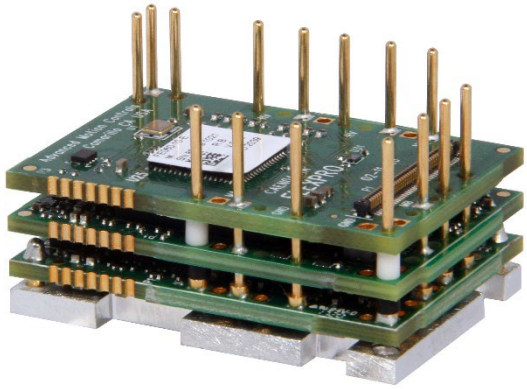
FE060-10-IPM

FlexPro® Series
Product Status: Active



SPECIFICATIONS

Current Peak	**20 A**
Current Continuous	**10 A**
DC Supply Voltage	**10 – 55 VDC**
Network Communication	**Ethernet/IP**

The **FE060-10-IPM** is a FlexPro® series servo drive with IMPACT™ architecture.

The **FE060-10-IPM** 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 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 **FE060-10-IPM** utilizes Ethernet/IP network communication and is configured via USB. All drives and motor parameters are stored in non-volatile memory. *ADVANCED* Motion Controls' Ethernet/IP protocol operates based on a control state machine as defined by CANopen standards. CIP Motion and CIP Sync are not currently supported.

IMPACT™ (**I**ntegrated **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

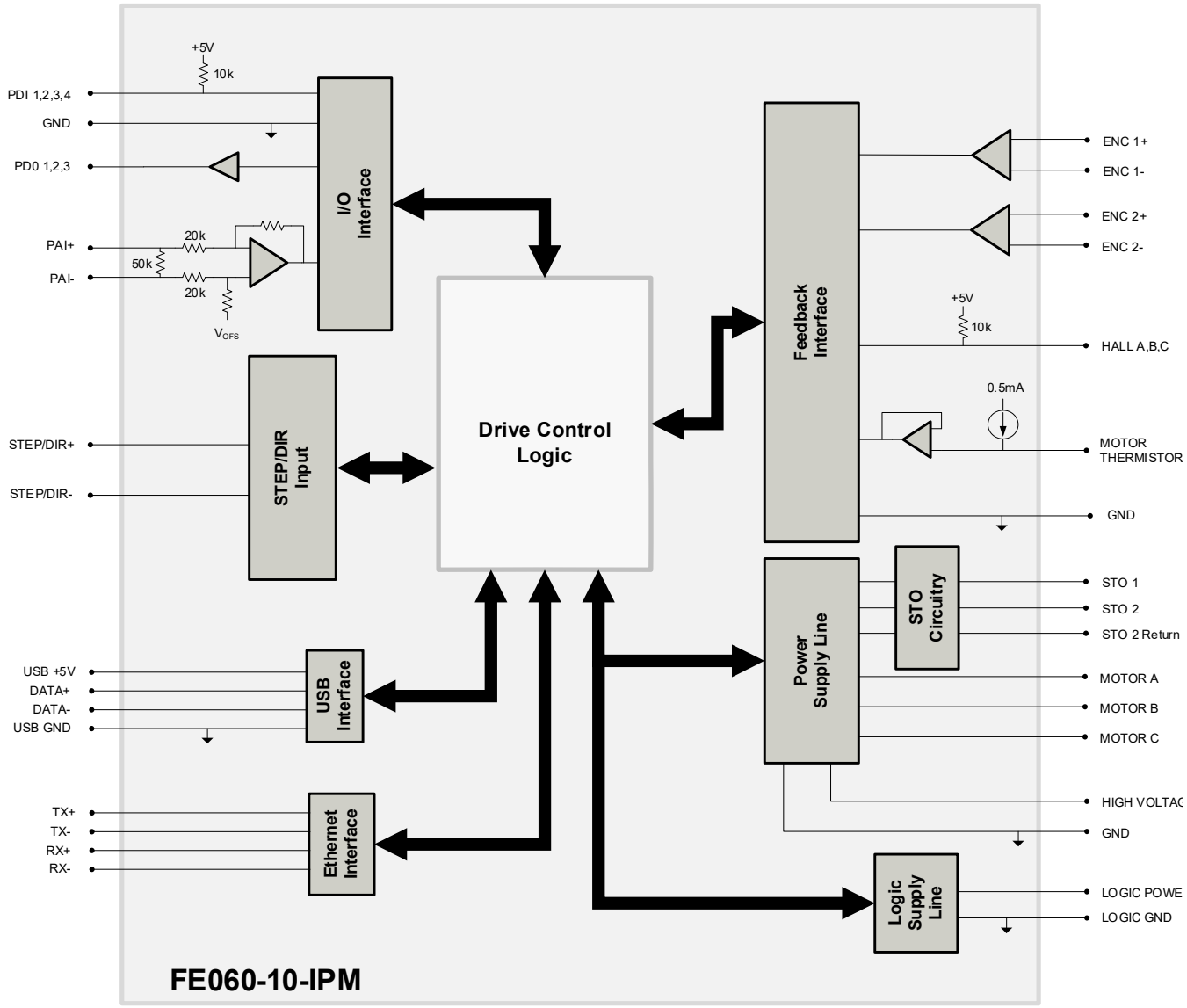
- Four Quadrant Regenerative Operation
- Programmable Gain Settings
- PIDF Velocity Loop
- Compact Size, High Power Density
- On-the-Fly Mode Switching
- On-the-Fly Gain Set Switching
- Dedicated Safe Torque Off (STO) Inputs
- Space Vector Modulation (SVM) Technology

