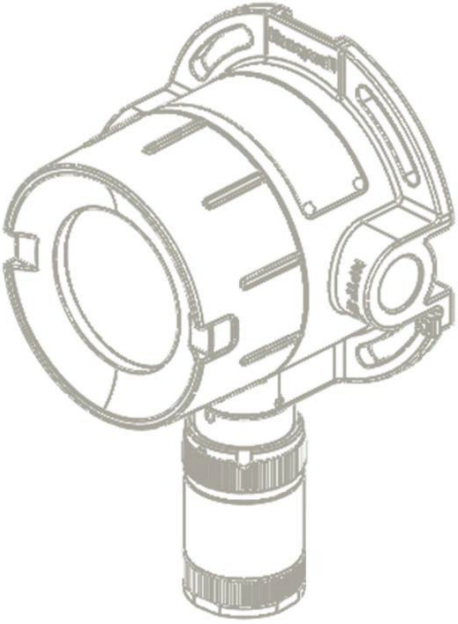
Honeywell

RAEGuard 3

Fixed Gas Detector

FGM-6100(S)/6200(S)/6300(S)



User Manual

D06-4001-000

Rev F

About this manual

This manual explains how to install and use RAEGuard 3 fixed gas detector. All personnel responsible for installation, commissioning, operation or maintenance of these products should read this manual.

Before installing the product, please read and fully understand the instruction given in this manual. We have tried our best to ensure the accuracy of this document, however Honeywell is not responsible for any errors or omissions or their results. We would appreciate you reporting any errors or omissions in this document. For information not included in this document, or for comments/corrections, please contact Honeywell with the contact details given on the back page.

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1 Safety

Ensure that this operation manual is read and understood **BEFORE** installing/operating/maintaining the equipment. Pay particular attention to "***Warnings***" and "***Notes"***. All the document **Warnings** are listed here and repeated where appropriate some of the start of relevant chapter(s) of the manual. **Notes** appear in the corresponding parts of each chapter where they apply.

WARNINGS

RAEGuard 3 is designed for installation and use in Zone 1, Zone 2 hazardous areas in many countries including Europe, China etc.

Installation must be in accordance with the recognized standards of the appropriate authority in the country concerned.

Access to the interior of detector, when carrying out any work, must only be conducted by trained personnel.

Before carrying out any work ensure local regulations and site procedures are followed. Appropriate standards must be followed to maintain the overall certification of the detector.

Two cable entries must be fitted with "seal fitting" appropriately, such as conduits, stopped plug, cable gland etc. For installation where conduit is used, there must be a "Seal fitting" installed for each of the cable gland entries within 150cm of RAEGuard 3. The total distance of location of these Seal Fitting is 150cm. (e.g. If all 3 gland entries are to be used, 3 Seal Fittings should be located, each within 50cm of the wiring entrance).

If using anti-seize compound, they should not contain substances that may poison or suppress the catalytic flammable gas sensor, such as silicides, sulfides, chlorine, lead, or halogenated hydrocarbons.

To reduce the risk of ignition of hazardous atmosphere, de-classify or disconnect the equipment from the supply circuit before opening the detector enclosure. Keep assembly tightly closed during operation.

Never attempt to open a junction box/enclosure or replace/refit flammable-gas/infrared sensor in potentially hazardous atmospheres while the transmitter is energized.

The detector must be earthed/grounded for electrical safety and to limit effects of radio frequency interference. Earth/ground points are provided inside and outside the unit. The internal grounding shall be used the primary equipment ground. The external terminal is only a supplemental bonding connection where local authorities permit or require such that.

Ensure that all screens/instrument earth/clean earth wiring is earthed/grounded at a single point (either at the controller or detector-BUT NOT BOTH) to prevent false reading or alarms that may occur due to potential earth/ground loops.

Take care when handling sensors as they may contain corrosive solutions.
Do not tamper with or in any way disassemble the sensor.
Do not expose to temperature outside the recommended ranges.
Do not expose sensors under storage conditions to organic solvents or flammable liquid.

When the service life of the sensor expires, the discarded sensors must be stored in a safe environment to prevent environmental pollution. Or hand it to Honeywell for proper disposal.

Electrochemical sensors should NOT be incinerated as this action may cause the cell to emit toxic fumes.

The sensor head must be fitted with the supplied waterproof cap, and mounted so that overall detector meets ingress protection rating.

Modbus, Hart, menu, and Bluetooth cannot be used to set up the instrument at the same time.

Special condition for safe use:

1. Compliance with the manual is required for safe use of RAEGuard 3.
2. Once the instrument steps into the “safe state”, must shut down and resume detector until it is ensured to be good.
3. Once the instrument will be under “safe state”, 4-20Ma current loop output will output a constant value, no further changes along with environmental gas concentration.
4. RAEGuard 3 has been calibrated by regular gas in factory before dispatched, but in order to ensure the sensitivity and accuracy of the instrument as far as we can, it is recommended that shall be calibrated by complied gas each 6-month at least, also must use the “Calibration cap” for calibration process.
5. In wiring, due to unexpected factors in the environment, the 4-20Ma output circuit may be attenuated. Checking and if not corresponding, please re-calibrate 4Ma and 20Ma after the instrument is installed.
6. High and Low Alarm default threshold value are experience, and they can be reset depending on the field applications or the demands of customer or local regulatory. (This function is optional, if no ordering, no offering).
7. Be Careful of low and high alarm trigger set. If the trigger set in menu is FALLING, the device will not send an alarm message even if a high concentration gas leak is detected!
8. Both STEL and TWA are nearly used in portable to protect personal safety working in hazardous environments for a long time. Default is set to DISABLE.
9. The CF set in menu is only enabled for catalytic sensor for detection of flammable gas.
10. For Oxygen sensor, customer in the field only needs to do SPAN calibration since its zero calibration has been completed at the factory.
11. For oxygen sensor, while the concentration of detector is in the range of 20.5%vol to 21.3%vol under normal status, the concentration on LCD will show 20.9% vol. If concentration is in the range of – 1%vol to 0%vol, detector shows 0% vol, and the output is 4 Ma.
12. For flammable gas, in normal measurement, when the measured value of detector is in the range of – 10% LEL to 1% LEL, the concentration will show 0% LEL and output 4 Ma.
13. First time switch on, recommend checking and re-set date/time of device.

14. For SIL applications, relays are not safety related, and cannot perform any safety function, and cannot be used for any safety current output.
15. When used in combustible dust atmospheres, there is potential electrostatic charging risk on the surface of the equipment. Avoid any actions that may cause the generation of electrostatic charge, such as rubbing with a dry cloth on coating surface of the product.

Warranty statement:

All products are designed and manufactured to the latest internationally recognized standards by Honeywell Analytics under Quality Management system that is certified to ISO9001. As such Honeywell Analytics warrants its products against defective parts and workmanship and will repair or (at its option) replace any instruments which are or may become defective under proper use for several popular gas sensors like LEL CO O_2 H_2S within 12 months from date of commissioning by an approved Honeywell Analytics representative or 18 months from date of shipment from Honeywell Analytics, whichever is the sooner. As for the special toxic gas, we only warrant it products against detective parts with 12-month from date of commissioning by approved Honeywell representative.

Defective goods must be returned to Honeywell Analytics premises accompanied by a detailed description of any issue. Where return of goods is not practicable Honeywell Analytics reserves the right to charge for any site attendance where any fault is not found with the equipment. Honeywell Analytics shall not be liable for any loss or damage whatsoever or howsoever occasioned which may be a direct or indirect result of the use or operation of the Contract Goods by the Buyer or any Party.

This warranty covers instrument and parts sold to the Buyer only by authorized distributors, dealers and representatives as appointed by Honeywell Analytics. The warranties set out in this clause are not pro rata, i.e. the initial warranty period is not extended by virtue of any works carried out there under.

In no event will Honeywell Analytics be liable for any incidental damages, consequential damages, special damages, punitive damages, statutory damages, indirect damages, loss of profits, loss of revenues, or loss of use, even if informed of the possibility of such damages. Honeywell Analytic's liability for any claims arising out of or related to this product will in no case exceed the order value. To the extent permitted by applicable law, these limitations and exclusions will apply regardless of whether liability arises from breach of contract, warranty, tort (including but not limited to negligence), by operation of law, or otherwise.

2 Introduction

The RAEGuard 3 gas detector consists of a transmitter and a range of sensors for detecting flammable, toxic and oxygen gases. It is designed for use in hazardous areas as well as non- hazardous environments.

The toxic gas and oxygen sensors feature an intrinsically safety design, allowing users to modify the detection range for greater application flexibility. RAEGuard 3 sensors support hot swapping in the field, simplifying the maintenance and system expansion.

The detector features a large graphic LCD display for real-time gas concentration readings and device status monitoring. It provides industry-standard 3-wire 4-20mA analog output and Modbus RTU digital signal output, enabling seamless integration with gas detection control systems or PLCs.

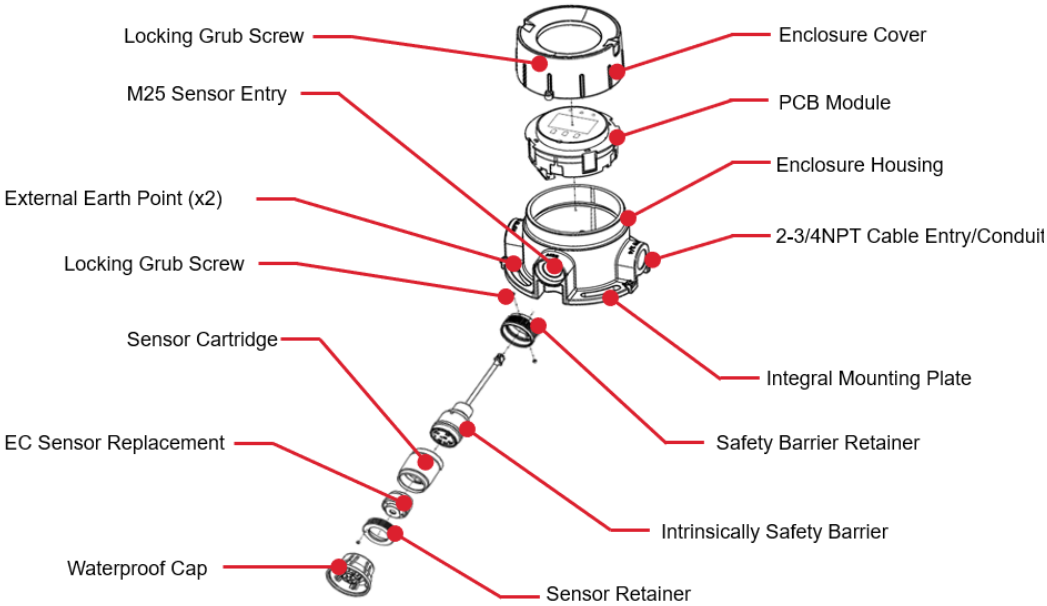
Calibration and maintenance can be conducted using a magnetic wand via three-button interface, facilitating straightforward non-intrusive operations by an individual operator.

The modular design of RAEGuard 3 supports expansions with options such as relays, audible and visual alarms, HART communication protocol, surge protection device (SPD) for lightning protection, and Bluetooth Low Energy (BLE) connectivity.

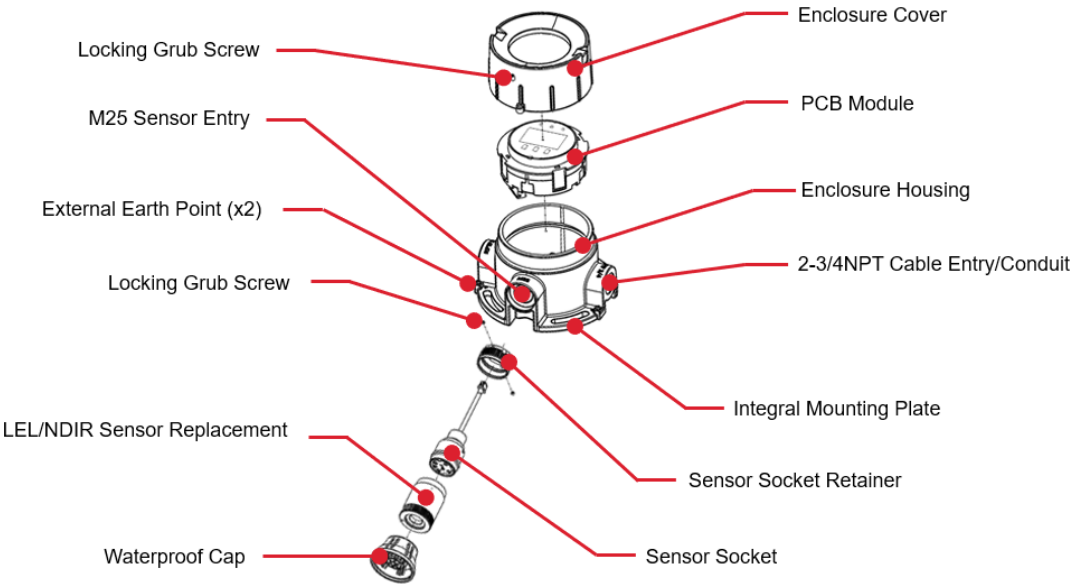
Additionally, various accessories such as collecting cone, sunshade, duct mount kit, gas-flow adapter and backboard mount kit are available to meet different application needs.

RAEGuard 3 consists of the following main components, as shown below.

Toxic and Oxygen model:



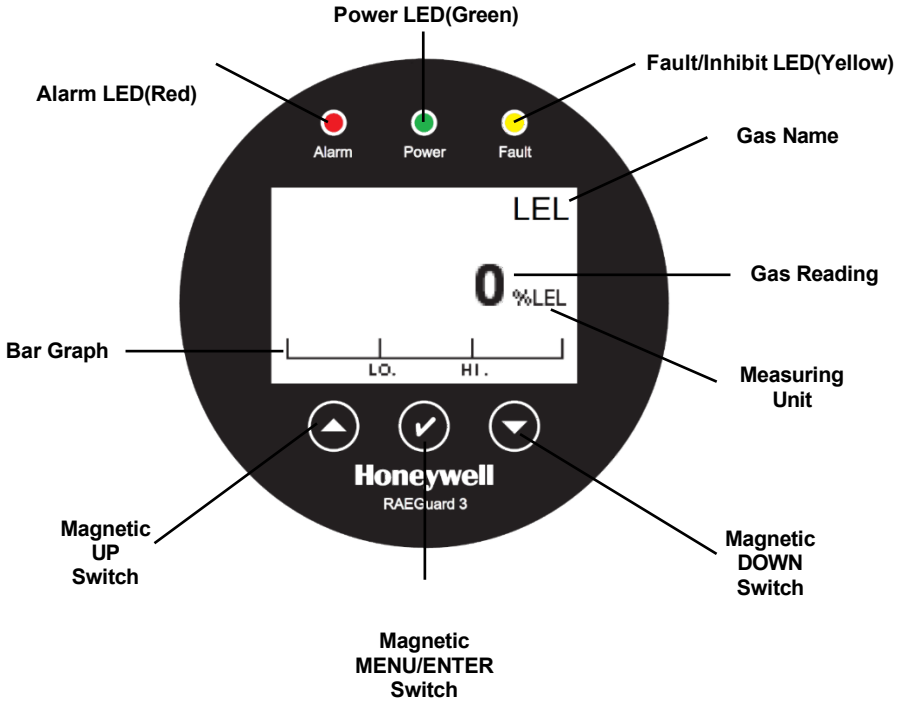
Flammable and NDIR model:



2.1 Transmitter

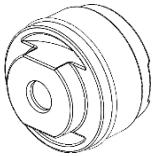
The RAEGuard 3 is with a universal transmitter, which can be connected to toxic and oxygen, catalytic and infrared(IR) sensor modules, and supports the remoted installation between sensor and transmitter separately.
RAEGuard 3 transmitter uses three magnetic wand switches to enable non-intrusive operation. Two cable entries/conduits can be connected to cables and other explosion-proof devices, such as SP07 visible and sound alarm, and remained entry is dedicated connecting sensor module.
Enclosure housing of the transmitter comes with an integral mounting plate, which can be directly installed on various sites, additional parts not required.
RAEGuard 3 transmitter are friendly and concise user interface:

- Graphic LCD display can display real-time gas reading, bar graph, gas name, alarm and fault, warning code and graphic icon, etc.
- Three high-recognized LED show the status of the transmitter.
- 3 magnetic switches "▲" "√" "▼" , to activate them, hold the magnetic end of wand up to the glass window and slowly swipe the magnet directly over the circle area.

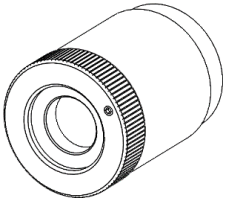


2.2 Flammable, Toxic and Oxygen Gas sensors

The RAEGuard 3 detector is designed to work with a variety of gas sensors for detecting flammable gases that adopts catalytic and infrared(NDIR) technology, with a wide range of toxic and oxygen sensor that uses electro-chemical technology. If it needs to be replaced, just replace it as follows: hot-swappable toxic and oxygen sensors and flammable/infrared sensors that need to be plugged out/in.



Toxic and oxygen sensor Cartridge

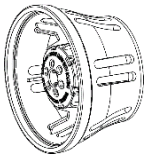


Flammable or NDIR sensor Cartridge

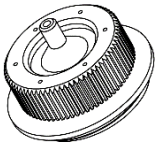
2.3 Accessories

A wide range of accessories is available to allow RAEGuard 3 to be used in a wider range of environments and installations.

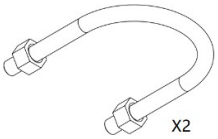
Standard accessories (**Note:** ATEX/IECEx versions not including Stopping Plug):



Waterproof Cap (PN: C07-2011-001) is designed to protect the sensor from changes in environmental conditions. Recommended to be fitted to RG3 for outdoor.



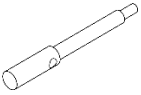
Calibration Cap (PN: C07-2018-001) must be used when calibrating the detector.



U-type Bolts (PN: 2013-2031-001), a standard mounting accessory which supports horizontal pipe and wall mounting

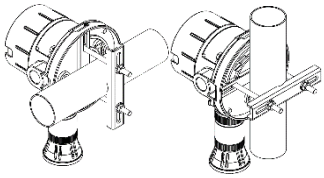
Stopping Plug (PN: 033-2061-001) is used to seal unused electrical interfaces on the transmitter

Z-type Tool (PN: M01-2055-001) is used to operate all fastening screws.

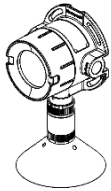


Magnetic Wand (PN: 2013-2031-001) is used to as a tool to allow users for configuration, calibration etc.

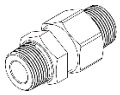
Optional accessories:



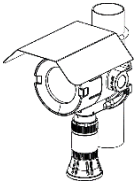
Mounting Plate Kit (PN: D06-3010-000) provides you with a more convenient, time-saving and labor-saving accessories.



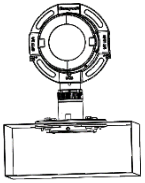
Collecting cone (PN: C07-2012-000) is designed for use with lighter than air for detection



Cable Gland, used to seal the connection between the cable and the transmitter.



Sunshade/Deluge Protection (PN: D06-2011-001) is fitted to the integral mounting plate. It is designed to protect RG3 from overheating in exposed hot and arid climates.



Duct Mounted Kit (PN: C07-2013-000) is designed for applications to allow the monitoring for the presence of gas inside a Heating, Ventilation or Air Conditioning duct is required.

Gas Flow Adapter (PN: C07-2014-000) facilitates the integration of detector into gas monitoring system.

2.4 Optional Hart® Function

RAEGuard 3 provides Hart® function, allowing the user or operator remotely set and maintain the detector via Hart® Communicator or Hart® Controller, including troubleshooting, routine practice, commissioning and calibration.

Before performing Hart® communication, please firstly confirm whether RAEGuard 3 DD files are installed in your Hart® Communicator or Controller. For example, 475 Hart Communicator, there are three accesses to download and install: infrared communication, Bluetooth communication and SD card. For more detailed information, please read Hart ® Communicator manual or consult manufacturer.

The DD file of RAEGuard 3 can be downloaded from the website: *https://data.hagascloud.com*, or from the Hart® Foundation website.

Note: *HART feature is optional.*

3 Installation

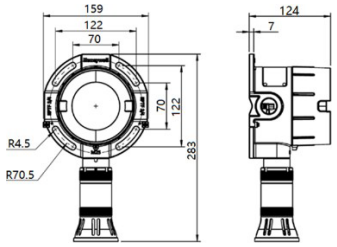
***Note**: The location of gas detectors should be made in accordance with any relevant local and national legislation, standards or codes of practice.*

Gas detector should be mounted where a potential hazard of gas is most likely to be present. The following points should be noted when locating gas sensors:

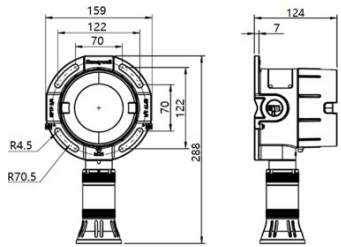
- When locating detectors consider the possible damage caused by natural events e.g. rain or flooding.
- Consider ease of access to the gas detector for functional testing and servicing.
- Consider how escaping gas may behave due to natural or forced air currents.

