Model 3050-DO
Moisture Analyzer

User Manual

Part Number: 305725901, Rev. R
Configurator Version 1.74

AMETEK
Process Instruments
455 Corporate Boulevard
Newark, DE 19702

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www.ametekpi.com

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

WARRANTY AND CLAIMS

We warrant that any equipment of our own manufacture or manufactured for us pursuant to our specifications which shall not be, at the time of shipment thereof by or for us, free from defects in material or workmanship under normal use and service will be repaired or replaced (at our option) by us free of charge, provided that written notice of such defect is received by us within twelve (12) months from date of shipment of portable analyzers or within eighteen (18) months from date of shipment or twelve (12) months from date of installation of permanent equipment, whichever period is shorter. All equipment requiring repair or replacement under the warranty shall be returned to us at our factory, or at such other location as we may designate, transportation prepaid. Such returned equipment shall be examined by us and if it is found to be defective as a result of defective materials or workmanship, it shall be repaired or replaced as aforesaid. Our obligation does not include the cost of furnishing any labor in connection with the installation of such repaired or replaced equipment or parts thereof, nor does it include the responsibility or cost of transportation. In addition, instead of repairing or replacing the equipment returned to us as aforesaid, we may, at our option, take back the defective equipment, and refund in full settlement the purchase price thereof paid by Buyer.

Process photometric analyzers, process moisture analyzers, and sampling systems are warranted to perform the intended measurement, only in the event that the customer has supplied, and AMETEK has accepted, valid sample stream composition data, process conditions, and electrical area classification prior to order acknowledgment. The photometric light sources are warranted for ninety (90) days from date of shipment. Resale items warranty is limited to the transferable portion of the original equipment manufacturer's warranty to AMETEK. If you are returning equipment from outside the United States, a statement should appear on the documentation accompanying the equipment being returned declaring that the goods being returned for repair are American goods, the name of the firm who purchased the goods, and the shipment date.

The warranty shall not apply to any equipment (or part thereof) which has been tampered with or altered after leaving our control or which has been replaced by anyone except us, or which has been subject to misuse, neglect, abuse or improper use. Misuse or abuse of the equipment, or any part thereof, shall be construed to include, but shall not be limited to, damage by negligence, accident, fire or force of the elements. Improper use or misapplications shall be construed to include improper or inadequate protection against shock, vibration, high or low temperature, overpressure, excess voltage and the like, or operating the equipment with or in a corrosive, explosive or combustible medium, unless the equipment is specifically designed for such service, or exposure to any other service or environment of greater severity than that for which the equipment was designed.

The warranty does not apply to used or secondhand equipment nor extend to anyone other than the original purchaser from us.

THIS WARRANTY IS GIVEN AND ACCEPTED IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION AND WARRANTIES OF FITNESS OR OF MERCHANTABILITY OTHER THAN AS EXPRESSLY SET FORTH HEREIN, AND OF ALL OTHER OBLIGATIONS OR LIABILITIES ON OUR PART. IN NO EVENT SHALL WE BE LIABLE UNDER THIS WARRANTY OR ANY OTHER PROVISION OF THIS AGREEMENT FOR ANY ANTICIPATED OR LOST PROFITS, INCIDENTAL DAMAGES, CONSEQUENTIAL DAMAGES, TIME CHANGES OR ANY OTHER LOSSES INCURRED BY THE ORIGINAL PURCHASER OR ANY THIRD PARTY IN CONNECTION WITH THE PURCHASE, INSTALLATION, REPAIR OR OPERATION OF EQUIPMENT, OR ANY PART THEREOF COVERED BY THIS WARRANTY OR OTHERWISE. WE MAKE NO WARRANTY, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF FITNESS OR OF MERCHANTABILITY, AS TO ANY OTHER MANUFACTURER'S EQUIPMENT, WHETHER SOLD SEPARATELY OR IN CONJUNCTION WITH EQUIPMENT OF OUR MANUFACTURE. WE DO NOT AUTHORIZE ANY REPRESENTATIVE OR OTHER PERSON TO ASSUME FOR US ANY LIABILITY IN CONNECTION WITH EQUIPMENT, OR ANY PART THEREOF, COVERED BY THIS WARRANTY.

Table of Contents

Appendix A Modbus Communication Interface

Safety Notes

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

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.

Important information that should not be overlooked.

Read this manual before beginning the installation and operation of the 3050 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 kV** 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.

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 one of the following these 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 our office listed in the front of the instruction manual.

Electromagnetic Compatibility (EMC)

Read and follow the recommendations in this section 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 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 that certain installation techniques and wiring practices are used to prevent or minimize erratic behavior of the Analyzer or its electronic neighbors. 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 so that the shield materials can be wrapped backwards onto the cable jacket and captured inside the gland, and tightened up against the metal interior.

Inductive loads connected to the low voltage "Alarm Contacts" are not recommended. However, if this becomes a necessity, adhere to proper techniques and wiring practices. 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 using 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 where its unshieled 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.

SPECIAL WARNINGS AND INFORMATION

EQUIPMENT USED IN CLASS I, DIVISION 2 HAZARDOUS LOCATIONS

This Equipment is Suitable for Use in Class I, Division 2, Groups ABCD, T4 or Non-Hazardous Areas Only.

NOTE

Division 2 stand-alone Analyzer is not supplied with the 24 VDC power supply option.)

WARNING

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.

WARNING

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 déconnecter l'équipement, coupez le courant où vous assurez que l'emplacement est designé 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 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 using double or reinforced insulation which has a minimum dielectric strength of 2300 VAC. When the 3050 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.

Declaration of Conformity

Manufacturer's Name: AMETEK Process Instruments Division
(ISO 9001:2000 Registered)

Manufacturer's Address: 455 Corporate Blvd.
Newark, DE. 19702-3331
United States of America
Phone: 302-456-4400 / Fax: 302-456-4444

EU Representative Address: AMETEK Precision Instruments Europe GmbH
Rudolf-Diesel Strasse 16
D-40670 Meerbusch
Germany
Phone: 49-21 59-91 36 0 / Fax: 49-21 59-91 36 80

Declare under our sole responsibility that the product:

Product Name: **Process Moisture Analyzer**
Model Number **3050-DO**

Is in conformity with the provision to the following EC Directives:

Electromagnetic Compatibility Directive 89/336/EEC using the following standards:

EN61326-1	1997	Electrical equipment for measurement, control, and laboratory use – Industrial Requirements
EN61000-4-2		4/8kV contact/air ESD Immunity
EN61000-4-3		10 V/m Radiated RF Immunity
EN61000-4-4		2 kV Power lines, 1kV Signal, EFT Immunity
EN61000-4-5		1kV/2kV Surge Immunity
EN61000-4-6		10V Conducted RF Immunity
EN61000-4-11		One full cycle Voltage Dip Immunity
EN 55011		Radiated and Conducted Emissions, ISM Device, Class A, Group 1
EN61000-3-3		Voltage Fluctuation/Flicker Emissions

Low Voltage Directive 73/23/EEC using the following standards:

EN61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1.

Pressure Equipment Directive 97/23/EC using the following standards:

Exempt under Article 1.3.6

Madeline D. Troegler
Quality Assurance Manager
Newark, Delaware
May 17, 2005

CE

AMETEK
Process & Analytical Instruments Division

PN 305567001, Rev. A

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3050-DO MOISTURE ANALYZER

Overview

The 3050 Moisture Analyzer is a smart sensor that measures trace concentrations of moisture in a process gas stream. At the heart of the 3050-DO Analyzer is a 3050-OLV, which has been modified for operation at moisture concentrations below 100 ppbv. The 3050 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 Table 1.1 for gas list. The analyzer is calibrated to measure moisture contents from 1 to 2500 ppmv. Data output can be in units of ppmv, ppmw, lb/mmscf, and mg/Nm^3.

The heart of the 3050 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.

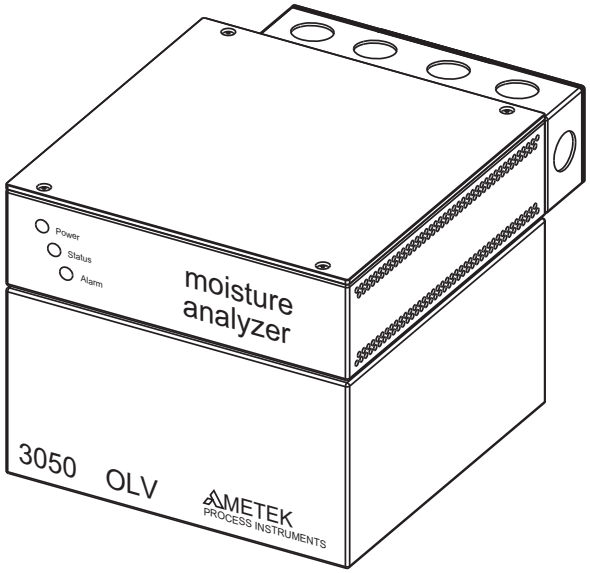

Figure 1-1.
3050 Analyzer

In the analyzers 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 0.010 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.

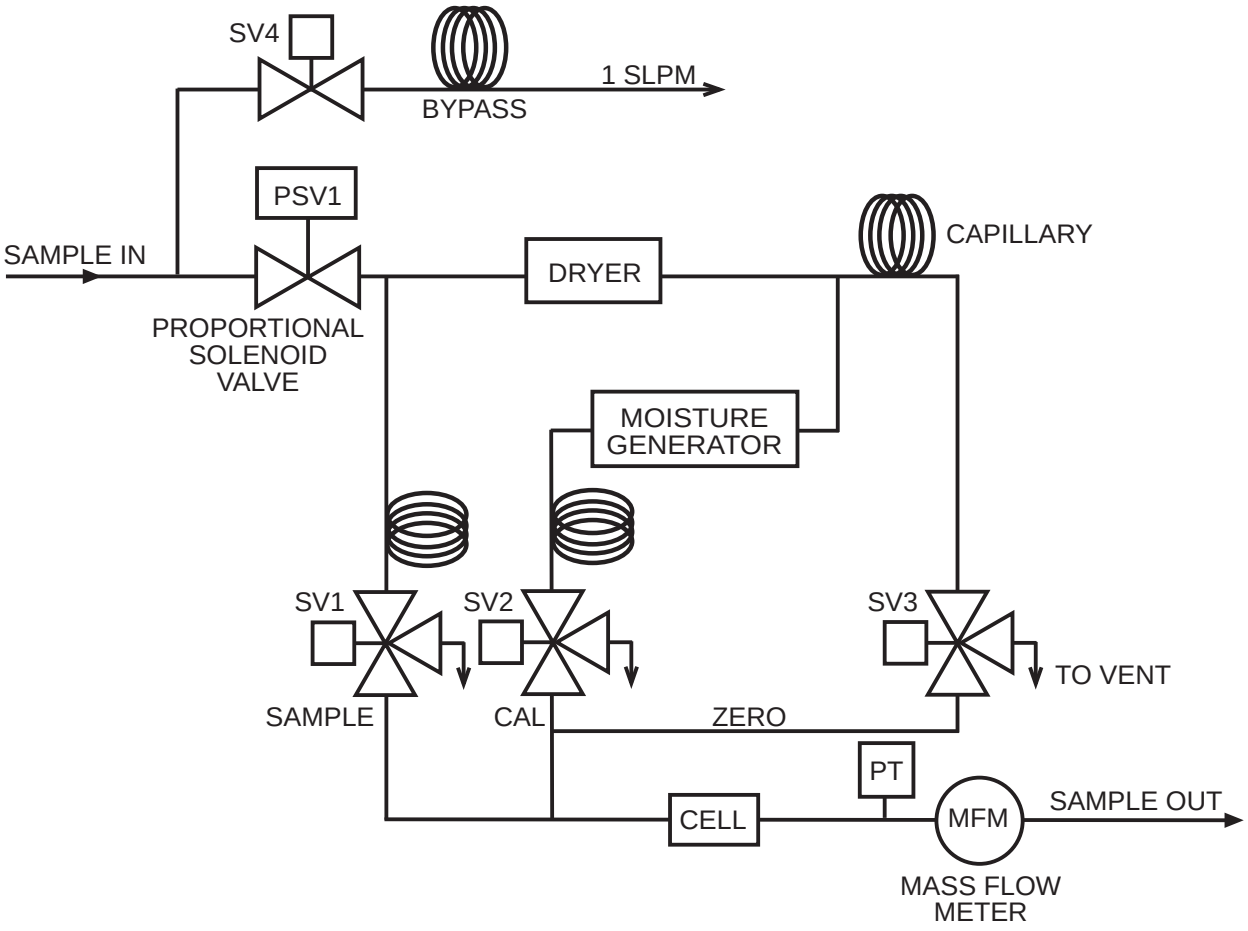

Figure 1-2.
3050 Analyzer Flow Diagram

Controller Communication

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

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

The 3050 has no local user programming functions. It requires serial communication with an external PC for configuration. Once configured, the analyzer is capable of stand alone 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 95/NT format. User provided software may also be used with the 3050 serial ports.

