

MagMaster BlackBox Manual 88001624

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BlackBox Diagram

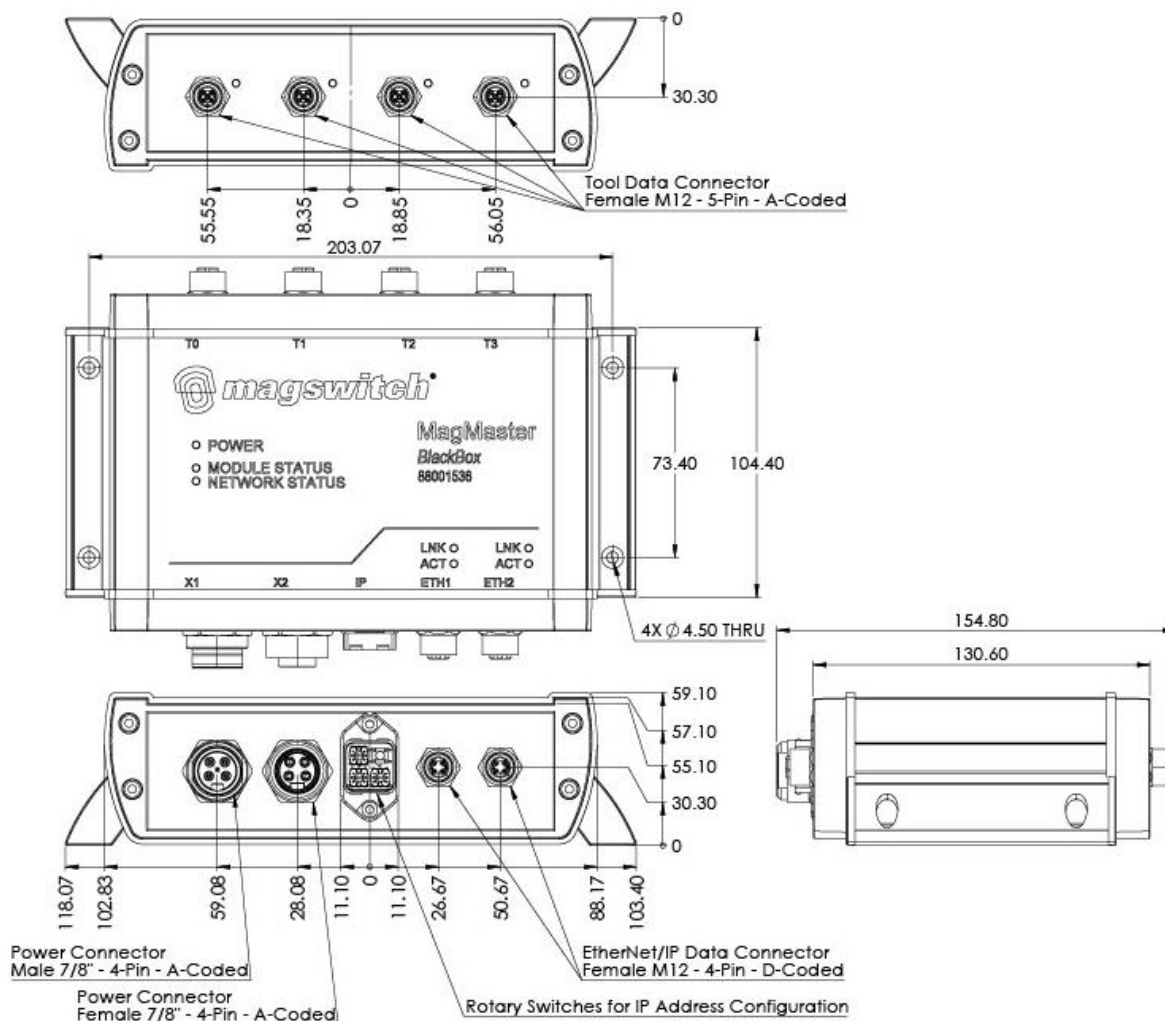


Figure 1: BlackBox 2D Drawing

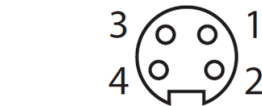
Specifications

Nominal Supply Voltage	24 V DC	
Peak Power Draw	10 A @ 24 V DC	
Net Weight	3.3 lb	1.5 kg
Connector Type	Power: Male 7/8" - 4-Pin - A-coded Power: Female 7/8" - 4-Pin - A-coded 2x EtherNet/IP Data: Female M12 - 4-Pin - D-coded 4x Tool Data: Female M12x1.0 – 5 Pin – A-coded	
Mounting Options	4x M4	

Connector Pinouts

Male/Female Power Connectors (7/8" 4-Pin)

Pin #	Function	Logic
1	V2 (V+)	+24 VDC
2	V1 (V+)	+24 VDC
3	GND V1 (V-)	GND
4	GND V2 (V-)	GND



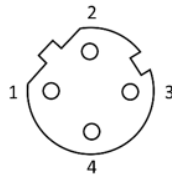
Pin Assignment 7/8", 4-pin, A-coded, Female Connector (socket-side) View



Pin Assignment 7/8", 4-pin, A-coded, Male Connector (pin-side) View

Female EtherNet/IP Connectors (M12 4-Pin D-coded)

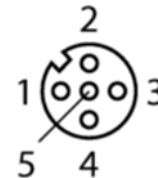
Pin #	Function
1	TX +
2	RX +
3	TX -
4	RX -



Pin Assignment M12, 4-pin, D-coded, Female Connector (socket-side) View

Tool Data Connector (M12 5-Pin)

Pin #	Function	Logic
1	Signal Shield	-
2	V1 (V+)	+24 V DC
3	GND V1 (V-)	GND
4	CANopen bus high	TX/RX high line (D1) (CAN H)
5	CANopen bus low	TX/RX low line (D0) (CAN L)



Pin Assignment M12, 5-pin, A-coded, Female Connector (socket-side) View

IP Address Setup



Figure 2 Rotary Cap Removal

Remove rotary cap by rotating the cap counter clockwise and pulling backwards to access rotary switches for IP address changes.

Rotary Switches for IP Address Configuration

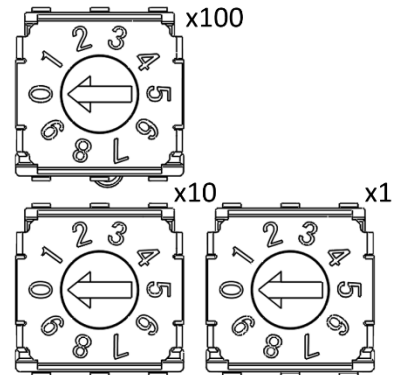
Rotary Switch Code*	IP Address	Note
999 (Default)	192.168.1.254	
255 or Greater	192.168.1.254	
254 or less	Sets the last octet	First 3 octets can be customized from web interface. Default is 192.168.1.XXX
000	DHCP	

*Requires restart after changing rotary switches

Default Gateway: 192.168.1.1 – changeable via web interface when rotary switches 254 or less

Default Subnet Mask: 255.255.255.0 – changeable via web interface when rotary switches 254 or less

Default IP Address: 192.168.1.39 – The rotary switches ship with the IP address set to “039”



LED Color Codes

LED	Color	Status	Description
Power	Green	Solid	The µC part of the device has power
		Off	No power or device damaged
Module Status	Green	Solid	Device is ready
		Off	Device is not ready, usually still in boot process
Network Status	Green	Solid	EtherNet/IP connection established
		Flashing	EtherNet/IP connection is gone
	Red	Flashing	EtherNet/IP Time Out
		Off	No EtherNet/IP connection since bootup
LNK (ETH1/ETH2)	Green	Solid	Ethernet link established
		Off	No Ethernet link
ACT (ETH1/ETH2)	Orange	Flashing	Ethernet activity
		Off	No Ethernet link
T0 – T3	Green	Solid	CANopen bus logic level “high”, usually bad wiring or damaged CANopen device
		Flashing	CANopen bus communication
		Off	CANopen bus logic level “low”, normal if no CANopen communication

Equipment and Cables required:

The below table shows the list of equipment, cables and connectors needed for setting up the tool. In the links column, example links have been provided to obtain this equipment from the Cable Manufacturer website.

