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GASTRON

GTD-1000Ex

Instruction Manual



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Read in detail for correct use.

Gas & Flame Detection System

GASTRON



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We sincerely thank you for purchasing the product of Gastron Co. Ltd.

Our Gastron Co.Ltd. is a company specialized in Gas detector and Gas Monitoring System, being recognized by many consumers due to the best quality and use convenience. We always enable you consumers to find desired products nearby and are ceaselessly studying and striving for development of Gas detectors satisfying customers. From now on, solve all anguishes concerning Gas detector with the products of Gastron Co. Ltd, We Gastron Co. will take a responsibility and give you satisfaction.

In the present instruction manual, operation method for Gas detector as well as simple methods for maintenance and repair, etc. are recorded If you read it in detail and keep it well, for reference when you have questions, then it will give you much help.

- For accurate operation of Gas detector, check up and calibrate for more than once in every 6 months.
(* In reference to KOSHA GUIDE: P-135/6-2018 / 7.2 In-house inspection, section 2)
- For accurate operation of Gas detector, checkup and calibration with calibration gas before measurement is recommended.
- When not calibrated, it may cause malfunction of the equipment due to problems resulting from Sensor aging.
- When the present instrument should be dismantled, those with professional skills for Gas detector should conduct the operation.
- For power supply cable, wire specifications should be determined by referring to the item of "Length of installed cable".
- For the contents on checkup and calibration of Gas detector, please use our company's engineering department , e-mail, or web site.

The present product and the product manual can be changed without advance notice for performance improvement and use convenience of the product.

* KOSHA GUIDE : P-135/6-2018

Calibration must be performed at a frequency requested by the manufacturer and shall be performed quarterly when the calibration period is not specified.

1. Overview	6
2. Configuration	6
3. Specification	7
3.1. Specifications	7
3.2. Mechanical Specifications	7
3.3. Electrical Specifications (Standard Type)	8
3.4. Environmental Specifications	8
4. Name and Description of Each Part	9
4.1. Components	9
5. Installation	11
5.1. Detachment of Housing Cover	11
5.2. Main PCB Configuration	12
5.3. Power and Signal Terminal Configuration	13
5.4. Method to Connect to External Control Unit	14
5.5. Installation Cable Length	15
6. Calibration and Maintenance	16
6.1. 4-20mA Output Diagnosis	16
6.2. Gas Sensor Status Diagnosis	16
6.3. 4mA Adjustment (ZERO Calibration)	17
6.4. SPAN Calibration	18
6.5. Gas Detector Calibration Method using Methane(CH4) Standard Gas	19
7. Drawings and Dimensions	20
8. Precautions before Installation	21
8.1. Selecting a Place for Installation (Occupational Health & Safety Act Data)	21

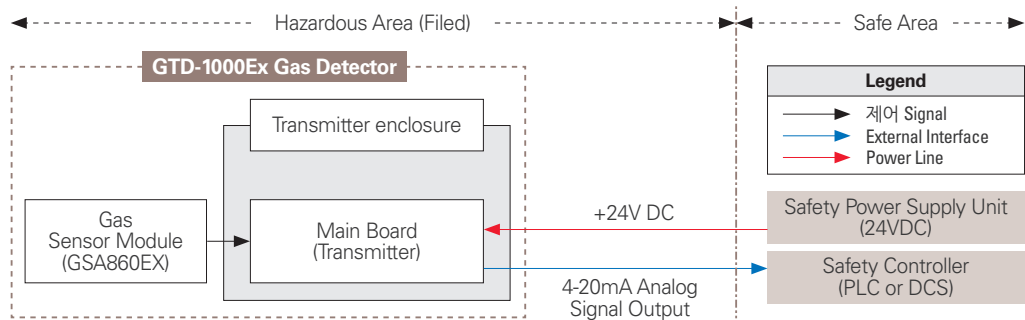
8.2. Selecting a Site for Installation (High-Pressure Gas Safety Control Act Data)	21
8.3. Precautions during Installation	21
9. Revision History	23

GTD-1000Ex toxic gas detector has been developed to detect gas leaked from industrial sites and various toxic gases generated from factories, gas storages, and manufacturing processes that produce or use toxic gases and to prevent accidents in advance.

GTD-1000Ex toxic gas detector is installed in areas with gas leak hazards and continuously monitors gas leak. It displays measurements on LCD of the detector, converts and transmits data in DC 4~20 mA standard output signal. Also, for DC 4~20 mA standard output, output signal transmission length between detector and receiver can be connected up to 2,000 m. (When Cable CVVS or CVVSB 1.5sq and above is used.)

