

**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.

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](http://www.a-m-c.com).

The DPR Hardware Installation Manual is available for download from [www.a-m-c.com](http://www.a-m-c.com). All drive and motor parameters are stored in non-volatile memory.

**Power Range**

|                    |                               |
|--------------------|-------------------------------|
| Peak Current       | 30 A (21.2 A <sub>RMS</sub> ) |
| Continuous Current | 15 A (15 A <sub>RMS</sub> )   |
| 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
- ▲ Built-in brake/shunt regulator
- ▲ On-the-Fly Mode Switching
- ▲ On-the-Fly Gain Set Switching

**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)

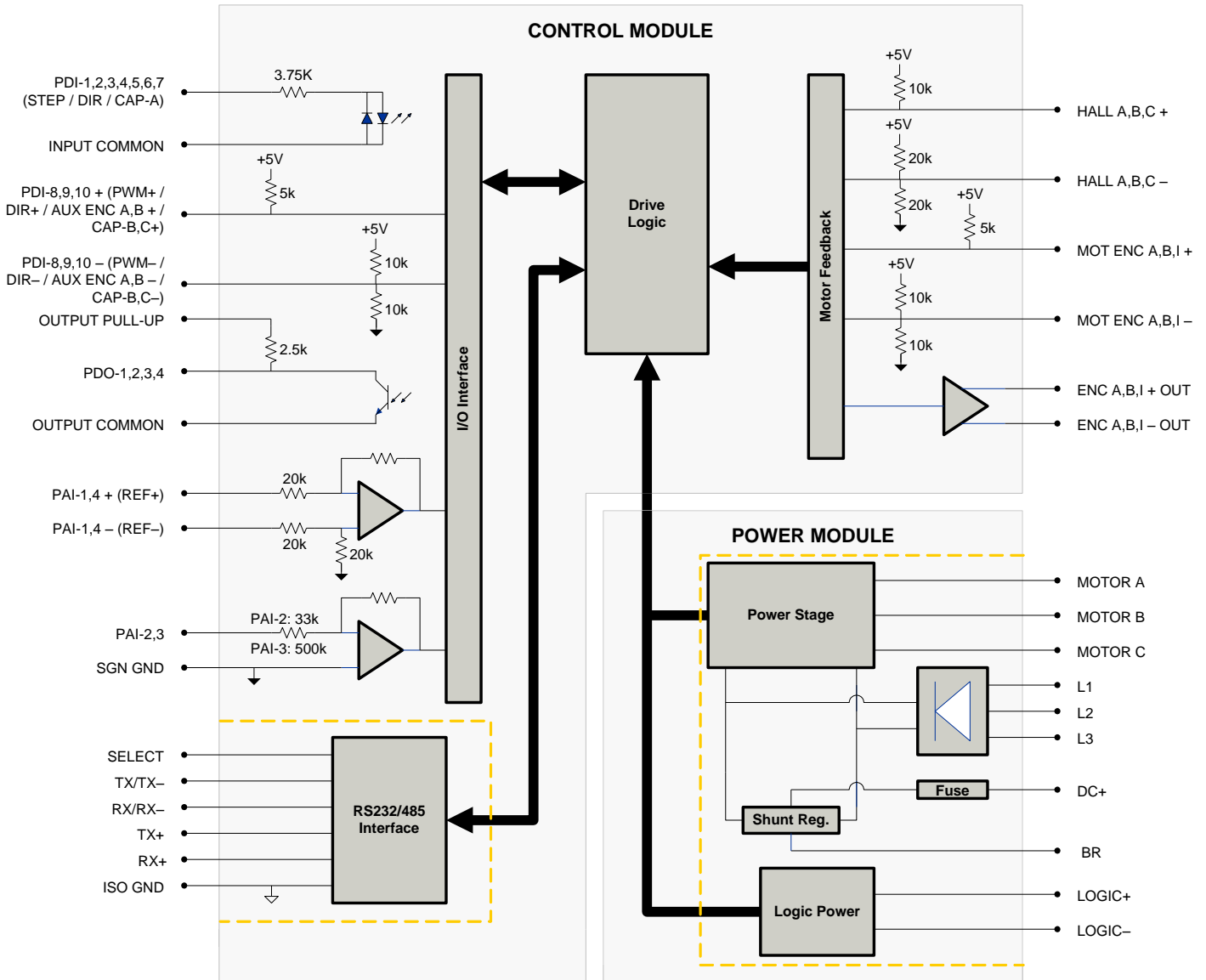
**INPUTS/OUTPUTS**

- 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**

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

**BLOCK DIAGRAM**



**Information on Approvals and Compliances**

|   |   |
|---|---|
|  | <p>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.</p>   |
|  | <p>Compliant with European EMC Directive 2004/108/EC on Electromagnetic Compatibility (specifically EN 61000-6-4:2007 for Emissions, Class A and EN 61000-6-2:2005 for Immunity, Performance Criteria A). LVD requirements of Directive 2006/95/EC (specifically, EN 60204-1:2004, a Low Voltage Directive to protect users from electrical shock).</p> |
|  | <p>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.</p>  |

**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 <sup>1</sup>                              | -         | 3   |
| AC Supply Frequency                                       | Hz        | 50 - 60   |
| DC Supply Voltage Range <sup>2</sup>                      | VDC       | 127 - 373   |
| DC Bus Over Voltage Limit                                 | VDC       | 429   |
| DC Bus Under Voltage Limit                                | VDC       | 55  |
| Logic Supply Voltage                                      | VDC       | 20 - 30 (@ 850 mA)  |
| Maximum Peak Output Current <sup>3</sup>                  | A (Arms)  | 30 (21.2)   |
| Maximum Continuous Output Current <sup>4</sup>            | A (Arms)  | 15 (15)   |
| Max. Continuous Output Power @ Rated Voltage <sup>5</sup> | W         | 4831  |
| Max. Continuous Power Dissipation @ Rated Voltage         | W         | 254   |
| Internal Bus Capacitance                                  | µF        | 1410  |
| External Shunt Resistor Minimum Resistance                | Ω         | 20  |
| Minimum Load Inductance (Line-To-Line) <sup>6</sup>       | µH        | 600   |
| Switching Frequency                                       | kHz       | 20  |
| Maximum Output PWM Duty Cycle                             | %         | 100   |
