copley controls

Accelnet Plus R42

RUGGEDIZED DIGITAL SERVO DRIVE
FOR BRUSHLESS/BRUSH MOTORS

RoHS

CANopen

CONTROL MODES
- Position, Velocity, Torque
- Indexer, Point-to-Point, PVT
- Camming, Gearing

COMMAND INTERFACE
- CANopen
- ASCII and discrete I/O
- Stepper commands
- ±10V position/velocity/torque command
- PWM velocity/torque command
- Master encoder (Gearing/Camming)

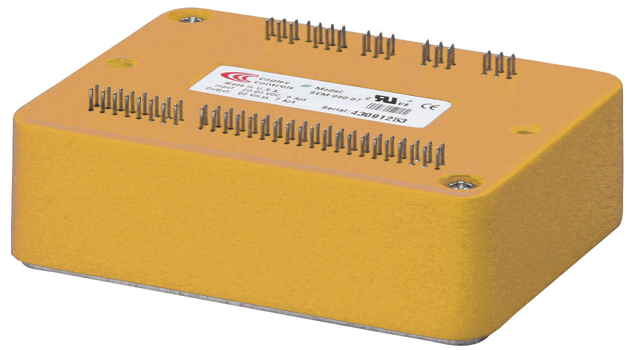
COMMUNICATIONS
- CANopen
- RS-232

FEEDBACK
- *Incremental*
- Digital quad A/B encoder
- Analog sin/cos encoder
- Panasonic Incremental A
- Digital Halls

Absolute
- SSI
- EnDat
- Absolute A
- Tamagawa Absolute A
- Panasonic Absolute A Format
- BiSS (B & C)

I/O
- Digital: 11 inputs, 6 outputs
- Analog: 1 input

DIMENSIONS: MM [IN]
- 76.3 x 58.2 x 20.5
  [3.01 x 2.29 x 0.81]



Model	Ic	Ip
R42-090-06	3	6
R42-090-14	7	14
R42-090-30	15	30

DESCRIPTION

Accelnet R42 is a high-performance, ruggedized, DC powered servo drive for position, velocity, and torque control of brushless and brush motors via CANopen. Using advanced FPGA technology, the *R42* provides a significant reduction in the cost per node in multi-axis CANopen systems.

The *R42* operates as an *CANopen* node using the CANopen over CANopen (CoE) protocol of DSP-402 for motion control devices. Supported modes include: Profile Position-Velocity-Torque, Interpolated Position Mode (PVT), and Homing.

Command sources also include ±10V analog torque/velocity/position, PWM torque/velocity, and stepper command pulses.

Feedback from a number of incremental and absolute encoders is supported.

Nine high-speed digital inputs with programmable functions are provided, and a low-speed input for motor temperature switches.

An SLI (Switch & LED Interface) function is supported by another high-speed input and four high-speed digital outputs. If not used for SLI, the input and outputs are programmable for other functions. Two open-drain MOSFET outputs can drive loads powered up to 24 Vdc.

An RS-232 serial port provides a connection to Copley's CME2 software for commissioning, firmware upgrading, and saving configurations to flash memory.

Drive power is transformer-isolated DC from regulated or unregulated power supplies. An AuxHV 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.

RUGGEDIZED STANDARDS CONFORMANCE

Ambient Temperature	Non-Operating	-50ºC to 85ºC
	Operating	-40ºC to 70ºC
Thermal Shock	Operating	-40ºC to 70ºC in 1 minute
Relative Humidity	Non-Operating	95% non-condensing at 60ºC
	Operating	95% non-condensing at 60ºC
Vibration	Operating	5 Hz to 500 Hz, up to 3.85 *g*rms
Altitude	Non-Operating	-400 m to 16,000 m
	Operating	-400 m to 16,000 m
Shock	Crash Safety	75 *g* peak acceleration
	Operating	40 *g* peak acceleration
MIL-STD specifications	MIL-STD-	461, 704, 810, 1275, 1399
IEC specifications	IEC-	60068, 60079

GENERAL SPECIFICATIONS

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

MODEL	R42-090-06	R42-090-14	R42-090-30	Units	
OUTPUT POWER					
Peak Current	6	14	30	A	DC, sinusoidal
	4.2	10	21	A	RMS, sinusoidal
Peak time	1	1	1	s	Sec
Continuous current	3	7	15	A	DC, sinusoidal
	2.1	5	10.6	A	RMS, sinusoidal
Maximum Output Voltage				V	Vout = HV*0.97 - Rout*Iout
INPUT POWER					
HVmin~HVmax	+14 to +90	+14 to +90	+14 to +90	V	DC, transformer-isolated
Ipeak	6	14	30	A	For 1 sec
Icont	3	7	15	A	Continuous
Aux HV	+14 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
CONTROL MODES	
	CANopen: Profile Position/Velocity/Torque, Interpolated Position (PVT), Homing
	Analog ±10 Vdc velocity/torque
	Digital PWM velocity/torque and stepper commands
	Discrete I/O: camming, internal indexer and function generator
COMMAND INPUTS	
Type	CANopen, galvanically isolated from drive circuits
Signals	CAN_H, CAN_L, CAN_GND
Data protocol	CANopen Device Profile DSP-402 over CANopen (CoE)
Address Selection	Programmable, or via digital inputs
Analog	±10 Vdc, torque/velocity/position control
Digital	High speed inputs for PWM/Polarity, Step/Direction, or Quad A/B master encoder
Camming	Quad A/B digital encoder
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
Bandwidth	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, type	11, 74LVC14 Schmitt trigger, V_T+ = 1.1~2.2 Vdc, V_T- = 0.8~1.5 Vdc, V_H+ = 0.3~0.45 Vdc
[IN1~9]	High-speed (HS) digital, 100 ns RC filter, 10 kΩ pull-up to +5 Vdc, +7 Vdc tolerant
[IN10]	SLI port MISO input, 47 ns RC filter, 10 kΩ pull-up to +5 Vdc
[IN11]	Motor temperature switch, 330 µs RC filter, 4.99 kΩ pull-up to +5 Vdc
Functions	Default functions are shown above, programmable to other functions
ANALOG INPUT	
Number	1
Type	Differential, ±10 Vdc, 12-bit resolution, 5 kΩ input impedance
DIGITAL OUTPUTS	
Number	6, function programmable (defaults shown below)
[OUT1~2]	Open-drain MOSFET with 1 kΩ pull-up with series diode to +5 Vdc 300 mAdc max, +30 Vdc max.
[OUT3~6]	SLI port MOSI, SCLK, & SS1 signals, 74AHCT125 line drivers; +5 Vdc tolerant
Functions	Default functions are shown above, programmable to other functions

FEEDBACK	
Incremental encoders:	
Digital Incremental Encoder	Quadrature signals, (A, /A, B, /B, X, /X), differential (X, /X Index signals not required) RS-422 differential line receivers, 5 MHz maximum line frequency (20 M counts/sec) Fault detection for open/shorted inputs, or low signal amplitude, external 121Ω terminators required
Analog Incremental Encoder	Sin/Cos, differential, internal 121Ω terminators between ± inputs, 1.0 Vp-p typical, 1.45 Vp-p maximum, Common-mode voltage 0.25 to 3.75 Vdc, , ±0.25 V, centered about 2.5 Vdc Signals: Sin(+), Sin(-), Cos(+), Cos(-), Frequency: 230 kHz maximum line (cycle) frequency, interpolation 12 bits/cycle (4096 counts/cycle)
Absolute encoders:	
Heidenhain EnDat 2.2, SSI	Serial Clock (X, /X), Data (S, /S) signals, differential 4-wire, external 121Ω terminator required for Data
Heidenhain EnDat 2.2	Clock (X, /X), Data (S, /S), sin/cos (sin+, sin-, cos+, cos-) signals Internal 121Ω terminators between sin/cos inputs, external 121Ω terminator required for Data
Absolute A, Tamagawa Absolute A, Panasonic Absolute A Format	SD+, SD- (S, /S) signals, 2.5 or 4 MHz, 2-wire half-duplex, external 121Ω terminator required Position feedback: 13-bit resolution per rev, 16 bit revolution counter (29 bit absolute position data) Status data for encoder operating conditions and errors
BiSS (B&C)MA+, MA- (X, /X), SL+, SL- (S, /S) signals, 4-wire, clock output from drive, data returned from encoder	External 121Ω terminator required for SL
Commutation:	Digital Hall signals, single-ended, 1.5 µs RC filter, 15 kΩ pull-up to +5 Vdc, 74LVC14 Schmitt trigger
Encoder power	+5 Vdc ±2% @ 400 mAdc max, current limited to 750 mAdc @ +1 Vdc if output overloaded (J3-3)
RS-232 PORT	
Signals	RxD, TxD, Gnd for operation as a DTE device
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, 1 µs RC filter, 10 kΩ pull-up to +5 Vdc, 74HC14 Schmitt trigger
Encoders	See FEEDBACK section above
Hall & encoder power	+5 Vdc ±2% @ 400 mAdc max, current limited to 750 mAdc @ +1 Vdc if output overloaded
Motemp [IN19~20]	Motor overtemperature switch input. Active level programmable, 4.99 kΩ pull-up to +3.3 Vdc Programmable to disable drive when motor over-temperature condition occurs
PROTECTIONS	
HV Overvoltage	$+HV > HV_{max}$ Drive outputs turn off until $+HV < HV_{max}$ (See Input Power for HV_{max})
HV Undervoltage	+HV < +14 Vdc Drive outputs turn off until +HV > +14 Vdc
Drive over temperature	Heat plate > 80°C ±3°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	76.3 x 58.2 x 20.5 [3.01 x 2.29 x 0.81]
Weight	0.27 lb (0.12 kg) without heatsink
Ambient temperature	-40 to +70°C operating, -50 to +85°C storage
Humidity	0 to 95%, non-condensing
Vibration	2 *g* peak, 10~500 Hz (sine), IEC60068-2-6
Altitude	-400 m (-1,312 ft) to 16,000 m (52,500 ft) operating and storage
Shock	10 *g*, 10 ms, half-sine pulse, IEC60068-2-27
Contaminants	Pollution degree 2
Environment	IEC68-2: 1990
Cooling	Heat sink and/or forced air cooling required for continuous power output

AGENCY STANDARDS CONFORMANCE

In accordance with EC Directive 2004/108/EC (EMC Directive)

EN 55011: 2007	CISPR 11:2003/A2:2006 Industrial, Scientific, and Medical (ISM) Radio Frequency Equipment – Electromagnetic Disturbance Characteristics – Limits and Methods of Measurement Group 1, Class A
EN 61000-6-1: 2007	Electromagnetic Compatibility (EMC) – Part 6-1: Generic Standards – Immunity for residential, Commercial and Light-industrial Environments

In accordance with EC Directive 2006/95/EC (Low Voltage Directive)

IEC 61010-1:2001	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use

Underwriters Laboratory Standards

UL 61010-1, 2nd Ed.: 2004	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use

UL File Number E249894

CANOPEN

Based on the CAN V2.0b 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.

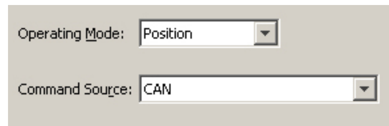
CANOPEN COMMUNICATION

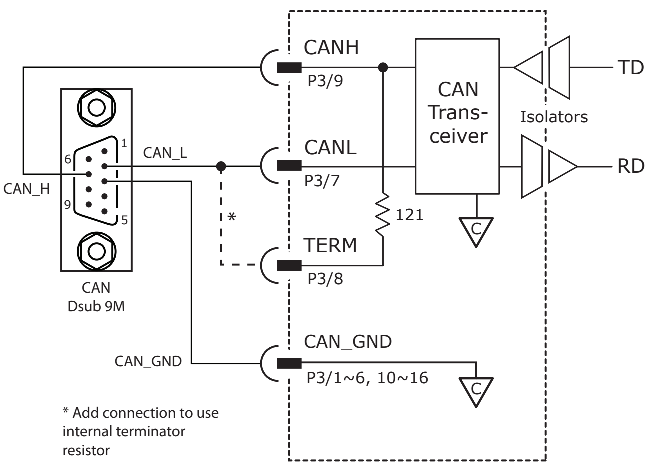
Accelnet uses the CAN physical layer signals CANH, CANL, and GND for connection, and CANopen protocol for communication.
Before installing the drive in a CAN system, it must be assigned a CAN address. A maximum of 127 CAN nodes are allowed on a single CAN bus. Up to seven digital inputs can be used to produce CAN addresses from 1~127, or the address can be saved to flash memory in the module. Address 0 is reserved for the CANopen master on the network.
For more information on CANopen communications, download the CANopen Manual from the Copley web-site: CANopen Manual

DIGITAL COMMAND INPUTS

The graphic below shows connections between the R42 and a Dsub 9M connector on a CAN card. If the R42 is the last node on a CAN bus, the internal terminator resistor can be used by adding a connection on the PC board as shown. The node address of the R42 may be set by using digital inputs, or programmed into flash memory in the drive.

