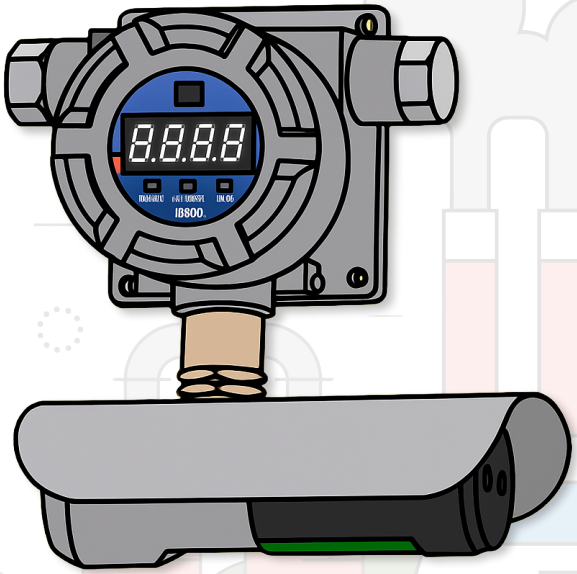
RESPO®
Responsive Detection

BS-03
Fixed Gas Detector



SIL 2
Safety Integrity Level

Infra Red Gas Detector
IR/Toxic/VOC Gas Detector

HART
COMMUNICATION PROTOCOL

Instructions For Use

WARNING
Strictly follow the Instructions for Use.
The user must fully understand and strictly observe the instructions. Use the product only for the purposes specified in the Intended use section of this document.

MADE IN INDIA
PREMIUM QUALITY

Safety Information

- Before using the product, carefully read the Instructions for Use.
- Strictly follow the Instructions for Use. The user must fully understand and strictly observe the instructions. Use the product only for the purposes specified in the Intended use section of this document.
- Do not dispose of the Instructions for Use. Ensure that they are retained and appropriately used by the product user.
- Only fully trained and competent users are permitted to use this product.
- Comply with all local and national rules and regulations associated with this product.
- Only trained and competent personnel are permitted to inspect, repair and service the product as detailed in these Instructions for Use. Further maintenance work that is not detailed in these Instructions for Use must only be carried out by Respo or personnel qualified by Respo. Respo recommends a Respo service contract for all maintenance activities.
- Properly trained service personnel must inspect and service this product as detailed in the Maintenance section of this document.
- Use only genuine Respo spare parts and accessories, or the proper functioning of the product may be impaired.
- Do not use faulty or incomplete products, and do not modify the product.
- The threads for the explosion proof enclosure do not conform to the minimum/maximum values in EN/IEC 60079-1. The threads must not be reworked by the user.
- Only operate the product within the framework of a risk-based alarm signalling concept.

Safe coupling with electrical devices

- Electrical connections to devices that are not listed in these Instructions for Use should only be made following consultation with the respective manufacturers or an expert.

Use in areas subject to explosion hazards

- Devices or components for use in explosion-hazard areas which have been tested and approved according to national, European or international Explosion Protection Regulations may only be used under the conditions specified in the approval and with consideration of the relevant legal regulations. The devices or components may not be modified in any manner. The use of faulty or incomplete parts is forbidden. The appropriate regulations must be always observed when carrying out repairs on these devices or components.

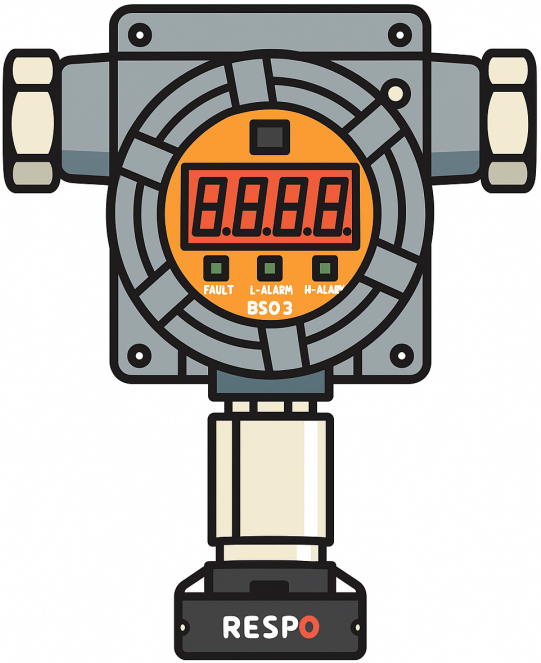
Table of Contents

1. Brief introduction

The BS-03 is an Infrared Sensor Technology based type gas detector with smart transmitter. The sensor is integrated to the transmitter having digital LCD-LED display This detector uses high-performance infrared components and micro-control technology, combined with sophisticated SMD process manufacturing. It has good repeatability, temperature and humidity characteristics, as well as long service life and convenient operation.

The output signal of the detector is 4~20mA standard signal with optional HART.

Besides Infrared Sensor the BS-03 is also available with Plug in SMART Sensors for Point Infrared, VOC's, Toxic's, Oxygen and Catalytic Combustion. These sensors are replaceable type and can be replaced without any special tools.