Item No.	Turck PN	Description	Link	Single-Mag Quantity	Multi-Mag Quantity (For P number of tools)	Maximum Cable Length Recommendation
1	RSC RKC 572-xM*	Cable: Magmaster Blackbox to E-Series Tool	http://pdb2.turck.de/en/DE/products/00000006000218520002003a	1	P	20 Meters **
2	RSSD RJ45S-441-xM*	Cable: M12 4 pin connector to RJ45	http://turck.de/en/DE/products/0000003700030d270003003a	1	1	100 Meters (328 ft)
3	RKM 43 - xM*	7/8" Male Power Cable to Field wires	https://www.turck.de/en/product/000000060003251c0001003a	1	1	N/A
4	7700-A4A01-U1C0500	7/8" 4 Pin Power	https://shop.murrelektronik.com/en/Connection-Technology/Connection-cables/Power/Mini-7-8-4-pole-Male-Ext-0-Female-0-7700-A4A01-U1C0500.html	1	0	N/A
5	7700-A4021-U1C0500	7/8" Female Power Cable to Field wires	https://shop.murrelektronik.com/en/Connection-Technology/With-open-ended-wires/Power/Mini-7-8-4-pole-Female-0-w-Cable-7700-A4021-U1C0500.html	0	P	N/A

* The x in the Turck PN refers to the length of the cable in Meters. Some of the links contain example lengths for these cables. Please order cables of lengths that are of the right length based on your requirements

** If longer cable lengths are required please contact Magswitch for more information.

After all the above cables are available, please follow the steps below to correctly connect all the required tools. The cable names are referenced based on the item number in the above table. Images are provided below each step for reference.

Single-Mag Setup:

Please refer to the schematic diagram below in Figure 3 for the wiring diagram setup for a Single Mag Setup
ONLY FOR THE TOOLS: E30, E50, ELAY30X5 AND ELAY 30X7

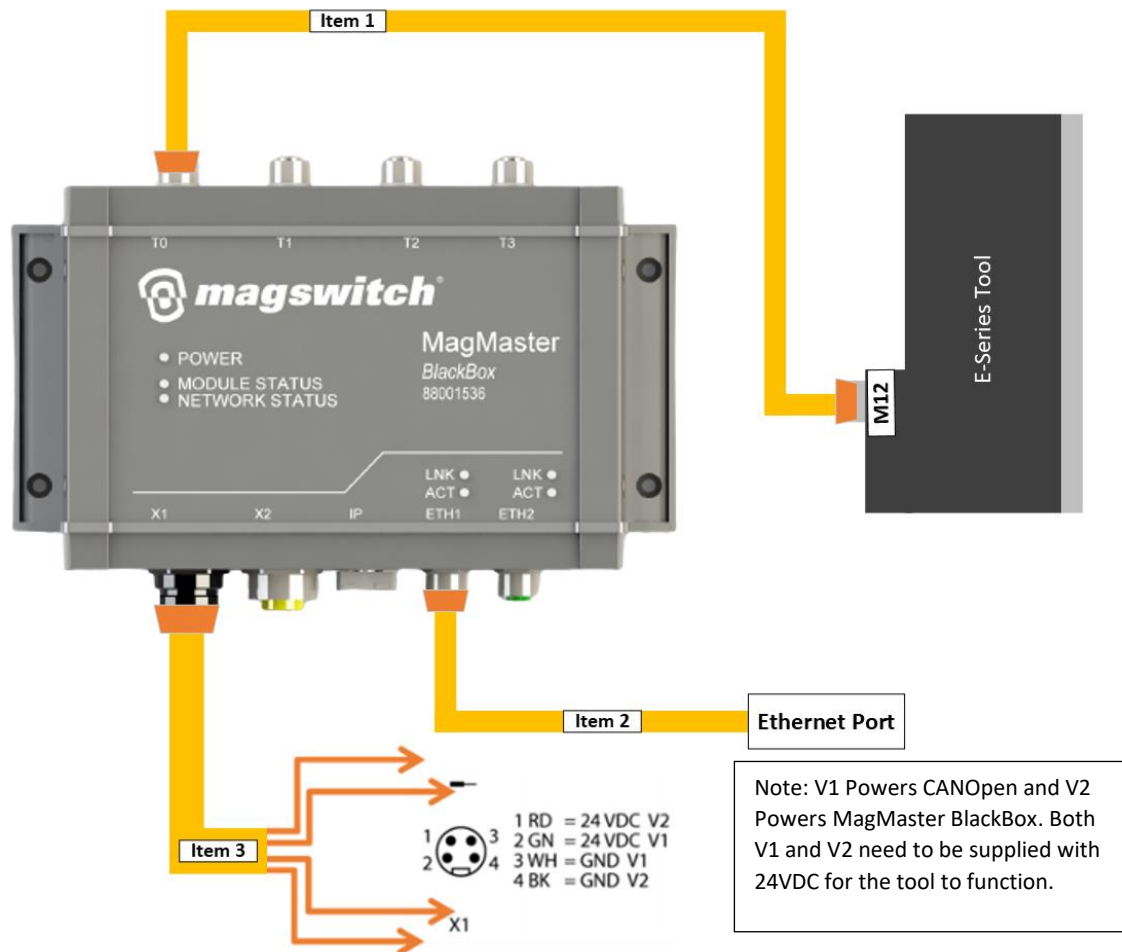


Figure 3: Single-Mag Setup for E30, E50, ELAY 30x5, ELAY 30x7

Note: In the above image (Figure 3) refer to the connector pinouts detailing the four pins connected to Item No.3. Only V1 needs to be wired and powered up. V1 powers the Serial Interface and MagMaster BlackBox.

Please refer to the schematic diagram below in Figure 4 for the wiring diagram setup for a Single Mag Setup
ONLY FOR THE TOOLS: ELAY 50X5 AND ELAY 70X6

