

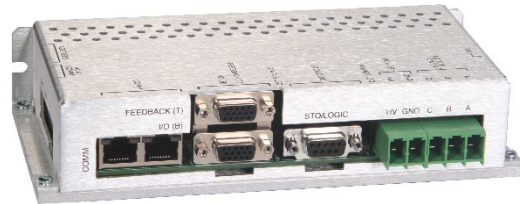
# FMP060-10-EM

FlexPro® Series

**Product Status:** Active

## SPECIFICATIONS

Current Peak	<b>20 A</b>
Current Continuous	<b>10 A</b>
DC Supply Voltage	<b>10 – 55 VDC</b>
Network Communication	<b>EtherCAT</b>



The **FMP060-10-EM** is a servo drive and integration board assembly for a FE060-10-EM FlexPro® series servo drive with IMPACT™ architecture. Connections to the controller, motor, power, and feedback are simplified through the standard connectors. The assembly is housed within a case, allowing vertical and horizontal panel mounting orientations.

The **FMP060-10-EM** offers full tuning control of all servo loops and is designed to drive brushed and brushless servo motors, and closed loop stepper motors. The drive assembly accepts a variety of external command signals, or can use the built-in Motion Engine, an internal motion controller used with Sequencing and Indexing commands. Programmable digital and analog I/O are included to enhance interfacing with external controllers and devices.

The **FMP060-10-EM** features an EtherCAT® interface for network communication using CANopen over EtherCAT (CoE) and USB connectivity for drive configuration and setup. All drive and motor parameters are stored in non-volatile memory.

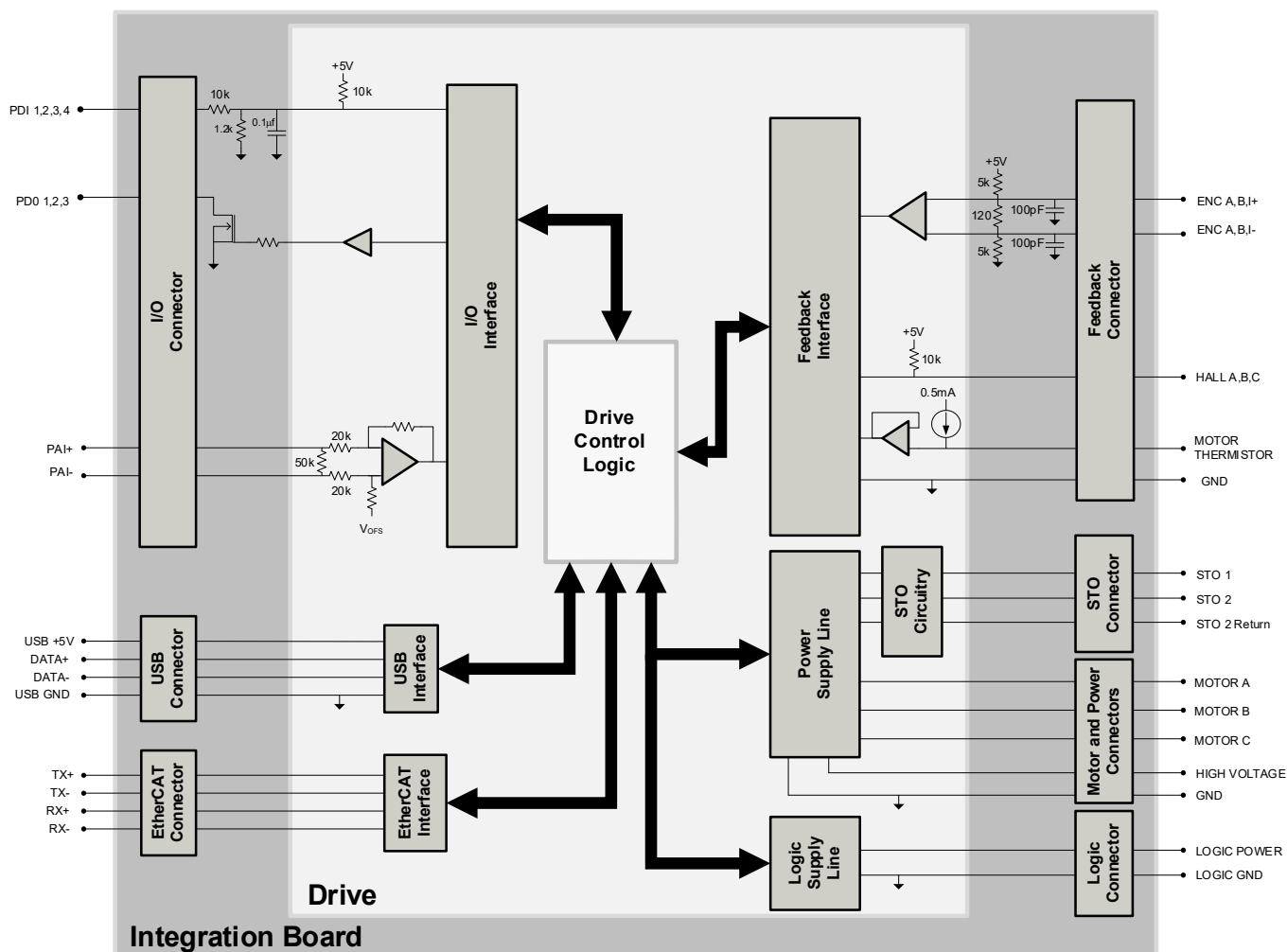
IMPACT™ (Integrated **M**otion **P**latform **A**nd **C**ontrol **T**echnology) combines exceptional processing capability and high-current components to create powerful, compact, feature-loaded servo solutions. IMPACT™ is used in all FlexPro® drives and is available in custom products as well.

