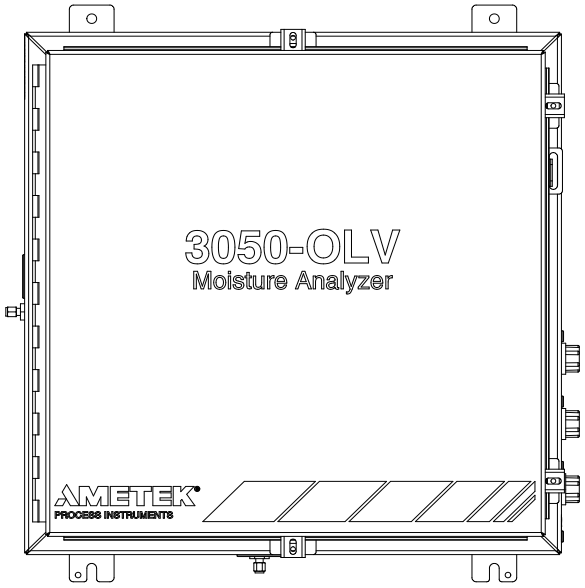
AMETEK®
PROCESS INSTRUMENTS

USER MANUAL

3050-OLV Moisture Analyzer



PN 305200901, Rev YT
AMETEK 3050 Configurator Software Version 2.0

Every successful enterprise has as its driving force someone with vision, courage and determination to make it succeed. Within the AMETEK Process Moisture Analysis business, such a person was John Day. Over a period of many years of practical experience working with customers, John became the committed "product champion" of the Quartz Crystal Microbalance method of moisture measurement. He constantly provided ideas on applications, marketing and product improvements which he felt were desirable for increasing the worldwide business.

Sadly, John was not to live to see the full results of this inspiration, so we proudly dedicate this new product to his memory.

JOHN DAY
1952 - 1997

To obtain a PDF of this manual, visit our Products page at www.ametekpi.com.

Contents

Safety Notes

WARNINGS, CAUTIONS, and NOTES contained in this manual emphasize critical instructions as follows:

Important information that should not be overlooked.

An operating procedure which, if not strictly observed, may result in personal injury or environmental contamination.

An operating procedure which, if not strictly observed, may result in damage to the equipment.

Burn hazard. Hot surface. Do not touch, allow to cool before servicing.

Read this manual before beginning the installation and operation of the 3050-OLV Analyzer system. Failure to do so, and/or use of the equipment in a manner not specified in this manual or accompanying documents, may impair the protection against fire, electrical shock and injury originally provided by this equipment. In addition, failure to follow the installation and start-up instructions may void the instrument warranty.

Electrical Safety

Up to **240 VAC** may be present in the analyzer housings. Always shut down power source(s) before performing maintenance or troubleshooting. Only a qualified electrician should make electrical connections and ground checks.

Any use of the equipment in a manner not specified by the manufacturer may impair the safety protection originally provided by the equipment.

Grounding

Instrument grounding is mandatory. Performance specifications and safety protection are void if instrument is operated from an improperly grounded power source.

Verify ground continuity of all equipment before applying power.

Personnel and Equipment Safety Information

This section describes important safety information to avoid personal injury and damage to the equipment while installing, operating, maintaining, or servicing the equipment. All safety regulations, standards, and procedures at the analyzer location must be followed.

All personnel involved with the installation, start-up, operation, maintenance, service, or troubleshooting of the analyzer must review and follow these Warnings and Cautions.

Do Not Operate without Covers
To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Use Caution When Lifting
Use caution when lifting the analyzer from its crate.

Use Proper Attire
Equipment is hot, user should wear protective groves while handling the equipment.

Use Proper Wiring
To avoid fire hazards, use only the wiring specified in the "Installation and Start-Up" chapter of this manual.

Avoid Electrical Overload
To avoid electrical shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.

Ground the Product
Follow the grounding instructions provided in the "Installation and Start-Up" chapter of this manual. Before making connections to the input or output terminals of this product, ensure that the product is properly grounded.

Use Proper Fuse

To avoid fire hazard, use only the fuse type and rating specified for this product.

Use Proper Power Source

Do not operate this product from a power source that applies more than the voltage specified.

Do Not Operate with Suspected Failures

If you suspect there is damage to this product, have it inspected by qualified service personnel.

Important Notice to Users

SPECIAL WARNINGS AND INFORMATION FOR USE OF THIS EQUIPMENT IN CLASS I, DIVISION 2 HAZARDOUS LOCATIONS:

This Equipment is designed to meet the requirements for: Class I, Division 2, Groups ABCD, T4 or Non-Hazardous Areas Only. (Note: The Division 2 Standalone Analyzer is not supplied with the 24 VDC power supply option.)

Explosion Hazard – Substitution of Components May Impair Suitability for Class I, Division 2.

AVERTISSEMENT – RISQUE D'EXPLOSION – LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE I, DIVISION 2.

Explosion Hazard – Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

AVERTISSEMENT – RISQUE D'EXPLOSION – AVANT DE DECONNECTER L'EQUIPEMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DESIGNE NON DANGEREUX.

All Input and Output Wiring Must be in Accordance with Class I, Division 2 Wiring Methods (NEC Sec 501.4(b) or CEC 18-152) and in Accordance with the Authority Having Jurisdiction.

If the 3050-OLV is to be powered by a source of 24 VDC other than that supplied by AMETEK, the power source's output must be isolated from hazardous mains voltages by use of double or reinforced insulation, having a minimum dielectric strength 2300 VAC. When the 3050-OLV is used in a Class I, Division 2 area, this external power source must be located in a General Purpose area or be Division 2 approved.

Electromagnetic Compatibility (EMC)

Read and follow the recommendations in this section in order to avoid performance variations or damage to the internal circuits of this equipment when installed in harsh electrical environments.

The various configurations of the 3050-OLV Analyzer should not produce, or fall victim to, electromagnetic disturbances as specified in the European Union's EMC Directive. Strict compliance to the EMC Directive requires certain installation techniques and wiring practices be used in order that erratic behavior of the Analyzer, or its electronic neighbors be prevented or minimized. Below are examples of the techniques and wiring practices to be followed:

In meeting the EMC requirements , the various Analyzer configurations described in this manual rely heavily on the use of metallic shielded cables used to connect to the customer's equipment and power. Foil and braid shielded I/O and DC power cables are recommended for use in otherwise unprotected situations. In addition, hard conduit, flexible conduit, and armor around non-shielded wiring also provides excellent control of radio frequency disturbances. However, use of these shielding techniques is effective only when the shielding element is connected to the equipment chassis/earth ground at both ends of the cable run. This may cause ground loop problems in some cases. These should be treated on a case-by-case basis. Disconnecting one shield ground may not provide sufficient protection depending on the electronic environment. Connecting one shield ground via a 0.1 microfarad ceramic capacitor is a technique allowing high frequency shield bonding while avoiding the AC ground, metal connection. In the case of shielded cables, the drain wire or braid connection must be kept short. A two inch connection distance between the shield's end, and the nearest grounded chassis point, ground bar or terminal is highly recommended. An even greater degree of shield performance can be achieved by using metallic glands for shielded cable entry into metal enclosures. Expose enough of the braid/foil/drain where it passes through the gland such that the shield materials can be wrapped backwards onto the cable jacket and captured inside the gland, tightened up against the metal interior.

Inductive loads connected to the low voltage "Alarm Contacts" is not recommended. However, if this becomes a necessity, proper techniques and wiring practices must be adhered to. Install an appropriate transient voltage suppression device (low voltage MOV, "Transzorb", or R/C) as close as possible to the inductive device to reduce the generation of transients. Do not run this type of signal wiring along with other I/O or DC in the same shielded cable. Inductive load wiring must be separated from other circuits in conduit by the use of an additional cable shield on the offending cable.

In general, for optimum protection against high frequency transients and other disturbances, do not allow installation of this Analyzer whereby its unshielded I/O and DC circuits are physically mixed with AC mains, or any other circuit that could induce transients into the Analyzer or the overall system. Examples of electrical events and devices known for the generation of harmful electromagnetic disturbances include motors, capacitor bank switching, storm related transients, RF welding equipment, static, and walkie-talkies.

Warning Labels

These symbols may appear on the instrument in order to alert you of existing conditions.

Protective Conductor Terminal
(BORNIER DE L'ECRAN DE PROTECTION)
Schutzerde

Caution – Risk of electric shock
(ATTENTION – RISQUE DE DÉCHARGE ÉLECTRIQUE)
Achtung – Hochspannung Lebensgefahr

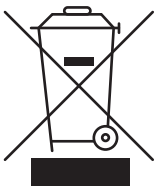
Caution – Refer to accompanying documents
(ATTENTION – SE RÉFERER AUX DOCUMENTS JOINTS)
Achtung – Beachten Sie beiliegende Dokumente

CAUTION – Hot Surface
(ATTENTION – SURFACE CHAUDE)
Achtung – Heiße Oberfläche

Environmental Information – WEEE

This AMETEK product contains materials that can be reclaimed and recycled. In some cases the product may contain materials known to be hazardous to the environment or human health. In order to prevent the release of harmful substances into the environment and to conserve our natural resources, AMETEK recommends that you arrange to recycle this product when it reaches its "end of life."

Waste Electrical and Electronic Equipment (WEEE) should never be disposed of in a municipal waste system (residential trash). The Wheelie Bin marking on this product is a reminder to dispose of the product properly after it has completed its useful life and been removed from service. Metals, plastics, and other components are recyclable and you can do your part by doing one of the following steps:



- When the equipment is ready to be disposed of, take it to your local or regional waste collection administration for recycling.
- In some cases, your "end of life" product may be traded in for credit towards the purchase of new AMETEK instruments. Contact your dealer to see if this program is available in your area.
- If you need further assistance in recycling your AMETEK product, contact us through our Customer Support page at https://www.ametekpi.com/customersupport/requestsupport.

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Overview

The 3050-OLV Moisture Analyzer measures trace concentrations of moisture in a process gas stream. The 3050-OLV is compatible with He, Ar, Ne, Xe, Kr, O_2, H_2, N_2, NO, CO, CO_2, light hydrocarbons, natural gas, refrigerants, air, and specialty gases. Refer to Figure 1-3 for a Gas List. The analyzer is calibrated to measure moisture contents from 0.1–2,500 PPMV. Data output can be in units of PPMV, PPMW, dewpoint Centigrade, dewpoint Fahrenheit, (required process pressure input) lb/mmscf, and mg/Nm^3.

The heart of the 3050-OLV is a quartz crystal microbalance (QCM) sensor that is sensitive to moisture. The QCM moisture sensor is simply a quartz crystal oscillator, in which the quartz crystal has been coated with a proprietary hygroscopic coating. This coating selectively, and reversibly, absorbs moisture from a Sample gas stream. As the crystal is exposed to a gas stream containing water vapor, the hygroscopic coating absorbs moisture from the gas stream, changing the mass of the coating. Changes in the mass are detected as changes in the natural resonance frequency of the oscillator.

In the analyzer's normal operating mode, the QCM sensor is alternately exposed to the Sample gas and a dry Reference gas. A dry Reference gas is produced by passing a portion of the Sample gas through a Dryer to remove any moisture present (i.e., the moisture content of the dry Reference is less than 0.025 PPMV). The difference in the resonant frequency of the QCM sensor, as measured when exposed to each of the two gas streams, is a function of the moisture content of the Sample gas. Thus, the moisture concentration of the Sample gas is determined from this frequency difference. The calibration data, which relates the moisture concentration of the gas stream to the measured frequency difference, are stored in an EEPROM within the QCM sensor module.

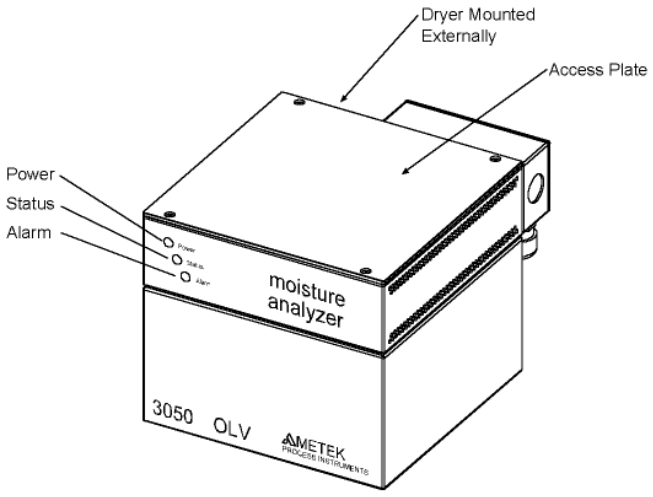

Figure 1-1.
3050-OLV Analyzer.

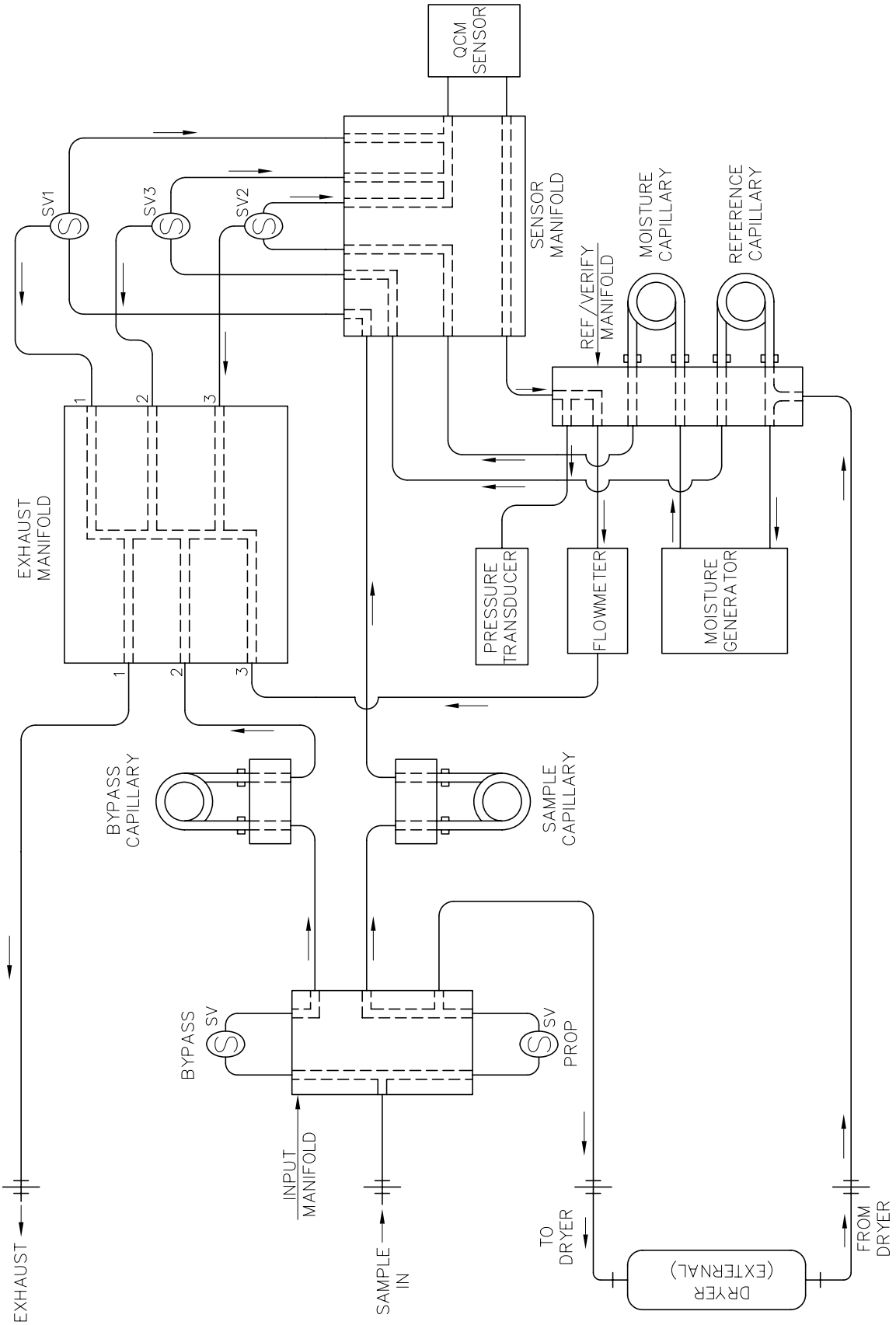

Figure 1-2.
3050-OLV Flow Diagram.

Controller Communication

All analyzer functions are controlled by a microprocessor housed within the analyzer. Communication with the analyzer is achieved through the following connections:

- One analog input, 4–20 mA.
- One analog output, 4–20 mA, isolated. Can be either loop powered or powered by the analyzer.
- Two alarm contacts (dry relay contacts).
- One RS-232 serial port.
- One RS-485 serial port.

The 3050-OLV has no local user programming functions. It requires serial communication with an external PC for configuration. Once configured, the analyzer is capable of standalone operation. The analyzer is factory configured and packaged with Configurator Software for initial setup of operating parameters. For enhanced interface and process monitoring, AMETEK offers optional System 2000 Software with graphical user interface to record and process your data in a Windows environment. User provided software may also be used with the 3050-OLV serial ports.

Verification

The 3050-OLV has a built-in Moisture Generator for onboard Verification. A portion of the dry Reference gas flows through the Moisture Generator where a known amount of moisture is added. When Cell Verification is initiated, the QCM sensor is alternately exposed to gas from the Moisture Generator and dry Reference gas. The moisture value is compared to a stored value. The sensor can make an adjustment if the value is within a tolerance band. If the value is outside the tolerance band, an alarm will activate.

Since the Moisture Generator uses a dried portion of Sample gas, sensor Verification is preformed on a sample of the process gas. This yields the most realistic test of the sensors performance under process conditions.

Gas Flow

The 3050-OLV Moisture Analyzer requires 150, ±20 SCCM sample volume to operate. The flow is split between Sample, Reference, and Moisture Generator sections of the sample system. The flow through the sample cell is maintained at 50 SCCM with the remaining gas vented to exhaust. There is a bypass valve in the analyzer that vents the inlet to exhaust through a flow restrictor. Activation of the bypass will increase total flow by approximately 1 SLPM. Note that the bypass valve will improve system response time.

Internal Timing

The analyzer operates in two timing modes. The **Normal** mode consists of short intervals of Sample and Reference gas. The **Sensor Saver** mode reduces the exposure of the sensor to the Sample gas by increasing the time spent on the dry Reference.

If the analyzer detects abnormal degradation of sensor performance over time in the **Normal** mode, the analyzer will automatically switch to **Sensor Saver** mode. Once the analyzer switches to **Sensor Saver** mode, it will not switch back on its own.

The **Sensor Saver** mode extends the life of the sensor, but provides slower response time. The analyzer updates every 2.5 minutes instead of one (1) minute.

Dewpoint Conversions

The 3050-OLV Analyzer is capable of outputting the moisture concentration in units of dewpoint (Centigrade or Fahrenheit). Dewpoint values are calculated from the moisture concentration measurements (PPMV) and the sample (i.e., process) pressure. For temperatures below 0 °C the 3050-OLV uses equations to determine the water vapor pressure over ice, rather than over super-cooled water. Thus, the 3050-OLV reports a "frostpoint" temperature, which is consistent with the physical form of the condensed phase in a real process stream. Water in super-cooled liquid state will only exist as a transient species, as the first bit of condensate starts to form on a smooth-chilled surface (i.e., the true method of measuring a "dew" point). Given more time, the "dew" layer will turn to ice, if the temperature is below the freezing point. While the "frostpoint" temperature will be higher than the "dewpoint" temperature, the exact magnitude of the difference will be a function of both the pressure and dewpoint/frostpoint temperature.

A second consideration, when using the 3050-OLV Analyzer to calculate dewpoint/frostpoint temperatures, is the sample (i.e., the process) pressure. The range of process pressures allowed by the 3050-OLV is restricted for many sample gases. Many gases liquefy at relatively low pressures, so calculating a dewpoint/frostpoint temperature for these compounds has no value. Therefore, the 3050-OLV is designed to report an error condition (i.e., process-pressure alarm), to alert the user of conditions that result in ambiguous dewpoint/frostpoint values.

Definition of Natural Gas

The composition of natural gas streams varies greatly from application to application. Normally, the methane content of these gas streams is approximately 90 %, and the concentration of the heavier hydrocarbons falls off with increasing molecular weight. Because the 3050-OLV Analyzer uses a thermal mass flow meter as part of its flow control system, it is necessary to define the composition of the gas stream to calculate the appropriate Flow Control parameters. A methane content of 80–90 % has been used to define the Flow Control parameters for the "natural gas" listed in the 3050-OLV Analyzer Gas List (Figure 1-3). If the methane content is above 95 %, AMETEK recommends selecting methane from the Gas List. In the event that the methane content is below 80 %, please contact AMETEK for instructions on selecting the appropriate gas from the listing.

Calculation of Dewpoint Values for Hydrocarbon Streams

The calculation of dewpoint values for hydrocarbon streams is covered by several standards. Because there are differences between the dewpoint values calculated with the older North American standard (ASTM D1142, which is based on the work published in IGT Research Bulletin #8) and the new European standard (ISO 18453, which is based on the work presented in GERG-Water Correlation: GERG Technical Monograph TM14, 2001), AMETEK has provided a means of using either method in the 3050-OLV product. Specifically, in the Gas List we have cited two separate entries for natural gas. The first entry is labeled "Natural Gas", and will provide dewpoint/frostpoint values consistent with ASTM D1142. The second entry is labeled "Natural Gas GERG", and will provide dewpoint/frostpoint values consistent with ISO 18453. All other aspects of analyzer performance are identical for both of the two natural gas listings.

