ADVANCED MOTION CONTROLS

DigiFlex® Performance™ Servo Drive   **DPRAHIA-015A400**

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 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 a single RS-232/RS-485 interface used for drive configuration and setup. Drive commissioning is accomplished using DriveWare® 7, available for download at www.a-m-c.com.

All drive and motor parameters are stored in non-volatile memory.

Power Range

Peak Current	15 A (10.6 A$_{RMS}$)
Continuous Current	7.5 A (7.5 A$_{RMS}$)
Supply Voltage	100 - 240 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
- On-the-Fly Mode Switching
- On-the-Fly Gain Set Switching

MODES OF OPERATION
- Current
- Position
- Velocity

COMMAND SOURCE
- PWM and Direction
- Encoder Following
- Over the Network
- ±10 V Analog
- 24V Step and Direction
- Sequencing
- Indexing
- Jogging

FEEDBACK SUPPORTED
- ±10 VDC Position
- Auxiliary Incremental Encoder
- Heidenhain EnDat®
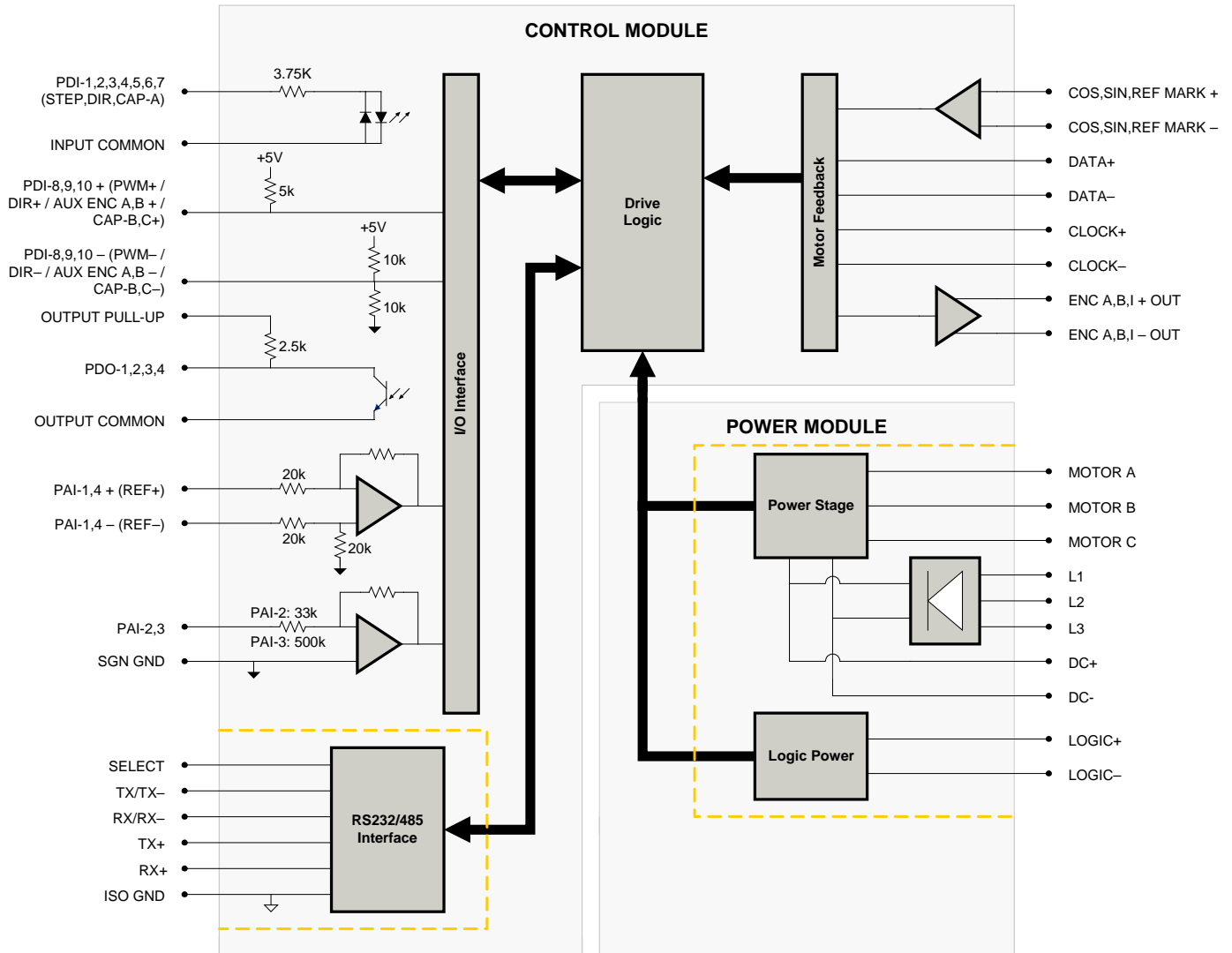- Stegmann Hiperface®
- Tachometer (±10 VDC)

