Model WPT-E_-S

User Manual

Michigan Scientific
Corporation

Contents

High Resolution Wheel Pulse Transducer...

• Contains precision electronics in a rugged housing

• Measures rotational velocity, angular position, and direction of rotation

• Used to determine wheel speed, acceleration, distance, and vehicle speed for GPS and map validation

• Mounts directly to production wheel

• Can be adapted to mount on many different vehicles

Specifications

Electrical Specifications

Input Voltage	+5 to +20 Vdc
Input Current	60 mA
Output Type	0-5 V TTL
Reverse Voltage Protection	20 V
Encoder Accuracy (Maximum Cumulative Error)	0.25°

Mechanical Specifications

Size (W x D x H)	2.50 in x 2.15 in x 3.52 in (63.5 mm x 54.61 mm x 89.4 mm)
Weight (Sensor Only)	14.5 oz (410 g)
Temperature Range	Up to 2,000 ppr: -40° F to 212° F (-40° C to 100° C) 2,000 ppr and up: -13° F to 212° F (-25° C to 100°C)
Protection Rating	IP67, NEMA 6
Maximum Speed	2,000 r/min
Unit Torque	21 in·oz
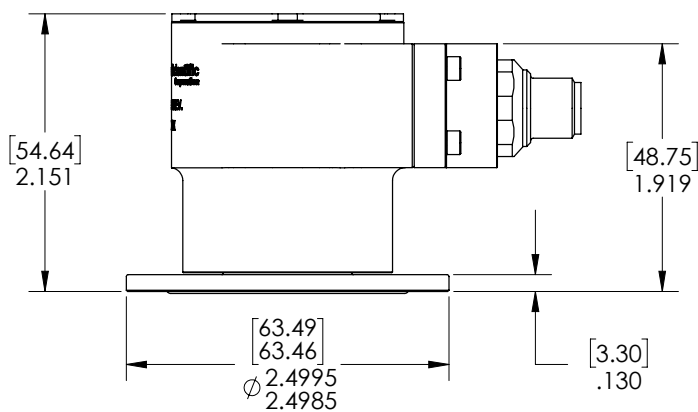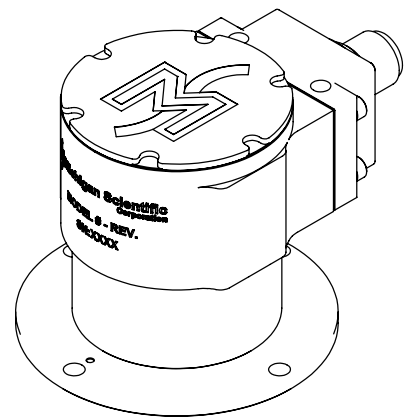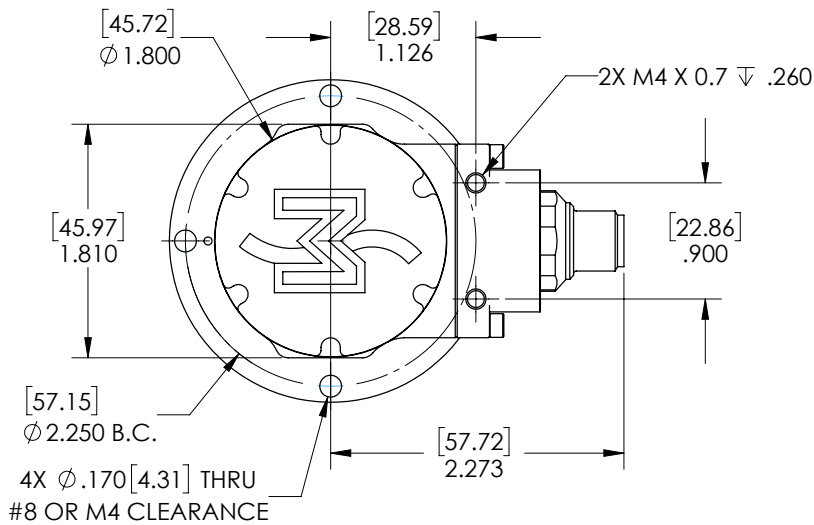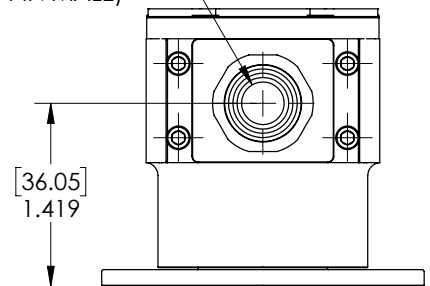
Encoder Output

