Belimo
Gas Monitors

Operating Manual

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1.0 General description

Safety Note

This operating manual provides all of the required information to properly install, operate, and maintain a Belimo gas monitoring system. Installation, operation, and maintenance not in accordance with this manual can result in a hazardous situation or harm. Please read and understand this document before installing and servicing your own system.

General Description

Closely monitoring the quality of air that we breathe improves our well-being. It keeps us safe and comfortable, and saves us energy and money, by allowing for on demand ventilation as opposed to continuous or scheduled ventilation.

All Belimo gas monitors are factory calibrated and can monitor up to two different gases simultaneously. All monitors feature internal horn and strobe alarms, and CAN bus communication that allows for standalone operation. Select models provide direct control through analog outputs and relays, and integration into a building management system (BMS) through BACnet MS/TP. All monitors are wired daisy chain, allowing up to 32 devices per chain, and can be easily assigned to groups on-site to zone ventilation on the same network. Optional accessories include communication modules, relay units, sensor modules, calibration kits, external horn and strobe alarms, transformers, duct and splash proof enclosures, high low kits, and security screws. All Belimo branded gas monitoring products come with a five-year warranty and all sensor modules come with a one-year warranty.

1.1 Warnings

WARNING: DO NOT PAINT THE MONITOR

- Belimo gas monitors are used to monitor the air quality or for gas leaks, where under normal conditions the targeted gases are not present in high concentrations in the space.
- All devices must be powered down during installation and maintenance.
- Belimo gas monitors wmust be installed, operated, and maintained by trained personnel in accordance with local codes. It is their responsibility to provide a safe and functional system.
- Installers must take caution for electrostatic discharge (ESD) during installation, service, and replacement of sensor modules.
- Install devices in locations that are easily serviceable, safely accessible, and protected from physical damage from cars, forklifts, equipment, etc.
- To prevent electrical interference, keep all devices and wiring away from mercury vapor lights, variable speed drives, and radio repeaters.
- To prevent mechanical interference, keep all devices and wiring away from electrical shock, continuous mechanical shock, and vibration.
- Substances to avoid include silicon vapor, paint fumes, and solvents, which can destroy or affect the gas monitor's performance.
- Do not paint any gas monitors or accessories.
- Protect gas monitors from continuous exposure to water by using a splash proof enclosure.
- When using methane, propane, or hydrogen gas monitors, it is **REQUIRED** to have more than one gas monitor installed in each room.
- When using methane, propane, or hydrogen gas monitors, it is **REQUIRED** to annually replace the sensor modules.
- For all applications it is recommended to have more than one gas monitor installed to limit the chance of failures.
- All gas monitors require a warm up time to operate and sense gas normally (See section 3.4).
- Belimo gas monitors are **REQUIRED** to be calibrated annually or more frequently as specified. Upon calibration, it is highly recommended to verify proper operation of the gas monitoring system.
- Annual sensor module replacement is **REQUIRED** when using catalytic technology to monitor for methane, propane, and hydrogen.
- Belimo gas monitors are designed for use in stationary systems and must not be used outside the specified field of application. Unauthorized modifications are prohibited. The product must not be used in relation with any equipment that in case of a failure may threaten humans, animals or assets.
- Intended applications include residential, light commercial, and light industrial. Non intended applications include heavy commercial, heavy industrial, or hazardous locations.
- Belimo gas monitors contain electrical and electronic components and must not be disposed of as household refuse. All locally valid regulations and requirements must be observed.

1.2 Applications

- **Residential Applications**
  - Apartment buildings
  - Condominium buildings
  - Private homes
- **Light Commercial Applications**
  - Data centers
  - Hotels
  - Medical facilities
  - Office buildings
  - Restaurants
  - Retail
  - Service centers
  - Warehouses
- **Light Industrial Applications**
  - Food processing plants
  - Textile plants
  - Vehicle and machinery facilities
  - Warehouses
- **Vehicle Emissions (CO, NO_2)**
  - Ambulance bays
  - Automotive maintenance facilities
  - Boiler rooms
  - Enclosed parking garages
  - Fire stations
  - Loading docks
  - Truck maintenance facilities
  - Warehouses
- **Indoor Air Quality (CO_2)**
  - 0...2000 ppm
    - Classrooms
    - Conference rooms
    - Warehouses
  - 0...5000 / 10000 ppm
    - Breweries
    - Compressor rooms
    - Greenhouses
    - Indoor grow farms
    - Mechanical rooms
    - Medical gas storage
- **Combustible and Toxic Gases (NH_3, CH_4, C_3H_8, H_2, H_2S, CL_2, O_2 Leak, O_2 Depletion)**
  - Cold storage (NH_3)
  - Compressor rooms (NH_3)
  - Food processing plants (NH_3)
  - Ice rinks (NH_3)
  - Mechanical rooms (NH_3)
  - Landfills (NH_3, H_2S, CH_4)
  - Recycle centers (NH_3, H_2S)
  - Water and wastewater treatment plants (NH_3, H_2S, CL_2)
  - Boiler rooms (CH_4)
  - Natural gas leaks (CH_4)
  - Commercial kitchens (CH_4, C_3H_8)
  - Laboratories (C_3H_8, O_2 Leak, O_2 Dep.)
  - Warehouses (C_3H_8, H_2)
  - Loaded lead acid battery charging stations (H_2)
  - Swimming pool mechanical rooms (CL_2)
  - Medical gas storage (O_2 Leak, O_2 Dep.)
  - Welding facilities (O_2 leak, O_2 Dep.)
- **Refrigerant Gas Leak Detection (Broadband Infrared)**
  - Compressor rooms
  - Grocery stores
  - Mechanical rooms

1.3 Features

- Monitors up to two different gases in each device
- Stand alone operation through CAN bus
- Integration into a BMS through BACnet MS/TP
- Three adjustable alarm levels
- Optional latching relays
- Configurable analog outputs
- Internal horn and strobe alarm
- Factory calibrated and field replaceable sensor modules
- Display and a four-button keypad interface
- Binary input for external switch or input (turn on fan or open damper)
- Programmable to meet customer's sequence of operations
- BACnet Testing Laboratories (BTL) listed smart sensor

1.4 Specifications

- Supply voltage:
  - 24 V AC, 50/60 Hz, 0.21 A, 5 VA
  - 24 V DC, 0.07 A, 3 W
  - Use a Class 2 Power Supply
  - Overvoltage Category II (OVC II)
- Operating temperature range:
  - -4ºF...+122ºF [-20ºC...+50ºC]: CO, NO_2, CO_2 (0...5000 / 10000 ppm), NH_3, H_2S, CL_2, O_2 Leak, O_2 Depletion
  - 14ºF...+122ºF [-10ºC...+40ºC]: CH_4, C_3H_8, H_2
  - 32ºF...+122ºF [0ºC...+40ºC]: CO_2 (0...2000 ppm)
- Operating humidity range:
  - 15...90% RH continuous, 0...99% RH intermittent, non-condensing
- Operating altitude range:
  - Calibration verification is recommended above 2000 ft [610 m]
  - Maximum altitude 6560 ft [2000 m]
- Relays:
  - SPDT, 5A @ 125 V AC / 4A @ 24 V DC, non-inductive
  - x1 relay available on all -A models
  - x2 relays available on all -B models
  - x4 relays available on all relay units
- Analog outputs:
  - 4...20 mA or 2...10 V, user selectable
  - x2 analog outputs available on all -A models.
- Agency listings:
  - Certified by CSA according to C22.2. No. 61010-1
  - Certified to UL according to UL 2075 and ULC-S588 for the following models: 22G02-5A, 22G02-5B, 22G02-5C, 22G14-5A, 22G14-5B, 22G14-5C, 22G0214-5A, 22G0214-5B, 22G0214-5C

- Housings:
  - Flame resistant polycarbonate ABS plastic enclosure
  - UL94 5 VA
  - NEMA 2 / IP44
  - IP 20 (EXT-OP-6021-C)
  - For indoor use
  - Pollution degree 2

1.5 User Interface

- Display shows gas types, gas concentrations, and alarm level status of the individual monitor, or of all monitors on the CAN bus network
- Over 80 different programmable settings
- 4 button keypad for programming and calibration
- Optional password protection
- Red LED alarm level indicators for alarm level 1 and 2
- High intensity white LED strobe and horn alarm (80 dB @ 1 meter) for alarm level 3

2.0 Model selection guide

Gas Monitors

22	G	..	-5	..
Power 22 = Active	**Gas Monitoring**	**Measured Values** 02 = Carbon Monoxide (CO) 0214 = Carbon Monoxide (CO) and Nitrogen Dioxide (NO_2) 03 = Carbon Monoxide Null Hydrogen (CO Null H_2) 04 = Ammonia (NH_3) 05 = Methane (CH_4) 06 = Propane (C_3H_8) 08 = Hydrogen (H_2) 14 = Nitrogen Dioxide (NO_2) 16 = Hydrogen Sulfide (H_2S) 17 = Chlorine (CL_2) 21 = Refrigerant (R11, R22, R23, R32, R125, *R134A, R404A, R407A, R407C, R407F, R410A, R448A, R449A, R452A, R455A, R507, R513A, R1233zd, R1234yf, R1234ze) 22 = Oxygen (O_2) Leak 23 = Oxygen (O_2) Depletion	**Region** -5 = Americas	**Signal Type** A = CAN bus, BACnet MS/TP, 1 Relay, 2 Analog Outputs B = CAN bus, BACnet MS/TP, 2 Relays C = CAN bus

Sensor Modules

22	G	..
Power 22 = Active	**Gas Monitoring**	**Measured Values** 02 = Carbon Monoxide (CO) 0214 = Carbon Monoxide (CO) and Nitrogen Dioxide (NO_2) 03 = Carbon Monoxide Null Hydrogen (CO Null H_2) 04 = Ammonia (NH_3) 05 = Methane (CH_4) 06 = Propane (C_3H_8) 08 = Hydrogen (H_2) 14 = Nitrogen Dioxide (NO_2) 16 = Hydrogen Sulfide (H_2S) 17 = Chlorine (CL_2) 22 = Oxygen (O_2) Leak 23 = Oxygen (O_2) Depletion

