

DESCRIPTION

The MMP740xxx-55-R2 is part of a family of smart motor driver modules for servo motor applications. This module is designed to fit 40mm and 42mm (NEMA 17) motors. It integrates an angular sensor, servo controller, and power stage components.

The module supports four commonly used motion control modes: profile position (PP), profile velocity (PV), profile torque (PT), and homing (HM). Other advanced functions, such as parameter identification, loop auto-tuning, notch filtering, feed-forward control, and AccuFilter are also implemented to improve motion control performance. The MMP740xxx-55-R2 has six I/Os with selectable functions and polarity.

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

This motor driver module makes it simple to develop a motor control system.

FEATURES

- RS-485 Interface with Modbus Protocol and Step/Direction Control Interface
- 12V to 50V Input Voltage (V_{IN}) Range
- 100W Maximum Continuous Power Output (P_{OUT})
- 3.5A to 7A Continuous Output Current (I_{OUT})
- 10.5A to 21A Peak Output Current (I_{OUT_MAX})
- 0.1° Position Resolution
- Four Control Modes: Profile Position (PP), Profile Velocity (PV), Profile Torque (PT), and Homing (HM)
- Motor and Load Parameter Identification and Loop Parameter Auto-Tuning
- AccuFilter for Low Noise and Vibration
- Advanced Motion Controller Enables Smooth Transition between Different Operational Modes
- Two Separate Notch Filters for Elastic Load Optimization
- Rich Protection Functions
- Six I/Os with Selectable Functions and Polarity
- Driver Module Temperature Sensing
- Applicable Motor Size: 40mm and 42mm (NEMA 17)

PRODUCT INFORMATION

| Part Number | Dimension (mm) | Power (W) | Maximum Voltage (V) | Control Mode | Control Interface |
|-------------------|----------------|-----------|---------------------|----------------|------------------------|
| MMP740050-55-R2-1 | 36x54 | 50 | 50 | PP, PV, PT, HM | Modbus, Step/Direction |
| MMP740100-55-R2-1 | 36x54 | 100 | 50 | PP, PV, PT, HM | Modbus, Step/Direction |



ACCESSORIES

There are two accessory packages available for order. The MMA01-1001 contains an I/O board with an RS-485 interface. The MMA03-4001 contains the connectors matching with the MMA01-1001.

| Part Number | Component | Description | Quantity |
|-------------|-------------------|------------------------------------|----------|
| MMA01-1001 | I/O board | I/O board with an RS-485 interface | 1 |
| MMA03-4001 | KF12EKD-2.5-6P-1G | 2.5mm pitch, 6-position connector | 1 |
| | KF12EKD-2.5-8P-1G | 2.5mm pitch, 8-position connector | 1 |
| | ZER-04V-S | 1.5mm pitch, 4-position connector | 2 |
| | SZE-002T-P0.3 | Socket contact tin 24-28 AWG crimp | 8 |

PRODUCT SPECIFICATIONS

| Parameter | Condition | Value | | Units |
|---|--|--------------------------------|------|-------|
| | | 50W | 100W | |
| Electrical Rating | | | | |
| DC input voltage (V_{IN}) | | 12 to 50 | | V |
| Continuous output power (P_{OUT}) | 0°C to 40°C. | 50 | 100 | W |
| Continuous output current (I_{OUT}) | 0°C to 40°C. | 3.5 | 7 | A |
| Peak output current (I_{OUT_MAX}) | 0°C to 40°C, <10s | 10.5 | 21 | A |
| Switching frequency (f_{SW}) | | 20 | | kHz |
| Current-sense resistor | | 4 | | mΩ |
| Current-sense gain | | 9 | | V/V |
| Logic pin voltage range | | -0.3 to +3.6 | | V |
| Voltage-sense lower resistor | | 10 | | kΩ |
| Voltage-sense upper resistor | | 402 | | kΩ |
| Maximum allowed speed | 1 pole pair | 60000 | | rpm |
| Position resolution | | 0.1 | | deg |
| Interfaces | | | | |
| RS-485 baud rate | Configurable | 9600 to 921600, default 115200 | | bps |
| USB 2.0 | | Full speed | | |
| Pulse frequency | | <500 | | kHz |
| Mechanical | | | | |
| Dimension | | 36x54 | | mm |
| Direction of rotation | Viewed from the load side with a forward run command | CCW | | |

