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.

The DPR Hardware Installation Manual is available for download from 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$_{RMS}$)
Continuous Current	30 A (21.2 A$_{RMS}$)
Supply Voltage	200 - 480 VAC

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
- 24V Step and Direction
- 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)
- 3 Programmable Digital Inputs (Differential)
- 7 Programmable Digital Inputs (Single-Ended)
- 4 Programmable Digital Outputs (Single-Ended)

COMPLIANCES & AGENCY APPROVALS
- CE Class A (LVD)
- CE Class A (EMC)
- RoHS
- TÜV Rheinland® (STO)

BLOCK DIAGRAM
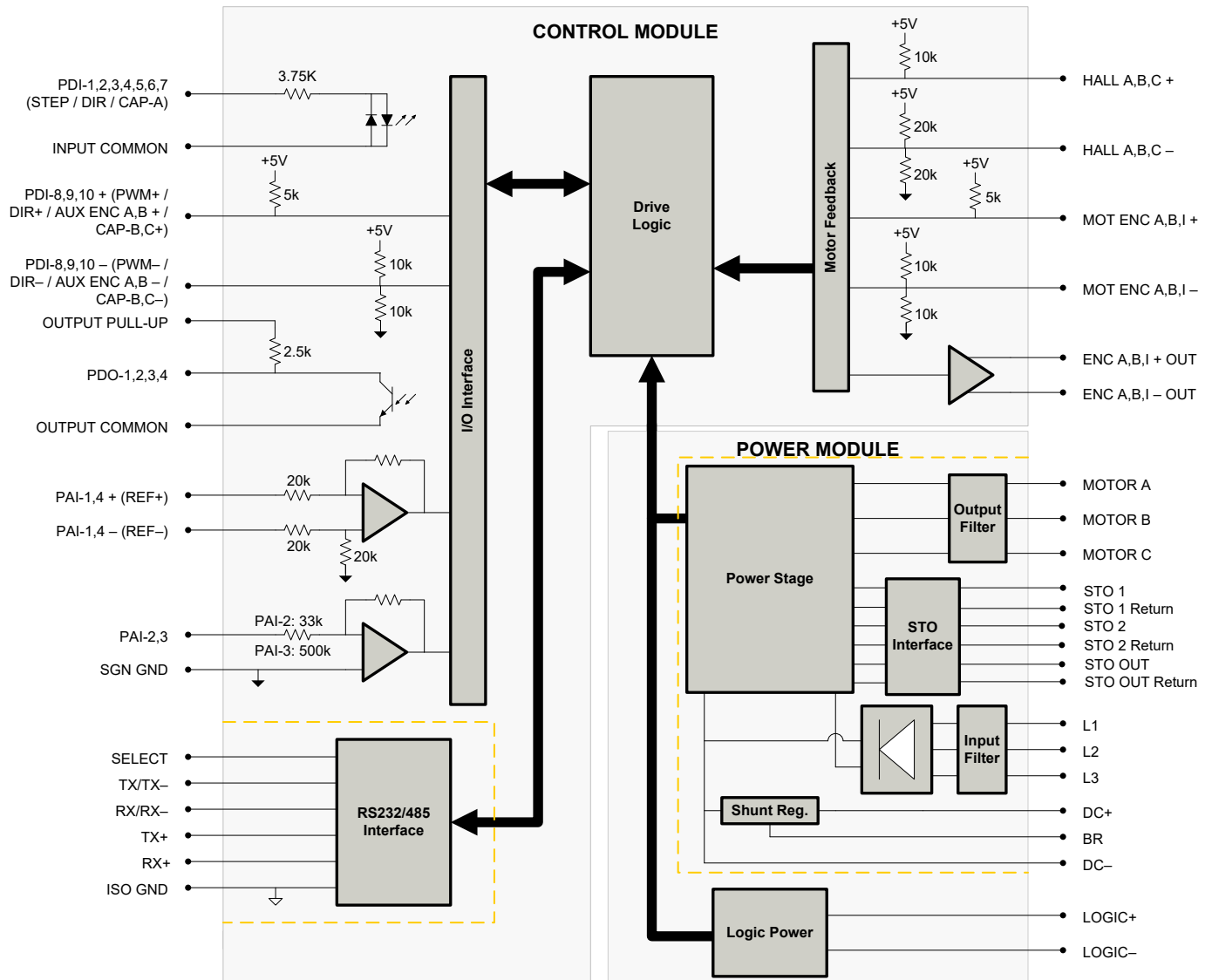
Information on Approvals and Compliances

