

CoBot SmartMagGrip E30 Fanuc Manual

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Magswitch Gripper PLUGIN Installation

Prior to powering on robot, please ensure the CoBot SmartMagGRip E30 (Magswitch Gripper) is plugged into the I/O connector on the robot wrist.

Before installing plugin please ensure that Karel is enabled and Multitasking is loaded by following the steps outlined below.

Press the menu key to Expand the options



Figure 1: Menu options



Under the system submenu select variables



Figure 2: Variables View Screen

Ensure that the variable KAREL_ENB has a value of 1

🕑 ikprogrammer			-		×
		100%	AUTO	7	R
SYSTEM Variables					
		418/	944		
397 \$IRCA_BUF001	[61] of ITEM_BUFF_EL				
398 \$IRCA_BUF002	[61] of ITEM_BUFF_EL				
399 \$IRCA_BUF003	[61] of ITEM_BUFF_EL				
400 \$IRCA_CFG	IRCA_CNF_T				
401 \$IRCA_HIS001	<pre>[7] of HIST_DAY_T</pre>				
402 \$IRCA_HIS002	<pre>[7] of HIST_DAY_T</pre>				
403 \$IRCA_HIS003	<pre>[7] of HIST_DAY_T</pre>				
404 SIRCA_I_CFG	<pre>[3] of ITEM_NAME_T</pre>				
405 \$IRPROG_CFG	IRPROG_CFG_T				
406 \$ISDT_ISOLC	<pre>[4] of INTEGER</pre>				
407 \$J23_DSP_ENB	TRUE				
408 \$JCR	JCR_T				
409 \$JCR_GRP	JCR_GRP_T				
410 \$JINC	JINC_T				
411 \$JOBPROC_ENB	0				
412 \$JOG_GROUP	UJR_GRP_T				
413 \$JOG_IN_AUTO	1				
414 \$JPOSREC_ENB	0				
415 \$KANJI_MASK	0				
416 \$KARELMON	KARELMON T				
417 \$KAREL CFG	KAREL CFG T				
418 \$KAREL ENB	1				
	gitam			_	

Figure 3: Karel_ENB screen



Press the Status key to expand the menu options

IRProgrammer					- 0	×
⊞ 🕈 ^{test} ⊠				100%		
STATUS Version ID						
ALARM	ORD NO: J513 J542			5	53/333	
1/0 >	J637 J650					
SETUP APER PUR-TIT	J539 H510					
USER	LCHK OPLG J502					
SELECT	MHCR PSLG					
EDIT	MCSP J506					
DATA >	J554 MDSW					
STATUS	OPCO MBBO					
AD GRAPHICS	R637 J600					
Clock	PCMF R000					
Variables						
OT Release						
Axis Limits	SOFTWARE	CONFIG	MOTOR	SERVO		>

Figure 5: Status screen

Press the version id key to access the software installed options

S iRProgrammer						- 0	×
⊞ 🕈 ^{test}					100%		R
STATUS Version ID							
ALARM ALARM	2 3 7 7 8 1 2 2	RD NO: J513 J542 J510 J637 J650 J539 H510 LCHK OPLG J503 MHCR PSLG MCSP			5	53/333	
EDIT DATA STATUS Axis Version ID Force Sensor Stop Signal Force bid		J506 J554 MDSW MDCO OPCO MPRO R637 J500 PCMF R000					
Exec-hist Memory		SOFTWARE	CONFIG	MOTOR	SERVO	>	





Press the F3 Config key

IRP IRP	rogrammer						-	0	×
≣						100%	uro	P	R
STAT	US Version ID								
1 2 3 4 5 6 7 8 9 10 11 12 3 14 15 16 7 18 9 20 21 22 23	SOFTWARE: HandlingTool S/W Serial No. Controller ID Robot No. Manufacturing ID Default Personality (1 CRX-101A/L Servo Code Cart. Mot. Parameter Joint Mot. Parameter Joint Mot. Parameter DCS Stop pattern Software Edition No. Update Version Update Version Doot MONITOR Teach Pendant Browser Flugins TP Core Firmware TP Operating System HTML5 Browser Media from FRA	ID: 7DF5/20 88340 F00000 From FD) V9.40P/20 1234567890 V3.00 V4.5.2 D V9.40P/20 None V9.40131 V0.00P/00 7D0D/01P ge,70.1 V9.40P/20 N/20/2021					1/2	4	
	III [TYPE]	SOFTWARE	CONFIG)	MOTOR	SERVO		>	

Figure 7: Config Version Screen

Scroll to find multi tasking and ensure order number J600 is present.