3.1 Mounting the transmitter

RAEGuard 3 transmitter has an integral mounting plate consisting of four mounting holes on the transmitter body. The transmitter may be fixed directly to the wall, or to a vertical or horizontal pipes/structure with standard spare U-type bolts, 38-60mm in diameter/cross section. (Unit: mm)



RAEGuad 3 Toxic and Oxygen



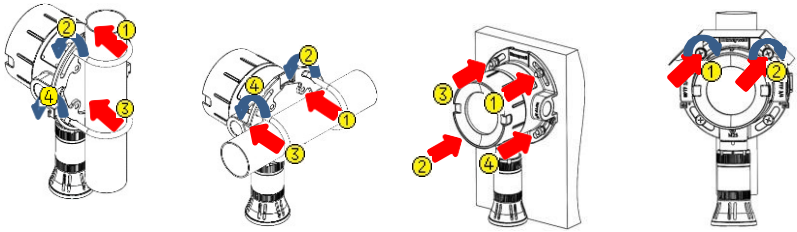
RAEGuard 3 Flammable and NDIR

RAEGuard 3 offers two mounted spares, one as standard spare along with product is 2Xu-type bolts; another as optional Mounting Plate Kit is for customer who can install quickly and conveniently, which includes 1-plate, 1-brackt and screws 2- M8*110, 4-M8*25 and 2-M8*6 separately.

Use standard installation spares and following procedure:

1. Select the suitable installation position and bury vertical or horizontal pipe/structure prior to mounting RAEGuard 3.
2. Pass 2Xu-type bolts through the vertical or horizontal pipe/structure and then through four holes of the transmitter housing.
3. Tighten four nuts with the spring and plain washers securely, the details please refer to the below diagrams.

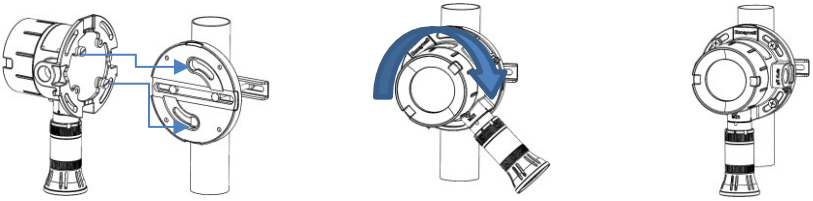
4. If you need to add sunshade/deluge protection cover, use the two M8*25 screws that comes with the sunshade/deluge protection, to fix it on the top of two holes. (See section 14 “Sunshade/Deluge Protection Drawing”)



Vertical Mounted | Horizontal Mounted | Wall Mounted | Mounted with Sunshade/Deluge protection

Use Mounting Plate Kit to mount:

1. Select the suitable installation position and bury vertical or horizontal pipe/structure (Diameter/cross section: 20-80mm) prior to mounting RAEGuard 3.
2. See the following procedure to fix the optional Mounting Plate Kit on the pipe/structure.
3. At diagonal positions secure the two M8*6 screws to the four holes in the back of enclosure of the RAEGuard 3 transmitter.
4. Refer to “Step 1”, align the transmitter to the 2 holes on the mounting plate.
5. As per “Step 2”, rotate the transmitter clockwise to perpendicular to the ground.
6. Tighten the four M8*25 screws through the four holes.

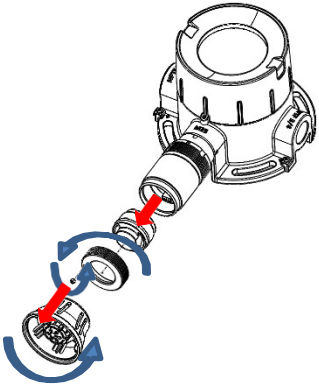


Step 1 | Step 2 | Step 3

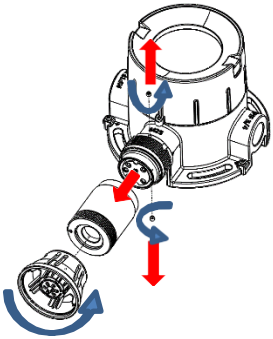
Note: *For further details and information, see Chapter 14.*
When installing, the detector’s sensor must be perpendicular to the ground!

3.2 Installing the sensor

Replacement or installation of toxic gas and oxygen sensor as well as flammable gas and NDIR sensor



Toxic gas and oxygen sensor



Flammable gas and NDIR sensor

Warning

Care should be taken when removing and refitting sensor module to the sensor socket so that damage to the connection pins can be avoided.

If using anti-seize compound, they should not contain substances that may poison or suppress the catalytic flammable gas sensor, such as silicides, sulfides, chlorine, lead, or halogenated hydrocarbons.

Take care when handling old sensors as they may contain corrosive substances.

Take care when removing or replacing Sensor Retainer as there may be sharp edges present on the adjoining threads.

To Replace/install the sensor module:

1. Remove the Waterproof Cap (if fitted) from the sensor.
2. Loosen the Locking Grub screw on the Sensor Retainer with the small end of the Z-type Tool.
3. Unscrew and remove the Sensor Retainer.
4. If replacing/installing Flammable gas and NDIR sensor, please skip Step 2&3 to Step 5 directly.
5. Remove the sensor module from the Sensor Socket and plug the new one in, taking care to align the sensor pins with the connector.
6. Refit the Sensor Retainer and tighten Locking Grub Screw and then screw the Waterproof Cap (if required) to the Sensor Retainer securely.

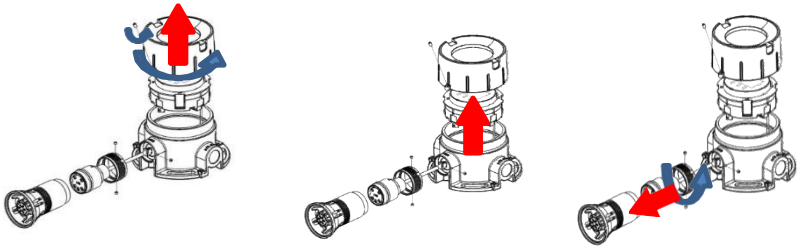
3.3 Remote Sensor Mounting

The remotely mounted sensor should be mounted using a suitable junction box or approved electrical conduit scheme.

To remotely mount the sensor parts, the procedure is following.

1. Select a suitably certified junction box.
2. Separate the whole sensor portion from the transmitter (See the below diagram process)
3. Fit the whole sensor to the junction box.
4. Connect the junction box to the transmitter using suitable cable and cable glands.
5. For wiring, see “Electrical Connection” section.

Note：The maximum cable length between the remotely mounted sensor and the RAEGuard 3 transmitter is Max. 10-meter for EC sensor and Max. 5-meter for Catalytic sensor. *Recommended to use 16AWG shielded cable.*



Step1 Step 2 Step 3

4 Electrical Connections

WARNINGS

RAEGuard 3 is designed for installation and use in Zone 1, Zone 2 hazardous areas in many countries including Europe, China etc.

Installation must be in accordance with the recognized standards of the appropriate authority in the country concerned.

Access to the interior of detector, when carrying out any work, must only be conducted by trained personnel.

Before carrying out any work ensure local regulations and site procedures are followed. Appropriate standards must be followed to maintain the overall certification of the detector.

Two cable entries must be fitted with "seal fitting" appropriately, such as conduits, stopped plug, cable gland etc. For installation where conduit is used, there must be a "Seal fitting" installed for each of the cable gland entries within 150cm of RAEGuard 3. The total distance of location of these Seal Fitting is 150cm. (e.g. If all 3 gland entries are to be used, 3 Seal Fittings should be located, each within 50cm of the wiring entrance).

If using anti-seize compound, they should not contain substances that may poison or suppress the catalytic flammable gas sensor, such as silicides, sulfides, chlorine, lead, or halogenated hydrocarbons.

To reduce the risk of ignition of hazardous atmosphere, de-classify or disconnect the equipment from the supply circuit before opening the detector enclosure. Keep assembly tightly closed during operation.

Never attempt to open a junction box/enclosure or replace/refit flammable-gas/infrared sensor in potentially hazardous atmospheres while the transmitter is energized.

The detector must be earthed/grounded for electrical safety and to limit effects of radio frequency interference. Earth/ground points are provided inside and outside the unit. The internal grounding shall be used the primary equipment ground. The external terminal is only a supplemental bonding connection where local authorities permit or require such that.

Ensure that all screens/instrument earth/clean earth wiring is earthed/grounded at a single point (either at the controller or detector-BUT NOT BOTH) to prevent false reading or alarms that may occur due to potential earth/ground loops.

Take care when handling sensors as they may contain corrosive solutions.
Do not tamper with or in any way disassemble the sensor.
Do not expose to temperature outside the recommended ranges.
Do not expose sensors under storage conditions to organic solvents or flammable liquid.

When the service life of the sensor expires, the discarded sensors must be stored in a safe environment to prevent environmental pollution. Or hand it to Honeywell for proper disposal.

Electrochemical sensors should NOT be incinerated as this action may cause the cell to emit toxic fumes.

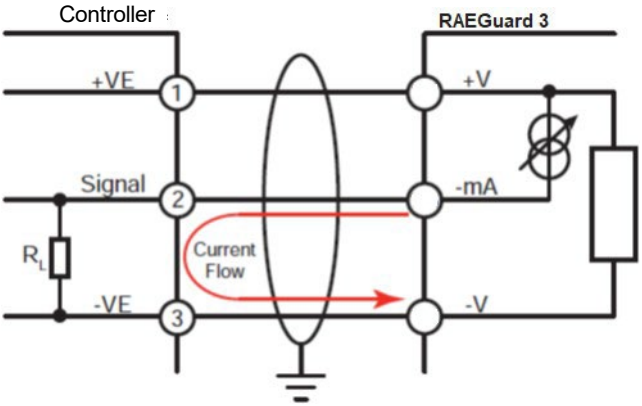
The sensor head must be fitted with the supplied waterproof cap, and mounted so that overall detector meets ingress protection rating.

Modbus, Hart, menu, and Bluetooth cannot be used to set up the instrument at the same time.

4.1 Transmitter wiring

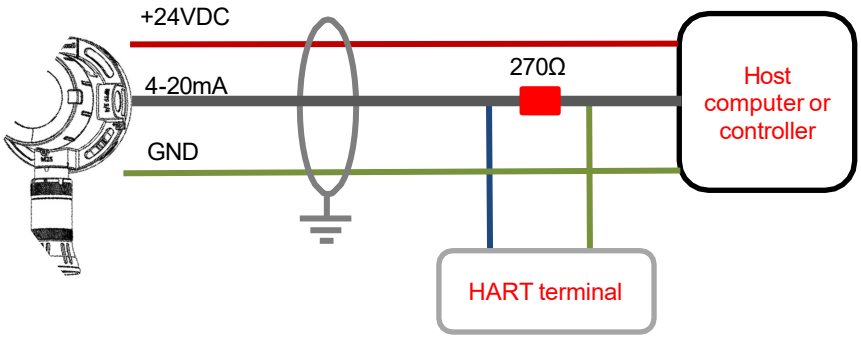
Note: All electrical connections should be made in accordance with any relevant local or national legislation, standards or codes of practice.

RAEGuard 3 transmitter only supports source current output with 3 wires 4-20Ma. Please refer to the wiring diagram as below.



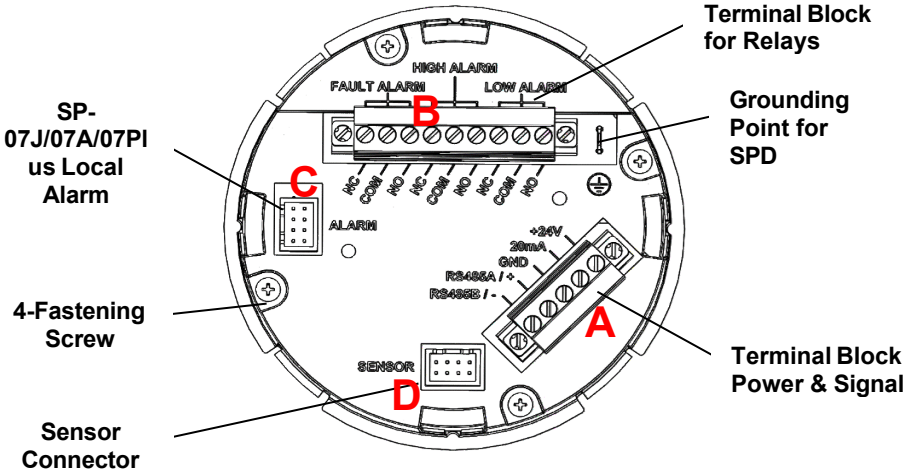
Note: *Terminate cable screen at detector or controller (that is maybe gas controller, also be upper system), not both.*
270ohm load resistor (RL) is installed in the factory, in case of connection with controller/host computer, this resistor should be removed because controller has load resistor internally.

If you choose a RAEGuard 3 transmitter that supports HART function. Communicate to the HART terminal, please refer to the following connection diagram.



4.2 Terminals

Note: *Before wiring, ensure that the PCB stack will be out of the enclosure of transmitter due to terminals at back of PCB stack.*



Terminal	Identification	Definition	Remarks
A	+24V	+VE Supply (16-32VDC)	Controller/Surge Protection Device (optional)
	20Ma	4-20Ma current & HART output	
	GND	-VE Supply	
	RS485A/+	Modbus A(+)	Modbus RTU
	RS485B/-	Modbus B(-)	
B	LOW ALARM-NO	Low Alarm- Normally Open	***Note****: If the function is not purchased at the time of ordering, there is no terminal.*
	LOW ALARM-COM	Low Alarm- Common	
	LOW ALARM-NC	Low Alarm- Normally Closed	
	HIGH ALARM-NO	High Alarm – Normally Open	
	HIGH ALARM-COM	High Alarm – Common	
	HIGH ALARM-NC	High Alarm – Normally Closed	
	FAULT ALARM-NO	Fault-Normally Open	
	FAULT ALARM-COM	Fault-Common	
	FAULT ALARM-NC	Fault-Normally Closed	
C	ALARM	External SP-07J/07A/07Plus	Optional
D	SENSOR	Connect with sensor	

4.3 Power

Note: *RAEGuard 3 series detector is designed for use in potentially explosive atmosphere and hazardous environments. The installation of detectors should ensure their explosion-proof performance and strictly comply with the relevant national standards, to use industrial-grade armored cables and explosion-proof glands and conduits.*
All unused and used cable/conduit entries must be sealed with a suitable certified sealing plug and cable gland.

Use 0.5mm^2 (20AWG) to 2.5mm^2 (13AWG) cross sectional area cable as needed to ensure minimum operating voltage at the detector, depending on installed cable length.

Operating Temperature	Sensor Type	Maximum Cable Length (km)							
		13AWG	14AWG	15AWG	16AWG	17AWG	18AWG	19AWG	20AWG
<= -10°C	Flammable gas and NDIR	1.12	0.89	0.71	0.56	0.44	0.35	0.28	0.22
> -10°C		1.76	1.39	1.11	0.88	0.69	0.55	0.43	0.34
<= -10°C	Toxic gas and oxygen	1.83	1.45	1.15	0.91	0.72	0.57	0.45	0.36
> -10°C		4.08	3.24	2.57	2.03	1.61	1.28	1.01	0.80
The above data is based on the normal supply voltage of 24VDC.									

RAEGuard 3 supports RS485 Modbus RTU protocol. It is recommended to use shielded twisted-pair cable to communicate with the master system. The maximum communication distance is as follows:

Type	Cable Spec	Max. length
Modbus RTU	13AWG-20AWG Shield	1000 meters

4.4 Cable and Earth/Ground regimes

Effective Earth/Ground bonding is important to ensure good EMC and RFI immunity.
The Earth Screen of the field cable should be “tied to Earth” or connected to Ground at one point only. It is common practice to adopt a STAR EARTH connection regime where all instrumentation screens are connected at one common point.
The Screen at the other end of the cable should be “parked” or terminated into a blank terminal.

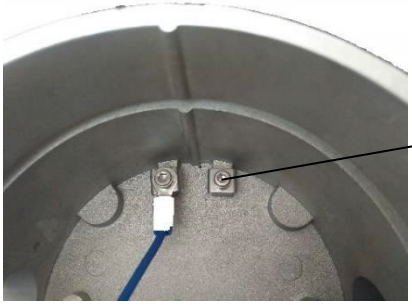
External Ground Connection

As shown in below figure, one end of the grounding wire is tightened to the detector housing and another end is grounded reliably. The grounded wire should

select a cable with a cross-section not less than 4mm^2, and the external grounded resistor should be guaranteed to be less than 4ohms.

Internal Ground Connection

This connection is the same as the external ground connection, as shown in the figure below. Usually, shielded cable is used, and the screen of cable is connected to internal ground point. When using independent cable to ground, its diameter should be no less than diameter of power cable.



5 Default Settings

The following default configurations of RAEGuard 3 transmitter are as follows.

Function	Default setting	Selectable range
Basic Password / Advanced Password	1111 / 8888	*0000-7999,8000-9999*
Fault Current Output	1 mA (±0.5 mA)	*1 mA or 2 mA or 3 mA*
Inhibit Current Output	2 mA (±0.5 mA)	1 mA or 2 mA or 3 mA
Warning Current Output	3 mA (±0.5 mA)	1 mA or 2 mA or 3 mA
Overrange Current Output	22 mA (±0.5 mA)	*21 mA or 22 mA or 23 mA*
Sound and Visual Alarm	SP07J	*SP07J, SP07A, SP-07Plus*
Location	A0000	*A000-Z9999*
Language	English	*Chinese, English*
HART address	0	*0-63*
RS485 ID, Baud Rate	1,19200	*1-247.* *4800,9600,* *19200,38400,57600*
Fault Relay**	Energized	*Energized, de-energized*
Low Alarm Relay*	Energized	*Energized, de-energized*
High Alarm Relay*	Energized	*Energized, de-energized*
Low Alarm Latch*	Non-Latching	*Latching, non-latching*
High Alarm Latch*	Non-Latching	*Latching, non-latching*
TWA/STEL	Disable	*Enable, disable*
Calibration interval	180	*0-360 (day)*

* Alarm relays automatically reset when reading falls within thresholds. If relay configured to LATCHING, then relays must be reset using the Magnetic Wand.
**Fault state (fault relay and analog output<1Ma) is always non-latching.

The default configurations for sensor are as follows:

Gas Name	Default Range	Low Alarm	Low Alarm Type	High Alarm	High Alarm Type
O_2	30.0%vol	19.5%vol	Falling	23.5%vol	Rising
H_2S	100ppm	10ppm	Rising	20ppm	Rising
CO	500ppm	25ppm	Rising	50ppm	Rising
LEL	100%LEL	25%LEL	Rising	50%LEL	Rising
CH_4-NDIR	100%LEL	25%LEL	Rising	50%LEL	Rising
SO_2	20ppm	5ppm	Rising	10ppm	Rising
CO_2	5%vol	4000ppm	Rising	8000ppm	Rising

For details of how to change the configuration of the RAEGuard 3 please refer to section 12.

6 Normal operation

RAEGuard 3 is generally running by the above default configuration. If the user needs adjustment based on the actual field conditions, please set it in terms of the setting range given by the instrument.
Two non-intrusive accesses to configure for RAEGuard 3 transmitter: Magnetic Wand and *Bluetooth*.
Note: Modbus, HART, menu, and Bluetooth cannot be used to set up the instrument at the same time.

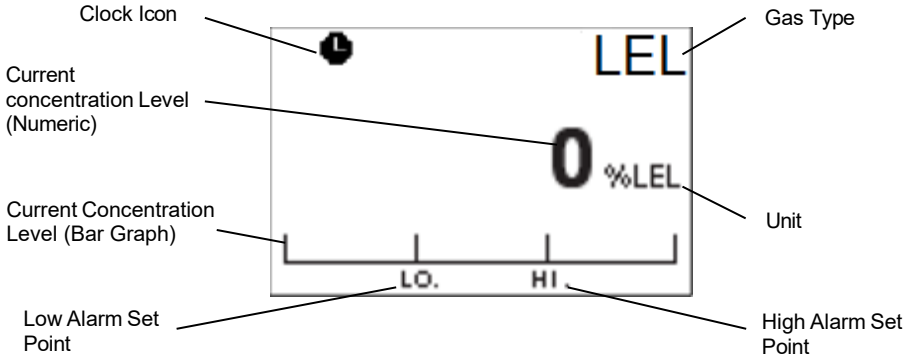
6.1 Display

RAEGuard 3 display features a graphical dot matrix Liquid Crystal Display with Numeric and bar-graph current concentration level, Unit, Alarm/Fault/Warning indication, Chinese/English language display, a target for magnetic switch activation etc. When an “event” occurs or the instrument is operated, the backlight of the LCD is triggered.

RAEGuard 3 has a high-bright 3-LED light, indicating various states of normal, fault, alarm, inhibit and so on respectively.

LCD screen uses automatic heating technology, and the display does not become sluggish even when operating over a wide temperature range of -40°C to +70°C.

***Note**: When the temperature of the instrument is lower than – 15 degree C, the LCD self-heating will start, resulting in greater power consumption of the instrument, so please fully consider the power supply capability when supplying power.*



6.2 System status

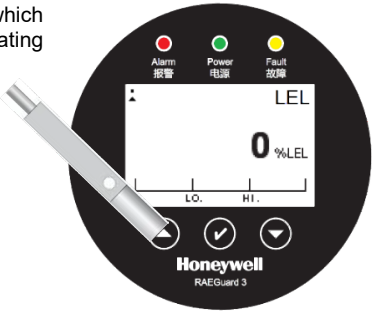
RAEGuard 3 provides users with simple and clear system status indications, which is convenient for users to judge and know the danger level of the site and whether the instrument is running normally.

