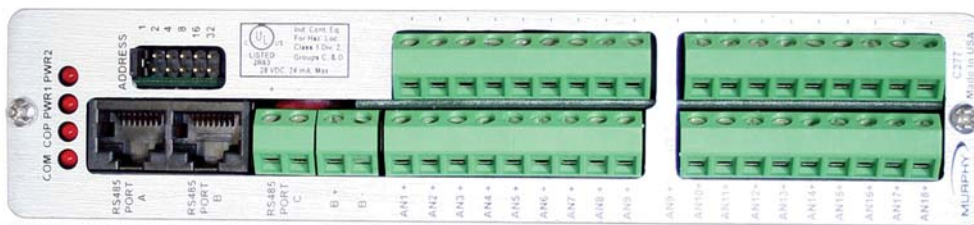
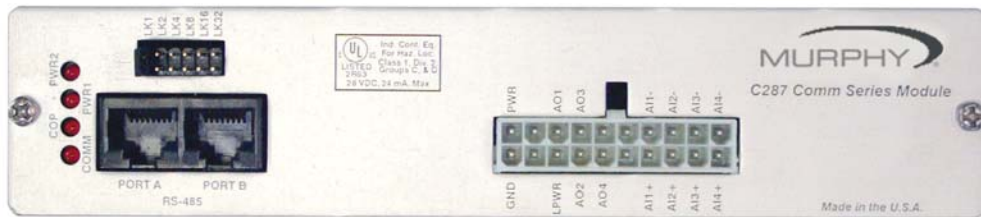


C267 Digital Input / Output, 0-5VDC / 0-20 mA Input



C277 Thermocouple, 0-24 mA Input



C287 0-20 mA Input, 0-24 mA Output

MODBUS RTU I/O Expansion Modules - Models C267, C277, and C287

Installation and Operations Manual

In order to consistently bring you the highest quality, full featured products, we reserve the right to change our specifications and designs at any time. The latest version of this manual can be found at www.fwmurphy.com.

Warranty - A limited warranty on materials and workmanship is given with this FW Murphy product. A copy of the warranty may be viewed or printed by going to www.fwmurphy.com/support/warranty.htm.



Please read the following information before installing.

BEFORE BEGINNING INSTALLATION OF THIS MURPHY PRODUCT READ AND FOLLOW ALL INSTALLATION INSTRUCTIONS.

EXPLOSION HAZARD: SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2

EXPLOSION HAZARD: WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES.

EXPLOSION HAZARD: DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

Please contact FW MURPHY immediately if you have any questions.

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Murphy Comm Series I/O Expansion Modules

The C267, C277, and C287 expansion modules provide input/output capability to existing and future Murphy Controllers via MODBUS RTU communication via an RS-485 port. Any mix of modules can be added to enable Digital and Analog I/O, and Thermocouple functionality for communication and monitoring by the controller.

C267 Digital Input / Output, 0-5VDC / 0-20 mA Input

UL/cUL Listed, Class I, Div. 2 Groups C & D

The C267 module can read up to eight digital inputs. Each input accepts either B+ or B- for activation and is approved for use with general purpose switches in hazardous areas.

C277 Thermocouple / 0-24 mA Input

UL/cUL Listed, Class I, Div. 2 Groups C & D

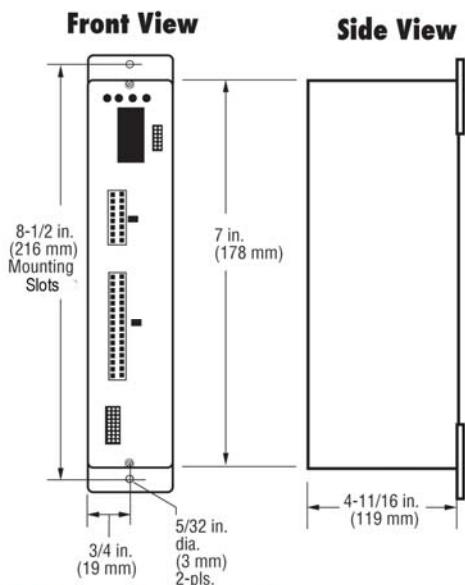
The C277 module adds analog input or thermocouple input ability to the master controller through MODBUS RTU communication via an RS485 port. It can read up to 18 thermocouple or 0-24 mA sources.

C287 0-20 mA Input, 0-24 mA Output

UL/cUL Listed, Class I, Div. 2 Groups C & D

The C287 module includes four 15-bit true 0-20 mA analog inputs and four 16-bit analog outputs. Software is configurable to 0-24 mA, 0-20 mA, or 4-20 mA.

Product Dimensions and Mounting



Vertical mounting suggested. Harnesses are available.

Accessories

Cables and Harnesses for All Expansion Modules (C267, C277, C287)

