**MAGSWITCH E50 EU**
P/N: 81501264
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magswitch.com

# E50 Smart Tool EU Version | P/N: 81501264

Featuring Variable Field Output (VFO) technology, this automation-ready magnetic gripper can be controlled using CANopen protocols to de-stack and pick single or multiple sheets. Adjustability of magnetic strength between 0 and 100% allows use of this magnet on both thin and thick sheets of varying sizes and material type. CANopen communication allows integration of multiple tools on the same CANopen bus, controlled simultaneously.


## Specifications

| | | |
|---|---|---|
| **Nominal Maximum Breakaway Force** [1,2] | 464.5 lb | 210.7 kg |
| **Nominal Maximum Shear Force** [1,2] | 160.9 lb | 73.0 kg |
| **Nominal Supply Voltage** | 24 V DC | |
| **Peak Power Draw** | 3 A @ 24 V DC | |
| **Net Weight** | 6.50 lb | 2.95 kg |
| **Connector Type** | Male M12x1.0 – 5 Pin – A-coded | |
| **Mounting Options** | TOP: Ø6-M8-Ø6 NAAMS pattern (x2)<br>TOP: M8-Ø6-M8 NAAMS pattern (x4) | |

| | | | | | |
|---|---|---|---|---|---|
| **De-stack Settings** [3] | Minimum Thickness for De-stack - mm (in) | 0.5 (0.020) | 1 (0.039) | 2 (0.079) | 7 (0.276) |
| | Partial Actuation | 15% | 20% | 35% | 100% |

| **Material Thickness - mm (in)** | 0.5 (0.020) | 1 (0.039) | 2 (0.079) | 3 (0.118) | 4 (0.157) | 5 (0.197) | 6 (0.236) | 7 (0.276) | 12.7 (0.500) | 50 (1.969) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Maximum Force** [1, 2, 5] **- kg (lbs)** | 14.60 (32.19) | 37.83 (83.41) | 70.10 (154.5) | 110.47 (243.5) | 153.40 (338.2) | 182.90 (403.2) | 194.47 (428.7) | 202.67 (446.8) | 210.50 (464.1) | 210.70 (464.5) |

$$SWL\ (Safe\ Working\ Load) = \frac{Maximum\ Force^{5}}{Safety\ Factor\ (\geq 5)}$$

[1] Determined in laboratory environment on SAE1018 Steel with surface roughness 63 micro inches with optimized pole shoes. Many factors contribute to the actual breakaway force and safe working load in each application. Consult a Magswitch Applications Engineer and test the Magswitch in each application before deployment.

[2] All data applies to unit with flat pole shoes installed.

[3] Determined with SAE1018 Steel L=200mm W=200mm.

[4] Values may vary by +/- 5%.

[5] Maximum forces listed above are not safe lifting forces. Designer must take into account safety factor when specifying tool. Magswitch recommends SWL = 5:1 for most applications.