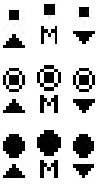
System status	Red LED	Green LED	Yellow LED	LCD Display	Analog current output
Low alarm	Solid	Flashing/1s		1 +Concentration	4-20(±0.1) Ma
High alarm	Flashing/1s	Flashing/1s		2 +Concentration	4-20(±0.1) Ma
Low alarm latch	Solid	Flashing/1s		+Concentration	4-20(±0.1) Ma
High alarm latch	Flashing/1s	Flashing/1s		+Concentration	4-20(±0.1) Ma
Overrange	Flashing/1s	Flashing/1s		OVER	22(±0.5) Ma
STEL alarm	Solid	Flashing/1s		STEL +Concentration	4-20(±0.1) Ma
TWA alarm	Solid	Flashing/1s		TWA + Concentration	4-20(±0.1) Ma
Inhibit		Flashing/1s	Solid		2(±0.5) Ma
Warning		Flashing/1s	Flashing/2s	W +warning code	3(±0.5) Ma
Fault		Flashing/1s	Flashing/1s	F +fault code	1(±0.5) Ma
Normal		Flashing/1s			4-20(±0.1) Ma
BLE Connected	Keeping	Solid	Keeping	+current detector's status	4-20(±0.1) Ma
Nore: Fault, inhibit and warning current can be set to 1 Ma or 2 Ma or 3 Ma. Overrange current can be set to 21 Ma or 22 Ma or 23 Ma. But It is not recommended to modify these default values.					

For more information on fault codes and warning codes, please refer to Section 11.

6.3 Magnetic Wand

Users can operate RAEGuard 3 via Magnetic Switch. There are 3-switch ▲, √, ▼ on the transmitter, which can be recognized by the Magnetic Switch operating icon on the LCD display.





Left, Mid, Right Click (>1s)

Left, Mid, Right Hold (>3s)

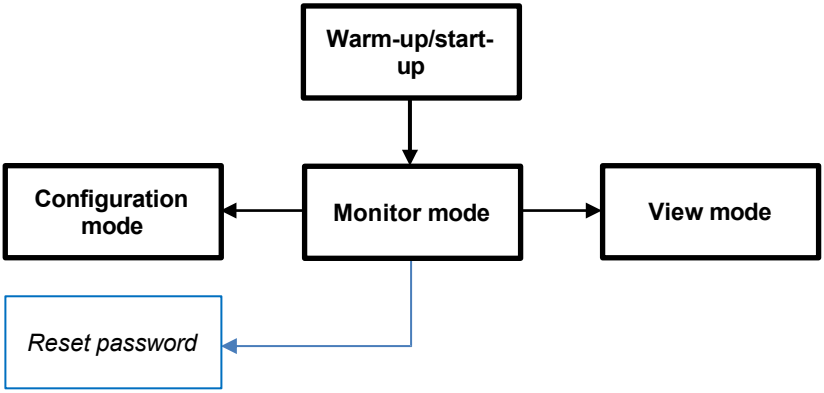
Left, Mid, Right Hold (>20s)

6.4 Operating mode

RAEGuard 3 detector offers three operating modes.

1. **Normal monitor mode:** is the normal operating status while RAEGuard 3 measures, and displays gas concentration. While the instrument alarm, fault, warning, etc. occur, the LED light will indicate the corresponding status of the instrument, and the corresponding information will be displayed on the LCD. At the same time, if the instrument is ordered with relay output function, the corresponding relay contacts will be activated according to the configuration.
2. **Configuration mode:** allows parameters relating to the configuration of the transmitter functions to be changed according to specific needs. This mode can be protected by two different passwords to prevent unauthorized changes being made.
3. **View mode:** allows the user to view the current configuration setting and instrument's common information.

Note: *Press and hold the "▲" button (keep the magnetic wand on the button for >20 s) to enter the "reset password" interface in case customers will forget password rather than operating instrument.*



For more detailed information on configuration, and parameter setting, Please refer to Section 12.

Note: *For Modbus, Hart, menu and Bluetooth cannot be used to set up the instrument at the same time.*

7 First Time Switch on (Commissioning)

Warning

The following procedure requires the Transmitter Cover to be removed while carrying out supply voltage checks. Therefore, the appropriate permits to work should be sought in preparation.

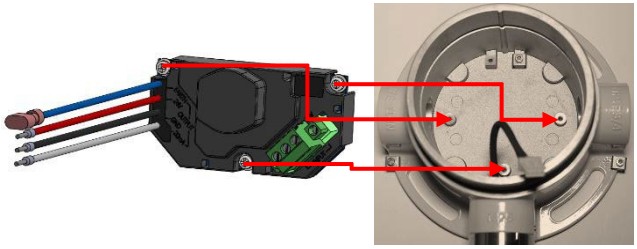
Prior to carrying out any HOT WORK ensure local, and site procedures are followed.

Ensure that the associated control panel output actuation is inhibited to prevent false alarms.

Note: *The following procedure should be followed carefully and only performed by suitably trained personnel.*
Calibration is mandatory before the detector can be used for gas monitoring. Refer to Section 8.1 Calibration for the proper procedure.

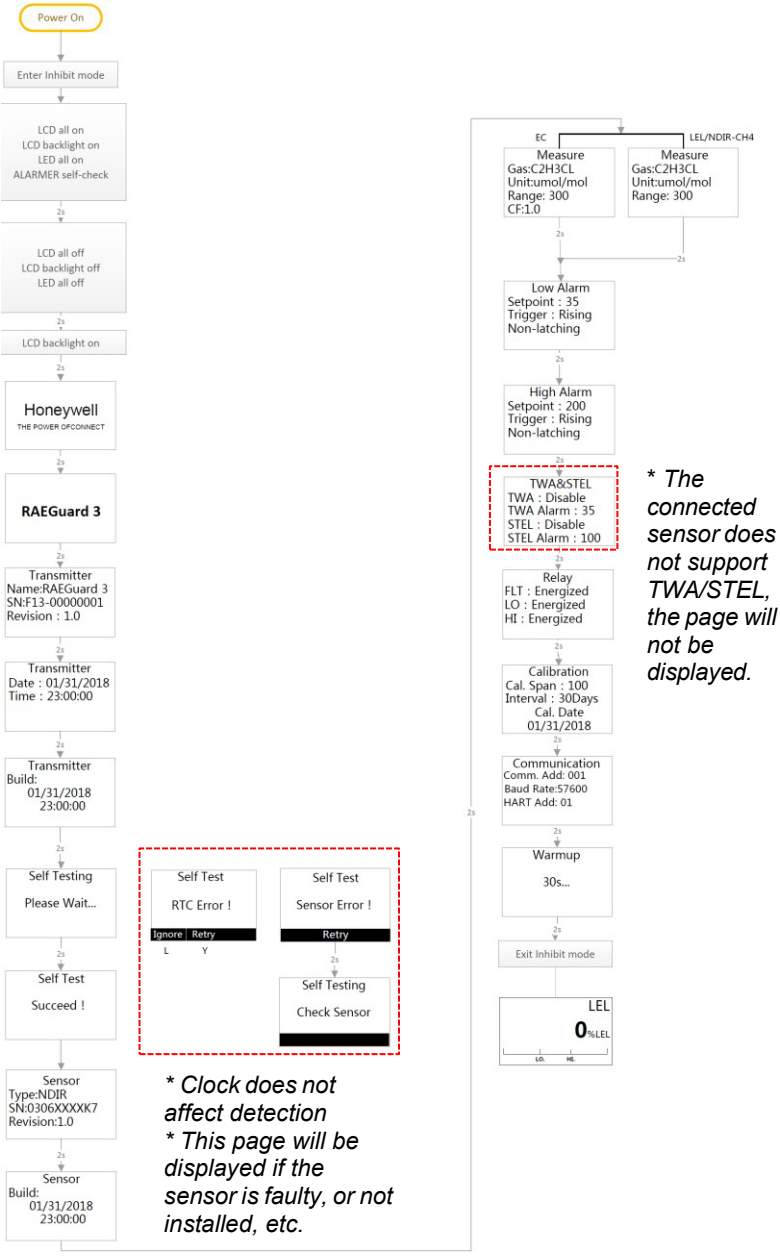
1. Remove the transmitter housing cover and detach the PCB block by lifting the semi-circular handle and pulling the assembly away from transmitter enclosure.
2. Refer to Section 4 to connect the cable and check that all electrical connections are correct completely.
3. Switch on the external power supply to the transmitter at the safe area gas detection controller (or PLC).
4. Using a Digital Multi Meter, check that the Supply Voltage should be 16VDC to 32VDC between the terminals “+24V” and “GND”.
5. Switch off the external power to the detector.
6. Re-fit the PCB block and Cover.

Note: *If you ordered a “Surge Protection Device(SPD)”, please mount it into the enclosure first, and then connect the blue, red, black and white on the SPD with the “Grounding point”, “+24 V”, “GND”, “20 Ma” on the “PCB module” (see Section 4). In this way, the power supply and signal loop have a surge protection function. The “+V” “-V” and “4-20 Ma” of the upper system or controller will be connected to the green 3-pin terminals “+24V”, “GND” and “20 Ma” on the SPD*



7. Switch on external power to the detector.
8. The transmitter enters inhibit mode, and the startup sequence is as

follows, which takes about 60s.



** The connected sensor does not support TWA/STEL, the page will not be displayed.*

** Clock does not affect detection*
** This page will be displayed if the sensor is faulty, or not installed, etc.*

8 Calibration and Bump Test

It is recommended to periodically carry out a gas response check on RAEGuard 3 to ensure correct operation. This may be done in two ways:

1. A simple Response Check often referred to as a “BUMP TEST” is a test using calibration gas applied to the sensor via the hole of the Waterproof Cap or using Calibration Cap
   If a BUMP TEST is done via the Waterproof Cap hole it may be necessary in windy conditions to increase flow rate of the test gas by further 1 LPM, or, to shelter the waterproof cap from wind.
   Oxygen sensor does not need BUMP TEST.
2. A full gas calibration of the sensor as described in the following section, using ONLY the Calibration Cap.

8.1 Zeroing and Span calibration

Warning

As some calibration gases may be hazardous, ensure that outlets from gassing accessories exhaust safely.

Note: Before initial calibration allow the detector to stabilize for 30 minutes after applying power. For some special gases, the sensor with bias voltage is used, which should have been running steadily for at least 24-72 hours.

When in zeroing and span calibration mode the current output from detector is inhibited (default 2mA) to avoid false alarms.

For Oxygen sensor, zeroing calibration has been done at the factory and the user does not need to recalibrate.

For all sensors calibration, use a calibration gas of approximately 50% FSD to ensure the accuracy and linearity of the instrument.

For some special gases with strong adsorption, the pipeline from cylinder to instrument should be kept as short as possible, and the Teflon material should be used for the pipe.

To calibrate the detector, use an appropriate span gas cylinder, constant flow regulator and the RAEGuard 3 Calibration Cap. The flow rates used for calibration gas are as follows:

Gas type	Flow rate (L/min)
Clean air or high pure nitrogen	0.5 to 1.0
O_2	0.5 to 1.0
H_2S	0.5 to 1.0
CO	0.5 to 1.0
Flammable gas	0.5 to 1.0
Methane (NDIR)	0.5 to 1.0
SO2	0.5 to 1.0
NH3	0.5 to 1.0
Cl2	0.5 to 1.0

Note: The detective gas not listed above table, recommended to apply the flow rate of range of 0.5 to 1.0L/min as well.

The RAEGuard 3 detector adopts a 2-point calibration method, i.e. zeroing calibration and span calibration. The calibration of the detector should follow the sequence below.

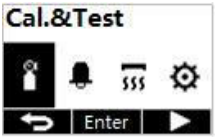
Note: The zero of the oxygen sensor does not need to be calibrated, nor does it require bump test. Clean air in the environment (20.9% vol oxygen) can be used to directly do span calibration.

Zero Calibration

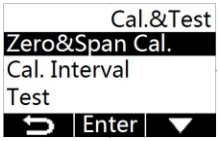
1. Remove the Waterproof Cap and fit the RAEGuard 3 Calibration Cap.

2. Put the magnet over the switch "√" for at least 3s.

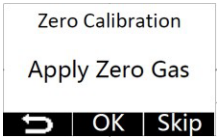
3. Click the left switch" ▲" to increment or decrement the values, use the right switch" ▼" to move to the next character. The basic password is: 1111, the advanced password is: 8888, select the switch" √" for confirmation.



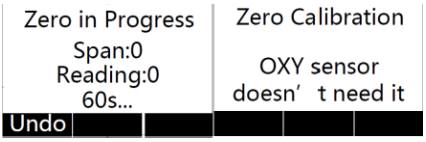
4. Select the switch" √" to enter the "Calibration & Test" menu as shown below.



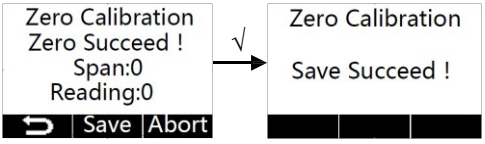
5. According to navigation, then select the switch" √" access to the calibration screen as shown below. At the same time, the detector enters the "Inhibit" mode.



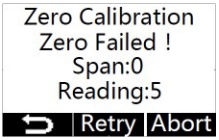
6. When zeroing gas is ready, please click the switch "√", if it is oxygen sensor, and "No Zero Calibration" is prompted, then go to "calibration concentration setting" menu. If you give up, please click the switch "▲" to return the "Calibration & Test" screen; click "▼" to skip the zero calibration to enter the "Span Concentration" setting menu.



7. Use the switch "▲" to abort the zeroing process at any time. After 60 seconds, if zero is successfully calibrated, click the switch "√" to save the results, as shown below. If not receiving, select the switch "▲" to abort and return the "Calibration & Test" screen.

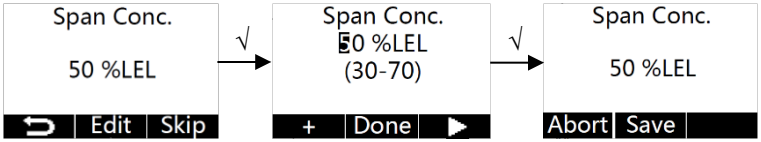


8. When zero calibration is failed, the following screen is as shown below. Click the switch "√" to recalibrate zero and repeat above process; click the switch "▼", give up and enter the "Span Concentration" setting menu; click the button "▲" to return to the "Calibration & Test" screen.

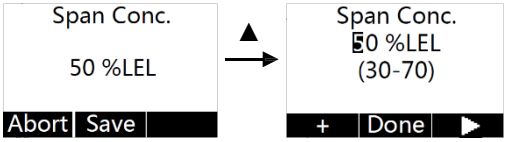


Span Calibration

9. After zero calibration, enter the “Span Concentration” setting menu as shown below. Click the button “√” to set the calibration span gas concentration. The following is the allowable setting range; if the displayed “Span Concentration” is consistent with cylinder gas concentration you are using, click the button “▼” to skip the span gas concentration setting; click the button “▲”, return to the “Calibration & Test” screen. The set range is difference for different gases.

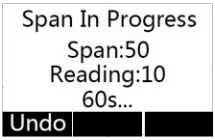


10. Click the “▲” button, give up and return to the “Span Concentration” setting, and re-enter the calibration span gas concentration to be set.

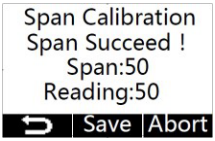


11. Click the “▲” button to change the number (0-9); click the “▼” button to move to the next character; after the setting is completed, click the “√” button, click again on the “√” button to save, and enter the following screen.

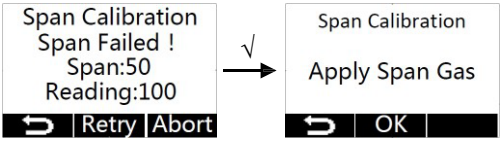
12. Connect the gas cylinder to the Calibration Cap through the Teflon pipe and click the “√” button to start the countdown for span calibration. Click the ”▲” button to abort the calibration and return to the “Calibration & Test” screen.



13. When the span calibration is successful, the following screen will be displayed. For confirmation, click the "√" button to save the calibration value; for giving up, click the "▼", or select the switch "▲" to return to the "Calibration & Test" screen.



14. When the span calibration fails, the display is as shown below. Use the switch "√" to repeat the 12, 13 or 14 above for the span calibration till succeed.

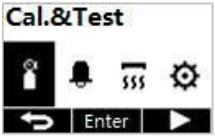


Note:
When instrument calibration is unsuccessful, it is recommended to check transmitters or sensors, and you can choose to retry or contact Customer Service Center.
If the instrument does not operate for 60 seconds, it will automatically return to the previous menu.
Ensure that the accuracy and other performance of the detector, it is recommended that the detector should be calibrated for at least six months.

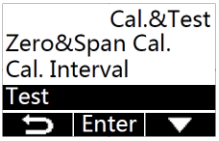
8.2 Bump test

1. Under the normal monitoring mode, put the magnet over the switch "√" for at least 3s.

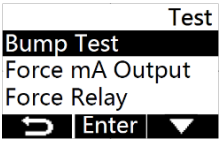
2. Click the left switch "▲" to increment or decrement the values, use the right switch" ▼" to move to the next character. The basic password is: 1111, the advanced password is: 8888, select the switch" √" for confirmation.



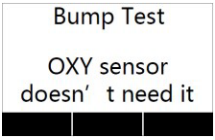
3. Select the "√" switch to enter the "Calibration & Test" menu, use the "▼" switch to select the item of "Test".



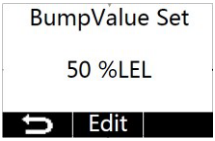
4. Select the "√" switch to enter the "Test" screen as shown below.



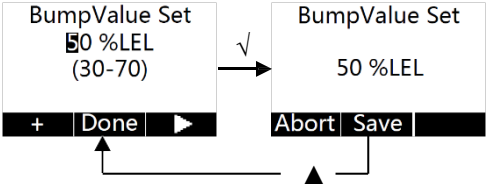
5. Select the "Bump Test" and use the "√" switch, at the same time the detector enters "Inhibit" mode. If it is an oxygen sensor, the prompts are as follows:



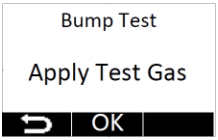
6. If it's not an oxygen sensor, the menu goes to "BumValue Set". Normally, the default bump gas concentration is 50% of the full scale. But its selectable range is varied for the different gases.



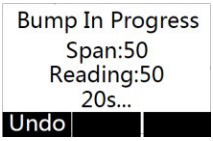
7. Use the "√" switch to edit the bump test gas concentration you need within the settable range according to the actual conditions on site. Use the switch "▲" to increment or decrement; Use the switch "▼" to move to the next character; Select the "√" switch to complete the setting.



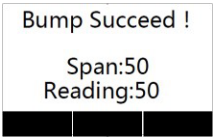
8. Use the "√" switch to save the settings and display as follows：



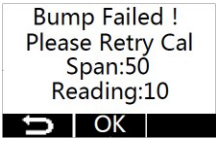
9. Connect the gas cylinder to the Calibration Cap through Teflon pipe, select the "√" switch, and the detector starts countdown (different sensors have different countdown set, which has been set at the factory). Use the "▲" switch to undo the calibration and return to the "Calibration & Test" screen.



10. If the gassing test is successful, the following screen will be displayed



11. If failed, it will be displayed as follows. Select the "▲" or "√" switch to return to the "Calibration & Test" screen.



Note:
When instrument calibration is unsuccessful, it is recommended to check transmitters or sensors, and you can choose to retry or contact Customer Service Center.
If the instrument does not operate for 60 seconds, it will automatically return to the previous menu.

Ensure that the accuracy and other performance of the detector, it is recommended that the detector should be calibrated for at least six months.

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9 General Maintenance

WARNINGS

RAEGuard 3 is designed for installation and use in Zone 1, Zone 2 hazardous areas in many countries including Europe, China etc.

Installation must be in accordance with the recognized standards of the appropriate authority in the country concerned.

Access to the interior of detector, when carrying out any work, must only be conducted by trained personnel.

Before carrying out any work ensure local regulations and site procedures are followed. Appropriate standards must be followed to maintain the overall certification of the detector.

Two cable entries must be fitted with "seal fitting" appropriately, such as conduits, stopped plug, cable gland etc. For installation where conduit is used, there must be a "Seal fitting" installed for each of the cable gland entries within 150cm of RAEGuard 3. The total distance of location of these Seal Fitting is 150cm. (e.g. If all 3 gland entries are to be used, 3 Seal Fittings should be located, each within 50cm of the wiring entrance).

If using anti-seize compound, they should not contain substances that may poison or suppress the catalytic flammable gas sensor, such as silicides, sulfides, chlorine, lead, or halogenated hydrocarbons.

To reduce the risk of ignition of hazardous atmosphere, de-classify or disconnect the equipment from the supply circuit before opening the detector enclosure. Keep assembly tightly closed during operation.

Never attempt to open a junction box/enclosure or replace/refit flammable-gas/infrared sensor in potentially hazardous atmospheres while the transmitter is energized.

The detector must be earthed/grounded for electrical safety and to limit effects of radio frequency interference. Earth/ground points are provided inside and outside the unit. The internal grounding shall be used the primary equipment ground. The external terminal is only a supplemental bonding connection where local authorities permit or require such that.

Ensure that all screens/instrument earth/clean earth wiring is earthed/grounded at a single point (either at the controller or detector-BUT NOT BOTH) to prevent false reading or alarms that may occur due to potential earth/ground loops.

Take care when handling sensors as they may contain corrosive solutions.
Do not tamper with or in any way disassemble the sensor.
Do not expose to temperature outside the recommended ranges.
Do not expose sensors under storage conditions to organic solvents or flammable liquid.

When the service life of the sensor expires, the discarded sensors must be stored in a safe environment to prevent environmental pollution. Or hand it to Honeywell for proper disposal.

Electrochemical sensors should NOT be incinerated as this action may cause the cell to emit toxic fumes.

The sensor head must be fitted with the supplied waterproof cap and mounted so that overall detector meets ingress protection rating.

Modbus, Hart, menu, and Bluetooth cannot be used to set up the instrument at the same time.

Honeywell Analytics recommends that gas detectors are tested and re-calibrated on a six-monthly basis, or according to site practice. If a toxic sensor is exposed to a gas concentration significantly above the measuring range, it shall be calibrated as soon as possible afterwards.

