

Encoder Selection Guide

SAE Dimension Encoders & Metric Dimension Encoders

SAE Dimension Encoder Selection									
Specification	TRDA-2E Series		TRDA-20 Series		TRDA-25 Series				
	TRDA-2ExxxBD	TRDA-2ExxxVD	TRDA-20R1NxxxRZD	TRDA-20R1NxxxVD	TRDA-25RNxxxRZWDMS	TRDA-25RNxxxVVDMS			
Description	Light duty incremental encoder with solid shaft		Medium duty incremental encoder with solid shaft		Medium duty incremental encoder with solid shaft				
Size	Body: 1.5 in. diameter and 1.6 in. depth; Shaft: 0.25 in. diameter		Body: 2.0 in. diameter and 1.7 in. depth; Shaft: 0.375 in. diameter		Removable Flange: 2.5 in. round; Body: 2.0 in. diameter and 2.15 in. depth; Shaft: 0.375 in. diameter				
Output Configuration	NPN open collector (BD)	Line driver (VD)	Totem pole (RZD)	Line driver (VD)	Totem pole (RZWD)	Line driver (VVD)			
Input Power	12–24 VDC (nominal) Range: 10.8–26.4 VDC	5VDC (nominal) Range: 4.75–5.25 VDC	5–30 VDC (nominal) Range: 4.75–30.0 VDC	5VDC (nominal) Range: 4.75–5.25 VDC	5–30 VDC (nominal) Range: 4.75–30.0 VDC	5VDC (nominal) Range: 4.75–5.25 VDC			
Resolutions Available	100 to 2500 pulses per revolution		100 to 2500 pulses per revolution		100 to 2500 pulses per revolution				
Output Type	Cable – 2m [6.6 ft], tinned		Cable – 2m [6.6 ft], tinned		Military style (MS) connector				
Frequency Response	200kHz		100kHz	200kHz	100kHz	200kHz			
Rating	IP50		IP50		IP65				
Accessories Available	couplings, mounting bracket, mounting flanges		couplings, mounting bracket, mounting flanges		cables, couplings, mounting flanges				
Metric Dimension Encoder Selection									
Specification	TRD-MX Series								
	TRD-MXxxxAD	TRD-MXxxxBD	TRD-MXxxxVD						
Description	Light duty incremental encoder with solid shaft		Light duty incremental encoder with solid shaft		Light duty incremental encoder with solid shaft				
Size	Body: 25mm diameter and 29mm depth; Shaft: 4mm diameter		Body: 25mm diameter and 29mm depth; Shaft: 4mm diameter		Body: 25mm diameter and 29mm depth; Shaft: 4mm diameter				
Output Configuration	NPN open collector (AD)		NPN open collector (BD)		Line driver (VD)				
Input Power	5–12 VDC (nominal); Range: 4.5–13.2 VDC		12–24 VDC (nominal); Range: 10.8–26.4 VDC		5VDC (nominal); Range: 4.75–5.25 VDC				
Resolutions Available	100 to 1024 pulses per revolution		100 to 1024 pulses per revolution		100 to 1024 pulses per revolution				
Output Type	Cable (two meter, tinned)		Cable (two meter, tinned)		Cable (two meter, tinned)				
Frequency Response	100kHz max		100kHz max		100kHz max				
Rating	IP50		IP50		IP50				
Accessories Available	Metric-to-metric and metric-to-S.A.E. couplings, mounting brackets								
Specification	TRD-S/TRD-SH Series			TRD-SR/TRD-SHR Series				TRD-N Series	
	TRD-S(H)xxxAD	TRD-S(H)xxx-BD	TRD-S(H)xxx-VD	TRD-S(H)RxxxA(5)D	TRD-S(H)RxxxAW(0)D	TRD-S(H)RxxxV(5)D	TRD-S(H)RxxxVW(0)D	TRD-Nxxx-RZWD	TRD-Nxxx-RZVWD
Description	Light duty incremental encoder with solid (S) or hollow (SH) shaft			Light duty incremental encoder with solid (S) or hollow (SH) shaft				Medium duty incremental encoder with solid shaft	
Size	Body: 38mm diameter and 30mm depth; Shaft: 6mm (S) or 8mm (SH) diameter			38mm Ø	40mm Ø	38mm Ø	40mm Ø	Body: 50mm diameter and 35mm depth; Shaft: 8mm diameter	
Output Configuration	NPN open collector (AD)	NPN open collector (BD)	Line driver (VD)	NPN open collector		Line driver (differential)		Totem pole (RZWD)	Line driver (RZVWD)
Input Power	5-12 VDC (nominal) Range: 4.75-13.2 VDC	12-24 VDC (nominal) Range: 10.8-26.4 VDC	5VDC (nominal) Range: 4.75-5.25 VDC	5-26 VDC (nominal) Range: 4.75-26.4 VDC		5VDC (nominal) Range: 4.75-5.25 VDC		5-30 VDC (nominal) Range: 4.75-30.0 VDC	5VDC (nominal) Range: 4.75-5.25 VDC
Resolutions Available	100 to 2500 pulses per revolution			100 to 2500 pulses per revolution				3 to 5000 pulses per revolution	
Output Type	Cable (two meter, tinned)			Cable (two meter, tinned)				Cable (two meter, tinned)	
Frequency Response	200kHz			200kHz				100kHz max	100kHz max (≤3000 ppr) 200kHz max (>3000 ppr)
Rating	IP40			IP50	IP65	IP50	IP65	IP65	
Accessories Available	Metric-to-metric and metric-to-S.A.E. couplings			Metric-to-metric and metric-to-S.A.E. couplings, mounting brackets				Metric-to-metric and metric-to-S.A.E. couplings, mounting brackets	
Specification	TRD-NH Series		TRD-NA Series		TRD-GK Series				
	TRD-NHxxx-RZWD	TRD-NHxxx-RZVWD	TRD-NAxxxNWD		TRD-GKxxx-RZD				
Description	Medium duty incremental encoder with hollow shaft		Medium duty absolute encoder with solid shaft		Heavy duty incremental encoder with solid shaft				
Size	Body: 50mm diameter and 35mm depth; Shaft: 8mm diameter		Body: 50mm diameter and 35mm depth; Shaft: 8mm diameter		Body: 78mm diameter and 60mm depth; Shaft: 10 mm diameter				
Output Configuration	Totem pole (RZWD)	Line driver (RZVWD)	NPN open collector		Totem pole				
Input Power	5–30 VDC (nominal) Range: 4.75–30.0 VDC	5VDC (nominal) Range: 4.75–5.25 VDC	12–24 VDC (nominal) Range: 10.8–26.4 VDC		10–30 VDC (nominal) Range: 9.7–30.9 VDC				
Resolutions Available	3 to 5000 pulses per revolution		32 to 2048 pulses per revolution		30 to 5000 pulses per revolution				
Output Type	Cable (two meter, tinned)		Cable (two meter, tinned)		Cable (two meter, tinned)				
Frequency Response	100kHz max	100kHz max (≤3000 ppr) 200kHz max (>3000 ppr)	20kHz max		100kHz				
Rating	IP65		IP65		IP65				
Accessories Available	-		Metric-to-metric and metric-to-S.A.E. couplings, mounting brackets		Metric-to-metric and metric-to-S.A.E. couplings, mounting brackets				

Light Duty Incremental Encoders (SAE Dimension Encoders)

TRDA-2E series Features

A light duty encoder that is cost-effective for small applications; has the following features:

- Small body with 1.5 in. diameter and 1.6 in. depth
- 0.25 in. diameter solid shaft
- Resolution available from 100 pulses per revolution to 2500 pulses per revolution
- Open collector or line driver output
- Up to 200kHz response frequency
- Two-meter cable with tinned ends
- IP50 environmental rating



TRDA-2Exxx-VD models

Incremental Light Duty Solid-shaft Encoders (Line-driver Output, TRDA-2ExxxVD)

Part Number	Price	Pulses per Revolution	Input Voltage	Output	Body Dia.
<u>TRDA-2E100VD</u>	Retired	100	5VDC	Line Driver (differential)	1.5 in.

Accessories

Accessories for TRDA-2E Series Encoders

Part Number	Price	Description
<u>F-2D</u>	\$42.50	Mounting flange, 1.86 inch bolt hole circle (1.05 inch height), metal. For use with Koyo TRDA-2E series encoders. Flange and encoder mounting hardware included.
<u>F-3D</u>	\$75.00	Mounting flange, 2.95 inch bolt hole circle (1.34 inch height), metal. For use with Koyo TRDA-2E series encoders. Flange and encoder mounting hardware included.
<u>F-6D</u>	\$57.50	Mounting flange, 1.86 inch bolt hole circle (1.34 inch height), metal. For use with Koyo TRDA-2E series encoders. Flange and encoder mounting hardware included.
<u>F-7D</u>	\$42.50	Mounting flange, 1 inch bolt hole circle (0.20 inch height), metal. For use with Koyo TRDA-2E series encoders. Flange and encoder mounting hardware included.
<u>F-8D</u>	\$57.50	Mounting flange, 2.95 inch bolt hole circle (1.71 inch height), metal. For use with Koyo TRDA-2E series encoders. Flange and encoder mounting hardware included.
<u>2ET-035D</u>	\$60.00	Mounting bracket for TRDA-2E series encoders

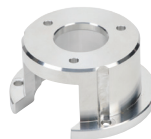
Couplings

For encoders with a solid shaft, please select a coupling that fits your encoder. All couplings are in stock, ready to ship.

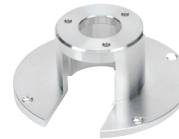
See the "Encoder Couplings" section for more information.



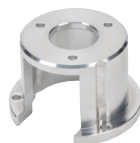
2ET-035D



F-2D



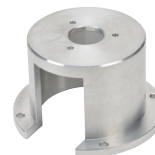
F-3D



F-6D



F-7D



F-8D

Light Duty Incremental Encoders (SAE Dimension Encoders)

Specifications – TRDA-2E series

Electrical Specifications (SAE Dimension Light Duty)				
Model		TRDA-2ExxxxBD (open collector)	TRDA-2ExxxxVD (line driver)	
Power Supply	Operating Voltage *	12–24 VDC (nominal) * Range: 10.8–26.4 VDC	5VDC (nominal) * Range: 4.75–5.25 VDC	
	Allowable Ripple	3% rms max.		
	Current Consumption	50mA max. no load		
Output Waveform	Signal Waveform	Quadrature + home position		
	Max. Response Frequency	200kHz		
	Operating Speed	(max response frequency / resolution) x 60		
	Duty Ratio (Symmetry)	50% ±25%		
	Index Signal Width (at Home Position)	100% ±50%		
Output	Rise/Fall Time **	1µs max. **	100 ns max. **	
	Output Type	Open collector (NPN sinking)	Line driver (26C31 or equivalent)	
	Output Logic	Negative logic (active low)	Positive logic (active high)	
	Output Current	Inflow	30mA max.	20mA max.
		Outflow	–	
	Output Voltage	H	–	2.5 V min.
		L	0.4 V max.	0.5 V max.
	Load Power Supply Voltage	30VDC max.		–
Short-circuit Protection	Between each output and 0V		–	
* To be supplied by Class II source.				
** With a cable of 2m or less; Max load.				
Mechanical Specifications				
Starting Torque	0.01 N·m [0.09 lb·in] max. @ 20 °C [68 °F]			
Max. Allowable Shaft Load	Axial: 20N [4.5 lb]; Radial: 30N [6.7 lb]			
Max. Allowable Speed	5000 rpm (highest speed that can support the mechanical integrity of encoder)			
Wire Size	26 AWG, shielded, oil-resistant PVC			
Mounting Orientation	can be mounted in any orientation			
Weight	approx. 170g [6.0 oz] (with 2m cable)			
Environmental Specifications				
Ambient Temperature	-10 to 70 °C [14 to 158 °F]			
Storage Temperature	-25 to 85 °C [-13 to 185 °F]			
Operating Humidity	35–85% RH (non-condensing)			
Voltage Withstand	630V grounded through capacitor (a 630V cap is connected between 0V & FG lines)			
Insulation Resistance	50 MΩ min. (excluding shield)			
Vibration Resistance	durable for one hour along three axes @ 10 to 55 Hz with 0.75 mm half-amplitude			
Shock Resistance	490 m/s ² (11 ms applied three times along three axes)			
Protection	IP50			
Agency Approvals	cUL _{US} (E189395)			

Light Duty Incremental Encoders (SAE Dimension Encoders)

Specifications – TRDA-2E series

Wiring Diagrams

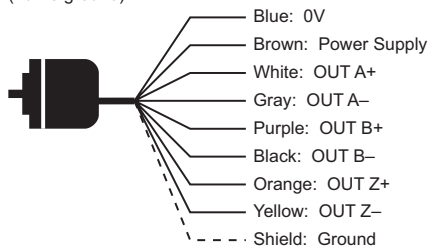
Open Collector Connections

Cable shield is connected to the encoder body (frame ground)



Line Driver Connections

Cable shield is connected to the encoder body (frame ground)



How to read the timing charts

Open Collector Models

Out A and Out B are 90 degrees out of phase. Like any quadrature encoder, four unique logic states are created internally to the encoder. This is based on the rising edge to rising edge (one cycle) on channel A or B that indicates one set of bars on the internal encoder disk has passed by the optical sensor.

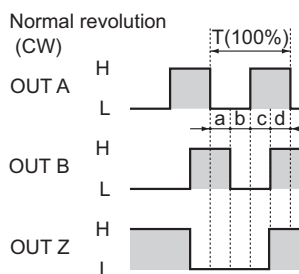
OUT Z is the absolute reference added to an incremental encoder and is also known as home position. It signifies a full rotation of the encoder shaft.

Line Driver Models

Channel A (OUT A and A-not) and Channel B (OUT B and B-not) are also 90 degrees out of phase on line driver encoders. OUT Z is the same as on open collector models, and is the absolute reference (home position). It signifies one full rotation of the encoder shaft.

