CANopen DIGITAL SERVOAMPLIFIER
for BRUSHLESS or BRUSH MOTORS

Accelnet™ Module

- **PCB Mount**
- **CANopen Distributed Drive**
  PVT, Profile, Homing
  Powerful Software Tools
- **Stand-Alone Operation**
  Stepper Controller Interface
  PWM Velocity / Torque Command
  Electronic gearing
- **Field-Oriented Control for**
  Optimal Speed / Torque
- **Auto-Tuning and Auto-Phasing**
- **Feedback**
  Digital Encoder and Halls
  Analog Encoder
- **Programmable I/O:**
  10 inputs, 3 outputs

MODEL	Ic	Ip	Vdc
ACM-055-18	6	18	55
ACM-090-09	3	9	90
ACM-180-09	3	9	180
ACM-180-18	6	18	180
ACM-180-20	10	20	180

DESCRIPTION

Accelnet™ is a digital servoamplifier that combines CANopen networking with 100% digital control of brush or brushless motors in a PC board mounting package with power options to 10 Adc continuous and 20 Adc peak from 20 Vdc to 180 Vdc power supplies.

Accelnet™ operates as a Motion Control Device using the DSP-402 protocol under the CANopen DS-301 V4.01 (EN 50325-4) application layer. DSP-402 modes supported include Interpolated Position Mode (PVT), Profile Position Mode, and Homing Mode.

Ten logic inputs are configurable as CAN address bits, enables, limit & home switches, motor temperature switch, stepper/encoder pulses, and reset. There are two logic outputs for reporting amplifier status, or driving a motor brake.

In addition to CANopen motion commands, *Accelnet™* can operate using incremental position commands from step-motor controllers in Pls/Dir or CW/CCW format, as well as A/B quadrature commands from a master-encoder.

Amplifier commissioning is facilitated by *CME 2™* software operating under Windows® communicating with *Accelnet™* via an RS-232 link. Auto-tuning algorithms in *CME 2™* slash set up times for fast system commissioning by automating motor phasing, and current-loop tuning. A powerful oscilloscope and waveform generator display amplifier performance for fine tuning. Amplifier configurations are saved in non-volatile flash memory. OEM's can inventory one part, and configure amplifiers on-site to each axis in a machine.

Space-vector modulation delivers higher motor speeds and lower motor power dissipation than conventional sine-PWM modulation. Carrier-cancellation modulation all but eliminates motor ripple current and dissipation at a standstill. Current-loop sampling is at 14 kHz, position and velocity loops at 2.8 kHz and PWM ripple at 28 kHz.

All amplifier circuits are DC coupled and operate from unregulated transformer-isolated linear DC power supplies, or regulated switching power supplies.

The PC-board mounting package is suitable for high-density, multi-axis installations in equipment where space is at a premium, and wiring must be minimized.

GENERAL SPECIFICATIONS

Test conditions: Load = Wye connected load: 1 mH+ 1Ω line-line. Ambient temperature = 25 °C. +HV = HV_{max}

MODEL	ACM-055-18	ACM-090-09	ACM-180-09	ACM-180-18	ACM-180-20	
OUTPUT POWER						
Peak Current	18 (12.7)	9 (6.34)	9 (6.34)	18 (12.7)	20 (14.14)	Adc (Arms, sinusoidal)
Peak time	1	1	1	1	1	Sec
Continuous current	6 (4.24)	3 (2.1)	3 (2.1)	6 (4.24)	10 (7.1)	Adc (Arms, sinusoidal)
Peak Output Power	0.99	0.81	1.62	3.24	3.6	kW
Continuous Output Power	0.33	0.27	0.54	1.08	1.8	kW
INPUT POWER						
HV_{min} to HV_{max}	+20 to +55	+20 to +90	+20 to +180	+20 to +180	+20 to +180	Vdc,transformer-isolated
Ipeak	18	9	9	18	20	Adc (1 sec) peak
Icont	6	3	3	6	10	Adc continuous
Aux HV	+20 to HV_{max}	2.5 W	Optional keep-alive power input when +HV is removed			

PWM OUTPUTS

Type	MOSFET 3-phase inverter, 14 kHz center-weighted PWM carrier, space-vector modulation
PWM ripple frequency	28 kHz

BANDWIDTH

Current loop, small signal	2.5 kHz typical, bandwidth will vary with tuning & load inductance
HV Compensation	Changes in HV do not affect bandwidth
Current loop update rate	15 kHz (66.7 µs)
Position & Velocity loop update rate	3.75 kHz (267 µs)

REFERENCE INPUTS

CANopen bus	Position Mode commands	Homing, Profile, and Interpolated profile modes
Digital position reference	Pls/Dir, CW/CCW	Stepper commands (2 MHz maximum rate)
	Quad A/B Encoder	2 Mline/sec, (8 Mcount/sec after quadrature)
Digital torque & velocity reference (Note 1)	PWM , Polarity	PWM = 0~100%, Polarity = 1/0
	PWM	PWM = 50% +/-50%, no polarity signal required
	PWM frequency range	1 kHz minimum, 100 kHz maximum
	PWM minimum pulse width	220 ns

DIGITAL INPUTS (NOTE 1)

All inputs	74HC14 Schmitt trigger operating from +5 Vdc with RC filter on input, 10 kΩ pull-up to +5 Vdc RC time-constants assume active drive on inputs and do not include 10 kΩ pull-ups.
Logic levels	Vin-LO < 1.35 Vdc, Vin-HI >3.65 Vdc, Maximum input voltage = +10 Vdc
Enable [IN1]	1 dedicated input for amplifier enable, active level programmable, 330 µs RC filter
GP [IN2,3,4,5]	4 General Purpose inputs with 330 µs (33 µs for [IN4]) RC filter, programmable functions, and active level select
HS [IN6,7,8,9,10]	5 High-Speed Inputs inputs with 100 ns RC filter, programmable functions, and active level select

DIGITAL OUTPUTS (NOTE 1)

