Smart encoders & actuators

A41 Series Light Duty Incremental Encoders

Features

- Compact industrial encoders
- Solid or hollow shaft version
- Universal output circuit: 5–30 VDC Push-Pull (Totem Pole) or NPN/PNP open collector (HTL), or Line Driver (TTL)
- Quadrature output signals with index (ABZ, /ABZ)
- High resolution up to 4096 PPR
- IP64 environmental rating

A41 Series Medium Duty Incremental (Quadrature) Encoders

Part Number	Price	Pulses per Revolution	Dimensional Drawing	Shaft Type	Body Diameter	Input Voltage	Cable	Output
A41S-0100-HZCP6-AL2	$108.00	100	PDF	1/4“ Solid	41mm	5–30 VDC	2m (6.5 ft) pigtail	Universal circuit: Push-Pull (Totem Pole), or NPN/ PNP open collector (HTL), or Line Driver (TTL)
A41S-0200-HZCP6-AL2	$101.00	200	PDF					
A41S-0360-HZCP6-AL2	$101.00	360	PDF					
A41S-0500-HZCP6-AL2	$101.00	500	PDF					
A41S-1000-HZCP6-AL2	$109.00	1000	PDF					
A41S-1024-HZCP6-AL2	$109.00	1024	PDF					
A41S-2000-HZCP6-AL2	$109.00	2000	PDF					
A41S-2048-HZCP6-AL2	$109.00	2048	PDF					
A41S-3600-HZCP6-AL2	$109.00	3600	PDF					
A41S-4096-HZCP6-AL2	$109.00	4096	PDF					
A41H-0100-HZCP6-AL2	$113.00	100	PDF	1/4” Hollow				
A41H-0200-HZCP6-AL2	$107.00	200	PDF					
A41H-0360-HZCP6-AL2	$107.00	360	PDF					
A41H-0500-HZCP6-AL2	$107.00	500	PDF					
A41H-1000-HZCP6-AL2	$113.00	1000	PDF					
A41H-1024-HZCP6-AL2	$113.00	1024	PDF					
A41H-2000-HZCP6-AL2	$113.00	2000	PDF					
A41H-2048-HZCP6-AL2	$113.00	2048	PDF					
A41H-3600-HZCP6-AL2	$113.00	3600	PDF					
A41H-4096-HZCP6-AL2	$113.00	4096	PDF					

Accessories - A41 Series

Accessories for A41 Series Encoders

Part Number	Price	Description
PF4266	$13.00	Lika Electronic round mounting flange, 48mm bolt hole circle, metal. For use with Lika Electronic A41 series encoders. Mounting hardware included.
LKM-386	$10.00	Lika Electronic servo mount clamp, metal. For use with Lika Electronic AQ58 and A41 series encoders. Mounting hardware included.

PF4266

Smart encoders & actuators

A41 Series Light Duty Incremental Encoders

Specifications - A41 Series

Electrical Specifications	
Resolution (PPR)	100, 200, 360, 500, 1000, 1024, 2000, 2048, 3600, 4096
Output Signals	Quadrature output signals with index (ABZ, /ABZ)
Counting Frequency	100kHz maximum
Output Circuits	Universal circuit: Push-Pull (Totem Pole), or NPN/PNP open collector (HTL), or Line Driver (TTL)
Power Supply	+5VDC to +30VDC
Consumption	70mA (typical)
Output Current (each channel)	40mA maximum
Protection	Against inversion of polarity and short circuit
EMC	Electro-magnetic immunity according to EN61000-4-2 and EN61000-4-4
Mechanical Specifications	
Shaft Diameter	Ø 6.35 mm (1/4")
Shaft Loading (axial, radial)	20N maximum
Shaft Rotational Speed	6000 rpm maximum
Starting Torque (@20°C)	0.1 Ncm (typical)
Bearings Life	10^9 rev. min
Electrical Connections	Cable output 2m (6.5 ft)
Weight	100g (3.5 oz)
Materials	
Flange	Anticorodal, UNI EN AW-6082
Housing	Fiberglass epoxy resin
Bearings	ABEC 5
Shaft	Stainless steel, non-magnetic, UNI EN 4305
Environmental Specifications	
Shock	250g, 6ms acc. to CEI EN 60068-2-27
Vibrations	10g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection	IP64
Operating Temperature Range	-25°C to 85°C (-13°F to 185°F)
Storage Temperature Range	-25°C to 85°C (-13°F to 185°F) (98% relative humidity without condensation)
Approvals	CE, UKCA, $_{c}UR_{us}$, RoHS

Smart encoders & actuators

A50 Series Medium Duty Incremental Encoders

Features

- Small size hollow shaft encoders, 1/4" and 3/8"
- Ideally suited for motor feedback applications
- Extended standard operating temperature from -40°C to 100°C
- Universal output circuit: 5–30 VDC Push-Pull (Totem Pole), or NPN/PNP open collector (HTL), or Line Driver (TTL)
- Quadrature output signals with index (ABZ, /ABZ)
- IP65 environmental rating

A50 Series Medium Duty Incremental (Quadrature) Encoders

Part Number	Price	Pulses per Revolution	Dimensional Drawing	Shaft Type	Body Diameter	Input Voltage	Cable	Output
A50H-0360-HZCP6-RL2	$116.00	360	PDF	1/4" Hollow	50mm	5–30 VDC	2m (6.5 ft) pigtail	Universal circuit: Push-Pull (Totem Pole), or NPN/ PNP open collector (HTL), or Line Driver (TTL)
A50H-1000-HZCP6-RL2	$116.00	1000	PDF					
A50H-1024-HZCP6-RL2	$116.00	1024	PDF					
A50H-2048-HZCP6-RL2	$116.00	2048	PDF					
A50H-0360-HZCP9-RL2	$116.00	360	PDF	3/8" Hollow				
A50H-1000-HZCP9-RL2	$116.00	1000	PDF					
A50H-1024-HZCP9-RL2	$116.00	1024	PDF					
A50H-2048-HZCP9-RL2	$116.00	2048	PDF					

Accessories - A50 Series

Accessories for A50 Series Encoders

Part Number	Price	Description
KIT-C50	$10.00	Lika Electronic encoder mounting plate, replacement, metal. For use with Lika Electronic A50 series encoders. Mounting hardware included.

KIT-C50

Smart encoders & actuators

A50 Series Medium Duty Incremental Encoders

Specifications - A50 Series

Electrical Specifications	
Resolution (PPR)	360, 1000, 1024, 2048
Output Signals	Quadrature output signals with index (ABZ, /ABZ)
Counting Frequency	100kHz maximum
Output Circuits	Universal circuit: Push-Pull (Totem Pole), or NPN/PNP open collector (HTL), or Line Driver (TTL)
Power Supply	+5VDC to +30VDC
Consumption	70mA (typical)
Output Current (each channel)	40mA maximum
Protection	Against inversion of polarity and short circuit (except inductive circuit)
EMC	Electro-magnetic immunity according to EN61000-4-2 and EN61000-4-4
Mechanical Specifications	
Shaft Diameter	Ø 6.35 mm (1/4"), 9.52 mm (3/8")
Shaft Loading (axial, radial)	20N maximum
Shaft Rotational Speed	6000 rpm maximum
Starting Torque (@20°C)	≤0.25 Ncm (typical)
Bearings Life	10^9 rev. min
Electrical Connections	Cable output 2m (6.5 ft)
Weight	100g (3.5 oz)
Materials	
Flange	Zamak 15, UNI EN1774
Housing	Zamak 15, UNIT EN1774
Bearings	ABEC 5
Shaft	Stainless steel, non-magnetic, UNI EN 4305
Environmental Specifications	
Shock	250g, 6ms acc. to CEI EN 60068-2-27
Vibrations	10g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection	IP65
Operating Temperature Range	-40°C to 100°C (-40°F to 212°F)
Storage Temperature Range	-40°C to 100°C (-40°F to 212°F) (98% relative humidity without condensation)
Approvals	CE, UKCA, $_cUR_{us}$, RoHS

Smart encoders & actuators

AQ5x Series Programmable Incremental Encoders

Features

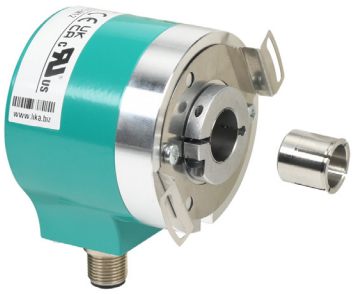
- Programmable incremental encoder
- Configurable resolution from 1 to 16,384 PPR (1024 default)
- Selectable index length of 90 or 180°
- Counting direction programmable CW or CCW
- Universal output circuit: 5–30 VDC Push-Pull (Totem Pole), or NPN/PNP open collector (HTL), or Line Driver (TTL)
- Quadrature output signals with index (ABZ, /ABZ)
- Programmable via USB cable and LIKA-IP-IQ software (free download at AutomationDirect on the AQ58S and AQ59H store pages)
- IP65 environmental rating

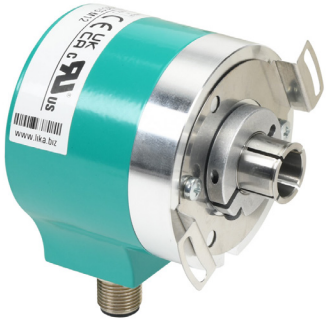
AQ5x Series Medium Duty Incremental (Quadrature) Encoders

Part Number	Price	Pulses per Revolution	Dimensional Drawing	Shaft Type	Body Diameter	Input Voltage	Cable	Output
AQ58S-PRG-HZCP9-M12	$160.00	Up to 16,384 (14-bit)	PDF	3/8" solid	58mm	5-30 VDC	M12 male	Universal circuit: Push-Pull (Totem Pole), or NPN/PNP open collector (HTL), or Line Driver (TTL)
AQ59H-PRG-HZC15-M12	$160.00		PDF	6 to 15 mm hollow	59mm			

Configurable Hollow Shaft Sizing

The AQ59H encoder features a hollow shaft that can be resized using removable bushings. The images below show the installation of a BR1-12 bushing. See the "Accessories - AQ5x Series" on page tECD-9 for all available options.





How to Configure your Encoder

Use one of the following cable(s) to configure the encoder:

- KIT-IP/IQ58-USB-M12 programming cable
- Combination of KIT-IP/IQ58 and EC-IP/IQ58-M12
- Combination of KIT-IP/IQ58 and EC-M12F12-LKT12-05 or EC-M12F12-LKT12-10
- Download the software from the AQ58S-PRG-HZCP9-M12 or AQ59H-PRG-HZC15-M12 store page

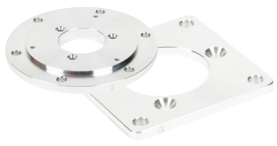
Smart encoders & actuators

AQ5x Series Programmable Incremental Encoders

Accessories - AQ5x Series

Accessories for AQ5x Series Encoders		
Part Number	**Price**	**Description**
BR1-6	$7.75	Lika Electronic reducer bushing, 15mm to 6mm, metal. For use with Lika Electronic AQ59 series encoders.
BR1-6.35	$7.75	Lika Electronic reducer bushing, 15mm to 1/4in, metal. For use with Lika Electronic AQ59 series encoders.
BR1-8	$7.75	Lika Electronic reducer bushing, 15mm to 8mm, metal. For use with Lika Electronic AQ59 series encoders.
BR1-9.52	$7.75	Lika Electronic reducer bushing, 15mm to 3/8in, metal. For use with Lika Electronic AQ59 series encoders.
BR1-10	$7.75	Lika Electronic reducer bushing, 15mm to 10mm, metal. For use with Lika Electronic AQ59 series encoders.
BR1-11	$7.75	Lika Electronic reducer bushing, 15mm to 11mm, metal. For use with Lika Electronic AQ59 series encoders.
BR1-12	$7.75	Lika Electronic reducer bushing, 15mm to 12mm, metal. For use with Lika Electronic AQ59 series encoders.
BR1-12.7	$7.75	Lika Electronic reducer bushing, 15mm to 1/2in, metal. For use with Lika Electronic AQ59 series encoders.
PF4256	$38.50	Lika Electronic round mounting flange, 61mm bolt hole circle, metal. For use with Lika Electronic AQ58 series encoders. Mounting hardware included.
PF0408	$142.00	Lika Electronic spring-loaded encoder mount, metal. For use with Lika Electronic AQ58 series encoders. Mounting hardware included.
PF4257	$21.00	Lika Electronic right angle bracket, metal. For use with Lika Electronic AQ58 series encoders. Mounting hardware included.
PF4259	$24.00	Lika Electronic square mounting flange, 92mm bolt hole circle, metal. For use with Lika Electronic AQ58 series encoders. Mounting hardware included.
PF4274	$109.00	Lika Electronic round mounting flange, 70mm bolt hole circle, metal. For use with Lika Electronic AQ58 series encoders. Mounting hardware included.
PF4258	$21.00	Lika Electronic round mounting flange, 75mm and 100mm bolt hole circle, metal. For use with Lika Electronic AQ58 series encoders. Mounting hardware included.
PF5000-A	$17.50	Lika Electronic square mounting flange, 70mm bolt hole circle, metal. For use with Lika Electronic AQ58 series encoders. Mounting hardware included.
LKM-386	$10.00	Lika Electronic servo mount clamp, metal. For use with Lika Electronic AQ58 and A41 series encoders. Mounting hardware included.
KIT-XX59	$10.00	Lika Electronic servo mount clamp, metal. For use with Lika Electronic AQ58 and AQ59 series encoders. Mounting hardware included.
KIT-IP/IQ58	$153.00	Lika Electronic programming cable, USB A to 4-position terminal block, 4.9ft/1.5m cable length. For use with Lika Electronic AQ58 and AQ59 series encoders. Requires Lika Electronic EC-IP/IQ58-M12 programming or EC-M12F12-LKT12-xx encoder cable.
EC-IP/IQ58-M12	$32.00	Lika Electronic programming cable, M12 axial female to pigtail, 2ft cable length. For use with Lika Electronic AQ58 and AQ59 series encoders. Requires Lika Electronic KIT-IP/IQ58 programming cable.
KIT-IP/IQ58-USB-M12	$109.00	Lika Electronic programming cable, USB A to M12 axial female, 1.6ft/0.5m cable length. For use with Lika Electronic AQ58 and AQ59 series encoders.
EC-M12F12-LKT12-05	$61.00	Lika Electronic encoder cable, M12 axial female to pigtail, shielded, 16.4ft/5m cable length. For use with Lika Electronic AQ58 and AQ59 series encoders.
EC-M12F12-LKT12-10	$83.00	Lika Electronic encoder cable, M12 axial female to pigtail, shielded, 32.8ft/10m cable length. For use with Lika Electronic AQ58 and AQ59 series encoders.

