DIGITAL SERVO DRIVE for BRUSHLESS or BRUSH MOTORS

Accelnet MACRO

RoHS

Control Modes
- Torque, velocity, position

Command Interface
- MACRO
- ±10V

Communications
- MACRO
- RS-232

Feedback
- Digital Incremental Quad A/B encoder
- Analog Incremental Sin/Cos encoder
- Digital Halls

I/O
- Digital inputs: 10 high speed, 1 motor temp
- Digital outputs: 3 MOSFET, 1 High-speed CMOS

Dimensions: mm [in]
- 196 x 99 x 30 [7.73 x 3.9 x 1.17]

Model	Ip	Ic	Vdc
AMP-055-18	18	6	55
AMP-090-09	9	3	90
AMP-090-18	18	6	90
AMP-090-36	36	12	90
AMP-180-09	9	3	180
AMP-180-18	18	6	180

DESCRIPTION

Accelnet MACRO is a high-performance, DC powered drive for position, velocity, and torque control of brushless and brush motors via MACRO (Motion And Control Ring Optical). MACRO is a high bandwidth, non-proprietary fiber optic or wired field bus protocol for machine control networks which is based upon 100BASEFX (FDDI) and 100BASETX (Ethernet) hardware technologies. Connections to a MACRO ring are via SC-type fiber optic connectors. The drive operates in Torque Drive, Velocity Drive, and Position Drive modes. MACRO address selection is via two rotary switches for Master and Node addresses.

Drive commissioning is fast and simple using CME 2™ software operating under Windows® and communicating with *Accelnet MACRO* via RS-232.

Motor feedback is either quad A/B digital or sin/cos analog incremental encoders. A multi-mode encoder port works as an output, buffering the quad A/B signals for connection to an external controller, or as an input for a secondary encoder on the load for a dual position-loop configuration. When using an analog encoder, the multi-mode port outputs interpolated quad A/B signals with programmable resolution (counts per sin/cos cycle)

There are 10 high speed digital inputs and 1 digital input for a motor over-temperature switch. Input [IN1] is dedicated to the drive enable function while [IN2~10] are programmable.

Inputs [IN1~10] have 1 µs RC filters for high speed operation and accept inputs from +5~24 Vdc. Each of these inputs has a 10 kΩ resistor that is independently programmable to pull up to +5 Vdc, or to pull down to ground. The Motemp input [IN11] has a fixed 4.99 kΩ pull up resistor to +5 Vdc for compatibility with PTC sensing resistors.

Digital outputs [OUT1~3] are open-collector MOSFET types with 1 kΩ pull up resistors to +5 Vdc. An isolating diode in each enables operation with current-sourcing opto-isolated inputs of PLC's by eliminating leakage currents back into the drive's +5 Vdc supply when the outputs are off. [OUT1] has an additional snubber diode that connects to the HV_AUX terminal. This, plus a 1 Adc current capability enables it to drive motor brakes which are inductive loads. [OUT4] is a high-speed CMOS output.

Drive power is transformer-isolated DC from regulated or unregulated power supplies. An HV_AUX input is provided for "keep-alive" operation permitting the drive power stage to be completely powered down without losing position information, or communications with the control system.

In addition to the MACRO interface, torque, velocity, and position mode operation is also supported via an analog input with a ±10 Vdc range.

GENERAL SPECIFICATIONS

Test conditions: Load = Wye connected load: 2 mH + 2 Ω line-line. Ambient temperature = 25°C, +HV = HV_{max}

MODEL	AMP-055-18	AMP-090-09	AMP-090-18	AMP-090-36	AMP-180-09	AMP-180-18	
OUTPUT POWER							
Peak Current	18 (12.7)	9 (6.9)	18 (12.7)	36 (26.5)	9 (6.4)	18 (12.7)	Adc (Arms, sinusoidal), ±5%
Peak time	1	1	1	1	1	1	Sec
Continuous current	6 (4.2)	3 (2.1)	6 (4.2)	12 (8.5)	3 (2.1)	6 (4.2)	Adc (Arms, sinusoidal)
Output resistance	0.075	0.075	0.075	0.075	0.075	0.075	Rout (Ω)
Maximum Output Voltage	Vout = HV*0.97 - Rout*Iout						
INPUT POWER							
HVmin~HVmax	20 - 55	20 - 90	20 - 90	20 - 90	20 - 180	20 - 180	+Vdc, Transformer-isolated
Ipeak	20	10	20	40	10	20	Adc (1 sec) peak
Icont	6.7	3.3	6.7	13.3	3.3	6.7	Adc continuous
HVAUX	+20 to +HV Vdc @ 500 mAdc maximum, 2.5 W						

PWM OUTPUTS

Type	3-phase MOSFET inverter, 16 kHz center-weighted PWM, space-vector modulation
PWM ripple frequency	32 kHz

