## Description

The DZRALTE-060L080 digital servo drive is designed to drive brushed and brushless servomotors from a compact form factor ideal for embedded applications. This fully digital drive operates in torque, velocity, or position mode and employs 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, this drive features 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 DZR Series drive features a single serial interface used for drive commissioning via DriveWare® 7, available for download at www.a-m-c.com.

The DZ 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 $A_{RMS}$) |
| Supply Voltage | 10 - 80 VDC |


Modbus

## 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
- 12-bit Analog to Digital Hardware
- On-the-Fly Mode Switching
- On-the-Fly Gain Set Switching

### MODES OF OPERATION
- Current
- Hall Velocity
- Position
- Velocity

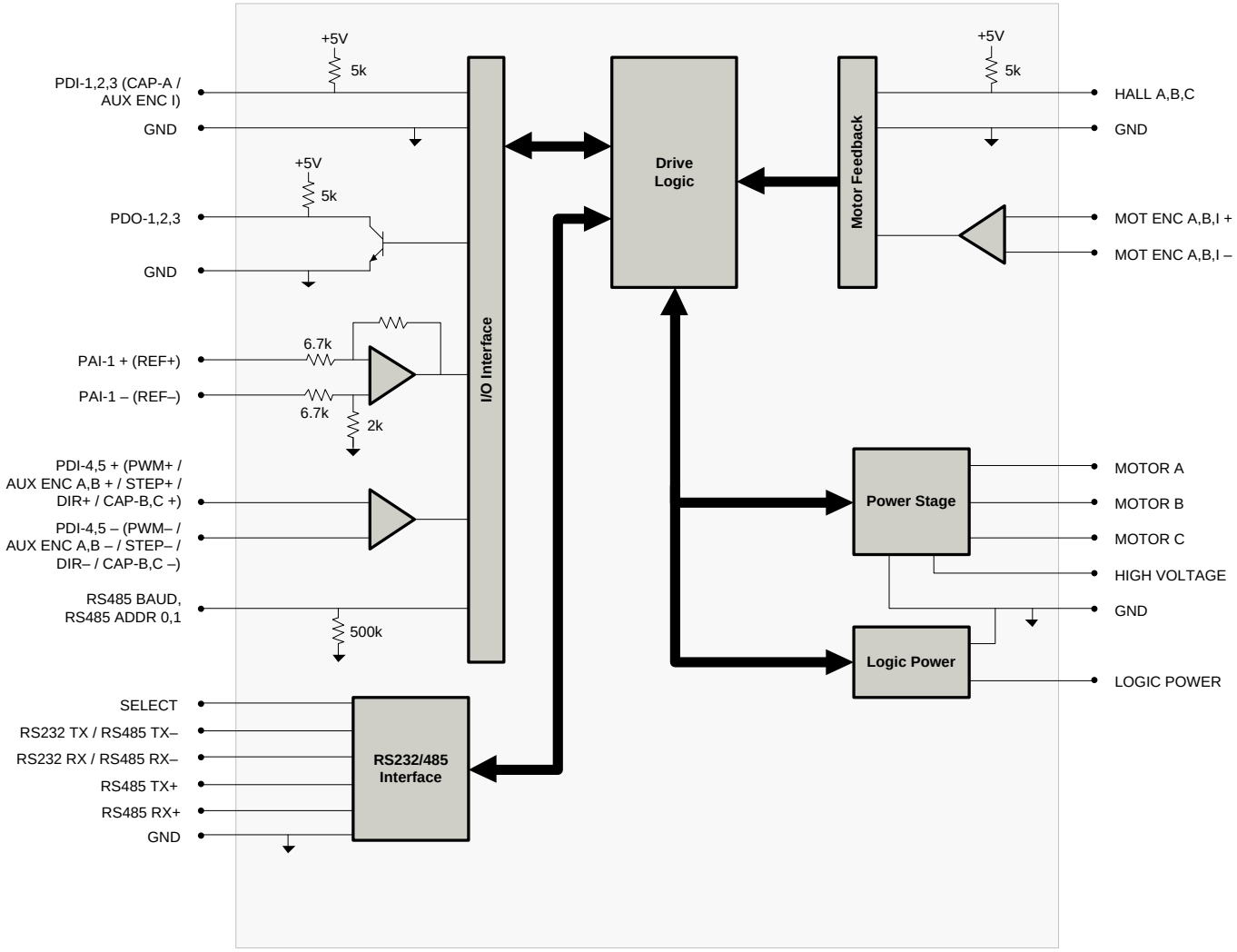
### COMMAND SOURCE
- PWM and Direction
- Encoder Following
- Over the Network
- ±10 V Analog
- 5V Step and Direction
- Sequencing
- Indexing
- Jogging

