MMP545400-75-E2

45mm, 400W, 75V,
Motor Driver Module, PEC Series

DESCRIPTION

The MMP545400-75-E2 is part of a family of motor driver modules for servo motor applications. This module is designed to fit 45mm motors. It integrates an angular sensor, EtherCAT communication interface, advanced motion controller, power inverter, and multifunctional, external I/O pins.

The motor driver module makes it easy to develop a motor control system.

The MMP545400-75-E2 includes AccuFilter, parameter identification, an auto-tune loop, load observation, a notch filter, and other advanced functions to improve motion control performance.

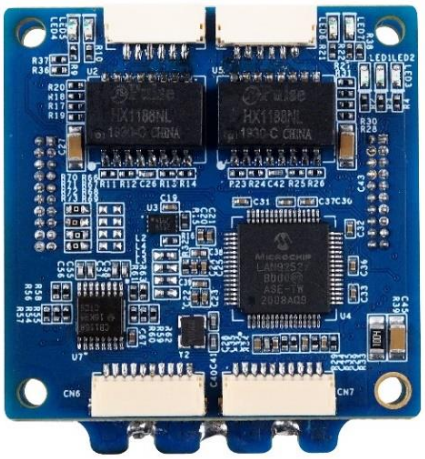
MotionLAB is an easy-to-use GUI software that allows users to flexibly optimize the design online via the USB interface. The parameters are saved in the module's non-volatile memory (NVM).

FEATURES

- PEC Series for EtherCAT Interface
- 100Mbps EtherCAT Communication Interface with Distributed Clock and CANopen over EtherCAT (CoE) Protocol
- Integrated High-Accuracy Angular Sensor
- Motor and System Parameter Identification and Auto-Tune Loop
- AccuFilter for Reduced Noise and Vibration
- On-the-Fly Mode Selection
- Two Separate Notch Filters for Elastic Load Optimization
- Control Modes: Profile Position (PP), Profile Velocity (PV), Profile Torque (PT), Homing (HM), Cyclic Synchronous Position (CSP), Cyclic Synchronous Velocity (CSV), and Cyclic Synchronous Torque (CST)
- Full Protection Features
- PWR, ERR, and BUS LED Status Indication
- NTC Input Temperature Sensing
- Max 400W Continuous Output Power (P_{OUT})

PRODUCT INFORMATION

Part Number	Dimension (mm)	Power (W)	Maximum Voltage (V)	Control Mode	Control Interface
MMP545400-75-E2-1	45x45	400	75	PP, PV, PT, CSP, CSV, CST, HM	EtherCAT



PRODUCT SPECIFICATIONS

Parameter	Conditions	Value	Units
Electrical Rating			
DC input voltage (V_{IN})		12 to 75	V
Continuous output power (P_{OUT})	0°C to 40°C	400	W
Continuous output current (I_{OUT})	0°C to 40°C	10	A
Peak output current (I_{OUT_MAX})	0°C to 40°C, <10s	30	A
Switching frequency (f_{SW})		20	kHz
Current-sense resistor		4	mΩ
Current-sense gain		5	
ADC resolution		12	bits
Logic pin voltage range		-0.3 to +3.6	V
Voltage-sense lower resistor		10	kΩ
Voltage-sense upper resistor		402	kΩ
Interfaces			
USB 2.0		Full speed	
EtherCAT		100M bits/s, two ports	
Mechanical			
Dimension		45x45	mm

There is an accessory package available for order that that is used for driver module evaluation. The MMA03-7001 includes the matching connectors for the MMP545400-75-E2.

Part Number	Component	Description	Quantity
MMA03-7001	SHR-04V-S-B	1mm pitch, 4-position connector	1
	GHR-06V-S	1.25mm pitch, 6-position connector	2
	SHR-06V-S-B	1mm pitch, 6-position connector	1
	SHR-10V-S-B	1mm pitch, 10-position connector	2
	SSH-003T-P0.2-H	28AWG to 32AWG crimp terminal	40
	SSHL-002T-P0.2	26AWG to 30AWG crimp terminal	12
	XT30U-F	DC supply plug, 15A	1

RECOMMENDED OPERATING CONDITIONS

Input voltage (V_{IN}) .....12V to 75V
Operating temperature.....0°C to 70°C
Storage temperature..... -40°C to +85°C

HARDWARE CONNECTIONS

The motor driver module can be installed into a motor (see Figure 1).

