Description

The DigiFlex® Performance™ (DP) Series digital servo drives are designed to drive brushed and brushless servomotors. 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 command source can be generated internally or can be supplied externally. 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 via Modbus TCP and a USB port for drive commissioning using DriveWare® 7, available for download at www.a-m-c.com.

Click&Move® motion control and automation programs can be executed using this drive. Click&Move is available for download and purchase at www.a-m-c.com.

All drive and motor parameters are stored in non-volatile memory. User variables in a Click&Move embedded project can also be stored in non-volatile memory.

Power Range

Power Range	
Peak Current	100 A (70.7 A$_{RMS}$)
Continuous Current	60 A (60 A$_{RMS}$)
Supply Voltage	20 - 80 VDC

Click&Move® Embedded   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
- On-the-Fly Mode Switching
- On-the-Fly Gain Set Switching
- Dedicated Safe Torque Off (STO) Inputs

MODES OF OPERATION
- Velocity
- Position

COMMAND SOURCE
- Embedded Click&Move® Program
- ±10 V Analog
- Encoder Following

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
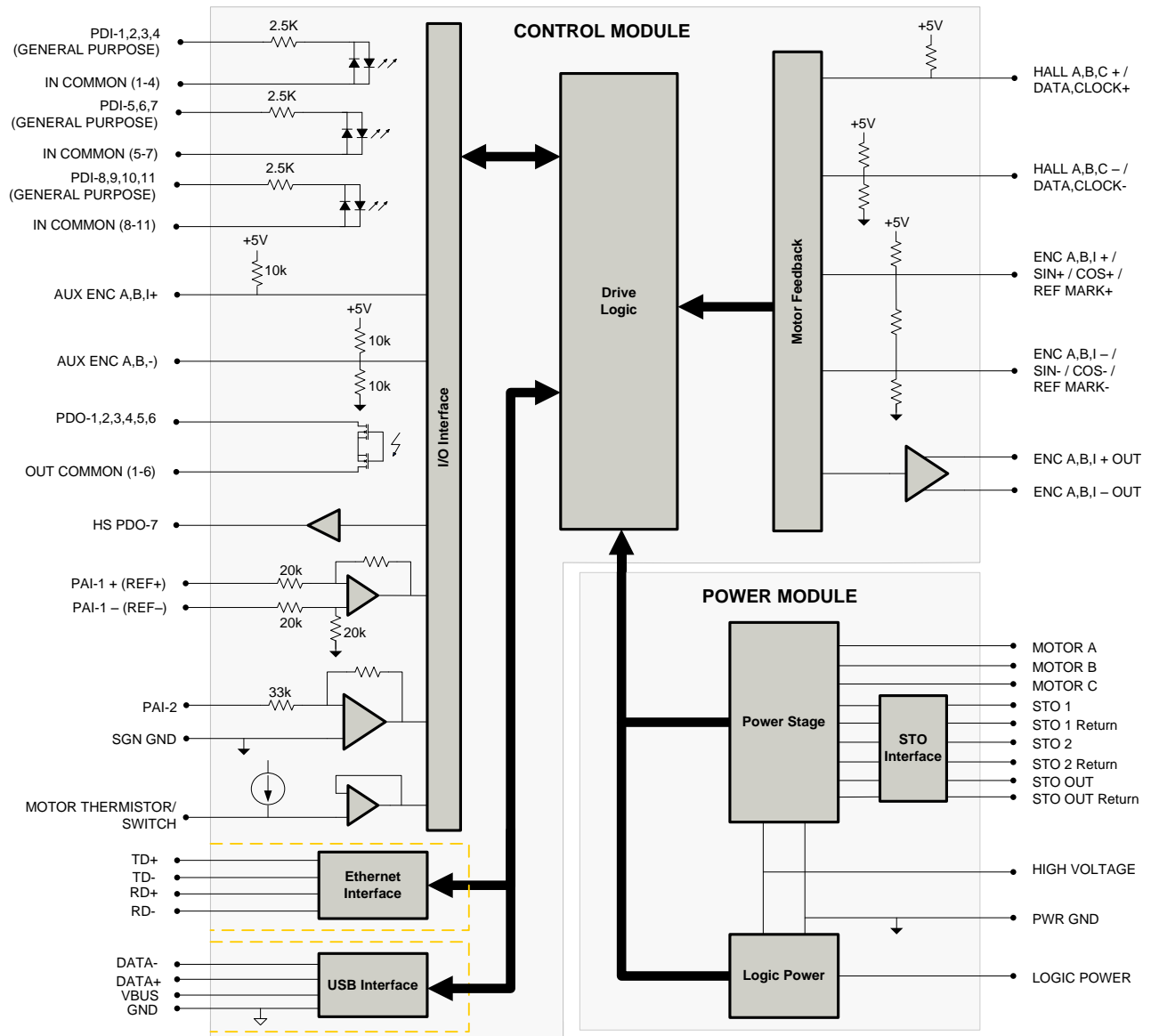- 6 General Purpose Programmable Digital Outputs
- 2 Programmable Analog Inputs

