copley controls AccelnetPlus Micro Module CANopen APV

DIGITAL SERVO DRIVE FOR BRUSH & BRUSHLESS MOTORS

Control Modes
- Profile Position-Velocity-Torque, Interpolated Position (PT,PVT), Homing
- Indexer, Point-to-Point, CPL
- Camming, Gearing
- Position, Velocity, Torque

Command Interface
- CANopen
- ASCII, Serial Binary, and discrete I/O
- Stepper or Quad A/B position commands
- PWM velocity/torque command
- Master encoder (Gearing/Camming)

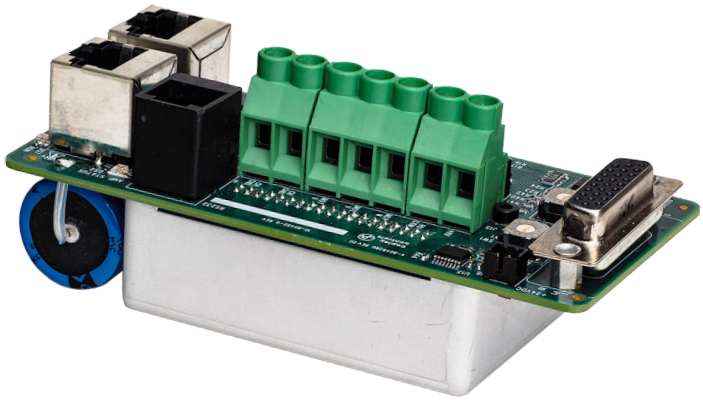
Communications
- CANopen
- RS-232

Feedback
- Dual Absolute Encoder Ports
  SSI
  EnDat 2.1, 2.2
  Absolute A
  Tamagawa Absolute A
  Panasonic , Sanyo Denki Absolute A Format
  BiSS
- Incremental
  Digital quad A/B/X encoder
  Analog Sin/Cos encoder
- Other
  Digital Halls

I/O
- 7 High-speed digital inputs
- 6 High-speed digital outputs
- 1 Differential analog input

Safe Torque Off (STO)
- SIL 3, Category 3, PL d

Dimensions: mm [in]
- 64 x 41 x 16.5 [2.5 x 1.6 x .65] APV
- 112 x 53.3 x 42.4 [4.4 x 2.1 x 1.7] APZ



Model	Ic	Ip	Vdc
APV-090-14	7	14	9~90
APV-090-30	15	30	9~90
APV-090-50	25	50	9~90
APZ-090-50	25	50	9~90
APV-180-10	5	10	20~180
APV-180-20	10	20	20~180

DESCRIPTION

APV sets new levels of performance, connectivity, and flexibility. CANopen communication provides a widely used cost-effective industrial bus. A wide range of absolute encoders are supported.

Safe Torque Off (STO) eliminates external contactors and wiring, reducing system cost and complexity. For safety critical applications, redundant STO disable inputs can be employed.

APV GENERAL SPECIFICATIONS

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

MODEL	APV-090-14	APV-090-30	APV-090-50	APZ-090-50	APV-180-10	APV-180-20	
OUTPUT POWER							
Peak Current	14 (9.9)	30 (21.2)	*50 (35.4)	50 (35.4)	10 (7.1)	20 (14.2)	Adc (Arms, sinusoidal)
Peak time	1	1	1	1	1	1	Sec
Continuous current	7 (5.0)	15 (10.6)	*25 (17.7)	25 (17.7)	5 (3.5)	10 (7.1)	Adc (Arms, sinusoidal)
Peak Output Power	1.26	2.7	4.5	4.5	1.8	3.6	kW
Continuous Output Power	0.63	1.4	2.3	2.3	0.9	1.8	kW
	* APV-090-50 must be soldered to mounting board for these ratings.						
INPUT POWER							
HVmin to HVmax	+9 to +90	+9 to +90	+9 to +90	+9 to +90	+20 to +180	+20 to +180	Vdc, transformer-isolated
Ipeak	14	30	50	50	10	20	Adc (1 sec) peak
Icont	7	15	25	25	5	10	Adc continuous
Vlog	+9 to +60	+9 to +60	+9 to +60	+9 to +60	+9 to +60	+9 to +60	Vdc, transformer-isolated
Vlog Power	4 W with no encoder, 6.6 W with 2 encoders, +5V @ 500 mA total						
PWM OUTPUTS							
Type	MOSFET 3-phase inverter, 16 kHz center-weighted PWM carrier, space-vector modulation						
PWM ripple frequency	32 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	16 kHz (62.5 µs)						
Position & Velocity loop update rate	4 kHz (250 µs)						
COMMAND INPUTS							
CANopen:							
	Profile Position/Velocity/Torque, Interpolated Position (PVT), Homing,						
Stand-alone mode							
Digital position reference	Pulse/Direction, CW/CCW	Stepper commands (4 MHz maximum rate)					
	Quad A/B Encoder	2 M line/sec, 8 Mcount/sec (after quadrature)					
Digital torque & velocity reference	PWM , Polarity	PWM = 0% - 100%, Polarity = 1/0					
	PWM 50%	PWM = 50% ±50%, no polarity signal required					
	PWM frequency range	1 kHz minimum, 100 kHz maximum					
	PWM minimum pulse width	220 ns					
Indexing	Up to 32 sequences can be launched from inputs or ASCII commands.						
Camming	Up to 10 CAM tables can be stored in flash memory						
ASCII	RS-232, 9600~115,200 Baud, 3-wire						
DIGITAL INPUTS							
Number	7						
All inputs	High-speed Schmitt trigger with 100 ns RC filter, 10 kΩ pull-up to +5 Vdc, maximum input voltage = +6 Vdc RC time-constants assume active drive on inputs and do not include 10 kΩ pull-ups.						
IN1~IN6	V_T+ = 1.42~2.38 Vdc, V_T- = 0.68~1.6 Vdc, V_H = 0.44~1.26						
IN7	V_T+ = 1.30~2.00 Vdc, V_T- = 0.55~1.30 Vdc, V_H = 0.40~0.79						
ANALOG INPUT							
Number	1						
Type	Differential, ±10 Vdc range, 16 bits, 14 kHz input filter bandwidth, sample-rate 16 kHz						
Function	Torque, velocity, or position command. Or, as general purpose analog input.						
DIGITAL OUTPUTS							
Number	6						
OUT1~3	CMOS inverters, functions programmable, +5 Vcc Source -4 mA @ VOH = 4.18 Vdc, Sink 4 mA @ VOL = 0.26 Vdc						
OUT4~6	CMOS inverters, functions programmable, for SPI port, +3.3 Vcc Source -24 mA @ VOH = 2.3 Vdc, Sink 24 mA @ VOL = 0.55 Vdc						
RS-232 COMMUNICATION PORT							
Signals	RxD, TxD, SGND						
Mode	Full-duplex, DTE serial communication port for drive setup and control, 9,600 to 230,400 Baud						
Protocol	ASCII or Binary format						
Isolation	Non-isolated. Referenced to Signal Ground.						
CANOPEN PORT							
Format	Galvanically isolated from drive circuits: CAN_H, CAN_L, CAN_GND, 1 mBit/sec maximum						
Protocol	CANopen, CiA 402						

APV GENERAL SPECIFICATIONS

DC POWER OUTPUT

+5 Vdc	500 mA maximum. Protected for overload or shorts. Shared by dual encoders.

SAFE TORQUE OFF (STO)

Function	PWM outputs are inactive and current to the motor will not be possible when the STO function is asserted
Standard	Designed to IEC-61508-1, IEC-61508-2, IEC-61800-5-2, ISO-13849-1
Safety Integrity Level	SIL 3, Category 3, Performance level d
Inputs	2 two-terminal: STO-IN1+,STO-IN1-, STO-IN2+, STO-IN2-
Type	Opto-isolators, 5 V compatible, Vin-LO ≤ 2.0 Vdc or open, Vin-HI ≥ 3.3 Vdc,
Input current (typical)	STO-IN1, STO-IN2: 11 mA each
Response time	2 ms from Vin ≤2.0 Vdc to interruption of energy supplied to motor
Muting	Wiring a shorting plug with jumpers (see page 7) will mute (bypass) the STO function

PROTECTIONS

HV Overvoltage	+HV > +95 ±1 Vdc	Drive outputs turn off until +HV is < +95 ±1 Vdc (90 V models)
	+HV > +185 ±1 Vdc	Drive outputs turn off until +HV is < +185 ±1 Vdc (180 V models)
HV Undervoltage	+HV < +8.5 ±0.5 Vdc	Drive outputs turn off until +HV > +8.5 Vdc ±0.5 Vdc (90 V models)
	+HV < +19.5 ±0.5 Vdc	Drive outputs turn off until +HV > +19.5 Vdc ±0.5 Vdc (180 V models)
Drive over temperature	PC Board > 90 °C +3/-0 °C	Programmable as latching or temporary fault
Short circuits	Output to output, output to ground, internal PWM bridge faults	
I^2T Current limiting	Programmable: continuous current, peak current, peak time for drive and motor	
Latching / Non-Latching	Programmable response to errors	

MECHANICAL & ENVIRONMENTAL

Size	APV: 2.5 x 1.6 x 0.69 in. [64 x 41 x 17.5 mm] APZ: 4.4 x 2.1 x 1.7 in. [112 x 53.3 x 42.4 mm]
Weight	APV: ≤ 0.16 lb (0.073 kg), add 0.13 lb (0.06 kg) for heatsink APZ: 0.40 lb (0.18 kg)
Ambient temperature	0 to +45 °C operating, -40 to +85 °C storage
Humidity	0 to 95%, non-condensing
Altitude	≤ 2000 m (6,500 ft)
Vibration	2 *g* peak, 10~500 Hz (sine)
Shock	10 *g*, 10 ms, half-sine pulse
Contaminants	Pollution degree 2
Cooling	Forced air cooling required for continuous power output

AGENCY STANDARDS CONFORMANCE

Standards and Directives

Functional Safety

IEC 61508-1, IEC 61508-2, IEC 61508-3, IEC 61508-4 (SIL 3)

Directive 2006/42/EC (Machinery)

ISO 13849-1/Cor. 1:2009 (Cat 3, PL d)

IEC 61800-5-2 (SIL3)

All of the agency standards are pending at this time.

Product Safety

Directive 2014/35/EU (Low Voltage)

IEC 61800-5-1

EMC

Directive 2014/30/EU (EMC)

IEC 61800-3

IEC 61800-5-2

Restriction of the Use of Certain Hazardous Substances (RoHS)

Directive 2011/65/EU (RoHS II)

Approvals

UL and cUL recognized component to:

UL 61800-5-1, UL 61800-5-2

IEC 61800-5-1, IEC 61800-5-2

DANGER	***Refer to the 16-01688 Accelnet Plus Micro Modules APV & APV STO Manual***
	The information provided in the *16-01688 Accelnet Plus Micro Modules APV & APV STO Manual* must be considered for any application using the APV drive STO feature. ***Failure to heed this warning can cause equipment damage, injury, or death.***

APV GENERAL SPECIFICATIONS

MOTOR CONNECTIONS	
Motor U,V,W	Drive outputs to 3-phase brushless motor, Wye or delta connected For DC brush motor use outputs U & V Minimum inductance: 200 µH line-line
Encoder	Digital encoders, incremental and absolute (see FEEDBACK below), Analog Sin/Cos incremental
Halls	see *Commutation* (below)
Motemp	Inputs are programmable to disable the drive if motor sensor drives input HI or LO.
FEEDBACK	
Incremental encoders:	
Digital Incremental Encoder	Quadrature signals, (A, /A, B, /B, X, /X), differential (X, /X Index signals not required) RS-422 line receivers, 5 MHz maximum line frequency (20 M counts/sec)
Analog Incremental Encoder	Sin/Cos format (Sin+, Sin-, Cos+, Cos-), differential, 1 Vpeak-peak ±20% BW > 300 kHz, 16-bit resolution, with zero-crossing detection
Absolute encoders:	
EnDat 2.1, 2.2, SSI Absolute A Format	Serial Clock (X, /X), and Data (A, /A) signals SD+, SD- (A, /A) signals, 2.5 or 4 MHz, half-duplex 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- (A, /A) signals, clock output from drive, data returned from encoder
Terminators	All encoder data inputs and clock outputs are differential and require external terminators
Commutation:	Hall signals (U,V,W), 15 kΩ pull-up to +5V, 15 kΩ/100 pF RC to 74LVC3G14 Schmitt trigger at +5 Vcc.
Encoder power	+5 Vdc ±2% @ 500 mAdc max, shared by dual encoders
HALLS	
Digital:	U, V, W: Single-ended, 120° electrical phase difference between U-V-W signals, Schmitt trigger, 1.5 µs RC filter from active HI/LO sources, 24 Vdc compatible, 15 kΩ pull-up to +5 Vdc Vt+ = 2.5~3.5 Vdc, VT- = 1.3~2.2 Vdc, VH = 0.7~1.5 Vdc
Analog:	U & V: Sin/Cos format (Sin+, Sin-, Cos+, Cos-), differential, 1 Vpeak-peak ±20%, ServoTube motor compatible, BW > 300 kHz, 121 Ω terminating resistors between Sin+ & Sin-, Cos+ & Cos- inputs 16-bit resolution, BW > 300 kHz, with zero-crossing detection
MULTI-MODE ENCODER PORT	
As Input:	See Digital Incremental Encoder above for electrical data on A, B, & X channels, or Absolute encoders using X or A channels. External terminators required as shown above
As Emulated Output:	Quadrature A/B encoder emulation with programmable resolution to 4096 lines (65,536 counts) per rev from analog Sin/Cos encoders or resolvers. A, /A, B, /B, outputs from MAX3032 differential line driver, X, /X, A, /A from MAX 3362 line drivers
As Buffered Output:	Digital A/B/X encoder signals from primary digital encoder are buffered as shown above, 5 MHz max
5V OUTPUT	
Number	1
Ratings	+5 Vdc @ 500 mA thermal and overload protected

16-01682 Document Revision History

Revision	Date	Remarks
00	November 26, 2018	Initial release
01	December 11, 2018	Fixed the Sin/Cos resolution typo, corrected p. 16, Note 1
02	March 8, 2019	Updated connector kits, clarified connection between HVCOM and SGND, removed APV-DCS

APV CANOPEN COMMUNICATIONS

CANOPEN

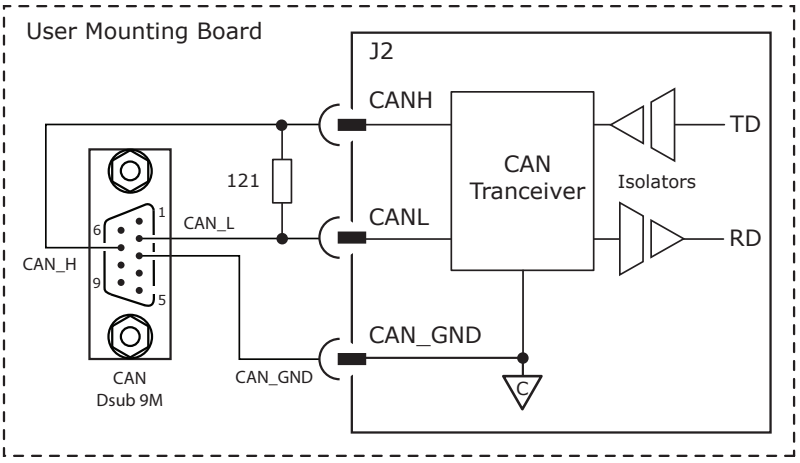
Based on the CAN V2.0b physical layer, a robust, two-wire communication bus originally designed for automotive use where low-cost and noise-immunity are essential, CANopen adds support for motion-control devices and command synchronization. The result is a highly effective combination of data-rate and 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

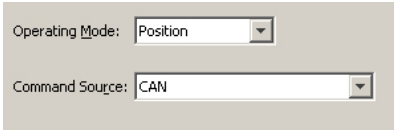
APV uses the CAN physical layer signals CANH, CANL, and GND for connection, and CANopen protocol for communication.
Before installing the drive in a CAN system, it must be assigned a CAN Node-ID (address). A maximum of 127 CAN nodes are allowed on a single CAN bus. Up to seven digital inputs can be used to produce CAN Node-IDs from 1~127, or the Node-ID can be saved to flash memory in the module. Node-ID 0 is reserved for the CANopen master on the network.

CANOPEN COMMAND INPUTS

The graphic shows connections between the APV and a Dsub 9M connector on a CAN card. If the APV 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 Node-ID of the APV may be set by using digital inputs, or programmed into flash memory in the drive.



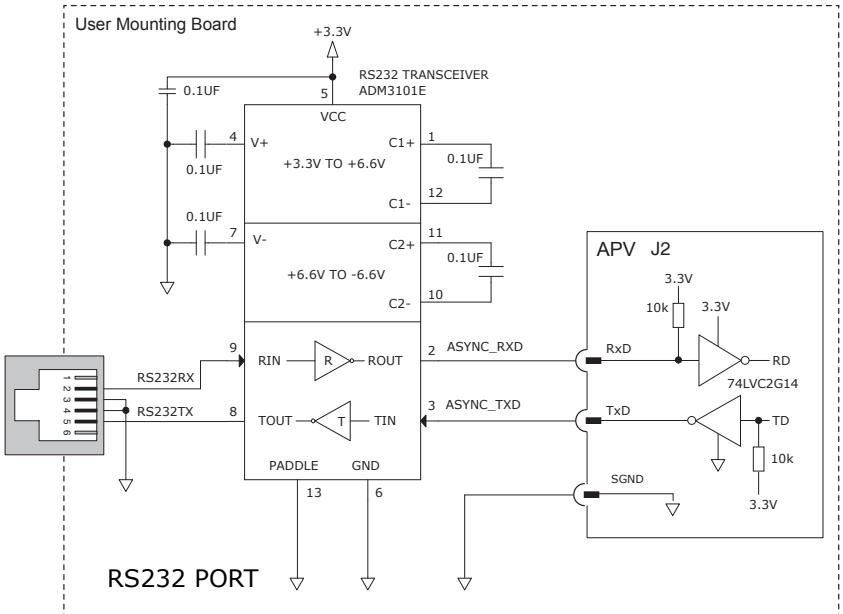
CME -> Basic Setup -> Operating Mode Options



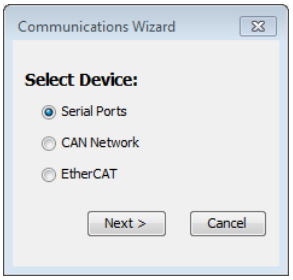
APV RS-232 COMMUNICATIONS

The serial port is a full-duplex, three-wire (RxD, TxD, SGND) type that operates from 9,600 to 230,400 Baud.
It can be used by CME for drive configuration and setup or by external equipment sending ASCII commands.

