Smart Tool Setup Procedure

Calibration and Commission

Step 1

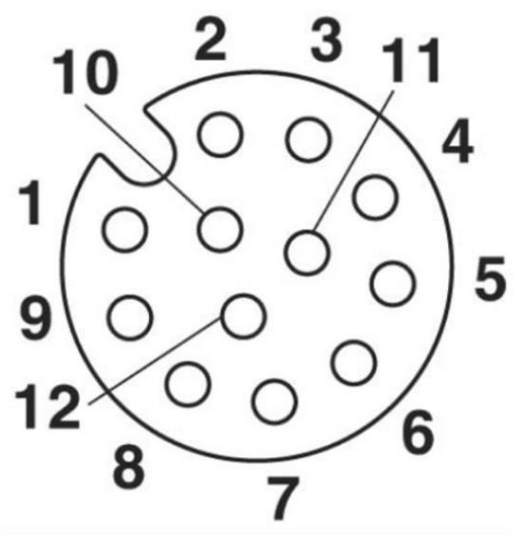
Make all necessary connections for Vin, GND, and I/O. All inputs into the tool are sinking and need to be a 24V HIGH and a 0V LOW. All outputs leaving the tool are sourcing and will be 24V signals. Calibration and Run Degauss inputs should be low other than when they are in use.

Table 1: Connector I/O Functionality

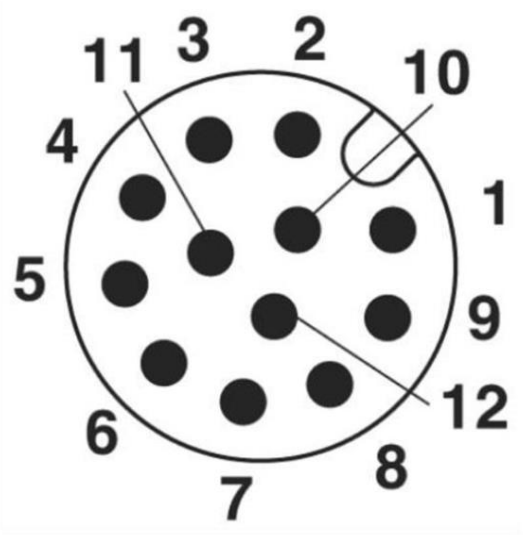
Pin #	Function	Logic	Direction
1	Vin		24VDC
2	GND		GND
3	Calibrate	Requires 1 second high to enter	Input
4	Run Degauss (when enabled)	Requires 20ms high to begin-when enabled	Input
5	Calibration Bit 1		Input
6	Calibration Bit 2		Input
7	Magnet On	High when magnet is on	Output
8	Magnet Off	High when magnet is off	Output
9	Calibrated Part Present	High when within calibrated range	Output
10	Degauss Cycle Running (when enabled)	High while Degauss is running - when enabled	Output
11	North Pole (disabled for MJxxAY tools)	High when within calibrated range	Output
12	South Pole (disabled for MJxxAY tools)	High when within calibrated range	Output

Table 2: Calibration I/O Functionality – output signals are not active on degauss tools

Pin #	Function	Logic	Direction
1	Vin	-	24VDC
2	GND	-	GND
3	Calibrate	Requires 1 second high to enter	Input
4	Exit Calibration	Goes back to sensing, does not store values	Input
5	N/A	-	Input
6	N/A	-	Input
7	Waiting for Limiting Position 1	High when true	Output
8	Limiting Position 1 Saved/ Waiting for Limiting Position 2	High when true	Output
9	N/A	-	Output
10	In Calibration	High while in calibration	Output
11	Sout Pole Position Saved/ Waiting for North Pole Position	High when true (disabled for MJxxAY tools)	Output
12	Limiting Position 2 Saved/ Waiting for South Pole Position	High when true (disabled for MJxxAY tools)	Output



Cable Side: Pin Assignment M12, 12-pos, Female Side View



Tool side: Pin Assignment of M12 Male Connector, 12-pos., A-coded view of the pin side

Figure 1: I/O Diagram for M12 12-Pin Connector

Calibrated Part Present signal will be HIGH (24V) when the contact quality is between Limiting Position 1 and Limiting Position 2. Minimums and maximums from the two limiting positions will be stored to incorporate the proper range for the Calibrated Part Present signal. In this document, you will calibrate for 4 positions.