### FEEDBACK SUPPORTED
- Halls
- Incremental Encoder
- ±10 VDC Position
- Auxiliary Incremental Encoder

### INPUTS/OUTPUTS
- 3 High Speed Captures
- 1 Programmable Analog Input (12-bit Resolution)
- 2 Programmable Digital Inputs (Differential)
- 3 Programmable Digital Inputs (Single-Ended)
- 3 Programmable Digital Outputs (Single-Ended)

### COMPLIANCES & AGENCY APPROVALS
- UL
- cUL
- CE Class A (LVD)
- CE Class A (EMC)
- RoHS

## BLOCK DIAGRAM




| Information on Approvals and Compliances | |
|---|---|
| c UL us | 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 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).<br>LVD requirements of Directive 2006/95/EC (specifically, EN 60204-1:2004, 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 |
| DC Supply Voltage Range | VDC | 10 - 80 |
| DC Bus Over Voltage Limit | VDC | 88 |
| DC Bus Under Voltage Limit | VDC | 8 |
| Logic Supply Voltage | VDC | 5 (+/- 5%) |
| Maximum Peak Output Current[1] | A (Arms) | 60 (42.4) |
| Maximum Continuous Output Current[2] | A (Arms) | 30 (30) |
| Maximum Continuous Output Power | W | 2280 |
| Maximum Power Dissipation at Continuous Current | W | 120 |
| Internal Bus Capacitance[3] | µF | 30 |
| Minimum Load Inductance (Line-To-Line)[4] | µH | 250 (at 80 V supply); 150 (at 48 V supply); 75 (at 24 V supply); 40 (at 12 V supply) |
| Switching Frequency | kHz | 20 |
| Maximum Output PWM Duty Cycle | % | 92 |
| **Control Specifications** | | |
| Description | Units | Value |
| Communication Interfaces | - | RS-485/232 / Modbus RTU |
| Command Sources | - | ±10 V Analog, 5V 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 |
| 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) | - | 5/3 |
| Programmable Analog Inputs/Outputs (PAIs/PAOs) | - | 1/0 |
| Primary I/O Logic Level | - | 5V TTL |
| 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) |
| **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) | 76.2 x 50.8 x 22.9 (3.0 x 2.0 x 0.9) |
| Weight | g (oz) | 123.9 (4.4) |
| Minimum Heatsink (Base) Temperature Range[5] | °C (°F) | 0 - 60 (32 - 140) |
| Storage Temperature Range | °C (°F) | -40 - 85 (-40 - 185) |
| Cooling System | - | Natural Convection |
| Form Factor | - | PCB Mounted |
| P1 Connector | - | 30-pin, 2.54 mm spaced, dual-row header |
| P2 Connector | - | 24-pin, 2.54 mm spaced, dual-row header |
| P3 Connector | - | 24-pin, 2.54 mm spaced, dual-row header |

**Notes**

1. 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.
2. Continuous $A_{rms}$ value attainable when RMS Charge-Based Limiting is used.
3. Requires an additional external 470µF, 100V capacitor on the power supply line bewteen High Voltage and Power Ground close to the drive.
4. Lower inductance is acceptable for bus voltages well below maximum. Use external inductance to meet requirements.
5. Thermal shutdown when PCB temperature reaches 75°C. The base plate temperature at this point may be between 60°C and 75°C depending on rate of base plate cooling (additional heat sinking), ambient temperature, and output current.

