

**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.

Network communication is accomplished using either RS-485/232 or Modbus RTU. This DP Series drive features a single serial interface used for drive commissioning via DriveWare® 7, available for download at [www.a-m-c.com](http://www.a-m-c.com).

The DPR Hardware Installation Manual is available for download from [www.a-m-c.com](http://www.a-m-c.com). All drive and motor parameters are stored in non-volatile memory.

**Power Range**

Peak Current	60 A (42.4 A <sub>RMS</sub> )
Continuous Current	30 A (30 A <sub>RMS</sub> )
AC Supply Voltage	200 - 240 VAC
DC Supply Voltage	255 - 373 VDC



**Features**

- ▲ 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**

- Current
- Position
- Velocity
- Hall Velocity

**COMMAND SOURCE**

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

**FEEDBACK SUPPORTED**

- Halls
- Incremental Encoder
- ±10 VDC Position
- Auxiliary Incremental Encoder
- Tachometer (±10 VDC)

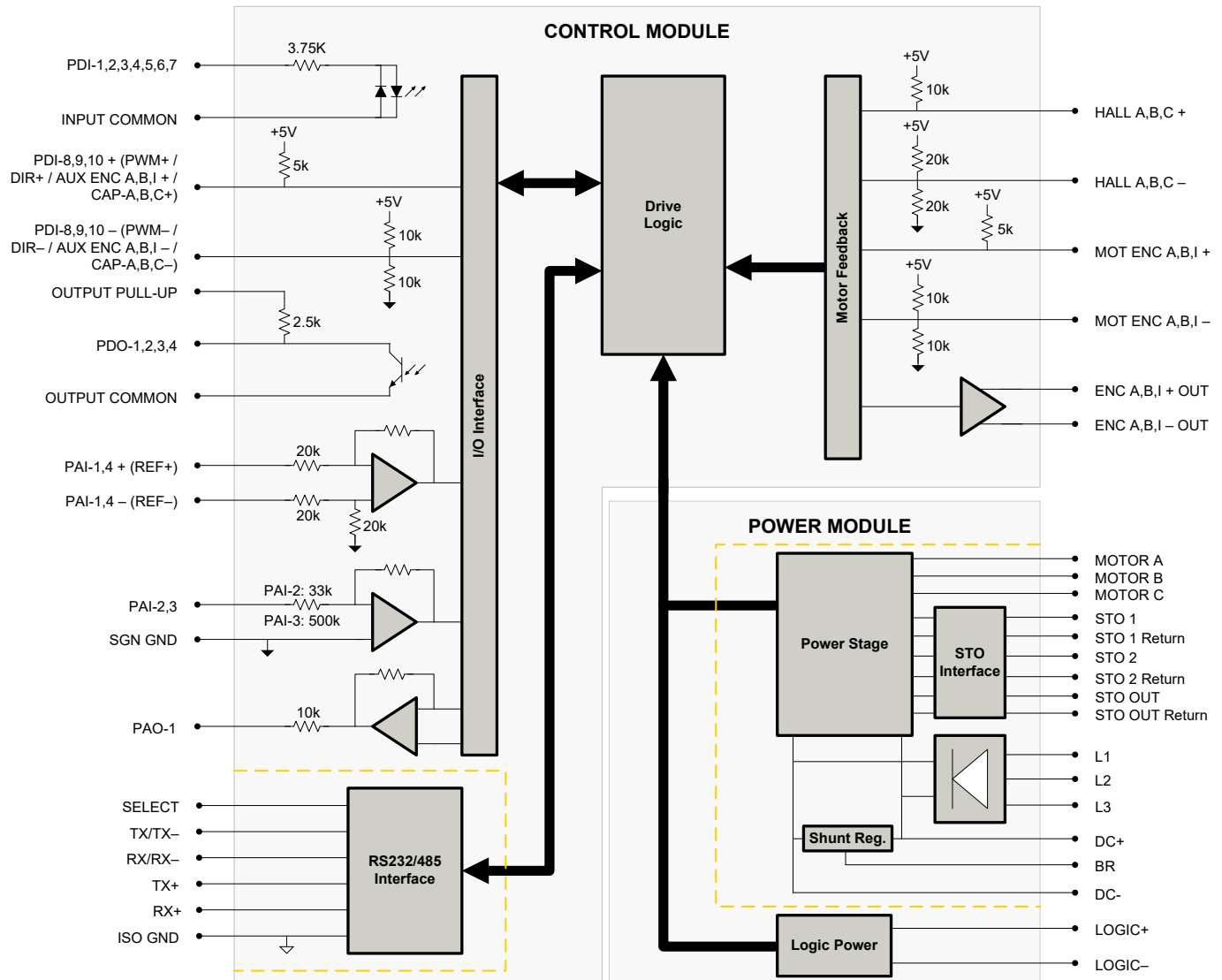
**INPUTS/OUTPUTS**

- 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)

**BLOCK DIAGRAM**



**Information on Approvals and Compliances**

	<p>US and Canadian safety compliance with UL 508c, the industrial standard for power conversion electronics. 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.</p>
	<p>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 60204-1:2006/A1:2009, a Low Voltage Directive to protect users from electrical shock).</p>
	<p>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.</p>
	<p>Functional Safety STO is TÜV Rheinland® certified and meets requirements of the following standards:</p> <ul style="list-style-type: none"> <li>• EN ISO 13849-1 Category 4 / PL e</li> <li>• EN IEC 61800-5-2 STO (SIL 3)</li> <li>• EN62061 SIL CL3</li> <li>• IEC 61508 SIL 3</li> </ul>

**SPECIFICATIONS**

Power Specifications			
Description	Units	Value	
Rated Voltage	VAC (VDC)	240 (339)	
AC Supply Voltage Range	VAC	200 - 240	
AC Supply Minimum	VAC	180	
AC Supply Maximum	VAC	264	
AC Input Phases <sup>1</sup>	-	3	
AC Supply Frequency	Hz	50 - 60	
DC Supply Voltage Range <sup>2</sup>	VDC	255 – 373	
DC Bus Over Voltage Limit	VDC	420	
DC Bus Under Voltage Limit	VDC	205	