CME2 -> Basic Setup -> Operating Mode Options

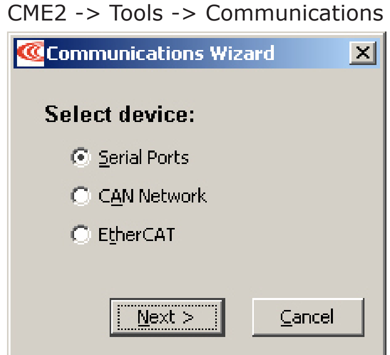




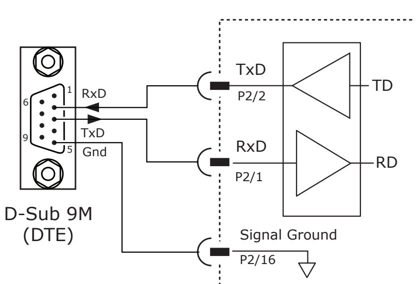
RS-232 COMMUNICATIONS

R42 is configured via a three-wire, full-duplex DTE RS-232 port that operates from 9600 to 115,200 Baud, 8 bits, no parity, and one stop bit. Signal format is full-duplex, 3-wire, DTE using RxD, TxD, and Gnd. Connections to the *R42* RS-232 port are through P2 The graphic below shows the connections between an *R42* and a computer COM port which is a DTE device.

CME2 -> Tools -> Communications Wizard



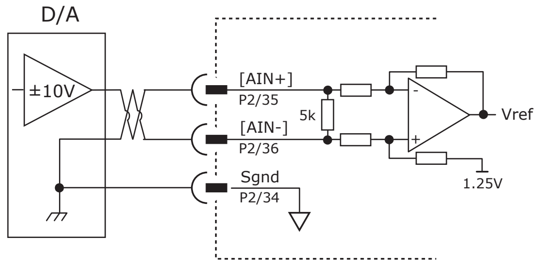
RS232 PORT



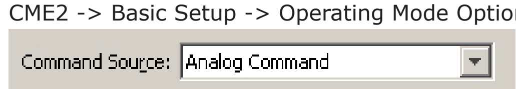
COMMAND INPUTS

ANALOG COMMAND INPUT

The analog input has a ±10 Vdc range. As a reference input it can take position/velocity/torque commands from a controller.



CME2 -> Basic Setup -> Operating Mode Options

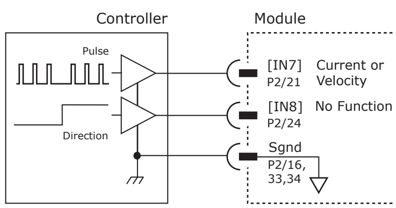


DIGITAL COMMAND INPUTS

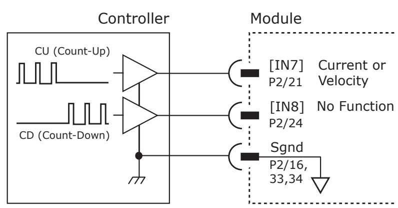
Digital commands are single-ended format and should be sourced from devices with active pull-up and pull-down to take advantage of the high-speed inputs. The active edge (rising or falling) is programmable for the Pulse/Dir and CU/CD formats.

DIGITAL POSITION

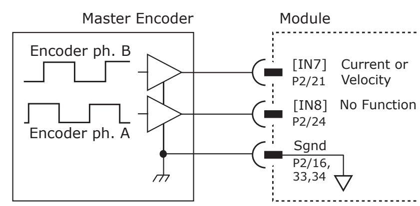
PULSE & DIRECTION



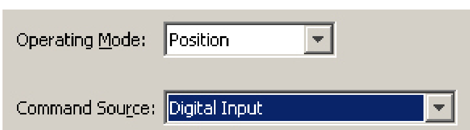
CU/CD



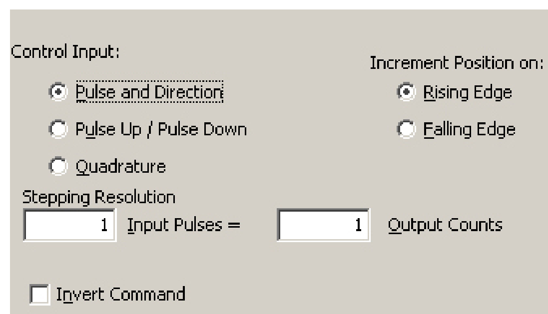
QUAD A/B ENCODER



CME2 -> Basic Setup -> Operating Mode Options

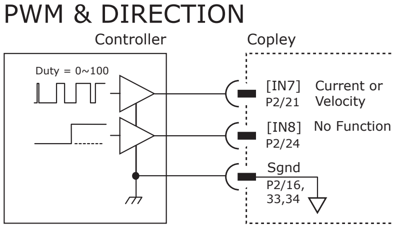


CME2 -> Basic Setup -> Operating Mode Options

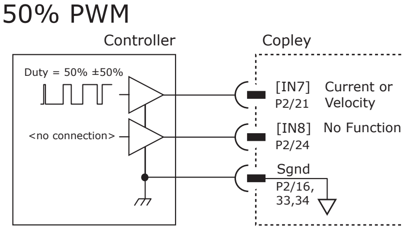


DIGITAL TORQUE, VELOCITY

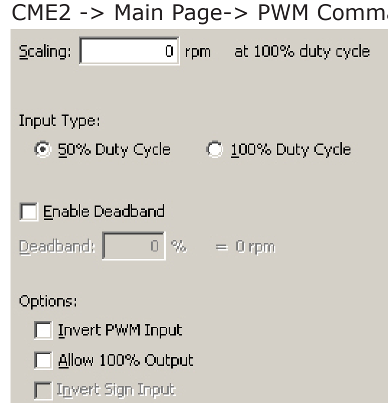
PWM & DIRECTION



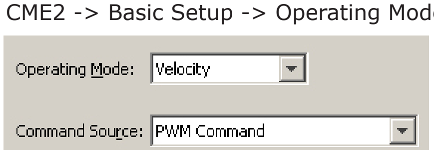
50% PWM



CME2 -> Main Page-> PWM Command



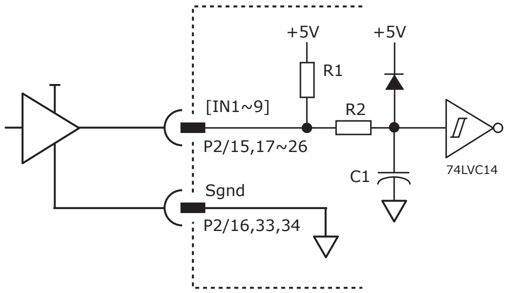
CME2 -> Basic Setup -> Operating Mode Options



INPUT-OUTPUT

HIGH SPEED DIGITAL INPUTS

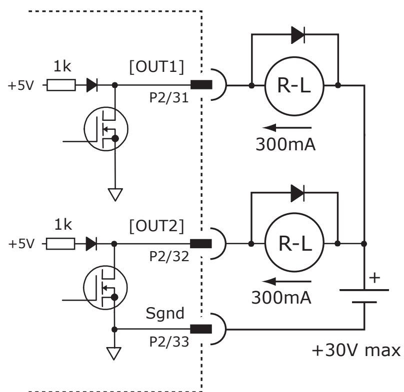
7V tolerant



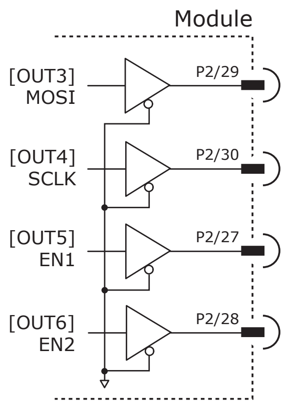
Input	P2 Pin	R1	R2	C1
IN1	15	10k	1k	100p
IN2	18			
IN3	17			
IN4	20			
IN5	19			
IN6	22			
IN7	21			
IN8	24			
IN9	23			
IN10	26			47p
IN11	25	4.99k	10k	33n

DIGITAL OUTPUTS

30V max



5V max



Output	P2 Pin
OUT1	31
OUT2	32
OUT3	29
OUT4	30
OUT5	27
OUT6	28

CAN NODE ADDRESS SWITCHES

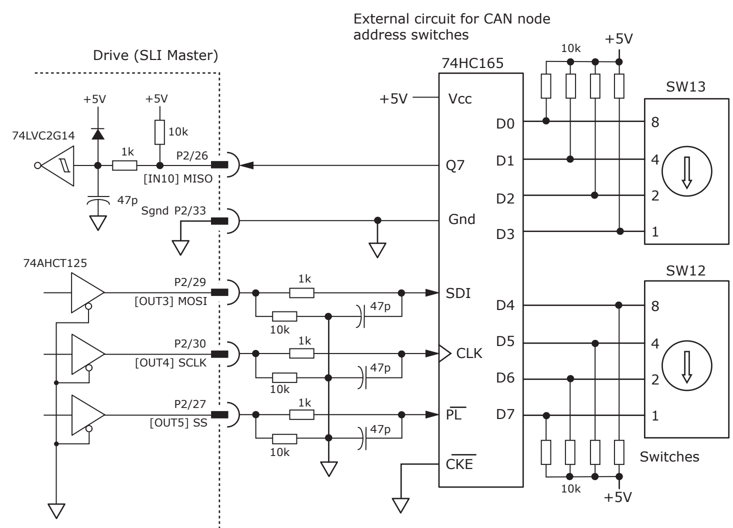
The SLI (Switch & LED Interface) port takes in the 8 signals from the two BCD encoded switches that set the CAN node address and controls the LEDs on the CAN bus connectors on the Development Kit.

The graphic below shows the circuit for reading the CAN node address switches.

The 74HC165 works as a parallel-in/serial-out device.

The 10k pull-down resistors pull the shift register inputs to ground when the R42 is initializing.

In the graphics below, switch SW13 is “S1” and SW12 is “S2”. The values of S1 are 16~255 and of S2 are 0~15. Together they provide addressing range of 0~255.



MOTOR CONNECTIONS

Motor connections consist of: phases, Halls, encoder, thermal sensor, and brake. 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. A brake can provide a fail-safe way to prevent movement of the motor when the drive is shut-down or disabled.

QUAD A/B INCREMENTAL ENCODER WITH FAULT PROTECTION

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 MAX3097 receiver has differential inputs with fault protections for the following conditions:

Short-circuits line-line: This produces a near-zero voltage between A & /A which is below the differential fault threshold.

Open-circuit condition: The 121Ω terminator resistor will pull the inputs together if either side (or both) is open. This will produce the same fault condition as a short-circuit across the inputs.

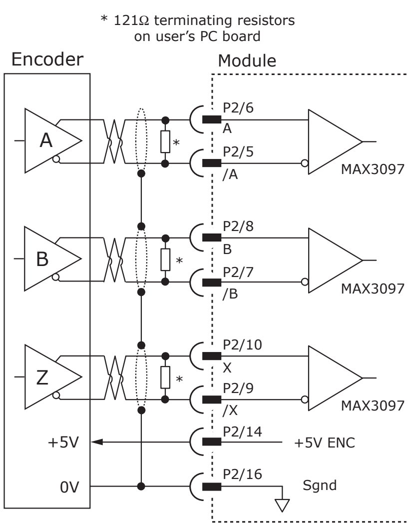
Low differential voltage detection: This is possible with very long cable runs and a fault will occur if the differential input voltage is < 200mV.

±15kV ESD protection: The 3097E has protection against high-voltage discharges using the Human Body Model.