RECOMMENDED OPERATING CONDITIONS

Input voltage (V_{IN}) 12V to 50V
 Logic pin voltage 0V to 3.3V
 Max pulse frequency 500kHz
 Operation temperature 0°C to 70°C
 Storage temperature -20°C to +85°C

HARDWARE CONNECTIONS

To allow the MMP740xxx-55-R2 to drive a servo motor, plug an I/O board into this device. EZmotion provides an accessory (MMA01-1001) that serves as a reference design. The MMA01-1001 can be ordered to evaluate the motor driver module’s performance (see Figure 1).

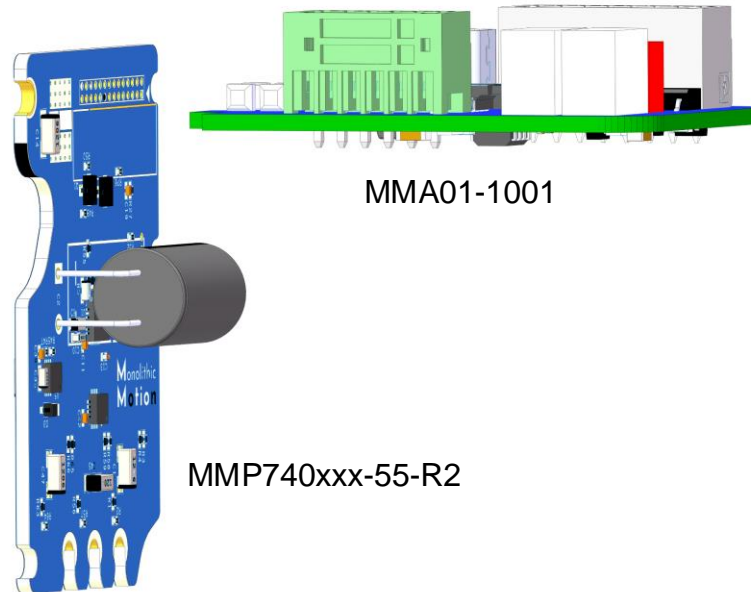


Figure 1: Assemble Motor Driver Module with I/O Board

Figure 2 shows how to install the motor driver module into a motor. The user can manufacture their own control board housing and magnet holder based on the actual motor dimensions.