Operational Life

The pellistors used in the Catalytic flammable gas sensor can suffer from a loss of sensitivity when in the presence of poisons or inhibitors, e.g. silicones, sulphides, chlorine, lead or halogenated hydrocarbons. The pellistors are poison resistant to maximize the operational life of the Catalytic flammable sensor. A typical operating life, subject to the presence of poisons/inhibitors is 36 months.

The NDIR (Infrared) flammable gas sensor is not affected by the above-mentioned poisons and therefore has a longer life span. A typical operating life is 5 years.

Typical life of a toxic gas sensor is dependent on the application, frequency and amount of gas exposure. Under normal conditions (3 monthly visual inspection and 6 monthly test/recalibration), the RAEGuard 3 Oxygen and other toxic sensors have an expected life equal to or greater than 24 months.

Refer to section 10 for sensor replacement procedures.

10 Servicing

WARNINGS

Take care when handling sensors as they may contain corrosive solution. Do not temper or in any way dis-assemble the sensor. Do not expose to temperatures outside the recommended range. Do not expose sensor to organic solvents or flammable liquids.

Care should be taken when removing and refitting the RAEGuard 3 sensor modules to the Sensor Socket so that damage to the connection pins can be avoided.

At the end of their working life, replacement electrochemical sensors for oxygen and toxic gas must be disposed of in an environmentally safe manner. Disposal should be according to local waste management requirements and environmental legislation.
Alternatively, old replaceable sensors may be securely packaged and returned to Hoenywell Analytics clearly marked for environmental disposal.

Electrochemical sensors should NOT be incinerated as this action may cause the cell to emit toxic fumes.

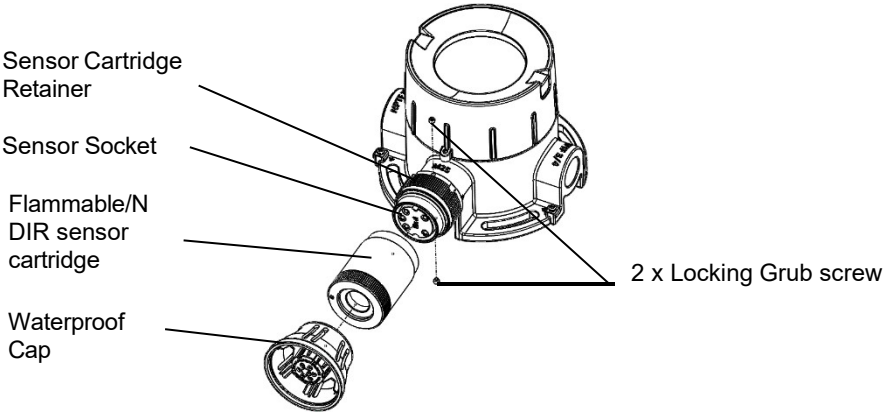
Note:
The following procedure should be followed carefully and only performed by suitably trained personnel.
For Flammable and NIDR sensors, it is forbidden to carry out hot plugging, which may damage the sensor or cause danger.

10.1 Sensor replacement

The Flammable Catalytic and Toxic ECC sensor that are used with the RAEGuard 3 Sensor Socket have no serviceable parts. When they have reached the end of their operational life, simply replace the cells.

To replace the plug-in sensor of a RAEGuard 3 Sensor Socket for Flammable and NDIR use the following procedure:

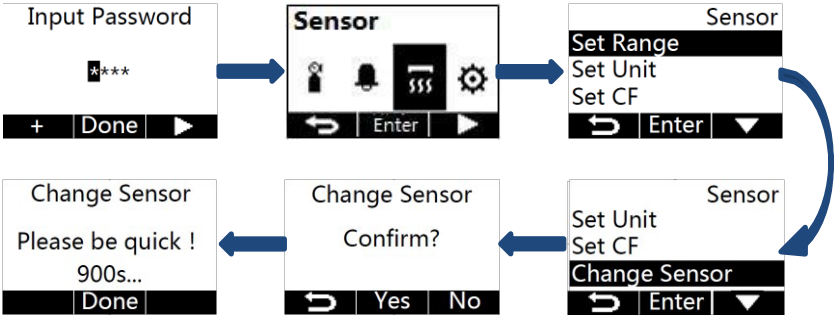
1. **Important:** Remove the Power from the RAEGuard 3 transmitter.
2. Remove the Waterproof Cap or other accessories from the sensor socket thread.
3. Loosen the two Locking Grub Screw with Z-tool and unscrew the Sensor Cartridge Retainer.
4. Carefully pull the old Sensor from the sensor socket without twisting.
5. Fit the new sensor in its place.
6. Calibrate sensor.



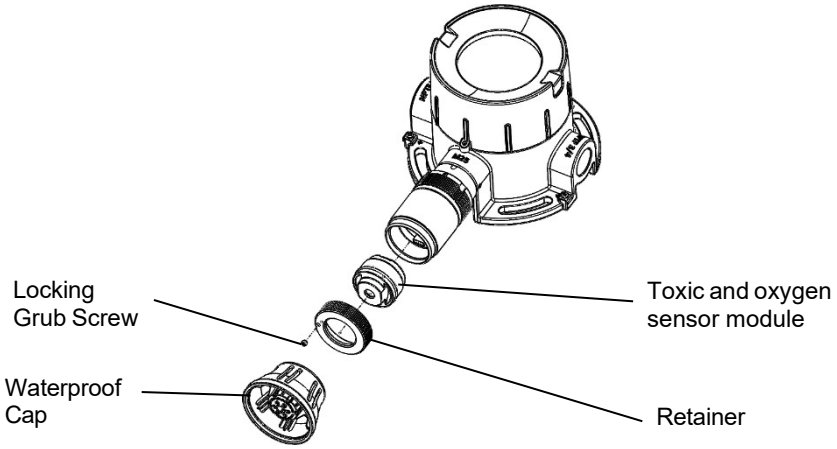
Flammable/NDIR Sensor Replacement

To replace the plug-in intrinsically safety oxygen and toxic sensor of a RAEGuard 3 Safety Barrier use the following procedure:

1. **Important:** Firstly, enter the menu of transmitter, working according to below diagram:



2. Remove the Waterproof Cap or other accessories from the thread.
3. Loosen the Locking Grub screw with Z-tool and unscrew the Retainer.
4. Carefully pull the old sensor module from the Safety Barrier without twisting.
5. Fit the new sensor module in its place.
6. Screw Retainer securely and unlock screw
7. After all fitting, select the switch “√” to complete the replacement of the sensor module, and the RAEGuard 3 automatically restarts.
8. Calibrate sensor.



Toxic and Oxygen Sensor Replacement

Note: *Waterproof Cap has static risk. When installing or operating, requires special attention.*

10.2 Replacing Modules within the Transmitter

The circuit module in the RAEGuard 3 transmitter housing contains 3 replaceable modules: Display PCB, Main PCB, and Terminal PCB (Relay output will not be provided if relay function is not ordered).

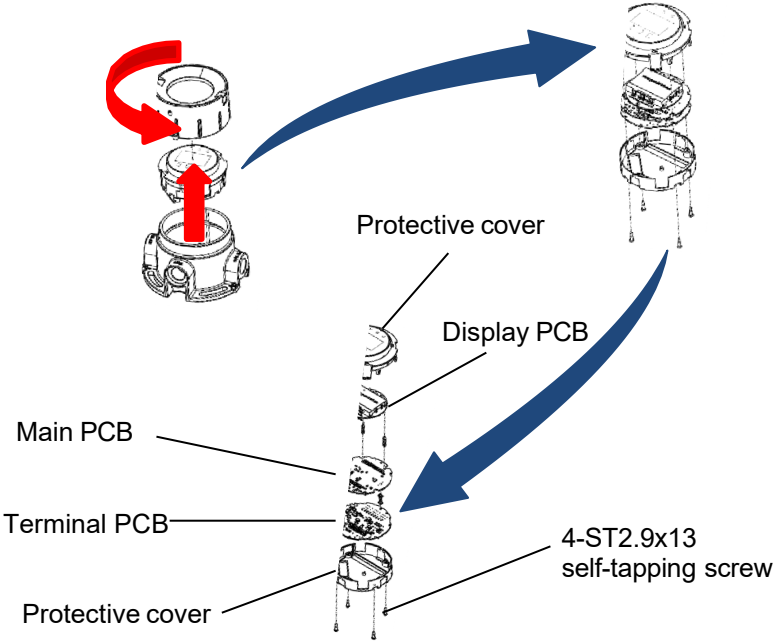
Unscrew and remove the cover of transmitter and pull the circuit board module from it, to easily replace the circuit module. The procedure of replacing the circuit module is as follows:

1. **Important:** Switch off the external power.
2. Unscrew and remove the cover of transmitter.
3. Pull the circuit board module from it, to easily replace the circuit module.
4. Unplug all connection terminals connected to the circuit module.
5. Loosen and remove the four ST2.9x13 self-tapping Phillips screws.
6. Carefully remove the circuit board cover.
7. Carefully remove the circuit board that will need to be replaced and fit the new circuit board.

Note*: Make sure that the board replacement personnel are free of static electricity!*

8. Finally, according to the reverse step, fit the circuit module, tighten the

cover of transmitter, and lock Locking Grub Screw.



11 Faults and Warnings

The table below provides details of possible error.

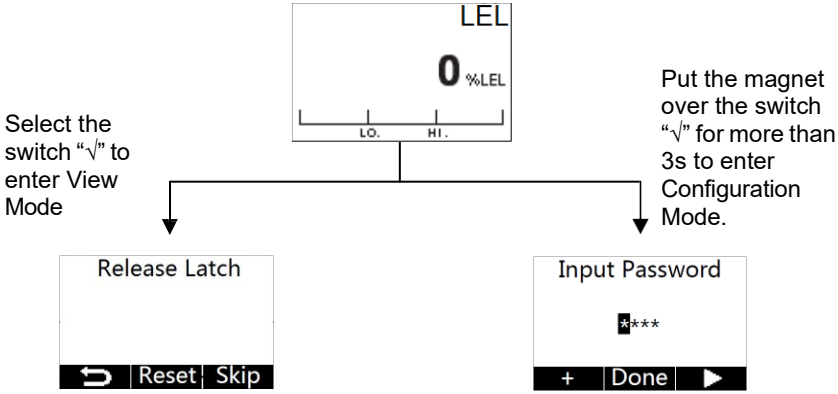
Message	Description	Action
F301	Sensor failure	Check terminal plate, safety barrier
F302	Sensor failure	Check sensor modules, or change
F321-325	Sensor failure	Check sensor modules, or change
F341	Sensor failure	Check sensor modules, or change
F342	Sensor failure	Check sensor modules, or change
F343	Sensor failure	Check sensor modules, or change
F344	Sensor failure	Check sensor modules, or change
F345	Sensor failure	Check sensor modules, or change
F346	Sensor failure	Check sensor modules, or change
F347	Sensor failure	Check sensor modules, or change
F348/349	Sensor failure	Check sensor modules, or change
F350	Sensor failure	Check sensor modules, or change
F351	Sensor failure	Check sensor modules, or change
F352	Sensor failure	Check sensor modules, or change
F353	Sensor failure	Check sensor modules, or change
F360-369	Sensor failure	Check sensor modules, or change
F380-383	Sensor failure	Check sensor modules, or change
F400-411	Sensor failure	Check sensor modules, or change
F420-433	Sensor failure	Check sensor modules, or change
F440-520	Sensor failure	Check sensor modules, or change
F562	Sensor failure	Check sensor modules, or change
F563	Unsupported sensor types	Replace the sensor module supported by RAEGuard 3.
F564	Sensor failure	Check sensor modules, or change
F566	Catalytic bead sensor calibration failure	Please recalibrate, or check whether the calibration operates in accordance with the process, or replace the sensor
F567	4-20 Ma current loop abnormalities	Check main board or sensor module, or replace them
F568	Terminal/power board failure	Check terminal / power board, or replace them
F569	Terminal/power board failure	Check terminal / power board, or replace them
F570	Sensor failure	Check sensor modules, or change
F571	Sensor failure	Check sensor modules, or change
F572	Sensor failure	Check sensor modules, or change, or contact the factory
F573	Sensor failure	Check sensor modules, or change, or contact the factory
F574	Communication failure between sensor and transmitter	Check the cable and safety barrier, re-energize the detector or replace the barrier, or contact the factory.

F653	Mainboard failure	Check the main board, or replace it
F654	Sensor failure	Check the sensor module, or replace it, or contact the factory
F655	Communication failure between sensor and transmitter	Check the cable and safety barrier, or replace them, or contact the factory.
	Clock failure	Perform “Date Setting” and “Time Setting” in the menu at the same time.
	Calibration expiration reminder	Please recalibrate the detector
±%	Zero negative drift	Perform zero calibration on the detector or replace the sensor.
	Sensor life expiration warning	Please replace the sensor and calibrate it or correct Year/Month/Date
	Low Alarm latch	After confirming that there is no leakage on site or the alarm is released, please click the “√” button to “reset” the latch.
	High Alarm latch	After confirming that there is no leakage on site or the alarm is released, please click the “√” button to “reset” the latch.
TWA	TWA alarm	Indicating that the gas cumulative concentration in 8 hours exceeds the standard
STEL	STEL alarm	Indicating that the gas cumulative concentration in 15 minutes exceeds the standard
OVER	Overrange alarm	Indicating that the gas concentration exceeds the range, and the detector returns to the normal detection mode after the site is safe.
1	Low Alarm	Indicating that the gas concentration on site exceeds the 45pprox.45d45ting set value.
2	High alarm	Indicating that the on-site gas concentration exceeds the high alarm setting value.

Note: *When the detector exceeds the Full-Scale Range, the normal detection mode is displayed after the on-site gas concentration returns to the normal range. But for Catalytic Bead sensor, its high working current, long time working under over-range conditions will lead to sensor damage. The detector will detect the gas concentration in the environment every 4 minutes until the ambient gas returns to the normal range, and the detector returns to the normal detection mode.*

12 Menu's and Advanced Configuration

RAEGuard 3 offers users a variety of operating modes, providing different management permissions for operators in different functions.

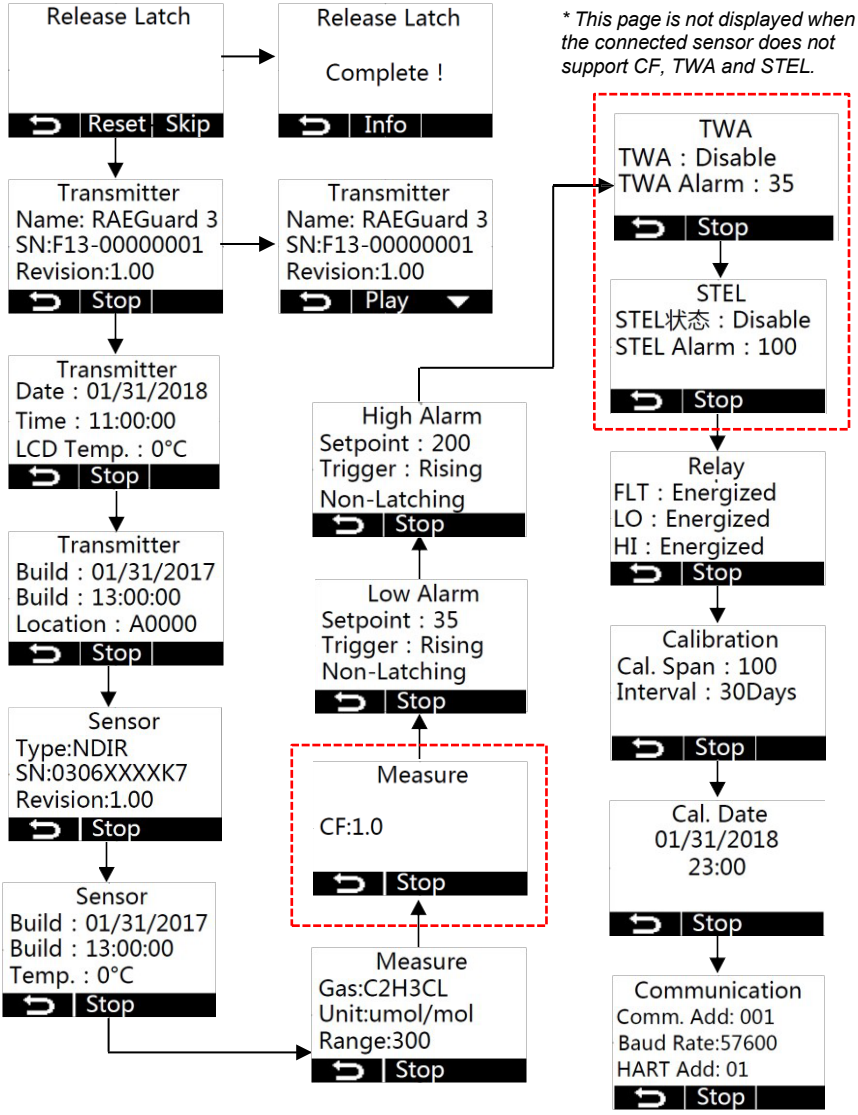


After entering the menu below, the 4-20 Ma current loop is locked in the "Inhibit" current, and the default "Inhibit" current is 2 Ma.

	Menu Item	4-20 Ma current output
1	Warm/Start up	Inhibit current output
2	Sensor Replacement	Inhibit current output
3	Alarm & fault simulation	Inhibit current output
4	4 Ma output calibration	4 Ma
5	20 Ma output calibration	20 Ma
6	Forced relay	Inhibit current output
7	Forced current output	Output corresponding set value
8	Bump test	Inhibit current output
9	Zero & Span calibration	Inhibit current output
10	HART Zero & Span calibration	Inhibit current output
11	APP Zero & Span calibration	Inhibit current output
12	APP Force current output	Output corresponding set value

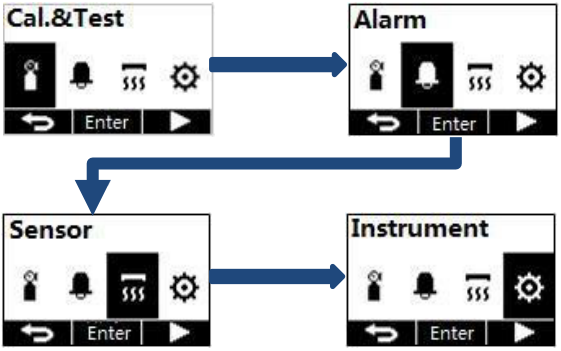
12.1 View mode

Under the normal detection mode of the detector, select the "√" button with the magnetic wand to quickly browse the detector parameter settings, which can only be viewed, but cannot be modified. Select " ↩ " to return to the "normal detection screen", select " ▼ " to turn to the next page.



12.2 Configuration Mode

RAEGuard 3 enters different settings menus depending on the passwords entered. “1111” enters the basic configuration mode; “8888” enters the advanced configuration mode.



Comparative tables of different menus in 2 configuration modes		
	Basic	Advanced
Calibration & Test		
• Zero & Standard Gas Calibration	●	●
• Calibration interval	●	●
• Test	●	●
○ Impact test	●	●
○ Forced current output	●	●
○ Forced relay	●	●
▪ Fault relay	●	●
▪ Low Alarm relay	●	●
▪ High Alarm relay	●	●
○ Alarm & fault simulation	●	●
▪ Warning simulation	●	●
▪ Fault simulation	●	●
▪ Low report simulation	●	●
▪ High report simulation	●	●
Alarm settings		
• Low Alarm settings	●	●
○ Low Alarm threshold	●	●
○ Low Alarm trigger direction:	●	●

above/*below*		
○ Low Alarm latch status: *latch*/***non-latch***	●	●
○ Low Alarm relay: ***energized***/*de-energized*	●	●
• High Alarm settings	●	●
○ High Alarm threshold	●	●
○ High Alarm trigger direction: ***above***/*below*	●	●
○ High Alarm latch status: *latch*/***non-latch***	●	●
○ Low Alarm relay: ***energized***/*de-energized*	●	●
• Fault relay settings: ***energized***/*de-energized*	●	●
• External alarm device: ***SP-07J***/*SP-07A/SP-07Plus*	●	●
• TWA settings:	●	●
○ TWA status: *start/* ***disable***	●	●
○ TWA threshold	●	●
○ Clear TWA: Yes / **No**	●	●
• STEL settings:	●	●
○ STEL status: *start/* ***disable***	●	●
○ STEL threshold	●	●
○ Clear STEL : Yes/**No**	●	●
Sensor settings		
• Range settings	●	●
• Unit settings *%vol; ppm; %LEL; umol/mol; mg/m^3*	●	●
• CF value settings	●	●
• Sensor replacement	●	●
Instrument settings		
• Language: *Chinese*/***English***	●	●
• Date & Time settings	●	●
○ Date settings: onth/Day/Year	●	●
○ Time setting: hour: minute: second	●	●
• Location code: ***A000***	●	●

• Password settings		●
○ Low-level password setting***111***		●
○ Advanced password settings: ***888***		●
• Communication settings	●	●
○ Address: ***001***	●	●
○ Baud rate: *4800;9600;**19200**;38400;57600*	●	●
○ HART address:***00***	●	●
• Output 50pprox. lvel		●
○ Fault mode ***1.0 Ma**;2.0 Ma;3.0 Ma*		●
○ Inhibit mode *1.0 Ma;**2.0 Ma**;3.0 Ma*		●
○ Warning mode *1.0 Ma;2.0 Ma;**3.0 Ma***		●
○ Out of range *21.0 Ma;**22.0 Ma**;23.0 Ma*		
• 4-20 Ma Output calibration		●
○ 4 Ma output calibration		●
○ 20 Ma output calibration		●
• Restore factory settings		●

***Note**: The **blackened** font in the table above is the factory default value.*

- Zero & Standard Gas Calibration: See section 8 for details.