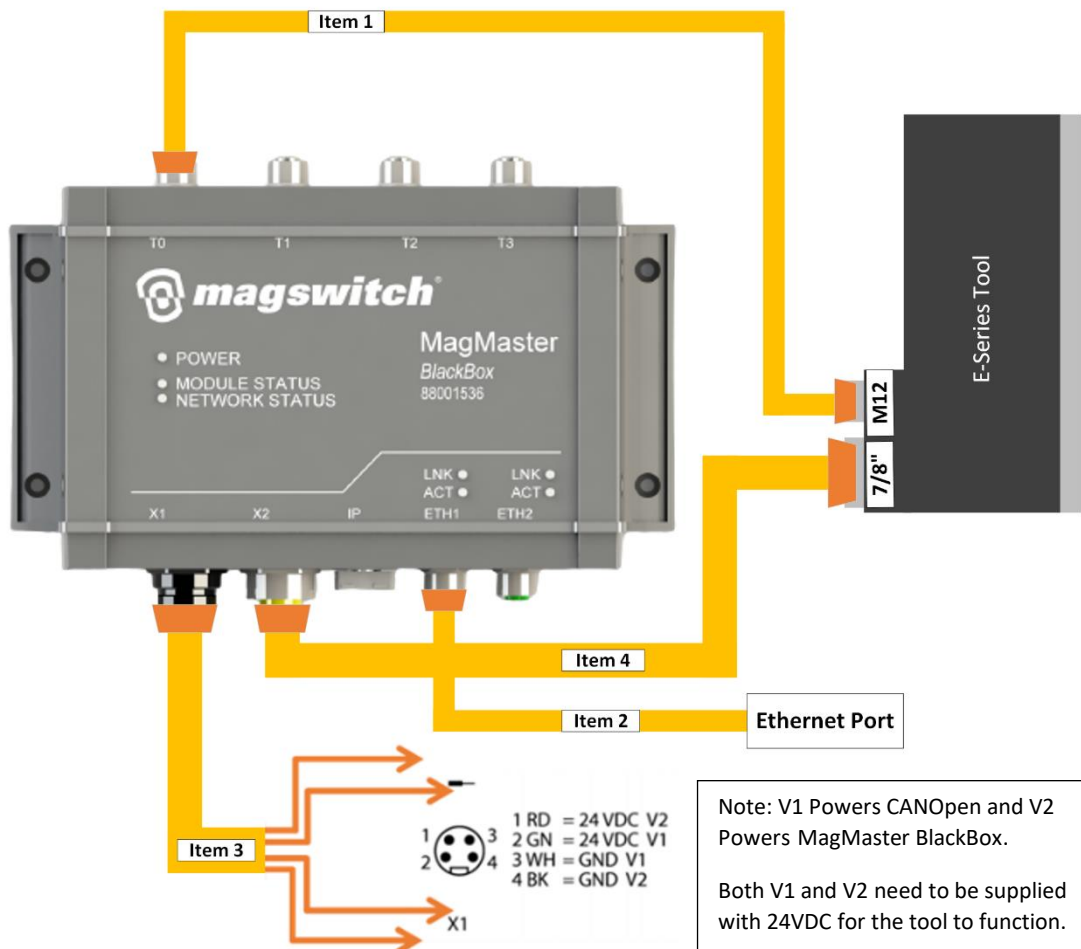


Figure 4: Single-Mag Setup for ELAY 50x5 and ELAY 70x6

Note: In the above image (Figure 4) refer to the connector pinouts detailing the four pins connected to Item No.3. Only V1 needs to be wired and powered up. V1 powers the Serial Interface and MagMaster BlackBox. Item No.4. can also be powered from external power supply rather than Blackbox connector X2

Multi-Mag Setup:

Please refer to the schematic diagram below in Figure5 for the wiring diagram setup for a Multi - Mag Setup.

Each Magmaster Blackbox can connect up to 4 tools at a time. Each tool has it's own dedicated Serial network and is connected to T0,T1,T2,T3. During a multimag setup tools may actuate at different intervals. If there are 4 tools connected and any of the tools are an E50 or ELAY 30x5 or 30x7, that internal firmware will actuate the magnets in two separate groups to manage power consumption.

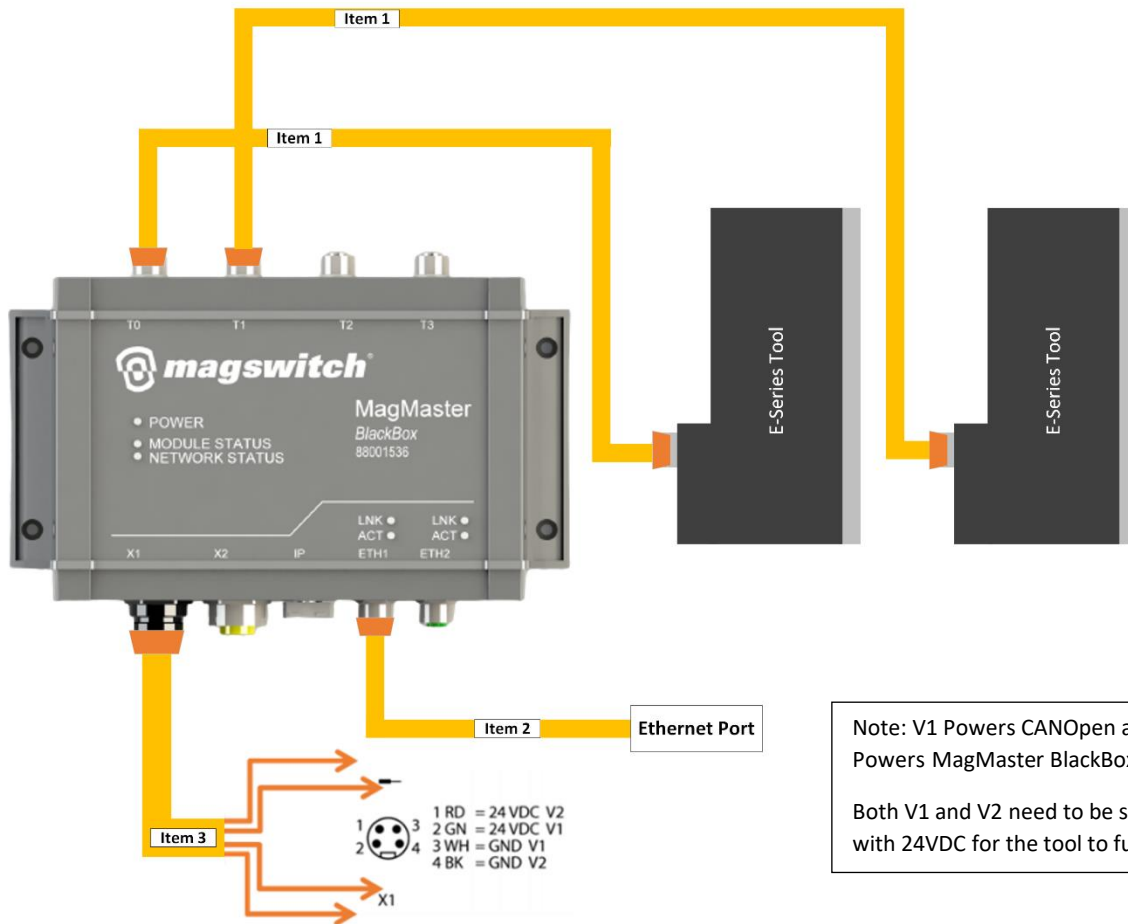


Figure 5: Multi-Mag Setup for E30, E50, ELAY 30x5, ELAY 30x7

Note: In the above image (Figure 5) refer to the connector pinouts detailing the four pins connected to Item No.3. Only V1 needs to be wired and powered up.

