PRODUCT MANUAL

BESAFE

Dual Channel Gas Detector for Battery Energy Storage

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crowcon
DETECTING GAS. SAVING LIVES.

Rev1.8

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1. BASIC SAFETY GUIDELINES

1.1. PERSONNEL REQUIREMENTS

- Only trained professional technicians are allowed to install, debug, operate, and maintain the device system.
- Technicians performing specific operations must be authorised by the factory.
- Only electricians are allowed to make electrical connections for the equipment.
- Technicians must read the Product Manual, understand and comply with the regulations therein.
- Only authorised personnel with professional training are allowed to troubleshoot measurement point failures.

1.2. WORKPLACE REQUIREMENTS

Users are responsible for and must comply with the requirements of the following safety standards:

- Installation guidelines
- Local standards and regulations
- Explosion-proof protection regulations

1.3. OPERATIONAL REQUIREMENTS

Before the entire measurement point is debugged, ensure that all connections are correct. Ensure that cable and hose connections are undamaged.
Do not operate damaged instruments to prevent incorrect debugging. Fault identification must be carried out for damaged instruments.
When the fault cannot be repaired: the instrument must be taken out of service to prevent incorrect debugging.

2. PRODUCT INTRODUCTION

2.1. OVERVIEW

BESafe by Crowcon offers fast, accurate detection of hydrogen (H_2), carbon monoxide (CO), and methane (CH_4) tailored for battery backup and energy storage systems. Its dual-channel capability enables simultaneous monitoring of two gases with flexible configuration for diverse applications. Featuring remote smart sensors, BESafe simplifies installation and reduces maintenance, delivering reliable, real-time protection for critical energy environments.

2.2. DESCRIPTION

Figure 1 Components

Identification	Description
1	Transmitter cover
2	Display panel (keys/OLED screen/indicators)
3	Transmitter cover screws: M4x16 hexagon (do not come off)
4	Channel 1 sensor module
5	Channel 1 sensor module indicator light
6	Channel 1 sensor module gas path
7	Channel 1 sensor module test gas inlet
8	Channel 2 sensor module
9	Transmitter base enclosure
10	Remote cable
11	M20 cable entry
12	Product label

Table 1 Component Description

BESafe consists of two main parts, the transmitter and the sensor modules (maximum 2). The sensor modules can be connected to the transmitter in two different ways:

Standard:

The sensor module is connected directly to the transmitter by plugging and unplugging. When the sensor module requires replacement, simply unplug the sensor module after turning the power off and then plug in the new sensor module.

Remote:

The sensor module can be mounted remotely using the remote cable.

Product labels

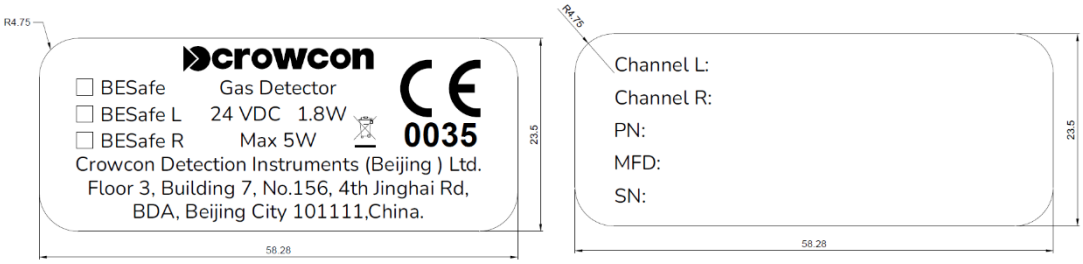


Figure 2 Transmitter labels

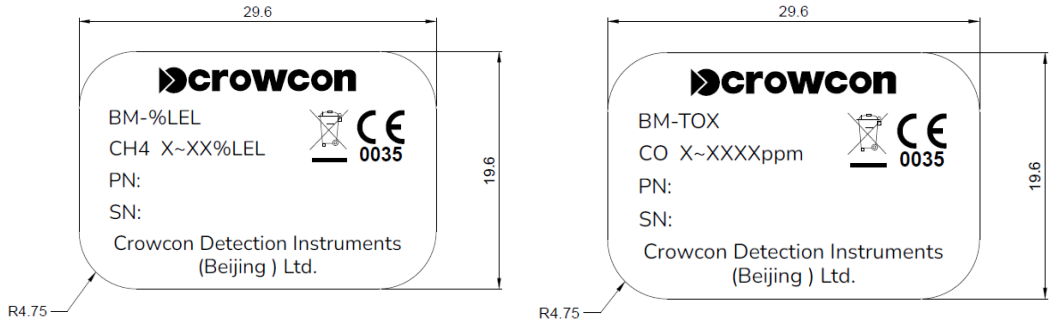


Figure 3 sensor module labels

2.3. DISPLAY

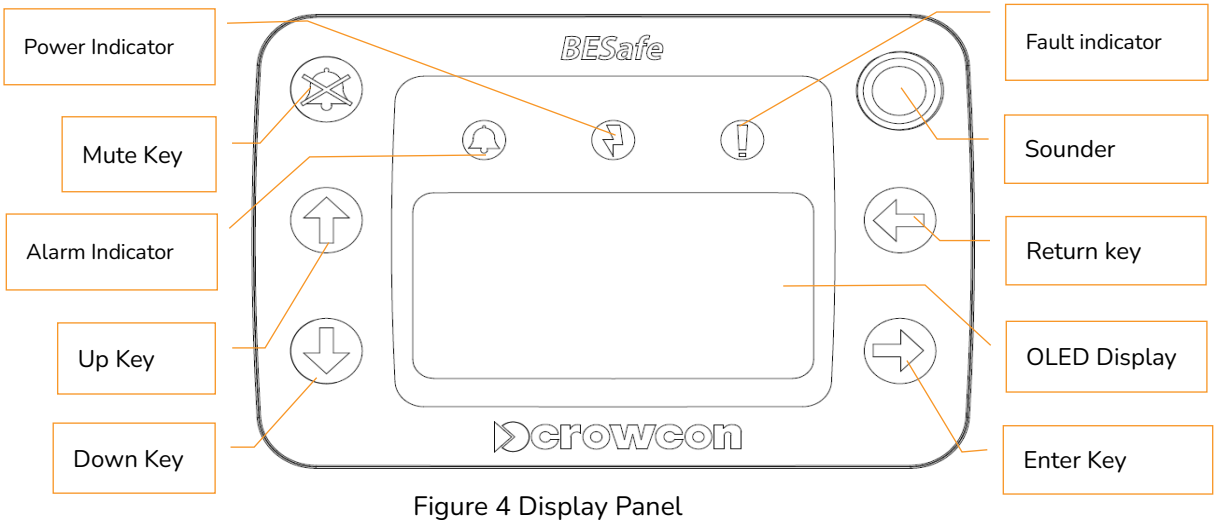


Figure 4 Display Panel

2.4. TECHNICAL SPECIFICATIONS

Size	175 x 150 x 55 mm
Weight	Base: 550g Adapter: 169g Sensor Module: 65g each
Enclosure Material	Polycarbonate
Ingress Protection	IP65
Cable Entry	5x M20
Power	10 to 30V DC, 24V DC Nominal 150mA (3.6W @ 24V dc), 5W Max
Display	2.8” (128x64) OLED
Electrical Output	2 x 4-20mA RS-485 Modbus RTU
Relays Output	SPDT Relay (1A at 24 VDC) Alarm 1, Alarm 2, Fault
Audio Visual Output	Sounder: 85dB @ 3m
Operating Temperature	-20 to +50°C
Operating Humidity	0 to 99% RH (non-condensing)
Data Logging	3000 data logs
Approvals	EN 61010-1 EN 50270 UL 2075*

Table 2 Transmitter Specifications

**Sensor is certified, detector is in certificate process

Type	Gas	Range	Temperature Range
Catalytic	Hydrogen (H_2) Methane (CH_4)	0-25% LEL 0-100% LEL	-20°C to +60°C
Electrochemical	Carbon Monoxide (CO)	0-1000PPM	-20°C to +50°C

Table 3 Sensor Specifications

2.5. DIMENSIONS

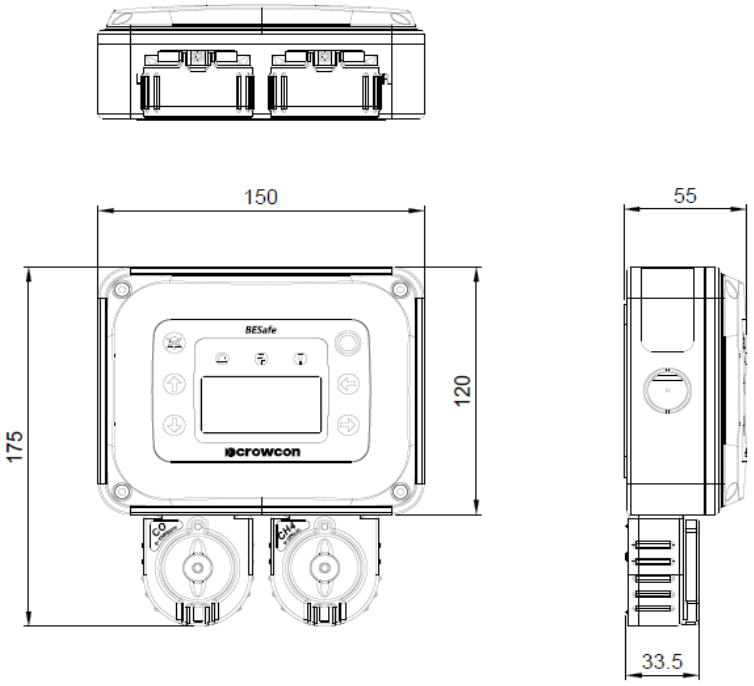


Figure 5 Standard BESafe with Two Sensor modules (mm)

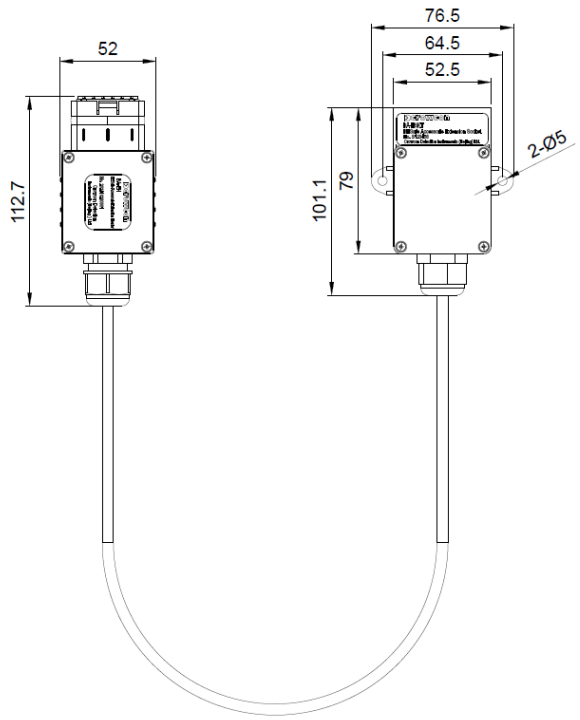


Figure 6 Remote Cable (mm)

3. INSTALLATION

3.1. LOCATION

BESafe should be mounted where the gas to be detected is most likely to be present. The following points should be considered when deciding mounting locations for gas detectors:

- To detect gases which are lighter than air, such as hydrogen, carbon monoxide and methane, the sensor module should be mounted at a high level. To detect gases heavier than air, such as hydrogen sulphide, mount the sensor module near the floor. Temperature of the target gas compared to the ambient temperature must also be taken into consideration. Hot gases tend to rise, and cold gases tend to fall.
- When locating detectors consider the possible damage caused by natural events e.g. rain or flooding. A sunshade is highly recommended for outdoor installation and use.
- Consider ease of access for functional testing and servicing.

The placement of sensor modules should be determined following advice of experts having specialist knowledge of gas dispersion and the plant processing equipment as well as safety and engineering issues. It's always recommended to go through a hazard, fire and gas mapping study for complex installation. Please contact Crowcon customer service for recommendations. The agreement reached on the locations of sensors should be recorded.

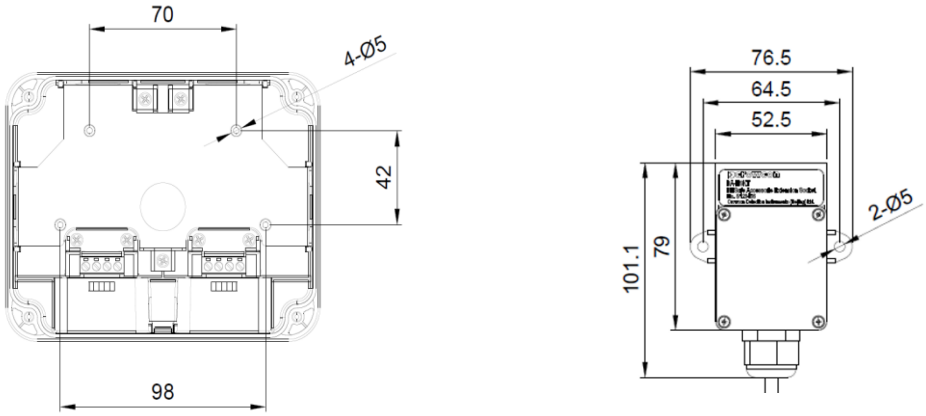


Figure 7 Mounting Points on Transmitter (left) and Remote Cable Sensor End Adapter (right) (mm)

3.2. MOUNTING STANDARD BESAFE

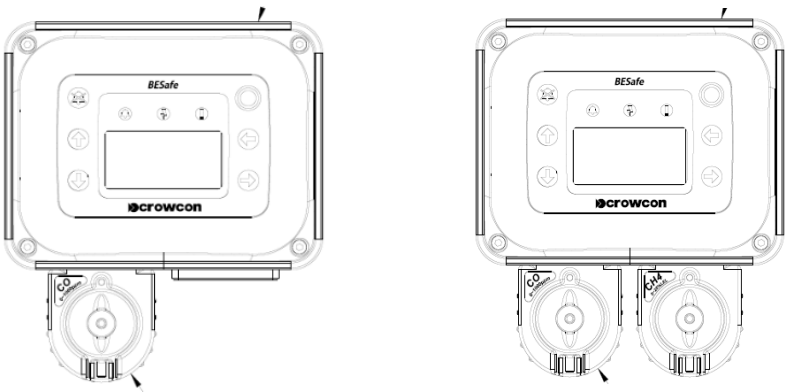


Figure 8 BESafe with Single Sensor (left) and Dual Sensors (right)

Installation Procedure:

- Carefully remove the cable entry cover from the transmitter base enclosure using a hammer and a flat-head screwdriver. Position the screwdriver tip along the groove of the cover for proper leverage. Before detaching the cover, observe the cable layout to ensure the correct cable is selected.