APPLICATION	GAS TYPE	ABBREVIATION	GAS TYPE IDENTIFICATION NUMBER	MEASURING RANGE
Vehicle Emissions	Carbon Monoxide	CO	02	0...250 ppm
		CO Null H_2	03	0...250 ppm
	Nitrogen Dioxide	NO_2	14	0...10 ppm
Indoor Air Quality	Carbon Dioxide	CO_2	15-003	0...2000 ppm
			15-005	0...5000 ppm
			15-006	0...10000 ppm
Combustible and Toxic Gases	Ammonia	NH_3	04	0...250 ppm
	Methane	CH_4	05	0...50% LEL
	Propane	C_3H_8	06	0...50% LEL
	Hydrogen	H_2	08	0...50% LEL
	Hydrogen Sulfide	H_2S	16	0...50 ppm
	Chlorine	CL_2	17	0...10 ppm
	Oxygen Leak	O_2 Leak	22	0...50% O_2
	Oxygen Depletion	O_2 Depletion	23	0...50% O_2
	Argon	Ar (O_2 Depletion)	23	0...50% O_2
	Helium	He (O_2 Depletion)	23	0...50% O_2
	Nitrogen	N_2 (O_2 Depletion)	23	0...50% O_2
Refrigerant Gas Leak Detection	Infrared Broadband Refrigerant	IR Ref.	21	0...2000 ppm
	R11, R22, R23, R32, R125, *R134A, R404A, R407A, R407C, R407F, R410A, R448A, R449A, R452A, R455A, R507, R513A, R1233zd, R1234yf, R1234ze			
	*Default			

Communication Modules

C	-22	G	-5	..
Communication	**Power** 22 = Active	**Gas Monitoring**	**Region** -5 = Americas	**Signal Type** A = CAN bus, BACnet MS/TP, 1 Relay, 2 Analog Outputs B = CAN bus, BACnet MS/TP, 2 Relays C = CAN bus

Relay Units

C	-22	G	-5	0
	Power 22 = Active	**Gas Monitoring**	**Region** -5 = Americas	**Signal Type** 0 = 4 Relays

Miscellaneous Accessories

A	-22	G	-A	..
Accessory	**Power** 22 = Active	**Gas Monitoring**		**Accessory Type** 08 = Calibration Kit (Infrared Refrigerant) 12 = Splash Proof Enclosure 13 = Duct Mount Enclosure 14 = High Low Kit 15 = External Strobe Alarm 22 = Calibration Kit 23 = Calibration Cap and Tube Replacement 24 = Security Screw Kit 50 = Transformer 50 VA 100 = Transformer 100 VA

3.0 Installation

3.1 Placement

All Belimo gas monitors have a coverage area and a recommended mounting height. Please see below for more details.

Coverage area
The coverage area is based on how long the target gas diffuses from its source and reaches the gas monitor. The coverage area is limited by any obstruction to the monitor. This includes walls, stairs, elevators, shelving with solid fill, tool chests, etc. The gas monitor must "see" the area of coverage; if not the coverage area is reduced and additional gas monitors are required. When placing gas monitors, avoid drafts, obstacles, aerosols, and silicones and place them in the center of their area of coverage as much as possible.

- For **air quality** monitoring (where the location of the target gas changes) the maximum radius of coverage is 50 feet (15 meters), and the maximum area of coverage is 7800 square feet (700 square meters).
- For **leak detection** monitoring (where the location of the potential leak is known), it is best practice to place the gas monitor as close to the leak as possible. The maximum radius of coverage is 30 feet (10 meters), and the maximum area of coverage is 2800 square feet (300 square meters).

Mounting height
The recommended mounting height is based on the density of the target gas relative to air.

- For gases with a **lighter density to air:**
  Ammonia (NH_3), Methane (natural gas, CH_4), Hydrogen (H_2):
  Install at 1 to 3 feet (0.3 to 0.9 meters) from the ceiling
- For gases with a **similar density to air:**
  Carbon monoxide (CO), Carbon dioxide (CO_2), Oxygen leak (O_2 leak), Oxygen depletion (O_2 dep.):
  Install at 3 to 7 feet (1 to 2 meters) from the floor.

  Nitrogen dioxide (NO_2): If diesel exhaust is **under** vehicles, or if the ceiling height is 15 feet or less, install at 3 to 7 feet (1 to 2 meters) from the floor.
  Nitrogen dioxide (NO_2): If diesel exhaust is **above** vehicles, or if the ceiling height is above 15 feet, install at half the ceiling height and above the vehicles.
- For gases with a **heavier density to air:**
  Propane (C_3H_8), Hydrogen sulfide (H_2S), Chlorine (CL2), Refrigerants:
  Install at 1 to 2 feet (0.3 to 0.5 meters) from the floor.

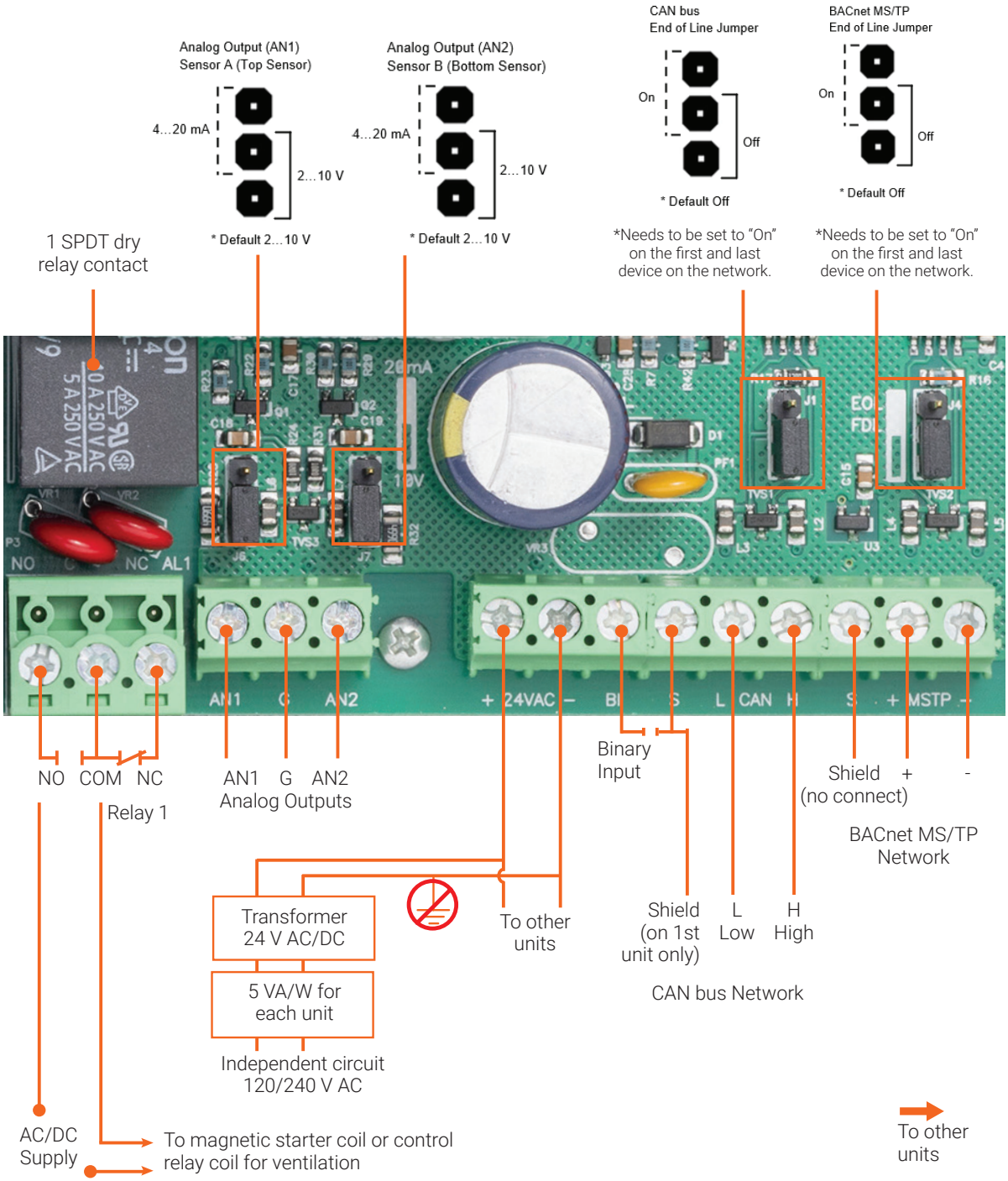
Use size #6 (3mm) or #8 (4mm) screws for mounting.

Installation on round columns
Please follow coverage area and mounting height recommendations above. To install gas monitors on round columns, use the plastic yellow feet provided with the gas monitor for stability on non flat surfaces. The plastic yellow feet are not required if installed on a flat surface. Use size #6 (3mm) or #8 (4mm) screws for mounting.

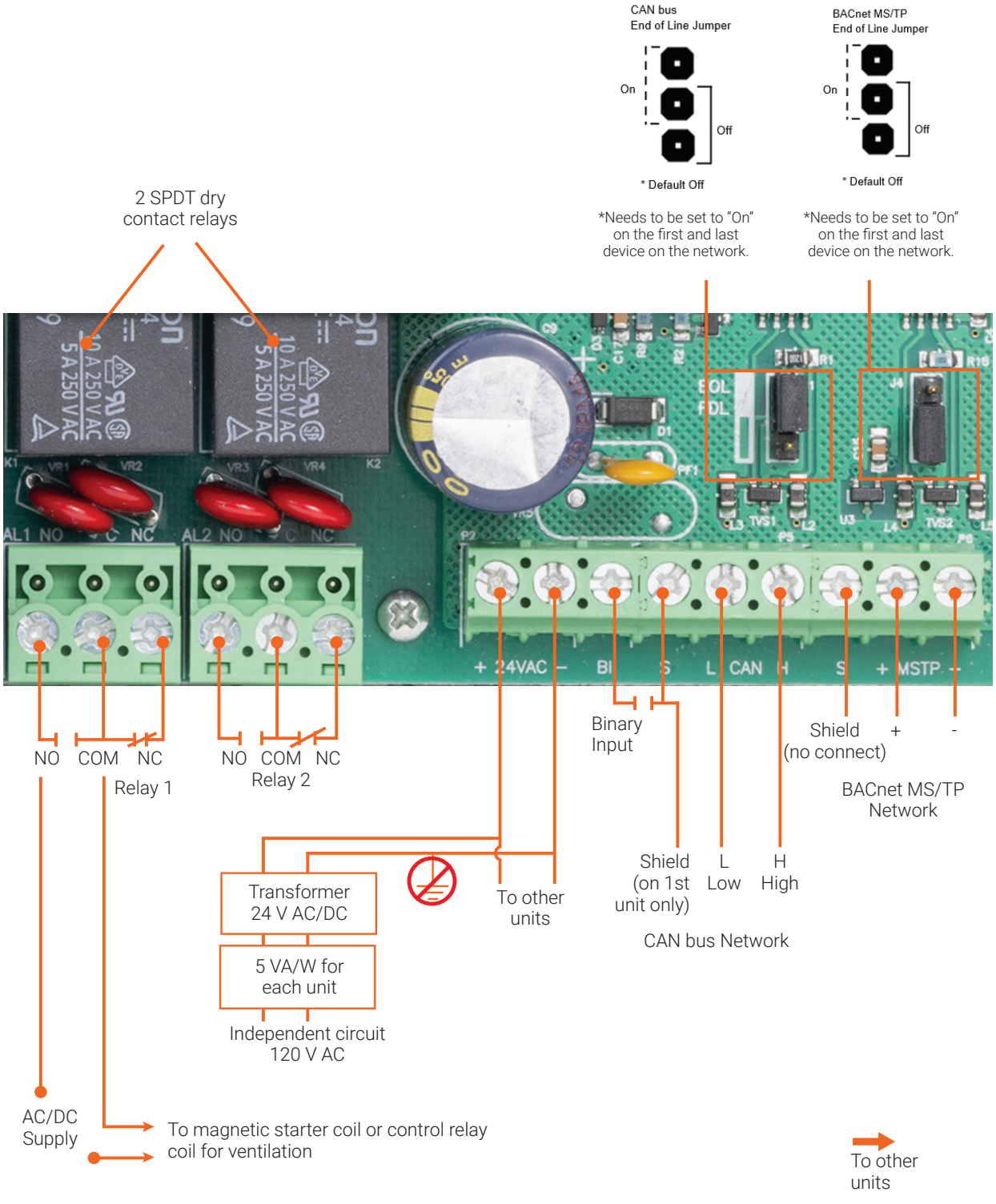
3.2 Wiring

Use 18...20 AWG (2.5...0.5 mm2) single pair stranded copper cable for power.
Use 22...24 AWG (0.34...0.25 mm@) 1.5 twisted pair, shielded jacketed, low capacitance stranded cable for communication.

