

Instruction Manual

Model GT-CT8900

Point Type

Combustible Gas Detector



Warranty

GASENSOR TECHNOLOGY Pte., Ltd. (hereinafter referred to as GASENSOR TECHNOLOGY) warrants the Model GT-CT8900 to be free from defects in workmanship or material under normal use and service, maintenance and installation of the mentioned product within two years from the date of shipment. All warranties are contingent upon proper use in the application for which the product was intended and do not cover the products which have been modified or repaired without GASENSOR TECHNOLOGY's written approval or which have been subjected to neglect, accident, improper installation or application, or on which the original identification marks have been removed or altered. GASENSOR TECHNOLOGY will repair or replace faulty parts found to be defective during the warranty period, free of charge. Determination of the nature of, and responsibility for defective or damaged equipment will be made by GASENSOR TECHNOLOGY's technical experts.

Defective or damaged equipment must be shipped to GASENSOR TECHNOLOGY plant or representative location from which the original shipment was made. In all cases, this warranty is limited to the cost of the equipment supplied by GASENSOR TECHNOLOGY. The customer will assume all liability for the misuse of this equipment.

Except for the express warranty stated above, GASENSOR TECHNOLOGY disclaims all warranties with regard to the product sold, including all implied warranties of merchantability and fitness, and the express warranties stated herein are in lieu of all obligations or liabilities on the part of GASENSOR TECHNOLOGY for damages including, but not limited to, consequential damages arising out of, or in connection with the performance of the product.

Important Notice

1. Please read the Instruction Manual carefully before using this equipment.
2. The operation and maintenance of this equipment must be carried out by suitably skilled and competent personnel only. GASENSOR TECHNOLOGY can provide such training.
3. Please follow strictly to the instruction manual for the installation of the equipment and comply strictly with the relevant national and corporate laws, regulations and standards, in order to fully ensure the safety of employees so as to avoid any undesired danger from happening.
4. We strongly recommend user to engage GASENSOR TECHNOLOGY with long-term maintenance service contract to ensure optimal operational of the instrument.

The information and technical data disclosed in this document may be used and disseminated only for the purposes and to the extent specifically authorized in writing by GASENSOR TECHNOLOGY.

Instruction Manual

REV: MAN-GT-CT8900-C170817

P/N: GT-TD-MAN.01E

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1 Preparing for installation

1.1 System Integrity Verification

The installation and maintenance of the GASENSOR TECHNOLOGY products must be carried out strictly according to the instruction manual. To maintain optimum operation of the equipment, we recommend the given maintenance steps to be followed.

1.2 Commissioning Safety System

Before power-up, verify wiring, terminal connections and stability of mounting for all integral safety equipment including, but not limited to:

- Power supply
- Control modules
- Field detection devices
- Signal input / output devices
- Accessories connected to field and signaling devices

After the initial application of power and any factory specified warm-up period to the safety system, verify that all signal outputs, to and from devices and modules, are within the manufacturer's specifications. Initial calibration, check and test should be performed per the manufacturer's recommendations and instructions. Proper system operation should be verified by performing a full, functional test on all component devices of the safety system, ensuring that the proper levels of alarm occur. Fault circuit operation should be verified.

1.3 NOTES & WARNINGS



WARNING: The components of the GT-CT8900 can be damaged by static electricity. In order to avoid static electricity, Special care must be taken when wiring the system to ensure that only the connection points are touched.



WARNING: The base unit and sensor of the GT-CT8900 are explosion-proof (XP), it can be used in hazardous areas.



WARNING: Wiring conduit must be sealed to ensure explosion-proof integrity of the GT-CT8900 is maintained, and to prevent water from entering the system through the conduit.



WARNING: RTV silicone rubber is not a moisture-proof seal, it's application may cause damage to the internal components of the instrument.



WARNING: A damaged housing of the GT-CT8900 may cause the internal parts being damaged or damage to the protective seal, these would endanger the safety and reliability of the instrument. Damaged GT-CT8900 cannot be used in any hazardous environments.



WARNING: Do not use a damaged GT-CT8900 instrument in any hazardous environments.

2 Product Description

2.1 General Description

The GT-CT8900 is a fixed equipment with a measurement range of 0 to 100%LEL (low explosive limit). It is able to continuously measure the concentration of combustible gases (methane) or vapors in

atmosphere. The instrument consists of a catalytic combustion sensor and a base unit. It incorporates a three high-brightness nixie tube and four-status indicators to meet the requirements of measured concentration reading and instrument's status displays. The instrument has various input and output interfaces, including a 4~20mA current signal output interface, three sets of relay contact output interfaces, two sets of RS-485 communication interfaces and a HART communication interface. Otherwise, the instrument is provided with the sensor life indication for user's ease in periodic maintenance. Thus, the reliability of the instrument is enhanced

2.2 Features & Benefits

32-bit Microprocessor-based: Provides faster processing speed and greater data throughput.

One Person Adjustment-free Calibration: Ease of zeroing and calibration operation, no requirement for manual adjustment.

4-20mA Analog Output: Transmits fault, calibration, and gas concentration levels to a remote display, computer, or other devices such as an alarm, dispending device, or master controller.

Dual Redundant MODBUS Communication: Provides the ability to operate the GT-CT8900 remotely, using 2 redundant channels. This interface allows the user to remotely change the alarm and warning relay settings, clear selected faults, issue calibration request, enable gas check, issue end/abort commands, clear error counters, change baud rates, and change format of the serial communication lines.

HART Communication: Provides the ability of a remote two-way GT-CT8900 operation via a 4-20mA signal line. This interface allows the user to remotely change the alarm and warning relay settings, issue calibration and gas check requests, issue end / abort commands, etc. For more details on HART commands, refer to the GT-CT8900 HART Communication Manual.

2.3 The Base Unit

The GT-CT8900 base unit provides display and control methods for the entire GT-CT8900. The base unit is built on the proven Intelligent Sensor platform and incorporates the following key features:

- Bright LED digital display (outdoor readable)
- MODBUS and HART communications
- High-power relay contacts
- Simple setup and calibration
- Simplifies site wiring connections
- Remaining Sensor Life Indication

2.4 Sensor

The GT-CT8900 sensor uses the catalytic combustion principle for the detection of combustible gases and vapors.



NOTE: The instrument has safety features so that if the sensor connection is wrong (staggered, short circuit, open circuit), the instrument can identify the fault and will display the fault code.