Logic Supply Voltage	VDC	20 - 30 (@ 850 mA)	
Safe Torque Off Voltage <sup>3</sup>	VDC	24 (±6)	
Maximum Peak Output Current <sup>4</sup>	A (Arms)	60 (42.4)	
Maximum Continuous Output Current <sup>5</sup>	A (Arms)	30 (30)	
Max. Continuous Output Power @ Rated Voltage <sup>6</sup>	W	9662	
Max. Continuous Power Dissipation @ Rated Voltage	W	509	
Internal Bus Capacitance	µF	1120	
External Shunt Resistor Minimum Resistance <sup>7</sup>	Ω	20	
Minimum Load Inductance (Line-To-Line) <sup>8</sup>	µH	600	
Switching Frequency	kHz	14	
Maximum Output PWM Duty Cycle	%	100	
Low Voltage Supply Outputs	-	+5 VDC (250 mA)	
Control Specifications			
Description	Units	Value	
Communication Interfaces	-	RS-485/232 / Modbus RTU	
Command Sources	-	±10 V Analog, Encoder Following, Over the Network, PWM and Direction, Sequencing, Indexing, Jogging	
Feedback Supported	-	±10 VDC Position, Auxiliary Incremental Encoder, Halls, Incremental Encoder, Tachometer (±10 VDC)	
Commutation Methods	-	Sinusoidal, Trapezoidal	
Modes of Operation	-	Current, Hall Velocity, Position, Velocity	
Motors Supported <sup>9</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	71.4	
Velocity Loop Sample Time	µs	142.9	
Position Loop Sample Time	µs	142.9	
Maximum Encoder Frequency	MHz	20 (5 pre-quadrature)	
Internal Shunt Regulator	-	Yes	
Internal Shunt Resistor	-	No	
Mechanical Specifications			
Description	Units	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)	256.50 x 181.0 x 83.70 (10.10 x 7.13 x 3.30)	
Weight	g (oz)	2812.3 (99.2)	
Heatsink (Base) Temperature Range <sup>10</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	
FAN Connector <sup>11</sup>	-	2-port, 5.08 mm spaced, screw terminal	
AUX ENCODER Connector	-	15-pin, high-density, male D-sub	
COMM Connector	-	9-pin, female D-sub	
FEEDBACK Connector	-	15-pin, high-density, female D-sub	
I/O Connector	-	26-pin, high-density, female D-sub	
MOTOR POWER Connector	-	4-port, 10.16 mm spaced, enclosed, friction lock header	
AC POWER Connector	-	4-port, 10.16 mm spaced, enclosed, friction lock header	
DC POWER Connector	-	4-port, 10.16 mm spaced, enclosed, friction lock header	
STO Connector	-	8-port, 2.0 mm spaced, enclosed, friction lock header	