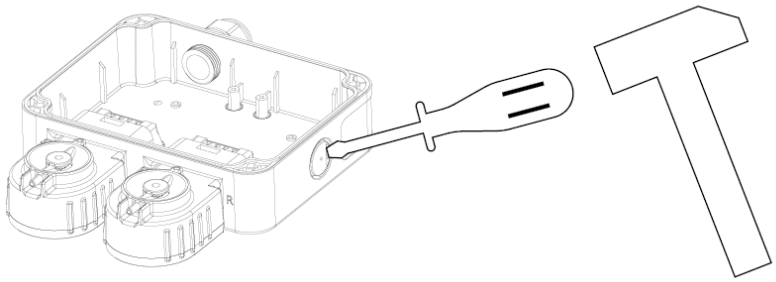


Figure 9 Removing the Cable Entry Cover

- Secure the waterproof cable gland to the cable entry point.

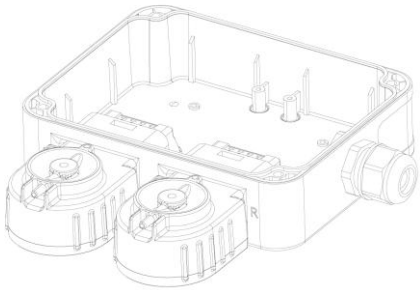


Figure 10 Transmitter Base Enclosure

- Mount the transmitter base enclosure onto the wall or desired surface, then proceed to connect the cables.

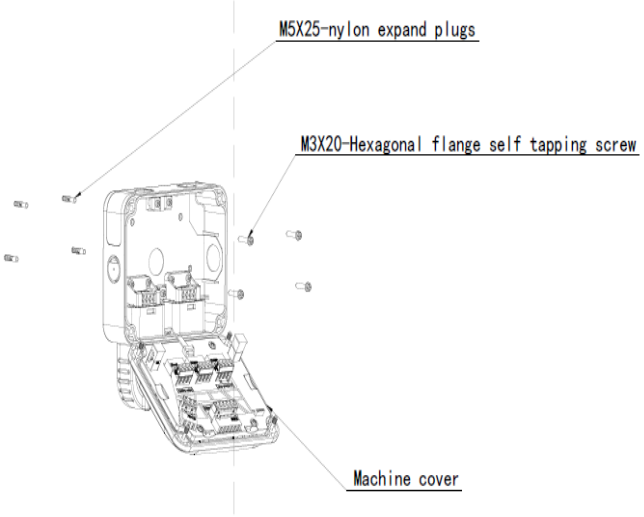


Figure 11 Wall Installation

- Refer to the dimensions in Figure 5 to drill four holes in the mounting surface. Insert wall plugs into the drilled holes.
- Use a professional Allen key driver to loosen the four hex screws on the transmitter's front cover.
- Align the transmitter base enclosure with the wall plugs. Fasten it securely by inserting four screws from inside the enclosure outward, tightening them into the wall plugs until the enclosure is firmly attached.
- Feed the cables through the waterproof gland and connect them to the terminal blocks.
- Close the transmitter's front cover and tighten the four hex screws to secure it.

3.3. MOUNTING REMOTE BESAFE

BESafe supports multiple configuration options for integration with remote sensors:

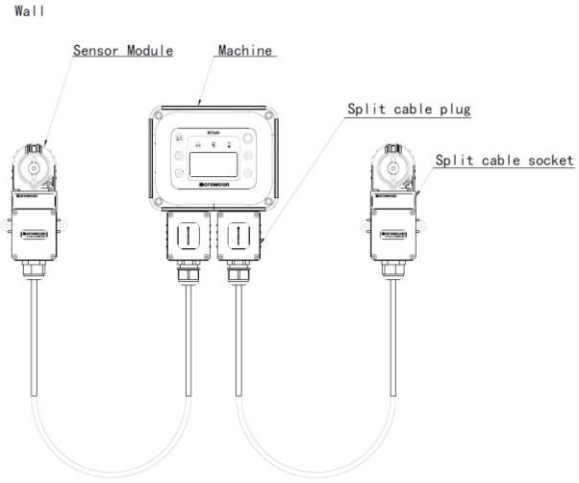


Figure 2 BESafe with Dual Remote Sensor Modules

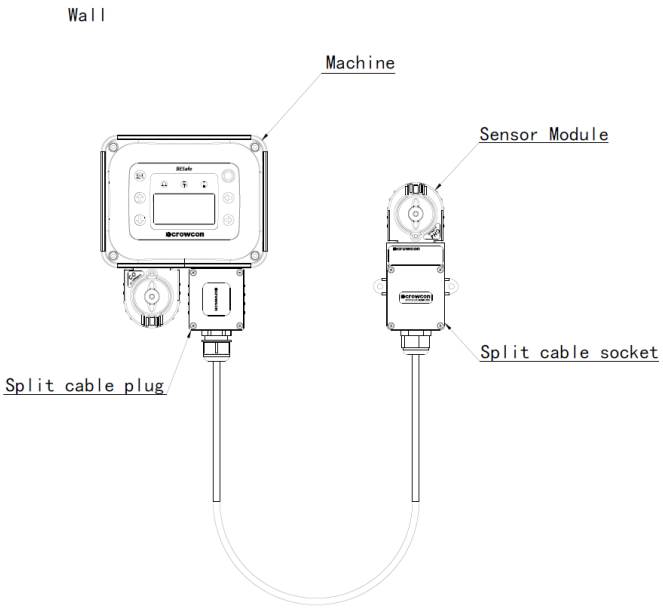


Figure 3 BESafe with Standard and Remote Sensor Modules

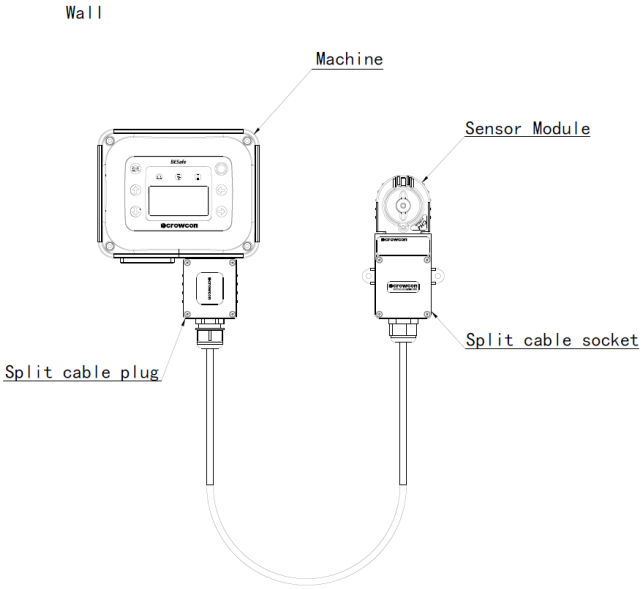


Figure 14 BESafe with Single Remote Sensor Module

Installation Procedure:

- Follow the standard BESafe installation procedure to mount the transmitter.
- Refer to Figure 5 for dimensions and drill two holes in the mounting surface for the remote sensor module. Insert wall plugs into the holes.
- Align the remote sensor module assembly with the wall plugs and secure it using two screws. Tighten until the module is firmly fixed to the wall.
- Connect the remote sensor module by inserting the transmitter-end adapter into the transmitter's sensor slot, and the sensor module into the sensor-end adapter of the remote cable.

3.4. CABLING REQUIREMENTS

- All cables used must comply with local laws and regulations and meet the electrical and functional specifications of the sensor module.
- It is recommended to use UL 2464-rated cables, specifically 2464-18AWG/4C, with a maximum length of 1 km.
- Suitable cable cross-section area: 0.75 mm² to 2 mm².
- For proper installation and maintenance, cables must allow easy identification of individual conductors. This can be achieved through colour-coded insulation and clearly marked wire differentiation techniques.

3.5. TERMINAL BLOCK

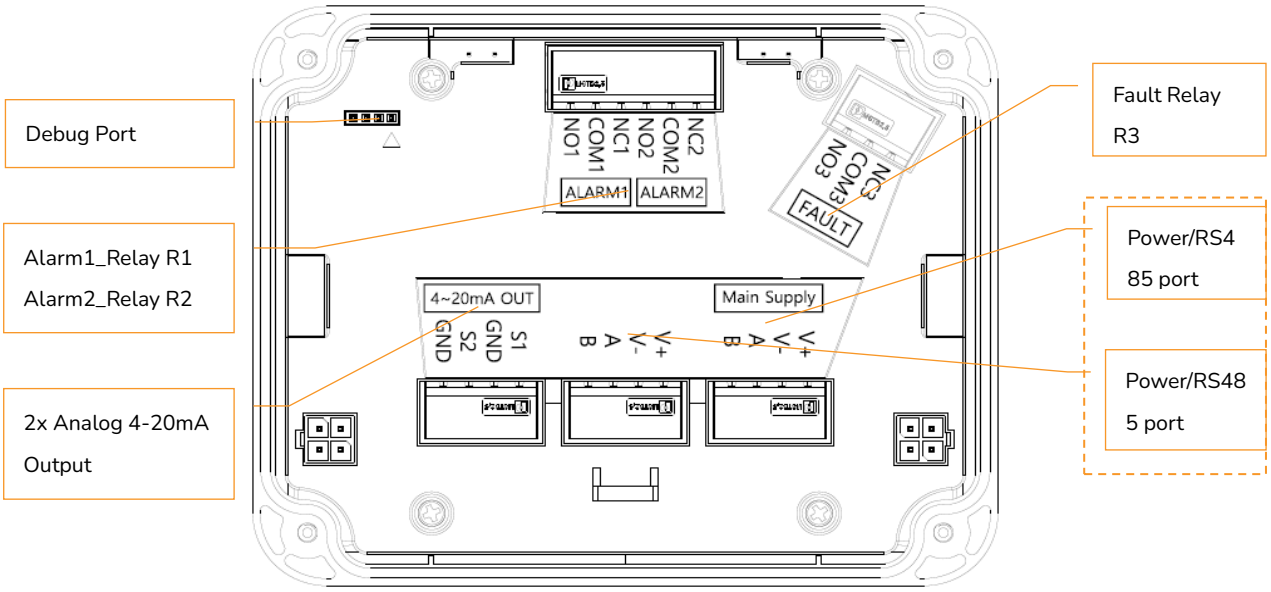


Figure 4 Terminal Block Identification and Description

The two terminals under Main Supply have the same electrical connection layout and can be used to power or connect multiple devices in a RS-485 chain as shown below.

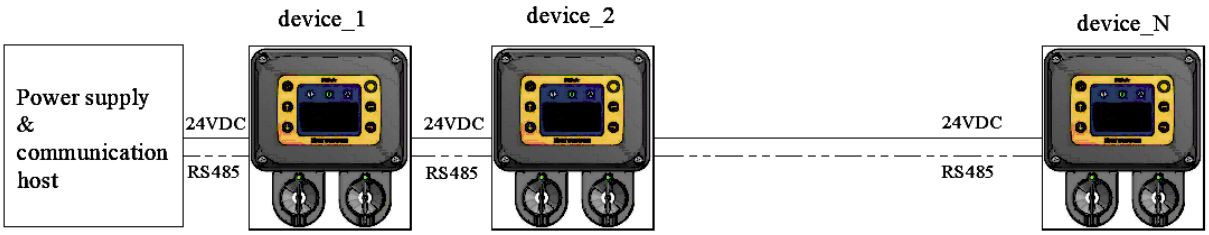


Figure 5 Power or RS-485 Daisy Chain

Port Function	Identification Symbol	Electrical Definition
Main Supply	V+	Positive terminal of power supply
	V-	Negative terminal of power supply
	A	485 communication A terminal
	B	485 communication B terminal
4-20mA Output	S1	Positive terminal of channel 1 output current
	GND	Negative terminal of channel 1 output current
	S2	Positive terminal of channel 2 output current
	GND	Negative terminal of channel 2 output current
Fault Relay(R3)	NO3	Normally open contact of the fault relay
	COM3	Common point of the fault relay
	NC3	Normally closed contact of the fault relay
Alarm 2 Relay (R2)	NO2	Normally open contact of the alarm 2 relay
	COM2	Common point of the alarm 2 relay
	NC2	Normally closed contact of the alarm 2 relay
Alarm 1 Relay (R1)	NO1	Normally open contact of the alarm 1 relay
	COM1	Common point of the alarm 1 relay
	NC1	Normally closed contact of the alarm 1 relay

Table 4 Terminal Block Wiring Diagram

3.6. WIRING DIAGRAMS

The following wiring diagrams illustrate the various configurations for connecting the BESafe:

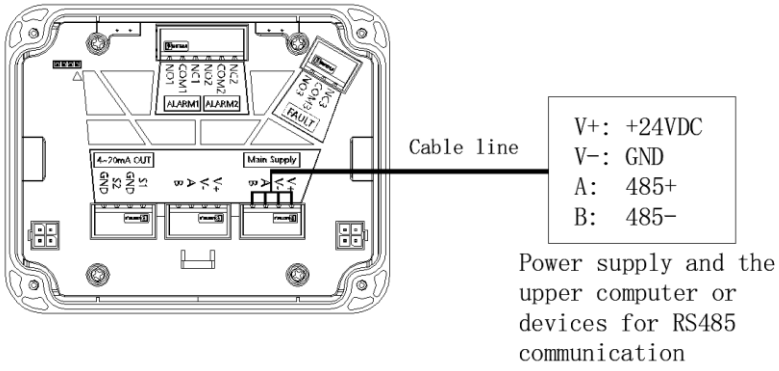


Figure 6 Power Supply and RS-485 Wiring for a Single unit

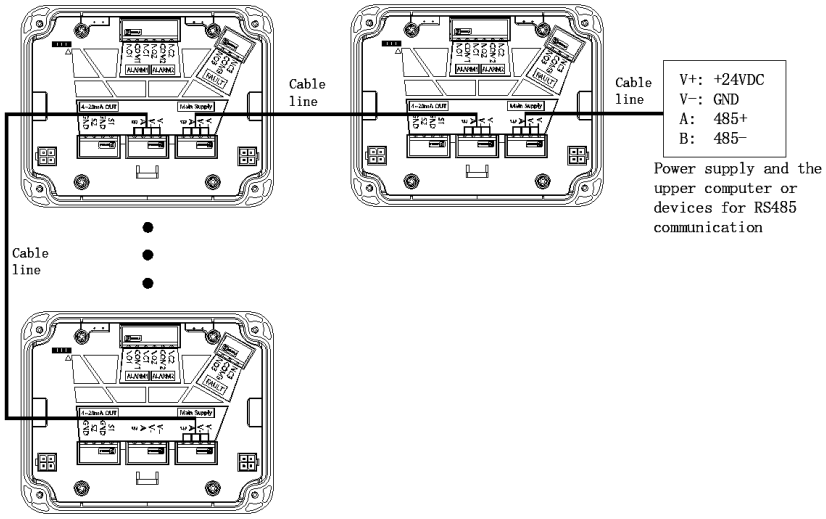


Figure 7 Power Supply and RS-485 Wiring for Multiple units in a Daisy-chain Configuration

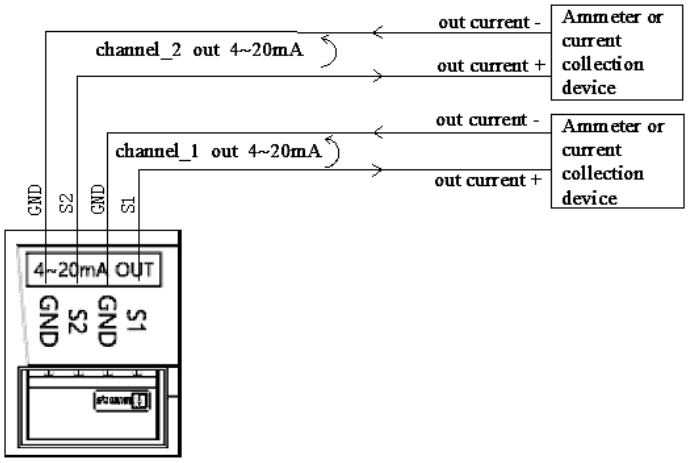


Figure 8 Wiring for Standalone Mode Operation

Note: If the output current is not connected to an external device (such as a control panel or load), BESafe will detect a fault indicating an open output current loop. To prevent this, short-circuit the channel's output current loop whenever no external device is connected as shown.

4. SYSTEM FUNCTIONS

4.1. POWER-ON

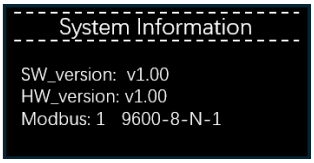
Upon powering on the device, the system initiates a startup sequence consisting of several display stages. During this process:

- The three LED indicators blink alternately at a frequency of 1 Hz.
- Once initialisation is complete, the buzzer emits a single beep, and the LED indicators return to their standard operating state.

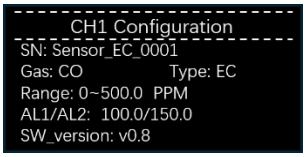
The startup sequence proceeds as follows:

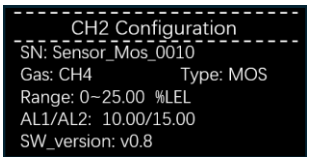
- **Crowcon Logo**
  The Crowcon logo appears on the screen for approximately 5 seconds.

- **System Information**
  The transmitter system parameters are displayed for 5 seconds, including:
  - **SW_version**: Transmitter software version
  - **HW_version**: Transmitter hardware version
  - **Modbus**: Communication settings (address, baud rate, data bits, parity, stop bits)



- **Channel Configuration**
  Configuration details for Channel 1 and Channel 2 are displayed sequentially, each for 5 seconds. The following parameters are shown for each channel:
  - **SN**: Sensor module serial number
  - **Gas**: Target gas type
  - **Type**: Sensor type
  - **Range**: Measurement range, including units and decimal precision
  - **SW_version**: Sensor module software version





4.2. WARM UP

A countdown timer (hh:mm:ss) is shown for both sensor modules. The default warm-up duration is 300 seconds. Upon completion, the system transitions to normal operation.

The warm-up screen can be exited in two ways:

- **Automatic**: The system automatically switches to the real-time monitoring screen when the countdown ends.
- **Manual**: Press and hold ⇦ key on the display panel to bypass the countdown and enter monitoring mode immediately.

If the warm-up screen is bypassed during sensor warm-up, an anmited warm up icon will appear, indicating the sensor is stabilising. Once warm-up is complete, the icon disappears, and the real-time gas reading is displayed for the channel.

4.3. MONITORING MODE

Once the warm-up phase is complete, the OLED screen displays live gas readings from the connected sensor modules. To access different types of system information, users can navigate through multiple display screens using the control keys. The associated block diagram illustrating this navigation flow is shown below:

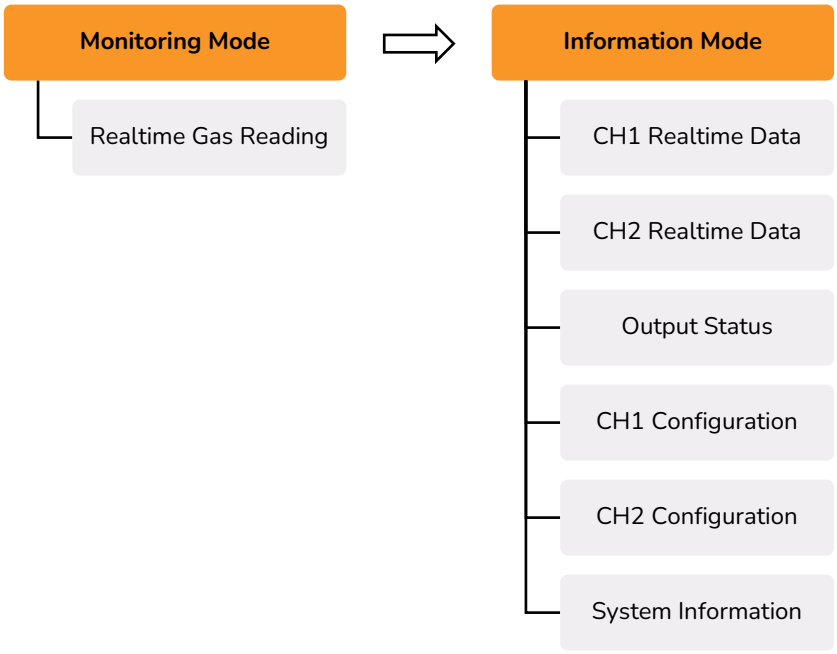


Figure 20 Monitoring Mode Navigation

The main display screen provides real-time information and alerts for each channel. The following indicators and behaviours may be observed:

Real-Time Data

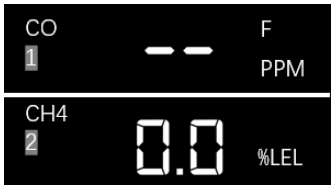
Displays the real-time gas concentration values for each active channel.

Alarm Condition

When an alarm is triggered, the corresponding channel display will alternate between showing gas reading and !ALM1 or !ALM2. The sounder beeps intermittently to signal the alarm.

Fault Conditions

If a sensor module is disconnected, the LCD displays “F”, the measured value area shows “--”, and the sounder beeps periodically. The sounder beep cycle is 5 seconds: 100 ms ON, 4.9 s OFF, unless an alarm is active—in which case, the alarm takes priority. Pressing the mute key silences the sounder.



Sensor Module End of Life Indicator

If a sensor module has exceeded its service life, the screen will display a prompt such as “Exp 0.02d”, indicating the sensor is 0.02 days past its expected lifespan. This message is displayed intermittently in a 45-second cycle: 5 seconds ON, followed by 40 seconds OFF. To temporarily clear the expiration warning, press and hold the Mute key, then enter the password “0006”. This will suppress the message for 24 hours.

Note: If the sensor has been expired for more than 7 days, the expiration warning cannot be cleared, and the message will remain on the screen continuously.

Inhibit mode

If a channel has been set to inhibit mode, the corresponding channel will display inhibit icon.

4.4. DISPLAY SCREENS

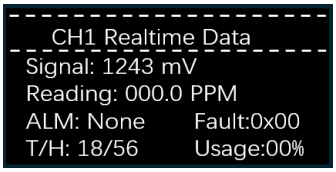
The BESafe device allows users to access various monitoring and information query screens using the navigation keys. These screens include real-time channel data, configuration details, output status, and system information.

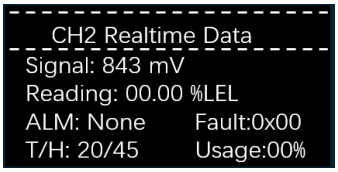
⇦ **key:** Return directly to the main display screen from any screen.

⇧ **key:** Scroll up through screens.

⇩ **key:** Scroll down through screens.

Channel Real-Time Data





Each channel's real-time screen displays the following sensor module data:

Signal: Measured voltage signal

Reading: Gas concentration value

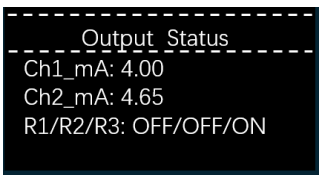
ALM: Alarm status (None, Level 1, or Level 2)

Fault: Fault code (refer to Appendix A)

T/H: Temperature and humidity readings

Usage: Sensor lifespan usage percentage (e.g., 90% means 90% consumed & 10% remaining)

Output Status



This screen displays output conditions for each channel and relay:

Ch1_mA: 4–20 mA output current value of channel 1

Ch2_mA: 4–20 mA output current value of channel 2

R1/R2/R3: Relay output status. R1(Alarm1_Relay) / R2 (Alarm2_Relay) / R3 (Fault_Relay):

- **ON** = Relay activated

- **OFF** = Relay deactivated

Channel Configuration

This screen shows configuration parameters for each sensor module:

SN: Serial number

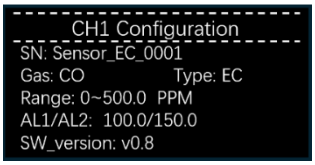
Gas: Target gas

Type: Sensor type

Range: Measurement range, unit, and decimal precision

AL1 / AL2: Alarm thresholds for Level 1 and Level 2

SW_version: Software version



System Information

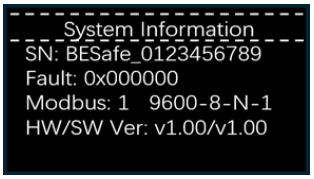
This screen displays transmitter system information:

SN: Host serial number

Fault: System-wide fault codes (see Appendix A)

Modbus: Communication settings (Address / Baud Rate / Data Bits / Parity / Stop Bit)

HW/SW Ver: Hardware and software versions of the transmitter



4.5. SENSOR MODULE STATUS INDICATOR

Each sensor module is equipped with a multi-colour LED indicator. The LED behaviour reflects the current status of the module, as detailed below:

Status	Description
Normal Operation	Green light blinks every 2 seconds (1s ON, 1s OFF)
Warming-up State	Purple light blinks every 2 seconds (1s ON, 1s OFF)
Fault	Yellow light blinks every 2 seconds (1s ON, 1s OFF)
Level 1 Alarm	Red light blinks every 2 seconds (1s ON, 1s OFF)
Level 2 Alarm	Red light blinks every 1 second (0.5s ON, 0.5s OFF)
Address Setting	Blue light blinks every 400 ms (200 ms ON, 200 ms OFF)
Zero/Calibration Command	Blue light blinks every 1.7 seconds (1.5s ON, 0.2s OFF)

Table 5 Sensor Module Status Indicator Guide

Note: When multiple device states occur simultaneously, the status indicator follows a defined priority order. The display reflects only the highest-priority condition, in the following sequence: Fault > Preheating > Level 2 Alarm > Level 1 Alarm > Normal Operation

4.6. TRANSMITTER STATUS INDICATOR

The transmitter display panel features three indicator lights, each representing a different system status. Their functions are described below:

Category	Colour	Description
Operation Indicator	Green	Remains steadily lit once the device is powered on.
Alarm Indicator	Red	Illuminates when a channel alarm is active (if alarm is enabled). **ON**: Gas concentration has reached the alarm threshold. **OFF**: Behaviour depends on the alarm latch setting: – Non-latched: The indicator turns off automatically when the alarm condition clears. – Latched: The indicator remains on until manually reset, even after the alarm condition clears. See the alarm parameter settings menu for configuration details.
Fault Indicator	Yellow	**ON**: A fault has occurred during device operation (refer to Appendix B for fault types). **OFF**: No faults are present.

Table 6 Transmitter Status Indicator Guide

4.7. ANALOG OUTPUT

The transmitter provides analog mA (milliampere) current outputs (S1 and S2) for each sensor module. The output signal varies according to the operating condition, as defined in the table below:

Operating Condition	Current Output (mA)	Description
Normal Gas Range	4-20	Output is proportional to the detected gas concentration
Sensor Disconnected	1	Sensor module is not connected, or communication is lost
Inhibit mode	2	Channel is in inhibit mode (e.g. during maintenance)
Warm-up	3	Sensor module is in warm-up phase after power-on
Overrange	>20 (max 21)	Gas level exceeds 100% of full scale

Table 7 Analog Output mA Values

4.8.RELAY OUTPUT

BESafe is equipped with three programmable relays (R1, R2, and R3), each with both normally open (NO) and normally closed (NC) contacts. These relays are not pre-assigned to specific functions; instead, their operation is fully configurable based on user-defined logic.