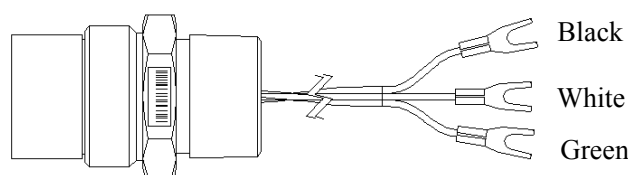




Figure 1: The component of Catalytic Combustion Sensor

3 Installation

 **NOTE:** The GT-CT8900 contains components which can be damaged by static electricity. Special care must be taken when operating and installing the instrument.

 **NOTE:** It is recommended to use cables which bear high temperature. The operating temperature of the cables cannot be lower than the highest temperature of the application environment.


 **NOTE:** ONLY skilled and trained personnel can perform installation and maintenance. The basic steps in a typical installation are listed in the table below. The installation process may vary depending on the exact site configuration.

Table 1: Installation Instruction

Steps of Installation		Reference Sections
1	Preparing to install	3.1&3.2
2	Installation of equipment	3.3
3	Installing the GT-CT8900	3.4
4	Cables installation between the GT-CT8900 and control room (including power supply, 4-20mA, MODBUS)	3.5
5	GT-CT8900 Power-up operation	3.6

3.1 Equipment Unpacking

All equipment shipped by GASENSOR TECHNOLOGY is pre-packed in shock absorbing containers, which provide protection against physical damage. Shipping container contents should be carefully removed and checked against the packing list. If any damage has occurred, or there is any discrepancy in the order, please notify GASENSOR TECHNOLOGY as soon as possible.

3.2 Preparing for Installation

The GT-CT8900 has unique installation procedures for either local or remote hardware configurations. Before installation, evaluate the gas leak locations and other conditions at the facility and configure the unit for that particular need.

3.2.1 Tools Required

The following tools are required to install the GT-CT8900

Table 2: Tools Required

Tools	Function
2mm Allen head wrench	To remove the GT-CT8900 Base Unit enclosure lid
Flat-head screwdriver, 5mm width maximum	To connect wires into the terminal block
Adjustable wrench	To make conduit and cable gland connections

3.2.2 Guidelines for Detector Locations

There are no standard rules for detector placement, since the optimum detector location is different for each application. The customer must evaluate conditions at the facility to make this determination before installing the GT-CT8900. The following guidelines can help you determine a reasonable installation location.

Find a suitable Installation location

1. Locate the GT-CT8900 near potential gas leak sources and away from excessive heat, light, wind, dust, water, vibration, shock, and radio frequency interference (RFI). For Environmental Specifications, refer to Section 7.5
2. Ensure the installation location has sufficient space to hold the instrument and all necessary cabling.
3. Mount the GT-CT8900 with the sensor pointing down and in an easily accessible location for reading of the LED display and performing routine maintenance

Sensors may be adversely affected by prolonged exposure to certain materials in low concentration or short-term exposure to certain materials in high concentration, which may result in loss of sensitivity. Such materials are:

1. **High concentration of H₂S;**
2. **Silicones (often contained in greases and aerosols);**
3. **Halogen compounds containing Fluorine, Bromine and Iodine;**
4. **Heavy metals (e.g. Tetraethyl Lead);**
5. **Caustic and acidic liquids and vapors.**



NOTE:For the feasibility of using a detector in such above mentioned area, GASENSOR TECHNOLOGY should be consulted. Detectors used in these areas usually require more frequent calibration checks than normal and typically have a shorter life. In many such applications, the standard two-year warranty would not apply. GASENSOR TECHNOLOGY discourages painting of sensor assemblies. If the sensor head is painted over, gas will not be able to diffuse into the sensor and will affect the normal operation of the instrument.



WARNING:Operation above or below temperature limits may cause unstable readings, result in false alarms or alarm failures. For Environmental Specifications, refer to Section 7.5.

3.3 Mounting Requirements

Please comply with following terms and conditions during the mounting of the instrument:

- During installation, strictly obey the principle “Cut off the Power before Opening the Cover” and comply to GB3836.15-2000 “Electrical Apparatus for Explosive Gas Atmospheres-Part 15: Electrical Installations in Hazardous Areas(Other than Mines)”.
- Although the instrument is RFI resistant, avoid installing the device near radio transmitters or similar equipment.
- Install the instrument as away from heat and light sources as possible.
- Install the instrument in areas free from wind, dust, water, shock and vibration.

- Make sure the location is suitable to hold the instrument before installation.
- Install the instrument in a way for ease of calibration. Install the instrument vertically to prevent dust and dirt from accumulating on the window. Also, install the instrument near the most possible source of leakage and in places where the concentration is the highest..
- A rain and dust cover provided by GASENSOR should be used for any outdoor applications. Refer to Figures 3 and 4 for installation position of the cover.
- The instrument housing should be properly grounded.
- The instrument has 3/4" NPT thread interfaces and any unused cable interfaces should be sealed with explosion-proof plugs.
- It is recommended to use RVVP3 X 1.5mm² wires for the connection between the instrument and system.
- Tubes used for the connection with the cable interface of junction box should be sealed or contain a draining loop.
- A cable gland is a must for hose connections with the cable interface of junction box. Please confirm the interface type during ordering among G1/2", G3/4", 1/2"NPT and 3/4"NPT, etc.
- Except for all terms and conditions stated above, follow "Code for Design of Combustible Gas Detection and Alarm Devices for Petrochemical Industry".

Once properly mounted, except for regular calibration and checking for system normal operation, the GT-CT8900 seldom needs maintenance. To keep the optimum operation of the instrument, GASENSOR TECHNOLOGY recommends the user to set up a whole system calibration/checking planning, including all the alarm circuits, and operate the calibration and checking at least every three months for the instrument.

The outline and mounting dimensions for the GT-CT8900 should be used when making installation determinations. Proper halogen-free solutions (water and alcohol are both suitable) can be used to remove particulates on the surface of the instrument. Where necessary, accessories may be cleaned by using compressed air before being connected to the instrument.

3.4 Mounting Instructions

Mount the GT-CT8900 using the bolt holes on the Base Unit. For easy access and readability, the instrument can be remotely mounted. For remote mounting, an additional explosion proof junction box must be used.

3.4.1 Mounting Dimensions

The following figure shows the mounting dimensions for the GT-CT8900.

