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 (30 A_{RMS})
AC Supply Voltage	200 - 240 VAC
DC Supply Voltage	255 - 373 VDC

Modbus

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

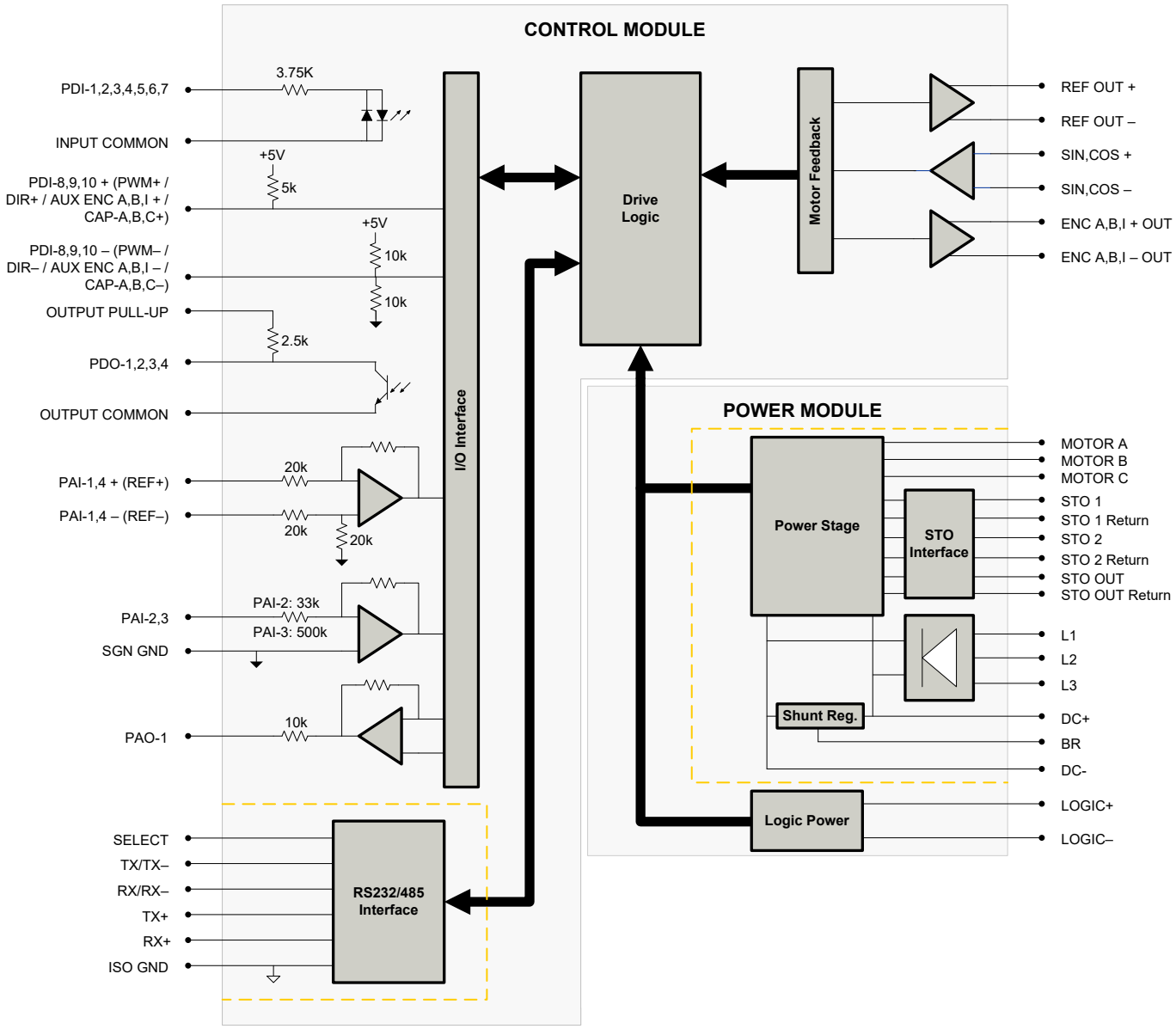
COMMAND SOURCE
- PWM and Direction
- Encoder Following
- Over the Network
- ±10 V Analog
- Sequencing
- Indexing
- Jogging

FEEDBACK SUPPORTED
- Resolver
- ±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	
cULus	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.
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	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