COMMAND INPUTS

Type	Torque drive, velocity drive, position drive via MACRO digital interface Torque, velocity, position via ±10 Vdc analog input
Connectors	Duplex SC optical fiber receptacle
Fiber medium	62.5 micron Multi-Mode Glass Fiber per ISO/IEC 9314-3 & ANSI X3.166-1990 Commonly referred to as "62.5/125 multi-mode" glass fiber cable
Wavelength	1300 nm
Data Format	MACRO
Data	CANopen Device Profile DSP-402 over MACRO
Address Selection	Dual 16-position rotary switches for Master and Node addresses
Address range	0x0 to 0xF hex (0~15 decimal) for Master & Node
Analog	±10 Vdc, 12 bit resolution, differential, 5 kΩ input impedance, non-isolated

DIGITAL CONTROL

Digital Control Loops	Current, velocity, position. 100% digital loop control
Sampling rate (time)	Current loop: 16 kHz (62.5 µs) Velocity, position loops: 4 kHz (250 µs)
Commutation	Sinusoidal, field-oriented control for brushless motors
Modulation	Center-weighted PWM with space-vector modulation
Bandwidths	Current loop: 2.5 kHz typical, bandwidth will vary with tuning & load inductance
HV Compensation	Changes in bus voltage do not affect bandwidth
Minimum load inductance	200 µH line-line

DIGITAL INPUTS

Number	10 HS (High-Speed), 1 GP (Motemp), non-isolated
[IN1~10]	HS: 1 µs RC filtered, CMOS, +5~24 Vdc, programmable pull up/down on each input V_T+ = 3.15 Vdc max, V_T- = 1.13 Vdc min, V_H = 0.6~1.40 Vdc
[IN11]	GP: Motor over-temperature switch, 33 µs RC filter, 4.99 kΩ fixed pull up to +5 Vdc Active level of all inputs is programmable

DIGITAL OUTPUTS

Number	3 GP (General Purpose), 1 HS (High-Speed), non-isolated
[OUT1]	GP: N-channel MOSFET, 1 Adc, +30 Vdc, with 1 kΩ pull-up resistor to +5 Vdc & snubber diode to HV_AUX
[OUT2,3]	GP: N-channel MOSFET, 100 mAdc, +30 Vdc, with 1 kΩ pull-up resistor to +5 Vdc Diode in series with pull up resistor prevents current flow into +5 Vdc supply when outputs are off and pulled up to voltages >5 Vdc
[OUT4]	HS: CMOS UHS buffer, ±20 mA source/sink, +5 Vdc max

MULTI-MODE ENCODER PORT

As Secondary Encoder Input	Digital quadrature encoder (A, /A, B, /B, X, /X), 121 Ω terminating resistors across complementary inputs 20M counts/sec, post-quadrature (5 M lines/sec), RS-422 line receiver
As Emulated Encoder Output	Quadrature encoder emulation with programmable resolution to 4096 lines (65,536 counts) per rev from analog sin/cos encoders. 18M counts/sec, post-quadrature (4.5 M lines/sec), RS-422 line driver
As Buffered Encoder Output	Buffered signals from digital quad A/B/X primary encoder. 20 M counts/sec, post-quadrature (5 M lines/sec) A, /A, B, /B, X, /X, signals from 26LS31 differential line driver, RS-422 line driver

RS-232 PORT

Signals	RxD, TxD, Gnd in 6-position, 4-contact RJ-11 style modular connector.
Mode	Full-duplex, DTE serial port for drive setup and control, 9,600 to 115,200 Baud
Protocol	ASCII or binary format

MOTOR CONNECTIONS

Phase U, V, W	PWM outputs to 3-phase ungrounded Wye or delta connected brushless motors, or DC brush motors
Hall U, V, W	Digital Hall signals, single-ended
Encoder Power	+5 Vdc @ 250 mA maximum combined current from J4-22 and J3-3
Digital Incremental Encoder	Quadrature signals, (A, /A, B, /B, X, /X), differential (X, /X Index signals not required) 5 MHz maximum line frequency (20 M counts/sec) 26LS32 differential line receiver with 121 Ω terminating resistor between complementary inputs
Analog Incremental Encoder	Sin/cos format (sin+, sin-, cos+, cos-), differential, 1 Vpeak-peak, ServoTube motor compatible
Motemp [IN11]	Motor overtemperature sensor input. Active level programmable 4.99 kΩ pull-up to +5 Vdc

STATUS INDICATORS

Amp Status	Bicolor LED, drive status indicated by color, and blinking or non-blinking condition
MACRO Status	Bicolor LED, status of MACRO bus indicated by color and blink codes to MACRO Indicator Specification V0.91

PROTECTIONS

HV Overvoltage	+HV > HV_{max}	Drive outputs turn off until +HV < HV_{max} (See Input Power for HV_{max})
HV Undervoltage	+HV < +20 Vdc	Drive outputs turn off until +HV > +20 Vdc
Drive over temperature	Heat plate > 70°C.	Drive outputs turn off
Short circuits	Output to output, output to ground, internal PWM bridge faults	
I^2T Current limiting	Programmable: continuous current, peak current, peak time	
Motor over temperature	Digital inputs programmable to detect motor temperature switch	
Feedback Loss	Inadequate analog encoder amplitude or missing incremental encoder signals	

