

Sensor for Oxygen

## Manning EC-F3-O<sub>2</sub> Instruction and Installation Manual

07/09

**Honeywell Confidential & Proprietary**

This work contains valuable, confidential, and proprietary information. Disclosure, use or reproduction outside of Honeywell Inc. is prohibited except as authorized in writing. This unpublished work is protected by the laws of the United States and other countries.

# Notices and Trademarks

---

**Copyright 2009 by Honeywell International Inc.**

**Release D July 2009**

While this information is presented in good faith and believed to be accurate, Honeywell disclaims the implied warranties of merchantability and fitness for a particular purpose and makes no express warranties except as may be stated in its written agreement with and for its customers.

In no event is Honeywell liable to anyone for any indirect, special or consequential damages. The information and specifications in this document are subject to change without notice.

Manning is a registered trademark of Honeywell International Inc.

Other brand or product names are trademarks of their respective owners.

Honeywell Analytics  
405 Barclay Blvd.  
Lincolnshire, IL 60069  
USA

1-800-538-0363

# About This Document

---

## World Wide Web

The following Honeywell web sites may be of interest.

Honeywell Organization	WWW Address (URL)
Corporate	<a href="http://www.honeywell.com">www.honeywell.com</a>
Honeywell Analytics	<a href="http://www.honeywellanalytics.com">www.honeywellanalytics.com</a>
Manning Gas Detection	<a href="http://www.manningsystems.com">www.manningsystems.com</a>

## Telephone

Contact us by telephone at the numbers listed below.

Organization		Phone Number
United States	Honeywell Analytics Inc.	1-800-538-0363 1-913-712-5576 1-913-712-5580 Fax
Canada	Honeywell Analytics Inc.	1-888-749-8878
Europe	Honeywell PACE	+44 (0)1202 676161
Asia Pacific	Honeywell Asia Pacific Inc.	+82 (0)2 2025 0307
Middle East	Honeywell Analytics Inc.	+971 4 3458 338





## Sales Information

Contact us at [detectgas@honeywell.com](mailto:detectgas@honeywell.com)

# Symbol Definitions

---

The following table lists those symbols used in this document to denote certain conditions.

Symbol	Definition
	<b>ATTENTION:</b> Identifies information that requires special consideration.
	<b>TIP:</b> Identifies advise or hints for the user, often in terms of performing a task.
	<b>REFERENCE-EXTERNAL:</b> Identifies an additional source of information outside of this bookset.
	<b>REFERENCE-INTERNAL:</b> Identifies an additional source of information within this bookset.

# Contents

Serial number:

---

Section	Title	Page
1	System Description	3
2	Installation	4
3	Operation	6
4	Limited Warranty	11

## Introduction

---

This manual has been prepared to help in the use and installation of the Manning EC-F3-O<sub>2</sub> Electrochemical-Oxygen Sensor. This manual will convey the operating principles of the sensor, ensure proper installation, and demonstrate start-up and routine maintenance procedures for the sensor.



**ATTENTION: This manual must be carefully followed by all individuals who have or will have the responsibility for using or servicing the sensor.** Warranties made by Honeywell Analytics with respect to this equipment will be voided if the equipment is not used and serviced in accordance with the instructions in this manual. If in doubt about a procedure, please contact Honeywell Analytics before proceeding.

# 1 System Description

---

The Manning EC-F3-O<sub>2</sub> Sensor is a three-wire, 4/20 mA sensor for oxygen available in ranges of 0-25% and 15-25%. The 15-25% range is designed for optimum resolution in oxygen depletion applications where typical warning and alarm levels are 19.5% and 18.0%, respectively.

The unit exhibits excellent accuracy and precision, with negligible response to common interference gases and dramatic changes in relative humidity. Reliable trip levels at 19.5% can be expected with the sensor. The unit exhibits extremely high reliability with no moving parts.

In oxygen depletion alarm applications the sensor is actively measuring the expected clean air concentration of 20.9% oxygen. A sensor failure will generally result in a reduced output, hence an alarm condition will be reported. When monitored by the Manning GM-1, GM-JR, GM-4, GM-10 or other appropriately configured alarm system, the result is a highly reliable system that ensures protection.

Monitoring equipment must be configured to indicate a fault if the signal is less than 1.5 mA.

Sensors are normally long-lived (over 5 years), unless physically damaged or wetted with water or other liquid.

