

Multi-zone Gas Detector Installation Operation Maintenance



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1 Introduction

To assure human safety and proper operation of Multi-zone Gas Detector please read carefully this manual. It provides important information on the installation, operation and maintenance.

1.1 Symbols Convention

When used in this manual the following symbols are defined:



Warning

This symbol indicates a potential hazard associated with the use of this equipment. It calls attention to a procedure, practice, condition, or the like, which if not correctly performed or adhered to, could result in injury or death.



Warning

This symbol indicates a potential hazard from **electrical shock**. It calls attention to a procedure, practice, condition, or the like, which if not correctly performed or adhered to, could result in injury or death.



Important

The use of this symbol calls attention to a procedure, practice, condition, or the like, which if not correctly performed or adhered to, could result in incorrect performance of or damage to the equipment and may void the warranty.

1.2 Safety precautions



Warning

This instrument has not been designed to be intrinsically safe for use in areas classified as hazardous locations. For your safety, DO NOT use it in hazardous (classified) locations.



Warning

This is NOT a safety device. Some gases which this instrument can detect may be combustible/flammable. When properly configured, this instrument is designed to alarm at concentrations that are lower than the explosive limit of the gas. As such, it is the buyer's responsibility to initiate an immediate planned response to any gas leaks as soon as they are detected. This equipment should NEVER be used to measure or

sample gases at or above their respective lower explosive limits.



Important

The gas monitor uses a universal power supply that is capable of accepting inputs of 100 to 240 VAC, 50/60 Hz. The system's power consumption is 20 Watts. It is highly recommended that the system be connected directly to the AC power source, preferably on its own circuit with UPS or surge protection.



Warning

A switch or circuit breaker must be included in the building installation. The switch must be in close proximity to the monitor and within easy reach of the operator. The switch must be clearly marked as the disconnecting device for the equipment.



Warning

Under no circumstances should the monitor be operated without connection to a protective ground. Doing so poses a potential shock hazard and is also a violation of electrical safety standards applicable to this type of equipment.



Warning

Do not operate this equipment in the presence of flammable liquids, vapors, or aerosols. Operation of any electrical instrument in such an environment constitutes a safety hazard.



Warning

It is imperative that the exhaust port on this instrument be properly vented as described in this manual. Failure to do so may constitute a safety hazard.

Warning

Extreme care should be exercised when accessing the interior of the monitor. Only qualified electrical maintenance personnel should make connections and perform adjustments. Always remove AC power before opening the monitor's enclosure.



Warning

The protection provided by the monitor may be impaired if the monitor is used in a manner not specified by JBK Company. Modifications to this monitor, not expressly approved, will void the warranty.



Warning

Do not continue to use this equipment if there are any symptoms of malfunction or failure. In the case of such occurrence, de-energize the power supply and contact a qualified repair technician.



Warning

This device uses 5x20 fuses. Replace ONLY with JBK-approved fuses.



Warning

Electrical installation should be performed by a certified electrician, and must comply with all applicable NEC/CEC and local electrical safety codes.



Warning

Use ONLY the provided knockout for electrical wiring. Drilling into the box will void the warranty.



Important

To clean the outside of the case use a dry cloth. To avoid shock hazard and/or equipment damage, DO NOT use soap and water.

1.3 Functional Overview

The Multi-zone Gas Detector provides continuous monitoring of CO_2 and R22 levels into 12 separate test zones. Gas samples are taken with the pump via internal valves. Valves switching are provided by internal equipment.

An alarm indicator on display and two 24VDC digital outputs are provided to signal alarm and fault condition. The alarm levels can be easily change for each zone. The system is equipped with three 4-20mA current loops for connection to remote equipment.

The Multi-zone Gas Detector requires only periodic replacement of filter, sensors calibration and valves

maintanance. The system incorporates diagnostics that continuously check the system for any malfunctions. A display indicator is provided to alert an operator of system malfunctions, and fault codes are generated that enable the user to identify the cause of the fault.

