MVFD MODBUS VENTILATION FAN CONTROLLER

CALIBRATION TECHNOLOGIES INC.
GAS DETECTION SPECIALISTS

Installation and Operation Manual

Warning

Use this product only in the manner described in this manual.
If the equipment is used in a manner not specified by Calibration Technologies, the protection provided by the equipment may be impaired.

This equipment should be installed by qualified personnel.

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GENERAL DESCRIPTION

The MVFD (*Modbus Variable Frequency Drive*) controller is designed to control ventilation fans in the event of high CO/NO2 concentrations. Used in conjunction with the DuoSense-M CO/NO2 detectors and the MVE gas detection control panel, the MVFD can be mounted on the Modbus network near the vent fan's motor starter, eliminating the need to run control wiring long distances.

Control of fan speed can be through the 4-20 mA analog output or via (3) relay outputs.

Setup at the MVFD only requires selecting a Modbus ID. All other programming is done at the MVE gas detection control panel.

LCD digital display
Inside the detector enclosure is an LCD display, 2.7" x 1.5", to assist with initial setup and calibration.

Communication
The MVFD uses the industry standard MODBUS RTU protocol over a RS-485 serial interface.

Enclosure
The enclosure for the MVFD is a chemical-resistant polycarbonate enclosure and is suitable for outdoor or washdown use.

Figure 1. MVFD controller

INSTALLATION

Mounting considerations:

- Mount unit close to VFD motor controller
- Keep unit out of harm's way (physical damage).
- Keep unit and wire runs away from mercury vapor lights and radio repeaters to prevent electrical interference.
- Mounting screws should be screwed into studs when mounting on a wall with studs.

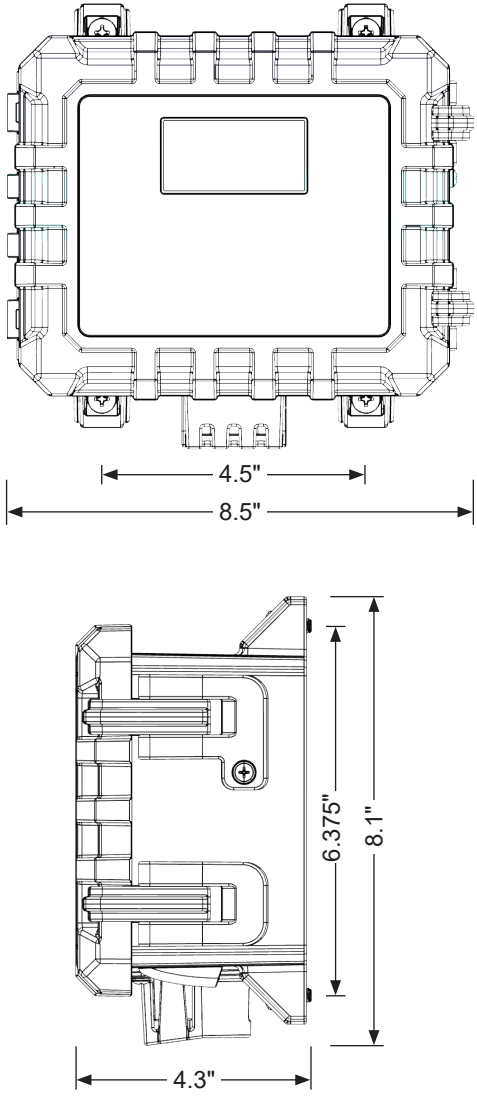


Figure 2. MVFD dimensions

WIRING

Overview

The MVFD comes equipped with a 4-20 mA output, RS-485 Modbus communication, and (3) three relay outputs.

Electrical Power: 24 Vdc regulated (12-30 Vdc), 135 mA.

- Always disconnect power at the controller before performing any wiring at the MVFD.
- Terminal blocks are plug-socket type.
- Electrical wiring must comply with all applicable codes.

Terminal	Connection	Description
24Vdc	24Vdc power	+24Vdc Power
GND	Ground (0Vdc)	
SIG	4-20 mA analog signal	4-20 Analog Output
SHLD	Drain wire	
A	RS-485 A	RS-485 Modbus Communication
B	RS-485 B	
COM	Modbus ground	
SHLD	Drain wire	
R1 NC	Relay 1 Normally Closed	Relay 1
R1 C	Relay 1 Common	
R1 NO	Relay 1 Normally Open	
R2 NC	Relay 2 Normally Closed	Programmable Relay 2
R2 C	Relay 2 Common	
R2 NO	Relay 2 Normally Open	
R3 NC	Relay 3 Normally Closed	Programmable Relay 3
R3 C	Relay 3 Common	
R3 NO	Relay 3 Normally Open	

Figure 3. Wire terminal table

4-20 mA Analog Output Wiring

Output: Linear 4-20 mA output. VFD monitoring equipment may have a maximum input impedance of 400 ohms.