## FEATURES

- CoE – Based on DSP-402 Device Profile for Drives and Motion Control
- Synchronization using Distributed Clocks
- Position Cycle Times down to 100µs
- Four Quadrant Regenerative Operation
- Programmable Gain Settings
- PIDF Velocity Loop
- On-the-Fly Mode Switching
- On-the-Fly Gain Set Switching
- Dedicated Safe Torque Off (STO) Inputs
- Bridge Status, Fault and Network Status LEDs
- Integrated Cooling Fan
- Standard Connections for Easy Setup

<b>Feedback Supported</b>	<ul style="list-style-type: none"> <li>• Absolute Encoder <ul style="list-style-type: none"> <li>◦ BiSS C-Mode</li> <li>◦ EnDat 2.2</li> </ul> </li> <li>• Incremental Encoder</li> <li>• Hall Sensors</li> <li>• Tachometer (±10V)</li> </ul>	<b>Motors Supported</b>	<ul style="list-style-type: none"> <li>• Three Phase</li> <li>• Single Phase</li> <li>• Stepper</li> </ul>	<b>Modes of Operation</b>	<ul style="list-style-type: none"> <li>• Profile Modes</li> <li>• Cyclic Synchronous Modes</li> <li>• Current</li> <li>• Velocity</li> <li>• Position</li> </ul>
<b>Command Sources</b>	<ul style="list-style-type: none"> <li>• Over the Network</li> <li>• ±10V Analog</li> <li>• Sequencing</li> <li>• Indexing</li> <li>• Jogging</li> </ul>	<b>Inputs / Outputs</b>	<ul style="list-style-type: none"> <li>• 4 Programmable Digital Inputs</li> <li>• 3 Programmable Digital Outputs</li> <li>• 1 Programmable Analog Input</li> </ul>	<b>Agency Approvals</b>	<ul style="list-style-type: none"> <li>• RoHS</li> <li>• UL/cUL</li> <li>• CE (LVD)</li> <li>• CE Class A (EMC)</li> </ul>

# BLOCK DIAGRAM



## INFORMATION ON APPROVALS AND COMPLIANCES



US and Canadian safety compliance with UL/IEC 61800-5-1, the industrial standard for adjustable speed electrical power drive systems. UL registered under file number E140173. Note that machine components compliant with UL are considered UL registered as opposed to UL listed as would be the case for commercial products.

Compliant with European EMC Directive 2014/30/EU on Electromagnetic Compatibility (specifically EN 61000-6-4:2007/A1:2011 for Emissions, Class A and EN 61000-6-2:2005 for Immunity, Performance Criteria A). LVD requirements of Directive 2014/35/EU (specifically, EN 60204-1:2019, a Low Voltage Directive to protect users from electrical shock).