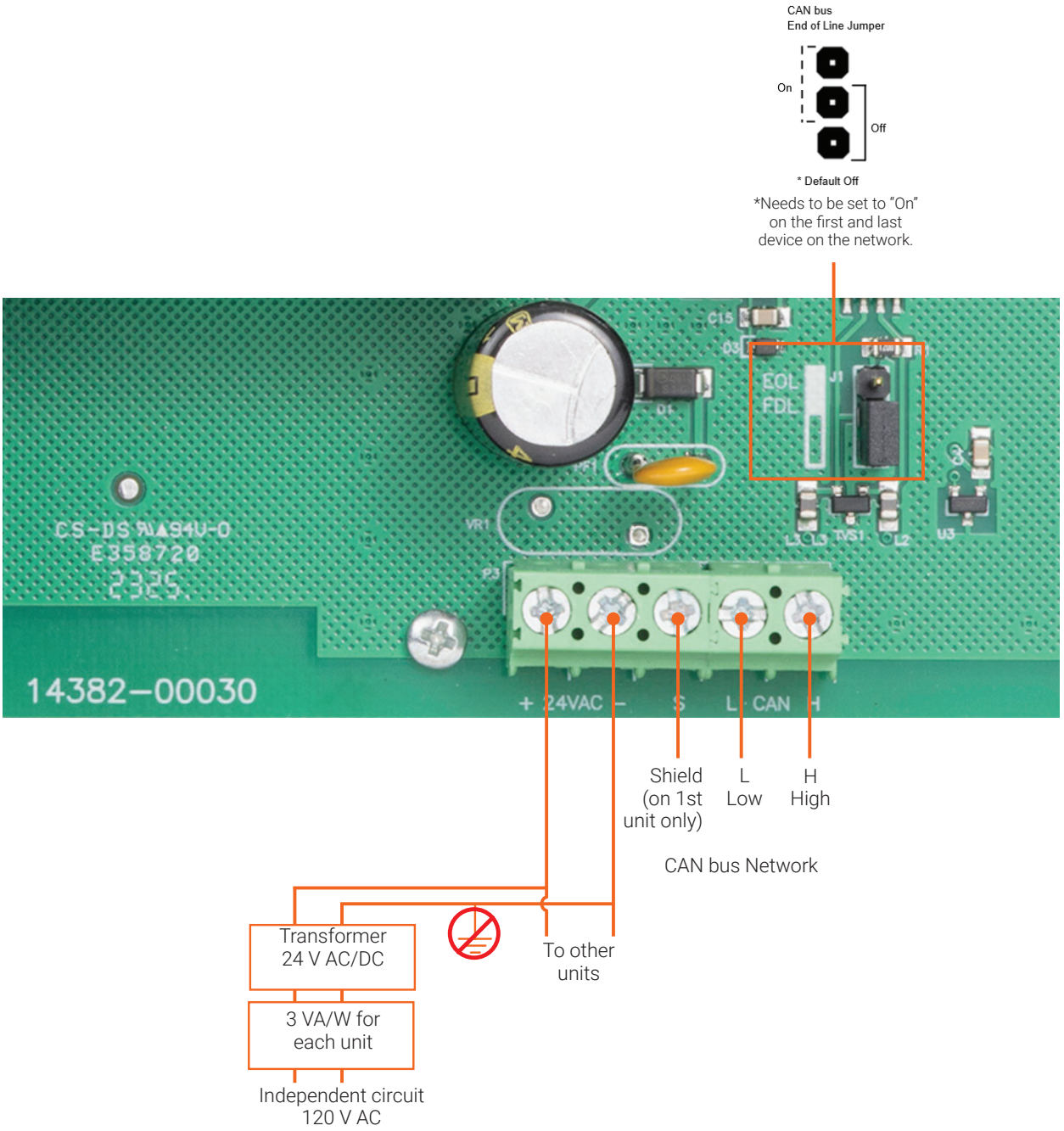
3.2.1 Wiring Diagram -A Model (22Gxx-5A / C-22G-5A)



3.2.2 Wiring Diagram -B Model (22Gxx-5B / C-22G-5B)



3.2.3 Wiring Diagram -C Model (22Gxx-5C / C-22G-5C)



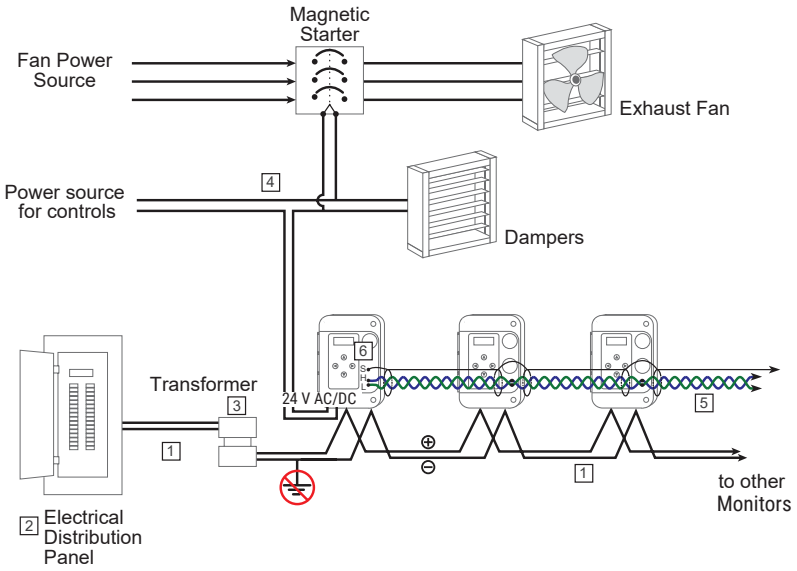
3.3 Check List

Important
All wiring must conform to local building codes, regulations and laws. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

1. Use ½ inch EMT conduit for all wiring.
2. A switch or circuit breaker must be included in the installation. It must be suitably located and easily reached in a secure location and identified as the disconnect for the "Gas Monitoring System".
3. All Belimo gas monitors are powered by 24 V AC/DC. When using AC power, install an enclosed 120 to 24 VAC or 240 to 24 VAC transformer. When using DC power install a 24 VDC power supply. Consider 5 VA or 3 W for each gas monitor, communication module, and relay unit when sizing the transformer or power supply. Use 18...20 AWG (0.75...0.5 mm²) wire for power. Do not tie the secondary of the transformer to the ground. Connect multiple devices to one transformer. Ensure that the polarity of the power connections is the same at each device, otherwise, communication and/or power will not function.
4. Connect relay contacts (usually relay 1) to ventilation system. Use a magnetic starter so that the gas monitor, communication module, or relay unit contacts energize the starter coil and not the fan motor directly. Relay contacts are rated at 5 amps @ 125 VAC non-inductive, and 4A @ 24 VDC non-inductive. When using the gas monitor relays to control external equipment that requires a greater load than 5 amps, an external relay with a higher current rating is required. Please consult Belimo for more information.
5. Use 22...24 AWG (0.34...0.25 mm²) twisted pair, low capacitance, shielded wire for all communications (CAN bus and BACnet MS/TP). To wire CAN bus, connect the communications wire from screw "L" and "H" on one device to the next, and continue the daisy chain to the last device. To wire BACnet MS/TP, connect communications wire from screw "+" and "-" on one device to the next, and continue the daisy chain to the last device. Maintain the same CAN bus and BACnet MS/TP polarity on each device. Do not use star, T, or H junctions, only a continuous daisy chain. Make all daisy chain connections at the devices. Connect the CAN bus and BACnet MS/TP shield to the "S" screw on the first device only and join the shields together at each additional device after the first, but do not physically connect it to the "S" screw of any other device.
6. When using CAN bus or BACnet MS/TP, move the end-of-line jumper to the on position (top two pins) on the first and last devices on the CAN bus and BACnet MS/TP network only. Any gas monitor, communication module, or relay unit can be located anywhere on the daisy chain. Ensure all device's end-of-line jumpers are off (bottom two pins) if they are in the middle of the chain. Device CAN bus and BACnet addresses can be in any location on the daisy chain.
7. Power on the units. They will display the gas types, gas concentrations, and alarm level statuses. First, set the CAN bus address on each gas monitor or communication module on the CAN bus network (by default they are all set to 0). To do this, press and hold → until you reach programmable setting 39 (Adr). Press ↑ to change the CAN bus address from 0 to any value between 0 and 31. (The daisy chain allows for up to 32 devices including 0 to 31. Press ↑ and ← at the same time to save, the screen will show "OK" if it was saved correctly. (Double check to make sure it was saved correctly). Press and hold ← for a few seconds to return to the home screen.

   To verify if the devices are communicating correctly, change programmable setting 56 (Net) on any one device. To do this, press and hold → until you reach programmable setting 56. Press ↑ to change the value from 0 to 1 to turn on the network display. Press ↑ and ← at the same time to save, the screen will show "OK" if it was saved correctly. (Double check to make sure it was saved correctly). Press and hold ← for a few seconds to return to the home screen. The device will now display all devices connected on CAN bus in order of their CAN address in a continuous repeating cycle. If the unit does not display all the devices on the network, go to the non-displayed/missing gas monitors and check the following:
   - each device must have a unique CAN bus address per programmable setting 39 (Adr), with no duplicates
   - end-of-line jumpers must be set to the on position (top two pins) on the devices at the beginning and end of the daisy chain only. (Do NOT set the end of line jumpers per floor or zone, but rather only set them where the entire daisy chain starts and ends.
   - polarity of both the communication cable and the power cable is the same on all devices.
   - verify wire connections for shorts, loose wires, correct polarity, etc.

