

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.

The DPR Hardware Installation Manual is available for download from 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 (30 A _{RMS}) |
| AC Supply Voltage | 200 - 240 VAC |
| DC Supply Voltage | 255 - 373 VDC |



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

- Current
- Position
- Velocity

COMMAND SOURCE

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

FEEDBACK SUPPORTED

- Resolver
- ±10 VDC Position
- Auxiliary Incremental Encoder
- Tachometer (±10 VDC)

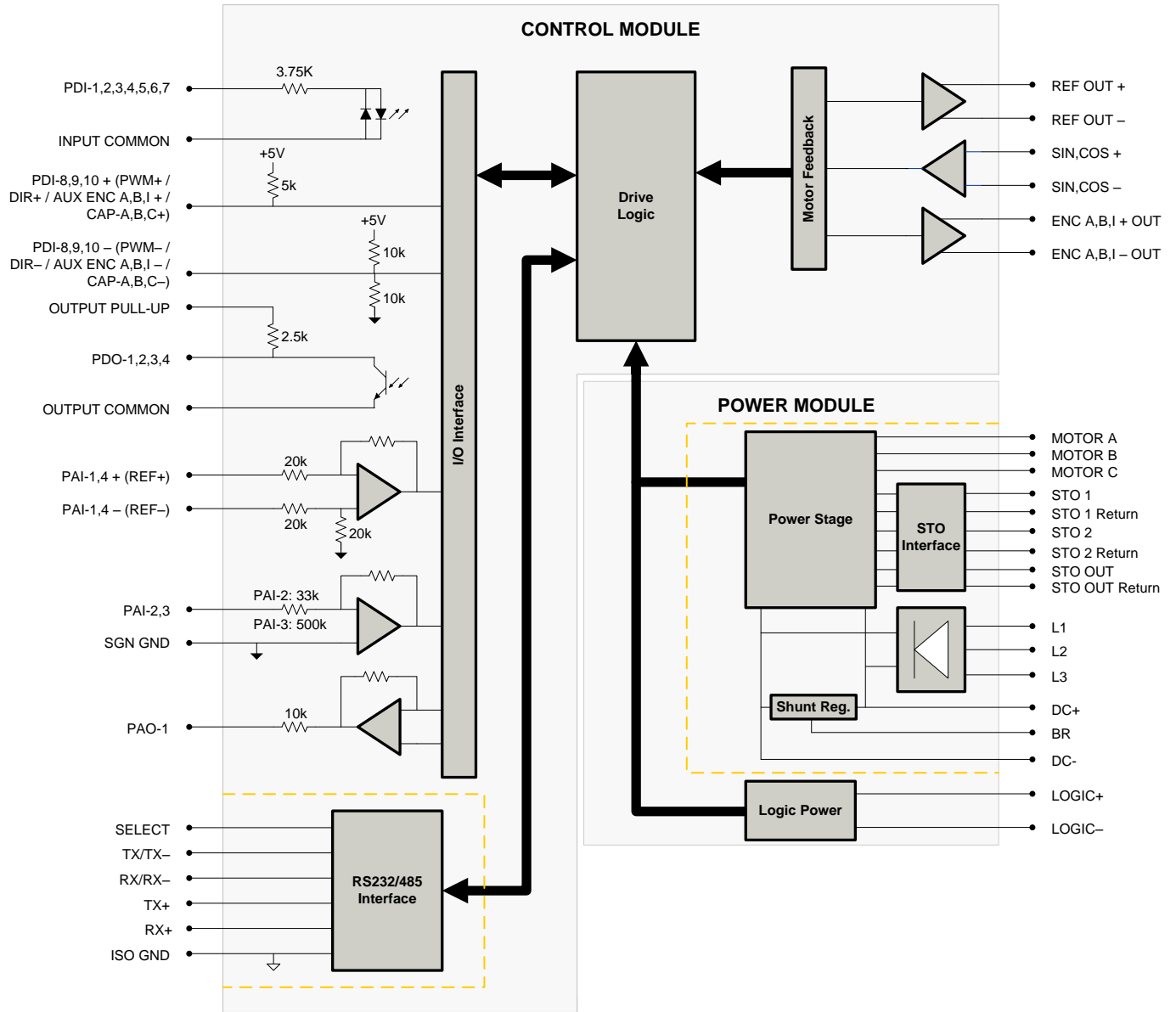
INPUTS/OUTPUTS

- 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

- UL
- cUL
- CE Class A (LVD)
- CE Class A (EMC)
- RoHS II
- TÜV Rheinland® (STO)