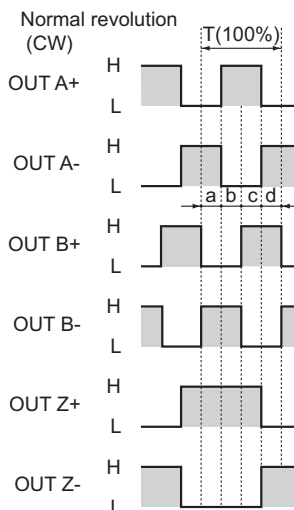
Channel Timing Charts

Open Collector Models (TRDA-2ExxxBD)



a, b, c, d = $1/4T \pm 1/8T$
"Normal" means clockwise revolution viewed from the shaft

Line Driver Models (TRDA-2ExxxVD)



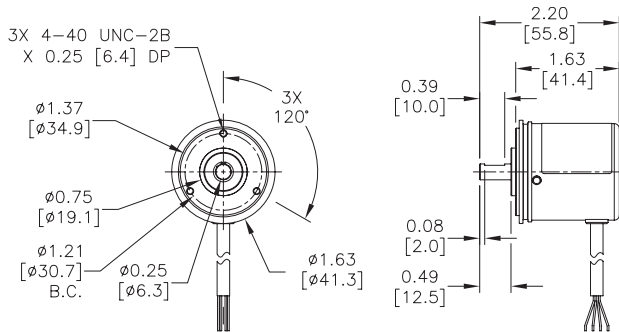
a, b, c, d = $1/4T \pm 1/8T$
"Normal" means clockwise revolution viewed from the shaft

Light Duty Incremental Encoders (SAE Dimension Encoders)

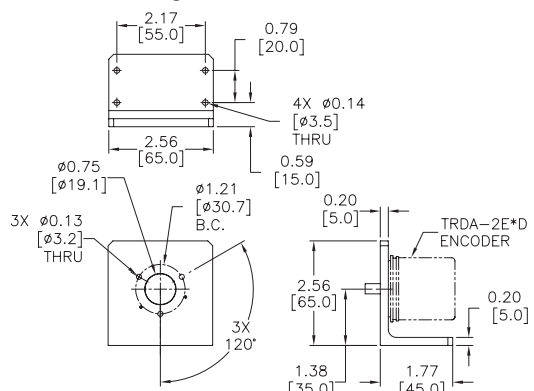
Dimensions – TRDA-2E series

Dimensions = in [mm]

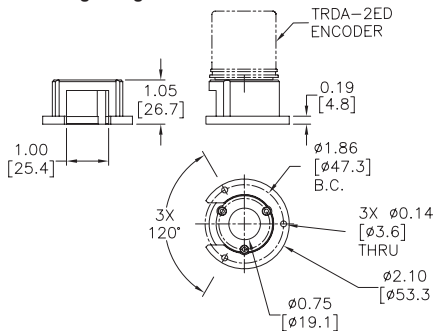
TRDA-2ExxxxD



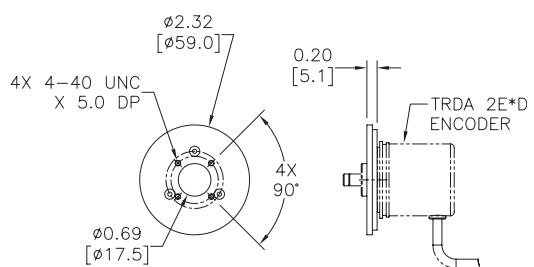
2ET-035D Mounting Bracket



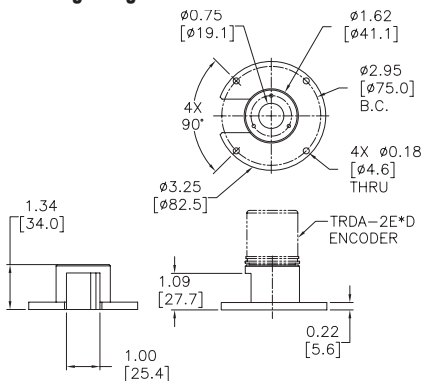
F-2D Mounting Flange



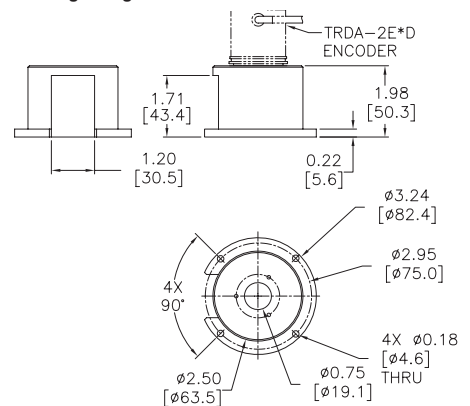
F-7D Mounting Flange



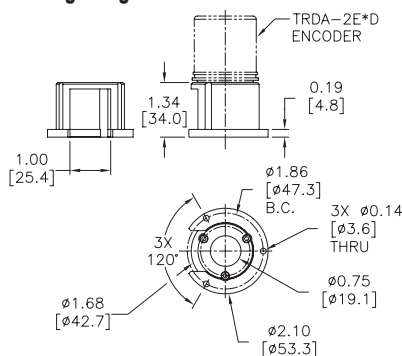
F-3D Mounting Flange



F-8D Mounting Flange



F-6D Mounting Flange



Medium Duty Incremental Encoders (SAE Dimension Encoders)

TRDA-20 series

Features

A medium duty encoder that is cost-effective for small applications; has the following features:

- Small body with 2.0 in. diameter and 1.7 in. depth
- 0.375 in. diameter solid shaft
- Resolution available from 100 pulses per revolution to 2500 pulses per revolution
- Totem pole or line driver output
- Up to 100 kHz response frequency (totem pole)
- Up to 200 kHz response frequency (line driver)
- Two-meter cable with tinned ends
- IP50 environmental rating



TRDA-20R1N models

TRDA-20 Medium Duty Solid-shaft Incremental Encoders (Totem-pole and Line-driver Output Models)					
Part Number	Price	Pulses per Revolution	Input Voltage	Output	Body Dia.
TRDA-20R1N100RZD	\$154.00	100	5-30 VDC	Totem-pole sink/source	2.0 in.
TRDA-20R1N360RZD	\$154.00	360			
TRDA-20R1N500RZD	\$154.00	500			
TRDA-20R1N1000RZD	\$154.00	1000			
TRDA-20R1N1024RZD	\$165.00	1024			
TRDA-20R1N2500RZD	\$167.00	2500	5VDC	Line-driver (differential)	
TRDA-20R1N100VD	\$154.00	100			
TRDA-20R1N360VD	\$154.00	360			
TRDA-20R1N500VD	\$154.00	500			
TRDA-20R1N1000VD	\$154.00	1000			
TRDA-20R1N1024VD	\$166.00	1024			
TRDA-20R1N2500VD	\$167.00	2500			

Accessories

Accessories for TRDA-20 Series Encoders *		
Part Number *	Price	Description
TRDA-20R1D	\$27.00	Mounting flange, round, 1.5 inch bolt-hole circle
TRDA-20R2D	\$39.00	Mounting flange, round, 1.625 inch bolt-hole circle
TRDA-20SND	\$59.00	Mounting flange, square
LM-001D**	\$120.00	Mounting bracket for TRDA-20 & TRDA-25 encoders

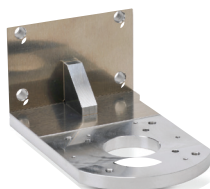
* The accessories in this table work only with TRDA-20R1Nxxxxx series encoders, unless marked otherwise.

** Use of LM-001D also requires a TRDA-20SND replacement mounting flange, plus four customer-supplied 6-32 x 0.50 in long fasteners.

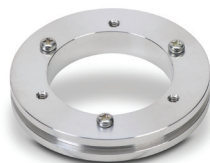
Couplings

For encoders with a solid shaft, please select a coupling that fits your encoder. All couplings are in stock, ready to ship.

See the "Encoder Couplings" section for more information.



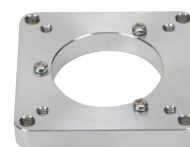
LM-001D



TRDA-20R1D



TRDA-20R2D



TRDA-20SND

Medium Duty Incremental Encoders (SAE Dimension Encoders)

Specifications – TRDA-20 series

Electrical Specifications (SAE Dimension Medium Duty)				
Model		TRDA-20R1NxxxRZD (Totem-pole)	TRDA-20R1NxxxVD (Line Driver)	
Power Supply	Operating Voltage *	5–30 VDC (nominal) * Range: 4.75–30.0 VDC	5VDC (nominal) * Range: 4.75–5.25 VDC	
	Allowable Ripple	3% rms max		
	Current Consumption	60 mA max		
Output Waveform	Signal Waveform	Quadrature + home position		
	Max. Response Frequency	100 kHz	200 kHz	
	Operating Speed	(max response frequency / resolution) x 60		
	Duty Ratio (Symmetry)	50% ±25%		
	Index Signal Width (at home position)	100% ±50%		
Output	Rise/Fall Time **	3µs max **	100 ns max **	
	Output Type	Totem-pole	Line driver (26C31 or equivalent)	
	Output Current	Inflow	30 mA max	20 mA max
		Outflow	10 mA max	
	Output Voltage	H	$[(\text{power voltage} - 2.5\text{V})]$ min	2.5V min
		L	0.4V max	0.5V max
	Load Power Supply Voltage	35 VDC max		–
Short-Circuit Protection	between each output and 0V terminal		–	
* To be supplied by Class II source. ** With a cable of 2m or less; Max load.				
Mechanical Specifications				
Starting Torque	0.003 N·m (0.002 lb-ft) max @ 20 °C [68 °F]			
Max Allowable Shaft Load	Radial: 50N (11.2 lb); Axial: 30N (6.7 lb)			
Max Allowable Speed	5000 rpm (max speed that the mechanical integrity of encoder can support)			
Wire Size	0.2 mm ² [24 AWG] shielded, oil-resistant PVC			
Mounting Orientation	can be mounted in any orientation			
Weight	approx 270g (9.52 oz) [with 2m cable]			
Environmental Specifications				
Ambient Temperature	-10 to 70 °C [14 to 158 °F]			
Storage Temperature	-25 to 85 °C [-13 to 185 °F]			
Operating Humidity	35 to 85 %RH			
Voltage Withstand	500 VAC @ 50/60Hz for one minute	grounded through capacitor		
Insulation Resistance	50 MΩ min (excluding shield)			
Vibration Resistance	10 to 55 Hz with 0.75 mm half amplitude; durable for one hour along three axes			
Shock Resistance	11 ms ~ 500 P/R metal slit 981 m/s ² applied three times along three axes 11 ms ~ 600 P/R glass slit 490 m/s ² applied three times along three axes			
Protection	IP50			
Agency Approvals	cUL _{US} (E189395)			

Medium Duty Incremental Encoders (SAE Dimension Encoders)

Specifications – TRDA-20 series

Wiring Diagrams

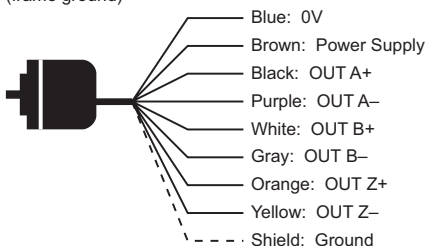
Totem Pole Connections

Cable shield is connected to the encoder body (frame ground)



Line Driver Connections

Cable shield is connected to the encoder body (frame ground)



How to read the timing charts

Totem Pole Models

Out A and Out B are 90 degrees out of phase. Like any quadrature encoder, four unique logic states are created internally to the encoder. This is based on the rising edge to rising edge (one cycle) on channel A or B that indicates one set of bars on the internal encoder disk has passed by the optical sensor.

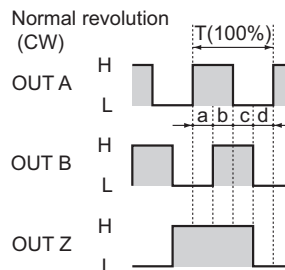
OUT Z is the absolute reference added to an incremental encoder and is also known as home position. It signifies a full rotation of the encoder shaft.

Line Driver Models

Channel A (OUT A and A-not) and Channel B (OUT B and B-not) are also 90 degrees out of phase on line driver encoders. OUT Z is the same as on open collector models, and is the absolute reference (home position). It signifies one full rotation of the encoder shaft.

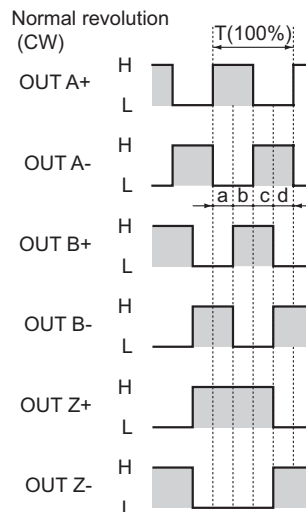
Channel Timing Charts

Totem Pole Models (TRDA-20R1NxxxRZD)



a, b, c, d = $1/4T \pm 1/8T$
 "Normal" means clockwise revolution viewed from the shaft

Line Driver Models (TRDA-20R1NxxxVD)



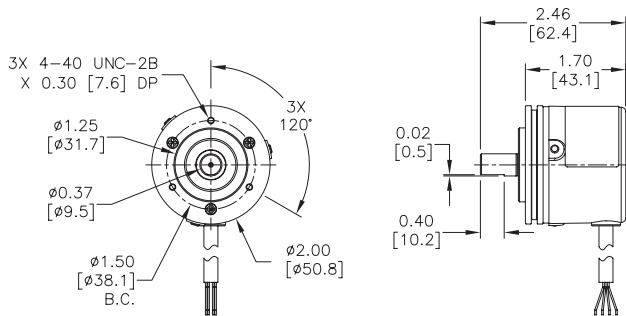
a, b, c, d = $1/4T \pm 1/8T$
 "Normal" means clockwise revolution viewed from the shaft

Medium Duty Incremental Encoders (SAE Dimension Encoders)

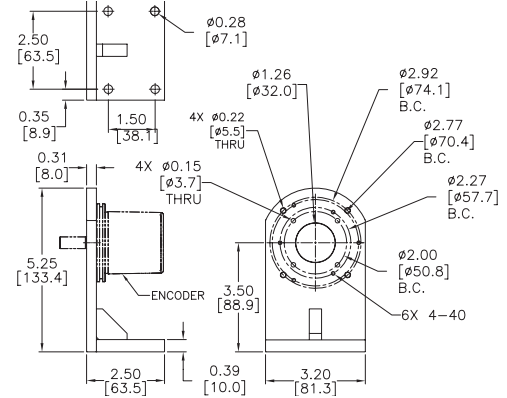
Dimensions – TRDA-20 series

Dimensions = in [mm]

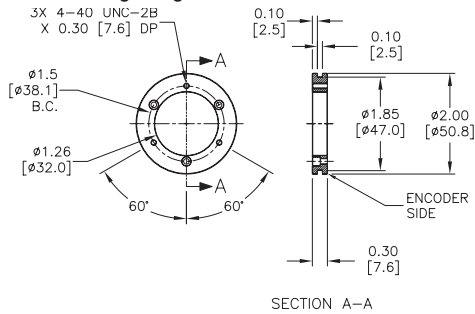
TRDA-20R1NxxxxxxD



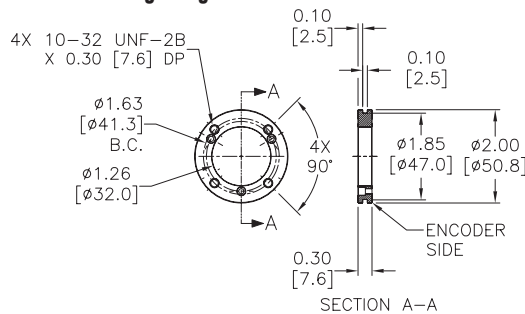
LM-001D Mounting Bracket



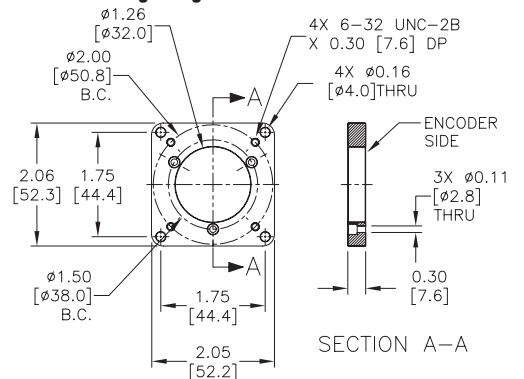
TRDA-20R1D Mounting Flange



TRDA-20R2D Mounting Flange



TRDA-20SND Mounting Flange



Medium Duty Incremental Encoders (SAE Dimension Encoders)

TRDA-25 series

Features

A medium duty encoder that is cost-effective for small applications; has the following features:

- Small body with 2.0 in. diameter and 2.15 in. depth
- 0.375 in diameter solid shaft
- Removable 2.5 in. round flange
- Resolution available from 100 pulses per revolution to 2500 pulses per revolution
- Totem pole or line driver output
- Up to 100 kHz response frequency (totem pole)
- Up to 200 kHz response frequency (line driver)
- Military-style connector (cable sold separately)
- IP65 environmental rating



TRDA-25 models

Accessories

Couplings

For encoders with a solid shaft, please select a coupling that fits your encoder. All couplings are in stock, ready to ship.

See the "Encoder Couplings" section for more information on.

TRDA-25 Medium Duty Solid-shaft Incremental Encoders – (Totem-pole and Line-driver Output Models) – MS Connector *					
Part Number *	Price	Pulses per Revolution	Input Voltage	Output	Body Dia.
TRDA25RN100RZWDMS	\$248.00	100	5–30 VDC	Totem-pole sink/source	2.0 in. (2.5 in. round flange)
TRDA25RN360RZWDMS	\$248.00	360			
TRDA25RN500RZWDMS	\$248.00	500			
TRDA25RN1000RZWDMS	\$248.00	1000			
TRDA25RN1024RZWDMS	\$248.00	1024			
TRDA25RN2500RZWDMS	\$268.00	2500	5VDC	Line-driver (differential)	
TRDA25RN100VWDMS	\$248.00	100			
TRDA25RN360VWDMS	\$248.00	360			
TRDA25RN500VWDMS	\$248.00	500			
TRDA25RN1000VWDMS	\$248.00	1000			
TRDA25RN1024VWDMS	\$248.00	1024			
TRDA25RN2500VWDMS	\$269.00	2500			

* TRDA25RNxxxxWDMS encoders do NOT include cables or connectors, which are sold separately in the "Accessories" section.

