Description

The 100A40 PWM servo drive is designed to drive brush type DC motors at a high switching frequency. A single red/green LED indicates operating status. The drive is fully protected against over-voltage, under voltage, over-current, over-heating and short-circuits across motor, ground and power leads. Furthermore, the drive can interface with digital controllers or be used stand-alone and requires only a single unregulated DC power supply. Loop gain, current limit, input gain and offset can be adjusted using 14-turn potentiometers. The offset adjusting potentiometer can also be used as an on-board input signal for testing purposes.

See Part Numbering Information on last page of datasheet for additional ordering options. The hardware installation manual for the analog drive family is available for download at www.a-m-c.com.

Power Range

Peak Current	100 A
Continuous Current	50 A
Supply Voltage	80 - 400 VDC

Features

- Optical Isolation Between High & Low Power Signals
- Four Quadrant Regenerative Operation
- DIP Switch Selectable Modes
- Differential Input Command
- Digital Fault Output Monitor
- On-Board Test Potentiometer
- Offset Adjustment Potentiometer
- Adjustable Input Gain
- DIP Switch Selectable Tuning
- Drive Status LED
- Directional Inhibit Inputs for Limit Switches

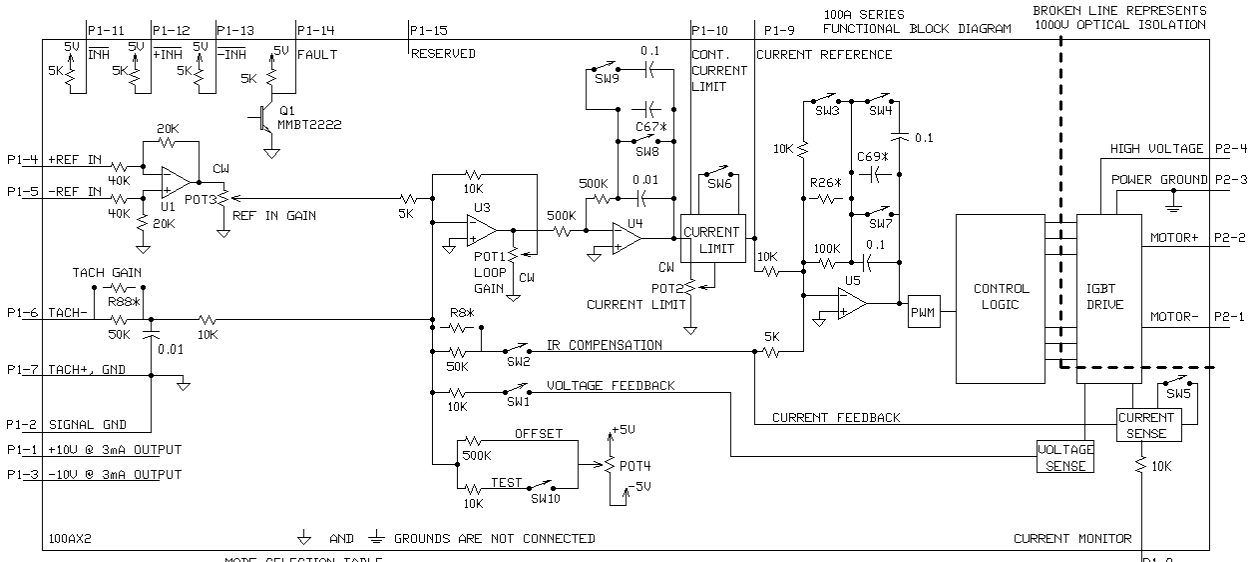
MODES OF OPERATION
- Current
- Voltage
- IR Compensation
- Velocity

COMMAND SOURCE
- ±10 V Analog

FEEDBACK SUPPORTED
- Tachometer (±60 VDC)

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

BLOCK DIAGRAM



MODE SELECTION TABLE

	SW1	SW2	SW3	SW4	SW7	SW8	SW9
CURRENT MODE	OFF	OFF	ON	OFF	OFF	ON	OFF
VOLTAGE MODE	ON	OFF	ON	OFF	OFF	OFF	OFF
IR COMPENSATION	ON	ON	ON	OFF	OFF	OFF	OFF
TACHOMETER MODE	OFF	OFF	ON	OFF	OFF	OFF	OFF

SW7 SHOULD BE OFF FOR MOST APPLICATIONS

LED GREEN – NORMAL OPERATION, LED RED – FAULT

RECOMMENDED SETTING FOR CURRENT MODE – POT1 FULLY CCW, POT3 FULLY CW. AMPLIFIERS ARE SHIPPED IN CURRENT MODE WITH MAXIMUM CURRENT SETTINGS FOR OTHER SWITCH FUNCTIONS SEE SWITCH DESCRIPTIONS
* OPTIONAL USER INSTALLED THROUGH HOLE COMPONENT

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 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).
RoHS Compliant	The RoHS Directive restricts the use of certain substances including lead, mercury, cadmium, hexavalent chromium and halogenated flame retardants PBB and PBDE in electronic equipment.

