Honeywell

Combustible Gas Monitor

Manning CGT-F2
Instruction and Installation Manual

07/09

Notices and Trademarks

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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	www.honeywell.com
Honeywell Analytics	www.honeywellanalytics.com
Manning Gas Detection	www.manningsystems.com

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

Symbol Definitions

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

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

Contents

Serial number:

Introduction

This manual has been prepared to help in the use and installation of the Manning CGT-F2-XXX-0/100%LEL-EXP Combustible Gas 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 Sensor Description

Manning series CGT sensor/transmitters combine catalytic bead type gas sensors and an electronic amplifier that transmits gas concentration using a standard 4/20 mA signal. They are designed to continuously monitor combustible gas concentrations in ambient air near process tanks or piping, or in enclosed spaces where combustible gases may accumulate.

Gas sensors are housed in a corrosion resistant stainless steel shell with a sintered metal flame arrestor isolating the sensing elements from the ambient air. A 3/4" NPT thread at the back of the sensor mates with the threaded entry on the explosion-proof transmitter enclosure. Manning CGT sensor transmitters are designed for use in Class 1, Division 1, Group B, C, or D locations. These transmitters should not be used in Group A environments.

Combustible gas sensors contain two heated elements. One of these elements is active and will allow combustible gases or vapors to burn on its catalytic surface. The other is passive and does not react to gases. These two elements form two legs of a Wheatstone bridge measuring circuit. When combustible gas contacts the sensor, the active element burns this gas and the temperature of this element increases, changing its resistance. The transmitter measures the imbalance in the bridge circuit and transmits the data.

Monitoring equipment must be configured to indicate a fault if the signal is less than 1.5 mA. Signals above 20 mA must be considered high level gas concentrations.

System Specifications

Electrical Power: 24 VDC at 100 mA nominal

Current Requirements: 100 mA nominal

Output: Linear 4/20 mA output, 250 ohm maximum load

Cable Recommendation: 3-conductor, #18 AWG, stranded, shielded cable with drain wire all enclosed in a vinyl jacket (Belden #8770 or equivalent)

Cable Length to Sensor: 500 feet maximum

Transmitter Enclosure: Galvanized cast iron

Area Classification: NEC Class 1, Division 1, Groups B, C and D

Sensor Specifications

Type: Catalytic bead type

Measurable Gases: Ammonia (NH_3), hydrogen (H_2), methane (CH_4), propane, butane, etc. (partial list)

Range: 0-100% LEL (Lower Explosion Limit)

Response Time (T90): 10 seconds

Sensitivity: 1% LEL

Zero Drift: <2% / month

Sensor Materials: 316 stainless steel

Method of Detection: Wheatstone bridge measuring circuit

Operating Ambient Temperature Range: –40°C to +70°C (–40°F to +158°F)

Storage Temperature: –40°F to +140°F

Gas Sampling: Diffusion

Weight: 3 lbs.

Dimensions: 6.1" high x 4.8" wide x 3.0" deep

2 Installation

A Locating the Manning CGT

These combustible gas sensors are used to detect a variety of gases or vapors. For gases that are lighter than air, such as methane, sensors should be located near the ceiling. For gases that are heavier than air, such as butane, sensors should be mounted near the floor. If the gas or vapor has a density near that of air, locate the sensor about 5 feet off the floor in enclosed areas. Gas sensors mounted outdoors should be located near anticipated leak sources (valves, flanges, compressors, etc.) and the location will depend on normal wind patterns and anticipated employee activity areas.

The following are a few common combustible gases, along with their relative density (air = 1.00). Densities less than one indicate gases that are lighter than air while those with densities greater than one are heavier than air. Combustible vapors from most solvents, such as Benzene, n-Hexane, Methanol, Ethanol, and MEK are heavier than air and will tend to accumulate near the floor in enclosed spaces with little air movement.

Methane	0.55
Butane	2.11
Propane	1.55
Hydrogen	0.07
Ammonia	0.60

Take air movement and ventilation patterns into consideration when locating sensors.