2. Configuration

Body of GTD-1000Ex is made of Aluminum alloy and the gas sensor module is made of stainless steel. It consists of a complete explosion-proof enclosure (Ex d IIC T6). This product can be installed in areas with potential combustible gas leak and explosion hazards and internal structure consists of 1 PCB board with display part for measurements and terminal part that outputs measurements (DC 4 - 20 mA) externally. External configuration consists of detector part that monitors gas leak and cable inlets.



[Figure 1. GTD-1000Ex Overview]

3.1. Basic Specifications

ITEMS	SPECIFICATION	
Measuring Type	Diffusion	
Measuring Method	- Catalytic Cell) - Thermal Conductivity Cell - Heated-semiconductor Cell	
Detectible Gas	Combustible Gas	
Measuring Range	0~100% LEL	
Accuracy	≤ ±3% / Full Range	
Zero Drift	≤ 2% / Full Range	
Response Time	90% of full Scale in less than 15 sec	
Approvals Classification	KCs: Ex d IIC T6	
Basic Interface	Analog 4-20mA current interface	
Option	Rain Cover	
Warranty	Transmitter	2Year
	Sensor	1Year

3.2. Mechanical Specifications

ITEMS	SPECIFICATION	
Explosion Proof type	Explosion-proof enclosure	
Dimension	136(W) × 166(H) × 95 (D) mm	
Weight including Sensor	App. 1.5kg	
Mounting type	Wall mount	
Mounting Holes	Ø 7 ±0.1	
Cable inlet	3/4" PF (1/2" or 3/4" NPT)	
Body material	Transmitter	aluminum alloy
	Sensor	Stainless Steel (STS316)

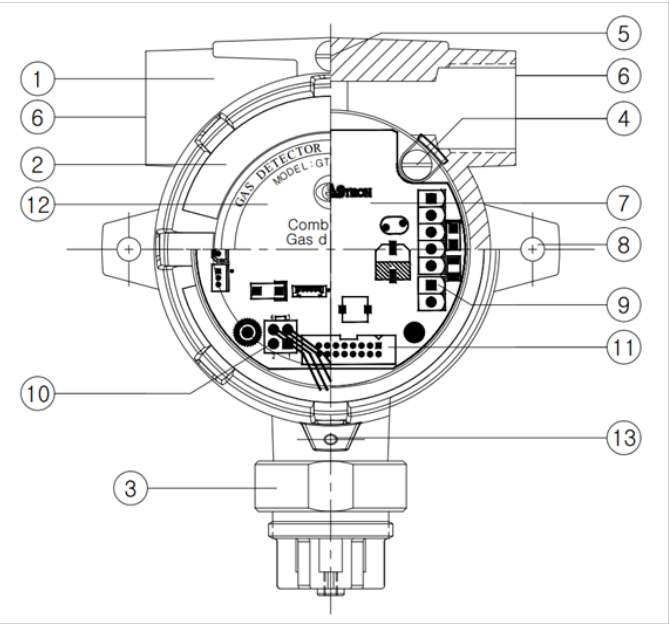
3.3. Electrical Specifications (Standard Type)

ITEMS	SPECIFICATION	
Input Voltage(Standard) ※ Customer supplied PSU must meet requirements IEC1010-1 and CE Marking requirements.	Absolute min:	18V
	Nominal:	24V
	Absolute max:	31V
	Ripple maximum allowed:	1V pk-pk
Wattage	Max. wattage:	4.8W @+24 VDC
	Max. current:	200mA @+24 VDC
Analog output Current	0-20mA(500 ohms max load)	
	All readings ± 0.2mA	
	Measured-value signal:	
	4mA(Zero) to 20mA(Full Scale)	
	Fault:	0mA
	0-100% LEL:	4mA - 20mA
	100-109%LEL:	21.6mA
	Over 110% LEL:	20mA - 21.4mA
	Maintenance:	3mA
Analog output current ripple & noise max		±20uA
Wiring requirement	Power	CVVS or CVVSB with shield
	Analog	CVVS or CVVSB with shield
Signal Transmission Distance (Cable Connection Length)	Analog	2500m
EMC Protection:		Complies with EN50270

3.4. Environmental Specifications

ITEMS	SPECIFICATION	
Operation Temperature	Transmitter	-20 to 50 °C
	Sensor	Refer to Sensor Specification
Storage Temperature	Transmitter	-20 to 50 °C
	Sensor	Refer to Sensor Specification
Operation Humidity	Transmitter	5 to 99% RH (Non-condensing)
	Sensor	Refer to Sensor Specification
Pressure Range	90 to 110KPa	
Max. air velocity	6m/s	