Type	Current-sinking MOSFET open-drain output with 1 kΩ pullup to +5 Vdc through diode 1 Adc sink max, +30 Vdc max
Functions	Programmable with *CME 2*™
Active Level	Programmable to either HI (off, pull-up to +5 Vdc) or LO (on, current-sinking) when output is active

RS-232 COMMUNICATION PORT

Signals	RxD, TxD, Gnd Full-duplex, serial communication port for amplifier setup and control, 9,600 to 115,200 Baud

CANopen COMMUNICATION PORT

Signals	CANH, CANL, Gnd. 1Mbit/sec maximum.
Protocol	CANopen Application Layer DS-301 V4.01
Device	DSP-402 Device Profile for Drives and Motion Control

MOTOR CONNECTIONS

Motor U,V,W	Amplifier outputs to 3-phase brushless motor, Wye or delta connected For DC brush motor use outputs U & V
Encoder	Quadrature encoder, differential outputs (A,/A,B,/B,X,/X), 5 Mlines/sec (20 Mcount/sec after quadrature)
Halls	Hall signals (U,V,W)
Motemp	Motor temperature sensor or switch

PROTECTIONS

HV Overvoltage	+185, +91, +56 Vdc	Amplifier outputs turn off until +HV is < overvoltage (for 180, 90, 55 Vdc models)
HV Undervoltage	+HV < +20 Vdc	Amplifier outputs turn off until +HV >= +20 Vdc
Amplifier over temperature	PC Board > 70 °C.	Amplifier latches OFF until amplifier is reset, or powered off-on
Short circuits		Output to output, output to ground, internal PWM bridge faults
I^2T Current limiting		Programmable: continuous current, peak current, peak time
Latching / Non-Latching		Programmable

Notes

1. [IN1] is not programmable and always works as amplifier Enable. Other digital inputs are programmable.

ACCELNET™ FEATURES

• CANopen Networking

Based on the CAN physical layer, a robust, two-wire communication bus originally designed for automotive use where low-cost and noise-immunity are essential, CANopen adds support for motion-control devices and command synchronization. The result is a highly effective combination of data-rate and low-cost for multi-axis motion control systems. Device synchronization enables multiple axes to coordinate moves as if they were driven from a single control card.

• Field-Oriented Motor Control

Unlike conventional sinusoidal commutation which controls only the amplitude of the motor phase currents, Field-Oriented Control (FOC) controls the electrical phase in order to maintain the optimum ±90° between the motor magnetic axis and the field produced by the phase currents. The effect is to maximize the efficiency of the motor, and minimize the heating produced by the drive currents. Torque is maintained over a wider range of speeds than with conventional sinusoidal commutation, and space-vector modulation gives higher motor speeds from the same power supply.

• PC Board Mounting

The small size, and cooling options enable *Accelnet*™ to be integrated into machinery with fewer cables and connections, and closer to the motor when required. Optional convection heatsinks provide two choices of cooling capacity. The *Accelnet*™ case has tabs molded-in that accept Socket-A compatible chip-coolers which have integral fans to provide even greater cooling capacity.

RS-232 COMMUNICATION

Accelnet™ is configured via a three-wire, full-duplex RS-232 port that operates from 9,600 to 115,200 Baud. *CME 2™* software provides a graphic user interface (GUI) to set up all of *Accelnet*™ features via a computer serial port.

The RS-232 port is used for amplifier set up and configuration. Once configured, *Accelnet*™ can be used in stand-alone mode taking digital position, velocity, or torque commands from a controller, or as a networked amplifier on a CANopen bus.

CANopen COMMUNICATION

Accelnet™ uses the CAN physical layer signals CANH, CANL, and GND for connection, and CANopen protocol for communication.

Before connecting *Accelnet*™ to the CAN network, it must be assigned a CAN address. This is done via the RS-232 port, which is also used for general amplifier setup. The CAN address is a combination of an internal address stored in flash memory, and digital inputs which have been configured to act as CAN address bits. A maximum of 128 CAN devices are allowed on a CAN bus network, so this limits the input pins used for this purpose to a maximum of seven, leaving three inputs available for other purposes. Most installations will use less than the maximum number of CAN devices, in which case the number of inputs used for a CAN address can be less than seven, leaving more inputs available for other functions.

When inputs are used for the CAN address bits, the internal address is added to the binary value that results from the inputs. If all the inputs are used as logic inputs, then the CAN address in flash memory is the amplifier CAN address.

DIGITAL INPUTS

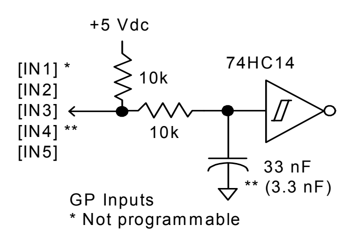
There are ten digital inputs to *Accelnet*™, nine of which can be programmed to a selection of functions. The Enable input which controls the on/off state of the PWM outputs is fixed to [IN1] as a safety measure so that an amplifier cannot be programmed in such a way that, once installed, it could not be shut down by the controller. The other nine inputs can be set to a selection of functions. Two types of RC filters are used (GP & HS). Input functions such as Pulse/Direction, CW/CCW, Quad A/B typically are wired to inputs having the HS filters, and inputs with the GP filters are used for general purpose logic functions, limit switches, and the motor temperature sensor. Input [IN4] has a 33 µs RC filter.

Programmable functions of the I/O inputs are:

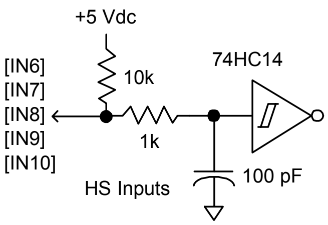
- CAN address
- Positive Limit switch
- Negative Limit switch
- Home switch
- Amplifier Reset
- Pls/Dir, or CW/CCW step motor control commands
- Quad A/B master encoder position commands
- Motor temperature sensor or switch input

In addition to the selection of functions, the active level for each input is individually programmable.

Amplifier reset takes place on transitions of the input and is programmable to 1/0 or 0/1. The motor temp sensor function will disable the amplifier if a switch in the motor opens or closes when the motor overheats.