Accessories for TRDA-25 Series Encoders *		
Part Number *	Price	Description
TRDA-25RND	\$39.00	Mounting flange, round (2.5 in. dia. w/ 1.88 in B.C.)
TRDA-25SND	\$39.00	Mounting flange, square (2.5 in. dia.)
TRDA-25CON-RZWD	\$55.00	Connector for TRDA-25RNxxxRZWD-MS, Totem Pole output, 7-pin MS connector
TRDA-25CBL-RZWD-10**	\$96.00	Cable for TRDA-25RNxxxRZWD-MS, Totem Pole output, 7-pin MS connector, 10 ft
TRDA-25CBL-RZWD-20**	\$118.00	Cable for TRDA-25RNxxxRZWD-MS, Totem Pole output, 7-pin MS connector, 20 ft
TRDA-25CBL-RZWD-30**	\$134.00	Cable for TRDA-25RNxxxRZWD-MS, Totem Pole output, 7-pin MS connector, 30 ft
TRDA-25CON-VWD	\$61.00	Connector for TRDA-25RNxxxVWD-MS, Line Driver output, 10-pin MS connector
TRDA-25CBL-VWD-10**	\$114.00	Cable for TRDA-25RNxxxVWD-MS, Line Driver output, 10-pin MS connector, 10 ft
TRDA-25CBL-VWD-20**	\$114.00	Cable for TRDA-25RNxxxVWD-MS, Line Driver output, 10-pin MS connector, 20 ft
TRDA-25CBL-VWD-30**	\$119.00	Cable for TRDA-25RNxxxVWD-MS, Line Driver output, 10-pin MS connector, 30 ft
LM-001D***	\$120.00	Mounting bracket for TRDA-20 & TRDA-25 encoders

[§] The accessories in this table work only with TRDA-25RNxxxxWD-MS series encoders, unless marked otherwise.
^{**} Cables have IP65 environmental rating.
^{***} Use of LM-001D also requires a TRDA-25SND replacement mounting flange, plus four customer-supplied 6-32 x 0.50 in long fasteners.



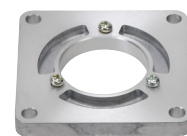
TRDA-25-CON-RZWD



LM-001D



TRDA-25RND



TRDA-25SND



TRDA-25-CON-VWD



TRDA-25CBL-RZWD



TRDA-25CBL-VWD

Medium Duty Incremental Encoders (SAE Dimension Encoders)


Specifications – TRDA-25 series


Electrical Specifications – TRDA-25 (SAE Dimension Medium Duty)				
Model		TRDA25RNxxxRZWDMS (Totem-pole)	TRDA25RNxxxVWDMS (Line Driver)	
Power Supply	Operating Voltage *	5–30 VDC (nominal) * Range: 4.75–30.0 VDC	5VDC (nominal) * Range: 4.75–5.25 VDC	
	Allowable Ripple	3% rms max		
	Current Consumption	60 mA max		
Output Waveform	Signal Waveform	Quadrature + home position		
	Max. Response Frequency	100 kHz	200 kHz	
	Operating Speed	(max response frequency / resolution) x 60		
	Duty Ratio (Symmetry)	50% ±25%		
	Index Signal Width (at home position)	100% ±50%		
Output	Rise/Fall Time **	3µs max **	100 ns max **	
	Output Type	Totem-pole	Line driver (26C31 or equivalent)	
	Output Current	Inflow	30 mA max	20 mA max
		Outflow	10 mA max	
	Output Voltage	H	[(power voltage voltage) - (2.5V)] min	2.5V min
		L	0.4V max	0.5V max
	Load Power Supply Voltage	35 VDC max	–	
Short-Circuit Protection	between each output and 0V terminal	–		
* To be supplied by Class II source. ** With a cable of 2m or less; Max load.				
Mechanical Specifications				
Starting Torque	0.05 N·m [0.04 lb·ft] @ 20 °C [68 °F]			
Max Allowable Shaft Load	Radial: 50N [11.2 lb]; Axial: 30N [6.7 lb]			
Max Allowable Speed	3000 rpm (max speed that the mechanical integrity of encoder can support)			
Wire Size	–			
Mounting Orientation	can be mounted in any orientation			
Weight	approx 280g [9.88 oz]			
Environmental Specifications				
Ambient Temperature	-10 to 70 °C [14 to 158 °F]			
Storage Temperature	-25 to 85 °C [-13 to 185 °F]			
Operating Humidity	35 to 85 %RH			
Voltage Withstand	500 VAC @ 50/60Hz for one minute	grounded through capacitor		
Insulation Resistance	50 MΩ min (excluding shield)			
Vibration Resistance	10 to 55 Hz with 0.75 mm half amplitude; durable for one hour along three axes			
Shock Resistance	11 ms ~ 500 P/R metal slit 981 m/s ² applied three times along three axes 11 ms ~ 600 P/R glass slit 490 m/s ² applied three times along three axes			
Protection	IP65			
Agency Approvals	cUL _{US} (E189395)			

Medium Duty Incremental Encoders (SAE Dimension Encoders)

Specifications – TRDA-25 series

Connector Pin-out

TRDA25RNxxxRZWDMS (Totem Pole)		
Connector	Pin	Signal
 <p>Viewed from wiring side (rear)</p>	A	Out A
	B	Out B
	C	Out Z
	D	Power Supply
	E	n.c.
	F	0V
	G	ground
A shielding wire is connected to frame ground.		

TRDA25RNxxxVWDMS (Line Driver)		
Connector	Pin	Signal
 <p>Viewed from wiring side (rear)</p>	A	Out A+
	B	Out B+
	C	Out Z+
	D	Power Supply
	E	n.c.
	F	0V
	G	ground
	H	Out A-
	I	Out B-
	J	Out Z-
A shielding wire is connected to frame ground.		

How to read the timing charts

Totem Pole Models

Out A and Out B are 90 degrees out of phase. Like any quadrature encoder, four unique logic states are created internally to the encoder. This is based on the rising edge to rising edge (one cycle) on channel A or B that indicates one set of bars on the internal encoder disk has passed by the optical sensor.

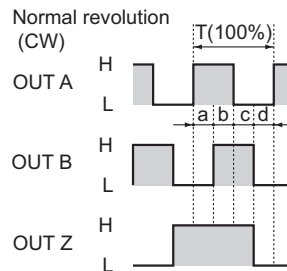
OUT Z is the absolute reference added to an incremental encoder and is also known as home position. It signifies a full rotation of the encoder shaft.

Line Driver Models

Channel A (OUT A and A-not) and Channel B (OUT B and B-not) are also 90 degrees out of phase on line driver encoders. OUT Z is the same as on open collector models, and is the absolute reference (home position). It signifies one full rotation of the encoder shaft.

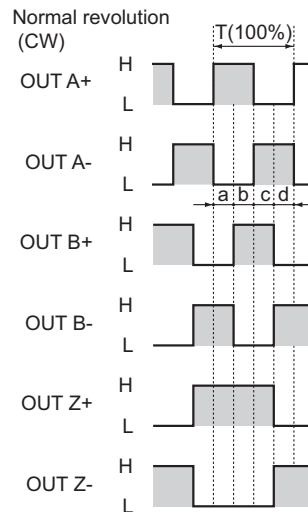
Channel Timing Charts

Totem Pole Models (TRDA25RNxxxRZWDxx)



a, b, c, d = $1/4T \pm 1/8T$
 "Normal" means clockwise revolution viewed from the shaft

Line Driver Models (TRDA25RNxxxVWDxx)



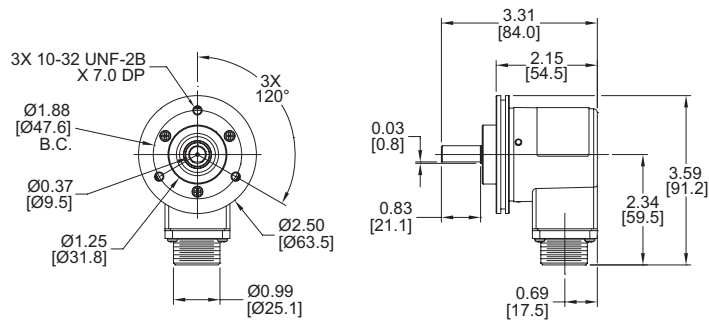
a, b, c, d = $1/4T \pm 1/8T$
 "Normal" means clockwise revolution viewed from the shaft

Medium Duty Incremental Encoders (SAE Dimension Encoders)

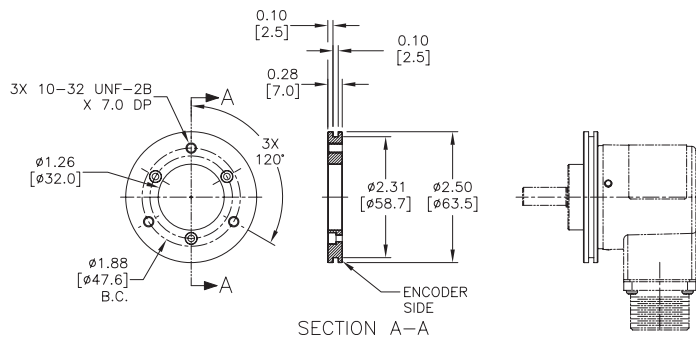
Dimensions – TRDA-25 series

Dimensions = in [mm]

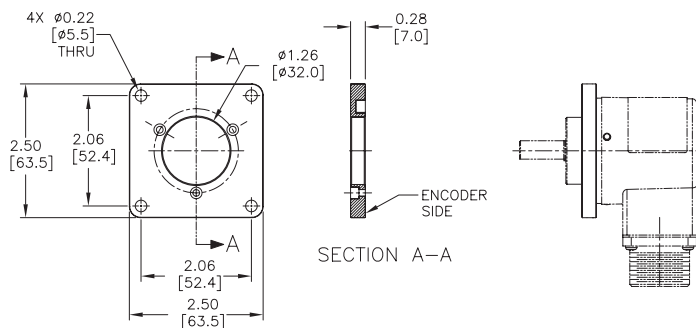
TRDA25RN Encoder



TRDA-25RND Mounting Flange



TRDA-25SND Mounting Flange



Light Duty Incremental Encoders (Metric Dimension Encoders)

TRD-MX series Features

A light duty incremental rotary encoder that is cost-effective for small applications; has the following features:

- Small body with 25 mm diameter and 29 mm depth
- 4 mm diameter solid shaft
- Resolution available from 100 pulses per revolution to 1024 pulses per revolution
- Open collector output (4.5–13.2 or 10.8–26.4 VDC), or line driver output (4.75–5.25 VDC)
- Up to 100 kHz response frequency
- Two-meter cable with tinned ends
- IP50 environmental rating
- Mounting bracket and couplings are available



TRD-MXxxx-AD/BD models



TRD-MXxxx-VD models

Light Duty Solid-shaft Incremental Encoders (NPN Open-collector Output, TRD-MXxxxAD/ BD)					
Part Number	Price	Pulses per Revolution	Input Voltage	Output	Body Dia.
TRD-MX100AD	\$96.00	100	4.5–13.2 VDC	NPN Open Collector	25 mm
TRD-MX360AD	\$96.00	360			
TRD-MX500BD	Retired	500	10.8–26.4 VDC		

Light Duty Solid-shaft Incremental Encoders (Line Driver Output, TRD-MXxxxVD)					
Part Number	Price	Pulses per Revolution	Input Voltage	Output	Body Dia.
TRD-MX100VD	\$96.00	100	4.75–5.25 VDC	Line Driver	25 mm
TRD-MX360VD	\$96.00	360			
TRD-MX500VD	\$96.00	500			

Accessories

Accessories for TRD-MX Series Encoders		
Part Number	Price	Description
MM-4D	\$8.00	Servo mounting clamp for TRD-MX series encoders
MT-030D	\$39.00	Right-angle mounting bracket for TRD-MX series encoders



MM-4D



MT-030D

Couplings

For encoders with a solid shaft, please select a coupling that fits your encoder. All couplings are typically in stock, and ready to ship.

See the “Encoder Couplings” section for more information.



Couplings

Light Duty Incremental Encoders (Metric Dimension Encoders)

Specifications – TRD-MX series

Electrical Specifications (Metric Dimension Light Duty TRD-MX)					
Model		TRD-MXxxxAD (open collector)	TRD-MXxxxBD (open collector)	TRD-MXxxxVD (line driver)	
Power Supply	Operating Voltage *	5–12 VDC (nominal) * 4.5–13.2 VDC	12–24 VDC (nominal) * 10.8–26.4 VDC	5VDC (nominal) * 4.75–5.25 VDC	
	Allowable Ripple	3% rms max			
	Current Consumption	50 mA max (no load)			
	Circuit Protection Required	Limit current to 100 mA or less		–	
Output Waveform	Signal Waveform	Quadrature + home position			
	Max. Response Frequency	100 kHz			
	Operating Speed	(max response frequency / resolution) x 60 Hz			
	Duty Ratio (Symmetry)	50% ±25%			
	Index Signal Width (at Home Position)	100% ±50%			
Output	Rise/Fall Time **	2µs ** (sink current < 30 mA)		0.1 µs max ** (source current < 20 mA)	
	Output Type	Open collector (NPN sinking)		Line driver (26C31 or equivalent)	
	Output Logic	Negative logic (active low)		Positive logic (active high)	
	Output Current	Inflow	30 mA max		20 mA max
		Outflow	–		
	Output Voltage	H	–		2.5V min (source current < 20 mA)
		L	0.4V max (sink current < 30 mA)		0.5V max (source current < 20 mA)
	Load Power Voltage	30 VDC max		–	
Short-circuit Protection	–		–		
* To be supplied by Class II source. ** Cable length ≤2m or less. Maximum load.					
Mechanical Specifications (Metric Dimension Light Duty TRD-MX)					
Starting Torque	0.001 N·m [0.009 lb·in] max @ 20 °C [68 °F]				
Max. Allowable Shaft Load	Axial: 5N [1.1 lb]; Radial: 10N [2.2 lb]				
Max. Allowable Speed	6000 rpm (highest speed that can support the mechanical integrity of encoder)				
Wire Size	26 AWG, shielded, oil-resistant PVC				
Weight	approx 120g [0.3 lb]				
Environmental Specifications (Metric Dimension Light Duty TRD-MX)					
Ambient Temperature	-10 to 70 °C [14 to 158 °F]				
Storage Temperature	-25 to 85 °C [-13 to 185 °F]				
Operating Humidity	35–85% RH (non-condensing)				
Withstand Voltage *	630V grounded through capacitor (a 630V cap is connected between 0V & FG lines)				
Insulation Resistance	20 MΩ min				
Vibration Resistance	durable for one hour along three axes @ 10 to 55 Hz with 0.75 mm half-amplitude				
Shock Resistance	490 m/s ² (11 ms applied 3-times, each X, Y, Z)				
Mounting Orientation	can be mounted in any orientation				
Protection	IP50				
Agency Approvals	CE, RoHS, cUL- _{US} (E189395)				
* Withstand voltage is good for power supply, signal, and case; not good for shield wire.					

Light Duty Incremental Encoders (Metric Dimension Encoders)

Specifications – TRD-MX series

Wiring Diagrams

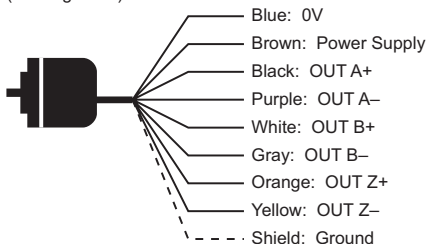
Open Collector Connections

Cable shield is connected to the encoder body (frame ground)



Line Driver Connections

Cable shield is connected to the encoder body (frame ground)



How to read the timing charts

Open Collector Models

Out A and Out B are 90 degrees out of phase. Like any quadrature encoder, four unique logic states are created internally to the encoder. This is based on the rising edge to rising edge (one cycle) on channel A or B that indicates one set of bars on the internal encoder disk has passed by the optical sensor.

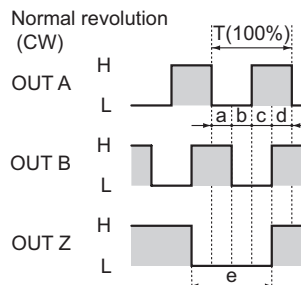
OUT Z is the absolute reference added to an incremental encoder and is also known as home position. It signifies a full rotation of the encoder shaft. It pulses once per revolution.