4.1. Components



[Figure 2. GTD-1000Ex Components]

NO	NAME	DESCRIPTIONS
1	Detector housing body	Protects PCB Board built in Sensor and Housing from external environmental change and shock.
2	Detector housing cover	It is assembled with detector housing body and protects PCB Board built in Sensor and Housing from external environmental change and shock
3	Sensor head	It is a site that detects actual gas leak. It converts the amount of gas leak into electrical signal and transmits to the Amp PCB.
4	Internal grand (2sq↑ cable)	It must be grounded to inside of detector for protection from external noise or strong electric field
5	External ground (2sq↑ cable)	It must be grounded to outside of detector for protection from external noise or strong electric field.
6	Conduit connection	It is supplied for inlet of power supply and measurement output signal for the detector during installation. For cable inlet, PF or NPT 1/2", 3/4" are prepared. (Default specification is PF 3/4".)
7	Mount holes(2-Ø7)	Hole to fix the gas detector on external wall or other installation sites.
8	Amp(main) PCB	Amplifies fine outputs generated from Sensor Element to transmit a converted output in 4~20 mA DC standard. It sends data to display part.

4.1. Components

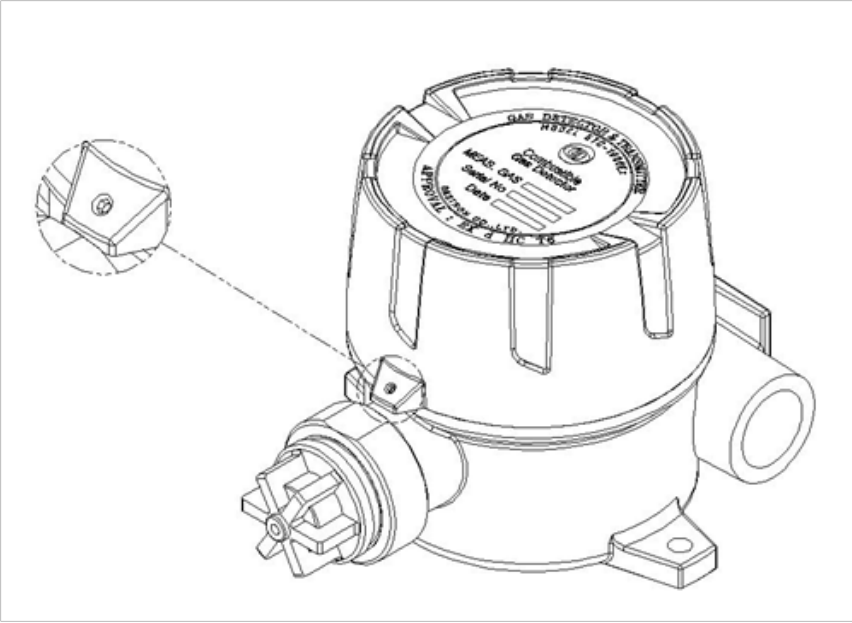
No	ITEMS	SPECIFICATION
9	Power/mA terminal	CN1 consists of power input of DC 18~31 V and connection terminal (+, mA, -, ET) for signal output.
10	Sensor terminal	CN2 is Sensor Connection Terminal.
11	Model name plate	Model name, measuring gas, serial number, etc. are labeled.
12	Set screw(M4-L6)	It is a set screw that prevents cover opening from the detector housing body.

[Table 1. GTD-1000Ex Components Description]

- It is prohibited for an individual, other than an approved user or a technician responsible for installation and repair from the head office, to install a gas leak sensor on site or open the cover of the installed gas leak detector and manipulate it. This may cause serious loss of life and property from fire, explosion, and etc. In addition, please check whether there is any remaining explosive gas or combustible material in the surroundings. Power must be turned off before performing work.

5.1. Detachment of Housing Cover

- Turn the slotted set screw (M4 x 1ea) fixing the cover part of main body 3~4 tuns counter clockwise (ccw) using a hex wrench (M2) then turn the cover of gas leak detector ccw to detach the cover.



[Figure 3. Slotted Set Screw]

5.2. Main PCB Configuration

■ After detaching the cover, the Main PCB terminal layout appears as shown in the figure below.

