

#### Description

The DigiFlex® Performance™ (DP) Series digital servo drives are designed to drive brushed and brushless servomotors, stepper motors, and AC induction motors. These fully digital drives operate in torque, velocity, or position mode and employ Space Vector Modulation (SVM), which results in higher bus voltage utilization and reduced heat dissipation compared to traditional PWM. The drive can be configured for a variety of external command signals. Commands can also be configured using the drive's built-in Motion Engine, an internal motion controller used with distributed motion applications. In addition to motor control, these drives feature dedicated and programmable digital and analog inputs and outputs to enhance interfacing with external controllers and devices.

This DP Series drive features a CANopen interface for networking and a RS-232 interface for drive configuration and setup. Drive commissioning is accomplished using DriveWare® 7, available for download at www.a-m-c.com.

All drive and motor parameters are stored in non-volatile memory. The DPC Series Hardware Installation Manual is available for download at www.a-m-c.com.

Power Range	
Peak Current	40 A (28.3 A <sub>RMS</sub> )
Continuous Current	20 A (20 A <sub>RMS</sub> )
Supply Voltage	100 - 240 VAC





#### **Features**

- ✓ Follows the CAN in Automation (CiA) 301
  Communications Profile and 402 Device Profile
- ▲ Four Quadrant Regenerative Operation
- Space Vector Modulation (SVM) Technology
- Fully Digital State-of-the-art Design
- Programmable Gain Settings
- Fully Configurable Current, Voltage, Velocity and Position Limits

- ▲ PIDF Velocity Loop
- ▲ PID + FF Position Loop
- ▲ Compact Size, High Power Density
- 16-bit Analog to Digital Hardware
- Built-in brake/shunt regulator
- On-the-Fly Mode Switching
- On-the-Fly Gain Set Switching
- ▲ Dedicated Safe Torque Off (STO) Inputs

#### **MODES OF OPERATION**

- Profile Modes
- Cyclic Synchronous Modes
- Current
- Velocity
- Position
- Interpolated Position Mode (PVT)

#### **COMMAND SOURCE**

- ±10 V Analog
- PWM and Direction
- Encoder Following
- Over the Network
- Sequencing
- Indexing
- Jogging

### **FEEDBACK SUPPORTED**

- ±10 VDC Position
- Auxiliary Incremental Encoder
- EnDat® 2.1/2.2
- Hiperface®
- 1Vp-p Sine/Cosine Encoder
- Tachometer (±10 VDC)

#### **INPUTS/OUTPUTS**

- 3 High Speed Captures
- 4 Programmable Analog Inputs (16-bit/12-bit Resolution)
- 1 Programmable Analog Output (10-bit Resolution)
- 3 Programmable Digital Inputs (Differential)
- 7 Programmable Digital Inputs (Single-Ended)
- 4 Programmable Digital Outputs (Single-Ended)

# **COMPLIANCES & AGENCY APPROVALS**

- UL
- cUL
- CE Class A (LVD)
- CE Class A (EMC)
- RoHS
- TÜV Rheinland® (STO)

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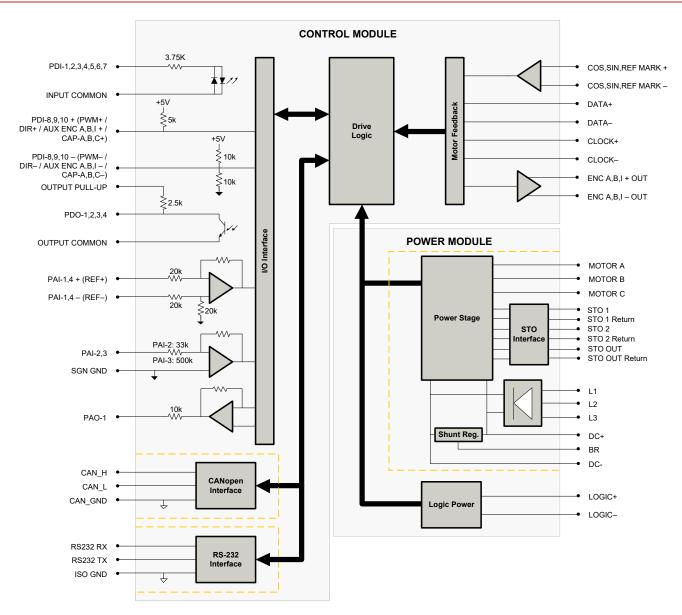
www.electromate.com