Description	Units	Value
Power Specifications		
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[1]	-	3
AC Supply Frequency	Hz	50 - 60
DC Supply Voltage Range[2]	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[3]	VDC	24 (±6)
Maximum Peak Output Current[4]	A (Arms)	60 (42.4)
Maximum Continuous Output Current[5]	A (Arms)	30 (30)
Max. Continuous Output Power @ Rated Voltage[6]	W	9662
Max. Continuous Power Dissipation @ Rated Voltage	W	509
Internal Bus Capacitance	µF	1120
External Shunt Resistor Minimum Resistance[7]	Ω	20
Minimum Load Inductance (Line-To-Line)[8]	µH	600
Switching Frequency	kHz	14
Maximum Output PWM Duty Cycle	%	100
Low Voltage Supply Outputs	-	+5 VDC (250 mA)
Control Specifications		
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, Resolver, Tachometer (±10 VDC)
Commutation Methods	-	Sinusoidal
Modes of Operation	-	Current, Position, Velocity
Motors Supported[9]	-	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
Resolver Reference/Excitation Signal	Vrms	4 Vrms @ 5 kHz
Expected Resolver Transformation Ratio	Vrms	0.5
Feedback Resolution / Emulated Encoder Resolution[10]	bit	High Res: 14 (16384 counts/resolver cycle), Low Res: 12 (4096 counts/resolver cycle)
Maximum Motor Speed Per Feedback Resolution	RPM	High Res: 5000, Low Res: 20000
Internal Shunt Regulator	-	Yes
Mechanical Specifications		
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[11]	°C (°F)	0 - 75 (32 - 167)
Storage Temperature Range	°C (°F)	-40 - 85 (-40 - 185)
Cooling System	-	Natural Convection
+24V LOGIC Connector	-	2-port, 3.5 mm spaced insert connector
FAN Connector[12]	-	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 A_{rms} value attainable when RMS Charge-Based Limiting is used.
6. P = (DC 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. Higher and lower resolution options are available. Contact Applications Engineering for more information.
11. Additional cooling and/or heatsink may be required to achieve rated performance.
12. 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	RESERVED	Reserved	-
2	RESERVED	Reserved	-
3	RESERVED	Reserved	-
4	REF OUT +	Resolver Reference/Excitation Output (50 mA maximum)	O
5	REF OUT -		O
6	SIN+	Resolver Sine Input	I
7	SIN-		I
8	COS+	Resolver Cosine Input	I
9	COS-		I
10	RESERVED	Reserved	-
11	RESERVED	Reserved	-
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	RESERVED	Reserved	-

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	Emulated Encoder Channel A Output	O
21	ENC A- OUT		O
22	ENC B+ OUT	Emulated Encoder Channel B Output	O
23	ENC B- OUT		O
24	ENC I+ OUT	Emulated 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	SGND
2	LOGIC PWR	Logic Supply Input. Turn on the Logic Supply first before turning on the main power supply.	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-)		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 + (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-)		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

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

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		-

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.

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.

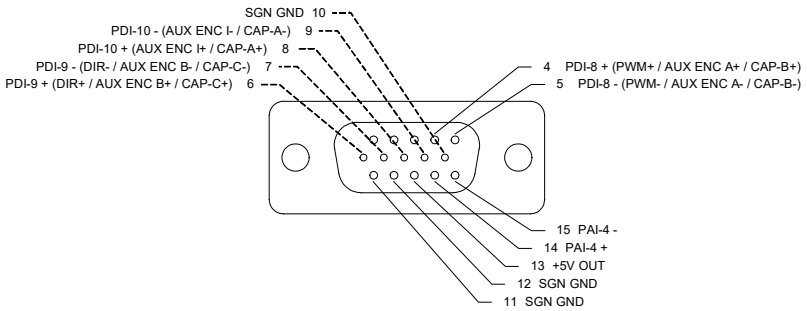
Baud Rate (kbps)	Value For Bit Rate Setting
Load from non-volatile memory	0
9.6	1
38.4	2
115.2	3

Safe Torque Off (STO) Inputs

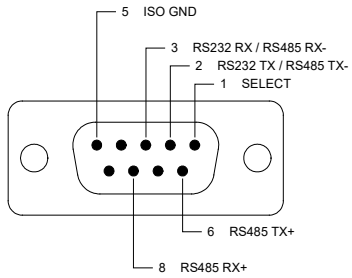
The Safe Torque Off (STO) Inputs are dedicated +24VDC max sinking single-ended inputs. For applications not using STO functionality, disabling of the STO feature is required for proper drive operation. STO may be disabled by installing the included mating connector for the STO connector and following 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