🕤 iRPr	rogrammer					- 0	\times
≣	TEST☑				100%		
STAT	US Version ID						
	FEATURE:	ORD NO:				53/333	
44	MMR Motion log	PSLG					
45	MechStop Protection	MCSP					
46	Mirror Shift	J506					
47	Mixed Logic	J554					
48	Mode Switch	MDSW					
49	Motion Diag. Core	MDCO					
50	Motion Optm. Core	OPCO					
51	Motion Profiler	MPRO DC27					
52	Motion logger	X637					
53	Multi-Tasking	DOVE					
54	Pow function	POMP					
50	Position Checking	T514					
50	Position Registers	7507					
50	Prog Num Selection	.7515					
50	Program Adjust	.7517					
60	Program Shift						
61	Program Status	DD90					
62	Program Viewar	7697					
63	RDM Robot Discovery	FROM					
64	Realtime Fred Anlus	FREO					
65	Remote Conn Standard	BMCN					
66	Robot Servo Code	H930					
	10200 00200 0040						
	[TYPE]	SOFTWARE	CONFIG	MOTOR	SERVO		

Figure 8: Multi tasking present verification



Open the settings menu and go to plugins. Install MS GRIP to start the process.



Figure 9: PLUGIN List Before Installation

After it is complete and the robot power is cycled, Magswitch Configuration and Magswitch Robot Setup are now shown in the PLUGIN directory.



Figure 10: Successful Installation of Magswitch PLUGIN

For more detailed steps on installing plugins, please refer to the Fanuc CRX manuals.



Configuring Robot Tool Center Point (TCP) and Registers

From the dropdown menu, under plugins, select MagSwitch Robot Setup.



Figure 11: Selecting Magswitch Robot Setup Screen

Once selected, the screen will look like the following figure. At any point, the 🖤 symbol can be selected to provide snippets of information from this manual relevant to that section.

8:47 🕅 🖬 🛓 🔹							NI 99 🗎
				10%	AUTO	7	R
Magswitch RobPRIO-230 r	therNet/IP	Adapter	Error (1)			V	RESET
Standard Magswitch N	lounts				/	🗑 mag	switch
Configuration Type: A	Configuration T	ype: B	Configu	ration Typ	De: C		
Teetti	Flat mounting plate	9	45° mar plat	anting a			
V136 polestrose Plat polestrose				mor V135 oleshoes Armor flat oleshoes rmor side we lat and V135	ills for both poleshoes]	
Configur	ation for T	ool Cen	ter Point	(TCP))		
Select the mount that matches your application.	▼						
Enter the tool number for the Magswitch TCP selected. Default is Tool 1.	1					?	
Co	nfiguratior	for Pa	rt Presen	t			
Enter the starting R[] number for Part Present checking. This register and the next 2 consecutive registers will hold the status values for Part Present, N Pole, S Pole.	150					?	
Apply selections							
▲ Play			▲ Robot	Operati	ion		

Figure 12: Magswitch Robot Setup Screen



45° mounting

plate

Armor V135

poleshoes

Armor flat poleshoes

Armor side walls for both flat and V135 poleshoes

Mount Poleshoe Configuration Naming Flat mounting Convention Teeth plate A Flat Flat Flat Α poleshoes V-Cut A Vcut135 Flat А V135 A Teeth А Flat Teeth poleshoes 45° **B** Armor Flat Flat В Flat 45° B Armor V135 V-Cut В poleshoe С C Armor Flat 45° Flat С C Armor V135 45° V-Cut

For selecting the TCP configuration, please refer to the following figure.



Figure 13: Tool Center Point configurations

Configuration Type A is when the eight-pinned connector on the wrist is aligned to the cable exit port on the CoBot SmartGrip E30 using the flat mount interface. Type B is when the 45° mounting plate is used and the cable exit port is closest to the eight-pinned connector. Type C also requires the 45° mounting plate but reversed tool mounting from type B. Once proper configuration is determined, select the correct TCP configuration from the dropdown menu as shown in the following Figure 6.



Figure 14: TCP Configuration Selected



Next, enter the tool number that is preferred for this TCP configuration for the User Tool Frame (UTool).