2. Features

- Double beam infrared technology, dual compensated, Non-Dispersive IR (NDIR) with temperature compensation for excellent stability and minimal drift.
- High accuracy, longer lifespan.
- 4-20mA signal output with HART (Optional).
- Relay output for alarm and fault alert.
- LED display, easy to read.
- Non-Intrusive Calibration.
- Special installation accessories, easy installation.
- Smart sensor module design, easy maintenance.
- Sensor with heated optics, excellent moisture and heat resistance.
- Dirty Optics warning with correct operation for obstruction up to 70-80% for NDIR Sensor.
- Easy cleaning of Mirror or Sensor replacement.
- Intrinsically Safe HART Port (Optional).
- “Chimney” Type Open Gas Path.
- Sensor Housing SS-316.
- Plug-in Sensors for Point IR, VOC’s, Toxics, Oxygen and Catalytic Combustion.
- Vibration and Shock Resistance up to 4G.
- Linearity: ∓ 2% of FSD
- NDIR Sensor Life: > 5 Years
- Fail-Safe as per SIL2

3. Specifications

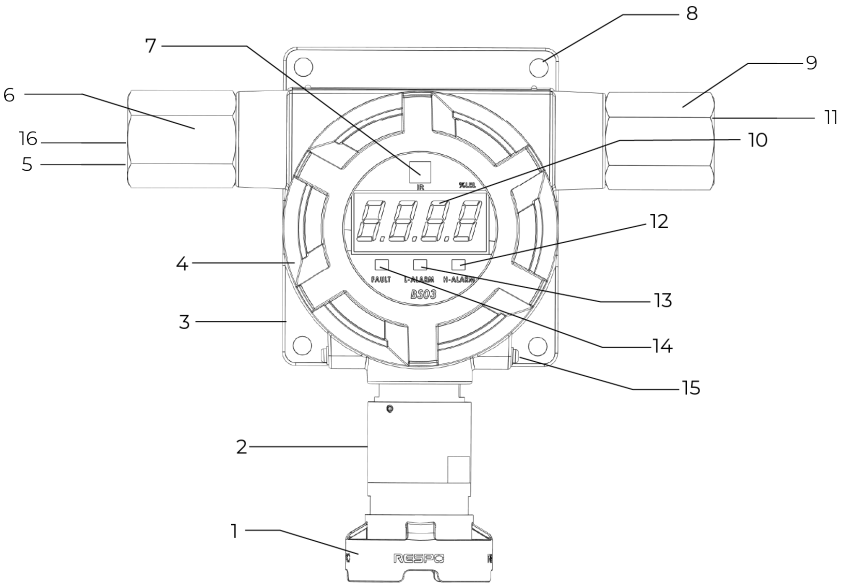
Dimensions	210mm x 200mm x 105mm
Weight	< 2 Kg Aluminium / < 6 Kg SS-316
Enclosure Material	Cast Aluminium Alloy or SS-316
Sensor Housing Material	SS-316
Ingress Protection	IP-66
Cable Entry	Two 1/2" NPT
Power	18-30VDC < 2W
Electrical Output	4-20mA Current Sink or Source RS-485 MODBUS RTU HART over 4-20mA Signal
Display	Main Display: LED-LCD (Red) Indicators: Alarm 1, Alarm 2, Fault
Relays	3 Configurable Relays (LOW, HIGH, FAULT) 5A@230VAC 5A@30VDC
Intrinsically Safe HART Port	Optional
Sampling Method	Natural Diffusion with Chimney Effect
Working Temperature	-40°C to +70°C
Working Humidity	0~95% RH (no dews)
Accuracy	± 1% for 0-100% range (NDIR) ± 2% to ± 3% for 0-100% range (TOXICS)
Repeteability	± 2% FSD
Warm-up Time	NDIR/Catalytic - 120 seconds Toxics - 60 seconds
Zero Drift	± 2% FSD per year maximum
Approvals	ATEX - Ex dB IIC T6 Gb PESO
Testing	EN 60079-0: 2012 EN 60079-1: 2014 SIL2 EN 50270:2015 EN IEC 60079-0:2018, EN 60079-1:2014, EN 60079-29-1:2016, EN 60079-2:2015

4. Sensor Ranges & Response Time

TARGET GAS	RANGE	RESOLUTION	SENSOR TYPE	RESPONSE TIME
CH4	0~100% LEL	1% LEL	Catalytic Combustion/ Non-Dispersive IR	T_{90} < 30 Sec (Cat) T_{90} < 3 Sec (NDIR)
	0~5% VOL	0.01% VOL		
	0~100% VOL	1% VOL		
C_3H_8	0~100% LEL	1% LEL		
H_2	0~100% LEL	1% LEL	Catalytic Combustion	T_{90} < 15 Sec
	0~1000 ppm	1 ppm	Electrochemical	T_{90} < 10 Sec
CO_2	0~5% VOL	0.01% VOL	Non-Dispersive IR	T_{90} < 3 Sec
	0~6000 ppm	1 ppm	Non-Dispersive IR	T_{90} < 3 Sec
C_4H_{10}	0~100% LEL	1% LEL	Catalytic Combustion/ Non-Dispersive IR	T_{90} < 30 Sec (Cat) T_{90} < 3 Sec (NDIR)
CO	0~1000 ppm	1 ppm	Electrochemical	T_{90} < 10 Sec
	0~500 ppm	1 ppm	Electrochemical	T_{90} < 10 Sec
H_2S	0~100 ppm	1 ppm	Electrochemical	T_{90} < 10 Sec
	0~30 ppm	1 ppm	Electrochemical	T_{90} < 10 Sec
O_2	0~30% VOL	0.1% VOL	Electrochemical	T_{90} < 10 Sec
NH_3	0~100 ppm	1 ppm	Electrochemical	T_{90} < 10 Sec
	0~1000 ppm	1 ppm	Electrochemical	T_{90} < 10 Sec
SO_2	0~100 ppm	1 ppm	Electrochemical	T_{90} < 10 Sec
Cl_2	0~20 ppm	0.1 ppm	Electrochemical	T_{90} < 10 Sec
VOC	0~1000 ppm	1 ppm	PID	T_{90} < 10 Sec
NO_2	0~100 ppm	1 ppm	Electrochemical	T_{90} < 10 Sec
ETO	0~100 ppm	1 ppm	Electrochemical	T_{90} < 10 Sec
HCN	0-100 ppm	1 ppm	Electrochemical	T_{90} < 10 Sec