Cable Recommendation: 18/3 shielded cable (Belden 8770 or equivalent). Length of cable to MVFD should be no greater than 1,500 feet.

- Always use 2-conductor, insulated, stranded, shielded copper cable with drain wire.
- If cable runs cannot be made without a splice; all splice connections should be soldered.
- Ground the shield at the main control panel. Connect the shield wire in the detector terminal block labeled SHLD.

Terminal Block Plug (4/20 mA):
SHLD: To case (earth) ground of monitoring equipment.

GND: To ground terminal of power supply.

24V: To 24V terminal of power supply.

SIG: To analog 4-20 mA signal input of VFD.

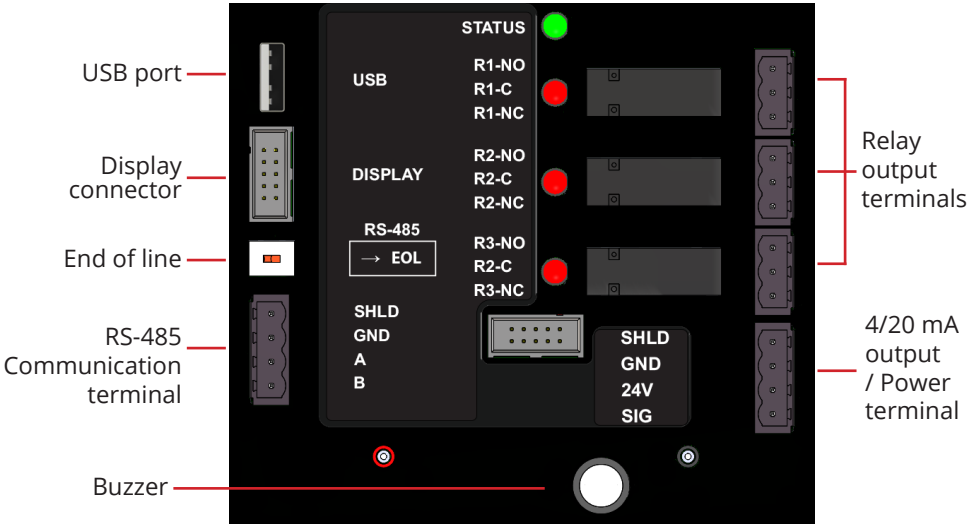


Figure 4. Circuit board layout / wire terminals

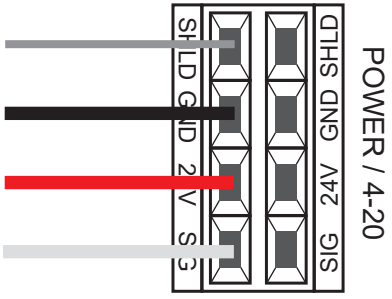


Figure 5. 4/20 mA Output Wiring Terminal

RS-485 Modbus Wiring:

RS-485 Communication Wiring
It is recommended to pull 24Vdc power cable with the communication cables. These cables can share the same conduit.

- RS-485 communication cable, 22-24 AWG, 2-conductor twisted pair, shielded, stranded, with drain wire (Alpha Wire 6460, Quabbin 8302, or equivalent).
- 4,000 ft max per Modbus channel.
- For optimum performance, it is recommended that no more than 128 devices are connected on any of the four channels.
- Avoid splices and T-taps. All terminations should be made at network device wire terminals.
- Wire shields must be connected at all shield terminals, creating a continuous shield run from the controller to the device at the end of the line.

Each MVFD has a communication port with four terminals, A, B, Ground and Shield. The communication cable is connected so all devices are connected in parallel. All of the 'A' terminals must be connected together and all of the 'B' terminals must be connected together, respectively.

Note: For "end of line" devices, set the EOL switch position to "ON". For all other devices, verify that the EOL switch is in the "OFF" position (see Figure 4).

Terminal Block Plug (RS-485 Comm):
SHLD: To case (earth) ground of monitoring equipment.
GND: Not used
A: To RS-485-A terminals of next and previous devices in line.
B: To RS-485-B terminals of next and previous devices in line.

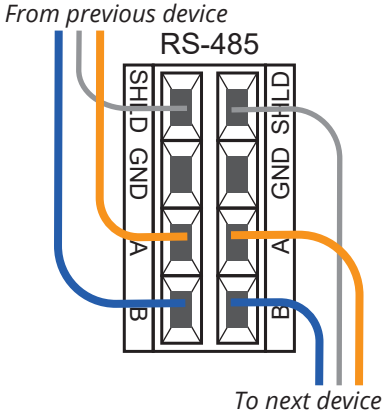


Figure 6. RS-485 Communication Wiring Terminal

Device Power Wiring

- Use 18 AWG, 2-conductor, shielded, stranded with drain wire (General Cable C2534A or equivalent).