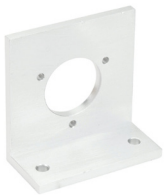
Bore Reducers



Mounting Flanges

PF0408

LKM-386



PF4257

KIT-IP/IQ58

EC-IP/IQ58-M12

KIT-IP/IQ58-USB-M12

EC-M12F12-LKT12-05

KIT-XX59

Smart encoders & actuators

AQ5x Series Programmable Incremental Encoders

Specifications - AQ5x Series

Electrical Specifications	
Resolution (PPR)	Programmable from 1 to 16,384 (default 1024 PPR)
Accuracy	± 0.15°
Output Signals	Quadrature output signals with index (ABZ, /ABZ)
Counting Frequency	500kHz maximum
Output Circuits	Universal circuit: Push-Pull (Totem Pole), or NPN/PNP open collector (HTL), or Line Driver (TTL)
Power Supply	+5VDC to +30VDC
Consumption	60mA (typical)
Output Current (each channel)	40mA maximum
Protection	Against inversion of polarity and short circuit
EMC	Electro-magnetic immunity according to EN61000-4-2 and EN61000-4-4
Mechanical Specifications	
Shaft Diameter	Ø 9.52 mm (3/8")
Hollow Shaft Diameter	Ø 15mm (available bore reducer sleeves for 6mm, 1/4", 8mm, 3/8", 10mm, 11mm, 12mm, 1/2")
Shaft Loading (axial, radial)	100N maximum
Shaft Rotational Speed	Typical 6000 rpm, temporary 12000 rpm maximum
Starting Torque (@20°C)	AQ58: 0.15 Ncm AQ59: 0.4 Ncm
Bearings Life	400×10^6 rev. min (10^9 rev. min. with shaft loading limited to 20N)
Electrical Connections	M12
Weight	200g (7 oz)
Materials	
Flange	Anticorodal, UNI EN AW-6082
Housing	Anticorodal, UNI EN AW-6082
Bearings	ABEC 5
Shaft	Stainless steel, non-magnetic, UNI EN 4305
Environmental Specifications	
Shock	100g, 6ms acc.
Vibrations	10g, 5-2000 Hz acc.
Protection	IP65
Operating Temperature Range	-40°C to 85°C (-40°F to 185°F)
Storage Temperature Range	-40°C to 100°C (-40°F to 212°F) (98% relative humidity without condensation)
Approvals	CE, UKCA, $_c$UR$_{us}$, RoHS

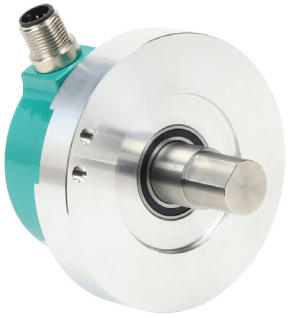
Smart encoders & actuators

A80 Series Medium Duty Incremental Encoders

Features

- Feedback encoder for large motors
- Precise optical sensing
- Very flat design
- Hollow shafts up to 30mm diameter
- Bore reducing sleeves of 5/8", 19mm, 20mm, 7/8", 1", 1 1/8"
- Universal output circuit: 5–30 VDC Push-Pull (Totem Pole), or NPN/PNP open collector (HTL), or Line Driver (TTL)
- Quadrature output signals with index (ABZ, /ABZ)
- Diecast housing with IP64 environmental rating (dustproof, splashproof)

A80H with M23 Connector



A80H with Pigtail Cable

A80 Series Medium Duty Incremental (Quadrature) Encoders								
Part Number	***Price***	***Pulses per Revolution***	***Dimensional Drawing***	***Shaft Type***	***Body Diameter***	***Input Voltage***	***Cable***	***Output***
A80H-1024-HZC30-M23	$164.00	1024	PDF	Multiple hollow shafts between 5/8" and 30mm	80	5–30 VDC	M23 male	Universal circuit: Push-Pull (Totem Pole), or NPN/ PNP open collector (HTL), or Line Driver (TTL)
A80H-1024-HZC30-RL2	$164.00		PDF				2m (6.5 ft) pigtail	

Configurable Hollow Shaft Sizing

The A80H encoder features a hollow shaft that can be resized using removable bushings. The images below show the installation of a BR2-25.4 bushing to an A80H-1024-HZC30-M23. See "Accessories - A80 Series" on page tECD-12 for all available options.

Smart encoders & actuators

A80 Series Medium Duty Incremental Encoders

Accessories - A80 Series

Accessories for A80 Series Encoders		
Part Number	*Price*	*Description*
BR2-15.875	$11.00	Lika Electronic reducer bushing, 30mm to 5/8in, metal. For use with Lika Electronic A80 series encoders. Mounting hardware included.
BR2-19	$11.00	Lika Electronic reducer bushing, 30mm to 19mm, metal. For use with Lika Electronic A80 series encoders. Mounting hardware included.
BR2-20	$11.00	Lika Electronic reducer bushing, 30mm to 20mm, metal. For use with Lika Electronic A80 series encoders. Mounting hardware included.
BR2-7/8	$11.00	Lika Electronic reducer bushing, 30mm to 7/8in, metal. For use with Lika Electronic A80 series encoders. Mounting hardware included.
BR2-25.4	$11.00	Lika Electronic reducer bushing, 30mm to 1in, metal. For use with Lika Electronic A80 series encoders. Mounting hardware included.
BR2-1-1/8	$11.00	Lika Electronic reducer bushing, 30mm to 1 1/8in, metal. For use with Lika Electronic A80 series encoders. Mounting hardware included.
EC-C12F-LKI8-05	$44.00	Lika Electronic encoder cable, M23 axial female to pigtail, shielded, 16.4ft/5m cable length. For use with Lika Electronic A80 series encoders.
EC-C12F-LKI8-10	$62.00	Lika Electronic encoder cable, M23 axial female to pigtail, shielded, 32.8ft/10m cable length. For use with Lika Electronic A80 series encoders.
E-PFL121	$16.50	M23 connector, 24 AWG, accepts cable diameter size 5mm. For use with Lika Electronic A80 series encoders.
KIT-C80	$10.00	Lika Electronic encoder mounting plate, replacement, metal. For use with Lika Electronic A80 series encoders. Mounting hardware included.

BR2-20

BR2-25.4

KIT-C80

EC-C12F-LKI8-05

E-PFL121

Smart encoders & actuators

A80 Series Medium Duty Incremental Encoders

Specifications - A80 Series

Electrical Specifications	
Resolution (PPR)	1024
Output Signals	Quadrature output signals with index (ABZ, /ABZ)
Counting Frequency	300kHz maximum
Output Circuits	Universal circuit: Push-Pull (Totem Pole), or NPN/PNP open collector (HTL), or Line Driver (TTL)
Power Supply	+5VDC to +30VDC
Consumption	70mA (typical)
Output Current (each channel)	40mA maximum
Protection	Against inversion of polarity and short circuit
EMC	Electro-magnetic immunity according to EN61000-4-2 and EN61000-4-4
Mechanical Specifications	
Shaft Diameter	Ø 30 mm
Reducing Sleeves	Ø 5/8" (15.875), 19, 20, 7/8", 1" (25.4), 1 1/8"
Shaft Loading (axial, radial)	30N maximum
Shaft Rotational Speed	6000 rpm maximum
Starting Torque (@20°C)	≤1.5 Ncm (typical)
Bearings Life	400×10^6 rev. min (10^9 rev. min. with shaft loading limited to 20N)
Electrical Connections	M23 12-pin plug or cable output 2m (6.5 ft)
Weight	300g (10.6 oz)
Materials	
Flange	Die cast aluminum, UNI EN-AC-46100
Housing	Die cast aluminum, UNI EN-AC-46100
Bearings	ABEC 5
Shaft	Stainless steel, non-magnetic, 1.4305 (UNI EN 10088-1)
Environmental Specifications	
Shock	250g, 6ms acc. to CEI EN 60068-2-27
Vibrations	10g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection	IP64
Operating Temperature Range	-25°C to +85°C (-13°F to +185°F)
Storage Temperature Range	-40°C to +100°C (-40°F to +212°F) (98% relative humidity without condensation)
Approvals	CE, UKCA, $_cUR_{us}$, RoHS

Smart encoders & actuators

AR01 Series Incremental Rotary Measuring Wheel Encoders

Features

- Measuring wheel encoder
- Metric & US/imperial wheel sizes
  - Standard 4" wheel (12.5" circumference)
  - Optional 80mm wheel (250mm circumference)
- Universal output circuit: 5–30 VDC Push-Pull (Totem Pole), or NPN/PNP open collector (HTL), or Line Driver (TTL)
- Quadrature output signals with index (AB, /AB)
- Spring loaded arm with up to 30mm deflection
- Conveyor speed control, cut-to-length, and object positioning applications
- IP65 environmental rating

AR01 Series Incremental Measuring Wheel Encoders										
Part Number	*Price*	*Pulses per Revolution*	*Dimensional Drawing*	*Shaft Type*	*Wheel Circumference*	*Linear Resolution**		*Input Voltage*	*Cable*	*Output*
AR01-0250-HM12-A	$329.00	250	PDF	n/a (Wheel assembly)	12.5"	0.0125"/ct	80cts/ inch	5–30 VDC	M12 male	Universal circuit: Push-Pull (Totem Pole), or NPN/PNP open collector (HTL), or Line Driver (TTL)
AR01-1250-HM12-A	$329.00	1250	PDF			0.0025"/ct	400cts/ inch			

*** Resolution = (quadrature PPR x 4) / (inches circumference)**

Accessories - AR01 Series

Accessories for AR01 Series Encoders		
Part Number	*Price*	*Description*
AR01X-WHEEL-A	$49.50	Lika Electronic encoder measuring wheel, replacement, 4in diameter (12.5in circumference), 15mm shaft, metal. For use with Lika Electronic AR01 series measuring wheel encoder assemblies. 15mm shaft bore size. BR1-xx shaft reducers can be used to accomodate shaft sizes from 6mm to 1/2 inch.
AR01X-WHEEL-B	$83.00	Lika Electronic encoder measuring wheel, replacement, 80mm diameter (250mm circumference), 15mm shaft, metal. For use with Lika Electronic AR01 series measuring wheel encoder assemblies. 15mm shaft bore size. BR1-xx shaft reducers can be used to accomodate shaft sizes from 6mm to 1/2 inch.
AR01X-0250-HM12	$231.00	Lika Electronic AR01 series incremental (quadrature) rotary encoder, replacement, 5-30 VDC, universal (line driver or NPN/ PNP open collector) output, medium duty, 250 ppr, 15mm dual shaft, 58mm diameter body, IP65, radial exit, M12 male.
AR01X-1250-HM12	$231.00	Lika Electronic AR01 series incremental (quadrature) rotary encoder, replacement, 5-30 VDC, universal (line driver or NPN/ PNP open collector) output, medium duty, 1250 ppr, 15mm dual shaft, 58mm diameter body, IP65, radial exit, M12 male.
EC-M12F8-LKM8-05	$44.00	Lika Electronic encoder cable, M12 axial female to pigtail, shielded, 16.4ft/5m cable length. For use with Lika Electronic AR01 series measuring wheel encoder assemblies.
EC-M12F8-LKM8-10	$62.00	Lika Electronic encoder cable, M12 axial female to pigtail, shielded, 32.8ft/10m cable length. For use with Lika Electronic AR01 series measuring wheel encoder assemblies.