COMPLIANCES & AGENCY APPROVALS
- RoHS II
- TÜV Rheinland® (STO)
- UL/cUL Pending
- CE Pending

BLOCK DIAGRAM

Information on Approvals and Compliances

The RoHS II Directive 2011/65/EU restricts the use of certain substances including lead, mercury, cadmium, hexavalent chromium and halogenated flame retardants PBB and PBDE in electronic equipment.

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

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SPECIFICATIONS

Power Specifications		
Description	Units	Value
DC Supply Voltage Range[2]	VDC	20 – 80
DC Bus Over Voltage Limit	VDC	88
DC Bus Under Voltage Limit	VDC	17
Logic Supply Voltage	VDC	20 - 80
Safe Torque Off Voltage[1]	VDC	24 (±6)
Maximum Peak Output Current[2]	A (A_{RMS})	100 (70.7)
Maximum Continuous Output Current[3]	A (A_{RMS})	60 (60)
Maximum Continuous Power @ Rated Voltage	W	4560
Maximum Continuous Power Dissipation @ Rated Voltage	W	240
Internal Bus Capacitance	μF	500
Minimum Load Inductance (Line-To-Line)[4]	μH	250 (at 80 V supply); 150 (at 48 V supply); 75 (at 24 V supply)
Switching Frequency	kHz	20
Maximum Output PWM Duty Cycle	%	100
Low Voltage Supply Outputs	-	+5 VDC (250 mA)
Control Specifications		
Description	Units	Value
Communication Interfaces	-	Modbus TCP / Ethernet (USB for Configuration)
Command Sources	-	Embedded Click&Move® Program, ±10 V Analog, Encoder Following
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	-	Velocity, Position
Motors Supported	-	Closed Loop Vector, Single Phase (Brushed, Voice Coil, Inductive Load), Three Phase (Brushless)
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	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
Mechanical Specifications		
Description	Units	Value
Agency Approvals	-	RoHS II, TÜV Rheinland® (STO), UL/cUL Pending, CE Pending
Size (H x W x D)	mm (in)	190.5 x 111.8 x 67.3 (7.50 x 4.40 x 2.65)
Weight	g (oz)	935 (32.98)
Heatsink (Base) Temperature Range[5]	°C (°F)	0 - 75 (32 - 167)
Storage Temperature Range	°C (°F)	-40 - 85 (-40 - 185)
Cooling System	-	Natural 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	-	3-port, 10.16 mm spaced, enclosed, friction lock header
POWER Connector	-	2-port, 10.16 mm spaced, enclosed, friction lock header
STO Connector	-	8-port, 2.0 mm spaced, enclosed, friction lock header

Notes

1. STO features must be disabled for applications not using STO. See page 6 for more information.
2. 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.
3. Continuous A_{rms} value attainable when RMS Charge-Based Limiting is used.
4. Lower inductance is acceptable for bus voltages well below maximum. Use external inductance to meet requirements.
5. Additional cooling and/or heatsink are required to achieve rated continuous performance.

