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 an Ethernet interface for network communication using Ethernet POWERLINK, Modbus TCP or Ethernet, and a USB port for drive commissioning using DriveWare® 7, available for download at www.a-m-c.com.

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

Power Range

Peak Current	100 A (70.7 A_{RMS})
Continuous Current	50 A (50 A_{RMS})
AC Supply Voltage	200 - 240 VAC
DC Supply Voltage	255 - 373 VDC

ETHERNET POWERLINK Modbus Ethernet

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
- Profile Modes
- Cyclic Synchronous Modes
- Current
- Velocity
- Position

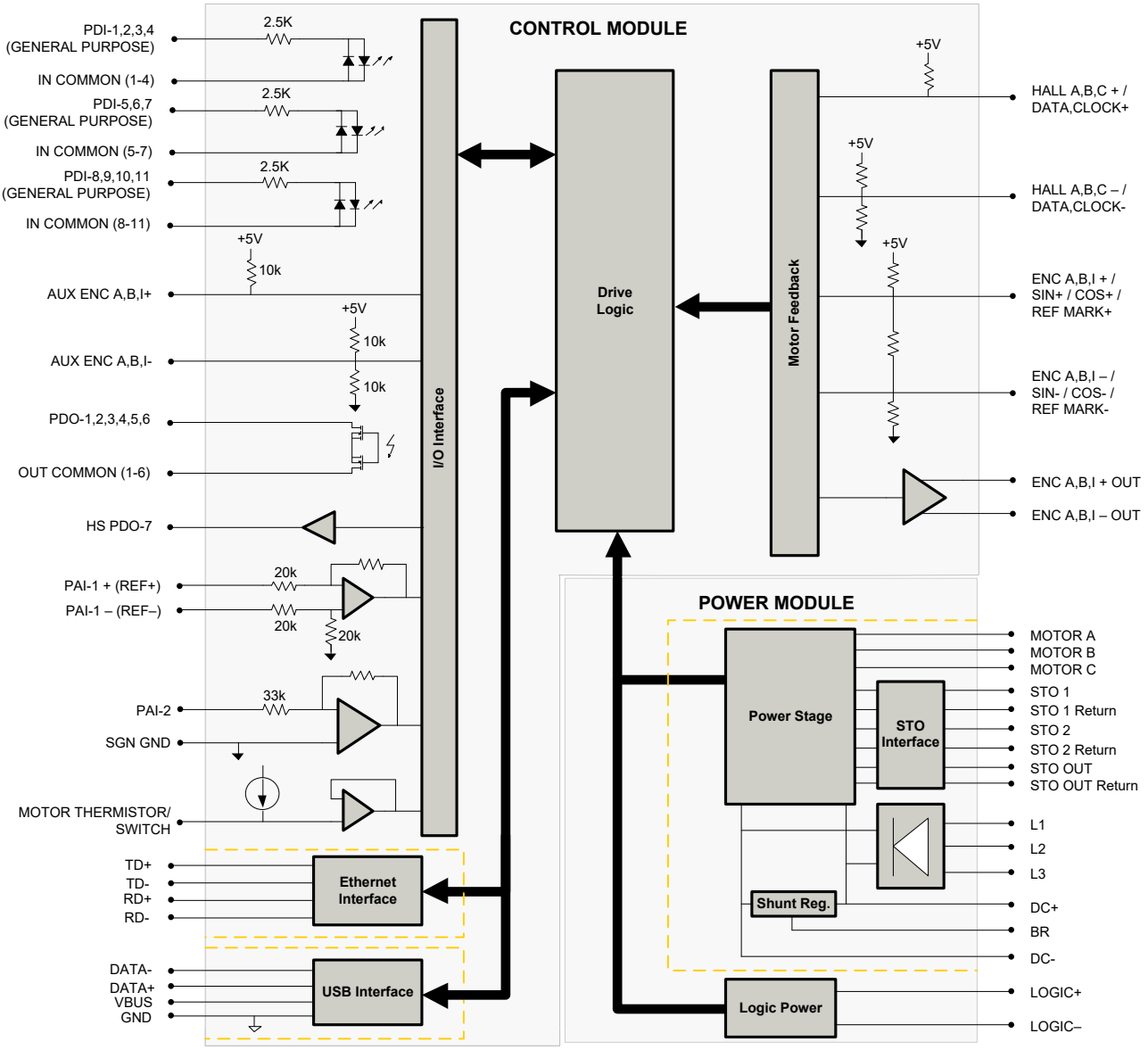
COMMAND SOURCE
- ±10 V Analog
- Encoder Following
- Over the Network
- Sequencing
- Indexing
- Jogging

