FAQs - Position Transducers

Here is a series of frequently-asked questions (FAQs) regarding the selection and use of our position transducers. If you have questions not answered here or in our literature, please contact us by phone, fax, or e-mail or make a technical support request.

ACCURACY
Q. What is the accuracy of your products?

A. We do not generally state the accuracy of our products due to these reasons:

- The term "accuracy" has evolved to where it has several meanings.
- "Accuracy" needs to be defined in regards to a specific environment: temperature range, shock and vibration, duration, pressure, and other variables. A simple one-line entry on a data sheet does not allow for this information.
- "Accuracy" is seldom an important criteria when making sensor purchasing decisions. In the majority of situations, linearity, repeatability, and hysteresis are far more important than is accuracy.

If you would like us to help characterize the accuracy of our products for your specific application, please contact us. To learn more about accuracy and contributors to accuracy, consider reading these Web documents:

- Application Note for Draw Wire Transducer Accuracy
- Introduction to Sensor Terminology
- Errors in Physical Measurements
- Classification of Measurement Errors

ELECTRICAL CONNECTOR AND SPLICING FOR 30 AWG ELECTRICAL WIRE
Q. Your subminiature position transducers use a very small electrical wire size of 30 AWG. Can you recommend an appropriate electrical connector or splicing solution for this wire size?

A. The 30 AWG wire size is used to minimize the mass of the cable and the size of the package. The small mass minimizes the cable strain due to vibration in rugged applications. This wire size is fully tested with the position transducer in a broad range of real-world high-vibration environments including missile launch, auto racing, military fighters, and industrial equipment.

Here are some solutions to consider when connecting to this small cable diameter:

- Glenair's Series 800 product is suitable for 30 AWG wire. Look at the 5-3 product.
- Bend over the wire to achieve a cross-sectional area equivalent to 28 AWG wire and use a connector suitable for 28 AWG. The MIL-C-38999 series connectors have been used successfully.
- Splice the wire to a larger-sized wire that has a suitable electrical connector attached. Raychem's MiniShield products are suitable for this and are rated to MIL-S-81824/1.

SMALL DIAMETER ELECTRICAL CABLE CRIMPING
Q. How do I crimp the small-gauge electrical wire on your Series 17X and 150 products? When I try to strip the wire, I always end up breaking it.

A. Due to their small size, these products use Teflon-insulated, 30-gauge (0.010-inch (0.254-mm)) diameter) electrical wire. When crimping the wire to connector pins, use a thermostripper such as HotWeezers and not a mechanical stripper.

ZEROING OF ELECTRICAL OUTPUT ON ANALOG-OUTPUT POSITION TRANSDUCERS
Q. How do I zero the output from unit to unit?

A. Below are a number of techniques you can use to zero the output on analog-output position transducer. If you have developed a technique not shown below, we would be interested in hearing about it.

- adjustable displacement cable termination - a turnbuckle, threaded plug, or similar devices allow you to adjust the cable length
- precision displacement cable leader - leaders specific to the application can be fabricated
- shims - thin layers of material ("shims") can be added as required on the mounting base or displacement cable termination
- rotating the potentiometer - for position transducers that use cam locks, the cam locks can be loosened and the potentiometer rotated to achieve the desired output; for units with multiturn potentiometers, exercise caution to ensure the spring torque is not applied to the fragile potentiometer wiper tracking mechanism
- trimming potentiometer - trim potentiometers can be added to the voltage divider circuit to control the zero point

CONTINUOUS TURNING POTENTIOMETER
Q. I ordered a Model 160-0241 position transducer with 3 inches of travel but the cable can be extended to over 6 inches. In addition, the voltage output from the potentiometer shows an open midway through the 6-inch stroke. Is there a problem?