The circuit shown here is used on the EZ board and is recommended for user's PC boards. It converts the single-ended TTL signals levels in the APV into the ANSI RS-232 levels which are the standard for serial communications and computer COMM ports.



CME -> TOOLS -> COMMUNICATION WIZARD



Signal	J2 Pins
RxD	28
TxD	30
SGND	32

APV SAFE TORQUE OFF (STO)

The Safe Torque Off (STO) function is defined in IEC 61800-5-2. Two channels are provided which, when de-energized, prevent the upper and lower devices in the PWM outputs from producing torque in the motor.

This provides a positive OFF capability that cannot be overridden by the control firmware, or associated hardware components. When the opto-couplers are energized (current is flowing in the input diodes), the control core will be able to control the on/off state of the PWM outputs to produce torque in the motor.

INSTALLATION

DANGER	***Refer to the 16-01688 Accelnet Plus Micro Modules APV & APV STO Manual***
	The information provided in the *16-01688 Accelnet Plus Micro Modules APV & APV STO Manual* must be considered for any application using the drive's STO feature. ***FAILURE TO HEED THIS WARNING CAN CAUSE EQUIPMENT DAMAGE, INJURY, OR DEATH.***

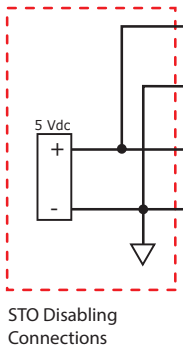
STO DISABLE

In order for the PWM outputs of the APV to be activated, current must be flowing through the opto-couplers that are connected to the STO-IN1 and STO-IN2 terminals and the drive must be in an ENABLED state. When either of the opto-couplers are OFF, the drive is in a Safe Torque Off (STO) state and the PWM outputs cannot be activated by the control core to drive a motor.

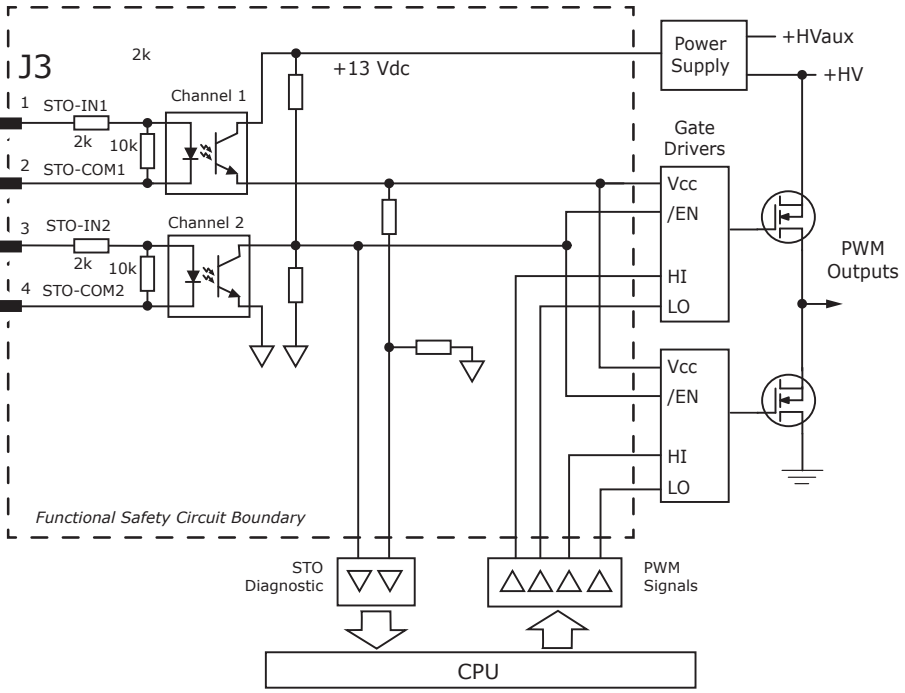
This diagram shows connections that will energize all of the opto-couplers from a +5V source. When this is done the STO feature is disabled and control of the output PWM stage is under control of the digital control core. ***If not using the STO feature, these connections must be made in order for the drive to be enabled.***

STO DISABLE CONNECTIONS

Current must flow through all of the opto-couplers before the drive can be enabled



FUNCTIONAL DIAGRAM



J3 STO

Signal	Pin		Signal
STO-IN1+	1	3	STO-IN2+
STO-IN1-	2	4	STO-IN2-

STO OPERATION

STO Input Voltage	STO State
STO-IN1 *AND* STO-IN2 ≥ 3.3 Vdc	STO Inactive. Drive can be enabled to produce torque
STO-IN1 *OR* STO-IN2 ≤ 2.0 Vdc	STO Active. Drive cannot be enabled to produce torque
STO-IN1 *OR* STO-IN2 Open	

Note: Voltages in the table above are referenced between an STO-INx+ and an STO-INx-.
E.g. V(STO-IN1) = V(STO-IN1+) - V(STO-IN1-)

APV DIGITAL COMMAND INPUTS: POSITION

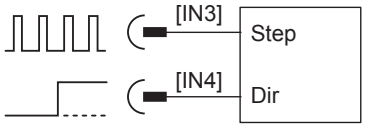
STAND-ALONE MODE DIGITAL POSITION-CONTROL INPUTS

APV works with motion controllers that output pulses to command position.
These formats are supported:

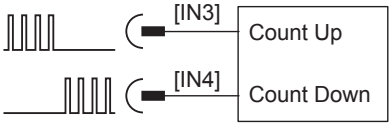
Step/Direction
Count-Up/Count-Down (CU/CD)
A/B Quadrature Encoder

In Step/Direction mode, a pulse-train controls motor position, and the direction is controlled by a DC level at the Direction input.
CU/CD (Count-Up/Count-Down) signals command the motor to move CW or CCW depending on which input the pulse-train is directed to. The motor can also be operated in an electronic gearing mode by connecting the inputs to a quadrature encoder on another motor. In all cases the ratio between input pulses and motor revolutions is programmable.

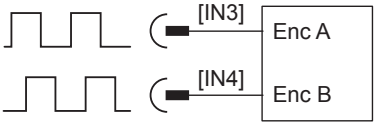
STEP/DIRECTION INPUTS



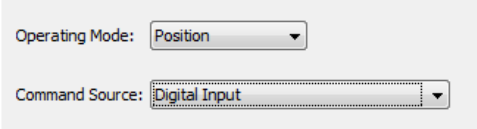
COUNT-UP/COUNT-DOWN INPUTS



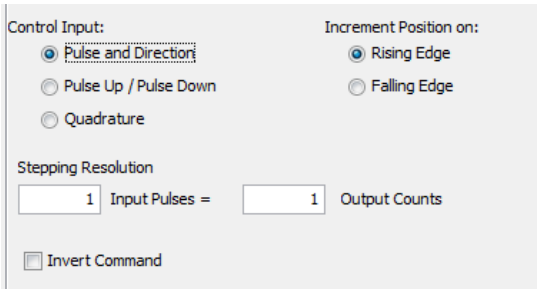
QUAD A/B ENCODER INPUTS



CME -> Basic Setup -> Operating Mode Options



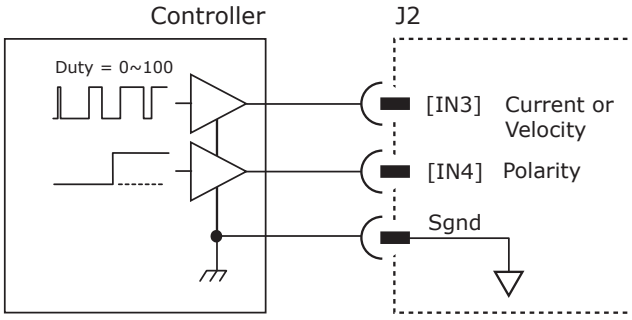
CME -> Basic Setup -> Operating Mode Options



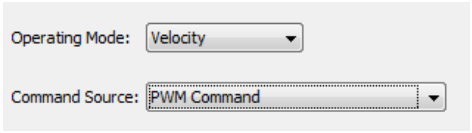
J2 SGND Pins
3,4,18,31,32,33,34,42,49,50,59,60

APV DIGITAL COMMAND INPUTS: VELOCITY, TORQUE

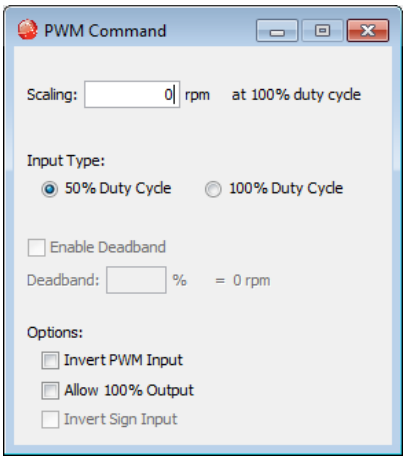
PWM & DIRECTION



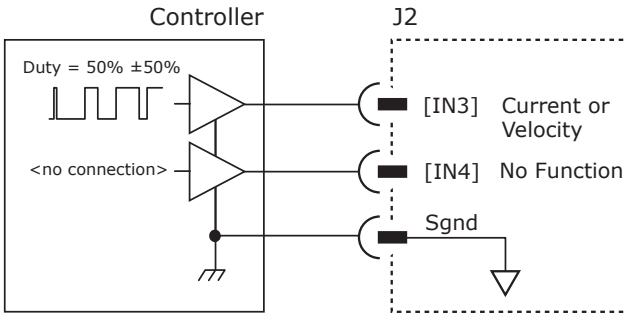
CME -> Basic Setup -> Operating Mode Options



CME -> Main Page-> PWM Command



50% PWM



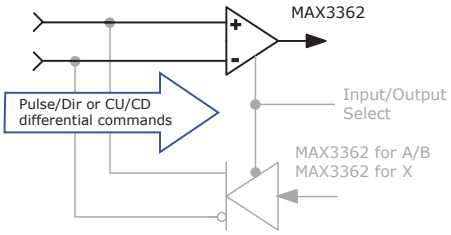
Signal	J2 Pins
IN3	7
IN4	8

APV MULTI-MODE PORT AS AN INPUT

COMMAND INPUT

POSITION COMMANDS: DIFFERENTIAL

- Pulse & Direction
- CW & CCW (Clockwise & Counter-Clockwise)
- Encoder Quad A & B
- Camming Encoder A & B input

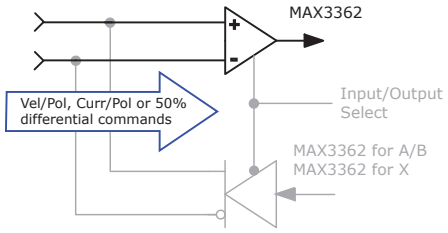


Command Signals	J2 Pins
Pulse, CW, Quad Encoder A, Vel-Curr-Magnitude, Vel-Curr-50%	51
/Pulse, /CW, Quad Encoder /A, /Vel-Curr-Magnitude, /Vel-Curr-50%	52
Direction, CCW, Quad Encoder B, Vel-Curr-Direction	53
/Direction, /CCW, Quad Encoder /B, /Vel-Curr-Direction	54

J2 SGND Pins
3,4,18,31,32,33,34,42,49,50,59,60

CURRENT or VELOCITY COMMANDS: DIFFERENTIAL

- Current/Velocity Magnitude & Direction
- Current/Velocity 50%

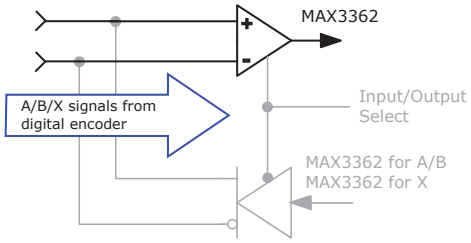


Feedback Signals	J2 Pins
Quad Encoder A, Half-Duplex CLK-DATA, Full-Duplex DATA	51
Quad Encoder /A, Half-Duplex /CLK-DATA, Full-Duplex /DATA	52
Quad Encoder B	53
Quad Encoder /B	54
Quad Encoder X, Full-Duplex CLOCK	55
Quad Encoder /X, Full-Duplex /CLOCK	56

FEEDBACK INPUT: ENCODER 2

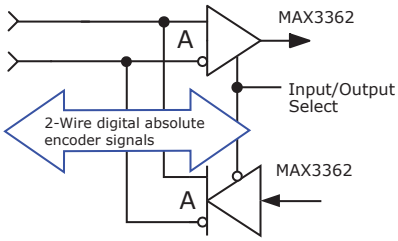
SECONDARY FEEDBACK: INCREMENTAL

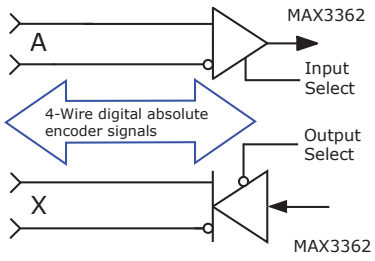
- Quad A/B/X incremental encoder

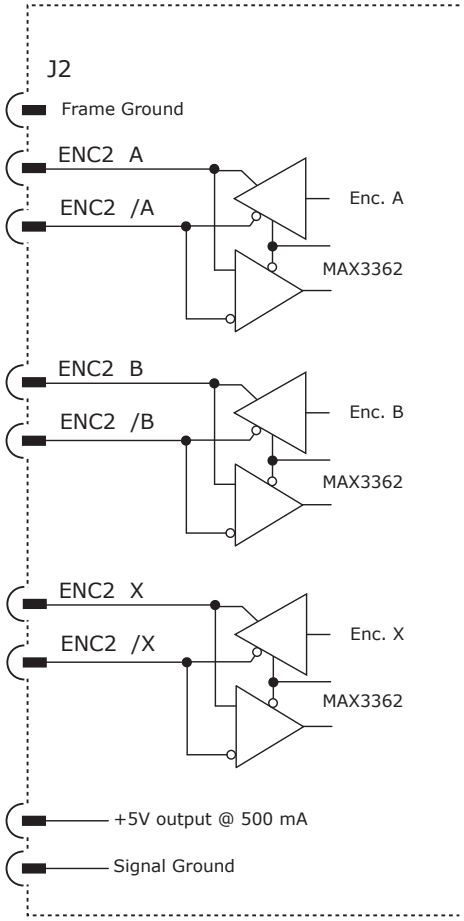


SECONDARY FEEDBACK: ABSOLUTE

- Half-Duplex: Absolute A encoders (2-wire)
  The A channel first transmits a Clock signal and then switches to a receiver to receive data from the encoder.
- Full-Duplex: SSI, BiSS, EnDat encoders (4-wire)
  The X channel sends the Clock signal to the encoder, which initiates data transmission to the A-channel.







APV MULTI-MODE PORT AS AN OUTPUT

OUTPUT TYPES

BUFFERED FEEDBACK OUTPUTS: DIFFERENTIAL

An incremental encoder connected as primary feedback from the motor is internally connected to the multi-port configured as an output. This can then be wired to a motion controller that needs position data without the need for split-wiring cables from the encoder alone.