South Pole Signal will be HIGH (24V) when the South Pole position is in equal to or better contact than the stored South Pole Position.

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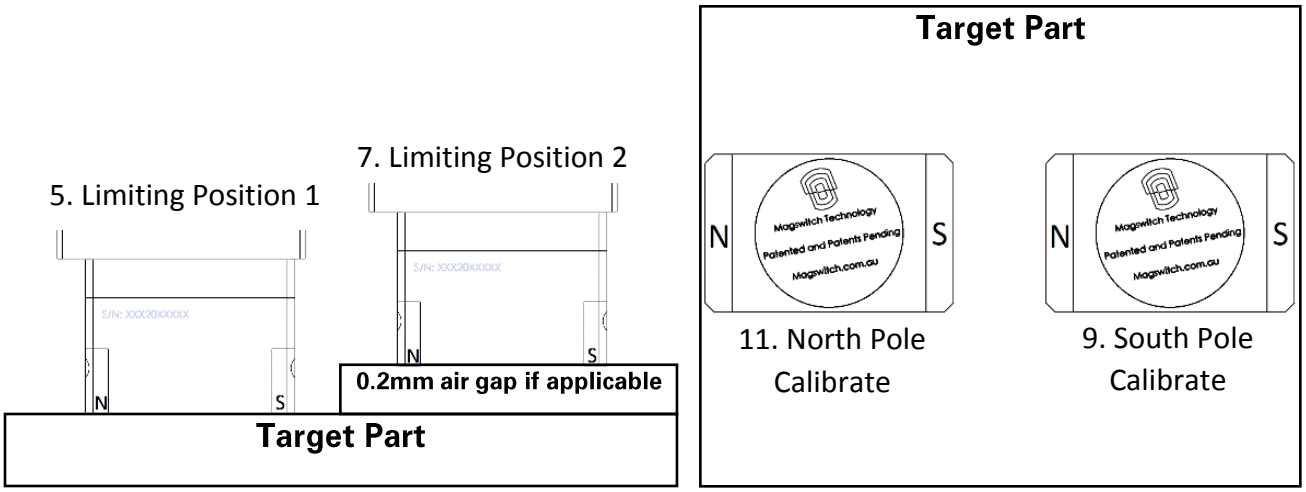

Figure 2: Step 1-4 Calibration Positions

LED Color Codes

Table 3: On-Tool LED Color Codes

LED #	LED Color	Status	Function
LED 1 (Power, Blue LED)	Blue	Off Solid Flashing	No power to tool Power to tool Calibration was triggered
LED 2 (State, RG LED)	Red Green Amber	Solid Solid Solid	Magnet OFF Magnet ON Degauss is Running

Table 4: Calibration Truth Table

Calibration Bit 1	Calibration Bit 2	Calibration #
LOW	LOW	Calibration 1
HIGH	LOW	Calibration 2
LOW	HIGH	Calibration 3
HIGH	HIGH	Calibration 4