Config	uration for Tool Center	Point (TCP)
Select the mount that matches your application.	A_Flat ▼	
Enter the tool number for the Magswitch TCP	1	0

Figure 15: UTool Configuration

Please then configure the starting point for the register values for the Magswitch Part Present, North Pole, and South Pole signals. In the following Figure 8, the value entered works as follows.

R[X] = Part Present

R[X+1] = North Pole

R[X+1] = South Pole

X = 150 in the following Figure 8.

Configuration for Part Present				
Enter the starting R[] number for Part Present				
checking. This register and	150			



Figure 16: Part Present, North Pole, and South Pole Configuration

Lastly, once the TCP and register have been configured, please select the button for Apply selections as shown in Figure 8 above.

C magswitch[®]

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Magswitch Gripper Configuration Screen

Select Magswitch Configuration under PLUGINS from the main dropdown menu as shown in Figure 9.



Figure 17: Selecting Magswitch Configuration Screen

The Magswitch Configuraton screen will then appear as in the following Figure 10.

10:15 関 🖼 İ 🔸	N) 🗣 🔒
	75% 🔤 🔁
Magswitch ConfiPRIO-230: EtherNe	et/IP Adapter Error (1) RESET
@ magswitch	°
Mag	switch Controls
Home	Magswitch Ready
Turn Full On	Magswitch Full On
Turn Full Off	Magswitch Full Off
Turn Partial On	Magswitch Partial On
Requested Position: 50	Actual Position: 0
	0
Lea	arning Controls
Simple Learn	Learn Learning 0 Complete step: 0
Multi-Step Learn	Learn Error
Cancel Learn	Part Present
Learned part: 0	N Pole On
Sensitivity: 0	S Pole On
	0
▲ Plav	▲ Robot Operation

Figure 18: Magswitch Configuration Screen



Ensuring that the Magswitch Gripper is plugged in and powered on (LEDs flashing on Magswitch Gripper), please press the Home button as indicated in Figure 11.

Magswitch Controls					
Home	Magswit	tch Ready			
Turn Full On	Magswit	tch Full On			
Turn Full Off	Magswit	tch Full Off			
Turn Partial On	Magswit	tch Partial On			
Requested Position: 50	Act	tual Position: 0			
			0		

Figure 19: Homing the Magswitch Gripper

During the homing process, the Magswitch Gripper LEDs will stop flashing and go blank. Once the homing process completes, the LEDs on the gripper will come on solid depending on the last state of the tool (only blue LED if Magnet is Off, both blue and green LED if magnet is On 100%). On the Magswitch Configuration screen, the Magswitch Ready LED will now be illuminated and the rest of the buttons will become available (no longer grayed out). The gripper can now be controlled from the buttons on this screen. The gripper can only be homed once after turning on. It needs to be rehomed if power to the tool is lost as shown in Figure 11.



Figure 20: Tool Configuration Screen After Homing



The below table shows the functionality of various buttons and signals on the Magswitch Configuration screen.

Type (from Gripper perspective)	Magswitch Gripper Controls	Description	Control Type
Input	Home Magswitch	Sends command to home Magswitch Gripper	Button
		**The gripper can only be homed once after turning on	
Input	Turn Magswitch Full On	Turn on Magswitch to 100% ON	Button
Input	Turn Magswitch Full Off	Turn off Magswitch to 0% ON	Button
Input	Requested Position	Can be set to a position between $0 - 100$.	Input Box
Input	Turn Magswitch Partial On	Sends command to turn magnet on to Requested Position	Button
Input	Simple Learn	Send command to perform simple learn	Button
Input	Multi Step Learn	Send command to perform multi step learn	Button
Input	Cancel Learn	Sends command to cancel the learning process	Button
Input	Learned Part	Sends command to change the learned part storage option (Learned Part 1-4)	Drop Down Box
Input	Sensitivity	Sends command to change magnet sensitivity of part present	Input Box
		Default = 0	
		Accepts values from -20 to 50 as input.	
		acceptable range.	
		"+" is less sensitive and increases the acceptable range.	
Output	Magswitch Ready	Indicates if Magswitch is Homed	Indication LED
Output	Magswitch Full On	Indicates if Magswitch is turned on at 100% position	Indication LED