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 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).</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> |
|  | <p>Functional Safety STO is TÜV Rheinland® certified and meets requirements of the following standards:</p> <ul style="list-style-type: none"> • EN ISO 13849-1 Category 4 / PL e • EN IEC 61800-5-2 STO (SIL 3) • EN62061 SIL CL3 • IEC 61508 SIL 3 |

SPECIFICATIONS

| Description | | Units | Value |
|--|-----------|---|-------|
| Power Specifications | | | |
| 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 (@ 850 mA) | |
| Safe Torque Off Voltage | VDC | 24 (±6) | |
| Maximum Peak Output Current ³ | A (Arms) | 60 (42.4) | |
| Maximum Continuous Output Current ⁴ | A (Arms) | 30 (30) | |
| Max. Continuous Output Power @ Rated Voltage ⁵ | W | 9662 | |
| Max. Continuous Power Dissipation @ Rated Voltage | W | 509 | |
| Internal Bus Capacitance | µF | 1120 | |
| External Shunt Resistor Minimum Resistance ⁶ | Ω | 20 | |
| Minimum Load Inductance (Line-To-Line) ⁷ | µH | 600 | |
| Switching Frequency | kHz | 14 | |
| Maximum Output PWM Duty Cycle | % | 100 | |
| 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, Encoder Following, Over the Network, PWM and Direction, Sequencing, Indexing, Jogging | |
| Feedback Supported | - | ±10 VDC Position, Auxiliary Incremental Encoder, Resolver, 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) | - | 4/1 | |
| Primary I/O Logic Level | - | 24 VDC | |
| Current Loop Sample Time | µs | 71.4 | |
| Velocity Loop Sample Time | µs | 142.9 | |
| Position Loop Sample Time | µs | 142.9 | |
| Resolver Reference/Excitation Signal | Vrms | 4 Vrms @ 5 kHz | |
| Expected Resolver Transformation Ratio | Vrms | 0.5 | |
| Feedback Resolution / Emulated Encoder Resolution ⁸ | bit | High Res: 14 (16384 counts/resolver cycle), Low Res: 12 (4096 counts/resolver cycle) | |
| Maximum Motor Speed Per Feedback Resolution | RPM | High Res: 5000, Low Res: 20000 | |
| 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, TÜV Rheinland® (STO), UL | |
| Size (H x W x D) | mm (in) | 256.50 x 181.0 x 83.70 (10.10 x 7.13 x 3.30) | |
| Weight | g (oz) | 2812.3 (99.2) | |
| Heatsink (Base) Temperature Range ⁹ | °C (°F) | 0 - 75 (32 - 167) | |
| Storage Temperature Range | °C (°F) | -40 - 85 (-40 - 185) | |
| Form Factor | - | Panel Mount | |
| Cooling System | - | Natural Convection | |
| +24V LOGIC Connector | - | 2-port, 3.5 mm spaced insert connector | |
| FAN 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 | |
| FEEDBACK Connector | - | 15-pin, high-density, female D-sub | |
| I/O Connector | - | 26-pin, high-density, female D-sub | |
| 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.
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. $P = (DC \text{ Rated Voltage}) * (Cont. RMS Current) * 0.95$.
6. *ADVANCED* Motion Controls recommends using an external fuse in series with an external shunt resistor. A 5 amp time delay fuse is typical.
7. Lower inductance is acceptable for bus voltages well below maximum. Use external inductance to meet requirements.
8. Higher and lower resolution options are available. Contact Applications Engineering for more information.
9. Additional cooling and/or heatsink may be required to achieve rated performance.

PIN FUNCTIONS
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 | RESERVED | Reserved | - |
| 2 | RESERVED | Reserved | - |
| 3 | RESERVED | Reserved | - |
| 4 | REF OUT + | Resolver Reference/Excitation Output | O |
| 5 | REF OUT - | | O |
| 6 | SIN+ | Resolver Sine Input | I |
| 7 | SIN- | | I |
| 8 | COS+ | Resolver Cosine Input | I |
| 9 | COS- | | I |
| 10 | RESERVED | Reserved | - |
| 11 | RESERVED | Reserved | - |
| 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 | RESERVED | Reserved | - |

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 | 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 |