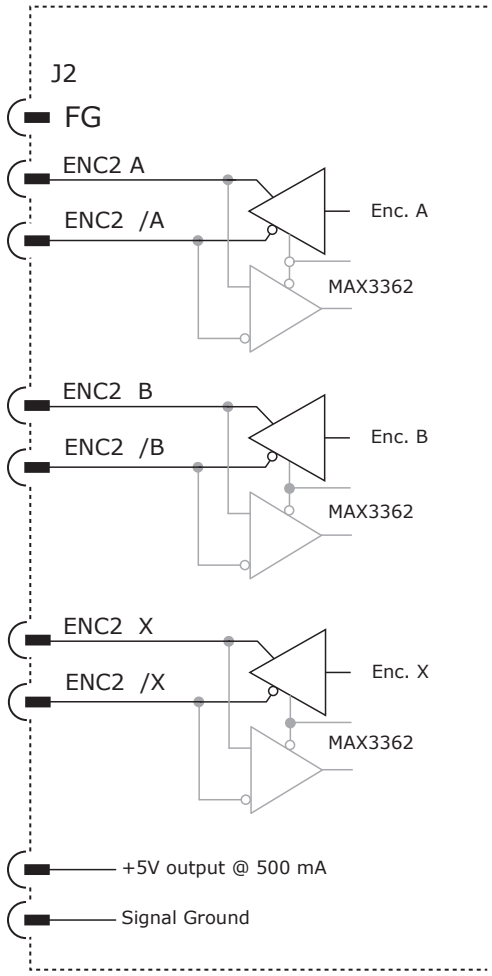
- Encoder Quad A, B, X channels
- Direct internal connection between quad A/B/X encoder feedback and differential line drivers for A/B/X outputs

EMULATED FEEDBACK OUTPUTS: DIFFERENTIAL

Firmware produces emulated quad A/B signals from feedback data from the following devices:

- Absolute encoders
- Analog Sin/Cos incremental encoders

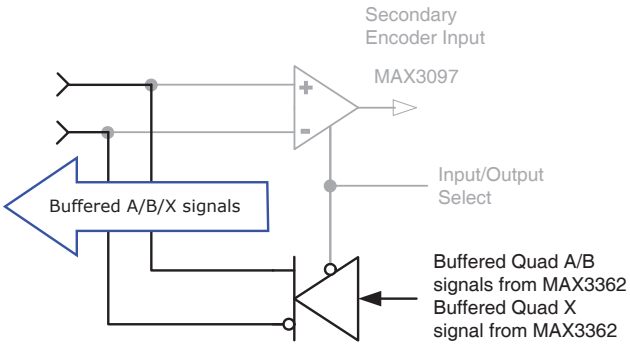
The X channel is not used in this mode



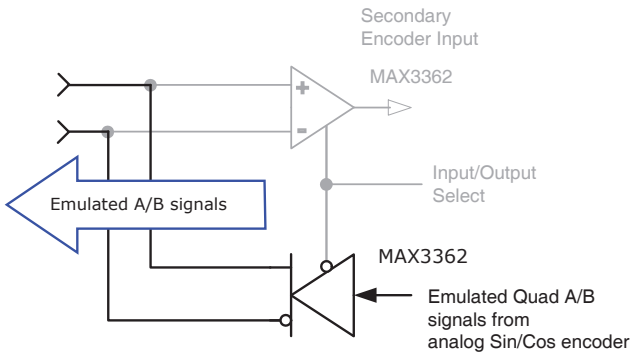
Signal	J2 Pins
Enc2 A	51
Enc2 /A	52
Enc2 B	53
Enc2 /B	54
Enc2 X	55
Enc2 /X	56

J2 SGND Pins
3,4,18,31,32,33,34,42,49,50,59,60

BUFFERED QUAD A/B/X OUTPUTS

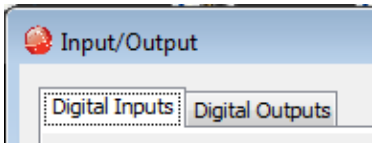


EMULATED QUAD A/B OUTPUTS

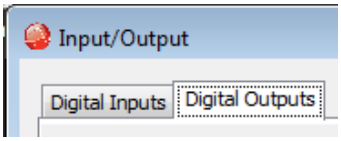


APV CME DEFAULTS

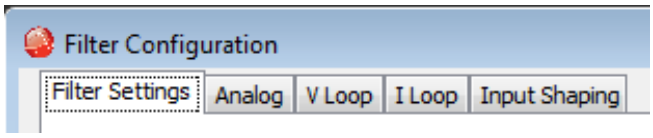
These tables show the CME default settings. They are user-programmable and the settings can be saved to non-volatile flash memory.



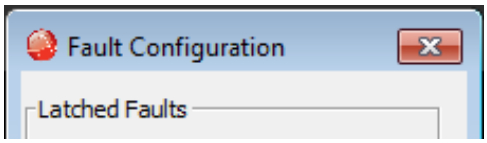
Name	Configuration
IN1	Amp Enable-LO Enables with Clear Faults
IN2	
IN3	
IN4	
IN5	Motor Temp-Hi Disables
IN6	Encoder Fault-Active HI
IN7	SLI MISO (Master Input Slave Output)



Name	Notes
OUT1	Fault-Active HI
OUT2	
OUT3	Brake-Active HI
OUT4	SLI MOSI (Master Output Slave Input)
OUT5	SLI CLK (Clock)
OUT 6	SLI SS (Slave Select)



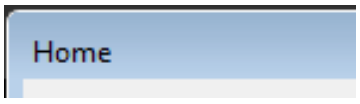
Name	Notes
Analog Reference	Disabled
V Loop Input	Disabled
V Loop Output 1	Low Pass, Butterworth, 2 poles, 200 Hz
V Loop Output 2	Disabled
V Loop Output 3	Disabled
I Loop Input 1	Disabled
I Loop Input 2	Disabled
Input Shaping	Disabled, 0.1 Hz



Active	Notes
√	Short Circuit
√	Amp Over Temperature
√	Motor Over Temp
	Over Voltage
	Under Voltage
√	Feedback Error
	Motor Phasing Error
√	Following Error
	Command Input Fault
	Motor Wiring Disconnected
	STO Active

OPTIONAL FAULTS

	Over Current (Latched)



Option	Notes
Method	Set Current Position as Home

APV HIGH SPEED INPUTS: IN1, IN2, IN3, IN4, IN5, IN6

The six digital inputs to the APV are programmable to a selection of functions.

All have 100 ns RC filters when driven by active sources (CMOS, TTL, etc) and all have 10 kΩ pull-up resistors to +5 Vdc.
In addition to the selection of functions, the active level for each input is individually programmable.

Input *level* functions have programmable HI or LO to activate the function.
Input *transition* functions are programmable to activate on LO -> HI, or HI -> LO transitions.

INPUT LEVEL FUNCTIONS

- Drive Enable, Enable with Clear Faults, Enable with Reset
- PWM Sync
- Positive Limit Switch
- Negative Limit Switch
- Home Switch
- Encoder Fault
- Motor Temperature Sensor Input
- Motion Abort
- High-Resolution Analog Divide

INPUT TRANSITION FUNCTIONS

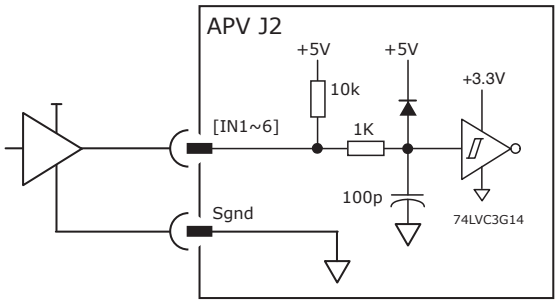
- Clear Faults and Event Latch
- Drive Reset
- PWM Sync Input
- Trajectory Update
- Count Input Edges, Save to Register
- High-Speed Position Capture
- Simulated Absolute Encoder Burst
- Abort Move if > N Counts From Destination in Register

SPECIFICATIONS

Input	Data	Notes
Input Voltages	HI	V_T+ = 1.42~2.38 Vdc
	LO	V_T+ = 0.68~1.6 Vdc
	Hys	V_H = 0.44~1.26
	Max	+6 Vdc
	Min	0 Vdc
Pull-up	R1	10 kΩ
Low pass filter	R2	1 kΩ
	C1	100 pF
	RC[1]	0.1 µs

CONNECTIONS

Signal	J2 Pins
IN1	5
IN2	6
IN3	7
IN4	8
IN5	9
IN6	10



J2 SGND PINS
3,4,18,31,32,33,34,42,49,50,59,60

APV HIGH SPEED INPUT: IN7

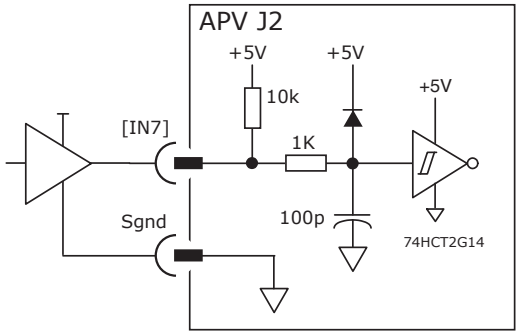
- Digital, non-isolated
- Programmable functions
- MISO Input when SPI port is in use.

SPECIFICATIONS

Input	Data	Notes
Input Voltages	HI	VT+ ≥ 1.3~2.0 Vdc
	LO	VT- ≤ 0.55~1.3 Vdc
	Hys	VH 0.4~0.79 Vdc
	Max	+6 Vdc
	Min	0 Vdc
Pull-up	R1	10 kΩ
Low pass filter	R2	1 kΩ
	C1	100 nF
	RC[1]	0.1 µs

CONNECTIONS

Signal	J2 Pins
IN7	11



* RC time constant applies when input is driven by active high/low device

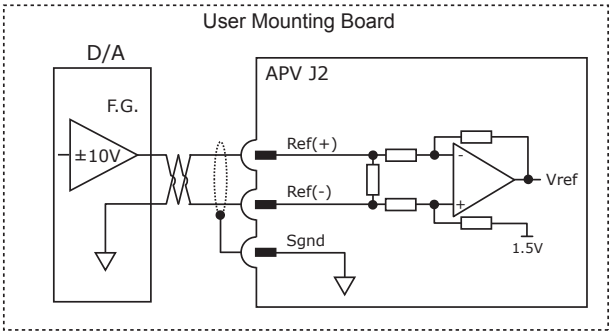
APV ANALOG INPUT: AIN1

As a reference input it takes position/velocity/torque commands from a controller.
If not used as a command input, it can be used as general-purpose analog input.

SPECIFICATIONS

Spec	Data	Notes
Input Voltage	Vref	±10 Vdc
Input Resistance	Rin	5 kΩ

Signal	J2 Pins
AIN(+)	2
AIN(-)	1

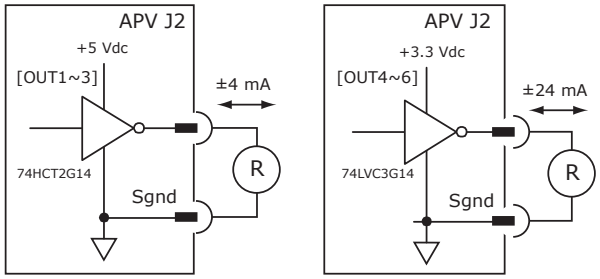


APV DIGITAL OUTPUTS: OUT1~OUT4

Digital outputs [OUT1~3] are CMOS inverters. They operate from +5V and can source/sink 4 mAdc.
[OUT4~6] operate from 3.3V and can source/sink 24 mA.
The output functions shown below are programmable to turn the output ON (HI) or OFF (LO) when active.

OUTPUT FUNCTIONS

- Fault
- Brake
- Custom event
- PWM Sync
- Custom Trajectory status
- Custom position-triggered output
- Program control



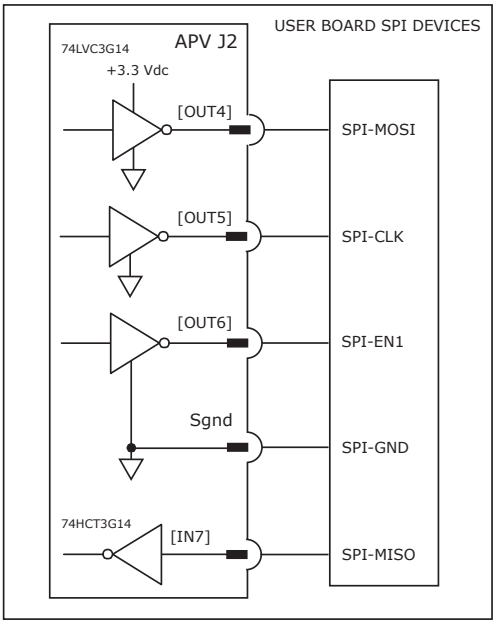
Signal	J2 Pins
OUT1	13
OUT2	12
OUT3	15
OUT4	14
OUT5	17
OUT6	16

APV SPI PORT

Digital outputs [OUT4~6] are high-speed buffers operating from +3.3V and can source/sink up to 24 mAdc and are programmable for other functions. They are programmable to turn the output ON (HI) or OFF (LO) when active. The graphic below shows them in SPI mode. [IN7] is shown here for completeness as part of the SPI function.

OUTPUT FUNCTIONS

- Fault
- Brake
- Custom event
- PWM Sync
- Custom Trajectory status
- Custom position-triggered output
- Program control

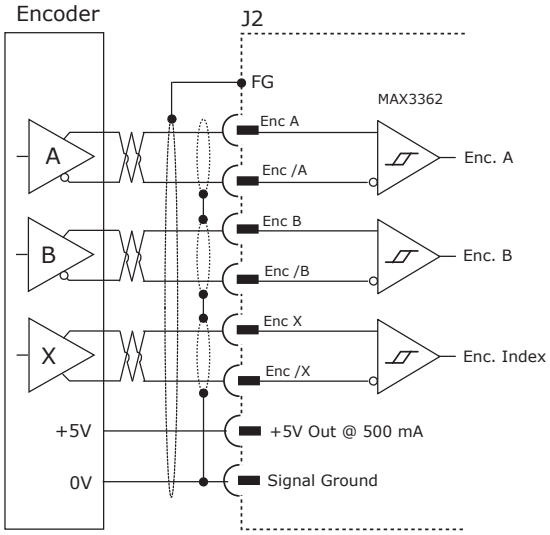


Signal	J2 Pins
SPI-MOSI	14
SPI-CLK	17
SPI-EN1	16
SPI-GND	18
SPI-MISO	11

J2 SGND Pins
3,4,18,31,32,33,34,42,49,50,59,60

APV ENCODER 1 (PRIMARY FEEDBACK)

QUAD ENCODER WITH INDEX



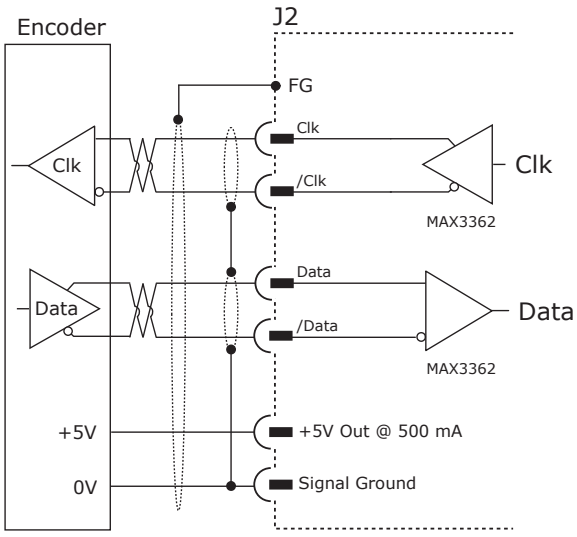
A/B/X SIGNALS

Signal	J2 Pins
Enc A	43
Enc /A	44
Enc B	45
Enc /B	46
Enc X	47
Enc /X	48
+5V	57,58

J2 SGND Pins
3,4,18,31,32,33,34,42,49,50,59,60

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 APV drive provides a train of clock signals in differential format 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. The hardware bus consists of two signals: SCLK and SDATA. Data is sent in 8 bit bytes, LSB first. The SCLK signal is only active during transfers. Data is clocked out on the falling edge and clock in on the rising edge of the Master.



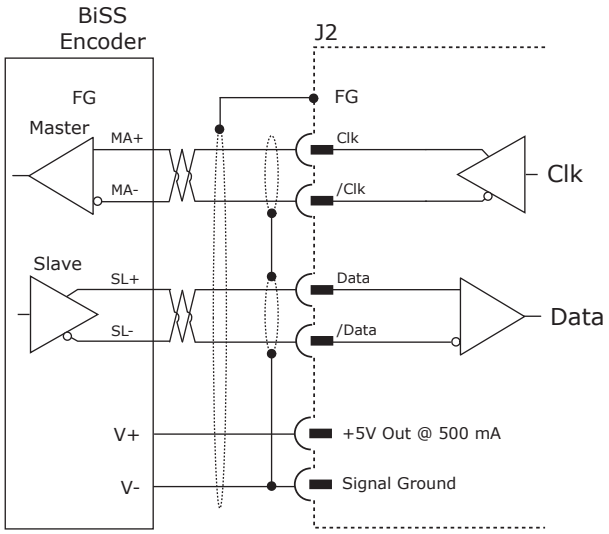
SSI,BiSS SIGNALS

SSI	BiSS	J2 Pins
Clk	MA+	47
/Clk	MA-	48
Data	SL+	43
/Data	SL-	44
+5V		57,58

BiSS ABSOLUTE ENCODER

BiSS is an - Open Source - digital interface for sensors and actuators. BiSS refers to principles of well known industrial standards for Serial Synchronous Interfaces like SSI, AS-Interface® and Interbus® with additional options.

- Serial Synchronous Data Communication
- Cyclic at high speed
- 2 unidirectional lines Clock and Data
  - Line delay compensation for high speed data transfer
  - Request for data generation at slaves
  - Safety capable: CRC, Errors, Warnings
  - Bus capability incl. actuators
- Bidirectional
  - BiSS B-protocol: Mode choice at each cycle start
  - BiSS C-protocol: Continuous mode



Note: Single (outer) shields should be connected at the drive end. Inner shields should only be connected to Signal Ground on the drive.

APV ENCODER 1 (PRIMARY FEEDBACK)

ENDAT ABSOLUTE ENCODER

The EnDat interface is a Heidenhain interface that is similar to SSI in the use of clock and data signals, but which also supports analog Sin/Cos channels from the same encoder. The number of position data bits is programmable as is the use of Sin/Cos channels. Use of Sin/Cos incremental signals is optional in the EnDat specification.

