## 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 | 60 A (42.4 $A_{RMS}$) |
| Continuous Current | 30 A (21.2 $A_{RMS}$) |
| Supply Voltage | 200 - 480 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

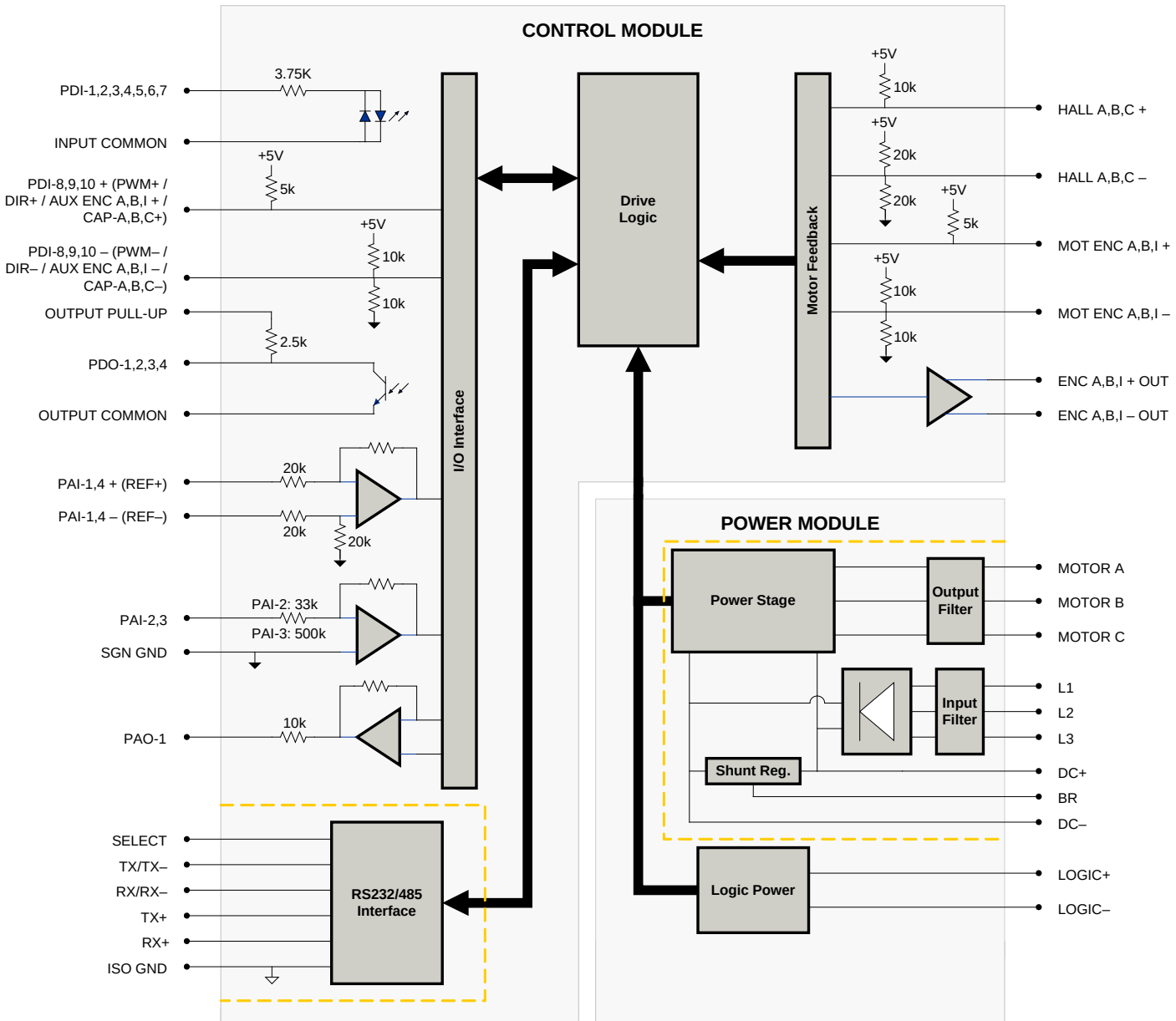
**COMMAND SOURCE**
- PWM and Direction
- Encoder Following
- Over the Network
- ±10 V Analog
- Sequencing
- Indexing
- Jogging