Logic Power Connector

| Pin | Name | Description / Notes | I/O |
|-----|-----------|---------------------|------|
| 1 | LOGIC GND | Logic Supply Ground | SGND |
| 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-) | Programmable Digital Input or PWM or Auxiliary Encoder or High Speed Capture (For Single-Ended Signals Leave Negative Terminal Open) | 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-) | Programmable Digital Input or Direction Input or Auxiliary Encoder or High Speed Capture (For Single-Ended Signals Leave Negative Terminal Open) | 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-) | Programmable Digital Input or Auxiliary Encoder or High Speed Capture (For Single-Ended Signals Leave Negative Terminal Open) | 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 |

Fan Power Connector

| Pin | Name | Description / Notes | I/O |
|-----|---------|---------------------|-----|
| 1 | FAN GND | Fan Ground | GND |
| 2 | FAN PWR | Fan Power 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 |

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 |

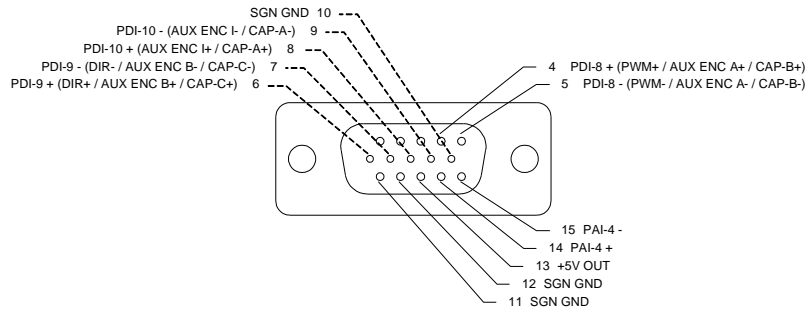
Safe Torque Off (STO) Inputs

The Safe Torque Off (STO) Inputs are dedicated +24VDC max sinking single-ended inputs. A dedicated STO Disable Key connector is included and should be installed for applications where STO is not required.

MECHANICAL INFORMATION

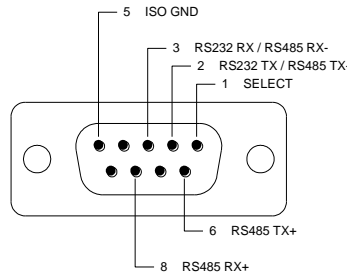
AUX ENCODER - Auxiliary Feedback Connector

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



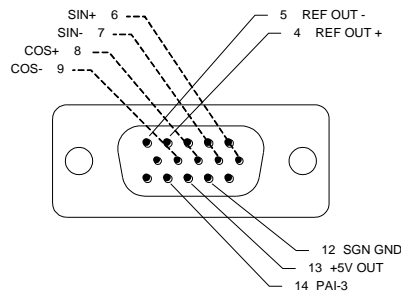
COMM - RS232/RS485 Communication Connector

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



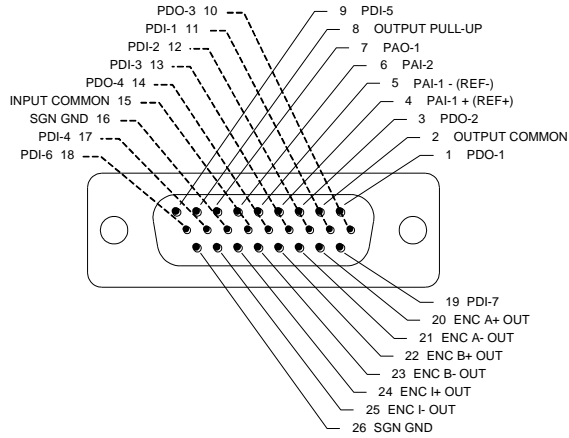
FEEDBACK - Feedback Connector

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



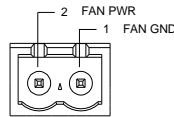
I/O - Signal Connector

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



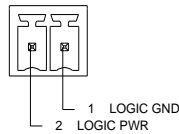
Fan Power Connector

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



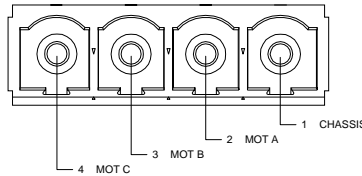
Logic Power Connector

| | | |
|-----------------------|---------------------|--|
| Connector Information | | 2-port, 3.5 mm spaced insert connector |
| Mating Connector | Details | Phoenix Contact: P/N 1840366 |
| | Included with Drive | Yes |