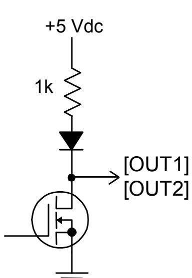
General-Purpose Inputs



High-Speed Inputs

DIGITAL OUTPUTS

The digital outputs OUT1, and OUT2 are open-drain MOSFETs with 1 kΩ pull-up resistors in series with a diode to +5 Vdc. They can sink up to 1 Adc from external loads operating from power supplies to +30 Vdc.
The outputs are typically configured as amplifier fault and motor brake. Additional functions are programmable.
As an amplifier fault output, the active level is programmable to be HI or LO when an amplifier fault occurs. As a brake output, it is programmable to be either HI or LO to release a motor brake when the amplifier is enabled.
When driving inductive loads such as a relay, an external fly-back diode is required. A diode in the output is for driving PLC inputs that are opto-isolated and connected to +24 Vdc. The diode prevents conduction from +24 Vdc through the 1 kΩ resistor to +5 Vdc in the amplifier. This could turn the PLC input on, giving a false indication of the amplifier output state.

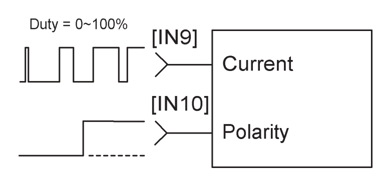


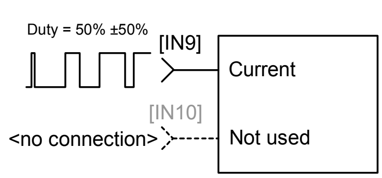
REFERENCE INPUTS

As a network amplifier, the primary command input is the CANopen bus. But, *Accelnet™* can also operate in stand-alone mode, taking position, velocity, or current (torque, force) commands in digital format from a motion controller.

DIGITAL REFERENCE INPUTS

Two logic inputs are used as digital reference inputs in the stand-alone mode. These will be assigned automatically to inputs that have the fast filters.
Current (torque, force) mode commands can be in one or two-wire format. In the one-wire format (50% PWM), a single input takes a square waveform that has a 50% duty cycle when the amplifier output should be zero. Thereafter, increasing the duty cycle to 100% will command an output current that will produce a maximum force or torque in a positive direction of motion, and decreasing the duty cycle to 0% will produce a maximum negative torque or force output.
In two-wire format (PWM/Dir), one input takes a PWM waveform of fixed frequency and variable duty cycle, and the other input takes a DC level that controls the polarity of the output current. The active level of the PWM signal for 0 current output is programmable. The direction of the force or torque produced will depend on the polarity of the DC signal on the direction input.



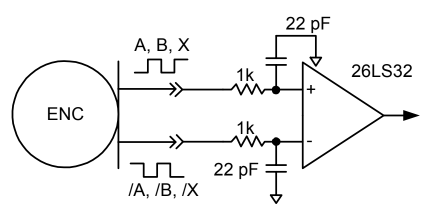


MOTOR CONNECTIONS

Motor connections are of three types: phase, Halls, and encoder. The phase connections carry the amplifier 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.

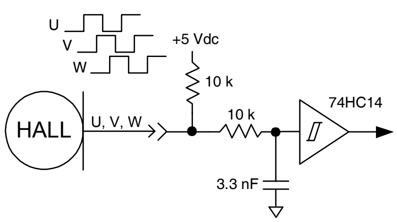
MOTOR ENCODER

The motor encoder interface is a differential line-receiver with R-C filtering on the inputs. The circuit is shown below. Encoders with differential outputs are preferred because they are less susceptible to noise that can be picked on single-ended outputs. PC board layouts should route the encoder signal-pairs as close to each other as possible for best transmission-line characteristics. If single-ended encoders are used, a pull-up resistor should be installed on the PC board, and the unused input can be left open. If this is done, it is recommended that the inverting input be left open as its' open-circuit voltage of 2.0 Vdc (typical) is closer to TTL and CMOS levels than the non-inverting input which has an open-circuit voltage of 2.9 Vdc (typical). The encoder input circuit is shown below.



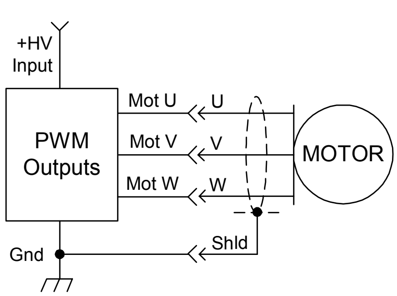
MOTOR HALL SIGNALS

Hall signals are single-ended signals that provide absolute feedback within one electrical cycle of the motor. There are three of them (U, V, & W) and they may be sourced by magnetic sensors in the motor, or by encoders that have Hall tracks as part of the encoder disc. They typically operate at much lower frequencies than the motor encoder signals, and in *Accelnet™* they are used for commutation-initialization after startup, and for checking the motor phasing after the amplifier has switched to sinusoidal commutation.



MOTOR PHASE CONNECTIONS

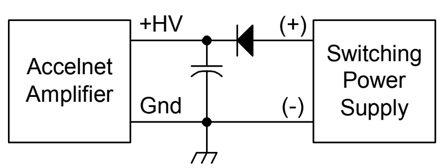
The amplifier output is a three-phase PWM inverter that converts the DC buss voltage (+HV) into three sinusoidal voltage waveforms that drive the motor phase-coils. The peak voltage between adjacent etches on the PC board is equal to the +HV power, and peak and continuous currents will not be greater than the ratings of the particular amplifier model. A trace width of 0.175 in, plating thickness of 3 oz copper, and spacing of 0.25 in is adequate for all models of *Accelnet™*.



POWER SUPPLIES

Accelnet™ 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 amplifiers maximum voltage rating. Power supply rating depends on the power delivered to the load by the amplifier. In many cases, the continuous power output of the amplifier 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 amplifier to prevent regenerative energy from reaching the output of the supply. If this is done, there must be external capacitance between the diode and amplifier. The minimum value required is 330 µF per amplifier.