8. To further test communication, press and hold the up button on any monitor for at least 5 seconds to start manual mode (default 5 minutes). This will close the relay 1 on that unit and all of the other units on the network.
   See section 5 to set up a configuration for multiple zones.



9. To test if any external devices are correctly connected to the gas monitor relays, press and hold ↑ on any monitor for at least 5 seconds to start manual mode (by default it will turn off in 5 minutes, but can be changed to turn off between 5 to 60 minutes by pressing the up and down arrows). Doing this will manually activate alarm level 1 and relay 1 on that unit and all of the other units on the on the same zone on the CAN bus network. Alarm level 2 and relay 2 and alarm level 3 can also be activated by holding ↑ and changing programmable setting 69 (Man) from 1 to 2 or 3.

3.4 Warm-up Time

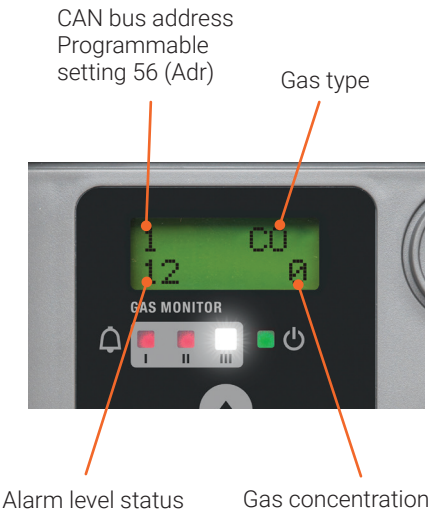
All Belimo gas monitors require a warm up time for the sensor modules to fully stabilize.

GAS TYPE IDENTIFICATION NUMBER	DESCRIPTION	WARM UP TIME
02 03 04 14 16 17	Carbon Monoxide (CO) Carbon Monoxide Null H_2 Ammonia (NH_3) Nitrogen Dioxide (NO_2) Hydrogen Sulfide (H_2S) Chlorine (CL_2)	5 minutes
15-003 15-005 15-006	Carbon dioxide (CO_2), 0...2000 ppm Carbon dioxide (CO_2), 0...5000 ppm Carbon dioxide (CO_2), 0...10000 ppm	10 minutes
21	Infrared Broadband Refrigerant	1 hour
05 06 08	Methane / Natural Gas (CH_4) Propane (C_3H_8) Hydrogen (H_2)	24 hours
22 23	Oxygen Leak (O_2) Oxygen Depletion (O_2)	48 hours

4.0 Operation

4.1 Display

The display shows the gas type, concentration, and alarm level status. If the gas monitor is monitoring for two gases, the display will alternate between the two showing their gas types and gas concentrations.



Any value from 0 to 31 (top left corner) indicates the gas monitor CAN bus address. This setting is deactivated by default but can be activated by setting programmable setting 56 (Net) to 1. This is a great CAN bus troubleshooting tool.

1 (bottom left corner) indicates that alarm level one has been reached and activated. Alarm level one will always activate relay 1 (on -A and -B models). The alarm level one parameter is configurable per programmable settings 0, 1, 2, 9, 10, 11 for sensor A (top sensor) and 18, 19, 20, 27, 28, 29 for sensor B (bottom sensor). It can also be activated by other gas monitors on the CAN bus network per programmable settings 36.

2 (bottom left corner) indicates that alarm level two has been reached and activated. Alarm level two will always activate relay 2 (on -B models). The alarm level two parameter is configurable per programmable settings 3, 4, 5, 12, 13, 14 for sensor A (top sensor) and 21, 22, 23, 30, 31 for sensor B (bottom sensor). It can also be activated by other gas monitors on the CAN bus network per programmable setting 37.

3 (bottom left corner) indicates that alarm level three has been reached and activated. Alarm level 3 will activate the horn and strobe alarm (unless they are deactivated per programmable setting 45). The alarm level three parameter is configurable per programmable settings 6, 7, 8, 15, 16, 17 for sensor A (top sensor) and 24, 25, 26, 33, 34, 35 for sensor B (bottom sensor). It can also be activated by other gas monitors on the CAN bus network per programmable setting 38.

M (bottom left corner) indicates that manual override is on. It provides the ability to test the ventilation system and manually bring in fresh air. To activate the manual override, go to the home screen and press and hold ↑ for at least 5 seconds to start. To adjust the time interval when the manual override automatically turns off, click ↑ again to increase the time between 5 to 60 minutes. The alarm level 1 will activate (or alarm level 2 or 3 per programmable setting 69) and send transmit messages (programmable settings 9-17 for sensor A and 27-35 for sensor B) to other devices on the CAN bus network. The gas monitor will return to normal operation after the time runs down. To cancel the manual override, press ↓ several times to reduce the time left to run, or from the home screen press ↓ several times until the manual override turns off. M also is displayed when the auto cycle timer is on (to have scheduled ventilation or air purges); refer to programmable setting 73.

T indicates that alarm one is on due to high ambient temperature reading (programmable setting 51) or low ambient temperature reading (programmable setting 55). This feature is mostly used during the summer for ventilation to protect the space from overheating. Please note that all gas monitors and communication modules have an internal temperature sensor. If turned on, the home screen will alternate between showing the gas type, gas concentration, alarm level status, and the temperature. To turn the internal temperature sensor on, press → until you reach programmable setting 44. Press ↑ to change the value from 0 to 1. Press ↑ and ← simultaneously to save. By default, the units are in °C. To change the internal temperature sensor from the Celsius to Fahrenheit, go to programmable setting 72 (°C/°F) and change the value from 0 to 1. Press ↑ and ← at the same time to save. Press and hold ← for a few seconds to return to the home screen. Please read section 4.6 before using the internal temperature sensor that is available on all gas monitors and communication modules.

4.2 Firmware

To view the firmware of a gas monitor or communication module at any time, press ← and ↓ at the same time. The firmware will appear on the display. Please note that all firmware versions are compatible with one another.

4.3 Default Alarm Levels

Alarm level setpoints are factory set with default values, but should be set to suit local regulations.

APPLICATION	GAS TYPE	GAS TYPE IDENTIFICATION NUMBER	MEASURING RANGE	ALARM LEVEL 1 (DEFAULT)	ALARM LEVEL 2 (DEFAULT)	ALARM LEVEL 3 (DEFAULT)
Vehicle Emissions	Carbon Monoxide (CO)	02	0...250 ppm	25 ppm	35 ppm	75 ppm
	Carbon Monoxide (CO Null H_2)	03	0...250 ppm	25 ppm	35 ppm	75 ppm
	Nitrogen Dioxide (NO_2)	14	0...10 ppm	0.5 ppm	1.0 ppm	2.0 ppm
Indoor Air Quality	Carbon Dioxide (CO_2)	15-xx3	0...2000 ppm	800 ppm	1200 ppm	1500 ppm
	Carbon Dioxide (CO_2)	15-xx5	0...5000 ppm	2000 ppm	3000 ppm	4000 ppm
	Carbon Dioxide (CO_2)	15-xx6	0...10000 ppm	2000 ppm	3000 ppm	4000 ppm
Combustible and Toxic Gases	Ammonia (NH_3)	04	0...250 ppm	25 ppm	50 ppm	100 ppm
	Methane (CH_4)	05	0...50% LEL	10% LEL	15% LEL	20% LEL
	Propane (C_3H_8)	06	0...50% LEL	10% LEL	15% LEL	20% LEL
	Hydrogen (H_2)	08	0...50% LEL	10% LEL	15% LEL	20% LEL
	Hydrogen Sulfide (H_2S)	16	0...50 ppm	2.5 ppm	3.5 ppm	7.5 ppm
	Chlorine (CL_2)	17	0...10 ppm	0.5 ppm	1.0 ppm	2.0 ppm
	Oxygen Leak (O_2 Leak)	22	0...50% O_2	24% O_2	27% O_2	30% O_2
	Oxygen Depletion (O_2 Depletion)	23	0...50% O_2	18% O_2	17% O_2	16% O_2
Refrigerant Gas Leak Detection	Infrared Broadband Refrigerant (IR)	21	0...2000 ppm	250 ppm	350 ppm	750 ppm

per UL 2075 and ULC-S588 the alarm levels for CO shall not exceed 200 ppm.

4.4 Password Protection

All Belimo gas monitors and communication modules can be password protected with a six-keystroke password. This locks the keypad and programmable settings to protect them from being tampered with. The default password is ↑↓↑↓↑↓. To create a unique six keystroke password, please follow the steps below.

1. Press → to enter settings.
2. Press and hold → until you reach setting MO PASS?
   *This is the last setting, and it does not have a number.
3. Press ↑ to enter a new password.
4. Enter any six-keystroke password using the ↑ ↓ ← → buttons.
5. Re-enter the six keystroke password using the ↑ ↓ ← → buttons.
6. Hold ← for five seconds to return to the home screen.
7. Press and hold → until you reach setting 49 (Keyboard Lock).
8. Press ↑ to change the value from 0 to 1.
9. Press ↑ and ← at the same time to save.
   *If saved correctly the word "OK" will appear on the LCD. If you do not see "OK" and the new value on the LCD, it is because the buttons were not pressed at the same time. Please try again.
10. Hold ← for five seconds to return to the home screen. You should now be locked out.
    If it worked correctly you will hear two clicks every time a button is pressed. Input your password to access the programmable settings.
    *If you enter your password and it does not work the first time, wait five seconds and try again slower. For lost or forgotten passwords please contact Belimo.

4.5 Changing Settings

Press → and ← to move through the programmable settings. If the keypad lock is on, enter the six-keystroke password first. The screen will display the setting number, a short description of the setting (e.g. AL1 for alarm level 1 set point) and the current value. For detailed descriptions of all programmable settings please see section 4.5. To change the programmable settings, press the ↑ or ↓ buttons to increase or decrease the value.

To save, press ↑ and ← at the same time. The word "OK" will appear. To if the changed value was properly saved scroll to a different programmable setting and then scroll back. If saved properly the new changed value will be displayed. If you do not see "OK" and the new value on the screen it is because the buttons were not pressed at the same time, and the new value was not saved correctly. Please try again.

4.6 Reset Settings

To reset all programmable settings back to their factory default values, press and hold → until you reach programmable setting 76 (RST P). Press ↑ button 3 times to change the value from 0 to ALL. To save, press ↑ and ← buttons at the same time. The word "*RESET?*" will appear on the screen. Press ↑ and ← buttons at the same time again. The gas monitor will then reboot with the factory default values.

This is a great troubleshooting tool, since Belimo gas monitors and communication modules have over 80 programmable settings that can be changed and configured. If settings are changed incorrectly, forgotten about, or if the gas monitor is not functioning how the customer would like it to, the settings can be reset and reprogrammed.