Feedback Supported	• Absolute Encoder
	  ○ BiSS C-Mode
	  ○ EnDat 2.2
	• Incremental Encoder
	• Hall Sensors
	• Aux Incremental Encoder
	• Tachometer (±10V)
		Motors Supported	• Three Phase
			• Single Phase
			• Stepper
				Modes of Operation	• Profile Modes
					• Current
					• Velocity
					• Position

Command Sources	• Over the Network • ±10V Analog • Sequencing • Indexing • Jogging • Step & Direction • Encoder Following	**Inputs / Outputs**	• 4 Programmable Digital Inputs • 3 Programmable Digital Outputs • 1 Programmable Analog Input	**Agency Approvals**	• RoHS • UL/cUL • CE (LVD) • CE Class A (EMC)

ADVANCED Motion Controls · 3805 Calle Tecate, Camarillo, CA, 93012
ph# 805-389-1935 · fx# 805-389-1165 · www.a-m-c.com

BLOCK DIAGRAM



INFORMATION ON APPROVALS AND COMPLIANCES

cULus	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.
CE	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).
RoHS Compliant	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

Electrical Specifications		
Description	Units	Value
Nominal DC Supply Input 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	5
Minimum Required External Bus Capacitance	µF	500
Maximum Peak Current Output[1]	A (Arms)	20 (14.1)
Maximum Continuous Current Output[2]	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)[3]	µH	150 (@ 48VDC supply); 75 (@24VDC supply); 40 (@12VDC supply)
Switching Frequency	kHz	20
Maximum Output PWM Duty Cycle	%	83
Control Specifications		
Description	Units	Value
Communication Interfaces	-	Ethernet/IP (USB for configuration)
Command Sources	-	±10 V Analog, Over the Network, Sequencing, Indexing, Jogging, Step & Direction, Encoder Following
Feedback Supported	-	Absolute Encoder (BiSS C-Mode, EnDat 2.2), Hall Sensors, Incremental Encoder, Auxiliary Incremental Encoder, Tachometer (±10V)
Commutation Methods	-	Sinusoidal, Trapezoidal
Modes of Operation	-	Profile Modes, Current, Velocity, Position
Motors Supported[4]	-	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	-	5 VDC, not isolated
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)
Mechanical Specifications		
Description	Units	Value
Size (H x W x D)	mm (in)	38.1 x 25.4 x 16.0 (1.50 x 1.00 x 0.61)
Weight	g (oz)	22.7 (0.8)
Ambient Operating Temperature Range[5]	°C (°F)	0 – 65 (32 – 149)
Storage Temperature Range	°C (°F)	-40 – 85 (-40 – 185)
Relative Humidity	-	0-95%, non-condensing
Form Factor	-	PCB Mounted
P1 SIGNAL CONNECTOR*	-	80-pin 0.4mm spaced connector
TERMINAL PINS	-	26x Terminal Pins