MAGSWITCH

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Type (from Gripper perspective)	Magswitch Gripper Controls	Description	Control Type
Output	Magswitch Full Off	Indicates if Magswitch is turned off at 0% position	Indication LED
Output	Magswitch Partial On	Indicates if Magnet is partially on – 2%- 99% ON	Indication LED
Output	Actual Position	Indicates actual position of the Magnet, value can be from 0 to 100%	Output Box
Output	Learn Complete	Indicates if gripper is last learning process is complete	Indication LED
Output	Learn Step	Indicates learning step, 0 = not in calibration 1 = waiting for best circuit 2 = waiting for worst circuit 3 = waiting for south pole 4 = waiting for north pole	Output Box
Output	Learn Error	Indicates error while performing learning. Magnet was not fully on when trying to teach the part.	Indication LED
Output	Part Present	Indicates proper Part Present within range of selected learned part	Indication LED
Output	N Pole On	Indicates if North Pole is on	Indication LED
Output	S Pole On	Indicates if South Pole is on	Indication LED

As noted previously, the *symbol* can be selected at any point to provide snippets of information from this manual relevant to that section.



Magswitch Gripper Calibration

Calibration Fundamentals

The gripper can be calibrated from the Magswitch Configuration screen, using Simple learn or Multi-Step learn. There are four calibration steps required to fully define magnetic field interaction between the tool and part and distinguish whether that interaction is sufficient or insufficient based on the user's configurations. Position of the tool's north and south poles relative to part edges and their proximity to the part during calibration steps govern whether poles are in adequate contact and whether the part is "present."

Learn complete indication LED will turn on when the tool is successfully calibrated for a particular calibration storage option (1-4).

North Pole indication LED will turn on only when the North Pole Position is in equal to or better contact than the stored North Pole Position.

South Pole indication LED will turn on only when the South Pole position is in equal to or better contact than the stored South Pole Position.

North Pole, South Pole and Part Present indication LEDs will turn on simultaneously only when the contact quality is between Limiting Position 1 and Limiting Position 2 *and* the North and South pole positions are in equal to or better contact than their respective stored positions.



Figure 21: Step 1-4 Calibration Positions

There are four separate calibration profiles which can be configured by following the calibration instructions in the next steps. It is important to select the calibration profile from the Learned Part drop down menu to values 1, 2, 3, or 4 before entering calibration mode to ensure a different calibration profile is not overwritten.



Tool Orientation



Figure 22: Tool Orientation for Magswitch Gripper NOTE: Magnet Housing at the North Pole side of the tool has N marked on it NOTE: North Pole side of the tool is on the same side as the LED



Calibration Methods

This section has a brief description of the two calibration/learning methods for the Magswitch Gripper. The next section contains detailed steps for these two methods. Below are a few simple steps. Detailed steps can be found in the next section of the manual.

Multi-Step Learn/Calibration

Select Learned Part from Drop Down Menu

- 1. Turn magnet "ON" fully and issue Multi-Step Learn command. The learning step will be set to 1.
- 2. Turn magnet "ON" fully on Limiting Position 1 and issue Multi-Step Learn command. The Learning step will be set to 2.
- 3. Turn magnet "ON" fully on Limiting Position 2 and issue Multi-Step Learn command. The Learning step will be set to 3.
- 4. Turn magnet "ON" fully on South Pole Position and issue Multi-Step Learn command. The learning step will be set to 4.
- 5. Turn magnet "ON" fully on North Pole Position and issue Multi-Step Learn command. The learning step will be sent to 0 and Learn Complete LED will turn on.
- 6. The Multi-step learn process is now complete.

Use Multi Step Learn/Calibration in the following scenarios:

- 1. Bin Picking Applications
- 2. Parts with different surface conditions. I.e., Increase/decrease in surface roughness to the part that causes to increase/decrease the airgap.
- 3. If your best and worst case scenario are on different parts, so that one calibration (Learned Part) can be used for the entire range of parts.

Simple Learn/Calibration

Steps to perform for Simple Learn:

- 1. Place tool on the location of the part that needs to be calibrated.
- 2. Turn magnet "ON" fully (100% ON)
- 3. Upon issuing Simple Learn Command, the tool will automatically go through four steps of the simple learn process.

4. Learned Complete LED should turn on if simple learn completed successfully else, Learn Error indication LED will turn on if the magnet was not fully on when starting the Simple Learn process.