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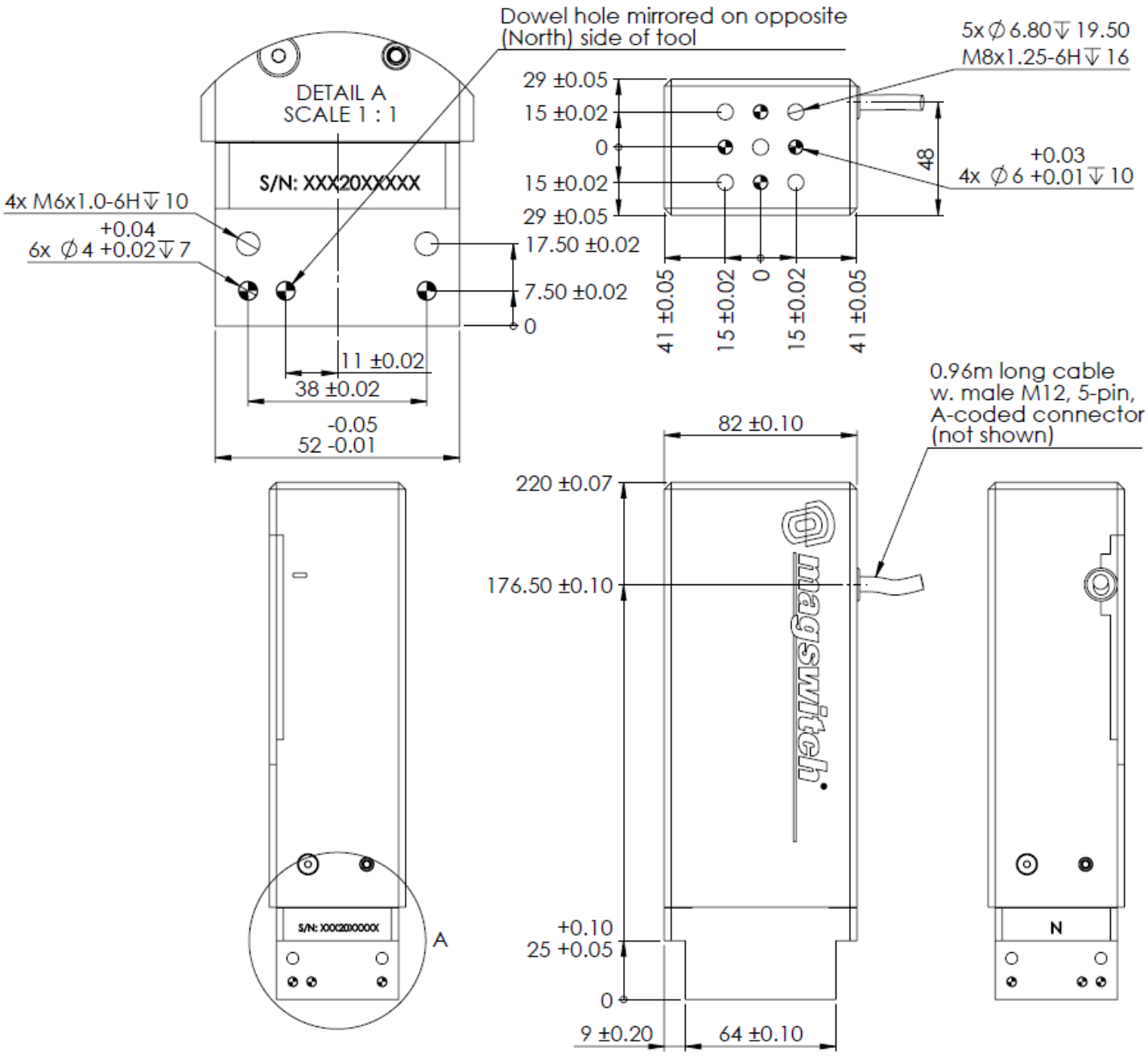
***Pole shoes required for operation***