AR01X-WHEEL-A

AR01X-0250-HM12

EC-M12F8-LKM8-05

Smart encoders & actuators

AR01 Series Incremental Rotary Measuring Wheel Encoders

Specifications - AR01 Series

Electrical Specifications	
Resolution (PPR)	250, 1250
Output Signals	Quadrature output signals with index (AB, /AB)
Counting Frequency	50kHz maximum
Output Circuits	Universal circuit: Push-Pull (Totem Pole), or NPN/PNP open collector (HTL), or Line Driver (TTL)
Power Supply	+5VDC to +30VDC
Consumption	70mA (typical)
Output Current (each channel)	40mA maximum
Protection	Against inversion of polarity and short circuit
EMC	Electro-magnetic immunity according to EN61000-4-2 and EN61000-4-4
Optoelectronic Life	100,000 hours minimum
Mechanical Specifications	
Wheel Circumference	AR01-WHEEL-A: 317.6 mm (standard) AR01-WHEEL-B: 250mm (optional)
Spring Arm Max Deflection	30mm
Shaft Max Rotational Speed	2000rpm
Shaft Loading (axial, radial)	50N maximum
Starting Torque (@20°C)	1 Ncm (typical)
Bearings Life	10^9 rev. min.
Electrical Connections	M12 8-pin plug
Weight	1.12 kg (2.50 lbs)
Materials	
Flange	Anodized aluminum, UNI EN AW-6082
Housing	Zamac die cast
Bearings	ABEC 5
Shaft	Stainless steel, non-magnetic, UNI EN 4305
Environmental Specifications	
Shock	250g, 6ms acc. to CEI EN 60068-2-27
Vibrations	10g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection	IP65
Operating Temperature Range	-25°C to 85°C (-13°F to 185°F)
Storage Temperature Range	-40°C to 100°C (-40°F to 212°F) (98% relative humidity without condensation)
Approvals	CE, RoHS, UKCA

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Encoder Accessories

Lika Encoder Accessories

Accessories for Lika Encoders			
Part Number	***Price***	***Description***	***Compatible With***
LKM-386	$10.00	Lika Electronic servo mount clamp, metal. For use with Lika Electronic AQ58 and A41 series encoders. Mounting hardware included.	A41, AQ58S series

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DWx Series Light and Medium Duty Draw Wire Encoders

Draw Wire Encoders, also known as string encoders or string potentiometers, use a spring-loaded cable reel that is wrapped with a steel cable. The reel is connected to a rotary encoder or potentiometer that can provide very accurate feedback of how far the steel cable has been pulled out. Our Draw Wire Encoders provide encoder (quadrature) and analog (0-10V, 4-20mA) outputs and are available from 2 meter pull lengths up to 10 meter lengths.

Typical applications include linear measuring, vertical lift measurement, cylinder stroke measurement, or any application where accurate, inexpensive, and easy to install measurement of a linear distance is required.

Features

DWI Series

- Encoder (quadrature) output 0.025–0.050 mm/count resolution
- Cost effective
- Miniature size (DWI-2M), robust and space saving construction
- Universal electrical output (line driver, open collector, etc.)
- Stainless steel draw wire
- Measuring lengths of 2000mm, 5000mm, and 10000mm
- Light duty IP64 and medium duty IP65 encoders available

DWP Series

- Analog voltage or current output: 0-10 V or 4-20 mA
- Robust design
- Smooth, stepless analog incrementing (potentiometer-based)
- Stainless steel draw wire
- Measuring lengths of 2000mm
- IP64

DWA Series

- Programmable Analog out: 0-10 V or 4-20 mA
- Easy to use Teach Mode (use pushbuttons on the back of the encoder or use digital inputs)
- Status LEDs
- Overrun function (alarm if wire is pulled outside the Teach limits)
- Convenient M12 cable connection
- Stainless steel draw wire
- Measuring lengths of 5000mm and 10000mm
- IP65

DWx Series Light and Medium Duty Draw Wire Encoders

Part Number	Price	Duty Type	Measuring Length	Measuring Speed	Feed Distance per Encoder Revolution	Resolution	Dimensional Drawing	Input Voltage	Output
DWI-2M-H0500-RL2	$249.00	Light	2000mm	1m/sec max	100mm	0.050 mm/count (quadrature)	PDF	5–30 VDC	Universal output circuit: Push-Pull (Totem Pole) or NPN/PNP open collector (HTL), or Line Driver (TTL) Quadrature (AB,/AB)
DWI-5M-H2000-RL2	$405.00	Medium	5000mm	2m/sec max	200mm	0.025 mm/count (quadrature)	PDF		Universal output circuit: Push-Pull (Totem Pole) or NPN/PNP open collector (HTL), or Line Driver (TTL) Quadrature with index (ABZ, /ABZ)
DWI-10M-H2000-RL2	$470.00		10000mm				PDF		
DWP-2M-4A-RL2	$299.00		2000mm	1m/sec max	100mm	Analog (stepless)	PDF	10–30 VDC	4–20 mA
DWP-2M-0V-RL2	$299.00						PDF		0–10 V
DWA-5M-4A-M12	$550.00		5000mm	2m/sec max	200mm	16bit (min 0.366 µA/step)	PDF	13–30 VDC	4–20 mA
DWA-5M-0V-M12	$550.00					16bit (min 0.153 mV/step)	PDF		0–10 V
DWA-10M-4A-M12	$625.00		10000mm			16bit (min 0.366 µA/step)	PDF		4–20 mA
DWA-10M-0V-M12	$625.00					16bit (min 0.153 mV/step)	PDF		0–10 V

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DWI Series Light and Medium Duty Draw Wire Encoders

Specifications - DWI Series

DWI Series Specifications				
Model		DWI-2M-H0500-RL2	DWI-5M-H2000-RL2	DWI-10M-H2000-RL2
Price		$249.00	$405.00	$470.00
Drawing		PDF	PDF	PDF
Electrical Specifications	Resolution	0.05 mm	0.025 mm	
	Output Signals	AB, /AB	ABZ, /ABZ	
	Output Circuits	Universal output circuit: Push-Pull (Totem Pole) or NPN/PNP open collector (HTL), or Line Driver (TTL), Quadrature (AB,/AB)	Universal output circuit: Push-Pull (Totem Pole) or NPN/PNP open collector (HTL), or Line Driver (TTL), Quadrature with index (ABZ, /ABZ)[1]	
	Power Supply	5–30 VDC		
	Output Current	40mA max		
	Input Current	60mA max		
Mechanical Specifications	Feed Distance per Encoder Revolution	100mm	200mm	
	Wire Retraction Force	3–5 N	3.2–6.5 N	3.2–6 N
	Measuring Length	2000mm	5000mm	10000mm
	Measuring Speed	1 m/sec max	2 m/sec max	
	Linearity[2]	± 0.3 mm	± 0.5 mm	
	Repeatability	± 0.1 mm		
	Signal Cable	2.0 m cable		
	Weight	0.2 kg	0.8 kg	
Materials	Housing	Aluminum plus plastic	Aluminum	
	Draw Wire	Stainless steel, non-magnetic – UNI EN 4305		
Environmental Specifications	Shock	100g, 6ms		
	Vibrations	10g, 5–2000 Hz		
	Protection	IP64	IP65	
	Operating Temperature Range	-25°C to +85°C (-13°F to +185°F)	-40°C to +85°C (-40°F to +185°F)	
	Storage Temperature Range	-40°C to +100°C (-40°F to +212°F), 98% relative humidity, non-condensing		
	Approvals	UKCA, CE, RoHS		

1 - Note: The index pulse is output every one encoder revolution which corresponds to the Feed Distance per Encoder Revolution. The index pulse will trigger every 200mm.
2 - Note: Linearity is the measurement difference between the ideal or expected output position (a straight line) and the reported output position of the draw wire.

DWI-2M-H0500-RL2

DWI-5M-H2000-RL2

DWI-10M-H2000-RL2

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DWP Series Medium Duty Draw Wire Encoders

Specifications - DWP Series

DWP Series Specifications			
Model		DWP-2M-4A-RL2	DWP-2M-0V-RL2
Price		$299.00	$299.00
Drawing		PDF	PDF
Electrical Specifications	Current Output	4–20 mA ± 5%	
	Power Supply (for current output)	10–30 VDC	
	Voltage Output	0–10 V ± 5%	
	Power Supply (for voltage output)	15–30 VDC	
	Input Current	2mA max	
Mechanical Specifications	Feed Distance per Encoder Revolution	100mm	
	Wire Retraction Force	3–5 N	
	Measuring Length	2000mm	
	Measuring Speed	1 m/sec max	
	Linearity[1]	± 0.25% of current position value	
	Repeatability	± 0.15 mm	
	Signal Cable	2.0 m cable	
	Weight	0.2 kg	
Materials	Housing	Aluminum	
	Draw Wire	Stainless steel, non-magnetic – UNI EN 4305	
Environmental Specifications	Shock	100g, 6ms	
	Vibrations	10g, 5–2000 Hz	
	Protection	IP64	
	Operating Temperature Range	-25°C to +85°C (-13°F to +185°F)	
	Storage Temperature Range	-40°C to +100°C (-40°F to +212°F), 98% relative humidity, non-condensing	
	Approvals	UKCA, CE, RoHS	

1 - Note: Linearity is the measurement difference between the ideal or expected output position (a straight line) and the reported output position of the draw wire.

DWP-2M-4A-RL2

DWP-2M-0V-RL2

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DWA Series Medium Duty Draw Wire Encoders

Specifications - DWA Series

DWA Series Specifications					
Model		DWA-5M-4A-M12	DWA-5M-0V-M12	DWA-10M-4A-M12	DWA-10M-0V-M12
Price		$550.00	$625.00	$550.00	$625.00
Drawing		PDF	PDF	PDF	PDF
Electrical Specifications	Resolution	65536 steps (min. step = 0.048 mm)			
	Power Supply	13–30 VDC			
	Output Circuit	4–20 mA		0–10 V	
	Output Range	Adjustable by teach-in buttons			
	Input current	1.5 W			
	Protection	Against inversion of polarity and short-circuit			
	EMC	Electro-magnetic immunity, according to: EN-61000-4-2 and EN-61000-4-4			
	Optoelectronic Life	>100,000 hours			
	Functions	Teach window of travel length Overrun limit alarm			
Mechanical Specifications	Feed Distance per Encoder Revolution	200mm			
	Wire Retraction Force	3.2–6.5 N	3.2–6 N	3.2–6.5 N	3.2–6 N
	Measuring Length	5000	10000	5000	10000
	Measuring Speed	2 m/sec max			
	Linearity[1]	± 0.5 mm			
	Repeatability	± 0.1 mm			
	Signal Cable	M12 plug			
	Weight	0.8 kg			
Materials	Housing	Aluminum			
	Draw Wire	Stainless steel, non-magnetic – UNI EN 4305			
Environmental Specifications	Shock	100g, 6ms			
	Vibrations	10g, 5–2000 Hz			
	Protection	IP65			
	Operating Temperature Range	-40°C to +85°C (-40°F to +185°F)			
	Storage Temperature Range	-40°C to +100°C (-40°F to +212°F), 98% relative humidity, non-condensing			
	Approvals	UKCA, CE, RoHS			

1 - Note: Linearity is the measurement difference between the ideal or expected output position (a straight line) and the reported output position of the draw wire.

DWA-10M-4A-M12

DWA-10M-0V-M12

DWA-5M-0V-M12

DWA-5M-4A-M12

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Smart encoders & actuators

Windows Configuration Software

Lika Configuration Software

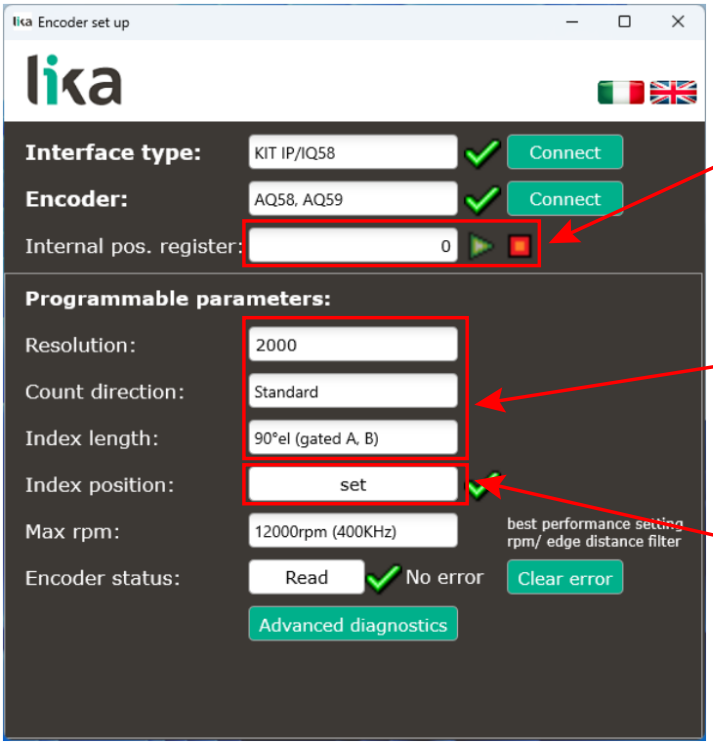
AQ58S and AQ59H programmable incremental encoders can use software expressly developed and released by Lika Electronic to easily program and configure the device.

This software is for use with the AQ58S and AQ59H programmable encoders only.

Use one of the following methods to configure the AQ58S or AQ59H encoder:

- KIT-IP/IQ58-USB-M12 programming cable.
- Combination of KIT-IP/IQ58 and EC-IP/IQ58-M12 programming kit.
- Combination of KIT-IP/IQ58 and EC-M12F12-LKT12-xx cable.

Lika Electronic Windows Configuration Software			
Part Number	***Price***	***Requires***	***Use With***
LIKA-IP-IQ	$0.00	KIT-IP/IQ58-USB-M12 or KIT-IP/ IQ58 programming cable	AQ58 and AQ59 series Lika encoders.