Optical encoder resolutions ranging from 32 to 5,000 pulses per revolution are offered. All encoder choices have four outputs. Outputs A and B are in quadrature, meaning they are 90° out of phase. Output I is an index pulse. Output A⊕B is the exclusive OR of A and B, which doubles the basic resolution of the encoder. The outputs, 0 to 5 volt pulses, can drive TTL loads.

Encoder Outputs

A
B
I
A⊕B

Pin	Channel	Color
1	5-20 Vdc	⬜
2	Ground	🟫
3	A Out	🟩
4	B Out	🟨
5	I Out	⬜
6	A⊕B Out	🟪

**Allen Wrench
9/64"
3/16"
3 mm**

**Magnetic Vehicle
Stator Restraint or
Precision Vehicle
Stator Restraint**

**Quick Connect
Lug Nut Collets**

Wheel Adapter Plate

Stator Restraint

**M4 x 0.7, 10 mm
SHCS**

1/4"-28 SHCS

**Wheel Pulse
Transducer Sensor**

**8-32 x 5/16
SHCS**
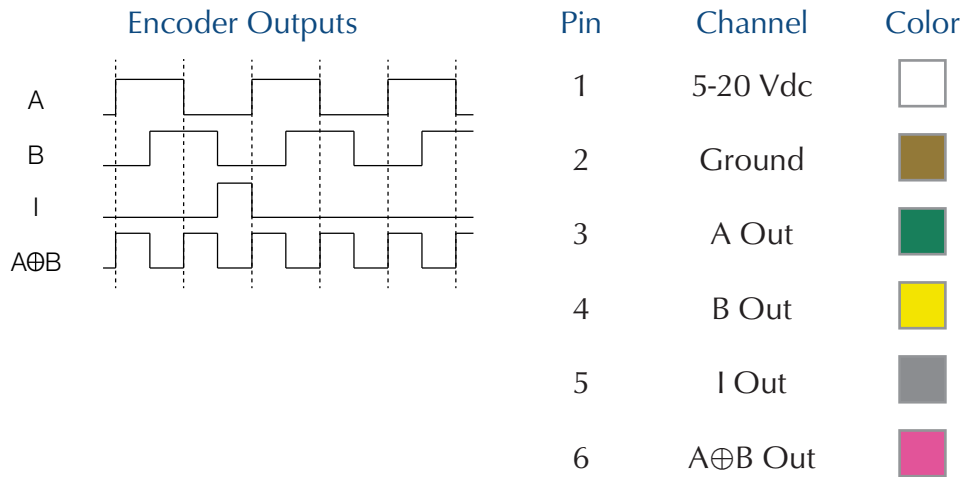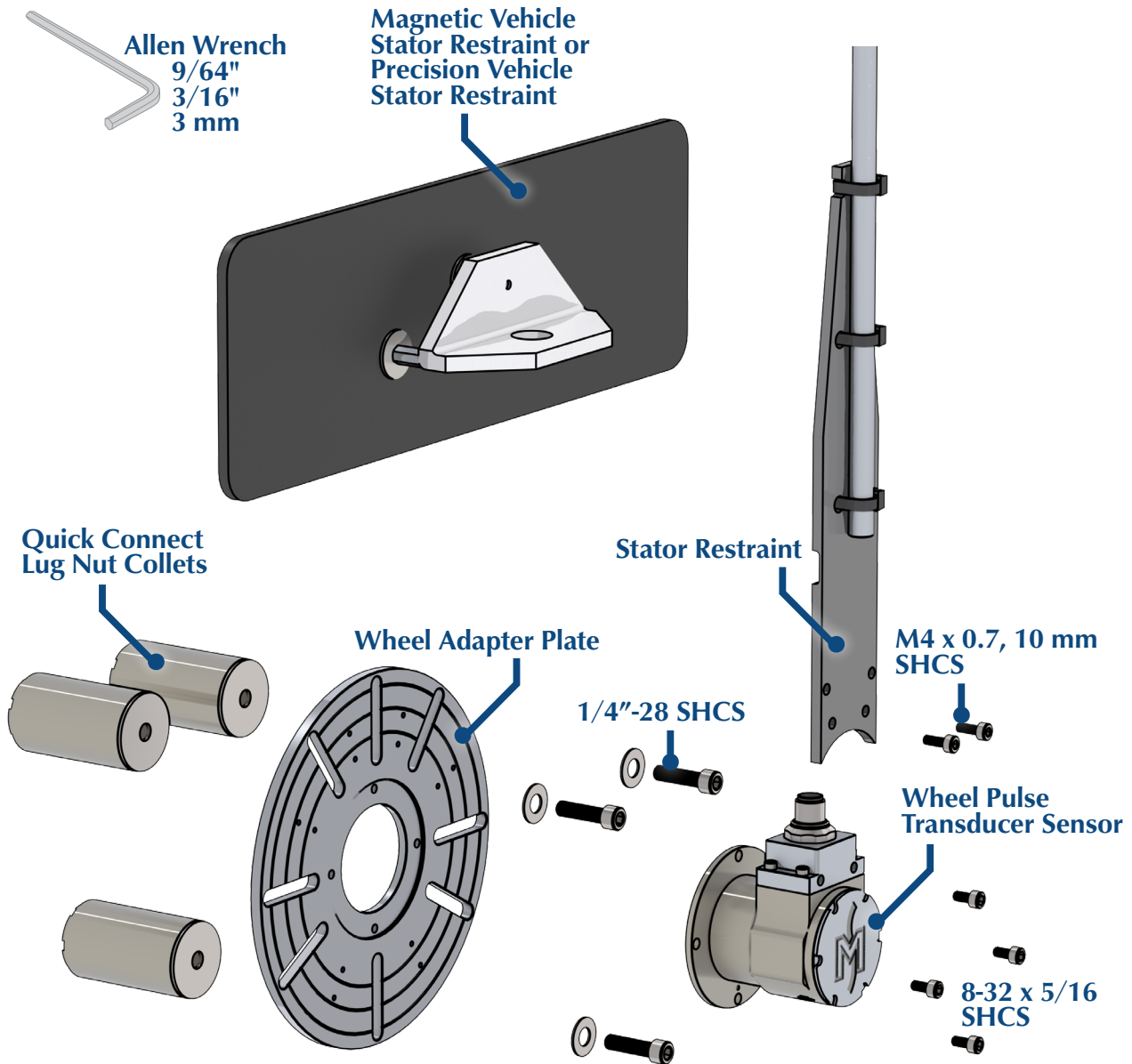
Mounting Plate Installation