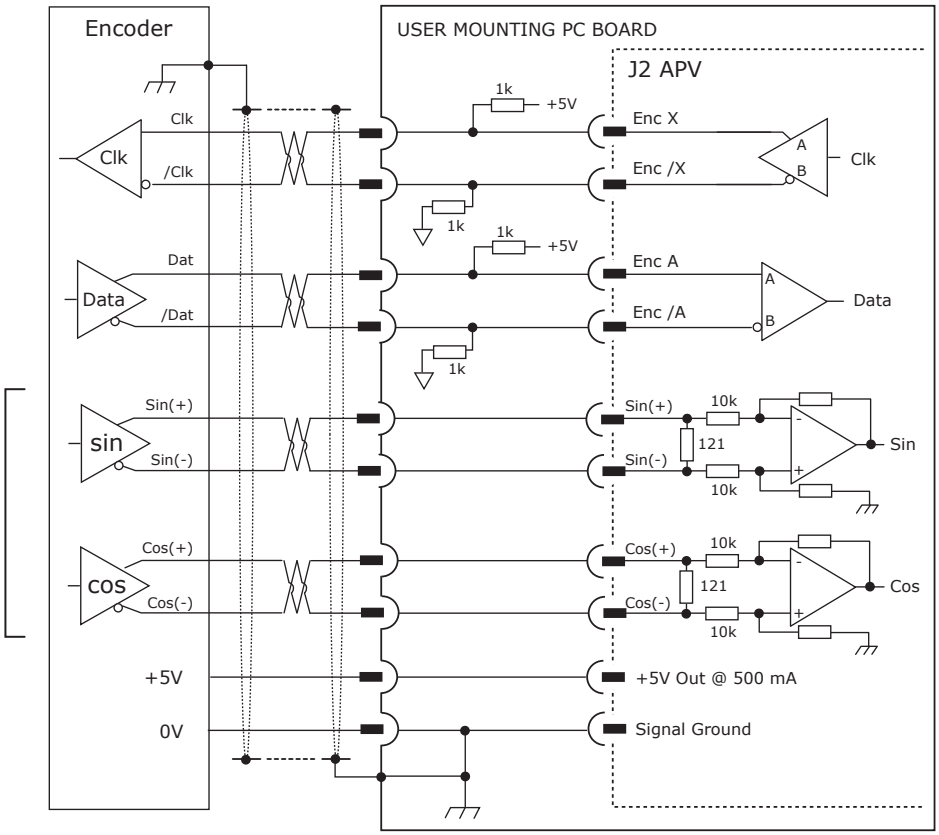
ENDAT SIGNALS

Signal	J2 Pins
Clk	47
/Clk	48
Data	43
/Data	44
Sin(+)	36
Sin(-)	35
Cos(+)	38
Cos(-)	37
+5V	57,58

* Optional

*** Sin/Cos *optional* with EnDat 2.2 or any 1 Mbit or faster Endat Sin/Cos *required* if EnDat 2.1 < 1 Mbit**

J2 Signal Ground Pins
3,4,18,31,32,33,34,42,49,50,59,60



ABSOLUTE-A ENCODER

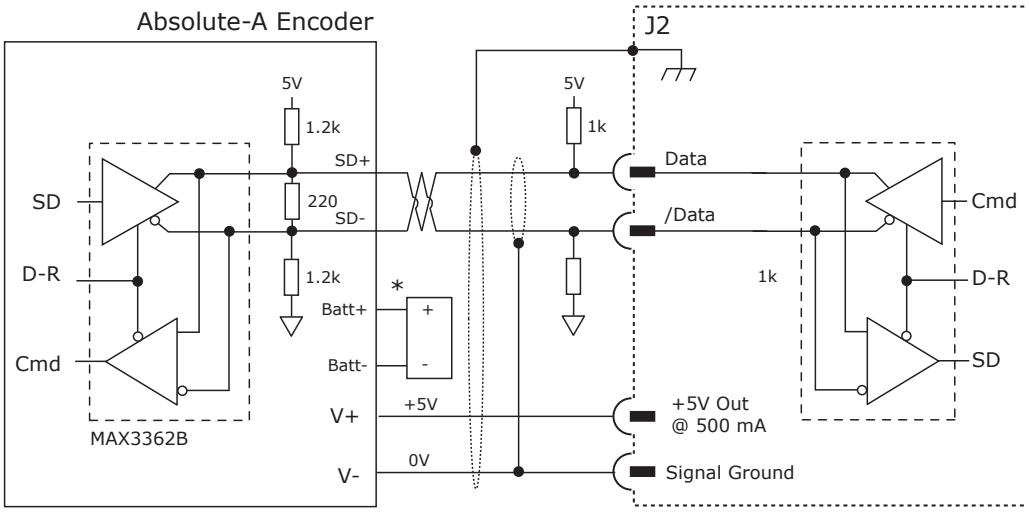
The Absolute A interface is a serial, half-duplex type that is electrically the same as RS-485. Note the battery which must be connected. Without it, the encoder will produce a fault condition.

ABSOLUTE-A SIGNALS

Signal	J2 Pins
Data	43
/Data	4
+5V	19,20

- Absolute A
- Tamagawa Absolute A
- Panasonic Absolute A Format
- Sanyo Denki Absolute A

*** Battery optionalt**



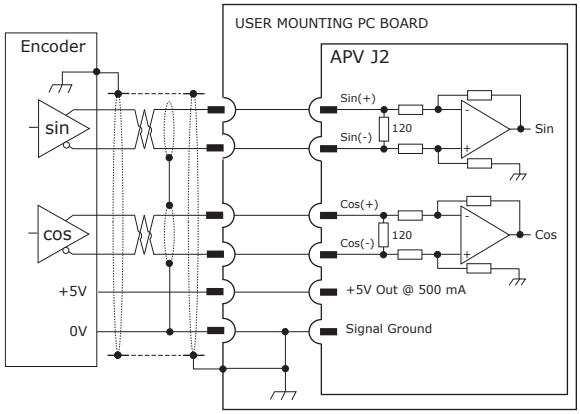
APV ANALOG ENCODER

SIN/COS ENCODERS

Sin/Cos sensors in linear brushless motors are produced from the magnetic field in the rod and provide commutation feedback as well as higher resolution position feedback by interpolating of the signals.

Incremental rotary encoders are also available with Sin/Cos outputs.

Programmable interpolation enables the number of counts per revolution or linear movement to be programmable.

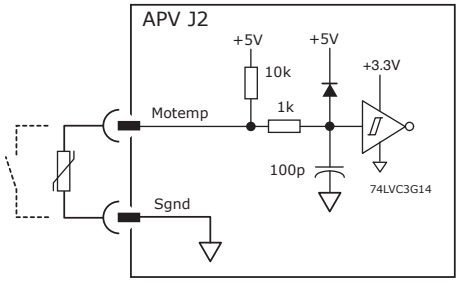


Input	J2 Pins
SIN(+)	36
SIN(-)	35
COS(+)	38
COS(-)	37
+5V	57,58

APV OTHER MOTOR CONNECTIONS

MOTOR TEMPERATURE SENSOR

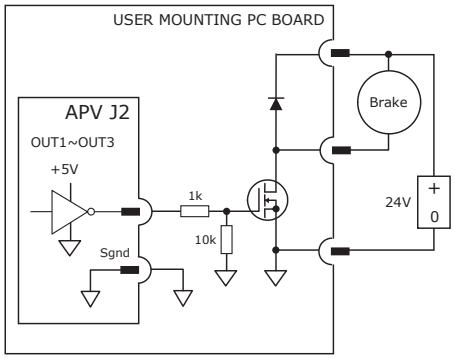
Any digital input is programmable for use with a motor overtemperature switch. Either a HI or LO input level is programmable to signal an over-temp condition.



Input	J2 Pins
Motemp	9
Sgnd	3

MOTOR BRAKE

OUT1~OUT3 have +5V outputs that can control a MOSFET. When programmed for brake control with an active HI level, the output will turn on the MOSFET, releasing the brake and allow the motor to move.

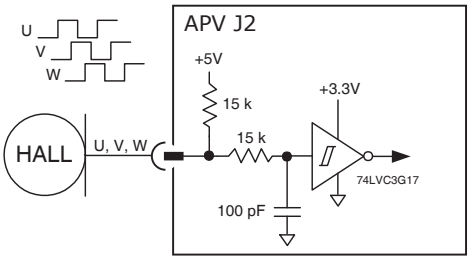


Output	J2 Pins
OUT1	13
OUT2	12
OUT3 *	15

* OUT3 is brake default

HALLS

Hall sensors in a brushless motor are produced from the magnetic field in the motor and provide commutation feedback without an encoder. When used with incremental encoders, they enable the motor to operate without a phase-finding cycle.



Input	J2 Pins
Hall U	39
Hall V	40
Hall W	41

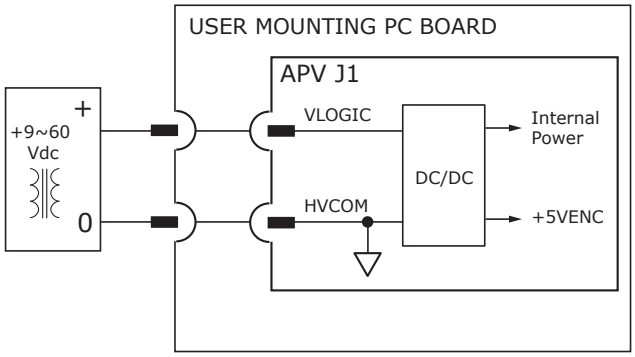
J2 Signal Ground Pins
3,4,18,31,32,33,34,42,49,50,59,60

APV VLOGIC

DESCRIPTION

Powers the internal logic and control circuits in the drive.
When using the STO feature, it must be produced by power supplies with transformer isolation from the mains and PELV or SELV ratings and a maximum output voltage of 60 Vdc.

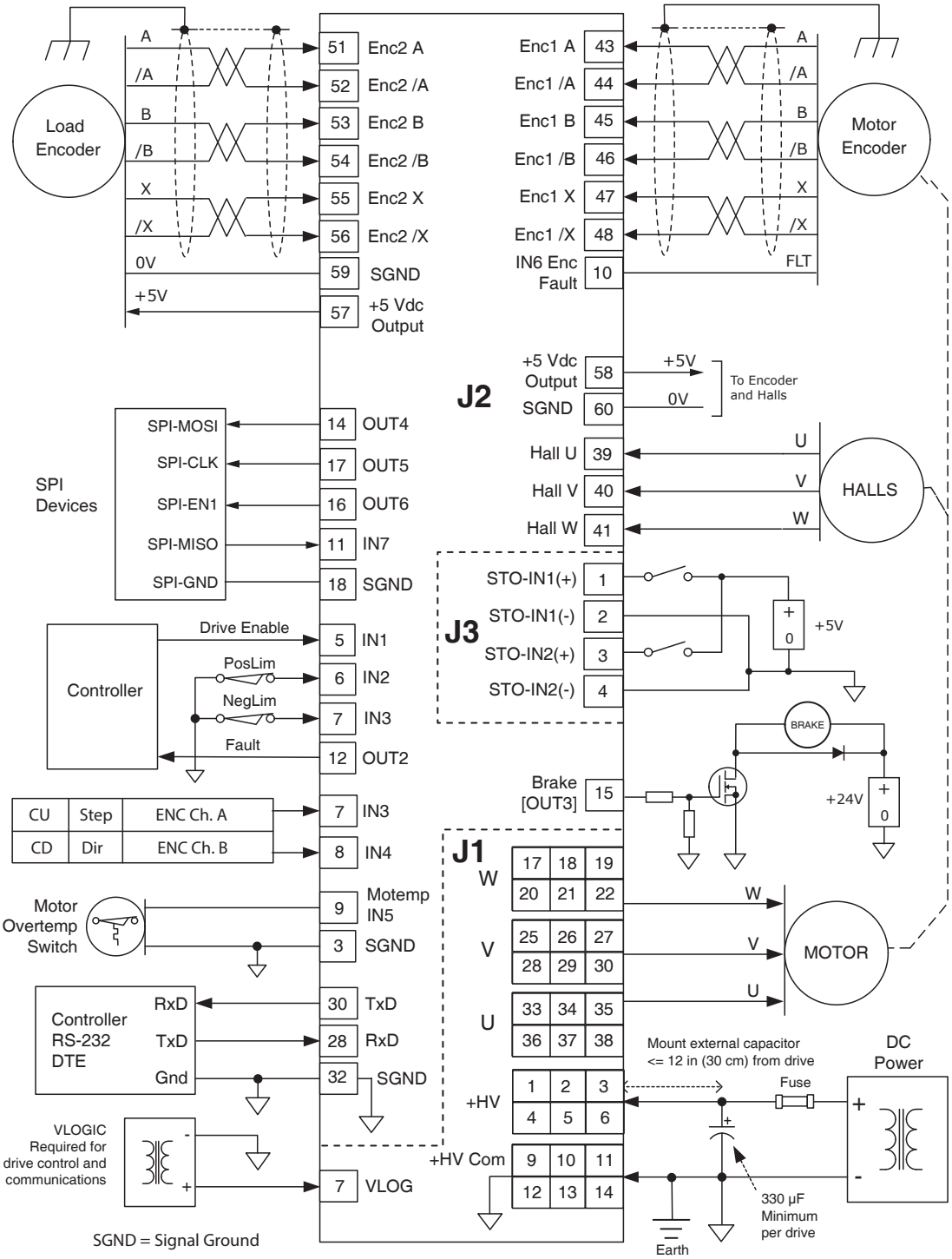
If the motor can operate from voltages of 60 Vdc or less, the +HV and VLOGIC can be driven from a single power supply.



Signal	J1 Pins
VLOGIC	7
HVCOMM	9,10,11, 12,13,14

APV TYPICAL CONNECTIONS

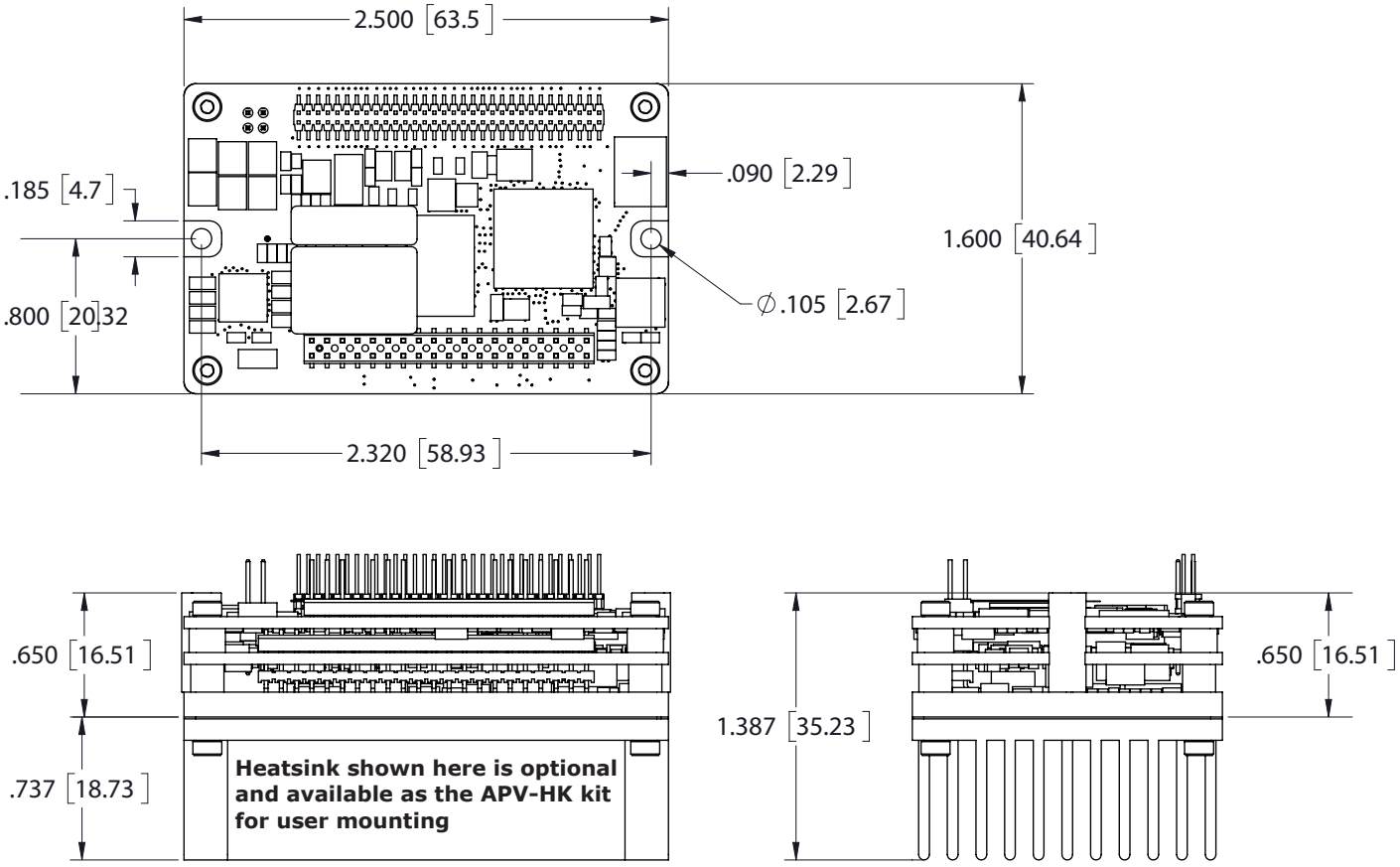
This graphic shows the functional connections between APV connectors and various devices. User mounting board connections are not shown.



NOTES

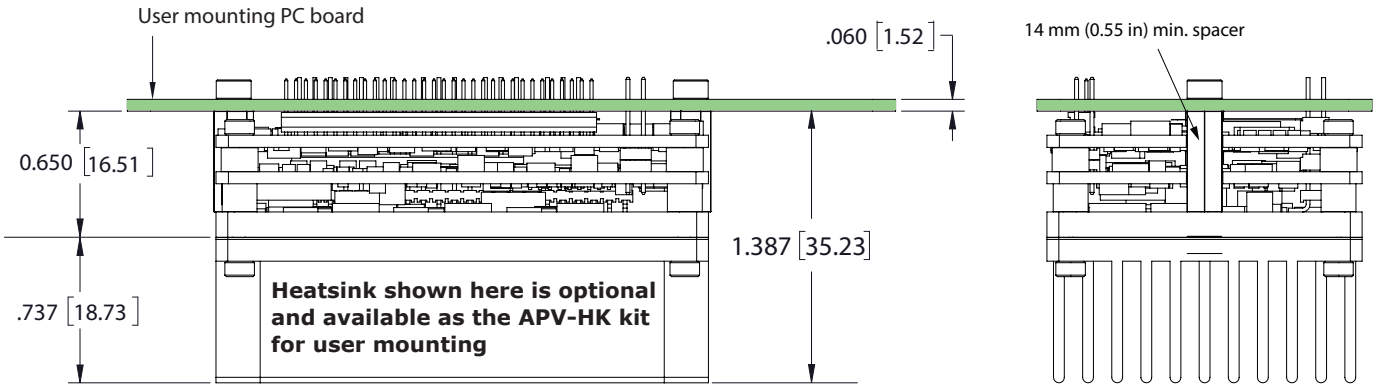
1. [IN1] is shown as Drive Enable and [IN2] and [IN7] are shown with some typical functions.
   [IN3] and [IN4] are shown as digital command inputs. [IN7] is shown twice.
   If SLI function is used, it will not be available for other functions. All inputs are programmable.
2. [OUT2] is shown as a Fault signal to the controller and [OUT3] is shown as control for a motor brake. All outputs are programmable.
3. Encoder connections are shown for incremental types, but absolute encoders are supported on both primary and load encoder inputs.