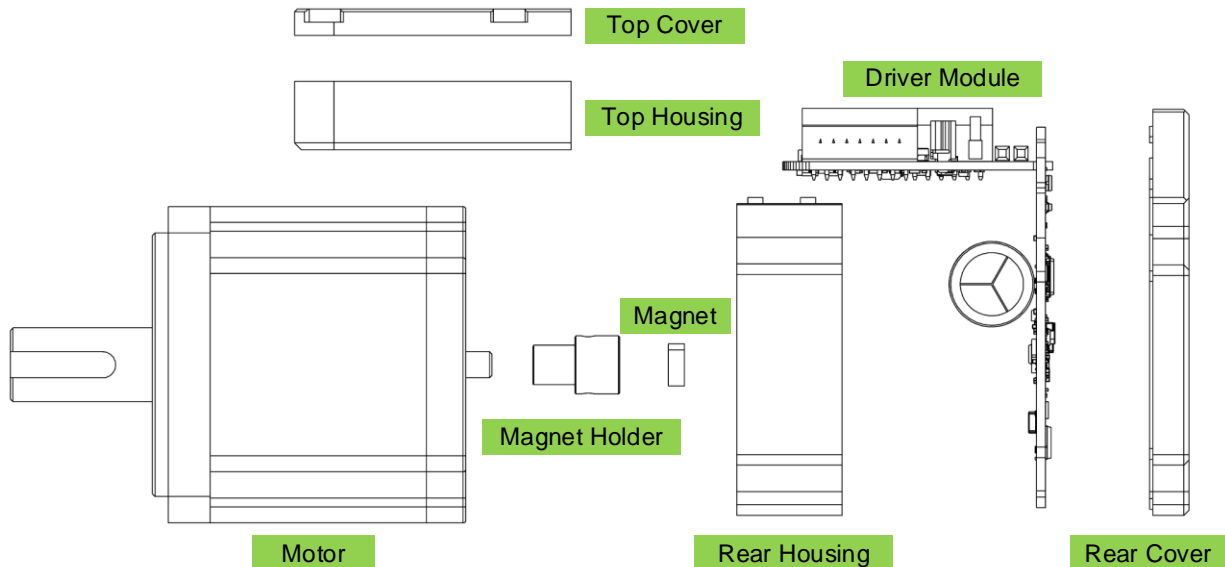


Figure 2: Installation of PCB Assembly in Motor

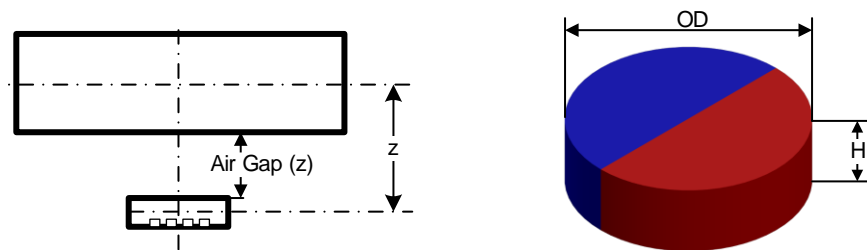
Table 1 on page 5 shows examples of recommended magnets that can be used with the MMP740xxx-55-R2, as well as the recommended minimum and maximum air gap spacing.

Table 1: Recommended Magnets and Air Gap

| OD (mm) | H (mm) | Material | Remanence (Br) (T) | Magnetization | Min to Max Recommended Air Gap (z) (mm) |
|---------|--------|----------|--------------------|---------------|---|
| 6.0 | 2.5 | N35 | 1.2 | Diametrical | 1.5 to 3.5 |
| 6.0 | 2.5 | Sm26/16 | 1.08 | Diametrical | 1.3 to 3.3 |
| 6.0 | 3.0 | N35 | 1.2 | Diametrical | 1.8 to 3.8 |
| 6.0 | 3.0 | Sm26/16 | 1.08 | Diametrical | 1.5 to 3.6 |
| 8.0 | 2.5 | N35 | 1.2 | Diametrical | 1.8 to 4.5 |
| 8.0 | 2.5 | Sm26/16 | 1.08 | Diametrical | 1.5 to 4.1 |
| 8.0 | 3.0 | N35 | 1.2 | Diametrical | 2.1 to 4.8 |
| 8.0 | 3.0 | Sm26/16 | 1.08 | Diametrical | 1.8 to 4.5 |

It is recommended to use a sintered neodymium (NdFeB) or samarium cobalt (SmCo) magnet with a diameter between 6mm and 8mm, a height between 2.5mm and 3mm, and a remanent field strength between 1T and 1.2T. The magnet’s diameter depends on the specific motor shaft and holder design. In addition, the magnetization should be diametrically polarized.

The magnet air gap spacing to the sensor surface should be set to achieve a field strength between 30mT and 80mT (see Figure 3).


Figure 3: Magnet Dimensions and Air Gap

Select the material (NdFeB or SmCo) based 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 holder should be a nonmagnetic material (e.g. aluminum, brass, or plastic) so that it does not influence or distort the sensor’s magnetic field.

