable concentration alarms, and a system alarm. Relay contacts ‘C’ type
Range ID contacts:	Relay contacts ‘A’ type
Digital Output:	RS232 at 9600 baud rate, RS232 output is compatible with VB-1/VB-3 for profibus communication

Digital Inputs: Two digital inputs for remote span and zero

Weight: 35 lbs (15.9 kg)

A.2 Recommended Replacement Parts List

Qty.	Part Number	Description
1	C75825A	Main PCB w/o EPROM
1	C84447A	Amplifier PCB
1	C84132A	Back Panel Power Supply PCB
1	C84129A	Front Panel Display PCB
1	S01748-120	Scrubber of N2 Gas for zero cal. (120 V)
		-OR-
1	S01748-240	Scrubber of N2 Gas for zero cal. (240 V)
1	F2374	Flow Control Module
1	A85552	2120XL std. EPROM for Main PCB

Note: Orders for replacement parts should include the part number (if available) and the model and serial number of the instrument for which the parts are intended.

Orders should be sent to:

TELEDYNE ANALYTICAL INSTRUMENTS

16830 Chestnut Street
City of Industry, CA 91748

Telephone: (626) 934-1500
Fax: (626) 961-2538

Web: www.teledyne-ai.com
or your local representative.

A.3 Drawing List

D84123	Outline Drawing
C85455	Internal Piping Drawing
C85454	Wiring Diagram

NOTES: UNLESS OTHERWISE SPECIFIED.

REVISIONS				
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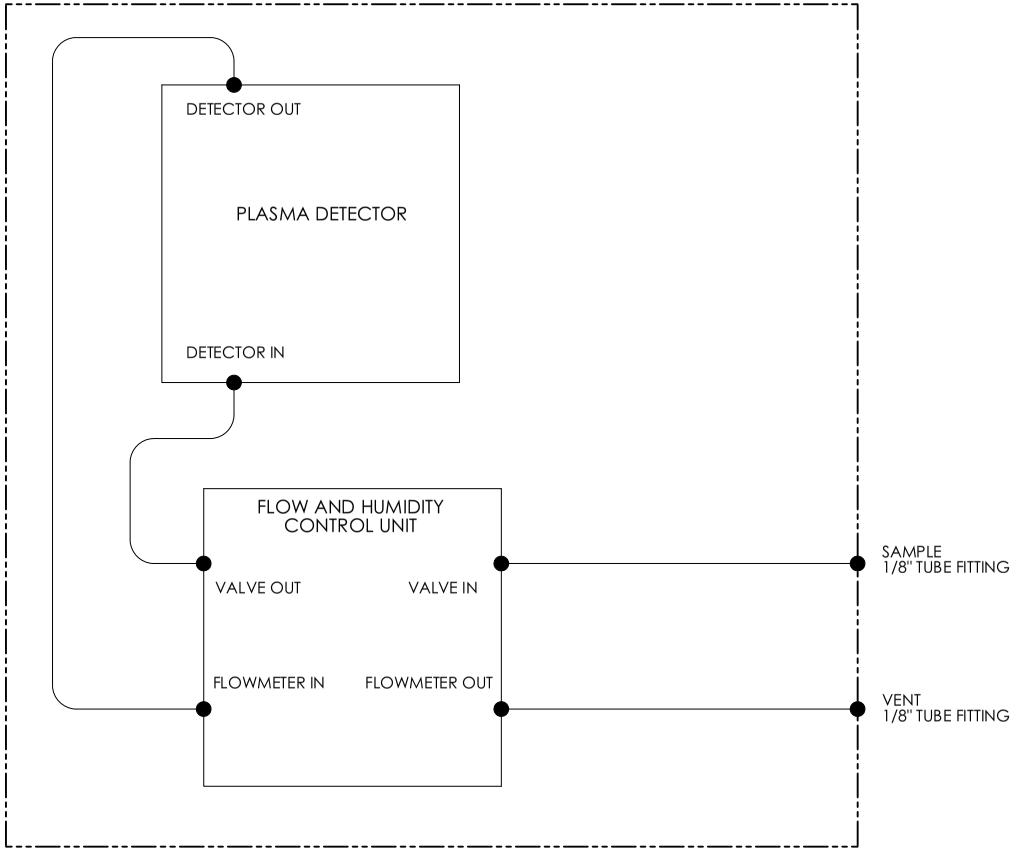
0	INITIAL RELEASE	04/08/11	A.A.	--



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O/	ENGR: ANGEL ALEGRIA	
F/ D84744	S.O. STANDARD	
REFERENCE	CAD ID C85455-0	

TITLE
PIPING DIAGRAM N2 ANALYZER MODEL 2120XL

SCALE 1:2
SIM NONE
SHEET 1 OF 1
MATL.
DWG NO. C85455
REV 0

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(1) ROUTE PLASMA EMISSION DETECTOR AC POWER CABLE UNDER THE DETECTOR.