1.3.1 Sensors

The Multi-zone Gas Detector is equipped with two sensors: R22 and CO_2 .

Sensor	R22	CO_2	
Technology	IR	IR	
Measuring range	0ppm - 1000ppm	0.00% - 4.00%	
Unit	1ppm	0.01%	
Sensitivity	3ppm	0.02%	
Zero offset	2.5% of measuring range	2.5% of measuring range	
Output	4-20mA - gas value	4-20mA - gas value	
	<4mA - heating or system malfunction	<4mA - heating or system malfunction	

Table 1: Sensors specification

1.3.2 Outputs

The Multi-zone Gas Detector has three current loops - R22 sensor output, CO_2 sensor outputs and SystemMulfunction. In addition there are two digital outputs - alarm and system malfunction.

1.3.3 Zones

The Multi-zone Gas Detector has 13 valves for 12 sampling zones and 1 clean air purge.

1.3.4 Zones switching

Zones (valves) are switching continously in order:

- 1st zone (valve 2)
- clean air purge (valve 1)
- 2nd zone (valve 3)
- clean air purge (valve 1)
- 3rd zone (valve 4)
- clean air purge (valve 1)
- 4th zone (valve 5)
- clean air purge (valve 1)
- 5th zone (valve 6)
- clean air purge (valve 1)

- 6th zone (valve 7)
- clean air purge (valve 1)
- 7th zone (valve 8)
- clean air purge (valve 1)
- 8th zone (valve 9)
- clean air purge (valve 1)
- 9th zone (valve 10)
- clean air purge (valve 1)
- 10th zone (valve 11)
- clean air purge (valve 1)
- 11th zone (valve 12)
- clean air purge (valve 1)
- 12th zone (valve 13)
- clean air purge (valve 1)

and the cycle starts over again.

2 Installation



Warning

Explosion hazard! Do not mount the Multi-zone Gas Detector in an area that may contain flammable liquids, vapors, or aerosols. Operation of any electrical equipment in such an environment constitutes a safety hazard.



Warning

Shock hazard! Always disconnect AC power before working inside the system.



Warning

Drilling holes in the Multi-zone Gas Detector enclosure may damage the unit and will void the warranty. Please use the knockouts provided for electrical connections.



Warning

The Multi-zone Gas Detector contains sensitive electronic components that can be easily damaged. Do not touch nor disturb any of these components.



Important

The Multi-zone Gas Detector has been tested prior to shipment, however it is recommended to re-check before installation for any signs of damage.

2.1 Installation Consideration

Installation of the Multi-zone Gas Detector should strictly follow the order:

- 1. Inspecting the System for any visible damage.
- 2. Choosing the right place and mounting the device.
- 3. Connecting the Samples, Clean air and Exhaust Lines.
- 4. Connecting the 4-20mA loops.
- 5. Connecting the binary outputs.
- 6. Connecting the 230VAC supply.

2.2 System components

The Multi-zone Gas Detector contains:

- Power Supply to power all electronic components.
- PCB Board to get necessary electronic wires and connect with pressure sensors.
- Sensors to measure R22 and CO_2 gas levels.
- Hydrophobic Filter.- to prevent water and dirt from getting inside
- Pump to get samples from the zones.
- PLC Controller to display data, configure system and control peripherals.
- Valves to purge samples and clean air
- Valves driver to control valves switching sequence



Figure 1: Device Interior

It is strongly recommended to inspect all of the elements listed above for any visible damage before the final installation.



Valves driver

Figure 2: Device Interior

2.3 Mounting the Device

Dirt, grease, and oils can adversely affect the operation of the System. The Multi-zone Gas Detector should be installed out of direct sunlight in a clean, dry area. It is also recommended to choose a mounting place which is easily accessible for visual monitoring and servicing.

The System should be mounted using the supplied brackets. Drilling in the housing is strictly prohibited and will void the guarantee.