Encoder Selection Guide

SAE Dimension Encoders & Metric Dimension Encoders

Encoder Selection Guide

Type	Duty	Series	Encoder Diameter	Shaft Diameter	Shaft Type	Operating Voltage (VDC) and Electrical Output	IP Rating	Cable	Max Radial Load (N)	Max Axial Load (N)	Available Resolutions (PPR)	Brand
Incremental	Modular Kit	AMT	28mm, 42mm	2, 3, 4, 5, 6, 8 mm 3/16, 1/4, 3/8, 1/2, 5/8 inch	Hollow	5V Line Driver (TTL) or 5V Push-Pull (Totem Pole)	IP20	Custom cables sold separately	N/A	N/A	Programmable up to 4096	Same Sky
		MTRA	31mm	5mm 1/4", 3/8"	Hollow	5V Line Driver (TTL) or 5V Push-Pull (Totem Pole)	IP20	Custom cables sold separately	N/A	N/A	400, 1000	SureStep
	Light Duty	TRD-S(H)R	38mm, 40mm	8mm	Solid or Hollow	5V Line Driver (TTL) or 5-26V NPN/PNP Open Collector (HTL)	IP50 or IP65	Integral 2m pigtal cable	20	10	100, 200, 360, 500, 600, 1000, 1024, 2000, 2500	JTEKT
		A41	41mm	1/4"	Solid or Hollow	5-30VDC Universal output circuit: Push-Pull (Totem Pole), or NPN/PNP Open Collector (HTL), or Line Driver (TTL)	IP64	Integral 2m pigtal cable	20	20	100, 200, 360, 500, 1000, 1024, 200, 2048, 3600, 4096	Lika
	Medium Duty	A50	50mm	1/4", 3/8"	Hollow		IP65	M12 cables sold seperately	20	20	360, 1000, 1024, 2048	
		A80	80mm	30mm (reducer bushings available for 19 & 20mm, 5/8", 7/8", 1, and 1 1/8")	Hollow		IP64	M23 cables sold separately	30	30	1024	
		AQ58/59	58mm, 59mm	3/8" solid, 15mm hollow (reducer bushings available for 6, 8, 10, 11, 12 mm; 1/4, 3/8, 1/2 inch)	Solid or Hollow		IP65	M12 cables sold seperately	100	100	Programmable from 1 to 16,384 (default 1024)	
		AR01	58mm	15mm	Solid Dual-shaft		IP65	M12 cables sold seperately	50	50	250 (linear res: 0.36 deg/cts) 1250 (linear res: 0.072 deg/cts)	
		TRDA-20	2"	3/8"	Solid	5VDC Line Driver (TTL) or 5-30VDC Push-Pull (Totem Pole)	IP50	Integral 2m pigtal cable	50	30	100, 360, 500, 1000, 1024, 2500	JTEKT
		TRDA-25	2.5" flange (w/2.0" body)	3/8"	Solid		IP65	Military Spec (MS) cables sold seperately	50	30	100, 360, 500, 1000, 1014, 2500	
		TRD-N(H)	50mm	8mm	Solid or Hollow		IP65	Integral 2m pigtal cable	50	30	3, 4, 5, 10, 30, 40, 50, 60, 100, 120, 200, 240, 250, 300, 360, 400, 480, 500, 600, 750, 1000, 1024, 1200, 2000, 2500	
	Heavy Duty	TRD-GK	78mm	10mm	Solid	10-30VDC Push-Pull (Totem Pole)	IP65	Integral 2m pigtal cable	100	50	30, 100, 120, 200, 240, 250, 300, 360, 400, 500, 600, 1000, 1200, 2000, 2500, 3600, 5000	
Absolute	Medium Duty	TRD-NA	50mm	8mm	Solid	10-30V NPN/PNP Open Collector (HTL)	IP65	Integral 2m pigtal cable	50	30	32, 64, 128, 180, 256, 360, 512, 720, 1024 (gray code)	

Light Duty Incremental Encoders (SAE Dimension Encoders)

TRDA-2E series

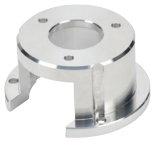
Accessories

Accessories for TRDA-2E Series Encoders		
Part Number	***Price***	***Description***
F-2D	$44.50	JTEKT round mounting flange, 1.86in bolt hole circle, (1.05in height), metal. For use with JTEKT TRDA-2E series encoders. Flange and encoder mounting hardware included.
F-3D	$79.00	JTEKT round mounting flange, 2.95in bolt hole circle (1.34in height), metal. For use with JTEKT TRDA-2E series encoders. Flange and encoder mounting hardware included.
F-6D	$60.00	JTEKT round mounting flange, 1.86in bolt hole circle, (1.34in height), metal. For use with JTEKT TRDA-2E series encoders. Flange and encoder mounting hardware included.
F-7D	$44.50	JTEKT round mounting flange, 1in bolt hole circle (0.20in height), metal. For use with JTEKT TRDA-2E series encoders. Flange and encoder mounting hardware included.
F-8D	$60.00	JTEKT round mounting flange, 2.95in bolt hole circle, (1.71in height), metal. For use with JTEKT TRDA-2E series encoders. Flange and encoder mounting hardware included.
2ET-035D	$63.00	JTEKT right angle bracket, metal. For use with JTEKT TRDA-2E series encoders. Bracket and encoder mounting hardware included.

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

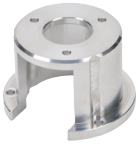
See the "Encoder Couplings" section for more information.

2ET-035D



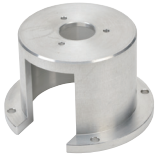
F-2D

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 eachoutput 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)

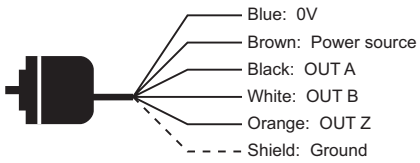
Light Duty Incremental Encoders (SAE Dimension Encoders)

Specifications – TRDA-2E series

Wiring Diagrams

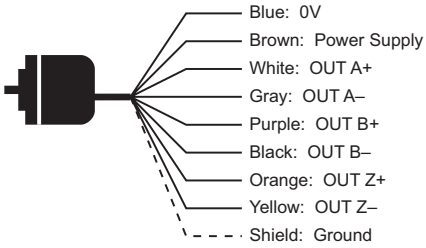
Open Collector Connections

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



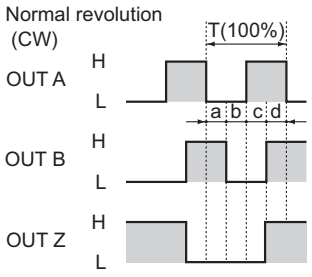
Line Driver Connections

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



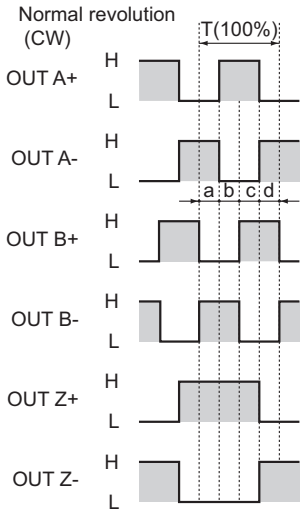
Channel Timing Charts

Open Collector Models (TRDA-2ExxxBD)



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

Line Driver Models (TRDA-2ExxxVD)



a, b, c, d = 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

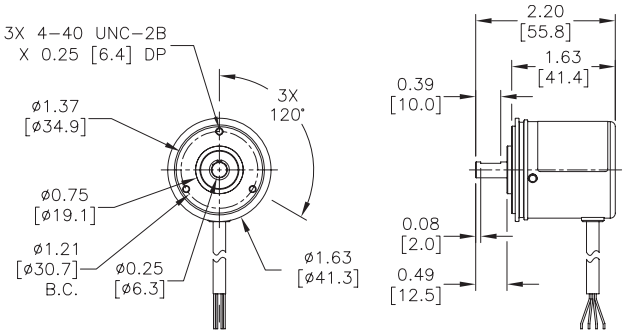
Channel A (OUT A and A-not) and Channel B (OUT B and B-not) are also 90 degrees out of phase on line driver encoders. OUT Z is the same as on open collector models, and is the absolute reference (home position). It signifies one full rotation of the encoder shaft.

Light Duty Incremental Encoders (SAE Dimension Encoders)

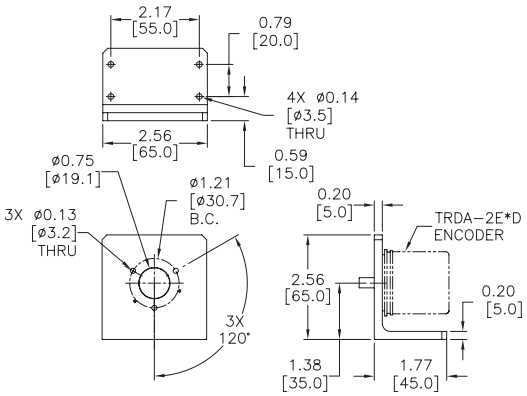
Dimensions – TRDA-2E series

Dimensions = in [mm]

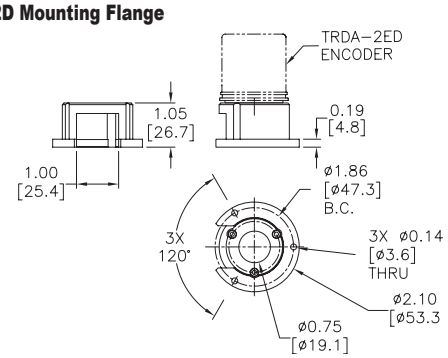
TRDA-2ExxxxD



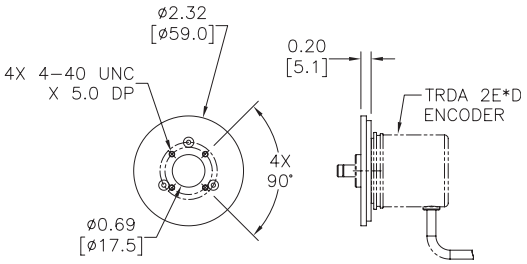
2ET-035D Mounting Bracket



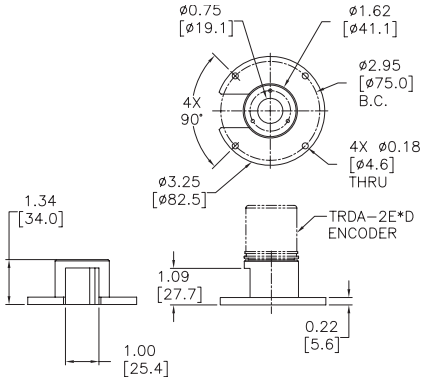
F-2D Mounting Flange



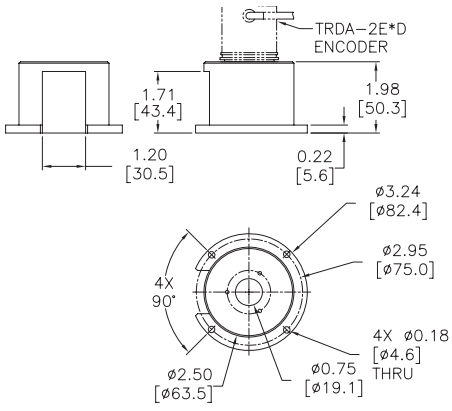
F-7D Mounting Flange



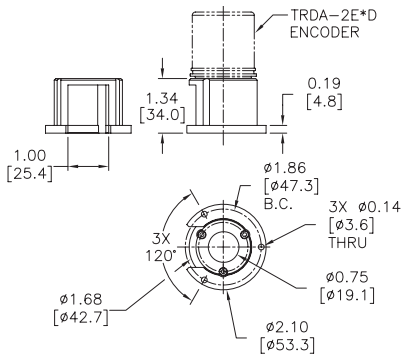
F-3D Mounting Flange



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	$162.00	100	5–30 VDC	Totem-pole sink/source	2.0 in.
TRDA-20R1N360RZD	$162.00	360			
TRDA-20R1N500RZD	$162.00	500			
TRDA-20R1N1000RZD	$162.00	1000			
TRDA-20R1N1024RZD	$173.00	1024			
TRDA-20R1N2500RZD	$175.00	2500			
TRDA-20R1N100VD	$162.00	100	5VDC	Line-driver (differential)	
TRDA-20R1N360VD	$162.00	360			
TRDA-20R1N500VD	$162.00	500			
TRDA-20R1N1000VD	$162.00	1000			
TRDA-20R1N1024VD	$174.00	1024			
TRDA-20R1N2500VD	$175.00	2500			

Accessories

Accessories for TRDA-20 Series Encoders *

Part Number *	Price	Description
TRDA-20R1D	$28.50	Mounting flange, round, 1.5 inch bolt-hole circle
TRDA-20R2D	$41.00	Mounting flange, round, 1.625 inch bolt-hole circle
TRDA-20SND	$62.00	Mounting flange, square
LM-001D**	$126.00	Mounting bracket for TRDA-20 & TRDA-25 encoders

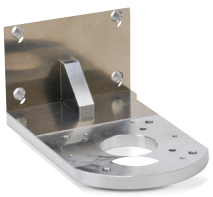
** The accessories in this table work only with TRDA-20R1Nxxxxxx series encoders, unless marked otherwise.*

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

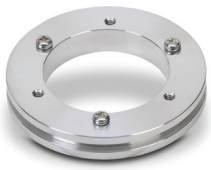
Couplings

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-20R1NxxxxRZD (Totem-pole)***	***TRDA-20R1NxxxxVD (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	0.003 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	$_{C}UL_{US}$ (E189395)	

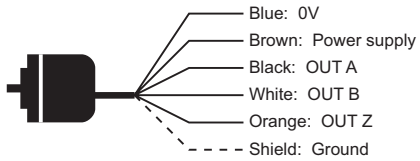
Medium Duty Incremental Encoders (SAE Dimension Encoders)

Specifications – TRDA-20 series

Wiring Diagrams

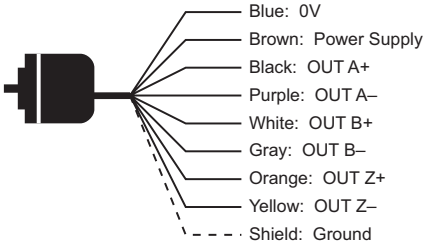
Totem Pole Connections

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.