- Calibration time interval: This menu is to remind users to calibrate regularly. The default value is 180 days. According to the actual situation, users can set it in 0-360. If 0 is set, the reminder function will be turned off; if other values are set, the detector will display and the LCD backlight will be always on when the calibration interval time is reached.

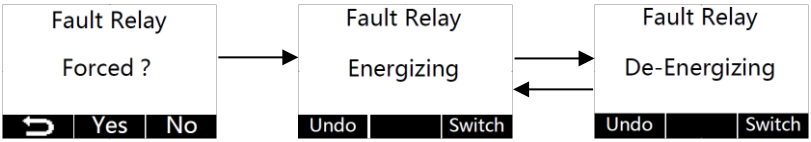
- Bump test: See section 8 for details.

- Forced current output: 4 Ma by default. It can force 4-20 Ma current loop to output the set current value between 0-25, and the increment and decrease

step is 0.5 Ma. At the same time, the detector FAULT LED is always on, indicating the “Inhibit” mode.

- Forced relay: It has 3 menus: fault relay, low alarm relay and high alarm relay. Entering any menu, the detector will enter the “Inhibit” indicator mode.

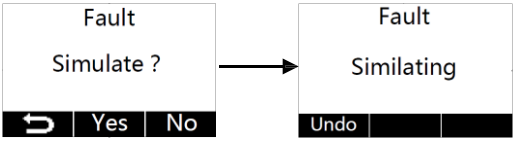
  - Fault relay: Use the switch “▼” to activate the energized or de-energized state of the fault relay. During the switch, the sound of the relay sucti d release can be hear icating that the relay is working no √ ; select “▲” to stop an ▼ n to the previous menu.



  - Low Alarm Relay: The operation is the same as the “Fault Relay”.
  - High Alarm Relay: The operation is the same as the “Fault Relay”.

- Alarm & Fault Simulation: It has four menus: fault simulation, warning simulation, low alarm simulation and high alarm simulation. Entering any menu, the detector will enter the “Inhibit” indicator mode.

  - Fault simulation: Selec √ switch “√”, the detector simulates the actual state of fault, triggering the fault relay.



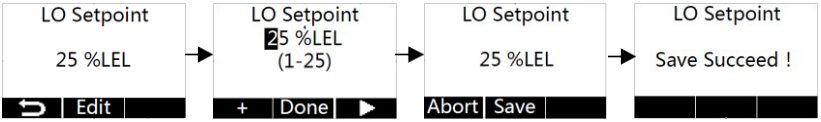
  - Warning simulation: This mode is only the “Warning” indicator mode, so no relay will be triggered.

  - Low Alarm simulation: It is same as “Fault Simulation”, triggering Low Alarm relay.

  - High Alarm simulation: It is same as “Fault Simulation”, triggering High Alarm relay.

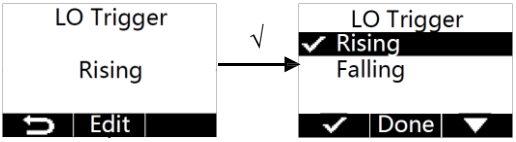
- Low Alarm settings: It has 4 menus: Low Alarm threshold, Low Alarm trigger direction, Low Alarm latch status and Low Alarm relay.

- Low Alarm threshold: Different sensors have different default values. According to the actual usage of the phenomenon, users can set the required low alarm value according to the LCD screen display prompt.

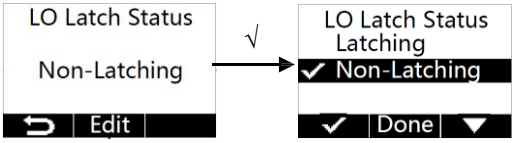


- Low Alarm trigger direction: In addition to Oxygen, when other gases are detected, the Low Alarm trigger direction default is “higher”, indicating that if the gas concentration value detected by the detector in real time is greater than the set Low Alarm threshold, the Low Alarm relay will be triggered. Oxygen, the default is “below”, indicating that if the gas concentration value detected by the detector in real time is less than the set low alarm threshold, the Low Alarm relay will be triggered.

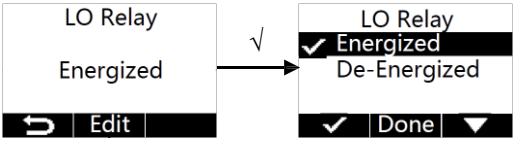
Note: *Be careful when setting this parameter. Once the setting is wrong, there may be no alarm, which will lead to serious accidents!*



- Low Alarm latch state: The default is “non-latching”，indicating that after the Low Alarm occurs, if the concentration value detected by the detector in real time is lower than the under-reporting threshold, the Low Alarm relay and Low Alarm LED indicators will return to normal; if it is “latching”, indicating that if the concentration value detected by detector in real time is lower than the Low Alarm threshold value, the Low Alarm relay, Low Alarm LED indicator s and LCD Low Alarm latch icon will remain unchanged status, which can be reset by “Alarm Latch Reset” in “View Mode” to return to the normal detection mode. See section 12.1 for details.



- Low Alarm relay: The default is “energized”.



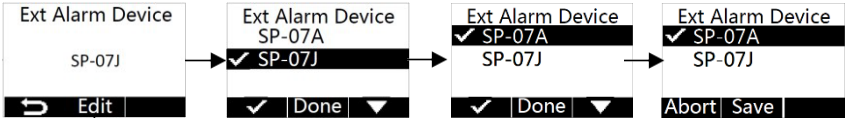
Relay setting	Normal	Fault	Low Alarm	High Alarm
De-energized	Terminal NC: *closed*	Terminal NC: *open*	Terminal NC: *open*	Terminal NC: *open*
	Terminal NO: open	Terminal NO: *closed*	Terminal NO: *closed*	Terminal NO: *closed*
Energized	Terminal NC: *open*	Terminal NC: *closed*	Terminal NC: *closed*	Terminal NC: *closed*
	Terminal NO: *closed*	Terminal NO: *open*	Terminal NO: *open*	Terminal NO: *open*

- High Alarm settings has 4 menus: High Alarm threshold, High Alarm trigger direction, High Alarm latch status and High Alarm relay. Refer to “Low Alarm Settings”.

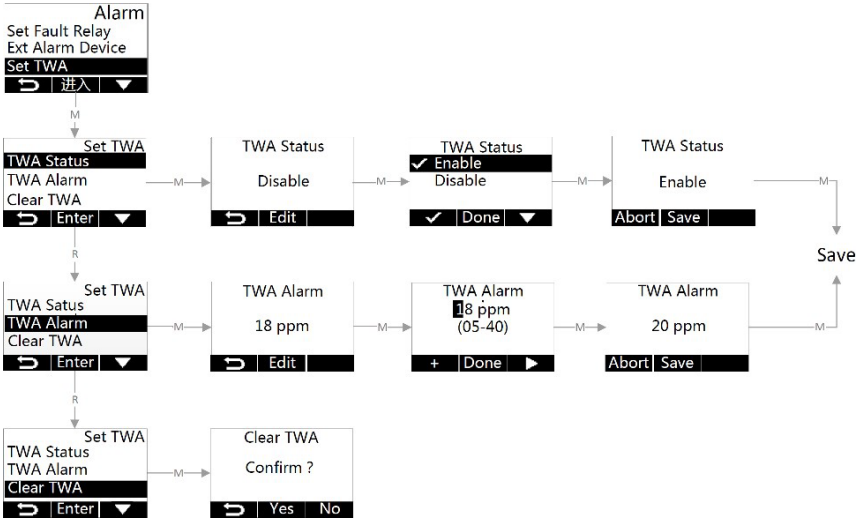
- Fault relay settings: For fault relays, only energized or de-energized state can be set. The default is energized. The setting process refers to “Low Alarm Relay” settings.

- External alarm device: It refers to the local sound and light alarm SP-07J and SP-07A and SP-07Plus provided by Honeywell, which cannot be connected to any other equipment. The default type is SP-07J.

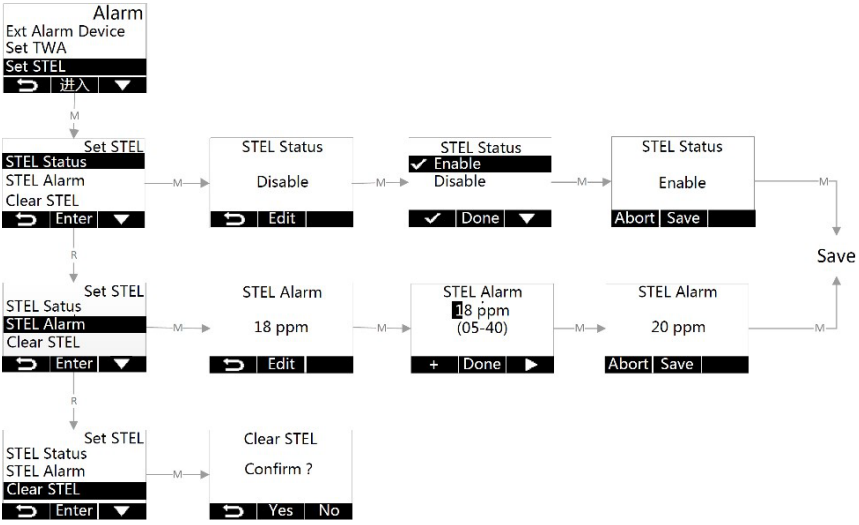
  Select the switch “▼”, move up and down to select the desired option; Use the switch “▲” to select the option; Select “√” to complete; then use the “√” to save.



- TWA settings: TWA is a time-weighted average allowable concentration, representing an average allowable exposure level of 8 hours. The default is disabled. This menu is only effective for toxic gas (excluding: oxygen, catalytic combustion flammable gas and NDIR infrared flammable gas). The operation process is as follows:

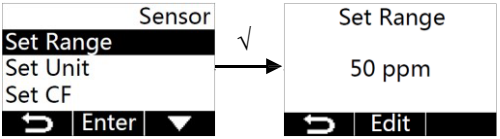


- STEL settings: STEL is the short-time contact allowable concentration, which representing the 15-minute time-weighted average allowable contact level. The default is disabled. This menu is only effective for toxic gas (excluding: oxygen, catalytic combustion flammable gas and NDIR infrared flammable gas). The operation process is as follows:



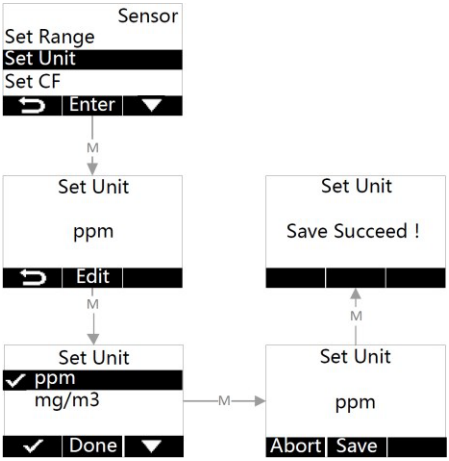
- Range settings: RAEGuard 3 is different from other products. Users can set

the detection range of the detector according to the actual needs or changes in the installation environment. Depending on the instrument, different sensors have different settings.

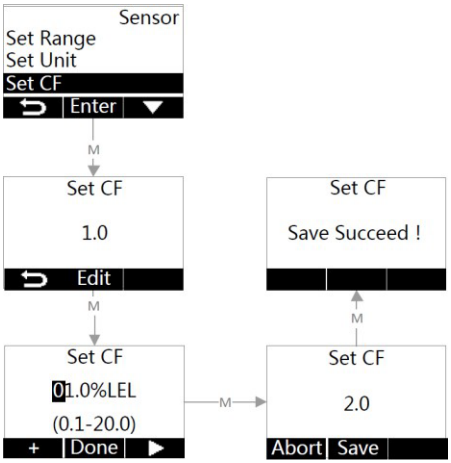


Note: After the range is modified, in order to ensure the linearity and detection accuracy of the detector, please calibrate the zero point and standard gas according to the calibration requirements.

- Unit settings: Depending on the type of sensor connected, oxygen defaults to% vol; catalytic combustion defaults to% LEL, the option is %vol; toxic gas defaults to ppm, the options are umol/mol, mg/m^3; NDIR flammable gas defaults to% LEL, the option is %vol; NDIR carbon dioxide defaults to ppm, and the option is %vol.



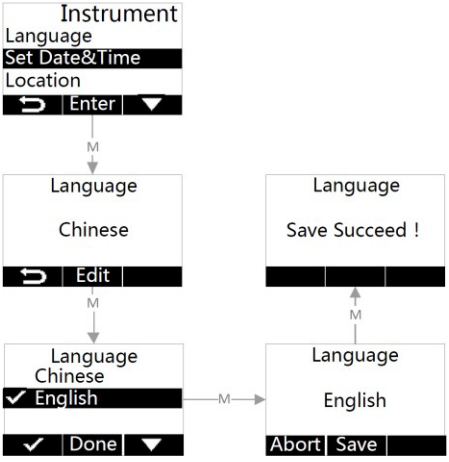
- CF value settings: This menu is only effective for catalytic combustion flammable gas sensors. This menu will not be displayed when the transmitter is connected to other sensors.
  The CF value table of catalytic combustion flammable gas is detailed in section 16.



CF value is set mainly for some detected gases without standard gas substances. “60% LEL standard methane gas” is equivalent to “60*0.8=48 (% LEL) hydrogen gas”.

- Sensor Replacement: This menu is only effective for toxic and oxygen sensors. See section 10 for detailed operation.

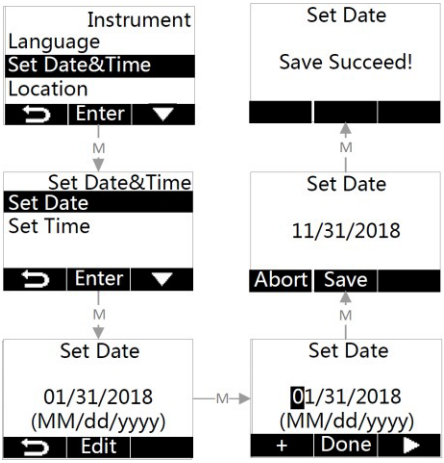
- Language selection: English by default.



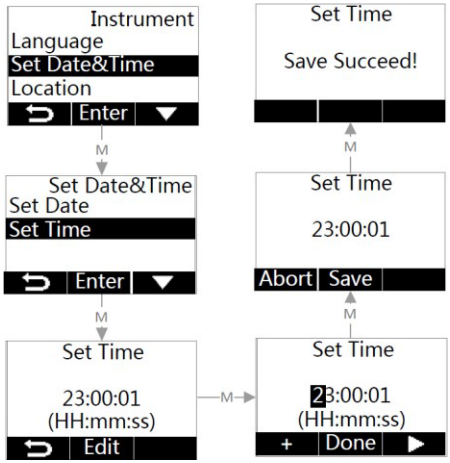
- Date & time settings: After the detector is powered on, if the LCD displays

a reminder, ***please note:*** *make sure to set the date and time correctly, otherwise it will affect the cycle management function of detector, such as calibration reminder, etc.*

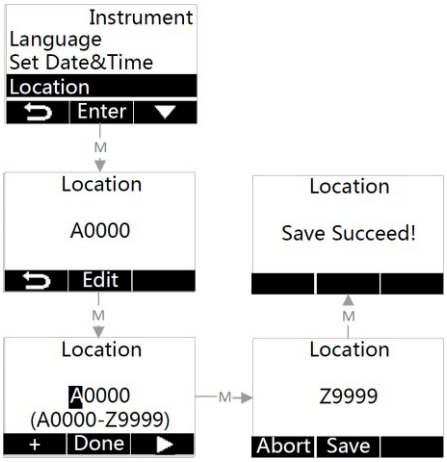
- Date settings:



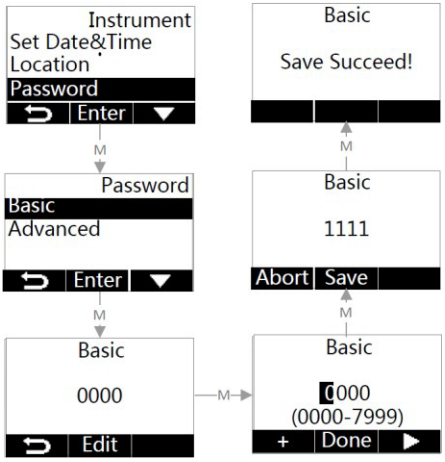
- Time settings:



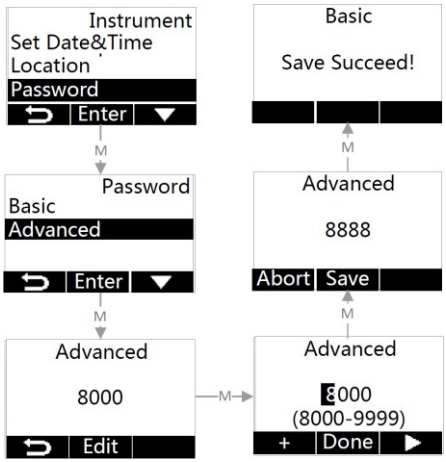
- Location code: Users can define the location information of detector by himself to facilitate the management of the detector.



- Password settings:
  Low-level password setting: The default is: 1111. Enter the password setting menu, select the switch "▲" to cyclically increment and decrement number; use "▼" to move to the next character; use "√" to complete; then select "√" to save.



  - Advanced password settings: The default is: 8888. The settings are the same as "Low-level Password Settings".

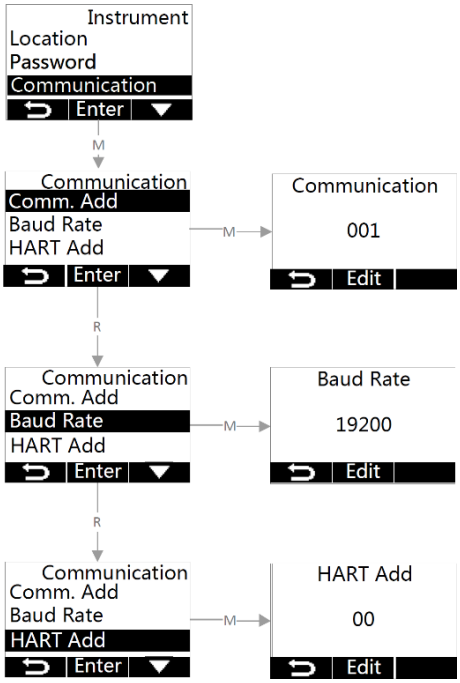


- Communication settings:
  - Address: RS485 Modbus RTU address, the default is 001, and the range is set to 001-247

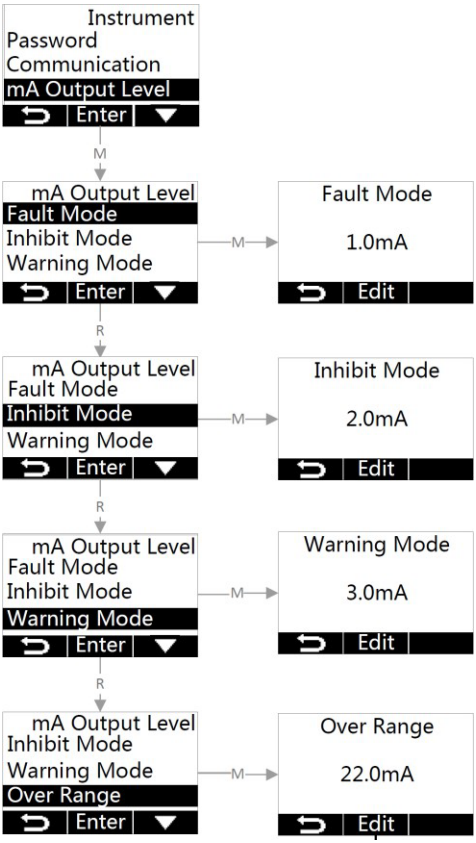
  - Baud rate: The default RS485 Modbus RTU communication rate is 19200, which can be set to: 4800, 9600, 19200, 38400, 57600.

  - HART address: The menu is poll Addr. In the HART Communicator, which is the HART network address. The default is 00, and the range is set to 00-63。

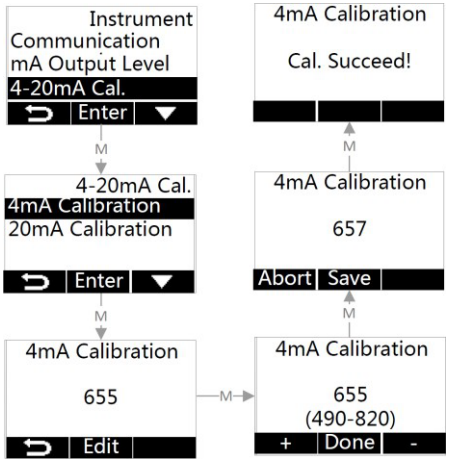
    ***Note**: This menu will only be displayed when you purchase a HART-enabled RAEGuard 3 detector.*



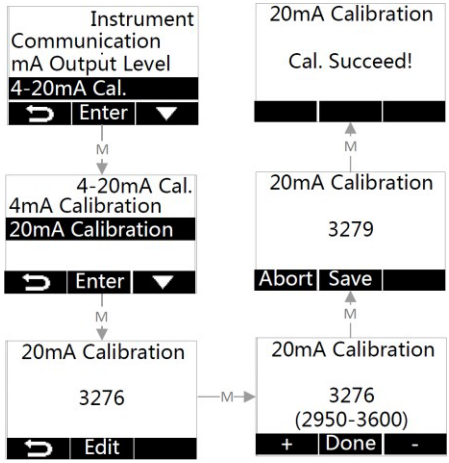
- Output Current Level: This menu includes fault mode, inhibit mode, warning mode, and out of range, which is used to set the current output of the instrument in different modes. Fault mode defaults to 1.0 Ma; inhibit mode defaults to 2.0 Ma; warning mode defaults to 3.0 Ma; overrange defaults to 22.0 Ma.