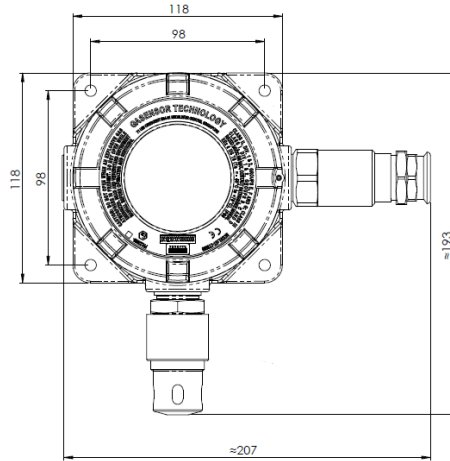


Figure 2: Wall Mounting Dimensions

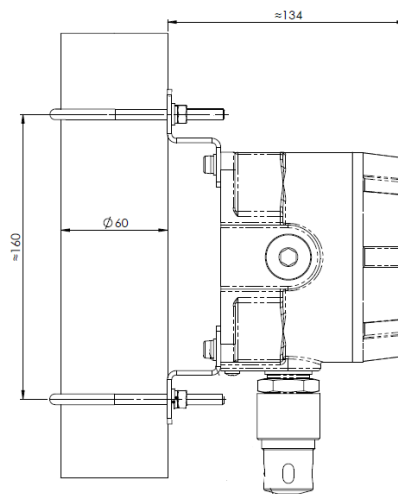


Figure 3: Pole Mounting Dimensions

Before mounting, please refer to the following sections :

Choosing the Sensor Locations Guidelines in Section 3.2.2

Environmental Specifications in Section 7.5



WARNING: To maintain the explosion proof integrity of the GT-CT8900, an explosion proof conduit must be used for remote mounting.

The conduit entries should be sealed in order to prevent water from entering the housing. Unused cable entry holes must be sealed with a suitable certified explosion-proof stopping plug. There are various types of electrical interfaces shown in the figure xx for the customers to choose from, NPT3/4", NPT1/2", G1/2", G3/4", M20*1.5. Customers can specify their needs in purchase orders. To prevent possible corrosion due to moisture or condensation, it is recommended that the conduit connected to the housing to be sealed, or contain a drain loop. Each conduit running from a hazardous zone to a non-hazardous zone should be sealed so that gases, vapors, and/or flames cannot pass through the seal. The purpose of having seals in a Class I hazardous zone is to prevent the leaking of gases, vapors or flames from one electrical installation to another through the conduit system. All cables used for connecting relay contacts should also be sealed within conduits. Acetic acid will cause damage to metal components, metal hardware and ceramic IC's. If there is any damage resulting from the use of a sealant that outgases acetic acid, the warranty will be void.

3.5 Wiring Connections

GASENSOR TECHNOLOGY recommends using 4-wire shield cable as the GT-CT8900 power supply & serial communication cables. The layout of Terminal Blocks TB1, TB2 & TB3 of GT-CT8900 is shown in figure 5. To ensure safety, connect the GT-CT8900 to DC power supply (Ground) first, then the MODBUS and analog devices, and lastly +24 VDC power supply. Power must remain disconnected until all other wiring connections have been made and the connection correctness has been checked.

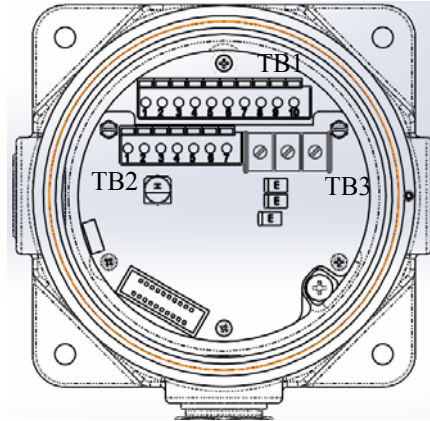


Figure 4: Terminal Block

Table 3: Terminal Connection Instruction

TB1		TB2		TB3	
1	GND	1	Remote Reset	1	Black
2	GND	2	Remote Calibration	2	Green
3	+24VDC	3	MOD1-	3	White
4	+24VDC	4	MOD1+		
5	Warning-C	5	MOD2-		
6	Warning-NO	6	MOD2+		
7	Alarm-C	7	4-20mA		
8	Alarm-NO				
9	Fault-C				
10	Fault-NC				

3.5.1 Wiring Safety Notices



WARNING: DO NOT OPEN explosion proof housing cover when power is “ON”. This is against hazardous area regulations and may lead to serious damage to the equipment. Equipment damaged in this manner is not covered under warranty.



WARNING: Connect Terminal TB1-1 or TB1-2 to the Ground Terminal before all other wiring is connected. Power must remain disconnected until all wiring connections are made. Please refer to “Start-up” procedure menu.



WARNING: Avoid close proximity to radio transmitters, welders, switch mode power supplies, battery chargers, ignition systems, generators, switch gear, arc lights. and other high frequency or high power switching process equipment.



NOTE: Contacting with PCB components should be avoided to prevent damage by static electricity. All wire connections are made to the terminal blocks. The following procedures are for attaching wires to connectors on the GT-CT8900 terminal blocks TB1, TB2, and TB3.

3.5.2 Terminal Block TB3 Connections

Terminal TB3 is designated for sensor’s terminal connections(Black, Green and White). For replacement of new sensor, loosen two captive screws and remove both “HART” and “Display” PCB’s, connect new sensor’s wires to TB3 and tighten securely.



WARNING: DO NOT connect +24VDC to TB3, or permanent damage will be caused to the sensor, which is not covered under warranty.

3.5.3 Terminal Blocks TB1 & TB2 Connections

Terminal TB1 is for +24VDC and Relay Contact. Detailed connection is as follow:

1. Remove equipment cover by loosening the set screw.
2. Remove both “HART” and “Display” PCB’s by loosening the captive screws. Refer to the figure 5 below.
3. Use flat head screw driver and depress the orange tab next to the terminal block to insert wire.
4. Insert the wire stripped for approximately 11mm into the terminal block. Remove the screw driver, clamping the wire in the terminal. Gently tug the wire to make sure that it is locked in.