4.7 List of Settings

All programmable settings are factory set with default values to facilitate set up and commissioning and can be changed at any time. Alarm level thresholds are also factory set with default values but should be set to suit local regulations.

Programmable settings for sensor A (top sensor module)

NO.	NAME	DESCRIPTION	RANGE	DEFAULT
0	AL1	Alarm 1 setpoint, activates relay 1	Gas specific. See section 4.3	Gas specific. See section 4.3
1	A1Del	Alarm 1 delay on (seconds)	2...1000	30
2	A1Off	Alarm 1 delay off (seconds)	0...1000	20
3	AL2	Alarm 2 setpoint, activates relay 2	Gas specific. See section 4.3	Gas specific. See section 4.3
4	A2Del	Alarm 2 delay on (seconds)	2...1000	30
5	A2Off	Alarm 2 delay off (seconds)	0...1000	20
6	AL3	Alarm 3 setpoint, activates horn and strobe	Gas specific. See section 4.3	Gas specific. See section 4.3
7	A3Del	Alarm 3 delay on (seconds)	2...1000	180
8	A3Off	Alarm 3 delay off (seconds)	0...1000	20
9	A1Tx	Alarm 1 transmit message, CAN bus	0...255	1
10	A1Tx	Alarm 1 transmit message, CAN bus	0...255	*0
11	A1Tx	Alarm 1 transmit message, CAN bus	0...255	*0
12	A2Tx	Alarm 2 transmit message, CAN bus	0...255	2
13	A2Tx	Alarm 2 transmit message, CAN bus	0...255	*0
14	A2Tx	Alarm 2 transmit message, CAN bus	0...255	*0
15	A3Tx	Alarm 3 transmit message, CAN bus	0...255	3
16	A3Tx	Alarm 3 transmit message, CAN bus	0...255	*0
17	A3Tx	Alarm 3 transmit message, CAN bus	0...255	*0

*0 = inactive

Programmable settings for sensor B (bottom sensor module)

NO.	NAME	DESCRIPTION	RANGE	DEFAULT
18	AL1-B	Alarm 1 setpoint, activates relay 1	Gas specific. See section 4.3	Gas specific. See section 4.3
19	A1Del	Alarm 1 delay on (seconds)	2...1000	30
20	A1Off	Alarm 1 delay off (seconds)	0...1000	20
21	AL2-B	Alarm 2 setpoint, activates relay 2	Gas specific. See section 4.2	Gas specific. See section 4.3
22	A2Del	Alarm 2 delay on (seconds)	2...1000	30
23	A2Off	Alarm 2 delay off (seconds)	0...1000	20
24	AL3-B	Alarm 3 setpoint, activates horn and strobe	Gas specific. See section 4.2	Gas specific. See section 4.3
25	A3Del	Alarm 3 delay on (seconds)	2...1000	180
26	A3Off	Alarm 3 delay off (seconds)	0...1000	20
27	A1Tx	Alarm 1 transmit message, CAN bus	0...255	1
28	A1Tx	Alarm 1 transmit message, CAN bus	0...255	*0
29	A1Tx	Alarm 1 transmit message, CAN bus	0...255	*0
30	A2Tx	Alarm 2 transmit message, CAN bus	0...255	2
31	A2Tx	Alarm 2 transmit message, CAN bus	0...255	*0
32	BiTx	Binary input transmit message when limit switch is closed, CAN bus. See section 3.2.1	0...255	*0
33	A3Tx	Alarm 3 transmit message, CAN bus	0...255	3
34	A3Tx	Alarm 3 transmit message, CAN bus	0...255	*0
35	A3Tx	Alarm 3 transmit message, CAN bus	0...255	*0
36	R1Rx	Receive message to activate relay 1, CAN bus	0...255	1
37	R2Rx	Receive message to activate relay 2, CAN bus	0...255	2
38	R3Rx	Receive message to activate horn and strobe alarm, CAN bus	0...255	0
39	Adr	CAN bus address	0...31	0
40	AnZA	Sensor A (top sensor module) analog output low point. Both analog outputs are configurable. To check and adjust this, use a voltmeter, and place the black lead on the G and the red lead on the AN1. Use the up and down arrows and the voltmeter screen to adjust the value. To save press ← and ↑ at the same time. To change to mA adjust the dip switch on the PCB. See section 3.2	0...1023	

*0 = inactive

Programmable settings for the gas monitor

NO.	NAME	DESCRIPTION	RANGE	DEFAULT
41	AnSA	Sensor A (top sensor module) analog output high point. Both analog outputs are configurable. To check and adjust this, use a voltmeter, and place the black lead on the G and the red lead on the AN1. Use the up and down arrows and the voltmeter screen to adjust the value. To save press ← and ↑ at the same time. To change to mA adjust the dip switch on the PCB. See section 3.2	0...1023	
42	AnZB	Sensor B (bottom sensor module) analog output low point. Same process as 40 but place red lead on AN2.	0...1023	
43	AnSB	Sensor B (bottom sensor module) analog output high point. Same process as 41 but place red lead on AN2.	0...1023	
44	Temp	Temperature display enabled	0/1	*0
45	Aud	Internal horn and strobe alarm. Enables or disables the internal horn and strobe alarm when the alarm level 3 setpoint is reached, and the missed calibration audible beep, when the gas monitor is past due to be recalibrated. 0 = Internal horn and strobe disabled (-), missed calibration horn alarm disabled (-). 1 = Internal horn and strobe enabled (+), missed calibration horn alarm enabled (+). 2 = Internal horn and strobe enabled (+), missed calibration horn alarm disabled (-). 3 = Internal horn and strobe disabled (-), missed calibration horn alarm enabled (+).	0/1	1
46	BAC	BACnet MS/TP mode select 0 = BACnet communication disabled 1 = BACnet communication enabled 2 = BACnet communication enabled and displays all devices on CAN bus through BACnet	0/1/2	*0
47	BMA	BACnet MS/TP MAC address	0...127	1
48	BBR	BACnet MS/TP baud rate 0 = 9600 1 = 19200 2 = 38400 3 = 76800	0/1/2/3	3
49	KBL	Keyboard lock. Activates the default or user set password.	0/1	*0
50	TMod	Internal temperature sensor offset	±9°C ±9°F	-3°C -3°F
51	ATHi	High temperature alarm limit used for summer ventilation. Alarm 1 is activated when temperature exceeds this setting. Changing programmable setting 72 (temperature units, °C/°F) will auto convert programmable settings 51 and 55 back to their default values.	0...90°C 0...150°F	60°C 140°F
52	W/U	Warm up delay. Disables alarms while warming up. Units are in seconds.	0...255	60

*0 = inactive

Programmable settings for the gas monitor

NO.	NAME	DESCRIPTION	RANGE	DEFAULT
53	BMM	BACnet MS/TP maximum MAC address when polling for master	0...127	127
54	BDiag	BACnet MS/TP diagnostic display while accessing this setting. In format XXXXYYZZ. Where YY is MAC address (in hex) of the device that just passed the token to the current one. ZZ is the device to which the token was passed to. Example 0305 would display on gas monitor or communication module with MAC address 4 For refrigerant gas leak detection monitors (22G21-5C) programmable setting 54 is used to reset the zero point of the sensor module. This needs to be done after installation.	0...90ºC 0...90ºF	
55	ATLo	Low temperature alarm limit used to protect pipes from freezing. Alarm 3 is activated when temperature reaches or drops below this set point. When using this feature, it is recommended to set the low temperature alarm limit at or above 40°F [4°C], not at 32°F [0°C]. Changing programmable setting 72 (temperature units, °C/°F) will auto convert programmable settings 51 and 55 back to their default values. 0 = Off		*0
56	Net	Enables the home screen of any device to remotely view all devices on CAN bus. 1 = 0n	0/1	*0
57	Ref-A	To select scale and type of refrigerant gas for sensor A. When replacing a methane (R-G05) or propane (R-G06) sensor module, programmable setting 57 and / or 58 must be used to confirm that the proper gas type is selected. Available refrigerants to select for EXT-OP-6021-C: *R134A (Default), R11, R22, R23, R32, R125, R404A, R407A, R407C, R407F, R410A, R448A, R449A, R452A, R455A, R507, R513A, R1233zd, R1234yf, R1234ze	select from list	CH_4 (Methane & Propane sensors) R134a (Refrigerant sensor)
58	Ref-B	When replacing a methane (R-G05) or propane (R-G06) sensor module, programmable setting 57 and / or 58 must be used to confirm that the proper gas type is selected.		CH_4 (Methane & Propane sensors)
59	FltTx	Fault alarm transmit message, CAN bus. Will transmit a desired message through CAN bus to activate relays and warnings when a fault or error is present on any gas monitor.	0...255	*0
60	ADTxA	Analog drive transmit message, sensor A (top sensor) CAN bus	0...255	*0
61	AMinA	Analog drive. Minimum percent of scale for zero output. Sensor A (top sensor)	0...100	0
62	AMaxA	Analog drive. Maximum percent of scale for full scale output. Sensor A (top sensor)	0...100	100
63	ADRxA	Receive message code to control local analog output. Sensor A (top sensor)	0...255	*0
64	ADTxB	Analog drive transmit message, sensor B (bottom) CAN bus	0...255	*0

*0 = inactive

Programmable settings for the gas monitor

NO.	NAME	DESCRIPTION	RANGE	DEFAULT
65	AMinB	Analog drive. Minimum percent of scale for zero output. Sensor B (bottom sensor)	0...255	0
66	AMaxB	Analog drive. Maximum percent of scale for full scale output. Sensor B (bottom sensor)	0...100	100
67	ADRxB	Receive message code to control local analog output. Sensor B (bottom sensor)	0...255	*0
68	Baud	CAN bus baud rate 0 = maximum wire length is 1500 feet 1 = maximum wire length is 3000 feet *Device will automatically reboot after the CAN bus baud rate is changed. Power cycle the device if it does not automatically reboot.	0/1	0
69	Man	Manual override 1 = activates alarm level 1 2 = activates alarm level 1 and 2 3 = activates alarm level 1, 2, and 3 *See section 4.1	1/2/3	1
70	BDI	BACnet MS/TP device instance Enter part 1 (1000 to 4,194,303) Press right arrow Enter part 2 (0 to 999)	0...4,194, 303	60,000 +BMA
71	Light	0 = backlight on when keyboard activated 1 = backlight always on	0/1	0
72	°C/°F	0 = °C, 1 = °F Changing programmable setting 72 will auto convert programmable settings 51 and 55 back to their default values.	0/1	0
73	Cycle	Automatic cycle timer Alarm 1 00C = total Cycle time in minutes Press right arrow 00R = Run time in minutes	0...255	*00/00 (inactive)
74	Age A/B	Sensor module A (top sensor) age in days Sensor module B (bottom sensor) age in days Press right arrow to display sensor B		0
75	VSD A	Variable speed drive logic analog outputs A combines analog outputs over CAN bus. See programmable settings 60-66 0 = highest reading wins 1= sensor readings are averaged 2= auto ramping increases analog output by one-minute intervals on alarm 1 and decreases when below alarm.	0/1/2	0
76	RST P	Reset Default Alarms A = Alarm level setpoints (Sensor A: top sensor) B = Alarm level setpoints (Sensor B: bottom sensor) A+B = Alarm level setpoints (Both sensors) ALL = All programmable settings reset back to Belimo's factory set values	0/1/2	0

