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TURCK

EZ-track® LTX R10 Series SSI Output

Manual

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NOTE:

Turck has checked the accuracy of this manual at the time it was approved for printing. This manual may not provide all possible ways of installing and maintaining the EZ-track. Any errors or additional possibilities to the installation and maintenance of the EZ-track will be added in subsequent editions. Comments for the improvement of this manual are welcome.

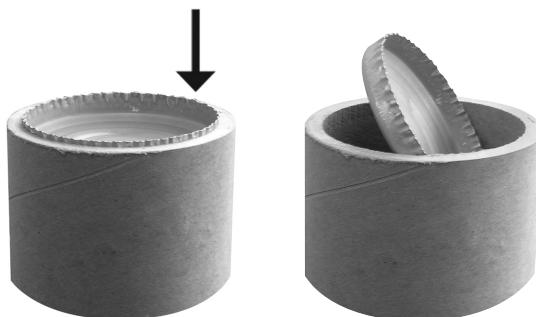
Turck reserves the right to revise and redistribute the entire contents or selected pages of this manual. All rights to the contents of this manual are reserved by Turck.

Unpacking

Carefully remove the contents of the shipping carton and check each item on the packing slip before destroying the packing materials. Any damage must be reported to the shipping company. If you do not receive all of the parts, contact Turck at 800-544-7769.

Most probes are shipped in a tube. To remove the metal end cap, use a large, flat blade screw driver or a metal rod and tap on the inner edge of the cap until it pivots. Grab the cap and pull it out. Use caution as the edge of the metal cap may be sharp.

If it is necessary to ship the probe after you have removed it from it's original packaging, it is recommended that you reuse the tube that it was shipped in or repackage the EZ-track in such a way that it cannot be damaged in transit.



Chapter 1: LTX R10 SSI Overview

The LTX R10 SSI is a magnetostrictive Linear Displacement Transducer (EZ-track) for highly accurate continuous machine positioning in a variety of industrial applications.

The LTX R10 SSI provides a Synchronous Serial Interface output signal that is proportional to the position of the magnet assembly along the length of the probe.

This sensor is built to withstand the most severe environmental conditions and is completely absolute. This means that power loss will not cause the unit to lose position information or require re-zeroing. The non-contact design allows this device to be used in highly repetitive applications without mechanical wear.

Features

The LTX R10 SSI has auto-tuning capability. This is the ability to sense a magnet other than the standard ring magnet and adjust its signal strength accordingly.

There is an indicator LED that is located at the connector end of the probe and provides visual status information regarding the operation of the probe. Green indicates proper or normal operation. Red indicates the loss of the magnetic signal or a probe failure. When the probe is in the normal mode of operation, the LED will remain illuminated green continuously.

LED Colors*	
Green	Magnet is present and within the active range.
Red	Fault, the EZ-track has lost its signal from the magnet or the magnet has moved into the Null Zone or Dead Band.
*Refer to diagnostics on page 13 for a complete list of LED colors and functions.	

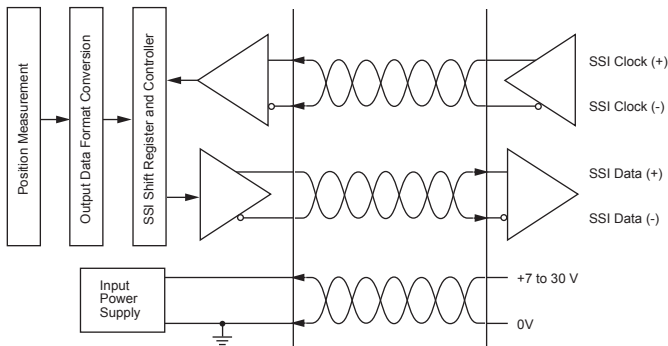
NOTE:

The series number on your EZ-track is a record of all the specific characteristics that make up your unit. This includes what interface type it has, its output signal and range, the type of connector the unit uses, and stroke length. For a translation of the model number, see Section 3.5 Part Number Key.

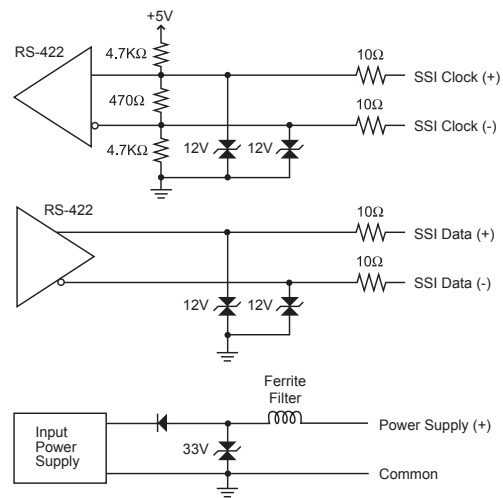
SSI (Synchronous Serial Interface)

The displacement value (position) is encoded into a 24, 25 or 26 Bit format and transmitted at high speeds. Synchronization in a closed loop system is made easy. A clock pulse train from a controller is used to shift out sensor data: one bit of position data is transmitted to the controller for one clock pulse received by the sensor. The absolute position data is continually updated by the sensor and converted by the shift register into serial information.