## PIN FUNCTIONS

| P1 - Signal Connector | | | |
|---|---|---|---|
| Pin | Name | Description / Notes | I/O |
| 1 | RS485 ADDR 0 | RS-485 Network Address Selector | I |
| 2 | RS485 ADDR 1 | | I |
| 3 | PAI-1 + (REF+) | Differential Programmable Analog Input or Reference Signal Input (12-bit Resolution) | I |
| 4 | PAI-1 - (REF-) | | I |
| 5 | GND | Ground | GND |
| 6 | RS485 BAUD | RS-485 Baud Rate Selector | I |
| 7 | PDO-1 | Programmable Digital Output | O |
| 8 | PDO-2 | Programmable Digital Output | O |
| 9 | PDO-3 | Programmable Digital Output | O |
| 10 | PDI-1 | Programmable Digital Input | I |
| 11 | PDI-2 | Programmable Digital Input | I |
| 12 | PDI-3 (CAP-A / AUX ENC I) | Programmable Digital Input or High Speed Capture or Auxiliary Encoder Index | I |
| 13 | RS232 RX / RS485 RX- | Receive Line (RS-232 or RS-485) | I |
| 14 | RS485 RX+ | Receive Line (RS-485) | I |
| 15 | RS232 TX / RS485 TX- | Transmit Line (RS-232 or RS-485) | O |
| 16 | RS485 TX+ | Transmit Line (RS-485) | O |
| 17 | PDI-4 + (PWM+ / STEP+ / AUX ENC A+ / CAP-B+) | Programmable Digital Input or PWM or Step+ or Auxiliary Encoder or High Speed Capture (For Single-Ended Signals see DZ HW Installation Manual) | I |
| 18 | PDI-4 - (PWM- / STEP- / AUX ENC A- / CAP-B-) | | I |
| 19 | PDI-5 + (DIR+ / AUX ENC B+ / CAP-C+) | Programmable Digital Input or Direction or Auxiliary Encoder or High Speed Capture (For Single-Ended Signals see DZ HW Installation Manual) | I |
| 20 | PDI-5 - (DIR- / AUX ENC B- / CAP-C-) | | I |
| 21 | GND | Ground | GND |
| 22 | HALL A | Single-ended Commutation Sensor Input | I |
| 23 | HALL B | | I |
| 24 | HALL C | | I |
| 25 | MOT ENC I+ | Differential Encoder Index Input (see MC1XDZR02-HP1 datasheet for recommended signal conditioning) | I |
| 26 | MOT ENC I- | | I |
| 27 | MOT ENC A+ | Differential Encoder A Channel Input (see MC1XDZR02-HP1 datasheet for recommended signal conditioning) | I |
| 28 | MOT ENC A- | | I |
| 29 | MOT ENC B+ | Differential Encoder B Channel Input (see MC1XDZR02-HP1 datasheet for recommended signal conditioning) | I |
| 30 | MOT ENC B- | | I |

| P2 and P3 - Power Connector | | | | |
|---|---|---|---|---|
| Pin | | Name | Description / Notes | I/O |
| 1a | | LOGIC PWR | Logic Supply Input (P2 only; Reserved on P3) | I |
| | 1b | RESERVED | Reserved | - |
| 2a | 2b | GND | Ground | GND |
| 3a | 3b | GND | | GND |
| 4a | 4b | HIGH VOLTAGE | DC Power Input. 3A Continuous Current Rating Per Pin. 470µF, 100V external capacitor required between High Voltage and Ground. | I |
| 5a | 5b | HIGH VOLTAGE | | I |
| 6a | 6b | RESERVED | Reserved | - |
| 7a | 7b | MOTOR C | Motor Phase Outputs. Current output distributed equally across both P2 and P3 connectors – 8 pins per motor phase. At ambient temperatures above 50ºC, 3A continuous current carrying capacity per pin. At 25ºC ambient, 6A continuous current carrying capacity per pin. | O |
| 8a | 8b | MOTOR C | | O |
| 9a | 9b | MOTOR B | | O |
| 10a | 10b | MOTOR B | | O |
| 11a | 11b | MOTOR A | | O |
| 12a | 12b | MOTOR A | | O |

### Pin Details

*RS485 ADDR 0 (P1-1)*

This pin, RS485 ADDR 0, as well as RS485 ADDR 1, are used for RS-485 network addressing. To set the address of a drive, use the formula

$$RS485Address = \frac{7 * Addr0}{3} + 8 * \frac{7 * Addr1}{3},$$

where *RS485Address* is the desired node address and *Addr0* and *Addr1* represent the voltage that should be applied to pins RS485 ADDR 0 and RS485 ADDR 1, respectively. The values for *Addr0* and *Addr1* are always integer multiples of 3/7 V within

the range 0-3 V. Examples of the voltages required to set certain node addresses are given in the table below. Note that setting a drive address of 0 will utilize the address stored in non-volatile memory.

| RS485 ADDR 0 Value (V) | RS485 ADDR 1 Value (V) | RS485 ADDR Tolerance (V) | RS485 Address (Address #) |
|---|---|---|---|
| 0 | 0 | ±0.1 | Address stored in non-volatile memory |
| 3/7 (0.43) | 0 | ±0.1 | 1 |
| 6/7 (0.86) | 0 | ±0.1 | 2 |
| 9/7 (1.3) | 0 | ±0.1 | 3 |
| … | … | ±0.1 | … |
| 18/7 (2.57) | 21/7 (3.0) | ±0.1 | 62 |
| 21/7 (3.0) | 21/7 (3.0) | ±0.1 | 63 |