3050-OLV Analyzer Gas List

The following gases have been tested for chemical compatibility with the seals and gaskets used in this instrument:

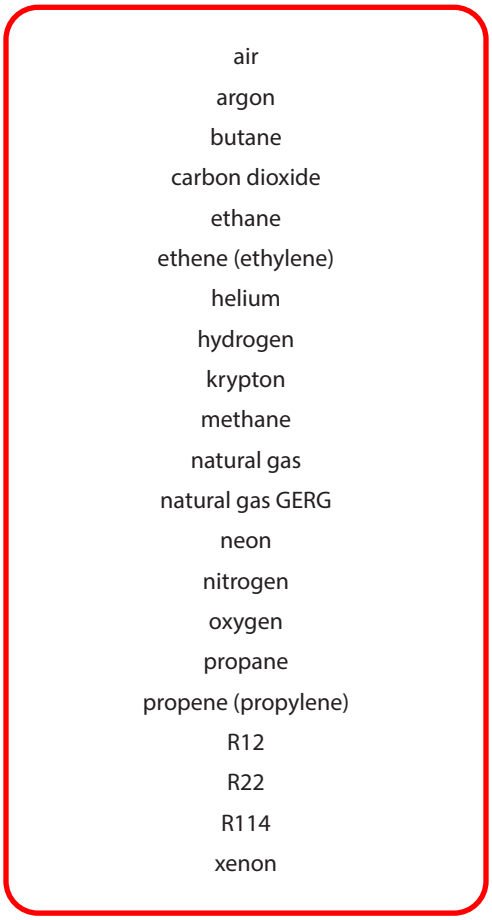

Figure 1-3.
3050-OLV Gas List.

NOTE

Contact AMETEK Service with inquiries regarding other applications.

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Installation and Start-up

Safety Considerations

Before beginning the installation of the analyzer and before powering it up, review and follow all safety information following the Table of Contents near the beginning of this manual. This information describes procedures to follow to avoid personal injury and/or damage to the equipment. All regulatory agency and personnel safety procedures for your jurisdiction must be followed.

"PN" in this chapter refers to AMETEK Part Number.

The installation of the analyzer must be in accordance with all of the customer and local regulatory standards and procedures. There are no operator-serviceable components inside the analyzer. Refer all servicing to qualified personnel.

Personnel Technical Level Required for Installation

The operations in this section should be performed only by qualified service personnel experienced in electrical safety techniques. Never service the analyzer unless power has been removed from the analyzer, and the analyzer has been allowed to cool for at least 90 minutes. Also, always use gloves when working on the analyzer.

Storage Prior to Installation

If the analyzer is stored for any period of time prior to installation, store the equipment in an environment where it is not subject to dripping or splashing liquids, corrosive gases, high humidity, or excessive heat or cold. Recommended storage conditions include:

Temperature:	0 °C to 50 °C (32 °F to 122 °F)
Relative Humidity:	<90 %, non-condensing

Failure to comply with these storage conditions will void your warranty.

Analyzer Site Preparation

Observe the following guidelines when selecting an analyzer installation location:

- **Space Requirements**
  The bench top model requires a bench area of approximately 25 cm x 30 cm plus clearance for analyzer connections and external components. Refer to Figures 2-1 and 2-2.

- Select a readily accessible location for the analyzer to allow for routine maintenance. Comfort levels for maintenance personnel should be considered in placement of the analyzer.

- The installation location should be free from excessive vibration and the ambient temperature is required to be within the limits listed in the specifications (refer to Chapter 5). If the ambient temperature is outside the specified limits or the vibration is excessive, contact your AMETEK representative to discuss solutions and special options to address ambient temperatures.

- **Power Requirements**
  The analyzer operates on 24 VDC. If 24 VDC is not available, a standalone 24 VDC power supply (PN 305442901) with universal input (85–265 V, 47–63 Hz) can be purchased from AMETEK. If the analyzer is powered by a 24 VDC source other than that supplied by AMETEK, the power source's output must be isolated from hazardous mains voltages by use of double or reinforced insulation having a minimum dielectric strength of 2300 VAC.

- **System Tubing**
  Recommended system tubing is 1/8-inch OD, 316 stainless steel, electro-polished, meeting ASTM #632 specifications (AMETEK PN 257707000 or better). For low-level (<20 PPMV) measurements 1/8-inch OD, 316L VAR stainless steel tubing with a finish of 10RA (or less) is highly recommended.

- **Dry Reference Gas**
  An external Dryer (AMETEK Dryer PN 305400901S or equivalent) is required to dry Reference gas to less than 0.025 PPMV.

  Dryers must be periodically replaced. In normal use, the AMETEK Dryer should dry a 50 PPM Reference gas to specification for one (1) year.

Unpacking and Inspecting the Equipment

Remove any packing material from the 3050-OLV Moisture Analyzer shipping crate. Check for damage. If equipment is damaged, notify the carrier and contact AMETEK Service (https://www.ametekpi.com/customersupport/request-support) immediately if parts are missing or damage is found, and to verify if damaged parts will require replacement prior to safely installing and operating the analyzer/equipment.

Tools, Equipment, and Supplies Required for Installation

To install the analyzer you need the following tools, equipment, and supplies:

- Set of open-end wrenches for fittings.
- Set of metric hexagonal wrenches.
- Set of ball drivers.
- Wire cutters, strippers, and crimpers.
- Flat blade instrument screwdriver.
- Soft, nonabrasive cloth.
- Wrist strap (for grounding).
- Detergent-based leak detector (Snoop® or another suitable leak detection agent is permissible).
- **Sample Gases**
  The 3050-OLV is designed to operate on a clean gas stream; specifically, the Sample gas stream must be free of particulates and aerosols. If the 3050-OLV Analyzer is being used on a clean gas stream (i.e., free from particulates and aerosols), AMETEK Process Instruments recommends that the analyzer be installed in accordance with the information provided in the following sections of this manual. However, if the process gas stream contains, or has the possibility of containing particulate materials, AMETEK Process Instruments recommends that an inline, 1/8" tube 2µ filter (supplied by AMETEK, PN 203641000) be installed on the Sample In fitting at the back of the analyzer. This filter is ideally suited for this purpose, and will mount directly on the Sample In fitting. While installing this filter will protect the analyzer from any particulates present in the Sample gas, it will also increase the response time of the system. This increase in response time is caused by the large surface area of the filter element.

  AMETEK Process Instruments manufactures sample systems for the 3050-OLV analyzer that are designed to remove particulates and aerosols from a gas stream, protecting the analyzer from damage, while maintaining fast sample system response. If you have questions concerning the sampling requirements of your process gas, please contact AMETEK Service.
- **Sample Pressure and Temperature Requirements**
  Pressure reduction is user-supplied to ensure sample pressure to the analyzer remains within the range of 20–50 PSIG. The pressure reducer/regulator with gauge should be installed near the Sample tap, between the tap and analyzer (see Figure 2-3). For optimum performance, the sample line should be heat traced to maintain a constant sample temperature. Optimum Sample gas input is 60 °C.

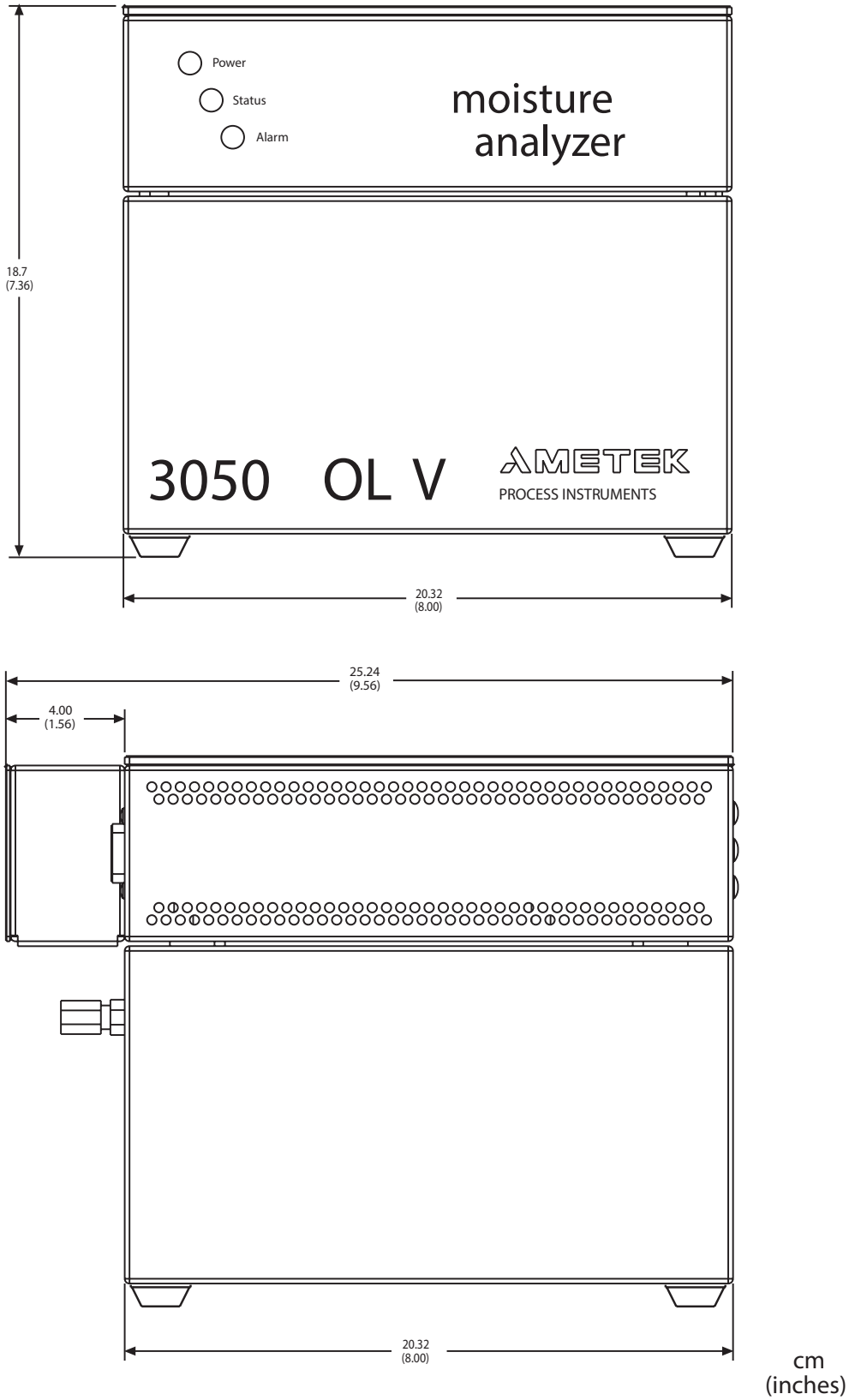


Figure 2-1.
3050-OLV Analyzer front and side view.

Mechanical Installation

Install the 3050-OLV Analyzer as close as possible to the sample source. The unit should be protected from direct exposure to weather and located so that the ambient temperature specifications will not be exceeded (see Figure 2-2 for connection locations).

1. If not already installed, install a main process shut-off valve and pressure reducer (recommended) at the Sample tap (Figure 2-3).

2. Connect the Dryer input to the "To Dryer" 1/8-inch compression fitting on the analyzer. Connect the Dryer output to the "From Dryer" 1/8-inch compression fitting. Refer to "Dryer Installation Instructions" and Figure 2-4.

3. Connect the exhaust fitting to appropriate vent system.

Leave "Exhaust Out" fitting capped or blocked with an isolation valve until Sample gas is flowing. This prevents ingress of wet ambient air. "Sample In" is protected with internal valve, which is closed when power is Off.

4. Open the main process shut-off valve and purge sample line to an appropriate area for at least five (5) minutes. Close the main process shut-off valve. This will help prevent contamination from entering the sensor.

5. Connect the sample line to the sample inlet 1/8-inch compression fitting.

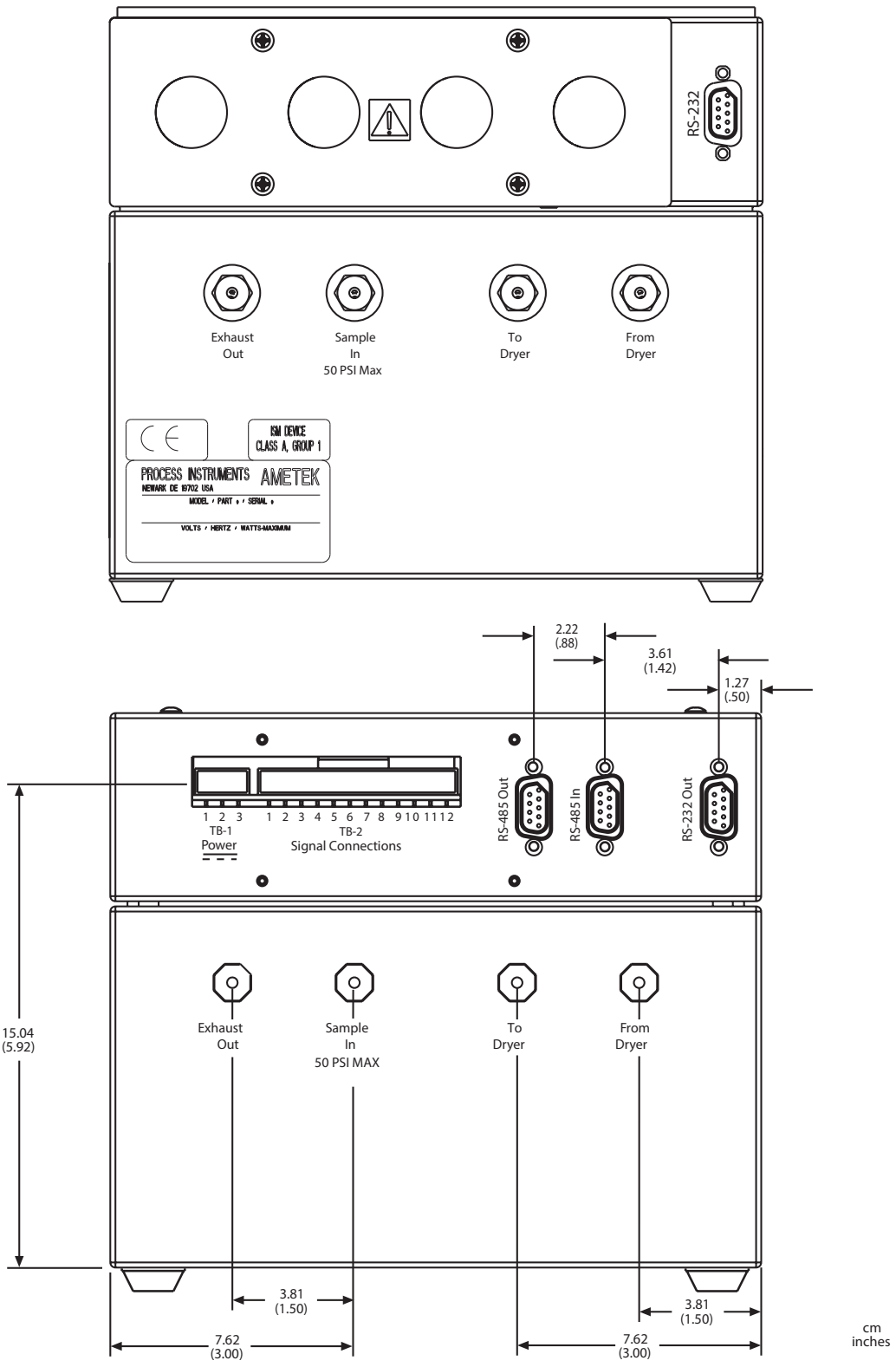


Figure 2-2.
3050-OLV Analyzer rear view.

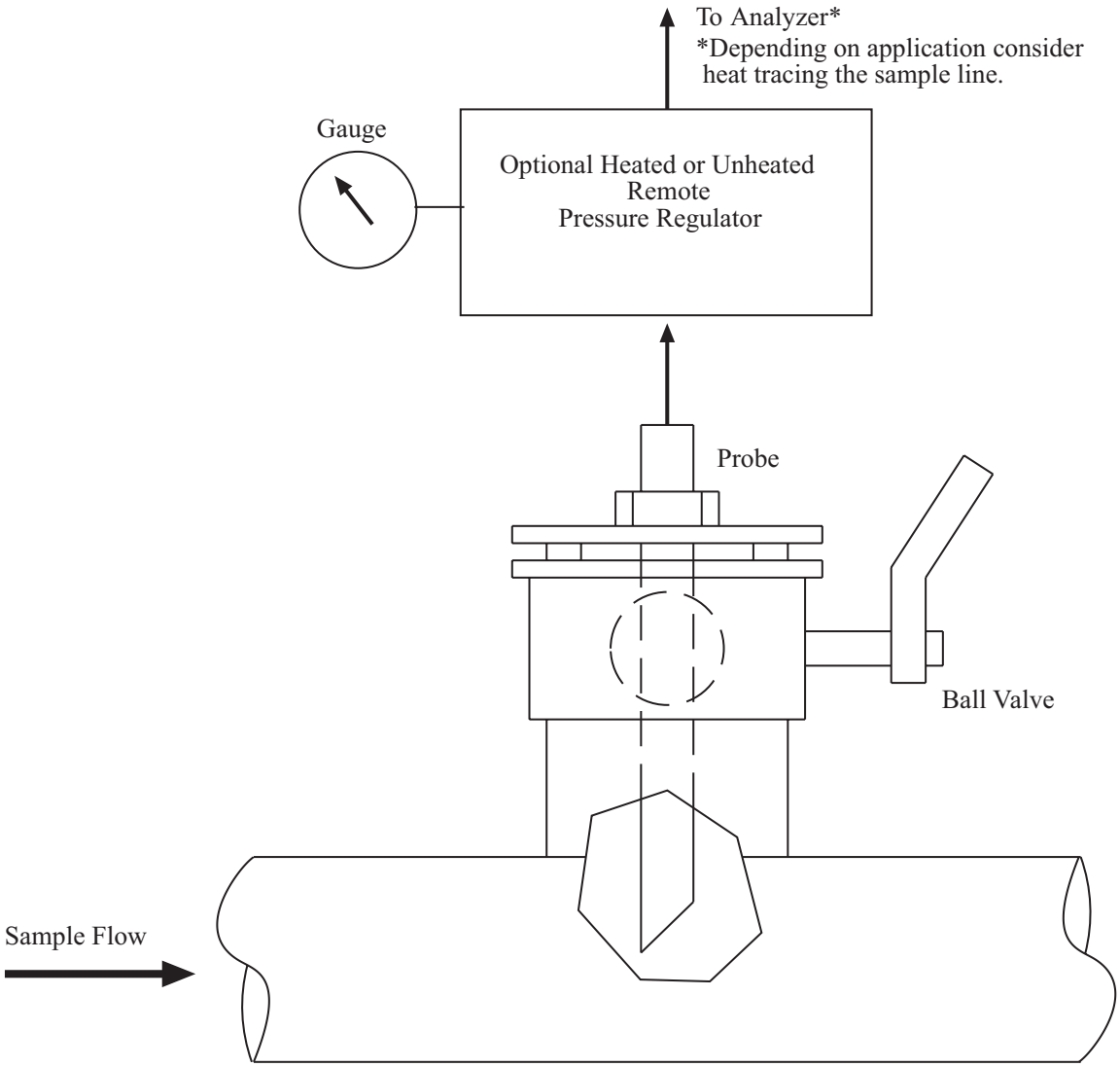


Figure 2-3.
Typical Probe Installation.

Dryer Installation Instructions

Tools needed to install Dryer:

- One #2 slotted screwdriver
- Two 7/16-inch wrenches
- One 5/8-inch wrench
- One 3/4-inch wrench

1. To alleviate stress on the tube connections attach the Dryer to the Dryer Bracket using two (2) 10-32 screws, and flat and lock washers (Figure 2-4).
2. Install adapter tubes onto the analyzer.
    a. Remove plastic dust caps from the Dryer input and output on the analyzer.
    b. Remove compression nuts and verify ferrule is properly installed.
    c. Reinstall nuts to finger tight.
    d. Insert adapter tubes through female compression nuts and ferrules until they bottom out.
    e. Using two (2) 7/16-inch wrenches (one to hold the bulkhead fitting), swage the compression fittings into the bulkhead fittings on the analyzer. For proper installation, the fitting should be 1/4-turn past finger-tight.
3. Attach the Dryer to adapter tubes:

Do not leave the Dryers open to ambient air. The high moisture levels present in ambient air can damage or shorten the life span of these components. Make Dryer connections promptly.

    a. Remove female VCR nuts from Dryer VCR glands.
    b. Verify VCR gaskets are in place.
    c. Align adapter tubs with Dryer VCR glands.
    d. Slide female nuts over VCR adapters and screw nuts onto Dryer glands. Secure VCR nut behind VCR adapter on the Dryer with 5/8-inch wrench. Use a 3/4-inch wrench to tighten nuts 1/8-turn past finger-tight.
    e. Check for leaks.