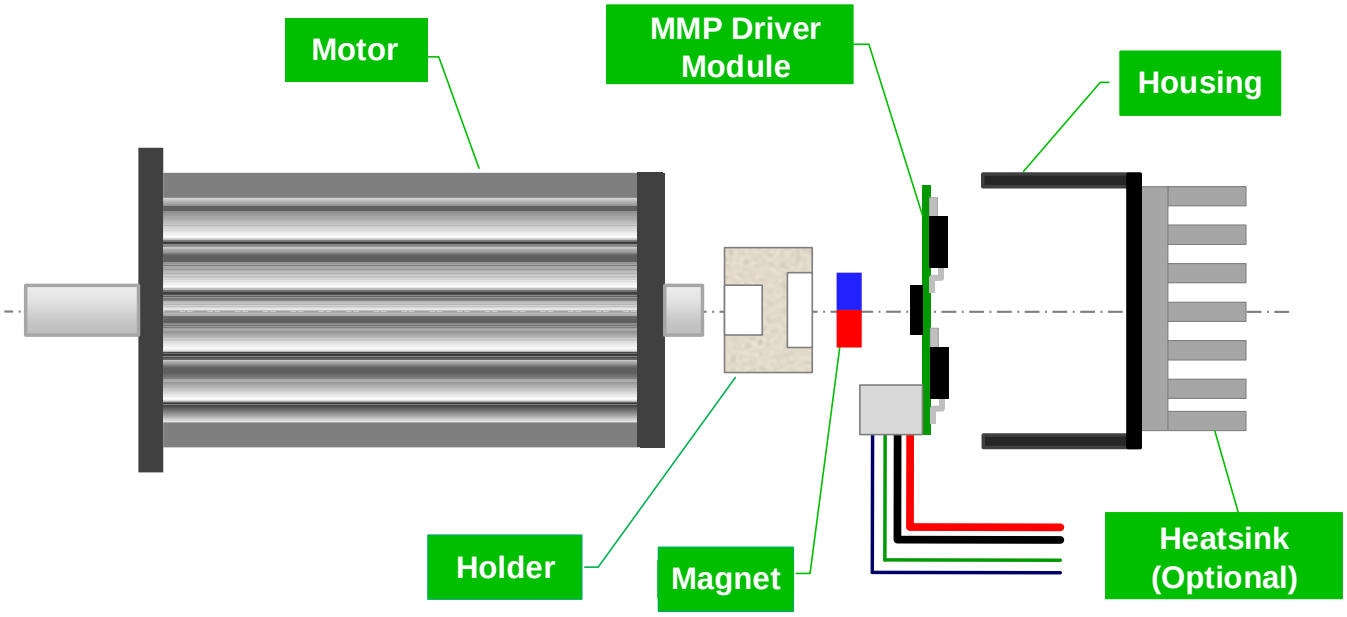


Figure 1: Installation of PCB Assembly in Motor

The user can manufacture custom control board housing and a magnet holder based on the actual motor dimensions. Table 1 lists recommended magnets to use with the MMP545400-75-E2, as well as the recommended minimum and maximum air gap spacing.

Table 1: Recommend Magnets and Air Gap

OD (mm)	H (mm)	Material	Remanence (Br) (T)	Magnetization	Min/Max Recommended Air Gap (mm)
6	2.5	N35	1.2	Diametrical	1.5 to 3.5
6	2.5	Sm26/16	1.08	Diametrical	1.3 to 3.3
6	3	N35	1.2	Diametrical	1.8 to 3.8
6	3	Sm26/16	1.08	Diametrical	1.5 to 3.6
8	2.5	N35	1.2	Diametrical	1.8 to 4.5
8	2.5	Sm26/16	1.08	Diametrical	1.5 to 4.1
8	3	N35	1.2	Diametrical	2.1 to 4.8
8	3	Sm26/16	1.08	Diametrical	1.8 to 4.5

A sintered neodymium (NdFeB) or samarium-cobalt (SmCo) magnet with a 6mm or 8mm diameter, 2.5mm to 3mm height, and remanent field strength between 1T to 1.2T is recommended. The magnet's diameter depends on the motor shaft and holder design selection. It is important that the magnetization is diametrically polarized.

The magnet air gap spacing to the sensor surface should be set to achieve a field strength between 30mT and 80mT. Figure 2 on page 4 shows the magnet dimensions and air gap.