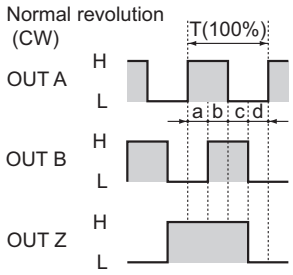
OUT Z is the absolute reference added to an incremental encoder and is also known as home position. It signifies a full rotation of the encoder shaft.

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.

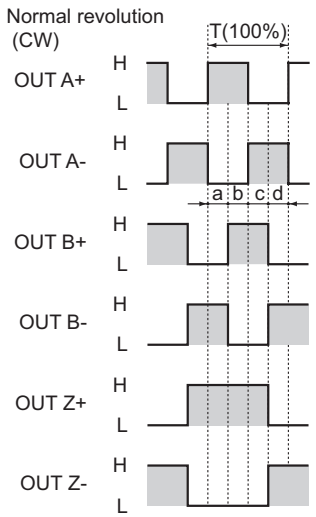
Channel Timing Charts

Totem Pole Models (TRDA-20R1NxxxRZD)



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

Line Driver Models (TRDA-20R1NxxxVD)



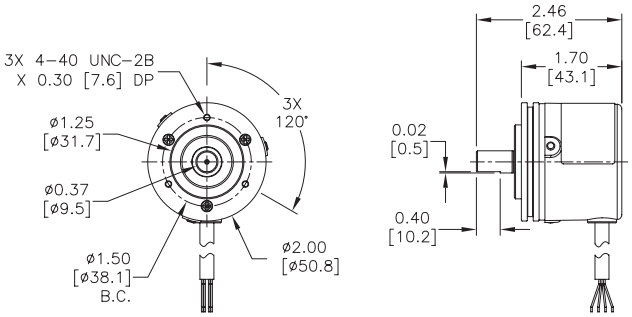
a, b, c, d = 1/4T±1/8T
"Normal" means clockwise revolution viewed from the shaft

Medium Duty Incremental Encoders (SAE Dimension Encoders)

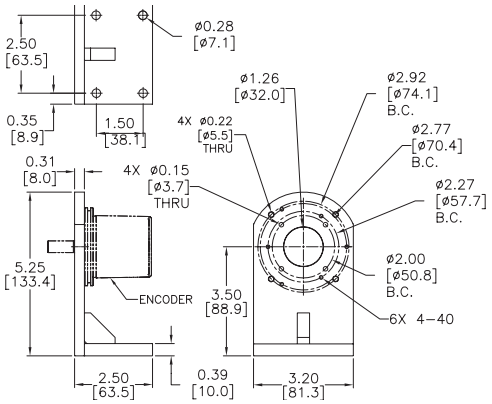
Dimensions – TRDA-20 series

Dimensions = in [mm]

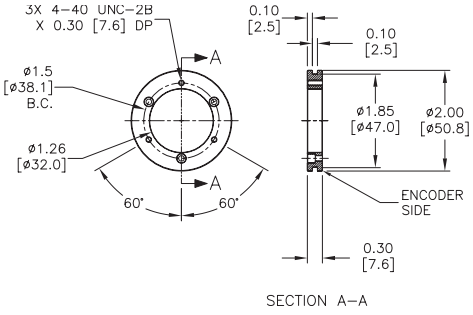
TRDA-20R1Nxxxxxx D



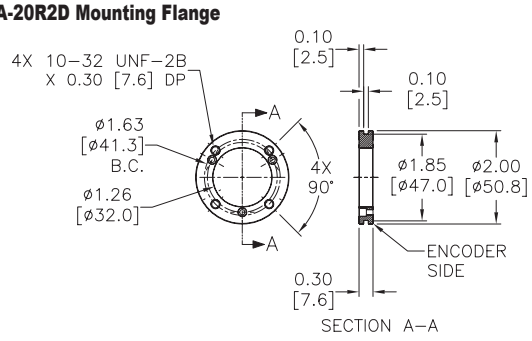
LM-001D Mounting Bracket



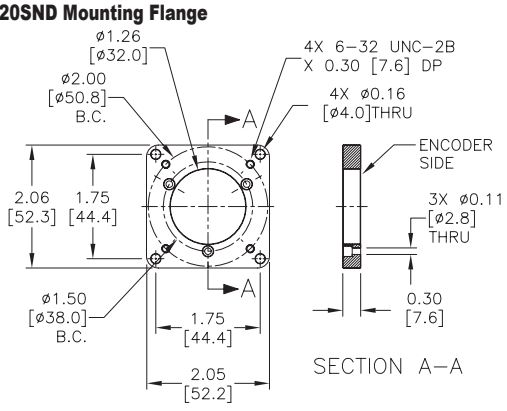
TRDA-20R1D Mounting Flange



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 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	$260.00	100	5–30 VDC	Totem-pole sink/source	2.0 in. (2.5 in. round flange)
TRDA25RN360RZWDMS	$260.00	360			
TRDA25RN500RZWDMS	$260.00	500			
TRDA25RN1000RZWDMS	$260.00	1000			
TRDA25RN1024RZWDMS	$260.00	1024			
TRDA25RN2500RZWDMS	$281.00	2500			
TRDA25RN100VWDMS	$260.00	100	5VDC	Line-driver (differential)	
TRDA25RN360VWDMS	$260.00	360			
TRDA25RN500VWDMS	$260.00	500			
TRDA25RN1000VWDMS	$260.00	1000			
TRDA25RN1024VWDMS	$260.00	1024			
TRDA25RN2500VWDMS	$282.00	2500			

** TRDA25RNxxxxxWDMS encoders do NOT include cables or connectors, which are sold separately in the "Accessories" section.*

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.

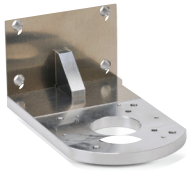
See the "Encoder Couplings" section for more information on.

Accessories for TRDA-25 Series Encoders *

Part Number *	Price	Description
TRDA-25RND	$41.00	Mounting flange, round (2.5 in. dia. w/ 1.88 in B.C.)
TRDA-25SND	$41.00	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***	$126.00	Mounting bracket for TRDA-20 & TRDA-25 encoders

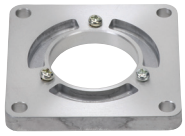
** The accessories in this table work only with TRDA-25RNxxxxxWD-MS series encoders, unless marked otherwise.*
*** Cables have IP65 environmental rating.*
**** Use of LM-001D also requires a TRDA-25SND replacement mounting flange, plus four customer-supplied 6-32 x 0.50 in long fasteners.*

TRDA-25-CON-RZWD



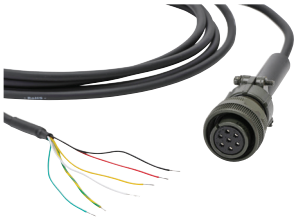
LM-001D

TRDA-25RND

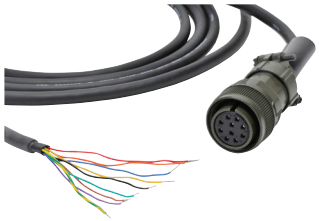


TRDA-25SND

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			***TRDA25RNxxxxRZWDMS (Totem-pole)***	***TRDA25RNxxxxVWDMS (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
 Viewed from wiring side (rear)	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
 Viewed from wiring side (rear)	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.

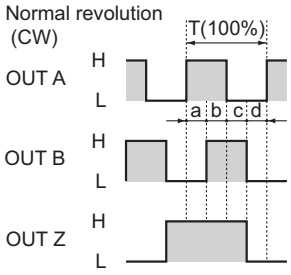
OUT Z is the absolute reference added to an incremental encoder and is also known as home position. It signifies a full rotation of the encoder shaft.

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.

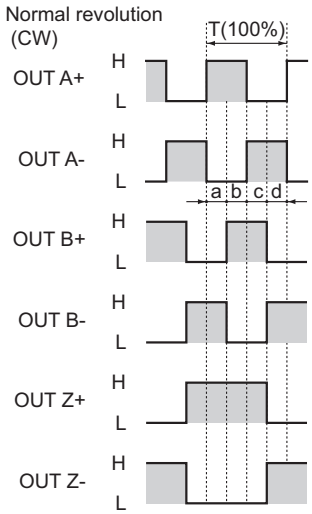
Channel Timing Charts

Totem Pole Models (TRDA25RNxxxRZWDxx)



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

Line Driver Models (TRDA25RNxxxVWDxx)



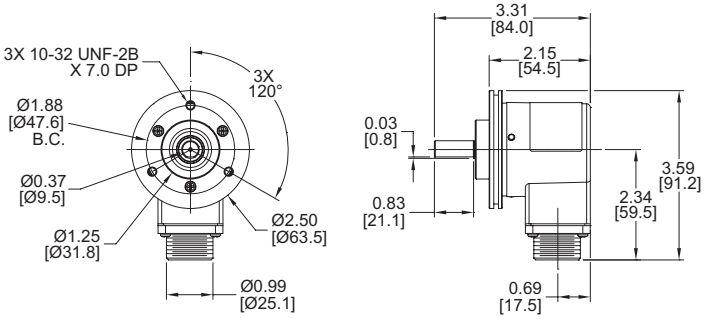
a, b, c, d = 1/4T±1/8T
"Normal" means clockwise revolution viewed from the shaft

Medium Duty Incremental Encoders (SAE Dimension Encoders)

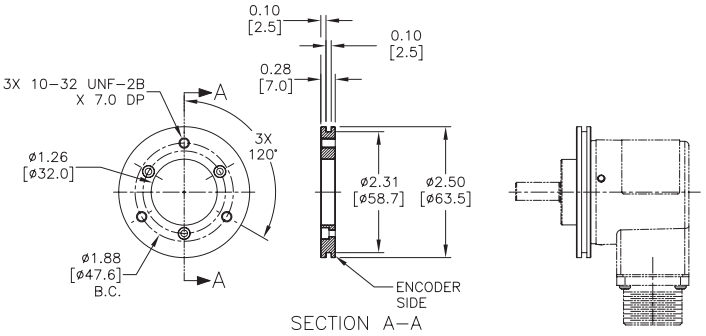
Dimensions – TRDA-25 series

Dimensions = in [mm]

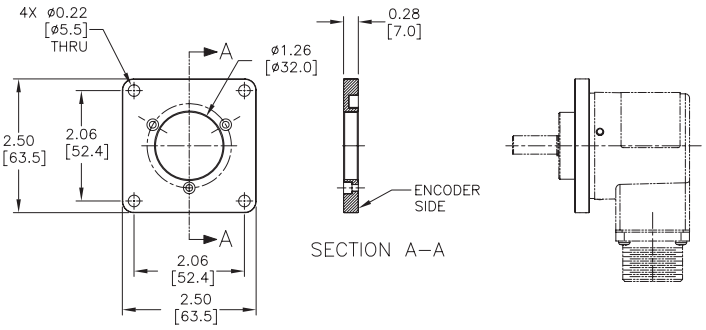
TRDA25RN Encoder



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-MXxxxx-AD/BD models

TRD-MXxxxx-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	Retired	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	Retired	100	4.75–5.25 VDC	Line Driver	25 mm
TRD-MX360VD	Retired	360			
TRD-MX500VD	Retired	500			

Accessories

Accessories for TRD-MX Series Encoders

Part Number	Price	Description
MM-4D	Retired	Servo mounting clamp for TRD-MX series encoders
MT-030D	$41.00	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, $_{C}UL_{US}$ (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

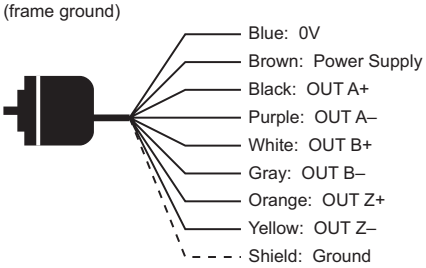
Wiring Diagrams

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.

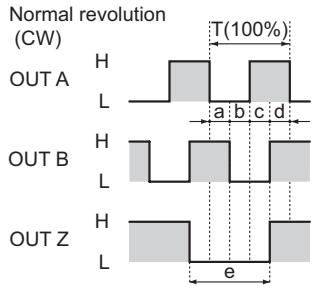
OUT Z is the absolute reference added to an incremental encoder and is also known as home position. It signifies a full rotation of the encoder shaft. It pulses once per revolution.

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.