1. Can operate on single-phase AC (208 VAC minimum) as long as output power does not exceed 3kW maximum.
2. Large inrush current may occur upon initial DC supply connection to DC Bus. See installation manual for details.
3. STO features must be disabled for applications not using STO. See page 6 for more information.
4. 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.
5. Continuous  $I_{rms}$  value attainable when RMS Charge-Based Limiting is used.
6.  $P = (DC \text{ Rated Voltage}) * (Cont. RMS Current) * 0.95$ .
7. ADVANCED Motion Controls recommends using an external fuse in series with an external shunt resistor. A 5 amp time delay fuse is typical.
8. Lower inductance is acceptable for bus voltages well below maximum. Use external inductance to meet requirements.
9. Maximum motor speed for stepper motors is 600 RPM. Consult the hardware installation manual for 2-phase stepper wiring configuration.
10. Additional cooling and/or heatsink may be required to achieve rated performance.
11. Fan connector is located internally. Contact ADVANCED Motion Controls for additional information on fan connections.

**PIN FUNCTIONS**
**COMM - RS232/RS485 Communication Connector**

Pin	Name	Description / Notes	I/O
1	SELECT	RS232/485 selection. Pull to ground (CN1-5) for RS485.	I
2	RS232 TX / RS485 TX-	Transmit Line (RS-232 or RS-485)	O
3	RS232 RX / RS485 RX-	Receive Line (RS-232 or RS-485)	I
4	RESERVED	Reserved	-
5	ISO GND	Isolated Signal Ground	IGND
6	RS485 TX+	Transmit Line (RS-485)	O
7	RESERVED	Reserved	-
8	RS485 RX+	Receive Line (RS-485)	I
9	RESERVED	Reserved	-

**FEEDBACK - Feedback Connector**

Pin	Name	Description / Notes	I/O
1	HALL A+	Commutation Sensor Inputs	I
2	HALL B+		I
3	HALL C+		I
4	MOT ENC A+	Differential Encoder A Channel Input (For Single Ended Signals Use Only The Positive Input)	I
5	MOT ENC A-		I
6	MOT ENC B+	Differential Encoder B Channel Input (For Single Ended Signals Use Only The Positive Input)	I
7	MOT ENC B-		I
8	MOT ENC I+	Differential Encoder Index Input (For Single Ended Signals Use Only The Positive Input)	I
9	MOT ENC I-		I
10	HALL A-	Commutation Sensor Input (For Differential Signals Only)	I
11	HALL B-	Commutation Sensor Input (For Differential Signals Only)	I
12	SGN GND	Signal Ground	SGND
13	+5V OUT	+5V Encoder Supply Output (Short Circuit Protected)	O
14	PAI-3	Programmable Analog Input (12-bit Resolution)	I
15	HALL C-	Commutation Sensor Input (For Differential Signals Only)	I