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
- UL
- cUL
- CE Class A (LVD)
- CE Class A (EMC)
- RoHS

Sold & Serviced By:

ELECTROMATE

Toll Free Phone (877) SERVO98
Toll Free Fax (877) SERVO99
www.electromate.com
sales@electromate.com

BLOCK DIAGRAM

CONTROL MODULE

PDI-1,2,3,4,5,6,7 (STEP,DIR,CAP-A) 3.75K

INPUT COMMON

+5V 5k

PDI-8,9,10 + (PWM+ / DIR+ / AUX ENC A,B + / CAP-B,C+)

+5V 10k

PDI-8,9,10 – (PWM– / DIR– / AUX ENC A,B – / CAP-B,C–) 10k

OUTPUT PULL-UP

2.5k

PDO-1,2,3,4

OUTPUT COMMON

PAI-1,4 + (REF+) 20k

PAI-1,4 – (REF–) 20k

20k

PAI-2,3 PAI-2: 33k

SGN GND PAI-3: 500k

I/O Interface

Drive Logic

Motor Feedback

COS,SIN,REF MARK +

COS,SIN,REF MARK –

DATA+

DATA–

CLOCK+

CLOCK–

ENC A,B,I + OUT

ENC A,B,I – OUT

POWER MODULE

Power Stage

MOTOR A

MOTOR B

MOTOR C

L1

L2

L3

DC+

DC-

Logic Power

LOGIC+

LOGIC–

SELECT

TX/TX–

RX/RX–

TX+

RX+

ISO GND

RS232/485 Interface

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 CE for both the Class A EMC Directive 2004/108/EC on Electromagnetic Compatibility (specifically EN 61000-6-4:2007 and EN 61000-6-2:2005) and LVD requirements of directive 2006/95/EC (specifically EN 60204-1:2006), a low voltage directive to protect users from electrical shock.
RoHS COMPLIANCE	RoHS (Reduction of Hazardous Substances) is intended to prevent hazardous substances such as lead from being manufactured in electrical and electronic equipment.

Sold & Serviced By:

ELECTROMATE

Toll Free Phone (877) SERVO98
Toll Free Fax (877) SERVO99
www.electromate.com
sales@electromate.com

SPECIFICATIONS

Power Specifications		
Description	Units	Value
Rated Voltage	VAC (VDC)	240 (339)
AC Supply Voltage Range	VAC	100 - 240
AC Supply Minimum	VAC	90
AC Supply Maximum	VAC	264
AC Input Phases[1]	-	3
AC Supply Frequency	Hz	50 - 60
DC Supply Voltage Range[2]	VDC	127 - 373
DC Bus Over Voltage Limit	VDC	394
DC Bus Under Voltage Limit	VDC	55
Logic Supply Voltage	VDC	20 - 30 (@ 850 mA)
Maximum Peak Output Current[3]	A (Arms)	15 (10.6)
Maximum Continuous Output Current[4]	A (Arms)	7.5 (7.5)
Max. Continuous Output Power @ Rated Voltage[5]	W	2415
Max. Continuous Power Dissipation @ Rated Voltage	W	127
Internal Bus Capacitance	µF	660
Minimum Load Inductance (Line-To-Line)[6]	µH	600
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	-	RS-485/232
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, Heidenhain EnDat®, Stegmann Hiperface®, Tachometer (±10 VDC)
Commutation Methods	-	Sinusoidal
Modes of Operation	-	Current, Position, Velocity
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)	-	10/4
Programmable Analog Inputs/Outputs (PAIs/PAOs)	-	4/0
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	-	CE Class A (EMC), CE Class A (LVD), cUL, RoHS, UL
Size (H x W x D)	mm (in)	177.5 x 139.7 x 55.9 (7 x 5.5 x 2.2)
Weight	g (oz)	1264 (44.6)
Heatsink (Base) Temperature Range[7]	°C (°F)	0 - 65 (32 - 149)
Storage Temperature Range	°C (°F)	-40 - 85 (-40 - 185)
Form Factor	-	Panel Mount
Cooling System	-	Natural Convection
IP Rating	-	IP10
+24V LOGIC Connector	-	2-port, 5.08 mm spaced, enclosed, friction lock header with threaded flange
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
POWER Connector	-	8-port, 7.62 mm spaced, enclosed, friction lock header