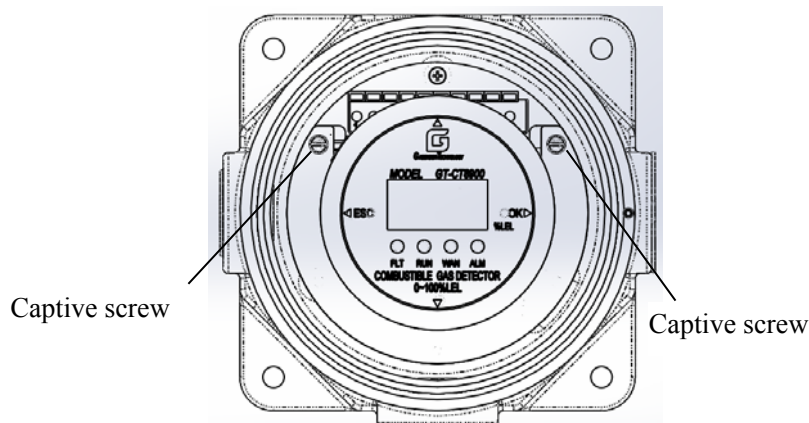


Figure 5: Captive Screw Position

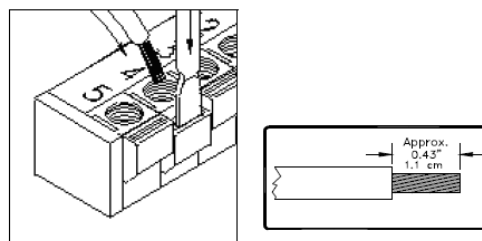


Figure 6: Terminal Diagram

3.5.4 Relay Contact Connection

Terminal block TB1 contains the relay contacts for connecting alarm equipment such as a sounder and beacon. The function of the Alarm and Warning relay connections varies depending on whether the relays are configured as Energized or De-Energized. For more information, refer to Table 4 below.



NOTE: The default setting for the Warning and Alarm relays is De-Energized. The Fault relay is normally energized and its NC contact will break after power-up. Use the following table as a guide for determining the Normally Open (NO) or the Normally Closed (NC) state of the relay .

Table 4: TB1 Relay Contact– Energized and De-Energized Relay Settings

Relay	Terminal	De-Energized	Energized
Warning	5	Common	Common
	6	Normally Open	Normally Closed
Alarm	7	Common	Common
	8	Normally Open	Normally Closed
Fault	9	--	Common
	10	--	Normally Closed



WARNING: Relay contacts must be protected against transient and over voltage conditions.

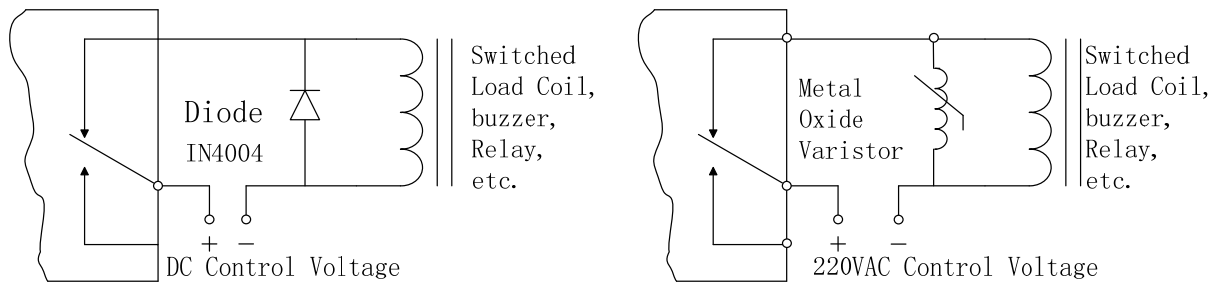


Figure 7: Relay Protection for DC and AC Loads

3.6 Power-up and Start-up

Upon completion of all wiring, the GT-CT8900 is ready for-power up. Prior to applying +24VDC power supply, please read and fully understand the following procedures:

3.6.1 Start-Up Checklist

Please check and follow all steps in Table 5 for system power-up:

Table 5: Start Up Checklist

Steps	Descriptions
1	Verify that the GT-CT8900 is properly mounted.
2	Verify that all the signal wiring is correct.
3	Verify connections between the GT-CT8900 Base Unit and Sensor.
4	Verify connections between the GT-CT8900 Base Unit and any control room devices.
5	Ensure GT-CT8900 explosion proof integrity.
6	Verify that the power supply is connected properly. The GT-CT8900 is powered by +24 VDC (20 to 36 VDC voltage range). The GT-CT8900 display outputs a low voltage fault at 18.5 VDC or below

3.6.2 Start-Up

Upon initial power-up, the GT-CT8900 should be allowed to stabilize for a while. The GT-CT8900 goes through the following process during this time period:

- Self-check.
- Sensor warm-up and displays “SU”
- Enters monitoring mode and displays a reading.



NOTE: GT-CT8900 displays “or”, this indicates reading is out-of-range.

3.7 Maintaining the Explosion-proof Integrity

The GT-CT8900 base unit and sensor are of explosion-proof type, rated for use in Class II, Zone 1 hazardous area:

Some of the factors that influence the explosion-proof integrity of the GT-CT8900 housing are:

- Strength of the enclosure material.
- Thickness of the enclosure wall.
- Flame path between the housing and cover.
- Flame path of threaded joints.

Anytime the GT-CT8900 Base Unit cover bolts or the Sensor are loosened while power is on, it is necessary to de-classify the area. When replacing the cover, make sure that it is tightened and locked with the set screw.

There are two NPT3/4” unused entry holes on GT-CT8900 housing.

GASENSOR TECHNOLOGY installs a plug in one of the unused threaded holes. Another threaded hole is pasted with a Label (for dust-proof only) indicating the Electrical interface. The unused threaded holes must be plugged with plugs provided by GASENSOR TECHNOLOGY.



NOTE: Strict compliance to national and local wiring and installation requirements is required during the installation of equipment and use approved conduit joints. When connecting a sensor to GT-CT8900 housing or remote explosion proof junction box, apply at least five turns to ensure the explosion proof integrity of the device is maintained.

4 Operation

This section offers detailed instructions for completing several start-up operation and configuration tasks using the GT-CT8900 menu system. Information regarding use of the GT-CT8900 Modbus commands as an alternate method for operating and configuring the unit is provided in Section 5.0, Modbus Interface



WARNING: To avoid the possibility of false alarms, always remove or turn off power supply prior to servicing, removing, or replacing a sensor.

4.1 User Menu Structure

The GT-CT8900 includes many selectable options that provide the most flexible gas detector possible. These options include Selectable Sensor Range, Warning and Alarm Relay Set points and Configuration, Modbus Communication Settings, and HART Communication Settings. These options allow the unit to operate as a standalone device or in conjunction with a wide variety of controllers, computers, PLC, and DCS based systems. The following sections explain the available options and how they can be customized.