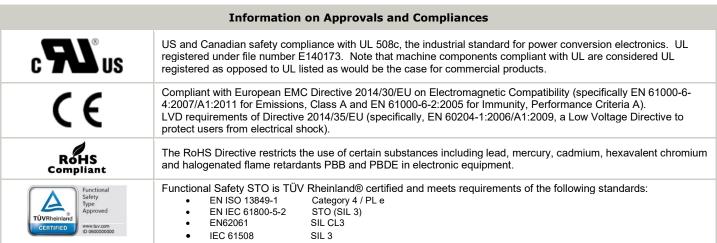


Release Date: Status: 7/9/2020 Active



### **BLOCK DIAGRAM**





Release Date: Status: 7/9/2020 Active



# **SPECIFICATIONS**

Description	He2te	Power Specifications
Description Rated Voltage	Units VAC (VDC)	Value 240 (339)
AC Supply Voltage Range	VAC (VDC)	100 - 240
AC Supply Voltage Nange  AC Supply Minimum	VAC	90
AC Supply Maximum  AC Supply Maximum	VAC	264
AC Input Phases <sup>1</sup>	VAC	3
AC Supply Frequency	Hz	50 - 60
DC Supply Voltage Range <sup>2</sup>	VDC	127 - 373
DC Bus Over Voltage Limit	VDC	394
DC Bus Under Voltage Limit	VDC	55
•	VDC	
Logic Supply Voltage Safe Torque Off Voltage <sup>3</sup>	VDC	20 - 30 (@ 850 mA) 24 (±6)
Maximum Peak Output Current <sup>4</sup>	A (Arms)	40 (28.3)
Maximum Continuous Output Current <sup>5</sup>	` '	
·	A (Arms)	20 (20)
Max. Continuous Output Power @ Rated Voltage <sup>6</sup>	W	6441
Max. Continuous Power Dissipation @ Rated Voltage		339
Internal Bus Capacitance	μF	660
External Shunt Resistor Minimum Resistance	Ω	25
Minimum Load Inductance (Line-To-Line) <sup>7</sup>	μH	600
Switching Frequency	kHz	20
Maximum Output PWM Duty Cycle	%	100
Low Voltage Supply Outputs	-	+5 VDC (250 mA)
Description	Units	Control Specifications  Value
Communication Interfaces	- Units	CANopen (RS-232 for configuration)
Command Sources	-	±10 V Analog, Encoder Following, Over the Network, PWM and Direction, Sequencing, Indexing, Jogging
	-	±10 VDC Position, Auxiliary Incremental Encoder, EnDat® 2.1/2.2, Hiperface®, 1Vp-p Sine/Cosine Encoder, Tachometer
Feedback Supported	-	(±10 VDC)
Commutation Methods	-	Sinusoidal
Modes of Operation	-	Profile Modes, Cyclic Synchronous Modes, Current, Velocity, Position, Interpolated Position Mode (PVT)
Motors Supported <sup>8</sup>	-	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 (PDIs/PDOs)	-	10/4
Programmable Analog Inputs/Outputs (PAIs/PAOs)	-	4/1
Primary I/O Logic Level	-	24 VDC
Current Loop Sample Time	μs	50
Velocity Loop Sample Time	μs	100
Position Loop Sample Time	μs	100
Maximum Sin/Cos Encoder Frequency	kHz	200
Maximum Sin/Cos Interpolation	-	2048 counts per sin/cos cycle
Internal Shunt Regulator	-	Yes
Description	Units	Mechanical Specifications Value
Agency Approvals	-	CE Class A (EMC), CE Class A (LVD), cUL, RoHS, TÜV Rheinland® (STO), UL
Size (H x W x D)	mm (in)	177.5 x 133.5 x 49.2 (6.99 x 5.26 x 1.94)
Weight	g (oz)	1720 (60.7)
Heatsink (Base) Temperature Range <sup>9</sup>	°C (°F)	0 - 75 (32 - 167)
Storage Temperature Range	°C (°F)	-40 - 85 (-40 - 185)
Form Factor	-	Panel Mount
Cooling System	-	Natural Convection
+24V LOGIC Connector	-	2-port, 3.5 mm spaced insert connector
AUX COMM Connector	-	3-pin, 2.5 mm spaced, enclosed, friction lock header
AUX ENCODER Connector	-	15-pin, high-density, male D-sub
COMM Connector	-	Shielded, dual RJ-45 socket with LEDs
FEEDBACK Connector	-	15-pin, high-density, female D-sub
I/O Connector	-	26-pin, high-density, female D-sub
AC POWER Connector	-	4-port, 5.0 mm spaced, push-in front spring connection header
DC POWER Connector	-	5-port, 5.0 mm spaced, push-in front spring connection header
MOTOR POWER Connector	-	4-port, 5.0 mm spaced, push-in front spring connection header
STO Connector	-	8-port, 2.0 mm spaced, enclosed, friction lock header
		ot ratings are reduced by at least 30%