Verification

The 3050 has a built-in moisture generator for on board 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 performed on a sample of the process gas. This yields the most realistic test of the sensors performance under process conditions.

Gas Flow

Normal operation of the 3050 includes an internal bypass, which increases the response speed of the system; however, the 3050 is capable of running in a gas saver mode which allows the analyzer to run on a sample volume of 150 SCCM.

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 savor mode. Once the analyzer switches to sensor savor mode, it will not switch back on its own.

The sensor saver mode extents the life of the sensor, but provides slower response time. The analyzer updates every 2.5 minutes instead of 1 minute; however, the analyzer still responds within specifications. Refer to analyzer specifications on page 1-4.

Table 1.1: Model 3050 Gas List

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

oxygen
carbon dioxide
hydrogen
nitrogen
helium
neon
argon
krypton
xenon
methane
ethane
propane
butane
ethene (ethylene)
natural gas
Freon R12
Freon R22
Freon R114
Carbon Dioxide

NOTE

Contact AMETEK Service with inquiries regarding other applications.

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SPECIFICATIONS

Operating Environment

-20 °C to 45 °C (-4 °F to 113 °F)
(Ambient temperature; Enclosed sample system)
90% RH maximum, noncondensing
IEC Pollution Degree 2
IEC Installation Category II
Maximum elevation 2,000 meters (6560 feet)
Indoor/outdoor use

Approvals and Certifications:

General Safety Requirements
UL/CSA Class I, Division 2, Groups ABCD T4
Electromagnetic Compatibility Directive; EN61326-1 Industrial
Low Voltage Directive; EN61010-1
Pressure Equipment Directive
Russian Gosstandart Pattern Approval

Ranges

0.02 to 2500 parts per million by volume (ppmv)
Readings can also be displayed in units of ppmw, lb/mmscf, and mg/Nm^3.

Outputs

Data:

Isolated 4 to 20 mA, 100 to 500Ω Analog output (software configurable)
RS-232 or RS-485 serial port, two and four wire mode

Alarms/Alerts:

Two independent contact closures 60 VDC, 30 VAC, 50 VA maximum resistive for system alarm and data valid. All are fail-safe by default.

Alarms are available on RS-485 interface.

Lower Detectable Limit

0.02 PPMV nominal

Sensitivity

0.01 PPMV or 1% of reading, whichever is greater

Accuracy

0.02 ppmv or +/- 10% of reading which ever is greater

Reproducibility

+/- 5% of reading from 0.2 to 2500 ppmv

Moisture Generator Value

1 ppmv nominal

Instrument Air Requirements

5 to 7 bar (70 to 100 psig)

Back Pressure Regulator Requirements (if purchased)

0 to 1 bar (0 to 15 psig) Maximum

Sample Inlet Pressure Requirement

138 kPa to 24150 kPa (20 psig to 3500 psig) to pressure reducer
138 kPa to 345 kPa (20 psig to 50 psig) Maximum, pressure reducer to analyzer

Exhaust Pressure

0 to 1 bar (0 to 15 psi) gauge

Minimum differential Pressure

20 psi gauge (Inlet pressure must be greater than 20 psig over the outlet pressure.

Sample Flow Requirement

150 SCCM, » 1 SLPM bypass flow available for increased response speed.

Inlet Gas Temperature

0 °C to 100 °C (32 °F to 212 °F)
Optimal results are obtained when inlet gas temperature is maintained at 60 °C (140 °F). Heat traced sample lines are recommended.

Power Requirements

120 +/-10% Vac, 50/60 Hz, 150W max. (305 679 901)
230 +/-10% Vac, 50/60 Hz, 150W max. (305 642 901)

Minimum PC Requirements for Software

Pentium 100
16 MB RAM for Windows 95,
32 MB RAM for Windows NT
Microsoft Windows 95 or Windows NT 4.0

Dimensions

Width:	61.2 cm	(24.11 inches)
Height:	64.6 cm	(25.42 inches)
Depth:	34.2 cm	(13.47 inches)

Net Weight

82 Kg (180 lb.)

NOTE

All specifications subject to change without notice.

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INSTALLATION AND START-UP

Unpacking and Inspection

Remove components from the packing case(s) carefully; check contents against packing list. Inspect all components for obvious damage and broken/loose parts or fittings. Notify the carrier and AMETEK Service (1-800-537-6044) immediately if parts are missing or damage is found.

Sample System Space Requirements

Nema-4x enclosure - approximately 64 x 35 x 67 cm plus clearance for analyzer connections. Refer to Figure 3-3.

Power Requirements

The System is shipped according to the customer order and is fused and set for the voltage of the required mains power. The power requirements are stated on the metal plate on the side of the casting and in the specification section of analyzer manual.

System Tubing

Recommended system tubing is 1/8 inch OD, 316 stainless steel meeting ASTM #632 specifications (AMETEK PN 571061017 or equivalent).

Dry Reference Gas

A dryer (AMETEK Dryer PN 305400901S or equivalent) is required to dry reference gas to less than 0.025 ppmv.

A dryer (AMETEK Dryer PN 305580901S or equivalent) is required to dry the gas to less than 0.01 ppmv for zeroing the 3050-DO.

Dryers must be periodically replaced. In normal use, the dryer (PN 305400901S) should dry a 50-ppm reference gas to specification for 1 year.

Sample Gases

The 3050 is designed to operate on a clean gas stream; specifically, the sample gas stream must be free of particulates and aerosols. If the 3050 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 a inline, 1/8" tube 7 UM filter (supplied) be installed an the inlet of the analyzer. AMETEK filter (part number 271639001) is ideally suited for this purpose, and will mount directly on the inlet fitting of the analyzer. While installing this filter at the inlet of the analyzer 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 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 us at any of the addresses located in the front of this manual.

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 in-between the tap and analyzer. Refer to figure 2.4 in analyzer manual. For optimum performance, sample line should be heat traced to maintain a constant sample temperature. Optimum sample gas input is 60°C.

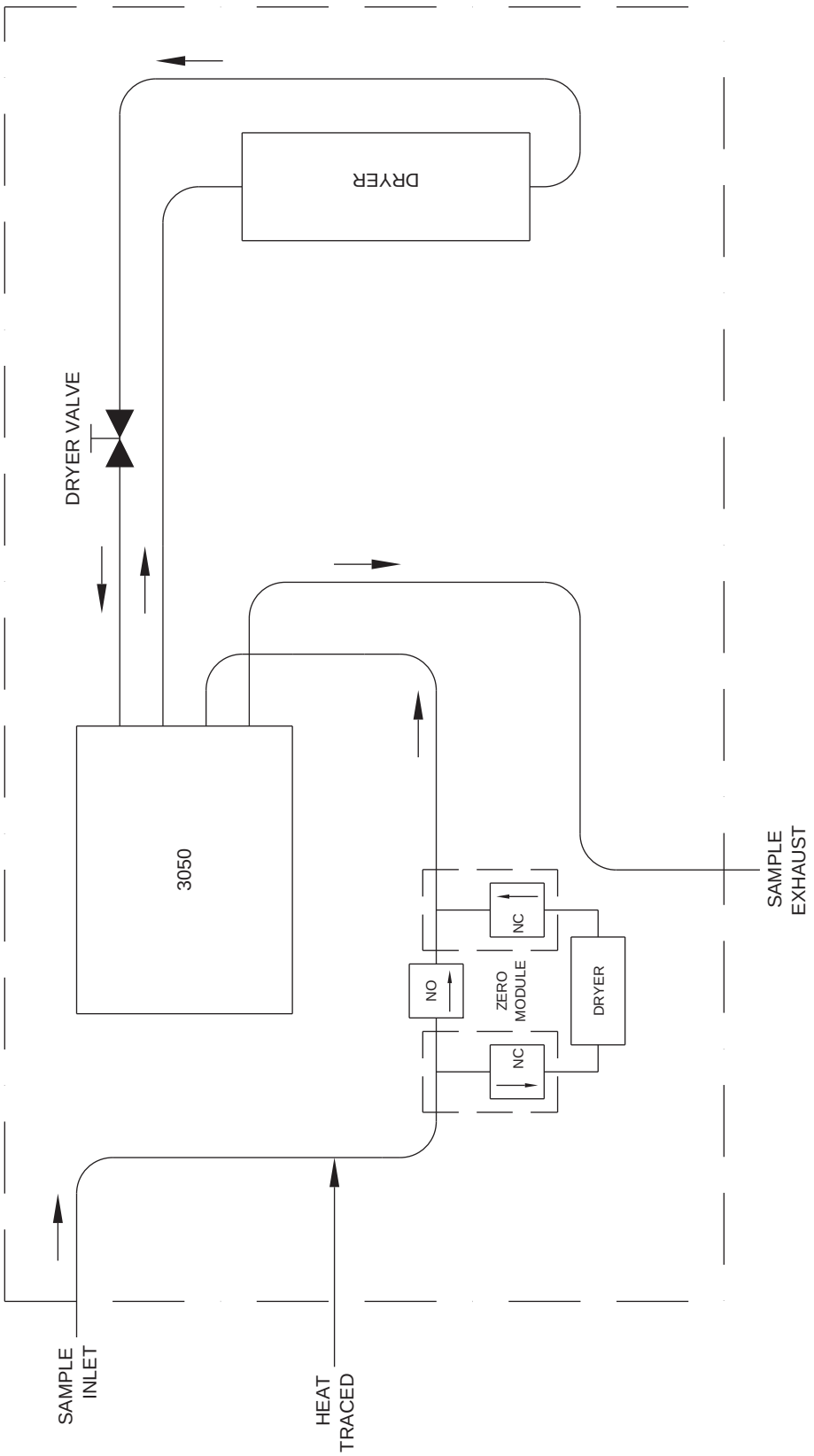


Figure 3-1:
DO Sample system flow diagram

Mechanical Installation

Locate the 3050 system as close as possible to the sample source. The unit should be protected from direct exposure to weather and sunlight; and located so that the ambient temperature specifications will not be exceeded.

1. If not already installed, install a main process shut-off valve at the sample tap. Refer to figure 3-4.

2. Mount system in selected location and bolt in place. Refer to figure 3-3.

3. Connect instrument air to 1/4-inch tube fitting. Maximum input 100 psig. Refer to figure 3-2.

4. Connect the analyzer 1/8-inch exhaust tube fitting to appropriate vent system. Refer to figure 3-2.

5. Connect the heated pressure reducer 1/4-inch relief out and vapor bypass tube fittings to appropriate vent system. Refer to figure 3-6.