Aux HV INPUT

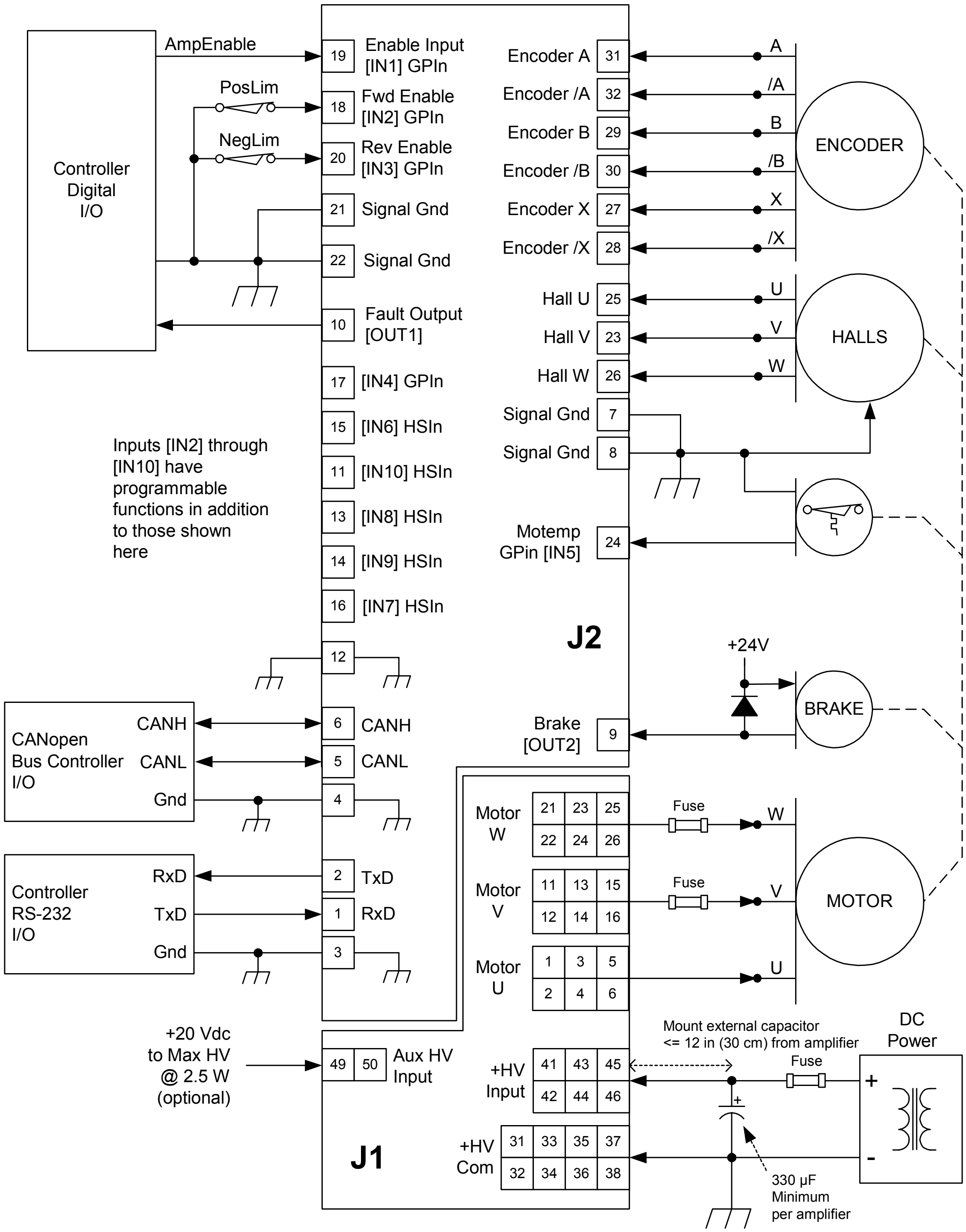
Accelnet™ can continue to communicate on a CANopen network under EMO (EMergency Off) conditions if auxiliary DC power is connected to the Aux HV input. This powers the internal DC/DC converter so that motor position and amplifier communications are preserved while +HV is removed from the PWM inverter stage. The minimum voltage is +20 Vdc, and the maximum is the same as the amplifier maximum +HV rating. The current requirements will vary with voltage and can be calculated based on an average power consumption of 2.5 W.

MOUNTING AND COOLING

Accelnet™ mounts on PC boards using two, dual-row, 0.1 in female headers. These permit easy installation and removal of the amplifier without soldering. Threaded standoffs swaged into the PC board provide positive retention of the amplifier and permit mounting in any orientation. Cooling options are: no heatsink, convection heatsinks, and chip-cooler heatsinks.

Convection heatsinks are available from Copley in standard, or low-profile forms. Chip-cooler heatsinks are not sold by Copley, but are available from a wide range of sources. The *Accelnet™* package has tabs that are designed to work with Socket-A clip-on heatsinks used most commonly in Pentium® based, or equivalent computers. The chip-cooler heatsinks have integral fans which provide a forced airstream over the fins. The advantage of this is that airflow is guaranteed regardless of the amplifier mounting position.