*RS485 BAUD (P1-6)*

The RS-485 baud rate is set by applying the appropriate voltage to the RS485 BAUD pin as given in the table below.

| RS485 BAUD Value (V) | RS485 BAUD Tolerance (V) | RS485 Baud Rate (bits/s) |
|---|---|---|
| 0 | ±0.388 | Bit rate stored in non-volatile memory |
| 1 | ±0.388 | 9.6k |
| 2 | ±0.388 | 38.4k |
| 3 | ±0.388 | 115.2k |

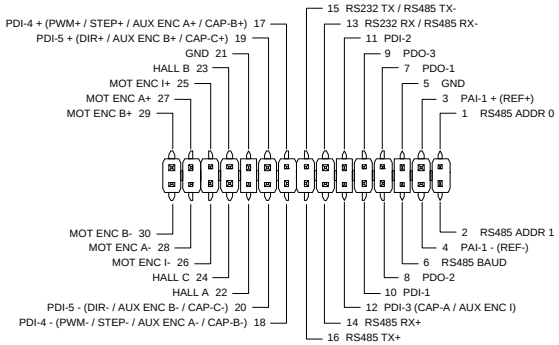
## HARDWARE SETTINGS

**Jumper Settings**

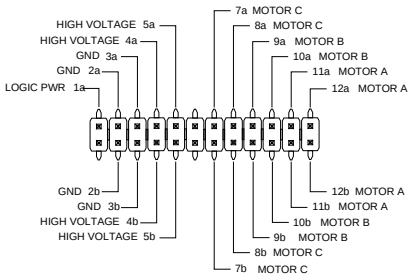
| Jumper | Description | Configuration | | |
|---|---|---|---|---|
| | Header Jumper | Not Installed | Pins 1-2 | Pins 2-3 |
| J1 | Reserved. | - | - | N/A |
| J2 | Reserved. | - | - | N/A |
| J3 | RS-485 selection. Install this jumper (2mm) to select RS-485 communication. This jumper is located on a 6-pin header between the PCB and heatsink. It consists of the two pins closest to the corner of the PCB. | RS-232 | RS-485 | N/A |

## MECHANICAL INFORMATION

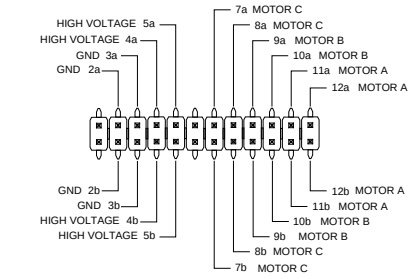
| P1 - Signal Connector | | |
|---|---|---|
| Connector Information | | 30-pin, 2.54 mm spaced, dual-row header |
| Mating Connector | Details | Samtec: SSM-115-L-DV |
| | Included with Drive | No |