The NDIR Sensor is configurable for C1-C12 Hydrocarbons.

5. Structure



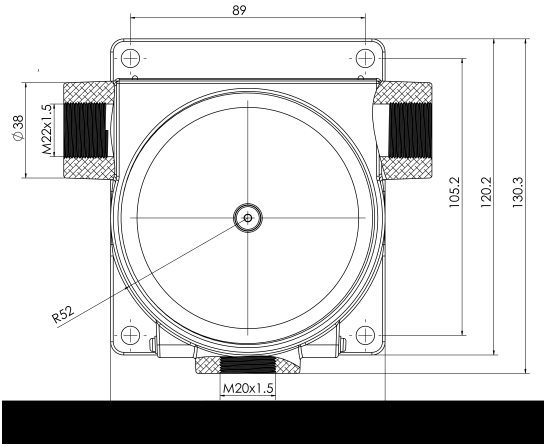
#	Name	#	Name
1	Protection cover	9	Pipe connector
2	Sensor Housing	10	Display screen
3	Lower shell	11	Wire connection hole
4	Upper shell	12	H-alarm LED
5	Wire connection hole	13	L-alarm LED
6	Pipe joint	14	Fault / Power LED
7	Remote control receiving window	15	Ground nut
8	Fixing hole	16	HART Connection

6. Installation

6.1 Installation Position

1) For petrol gas, oil gas and alcohol gas etc. which is heavier than the air, the position is 0.3m-0.6m higher than the ground.
2) For natural gas, CH4 etc which is lighter than the air, the position is 0.5m-2m higher than the gas source. Gas density more than 0.97kg/CBM, then it's heavier. Gas density less than 0.97kg/CBM, then it's lighter.
3) The position should be far away from shocking, shattering, strong electromagnetic interference. Around the position, there should be at least 0.3m empty place.
4) The position should be within 1m around the possible gas leakage area, such as valve, pipe connection point, gas outlet place. Please try to install it nearer to the above places, but avoid influencing the working of the other equipment. Please avoid the environment of high temperature and humidity. Also please keep it from water swashing, oil and mechanical damage. Please also consider the convenience of maintenance and calibration.
5) For large scale detection, we suggest install 1pc every 10-12 square meters, so as to get the best detection result.

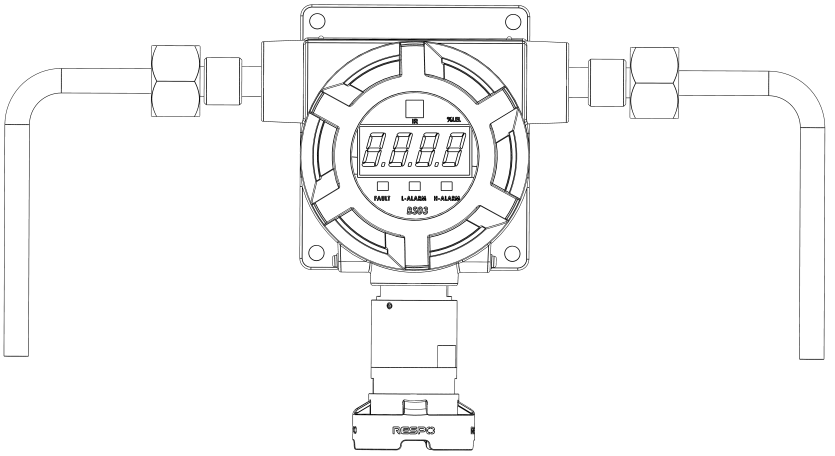
6.2 Dimensions



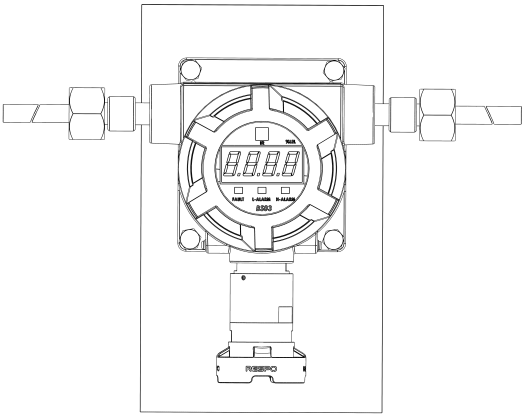
6.3 Installation Methods

Note: Fix the detector with sensor head downwards!
According to the installation place, you can fix the detector onto the wall or to the gas pipes. Please follow the details as below:

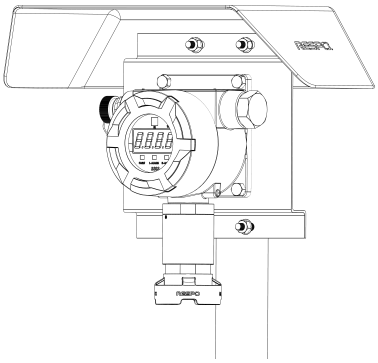
- Method 1(thread butted type fixing method): If there are transverse or vertical siphon with G3/4 Screw thread in installed places, please connect the two terminals of the detector to the gas pipes. Then connect and screw down the pipe screw thread nut and fix it tightly.