Determine the attachment method for the shaft based on the motor’s design criteria. To avoid detachment due to the different thermal expansion coefficients between the magnet, holder, and shaft, it is recommended to use a high-temperature industrial adhesive

The magnet holder requires a motor with a shaft that extends from the rear of the motor. To determine the required holder size and housing depth, contact your individual motor supplier to discuss what options they have for shaft diameter and length.

The PCB housing should be designed to meet proper heatsinking requirements for the motor driver components, clearance for power supply capacitor and EMC filtering, and any other requirements to meet the target specifications. The housing should axially align the angle sensor IC with the motor shaft magnet with a maximum axial displacement of $\pm 0.4\text{mm}$ and in accordance with air gap recommendations noted in Table 1.

MotionLAB is a GUI software that allows users to flexibly configure control parameters and test system performance. To connect the module to MotionLAB, use a USB cable with a mini USB Type-B port (see Figure 4 on page 6).

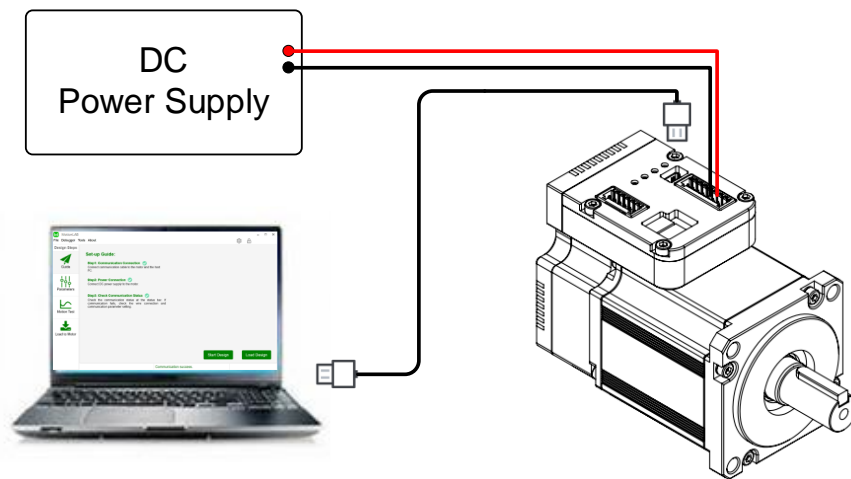
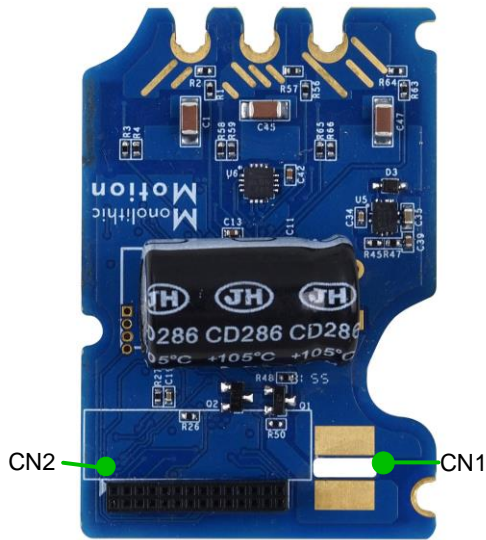
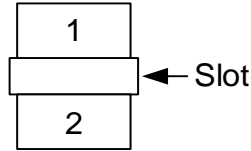
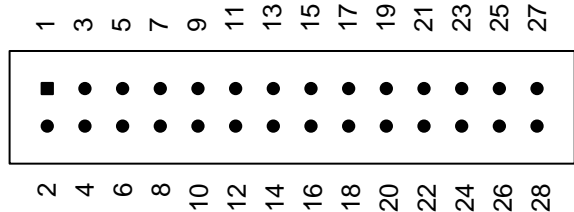