6. Open the main process shut-off valve and purge entire length of sample line (up to the analyzer) to an appropriate area for at least five minutes. Close the main process shut-off valve. This will help prevent contamination from entering the cell.

7. Connect the sample line to the sample valve 1/8-inch tube fitting. Refer to figure 3-2.


NOTE

Connect as soon as purge is complete.

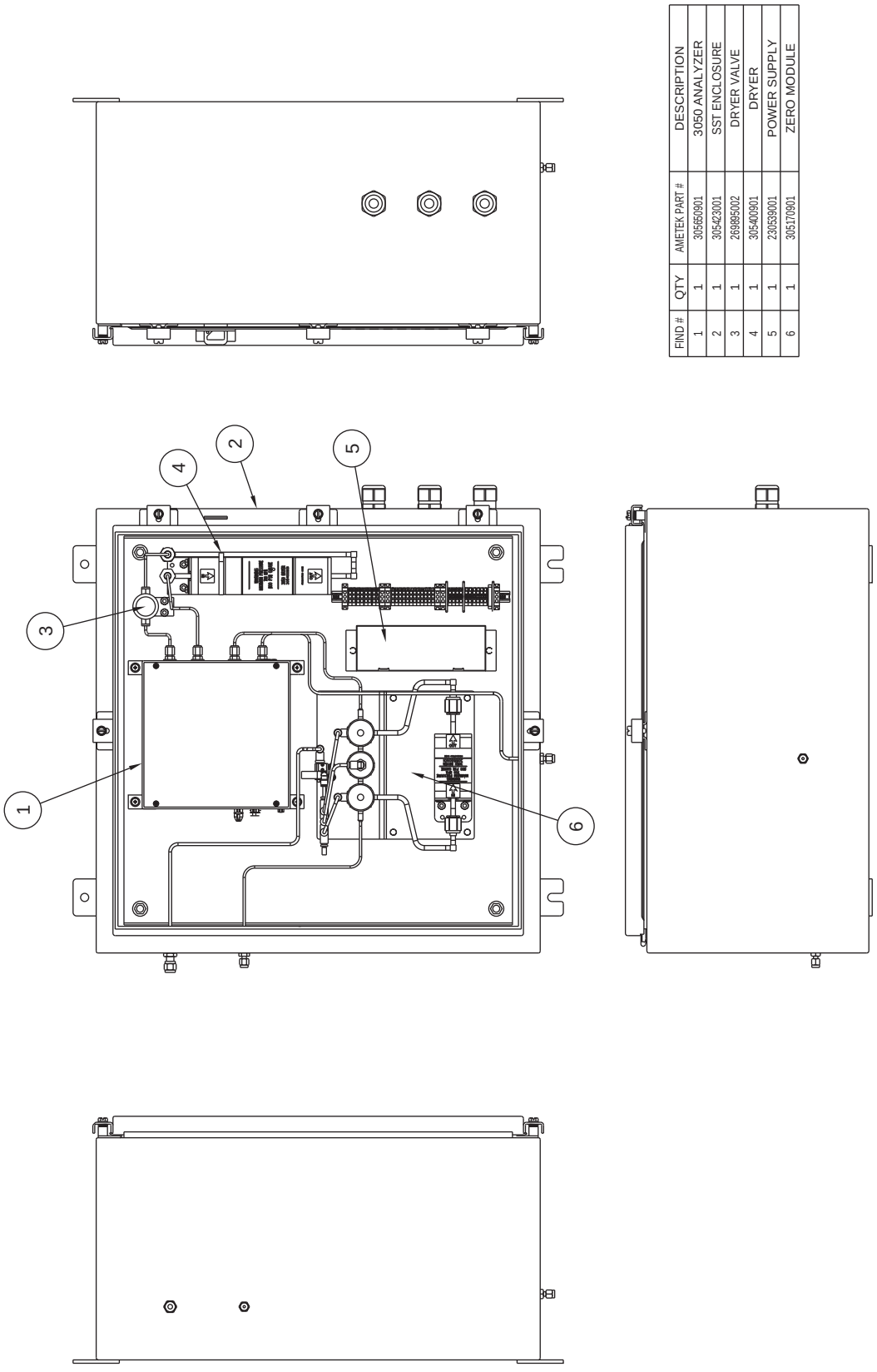
8. Re-inspect process line connections making certain that all are connected to the proper external supply, exhaust, and drain tubing such that there shall be no release of hazardous process gas to the atmosphere.


NOTE

Differential pressure between inlet and outlet must be at least 20 psig.

9. Open main process shut-off valve.

10. Open valve to dryer 1/4 to 1/2 turn prior to starting analyzer.



FIND #	QTY	AMETEK PART #	DESCRIPTION
1	1	305660901	3050 ANALYZER
2	1	305423001	SST ENCLOSURE
3	1	269895002	DRYER VALVE
4	1	305400901	DRYER
5	1	230539001	POWER SUPPLY
6	1	305170901	ZERO MODULE