- Method 2: If the user needs to install the detector onto the wall, please choose an appropriate place on the wall according to the detector dimensions. Then fix the detector by using 3 pieces of M6×70 bulge bolts in the corresponding installed holes.



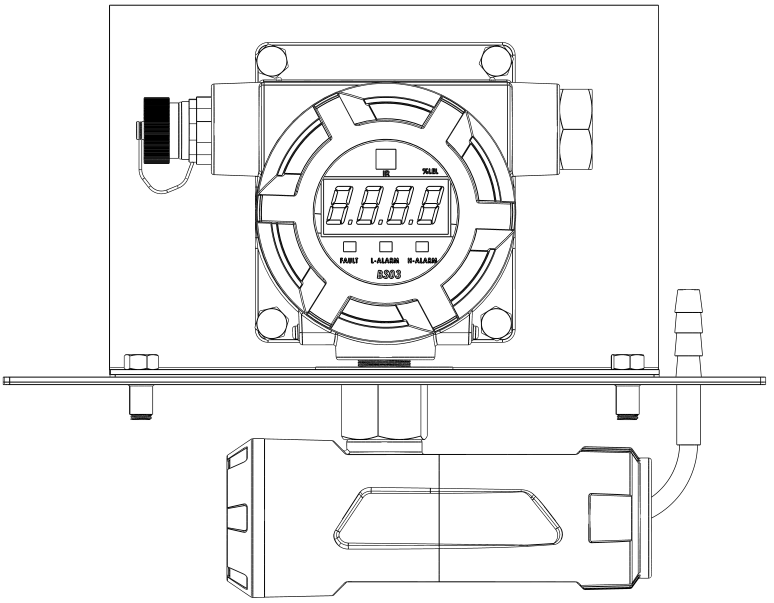
- Method 3: If there is 1" to 2" (diameter) pipe, the user can use 2 U-type bolts to fix the hanging plate on the pipe, and then fix the detector onto the plate. Or, the user can first fix the detector onto the plate and then fix the plate on the pipe.



- Duct Mount

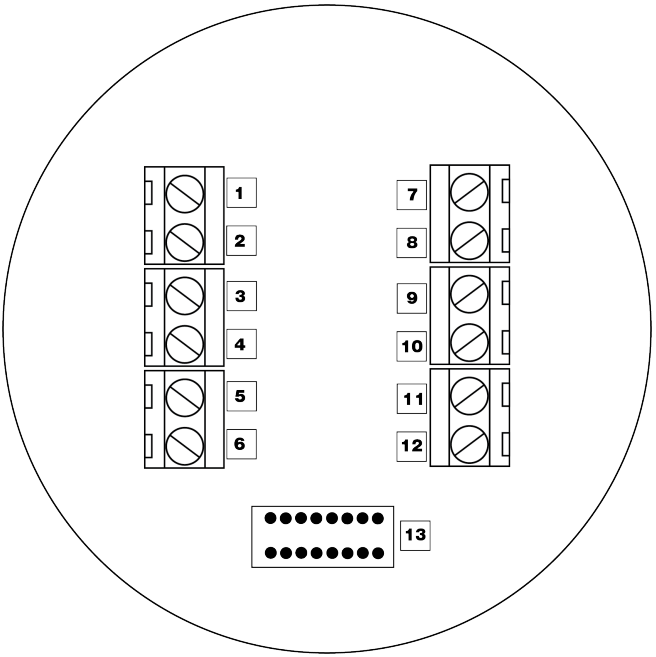
A duct mount kit for a fixed gas detector is a specialized accessory that allows a gas detector to be mounted on HVAC ducts, ventilation shafts, or air handling units, enabling the detector to sample air flowing through the duct without exposing the sensor directly to the air stream. This ensures gas detection within the ducted airflow—especially useful for early leak detection in controlled environments.

A duct mount kit includes:
1. A stainless steel or aluminium mounting plate or housing
2. Sampling tube or probe that extends into the duct
3. Sealing grommets or flanges for airtight installation
4. Flow adapter or bypass chamber (optional) to draw air across the sensor



7. Wire Connection

1. Note: Electricity power must be cut off before wire connection. Wire connecting steps:
1. Screw down the cover in counter-clockwise way. Then use a cross-type screw to screw down the 3 bolts and take off the display PCB.
2. Screw down the pipe connector in counter-clockwise way. Take out the explosion-proof pad. In turns, put 3-line wire to the internal of the enclosure through the pipe connector, compaction circle, air-proof closing plug and the wire connection hole. According to the explosion-proof requirement, please don't take out the explosion-proof closing plug from the unused wire connection holes. Please don't throw away any part inside the enclosure or the PCB.
3. All the wires should be connected to the terminals. The terminal instruction is as follows:



A. If the output signal is 4-20mA signal, then the terminal definitions are as below:

#	Mark	Function	Spec
1	L-Alarm (IN)	Low alarm output	Switching value Dry Contact
2	L-Alarm (OUT)	Low alarm output	
3	24V	Power input	DC24V±25%
4	GND	Power input	
5	Iout	Current output	4～20mA
6	F-Alarm (IN)	Fault Alarm Output	Dry Contact (Optional)
7	H-Alarm (IN)	High alarm output	Switching value Dry Contact
8	H-Alarm (OUT)	High alarm output	
9	24V	Power input	DC24V±25%
10	GND	Power input	
11	Iout	Current output	4～20mA
12	F-Alarm (OUT)	Fault Alarm Output	Dry Contact (Optional)
13	Display Connector		

B. If the output signal is RS485 signal, then the terminal definitions are as below:

#	Mark	Function	Spec
1	L-Alarm	Low alarm output	Switching value
2	L-Alarm	Low alarm output	
3	24V	Power input	DC24V±25%
4	GND	Power input	
5	A	Data communication	RS485A
6	B	Data communication	RS485B
7	H-Alarm	High alarm output	Switching value
8	H-Alarm	High alarm output	
9	24V	Power input	DC24V±25%
10	GND	Power input	
11	A	Data communication	RS485A
12	B	Data communication	RS485B

4. After the correct wire connection, take out the useless wire from the enclosure. Then tighten the compaction circle, rubber air-proof circle and wire. Explosion-proof soft tube can also be connected with the device directly. Note: The size of the connection wire between the controller and detector should not be less than 6mm, and the distance should be note more than 1000m.
5. After checking all the connection well, install the display PCB and the front cover. Make sure O-type circle is put on and connected with the cover tightly.

8. Operation

On the remote controller, there are totally five buttons as follows: “Setup”, “Confirm”, “Cancel”, “+” and “-”.
Warning: Do not replace the batteries for the remote control in working area.
Note: “Setup”, “Confirm” and “Cancel” are single-spring buttons. These buttons can only be triggered once even if you press them continuously, and the interval between two springs should not be less than 1 second. “+” and “-” are continuous-spring buttons and can be triggered by continuous pressing. Setting can only be affected after pressing “Confirm”. After setting, press “Cancel” to return to the normal mode. Effective setting can be kept till the next setup, even if without power.

Display in different status:

1. Normal status: Display the detecting result of the gas concentration
2. Sensor fault status: Screen display “E-02”; yellow LED is on.
3. High concentration protection status(only available for LEL type): Screen display “100”, 3 LED lights are all on, electrical current output 21.3mA.
4. Low alarm status: red L-ALARM LED light is on
5. High alarm: red L-ALARM LED light and red H-ALARM LED lights are on.
6. Low alarm setting: “F--1”
7. High alarm setting: “F--2”
8. Zero calibration: “F--3”
9. Single point calibration: “F--4”
10. Factory setting: “F--5”(Unavailable to the customers)

8.1 Low Alarm Setting

In normal status, press “Setup” once and it displays “F-1”. Press “Confirm”, it displays the default low alarm. This figure can be adjusted by pressing “+” or “-”. After the setting is completed, press “Confirm” to save the setting. The setting will be effective immediately after exit. The screen will display “F-1”. You can press “setup” to make the other settings or press “Cancel” to exit to return to the normal status.

8.2 High Alarm Setting

In normal status, press “Setup” twice and it displays “F-2”. Then press “Confirm”, it displays the default high alarm. This figure can be adjusted by pressing “+” or “-”. After setting completed, press “Confirm” to save the setting. The setting will be effective immediately after exit. Then the screen will display “F-2”. User can press “setup” to make the other settings or press “Cancel” to return to the normal status.

8.3 Zero Translation

After the detector have been used for a long time, or the detector was put in a new type environment, it may not display “0” in clean air, this phenomenon is called “zero drift”, zero drift is normally caused by big change of temperature or humidity, and this phenomenon can be corrected by zero translation.

Zero translation can do simple correction for gas detector, but comparing with calibration, it cannot correct the sensitivity deviation after long time use. So in principle, please do zero translation for correction only when calibration is not convenient to do, and proceed zero calibration every half year even zero translation have been made.

Zero translation method: after the detector works more than 20 minutes, put it into clean air (zero translation can not be done when there is other gas in the environment, if the detecting gas is O2 or CO2, zero translation must be done in pure N2 gas environment), in normal working status, press “Setup” three times, screen will display “F-3”, then press “Confirm”, it displays “XXXX” (The A/D value of the present zero point). After this figure on the screen is steady, press “Confirm” to remember this figure to complete zero translation. The translation will be effective immediately after exit. Then the screen displays “F-3”. The user can press “setup” to make other setting or press “Cancel” to return to the normal status.

8.4 Single Point Calibration

Detector's calibration must be operated by professional engineers and using standard gas, it is forbidden to calibrate the detector privately. In order to keep the detector's accuracy, we suggest calibrate the detector at least once every half year.

Calibration method: After the detector has been working for more than 20 minutes, input standard gas (gas concentration is half of the detector's detecting range) into the detector. Then press "Setup" four times in normal working status, the screen will show "F-4", then press "Confirm" and it will display the default calibration point. Press "+" or "-" to change the calibration point to be same with the input gas concentration level, then press "Confirm" to remember this figure, it will display "XXXX" (The A/D value of the present gas environment). After the A/D value on the screen is steady, press "Confirm" to remember this figure for calibration. The calibration operation will go into effect immediately after exit. After then the screen will display "F-4". The user can press "setup" to make other settings or press "Cancel" to return to the normal status.