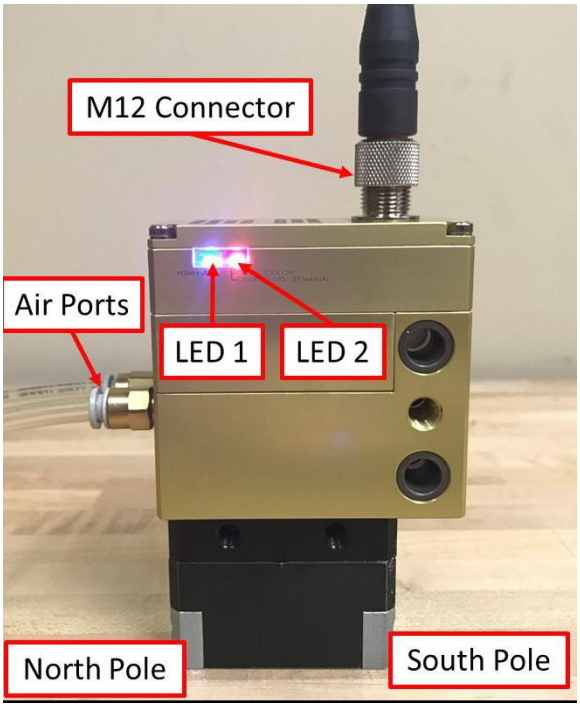

Figure 3: Tool Orientation for Magswitch J30

NOTE: Air ports are on the NORTH POLE side of the tool

Step 2

Turn the power supply on. Power LED 1 (blue) will be illuminated followed by the Magnet LED 2 (red or green) 1 second later. Please refer to ***Figure 4*** for an example. Please note that if the "A" air port has been energized before powering on the tool that LED 2 will be green. Otherwise, LED 2 will be red.

Figure 4: Magswitch J30 Startup Sequence – Power LED 1 (blue) and Magnet LED 2 (red) illuminated when complete

Step 3

Make sure both calibration bits are LOW (0V) to store the initial calibration in Calibration 1.

Step 4

Toggle the calibration input (Pin 3) HIGH (24V) for 1 second then back to LOW (0V) to enter calibration.
Now the user is in calibration mode.

a. Wait for the power LED 1 to stop flashing. (3 Flashes)
b. The software will not move onto the next step until the input (Pin 3) goes back to LOW (0V).

Step 5

To calibrate Limiting Position 1:

a. Place the unit on the target part at one end of its limiting range for the Calibrated Part Present signal and pneumatically actuate the magnet to the on position. Some recommended positions are provided below.
   i. The maximum steel in vicinity (for complex or bin picking shapes)
   ii. The best contact
   iii. The least air gap
   iv. The maximum for one pole, but minimum for the other
b. Please refer to **Figure 5** for an example.

NOTE: The unit is centered on the part with little to no air gap between the pole shoes and part.

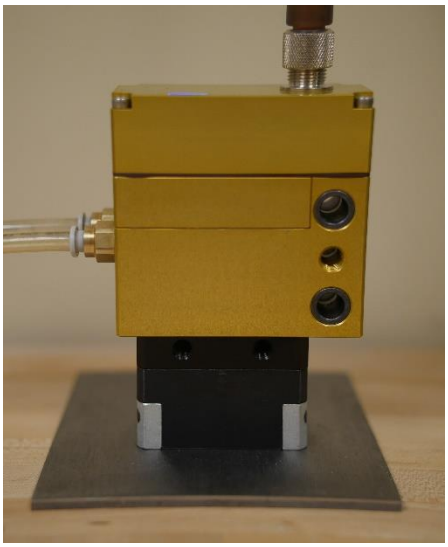

Figure 5: Example of Limiting Position 1 for Calibrated Part Present Signal

Step 6

To store Limiting Position 1: Toggle the calibration input (Pin 3) HIGH (24V) then back to LOW (0V).

a. The software will not move onto the next step until the input (Pin 3) goes back to a LOW (0V).
b. The power LED 1 will flash when the Limiting Position 1 data has been evaluated.
c. Once the power LED 1 stops flashing (3 flashes), pneumatically de-actuate the magnet.

Step 7

To calibrate Limiting Position 2:

a. Place the unit on the target part at the other end of its limiting range for the Calibrated Part Present signal and pneumatically actuate the magnet to the on position. Some recommended positions are provided below.
   i. The minimum steel in vicinity (for complex or bin picking shapes)
   ii. The worst contact.
   iii. The maximum allowable air gap (coatings)
   iv. The minimum for one pole, but the maximum for the other
b. Please refer to ***Figure 6*** for an example.

NOTE: The unit is centered on the part but an air gap of 0.2mm approximately equal to 2 layers of standard copy paper is added between the pole shoes and part. Artificial air gaps can be used to simulate scale, paint, or debris on a part but it is preferable to use the authentic "worst-case" allowable part condition rather than nonferrous shims.