Figure 4: Connect Motor Driver Module to MotionLAB GUI

PIN CONFIGURATION


CN1: Power Interface

CN2: I/O Interface


MMP740xxx-55-R2 Pin Definitions

Power Interface (CN1)

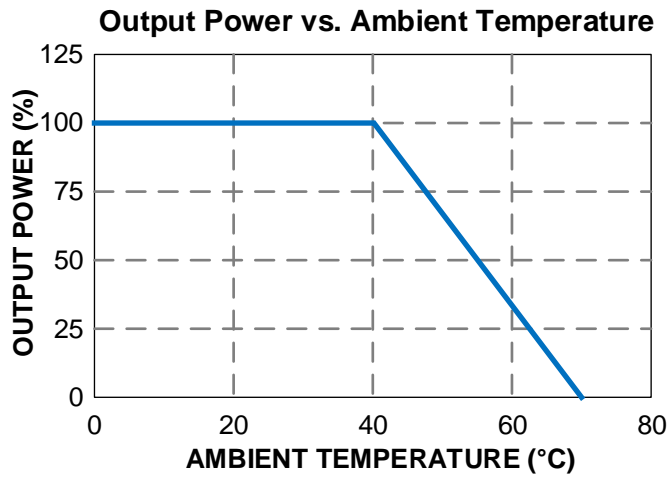
| Pin Number | Designation | Pin Description |
|------------|-------------|--------------------|
| 1 | GND | Power ground |
| 2 | VIN | Input power supply |

I/O Interface (CN2)

