FD060-10-RM

FlexPro® Series
Product Status: Active

SPECIFICATIONS

Current Peak	**20 A**
Current Continuous	**10 A**
DC Supply Voltage	**10 – 55 VDC**
Network Communication	**RS485/232**

The **FD060-10-RM** is a servo drive and development board assembly for a FE060-10-RM FlexPro® series servo drive with IMPACT™ architecture. Connections to the controller, motor, power, and feedback are simplified through the standard connectors featured on the board. The **FD060-10-RM** is ideal for prototyping and can be used in production and industrial environments as well.

The **FD060-10-RM** offers full tuning control of all servo loops and is designed to drive brushed and brushless servo motors, stepper motors, and AC induction 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 **FD060-10-RM** features an RS485/232 interface for network communication and USB connectivity for drive configuration and setup. All drive and motor parameters are stored in non-volatile memory.

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

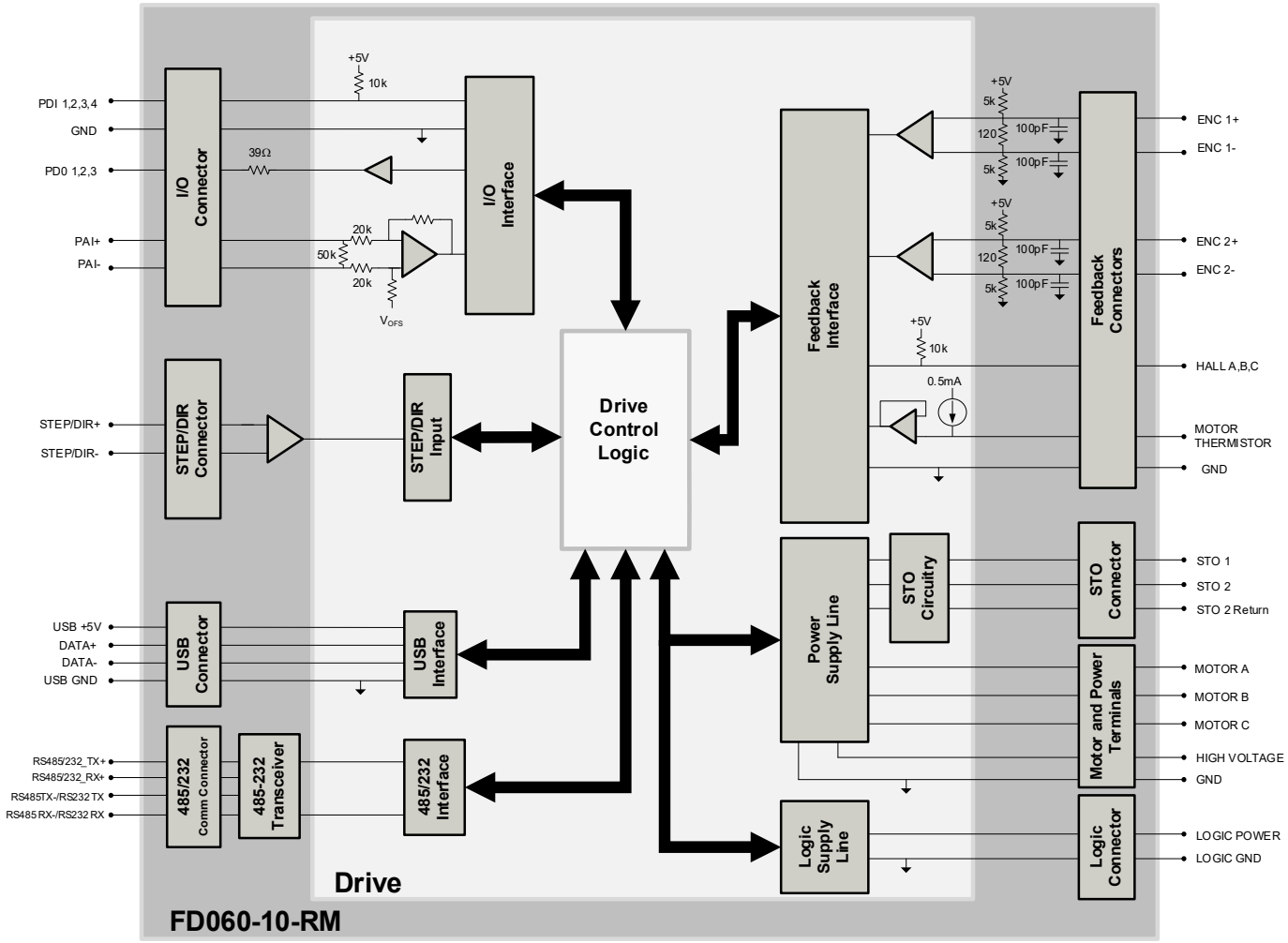
- Four Quadrant Regenerative Operation
- Programmable Gain Settings
- PIDF Velocity Loop
- On-the-Fly Mode Switching
- On-the-Fly Gain Set Switching
- Dedicated Safe Torque Off (STO) Inputs
- Bridge Status, Fault and Network Status LEDs
- I/O Status LEDs
- Standard Connections for Easy Setup