Assuming an even distribution of devices on the channel (cable run), refer to the MVE controller manual for number of devices per channel. The MVFD nominal current draw is equivalent to nine DuoSense detectors.

Caution: To prevent excessive voltage drops and/or power supply overloads, consider all 24Vdc devices on each power supply. Total current draw for all devices should not exceed the power supply rating at the controller.

If the supply voltage drops below a device's minimum supply voltage at any device on the network, a power supply should be added at that point on the power cable.

Terminal Block Plug (Power / 4-20 mA):
SHLD: (if used) To case (earth) ground of monitoring equipment.
GND: To ground (0Vdc) terminal of power supply.
24V: To 24Vdc terminal of power supply.
SIG: (if used) To 4-20 mA analog input of VFD

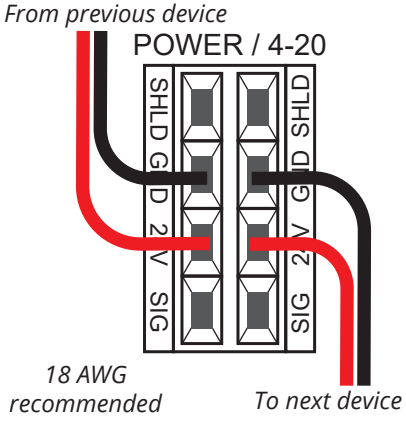


Figure 8. RS-485 Power Wiring Terminal

Relay Output Wiring

The MVFD is equipped with (3) three Form C, SPDT relays. These relays are rated at 5A @ 24Vdc or 8A @ 120Vac.

Each relay has a status LED. If LED is lit, the relay coil is energized.

Do not pull communications wiring with AC power cables. This can cause electrical interference.

The Form C relays are dry contacts and have no voltage on them. 24Vdc can be provided by the 24V terminal and jumped to the relay terminals. *Keep in mind device current draw and minimum voltage requirements.*

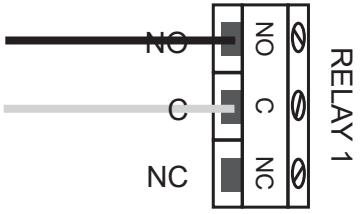


Figure 9. Relay Output WiringTerminal

OPERATION

Power-up

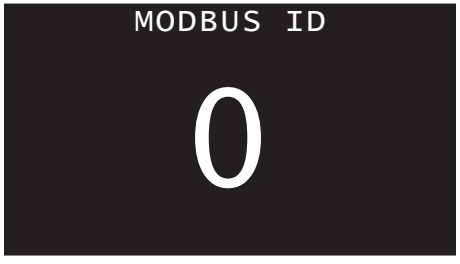
Before applying power, make a final check of all wiring for continuity, shorts, grounds, etc.

Upon power up, the CTI logo is display for 1-2 seconds.

Home Screen

Once the MVFD is powered up, the Home screen is displayed, which displays the current Modbus ID. The MVFD is shipped with a Modbus ID of 0. Note that the ID# will need to be changed from 0 to operate on the Modbus network. See Programming section on this page.

Note: After 5 minutes of inactivity, the screen saver will turn on. Press any key to show the Home screen.



Operator Interface

The only keys used on the MVFD are the ▲▼ ENTER and ESCAPE.

The ◀ ▶ SILENCE and RESET keys are not needed for this device.

Enter key is used to edit the Modbus ID and is used to exit and save.

Pressing the Escape key returns to the Home screen

Up and Down keys are used to select the Modbus ID value and to navigate the status menu.

Programming

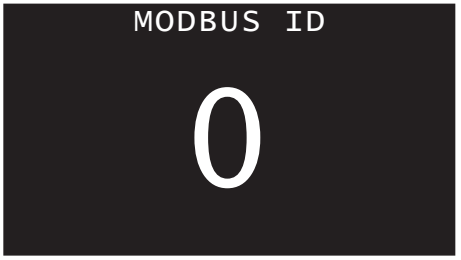
The only value to program at the MVFD is the Modbus ID. The 4-20 analog output and relays are controlled by the Modbus gas detection controller and need to be setup at the controller.

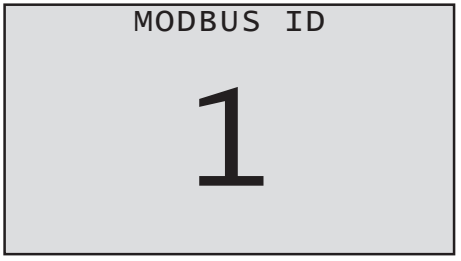
Modbus ID

Assign the Modbus ID to the MVFD. Select a number between 1 and 255. Each device must have a unique ID to communicate properly on the network. Default ID is 0.