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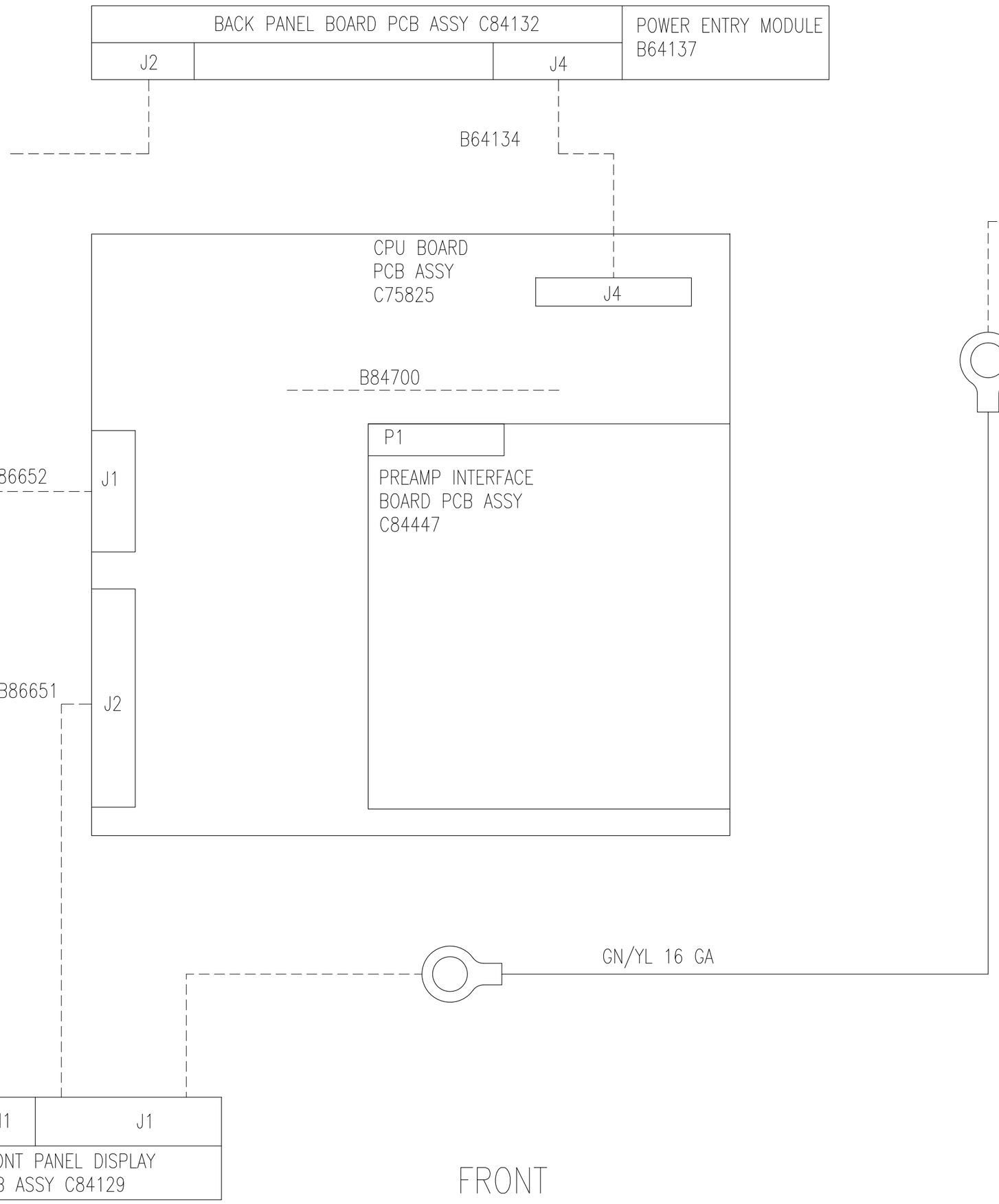