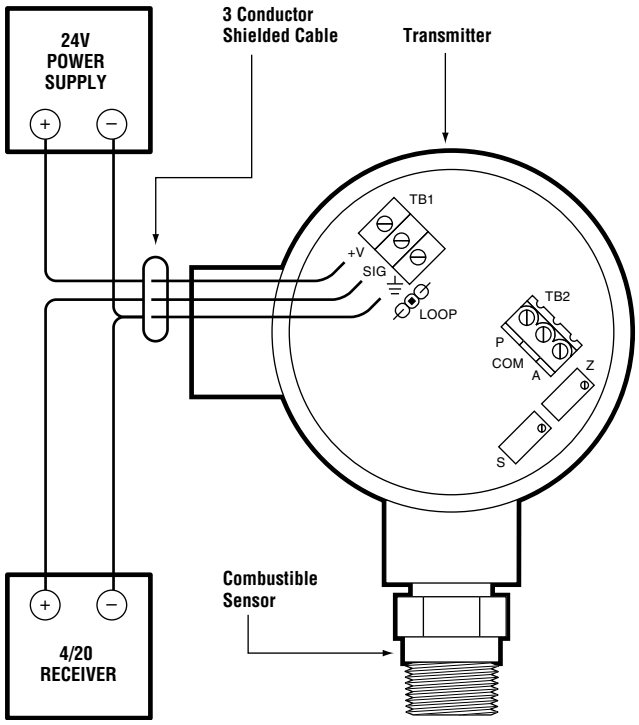
If the primary application is the fastest possible leak detection, mount the sensor near the potential leak sources. In the case of ammonia, this is usually near the ceiling as ammonia vapor is lighter than air. In doing this, be aware that the indicated concentration will not be representative of personnel exposure and easy access for the required calibration and maintenance could be compromised.

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 consideration.
- 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.).
- If mounting sensor outdoors, consider prevailing winds and proximity to most likely source of leak. Protect from sun and rain as much as possible.
- For highly critical locations, more than one sensor should be installed in each room.

Figure 1: Typical Installation for the Manning CGT



Potential Interferences:

Combustible sensors are adversely affected by a few compounds that may be present in a given application. **Silicone vapors from silicone-based lubricants or sealants can cause complete loss of sensor sensitivity in as little as a few hours.** These sensors should not be used where silicon vapors are normally present, and sensors should be protected from these vapors if such compounds are in use temporarily.

Lead compounds and high levels of hydrogen sulfide can also cause degradation of combustible sensors. While lead vapors are not commonly encountered, they can also cause complete sensor failure if encountered. Hydrogen sulfide will cause reduced sensitivity over the first few weeks of exposure but then will level out. The effect of hydrogen sulfide can normally be compensated for by re-calibration after the first few weeks of use.