| Internal Shunt Fuse Rating                                | A         | 3 A time-delay fuse   |
| 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  | -         | 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 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), cUL, RoHS II, UL  |
| Size (H x W x D)  | mm (in)   | 202 x 157 x 70 (8 x 6.2 x 2.8)  |
| Weight  | g (oz)    | 1722 (60.7)   |
| Heatsink (Base) Temperature Range <sup>7</sup>            | °C (°F)   | 0 - 75 (32 - 167)   |
| 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-contact, 11.10 mm spaced, dual-barrier terminal block   |

**Notes**

- Can operate on single-phase VAC if peak/cont. current ratings are reduced by at least 30%.
- DC Supply operation will reduce peak/cont. current ratings by at least 30%.
- 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.
- Continuous  $I_{Arms}$  value attainable when RMS Charge-Based Limiting is used.
- $P = (DC \text{ Rated Voltage}) * (Cont. RMS Current) * 0.95$ .
- Lower inductance is acceptable for bus voltages well below maximum. Use external inductance to meet requirements.
- Additional cooling and/or heatsink may be required to achieve rated performance.

**PIN FUNCTIONS**

| <b>+24V LOGIC - Logic Power Connector</b> |           |                     |     |
|---|-----------|---------------------|-----|
| Pin                                       | Name      | Description / Notes | I/O |
| 1   | LOGIC GND | Logic Supply Ground | GND |
| 2   | LOGIC PWR | Logic Supply Input  | I   |

| <b>AUX ENCODER - Auxiliary Feedback Connector</b> |                                      |  |      |
|---|--------------------------------------|--|------|
| 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    |

| <b>COMM - RS232/RS485 Communication Connector</b> |                      |  |      |
|---|----------------------|--|------|
| 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   | -    |

| <b>FEEDBACK - Feedback Connector</b> |            |   |      |
|--------------------------------------|------------|---|------|
| 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    |

| <b>I/O - Signal Connector</b> |                |  |      |
|-------------------------------|----------------|--|------|
| 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 |

| <b>POWER - Power Connector</b> |         |  |     |
|--------------------------------|---------|--|-----|
| 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+     | Brake Resistor DC+. Connection for brake resistor. | O   |
| 5                              | BR      | External Brake Resistor Connection                 | -   |
| 6                              | L1      | AC Supply Input (Single or Three Phase)            | I   |
| 7                              | L2      |  | 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*