Notes

1. Capable of supplying drive rated peak current for 2 seconds with 5 second foldback to continuous value. Longer times are possible with lower current limits.
2. Continuous A_{rms} 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. Maximum motor speed for stepper motors is 600 RPM. Consult the hardware installation manual for 2-phase stepper wiring configuration.
5. Additional cooling and/or heatsink may be required to achieve rated performance.

*Mating Connector Kit

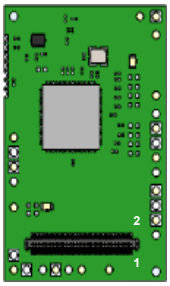
Surface mount board connector for P1 and board spacers can be ordered as a kit using *ADVANCED* Motion Controls' part number **KC-MC1XFE01**.

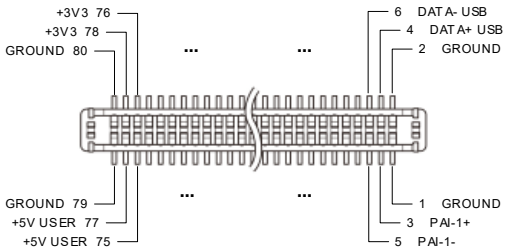
PIN FUNCTIONS

P1 – Signal Connector

Pin	Name	Description / Notes	I/O	Pin	Name	Description / Notes	I/O
1	GROUND	Ground	GND	2	GROUND	Ground	GND
3	PAI-1+	Differential Programmable Analog Input or Reference Signal Input (12-bit Resolution)	I	4	DATA+ USB	USB Data Channel	I/O
5	PAI-1-		I	6	DATA- USB		I/O
7	THERMISTOR	Motor Thermal Protection.	I	8	GROUND	Ground	GND
9	GROUND	Ground	GND	10	SCLA	I²C Data Signals for Addressing, Network Error LED, and Bridge Status LED. See Hardware Manual for more info.	O
11	ENC 1 DATA+ / A+	Differential Data Line for Absolute Encoders (BiSS: SLO+/-) or Differential Incremental Encoder A.	I/O	12	SDAA		I/O
13	ENC 1 DATA- / A-		I/O	14	HALL A	Single-ended Commutation Sensor Inputs	I
15	ENC 1 CLK+ / B+	Differential Clock Line for Absolute Encoders (BiSS: MA+/-) or Differential Incremental Encoder B.	I/O	16	HALL B		I
17	ENC 1 CLK- / B-		I/O	18	HALL C		I
19	GROUND	Ground	GND	20	GROUND	Ground	GND
21	ENC 1 REF+ / I+	Differential Reference Mark for Absolute Encoders (Leave open for BiSS) or Differential Incremental Encoder Index.	I	22	ENC 2 A+	Differential Incremental Encoder A.	I
23	ENC 1 REF- / I-		I	24	ENC 2 A-		I
25	NET_STATUS	Network Status indicator. Function based on protocol specification. See Hardware Information below.	I/O	26	ENC 2 B+	Differential Incremental Encoder B.	I
27	RESERVED	Reserved. Do not connect.	-	28	ENC 2 B-		I
29	RESERVED	Reserved. Do not connect.	-	30	ENC 2 I+	Differential Incremental Encoder Index.	I
31	PDI-1	Programmable Digital Input	I	32	ENC 2 I-		I
33	PDI-2	Programmable Digital Input	I	34	PDO-1	Programmable Digital Output (TTL/8mA)	O