2.4 Connecting the Sample and Exhaust Lines

The side views of the System are shown on Figure 4 and 5. Pneumatic line from place with clean air should be connected to Air valve. Pneumatic lines from sample zones should be connected to valves labeled Zone1..12. Line from the Exhaust connector should be run to the safe, ventilated place away from the people.



PLC Controller

Information Card

Figure 3: Device Door



Figure 4: Device Bottom Side



Figure 5: Device Right Side

Connecting and disconnecting lines are shown on Figure 6.



Figure 6: Connecting and Disconnecting Tubes

2.5 4-20mA Loops

The System is equipped with three current loops to provide R22, $C0_2$ and SystemMulfunction values to external devices. Current loop connectors are located on the top of the PCB Board (Figure 7). External devices are connected using a two wire 20-24AWG cable. Use knockouts to gain access to the interior of the Multi-zone Gas Detector. Then connect cables respectively to CO2 Output - GND, R22 Output - GND,

System Mulfunction Output - GND. Check to make sure the polarity matches the wiring at the external device.



Warning

The 4-20 mA DC output connector are SIGNAL OUT ONLY. DO NOT APPLY POWER.



Important

The ground connections of the 4-20 mA DC output connector are common.



Figure 7: Analog outputs

2.6 Binary Outputs

Two 24VDC PLC Controller outputs have been programmed as a Alarm and System Error - Figure 8. This means if any of the System Alarms occur (R22 or CO_2 level exceed threshold in any zone) the *Alarm* output will be set to 1 and if any of the System Errors occur the *Systemerror* output will be set to 1. Use one of the electrical knockouts to gain access to the interior of the Device. Then route the 20-24AWG cable sideways through the electrical handles and connect to the proper port.

2.6.1 End-line air input filters

In order to keep values in good condition it is strongly recommended to install filters on the end of each sample line. It can be done in two ways: by directly mounting filter on the line or by using pass-through connector (Figure 9).



Figure 8: Binary outputs and coil input



Figure 9: End-line filter

3 General Operation

3.1 Controller Overview

The main unit of the Multi-zone Gas Detector is the controller (Figure 10) with:

- 4 arrow keys,
- enter key,
- esc key,
- functional F1-F10 keys,
- special LT, LB, RT, RB keys,
- display.

Depending on the current screen each key can be used for different operation.



Figure 10: Controller

3.2 Power Up

When the Multi-zone Gas Detector is powered up, self-test will be performed and the main screen (Figure 11) will appear on display. The sensors heat up for the first 3 minutes (their value is set to -1).



Figure 11: Main Screen

3.3 Main Screen

The Main Screen shown on Figure 11 contains:

- 1. Current zone indicator located in left-top corner: Zone 1..12, Air.
- 2. Alarm indicator located in right-top corner. When this indicator blinks, alarm occurs.
- Current R22 value expressed in 1ppm unit value 100 means 100*1ppm=100ppm gas concentration. When the sensor is heating -1 value is set. Because of the sensor's zero offset, gas values under 2.5% of measuring range (25ppm) will be rounded to 0.
- 4. Current *CO*₂ value expressed in 0.01% unit value 100 means 100*0.01%=1.00% gas concentration. When the sensor is heating -1 value is set. Because of the sensor's zero offset gas values under 2.5% of measuring range (0.10%) will be rounded to 0.

3.4 Sensors Details Screens

When current screen is Main, after pressing LB key R22 Sensor Screen should appear (Figure 12).



Figure 12: R22 Sensor Screen

It contains:

- Scale full scale sensor value.
- Value current gas value (exactly the same as in the Main Screen).

- ErReg value of the internal sensor error register.
- Heat indicator, turned on during a heating of the sensor.
- Error indicator, turned on when the sensor reports an error.

Navigation to the other screens in this group is based on LT and RT keys. CO_2 Sensor Screen is next (Figure 13). It contains similar elements:



Figure 13: CO₂ Sensor Screen

- Scale full scale sensor value.
- Value current gas value (exactly the same as in the Main Screen).
- ErReg value of the internal sensor error register.
- Heat indicator, turned on during a heating of the sensor.
- Error indicator, turned on when the sensor reports an error.