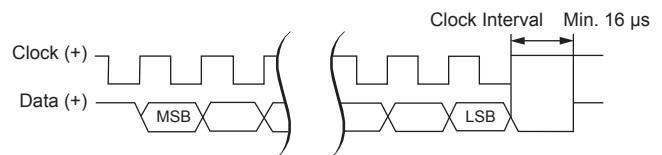
SSI Logic Diagram



SSI Sensor Input

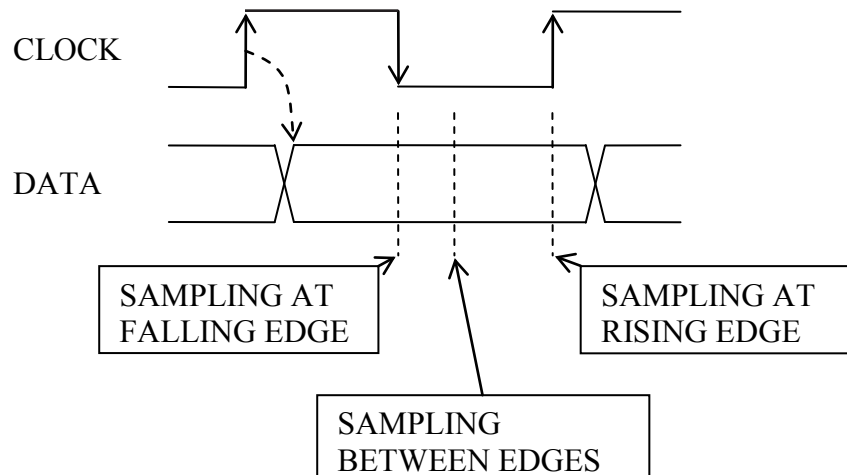


SSI Timing Diagram



Note: Based on Turck cordset number RKC 6T-30/S618

New data is placed on the "data" signal 605ns after the rising edge of the "clock" signal. This time, plus the delay caused by cable length, must be considered when determining the setup times (frequency) of the controller.



Chapter 2: Installing the EZ-track

When mounting an EZ-track, it is recommended that the measuring rod not be mounted within 0.25" of any ferromagnetic material (metal that can be magnetized). If the surrounding metal becomes magnetized, it can cause inaccurate measurement of the position magnet.

Non-ferrous materials, such as brass, copper, aluminum, non-magnetic stainless steel, or plastics, can be in direct contact with the magnet assembly and rod end without producing any adverse results.

2.1: Installing the EZ-track to a Mounting Bracket

Parts discussed in this section can be found in Figures 1-1 and 2-1.

1. Unscrew the EZ-track's jam nut from the threads protruding from the hex mounting base.
2. Insert the EZ-track's rod end into the mounting bracket's hole. The mounting bracket may contain a 3/4-16 UNF-2B threaded hole. In this case, screw the EZ-track into this hole using the threads protruding from the hex mounting base.
3. Once the EZ-track is in place, screw the jam nut back onto the threads of the hex mounting base. Use the 1.75" hex mounting base on the head assembly to tighten the EZ-track to the bracket.

WARNING:

Do not use the black aluminum cover of the head assembly to tighten the EZ-track within the bracket (see Figure 2-1). This may damage the EZ-track and will void your warranty. To tighten the EZ-track within the bracket, use the 1.75" hex mounting base on the head assembly.

If the length of the EZ-track's rod end is less than 30", skip to the sub-section: Mounting the Magnet Assembly.

Installing Support Brackets

It is recommended that a support bracket be used with EZ-tracks having a rod 30-71 inches in length. Supporting the end of the rod will minimize operational errors and protect against damage due to shock and vibration. If the length of the EZ-track's rod is 72" or longer, it is recommended that additional support brackets be used. These additional support brackets must be made of a non-ferrous material. Because these additional support brackets will interfere with the magnet's movement, a special split-type magnet assembly must be used. To order a split magnet (SPM-AL-R10) and support brackets (P/N MB-R10), contact the factory at 800-544-7769.

To install a support bracket for an EZ-track having a rod 30-71 inches in length, perform step 4a. If the rod is longer than 71", perform step 4b.

- 4a. If the support bracket is made of a ferromagnetic material (material readily magnetized), install the support bracket no closer than 0.25" from where the EZ-track's dead band ends and the area of stroke begins. Continue to the sub-section: Mounting the Magnet Assembly.

To install two or more support brackets for a EZ-track having a rod 72" or longer in length, perform the following steps:

- 4b. Install support brackets at increments of 48" throughout the EZ-track's rod. Support brackets placed within the Null Zone and area of stroke or closer than 0.25" to the beginning of these areas must be made of a non-ferrous material.

Mounting the Magnet Assembly

Before mounting the magnet assembly, the following should be considered:

- Ferromagnetic material should not be placed closer than 0.25" from the EZ-track's magnet assembly or rod end. Failure to do so could cause erratic operations.
- Minimal clearance between the EZ-track's rod and the magnet assembly through the full stroke is required. Stress between the magnet and the rod can cause flexing of the mounting brackets. This may result in non-linearity.
- EZ-tracks using a split magnet assembly must keep the diameter of the magnet assembly around the rod throughout the complete stroke. The diameter of this magnet assembly should not be more than 0.2" away from the rod. Split magnet assemblies outside of this range will cause signal loss.

To install the magnet assembly, perform the following steps:

1. Slide the magnet assembly over the EZ-track rod.
2. Mount the magnet to the non-ferrous, movable portion of the device being controlled using non-ferrous screws.