- Can operate on single-phase VAC if peak/cont. current ratings are reduced by at least 30%. Large inrush current may occur upon initial DC supply connection to DC Bus. See installation manual for details.
- Capable of supplying drive rated peak current for 2 seconds with 10 second foldback to continuous value. Longer times are possible with lower current limits. Continuous Arms value attainable when RMS Charge-Based Limiting is used.

  P = (DC Rated Voltage) \* (Cont. RMS Current) \* 0.95.

  Lower inductance is acceptable for bus voltages well below maximum. Use external inductance to meet requirements.

- Maximum motor speed for stepper motors is 600 RPM. Consult the hardware installation manual for 2-phase stepper wiring configuration. Additional cooling and/or heatsink may be required to achieve rated performance.

Release Date: Status: 7/9/2020 Active



# **PIN FUNCTIONS**

	+24V LOGIC - Logic Power Connector			
Pin	Name	Description / Notes	I/O	
1	LOGIC GND	Logic Supply Ground	GND	
2	LOGIC PWR	Logic Supply Input		

	AUX COMM - RS232 Communication Connector			
Pin	Name	Description / Notes	I/O	
1	RS232 RX	Receive Line (RS-232)	I	
2	RS232 TX	Transmit Line (RS-232)	0	
3	ISO GND	Isolated Signal Ground	IGND	

AUX ENCODER - Auxiliary Feedback Connector			
Pin	Name	Description / Notes	I/O
1	RESERVED	Reserved	-
2	RESERVED	Reserved	-
3	RESERVED	Reserved	-
4	PDI-8 + (PWM+ / AUX ENC A+ / CAP-B+)	Programmable Digital Input or PWM or Auxiliary Encoder or High Speed Capture (For	I
5	PDI-8 - (PWM- / AUX ENC A- / CAP-B-)	Single-Ended Signals Leave Negative Terminal Open)	I
6	PDI-9 + (DIR+ / AUX ENC B+ / CAP-C+)	Programmable Digital Input or Direction Input or Auxiliary Encoder or High Speed Capture	I
7	PDI-9 - (DIR- / AUX ENC B- / CAP-C-)	(For Single-Ended Signals Leave Negative Terminal Open)	I
8	PDI-10 + (AUX ENC I+ / CAP-A+)	Programmable Digital Input or Auxiliary Encoder or High Speed Capture (For Single-Ended	I
9	PDI-10 - (AUX ENC I- / CAP-A-)	Signals Leave Negative Terminal Open)	I
10	SGN GND	Signal Ground	SGND
11	SGN GND	Signal Ground	SGND
12	SGN GND	Signal Ground	SGND
13	+5V OUT	+5V Encoder Supply Output (Short Circuit Protected)	0
14	PAI-4 +	Differential Programmable Analog Innut (42 bit Becelution)	I
15	PAI-4 -	Differential Programmable Analog Input (12-bit Resolution)	I