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 60204-1:2006/A1:2009, 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.
TÜVRheinland® CERTIFIED Functional Safety Type Approved www.tuv.com ID 0600000000	Functional Safety STO is TÜV Rheinland® certified and meets requirements of the following standards: • EN ISO 13849-1 Category 4 / PL e • EN IEC 61800-5-2 STO (SIL 3) • EN62061 SIL CL3 • IEC 61508 SIL 3

SPECIFICATIONS

Power Specifications		
Description	Units	Value
Rated Voltage	VAC (VDC)	480 (678)
AC Supply Voltage Range	VAC	200 - 480
AC Supply Minimum	VAC	180
AC Supply Maximum	VAC	528
AC Input Phases	-	3
AC Supply Frequency	Hz	50 - 60
DC Supply Voltage Range[1]	VDC	255 - 747
DC Bus Over Voltage Limit	VDC	850
DC Bus Under Voltage Limit	VDC	230
Logic Supply Voltage	VDC	20 - 30 (@ 850 mA)
Safe Torque Off Voltage[2]	VDC	24 (±6)
Maximum Peak Output Current[3]	A (Arms)	60 (42.4)
Maximum Continuous Output Current	A (Arms)	30 (21.2)
Max. Continuous Output Power @ Rated Voltage[4]	W	13680
Max. Continuous Power Dissipation @ Rated Voltage	W	720
Internal Bus Capacitance	µF	330
External Shunt Resistor Minimum Resistance[5]	Ω	40
Minimum Load Inductance (Line-To-Line)[6]	µH	3000
Switching Frequency	kHz	10
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, 24V Step and Direction, 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[7]	-	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)	-	4/0
Primary I/O Logic Level	-	24 VDC
Current Loop Sample Time	µs	100
Velocity Loop Sample Time	µs	200
Position Loop Sample Time	µs	200
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), TÜV Rheinland® (STO), RoHS
Size (H x W x D)	mm (in)	300.51 x 229.69 x 141.40 (11.83 x 9.04 x 5.54)
Weight	g (oz)	6165 (217.5)
Heatsink (Base) Temperature Range	°C (°F)	0 - 75 (32 - 167)
Storage Temperature Range	°C (°F)	-40 - 85 (-40 - 185)
Form Factor	-	Panel Mount
Cooling System	-	Forced Convection
+24V LOGIC Connector	-	2-port, 3.5 mm spaced insert connector
AUX ENCODER Connector	-	15-pin, high-density, male D-sub
COMM Connector	-	9-pin, female D-sub
DC BUS Connector	-	4-port, 7.62 mm spaced, enclosed, friction lock header
FEEDBACK Connector	-	15-pin, high-density, female D-sub
I/O Connector	-	26-pin, high-density, female D-sub
MOTOR POWER Connector	-	4-port, 7.62 mm spaced, enclosed, friction lock header
POWER Connector	-	3-port, 7.62 mm spaced, enclosed, friction lock header
STO Connector	-	8-port, 2.0 mm spaced, enclosed, friction lock header

1. Large inrush current may occur upon initial DC supply connection to DC Bus. See installation manual for details.
2. STO features must be disabled for applications not using STO. See page 6 for more information.
3. 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.
4. P = (DC Rated Voltage) * (Cont. RMS Current) * 0.95.
5. *ADVANCED* Motion Controls recommends using an external fuse in series with the shunt resistor. A 3 amp motor delay fuse is typical.
6. Lower inductance is acceptable for bus voltages well below maximum. Use external inductance to meet requirements.
7. Maximum motor speed for stepper motors is 600 RPM. Consult the hardware installation manual for 2-phase stepper wiring configuration.

PIN FUNCTIONS

+24V LOGIC - Logic Power Connector

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

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-)		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-)		I
8	PDI-10 +	Programmable Digital Input (For Single-Ended Signals Leave Negative Terminal Open)	I
9	PDI-10 -		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

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	-

DC BUS - Power Connector

Pin	Name	Description / Notes	I/O
1	DC-	Internal DC Bus Voltage (Can Be Used To Connect External Shunt Regulator)	I/O
2	BR	External Brake Resistor Connection	-
3	DC+	Brake Resistor DC+. Connection for brake resistor.	O
4	DC+	Internal DC Bus Voltage (Can Be Used To Connect External Shunt Regulator)	I/O

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	SGN GND	Signal Ground	SGND
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 (STEP)	Isolated Programmable Digital Input or Step	I
18	PDI-6 (DIR)	Isolated Programmable Digital Input or Direction	I
19	PDI-7 (CAP-A)	Isolated Programmable Digital Input or High Speed Capture	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