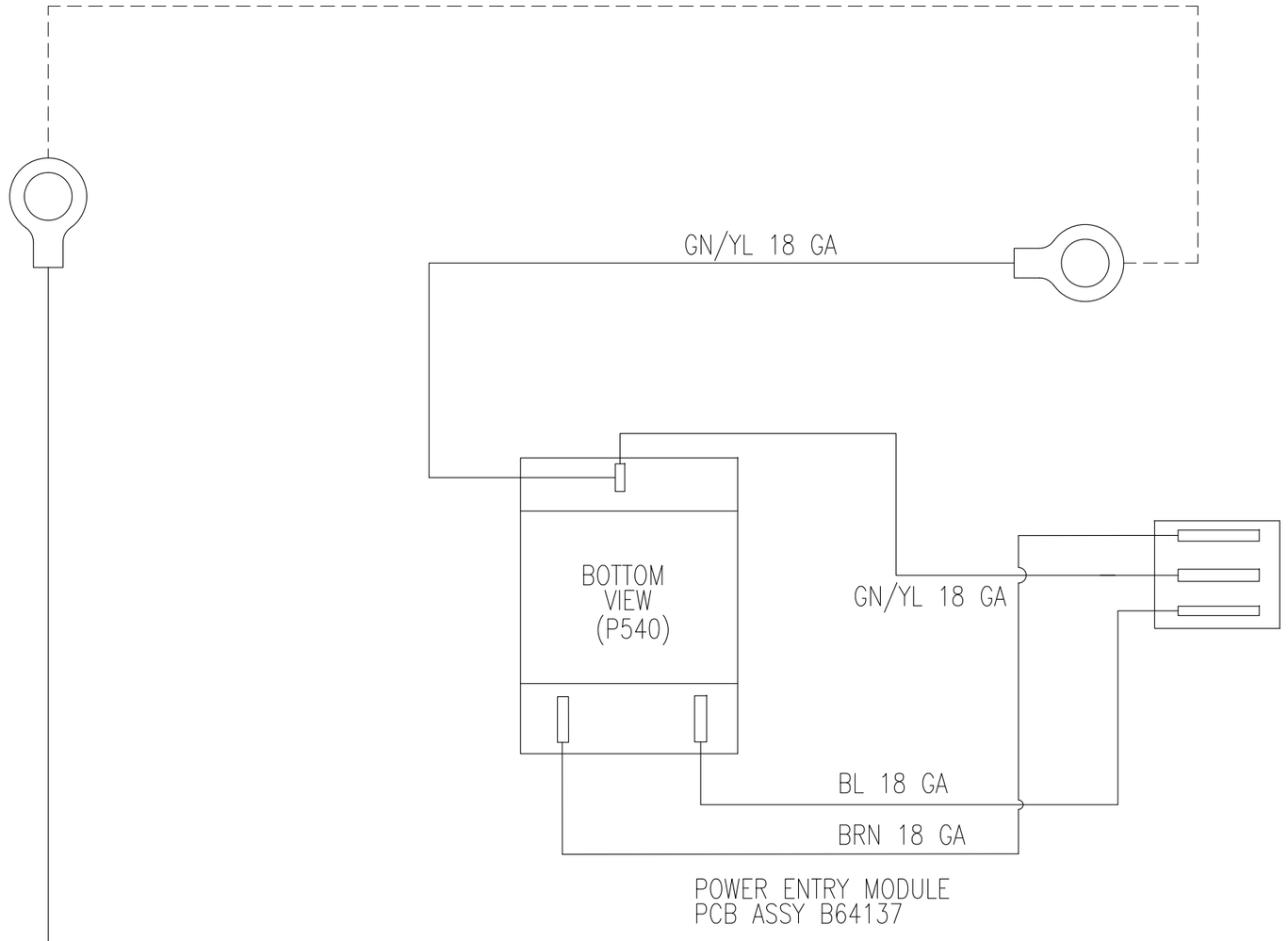
1	INC ECO 19-0034	11/18/19	AA	VF