Each relay supports up to six configurable conditions, evaluated using OR logic. This means the relay will be activated if any one of the selected conditions is met.

Relays can be mapped to respond to a combination of the following events:

- System faults

- Alarm 1 or Alarm 2 from any channel

Users can define and modify relay logic through the keypad menu interface, allowing flexible integration with various control or notification systems.

	CHANNEL 1			CHANNEL 2		
Relay Number	**Fault**	**Alarm 2**	**Alarm 1**	**Fault**	**Alarm 2**	**Alarm 1**
R1	▣/□	▣/□	▣/□	▣/□	▣/□	▣/□
R2	▣/□	▣/□	▣/□	▣/□	▣/□	▣/□
R3	▣/□	▣/□	▣/□	▣/□	▣/□	▣/□

Table 8 Relay Logic Map

▣: Represents correlated

□: Represents not correlated

4.9.MODBUS OUTPUT

BESafe features an RS-485 communication interface that supports flexible configuration of communication parameters to meet various system requirements. It communicates using the standard hexadecimal MODBUS (RTU) protocol. Users can configure the following parameters through the device's menu interface:

Parameter	User Configurable	Default Value
Device address	Yes	1
Baud rate	Yes	115200
Data bits	No	8
Parity	Yes	None
Stop bit	Yes	1

Table 9 MODBUS Parameters

As the slave device side, uses the function codes including: **03H (read) and 10H (write).**
The Modbus register address allocation table (each address stores 16 bits) is as follows:

Data Item	Register Address	Register Quantity	Data Type	Read/Write
Parameters of Channel 1				
Channel 1_Serial Number	400	8	u16	Read Only
Channel 1_Unit	408	4	u16	Read Only
Channel 1_Name	412	4	u16	Read Only
Channel 1_Measuring Range	416	2	float	Read Only
Channel 1_Sensor Signal Voltage	436	2	float	Read Only
Channel 1_Gas Concentration Value	438	2	float	Read Only
Channel 1_Alarm Status: 0：none 1: alarm1 2: alarm2	440	1	u16	Read Only
Channel 1_Fault Status: The lower 8 bits are valid. See "Appendix A" for details.	441	1	u16	Read Only
Channel 1_Temperature	442	2	float	Read Only
Channel 1_Humidity	444	2	float	Read Only
Channel 1_Sensor Service Life	446	1	u16	Read Only
Parameters of Channel 2				
Channel 2_Serial Number	418	8	u16	Read Only
Channel 2_Unit	426	4	u16	Read Only
Channel 2_Name	430	4	u16	Read Only
Channel 2_Measuring Range	434	2	float	Read Only
Channel 2_Sensor Signal Voltage	447	2	float	Read Only
Channel 2_Gas Concentration Value	449	2	float	Read Only
Channel 2_Alarm Status: 0：none 1: alarm1 2: alarm2	451	1	u16	Read Only
Channel 2_Fault Status: The lower 8 bits are valid. See "Appendix A" for details.	452	1	u16	Read Only
Channel 2_Temperature	453	2	float	Read Only
Channel 2_Humidity	455	2	float	Read Only
Channel 2_Sensor Service Life	457	1	u16	Read Only
System Parameters				
System Total Fault Code: The lower 24 bits are valid. See "Appendix A" for details.	200	2	uint32	Read Only
Host Hardware Version	202	1	u16	Read Only
Host Software Version	203	1	u16	Read Only
Channel 1 Alarm Configuration Parameters				
Channel 1_Channel Mask 0: The channel is not masked 1: The channel is masked	300	1	u16	Read & Write

Channel 1_Alarm Switch 0：Turn off the alarm 1：Enable the alarm	301	1	u16	Read & Write
Channel 1_Alarm Direction 0：X12 1: 21X 2: 1X2 3: 2X1	302	1	u16	Read & Write
Channel 1_Alarm 1 Value	303	2	float	Read & Write
Channel 1_Alarm 2 Value	305	2	float	Read & Write
Channel 2 Alarm Configuration Parameters				
Channel 2_Channel Mask 0: The channel is not masked 1: The channel is masked	320	1	u16	Read & Write
Channel 2_Alarm Switch 0：Turn off the alarm 1：Enable the alarm	321	1	u16	Read & Write
Channel 2_Alarm Direction 0：X12 1: 21X 2: 1X2 3: 2X1	322	1	u16	Read & Write
Channel 2_Alarm 1 Value	323	2	float	Read & Write
Channel 2_Alarm 2 Value	325	2	float	Read & Write
System Configuration Parameters				
Action Time of Screen Saver (minutes)	340	1	u16	Read & Write
Alarm Reset Mode 0: Not Latching; 1：Latching；	341	1	u16	Read & Write
Channel 1 Zero and Span Calibration				
Channel 1_Calibration Flag: 1：Calibrate zero point 2：Calibrate high point	360	1	u16	Read & Write
Channel 1_Calibrated High Point Value	361	2	float	Read & Write
Channel 2 Zero and Span Calibration				
Channel 2_Calibration Flag: 1：Calibrate zero point 2：Calibrate high point	370	1	u16	Read & Write
Channel 2_Calibrated High Point Value	371	2	float	Read & Write

Table 10 Definition of Output MODBUS Registers

5. OPERATION

Users can configure system parameters and perform both zero calibration and span calibration through the controller's menu interface.

5.1. SCREEN NAVIGATION

The controller features a multi-level menu structure, designed for intuitive navigation and efficient access to key functions. The overall menu logic is organised hierarchically, allowing users to:

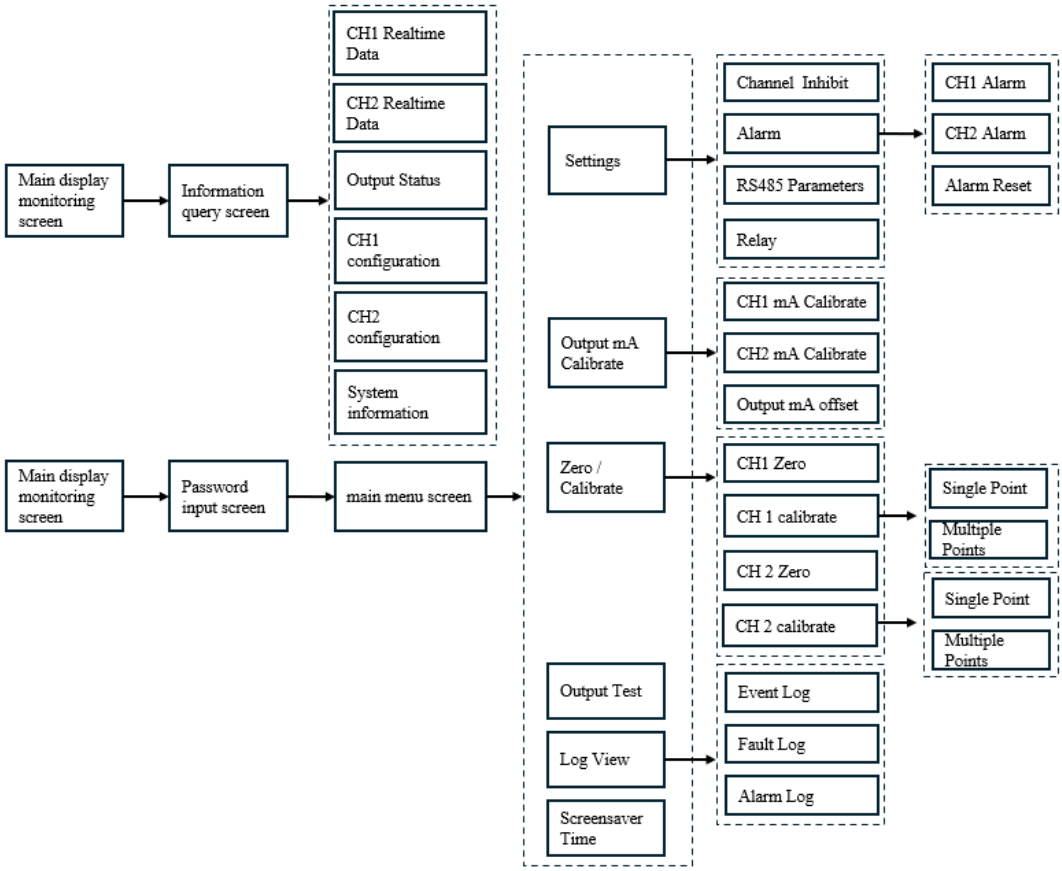


Figure 21 Menu Navigation Map

5.2. KEY FUNCTIONS

Refer to the table below for an overview of the button functions used to navigate the BESafe device menus and settings. When adjusting values in edit (cursor) mode, the buttons operate as follows:

- ⇩ **keys**: Increases the numeric value
- ⇧ **keys**: Moves the cursor to the next digit
- ⇨ **key**: Confirms the input and exit the modification mode
- ⇦ **key**: Cancel the modification and exits without saving changes

Key	Action	Working Mode	Function Introduction
	Short press	Menu mode	Alarm mute
		Monitoring mode	Alarm mute
	Long press	Menu mode	None
		Monitoring mode	Manual reset of the alarm (when the alarm is set to the latched mode), alarm reset password is “1111”
⇧	Short press	Menu mode	Menu option moves up Character data modification: Modify data selection Data modification: Move the cursor of the data bit
		Monitoring mode	Switch the query screen
	Long press	Menu mode	None
		Monitoring mode	In multi-point calibration, return to the previous operation
⇩	Short press	Menu mode	Menu option moves down Parameter modification: Modify the corresponding character and data
		Monitoring mode	Switch the query screen
	Long press	Menu mode	None
		Monitoring mode	In multi-point calibration, enter the next calibration operation
⇦	Short press	Menu mode	Exit the current menu and return to the previous level menu
		Monitoring mode	Return to the main display screen with one key
	Long press	Menu mode	In zero and span calibration, abandon the calibration operation and return to the previous level menu
		Monitoring mode	Exit warming-up countdown display Return to the main display screen.
⇨	Short press	Menu mode	Short press Menu mode Enter the next level menu Enter or complete the data modification state
		Monitoring mode	None
	Long press	Menu mode	Parameter saving In zero and span calibration, enter the next operation step

		Monitoring mode	Enter the password input screen of the menu. Password is “0002”

Table 11 Key Function Definition

5.3. MAIN MENU

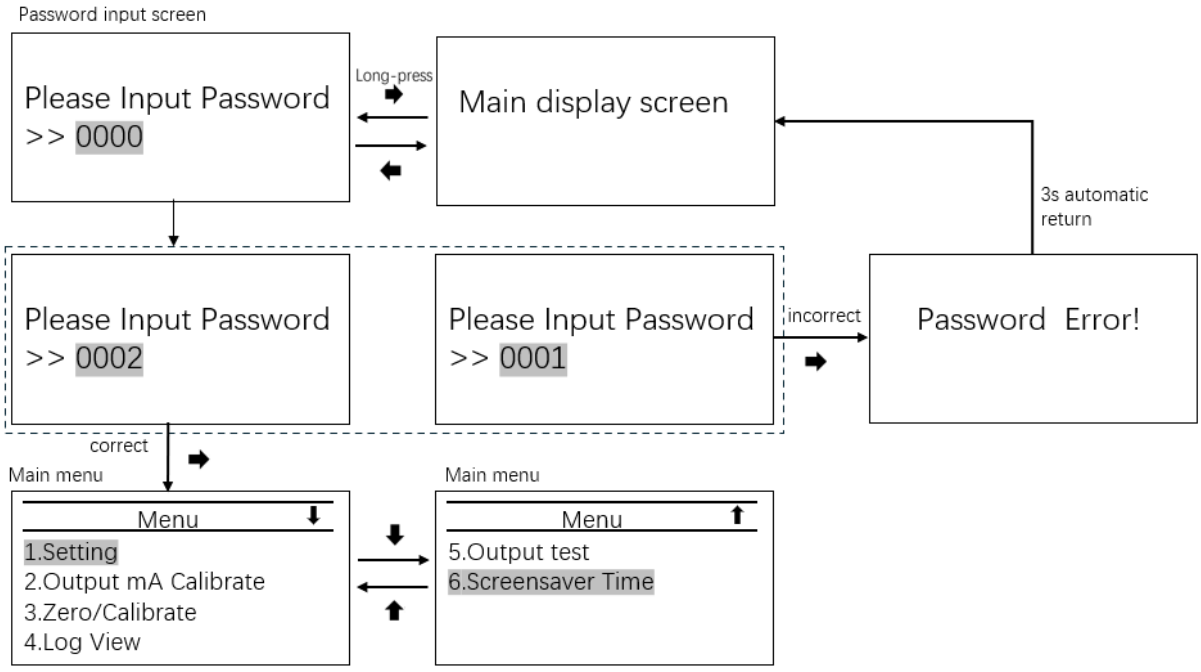


Figure 9 Entering Menu Mode

To access the main menu, follow the steps below:

- From the main display screen, press and hold the ⇨ key. When prompted, enter the password: 0002.
- Press the ⇨ key to confirm and enter the main menu screen.
- If the password is incorrect, an error message will be displayed. The screen will automatically return to the main display after 3 seconds.
- Use the ⇩/⇧ keys to scroll through the menu options.
- Press the ⇨ key to select a highlighted menu item.
- To exit the main menu and return to the main display screen, press the ⇦ key.