FEEDBACK SUPPORTED (FIRMWARE DEPENDENT)
- Halls
- Incremental Encoder
- Absolute Encoder (EnDat® 2.1/2.2, Hiperface®, or BiSS C-Mode)
- 1Vp-p Sine/Cosine Encoder
- Auxiliary Incremental Encoder
- Tachometer (±10 VDC)

INPUTS/OUTPUTS
- 1 Motor Thermistor/Switch Input
- 11 General Purpose Programmable Digital Inputs
- 1 High Speed Programmable Digital Output
- 6 General Purpose Programmable Digital Outputs
- 2 Programmable Analog Inputs

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

BLOCK DIAGRAM



Information on Approvals and Compliances	
c UL us	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

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[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 (@ 1 A)
Safe Torque Off Voltage[3]	VDC	24 (±6)
Maximum Peak Output Current[4]	A (A_{RMS})	100 (70.7)
Maximum Continuous Output Current[5]	A (A_{RMS})	50 (50)
Maximum Continuous Power @ Rated Voltage[6]	W	16103
Maximum Continuous Power Dissipation @ Rated Voltage	W	848
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	10
Maximum Output PWM Duty Cycle	%	100
Low Voltage Supply Outputs	-	+5 VDC (250 mA)
Control Specifications		
Description	Units	Value
Communication Interfaces	-	Ethernet POWERLINK / Modbus TCP / Ethernet (USB for Configuration)
Command Sources	-	±10 V Analog, Encoder Following, Over the Network, Sequencing, Indexing, Jogging
Feedback Supported	-	Halls, Incremental Encoder, Absolute Encoder (EnDat® 2.1/2.2, Hiperface®, or BiSS C-Mode), 1Vp-p Sine/Cosine Encoder, Auxiliary Incremental Encoder, Tachometer (±10 VDC)
Commutation Methods	-	Sinusoidal, Trapezoidal
Modes of Operation	-	Profile Modes, Cyclic Synchronous Modes, Current, Velocity, Position
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)	-	11/7
Programmable Analog Inputs/Outputs (PAIs/PAOs)	-	2/0
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 Sin/Cos Encoder Frequency	kHz	200
Maximum Sin/Cos Interpolation	-	2048 counts per sin/cos cycle
Internal Shunt Regulator	-	Yes
Internal Shunt Resistor	-	No
Mechanical Specifications		
Description	Units	Value
Agency Approvals	-	RoHS, TÜV Rheinland® (STO), UL, cUL, CE Class A (EMC), CE Class A (LVD)
Size (H x W x D)	mm (in)	256.50 x 181.0 x 135.30 (10.10 x 7.13 x 5.33)
Weight	g (oz)	3560.7 (125.6)
Heatsink (Base) Temperature Range[10]	°C (°F)	0 - 75 (32 - 167)
Storage Temperature Range	°C (°F)	-40 - 85 (-40 - 185)
Cooling System	-	Forced Convection
Form Factor	-	Panel Mount
AUX. COMM Connector	-	5-pin, Mini USB B Type port
COMM Connector	-	Shielded, dual RJ-45 socket with LEDs
FEEDBACK Connector	-	15-pin, high-density, female D-sub
AUX. ENCODER Connector	-	15-pin, high-density, male D-sub
I/O Connector	-	26-pin, high-density, female D-sub
+24V LOGIC Connector	-	2-port, 3.5 mm spaced insert connector
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. Current limits are de-rated to 30A cont. / 60A peak.
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 the shunt resistor. A 5 amp motor 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.

