Table of Contents

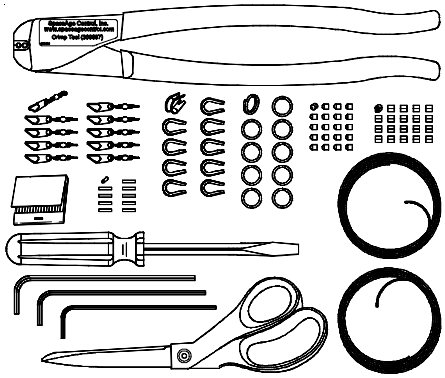
Introduction

Thank you for purchasing a SpaceAge Control position transducer. Please read this Installation Guide before operating your position transducer. By following the guidelines in this Installation Guide, you will be assured of a simple setup and millions of accurate readings. If you have any problems, please contact us by phone, fax, e-mail, or Web.

A list of Frequently Asked Questions (FAQ) is maintained on our Web site at http://www.spaceagecontrol.com/ptfaqs.htm.

160001-01 Installation Kit

If you do not have a set of tools for mounting the position transducer and crimping the displacement cable, you may want to purchase the 160001-01 installation kit (see below for contents).



The 160001-01 installation kit includes:

- crimp tool
- displacement cable cutting shears
- annealing heat source (matches)
- ball-end plugs (20)
- loop sleeves (20)
- swivels (10)
- pull rings (10)
- copper sleeves (10)
- thimbles (10)
- hex wrenches (3 sizes)
- screwdriver
- 0.018-inch (0.4572 mm) dia. 7x7 displacement cable (10 feet (3.048 m))
- 0.027-inch (0.6858 mm) dia. 7x7 displacement cable (10 feet (3.048 m))

Please contact us for information on how to purchase the 160001-01 installation kit.

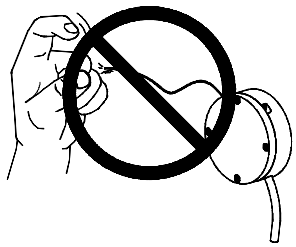
SpaceAge Control, Inc. **661-273-3000** **email@spaceagecontrol.com**
38850 20th Street East, Palmdale, CA 93550 USA **Fax: 661-273-4240** **www.spaceagecontrol.com**

Before You Start

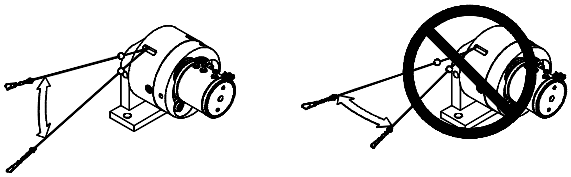
Keep the following items in mind when mounting and using your position transducer:

General

1. The cable should have tension on it at all times and should not be allowed to snap back ("freewind"). If the cable is allowed to freewind into the position transducer cover, damage will occur *that is not covered by the product's warranty*.



2. On units with slot cable exits, when the displacement cable is cycled, it should be kept in a position such that it does not drag on any part of the cable exit slot it passes through. This advice is for both set-up and use of the product. It is also important to keep the cable in line with the drum (pulley) groove. Doing so will keep the cable in the groove, preventing it from jumping track and getting jammed internally.



3. Do not open the product. The power spring can quickly unwind and cause injury. *The warranty is voided for products that have been opened.*

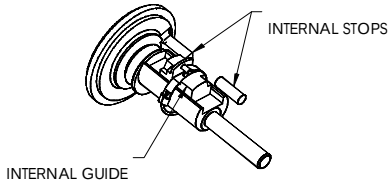
4. Do not travel past the range stated on the product's data sheet. Permanent damage will occur.

5. When operating in a wet environment, if possible, ensure the displacement cable is pointing down to avoid any liquids streaming into the product from the displacement cable. In all environments and to the extent possible, ensure the displacement cable is extracting and retracting in line with the cable exit. A mis-aligned displacement cable reduces the displacement cable life.

Analog-Output Position Transducers

1. Unless otherwise specified, all analog-output position transducers have either conductive plastic or hybrid resistive elements. While these potentiometers give higher accuracy, infinite resolution, and long life, it also means they are best used as voltage dividers. Use of these products as rheostats (resistance change measurement) is not recommended.

2. Multi-turn potentiometers have a fragile internal guide (see figure below). This guide will damage easily if the displacement cable is taken to the minimum or maximum limits of travel with excessive force. This guide will not take much abuse and, if broken, will render the potentiometer non-functional and non-repairable. The internal guide endpoints should not be used as physical stops for the position transducer. When setting up and using the position transducer, allow enough cable travel so the cable motion range is within both stops and not touching either one of them. Multi-turn potentiometers are used on position transducers with part numbers ending in "3" or "5" (for example, 180-0803 or 161-1915).