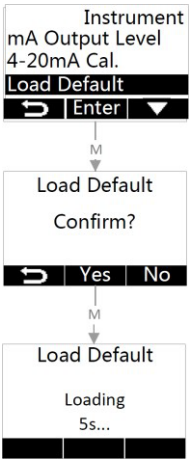
- 4-20 Ma output calibration: This menu is used to fine-tune the 4-20 Ma circuit, mainly to adjust the current transmission error caused by wiring.
    - 4 Ma output calibration: The current value of 4 Ma is adjusted while the instrument enters the inhibit mode.



- 20 Ma output calibration: The current value of 20 Ma is adjusted while the instrument enters the inhibit mode.



- Restore factory settings: After the menu is executed, the instrument “restart” will restore all settings in the detector to the factory default value.


Instrument
mA Output Level
4-20mA Cal.
Load Default
Enter
M
Load Default
Confirm?
Yes
No
M
Load Default
Loading
5s...

13 Technical specifications

RAEGuard 3 Gas Detector	
Use	Universal transmitter with standard configuration of 3-wire, 4-20Ma and RS485 MODBUS output for use with a wide range of applications for the detection of flammable, toxic and Oxygen gas hazards.
Electrical parameters	
Input Voltage Range	16-32 VDC（24VDC nominal）
Max Power Consumption	Electrochemical Cells: 5.5W; Catalytic or NDIR: 7.5 W
Current output	Completely configurable 4-20Ma (source type) with optional HART® 7.2 protocol as following as default configurations of current output **Default current output:** 1mA Fault 2mA Inhibit (during configuration or setup) 3mA Warning 4-20mA Normal 22mA Overrange ***Note**: HART communication will not work properly when the current output is less than 3Ma.*
Terminals	5 terminals (14 terminals for use with relay output), wire diameter 0.5mm^2（20AWG）to 2.5mm^2（13AWG）
Relays	3 x 2A@30VDC. Selectable normally open or normally closed and 64 approx. 64 d/de-energized(programmable) and latch/non-latch Alarm relays default 64pprox.64d/non-latch. Fault relay default energized/non-latch.
Communication	RS485, Modbus RTU Optional Bluetooth
Construction	
Transmitter Housing Material	Aluminum Alloy or 316 Stainless Steel
Sensor Housing Material	316 Stainless Steel
Weight (64pprox.)	Aluminum Alloy: 3.0kg; Stainless Steel: 5.0kg
Mounting	Integral mounting plate with 4 x mounting holes suitable for M8 to fit onto Wall or Pipe
Entries	2 x 3/4'' NPT cable/conduit entries and 1 x M25 sensor entry. 1 x plug supplied for use for only 1 entry used. Seal to maintain IP rating
Performance****	

Repeatability	<2%
Response Time	Depending on sensor
Certification	
European	ATEX: LEL/NDIR: CE2460 Ⓔx II 2G Ex db IIC T6 Gb Ex tb IIIC T85°C Db IP66 Ta = -40°C to +65°C Toxic and Oxygen: CE2460 Ⓔx II 2G Ex db ia IIC T6 Gb Ex tb IIIC T85°C Db IP66 Ta = -20°C to +55°C
International	IECEx: LEL/NDIR: Ex db IIC T6 Gb Ex tb IIIC T85°C Db IP66 Ta = -40°C to +65°C Toxic and Oxygen: Ex db ia IIC T6 Gb Ex tb IIIC T85°C Db IP66 Ta=-20°C to +55°C
China	LEL/NDIR: Ex d IIC T6 Gb Ex Td A21 IP66 T85°C Toxic and Oxygen: Ex d ia IIC T6 Gb Ex Td A21 IP66 T85°C
EMC	EN50270:2015, IEC61000-4-5
Performance	IEC60079-29-1, EN50104:2019, EN50271:2018 IEC61508(SIL Assessment, SIL2)
Surge Immunity	Optional Surge Protection Device, Compliance with GB/T17626.5-2008/IEC61000-4-5:2005, Meets "Installation Class 4"
Environment	
IP Rating	Toxic and Oxygen: IP66/67 LEL/NDIR: IP66
Operating Temperature***	-40°C to +70°C
Operating Humidity	LEL/NDIR：0-95%RH（Non-condensing） Toxic gas and oxygen: 15% - 95%RH（Non-condensing）
Operating Pressure	70 -130kPa
Storage conditions	-20°C to +50°C, 45-75%RH(Non-condensing), in clean air

Remarks:
** RAEGuard 3 will provide users more communication interfaces and gas types in the future, such as wireless, etc. For availability, please contact Honeywell Analytics.*
**** Catalytics and NDIR-CH4 sensor can work continuously at -40°C to +70°C; toxic and Oxygen sensor can work continuously at -20°C to +55°C, intermittently at -40°C to +70°C (The accuracy and response time of sensors operating in this temperature range will be affected, and long-term operation may lead to sensor sensitivity decline or even damage.)*
***** The performance characteristics of the products mentioned above are typical results tested in an environment with a temperature of +20 ° C and a humidity of 50% RH. When calibrating, use the calibration cap and the recommended flow for detection. If the sunshade/deluge protection is used instead or the detection is carried out at low temperature, its response speed will be slowed down.*

Gas	Default Range	Selectable Full-Scale Range	Resolution	Lower Detectable Limit	Default Cal. Point	Selectable Cal. Gas Range	T90 Response Time	T10 Recovery Time	Detection Error	Default Alarm 2	Default Alarm 1
O_2	30.0%vol	25.0~30.0%vol	0.1%vol	-	20.9%vol	20.9%vol (Fixed)	<20s	<30s	<±0.7%vol	23.5%vol ▲	19.5%vol ▼
H_2S	100ppm	20.0~200.0ppm	0.1ppm	0.5ppm	50ppm	30% to 70% of Full Scale Range	<25s	<25s	<±5ppm	20ppm▲	10ppm▲
CO	500ppm	50-1000ppm	1ppm	3ppm	250ppm		<25s	<25s	<±5ppm	500ppm▲	150ppm
LEL	100%LEL	3%~100%LEL	1%LEL	-	50%LEL		<25s	<30s	<±5%LEL	50%LEL▲	25%LEL▲
CH_4-IR	100%LEL	3%~100%LEL	1%LEL	-	50%LEL		<30s	<35s	<±5%LEL	50%LEL▲	25%LEL▲
NH_3-L	100ppm	20.0~100.0ppm	0.1ppm	2ppm	50ppm	20% to 80% of Full Scale Range	<60s	<35s	<±5ppm	70ppm▲	35ppm▲
NH_3-H	500ppm	200~1000ppm	1ppm	3ppm	250ppm		<90s	<120s	<±10% or ±5%FS	300ppm▲	150ppm▲
Cl_2	10ppm	5.0~50.0ppm	0.05ppm	0.1ppm	5ppm		<40s	<50s	<±1ppm	6ppm▲	3ppm▲
SO_2	20ppm	10.0~50.0ppm	0.1ppm	0.2ppm	5ppm		<25s	<40s	<±0.5ppm	10ppm▲	5ppm▲
C_2H_3Cl	100ppm	10.0~100.0ppm	0.1ppm	0.3ppm	50ppm		<90s	<180s	<±10%	10ppm▲	5ppm▲
Cl_2-L	5ppm	1.00~5.00ppm	0.01ppm	0.2ppm	2ppm		<70s	<60s	<±0.2ppm	0.6ppm▲	0.3ppm▲
H_2	1000ppm	1000ppm	1ppm	5ppm	200ppm		<90s	<90s	<±10% or ±5%FS	400ppm▲	200ppm▲
ETO	100ppm	10.0~100.0ppm	0.1ppm	0.3ppm	50ppm		<150s (T50<45s)	<260s	<±10% or ±5%FS	10ppm▲	5ppm▲
HCl	30ppm	10.0~30.0ppm	0.1ppm	0.3ppm	10ppm		<45s	<30s	<±10% or ±5%FS	10ppm▲	5ppm▲
NO_2	20ppm	10.0~50.0ppm	0.1ppm	0.3ppm	10ppm		<12s	<12s	<±10% or ±5%FS	10ppm▲	5ppm▲
HCN	30ppm	10.0~50.0ppm	0.1ppm	0.4ppm	15ppm		<45s	<35s	<±10% or ±5%FS	10ppm▲	5ppm▲
CO_2	50000ppm	10000~50000ppm	10ppm	200ppm	20000ppm		<30s	<35s	<±10% or ±5%FS	8000ppm▲	4000ppm▲
PH_3	5ppm	5.00~20.00ppm	0.01ppm	0.3ppm	2.5ppm		<30s	<40s	<±10% or ±5%FS	4ppm▲	2ppm▲
C_3H_3N	10ppm	4.0~20.0ppm	0.1ppm	0.4ppm	5ppm		<120s	<240s	<±10% or ±5%FS	8ppm▲	5ppm▲
NO	100ppm	50~250ppm	0.5ppm	2.0ppm	50ppm		<25s	<30s	<±10% or ±5%FS	60ppm▲	30ppm▲
Propane-IR	100%LEL	100%LEL	1%LEL	-	50%LEL	30% to 70% of Full Scale Range	<30s	<35s	<±5%LEL	50%LEL▲	25%LEL▲
Propylene-IR	100%LEL	100%LEL	1%LEL	-	50%LEL		<30s	<35s	<±5%LEL	50%LEL▲	25%LEL▲

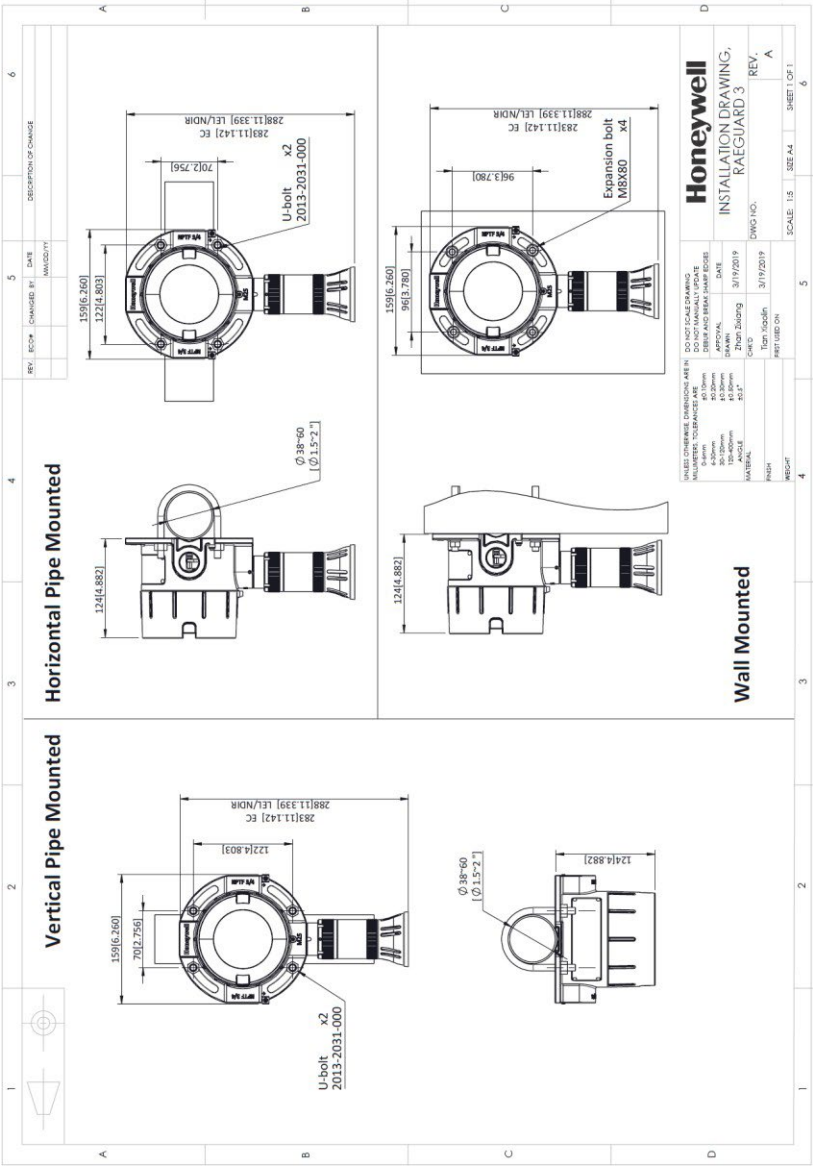
Note: The performance characteristics of the above products are typical results tested in an environment with a temperature of +20 ° C and a humidity of 50% RH. When calibrating, use the calibration cap and the recommended flow for detection. If the sunshade/deluge protection is used instead or the detection is carried out at low temperature, its response speed will be slowed down.

- *Catalytic and IR sensor can work continuously at -40°C ~ +70°C; toxic and oxygen sensor can work continuously at -20°C ~ +55°C, intermittently at -40°C ~ +70°C (The accuracy and response time of sensors operating in this temperature range will be affected, and long-term operation may lead to sensor sensitivity decline or even damage). When ambient temperature is less than 10°C,*
- *substance ETO will exist by liquid, which will affect the detector's performance probably.*
- *LEL model is FGM-6100/6100S. NDIR model is FGM-6200/6200S. Toxic and Oxygen models are: FGM-6300/6300S. No suffix that means aluminum alloy housing material, and "S" that means a stainless-steel housing material.*
- *1ppm is equivalent to 1μmol/mol.*
- *Adjustable Alarm Ranges:*
  - *Flammable/IR Sensors: Alarm1: 5%-25%LEL, Alarm2: 40%-60%LEL*
  - *Oxygen Sensors: 0-25%vol*
  - *Toxic Gas Sensors: Adjustable from 1%-100% full-scale*

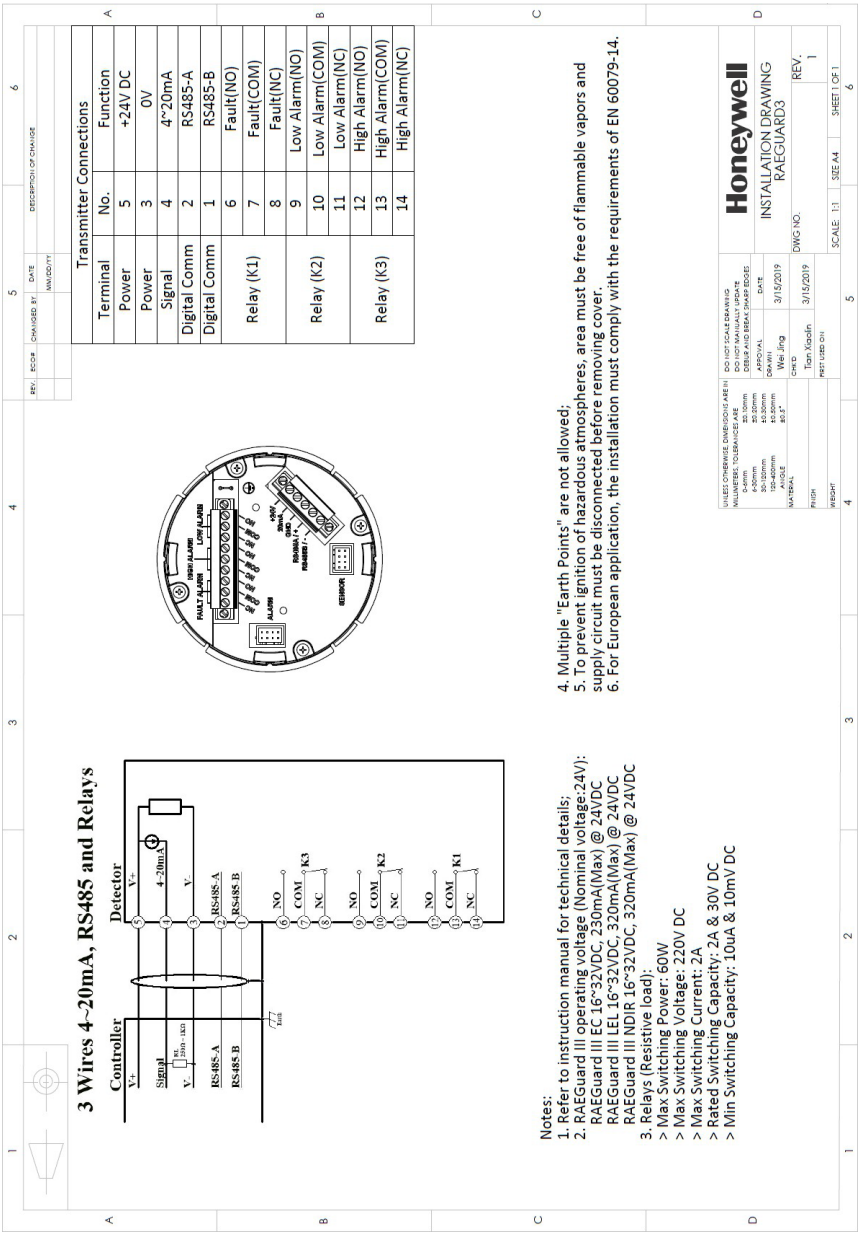
** For more gas type availability, please contact Honeywell Automation.*