PIN FUNCTIONS

COMM – Ethernet Communication Connector			
Pin	Name	Description / Notes	I/O
1	RD+	Receiver + (100Base-TX)	I
2	RD-	Receiver - (100Base-TX)	I
3	TD+	Transmitter + (100Base-TX)	O
4	RESERVED	-	-
5	RESERVED	-	-
6	TD-	Transmitter - (100Base-TX)	O
7	RESERVED	-	-
8	RESERVED	-	-
9	RESERVED	-	-

I/O – Signal Connector			
Pin	Name	Description / Notes	I/O
1	PDO-1	General Purpose Programmable Digital Output (120 mA maximum)	O
2	PDO-2	General Purpose Programmable Digital Output (120 mA maximum)	O
3	PDO-3	General Purpose Programmable Digital Output (120 mA maximum)	O
4	OUT COMMON	Digital Output Common (1-6)	OCOM
5	GROUND	Ground	GND
6	PDO-4	General Purpose Programmable Digital Output (120 mA maximum)	O
7	PDO-5	General Purpose Programmable Digital Output (120 mA maximum)	O
8	HS PDO-7	High Speed Programmable Digital Output (5V CMOS Compatible Output)	O
9	PDO-6	General Purpose Programmable Digital Output (120 mA maximum)	O
10	PDI-1	General Purpose Programmable Digital Input	I
11	PDI-2	General Purpose Programmable Digital Input	I
12	PDI-3	General Purpose Programmable Digital Input	I
13	PDI-4	General Purpose Programmable Digital Input	I
14	IN COMMON	Digital Input Common (1-4)	ICOM
15	IN COMMON	Digital Input Common (5-7)	ICOM
16	PDI-5	General Purpose Programmable Digital Input	I
17	PDI-6	General Purpose Programmable Digital Input	I
18	PDI-7	General Purpose Programmable Digital Input	I
19	PDI-8	General Purpose Programmable Digital Input	I
20	PDI-9	General Purpose Programmable Digital Input	I
21	PDI-10	General Purpose Programmable Digital Input	I
22	PDI-11	General Purpose Programmable Digital Input	I
23	IN COMMON	Digital Input Common (8-11)	ICOM
24	PAI-1+	General Purpose Differential Programmable Analog Input or Reference Signal Input (16-bit Resolution)	I
25	PAI-1-		I
26	GROUND	Ground	GND

FEEDBACK – Feedback Connector*					
Pin	Incremental Encoder	Absolute Encoder	1Vp-p Sin/Cos Encoder	Description / Notes	I/O
1	HALL A+	DATA-	HALL A+	Differential Hall A+/ Differential Data Line (BiSS: SLO-)	I
2	HALL B+	CLOCK+	HALL B+	Differential Hall B+ / Differential Clock Line (BiSS: MA+)	I
3	HALL C+	N/C	HALL C+	Differential Hall C+	I
4	ENC A+	SIN +	SIN +	Differential Encoder A / Differential Sine Input (Leave open for BiSS and EnDat 2.2)	I
5	ENC A-	SIN -	SIN -		I
6	ENC B+	COS +	COS +	Differential Encoder B/ Differential Cosine Input (Leave open for BiSS and EnDat 2.2)	I
7	ENC B-	COS -	COS -		I
8	ENC I+	REF MARK+	REF MARK +	Differential Encoder Index / Differential Reference Mark (Leave open for BiSS and EnDat 2.2)	I
9	ENC I-	REF MARK-	REF MARK -		I
10	HALL A-	DATA+	HALL A-	Differential Hall A- / Differential Data Line (BiSS: SLO+)	I
11	HALL B-	CLOCK-	HALL B-	Differential Hall B- / Differential Clock Line (BiSS: MA-)	I
12	SGND	SGND	SGND	5V Return (Signal Ground)	SGND
13	+5V OUT	+5V OUT	+5V OUT	+5V Encoder Supply Output. Short-circuit protected. (250mA)	O
14	THERMISTOR	THERMISTOR	THERMISTOR	Motor Thermal Protection	I
15	HALL C-	N/C	HALL C-	Differential Hall C-.	I

*Note: Feedback supported (Incremental Encoder, Absolute Sin/Cos Encoder, or 1Vp-p Sin/Cos Encoder) will be dependent on firmware.