**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)
- 1 Programmable Analog Output (10-bit Resolution)
- 3 Programmable Digital Inputs (Differential)
- 7 Programmable Digital Inputs (Single-Ended)
- 4 Programmable Digital Outputs (Single-Ended)

**COMPLIANCES & AGENCY APPROVALS**
- CE Class A (LVD)
- CE Class A (EMC)
- RoHS

## BLOCK DIAGRAM




| Information on Approvals and Compliances | |
|---|---|
| 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. |

## SPECIFICATIONS

| Power Specifications | | |
|---|---|---|
| Description | Units | Value |
| Rated Voltage | VAC (VDC) | 480 (678) |
| AC Supply Voltage Range | VAC | 200 - 480 |
| AC Supply Minimum | VAC | 180 |
| AC Supply Maximum | VAC | 528 |
| AC Input Phases | - | 3 |
| AC Supply Frequency | Hz | 50 - 60 |
| DC Supply Voltage Range[1] | VDC | 255 - 747 |
| DC Bus Over Voltage Limit | VDC | 850 |
| DC Bus Under Voltage Limit | VDC | 230 |
| Logic Supply Voltage | VDC | 20 - 30 (@ 850 mA) |
| Maximum Peak Output Current[2] | A (Arms) | 60 (42.4) |
| Maximum Continuous Output Current | A (Arms) | 30 (21.2) |
| Max. Continuous Output Power @ Rated Voltage[3] | W | 13680 |
| Max. Continuous Power Dissipation @ Rated Voltage | W | 720 |
| Internal Bus Capacitance | µF | 330 |
| External Shunt Resistor Minimum Resistance[4] | Ω | 40 |
| Minimum Load Inductance (Line-To-Line)[5] | µH | 3000 |
| 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 | - | RS-485/232 |
| Command Sources | - | ±10 V Analog, 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) | - | 4/1 |
| 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 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), RoHS |
| Size (H x W x D) | mm (in) | 300.5 x 232.1 x 139.3 (11.8 x 9.1 x 5.5) |
| Weight | g (oz) | 6163 (217.4) |
| Heatsink (Base) Temperature Range[6] | °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 |
| AUX ENCODER Connector | - | 15-pin, high-density, male D-sub |
| COMM Connector | - | 9-pin, female D-sub |
| DC BUS Connector | - | 4-port, 7.62 mm spaced, enclosed, friction lock header |
| FEEDBACK Connector | - | 15-pin, high-density, female D-sub |
| I/O Connector | - | 26-pin, high-density, female D-sub |
| MOTOR POWER Connector | - | 4-port, 7.62 mm spaced, enclosed, friction lock header |
| POWER Connector | - | 3-port, 7.62 mm spaced, enclosed, friction lock header |

**Notes**

1. DC supply operation through the L1, L2, or L3 terminals will reduce peak/cont. current ratings by 30%. See installation manual for details.
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. P = (DC Rated Voltage) * (Cont. RMS Current) * 0.95.
4. *ADVANCED* Motion Controls recommends using an external fuse in series with the shunt resistor. A 3 amp motor delay fuse is typical.
5. Lower inductance is acceptable for bus voltages well below maximum. Use external inductance to meet requirements.
6. 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 PWR | Logic Supply Input | I |
| 2 | LOGIC GND | Logic Supply Ground | GND |