4.1.1 Instrument Operation Interface

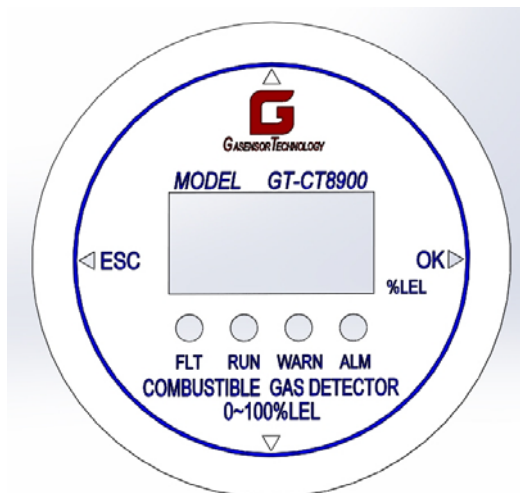
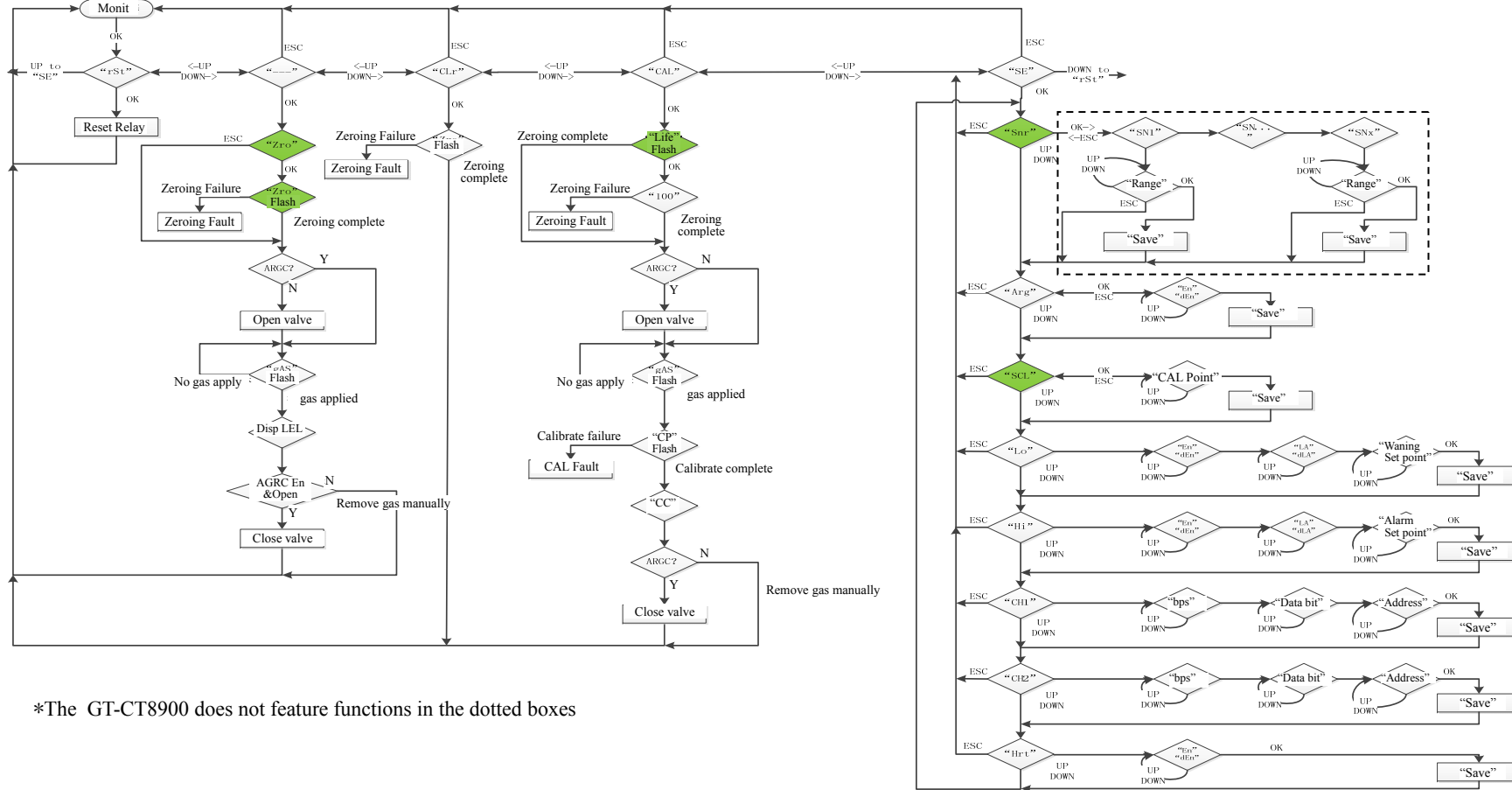


Figure 8: GT-CT8900 Instrument Operation Interface

There are four reed switches separately located at left, right, top and bottom of the display section at positions shown in above figure, and respective indication is fulfilled by magnetic activation of respective switch.

4.1.2 Menu Structure Flowchart

Following shows the detail of Menu Structure Flowchart of the GT-CT8900:



*The GT-CT8900 does not feature functions in the dotted boxes

Figure 9: Menu Structure Flowchart



NOTE: If the GT-CT8900 is purchased without relays or Modbus communications, changing the relay or Modbus settings will have no effect on the operation of the unit.

4.2 USER MENU DISPLAY

4.2.1 Main Menu:

“rst”: Relay Rest

“SP”: Special

“---”: Gas Check

“CLr”: Clear

“CAL”: Calibration

“SE”: Setup

4.2.2 Reset Submenu

When “rSt” is displayed, press OK to enter the Reset Mode. After reset is done, the instrument will return to monitoring menu.

4.2.3 Special Function Submenu

When “SP” is displayed, press OK to enter the Special Function Setup.

“En”: Special function is enabled, zeroing and calibration are allowed with warning and alarm conditions.

Warning: This function is for fault conditions only. Or it will lead to the loss of accuracy or fault.

“dEn”: Special function is disabled

4.2.4 Gas Check Submenu

When “---” is displayed, press OK to enter the Gas Check Mode.

“Zro”: Non-flashing, wait for zeroing or non-zeroing check

“Zro”: Flashing, zeroing is in process as per customer’s command

“gAS”: Flashing, the instrument is waiting for the gas

“###”: Non-flashing, “###” refers to the gas concentration

4.2.5 Independent Zeroing Submenu

When “CLr” is displayed, press OK to enter the Independent Zeroing Mode.