APV DIMENSIONS



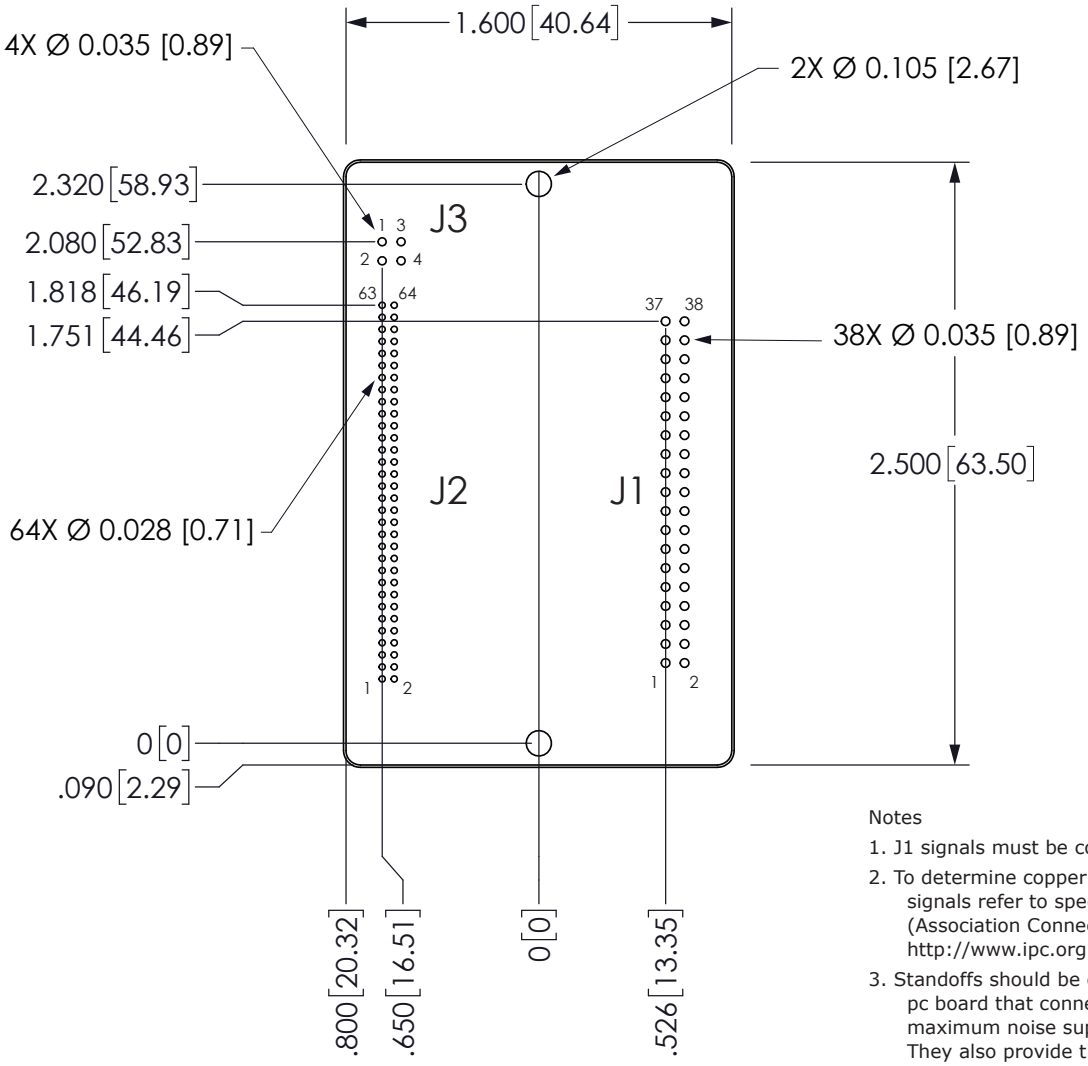
Dimensions are in inches [mm].

APV MOUNTING DIMENSIONS: SOLDERED INTO USER PC BOARD

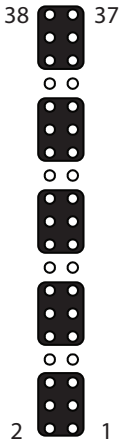


APV PC BOARD MOUNTING & DRILLING DIMENSIONS

Top view looking down on mounting PC board.



J1 Signal Grouping for current-sharing



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. They also provide the PE (Protective Earth) connection between the heatplate and ground.

Dimensions are in inches [mm].

For Sockets on User PC Board:

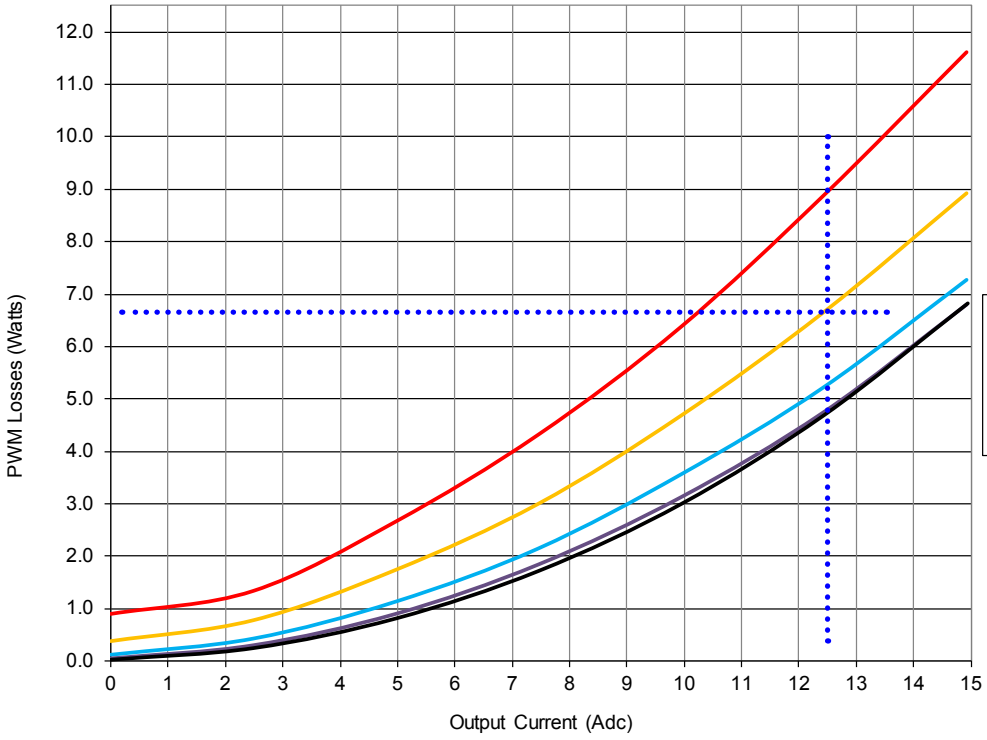
Qty	Description	Mfgr	Part Number	Ref Des	Remarks
1	Socket Strip	Samtec	SQT-119-01-G-D	J1	2.00 mm (0.0787 in) pitch
1	Socket Strip	Samtec	SFMC-132-01-L-D	J2	0.050" (1.27 mm) pitch
1	Socket Strip	Samtec	SQT-102-01-G-D	J3	2.00 mm (0.0787 in) pitch
2	Standoff	hex, 13 mm long, M2,5 mm thread			

For Soldering to User PC Board:

Qty	Description	Mfgr	Part Number	Ref Des	Remarks
1	For J1, refer to this document: http://suddendocs.samtec.com/processing/through-hole-printing.pdf				
1	Socket Strip	Samtec	CLP-132-02-L-D-BE-A-K-TR	J2	0.050" (1.27 mm) pitch
1	Socket Strip	Samtec	CLT-102-2-G-D-BE	J3	2.00 mm (0.0787 in) pitch
2	Standoff	hex, 19 mm long, M 2.5 mm thread			

APV THERMALS

APV-090-30: PWM OUTPUT DISSIPATION

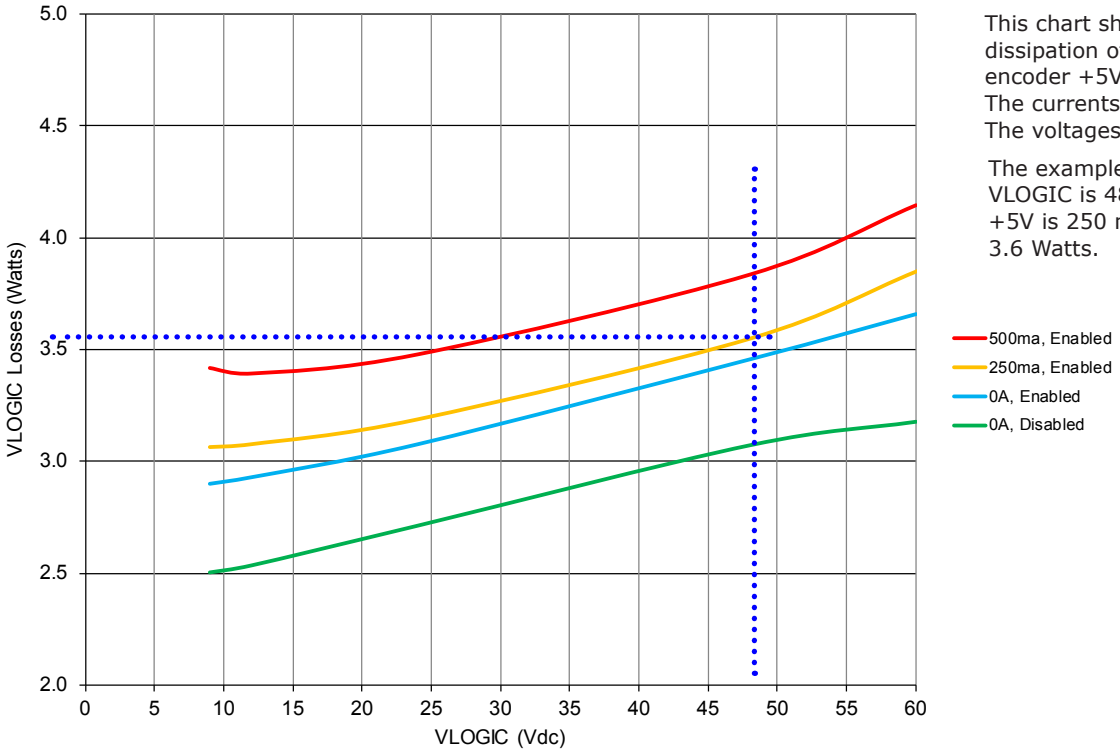


This chart shows the power dissipation of the PWM outputs vs. +HV and output current. The currents shown are in Adc (peak of sine).
The voltages in the box are Vdc.

The example shows an output current of 12.5 Adc and +HV of 48 Vdc. The PWM losses are about 6.6 Watts.

In this example the total internal power disspation in the drive would be 10.2 Watts (6.6 + 3.6 Watts)

APV-090-30: VLOGIC AND ENCODER +5V OUTPUT DISSIPATION



This chart shows the power dissipation of VLOGIC vs. +HV and encoder +5V output current. The currents shown are in Adc .
The voltages in the box are +HV.

The example (blue dotted lines) VLOGIC is 48 Vdc and the encoder +5V is 250 mA. The losses are about 3.6 Watts.

APV PC BOARD CONNECTORS

Drive viewed from above looking down on the pc board on which it is mounted.

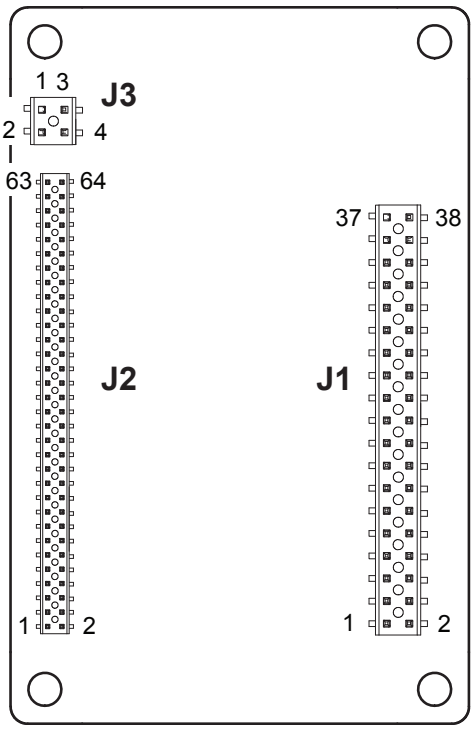
J3 STO

Signal	Pin		Signal
STO-IN1(+)	1	3	STO-IN2(+)
STO-IN1(-)	2	4	STO-IN2(-)

J2 SIGNAL

Signal	Pin		Signal
Note 1	63	64	Note 1
Note 1	61	62	Note 1
SGND	59	60	SGND
Enc +5V	57	58	Enc +5V
Enc2 X	55	56	Enc2 /X
Enc2 B	53	54	Enc2 /B
Enc2 A	51	52	Enc2 /A
SGND	49	50	SGND
Enc1 X	47	48	Enc1 /X
Enc1 B	45	46	Enc1 /B
Enc1 A	43	44	Enc1 /A
Hall W	41	42	SGND
Hall U	39	40	Hall V
Cos(-)	37	38	Cos(+)
Sin(-)	35	36	Sin(+)
SGND	33	34	SGND
SGND	31	32	SGND
CANH	29	30	RS232 TxD
CANL	27	28	RS232 RxD
CAN_GND	25	26	CAN_GND
SGND	23	24	SGND
SGND	21	22	SGND
SGND	19	20	SGND
[OUT5] SPI-CLK	17	18	SGND
Brake [OUT3]	15	16	[OUT6] SPI-EN1
[OUT1]	13	14	[OUT4] SPI-MOSI
[IN7] SPI-MISO	11	12	[OUT2]
Motemp [IN5]	9	10	[IN6] Enc Fault
[IN3]	7	8	[IN4]
Enable [IN1]	5	6	[IN2]
SGND	3	4	SGND
Refin1(-)	1	2	Refin1(+)

Top View



J1: +HV, SGND, & Motor Outputs
Dual row, 2.0 mm centers
38 position female header
Samtec: SQT-119-01-G-D

J2: Signal
Dual row, 0.050 in. centers
64 position female header
Samtec: SFMC-132-01-L-D

J3: Safety
Dual row, 2.0 mm centers
4 position female header
Samtec: SQT-102-01-G-D

J1 +HV & MOTOR

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

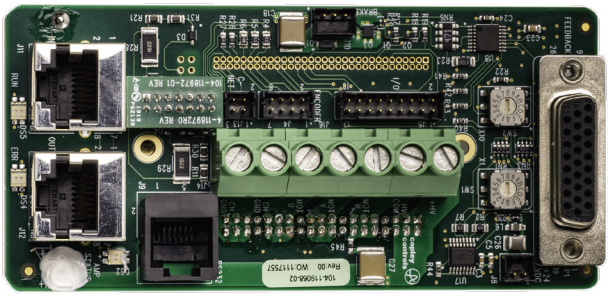
Note 2

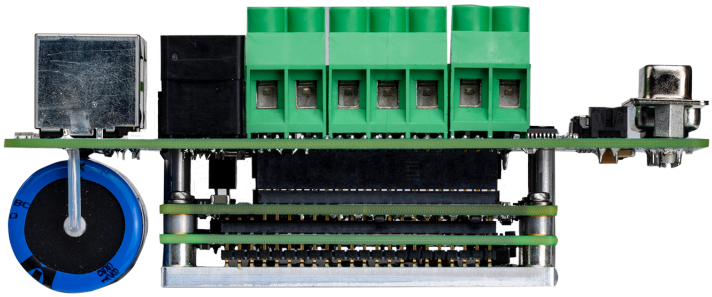
NOTES

1. Grey-shaded pins in J1 & J2 are N.C. (No Connection) and *must be left open*.
2. Signals are grouped for current-sharing on the power connector J1. When laying out pc board artworks, all pins in groups having the same signal name must be connected on top and bottom layers of the PC board.

DESCRIPTION

The EZ board provides conectivity to the APZ so it can be mounted directly to equipment surfaces.

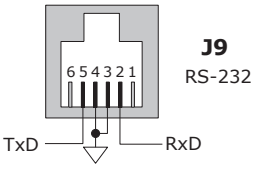


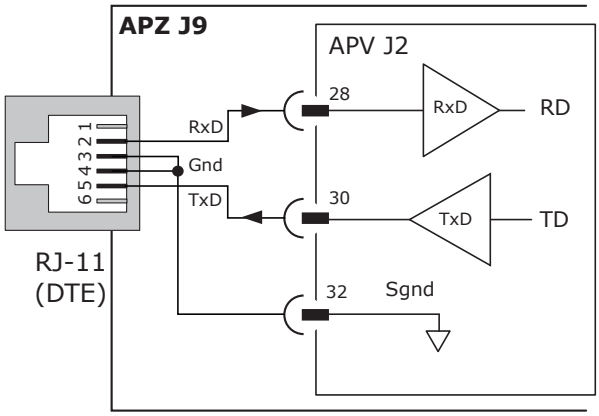


RS-232 CONNECTION

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™ software communicates with the drive over this link and is then used for complete drive setup. The CANopen Device ID that is set by the rotary switches can be monitored, and a Device ID programmed as well.