## System Specifications

---

**Electrical Power:** 24 Volts DC regulated, 30 mA. If ATMOS equipped®, up to 500 mA @ 24 VDC.

**Output:** Linear 4/20 mA output into a load resistor of 250 ohm maximum

**Cable Recommendation:** Three-conductor, #18 AWG, stranded, shielded cable with drain wire all enclosed in a vinyl jacket (Belden #8770 or equivalent)

**Cable Length to Sensor:** 1,500 feet maximum

**Unit Enclosure:** NEMA 1, gasketed, 16-gauge steel. Special enclosures available for NEMA 4, low temperatures, ventilation ducts, washdown areas, etc.

**NOTE: The standard Manning EC is for use in non-classified areas only.**

## Sensor Specifications

---

**Type:** Oxygen-selective electrochemical gas sensor/ transmitter EC-F3-O<sub>2</sub>

**Method of Detection:** Electrochemical

**Ranges Available:**

0–25%

15–25%

**Accuracy:** ± 2% of full scale

**Humidity:** 5-95% RH (non-condensing).  
Modifications are available for more severe conditions.

**Operating Ambient Temperature Range:** –15° F to +120° F

**Storage Temperature:** +15° F to +120° F

**Gas Sampling:** Diffusion

**Weight:** 3 lbs.

**Dimensions:** 8" high x 6" wide x 3.5" deep

# 2 Installation

## A Locating the Manning EC-F3 Sensor



Because each sensor is a point measurement, **it is very important that the sensor be located properly.**

One of the most important considerations when installing EC sensors is that they must be easily accessible for calibration and maintenance.

If the primary application is **personnel protection** (representative concentration reading that an employee would be exposed to), mount the sensor at a height in the breathing zone of the employees. It would typically be about five feet off the ground, which also allows easy access.

No matter where the sensor is mounted, it must be easily accessible.

### General Mounting Considerations:

- Must be easily accessible for calibration and maintenance.
- Always mount the sensor vertically.
- Mount the sensor close to the potential leak source.
- If personnel protection is the primary application, mount in the “breathing zone.”
- Protect sensor from water, excessive humidity, and wash-down.
- Take air movement and ventilation patterns into account.
- To prevent electrical interference, keep sensor and wire runs away from mercury vapor lights, variable speed drives, and radio repeaters.
- Protect sensor from physical damage (fork lifts, etc.).
- Do not mount the sensor over a door in a refrigerated area.
- If mounting sensor outdoors, consider prevailing wind direction and proximity to the most likely source of leaks. Protect the sensor from sun and rain as much as possible.

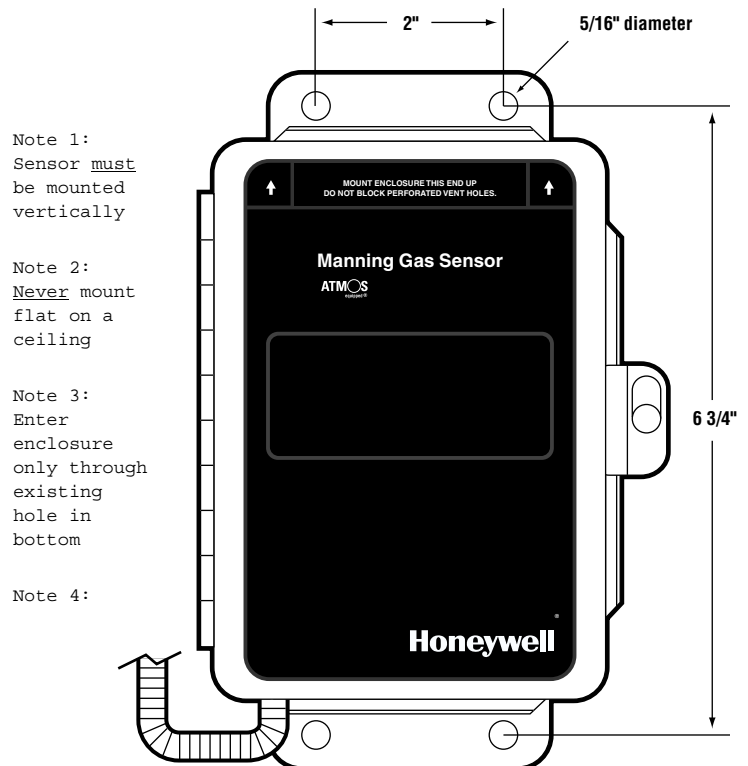
- For highly critical locations more than one sensor should be installed in each room.
- An additional sensor to monitor the gas causing oxygen displacement should be considered for the highest level of safety.