35	PDI-3	Programmable Digital Input	I	36	PDO-2	Programmable Digital Output (TTL/8mA)	O
37	PDI-4	Programmable Digital Input	I	38	PDO-3	Programmable Digital Output (TTL/8mA)	O
39	GROUND	Ground	GND	40	GROUND	Ground	GND
41	TX- IN	Transmit Line IN (100 Base TX)	I	42	TX- OUT	Transmit Line OUT (100 Base TX)	O
43	TX+ IN		I	44	TX+ OUT		O
45	RX- IN	Receive Line IN (100 Base TX)	I	46	RX- OUT	Receive Line OUT (100 Base TX)	O
47	RX+ IN		I	48	RX+ OUT		O
49	+3V BIAS IN	+3V Supply for Transformer/Magnetics Bias	O	50	+3V BIAS OUT	+3V Supply for Transformer/Magnetics Bias	O
51	LINK/ACT IN	Link and Activity Indicator for IN port.	I/O	52	LINK/ACT OUT	Link and Activity Indicator for OUT port.	I/O
53	MOD_STATUS	Module Status indicator. Function based on protocol specification. See Hardware Information below.	I/O	54	RESERVED	Reserved. Do not connect.	-
55	RESERVED	Reserved. Do not connect.	-	56	RESERVED	Reserved. Do not connect.	-
57	RESERVED	Reserved. Do not connect.	-	58	RESERVED	Reserved. Do not connect.	-
59	GROUND	Ground	GND	60	GROUND	Ground	GND
61	RESERVED	Reserved. Do not connect.	-	62	RESERVED	Reserved. Do not connect.	-
63	RESERVED	Reserved. Do not connect.	-	64	RESERVED	Reserved. Do not connect.	-
65	RESERVED	Reserved. Do not connect.	-	66	RESERVED	Reserved. Do not connect.	-
67	RESERVED	Reserved. Do not connect.	-	68	STEP	Step Input.	I
69	RESERVED	Reserved. Do not connect.	-	70	DIR	Direction Input.	I
71	RESERVED	Reserved. Do not connect.	-	72	RESERVED	Reserved. Do not connect.	-
73	+5V	+5VDC unprotected supply for local logic (See Note 1)	O	74	RESERVED	Reserved. Do not connect.	-
75	+5V_USER	+5VDC User Supply for feedback or external devices (See Note 1)	O	76	+3V3	+3.3VDC supply for local logic signals (100 mA max)	O
77	+5V_USER		O	78	+3V3		O
79	GROUND	Ground	GND	80	GROUND	Ground	GND

Connector Information	80-pin, 0.4mm spaced connector
Mating Connector Details	PANASONIC: P/N AXT380224
Mating Connector Included with Drive	No



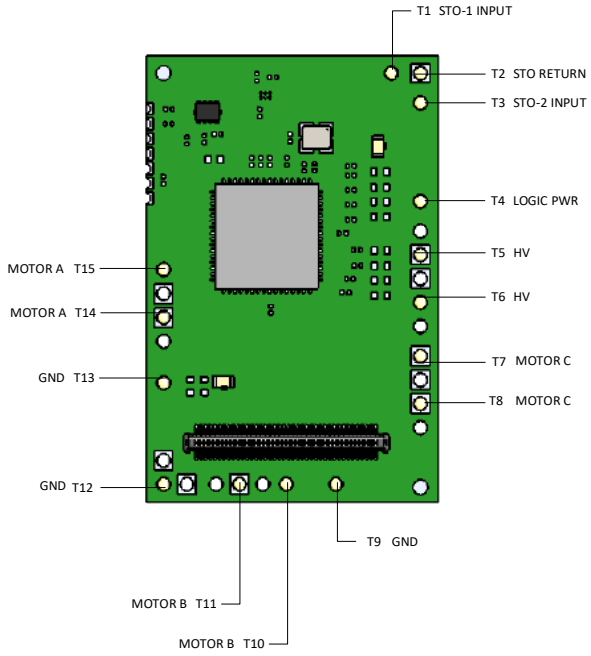


Notes

1. Total current through pins P1-73/75/77 should not exceed 300mA, while no single pin should be loaded more than 150mA.

TERMINAL PIN LOCATIONS

The 15 Terminal Pins provide connection to the high power drive signals. Terminal Pins must be soldered to an interface board.