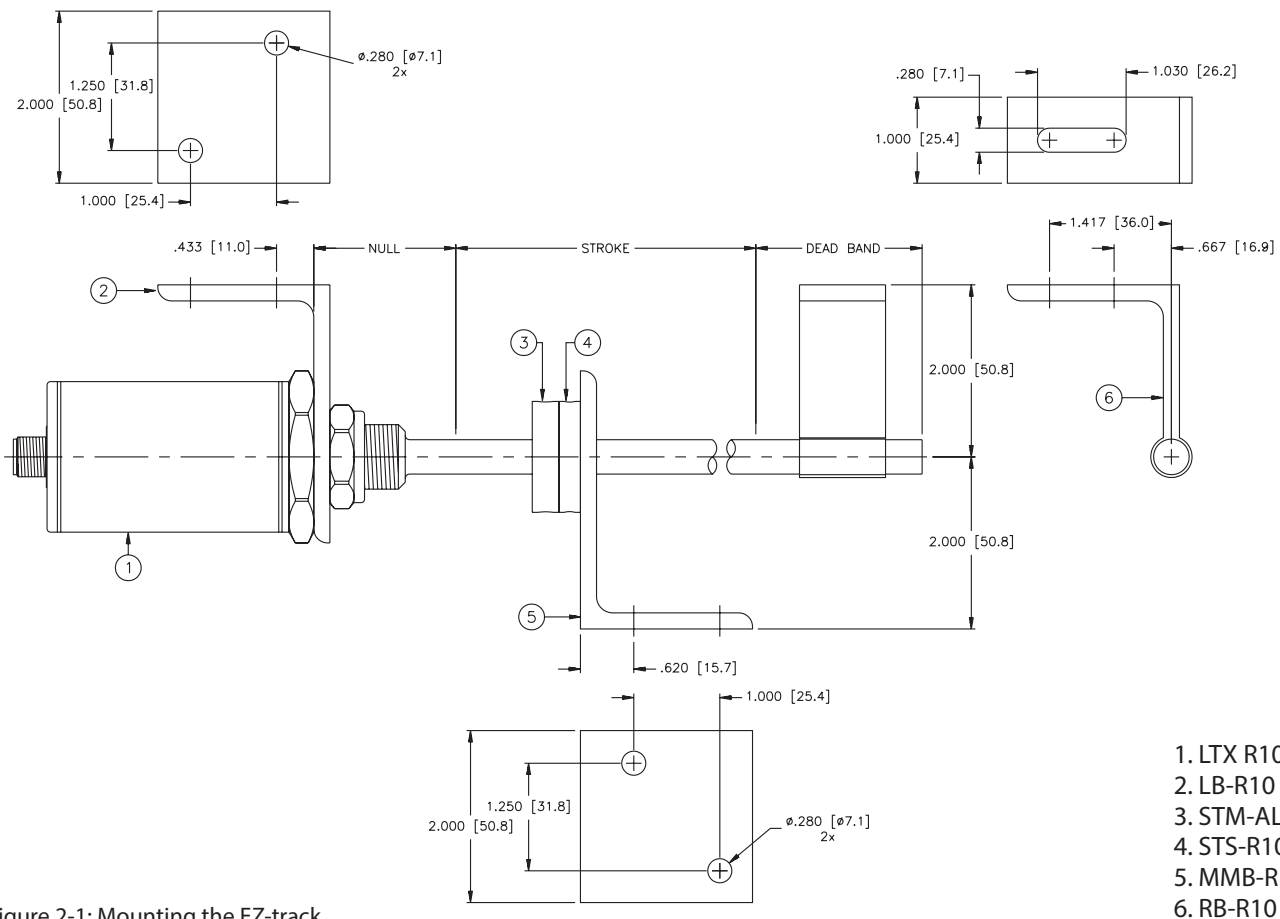


Figure 2-1: Mounting the EZ-track

2.2: Installing the EZ-track in a Hydraulic Cylinder

Before installing an EZ-track in a hydraulic cylinder, note the following considerations. Items discussed in this section are found in Figures 1-1 and 2-1.

- A non-ferrous spacer must be used to separate the magnet assembly from the head of the piston rod. See Figure 2-2.
- The magnet should not be closer than 2.0" from the base of the EZ-track's hex head when the piston rod is fully retracted. In instances where space restraints exist, it may be required to countersink the magnet into the piston rod. Two magnets are available for mounting to the piston: the standard 1.29" in diameter (P/N **STM-AL-R10**) four-hole magnet and the 1.0" magnet (P/N **CM-R10**) designed exclusively for countersunk mounting applications. The 1.0" magnet must be secured with a snap ring.
- An O-ring is provided at the base of the EZ-track's mounting hex for pressure sealing. The O-ring seal was designed to meet Mil-Std-MS33656. Refer to SAE J514 or SAE J1926/1 for machining of mating surfaces.
- A chamfered rod bushing in front of the magnet may be required. It is recommended that a chamfered rod bushing be used with EZ-tracks having a rod 60.0" or longer. This bushing will prevent wear on the magnet assembly (wear occurs as the piston retracts from extended lengths). This rod bushing should be manufactured from a high wear polymer, such as PTFE.
- It is recommended the bore for the cylinder piston rod have an inside diameter of at least 0.50". The EZ-track rod has an outside diameter of 0.405". Use standard practices for machining and mounting these components. Consult the cylinder manufacturer for details on applicable SAE or military specifications.

It may be necessary to perform machining and mounting operations on the hydraulic cylinder before installing the EZ-track. Consult the information and specifications provided by the cylinder manufacturer before beginning the following steps:

1. Unscrew the EZ-track's jam nut from the threads protruding from the hex mounting base.
2. Position the non-ferrous spacer against the piston face, followed by the magnet, and then the chamfered rod bushing if the EZ-track's rod is 60.0" or longer in length.
3. Insert non-ferrous screws through the chamfered rod bushing (if used), magnet, and non-ferrous spacer. Secure items by tightening screws.