**AUX ENCODER - Auxiliary Feedback Connector**

| Pin | Name | Description / Notes | I/O |
|---|---|---|---|
| 1 | RESERVED | Reserved | - |
| 2 | RESERVED | Reserved | - |
| 3 | RESERVED | Reserved | - |
| 4 | PDI-8 + (PWM+ / AUX ENC A+ / CAP-B+) | Programmable Digital Input or PWM or Auxiliary Encoder or High Speed Capture (For Single-Ended Signals Leave Negative Terminal Open) | I |
| 5 | PDI-8 - (PWM- / AUX ENC A- / CAP-B-) | | I |
| 6 | PDI-9 + (DIR+ / AUX ENC B+ / CAP-C+) | Programmable Digital Input or Direction Input or Auxiliary Encoder or High Speed Capture (For Single-Ended Signals Leave Negative Terminal Open) | I |
| 7 | PDI-9 - (DIR- / AUX ENC B- / CAP-C-) | | I |
| 8 | PDI-10 + (AUX ENC I+ / CAP-A+) | Programmable Digital Input or Auxiliary Encoder or High Speed Capture (For Single-Ended Signals Leave Negative Terminal Open) | I |
| 9 | PDI-10 - (AUX ENC I- / CAP-A-) | | I |
| 10 | SGN GND | Signal Ground | SGND |
| 11 | SGN GND | Signal Ground | SGND |
| 12 | SGN GND | Signal Ground | SGND |
| 13 | +5V OUT | +5V Encoder Supply Output (Short Circuit Protected) | O |
| 14 | PAI-4 + | Differential Programmable Analog Input (12-bit Resolution) | I |
| 15 | PAI-4 - | | I |

**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 | - |

**DC BUS - Power Connector**

| Pin | Name | Description / Notes | I/O |
|---|---|---|---|
| 1 | DC- | Internal DC Bus Voltage (Can Be Used To Connect External Shunt Regulator) | I/O |
| 2 | BR | External Brake Resistor Connection | - |
| 3 | DC+ | Brake Resistor DC+. Connection for brake resistor. | O |
| 4 | DC+ | Internal DC Bus Voltage (Can Be Used To Connect External Shunt Regulator) | I/O |

**FEEDBACK - Feedback Connector**

| 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 |

**I/O - Signal Connector**

| Pin | Name | Description / Notes | I/O |
|---|---|---|---|
| 1 | PDO-1 | Isolated Programmable Digital Output | O |
| 2 | OUTPUT COMMON | Digital Output Common | OGND |
| 3 | PDO-2 | Isolated Programmable Digital Output | O |
| 4 | PAI-1 + (REF+) | Differential Programmable Analog Input or Reference Signal Input (16-bit Resolution) | I |
| 5 | PAI-1 - (REF-) | | I |
| 6 | PAI-2 | Programmable Analog Input (12-bit Resolution) | I |
| 7 | PAO-1 | Programmable Analog Output (10-bit Resolution) | O |
| 8 | OUTPUT PULL-UP | Digital Output Pull-Up For User Outputs | I |
| 9 | PDI-5 | Isolated Programmable Digital Input | I |
| 10 | PDO-3 | Isolated Programmable Digital Output | O |
| 11 | PDI-1 | Isolated Programmable Digital Input | I |
| 12 | PDI-2 | Isolated Programmable Digital Input | I |
| 13 | PDI-3 | Isolated Programmable Digital Input | I |
| 14 | PDO-4 | Isolated Programmable Digital Output | O |
| 15 | INPUT COMMON | Digital Input Common (Can Be Used To Pull-Up Digital Inputs) | IGND |
| 16 | SGN GND | Signal Ground | SGND |
| 17 | PDI-4 | Isolated Programmable Digital Input | I |
| 18 | PDI-6 | Isolated Programmable Digital Input | I |
| 19 | PDI-7 | Isolated Programmable Digital Input | I |
| 20 | ENC A+ OUT | 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 |

**MOTOR POWER - Power Connector**

| Pin | Name | Description / Notes | I/O |
|---|---|---|---|
| 1 | SHIELD | Motor cable shield. Internally connected to protective earth ground. | - |
| 2 | MOTOR C | Motor Phase C | O |
| 3 | MOTOR B | Motor Phase B | O |
| 4 | MOTOR A | Motor Phase A | O |

**POWER - Power Connector**

| Pin | Name | Description / Notes | I/O |
|---|---|---|---|
| 1 | L3 | AC Supply Input (Three Phase) | I |
| 2 | L2 | | I |
| 3 | L1 | | 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 |

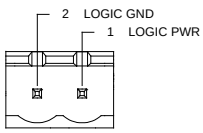
*Additional Details*

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.