MECHANICAL & ENVIRONMENTAL

Size	7.73 in (196.3 mm) X 3.90 in (99.1 mm) X 1.17 in (29.7 mm)
Weight	1.0 lb (0.45 kg)
Ambient temperature	0 to +45°C operating, -40 to +85°C storage
Humidity	0 to 95%, non-condensing
Vibration	<tbd>
Contaminants	Pollution degree 2
Environment	IEC68-2: 1990
Cooling	Heat sink and/or forced air cooling required for continuous power output

CME 2™ SOFTWARE

Drive setup is fast and easy using CME 2™ software. All of the operations needed to configure the drive are accessible through this powerful and intuitive program. Auto-phasing of brushless motor Hall sensors and phase wires eliminates "wire and try". Connections are made once and CME 2™ does the rest thereafter. Encoder wire swapping to establish the direction of positive motion is eliminated.

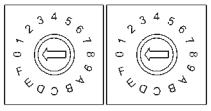
Motor data can be saved as .CCM files. Drive data is saved as .CCX files that contain all drive settings plus motor data. This eases system management as files can be cross-referenced to drives. Once a drive configuration has been completed systems can be replicated easily with the same setup and performance.

MACRO ADDRESS

Two 16-position hexadecimal rotary switches set the master and slave node addresses. A MACRO ring supports up to sixteen masters and 14 physical slaves per master, eight of which are for motion controls and six are for I/O. The chart below shows the available slave addresses for *Accelnet MACRO* (0~7). Slave addresses (E~F) are reserved.

MACRO Address Switch Decimal Values

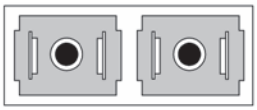
S2 S1



Master Slave

J6: MACRO PORT

Duplex type SC optical fiber connector



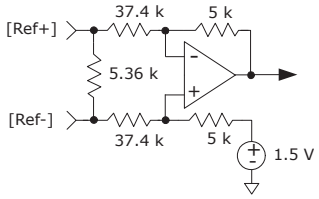
OUT IN

Switch	S2	S1
Address	MASTER	SLAVE
HEX	DEC	
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	I/O
9	9	I/O
A	10	I/O
B	11	I/O
C	12	I/O
D	13	I/O
E	14	RSVD
F	15	RSVD

ANALOG INPUT

The differential configuration of the analog input has a ±10 Vdc range and is the alternate command input. One of the input terminals connects to a voltage source in the controller and the other connects to signal ground at the voltage source. Shielded, twisted-pair wires are the best choice for connecting the input to the voltage source.

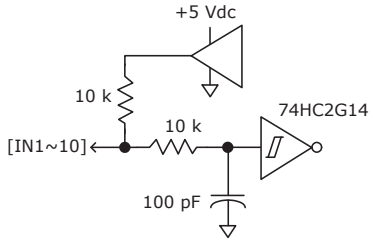
ANALOG INPUT [Ref+/-]



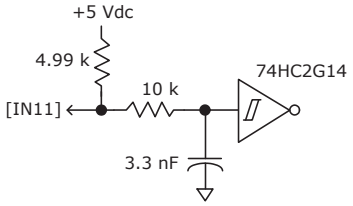
DIGITAL INPUTS

These are high-speed (HS) non-isolated types with pull-up resistors to +5 Vdc and 1 µs RC filters when driven by active sources. The active level is programmable on each input. Input [IN1] is dedicated to the drive enable function. The remaining inputs [IN2~IN10] have programmable functions. Input [IN11] is set up for the motor overtemperature function and connects to the feedback connector J3. If not used as the Motemp input it can be programmed for other functions. All of the inputs can operate from +5 to +24 Vdc sources.

HS Inputs [IN1~10]



MOTEMP [IN11]



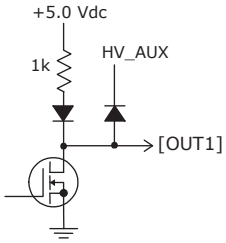
DIGITAL OUTPUTS

The table below shows the features of the four digital outputs. Programmable functions include:

- Drive fault indicator
- Motor brake
- PWM sync
- Program control
- Custom event

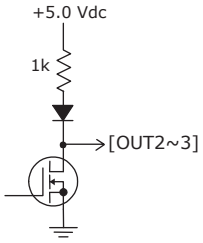
GP [OUT1]

1 Adc, 30 Vdc max



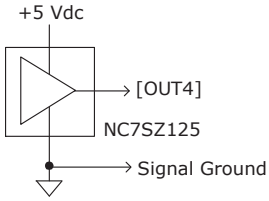
GP [OUT2~3]

100 mAdc, 30 Vdc max



HS [OUT4]

±20 mAdc 5 Vdc max



MULTI-MODE ENCODER PORT

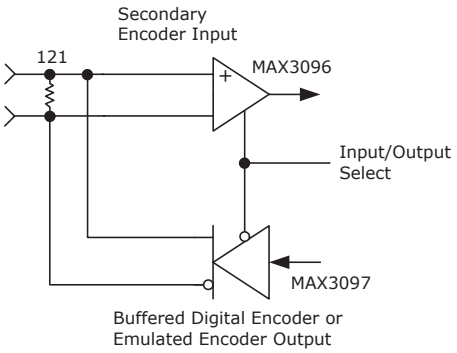
Depending on drive set-up, this port functions either as an input or output for differential encoder signals.