A. No, you are using a position transducer with a single-turn potentiometer that can revolve continuously. The position transducer will rotate 1 revolution and measure 3 inches and then pass over the open on the potentiometer. It will continue to rotate until the end of the cable is reached. Position transducers with this potentiometer type allow you to easily set the zero point by rotating the potentiometer (see the User's Guide). In addition, cable breakage or cable over-extension do not break this type of potentiometer due to its continuous rotation. Multi-turn potentiometers are rendered useless when internal stops are damaged.

Series 160, 161 & 162 position transducer models with a "1" at the end (for example 161-0361) use single-turn potentiometers that continuously revolve. Series 150, 173, and 174 products use single-turn potentiometers that do not continuously revolve.

DISPLACEMENT CABLE CONNECTORS
Q. Your standard displacment cable connectors will not work in my application. What other connectors can you provide to connect the cable to my application?

A. Several connectors are provided standard on all position transducers. Upon request, we can discuss a range of other connectors including rings, threaded plugs, line connectors, screws, crimped balls, and user-specified components. If you have a specific requirement, please send us a sketch of your application or connector idea and we will reply with a design concept.

You may also want to consider purchasing the 160001-01 installation kit for position transducers or reviewing other stock solutions.

EXTRA DISPLACEMENT CABLE
Q. I need to measure 18 cm of motion but the position transducer is located over 125 cm from the application. Can I order a position transducer with a longer cable?

A. Yes, simply state on your order the extra cable length you would like. We can provide extra cable at no charge for reasonable lengths. A minimum of 12 inches (305 mm) of cable is provided standard (measured from the cable exit point with the cable in its fully retracted position) with all standard products.

SENSOR COVER PURPOSE
Q. I've seen your sensor cover mentioned in the Series 160 data sheet. What is the purpose of this accessory?

A. The sensor cover (part number 160060), like its name implies, protects the sensor on Series 160, 161 and 162 products when used in dirty or hazardous environments. For example, sensor covers are used in applications where unpredictable events may cause an exposed potentiometer to be damaged. About 25% of our Series 160, 161, and 162 products are provided with sensor covers.

MOUNTING BASE REVERSAL
Q. I am using a Model 160-1505 with a standard base and want the cable to exit straight down but the standard base is in the way. Do you make a mounting base that allows this?

A. Most of our mounting bases can be reversed to allow the cable to exit straight down. No additional bases are required.

DATA ACQUISITION RECOMMENDATIONS
Q. I need some accessories to complete my displacement measurement application. Do you provide items like power supplies, digital meters, and data loggers?

A. In general, we prefer to provide only the position transducer. However, we are happy to suggest sources for these types of accessories after learning more about your application. We can provide non-stock accessories for OEM and

large-volume purchases or if you prefer, we can create a complete solution.

Our Related Products and Partners page has sources for these items that you may want to consider.

MAGNETS FOR CABLE CONNECTION
Q. Can the displacement cable be attached to my application with a magnet?

A. Yes, you can use a magnet attached to the cable as the connector to your application. For a source of magnets, please visit our Related Products and Partners page.

MAXIMUM DISPLACEMENT RANGE
Q. I need to measure 140 inches (3.56 m) of displacement but your standard product line has a maximum range of 100 inches (2.540 m). Do you make a longer range product line?

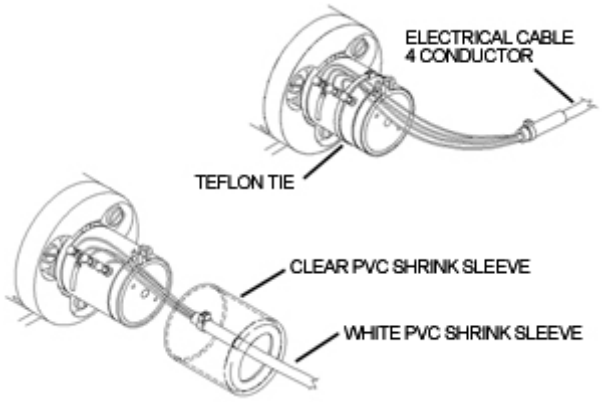
A. We do not have a standard product line today that can track displacements in excess of 100 inches (2.540 m). However, depending on your application, we can modify our current products or refer you to other sources to meet requirements that are in excess of our standard range. If this is of interest, please complete a Custom Solution Request.

