AccelnetPlus Micro Module CANopen Ruggedized R43

DIGITAL SERVO DRIVE FOR BRUSH & BRUSHLESS MOTORS

Control Modes
- Cyclic Synchronous Position-Velocity-Torque (CSP, CSV, CST)
- Cyclic Synchronous Torque with Commutation Angle (CSTCA)
- Profile Position-Velocity-Torque, Interpolated Position (PT, PVT), Homing
- Indexer, Point-to-Point, CPL
- Camming, Gearing

Command Interface
- CANopen®, SAE J1939™
- ASCII, Serial Binary, and Discrete I/O
- Stepper or Quad A/B Position Commands
- PWM Position/Velocity/Torque Command
- Master Encoder (Gearing/Camming)
- ±10 V Position-Velocity-Torque

Communications
- CAN
- RS-232

Feedback
- Dual Absolute Encoder Ports
  BiSS, SSI, CSR Resolver
  EnDat 2.1, 2.2
  Absolute A
  Tamagawa™, Panasonic™, Sanyo Denki™
- Incremental
  Digital Quad A/B/X Encoder
  Analog Sin/Cos Encoder
  Digital Halls

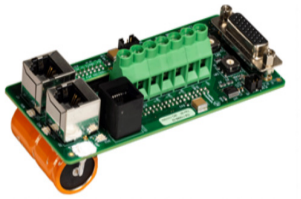
I/O
- 1 Analog Input ±10V, 16-bit
- 7 High-speed Digital Inputs
- 6 High-speed Digital Outputs
- 1 Differential Analog Input

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

Dimensions: in [mm]
- R43: 2.5 x 1.6 x .69 [64 x 41 x 17.6]
- R43-EZ: 4.4 x 2.1 x 1.85 [112 x 53.3 x 47]

R43

Model	Ic	Ip	Vdc
R43-090-14	7	14	9~90
R43-090-30	15	30	9~90
R43-090-50	25	50	9~90
R43-090-50-C	50	50	9~90
R43-180-10	5	10	20~180
R43-180-20	10	20	20~180



R43 EZ-Board

Model	Ic	Ip	Vdc
R43-EZ-090	15	30	9~90
R43-EZ-180	10	20	20~180

Note: The R43-EZ boards are not compatible with the R43-090-50 or R43-090-50-C solder only models.

DESCRIPTION:

The R43 Servo Drive is a ruggedized version of the commercial APV Servo Drive. CANopen application protocol over EtherCAT (CoE) communication provides a widely used cost-effective industrial bus. A wide range of absolute encoders are supported. It delivers performance you can trust in the harshest environments. The R43 is designed to endure temperature extremes, high humidity, vibration and shock.

Copley's proven drive technology is ideal for use in applications in COTS military, nautical, aviation, oil refining and vehicle-based systems. In addition, the R43-EZ ruggedized mounting board is available for the same harsh environments. It has a protective, conformal coating with sockets good to 15A continuous, 30A peak.

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 70ºC
	Operating	95% non-condensing at 70ºC
Vibration	Operating	5 Hz to 500 Hz, up to 3.85 *g*rms
Altitude	Non-Operating	-400 m to 12,200 m
	Operating	-400 m to 5,000 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

*For additional or higher environmental standards, please consult the Factory.

GENERAL SPECIFICATIONS

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

MODEL	R43-090-14	R43-090-30	R43-090-50	R43-090-50-C	R43-180-10	R43-180-20	Units
OUTPUT POWER							
Peak Current	14 (9.9)	30 (21.2)	*50 (35.4) **32(22.6)@70C	*50 (35.4) **32(22.6)@70C	10 (7.1)	20 (14.2)	Adc (Arms)
Peak Time	1	1	1	n/a	1	1	Sec
Continuous Current	7 (5.0)	15 (10.6)	*25 (17.7) **16(11.3)@70C	*50 (35.4) **32(22.6)@70C	5 (3.5)	10 (7.1)	Adc (Arms)
Peak Output Power	1.26	2.7	4.5	4.5	1.8	3.6	kW
Continuous Output Power	0.63	1.35	2.25	4.5	0.9	1.8	kW
			Notes: * R43-090-50 & R43-090-50-C must be soldered to a mounting board for these ratings. ** R43-090-50 & R43-090-50-C peak and continuous currents are @70 ºC ambient.				
INPUT POWER							
HVmin to HVmax	+9 ~ 90	+9 ~ 90	+9 ~ 90	+9 ~ 90	+20 ~ 180	+20 ~ 180	Vdc
Ipeak	14	30	50	50	10	20	Adc
Icont	7	15	25	50	5	10	Adc
Vlogic	+9 ~ 60	+9 ~ 60	+9 ~ 60	+9 ~ 60	+9 ~ 60	+9 ~ 60	Vdc
Vlogic Power	Vlogic @ 9 Vdc 3.4 W, @ 24 Vdc 3.5 W, @ 60 Vdc 4.2 W with 2 encoders @ +5 V, 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:	Cyclic Synchronous Position/Velocity/Torque Profile Position/Velocity/Torque, Interpolated Position (PVT), Homing Cyclic Synchronous Torque with Commutation Angle (CSTCA)						
Stand-alone Mode							
Digital Position Reference	Pulse/Direction, CW/CCW Quad A/B Encoder		Stepper commands (4 MHz maximum rate) 2 M line/sec, 8 Mcount/sec (after quadrature)				
Digital Torque & Velocity Reference	PWM, Polarity PWM 50% PWM frequency range PWM minimum pulse width		PWM = 0% - 100%, Polarity = 1/0 PWM = 50% ±50%, no polarity signal required. 1 kHz minimum, 100 kHz maximum 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, 9600~230,400 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, max. 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 HCT inverters, functions programmable, +5 Vcc Source -8 mA @ VOH = 2.4 Vdc, Sink 6 mA @ VOL = 0.5 Vdc						
OUT4~6	CMOS LVC inverters, functions programmable, for SLI 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						

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 enabled.
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 e
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 6) 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 is > +8.5 Vdc ±0.5 Vdc (90 V models).
	+HV < +19.5 ±0.5 Vdc	Drive outputs turn Off until +HV is > +19.5 Vdc ±0.5 Vdc (180 V models).
Drive Over Temperature	PC Board > 90 °C +3/-0 ºC	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	R43: 2.5 x 1.6 x 0.69 in [64 x 41 x 17.6 mm] R43-xxx-xx w/EZ: 4.4 x 2.1 x 1.85 in [112 x 53.3 x 47 mm]
Weight	R43:≤ 0.16 lb (0.073 kg), add 0.106 lb (0.048 kg) for pins heatsink, +0.304 lb (0.138 kg) for tall pins heatsink R43-xxx-xx w/EZ: 0.40 lb (0.18 kg)
Ambient Temperature	Operating:-40°C to 70°C, Non-Operating:-50°C to 85°C
Thermal Shock	Operating:-40°C to 70°C in 1 minute
Relative Humidity	Operating:95% non-condensing at 70°C, Non-Operating:95% non-condensing at 70°C
Altitude	Operating:-400 m to 5,000 m*, Non-Operating:-400 m to 12,200 m
Vibration	Operating:5 Hz to 500 Hz, up to 3.85 *g*rms
Shock	Crash Safety:75 *g* peak acceleration, Operating:40 *g* peak acceleration
Contaminants	Pollution Degree 2
Cooling	Forced air cooling required for continuous power output.
	*Altitude Note: For additional or higher environmental standards, please consult the Factory.

AGENCY STANDARDS CONFORMANCE

Standards and Directives

Functional Safety

IEC 61508-1, IEC 61508-2, IEC 61508-3, (SIL 3)
Directive 2006/42/EC (Machinery)
ISO 13849-1 (Cat 3, PL e)
IEC 61800-5-2 (SIL3)

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

Approvals

UL recognized component to:

UL 61800-5-1, UL 61800-5-2 (E168959-20200424A)
IEC 61800-5-1, IEC 61800-5-2

FUNCTIONAL SAFETY

ISO 13849-1
Up to PL e (Cat 3)
IEC 61800-5-2
Up to SIL 3

RoHS Directive 2011/65/EU is now part of the CE marking procedure.

DANGER

Refer to the Accelnet Plus Micro Modules AEV & APV User Guide, Part Number 16-01687.

The information provided in the *Accelnet Plus Micro Modules AEV & APV User Guide* (PN:*16-01687)* must be considered for any application using the R43 drive STO feature.

Failure to heed this warning can cause equipment damage, injury, or death.

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 the 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	Serial Clock (X, /X), and Data (A, /A) signals
Absolute A Format	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 the 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 V_T+ = 2.5~3.5 Vdc, V_T- = 1.3~2.2 Vdc, V_H = 0.7~1.5 Vdc
Analog	U & V: Sin/Cos format (Sin+, Sin-, Cos+, Cos-), differential, 1 Vpeak-peak ±20% 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 above Digital Incremental Encoder 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., 20 mega count/sec
5V OUTPUT	
Number	1
Ratings	+5 Vdc @ 500 mA thermal and overload protected.

Note: Inputs and outputs may have more than one function. The Data tables include a Signals column that has the signal names used in the Reference Kits. Other columns show the signal names that are used in the datasheets.

CANOPEN COMMUNICATIONS

CANOPEN

Based on the CAN V2.0b physical layer, a robust, two-wire communication bus which was 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

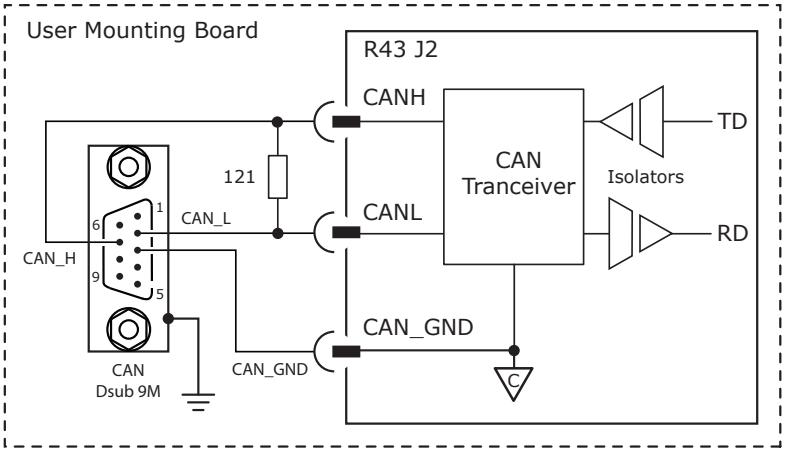
R43 uses the CAN physical layer signals CANH, CANL, and CAN_GND for connection, and CANopen protocol for communication.
Before installing the drive in a CAN system, it must be assigned a CAN Node-ID (address).

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 R43 and a Dsub 9M connector on a CAN card. If the R43 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. If there are multiple R43 on the mounting PCB, then the terminating resistor should be near the R43 that is farthest from the CAN network connection to the PCB. The node Node-ID of the R43 may be set by using digital inputs, or programmed into flash memory in the drive.

Signal	J2 Pins
CANH	29
CANL	27
CAN_GND	25,26

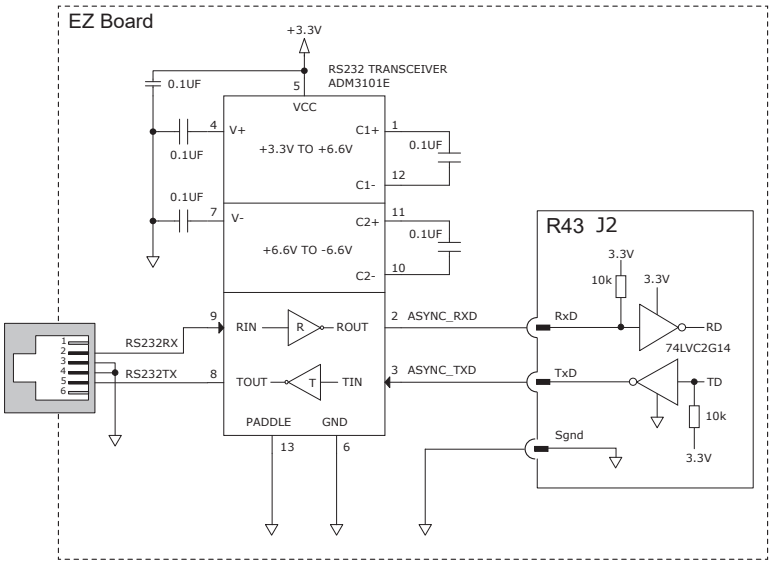


RS-232 COMMUNICATIONS

RS-232 PORT

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 software for drive configuration and setup or it can be used by the external equipment sending ASCII commands.

In the diagram, the circuit shown is used on the EZ board and it is recommended for the user's PC boards. It converts the single-ended TTL signals levels in the R43 into the ANSI RS-232 levels which are the standard for serial communications and computer COMM ports.



RS-232	Signal	J2 Pins
RxD	ASYNC_RXD	28
TxD	ASYNC_TXD	30
SGND	SGND	32

WARNING

Refer to Accelnet Plus Micro Module AEV/APV Reference Designs & Drawings.

Do not use 5V RS232 logic with module 3.3V logic. Use ANSI RS232 Transceiver logic.

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 (for example, the 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 Accelnet Plus Micro Modules AEV & APV User Guide, Part Number 16-01687.

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Failure to heed this warning can cause equipment damage, injury, or death.

STO DISABLE

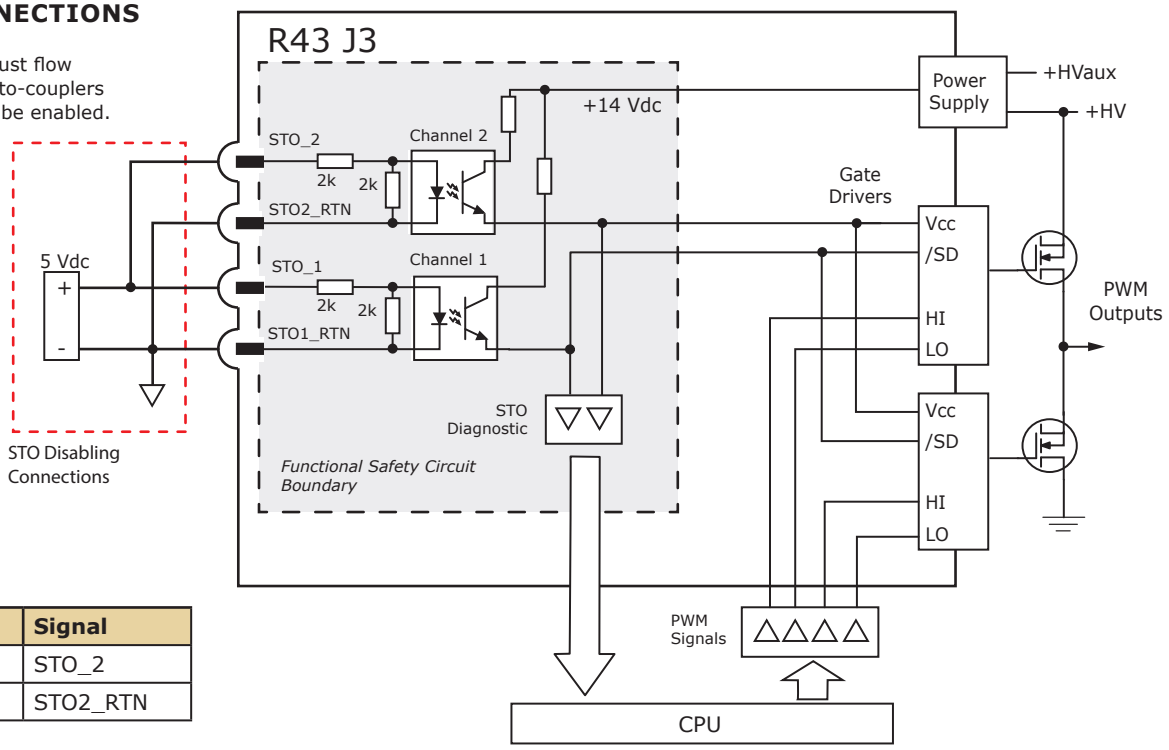
In order for the PWM outputs of the R43 to be activated, the current must be flowing through the opto-couplers that are connected to the STO_1 and STO_2 terminals and the drive must be in an ENABLED state. When either of the opto-couplers are Off, the drive is in a Safe Torque Off (STO) state and the PWM outputs cannot be activated by the control core to drive a motor.

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

STO DISABLE CONNECTIONS

Note: The current must flow through all of the opto-couplers before the drive can be enabled.

FUNCTIONAL DIAGRAM



J3 STO

Signal	Pin		Signal
STO_1	1	3	STO_2
STO1_RTN	2	4	STO2_RTN

STO OPERATION

STO Input Voltage	STO State
STO_1 *AND* STO_2 ≥ 3.3 Vdc	STO Inactive. Drive can be enabled to produce torque.
STO_1 *OR* STO_2 ≤ 2.0 Vdc	STO Active. Drive cannot be enabled to produce torque.
STO_1 *OR* STO_2 Open	

Note: Voltages in the above table are referenced between an STO_X and an STOX_RTN.
For Example, V(STO_1) = V(STO_1) - V(STO1_RTN)

STO STATUS

A digital output can be programmed to be active when the drive is disabled by the STO function. The active level of the output is programmable to be HI or LO.
Note: STO Status is not part of the STO Safety Function.

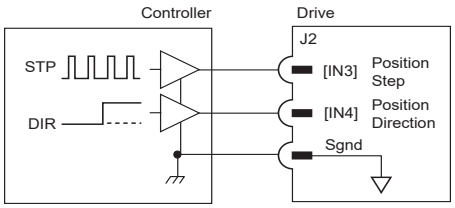
DIGITAL COMMAND INPUTS: POSITION

STAND-ALONE MODE DIGITAL POSITION-CONTROL INPUTS

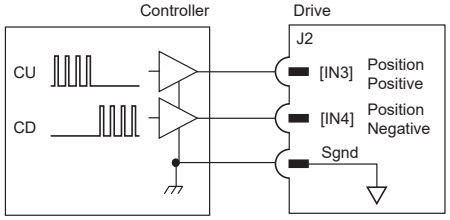
R43 works with motion controllers that output pulses to command position.
The following formats are supported:

- Step/Direction
  In Step/Direction mode, a pulse-train controls motor position, and the direction is controlled by a DC level at the Direction input.
- Count-Up/Count-Down (CU/CD)
  CU/CD (Count-Up/Count-Down) signals command the motor to move CW or CCW depending on to which input the pulse-train is directed.
- A/B Quadrature Encoder
  In the A/B Quadrature Encoder mode, the motor can 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.