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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	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	I
25	PAI-1-	(16-bit Resolution)	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.

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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

+24V LOGIC - Logic Power Connector

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

MOTOR POWER - Power Connector

Pin	Name	Description / Notes	I/O
1	MOTOR A	Motor Phase A	O
2	MOTOR B	Motor Phase B	O
3	MOTOR C	Motor Phase C	O

POWER - Power Connector

Pin	Name	Description / Notes	I/O
1	PWR GND	Power Ground (Common With Signal Ground)	PGND
2	HIGH VOLTAGE	DC Power Input	I
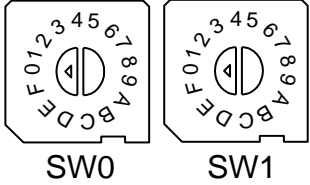
STO – Safe Torque Off Connector*

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.

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HARDWARE SETTINGS

Network IP Address Switches

Switch Diagram	Description
SW0 SW1	Hexadecimal switch settings correspond to the last octet of the IP Address of the drive within the Ethernet network.

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.
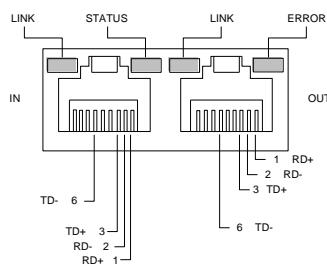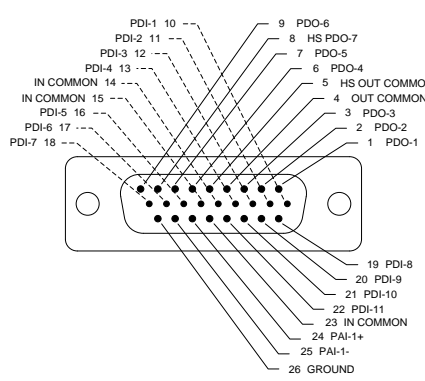
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MECHANICAL INFORMATION

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

LINK   STATUS   LINK   ERROR
IN   OUT

1 RD+
2 RD-
3 TD+
6 TD-

TD- 6
TD+ 3
RD- 2
RD+ 1
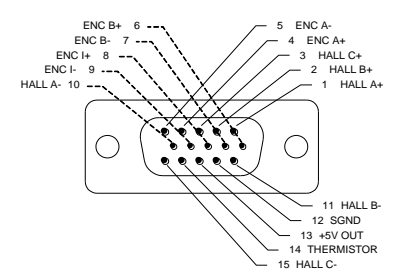
I/O - Signal Connector

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

PDI-1 10   9 PDO-6
PDI-2 11   8 HS PDO-7
PDI-3 12   7 PDO-5
PDI-4 13   6 PDO-4
IN COMMON 14   5 HS OUT COMMON
IN COMMON 15   4 OUT COMMON
PDI-5 16   3 PDO-3
PDI-6 17   2 PDO-2
PDI-7 18   1 PDO-1

19 PDI-8
20 PDI-9
21 PDI-10
22 PDI-11
23 IN COMMON
24 PAI-1+
25 PAI-1-
26 GROUND

FEEDBACK - Feedback Connector

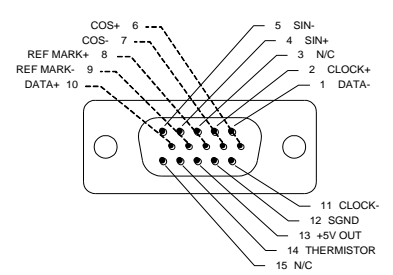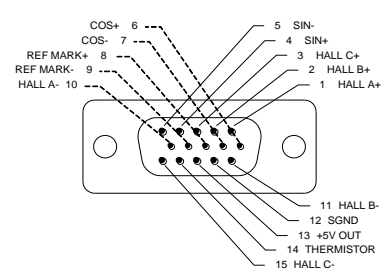| Connector Information		15-pin, high-density, female D-sub
Mating Connector	Details	TYCO: Plug P/N 748364-1; Housing P/N 5748677-2; Terminals P/N 1658670-2 (loose) or 1658670-1 (strip)
	Included with Drive	No