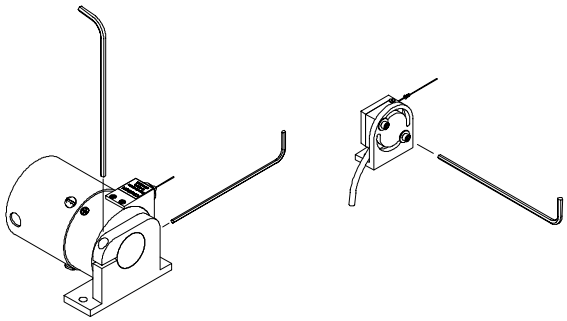


SpaceAge Control, Inc. 661-273-3000 email@spaceagecontrol.com
38850 20th Street East, Palmdale, CA 93550 USA Fax: 661-273-4240 www.spaceagecontrol.com

3. The maximum input voltage must not cause the potentiometer to exceed its power rating. See each product's Data Sheet for power ratings. The maximum voltage may be calculated with the formula of V = square root (P x R) where V is voltage, P is power, and R is the potentiometer resistance. Also, never apply power to the wiper or short the wiper to the power source. If the possibility for this exists, consider putting a current-limiting resistor in series with the wiper.

Mounting

Mount the position transducer using the mounting holes shown on each product's Data Sheet. Ensure that when the cable is attached to the point of contact, it exits the transducer aligned with the cable exit hole. You can also mount the product using epoxy, magnets, suction cups, double-backed tape, clamps, or a custom mounting bracket. We can develop a mounting bracket specific to your application. The 160001-01 installation kit provides hex wrenches for adjusting the mounting hardware located on the position transducer.



Wiring

Using the wiring scheme on each product's Data Sheet, connect the electrical terminals or cable leads to your electrical connector, data acquisition system, and power supply (as appropriate). *Ensure power does not get applied to incorrect wires such as the wiper.*

Special Notes For Analog-Output Position Transducers Using Cam Lock-Mounted Potentiometers

For single-turn potentiometer models mounted with cam locks (these units have part numbers ending in a 1 such as 160-0241), the zero voltage point may be adjusted by loosening the 3 cam lock screws securing the potentiometer to the position transducer housing. The potentiometer can be rotated to the desired position and the cam lock screws re-tightened. Multi-turn potentiometers (part numbers ending in “3” or “5”) cannot be adjusted.

Single-turn potentiometer models mounted with cam locks do not have a physical stop on them and additional cable is provided on the threaded drum. Therefore, these models will rotate beyond 360°. After the 360° point, the electrical signal will show a discontinuity as the potentiometer wiper goes over the open segment of the potentiometer element. Be aware of this as you plan your position measurement application.

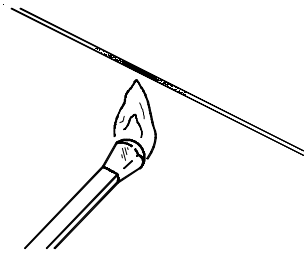
Do not turn the terminals on the potentiometers. Doing this will break the electrical connections within the potentiometers and render them non-functional and non-repairable.

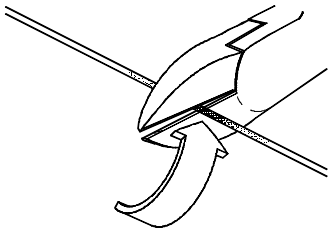
SpaceAge Control, Inc. **661-273-3000** **email@spaceagecontrol.com**
38850 20th Street East, Palmdale, CA 93550 USA **Fax: 661-273-4240** **www.spaceagecontrol.com**

Connecting The Displacement Cable

Standard position transducers are provided with a swivel and pull ring for attachment to the application. An uncrimped loop sleeve and copper sleeve are provided for securing the cable into a loop. This arrangement allows you to place the swivel or pull ring on the displacement cable precisely where you need it.

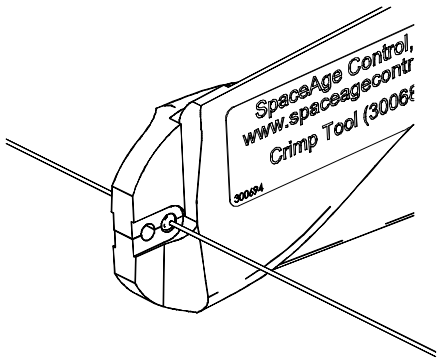
If you need to cut uncoated displacement cable, you should anneal the cable with a flame (a candle, lighter, or match will work fine) at the cutting point to ensure the cable does not fray after cutting. Heat the cable until it glows red and then cut the cable in the area that was heated.