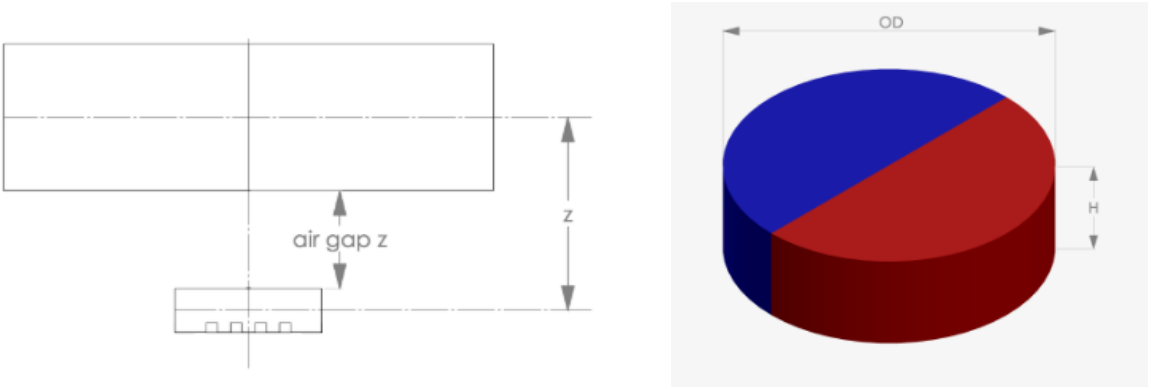


Figure 2: Magnet Dimensions and Air Gap

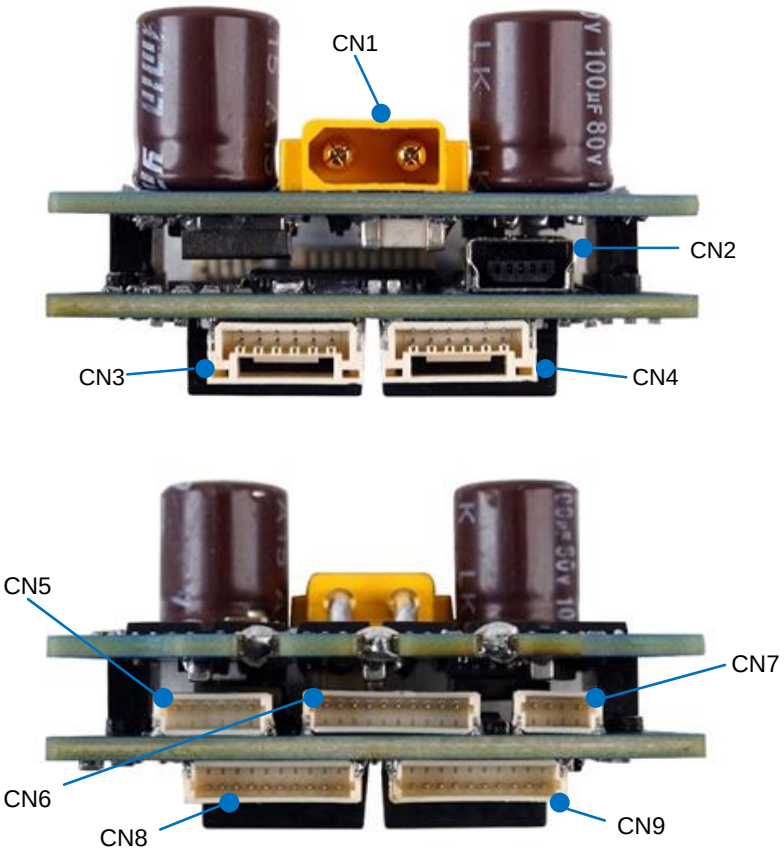
Selecting between NdFeB or SmCo material depends on the target motor end application. SmCo magnets have a higher working temperature range and corrosion resistance.

Selecting the holder material is also important. The material must be nonmagnetic, such as aluminum, brass, or plastic, in order to not influence or distort the sensor magnets field. The user can choose the attachment method to the shaft according to the motor design criteria. Using a high-temperature industrial adhesive is a possible approach to avoid detachment due to the magnet, holder, and shaft's different coefficients for thermal expansion.

The magnet holder requires a motor with a shaft that extends from its rear. Contact the motor supplier to discuss the options available for shaft diameter and length, which determine the required holder size and housing depth.

The PCB housing should be designed to consider any requirements regarding heatsinking for the motor driver components, additional bulk motor supply capacitance, and EMC filtering necessary to meet the target application specifications. The housing should align the central angle sensor IC with the motor shaft magnet holder in the center with a maximum ±0.4mm axial misalignment.