Feedback Supported	• Absolute Encoder
	  ○ BiSS C-Mode
	  ○ EnDat 2.2
	  ○ Tamagawa/Nikon
	  ○ SSI
	• Incremental Encoder
	• Hall Sensors
	• Aux Incremental Encoder
	• Tachometer (±10V)
		Motors Supported	• Three Phase
			• Single Phase
			• Stepper
			• AC Induction
				Modes of Operation	• 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 (Pending) • CE (Pending) • TUV Rheinland (STO) (Pending)

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

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
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	-	RS485/232 (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, Tamagawa/Nikon, SSI), Incremental Encoder, Hall Sensors, Auxiliary Incremental Encoder,, Tachometer (±10V)
Commutation Methods	-	Sinusoidal, Trapezoidal
Modes of Operation	-	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), AC Induction (Closed Loop Vector)
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)	114.3 x 91.4 x 26.0 (4.50 x 3.60 x 1.03)
Weight	g (oz)	178.5 (6.3)
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
P2 LOGIC POWER CONNECTOR	-	2-port Screw Terminal
P3 USB COMMUNICATION CONNECTOR	-	5-pin, Mini USB B Type port
P5 SERIAL COMMUNICATION CONNECTOR	-	8-pin, dual row, 2.00 mm spaced plug terminal
P6 STO CONNECTOR	-	8-pin 2.00 mm spaced, enclosed, friction lock header
P7 IO CONNECTOR	-	12-pin 2.00 mm spaced dual-row plug terminal
P8 STEP/DIR CONNECTOR	-	8-pin 2.00 mm spaced dual-row plug terminal
P9 FEEDBACK 2 CONNECTOR	-	15-pin vertical D-Sub
P10 FEEDBACK 1 CONNECTOR	-	15-pin vertical D-Sub
P11/12/13 MOTOR POWER TERMINALS	-	3x Hex Screw Lug
P14/15 DC POWER TERMINALS	-	2x Hex Screw Lug

Notes

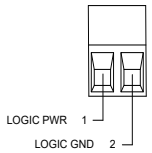
1. Capable of supplying drive rated peak current for 2 seconds with 5 second foldback to continuous value. Longer times are possible with lower current limits.
2. Continuous A_{rms} value attainable when RMS Charge-Based Limiting is used.
3. Lower inductance is acceptable for bus voltages well below 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.

PIN FUNCTIONS

P2 – Logic Power Connector

Pin	Name	Description / Notes	I/O
1	LOGIC PWR	Logic Supply Input (10 – 55VDC) (optional)	I
2	LOGIC GND	Ground	GND

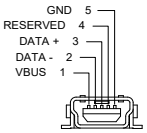
Connector Information	2-port Screw Terminal
Mating Connector Details	N/A
Mating Connector Included	N/A



P3 – 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

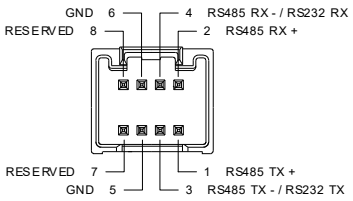
Connector Information	5-pin, Mini USB B Type port
Mating Connector Details	TYCO: 1496476-3 (2-meter STD-A to MINI-B ASSY)
Mating Connector Included	No



P5 – Serial Communication Connector

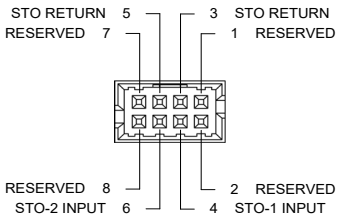
Pin	Name	Description / Notes	I/O
1	RS485 TX+	Transmit Line (RS485)	I/O
2	RS485 RX+	Receive Line (RS485)	I/O
3	RS485 TX - / RS232 TX	Transmit Line (RS485 or RS232)	I/O
4	RS485 RX - / RS232 RX	Receive Line (RS485 or RS232)	I/O
5	GND	Ground	GND
6	GND	Ground	GND
7	RESERVED	Reserved.	-
8	RESERVED	Reserved.	-