Note: Please don't carry the above calibration when the detector is working or there is no standard calibration gas.

8.5 Address Code Setting

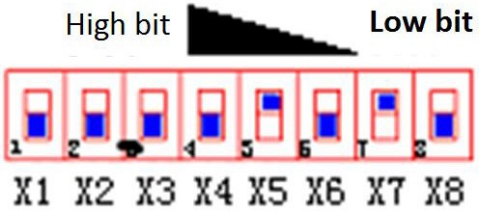
If the detector's output signal is RS485 signal, the detector's address code can be set as the following:

Address code switching locate inside the detector, you must cut off the power and open the cover only then you set the switching.

The address code is set by the dial switch from second switch to the eighth switch, and they are calculated by binary method, right side are low bit, left side are high bit. Switch at up position "ON" means 1, at low position "OFF" means 0. From right to left, every switch means in turn 1、2、4、8、16、32、64. Calculating formula: ADD= X2×64+X3×32+X4×16+X5×8+X6×4+X7×2+X8×1. (X2 to X8 only can be "0" or "1").

For example: from low bit to high bit, second switch and fourth are at up position "ON", then X7=X5=1, other bits are all 0, so the address code shall be calculated as:

ADD=0×64 +0×32+0×16+1×8+0×4+1×2+0×1=10



You can find the address code settings at the last pages of this manual. The first code switch only can be used during maintenance operation, but it must be at “ON” position normally. To same one controller, there cannot be more than one detectors which are set at same address code.

Key1: SETUP
Key2: CONFIRM
Key3: CANCEL

After 180S warm up：
Pree key 1，display rotation from F--0 to F--4。

Menu	Function
F--0	Setting C1-C12 (MHZ40)
F--1	Setting of low alarm value
F--2	Setting of high alarm value
F--3	Zero calibration
F--4	Span calibration
F5--0	Zero calibration in multi-points calibration
F5--1	Span calibration in multi-points calibration
F--6	Adjust 4.0mA
F--7	Adjust 20.0mA

In monitoring status，long press Key 4，displays password interface 0000；
Press Key 2 to confirm，display F5--0，press Key 1，display F--6，

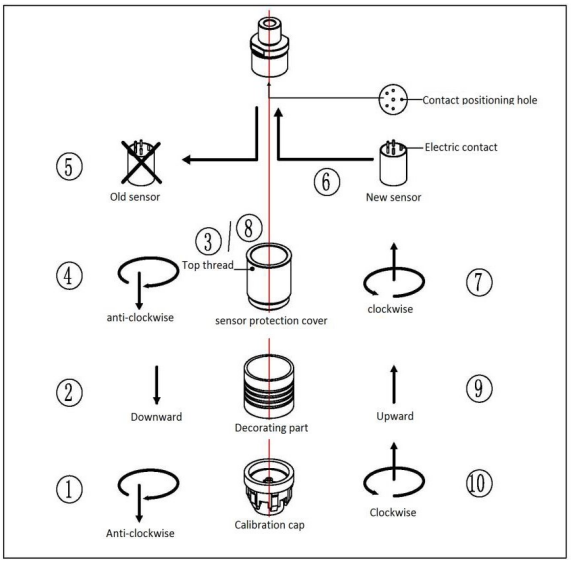
1) Press Key2，press up or down key to adjust the value for 4mA calibration.
2) Or Press key 1 again, display F--7

9. Sensor Replacement

In normal working environment, catalytic sensor's using life is 3 years, electrochemical sensor's using life is 2 years. When the sensor life is overdue, the detection result may be not accurate.

To replace the sensor, please first cut off the power but it won't be necessary to open the detector's housing, only need to open the sensor assembly.