**I/O - Signal Connector**

Pin	Name	Description / Notes	I/O
1	PDO-1	Isolated Programmable Digital Output	O
2	OUTPUT COMMON	Digital Output Common	OGND
3	PDO-2	Isolated Programmable Digital Output	O
4	PAI-1 + (REF+)	Differential Programmable Analog Input or Reference Signal Input (16-bit Resolution)	I
5	PAI-1 - (REF-)		I
6	PAI-2	Programmable Analog Input (12-bit Resolution)	I
7	PAO-1	Programmable Analog Output (10-bit Resolution)	O
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	O
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	O
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	Buffered Encoder Channel A Output	O
21	ENC A- OUT		O
22	ENC B+ OUT	Buffered Encoder Channel B Output	O
23	ENC B- OUT		O
24	ENC I+ OUT	Buffered Encoder Index Output	O
25	ENC I- OUT		O
26	SGN GND	Signal Ground	SGND

**Logic Power Connector**

Pin	Name	Description / Notes	I/O
1	LOGIC GND	Logic Supply Ground	GND
2	LOGIC PWR	Logic Supply Input	I

**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 Single-Ended Signals Leave Negative Terminal Open)	I
5	PDI-8 - (PWM- / AUX ENC A- / CAP-B-)	Programmable Digital Input or PWM or Auxiliary Encoder or High Speed Capture (For 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 (For Single-Ended Signals Leave Negative Terminal Open)	I
7	PDI-9 - (DIR- / AUX ENC B- / CAP-C-)	Programmable Digital Input or Direction Input or Auxiliary Encoder or High Speed Capture (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 Signals Leave Negative Terminal Open)	I
9	PDI-10 - (AUX ENC I- / CAP-A-)	Programmable Digital Input or Auxiliary Encoder or High Speed Capture (For Single-Ended 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)	O
14	PAI-4 +	Differential Programmable Analog Input (12-bit Resolution)	I
15	PAI-4 -		I

**AC Power Connector**

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

**DC Power Connector**

Pin	Name	Description / Notes	I/O
1	DC-	Power Ground	PGND
2	DC+	DC Power Input	I
3	DC+	External Shunt Resistor Connection. Connect resistor between DC+ and BR.	-
4	BR		-

**Motor Power Connector**

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

**STO – Safe Torque Off Connector\***

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

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

**HARDWARE SETTINGS**

**Switch Functions**

Switch	Description	Setting	
		On	Off
1	Bit 0 of binary RS-485 drive address. Does not affect RS-232 settings.	1	0
2	Bit 1 of binary RS-485 drive address. Does not affect RS-232 settings.	1	0
3	Bit 2 of binary RS-485 drive address. Does not affect RS-232 settings.	1	0
4	Bit 3 of binary RS-485 drive address. Does not affect RS-232 settings.	1	0
5	Bit 4 of binary RS-485 drive address. Does not affect RS-232 settings.	1	0
6	Bit 5 of binary RS-485 drive address. Does not affect RS-232 settings.	1	0
7	Bit 0 of drive RS-485 baud rate setting. Does not affect RS-232 settings.	1	0
8	Bit 1 of drive RS-485 baud 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.

Baud Rate (kbps)	Value For Bit Rate Setting
Load from non-volatile memory	0
9.6	1
38.4	2
115.2	3

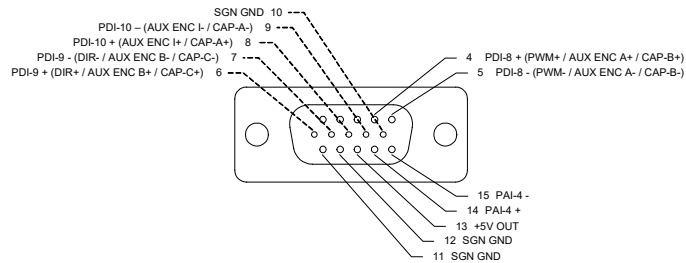
**Safe Torque Off (STO) Inputs**

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.