RJ45 cable assembly, 2 ft. (60.96 cm) length – P/N **00005293**

RJ45 cable assembly, 4 ft. (121.92 cm) length – P/N **00004925**

Terminating Resistor Module – P/N **00005292**

Cables and Harnesses for C267 Only

Wiring Diagram 1

Interface Terminal board C267TBIF – P/N 00007719

Harness, C267 10-wire Molex to C267TBIF – P/N 00007196

Harness, C267 18-wire Molex to C267TBIF – P/N 00007197

Wiring Diagram 2

Molex-to-raw wires harness, 2 ft. (60.96 cm), 35267HRNSKIT – P/N 00004924

Cables and Harnesses for C287 Only

C287 harness kit 35287HRNSKIT – P/N **50000999**

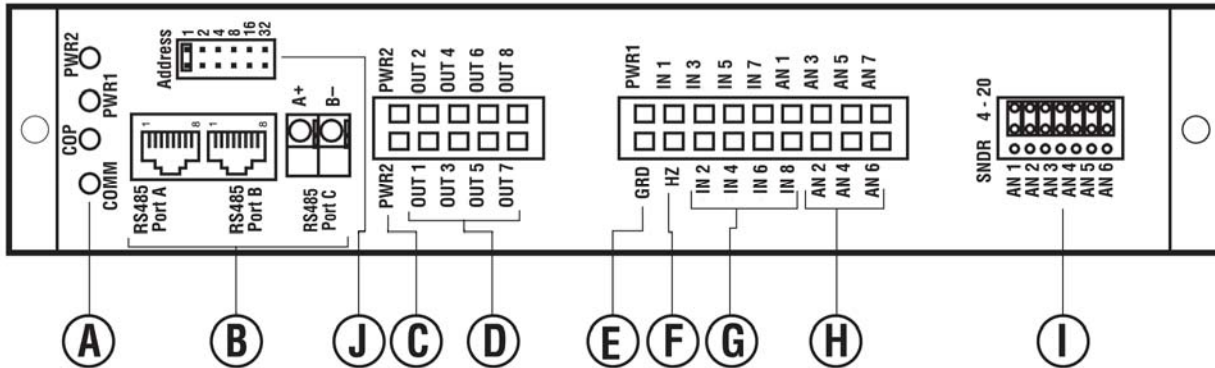
Specifications

Operating Temperature: -30° to +70°C

Storage Temperature: -30° to +70°C

Power Input Voltage: 9 to 28 VDC

C267 Digital Input / Output, 0-5VDC / 0-20 mA Input



<p>A</p>	<p>Status LED's: There are Four Status LED's on the C267.</p> <ul style="list-style-type: none"> • COMM stands for Communication. It will flash any time a communication packet passes to or from the C267. • COP stands for Controller Operating Properly. It will flash every quarter second if the internal CPU is functioning properly. This light should start flashing as soon as power is supplied to the PWR1 connection. • PWR1 stands for Power 1. This light will turn on when power is properly applied to the Pins PWR1 and GND. This is the control power. • PWR2 stands for Power 2. This light will turn on when power is properly applied to the PWR2 and GND pins. This is the battery plus power for the FET outputs. Note: Both PWR2 pins should be connected to increase the amperage capability of the outputs.
<p>B</p>	<p>RS-485 Communication Port: Ports A, B and C are electrically common for wiring convenience.</p>
<p>C</p>	<p>Power 2: This is the battery (+) power for the FET outputs.</p> <p>NOTE: Both PWR2 pins should be connected to increase the amperage capability of the outputs.</p>
<p>D</p>	<p>MODBUS Address Select Shunts: These shunts allow you to assign a unique address to each C267 that may be in the system. This allows the master controller to differentiate between the modules. For example, to name the controller address 21, place the shunts on LK1, LK4, and LK16. . (Refer to the Communications chapter of this manual.)</p>
<p>E</p>	<p>Output Connections:</p> <p>8 – OUT1 through OUT8 are the controller output connections consistent with use in Class 1 Division 2 Hazardous areas. Each output supplies battery plus at 5 Amps.</p> <p>NOTE: The maximum current draw for the unit is 18 amps when both PWR2 pins are connected.</p>
<p>F</p>	<p>Control Power 1: Connect this to battery (+). This supplies power to the control portion of the circuitry.</p>

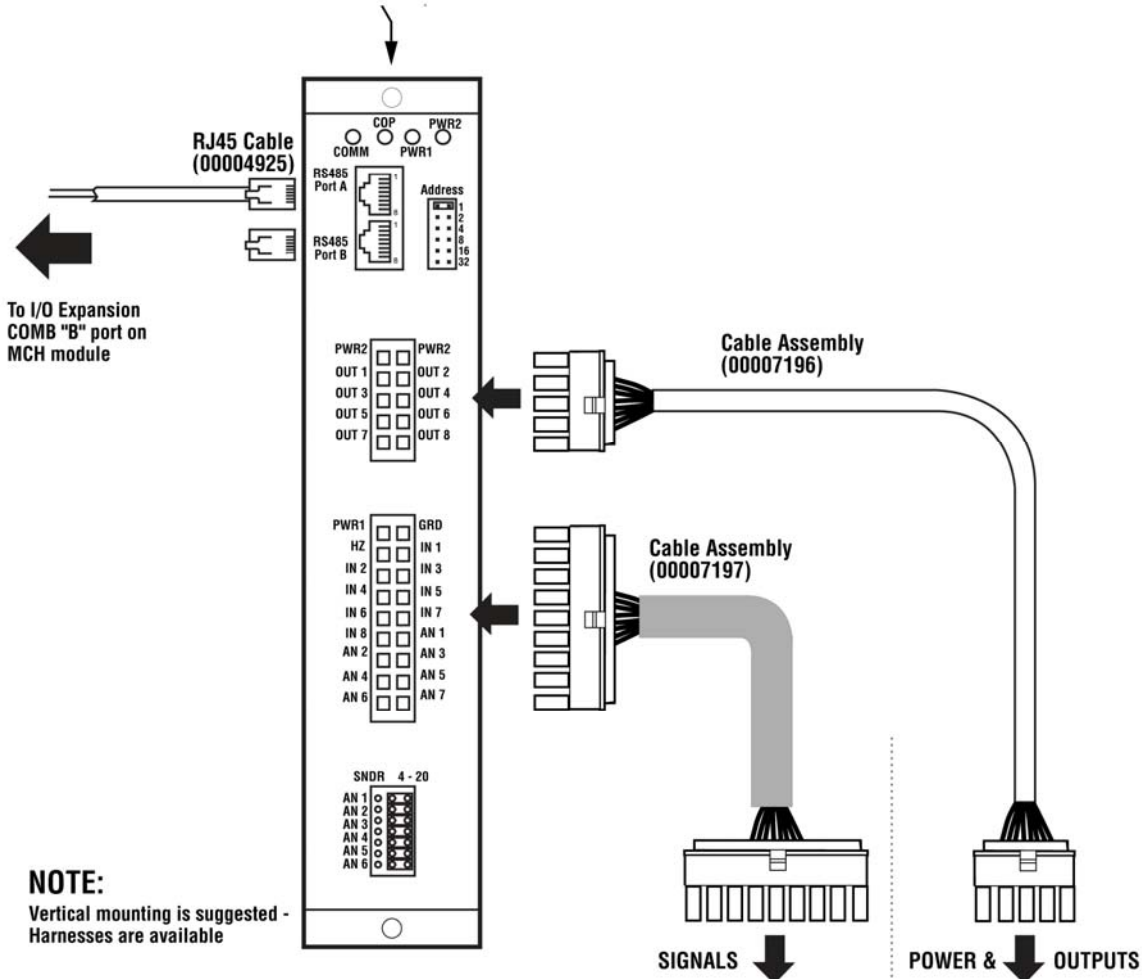
G	<p>Frequency Input: This input is used to sense frequency via a magnetic pickup. Optically Isolated Frequency input requiring at least 2 Vrms for activation. Used for speed reference. Range: 60 – 10,000 Hz.</p> <p>Frequency Input Voltage</p> <ul style="list-style-type: none"> • 2 Vrms Minimum @ 100 Hz and Higher • 4 Vrms Minimum @ 100 Hz and Lower
H	<p>Digital Inputs: IN1 through IN8 are optically isolated digital inputs for use with ground or battery (+) digital switches. Accepts either B+ or B- for activation.</p>
I	<p>Analog Inputs:</p> <p>7 - AN1 through AN7 are 8-bit analog inputs that can be shunt selected to read 0-5 VDC, 4-20 mA, and / or resistive electric gauge sending units / close to ground digital inputs. Additionally, selecting Electric Gauge Sending Unit allows each analog input to be utilized as additional B- digital inputs. These analog inputs can be configured independently. 7 analog inputs configured as sender can also be digital inputs as close to ground.</p> <p>1 – Internal Battery Monitor.</p>
J	<p>Analog Selector Shunts: These shunts are used to configure what type of end device is being used to supply the analog signal for each analog channel. To select 0-20 mA, place the shunt on top two pins. To select electric gauge sending unit, place the shunt on the bottom two pins. To select 0-5 VDC, remove the shunt from the channel.</p>