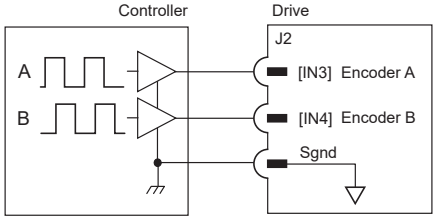
STEP/DIRECTION INPUTS



COUNT-UP/COUNT-DOWN INPUTS



QUAD A/B ENCODER INPUTS



Command Options	Signal	J2 Pins
Step, Position Positive, Encoder A	IN3	7
Direction, Positioni Negative, Encoder B	IN4	8

J2 Signal Pins
3,4,18,19,20,21,22,23,24, 31,32,33,34,42,49,50,59,60

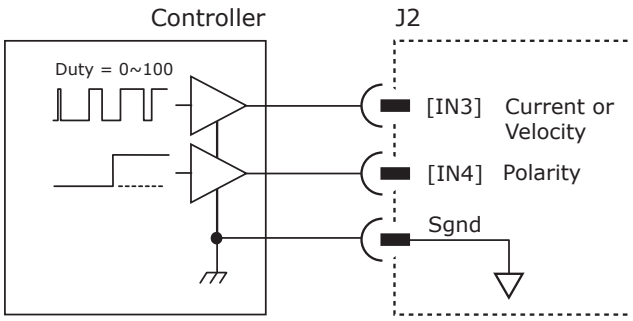
DIGITAL COMMAND INPUTS: VELOCITY, TORQUE

STAND-ALONE MODE DIGITAL VELOCITY/TORQUE CONTROL INPUTS

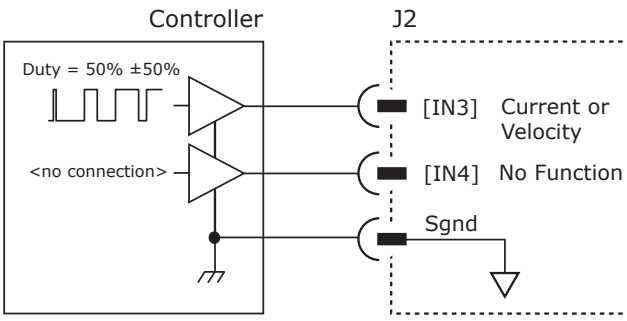
R43 works with motion controllers that output pulses to command velocity and torque (current).
The following formats are supported:

- PWM/Direction
  In PWM/Direction mode, a pulse-train with variable duty-cycle controls motor Velocity/Torque, and the polarity or direction is controlled by HI/LO levels at the Direction input.
- 50 % PWM
  With 50% PWM operation, there is a single signal. A 50% duty cyle produces zero output. Increasing the duty cycle to 100% produces a full-scale output in one direction and 0% duty cycle produces a full-scale output in the opposite direction.

PWM & DIRECTION



50% PWM



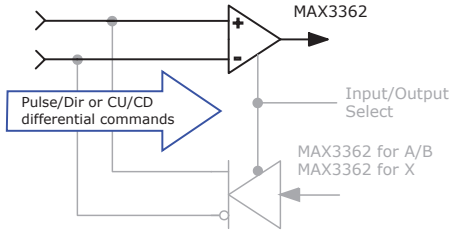
Command Options	Signal	J2 Pins
PWM/Dir Current or Velocity	IN3	7
PWM/Dir Polarity	IN4	8

MULTI-MODE PORT AS AN INPUT

COMMAND INPUT

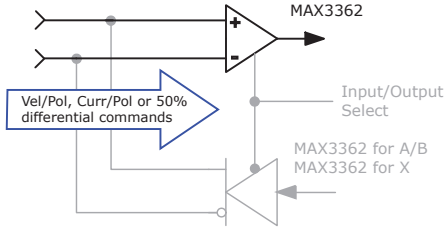
POSITION COMMANDS: DIFFERENTIAL

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



CURRENT or VELOCITY COMMANDS: DIFFERENTIAL

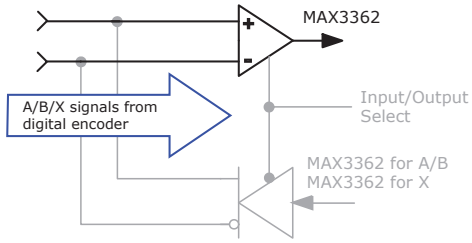
- Current/Velocity Magnitude & Direction
- Current/Velocity 50%



FEEDBACK INPUT: ENCODER 2

SECONDARY FEEDBACK: INCREMENTAL

- Quad A/B/X Incremental Encoder



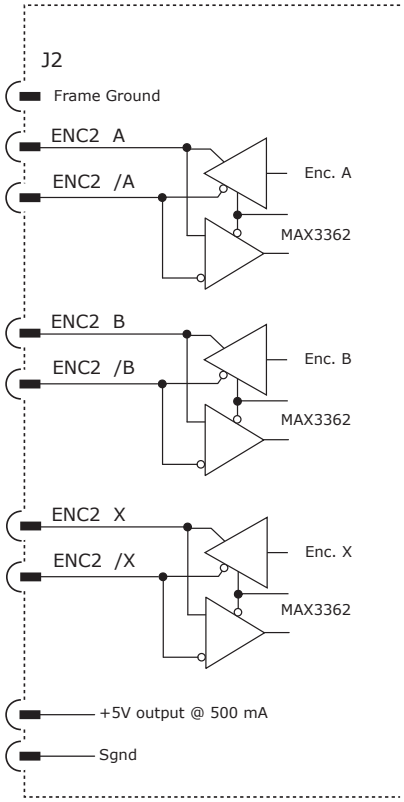
SECONDARY FEEDBACK: ABSOLUTE

- 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.

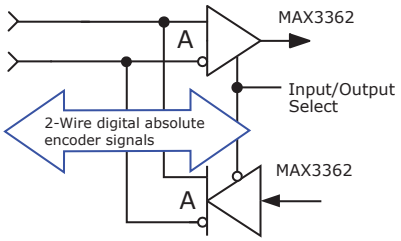
Command Signals	J2 Pins
Pulse, CW, Quad Encoder A, Vel-Curr-Magnitude, Vel-Curr-50%	51
/Pulse, /CW, Quad Encoder /A, /Vel-Curr-Magnitude, /Vel-Curr-50%	52
Direction, CCW, Quad Encoder B, Vel-Curr-Direction	53
/Direction, /CCW, Quad Encoder /B, /Vel-Curr-Direction	54

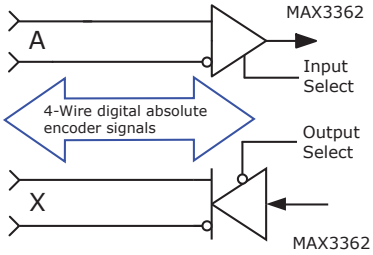
J2 SIGNALS

Signal	Pin
ENCA2	51
/ENCA2	52
ENCB2	53
/ENCB2	54
ENCX2	55
/ENCX2	56



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





J2 Signal Pins
3,4,18,19,20,21,22,23,24, 31,32,33,34,42,49,50,59,60

MULTI-MODE PORT AS AN OUTPUT

OUTPUT TYPES

BUFFERED FEEDBACK OUTPUTS: DIFFERENTIAL

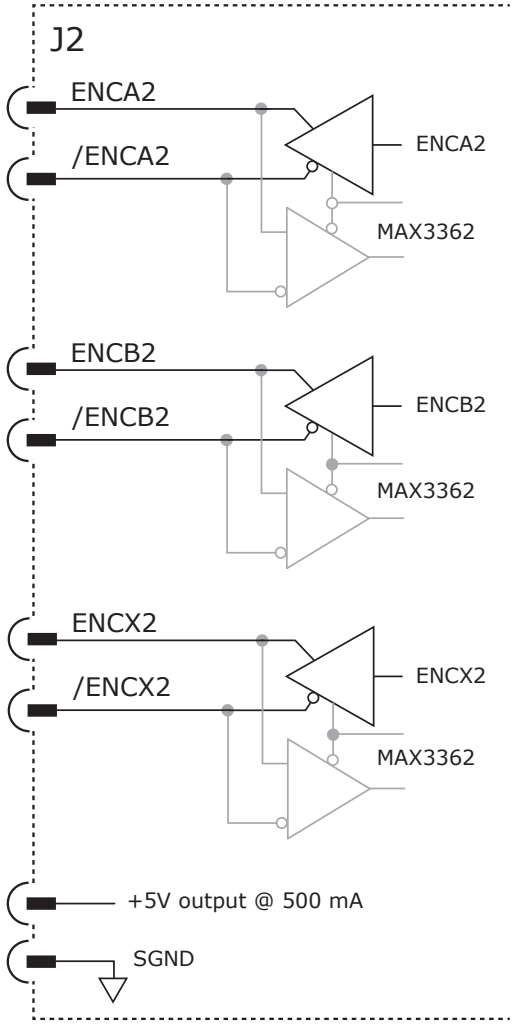
An incremental encoder, connected as the primary feedback from the motor, is internally connected to the multi-port which is configured as an output. This can then be wired to a motion controller that needs position data without the need for split-wiring cables from the encoder alone.

- 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 the feedback data from the following devices:

- Absolute Encoders
- Analog Sin/Cos Incremental Encoders
  The X channel is not used in this mode.

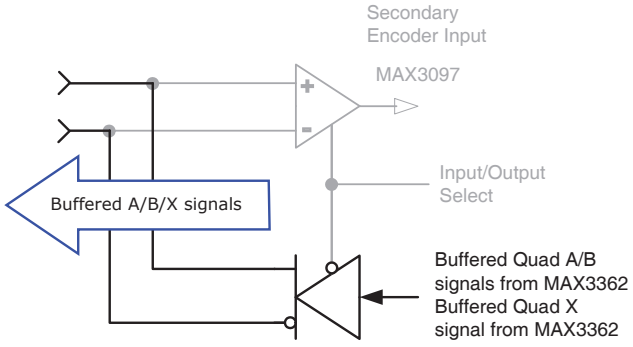


J2 SIGNALS

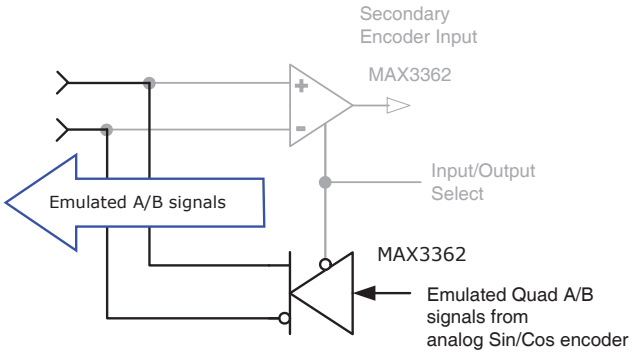
Buffered A/B/X	Emulated A/B	Signal	Pin
Buffered A	Quad A	ENCA2	51
Buffered /A	Quad /A	/ENCA2	52
Buffered B	Quad B	ENCB2	53
Buffered /B	Quad /B	/ENCB2	54
Buffered X		ENCX2	55
Buffered /X		/ENCX2	56

J2 Sgnd Pins
3,4,18,19,20,21,22,23,24, 31,32,33,34,42,49,50,59,60

BUFFERED QUAD A/B/X OUTPUTS



EMULATED QUAD A/B OUTPUTS



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

The six digital inputs to the R43 can be programmed to a selection of functions. All inputs include the following:

- 100 ns RC filters when they are driven by the active sources (CMOS, TTL, etc.)
- 10 kΩ pull-up resistors to +5 Vdc

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

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 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

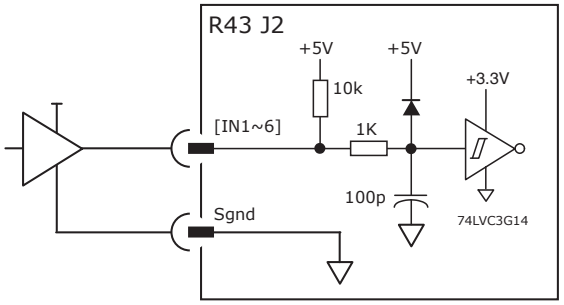
Input	Data	Notes
Input Voltages	HI	V_T+ = 1.42~2.38 Vdc
	LO	V_T+ = 0.68~1.6 Vdc
	Hys	V_H = 0.44~1.26
	Max	+6 Vdc
	Min	0 Vdc
Pull-up	R1	10 kΩ
Low Pass Filter	R2	1 kΩ
	C1	100 pF
	RC[1]	0.1 µs

[1]Note: RC time constant applies when the input is driven by the active high/low device.

CONNECTIONS

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

J2 Sgnd Pins
3,4,18,19,20,21,22,23,24, 31,32,33,34,42,49,50,59,60



WARNING

Consult the Factory for Adapting 24V logic to 5V logic.

5V logic. Do not exceed 6V. Do not connect a 24V logic to this input.

HIGH SPEED INPUTS: IN7

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

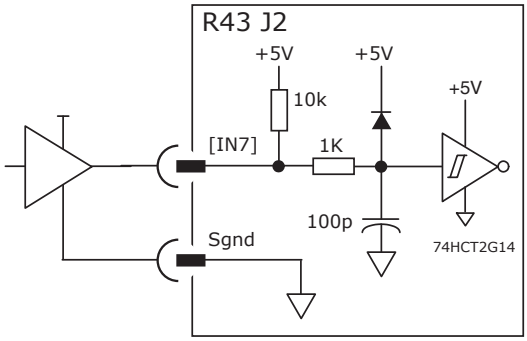
SPECIFICATIONS

Input	Data	Notes
Input Voltages	HI	VT+ ≥ 1.3~2.0 Vdc
	LO	VT- ≤ 0.55~1.3 Vdc
	Hys	VH 0.40~0.79 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

[1]Note: The RC time constant applies when the input is driven by an active high/low device.

CONNECTIONS

Signal	J2 Pins
IN7	11



ANALOG INPUT: AIN1

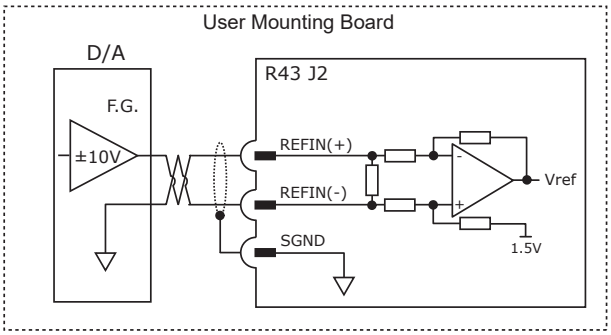
As a reference input, it takes Position/Velocity/Torque commands from a controller.

If it is not used as a command input, it can be used as general-purpose analog input.

SPECIFICATIONS

Specifications	Data	Notes
Input Voltage	Vref	±10 Vdc
Input Resistance	Rin	5.36 kΩ

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



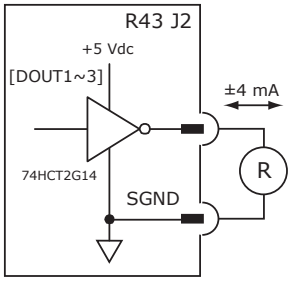
DIGITAL OUTPUTS: OUT1~OUT6

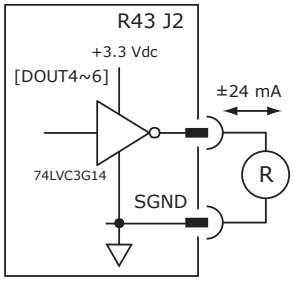
Digital outputs [OUT1~3] are HCT CMOS inverters. They operate from +5V and can source/sink 4 mAdc. [OUT4~6] are LVC CMOS inverters.

They operate from 3.3V and can source/sink 24 mA. In the diagram below, the output functions shown 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
DOUT1	13
DOUT2	12
DOUT3	15
DOUT4	14
DOUT5	17
DOUT6	16

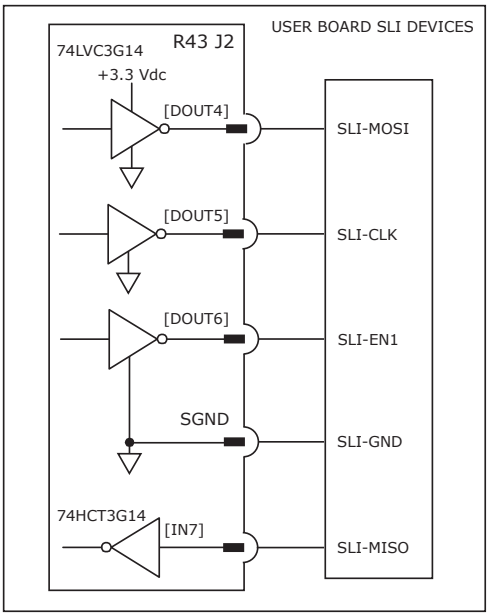
SLI (SWITCH & LED INTERFACE) PORT

The three outputs and one input operate as an SLI (Switch and LED Interface) port. They are used for controlling LEDs and reading the settings of the network address switches. In the diagram, it shows an example of them in SLI mode.

If they are not used for SLI, they are programmable for other functions to turn the output On (HI) or Off (LO) when active. [IN7] is shown in the diagram for completeness as part of the SLI function.