If the leading edge of the magnet will come closer than 2.0" from the base of the EZ-track's hex head when the piston rod is fully retracted, it will be necessary to counterbore the magnet assembly into the piston rod. Both the standard 1.29" four-hole magnet assembly (P/N **STM-AL-R10**) and the 1.0" magnet assembly (P/N **CM-R10**) are designed for counterbored mounting applications. If it has a 1.0" magnet assembly, a snap ring will be needed to hold it in place.

4. Insert the EZ-track's rod into the hole of the hydraulic cylinder's mounting bracket.

The protective plug may need to be removed from the hydraulic cylinder before inserting the EZ-track. The end cap should contain a 3/4-16 UNF-2B threaded hole (M18 x 1.5 for metric units). Screw the EZ-track into this hole using the threads protruding from the EZ-track's hex mounting base.

WARNING:

Do not use the black aluminum cover of the head assembly to tighten the EZ-track within the bracket (see Figure 2-1). This may damage the EZ-track and will void your warranty. To tighten the EZ-track within the bracket, use the 1.75" hex mounting base on the head assembly.

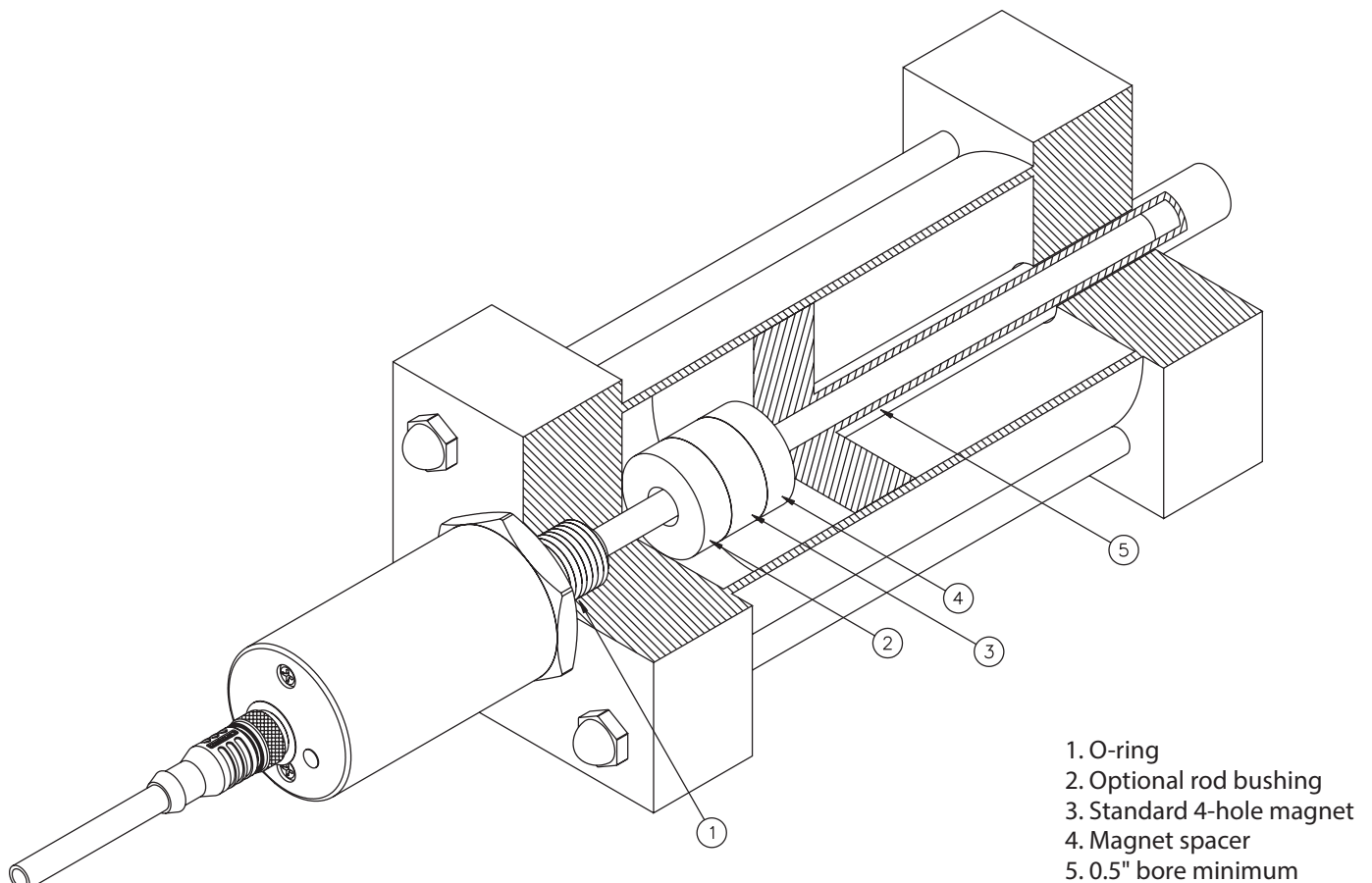


Figure 2-2: Mounting EZ-track in a Hydraulic Cylinder

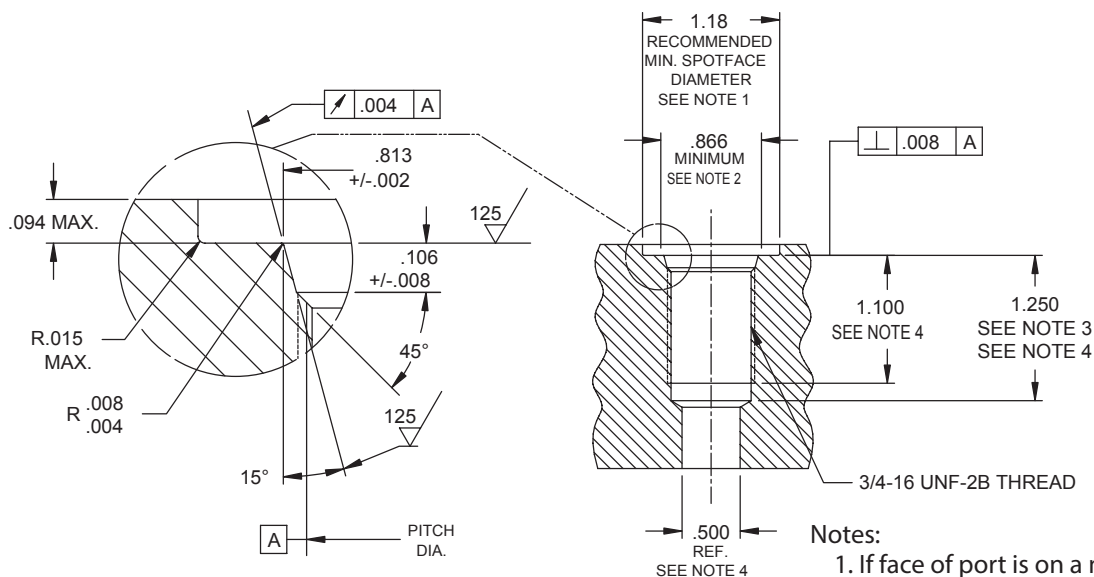


Figure 2-3: Port Detail (SAE J1926/1)

Notes:

1. If face of port is on a machined surface, dimensions 1.180 and .094 need not apply as long as R.008/.0004 is maintained to avoid damage to the o-ring during assembly.
2. Measure perpendicularity to A at this diameter.
3. This dimension applies when tap drill cannot pass through entire boss.