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	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	I
7	RESERVED	Reserved	-
8	STO OUT RETURN	Safe Torque Off Output Return	STORETO

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

MOTOR POWER - Power Connector

Pin	Name	Description / Notes	I/O
1	SHIELD	Motor cable shield. Internally connected to protective earth ground.	-
2	MOTOR C	Motor Phase C	O
3	MOTOR B	Motor Phase B	O
4	MOTOR A	Motor Phase A	O

POWER - Power Connector

Pin	Name	Description / Notes	I/O
1	L3	AC Supply Input (Three Phase)	I
2	L2		I
3	L1		I

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.
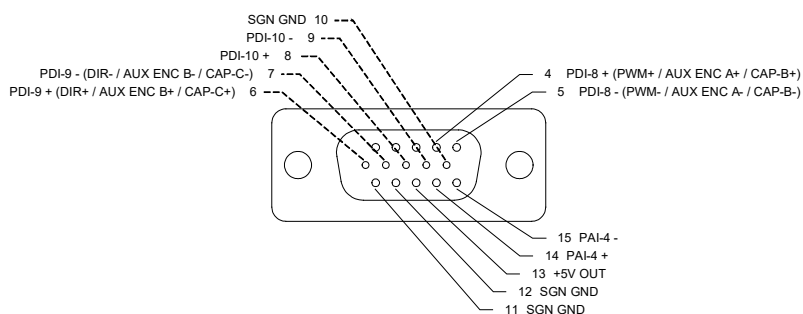
MECHANICAL INFORMATION

+24V LOGIC - 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
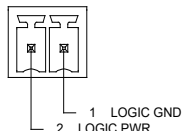
1   LOGIC GND
2   LOGIC PWR

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

SGN GND   10
PDI-10 -   9
PDI-10 +   8
PDI-9 - (DIR- / AUX ENC B- / CAP-C-)   7
PDI-9 + (DIR+ / AUX ENC B+ / CAP-C+)   6

4   PDI-8 + (PWM+ / AUX ENC A+ / CAP-B+)
5   PDI-8 - (PWM- / AUX ENC A- / CAP-B-)

15   PAI-4 -
14   PAI-4 +
13   +5V OUT
12   SGN GND
11   SGN GND

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

5   ISO GND
3   RS232 RX / RS485 RX-
2   RS232 TX / RS485 TX-
1   SELECT
6   RS485 TX+
8   RS485 RX+

DC BUS - Power Connector

Connector Information		4-port, 7.62 mm spaced, enclosed, friction lock header
Mating Connector	Details	Phoenix Contact: P/N 1804920
	Included with Drive	Yes

1 DC-
2 BR
3 DC+
4 DC+

FEEDBACK - Feedback Connector

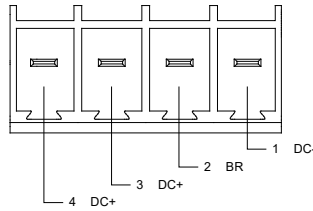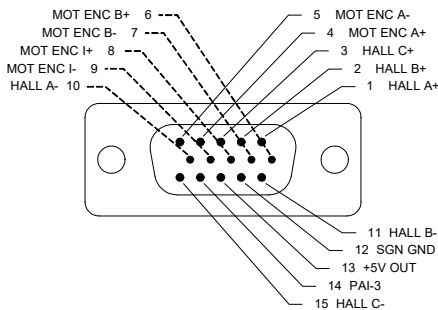| Connector Information		15-pin, high-density, female D-sub
Mating Connector	Details	TYCO: Plug P/N 748364-1; Housing P/N 5748677-1; Terminals P/N 1658670-2 (loose) or 1658670-1 (strip)
	Included with Drive	No

MOT ENC B+ 6
MOT ENC B- 7
MOT ENC I+ 8
MOT ENC I- 9
HALL A- 10
5 MOT ENC A-
4 MOT ENC A+
3 HALL C+
2 HALL B+
1 HALL A+
11 HALL B-
12 SGN GND
13 +5V OUT
14 PAI-3
15 HALL C-