For dual-loop position-mode operation that employs a primary encoder on the motor, and a secondary encoder on the load, the port works as an input receiving the secondary encoder's quad A/B/X signals.

For stand-alone operation with an external motion controller, the signals from the digital encoder on the motor are buffered and made available at the control signal connector for transmission to the controller. This eliminates split-wired motor cables with dual connectors that take the encoder signals to both drive and controller.

When used with ServoTube motors, or other motors using analog encoders with sin/cos signal format, the drive interpolates the sin/cos signals to a resolution that is programmable. The incremental changes in position are then converted to digital quad A/B/X format for use by the external motion controller.

FUNCTIONAL DIAGRAM OF ONE CHANNEL

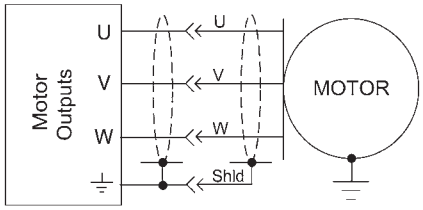


MOTOR CONNECTIONS

Motor connections consist of: phases, Halls, encoder, and thermal sensor. The phase connections carry the drive output currents that drive the motor to produce motion. The Hall signals are three digital signals that give absolute position feedback within an electrical commutation cycle. The encoder signals give incremental position feedback and are used for velocity and position modes, as well as sinusoidal commutation. A thermal sensor that indicates motor overtemperature is used to shut down the drive to protect the motor.

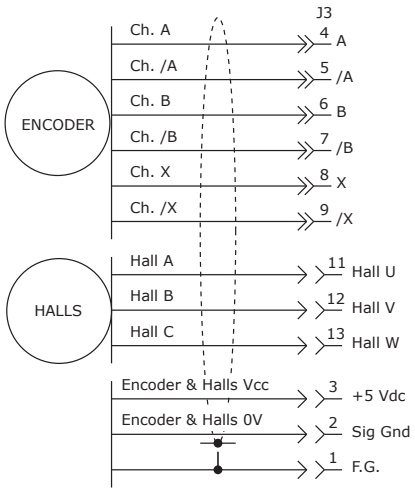
PHASE CONNECTIONS

The drive output is a three-phase PWM inverter that converts the DC bus voltage (+HV) into three sinusoidal voltage waveforms that drive the motor phase-coils. Cable should be sized for the continuous current rating of the drive. Motor cabling should use twisted, shielded conductors for CE compliance, and to minimize PWM noise coupling into other circuits. The motor cable shield should connect to motor frame and the drive HV ground terminal (J2-1) for best results. When driving a DC motor, the W output is unused and the motor connects between the U & V outputs.



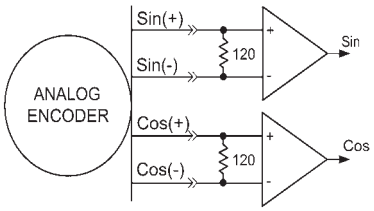
DIGITAL QUAD A/B ENCODER AND HALLS

Encoders with differential line-driver outputs provide incremental position feedback via the A/B signals and the optional index signal (X) gives a once per revolution position mark. The Hall signals are single ended and provide commutation information. After start up, the drive operates in trapezoidal mode until one of the Halls changes state at which point the mode switches to sinusoidal. Because the Hall feedback is absolute within one electrical commutation cycle they can also be used to shutdown the drive in case the incremental feedback from the A/B signals either fails or is corrupted by noise. When this happens the apparent position will shift from one Hall state to another and this can be programmed to generate a fault condition in the drive.



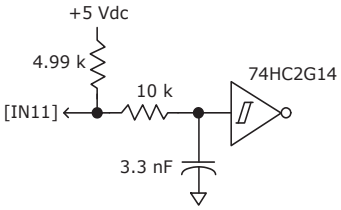
ANALOG SIN/COS INCREMENTAL ENCODER

The sin/cos inputs are differential with 121 Ω terminating resistors and accept 1 Vp-p signals in the format used by incremental encoders with analog outputs, or with ServoTube motors.



TEMPERATURE SENSOR

The MOTEMP input connects to J3-14 for use with a motor overtemperature switch. The switch or sensor must be grounded so that the input changes from LO to HI when the switch opens. The active level is programmable for use with switches that either open or close when the motor is overheating.



GROUNDING CONSIDERATIONS

Power and control circuits in *Accelnet MACRO* share a common circuit-ground (HV_COM on J1-1, and Signal Ground on J3-2 & 15 and J4-2 & 23). Circuits that are referenced to Signal Ground are the analog Reference input, buffered encoder outputs, motor encoder and Hall signals, and the PWM outputs. For this reason, drive Signal Gnd terminals should connect to the users' common ground system so that signals between drive and controller are at the same common potential, and to minimize noise. The system ground should, in turn, connect to an earthing conductor at some point so that the whole system is referenced to "earth". The MACRO ports are transformer-isolated from the drive circuits.