5.4. ALARM SETTINGS

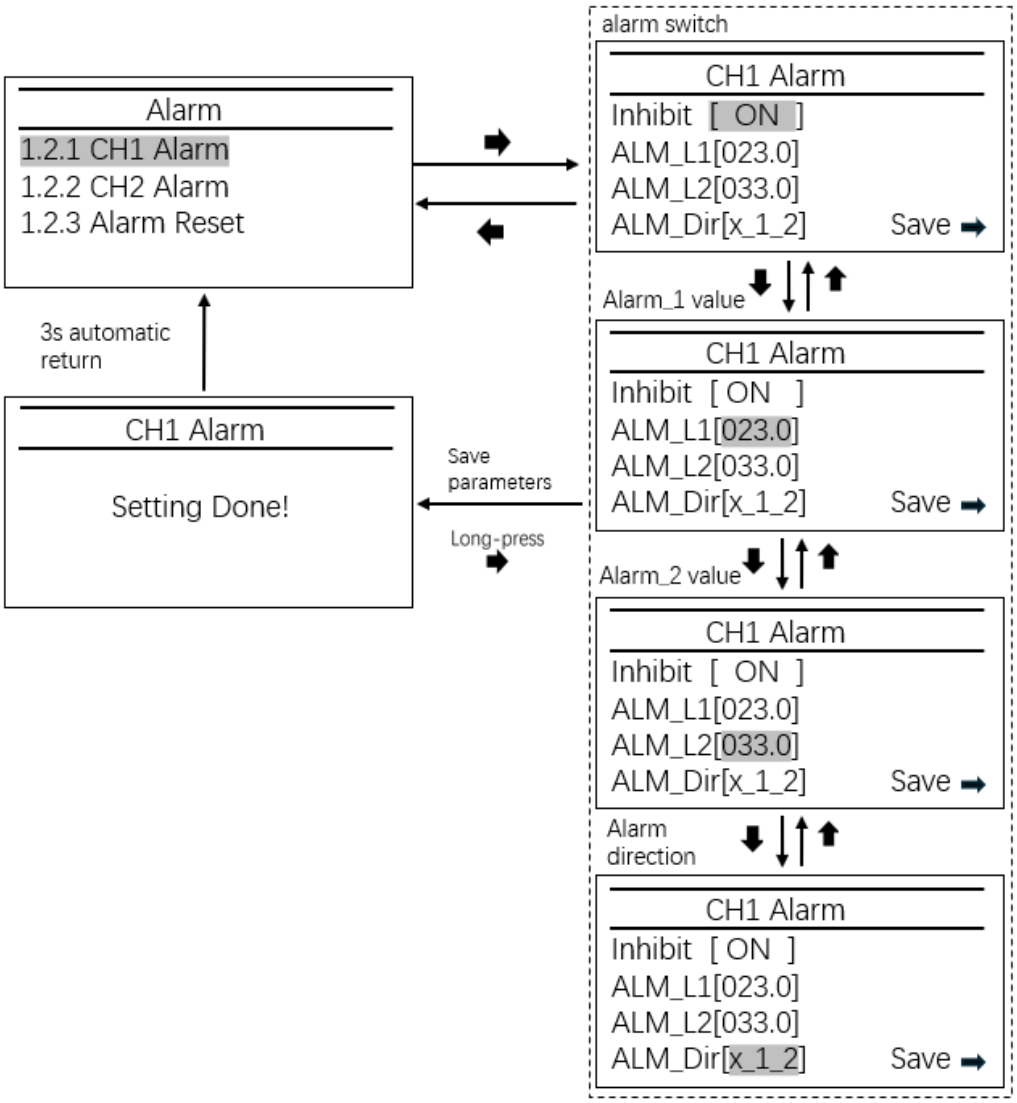


Figure 10 Alarm Settings

This function enables users to configure alarm parameters for each sensor module. Each channel includes the following four alarm-related settings:

Alarm Switch: Enables or disables the alarm (ON/OFF)

Alarm 1: Threshold value for Alarm Level 1

Alarm 2: Threshold value for Alarm Level 2

Alarm Direction: Defines the logic of alarm triggering based on the relationship between the measured value (X), Alarm 1 (AL1), and Alarm 2 (AL2). Available modes:

x_1_2: X < AL1 < AL2

1_x_2: AL1 < X < AL2

2_1_x: AL2 < AL1 < X

2_x_1: AL2 < X < AL1

To adjust alarm settings:

- From the main menu, navigate to "Settings" and select "Alarm". Choose the desired channel.
- Use the ⇩/⇧ keys to highlight the alarm parameter to be modified, then press the ⇨ key to

enter edit mode.

- While editing short press ⇨ to confirm or long press ⇨ to save changes and exit. Alternatively, long press ⇨ at any point to save and exit.
- Upon successful modification, a confirmation message will appear. The screen will automatically return to the previous menu after 3 seconds.

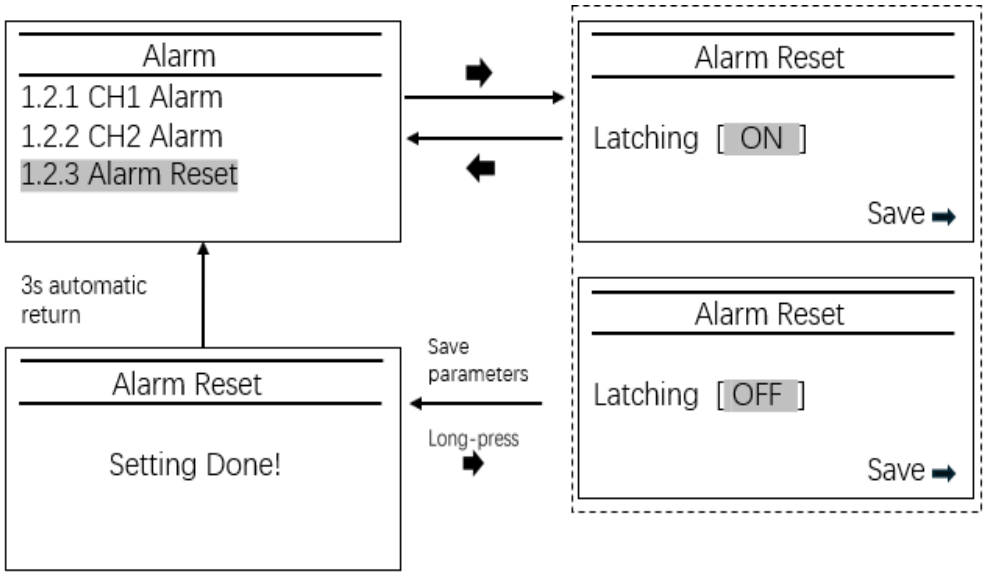


Figure 11 Alarm Latch Mode

Users can set the alarm to latching on non-latching mode. When the latch mode is set to **ON**, the alarm will continue to go off even after the alarm trigger (gas presence) disappears and does not automatically get reset. Long press the mute key to reset the alarm. When the latch mode is set to OFF, the alarm automatically gets reset after the alarm trigger disappears.

Follow these steps to change latch settings:

- From the main menu, navigate to "Settings", select "Alarm" and select ”Alarm Reset”
- Press the ⇨ key to start editing the values. Use ⇩/⇧ keys to switch between ON and OFF.
- While editing short press ⇨ to confirm or long press ⇨ to save changes and exit. Alternatively, long press ⇨ at any point to save and exit.
- Upon successful modification, a confirmation message will appear. The screen will automatically return to the previous menu after 3 seconds.

5.5. ANALOG MA OUTPUT SETTINGS

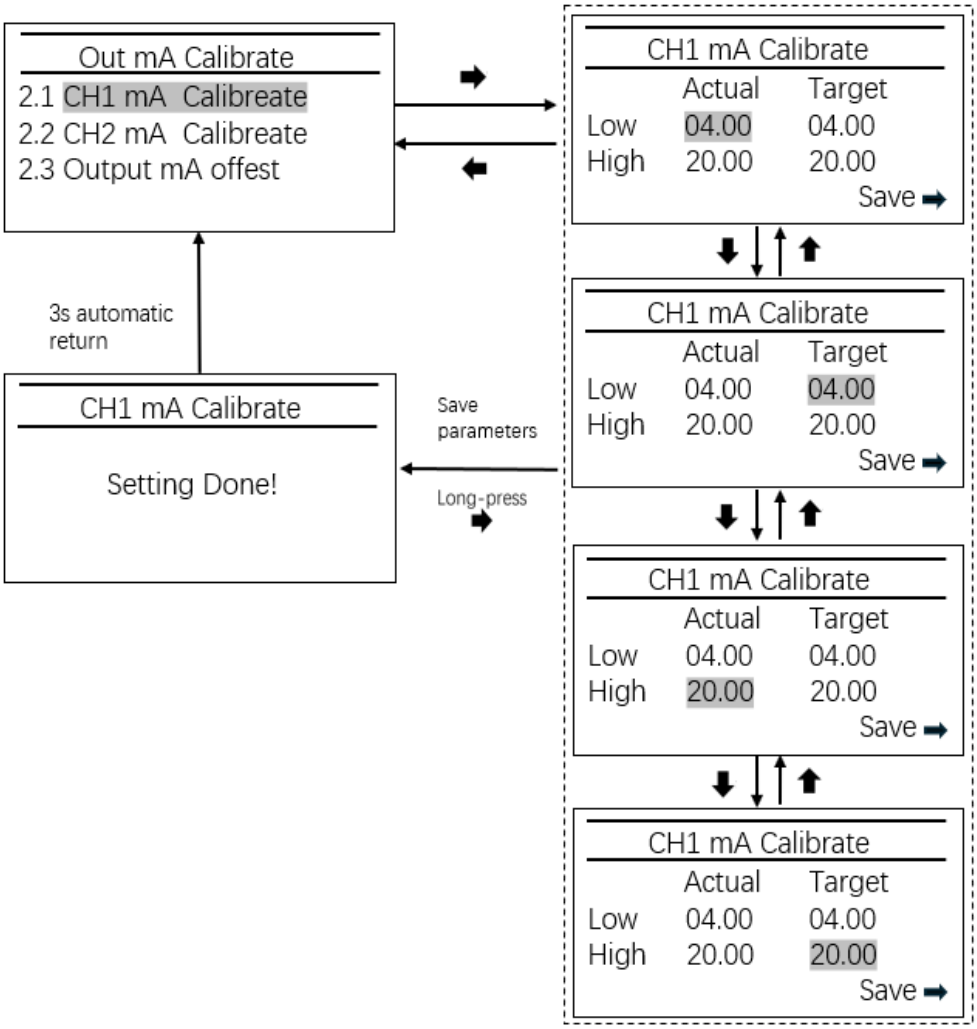


Figure 12 Analog mA Output Calibration

The analog output (mA) can be calibrated using four parameters to align with specific system requirements. The parameters are defined as follows:

Actual: The measured current value from the device

Target: The expected (theoretical) current value

Low: The lower calibration point (typically **4 mA**)

High: The upper calibration point (typically **20 mA**)

To perform analog mA output calibration:

- From the main menu, select "Out mA Calibrate". Choose the desired channel.
- Adjust the different parameters as prompted.
- While editing short press ⇨ to confirm or long press ⇨ to save changes and exit. Alternatively, long press ⇨ at any point to save and exit.
- Upon successful modification, a confirmation message will appear. The screen will automatically return to the previous menu after 3 seconds.

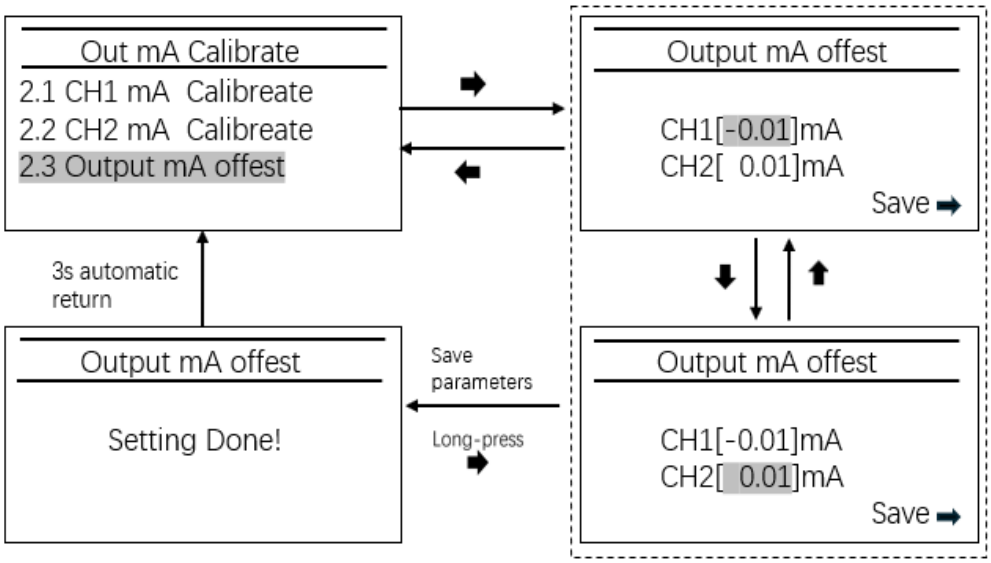


Figure 13 Analog Output Offset

Users can apply a **current offset** to each channel's analog mA output to correct for deviations and ensure compatibility with external systems. This adjustment helps eliminate minor current discrepancies and achieve precise system matching.

The final output is calculated as **Final Output = Measured Current Output + Current Offset**

Note: The allowable range for the current offset is -0.2 mA to +0.2 mA.

To adjust analog output offset:

- From the main menu, select "Out mA Calibrate" and select “Output mA offset”
- Adjust the offset for both the channels as required.
- While editing short press ⇨ to confirm or long press ⇨ to save changes and exit. Alternatively, long press ⇨ at any point to save and exit.
- Upon successful modification, a confirmation message will appear. The screen will automatically return to the previous menu after 3 seconds.

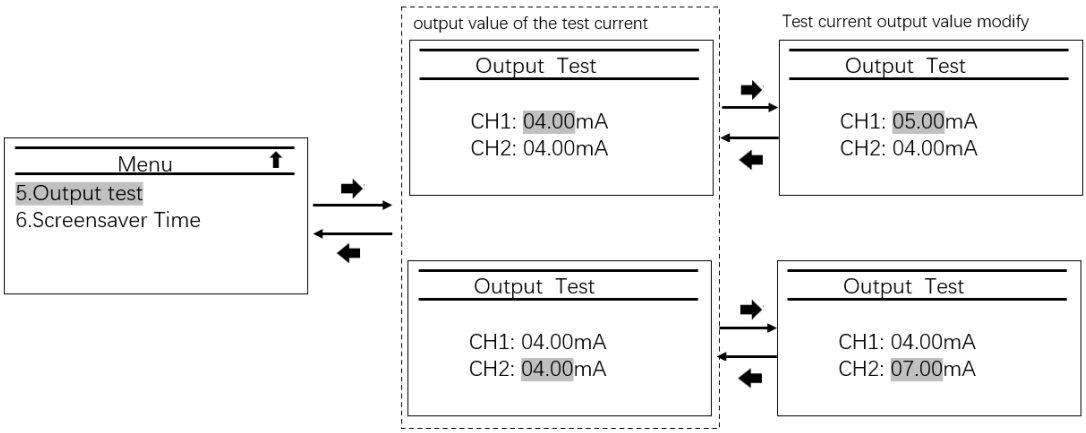


Figure 14 mA Output Signal Test

The Output Test function allows users to simulate a specific analog mA output for troubleshooting and system verification purposes. It can be used to confirm the accuracy and response of the analog

signal.