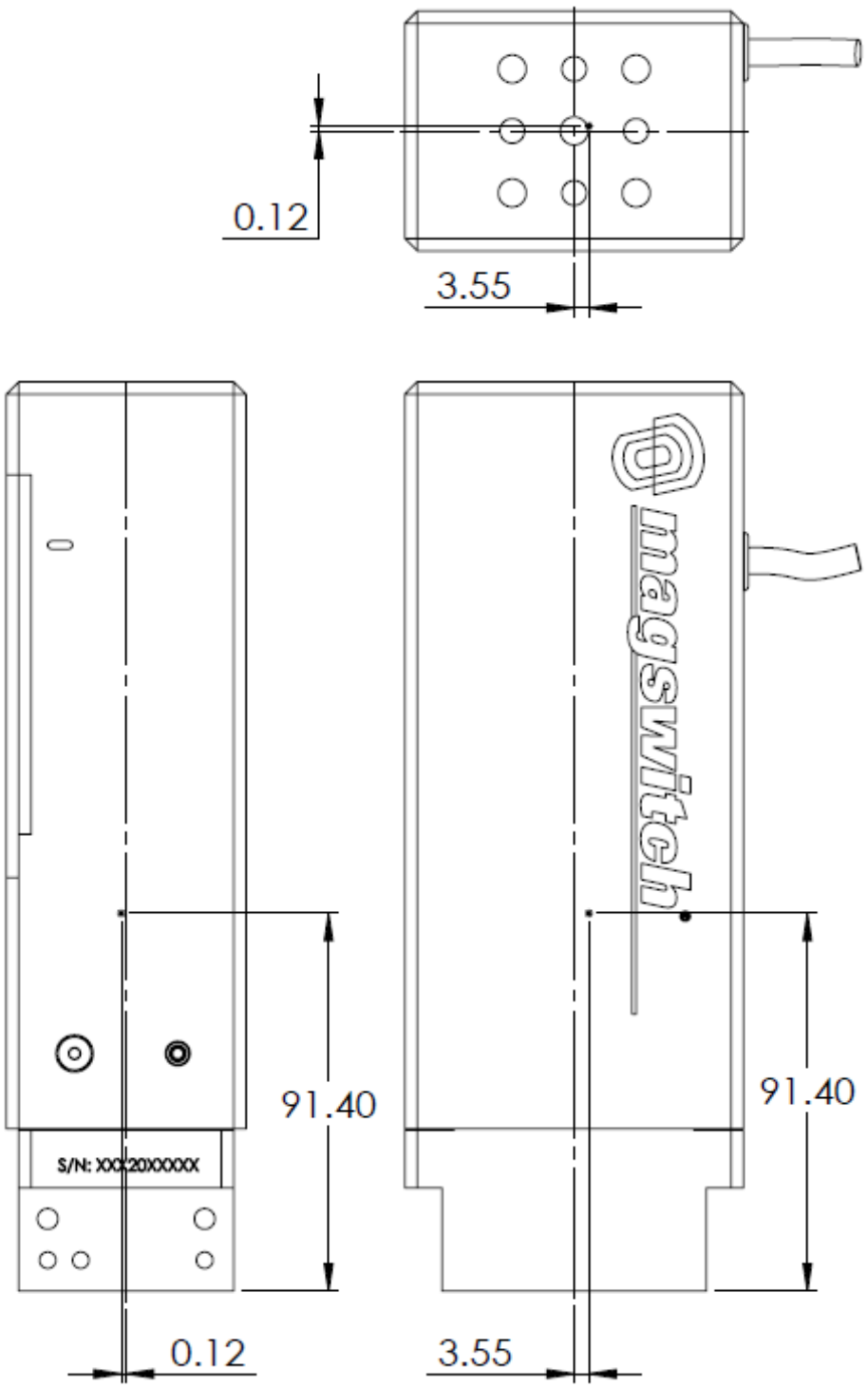
**Standard Kits Available:**

| | |
|---|---|
| Standard Flat Pole Shoe Kit | 8800837 |
| MagMaster: Communication Module for E Series | 8800826 |

**WARNING!**
**Do Not Operate Unless In Contact With Ferrous Target!**



## Center of Mass (COM) Information



## General Electrical Characteristics

| Parameter | Value |
|---|---|
| Input Voltage Range | 24±5% V DC |
| Rated Current Draw (Continuous and Peak) | 3 A DC @ 24 V DC |
| Connection to tool | 0.96 m long, 7.2mm diameter cable, horizontal |
| Connector Style | Male M12 – 5 Pin – A-Coded |