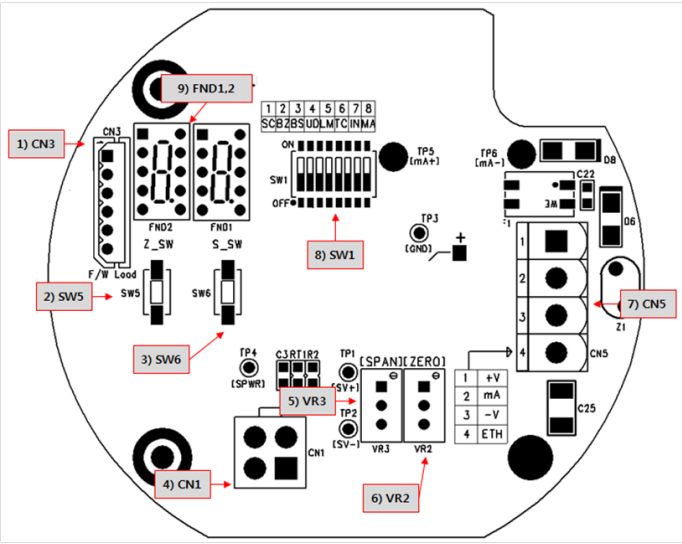


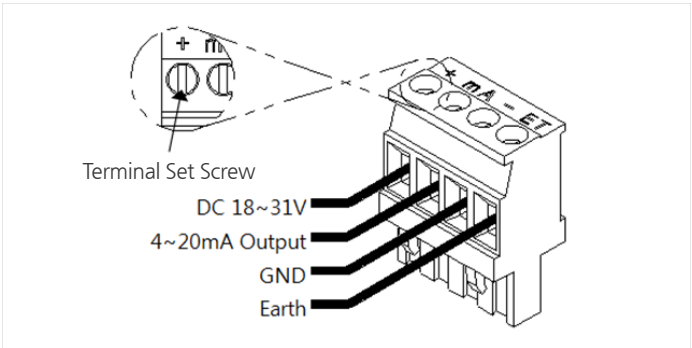
Figure 4. Main PCB Key Layout

No	NAME	DESCRIPTION
1	CN3	Program download Connector
2	SW5	Zero Calibration Switch
3	SW6	Span Calibration Switch
4	CN1	Sensor Connector
5	VR3	Potentiometer for SPAN Output Adjustment
6	VR2	Potentiometer for ZERO Output Adjustment
7	CN5	Power & Output Signal Terminal
8	SW1	Mode Control DIP Switch
9	FND1, 2	FND for Internal Status Display

Table 2. Main PCB Key Part Description

5.3. Power and Signal Terminal Configuration

- After disassembling display parts, there is a terminal block in the Main PCB as shown in the figure below. Holding it with hands and pulling towards ceiling detaches it from the Main PCB.
- Loosen 5 terminal fixing screws located at top part of detached terminal block CN8 (VIS, +, mA, -, ETH) Connector by turning counter-clockwise using a Θ driver. Connect DC 18~24 V power to +, and - then connect signal cable to mA. Tighten 5 terminal fixing screws clockwise so that terminal does not leave the track then insert Main PCB as the same condition before disassembly.



[Figure 5. CN1 Terminal Configuration]

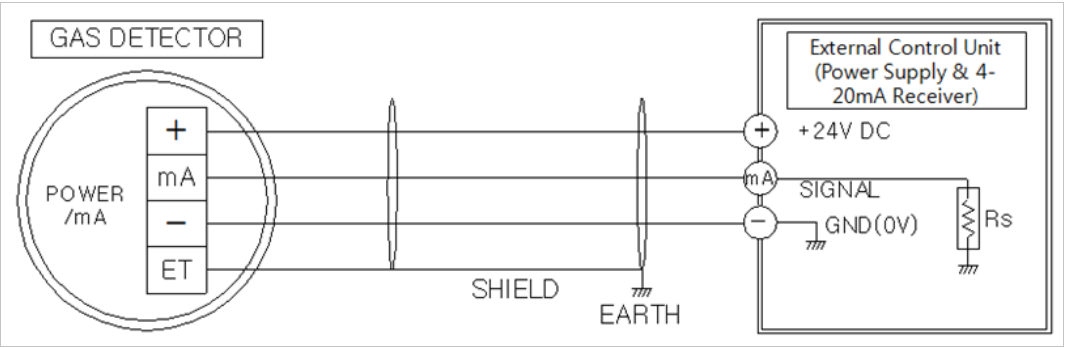
NO	PIN NAME	DESCRIPTION
1	+	+24V / POWER (+)
2	mA	4~20mA Source Out
3	-	GND / POWER (-)
4	ET	EARTH

[Table 3. CN1 Terminal Detailed Description]

- Use CVVS or CVVSB 2.0sq↑ Shield Cable for terminal configuration.