The RoHS Directive restricts the use of certain substances including lead, mercury, cadmium, hexavalent chromium and halogenated flame retardants PBB and PBDE in electronic equipment.

## SPECIFICATIONS

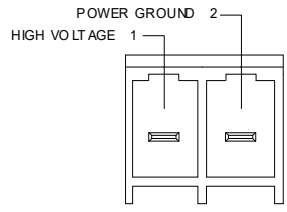
Description		Electrical Specifications		Value
		Units		
Nominal DC Supply Voltage Range		VDC	12 – 48	
DC Supply Input Range		VDC	10 – 55	
DC Supply Undervoltage		VDC	8	
DC Supply Overvoltage		VDC	58	
Logic Supply Input Range (optional)		VDC	10 – 55	
Safe Torque Off Voltage (Default)		VDC	24	
Bus Capacitance		µF	221	
Maximum Peak Current Output <sup>1</sup>		A (Arms)	20 (14.1)	
Maximum Continuous Current Output <sup>2</sup>		A (Arms)	10 (10)	
Efficiency at Rated Power		%	99	
Maximum Continuous Output Power		W	545	
Maximum Power Dissipation at Rated Power		W	6	
Minimum Load Inductance (line-to-line) <sup>3</sup>		µH	150 (@ 48VDC supply); 75 (@24VDC supply); 40 (@12VDC supply)	
Switching Frequency		kHz	20	
Maximum Output PWM Duty Cycle		%	83	
Description		Control Specifications		Value
		Units		
Communication Interfaces <sup>4</sup>		-	EtherCAT® (USB for configuration)	
Command Sources		-	±10 V Analog, Over the Network, Sequencing, Indexing, Jogging	
Feedback Supported		-	Absolute Encoder (BiSS C-Mode, EnDat 2.2), Incremental Encoder, Hall Sensors, Tachometer (±10V)	
Commutation Methods		-	Sinusoidal, Trapezoidal	
Modes of Operation		-	Profile Modes, Cyclic Synchronous Modes, Current, Velocity, Position	
Motors Supported <sup>5</sup>		-	Three Phase (Brushless Servo), Single Phase (Brushed Servo, Voice Coil, Inductive Load), Stepper (2- or 3-Phase Closed Loop)	
Hardware Protection		-	40+ Configurable Functions, Over Current, Over Temperature (Drive & Motor), Over Voltage, Short Circuit (Phase-Phase & Phase-Ground), Under Voltage	
Programmable Digital Inputs/Outputs		-	4/3	
Programmable Analog Inputs/Outputs		-	1/0	
Primary I/O Logic Level		VDC	24	
Current Loop Sample Time		µs	50	
Velocity Loop Sample Time		µs	100	
Position Loop Sample Time		µs	100	
Maximum Encoder Frequency		MHz	20 (5 pre-quadrature)	
Description		Mechanical Specifications		Value
		Units		
Size (H x W x D)		mm (in)	190.50 x 88.90 x 41.28 (7.50 x 3.50 x 1.63)	
Weight		g (oz)	484.8 (17.1)	
Relative Humidity		-	0-95%	
Ambient Operating Temperature		°C (°F)	0 – 40 (32 – 104)	
Storage Temperature		°C (°F)	-20 – 85 (-4 – 185)	
Shock		-	15g, 11ms, Half-sine	
Vibration		-	30 grms for 5 minutes in 3 axes	
Cooling System		-	Fan Cooled	
IP Rating		-	IP20	
P1 POWER CONNECTOR		-	2-port, 7.62mm spaced, enclosed, friction lock header	
P2 MOTOR POWER CONNECTOR		-	3-port, 7.62mm spaced, enclosed, friction lock header	
P3 IO CONNECTOR		-	15-pin high-density female D-Sub	
P4 FEEDBACK CONNECTOR		-	15-pin high-density female D-Sub	
P5 ETHERNET COMMUNICATION CONNECTORS		-	Shielded, Dual RJ-45 socket with LEDs	
P6 STO / LOGIC CONNECTOR		-	9-pin female D-sub	
P9 USB COMMUNICATION CONNECTOR		-	5-pin, Mini USB B Type port	

### Notes

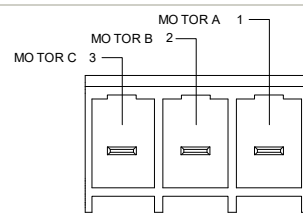
1. Capable of supplying drive rated peak current for 2 seconds with 5 second fallback to continuous value. Longer times are possible with lower current limits.
2. Continuous Arms value attainable when RMS Charge-Based Limiting is used.
3. Lower inductance is acceptable for bus voltages well below maximum. Use external inductance to meet requirements.
4. EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.
5. Maximum motor speed for stepper motors is 600 RPM. Consult the hardware installation manual for 2-phase stepper wiring configuration.