4. This dimension does not conform to SAE J1926-1.

Chapter 3: Wiring

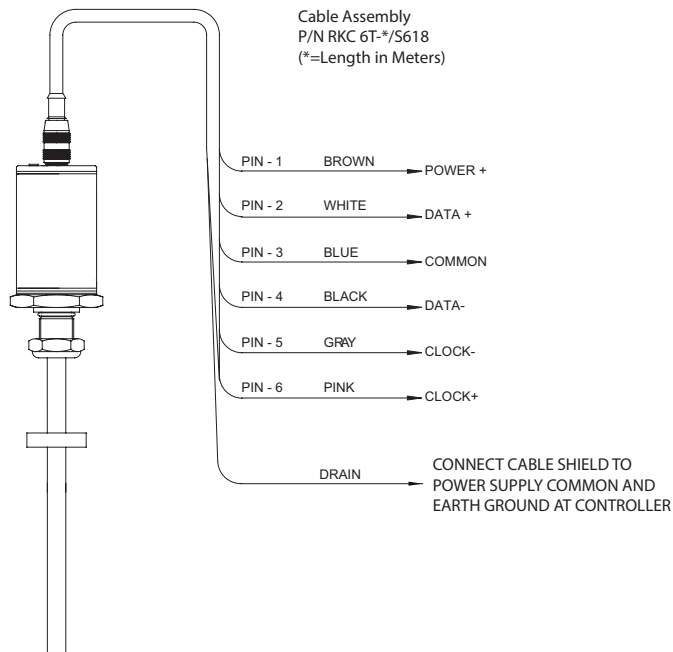


Figure 3-1: Wiring for Connector Option H1161, 6 pin **eurofast®**

3.1 Wiring Connections

Once the EZ-track has been installed, wiring connections can be made. There are two groups of connections you will need to make. They are as follows:

- Power Supply Connections
(including ground and shield)
- EZ-track Input/Output Connections

The LTX R10 SSI standard cable is a 6 Pin, 12mm, eurofast cordset. It has 6 conductors of 24 AWG, with an aluminum/polyester/aluminum foil with drain wire. Cable O.D. is .230 inch. To reduce electrical noise, the shield must be properly used. Connect the cable's shield to the controller system GND.

Always observe proper grounding techniques such as single point grounding and isolating high voltage (i.e. 120/240 VAC) from low voltage (7-30 VDC cables). Whenever possible, this cable should be run in conduit by itself. The power supply common, the cable shield and a good earth ground should be connected together at the location of the power supply common.

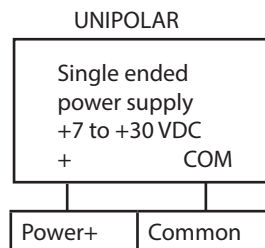


Figure 3.5 Power Supply Wiring

WARNING:

Do not route the LTX R10 SSI output cable near high voltage sources.

In order for the LTX R10 SSI to operate properly, the EZ-track's external power supply must provide a voltage between +7 to +30 VDC. The power supply must be rated at 150mA minimum. The power supply should provide less than 1% ripple and 10% regulations. (The power supply should be dedicated to the EZ-track to prevent noise from external loads from affecting the position readings.)