Connector Information	8-pin, dual row, 2.00 mm spaced plug terminal
Mating Connector Details	Molex: P/N 51353-0800 (housing); 56134-9100 (contacts)
Mating Connector Included	Yes



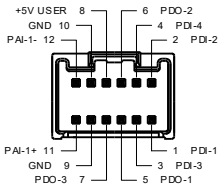
P6 – STO Connector			
Pin	Name	Description / Notes	I/O
1	RESERVED	Reserved.	-
2	RESERVED	Reserved.	-
3	STO RETURN	Safe Torque Off Return	STORET
4	STO-1 INPUT	Safe Torque Off – Input 1	I
5	STO RETURN	Safe Torque Off Return	STORET
6	STO-2 INPUT	Safe Torque Off – Input 2	I
7	RESERVED	Reserved.	-
8	RESERVED	Reserved.	-

Connector Information	8-port, 2.00 mm spaced, enclosed, friction lock header
Mating Connector Details	Molex: P/N 51110-0860 (housing); 50394-8051 (pins)
Mating Connector Included	Yes



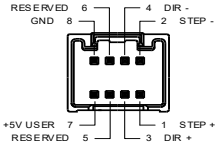
P7 – IO Connector			
Pin	Name	Description / Notes	I/O
1	PDI-1	General Purpose Programmable Digital Input	I
2	PDI-2	General Purpose Programmable Digital Input	I
3	PDI-3	General Purpose Programmable Digital Input	I
4	PDI-4	General Purpose Programmable Digital Input	I
5	PDO-1	General Purpose Programmable Digital Output (TTL/8mA)	O
6	PDO-2	General Purpose Programmable Digital Output (TTL/8mA)	O
7	PDO-3	General Purpose Programmable Digital Output (TTL/8mA)	O
8	+5V USER	+5V Supply Output. Short-circuit protected. (300ma total load capacity shared between P7-8, P8-7, P9-13, and P10-13)	O
9	GND	Ground.	GND
10	GND	Ground.	GND
11	PAI-1+	General Purpose Differential Programmable Analog Input or Reference Signal Input. ±10VDC Range (12-bit Resolution)	I
12	PAI-1-		I

Connector Information	12-pin, dual row, 2.00 mm spaced plug terminal
Mating Connector Details	Molex: P/N 51353-1200 (housing); 56134-9100 (contacts)
Mating Connector Included	Yes



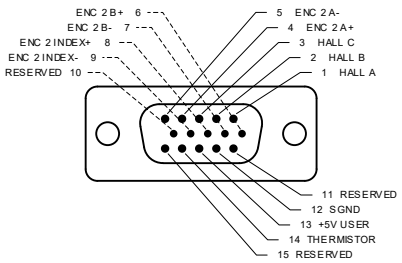
P8 – STEP/DIR Connector			
Pin	Name	Description / Notes	I/O
1	STEP +	Differential Step Input.	I
2	STEP -		I
3	DIR +	Differential Direction Input.	I
4	DIR -		I
5	RESERVED	Reserved.	-
6	RESERVED		-
7	+5V USER	+5V Supply Output. Short-circuit protected. (300ma total load capacity shared between P7-8, P8-7, P9-13, and P10-13)	O
8	GND	Ground.	GND

Connector Information	8-pin, dual row, 2.00 mm spaced plug terminal
Mating Connector Details	Molex: P/N 51353-0800 (housing); 56134-9100 (contacts)
Mating Connector Included	Yes



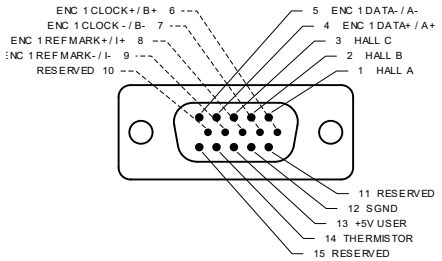
P9 – Feedback 2 Connector			
Pin	Incremental Encoder	Description / Notes	I/O
1	HALL A	Single-ended Commutation Sensor Inputs. Signals shared with Feedback 1 connector. Use only Hall connections on either Feedback 1 or Feedback 2.	I
2	HALL B		I
3	HALL C		I
4	ENC 2 A+	Differential Incremental Encoder A.	I
5	ENC 2 A-		I
6	ENC 2 B+	Differential Incremental Encoder B.	I
7	ENC 2 B-		I
8	ENC 2 INDEX+	Differential Incremental Encoder Index.	I
9	ENC 2 INDEX-		I
10	RESERVED	Reserved.	-
11	RESERVED	Reserved.	-
12	GND	Ground.	GND
13	+5V USER	+5V Supply Output. Short-circuit protected. (300ma total load capacity shared between P7-8, P8-7, P9-13, and P10-13)	O
14	THERMISTOR	Motor Thermal Protection. Select which Thermistor pin is active using DIP Switch SW6 (see Board Configuration section below). Only one Thermistor pin between Feedback 1 and Feedback 2 Connector can be active.	I
15	RESERVED	Reserved.	-