Because current flow through conductors produces voltage-drops across them, it is best to connect the drive HV Return to system earth, or circuit-common through the shortest path, and to leave the power-supply floating. In this way, the power supply (-) terminal connects to ground at the drive HV Return terminals, but the voltage drops across the cables will not appear at the drive ground, but at the power supply negative terminal where they will have less effect.

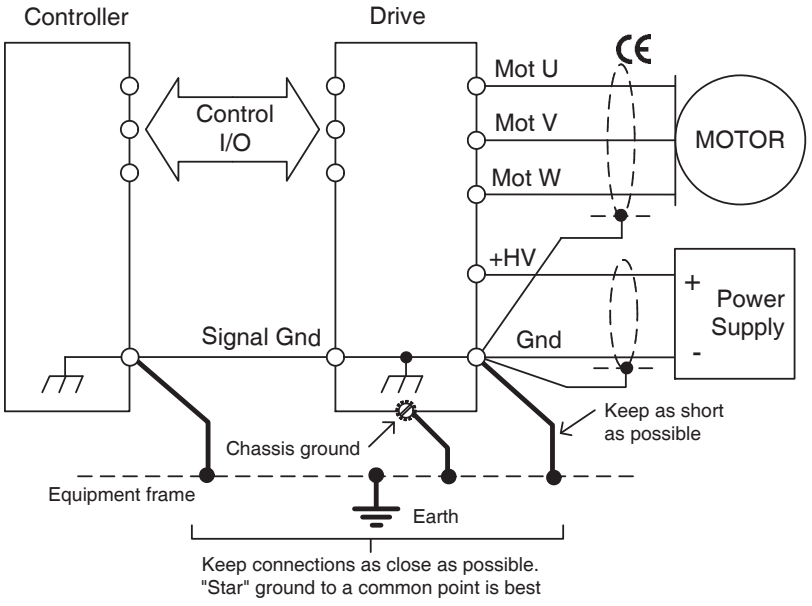
Motor phase currents are balanced, but currents can flow between the PWM outputs, and the motor cable shield. To minimize the effects of these currents on nearby circuits, the cable shield should connect to Frame Gnd (J2-1).

The drive frame (heatplate) does not connect to any drive circuits. Connections to the frame are provided on connectors J2-1, J3-1, J4-1. Cables to these connectors should be shielded for CE compliance, and the shields should connect to these terminals. When installed, the drive case should connect to the system chassis. This maximizes the shielding effect of the case, and provides a path to ground for noise currents that may occur in the cable shields.

Signals from controller to drive are referenced to +5 Vdc, and other power supplies in user equipment. These power supplies should also connect to system ground and earth at some point so that they are at same potential as the drive circuits.

The final configuration should embody three current-carrying loops. First, the power supply currents flowing into and out of the drive at the +HV and HV_COM pins on J1. Second the drive outputs driving currents into and out of the motor phases, and motor shield currents circulating between the U, V, and W outputs and Gnd. And, lastly, logic and signal currents connected to the drive control inputs and outputs.

For CE compliance and operator safety, the drive should be earthed by using external tooth lock washers under the mounting screws. These will make contact with the aluminum chassis through the anodized finish to connect the chassis to the equipment frame ground.

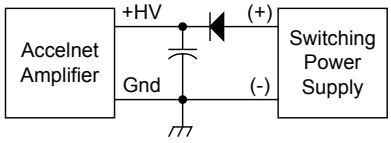


CE = Shielded cables required for CE compliance

POWER SUPPLIES

Accelnet MACRO operates typically from transformer-isolated, unregulated DC power supplies. These should be sized such that the maximum output voltage under high-line and no-load conditions does not exceed the drives maximum voltage rating. Power supply rating depends on the power delivered to the load by the drive. In many cases, the continuous power output of the drive is considerably higher than the actual power required by an incremental motion application.

Operation from regulated switching power supplies is possible if a diode is placed between the power supply and drive to prevent regenerative energy from reaching the output of the supply. If this is done, there must be external capacitance between the diode and drive.



AUXILIARY HV POWER

Accelnet MACRO has an input for HV_AUX. This is a voltage that can keep the drive communications and feedback circuits active when the PWM output stage has been disabled by removing the main +HV supply. This can occur during EMO (Emergency Off) conditions where the +HV supply must be removed from the drive and powered-down to ensure operator safety. The HV_AUX input operates from any DC voltage that is within the operating voltage range of the drive and powers the DC/DC converter that supplies operating voltages to the drive DSP and control circuits.

When the drive +HV voltage is greater than the HV_AUX voltage it will power the DC/DC converter. Under these conditions the HV_AUX input will draw no current.

MOUNTING & COOLING

Accelnet MACRO has slots for mounting to panels at 0° or 90°. Cooling is by conduction from drive heatplate to mounting surface, or by convection to ambient.

A heatsink (optional) is required for the drive to deliver the rated continuous output current. Depending on the drive mounting and cooling means this may not be required.