LIFECYCLE RATING
Q. Your data sheets state your 5-turn potentiometer for the Series 160, 161, and 162 products has a mechanical life of 5 million shaft revolutions. Is my Model 160-1705 product rated for 5 million fullscale cycles?

A. No. Because each cycle (full extraction and retraction) of the position transducer rotates the 5-turn potentiometer a total of 10 times, the position transducer has an estimated life of 500,000 cycles.

ELECTRICAL CABLE STRAIN RELIEF
Q. I am preparing to install my position transducer. Do you have any recommendations on how to provide an electrical cable strain relief?

A. For Series 160, 161, and 162 products, two ways to provide an electrical cable strain relief are shown below.



CURRENT-LIMITING RESISTOR
Q. Sometimes our instrumentation installers wire the position transducer with power to the wiper. This burns out the potentiometer. How do I prevent this?

A. You can either severely discipline the installer or use a current-limiting resistor with the transducer. Using a current-limiting resistor is probably the easiest thing to do.

A current-limiting resistor provides protection in case power is applied to the wiper. If a short condition should occur between the wiper (white) and the common (black) ledes while the wiper is at CW (red), full available current from the power source would be dumped into the wiper. Depending on the the available current, this could burn out the potentiometer.

To limit current to 0.005 A (5 mA), use the following equation to determine the value of the current-limiting resistor:

resistor value (ohms) = (input voltage/5) x 1000

Contact us if you have any questions on potentiometer protection.

DISPLACEMENT CABLE THERMAL EXPANSION
Q. What is the thermal expansion coefficient of your standard displacement cables? How do they vary in length over the operating temperature range of your products?

A. Our standard cables are constructed of Type 304 stainless steel and have a thermal expansion coefficient of 9.6 ppm/° F (17.82 ppm/° C). The equation for change in length due to thermal expansion is delta l = a * l * delta T. Over a nominal 10-inch range (254.00 mm) (assuming a total of 15 inches (381.00 mm) of cable being used to attach to the application), the cable would increase approximately 0.05 inches (1.27 mm) in length when going from -85° F to +257° F (-65° C to +125° C). For more details, see our Temperature Effect on Displacement Cable Length Calculator.

ERRORS AND CHANGING TEMPERATURE
Q. I have a Model 150-0121 position transducer. What errors will I see with changing temperature?

A. All standard analog-output Firstmark Controls position transducers use conductive plastic or hybrid potentiometers that should be used as voltage dividers (voltage measurement) and not rheostats (resistance measurement). As such, because the changing temperature is changing the material characteristics of the entire potentiometric element, there will be no errors due to temperature change from the potentiometer. However, thermal expansion will slightly affect the transducers mechanical parts. The biggest component of this thermal change effect is the displacement cable. To learn more about this effect, which is generally negligible for most applications, see our Temperature Effect on Displacement Cable Length Calculator.

POTENTIOMETER AND ENCODER INFORMATION
Q. Where can I go to learn more about potentiometers and encoders?

A. Try these sources:

- Wirewound and Non-wirewound Precision Potentiometers Industry Standard (pdf (~10 MB size))
- Encoder Industry Standards
- Encoder Technical Articles
- Encoder FAQs

DISPLAY METER FOR QUADRATURE OUTPUT POSITION TRANSDUCERS
Q. I need a display meter that accepts the quadrature output provided by your digital position transducers. Any ideas?

A. Contact US Digital regarding their ED3 and ED2 meters:

- ED3 Meter

or

- ED2 Meter
- ED2-Kit A or ED2-Kit B
- EA-R10 Receiver
- CA-1743-6FT Cable and Connector

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Business hours: Mon-Fri, 8:00am to 5:00pm (Eastern time)
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