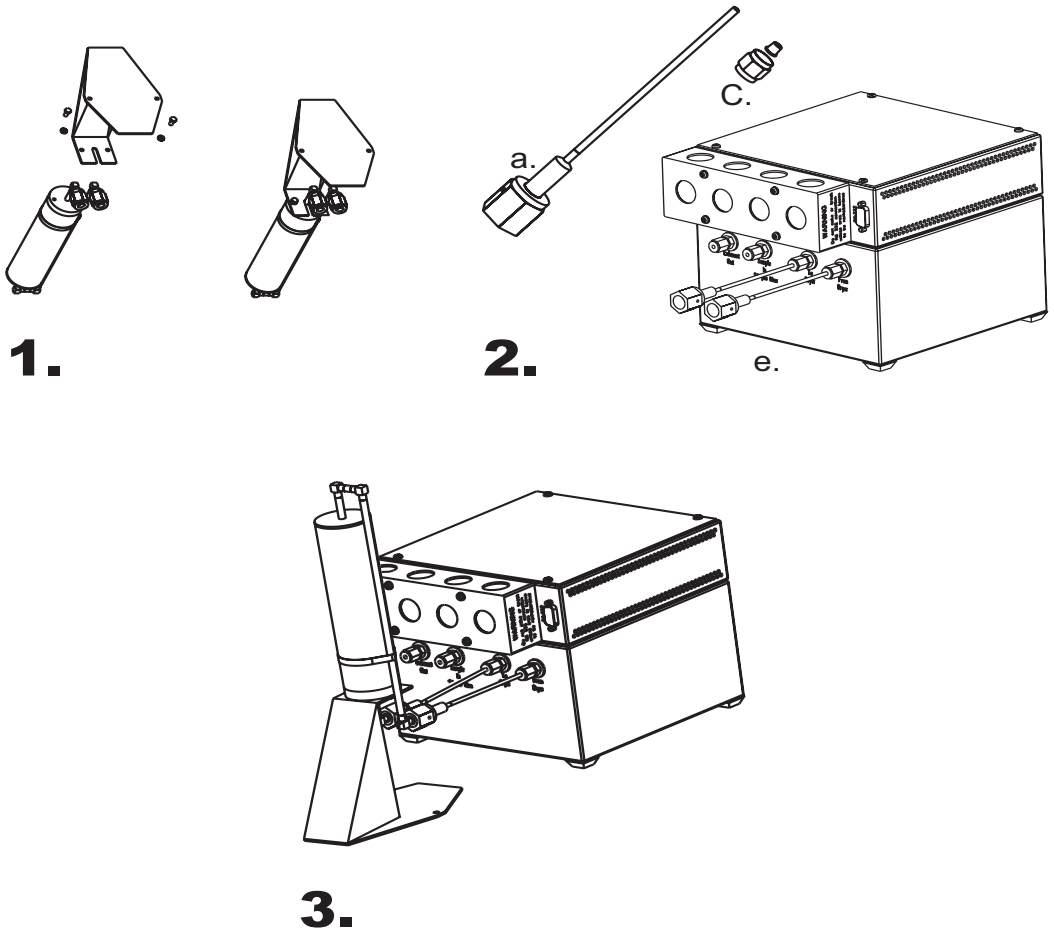


Figure 2-4.
Dryer Installation.

Electrical Connections

1. Remove terminal cover.
2. Connect the 4–20 mA analog output and alarm contacts from the analyzer to user recording equipment (Figures 2-5 and 2-6).
3. Connect RS-232 or RS-485 serial communication from analyzer to the PC being used for customer parameter setup (Figures 2-7 through 2-9).
4. Insert the RS-485 termination plug into the RS-485 out connection if communicating with one analyzer or the last in a chain (Figure 2-8).
5. Connect 24 VDC power to analyzer.

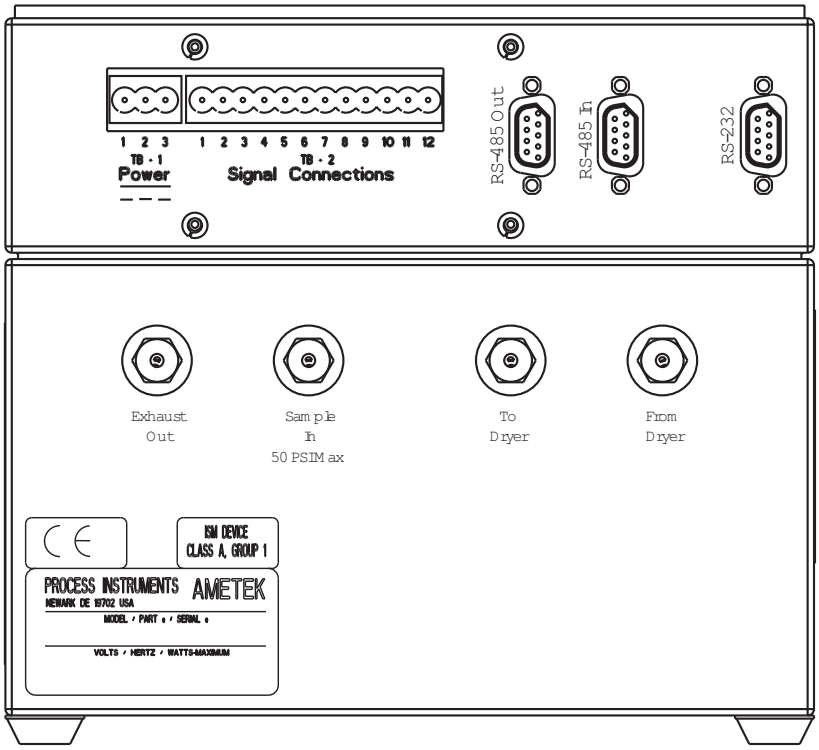


Figure 2-5.
3050-OLV Power and Signal Connections, Rear View.

3050-OLV Power and Signal Connections

Power Connections

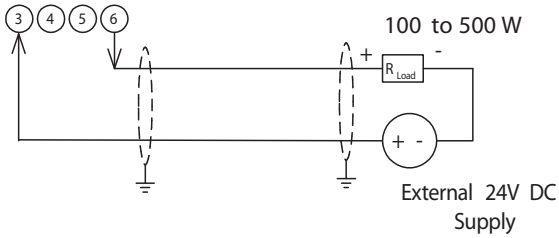
Terminal	Function
1	DC Power, 24 ±4 Volts 3.15 Amps F used
2	DC Common
3	Chassis Ground

Signal Connections

Terminal	Function
1	Remote Pressure Transmitter +
2	Remote Pressure Transmitter Return
3	4–20 mA Output Source
4	Isolated 24 V power supply +, 50 mA maximum
5	Isolated 24 V power supply
6	4–20 mA Output Return
7	System Alarm Relay
8	System Alarm Relay
9	Concentration Alarm Relay
10	Concentration Alarm Relay
11	Data Valid Relay
12	Data Valid Relay

4–20 mA Output Wiring

4-20 mA Output, Loop Powered (TB-2)



4-20 mA Output, Self Powered (TB-2)

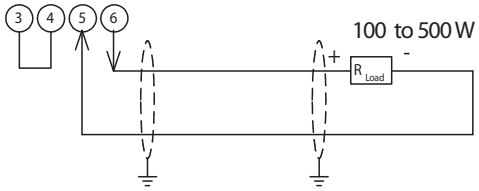


Figure 2-6.
3050-OLV Analyzer Power and Signal Connections.

NOTE

The cable should be shielded with single twisted pair.

NOTE

Cable shields should be connected to both the analyzer and the DCS. If this is not possible, cable shields should be tied to the chassis at each 3050-OLV. If this is not possible, tie the shield at the PC or DCS to chassis and remaining shield to the chassis through a 0.1 mF @ 500 V capacitor.

NOTE

The 3050-OLV Analyzer signal common is connected to earth ground. If the analog output is also grounded, the analog output will no longer be electrically isolated. Contact AMETEK if this situation occurs.

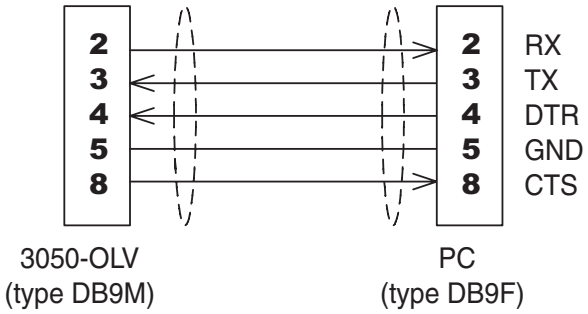
Analyzer power must be removed when connecting or disconnecting the 4–20 mA signal.

The 4–20 mA loop circuit must have a load resistance of between 100–500 ohms or malfunction may occur. If a loop check is performed, a 100 ohm resistor must be placed in series with the ammeter.

RS-232 Wiring

Maximum cable length is 10 metres.

9 pin PC connector



25 pin PC connector

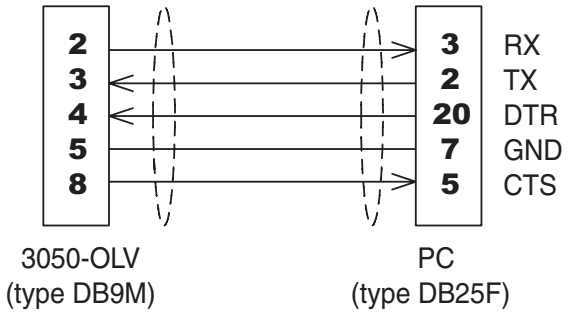


Figure 2-7.
RS-232 Wiring.

RS-485 Cables, Multiple 3050-OLV Analyzers

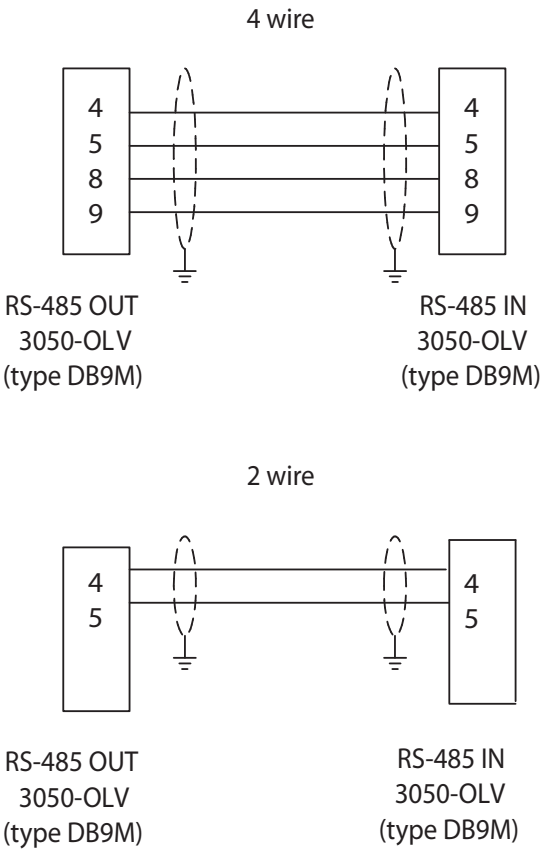


Figure 2-8.
RS-485 Cables,
Multiple 3050-OLV Analyzers.

NOTE

Total cable length not to exceed 1000 m. Cable should be low capacitance type for use in RS-485 applications (nominal impedance of 120 ohms, shielded twisted pairs). For example Belden 9841 in 2-wire applications, Belden 9842 in 4-wire applications.

NOTE

*Install terminator plug (PN 305900901) in RS-485 **OUT** position of last controller in networks with both single and multiple 3050-OLV Analyzers.*

NOTE

Cable shields should be connected to both the analyzer and the DCS. If this is not possible, cable shields should be tied to the chassis at each 3050-OLV. If this is not possible, tie the shield at the PC or DCS to chassis and remaining shield to the chassis through a 0.1 mF @ 500 V capacitor.

NOTE

*Adding a jumper between **Pins** '**1**' and '**3**' disables software control of the RS-485 mode. With a jumper installed, the 3050-OLV will always be in 4-wire mode.*

RS-485 to RS-232 Conversion for Host PC

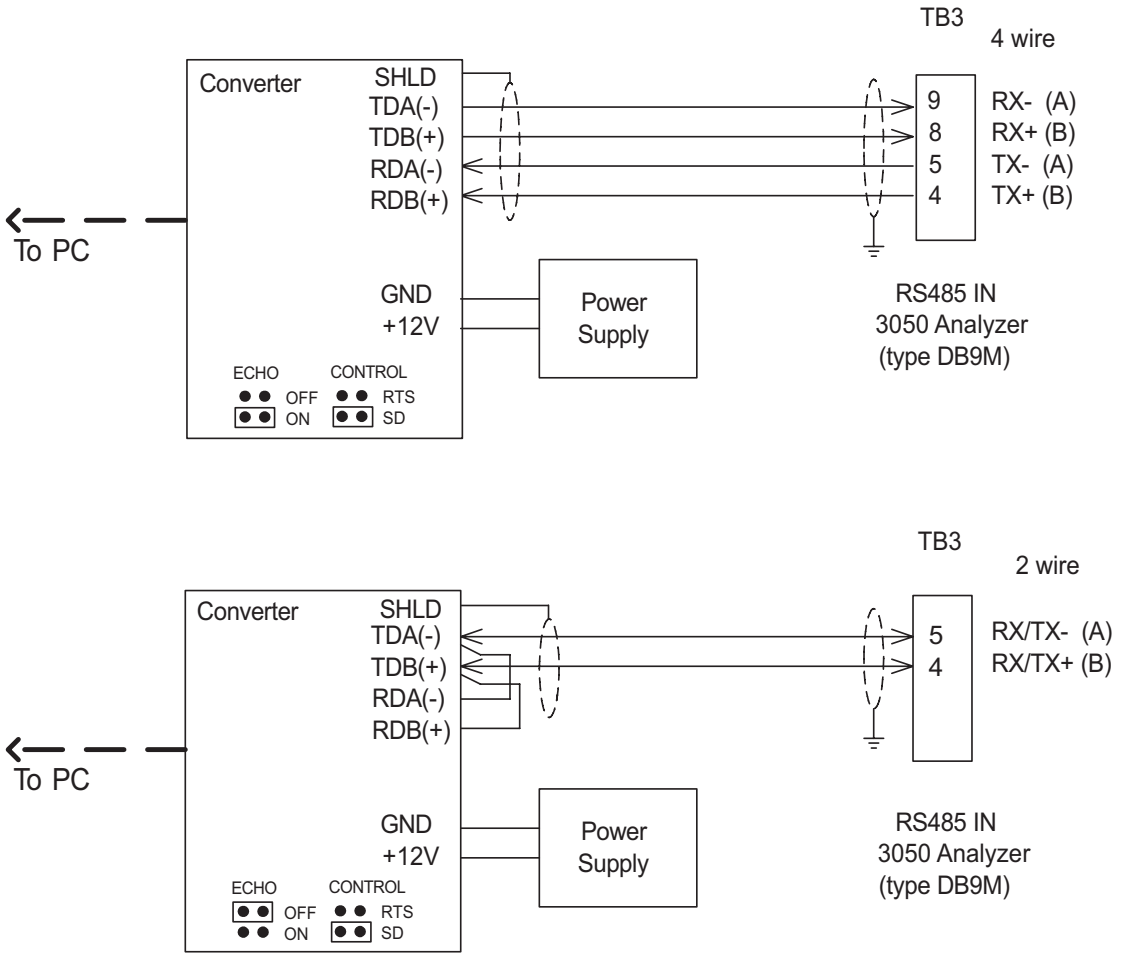


Figure 2-9.
RS-485 to RS-232 Conversion for Host PC.

NOTE

Converter and Power Supply are not suitable for use in hazardous locations.

Refer to Chapter 4 for replacement part numbers.

Analyzer Start-up

1. Turn On the power source.

2. Open main process shut-off valve. Adjust sample pressure between 20–50 PSIG. Allow the analyzer to dry down before recording moisture concentration measurements.

Dry Down Period

Allow a minimum of two (2) hours for the analyzer to dry down and stabilize. For sample systems, allow a minimum of three (3) days. System alarms are normal during this period. When dry down is complete, Cell frequency will be stable and the recorded data will have leveled off.

Status LEDs and Alarms

There are three (3) LEDs used for local indication of the system status:

- The GREEN LED indicates power is supplied to the system.
- The RED LED is used to reflect the status of the Concentration, Data valid, and System alarms. In the event of a Concentration Alarm, the RED LED will be On.
- The YELLOW LED reflects sample flow status. On indicates Sample gas is being measured, Off indicates dry Reference gas.

For more information about alarms, refer to "Alarm and Warning Messages" in Chapter 4.

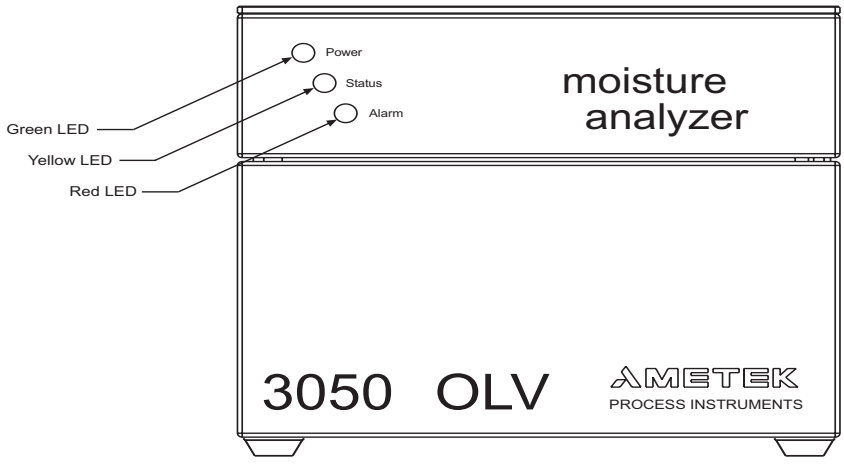


Figure 2-10.
Status LED alarms.

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AMETEK 3050 Configurator Software

The 3050 Configurator Software provides a graphical user interface to set up parameters for either a single analyzer or multiple analyzers.

Although you can set and view parameters for multiple analyzers using the 3050 Configurator Software, you can only work with one analyzer at any time.

Installing the Configurator Software

1. Insert the Configurator Software CD into the PC's CD ROM drive.

2. The installation program should begin to run immediately. If it does not start automatically, click **RUN** from the Windows **Start** menu. Type the appropriate drive letter, followed by a colon (:) and a backslash (\ ) and the word "setup.exe" (for example, d:\setup.exe) and click **OK** to start the installation program.

3. Follow the instructions on the subsequent screens to complete the installation. When you get to the **Setup Complete** screen, click **Finish** to complete the installation. The default location for the 3050 Configurator Software is in the **AMETEK** folder.

Configuring the 3050-OLV Analyzer

This section provides instructions for setting up your operating parameters using the 3050 Configurator Software.

Working From the General Tab

Use the **General** tab to view the current configuration and define parameters for the analyzer and to configure the **PC Communications** (Figure 3-1). With Version 2.0 and later, you must click the **Setup** button and accept the changes before communications begin.

NOTE

*After communication with the analyzer has been established, any changes to the analyzer communications parameters must be made from the **Device Communication** tab. These changes must be made before you make any changes to the computer serial port settings.*

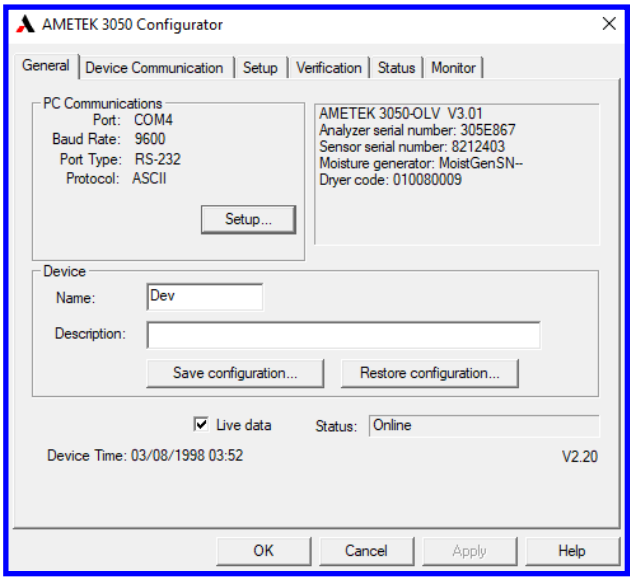

Figure 3-1.
General tab.

PC Communications

Displays information that has been configured from the **Communication Settings** dialog box.

Setup

Allows you to set up the communication parameters required to establish communication with the analyzer (see "**PC Communications Setup Options**" in this chapter).

Click the **Setup** button to view the serial port **Communication Settings** dialog box, where you can configure **PC Communications** (Figure 3-2).

Serial Numbers

When the analyzer is connected to the PC, the **Analyzer Name** and **Software Version**, **Analyzer serial number**, **Sensor serial number**, and the **Moisture generator** and **Dryer codes** are displayed to the right of **PC Communications** (Figure 3-1).

In the lower right-hand corner, above the **Help** button, the **Configurator Software version number** is displayed.

Device

Name

Enter a name for the analyzer.

Description

Enter a description for the analyzer.

Save Configuration

Saves the analyzer's current internal parameters to a file. The **Save As** dialog box opens so that you can name and save the file.