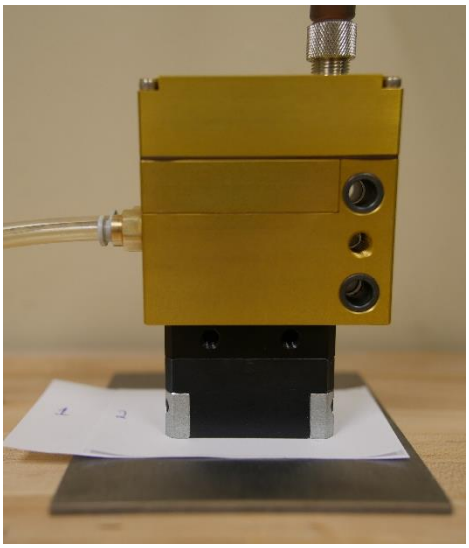

Figure 6: Example of Limiting Position 2 for Calibrated Part Present Signal

Step 8

To store Limiting Position 2: Toggle the calibration input HIGH (24V) then back to LOW (0V).

a. The software will not move onto the next step until the input goes back to a LOW (0V).
b. The power LED 1 will flash when the Limiting Position 2 data has been evaluated.
c. Once the power LED 1 stops flashing (3 flashes), pneumatically de-actuate the magnet.

Step 9

To calibrate South Pole Position: Place the unit so that the South Pole is in its desired position for the South Pole Signal and pneumatically actuate magnet on. Please refer to ***Figure 7*** for an example.

Figure 7: Example of South Pole Signal Position

Step 10

To store South Pole Position: Toggle the calibration input HIGH (24V) then back to LOW (0V).

a. The software will not move onto the next step until the input goes back to a LOW (0V).
b. The power LED 1 will flash when the South Pole data has been evaluated.
c. Once the power LED 1 stops flashing, pneumatically de-actuate the magnet.

Step 11

To calibrate North Pole Position: Place the unit so that the North Pole is in its desired position for the North Pole Signal and pneumatically actuate the magnet on. Please refer to ***Figure 8*** for an example.

Figure 8: Example of North Pole Signal Position

Step 12

To store North Pole Position: Toggle the calibration input HIGH (24V) then back to LOW (0V).

a. The software will not move onto the next step until the input goes back to a LOW (0V).
b. The power LED 1 will flash when the North Pole data has been evaluated.
c. Leave the unit in its North Pole Signal position with the magnet pneumatically actuated in the on position. This will make testing calibration faster.

Step 13

Once the power LED 1 stops flashing, the unit will go back into sensing mode.

a. At this point in time, the state outputs should be functioning properly.

Step 14

To add calibrations 2-4, repeat steps 4-13 with the proper Calibration Bit setting.

a. Calibration 1:
    i. Calibration Bit 1: LOW (0V)
    ii. Calibration Bit 2: LOW (0V)
b. Calibration 2:
    i. Calibration Bit 1: HIGH (24V)
    ii. Calibration Bit 2: LOW (0V)
c. Calibration 3:
    i. Calibration Bit 1: LOW (0V)
    ii. Calibration Bit 2: HIGH (24V)
d. Calibration 4:
    i. Calibration Bit 1: HIGH (24V)
    ii. Calibration Bit 2: HIGH (24V)

NOTE: To use the different calibrations, set the Calibration Bit signals as shown above before entering calibration mode.

Testing Calibration

If the North Pole Signal and/or North Pole Signal Position are less than the minimum of the Calibrated Part Present signal range (this is the case for the calibration shown in this document):