PIN CONFIGURATION



CN1: Power Supply
CN2: USB 2.0 Interface
CN3: ETHERCAT OUT
CN4: ETHERCAT IN
CN5: NTC
CN6: I/O
CN7: Debug
CN8: SPI/SSI 1
CN9: SPI/SSI 2

MMP545400-75-E2 Pin Definitions (1)

Note:

1) The leftmost pin of each connector is pin 1.

Power Supply (CN1)

CN1 Pin	Signal	Description
1	GND	Ground
2	VDC	Power supply voltage (12V to 75V)

EtherCAT OUT/IN (CN3/CN4)

CN3/CN4 Pin	Signal	Description
1	TX+	Transmission data positive
2	CMTT	Common transmission terminal, float CMTT
3	TX-	Transmission data negative
4	RX+	Receive data positive
5	CMTR	Common transmission terminal, float CMTR
6	RX-	Receive data negative

NTC (CN5)

CN5 Pin	Signal	Description
1	GND	Ground
2	NTC3	Temperature-sense, NTC input 3
3	GND	Ground
4	NTC2	Temperature-sense, NTC input 2
5	GND	Ground
6	NTC1	Temperature-sense, NTC input 1

I/O (CN6)

CN5 Pin	Signal	Description
1	+5V	5V output
2	GND	Ground
3	IO1	General purpose I/O1
4	IO2	General purpose I/O2
5	IO3	General purpose I/O3
6	IO4	General purpose I/O4
7	IO5	General purpose I/O5
8	IO6	General purpose I/O6
9	IO7	General purpose I/O7
10	IO8	General purpose I/O8

Debug (CN7)

CN7 Pin	Signal	Description
1	+3.3V	Ground
2	SWD_DAT	SWD data signal
3	SWD_CLK	SWD clock signal
4	Ground	Ground

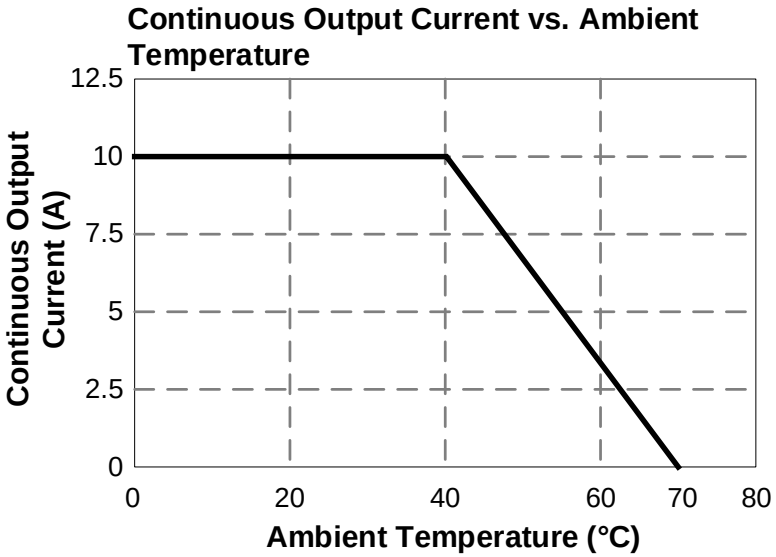
SPI/SSI (CN8/CN9)

CN8/CN9 Pin	Signal	Description
1	NSS-	SPI chip select negative
2	NSS+	SPI chip select positive
3	MOSI-	SPI MOSI negative
4	MOSI+	SPI MOSI positive
5	MISO-	SPI MISO negative
6	MISO+	SPI MISO positive
7	SCK-	SPI SCK negative
8	SCK+	SPI SCK positive
9	GND	Ground
10	+5V	5V output