Notes

1. Can operate on single-phase VAC if peak/cont. current ratings are reduced by at least 30%.
2. Large inrush current may occur upon initial DC supply connection to DC Bus.
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. Continuous A_{rms} value attainable when RMS Charge-Based Limiting is used.
5. P = (DC Rated Voltage) * (Cont. RMS Current) * 0.95.
6. Lower inductance is acceptable for bus voltages well below maximum. Use external inductance to meet requirements.
7. Additional cooling and/or heatsink may be required to achieve rated performance.

PIN FUNCTIONS

+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

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	-

FEEDBACK - Feedback Connector

Pin	Name	Description / Notes	I/O
1	COS +	Cosine Input	I
2	COS -		I
3	SIN +	Sine Input	I
4	SIN -		I
5	SGN GND	Signal Ground	SGND
6	DATA-	Differential Data Line	I/O
7	DATA+		I/O
8	CLOCK+	Differential Clock Line	O
9	CLOCK-		O
10	REF MARK +	Reference mark from sine/cosine encoder	I
11	RESERVED	Reserved	-
12	RESERVED	Reserved	-
13	+5V OUT	+5V Encoder Supply Output (Short Circuit Protected)	O
14	PAI-3	Programmable Analog Input (12-bit Resolution)	I
15	REF MARK -	Reference mark from sine/cosine encoder	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	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

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
4	DC+	Internal DC Bus Voltage (Can Be Used To Connect External Shunt Regulator)	I/O
5	DC-		I/O
6	L1		I
7	L2	AC Supply Input (Single or Three Phase)	I
8	L3		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

MECHANICAL INFORMATION

| +24V LOGIC - Logic Power Connector		
Connector Information		2-port, 5.08 mm spaced, enclosed, friction lock header with threaded flange
Mating Connector	Details	Phoenix Contact: P/N 1777808
	Included with Drive	Yes
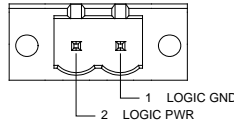
1 LOGIC GND
2 LOGIC PWR

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
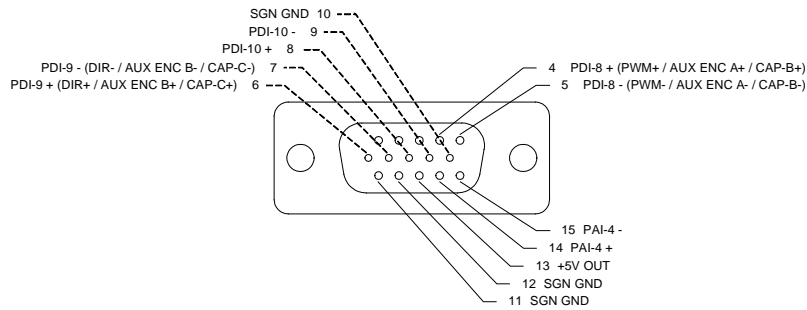
COMM - RS232/RS485 Communication Connector		
Connector Information		9-pin, female D-sub
Mating Connector	Details	TYCO: Plug P/N 205204-4; Housing P/N 5748677-1; Terminals P/N 1658540-5 (loose) or 1658540-4 (strip)
	Included with Drive	No
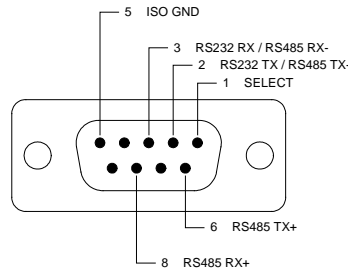
5 ISO GND
3 RS232 RX / RS485 RX-
2 RS232 TX / RS485 TX-
1 SELECT
6 RS485 TX+
8 RS485 RX+

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

```
DATA-    6          5  SGN GND
DATA+    7          4  SIN -
CLOCK+   8          3  SIN +
CLOCK-   9          2  COS -
REF MARK + 10       1  COS +

                   13  +5V OUT
                   14  PAI-3
                   15  REF MARK -
```