C267 Installation Instructions (UL)

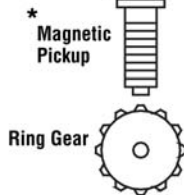
When installing a 267 Controller, power, analog input and analog output (I/O) wiring must be in accordance with Class 1, Division 2 wiring methods [Article 501-4(b) of the National Electrical Code, NFPA 70] and in accordance with the authority having jurisdiction.

Wiring Diagram 1

Expansion Module C267 Model To Interface Module C267TBIF

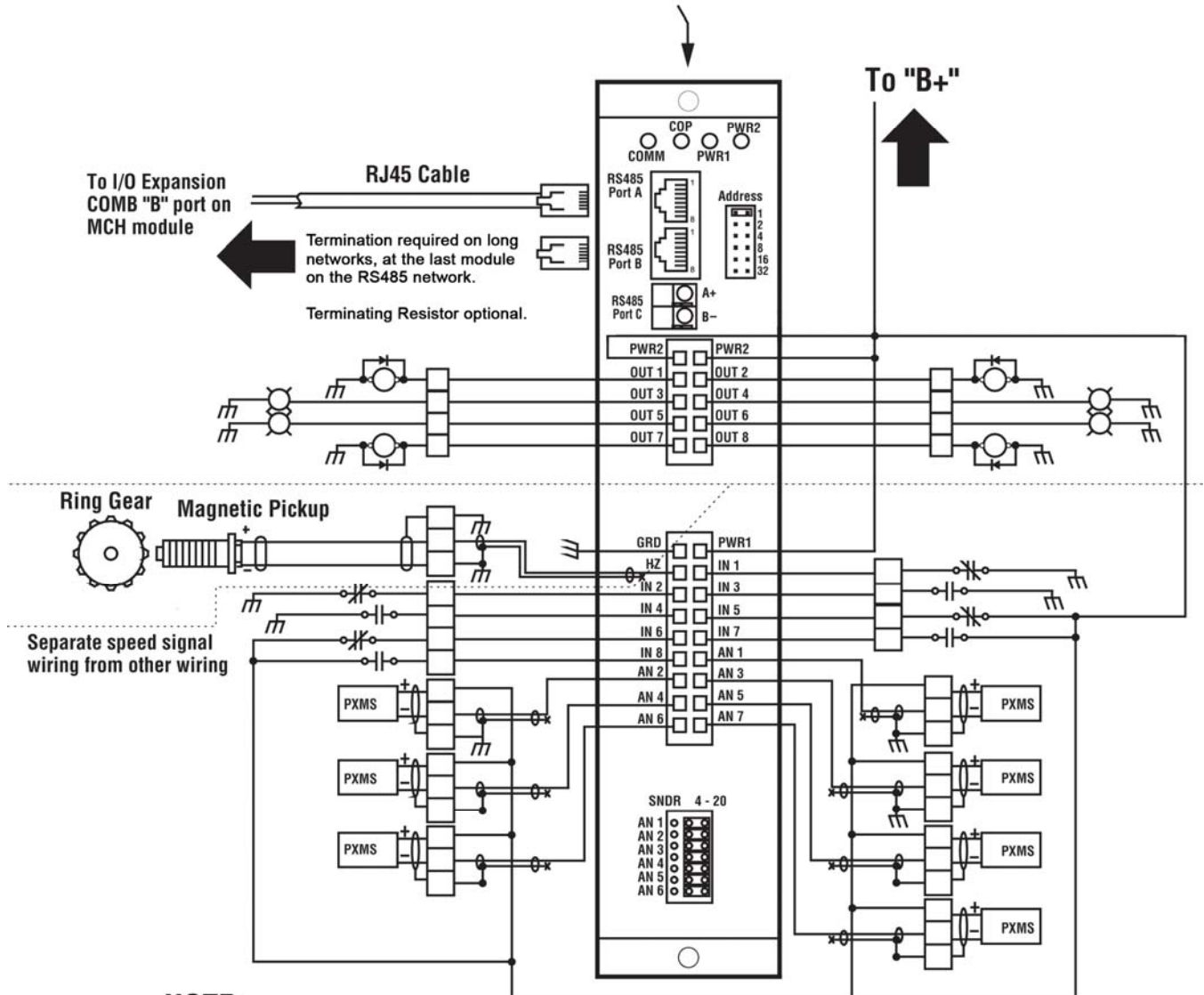


* Use shielded twisted pair cable with shielded drain wire connected at the EMSTBIF end only.



Wiring Diagram 2

Expansion Module C267 Model

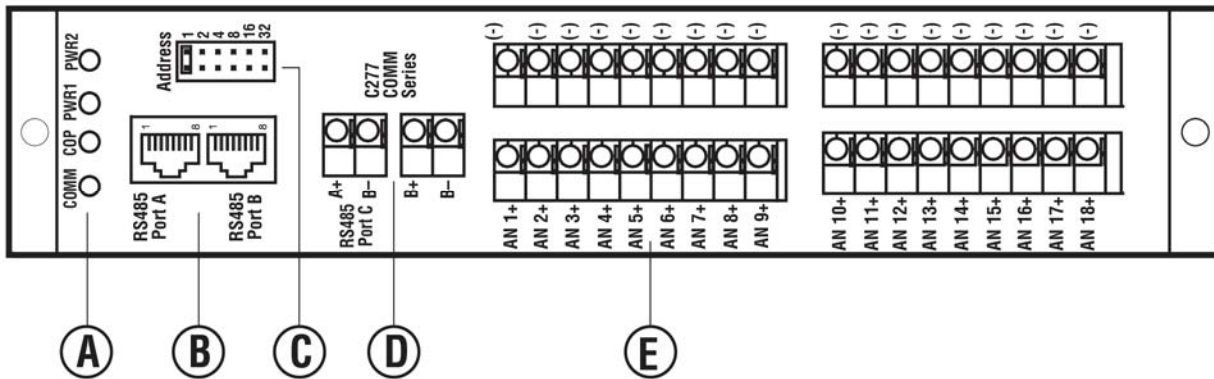



NOTE:

□ = Screw terminal block

- Vertical mounting is suggested - Harnesses are available.
- Use Molex crimp pins 39000039 (Murphy 00007181).
- Use crimper specifically designed for these Molex pins.
- Separate signal wiring from power and output wiring.
- Use shielded twisted pair cable for 4-20 mA/Transmitter/Speed signal wiring.
- Connect shield drain wire to ground of the device reading the signal, only.