Chapter 3: Wiring Connections (Continued)

Cable lengths

Turck recommends that the maximum cable length be 10 meters. Cables greater than 10 Meters are available; however, proper care must be taken during installation.

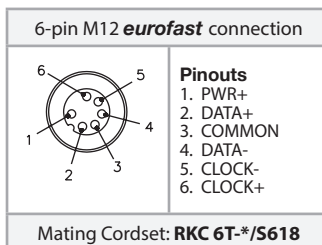
Any extension to the existing cabling should be mounted in a junction box free of any other cabling, the cable should be a twisted shielded pair with a braided shield. The shield should pass straight thru this enclosure and not tied to ground. When grounding the EZ-track, a single earth ground should be connected to the power supply common. The EZ-track power supply common should be connected to the power supply common (-) terminal. The EZ-track's shield should be tied to the earth ground at the power supply.

Cable length limitations are based on SSI clock frequencies. Apply good industry practices for long cable runs - keep cable away from high power AC lines and all motor drive cables.

Cable Length		Controller Data Sampling	
		Falling Edge	Rising Edge
6 ft	1.83 m	750 kHz	1500 kHz
30 ft	9.14 m	650 kHz	1300 kHz
100 ft	30.48 m	500 kHz	1000 kHz
150 ft	45.72 m	400 kHz	800 kHz
300 ft	91.44 m	270 kHz	540 kHz
600 ft	182.88 m	160 kHz	320 kHz
1200 ft	365.76 m	90 kHz	180 kHz

R10 SSI Wiring Diagram

- 1. = Brown
- 2. = White
- 3. = Blue
- 4. = Black
- 5. = Gray
- 6. = Pink



Note: Minimum SSI clock frequency rate is 70 kHz.

Chapter 3: Wiring Connections (Continued)

Startup

1. Verify connections

The LTX R10 SSI is reverse polarity protected; however, components can be damaged from improper connections or over voltage. Before applying power verify connections are correct.

2. Turning on power

Note that the system may execute uncontrolled movement when power is first applied when the LTX R10 SSI is part of a closed loop system whose parameters have not yet been configured.

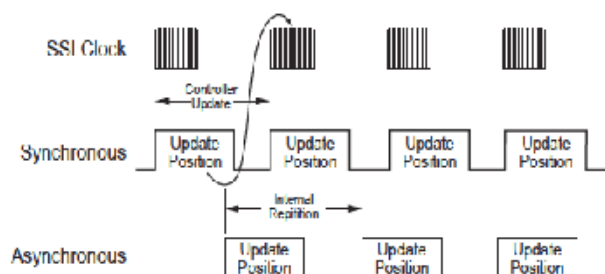
Position Update

The position of the magnet on the rod is precisely determined by a time of flight method. The LTX R10 SSI converts this position value to a 24, 25, or 26 bit Binary or Gray code data stream where it is transmitted to the host controller via SSI. All displacement outputs are absolute and do not lose their position after loss of power.

Position update frequencies are available up to 6500 measurements per second (Length dependant) in Asynchronous mode, and are controller dependant in the Synchronous mode. However, if the controller interrogates the Ez-track quicker than the LDT can provide data, the LTX R10 SSI will automatically switch to the Asynchronous mode and supply the host controller with the most up to date positional information.

Synchronous Update Mode

A clock pulse train from the host controller is used to shift out sensor data, one bit of positional data is transmitted to the controller for each clock pulse received by the sensor. The first clock pulse edge from the host controller signals the Ez-track to make a measurement. The positional data from this measurement will be used during the next controller update cycle.



Note:

The data in this mode will always be one update cycle old.

Asynchronous Update Mode

The LTX R10 SSI takes measurements at its preset internal interrogation rate (length dependant) and provides information when requested from the host controller.

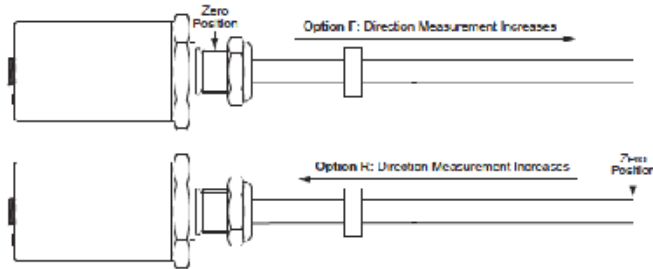
Note:

If the controller or interface module does not specify Synchronous mode, we recommend using the LDT in the Asynchronous mode.

Chapter 3: Wiring Connections (Continued)

Direction

The LTX R10 SSI can be configured increasing, decreasing, position, or velocity. Option “F” (Measure Direction Forward) will increase counts as the magnet moves from the head of the LDT to the tip. Option “R” will be exactly opposite. The zero position will be located in the mounting threads. This is an area where it is physically impossible to detect a magnetic signal. If the LTX R10 SSI is in the “Measure Direction Reverse” option, the zero point will be at the far tip of the LDT, again a position that the magnet cannot be detected. If the velocity option is selected, the unit will output velocity and not displacement.



Resolution

The resolution of the positional output is selectable in the part number and can be ordered in English (Imperial) or metric units. Selections 1 thru B are valid options. Refer to section 3.5 Part Number Key for further details.

3.2 Features

Automatic Gain Control

The Automatic Gain Control feature will automatically search and find the magnet on power up. If power is applied without a magnet on the EZ-track, the LED will turn RED indicating no magnet signal is detected. Turn power off and place magnet within the active stroke area. Re-apply power.

Diagnostics

The LTX R10 SSI is equipped with a tri-color LED next to the connector to help while troubleshooting. The chart below explains the possible LED colors and the faults they represent.