Figure 3-2.
Analyzer Arrangement

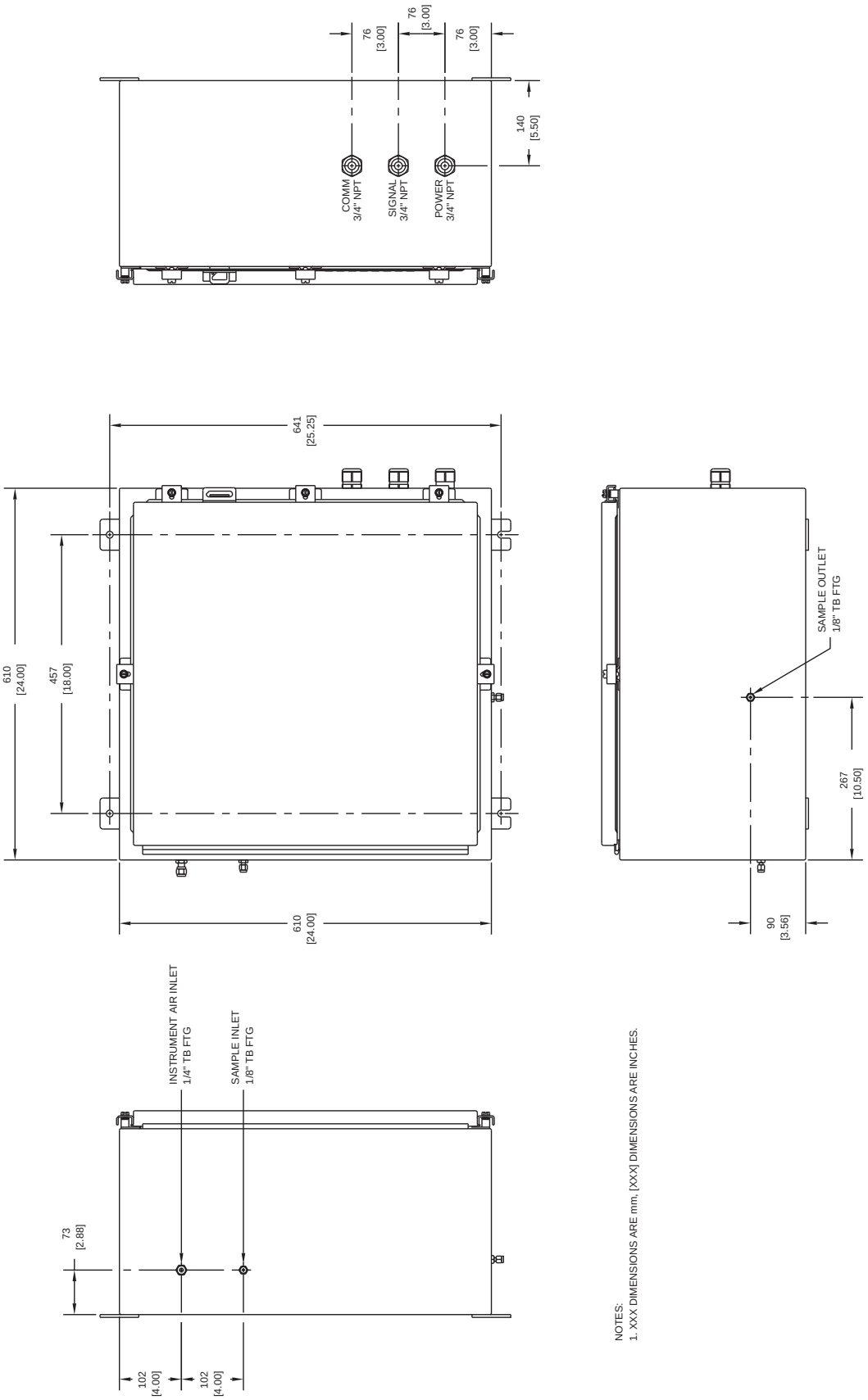


Figure 3-3. Installation Dimensions

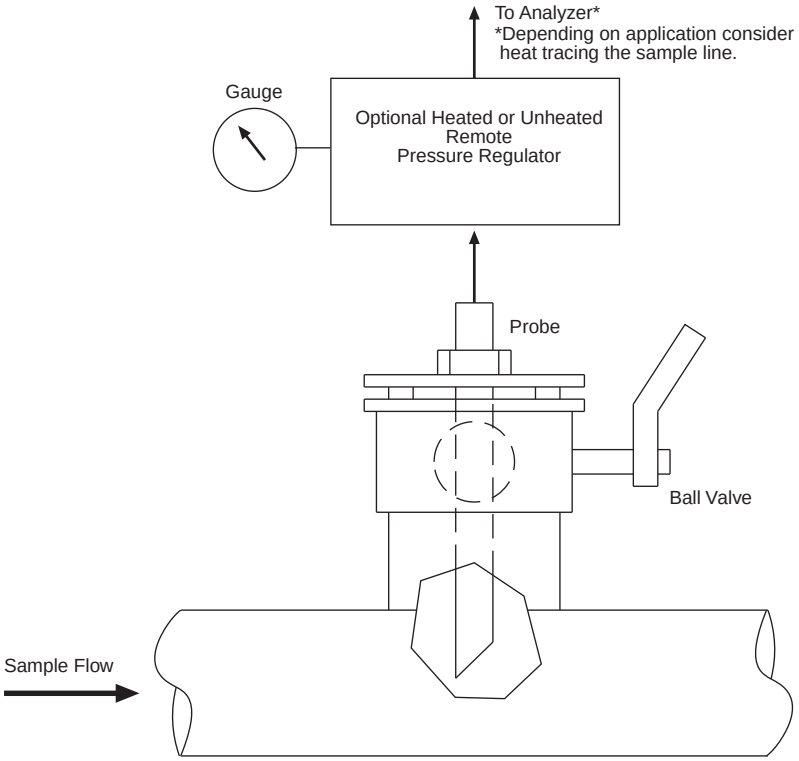


Figure 3-4. Typical Probe Installation

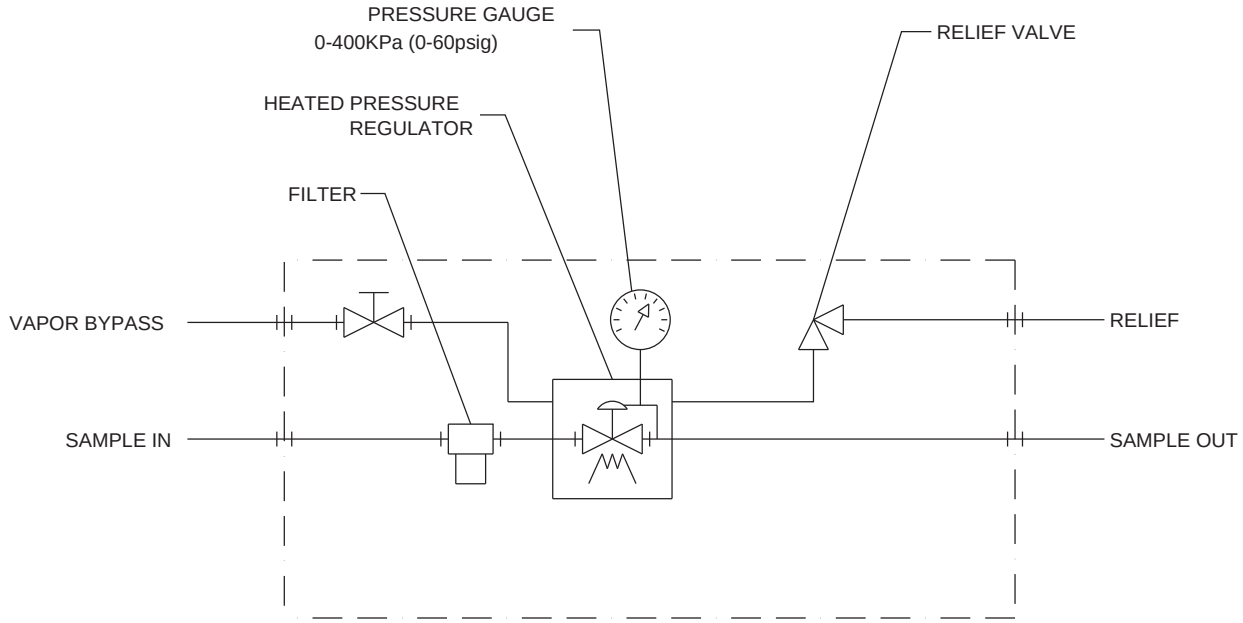


Figure 3-5. Optional heated pressure reduction flow

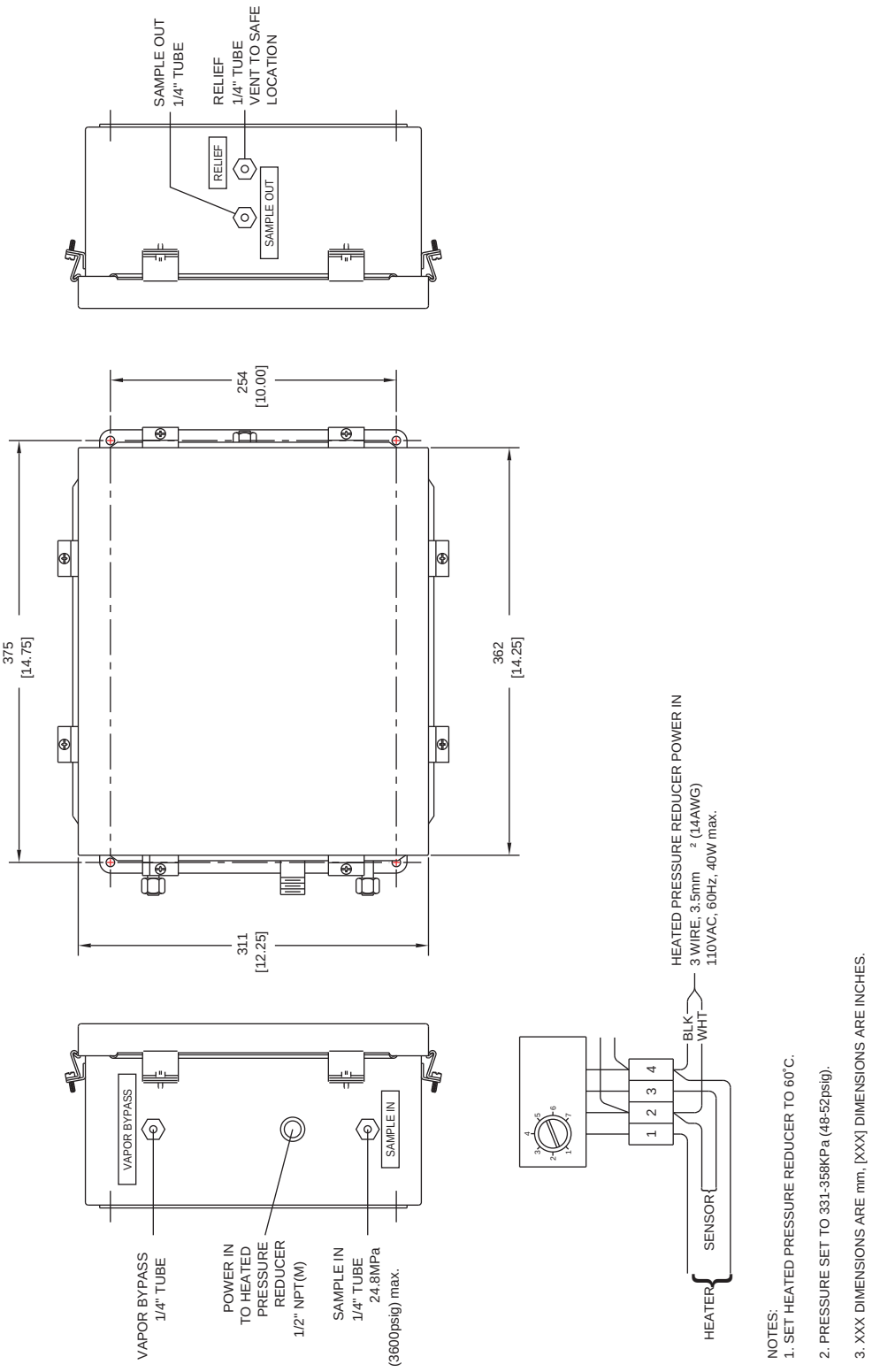


Figure 3-6.
Optional heated pressure reduction Installation

Electrical Connections

1. Access terminal block.

2. Connect the 4 to 20 mA analog output and alarm contacts from the terminal block to user recording equipment as shown on wiring diagram figure 3-7.

3. Connect serial communication from analyzer to the PC being used for customer parameter setup. Refer to figure 3-8 through 3-10.

   RS-232 Out - Connect RS-232 cable to the back of the analyzer.

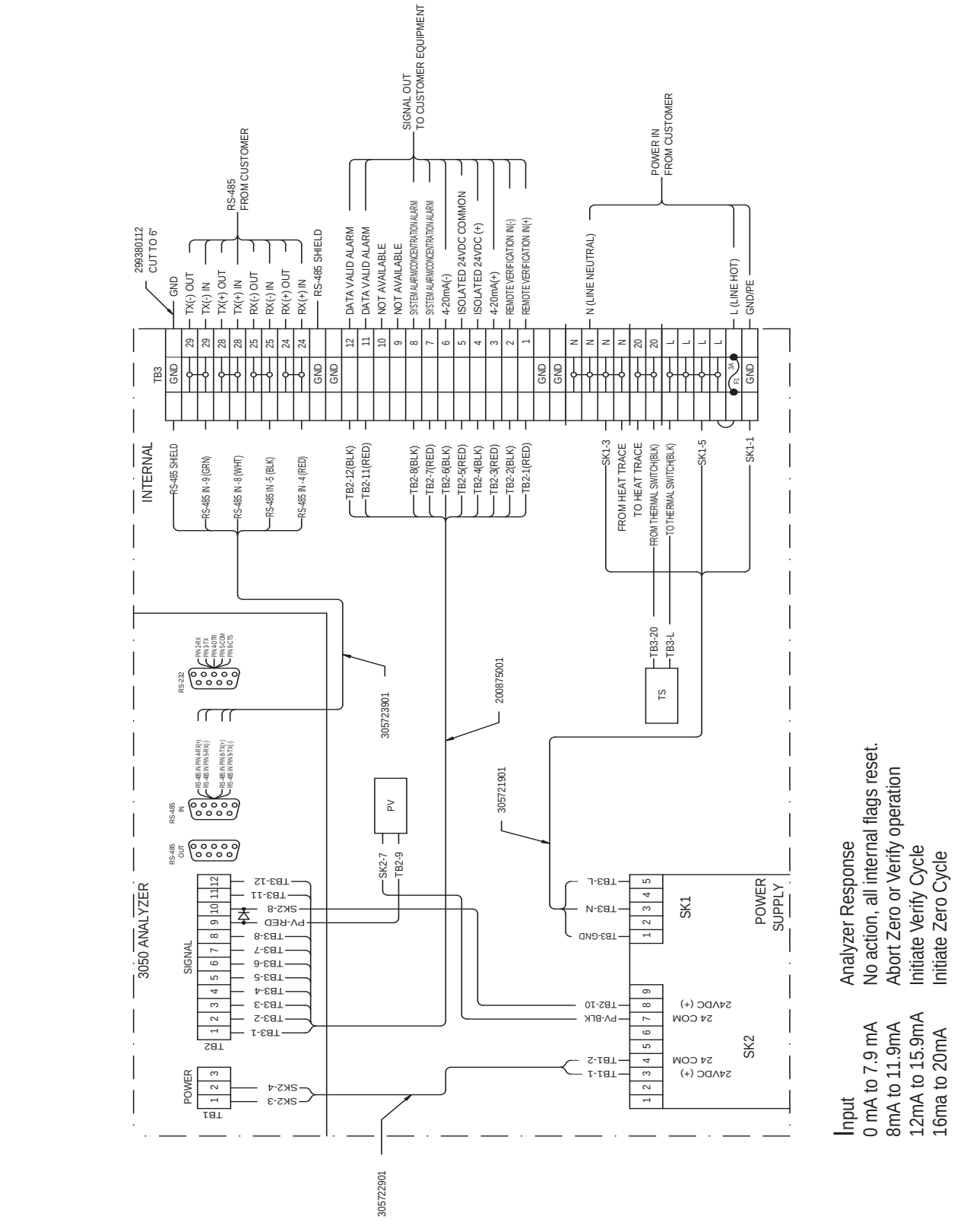
   OR

   RS-485 In - Connect RS-485 in cable to the terminal block.

   RS-485 Out - Termination plug is installed at the factory. Remove the RS-485 termination plug from the RS-485 Out connection when communicating with multiple analyzers except for the last analyzer in a chain.

4. Connect line power to analyzer. Refer to figure 3-7.

5. Connect line power to heated pressure regulator (If purchased). Refer to figure 3-6.

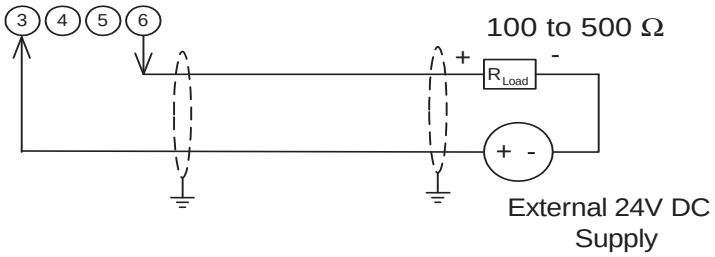


Input	Analyzer Response
0 mA to 7.9 mA	No action, all internal flags reset.
8mA to 11.9mA	Abort Zero or Verify operation
12mA to 15.9mA	Initiate Verify Cycle
16ma to 20mA	Initiate Zero Cycle

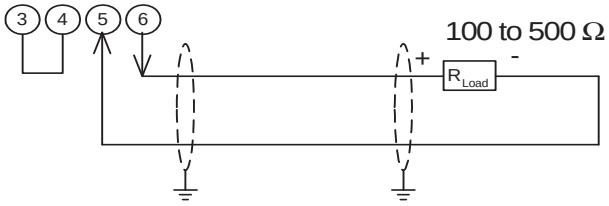
Figure 3-7.
Interconnect Wiring

4-20 mA Output Wiring

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



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



Notes

1. Cable should be shielded with single twisted pair.

2. 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 μF @ 500V capacitor

3. The 3050-OLV 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.

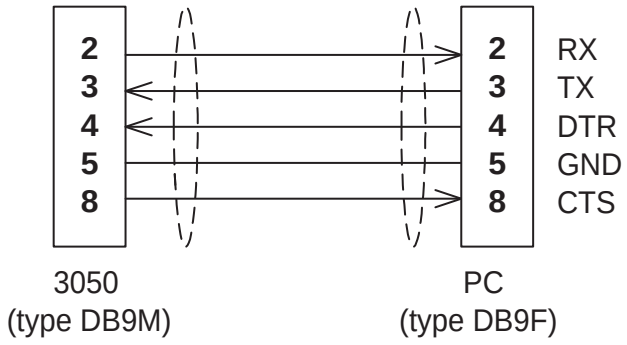
Analyzer power must be removed when connecting or disconnecting the 4-20 mA signal.

