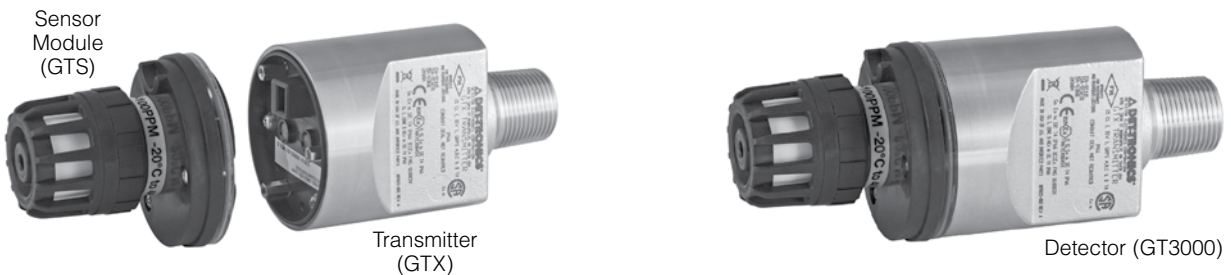


Electrochemical Gas Detector GT3000 Series Includes Transmitter (GTX) with H₂S or O₂ Sensor Module (GTS)



SAFETY CERTIFIED GT3000 SERIES ELECTROCHEMICAL GAS DETECTOR

This manual addresses the specific requirements and recommendations applicable to the proper installation, operation, and maintenance of all Safety-Certified (SIL-Certified) GT3000 Electrochemical Gas Detector product versions. For complete information regarding system overview, performance, installation, operation, maintenance and specifications of the GT3000 Series, refer to instruction manual 95-8616.

QUALITY POLICY STATEMENT

All quality assurance control measures necessary for safety management as specified in IEC 61508 Part 1 have been implemented. The quality management system of Det-Tronics is based on the requirements of EN ISO 9001 and ANSI/ASQC Q9001 through the application of the United Technologies Company Achieving Competitive Excellence (ACE) program. In addition, the Quality Management System complies with the European ATEX Directive requirements per EN 13980, the International Electrotechnical Commission requirements per OD005/V2, and the supervised testing requirements per ISO 17025.

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of personnel performing the operations. Information that raises potential safety issues is indicated by the word "Warning". Always read and understand these safety messages.

WARNING

The GT3000 Electrochemical Gas Detector is intended for use in hazardous environments that may include explosive levels of flammable gases and vapors. This product must be properly installed, operated and maintained. Improper installation or use could result in an explosion or fire resulting in death or serious injury.

- *Do not remove the cover of a junction box in explosive environments when device power is on and circuits are live.*
- *Device must be properly installed to meet hazardous area explosion-proof/non-incendive and intrinsic safety requirements.*

DESIGN

The GT3000 Electrochemical Gas Detector is an intelligent stand-alone industrial gas detector, designed to provide continuous monitoring of the atmosphere for hazardous gas leaks or oxygen depletion. The GT3000 Gas Detector consists of a replaceable sensor module (Model GTS) connected to a transmitter module (Model GTX). The GT3000 is a 2-wire device that generates a 4-20 mA output signal with HART communication that is proportional to the concentration of the target gas. The GT3000 is compatible with FlexVu® Model UD10 and UD20 Universal Display Units, as well as other devices that are able to monitor a linear 4-20 mA dc signal. All alarm functions are provided by the monitoring device.

The GT3000 is classified as Type B smart element according to IEC61508. The GT3000 contains self-diagnostics and sends the current output to a specified failure state upon internal detection of a failure (see GT3000 instruction manual for details).

Safety-Certification of the GT3000 Series Electrochemical Gas Detector includes:

- the 4-20 mA output of the GTX in combination with H₂S or O₂ GTS modules.

Non-Interfering Outputs

Safety Certification of the GT3000 includes the following non-interfering outputs:

- LEDs and magnetic switches
- HART communication

The HART communication protocol is non-interfering and is to be used for diagnostics within the SIL 2 safety loop in the Safety operation mode. Diagnostics are defined as read only information. Local HART communication with the GT3000 using a handheld HART field communicator, or AMS program connected to the 4-20 mA output, is acceptable. Proper analog signal loop resistance must be installed as documented in the instruction manual to enable local HART communication.

The UD20 is a loop-powered device that is approved for use in-line with a Safety-Certified GT3000. The GT3000 comes with one of two pre-programmed fault output levels: 2.45 mA or 3.5 mA. The UD20 must only be used in conjunction with 3.5 mA fault level GT3000 versions.

VALID INPUT RANGE

GT3000 fault annunciation is provided on the 4-20 mA signal output loop by signaling to a specific mA current output level. The receiving device must be programmed to indicate a fault condition when current levels reach under-current of 3.6 mA or less or over-current of 21 mA or more.

NOTE

The GT3000 analog signal is not safety-rated during detector warm-up or calibration mode. Alternative means should be used at the job site to ensure facility safety during these activities.