**Engine Rooms:** The Manning EC sensor should be mounted in a cool part of the room, if possible. Keep the sensor away from hot air exhausting from electric motors or other machinery. Usually the best location is four or five feet above the floor in a location where the room exhaust fan will move air across the sensor from the potential leak source.

**Vehicles:** If the unit is mounted in a vehicle be sure to shock-mount the unit to isolate it from vibration.

**Other Locations:** When mounting EC sensors in locations such as duct-work, attic spaces, makeup air intakes, etc., contact Honeywell Analytics for application assistance and recommendations. Figure 1 presents mounting dimensions for the Manning EC-F3 Sensor.

Figure 1: Mounting dimensions for the Manning EC Sensor



# 2 Installation continued

## B Wiring

Figure 2 presents wiring information for the Manning EC-F3-O<sub>2</sub> sensor.

Electrical wiring must comply with all applicable codes. Plant equipment that may be involved and operating conditions should be discussed with local operating personnel to determine if any special needs should be taken into account.

Almost all start-up problems are due to improper wiring or monitor configuration. Please follow these guidelines carefully.

Always use three conductor, insulated, stranded, shielded copper cable. Use only three conductor cable, not two cables of two conductor wire.

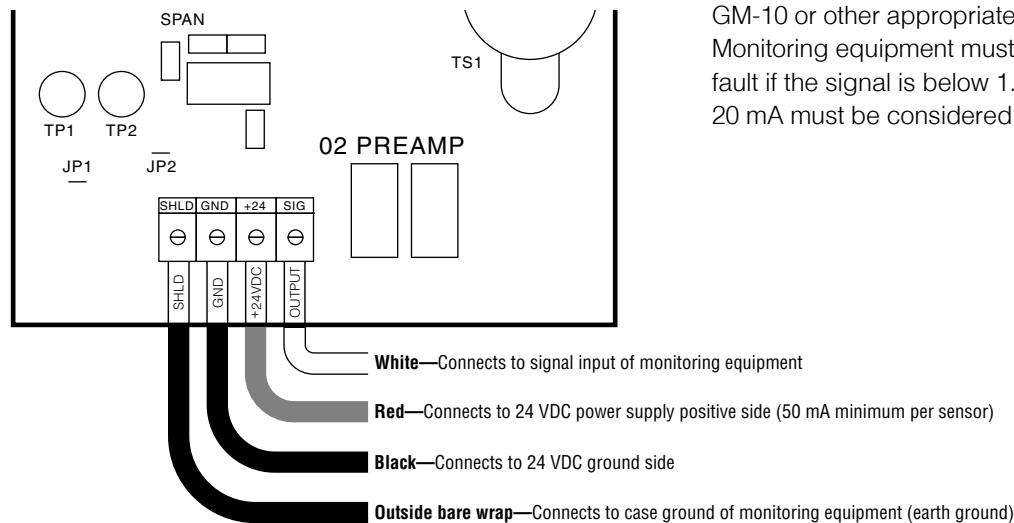


### Do not pull sensor wiring with AC power cables.

This will cause electrical interference. Be sure there are no breaks or splices in sensor wiring runs. If cable runs cannot be made without a splice, all connections must be soldered. Soldering should be done using a rosin flux to tie the connecting ends of sensor wires to ensure a positive and long-lasting contact.

Ground the shield at the main control panel. Connect the shield wire in the sensor terminal block labeled *SHLD*.

**Figure 2: Wiring diagram for the Manning EC Sensor**



Tape all exposed shield wire at the sensor to insulate it from the enclosure.

All penetrations into a refrigerated room should be sealed to prevent condensate from forming in the conduit and dripping into the sensor enclosure. Silicone should not be used near the sensor, because silicone can damage the sensor.

Make drip loops for cables going into sensor housings. When using ATMOS equipped<sup>®</sup> enclosures, follow the special mounting instructions on the enclosure (...*This End Up*).

Mount sensor enclosures through the flange holes as shown in Figure 1, and always mount vertically.