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

Figure 3.8: 4-20 mA Output Wiring

RS232 Wiring
(maximum cable length 10m)

9 pin PC connector



25 pin PC connector

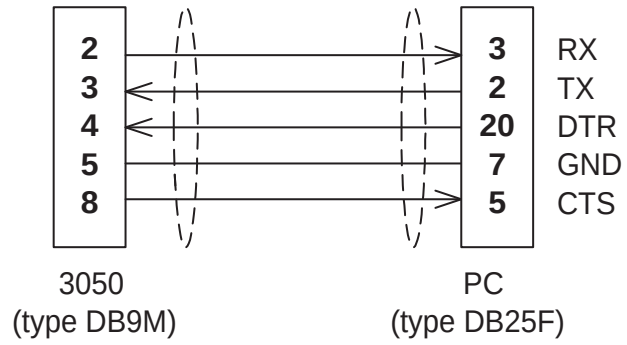
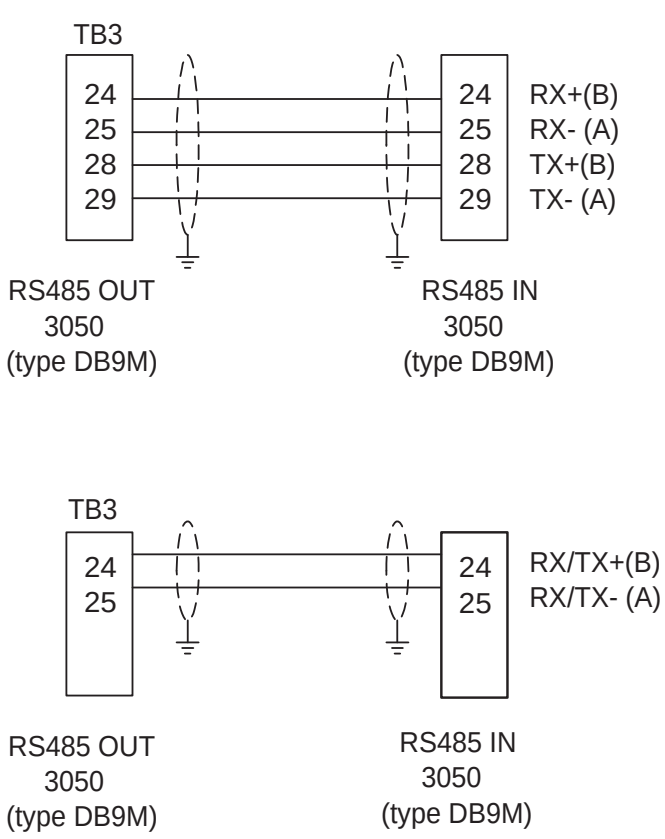


Figure 3-9.
RS-232 Wiring

RS485 Cables, Multiple 3050 Analyzers



Notes

1. Total cable length not to exceed 1000m. 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 two wire applications, Belden 9842 in 4 wire applications.

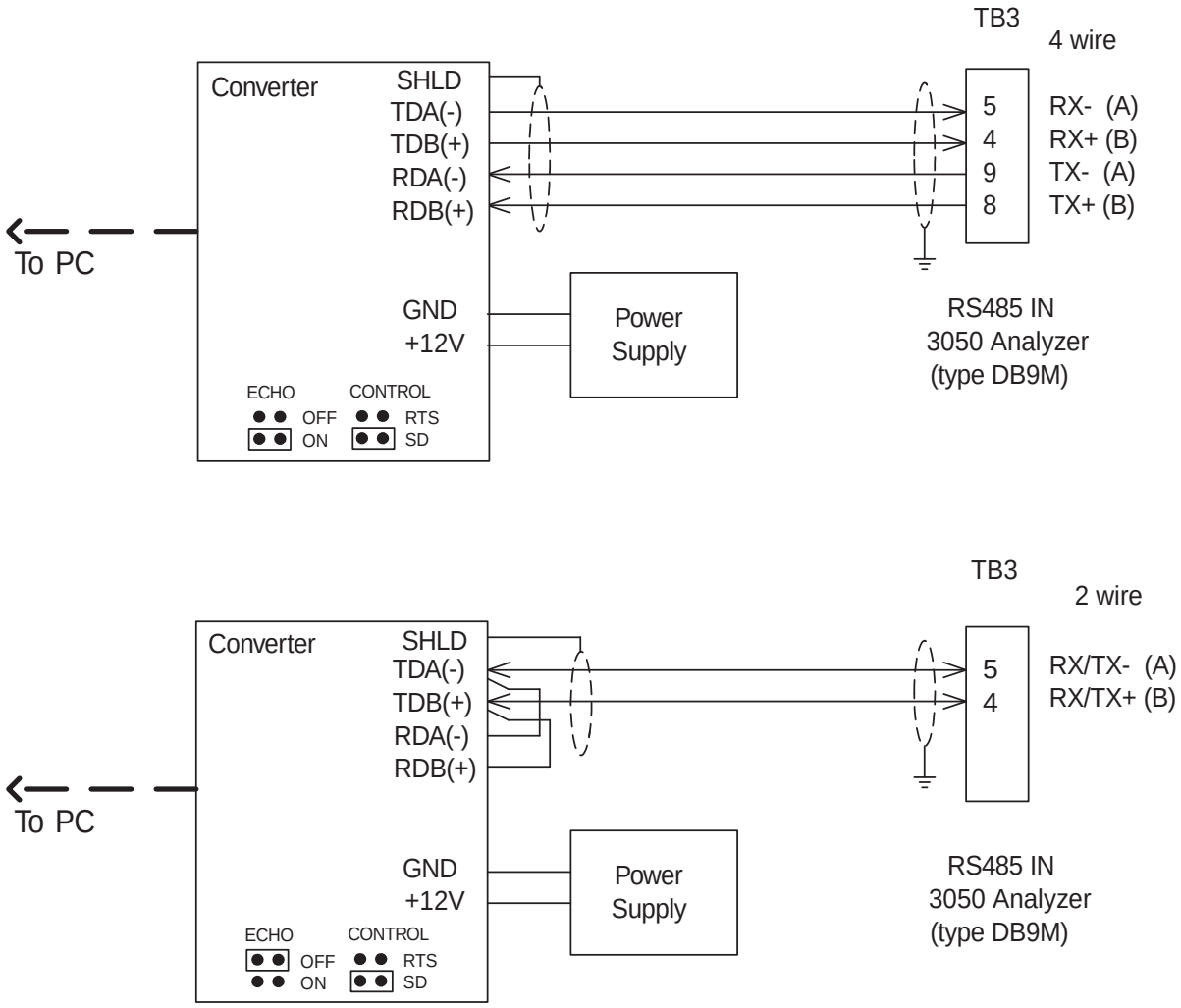
2. Install terminator plug (p/n 305 900 901) in RS485 OUT position of last controller in networks with both single and multiple 3050 analyzers.

3. Cable shields should be tied to TB3-GND at each 3050. If this is not possible (for example, in the case of a ground loop) , tie the shield at the PC or DCS to chassis and all other shields to earth through a 0.1uF @ 500 V capacitor.

4. Adding a jumper between pins 1 and 3 disables software control of the RS4895 mode. With jumper installed, the 3050 will always be in 4 wire mode.

Figure 3-10.
RS-485 Cables,
Multiple 3050's

RS485 to RS232 Conversion for Host PC



Notes:

1. Converter and Power Supply are not suitable for use in hazardous locations.
2. Refer to Chapter 6 for replacement part numbers.

Figure 3-11.
RS-485 to RS-232 Conversion for Host PC

Analyzer Start-up

1. Turn on power source.

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

Dry Down Period

Allow a minimum of two hours for the analyzer to dry down and stabilize. For sample systems, allow a minimum of three 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 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. In the event of a system alarm, the red LED will signal the source of the problem. The red LED will flash on for one second and off for one second with the number of flashes as indicated in Table 3.1. Once a flash sequence has completed, the LED will remain off for five 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.

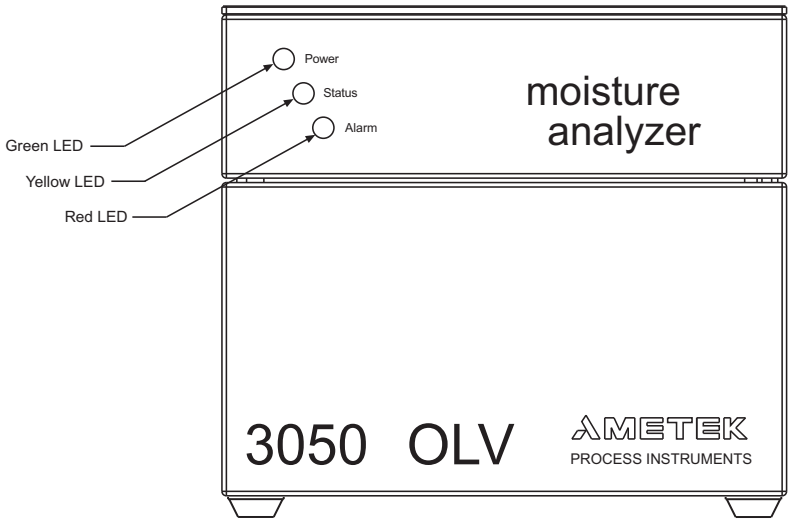


Figure 3.12

Table 3.1 LEDs and Alarms

Alarm Source / LED Flashes per Cycle		Problem	Action
Zero Alarm Problem*	1	Zero parameter is out of range	Replace zero dryer or call AMETEK Service.
Sample Sensor Failure*	2	Sample sensor hardware failure	Replace sensor or call AMETEK Service.
Calibration Failure*	3	Analyzer performance out of tolerance as detected during verification cycle.	Call AMETEK Service.
Oven Temperature*	4	Oven temperature is out of tolerance.	This will occur during start-up until the oven warms up. Call AMETEK Service if problem persists.
Flow Out of Tolerance*	5	Sample flow rate too high or too low	Check inlet and outlet pressure. Call AMETEK Service if problem persists.
Battery Low*	6	Battery needs to be replaced.	Call AMETEK Service.
Reference Gas*	7	Analyzer detected problem with reference gas.	Check and/or replace dryer. Call AMETEK Service if problem persists.
Enclosure Temperature	8	Excessive internal temperature.	External temperature should be 80°C or less. Call AMETEK Service.
Moisture Generator Date	N/A	Moisture generator date has expired.	Replace moisture generator.
Dryer Alarm	10	Dryer failure Imminent	Replace dryer
Concentration Alarm	11	Moisture concentration is out of user defined limits.	Review alarm settings.

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. Red LED flashes 11 times if an invalid condition occurs.

* Indicates System Alarm and Data Invalid Signal

PC INTERFACE

AMETEK 3050 Moisture Configurator Software

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


NOTE

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

Configurator Software Installation

1. Insert the configurator software CD into 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" (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 software is in the **AMETEK** folder.