TYPICAL AMPLIFIER CONNECTIONS



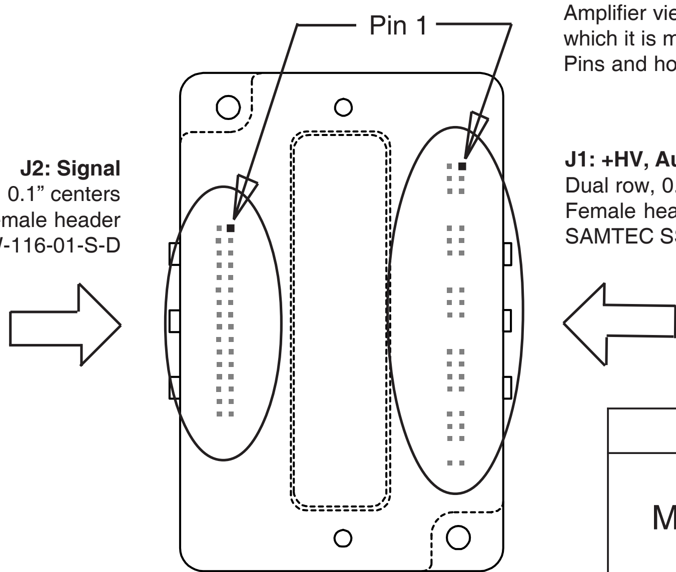
NOTES

1. [IN1] always functions as Amp Enable and is not programmable.
   [IN2]~[IN10] are programmable.
2. HS inputs [IN6,7,8,9, 10] are for high-speed signals and have 100 ns RC filters.
   GP inputs [IN1,2,3, &5] have 330 µs filters, [IN4] has a 33 µs filter.
   RC filter time constants apply when inputs are driven by active sources and do not include the 10 kΩ pull-up resistors.

AMPLIFIER PC BOARD CONNECTORS

Amplifier viewed from above looking down on the pc board on which it is mounted.
Pins and housing shapes are shown in phantom view.

J2: Signal
Dual row, 0.1” centers
32 position female header
SAMTEC SSW-116-01-S-D



J1: +HV, Aux HV, Gnd, & Motor Outputs
Dual row, 0.1” centers
Female header
SAMTEC SSW-125-01-S-D

Signal	J2 Pin		Signal
RS-232 TxD	2	1	RS-232 RxD
Signal Ground	4	3	Signal Ground
CANH	6	5	CANL
Signal Ground	8	7	Signal Ground
Fault [OUT1]	10	9	[OUT2] Brake
Signal Ground	12	11	[IN10] HSInput
HSInput [IN9]	14	13	[IN8] HSInput
HSInput [IN7]	16	15	[IN6] HSInput
GPInput [IN2]	18	17	[IN4] GPInput
GPInput [IN3]	20	19	[IN1] GPInput
Signal Ground	22	21	Signal Ground
GPInput [IN5]	24	23	Hall V
Hall W	26	25	Hall U
Encoder /X	28	27	Encoder X
Encoder /B	30	29	Encoder B
Encoder /A	32	31	Encoder A

Signal	J1 Pin		Signal
Motor U	2	1	Motor U
	4	3	
	6	5	
No Connection	8	7	No Connection
	10	9	
Motor V	12	11	Motor V
	14	13	
	16	15	
No Connection	18	17	No Connection
	20	19	
Motor W	22	21	Motor W
	24	23	
	26	25	
No Connection	28	27	No Connection
	30	29	
HV COM (Ground)	32	31	HV COM (Ground)
	34	33	
	36	35	
	38	37	
No Connection	40	39	No Connection
+HV	42	41	+HV
	44	43	
	46	45	
No Connection	48	47	No Connection
Aux HV	50	49	Aux HV

NOTES

1. Signals are grouped for current-sharing on the power connector. When laying out pc board artworks, all pins in groups having the same signal name must be connected.

PC BOARD DESIGN

Printed circuit board layouts for *Accelnet*™ amplifiers should follow some simple rules:

1. Install a low-ESR electrolytic capacitor not more than 12 inches from the amplifier. PWM amplifiers produce ripple currents in their DC supply conductors. *Accelnet*™ amplifiers do not use internal electrolytic capacitors as these can be easily supplied by the printed circuit board. In order to provide a good, low-impedance path for these currents a low-ESR capacitor should be mounted as close to the amplifier as possible. 330 µF is a minimum value, with a voltage rating appropriate to the amplifier model and power supply.

2. Connect J1 signals (U,V,W outputs, +HV, and +HV Common) in pin-groups for current-sharing. The signals on J1 are all high-current types (with the exception of the +24 Vdc Aux HV supply). To carry these high currents (up to 20 Adc peak) the pins of J1 must be used in multiples to divide the current and keep the current carrying capacity of the connectors within specification. The diagram on page 8 shows the pin groups that must be interconnected to act as a single connection point for pc board traces.