Test Procedure:

- From the main menu, select "Output Test".
- The screen will display the current analog mA output values for both channels.
- Press the ⇨ key on the desired channel to enter edit mode and adjust the output value.
- Press the ⇨ key again to confirm and return to the previous screen. The analog output will now reflect the new test value.
- To exit the output test, press the ⇦ key. Upon exit, the analog mA outputs for both channels will automatically return to normal operation.

5.6.RS-485 SETTINGS

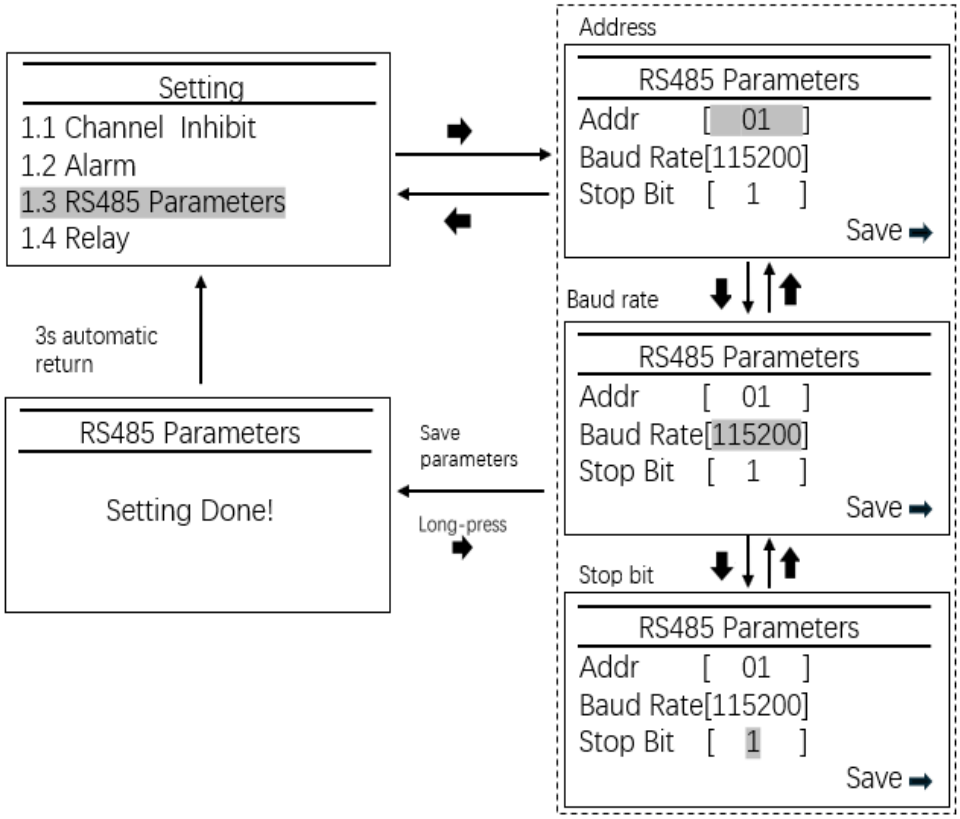


Figure 15 RS-485 Settings

Users can modify the RS-485 communication settings as needed to match system requirements. The following parameters are available:

Communication Address: Configurable range from 0 to 99

Baud Rate: Selectable options include 1200, 2400, 4800, 9600, 19200, and 115200

Stop Bits: Choose between 1 bit or 2 bits

To change RS-485 settings:

- From the main menu, navigate to "Settings" and select "RS485 Parameters".
- Use the ⇩/⇧ keys to highlight the alarm parameter to be modified, then press the ⇨ key to enter edit mode.

- While editing short press ⇨ to confirm or long press ⇨ to save changes and exit. Alternatively, long press ⇨ at any point to save and exit.
- Upon successful modification, a confirmation message will appear. The screen will automatically return to the previous menu after 3 seconds.

5.7. RELAY SETTINGS

BESafe is equipped with three relays (R1, R2, and R3), each configurable to operate based on up to six logic conditions using OR logic—meaning the relay activates if any selected condition is met. The available conditions include Fault, Alarm 2, and Alarm 1 for both Channel 1 and Channel 2. Each condition can be individually set as Correlated (relay responds) or Not Correlated (relay ignores). This flexible configuration allows each relay to be tailored to specific operational requirements via the keypad interface.

	CHANNEL 1			CHANNEL 2		
Relay Number	**Fault**	**Alarm 2**	**Alarm 1**	**Fault**	**Alarm 2**	**Alarm 1**
R1	▣/□	▣/□	▣/□	▣/□	▣/□	▣/□
R2	▣/□	▣/□	▣/□	▣/□	▣/□	▣/□
R3	▣/□	▣/□	▣/□	▣/□	▣/□	▣/□

Table 12 Relay Configuration

▣: Represents correlated

□: Represents not correlated

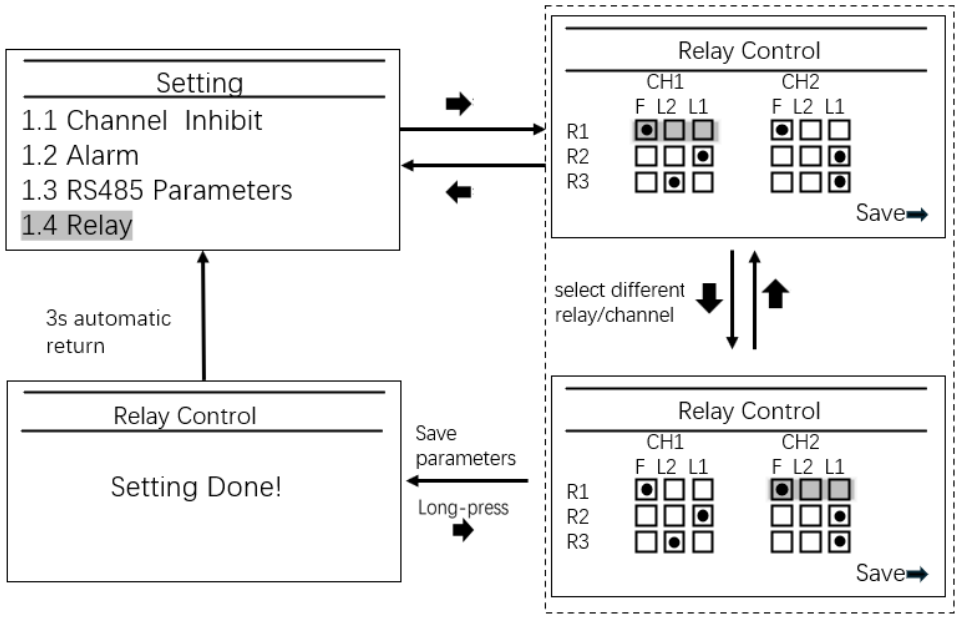


Figure 169 Relay Settings

Procedure:

- From the main menu, navigate to "Settings" and select "Relay".
- Press the ⇨ key to edit individual relay settings. Press ⇩ key to scroll through different relay corelation combinations.
- While editing short press ⇨ to confirm or long press ⇨ to save changes and exit. Alternatively,

long press ⇨ at any point to save and exit.

- Upon successful modification, a confirmation message will appear. The screen will automatically return to the previous menu after 3 seconds.

5.8.ZERO CALIBRATION

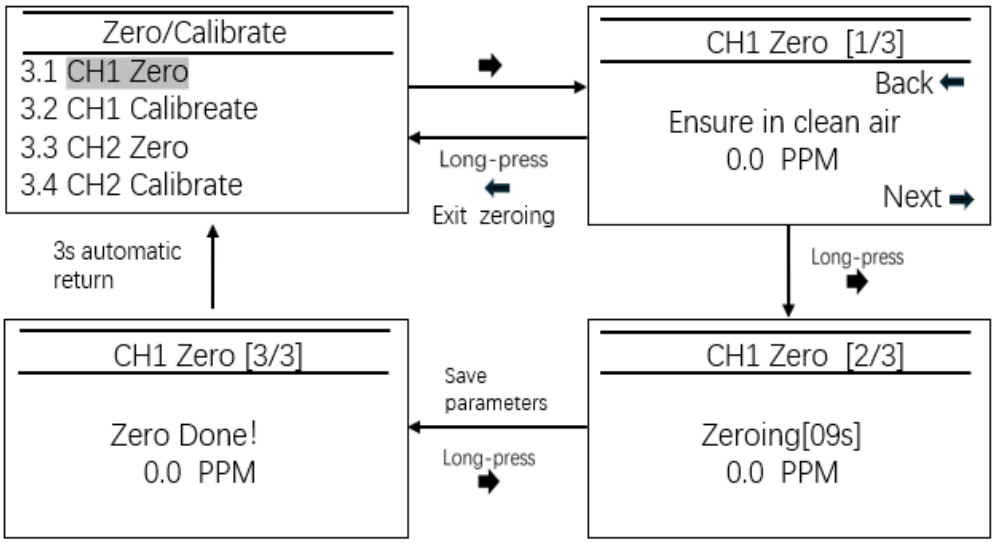


Figure 17 Zero Calibration Process

If the device has been in use for an extended period and a deviation in the zero point is observed, users can correct this by performing a zero calibration on the relevant channel.

Zero calibration procedure:

- Place the device in a clean air environment.
- From the main menu, select "Zero/Calibrate". Choose the desired sensor channel.
- Press the ⇨ key to initiate the zero calibration process. The screen will prompt: "Ensure in clean air."
- Wait for the gas concentration reading to stabilize, then long press the ⇨ key to proceed. To cancel and return to the previous menu, long press the ⇦ key instead.
- The device will begin a countdown from 9 to 0 seconds to complete the calibration.
- Once finished, the screen will display "Zero Done!", confirming that the calibration was successful.
- The system will automatically return to the previous menu after 3 seconds.

5.9.SPAN CALIBRATION

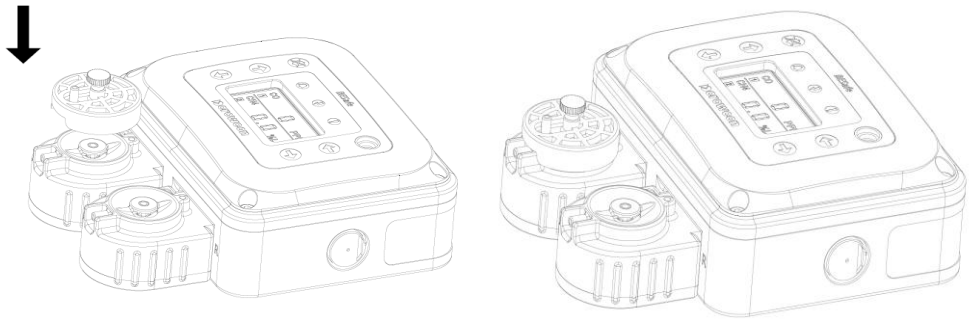


Figure 31 Installing the Sensor Module Test Cover

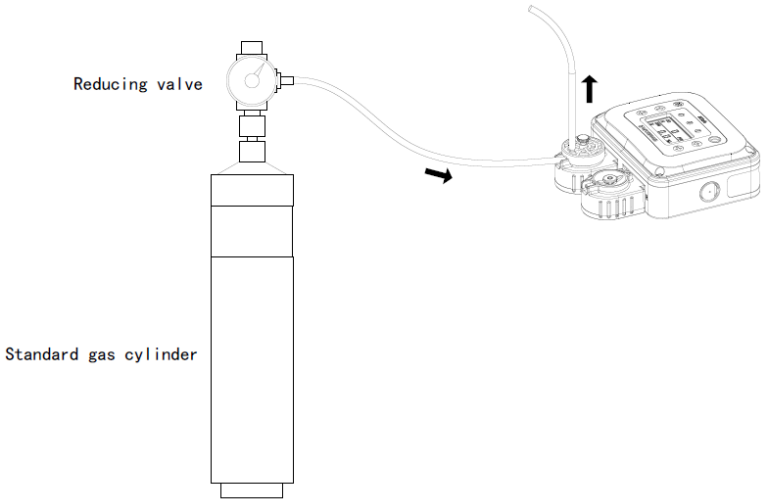


Figure 18 Applying Test Gas to the Sensor Module

Note: Ensure the gas exhaust outlet is directed to a safe, open outdoor area. Do not release gas into a closed indoor space to avoid potential harm to personnel or equipment.