1. Remove the 1/4"-28 socket head cap screw (SHCS) and small washer from the top of the Quick Connect Lug Nut Collets.

2. Place the Quick Connect Lug Nut Collets on the back side of the plate, keeping the large washer between the top of the collet and the plate.

3. Align the collets with the respective slots based on the total number of lugs.

4. Install the screw and washer through the plate and into the collet, but do not tighten the screw yet.

5. Attach the Quick Connect Lug Nut Collets to the vehicle lug nuts and tighten the screws until snug.

6. Using the concentric rings etched on the wheel plate as a guide, adjust the plate until it is centered on the wheel.

7. After the plate is centered, torque the screws to 75 in·lb (8.5 N·m).

Magnetic Vehicle Stator Restraint (MVSR) or Precision Vehicle Stator Restraint (PVSR)

1. Assemble the MVSR/PVSR by threading the stand-offs into the plastic bracket.

2. Insert the 8-32 flat head screws through the back of the magnetic sheet into the threaded stand-offs.

3. Attach the MVSR/PVSR to the body of the vehicle near the wheel so that the centerline of the magnetic sheet lines up with the center axis of the wheel.

Optional: Apply waterproof tape around the edges of the magnet on the vehicle to increase holding strength.

Wheel Pulse Transducer (WPT) Sensor

1. Pilot the rotor of the WPT sensor to the mounting plate.

2. Install four 8-32 x 5/16 in SHCS to the rotor and mounting holes.

3. Torque the screws to 22 in·lb (2.5 N·m).

Stator Restraint

1. Insert the end of the stator restraint tube into the hole in the MVSR or PVSR.

2. Attach the plastic end of the stator restraint to the end of the encoder module using two M4 x 0.7, 10 mm length SHCS.