OUTPUT FUNCTIONS

- Fault
- Brake
- Custom Event
- PWM Sync
- Custom Trajectory Status
- Custom Position-triggered Output
- Program Control

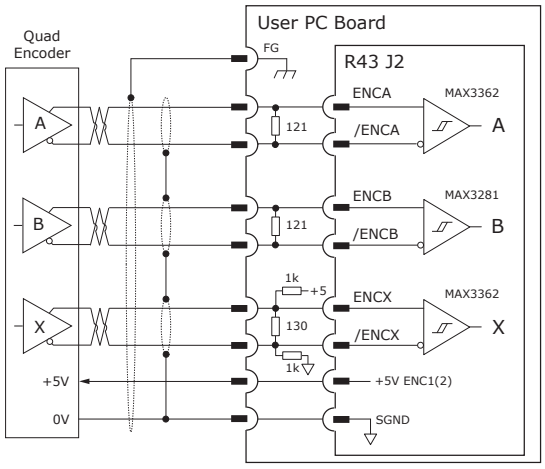


SLI PORT	Signal	J2 Pins
SLI-MOSI	DOUT4	14
SLI-CLK	DOUT5	17
SLI-EN1	DOUT6	16
SLI-GND	SGND	18
SLI-MISO	IN7	11

J2 Sgnd Pins
3,4,18,19,20,21,22,23,24, 31,32,33,34,42,49,50,59,60

ENCODER 1 (PRIMARY FEEDBACK)

QUAD ENCODER WITH INDEX



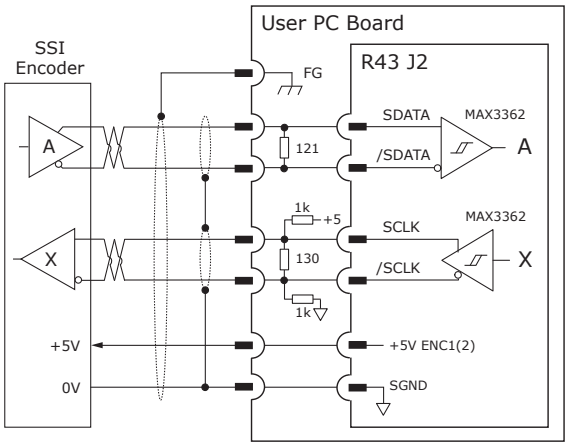
A/B/X SIGNALS

Signal	J2 Pins
ENCA1	43
/ENCA1	44
ENCB1	45
/ENCB1	46
ENCX1	47
/ENCX1	48
+5VENC	57,58

J2 Sgnd Pins
3,4,18,19,20,21,22,23,24, 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 R43 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 number of encoder data bits and counts per motor revolution are programmable. The hardware bus consists of two signals: SCLK and SDATA. The SCLK signal is only active during transfers. Data is clocked in on the falling edge of the clock signal.



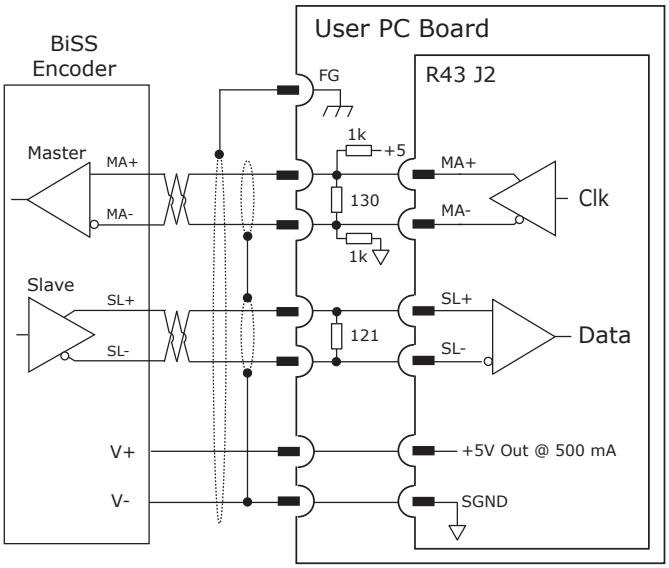
SSI,BiSS SIGNALS

SSI	BiSS	Signal	J2 Pins
SCLK	MA+	ENCX1	47
/SCLK	MA-	/ENCX1	48
SDATA	SL+	ENCA1	43
/SDATA	SL-	/ENCA1	44
+5V		+5VENC	57,58

BiSS ABSOLUTE ENCODER

BiSS is an Open Source digital interface used 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 including 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 are optional for digital encoders and should only be connected to Signal Ground on the drive.

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.

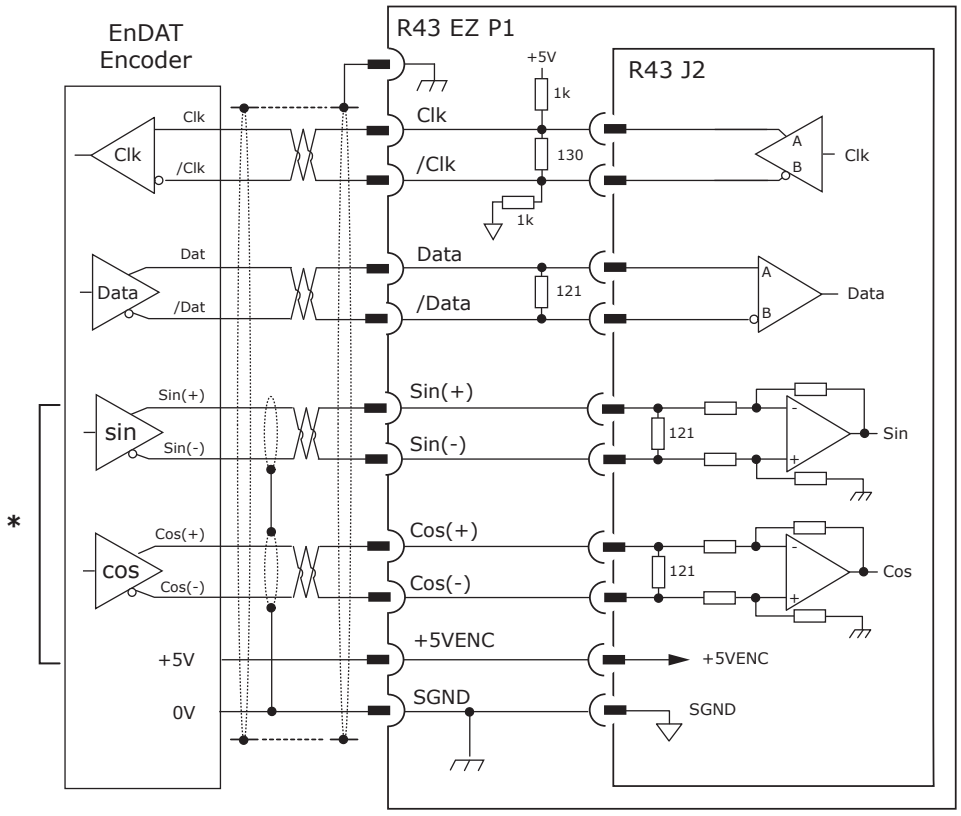
The number of position data bits is programmable as is the use of Sin/Cos channels. The use of Sin/Cos incremental signals are optional in the EnDat specification.

ENDAT SIGNALS

EnDAT	Signal	J2 Pins
Clk	ENCX1	47
/Clk	/ENCX1	48
Data	ENCA1	43
/Data	/ENCA1	44
Sin(+)*	SIN1+	36
Sin(-)*	SIN1-	35
Cos(+)*	COS1+	38
Cos(-)*	COS1-	37
+5V	+5ENC	57,58

*Note: In the EnDAT column, the Sin/Cos is optional with EnDat 2.2 or any 1 Mbit or faster. Endat Sin/Cos is required if EnDat 2.1 < 1 Mbit.

J2 Signal Ground Pins
3,4,18,19,20,21,22,23,24, 31,32,33,34,42,49,50,59,60



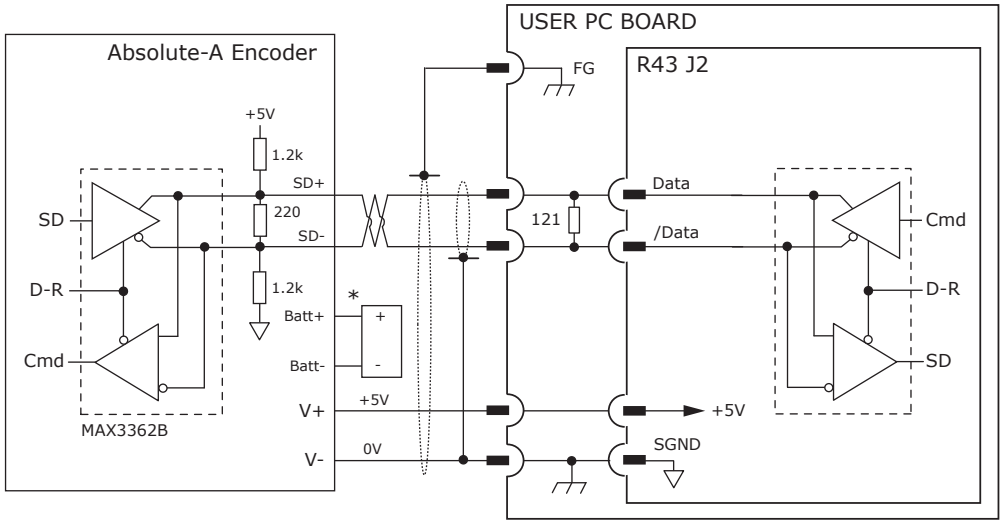
ABSOLUTE-A ENCODER

The Absolute A interface is a serial, half-duplex type that is electrically the same as the RS-485.

ABSOLUTE-A SIGNALS

ABS-A	Signal	J2 Pins
Data	ENCA1	43
/Data	/ENCA1	44
+5V	+5ENC	57,58

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



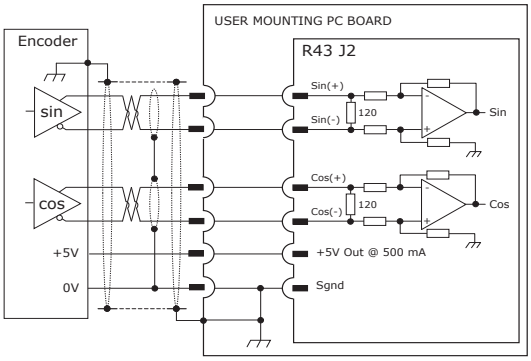
*Note 1: A battery is required for the multi-turn absolute position. If the feedback is battery-free or single-turn absolute, a battery is not required.

Note 2: Signal (outer) shields should be connected at the drive end. The inner shield is optional for digital encoders and should be connected to only the Signal Ground on the drive.

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.

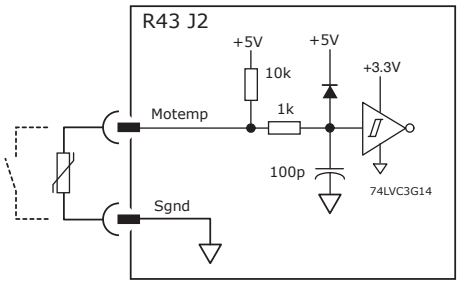


Encoder	Signal	J2 Pins
Sin(+)	SIN1+	36
Sin(-)	SIN1-	35
Cos(+)	COS1+	38
Cos(-)	COS1-	37
+5V	+5VENC	57,58

OTHER MOTOR CONNECTIONS

MOTOR TEMPERATURE SENSOR

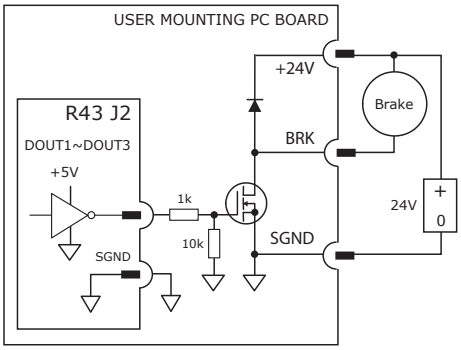
Any digital input is programmable for use with a motor overtemperature switch. Either a HI or LO input level is programmable to signal an over-temp condition.



Input	Signal	J2 Pins
Motemp	IN5	9
SGND	SGND	3

MOTOR BRAKE

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

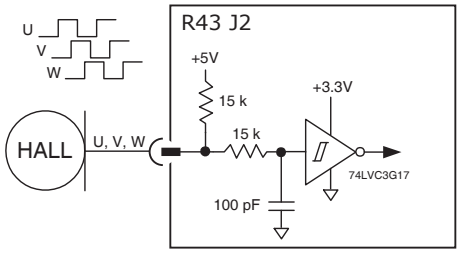


Brake	Signal	J2 Pins
OUT1	DOUT1	13
OUT2	DOUT2	12
OUT3 *	DOUT3	15

*Note: OUT3 indicates the 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 they are used with incremental encoders, they enable the motor to operate without a phase-finding cycle.



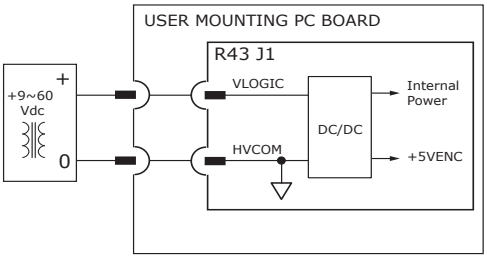
Input	Signal	J2 Pins
Hall U	HALLU	39
Hall V	HALLV	40
Hall W	HALLW	41

J2 Sgnd Pins
3,4,18,19,20,21,22,23,24, 31,32,33,34,42,49,50,59,60

VLOGIC

DESCRIPTION

The Vlogic powers the internal logic and control circuits in the drive. When the STO feature is used, it must be produced by power supplies with transformer isolation from the mains and PELV or SELV ratings and provide 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. In this case, the pump-up due to load deceleration must be limited to 60 Vdc to prevent damage to the drive.

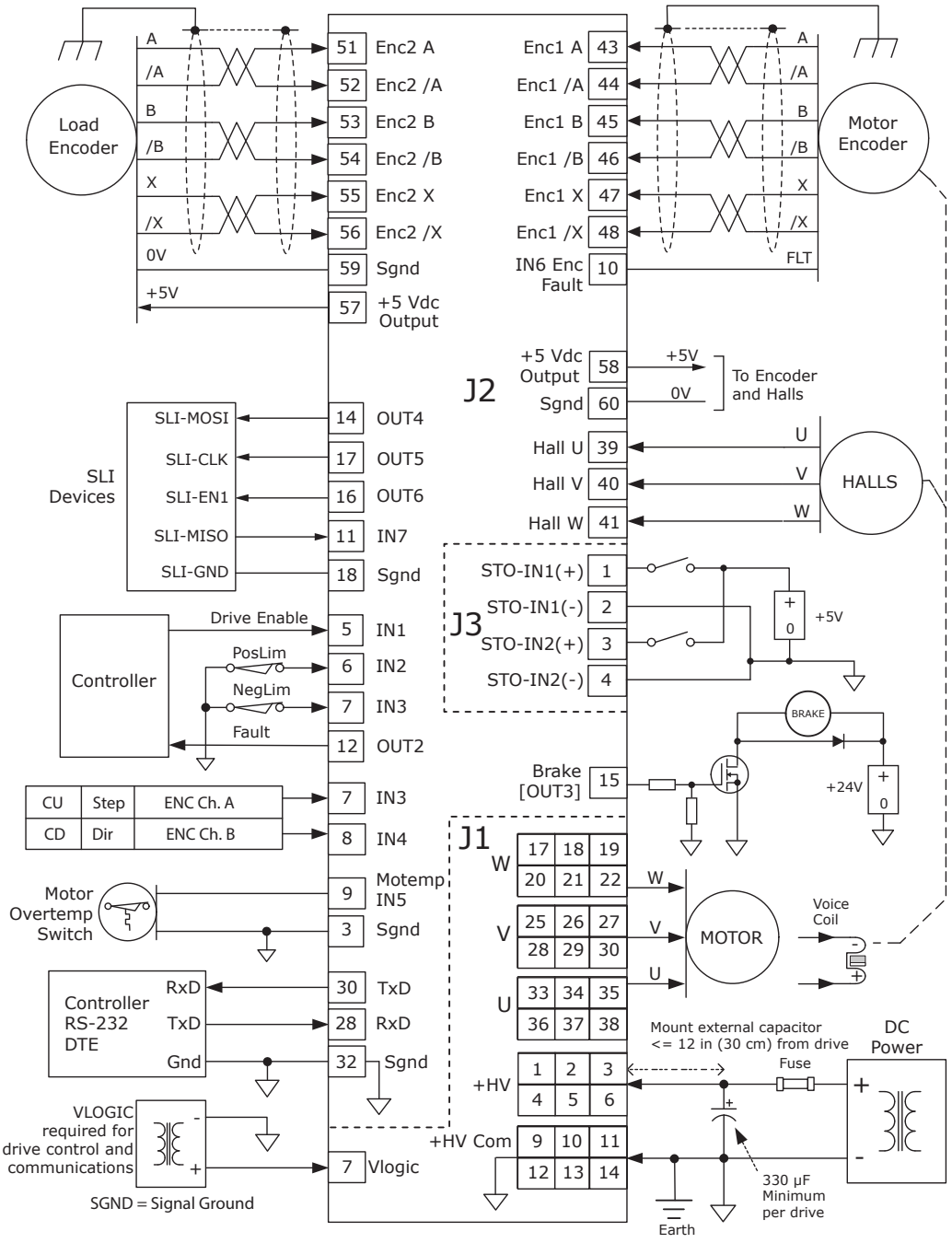


Signal	J1 Pins
VLOGIC	7
HVCOM	9,10,11, 12,13,14

WARNING	***Refer to the AN136 Accelnet External Regen Application Note, Part Number 16-125661.***
	Vlogic +9~60. 24V power is recommended. If common to HV do not exceed 60V, use REGEN protection and diode isolation from HV.

TYPICAL CONNECTIONS

The following diagram shows the functional connections between the R43 connectors and various devices. The user mounting board connections are not shown.