AUX. ENCODER – Auxiliary Encoder Connector

Pin	Name	Description / Notes	I/O
1	ENC A+ OUT / RESERVED	Buffered Encoder Channel A Output* or Reserved.	O
2	ENC A- OUT / RESERVED		O
3	ENC B+ OUT / RESERVED	Buffered Encoder Channel B Output* or Reserved.	O
4	AUX ENC A+	Auxiliary Encoder Input (For single ended signal leave negative terminal open)	I
5	AUX ENC A-		I
6	AUX ENC B+	Auxiliary Encoder Input (For single ended signal leave negative terminal open)	I
7	AUX ENC B-		I
8	AUX ENC I+	Auxiliary Encoder Index Input (For single ended signal leave negative terminal open)	I
9	AUX ENC I-		I
10	ENC B- OUT / RESERVED	Buffered Encoder Channel B Output* or Reserved.	O
11	ENC I+ OUT / RESERVED	Buffered Encoder Index Output* or Reserved.	O
12	SGND	Signal Ground	SGND
13	+5V OUT	+5 VDC User Supply	O
14	PAI-2	Programmable Analog Input (12-bit Resolution)	I
15	ENC I- OUT / RESERVED	Buffered Encoder Index Output* or Reserved.	O

*Buffered encoder output only available with incremental encoder or 1Vp-p sin/cos encoder feedbacks. 1:1 input-to-output ratio, 5V square wave output. Reserved pins for all other feedbacks.

AUX. COMM - 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	-	-
5	USB GND	USB Ground	UGND

Logic Power Connector

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

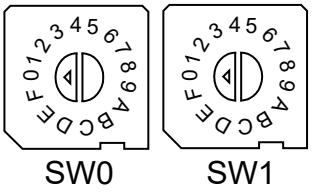
STO – Safe Torque Off Connector*

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

Network IP Address Switches

Switch Diagram	Description
	Hexadecimal switch settings correspond to the last octet of the IP Address of the drive within the Ethernet network. Note that for POWERLINK, the IP address will always be 192.168.100.xxx.

SW1	SW0	Node ID
0	0	Address stored in NVM
0	1	001
0	2	002
…	…	…
F	D	253
F	E	254
F	F	255

LED Functions (on RJ-45 Communication Connectors)

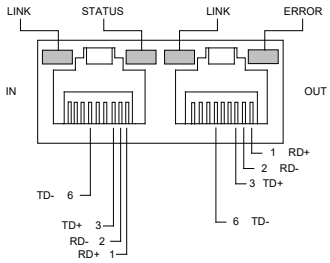
LINK LED	
LED State	**Description**
Green – On	Valid Link - No Activity
Green – Flickering	Valid Link - Network Activity
Off	Invalid Link

Safe Torque Off (STO) Inputs

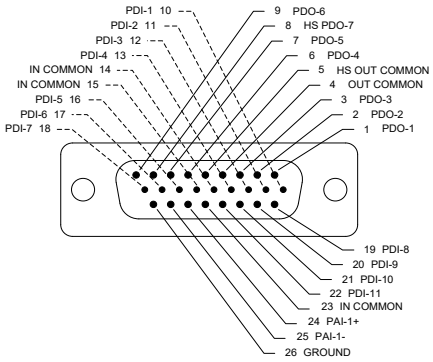
The Safe Torque Off (STO) Inputs are dedicated +24VDC max sinking single-ended inputs. For applications not using STO functionality, disabling of the STO feature is required for proper drive operation. STO may be disabled by installing the included mating connector for the STO connector and following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

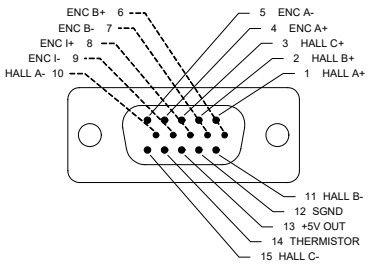
COMM - Ethernet Communication Connector		
Connector Information		Shielded, dual RJ-45 socket with LEDs
Mating Connector	Details	Standard CAT 5e or CAT 6 ethernet cable
	Included with Drive	No