3. Torque screws to 25 in·lb (2.8 N·m).

Notes

It may be useful to use an angular measuring device to confirm that the magnetic sheet is properly aligned with the center axis of the wheel.

Stator Cable

1. Attach the female connector end on the stator cable to the male connector on the WPT sensor.

2. Route the stator cable along the stator restraint tube, securing it with zip-ties.

3. Secure the cable to the body of the vehicle.

4. Wrap fusion tape around the connector and receptacle.

Notes

Do not route the cable through the MVSR.

Leave enough slack in the cable to accommodate the full wheel travel. The cable must be routed so that the bend radius of the cable is greater than 2.25 in [57 mm] for the entire travel of the wheel.

Fully-installed example

Technical Considerations

Encoder Signal Conditioners

Michigan Scientific Corporation manufacturers encoder signal conditioners which can be used to convert the digital pulses of the WPT sensor encoder to other signal formats. The EC-LV and EC-SC are small enclosures that can be added in-line with the stator cable and do not require any additional programming. The EC-LV converts digital pulses to linear voltages and the EC-SC converts digital pulses to digital sine and cosine waves.

Specifications

Electrical Specifications

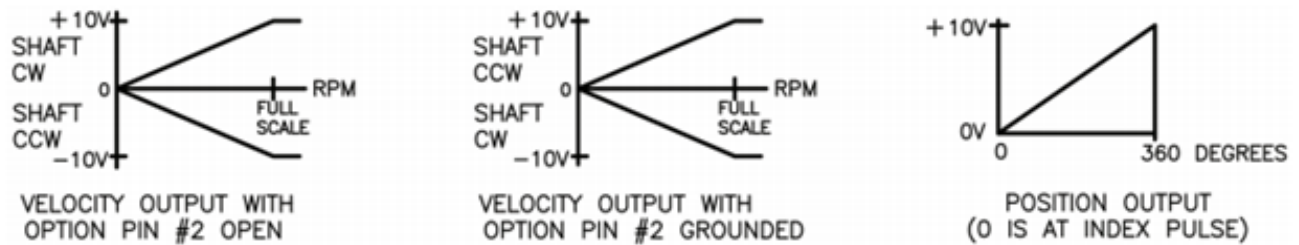|	
Input Voltage	+5 to +20 Vdc
Maximum Input Current	270 mA
Output Type (Angular Position)	0-10 Vdc
Output Type (Angular Velocity)	± 10 Vdc
Output Type (Sine-Cosine)	10 V peak-to-peak
Reverse Voltage Protection	20 Vdc

Mechanical Specifications

|	
Size (W x D x H)	5.6 in x 3.7 in x 2.2 in (142 mm x 94 mm x 56 mm)
Weight	12.4 oz (351 g)
Temperature Range	-40 °F to 212 °F (-40 °C to 100 °C)
Protection Rating	IP40
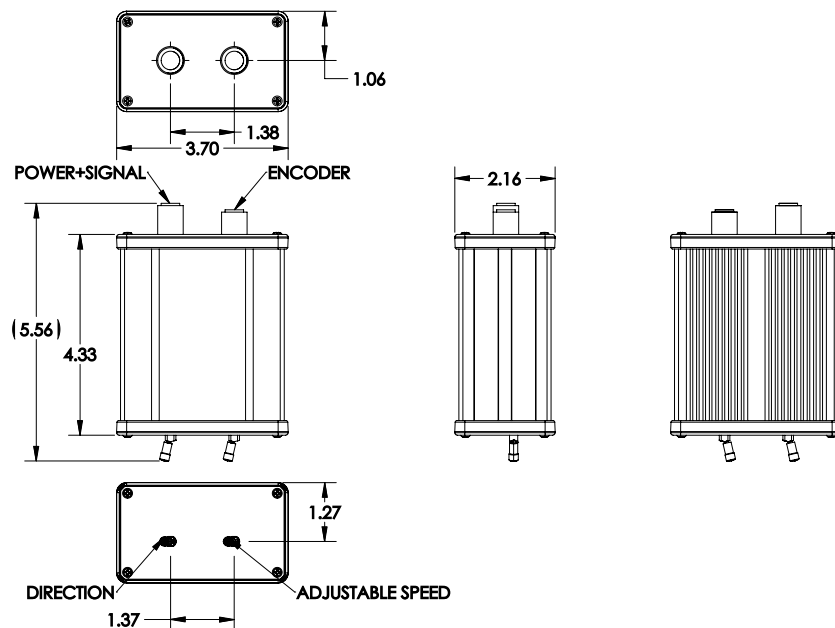
EC-LV Linear Voltage Conditioner