**MECHANICAL INFORMATION**

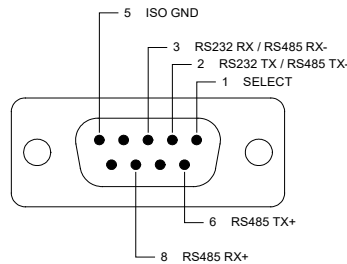
**AUX ENCODER - Auxiliary Feedback Connector**

Connector Information	15-pin, high-density, male D-sub	
Mating Connector	Details	TYCO: Plug P/N 1658681-1; Housing P/N 5748677-1; Terminals P/N 1658686-2 (loose) or 1658686-1 (strip)
	Included with Drive	No



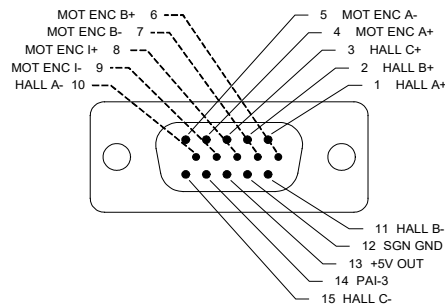
**COMM - RS232/RS485 Communication Connector**

Connector Information	9-pin, female D-sub	
Mating Connector	Details	TYCO: Plug P/N 205204-4; Housing P/N 5748677-1; Terminals P/N 1658540-5 (loose) or 1658540-4 (strip)
	Included with Drive	No



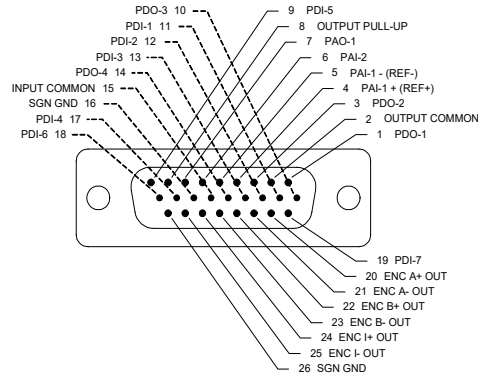
**FEEDBACK - Feedback Connector**

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



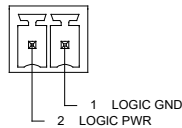
**I/O - Signal Connector**

Connector Information		26-pin, high-density, female D-sub
Mating Connector	Details	TYCO: Plug P/N 1658671-1; Housing P/N 5748677-2; Terminals P/N 1658670-2 (loose) or 1658670-1 (strip)
	Included with Drive	No



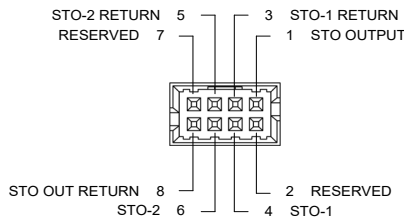
**Logic Power Connector**

Connector Information		2-port, 3.5 mm spaced insert connector
Mating Connector	Details	Phoenix Contact: P/N 1840366
	Included with Drive	Yes



**STO - Safe Torque Off Connector**

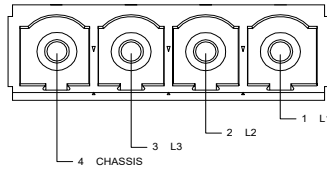
Connector Information		8-port, 2.00 mm spaced, enclosed, friction lock header
Mating Connector	Details	Molex: P/N 51110-0860 (housing); 50394-8051 (pins)
	Included with Drive	Yes





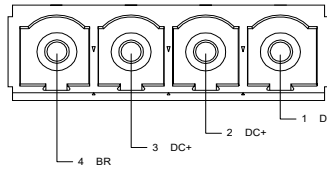
**AC Power Connector**

Connector Information		4-pin, 10.16 mm spaced, enclosed, friction lock header
Mating Connector	Details	Phoenix Contact: P/N 1913523
	Included with Drive	Yes