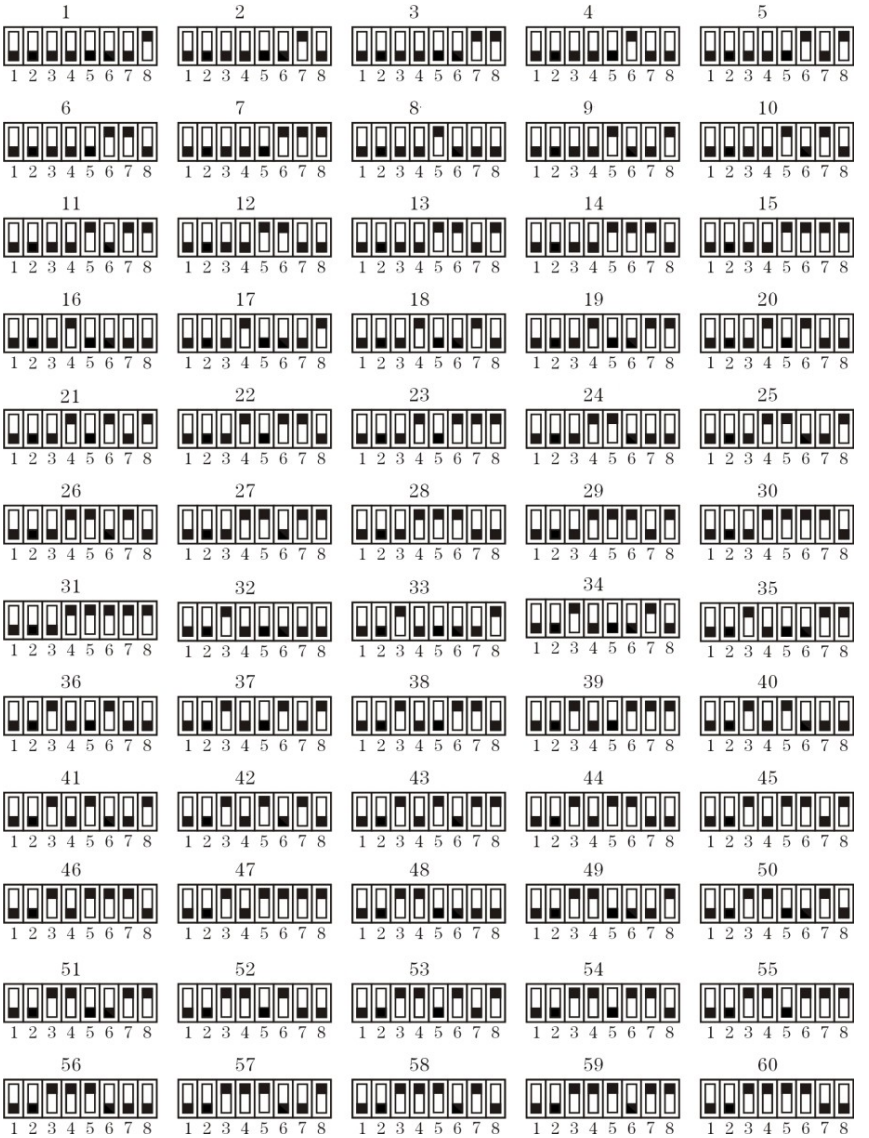
1. Take off the calibration cover in anti-clockwise.
2. Pull out the decoration part downwards.
3. Screw off the top thread from the sensor protection cover.
4. Take off the protection cover in counter-clockwise.
5. Take out the old sensor.
6. Install new sensor, make sure the electric contact match to each contact positioning hole.
7. Then install in turns protection cover, top thread, decoration part and calibration cap.
8. Power on the detector and calibrate the detector.



10. Troubleshooting

Problems	Possible Reason	Solution
No response to gas	Sensor damage	Replace sensor
	Electrical fault	Contact with seller
Abnormal connection with controller	Wiring fault	Check the wiring
	Electrical fault	Contact with seller
E-01	Calibration fault	Recalibrating
E-02	Wiring fault, connection fault or sensor fault	Reconnect the wire or replace sensor
E-04	Sensor drift	Replace sensor
E-06	System's parameter fault	Reload system parameter

11. Address Code Settings



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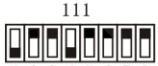

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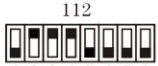

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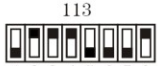

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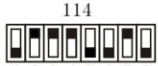

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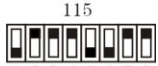

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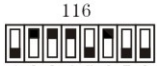

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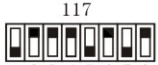

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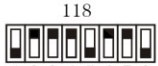

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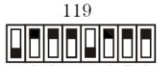

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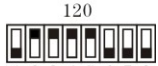

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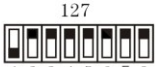


Annexure 1

BS03-HART Operation Instruction

Note: Please prepare a Hart communicator before using the Hart function of BS03.

1. Device Identification

Model Name(s): BS03

Manufacture ID Code: 24885 (6135 Hex)

Device Type Code: 58117 (E305 Hex)

HART Protocol Revision 7.5

Device Revision: 1

Number of Device Variables：1

Physical Layers Supported FSK

Physical Device Category Current output (4-20mA)

2. Operation

First, load the DD file provided by the company into the Hart Communicator. Then connect the Hart communicator with the current output signal of the detector. After that the Communicator will turn on. The main interface will display the current gas concentration, current output value, and the upper and lower limits of the range.

Settings:

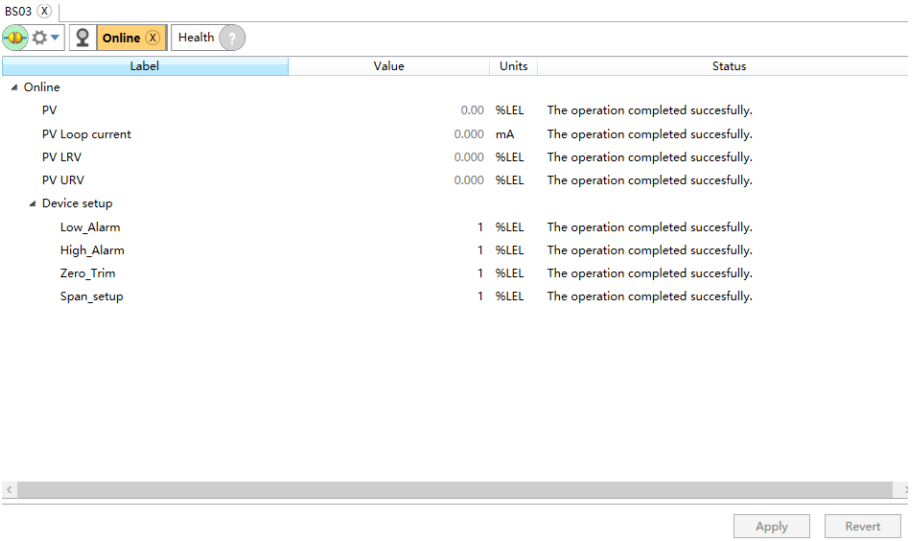
2.1. Low alarm: Click “Device setup”, input the low alarm value in the data box after Low_Alarm. Then click “Apply”, and wait for the entered setting value to be displayed.