14 Installation Drawings

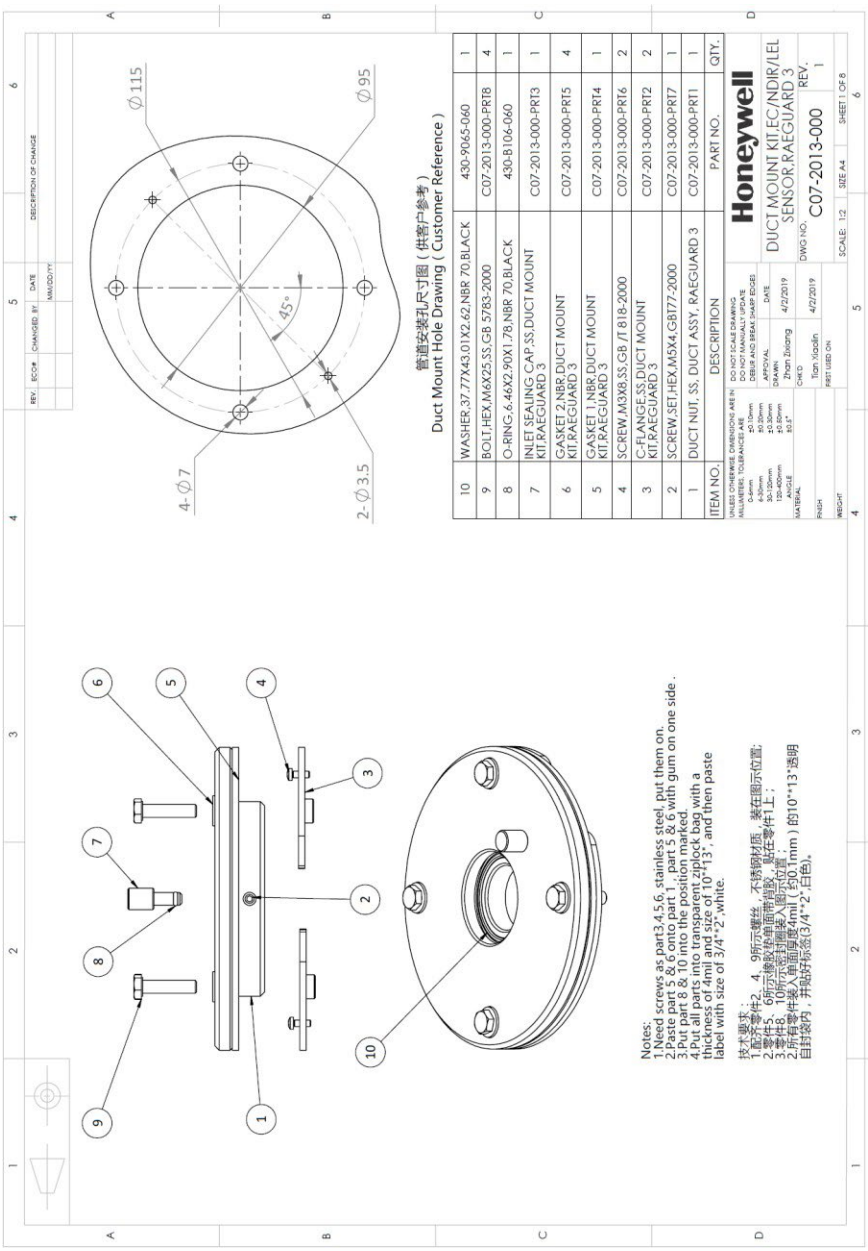
14.1 Mechanical installation Drawing



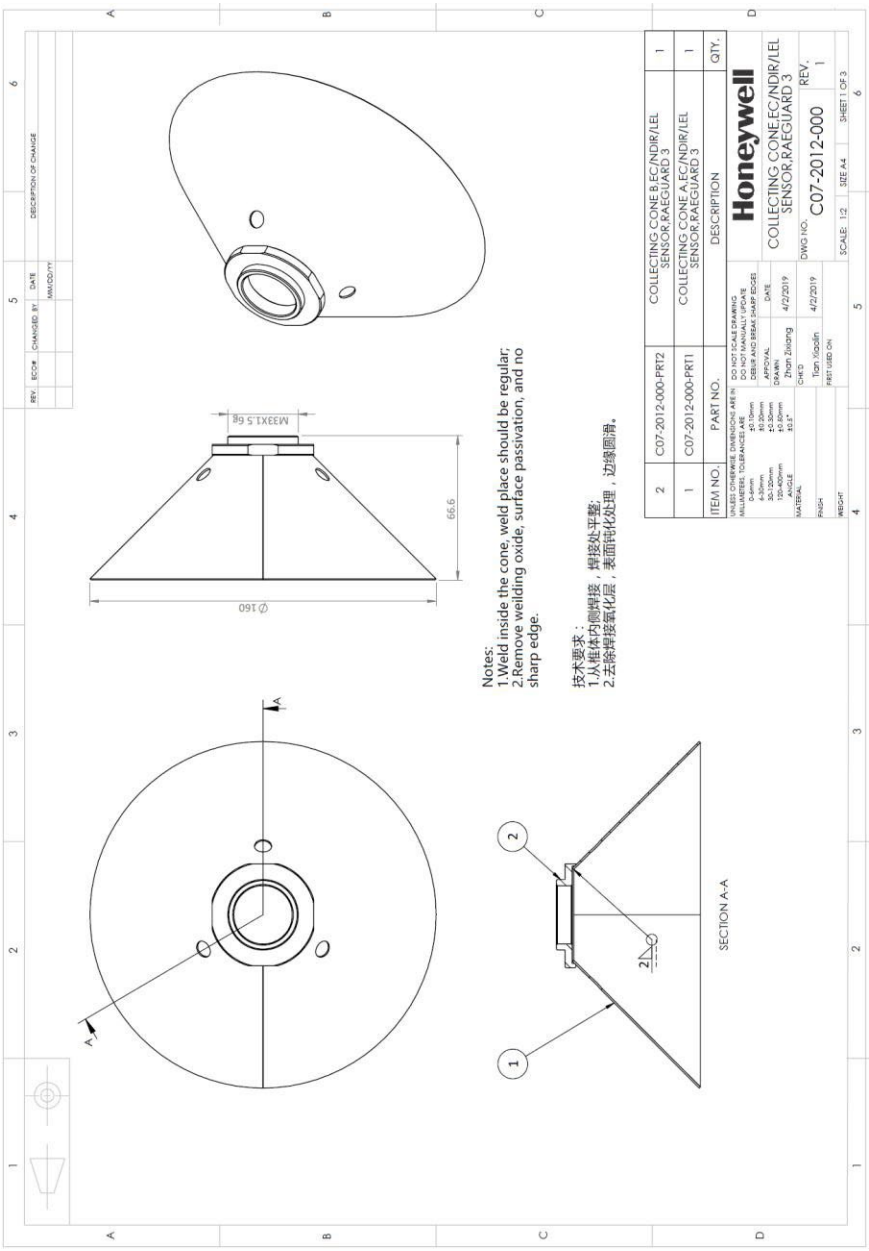
14.2 Electronic Connection Drawing



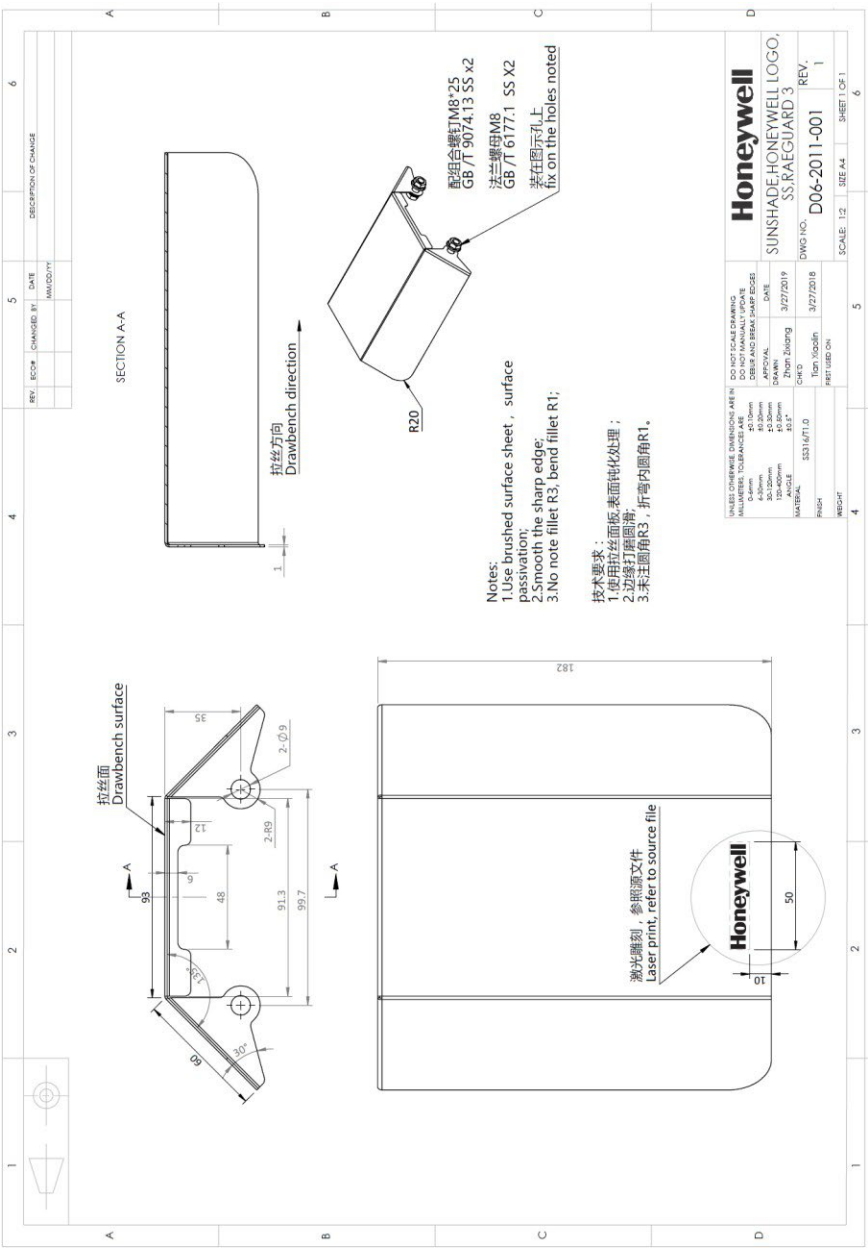
14.3 Duct Mounting Drawing



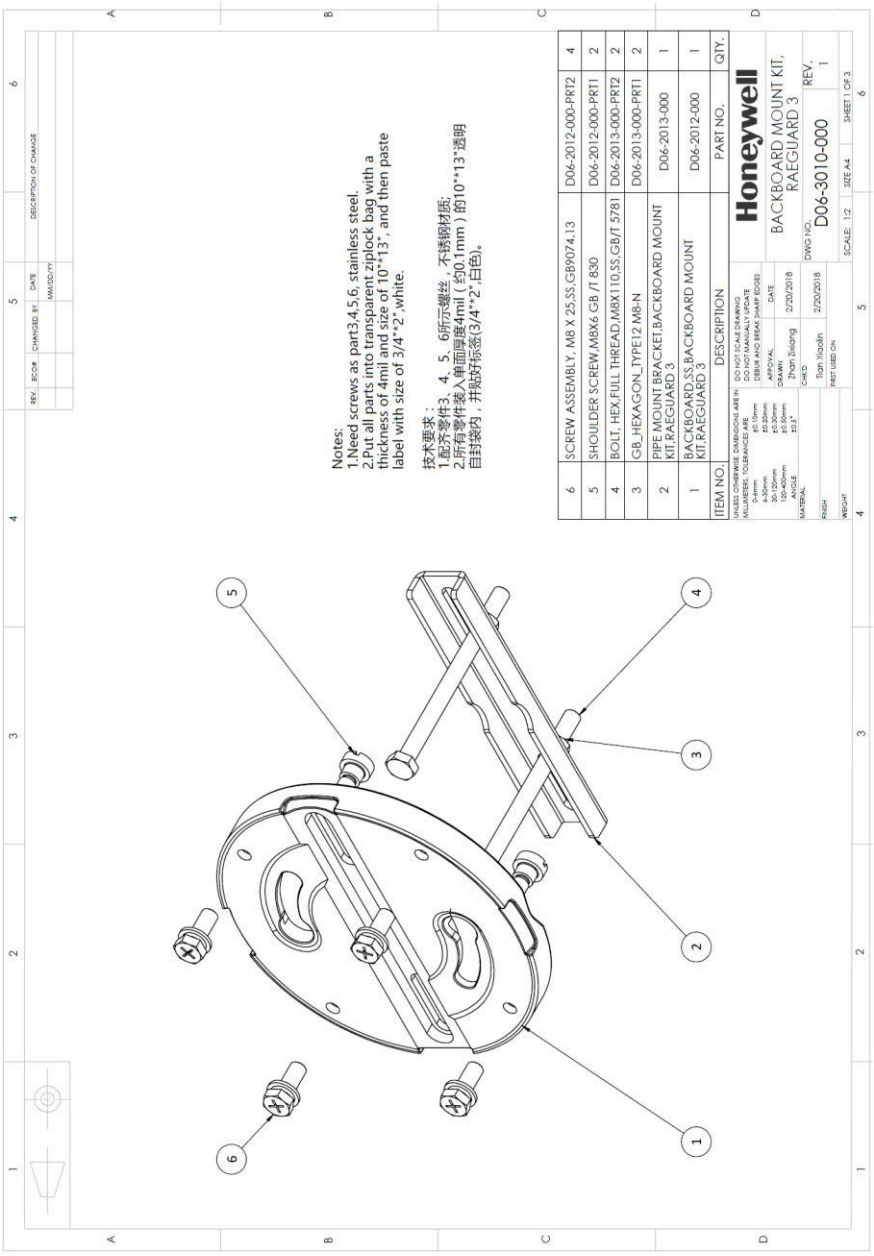
14.4 Collecting Cone Drawing



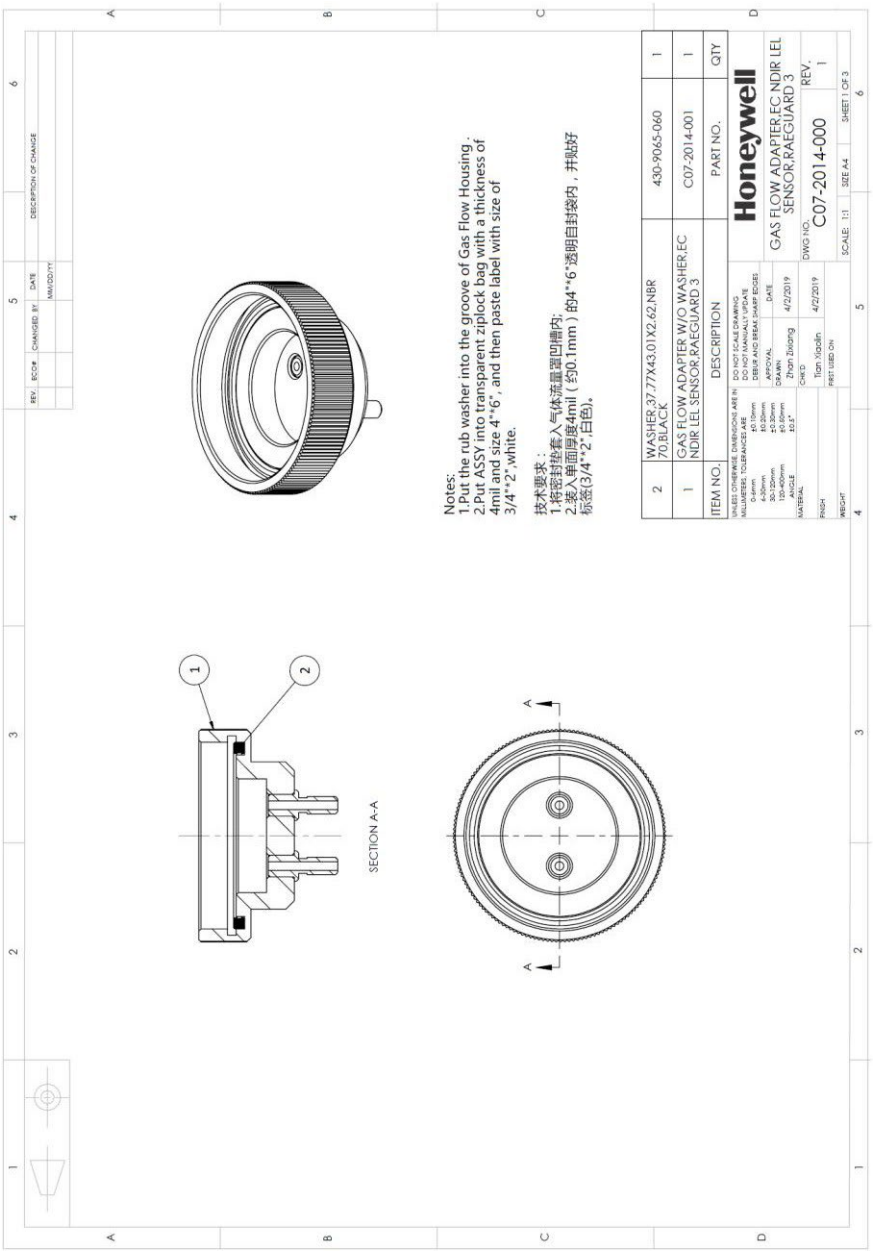
14.5 Sunshade/Deluge Protection Drawing



14.6 Mounting Plate Kit Drawing

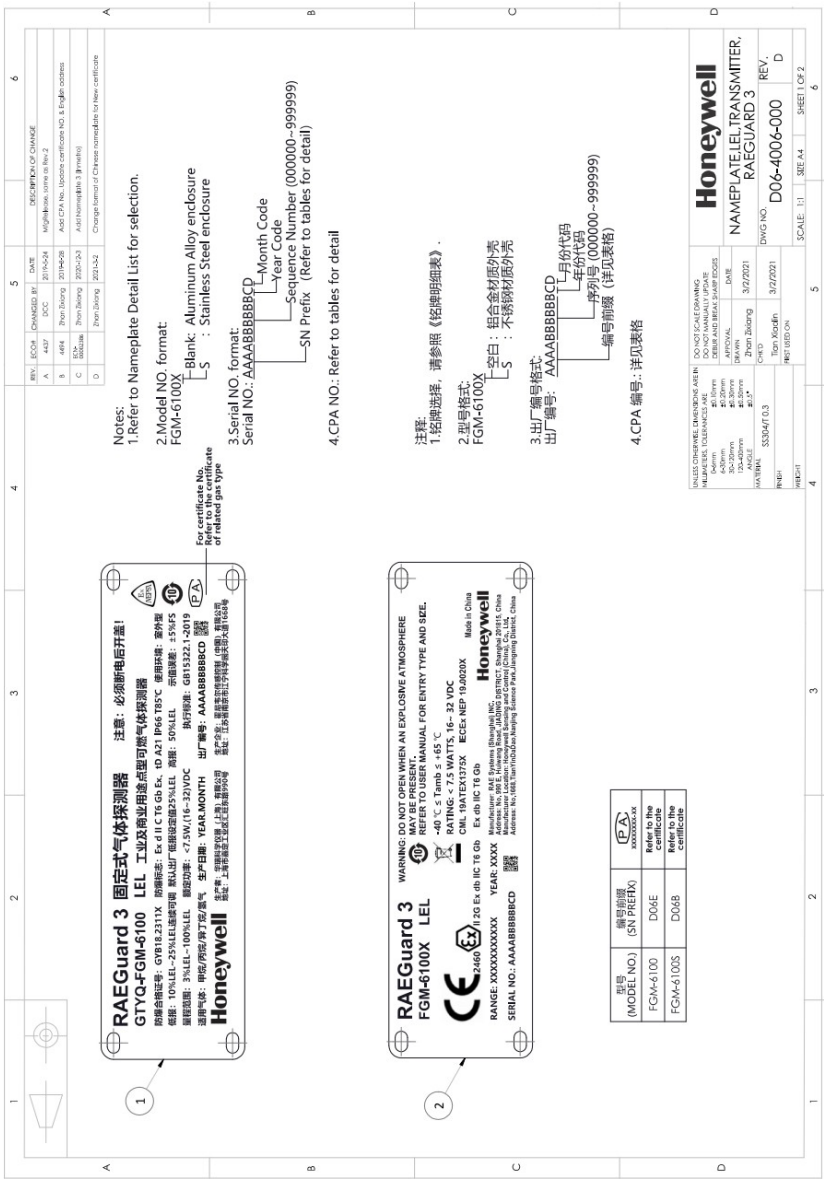


14.7 Gas Flow Adapter Drawing

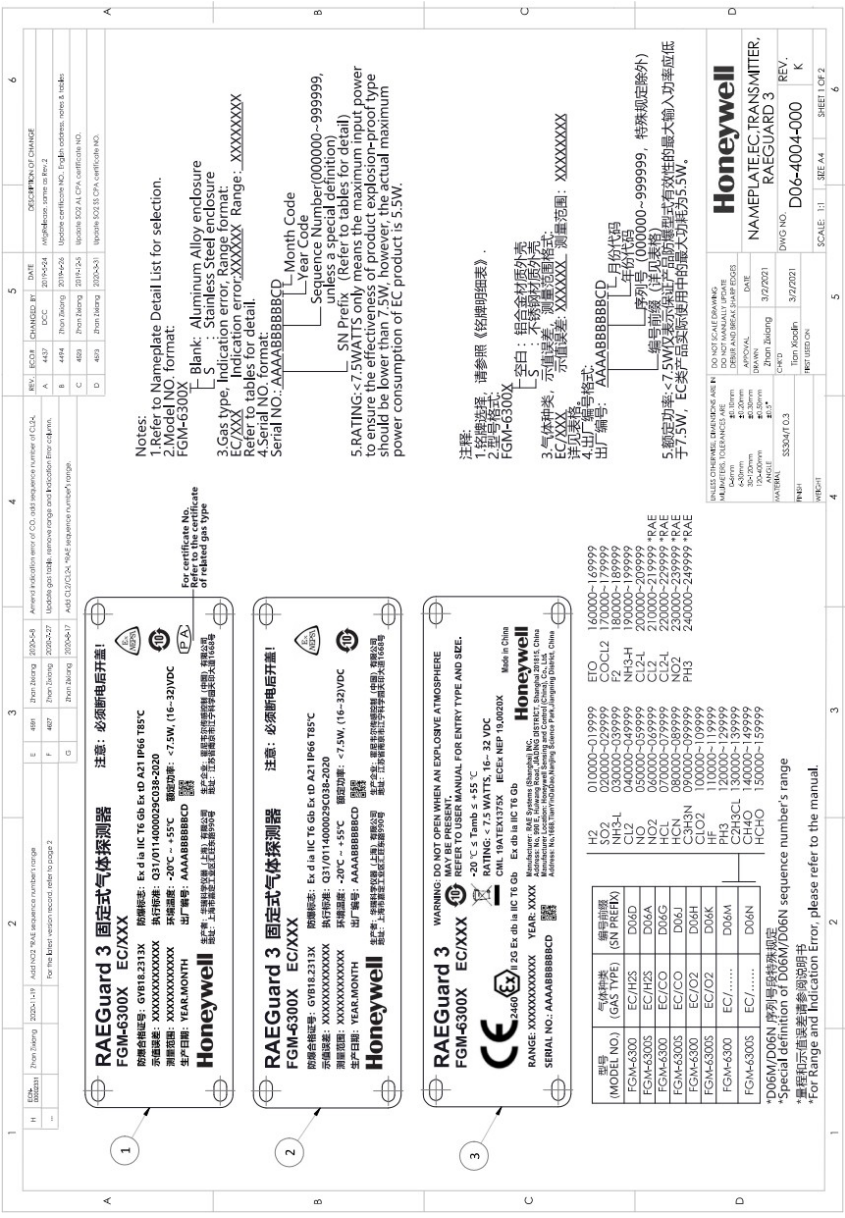


15 Nameplates

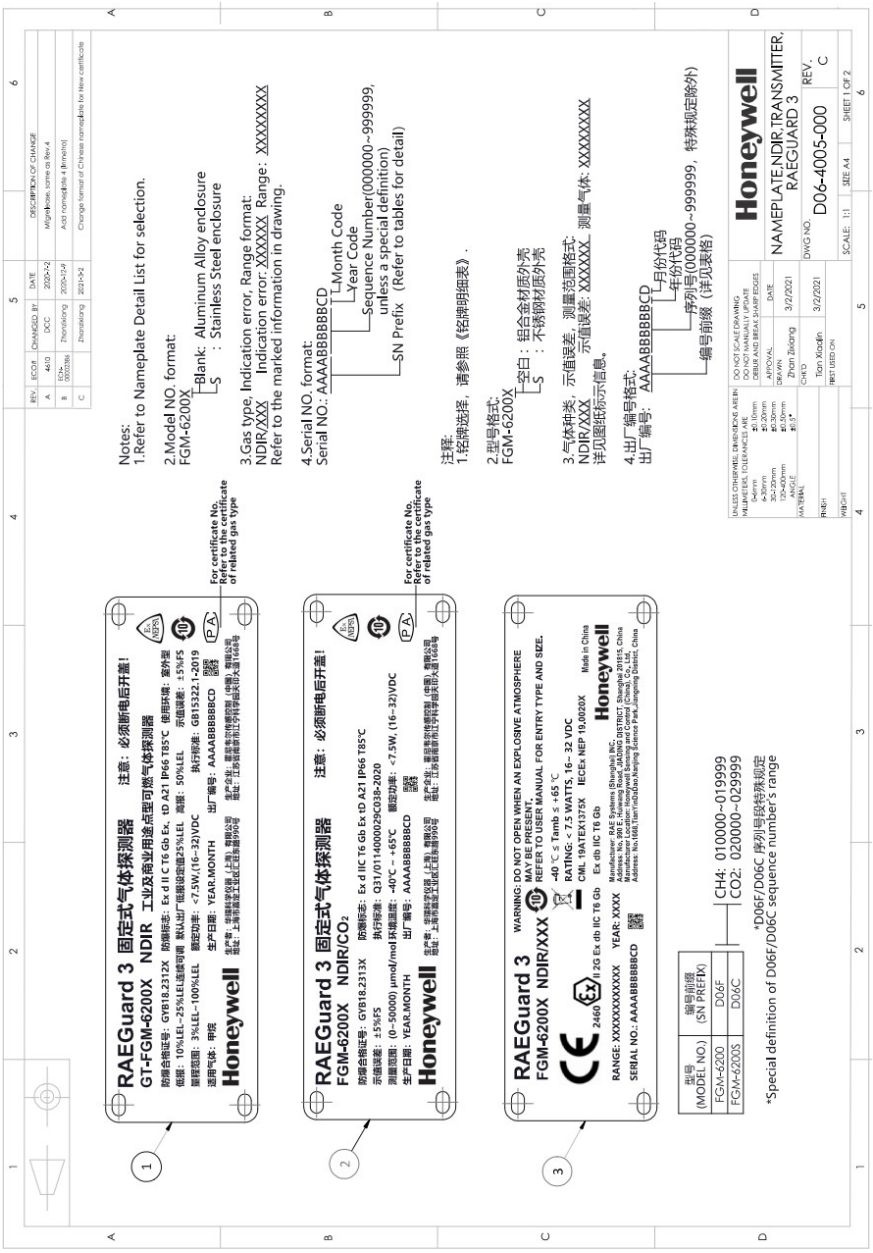
15.1 RAEGuard 3 LEL



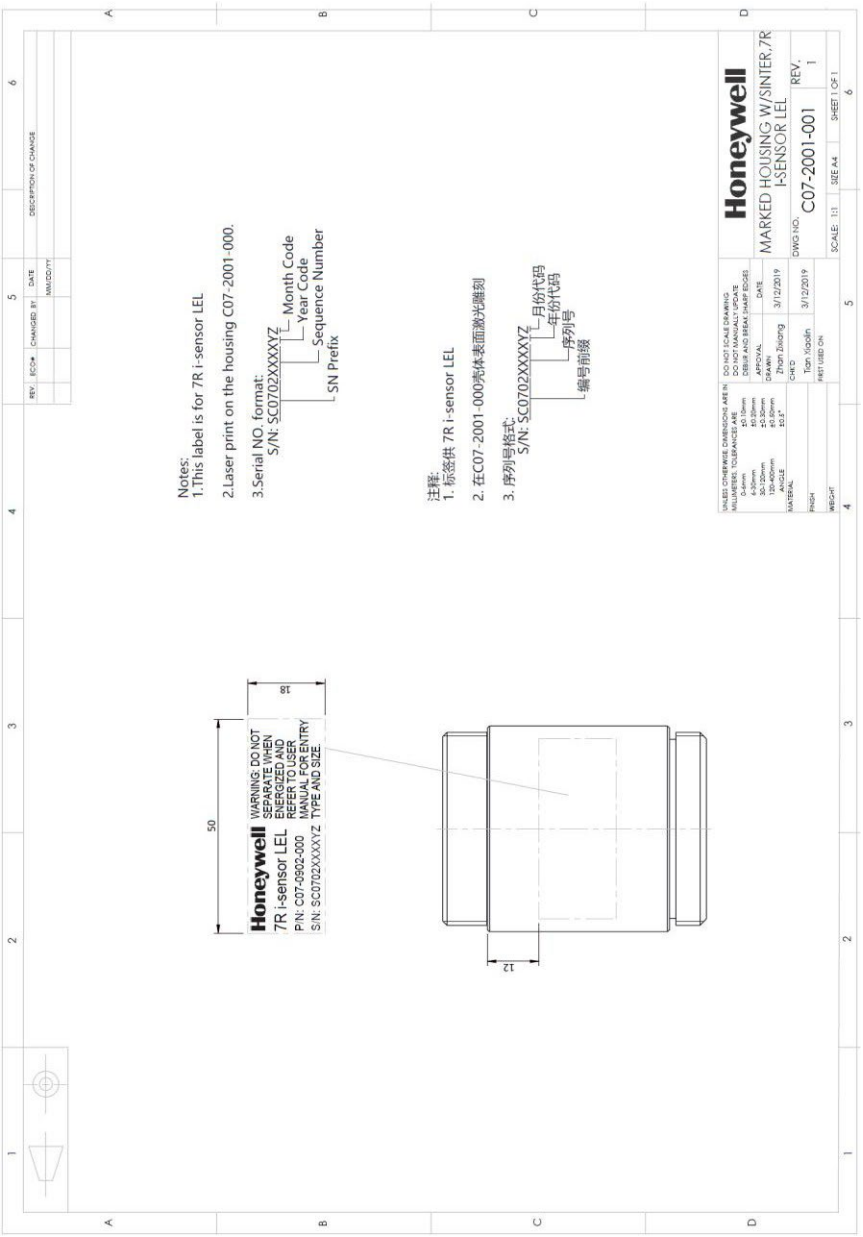
15.2 RAEGuard 3 EC



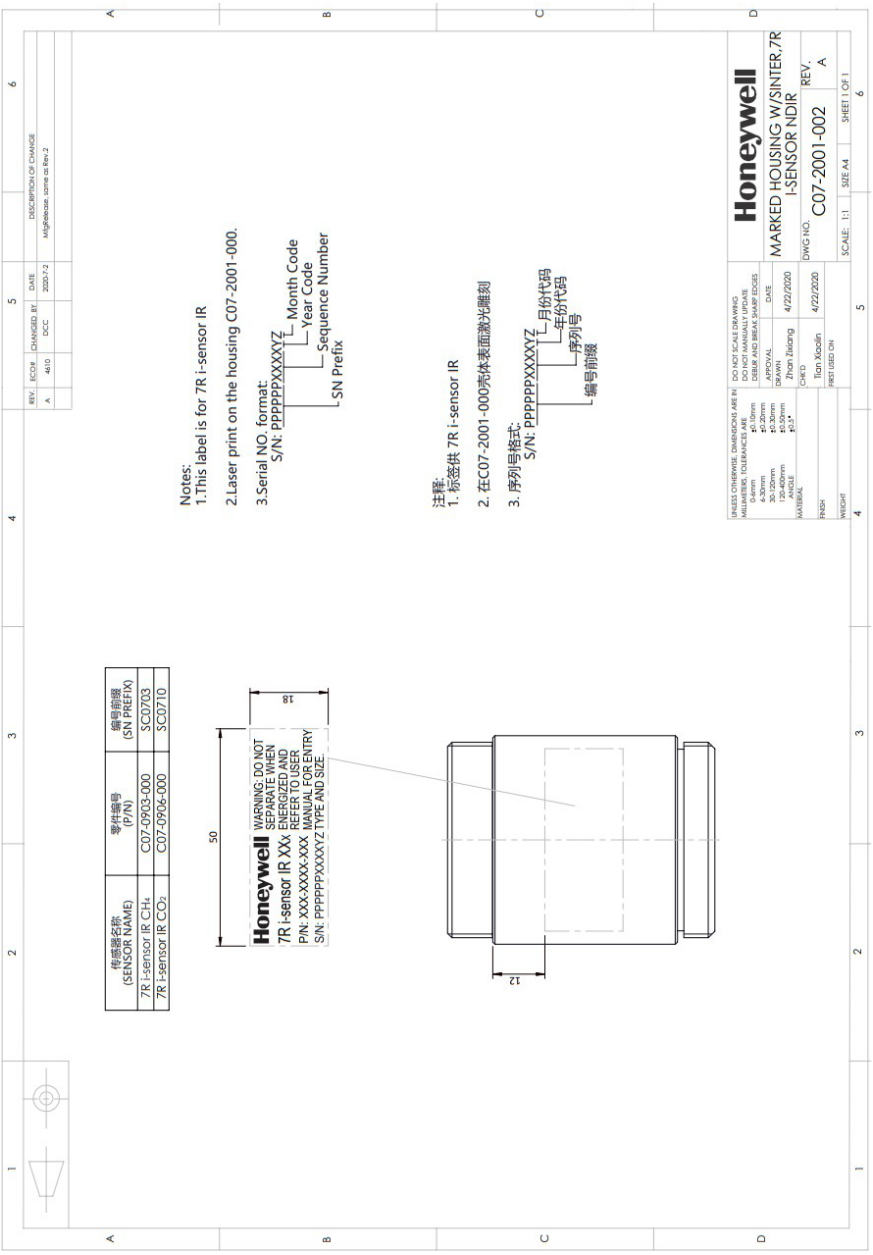
15.3 RAEGuard 3 NDIR



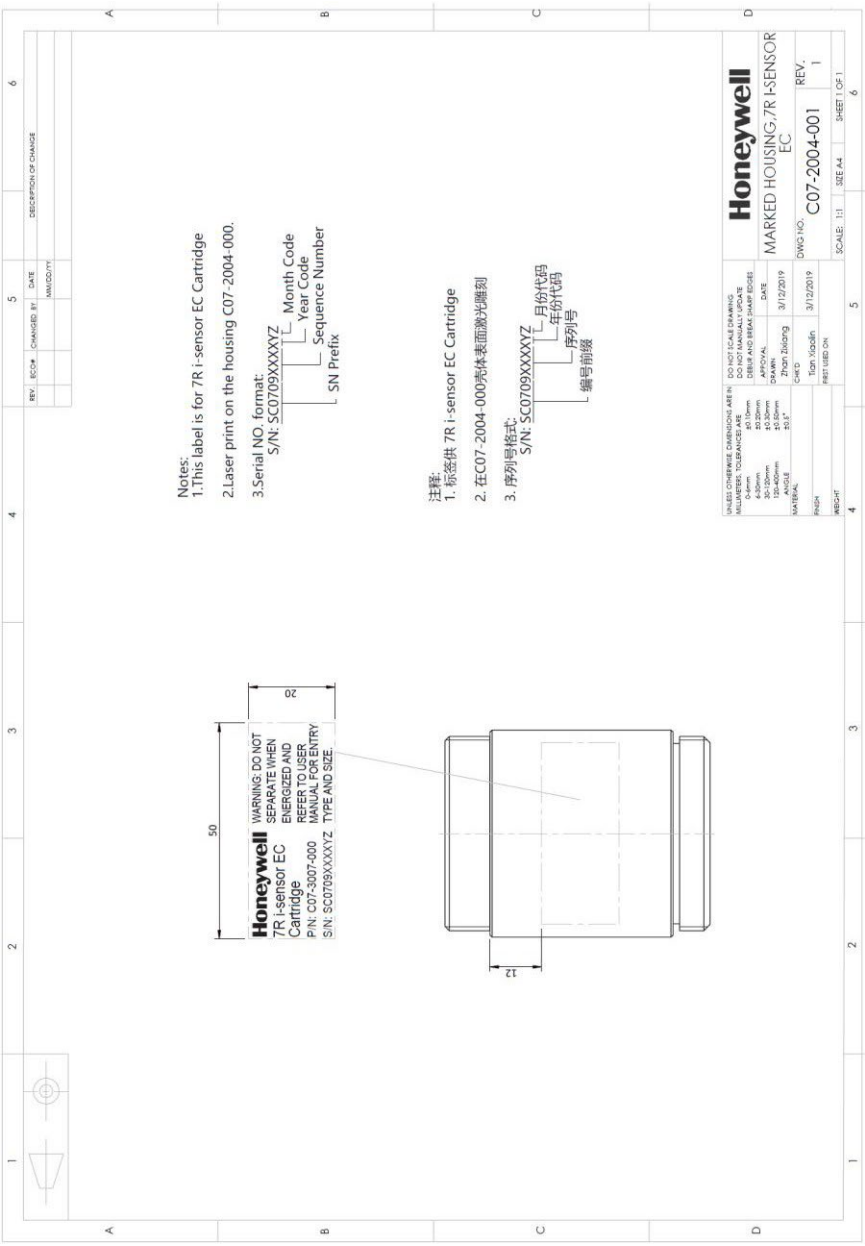
15.4 7R i-sensor LEL



15.5 7R i-sensor NDIR



15.6 7R i-sensor EC



16 Cross Interference and Cross calibration

16.1 Cross interference Table for Toxic and Oxygen

The below table shows the relative cross sensitivity of the RAEGuard 3 to other gases. “Gas Type” indicated the RAEGuard 3 sensor type fitted to the RAEGuard 3. “Gas Type Applied” indicates the gas that may be applied to that sensor and the resulting Reading.

The table does not claim to be complete, the sensor might also be sensitive to other gases.

Gas Type	Gas Type Applied	Concentration	Readings
O_2	CO	5%vol	0.1%vol
H_2S	NH_3	50ppm	0ppm
	CO_2	5000ppm	0ppm
	CO	100ppm	<2ppm
	Cl_2	0.5ppm	0ppm
	C_2H_4	100ppm	0ppm
	H_2S	10ppm	10ppm
	NO_2	3ppm	0ppm
	NO	25ppm	0ppm
	SO_2	2ppm	0ppm
CO	NH_3	50ppm	0ppm
	CO_2	5000ppm	0ppm
	CO	50ppm	50ppm
	Cl_2	0.5ppm	0ppm
	C_2H_4	100ppm	100ppm
	H_2	100ppm	~ 25ppm
	H_2S	20ppm	<5ppm
	CH_3OH	200ppm	0ppm
	NO_2	20ppm	-5 ~ 0ppm
	NO	50ppm	<25ppm
	SO_2	2ppm	<5ppm
NH_3-L	Alcohols	1000 ppm	0 ppm
	CO_2	5000 ppm	0 ppm
	CO	100 ppm	0 ppm
	Hydrocarbons	10000 ppm	0 ppm
	H_2	10000 ppm	0 ppm
	H_2S	20 ppm	2 ppm
NH_3-H	Alcohols	1000 ppm	0 ppm

	CO	100 ppm	0 ppm
	CO_2	5000 ppm	0 ppm
	Cl_2	30 ppm	5 ppm
	NO	100 ppm	0 ppm
	NO_2	10 ppm	6.5 ppm
	SO_2	200 ppm	-20 ppm
	H_2	3000 ppm	0 ppm
	H_2S	200 ppm	120 ppm
SO_2	CO	300 ppm	<1 ppm
	NO	50 ppm	0~5 ppm
	NO_2	6 ppm	<-10 ppm
	H_2S	25 ppm	<0.1 ppm
	Cl_2	5 ppm	<-2 ppm
	NH_3	20 ppm	0 ppm
	H_2	400 ppm	<1 ppm
	HCN	10 ppm	<5 ppm
	Acetylene	10 ppm	<30 ppm
	Ethene	50 ppm	<45 ppm
Cl_2/Cl_2-L	NH_3	100 ppm	0 ppm
	Br_2	1 ppm	1 ppm
	CO_2	1 %vol	0 ppm
	CO	100 ppm	0 ppm
	ClO_2	1 ppm	0.5 ppm
	F_2	1 ppm	0.4 ppm
	H_2	3000 ppm	0 ppm
	H_2S	20 ppm	0 ppm
	NO_2	10 ppm	2 ppm
	O_3	0.25 ppm	0.05 ppm
	SO_2	20 ppm	3.5 ppm
C_2H_3Cl	CO	2.75 ppm	~1 ppm
	Methyl-ethyl-ketone	11 ppm	~1 ppm
	Ethanol	2.0 ppm	~1 ppm
	Toulene	5.5 ppm	~1 ppm
H_2	CO	300 ppm	<60 ppm
	H_2S	15 ppm	<3 ppm
	SO_2	5 ppm	0 ppm
	NO	35 ppm	~10 ppm
	NO_2	5 ppm	0 ppm
	Cl_2	1 ppm	0 ppm

	HCN	10 ppm	~3 ppm
	HCl	5 ppm	0 ppm
	Ethylene	100 ppm	~80ppm
ETO	CO	2.5 ppm	~1 ppm
	Methyl-ethyl-ketone	10 pm	~1 ppm
	Ethanol	1.82 ppm	~1 ppm
	Toulene	5 ppm	~1 ppm
HCl	Alcohols	1000 ppm	0 ppm
	NH_3	100 ppm	0 ppm
	AsH_3	0.2 ppm	0.7 ppm
	CO_2	5000 ppm	0 ppm
	CO	100 ppm	0 ppm
	Cl_2	5 ppm	<±0.1 ppm
	Hydrocarbons	% range	0 ppm
	H_2	10000 ppm	0 ppm
	HCN	20 ppm	7 ppm
	H_2S	20 ppm	60 ppm
	NO	100 ppm	45 ppm
	N_2	100 %	0 ppm
	NO_2	10 ppm	<±0.5 ppm
	PH_3	0.1 ppm	0.3 ppm
	SO_2	20 ppm	8 ppm
NO_2	Alcohols	1000 ppm	0 ppm
	CO_2	5000 ppm	0 ppm
	Cl_2	1 ppm	1 ppm
	NO	100 ppm	0.4 ppm
	SO_2	20 ppm	-5 ppm
	H_2	3000 ppm	0 ppm
HCN	Alcohols	1000 ppm	0 ppm
	CO_2	5000 ppm	0 ppm
	CO	100 ppm	0 ppm
	Hydrocarbons	% range	0 ppm
	H_2	10000 ppm	0 ppm
	NO	100 ppm	-5 ppm
	NO_2	10 ppm	-7 ppm
	H_2S	20 ppm	0 ppm
PH_3	NH_3	108 ppm	<0.1 ppm
	AsH_3	0.15 ppm	0.12 ppm

	CO_2	5000 ppm	0 ppm
	CO	85 ppm	0 ppm
	Cl_2	0.85 ppm	<-0.05 ppm
	B_2H_6	0.2 ppm	0.01 ppm
	CH_4	18000 ppm	0.0 ppm