1. Magnet is pneumatically de-actuated:
    a. Tool On Signal: LOW (0V)
    b. Tool Off Signal: HIGH (24V)
    c. South Pole Signal: LOW (0V)
    d. North Pole Signal: LOW (0V)
    e. Calibrated Part Present Signal: LOW (0V)
2. Unit positioned within Calibrated Part Present signal range and the magnet is pneumatically actuated on:
    a. Tool On Signal: HIGH (24V)
    b. Tool Off Signal: LOW (0V)
    c. South Pole Signal: HIGH (24V)
    d. North Pole Signal: HIGH (24V)
    e. Calibrated Part Present Signal: HIGH (24V)
3. Unit positioned with South Pole outside of Calibrated Part Present signal range and the magnet is pneumatically actuated on:
    a. Tool On Signal: HIGH (24V)
    b. Tool Off Signal: LOW (0V)
    c. South Pole Signal: LOW (0V)
    d. North Pole Signal: HIGH (24V)
    e. Calibrated Part Present Signal: LOW (0V)
4. Unit positioned with North Pole outside of Calibrated Part Present signal range and the magnet is pneumatically actuated on:
    a. Tool On Signal: HIGH (24V)
    b. Tool Off Signal: LOW (0V)
    c. South Pole Signal: HIGH (24V)
    d. North Pole Signal: LOW (0V)
    e. Calibrated Part Present Signal: LOW (0V)
5. Unit positioned with North/South Poles within South/North Pole Signal range, but not within Calibrated Part Present signal range:
    a. Tool On Signal: HIGH (24V)
    b. Tool Off Signal: LOW (0V)
    c. South Pole Signal: HIGH (24V)
    d. North Pole Signal: HIGH (24V)
    e. Calibrated Part Present Signal: LOW (0V)
6. Unit positioned with neither pole within the Calibrated Part Present signal nor South/North Pole Signal range and the magnet is pneumatically actuated on:
    a. Tool On Signal: HIGH (24V)

Testing Calibration

If the South Pole Signal and North Pole Signal Position are equal to the minimum of the Calibrated Part Present signal range:

1. Magnet is pneumatically de-actuated:
   a. Tool On Signal: LOW (0V)
   b. Tool Off Signal: HIGH (24V)
   c. South Pole Signal: LOW (0V)
   d. North Pole Signal: LOW (0V)
   e. Calibrated Part Present Signal: LOW (0V)
2. Unit positioned within Calibrated Part Present signal range and the magnet is pneumatically actuated on:
   a. Tool On Signal: HIGH (24V)
   b. Tool Off Signal: LOW (0V)
   c. South Pole Signal: HIGH (24V)
   d. North Pole Signal: HIGH (24V)
   e. Calibrated Part Present Signal: HIGH (24V)
3. Unit positioned with South Pole outside of Calibrated Part Present signal range and the magnet is pneumatically actuated on:
   a. Tool On Signal: HIGH (24V)
   b. Tool Off Signal: LOW (0V)
   c. South Pole Signal: LOW (0V)
   d. North Pole Signal: HIGH (24V)
   e. Calibrated Part Present Signal: LOW (0V)
4. Unit positioned with North Pole outside of Calibrated Part Present signal range and the magnet is pneumatically actuated on:
   a. Tool On Signal: HIGH (24V)
   b. Tool Off Signal: LOW (0V)
   c. South Pole Signal: HIGH (24V)
   d. North Pole Signal: LOW (0V)
   e. Calibrated Part Present Signal: LOW (0V)
5. Unit position with neither pole within the Calibrated Part Present signal range and the magnet is pneumatically actuated on:
   a. Tool On Signal: HIGH (24V)
   b. Tool Off Signal: LOW (0V)
   c. South Pole Signal: LOW (0V)
   d. North Pole Signal: LOW (0V)
   e. Calibrated Part Present Signal: LOW (0V)

Troubleshooting

Lost in Calibration

If you are stuck and/or lost in the calibration procedure, turn off the power going to the unit. Make sure that the power LED is no longer illuminated then turn the power to the unit back on. When the unit turns back on, it will be back in the normal standby mode. At this point, start the calibration procedure from step 2.

While in calibration mode, raising pin 4 voltage HIGH (24V) will also return the tool to standby mode without saving.

At each calibration step the Power (Blue) LED light will flash 3 times. After each calibration trigger, the light will flash 3 times when the data is stored.

Tool Does Not Enter Degauss Cycle

For degauss to be successful the magnet MUST be off (pneumatically de-actuated). If the magnet is pneumatically actuated in the on position, then the degauss cycle will not run. Make sure that the magnet is pneumatically de-actuated before running the degauss cycle on the part. When the tool is off and degauss is run properly, LED 2 will sustain an amber color until the cycle is finished. If degauss is NOT enabled, toggling the degauss input will not do anything.

J-Series Operational Flowchart