Restore Configuration

Restore previously saved parameters to the analyzer from a file. The **Open** dialog box appears so that you can select and open the file.

*The **Restore configuration** button can also be used to restore analyzer parameters.*

Live Data

Checked (default)	The system connects to and uses live data from the analyzer.
Not checked	The system uses demonstration data.

Status

Displays the status of the analyzer (device) you are communicating with. Indicates if the analyzer is Online, Offline, or in Demo Mode.

Online	The PC and analyzer are connected and communicating properly.
Offline	The **Live Data** box is checked on the **General** tab and the connection is broken or Offline.
Demo Mode	The **Live Data** box is not checked on the **General** tab. No analyzer is connected through the serial port. This allows you to exercise program options without communication with the analyzer.

Saving the Settings on the General Tab

To save settings on the **General** tab, click **Apply**.

To discard the changes you have made, click **Cancel**. This will close the 3050 Configurator Software program.

*Clicking **OK** or **Cancel** will close the 3050 Configurator Software.*

PC Communications Setup Options

When you select **Setup** from the **PC Communications** area on the **General** tab, you will be able to choose from two communications options, each with its own parameter settings (Figure 3-2.1):

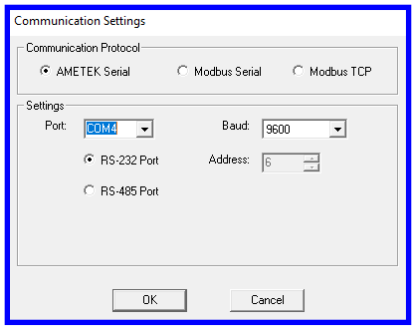

Figure 3-2.1.
PC Serial Communication Settings dialog box (AMETEK Serial selected).

Communication Protocol

AMETEK Serial

Select this for *initial* PC Communications setup. Once communication with the analyzer has been established, the **Modbus Serial** can be selected if desired.

Modbus Serial

If desired, this can be selected after communication with the analyzer has been established.

Modbus TCP

If desired, this can be selected after communication with the analyzer has been established. Using this option allows for remote communication between the analyzer and the customer DCS, DAS, or PLC.

NOTE

*When changing from **AMETEK Serial** to **Modbus Serial** or **Modbus TCP**, the analyzer communication parameters must be changed* before *the computer serial port settings.*

AMETEK Serial Communication Setup

When you select the **AMETEK Serial** communication option (Figure 3-2.1), the following parameter settings are available:

Settings

Port

Select the COM port on your computer where the connection to the analyzer is installed.

Baud (Rate)

Select the baud rate at which data will be transferred.

RS-232 Port

Select this if the analyzer is connected to an RS-232 port.

RS-485 Port

Select this if the analyzer is connected to an RS-485 port.

Address

Choose the network address to which the analyzer is connected.

Modbus Serial Communication Setup

When you select the **Modbus Serial** communication option (Figure 3-2.2), the following parameter settings are available:

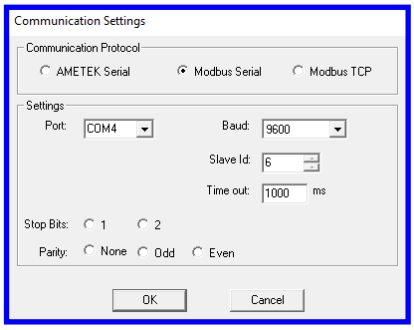

Figure 3-2.2.
PC Serial Communication Settings dialog box (Modbus Serial selected).

Settings

Port

Select the COM port on your computer where the connection to the analyzer is installed.

Baud (Rate)

Select the baud rate at which data will be transferred.

Slave Id

This is the Modbus® slave address of the analyzer, where 0 = *Disabled* and 1–255 = *Enabled*. If using the RS-232 port, the address setting is not applicable (it is greyed out).

If using the RS-485 port, enter a unique Modbus address (Slave ID) for the analyzer.

Time out (ms)

Time out value (duration) that the software will use to attempt to establish communications with the analyzer. AMETEK recommends a value of 1000 ms.

Stop Bits

Select the number of stop bits (1 or 2) of the Modbus network.

Parity

Select the parity of the Modbus network (None, Odd, or Even).

Modbus TCP Communication Setup

When you select the **Modbus TCP** communication option (Figure 3-2.3), the following parameter settings are available:

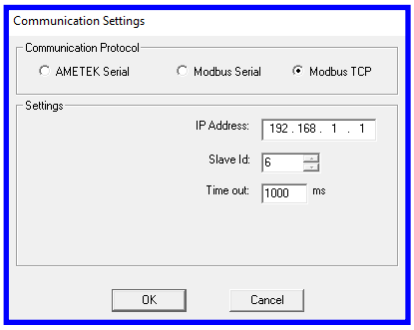

Figure 3-2.3.
PC Serial Communication Settings dialog box (Modbus TCP selected).

Settings

IP Address

Enter a unique address for each analyzer. This is determined based on network settings for the analyzer.

Slave Id

This is the Modbus® slave address of the analyzer, where 0,1 = *Disabled* and 2–255 = *Enabled*. If using the RS-232 port, the address setting is not applicable (it is greyed out).

If using the RS-485 port, enter a unique Modbus address (Slave ID) for the analyzer.

Time out (ms)

Time out value (duration) that the software will use to attempt to establish communications with the analyzer. AMETEK recommends a value of 1000 ms.

Saving the PC Communication Settings

To save the settings from any of the **PC Communications** settings screen, click **OK**.

To discard the changes you have made, click **Cancel**.

Working From the Device Communication Tab

NOTE

*For initial setup of **PC Communications** parameters, click the **Setup** button on the **General** tab.*

Configuring Multiple Analyzers

Use the **Device Communication** tab (Figures 3-3.1 and 3-3.2) to set the analyzer's communication parameters to agree with the PC settings when controlling analyzers connected in a daisy chain.

Changing Communication Parameters

1. Change the *analyzer* parameter(s) first.
2. Click **Apply** to confirm the change. This may cause the analyzer to go Offline.
3. Change the PC settings or physical wires/cables.
4. Reset the analyzer by cycling the AC power Off-On.

Baud (Rate)
Select the baud rate at which data will be transferred.

RS-485 Port
Identifies the analyzer's type of serial communication cable that is being used.

Two-Wire RS-485	Select this if you are using a two-wire cable.
Four-Wire RS-485	Select this if you are using a four-wire cable.

Address
This identifies the analyzer's address. Choose the network address for the analyzer being connected.

Parity (**Modbus Serial** communication only)
Select the parity of the Modbus network for your analyzer.

Stop Bits (**Modbus Serial** communication only)

Select the number of stop bits of the Modbus network for your analyzer.

NOTE

The 3050 Analyzer can only operate at the four combinations listed below.

Parity	Stop Bits
Odd	1
Even	1
None	1
None	2

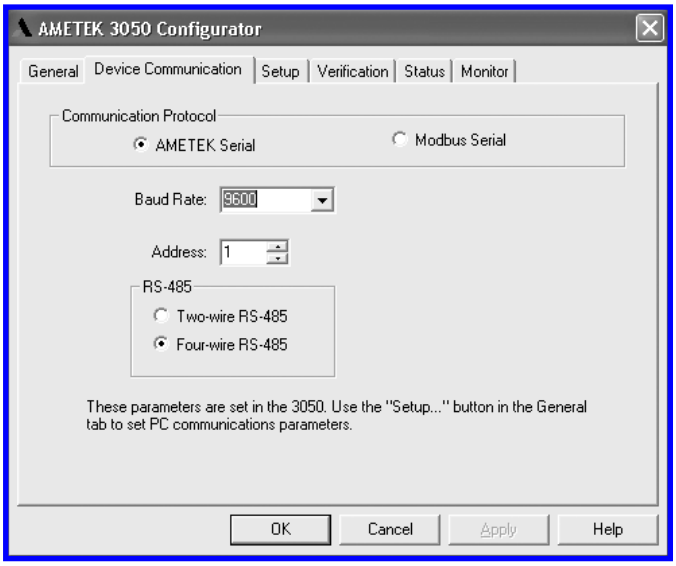

Figure 3-3.1.
Device Communications setup screen for AMETEK Serial.

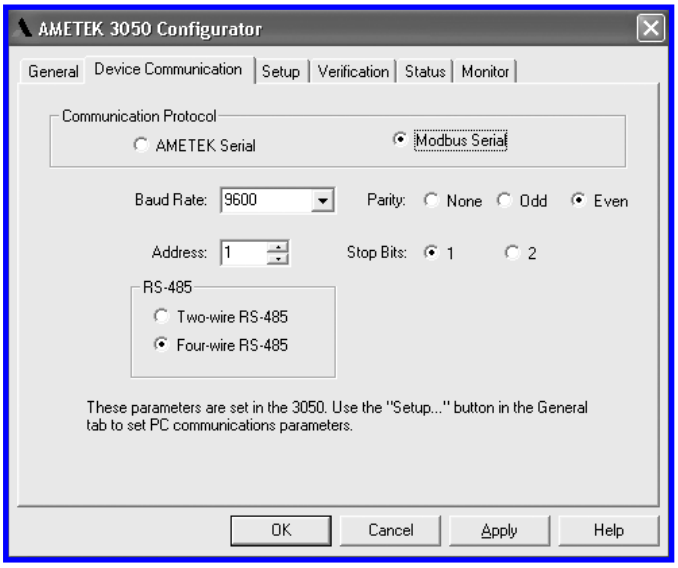

Figure 3-3.2.
Device Communications setup screen for Modbus Serial.

Saving the Settings on the Device Communication Tab

To save settings on the **Device Communication** tab, click **Apply**.

To discard the changes you have made, click **Cancel**. This will close the 3050 Configurator Software program.

PC Communications

Once the Device (analyzer) communication settings have been changed, the **PC Communications** setup screen will automatically open. Select the appropriate options that correspond with the communication settings on the Device and click **OK**.

It will take a few seconds to establish communication and display "**Online**" in the **Status** field on the **General** tab.

NOTE

*If communication is lost, cycle the analyzer AC power Off-On and click **Setup** on the **General** tab to change the PC Communications.*

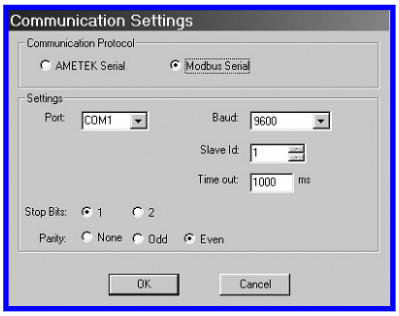

Figure 3-4.
PC Serial Communication Settings dialog box, for Modbus Serial.

Working From the Setup Tab

Use the **Setup** tab to define analyzer parameters.

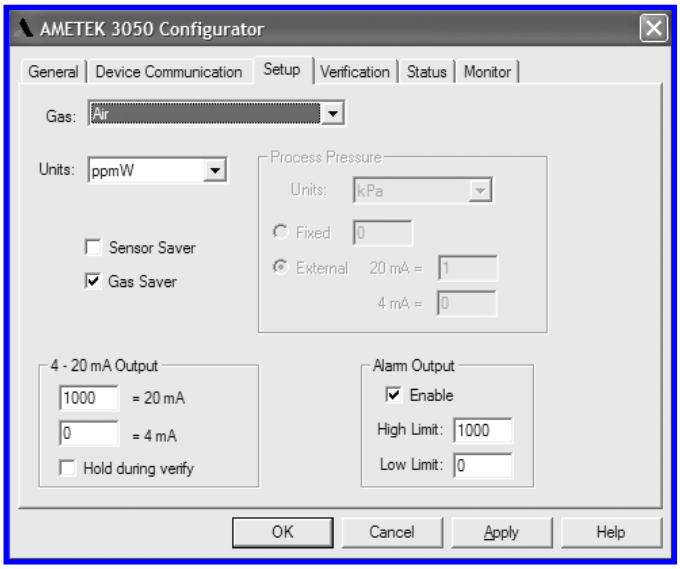

Figure 3-5. Setup tab.

Gas

Select the gas being sampled.

Units

Select the unit of measurement.

All values entered must be in the same unit of measure as selected.

Process Pressure

Used when ***dewpoint C*** or ***dewpoint F*** is selected as unit of measure (from the **Units** dropdown list).

Units

This dropdown list box allows you to specify the unit of measure for pressure input.

Fixed

Select this if using a fixed input. If selected, you must enter a *fixed* value.

External

Select this if using an external input. If selected, you must enter values for **20 mA** and **4 mA** points.

Absolute pressure is required.

Sensor Saver

Select this check box to enable **Sensor Saver**.

Checked	Analyzer operates with a slow cycle time, maximizing Measuring Cell life at the expense of system response time.
Not Checked	Analyzer operates with a rapid cycle time, minimizing system response time.

Gas Saver

Select this check box to enable **Gas Saver**.

Checked	Analyzer runs on a sample flow rate of 150 SCCM.
Not Checked	Analyzer uses an internal bypass, which increases the response speed of the system. Provides sample flow rate >1 SLPM.

4–20 mA Output

Set up your analog output range.

20 mA	Enter your high analog output limit.
4 mA	Enter your low analog output limit.
Hold during verify	Check this box to hold analyzer output during the Verification.

Alarm Output

Select this check box to set up the limits for the Concentration Alarm.

Enable	Check this box to enable the Concentration Alarm.
High Limit	Enter the high limit for the Concentration Alarm.
Low Limit	Enter the low limit for the Concentration Alarm.

Saving the Settings on the Setup Tab

To save settings on the **Setup** tab, click **Apply.**

Working From the Verification Tab

Use the **Verification** tab to schedule a routine **Verification**.

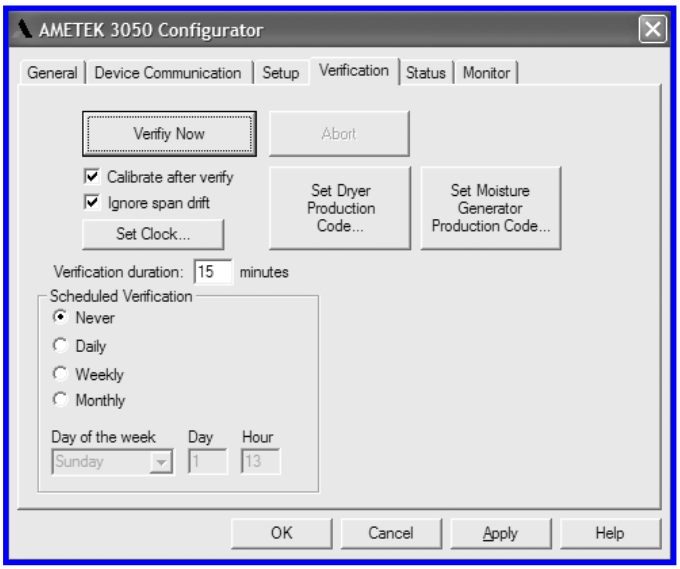

Figure 3-6.1. Verification tab.

Verify Now

Click this button to start the Verification.

Abort

Click this button to terminate the Verification.

Calibrate after verify

Checked	The analyzer performs a Span adjustment at the end of the Verification.
Not Checked	The analyzer performs only a Verification.

Ignore span drift

Checked	One time Span value change is not limited.
Not Checked	One time Span value change is limited to 10 % of the existing Span value.

Set Dryer Production Code

Click to enter the **Dryer Production Code** for the Dryer that is installed in the analyzer. Click **OK** to accept.

NOTE

You must enter a new Dryer code each time you replace the Dryer.

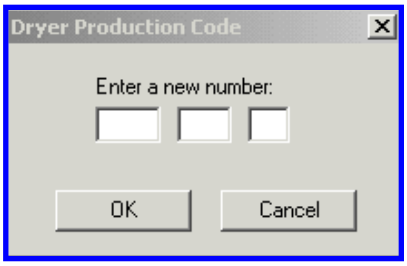

Figure 3-6.2.
Dryer Production Code entry dialog box.

Set Moisture Generator Production Code

Click to enter the **Moisture Generator Production Code**. Click **OK** to accept.

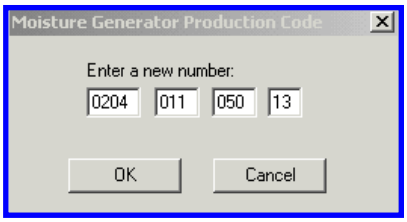

Figure 3-6.3.
Moisture Generator Production Code entry dialog box.

Set Clock

Click **Set Clock** to synchronize the clock within the analyzer with the PC. The **Time Synchronization** box opens with the PC time and date and the analyzer time and date. Click **Synchronize** to set the time, or click **Cancel** to close the box.

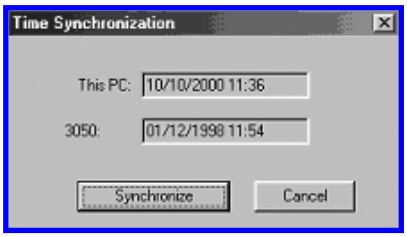

Figure 3-6.4.
Time Synchronization dialog box.

Verification duration

Enter the **Verification duration** in minutes. The system defaults to the minimum time required.

Scheduled Verification

Use this to schedule the frequency and time for a Verification function to take place.

Never	Select *Never* to disable the Verification function from being performed. This will disable the **Day of the week**, **Day**, and **Hour** fields.
Daily	Select *Daily* to enable a daily Verification function. Then, enter the time of day (1 through 24) in the **Hour** field.

The analyzer uses a 24-hour clock. Example, 1:00 PM = 13 Hours.

Weekly	Select *Weekly* to enable a weekly Verification function. Then, select a day from the **Day of the week** drop-down list, and enter the time of day (1 through 24) in the **Hour** field, to indicate when the Verification function will begin.
Monthly	Select *Monthly* to enable a monthly Verification function. Then, enter the day of the month (1 through 28) in the **Day** field, and the time of day (1 through 24) in the **Hour** field, to indicate when the Verification function will begin.

Saving the Settings on the Verification Tab

To save settings on the **Verification** tab, click **Apply.**

To discard the changes you have made, click **Cancel**. This will close the 3050 Configurator Software program.

Viewing Live Data From the Status Tab

Use the **Status** tab to view current readings and the status of the analyzer.

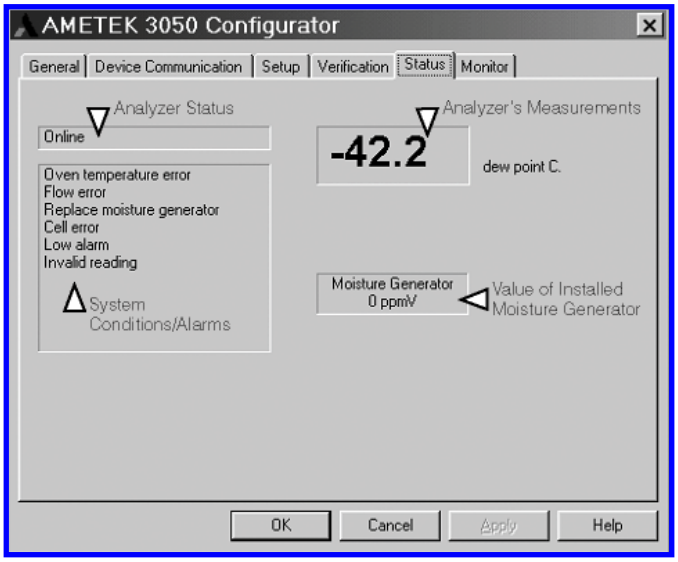

Figure 3-7.
Status tab.

Working From the Monitor Tab

Use the **Monitor** tab to observe analyzer operation. From this tab you can also collect data, calibrate the internal flow meter, and test the analyzer alarm contacts and mA outputs.

NOTE

Using the test buttons takes the analyzer Offline.

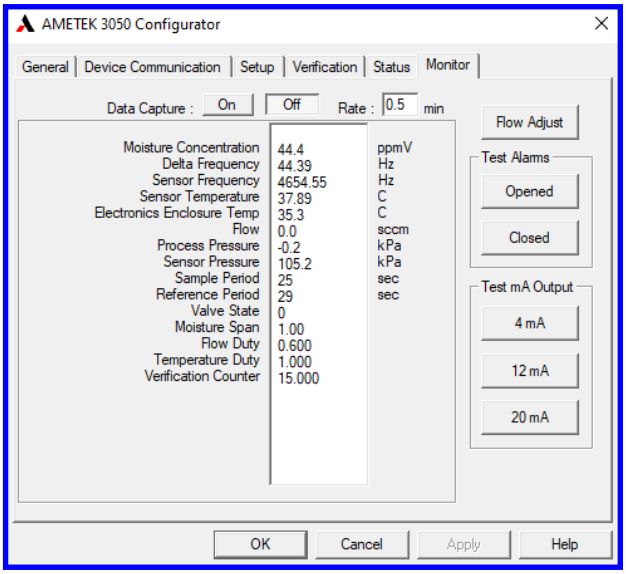

Figure 3-8.1. Monitor tab.

Data Capture

Use the data capture feature to collect and save analyzer data displayed on the **Monitor** tab to an Excel compatible file.

On — Press the **On** button to start data collection. Enter a file name in the "**Save As**" dialog box (see Figure 3-8.2) and click "**Save**" button. The file format is ".csv" which is Excel compatible. All data displayed on the **Monitor** tab will be stored in this file.