REAR



FRONT



POWER ENTRY MODULE
PCB ASSY B64137

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WIRING DIAGRAM N2 ANALYZER MODEL 2120XL

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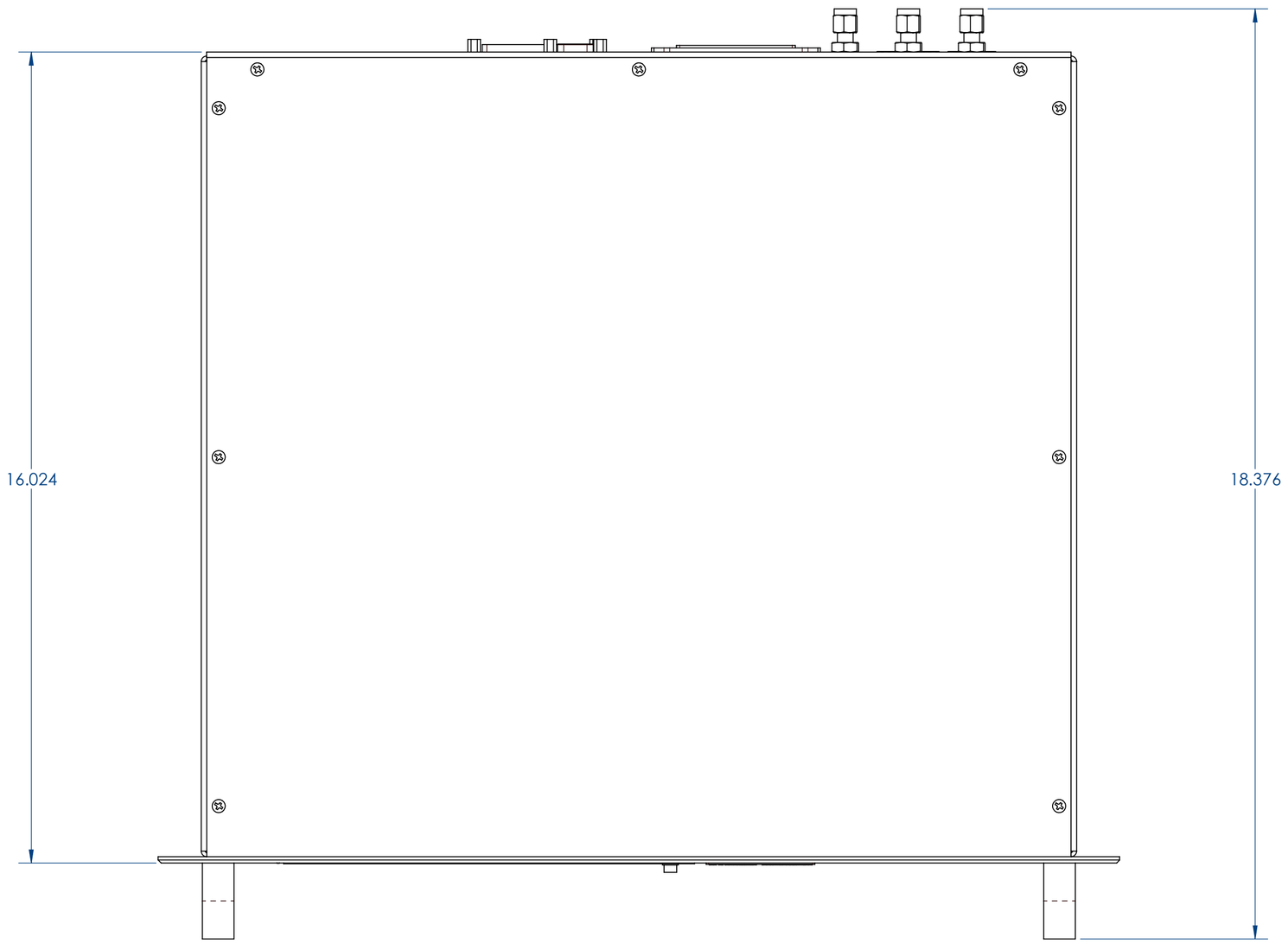