	COMM - CAN Communication Connector			
Pin	Name	Description / Notes	I/O	
1	CAN_H	CAN_H Line (Dominant High)	I	
2	CAN_L	CAN _L Line (Dominant Low)	I	
3	CAN_GND	CAN Ground	CGND	
4	RESERVED	Reserved	-	
5	RESERVED	Reserved	-	
6	RESERVED	Reserved	-	
7	CAN_GND	CAN Ground	CGND	
8	RESERVED	Reserved	-	

FEEDBACK - Feedback Connector			
Pin	Name	Description / Notes	I/O
1	COS +	Occine land	I
2	COS -	Cosine Input	I
3	SIN +	Sine Innut	I
4	SIN -	Sine Input	I
5	SGN GND	Signal Ground	SGND
6	DATA-	Differential Data Line (Differential Hall A if using 1Vp-p Sine/Cosine encoder. Pin 6 = Hall	I/O
7	DATA+	A+, Pin 7 = Hall A For single-ended Halls leave negative terminal open.)	I/O
8	CLOCK+	Differential Clock Line (Differential Hall B if using 1Vp-p Sine/Cosine encoder. Pin 8 = Hall	0
9	CLOCK-	B+, Pin 9 = Hall B For single-ended Halls leave negative terminal open.)	0
10	REF MARK +	Reference mark from sine/cosine encoder	1
11	RESERVED	Reserved (Differential Hall C if using 1Vp-p Sine/Cosine encoder. Pin 11 = Hall C+, Pin 12 =	-
12	RESERVED	Hall C For single-ended Halls leave negative terminal open.)	-
13	+5V OUT	+5V Encoder Supply Output (Short Circuit Protected)	0
14	PAI-3	Programmable Analog Input (12-bit Resolution)	1
15	REF MARK -	Reference mark from sine/cosine encoder	I

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		I/O - Signal Connector	
Pin	Name	Description / Notes	I/O
1	PDO-1	Isolated Programmable Digital Output	0
2	OUTPUT COMMON	Digital Output Common	OGND
3	PDO-2	Isolated Programmable Digital Output	0
4	PAI-1 + (REF+)	D''' '' ID	I
5	PAI-1 - (REF-)	Differential Programmable Analog Input or Reference Signal Input (16-bit Resolution)	I
6	PAI-2	Programmable Analog Input (12-bit Resolution)	I
7	PAO-1	Programmable Analog Output (10-bit Resolution)	0
8	OUTPUT PULL-UP	Digital Output Pull-Up For User Outputs	I
9	PDI-5	Isolated Programmable Digital Input	I
10	PDO-3	Isolated Programmable Digital Output	0
11	PDI-1	Isolated Programmable Digital Input	I
12	PDI-2	Isolated Programmable Digital Input	I
13	PDI-3	Isolated Programmable Digital Input	I
14	PDO-4	Isolated Programmable Digital Output	0
15	INPUT COMMON	Digital Input Common (Can Be Used To Pull-Up Digital Inputs)	IGND
16	SGN GND	Signal Ground	SGND
17	PDI-4	Isolated Programmable Digital Input	I
18	PDI-6	Isolated Programmable Digital Input	I
19	PDI-7	Isolated Programmable Digital Input	I
20	ENC A+ OUT	Family to d Family Observed A Outside	0
21	ENC A- OUT	Emulated Encoder Channel A Output	0
22	ENC B+ OUT	Family A. Francisco Character D. Outrot	0
23	ENC B- OUT	Emulated Encoder Channel B Output	0
24	ENC I+ OUT	Foundated Foundation Outside	0
25	ENC I- OUT	Emulated Encoder Index Output	0
26	SGN GND	Signal Ground	SGND