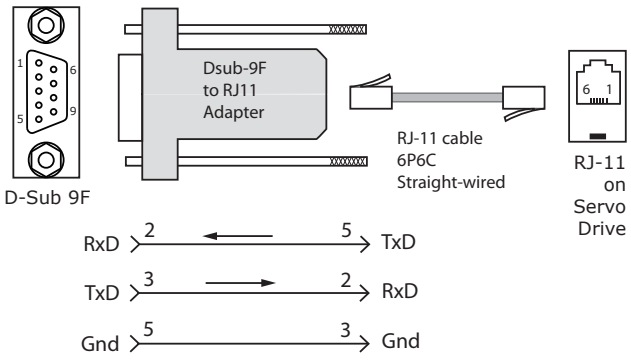
The RS-232 connector, J9, is a modular RJ-11 type that uses a 6-position plug, four wires of which are used for RS-232. A connector kit is available (SER-CK) that includes the modular cable, and an adaptor to interface this cable with a 9-pin RS-232 port on a computer.





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 EZ board. It includes an adapter that plugs into the COM1 (or other) port of a PC and uses a straight-through modular cable to connect to the APV. The connections are shown in the diagram below.



Don't forget to order a Serial Cable Kit SER-CK when placing your order for an APZ drive, or an EZ board.

EZ BOARD CANOPEN CONNECTIONS

Dual RJ-45 sockets accept standard Ethernet cables. The IN port connects to a master, or to the OUT port of a device that is 'upstream' between the APV and the master. The OUT port connects to 'downstream' nodes. If the APV is the last node on a network, only the IN port is used. No terminator is required on the OUT port.

CANOPEN LEDS

RUN

Green shows the CANopen State Machine:

Off	=	INIT state
Blinking	=	PRE-OPERATIONAL
Single Flash	=	SAFE-OPERATIONAL
On	=	OPERATIONAL

ERR

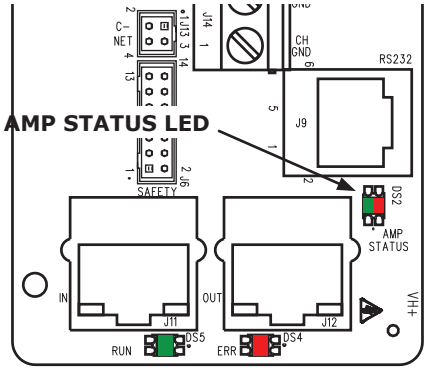
Red shows error conditions:

Blinking	=	Invalid configuration
Single Flash	=	Unsolicited state change
Double Flash	=	Application watchdog timeout

L/A (LINK/ACT)

Green indicates the state of the CANopen network:

LED	LINK	ACTIVITY		CONDITION
ON	**Yes**	**No**	**=**	**Port Open**
Flickering	**Yes**	**Yes**	**=**	**Port Open with activity**
Off	**No**	**(N/A)**	**=**	**Port Closed**



CANopen LEDs

AMP STATUS LED

A bi-color LED gives the state of the drive. Colors do not alternate, and can be solid ON or blinking.
If multiple conditions occur, only the top-most condition will be displayed. When that condition is cleared the next one below will shown.

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

LATCHING FAULTS

Default	Optional (programmable)
Short circuit (Internal or external)	Over-voltage
Drive over-temperature	Under-voltage
Motor over-temperature	Motor Phasing Error
Feedback Error	Command Input Lost
Following Error	Motor Wiring Disconnected
	Over Current (latched)

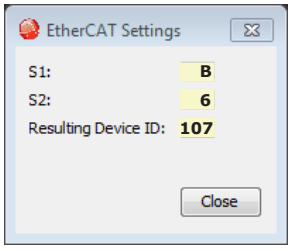
CANopen DEVICE ID

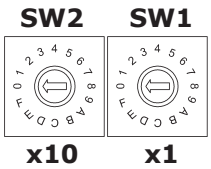
In an CANopen network, slaves are automatically assigned fixed addresses based on their position on the bus. When a device must have a positive identification that is independent of cabling, a Device ID is needed. In the EZ board this is provided by two 16-position rotary switches with hexadecimal encoding. These can set the Device ID of the drive from 0x01~0xFF (1~255 decimal). The chart shows the decimal values of the hex settings of each switch.

Example 1: Find the switch settings for decimal Device ID 107:

1) Find the highest number under SW2 that is less than 107 and set SW2 to the hex value in the same row: 96 < 107 and 112 > 107, so SW2 = 96 = Hex 6
2) Subtract 96 from the desired Device ID to get the decimal value of switch SW1 and set SW1 to the Hex value in the same row: SW1 = (107 - 96) = 11 = Hex B

CME -> Amplifier -> Network Configuration





CME -> Input/Output -> Digital Outputs

CANopen
Device ID Switch
Decimal values

	SW2	SW1
HEX	**DEC**	
0	**0**	**0**
1	**16**	**1**
2	**32**	**2**
3	**48**	**3**
4	**64**	**4**
5	**80**	**5**
6	**96**	**6**
7	**112**	**7**
8	**128**	**8**
9	**144**	**9**
A	**160**	**10**
B	**176**	**11**
C	**192**	**12**
D	**208**	**13**
E	**224**	**14**
F	**240**	**15**

EZ BOARD CANOPEN CONNECTORS

CANOPEN CONNECTORS

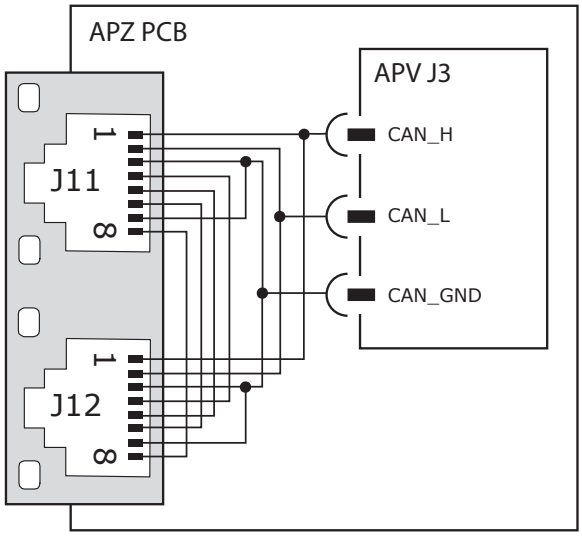
Dual RJ-45 connectors that accept standard Ethernet CAT-5 cables are provided for CANopen connectivity.

J11 CAN

Pin	Signal
1	CAN_H
2	CAN_L
3	CAN_GND
4	AUX 1
5	AUX 2
6	AUX 3
7	CAN_GND
8	AUX 4

J12 CAN

Pin	Signal
1	CAN_H
2	CAN_L
3	CAN_GND
4	AUX 1
5	AUX 2
6	AUX 3
7	CAN_GND
8	AUX 4

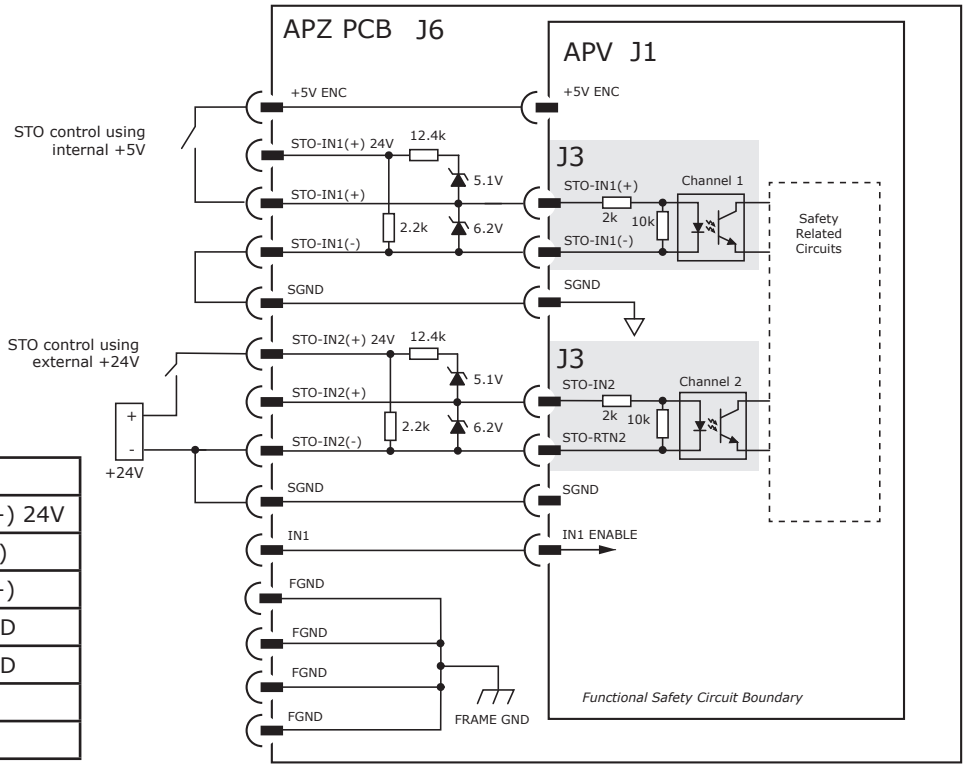


EZ BOARD SAFE TORQUE OFF (STO)

DESCRIPTION

This shows the use of the internal +5V or external 24V to energize the STO inputs.

Both STO inputs must be energized in order to enable the drive. IN1, the hardware Enable input is for use with an immediate contact relay to bring the motor to a stop before a delayed contact relay de-energizes the STO inputs and prevents torque production in the motor.



J6 STO

Signal	Pin		Signal
STO-IN2(+) 24V	1	2	STO-IN1(+) 24V
STO-IN2(-)	3	4	STO-IN1(-)
STO-IN2(+)	5	6	STO-IN1(+)
FRAME GND	7	8	FRAME GND
FRAME GND	9	10	FRAME GND
SGND	11	12	SGND
IN1	13	14	+5 VENC

EZ BOARD SPI PORT SWITCHES & LEDS

CANOPEN DEVICE ID (STATION ALIAS) SWITCH CONNECTIONS

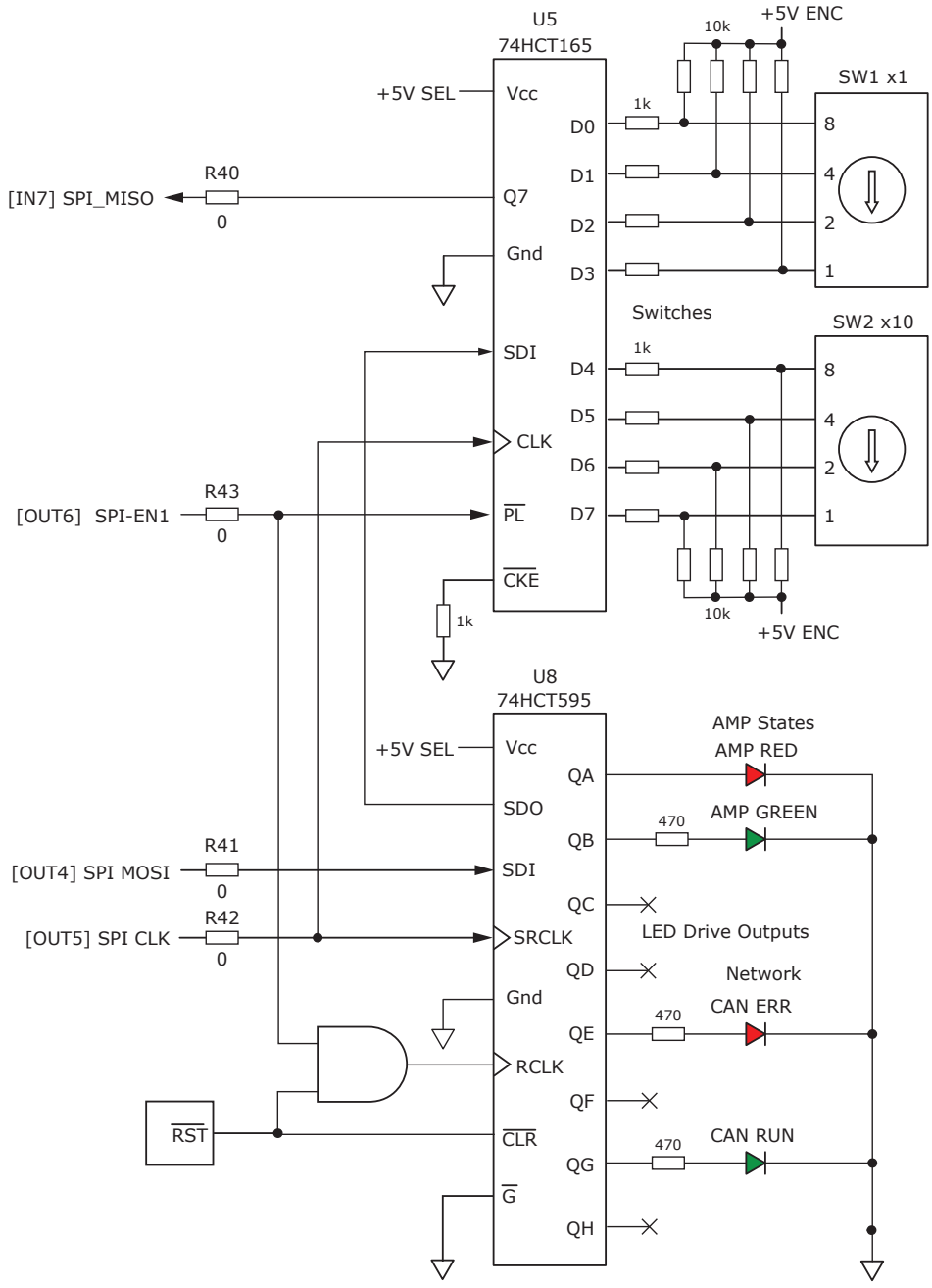
The graphic below shows the connections to the CANopen Device ID switches and status LEDs. The switches are read after the drive is reset, or powered-on. When changing the settings of the switches, be sure to either reset the drive, or to power it off-on. Outputs [OUT4,5,6,] and input [IN7] operate as an SPI port which reads the settings on the CANopen Device ID switches, and controls the Amp and CANopen status LEDs.

CME -> Input/Output -> Digital Outputs

NOTE:

R40, R41, R42, R43 may be removed by the user if IN7, OUT4, OUT5, OUT6 are needed for other functions.

This will disable the address switches and LEDS.

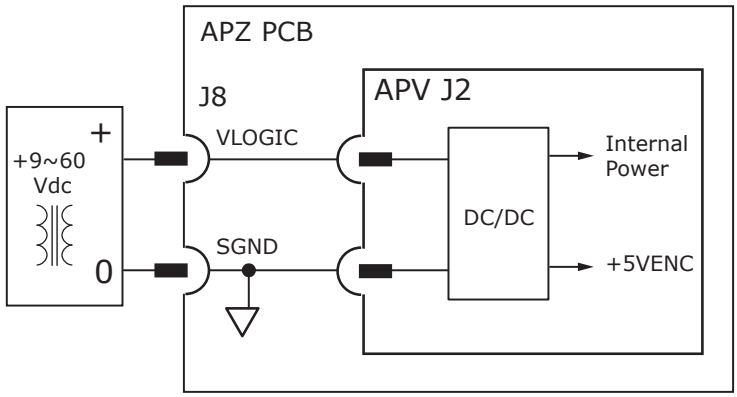


EZ BOARD VLOGIC

DESCRIPTION

Powers the internal logic and control circuits in the drive. When using the STO feature, it must be produced by power supplies with transformer isolation from the mains and PELV or SELV ratings and a maximum output voltage of 60 Vdc.

If the motor can operate from voltages of 60 Vdc or less, the +HV and VLOGIC can be driven from a single power supply.



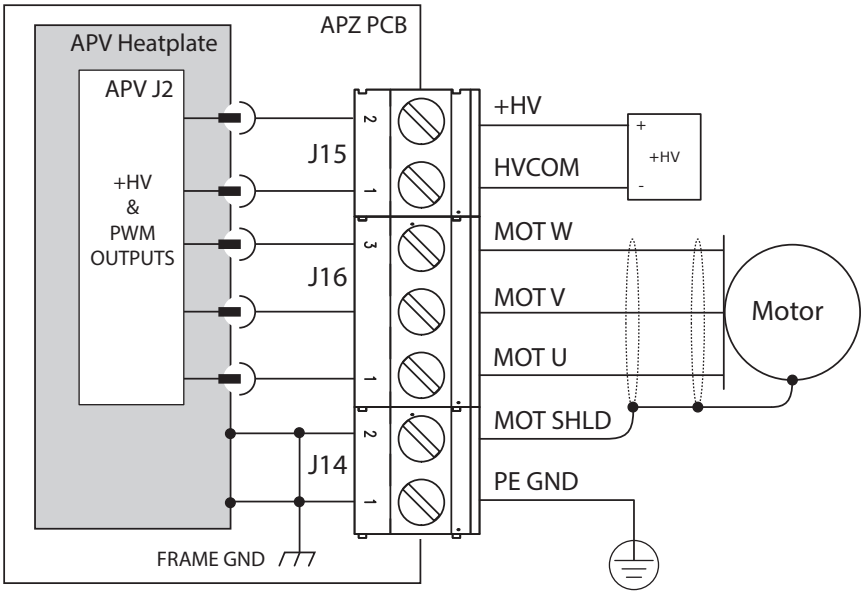
J8 VLOGIC

Pin	Signal
1	VLOGIC
2	SGND

EZ BOARD +HV & MOTOR CONNECTIONS

DESCRIPTION

J15 provides connection to the DC power supply.
J16 carries three conductors for brushless motors.
J14-1 provides a connection for a shielded cable connecting the motor housing to chassis ground.
The PE (Protective Earth) terminal provides a single connection to earth for bonding of the APV to an earth-ground point.