Line Driver Models

Channel A (OUT A and A-not) and Channel B (OUT B and B-not) are also 90 degrees out of phase on line driver encoders. OUT Z is the same as on open collector models, and is the absolute reference (home position). It signifies one full rotation of the encoder shaft. It pulses once per revolution.

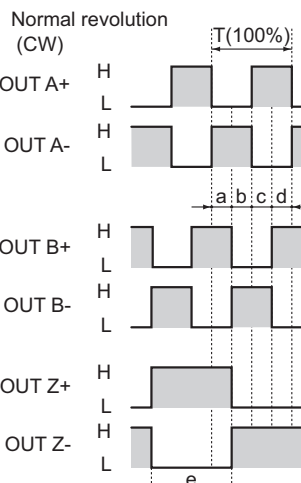
Channel Timing Charts

Open Collector Models (TRD-MXxxxAD/BD)



$a, b, c, d = 0.25T \pm 0.125T$; $e = 1T \pm 0.125T$
"Normal" means clockwise revolution viewed from the shaft

Line Driver Models (TRD-MXxxxVD)

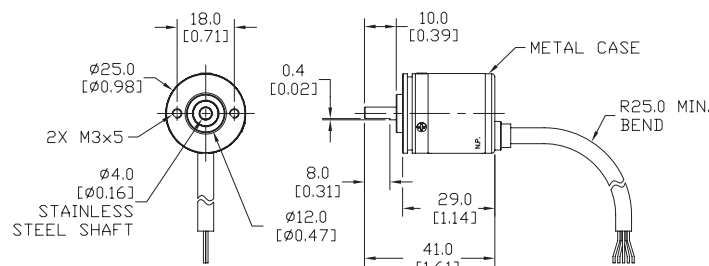


$a, b, c, d = 0.25T \pm 0.125T$; $e = 1T \pm 0.125T$
"Normal" means clockwise revolution viewed from the shaft

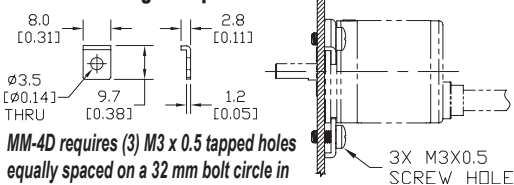
Dimensions – TRD-MX series

Dimensions = mm [in]

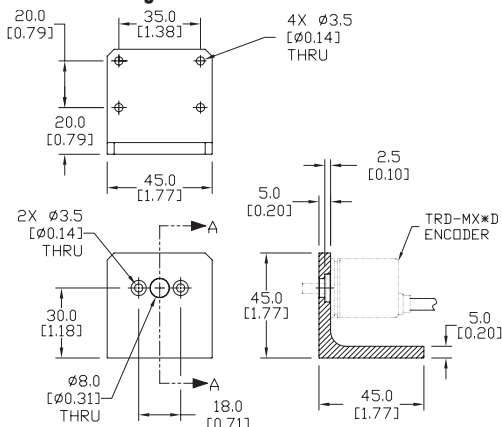
TRD-MXxxxD



MM-4D Mounting Clamp



MT-030D Mounting Bracket



SECTION A-A

Light Duty Incremental Encoders (Metric Dimension Encoders)

TRD-SR series

Features

A light duty incremental (quadrature) encoder that is cost-effective for small applications and has the following features:

- Small body available in 38mm or 40mm diameters
- Separate dust proof (IP50 rating) and water resistant (IP65) ratings
- 6 mm solid shaft
- Resolution available from 100 pulses per revolution to 2500 pulses per revolution
- Open collector or line driver output
- Up to 200 kHz response frequency
- Two-meter cable, pigtail
- Mounting dimensions: 2 and 3 hole patterns on 28mm and 30mm diameters



Solid-shaft (TRD-SR) model

TRD-SR Light Duty Solid Shaft Incremental Encoders (NPN Open Collector and Line Driver models)								
Part Number	Price	Pulses per Revolution	Drawing	Input Voltage	Output	Weight	Protection Rating	Body Diameter
TRD-SR100AD	\$98.00	100	PDF	5–26 VDC	NPN open collector	160g with 2m cable	IP50	38mm
TRD-SR200AD	\$98.00	200	PDF					
TRD-SR360AD	\$98.00	360	PDF					
TRD-SR500AD	\$98.00	500	PDF					
TRD-SR600AD	\$98.00	600	PDF					
TRD-SR1000AD	\$98.00	1000	PDF					
TRD-SR1024AD	\$104.00	1024	PDF					
TRD-SR2000AD	\$104.00	2000	PDF					
TRD-SR2500AD	\$104.00	2500	PDF					
TRD-SR100VD	\$98.00	100	PDF					
TRD-SR200VD	\$98.00	200	PDF					
TRD-SR360VD	\$98.00	360	PDF					
TRD-SR500VD	\$98.00	500	PDF					
TRD-SR600VD	\$98.00	600	PDF					
TRD-SR1000VD	\$98.00	1000	PDF					
TRD-SR1024VD	\$104.00	1024	PDF					
TRD-SR2000VD	\$104.00	2000	PDF					
TRD-SR2500VD	\$104.00	2500	PDF					
TRD-SR100AWD	\$131.00	100	PDF	5–26 VDC	NPN open collector	190g with 2m cable	IP65	40mm
TRD-SR200AWD	\$131.00	200	PDF					
TRD-SR360AWD	\$131.00	360	PDF					
TRD-SR500AWD	\$131.00	500	PDF					
TRD-SR600AWD	\$131.00	600	PDF					
TRD-SR1000AWD	\$131.00	1000	PDF					
TRD-SR1024AWD	\$137.00	1024	PDF					
TRD-SR2000AWD	\$137.00	2000	PDF					
TRD-SR2500AWD	\$137.00	2500	PDF					
TRD-SR100VWD	\$131.00	100	PDF					
TRD-SR200VWD	\$131.00	200	PDF					
TRD-SR360VWD	\$131.00	360	PDF					
TRD-SR500VWD	\$131.00	500	PDF					
TRD-SR600VWD	\$131.00	600	PDF					
TRD-SR1000VWD	\$131.00	1000	PDF					
TRD-SR1024VWD	\$137.00	1024	PDF					
TRD-SR2000VWD	\$137.00	2000	PDF					
TRD-SR2500VWD	\$137.00	2500	PDF					

Light Duty Incremental Encoders (Metric Dimension Encoders)

TRD-SHR series

Features

A light duty incremental (quadrature) encoder that is cost-effective for small applications and has the following features:

- Small body available in 38mm or 40mm diameters
- Separate dust proof (IP50 rating) and water resistant (IP65) ratings
- 8 mm hollow shaft
- Resolution available from 100 pulses per revolution to 2500 pulses per revolution
- Open collector or line driver output
- Up to 200 kHz response frequency
- Two-meter cable, pigtail
- IP50=45mm Ø mounting pattern (can change to 40mm with SHRS-040D), IP65=40mm Ø mounting pattern



Hollow-shaft (TRD-SHR) model

TRD-SHR Light Duty Hollow Shaft Incremental Encoders (NPN Open Collector and Line Driver models)								
Part Number	Price	Pulses per Revolution	Drawing	Input Voltage	Output	Weight	Protection Rating	Body Diameter
TRD-SHR100A5D	\$105.00	100	PDF	5-26 VDC	NPN open collector	170g with 2m cable	IP50	38mm
TRD-SHR200A5D	\$105.00	200	PDF					
TRD-SHR360A5D	\$105.00	360	PDF					
TRD-SHR500A5D	\$105.00	500	PDF					
TRD-SHR600A5D	\$105.00	600	PDF					
TRD-SHR1000A5D	\$105.00	1000	PDF					
TRD-SHR1024A5D	\$109.00	1024	PDF					
TRD-SHR2000A5D	\$109.00	2000	PDF					
TRD-SHR2500A5D	\$109.00	2500	PDF					
TRD-SHR100V5D	\$105.00	100	PDF	5VDC	Line driver (differential)	170g with 2m cable	IP50	38mm
TRD-SHR200V5D	\$105.00	200	PDF					
TRD-SHR360V5D	\$105.00	360	PDF					
TRD-SHR500V5D	\$105.00	500	PDF					
TRD-SHR600V5D	\$105.00	600	PDF					
TRD-SHR1000V5D	\$105.00	1000	PDF					
TRD-SHR1024V5D	\$109.00	1024	PDF					
TRD-SHR2000V5D	\$109.00	2000	PDF					
TRD-SHR2500V5D	\$109.00	2500	PDF					
TRD-SHR100AW0D	\$138.00	100	PDF	5-26 VDC	NPN open collector	200g with 2m cable	IP65	40mm
TRD-SHR200AW0D	\$138.00	200	PDF					
TRD-SHR360AW0D	\$138.00	360	PDF					
TRD-SHR500AW0D	\$138.00	500	PDF					
TRD-SHR600AW0D	\$138.00	600	PDF					
TRD-SHR1000AW0D	\$138.00	1000	PDF					
TRD-SHR1024AW0D	\$142.00	1024	PDF					
TRD-SHR2000AW0D	\$142.00	2000	PDF					
TRD-SHR2500AW0D	\$142.00	2500	PDF					
TRD-SHR100VW0D	\$138.00	100	PDF	5VDC	Line driver (differential)	200g with 2m cable	IP65	40mm
TRD-SHR200VW0D	\$138.00	200	PDF					
TRD-SHR360VW0D	\$138.00	360	PDF					
TRD-SHR500VW0D	\$138.00	500	PDF					
TRD-SHR600VW0D	\$138.00	600	PDF					
TRD-SHR1000VW0D	\$138.00	1000	PDF					
TRD-SHR1024VW0D	\$142.00	1024	PDF					
TRD-SHR2000VW0D	\$142.00	2000	PDF					
TRD-SHR2500VW0D	\$142.00	2500	PDF					

Light Duty Incremental Encoders (Metric Dimension Encoders)

Specifications – TRD-SR/SRH series

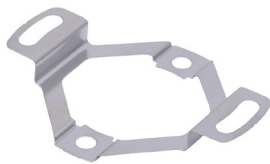
Electrical Specifications				
Model		TRD-SRxxxxAx TRD-SHRxxxxAxx (open collector)	TRD-SRxxxxVx TRD-SHRxxxxVxx (line driver)	
Power Supply	Operating Voltage *	5–26 VDC (nominal) * Range: 4.75–26.4 VDC	5VDC (nominal) * Range: 4.75–5.25 VDC	
	Allowable Ripple	3% max.		
	Current Consumption	90mA max.		
Signal Waveform		Quadrature + home position		
Resolutions Available		100 to 2500 pulses per revolution		
Max. Response Frequency		200kHz		
Max. Electrical Speed**		(max response frequency / resolution) x 60		
Duty Ratio		50% ±25%		
Phase Difference Width		25% ±12.5%		
Signal Width at Home Position		100 ±50%		
Output	Rise/Fall Time	1µs max. (when cable length is 1m)		
	Output Type	NPN open collector output, sinking	Line driver output (26C31 or equivalent)	
	Output Logic	Negative logic (active low)	Positive logic (active high)	
	Output Voltage	H	–	2.5 V min.
		L	0.4 V max.	0.5 V max.
	Current	30mA max.	20 mA max.	
	Load Power Voltage	30 VDC max.	–	
	Short-Circuit Protection	Between output and power supply	–	
Mechanical Specifications				
Starting Torque	0.001 Nm (0.00074 ft/lb) max			
Shaft Moment of Inertia	0.6 x 10 ⁴ kg·m ²			
Max. Allowable Shaft Load	Radial: 30N (6.7 lb-f); Axial: 20N (4.5 lb-f)			
Max. Mechanical Speed**	6000rpm (maximum possible without compromising encoder mechanical integrity)			
Wire Size	AWG26			
Mounting Orientation	can be mounted in any orientation			
Environmental Specifications				
Ambient Temperature	-10 to 80 °C (14 to 176 °F)			
Storage Temperature	-25 to 85°C (-13 to 185°F)			
Operating Humidity	35–85% RH (non-condensing)			
Withstand Voltage	Grounded through capacitor			
Insulation Resistance	50MΩ min.			
Vibration Resistance	durable for one hour along three axes at 10 to 55 Hz with 0.75 mm amplitude			
Shock Resistance	11 ms with 490 m/s ² applied three times along three axes			
Protection	IP50 standard encoders. IP65 for encoders with "W" in the part number.			
Agency Approvals	cUL _{US} (E189395)			
* To be supplied by Class II source.				
** Encoder maximum speed is the lesser value of Max. Electrical Speed and Max. Mechanical Speed.				

Light Duty Incremental Encoders (Metric Dimension Encoders)

TRD-SR/SHR series Mounting Accessories

Mounting Accessories					
Part Number	Price	Description	Weight	Drawing	Compatibility
SHRS-040D*	\$9.00	Flexible mounting bracket for IP50 hollow shaft encoders, converts standard 45mm mounting to 40mm mounting.	<2g	PDF	TRD-SHR series, IP50
SHRS-045D*	\$9.00	Replacement 45mm flexible mounting bracket for IP50 rated hollow shaft encoders.		PDF	
SHRS-W40D*	\$9.00	Replacement 40mm flexible mounting bracket for IP65 rated hollow shaft encoders.		PDF	
SRT-035D	\$23.00	Right angle mounting bracket for solid shaft TRD-SR encoders.	140g	PDF	TRD-SR series

* Note: The IP50 flexible mounting brackets will not fit on the IP65 encoders. Likewise, the IP65 flexible mounting bracket will not fit on the IP50 encoders.



SHRS-040D



SHRS-045D



SHRS-W40D

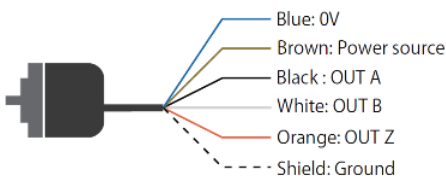


SRT-035D

Wiring diagrams

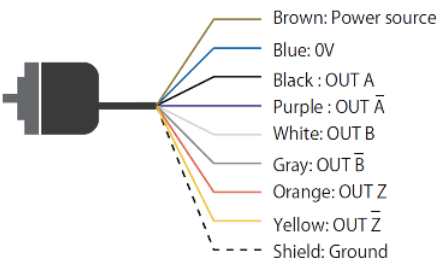
Open Collector Models

Cable shield is NOT connected to the encoder body (frame ground)



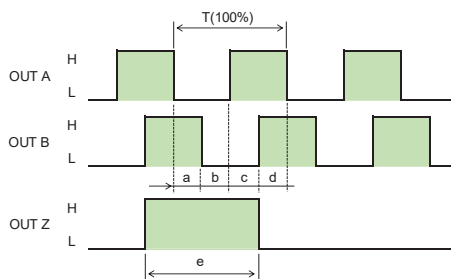
Line Driver Models

Cable shield is NOT connected to the encoder body (frame ground)

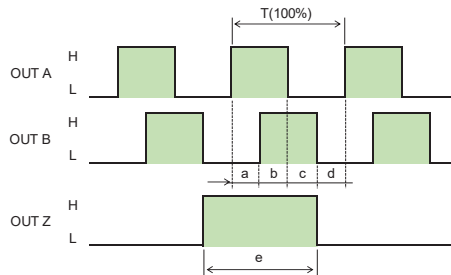


Channel timing charts

TRD-SR/SHR "A" Models



TRD-SR/SHR "V" Models



$$T = a + b + c + d \quad a, b, c, d = 1/4 T \pm 1/8 T \quad e = 1 \pm$$

This Output waveform is Normal revolution (CW).
"Normal" means clockwise revolution viewed from the shaft end.

How to read the timing charts

Open Collector Models

Out A and Out B are 90 degrees out of phase. Like any quadrature encoder, four unique logic states are created internally to the encoder. This is based on the rising edge to rising edge (one cycle) on channel A or B that indicates one set of bars on the internal encoder disk has passed by the optical sensor.

OUT Z is the absolute reference added to an incremental encoder and is also known as home position. It signifies a full rotation of the encoder shaft.

Line Driver Models

Channel A (OUT A and A-not) and Channel B (OUT B and B-not) are also 90 degrees out of phase on line driver encoders. OUT Z is the same as on open collector models, and is the absolute reference (home position). It signifies one full rotation of the encoder shaft.