Off — Press the **Off** button to stop data collection. The file will close when the **Off** button is pressed or another configurator button is selected.

NOTE

*If you exit the **Monitor** tab, the **Data Capture** will automatically terminate.*

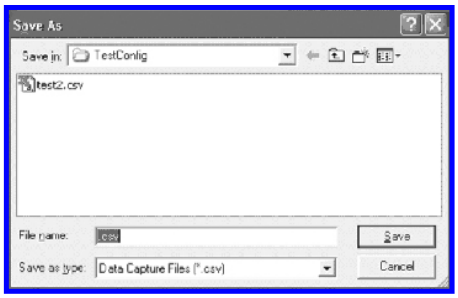

Figure 3-8.2.
Save As dialog box, Monitor tab.

Rate

The preferred data collection rate is "0.5" minutes (factory-set default). A record is created every 30 seconds. The collection rate can be increased to one (1) minute or more.

Flow Adjust

Flow Adjust is a utility designed to calibrate the internal flow meter inside the 3050 Analyzer. To calibrate the flow meter, an external flow meter is needed to compare the flow reading on the analyzer with the actual flow.

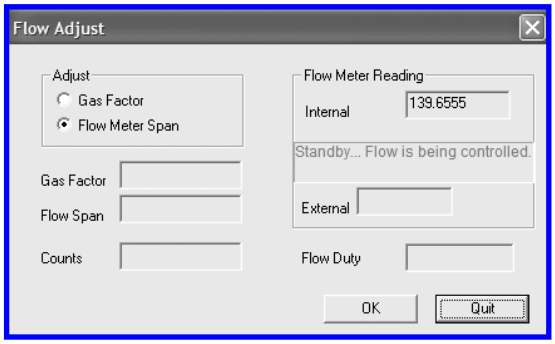

Figure 3-8.3.
Flow Adjust dialog box, Flow is being controlled.

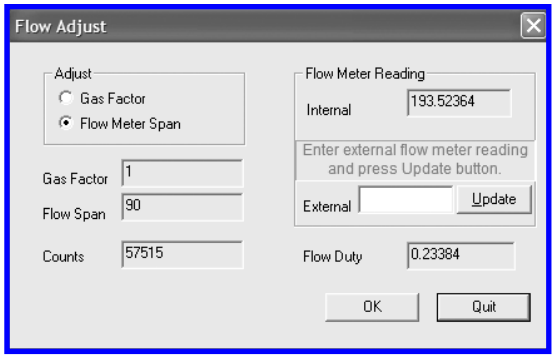

Figure 3-8.4.
Flow Adjust dialog box, enter external flow meter reading.

Adjust

Gas Factor

Select **Gas Factor** if you run gas mixtures.

Flow Meter Span

Select **Flow Meter Span** if you run pure gases.

Flow Meter Reading

This function is used to calibrate the **Internal** flow meter. To do this:

1. Run a sample line to the **Sample In** port at the back of the analyzer.

2. Connect the flow meter to the **Exhaust Out** port at the back of the analyzer.

3. Turn On the analyzer and wait for the analyzer to control the oven temperature at around 60 °C.

4. From the **Monitor** tab, click the **Flow Adjust** button.

   Wait a few minutes for the analyzer to control the flow, and the **External** text field to become enabled (see Figure 3-8.4).

   Enter the value displayed on the external flow meter and click the **Update** button. The **External** text field will become disabled again and the configurator will calculate a new **Flow Span** and send it to the analyzer. The analyzer will attempt to control the flow again and when it's done, the **External** text field will become enabled again. You can repeat this process until the value of the *internal* flow meter matches the *external* flow meter. When calibration is complete, click **OK** to return to the **Monitor** tab.

Test Alarms

The **Test Alarms** buttons allow you to toggle the alarm contacts to an *Opened* or *Closed* state. Use a multi-meter set to ohms to read resistance. Refer to Figure 2-5 and to "3050-OLV Power and Signal Connections" in Chapter 2 for the analyzer contact locations.

Opened contacts should read infinity.

Closed contacts should read zero ('**0**').

Test mA Output

The **Test mA Output** buttons allow you to test the analog outputs. Use a meter while testing the outputs. Refer to Figure 2-6 for wiring.

To exit out of **Test** mode, click another button. **Test** mode will automatically time out after 10 minutes of inactivity.

*When the analyzer switches from **Test** mode to **Online**, the analyzer resets itself.*

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Maintenance and Troubleshooting

Remove AC power from the analyzer and allow it to cool for at least 90 minutes before performing any maintenance or troubleshooting activities.

Always use gloves when working on the analyzer.

This chapter assumes that you have installed the AMETEK 3050 Configurator Software program and that you are using the program to troubleshoot the analyzer. This chapter only addresses troubleshooting the black box (electronics unit inside the cast enclosure) problems and not any external sample system problems. This chapter also assumes that you have already tried to upload all of the analyzer's memory parameters onto the black box using the 3050 Configurator Software and the **.DEV** file that was shipped with your analyzer, or the **.DEV** file which you have saved after initial analyzer startup.

This chapter describes includes analyzer Diagnostic Charts, and Alarm and Warning Messages.

The operations in this chapter should be performed only by qualified service personnel experienced in electrical safety techniques.

Aftermarket Excellence and Long-Term Commitment to Safety and Quality

Safety is a core value at AMETEK Process Instruments and is our primary consideration in every decision. We believe all accidents, injuries, and occupational illnesses are preventable. We adhere to the highest design and safety standards with a full understanding of the process and site installation so that our customers, channel partners, employees, and communities are safe from potential hazards. AMETEK Process Instruments designs, tests, and selects components that are meant to work safely and properly together. Sourcing substitute parts from unauthorized dealers carries significant risk, especially in safety sensitive environments.

We understand the importance of maintaining your budget and keeping costs low. At AMETEK Process Instruments, we pride ourselves in the value we add to your organization by providing you with Best in Class analyzers, genuine parts, engineered solutions, and World Class global support that provide valuable OPEX cost savings by maximizing uptime. Safety incidents, unplanned releases, unplanned down situations, and running analyzers to failure come at a much higher cost.

Our customer commitment continues well beyond the start-up and commissioning of analyzers. Together with our channel partners, WE ARE ONE Aftermarket team of factory-trained personnel here to support our customers' needs globally, on site, or remotely with virtual tools – for the entire product life cycle. Moreover, we offer a wide variety of customized services and service plans to meet their needs.

From pre-commissioning to end-user handoff, service training, pre-RATA checks, turnaround support, in-house repair, expedited support, web-to-case support, and extended remote support sessions we are here to support. Please contact us if you need help identifying your local channel partner for support.

Our Aftermarket team also offers consultative service plans which are fully customized for the process needs of the individual site. Service plans establish a preventative maintenance routine and/or training program that is designed to deliver optimal results by maximizing analyzer uptime and controlling maintenance costs. We are fully committed to being our customers' preferred partner in helping them achieve their goals.

Requesting Technical Support

To request service support, a call back, or product information we encourage you to use our Web-to-Case online tool, so we are instantly aware of your request no matter the time zone or day of the week. To do this, follow the link below.

https://www.ametekpi.com/customersupport/requestsupport

Requesting Authorization to Return Equipment

Before returning equipment for repair, please obtain a Return Material Authorization. To do this, follow the link below or click the **Return Authorization** link on our main **Customer Support** page. Complete the form and click **Submit**.

https://www.ametekpi.com/customersupport/return-authorization

Requesting Authorization to Return Equipment

To request training, visit our main **Customer Support** page and choose **Analyzer Training** and then **Analyzer Training Form**, or follow the link below.

https://www.ametekpi.com/customersupport/analyzer-training/requestform

3050-OLV Analyzer Replacement Parts

** Indicates recommended stock spare parts to have on hand.*

Refer to the Figure number listed for the location of the part.

Part Description	AMETEK Part No.	Figure
Moisture Generator, 50 PPM (nominal)*	305010901S	4-7, 4-11
Sensor Assembly *	305122901S	4-12
Sour Natural Gas Sensor Assembly	305122902S	4-12
CO2 Calibrated Sensor Assembly	305122903S	4-12
Solenoid Valves (4) General Services (Viton)	305644901S	4-12
Solenoid Valves (4) Sour Natural Gas (EPDM)	305644902S	4-12
High Capacity Dryer *	305400901S	2-4, 4-11
3050-OLV Moisture Analyzer *User Manual*	305200901	—
MCU Board	305110901S	—
Cell Interface Board	305113903S	4-4, 4-6
Sample, Reference, and Verify Capillary, Matched Set	305431901S	4-12
RS-485 to RS-232 Converter	265858005	2-9
RS Converter Power Supply, Universal	269128002	2-9
RS-485 to RS-232 Self-powered Converter	590858901	2-6
RS-485 Termination Plug	305900901	2-5, 2-8
3050 Power Supply Assembly, 24 VDC	305442901	—
Fuse, 3.15 A	280750251	—
Fuse, 0.125 A, 250 V	280750238	—
Flow Meter	305449901S	4-9
2 Micron Filter, inline 1/8-inch tube (installed on the Sample Inlet at back of analyzer)	203641000	—
Tubing, 1/8" OD, 316 SST, EP, 0.028" Wall (external tubing)	257707000	—

Diagnostics Charts

While performing many of these checks, it will be necessary to be simultaneously working with the AMETEK 3050 Configurator Software program running.

Pressure Checks

Possible Cause	Corrective Action
Process Pressure set incorrectly	Make sure your inlet sample pressure supply is between 1.38–3.45 BARG and stable (or if your unit was created to run at some other inlet pressure, check your Manual Supplement for actual parameters). Make sure that the analyzer is venting into either ambient air or a stable vent header with no back pressure. If there is any back pressure from a vent header, then you must use another venting source or install an AMETEK Process Instruments supplied back pressure regulator. The vent pressure, being measured by the Sensor, can be viewed using the AMETEK 3050 Configurator Software program (called **Sensor Pressure** on the **Monitor** tab). You can view this parameter change. While venting into the header, disconnect the vent header to view the change. If there is a substantial change, then seek another venting method.

Temperature Checks

Temperature can be viewed using the Configurator Software. Navigate to the **Monitor** tab to view the **Sensor Temperature** reading.

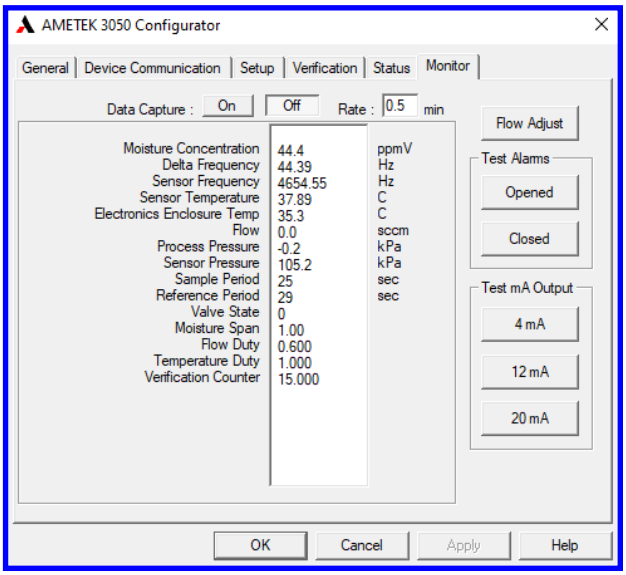


Figure 4-1.
Monitor tab.

Possible Cause	Corrective Action
3050-OLV temperature does not reach 60 °C after warm-up.	After warm-up (approximately 30 minutes, ±10 minutes after analyzer power-up), the temperature will be at 60 °C, ±1 and should be stable. If the analyzer does not reach 60 °C check for the following issues: • Physical heating circuit, following the attached diagram and using an ohm meter. • Check the software parameters to ensure they are set to proper values. • Check the oven's insulation to ensure it is intact and has no obvious gaps or lack of insulation around the oven walls.

First, start with checking the software:

1. The software parameters should be accessed using the **ALT-C** window. Working in the 3050 Configurator Software, view the **Setup** tab and, using your computer's keyboard, simultaneously press the "**ALT**" and "**C**" keys to display the **Command** dialog box.

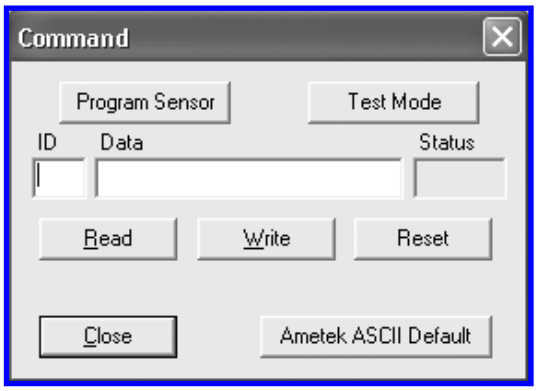


Figure 4-2.
Command dialog box.

2. Type the **ID Number** (Hex) – see Figure 4-3 – into the **ID** field and click the **Read** button. The corresponding value will appear in the **Data** field. If the value shown does not match the values listed in Figure 4-3, change the **Data** field accordingly and click the **Write** button to download the correct data to memory.

ID Name	ID Number	Description and default value
ProBandLoop2	1D	Oven control parameter default 6.0
TsLoop2	1E	Oven control parameter default 2.0
TiLoop2	1F	Oven control parameter default 2400
SetPointLoop2	20	Oven control parameter TEMP SET PT 60 °C
ActuatorLoop2	21	Oven control parameter default 0.0
uMaxLoop2	21	Oven control HEATER DUTY CYCLE MAX 1.0
uMinLoop2	23	Oven control HEATER DUTY CYCLE MIN 0.0
CellTempFilter	0C	Oven Noise factor for cell temperature 0.2

Figure 4-3.
Parameter names, numbers, descriptions.

Example:
ID Number '**1D**' should have a default value of 6.0. If you click the **Read** button and the displayed value does not match 6.0, type in the correct value in the **Data** field and click the **Write** button. This will write the new value of 6.0 into the parameter '**1D**'.

3. If everything appears to be set correctly in the analyzer's memory, the next step is to troubleshoot the sensor and heating circuitry. This will require removing the analyzer and taking it to your shop bench.

4. Remove the four (4) screws that secure the lid and remove the four (4) corner screws securing the Electronics Enclosure to the Cell Oven Enclosure. Take the Electronics Enclosure and have it lay to the side of the main black box. It will only extend as far as the wire harness will allow; take care not to pull or damage the wires.

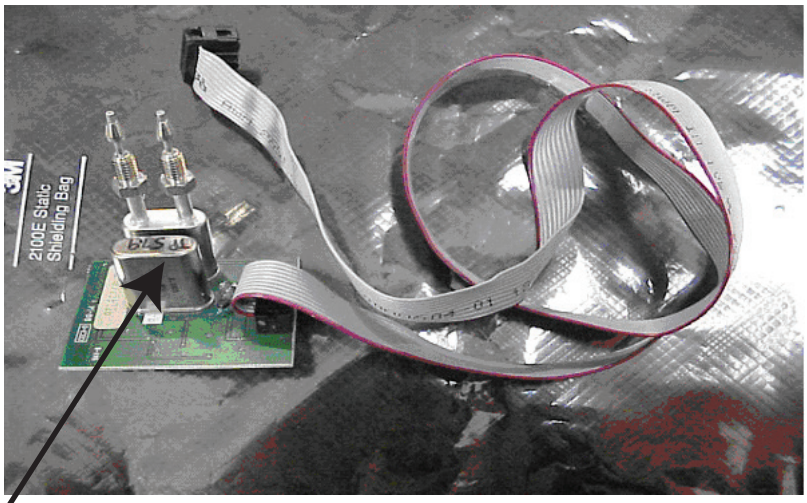
5. Connect your computer to the analyzer and power up the computer, and run the Configurator Software.

6. Apply the required 24 VDC power to the unit.

Oven Sensor Checks

Temperature problems can be found in various location, as listed under Possible Causes:

Possible Causes	Corrective Action
Cell Detector PC board (the sensing device) problems/failure Cell Interface board problems/failure Cutout switch failure Heater pad failure Heater pad wires shorting to the chassis Bad crimp connector Software issues	The Oven Sensor is located on the **Cell Detector PC** board. The thermistor is a solid state device on the **Cell Detector PC** board and cannot be replaced. However, you can troubleshoot it to determine if the problem is with the board. After locating the Sensor on the **Cell Detector PC** board, apply moderate heat to it using an external heat source. If you are using a heat gun, pay close attention to the distance between the end of the heat gun and the Sensor. **Do not increase the temperature above 60 °C.** If the Sensor temperature appears to be increasing while the heat is being applied, this indicates the problem is in the heating circuit, not in the sensing circuit. The Heater Control Circuit schematic is shown in Figure 4-5. Remove Connector **P1** from the **Cell Interface** board, which is the top-most PC board in the Electronics Enclosure and the only board in which you can see the connectors easily. If you remove connector **P1** from the **Cell Interface** board and measure between the two (2) Red wires, you should see a resistance of 18 ohms, ±5 ohms respectively. Figure 4-5 also shows you the thermal cut out PN 269253001 on **P1 Pins 1-2**. The thermal cut out is shorted below 70 °C and opens when the heat rises above 90 °C. This is for over-heating protection only. It's possible that this cut out has failed and is open all the time.



Oven sensor on
the cell PC Board

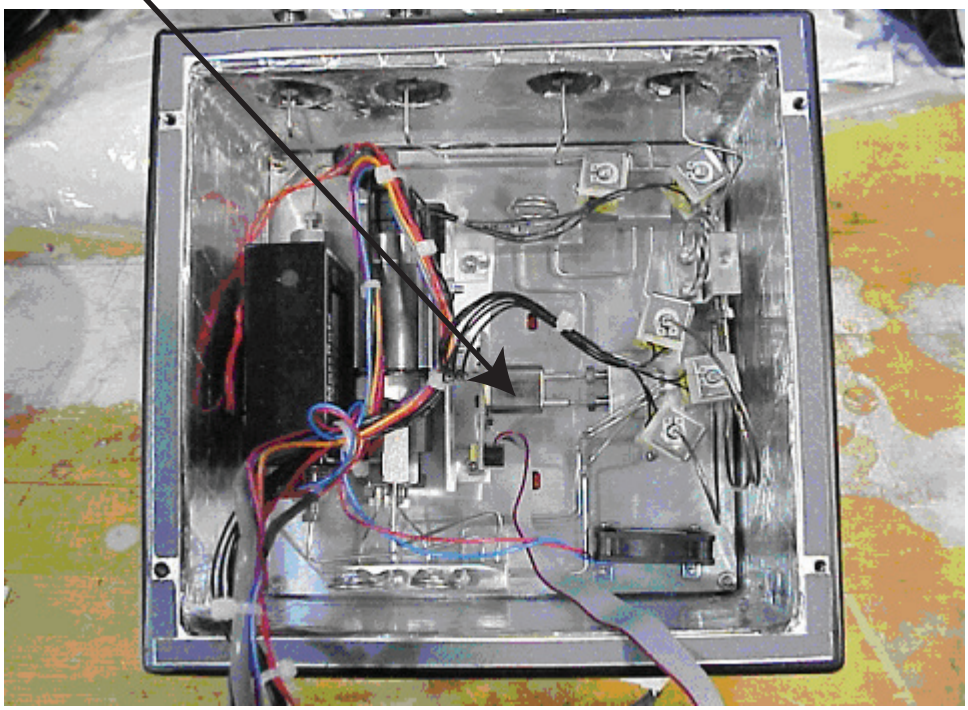


Figure 4-4.
Oven Sensor location,
on Cell Detector PC board.

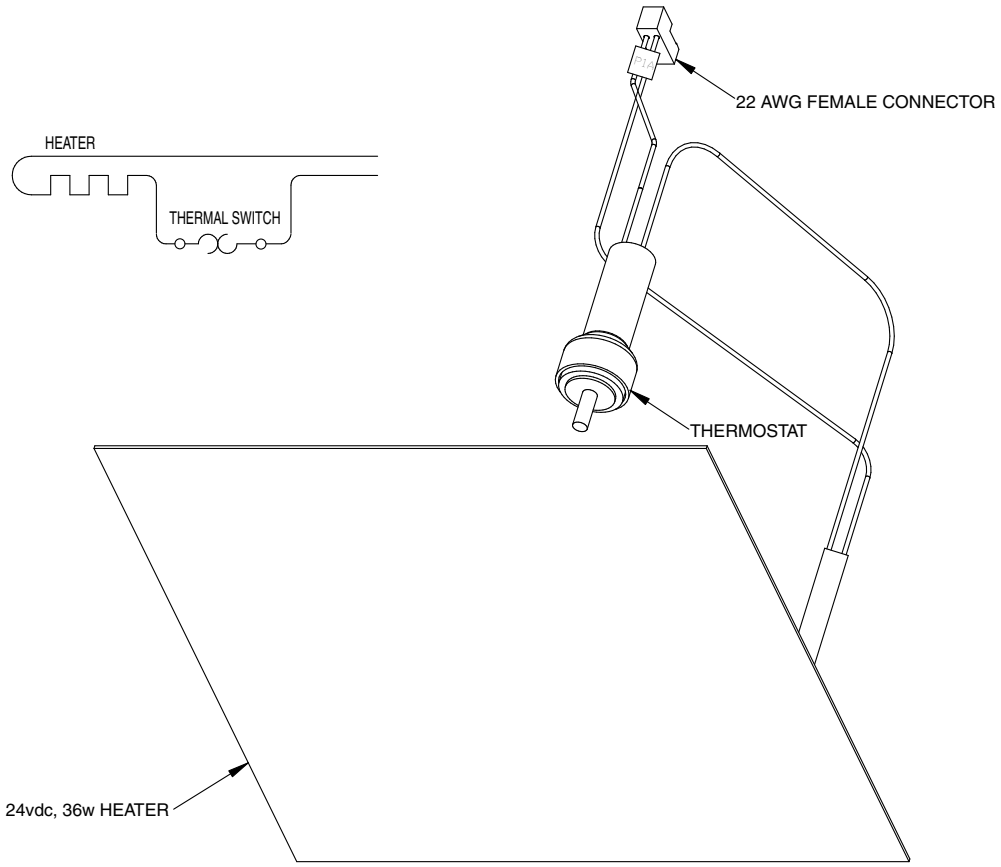


Figure 4-5.
Heater Control Circuit Schematic.