Crimping the Ball-End Plug Using the Crimp Tool (provided in the 160001-01 installation kit)

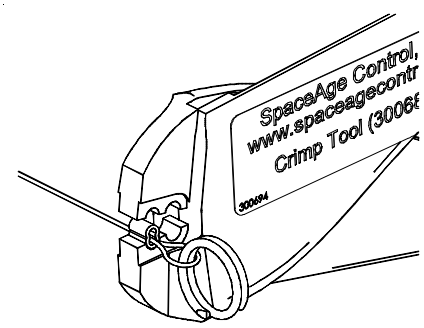
1. Grip and center the ball-end plug lengthwise in the crimp tool using the bottom hole (hole closest to the crimp tool handles ; see figure below).
2. Thread displacement cable through ball-end plug until desired crimping location is reached.
3. Squeeze crimp tool firmly. Rotate the ball-end plug 90° and squeeze crimp tool firmly. Minor crimp imperfections are to be expected.
4. Pull on the displacement cable while holding the ball-end plug and ensure that the crimped ball-end plug is secure.



SpaceAge Control, Inc. **661-273-3000** **email@spaceagecontrol.com**
38850 20th Street East, Palmdale, CA 93550 USA **Fax: 661-273-4240** **www.spaceagecontrol.com**

Crimping the Loop Sleeve Using the Crimp Tool (provided in the 160001-01 installation kit)

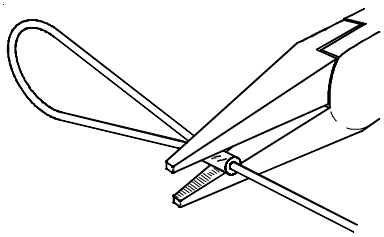
1. Grip and center the loop sleeve lengthwise in the crimp tool using the top hole (hole farthest from the crimp tool handles; see figure below).
2. Thread displacement cable through loop sleeve to form a loop until desired crimping location is reached.
3. Squeeze crimp tool firmly. Rotate the loop sleeve 90° and squeeze crimp tool firmly. Minor crimp imperfections are to be expected.
4. Pull on the displacement cable loop while holding the loop sleeve and ensure that the crimped loop sleeve is secure.



Crimping the Copper Sleeve Using Electrical Connector Crimping Tools and Non-Specialized Pliers

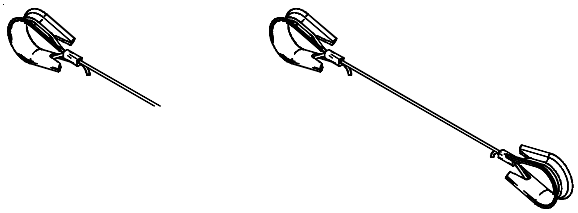
To crimp the copper sleeve to the displacement cable, loop the displacement cable through the copper sleeve, through the swivel or pull ring, and then back through the copper sleeve. Crimp the copper sleeve using a 4-pronged electrical connector crimping tool or equivalent.

SpaceAge Control does not provide the crimping tools for crimping the copper sleeve to the displacement cable. There are numerous suppliers of these types of products worldwide. One company that produces these products is Astro Tool Corp. (http://www.astrotool.com, 503-642-9853, 503-591-7766 (fax)). Their 621103 crimp tool will work. For crimping the copper sleeve to the looped (double thickness) 0.018-inch (0.4572 mm) diameter displacement cable, use a 0.041-inch (1.0414-mm) gage pin to set the crimping diameter on the crimp tool and then do a pull test. For the looped (double thickness) 0.027-inch (0.6858 mm) diameter displacement cable, use a 0.049-inch (1.2446-mm) gage pin. You may also purchase an appropriate calibrating tool from Astro Tool Corp. An acceptable but aesthetically less pleasing way to crimp to the copper sleeve is to use simple pliers (see figure below).



Use of the Thimble and Creating Leaders

The thimbles provided in the 160001-01 installation kit can be used with the loop sleeve or copper sleeve to produce very rugged displacement cable terminations (left figure below) or leaders for attachment of the position transducer to the application (right figure below).