Configuring the 3050

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

General Tab

Use the **General** tab to view the current configuration and define parameters for the analyzer and for **PC communications** (Figure 4-1).

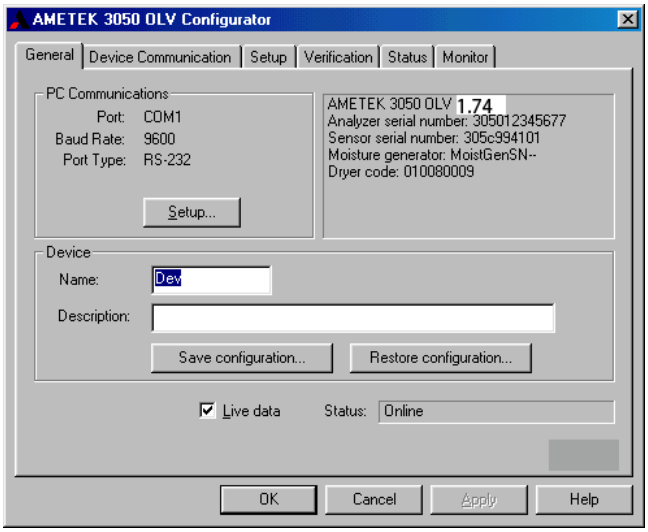


Figure 4-1. General tab Configurator software.

NOTE

*After communication with analyzer is established, any changes to the analyzer communications parameters must be made using the **Device Communications** tab. These changes must be made before you make any changes to the computer serial port settings.*

PC Communications

Click the **Setup** button to configure **PC Communication**s. The **Serial Port Communication** screen opens (Figure 4-2).

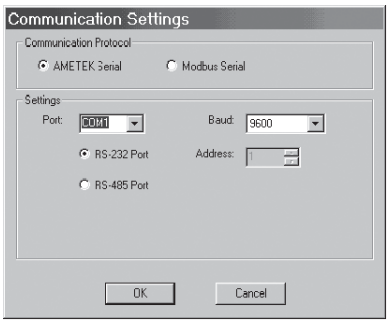


Figure 4-2. PC Serial Communications setup screen.

Communication Protocol
Select AMETEK Serial for inital PC communication setup. Once communications with the analyzer are established, the Modbus serial can be selected if desired.


NOTE

When changing from AMETEK Serial to Modbus Serial, the analyzer communications parameters must be changed before the computer serial port 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 Click if the analyzer is connected to an RS-232 port.

RS-485 Port Click if the analyzer is connected to an RS-485 port.

Address Type the network address to which the analyzer is connected.

Saving Your Settings

To save **PC Communications** settings, click **OK**.
To abort changes you have made, click **Cancel**.

Device

Refer to Figure 4-1.

Name Type in a name for the analyzer.

Description Type in a description for the analyzer.

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

Restore Configuration button
Restore the analyzer's internal parameters from a file. The **Open** dialog box appears so that you can select and open the file.


NOTE

The Restore Configuration button can also be used to restore PC analyzer parameters.

Live Data

Checked The system connects to and uses live data from the analyzer.

Not checked The system uses demonstration data.

Status

Indicates if the analyzer is on-line, off-line, or in demo mode.

On-Line The PC and analyzer are connected and communicating properly.

Off-Line The **Live Data** box is checked on the **General** tab and the connection is broken or off-line.

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.

Serial Numbers

The analyzer name and analyzer software version are displayed on the first line in the upper right-hand corner. The **analyzer serial number** and **sensor serial number**, and the **moisture generator** and **dryer codes** are also displayed.

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

Saving Your Settings

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

To abort changes you have made, click **Cancel**. This will close the Configurator software program.

NOTE

Clicking OK or CANCEL will close the configurator application.

Device Communications Tab

NOTE

*For initial setup of PC communication parameters, use the **Setup** button on the **General** tab.*

Configuring Multiple Analyzers

Use the **Device Communications** tab to set the analyzer's communication parameters to agree with the PC settings when controlling analyzers in a daisy chain.

Changing Communication Parameters

- Change the ANALYZER parameter(s) first.
- Click **Apply** to confirm the change. This may cause the analyzer to go off-line.
- Change the PC settings or physical wires/cables.
- Reset the analyzer by recycling power if needed.

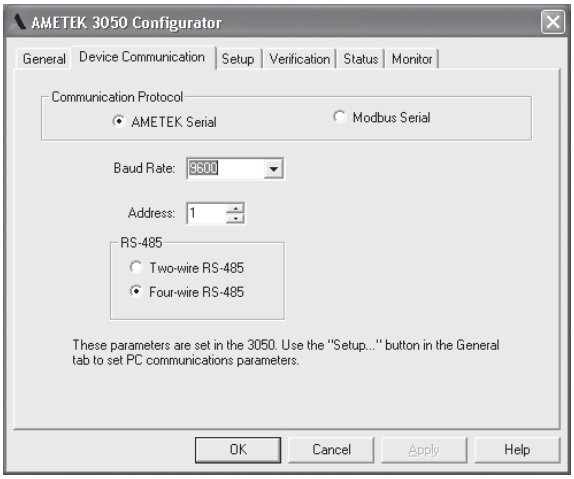


Figure 4-3a. Device Communications setup screen for AMETEK Serial.

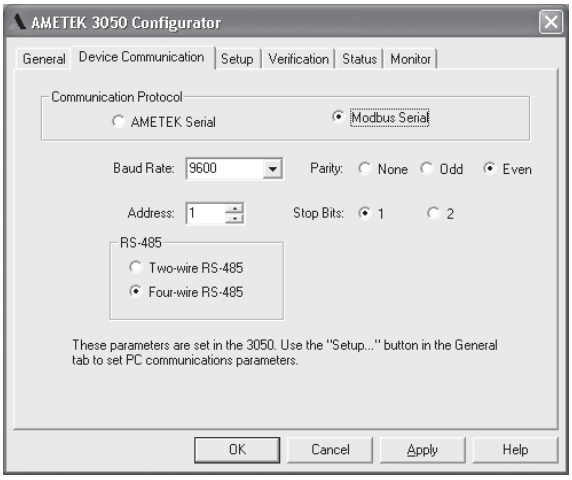


Figure 4-3b. Device Communications setup screen for Modbus

Baud Rate

Select the baud rate at which data will be transferred.

Address

Identifies the analyzer's address. Type the network address for the analyzer being connected.

RS-485

Identifies the analyzer's type of serial communication cable that is being used.

Two-Wire RS-485 Click if you are using a 2-wire cable.
Four-Wire RS-485 Click if you are using a 4-wire cable.

Parity and Stop Bits

For Modbus serial communications select the Parity and Stop Bits parameters for your analyzer. The 3050 analyzer can only operate at the four combinations listed below.

Parity	Stop Bits
Odd	1
Even	1
None	1
None	2

Saving Your Settings

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

To abort changes you have made, click **Cancel**. This will close the Configurator software program.

PC Communications

Once the device communication settings are changed, the **PC Communications** setup screen will automatically open. Select the approciate options that correspond to the communciation setting on the device and press OK .

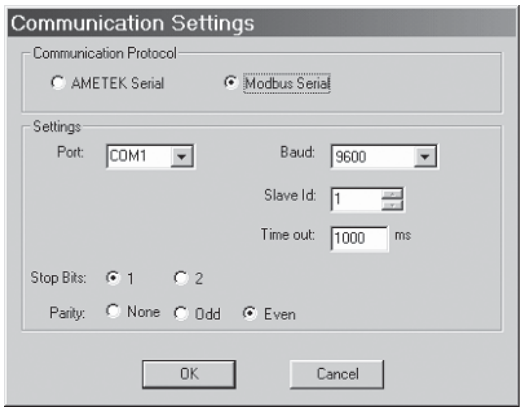


Figure 4-4. PC Serial Communications setup screen for Modbus.

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

NOTE

If communitcation is lost, recycle power on the analyzer and click Setup on the General Tab to change the PC Communications.

Setup Tab

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

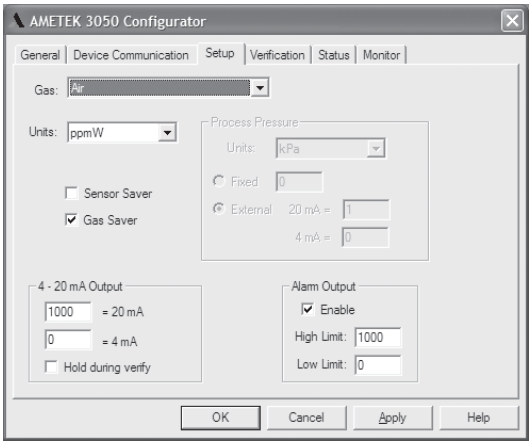


Figure 4-5.
Setup tab.

Gas

Select the gas being sampled.

Units

Select the unit of measurement.

NOTE

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

NOTE

***Dewpoint Temp** - This analyzer cannot be configured to read Dewpoint output. The 4-20 mA inputs are to be used for remote verification only. Refer to Chapter 5.*

Sensor Saver check box

Check this box to enable **Sensor Saver**.

Checked — Analyzer operates with a slow cycle time, maximizing cell life at the expense of system response time.

Not Checked — Analyzer operates with a rapid cycle time, minimizing system response time.

Gas Saver check box

Check this 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 Zero	Check this box to hold analyzer output during verification and Zero.

Alarm Output

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.

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

Verification Tab

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

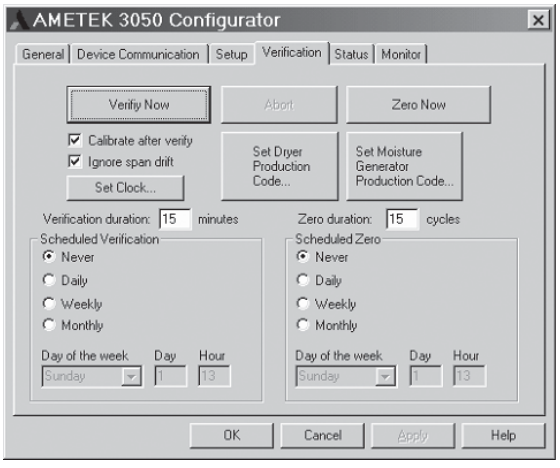


Figure 4-6.
Verification tab.

Verify Now Button
Click to begin verification cycle now.

Abort Button
Click to terminate verification or zero.

Zero Now Button
Click to begin zero cycle now.

Adjust Span After Verfy check box
Checked The analyzer performs an span adjustment at the end of the zero cycle.
Not checked The analyzer verifies only.

Ignore Span Drift check box
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 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 S**ynchronize** to set the time, or click **Cancel** to close the box.

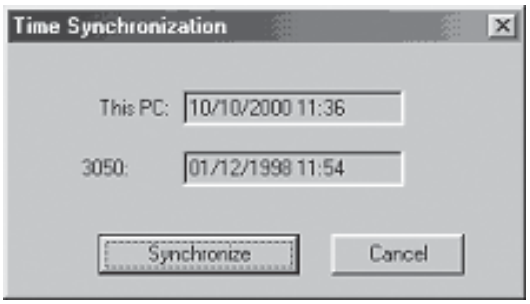


Figure 4-7. Time Synchronization screen.

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.

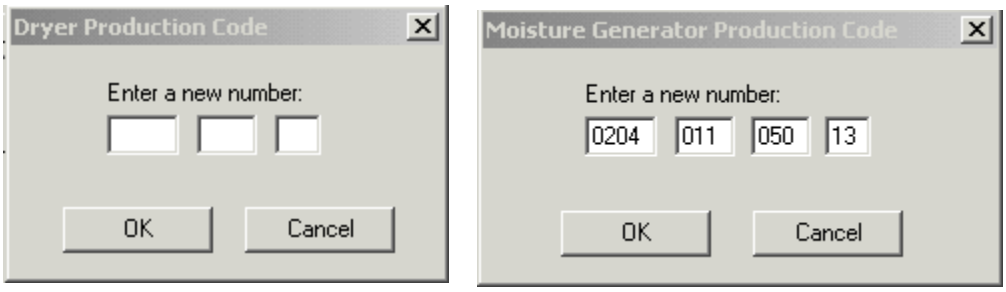


Figure 4-8.
Dryer and Moisture Generator code entry screens.