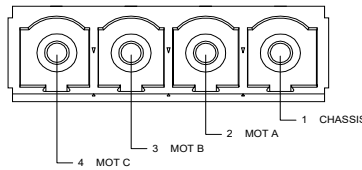
**DC Power Connector**

Connector Information		4-pin, 10.16 mm spaced, enclosed, friction lock header
Mating Connector	Details	Phoenix Contact: P/N 1913523
	Included with Drive	Yes

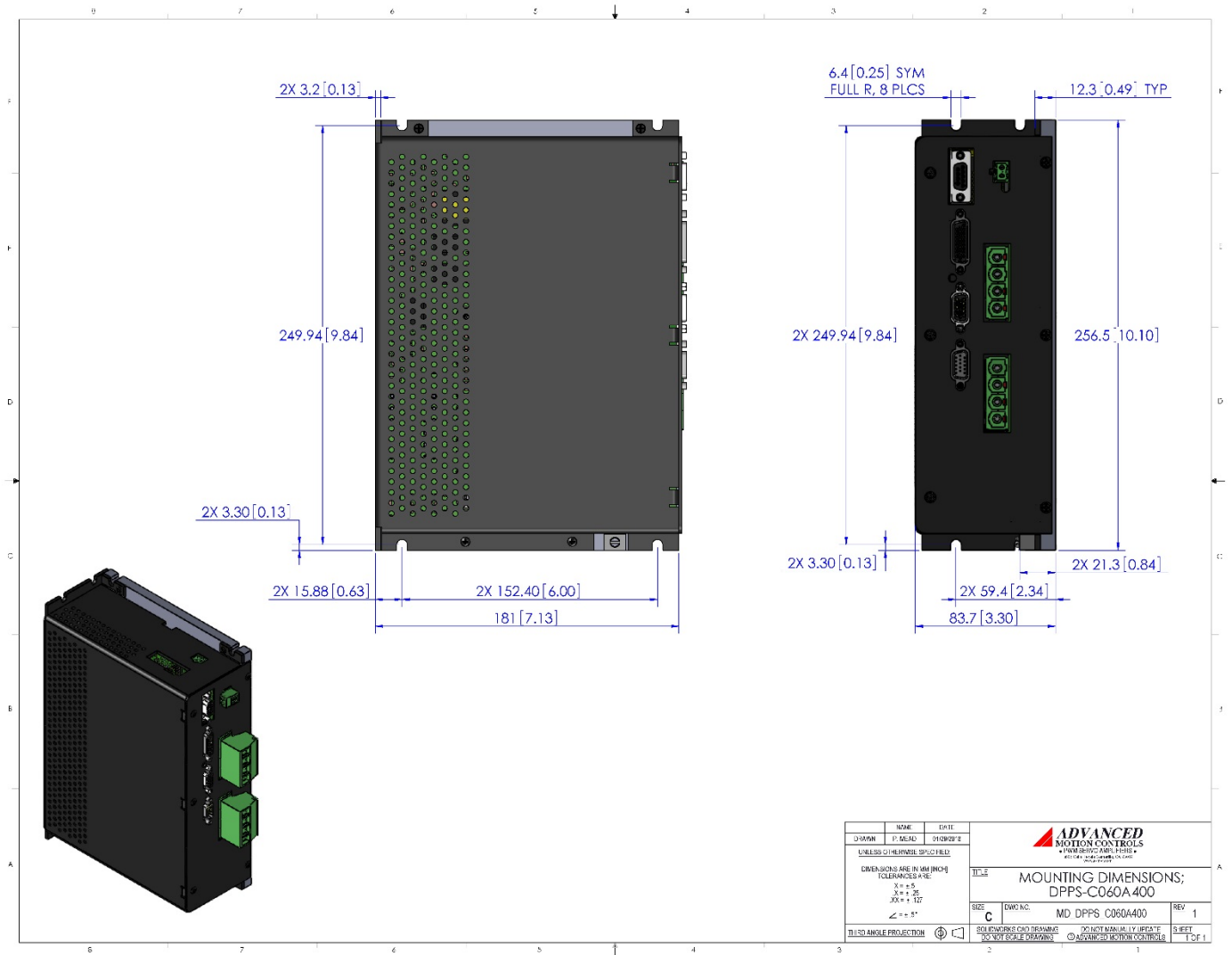


**Motor Power Connector**

Connector Information		4-pin, 10.16 mm spaced, enclosed, friction lock header
Mating Connector	Details	Phoenix Contact: P/N 1913523
	Included with Drive	Yes



**MOUNTING DIMENSIONS**



**PART NUMBERING INFORMATION**

Example: **D P R A N I E - C 0 6 0 A 4 0 0 -**

<b>Drive Series</b>	DP DigiFlex® Performance™
<b>Communication</b>	C CANopen® E EtherCAT® M Click&Move® Embedded P POWERLINK / Modbus TCP / Ethernet R RS485 / Modbus RTU
<b>Command Inputs</b>	AN Analog (±10V) No Step & Direction AL Analog (±10V) Low Voltage Step & Direction (5V) AH Analog (±10V) High Voltage Step & Direction (24V)
<b>Digital I/O</b>	I Isolated (24V) T TTL (5V) Non-Isolated
<b>Motor Feedback</b>	E Incremental Encoder and/or Halls R Resolver A Absolute Encoder U Universal (Halls, Inc. Enc., Abs. Enc., 1Vp-p Sin/Cos Enc.)