5.4. Method to Connect to External Control Unit

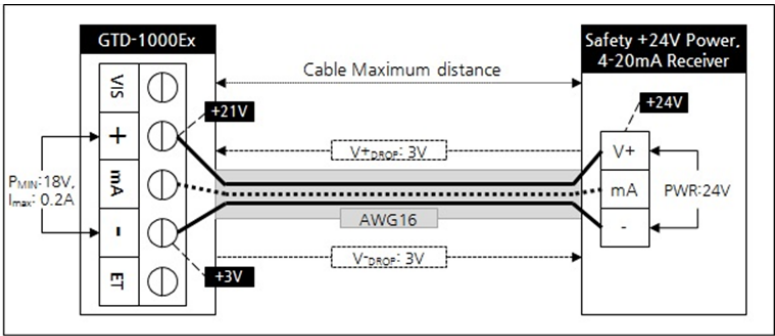
- Connect 18 V~31 V DC operation power to CN1 (+, mA, -, ET) Connection Terminal of the gas detector then connect a device that can receive 4~20 mA signals to mA.



[Figure 6. External Control Unit Connection Method]

5.5. Installation Cable Length

- The maximum length between GTD- 1000Ex and power supply is decided by wire specification.
- Max. Installation Length = $V_{MAXDROP} \div I_{MAX} \div WIRER/m \div 2$
 - VMAXDROP: Maximum Power Loop Voltage Drop (=Power Supply voltage - min operating voltage)
 - IMAX : Max. Current of GTD-1000Ex
 - WIRER/m: The resistance of the wire (ohms/meter value available in wire manufacturer's specification data sheet)
- Example of installation lengths using 24 V power supply and 16 AWG is as follows.
 - GTD-1000Ex minimum operating voltage = 18 Vdc
 - VMAXDROP = 24 - 18 = 6V
 - IMAX = 0.2A(200mA)
 - $6 \div 0.2 \div 0.01318 \div 2 = 1138.088m \div 1138m$



[Figure 7. Calculation of GTD-1000Ex Installation Cable Length]

- Power cable installation for each cable type is as shown in the table below.

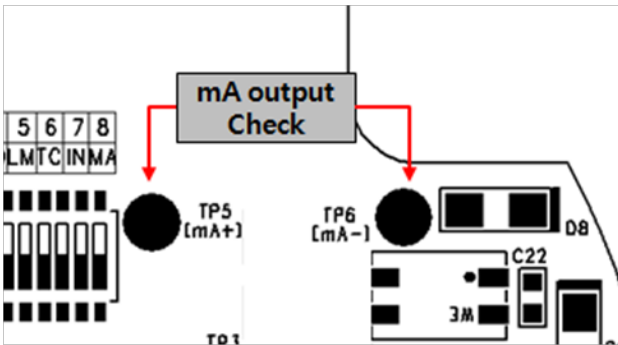
AWG	mm2	COPPER RESISTANCE(ohms/m)	METERS
12	3.31	0.00521	2879
14	2.08	0.00828	1811
16	1.31	0.01318	1138
18	0.82	0.02095	715
20	0.518	0.0333	450

[Table 4. GTD- 1000Ex Power Cable Installation Length]

- Stabilization time of 30 min from the initial supply of operation power to the sensor for the stabilization of the sensor. Calibration and test must be performed approx. 30 min after when the sensor has been stabilized.

6.1. 4-20mA Output Diagnosis

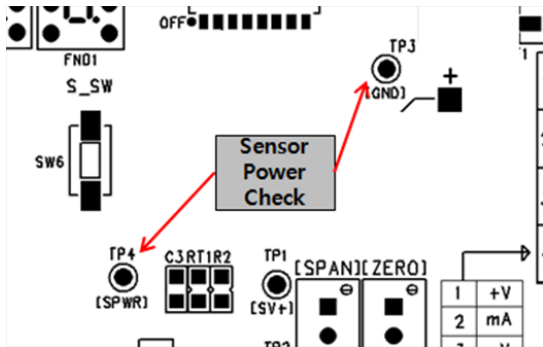
- It supplies voltage of 18~31 V and current of 200 mA to the sensor. When the voltage is measured by connecting a multimeter to TP5 (+mA) and TP6 (-mA) of AMP PCB, current of 4~20 mA can be confirmed.