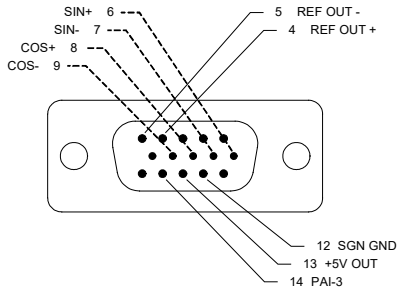
AUX ENCODER - Auxiliary Feedback Connector		
Connector Information		15-pin, high-density, male D-sub
Mating Connector	Details	TYCO: Plug P/N 1658681-1; Housing P/N 5748677-1; Terminals P/N 1658686-2 (loose) or 1658686-1 (strip)
	Included with Drive	No



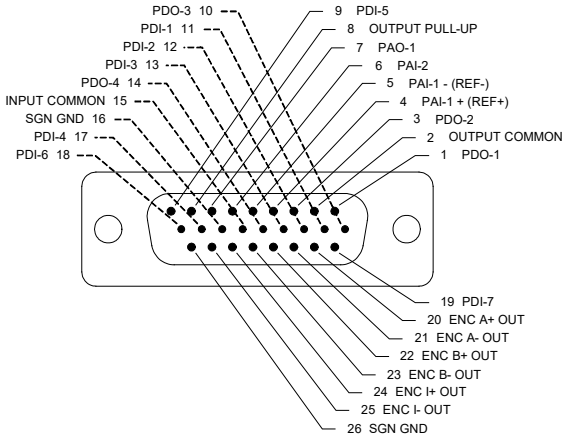
COMM - RS232/RS485 Communication Connector		
Connector Information		9-pin, female D-sub
Mating Connector	Details	TYCO: Plug P/N 205204-4; Housing P/N 5748677-1; Terminals P/N 1658540-5 (loose) or 1658540-4 (strip)
	Included with Drive	No



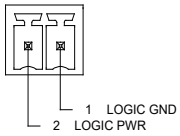
FEEDBACK - Feedback Connector		
Connector Information		15-pin, high-density, female D-sub
Mating Connector	Details	TYCO: Plug P/N 748364-1; Housing P/N 5748677-1; Terminals P/N 1658670-2 (loose) or 1658670-1 (strip)
	Included with Drive	No



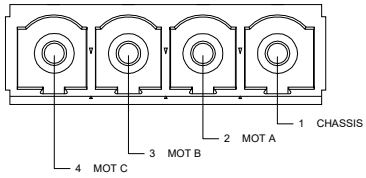
I/O - Signal Connector		
Connector Information		26-pin, high-density, female D-sub
Mating Connector	Details	TYCO: Plug P/N 1658671-1; Housing P/N 5748677-2; Terminals P/N 1658670-2 (loose) or 1658670-1 (strip)
	Included with Drive	No



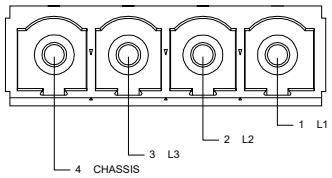
Logic Power Connector		
Connector Information		2-port, 3.5 mm spaced insert connector
Mating Connector	Details	Phoenix Contact: P/N 1840366
	Included with Drive	Yes



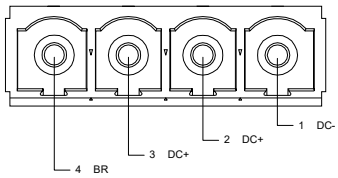
Motor Power Connector		
Connector Information		4-pin, 10.16 mm spaced, enclosed, friction lock header
Mating Connector	Details	Phoenix Contact: P/N 1913523
	Included with Drive	Yes



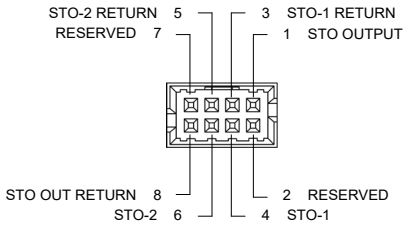
AC Power Connector		
Connector Information		4-pin, 10.16 mm spaced, enclosed, friction lock header
Mating Connector	Details	Phoenix Contact: P/N 1913523
	Included with Drive	Yes