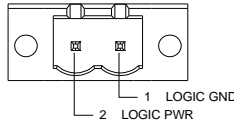
The drive can be configured to use the address and/or bit rate stored in non-volatile memory by setting the address and/or bit rate value to 0. Use the table below to map actual bit rates to a bit rate setting.

| 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**

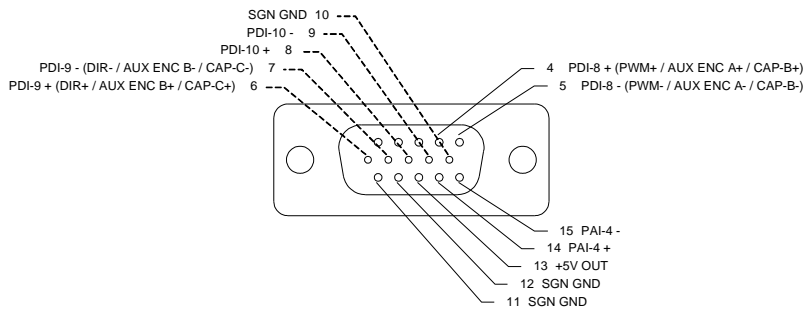
**+24V LOGIC - Logic Power Connector**

|                       |                     |   |
|-----------------------|---------------------|---|
| 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   |



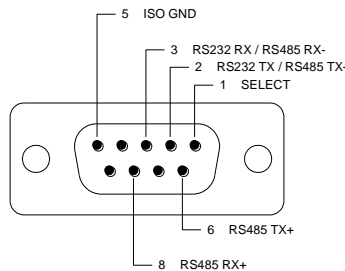
**AUX ENCODER - Auxiliary Feedback Connector**

|                       |                     |   |
|-----------------------|---------------------|---|
| 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  |



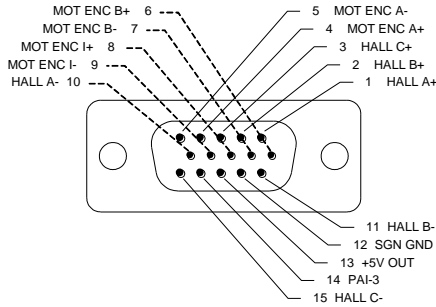
**COMM - RS232/RS485 Communication Connector**

|                       |                     |  |
|-----------------------|---------------------|--|
| 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   |



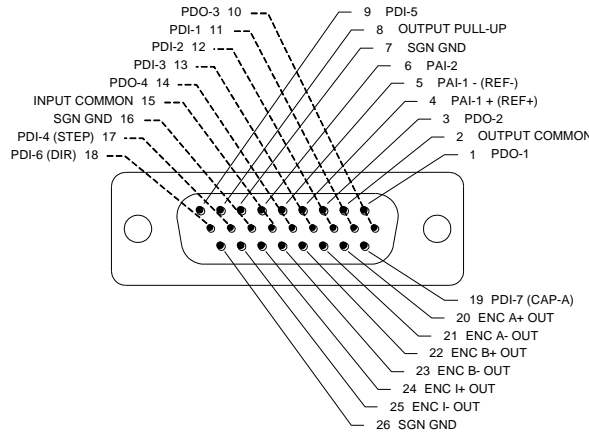
**FEEDBACK - Feedback Connector**

|                       |                     |  |
|-----------------------|---------------------|--|
| 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   |



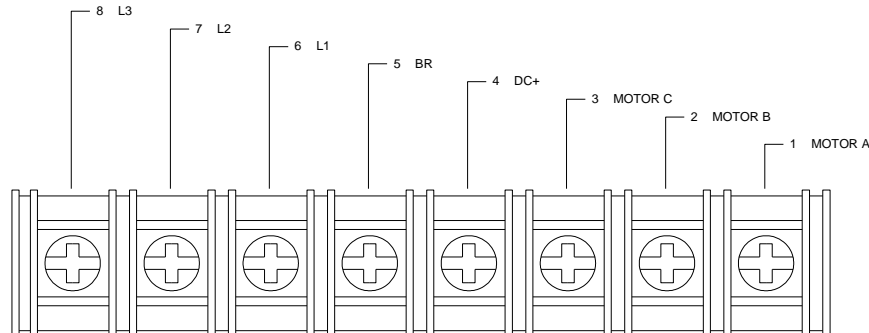
**I/O - Signal Connector**

|                       |                     |   |
|-----------------------|---------------------|---|
| 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  |