[Figure 8. 4-20mA Output Test Terminal]

6.2. Gas Sensor Status Diagnosis

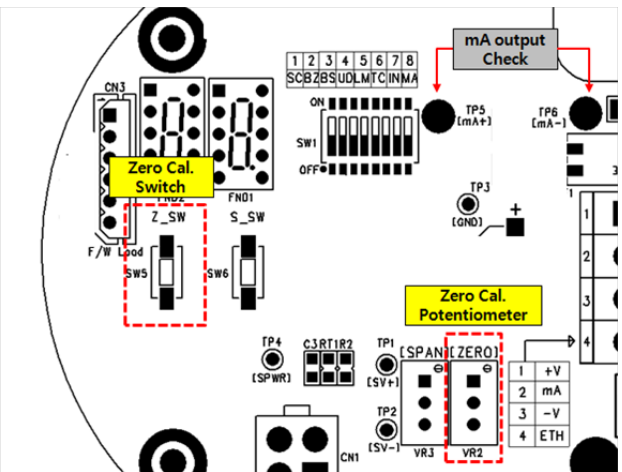
- After supplying a voltage of 18~31 V to the sensor, it is normal if a voltage of 2.5 V ~ 2.6 V is measured by connecting multimeter to TP3 (GND) and TP4 (SPWR) of AMP PCB.



[Figure 9. Sensor Power Test Terminal]

6.3. 4mA Adjustment (ZERO Calibration)

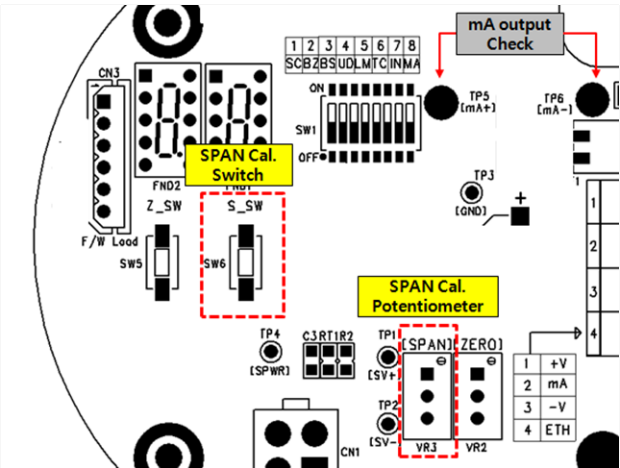
- Check voltage of 18~31 V DC at both (+24 V) and (GND) of terminal block 'N5'.
- Check whether (mA) terminal of terminal block 'CN5' is connected to the receiver.
- Change DMM to current measuring mode, then connect (+) and (-) terminals or DMM to TP5 (+mA) and TP6(-mA) of AMP PCB, respectively.
- When zero switch (SW5) is pressed for 3 sec, a message "[ZE][RO]" flashes 3 times on FND1 and FND2 and it enters zero calibration mode.
- When clean air or 99.9% nitrogen (N2) is injected to cell part, 4 mA output is observed. If the output is not 4 mA, adjust the potentiometer 'VR2 (ZERO)' left and right to set 4mA.
- Adjust 'ZERO' potentiometer to obtain a current of 4.00 mA to be displayed on FND1 and FND2.
- When zero switch (SW5) is pressed for 3 sec after output is set to 4 mA, result from zero calibration is displayed on FND1 and FND2. "[PA][SS]" means that the calibration has performed successfully. "[FA][IL]" means that the calibration has not met the condition and failed. In this case, sensor and power must be reconfirmed then calibration shall be performed again.



[Figure 10. ZERO Calibration related Parts]

6.4. SPAN Calibration

- Check voltage of 18~31 V DC at both (+24 V) and (GND) of terminal block ‘CN5’.
- Check whether (mA) terminal of terminal block ‘CN5’ is connected to the receiver.
- Change DMM to current measuring mode, then connect (+) and (-) terminals or DMM to TP5 (+mA) and TP6(-mA) of AMP PCB, respectively.
- When span switch (SW6) is pressed for 3 sec, a message "[SP][AN]" flashes 3 times on FND1 and FND2 and it enters span calibration mode.
- When the standard calibration gas is injected into cell part, 12 mA output is observed. If the output is not 12 mA, adjust the potentiometer 'VR3 (SPAN)' left and right to set 12 mA.
- Adjust 'SPAN' potentiometer to obtain the correct current output for the standard gas to be displayed on FND1 and FND2.
- When SPAN switch (SW6) is pressed for 4 sec after it is set to a desired output, result from span calibration is displayed on FND1 and FND2. "[PA][SS]" means that the calibration has performed successfully. "[FA][IL]" means that the calibration has not met the condition and failed. In this case, sensor and power must be reconfirmed then calibration shall be performed again.