*0 = inactive

Programmable settings for the gas monitor

NO.	NAME	DESCRIPTION	RANGE	DEFAULT
77	NQty	Number of gas monitors and communication modules on CAN bus	0...32	*0
78	BAC A	Controlling relays over BACnet Allows CAN bus alarm messages to be sent through BACnet for specific alarms level set points (AL1, AL2, AL3) or all alarm level set points. To access and use this setting, BACnet communication needs to be enabled per programmable setting 46 (BAC) by setting it to 1 or 2. 0 = Deactivated 1 = CAN bus transmit message for AL1 only is sent through BACnet. 2 = CAN bus transmit message for AL2 only is sent through BACnet. 3 = CAN bus transmit message for AL3 only is sent through BACnet. 4 = CAN bus transmit message for AL1, AL2, and AL3 are sent through BACnet	0/1/2/3/4	*0
79	LATCH	Latching alarms and relays Latches alarms and corresponding relays, causing them to stay on activated even after gas levels have dropped below the alarm level setpoints. To unlatch the alarms, someone must physically go to the product and pressing the ↓ button. Display will read “AL OFF”. 0 = Deactivated. Alarms and relays deactivate normally. 1 = AL1 and relay 1 only remains on and active. 2 = AL2 and relay 2 only remains on and active. 3 = AL3 and horn and strobe only remain on and active. 4 = AL1, AL2, AL3 all remain on and active.	0/1/2/3/4	*0
80	SERVA	Missing calibration (sensor A, top sensor module) in days Gas monitors are required to be calibrated annually. By default, all gas monitors have a calibration warning set to 390 days. When 390 days is reached without calibration, the screen will flash, it will say “SERV.AB OVERDUE”, and beep. The beep can be silenced per programmable setting 45 (Aud). The calibration timer is reset whenever the zero or span point is saved during calibration	0...3650	390
81	SERVB	Missing calibration (sensor B, bottom sensor module) in days Same description as SERVA. Please see description above.	0...3650	390
	MO PASS?	Password protection Allows the user to select a six-keystroke password to lock the keypad and programmable settings		

*0 = inactive

4.8 Sequence of Operations

1. Gas monitors and communication modules are preloaded with default programmable settings for normal operation and can be changed by the user at any time via the key pad.
2. On power-up the display will show the firmware version number and the warm up timer will count down (programmable setting 52, default 1 minute). Relays are inactive during this time. Press any button to cancel the warm-up period. To view the firmware version number at any time, press ← and ↓ at the same time.
3. The home screen on the LCD display will show the gas types, gas concentrations, and alarm level statuses. For gas monitors monitoring two gases, the display will alternate between the two gas types showing the gas type and concentration of each. If the network display option is turned on (programmable setting 56, default turned off for all gas monitors and on for communication modules) the display will show each device that is connected via the CAN bus network, its address, gas type, gas concentration, alarm level status. Each gas monitor will display for 3 seconds and then cycle to the next, lowest address to the highest and then start again.
4. If the gas level rises above the alarm 1 set point, then the delay on timer will start (by default it is set to 30 seconds). The delay on is how long the gas has to remain above the alarm level set point until the alarm turns on. It is used to prevent false alarms and to stop the fan from constantly fluctuating on and off. The timer will clear and reset if the gas drops below the alarm level 1 set point.
5. If the gas level stays above the alarm 1 set point longer than the delay on timer (default 30 seconds), alarm level 1 will activate, causing a red LED to turn on and relay one to energize (only on -A, -B models). The gas monitor will transmit a message through CAN bus saying alarm level 1 has been activated (sends out a 1 by default, programmable setting 9, 10, 11 for top sensor and 27, 28, 29 for bottom sensor). Relay 1 will stay energized as long as the gas level remains above the alarm 1 set point. In addition to this, any other gas monitors, communication modules, or relay units on CAN bus with the same relay 1 receive message (programmable setting 36, set to 1 by default) will also activate their alarm level 1, and energize their relay 1.
6. If the gas level drops below the alarm 1 set point, then the delay off timer will start (by default it is set to 20 seconds). The delay off is how long the gas has to remain below the alarm level set point until the alarm turns off. It is used to prevent false alarms and to stop the fan from constantly fluctuating on and off. The timer will clear and reset if the gas rises above the alarm level 1 set point.
7. When the delay-off timer times out relay 1 will de-energize, the alarm level 1 red LED will turn off and the relay 1 transmit message will stop being sent, thereby de-energising relays on other devices. Please note there is a 20 second delay on the CAN bus network when a code has stopped being sent.

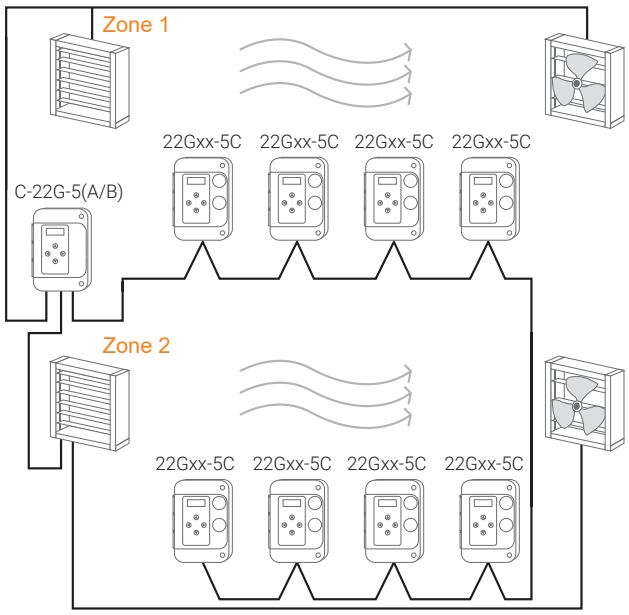
8. If the temperature exceeds the high temperature alarm limit (programmable setting 51), relay 1 will activate, the alarm 1 red LED will turn on and the alarm 1 transmit message will be sent via the CAN bus network to other gas monitors and communication modules. When the temperature drops below the high temperature alarm limit, the alarm 1 will be turned off and the alarm 1 transmit message will stop being sent.
9. If the gas level rises to the alarm level 2 set point, then the alarm level 2 delay on timer will begin, and after timing out, the on-board relay 2 will activate, and the alarm 2 red LED will turn on. The relay 2 transmit message (default = 2) will be sent out on the CAN bus network activating remote units with that same relay 2 receive message (option 37). Note that all 3 alarms operate independently and can be higher or lower that the others.
10. When the current gas concentration drops below the alarm level 2 set point for longer than the alarm 2 delay off setting, the relay 2 will turn off, the relay 2 red LED will turn off, and the relay 2 transmit message will stop being sent on the CAN bus network.
11. When the gas concentration rises above the alarm level 3 set point for more than the alarm 3 delay on timer the audible alarm will sound,the flashing white LED strobe light will activate (programmable setting 45, enabled by default), a 3 will appear in the bottom left corner of the display, and the alarm 3 transmit message (default 3) will be sent to other gas monitors and communication modules. The alarm level 3 audible and visual alarm can be silenced by pressing any button.
12. When the gas concentration drops below the alarm 3 set point for longer than the alarm 3 delay off setting then the audible alarm and strobe flasher will stop and the alarm level 3 transmit message will stop being sent on the CAN bus network.
13. If a gas monitor experiences any faults, the device will transmit the fault transmit message, (programmable setting 59, disabled by default), to other gas monitors and communication modules on the CAN bus network.
14. Manual override mode is available to test relay functions and to activate ventilation. From the home screen press and hold the up arrow for at least 5 seconds. Press the up arrow to increase the timer by 5 minutes per click up to 60 minutes. The screen will display MAN 5 and timer will energize relay 1 and send the alarm 1 transmit message on the CAN bus network. After the time runs down the unit will return to automatic operation. To cancel, press the down arrow several times to reduce the timer to zero and return to normal operation. To activate alarm level 2 or 3 as well with this procedure, set programmable setting 69 to 2 or 3.

This sample sequence of operation shows the operation of a basic network for one zone. See section 4 Operation to see how to change settings and section 5 Configurations for setting up multiple zones.

5.0 Network configuration (CAN bus), standalone

5.1 Using CAN bus With a Communication Module

Belimo gas monitors can control external equipment (fans, actuators, external alarms, etc.) directly through their on-board relays and analog outputs, however if a customer would like all external equipment to be controlled at a specific location (mechanical room, office room, etc.) communication modules and relay units can be used. The gas monitors will transmit their gas readings and alarm statuses through CAN bus to the communication module and relay unit, which in return will control all the external equipment (fans, actuators, external alarms, etc.) themselves.

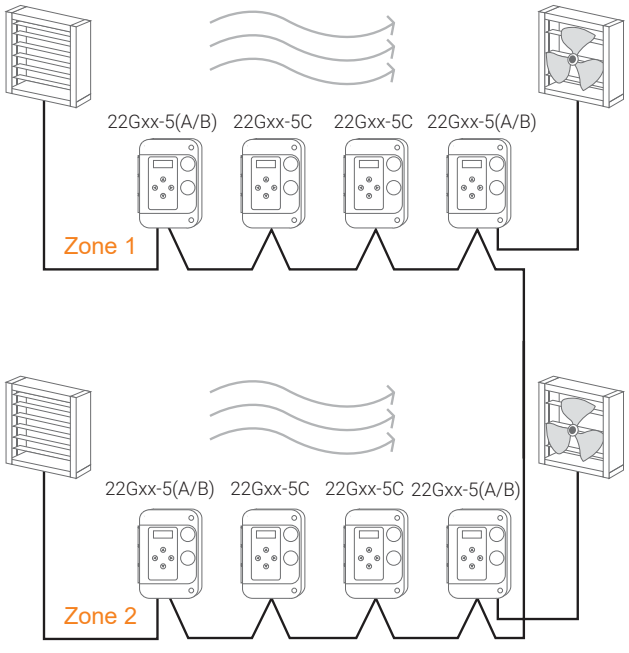


Another feature available on communication modules and all gas monitors is the ability to remotely view all devices on the CAN bus network. (This feature by default is turned ON for communication modules and turned OFF for gas monitors. It is configurable per programmable setting 56 Net). This allows a communication module to be installed somewhere easily accessible (maintenance room, office room, etc.), so that someone can see what is happening on the entire gas monitoring system and be alerted if any gas monitor goes into alarm.