CONNECTORS & SIGNALS

J4: CONTROL

J4 SIGNALS	PIN
Frame Ground	1
Signal Ground	2
Enable HS [IN1]	3
HS [IN2]	4
HS [IN3]	5
HS [IN4]	6
HS [IN5]	7
HS [IN6]	8
HS [IN7]	9
HS [IN8]	10
HS [IN9]	11
HS [OUT4]	12
GP [OUT1]	13

J3: FEEDBACK

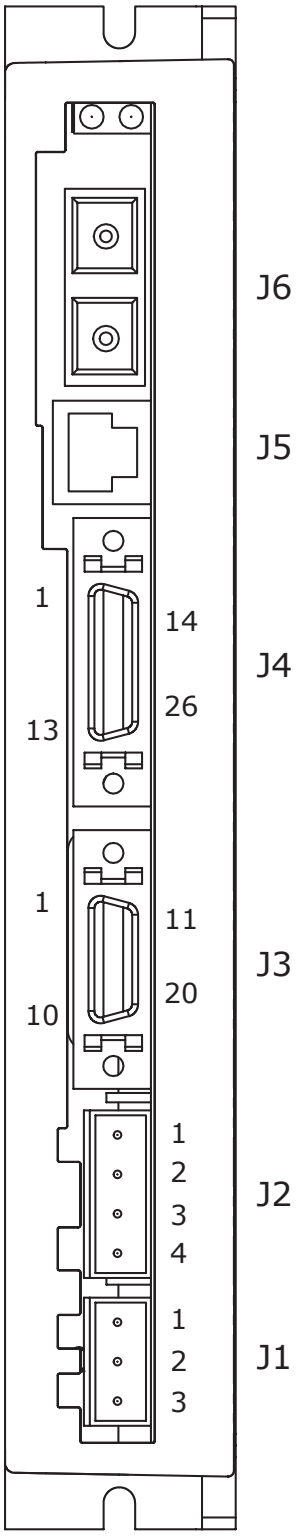
J3 SIGNALS	PIN
Frame Ground	1
Signal Ground	2
+5 Vdc @ 250 mA	3
Encoder A	4
Encoder /A	5
Encoder B	6
Encoder /B	7
Encoder X	8
Encoder /X	9
Encoder S	10

J1: POWER

J1 SIGNALS	PIN
HV_COM	1
+HV	2
HV_AUX	3

J1 CABLE CONNECTOR:

3 position 5.08 mm Euro-Style plug
Copley: 57-00465-000
PCD: ELFP03210
Ria: 31249103
Weco: 121-A-111/03



J4: CONTROL

PIN	J4 SIGNALS
14	GP [OUT2]
15	GP [OUT3]
16	Multi-mode Encoder A
17	Multi-mode Encoder /A
18	Multi-mode Encoder B
19	Multi-mode Encoder /B
20	Multi-mode Encoder X
21	Multi-mode Encoder /X
22	+5 Vdc @ 250 mA
23	Signal Ground
24	[Ref+]
25	[Ref-]
26	GP [IN10]

J4 CABLE CONNECTOR:

Solder Cup, 26 position male, 1.27 mm pitch
Cable: 26 conductor, shielded
Standard with Snap locks
3M: 10126-3000 VE connector
3M: 10326-52F0-008 backshell
Rugged with Screw-locks
Molex: 54306-2619 connector
Molex: 54331-0261 backshell

Note: Molded cable assemblies are available for J3 & J4. See p. 10 for cable colors.

J3: FEEDBACK

PIN	J3 SIGNALS
11	Hall U
12	Hall V
13	Hall W
14	Motemp [IN11]
15	Signal Ground
16	Analog Sin(+)
17	Analog Sin(-)
18	Analog Cos(+)
19	Analog Cos(-)
20	Encoder /S

J3 CABLE CONNECTOR:

Solder Cup,20 position male, 1.27 mm pitch
Cable: 20 conductor, shielded
Standard with Snap locks
3M: 10120-3000VE connector
3M: 10320-52F0-008 backshell
Rugged with Screw-locks
Molex: 54306-2019 connector
Molex: 54331-0201 backshell

J2: MOTOR

PIN	J2 SIGNALS
1	Frame Gnd
2	Motor U
3	Motor V
4	Motor W

J2 CABLE CONNECTOR:

4 position 5.08 mm Euro-Style plug
Copley: 57-00466-000
PCD: ELFP04210
Ria: 31249104
Weco: 121-A-111/04

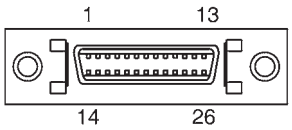
Note:
1. The total +5 Vdc output current from J3-3 and J4-22 cannot exceed 250 mA.

ACCESSORY CABLE CONNECTIONS

Note: Wires are solid-color with a stripe of an alternate color.
E.g. "Black / Orange" is a black wire with an orange stripe.

CONTROL CABLE (AMP-CC-10)

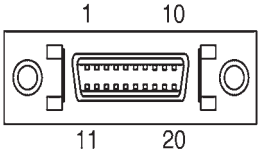
Plug assembly: Molex 52316-2611
Boot cover: Molex 52370-2610
Molded connector mates with drive J4 and has flying-lead terminations with colors shown in chart below.