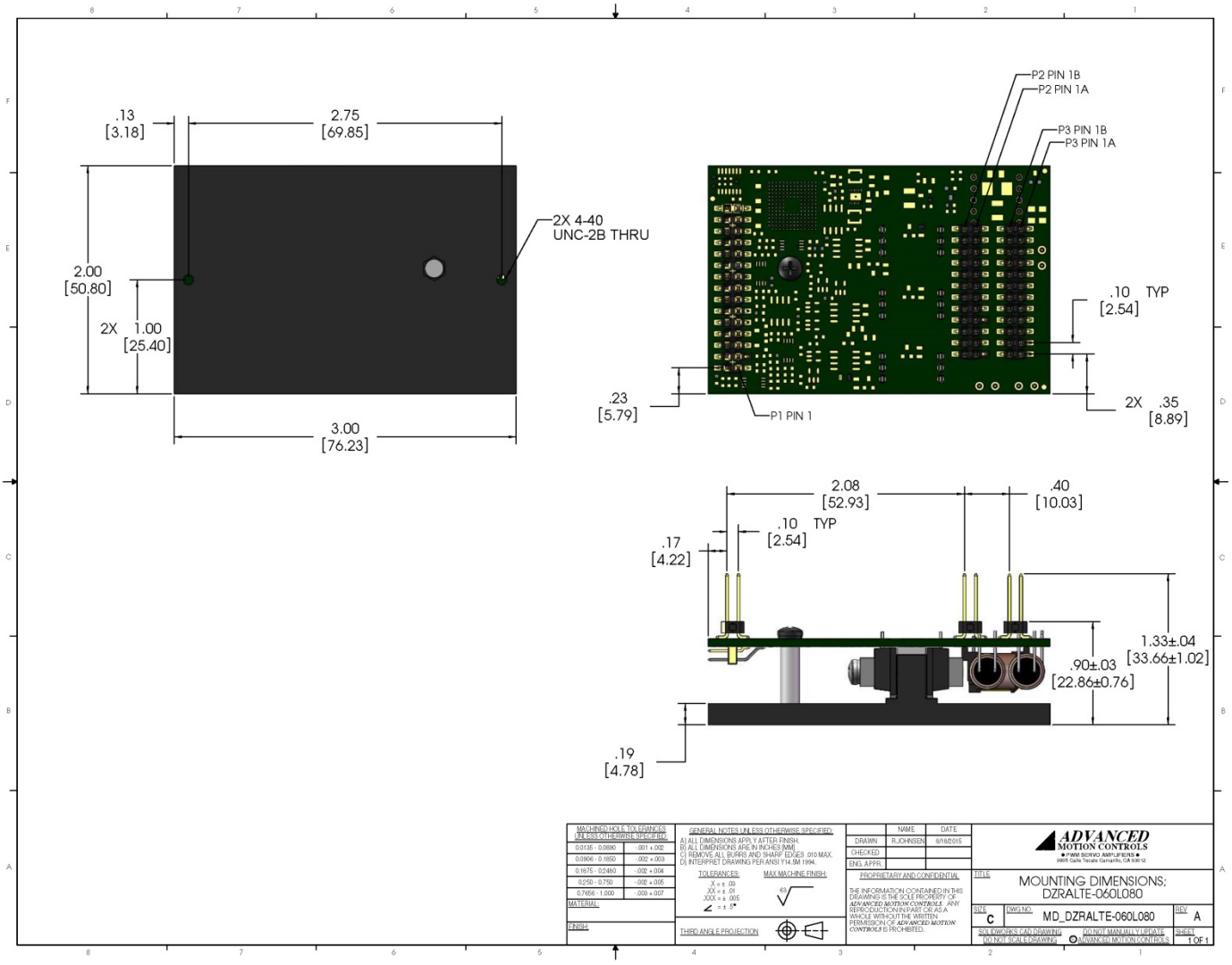

| P2 - Power Connector | | |
|---|---|---|
| Connector Information | | 24-pin, 2.54 mm spaced, dual-row header |
| Mating Connector | Details | Samtec: BCS-112-L-D-PE |
| | Included with Drive | No |




| P3 - Power Connector | | |
|---|---|---|
| Connector Information | | 24-pin, 2.54 mm spaced, dual-row header |
| Mating Connector | Details | Samtec: BCS-112-L-D-PE |
| | Included with Drive | No |



## MOUNTING DIMENSIONS



## PART NUMBERING INFORMATION

Example: **D Z R A L T E - 0 6 0 L 0 8 0**

| Drive Series | |
|---|---|
| DZ | DigiFlex Z (PCB Mount) |

| Communication | |
|---|---|
| C | CANopen |
| E | EtherCAT |
| S | EtherCAT Sub-node |
| P | POWERLINK / Modbus TCP / Ethernet |
| R | RS485 / Modbus RTU |

| Command Inputs | |
|---|---|
| AN | Analog (±10V)<br>No Step & Direction |
| AL | Analog (±10V)<br>Low Voltage Step & Direction (5V) |

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

| Motor Feedback | |
|---|---|
| E | Incremental Encoder and/or Halls |
| U | Universal (Halls, Inc. Enc., Abs. Enc, 1Vp-p Sin/Cos Enc.) |

| Max DC Bus Voltage ($V_{DC}$) | |
|---|---|
| 080 | 80 |
| 200 | 175 |

| Power and Logic Supply | |
|---|---|
| B | DC Input<br>Both Logic Supply Options (Internal or User) |
| L | DC Input<br>Logic Supply Required |

| Peak Current ($A_{0\ to\ Peak}$) | | |
|---|---|---|
| 012 | 12 A | 80V Drives |
| 020 | 20 A | |
| 040 | 40 A | |
| 060 | 60 A | |
| 010 | 10 A | 175V Drives |
| 020 | 20 A | |
| 025 | 25 A | |

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.

Power Supplies

Shunt Regulators

Mounting Card MC1XDZR02-HP1

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.