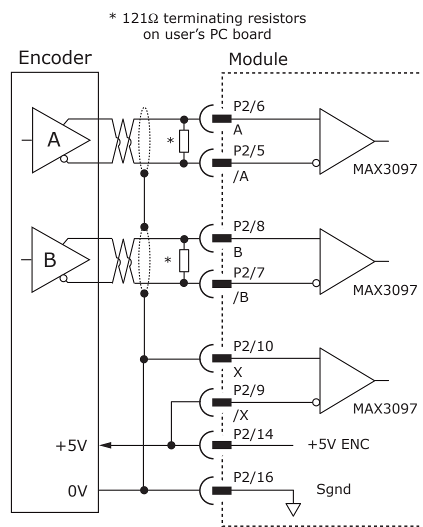
Extended common-mode range: A fault occurs if the input common-mode voltage is outside of the range of -10V to +13.2V

If encoder fault detection is selected (CME2 main page, Configure Faults block, Feedback Error) and an encoder with no index is used, then the X and /X inputs must be wired as shown below to prevent the unused index input from generating an error for *low differential voltage detection*.

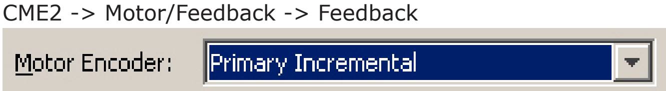
DIGITAL QUADRATURE ENCODER INPUT
5V



A/B CONNECTIONS (NO INDEX)



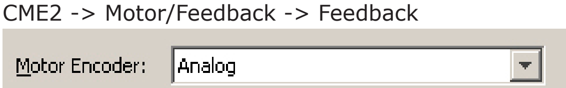
CME2 -> Motor/Feedback -> Feedback

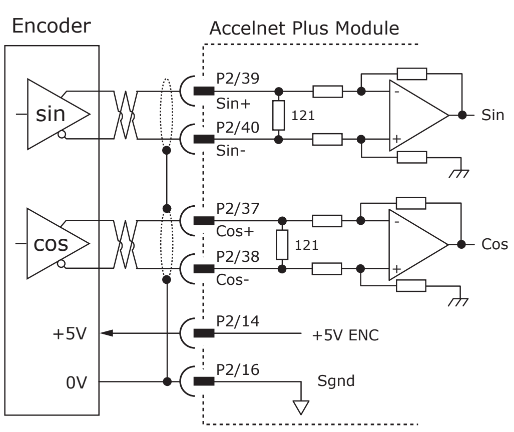


ANALOG SIN/COS INCREMENTAL ENCODER

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.

CME2 -> Motor/Feedback -> Feedback

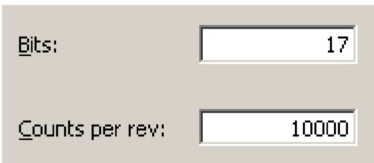


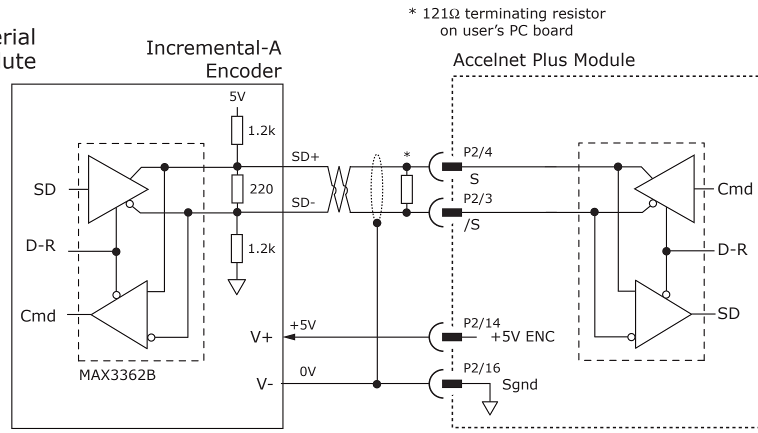


PANASONIC INCREMENTAL A ENCODER

This is a "wire-saving" incremental encoder that sends serial data on a two-wire interface in the same fashion as an absolute encoder.

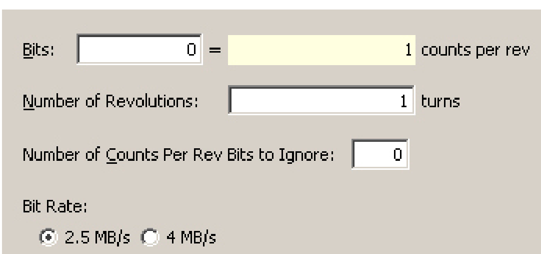
CME2 -> Basic setup -> Feedback

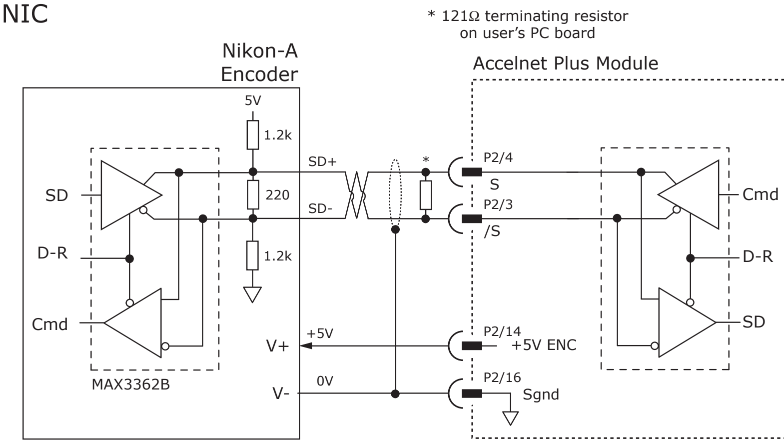




ABSOLUTE A ENCODER, TAMAGAWA, AND PANASONIC

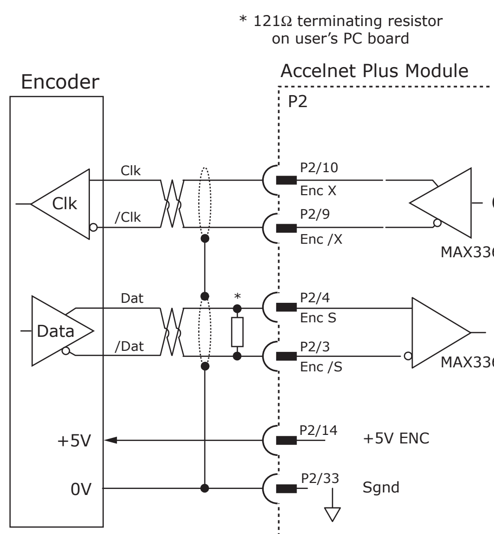
CME2 -> Motor/Feedback -> Feedback



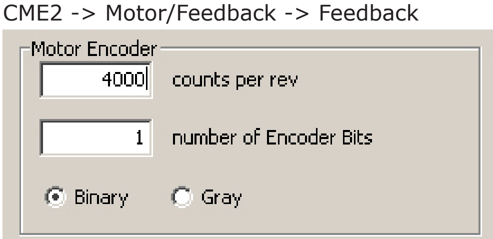


SSI ABSOLUTE ENCODER

The SSI (Synchronous Serial Interface) is an interface used to connect an absolute position encoder to a motion controller or control system. The Accelnet drive provides a train of clock signals in differential format (Clk, /Clk) to the encoder which initiates the transmission of the position data on the subsequent clock pulses. The polling of the encoder data occurs at the current loop frequency (16 kHz). The number of encoder data bits and counts per motor revolution are programmable. Data from the encoder in differential format (Dat, /Dat) MSB first. Binary or Gray encoding is selectable. When the LSB goes high and a dwell time has elapsed, data is ready to be read again.



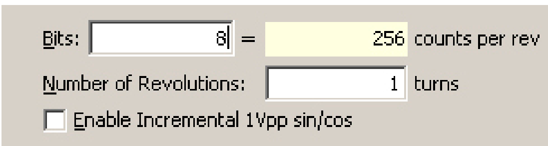
CME2 -> Motor/Feedback -> Feedback

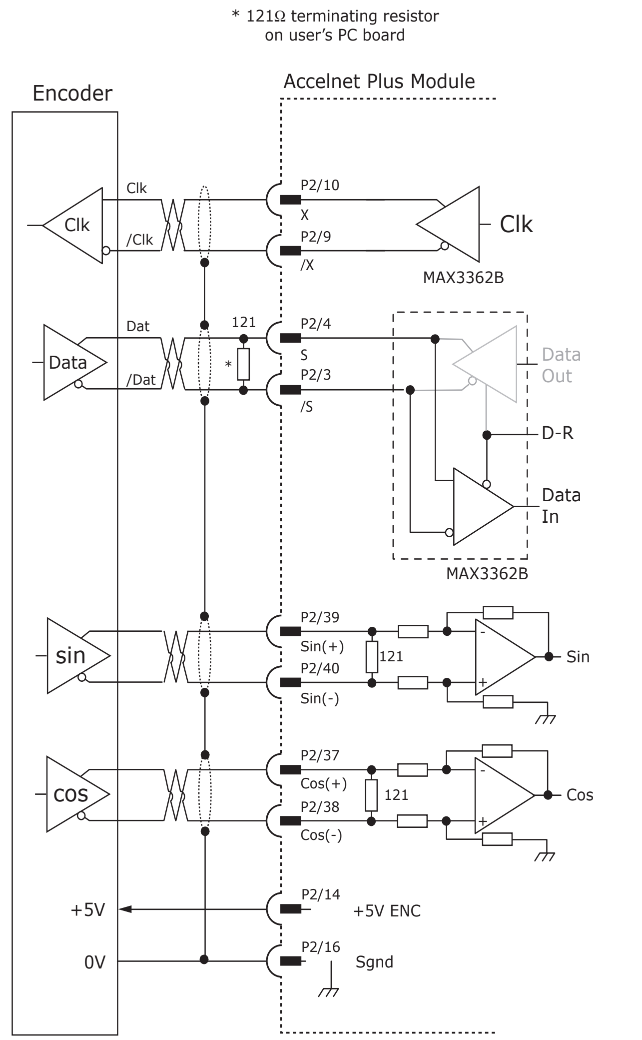


ENDAT ABSOLUTE ENCODER

The EnDat interface is a Heidenhain interface that is similar to SSI in the use of clock and data signals for synchronous digital, bidirectional data transfer. It also supports analog sin/cos channels from the same encoder. The number of position data bits is programmable Use of sin/cos incremental signals is optional in the EnDat specification.

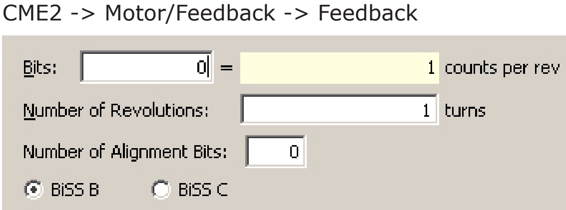
CME2 -> Motor/Feedback -> Feedback

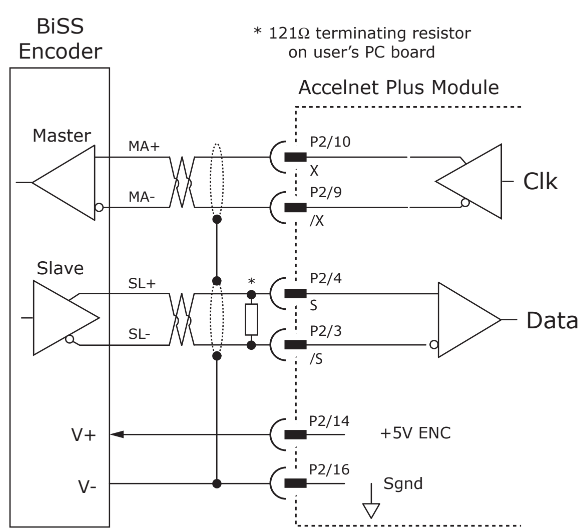




BISS (B & C) ABSOLUTE ENCODER

CME2 -> Motor/Feedback -> Feedback

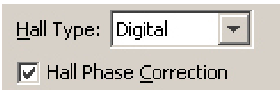




DIGITAL HALL SIGNALS

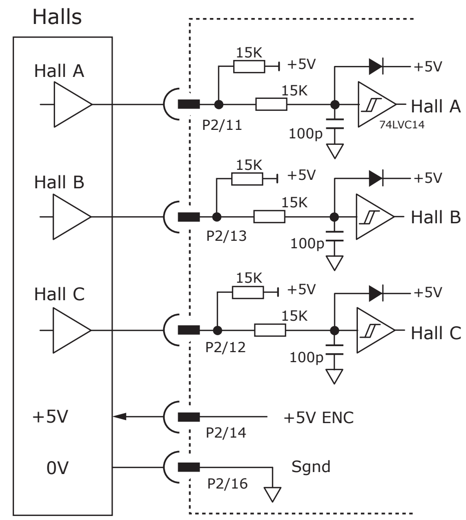
Hall signals are single-ended signals that provide absolute feedback within one electrical cycle of the motor. There are three of them (U, V, & W) and they may be sourced by magnetic sensors in the motor, or by encoders that have Hall tracks as part of the encoder disc. They typically operate at much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

CME2 -> Basic Setup -> Feedback Options



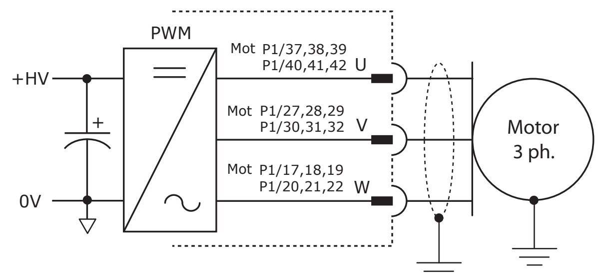
HALL INPUTS

5V

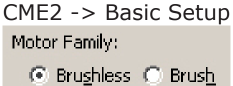


PHASE CONNECTIONS

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.