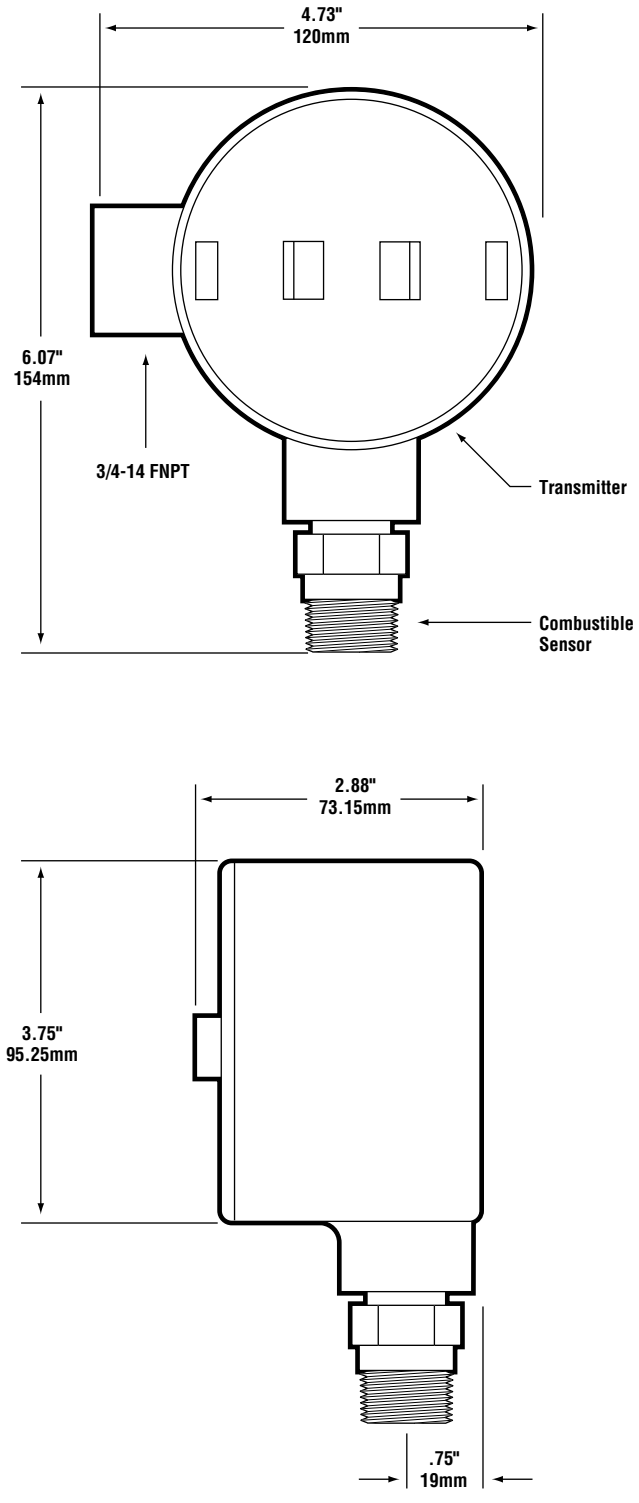
B Explosion-proof Mounting Procedures

Combustible gas sensor/transmitters are explosion-proof assemblies that are normally mounted directly to suitable explosion-proof conduit. To maintain the explosion-proof integrity of the transmitter, a suitable cable entry seal must be used in accordance with the applicable electrical code. Sensor/transmitters should be mounted with the sensor facing down as shown in Figure 2.

NOTE: Gas sensors are shipped with a protective plastic cap over the end. This cap should be left in place to avoid damage to the sensor during installation. If the detection system is to be activated within a few days of installation, the cap should be removed when installation is complete. Otherwise, leave the cap in place until the system is to be placed in service. Be sure to leave the protective cap on the sensor if painting is to be done in the area of the sensor.

Manning CGT transmitters require connection to a DC power supply and connection of the 4/20 mA output to a receiving device, such as a computer, recorder or data logger. A 3-conductor cable may be used for this purpose and is made at the terminals marked TB1 on Figure 3.

Figure 2: Manning CGT Sensor Dimensions



c Wiring

Figures 3 and 4 present wiring information for the Manning CGT 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.

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

Always use 3-conductor, insulated, stranded, shielded copper cable. Use only 3-conductor cable, not two cables of 2-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. 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. Follow the mounting instructions on the enclosure.

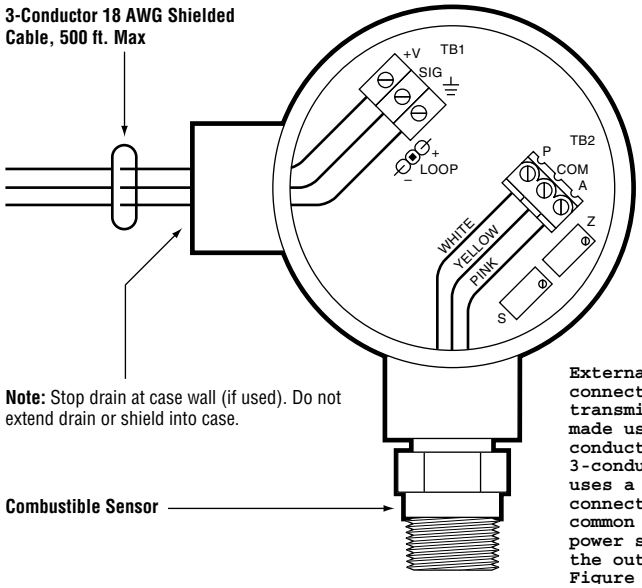
Electrical Power: 24 VDC regulated, 100 mA nominal

Output: 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 500 feet.