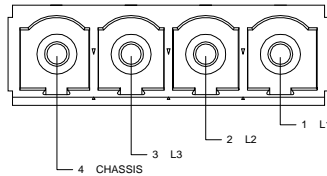
Motor Power Connector

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



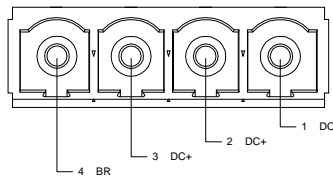
AC Power Connector

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



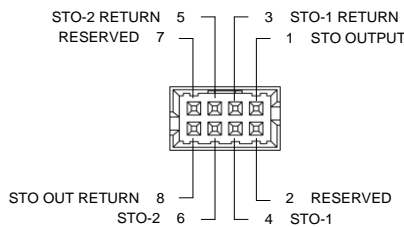
DC Power Connector

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

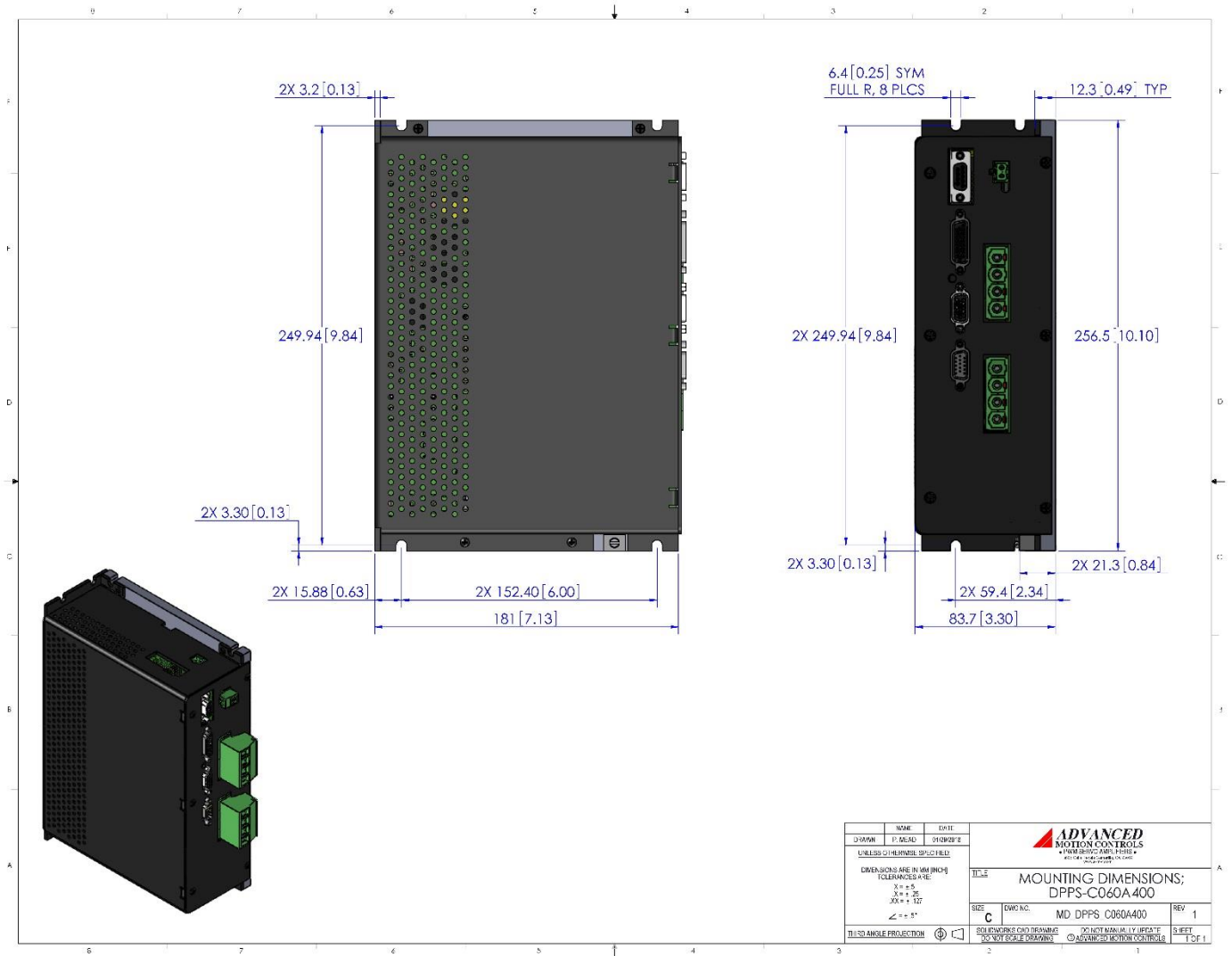


STO – Safe Torque Off Connector

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

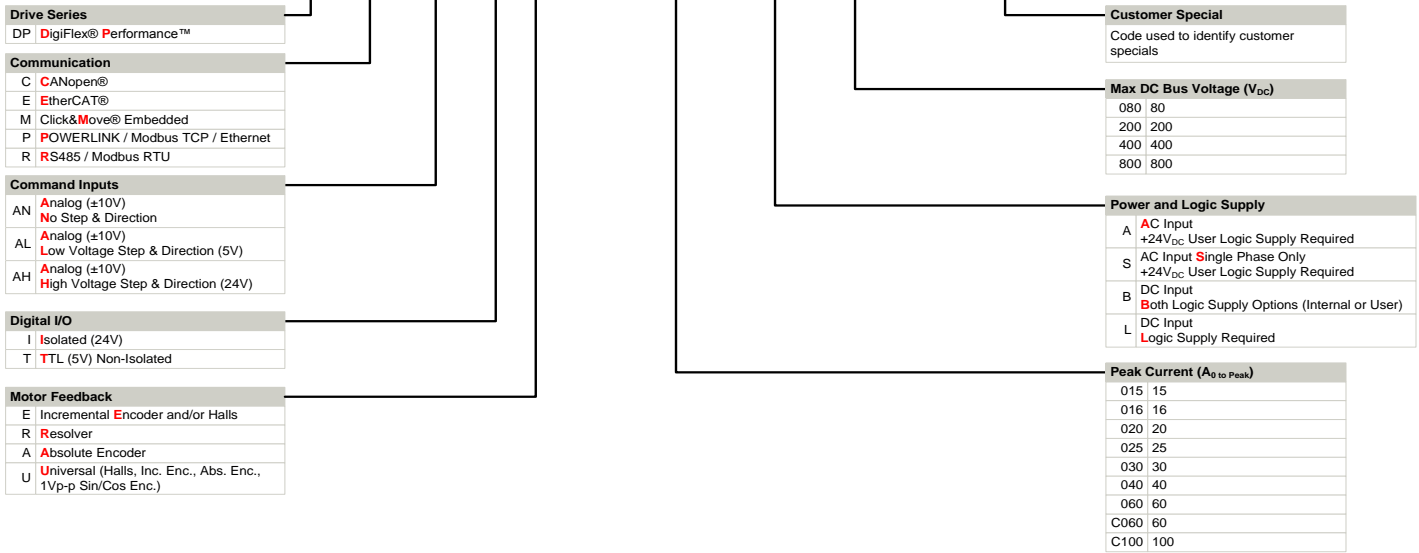


MOUNTING DIMENSIONS



PART NUMBERING INFORMATION