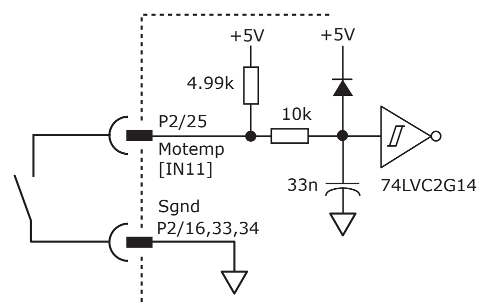
CME2 -> Basic Setup -> Motor Options



MOTOR OVER TEMP INPUT

The 4.99k pull-up resistor works with PTC (positive temperature coefficient) thermistors that conform to BS 4999:Part 111:1987 (table below), or switches that open/close indicating a motor over-temperature condition. The active level is programmable.

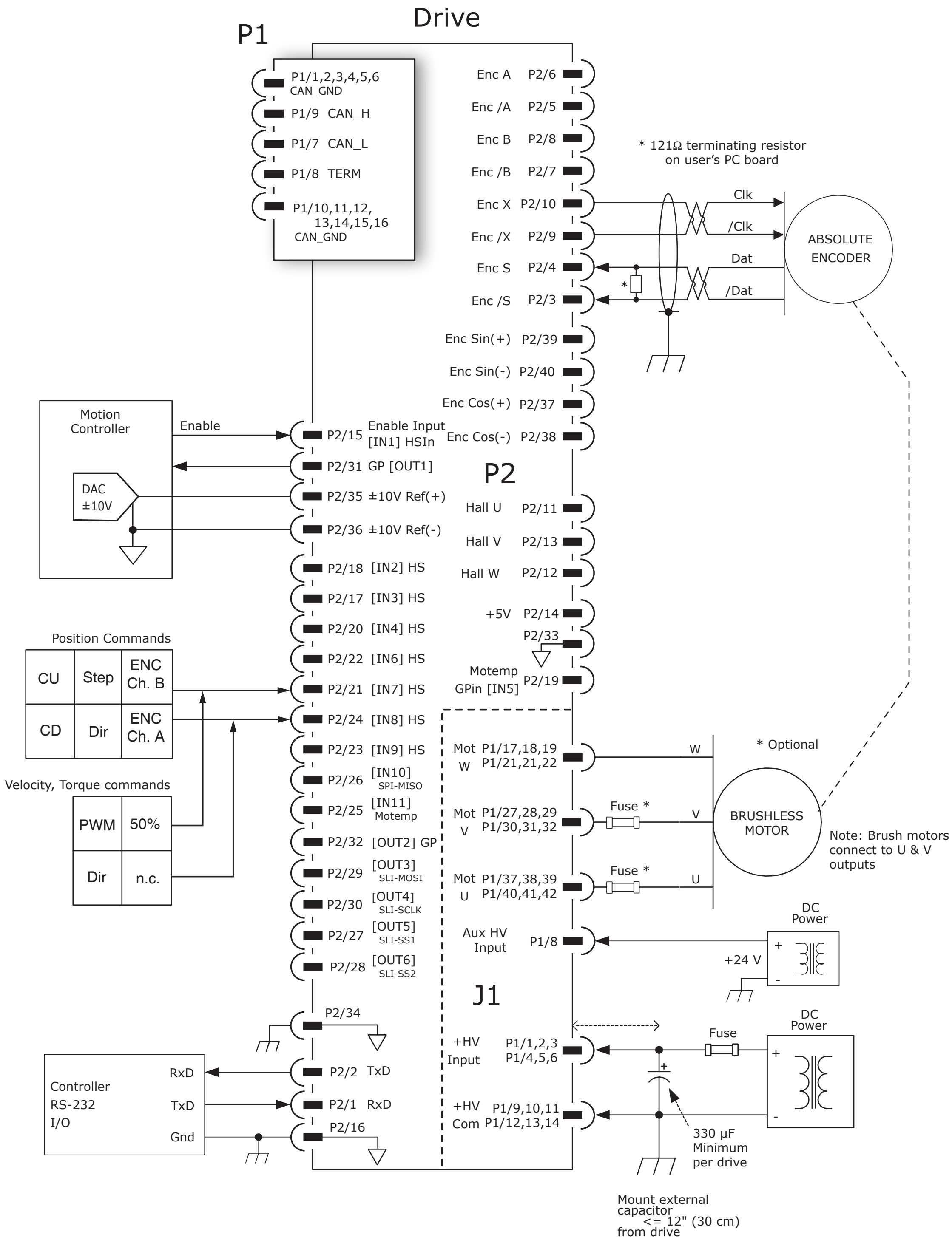
Property	Ohms
Resistance in the temperature range 20°C to +70°C	60~750
Resistance at 85°C	≤1650
Resistance at 95°C	≥3990
Resistance at 105°C	≥12000



CME2 -> Input / Output

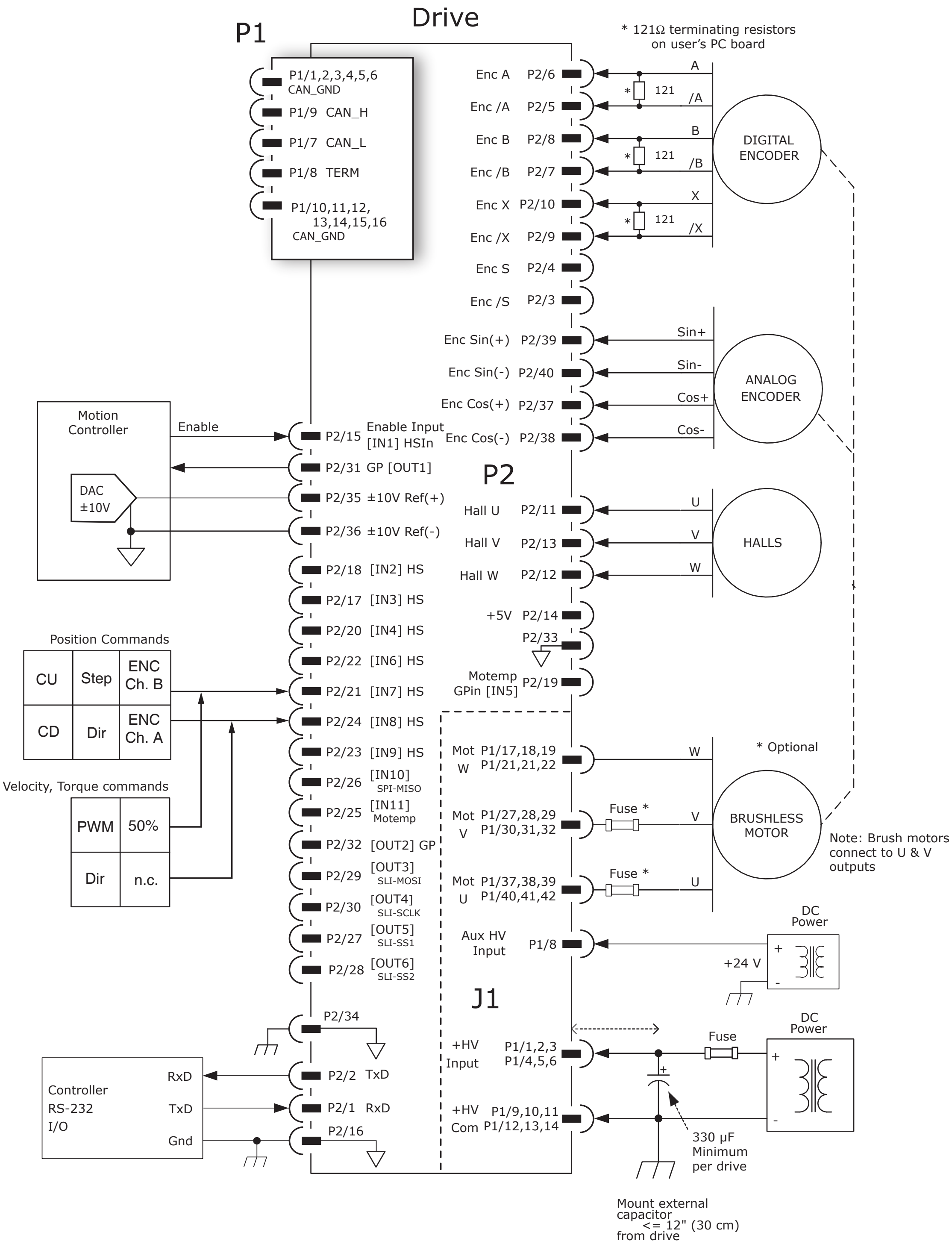
THIS PAGE LEFT BLANK INTENTIONALLY

CONNECTIONS FOR ABSOLUTE ENCODER WITH DUPLEX CLOCK/DATA



Notes:
1. Encoders with this type of connection include BiSS and SSI.

