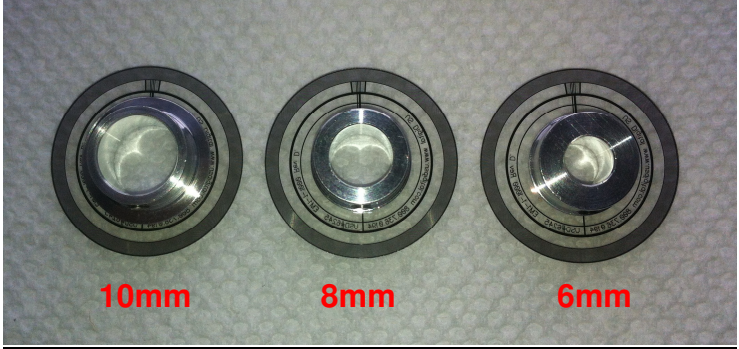
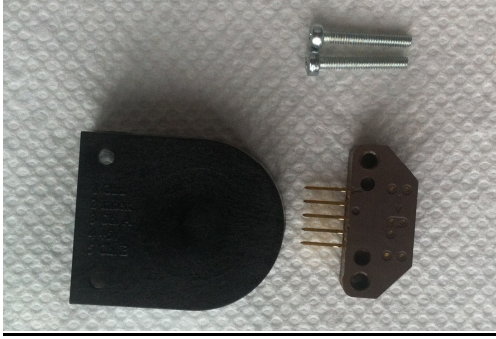




# Smart Arm Encoder Installation Guide

PS1E, PS2E and PS150E

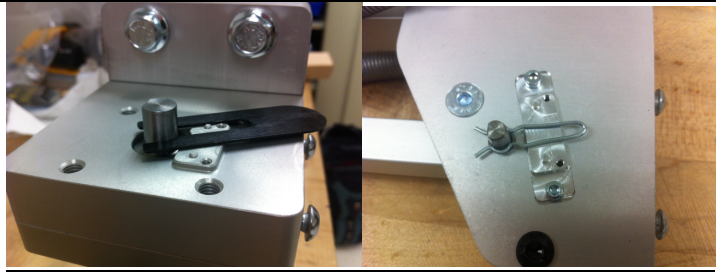
**Objective:** The guideline is intended to detail the installation of the rotary encoders used on the Smart Motion Smart Arm system. Note: Disassembly of encoder can be accomplished by reversing the instructions.

**Materials Required:**

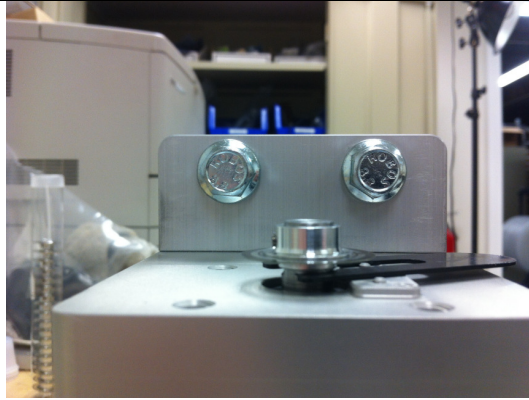
|  |  |
|--|--|
| <p>1.) Encoder disks. Three options 10mm, 8mm and 6mm.</p> <p>PS1E: H1,H2 (10mm), H3 (8mm)<br/>         PS2E: H1,H2 (10mm), H3 (6mm)<br/>         PS150E:H1,H2,H3 (10mm)</p> <p>H1 Encoder: Located at arm elbow<br/>         H2 Encoder: Located closest to pillar<br/>         H3 Encoder: Located on side of portion of arm that moves up and down.</p> |    |
| <p>2.) Encoder Reader, cover and Two M2.5x16 Philips screws</p>  |   |
| <p>3.) 10mm disk spacer. Note: Spacer is not required to install the encoder disk. Proper disk location can also be verified via visual inspection as outlined below.</p>  |  |
| <p>4.) 6mm and 8mm disk spacer. Note: Spacer is not required to install the encoder disk. Proper disk location can also be verified via visual inspection as outlined below.</p>   |  |
| <p>5.) M1 Allen wrench.</p>  |  |