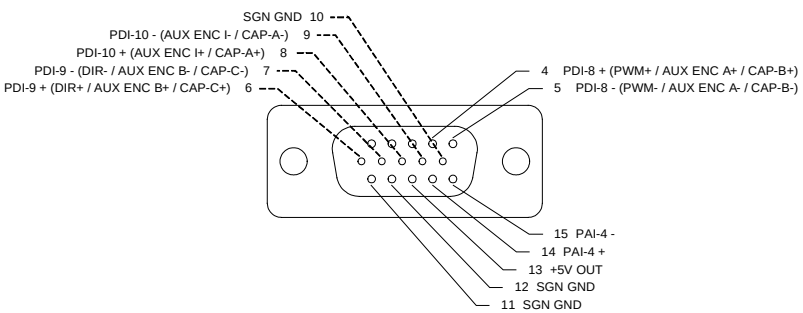
| Baud Rate (kbps) | Value For Bit Rate Setting |
|---|---|
| Load from non-volatile memory | 0 |
| 9.6 | 1 |
| 38.4 | 2 |
| 115.2 | 3 |

## MECHANICAL INFORMATION

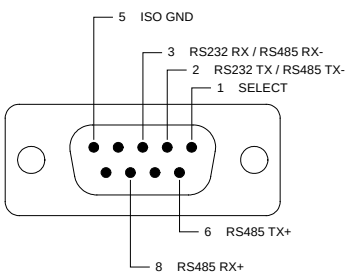
| +24V LOGIC - Logic Power Connector | | |
|---|---|---|
| Connector Information | | 2-port, 5.08 mm spaced, enclosed, friction lock header |
| Mating Connector | Details | Phoenix Contact: P/N 1757019 |
| | Included with Drive | Yes |



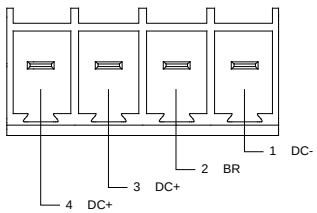

| AUX ENCODER - Auxiliary Feedback Connector | | |
|---|---|---|
| Connector Information | | 15-pin, high-density, male D-sub |
| Mating Connector | Details | TYCO: Plug P/N 1658681-1; Housing P/N 5748677-1; Terminals P/N 1658686-2 (loose) or 1658686-1 (strip) |
| | Included with Drive | No |



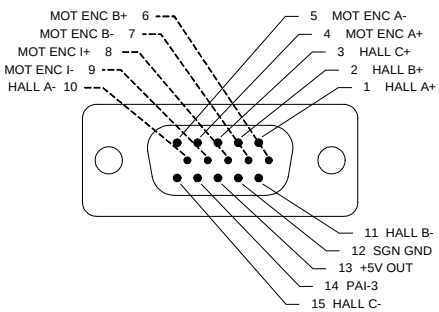

| COMM - RS232/RS485 Communication Connector | | |
|---|---|---|
| Connector Information | | 9-pin, female D-sub |
| Mating Connector | Details | TYCO: Plug P/N 205204-4; Housing P/N 5748677-1; Terminals P/N 1658540-5 (loose) or 1658540-4 (strip) |
| | Included with Drive | No |