Note:

If there is ever a loss of magnet, the LED will turn red and the unit will transmit a position of zero.

LTX R10 LED Output Summary	
Output	SSI
Flashing Red	Flash memory corrupt
Flashing Red/Green	EE memory corrupt
Flashing Yellow	Communication/programming mode
Fast Flashing Yellow	Clock input held asserted at power up
Solid Red	No magnet signal detected
Green/Red Blip (1s to 0.12s)	Max Gain but signal detected and within range
Solid Green	Normal probe operation; magnet signal and SSI clock operational
Solid Yellow	No SSI clock pulses detected
Yellow/Red Blip (1s to 0.12s)	SSI clock pulses do not match EZ-track SSI data length
Green/Yellow Blip (1s to 0.12s)	EZ-track data not synchronous with controller (if EZ-track is programmed for synchronous mode)

Alarm Bit

The LTX R10 can be configured to output a fault bit should there be a problem with the EZ-track. Consult Factory.

3.3 Troubleshooting for LTX R10 SSI

Troubleshooting describes common problems that may occur when installing the EZ-track and offers possible solutions to these problems. If, after reading this appendix, you are unable to resolve a problem, contact our application support department at 1-800-544-7769.

General Checks

Make sure that the magnet is located within the EZ-track's active stroke area. Magnet assemblies should be positioned so that they can move freely over the entire area of the active stroke without binding or pushing on the rod.

NOTE:

Ferromagnetic material (material readily magnetized) should be located no closer than 0.25" from the sensing surface of the EZ-track. This includes mounting brackets, magnet spacers, magnet brackets, and mounting screws. Ferromagnetic material can distort the magnetic field, causing adverse operation or failure of the EZ-track.

Check all EZ-track wires for continuity and/or shorts. It is preferable that the cable between the EZ-track and the interface device be one continuous run. If you are using a junction box, it is highly recommended that the splice junction box be free of AC and/or DC transient-producing lines. The shield should be carried through the splice and terminated at the interface device end.

Power Supply Check

This will help you to determine if your power supply is adequate for the EZ-track to operate properly, or if the EZ-track's cable has a short or open.

In order for the LTX R10 SSI to operate properly, the external power supply must provide a voltage level between 7 to 30 VDC. A power supply providing voltage above this specified range may damage the EZ-track. A power supply providing power below this specified range will not be sufficient to power the EZ-track. When powering more than one LTX R10 SSI on a single power supply, remember that each LTX R10 SSI typically requires 1 watt of power*. The amount of current draw will vary based on the input voltage, as well as other operating parameters. To approximate the current draw for a particular EZ-track, divide the EZ-track wattage by the input voltage. For example, 1 watt divided by 24 VDC equals 40mA.

* See Section 3.4 page 15: Specifications for more information on power consumption.

If your EZ-track is not operating properly, the EZ-track's cable may have an open or short, or the power supply is not supplying sufficient power. To verify this, perform the following steps:

1. Turn the power supply off.
2. Remove the mating connector from the EZ-track.
3. Turn the power supply on.
4. Using a digital voltmeter, check from the Power Supply Common to the Power Supply + on the mating end of the cable for a level between +7 and +30 VDC.

If reading is between 7 and 30 VDC, turn power supply off and go to step 7. If reading is below 7 VDC, either your power supply is not providing enough power or the EZ-track's cable possibly has a short/open. Readings of no voltage or minimal voltage (less than 5 volts) may be due to short/open in the cable. If reading is NOT between 7 and 30 VDC, go to step 5. If reading is above 30 VDC, adjust power supply or replace.

5. Turn the power supply off.
6. Check the continuity of the individual wires of the cable between the power supply and the EZ-track. Check for continuity from one end of the cable to the other. Also verify that no shorts exist between pins.
7. Reconnect the mating connector to the EZ-track.
8. Turn power supply on.
9. Using a digital voltmeter, check the power supply's "+" and "-" terminals for a voltage between 7 and 30 VDC.

Low voltage readings may indicate a power supply with a wattage (current) rating that is too low. (Each EZ-track requires approximately 1.3 watts). If the cabling checks out in step 6 and your voltage is below 7 VDC, check your power supply current rating. If voltage is between 7 to 30 VDC and the EZ-track is still inoperative, contact factory.

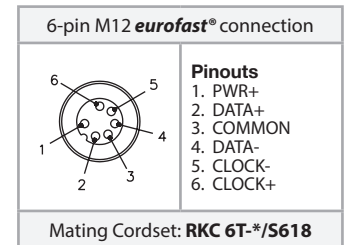
3.4 Specifications

LTX R10 SSI Specifications:

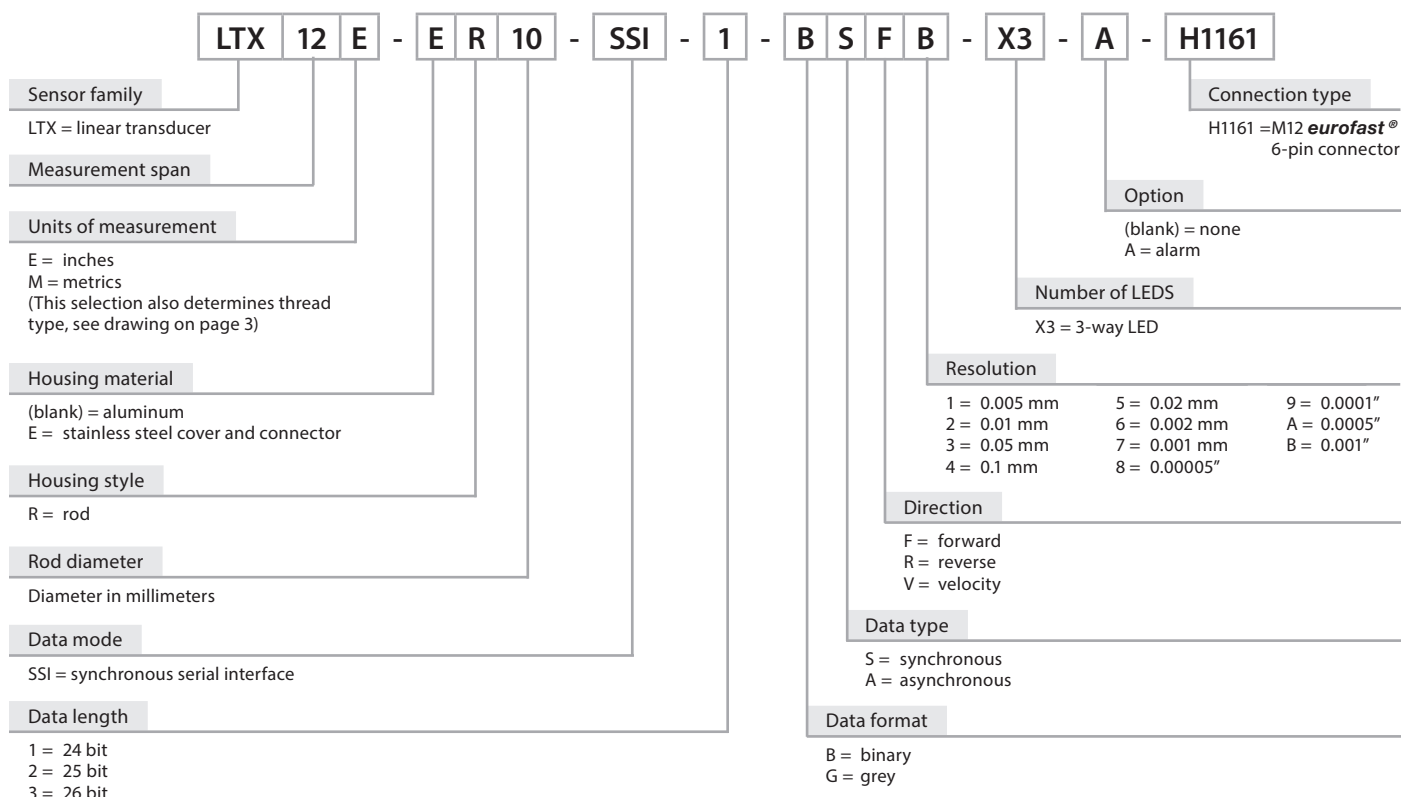
	SSI
Output:	24, 25 or 26 Bit, Binary or Gray Code
Span:	1-300"
Repeatability:	Equal to output resolution
Resolution:	English: 0.00005", 0.0001", 0.0005", 0.001" Metric: 1, 5, 10, 20 micron
Operating Temperature:	Head(Electronics): -40 to 185°F (-40 to 85°C) Guide Tube: -40 to 221°F (-40 to 105°C)
Storage Temperature:	-40 to 221°F (-40 to 105°C)
Null Zone:	2.00"
Dead Zone:	2.50"
Operating Pressure:	5,000 PSI operating, 10,000 PSI spike
Operating Voltage:	7-30 VDC
Current Consumption:	1.3 watt typical at 1ms interrogation time. Power consumption increases as interrogation times increase. 53 mA at 24 VDC typical
Response Time:	4.0 K measurements/sec. (span length 1-12") 2.4 K measurements/sec. (span length 13-30") 2.0 K measurements/sec. (span length 31-40") 1.1 K measurements/sec. (span length 41-80") 0.5 K measurements/sec. (span length 81-197")
Shock:	1000 G
Vibration:	30 G
Hysteresis:	0.001"
Non-Linearity	< 0.01% or +/-0.005", whichever is greater
Rod End / Mounting Hex:	316 stainless steel, 0.405" (10.29 mm) outer diameter
LED:	Tri-color diagnostic
Protection Rating:	IP68
Agency Approval:	CE

R10 SSI Wiring Diagram

1. = Brown
2. = White
3. = Blue
4. = Black
5. = Gray
6. = Pink



3.5 Part number key: SSI R10 rod style series



NOTE: Contact our Application Support at 1-800-544-7769 for custom configurations.

Accessories

Standard 4-Hole Magnet - Al.....STM-AL-R10
 Standard 4-Hole Magnet - SST.....STM-SS-R10
 Standard Magnet SpacerSTS-R10
 Split Magnet - AlSPM-AL-R10
 Split Magnet - SSTSPM-SS-R10
 Split Magnet SpacerSPS-R10
 Cylinder MagnetCM-R10
 Mounting Bracket KitMB-R10
 Rod Support Bracket.....RB-R10
 Magnet Mount BracketMMB-R10


Egg Shape Float - SST.....EF-R10
 Miniature Float - SSTMF-R10
 2 meter Cable, Straight CordsetRKC 6T-2/S618
 4 meter Cable, Straight CordsetRKC 6T-4/S618
 2 meter Cable, Right Angle CordsetWKC 6T-2/S618
 4 meter Cable, Right Angle CordsetWKC 6T-4/S618

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