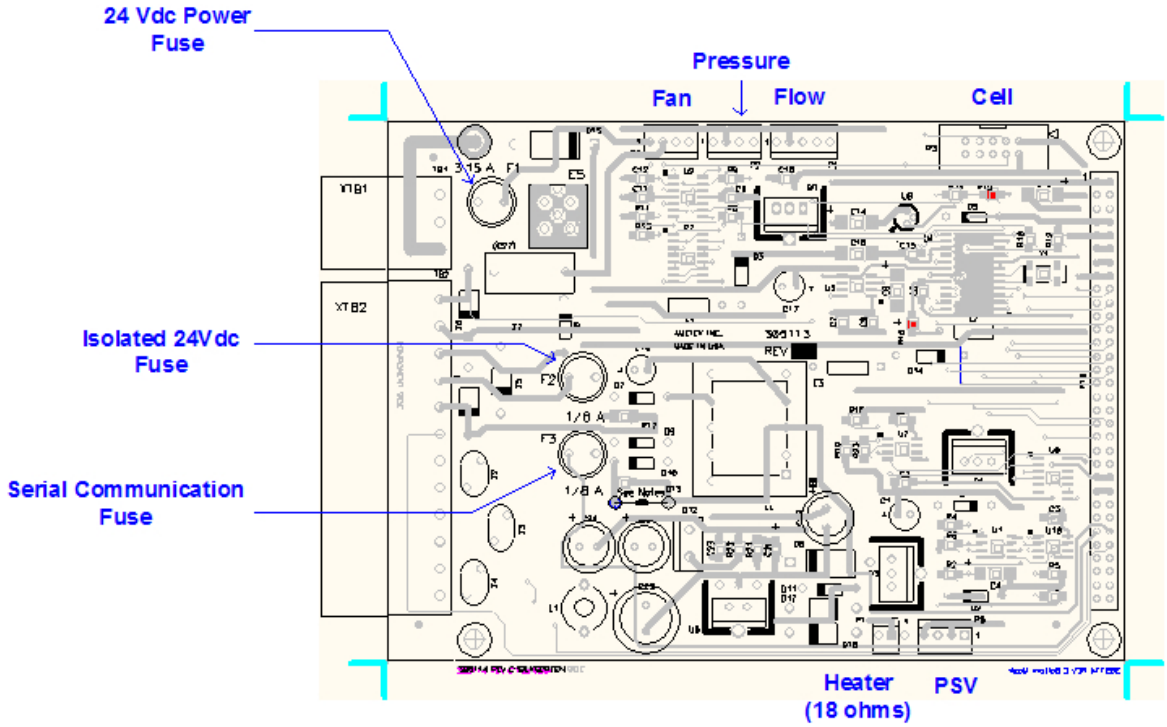


Figure 4-6.
Cell Interface board (AMETEK PN 305113903S).

Flow Checks

The 3050-OLV-SLR, -TE, and -DO analyzer black boxes all have an internal Plumbing diagram (Figure 4-7).

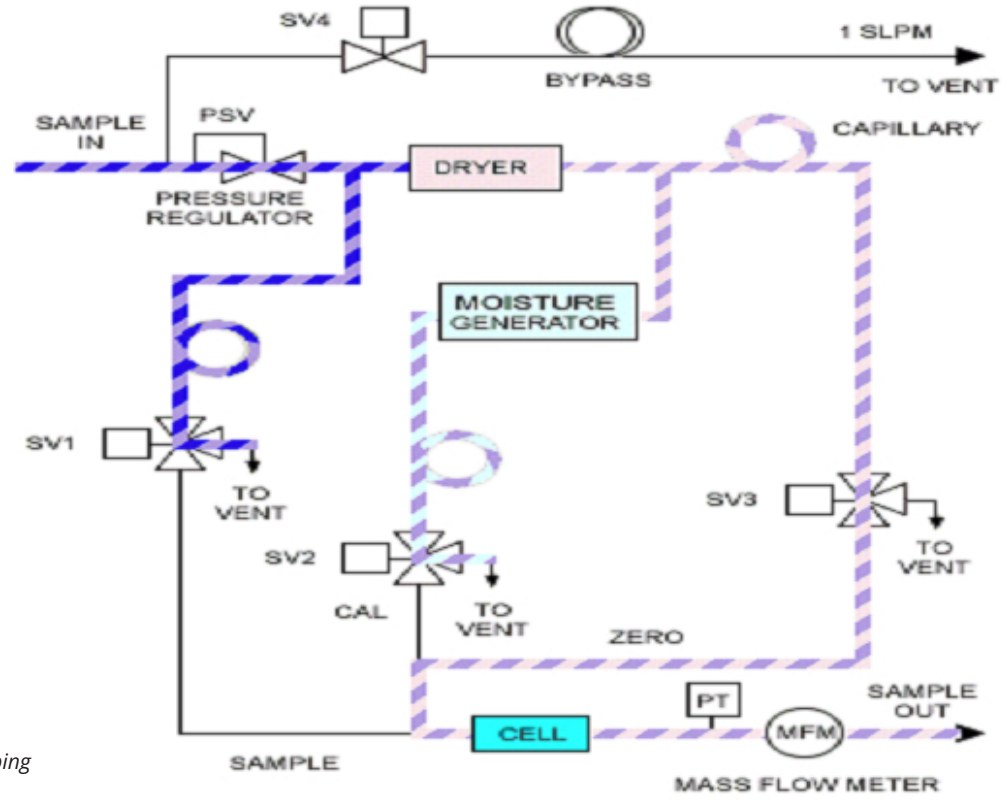


Figure 4-7.
3050-OLV Internal Plumbing Diagram.

Note that there is one common input, **Sample In**, and one common output, **Sample Out**. All four vents from the valves are tied to the sample out vent. Although this diagram is simplified, visualize that all vents are tied to this common vent. The flow through the detector is controlled by the inlet **PSV** (Proportional valve), which in turn is controlled by the **MCU** board. The **MCU** board reads the flow from the Mass Flow Meter (**MFM**) and in turn controls the **PSV** valve to a set point of 50 SCCM, ±5 SCCM. At any given moment, there is only one flow through the cell. Thus, since all flows are tied to the same vent, if you place a flow meter on the common exhaust it should read a total flow very close to 150 SCCM (50 SCCM, ±5 SCCM per leg: *Sample*, *Reference*, and *Moisture Generator* legs).

Note that the **Bypass** valve remained closed during this process. The **Bypass** valve will increase flow by about approximately 1 liter/minute, ±100 SCCM. For troubleshooting purposes, the **Bypass** valve should remain closed until the flow problem is fixed.

To turn off (close) the **Bypass** valve using the 3050 Configurator Software, view the **Setup** tab and click the **Gas Saver** check box.

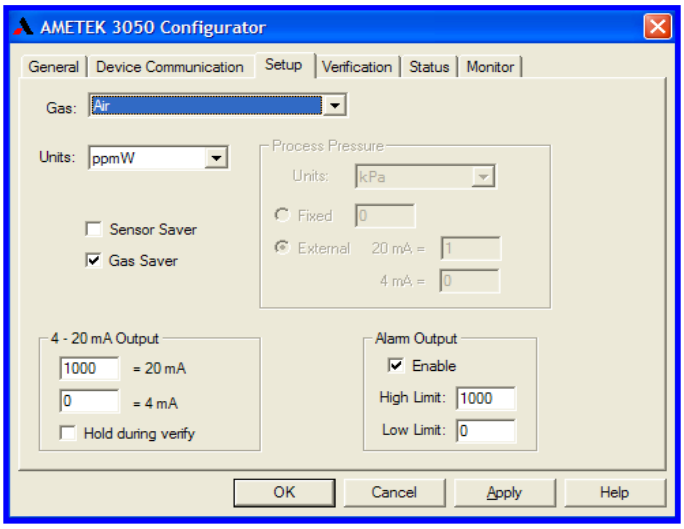


Figure 4-8.
Setup tab.

Flow Parameters Verification

Working in the 3050 Configurator Software, view the **Setup** tab and, using your computer's keyboard, simultaneously press the "**ALT**" and "**C**" keys to display the **Command** dialog box.

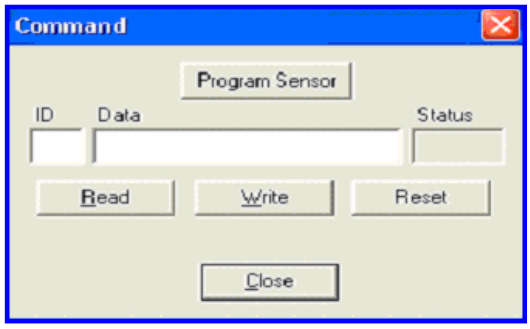


Figure 4-9.
Configurator Setup Command dialog box.

Verify that the parameters listed below are set to their default values, with the exception of **ID Numbers** 16, 17, and 18. These parameters (16, 17, and 18) should only be logged and reported to AMETEK if the flow problem cannot be fixed. When contacting AMETEK, also report the Gas that has been chosen or that is displayed in the **Gas** field on the **Setup** tab. Whichever Gas is chosen, it has specific **Values** for **ID Numbers** 16, 17, and 18. Simply record the **Values**. The other parameters (19, 1A, 1B, and 1C) should be set to the factory default value if they have been changed.

Value	ID Name	ID Number	ID Description
250	PRBandLoop1	16	Flow control parameter (comes from Gas file column e)
10	TsLoop1	17	Flow control parameter
10	TiLoop1	18	Flow control parameter (Gas file column f)
50	SetPointLoop1	19	Flow control parameter (This is your 50 SCCM set point)
0	ActuatorLoop1	1A	Flow control parameter
0.6	uMaxLoop1	1B	Flow control DUTY CYCLE MAX ALLOWABLE SET POINT
0.1	uMinLoop1	1C	Flow control DUTY CYCLE MIN ALLOWABLE SET POINT

Figure 4-10.
Parameter values, names, numbers, descriptions.

If all parameters are found to be okay, the next step is to check the hardware, inlet, and outlet pressure parameters. The inlet and outlet pressures need to be stable and within the analyzer's specifications. The inlet pressure must be 1.38–3.45 BARG (unless you have a specially designed analyzer with different input specifications) and stable. Make sure it is within its limits and is stable. If the inlet or outlet pressure is changing, there is a possible external (customer supplied) sample pressure regulator problem or vent header problem. The exhaust pressure should be at ambient pressure and should not be changing, unless it is exhausting into a vent header of some type. In this case you should have a back pressure regulator installed. Make sure there are no leaks in the system.

For troubleshooting purposes, remove the exhaust fitting from your header and let the analyzer exhaust to ambient air for 15–20 minutes.

Do not exhaust into ambient air if the room in which the analyzer is mounted is not adequately set up to handle your gas. If in doubt, check with your local safety officer/person or facilities to determine if this could cause an unsafe condition.

If the flow problem clears within 10–20 minutes, replace the exhaust fitting. If the problem persists, the issue is with the exhaust header. You must either find a new exhaust vent or install an AMETEK Process Instruments supplied back pressure regulator. If a back pressure regulator is being used, the differential pressure (delta P) between the inlet and outlet of the analyzer must be maintained at a minimum of 15 PSIG.

For example, an inlet pressure of 20 PSIG will not work if the back pressure is set to 10 PSIG. The delta P is 10 PSIG. It must be greater or equal to 15 PSIG.

If your flow problem still exists, and you have checked your software parameters and the Inlet and Outlet Pressure are all okay, replace the capillaries.

There are four (4) capillaries located in the black box (see Figure 4-11). Only three (3) need to be replaced and they must be replaced as a matched set (AMETEK PN 305431901S); this set includes the Sample, Reference, and Moisture Generator capillaries. If, after replacing the capillaries and allowing the unit to fully warm up (no alarms condition) the flow problem still persists, check the PSV valve and the flow meter.

Since the flow control is a closed loop method of control, troubleshooting and isolating the Proportional Solenoid Valve (PSV) versus the Flow Meter can be slightly difficult. First, focus on the control of the PSV. This proportional valve is ever neither completely closed nor completely open. During normal operation, its duty cycle range is approximately 45–50 % (or, 45–50 % open). To check the PSV duty cycle, observe the **Flow Duty** parameter on the **Monitor** tab.

As the **Reference** and **Sample Period** timers count down during their corresponding cycles, you can observe the flow duty number changing in order to maintain the 50 SCCM flow rate, regardless of the path or leg the gas is flowing through. If you notice that during the **Sample Countdown** period, the flow seems to be controlled, but during the **Reference** period the flow seems to drift out of tolerance, then you have isolated the flow problem to the **Reference** path or leg. Try removing the ***Reference* Dryer** and installing a jumper or bypass in its place (1/8-inch tubing). There could be some obstruction in the Dryer (internal). As a result, even when the PSV valve is at its maximum duty cycle, a higher pressure differential will be needed to overcome the flow obstruction. This will cause the electronic feedback loop flow control to fail.

If after removing the Dryer the flow problem persists and you cannot determine if it is in either the Sample or Reference legs, the next step will be to replace the Flow Meter. Contact AMETEK to purchase a Flow Meter replacement kit (PN 305449901S). If the new Flow Meter still does not fix the problem, the last step will be to replace the PSV valve (PN 230510001).

In summary, flow problems could be caused by one or more of the following factors:

- Inlet pressure, Outlet pressure, or both.
- Partially or fully plugged capillary or manifold.
- Bad PSV valve, Flow Meter, or both.
- Software problem. Software problems on flow are not common, but should be considered and checked. AMETEK will have you check software parameters if needed.

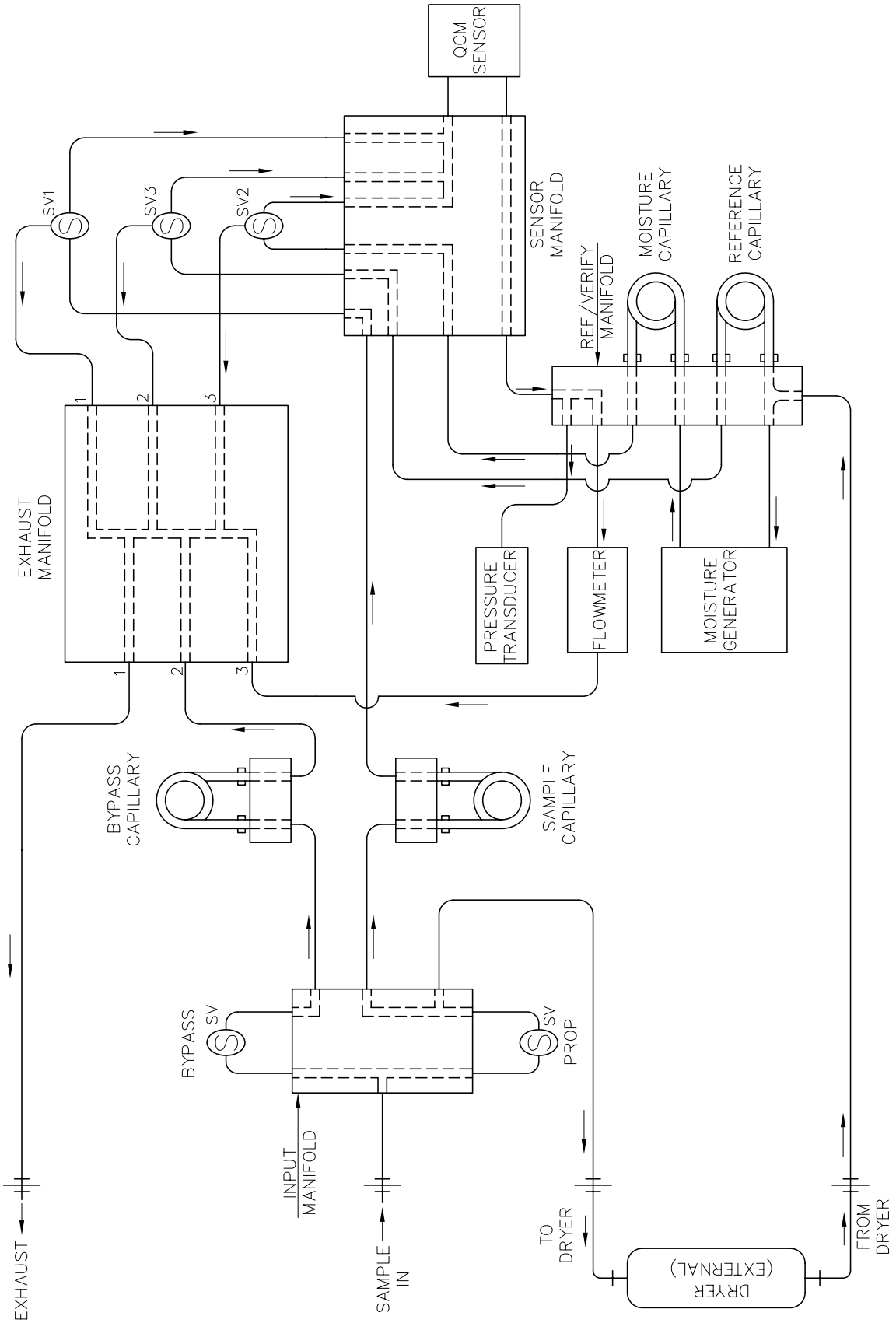


Figure 4-11.
Flow diagram.

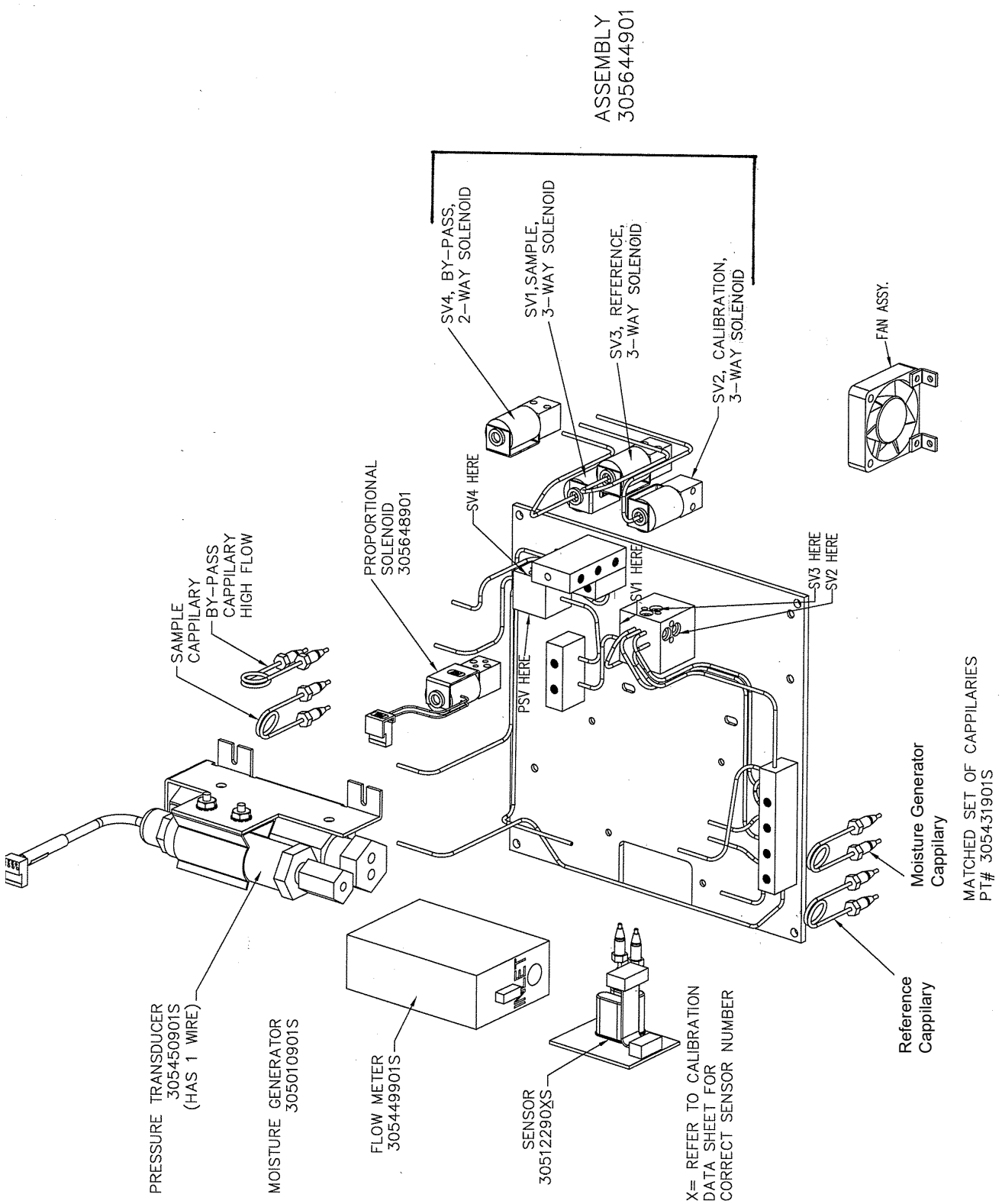


Figure 4-12.
Capillaries.