## Ambient Conditions

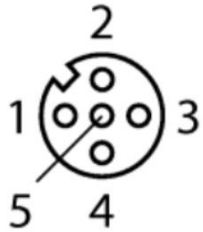
| Parameter | Range |
|---|---|
| Ambient Temperature (Operation) | -10 to +40 Degrees Celsius |
| Ambient Temperature (Storage) | -25 to +80 Degrees Celsius |
| Relative Humidity (non-condensing) | 0 to 95% |

## LED Color Codes

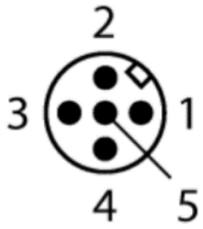
| Function/State | Blue LED State | Green LED State |
|---|---|---|
| No power to tool | OFF | OFF |
| Waiting to home magnet | Blinking | Blinking |
| Magnet actuated OFF | ON | OFF |
| Magnet actuated ON 100% (Fail-Safe) | ON | ON |
| Magnet partially actuated | ON | Blinking |
| Standard calibration routine | Blinks when calibration mode is entered<br>Blinks when steps 1-4 are confirmed | OFF/ON depending on magnet state |
| Auto-calibration routine | Blinks on entry and exit/confirmation | OFF/ON depending on magnet state |

## Connector Pinout

| Pin # | Function | Logic |
|---|---|---|
| 1 | Signal Shield | - |
| 2 | Vin (V+) | +24 VDC |
| 3 | GND (V-) | GND |
| 4 | CANopen bus high | TX/RX high line (D1) (CAN H) |
| 5 | CANopen bus low | TX/RX low line (D0) (CAN L) |



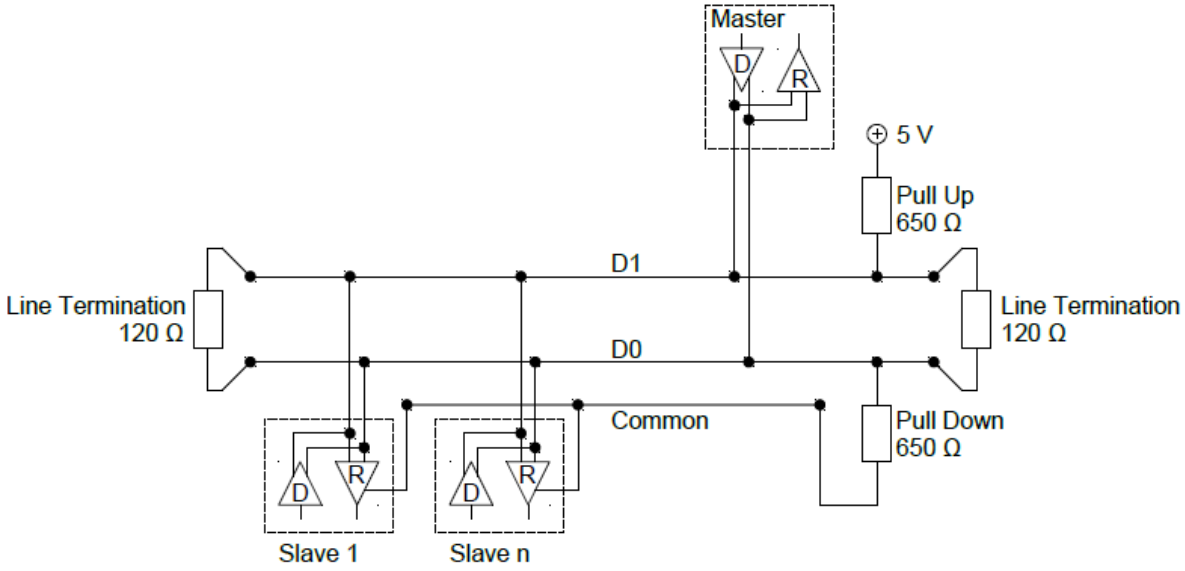

Cable Side: Pin Assignment M12, 5-pin, A-coded, Female Connector (socket-side)