Set Moisture Generator Production Code

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

Verification Duration

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

Zero Duration

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

Scheduled Verification

Schedule routine verifications by clicking the **Daily**, **Weekly**, or **Monthly** button

Never — No zero cycle will be done. Scheduling slots at the bottom of the box are not available.

Daily — Select the time of day by entering a number in the **Hour** slot at the bottom of the box.

NOTE

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

Weekly — Select the day of the week from the drop-down list under **Day of the week** at the bottom of the box. You must also enter a time of day (1 through 24) in the **Hour** slot to begin the zero cycle.

Monthly — Enter the numeric (1 through 28) day of the month in the **Day** slot, and the time (1 through 24) in the **Hour** slot to begin zero cycle.

Scheduled Zero

Schedule routine Zeros by clicking the **Daily**, **Weekly**, or **Monthly** button

Never — No zero cycle will be done. Scheduling slots at the bottom of the box are not available.

Daily — Select the time of day by entering a number in the **Hour** slot at the bottom of the box.

NOTE

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

Weekly — Select the day of the week from the drop-down list under **Day of the week** at the bottom of the box. You must also enter a time of day (1 through 24) in the **Hour** slot to begin the zero cycle.

Monthly — Enter the numeric (1 through 28) day of the month in the **Day** slot, and the time (1 through 24) in the **Hour** slot to begin zero cycle.

Saving Your Settings

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

To abort changes you have made, click **Cancel**. This will close the Configurator software program.

Status Tab

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

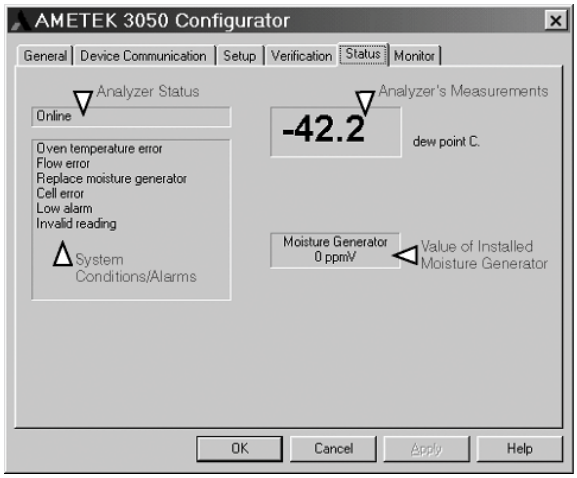


Figure 4-9. Status tab.

Monitor Tab

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

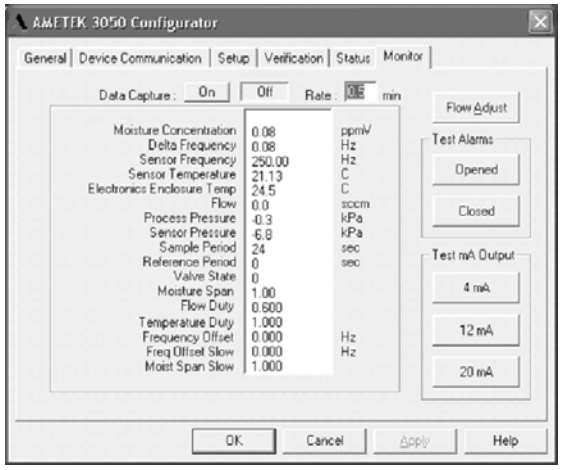


Figure 4-10a.
Monitor tab.

NOTE

Using the test buttons takes the analyzer offline.

Data Capture

The data capture feature allows the user to collect and save analyzer data displayed on the Monitor screen to an Excel compatible file.

On — Press the ON button to start data collection. Specify the file name in the "Save As" dialog and press "Save" button. The file format is ".csv" which is Excel compatible. All data displayed on the Monitor page will be stored in the specified file.

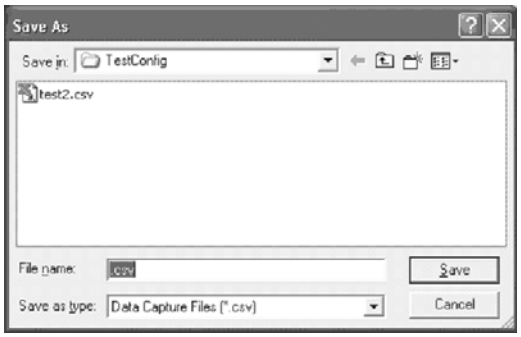


Figure 4-10a.
Monitor tab - save as.

Off — Data collection will terminate and the file will close whenthe Off button is pressed or another configurator tab is selected.

Rate — The preferred data collection rate is "0.5" minutes and is set as the default. A record is created every 30 seconds. The collection rate can be increased to one minute or more.

Flow Adjust

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

Gas Factor
Check Gas Factor if you run gas mixtures.

Flow Meter Span
Check Flow meter Span if you run pure gases.

Flow Meter Reading
To calibrate the internal flow meter:

1. Run a sample into the sample intake of the analyzer.
2. Connect the flow meter to the exhaust line of the analyzer.
3. Turn on the analyzer and wait for the analyzer to control the oven temperature at around 60 degrees Celsius.
4. Then click on the **Flow Adjust** button from the **Monitor** tab.

Wait a few minutes for the analyzer to control the flow. After a few minutes, the text field labeled External will unlock as shown in Figure 3-11a..

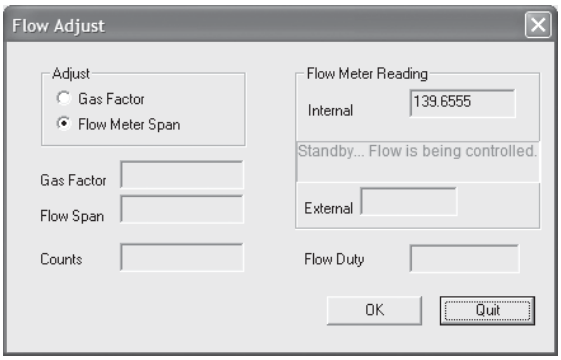


Figure 4-11a.
Flow Adjust Screen.

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

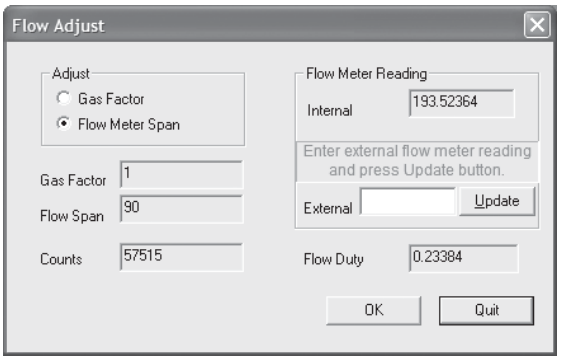


Figure 4-11b.
Flow Adjust Screen.

Test Alarms

The Test Alarms push 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 2.7 for location of contacts on analyzer.

- Opened contacts should read infinity.
- Closed contacts should read zero.

Test mA Output

The Test mA Output push buttons allow you to test the analog outputs. Use a meter to test output. Refer to figure 2.8 of for wiring.

To discontinue test mode, press another tab. Test mode will automatically time out after 10 minutes of inactivity.

NOTE

When the analyzer switches from test mode to online, the analyzer resets itself.

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REMOTE VERIFICATION

The analyzer can be commanded to initiate Zero and Verify functions remotely via a 4-20 milliamp input into terminals 1 (+) and 2 (-) of TB3 (See Figure 3.7). The table below describes the analyzer response to a current input.

Input	**Analyzer Response**
0 mA to 7.9 mA	No action, all internal flags reset.
8mA to 11.9mA	Abort Zero or Verify operation
12mA to 15.9mA	Initiate Verify Cycle
16ma to 20mA	Initiate Zero Cycle

A current level should be **maintained for a minimum of 2 seconds** for the analyzer to accept the command.

Once a command has been accepted, the current input must drop below 8 milliamps before a subsequent command will be accepted.

For example, with an input level of 4 milliamps, a remote DCS raises the input to 14 milliamps for 2 seconds. The analyzer will initiate a Verify Cycle. To abort the cycle, the input must first be lowered to less than 8 milliamps for two seconds, then increased to 10 milliamps for two seconds. Finally the input should again be dropped to less than 8 milliamps to reset all internal flags before another remote command is accepted.

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REPLACEMENT PARTS

Table 1 lists the replacement parts available for the Model 3050 Moisture Analyzer. Please contact the AMETEK Sales office (800-222-6789) for pricing and ordering information.

Table 6.1: Model 3050 Replacement Parts

Part Description	AMETEK Part Number
Moisture Generator, 1 ppm (nominal)*	305540901S
Sensor Assembly *	305122901S
Sour Natural Gas Sensor Assembly	305122902S
Dryer *	305400901S
Dryer Zero Module	305580901S
User Manual	305725901
MCU Board	305110902S
Interface Board	305113901S
Sample, Bypass, Reference, and Verify Capillary	305431901S
RS-485 to RS-232 Converter	265858005
RS Converter Power Supply, Universal	269128002
RS-485 to RS-232 Self-powered Converter	590858901
RS-485 Termination Plug	305900901
Sample System 24 Volt DC Power Supply	230539001
Fuse, 3.15A	280750251
Fuse, 0.125A, 250V	280750238
Flow Meter	305449901S
7 Micron Filter, inline 1/8 inch tube	271639001

* Recommended Stock Spare Parts

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GLOSSARY OF TERMS

Annunciator Display	A graphical representation of a panel annunciator on which alarm status of 3050 results are displayed.
Address	A decimal number that must be assigned to a Model 3050, when the host PC is communicating with multiple Model 3050 Moisture Analyzers.
Alarm Output	Relay contact, which opens to indicate a concentration alarm. The alarm set points can be changed via the configurator software.
Appropriate Vent System	Gas manifold designed to transport the gas exhausted from the analyzer to a safe disposal.
Baud Rate	The rate, in bits per second, at which serial communications take place between the 3050 analyzer and the host PC.
Configuration	A set of operating parameters that has been set up using the configurator software for control of a single Model 3050 Moisture Analyzer.
Configurator Software	A Windows-based graphical user interface that provides a means for communicating with a single Model 3050 Moisture Analyzer.
Contaminates	Liquids, solids, or gases that cause deterioration of system performance.
Contaminate Trap	A small packed column designed to remove glycols and other contaminates that may degrade the performance of the QCM sensor.
Custom Display	A display mode in which any combination of Trend, Tabular, Meter or Annunciator displays may be combined and stored as a display configuration under a unique file name. The display configuration may be assigned to one of three buttons on the main tool bar, for instantaneous activation of

	the custom display mode.
Data Valid	Relay contact, which opens to indicate a verification is in process or an alarm condition. The data valid contact opens on all alarms and stays closed during normal functions and readings.
Device	A single 3050 Moisture Analyzer, or an addressable I/O device, such as an Optomux module.
Display Mode	One of five different means of displaying 3050 results on-screen.
EEPROM	Electrical Erasable Programmable Read Only Memory
Four-Wire Mode	RS-485 communication mode, in which four wires are used, connected to the "Send Data" and "Receive Data" terminals. Bi-directional communications may take place simultaneously using four-wire mode.
Gas Saver	A mode in which gas normally flowing in a bypass leg, internal to the Model 3050, is shut off. This reduces consumption of expensive gases, however analyzer response time may be somewhat degraded.
H_2S Treated Sensor	A moisture sensor that has been specially treated for use in sample streams containing high levels of hydrogen sulfide.
LED	Light Emitting Diode
Lbs/mmscf	Pounds per million standard cubic feet (101.3 Kpa, 15.6°C)
Loop Powered	Refers to powering the 4-20 mA analog output from an external power supply. The analog outputs on the 3050 can be powered from either the loop or the analyzer.
mA	Milliamp
mg/Nm^3	Milligrams per normal cubic meter
Meter Display	A graphical representation of a vertical panel meter, on which 3050 analyzer results are displayed.
Moisture Generator	A device capable of generating a known precise moisture level, which is installed in a Model 3050 and used for verification of the analyzer's proper operation.
PC	Personal computer