Frequency Offset

Frequency offset is only used with the 3050-SLR, -TE, and -DO models. The 3050-OLV has no Zeroing method but it is important to be aware of what this parameter is and how it affects the instrument readings.

Frequency offset is defined by AMETEK Process Instruments as the amount of **Delta Frequency** deviation from 0.0 Hz (plus or minus), at the end of the Zero calibration. Remember that during this calibration, the analyzer is running dry or Zero gas. This means that every time your moisture analyzer performs a Zero calibration, whatever **Delta Frequency** the instrument reads at the end of the Zero, it is stored in memory (**ID Number** 38 Hex). During normal operation, this offset is subtracted from the **Delta Frequency** readings due to sample or wet gas, thus eliminating the Zero offset.

The 3050-OLV Analyzer uses two Dryers to perform the Zero calibration, **Sample** and **Reference** respectively. Since these Dryers are never exactly the same and due to the asymmetry of the manifold, tubing, etc., the instrument will read a Delta frequency slightly different from 0.0 Hertz. This is exactly what the Zero accomplishes. It takes care of those differences, expressed in **Delta Frequency**, by Zeroing the analyzer. As long as the differences are repeatable, they can be reliably subtracted to remove any Zero offset.

Normal Zero **Delta Frequency** will be around ±0.4 Hertz (the smaller the number the better). If it is greater than ±0.5 Hertz, it will trigger a Zero error alarm. This is defined by parameter **ID Number** 86 Hex (MaxZero Error) = 0.5. This is the limit for any Zero sequence. Although the 3050-OLV does not use this **MaxZeroError** parameter, it does have a Zero offset parameter **ID Number** 38. This parameter is set during the calibration process in our plant. It is important to check its integrity because, as explained before, its value affects the analyzer's reading.

The last Zero **Delta Frequency** value can be viewed from the Configurator Software, on the **Monitor** tab as shown below or by reading parameter ID# 38 Hex. This parameter is your last successful Zero **Delta Frequency**. Note that the 3050-OLV will not have a **Frequency Offset** on the **Monitor** tab since it does not have zeroing capability. In the example below, the Zero **Delta Frequency** is 0.0000 Hz. This is because the Zero calibration has not been run yet, or unsuccessful Zero attempts were performed, therefore, the **MaxZeroError** (**ID Number** 86 Hex) did not allow zeroing.

The Zero calibration should be implemented daily (once a day).

Monitoring the Zero Delta Frequency will help you to determine the health of the Dryers. The Dryers dry the Reference gas during normal operation and during the Zero calibration, the Sample gas. Hence the reason for two Dryers: one is used in the Reference path (normal operation), the other for drying the Sample gas during the Zero (Zero Dryer). Dryers do not have an infinite life. Their life time depends on the dryness of the Sample gas and the precautions that should be taken while installing them. If during the installation of a new Dryer, the technician replacing the device removes the caps that protects the Dryer from ambient air moisture (H_2O) and does not install the Dryer fast enough or leaves the unprotected ends of the Dryer exposed to ambient air too long (more than three minutes), the Dryer's life will be shortened. Dryers act like a sponge. They have a great ability to absorb water (H_2O), but like a sponge, at some point they will stop absorbing water due to saturation.

When a Dryer becomes saturated, it no longer removes water (H_2O) from the gas, it simply passes it on to the detector. As the normal Reference Dryer begins to get more wet (saturated), the Zero Delta Frequency value will begin to drift negatively (increase in the negative direction). Conversely, as the Zero Dryer begins to get more wet (saturated), the Zero Delta Frequency will begin to drift positively (increase in the positive direction). The reason is because we measure wet Sample versus dry Reference gas (refer to the "Overview" section – Chapter 1 of this manual – for more information about the QCM).

In ideal conditions, if the Reference (dry) gas stream were always perfectly dry and never deviating from 0.000 PPMV of moisture (H_2O), the Zero Delta Frequency would always be a positive number. But, since it depends on the quality of the Dryers, it will drift in either direction (positive or negative).
As stated earlier, the Zero Delta Frequency is limited by the value assigned to the variable **ID Number** 86 Hex (**MaxZeroError**). The default value for this parameter is 0.5 Hz.

This means that when the Zero Delta Frequency exceeds this limit, a Zero Error message will be displayed and no Zero adjustment will take place. This error message cannot be cleared until a successful Zero is accomplished. You can obtain a good Zero by increasing this limit and running another Zero. By doing this, you will bring the analyzer back on line (eliminate the alarm), but you will have to replace the defective Dryer as soon as possible.

Span Factor

Span Factor, **ID Number** 6E Hex, is simply a multiplication factor to the moisture (PPMV) readings. This factor is manipulated by the software every time you run a Verification/Calibration. For example, by increasing this factor to 1.10, the analyzer readings will be 10 % higher. Conversely, by decreasing this factor to 0.9 the analyzer readings will be 10 % lower. AMETEK analyzers leave the factory with Moisture Span set to 1.00. Normal Span Factor numbers in the field will range from 0.5 to 3.00.

There are limits in the software to this parameter (**ID Numbers** 94 and 95 Hex). **ID Number** 94 is the high limit (3.00) and 95 is the low limit (0.3). These limits are adjustable. Any analyzer with a Span Factor reaching 3.00 requires detector (cell) replacement. Faulty Dryers might also have an impact on this number. As contamination from a gas stream gets deposited on the detector, this will cause its sensitivity to decline.

To compensate for this, run a Verification/Calibration, which will make the necessary Moisture Span adjustments. This is equivalent to restoring the sensor (cell) sensitivity. This Span Factor may be interpreted as "electronic gain." A gain of '1' is perfect (neutral). As the gain approaches a value of '2', the amount of gain is doubled.

Alarm and Warning Messages

This section lists the Error (Alarm / Warning) messages that can be triggered by the system, to alert you to potential or impending problems with the analyzer. Descriptions of the Alarms and Warnings, along with corrective action to take to correct the Error, are also included.

If a system alarm is triggered, the RED LED on the front panel of the 3050-OLV Analyzer will flash to signal the source of the problem. The RED LED will flash On for one (1) second and Off for one (1) second. Once a flash sequence has completed, the LED will remain off for five (5) seconds. At the end of the pause period, the sequence will be repeated. If there are multiple system alarms then the highest priority alarm will be indicated until it clears. The alarms are listed in order of priority with the higher priority alarm having the fewest flashes.

** Indicates System Alarm and Data Invalid Signal.*

Alarm Condition / Description / Corrective Action
Memory Failure*   CPU hardware failure.   ***Corrective Action:***   Call AMETEK Service.
Sample Sensor Failure*   Sample sensor hardware failure.   ***Corrective Action:***   Replace the sensor or call AMETEK Service.
Calibration Failure*   Analyzer performance out of tolerance as detected during Verification.   ***Corrective Action:***   Call AMETEK Service.
Oven Temperature*   Oven temperature is out of tolerance.   ***Corrective Action:***   This will occur during start-up until the oven warms up. Call AMETEK Service if the problem persists.

Alarm Condition / Description / Corrective Action
Flow Out of Tolerance*   Sample flow rate too high or too low.   ***Corrective Action:***   Check the Inlet and Outlet pressure. Call AMETEK Service if the problem persists.
Battery Low*   Battery needs to be replaced.   ***Corrective Action:***   Call AMETEK Service.
Reference Gas*   Analyzer detected problem with Reference gas.   ***Corrective Action:***   Check and/or replace the Dryer. Call AMETEK Service if the problem persists.
Enclosure Temperature   Excessive internal temperature.   ***Corrective Action:***   External temperature should be 50 °C or less. Call AMETEK Service.
Moisture Generator, Date N/A   Moisture generator date has expired.   ***Corrective Action:***   Replace the Moisture Generator.
Dryer Alarm   Dryer failure Imminent.   ***Corrective Action:***   Replace the Dryer.
Reading Alarm   Moisture concentration is out of user defined limits, or analyzer is Offline verifying, or pressure is outside of range for dewpoint calculations.   ***Corrective Action:***   Review alarm settings and use the Configurator Software to identify source of error.

NOTE

Data Valid contact opens on all alarms and stays closed during normal functions and readings. An open Data Valid contact indicates Verification is in process or an alarm condition.

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Specifications

Specifications included in this chapter are typical for the ranges listed. For custom ranges/applications, or consult with your AMETEK representative.

3050-OLV Moisture Analyzer Specifications

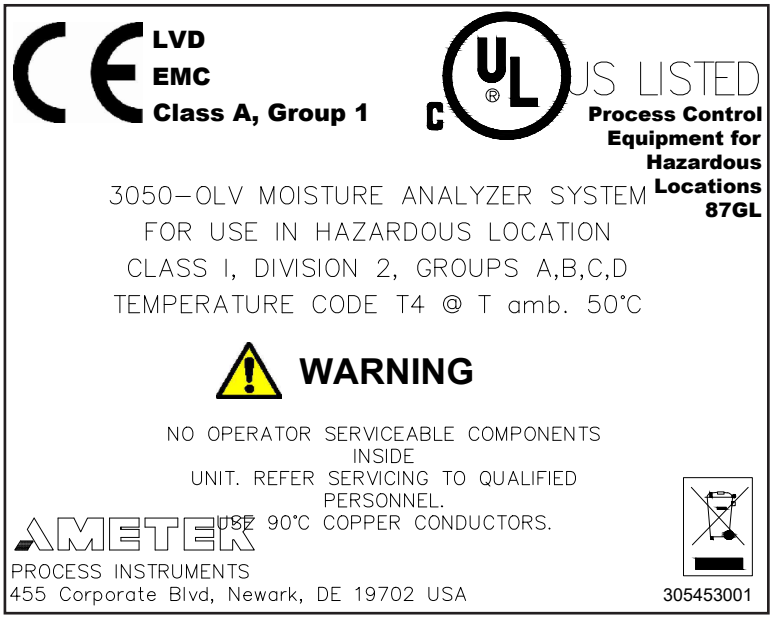
Specification	Description
Ranges	Calibrated 0.1–2,500 parts per million by volume (PPMV) Readings can also be displayed in units of PPMW, lb/mmscf, mg/Nm^3, and dewpoint (requires process pressure input)
Accuracy	±10 % of reading or ±0.1 PPMV, whichever is greater.
Repeatability	±5 % of reading or ±0.05 PPMV, whichever is greater.
Reproducibility	±10 % of reading from 1–100 PPMV or ±0.05 PPMV, whichever is greater.
Limit of Detection	0.1 PPMV when used with 3050-OLV Dryer
Response Time	63 % to a step change in less than three (3) minutes. 95 % to a step change in less than five (5) minutes.
Sensitivity	±5 % of reading or ±0.05 PPMV, whichever is greater.
Allowable Inlet Pressure Range	1.38–3.45 BARG
Exhaust Pressure	0–1.03 BARG
Sample Gas Temperature	0 °C to 100 °C (32 °F to 212 °F)
Gas Flow Requirements	Sample: 150 ±20 SCCM Bypass: 1 ±0.1 SLPM
Outputs	Isolated 4–20 mA (software configurable; 12 bit resolution), 100–500 Ω load required. RS-232 or RS-485, 2- and 4-wire mode.
Alarms	Concentration Alarm Data Valid System Alarm All contacts hermetically sealed reed type (30 VAC maximum, 60 VDC maximum, 50 VA maximum, Resistive)
Environmental	Ambient Temperature: Base Analyzer: 5° to 50 °C (41° to 122 °F) Zone 1/Division 1 IP65 and Division 2 NEMA-4X Analyzer: -20° to 50 °C (-4° to 113 °F) Maximum Altitude: 2000 meters Relative Humidity: Up to 90 %, non-condensing Pollution Degree 2 Installation Category II

Specification	Description	
Voltage and Power Requirements	Base Analyzer: Analyzer with Enclosed Sample System:	24 VDC, 50 watts maximum 120 ±10 % VAC, 50/60 Hz, 150 W maximum 230 ±10 % VAC, 50/60 Hz, 150 W maximum
Moisture Generator Value	50 PPMV nominal	
Weight of Analyzer	4.2 Kg	
Minimum PC Requirements	Windows XP, 7, or 10	

3050-OLV Moisture Analyzer Approvals and Certifications

Approvals and Certifications	UL/CSA General Safety Requirements (General Purpose) UL/CSA Class I, Division 2, Groups A, B, C, D T4 UL/CSA Class I, Division 1, Groups B, C, D T5 T6 ATEX/IECEx db eb IIB + H2 T* Gb IP65 T6: -20 to 40 °C or T5: -20 to 50 °C Complies with all relevant European directives: EAC Ex db eb IIB + H2 Gb GOST R Pattern Approval
Environmental	Pollution Degree 2 (all Analyzer versions) Installation Category II (all Analyzer versions) Indoor use only (base Analyzer)

3050-OLV Moisture Analyzer Rating Label



Serial Communication Interface (Modbus®)

This section describes the customer serial communication interface on the 3050 Analyzer. The communication protocol implemented is Modicon Modbus as defined in "Modicon Modbus Protocol Reference Guide" (PI-MBUS-300 RevJ). The Modbus protocol transmission mode implemented is Remote Terminal Unit (RTU) with the analyzer operating as a slave device.

The 3050 Analyzer supports both RS-485 and RS-232 serial communication standards.

The physical communication connection between a 3050 Analyzer and a customer DCS\SCADA\PLC\DAS or a general purpose computer is RS-485 or RS-232. The analyzer RS-485 connection supports both four-wire and two-wire multi-drop systems. The RS-232 connection is used to communicate with a single analyzer using short standard cable.

The 3050 Analyzer understands two serial communication protocols. The first protocol is a proprietary ASCII serial communication protocol. This protocol is supported by AMETEK 3050 Configurator Software, which is supplied with each analyzer. This program provides a graphical user interface to set up all the analyzer parameters as explained in Chapter 3.

The variable called SerialMode allows switching communication protocol from AMETEK ASCII to Modbus protocol and back from Modbus to AMETEK ASCII. This variable can be reached from AMETEK ASCII protocol by ID=38(26Hex) and SerialMode can be modified by modifying holding register #28(4029), as indicated in the holding registers table.

The SerialMode variable could be set as follows:

Value	RS-485	Protocol
0	Two-Wire	ASCII
1	Four-Wire	ASCII
2	Two-Wire	MODBUS
3	Four-Wire	MODBUS

The default **SerialMode** parameter setting is '**1**'.

The **SerialMode** parameter change will not affect the present serial communication link. Power should be cycled Off-On or a reset command should be issued to activate the change in the serial mode setting.

It is strongly recommended to conFigure and to test 3050 Analyzer in AMETEK ASCII mode using user-friendly 3050 Configurator Software. The Modbus RTU protocol mode should be used for monitoring purposes.

When designing a Modbus RS-485 multi-drop communication system with the 3050, the system designer should consider the following:

- Analyzer primary output is moisture concentration and analyzer status codes. The update rate of the moisture concentration is one time per minute or less. Polling of these registers more frequently than once a second is not recommended.

- The maximum polling rate of a Modbus multi-drop system is determined by a number of factors including the number of devices on the system, the number of registers being polled from each device, the Baud Rate in half-duplex operation. Calculations, and possibly experimentation, are needed to attain optimal system operation.

Analyzer Modbus Interface Parameters

A number of analyzer Modbus interface parameters need to be set up in order to establish communication with the Modbus master. These parameters are accessed via the service port on the analyzer using a service program running on a PC.

Modbus Address

The analyzer needs to be assigned a Modbus slave address, which can be a number from **1–247** with zero ('**0**') interpreted as a broadcast address (that analyzer will execute the command but will not send a respond back to the Modbus master).

Communication Parameters

The number of Data Bits is always eight (8); the Baud Rate is 9600 or 19200, the number of Stop Bits, and the Parity of the analyzer **Modbus Serial** communication port are software selectable. The default communication parameter settings are 9600 baud, one Stop Bit, and Even parity. A variable called ParityAndStop located in holding register '31' with Modbus slave address of 4032 determines the port settings.

Power should be cycled Off-On or a reset command should be issued to activate the Slave Address or Parity and Stop Bit change. The Baud Rate change will take effect immediately.

Value	Stop Bits	Parity
0	1	NONE
1	2	NONE
2	1	EVEN

Modbus Functions

As the Modbus protocol is designed for communication among Programmable Logic Controllers (PLCs), not all Modbus function codes supported by a slave PLC are applicable to the 3050 Analyzer. Only the following relevant function codes are implemented:

In accordance with Modbus protocol specifications, all address references in Modbus messages are numbered relative to zero. For example, the first holding register in a Modbus slave being referenced as 40001 would be addressed as zero ('**0**').

Code	Description
03	Read multiple holding registers (4x references)
06	Write one holding register (4x references)
16	Write multiple holding registers (4x references)
17	Read slave ID and status information

Exception Code

The 3050 Analyzer Modbus protocol implementation supports these exception codes:

Code	Description
01	Illegal Function
02	Illegal Address
03	Illegal Value

Unsupported function requests from the Modbus master result in exception code 01 being returned. Illegal address exception code is returned when the requested address is outside the allowed range or writing to a read-only location. When the values to be written to holding registers are outside the appropriate ranges, exception code 03 is returned.

Holding Registers

Since the RAM space on the analyzers is limited and not every customer's DCS\SCADA\DAS\PLC supports Modbus floating point value transfer, floating point values that are commonly accessed on a 3050 Analyzer are scaled and converted into integer values to load into Modbus registers for transmission. The Register values need to be scaled back at the receiving end to yield the actual values. The size of a Modbus holding register is 16-bit which can assume a value from -32768 to +32767 in two's complement. The holding **Register Definitions**, **Units** of measurement, and **Scaling** factors are shown below. **Access** is 'r' (read) or 'w' (write).