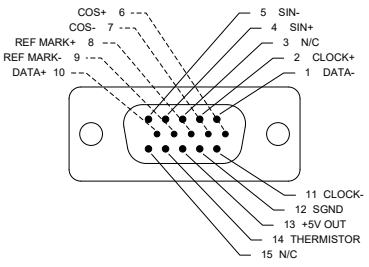
I/O - Signal Connector		
Connector Information		26-pin, high-density, female D-sub
Mating Connector	Details	TYCO: Plug P/N 1658671-1; Housing P/N 5748677-3; Terminals P/N 1658670-2 (loose) or 1658670-1 (strip)
	Included with Drive	No



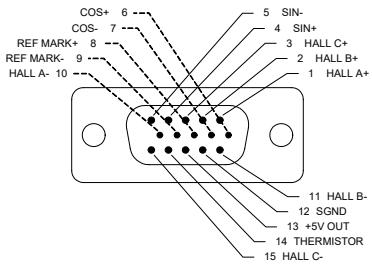
FEEDBACK - Feedback Connector		
Connector Information		15-pin, high-density, female D-sub
Mating Connector	Details	TYCO: Plug P/N 748364-1; Housing P/N 5748677-2; Terminals P/N 1658670-2 (loose) or 1658670-1 (strip)
	Included with Drive	No



Incremental Encoder

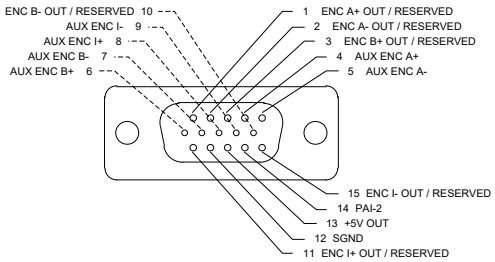


Absolute Encoder

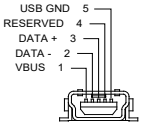


1Vp-p Sin/Cos Encoder

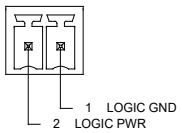
AUX. ENCODER - Auxiliary Feedback Connector		
Connector Information		15-pin, high-density, male D-sub
Mating Connector	Details	TYCO: Plug P/N 1658681-1; Housing P/N 5748677-2; Terminals P/N 1658686-2 (loose) or 1658686-1 (strip)
	Included with Drive	No



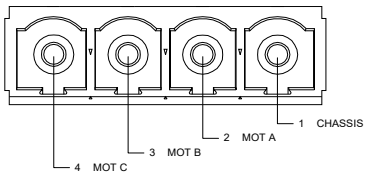
AUX. COMM – USB Communication Connector		
Connector Information		5-pin, Mini USB B Type port
Suggested Mating Cable	Details	TYCO: 1496476-3 (2-meter STD-A to MINI-B ASSY)
	Included with Drive	No



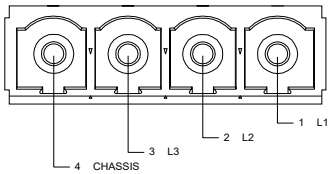
+24V LOGIC - Logic Power Connector		
Connector Information		2-port, 3.5 mm spaced insert connector
Mating Connector	Details	Phoenix Contact: P/N 1840366
	Included with Drive	Yes



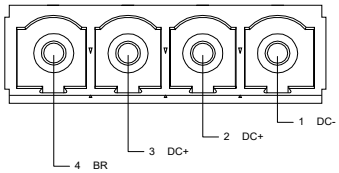
Motor Power Connector		
Connector Information		4-pin, 10.16 mm spaced, enclosed, friction lock header
Mating Connector	Details	Phoenix Contact: P/N 1913523
	Included with Drive	Yes



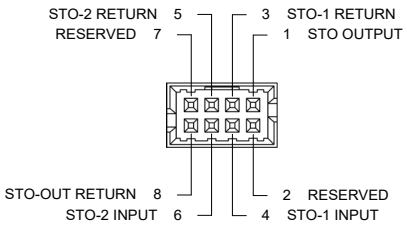
AC Power Connector		
Connector Information		4-pin, 10.16 mm spaced, enclosed, friction lock header
Mating Connector	Details	Phoenix Contact: P/N 1913523
	Included with Drive	Yes