ENC B+ 6   5 ENC A-
ENC B- 7   4 ENC A+
ENC I+ 8   3 HALL C+
ENC I- 9   2 HALL B+
HALL A- 10   1 HALL A+

11 HALL B-
12 SGND
13 +5V OUT
14 THERMISTOR
15 HALL C-

Incremental Encoder

COS+ 6   5 SIN-
COS- 7   4 SIN+
REF MARK+ 8   3 N/C
REF MARK- 9   2 CLOCK+
DATA+ 10   1 DATA-

11 CLOCK-
12 SGND
13 +5V OUT
14 THERMISTOR
15 N/C

Absolute Encoder

COS+ 6   5 SIN-
COS- 7   4 SIN+
REF MARK+ 8   3 HALL C+
REF MARK- 9   2 HALL B+
HALL A- 10   1 HALL A+

11 HALL B-
12 SGND
13 +5V OUT
14 THERMISTOR
15 HALL C-

1Vp-p Sin/Cos Encoder
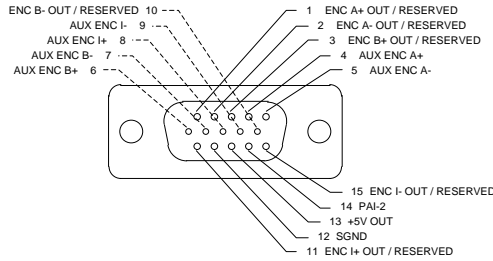
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AUX. ENCODER - Auxiliary Feedback Connector

| 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

ENC B- OUT / RESERVED 10
AUX ENC I- 9
AUX ENC I+ 8
AUX ENC B- 7
AUX ENC B+ 6

1 ENC A+ OUT / RESERVED
2 ENC A- OUT / RESERVED
3 ENC B+ OUT / RESERVED
4 AUX ENC A+
5 AUX ENC A-

15 ENC I- OUT / RESERVED
14 PAI-2
13 +5V OUT
12 SGND
11 ENC I+ OUT / RESERVED

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

USB GND 5
RESERVED 4
DATA + 3
DATA - 2
VBUS 1
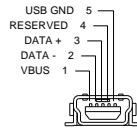
+24V LOGIC - Logic Power Connector

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
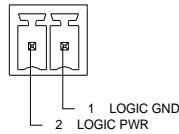
MOTOR POWER - Power Connector

Connector Information		3-pin, 10.16 mm spaced, enclosed, friction lock header
Mating Connector	Details	Phoenix Contact: P/N 1913510
	Included with Drive	Yes
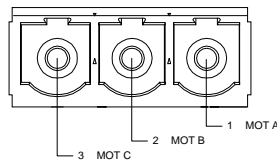
1 MOT A
2 MOT B
3 MOT C

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POWER - Power Connector

Connector Information		2-pin, 10.16 mm spaced, enclosed, friction lock header
Mating Connector	Details	Phoenix Contact: P/N 1913507
	Included with Drive	Yes