CONNECTIONS FOR INCREMENTAL DIGITAL OR ANALOG ENCODERS



PRINTED CIRCUIT BOARD CONNECTORS & SIGNALS

P3 CANOPEN

Signal	Pin		Signal
CAN_GND	2	1	CAN_GND
CAN_GND	4	3	CAN_GND
CAN_GND	6	5	CAN_GND
Term	8	7	CAN_L
CAN_GND	10	9	CAN_H
CAN_GND	12	11	CAN_GND
CAN_GND	14	13	CAN_GND
CAN_GND	16	15	CAN_GND

P2: Control
Dual row, 2 mm- centers
16 position female header
SAMTEC SQW-108-01-L-D

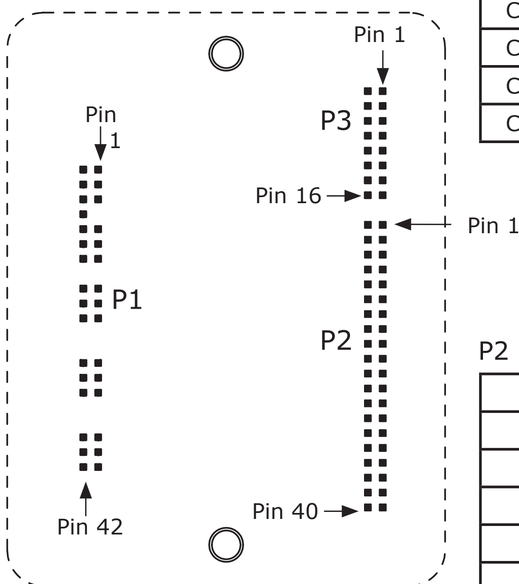
P1 POWER & MOTOR

Signal	Pin		Signal
+HV	2	1	+HV
+HV	4	3	+HV
+HV	6	5	+HV
Aux HV	8	7	
HVGnd	10	9	HVGnd
HVGnd	12	11	HVGnd
HVGnd	14	13	HVGnd
	16	15	
Mot W	18	17	Mot W
Mot W	20	19	Mot W
Mot W	22	21	Mot W
	24	23	
	26	25	
Mot V	28	27	Mot V
Mot V	30	29	Mot V
Mot V	32	31	Mot V
	34	33	
	36	35	
Mot U	38	37	Mot U
Mot U	40	39	Mot U
Mot U	42	41	Mot U

P1: Power & Motor
Dual row, 2 mm- centers
42 position female header
SAMTEC SQW-121-01-L-D

TOP VIEW

Viewed from above looking down on the connectors or PC board footprint to which the module is mounted



P2 CONTROL

Signal	Pin		Signal
RS-232 TxD	2	1	RS-232 RxD
Enc S	4	3	Enc /S
Enc A	6	5	Enc /A
Enc B	8	7	Enc /B
Enc X	10	9	Enc /X
Hall W	12	11	Hall U
Enc +5V	14	13	Hall V
Sgnd	16	15	[IN1] Enable
[IN2]	18	17	[IN3]
[IN4]	20	19	[IN5]
[IN6]	22	21	[IN7]
[IN8]	24	23	[IN9]
MISO [IN10]	26	25	[IN11] Motemp
[OUT6]	28	27	[OUT5] SS1
SCLK [OUT4]	30	29	[OUT3] MOSI
[OUT2]	32	31	[OUT1]
Sgnd	34	33	Sgnd
Ref (-)	36	35	Ref (+)
Enc Cos(-)	38	37	Enc Cos(+)
Enc Sin (-)	40	39	Enc Sin(+)

P2: Control
Dual row, 2 mm- centers
40 position female header
SAMTEC SQW-120-01-L-D

Notes:
1. P1 connections use multiple pins to share current. *All signals of the same name must be connected* on the PC board to which the R42 is mounted.
2. Cells in table above that are filled in grey are connector contacts that have no circuit connections.

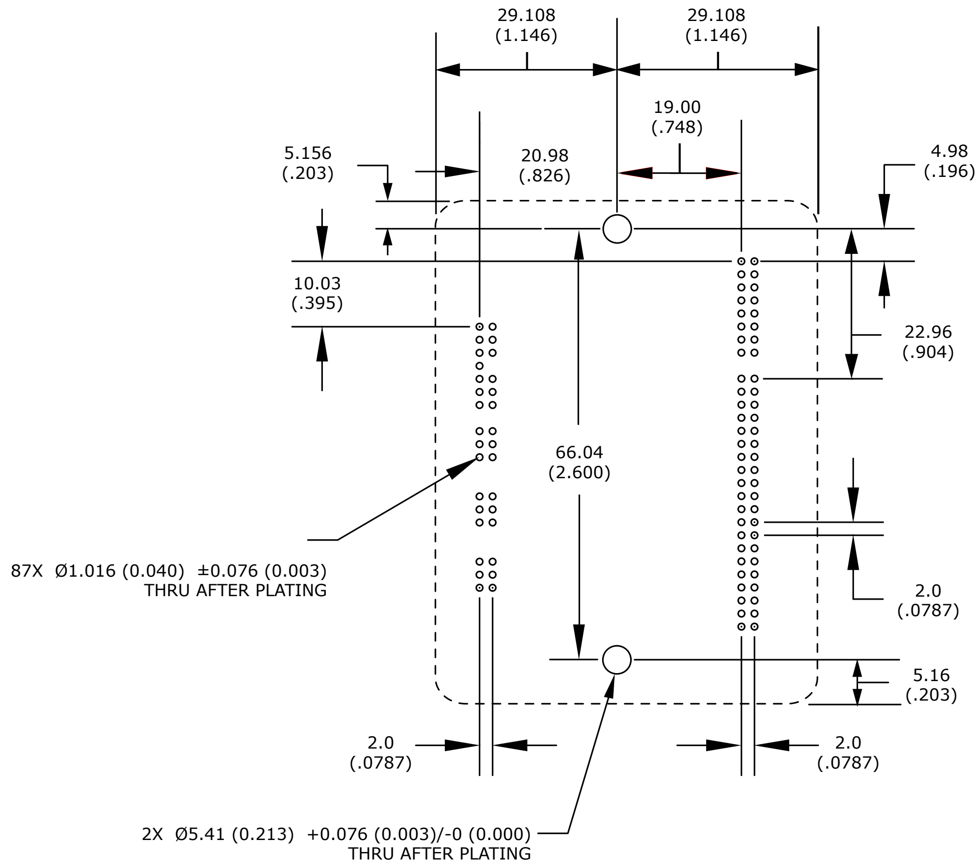
PRINTED CIRCUIT BOARD FOOTPRINT

Dimensions are in. [mm]

J1 Signal Grouping
for current-sharing
See Note 1

TOP VIEW

Viewed from above looking down on the connectors or PC board footprint to which the module is mounted



Mounting Hardware:

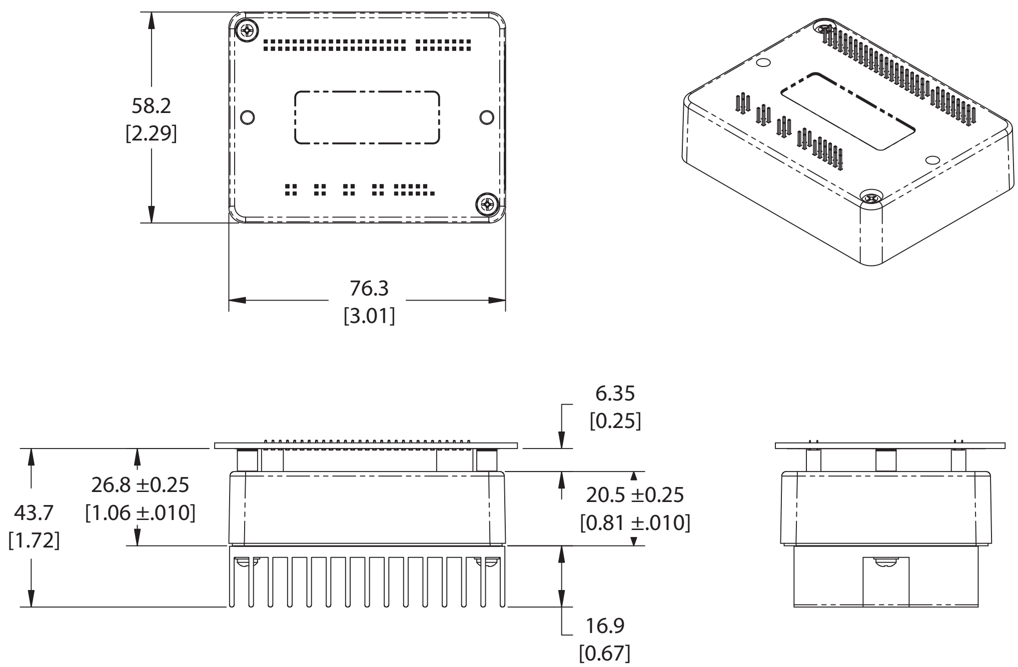
Qty	Description	Mfgr	Part Number	Remarks
1	Socket Strip	Samtec	SQW-121-01-L-D	J1 HV & Motor
1	Socket Strip	Samtec	SQW-120-01-L-D	J2 Control
1	Socket Strip	Samtec	SQW-108-01-L-D	J3 CANopen
2	Standoff 6-32 X 1/4”	PEM	KFE-632-8ET	

Notes

1. J1 signals of the same name must be connected for current-sharing (see graphic above).
2. To determine copper width and thickness for J3 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.

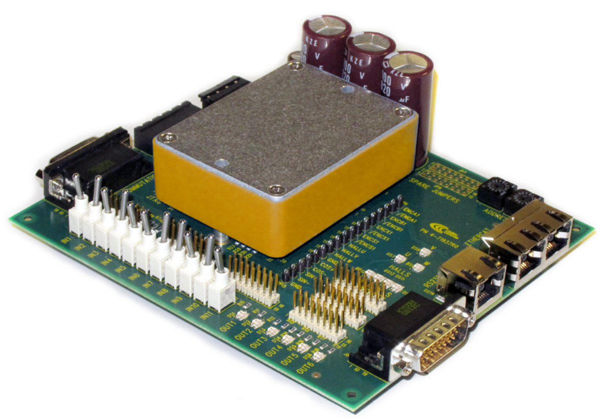
DIMENSIONS

Dimensions: mm [in]



DESCRIPTION

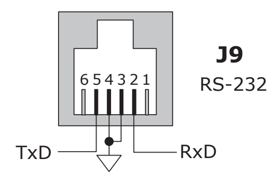
The Development Kit provides mounting and connectivity for one R42 drive. Solderless jumpers ease configuration of inputs and outputs to support their programmable functions. Switches can be jumpered to connect to digital inputs 1~11 so that these can be toggled to simulate equipment operation. Six LED's provide status indication for the digital outputs. Dual CANopen connectors make daisy-chain connections possible so that other CANopen devices such as Copley's Accelnet Plus or Xenus Plus CANopen drives can easily be connected.



RS-232 CONNECTION

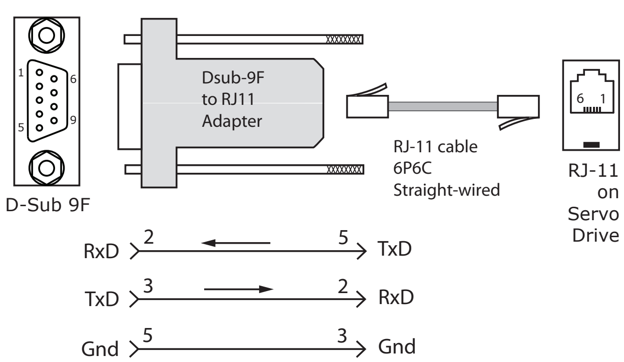
The RS-232 port is used to configure the drive for stand-alone applications, or for configuration before it is installed into an CANopen network. CME 2™ software communicates with the drive over this link and is then used for complete drive setup. The CANopen Slave ID address that is set by the rotary switch can be monitored, and an address offset programmed as well.

The RS-232 connector, J9, is a modular RJ-11 type that uses a 6-position plug, four wires of which are used for RS-232. A connector kit is available (SER-CK) that includes the modular cable, and an adaptor to interface this cable with a 9-pin RS-232 port on a computer.



SER-CK SERIAL CABLE KIT

The SER-CK provides connectivity between a D-Sub 9 male connector and the RJ-11 connector J9 on the Development Kit. It includes an adapter that plugs into the COM1 (or other) port of a PC and uses common modular cable to connect to the Development Kit. The connections are shown in the diagram below.

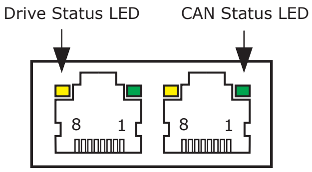


Don't forget to order a Serial Cable Kit SER-CK when placing your order for a Development Kit!

CANOPEN CONNECTORS

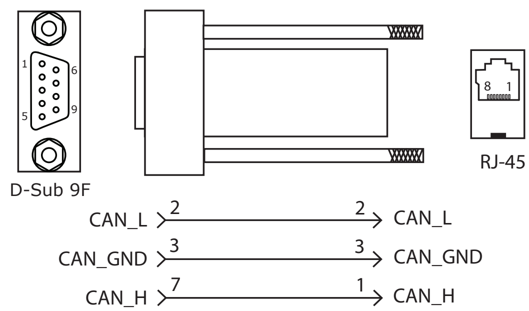
Dual RJ-45 connectors that accept standard Ethernet cables are provided for CAN bus connectivity. Pins are wired-through so that drives can be daisy-chained and controlled with a single connection to the user's CAN interface. A CAN terminator should be placed in the last drive in the chain. The XTL-NK connector kit provides a D-Sub adapter that plugs into a CAN controller and has an RJ-45 socket that accepts the Ethernet cable.

J10 CAN CONNECTIONS



APK-NK CAN CONNECTOR KIT

The kit contains the XTL-CV adapter that converts the CAN interface D-Sub 9M connector to an RJ-45 Ethernet cable socket, plus a 10 ft (3 m) cable and terminator. Both connector pin-outs conform to the CiA DR-303-1 specification.