Note: When assigning Modbus ID's; use sequential numbering starting at the device closest to the controller to avoid confusion.

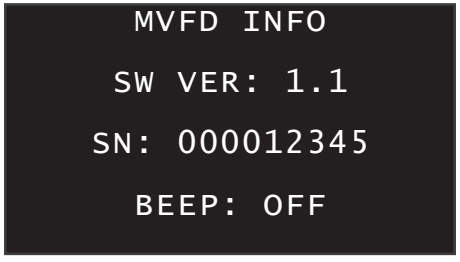
Press ENTER to edit/change the Modbus ID. Upon pressing the Enter key, the display will invert to indicate the device is in edit mode. Use the ▲▼ keys to select the new Modbus ID. Press ENTER to exit edit mode and save the new value.





Status Menu Tree

No changes can be made from the Status screens. Use the ▲▼ keys to scroll through the status screens. The Status screens display the 4/20 mA analog output value, relay states, software version, and serial number.



Comm Fault condition

A fault condition can occur if the MVFD loses communication with the controller or PLC. This is usually a wiring problem but can also occur if another device on the network shares the same Modbus ID. All relays and analog output signal will remain locked in their current state or value until communication is restored.

START-UP TEST

It is recommended that the MVFD be tested to make sure it operates as intended upon alarm conditions.

Start-Up test:

The easiest way to test the alarm functionality is to have one person expose a gas detector in that alarm group to calibration gas or target gas. A second person may be needed to verify the ventilation fan and/or alarm operates as intended.

SPECIFICATIONS

Input Voltage:
+24 Vdc, (10-30 Vdc), power supply with isolation or class II power supply

Max Current Draw:
135 mA max

Dimensions:
8.1" high x 8.5” wide x 4.4” deep (206mm high x 216mm wide x 112mm deep)

Weight:
4 lbs (1.81 kg)

Enclosure:
Injection-molded, polycarbonate enclosure housing with hinged lid and latches with captive screw. For non-classified areas.

Temperature Range:
-40° to 122°F (-40° to 50°C)

Humidity Range:
0% to 100% condensing (with proper conduit seals)

Analog Output:
4-20 mA (max VFD input impedance: 400 Ω)

Relay Outputs:
(3) SPDT relays, Form C dry contacts. 5A @ 24 Vdc or 8A @ 120-240 Vac.

4-20 mA Output Wiring Connections:
3 conductor, shielded, stranded, 18 AWG cable (General Cable C2534A or equivalent). Cable should not exceed 1,500 feet total length.

RS-485 Wiring Connections:
RS-485 communication cable, 22-24 AWG, 2 conductor, twisted pair, shielded, stranded, with drain wire (Alpha Wire 6460 or Quabbin 8302 or equivalent).

Terminal Blocks (Field Wiring):
26-12 AWG, torque 4.4 in-lbs.

Display:
Monochrome OLED, 2.7" x 1.5" viewing area. (68.6 mm x 38.1 mm)

WARRANTY

Limited Warranty & Limitation of Liability

Calibration Technologies, Inc. (CTI) warrants this product to be free from defects in material and workmanship under normal use and service for a period of two years, beginning on the date of shipment to the buyer. This warranty extends only to the sale of new and unused products to the original buyer. CTI's warranty obligation is limited, at CTI's option, to refund of the purchase price, repair, or replacement of a defective product that is returned to a CTI authorized service center within the warranty period. In no event shall CTI's liability hereunder exceed the purchase price actually paid by the buyer for the product.

This warranty does not include:

a) routine replacement of parts due to the normal wear and tear of the product arising from use;

b) any product which in CTI's opinion has been misused, altered, neglected or damaged by accident or abnormal conditions of operation, handling or use;

c) any damage or defects attributable to repair of the product by any person other than an authorized dealer or contractor, or the installation of unapproved parts on the product

The obligations set forth in this warranty are conditional on:

a) proper storage, installation, calibration, use, maintenance and compliance with the product manual instructions and any other applicable recommendations of CTI;

b) the buyer promptly notifying CTI of any defect and, if required, promptly making the product available for correction. No goods shall be returned to CTI until receipt by the buyer of shipping instructions from CTI; and

c) the right of CTI to require that the buyer provide proof of purchase such as the original invoice, bill of sale or packing slip to establish that the product is within the warranty period.

THE BUYER AGREES THAT THIS WARRANTY IS THE BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. CTI SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, WHETHER ARISING FROM BREACH OF WARRANTY OR BASED ON CONTRACT, TORT OR RELIANCE OR ANY OTHER THEORY.

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GAS DETECTION SPECIALISTS

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