“Zro”: Flashing, the system is in the process of zeroing and will return to the monitoring menu after it.

4.2.6 Calibration Submenu

When “CAL” is displayed, press OK to enter the Zeroing & Calibration Mode.

“###”: Flashing, “###” refers to the remaining sensor life, the instrument is in the process of zeroing

“100”: Non-flashing, sensor life is reset to 100 and the instrument is still in the process of zeroing

“gAS”: Flashing, zeroing is complete and the instrument is waiting for the gas

“CP”: Flashing, the instrument has detected the gas with the concentration over 5%LEL and enters the calibration mode

“CC”: Non-flashing, calibration is complete, indicating that the customer can remove the gas. The instrument will return to monitoring menu when the gas concentration is under 5%LEL

4.2.7 Setup Submenu

When “SE” is displayed, press OK to enter the Setup Mode.

“Snr”: N/A

“Arg”:

“En”: Remote automatic calibration is enabled.

“dEn”: Remote automatic calibration is disabled. “SCL”: Calibration Set Point

“Lo”/“Hi”: Warning/Alarm Relay Setup

“En”: Energized

“dEn”: De-energized

“LA”: Latching

“nLA”: Non-latching

“CH1”/“CH2”: Modbus Channel 1/Channel 2 Setup

Baud Rate: “24”, “48”, “96”, “192”

Data Format: “8N1”, “8E1”, “8o1”, “8n2”

“Hrt”: Hart enabled

“En”: Enabled

“dEn”: Disabled

“Zr”: Zero Current Adjustment

4.3 Start-Up

Upon power-up, three 7-segment digital displays will display “8.8.8.” and the software revision letters “rN” (N – revision letter). Then the unit enters Start-up Mode “SU”. Upon sensor stabilization, the unit enters Operation Mode and displays the current gas concentration.

4.4 Main Menu

In the Monitoring Mode, press “OK” to enter the Main Menu and then use the “Down key” to control the menu in sequence as follow:

“rSt” → “SP” → “---” → “CLr” → “CAL” → “SE” → “rSt”;

And “UP” key to control the menu in sequence as follow:

“rSt” → “SE” → “CAL” → “CLr” → “---” → “SP” → “rSt”.

Applying magnet to “ESC” key will return to the monitoring interface and to “OK” key will enter relevant submenus.



NOTE: The instrument will automatically return to the monitoring interface if the user does nothing to the Main Menu within 15 seconds.

4.5 Selectable Options

4.5.1 Sensor Range Selection

Please note that this function applicable ONLY to toxic gas detector, the GT-CT8900 does not have such function selection.

4.5.2 ARGV Settings

ARGV(Automatic Remote Gas Calibration) is default in de-energized status(dEn). When the user has installed automatic remote gas calibrator device, he/she needs to open ARGV function through menu select or Modbus communication.



NOTE: If automatic remote gas calibration device has not been installed, set ARGV to “dEn”, or the calibration line cannot be used.

4.5.3 SCL Settings

The user can adjust the SCL Settings for all sensors. The SCL options are as follows:

- 50%FS (Default Setting)
- 25%FS (Minimum)
- 90%FS (Maximum)

Under the “SCL” menu, place magnet on “OK”, the unit will show calibration set point on its display. Use “DOWN” to control the cursor between the unit’s digit and ten’s digit(the selected digit is flashing). Use “UP” to increase the value of the current digit by 1. Place magnet on “OK” to save the current setting and the system will jump to “Lo” menu.

4.5.4 Lo Settings

The user can adjust the Warning Relay Settings. The factory default settings are as follows:

- Non-latching (default)
- De-energized (default)
- 25% FS set point (default)
- 5% FS (minimum)
- Alarm relay set point (maximum)

Under “Lo” menu, place magnet on “OK” to enter the relay energized/de-energized mode. Use “UP” or “DOWN” to change between “dEn” and “En”. Place magnet on “OK” to enter the relay latching/non-latching setting mode. The procedure used for En/dEn setting is applicable for this setting. Refer to “SCL” setting for alarm set point setting. Place magnet on “OK” to save the current warning setting and the system will automatically jump to “Hi” menu.



NOTE: Placing magnet on “ESC” after the dEn/En or dLA/LA setting will exit the current menu without saving the setting. The current setting will only be saved by placing magnet on “OK” after the alarm set point has been set.

4.5.5 Hi Settings

The user can adjust the Warning Relay Settings. The factory default settings are as follows:

- Latching (default)
- De-energized (default)
- 50% FS set point (default)
- 95%FS (maximum)
- Warning relay set point (minimum)

Place magnet on “OK” to enter the relay energized/de-energized mode. Use “UP” or “DOWN” to change between “dEn” and “En”. Place magnet on “OK” to enter the relay latching/non-latching setting mode. The procedure used for En/dEn setting is applicable for this setting. Refer to “SCL” setting for alarm set point setting. Place magnet on “OK” to save the current warning setting and the system will automatically jump to “CH1” menu.



NOTE: Placing magnet on “ESC” after the dEn/En or dLA/LA setting will exit the current menu without saving the setting. The current setting will only be saved by placing magnet on “OK” after the alarm set point has been set.

4.5.6 CH1, CH2 Settings



NOTE: The available address ranges from 1 to 247 for both Channel 1 and Channel 2.



The default settings for Channel 1 are:

- Address 1
- 9,600 baud rate
- 8-N-1

The default settings for Channel 2 are:

- Address 2
- 9,600 baud rate
- 8-N-1

Baud rate settings: “UP”、 “DOWN” provides the switch among:

- “24” : 2400
- “48” : 4800
- “96” : 9600
- “192” : 19200

Use “ESC” to return to previous submenu. Place magnet on “OK” to enter the Data Format submenu.

Data format settings: Use “UP” or “DOWN” to switch among:

- “8n1” : 8-N-1
- “8E1” : 8-E-1
- “8o1” : 8-O-1
- “8n2” : 8-N-2

Use “ESC” to return to previous submenu. Place magnet on “OK” to enter the COMM Address submenu.

Communication address settings: Under “add” menu, the cursor is flashing at the top digit of address. Use “UP” to increase data and data will be cleared to 0 in the case when it exceeds digit 9. “DOWN” is used for switching the cursor among unit’s and ten’s and hundred’s. Use “Esc” to return to previous menu. “OK” is used to save current settings and the system will jump to the “SE” submenu.