<b>Customer Special</b>	Code used to identify customer specials
<b>Max DC Bus Voltage (V<sub>DC</sub>)</b>	080 80 200 200 400 400 800 800
<b>Power and Logic Supply</b>	A AC Input +24V <sub>DC</sub> User Logic Supply Required S AC Input Single Phase Only +24V <sub>DC</sub> User Logic Supply Required B DC Input Both Logic Supply Options (Internal or User) L DC Input Logic Supply Required
<b>Peak Current (A<sub>0-10 Peak</sub>)</b>	015 15 016 16 020 20 025 25 030 30 040 40 060 60 C060 60 C100 100

DigiFlex® Performance™ 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.

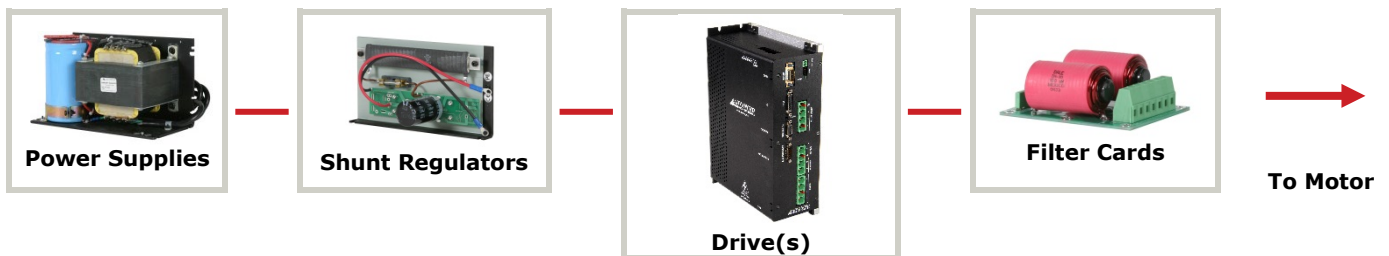
ADVANCED Motion Controls also has the capability to promptly develop and deliver specified products for OEMs with volume requests. Our Applications and Engineering Departments will work closely with your design team through all stages of development in order to provide the best servo drive solution for 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 [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.