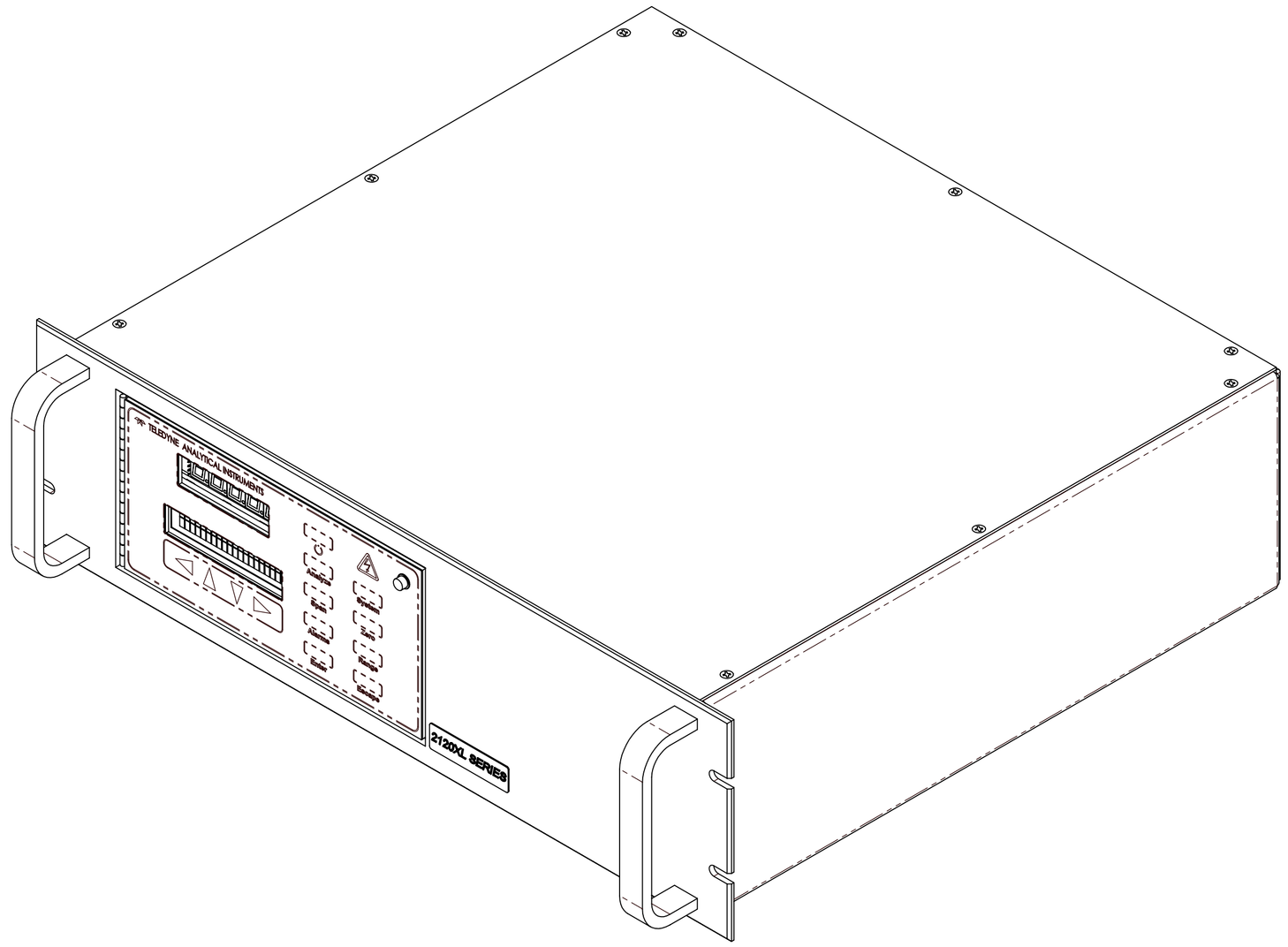

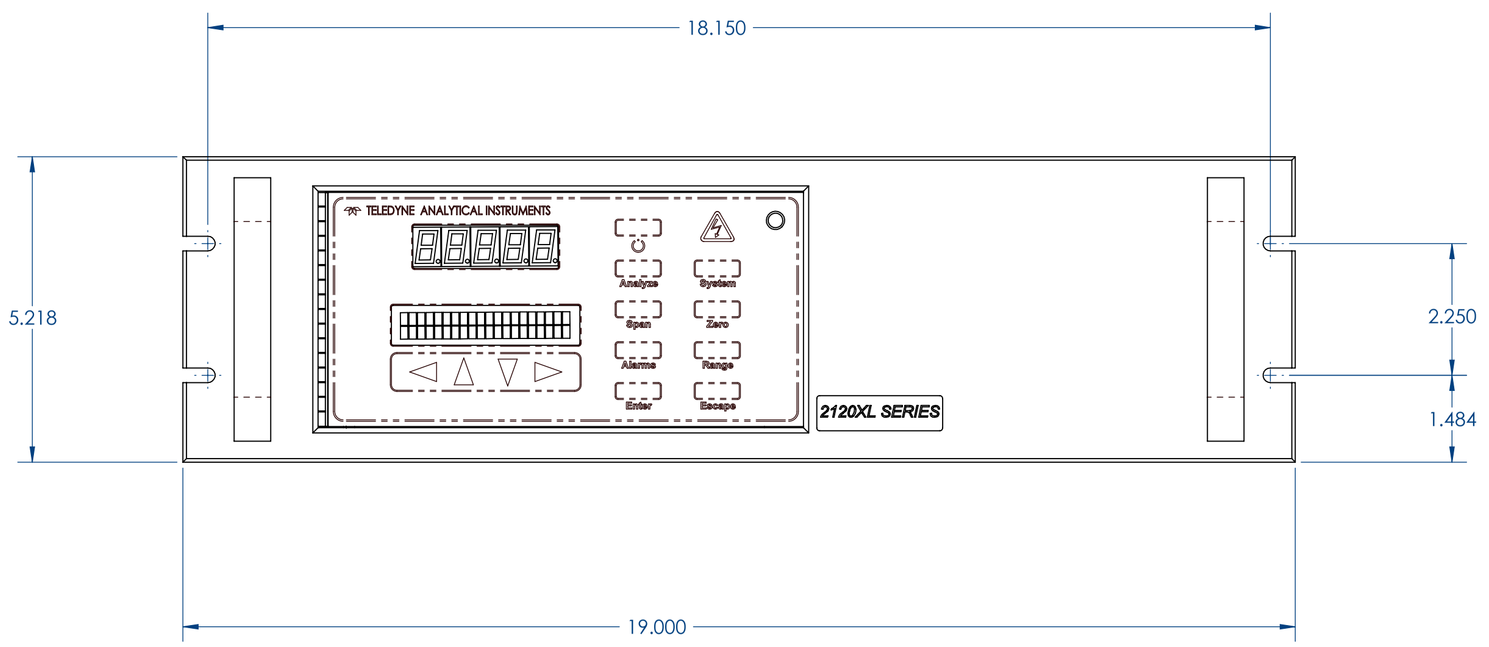

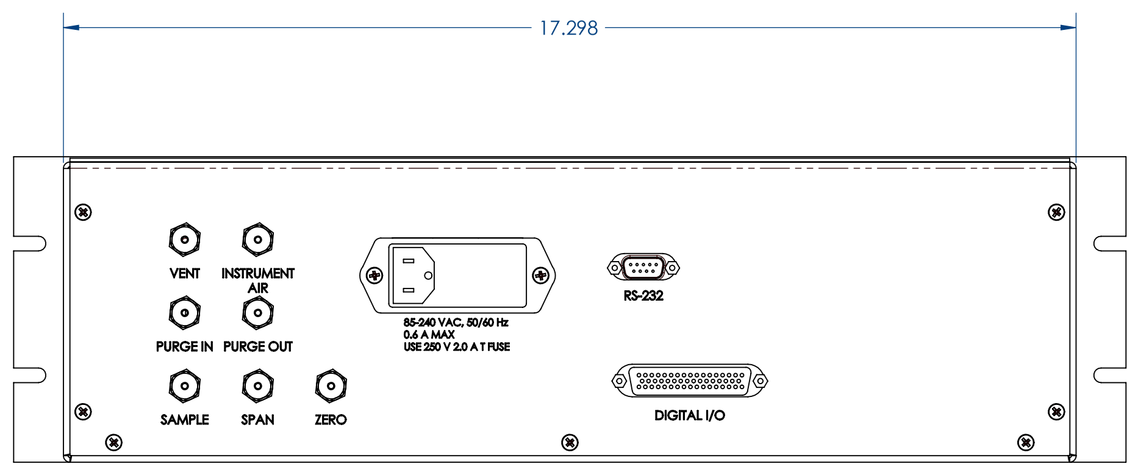

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REFERENCE	CAD ID D84123-0	

TITLE: OUTLINE DIAGRAM
N2 ANALYZER
MODEL 2120XL

SCALE 1:2
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SHEET 1 OF 1

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DWG NO. D84123
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