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

PDO-3 10
PDI-1 11
PDI-2 12
PDI-3 13
PDO-4 14
INPUT COMMON 15
SGN GND 16
PDI-4 (STEP) 17
PDI-6 (DIR) 18
9 PDI-5
8 OUTPUT PULL-UP
7 SGN GND
6 PAI-2
5 PAI-1 - (REF-)
4 PAI-1 + (REF+)
3 PDO-2
2 OUTPUT COMMON
1 PDO-1
19 PDI-7 (CAP-A)
20 ENC A+ OUT
21 ENC A- OUT
22 ENC B+ OUT
23 ENC B- OUT
24 ENC I+ OUT
25 ENC I- OUT
26 SGN GND
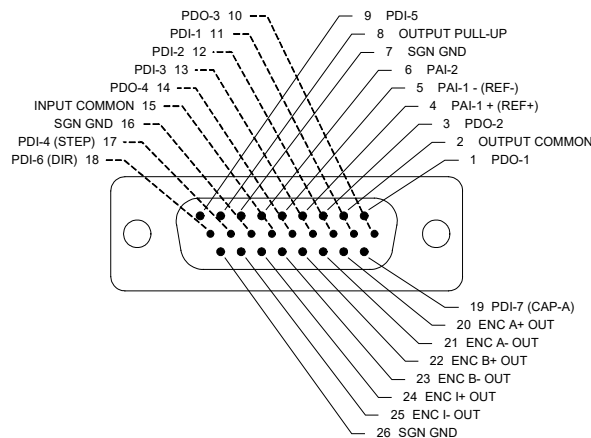
STO – Safe Torque Off Connector

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	No

STO-2 RETURN 5 — 3 STO-1 RETURN
RESERVED 7 — 1 STO OUTPUT

STO OUT RETURN 8 — 2 RESERVED
STO-2 6 — 4 STO-1

MOTOR POWER - Power Connector

Connector Information		4-port, 7.62 mm spaced, enclosed, friction lock header
Mating Connector	Details	Phoenix Contact: P/N 1804920
	Included with Drive	Yes

1 SHIELD
2 MOTOR C
3 MOTOR B
4 MOTOR A
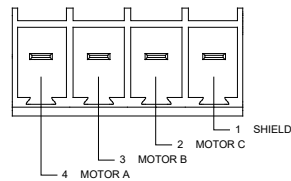
POWER - Power Connector

Connector Information		3-port, 7.62 mm spaced, enclosed, friction lock header
Mating Connector	Details	Phoenix Contact: P/N 1804917
	Included with Drive	Yes

1 L3
2 L2
3 L1

MOUNTING DIMENSIONS

Mounting dimensions drawing callouts:
- 2.4 [0.09] TYP
- 6.35 [0.25] SYM FULL R, 4 PLCS
- 44 [1.71]
- 300.51 [11.83]
- 2X 287.81 [11.33]
- 229.69 [9.04]
- 2X 6.35 [0.25]
- 2X 54.2 [2.13]
- 2X 79.3 [3.12]
- 97.4 [3.83]