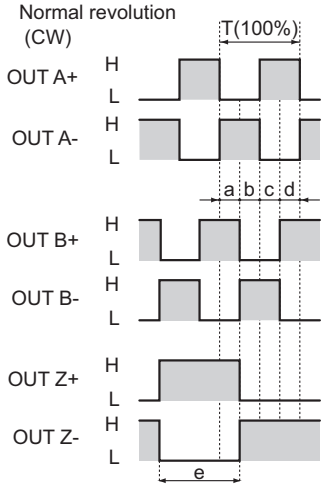
Channel Timing Charts

Open Collector Models (TRD-MXxxxAD/BD)



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

Line Driver Models (TRD-MXxxxVD)

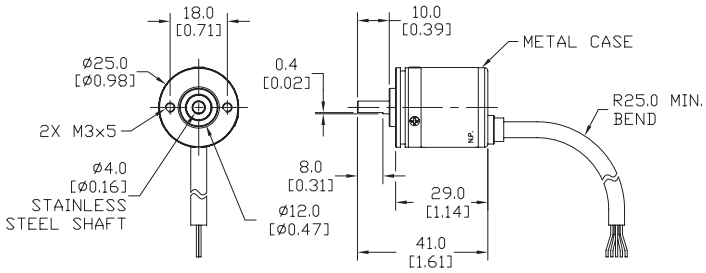


a, b, c, d = 0.25T ±0.125T; e = 1T ±0.125T
"Normal" means clockwise revolution viewed from the shaft

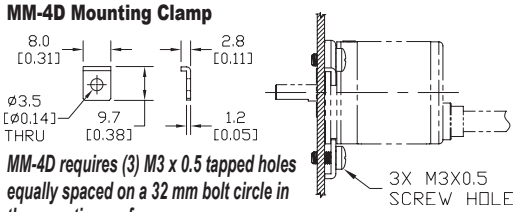
Dimensions – TRD-MX series

Dimensions = mm [in]

TRD-MXxxxxD

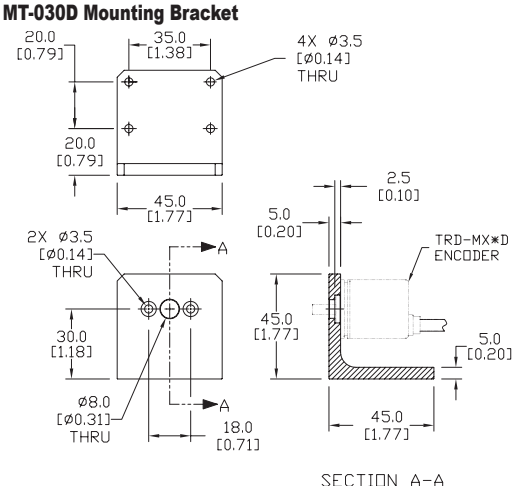


MM-4D Mounting Clamp



MM-4D requires (3) M3 x 0.5 tapped holes equally spaced on a 32 mm bolt circle in the mounting surface.

MT-030D Mounting Bracket



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	$103.00	100	PDF	5–26 VDC	NPN open collector	160g with 2m cable	IP50	38mm
TRD-SR200AD	$103.00	200	PDF					
TRD-SR360AD	$103.00	360	PDF					
TRD-SR500AD	$103.00	500	PDF					
TRD-SR600AD	$103.00	600	PDF					
TRD-SR1000AD	$103.00	1000	PDF					
TRD-SR1024AD	$109.00	1024	PDF					
TRD-SR2000AD	$109.00	2000	PDF					
TRD-SR2500AD	$109.00	2500	PDF					
TRD-SR100VD	$103.00	100	PDF	5VDC	Line driver (differential)			
TRD-SR200VD	$103.00	200	PDF					
TRD-SR360VD	$103.00	360	PDF					
TRD-SR500VD	$103.00	500	PDF					
TRD-SR600VD	$103.00	600	PDF					
TRD-SR1000VD	$103.00	1000	PDF					
TRD-SR1024VD	$109.00	1024	PDF					
TRD-SR2000VD	$109.00	2000	PDF					
TRD-SR2500VD	$109.00	2500	PDF					
TRD-SR100AWD	$138.00	100	PDF	5–26 VDC	NPN open collector	190g with 2m cable	IP65	40mm
TRD-SR200AWD	$138.00	200	PDF					
TRD-SR360AWD	$138.00	360	PDF					
TRD-SR500AWD	$138.00	500	PDF					
TRD-SR600AWD	$138.00	600	PDF					
TRD-SR1000AWD	$138.00	1000	PDF					
TRD-SR1024AWD	$144.00	1024	PDF					
TRD-SR2000AWD	$144.00	2000	PDF					
TRD-SR2500AWD	$144.00	2500	PDF					
TRD-SR100VWD	$138.00	100	PDF	5VDC	Line driver (differential)			
TRD-SR200VWD	$138.00	200	PDF					
TRD-SR360VWD	$138.00	360	PDF					
TRD-SR500VWD	$138.00	500	PDF					
TRD-SR600VWD	$138.00	600	PDF					
TRD-SR1000VWD	$138.00	1000	PDF					
TRD-SR1024VWD	$144.00	1024	PDF					
TRD-SR2000VWD	$144.00	2000	PDF					
TRD-SR2500VWD	$144.00	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	$110.00	100	PDF	5–26 VDC	NPN open collector	170g with 2m cable	IP50	38mm
TRD-SHR200A5D	$110.00	200	PDF					
TRD-SHR360A5D	$110.00	360	PDF					
TRD-SHR500A5D	$110.00	500	PDF					
TRD-SHR600A5D	$110.00	600	PDF					
TRD-SHR1000A5D	$110.00	1000	PDF					
TRD-SHR1024A5D	$114.00	1024	PDF					
TRD-SHR2000A5D	$114.00	2000	PDF					
TRD-SHR2500A5D	$114.00	2500	PDF					
TRD-SHR100V5D	$110.00	100	PDF	5VDC	Line driver (differential)			
TRD-SHR200V5D	$110.00	200	PDF					
TRD-SHR360V5D	$110.00	360	PDF					
TRD-SHR500V5D	$110.00	500	PDF					
TRD-SHR600V5D	$110.00	600	PDF					
TRD-SHR1000V5D	$110.00	1000	PDF					
TRD-SHR1024V5D	$114.00	1024	PDF					
TRD-SHR2000V5D	$114.00	2000	PDF					
TRD-SHR2500V5D	$114.00	2500	PDF					
TRD-SHR100AW0D	$145.00	100	PDF	5–26 VDC	NPN open collector	200g with 2m cable	IP65	40mm
TRD-SHR200AW0D	$145.00	200	PDF					
TRD-SHR360AW0D	$145.00	360	PDF					
TRD-SHR500AW0D	$145.00	500	PDF					
TRD-SHR600AW0D	$145.00	600	PDF					
TRD-SHR1000AW0D	$145.00	1000	PDF					
TRD-SHR1024AW0D	$149.00	1024	PDF					
TRD-SHR2000AW0D	$149.00	2000	PDF					
TRD-SHR2500AW0D	$149.00	2500	PDF					
TRD-SHR100VW0D	$145.00	100	PDF	5VDC	Line driver (differential)			
TRD-SHR200VW0D	$145.00	200	PDF					
TRD-SHR360VW0D	$145.00	360	PDF					
TRD-SHR500VW0D	$145.00	500	PDF					
TRD-SHR600VW0D	$145.00	600	PDF					
TRD-SHR1000VW0D	$145.00	1000	PDF					
TRD-SHR1024VW0D	$149.00	1024	PDF					
TRD-SHR2000VW0D	$149.00	2000	PDF					
TRD-SHR2500VW0D	$149.00	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

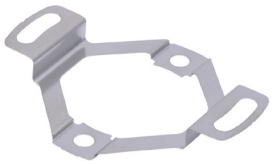
Environmental Specifications	
Ambient Temperature	-10 to 80 °C (14 to 176 °F)
Storage Temperature	-25 to 85°C (-13 to 185°F)
Operating Humidity	35–85% RH (non-condensing)
Withstand Voltage	Grounded through capacitor
Insulation Resistance	50MΩ min.
Vibration Resistance	durable for one hour along three 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	$_{C}UL_{US}$ (E189395)

**** To be supplied by Class II source.***
***** Encoder maximum speed is the lesser value of Max. Electrical Speed and Max. Mechanical Speed.***

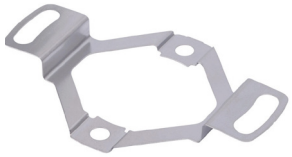
Light Duty Incremental Encoders (Metric Dimension Encoders)

TRD-SR/SHR series Mounting Accessories

Mounting Accessories					
Part Number	*Price*	*Description*	*Weight*	*Drawing*	*Compatibility*
SHRS-040D*	$9.50	Flexible mounting bracket for IP50 hollow shaft encoders, converts standard 45mm mounting to 40mm mounting.	<2g	PDF	TRD-SHR series, IP50
SHRS-045D*	$9.50	Replacement 45mm flexible mounting bracket for IP50 rated hollow shaft encoders.		PDF	
SHRS-W40D*	$9.50	Replacement 40mm flexible mounting bracket for IP65 rated hollow shaft encoders.		PDF	TRD-SHR series, IP65
SRT-035D	$24.00	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



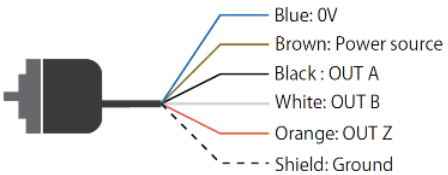
SHRS-045D

SHRS-W40D

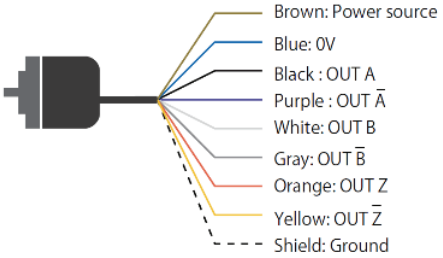
SRT-035D

Wiring diagrams

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

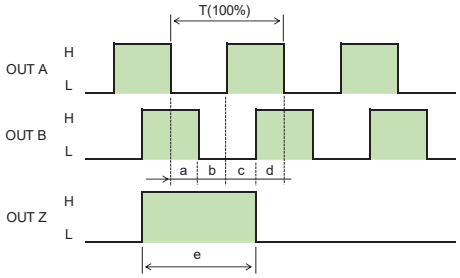


Line Driver Models
Cable shield is NOT connected to the encoder body (frame ground)

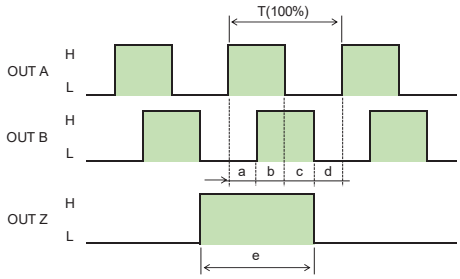


Channel timing charts

TRD-SR/SHR "A" Models



TRD-SR/SHR "V" Models



T = a + b + c + d a, b, c, d = 1 / 4 T ± 1 / 8 T e = 1 ±

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	Retired	100	5-12 VDC	NPN open collector	38mm
TRD-S360AD	Retired	360			
TRD-S500AD	Retired	500			
TRD-S1000AD	Retired	1000			
TRD-S1024AD	Retired	1024			
TRD-S2500AD	Retired	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	Retired	300			
TRD-S400VD	Retired	400			
TRD-S800VD	Retired	800			
TRD-S1000-VD	Retired	1000			
TRD-S1200VD	Retired	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	Retired	100	5-12 VDC	NPN open collector	38mm
TRD-SH360AD	Retired	360			
TRD-SH500AD	Retired	500			
TRD-SH1000AD	Retired	1000			
TRD-SH1024AD	Retired	1024			
TRD-SH2500AD	Retired	2500			
TRD-SH400BD	Retired	400	12–24 VDC	NPN open collector	
TRD-SH500-BD	Retired	500			
TRD-SH600BD	Retired	600			
TRD-SH1000-BD	Retired	1000			
TRD-SH1200BD	Retired	1200			
TRD-SH2000BD	Retired	2000			
TRD-SH2500-BD	Retired	2500			
TRD-SH100-VD	Retired	100	5VDC	Line driver (differential)	
TRD-SH200VD	Retired	200			
TRD-SH250VD	Retired	250			
TRD-SH300VD	Retired	300			
TRD-SH360-VD	Retired	360			
TRD-SH400VD	Retired	400			
TRD-SH500-VD	Retired	500			
TRD-SH600VD	Retired	600			
TRD-SH800VD	Retired	800			
TRD-SH1000-VD	Retired	1000			
TRD-SH1200VD	Retired	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

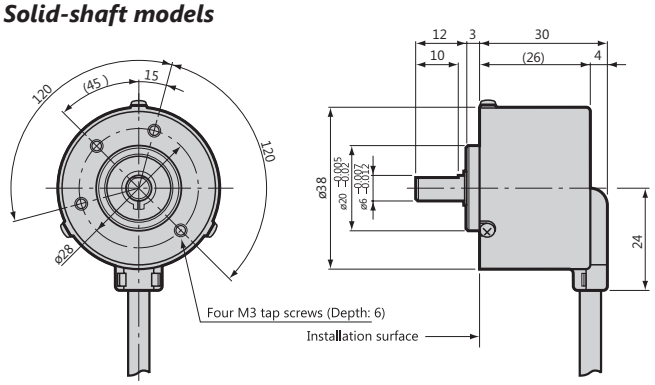
Environmental Specifications	
Ambient Temperature	-10 to 70°C; 14 to 158°F
Storage Temperature	-25 to 85°C; -13 to 185°F
Operating Humidity	35–85% RH
Withstand Voltage	500VAC (50/60Hz) for one minute
Insulation Resistance	50MΩ min.
Vibration Resistance	durable for one hour along three axes at 10 to 55 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)