Example: **D P R A N I R - C 0 6 0 A 4 0 0 -**



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.

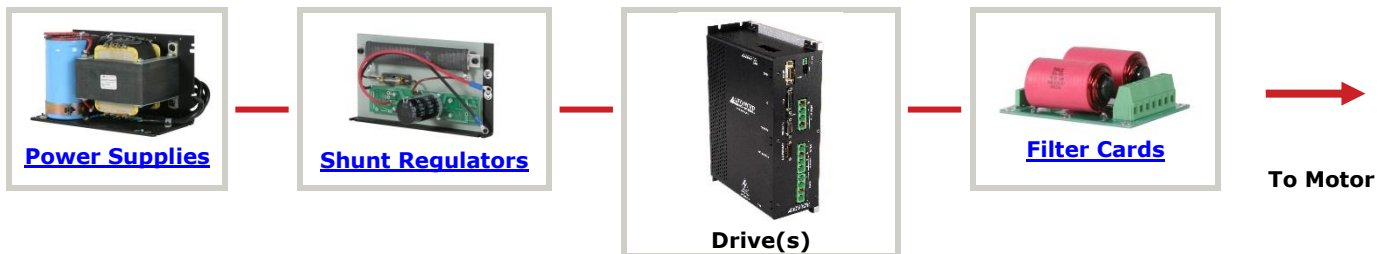
ADVANCED Motion Controls also has the capability to promptly develop and deliver specified products for OEMs with volume requests. Our Applications and Engineering Departments will work closely with your design team through all stages of development in order to provide the best servo drive solution for 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.



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