Use Simple Learn in the following scenarios:

- 1. Double blank/multiple sheet detection
- 2. Handling parts where best and worse are nearly similar and surface conditions do not very much between parts



Calibration Steps in Detail

Steps for Calibrating Gripper using Simple Learn

Step 1:

Navigate to the select Magswitch Configuration screen under PLUGINS from the main dropdown menu. Please then select the Learned Part storage preference.



Figure 23: Selecting the Learned Part Storage Option

Step 2:

Ensure that the gripper is in full contact with the target and turn the magnet full on to 100% position.



Figure 24: Preparing for Magswitch Gripper for Simple Learn



Step 3:

Press the Simple Learn button. Once the process starts, the Learn Complete indication LED will no longer be illuminated and the Learning Step will increase to 1 through 4 and back to 0.

Learning Controls				
Simple Learn	0	Learn Complete	Learning step:	0
Multi-Step Learn		Learn Error		
Cancel Learn	\bigcirc	Part Present		
Learned part: 0	\bigcirc	N Pole On		
Sensitivity: 0	\bigcirc	S Pole On		
E				?
Figure 17: Selecting Simple Learn				
Compl	ete	Learning step:	2	

Figure 25: Indicactors While in the Simple Learn Process

Step 4:

Wait for Learn Complete indication LED to turn on and the Learning Step to return to 0. This indicates that the learning process has completed successfully. In the case that the learning process fails, the Learn Error indication LED will turn on instead.



Learning step:

0

Figure 26: Simple Learn Complete



Steps for Calibrating Gripper using Multi-Step Learn

Step 1:

Navigate to the select Magswitch Configuration screen under PLUGINS from the main dropdown menu. Please then select the Learned Part storage preference.



Figure 27: Selecting the Learned Part Storage Option

Step 2:

Ensure that gripper is present on the target in Limiting Position 1 and turn magnet full on. Some recommended positions are provided below.

- i. The maximum ferrous material 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

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



Figure 28: Example of Limiting Position 1 for Calibrated Part Present Signal



Step 3:

Press the Multi-Step Learn button. Once the process starts, the learn complete indication LED will no longer be illuminated and the Learning Step will increase to 1.

Learning Controls					
Simple Learn	\bigcirc	Learn Complete	Learning step:	0	
Multi-Step Learn	۲	Learn Error			
Cancel Learn	\bigcirc	Part Present			
Learned part: 2	\bigcirc	N Pole On			
Sensitivity: 0	\bigcirc	S Pole On			
				(?
Figure 29: Multi-Step Learn Initiated					
Comple	ete	Lost	earning tep:	1	

Figure 30: Multi-Step Learn Waiting for Limiting Position 1

Step 4:

Press Multi-Step Learn Button, the gripper blue LED will flash three times and learning step will display 2. This indicates that the gripper has stored Limiting position 1 and is waiting for Limiting Position 2.



Learning step:

2

Figure 31: Limiting Position 1 Stored and Ready for Limiting Position 2



Step 5:

- a. Turn off magnet, place gripper on the target in Limiting Position 2 and turn magnet full on. 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

NOTE: The unit is centered on the part with an air gap of 0.2mm (approximately equal to two 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 non-ferrous shims.



Figure 32: Example of Limiting Position 2 for Proper Part Present Signal

Step 6:

Press Multi-Step Learn Button, the gripper blue LED will flash three times and learning step will display 3. This indicates that the gripper has stored Limiting Position 2 and is now waiting for the South Pole Position. In case of an error, the Learn Error LED will turn on.



Learning step:

3

Figure 33: Limiting Position 2 Stored and Ready for South Pole Position



Step 7:

Turn off magnet, place gripper on the target in the desired position for South Pole Signal and turn magnet full on.



Figure 34: Example of South Pole Position

Step 8:

Press Multi-Step Learn Button, the gripper blue LED will flash three times and learning step will display 4. This indicates that the gripper has stored the South Pole Position and is waiting for the North Pole Position. In case of an error, the Learn Error LED will turn on.



Learning step:

4

Figure 35: South Pole Position Stored and Ready for North Pole Position



Step 9:

Turn off the magnet, place the gripper on the target in the desired position for the North Pole Signal and turn the magnet full on.



Figure 36: Example of North Pole Position

Step 10:

Press Multi-Step Learn button, the gripper blue LED will flash three times, the learning step will display 0, and learn complete LED will turn on when the process is finished. This indicates that the gripper has stored the North Pole Position and multi-step calibration is complete. In case of an error, the Learn Error LED will turn on.