SpaceAge Control, Inc. **661-273-3000** **email@spaceagecontrol.com**
38850 20th Street East, Palmdale, CA 93550 USA **Fax: 661-273-4240** **www.spaceagecontrol.com**

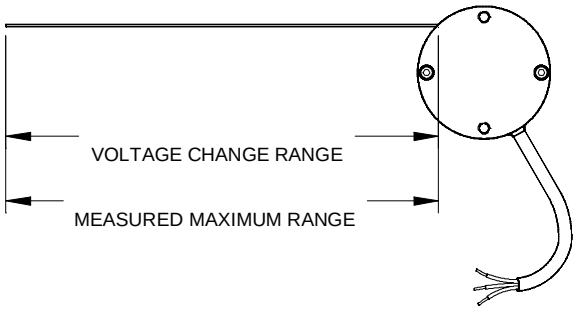
Tips And Troubleshooting

How do I zero the potentiometer?
The zero point for the potentiometer is set by manually adjusting the cable extension to the desired point. Depending on your application, this may be an iterative process. On position transducers with single-turn potentiometers mounted with cam locks, the potentiometer zero point may also be set by mechanically rotating the potentiometer. Page 3 of this Installation Guide has more information on this technique.

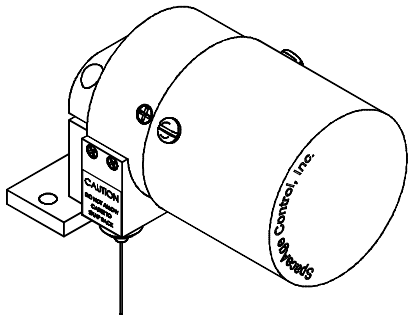
How do I convert the output from volts to a unit of displacement?
To convert from a voltage to a unit of displacement, simply divide the measure maximum range of the position transducer by the voltage change over the measured maximum range. Then, multiply this number by the output voltage to get the unit of displacement output.
This calculation may, of course, be done manually or through your data acquisition/recording system.

Example: voltage change = 9.8 volts
output voltage = 6.5 volts
measured maximum range = 18.3 inches (Model 161-1443)

18.3 inches ÷ 9.8 volts = 1.867 inches/volt -> 1.867 inches/volt x 6.5 volts = 12.14 inches



I am using a Model 160-1505 position transducer 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?
The standard, universal, and L Bases can all be reversed to allow the cable to exit straight down (see figure below). No additional bases are required.



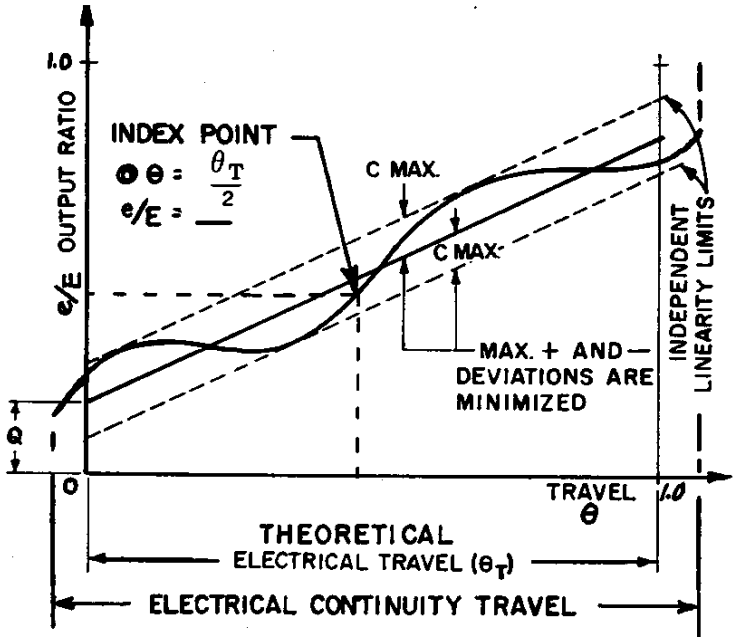
Which resistance value should I order for the potentiometer of analog-output position transducers?
The selection of the resistance value is solely dependent upon the requirement of your data acquisition or control circuitry. Accuracy and resolution are independent of the actual resistance value. We have standardized on a 5K ohm value although other resistance values are available upon request. Note that price and delivery may be affected by selecting non-standard potentiometer resistances.

SpaceAge Control, Inc. **661-273-3000** **email@spaceagecontrol.com**
38850 20th Street East, Palmdale, CA 93550 USA **Fax: 661-273-4240** **www.spaceagecontrol.com**

Do you have additional calibration data beyond the 3-point data table provided with the position transducers?
SpaceAge Control can provide an extra-cost acceptance test data sheet (ATDS) that contains tested electrical and mechanical data for the position transducer including cable tension, outputs, and linearity. Please contact us if you would like more information or if you have unique calibration requirements. For more information on linearity and calibration, visit http://www.spaceagecontrol.com/calclin.htm.