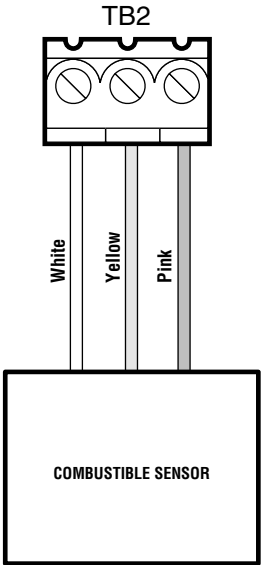
Monitoring: The Manning CGT Combustible Sensor may be monitored by the Manning GM-1, GM-JR, GM-4, GM-10 or other appropriately configured system. Monitoring equipment must be configured to indicate a fault if the signal is below 1.5 mA. All signals over 20 mA must be considered a high gas concentration.

Figure 3: Electrical Connections – CGT Transmitter



External connections to the transmitter can be made using 3-conductor cable. A 3-conductor cable uses a single connector for the common of both the power supply and the output signal. Figure 3

Figure 4: Electrical Connections – CGT Sensor



Standard transmitters supplied with the sensor close coupled to the transmitter enclosure are factory wired as shown in Figure 4.

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.

When installation is complete, the combustible gas transmitter is ready for operation. After verifying that electrical connections have been made properly, put the transmitter into operation by simply applying DC power. As soon as power is applied, the unit will begin to stabilize.

NOTE: The output of the transmitter will go to a high value when power is first applied. Alarm devices should be inhibited at this time so that alarm systems are not activated. The output will stabilize at 4 mA within about 10 minutes.

After power-up, allow 24 hours for the system to stabilize before testing the sensors. Because sensors are normally 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 a small amount of the gas that is being monitored.

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.

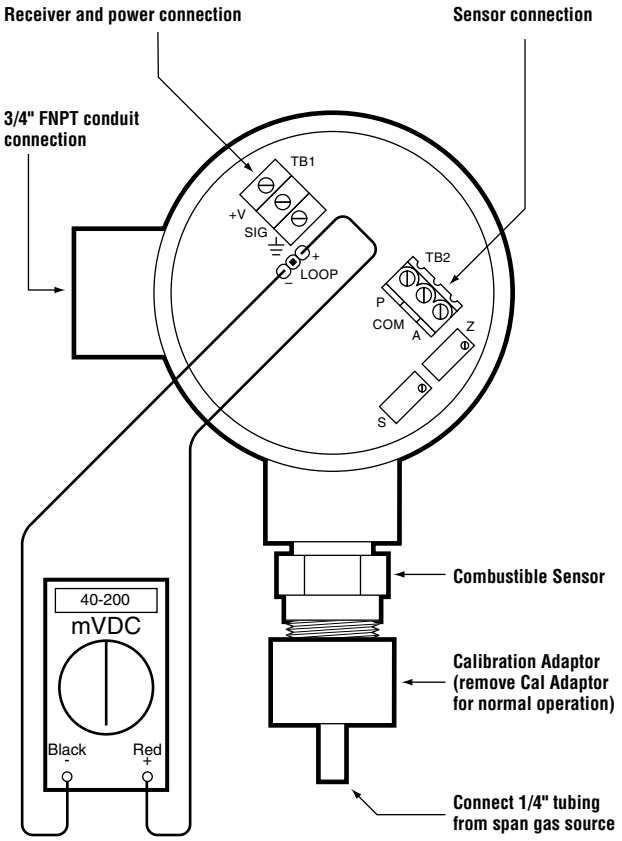
B Calibration

Combustible gas sensor/transmitters are factory calibrated for a standard range of 0-100% LEL Methane, using methane gas as the calibration standard. However, combustible gas sensors do not respond exactly the same to every combustible gas, and the percent of each gas that represents 100% LEL also differs for each gas. While methane gas standards can always be used for calibration, the value that the transmitter is adjusted to will vary depending on what type of gas the system is meant to detect.