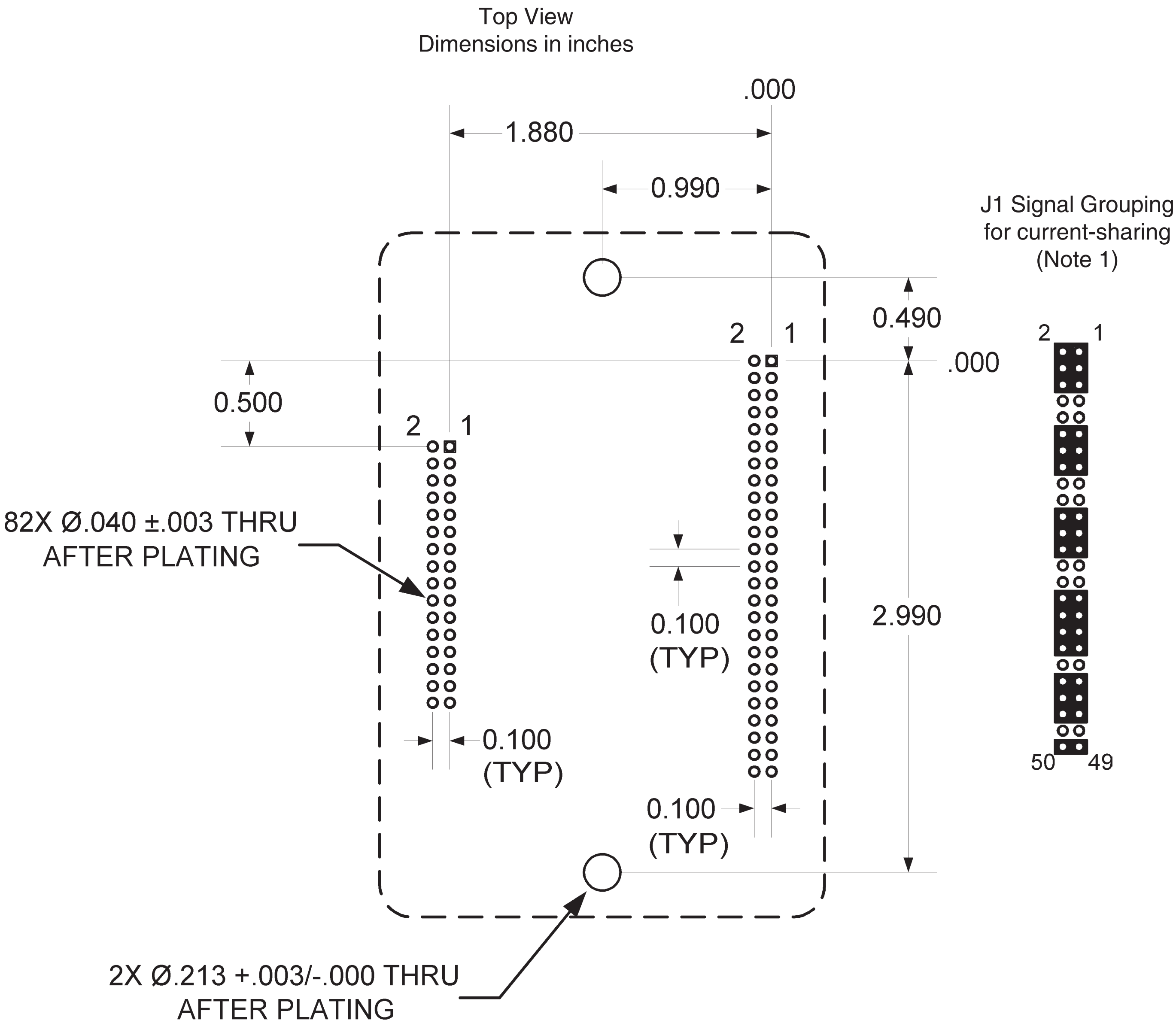
3. Follow IPC-2221 rules for conductor thickness and minimum trace width of J1 signals. The width and plating should depend on the model of amplifier used, the maximum voltage, and maximum current expected to be used for that model. Power supply traces (+HV, +HV Common) should be routed close to each other to minimize the area of the loop enclosed by the amplifier DC power. Noise emission or effects on nearby circuitry are proportional to the area of this loop, so minimizing it is good layout practice.

Motor signals (U,V,W) should also be routed close together. All the motor currents sum to zero, and while the instantaneous value in a given phase will change, the sum of currents will be zero. So, keeping these traces as closely placed as possible will again minimize noise radiation due to motor phase currents.

Accelnet™ circuit grounds are electrically common, and connect internally. However, the J1 signals carry high currents while the grounds on J2 (signal ground) carry low currents. So, J2 signals should be routed away from, and never parallel to the signals on J1. Encoder signal pairs (A, /A, B, /B, and X, /X) should be routed close together for good transmission-line effect to reduce reflections and noise.

The amplifier heatplate is electrically isolated from all amplifier circuits. For best noise-immunity it is recommended to connect the standoffs to frame ground and to use metal mounting screws to maintain continuity between heatplate and standoffs.

PC BOARD MOUNTING FOOTPRINT



Accelnet Mounting Hardware:

Qty	Description	Mfgr	Part Number	Remarks
1	Socket Strip	Samtec	SSW-116-01-S-D	J2
1	Socket Strip	Samtec	SSW-125-01-S-D	J1
2	Standoff 6-32 X 3/8”	PEM	KFE-632-12-ET	

NOTES

1. J1 signals must be connected for current-sharing.
2. To determine copper width and thickness for J1 signals refer to specification IPC-2221. (Association Connecting Electronic Industries, http://www.ipc.org)
3. Standoffs should be connected to etches on pc board that connect to frame ground for maximum noise suppression and immunity.

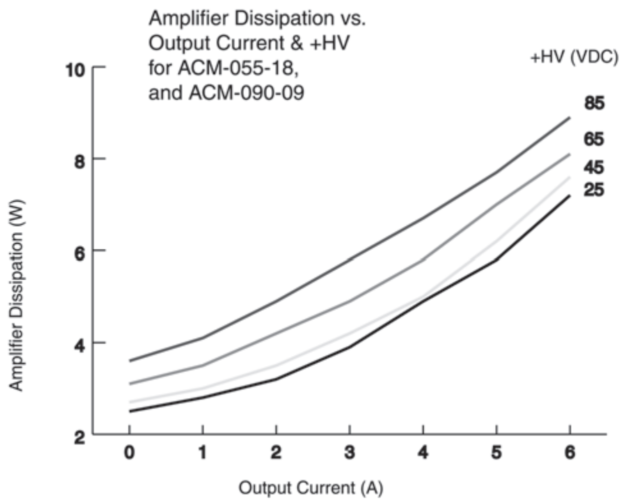
POWER DISSIPATION

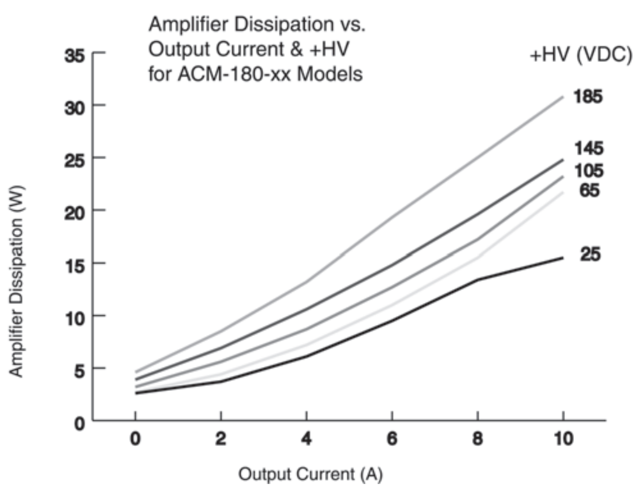
The charts on this page show the amplifier internal power dissipation for different models under differing power supply and output current conditions. Amplifier output current is calculated from the motion profile, motor, and load conditions. The values on the chart represent the rms (root-mean-square) current that the amplifier would provide during operation. The +HV values are for the average DC voltage of the amplifier power supply.