I/O - Signal Connector

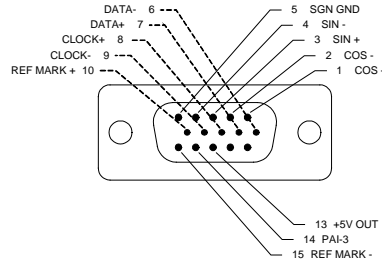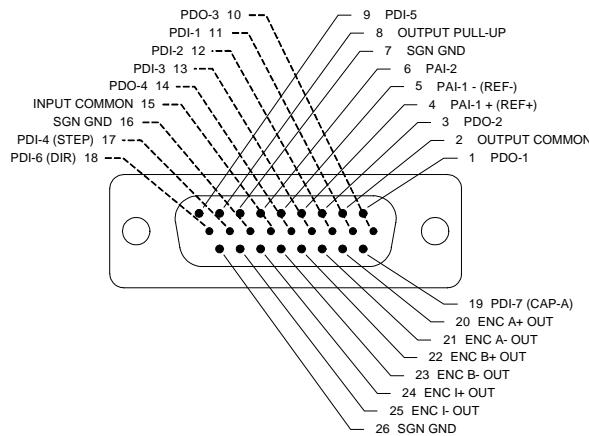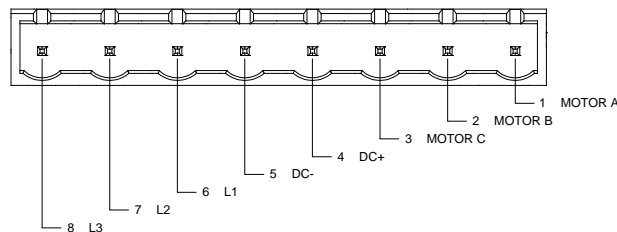| Connector Information		26-pin, high-density, female D-sub
Mating Connector	Details	TYCO: Plug P/N 1658671-1; Housing P/N 5748677-2; Terminals P/N 1658670-2 (loose) or 1658670-1 (strip)
	Included with Drive	No

```
PDO-3   10          9  PDI-5
PDI-1   11          8  OUTPUT PULL-UP
PDI-2   12          7  SGN GND
PDI-3   13          6  PAI-2
PDO-4   14          5  PAI-1 - (REF-)
INPUT COMMON  15    4  PAI-1 + (REF+)
SGN GND  16         3  PDO-2
PDI-4 (STEP)  17    2  OUTPUT COMMON
PDI-6 (DIR)  18     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
```

POWER - Power Connector

Connector Information		8-port, 7.62 mm spaced, enclosed, friction lock header
Mating Connector	Details	Phoenix Contact: P/N 1767067
	Included with Drive	Yes

```
1  MOTOR A
2  MOTOR B
3  MOTOR C
4  DC+
5  DC-
6  L1
7  L2
8  L3
```

MOUNTING DIMENSIONS

NOTE: DIMENSIONS IN [ ] ARE IN MM.

REV		DESCRIPTION	DATE	BY	ECO

DPRAHIS-015A400A
DPRAHIR-015A400A
DPRNLIR-015A400A
DPRANIR-015A400A
DPRAHIE-015A400A
DPRNLIE-015A400A
DPRAHIA-015A400A
DPRANIE-015A400A

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES
.XX ± .010
.XXX ± .005
DO NOT SCALE DRAWING

ADVANCED MOTION CONTROLS
• PWM SERVO AMPLIFIERS
3805 Calle Tecate, Camarillo, CA 93012

TITLE: MOUNTING DIMENSIONS, DPRANXX-015A400A

DRAWN BY: R. BAUTISTA   DATE: 06/07/07

CHECK BY: DATE:

DESIGN APPROVED: DATE:

SIZE: D   DWG. NO. MDDPRO15A400A   REV: A

SCALE: FULL   SHT. 1 OF 1

USED ON

PART NUMBERING INFORMATION

Example: **D P R A H I A - 0 1 5 A 4 0 0 -**

Drive Series

DP	**D**igiFlex **P**erformance

Communication

R	**R**S232/RS485
C	**CA**Nopen or RS232
E	**E**therCAT
P	Ethernet **P**owerlink or TCP/IP

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)
NL	**N**o Analog **L**ow Voltage Step & Direction (5V)
NN	**N**o Analog, **N**o Step & Direction (Communication Interface Only)

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 Sin/Cos (Hiperface & Endat)
S	**S**in/Cos with Halls
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
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.

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.