Calibration of a combustible gas sensor/transmitter requires a digital volt meter (DVM), a source of calibration gas and a calibration adapter for the sensor. Calibration gas can be obtained in convenient disposable cylinders or as complete calibration kits from Honeywell Analytics. These kits contain one methane gas standard (1% methane in air, which is 20% LEL) in a disposable cylinder, a bottle of zero air, a cylinder regulator and a calibration adapter.

Prior to calibration, remove the cover from the sensor/transmitter enclosure and connect a DVM to the test points (LOOP) shown in Figure 5. The test points will provide a 40-200 mVDC signal proportional to transmitter range. For a standard 0-100% LEL unit, 0% is 40 mV and 100% is 200 mV.

Figure 5: Sensor/Transmitter Connectors, Controls and Test Points



3 Operation continued

Transmitter Zero: The transmitter zero is adjusted with the sensor exposed to air that contains no combustible gas. Generally, the easiest method of zeroing the transmitter is to make the adjustment when you know that the area is free of combustibles. Because it is normally necessary to check the area with a portable combustible detector prior to removing the cover from the transmitter, the absence of any combustible gases or vapors can be verified fairly easily.

The transmitter can also be set to zero using "zero air" available in cylinders. Zero air cylinders and regulators are available from Honeywell Analytics. Connect the zero air cylinder to the calibration adapter and adjust gas flow to 1.0 L/min*. When the DVM stabilizes near 40 mV, adjust the zero potentiometer until the DVM reads 40 plus or minus 0.5 mV.

Transmitter Span: The span setting for a combustible gas sensor/transmitter will depend on the gas or vapor for which the unit will be mainly used. To calibrate the system for applications where methane is the main combustible to be expected, connect tubing from your span gas cylinder (1% Methane) to the calibration adapter inlet. Turn on the gas flow and adjust to approximately 1.0 L/min*. The reading on the DVM attached to the transmitter test points will immediately start to increase. Allow the gas to flow to the sensor for 2-3 minutes and observe the reading on the DVM. The reading should be relatively stable, plus or minus 0.5 mV. Use the span potentiometer to adjust the DVM to 72 mV. This adjustment assumes the use of 1% methane gas standards, which are the equivalent of 20% LEL. If using another methane concentration, calculate the voltage setting as follows:

(v/o = Volume Percent)

V = 40 mV + [160 mV X (Span Gas Concentration in v/o divided by 5 v/o)]

As an example, if your span gas cylinder is marked with a concentration of 2.5% Methane, the calculation would be:

V = 40 mV + [160 mV X (2.5 v/o divided by 5 v/o)] = 120 mV

When the span has been set, turn off the span gas flow and remove the calibration adapter from the sensor. Place the lid back on the transmitter enclosure and tighten the cover to insure the enclosure remains water tight.

Calibration for Other Combustible Gases: As previously mentioned, a combustible gas sensor has a slightly different response to each combustible gas or vapor. In addition, the LEL (Lower Explosive Limit) represents different percent concentrations for different gases. For instance, the LEL for methane is 5% by volume while the LEL for butane is 1.9% by volume. Because of these factors, a combustible transmitter must be adjusted differently if the system is meant to detect a gas or vapor other than methane.

A 1% methane gas standard may still be used for calibration of combustible transmitters when used for other gases. However, the voltage that you set at the transmitter test point will be different for each gas. Table 1 provides the voltage setting for various gases and the corresponding percent LEL reading for each.