**(A) Installation:**

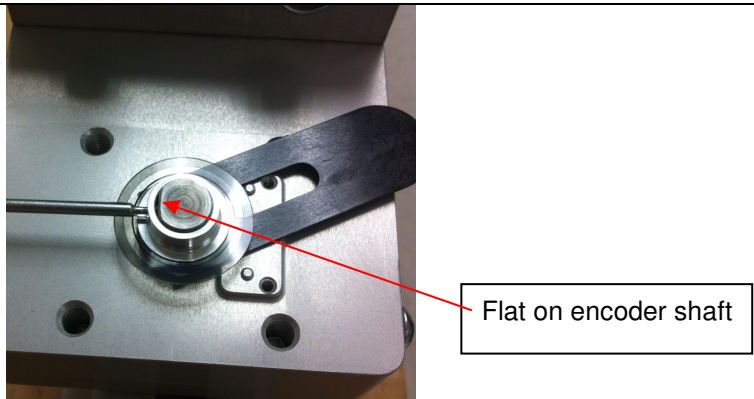
- 1.) Install spacer if available on encoder shaft as per photo detail.



- 2.) Place encoder disk over shaft with Allen screw hole located on topside of disk. Bottom of encoder disk hub should rest on top of spacer. Do not push down on the encoder disk.



- 3.) Tighten M1 Allen set screw while maintaining proper disk position. Make sure that Allen set screws locks into position onto the encoder shaft at the location of the flat on the encoder shaft.



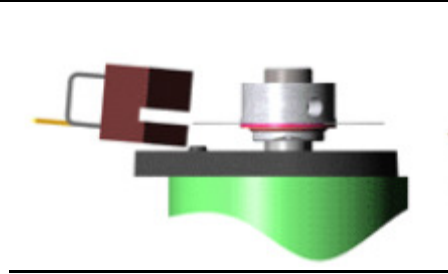
- 4.) Verify correct location of index strip for each disk. For 10mm disks, indexing strip must be located in the center of the reader mounting posts. For the 6mm and 8mm disk, the indexing strip must be off center of the reader mounting posts, closest to the lower post. This allows the encoder to home as the arm is lowered.



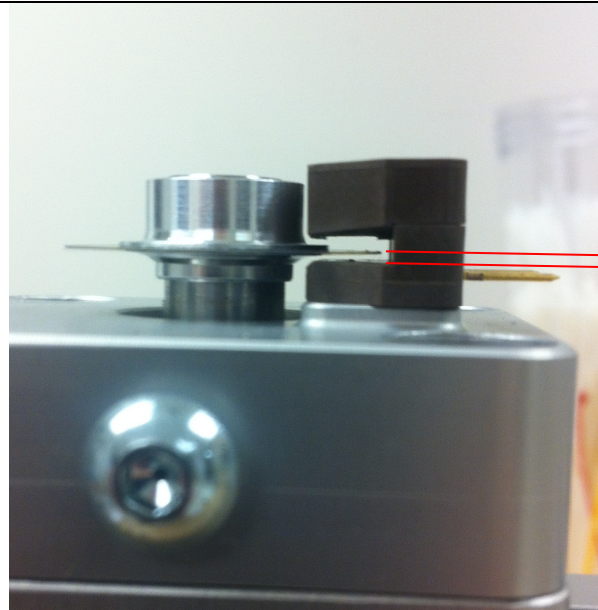


**Installation Cont:**

5.) Carefully slide reader under encoder disk and press reader onto mounting posts.

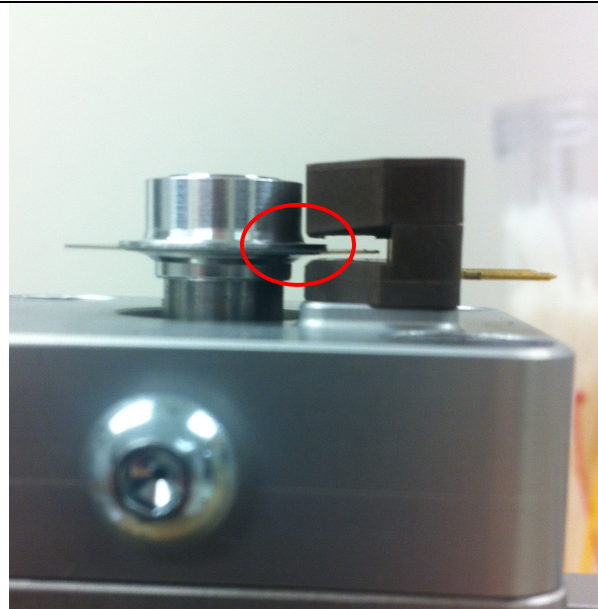


6.) Prior to installing cover, visually verify position of the encoder disk in the slot of the reader. Note the gap location. Nominal gap is approx. 0.025". A good visual is to verify disk is approx. 1/3 of the total spacer gap from the bottom of the reader