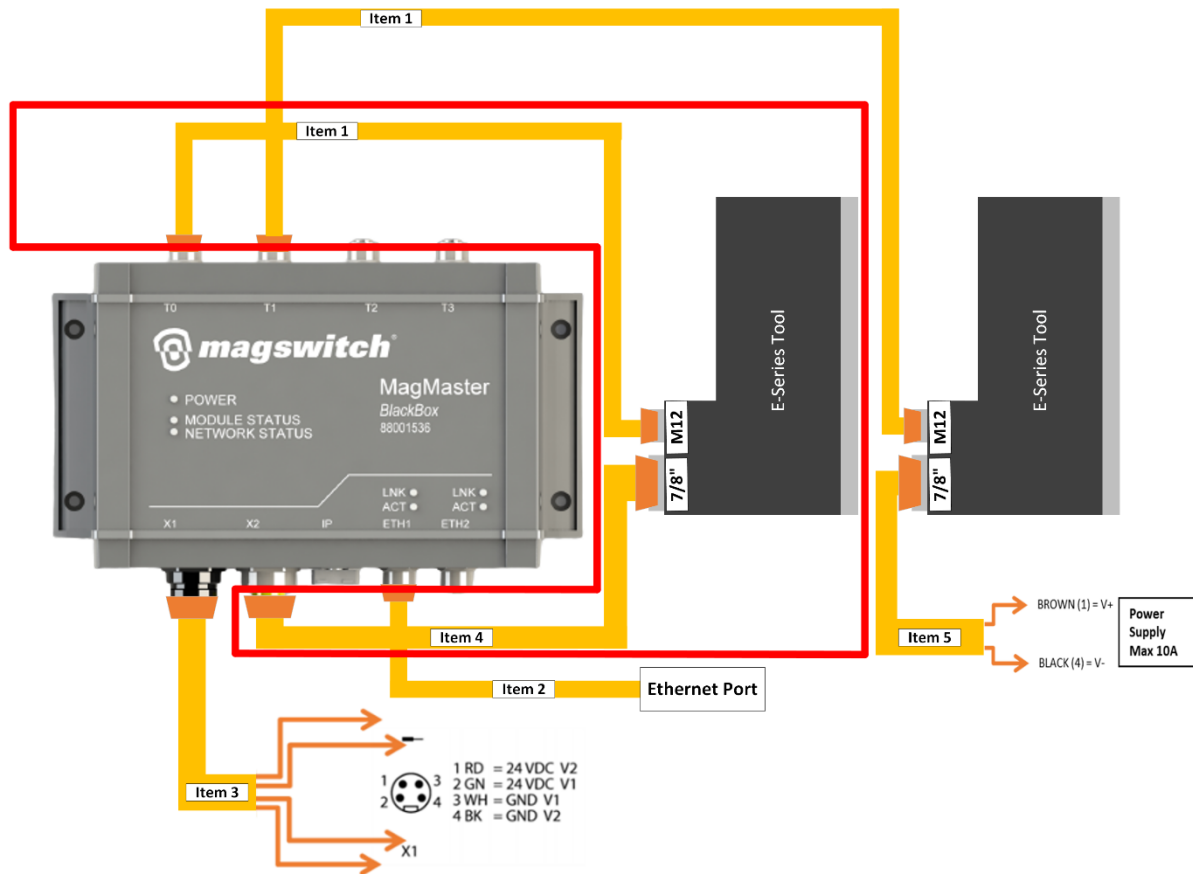



Figure 6: Multi-Mag Setup for E30, E50, ELAY 30x5, ELAY 30x7

Note: In the above image (Figure 6) refer to the connector pinouts detailing the four pins connected to Item No.3. Only V1 needs to be wired and powered up. V1 powers the Serial Interface and MagMaster BlackBox. Item No.4. can also be powered from external power supply rather than Blackbox connector X2.

Web Interface Access

To access web interface, go to IP address in a web browser. Please review prior section for IP address setup. The default Dashboard page will look as follows upon loading the web browser page. This page contains basic information about the device and established connections. The Dashboard, Configuration, Tool Control, and EDS-File pages can all be accessed without a password. The System and Diagnosis pages require a username and password. Username: Debug / Password: m@gDB



Refreshing... ●

Dashboard

Configuration

Tool Control

System

Diagnosis

EDS-File



MagMaster BlackBox Standard

IP-Address:	192.168.1.99	Ethernet	Port 1	Port 2
MAC-Address:	b4:bc:7c:f5:12:f4	Link:	OK	No Link
Serial #:	88001539			
HW Rev:	V1.0			
FW Version:	V2.1.2			
Order #:	88001624			


EtherNet/IP:	Not Running
Tools are controlled by:	EtherNet/IP
Switched Power:	Out of Rangel (0.0V)

	T0	T1	T2	T3
Magnet Position:	Disabled	Disabled	Disabled	Disabled
North Pole:	-	-	-	-
South Pole:	-	-	-	-

Figure 7: MagMaster BlackBox Web Interface

Web Interface – Configuration

The Configuration page allows the user to enable power and communication for Magswitch E Series tools on ports T0-T3. The page also gives additional information about the connected tool such as tool type and software version. When checking or unchecking the Power Enabled or the Tool Enabled, the user must click Apply for the changes to take effect.



Refreshing...

Dashboard

Configuration

Tool Control

System

Diagnosis

EDS-File

Port Configuration

Apply the changes for all ports:

Apply

Discard

T0

T1

T2

T3

Power Enabled:	<input checked="" type="checkbox"/>
Tool:	
Communication Enabled:	<input checked="" type="checkbox"/>
Node ID:	14
Type:	30
Serial No:	32519010
SW Version:	18
Cycle Count:	1
Error Code:	h0

Figure 8: Configuration Page

Web Interface – Tool Control

To control the connected Magswitch tools from the web interface, please select the Tool Control tab from the left hand side of the screen. This screen now has four tabs similar to the configuration screen for monitoring and controlling each tool T0-T3 individually from the web interface. In order to control the selected tool from the web interface, the Force Control checkbox must be enabled. If this checkbox is disabled, the tools will be controlled by EtherNet/IP communication. However, the status can still be seen from the web interface even when being controlled by the EtherNet/IP network. Please note that to return tool to normal operation the Force Control box must be unchecked.

Tool Control

Force Control ☒ **Note:** If this box is checked, all tools are controlled by the Web Interface only.

T0

T1

T2

T3

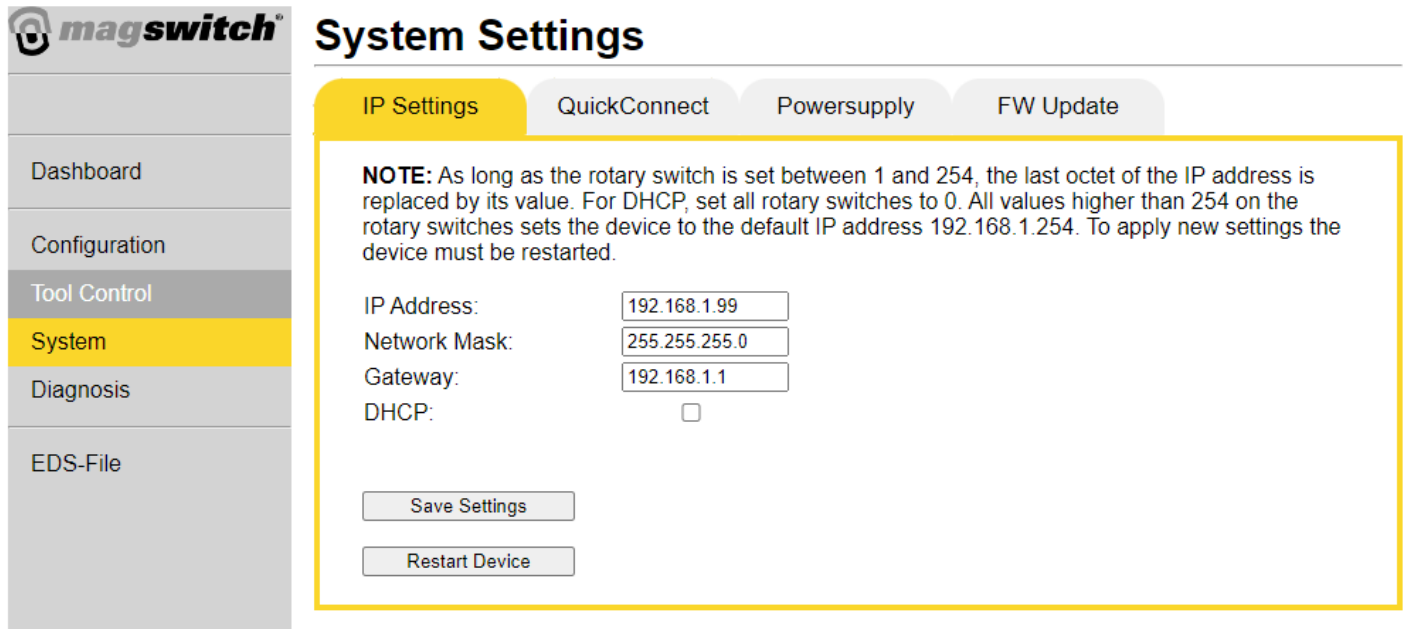
Control	Status
Home Magswitch	Magswitch Online: <input checked="" type="radio"/>
Turn Magswitch Full On	Magswitch Ready: <input checked="" type="radio"/>
Turn Magswitch Full Off	Magswitch Full On: <input type="radio"/>
Restart Tool	Magswitch Full Off: <input checked="" type="radio"/>
Request Position	Magswitch Partial On: <input type="radio"/>
	Magswitch Position: 0
	North: 473
	South: 521
Simple Learn	Learn Complete: <input checked="" type="radio"/>
Multi-Step Learn	Learning Step: 0
Cancel Learn	Learn Error: <input type="radio"/>
	(Magnet Full On?)
Learn Part (0 to 3): 0	Part Present: <input type="radio"/>
Sensitivity (-20 to 50): 0	N Pole On: <input type="radio"/>
	S Pole On: <input type="radio"/>