When +HV and amplifier output current are known, the amplifier power dissipation can be found from the charts. The next step is to determine the temperature rise the amplifier will experience when it's installed. For example, if the ambient temperature in the amplifier enclosure is 40 °C, and the heatplate temperature is to be limited to 65 °C to avoid shutdown, the rise would be 25 °C.

Divide the temperature rise by amplifier dissipation to get a result in units of °C/W. For a model ACM-180-18 operating at 150 Vdc and outputting 4 Arms, the dissipation would be about 11 W. This would give 25 °C/11W, or 2.27 °C/W as the maximum thermal resistance (R_{th}) of a heatsink.

From the illustrations on the opposite page, if it is desired to use the amplifier without fan cooling, the -HS heatsink option would work as it has an R_{th} of 2.2 °C/W.



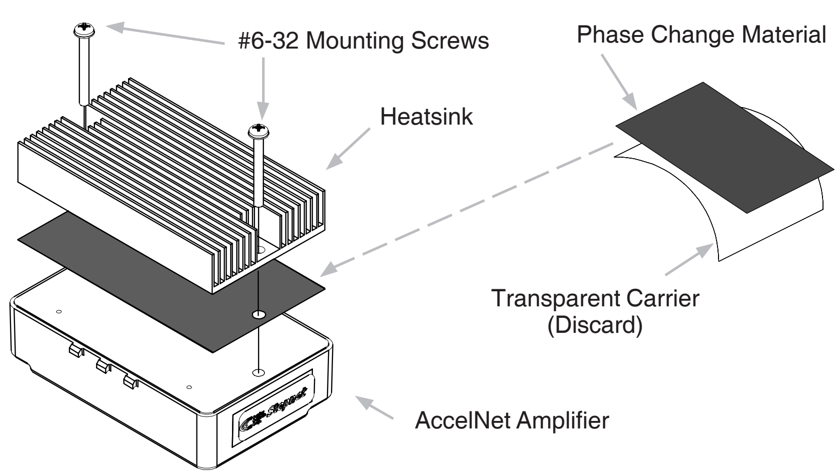


HEATSINK INSTALLATION

If a heatsink is used it is mounted using the same type of screws used to mount the amplifier without a heatsink but slightly longer. Phase change material (PSM) is used in place of thermal grease. This material comes in sheet form and changes from solid to liquid form as the amplifier warms up. This forms an excellent thermal path from amplifier heatplate to heatsink for optimum heat transfer.

STEPS TO INSTALL

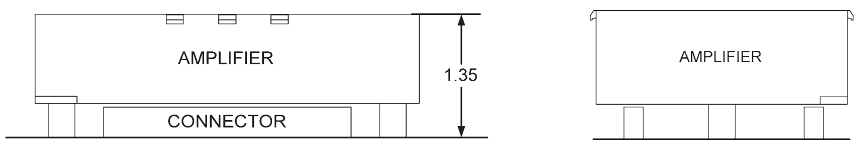
1. Remove the PSM (Phase Change Material) from the clear plastic carrier.
2. Place the PSM on the Accelnet aluminum heatplate taking care to center the PSM holes over the holes in the amplfier body.
3. Mount the heatsink onto the PSM again taking care to see that the holes in the heatsink, PSM, and amplifier all line up.
4. Torque the #6-32 mounting screws to 8~10 lb-in (0.9~1.13 N·m).



HEATSINK OPTIONS

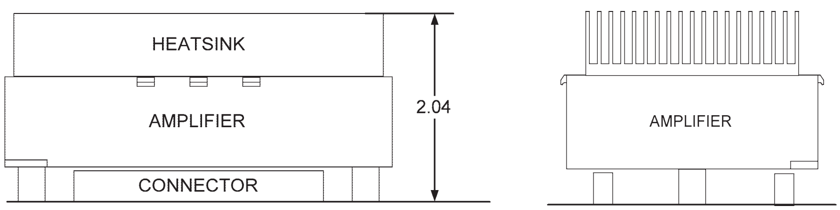
R_{th} expresses the rise in temperature of the amplifier per Watt of internal power loss. The units of R_{th} are °C/W, where the °C represent the rise above ambient in degrees Celsius. The data below show thermal resistances under convection, or fan-cooled conditions for the no-heatsink, HL, and HS heatsinks, and for the chip-cooler with integral fan.

NO HEATSINK



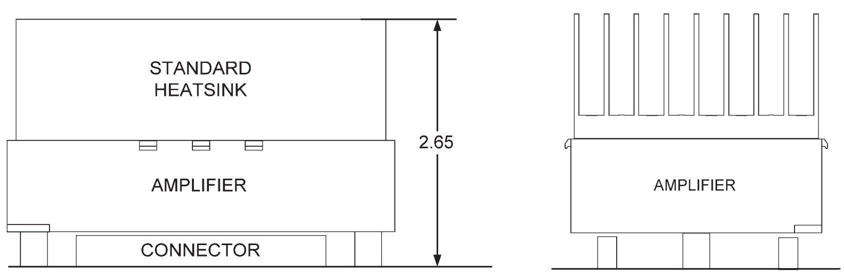
NO HEATSINK	°C/W
CONVECTION	6.2
FORCE AIR (300 LFM)	2.1

LOW-PROFILE HEATSINK (ACM-HL)