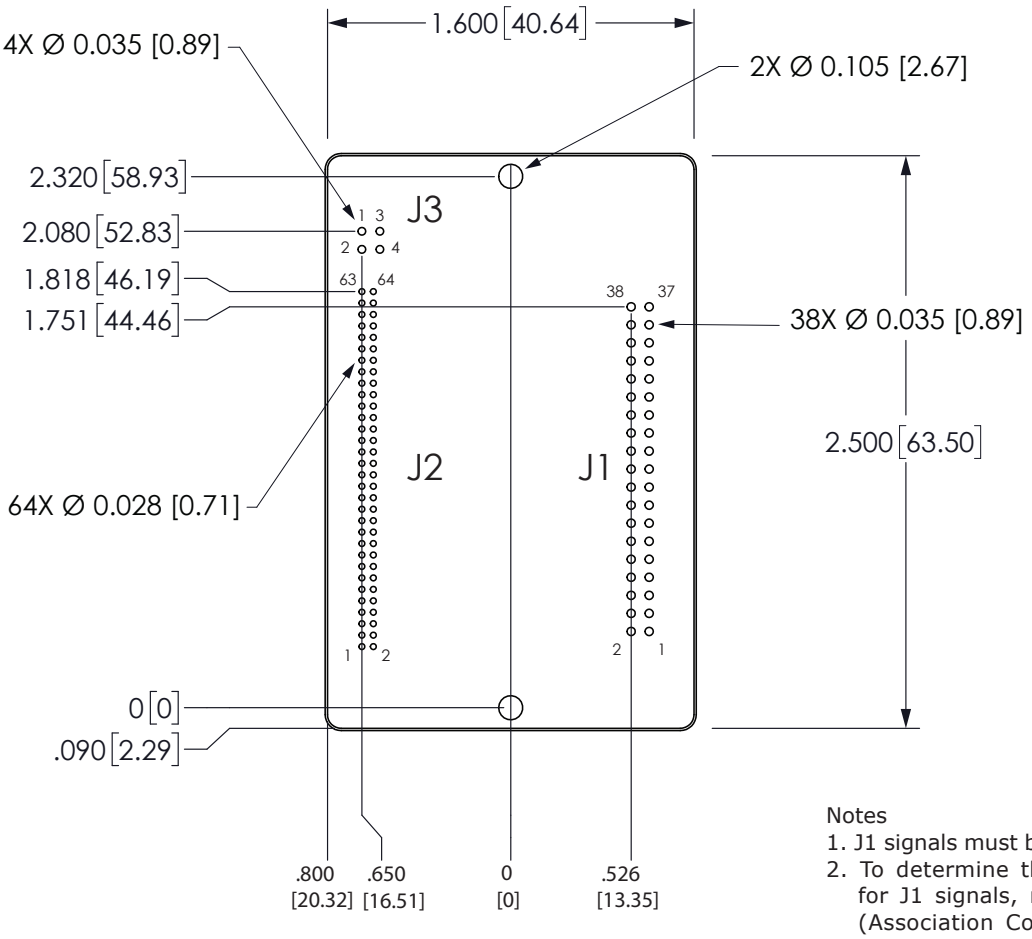
R43 Connections Diagram

NOTES

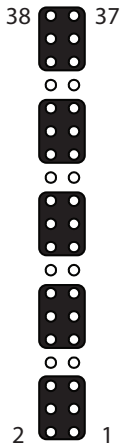
1. [IN1] is shown as Drive Enable and [IN2] and [IN3] are shown with some typical functions. [IN3] and [IN4] are shown as digital command inputs. The [IN3] is shown twice, but use [IN3] for no more than one function. If SLI function is used, it will not be available for other functions. All inputs are 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.
4. If Vlogic and +HV are driven from the same power supply, there must be protection to limit the voltage to 60V. This is required to protect against overvoltage from the motor regeneration when decelerating.

PC BOARD MOUNTING & DRILLING DIMENSIONS

The following diagram shows the topside view looking down on mounting PC board.



J1 Signal Grouping for current-sharing



Dimensions are in inches [mm]

Notes
1. J1 signals must be connected for current-sharing.
2. To determine the 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 the PC board that connects to frame ground for maximum noise suppression and immunity. They also provide the PE (Protective Earth) connection between the heatplate and ground.

For Sockets on User PC Board:

Qty	Description	Manufacturer	Part Number	Ref Des	Remarks
1	Socket Strip	Samtec™	SQT-119-01-G-D	J1	0.0787 in (2.00 mm) pitch
1	Socket Strip	Samtec	FLE-132-01-G-DV-K-TR	J2	0.050 in (1.27 mm) pitch
1	Socket Strip	Samtec	TLE-102-01-G-DV-TR	J3	0.0787 in (2.00 mm) pitch
2	Standoff	hex, 20.5 mm long, M2.5 mm thread			

For Soldering to User PC Board:

Qty	Description	Manufacturer	Part Number	Ref Des	Remarks
1	For J1, refer to the Paste and Hole Printing document from Speedline Technology, Franklin, MA. *http://suddendocs.samtec.com/processing/through-hole-printing.pdf*				
2	Standoff	hex, 15 mm long, M 2.5 mm thread			

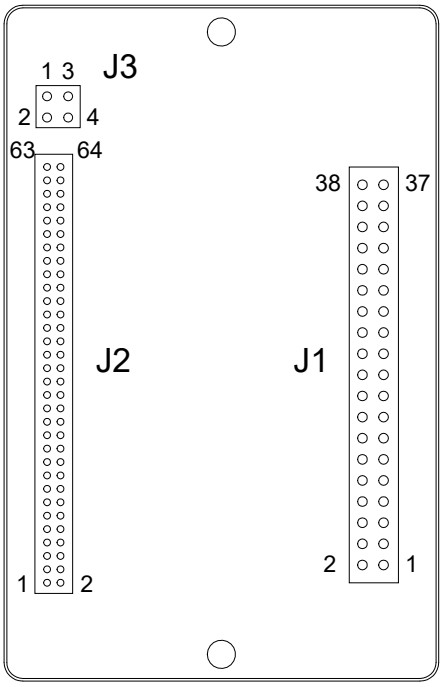
PC BOARD SIGNALS

J3 SAFETY

SIGNAL	PIN	PIN	SIGNAL
STO_1	1	3	STO_2
STO1_RTN	2	4	STO2_RTN

TOP VIEW

The following diagram shows the top viewed from above looking down on the connectors or PC board footprint to which the module is mounted.



Connector part numbers for socket mounting

Note:

J1: HV & Motor

Dual row, 2 mm centers
38 position female header
Samtec: SQT-119-01-G-D

J2: Feedback

Dual row, 0.050 inch centers
64 position female header
Samtec: FLE-132-01-G-DV-K-TR

J3: Safety

Dual row, 2 mm centers
4 position female header
Samtec: TLE-102-01-G-DV-TR

J2 FEEDBACK

Signal	J2 Pin		Signal
*	63	64	*
*	61	62	*
SGND	59	60	SGND
+5VENC	57	58	+5VENC
ENCX2	55	56	/ENCX2
ENCB2	53	54	/ENCB2
ENCA2	51	52	/ENCA2
SGND	49	50	SGND
ENCX1	47	48	/ENCX1
ENCB1	45	46	/ENCB1
ENCA1	43	44	/ENCA1
HALLW	41	42	SGND
HALLU	39	40	HALLV
COS1-	37	38	COS1+
SIN1-	35	36	SIN1+
SGND	33	34	SGND
SGND	31	32	SGND
CANH	29	30	ASYNC_TXD
CANL	27	28	ASYNC_RXD
CANGND	25	26	CANGND
SGND	23	24	SGND
SGND	21	22	SGND
SGND	19	20	SGND
(SLI-CLK) DOUT5	17	18	SGND
(BRAKE) DOUT3	15	16	DOUT6 (SLI-EN1)
DOUT1	13	14	DOUT4 (SLI-MOSI)
(SLI-MISO) IN7	11	12	DOUT2
IN5	9	10	IN6
IN3	7	8	IN4
(Enable) IN1	5	6	IN2
SGND	3	4	SGND
REFIN(-)	1	2	REFIN(+)

*Note: In the Signal column, do not connect or use the corresponding pins in the J2 Pin column.

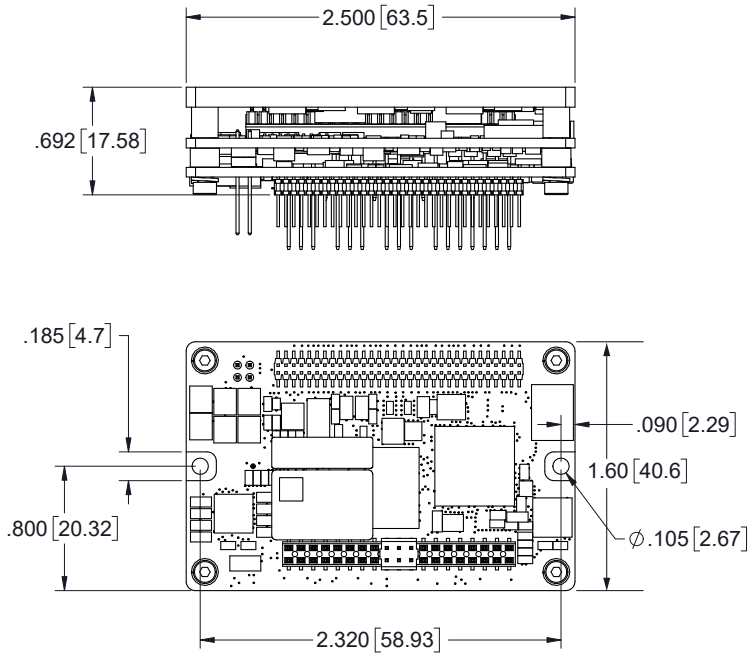
J1 POWER & MOTOR

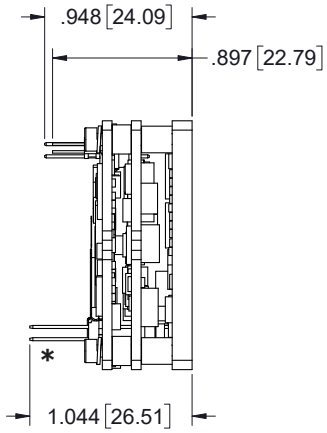
Signal	J1 Pin		Signal
MOTU	38	37	MOTU
	36	35	
	34	33	
*	32	31	*
MOTV	30	29	MOTV
	28	27	
	26	25	
*	24	23	*
MOTW	22	21	MOTW
	20	19	
	18	17	
*	16	15	*
HVCOM	14	13	HVCOM
	12	11	
	10	9	
*	8	7	VLOGIC
+HV	6	5	+HV
	4	3	
	2	1	

*Note: In the Signal column, do not connect or use the corresponding pins in the J1 Pin column.

DIMENSIONS

R43-090-50, R43-090-50-C

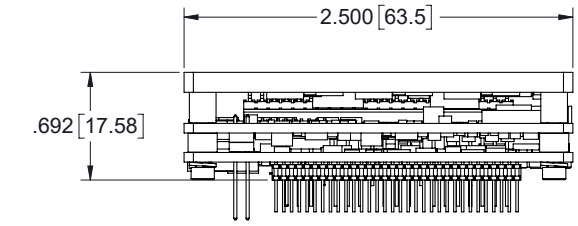


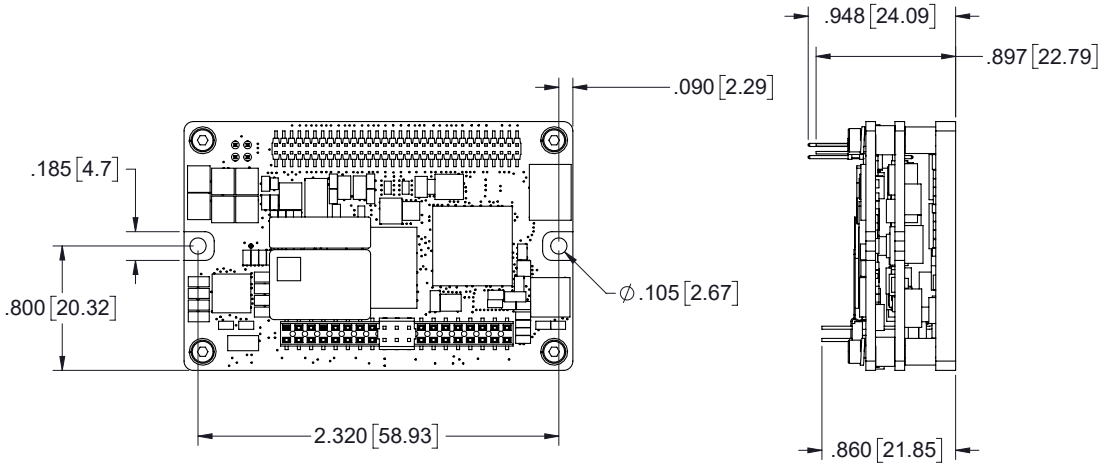


Dimensions are in inches [mm]

*Note: The asterisk indicates the pins are longer for soldering to the user PC board.

R43-090-14, R43-090-30, R43-180-10, R43-180-20





Dimensions are in inches [mm]

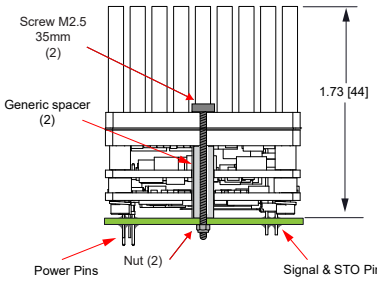
MOUNTING: SOLDERED INTO USER PC BOARD

R43-090-50, R43-090-50-C

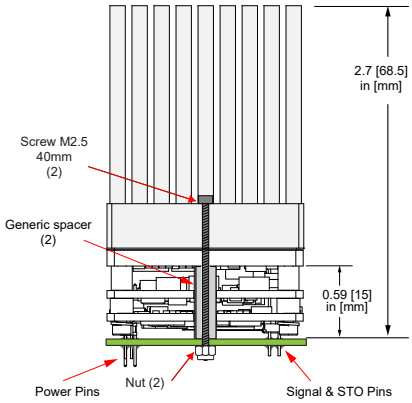
The Kits are not available for this configuration. The following list the required parts and the diagrams show the dimensions:

- Standoffs: 15 mm, diameter 4.5 mm, hollow, aluminum, RAF M0514-25, qty 2
- Thermal pad: Copley CC 6-83985-01, qty 1
- Pins Heatsink: Copley CC 21-126260-01, qty 1
- Screws: M2.5, Length dependent on assembly, qty 2
- Nuts: M2.5, Dependent on assembly, qty 2

Pins Heatsink



Tall Pins Heatsink



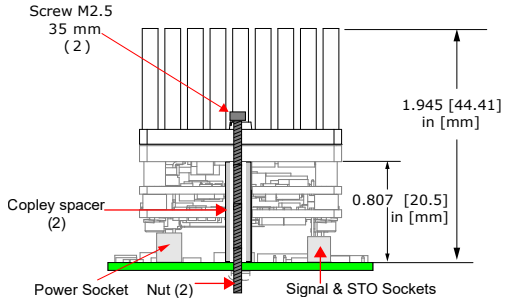
MOUNTING: SOCKETED INTO USER PC BOARD

R43-090-14, R43-090-30, R43-180-10, R43-180-20

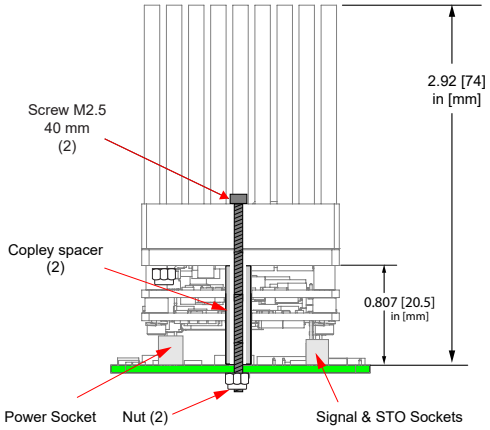
The following diagrams show the connections socketed.

- With the pins heatsink, use the 35 mm screws.
- With the long (tall) pins heatsink, use the 40 mm screws.

Pins Heatsink



Tall Pins Heatsink



PINS HEATSINK KIT: APV-HK

Part	Part Number	Qty
Screw	M2.5-0.45 x 35 mm slotted cheese head	2
Nut	M2.5-0.45 DIN nylon lock nut	2
Thermal material	Copley	1
Spacer	Copley non-threaded spacer 20.5 mm	2
Heatsink	Pins Heatsink, 1 inch tall	1

TALL PINS HEATSINK KIT: APV-THK

Part	Part Number	Qty
Screw	M2.5-0.45 x 40 mm slotted cheese head	2
Nut	M2.5-0.45 DIN nylon lock nut	2
Thermal material	Copley	1
Spacer	Copley non-threaded spacer 20.5 mm	2
Heatsink	Tall Pins Heatsink, 2 inch tall	1

CONNECTORS FOR SOCKETING

Part	Mfgr	Part Number	Qty
Power Socket J1	Samtec	SQT-119-01-G-D	1
Signal Socket J2	Samtec	FLE-132-01-G-DV-K-TR	1
STO Socket J3	Samtec	TLE-102-01-G-DV-TR	1

For the half-soldered configuration, the dimensions, spacers, screws, and nuts are the same.

MOUNTING: HALF-SOCKETED INTO USER PC BOARD

For R43-090-50 and R43-090-50-C only

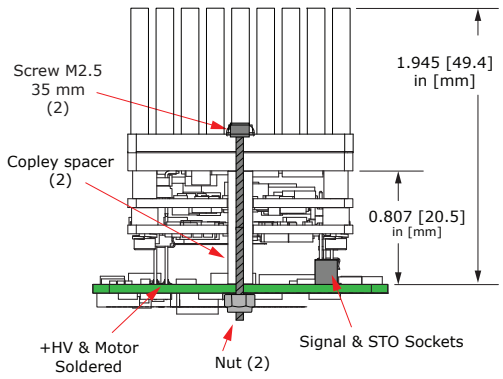
Signal J2 and STO J3 are socketed. Power and motor J1 are soldered. The following diagrams show the connections half-socketed.