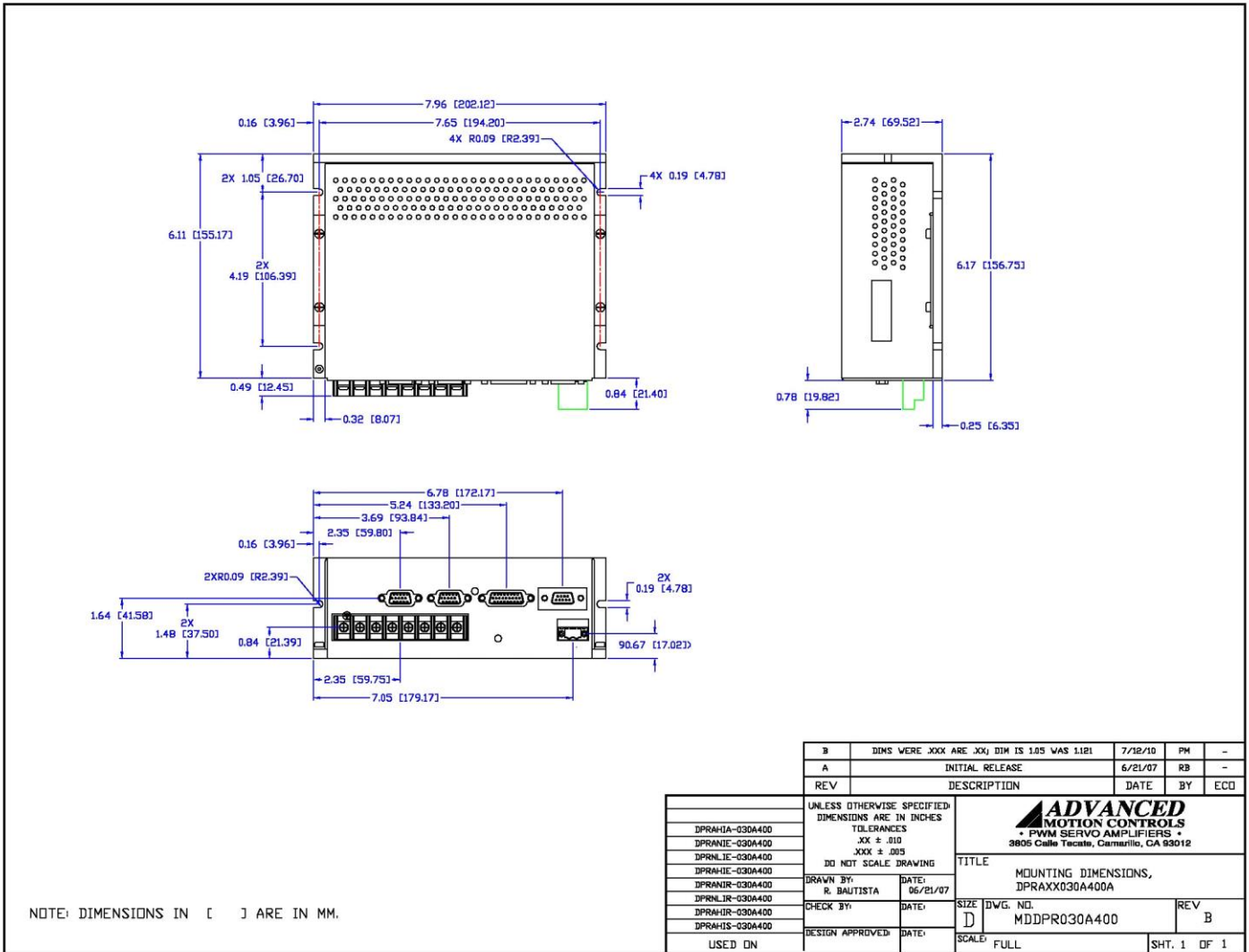
**POWER - Power Connector**

|                       |                     |   |
|-----------------------|---------------------|---|
| Connector Information |                     | 8-contact, 11.10 mm spaced, dual-barrier terminal block |
| Mating Connector      | Details             | Not applicable  |
|                       | Included with Drive | Not applicable  |