[Figure 11. SPAN Calibration related Parts]

- CH4 50% LEL calibration output calculation is as follows.
Range : 0-100#LEL
Output signal : 4-20mA
Calibration Gas: CH4 50% LEL /N2
balance Test point signal (TP5, TP6)

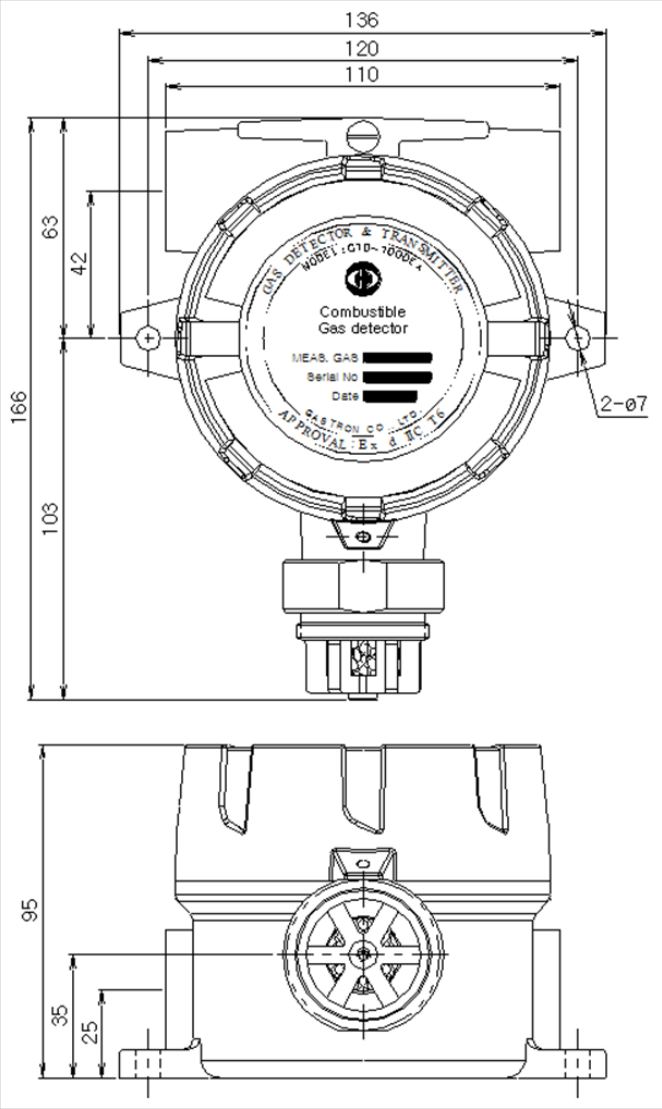
$$(200 - 40) \times \frac{50\%LEL \text{ (Standard Gas)}}{100\%LEL \text{ (Full Range)}} + 40 = 120 = 12.0mA$$

6.5. Gas Detector Calibration Method using Methane(CH4) Standard Gas

- Combustible gas sensor used for device can measure various types of combustible gas. However, each combustible gas has different properties including explosion range, heat generation rate, specific gravity, etc., therefore, it is impossible to perform calibration with every standard gas.
- Thus, this product uses methane gas as a reference and applies comparative properties of each combustible gas analyzed as shown in the table below.

Gas Type		Explosion Range (VOL%)	Relative Span LEL%(CH4)
Methane	CH4	5.0	100
Propane	C3H8	2.2	80
iso-Butane	C4H10	1.8	80
n-Pentan	C5H12	1.4	80
n-Hexane	C6H14	1.2	75
n-Heptane	C7H16	1.05	65
iso-Octane	C8H18	0.95	60
Methanol	CH3OH	6.7	130
Ethanol	C2H5OH	3.3	95
iso-Propanol	C3H7OH	2.2	80
Acetone	(CH3)2OH	2.6	85
Toluene	C6H5CH3	1.2	70
Ethyl Acetate	CH3COOC2H5	2.2	75
Hydrogen	H2	4.0	125
Ammonia	NH3	15	150
Cyclohexane	C6H12	1.3	75
Acetylene	C2H2	2.5	35
Ethylene	C2H4	2.7	95

- When iso-Butane sensor is calibrated with 2.5% methane standard gas, calculate as shown below.
(Explosion range of iso-butane is 1.8% and methane is 5%.)
- In sensor, it becomes: $(100\%LEL \div 80\%LEL) \times (2.5\% \div 5\%) \times 100\%LEL = 62.5\%LEL$
- At this time, output from the sensor becomes: $20mA - 4mA) \times 0.625 + 4mA = 14mA$



[Figure 12. GTD-1000Ex Drawing]

8.1. Selecting a Place for Installation (Occupational Health & Safety Data)

A gas leak detector alarm shall be installed in the following places.