## PIN FUNCTIONS

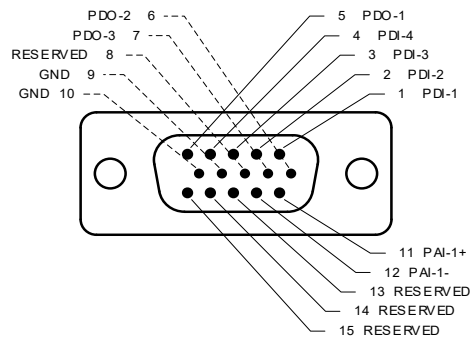
### P1 - Power Connector

Pin	Name	Description / Notes	I/O
1	POWER GROUND	Power Ground. (Common with Signal Ground)	GND
2	HIGH VOLTAGE	DC Supply Input (10-55 VDC).	I
<b>Connector Information</b>		2-port, 7.62mm spaced, enclosed, friction lock header	
<b>Mating Connector Details</b>		Amphenol: P/N ET0201500000G	
<b>Mating Connector Included</b>		Yes	

### P2 - Motor Power Connector

Pin	Name	Description / Notes	I/O
1	MOTOR A	Motor Phase A.	O
2	MOTOR B	Motor Phase B.	O
3	MOTOR C	Motor Phase C.	O
<b>Connector Information</b>		3-port, 7.62mm spaced, enclosed, friction lock header	
<b>Mating Connector Details</b>		Amphenol: P/N ET0301500000G	
<b>Mating Connector Included</b>		Yes	

### P3 - IO Connector

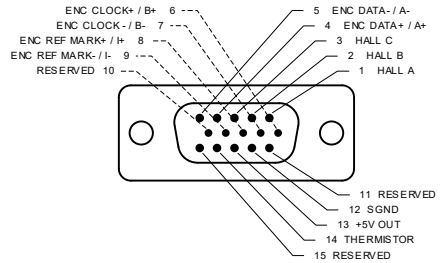
Pin	Name	Description / Notes	I/O
1	PDI-1	General Purpose Programmable Digital Input (24V)	I
2	PDI-2	General Purpose Programmable Digital Input (24V)	I
3	PDI-3	General Purpose Programmable Digital Input (24V)	I
4	PDI-4	General Purpose Programmable Digital Input (24V)	I
5	PDO-1	General Purpose Programmable Digital Output (24V Open Drain/1A)	O
6	PDO-2	General Purpose Programmable Digital Output (24V Open Drain/1A)	O
7	PDO-3	General Purpose Programmable Digital Output (24V Open Drain/1A)	O
8	RESERVED	Reserved.	-
9	GND	Signal Ground. (Common with Power Ground)	GND
10	GND	Ground.	GND
11	PAI-1+	General Purpose Differential Programmable Analog Input or Reference Signal Input.	I
12	PAI-1-	±10VDC Range (12-bit Resolution)	I
13	RESERVED	Reserved.	-
14	RESERVED	Reserved.	-
15	RESERVED	Reserved.	-
<b>Connector Information</b>		15-pin high-density female D-Sub	
<b>Mating Connector Details</b>		TYCO: Plug P/N 748364-1; Housing P/N 5748677-2; Terminals P/N 1658670-2 (loose) or 1658670-1 (strip)	
<b>Mating Connector Included</b>		No	