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



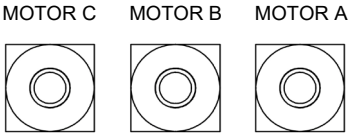
P10 – Feedback 1 Connector				
Pin	Absolute Encoder	Incremental Encoder	Description / Notes	I/O
1	HALL A	HALL A	Single-ended Commutation Sensor Inputs. Signals shared with Feedback 2 connector. Use only Hall connections on either Feedback 1 or Feedback 2.	I
2	HALL B	HALL B		I
3	HALL C	HALL C		I
4	ENC 1 DATA+	ENC 1 A+	Differential Data Line for Absolute Encoders (BiSS: SLO+/-) or Differential Incremental Encoder A.	I
5	ENC 1 DATA-	ENC 1 A-		I
6	ENC 1 CLOCK+	ENC 1 B+	Differential Clock Line for Absolute Encoders (BiSS: MA+/-) or Differential Incremental Encoder B.	I
7	ENC 1 CLOCK-	ENC 1 B-		I
8	ENC 1 REF MARK+	ENC 1 I+	Differential Reference Mark for Absolute Encoders (Leave open for BiSS and EnDat 2.2) or Differential Incremental Encoder Index.	I
9	ENC 1 REF MARK-	ENC 1 I-		I
10	RESERVED	RESERVED	Reserved.	-
11	RESERVED	RESERVED	Reserved.	-
12	GND	GND	Ground.	GND
13	+5V USER	+5V USER	+5V Supply Output. Short-circuit protected. (300ma total load capacity shared between P7-8, P8-7, P9-13, and P10-13)	O
14	THERMISTOR	THERMISTOR	Motor Thermal Protection. Select which Thermistor pin is active using DIP Switch SW6 (see Board Configuration section below). Only one Thermistor pin between Feedback 1 and Feedback 2 Connector can be active.	I
15	RESERVED	RESERVED	Reserved.	-

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



P11/12/13 - Motor Power Terminals			
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

Connector Information	Bushings with M4 Screw
Mating Connector Details	N/A
Mating Connector Included	N/A



P14/15 - DC Power Terminals			
Pin	Name	Description / Notes	I/O
1	HV	DC Supply Input (10-55 VDC).	I
2	POWER GND	Ground.	GND

Connector Information	Bushings with M4 Screw
Mating Connector Details	N/A
Mating Connector Included	N/A

BOARD CONFIGURATION

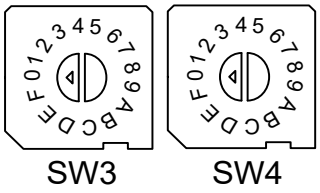
Status LED Functions

LED	Description
STAT	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.
LOGIC PWR	Indicates that logic power is available to the drive. GREEN when logic power is available.
EMA	Indicates whether the Emulated Encoder Output functionality is active. GREEN for Emulated Encoder Output active. OFF for Step & Direction Input or PWM & Direction Input.
SEL	Indicates serial communication mode. GREEN for RS485.

Input/Output LED Functions

LED	Description
DI1 – DI4	Indicates digital input status. GREEN when the corresponding digital input is active.
DO1 – DO3	Indicates digital output status. BLUE when the corresponding digital output is active

Drive Address Switches

Switch Diagram	Description
	Hexadecimal switch settings correspond to the RS485/232 drive address. Allowable addresses are 1 - 63. Drive address can also be set via ACE setup software or network commands and stored to NVM. Setting the rotary switches to zero will use the address stored in NVM.