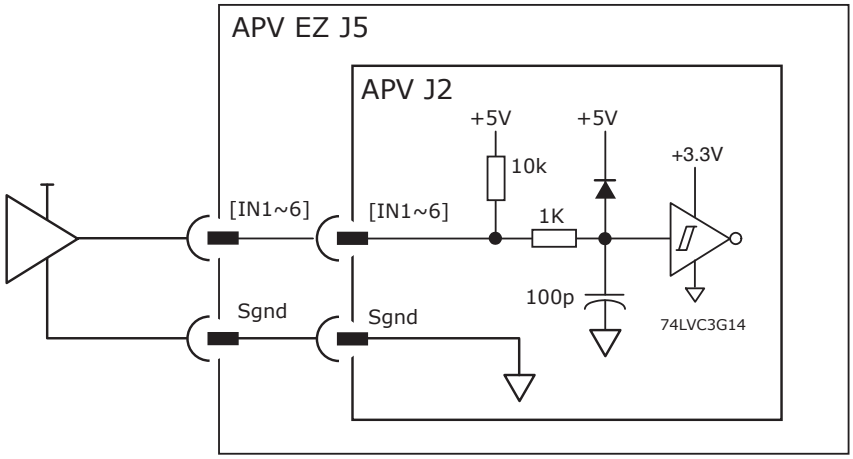


J#	Pins	Signal
J15	2	+HV
	1	HVCOM
J16	3	MOT W
	2	MOT V
	1	MOT U
J14	2	MOT SHLD
	1	PE GND

EZ BOARD CONNECTORS & SIGNALS

LOGIC INPUTS

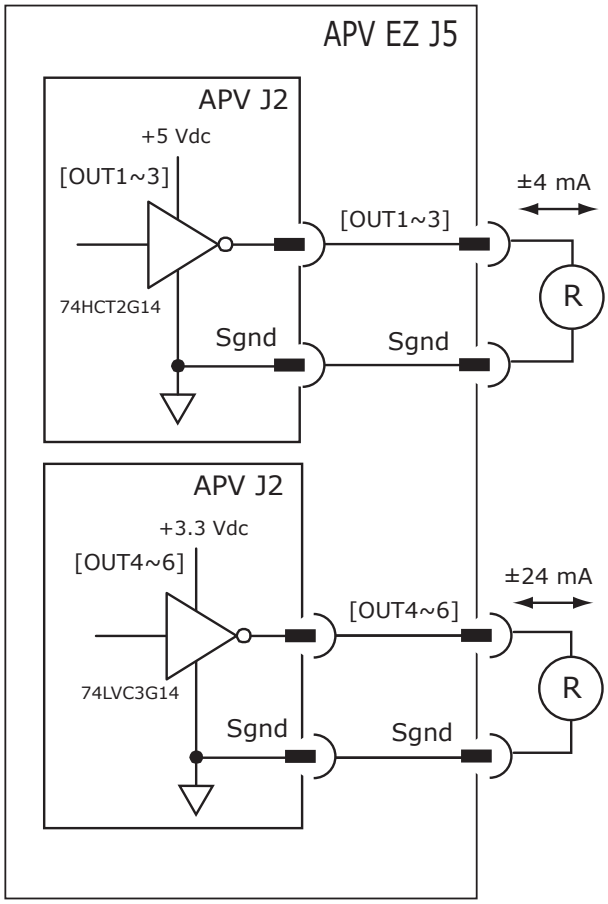
Signal	J5 Pins
IN1 Enable	4
IN2	3
IN3	6
IN4	5
IN5 Motemp	8
IN6 Encoder Fault	7
IN7 SPI MISO	10
SGND	5, 17, 18



LOGIC OUTPUTS

CONNECTIONS

Signal	J5 Pins
OUT1	12
OUT2	9
OUT3 Brake	14
OUT4 SPI-MOSI	11
OUT5 SPI-CLK	16
OUT6 SPI-EN1	13
SGND	5, 17, 18



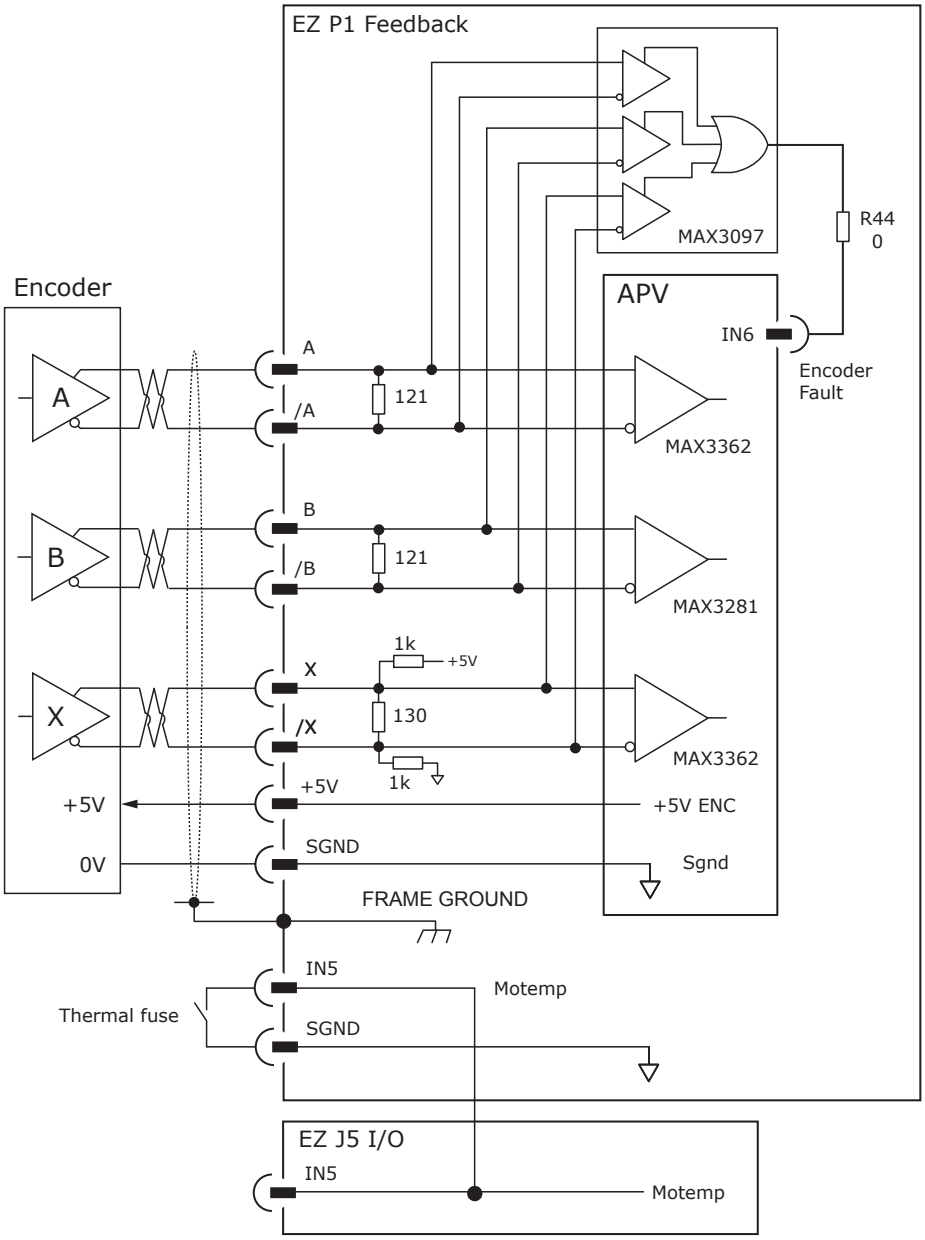
EZ BOARD PRIMARY FEEDBACK CONNECTOR P1

QUAD A/B ENCODER WITH FAULT PROTECTION

Encoders with differential line-driver outputs are required (single-ended encoders are not supported) and 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

FAULT DETECTION



P1 ENCODER 1 SIGNALS

Signal	Pins
Enc A	13
Enc /A	12
Enc B	11
Enc /B	10
Enc X	23
Enc /X	22
+5V	6
IN5	7
SGND	5,16, 25,26

SGND = Signal Ground

NOTE:

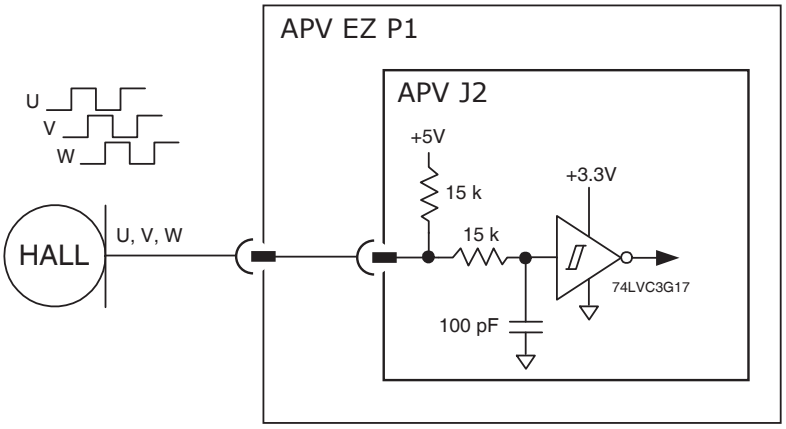
R44 connects IN6 to the encoder fault detection by default.
If this feature is not used, then removing R44 allows IN6 to be programmed for user's function.

J5 I/O SIGNALS

Signal	Pins
IN5	8
IN6	7
SGND	15, 17, 18

EZ BOARD PRIMARY FEEDBACK CONNECTOR P1

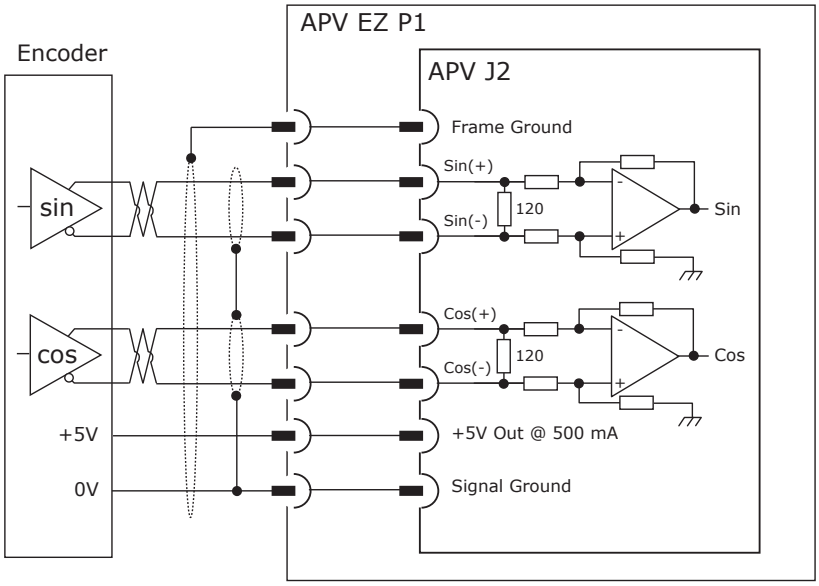
HALLS



HALL SIGNALS

Signal	Pins
Hall U	2
Hall V	3
Hall W	4

SIN/COS ENCODERS



SIN/COS SIGNALS

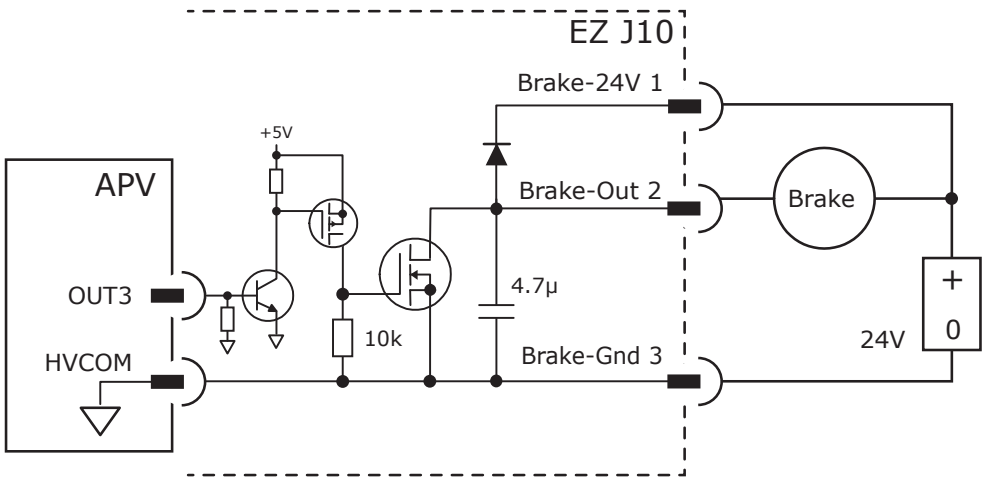
Signal	Pins
Sin(+)	19
Sin(-)	18
Cos(+)	21
Cos(-)	20

P1 Signal Ground Pins
5, 16,25,26

EZ BOARD BRAKE CONNECTOR & SIGNALS

The brake circuit on the EZ board is a MOSFET driven by OUT3 of the APV.

- Brake output [OUT3]
- 24V Compatible
- Programmable functions



SPECIFICATIONS

Output	Data	Notes
Voltage Range	Max	+30 Vdc
Output Current	Ids	1.0 Adc

HI/LO DEFINITIONS: OUTPUTS

Input	State	Condition
BRAKE [OUT3]	LO	Output MOSFET Q3 is OFF Brake is un-powered and locks motor Motor cannot move Brake state is Active
	HI	Output MOSFET Q3 is ON Brake is powered, releasing motor Motor is free to move Brake state is NOT-Active

CME Default Setting for Brake Output [OUT3] is "Brake - Active Low"
Active = Brake is holding motor shaft (i.e. the *Brake is Active*)
Motor cannot move
No current flows in coil of brake
CME I/O Line States shows [OUT3] as LO
BRK Output voltage is HI (24V), MOSFET Q3 is OFF
Servo drive output current is zero
Servo drive is disabled, PWM outputs are off
Inactive = Brake is not holding motor shaft (i.e. the *Brake is Inactive*)
Motor can move
Current flows in coil of brake
CME I/O Line States shows [OUT3] as HI
BRK output voltage is LO (~0V), MOSFET Q3 is ON
Servo drive is enabled, PWM outputs are on
Servo drive output current is flowing

The EZ brake circuit is referenced to HVCOM in the APV.

J10 BRAKE SIGNALS

Pin	Signal
1	**Brake-24V**
2	**Brake-Out**
3	**Brake-Gnd**

EZ BOARD CONNECTORS

P1 ENCODER 1

Pin	Signal
26	SGND
25	SGND
24	N.C.
23	Enc1 X
22	Enc1 /X
21	Cos(+)
20	Cos(-)
19	Sin(+)

Pin	Signal
18	Sin(-)
17	+5V ENC
16	SGND
15	Enc1 A
14	Enc1 /A
13	Enc1 A
12	Enc1 /A
11	Enc1 B
10	Enc1 /B

Pin	Signal
9	Enc1 X
8	Enc1 /X
7	[IN5] Motemp
6	+5V ENC
5	SGND
4	Hall W
3	Hall V
2	Hall U
1	FRAME GND

J5 I/O

Signal	Pin		Signal
Aref(-)	2	1	Aref(+)
Enable IN1	4	3	IN2
IN3	6	5	IN4
Motemp IN5	8	7	IN6 Enc-Fault **
* SPI-MISO IN7	10	9	OUT2
OUT1	12	11	OUT4 SPI-MOSI *
* Brake OUT3	14	13	OUT6 SPI-EN1 *
* SPI-CLK OUT5	16	15	SGND
SGND	18	17	SGND

J10 BRAKE

Pin	Signal
3	HVCOM
2	Brake output
1	+24V Input

J4 ENCODER 2

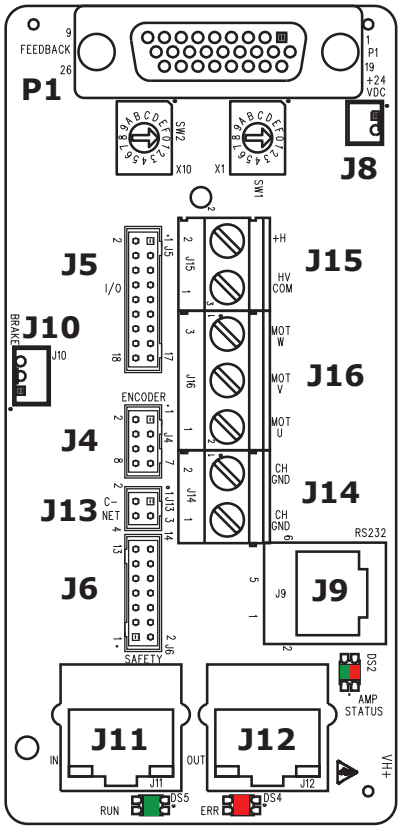
Signal	Pin		Signal
Enc2 A	2	1	Enc2 /A
Enc2 B	4	3	Enc2 /B
Enc2 X	6	5	Enc2 /X
SGND	8	7	+5V ENC

J13

Signal	Pin		Signal
***	2	1	***
***	4	3	***

J6 STO

Signal	Pin		Signal
IN1	13	14	+5V ENC
SGND	11	12	SGND
FRAME GND	9	10	FRAME GND
FRAME GND	7	8	FRAME GND
STO-IN2(+)	5	6	STO-IN1(+)
STO-IN2(-)	3	4	STO-IN1(-)
STO-IN2(+) 24V	1	2	STO-IN1(+) 24V



* These signals are wired for the functions shown. They can be programmed for other functions but the default functions will no longer function.

** This input can be programmed for other functions by removing the resistor R44 that connects the input to the encoder 1 fault-detection circuit.