CAN STATUS LED

DRIVE STATE — LED ON-OFF CONDITION

Pre-operational

Operational

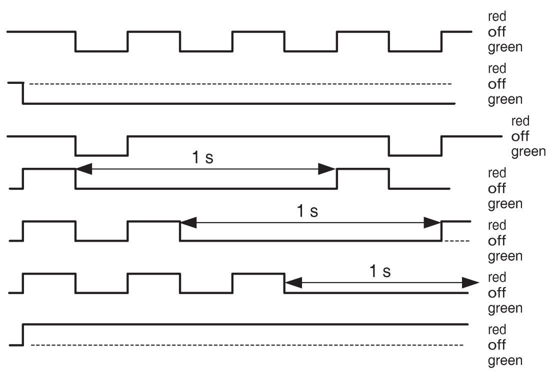
Stopped

Warning Limit Reached

Error Control Event

Sync Error

Bus-off



Note: Red & green led on-times do not overlap.
LED color may be red, green, off, or flashing of either color.

DRIVE STATUS LED

A single bi-color LED gives the state of the drive by changing color, and either blinking or remaining solid.
The possible color and blink combinations are:

- *Green/Solid:* Drive OK and enabled. Will run in response to reference inputs or CANopen commands.
- *Green/Slow-Blinking:* Drive OK but NOT-enabled. Will run when enabled.
- *Green/Fast-Blinking:* Positive or Negative limit switch active. Drive will only move in direction not inhibited by limit switch.
- *Red/Solid:* Transient fault condition. Drive will resume operation when fault is removed.
- *Red/Blinking:* Latching fault. Operation will not resume until drive is Reset.

Drive Fault conditions:

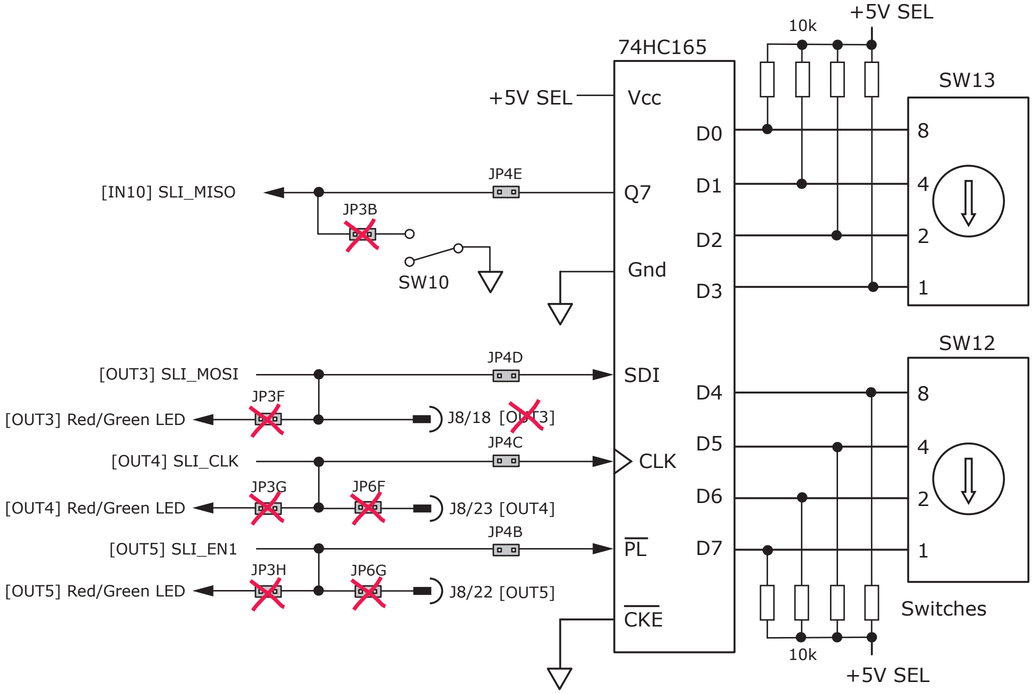
- Over or under-voltage
- Motor over-temperature
- Encoder +5 Vdc fault
- Short-circuits from output to output
- Short-circuits from output to ground
- Internal short circuits
- Drive over-temperature

Faults are programmable to be either transient or latching

CANOPEN NODE ADDRESS SWITCH CONNECTIONS

The graphic below shows the connections to the CANopen address switches. These are read after the drive is reset, or powered-on. When changing the settings of the switches, be sure to either reset the drive, or to power it off-on. Outputs [OUT3,4,5] and input [IN10] operate as an SLI (Switch & LED Interface) port which reads the settings on the CANopen address switches, and controls the LEDs on the serial and CANopen port connectors.

The jumpers marked with red "X" should be removed so that SW10, or external connections to the signals do not interfere with the operation of the SLI port.



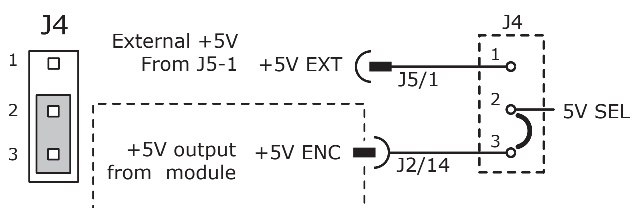
5V POWER SOURCES

The feedback connector J7 has connections for two power supplies:

Pin 6 has +5V supplied by the R42 module
Pin 17 connects to jumper J4 for the selection of the 5V power source:
On J4, when the jumper connects pins 2 & 3, the power source is the R42 internal supply (the default setting)
When the jumper is on pins 1 & 2, the power source comes from an external power supply connecting to J5-1.

5V power on the Development Kit that comes from the selectable 5V power source on J4 is labeled "5V SEL".

Circuits powered by 5V supplied only by the R42 are labeled "5V R42"

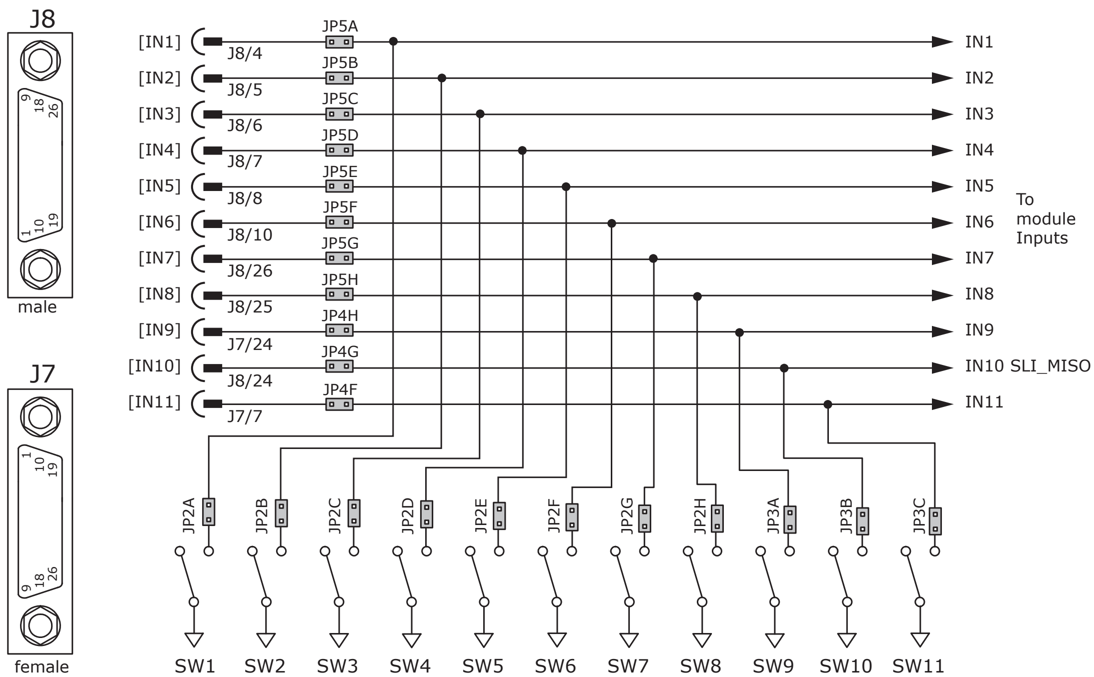


LOGIC INPUTS & SWITCHES

The Development Kit has jumpers that can connect the R42 digital inputs to switches on the kit, or to the Signal connector J8.

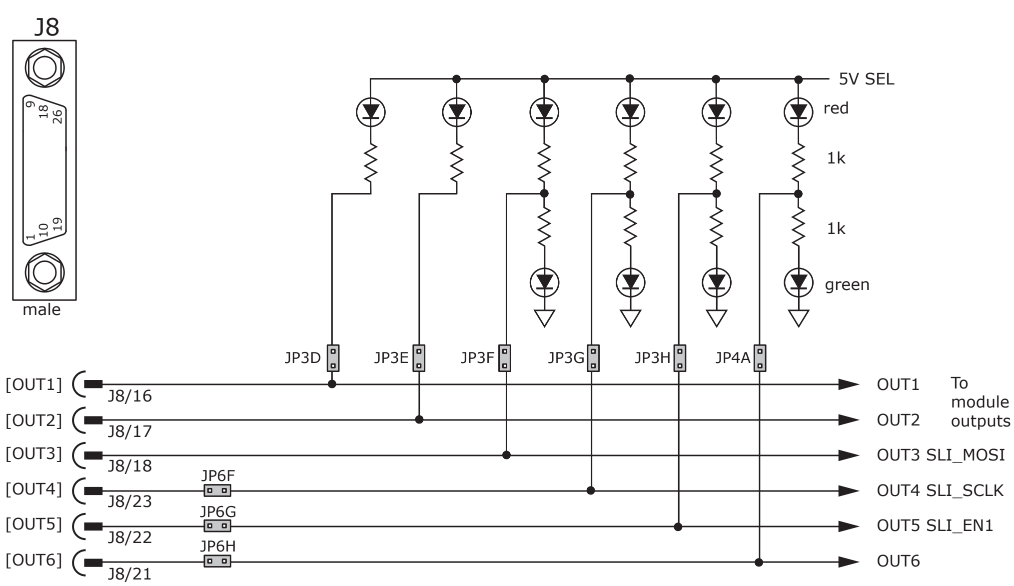
As delivered, all of these jumpers are installed as shown. If connecting to external devices that actively control the level of an input, it is desirable to disconnect the switch which could short the input to ground.

For example, if [IN1] is connected to an external device for the Enable function, then jumper JP2A should be removed to take the switch SW1 out of the circuit. The figure below shows these connections.



LOGIC OUTPUTS

There are six logic outputs that can drive controller logic inputs or relays. If relays are driven, then flyback diodes must be connected across their terminals to clamp overvoltages that occur when the inductance of the relay coil is suddenly turned off. Outputs 3,4,5 & 6 are CMOS types that pull up to 5V or down to ground. When these outputs go high it turns on the green LED. When they are low, the red LED is turned on. Outputs 1 & 2 are MOSFET types that sink current when ON, and appear as open-circuit when OFF. When these outputs are ON a red LED is turned on. When the outputs are OFF, the red LED is off. The green LED is not used on these outputs.



MOTOR FEEDBACK CONNECTOR J7

For motors with differential encoders: install jumpers JP1B, JP1D, JP1F, and JP1H to connect 121 ohm terminators across inputs
Jumpers JP1A, JP1C, JP1E, and JP1G do not affect this setting and may remain in place or be removed.