The communication module will display each device's address, gas type, gas concentration, and alarm level status. The optional on-board relays can be configured to activate at similar or different gas levels in one zone, or in multiple zones. If more relays are needed, a relay unit (C-22G-50) can be added which has four additional relays.

5.2 Using CAN bus Without a Communication Module

Belimo gas monitors can control external equipment (fans, actuators, external alarms, etc.) directly through their on-board relays and analog outputs. Therefore, the use of a dedicated controller is optional, and only required if the customer wants all equipment to be controlled at a specific location. When using the gas monitors to control external equipment, starters and air dampers are typically connected to the gas monitor closest to it in each zone.



5.3 Default Configuration

Gas monitors and communication modules are shipped pre-loaded with default settings which can be changed in the field to suit the desired sequence with simple keypad input. When a gas monitor or communication module goes into alarm level 1, 2 or 3 it activates its relays and transmits a message to other devices to activate their alarm levels and relays also. The alarm 3 transmit message is transmitted by default, but the alarm level 3 receive message (programmable setting 38) by default is turned off so the audible alarms and strobe operate locally and not everywhere. The ventilation system can be connected to any of the relays (usually level 1 relay). If the transmit and receive codes are not adjusted, all gas monitors will operate in one ventilation zone. Default alarm level set points are for general guidance and testing and should be set to suit local regulations.

5.4 Creating Zones or Groups

To control multiple zones on the same network, set the transmit messages on each gas monitor to different messages for each zone. The default transmit messages are 1, 2, 3 for alarm levels 1, 2, 3 for zone 1.

For zone 2 gas monitors set transmit messages to 4, 5, 6
For zone 3 gas monitors set messages to 7, 8, 9, and so on

5.5 Addresses

Set each gas monitor, communication module, and relay unit to a different CAN bus address (programmable setting 39). 1, 2, 3, 4 etc. It is important to have no duplicates on the same daisy chained network.

5.6 Relay Outputs

Relay number 1 and 2 will activate if the gas on that monitor goes into alarm level 1, or 2. It will also activate when it sees it's receive code (programmable setting 36, 37) on the CAN bus network sent by other gas monitors. If more than 2 relays are needed, a relay unit (C-22G-50) can be added which has four additional SPDT relays. It can be installed anywhere on the CAN network.

A communication module has no sensors on board so the relays will only activate when it sees it's receive codes on the network. The communication module could control two zones via its two relays. When no communication module is used, gas monitor physically connected to an external device (ex: fan, damper, etc.) will activate if it detects a gas, or when it sees its receive codes on the network.

6.0 Network configuration (BACnet MS/TP), integrated

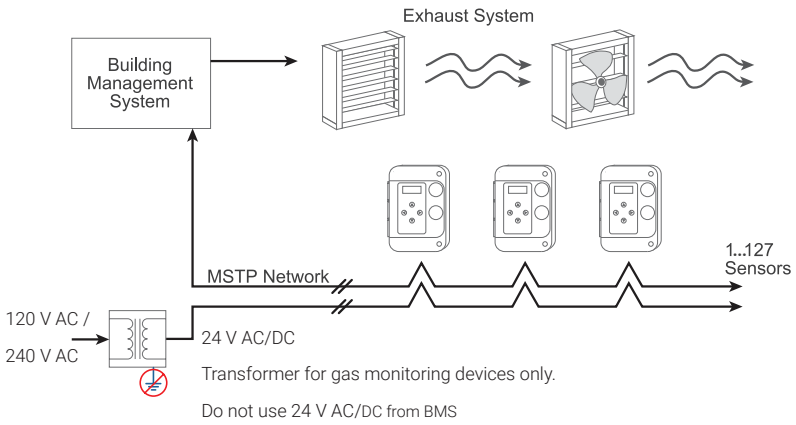
6.1 List of Settings: BACnet MS/TP

For instructions on changing settings, see section 4.5

Setting 46	BACnet MS/TP mode select 0 = communication disabled 1 = communication enabled 2 = communication enabled and display all monitors on CAN network	0, 1, 2	*0
Setting 47	BACnet MS/TP MAC address	0-127	0
Setting 48	Baud rate	0 = 9600 1 = 19200 2 = 38400 3 = 76800	3
Setting 53	Max master	0-127	127
Setting 54	Diagnostic tool to test MS/TP communication. Format XXXXYYZZ where YY= ID of device that passed token to current sensor and ZZ = ID of device that received token.		
Setting 70	Device ID	4,194,303	60,000+BMA

*0 = inactive

Ventilation Controlled by BACnet Building Automation



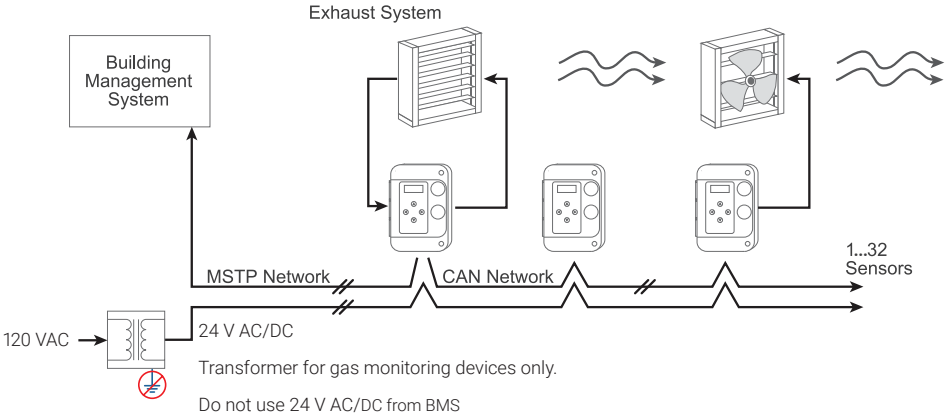
6.2 BACnet MS/TP Protocol Implementation Conformance Statement (PICS)

Object Table

TYPE AND INSTANCE	OBJECT NAME	OBJECT PROPERTY	PARAMETER
AV0	gas reading 1	Present value (R)	Gas reading local sensor A
AV1	gas reading 2	Present value (R)	Gas reading local sensor B
AV2	Ambient temperature	Present value (R)	Temperature in celsius
BI 0	Input 1	Present value (R)	Auxiliary input state 0/1
BO 0	Relay 1	Present value (R/W)	Relay 1 status on 0/1
BO 1	Relay 2 or alarm 2	Present value (R/W)	Relay 2 or alarm 2 status 0/1
BO 2	Alarm 3	Present value (R/W)	Alarm 3 Indicator status 0/1
AV XYY	Gas reading XYY	Present value (R)	Gas reading remote sensors if setting 46=2

X = sensor 1 (top) or 2 (bottom),
YY = CAN bus address
Analog value for each gas reading will display description of gas type and scale

Ventilation controlled directly by gas monitors



7.0 Maintenance

All gas monitors and sensor modules are factory calibrated. To maintain accuracy, it is essential that the gas monitors are calibrated by a qualified technician once or twice per year, depending on the application and gas being monitored. Gas monitors sensing methane, propane, and hydrogen are required to have their sensor modules replaced once per year.

7.1 Sensor Module Types

GAS TYPE	GAS TYPE IDENTIFICATION NUMBER	SENSOR MODULE TYPE
Carbon Monoxide (CO)	02	Electro-Chemical
Carbon Monoxide (CO Null H_2)	03	
Nitrogen Dioxide (NO_2)	14	
Ammonia (NH_3)	04	
Hydrogen Sulfide (H_2S)	16	
Chlorine (CL_2)	17	
Oxygen Leak (O_2 Leak)	22	
Oxygen Depletion (O_2 Dep.)	23	
Methane (CH_4)	05	Catalytic
Propane (C_3H_8)	06	
Hydrogen (H_2)	08	
Carbon Dioxide (CO_2, 0…2000 ppm)	15-003	Infrared ABC Logic
Carbon Dioxide (CO_2, 0…5000 ppm)	15-005	Infrared Dual Channel
Carbon Dioxide (CO_2, 0…10000 ppm)	15-006	
Infrared Broadband Refrigerant (IR)	21	Infrared Broadband

7.2 Calibration Procedure Overview

All sensor modules used in Belimo gas monitors are either electro-chemical, catalytic, or infrared types. Certified gas bottles of ± 2% accuracy (or better) should be used for both the zero and the span point. In conjunction with certified gas bottles, it is recommended to use the Belimo calibration kit (A-22G-A22) that includes a regulator (0.5 LPM), tube, and cap to adjust the sensitivity of the sensor module due to normal aging. For calibrating the span point, please use a certified gas bottle that is within the specified range of the sensor module.

7.3 Calibration Procedure: Electro-Chemical and Catalytic Sensor Modules

1. Use certified gas bottles of ± 2% accuracy (or better) for calibration.
2. Before calibrating, ensure the gas monitors have been powered for a minimum of the warm up time of the sensor modules. For electro chemical type, the warm up time is 5 minutes, for catalytic type, the warm up time is 24 hours.
3. Press → to enter programmable settings.
4. Press ↑ and → at the same time to enter the calibration mode.

   *When calibrating the top sensor module (sensor A), stay at SAZ.

   *When calibrating the bottom sensor module (sensor B), press the → button twice to get to SBZ.
5. While at SAZ (sensor A) or SBZ (sensor B) flood the certified zero gas over the sensor module. To do this, connect the zero gas bottle to the Belimo regulator, and insert the calibration cap onto the sensor hole located on the gas monitor front cover. Flood the sensor with the zero gas at a flow rate of 0.5 LPM for 90 seconds or until the reading stabilizes. To calibrate gas monitors it is important to keep the front cover on, and make sure it is securely screwed to the base. When not using the Belimo calibration cap, it is important that the calibration cap you are using has a small outlet hole, otherwise the pressure will increase and distort the reading.
6. Adjust gas reading to 0 with the ↑ and ↓ buttons.
7. Press ↑ and ← at the same time to save.
8. Press → and ← to get to SAS (sensor A span) or SBS (sensor B span).
9. While at SAS (sensor A span) or SBS (sensor B span) flood the certified span gas over the sensor module. To do this, connect the span gas bottle to the Belimo regulator, and insert the calibration cap onto the sensor hole located on the gas monitor front cover. Flood the sensor with the span gas at a flow rate of 0.5 LPM for 90 seconds or until the reading stabilizes. For chlorine on average stabilization time takes 5 to 10 minutes. To calibrate gas monitors it is important to keep the front cover on, and make sure it is securely screwed to the base. When not using the Belimo calibration cap, it is important that the calibration cap you are using has a small outlet hole, otherwise the pressure will increase and distort the reading.
10. Adjust gas reading by pressing the ↑ and ↓ buttons until the concentration on the gas monitor and calibration gas bottle match.
11. Press ↑ and ← at the same time to save.

    Press and hold down ← to exit the calibration mode.