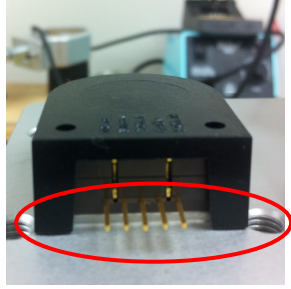
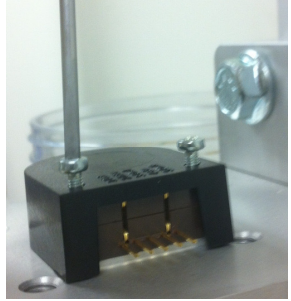
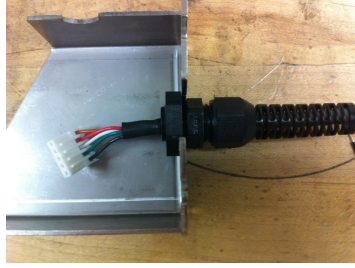
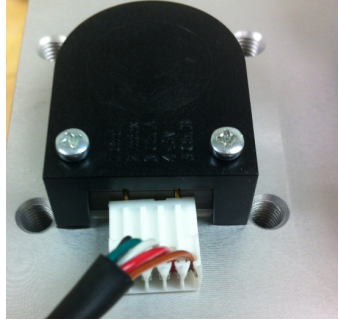


Disk gap

7.) Inspect and verify disk hub does not come in contact with reader body on top or bottom side of disk.



**Installation Cont:**


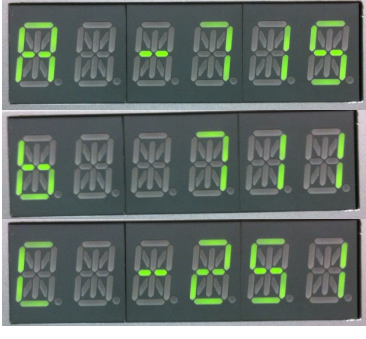

|   |  |
|---|--|
| <p>8.) Place encoder cover over disk and reader, ensure reader does not dislodge from the encoder reading mounting posts. Make sure lower portion of reader stays in contact with mounting surface.</p> |    |
| <p>9.) Install two M2.5x16 screws, making sure reader stays in proper position</p>  |    |
| <p>10.) Install encoder cable strain relief into slot of the metal protective encoder cover, lock strain relief using the threaded nut assembly</p>   |   |
| <p>11.) Install encoder cable onto encoder reader, note connector orientation</p>   |  |

12.) Install metal protective cover and tighten the two M3 socket head cap screws.



**(B) Encoder Operation Verification:** This portion of the document details the process to verify that all the encoders are functioning as required.

Below is the list of variables that will be used to verify encoder operation:

|  |  |
|--|--|
| <p>Home Indexing Counters: The variables of H1, H2 and H3 are counters that indicate that the homing index pulse is being recognized by the encoder reader. Counter's maximum value will be 255, once the counter reaches 255 the counter will not advance any further. This does not mean the homing index does not work properly, just the smart control box can not verify the performance. Restarting the Smart arm controller will reset these counters</p> |   |
| <p>Raw Encoder data: The variables A, B and C displays the raw encounter count information for H1, H2 and H3 encoders respectively.</p>  |  |
| <p>Actual calculated arm position: The variables of X and Y are the actual X and Y calculated location of the arm in mm.</p>   |  |

**Home Pulse Verification:** Repeat this process for H1, H2 and H3.

- 1.) Scroll the jog dial into the Maintenance menu until the desired home pulse counter is displayed
- 2.) It will be necessary to isolate the encoder that needs to be tested for the next step. For H1 and H2 encoders, the home index pulse is best located with the arm straight out from the pillar to max reach. For H3, the homing index pulse should be about 15-30° down from horizontal.
- 3.) For H1 and H2, move the arm back and forth through the encoders homing index region. Please move only the one section of the arm that pertains to the encoder under test. As you move back and forth in the homing index region, you should see the index counter increase by two, once when you move left and another when you move back to the right. For the H3 encoder, the process is similar but the motion will be up and down. Again the counter should increment by two, one as you move down and one as you move back up.