What type of output do I get with the analog-output position transducers? How is the linearity determined?
The output and linearity for these position transducers is defined per VRCI-P-100A (published by the Variable Resistive Components Institute). This publication defines independent linearity as the maximum deviation of the actual function characteristics from a straight reference line with its slope and position chosen to minimize the maximum deviations. It is expressed as a percentage of the Total Applied Voltage and is measured over the Theoretical Electrical Travel. The slope of the reference line, if limited, must be separately specified. An Index Point on the actual output is required. Unless otherwise specified, the Index Point will be at $\theta = \theta_T/2$.

Mathematically, $e/E = P(\theta/\theta_T) + Q \pm C$ where P is unspecified slope, Q is unspecified intercept at $\theta = 0$ and both P and Q are chosen to minimize C but are limited by the End Voltage requirements.



What methods are available for reading the electrical outputs from the digital-output position transducers?

Quadrature (digital) outputs can be read from a variety of devices including:

- digital meters
- RS-232 and USB interfaces
- PLCs
- data acquisition boards with digital inputs
- custom-made interfaces using counter and frequency components

For sources of these items, please contact us or visit http://www.spaceagecontrol.com/pmc0402.htm.

Repairs

SpaceAge Control position transducers are rugged and built to last. Nevertheless, adverse environments and extraordinary use may require the products to be repaired. If your position transducer should need repair, you may return the unit to SpaceAge Control. You may obtain an RMA

SpaceAge Control, Inc. 661-273-3000 email@spaceagecontrol.com
38850 20th Street East, Palmdale, CA 93550 USA Fax: 661-273-4240 www.spaceagecontrol.com

(return material authorization) number automatically on our Web site at http://www.spaceagecontrol.com/reqrmano.htm. Return the product freight prepaid in sturdy packaging. Include a note describing the problem or malfunction you are experiencing as well as your contact information and the RMA number.

Warranty

SpaceAge Control warrants that its products are free from defects in material or workmanship under normal use and service for a period of 12 months from date of shipment excluding displacement cable breakage and related damage. SpaceAge Control's obligations under this warranty are limited to replacing or repairing, at our option, at our facility, any of the products that shall within the applicable period after shipment be returned to us, transportation charges prepaid, and that are, after examination, disclosed to the satisfaction of SpaceAge Control to be thus defective. The warranty does not apply to any products or equipment that have been opened, disassembled, repaired or altered, except by SpaceAge Control, or that have been subjected to misuse, negligence, or accident. Under no circumstances shall SpaceAge Control's liability exceed the original purchase price. The aforementioned provisions do not extend the original warranty period of any product that has been repaired or replaced by SpaceAge Control.

General Disclaimer

In accordance with our quality policy of continuous improvement, we reserve the right to make changes/improvements to our products and/or their specifications at any time without prior notice. Prices are also subject to change without notice. We make every effort to ensure information provided in our technical literature is accurate and reliable. We cannot, however, assume responsibility for inadvertent errors, inaccuracies, omissions, or subsequent changes. We similarly assume no responsibility for the use of this information, and any and all such use of this information shall be entirely at the user's own risk. No patent rights or licenses applicable to any SpaceAge Control intellectual property described herein are granted to any third party, either directly, by implication, or any other means.

Limitations On The Use Of Products

Our products are not designed for and should not be used, without the specific prior written consent of SpaceAge Control, in any life-support systems, nuclear-facility applications, aircraft-control applications, or any other applications in which failure of the product, in any way, could reasonably result in harm to life, property, or the environment. A life-support system is defined as a product or system intended to support or sustain life and whose failure can be reasonably expected to result in significant personal injury or death. Nuclear-facility applications are defined as any application involving a nuclear reactor or the handling and processing of radioactive materials in which the failure of equipment, in any way, could reasonably result in harm to life, property, or the environment.

If you have comments or questions about our warranty, terms, and conditions, please contact us.

Record of Purchase

You may want to record information about your purchase below for future reference.

Date of purchase _____ _____

Model number(s) _____

Serial numbers(s) _____

Purchase Order _____

Sales Order _____

SpaceAge Control, Inc. **661-273-3000** **email@spaceagecontrol.com**
38850 20th Street East, Palmdale, CA 93550 USA **Fax: 661-273-4240** **www.spaceagecontrol.com**