C277 Thermocouple / 0-24 mA Input



A	<p>Status LED's: There are Four Status LED's on the C277.</p> <ul style="list-style-type: none"> • COM stands for Communication. It will flash any time a communication packet passes to or from the C277. • COP stands for Controller Operating Properly. It will flash every half-second if the internal CPU is functioning properly. This light should start flashing as soon as power is supplied to the PWR1 connection. • PWR1 stands for Power 1. This light will turn on when power is properly applied to the Pins B+ and B-. This is the control power. • PWR2 stands for Power 2. This lights when the internal (-) 5 VDC supply is functioning properly.
B	<p>RS-485 9600-N-8-1Communication Port: Ports A, B and C are electrically common for wiring convenience.</p>
C	<p>MODBUS Address Select Shunts: These shunts allow you to assign a unique address to each C277 that may be in the system. This allows the master controller to differentiate between the modules. For example, to name the controller address 21, place the shunts on LK1, LK4, and LK16. . (Refer to the Communications chapter of this manual.)</p>
D	<p>Screw Terminals: Connect battery (+) to the terminal labeled B+. Hook Battery (-) to the terminal labeled B-.</p>
E	<p>Channel Connection Terminals: Each channel has two dedicated terminals. The top row is the negative side of the connection and the bottom row is the positive side of the connection.</p> <p>It is recommended practice to use externally wired ground jumpers. If 0-24 mA is used, a shunt must be installed on that channel in the area circled in this picture</p>  <p>NOTE: If current is applied to the channel without installing the shunt, damage to the board can occur.</p> <p>Shunts have been provided to connect each channel's - input to DC-. These are found on the raised board.</p>

Application Tips

For maximum temperature accuracy the C277 should be at a constant temperature with no channels assigned to 4 to 20 mA signals. The unit will still achieve excellent accuracy with slowly varying temperature as long as the temperature source is not a point source. When mixing thermocouples and 4 to 20 mA signals on the same C277, best accuracy will result from putting the thermocouples signals in the middle terminal blocks and 4 to 20 mA signals at the end terminal blocks.

Application Do's and Don'ts

- **Do** use measurement channels for temperature starting at 9 and 10, 8 and 11, etc.
- **Do not** use channels near the center for 4 to 20 mA measurements.
- **Do not** place heat-radiating devices near the C277 in the panel.
- **Do not** have a windowed panel that allows sunlight to fall on the C277.
- **Do not** mount the C277 with its terminal blocks perpendicular to a panel side that will be hot from engine heat or sun.

POWER-UP NOTE: Due to the signals the C277 is reading, there is a great deal of averaging done at power-on. If all 18 channels are active, it can take up to 48 seconds to reach full accuracy. Once this initial power-up sequence is complete, each complete update takes about 4.5 seconds at a filter frequency of 60 Hz.

C277 Installation Instructions (UL)

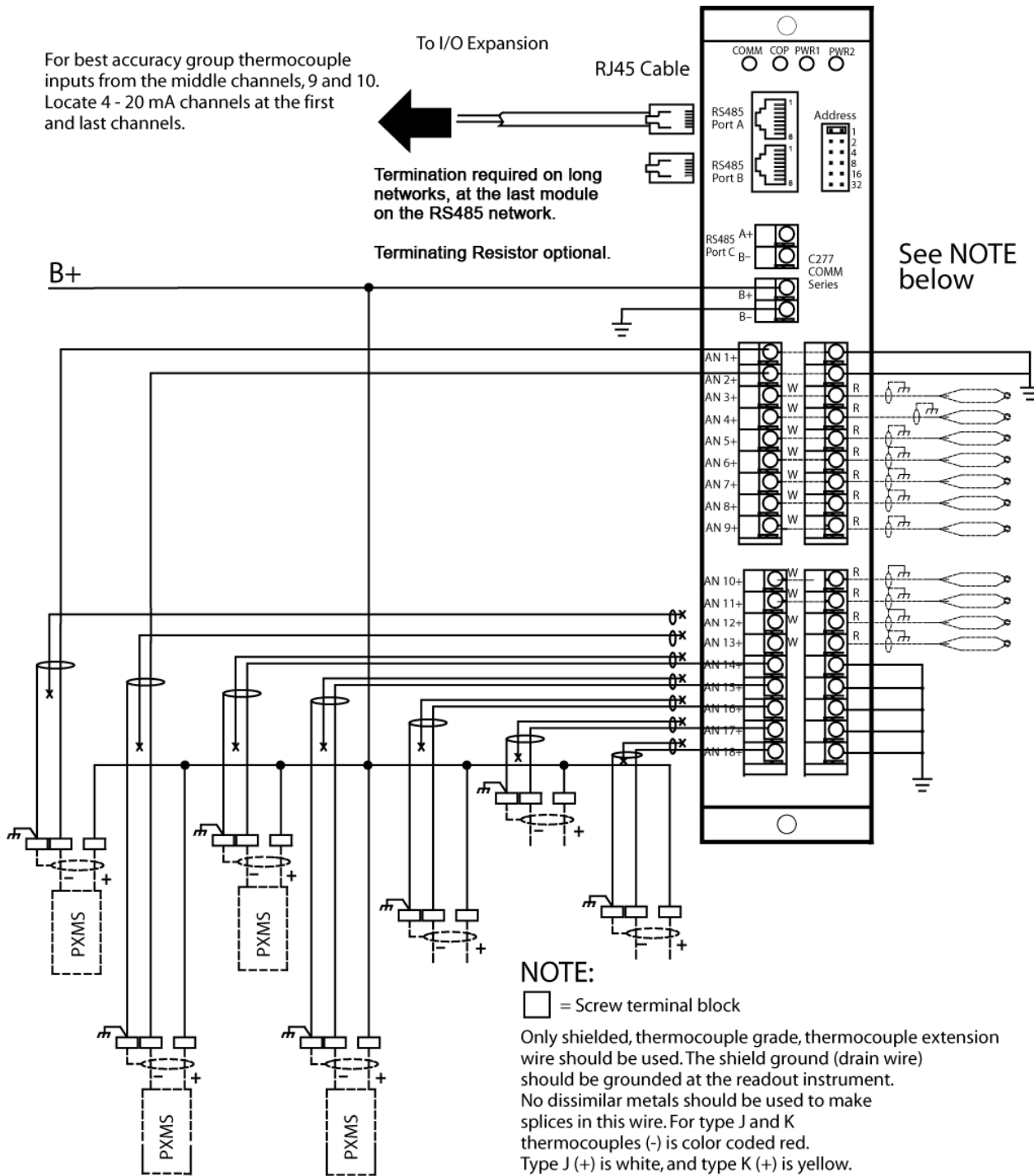
When installing a 277 Comm Controller, power, analog input and analog output (I/O) wiring must be in accordance with Class 1, Division 2 wiring methods [Article 501-4(b) of the National Electrical Code, NFPA 70] and in accordance with the authority having jurisdiction.