### P4 – Feedback Connector

Pin	Absolute Encoder	Incremental Encoder	Description / Notes	I/O
1	RESERVED	HALL A	Reserved for Absolute Encoders or Single-ended Commutation Sensor Inputs.	I
2	RESERVED	HALL B		I
3	RESERVED	HALL C		I
4	ENC DATA+	ENC A+	Differential Data Line for Absolute Encoders (BiSS: SLO+/-) or Differential Incremental Encoder A.	I
5	ENC DATA-	ENC A-	Differential Clock Line for Absolute Encoders (BiSS: MA+/-) or Differential Incremental Encoder B.	I
6	ENC CLOCK+	ENC B+		I
7	ENC CLOCK-	ENC B-	Reserved for Absolute Encoders or Differential Incremental Encoder Index.	I
8	RESERVED	ENC I+		I
9	RESERVED	ENC I-	Reserved.	-
10	RESERVED	RESERVED		-
11	RESERVED	RESERVED	Ground.	GND
12	GND	GND		GND
13	+5V OUT	+5V OUT	+5V Supply Output. Short-circuit protected. (300ma total load capacity)	O
14	THERMISTOR	THERMISTOR	Motor Thermal Protection.	I
15	RESERVED	RESERVED	Reserved.	-

<b>Connector Information</b>	15-pin, high-density, female D-sub
<b>Mating Connector Details</b>	TYCO: Plug P/N 748364-1; Housing P/N 5748677-2; Terminals P/N 1658670-2 (loose) or 1658670-1 (strip)
<b>Mating Connector Included</b>	No

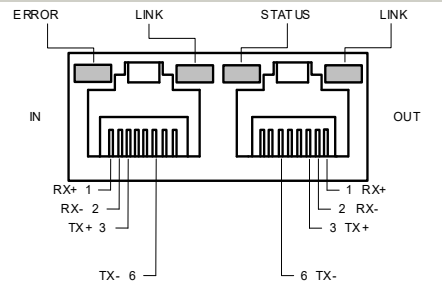
  


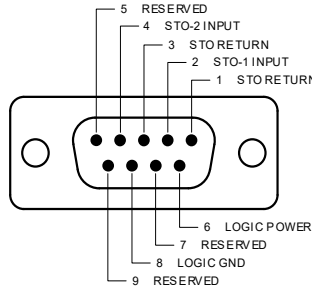
### P5 – EtherCAT Communication Connectors

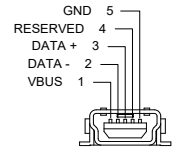
Pin	Name	Description / Notes	I/O
1	RX+	Receiver + (100Base-TX)	I
2	RX-	Receiver - (100Base-TX)	I
3	TX+	Transmitter + (100Base-TX)	O
4	RESERVED	Reserved.	-
5	RESERVED	Reserved.	-
6	TX-	Transmitter - (100Base-TX)	O
7	RESERVED	Reserved.	-
8	RESERVED	Reserved.	-

<b>Connector Information</b>	Shielded, dual RJ-45 socket with LEDs
<b>Mating Connector Details</b>	CAT 5 Cable
<b>Mating Connector Included</b>	No

P6 – STO / Logic Connector			
Pin	Name	Description / Notes	I/O
1	STO RETURN	Safe Torque Off Return	STORET
2	STO-1 INPUT	Safe Torque Off – Input 1	I
3	STO RETURN	Safe Torque Off Return	STORET
4	STO-2 INPUT	Safe Torque Off – Input 2	I
5	RESERVED	Reserved.	-
6	LOGIC POWER	Logic Supply Input.	I
7	RESERVED	Reserved.	-
8	LOGIC GND	Logic Supply Ground. (Common with Signal Ground)	GND
Connector Information		9-pin, female D-sub	
Mating Connector Details		TYCO: P/N 205204-4 (Plug); 5748677-1 (Housing); 1658540-5 (Terminals – Loose); 1658540-4 (Terminals – Strip)	
Mating Connector Included		No	

P9 – USB Communication Connector			
Pin	Name	Description / Notes	I/O
1	VBUS	Supply Voltage	O
2	DATA-	Data -	I/O
3	DATA+	Data +	I/O
4	RESERVED	Reserved.	-
5	GND	Ground	GND
Connector Information		5-pin, Mini USB B Type port	
Mating Connector Details		TYCO: 1496476-3 (2-meter STD-A to MINI-B ASSY)	
Mating Connector Included		No	

## BOARD CONFIGURATION

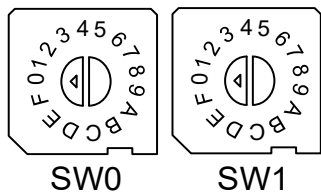
### Status LED Functions

LED	Description
STATUS	Indicates drive power bridge status. GREEN when DC bus power is applied and the drive is enabled. RED when the drive is in a fault state.
POWER	Indicates that power is available to the drive. GREEN when power is applied.