Learn Complete Learning step:

0

Figure 37: Multi-Step Learn Complete



Testing Calibration – Configuration 1 – Multi-Step Learn

If the North Pole Signal and/or South 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 electrically de-actuated:
 - a. Magswitch Full On indication LED turns Off
 - b. Learning Step is shown as 0
- 2. Unit positioned within Calibrated Part Present signal range and the magnet is electrically actuated between 2% and 99%, by setting Requested Position as a value between 2 and 99 (Magnet 2%-99% ON):
 - a. Magswitch Partial On LED turns On
 - b. Check below table for the expected LED Indication values at this step

Indication LED	Value
S Pole On	Off
N Pole On	Off
Part Present	Off

- 3. Unit positioned within Calibrated Part Present signal range and the magnet is electrically actuated on (100%), by setting Requested Position = 100 (Magnet 100% ON) or issuing Turn Magswitch Full On command:
 - a. Magswitch Full On indication LED turns On
 - b. Check below table for the expected LED Indication values at this step

Indication LED	Value
S Pole On	On
N Pole On	On
Part Present	On

- 4. Unit positioned with South Pole outside of South Pole Signal range and the magnet is electrically actuated on (100%), by setting Requested Position = 100 (Magnet 100% ON) or issuing Turn Magswitch Full On command:
 - a. Magswitch Full On indication LED turns On
 - b. Check below table for the expected LED Indication values at this step

Indication LED	Value
S Pole On	Off
N Pole On	On
Part Present	Off



- 5. Unit positioned with North Pole outside of North Pole signal range and the magnet is electrically actuated on (100%), by setting Requested Position = 100 (Magnet 100% ON) or issuing Turn Magswitch Full On command:
 - a. Magswitch Full On indication LED turns On
 - b. Check below table for the expected LED Indication values at this step

Indication LED	Value
S Pole On	On
N Pole On	Off
Part Present	Off

- Unit positioned with North/South Poles within South/North Pole Signal range and the magnet is electrically actuated on (100%), but not within Calibrated Part Present signal range, by setting Requested Position = 100 (Magnet 100% ON) or issuing Turn Magswitch Full On command:
 - a. Magswitch Full On indication LED turns On
 - b. Check below table for the expected LED Indication values at this step

Indication LED	Value
S Pole On	On
N Pole On	On
Part Present	Off

- 7. Unit positioned with neither pole within the Calibrated Part Present signal nor South/North Pole Signal range and the magnet is electrically actuated on (100%), by setting Requested Position = 100 (Magnet 100% ON) or issuing Turn Magswitch Full On command:
 - a. Magswitch Full On indication LED turns On
 - b. Check below table for the expected LED Indication values at this step

Indication LED	Value
S Pole On	Off
N Pole On	Off
Part Present	Off



Testing Calibration – Configuration 2 – Multi-Step Learn

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 electrically de-actuated, by issuing Magswitch Full Off command:
 - a. Magswitch Full Off indication LED turns On
 - b. Check below table for the expected LED Indication values at this step

Indication LED	Value
S Pole On	Off
N Pole On	Off
Part Present	Off

- 2. Unit positioned within Calibrated Part Present signal range and the magnet is electrically actuated between 2% and 99%, by setting Requested Position as any value between 2 and 99(Magnet 2%-99% ON):
 - a. Magswitch Partial On indication LED Turns On
 - b. Check below table for the expected LED Indication values at this step

Indication LED	Value
S Pole On	Off
N Pole On	Off
Part Present	Off

- 3. Unit positioned within Calibrated Part Present signal range and the magnet is electrically actuated on (100%), by setting Requested Position = 100 (Magnet 100% ON) or issuing Turn Magswitch Full On command:
 - a. Magswitch Full On indication LED Turns On
 - b. Check below table for the expected LED Indication values at this step

Indication LED	Value
S Pole On	On
N Pole On	On
Part Present	On

- 4. Unit positioned with South Pole outside of Calibrated Part Present signal range and the magnet is electrically actuated on (100%), by setting Requested Position = 100 (Magnet 100% ON) or issuing Turn Magswitch Full On command:
 - a. Magswitch Full On indication LED Turns On
 - b. Check below table for the expected LED Indication values at this step