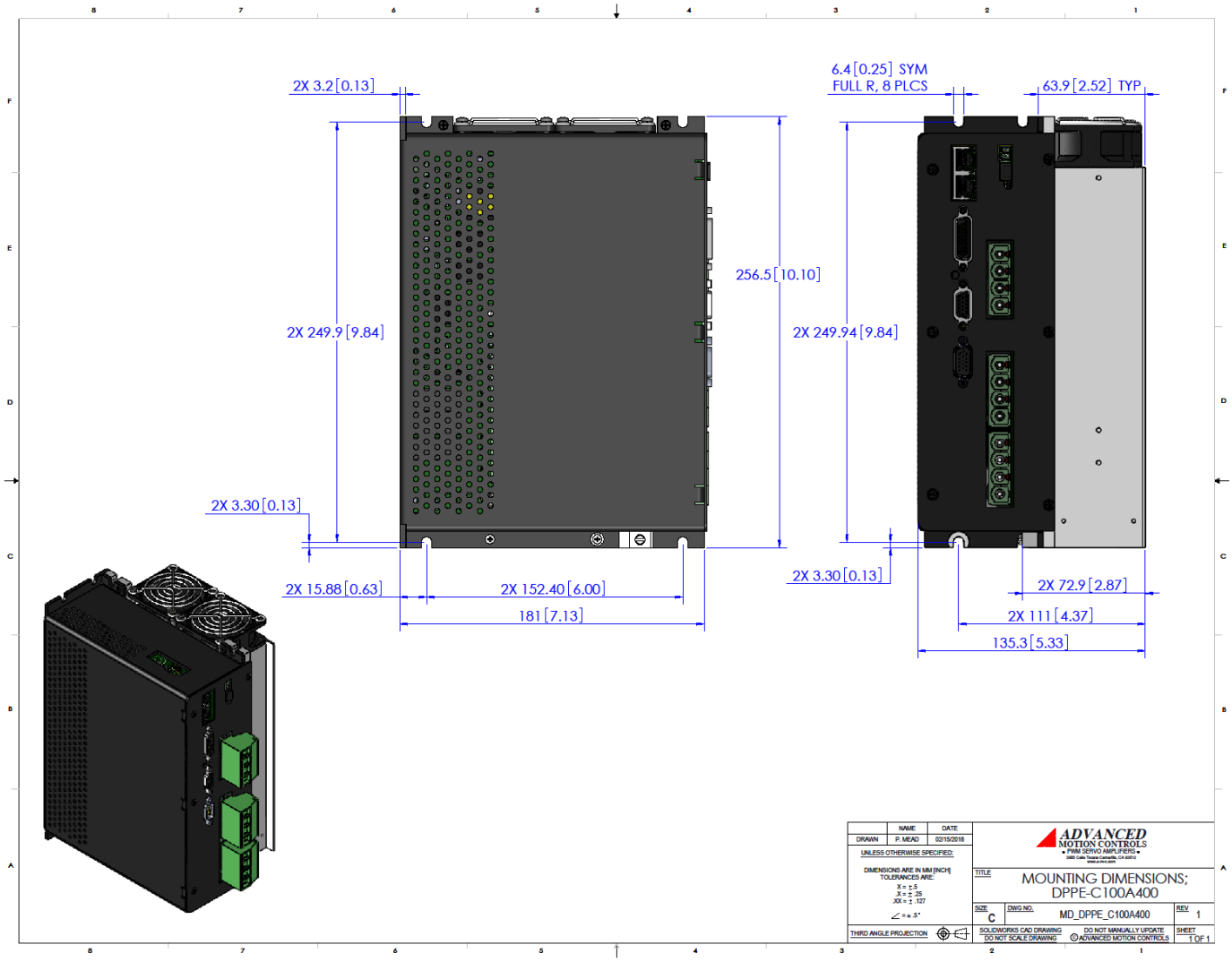
DC Power Connector		
Connector Information		4-pin, 10.16 mm spaced, enclosed, friction lock header
Mating Connector	Details	Phoenix Contact: P/N 1913523
	Included with Drive	Yes



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 P A N I U - C 1 0 0 A 4 0 0 -

Drive Series	
DP	DigiFlex® Performance™ Panel Mount

Communication	
R	RS232/RS485
C	CANopen or RS232
E	EtherCAT
P	POWERLINK / Modbus TCP / Ethernet

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.