Light Duty Incremental Encoders (Metric Dimension Encoders)

TRD-S(H) series

Features

A light duty encoder that is cost-effective for small applications and has the following features:

- Small body with 38 mm diameter and 30 mm depth
- Dust proof (IP40 rating)
- 6 mm solid shaft or 8 mm hollow shaft
- Resolution available from 100 pulses per revolution to 2500 pulses per revolution
- Open collector or line driver output
- Up to 200 kHz response frequency
- Two-meter cable, tinned ends



Solid-shaft (TRD-S) model



Hollow-shaft (TRD-SH) model

Light Duty Solid Shaft Incremental Encoders (NPN Open Collector and Line Driver models)					
Part Number	Price	Pulses per Revolution	Input Voltage	Output	Body Diameter
TRD-S100AD	\$111.00	100	5-12 VDC	NPN open collector	38mm
TRD-S360AD	Retired	360			
TRD-S500AD	\$111.00	500			
TRD-S1000AD	\$111.00	1000			
TRD-S1024AD	\$111.00	1024			
TRD-S2500AD	\$116.00	2500			
TRD-S250BD	Retired	250	12-24 VDC	NPN open collector	
TRD-S300BD	Retired	300			
TRD-S600BD	Retired	600			
TRD-S1000-BD	Retired	1000			
TRD-S1024-BD	Retired	1024			
TRD-S1200BD	Retired	1200			
TRD-S100-VD	\$111.00	100	5VDC	Line driver (differential)	
TRD-S250VD	Retired	250			
TRD-S300VD	\$111.00	300			
TRD-S400VD	\$111.00	400			
TRD-S800VD	\$111.00	800			
TRD-S1000-VD	Retired	1000			
TRD-S1200VD	\$111.00	1200			
TRD-S2500-VD	Retired	2500			

Light Duty Hollow Shaft Incremental Encoders (NPN Open Collector and Line Driver models)					
Part Number	Price	Pulses per Revolution	Input Voltage	Output	Body Diameter
TRD-SH100AD	\$113.00	100	5-12 VDC	NPN open collector	38mm
TRD-SH360AD	\$113.00	360			
TRD-SH500AD	\$113.00	500			
TRD-SH1000AD	\$113.00	1000			
TRD-SH1024AD	Retired	1024			
TRD-SH2500AD	\$119.00	2500			
TRD-SH400BD	Retired	400	12-24 VDC	NPN open collector	
TRD-SH500-BD	Retired	500			
TRD-SH600BD	Retired	600			
TRD-SH1000-BD	\$113.00	1000			
TRD-SH1200BD	Retired	1200			
TRD-SH2000BD	Retired	2000			
TRD-SH2500-BD	Retired	2500	5VDC	Line driver (differential)	
TRD-SH100-VD	\$113.00	100			
TRD-SH200VD	\$113.00	200			
TRD-SH250VD	\$113.00	250			
TRD-SH300VD	\$113.00	300			
TRD-SH360-VD	\$113.00	360			
TRD-SH400VD	\$113.00	400			
TRD-SH500-VD	\$113.00	500			
TRD-SH600VD	\$113.00	600			
TRD-SH800VD	\$113.00	800			
TRD-SH1000-VD	Retired	1000			
TRD-SH1200VD	\$119.00	1200			
TRD-SH2000VD	Retired	2000			
TRD-SH2500-VD	Retired	2500			

Light Duty Incremental Encoders (Metric Dimension Encoders)

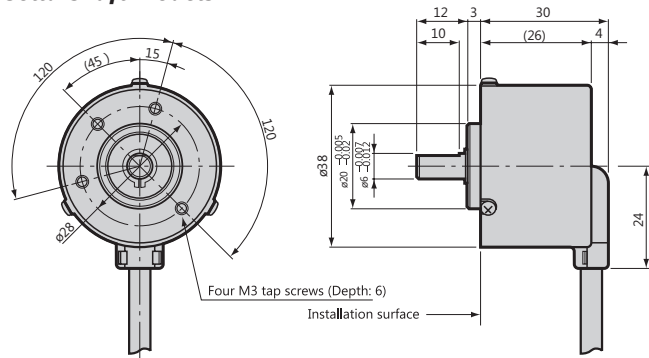
Specifications – TRD-S(H) series

Electrical Specifications					
Model		TRD-SxxxxAD TRD-SHxxxxAD (open collector)	TRD-Sxxxx-BD TRD-SHxxxxBD (open collector)	TRD-Sxxxx-VD TRD-SHxxxxVD (line driver)	
Power Supply	Operating Voltage *	5–12 VDC (nominal) * Range: 4.75–13.2 VDC	12–24 VDC (nominal) * Range: 10.8–26.4 VDC	5VDC (nominal) * Range: 4.75–5.25 VDC	
	Allowable Ripple	3% max.			
	Current Consumption	50 mA max.			
Signal Waveform		Quadrature + home position			
Max. Response Frequency		200kHz			
Operating Speed		(max response frequency / resolution) x 60			
Duty Ratio		50% ±25%			
Phase Difference Width		25% ±12.5%			
Signal Width at Home Position		100 ±50%			
Output	Rise/Fall Time	1µs max. (when cable length is 1m)		–	
	Output Type	NPN open collector output, sinking		Line driver output (26C31 or equivalent)	
	Output Logic	Negative logic (active low)		Negative logic (active high)	
	Output Voltage	H	–		2.5 V min.
		L	0.4 V max.		0.5 V max.
	Current	30mA max.		20 mA max.	
	Load Power Voltage	35 VDC max.		–	
Short-Circuit Protection	Between output and power supply		–		
* To be supplied by Class II source					
Mechanical Specifications					
Starting Torque	0.001 Nm (0.00074 ft/lb) max				
Max. Allowable Shaft Load	Radial: 20N (4.5 lb); Axial: 10N (2.25 lb)				
Max. Allowable Speed	6000 rpm (highest speed that can support the mechanical integrity of encoder)				
Wire Size	AWG26				
Mounting Orientation	can be mounted in any orientation				
Weight	approx. 150g (5.3 oz) with 2m cable				
Environmental Specifications					
Ambient Temperature	-10 to 70°C; 14 to 158°F				
Storage Temperature	-25 to 85°C; -13 to 185°F				
Operating Humidity	35–85% RH				
Withstand Voltage	500VAC (50/60Hz) for one minute				
Insulation Resistance	50MΩ min.				
Vibration Resistance	durable for one hour along three axes at 10 to 55 Hz with 0.75 amplitude				
Shock Resistance	11 ms with 490 m/s ² applied three times along three axes				
Protection	IP40				

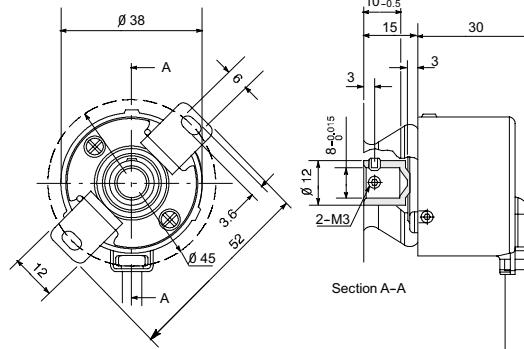
Light Duty Incremental Encoders (Metric Dimension Encoders)

Dimensions – TRD-S(H) series

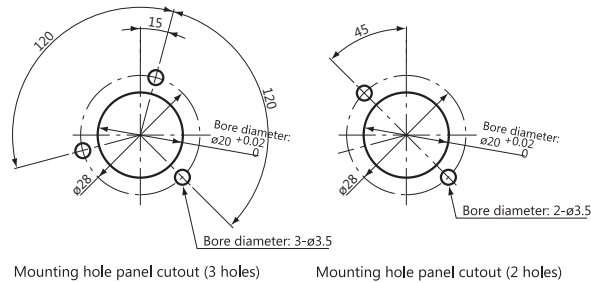
Solid-shaft models



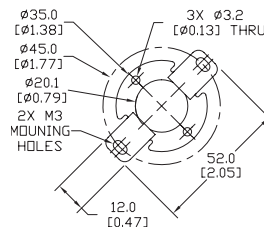
Hollow-shaft models



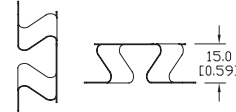
All dimensions in mm
1mm = 0.03937in



TRD-SH-BKT (bracket)



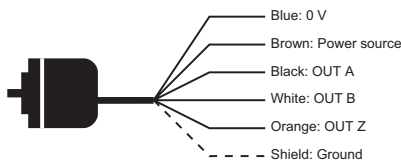
Mounting Accessories		
Part #	Price	Description
TRD-SH-BKT	\$7.00	Flexible mounting bracket, replacement. For use with Koyo TRD-SH series hollow shaft encoders



Wiring diagrams

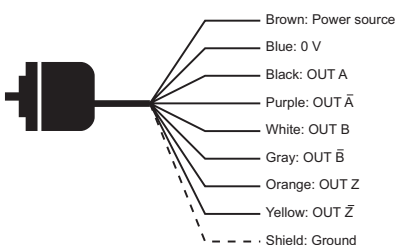
Open collector connections

Cable shield is not connected to the encoder body; enclosure is grounded through the 0V wire



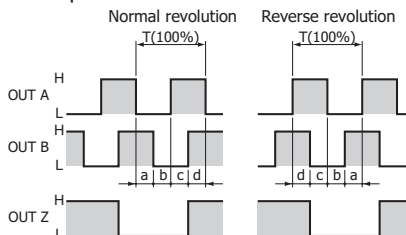
Line driver connections

Cable shield is not connected to the encoder body; enclosure is grounded through the 0V wire

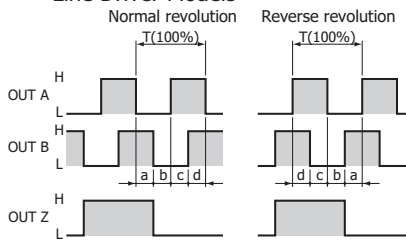


Channel timing charts

Open Collector Models



Line Driver Models



a, b, c, = 1/4T ± 1/8T
"Normal" means clockwise revolution viewed from the shaft.

How to read the timing charts

Open Collector Models

OUT A and Out B are 90 degrees out of phase. Like any quadrature encoder, four unique logic states are created internally to the encoder. This is based on the rising edge to rising edge (one cycle) on channel A or B that indicates one set of bars on the internal encoder disk has passed by the optical sensor.

OUT Z is the absolute reference added to an incremental encoder and is also known as home position. It signifies a full rotation of the encoder shaft.

Line Driver Models

Channel A (OUT A and A-not) and Channel B (OUT B and B-not) are also 90 degrees out of phase on line driver encoders. OUT Z is the same as on open collector models, and is the absolute reference (home position). It signifies one full rotation of the encoder shaft.

Medium Duty Incremental Encoders (Metric Dimension Encoders)

TRD-N(H) series

Features

The medium duty encoder offers the greatest flexibility of choice in a very high-quality encoder, all for a very low price. Features:

- Small body with 50 mm diameter and 35 mm depth
- Splash proof (IP65 rating)
- 8 mm solid shaft or 8 mm hollow shaft
- Incremental resolution available from 3 pulses per revolution to 5,000 pulses per revolution
- Line driver or Totem-pole (push-pull) output
- Up to 200 kHz response frequency



Solid-shaft (TRD-N) model



Hollow-shaft (TRD-NH) model

Incremental Medium Duty Solid Shaft Encoders (Totem-pole Output, TRD-Nxxx-RZWD)					
Part Number	Price	Pulses per Revolution	Input Voltage	Output	Body Dia.
TRD-N3-RZWD	\$160.00	3	5-30 VDC	Totem-pole (push-pull) sink/source	50 mm
TRD-N4-RZWD	\$160.00	4			
TRD-N5-RZWD	\$160.00	5			
TRD-N10-RZWD	\$160.00	10			
TRD-N30-RZWD	\$160.00	30			
TRD-N40-RZWD	\$160.00	40			
TRD-N50-RZWD	\$160.00	50			
TRD-N60-RZWD	\$160.00	60			
TRD-N100-RZWD	\$160.00	100			
TRD-N120-RZWD	\$180.00	120			
TRD-N200-RZWD	\$180.00	200			
TRD-N240-RZWD	\$180.00	240			
TRD-N250-RZWD	\$180.00	250			
TRD-N300-RZWD	\$180.00	300			
TRD-N360-RZWD	\$180.00	360			
TRD-N400-RZWD	\$180.00	400			
TRD-N480-RZWD	\$180.00	480			
TRD-N500-RZWD	\$180.00	500			
TRD-N600-RZWD	\$180.00	600			
TRD-N750-RZWD	\$180.00	750			
TRD-N1000-RZWD	\$180.00	1000			
TRD-N1024-RZWD	\$180.00	1024			
TRD-N1200-RZWD	\$235.00	1200			
TRD-N2000-RZWD	\$235.00	2000			
TRD-N2500-RZWD	\$236.00	2500			
TRD-N3000-RZWD	\$236.00	3000			
TRD-N3600-RZWD	\$236.00	3600			
TRD-N5000-RZWD	\$236.00	5000			

Incremental Medium Duty Hollow Shaft Encoders (Totem-pole Output, TRD-NHxxx-RZWD)					
Part Number	Price	Pulses per Revolution	Input Voltage	Output	Body Dia.
TRD-NH3-RZWD	\$180.00	3	5-30 VDC	Totem-pole (push-pull) sink/source	50 mm
TRD-NH4-RZWD	\$180.00	4			
TRD-NH5-RZWD	\$180.00	5			
TRD-NH10-RZWD	\$180.00	10			
TRD-NH30-RZWD	\$180.00	30			
TRD-NH40-RZWD	\$180.00	40			
TRD-NH50-RZWD	\$180.00	50			
TRD-NH60-RZWD	\$180.00	60			
TRD-NH100-RZWD	\$180.00	100			
TRD-NH120-RZWD	\$200.00	120			
TRD-NH200-RZWD	\$200.00	200			
TRD-NH240-RZWD	\$200.00	240			
TRD-NH250-RZWD	\$200.00	250			
TRD-NH300-RZWD	\$200.00	300			
TRD-NH360-RZWD	\$200.00	360			
TRD-NH400-RZWD	\$200.00	400			
TRD-NH480-RZWD	\$200.00	480			
TRD-NH500-RZWD	\$200.00	500			
TRD-NH600-RZWD	\$205.00	600			
TRD-NH750-RZWD	\$205.00	750			
TRD-NH1000-RZWD	\$205.00	1000			
TRD-NH1024-RZWD	\$201.00	1024			
TRD-NH1200-RZWD	\$251.00	1200			
TRD-NH2000-RZWD	\$251.00	2000			
TRD-NH2500-RZWD	\$251.00	2500			
TRD-NH3000-RZWD	\$255.00	3000			
TRD-NH3600-RZWD	\$251.00	3600			
TRD-NH5000-RZWD	\$255.00	5000			

Medium Duty Incremental Encoders (Metric Dimension Encoders)

TRD-N(H) series

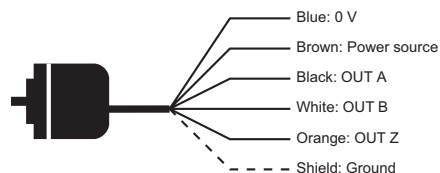
Incremental Medium Duty Solid Shaft Encoders (Line Driver Output, TRD-Nxxx-RZVWD)					
Part Number	Price	Pulses per Revolution	Input Voltage	Output	Body Dia.
TRD-N3-RZVWD	\$167.00	3	5VDC	Line driver (differential)	50 mm
TRD-N4-RZVWD	\$167.00	4			
TRD-N5-RZVWD	\$167.00	5			
TRD-N10-RZVWD	\$167.00	10			
TRD-N30-RZVWD	\$167.00	30			
TRD-N40-RZVWD	\$167.00	40			
TRD-N50-RZVWD	\$167.00	50			
TRD-N60-RZVWD	\$167.00	60			
TRD-N100-RZVWD	\$167.00	100			
TRD-N120-RZVWD	\$198.00	120			
TRD-N200-RZVWD	\$198.00	200			
TRD-N240-RZVWD	\$198.00	240			
TRD-N250-RZVWD	\$198.00	250			
TRD-N300-RZVWD	\$198.00	300			
TRD-N360-RZVWD	\$198.00	360			
TRD-N400-RZVWD	\$198.00	400			
TRD-N480-RZVWD	\$198.00	480			
TRD-N500-RZVWD	\$198.00	500			
TRD-N600-RZVWD	\$198.00	600			
TRD-N750-RZVWD	\$198.00	750			
TRD-N1000-RZVWD	\$200.00	1000			
TRD-N1024-RZVWD	\$200.00	1024			
TRD-N1200-RZVWD	\$235.00	1200			
TRD-N2000-RZVWD	\$235.00	2000			
TRD-N2500-RZVWD	\$235.00	2500			
TRD-N3000-RZVWD	\$236.00	3000			
TRD-N3600-RZVWD	\$236.00	3600			
TRD-N5000-RZVWD	\$236.00	5000			