**Electrical Power:** 24 VDC regulated, 30 mA. When sensor is ATMOS equipped<sup>®</sup>, the current draw is 500 mA max.

**Output:** Circuit board mounted sensor provides a linear 4/20 mA output. Monitoring equipment may have a maximum input impedance of 250 ohms.

**Cable Recommendation:** #18/3 shielded cable (Belden #8770 or equivalent). Length of cable to sensor should be no greater than 1,500 feet. Use only the existing punched holes for connections to the sensor.

**Monitoring:** The Manning EC-F3 oxygen sensor may be monitored by the Manning GM-1, GM-JR, GM-4, GM-10 or other appropriately configured system. Monitoring equipment must be configured to indicate a fault if the signal is below 1.5 mA. All signals over 20 mA must be considered a high gas concentration.

# 3 Operation

## A Start-Up Procedures

Before applying power, make a final check of all wiring for continuity, shorts, grounds, etc. It is usually best to disconnect external alarms and other equipment from the sensor until the initial start-up procedures are completed.

After power-up, allow 24 hours for the system to stabilize before testing the sensors. If sensors are located at a distance from the main unit, the test time required and accuracy of the response checks will be improved if two people perform the start-up procedures and use radio contact.

### Start-Up Test:

- 1) One person exposes each sensor to nitrogen calibration gas.
- 2) The second person stays at the control unit to determine that each sensor, when exposed to the gas fumes, is connected to the proper input and responds, causing appropriate alarm functions.

## B Calibration

The Manning EC-F3 oxygen sensor comes factory calibrated but may require a span adjustment upon installation to compensate for local altitude and barometric pressure conditions.

**Effects of Barometric Pressure on Oxygen:** The output of the Manning EC-F3-O<sub>2</sub> sensor is affected by changes in barometric pressure. If a unit is calibrated at a barometric pressure of 29.00 inches Hg in clean air to output 20.9% O<sub>2</sub>, and the barometric pressure changes to 28.00 inches Hg, the output will indicate 20.2% O<sub>2</sub>. Because of this, the installer should always perform a nominal calibration as described below when the unit is started up. After the nominal calibration is performed, the output will be expected to vary slightly with barometric pressure.

**Nominal Calibration:** After the unit is installed and has been powered up for a minimum of 8 hours, a nominal calibration will be achieved by the following method.

- Be sure the unit is in clean air with the area well ventilated.

- The sensor should indicate a concentration of approximately 20.9%, which is the normal concentration of oxygen in clean air. This will vary depending on elevation and barometric pressure.
- Adjust the span pot until the sensor output indicates a concentration of 20.9% (see Figure 3, Note 1). For the following ranges, the test signals should be (see Figure 4):

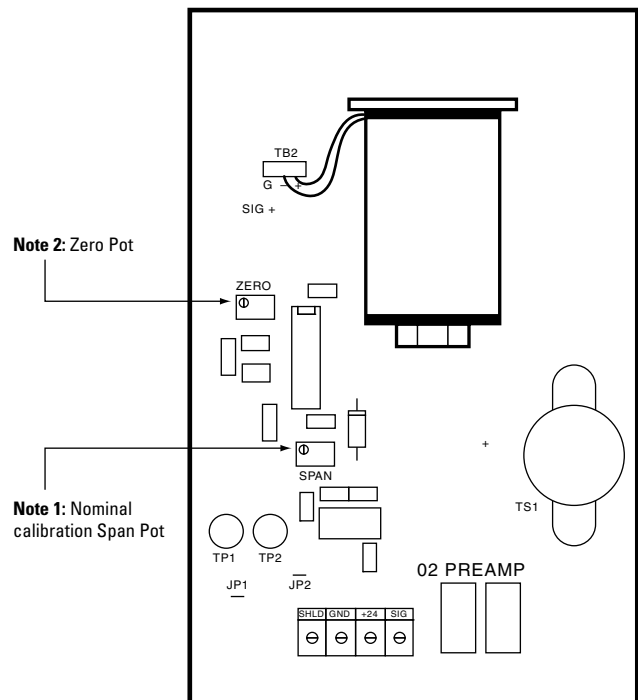
### Range 0-25%

0% = 4 mA or 40 mV (TP1-TP2)  
20.9% = 17.37 mA or 173.7 mV  
(TP1-TP2)

### Range 15-25%

15% = 4 mA or 40 mV (TP1-TP2)  
20.9% = 13.44 mA or 134.4 mV  
(TP1-TP2)

Figure 3: Zero and span adjustments



# 3 Operation continued

---

**Zero Calibration:** DO NOT adjust the zero pot without certified calibration gas. If zero adjustment is required, the following procedure will zero the unit.