- With the pins heatsink, use 35 mm screws.
- With the long pins heatsink, use 40 mm screws.

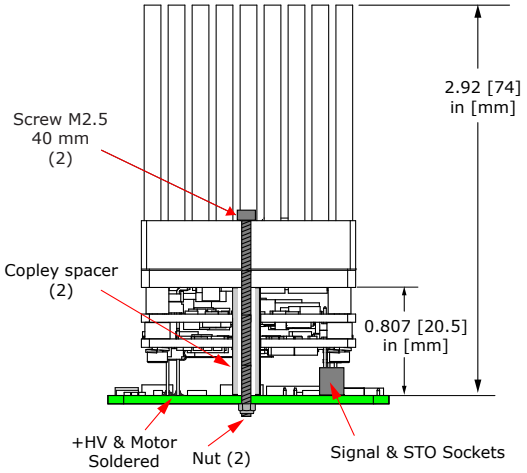
CONNECTORS FOR HALF-SOCKETING

Part	Mfgr	Part Number	Qty
Signal Socket J2	Samtec	FLE-132-01-G-DV-K-TR	1
STO Socket J3	Samtec	TLE-102-01-G-DV-TR	1

Pins Heatsink



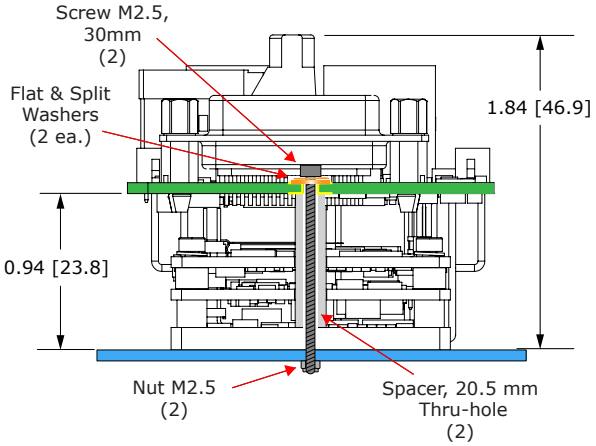
Tall Pins Heatsink



PANEL MOUNTING

R43-090-14, R43-090-30, R43-180-10, R43-180-20

In the diagram below, the above models are shown socketed into an EZ Board. The screws pass through the EZ Board and through the standoffs to the nuts that secure the drive to the panel. Tapping a hole in the panel to accept the M2.5-0.45 screw allows the drive to be mounted and removed from one side of the panel. User-designed mounting boards should have the same conductive etch rings around the screw holes to provide PE grounding for their circuits.



EZ Board Diagram

R43-090-50

The R43-090-50 model has the motor, +HV, and grounding pins soldered to the EZ board. The signal and STO pins are socketed. The dimensions and mounting to a panel are the same as the R43 models.

Note 1: The EZ Board diagram example shows the EZ Board mounted to a panel that does not use the same panel mounting for the R43-090-50 and R43-090-50-C models. These modesl are incompatible with the EZ board.

Note 2: Standoffs must be metal, preferably brass. The EZ Board has conductive etch rings on each side of the screw holes which connect via etch through to the holes. The screws then provide a path from the PE circuits on the drive through the standoffs and drive heatplate to the mounting panel which should be earthed. The etch on the bottom of the holes connects to the standoffs and drive heatplate, providing a PE ground for the heatplate. The thermal material between the mounting board and heatplate of the drive is non-conductive so effective grounding of the heatplate is provided through the standoffs.

PANEL MOUNTING PARTS

Part	Part Number	Qty
Screw	M2.5-0.45 x 30 mm slotted cheese head	2
Nut	M2.5-0.45 DIN nylon lock nut	2
Thermal material*	Thermal grease (white)	1
Spacer	20.5 mm, RAF [M0500-25-ALMODL]	2
Flat Washer*	Metric, M2.5, flat	2
Split Lock Washer*	Metric, M2.5, lock	2

*Note: In the Part column, it indicates the mounting hardware and parts that are not supplied. The user is required to supply those parts.

THERMALS: PWM OUTPUT DISSIPATIONS

The following charts show power dissipation in the drive when the PWM outputs are driving a motor. The next page (22) shows the dissipation in the Vlogic circuits that power the drive's control circuits and external encoders.

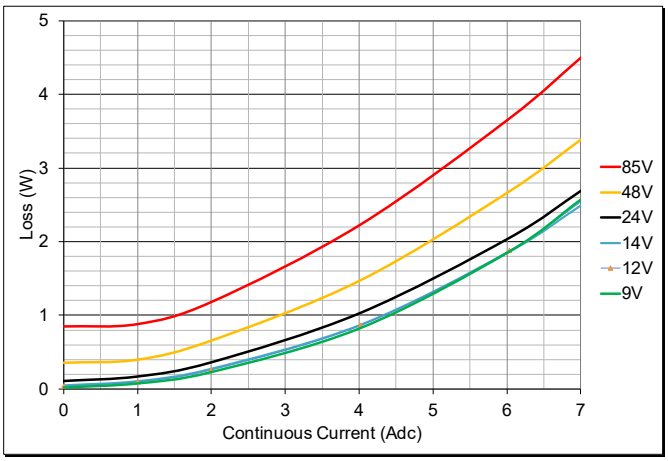
Adding the PWM dissipation to the Vlogic dissipation will yield the total dissipation in Watts for the drive. The dotted lines in the R43-090-30 chart show a dissipation of 9.5 W. at a continuous current of 13 Adc and +HV = 85 Vdc.

WARNING

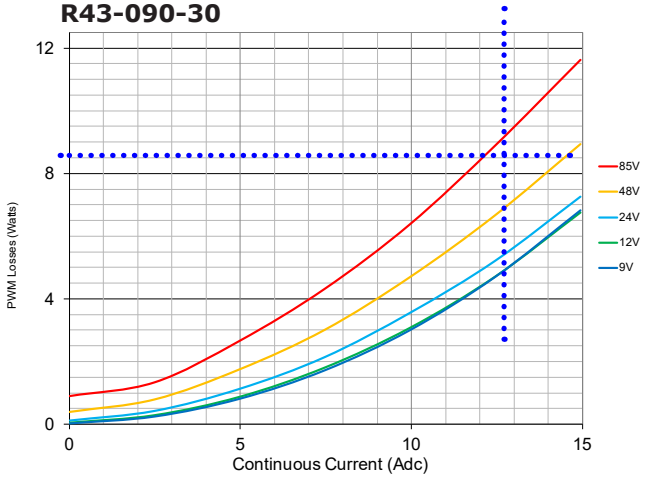
Refer to the AN136 Accelnet External Regen Application Note, Part Number 16-125661.

Vlogic +9~60. 24V power is recommended. If common to HV do not exceed 60V, use REGEN protection and diode isolation from HV.

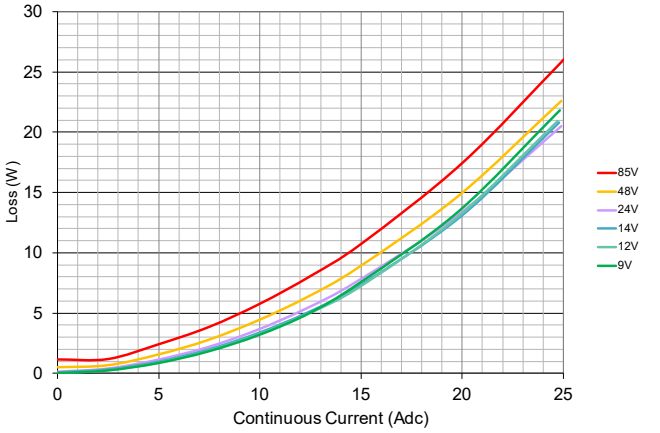
R43-090-14



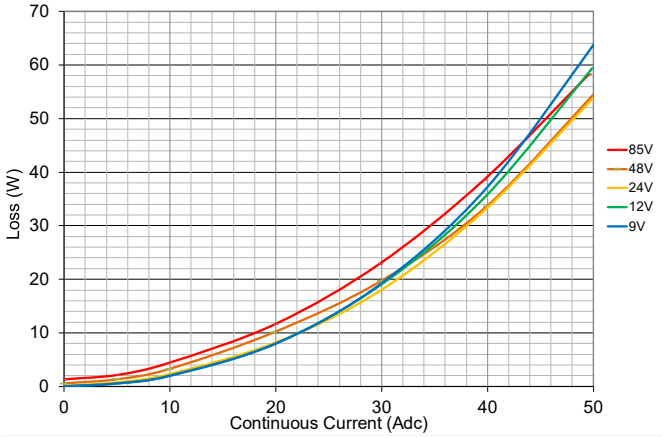
R43-090-30



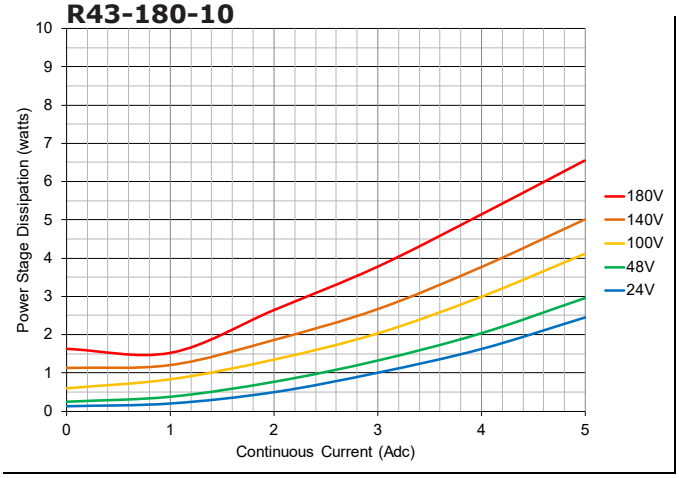
R43-090-50



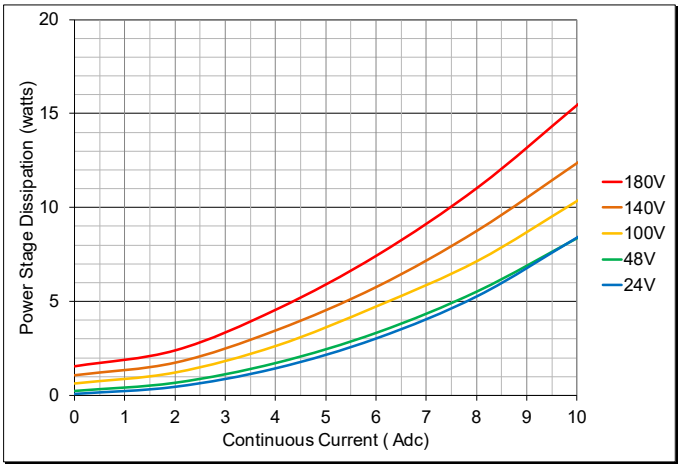
R43-090-50-C



R43-180-10



R43-180-20

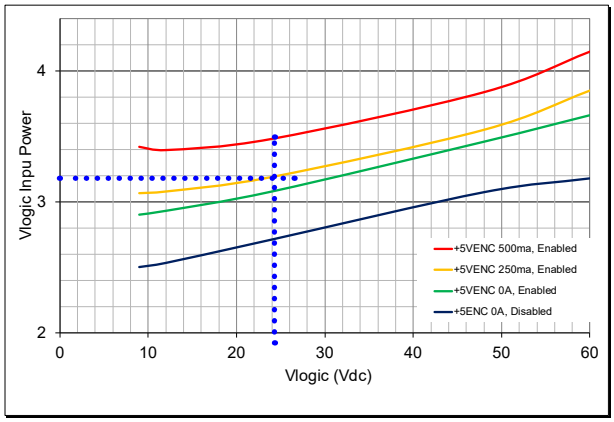


THERMALS: VLOGIC & ENCODER +5V OUTPUT DISSIPATION

The following chart shows the power dissipation in the Vlogic circuits that power the drives control circuits and external encoders. Adding the PWM dissipation to the Vlogic dissipation will yield the total dissipation in Watts for the drive.

On the chart, the dotted lines show a dissipation of 3.2 W. at Vlogic = 24 Vdc when the drive is in an Enabled state and outputting 250 mA for an encoder.

R43 All Models



THERMAL RESISTANCE

Thermal resistance Rth is a measure of the way the drive resists the flow of heat produced internally to the environment. The lower the resistance the more freely the heat can be dissipated. Thermal resistance Rth is measured in units of degrees-Centigrade per Watt (C/W).

Lowering Rth can be done with heatsinks that increase the area that is exposed to the environment and it is done by using fans to circulate the air over the surfaces. The flow of fan forced air is measured in Linear-Feet-per-Minute (LFM).

No Heatsink

LFM	0	100	200	300
Rth	8.5	6.5	5.5	4.0

Pins Heatsink A-Airflow

LFM	0	100	200	300
Rth	-	2.9	1.8	1.4

Pins Heatsink B-Airflow

LFM	0	100	200	300
Rth	-	4.2	2.6	1.9

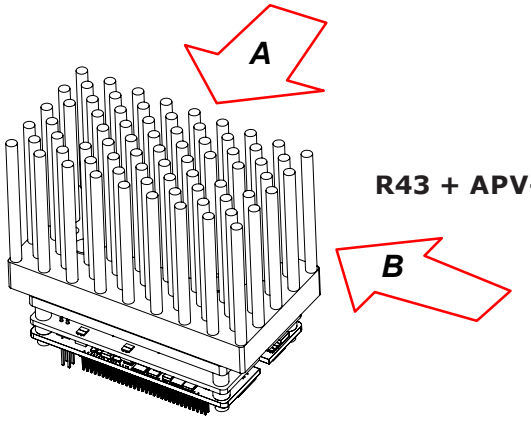
Tall Pins Heatsink A-Airflow

LFM	0	100	200	300
Rth	-	1.3	0.9	0.7

Tall Pins Heatsink B-Airflow

LFM	0	100	200	300
Rth	-	2.2	1.4	1.1

R43



R43 + APV-THK

Tall Pins Heatsink Diagram

Note: In the above diagram, the Tall Pins Heatsink are shown.

THERMAL CALCULATIONS

THERMAL CALCULATIONS EXAMPLE: R43-090-30, +HV = 85 V, IOUT = 13 A, AMBIENT TEMP 32 °C

FIND THE COOLING MEANS REQUIRED WHEN DISSIPATION AND AMBIENT TEMP ARE KNOWN.

Given: Tamb = 32 ºC (89.6 ºF), +HV dissipation = 9.5 W., Vlogic dissipation = 3.2 W
Tmax = 90 ºC (drive shut-down temperature)
Find: Thermal Resistance Rth:
Delta-T = Tmax - Tamb = 90 - 32 = 58 ºC
Total dissipation = 9.5 + 3.2 = 12.7 W
Rth = Delta-T / dissipation = ºC / Watt = 58 / 12.7 = 4.57 ºC/W

In the Thermal Resistance section (page 22), the tables show three configuations that provide Rth less than 4.57 ºC/W:

- No heat sink, forced air at 300 LFM.
- With short pins heat sink, forced air at A or B direction, 100 LFM or greater.
- With long pins heat sink, convection with forced air not required.

FIND THE MAX. AMBIENT TEMPERATURE WHEN THE DRIVE CONFIGURATION IS KNOWN.

Given: R43-090-30 with pins heatsink, forced-air at 200 LFM, A direction, dissipation is 12.7 W.
Rth = 1.8 ºC/W
Tmax = 90 ºC (drive shut-down temperature)
Find: Max. ambient operating temperature
Delta-T = 12.7 W x 1.8 ºC/W = 22.9 ºC
Max. Tamb = Tmax - Delta-T = 90 - 22.9 = 67.1 ºC
Max. ambient operating temperature is 45 °C, and it can operate up to this temperature.

BEST PRACTICES FOR THERMAL MANAGEMENT

The following list the recommended practices for thermal management.

- All of the variables in an installation are usually not known.
- The calculations, similar to the above calculation examples, use values that may be estimates, not exact values.
- Movement of air is very important. Even when enclosures have no openings, the internal fans circulate the air to move the heat from the drives to the enclosure walls and to prevent hot-spotting.
- A heatsink cuts the R43 thermal resistance significantly with forced air.
- Overheating can shut down the drive, but over-cooling is not possible.
- Use CME software to calculate the measurement of the drive temperature as it is the best indicator to identify the need for a heat sink. It shows the combined effect of all the following variables:
  -Thermal dissipation
  -Ambient temperature
  -Cooling means
  -Environment, etc.

EZ BOARD

DESCRIPTION

The EZ Boards provide connectivity to these R43 models so that they can be mounted directly to equipment surfaces.
The R43-EZ-090 EZ Board accepts the following models as plug-ins:

- R43-090-14
- R43-090-30

The R43-EZ-180 EZ Board accepts the following models as plug-ins:

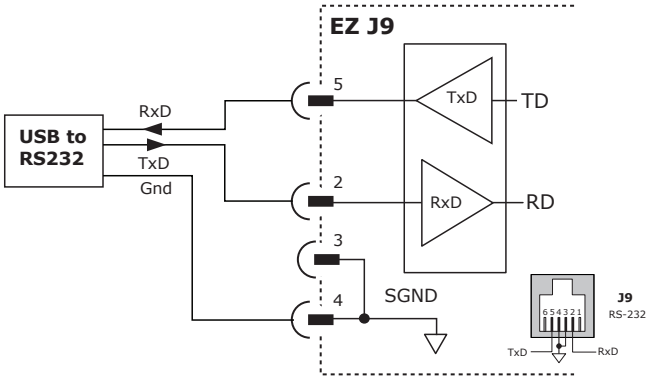
- R43-180-10
- R43-180-20

Important Note: The R43-EZ-090 EZ Board is not compatible with the R43-090-50 and R43-090-50-C models.
Note: For a higher current, use the R43-EZ-090. At the factory, the R43-090-50 is soldered to the EZ Board as a single assembly.