SPECIFICATIONS

Power Specifications		
Description	Units	Value
DC Supply Voltage Range	VDC	80 - 400
DC Bus Over Voltage Limit	VDC	420
Maximum Peak Output Current[1]	A	100
Maximum Continuous Output Current	A	50
Maximum Continuous Output Power	W	19000
Maximum Power Dissipation at Continuous Current	W	1000
Minimum Load Inductance (Line-To-Line)[2]	µH	600
Low Voltage Supply Outputs	-	±10 VDC (3 mA)
Switching Frequency	kHz	14.5
Control Specifications		
Description	Units	Value
Command Sources	-	±10 V Analog
Feedback Supported	-	Tachometer (±60 VDC)
Commutation Methods	-	Brush Type
Modes of Operation	-	Current, IR Compensation, Velocity, Voltage
Motors Supported	-	Single Phase (Brushed, Voice Coil, Inductive Load)
Hardware Protection	-	Over Current, Over Temperature, Over Voltage, Under Voltage, Short Circuit (Phase-Phase & Phase-Ground)
Primary I/O Logic Level	-	5V TTL
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)	235 x 183.2 x 92.4 (9.3 x 7.2 x 3.6)
Weight	g (oz)	3410 (120.3)
Heatsink (Base) Temperature Range[3]	°C (°F)	0 - 65 (32 - 149)
Storage Temperature Range	°C (°F)	-40 - 85 (-40 - 185)
Form Factor	-	Panel Mount
P1 Connector	-	15-pin, female D-sub
P2 Connector	-	4-contact, 16 mm spaced, dual-barrier terminal block

Notes

1. Maximum duration of peak current is ~2 seconds. Peak RMS value must not exceed continuous current rating of the drive.
2. Lower inductance is acceptable for bus voltages well below maximum. Use external inductance to meet requirements.
3. Additional cooling and/or heatsink may be required to achieve rated performance.

PIN FUNCTIONS

P1 - Signal Connector			
Pin	Name	Description / Notes	I/O
1	+10V 3mA OUT	±10 V @ 3 mA low power supply for customer use. Short circuit protected. Reference ground common with signal ground.	O
2	SIGNAL GND		SGND
3	-10V 3mA OUT		O
4	+REF IN	Differential Reference Input (±10 V Operating Range, ±15 V Maximum Input)	I
5	-REF IN		I
6	-TACH IN	Negative Tachometer Input (Maximum ±60 V). Use signal ground for positive input.	I
7	+TACH / GND	Positive Tachometer Input and Signal Ground	SGND
8	CURR MONITOR OUT	Current Monitor. Analog output signal proportional to the actual current output. Polarity is reversed from command voltage. Scaling is 15.8 A/V by default but may be reduced to half this value by setting DIP switch SW-5 to OFF (see Hardware Settings section below). Measure relative to signal ground.	O
9	CURRENT REF OUT	Measures the command signal to the internal current-loop. This pin has a maximum output of ±7.25 V when the drive outputs maximum peak current. Measure relative to signal ground.	O
10	CONT CURRENT LIMIT	Can be used to reduce the factory-preset maximum continuous current limit without affecting the peak current limit by attaching an external current limiting resistor between this pin and signal ground. See pin details below for resistor values.	I
11	$\overline{\text{INHIBIT IN}}$	TTL level (+5 V) inhibit/enable input. Leave open to enable drive. Pull to ground to inhibit drive. Inhibit turns off all power devices.	I
12	$\overline{\text{+INHIBIT IN}}$	Positive Direction Inhibit (Does Not Cause A Fault Condition)	I
13	$\overline{\text{-INHIBIT IN}}$	Negative Direction Inhibit (Does Not Cause A Fault Condition)	I
14	FAULT OUT	TTL level (+5 V) output becomes high when power devices are disabled due to at least one of the following conditions: inhibit, output short circuit, over voltage, over temperature, power-up reset.	O
15	NC	Not Connected (Reserved)	-

P2 - Power Connector			
Pin	Name	Description / Notes	I/O
1	-MOT	Negative Motor Output	O
2	+MOT	Positive Motor Output	O
3	PWR GND	Power Ground (Isolated From Signal Ground)	PGND
4	HIGH VOLT	DC Power Input	I

Pin Details

CONT CURRENT LIMIT (P1-10)

This pin can be used to reduce the continuous current limit without affecting the peak current limit by connecting an external current limiting resistor between this pin and signal ground. See table below.