2   HV IN   1   GND
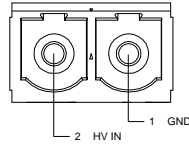
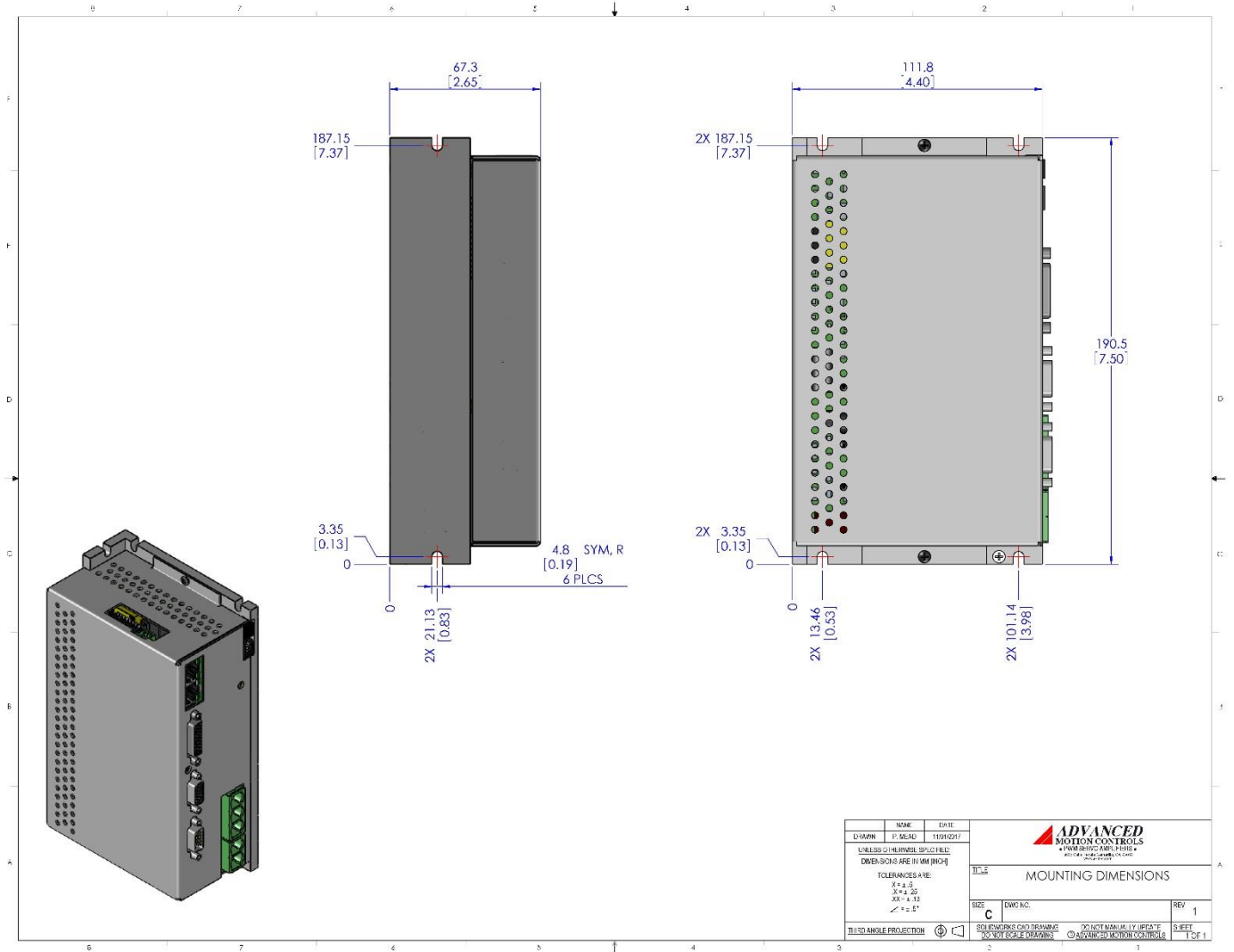## STO – Safe Torque Off Connector

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	Yes

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

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

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MOUNTING DIMENSIONS

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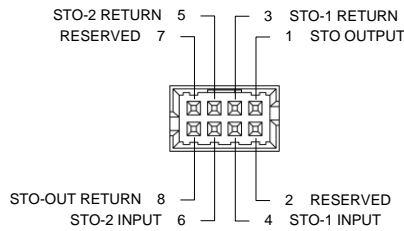
PART NUMBERING INFORMATION

Example: D P M A N I U - 1 0 0 B 0 8 0 -

Drive Series	
DP	**D**igiFlex® **P**erformance™

Communication	
C	**C**ANopen®
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	**A**C 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
100	100
C060	60
C100	100

DigiFlex® Performance™ series of products are available in many configurations. 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**

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