Single Point

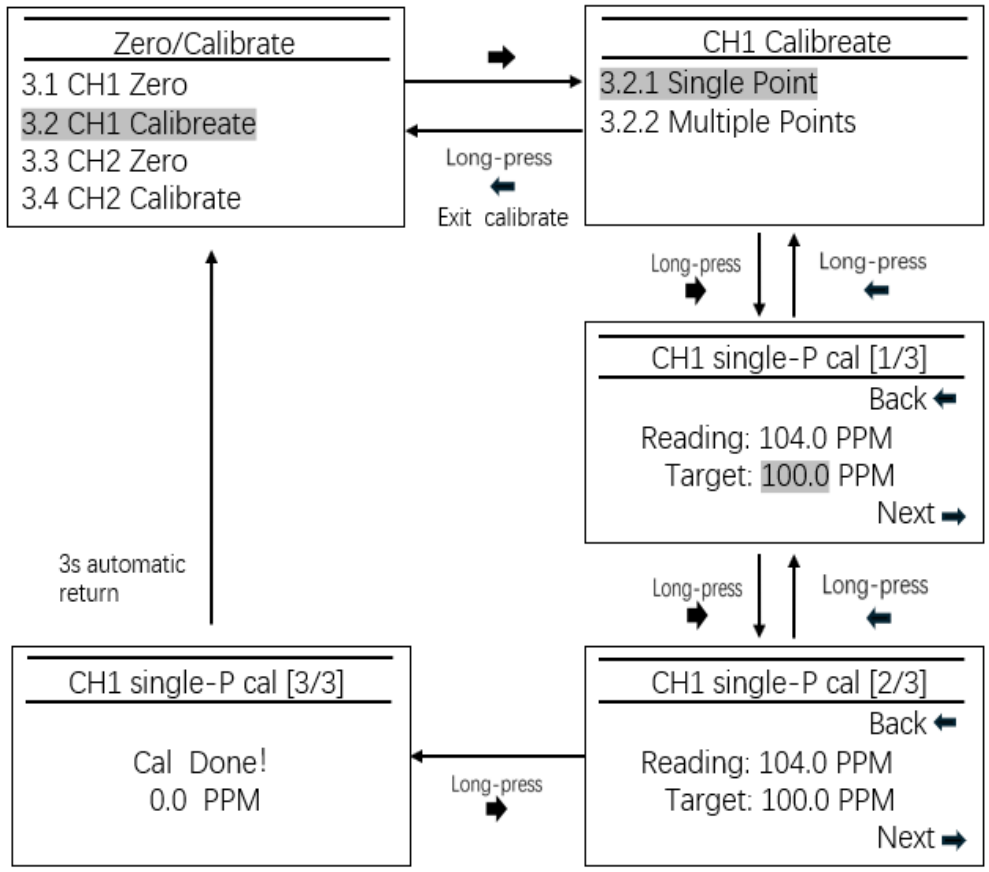


Figure 19 Single Point Span Calibration Process

Single point calibration procedure:

- From the main menu, navigate to “Zero/Calibrate”, select the appropriate channel, and choose “Single Point”.
- The screen will display the current gas concentration (*Reading*) and the span value (*Target*).
- Adjust the *Target* value to match the concentration of the test gas being applied. Position the gas test cover over the sensor module as illustrated. Secure it firmly by tightening the screws.
- Connect a certified gas cylinder using a pressure regulator and tubing. Attach the tubing to the gas inlet of the sensor module.
- Set the gas flow rate to approximately 500–700 ml/min. Allow the test gas to flow for 1–2 minutes, or until the reading stabilises.
- Long-press the ⇨ key to begin calibration. To cancel and return to the previous screen, long-press the ⇦ key.
- Once complete, the screen will display “Cal Done!” confirming a successful calibration. The system will automatically return to the previous menu after 3 seconds.

Multi Point

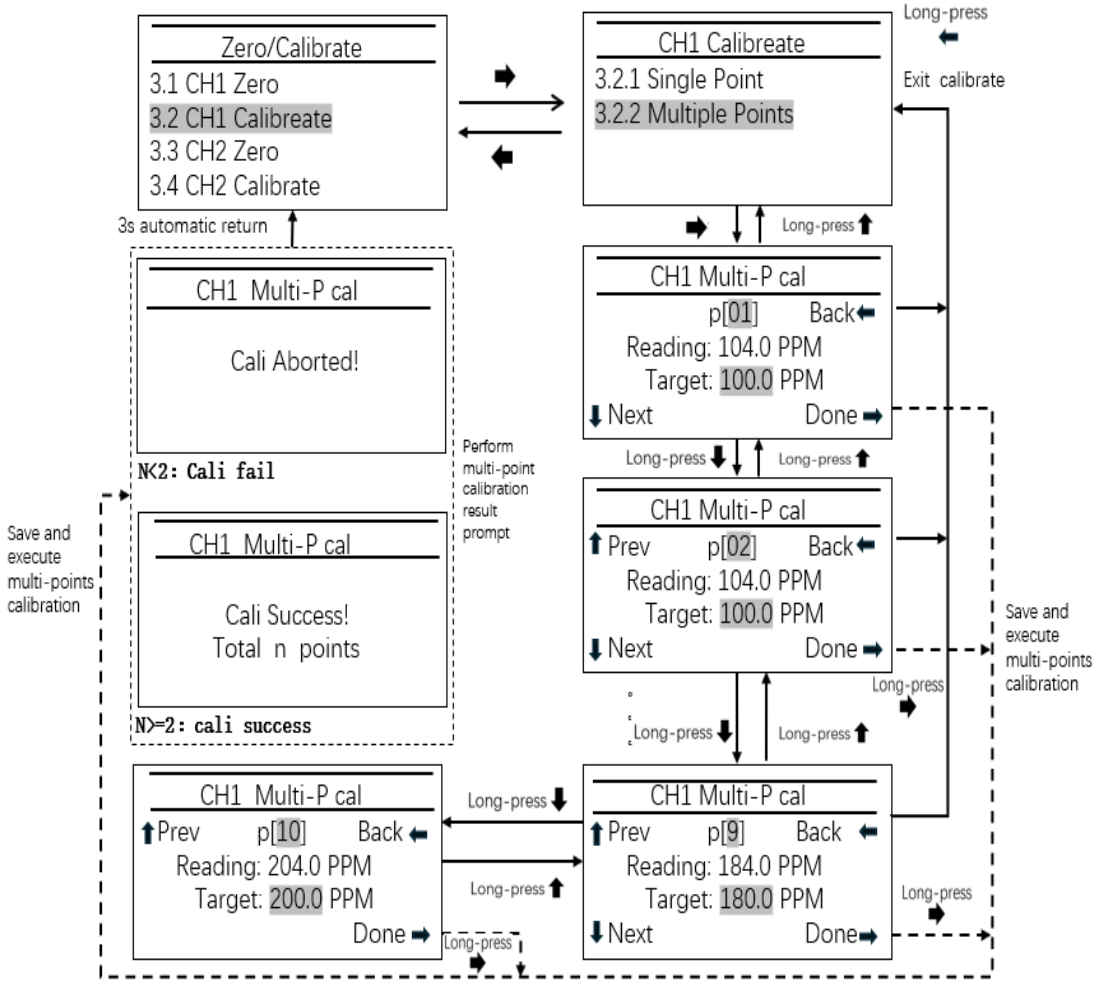


Figure 20 Multi Point Span Calibration Process

The device supports multi-point calibration with a minimum of 2 points and a maximum of 10 points. **Note:** If fewer than 2 points are entered, a calibration failure message will be displayed. Each calibration screen includes:

- **Reading**: The current measured gas concentration
- **Target**: The desired calibration value
- **P[XX]**: Indicates the calibration point number (e.g., P[01] for the first point)

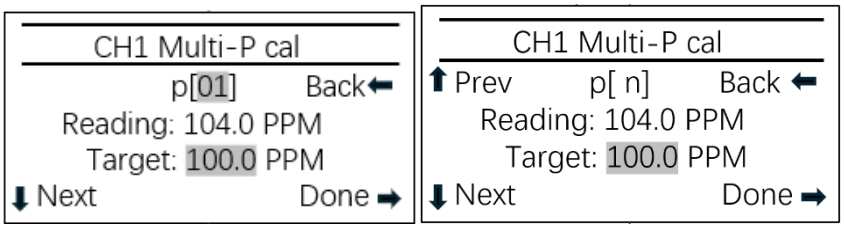


Figure 21 First (left) and Last (right) Point Calibration Display

Calibration Procedure:

- From the main menu, navigate to “Zero/Calibrate”, select the appropriate channel, and choose “Multiple Points”.

- The screen will display the current gas concentration (*Reading*) and the span value (*Target*) for the first calibration point.
- Adjust the *Target* value to match the concentration of the test gas being applied.
  Position the gas test cover over the sensor module as illustrated. Secure it firmly by tightening the screws.
- Connect a certified gas cylinder using a pressure regulator and tubing. Attach the tubing to the gas inlet of the sensor module.
- Set the gas flow rate to approximately 500–700 ml/min. Allow the test gas to flow for 1–2 minutes, or until the reading stabilises.
- Long-press the ⇩ key to proceed to the next calibration point.
- Repeat the process until the desired number of calibration points (minimum 2, maximum 10) have been achieved.
- Long-press the ⇨ key to begin calibration. To cancel and return to the previous screen, long-press the ⇦ key.
- A confirmation message will appear indicating successful calibration. The system will return to the previous menu after 3 seconds

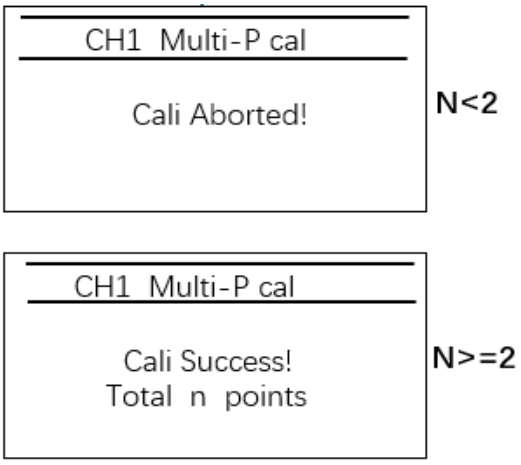


Figure 22 Final Step in Multipoint Calibration

5.10. INHIBIT MODE

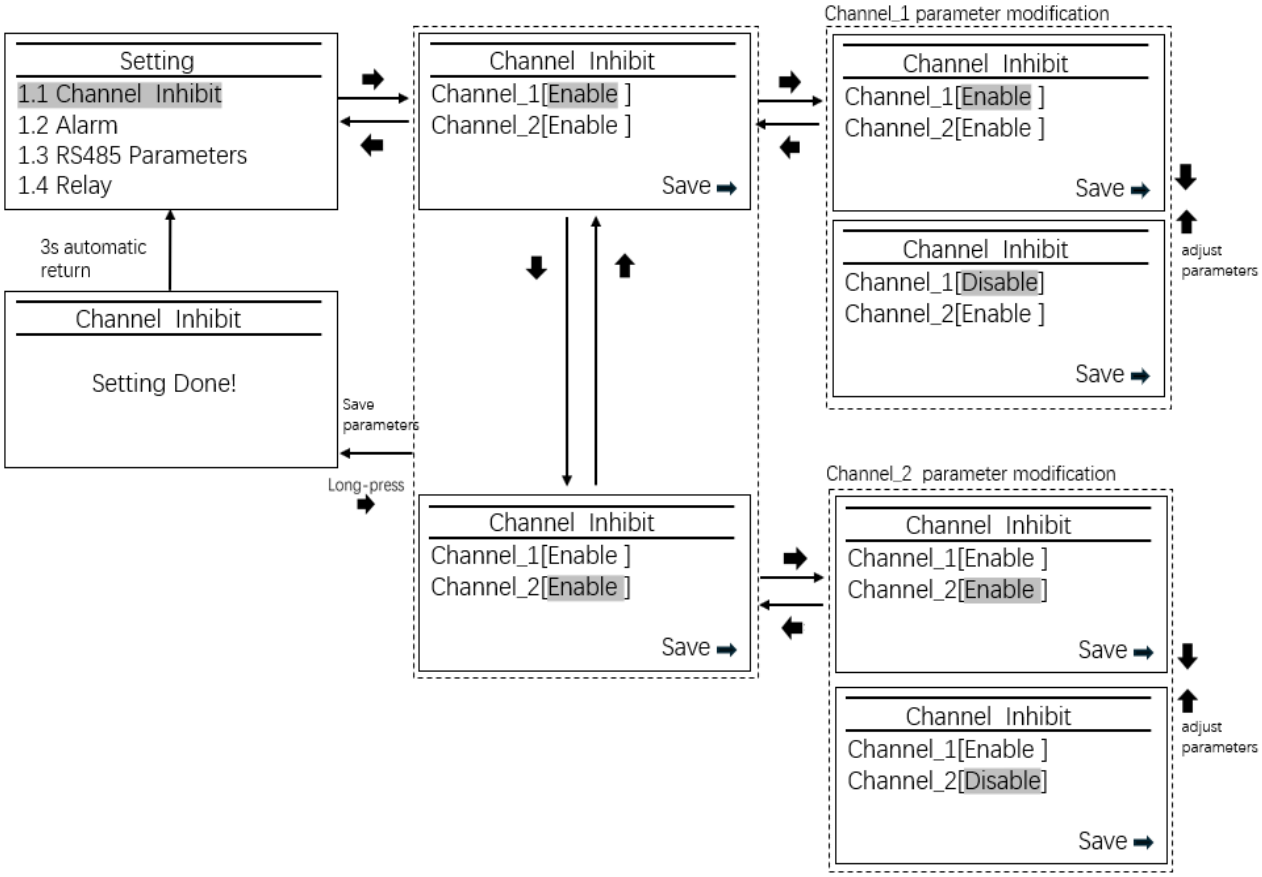


Figure 23 Inhibit Sensor Module

Users can enable or disable inhibit mode on individual channels or sensor modules as needed during maintenance to prevent the transmitter from generating fault alarms or disconnection signals.

To enable/disable inhibit mode:

- From the main menu, navigate to "Settings" and select "Channel Inhibit". Choose the desired channel.
- Press the ⇨ key to start editing the values. Use ⇩/⇧ keys to switch between Enable and Disable.
- While editing short press ⇨ to confirm or long press ⇨ to save changes and exit. Alternatively, long press ⇨ at any point to save and exit.
- Upon successful modification, a confirmation message will appear. The screen will automatically return to the previous menu after 3 seconds.