Incremental Medium Duty Hollow Shaft Encoders (Line Driver Output, TRD-NHxxx-RZVWD)					
Part Number	Price	Pulses per Revolution	Input Voltage	Output	Body Dia.
TRD-NH3-RZVWD	\$180.00	3	5VDC	Line driver (differential)	50 mm
TRD-NH4-RZVWD	\$180.00	4			
TRD-NH5-RZVWD	\$180.00	5			
TRD-NH10-RZVWD	\$180.00	10			
TRD-NH30-RZVWD	\$180.00	30			
TRD-NH40-RZVWD	\$180.00	40			
TRD-NH50-RZVWD	\$180.00	50			
TRD-NH60-RZVWD	\$180.00	60			
TRD-NH100-RZVWD	\$180.00	100			
TRD-NH120-RZVWD	\$198.00	120			
TRD-NH200-RZVWD	\$198.00	200			
TRD-NH240-RZVWD	\$198.00	240			
TRD-NH250-RZVWD	\$198.00	250			
TRD-NH300-RZVWD	\$198.00	300			
TRD-NH360-RZVWD	\$198.00	360			
TRD-NH400-RZVWD	\$198.00	400			
TRD-NH480-RZVWD	\$198.00	480			
TRD-NH500-RZVWD	\$198.00	500			
TRD-NH600-RZVWD	\$217.00	600			
TRD-NH750-RZVWD	\$217.00	750			
TRD-NH1000-RZVWD	\$217.00	1000			
TRD-NH1024-RZVWD	\$217.00	1024			
TRD-NH1200-RZVWD	\$251.00	1200			
TRD-NH2000-RZVWD	\$251.00	2000			
TRD-NH2500-RZVWD	\$251.00	2500			
TRD-NH3000-RZVWD	\$251.00	3000			
TRD-NH3600-RZVWD	\$251.00	3600			
TRD-NH5000-RZVWD	\$251.00	5000			

Wiring diagrams

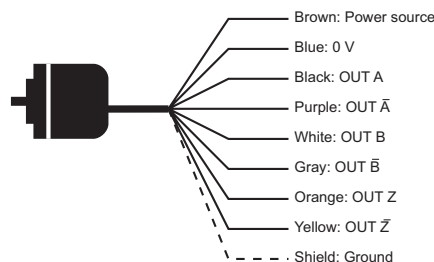
Totem-pole (push-pull) connections

Cable shield is not connected to the encoder body; enclosure is grounded through the 0V wire



Line driver connections

Cable shield is not connected to the encoder body; enclosure is grounded through the 0V wire



Medium Duty Incremental Encoders (Metric Dimension Encoders)

Specifications – TRD-N(H) series

Electrical Specifications				
Model		TRD-N(H)xxxx-RZWD (Totem-pole)	TRD-N(H)xxxx-RZVWD (Line Driver)	
Power Supply	Operating Voltage *	5–30 VDC (nominal) * Range: 4.75–30.0 VDC	5VDC (nominal) * Range: 4.75–5.25 VDC	
	Allowable Ripple	3% rms max.		
	Current Consumption	60 mA max.		
Signal Waveform		Quadrature + home position		
Max. Response Frequency		100 kHz	100kHz for ≤ 3000 ppr 200kHz for > 3000 ppr	
Operating Speed		(max response frequency / resolution) x 60		
Duty Ratio		50% ±25% (square wave)		
Signal Width at Home Position		100% ±50%		
Output	Rise/Fall Time **	3µs max **	100 ns max **	
	Output Type	Totem Pole (Push Pull)	Line Driver (26C31 or equivalent)	
	Output Current	Negative logic (active low)	Positive logic (active high)	
	Output Current	“H” (inflow)	30 mA max.	20 mA max
		“L” (outflow)	10 mA max.	
	Output Voltage	“H”	[(Load power volt) - 2.5V]	2.5V min
“L”		0.4V max	0.5V max	
Load Power Voltage		35 VDC max	–	

* To be supplied by Class II source

** Cable length ≤2m or less. Maximum load.

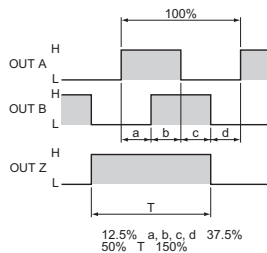
Mechanical Specifications	
Starting Torque	N (solid shaft): 0.02 N·m [0.18 lb·ft] ; NH (hollow shaft): 0.05 N·m [0.44 lb·ft]
Max. Allowable Shaft Load	Radial: 50N [11.24 lb] ; Axial: 30N [6.74 lb]
Max. Allowable Speed	Continuous: 3,000 rpm; Instantaneous: 5,000 rpm
Wire Size	24 AWG
Weight	Approx. 270g [9.52 oz] with 2m cable

Environmental Specifications	
Ambient Temperature	-10 to 70 °C [14 to 158 °F]
Storage Temperature	-25 to 85 °C [-13 to 185 °F]
Operating Humidity	35–85% RH
Withstand Voltage *	500 VAC (50/60Hz) for one minute * Grounded through a capacitor
Insulation Resistance	50 MΩ min. (excluding shield between power supply, signal cable and case)
Vibration Resistance	durable for one hour along three axes at 10 to 55 Hz with 0.75 mm amplitude (excluding shield between power supply, signal cable and case)
Shock Resistance	≤500 ppr (metal slit) = 11 ms with 981 m/s ² applied three times along three axes ≥600 ppr (glass slit) = 11 ms with 490 m/s ² applied three times along three axes
Mounting Orientation	can be mounted in any orientation
Protection	IP65
Agency Approvals	cUL _{US} (E189395)

* Voltage withstand is good for power supply, signal, and case; not good for shield wire.

Channel timing chart

Output Signal Timing Chart - Totem Pole Models



The above waveforms apply to normal (clockwise) revolution viewed from the shaft. OUT Z phase is reversed on the RZL and RZWL models.

Accessories

Couplings

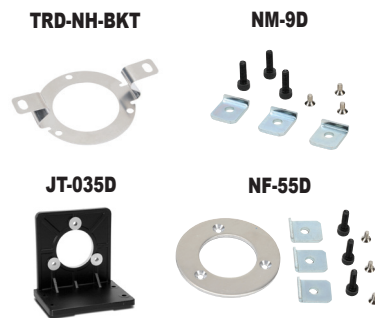
For encoders with a solid shaft, please select a coupling that fits your encoder. All couplings are typically in stock, ready to ship.

See the “Encoder Couplings” section for more information.

Mounting Flange & Brackets

Mounting Accessories		
Part #	Price	Description
JT-035D	\$18.00	Mounting Bracket: Metal; for use with all TRD-N/NH/NA encoders
NM-9D*	\$8.00	Mounting Clamp: Metal; for use with all TRD-N/NA encoders *
NF-55D*	\$20.00	Mounting Flange Kit: includes aluminum flange & NM-9D clamp; for use with all TRD-N/NA encoders *
TRD-NH-BKT	\$6.50	Flexible mounting bracket, replacement. For use with Koyo TRD-NH series hollow shaft encoders

* Order NF-55D (flange & clamp) for new installations.
Order NM-9D (clamp) for replacement parts only.



How to read the timing charts

Totem Pole Models

Out A and Out B are 90 degrees out of phase. Like any quadrature encoder, four unique logic states are created internally to the encoder. This is based on the rising edge to rising edge (one cycle) on channel A or B that indicates one set of bars on the internal encoder disk has passed by the optical sensor.

OUT Z is the absolute reference added to an incremental encoder and is also known as home position. It signifies a full rotation of the encoder shaft.

Line Driver Models

Channel A (OUT A and A-not) and Channel B (OUT B and B-not) are also 90 degrees out of phase on line driver encoders. OUT Z is the same as on open collector models, and is the absolute reference (home position). It signifies one full rotation of the encoder shaft.

Medium Duty Absolute Encoders (Metric Dimension Encoders)

TRD-NA series

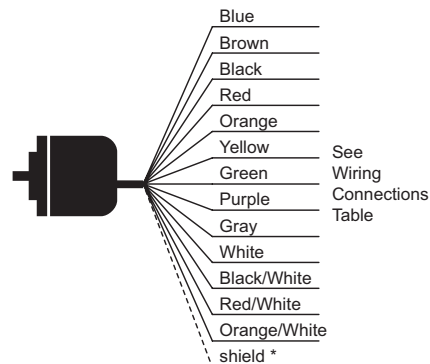
Features

Why use an absolute encoder?
Absolute encoders provide their exact position at all times, allowing monitoring equipment to read the correct position, even when power cycles. Features include:

- Small body with 50mm diameter and 35mm depth
- Splash proof (IP65 rating)
- 8mm solid shaft
- Absolute resolution available from 32 pulses per revolution to 2048 pulses per revolution
- Open collector output
- Up to 20kHz response frequency



Standard shaft (TRD-NA) model



* Cable shield is not connected to the encoder body;

Absolute Medium Duty Solid Shaft Encoders					
Part Number	Price	Resolution	Input Voltage	Output	Body Dia.
TRD-NA32NWD	\$366.00	5 bit gray code, 32 pulses per revolution	10-26 VDC	NPN open collector	50 mm
TRD-NA64NWD	\$366.00	6 bit gray code, 64 pulses per revolution			
TRD-NA128NWD	\$366.00	7 bit gray code, 128 pulses per revolution			
TRD-NA180NWD	\$366.00	8 bit gray code, 180 pulses per revolution			
TRD-NA256NWD	\$366.00	8 bit gray code, 256 pulses per revolution			
TRD-NA360NWD	\$366.00	9 bit gray code, 360 pulses per revolution			
TRD-NA512NWD	\$366.00	9 bit gray code, 512 pulses per revolution			
TRD-NA720NWD	\$366.00	10 bit gray code, 720 pulses per revolution			
TRD-NA1024NWD	\$366.00	10 bit gray code, 1024 pulses per revolution			
TRD-NA2048NWD	\$366.00	11 bit gray code, 2048 pulses per revolution			

Wiring Connections								
Wire color	Connector Pin No.	Resolution						
		2048	1024 / 720	512 / 360	256 / 180	128	64	32
Blue	1	0V						
Brown	2	12/24V						
Black	3	bit 0 (20) *	bit 0 (20) *	no connection				
Red	4	bit 1 (21) *	bit 1 (21) *	bit 0 (20) *	no connection			
Orange	5	bit 2 (22) *	bit 2 (22) *	bit 1 (21) *	bit 0 (20) *	no connection		
Yellow	6	bit 3 (23) *	bit 3 (23) *	bit 2 (22) *	bit 1 (21) *	bit 0 (20) *	no connection	
Green	7	bit 4 (24) *	bit 4 (24) *	bit 3 (23) *	bit 2 (22) *	bit 1 (21) *	bit 0 (20) *	no connection
Purple	8	bit 5 (25) *	bit 5 (25) *	bit 4 (24) *	bit 3 (23) *	bit 2 (22) *	bit 1 (21) *	bit 0 (20) *
Gray	9	bit 6 (26) *	bit 6 (26) *	bit 5 (25) *	bit 4 (24) *	bit 3 (23) *	bit 2 (22) *	bit 1 (21) *
White	10	bit 7 (27) *	bit 7 (27) *	bit 6 (26) *	bit 5 (25) *	bit 4 (24) *	bit 3 (23) *	bit 2 (22) *
Black / White	11	bit 8 (28) *	bit 8 (28) *	bit 7 (27) *	bit 6 (26) *	bit 5 (25) *	bit 4 (24) *	bit 3 (23) *
Red / White	12	bit 9 (29) *	bit 9 (29) * (MSB)	bit 8 (28) * (MSB)	bit 7 (27) * (MSB)	bit 6 (26) * (MSB)	bit 5 (25) * (MSB)	bit 4 (24) * (MSB)
Orange / White	13	bit 10 (210) * (MSB)	no connection					
Shield	-	GND **						

* Numbers in parentheses () are the bits corresponding to binary code.
** GND (cable shield) is not connected to encoder body; the enclosure is grounded through the 0VDC line.
Note: Numbers in parentheses () are the bits corresponding to binary code.

Medium Duty Absolute Encoders (Metric Dimension Encoders)

Specifications – TRD-NA series

Electrical Specifications		
Model	TRD-NAxxxx-NWD	
Power Supply	Operating Voltage *	12–24 VDC (nominal) * Range: 10.8–26.4 VDC
	Allowable Ripple	3% rms max.
	Current Consumption	70mA max.
Output Code	Gray binary (38 gray codes at 180 resolution, 76 at 360 resolution, and 152 at 720 resolution)	
Max. Response Frequency	20kHz (Maximum revolution speed = (max. response frequency / resolution) x 60). (The encoder does not respond to revolution faster than the maximum speed.)	
Accuracy	$\frac{360}{\text{Resolution}} = \text{degree of accuracy}$	
Direction of Rotation	Normal (CW) or reversed (CCW) (When viewed from the shaft, CW is clockwise direction, and CCW is counterclockwise direction)	
Rise/Fall Time	2µs max. (at 1kW load resistance and when cable length is 2m or less)	
Output	Output Type	NPN open collector
	Output Logic	Negative logic (active low)
	Sinking Current	32mA max.
	Residual Voltage	16mA or less: 0.4 V max. 16mA → 32mA: 1.5 V max.
	Load Power Voltage	35VDC max.
* To be supplied by Class II source		
Mechanical Specifications		
Starting Torque	0.03 N·m [0.02 lb·ft]	
Max. Allowable Shaft Load	Radial: 50N [11.24 lbs]; Axial: 30N [6.74 lbs]	
Max. Allowable Speed	Continuous: 3000 rpm, instantaneous: 5000 rpm; (highest speed that can support the mechanical integrity of encoder)	
Wire Size	26 AWG	
Weight	Approx. 300g (10.58 oz) with 2m cable	
Environmental Specifications		
Ambient Temperature	-10 to 60 °C [14 to 140 °F]	
Storage Temperature	-25 to 85 °C [-13 to 185 °F]	
Operating Humidity	25–85% RH (with no condensation)	
Insulation Resistance	10MΩ min.	
Vibration Resistance	Durable for one hour along three axes at 10 to 55 Hz with 0.75 mm amplitude	
Shock Resistance	11ms with 980m/s ² applied three times along three axes	
Mounting Orientation	Can be mounted in any orientation	
Protection	IP65	
Agency Approvals	cUL _{US} (E189395)	

Accessories

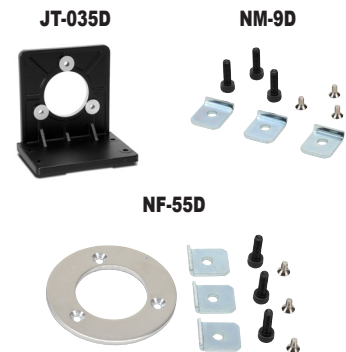
Couplings

For encoders with a solid shaft, please select a coupling that fits your encoder. All couplings are typically in stock, ready to ship.

See the “Encoder Couplings” section for more information.

Mounting Bracket & Clamps

Mounting Accessories		
Part #	Price	Description
JT-035D	\$18.00	Mounting Bracket: Metal; for use with all TRD-N/NH/NA encoders
NM-9D*	\$8.00	Mounting Clamp: Metal; for use with all TRD-N/NA encoders *
NF-55D*	\$20.00	Mounting Flange Kit: includes aluminum flange & NM-9D clamp; for use with all TRD-N/NA encoders *
* Order NF-55D (flange & clamp) for new installations. Order NM-9D (clamp) for replacement parts only.		