Wiring Diagram

For best accuracy group thermocouple inputs from the middle channels, 9 and 10. Locate 4 - 20 mA channels at the first and last channels.

To I/O Expansion
 Termination required on long networks, at the last module on the RS485 network.

Terminating Resistor optional.



See NOTE below

NOTE:

□ = Screw terminal block

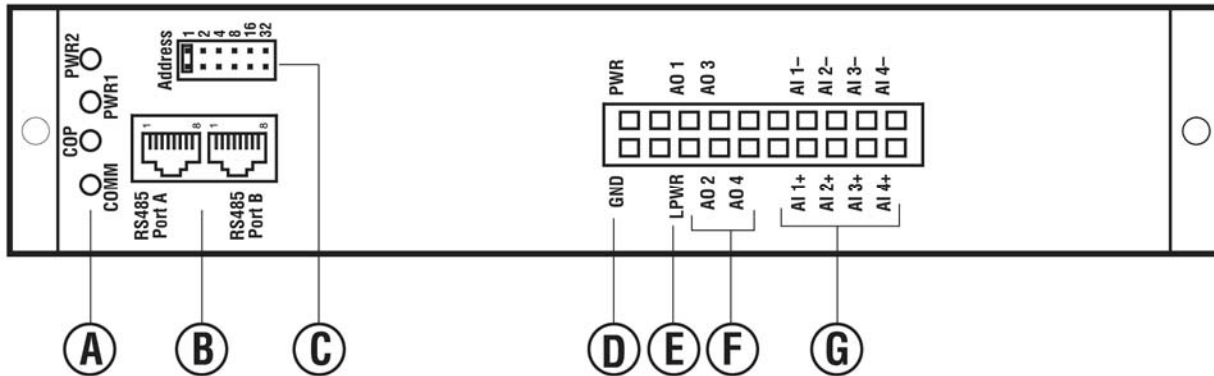
Only shielded, thermocouple grade, thermocouple extension wire should be used. The shield ground (drain wire) should be grounded at the readout instrument.

No dissimilar metals should be used to make splices in this wire. For type J and K thermocouples (-) is color coded red.

Type J (+) is white, and type K (+) is yellow.

For other types consult a thermocouple reference book. Pressure transmitters should be wired using shielded twisted pair cabling.