Figure 9: Tool Control

After selecting the desired tool, simply click on the Home magswitch. This will initiate the homing process for the E-Series tool, and the Magswitch Ready box should be checked, as depicted in Figure 10 below. Once the Magswitch Ready feature has been confirmed, the user may proceed to power the tool on or off. By selecting Full On, the tool will activate to its full capacity, and the user can effortlessly switch between full on, partial on, or full off modes without any further steps. If users encounter any unexpected behavior from the tool, they have the option to perform a restart. This action will initiate a reset of the tool's firmware, which may help address any issues they are experiencing. However, it's important to note that after the restart, the tool will need to be homed again. The Simple Learn and Multi-Step Learn processes are detailed in the document 1101474 – E-Series Magmaster Calibration Manual.

Web Interface – System

The System page allows the user access to view and various system settings within the BlackBox. The IP settings tab is to configure the IP address and network settings as well as restart the BlackBox.



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System Settings

IP Settings QuickConnect Powersupply FW Update

NOTE: As long as the rotary switch is set between 1 and 254, the last octet of the IP address is replaced by its value. For DHCP, set all rotary switches to 0. All values higher than 254 on the rotary switches sets the device to the default IP address 192.168.1.254. To apply new settings the device must be restarted.

IP Address: 192.168.1.99

Network Mask: 255.255.255.0

Gateway: 192.168.1.1

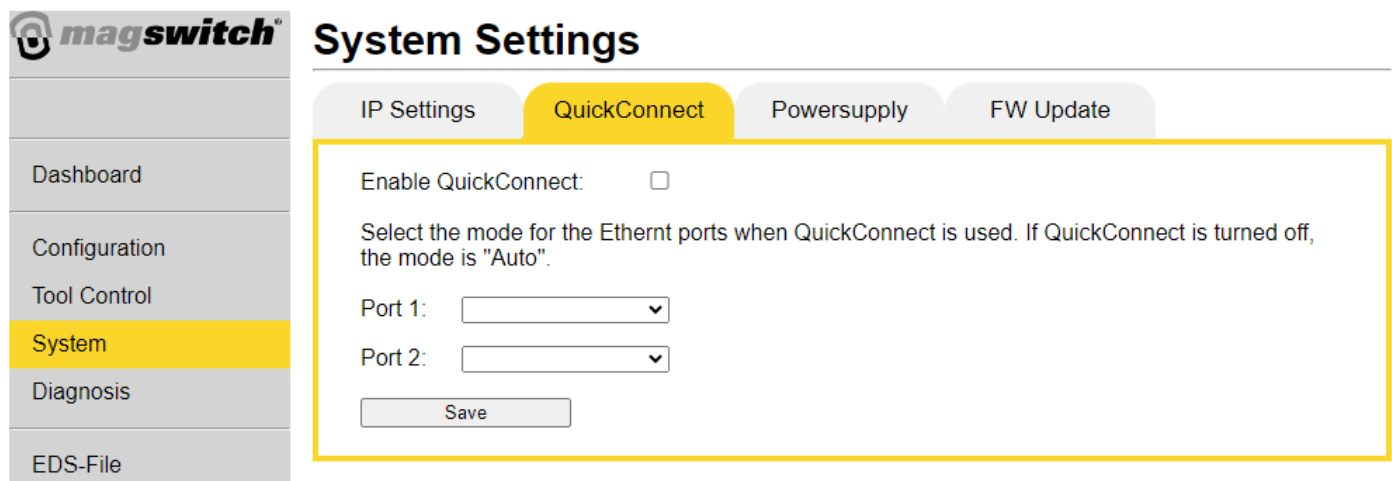
DHCP: ☐

Save Settings

Restart Device

Figure 10: IP Settings

The “QuickConnect” tab shown in Figure 11 allows the user to change to enable quick connect meaning, the ethernet port can be pre selected to half or full duplex allowing for quick connectivity.



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System Settings

IP Settings QuickConnect Powersupply FW Update

Enable QuickConnect: ☐

Select the mode for the Ethernet ports when QuickConnect is used. If QuickConnect is turned off, the mode is "Auto".

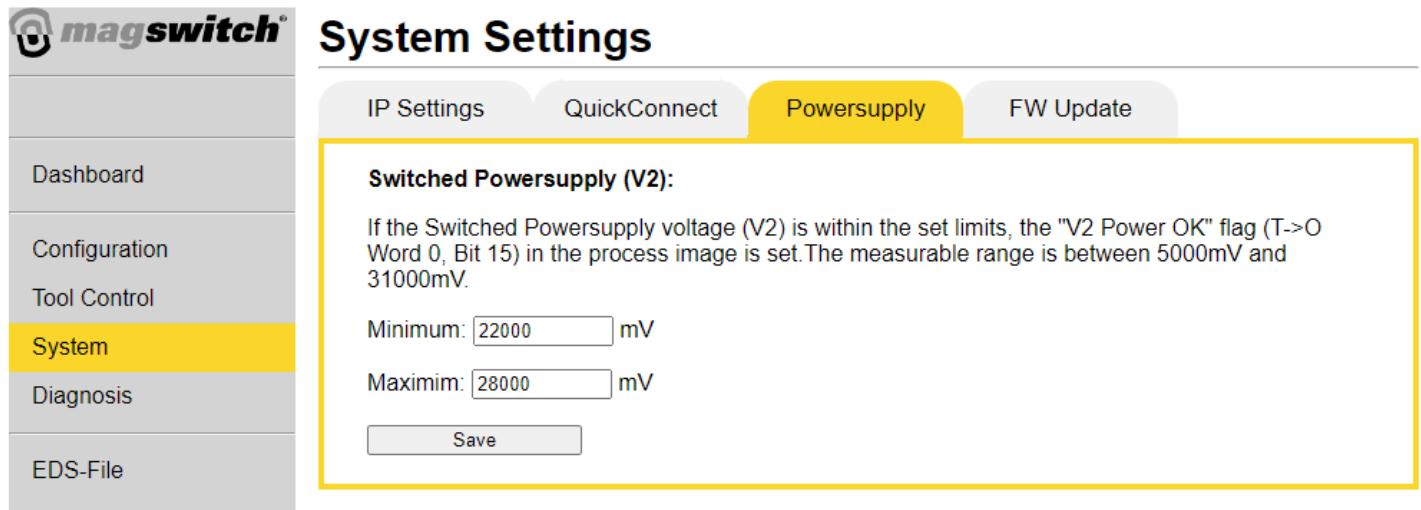
Port 1:

Port 2:

Save

Figure 11: QuickConnect

The “PowerSupply” tab shown in figure 13 allows for the user to set a minimum and maximum voltage levels that will be output to the ethernet map to determine if the supply power is within the specified range.