Title block:
- DRAWN P. MEAD
- UNLESS OTHERWISE SPECIFIED
- DIMENSIONS ARE IN MM [INCH] TOLERANCES ARE
- ADVANCED MOTION CONTROLS
- TITLE: MOUNTING DIMENSIONS; DPPS-060A800
- SIZE C
- DWG NO. MD DPPS 060A800
- REV 1
- THIRD ANGLE PROJECTION
- SHEET 1 OF 1
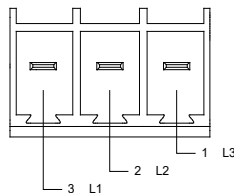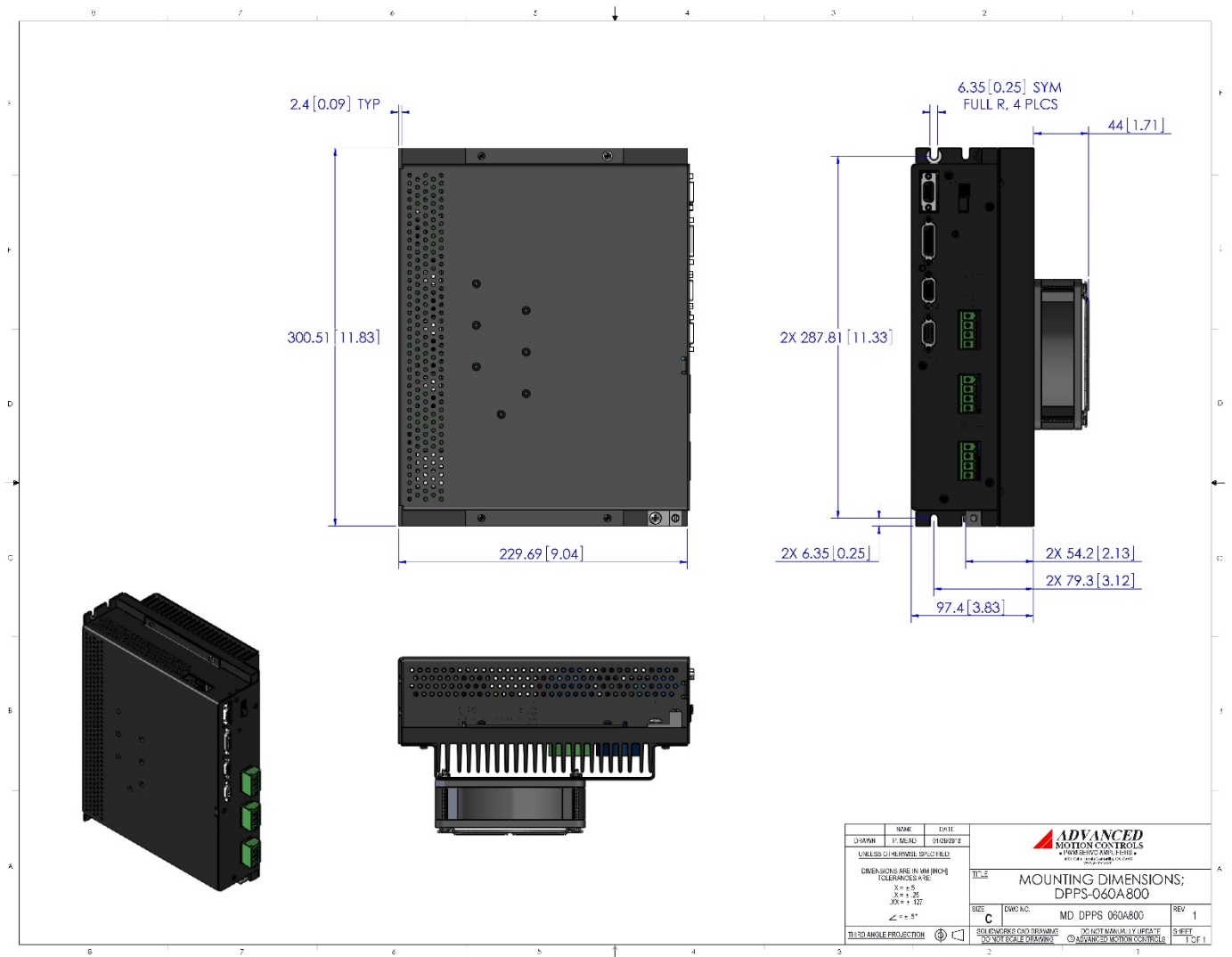
PART NUMBERING INFORMATION

Example: D P R A H I E - 0 6 0 A 8 0 0 -

Drive Series

DP	**D**igiFlex® **P**erformance™

Communication

C	**CA**Nopen®
E	**E**therCAT®
M	Click&**M**ove® Embedded
P	**P**OWERLINK / Modbus TCP / Ethernet
R	**R**S485 / Modbus RTU

Command Inputs

AN	**A**nalog (±10V) **N**o Step & Direction
AL	**A**nalog (±10V) **L**ow Voltage Step & Direction (5V)
AH	**A**nalog (±10V) **H**igh Voltage Step & Direction (24V)

Digital I/O

I	**I**solated (24V)
T	**T**TL (5V) Non-Isolated

Motor Feedback

E	Incremental **E**ncoder and/or Halls
R	**R**esolver
A	**A**bsolute Encoder
U	**U**niversal (Halls, Inc. Enc., Abs. Enc., 1Vp-p Sin/Cos Enc.)

Customer Special

Code used to identify customer specials

Max DC Bus Voltage (V$_{DC}$)

080	80
200	200
400	400
800	800

Power and Logic Supply

A	**AC** Input +24V$_{DC}$ User Logic Supply Required
S	AC Input **S**ingle Phase Only +24V$_{DC}$ User Logic Supply Required
B	DC Input **B**oth Logic Supply Options (Internal or User)
L	DC Input **L**ogic Supply Required

Peak Current (A$_{0\ to\ Peak}$)

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	◢ 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

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.
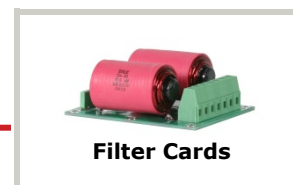
Drive(s) — **Filter Cards** → **To Motor**

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