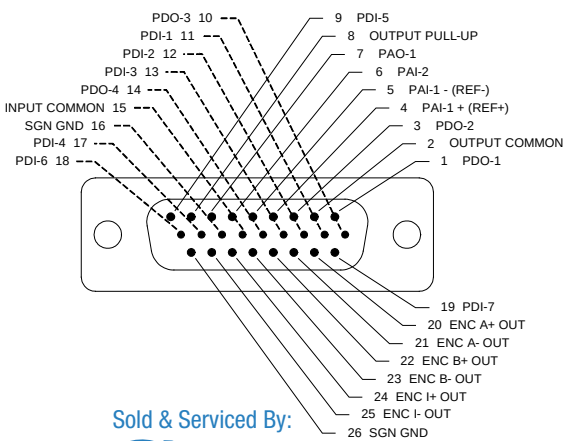
| DC BUS - Power Connector | | |
|---|---|---|
| Connector Information | | 4-port, 7.62 mm spaced, enclosed, friction lock header |
| Mating Connector | Details | Phoenix Contact: P/N 1804920 |
| | Included with Drive | Yes |



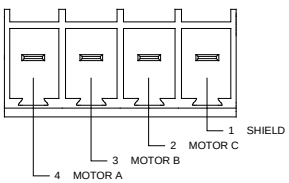

| FEEDBACK - Feedback Connector | | |
|---|---|---|
| Connector Information | | 15-pin, high-density, female D-sub |
| Mating Connector | Details | TYCO: Plug P/N 748364-1; Housing P/N 5748677-1; Terminals P/N 1658670-2 (loose) or 1658670-1 (strip) |
| | Included with Drive | No |



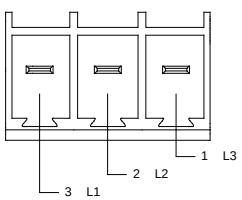

| I/O - Signal Connector | | |
|---|---|---|
| Connector Information | | 26-pin, high-density, female D-sub |
| Mating Connector | Details | TYCO: Plug P/N 1658671-1; Housing P/N 5748677-2; Terminals P/N 1658670-2 (loose) or 1658670-1 (strip) |
| | Included with Drive | No |