### Communication Status LED Functions (on RJ-45 Communication Connectors)

LED	Description
LINK/ACT IN/OUT	Green – On
	Green – Flickering
	Off
ETHERCAT STATUS	Valid Link - No Activity
	Valid Link - Network Activity
	Invalid Link
	The device is in the state OPERATIONAL
	The device is in the state PRE-OPERATIONAL
	The device is in state SAFE-OPERATIONAL
ERROR	The device is booting and has not yet entered the INIT state or The device is in state BOOTSTRAP or Firmware download operation in progress
	The device is in state INIT
	A PDI Watchdog timeout has occurred. Example: Application controller is not responding anymore. General Configuration Error.
	Example: State change commanded by master is impossible due to register or object settings.
	Bootling Error was detected. INIT state reached, but parameter "Change" in the AL status register is set to 0x01:change/error Example: Checksum Error in Flash Memory.
	The slave device application has changed the EtherCAT state autonomously: Parameter "Change" in the AL status register is set to 0x01:change/error. Example: Synchronization error; device enters SAFE-OPERATIONAL automatically
	An application Watchdog timeout has occurred. Example: Sync Manager Watchdog timeout.

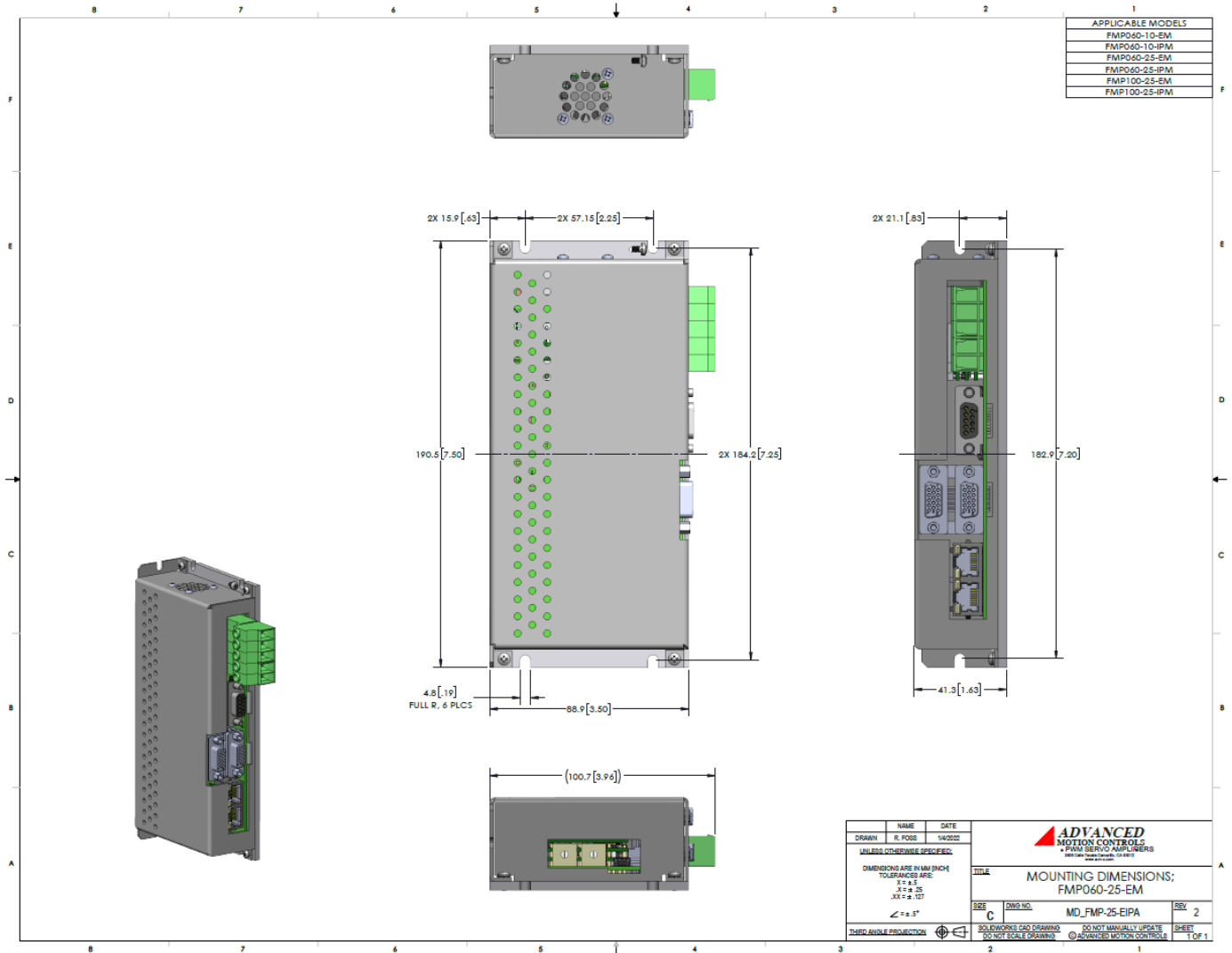
### Address Selector Switches

Switch Diagram	Description																								
	<p>Hexadecimal switch settings correspond to the drive Station Alias (EtherCAT). Note that drives on an EtherCAT network will be given an address automatically based on proximity to the host. Setting the switches manually is optional, and only necessary if a fixed address is required.</p> <table><tr><th>SW1</th><th>SW0</th><th>Node ID</th></tr><tr><td>0</td><td>0</td><td>Address stored in NVM</td></tr><tr><td>0</td><td>1</td><td>001</td></tr><tr><td>0</td><td>2</td><td>002</td></tr><tr><td>...</td><td>...</td><td>...</td></tr><tr><td>F</td><td>D</td><td>253</td></tr><tr><td>F</td><td>E</td><td>254</td></tr><tr><td>F</td><td>F</td><td>255</td></tr></table>	SW1	SW0	Node ID	0	0	Address stored in NVM	0	1	001	0	2	002	...	...	...	F	D	253	F	E	254	F	F	255
SW1	SW0	Node ID																							
0	0	Address stored in NVM																							
0	1	001																							
0	2	002																							
...	...	...																							
F	D	253																							