Table 1

Gas	mV	mA	% LEL
Methane	72	7.2	20
Ethane	86	8.6	29
Propane	96	9.6	35
n-Butane	96	9.6	35
n-Pentane	104	10.4	40
n-Hexane	120	12.0	50
Hydrogen	88	8.8	30
Methanol	88	8.8	30
Ethanol	104	10.4	40
Isopropyl Alcohol	128	12.8	55
Acetone	120	12.0	50
Methyl Ethyl Ketone	120	12.0	50
Benzene	128	12.8	55
Toluene	136	13.6	60
Di-ethyl Ether	56	5.6	10
Ammonia	64	6.4	15

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

Sensor Response Test: While zero and span adjustments are required only periodically, gas sensors should be checked regularly for proper response. The response check can be done quickly by simply aiming the outlet tube from the span gas cylinder at the face of the sensor and turning on the gas flow for 10-20 seconds. The sensor should begin to respond within 5 seconds.

To observe the response at the transmitter, it is necessary to connect a DVM to the test points indicated in Figure 5. If the sensor does not respond, it should be replaced.

Sensor Replacement: Combustible gas sensors used in the Manning CGT are warranted for 12 months and generally last 5 years or more in the absence of poisoning agents. When sensor replacement is required, it can be done easily and quickly. Open the transmitter and remove the sensor cable from the sensor terminal block on the transmitter module. Unscrew the sensor from the explosion-proof transmitter housing using a wrench on the hex provided on the sensor. Screw in the replacement sensor.

Connect the new sensor to the terminal block (Figure 4) on the transmitter board and replace the transmitter cover. After a new sensor has been connected, allow 4 hours for the new sensor to completely stabilize. Then perform a zero and span calibration as described on page 8.

C Maintenance

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

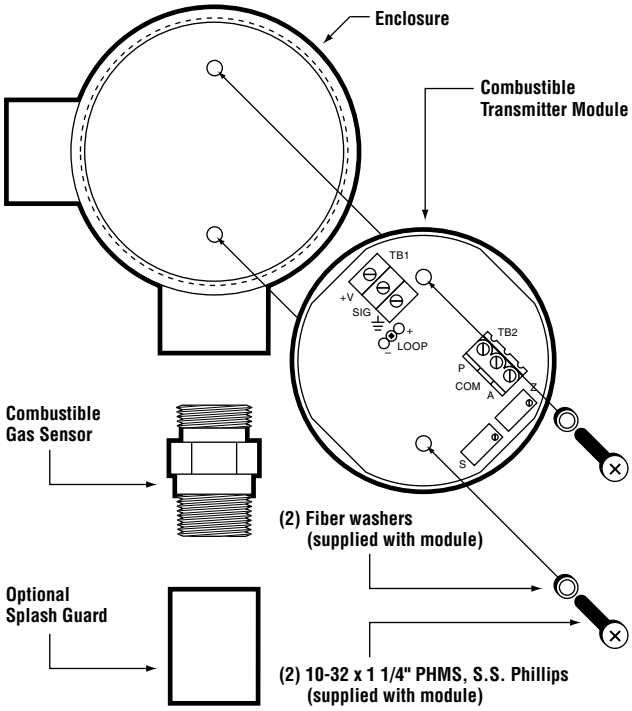
- Response test once per month. Expose sensor to the target gas to verify proper sensor response and alarm functions.
- Calibration should be performed with certified calibration gas every six months. Calibration kits are available from Honeywell Analytics.
- All tests and calibrations must be logged.

When the sensor 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.

D Replacement Parts

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

Figure 6: Transmitter Spare Parts List



PART NUMBER	DESCRIPTION
CGT-4070-00	Combustible transmit ter module
CGT-7100-08	Explosion-proof enclosure
CGT-2520-00	Combustible sensor assembly
CGT-3400-29	10-32 x 1 1/4" PHMS, S.S. Phillips
CGT-4400-29	Fiber washer
CGT-7100-12	Optional Splash Guard

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 Manning 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

Manning 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 MERCHANT-ABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.

5. Limitation of Liability

IT IS UNDERSTOOD AND AGREED THAT MANNING'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 MANNING BE LIABLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES. THE PRICE STATED FOR THE PRODUCT IS A CONSIDERATION LIMITING MANNING'S 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 ACTION HAS OCCURRED.