Pin	Name	Description / Notes	I/O
T1	STO-1 INPUT	Safe Torque Off – Input 1	I
T2	STO RETURN	Safe Torque Off Return	STORET
T3	STO-2 INPUT	Safe Torque Off – Input 2	I
T4	LOGIC PWR	Logic Supply Input (10 – 55VDC) (optional). When using a separate logic power supply, turn on the logic supply first before turning on the main power supply	I
T5	HV	DC Supply Input (10 - 55 VDC). Minimum 500µF external capacitance required between HV and POWER GND.	I
T6	HV		I
T7	MOTOR C	Motor Phase C. All provided motor phase output pins must be used.	O
T8	MOTOR C		O
T9	GND	Ground.	GND
T10	MOTOR B	Motor Phase B. All provided motor phase output pins must be used.	O
T11	MOTOR B		O
T12	GND	Ground.	GND
T13	GND		GND
T14	MOTOR A	Motor Phase A. All provided motor phase output pins must be used.	O
T15	MOTOR A		O

Terminal Pin Details

Safe Torque Off (STO) Inputs

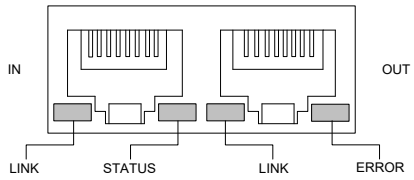
The Safe Torque Off (STO) inputs are dedicated +5VDC sinking single-ended inputs. For applications not using STO functionality, disabling of the STO feature is required for proper drive operation. STO may be disabled by following the STO Disable wiring instructions as given in the hardware installation manual. Consult the hardware installation manual for more information.

HARDWARE INFORMATION

LED Functionality

LINK/ACT IN (P1-51); LINK/ACT OUT (P1-52); STATUS (P1-53);

The *LINK/ACT IN, LINK/ACT OUT, MOD_STATUS* and *NET_STATUS* pins serve as Ethernet/IP network indicators. On a standard RJ-45 connector used with Ethernet/IP network topology, the typical network indicator LED locations are as shown in the below diagrams. **Note that the drive features signals for connection to LEDs on an RJ-45 connector, but the connector itself is not included on the drive.**