The screenshot shows the 'System Settings' page with the 'Powersupply' tab selected. The left sidebar contains links to Dashboard, Configuration, Tool Control, System (highlighted), Diagnosis, and EDS-File. The main content area has tabs for IP Settings, QuickConnect, Powersupply, and FW Update. Under the Powersupply tab, the 'Switched Powersupply (V2):' section contains a text description, two input fields for 'Minimum' (22000 mV) and 'Maximum' (28000 mV), and a 'Save' button.

Switched Powersupply (V2):

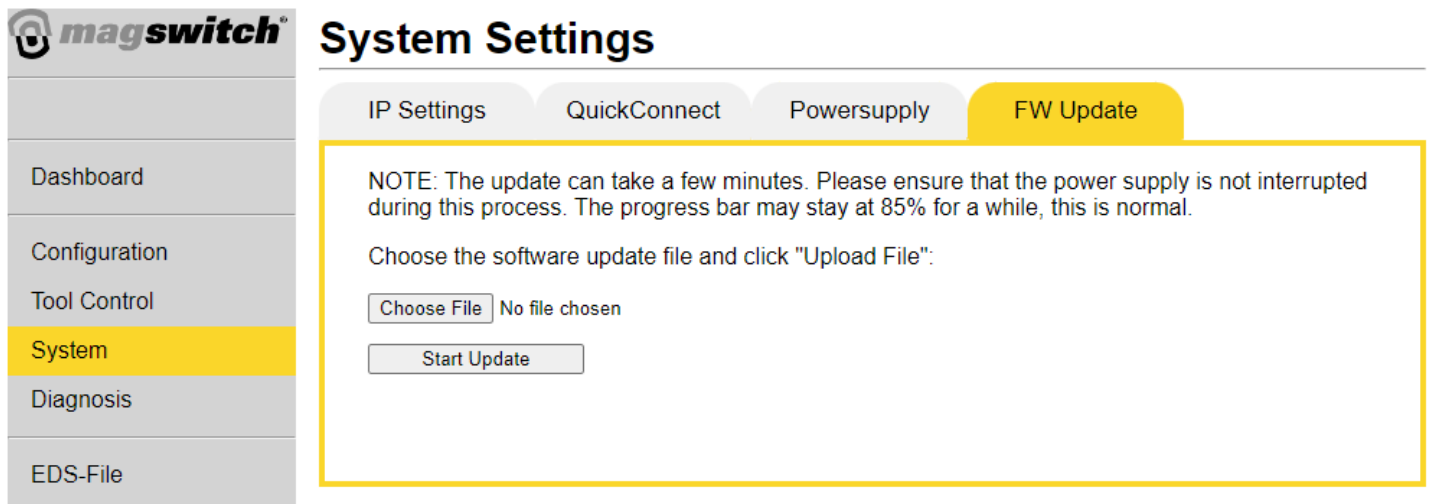
If the Switched Powersupply voltage (V2) is within the set limits, the "V2 Power OK" flag (T->O Word 0, Bit 15) in the process image is set. The measurable range is between 5000mV and 31000mV.

Minimum: mV

Maximum: mV

Figure 12: Powersupply

Finally, figure 14 allows the user to update the firmware revision of the BlackBox.



The screenshot shows the 'System Settings' page with the 'FW Update' tab selected. The left sidebar is the same as in Figure 12. The main content area has tabs for IP Settings, QuickConnect, Powersupply, and FW Update (highlighted). Under the FW Update tab, there is a 'NOTE' about the update process, instructions to choose a software update file, a 'Choose File' button (showing 'No file chosen'), and a 'Start Update' button.

NOTE: The update can take a few minutes. Please ensure that the power supply is not interrupted during this process. The progress bar may stay at 85% for a while, this is normal.

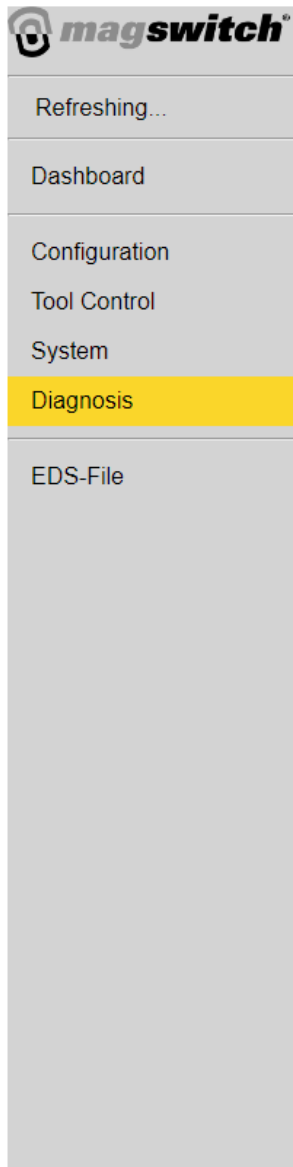
Choose the software update file and click "Upload File":

No file chosen

Figure 13: Powersupply

Web Interface – Diagnosis

The Diagnosis page allows the user to control and monitor the tool similar to the setup page, but also adds additional features for the debugging. The Reset Reference button is intended for debug purposes only and should only be used when directed by Magswitch. This function is utilized to reset some of the internal values of the tool in event of specific errors and needs to be used with caution as the magnet will turn on and off during this process. The READ/WRITE SDO feature should only be used in debugging. Reading specific registers can help diagnose any problems the tool is having. **Warning writing to unknown indexes can cause unexpected behaviour please consult with Magswitch before attempting any write operations.**



Diagnosis

Force Control ☐ **Note:** If this box is checked, all tools are controlled by the Web Interface only.

T0		T1	T2	T3
Control		Status		
Home Magswitch		Magswitch Online: <input type="radio"/>		
Turn Magswitch Full On		Magswitch Ready: <input type="radio"/>		
Turn Magswitch Full Off		Magswitch Full On: <input type="radio"/>		
Restart Tool		Magswitch Full Off: <input type="radio"/>		
Request Position		Magswitch Partial On: <input type="radio"/>		
50		Magswitch Position: 0		
		North: 0		
		South: 0		
Simple Learn		Learn Complete: <input type="radio"/>		
Multi-Step Learn		Learning Step: 0		
Cancel Learn		Learn Error: <input type="radio"/> (Magnet Full On?)		
Learn Part (0 to 3): 0		Part Present: <input type="radio"/>		
Sensitivity (-20 to 50): 0		N Pole On: <input type="radio"/>		
		S Pole On: <input type="radio"/>		
Reset Reference		Braking Chopper State: OK		
		Braking Chopper Temp: 29 °C / 84 °F		
Index: Sub: Value:		SDO: Index: Sub-Index: Date:		
16# 16# 16#		Hardstop: 16#2410 16#20 0		
Read Write		Serial number: 16#2500 16#09 0		
		Software Version: 16#2500 16#0A 0		
		ToolType: 16#2500 16#0B 0		
		Encoder Alignment: 16#2050 16#00 0		

Figure 14: Diagnosis

Web Interface – EDS File

To download the EDS file, click the EDS-File tab on the left hand side of a the screen on the web interface. “MagMaster_BlackBox.eds” will be begin downloading as soon as this tab is clicked.