**MOUNTING DIMENSIONS**

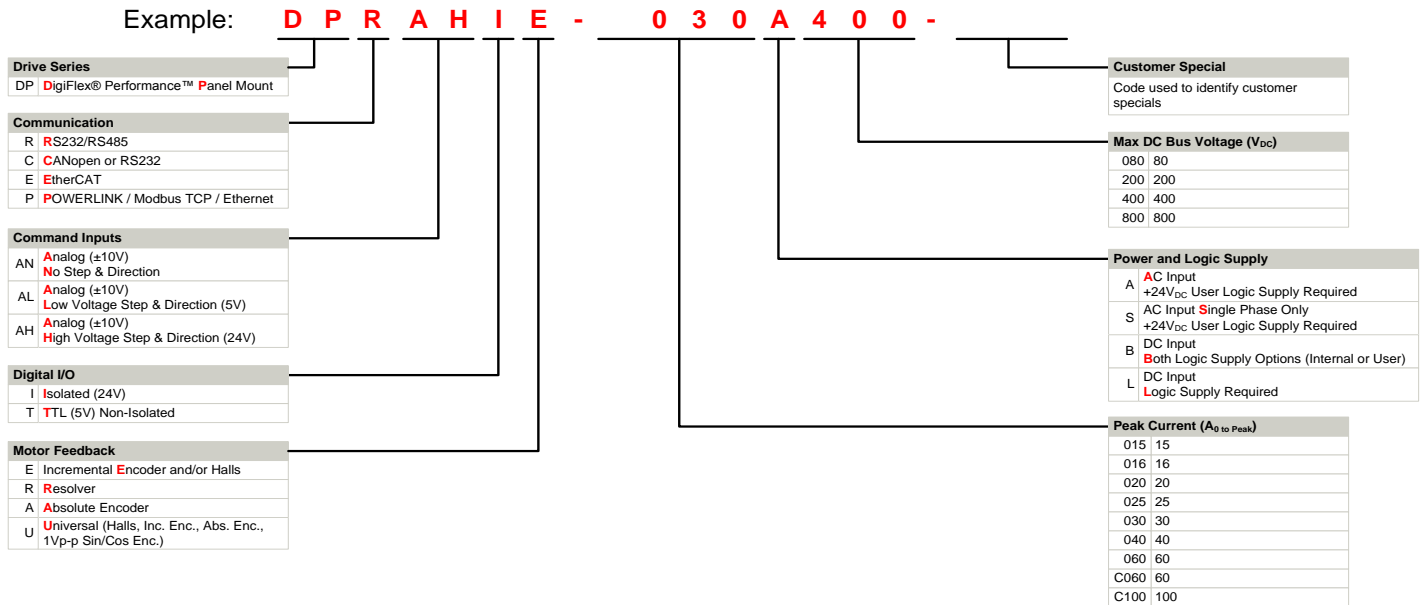


|     |  |         |    |     |
|-----|--|---------|----|-----|
| B   | DIMS WERE .XXX ARE .XX DIM IS 1.05 WAS 1.121 | 7/12/10 | PM | -   |
| A   | INITIAL RELEASE                              | 6/21/07 | RB | -   |
| REV | DESCRIPTION                                  | DATE    | BY | ECC |

|   |                   |  |             |
|---|-------------------|--|-------------|
| UNLESS OTHERWISE SPECIFIED:<br>DIMENSIONS ARE IN INCHES |                   | <br>• PWM SERVO AMPLIFIERS •<br>3805 Calle Tecate, Camarillo, CA 93012 |             |
| TOLERANCES<br>.XX ± .010<br>.XXX ± .005                 |                   |  |             |
| DO NOT SCALE DRAWING                                    |                   | TITLE<br>MOUNTING DIMENSIONS,<br>DPRAHIE030A400A                       |             |
| DRAWN BY:<br>R. BALTIISTA                               | DATE:<br>06/21/07 | SIZE<br>D  | REV<br>B    |
| CHECK BY:   | DATE:             | DWG. NO.<br>MDDPR030A400   |             |
| DESIGN APPROVED:  | DATE:             | SCALE:<br>FULL   | SHT. 1 OF 1 |

**PART NUMBERING INFORMATION**



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](http://www.a-m-c.com) to see which accessories will assist with your application design and implementation.



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