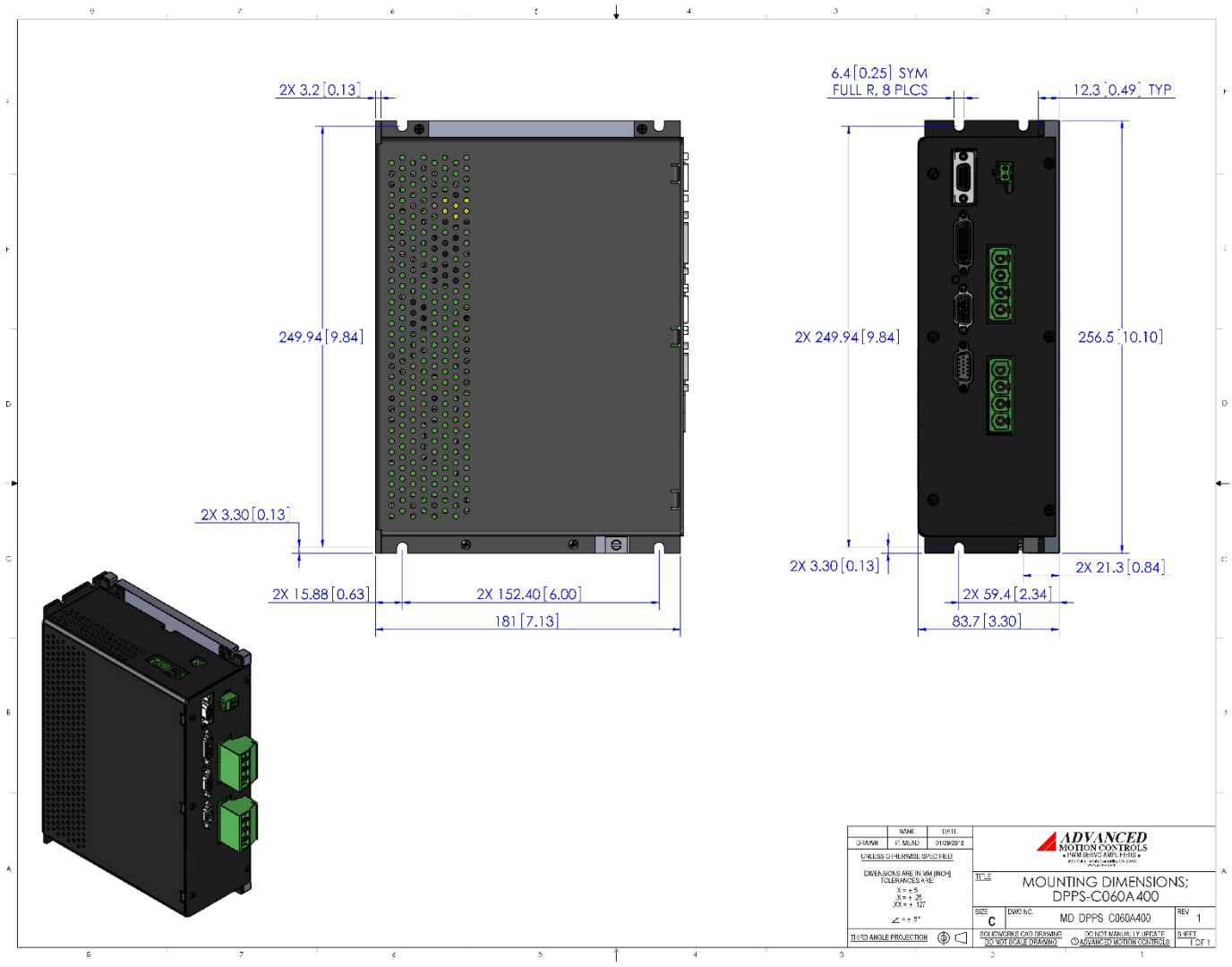
DC Power Connector		
Connector Information		4-pin, 10.16 mm spaced, enclosed, friction lock header
Mating Connector	Details	Phoenix Contact: P/N 1913523
	Included with Drive	Yes



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



MOUNTING DIMENSIONS



PART NUMBERING INFORMATION

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

Drive Series	
DP	DigiFlex® Performance™

Communication	
C	CANopen®
E	EtherCAT®
M	Click&Move® Embedded
P	POWERLINK / Modbus TCP / Ethernet
R	RS485 / Modbus RTU

Command Inputs	
AN	Analog (±10V) No Step & Direction
AL	Analog (±10V) Low Voltage Step & Direction (5V)
AH	Analog (±10V) High Voltage Step & Direction (24V)

Digital I/O	
I	Isolated (24V)
T	TTL (5V) Non-Isolated

Motor Feedback	
E	Incremental Encoder and/or Halls
R	Resolver
A	Absolute Encoder
U	Universal (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 Single Phase Only +24V_{DC} User Logic Supply Required
B	DC Input Both Logic Supply Options (Internal or User)
L	DC Input Logic 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
- 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 to see which accessories will assist with your application design and implementation.

Power Supplies

Shunt Regulators

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.