Current Limit Resistor	40 kΩ	20 kΩ	3 kΩ	1 kΩ	0 kΩ (SHORT)
Continuous Current Limit	90%	80%	50%	30%	10%

Note: These values are secondary to the continuous/peak ratio set by the DIP switches.

HARDWARE SETTINGS

Switch Functions

Switch	Description	Setting	
		On	Off
1	Voltage feedback. Mode dependent (see mode selection table below).	On	Off
2	IR compensation. Activates or deactivates IR feedback. ON for IR compensation mode and OFF for other modes.	On	Off
3	Current loop proportional gain adjustment. ON by default.	Decrease	Increase
4	Inner (current) loop integral gain adjustment. OFF by default.	Decrease	Increase
5	Current scaling. When OFF, increases sensitivity of current sense thus reducing both peak and continuous current limit by 50%. The scaling of the current monitor output signal becomes ½ its ordinary value when this switch is OFF.	Full-current	Half-current
6	Current limit ratio. Used to set continuous-to-peak current limit ratio. Default is OFF.	Cont./Peak Ratio = 25%	Cont./Peak Ratio = 50%
7	Current loop integral gain. Activates or deactivates integration. OFF by default.	Inactive	Active
8	Outer loop integration. Activates or deactivates integration. ON, by default, for current mode and OFF for other modes.	Inactive	Active
9	Outer loop integral gain adjustment. It is recommended to leave this switch OFF for most applications.	Decrease	Increase
10	Test/Offset. Switches the function of the Test/Offset pot between an on-board command input for testing or a command offset adjustment. OFF by default.	Test	Offset

Mode Selection Table

	SW1	SW2	SW3	SW4	SW7	SW8	SW9
CURRENT	OFF	OFF	ON	OFF	OFF	ON	OFF
VOLTAGE	ON	OFF	ON	OFF	OFF	OFF	OFF
IR COMPENSATION	ON	ON	ON	OFF	OFF	OFF	OFF
TACHOMETER	OFF	OFF	ON	OFF	OFF	OFF	OFF

Note: SW7 should be off for most applications

Potentiometer Functions

Potentiometer	Description	Turning CW
1	Loop gain adjustment for voltage/velocity modes. Turn this pot fully CCW in current mode.	Increases gain
2	Current limit. It adjusts both continuous and peak current limit while maintaining their ratio.	Increases limit
3	Reference gain. Adjusts the ratio between input signal and output variables (voltage, current, or velocity).	Increases gain
4	Offset / Test. Used to adjust any imbalance in the input signal or in the amplifier. Can also be used as an on-board signal source for testing purposes.	Adjusts offset in negative direction

Note: Potentiometers are approximately linear and have 12 active turns with 1 inactive turn on each end.

Through-hole Components†

Location	Description
C67*	Velocity Loop Integrator. Through-hole capacitor that can be added for more precise velocity loop tuning. See section below on Tuning with Through-hole components for more details.
C69*	Current Loop Integrator. Through-hole capacitor that can be added for more precise current loop tuning. See section below on Tuning with Through-hole components for more details.
R26*	Current Loop Proportional Gain. Through-hole resistor that can be added for more precise current loop tuning. See section below on Tuning with Through-hole components for more details.
R8*	IR Compensation Scaling. Through-hole resistor that can be added to configure the amplifier for IR Compensation mode. See section below on IR Compensation Notes for more details.
R88*	Tachometer Input Scaling. Through-hole resistor that can be added to change the gain of the tachometer input. See section below on Tachometer Gain for more details.

Tuning With Through-hole Components

In general, the drive will not need to be further tuned with through-hole components. However, for applications requiring more precise tuning than what is offered by the potentiometers and dipswitches, the drive can be manually modified with through-hole resistors and capacitors as denoted in the above table. By default, the through-hole locations are not populated when the drive is shipped. Before attempting to add through-hole components to the board, consult the section on loop tuning in the installation notes on the manufacturer's website. Some general rules of thumb to follow when adding through-hole components are:

- A larger resistor value will increase the proportional gain, and therefore create a faster response time.
- A larger capacitor value will increase the integration time, and therefore create a slower response time.

Proper tuning using the through-hole components will require careful observation of the loop response on a digital oscilloscope to find the optimal through-hole component values for the specific application.