R43 EZ Board

RS-232 CONNECTION

The RS-232 port is used to configure the drive for stand-alone applications, or it is used for configuration before it is installed into an CANopen network. CME software communicates with the drive over this link, and it is then used for the 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 Serial Interface Cable: USB to RJ11 (SER-USB-RJ11) is available. It includes the USB and the RJ-11 connectors to interface this cable with a 6-pin RS-232 port.



EZ Board J9 Connection

SER-USB-RJ11

This device provides connectivity between a USB connector and the RJ-11 connector J9 on the DEV board.

Note: The Serial Interface Cable USB to RJ11 (SER-USB-RJ11) can be used to plug-into either a customer-designed board with an RJ11 or a Copley R3-EZ-xxx board. When you order either type of board, the Manufacturer recommends you order the Serial Interface Cable USB to RJ11 (SER-USB-RJ11).

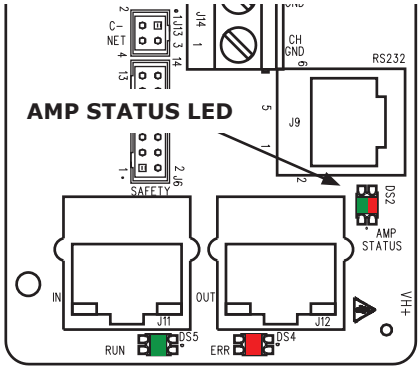
EZ BOARD CANOPEN INDICATORS & ADDRESS SWITCHES

Dual RJ-45 sockets accept standard Ethernet cables. The IN port connects to a master, or it connects to the OUT port of a device that is 'upstream' between the R43 and the master.

The OUT port connects to 'downstream' nodes. If the R43 is the last node on a network, only the IN port is used. A 121 Ω terminator is required on the OUT port.

CANOPEN LEDS

RUN Green: Shows the state of the FSA (Finite State Automaton):		**ERR** Red: Shows errors such as watchdog timeouts and unsolicited R43 state changes due to local errors:	
Off	= Init State	Off	= CANopen communications are working correctly.
Blinking	= Pre-operational	Blinking	= Invalid configuration, general configuration error
Single Flash	= Safe-Operational	Single Flash	= Local error, slave has changed CANopen state autonomously.
ON	= Operational	Double Flash	= PDO or CANopen watchdog timeout, or an application watchdog timeout occurred.



CANopen LEDs

AMP STATUS LED

A bi-color LED gives the state of the drive. Colors do not alternate, and they can display solid On or Blinking.

If multiple conditions occur, only the top-most condition will be displayed. When that condition is cleared, the next condition in the table below is shown.

LED	Condition Description
Red/Blinking	Latching fault. Operation can not resume until the drive is Reset.
Red/Solid	Transient fault condition. Drive can resume the 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 the direction not inhibited by limit switch.
Green/Solid	Drive OK and enabled. Can run in response to reference inputs or CANopen commands.

LATCHING FAULTS

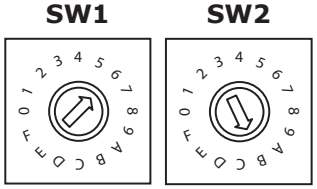
Default	Optional (Programmable)
Short circuit (Internal or External)	Over-voltage
Drive over-temperature	Under-voltage
Motor over-temperature	Motor Phasing Error
Feedback Error	Command Input Lost
Following Error	Motor Wiring Disconnected
	Over Current (Latched)

CANopen DEVICE ID

In the CANopen network, switches provide positive identification that are independent of cabling. In the EZ board, this is provided by two 16-position rotary switches with hexadecimal encoding. These switches can set the Device ID of the drive from 0x01~0xFF (1~255 decimal). The table shows the decimal values of the hex settings of each switch.

Example 1: To find the switch settings for decimal Device ID 107, refer to the table to calculate the following:

1) In the table SW1 column, find the highest number that is less than 107, (96).
   Refer to the SW1 column and set SW1 (96) to the corresponding hex value that appears in the Hex column, (6).
   96 < 107 and 112 > 107, so SW1 = 96 = Hex 6
2) Subtract 96 from the desired Device ID (107) to get the decimal value of switch SW2, (11). Refer to the SW2 column and set SW2, (11) to the corresponding hex value that appears in the Hex column, (B).
   SW2 = (107 - 96) = 11 = Hex B



CANopen Device ID Switch Decimal Values

		SW1	SW2
	HEX	DEC	
	0	0	0
	1	16	1
	2	32	2
	3	48	3
	4	64	4
	5	80	5
1	6	96	6
	7	112	7
	8	128	8
	9	144	9
	A	160	10
2	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 the CANopen connectivity.

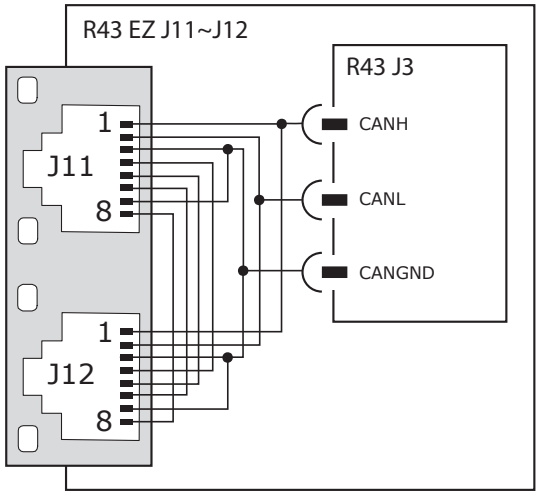
J11 CAN

Pin	Signal
1	CANH
2	CANL
3	CANGND
4	*
5	*
6	*
7	CANGND
8	*

J12 CAN

Pin	Signal
1	CANH
2	CANL
3	CANGND
4	*
5	*
6	*
7	CANGND
8	*

*Note: In the Signal column, the pins are pass-through and have no connections to the drive circuits.



EZ BOARD SAFE TORQUE OFF (STO)

DESCRIPTION

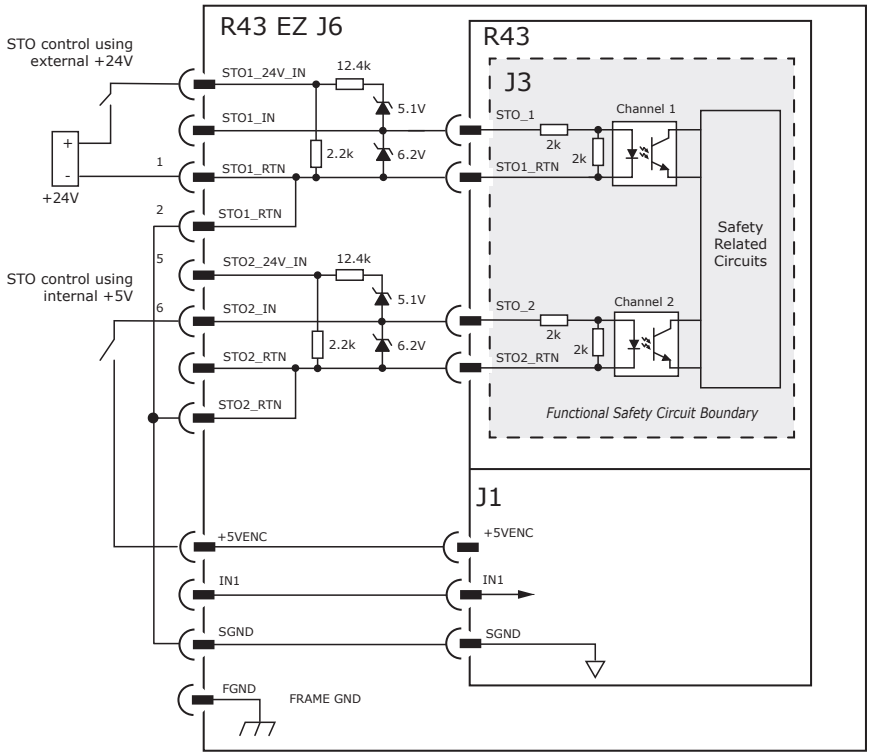
In the following diagram, it shows the use of the internal +5V or external 24V to energize the STO inputs. Both STO inputs must be energized in order to enable the drive.

IN1, the hardware Enable input, is used 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
STO1_RTN	1	2	STO1_24V_IN
STO1_RTN	3	4	STO1_IN
N.C.	5	6	N.C.
STO2_RTN	7	8	STO2_24V_IN
STO2_RTN	9	10	STO2_IN
N.C.	11	12	N.C.
SGND	13	14	FGND
IN1	15	16	+5VENC

Note: In the table, the term, N.C., indicates No Connection.



EZ BOARD SLI PORT SWITCHES & LEDS

CANOPEN DEVICE ID (STATION ALIAS) SWITCH CONNECTIONS

In the diagram, it shows the connections to the CANopen Device ID switches and the 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 power it Off-On.

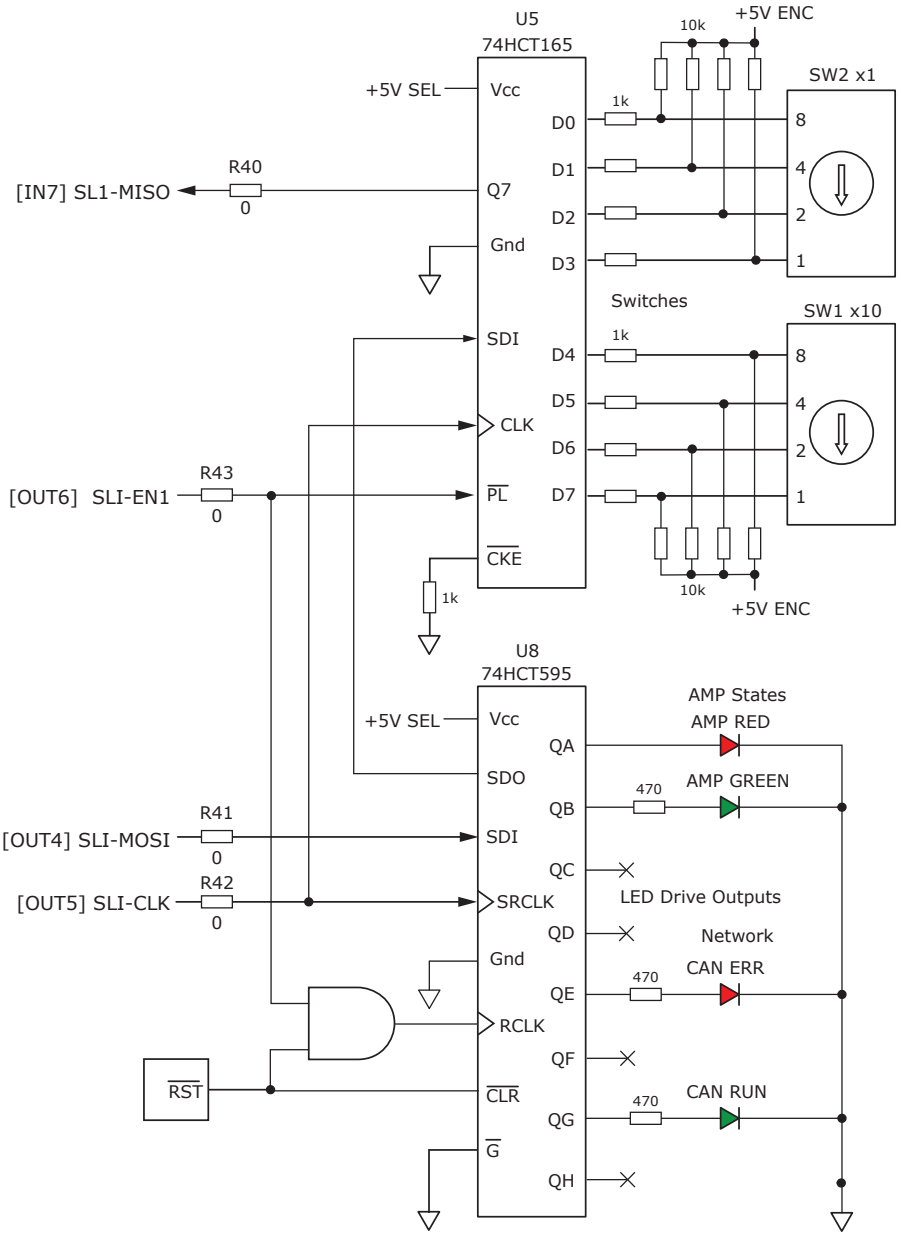
Note: R40, R41, R42, R43 may be removed by the user if IN7, OUT4, OUT5, OUT6 are needed for other functions. This will disable the address switches and LEDS.

SLI PORT

SLI-Port	Signal	Pin
SLI-MISO (IN7)	IN7	11
SLI-EN1 (OUT6)	DOUT6	16
SLI-MOSI (OUT4)	DOUT4	14
SLI-CLK (OUT5)	DOUT5	17

Note: In the Reference Design schematic diagram, the term, SLI-xxxx, appears as SPI-xxxx. The SPI interface is not supported in the R43.

Outputs [OUT4,5,6] and input [IN7] operate as an SLI port which reads the settings on the CANopen Device ID switches, and controls the Amp and CANopen status LEDs.



Reference Design Diagram

EZ BOARD VLOGIC

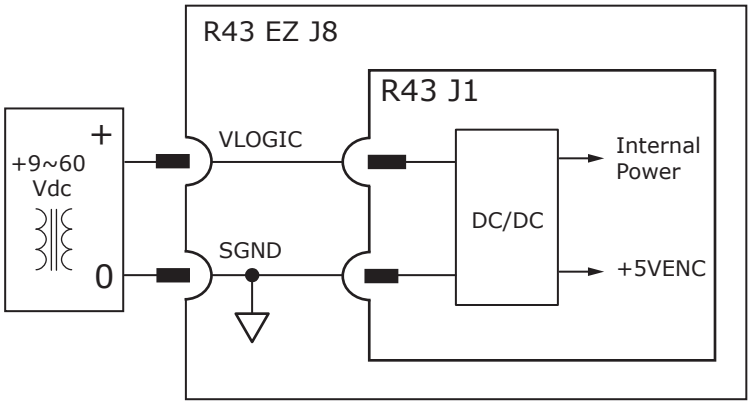
DESCRIPTION

The EZ board Vlogic powers the internal logic and control circuits in the drive. When the STO feature is used, it must be produced by power supplies with the transformer isolation from the mains and PELV or SELV ratings and produce 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. If Vlogic and +HV are driven from the same power supply, there must be protection to limit the voltage to 60V. This is to protect against overvoltage from the motor regeneration when decelerating.

J8 VLOGIC

Pin	EZ-Board	Signal
1	VLOGIC	+24V_VLOGIC
2	SGND	SGND



WARNING

Refer to the AN136 Accelnet External Regen Application Note, Part Number 16-125661.

Vlogic +9~60. 24V power is recommended. If common to HV do not exceed 60V, use REGEN protection, and diode isolation from HV.

EZ BOARD +HV & MOTOR CONNECTIONS

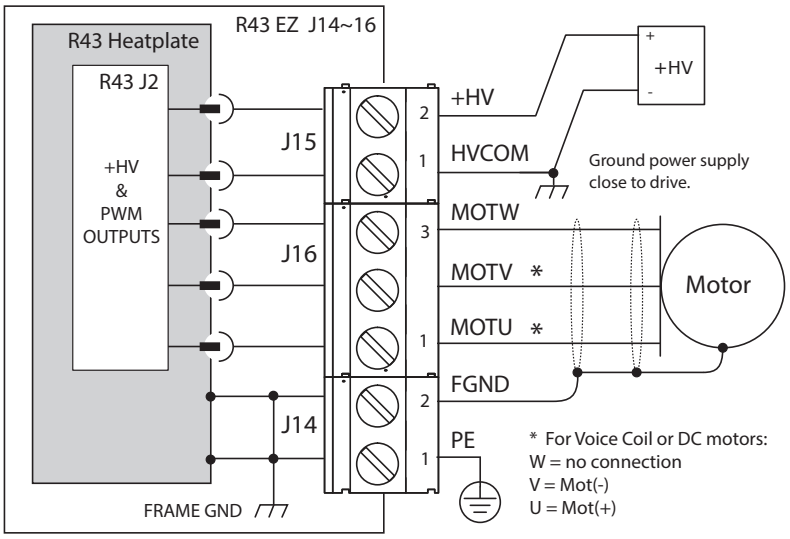
DESCRIPTION

The following describe the connections:

- J15 provides the 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 R43 to an earth-ground point.

J#	Pins	EZ-Board	Signal
J15	2	+HV	+HV
	1	HVCOM	HVCOM
J16	3	MOT W	MOTW
	2	MOT V*	MOTV
	1	MOT U*	MOTU
J14	2	FGND	CHASSIS
	1	PE	PE



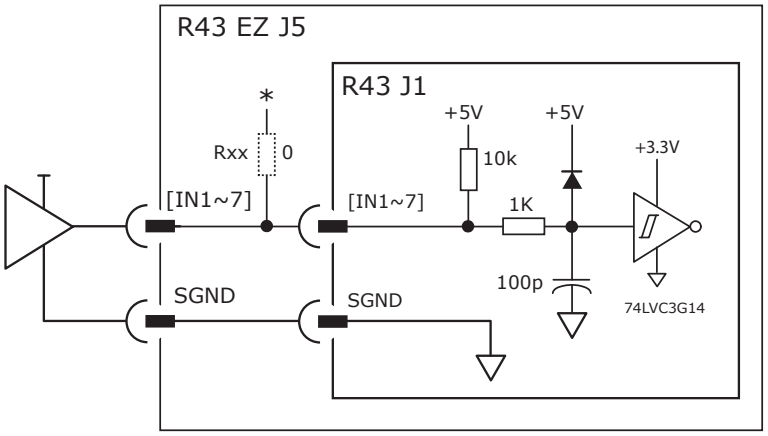
EZ BOARD I/O CONNECTORS

Logic inputs maximum input voltage is +6 Vdc.
IN5 is connected to P1, the primary encoder Motemp input. If IN5 is not used for that function, then IN5 is available as a logic input.