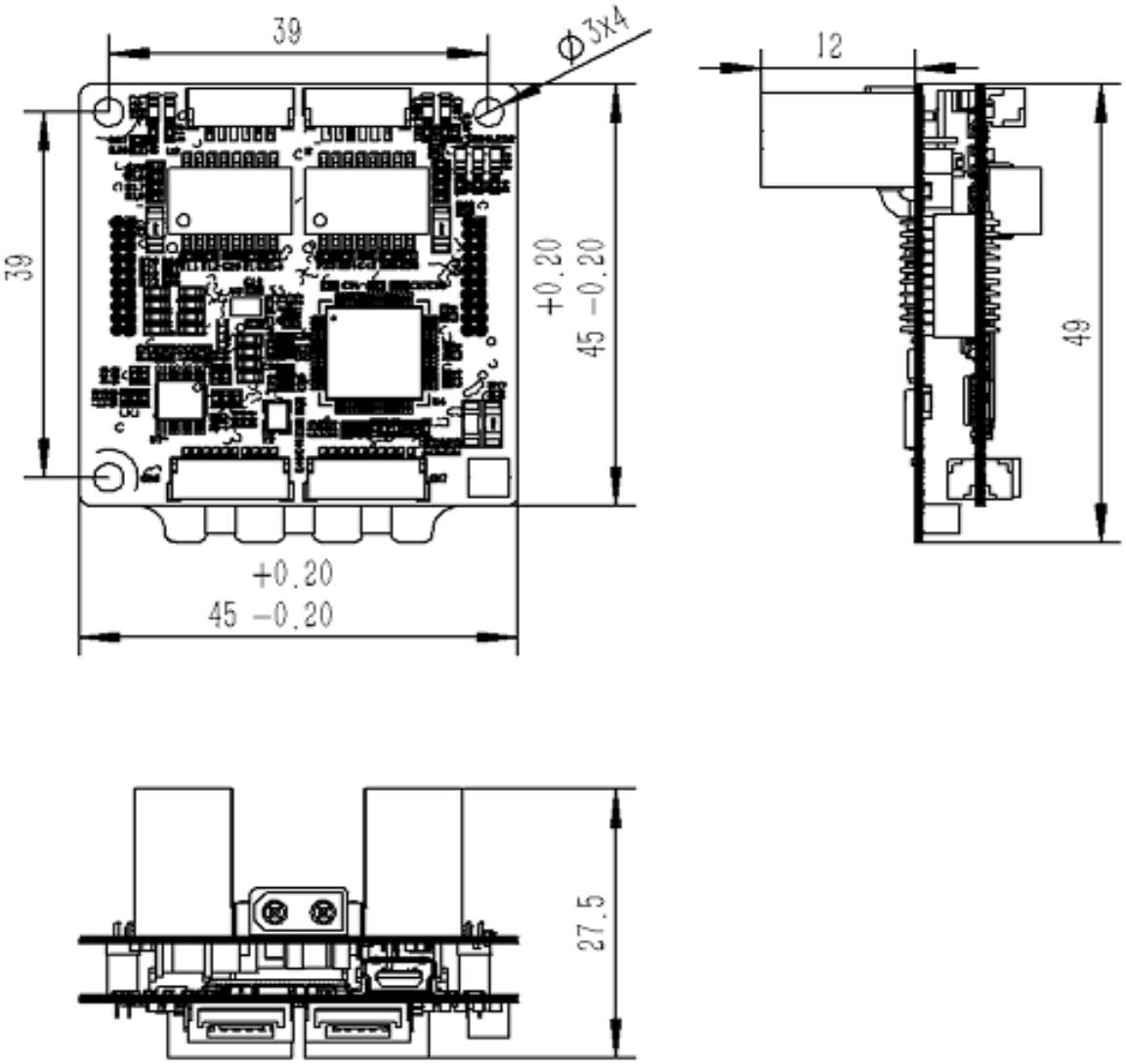
Connectors and Plug Part Numbers

Connector	Type	Plug PN
CN1 (XT30U-M)	Plug	XT30U-F
CN2	Plug	USB mini-B
CN3 (SM06B-GHS-TB)	Housing	JST GHR-06V-S
	Contact	JST SSHL-002T-P0.2
CN4 (SM06B-GHS-TB)	Housing	JST GHR-06V-S
	Contact	JST SSHL-002T-P0.2
CN5 (SM06B-SRSS-TB)	Housing	JST SHR-06V-S-B
	Contact	JST SSH-003T-P0.2-H
CN6 (SM10B-SRSS-TB)	Housing	JST SHR-10V-S-B
	Contact	JST SSH-003T-P0.2-H
CN7 (SM04B-SRSS-TB)	Housing	JST SHR-04V-S-B
	Contact	JST SSH-003T-P0.2-H
CN8 (SM10B-SRSS-TB)	Housing	JST SHR-10V-S-B
	Contact	JST SSH-003T-P0.2-H
CN9 (SM10B-SRSS-TB)	Housing	JST SHR-10V-S-B
	Contact	JST SSH-003T-P0.2-H

TYPICAL PERFORMANCE CHARACTERISTICS



MECHANICAL DRAWING (2)



Note:

2) Units are mm.

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	10/5/2022	Initial Release	-