IR Compensation Notes

For applications that will use IR Compensation mode, a resistor can be added to the location named in the table above. The combination of the added resistor and correct dipswitch settings will configure the amplifier for IR Compensation mode. While in IR Compensation mode, the amplifier will adjust the duty cycle to compensate for changes in the output current. Consult the amplifier's functional block diagram and the manufacturer's website for more information.

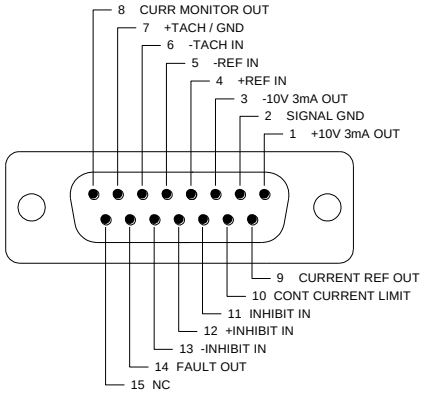
Tachometer Gain

Some applications may require an increase in the gain of the tachometer input signal. This occurrence will be most common in designs where the tachometer input has a low voltage to RPM scaling ratio. The drive offers a through-hole location listed in the above table where a resistor can be added to increase the tachometer gain. Use the drive's block diagram to determine an appropriate resistor value.

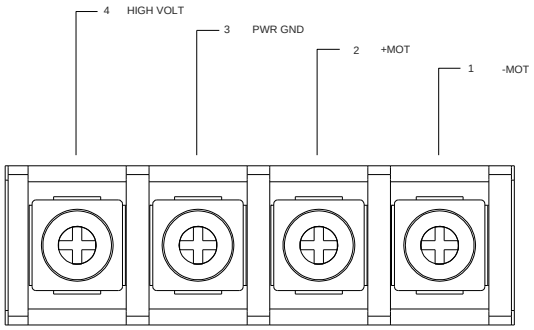
†Note: Damage done to the drive while performing these modifications will void the warranty.

MECHANICAL INFORMATION

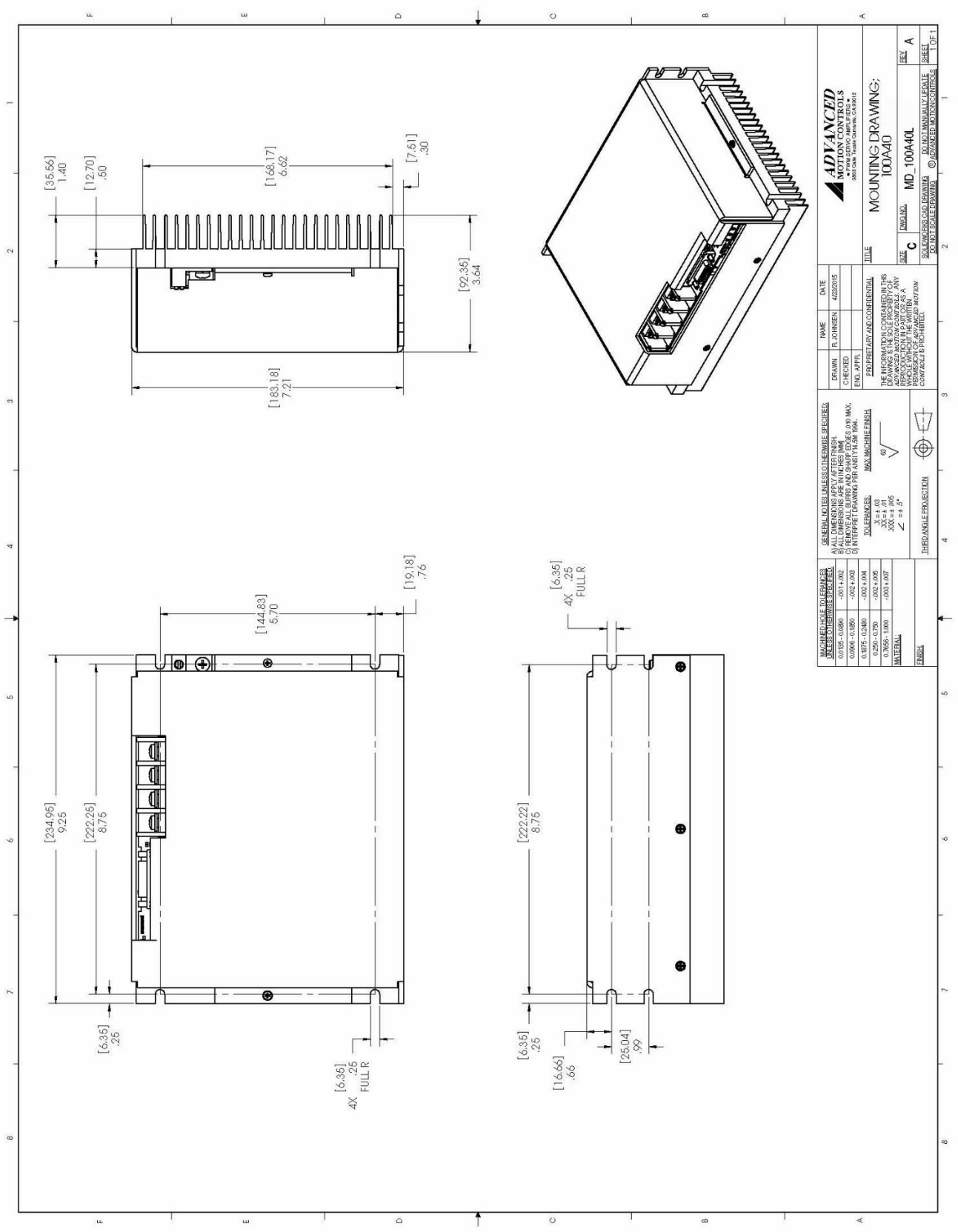
P1 - Signal Connector		
Connector Information		15-pin, female D-sub
Mating Connector	Details	TYCO: Plug P/N 205206-3; Housing P/N 5745172-1; Terminals P/N 1658540-5 (loose) or 1658540-4 (strip)
	Included with Drive	No