For controllers that do not accept EDS file uploads and require manual input please use the following information:

<u>Device/Vendor info</u>	
Vendor ID	1730
Device Type	12
Product Code	1001

<u>Class 1 Connection Information</u>		
	Instance	Size in Bytes:
Configuration	103	
Output	102	8
Input	101	24

Output Datamap (from Robot/Controller Perspective)

Tool #	Word #	Bit #	Function	Description
T0	Word 0	0	Enable MultiMag	Enable MultiMag Communication and allows all tools connected to be controlled from word 0 of memory map for easy and fast tool synchronization
		1	Magnet Full ON	Turns Magnet to full on position (Magnet Full Off must be off)
		2	Magnet Full Off	Turns Magnet to full off position
		3	Magnet Partial ON	Enables tool to have partial position (Magnet Full ON and Magnet Full Off must be off)
		4	HOME	Starts tool homing sequence
		5	Restart Tool	Reboots tool for fault and or debug purposes
		6	Simple Learn	Please refer to 1101474 for calibration procedures
		7	Multi-Step Learn	
		8	Cancel Learn	
		9	Learned Part 1	Combined Value range is 0-3
		10	Learned Part 2	
		11	Negative Sensitivity Range Enable	Sets positive or negative range in sensitivity values in word 1 of data map
		12	N/A	

Tool #	Word #	Bit #	Function	Description
	Word 1	13	N/A	
		14	N/A	
		15	N/A	
			REQ PSN 1	Sends numerical value for requested position of tool (0-100) range
			REQ PSN 2	
			REQ PSN 4	
			REQ PSN 8	
			REQ PSN 16	
			REQ PSN 32	
			REQ PSN 64	
			REQ PSN 128	
			Sensitivity 1	When Word 0 Bit 11 is Low range is 0-50. When Word 0 Bit 11 is High range is -20-0. Sent to Object 2400:05
			Sensitivity 2	
			Sensitivity 4	
			Sensitivity 8	
			Sensitivity 16	
			Sensitivity 32	
			Sensitivity 64	
			Sensitivity 128	
T1	Word 2	0	Enable MultiMag	Enable MultiMag Communication and allows all tools connected to be controlled from word 0 of memory map for easy and fast tool synchronization
		1	Magnet Full ON	Turns Magnet to full on position (Magnet Full Off must be off)
		2	Magnet Full Off	Turns Magnet to full off position
		3	Magnet Partial ON	Enables tool to have partial position (Magnet Full ON and Magnet Full Off must be off)
		4	HOME	Starts tool homing sequence
		5	Restart Tool	Reboots tool for fault and or debug purposes
		6	Simple Learn	Please refer to 1101474 for calibration procedures
		7	Multi-Step Learn	
		8	Cancel Learn	
		9	Learned Part 1	Combined Value range is 0-3
		10	Learned Part 2	
		11	Negative Sensitivity Range Enable	Sets positive or negative range in sensitivity values in word 3 of data map
		12	N/A	
		13	N/A	
		14	N/A	
		15	N/A	
	Word 3		REQ PSN 1	Sends numerical value for requested position of

Tool #	Word #	Bit #	Function	Description
			REQ PSN 2	tool (0-100) range
			REQ PSN 4	
			REQ PSN 8	
			REQ PSN 16	
			REQ PSN 32	
			REQ PSN 64	
			REQ PSN 128	
			Sensitivity 1	When Word 0 Bit 11 is Low range is 0-50. When Word 0 Bit 11 is High range is -20-0. Sent to Object 2400:05
			Sensitivity 2	
			Sensitivity 4	
			Sensitivity 8	
			Sensitivity 16	
			Sensitivity 32	
			Sensitivity 64	
			Sensitivity 128	
T2	Word 4	0	Enable MultiMag	Enable MultiMag Communication and allows all tools connected to be controlled from word 0 of memory map for easy and fast tool synchronization
		1	Magnet Full ON	Turns Magnet to full on position (Magnet Full Off must be off)
		2	Magnet Full Off	Turns Magnet to full off position
		3	Magnet Partial ON	Enables tool to have partial position (Magnet Full ON and Magnet Full Off must be off)
		4	HOME	Starts tool homing sequence
		5	Restart Tool	Reboots tool for fault and or debug purposes
		6	Simple Learn	Please refer to 1101474 for calibration procedures
		7	Multi-Step Learn	
		8	Cancel Learn	
		9	Learned Part 1	Combined Value range is 0-3
		10	Learned Part 2	
		11	Negative Sensitivity Range Enable	Sets positive or negative range in sensitivity values in word 5 of data map
		12	N/A	
		13	N/A	
		14	N/A	
		15	N/A	
	Word 5		REQ PSN 1	Sends numerical value for requested position of tool (0-100) range
			REQ PSN 2	
			REQ PSN 4	
			REQ PSN 8	
			REQ PSN 16	

Tool #	Word #	Bit #	Function	Description
			REQ PSN 32	When Word 0 Bit 11 is Low range is 0-50. When Word 0 Bit 11 is High range is -20-0. Sent to Object 2400:05
			REQ PSN 64	
			REQ PSN 128	
			Sensitivity 1	
			Sensitivity 2	
			Sensitivity 4	
			Sensitivity 8	
			Sensitivity 16	
			Sensitivity 32	
			Sensitivity 64	
			Sensitivity 128	
T3	Word 6	0	Enable MultiMag	Enable MultiMag Communication and allows all tools connected to be controlled from word 0 of memory map for easy and fast tool synchronization
		1	Magnet Full ON	Turns Magnet to full on position (Magnet Full Off must be off)
		2	Magnet Full Off	Turns Magnet to full off position
		3	Magnet Partial ON	Enables tool to have partial position (Magnet Full ON and Magnet Full Off must be off)
		4	HOME	Starts tool homing sequence
		5	Restart Tool	Reboots tool for fault and or debug purposes
		6	Simple Learn	Please refer to 1101474 for calibration procedures
		7	Multi-Step Learn	
		8	Cancel Learn	
		9	Learned Part 1	Combined Value range is 0-3
		10	Learned Part 2	
		11	Negative Sensitivity Range Enable	Sets positive or negative range in sensitivity values in word 7 of data map
		12	N/A	
		13	N/A	
		14	N/A	
		15	N/A	
	Word 7		REQ PSN 1	Sends numerical value for requested position of tool (0-100) range
			REQ PSN 2	
			REQ PSN 4	
			REQ PSN 8	
			REQ PSN 16	
			REQ PSN 32	
			REQ PSN 64	
			REQ PSN 128	
			Sensitivity 1	When Word 0 Bit 11 is Low range is 0-50. When



MAGSWITCH
MagMaster BlackBox Manual 88001624
+ 1(303) 468.0662
magswitch.com

Tool #	Word #	Bit #	Function	Description
			Sensitivity 2	Word 0 Bit 11 is High range is -20-0. Sent to Object 2400:05
			Sensitivity 4	
			Sensitivity 8	
			Sensitivity 16	
			Sensitivity 32	
			Sensitivity 64	
			Sensitivity 128	

Input Datamap (from Robot/Controller Perspective)

Tool #	Word #	Bit #	Function	Description
T0	Word 0	0	Magnet is Full ON	Magnet in tool is in fully on position
		1	Magnet is Full Off	Magnet in tool is in fully off position
		2	Magnet is Partial ON	Magnet in tool is in partial on position
		3	Magnet 1 Ready	Magnet in tool is ready
		4	Comm OK Magnet 1	Communication from tool is OK
		5	Tool Error**	See Note **
		6	Part Present	Please refer to 1101474 for calibration procedures
		7	N Pole ON	
		8	S Pole ON	
		9	Learn Part Complete	
		10	Learn Part Error	Combined Value range is 0-4
		11	Learn Step 1	
		12	Learn Step 2	
		13	Learn Step 4	
		14	N/A	
		15	V2 Power Within Range	Bit remains high if voltage in range as seen in Figure 12.
	Word 1	0	Act PSN 1	Actual numerical value of magnet position in tool (0-100)
		1	Act PSN 2	
		2	Act PSN 4	
		3	Act PSN 8	
		4	Act PSN 16	
		5	Act PSN 32	
		6	Act PSN 64	
		7	Act PSN 128	
		8	N/A	
		9	N/A	
		10	N/A	
		11	N/A	
		12	N/A	
		13	N/A	
		14	N/A	
		15	N/A	
T1	Word 2	0	Magnet is Full ON	Magnet in tool is in fully on position
		1	Magnet is Full Off	Magnet in tool is in fully off position
		2	Magnet is Partial ON	Magnet in tool is in partial on position
		3	Magnet 1 Ready	Magnet in tool is ready
		4	Comm OK Magnet 1	Communication from tool is OK