DIAGNOSTIC RESPONSE TIME

The GT3000 will perform all critical diagnostic functions within one hour, worst case diagnostic detection time.

CERTIFICATION

The GT3000 Safety-Certified version is certified by *exida*® to IEC61508 for single input use in low demand, SIL 2 Safety Instrumented Systems.

SAFETY-CERTIFIED PRODUCT IDENTIFICATION

Safety Certification of all GT3000 models meeting SIL 2 safety standards is clearly identified on the product label.

INSTALLATION

NOTE

For complete information regarding performance, installation, operation, maintenance and specifications of the GT3000 Series, refer to instruction manual 95-8616.

No special or additional detector installation requirements exist above and beyond the standard installation practices documented in the GT3000 instruction manual.

The operating temperature range for the Safety Certified GT3000 depends on the specific sensor being used. Refer to the GT3000 instruction manual for details. Other environmental operating specifications are applicable as published in the general specifications section in the GT3000 instruction manual.

The GT3000 operating power distribution system should be designed and installed so the GT3000 terminal voltage does not drop below 12 Vdc when measured at any specific location. The external system providing power to the GT3000 must have over-voltage protection that ensures supply voltage does not exceed 30 Vdc.

NOTE

All safety functions of the GT3000 are active within 150 seconds of power-up without any user action required.

COMMON MISUSE SCENARIOS

Refer to the Installation and Maintenance sections of the instruction manual for information on avoidance and resolution of common misuse scenarios. Applications to avoid include the following:

- Locations where impact or other excessive mechanical stress is likely.
- Locations where regular contamination from debris, trash, snow, mud, etc. is likely to contact the sensor.
- Horizontal mounting of the GT3000 (see DEVICE MOUNTING ORIENTATION section of the GT3000 Instruction Manual).
- Locations where sensor cross-sensitivity to other gases will be a problem (see Appendix A of the GT3000 Instruction Manual for details).

NOTE

If the user suspects that damage or misuse has occurred to the GT3000, a full proof test shall be performed.

START-UP AND COMMISSIONING

Commissioning Personnel

The Safety Certified GT3000 Gas Detector can be commissioned by any qualified person with knowledge of gas detection instruments and the configuration device being used.

Refer to the Installation and Calibration sections provided in the GT3000 instruction manual.

Configuration

A HART handheld device can be used to monitor internal status or to modify the factory settings of the GT3000. Refer to the GT3000 HART Communication section of the instruction manual for guidance on using HART communication.

NOTE

Prior to device configuration all alarm outputs must be bypassed. The device is not safety certified during configuration change activities.

NOTE

All configuration changes to the GT3000 must be verified by the user via a proof test, power cycle and re-check of settings, or other appropriate method.

Configuration Protection

Upon completion of installation and commissioning, it is required that the user password-protect the GT3000 safety related parameters that are accessible via HART in order to prevent accidental or deliberate change of configuration data during normal operation. To password protect the GT3000, the user must set the write-protect function to "on" and enter an 8 character password.

The user will be required to disable write protect prior to any future configuration changes, and must re-enable write protect upon completion of these changes to ensure that HART communication remains non-interfering.

Table 1—Frequency for Performing Proof Tests

GT3000 Proof Test Name	Commissioning	Frequency
Visual Field Inspection Proof Test	Yes	As needed, depending on level and type of contaminants present
Response Proof Test	Yes	1 year

OPERATION, MAINTENANCE, INSPECTION AND PROOF TESTING

All normal installation and field calibration recommendations as documented in the GT3000 instruction manual are applicable to the Safety Certified GT3000 Gas Detector.

Safety-Certified GT3000 gas detectors require Proof testing to be performed in all cases.

Personnel performing Proof Test procedures shall be competent to perform the task. All proof test results must be recorded and analyzed. Any corrective actions taken must be documented in the event that an error is found in the safety functionality. The Proof tests must be performed at a frequency as shown in Table 1.

WARNING

Failure to perform the specified testing and inspection may lower or void the SIL rating for the product or system.

VISUAL FIELD INSPECTION PROOF TEST

Tools Required: None

Visual inspection of all Safety-Certified GT3000 gas detectors shall be conducted as needed to confirm that no external blockage of gas/vapor path into the sensing chamber exists, eg. debris, trash, snow, mud, external equipment, etc. Corrective action shall include removal of such impediments should they exist. All gas detectors must be inspected to ensure that they are capable of providing expected performance and protection.

Completion of Visual Field Inspection Proof test must be recorded and documented in the SIS logbook.

RESPONSE PROOF TEST

Tools Required: Compressed Calibration Gas Kit provided by Det-Tronics

This proof test, commonly referred to as a “gas bump test”, requires application of high accuracy compressed calibration gas to the detector while in NORMAL operational mode and inspecting the signal output level to ensure that the signal output is accurately indicative of the applied test gas concentration.

WARNING

Any external alarm equipment, systems or signaling devices that could be automatically initiated by performing this test must be disabled or bypassed before performing this test!