C287 0-20 mA Input, 0-24 mA Output

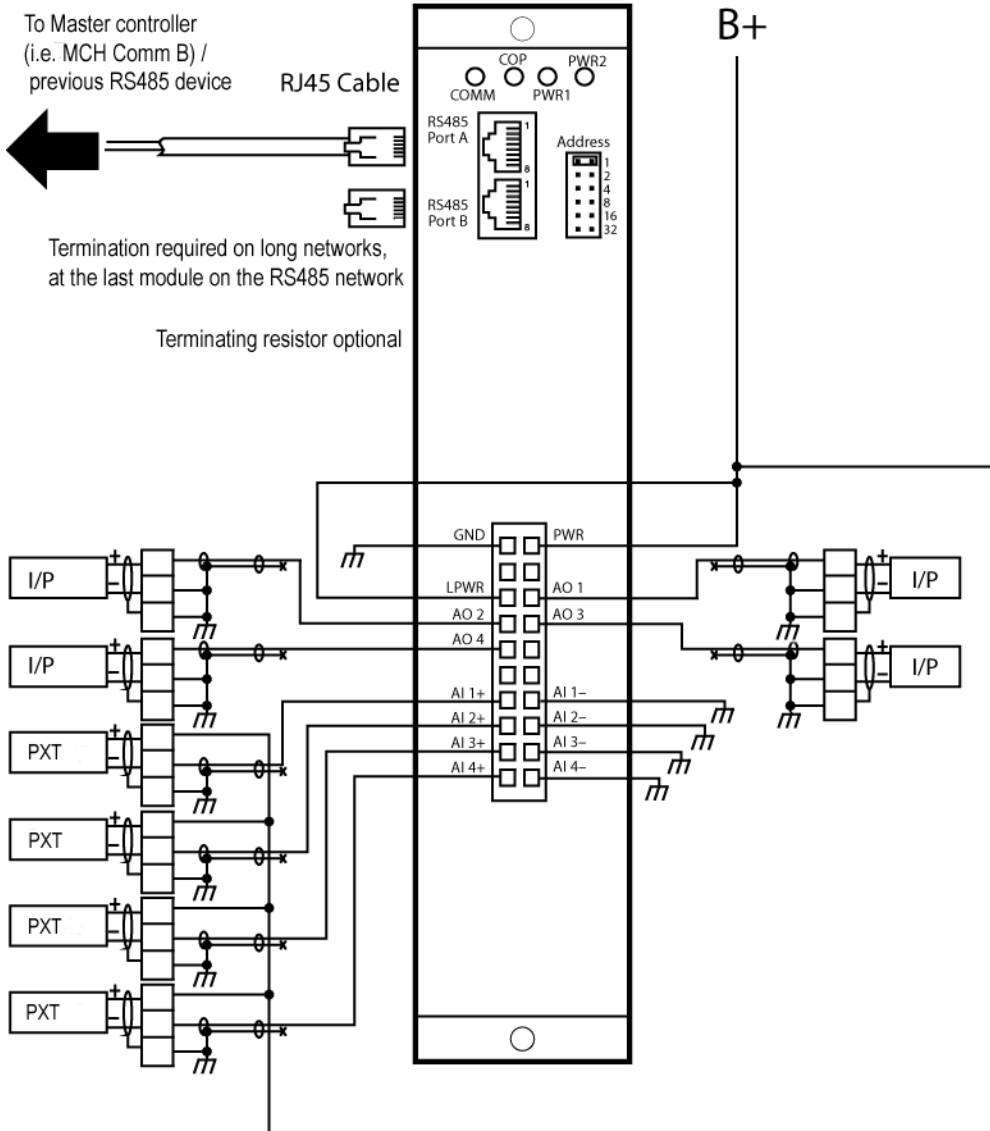


A	<p>Status LED's: There are Four Status LED's on the C287.</p> <ul style="list-style-type: none"> • COMM stands for Communication. It will flash any time a communication packet passes to or from the C287. • COP stands for Controller Operating Properly. It will flash every half-second if the internal CPU is functioning properly. This light should start flashing as soon as power is supplied to the PWR connection. • PWR1 stands for Power 1. This light will turn on when power is properly applied to the Pins PWR1 and GND. This is the control power. • PWR2 stands for Power 2. This light will turn on when the internal +/- 15 VDC power is functioning properly.
B	<p>RS-485 Communication Port: Ports A and B are electrically common for wiring convenience.</p>
C	<p>MODBUS Address Select Shunts: These shunts allow you to assign a unique address to each C287 that may be in the system. This allows the master controller to differentiate between the modules. For example, to name the controller address 21, place the shunts on LK1, LK4, and LK16. . (Refer to the Communications chapter of this manual.)</p>
D	<p>Control Power: Connect battery (+) to PWR and battery (-) to GND. This supplies power to unit</p>
E	<p>Analog Loop Power: Connect the analog Loop Power to this input.</p>
F	<p>Analog Outputs: 4 – 16 bit analogs, software configurable to 0-24 mA, 0-20 mA, or 4-20 mA.</p>
G	<p>Analog Inputs: 4 – 15 bit true 0-20 mA. When used as the last unit on an analog loop, ground the AN(-) pin and hook the output from the transmitter to the AN(+) pin. When used in a loop, bring the output from the transmitter into the AN(+) pin and come out of the AN(-) pin to the next device.</p>

C287 Installation Instructions (UL)

When installing a 287 Controller, power, analog input and analog output (I/O) wiring must be in accordance with Class 1, Division 2 wiring methods [Article 501-4(b) of the National Electrical Code, NFPA 70] and in accordance with the authority having jurisdiction.

Wiring Diagram



NOTE:

□ = Screw terminal block

- Vertical mounting is suggested - Harnesses are available.
- Use Molex crimp pins 39000039.
- Use crimper specifically designed for these Molex pins.
- Use shielded twisted pair cable for 4-20 mA/Transmitter/any Analog Input & Output.

MODBUS Communications

Physical Layer: Each module features one asynchronous RS485 serial communication port. These networks are 2-wire, half-duplex, and feature an “A” and “B” connection. The A terminal is the + or non-inverting signal, and the B terminal is the – or inverting signal. These signal lines will take turns transmitting and receiving depending on the device using the RS485 network at any given instant.

RS485 Interconnect: The modules are equipped with RJ45 jacks, called Ports A and B, for interconnection between the modules using standard RJ45 cables. The C277 and C267 modules also feature screw terminals on Port C for interconnection using twisted shielded pair cable with 120 ohm impedance suitable for RS485 networks.

If more than one module is used in a communication network, interconnection should be done using a daisy chain approach from the master to the first module, then from that module to the next, until the network is complete. Each module should be wired such that the A lines are connected together, and the B lines are connected together.

RS485 Line Conditioning: Proper RS485 line biasing is required for a robust RS485 network. If the Modbus RTU master cannot provide this feature on board, an FWMurphy 10007607 RS485 Signal Conditioner installed according to its connection diagram on the RS485 network is suitable for this purpose.

RS485 Line Termination: Proper RS485 line termination of 120 ohms at each end of the network is required for a robust RS485 networks greater than approximately 50 feet. An FWMurphy 00005292 Terminating Resistor Module installed in the RJ45 jack of the last module is suitable for this purpose.

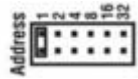
Baud Rate: 9600 fixed

Protocol: Modbus RTU. This is a binary communication protocol. All data will be contained in unsigned 16-bit Modbus Holding Registers (addressed starting at 40001). Following the Modbus RTU specification, the Most Significant Byte in a 16-bit word is broadcast first, followed by the Least Significant Byte.

The Modbus RTU master must perform a Modbus Read Holding Registers command, Function 03 to request data from the modules and a Modbus Preset Registers Command, Function 16 or 06, to configure the modules and send output commands.

Refer to the Modbus RTU map provided in the Installation and Operation manual for a detailed mapping of the available data and data scaling.

Modbus RTU Address Select Shunts: A jumper shunt header is provided to assign a unique Modbus RTU address to each expansion module that may be in the network. This allows the Modbus RTU master controller to differentiate between the modules. Addressing is done in binary format, and each incrementing jumper increases the weight by a factor of 2.



For example, to name the controller address 21, place the shunts on LK1, LK4, and LK16. The sum makes 21 (16+4+1).

NOTE: Communication is 9600-N-8-1 for Address 0-31 and 9600-N-8-2 for Address 32-63.

Registers start at 40,001.

Stop Bits: The module will respond with 1 stop bit for Modbus RTU addresses 1 through 31 and 2 stop bits for addresses 32 through 63. This maintains flexibility for systems requiring 2 stop bits.

Modbus RTU Polling Frequency: The module should be polled by the Modbus RTU Master with a delay of 30-50mS between packets, and typical response times will be < 100mS. This may vary depending on the amount of data requested on each module. Typical Modbus RTU timeout settings should be set to \geq 400mS.

Modbus RTU Holding Register Bitmapping: Some modules feature digital inputs and outputs which must communicate their “true” and “false” boolean conditions through Modbus RTU 16-bit registers. To efficiently communicate this data, bitmaps are used to send up to 16 boolean conditions in one word. Whenever the term “bitmap” is used, this means that data must be interpreted at a bit level within that 16 bit word. The least significant bit in the word is the 1st bit in that word.

If less than 16 boolean conditions exist to be broadcast, the additional upper bits will remain at 0, and serve as padding to make a proper 16-bit word to comply with Modbus RTU specifications.

Example #1: Bitmapped word for digital input status.

Bit 1 = Digital Input 1 status (decimal value 1...the least significant bit in the word)

Bit 2 = Digital Input 2 status (decimal value 2)

Bit 3 = Digital Input 3 status (decimal value 4)

Bit 4 = Digital Input 4 status (decimal value 8)

Bit 5 = Digital Input 1 status (decimal value 16)

Bit 6 = Digital Input 2 status (decimal value 32)

Bit 7 = Digital Input 3 status (decimal value 64)

Bit 8 = Digital Input 4 status (decimal value 128)

If more than one digital input is true (closed), the decimal value will be summed.