LED Indication	Value
S Pole On	Off
N Pole On	On
Part Present	Off



- 5. Unit positioned with North Pole outside of Calibrated Part Present signal range and the magnet is electrically actuated on (100%), by setting Requested Position = 100 (Magnet 100% ON) or issuing Turn Magswitch Full On command:
 - a. Magswitch Full On indication LED Turns On
 - b. Check below table for the expected LED Indication values at this step

LED Indication	Value
Input Word 2: Bit 9 (S Pole On)	On
Input Word 2: Bit 8 (N Pole On)	Off
Part Present	Off

- 6. Unit position with neither pole within the Calibrated Part Present signal range and the magnet is electrically actuated on (100%), by setting Requested Position = 100 (Magnet 100% ON) or issuing Turn Magswitch Full On command:
 - a. Magswitch Full On indication LED Turns On
 - b. Check below table for the expected LED Indication values at this step

Bit Number (Short Name)	Bit Return Value
S Pole On	Off
N Pole On	Off
Part Present	Off



Testing Calibration – Configuration 3 – Simple Learn/Multi-Step Learn

If Simple learn is used or Multi-Step Learn is done in such a way that all the steps were calibrated in a single position:

- 1. Magnet is electrically de-actuated:
 - a. Magswitch Full On indication LED turns Off
 - b. Learning Step returns 0
- 2. Unit positioned within Calibrated Part Present signal range and the magnet is electrically actuated between 2% and 99%, by setting Requested Position as a value between 2 and 99 (Magnet 2%-99% ON):
 - a. Magswitch Partial On indication LED turns On
 - b. Check below table for the expected LED Indication values at this step

LED Indication	Value
S Pole On	Off
N Pole On	Off
Part Present	Off

- 3. Unit positioned within Calibrated Part Present signal range and the magnet is electrically actuated on (100%), by setting Requested Position = 100 (Magnet 100% ON) or issuing Turn Magswitch Full On command:
 - a. Magswitch Full On indication LED turns On
 - b. Check below table for the expected LED Indication values at this step

LED Indication	Value
S Pole On	On
N Pole On	On
Part Present	On

- 4. Unit positioned with North/South Poles within South/North Pole Signal range and the magnet is electrically actuated on (100%), but not within Calibrated Part Present signal range %), by setting Requested Position = 100 (Magnet 100% ON) or issue Turn Magswitch Full On command
 - a. Magswitch Full On indication LED turns On
 - b. Check below table for the expected LED Indication values at this step

LED Indication	Value
S Pole On	On
N Pole On	On
Part Present	Off

magswitch[®]

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Using Magswitch Gripper Program Nodes

From the main dropdown menu, under Teaching, select Editor to begin using Magswitch Gripper Program Nodes.



Figure 38: Selecting the Program Editor



Figure 39: Programming screen with Mag Control and Mag Status



Magswitch Control (Mag Control):

The Magswitch Control is used to send position control commands to the Magswitch Gripper. Select the radio button for the desired function. The tool must be homed prior to any other commands. The Execute button allows the user to test the function without running the program. The position for Partial On can be selected using the up/down arrows or entering the value in the text box between 0-100% in increments of 1.

	· 5	، ، جر			
Programming			C	Details	
Home Full On	Requested	Position: 5	0 🛛	~	^ *
Full OffPartial On		Execut	e		0
▲ Play			Robot Op	eration	

Fig 40: Mag Control Program Node

Mag Control Functions	Description
Home	Sends Command to Home Magswitch Gripper
Full On	Turn on Magswitch to 100% ON
Full Off	Turn off Magswitch to 0% ON
Partial On	Sends command to turn magnet on at requested position
Requested Position	Can be set to a position between 0 – 100 %.



Magswitch Status (Mag Status):

The Magswitch Status can be used to read the state of the gripper. The commands are summarized in the table below. The Execute button allows the selected function to be tested when the program is not running. The arrows or the text box can be used to adjust the Sensitivity. The Learned Part is selected from a dropdown menu. The status value for Part Present (R[x]), N Pole (R[x+1]), and S Pole (R[x+2]) are stored in the register (x) as setup in the Magswitch Robot Setup screen. The registor will equal 1 if true, and 0 if false.