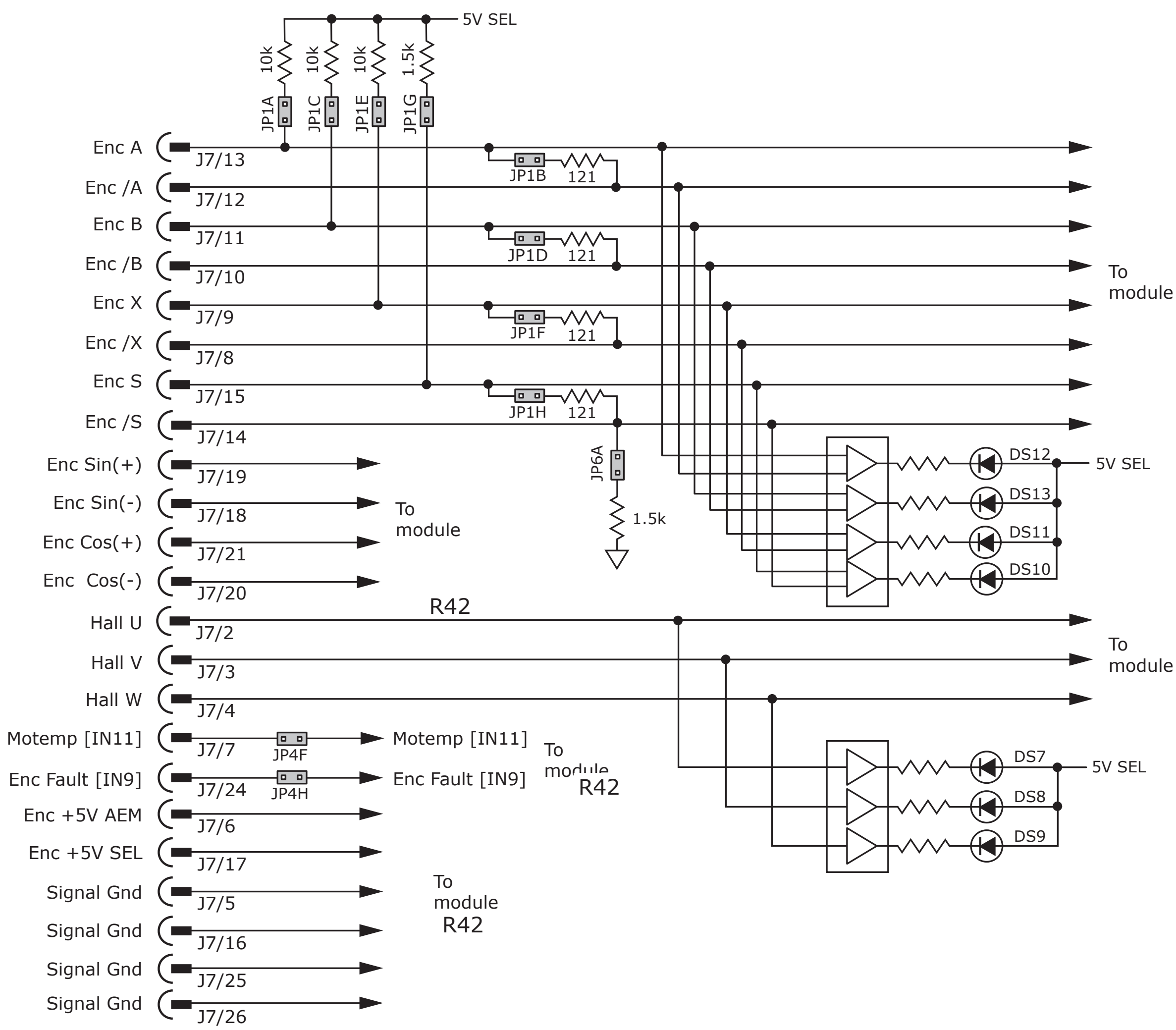
For motors with single-ended encoders: remove jumpers JP1B, JP1D, JP1F, and JP1H to disconnect 121 ohm terminators
Install jumpers JP1A, JP1C, JP1E, and JP1G

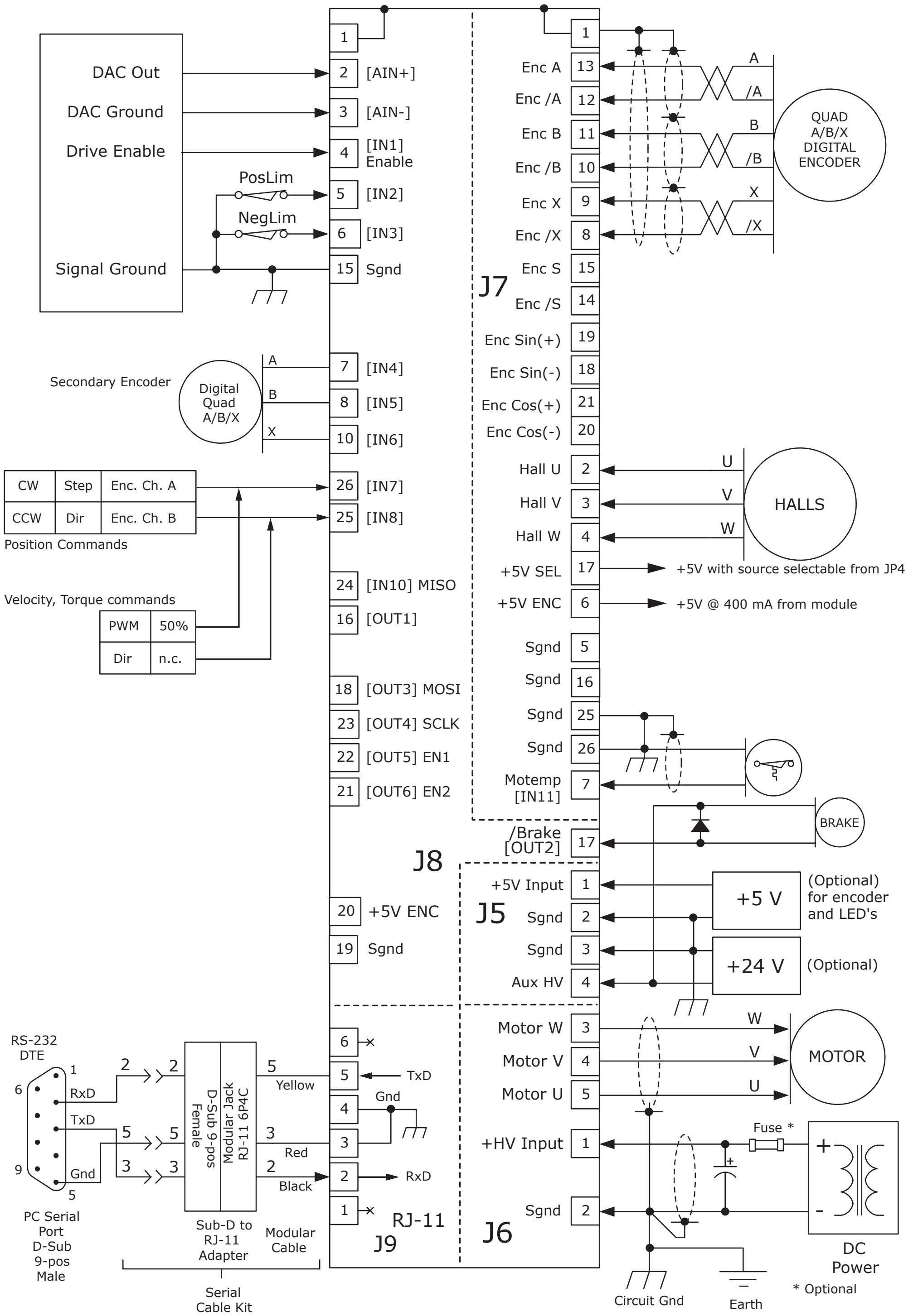
A motor temperature sensor that connects to [IN11] must have jumper JP4F installed and JP3C removed to prevent switch SW11 from grounding the Motemp[IN11] signal.

If the encoder has a fault output, then jumper JP4H must be in place and jumper JP3A must be removed to prevent switch SW9 from grounding the Enc Fault [IN9] signal.

Absolute encoders such as the Nikon A type that use 2-wire bidirectional signals require biasing the lines when they are in a quiescent state. Jumpers JP1G, JP1H, and JP6A must be in place to provide line termination and biasing.

LED's are provided to show the status of the encoder and Hall signals.





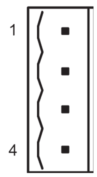
Notes:
1. CANopen connectors J10 are not shown here. For details see pp 4 & 13.

DEVELOPMENT KIT

The Development Kit mounts a single R42 module and enables the user to test and operate the R42 before it is mounted onto a PC board in the target system.

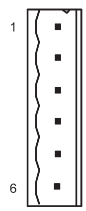
J5 AUX HV & EXT 5V

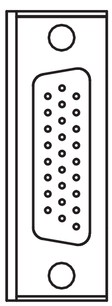
Signal	Pin
+5V Ext	1
Gnd	2
Gnd	3
Aux HV Input	4