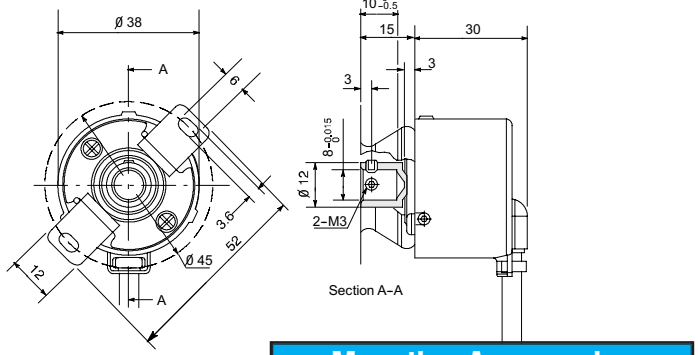
Dimensions – TRD-S(H) series

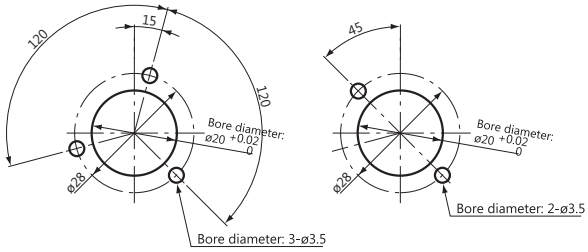
All dimensions in mm
1mm = 0.03937in

Solid-shaft models



Hollow-shaft models

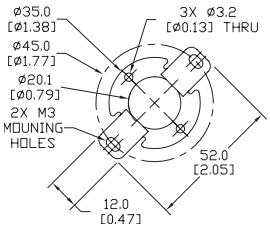


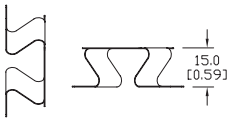


Mounting hole panel cutout (3 holes)

Mounting hole panel cutout (2 holes)

TRD-SH-BKT (bracket)



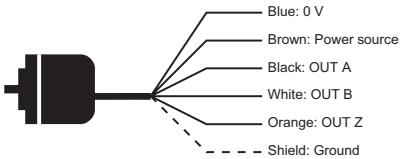


Mounting Accessories		
Part #	***Price***	***Description***
TRD-SH-BKT	$7.00	JTEKT flexible mounting bracket, replacement, metal. For use with JTEKT TRD-SH series hollow shaft encoders.

Wiring diagrams

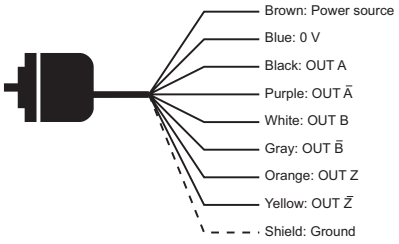
Open collector connections

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



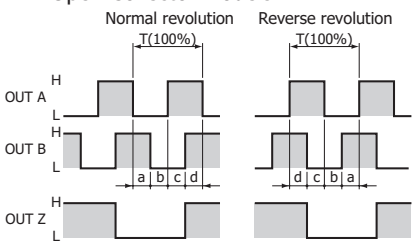
Line driver connections

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

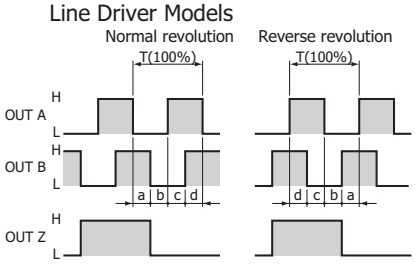


Channel timing charts

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	$168.00	3	5–30 VDC	Totem-pole (push-pull) sink/source	50 mm
TRD-N4-RZWD	$168.00	4			
TRD-N5-RZWD	$168.00	5			
TRD-N10-RZWD	$168.00	10			
TRD-N30-RZWD	$168.00	30			
TRD-N40-RZWD	$168.00	40			
TRD-N50-RZWD	$168.00	50			
TRD-N60-RZWD	$168.00	60			
TRD-N100-RZWD	$168.00	100			
TRD-N120-RZWD	$189.00	120			
TRD-N200-RZWD	$189.00	200			
TRD-N240-RZWD	$189.00	240			
TRD-N250-RZWD	$189.00	250			
TRD-N300-RZWD	$189.00	300			
TRD-N360-RZWD	$189.00	360			
TRD-N400-RZWD	$189.00	400			
TRD-N480-RZWD	$189.00	480			
TRD-N500-RZWD	$189.00	500			
TRD-N600-RZWD	$189.00	600			
TRD-N750-RZWD	$189.00	750			
TRD-N1000-RZWD	$189.00	1000			
TRD-N1024-RZWD	$189.00	1024			
TRD-N1200-RZWD	$247.00	1200			
TRD-N2000-RZWD	$247.00	2000			
TRD-N2500-RZWD	$248.00	2500			
TRD-N3000-RZWD	$248.00	3000			
TRD-N3600-RZWD	$248.00	3600			
TRD-N5000-RZWD	$248.00	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	$189.00	3	5–30 VDC	Totem-pole (push-pull) sink/source	50 mm
TRD-NH4-RZWD	$189.00	4			
TRD-NH5-RZWD	$189.00	5			
TRD-NH10-RZWD	$189.00	10			
TRD-NH30-RZWD	$189.00	30			
TRD-NH40-RZWD	$189.00	40			
TRD-NH50-RZWD	$189.00	50			
TRD-NH60-RZWD	$189.00	60			
TRD-NH100-RZWD	$189.00	100			
TRD-NH120-RZWD	$210.00	120			
TRD-NH200-RZWD	$210.00	200			
TRD-NH240-RZWD	$210.00	240			
TRD-NH250-RZWD	$210.00	250			
TRD-NH300-RZWD	$210.00	300			
TRD-NH360-RZWD	$210.00	360			
TRD-NH400-RZWD	$210.00	400			
TRD-NH480-RZWD	$210.00	480			
TRD-NH500-RZWD	$210.00	500			
TRD-NH600-RZWD	$215.00	600			
TRD-NH750-RZWD	$215.00	750			
TRD-NH1000-RZWD	$215.00	1000			
TRD-NH1024-RZWD	$211.00	1024			
TRD-NH1200-RZWD	$264.00	1200			
TRD-NH2000-RZWD	$264.00	2000			
TRD-NH2500-RZWD	$264.00	2500			
TRD-NH3000-RZWD	$268.00	3000			
TRD-NH3600-RZWD	$264.00	3600			
TRD-NH5000-RZWD	$268.00	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	$175.00	3	5VDC	Line driver (differential)	50 mm
TRD-N4-RZVWD	$175.00	4			
TRD-N5-RZVWD	$175.00	5			
TRD-N10-RZVWD	$175.00	10			
TRD-N30-RZVWD	$175.00	30			
TRD-N40-RZVWD	$175.00	40			
TRD-N50-RZVWD	$175.00	50			
TRD-N60-RZVWD	$175.00	60			
TRD-N100-RZVWD	$175.00	100			
TRD-N120-RZVWD	$208.00	120			
TRD-N200-RZVWD	$208.00	200			
TRD-N240-RZVWD	$208.00	240			
TRD-N250-RZVWD	$208.00	250			
TRD-N300-RZVWD	$208.00	300			
TRD-N360-RZVWD	$208.00	360			
TRD-N400-RZVWD	$208.00	400			
TRD-N480-RZVWD	$208.00	480			
TRD-N500-RZVWD	$208.00	500			
TRD-N600-RZVWD	$208.00	600			
TRD-N750-RZVWD	$208.00	750			
TRD-N1000-RZVWD	$210.00	1000			
TRD-N1024-RZVWD	$210.00	1024			
TRD-N1200-RZVWD	$247.00	1200			
TRD-N2000-RZVWD	$247.00	2000			
TRD-N2500-RZVWD	$247.00	2500			
TRD-N3000-RZVWD	$248.00	3000			
TRD-N3600-RZVWD	$248.00	3600			
TRD-N5000-RZVWD	$248.00	5000			

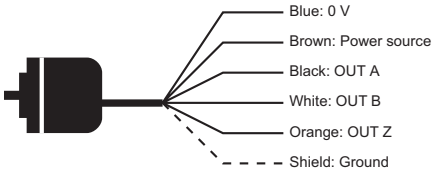
Incremental Medium Duty Hollow Shaft Encoders (Line Driver Output, TRD-NHxxx-RZVWD)

Part Number	Price	Pulses per Revolution	Input Voltage	Output	Body Dia.
TRD-NH3-RZVWD	$189.00	3	5VDC	Line driver (differential)	50 mm
TRD-NH4-RZVWD	$189.00	4			
TRD-NH5-RZVWD	$189.00	5			
TRD-NH10-RZVWD	$189.00	10			
TRD-NH30-RZVWD	$189.00	30			
TRD-NH40-RZVWD	$189.00	40			
TRD-NH50-RZVWD	$189.00	50			
TRD-NH60-RZVWD	$189.00	60			
TRD-NH100-RZVWD	$189.00	100			
TRD-NH120-RZVWD	$208.00	120			
TRD-NH200-RZVWD	$208.00	200			
TRD-NH240-RZVWD	$208.00	240			
TRD-NH250-RZVWD	$208.00	250			
TRD-NH300-RZVWD	$208.00	300			
TRD-NH360-RZVWD	$208.00	360			
TRD-NH400-RZVWD	$208.00	400			
TRD-NH480-RZVWD	$208.00	480			
TRD-NH500-RZVWD	$208.00	500			
TRD-NH600-RZVWD	$228.00	600			
TRD-NH750-RZVWD	$228.00	750			
TRD-NH1000-RZVWD	$228.00	1000			
TRD-NH1024-RZVWD	$228.00	1024			
TRD-NH1200-RZVWD	$264.00	1200			
TRD-NH2000-RZVWD	$264.00	2000			
TRD-NH2500-RZVWD	$264.00	2500			
TRD-NH3000-RZVWD	$264.00	3000			
TRD-NH3600-RZVWD	$264.00	3600			
TRD-NH5000-RZVWD	$264.00	5000			

Wiring diagrams

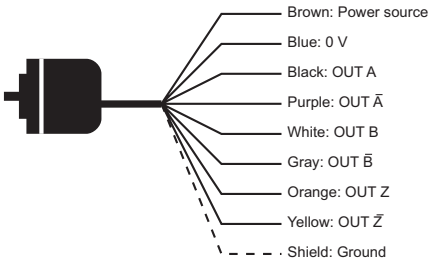
Totem-pole (push-pull) connections

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.*

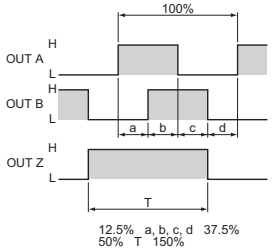
Mechanical Specifications		
Starting Torque	N (solid shaft): 0.02 N·m [0.18 lb·ft] ; NH (hollow shaft): 0.05 N·m [0.44 lb·ft]	
Max. Allowable Shaft Load	Radial: 50N [11.24 lb] ; Axial: 30N [6.74 lb]	
Max. Allowable Speed	Continuous: 3,000 rpm; Instantaneous: 5,000 rpm	
Wire Size	24 AWG	
Weight	Approx. 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	$_{C}UL_{US}$ (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	$19.00	Mounting Bracket: Metal; for use with all TRD-N/NH/NA encoders
NM-9D*	$8.50	Mounting Clamp: Metal; for use with all TRD-N/NA encoders *
NF-55D*	$21.00	Mounting Flange Kit: includes aluminum flange & NM-9D clamp; for use with all TRD-N/NA encoders *
TRD-NH-BKT	$6.75	JTEKT flexible mounting bracket, replacement, metal. For use with JTEKT TRD-NH series hollow shaft encoders.

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

TRD-NH-BKT

NM-9D

JT-035D

NF-55D

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)

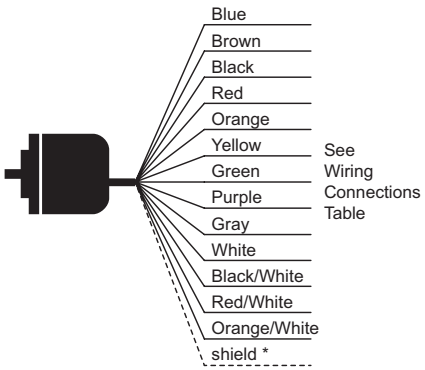
TRD-NA series

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	$384.00	5 bit gray code, 32 pulses per revolution	10–26 VDC	NPN open collector	50 mm
TRD-NA64NWD	$384.00	6 bit gray code, 64 pulses per revolution			
TRD-NA128NWD	$384.00	7 bit gray code, 128 pulses per revolution			
TRD-NA180NWD	$384.00	8 bit gray code, 180 pulses per revolution			
TRD-NA256NWD	$384.00	8 bit gray code, 256 pulses per revolution			
TRD-NA360NWD	$384.00	9 bit gray code, 360 pulses per revolution			
TRD-NA512NWD	$384.00	9 bit gray code, 512 pulses per revolution			
TRD-NA720NWD	$384.00	10 bit gray code, 720 pulses per revolution			
TRD-NA1024NWD	$384.00	10 bit gray code, 1024 pulses per revolution			
TRD-NA2048NWD	$384.00	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		360 / Resolution x 2 = 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	$_{C}UL_{US}$ (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.