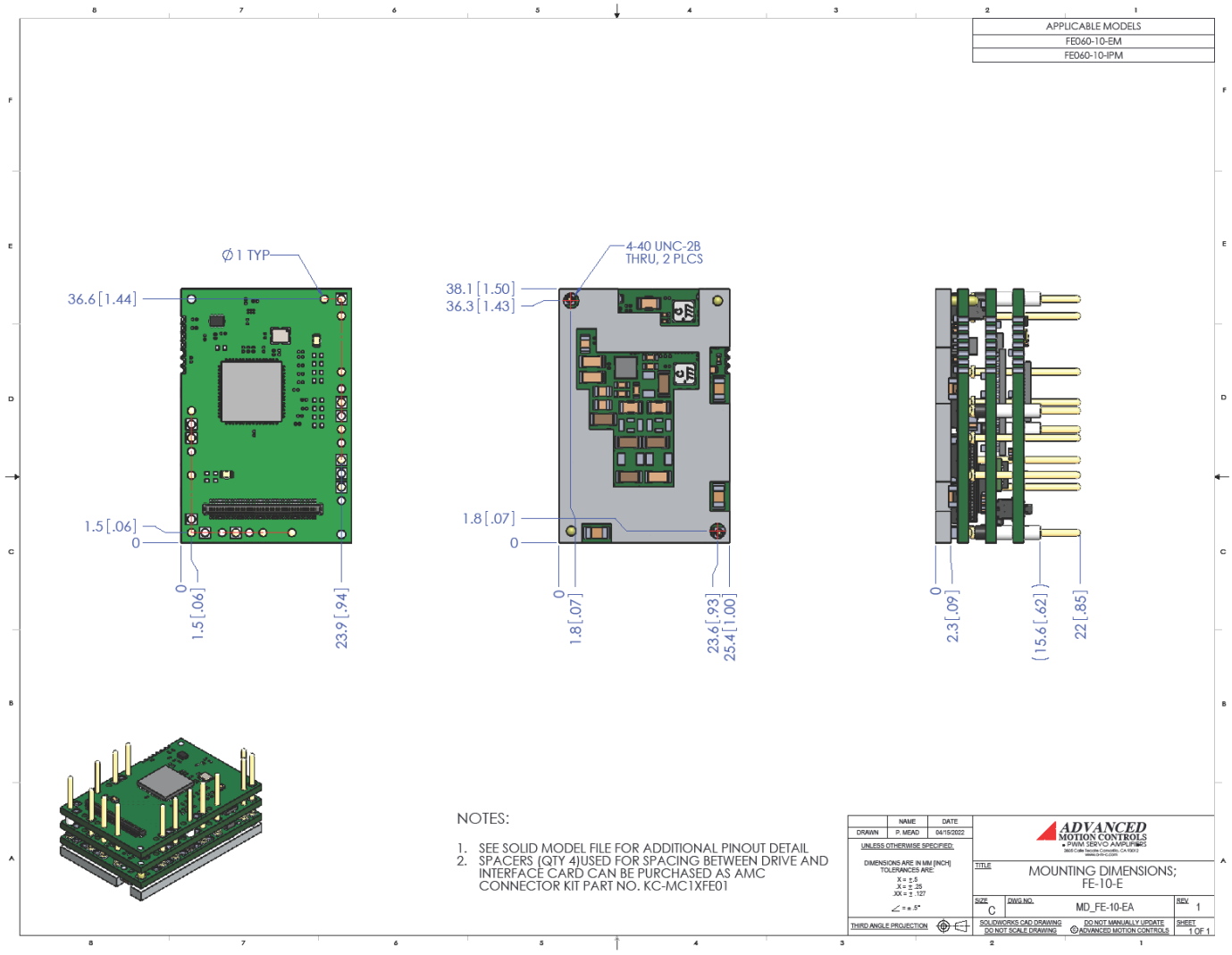


LINK/ACT IN and *LINK/ACT OUT* are used to drive the corresponding LINK IN and LINK OUT LEDs on a typical RJ-45 connector. The MOD_STATUS pin is used to drive the Module Status LED, and the NET_STATUS pin is used to drive the Network Status LED. Consult the hardware installation manual for recommended wiring connections. The LED Function Protocol tables below describe typical LED functionality.

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

LED	Description	
MODULE STATUS	Off	No power
	Green	Device Operational
	Flashing Green	Standby
	Flashing Red	Minor Fault
	Red	Major Fault
	Flashing Green/Red	Self-test
NETWORK STATUS	Off	Not powered, no IP address
	Flashing Green	No connections
	Green	Connected
	Flashing Red	Connection Timeout
	Red	Duplicate IP address
	Flashing Green/Red	Self-test

MOUNTING DIMENSIONS



PART NUMBERING AND CUSTOMIZATION INFORMATION

F E 060 – 10 – IP M

Drive Series
- **F** FlexPro®

Environment
- **X** EXtended Environment

Form Factor
- **E** FlexPro® Embedded
- **D** FlexPro® E (W/ Development board)
- **M** FlexPro® Machine Mount

Maximum DC Bus Voltage
- **060** 60 VDC
- **100** 100 VDC

Feedback
- **M** Multi Encoder (BiSS, 5V Incremental)

Network Communication
- **E** EtherCAT
- **C** CANopen
- **R** RS485/232
- **IP** Ethernet/IP

Continuous Current
- **5** 5A
- **10** 10A
- **25** 25A
- **50** 50A
- **60C** 60A (continuous only, no peak)
- **100** 100A

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