Tool side: Pin Assignment M12, 5-pin, A-coded, Male Connector (pin-side) View

# CANopen Configuration Information

| | |
|---|---|
| CAN Baud Rate | 250 kBaud (Note software version on Page 8) |
| Default CAN Node ID | $14_d = E_h$, See 2a and 2b below for details |
| Device Terminating Resistor | 120 Ω **NOT** enabled |
| Master Device Termination | Master device must have line polarization/termination OR:<br>Apply 450-650 Ω pull-up to +5V on high line (D1) (CAN_H)<br>Apply 450-650 Ω pull-down to GND on low line (D0) (CAN_L) |




## Changing CANopen NodeID

1. Check object $2009_h$ for current CANopen NodeID.
   a. Default NodeID = $14_d = E_h$ (Node ID range in Step 2-a)
2. Write desired NodeID value to $2009_h$.
   a. Software Version 3 & above: Acceptable NodeID value range = $1_d$-$23_d$ (Defaults to 14 if node ID is out of range)
   b. Software Version 2 & below: Acceptable NodeID value range = $1_d$-$127_d$
3. To save, write to object $1010_h$ sub-index $02_h$ the value $1702257011_d$ ($65766173_h$).
4. Wait until object $1010_h$ sub-index $02_h$ is equal to 1.
5. Disconnect and reconnect power.
6. The device NodeID will now be changed.

## Changing CANopen Baud Rate (Not configurable for software version 3 and above)

For changing tool CANopen baud rates, please consult integration/assembly manual 1101334. Available baud rates are 10, 20, 50, 125, 250, 500, and 1000 kBaud.

## CANopen I/O Service Data Objects (SDO's) and Functionality

| Type | Object (hex) | Sub Index (hex) | Short Name | Description |
|---|---|---|---|---|
| Inputs | 2400 | 01 | Move Enable | 1 = home magnet<br>2 = move to position set in 2400:02<br>**0 =reset trigger after each move** |
| | 2400 | 02 | Set Position | Position 0-100% (increments of 1) |
| | 2400 | 03 | Calibration Trigger | Standard Calibration: 1 = trigger (must be reset to 0 after each trigger in standard calibration)<br>Auto Calibration: 1 = start (with Calibration Mode already set to 1)<br>999 = exit & don't save<br>**0 = reset trigger after setting 1 or 999** |
| | 2400 | 04 | Calibration Select | Select calibration storage options 0-3 (4 possible calibrations) |
| | 2400 | 05 | Sensitivity | default = 0<br>more sensitive = -x<br>less sensitive = x<br>typical x values = 5, 10, 20 |
| | 2400 | 06 | Calibration Mode | 0 = standard calibration procedure (good for bin picking, etc)<br>1 = auto calibrate |
| Outputs | 2500 | 01 | Magnet Position | 0-100% (<=2 is considered 0) |
| | 2500 | 02 | Magnet State | 0 = OFF<br>1= Partial ON<br>2 = Magnet ON 100% (Fail-Safe) |
| | 2500 | 03 | Calibration State | 0 = no South Pole, no North Pole, and no part present in range<br>1 = only North pole on<br>2 = only South Pole on<br>3 = both poles on, but no part present<br>4 = North, South, part present all within Range |
| | 2500 | 04 | In Calibration | 0 = not in Calibration<br>1 = In Standard Calibration<br>2 = In Auto Calibration |
| | 2500 | 05 | Calibration Step | 0 = not in calibration<br>1 = waiting for best circuit<br>2 = waiting for worst circuit<br>3 = waiting for South Pole<br>4 = waiting for North pole |
| | 2500 | 06 | Cycle Count | Number of times the tool has been turned on to full power |
| | 2500 | 07 | Home Status | 0 = not properly homed<br>1= Properly homed |
| | 2500 | 08 | Move Status | 0 = not complete<br>1 = Last set move complete |
| | 2500 | 09 | Serial Number | Magswitch Tool Serial Number |
| | 2500 | 0A | Magnet Software Version | Magswitch Software Version |
| | 2500 | 0B | Tool Type | 30 for E30, 50 for E50 |
| | 2005 | | CANopen Baud Rate | $85_h = 133_d$ = 250 kBaud by default.<br>Consult configuration manual 1101334 before changing |
| | 2009 | | CANopen Node ID | Refer to Pg.7: Step 2a and 2b for more details on NodeID range<br>$E_h = 14_d$ by default |