Port	The specific COM (serial) port of a host PC that will be used for RS-232 serial communication with a Model 3050.
ppmv	Parts per million by volume
ppmw	Parts per million by weight
Process Pressure	The pressure of the process gas, expressed in one of various possible units. Only required when engineering units of "dewpoint" are selected. The pressure may be entered as a fixed value, or as an input to the 3050 from a pressure transmitter with a 4-20mA output, with specified scaling.
Resonance Frequency	The frequency at which the QCM operates.
RS-232	A serial communication protocol, in which the RS-232 serial output of a Model 3050 Analyzer may be directly connected to one of the COM ports of a personal computer (PC). Distance between the analyzer and the PC is limited to a maximum of 10 meters.
RS-485	A serial communication protocol, in which the RS-485 serial output of a Model 3050 analyzer may be input to a converter, which converts it to RS-232 protocol, then input to one of the COM ports of a PC. Alternatively, RS-485 may be run directly into a PC with an RS-485 interface board installed. RS-485 may be run in either 2-wire mode, or 4-wire mode, over distances up to 1000 meters between the analyzer and the PC or converter.
Sample	Gas that is being measured for moisture content.
SCCM	Standard cubic centimeters per minute (101.3 Kpa, 0°C)
Sensor Frequency	Signal frequency produced by the QCM module. This frequency is a function of moisture content of the sample gas.
Sensor Saver	A mode in which the analyzer timing is configured such that the reference gas is flowing for a greater portion of time than the sample gas. This helps to prolong the life of the QCM sensor.
SLPM	Standard liters per minute (101.3 Kpa, 0°C)
Span Adjustment	The adjustment of the analyzers response to match the target value of the moisture generator. This adjustment is normally performed after the verification cycle.

System Alarm	The analyzer operating condition which requires prompt user attention.
Tabular Display	A table, on which results from one or more 3050 analyzers are displayed in real-time.
Trend Display	A line plot of 3050 analyzer results with respect to time.
Two-Wire Mode	RS-485 communication mode, in which only two wires are used, connected to the “Send Data” and “Receive Data” terminals. Simultaneous bi-directional communications are not possible using two-wire mode.
Units	Specific engineering units in which the Model 3050 moisture results are represented. Examples are ppmv, ppmw, etc..
Verification	A check of the accuracy of the Model 3050’s results, by reference to an internally installed moisture standard. A verification cycle may be initiated manually, or at scheduled intervals. The analyzer’s calibration factors may be automatically adjusted if the “Calibrate after verify” box is checked.

MODBUS COMMUNICATION INTERFACE

OVERVIEW

This document describes the customer serial communication interface on Model 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 AMETEK 3050 analyzer supports both RS485 and RS232 serial communication standards.

The physical communication connection between a Model 3050 analyzer and a customer DCS\SCADA\PLC\DAS or a general-purpose computer is RS485 or RS232. The analyzer RS485 connection supports both 4-wire and 2-wire multi-drop systems. The RS232 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 program, which supplied with the 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.

Serial mode variable could be set as follows:

VALUE	RS-485	Protocol
0	2-Wire	ASCII
1	4-Wire	ASCII
2	2-Wire	MODBUS
3	4-Wire	MODBUS

The SerialMode parameter is set to 1 by default.

The SerialMode parameter change will not disturb the present serial communication link. Power should be recycled 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 RS485 multi-drop communication system with the Model 3050 analyzer, 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 to 247 with 0 interpreted as a broadcast address (Meaning 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 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, 1 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 recycled 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
3	1	Odd

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 Model 3050 analyzer. Only the following relevant function codes are implemented:

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

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 0.

EXCEPTION CODE

The Model 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 Model 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 in the following table.

TABLE A-1

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)	sec	1	r
18	Sample period counter (SamplePer= 6A Hex)	sec	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 cycles counter (CalcCycleCount= 6F Hex)	min	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

TABLE A-1 cont.

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)	sec	1	r,w
34	Sensor assembly setting (SmplPeriod= 05 Hex)	sec	1	r,w
35	Sensor temperature coefficient (CellTempSpan = 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 (MaOutOffset= 0F Hex)	-	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

TABLE A-1 cont.

REG	DEFINITION	UNITS	SCALING	ACCESS
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
62	Heater control parameter (uMinLoop2= 23 Hex	-	1	r,w
63	Gas based coefficient (PpmW= 24 Hex)	-	1000	r,w
64	Flow control parameter (TempLoopDelay= 29 Hex)	sec	1	r,w
65	Unit of measurement selection (MoistureUnits= 2B Hex)	-	1	r,w
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)	min	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

TABLE A-1 cont.

REG	DEFINITION	UNITS	SCALING	ACCESS
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)	min	1	r,w
91	Current second (Second= 59 Hex)	sec	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)	min	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	-	-	-
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

TABLE A-1 cont.

REG	DEFINITION	UNITS	SCALING	ACCESS
113-114	Converts input counts to voltage (AD16Span= 00 Hex)	-	float	r
115-116	Dew point temperature conversion coefficient (DewCoeff0= 14 Hex)	-	float	r
117-118	Dew point temperature conversion coefficient (DewCoeff1= 15 Hex)	-	float	r
119-120	Dew point temperature conversion coefficient (DewCoeff2= 42 Hex)	-	float	r
121-122	Dew point 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

TABLE A-1 cont.

REG	DEFINITION	UNITS	SCALING	ACCESS
183-189	Analyzer serial number (SerialNumber= 44 Hex)	-	string	r,w
190-196	Sensor serial number (CellSerialNumber= 45 Hex)	-	string	r
197-203	Moisture generator serial number (MoistureGeneratorSN= 46 Hex)	-	string	r,w
204-209	Current date string (Date= 5D Hex)	-	string	r,w
210-212	Current time string (Time= 5E Hex)	-	string	r,w
213-220	Analyzer model name (ModelName= 77 Hex)	-	string	r
221-225	Dryer production code (DryerDateCode= 79 Hex)	-	string	r,w
226-228	Reserved	-	string	
229	Hi Span Limit (HiSpanLimit= 94 Hex)	-	100	r,w
230	Low Span Limit (LowSpanLimit= 95 Hex)	-	100	r,w
231	EquilCal (EquilCal = 7D Hex)	-	1	r,w
232	(EquilZero = 7E HEquilZero ex)	-	1	r,w
233	ZeroDurationLimit (ZeroDurationLimit = 7F)	-	1	r,w
234	ZeroCycleCount (ZeroCycleCount = 80)	-	1	r,w
235	ZeroHour (ZeroHour = 81)	-	1	r,w
236	ZeroPeriod (ZeroPeriod = 82)	-	1	r,w
237	ZeroMonthDays (ZeroMonthDays = 83)	-	1	r,w

Table A-1 Continued

REG	DEFINITION	UNITS	SCALING	ACCESS
238	ZeroWeekDays (ZeroWeekDays = 84)	-	1	r,w
239	ZeroType (ZeroType = 85)	-	1	r,w
240	MaxZeroError (MaxZeroError = 86)	hz	100	r,w
241	MaxZeroDrift (MaxZeroDrift = 87)	hz	100	r,w
242	MoistureSpanSlow (MoistureSpanSlow = 88)	-	1000	r,w
243	FreqOffsetSlow (FreqOffsetSlow = 89)	-	1000	r,w

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 cycle. 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 synchronise 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: The value of SystemState is 12612 which is the same as 3144 hexadecimal number. Corresponding alarms started from the list significant bit are: Invalid Reading, Calibration Failure, Flow Alarm, Moisture Generator Date and Dryer Alarm.

Register #25 is a ModbusCommand register. This register allows sending special commands to the 3050 analyzer as shown in the table below.

ALARM NAME	System State Bit	Number of blinks	Comment
Memory Failure	Bit 4	1	System Alarm
Sensor Failure	Bit 5	2	Frequency&Sensor Access
Calibration Failure	Bit 6	3	Span Out of Limit
Oven Temperature Out	Bit 7	4	Temperature Out of Limit
Flow Out of Range	Bit 8	5	System Alarm
Battery Low	Bit 9	6	BatteryState
Reference Gas Alarm	Bit 10 Warnings	7	Set if Delta Freq < -0.3Hz
Enclosure Temperature	Bit 11	8	Temp > 70 degrees C
Moisture Generator Date	Bit 12	N/A	Good for 2 years
Dryer Alarm	Bit 13	10	Exceeding PPM Hours
Concentration Alarm	Bit0 – Bit1	11	Concentration out of range
Invalid Reading	Bit2	11	Verification or System Alarm
Process pressure	Bit3	11	Process pressure out of limits

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. 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 0 indicates the end of the ASCII string.

VALUE	COMMAND DESCRIPTION
71	Start Verification Cycle
76	Load Sensor Memory
81	Quit Verification Cycle
82	Reset Analyzer
84	Start/Stop Test Mode
90	Start Zero Cycle

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 Model 3050 analyzer
1 byte Run Status	= FFh for Analyzer on Line (invalid signal = 0)
	= 00h for Analyzer off Line (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

In this section, configuring the analyser with the MODBUS is discussed. The 3050 analyzer shipped ready to communicate via MODBUS using the serial communications port. While the 3050 analyzer can be completely configured using the MODBUS connection, AMETEK recommends the use of the 3050 Configurator software for configuring the analyser. 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, which is discussed in the next section.

All of the configuration parameters of the analyser 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.
Enable Alarm Output. Device address is 2.

ACTION.
Write one holding register (function 06). Register address = 102 (holding register #40103). Value = 1(1-enable, 0-disable).

MODBUS transaction:

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
RegisterValue Hi	=00Hex
Register Value Lo	=01Hex
CRC Hi	
CRC Lo	

Example 2: Setting the High-Alarm Limit:

TASK.
Set the analyser to produce a “high-concentration” alarm, when the moisture concentration exceeds 1000 ppm.

ACTION.
Write one holding register (function 06). Register address = 66 (holding register #40067). Value = 1000.

Example 3: Setting the Low-Alarm Limit:

TASK.
Set the analyser to produce a “low-concentration” alarm, when the moisture concentration falls below 0 ppm .

ACTION.
Write one holding register (function 06). Register address = 67 (holding register #40068). Value = 0.

Example 4: Enabling “Hold During Verify”:

TASK.
Enable hold the analog outputs at the last measured value, when the analyser is off-line to perform a verification cycle.

ACTION.

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.
Setup the analog output so that a moisture concentration of 100 ppm produces a 20 ma current output.

ACTION.
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.
Setup the analog output so that a moisture concentration of 1ppm produces a 4 ma current output.

ACTION.
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.
Set the analyser to operate in the sensor-saver mode.

ACTION.
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.
Set the analyser 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, dew point C = 4, dew point 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.
Set the analyser 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 Dew Point 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.
Set the analyser to automatically trigger a verification cycle. For this example, the analyser will be set to perform a verification cycle on the 3rd 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 12.
Write one holding register (function 06). Register address = 77 (holding register #40078) value =0CHex.

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