SYSTEMS ELECTRONICS GROUP

SYSTEMS M200 INTERFACE MODULES

M245: QUADRATURE ENCODER SIGNAL CONVERTER

- **Converts quadrature encoder signals to "forward" / "reverse" signals for use by standard PLC input interrupts**
- **Optically isolated 5-10 VDC and 10-30 VDC differential inputs for quadrature phase "A" and "B"**
- **10-30 VDC "forward" and "reverse" sourcing outputs with short circuit protection**
- **Powered from 10-15VDC or 15-30VDC**
- **Removable Field Wiring Connector**
- **Standard 3" x 3" x 1" DIN Rail Mountable Module**

General Description

When Quadrature encoders are used for angular positioning in PLC based systems, special input modules are used to decode the quadrature inputs into position information. The M245 allows the quadrature encoder to be used without having to have the special quadrature decode module, instead standard PLC interrupt inputs can be used. The M245 is a signal converter which converts Quadrature encoder signals (phase A and phase B) to two signals, "forward" and "reverse", which can be input to standard PLC interrupt inputs for angular positioning.

Figure 1 is a timing diagram which shows the "forward" and "reverse" outputs as a function of the Quadrature phase A and phase B signals and the direction of rotation of the encoder. When the encoder is moving in the forward direction (clockwise), the "forward" output of the M245 is pulsed "on" as shown. The "reverse" output is "off" as long as the encoder is turning forward. When the encoder is moving in the reverse direction (counter-clockwise), the "reverse" output is pulsed "on" as shown in figure 1. The "forward" output is "off" as long as the encoder is turning in reverse.

These two outputs can then be feed into PLC interrupt inputs. Every time a "forward" pulse occurs, an internal register can be incremented in the input interrupt service routine. Every time a "reverse" pulse occurs, the internal register should be decremented. The internal register corresponds to the current angular position of the encoder. An index pulse (once per revolution) would be used to reset the internal register corresponding to position zero.

General Description (cont'd)

The M245 algorithm is implemented per the following truth table:

Quadrature Inputs		M245 Outputs	
Phase A	Phase B	Forward	Reverse
0-to-1	0	1	0
1	0-to-1	0	0
1-to-0	1	1	0
0	1-to-0	0	0
0	0	0	0
0	0-to-1	0	0
0-to-1	1	0	1
1	1-to-0	0	0
1-to-0	0	0	1
0	0-to-1	0	0
0-to-1	1	0	1
1-to-0	1	1	0
0	1-to-0	0	0
0-to-1	0	1	0
1-to-0	0	0	1

In general, phase B of the encoder is sampled at the leading edge (0-to-1) and trailing edge (1-to-0) transitions of phase A. Depending on the state of phase B at these transitions, either the "forward" or "reverse" output is set. The corresponding output will stay set until a transition of either phase A or B.

The M245 inputs are optically isolated differential inputs. Inputs are provided for both 5-10VDC and 10-30VDC on both phase A and B depending on the output signals of the quadrature encoder. The "forward" and "reverse" outputs are 10-30VDC sourcing outputs at 100 milliamps with short circuit (to ground) protection. The module is powered from either 10-15VDC or 15-30VDC.

Figure 2 shows the typical module wiring for a +15VDC supply with 5VDC sinking quadrature inputs. Figure 3 shows the typical module wiring for a +24VDC supply and 24VDC sourcing quadrature inputs. Note the 100ohm, 1W resistor between the 10-30VDC power input (pin11) and 10-15VDC power input (pin10) when the module is powered from +24VDC (15-30VDC). The 10-15VDC power input (pin10) is used to power the internal logic of the M245 while the 10-30VDC power input (pin11) is used to power the M245 outputs. The 100ohm resistor is used to limit the logic power to 10-15VDC when the module supply power is over 15 volts. The "forward" and "reverse" outputs operate at the voltage used to power the M245 module (pin 11).

Typical applications include angular positioning using quadrature encoders and standard PLC interrupt inputs.