Motor Power Connector			
Pin	Name	Description / Notes	I/O
1	CHASSIS	Chassis Ground	CGND
2	MOTOR A	Motor Phase A	0
3	MOTOR B	Motor Phase B	0
4	MOTOR C	Motor Phase C	0

AC Power Connector			
Pin	Name	Description / Notes	I/O
1	L1	40.0 L.L. (/TL. BL. ) E.L. 100.4 (' L.L. (	1
2	L2	AC Supply Input (Three Phase). External 20 A time delay fuses are recommended in series with the AC input lines.	I
3	L3	with the AC input lines.	I
4	CHASSIS	Chassis Ground	CGND

DC Power Connector			
Pin	Name	Description / Notes	I/O
1	DC-	Power Ground	PGND
2	NC	No Connect	-
3	DC+	DC Power Input	I
4	DC+	External Shunt Resistor Connection. Connect resistor between DC+ and BR.	-
5	BR	External Shufft Resistor Conflection. Conflect resistor between DC+ and BR.	-

	STO – Safe Torque Off Connector*			
Pin	Name	Description / Notes	I/O	
1	STO OUTPUT	Safe Torque Off Output	0	
2	RESERVED	Reserved	-	
3	STO-1 RETURN	Safe Torque Off 1 Return	STORET1	
4	STO-1	Safe Torque Off – Input 1	I	
5	STO-2 RETURN	Safe Torque Off 2 Return	STORET2	
6	STO-2	Safe Torque Off – Input 2	1	
7	RESERVED	Reserved	-	
8	STO OUT RETURN	Safe Torque Off Output Return	STORETO	

<sup>\*</sup>STO features must be disabled for applications not using STO. See page 6 for more information.

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#### HARDWARE SETTINGS

#### **Switch Functions**

Switch	Description	Setting		
Switch	Description	On	Off	
1	Bit 0 of binary CANopen node ID. Does not affect RS-232 settings.	1	0	
2	Bit 1 of binary CANopen node ID. Does not affect RS-232 settings.	1	0	
3	Bit 2 of binary CANopen node ID. Does not affect RS-232 settings.	1	0	
4	Bit 3 of binary CANopen node ID. Does not affect RS-232 settings.	1	0	
5	Bit 4 of binary CANopen node ID. Does not affect RS-232 settings.	1	0	
6	Bit 5 of binary CANopen node ID. Does not affect RS-232 settings.	1	0	
7	Bit 0 of drive CANopen bit rate setting. Does not affect RS-232 settings.	1	0	
8	Bit 1 of drive CANopen bit rate setting. Does not affect RS-232 settings.	1	0	

#### Additional Details

The drive can be configured to use the address and/or bit rate stored in non-volatile memory by setting the address and/or bit rate value to 0. Use the table below to map actual bit rates to a bit rate setting. Note that higher bit rates are possible when using the value stored in NVM.

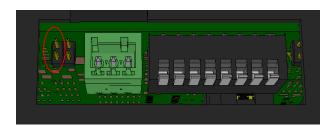
Bit Rate (kbits/sec)	Value For Bit Rate Setting
Load from non-volatile memory	0
500	1
250	2
125	3

# Safe Torque Off (STO) Inputs

The Safe Torque Off (STO) Inputs are dedicated +24VDC max 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.