7.4 Calibration Procedure: Infrared ABC Logic and Infrared Dual Channel Sensor Modules

1. Use a certified gas bottle of ± 2% accuracy (or better) for calibration.
2. Before calibrating, ensure the gas monitors have been powered for a minimum of the warm up time of the sensor modules. For infrared ABC logic type, the warm up time is 10 minutes.
3. Press → to enter programmable settings.
4. Press ↑ and → at the same time to enter the calibration mode.
5. Do not calibrate SAZ (sensor A) or SBZ (sensor B).
6. Press → and ← to get to SAS (sensor A span) or SBS (sensor B span).
7. While at SAS (sensor A span) or SBS (sensor B span) flood the certified span gas over the sensor module. To do this, connect the span gas bottle to the Belimo regulator, and insert the calibration cap onto the sensor hole located on the gas monitor front cover. Flood the sensor with the span gas at a flow rate of 0.5 LPM for 90 seconds or until the reading stabilizes. To calibrate gas monitors it is important to keep the front cover on, and make sure it is securely screwed to the base. When not using the Belimo calibration cap, it is important that the calibration cap you are using has a small outlet hole, otherwise the pressure will increase and distort the reading.
8. Adjust gas reading by pressing the ↑ and ↓ buttons until the concentration on the gas monitor and calibration gas bottle match.
9. Press ↑ and ← at the same time to save.
10. Press and hold down ← to exit the calibration mode.

7.5 Calibration Procedure: Infrared Broadband Sensor Modules

1. Use certified gas bottles of ± 2% accuracy (or better) for calibration.
2. Before calibration install the infrared broadband gas monitors on site, on a vertical level surface. ensure the gas monitors have been powered for a minimum of the warm up time of the sensor modules. For infrared broadband type, the warm up time is 1 hour.
3. Press → to enter programmable settings.
4. Press and hold → until you reach programmable setting 57 (Select Desired Refrigerant Type). Press the ↑ and ↓ buttons to find the desired refrigerant that the gas monitor will detect. By default the gas monitor will detect R134A. To save press ↑ and ← at the same time. If saved correctly, the LCD screen will display ** OK **. Press and hold ← until the home screen is displayed. The targeted refrigerant along with its concentration will be displayed in the screen.
5. Press → to enter programmable settings.

6. Press and hold → until you reach programmable setting 54 (Zero Reset). This setting is used to set the zero point of the gas monitor. Check if programmable setting 54 is displaying any value other than 0. If any value other than 0 is shown, and there is no refrigerant gas present, reset the zero point by pressing ↑ and ↓ at the same time. Once again, allow 1 hour after the reset for the gas monitor to stabilize.
7. Verify that programmable setting 54 (Zero Reset) displays 0. If a non 0 value between ±5 exists, change this value to 0 by adjusting the Sensor A Zero (SAZ) . To do this go to the home screen, press ↑ and → at the same time to enter the calibration mode, and adjust SAZ gas reading to 0 (the top value) with the ↑ and ↓ buttons. Press ↑ and ← at the same time to save. If it does not repeat step 6.
8. Press and hold ← until the home screen is displayed.
9. Press ↑ and → at the same time to enter the calibration mode.
10. While at SAZ (sensor A) flood the certified zero gas over the sensor module. To do this, connect the zero gas bottle to the Belimo regulator, and insert the calibration cap onto the rectangular sensor hole located on the gas monitor front cover. Flood the sensor with the zero gas at a flow rate of 0.5 LPM for 90 seconds or until the reading stabilizes. To calibrate gas monitors it is important to keep the front cover on, and make sure it is securely screwed to the base. When not using the Belimo calibration cap, it is important that the calibration cap you are using has a small outlet hole, otherwise the pressure will increase and distort the reading.
11. Adjust gas reading to 0 with the ↑ and ↓ buttons.
12. Press ↑ and ← at the same time to save.
13. Press → and ← to get to SAS (sensor A span)
14. While at SAS (sensor A span) flood the certified span gas over the sensor module. To do this, connect the span gas bottle to the Belimo regulator, and insert the calibration cap onto the sensor hole located on the gas monitor front cover. Flood the sensor with the span gas at a flow rate of 0.5 LPM for 90 seconds or until the reading stabilizes. To calibrate gas monitors it is important to keep the front cover on, and make sure it is securely screwed to the base. When not using the Belimo calibration cap, it is important that the calibration cap you are using has a small outlet hole, otherwise the pressure will increase and distort the reading.
15. Adjust gas reading by pressing the ↑ and ↓ buttons until the concentration on the gas monitor and calibration gas bottle match.
16. Press ↑ and ← at the same time to save.
17. Press and hold down ← to exit the calibration mode.
18. After calibration press and hold → until you reach programmable setting 57, and select the refrigerant gas to be monitored.
19. Press ↑ and ← at the same time to save.
20. Hold ← for five seconds to return to the home screen.

7.6 Sensor Module Replacement

All sensor modules are factory calibrated but are required to be recalibrated at a minimum of once per year. When installing gas monitors in locations above 2000 ft [610 m], it is recommended to perform calibration upon installation.

In addition, anytime a sensor module is replaced or the location is changed (for example by swapping the top and bottom sensor modules, or by swapping sensor modules from other gas monitors), as a safety protocol, the sensor module needs to be registered. To register it please follow the steps below. Please also remember that swapping sensor modules out for others that monitor different gases, (ex: swapping the top CO sensor module with any sensor module that is not CO) is not recommended, as the side label on the gas monitor will be incorrect. In addition, the alarm level set points will have to be reprogrammed for the new sensor module (unless it is the same as the original). This is done by going to programmable setting 74 (RST P) and changing the value to either A, B, or A+B (depending on which sensor was replaced or swapped). In addition, the density of the gas that the new gas detects must also be kept in mind. If the gas monitor is detecting two gases with different densities, a remote enclosure might be required (A-22G-A14), which allows you to remotely monitor one sensor module.

1. Remove the existing sensor module by opening the gas monitor cover and pulling the sensor module out from the gas monitor. The entire sensor module should be removed, which includes the sensing element and the small green PCB board attached to it.
2. Install the new sensor module by removing it from its packaging and inserting the metal pins into the the correct location on the gas monitor.
3. Press → to enter settings.
4. Press ↑ and → at the same time to enter the calibration mode.
   *When replacing the top sensor module (sensor A), stay at SAZ.
   *When replacing the bottom sensor module (sensor B), press the → button twice to get to SBZ.
5. Press ↑ and ← at the same time to register the sensor module. The gas level will then be displayed on the top line of the LCD, and the gas monitor will stop flashing and beeping, and will function normally.
6. Press and hold down ← to exit the calibration mode.

7.7 Sensor Module Expected Life Span and End of Life

All sensor modules have an expected life span and an end of life. The expected life span is how long the sensor module will last (under normal conditions) until it should be replaced with a new one. Please note that the exact lifespan of the sensor module is heavily dependent on the application, including how dirty the environment is and how much of the target gas is present in the environment.

The end of life is a safety precaution, and it is how long the sensor module can stay powered in the gas monitor until the gas monitor will go into alarm to tell the end user it is time to replace the sensor module.

APPLICATION	GAS TYPE	NOMENCLATURE	EXPECTED LIFESPAN (YEARS)	END OF LIFE (YEARS)
Vehicle Emissions	Carbon Monoxide (CO)	02	5...8	10
	Carbon Monoxide (CO Null H_2)	03	2...4	5
	Nitrogen Dioxide (NO_2)	14	2...4	5
Indoor Air Quality	Carbon Dioxide (CO_2)	15-003	10	13
	Carbon Dioxide (CO_2)	15-005	10	13
	Carbon Dioxide (CO_2)	15-006	10	13
Combustible and Toxic Gases	Ammonia (NH_3)	04	2...4	5
	Methane (CH_4)	05	4...7*	9*
	Propane (C_3H_8)	06	3...5*	8*
	Hydrogen (H_2)	08	4...7*	9*
	Hydrogen Sulfide (H_2S)	16	2...4	5
	Chlorine (CL_2)	17	2...4	5
	Oxygen Leak (O_2 Leak)	22	3...6	8
	Oxygen Depletion (O_2 Depletion)	23	3...6	8
	Argon (Ar), (O_2 Depletion)	23	3...6	8
	Helium (He), (O_2 Depletion)	23	3...6	8
	Nitrogen (N_2), (O_2 Depletion)	23	3...6	8
Refrigerant Gas Leak Detection	Infrared Broadband Refrigerant (IR)	21	5...10	15

* Methane (CH4), Propane (C3H8), and Hydrogen (H2) sensor modules are required to be replaced annually. They are not recommended to be re calibrated.

7.8 Fault Monitoring

FAULT CODE	MESSAGE
00	Error cleared (no error)
01	No sensor
02	Low voltage
04	High voltage
08	Sensor A missing or not registered
10	Sensor B missing or not registered
18	Both sensors missing or not registered
20	Sensor A end of life (need to replace sensor)
40	Sensor B end of life (need to replace sensor)
60	Both sensors end of life
80	CAN bus error: Qty not matching option 77
Err-S	Missing sensors

Notes:

- For 22Gxx-5A & C-22G-5A model, any fault from above table will turn the corresponding analog output to 0V/0mA
- On BACnet MS/TP, any fault from the above table will change the system status of the device object to non operational.

Please contact Belimo technical support with any fault codes not in this list.

Exceptional service

At Belimo, we continually invest in new technologies that increase customer value by improving occupant comfort, energy efficiency, simplified installation, and maintenance-free operation. Our sales team is available to consult and provide insight and advice on how to achieve the best solution to help increase your system performance. Belimo will continue to focus on providing you with exceptional product availability, fast delivery times, and world-class customer service and technical support. We remain dedicated to continuously improve our standards and are committed to providing you with the highest value possible.

Whatever your HVAC application, our global network of support experts are on hand and ready to assist.

- Global support
- Tested quality
- On-time delivery
- Extensive service
- Complete product range

BELIMO Americas
USA Locations
33 Turner Road, Danbury, CT 06810
1049 Fortunato Loop, Sparks, NV 89436

Tel. 800-543-9038, customerservice@us.belimo.com

Canada Location
2495 Meadowpine Blvd., Unit #2 Mississauga, Ontario L5N 6C3
Tel. 866-805-7089, orders.ca@ca.belimo.com

BELIMO Brasil Comércio de Automação Ltda.
Rua Barbalha, 251, São Paulo/SP, Brazil
Tel: 55 11 3643-5656, atendimentoaocliente@br.belimo.com

BELIMO Mexico
Av. Insurgentes Sur 1602, Col. Credito Constructor, Del. Benito Juarez, Mexico City 03940
Tel: 55 4125 7890, servicioalcliente@mx.belimo.com

Latin America and the Caribbean Customer Service
Tel. +1 905-712-3118, Orders.LatAm@us.belimo.com

www.belimo.com