The EC-LV conditioner converts 0-5 V digital pulses to linear voltages proportional to angular position and angular velocity. The external switches allow the user to select the speed range and direction of rotation. It outputs angular position and velocity signals in addition to the encoder signals.

VELOCITY OUTPUT WITH
OPTION PIN #2 OPEN

VELOCITY OUTPUT WITH
OPTION PIN #2 GROUNDED

POSITION OUTPUT
(0 IS AT INDEX PULSE)

EC-SC Sine-cosine Conditioner

The EC-SC conditioner converts 0-5 V digital pulses to digital sine and cosine waves. The sine and cosine waves are 90° out of phase and one complete cycle is equivalent to one revolution of the vehicle wheel. The output voltages are 10 V peak-to-peak. The EC-SC has an external switch to select the direction of rotation.
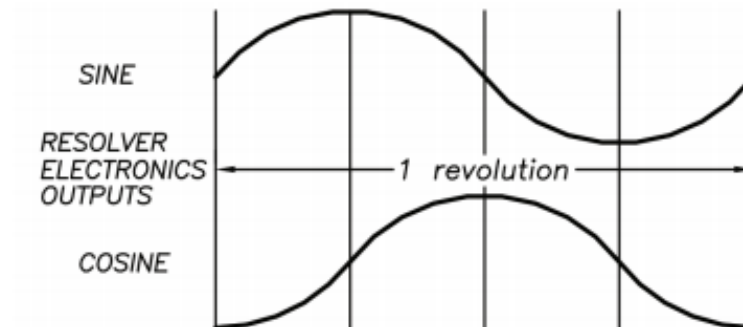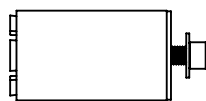
Mechanical Considerations

Quick Connect Lug Nut Collet Extensions

Michigan Scientific offers a wide variety of Quick Connect Lug Nut Collets that mount wheel adapter plates directly to a vehicle's original lug nuts. The table below shows the standard sizes available.
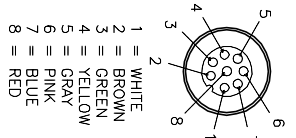
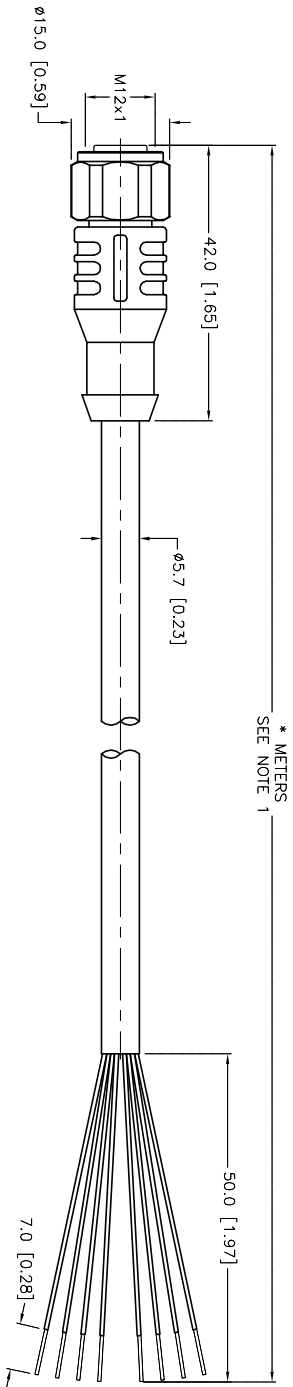| Quick Connect Collet Lug Nut Extension Specifications				
Model	Min. Lug Size (inch [mm])	Max. Lug Size (inch [mm])	Available Lengths (inch [mm])	Outside Diameter (inch [mm])
AAA	0.560 [14.2]	0.625 [15.9]	1.625, 2.500 [41.3], [63.5]	0.945 [24.8]
AA	0.625 [15.9]	0.688 [17.5]	1.625, 2.500 [41.3], [63.5]	0.945 [24.8]
A	0.688 [17.5]	0.75 [19.1]	1.470, 1.625, 2.000, 3.000 [37.3], [41.3], [50.8], [76.2]	1.100 [27.9]
AB	0.728 [18.5]	0.787 [20.0]	1.625 [41.3]	1.125 [28.6]
BB	0.765 [19.4]	0.825 [21.0]	2.125, 3.000 [54.0], [76.2]	1.270 [32.3]
B	0.813 [20.7]	0.875 [22.2]	2.125, 3.000 [54.0], [76.2]	1.270 [32.3]
B-SS	0.813 [20.7]	0.875 [22.2]	2.125 [54.0]	1.220 [31.0]
CCC	0.875 [22.2]	0.938 [23.8]	2.125, 3.000 [54.0], [76.2]	1.302 [33.1]
CC	0.921 [23.4]	0.984 [25.0]	2.125, 3.000 [54.0], [76.2]	1.470 [37.3]
C	1.000 [25.4]	1.063 [27.0]	2.125, 3.000 [54.0], [76.2]	1.470 [37.3]
DD	1.125 [28.6]	1.188 [30.2]	3.000 [76.2]	1.630 [47.4]
D	1.250 [31.8]	1.310 [33.3]	2.875 [73.0]	1.850 [47.0]
D-HS	1.250 [31.8]	1.310 [33.3]	3.250 [82.6]	1.875 [47.6]
DF	1.475 [37.5]	1.535 [39.0]	3.250 [82.6]	2.186 [55.6]
F	1.563 [38.3]	1.625 [41.3]	3.250 [82.6]	2.186 [55.6]