Example #2: Bitmapped word for digital output status.

- Bit 1 = Digital Output 1 status (decimal value 1...the least significant bit in the word)
- Bit 2 = Digital Output 2 status (decimal value 2)
- Bit 3 = Digital Output 3 status (decimal value 4)
- Bit 4 = Digital Output 4 status (decimal value 8)
- Bit 5 = Digital Output 5 status (decimal value 16)
- Bit 6 = Digital Output 6 status (decimal value 32)
- Bit 7 = Digital Output 7 status (decimal value 64)
- Bit 8 = Digital Output 8 status (decimal value 128)

If more than one digital output is true (on), the decimal value must be summed.

PC Connection: Most commercial PC's are equipped with one RS232 serial port in the form of a 9 pin D-Sub connection. If not, USB to RS232 adapters are also readily available. Testing for RS485 traffic can be done using a PC equipped with any Modbus RTU Master software and a serial interface converter that can convert RS232 traffic to RS485. The PC in this case would serve as the Modbus RTU master in lieu of an external controller.

Contact FW Murphy™ to obtain configuration templates to use MConfig™ software to poll these devices for configuration and monitoring purposes.

C267 Module - MODBUS RTU Description

Register #	Description
40001	Battery monitor (0-255)
40002	analog 1 input (0-255)
40003	analog 2 input (0-255)
40004	analog 3 input (0-255)
40005	analog 4 input (0-255)
40006	analog 5 input (0-255)
40007	analog 6 input (0-255)
40008	analog 7 input (0-255)
40009	Frequency input (0 – 10000)
40010	Digital inputs 1 – 8 (0-255) Bitmapped
40011	Analog as Digital's (0-127) Bitmapped
40012	Digital Outputs (0-255) Bitmapped
40013	Comm Active (0 – 65535)
40014	Output At Power Up (0-255) Bitmapped
40015	Output If Comm Fails (0-255) Bitmapped
40016	Comm Fail Time Delay (0-65535 Seconds)
40017	Processor Configuration
40018	Reserved For Future
40019	Capture Inputs
40020	Software Version Number
40021	Hardware Type

Register 13 Value Description

Register 13 is used to determine if the communication is active. The master controller can send a different value to this register each time a communication packet is sent. If this value is not changed within a programmable time (Set in Register 40,016) the C267 will preset the outputs to the value in register 40,015 based on a communication failure.

Register 14 Value Description

Register 14 allows you to pre-set the output status for power on. When power is first applied to the unit, the outputs will be in this pre-determined configuration.

NOTE: Systems should be designed for safe controlled operation when outputs turn off. That should be the primary choice. When that is not possible, then these registers can control the state of the outputs at power-up or loss of communications.

Register 15 Value Description

Register 15 allows you to pre-set the output status if the communications fails during operation.

Register 16 Value Description

Register 16 is used to set the communication failure time delay. If set to zero (0) the communication fail function will be disabled. Any other value will be a time delay in seconds.

Register 17 Value Description

Register 17 is a read-only register that allows you to view the value in the configuration register. It should be set to 0B.

Register 19 Value Description

Register 19 is a read-only register. It is used for factory troubleshooting.

Register 20 Value Description

Register 20 is a read-only register. This register holds the current software revision number. You may be asked for this information if you are working with our tech support.

Register 21 Value Description

Register 21 is a read-only register. This register holds the model number of the hardware. If you are using multiple Comm modules, it is sometimes helpful to confirm that you are communicating with the expected module type. In this case, it will return 267.

C277 Module - MODBUS RTU Description

Register #	Description
40001	Channel 1 ($\pm 0-32767$)
40002	Channel 2 ($\pm 0-32767$)
40003	Channel 3 ($\pm 0-32767$)
40004	Channel 4 ($\pm 0-32767$)
40005	Channel 5 ($\pm 0-32767$)
40006	Channel 6 ($\pm 0-32767$)
40007	Channel 7 ($\pm 0-32767$)
40008	Channel 8 ($\pm 0-32767$)
40009	Channel 9 ($\pm 0-32767$)
40010	Channel 10 ($\pm 0-32767$)
40011	Channel 11 ($\pm 0-32767$)
40012	Channel 12 ($\pm 0-32767$)
40013	Channel 13 ($\pm 0-32767$)
40014	Channel 14 ($\pm 0-32767$)
40015	Channel 15 ($\pm 0-32767$)
40016	Channel 16 ($\pm 0-32767$)
40017	Channel 17 ($\pm 0-32767$)
40018	Channel 18 ($\pm 0-32767$)
40019	Cold Junction Compensation (Terminal Block Temperature) ($\pm 0-32767$)
40020 - 24	Reserved For Future
40025	Comm Active (0-65535)
40026	Comm Fail Time Delay (0-65535 Seconds)
40027	Channel Filter Frequency
40028	Channel 1 Configuration
40029	Channel 2 Configuration
40030	Channel 3 Configuration
40031	Channel 4 Configuration
40032	Channel 5 Configuration
40033	Channel 6 Configuration
40034	Channel 7 Configuration
40035	Channel 8 Configuration
40036	Channel 9 Configuration
40037	Channel 10 Configuration
40038	Channel 11 Configuration
40039	Channel 12 Configuration
40040	Channel 13 Configuration
40041	Channel 14 Configuration
40042	Channel 15 Configuration
40043	Channel 16 Configuration
40044	Channel 17 Configuration

Register #	Description
40045	Channel 18 Configuration
40046	Cold Junction Calibration (+/- 2.0 °C)
40047	Software Version Number
40048-54	Factory Use Only
40055	Hardware Type

Register 1-19 Value Description

The number returned in this register is signed 16 bit data. 0-24mA configured channels are shown in mA x 100. For example, a read value of 1200 means 12.00mA is being read. Thermocouple configured channels are shown in °C x 10. For example, a read value of -182 means -18.2 °C is being read.

NOTE: These values are not averaged before they are updated in the C277. The device reading these values must perform some sort of averaging to filter out sporadic erroneous reading.

Register 25 Value Description

Register 25 is used to determine if the communication is active. The master controller can send a different value to this register each time a communication packet is sent. If this value is not changed within a programmable time (Set in Register 40,026) the C277 will register a communications failure internally, but will not change the way it functions.

Register 40026 Value Description

Register 40,026 is used to set the amount of time the value in register 40,025 can remain unchanged before a communications failure is registered.

Register 27 Value Description

Register 40027 is used to select the filter frequency for all the channels. Valid numbers are from 10 to 1560 Hz. Higher filter frequencies allow faster channel update rates but the accuracy is lower. A filter frequency of 240 Hz will yield an update rate 4 times faster than a filter frequency of 60 Hz.