Tool #	Word #	Bit #	Function	Description
		5	Tool Error**	See Note **
		6	Part Present	Please refer to 1101474 for calibration procedures
		7	N Pole ON	
		8	S Pole ON	
		9	Learn Part Complete	
		10	Learn Part Error	
		11	Learn Step 1	Combined Value range is 0-4
		12	Learn Step 2	
		13	Learn Step 4	
		14	N/A	
		15	N/A	
	Word 3	0	Act PSN 1	Actual numerical value of magnet position in tool (0-100)
		1	Act PSN 2	
		2	Act PSN 4	
		3	Act PSN 8	
		4	Act PSN 16	
		5	Act PSN 32	
		6	Act PSN 64	
		7	Act PSN 128	
		8	N/A	
		9	N/A	
		10	N/A	
		11	N/A	
		12	N/A	
		13	N/A	
		14	N/A	
		15	N/A	
T2	Word 4	0	Magnet is Full ON	Magnet in tool is in fully on position
		1	Magnet is Full Off	Magnet in tool is in fully off position
		2	Magnet is Partial ON	Magnet in tool is in partial on position
		3	Magnet 1 Ready	Magnet in tool is ready
		4	Comm OK Magnet 1	Communication from tool is OK
		5	Tool Error**	See Note **
		6	Part Present	Please refer to 1101474 for calibration procedures
		7	N Pole ON	
		8	S Pole ON	
		9	Learn Part Complete	
		10	Learn Part Error	
		11	Learn Step 1	Combined Value range is 0-4

Tool #	Word #	Bit #	Function	Description
		12	Learn Step 2	
		13	Learn Step 4	
		14	N/A	
		15	N/A	
	Word 5	0	Act PSN 1	Actual numerical value of magnet position in tool (0-100)
		1	Act PSN 2	
		2	Act PSN 4	
		3	Act PSN 8	
		4	Act PSN 16	
		5	Act PSN 32	
		6	Act PSN 64	
		7	Act PSN 128	
		8	N/A	
		9	N/A	
		10	N/A	
		11	N/A	
		12	N/A	
		13	N/A	
		14	N/A	
		15	N/A	
T3	Word 6	0	Magnet is Full ON	Magnet in tool is in fully on position
		1	Magnet is Full Off	Magnet in tool is in fully off position
		2	Magnet is Partial ON	Magnet in tool is in partial on position
		3	Magnet 1 Ready	Magnet in tool is ready
		4	Comm OK Magnet 1	Communication from tool is OK
		5	Tool Error**	See Note **
		6	Part Present	Please refer to 1101474 for calibration procedures
		7	N Pole ON	
		8	S Pole ON	
		9	Learn Part Complete	
		10	Learn Part Error	Combined Value range is 0-4
		11	Learn Step 1	
		12	Learn Step 2	
		13	Learn Step 4	
		14	N/A	
		15	N/A	
	Word 7	0	Act PSN 1	Actual numerical value of magnet position in tool (0-100)
		1	Act PSN 2	
		2	Act PSN 4	

Tool #	Word #	Bit #	Function	Description
		3	Act PSN 8	
		4	Act PSN 16	
		5	Act PSN 32	
		6	Act PSN 64	
		7	Act PSN 128	
		8	N/A	
		9	N/A	
		10	N/A	
		11	N/A	
		12	N/A	
		13	N/A	
		14	N/A	
		15	N/A	

**** If the Tool Error bit is set, kindly navigate to the web interface tool configuration, as shown in Figure 8, to check the error code. Please make a note of the error code and consult with Magswitch for further assistance.**

Sensor Values

Accurately determining the presence and thickness of parts on the tool is essential for proper functioning. When the tool is in operation with no part present, the north sensor reading will approach 1023, while the south sensor will approach 0. However, if a part is present, the north and south sensor values depend on the thickness of the part and quality of the magnetic circuit. The thicker the part or better the magnetic circuit, the closer the north and south pole magnetic sensor values will move towards approximately 500 as shown in Figure 13. The quality of the magnetic circuit can be affected in different ways such as by air gaps, pole shoe geometry, pole shoe coatings or part conditions (rust, burrs, casting imperfections, etc.).

Customers can program their respective controller or robot to learn various part specifications through sensor values, ensuring precise part selection. By leveraging sensor values, we can guarantee that the correct part is present, accurately selected, and correctly gripped.

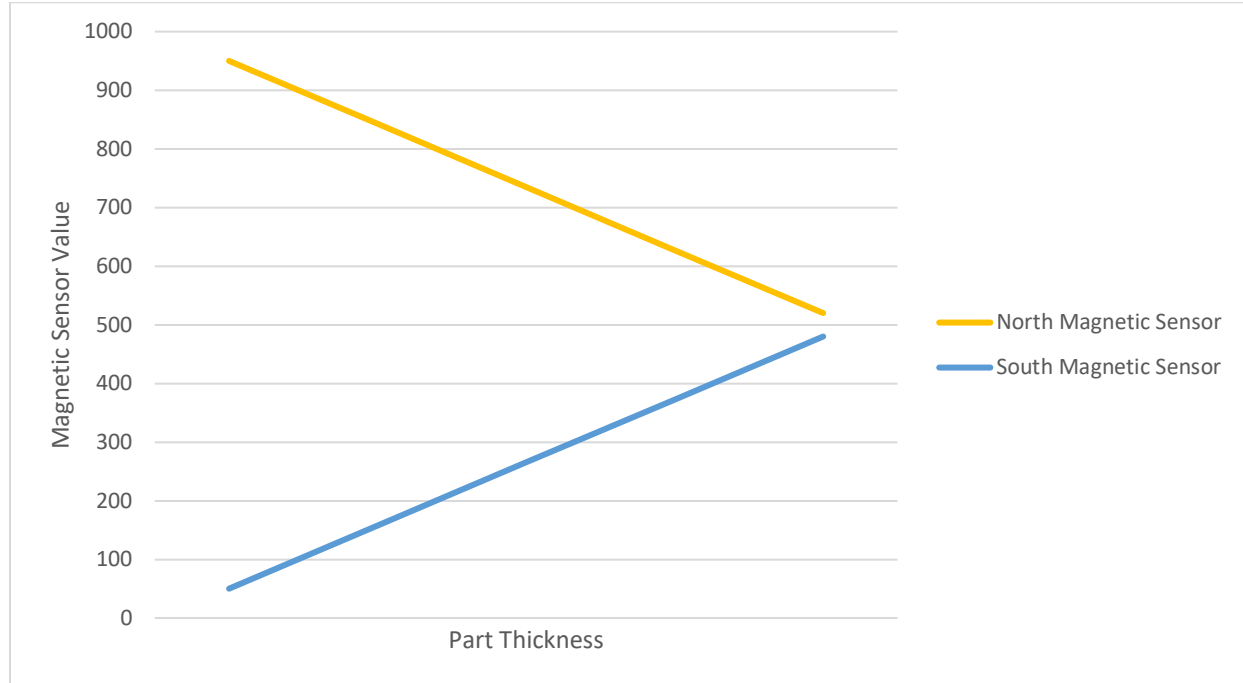


Figure 13 North and South magnetic sensor value's, with tool fully on and part thickness increases