Proof Test Sequence

1. Inhibit alarm and fault response at the control device.
2. Apply calibration test gas to the sensor.
3. Verify correct change of state at the control device for the GT3000 4-20 mA output. Criteria for the 4-20 mA inspection pass is a response signal within ±10% for H₂S and ±0.5% V/V for O₂ of applied gas concentration (generally, a 50% full scale test concentration is applied).
4. Remove the test gas and ensure that the unit returns to normal operation.
5. Re-activate alarm and fault response at the control device.

If response test is not within acceptable limits or fails for any reason, a Full Calibration procedure must be performed and the Proof Test re-performed.

Calibration

Tools Required: Compressed Calibration Gas Kit provided by Det-Tronics
Magnet or HART Communicator

Calibration shall be conducted when required as documented in the Calibration section of the GT3000 instruction manual. It is permissible to conduct the calibration using either the onboard magnetic calibration switch or using an approved HART handheld field communicator. In all cases the GT3000 and attached transmitter should be allowed to warm up for one hour minimum before conducting calibration.

Completion of the Response Proof Test must be recorded and documented in the SIS logbook.

WARNING

Any external alarm equipment, systems or signaling devices that were disabled must be re-activated at the conclusion of proof testing activities.

FAULT/FAILURE ACTION PLAN

In the event that a Calibration does not result in an acceptable Response Proof test, then the standard Maintenance and Device Repair and Return procedures as listed in the GT3000 instruction manual must be followed. Any failure to successfully complete the Response Proof Test must be recorded and documented in the SIS logbook.

PRODUCT REPAIR

Field repair of the GT3000 is limited to replacement of the filter and/or sensor module. All other device repairs must be conducted at the factory. No firmware changes are permitted or authorized. All failures detected by the device diagnostics or by the Proof Tests that cannot be resolved through the procedures described in the FAULT/FAILURE ACTION PLAN section must be reported to the manufacturer.

OPERATING, ENVIRONMENTAL, AND PERFORMANCE SPECIFICATIONS

The Safety-Certified GT3000 product versions fully comply with, and must be operated in accordance with the functional, environmental, and performance specifications provided in the GT3000 instruction manual. A 24 hour mean time to repair should be assumed for safety availability calculations. All GT3000 diagnostics have a maximum one hour test interval.

SPARE PARTS

Refer to "Ordering Information" in the GT3000 instruction manual. Safety Certification is based on a sufficient number of spares to achieve a 24 hour mean time to repair.

CERTIFICATION AND FAILURE RATE DATA

All Safety-Certified GT3000 Gas Detectors are certified compliant to:

IEC61508: 2010

Type B Element

Systematic Capability: SIL 2 certified

HFT: 0

Low Demand Mode

PFDavg should be calculated for any safety instrumented function using the GT3000. (Refer to FMEDA report for necessary information, including DU rate.)

Safety Accuracy: ±10% of applied gas concentration.

Safety Response Time: Depends on sensor module being used. Refer to GT3000 instruction manual for details.

Product Life: 3-5 years, based on manufacturer data.

All failure rate data for SIL verification is in the FMEDA report, which is available upon request.

ADDITIONAL CERTIFICATIONS

FM, CSA, ATEX, IECEx, CE, and others. Refer to the GT3000 Instruction Manual for details.

For complete information regarding performance, installation, operation, maintenance and specifications of the GT3000, refer to instruction manual 95-8616.

TERMS AND DEFINITIONS

AMS	Asset Management System
FMEDA	Failure Mode Effects and Diagnostics Analysis
HART	Highway Addressable Remote Transducer
HFT	Hardware Fault Tolerance
LFL	Lower Flammable Limit
V/V	Percent by volume
PFD	Probability of Failure on Demand (Probability of Dangerous Failure)
PFDavg	Average Probability of Failure on Demand
SFF	Safe Failure Fraction
SIF	Safety Instrumented Function
SIL	Safety Integrity Level
SIS	Safety Instrumented System
GT3000	Electrochemical Gas Sensor (consists of one GTX Transmitter and one GTS Sensor Module)

IEC 61508 Failure Rates in FIT¹

Device	λ_{sd}	λ_{su^2}	λ_{dd}	λ_{du}	SFF ³
GT3000 Analog Output with O ₂ Sensors	0	243	3123	141	96.0%
GT3000 Analog Output with H ₂ S Sensors	0	199	3136	275	92.4%
GT3000 Analog Output with H ₂ S+ Sensors	0	194	3151	271	92.5%
FlexVu™ Universal Display UD20 adder ⁴	0	54	36	19	–

¹ FIT = 1 Failure / 10⁹ Hours

² It is important to realize that the No Effect failures are no longer included in the Safe Undetected failure category according to IEC 61508, ed2, 2010.

³ Safe Failure Fraction needs to be calculated on (sub)system level.

⁴ Add these FITs to any GT3000 version above when UD20 is used.

Specifications subject to change without notice.

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