4.5.7 HART Settings

The default settings for HART is de-energized(dEn). When the user needs to open or close HART function, place magnet on “OK” under the “Hart” menu to enter the Hart Function Select menu. Use “UP”“DOWN” function to switch between “dEn” and “En”. Press “OK” to save the current setting and jump to the “Snr” menu.

4.5.8 Zr Settings

Zero current can be adjusted under Zr menu. Under “Zr” menu, press “OK” to display the real-time current value. Use “UP” and “DOWN” to regulate the current up or down.

4.5.9 Warning/ Alarm Relay Reset

If warning or alarm relay is set to latching, once the gas concentration drops to a level below the set point, it must be manually reset. This can be accomplished by three different methods:

- 1.The relays can be reset via the Modbus Interface.
- 2.The relays can be reset via the magnetic switch on the base unit. Place the magnet on “OK” to select the “rSt” submenu, the relays then can be reset by placing magnet on “OK” again.
- 3.The relays can be reset via the Remote Reset input terminal on TB2.

4.5.10 Gas Check

1. Under the “---” menu, place magnet on “OK” to enter the “Zro” interface. The user is asked whether to carry out the zeroing process.
2. Under the “Zro” menu, place magnet on “OK” to initiate the zeroing process which is accompanied by “Zro” flashing. Upon the completion of zeroing, or by applying magnet on “ESC” directly under the “Zro” interface, the instrument will enter the “GAS” menu.
3. The instrument will display gas concentration upon being applied with test gas (normally the reading will stabilize in 1 minute).
4. For gas check that is to be completed with zeroing, after the gas reading stabilizes, place magnet on “OK” to enter the calibration procedure, “CP” will flash in the calibration menu.
5. When the reading has stabilized and the test is complete, remove the gas. When the gas concentration drops below 5% FS, the instrument will return to normal operational mode.



NOTE: In this state, warning and alarm are disabled.

4.5.11 Independent Zeroing Operation

Select submenu “Zro” from menu “CLr” and place magnet on “OK”, “Zro” will flash and zeroing will start. Upon completion of the zeroing process, the unit will return to monitoring interface, or the unit will display relevant fault code.



NOTE: In this state, warning and alarm are disabled. This operation is for instrument functional check and maintenance only. During the real instrument operation, calibration must be carried out instead of the independent zeroing. GASENSOR disclaim any responsibility resulting from the independent zeroing.

4.5.12 Calibration

1. Select “CAL” submenu from the main menu, place magnet on “OK” to enter the Calibration Mode and initiate the zeroing process. The display window is now flashing the Remaining Sensor Life.

2. It is the user’s choice to reset the sensor life or not. Place magnet on “OK” to reset the sensor life to 100; place magnet on “ESC” to retain the current sensor indication which will stop flashing then.

3. Apply the calibration gas to the sensor (50% FS of detected gas). The display changes from “gAS” to “CP”, indicating that the sensor is responding to the calibration gas.

4. With the completion of gas calibration, the display changes from “CP” to “CC”, indicating that the calibration is complete.

5. Remove the gas and wait for the unit to return to normal operation. The display may indicate a few percent of FS and will gradually drop to “0.” If a unit time out occurs the user receives a calibration fault.



NOTE: In this state, warning and alarm are disabled and the default calibration gas is 50% LEL methane gas.

5 Maintenance

5.1 General Maintenance



WARNING: Disconnect the external devices such as the Controller, PLC or DCS before the maintenance of the GT-CT8900.

5.2 Storage

The GT-CT8900 should be stored in a clean and dry area and within the range of temperature and humidity as stated in the Appendix 7.5.

6 Troubleshooting



NOTE:Electrical repair must be undertaken either by GASENSOR TECHNOLOGY personnel or by competent GASENSOR TECHNOLOGY authorized service engineers. PCB repair shall only be performed at a GASENSOR TECHNOLOGY facility. Failure to comply with this requirement will void the warranty.



NOTE:Please shut down or disconnect all external alarm devices before any check that could lead to an alarm condition.

6.1 Fault Code and Repair Method

The GT-CT8900 is designed and built with self-diagnostics functions in its hardware. Once any fault condition is detected, the output current signal drops to 0mA, the fault relay actuates and the instrument displays the fault code.

Table 6 below lists the possible faults and suggested actions to remove the faults. Failure to remove the faults upon repeat attempts, the unit must be returned to GASENSOR TECHNOLOGY or the GASENSOR TECHNOLOGY authorized service center for investigation and/or service.

Table 6: Fault Codes

Fault Codes	Type of Faults	Fault Analysis	Actions
F0**	Base Unit ROM Error	Base Unit Micro-processor ROM Error	<ul style="list-style-type: none"> • Replace the processor board • Send to factory for repair
F1**	Base Unit RAM or EEPROM Error	Micro Processor RAM or EEPROM Error	<ul style="list-style-type: none"> • Send to factory for repair • Check for strong interference
F2	Low Power Supply	DC power supply < +18.5VDC	<ul style="list-style-type: none"> • Check power supply requirement
F3	Reference voltage error	Instrument internal reference voltage fault	<ul style="list-style-type: none"> • Send to factory for repair
F5	Switch Value Error	<ol style="list-style-type: none"> 1. Instrument reed switches fault 2. Remote calibration/reset line fault 	<ul style="list-style-type: none"> • Send to factory for repair of reed switches • Check wiring
F11**	Sensor drift	Sensor drift greater than 9% of full scale	<ul style="list-style-type: none"> • Re-calibrate • Replace sensor • Send to factory for repair if problem remains unsolved
F12	Zeroing failure	Incomplete zeroing process	<ul style="list-style-type: none"> • Check environmental condition for zeroing, use zero gas for zeroing • Replace sensor • Send to factory for repair if problem remains unsolved
F13**	Calibration failure	Incomplete gas calibration process	<ul style="list-style-type: none"> • Check calibration gas • Replace sensor • Send to factory for repair if problem remains unsolved
F14**	Sensor Missing or Fault	<ol style="list-style-type: none"> 1. Missing sensor or sensor wiring error 2. Open circuit/short circuit in the sensor 3. Abnormal sensor output 	<ul style="list-style-type: none"> • Use GASENSOR's sensor • Send to factory for repair if problem remains unsolved • Remove strong interference on the instrument, if any
F15	Calibration timeout error	Calibration gas supply failure or fail to timely remove calibration gas upon calibration complete	<ul style="list-style-type: none"> • Re-calibrate instrument
F16	Gas Check timeout error	Failure to provide correct calibration gas of certain concentration or prolonged gas supply	<ul style="list-style-type: none"> • Refer to Operation Menu for proper operating procedure • Remove fault condition through menu "RSt"

*Prompt: Recommended GT-CT8900 power cable resistance should be less than 20 Ω , circuit resistance is less than 40 Ω (+24VDC) .