Signals	Pin	Color (Body / Stripe)	Pair		Color (Body / Stripe)	Pin	Signals
Frame Ground	1	White / Tan	1a	8a	White / Violet	14	GP [OUT2]
Signal Ground	2	Tan / White	1b	8b	Violet / White	15	GP [OUT3]
Enable GPI [IN1]	3	White / Brown	2a	9a	White / Gray	16	Multi-mode Encoder A
GPI [IN2]	4	Brown / White	2b	9b	Gray / White	17	Multi-mode Encoder /A
GPI [IN3]	5	White / Pink	3a	10a	Tan / Brown	18	Multi-mode Encoder B
GPI [IN4]	6	Pink / White	3b	10b	Brown / Tan	19	Multi-mode Encoder /B
GPI [IN5]	7	White / Orange	4a	11a	Tan / Pink	20	Multi-mode Encoder X
GPI [IN6]	8	Orange / White	4b	11b	Pink / Tan	21	Multi-mode Encoder /X
HS [IN7]	9	White / Yellow	5a	12a	Tan / Orange	22	+5 Vdc @ 250 mA
HS [IN8]	10	Yellow / White	5b	12b	Orange / Tan	23	Signal Ground
HS [IN9]	11	White / Green	6a	13a	Tan / Yellow	24	[Ref+]
HS [OUT4]	12	Green / White	6b	13b	Yellow / Tan	25	[Ref-]
GP [OUT1]	13	White / Blue	7a	7b	Blue / White	26	GP [IN10]

FEEDBACK CABLE (AMP-FC-10)

Plug assembly: Molex 52316-2011
Boot cover: Molex 52370-2010
Molded connector mates with drive J3 and has flying-lead terminations with colors shown in chart below.