The last one is Pressure Sensor Screen.



Figure 14: Pressure Sensor Screen

There are only 3 elements:

- Pr. Filter pressure measured on the filter. Indicates filter wear.
- Pr. Pump pressure measured on the pump input.
- Err indicator, turned on when the sensor reports an error.

3.5 Alarms

The alarms indicator is placed in top-right corner of the Main Screen. If the alarm occurs it will start blinking. After pressing RT key the Alarm screen will show up. Table 2 and Table 3 present all of the possible errors. They are divided into two groups:

- System malfunctions contain all of the critical system errors.
- System alarms occurring when gas level exceed alarm level.

Code	Description	Fixing	
	P22 concor indicator or commu	Check sensor connection and $ErReg$	
R22 Sensor Error	nication with sonsor is broken	value. Contact supplier for further in-	
	nication with sensor is broken.	formation.	
	CO. sonsor indicatos orror or com-	Check sensor connection and $ErReg$	
CO ₂ Sensor Error	munication with sensor is broken	value. Contact supplier for further in-	
	indification with sensor is broken.	formation.	
Prossure Sensor Error	Pressure sensor indicates error or	Check sensor connection	
	communication with sensor is broken.	Check Sensor Connection.	
Filter Pressure Error	Too high pressure on filter. Probably	Check filter and change it if neces-	
	high filter wear.	sary.	
Pump Prossure Error	Pump damaged or line broken	Check lines and pump. Contact sup-	
	i unp damaged of line bloken.	plier for further information.	
Valve Pressure Error	Too high pressure on valve.	Check the valve for proper operation.	

Table 2: System malfunction codes

Code	Description
R22 Alarm Zone XYZ	R22 gas level exceed alarm threshold in zone XYZ
CO_2 Alarm Zone XYZ	CO_2 gas level exceed alarm threshold in zone XYZ

Table 3: System alarm codes

4 Configuration

Configuration of the Multi-zone Gas Detector is divided into two groups. The first one allows operator for configuring general settings like: sampling time, length, R22 alarm level, CO_2 alarm level and current time. The second one is designed for sensors calibration and access to this menu requires a password.

4.1 General settings

General settings group can be accessed from Main Screen by pressing LT key. This group contain 14 screens - 12 zones, time and global settings. Navigating between these screens is done by using two buttons - LT for navigating to previous screen and RT for next screen. Esc key is responsible for backing to Main Screen. Figure 15 contain all types of the screens in this group.



Figure 15: Configuration screens

4.1.1 Zone configuration

There are 12 different zones. Each one of them can be separately configured. There are 4 different parameters to set:

- Len length of the sampling line to the measuring point.
- Time sampling time after which current zone changes to the next one.
- R22 Al R22 alarm threshold.
- CO_2 Al CO_2 alarm threshold.

<	Zone 1	\succ	Zone 2	> <	Zone 12	\geq
Len	### R22 A1	### Len	### R22 A1	### Len	### R22 A1	###
Time	### CO2 A1	### Time	### CO2 A1	### Time	### CO2 A1	###

Figure 16: Zone configuration

Changing these parameters is done in following sequence:

- 1. Use LT and RT keys for navigating to desired zone.
- 2. Use arrow keys to select proper parameter and press enter.
- 3. Type new value and press enter for accepting.

The Time value should be carefully set. Entering to low value will cause concentration underestimate problem.

4.1.2 Global parameters

The manufacturer has also designed screen (Figure 17) for changing parameters globally - for all zones at once. It is divided into two groups - binaries and values. Turned on binary allows to change the corresponding value.