SW3	SW4	Node ID
0	0	Address stored in NVM
0	1	1
0	2	2
…	…	…
3	D	61
3	E	62
3	F	63

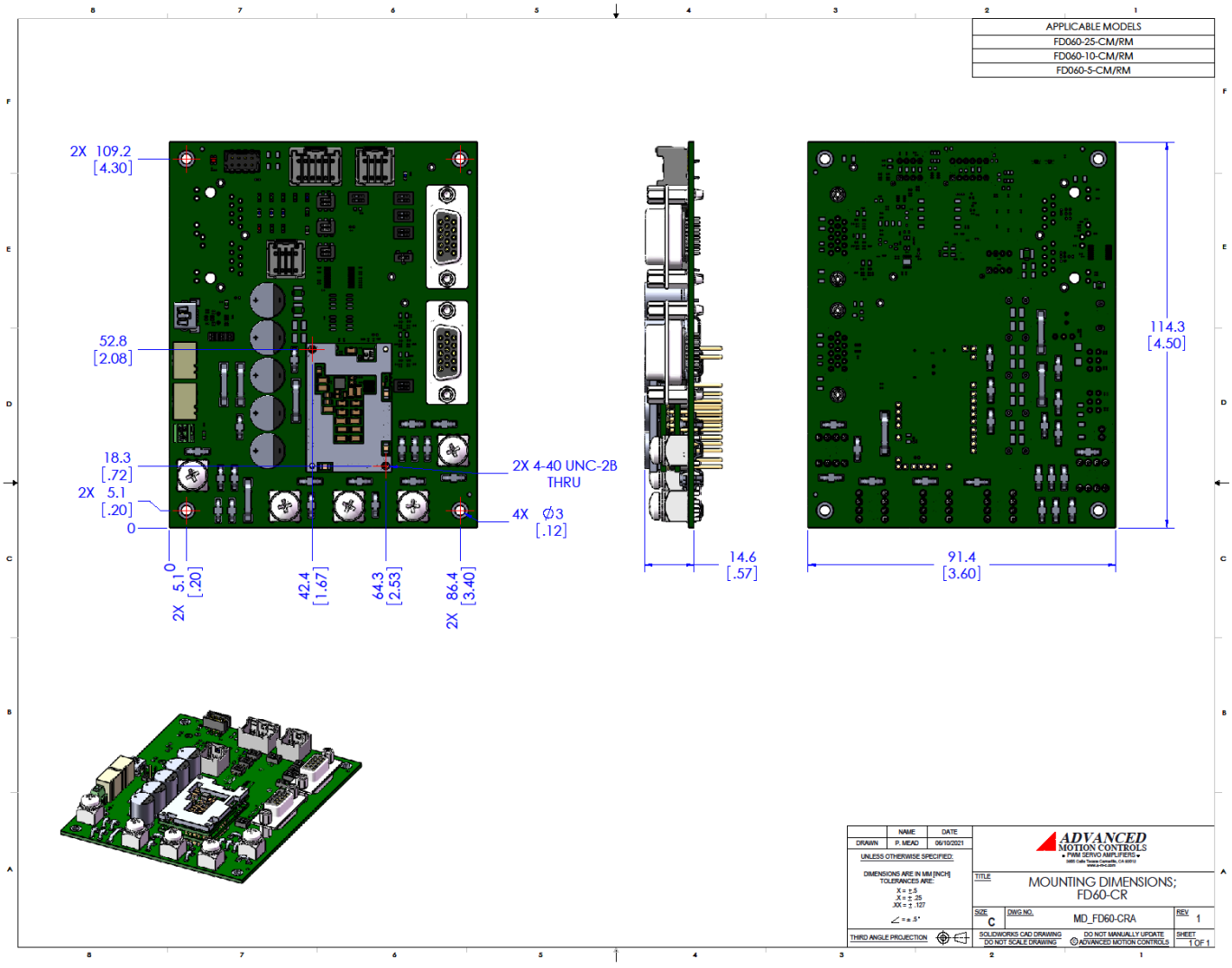
DIP Switches

Switch	Description	ON	OFF
SW5	RS232/485 Mode	RS232	RS485
SW6	Motor Thermistor Selection. Note that both switches on SW6 must be set to the same position for proper operation.	Uses the motor thermistor reading from P9 – Feedback 2 Connector	Uses the motor thermistor reading from P10 – Feedback 1 Connector
SW7	RS485 Termination. SW7-1 adds termination to RS485 RX line. SW7-2 adds termination to RS485 TX line.	Terminated	Not terminated
SW8	2/4 Wire Mode. Note that this switch must be OFF for RS232 communication.	2-wire RS485 Mode	4-wire Mode/RS232 Mode
SW10	Serial Communication Selection. Note that all 4 switches of SW10 and SW11 must be set to the same position for proper operation.	RS232/485	-
SW11			

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 installing the included mating connector for the STO connector and following the STO Disable wiring instructions as given in the hardware installation manual. Consult the hardware installation manual for more information. Alternatively, a dedicated STO Disable Key connector is available for purchase for applications where STO is not in use. Contact the factory for ordering information.

MOUNTING DIMENSIONS



PART NUMBERING AND CUSTOMIZATION INFORMATION

F D 060 – 10 – R 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.