*** No connections

J8 V-LOGIC

Pin	Signal
1	+9~60 Vdc
2	SGND

J15 DC-POWER

Pin	Signal
2	+HV
1	HV COM

J16 MOTOR

Pin	Signal
3	Mot W
2	Mot V
1	Mot U

J14 GROUNDS

Pin	Signal
2	Mot Shield
1	FRAME GND

J9 RS-232

Pin	Signal
1	N.C.
2	RxD
3	SGND
4	SGND
5	TxD
6	N.C.

J11 CAN

Pin	Signal
1	CAN_H
2	CAN_L
3	CAN_GND
4	AUX 1
5	AUX 2
6	AUX 3
7	CAN_GND
8	AUX 4

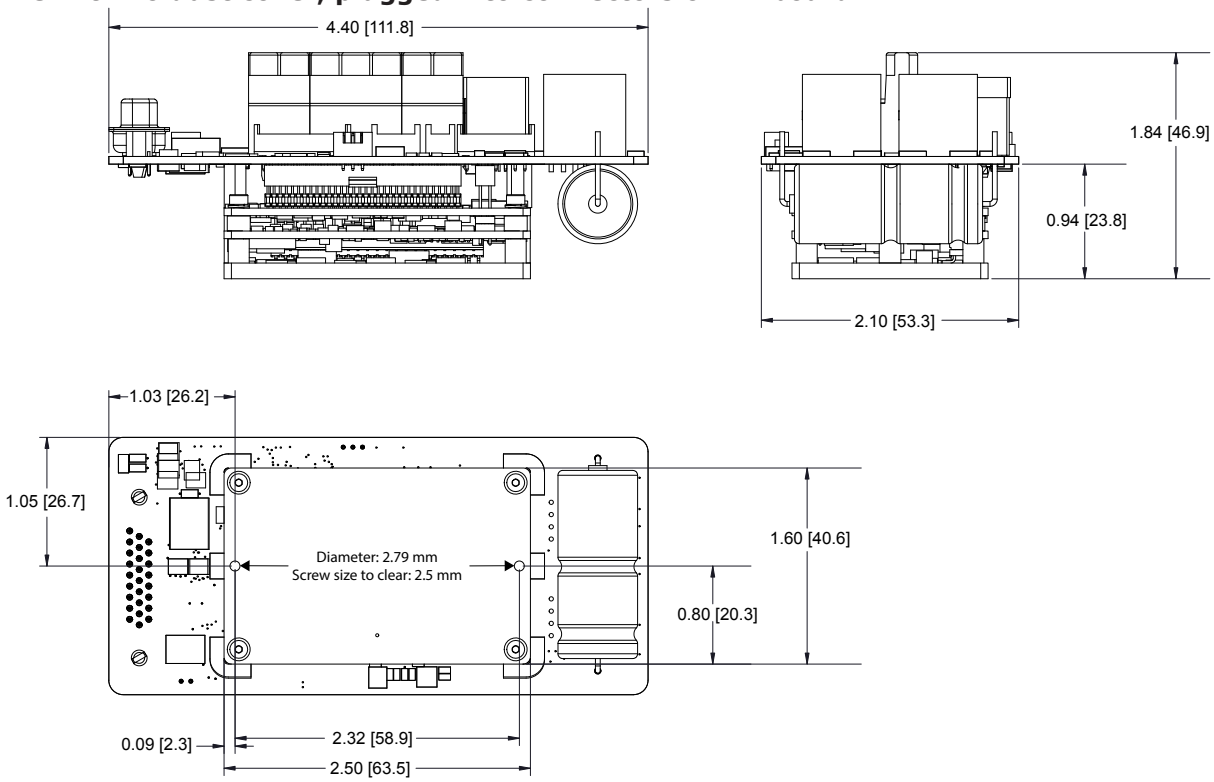
J12 CAN

Pin	Signal
1	CAN_H
2	CAN_L
3	CAN_GND
4	AUX 1
5	AUX 2
6	AUX 3
7	CAN_GND
8	AUX 4

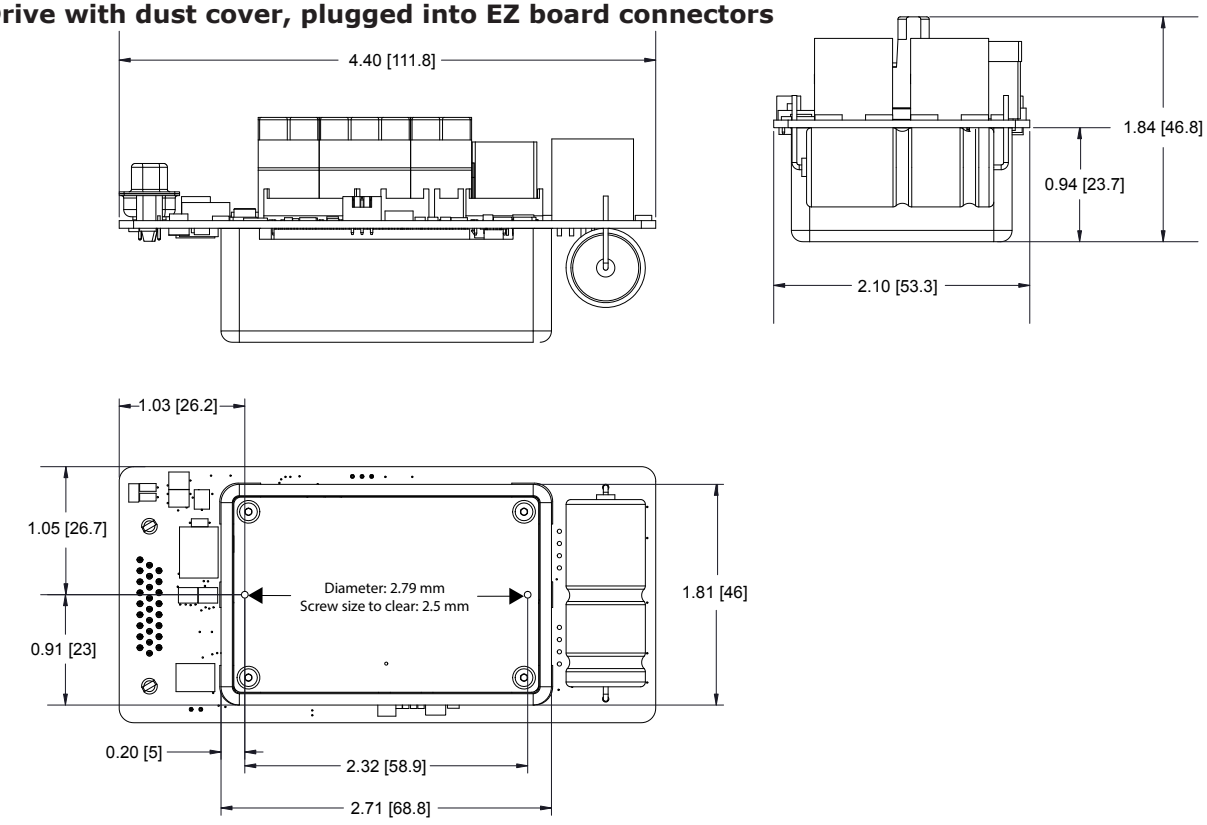
AUX signals have no connections to APV circuits. They connect pins with the same names on J11 and J12.

EZ BOARD DIMENSIONS

APV Drive with no dust cover, plugged into connectors on EZ board

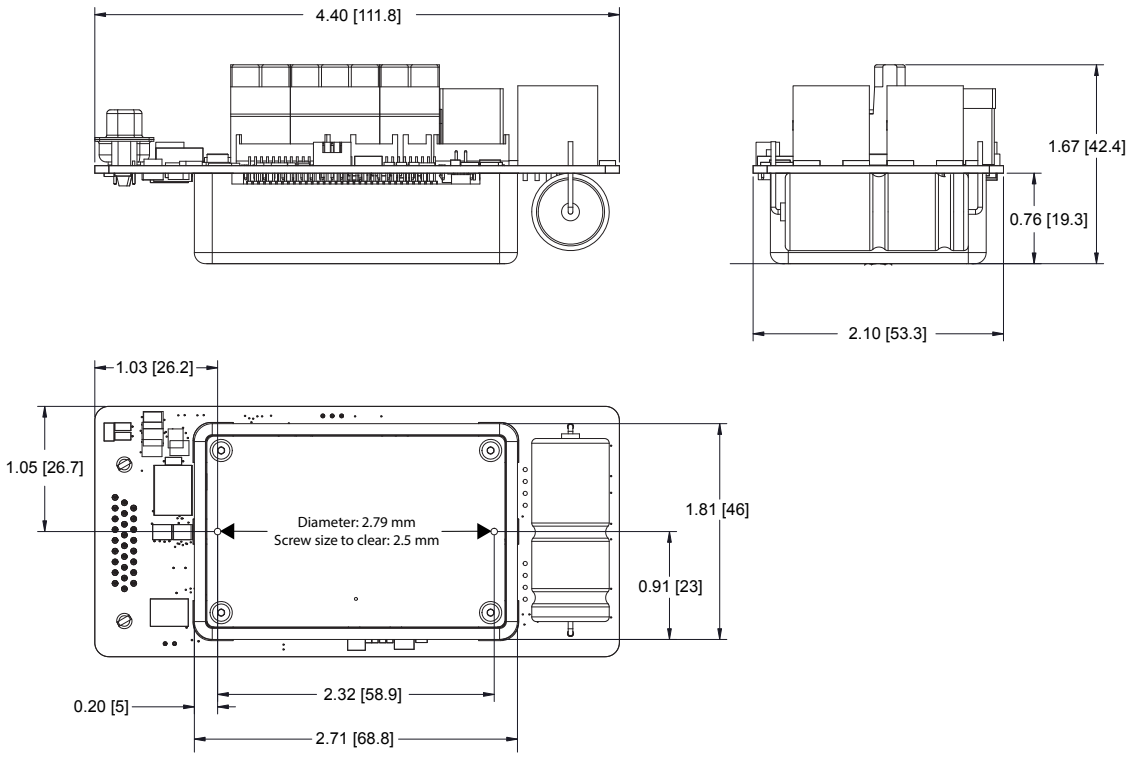


APV Drive with dust cover, plugged into EZ board connectors



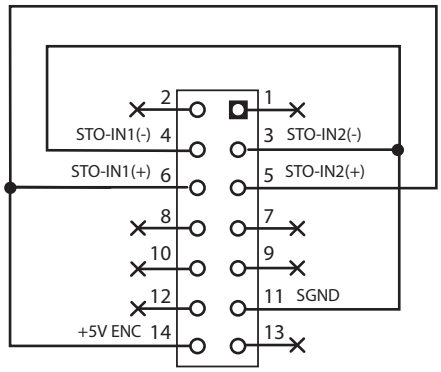
EZ BOARD DIMENSIONS

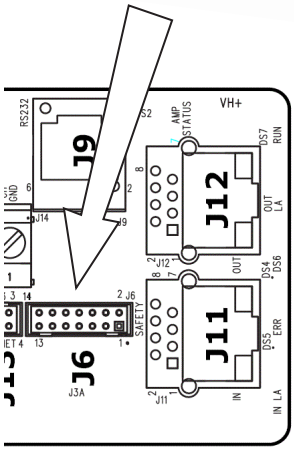
APZ Drive with dust cover, soldered into EZ board



AEV-EZ-STO SAFE TORQUE OFF DISABLING ACCESSORY

The AEV-EZ-STO, when inserted into J6 will disable the STO function, allowing normal operation of the AEV drive when the STO function is not required. As shown below, the STO inputs are energized in parallel using the encoder +5V from the drive



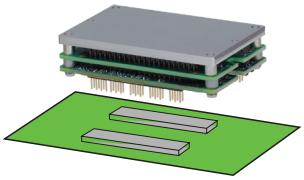


ORDERING CONFIGURATIONS

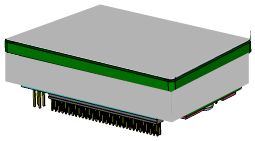
CONFIGURATION #1: MOUNTING TO USER PC BOARD WITH SOCKETS OR SOLDERING

Models
APV-090-14
APV-090-30 *
APV-090-50 *
APV-180-10
APV-180-20
Options
APV-HK
APV-DCP

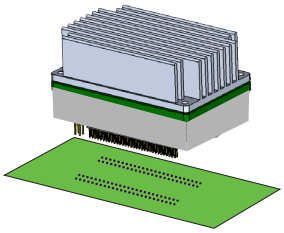
APV



APV
APV-DCP



APV + APV-HK
APV-DCP



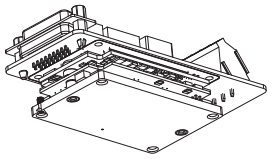
ORDER: APV Drive model
OPTIONAL: APV-HK Heatsink kit
OPTIONAL: APV-DCP Dust Cover if socketing to PC board

*** NOTE: Soldering to user PC board is required if continuous output current is > 15 Adc (10.6 Arms)**

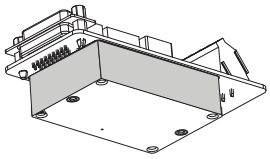
CONFIGURATION #2: USING PLUGGABLE EZ BOARD KIT

Models	EZ Kit
APV-090-14	APV-EZ-090
APV-090-30 *	
APV-090-50 *	
APV-180-10	APV-EZ-180
APV-180-20	
Options	
APV-EZ-CK	EZ Board Connector Kit
APV-DCP	Dust Cover for socketing

APV +
APV-EZ-090 or APV-EZ-180



APV + APV-DCP +
APV-EZ-090 or APV-EZ-180



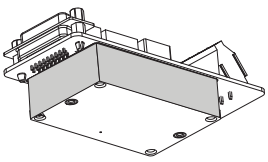
ORDER: APV Drive model
EZ Kit model
OPTIONAL: APV-DCP Dust Cover for socketing to EZ board
OPTIONAL: APZ-CK Connector Kit

* Note: Continuous output current must be ≤ 15 Adc (10.6 Arms) with this option

CONFIGURATION #3: EZ BOARD SOLDERED TO APV AS SINGLE ASSEMBLY: APZ-090-50

Models	EZ Kit
APZ-090-50	(Included)
Options	
APZ-CK	EZ Board Connector Kit

APZ-090-50



ORDER: APZ-090-50
OPTIONAL: APZ-CK Connector Kit

ORDERING GUIDE

MICRO MODULES

APV-090-14	*Accelnet Plus Micro Module* APV servo drive, 7/14 A, 90 Vdc
APV-090-30	*Accelnet Plus Micro Module* APV servo drive, 15/30 A, 90 Vdc
APV-090-50*	*Accelnet Plus Micro Module* APV servo drive, 25/50 A, 90 Vdc
APZ-090-50**	*Accelnet Plus Micro Module* APV servo drive + EZ board, dust cover, 25/50 A, 90 Vdc
APV-180-10	*Accelnet Plus Micro Module* APV servo drive, 5/10 A, 180 Vdc
APV-180-20	*Accelnet Plus Micro Module* APV servo drive, 10/20 A, 180 Vdc
* Continuous current > 15 A (10.6 Arms) requires soldering of motor and DC power pins to user PC board. Signal connectors may be socketed	
** APV with dust cover, soldered to EZ board as a single assembly	

ACCESSORIES FOR MICRO MODULES

APV-HK	Heatsink kit (Heatsink, thermal pad, and hardware), not required when drive heatplate is mounted to equipment frame.
APZ-DCP	Dust Cover kit (Dust cover & hardware for APV models plugged into user PC boards or EZ board)
APV-EZ-090	EZ Board (Pluggable for 90V APV modules, includes APZ-DCP)
APV-EZ-180	EZ Board (Pluggable for 180V APV modules, includes APZ-DCP)
APV-EZ-CK	EZ Board Connector Kit (see below)
SER-CK	Serial Cable Kit: 9-Pin Dsub receptacle to 6-pin modular adapter, plus modular cable for EZ board

ORDERING GUIDE: EZ BOARD CONNECTOR KIT WITH SHELLS & CRIMP CONTACTS

CONNECTOR KITS FOR EZ BOARD

	QTY	REF	Name	DESCRIPTION	MFGR/PART NUMBER
APV-EZ-CK Connector Kit	1	J4	Encoder 2	Connector, socket, double row, 2.00 mm, 8 pos	Hirose: DF11-8DS-2C
	1	J5	I/O	Connector, socket, double row, 2.00 mm, 18 pos	Hirose: DF11-18DS-2C
	1	J6	STO	Connector, socket, double row, 2.00 mm, 14 pos	Hirose: DF11-14DS-2C
	1	J8	VLOGIC	Connector, socket, single row, 2.00 mm, 2 pos	Hirose: DF3-2S-2C
	1	J10	Brake	Connector, socket, single row, 2.00 mm, 3 pos	Hirose: DF3-3S-2C
	40	J4,J5,J6	Crimp socket, 24~28 AWG, gold		Hirose: DF11-2428SCFA
	5	J8,J10	Crimp socket, 24~28 AWG, gold		Hirose: DF3-2428SCFC
	16	J4,J5,J6	White Flying Lead with pins at both ends, 26 AWG, gold, 12"		Hirose: H3BBG-10112-W6
	1		Red Flying Lead with pins at both ends, 26 AWG, gold, 12"		Hirose: H3BBG-10112-R6
	3		Black Flying Lead with pins at both ends, 26 AWG, gold, 12"		Hirose: H3BBG-10112-B6
	1	J8,J10	Blue Flying Lead with pins at both ends, 26 AWG, gold, 12"		Hirose: H2BBG-10112-L6
	1		Red Flying Lead with pins at both ends, 26 AWG, gold, 12"		Hirose: H2BBG-10112-R6
	1		Black Flying Lead with pins at both ends, 26 AWG, gold, 12"		Hirose: H2BBG-10112-B6
	1	P1	Encoder 1	Connector, high-density DB-26M, 26 pos, male, solder cup	Norcomp: 180-026-103L001
	1			Metal Backshell, DB-15, RoHS	3M: 3357-9215
	1	J6	APV-EZ-STO EZ board plug-in to J6 for disabling STO function		

Note: Specifications subject to change without notice