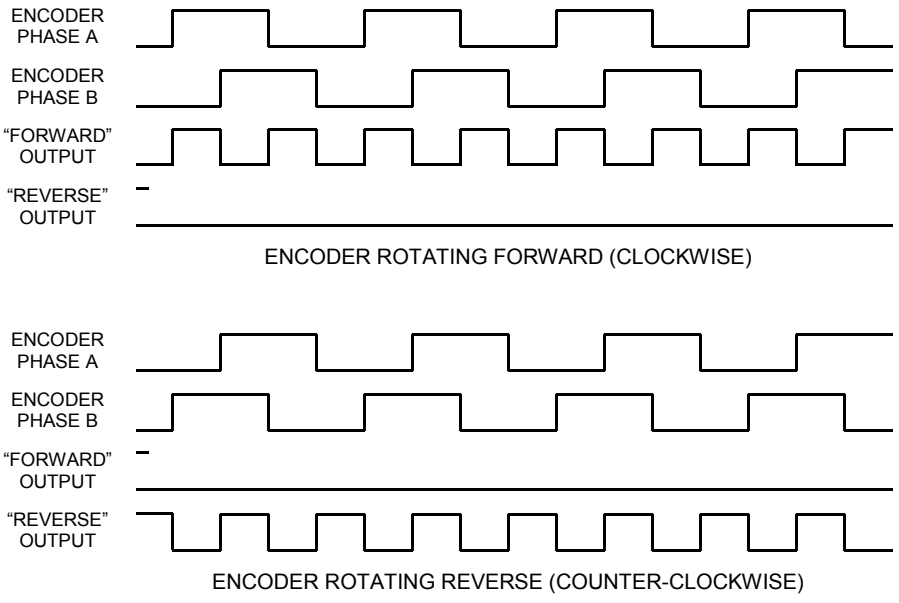

Figure 1
Timing Diagram Example

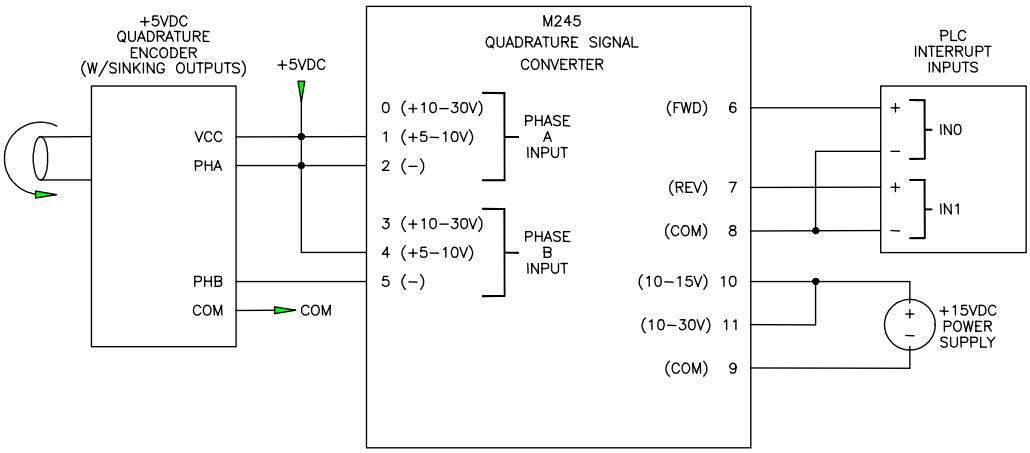

Figure 2
Sinking Encoder / +15VDC Power Supply

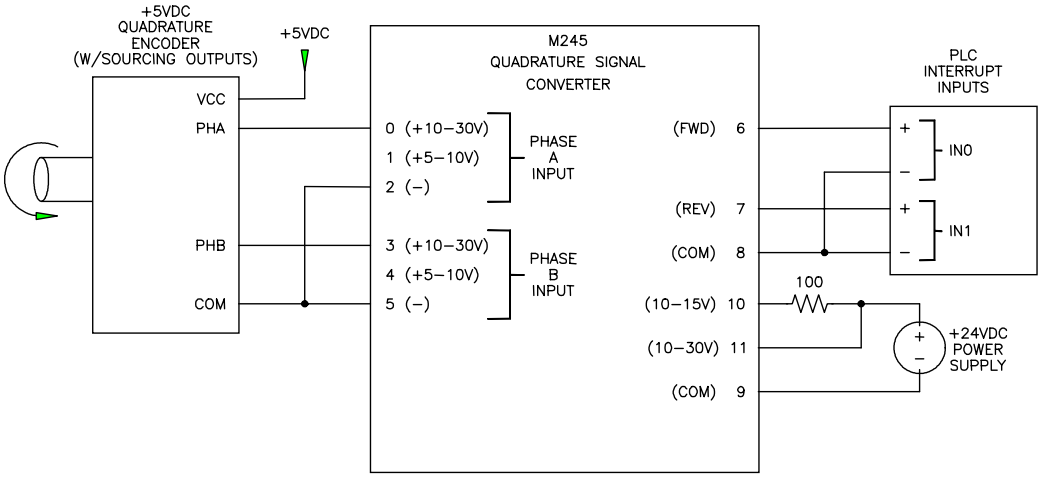

Figure 3
Sourcing Encoder / +24VDC Power Supply

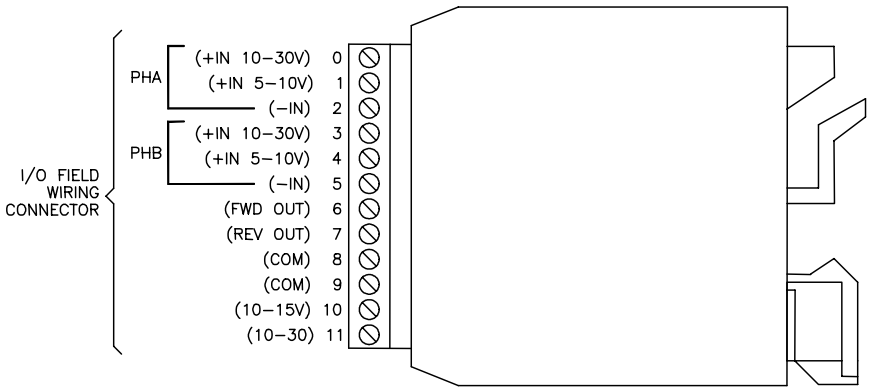

Figure 4
Connector Pin-Out

M245: QUADRATURE ENCODER
SIGNAL CONVERTER

Specifications

Module Size:

Length:	3.25”
Height:	3.75”
Width:	1.00”

Input Section:

5-10VDC Inputs:

Vin (on-min):	4.0 volts
Vin (on-max):	10.0 volts
Vin (off-min):	2.5 volts
Input Current (typ):	10 milliamps at Vin=5volts
Input Current (max):	25 milliamps at Vin=10volts
Input to Output Optical Isolation:	1500 Vrms
Input Configuration:	Can be wired for Sourcing, Sinking, or Differential

10-30VDC Inputs:

Vin (on-min):	10.0 volts
Vin (on-max):	30.0 volts
Vin (off-min):	5.0 volts
Input Current (typ):	15 milliamps at Vin=24volts
Input Current (max):	20 milliamps at Vin=30volts
Input to Output Optical Isolation:	1500 Vrms
Input Configuration:	Can be wired for Sourcing, Sinking, or Differential

Output Section:

Output Type:	True high sourcing (PNP)
Voltage Range:	10 to 30 VDC
Vout (on-min):	Vcc-2.00 volts
Vout (on-max):	Vcc-0.20 volts
Vout (off-max):	1.5 volts
Output Current (max):	100 milliamps
Short Circuit Protection:	Yes

Power Requirements:

User Supply Voltage:	10-30VDC
User Supply Current:	100 milliamps

Temperature Ranges:

Storage:	0 to 85 degrees C
Operating:	0 to 60 degrees C

Relative Humidity: 5 to 95% non-condensing