Quick Connect Lug Nut Collet

FEMALE END VIEW

1 = WHITE
2 = BROWN
3 = GREEN
4 = YELLOW
5 = GRAY
6 = PINK
7 = BLUE
8 = RED

Ø15.0 [0.59]

M12x1

42.0 [1.65]

Ø5.7 [0.23]

* METERS
SEE NOTE 1

50.0 [1.97]

7.0 [0.28]

SPECIFICATIONS

CONTACT CARRIER MATERIAL	NYLON OR TPU
MOLDED HEAD MATERIAL/COLOR	TPU/YELLOW
CONTACT MATERIAL/PLATING	BRASS/GOLD
COUPLING NUT MATERIAL/FINISH	STAINLESS STEEL/PASSIVATED
RATED CURRENT [A]	2.0 A
RATED VOLTAGE [V]	60 VAC/75 VDC
OUTER CABLE JACKET MATERIAL/COLOR	TPU/GRAY
CONDUCTOR INSULATION MATERIAL	PVC
NUMBER OF CONDUCTORS [AWG]	8x24 AWG
TEMPERATURE RANGE	−40°C to +90°C (−40°F to +194°F)
PROTECTION CLASS	NEMA 1,3,4,6P AND IEC IP68, IP69K

CABLE LENGTH

CABLE LENGTH	TOLERANCE*
ALL LENGTHS	+ 4% (OR 50mm) OF LENGTH − 0% (OR 0mm) OF LENGTH WHICHEVER IS GREATER

STRIP LENGTH

STRIP LENGTH	TOLERANCE*
0–7mm	±0.5mm
8–29mm	±1.0mm
30–49mm	±2.0mm
50–69mm	±3.0mm
70–100mm	±4.0mm
OVER 100mm	±5.0mm

* UNLESS OTHERWISE SPECIFIED

NOTES:

1. "*" INDICATES CABLE LENGTH IN METERS. CONTACT TURCK TO ORDER SPECIFIC LENGTHS.

2. "/S90" DESIGNATES POLYURETHANE (TPU) CABLE.

RELATED DOCUMENTS
1.
2.
3.
4.

MATERIAL   SEE SPECIFICATIONS

FINISH   SEE SPECIFICATIONS

3RD ANGLE PROJECTION

ALL DIMENSIONS DISPLAYED ON THIS DRAWING ARE FOR REFERENCE ONLY

CONTACT TURCK FOR MORE INFORMATION

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DRFT   RWC
DSGN

DATE 06/01/07

DESCRIPTION

IDENTIFICATION NO.