Example: At 10 Hz with all 18 channels acquiring data, the update rate for all channels will be approximately 114 seconds. At 60 Hz, the update rate for all channels drops to approximately 4.5 seconds.

NOTE: At update rates above 60 Hz, the accuracy of the reading begins to degrade.

Register 28 - 45 Value Description

Registers 28 through 45 allow you to configure what type of sensor is attached to each channel. The module will return a value in engineering units. Use the list below to determine what value you should write based on the sensor installed. If you select end of line 0 to 24 mA for a channel, you must install a shunt on that channel. See “Shunts” earlier.

NOTE: If you are not using a channel, write a 0 to disable it. Updates will be faster.

- 0 – Disable Channel
- 1 – Type K thermocouple (output 0.1°C resolution)
- 2 – Type J thermocouple (output 0.1°C)
- 3 – Type E thermocouple (output 0.1°C)
- 4 – Type T thermocouple (output 0.1°C)

Thermocouple Break Detection: The C277 signals thermocouple break by outputting 32767 in the register.

Thermocouple Ranges: Maximum readings:

- Type K = 1180°C
- Type J = 760°C
- Type E = 638°C
- Type T = 400°C.
- The minimum temperature reading on all types is –150°C.

- 5 – Reserved for Future Use
- 6 – Reserved for Future Use
- 7 – Reserved for Future Use
- 8 – Reserved for Future Use
- 9 – Reserved for Future Use
- 10 – end of line 0-24 mA (output .01 mA)

EXAMPLE: To configure channel 2 to read a type K thermocouple just send a 1 to register 40,029. The controller will read this and configure the register automatically. If you read back the value in the register, it will not be 1. To disable the channel, simply send the register a 0.

Register 55 Value Description

Register 55 is a read-only register. This register holds the model number of the hardware. If you are using multiple Comm modules, it is sometimes helpful to confirm that you are communicating with the expected module type. In this case, it will return 277.

C287 Module - MODBUS RTU Description

Register #	Description
40001	Analog 1 input (0-32767)
40002	Analog 2 input (0-32767)
40003	Analog 3 input (0-32767)
40004	Analog 4 input (0-32767)
40005	Output OK status (0-15) output 1-4 status bitmap
40006	Analog 1 output (0-65535)
40007	Analog 2 output (0-65535)
40008	Analog 3 output (0-65535)
40009	Analog 4 output (0-65535)
40010	Comm Active (0 – 65535)
40011	Analog 1 output at power-up (0-65535)
40012	Analog 2 output at power-up (0-65535)
40013	analog 3 output at power-up (0-65535)
40014	analog 4 output at power-up (0-65535)
40015	analog 1 output at Comm fail (0-65535)
40016	analog 2 output at Comm fail (0-65535)
40017	analog 3 output at Comm fail (0-65535)
40018	analog 4 output at Comm fail (0-65535)
40019	Output Configuration (0-255) bitmap
40020	Comm Fail Time Delay (0-65535 Seconds)
40021	Processor Configuration
40022	Software Version Number
40023	Hardware Type

Register 10 Value Description

Register 10 is used to determine if the communication is active. The master controller can send a different value to this register each time a communication packet is sent. If this value is not changed within a programmable time (Set in Register 40,020) the C287 will set the outputs to the values specified in registers 40,015-18.

Registers 11-14 Value Description

Registers 11-14 allow you to pre-set the output values for power on. When power is first applied to the unit, the outputs will be in this pre-determined configuration.

Register 19 Value Description

Register 19 is used to set the output configuration for the analog out channels. Your choices are: No output, 4-20 mA, 0-20 mA, or 0-24 mA. This register is an 8-bit value. Please consult the table below to see the binary value for the register. Once the binary value is known, send the decimal equivalent to this register to configure the outputs.

To build the number, use the following values:

Second Bit	First Bit	Output Range
0	0	No Output
0	1	4-20 mA
1	0	0-20 mA
1	1	0-24 mA

The table below is based on the following assumptions:

Analog output 1 = 0-24 mA

Analog output 2 = No Output

Analog output 3 = 4-20 mA

Analog output 4 = 0-20 mA

Using the table above and starting from right to left, you will build a binary number of 10010011.

Register 20 Value Description

Register 20 is used to set the communication failure time delay. If set to zero (0) the communication fail function will be disabled. Any other value will be a time delay in seconds.

Register 21 Value Description

Register 21 is a read-only register that allows you to view the value in the configuration register. It should be set to 11.

Register 22 Value Description

Register 22 is a read-only register. This register holds the current software revision number. You may be asked for this information if you are working with our tech support.

Register 23 Value Description

Register 23 is a read-only register. This register holds the model number of the hardware. If you are using multiple Comm modules, it is sometimes helpful to confirm that you are communicating with the expected module type. In this case, it will return 287.

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FW MURPHY

P.O. Box 470248
Tulsa, Oklahoma 74147 USA
+1 918 317 4100 Fax: +1 918 317 4266
E-mail: sales@fwmurphy.com

INDUSTRIAL PANEL DIVISION

Fax: +1 918 317 4124
E-mail: ipdsales@fwmurphy.com

MURPHY POWER IGNITION

Web site: www.murphy-pi.com

CONTROL SYSTEMS & SERVICES DIVISION

P.O. Box 1819
Rosenberg, Texas 77471 USA
Phone: +1 281 633 4500 Fax: +1 281 633 4588
E-mail: css-solutions@fwmurphy.com

FRANK W. MURPHY LTD.

Church Road, Laverstock
Salisbury, SP1 1QZ, UK
Phone: +44 1722 410055 Fax: +44 1722 410088
E-mail: sales@fwmurphy.co.uk
Web site: www.fwmurphy.co.uk

COMPUTRONIC CONTROLS

41 - 43 Railway Terrace
Nechells, Birmingham, B7 5NG, UK
Phone: +44 121 327 8500 Fax: +44 121 327 8501
E-mail: sales@computroniccontrols.com
Web site: www.computroniccontrols.com

www.fwmurphy.com

FW MURPHY INTERNATIONAL TRADING (SHANGHAI) CO., LTD.

Suite 1704, Tower B, City Center of Shanghai, 100 Zunyi Road
Shanghai, 200051, China
Phone: +86 21 6237 2082 Fax: +86 21 6237 2083
E-mail: mhong@fwmurphy.com

FW MURPHY INSTRUMENTS (HANGZHOU) CO., LTD.

77 23rd Street
Hangzhou Economic & Technological Development Area
Hangzhou, Zhejiang, 310018, China
Phone: +86 571 8788 6060 Fax: +86 571 8684 8878



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