** Prompt: The failures that marked with ** are not covered by warning or alarm state. their priorities are higher than other faults. For all the other faults, their priorities are lower than warning or alarm.

The higher priority fault code will be displayed if two or more faults occur at the same time.

Following figure shows fault code priority:

6.1.2 Fault Code Priority

Table 7: Fault Code Priority Table

Priority	Faults	Priority	Faults
1	F0	8	F3

2	F1	9	F16
3	F14	10	F2
4	F12	11	F5
5	F13		
6	F11		
7	F15		

7 Appendix

7.1 Analog Current Output Formula

$$\text{Analog current output (mA)} = 0.16 \times \%LEL + 4$$

7.2 Periodic Check / Calibration

Periodic test and calibration of the GT-CT8900 shall be carried out with stipulated equipment maintenance schedule which includes but not limited to items below:

- Zero Check.
- Gas Check.

If test result obtained is out of GASENSOR TECHNOLOGY' recommended range in Table 8, re-calibration OR repair of equipment is required. Please reference section 4.5.10, 4.5.11 and 4.5.12 to complete the periodic check. The check/calibration interval time should less than 3 months to ensure the PFD(Average Freq' of Dangerous failure) in Table 12.

7.3 Periodic System Integrity Check

System Integrity check shall be carried out annually for items below :

- Check all the wiring, terminal connections and installation of integrated safety equipment which includes but not limited to:
 - DC power supply
 - Control module
 - On-site testing equipment
 - Signal and Display equipment
 - Accessories connected with on-site and signal equipment
- Check the operation status of the safety system by a full functional test of all components and ensure alarm and warning conditions are properly set.
- Check fault and alarm circuits.

The system integrity interval time should less than 6 months.

7.4 Technical Specifications

Table 8: System Specifications

Technical Specifications	Descriptions
Sensor Type	Catalytic combustion sensor
Typical Sensor Life	3 to 5 years (Under normal using conditions)

Warranty	2 years
Measuring Range	0~100% LEL
Response Time	$T_{90} \leq 30$ S (typically ≤ 20 S)
Accuracy	$\pm 3\%$ FS
Zero Drift	Less than 5% of full scale per year

Table 9: Cable Requirements

Max. Distance between the GT-CT8900 and power source @ 24 VDC as below:

AWG	Meters
14	1800
16	1100
18	700
20	500

Max. distance for analog output (500 Ohms max):

AWG	Meters
14	2700
16	1600
18	1200
20	750

7.5 Electrical Specifications

Table 10: Electrical Specifications

Technical Specifications	Descriptions
Normal Installation	Refer to table 9 for distance between the GT-CT8900 and power source (Fixed +24VDC)
Input Power	20-36VDC, 120mA rated current @+24VDC nominal, 5W MAX
Relay Contact Rating	8A@250VAC/8A@30VDC (Maximum) (3x) SPST – Warning, Fault and Fault
Output Current	24VDC, 500Ω (maximum) Signal range:0-22mA Measured output:4-20mA Start-up: 1.5mA Calibration: 1.5mA Gas check: 1.5mA Configuration: 1.5mA Fault: <1.0mA Over range: 21.5mA HART: Signal range:3.5-22mA Measured output:4-20mA Start up: 3.5mA Calibration: 3.5mA Gas check: 3.5mA Configuration: 3.5mA Fault: 3.5mA Over range: 21.5mA HART(Modified): Signal range:1.25-22mA Measured output:4-20mA

	Start-up: 1.5mA Gas check: 1.5mA Fault: 1.25mA	Calibration: 1.5mA Configuration: 1.5mA Over range: 21.5mA
Explosion Proof Classification	ATEX II 2G Ex db IIC T6 Gb IP66 (Tamb = -40°C to +70°C)	
Approval of the production Quality assurance	ATEX 1354	

Table 11: Environmental Requirements

Technical Requirements	Descriptions
Operating Temperature Range	-40°C~+70°C
Storage Temperature Range	-40°C~+85°C
Operating Humidity Range	15% to 100% RH, non-condensing
Atmosphere	Standard atmosphere ±10%

7.6 Safety Function Information

Table 12: Safety Function Information

<p>Safety Function: To provide the host system signal information of the combustible gas concentration of the LEL set-point using 4-20mA and relay contact outputs.</p> <p>Output currents < 3.6mA and > 21mA are reserved for revealed failures.</p> <p>Output currents $\geq 3.6\text{mA}$ and $\leq 21\text{mA}$ are normal conditions.</p>		
Summary of IEC 61508-2 Clauses 7.4.2 and 7.4.4	GT-CT8900	Verdict
Architectural constraints & Type of product A/B	HFT=0	Type B
Safe Failure Fraction (SFF)	93%	SIL 2
Random hardware failures: [h ⁻¹]	λ_{DD} 2.48E-07 λ_{DU} 6.55E-08	
Random hardware failures: [h ⁻¹]	λ_{SD} 3.64E-08 λ_{SU} 6.69E-07	
Diagnostic coverage (DC)	79%	
Average Freq' of Dangerous failure (High Demand - PFH)	6.55E-08	SIL 2
Hardware safety integrity compliance	Route 1 _H	
Systematic safety integrity compliance	Route 1_S See report R70008839b	
Systematic Capability (SC1, SC2, SC3, SC4)	SC2 (HFT:0) See report R70008839B	
Hardware safety integrity achieved	SIL 2 low demand, HFT=0 (1oo1) SIL 2 high demand, HFT=0 (1oo1)	
Software safety integrity compliance	SIL2	

History Record

S/N	Rev. #	Change Description	Remark
1	A130820	First Edition	
2	B160307	1.Change data in Table 9 "Cable Requirements"; 2.Add output current parameters under HART(Compatible) mode in Table 10; and ATEX certificate no.; 3. Other modifications in detail.	GT-ECR00012
3	C170817	1.New ATEX directive 2014/34/EU and standard evolution 2.Add Table 12, the Table 12 include the information of SFF, DC, PFH etc.	GT-ECR00030



Gasensor Technology Pte.Ltd

Add: 71 Ubi Crescent # 04-01 Excalibur Centre Singapore 408571

Tel: (+65) 6744、6268

Fax: (+65) 6744、6269

E_mail: sales@ gasensor.com /gasensor@ gasensor.com Web: www.gasensor.com