- Around chemical equipment and accessories that have concerns of gas leak. This includes compressors, valves, reactors, pipe joints, etc. installed inside and outside of a building that handle combustible and toxic materials.
- Places that are easier for gases to stay such as areas around manufacturing facilities with ignition sources like heating furnace, etc,
- Areas around equipment for filling combustible and toxic materials.
- Substations, panel rooms, control rooms, and etc. located within explosive area.
- Other areas that are easier for gases to stay.

8.2. Selecting a Site for Installation (High-Pressure Gas Safety Act Data)

Gas detector of gas leak detector alarm must be installed as close to the areas with concerns of gas leakage as possible. However, for areas where direct gas leakage is not expected but are easier for leaked gas to stay, the detector must be installed at the point 1 of the following.

- Gas leak detector alarm installed outside a building shall be installed at points where gas is likely to stay in consideration to wind direction, wind speed, specific gravity of gas, etc.
- Gas leak detector alarm installed inside a building shall be installed near the floor when the specific gravity of gas is heavier than air and near ventilation of ceiling when it is lighter than air.
- Alarm for gas leak detector alarm must be installed at sites where the gas detector is installed and workers are present.

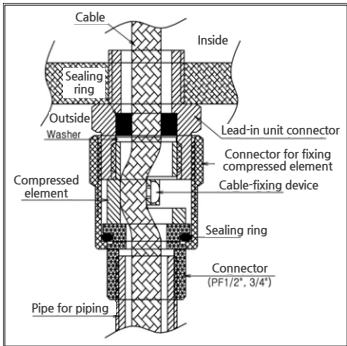
8.3. Precautions during Installation

Avoid areas with electrical barriers such as rain water, etc. It is recommended to be installed in areas that are easier to work in since regular maintenance is needed. Avoid areas with vibration or shock since they can affect output values. Sensor part must be installed towards the direction of gravity.

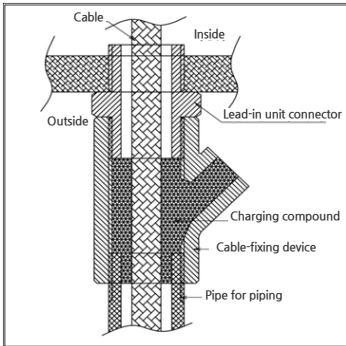
- This equipment has explosion-proof construction for internal pressure and belongs to GROUP II for gas and vapor in general work sites and chemical plants. It can be used in ZONE 1 (ONE) and ZONE 2 (TWO) hazardous sites.
- Allowable temperature is 85 C or below, which corresponds to T6.

- Use with surrounding temperature in a range of -20 C ~ 50 C.
- Installation Height: 1,000 M below sea level
- Relative Humidity: 5% ~ 99%
- Installation Site: Indoor and Outdoor
- Explosion Ignition Grade for the Gas or Vapor: Ex d IIC T6
- During wiring work, use explosion-proof cable gland at cable inlet or tightly seal cable conduit during metal cable wiring construction to prevent spread of flames in case of explosion or movement of gas, etc. through the cable conduit within 50 mm. All materials including materials used for sealing of unused inlets must have safety certificates!
- When connecting the equipment with cable, screw thread must be tightened 5 threads or more.
- Work in conditions satisfying other [Standards for Selection, Installation, and Maintenance, etc. of Explosion-proof Electric Machine and Equipment Wiring, etc. at Work Site]
- All materials used for cable inlet such as cable gland and sealing fitting, etc. and used as sealing unused inlets must pass the verification!

VERSION	CONTENTS	DATE
0.0	* Manual Initial Revision	2013.06.10
1.0	* Drawing and Function Added.	2015.06.29
1.1	* Changed Font	2016.05.19
2.0	* Separated Factory mode manual	2016.09.27
3.0	* Changed Explosion-proof Equipment Cable Entry Installation Regulation 45 cm → 50 mm	2017.01.20



[Figure 13. High-Pressure Packing Type]



[Figure 14. Y Sealing Compound]