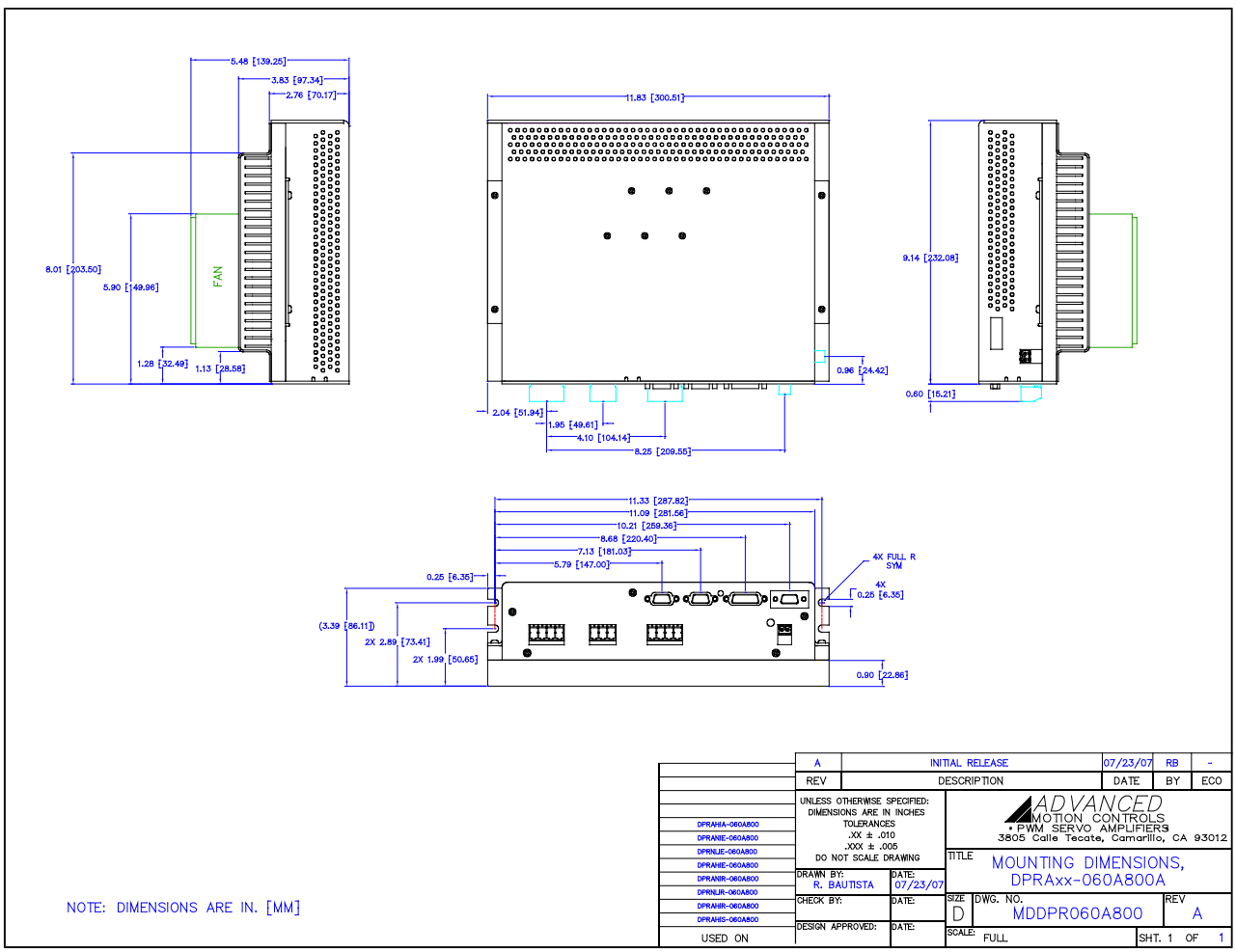
| MOTOR POWER - Power Connector | | |
|---|---|---|
| Connector Information | | 4-port, 7.62 mm spaced, enclosed, friction lock header |
| Mating Connector | Details | Phoenix Contact: P/N 1804920 |
| | Included with Drive | Yes |




| POWER - Power Connector | | |
|---|---|---|
| Connector Information | | 3-port, 7.62 mm spaced, enclosed, friction lock header |
| Mating Connector | Details | Phoenix Contact: P/N 1804917 |
| | Included with Drive | Yes |



## MOUNTING DIMENSIONS



## PART NUMBERING INFORMATION

Example: D P R A N I E - 0 6 0 A 8 0 0 -

| Drive Series | |
|---|---|
| DP | DigiFlex Performance |

| Communication | |
|---|---|
| R | RS232/RS485 |
| C | CANopen or RS232 |
| E | EtherCAT |
| P | Ethernet Powerlink or TCP/IP |

| Command Inputs | |
|---|---|
| AN | Analog (±10V)<br>No Step & Direction |
| AL | Analog (±10V)<br>Low Voltage Step & Direction (5V) |
| AH | Analog (±10V)<br>High Voltage Step & Direction (24V) |
| NL | No Analog<br>Low Voltage Step & Direction (5V) |
| NN | No Analog, No Step & Direction<br>(Communication Interface Only) |

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

| Motor Feedback | |
|---|---|
| E | Incremental Encoder and/or Halls |
| R | Resolver |
| A | Absolute Sin/Cos (Hiperface & Endat) |
| S | Sin/Cos with Halls |
| 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<br>+24$V_{DC}$ User Logic Supply Required |
| S | AC Input Single Phase Only<br>+24$V_{DC}$ User Logic Supply Required |
| B | DC Input<br>Both Logic Supply Options (Internal or User) |
| L | DC Input<br>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.

Drive(s)

Filter Cards

To Motor