UNIT OF MEASUREMENT
MILLIMETER [INCH]

SCALE   1 = 1.0

DO NOT SCALE THIS DRAWING

SOURCE DRAWING - FOR REFERENCE ONLY

DESCRIPTION   RKCV 8T−*/S90

FILE: 77010369

REV D

SHEET 1 OF 1

REV	DESCRIPTION	BY	DATE	ECO NO.
D	DRAWING PROCESSED AS PART OF ECO 33971	CBM	04/06/11	33971

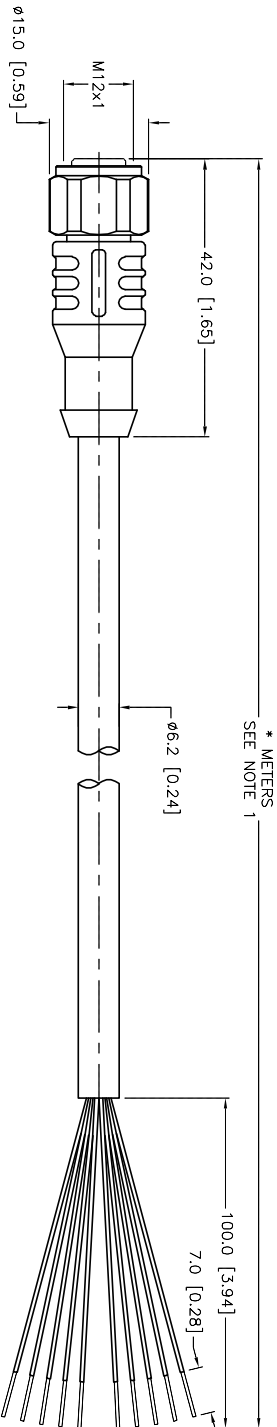## FEMALE END VIEW

1 = WHITE
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4 = YELLOW
5 = GREY
6 = PINK
7 = BLUE
8 = RED
9 = ORANGE
10 = TAN

M12x1

Ø15.0 [0.59]

42.0 [1.65]

Ø6.2 [0.24]

* METERS
SEE NOTE 1

100.0 [3.94]

7.0 [0.28]

CABLE LENGTH

CABLE LENGTH	TOLERANCE*
ALL LENGTHS	+ 4% (OR 50mm) OF LENGTH − 0% (OR 0mm) OF LENGTH WHICHEVER IS GREATER

STRIP LENGTH	TOLERANCE*
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REV	DESCRIPTION	BY	DATE	ECO NO.
E	UPDATE COUPLING NUT	NF	02/21/20	75678

SPECIFICATIONS

CONTACT CARRIER MATERIAL	NYLON OR TPU
MOLDED HEAD MATERIAL/COLOR	TPU/YELLOW
CONTACT MATERIAL/PLATING	BRASS/GOLD
COUPLING NUT MATERIAL/FINISH	STAINLESS STEEL/PASSIVATED
RATED CURRENT [A]	2.0 A
RATED VOLTAGE [V]	60 VAC/75 VDC
OUTER CABLE JACKET MATERIAL/COLOR	TPU/GRAY
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TEMPERATURE RANGE	−40°C to +90°C (−40°F to +194°F)
PROTECTION CLASS	NEMA 1,3,4,6P AND IEC IP68, IP69K

RELATED DOCUMENTS

1.
2.
3.
4.

MATERIAL	SEE SPECIFICATIONS
FINISH	SEE SPECIFICATIONS

3RD ANGLE PROJECTION

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CONTACT TURCK FOR MORE INFORMATION

DRFT	RWC	DATE 05/16/07
APVD		SCALE 1=1.0

UNIT OF MEASUREMENT
MILLIMETER [INCH]

TURCK

3000 CAMPUS DRIVE
MINNEAPOLIS, MN 55441
1−800−544−7769
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(763) 553−0708 fax
www.turck.us

SOURCE DRAWING - FOR REFERENCE ONLY

DESCRIPTION
RKCV 10T−*/S90

IDENTIFICATION NO.

FILE: 777010374

DO NOT SCALE THIS DRAWING

REV	E
SHEET	1 OF 1