2.2. High alarm: Click “Device setup”, input the high alarm value in the data box after High_Alarm. Then click “Apply”, and wait for the entered setting value to be displayed.

2.3. Zero shift: Click “Device setup”, input “0” in the data box after Zero_Trim. Then click “Apply”, and wait until it shows 0. If

it shows 1 or other values, it means fail and need to re-operate.

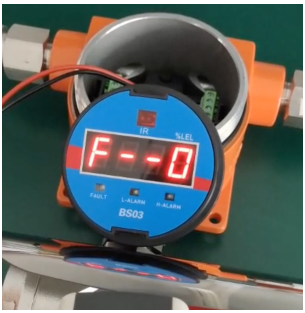
2.4. Span calibration: feed the calibration gas to the detector. After the detector display is stable, click “Device setup”. Input the concentration value of the standard calibration gas in the data box after Span_Setup. Then click “Apply”, and wait until it shows 0. If it shows 1 or other values, it means fail and need to re-operate.

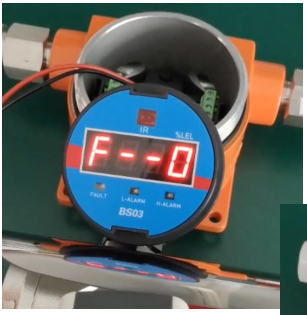


Annexure 2

BS03-Inbuilt Library Function Settings: Hydrocarbons C1~C12

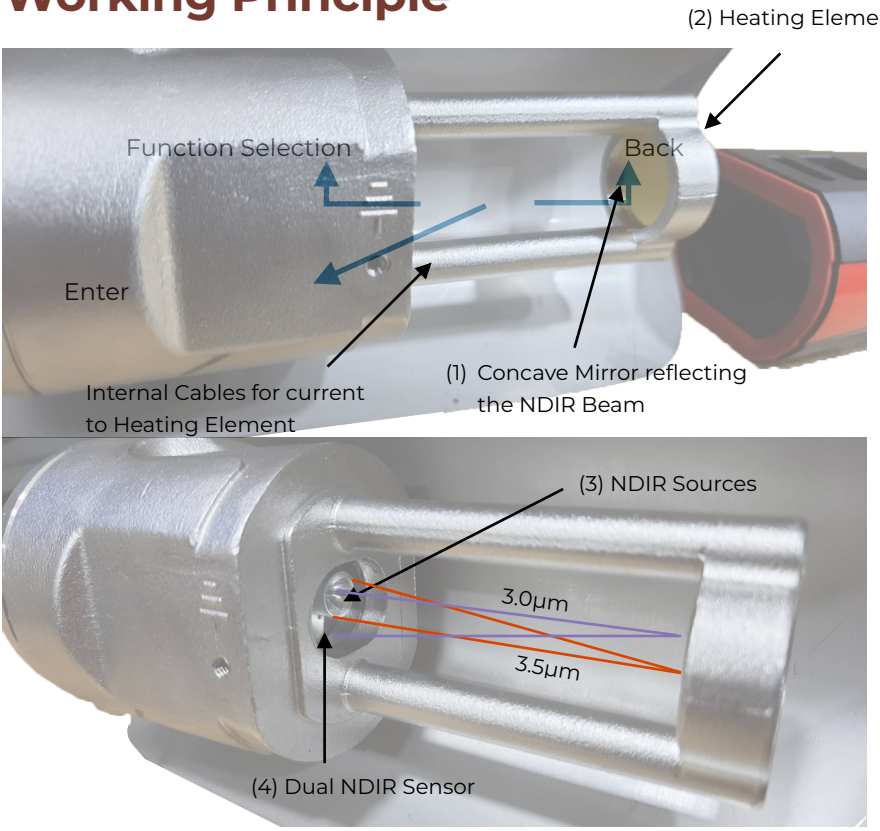
In the function menu, use the UP ⬆️ and DOWN ⬇️ arrow keys in the IR Remote to select your desired Hydrocarbon measurement. The instrument will Display the required Gas and return to “0, " completing the selection.





Selection	Gas	Molecular Formula
1	Methane (C1)	CH_4
2	Ethane (C2)	C_2H_6
3	Propane (C3)	C_3H_8
4	Butane (C4)	C_4H_{10}
5	Pentane (C5)	C_5H_{12}
6	Hexane (C6)	C_6H_{14}
7	Heptane (C7)	C_7H_{16}
8	Octane (C8)	C_8H_{18}
9	Nonane (C9)	C_9H_{20}
10	Decane (C10)	$C_{10}H_{22}$
11	Undecane (C11)	$C_{11}H_{24}$
12	Dodecane (C12)	$C_{12}H_{26}$

Working Principle



The Sensor Housing has the following main components

1. Concave Mirror: The NDIR Light from the Source is reflected from the Concave Mirror back the the Dual Bandwidth NDIR Sensor.
2. Heating Element: The Concave Mirror is continuously heated by the Heater to avoid condensation in high humidity conditions.
3. NDIR Sources: The dual source emits the NDIR Light between 3.0µm-3.5µm
4. NDIR Sensor: The reflected NDIR light from the mirror is received by the dual sensor and though the narrow bandpass filter according to the gas of interest.

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