	H_2	3100 ppm	<0.05 ppm
	HCl	7.9 ppm	0 ppm
	HCN	12.6 ppm	0.3 ppm
	HF	7.2 ppm	0 ppm
	SeH_2	0.85 ppm	0 ppm
	H_2S	18.2 ppm	0 ppm
	NO_2	10.1 ppm	-1.6 ppm
	Propan-2-ol	20000 ppm	<0.05 ppm
	SiH_4	3.5 ppm	0.4 ppm
	SO_2	17.8 ppm	0 ppm
C_3H_3N	CO	300 ppm	23 ppm
	H_2	10000 ppm	35 ppm
	NO_2	5 ppm	1 ppm
	Cl_2	1 ppm	-0.5 ppm
	NO	35 ppm	63 ppm
	H_2S	15 ppm	74 ppm
	HCN	15 ppm	13 ppm
NO	Alcohols	1000 ppm	0 ppm
	CO_2	5000 ppm	0 ppm
	CO	100 ppm	0 ppm
	Cl_2	1 ppm	0 ppm
	Hydrocarbons	5ppm	0 ppm
	H_2	3000 ppm	0 ppm
	HCN	20 ppm	5 ppm
	H_2S	10 ppm	yes, but no test data offered
	NO	100 %vol	0 ppm
	NO_2	10 ppm	3.5 ppm
	O_3	0.25 ppm	0 ppm
	SO_2	20 ppm	6 ppm
	Unstable Hydrocarbons		yes, but no test data offered

16.2 Cross Calibration Flammable Gas Detector (Not tested as part of the performance approval)

For greatest accuracy, a catalytic gas detector should be calibrated using a certified gas/air mixture equal to 50%LEL of the actual target gas intended to be monitored.

However, it is not always practical to obtain every detectable type of hydrocarbon gas in a calibration-ready, certified and verifiable form. Therefore, it is possible to carry out a “correction factor” to calibrate using another hydrocarbon gas/air mixture.

Notes:

Where the user calibrates any sensor using a difference gas, responsibility for identifying and recording calibration rests with the user. Refer to the local regulations where appropriate.

Gas/Vapour	Relative Response%	Correction Factors (CF)
Methane	100	1.0
Hydrogen	121	0.8
Ethane	70	1.4
Propane	61	1.6
Butane	49	2.0
Pentane	42	2.4
Hexane	39	2.6
Heptane	35	2.9
Octane	32	3.1
Ethylene	70	1.4
Methanol	72	1.4
Ethanol	54	1.9
Propan-2-ol	40	2.5
Acetone	42	2.4
Butan-2-one (MEK)	40	2.5
MIBK	30	3.3
Cyclohexane	37	2.7
Di-Ethyl Ether	39	2.6
Ethyl Acetate	37	2.7
Toluene	35	2.9

Xylene	26	3.9
Acetylene	39	2.6

As for detector calibrated by Methane, for example, if you intend to monitor Propane, so long as set CF @1.6 in menu of RAEGuard 3, which appears detector just detects Propane.

If RAEGuard 3 detector is calibrated by non-Methane compounds, when calibrating with Propane the new CF for Ethane is 1.4/1.6 = 0.9. For example, to detect Ethane with RAEGuard 3, you just set CF is 0.9, which appears detector is monitor Ethane concentration real-time.

Appendix A - Modbus® Protocol:

RAEGuard 3 detectors support RS485 data transmission and communicate as MODBUS RTU. The detector provides 4-byte register data.

Note: *The communication only transmits the tested concentration value of the gas.*

For example: 34 hex = 52 decimal

RAEGuard 3 detector supports RS-485 ModBus communication function. The following are the communication protocols that support this communication.

- **Communication settings**

Communication mode: RTU

Baud rate: 4800，9600，**19200**，38400，57600

- **Information structure / communication steps**

RAEGuard 3 only supports the 0x03 (read-only register) function code, i.e. The detector only supports reading values.

0x03: Read-only register

Request information:

Device Address	Function Code	Register Address High Byte	Register Address Low Byte	Quantity of Registers High Byte	Quantity of Registers Low Byte	CRC Low Byte	CRC High Byte
Client ID	03	00	08	00	02	CRC	CRC

Response information:

Device Address	Function Code	Byte Count	Register Value				CRC Low Byte	CRC High Byte
Client ID	03	04	Reading Highest Byte	Reading Higher Byte	Reading High Byte	Reading Low Byte	CRC	CRC

Note: The data sent by the detector is 4 bytes long.

For example:

Request:	01	03	00	08	00	02	45	C9	
Response:	01	03	04	00	00	00	D1	3A	6F

Note: The maximum transmission distance of standard 1.5 mm^2 communication cable is less than 1 km.

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