F	E	254																							
F	F	255																							

### Safe Torque Off (STO) Inputs

The Safe Torque Off (STO) inputs are dedicated +24VDC sinking single-ended inputs. For applications not using STO functionality, disabling of the STO feature is required for proper drive operation. STO may be disabled by following the STO Disable wiring instructions as given in the hardware installation manual. Consult the hardware installation manual for more information.

**MOUNTING DIMENSIONS**





## CUSTOMIZATION INFORMATION

ADVANCED Motion Controls also has the capability to promptly develop and deliver specified products for OEMs with volume requests. Our Applications and Engineering Departments will work closely with your design team through all stages of development in order to provide the best servo drive solution for your system. Equipped with on-site manufacturing for quick-turn customs capabilities, ADVANCED Motion Controls utilizes our years of engineering and manufacturing expertise to decrease your costs and time-to-market while increasing system quality and reliability.

### Examples of Customized Products

- |                                |                                   |
|--------------------------------|-----------------------------------|
| ▲ Optimized Footprint          | ▲ Tailored Project File           |
| ▲ Private Label Software       | ▲ Silkscreen Branding             |
| ▲ OEM Specified Connectors     | ▲ Optimized Base Plate            |
| ▲ No Outer Case                | ▲ Increased Current Limits        |
| ▲ Increased Current Resolution | ▲ Increased Voltage Range         |
| ▲ Increased Temperature Range  | ▲ Conformal Coating               |
| ▲ Custom Control Interface     | ▲ Multi-Axis Configurations       |
| ▲ Integrated System I/O        | ▲ Reduced Profile Size and Weight |

Feel free to contact us for further information and details!

### Available Accessories

ADVANCED Motion Controls offers a variety of accessories designed to facilitate drive integration into a servo system. Visit [www.a-m-c.com](http://www.a-m-c.com) to see which accessories will assist with your application design and implementation.

All specifications in this document are subject to change without written notice. Actual product may differ from pictures provided in this document.