5.11. LOG VIEW

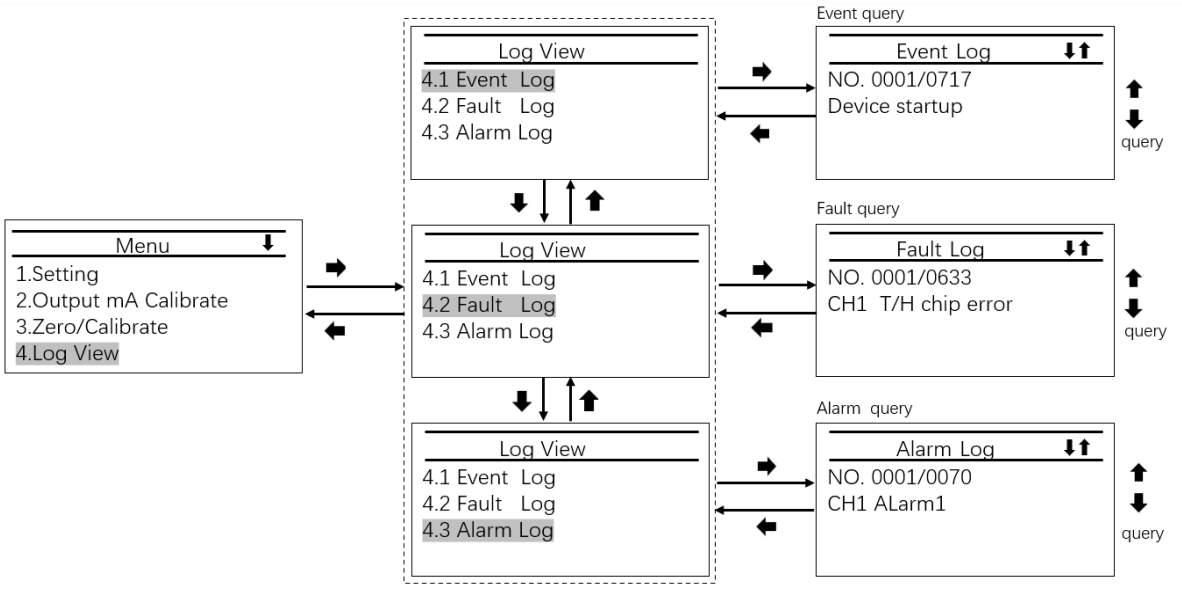


Figure 24 Viewing Logs

The device maintains an event log, fault log, and an alarm log. Every log indicated the following information:

Record Index: Total number of records (maximum of 1024 per log type)

Log Details: Specific content of the log (refer to Appendix B for descriptions)

Timestamp: Date and time of the recorded event

Steps to View Logs:

- From the main menu, navigate to “Log View”
- Use the ⇧/⇩ keys to select the desired log type (Event, Fault, or Alarm), then press ⇨ to open the selected log.
- Use the ⇧/⇩ keys to scroll the log record. Press the ⇦ key to return to the previous menu.

5.12. SCREENSAVER TIMER SETTINGS

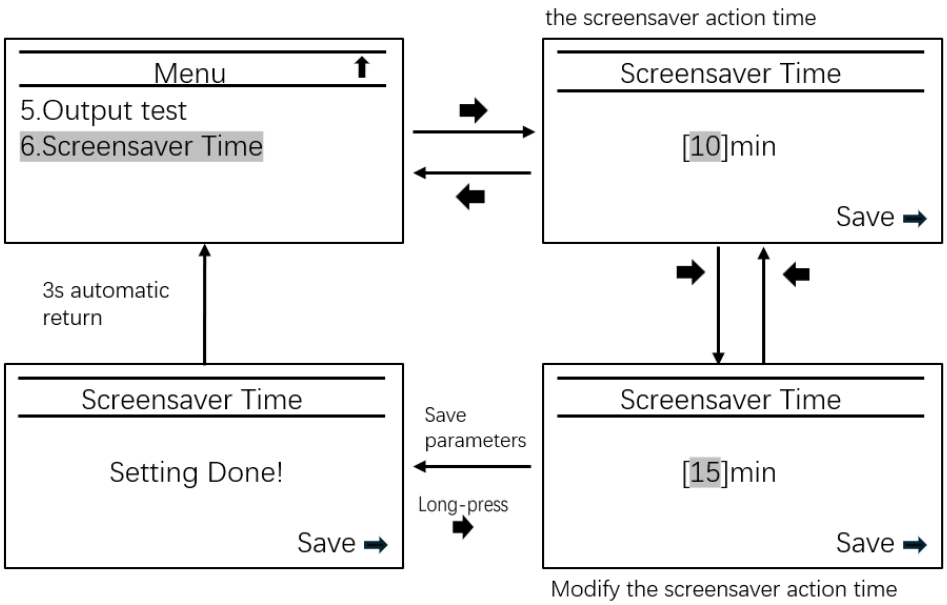


Figure 25 Screensaver Timer Settings

The device allows users to configure the OLED screensaver activation time based on operational needs.

Note: The timer is set in minutes. Setting the timer to 0 disables the screensaver. The screensaver (black screen) activates when no faults, alarms, or key operations are detected and/or the configured timer duration has elapsed. Pressing any key exits the screensaver. The screensaver automatically exits if an alarm or fault occurs.

The operation steps are as follows:

1. From the main menu, navigate to “Screensaver Time”
2. Press the ⇨ key to begin edit the timer value
3. While editing short press ⇨ to confirm or long press ⇨ to save changes and exit. Alternatively, long press ⇨ at any point to save and exit.
4. Upon successful modification, a confirmation message will appear. The screen will automatically return to the previous menu after 3 seconds.

6. MAINTENANCE

6.1. TROUBLESHOOTING GUIDE

Issue	Possible Causes	Recommended Actions
Instrument Fails to Start	- Power supply not connected - Internal fuse blown - Input voltage too low	- Check power supply connection - Inspect and replace fuse if necessary - Measure input voltage and ensure it meets specifications - If unresolved, inspect internal circuitry
Display Malfunction	- Loose or incorrect wiring - Disconnected or damaged sensor modules - Low zero point - Unstable power supply voltage	- Inspect wiring and sensor module connections - Verify power supply stability - Recalibrate as needed
Unstable or Inaccurate Readings	- Zero or range drift - Mismatch between target gas and calibration gas - Sensor module nearing end of life	- Adjust sensor module range - Recalibrate the sensor module - Replace sensor module if required
Delayed Response	- Sensor module aging due to harsh environment - Incorrect range settings	- Inspect sensor module for wear - Adjust range settings - Replace sensor module if necessary
No Response During Gas Test	- Transmitter or Sensor module failure - Circuit board damage	- Test with standard test gas - If no response or low reading, investigate further - Replace sensor module or replace parts as needed

Table 13 Troubleshooting Guide

6.2.ACCESSORIES & SPARES

Part No.	Description	Image
C038001	Gas Test Cap Used to close the sensor gassing area while applying test gas	
C038002	Gas Tube 1m (OD 6.4 x ID 3.2)	
C038003	M20 (x1.5 mm) Cable Gland	
C038004	Sensor Slot Cover Used to cover empty sensor slots to maintain water and dust ingress protection	
C038005 C038006 C038007 C038008 C038009 C038010	Remote Sensor Cable 1m Remote Sensor Cable 2m Remote Sensor Cable 5m Remote Sensor Cable 8m Remote Sensor Cable 10m Remote Sensor Cable 15m	
C038A11 C038A12 C038A21 C038A22 C038A35 C038A34 C038A33 C038A32 C038A31	Sensor Module Methane CH4 Cat. 0-100% LEL Sensor Module Methane CH4 Cat. 0-25% LEL Sensor Module Hydrogen H2 Cat. 0-100% LEL Sensor Module Hydrogen H2 Cat. 0-25% LEL Sensor Module Carbon Monoxide CO EC 0-50 ppm Sensor Module Carbon Monoxide CO EC 0-100 ppm Sensor Module Carbon Monoxide CO EC 0-200 ppm Sensor Module Carbon Monoxide CO EC 0-500 ppm Sensor Module Carbon Monoxide CO EC 0-1000 ppm	

Table 14 Accessories and Spares

6.3. MAINTENANCE

To ensure continued safe and reliable operation, the BESafe must be maintained through regular checks and testing. The following maintenance activities are recommended:

Visual and Functional System Inspections
Conduct routine inspections to check for physical damage, corrosion, loose connections, or environmental wear. Ensure that enclosures are sealed and cable entries are secure. Additionally, verify that all system functions—such as power supply, communication interfaces, and indicator responses—are operating correctly.

Regular Functional Gas Tests
Perform scheduled tests using certified test gases to confirm that sensor modules and alarm systems respond accurately. These tests help validate the system's ability to detect gas hazards, trigger alerts, and identify any blockages in the gas path.

Technical Support
For further technical information or assistance, please contact **Crowcon Technical Support** technicalsupport@crowcon.com. Our team is available to provide expert guidance and help resolve any operational or maintenance-related concerns.

7. WARRANTY

This equipment leaves our factory fully tested and calibrated. If within the warranty period of two years from dispatch, the equipment is proved to be defective by reason of faulty workmanship or material, we undertake at our option either to repair or replace it free of charge, subject to the conditions below.

Warranty Procedure

To facilitate efficient processing of any claim, please visit https://www.crowcon.com/help-and-advice/customer-support/warranty and provide the information listed below. You will receive a warranty reference number which must be clearly shown on the address label when the goods are returned.

- Your company name, contact name, phone number and email address.
- Description and quantity of goods being returned, including any accessories.
- Instrument serial number(s).
- Reason for return.

This warranty will be rendered invalid if the detector is found to have been altered, modified, dismantled, tampered with, or has not used Crowcon spares for replacement parts or has been serviced or repaired by any party not authorised and certified by Crowcon to do so. This warranty does not cover consumable parts like filters.

Warranty Disclaimer

Crowcon accept no liability for consequential or indirect loss or damage howsoever arising (including any loss or damage arising out of the use of the detector) and all liability in respect of any third party is expressly excluded. This warranty excludes calibration accuracy and cosmetic finish. The unit must be maintained in accordance with the instructions in this manual.

The warranty on replacement consumable items supplied under warranty to replace faulty items, will be limited to the unexpired warranty of the original supplied item.

Crowcon reserves the right to determine a reduced warranty period or decline a warranty period for any sensor module supplied for use in an environment or for an application known to carry risk of degradation or damage to the sensor module.

Our liability in respect of defective equipment shall be limited to the obligations set out in the guarantee and any extended warranty, condition or statement, express or implied statutory or otherwise as to the merchantable quality of our equipment or its fitness for any particular purpose is excluded except as prohibited by statute. This guarantee shall not affect a customer's statutory rights. Crowcon reserves the right to apply a handling and carriage charge whereby units returned as faulty, are found to require only normal calibration or servicing, which the customer then declines to proceed with.

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Link: https://www.crowcon.com/support/warranty/

8. APPENDIX A: SYSTEM FAULT CODES

A total of 24-bit binary number (1: fault, 0: no fault), composed as follows:

bit (High -> Low)

24~17	16~9	8~1
System fault code	Channel 2 fault code	Channel 1 fault code

Table 15 System Fault Code

8.1. CHANNEL FAULT CODES

Each channel has an 8-bit binary code (1: fault, 0: no fault):

bit (High -> Low)

8	7	6	5	4	3	2	1
AD chip fault	Sensor preheating timeout fault	Overrange fault	Sensor fault	Sensor conditioning circuit fault	Parameter reading fault	Basic information reading fault	Temperature and humidity fault

Table 16 Channel Fault Code Definition

8.2. SYSTEM FAULT CODES

System fault code:

bit (High -> Low)

8	7	6	5	4	3	2	1
Reserved	Reserved	Channel 2 output analog current wire break fault	Channel 1 output analog current wire break fault	Channel 2 sensor service life expired fault	Channel 1 sensor service life expired fault	Channel 2 wire break fault	Channel 1 wire break fault

Table 17 Transmitter Fault Code Definition

9. APPENDIX B: LOG DEFINITIONS

9.1. EVENT LOG

Message	Description
Device startup	Equipment startup
Alarm mute	Alarm mute
Alarm reset	Manual alarm reset (when the alarm reset mode is latch)
CH1 enable	Channel 1: Not masked
CH2 enable	Channel 2: Not masked
CH1 inhibit	Channel 1: masked；
CH2 inhibit	Channel 2: masked；
CH1 alarm enable	Channel 1: Alarm enabled is On
CH2 alarm enable	Channel 2: Alarm enabled is On
CH1 alarm inhibit	Channel 1: Alarm enabled is Off
CH2 alarm inhibit	Channel 2: Alarm enabled is off
CH1 online	Channel 1: Re-online
CH2 online	Channel 1: Re-online
Sensors exp reset	Channel 1&2 sensors life expired prompt display reset

Table 18 Event Log Definition

9.2. FAULT LOG

Display Content	Explanation
CH1 T/H chip error	Channel 1: Temperature and humidity fault
CH1 info read error	Channel 1: Information reading fault
CH1 params read error	Channel 1: Parameter reading fault
CH1 EC chip error	Channel 1: Sensor conditioning circuit fault
CH1 sensor fault	Channel 1: Sensor fault
CH1 over range	Channel 1: Overrange fault
CH1 warmup timeout	Channel 1: Sensor preheating timeout fault
CH1 AD chip error	Channel 1: AD acquisition fault
CH2 T/H chip error	Channel 2: Temperature and humidity fault
CH2 info read error	Channel 2: Information reading fault
CH2 params read error	Channel 2: Parameter reading fault
CH2 EC chip error	Channel 2: Sensor conditioning circuit fault
CH2 sensor fault	Channel 2: Sensor fault

CH2 over range	Channel 2: Overrange fault
CH2 warmup timeout	Channel 2: Sensor preheating timeout fault
CH2 AD chip error	Channel 2: AD acquisition fault
CH1 out mA loop error	Channel 1: output analog current 4~20mA wire break
CH2 out mA loop error	Channel 2: output analog current 4~20mA wire break
CH1 sensor expired	Channel 1: sensor using life is expired
CH2 sensor expired	Channel 2: sensor using life is expired

Table 19 Fault Log Definition

9.3.ALARM LOG

Display Content	Explanation
CH1 Alarm1	Channel 1：Alarm 1
CH1 Alarm2	Channel 1：Alarm 2
CH2 Alarm1	Channel 2：Alarm 1
CH2 Alarm2	Channel 2：Alarm 2

Table 20 Alarm Log Definition

10. APPENDIX C: DEFAULT PASSWORDS

Function	Action	Password
Sensor Expiration Warning Reset	Press and hold mute	0006
Reset Alarm in Latched Mode	Press and hold mute key	1111
Accessing Menu Password Input Screen	Press and hold -> from monitoring mode	0002

Table 21 List of Default Passwords

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