**Encoder Reading Verification:** Repeat this process for H1, H2 and H3 (A,B and C)

- 1.) Scroll the jog dial into the Maintenance menu until the desired encoder count value is displayed
- 2.) Pick a fixed location on your part, work bench or tooling that can be accurately located easily, Point A. Move your tool to point A with the arm in left orientation (elbow of arm on left side of pillar) and record the actual encoder count value for the encoder under test. Remove the arm from Point A and move the arm through the full reach area of the arm. Make sure you move the arm from left to right orientation to ensure that each encoder passes through the home index pulse. Move back to Point A and record the value.
- 3.) Repeat the previous step 5-10 times to verify that the encoder raw reading value is consistently reporting the same count information. For standard reach arms that are properly anchored, raw data should be within 5 counts or better from reading to reading. It is very important to make sure that the arm is properly mounted and the tool or tool bit does not contribute to inaccuracies in this test.
- 4.) Repeat this process for opposite orientation of arm.

**Calculated Position Verification:**

- 1.) Scroll the jog dial into the Maintenance menu until the desired X or Y location is displayed.
- 2.) Pick a fixed location on your part, work bench or tooling that can be accurately located easily, Point A. Move your tool to point A with the arm in left orientation (elbow of arm on left side of pillar) and record the position value. Remove the arm from Point A and move the arm through the full reach area of the arm. Make sure you move the arm from left to right orientation to ensure that each encoder passes through the home index pulse. Move back to Point A in the same orientation and record the value. **Note:** Arms which have been setup using the “Setorg” process with vertical tools, the same X or Y value should be the exact same whether in left or right orientation. If horizontal tools or multiple position tool holders are used, this process can only be completed in one orientation.
- 3.) Repeat the previous step 5-10 times to verify that the location value is repeatable. For standard reach arms that are properly anchored, the value should be within 2-3 mm from reading to reading. It is very important to make sure that the arm is properly mounted and the tool or tool bit does not contribute to inaccuracies in this test.

**(C) Troubleshooting**

| <b>Symptom</b>   | <b>Possible Causes</b>   | <b>Resolution</b>  |
|--|--|--|
| Upon powering up smart arm controller, display constantly flashes "Homing". Will not go away as you move the arm back and forth    | <ol style="list-style-type: none"> <li>1.) H1 or H2 Encoder cable defective</li> <li>2.) Encoder reader out of position</li> <li>3.) Encoder reader defective</li> </ol>           | <ol style="list-style-type: none"> <li>1.) Swap out encoder cable with H3 and see if problem goes away. Replace cable as necessary.</li> <li>2.) Attempt to readjust reader position as per instructions below.</li> <li>3.) Replace encoder reader. See installation instructions.</li> </ol> |
| Upon powering up smart controller, display constantly flashes "Home Z". Will not go away as you move arm up and down.              | <ol style="list-style-type: none"> <li>4.) H3 Encoder cable defective</li> <li>5.) Encoder reader out of position</li> <li>6.) Encoder reader defective</li> </ol>                 | <ol style="list-style-type: none"> <li>4.) Swap out encoder cable with H1 or H2 and see if problem goes away. Replace cable as necessary.</li> <li>5.) Attempt to readjust reader position. See Section D.</li> <li>6.) Replace encoder reader. See Section A.</li> </ol>                      |
| Arm does not enable tool at correct location in both left and right orientation (Does not apply for horizontal tools or 90° tools. | <ol style="list-style-type: none"> <li>1.) Setorg process not completed or incorrectly completed</li> <li>2.) Tool loose in tool holder</li> </ol>                                 | <ol style="list-style-type: none"> <li>1.) Complete Setorg process per Installation and Setup Guide</li> <li>2.) Tighten tool holder</li> </ol>  |
| Arm does not enable tool at correct location   | <ol style="list-style-type: none"> <li>1.) Part may have moved from original taught location</li> <li>2.) Defective encoder reader</li> <li>3.) Defective encoder cable</li> </ol> | <ol style="list-style-type: none"> <li>1.) Re-teach locations</li> <li>2.) Verify encoder performance as per instructions above</li> <li>3.) Swap out cable to verify</li> </ol>   |

**(D) Encoder Reader Adjustment:**

- 1.) Remove Stainless steel encoder cover.
- 2.) You will see a black plastic cover which covers the encoder disk and reader (brown body component that the cable plugs into)
- 3.) Loosen up the 2 Philips head screws holding on the cover, this will allow the reader to be repositioned. Do not remove the screws completely.
- 4.) Apply a small amount of pressure on the encoder reader, forcing the reader more inside the black cover.
- 5.) Retighten Philips screws while holding pressure on the reader to keep in place.
- 6.) Verify Encoder performance as per Section B. Replace encoder reader if necessary.