- * Rxx shows the locations of 0 Ω resistors that are in place by default as R43 and R40.
- R43 connects the Encoder Fault signal to IN6.
- R40 connects the SLI-MISO signal to IN7 which is used by the SLI port that controls the LEDs and reads the address switches.
- If neither of these functions are needed, then R40 and/or R43 can be removed making IN6 & IN7 available as logic inputs.

LOGIC INPUTS

EZ-Board	Signal	J5 Pins
IN1 Enable	IN1	4
IN2	IN2	3
IN3	IN3	6
IN4	IN4	5
IN5	IN5	8
IN6 Encoder Fault	IN6	7
IN7 SLI MISO	IN7	10
SGND	SGND	15, 17, 18

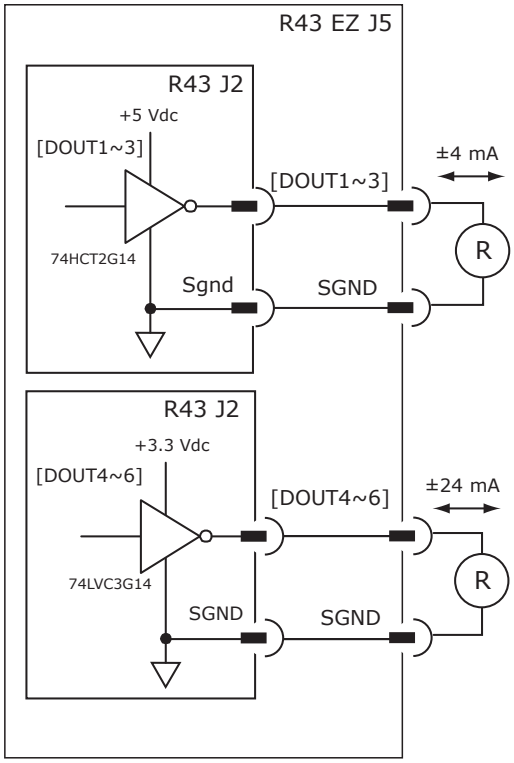


OUT3 is connected by default to the MOSFET that is the Brake output on J10. OUT1~2 are available as logic outputs.
OUT4~6 connect to the SLI circuit that drives the displays and reads the address switches. If the SLI function is not needed, then these outputs can be used as logic outputs by removing the Rxx as follows:

- OUT4: R41
- OUT5: R42
- OUT6: R43

LOGIC OUTPUTS

EZ-Board	Signal	J5 Pins
DOUT1	DOUT1	12
DOUT2	DOUT2	9
DOUT3 (Brake)	DOUT3	14
DOUT4 (SLI-MOSI)	DOUT4	11
DOUT5 (SLI-CLK)	DOUT5	16
DOUT6 (SLI-EN1)	DOUT6	13
SGND	SGND	15, 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). They provide incremental position feedback via the A/B signals. The MAX3097 receiver has differential inputs with fault protections for the following conditions:

Short-Circuits Line-Line: This condition produces a near-zero voltage between A & /A or B & /B which is below the differential fault threshold.

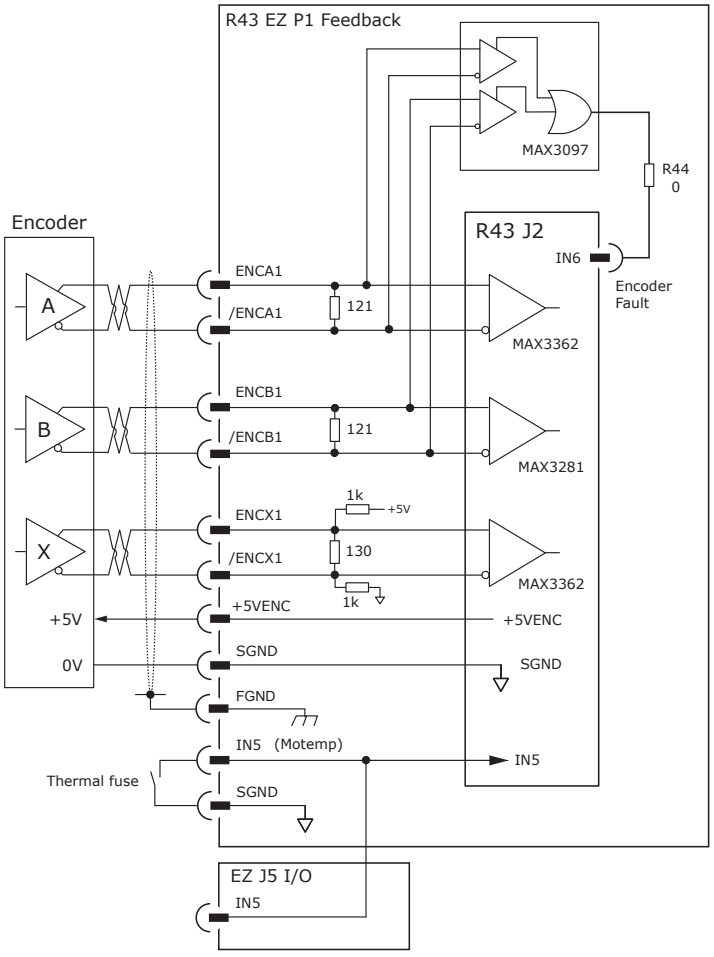
Open-Circuit Condition: The 121Ω terminator resistor will pull the inputs together if either side (or both) is open. This condition will produce the same fault condition as a short-circuit across the inputs.

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

±15kV ESD Protection: The 3097 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



J5 I/O SIGNALS

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

Note: IN5 on the feedback connector is connected to the drive IN5.

P1 ENCODER SIGNALS

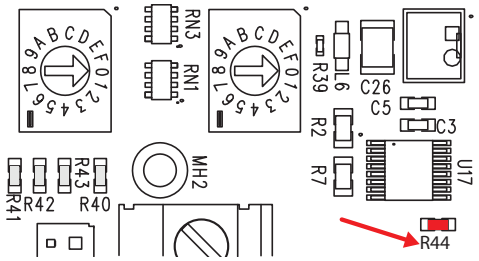
EZ-Board	Signal	Pins
Enc1 A	ENCA1	13
Enc1 /A	/ENCA1	12
Enc1 B	ENCB1	11
Enc1 /B	/ENCB1	10
Enc1 X	ENCX1	9, 23
Enc1 /X	/ENCX1	8, 22
+5V ENC	+5VENC	6, 17
[IN5] Motemp	IN5	7
FGND	FGND	*
SGND	SGND	5,16, 25,26

*Note: In the Pins column, FGND on P1 is the metal shell.

IN5 MOTEMP SIGNALS

Connector	Signal	Pins
EZ P1	IN5	7
	SGND	5, 16, 25, 26
EZ J5	IN5	8
	SGND	15, 17, 18

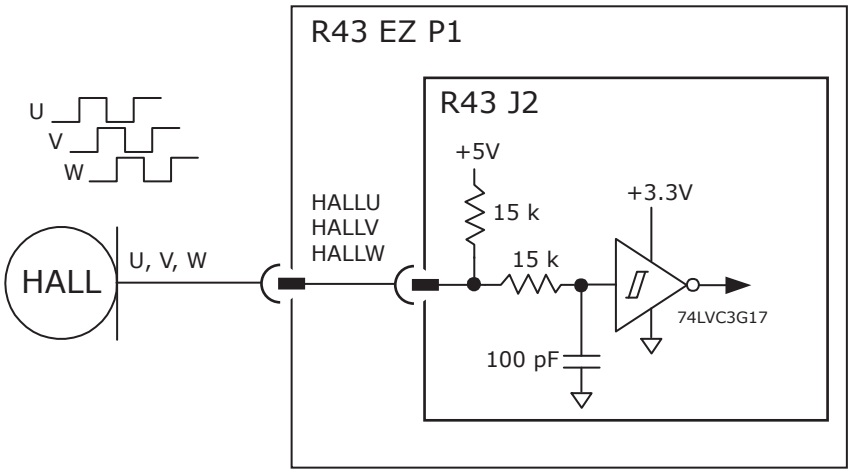
R44 LOCATION



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 the user's function.

EZ BOARD PRIMARY FEEDBACK CONNECTOR P1

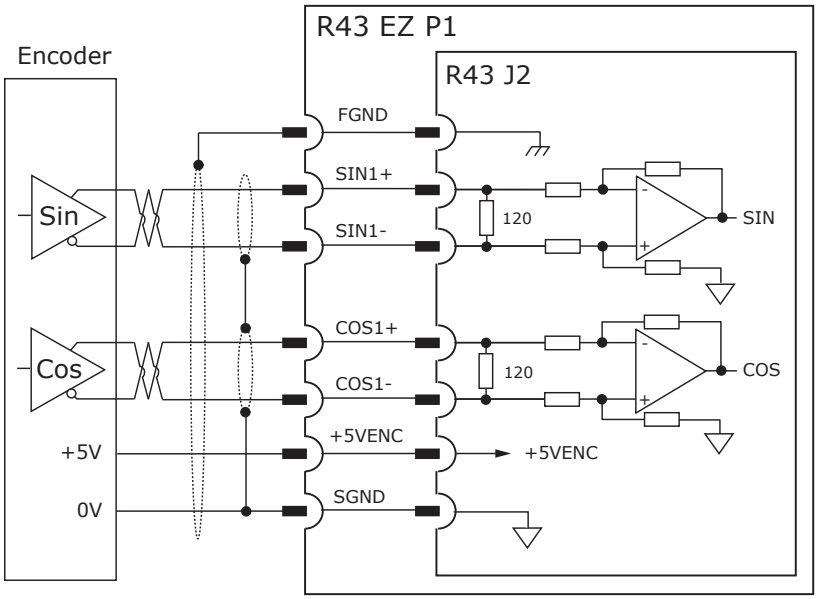
HALLS



P1 HALL SIGNALS

HALLS	Signal	Pins
Hall U	HALLU	2
Hall V	HALLV	3
Hall W	HALLW	4

SIN/COS ENCODERS



P1 SIN/COS SIGNALS

Sin/Cos	Signal	Pins
Sin(+)	SIN1+	19
Sin(-)	SIN1-	18
Cos(+)	COS1+	21
Cos(-)	COS1-	20

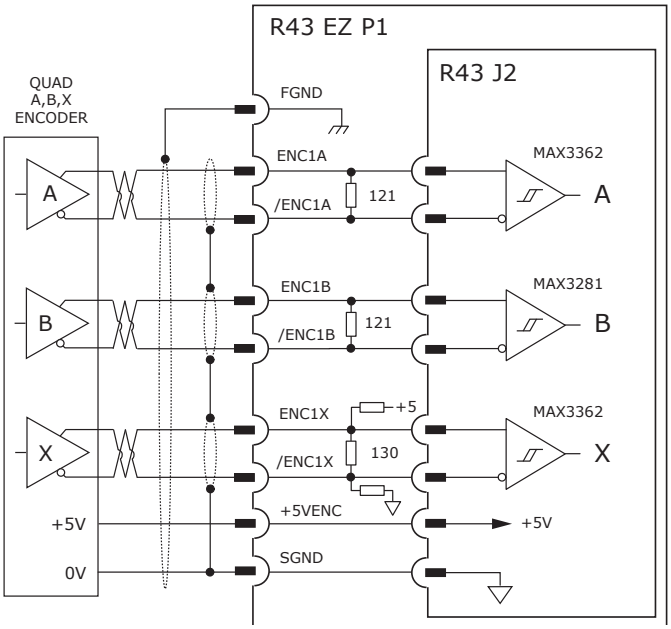
P1 +5V & SGND

Signal	Pins
+5VENC	6, 17
SGND	5, 16, 25, 26

Note: Use double-shielded cable for the Sin/Cos signals that are analog and more susceptible to noise. Use two inner shields to provide one shield for each twisted-pair and to connect to SGND. The outer shield connects to Frame Ground on the drive end, and it is not connected to the motor frame on the other end. With the cable for the PWM outputs to the motor connected to Frame Ground on the drive end, the motor casing is connected on the other end. Additionally, there is a return path for currents produced by the capacitance between the UVW output wires and the motor cable shield.

EZ BOARD PRIMARY FEEDBACK CONNECTOR P1

QUAD ENCODER WITH INDEX



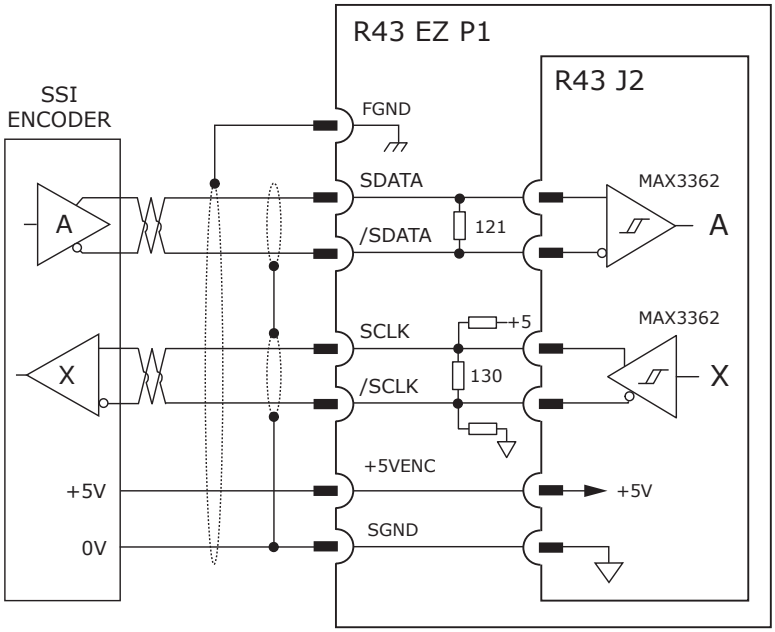
A/B/X SIGNALS

QUAD	Signal	P1 Pins
Enc1 A	ENCA1	13
Enc1 /A	/ENCA1	12
Enc1 B	ENCB1	11
Enc1 /B	/ENCB1	10
Enc1 X	ENCX1	9
Enc1 /X	/ENCX1	8
+5V ENC	+5VENC	6,17
SGND	SGND	5,16,25,26
FGND	FGND*	27, 28

*Note: In the Signal column, FGND indicates FGND on P1 as the metal shell of the connector. This makes contact with the feedback cable backshell which then makes contact with the motor feedback cable's shielding. In the table, it is shown as pins 27 & 28 which is how it appears in the EZ board schematic.

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 R43 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 number of encoder data bits and counts per motor revolution are programmable. The hardware bus consists of two signals: SCLK and SDATA. The SCLK signal is only active during transfers. Data is clocked in on the falling edge of the clock signal.



BiSS ABSOLUTE ENCODER

BiSS is an - Open Source - digital interface used 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 including Actuators
- Bidirectional
  - -BiSS B-protocol: Mode choice at each cycle start
  - -BiSS C-protocol: Continuous mode

SSI,BiSS SIGNALS

SSI	BiSS	Signal	P1 Pins
SDATA	SL+	ENCA1	13
/SDATA	SL-	/ENCA1	12
SCLK	MA+	ENCX1	9
/SCLK	MA-	/ENCX1	8
+5V		+5VENC	6,17

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

EZ BOARD PRIMARY FEEDBACK CONNECTOR P1

ENDAT ABSOLUTE ENCODER

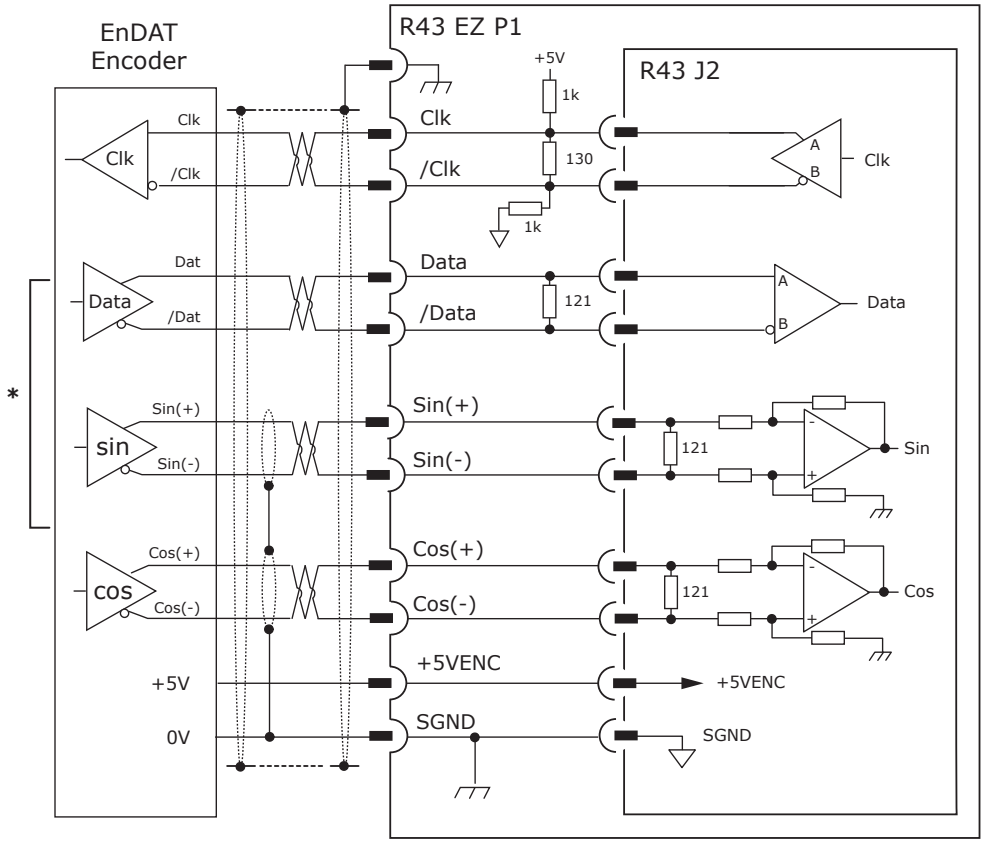
The EnDat interface is a Heidenhain interface that is similar to SSI in the use of clock and data signals, but which also supports analog Sin/Cos channels from the same encoder.