<	Se	>			
Ġ1	Time	0	Time	•	###
			Pung	je	###
G1	R22A1	0	R22	A1	###
G1	C02A1	0	C02	A1	###

Figure 17: Global parameters

This screen contain:

- GI Time Global Sampling Time binary switchable by the F1 button. After turning on, all of the zones will have the same Sampling Time value (set by Time indicator).
- Purge purging time before switching to next zone.
- GI R22AI Global R22 Alarm Threshold binary switchable by the F3 button. After turning on, all of the zones will have the same R22 Alarm Threshold value (set by R22 Al indicator).
- GI CO2AI Global CO2 Alarm Threshold binary switchable by the F4 button. After turning on, all of the zones will have the same CO2 Alarm Threshold value (set by CO2 Al indicator).

Changing values is possible only when corresponding binary is turned on and is done in following order:

- 1. Use arrow keys to select proper parameter and press enter.
- 2. Type new value and press enter for accepting.

4.1.3 Time Configuration

Last but not least screen in this group is desired for configuring current time - Figure 18. To read the time use LB key. Current date and time values should appear in proper fields. To write new time:

1. Use arrows for navigating to Sec indicator and press enter.



Figure 18: Time

- 2. Type new seconds value and press enter.
- 3. Repeat 1-2 steps for minutes, hours, date, time and year.
- 4. Press RB key to write new time.

4.2 Sensors Calibration

Sensors Calibration screen (Figure 19) can be accessed from Main Screen by pressing RB key. Access to the next screens is allowed only after typing following password: 52255.



Figure 19: Calibration Screen

There are two main ideas of the calibration:

- 1. Setting Zero Value 0x2008 this value is required to know what is the value in internal sensor points at 0ppm.
- 2. Setting Kappa Value it is required to set proper span of the sensor.



Warning

Every calibration demands performing all of the following 4 sequences: R22 Zero Calibration, R22 Span Calibration, CO_2 Zero Calibration, CO_2 Span Calibration.



Warning

Span Calibration should always be done after Zero Calibration.

4.2.1 Applying gas

Every following procedure requires applying gas:

- 1. Using hand screw the flowmeter into the gas cylinder until you fill the resistance. The flowmeter is very fragile do not use any tools.
- 2. Disconnect Sample Input (Figure ?? and Figure 6).
- 3. Connect flowmeter output to the Sample Input.
- 4. Open the flowmeter until indicator (white ball) reaches the maximum.

After the end of the procedure close the flowmeter, disconnect it from Sample Input, connect proper tube and unscrew flowmeter from the gas cylinder.

4.2.2 R22 Zero Calibration

After pressing LT key R22 Zero Calibration screen (Figure 20) will appear.



Figure 20: R22 Zero Calibration

Zero calibration procedure is performed in following order:

- 1. Apply clean gas to the R22 Sensor.
- 2. Press LB key.
- 3. Wait until 0x2008 value will be equal to 0x1000.

4.2.3 R22 Span Calibration

After pressing LB key R22 Span Calibration screen (Figure 21) will appear.

R22 Span Calibration					
Gas	####	Act	к	####	
Val.	####	New	к	####	
<pre>Per for m </pre>					



Span calibration procedure is performed in following order:

- 1. Enter target gas value concentration (Gas indicator) in ppm units.
- 2. Apply target gas to the R22 Sensor.
- 3. Wait until Gas Value (Val. indicator) will stabilize.
- 4. If the New Kappa (New K ind.) differs more than 30% from Actual Kappa (Act K ind.) break the procedure and contact supplier.
- 5. Press LB key.
- 6. Wait until Actual Kappa value will be equal to New Kappa.

4.2.4 CO2 Zero Calibration

After pressing RT key CO_2 Zero Calibration screen (Figure 22) will appear.



Figure 22: CO₂ Zero Calibration

Zero calibration procedure is performed in following order:

- 1. Apply clean gas to the CO2 Sensor.
- 2. Press LB key.
- 3. Wait until 0x2008 value will be equal to 0x1000.

4.2.5 CO2 Span Calibration

After pressing RB key CO_2 Span Calibration screen (Figure 23) will appear.