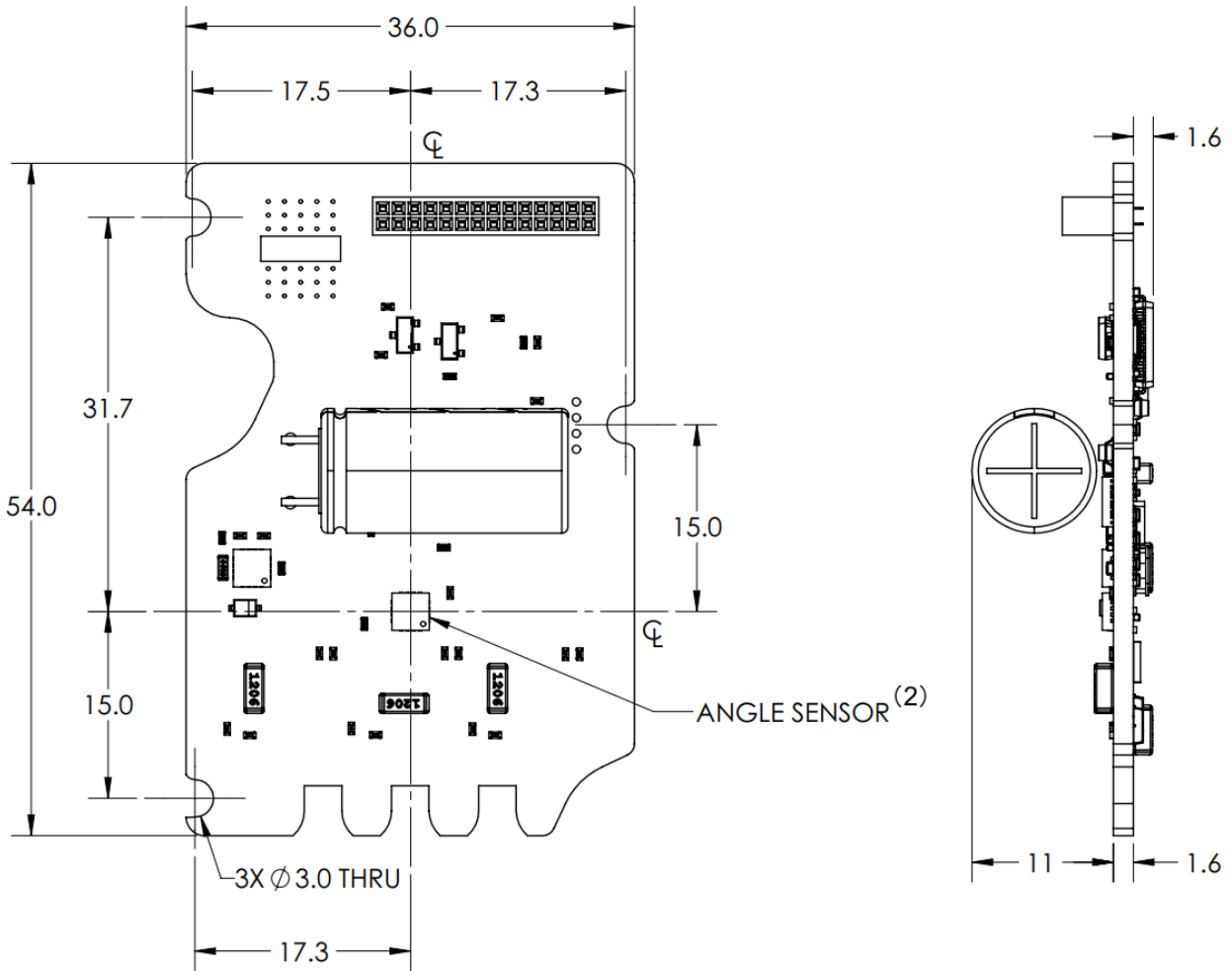
| Pin Number | Designation | Pin Description |
|--------------------|-------------|---|
| 1 | PWR | Power good output |
| 2 | ALARM | Alarm signal output |
| 3 | DI4 | Digital input signal 4, default homing enable |
| 4 | DO1 | Digital output signal 1, default PEND output |
| 5 | COM1 | Communicational status indication output. |
| 6 | DE | RS-485 flow control signal. |
| 7 | USART_TX | RS-485 communication data transmit pin. |
| 8 | USART_RX | RS-485 communication data receive pin. |
| 9 | DO4 | Digital signal output 4, default UART TX |
| 10 | DI5 | Digital signal input 5, default UART RX |
| 11 | DI2 | Digital input signal 2, default PUL/PWM input |
| 12 | DO2 | Digital output signal 2, default ALARM output |
| 13 | DI1 | Digital input signal 1, default DIR input |
| 14 | DI3 | Digital input signal 3, default ENA input |
| 15, 16, 21, 22, 26 | SGND | Signal ground pin |
| 17 | Reserved | Unused |
| 18 | +5V | +5V output pin |
| 19 | R- | DC link voltage limit switching output with push-pull circuit |
| 20 | DO3 | Digital output signal 3. Default function is brake signal output to control brake relay |
| 23 | USBFS_DP | USB debug port DP signal |
| 24 | USBFS_DM | USB debug port DM signal |
| 25 | A | Encoder signal A output |
| 27 | Z | Encoder signal Z output |
| 28 | B | Encoder signal B output |

TYPICAL PERFORMANCE CHARACTERISTICS

$V_{IN} = 24V$, unless otherwise noted.



MECHANICAL DRAWING (1) (2)



UNLESS OTHERWISE SPECIFIED:
 DIMENSIONS ARE IN MM
 TOLERANCES:
 ANGULAR (MACH) = ± 0.1°
 ANGULAR (BEND) = ± 0.5°
 XX = ± 0.5
 XX.X = ± 0.1
 XX.XX = ± 0.05

Notes:

- 1) Units are in mm.
- 2) Refer to CAD model for the angle sensor location.

REVISION HISTORY

| Revision # | Revision Date | Description | Pages Updated |
|------------|---------------|-----------------|---------------|
| 1.0 | 8/30/2023 | Initial Release | - |

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