- Apply zero gas at 1.0 L/min\* (zero gas must be in nitrogen).
- After zero gas has been on sensor for two minutes, adjust the zero pot until the correct output is achieved (see Figure 3, Note 2).

**Span Calibration:** Span calibration can be achieved by performing the nominal calibration described at the beginning of this section or by using calibration gas as follows:

- Perform zero adjustment before spanning.
- Apply span gas at 1.0 L/min\* (span gas must be in nitrogen).
- After span gas has been on sensor for two minutes, adjust the span pot until the correct output is achieved (see Figure 3, Note 1).

Calibration kits are available from Honeywell Analytics.

## c Troubleshooting

---

**If the sensor output is 0 mA:** First, verify +24 VDC at the sensor terminal block (see Figure 4).

Second, check voltage between TP1 and TP2 (see Figure 4). Voltage should be in the range of 40 mV to 200 mV corresponding to an actual current flow of 4 mA to 20 mA. If this voltage is 0 mV, the signal has no path to ground. Check monitoring equipment connections and configuration. Input impedance must be 250 ohms or less.

**If sensor output indicates a gas concentration other than expected:**

- Keep in mind that the sensor output will fluctuate with changes in barometric pressure. To keep a nominal output of 20.9% O<sub>2</sub> in clean air, perform the nominal calibration at a time when the barometric pressure is in the middle of the barometer's normal range for your area.
- As the cell ages, its sensitivity may slowly decrease. This will result in an output of significantly less than 20.9% O<sub>2</sub>. Periodic logging of the signal will identify this trend at which time a new calibration can be performed.
- When the unit reaches the point where proper calibration adjustments can no longer be made, the cell has expired and needs replacement. Expected cell life is longer than five years for most applications. Contact Honeywell Analytics for replacement cells.

\*Check with Technical Support for use with another type of regulator or the discontinued flow meter.

# 3 Operation continued

## D Maintenance

For proper operation it is essential that the test and calibration schedule be adhered to. Honeywell Analytics recommends the following maintenance schedule:

- Response test once per month. Expose sensor to a nitrogen sample to verify proper sensor response and alarm functions. Test more frequently in highly critical applications.
- Calibration should be performed with certified calibration gas every six months. Calibration kits are available from Honeywell Analytics.
- All tests and calibrations must be logged

**Sensor Life:** Manning electrochemical cells are extremely reliable, but several things can cause the cell chemicals to become depleted including:

- a period of time,
- exposure to high temperatures,
- exposure to varying concentrations of the target gas,
- exposure to high moisture for extended periods without proper sensor enclosure.



When the cell becomes depleted, the unit will give no indication of failure other than that the sensor will not respond. For this reason it is **absolutely essential that these units be exercised with a gas sample on a regular and timely basis.**

Typical sensor life is longer than five years in most applications. In addition to timely response checks, a preventative maintenance program of periodic cell replacement should be implemented.

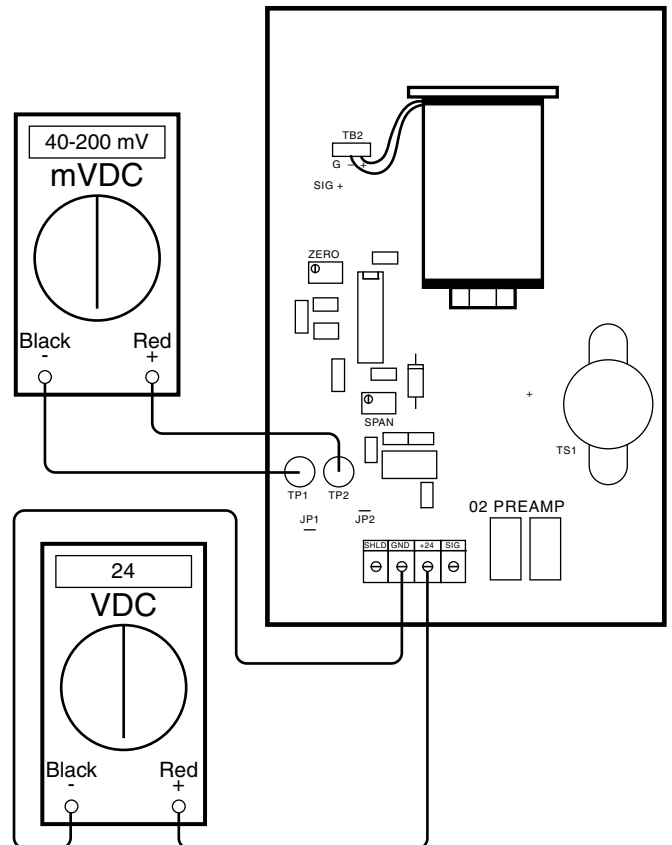
When the cell becomes depleted, a replacement cell can be obtained from Honeywell Analytics. Simply remove the red plug from its white connector, pull the old cell from the spring clip, discard the old cell and replace it with a new one.