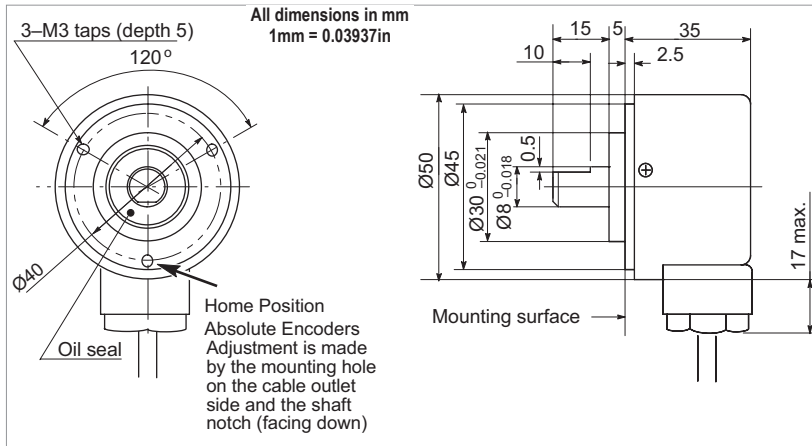


Medium Duty Absolute and Incremental Encoders (Metric Dimension Encoders)

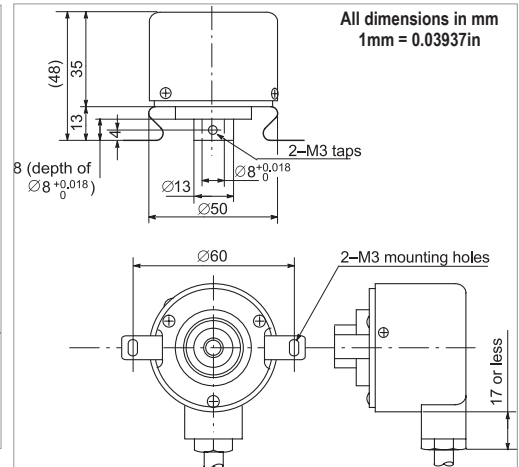
Dimensions – TRD-N(H) & TRD-NA series

The following are the external dimensions of both incremental and absolute medium duty encoders and optional mounting accessories.

Solid Shaft Incremental and Absolute Encoders (TRD-N, TRD-NA)



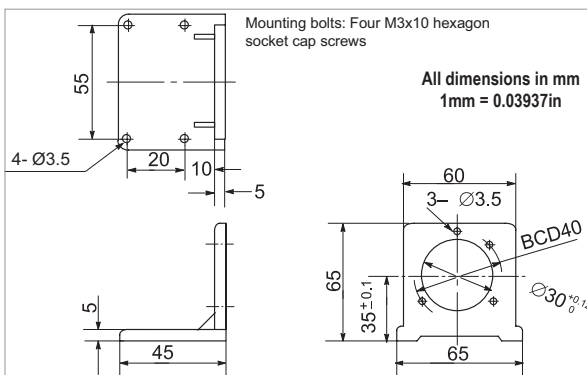
Hollow Shaft Incremental Encoders only (TRD-NH)



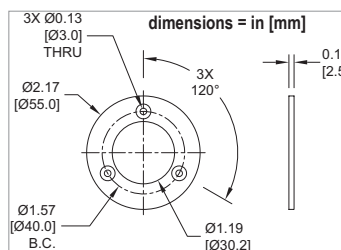
Optional Mounting Flange and Brackets for Medium Duty Encoders

NOTE: NF-55D flange & included NM-9D bracket: Requires (3) M4 x 0.7 tapped holes equally spaced on a 64mm bolt circle in the mounting surface.

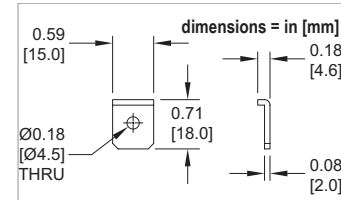
JT-035D (bracket)



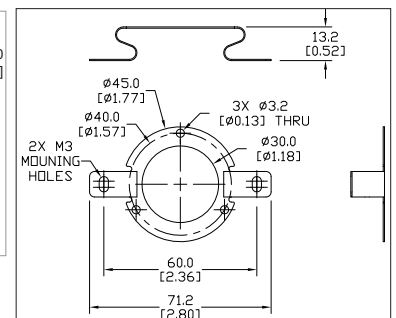
NF-55D (flange)



NM-9D (clamp)(included with NF-55D)



TRD-NH-BKT (bracket)



Heavy Duty Incremental Encoders (Metric Dimension Encoders)

TRD-GK series

Features

A heavy duty encoder is the most rugged encoder you can buy. Top-of-the-line bearings allow a service life of 12 billion revolutions. Features include:

- 10 mm solid shaft
- Rugged body with 78 mm diameter and 60 mm depth
- Splash-proof IP65 rating
- Incremental operation from 30 pulses per revolution to 5,000 pulses per revolution
- 100 kHz maximum response frequency
- 10-30 VDC, Totem-pole output



Solid-shaft (TRD-GK) model

Heavy Duty Standard Shaft Incremental Encoders					
Model	Price	Pulses per Revolution	Input Voltage	Output	Body Diameter
TRD-GK30-RZD	\$319.00	30	10-30 VDC	Totem-pole (sink/source)	78mm
TRD-GK100-RZD	\$319.00	100			
TRD-GK120-RZD	\$319.00	120			
TRD-GK200-RZD	\$319.00	200			
TRD-GK240-RZD	\$319.00	240			
TRD-GK250-RZD	\$319.00	250			
TRD-GK300-RZD	\$319.00	300			
TRD-GK360-RZD	\$319.00	360			
TRD-GK400-RZD	\$319.00	400			
TRD-GK500-RZD	\$366.00	500			
TRD-GK600-RZD	\$366.00	600			
TRD-GK800-RZD	Retired	800			
TRD-GK1000-RZD	\$366.00	1000			
TRD-GK1200-RZD	\$366.00	1000			
TRD-GK1500-RZD	\$420.00	1500			
TRD-GK1800-RZD	Retired	1800			
TRD-GK2000-RZD	\$437.00	2000			
TRD-GK2500-RZD	\$519.00	2500			
TRD-GK3600-RZD	\$579.00	3600			
TRD-GK5000-RZD	\$579.00	5000			

Electrical Specifications		
Model	TRD-GKxxxx-RZD	
Power Supply	Operating Voltage	10–30 VDC (nominal) * Range: 9.7–30.9 VDC
	Allowable Ripple	3% rms max.
	Current Consumption	At less than 16VDC: 50 mA max. / at 16VDC or more: 70mA max.
Output Waveform	Output Signal	Quadrature + home position
	Duty Ratio	50% ±25%
	Max. Frequency Response	100kHz max.
	Operating Speed	(max response frequency / resolution) x 60
	Signal Width at Home Position	At 400P or less: 25 to 150%; at 500P or more: 1° at 30'
Output	Rise/Fall Time	2µs max. (when cable length is 2m or less)
	Output Type	Totem-pole
	Current: Outflow: H	30mA max.
	Voltage: H	(power source voltage - 4V) min.
	Voltage: L	2V max.
Load Power Voltage	35VDC max.	
* To be supplied by Class II source		
Mechanical Specifications		
Starting Torque	Max. 0.1 N·m (0.07 ft·lbs) max. at 20°C (68°F)	
Max. Allowable Shaft Load	Radial: 100N (22.48 lbs) Axial: 50N (11.24 lbs)	
Max. Allowable Speed	5,000 rpm	
Service Life of Bearing	12 billion revolutions (at max. allowable speed)	
Wire Size	AWG24	
Weight	Approx. 600g (21.16 oz) with 2m cable	
Environmental Specifications		
Ambient Temperature	-10 to 70 °C [14 to 158 °F]	
Storage Temperature	-25 to 85 °C [-13 to 185 °F]	
Operating Humidity	35–85% RH (with no condensation)	
Insulation Resistance	50MΩ min.	
Vibration Resistance	At 500P or less: Durable for one hour along three axes at 10 to 55 Hz with 0.75 mm amplitude At 600P or more: Durable for one hour along three axes at 10 to 55 Hz with 0.35 mm amplitude	
Shock Resistance	At 500P or less: 11 ms with 980 m/s ² applied three times along three axes At 600P or more: 11 ms with 294 m/s ² applied three times along three axes	
Protection	IP65	

Heavy Duty Incremental Encoders (Metric Dimension Encoders)

TRD-GK series

Accessories

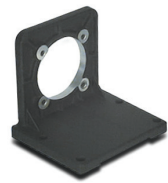
Couplings

For encoders with a solid shaft, please select a coupling that fits your encoder. All couplings are in stock, ready to ship.

See the "Encoder Couplings" section for more information.

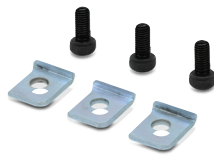
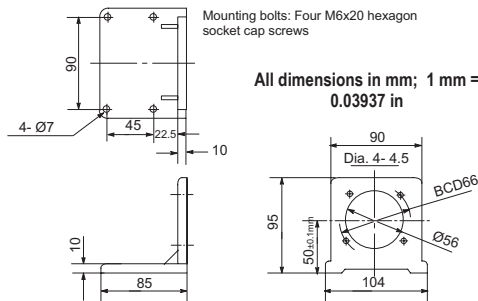
Mounting Brackets

Mounting brackets for all TRD-GK encoders.



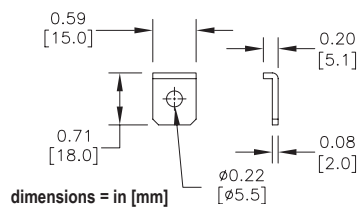
RT-11D

• \$33.00



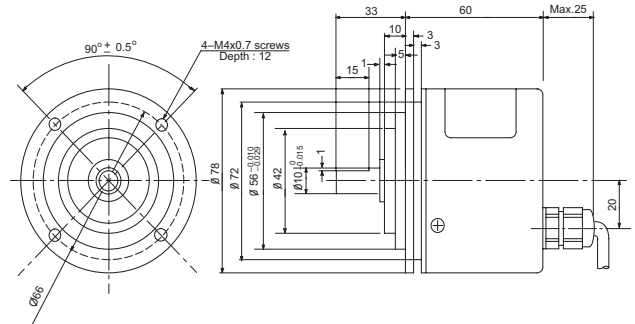
KM-9D

• \$8.00



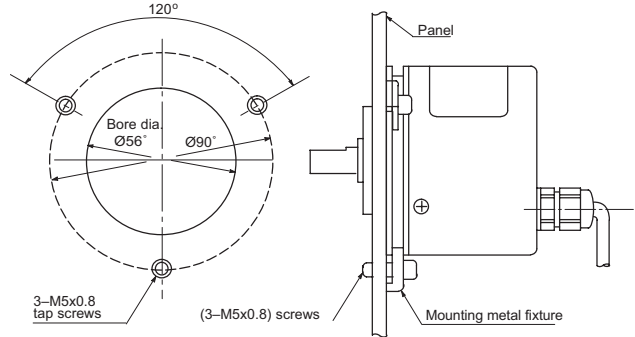
Dimensions

External dimensions



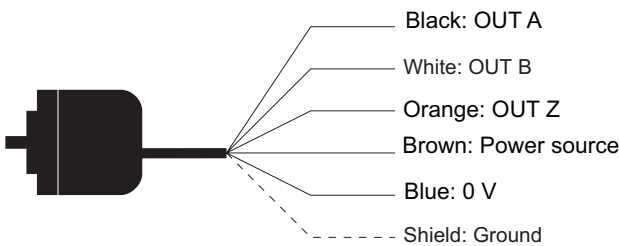
All dimensions in mm; 1 mm = 0.03937 in

Servo mounting



All dimensions in mm; 1 mm = 0.03937 in

Wiring diagram



Cable shield is not connected to the encoder body; enclosure is grounded through the 0V wire.

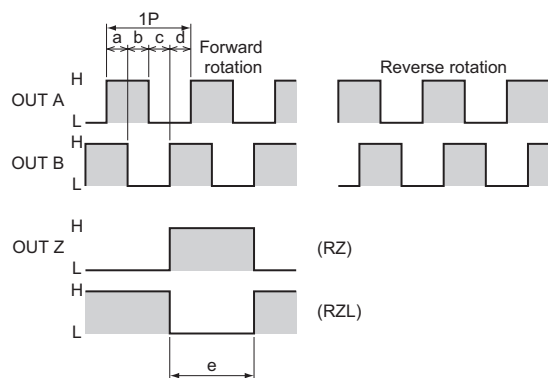
How to read the timing charts

Totem Pole Models

Out A and Out B are 90 degrees out of phase. Like any quadrature encoder, four unique logic states are created internally to the encoder. This is based on the rising edge to rising edge (one cycle) on channel A or B that indicates one set of bars on the internal encoder disk has passed by the optical sensor.

OUT Z is the absolute reference added to an incremental encoder and is also known as home position. It signifies a full rotation of the encoder shaft.

Channel timing chart



a, b, c, d = (1/4 ± 1/8) P
 e: 400 P or less: 25 to 150%
 500 P or more: 1 ± 30%
 (At 1,800, 3,600, 5000 pulses only: 50 to 150%)

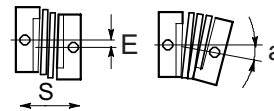
OUT Z generates home position in both directions.

Encoder Accessories – Couplings

Encoder Couplings

Couplings provide a connection between solid-shaft encoders and solid shafts. We offer aluminum, fiberglass, and polymer couplings for metric, S.A.E. and metric-to-S.A.E. applications.