## CANopen I/O Process Data Objects (PDO's) and Functionality

NOTE: PDO functionality is ONLY available on E50 model 81151264 labeled "E50_01EU" or per custom arrangement with Magswitch Technology. Model 81401264 labeled "E50_01US" is NOT configured to use PDO's by default.

| RxPDO | Offset in Byte | COB-ID | Description (Object) |
|---|---|---|---|
| 1 | 0 | NodeID + 0x200 | 2400:03 Control word |
| | 1 | | |
| | 2 | | |
| | 3 | | |
| | 4 | | 2400:01 Mode |
| | 5 | | |
| | 6 | | |
| | 7 | | |
| 2 | 8 | NodeID + 0x300 | 2400:02 Position Value |
| | 9 | | |
| | 10 | | |
| | 11 | | |
| | 12 | | 2400:04 Select calibration bank 0--3 |
| | 13 | | |
| | 14 | | |
| | 15 | | |
| 3 | 16 | NodeID + 0x400 | 2400:05 Set senstivity |
| | 17 | | |
| | 18 | | |
| | 19 | | |
| | 20 | | 2400:06 Calibration Mode |
| | 21 | | |
| | 22 | | |
| | 23 | | |

Note that COB-IDs are NodeID dependent for simultaneous operation of several E-series tools on the same CANopen bus.

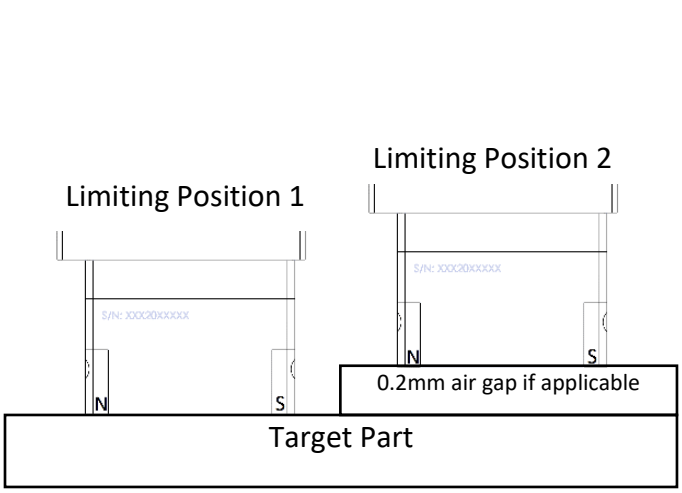
| TxPDO | Offset in Byte | COB-ID | Description (Object) |
|---|---|---|---|
| 1 | 0 | NodeID + 0x180 | 2500:06 Cycle count |
| | 1 | | |
| | 2 | | |
| | 3 | | |
| | 4 | | 2500:09 Serial number |
| | 5 | | |
| | 6 | | |
| | 7 | | |
| 2 | 8 | NodeID + 0x280 | 2500:0A Software version |
| | 9 | | |
| | 10 | | |
| | 11 | | |
| | 12 | | 2500:0B Tool type |
| | 13 | | |
| | 14 | | |
| | 15 | | |
| 3 | 16 | NodeID + 0x380 | 2500:01 Drive position value |
| | 17 | | |
| | 18 | | |
| | 19 | | |
| | 20 | | 2500:02 Magnet State |
| | 21 | | |
| | 22 | | |
| | 23 | | |
| 4 | 24 | NodeID + 0x480 | 2500:03 Calibration State |
| | 25 | | |
| | 26 | | |
| | 27 | | |
| | 28 | | 2500:05 Calibration Step |
| | 29 | | |
| | 30 | | |
| | 31 | | |
| 5 | 32 | NodeID + 0x48D | 2500:04 In Calibration? |
| | 33 | | |
| | 34 | | |
| | 35 | | |
| | 36 | | 2500:07 Homed? |
| | 37 | | |
| | 38 | | |
| | 39 | | |
| 6 | 40 | NodeID + 0x48E | 2500:08 Last Movement Complete? |
| | 41 | | |
| | 42 | | |
| | 43 | | |
| | 44 | | Disregard Data – Internal Use only |
| | 45 | | |
| | 46 | | |
| | 47 | | |