# **CAN Termination Jumper Configuration**

Jumper	Description	Configuration		
	Header Jumper	Not Installed	Pins 1-2	Pins 3-4
J1	CAN bus termination. For the last drive in a CAN network, a jumper (2.54mm) must be installed on the 4-pin header adjacent to the RS-232 connector. The jumper should be installed between pins 1 and 2, which are the two pins furthest from the connector (see graphic below).	Non- terminating Node	Terminating Node	N/A



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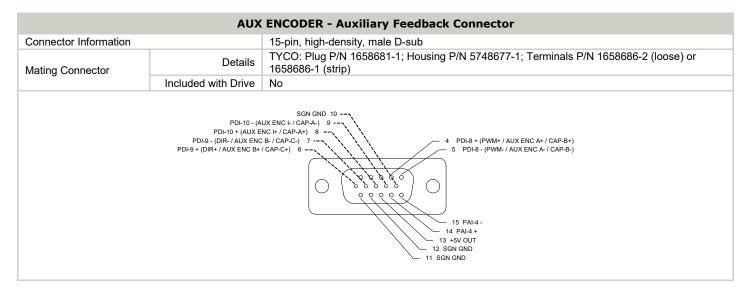






# **MECHANICAL INFORMATION**

AUX COMM - RS232 Communication Connector		
Connector Information		3-pin, 2.5 mm spaced, enclosed, friction lock header
Matina Cannastan	Details	Phoenix: Plug P/N 1881338
Mating Connector	Included with Drive	Yes
3 ISO GND  2 RS232 TX  1 RS232 RX		



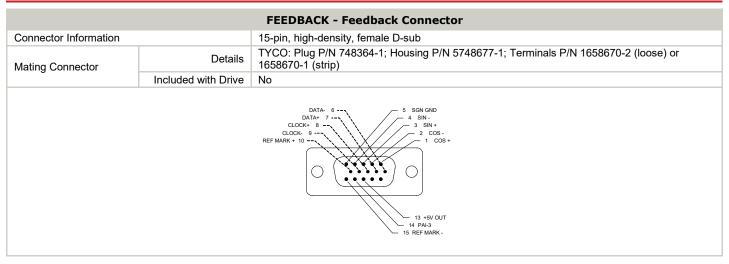
COMM - CAN Communication Connector		
Connector Information		Shielded, dual RJ-45 socket with LEDs
Mating Companies	Details	AMP: Plug P/N 5-569552-3
Mating Connector	Included with Drive	No
		A  CAN_GND 7  CAN_GND 3  CAN_L 2  CAN_H 1  7 CAN_GND

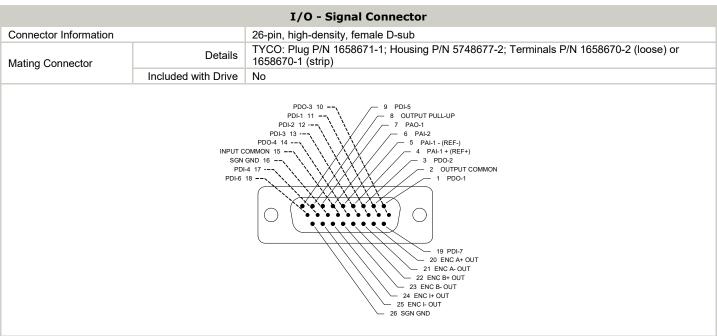
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Motor Power Connector		
Connector Information		4-port, 5.0 mm spaced, push-in front spring connection header
Mating Connector	Details	Push-in direct plug-in method for solid or stranded conductors with or without ferrules
Mating Connector	Included with Drive	Not Applicable
		MOTOR B 3 2 MOTOR A MOTOR C 4 1 CHASSIS

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DC Power Connector			
Connector Information 5-port, 5.0 mm spaced, push-in front spring connection header		5-port, 5.0 mm spaced, push-in front spring connection header	
Mating Commanton	Details	Push-in direct plug-in method for solid or stranded conductors with or without ferrules	
Mating Connector	Included with Drive	Not Applicable	
		3 DC+	
		DC+ 4 — 2 NC	
		BR 5 1 DC-	