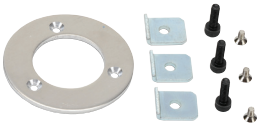
Mounting Bracket & Clamps

Mounting Accessories		
Part #	***Price***	***Description***
JT-035D	$19.00	Mounting Bracket: Metal; for use with all TRD-N/NH/NA encoders
NM-9D*	$8.50	Mounting Clamp: Metal; for use with all TRD-N/NA encoders *
NF-55D*	$21.00	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.*		

JT-035D

NM-9D

NF-55D

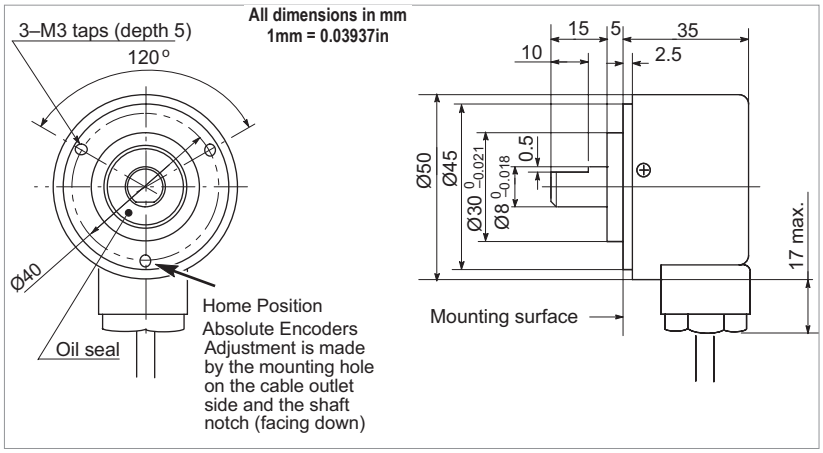


Medium Duty Absolute and Incremental Encoders (Metric Dimension Encoders)

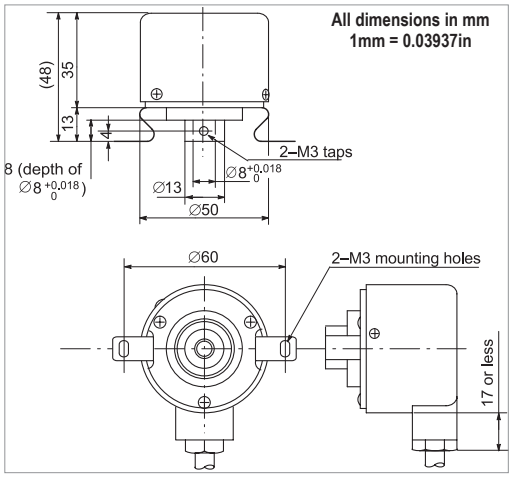
Dimensions – TRD-N(H) & TRD-NA series

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)



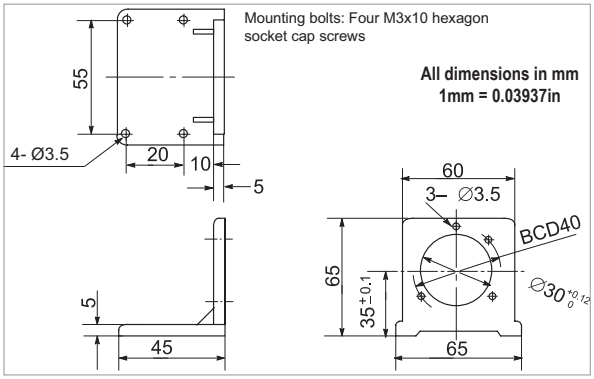
Hollow Shaft Incremental Encoders only (TRD-NH)



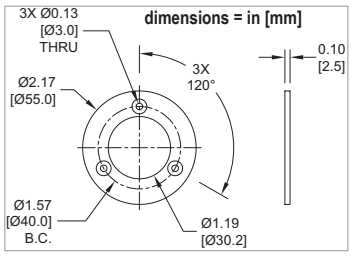
Optional Mounting Flange and Brackets for Medium Duty Encoders

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.

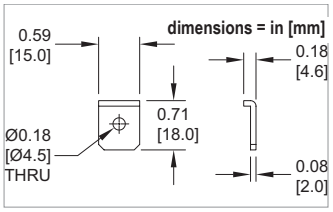
JT-035D (bracket)



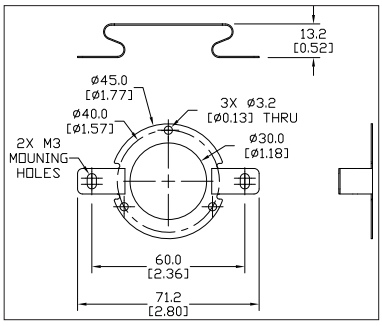
NF-55D (flange)



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	$335.00	30	10-30 VDC	Totem-pole (sink/source)	78mm
TRD-GK100-RZD	$335.00	100			
TRD-GK120-RZD	$335.00	120			
TRD-GK200-RZD	$335.00	200			
TRD-GK240-RZD	$335.00	240			
TRD-GK250-RZD	$335.00	250			
TRD-GK300-RZD	$335.00	300			
TRD-GK360-RZD	$335.00	360			
TRD-GK400-RZD	$335.00	400			
TRD-GK500-RZD	$384.00	500			
TRD-GK600-RZD	$384.00	600			
TRD-GK800-RZD	Retired	800			
TRD-GK1000-RZD	$384.00	1000			
TRD-GK1200-RZD	$384.00	1000			
TRD-GK1500-RZD	Retired	1500			
TRD-GK1800-RZD	Retired	1800			
TRD-GK2000-RZD	$459.00	2000			
TRD-GK2500-RZD	$545.00	2500			
TRD-GK3600-RZD	$608.00	3600			
TRD-GK5000-RZD	$608.00	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'
	Rise/Fall Time	2µs max. (when cable length is 2m or less)
Output	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

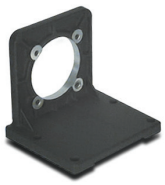
Couplings

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.

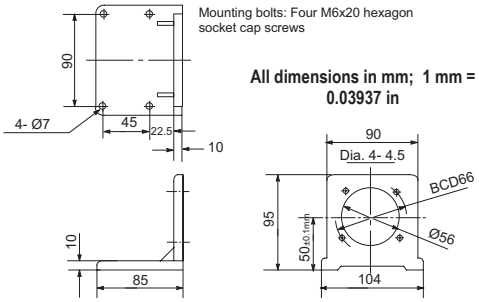
Mounting Brackets

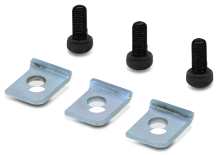
Mounting brackets for all TRD-GK encoders.



RT-11D

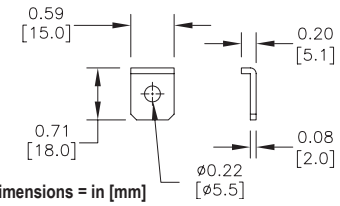
- **$34.50**



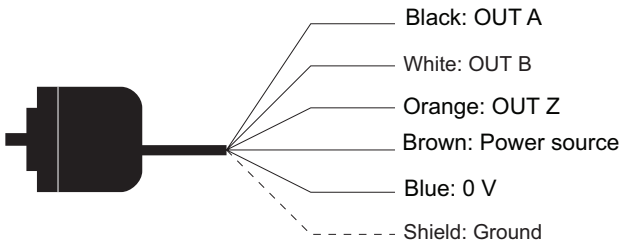


KM-9D

- **$8.50**



Wiring diagram



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

How to read the timing charts

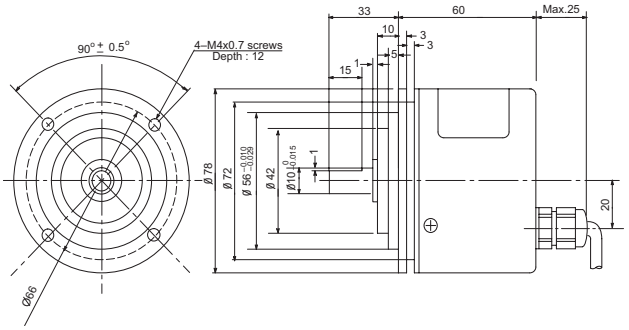
Totem Pole Models

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.

Dimensions

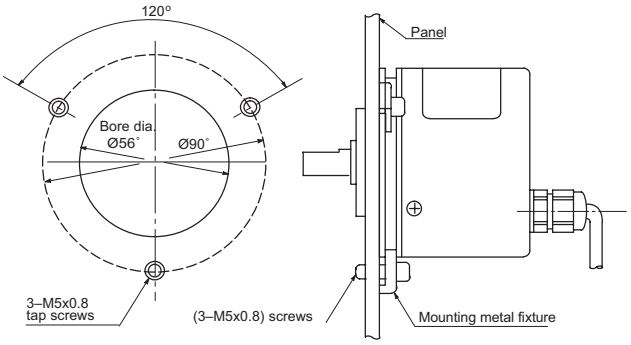
External dimensions



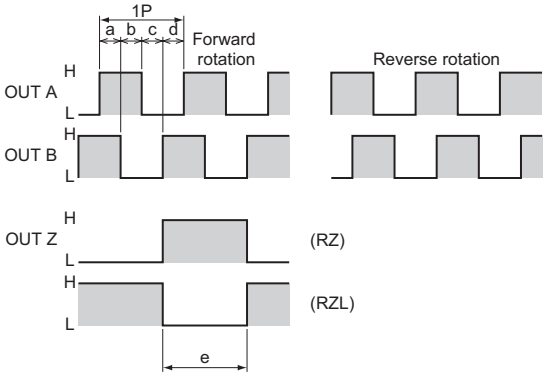
All dimensions in mm; 1 mm = 0.03937 in

Servo mounting

All dimensions in mm; 1 mm = 0.03937 in



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%)

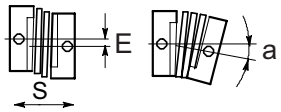
OUT Z generates home position in both directions.

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

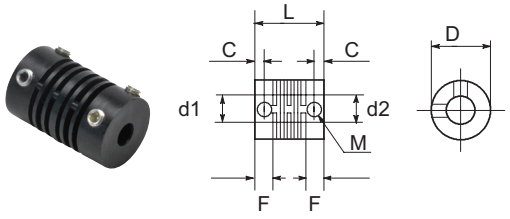
Type	Part Number	Price	Applicable Encoders (shaft size)	Shaft Diameter		D	L	F	C	M	a	E max	S max	Working Torque	Torsional Rigidity	Material
				d1	d2	(mm [in])						(mm [in])		(N·m)		
Fiberglass (metric)	GJ-4D	$12.50	TRD-MX (4mm)	4mm	4mm	13 [0.51]	21 [0.83]	5.3 [0.21]	3 [0.12]	M3 set screw	5°	0.4 [0.02]	0.4 [0.02]	0.6 N·m	6 N·m/rad	Glass-fiber reinforced resin
	GJ-6D	$9.75	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	$11.50	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	$12.50	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	$23.00	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	
	GJK-953D	$28.50	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	$30.00	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	$30.00	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	$54.00	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	$61.00	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	$54.00	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	$63.00	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	$54.00	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	$54.00	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	$34.50	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	$45.00	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	$46.00	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	$57.00	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	$58.00	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	$55.00	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	$53.00	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*

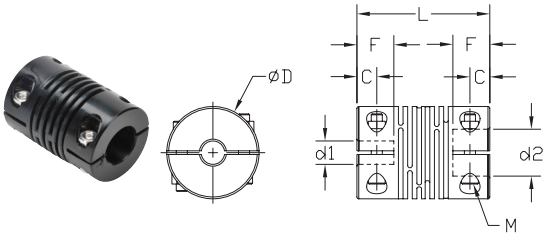
Encoder Accessories – Couplings

Encoder Couplings – Dimensions

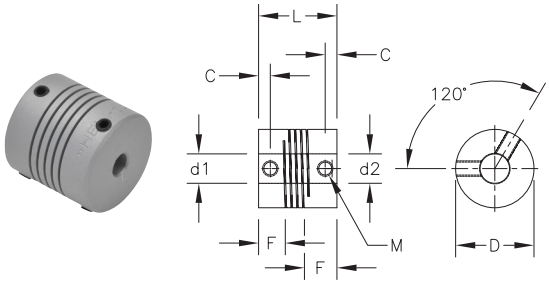
GJ-xxD Fiberglass Couplings (metric) &
GJx-xxxD Fiberglass Couplings (SAE)



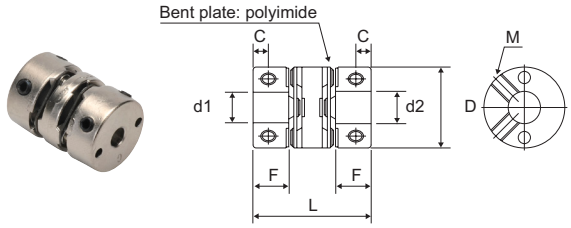
STP-MTRA-SC-xxxx Polymer Couplings



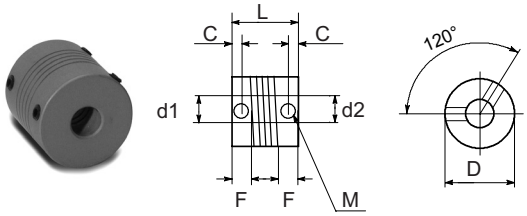
ARM-xxxxxxD Aluminum Couplings (metric & SAE)



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 chose 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 chose 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 compliment, 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.