ACM-HL HEATSINK	°C/W
CONVECTION	4.0
FORCE AIR (300 LFM)	0.9

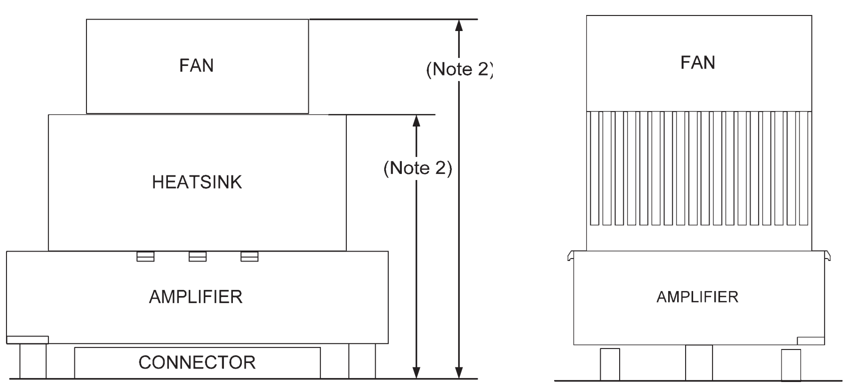
STANDARD HEATSINK (ACM-HS)



ACM-HS HEATSINK	°C/W
CONVECTION	2.2
FORCE AIR (300 LFM)	0.5

Dimensions in inches
using recommended connectors
and standoffs (see page 9)

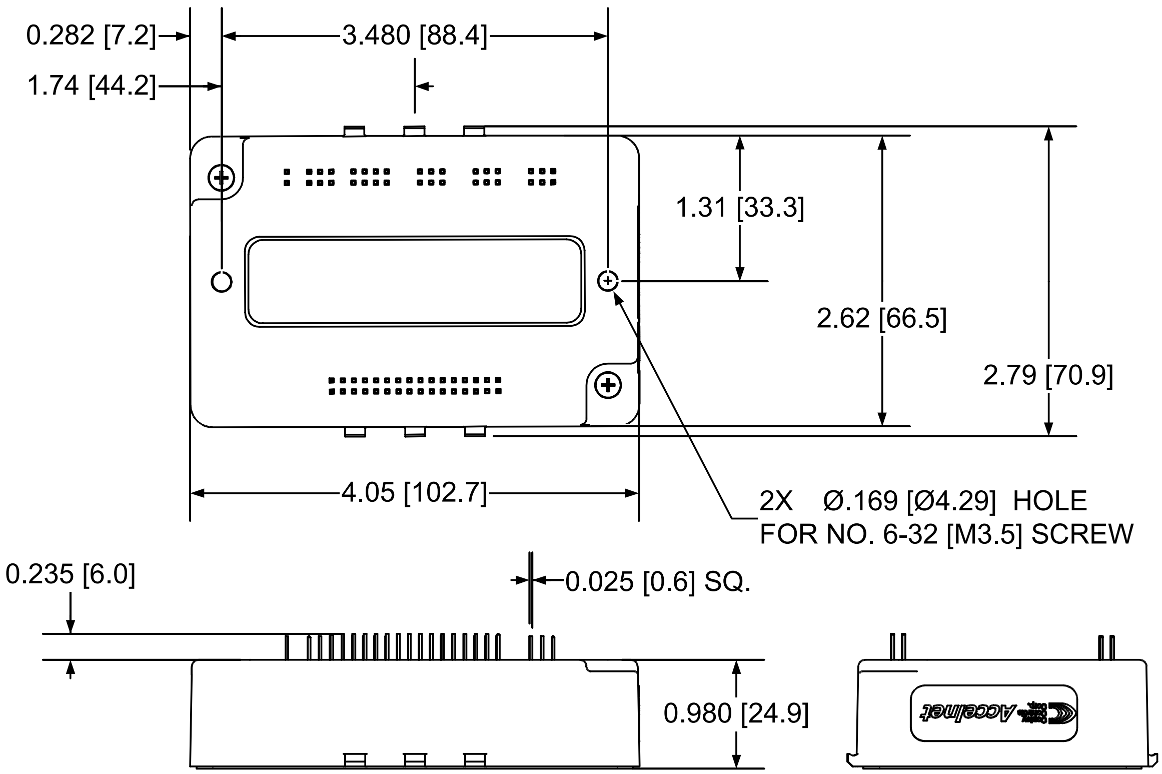
CHIP-COOLER HEATSINKS
(SHOWN FOR EXAMPLE ONLY. NOT AVAILABLE FROM COPLEY CONTROLS)



CHIP-COOLER	°C/W
WITH 24VDC/2W FAN (HF-24)	0.5

Notes:
1. Thermal data is approximate and based on one unit tested. Users should qualify chip coolers with amplifier under actual operating conditions.
2. Chip cooler dimensions will vary with model.

DIMENSIONS



Notes

1. Dimensions shown in inches [mm].

ORDERING GUIDE

PART NUMBER	DESCRIPTION
ACM-055-18	*Accelnet*™ Servoamplifier 6/18 Adc @ 55 Vdc
ACM-090-09	*Accelnet*™ Servoamplifier 3/9 Adc @ 90 Vdc
ACM-180-09	*Accelnet*™ Servoamplifier 3/9 Adc @ 180 Vdc
ACM-180-18	*Accelnet*™ Servoamplifier 6/18 Adc @ 180 Vdc
ACM-180-20	*Accelnet*™ Servoamplifier 10/20 Adc @ 180 Vdc
MDK-180-01	*Accelnet*™ Development Kit
MDK-CK	*Accelnet*™ Development Kit Connector Kit
ACM-HL	*Accelnet*™ Modular Amp Heatsink Kit, Low-profile
ACM-HS	*Accelnet*™ Modular Amp Heatsink Kit, Standard
CME2	*CME 2*™ Drive Configuration Software CD-ROM
SER-CK	Serial Cable Kit

ORDERING INSTRUCTIONS

Example: Order 1 ACM-090-09 amplifier with Standard Heatsink, Development Kit, and Development Kit Connector Kit

Qty	Item	Remarks
1	ACM-090-09	*Accelnet™* servoamplifier
1	ACM-HS	Standard Heatsink
1	MDK-180-01	*Accelnet™* Development Kit
1	MDK-CK	Connector Kit for Development Kit
1	CME2	*CME2™* CD
1	SER-CK	Serial Cable Kit

NOTES

1. Heatsink kits are ordered separately and assembled by the customer, not at the factory.

Note: Specifications are subject to change without notice

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