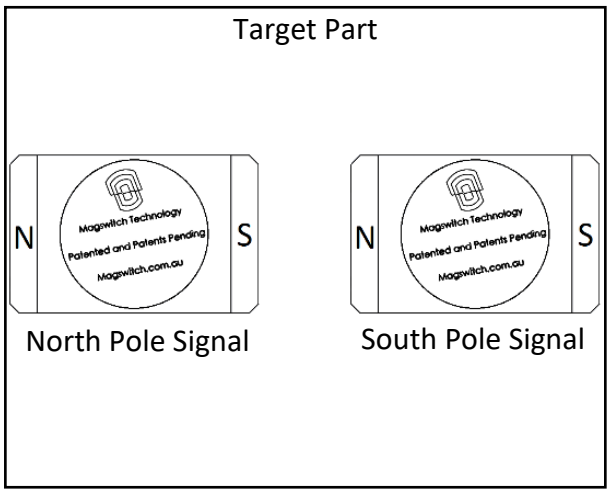
## 4-Step Calibration Procedure

**See setup manual 1101340 for more detail.**

**Step 1**
Limiting Position 1 for Calibration Match Signal
**Step 2**
Limiting Position 2 for Calibration Match Signal
**Step 3**
South Pole Position for South Pole Signal
**Step 4**
North Pole Position for North Pole Signal

Object **CalState (2500:03$_h$)** will return 4 when the contact quality between both poles and the part lie within the zone created by bounding Limiting Position 1, Limiting Position 2, and North and South Pole calibration signals.
Object **CalState (2500:03$_h$)** will return 2, 3, or 4 if contact quality is equal to or better than the stored South Pole signal.
Object **CalState (2500:03$_h$)** will return 1, 3, or 4 if contact quality is equal to or better than the stored North Pole signal.




The following flowchart shows the proper CANopen signaling required to enter and set calibrations 0-4. Note that all "output" objects can be polled at any time to determine the current state of the calibration process.

It is critical that the magnet be fully actuated (setPosition / OutPos = 100) at each calibration step to guarantee proper field values are stored. **The tool will not allow you to confirm calibration steps 1 through 4 unless the magnet is ON and the green light is lit.**

The supplementary document 1101340 can be provided by Magswitch if additional information regarding calibration procedure is needed.

## Auto-Calibration Procedure

Actuate tool OFF and enter auto-calibration mode by setting object 2400:04=$1_d$ and then writing 2400:03=$1_d$. Position the tool on the desired part. Once the tool is actuated ON and the green light is lit, the tool records magnetic field strengths in the current configuration and stores them as allowable Part Present boundaries. Add or adjust parts and fixtures to widen the allowable range of field strengths. By writing 2400:03=$0_d$, auto-calibration parameters are saved and standard operation resumes. Tool should NOT be actuated OFF until auto-calibration is exited and saved otherwise calibration values will be skewed. Tool should not be actuated off-target or calibration range will exceed practical usage and part present functionality will be inaccurate.

# E-Series Operational Flowchart