REG	DEFINITION	UNITS	SCALING	ACCESS
0	Current moisture concentration (Moisture= 51 Hex)	ppm	100	r
1	Concentration held during verification (HeldConc= 52 Hex)	units	100	r
2	Sensor frequency (Frequency= 53 Hex)	Hz	1	r
3	Delta frequency (DeltaFrequency= 54 Hex)	Hz	100	r
4	Flow reading (Flow= 55 Hex)	sccm	100	r
5	Sensor pressure (Pressure1= 4B Hex)	kPa	100	r
6	Electronics temperature (EETemp= 4C Hex)	°C	100	r
7	Sensor temperature (CellTemp= 4d Hex)	°C	100	r
8	System alarms and warnings (SystemState= 5F Hex)	—	1	r
9	Flow control output (Loop1Duty= 60 Hex)	—	100	r
10	Heater control output (Loop2Duty= 61 Hex)	—	100	r
11	Reading is ready (DataState= 62 Hex)	—	1	r
12	Sensor pressure analog input (Analog0= 64 Hex)	counts	1	r
13	Flow analog input (Analog1= 65 Hex)	counts	1	r
14	Sensor temperature analog input (Analog2= 66 Hex)	counts	1	r
15	Process pressure analog input (Analog3= 67 Hex)	counts	1	r
16	Analyzer cycle status (OutputState= 68 Hex)	—	1	r
17	Reference period counter (ReferencePer= 69 Hex)	second	1	r
18	Sample period counter (SamplePer= 6A Hex)	second	1	r
19	Wet sensor frequency reading (WetFreq= 6B Hex)	Hz	1	r
20	Dry sensor frequency reading (DryFreq= 6C Hex)	Hz	1	r
21	Verification counter (CalcCycleCount= 6F Hex)	minute	1	r
22	Electronics temperature input (AnalogEE= 70 Hex)	counts	1	r
23	Current flow reading (CurrentFlow= 8A Hex)	sccm	100	r
24	Maximum flow deviation (MaxFlowDev= 8E Hex	sccm	100	r
25	Special command (MODBUSCommand= 93 Hex)	—	1	r,w
26	Sensor pressure coefficient (Pressure1Span= 2 Hex)	kPa	100	r,w
27	Sensor pressure offset (Pressure1Offset= 3 Hex)	kPa	100	r,w

REG	DEFINITION	UNITS	SCALING	ACCESS
28	Serial comunication mode (SerialMode= 26 Hex)	—	1	r,w
29	Slave address (NodeAddress= 27 Hex)	—	1	r,w
30	Baud rate (Baud= 25 Hex)	—	1	r,w
31	MODBUS protocol setting (ParityAndStop= 92 Hex)	—	1	r,w
32	Counts to voltage coefficient (AD16Offset= 01 Hex)	—	1	r,w
33	Sensor assembly setting (RefPeriod= 04Hex)	second	1	r,w
34	Sensor assembly setting (SmplPeriod= 05 Hex)	second	1	r,w
35	Sensor temperature coefficient (CellTempSpan 36 = 06 Hex)	—	100	r,w
36	Sensor temperature coefficient (CellTempOffset= 07 Hex)	—	10	r,w
37	Process pressure coefficient (CustomerSpan= 08 Hex)	—	1000	r,w
38	Process pressure coefficient (CustomerOffset= 09 Hex)	—	100	r,w
39	Sensor pressure filter coefficient (Pressure1Filter= 0A Hex)	—	100	r,w
40	Flow filter coefficient (FlowFilter= 0B Hex)	—	100	r,w
41	Sensor temperature filter coefficient (CellTempFilter= 0C Hex)	—	100	r,w
42	Process pressure filter coefficient (CustomerFilter= 0D Hex)	—	100	r,w
43	Current output conversion parameter (MaOutSpan= 0E Hex)	—	1	r,w
44	Current output correction parameter	—	10	r,w
45	Current output coefficient (AnalogOutSpan= 10 Hex)	—	1	r,w
46	Current output coefficient (AnalogOutOffset= 11 Hex)	—	1	r,w
47	Process pressure coefficient (ProcessSpan= 12 Hex)	—	10	r,w
48	Process pressure coefficient (ProcessOffset= 13 Hex)	—	10	r,w
49	Flow control parameter (ProBandLoop1= 16 Hex)	—	1	r,w
50	Flow control parameter (TsLoop1= 17 Hex)	—	1	r,w
51	Flow control parameter (TiLoop1= 18 Hex)	—	1	r,w
52	Flow control parameter (SetPointLoop1= 19 Hex)	—	1	r,w
53	Flow control parameter (ActuatorLoop1= 1A Hex)	—	1	r,w
54	Flow control parameter (uMaxLoop1= 1B Hex)	—	10	r,w
55	Flow control parameter (uMinLoop1= 1C Hex)	—	10	—
56	Heater control parameter (proBandLoop2= 1D Hex)	—	1	r,w
57	Heater control parameter (TsLoop2= 1E Hex)	—	1	r,w
58	Heater control parameter (TiLoop2= 1F Hex)	—	1	r,w
59	Heater control parameter (SetPointLoop2= 20 Hex)	—	1	r,w
60	Heater control parameter (ActuatorLoop2= 21 Hex)	—	1	r,w
61	Heater control parameter (uMaxLoop2= 22 Hex) — 1 r,w	—	1	r,w
62	Heater control parameter (uMinLoop2= 23 Hex — 1 r,w	—	1	r,w
63	Gas based coefficient (PpmW= 24 Hex) — 1000 r,w	—	—	—
64	Flow control parameter (TempLoopDelay= 29 Hex)	second	1	r,w
65	Unit of measurement selection (MoistureUnits= 2B Hex)	—	1	r,w

REG	DEFINITION	UNITS	SCALING	ACCESS
66	Concentration alarm range (Alarm1Hi= 2C Hex)	—	1	r,w
67	Concentration alarm range (Alarm1Lo= 2D Hex)	—	1	r,w
68	Concentration alarm range (Alarm2Hi= 2E Hex)	—	1	r,w
69	Concentration alarm range (Alarm2Lo= 2F Hex)	—	1	r,w
70	Process pressure units (PressUnits= 30 Hex)	—	1	r,w
71	Bypass valve state (BypassState= 31 Hex)	—	1	r,w
72	Zero coefficient (FrequencyOffset= 38 Hex)	Hz	1000	r,w
73	Gas based flow coefficient (FlowCoeff0= 39 Hex)	—	1000	r,w
74	Gas based flow coefficient (FlowCoeff1= 3A Hex)	—	1000	r,w
75	Process pressure upper limit (FlowCoeff2= 3B Hex)	kPa	1	r,w
76	Flow meter parameter (FlowSpan= 3C Hex)	—	100	r,w
77	Auto verification hour (CalHour= 3D Hex)	—	1	r,w
78	Verification time in minutes (CalPeriod= 3E Hex)	minute	1	r,w
79	Auto verification day of month (CalMonthDays= 3F Hex)	—	1	r,w
80	Auto verification day of week (CalWeekDays= 40 Hex)	—	1	r,w
81	Hourly, daily, monthly auto verification (CalType= 41 Hex)	—	1	r,w
82	Software revision number (Version= 47 Hex)		100	r,w
83	Reset variable (SystemReset= 48 Hex)	—	1	r,w
84	Default memory flag (newFlag= 49 Hex)	—	1	r,w
85	Read only except test mode (AnalogInput= 4E Hex)	—	10	r,w
86	Read only except test mode (AnalogOutput= 4F Hex	—	1	r,w
87	Used in test mode (ReadTestFixture= 50 Hex)	—	1	r
88	Sample = 0,generator = 1,reference = 2 (ValveState= 56 Hex)	—	1	r,w
89	Current hour (Hour= 57 Hex)	hour	1	r,w
90	Current minute (Minute= 58 Hex)	minute	1	r,w
91	Current second (Second= 59 Hex)	second	1	r,w
92	Current month (Month= 5A Hex)	—	1	r,w
93	Current day (Day= 5B Hex)	—	1	r,w
94	Current year (Year= 5C Hex)	—	1	r,w
95	Used in test only (WriteTestFixture= 63 Hex)	—	1	—
96	Current day of week (WeekDay= 6D Hex)	—	1	r,w
97	Verification coefficient (MoistureSpan= 6E Hex)	—	1000	r,w
98	Track or hold current output flag (HoldOut= 71 Hex)	—	1	r,w
99	Fast cycle =0, slow cycle=1 (SlowTiming= 72 Hex)	—	1	r,w
100	Minimum verification duration (VerDurationLimit= 73 Hex)	minute	1	r,w
101	Adjust span in verification flag (AdjustSpan= 74 Hex)	—	1	r,w
102	Alarm 1 enable flag (EnableAlarm1= 75 Hex)	—	1	r,w
103	Alarm 2 enable flag (EnableAlarm2= 76 Hex)	—	1	r,w
104	Reserved	—	—	—

REG	DEFINITION	UNITS	SCALING	ACCESS
105	Dryer limit (DryerPpmHours= 7A Hex)	ppmH	1	r,w
106	Dryer counter (CurrentPpmHours= 7B Hex)	—	1	r,w
107	Flow correction coefficient (FlowCorrection= 8B Hex)	—	10	r,w
108	Corrected generator reading (MoistureCorr= 8C Hex)	—	10	r,w
109	Flow correction multiplier (FlowWeight= 8D Hex)	—	10	r,w
110	Previous span before adjustment (OldMoistSpan= 8F Hex)	—	1000	r,w
111	Skip span drift limit (IgnoreSpanDrift= 90 Hex)	—	1	r,w
112	Previous offset number (OldFreqOffset= 91 Hex)	—	1000	r,w
113-114	Converts input counts to voltage (AD16Span= 00 Hex)	—	float	r
115-116	Dewpoint temperature conversion coefficient (DewCoeff0= 14 Hex)	—	float	r
117-118	Dewpoint temperature conversion coefficient (DewCoeff1= 15 Hex)	—	float	r
119-120	Dewpoint temperature conversion coefficient (DewCoeff2= 42 Hex)	—	float	r
121-122	Dewpoint temperature conversion coefficient (DewCoeff3= 43 Hex)	—	float	r
123-124	Sensor calibration coefficient (PolyCoeff0= 32 Hex)	—	float	r
125-126	Sensor calibration coefficient (PolyCoeff1= 33 Hex)	—	float	r
127-128	Sensor calibration coefficient (PolyCoeff2= 34 Hex)	—	float	r
129-130	Sensor calibration coefficient (PolyCoeff3= 35 Hex)	—	float	r
131-132	Sensor calibration coefficient (PolyCoeff4= 36 Hex)	—	float	r
133-134	Sensor calibration coefficient (PolyCoeff5= 37 Hex)	—	float	r
135-136	Current concentration (Moisture= 51 Hex)	—	float	r
137-138	Concentration held during verification (HeldConc= 52 Hex)	engineer units	float	r
139-140	Delta frequency (DeltaFrequency= 54 Hex)	Hz	float	r
141-161	Customer analyzer name (AnalyzerName= 28 Hex)	—	string	r,w
162-182	Selected gas (Gas= 2A Hex)	—	string	r,w
183-189	Analyzer serial number (SerialNumber= 44 Hex)	—	—	—
190-196	Sensor serial number (CellSerialNumber= 45 Hex)	—	—	—
197-203	Moisture generator serial number (MoistureGeneratorSN= 46 Hex)	—	—	—
204-209	Current date string (Date=5D Hex)	—	—	—
210-212	Current time string (Time= 5E Hex)	—	—	—
213-220	Analyzer model name (ModelName= 77 Hex)	—	—	—
221-225	Dryer production code (DryerDateCode= 79 Hex)	—	—	—
226-228	Reserved	—	—	—
229	Hi Span Limit (HiSpanLimit= 94 Hex)	—	—	—
230	Low Span Limit (LowSpanLimit= 95 Hex)	—	—	—

Register #0 holds the moisture concentration value not held during Verification. This value is in PPM.

A pair of registers #135 and #136 provide the same moisture concentration value in floating point Modicon standard.

Register #1 holds the moisture concentration value held during Verification. The units of measurement are changing depending of flag status located in register #65.

A pair of registers #137 and #138 provide the same information in floating point format.

Register #11 is a DataState register, which is designed to synchronize the data acquisition process. This flag is cleared by read. A value of one indicates new data is available.

Register #8 is the SystemState variable, which is set to alarms and warnings. This value is decoded according to the table below.

Example:
If the value of SystemState is 12612, which is the sum of 4, 64, 256, 4096, and 8192 then the corresponding alarms are: **Reading Alarm**, **Calibration Failure**, **Flow Out of Tolerance**, **Moisture Generator Date**, and **Dryer Alarm**, respectively.

Alarm Name	System State Bit	Decimal Value	Comment
Memory Failure	Bit 4	16	System Alarm
Sample Sensor Failure	Bit 5	32	Frequency & Sensor Access
Calibration Failure	Bit 6	64	Span Out of Limit
Oven Temperature	Bit 7	128	Temperature Out of Limit
Flow Out of Tolerance	Bit 8	256	System Alarm
Battery Low	Bit 9	512	Battery State
Reference Gas	Bit 10 Warnings	1024	Set if Delta Frequency < -0.3 Hz
Enclosure Temperature	Bit 11	2048	Temperature >70 ℃
Moisture Generator Date	Bit 12	4096	Good for Two (2) Years
Dryer Alarm	Bit 13	8192	Exceeding PPM Hours
Concentration Alarm	Bit 0 – Bit 1	1 & 2	Concentration Out of Range
Reading Alarm	Bit2	4	Verification or System Alarm
Process Pressure	Bit3	8	Process Pressure Out of Limits

Register #25 is a MODBUSCommand register. This register allows sending special commands to the 3050 Analyzer as shown below.

Value	Command Description
71	Start Verification
76	Load Sensor Memory
81	Quit Verification
82	Reset Analyzer
84	Start/Stop Test Mode
90	Start Zero Calibration

The last set of registers starting from #141 represents ASCII strings. Each register is holding two ASCII characters. End of the string should be marked with integer number of zero ('**0**'). For example, if the AnalyzerName variable is set to "Dev", the holding register values are (considering that high byte located first) #141 (68, 101) and #142 (118, 0). Note that zero ('**0**') indicates the end of the ASCII string.

ID/Status Information

The Modbus master can poll the analyzer periodically for status information via Modbus function 17 (11Hex). The returned information has the following format:

1 byte Slave ID	= 50h for 3050-OLV Analyzer
1 byte Run Status	= FFh for Analyzer Online (invalid signal = 0)
	= 00h for Analyzer Offline (invalid signal = 1)
2 bytes Status Word	= System State which is Register 8 The most significant byte comes first.
15 bytes Model Name	= Analyzer Model Name are Registers 213–220
12 bytes Serial Number	= Analyzer Serial Number located in Registers 183–189
4 bytes Version Number	= S200 located in Register 82

The byte count is 35 (23Hex).

Analyzer Configuration Operations

This section discusses configuring the analyzer with Modbus. The 3050 Analyzer is shipped ready to communicate via Modbus using the serial communications port. While the 3050 can be completely configured using the Modbus connection, AMETEK recommends the use of the 3050 Configurator Software for configuring the analyzer. The 3050 Configurator Software is compatible with Modbus RTU as well. Switching protocols can be accomplished with the 3050 Configurator Software or with the AMETEK "ProtocolSwitch" utility.

Configuration Examples

All of the configuration parameters of the analyzer can be modified by the "write one or multiple holding registers" command. In most cases, it is a one-step operation involving setting the contents of the corresponding register. Ten different examples of using this command are presented below. The first example is presented with all "request" and "response" formatting information. For brevity, the remaining examples list just the key register information.

Example 1: Alarm Enable

Task	Action	Modbus transaction
Enable Alarm Output. Device address is 2.	Write one holding register (function 06). Register address = 102 (holding register #40103). Value = 1(1-enable, 0-disable).	Request Device Address = 02Hex Function Code = 06Hex Register Address Hi = 00Hex Register Address Lo = 66Hex Register Value Hi = 00Hex Register Value Lo = 01Hex CRC Hi CRC Lo Response Device Address = 02Hex Function Code = 06Hex Register Address Hi = 00Hex Register Address Lo = 66Hex Register Value Hi = 00Hex Register Value Lo = 01Hex CRC Hi CRC Lo

Example 2: Setting the High Alarm Limit

Task	Action
Set the analyzer to produce a "high concentration" alarm, when the moisture concentration exceeds 1000 PPM.	Write one holding register (function 06). Register address = 66 (holding register #40067). Value = 1000.

Example 3: Setting the Low Alarm Limit

Task	Action
Set the analyzer to produce a "low concentration" alarm, when the moisture concentration falls below 0 PPM.	Write one holding register (function 06). Register address = 67 (holding register #40068). Value = 0.

Example 4: Enabling "Hold During Verify"

Task	Action
Enable hold the analog outputs at the last measured value, when the analyzer is Offline to perform a Verification.	Write one holding register (function 06). Register address = 98 (holding register #40099). Value = 1 (0-track during verify, 1-hold during verify).

Example 5: Setting the High-End of the Analog Output

Task	Action
Set up the analog output so that a moisture concentration of 100 PPM produces a 20 mA current output.	Write one holding register (function 06). Register address = 45 (holding register #40046). Value = 100.

Example 6: Setting the Low-End of the Analog Output

Task	Action
Set up the analog output so that a moisture concentration of 1 PPM produces a 4 mA current output.	Write one holding register (function 06). Register address = 46 (holding register #40047). Value = 100 (multiplied by scale of 100).

Example 7: Switching to "Sensor Saver" Mode

Task	Action
Set the analyzer to operate in the **Sensor Saver** mode.	Write one holding register (function 06). Register address = 99 (holding register #40100). Value = 1 (enable sensor saver =1, disable sensor saver = 0).

Example 8: Switch to Dewpoint Readings

Task	Actions
Set the analyzer to output the moisture concentration as a dewpoint, using the Centigrade scale. A fixed process pressure of 150 kPa is used for this example.	**ACTION 1** Write one holding register (function 06). Register address = 65 (holding register #40066). Value = 4 (PPMV = 0, lbs/mmscf = 1, mg/Nm3 = 2, PPMW = 3, dewpoint C = 4, dewpoint F = 5). **ACTION 2** Set process pressure units to kPa. Write one holding register (function 06). Register address = 70 (holding register #40071). Value = 0 (kPa= 0, PSIA = 1, bar = 2, Atm = 3). **ACTION 3** Set process pressure to fixed 150 kPa. Write one holding register (function 06). Register address = 47 (holding register #40048). Value = 1500. Write one holding register (function 06). Register address = 48 (holding register #40048). Value = 1500.

Example 9: Selecting a Sample Gas

Task	Actions
Set the analyzer to operate on a Sample gas, using the data provided in the "GasNew.csv" file (located on the customer configuration disk). For the purpose of this example, the Sample gas selected will be air.	**ACTION 1** Write multiple holding registers (function 16). Register address = 162 (holding register #40163) value = 4169Hex, Register address = 163 (holding register #40164) value = 7200Hex (Air0). **ACTION 2** Set gas related coefficients. Coefficients can be obtained from the GasNew.csv file located on the Customer Configuration floppy disk. Register address = 74 (holding register #40075). Value = 998 Register address = 75 (holding register #40076). Value = 14000 Register address = 63 (holding register #40064). Value = 622 Next registers should be set for Dewpoint temperature reading only. Register address = 115,116. Value = 7.89E-04 Register address = 117,118. Value = -7.14E-06 Register address = 119,120. Value = 2.31E-08 Register address = 121,122. Value = -2.57E-11 **ACTION 3** Set process pressure to fixed 150 kPa Write one holding register (function 06). Register address = 47 (holding register #40048). Value = 1500Hex (multiplied by the scaling factor of 10). Write one holding register (function 06). Register address = 48 (holding register #40049). Value = 1500Hex (multiplied by the scaling factor of 10).

Example 10: Setting Verification Schedule

Task	Actions
Set the analyzer to automatically trigger a Verification. For this example, the analyzer will be set to perform a Verification on the third day of each month, at noon (12:00).	**ACTION 1** Set the Verification type to **Monthly**. Write one holding register (function 06). Register address = 81 (holding register #40082) value = 3Hex (never = 0, daily = 1, weekly = 2, monthly = 3). **ACTION 2** Set the Day of the **Month** to 3. Write one holding register (function 06). Register address = 79 (holding register #40080) value = 3Hex. **ACTION 3** Set the **Hour** to 12. Write one holding register (function 06). Register address = 77 (holding register #40078) value =0CHex.

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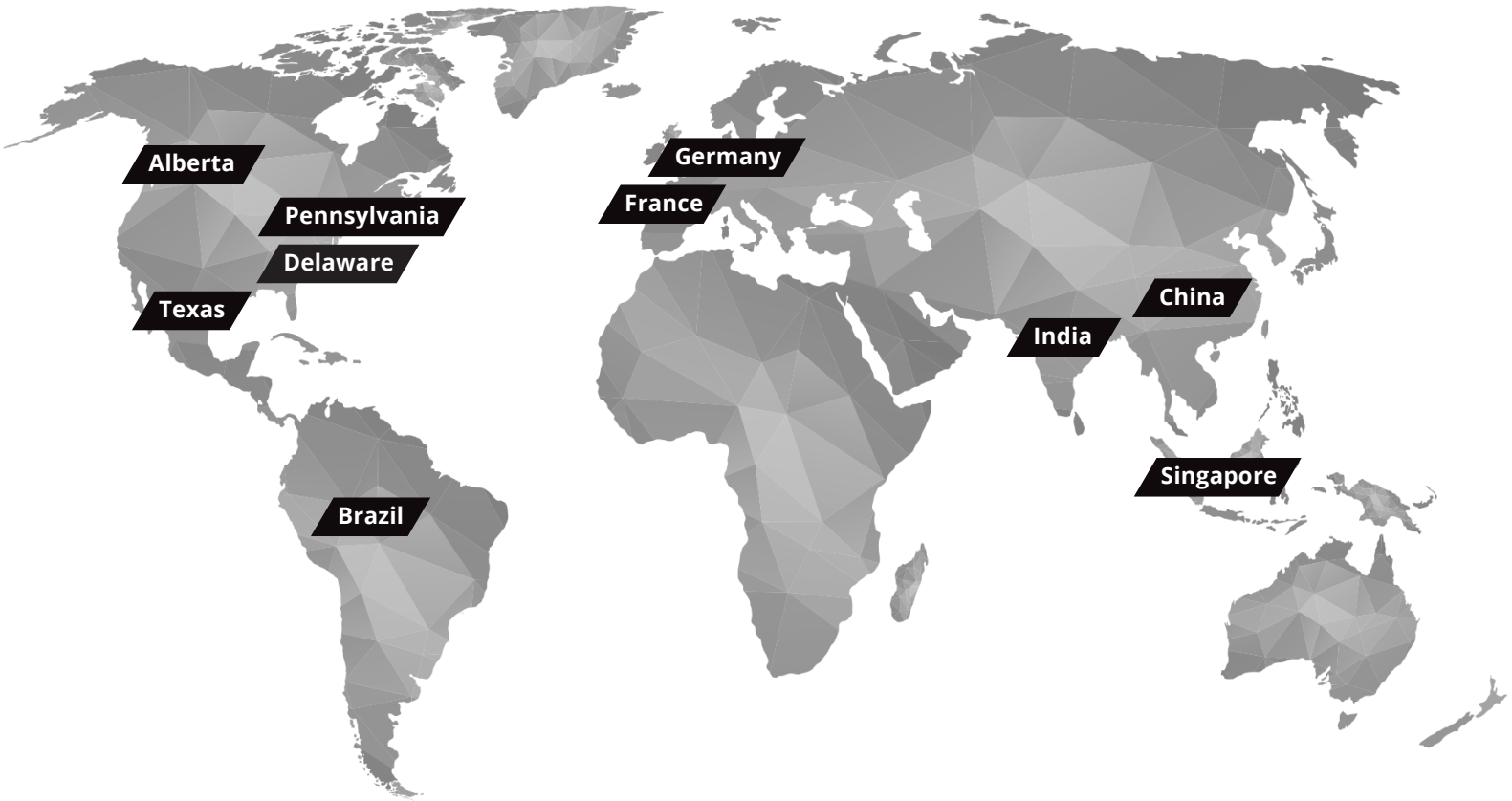

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Tel: +1 302 456 4400
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