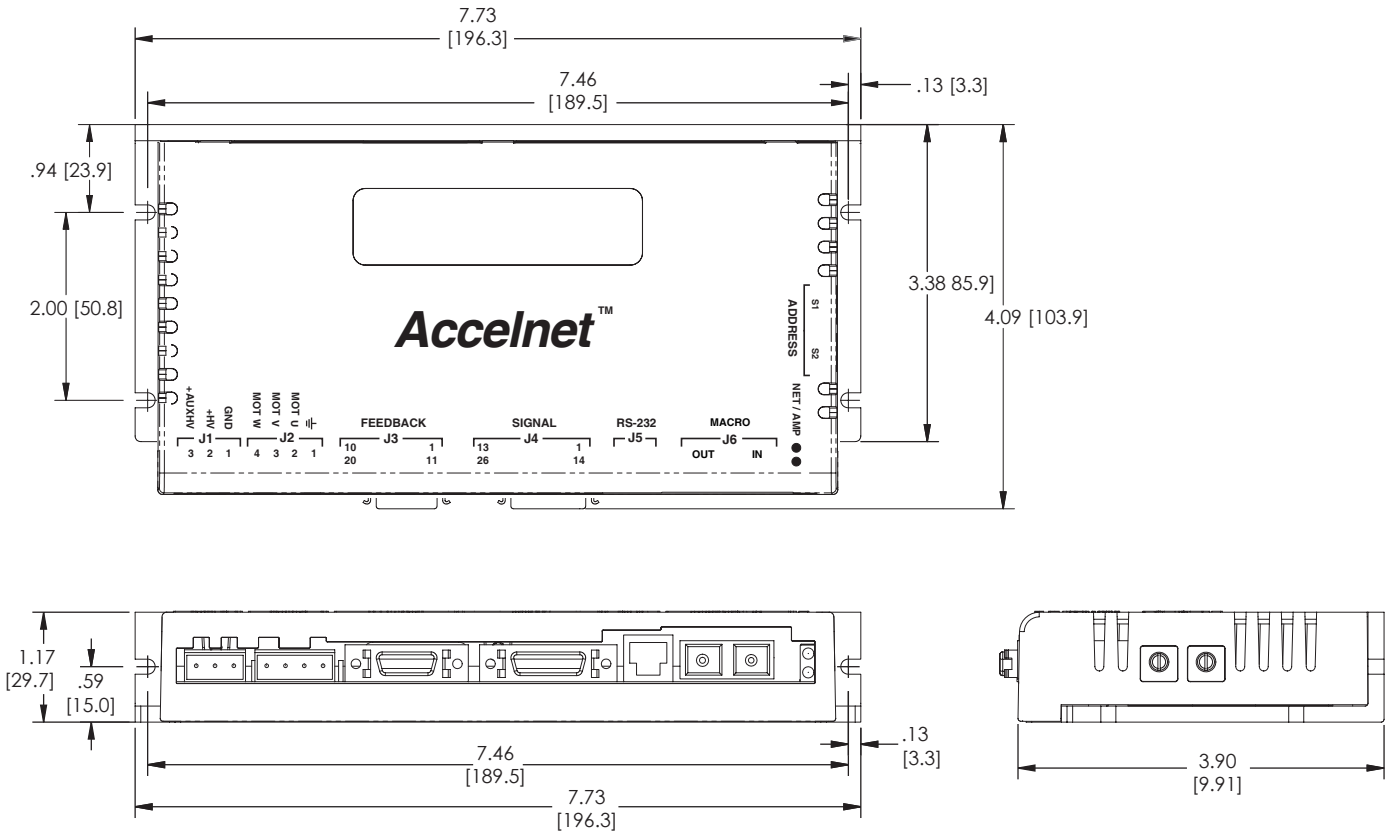


Signals	Pin	Color (Body / Stripe)	Pair		Color (Body / Stripe)	Pin	Signals
Frame Ground	1	White / Tan	1a	1b	Tan / White	11	Hall U
Signal Ground	2	White / Brown	2a	7a	White / Blue	12	Hall V
+5 Vdc @ 250 mA	3	Brown / White	2b	7b	Blue / White	13	Hall W
Encoder A	4	White / Pink	3a	8a	White / Violet	14	Motemp [IN11]
Encoder /A	5	Pink / White	3b	8b	Violet / White	15	Signal Ground
Encoder B	6	White / Orange	4a	9a	White / Gray	16	Analog Sin(+)
Encoder /B	7	Orange / White	4b	9b	Gray / White	17	Analog Sin(-)
Encoder X	8	White / Yellow	5a	10a	Tan / Brown	18	Analog Cos(+)
Encoder /X	9	Yellow / White	5b	10b	Brown / Tan	19	Analog Cos(-)
Encoder S	10	White / Green	6a	6b	Green / White	20	Encoder /S

DIMENSIONS

NOTES

1. Dimensions shown in inches [mm].



Weights:

Drive: 0.94 lb (0.43 kg)
Heatsink: 1.0 lb (0.45 kg)

MASTER ORDERING GUIDE

AMP-055-18	*Accelnet MACRO* Servo drive, 55 Vdc, 6/18 A
AMP-090-09	*Accelnet MACRO* Servo drive, 90 Vdc, 3/9 A
AMP-090-18	*Accelnet MACRO* Servo drive, 90 Vdc, 6/18 A
AMP-090-36	*Accelnet MACRO* Servo drive, 90 Vdc, 12/36 A
AMP-180-09	*Accelnet MACRO* Servo drive, 180 Vdc, 3/9 A
AMP-180-18	*Accelnet MACRO* Servo drive, 180 Vdc, 6/18 A

ACCESSORIES

	QTY	REF	DESCRIPTION	MANUFACTURER PART NO.
Connector Kit Solder-Cup AMP-CK	1	J1	Plug, 3 position, 5.08 mm, female	PCD: ELFP03210, Weco: 121-A-111/03
	1	J2	Plug, 4 position, 5.08 mm, female	PCD: ELFP04210, Weco: 121-A-111/04
	1	J3	20 Pin Connector, High Density, D-Sub, Solder Cup	3M: 10120-3000VE
	1		20 Pin Connector Backshell	3M: 10320-52F0-008
	1	J4	26 Pin Connector, High Density, D-Sub, Solder Cup	3M: 10126-3000VE
	1		26 Pin Connector Backshell	3M: 10326-52F0-008
Connector Kit Cable Assy AMP-CA	1	J1	Plug, 3 position, 5.08 mm, female	PCD: ELFP03210, Weco: 121-A-111/03
	1	J2	Plug, 4 position, 5.08 mm, female	PCD: ELFP04210, Weco: 121-A-111/04
	1	J3	Cable assembly, control, 10 ft (3 m)	Molex: 52316-2611, plug assy, Molex 52370-2610 boot cover
	1	J4	Cable assembly, feedback, 10 ft (3 m)	Molex: 52316-2011, plug assy, Molex 52370-2010 boot cover
AMP-CC-10		J3	Cable assembly, control, 10 ft (3 m)	Molex: 52316-2611, plug assy, Molex 52370-2610 boot cover
AMP-FC-10		J4	Cable assembly, feedback, 10 ft (3 m)	Molex: 52316-2011, plug assy, Molex 52370-2010 boot cover
SER-CK		J5	Serial Cable Kit: D-Sub 9 female to drive J5 connector, 6 ft (1.8 m)	
CME 2			CME 2™ CD (CME 2)	
Heatsink Kit AMP-HK	1		Heatsink	
	1		Thermal Material	
	A/R		Hardware	

Note: To order drive with heatsink installed at factory, add "-H" to the drive part number. E.g., AMP-090-09-H

ORDERING INSTRUCTIONS

Example: Order 1 AMP-090-18 drive with heatsink installed at factory and associated components:

Qty	Item	Remarks
1	AMP-090-18-H	*Accelnet MACRO* servo drive
1	AMP-CA	Connector Kit with molded cables for control & feedback
1	SER-CK	Serial Cable Kit
1	CME2	CME 2™ CD

Check out the PST power supplies for mounting and DC power:
http://www.copleycontrols.com/motion/downloads/pdf/pst_psx.pdf

Note: Specifications subject to change without notice

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