Figure 41: Mag Status Program Node

Mag Status Functions	Description
Learned Part	Selects the Learned Part 1-4
Sensitivity	Sends command to change magnet sensitivity Default = 0 Takes values from -20 to 50 as input
PART PRESENT	True if part present detected, else False
N POLE	True if North Pole on, else False
S POLE	True if South Pole on, else False



Example Demonstrating Turn Magswitch Full On:

Commands can be sent to the gripper from the Mag Control in the program. The below program example shows how to send a command to turn the magnet on at 100% position.



Figure 42: Example Program to Set Magswitch Gripper Full On Position to 100%

Example Demonstrating Partial Magnet On:

The following program example turns on the magnet at 50% position.



Figure 43: Example Program to Set Magswitch Gripper Full On Position to 50%



Example Demonstrating Checking Part Present:

The state Part Present can be checked by placing the Mag Status into the drag-and-drop editor. The below program example shows how to check the state of the gripper by following the Mag Status with an IF statement. This example matches the Magswitch Robot Setup used in this document with the Magswitch register starting position starting at x=150. This could be done in a similar manner with N Pole and S Pole. In this example, the N Pole register would equal 151 and the S Pole register would equal 152.



Figure 44: Selecting Part Present as Value to Check in Mag Status



Figure 45: Using IF Statement to Check for Part Present Register When Setup as x=150



Using the Traditional Teach Pendant and Program Editor

Instead of using the visual programming interface, it is also possible to use the traditional Fanuc text program editor. To get to the traditional teach pendant, please select the icon in the bottom right corner as shown in the following Figure 39.



Figure 46: Selecting the Traditional Teach Pendant

Once selected, the traditional teach pendant will appear as shown in Figure 40. Please then select edit.



Figure 47: Selecting Edit Program from Traditional Teach Pendant



This will bring up the traditional teach pendant program editor window for the currently selected program. If the program is empty, it will look like the following Figure 41.





There are two Magswitch specific functions for controlling and reading the status from the gripper. They are list below. *IPL_MS_GRIP_CLOSE (Position Percent, Control Function Code) IPL_MS_GRIP_CHECKPART (Sensitivity, Status Function Code, Learned Part Number)*



For IPL_MS_GRIP_CLOSE (Position Percent, Control Function Code):

Position Percent = 0 to 100 in increments of 1 for controlling the variable output of the Magswitch Gripper. Control Function Code = 1 to 4, 1 = Home, 2 = Full On, 3 = Partial On, 4 = Full Off Function command to home: IPL_MS_GRIP_CLOSE(0, 1) Function command to turn full off: IPL_MS_GRIP_CLOSE(0, 4) Function command to turn full on: IPL_MS_GRIP_CLOSE(100, 2) Function command to turn partial on to 50%: IPL_MS_GRIP_CLOSE(50, 3)

For IPL_MS_GRIP_CHECKPART (Sensitivity, Status Function Code, Learned Part Number):

Sensitivity = -20 to 50, negative makes it more sensitive and positive makes it less sensitive Status Function Code = [1, 2, 4], 1 = Part Present, 2 = North Pole, 4 = South Pole Learned Part Number = 0 to 3, selects the saved Learned Part number Function command to check Part Present with default sensitivity Learned Part 0: *IPL_MS_GRIP_CHECKPART(0, 1, 0)* Function command to check Part Present with -10 sensitivity Learned Part 1: *IPL_MS_GRIP_CHECKPART((-10), 1, 1)* Function command to check Part Present with +10 sensitivity Learned Part 2: *IPL_MS_GRIP_CHECKPART(10, 1, 2)* Function command to check North Pole with default sensitivity Learned Part 0: *IPL_MS_GRIP_CHECKPART(0, 2, 0)* Function command to check South Pole with default sensitivity Learned Part 0: *IPL_MS_GRIP_CHECKPART(0, 2, 0)*

The following Figure 42 shows an example on the robot of turning the Magswitch to full on and checking the part present of Learned Part 1 with the default sensitivity.



Figure 49: Example Calling Magswitch Function in Traditional Teach Pendant Program Editor



PIUGIN Alarms and Warnings

When using the Mag Control or associated function, the program will issue a plugin alarm warning when it is running if the tool has not been homed or if it does not reach its desired position.

When using the Mag Status or associated function, the program will issue a plugin alarm warning when it is running if the selected item is not present. This is for Part Present, North Pole, and South Pole.



Figure 50: Example of Part Present Not On Alarm