The sensor should be calibrated after a 24 hour warm-up period.

## E Replacement Parts

For replacement parts, contact Honeywell Analytics. Be sure to give serial number of unit and model number.

**Figure 4: Checking voltage between TP1 and TP2**



# 4 Limited Warranty

---

## 1. Limited Warranty

Honeywell Analytics, Inc. warrants to the original purchaser and/or ultimate customer ("Purchaser") of Manning products ("Product") that if any part thereof proves to be defective in material or workmanship within eighteen (18) months of the date of shipment by Honeywell Analytics or twelve (12) months from the date of first use by the purchaser, whichever comes first, such defective part will be repaired or replaced, free of charge, at Honeywell Analytics' discretion if shipped prepaid to Honeywell Analytics at 405 Barclay Blvd., Lincolnshire, IL 60069, in a package equal to or in the original container. The Product will be returned freight prepaid and repaired or replaced if it is determined by Honeywell Analytics that the part failed due to defective materials or workmanship. The repair or replacement of any such defective part shall be Honeywell Analytics' sole and exclusive responsibility and liability under this limited warranty.

## 2. Exclusions

- A. If gas sensors are part of the Product, the gas sensor is covered by a twelve (12) month limited warranty of the manufacturer.
- B. If gas sensors are covered by this limited warranty, the gas sensor is subject to inspection by Honeywell Analytics for extended exposure to excessive gas concentrations if a claim by the Purchaser is made under this limited warranty. Should such inspection indicate that the gas sensor has been expended rather than failed prematurely, this limited warranty shall not apply to the Product.
- C. This limited warranty does not cover consumable items, such as batteries, or items subject to wear or periodic replacement, including lamps, fuses, valves, vanes, sensor elements, cartridges, or filter elements.

## 3. Warranty Limitation and Exclusion

Honeywell Analytics will have no further obligation under this limited warranty. All warranty obligations of Honeywell Analytics are extinguishable if the Product has been subject to abuse, misuse, negligence, or accident or if the Purchaser fails to perform any of the duties set forth in this limited warranty or if the Product has not been operated in accordance with instructions, or if the Product serial number has been removed or altered.

## 4. Disclaimer of Unstated Warranties

THE WARRANTY PRINTED ABOVE IS THE ONLY WARRANTY APPLICABLE TO THIS PURCHASE. ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.

## 5. Limitation of Liability

IT IS UNDERSTOOD AND AGREED THAT HONEYWELL ANALYTIC'S LIABILITY, WHETHER IN CONTRACT, IN TORT, UNDER ANY WARRANTY, IN NEGLIGENCE OR OTHERWISE SHALL NOT EXCEED THE AMOUNT OF THE PURCHASE PRICE PAID BY THE PURCHASER FOR THE PRODUCT AND UNDER NO CIRCUMSTANCES SHALL HONEYWELL ANALYTICS BE LIABLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES. THE PRICE STATED FOR THE PRODUCT IS A CONSIDERATION LIMITING HONEYWELL ANALYTICS' LIABILITY. NO ACTION, REGARDLESS OF FORM, ARISING OUT OF THE TRANSACTIONS UNDER THIS WARRANTY MAY BE BROUGHT BY THE PURCHASER MORE THAN ONE YEAR AFTER THE CAUSE OF ACTIONS HAS OCCURRED.