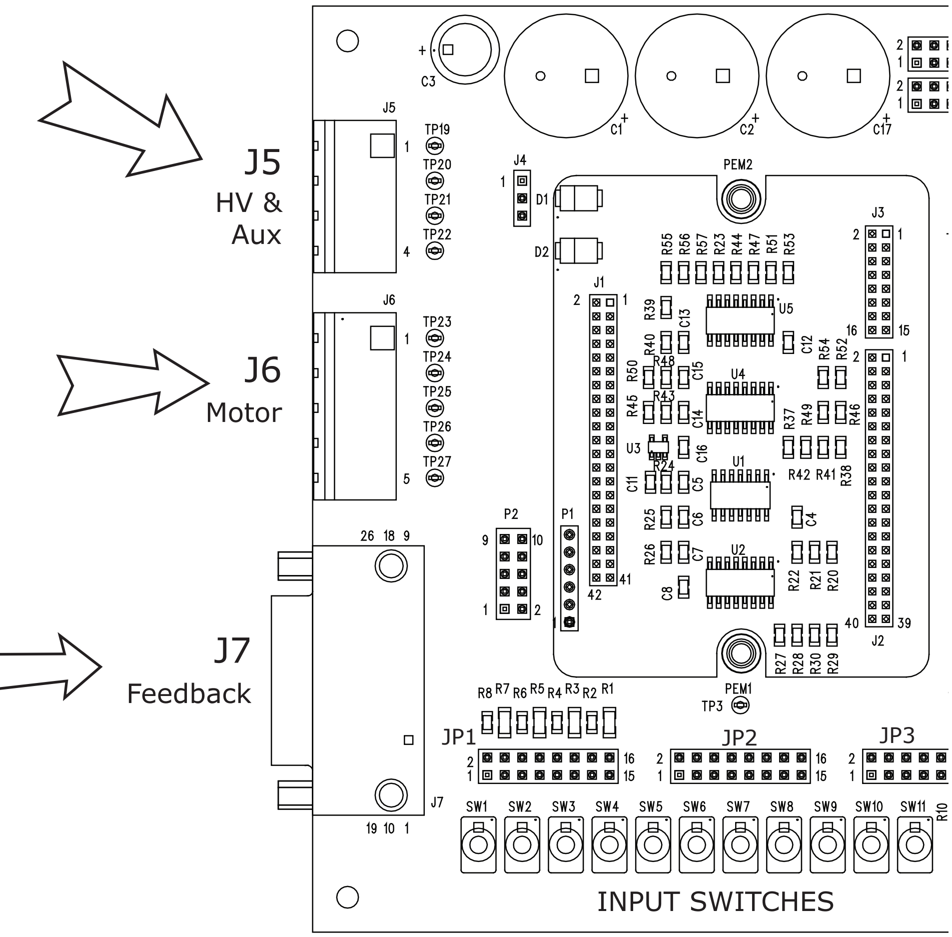


J6 MOTOR

Signal	Pin
+HV Input	1
HV Gnd	2
Motor W	3
Motor V	4
Motor U	5







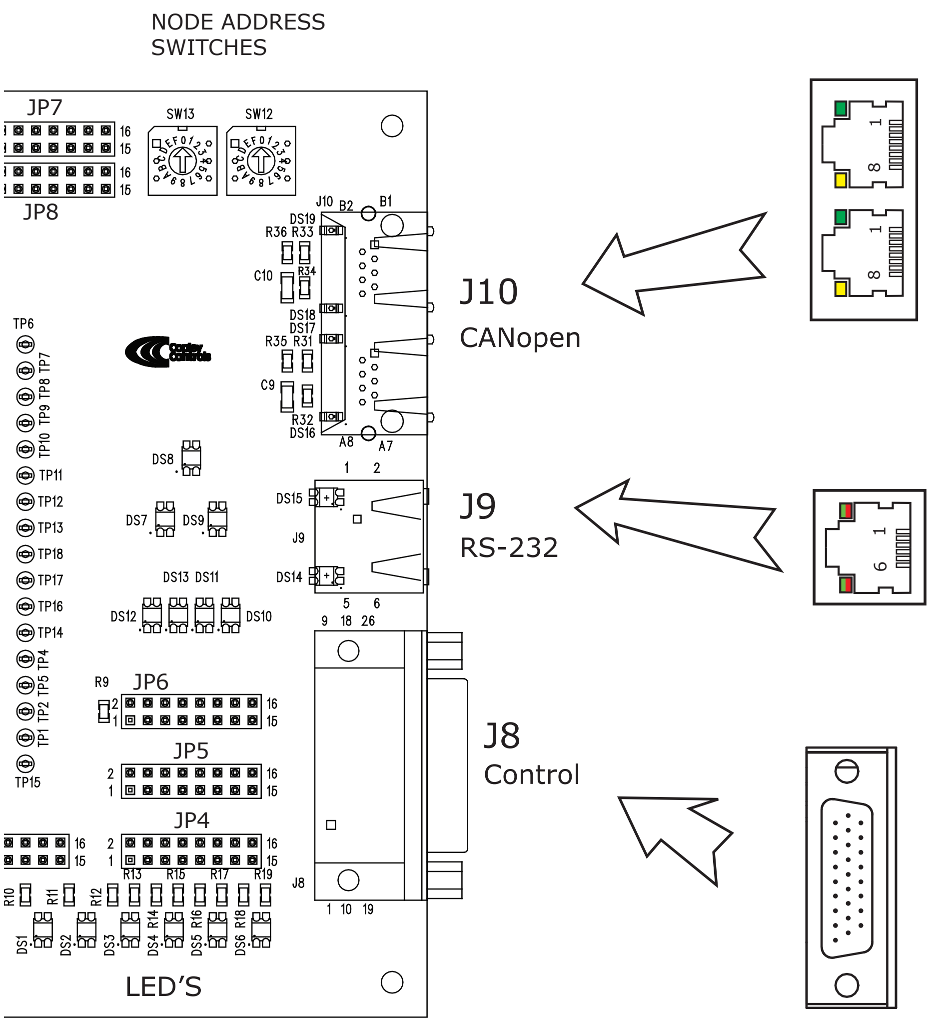
J7 FEEDBACK

PIN	SIGNAL
26	Signal Gnd
25	Signal Gnd
24	[IN9] Enc Fault*
23	n.c.
22	n.c.
21	Cos(+)
20	Cos(-)
19	Sin(+)

PIN	SIGNAL
18	Sin(-)
17	+5 Vdc Out
16	Signal Gnd
15	Enc S
14	Enc /S
13	Enc A
12	Enc /A
11	Enc B
10	Enc /B

PIN	SIGNAL
9	Enc X
8	Enc /X
7	[IN11] Motemp*
6	+5 Vdc Out
5	Signal Gnd
4	Hall W
3	Hall V
2	Hall U
1	Frame Gnd

* Signal connections on the PC board are affected by jumper placement



J10 CANOPEN

Pin	Signal
1	CAN_H
2	CAN_L
3	CAN_GND
4	Pass-thru
5	Pass-thru
6	Pass-thru
7	CAN_GND
8	Pass-thru

J9 RS-232

Pin	Signal
1	n.c.
2	RxD
3	Sgnd
4	Sgnd
5	Txd
6	n.c.

J8 CONTROL

PIN	SIGNAL
9	n.c.
8	[IN5] HS*
7	[IN4] HS*
6	[IN3] HS*
5	[IN2] HS*
4	[IN1] HS*
3	[AIN-]
2	[AIN+]
1	Frame Gnd

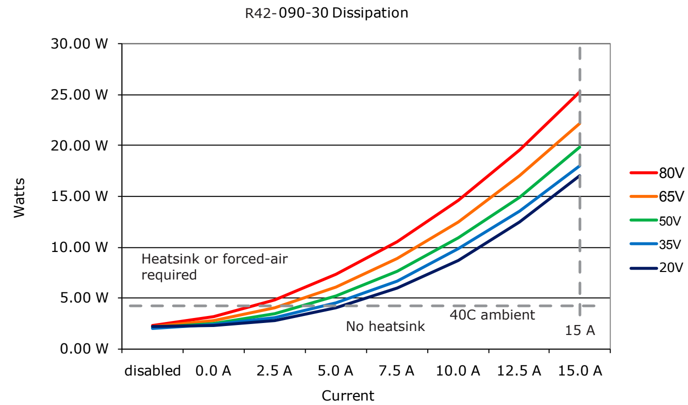
PIN	SIGNAL
18	[OUT3] MOSI*
17	[OUT2]
16	[OUT1]
15	Signal Gnd
14	n.c.
13	n.c.
12	n.c.
11	n.c.
10	[IN6] HS*

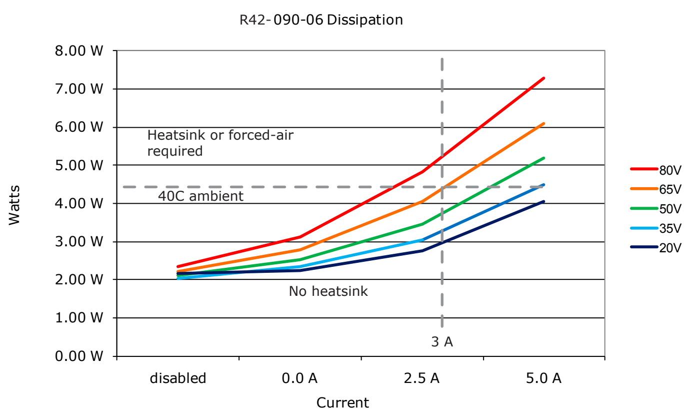
PIN	SIGNAL
26	[IN7] HS*
25	[IN8] HS*
24	[IN10] MISO*
23	[OUT4] SCLK*
22	[OUT5] SS1*
21	[OUT6]
20	+5 Vdc Out
19	Signal Gnd

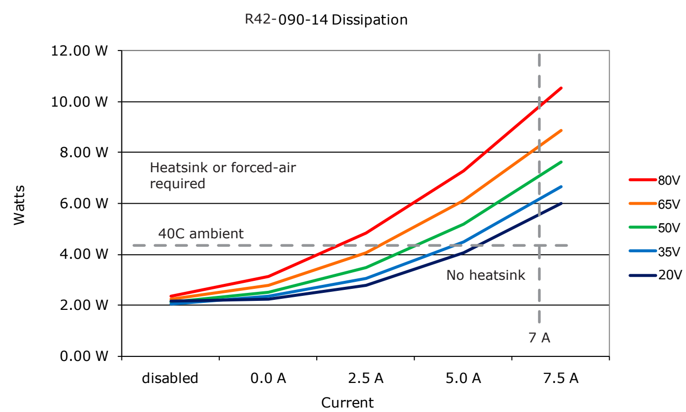
POWER DISSIPATION

The charts on this page show the drive's internal power dissipation for different models under differing power supply and output current conditions. Drive 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 drive would provide during operation. The +HV values are for the average DC voltage of the drive power supply.

To see if a heatsink is required or not, the next step is to determine the temperature rise the drive will experience when it's installed. For example, if the ambient temperature in the drive enclosure is 40 °C, and the heatplate temperature is to be limited to 80° C or less to avoid shutdown, the maximum rise would be 80C - 40C. or 40° C. Dividing this dissipation by the thermal resistance of 9º C/W with no heatsink gives a dissipation of 4.4 W. This line is shown in the charts. For power dissipation below this line, no heatsink is required. The vertical dashed line shows the continuous current rating for the drive model.







HEATSINK INSTALLATION

If a heatsink is used it is mounted using the same type of screws used to mount the drive 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 drive warms up. This forms an excellent thermal path from drive heatplate to heatsink for optimum heat transfer.

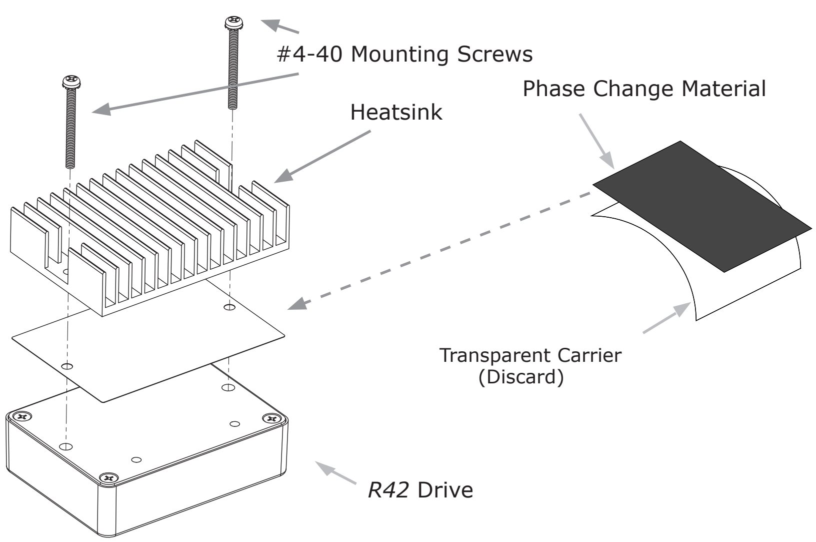
STEPS TO INSTALL

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 drive body.

3. Mount the heatsink onto the PSM again taking care to see that the holes in the heatsink, PSM, and drive all line up.

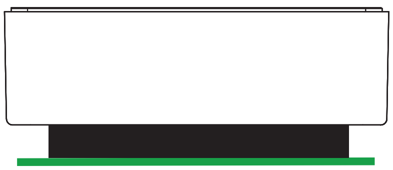
4. Torque the #4-40 mounting screws to 3~5 lb-in (0.34~0.57 N·m).



HEATSINK OPTIONS

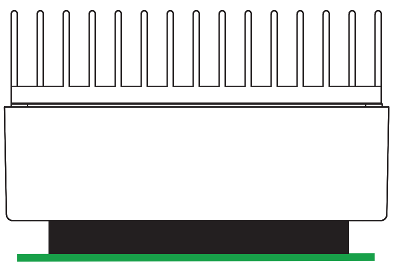
Rth expresses the rise in temperature of the drive per Watt of internal power loss. The units of Rth are °C/W, where the °C represent the rise above ambient in degrees Celsius. The data below show thermal resistances under convection, or fan-cooled conditions for the no-heatsink, and R42-HS heatsink.

NO HEATSINK



NO HEATSINK	**C/W**
CONVECTION	9.1
FORCED AIR (300 LFM)	3.3

STANDARD HEATSINK (R42-HK)



WITH HEATSINK	**C/W**
CONVECTION	5.3
FORCED AIR (300 LFM)	1.1

THIS PAGE
LEFT BLANK
INTENTIONALLY

MASTER ORDERING GUIDE

R42-090-06	*Accelnet* R42 servo drive, 3/6 A, 90 Vdc
R42-090-14	*Accelnet* R42 servo drive, 7/14 A, 90 Vdc
R42-090-30	*Accelnet* R42 servo drive, 15/30 A, 90 Vdc
APK-090-01	Development Kit for R42 servo drive

ACCESSORIES

	QTY	DESCRIPTION
Connector Kit for Development Kit APK-CK-01	1	Connector, Euro, 5 Terminal, 5.08 mm
	1	Connector, Euro, 4 Terminal, 5.08 mm
	1	26 Pin Connector, High Density, D-Sub, Male, Solder Cup
	1	26 Pin Connector, High Density, D-Sub, Female, Solder Cup
	2	26 Pin Connector Backshell
CANopen Network Kit APK-NK	1	Adapter Assy, DB9 Female to RJ45 Jack (APK-CV)
	1	CANopen Network Cable, 10 ft. (APK-NC-10)
	1	CANopen Network Terminator (APK-NT)
Heatsink Kit R42-HK	1	Heatsink for R42
	1	Heatsink Thermal Material
	4	Heatsink Hardware
APK-CV		Adapter Assembly, DB9 Female to RJ45 Jack
APK-NC-10		CANopen Network Cable, 10 ft
APK-NC-01		CANopen network cable, 1 ft
APK-NT		CANopen Network Terminator
SER-CK		Serial Cable Kit

16-01584 Document Revision History

Revision	Date	Remarks
00	October 18, 2016	Initial released version

Note: Specifications subject to change without notice