Misalignment compensation



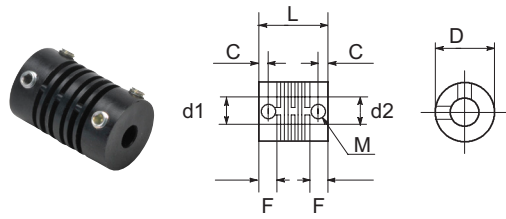
Couplings Selection Guide and Dimensions																
Type	Part Number	Price	Applicable Encoders (shaft size)	Shaft Diameter		D	L	F	C	M	a	E	S	Working Torque (N·m)	Torsional Rigidity	Material
				d1	d2	(mm [in])					max					
				(mm [in])												
Fiberglass (metric)	GJ-4D	\$12.00	TRD-MX (4mm)	4mm	4mm	13 [0.51]	21 [0.83]	5.3 [0.21]	3 [0.12]	M3 set screw	5°	0.4 [0.02]	0.4 [0.02]	0.6 N·m	6 N·m/rad	Glass-fiber reinforced resin
	GJ-6D	\$9.25	TRD-S/SR (6mm)	6mm	6mm	15 [0.59]	22 [0.87]	5.2 [0.20]	3 [0.12]	M3 set screw	6°	0.5 [0.02]	0.12 [0.005]	0.8 N·m	10 N·m/rad	
	GJ-8D	\$11.00	TRD-N/NA (8mm)	8mm	8mm	19 [0.75]	24 [0.94]	6.8 [0.27]	3.5 [0.14]	M4 set screw	5°	0.5 [0.02]	0.4 [0.016]	1.5 N·m	20 N·m/rad	
	GJ-10D	\$12.00	TRD-GK (10 mm)	10 mm	10 mm	22 [0.87]	26 [1.02]	7.1 [0.28]	4 [0.16]	M4 set screw	5°	0.5 [0.02]	0.12 [0.005]	2.0 N·m	32 N·m/rad	
Fiberglass (SAE)	GJ-635D	\$22.00	TRDA-2E (0.25 in)	0.25 in	0.25 in	15 [0.59]	22 [0.87]	5.2 [0.20]	3 [0.12]	M3 set screw	5°	0.5 [0.02]	0.12 [0.005]	0.8 N·m	10 N·m/rad	Glass-fiber reinforced resin
	GJK-953D	\$27.00	TRDA-20/25 (0.375 in)	0.375 in	0.375 in	25 [0.98]	32 [1.26]	7.3 [0.29]	3.5 [0.14]	M4 set screw	5°	0.5 [0.02]	0.12 [0.005]	2.0 N·m	32 N·m/rad	
Polymer (SAE)	STP-MTRA-SC-1412	\$22.50	TRDA-2E (0.25 in)	0.25 in	0.50 in	25 [0.98]	38 [1.50]	9.9 [0.39]	5.4 [0.21]	M3 cap screw	5°	0.3 [0.01]	0.12 [0.005]	3.7 N·m	0.36 °/lb·in	Engineered polymer
	STP-MTRA-SC-3812	\$22.50	TRDA-20/25 (0.375 in)	0.375 in	0.50 in	25 [0.98]	38 [1.50]	9.9 [0.39]	5.4 [0.21]	M3 cap screw	5°	0.3 [0.01]	0.12 [0.005]	3.7 N·m	0.36 °/lb·in	
Aluminum (metric)	ARM-075-5-4D	\$51.50	TRD-MX (4mm)	4mm	5mm	19.1 [0.75]	19.1 [0.75]	4.6 [0.18]	2.4 [0.09]	M3 set screw	5°	0.25 [0.01]	0.25 [0.01]	2.3 N·m	8.2 N·m/rad	Aluminum alloy
	RU-075D	\$58.00	TRD-S/SR (6mm)	6mm	6mm	19.1 [0.75]	19.1 [0.75]	4.6 [0.18]	2.4 [0.09]	M3 set screw	5°	0.25 [0.01]	0.12 [0.005]	1.0 N·m	8.2 N·m/rad	
	JU-100D	\$51.50	TRD-N/NA (8mm)	8mm	8mm	25.4 [1.00]	25.4 [1.00]	6.6 [0.26]	3.8 [0.15]	M5 set screw	5°	0.25 [0.01]	0.25 [0.01]	1.6 N·m	14.3 N·m/rad	
	RU-100D	\$60.00	TRD-GK (10 mm)	10 mm	10 mm	25.4 [1.00]	25.4 [1.00]	6.6 [0.26]	3.8 [0.15]	M5 set screw	5°	0.25 [0.01]	0.12 [0.005]	1.6 N·m	14.3 N·m/rad	
Aluminum (metric-to-SAE)	ML13P-4-476D	\$51.50	TRD-MX (4mm)	4mm	0.1875 in	13 [0.51]	19 [0.75]	5.5 [0.22]	2.5 [0.10]	M2 set screw	5°	0.4 [0.02]	0.2 [0.01]	0.25 N·m	44 N·m/rad	Aluminum alloy (Bent plate: Polyimide)
	ML16P-4-635D	\$51.50	TRD-MX (4mm) TRDA-2E (0.25 in)	4mm	0.25 in	16 [0.63]	23 [0.91]	7 [0.28]	3 [0.12]	M3 set screw	5°	0.6 [0.02]	0.3 [0.01]	0.4 N·m	70 N·m/rad	
	MCGL16-6-635	\$33.00	TRD-S/SR (6mm) TRDA-2E (0.25 in)	6mm	0.25 in	16 [0.63]	23.2 [0.91]	7 [0.28]	3 [0.12]	M3 set screw	3.5°	0.3 [0.01]	0.3 [0.01]	0.4 N·m	70 N·m/rad	
	MCGL20-8-635	\$43.00	TRD-N/NA (8mm) TRDA-2E (0.25 in)	8mm	0.25 in	20 [0.79]	26 [1.02]	7.5 [0.30]	3.7 [0.15]	M3 set screw	3.5°	0.3 [0.01]	0.4 [0.02]	0.6 N·m	130 N·m/rad	
	MCGL20-8-952	\$44.00	TRD-N/NA (8mm) TRDA-20/25 (0.375 in)	8mm	0.375 in	20 [0.79]	26 [1.02]	7.5 [0.30]	3.7 [0.15]	M3 set screw	3.5°	0.3 [0.01]	0.4 [0.02]	0.6 N·m	130 N·m/rad	
	MCGL25-10-635	\$54.00	TRD-GK (10 mm) TRDA-2E (0.25 in)	10 mm	0.25 in	25 [0.98]	30.2 [1.19]	9 [0.35]	4 [0.16]	M4 set screw	3.5°	0.3 [0.01]	0.5 [0.02]	1.4 N·m	240 N·m/rad	
	MCGL25-10-952	\$55.00	TRD-GK (10 mm) TRDA-20/25 (0.375 in)	10 mm	0.375 in	25 [0.98]	30.2 [1.19]	9 [0.35]	4 [0.16]	M4 set screw	3.5°	0.3 [0.01]	0.5 [0.02]	1.4 N·m	240 N·m/rad	
Aluminum (SAE)	ARM-075-635-635D	\$52.00	TRDA-2E (0.25 in)	0.25 in	0.25 in	19.1 [0.75]	19.1 [0.75]	4.6 [0.18]	2.4 [0.09]	M3 set screw	5°	0.25 [0.01]	0.25 [0.01]	1.0 N·m	8.2 N·m/rad	Aluminum alloy
	ARM-100-9525-9525D	\$50.00	TRDA-20/25 (0.375 in)	0.375 in	0.375 in	25.4 [1.00]	25.4 [1.00]	6.6 [0.26]	3.8 [0.15]	M5 set screw	5°	0.25 [0.01]	0.25 [0.01]	1.6 N·m	14.3 N·m/rad	

* mm ÷ 25.4 = inches

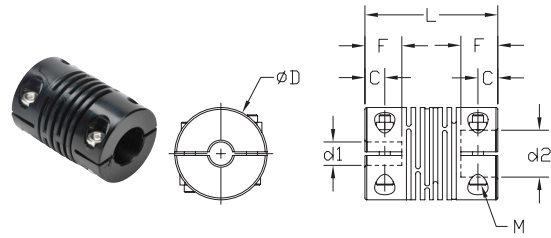
Encoder Accessories – Couplings

Encoder Couplings – Dimensions

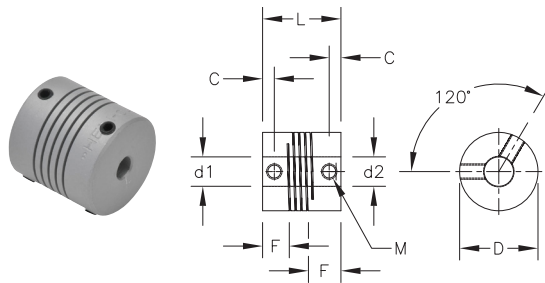
GJ-xxD Fiberglass Couplings (metric) & GJx-xxxD Fiberglass Couplings (SAE)



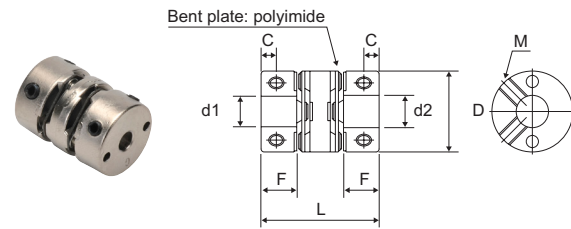
STP-MTRA-SC-xxxx Polymer Couplings



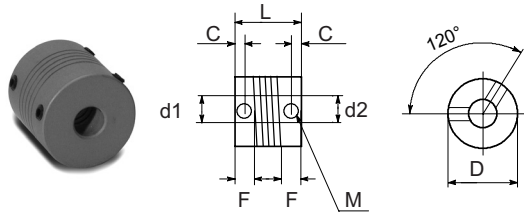
ARM-xxxxxxD Aluminum Couplings (metric & SAE)



MCGLxx Aluminum Couplings & ML1xP-4-xxxD Aluminum Couplings



RU-075D, RU-100D, and JU-100D Aluminum Couplings



Encoders Frequently Asked Questions

Q: What is a differential line output?

A: Differential output refers to the fact that each channel has a complement channel, i.e. Channel A and Channel A not. A differential line driver is used to help increase noise immunity. It also allows you to sink or source more current than a Totem-pole output. A differential line driver will work with either a sinking or sourcing circuit. It can also help in increasing the distance that a signal is transmitted.

Q: What is an open collector output?

A: An open collector output is an NPN transistor. An NPN transistor allows the sinking of current to common. It can be thought of as a switch that allows the circuit to be connected to common after the load. This means that a source is required for the output to work. A supply through a load must be connected to the output, otherwise the NPN transistor is simply creating a path to common, i.e. a dry contact. Therefore, if you were to measure the voltage at the output of an open collector that is not connected to a supply, you would not see a change in voltage. The voltage should be measured across the output load to determine if the open collector is working properly.

Q: What is a Totem-pole output?

A: A Totem-pole output, sometimes referred to as a push-pull output, is a bipolar output with active devices that are controlled such that, as the resistance of one increases, the resistance of the other decreases; so that according to the relative states of the two active devices, the output voltage can swing between levels approaching the two supply voltages. The term 'totem-pole output,' as commonly used, does not include three-state outputs. A Totem-pole circuit can sink current from a voltage source or it can supply current to a sinking device (but only one configuration can be wired at one time).

Q: What is a quadrature output?

A: Quadrature output refers to the use of two output channels (A and B) separated by 90 degrees of phase shift. The fact that the signals are 90 degrees out of phase allows a controller to determine the direction of rotation, i.e. if channel A leads B then the encoder is spinning one direction, if B leads A then it is spinning the other direction. Refer to the channel timing charts for a graphical view of this concept. Remember that each channel provides the rated pulses per revolution (PPR) for each encoder. For example: with a 100 PPR encoder, there are 100 pulses

per revolution from channel A, and 100 pulses from channel B. This is a total of 200 pulses if your controller can count both channels (X2 logic). Some controllers can count the rising edge and the falling edge of each pulse (on both channels) thereby increasing the effective resolution by a factor of four (X4 logic), and counting 400 edges per revolution on a 100 PPR quadrature encoder. This doesn't mean that there are 400 pulses coming from a 100 PPR quadrature encoder.

Q: Why do I need a pull-up resistor?

A: A pull-up resistor is used to pull the logic high voltage level up to the level of the operating voltage. This is useful when the output of the open collector is not reaching the voltage level needed to indicate a logic high signal or when noise is present on the signal line. When a logic high signal is present, its voltage level will be approximately that of the operating voltage for an open circuit. The difference is due to the voltage drop across the pull-up resistor. This is not necessarily true if the load is referenced to ground. Pull-up resistors are also used to convert sinking devices to sourcing devices, which inverts the pulse train.

Q: What is the difference between X2 and X4 logic?

A: Some devices that are commonly interfaced to encoders (controllers, counters, displays) can detect more events per revolution than the rated PPR output of a quadrature encoder signal. Because a quadrature encoder provides two channels of pulses, a controller that counts the pulses on both channels can count twice (X2) the PPR output of a given encoder. For example, a controller with X2 logic can count 240 pulses per rev. from a 120 PPR encoder. Some controllers can count the rising edge and the falling edge of each pulse (on both channels) thereby counting four times (X4) the PPR rating of the encoder (or 480 edges per revolution in our example). It's important to remember that a quadrature encoder produces two channels of pulses at a given PPR. X2 or X4 logic refers to how the controller (or other device) interprets those pulse streams.

Q: Is shielded cable needed?

A: YES. The use of shielded cable is highly recommended. This is especially true for areas in which large amounts of electrical noise exist. If you are having any noise problems, or suspect that you might, then use a shielded cable.

Q: How do I set my calibration constant?

A: The calibration constant can be simplified by selecting the correct pulses

per revolution (PPR). When choosing your calibration constant, remember, the closer to 1 the better. The value of the calibration constant is your best resolution per pulse of the encoder.

Q: How do I choose the pulses per revolution (PPR)?

A: When choosing the PPR value of the encoder, you should follow a few simple rules. Make sure that you do not choose a PPR that will exceed the maximum input frequency of the controller (or whatever device the encoder is driving). To calculate the max frequency of the encoder signal (in Hz): simply multiply the speed that the encoder will spin (in revs/sec) by the PPR of the encoder (don't forget to take X2 or X4 logic into account if it applies for your application). Try to choose a PPR that is an even multiple of the value you are trying to measure or display. For example, if one revolution of the encoder equates to 12 inches of travel, you might choose a 1200 PPR encoder. This can eliminate or simplify the need for a calibration constant or scaling factor and more importantly, it eliminates the possibility of accumulating a rounding error over many cycles of the encoder. In this example you would be able to measure the travel to a resolution of 1/100 of an inch. You should also consider any 2x or 4x counting logic in your controller. If your controller can "see" pulses on both the A and B channels (2x logic), then it will count 2400 pulses for every 12 inches of travel in our example. If the controller counts both the leading edge and the trailing edge of each of the pulses on both channels (4x logic), then it will count 4800 edges per revolution and your effective resolution would increase to 1/400 of an inch per count.

(FAQs continued on next page)

Q: How accurate will an encoder be in my application?

A: Encoders can provide a very accurate indication of rotational position, but it's impossible to say how accurate a given encoder will be in a real-world application. Mechanical inaccuracies and electrical issues such as noise, or lost counts can affect the accuracy of any system. A good rule of thumb is to design the system to measure from 2 to 5 times more resolution than your desired accuracy. For example: if you wish to accurately measure movement of 1/100th of an inch, you should select an encoder that can deliver at least 200 counts per inch of resolution. In a rotary application - if you need accuracy within 6 degrees, select an encoder that can deliver at least 120 counts per revolution (a resolution of 3 degrees) to your controller.

Encoders Frequently Asked Questions

Q: How far away can I place my encoder from my system?

A: There is no set answer to this question. Many factors play a role in determining the maximum length of cable that can be used to connect the units together. The largest problem with running long lengths of cable is that the cable becomes more susceptible to noise. This is due to the capacitance of the cable, the cable acting as an antenna, and the loss of power through the cable. The maximum distance of cable can be achieved by following some basic wiring principles. Do not run the cable near objects that create a lot of electrical noise. This includes AC motors, arc welders, AC power lines, and transformers. Use twisted pair cabling when using the signal and its complement, and shielded cabling when running any type of signal. Use the highest voltage available for the output voltage. For example, if the encoder will output 5 to 24 volts, then use 24 volts. Use an open collector or differential line driver output with a differential receiver so that the maximum amount of current can be sink/sourced. If you are using the encoder as an input to more than one controller, use a signal amplifier. This is also a good way to help increase the distance a signal can travel. Typical maximum distances for a differential line driver are around 100 feet or more when using a differential input. For an open collector the distance is around 35 feet.

Q: Why use an absolute encoder?

A: An absolute encoder has each position of the revolution uniquely numbered. This means that instead of an output of pulses, you get an output that is a specific value in a binary format. This is very useful when exact positioning is a must. If the power should be lost, the actual value of the position will be known when power is restored, since each location in an absolute encoder's revolution is a unique binary value. The exact position will be known even if the controller loses power and the process is moved.

Q: What is Gray code?

A: Gray code is a form of binary. The difference between Gray code and binary is the method of incrementing to the next number. In Gray code, only one digit may change states for every increment. This means the count sequence would look something like this: 0, 1, 3, 2, 6, and 7. This is different than standard binary, where the sequence would be 0, 1, 2, 3, 4, and 5.

Gray code is used to prevent errors as transitions to the next state occur. An example of how an error could occur would be when both values in the sequence were true. This can occur due to the timing sequence and the capacitance of the cable. The transition from 0011 to 0100 could cause 0111 to be generated for a couple of microseconds. With gray code this is not possible since only one bit changes state at any given time.

Q: How do I convert Gray code to binary?

A: The conversion from Gray code to binary is simple.

Step 1: Write the number down and copy the left most digit under itself.

Step 2: Add the highlighted binary digit to the Gray code immediately up and to the right of it. So, 1 plus 1 is 0 dropping the carried digit. Write the result next to the binary digit just added. Drop all of the carried digits.

Step 3: Repeat Step 2 until the number is completed. Fortunately, many PLCs have easy-to-use Gray code conversion instructions available.

Q: What is a sinking or sourcing input?

A: The terms sinking and sourcing inputs simply refer to the current flow in a transistor. This means that the inputs require a voltage (current) and a load to operate.

Sinking inputs:

- Require the external circuit to supply voltage/current.
- "Sink" the supplied voltage (current).
- Will be OFF when there is 0V on the terminal.
- Will be ON when there is +VDC on the terminal.

Sourcing inputs:

- Require the external circuit to provide a path to 0V.
- "Source" voltage (current) into the external circuit.
- Will be OFF when there is +VDC on the terminal (no current is flowing from the input).
- Will be ON when there is 0V on the terminal (current is flowing from the input).

A pushbutton (with a set of N.O. contacts)

can be wired for use with either sinking or sourcing inputs. If used with a sinking input, one side of the pushbutton would be wired to +VDC and the other side wired to the sinking input. If used with a sourcing input, one side of the pushbutton would be wired to 0V and the other side wired to the sourcing input.