P2 - Power Connector		
Connector Information		4-contact, 16 mm spaced, dual-barrier terminal block
Mating Connector	Details	Not applicable
	Included with Drive	Not applicable



MOUNTING DIMENSIONS



PART NUMBERING INFORMATION

100 A 40 -

Peak Current
Maximum peak current rating in Amps.

Peak Voltage
Peak voltage rating scaled 1:10 in Volts.

Additional Options*
-ANP: Analog Position Loop
-INV: Inverted Inhibit

* Options available for orders with sufficient volume. Contact *ADVANCED* Motion Controls for more information.

ADVANCED Motion Controls analog series of servo drives 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.

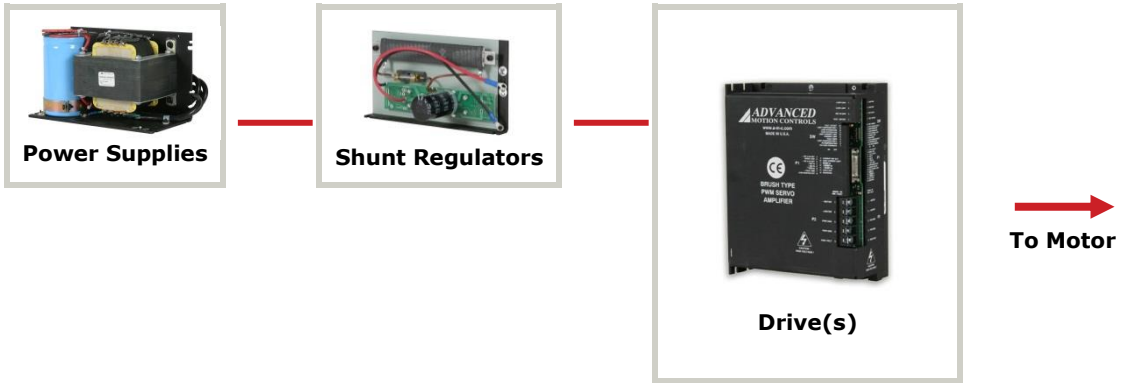
Examples of Modifications and Customized Products

- Integration of Drive into Motor Housing
- Mount OEM PCB onto Drive Without Cables
- Multi-axis Configuration for Compact System
- Custom PCB and Baseplate for Optimized Footprint
- RTV/Epoxy Components for High Vibration
- OEM Specified Connectors for Instant Compatibility
- OEM Specified Silkscreen for Custom Appearance
- Increased Thermal Limits for High Temp. Operation
- Integrate OEM Circuitry onto Drive PCB
- Custom Control Loop Tuned to Motor Characteristics
- Custom I/O Interface for System Compatibility
- Preset Switches and Pots to Reduce User Setup
- Optimized Switching Frequency
- Ramped Velocity Command for Smooth Acceleration
- Remove Unused Features to Reduce OEM Cost
- Application Specific Current and Voltage Limits

Feel free to contact Applications Engineering for further information and details.

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.