Figure 23: CO₂ Span Calibration

Span calibration procedure is performed in following order:

- 1. Enter target gas value concentration (Gas indicator) in 0.01% units.
- 2. Apply target gas to the CO2 Sensor.
- 3. Wait until Gas Value (Val. indicator) will stabilize.
- 4. If the New Kappa (New K ind.) differs more than 30% from Actual Kappa (Act K ind.) break the procedure and contact supplier.
- 5. Press LB key.
- 6. Wait until Actual Kappa value will be equal to New Kappa.

5 Maintenance



Warning

Shock hazard! Always disconnect AC power before opening the enclosure of the monitor.



Warning

The AC power ground wire must first be connected to the system's ground stud. Under no circumstances should this system be operated without a protective ground. Doing so poses a potential shock hazard, and is a violation of electrical safety standards applicable to this type of equipment.



Warning

Electrical installation should be performed by a certified electrician, and must comply with all applicable NEC/CEC and local electrical safety codes.



Warning

Do not use parts that are not certified by JBK Company.



Important

The Multi-zone Gas Detector contains sensitive electronic components that can be easily damaged. Do not touch nor disturb any components. Do not dislodge electrical wiring or pneumatic tubing.

5.1 Filter Changing

Filter should be changed every six months at least.

To change the filter, unplug two tubes, remove old filter, replace it with new one and finally plug the tubes back with the same order.



Warning

Shock hazard! Always disconnect AC power before changing the filter.

5.2 Sensors Calibration

Sensors calibration should be performed after every changing the filter or more frequently if local law regulations demand it. The procedure of calibration has been described in Configuration Section.

5.3 Fuses Changing

The Multi-zone Gas Detector uses 5x20 type fuses. The first two are located on the bottom of the IEC 230VAC connector. They can be changed from the outside of the Device by prying with a screwdriver the small black flap (Figure 24). Use only 1A/250VAC certified fuses.



Figure 24: IEC Connector

Another 5 fuses are located in the PCB Board (Figure 25):

- F1 100mA,
- F2 500mA,
- F3 1A,
- F4 500mA,
- F5 500mA,



F1 F3

Figure 25: Fuses on PCB Board

5.4 Part List

Part Name	P/N	Description		
Hydrophobic Filter	0102-1118	The hydrophobic filter prevents water from entering to sensors.		
Fuses	0103-1118	The Multi-zone Gas Detector uses 5x20 type fuses. Lo cate fuses holders, check for continuity and replace as required.		
R-22 Gas Cylinder, 1000 PPM	0104-1118	The gas used for the calibration.		
CO2 Gas Cylinder, 4%	0105-1118	The gas used for the calibration.		
Flowmeter	0106-1118	The flowmeter keeps the constant flow from Gas Cylin- der.		
Controller	0107-1118	The controller integrates all of the peripherals and display a data.		
R22 Sensor	0108-1118	The sensor responsible for measuring gas value.		
CO ₂ Sensor	0109-1118	The sensor responsible for measuring gas value.		
Sensors case	0110-1118	The case responsible for holding the sensors in prope position.		
PCB Board	0111-1118	The PCB Board mainly contains pressure sensors, fuses and connections between peripherals.		
Pump	0112-1118	The sample pump draws the gas sample into the system through the sensors and discharges the sample via the exhaust port.		
Power Supply	0113-1118	The Power Supply supplies the PCB Board with 24V.		
AC Power Socket	0114-1118	AC Power Socket		
Cable Gland	0115-1118	Cable Gland		
Pneumatic Gland	0116-1118	Pneumatic Gland		
T-type Pneumatic Joint	0117-1118	T-type Pneumatic Joint		
Y-type Pneumatic Joint	0118-1118	Y-type Pneumatic Joint		
End-line filter	JBK-F-6/8-5	End-line air input filter		
Solenoid valve	0102-0720	Solenoid valve for taking smaple		
Solenoid valves driver	0103-0720	Electronic valves driver		

Table 4: Replacement Part and Additional Accessories List