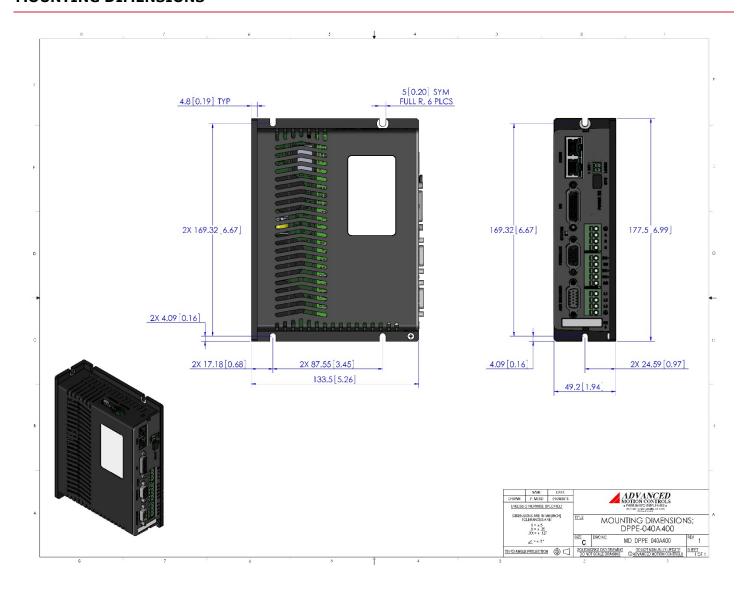
AC Power Connector		
Connector Information		4-port, 5.0 mm spaced, push-in front spring connection header
Mating Connector	Details	Push-in direct plug-in method for solid or stranded conductors with or without ferrules
Mating Connector	Included with Drive	Not Applicable
		CHASSIS 4 1 L1

STO - Safe Torque Off Connector		
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 with Drive	Yes
		STO-2 RETURN 5 3 STO-1 RETURN 1 STO OUTPUT  STO OUT RETURN 8 2 RESERVED  STO-2 6 4 STO-1

+24V LOGIC - Logic Power Connector		
Connector Information	Connector Information 2-port, 3.5 mm spaced, enclosed, friction lock header	
Details		Phoenix Contact: P/N 1840366
Mating Connector	Included with Drive	Yes
1 LOGIC GND 2 LOGIC PWR		



# **MOUNTING DIMENSIONS**



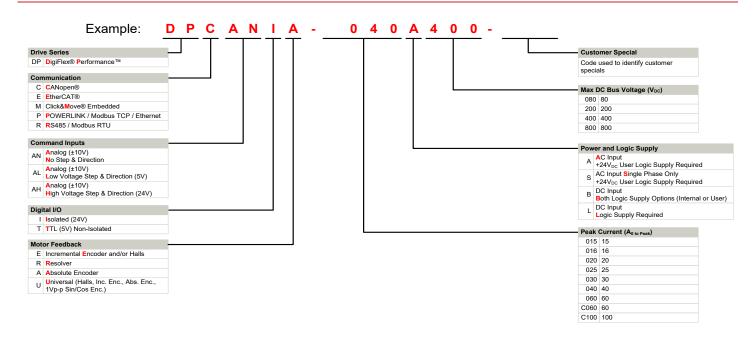
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# PART NUMBERING INFORMATION



DigiFlex® Performance $^{\text{TM}}$  series of products are available in many configurations. Note that not all possible part number combinations are offered as standard drives. All models listed in the selection tables of the website are readily available, standard product offerings.

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. Feel free to contact Applications Engineering for further information and details.

# **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

# **Available Accessories**

ADVANCED Motion Controls offers a variety of accessories designed to facilitate drive integration into a servo system. Visit <a href="https://www.a-m-c.com">www.a-m-c.com</a> 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.

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