The number of position data bits is programmable as is the use of Sin/Cos channels. The use of Sin/Cos incremental signals is optional in the EnDat specification.

ENDAT SIGNALS

EnDAT	Signal	P1 Pins
Clk	ENCX1	9
/Clk	/ENCX1	8
Data	ENCA1	13
/Data	/ENCA1	12
Sin(+)*	SIN1+	19
Sin(-)*	SIN1-	18
Cos(+)*	COS1+	21
Cos(-)*	COS1-	20
+5V	+5VENC	6,17
0V	SGND	5, 16, 25, 26

*Note: In the EnDAT column, the Sin/Cos is optional with EnDat 2.2 or any 1 Mbit or faster. Endat Sin/Cos is required if EnDat 2.1 < 1 Mbit.



ABSOLUTE-A ENCODER

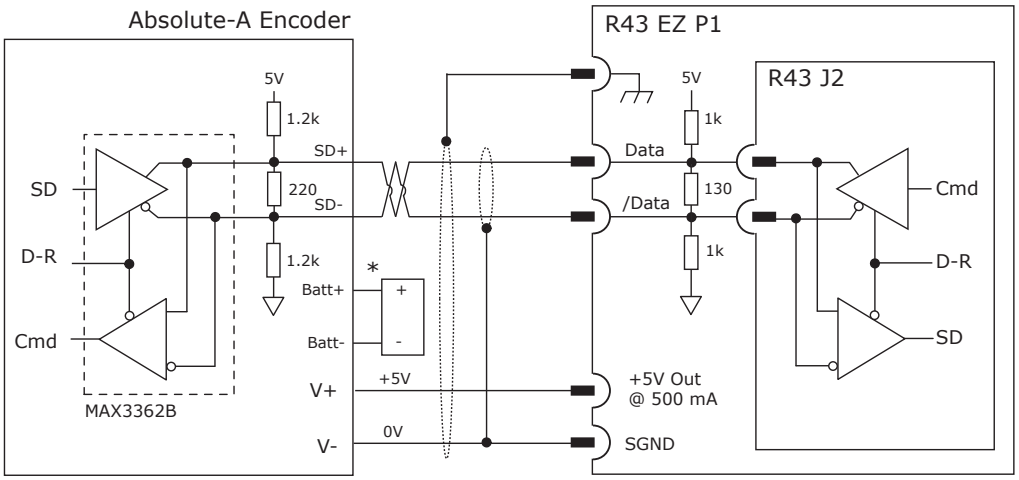
The Absolute A interface is a serial, half-duplex type that is electrically the same as RS-485.

*Note: In the following diagram, the asterisk indicates a battery is required for the multi-turn absolute position. If the feedback is battery-free or single-turn absolute, a battery is not required.

ABSOLUTE-A SIGNALS

ABS-A	Signal	J2 Pins
Data	ENCA1	13
/Data	/ENCA1	12
+5V	+5VENC	6, 17

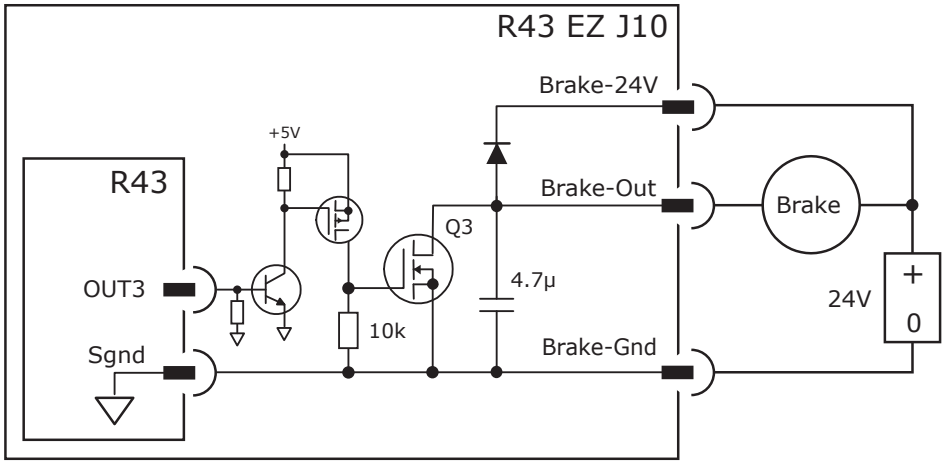
- Absolute A
- Tamagawa Absolute A
- Panasonic Absolute A Format
- Sanyo Denki Absolute A



EZ BOARD BRAKE OUTPUT

The brake circuit on the EZ board is MOSFET driven by OUT3 of the R43.

- 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.

J10 BRAKE SIGNALS

Pin	Brake	Signal
1	Brake-24V	+24V_IN
2	Brake-Out	BRAKE
3	Brake-Gnd	24V_GND_IN

Note: The EZ brake circuit is referenced to SGND in the R43.

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.

WARNING	***Refer to the AN136 Accelnet External Regen Application Note, Part Number 16-125661.***
	Vlogic +9~60. 24V power is recommended. If using a 24V Brake, 24V is required. If common to HV do not exceed 60V, use REGEN protection and diode isolation from HV.

EZ BOARD CONNECTORS

P1 ENCODER 1

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

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

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

J10 BRAKE

Pin	EZ Board
3	HVCOM
2	Brake output
1	+24V Input

J8 V-LOGIC

Pin	EZ Board
1	VLOGIC
2	SGND

J15 DC-POWER

Pin	EZ Board
2	+HV
1	HV COM

J16 MOTOR

Pin	EZ Board
3	Mot W
2	Mot V
1	Mot U

J14 GROUNDS

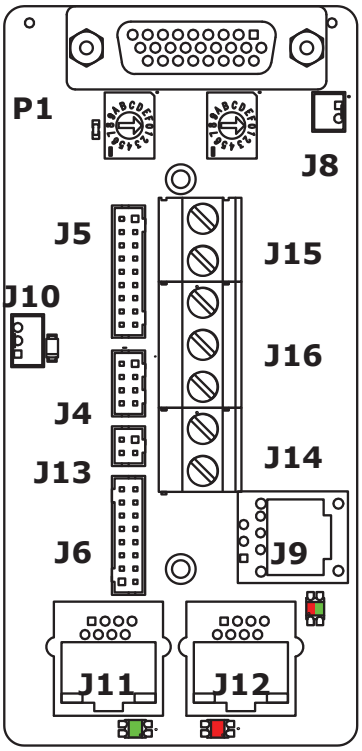
Pin	EZ Board
2	FGND
1	PE

J9 RS-232

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

J5 I/O

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



J4 ENCODER 2

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

J13

EZ Board	Pin		EZ Board
***	2	1	***
***	4	3	***

J6 STO

EZ Board	Pin		EZ Board
IN1	15	16	+5VENC
SGND	13	14	FGND
N.C.	11	12	N.C.
STO2_RTN	9	10	STO2_IN
STO2_RTN	7	8	STO2_24V_IN
N.C.	5	6	N.C.
STO1_RTN	3	4	STO1_IN
STO1_RTN	1	2	STO1_24V_IN

Notes:

In the tables, the asterisks refer to the following notes:

*Note 1:

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

**Note 2:

This input can be programmed for other functions by removing the resistor R43 that connects the input to the encoder 1 fault-detection circuit.

***Note 3:

No connections.

J11 CAN-IN

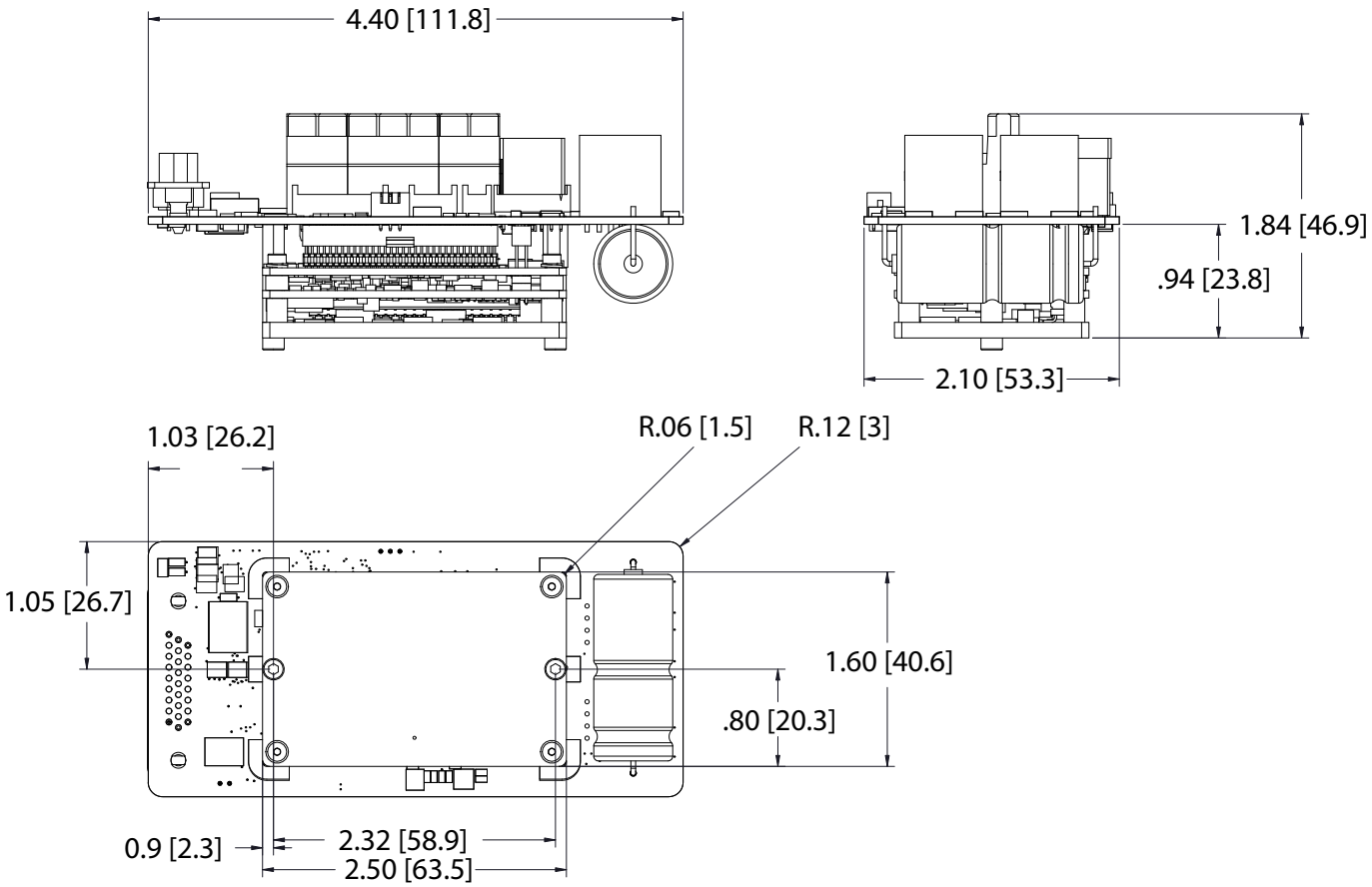
Pin	EZ Board
1	CANH
2	CANL
3	CANGND
4	Pass-thru
5	Pass-thru
6	Pass-thru
7	CANGND
8	Pass-thru

J12 CAN-OUT

Pin	EZ Board
1	CANH
2	CANL
3	CANGND
4	Pass-thru
5	Pass-thru
6	Pass-thru
7	CANGND
8	Pass-thru

EZ BOARD DIMENSIONS

The following diagrams show the dimensions for an R43 drive socketed into an EZ Board.



EZ Board Dimensions Diagram

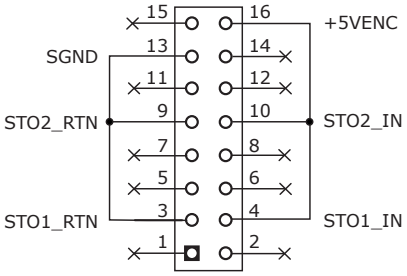
R43-EZ-STO SAFE TORQUE OFF DISABLING ACCESSORY

The R43-EZ-STO, when inserted into J6, will disable the STO function, allowing normal operation of the R43 drive when the STO function is not required.

In the diagram below, it shows the STO inputs energized in parallel using the encoder +5V from the drive. The R43-EZ-STO is used on the EZ Board.

R43-EZ-STO Board

Signal	Pin		Signal
IN1	15	16	+5V ENC
SGND	13	14	FGND
N.C.	11	12	N.C.
STO-IN2(-)	9	10	STO-IN2(+)
STO-IN2(-)	7	8	STO-IN2(+) 24V
N.C.	5	6	N.C.
STO-IN1(-)	3	4	STO-IN1(+)
STO-IN1(-)	1	2	STO-IN1(+) 24V



R43-EZ-STO

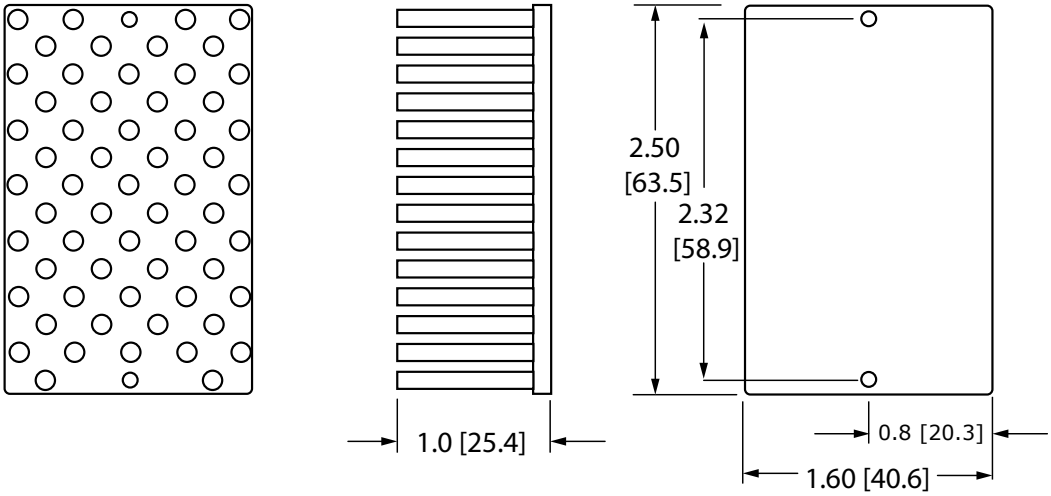
J6 STO Signals

Signal	Pin		Signal
IN1	15	16	+5V ENC
SGND	13	14	FGND
N.C.	11	12	N.C.
STO2_RTN	9	10	STO2_IN
STO2_RTN	7	8	STO2_24V_IN
N.C.	5	6	N.C.
STO1_RTN	3	4	STO1_IN
STO1_RTN	1	2	STO1_24V_IN

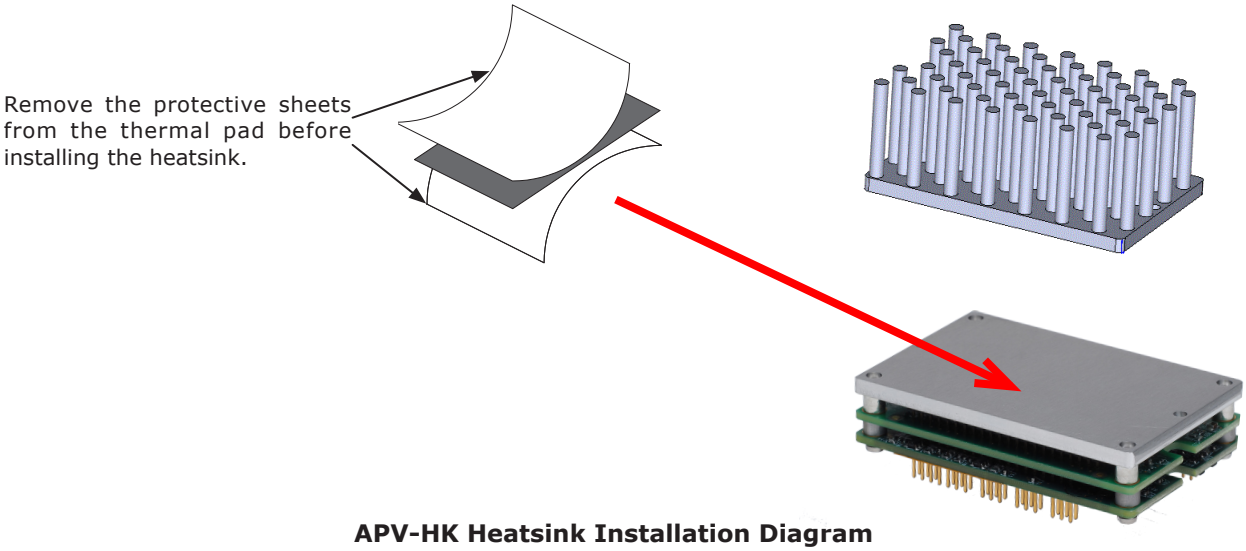
APV-HK HEATSINK KIT (DIMENSIONS, MOUNTING & PARTS)

APV-HK HEATSINK KIT

The APV-HK Kit contains a heatsink, thermal material, and hardware to mount it to the drive and the PC board.



APV-HK Heatsink Dimensions Diagram



APV-HK Heatsink Installation Diagram

APV-HK Pins Heatsink Kit

Qty	Description
1	Pins Heatsink, 1 inch tall
1	Thermal material
2	Copley non-threaded spacer, 20.5 mm
2	Screw, M2.5-0.45 x 35 mm slotted drive cheese head
2	Nut, M2.5x0.45 DIN Zinc Plated Nylon Insert Lock

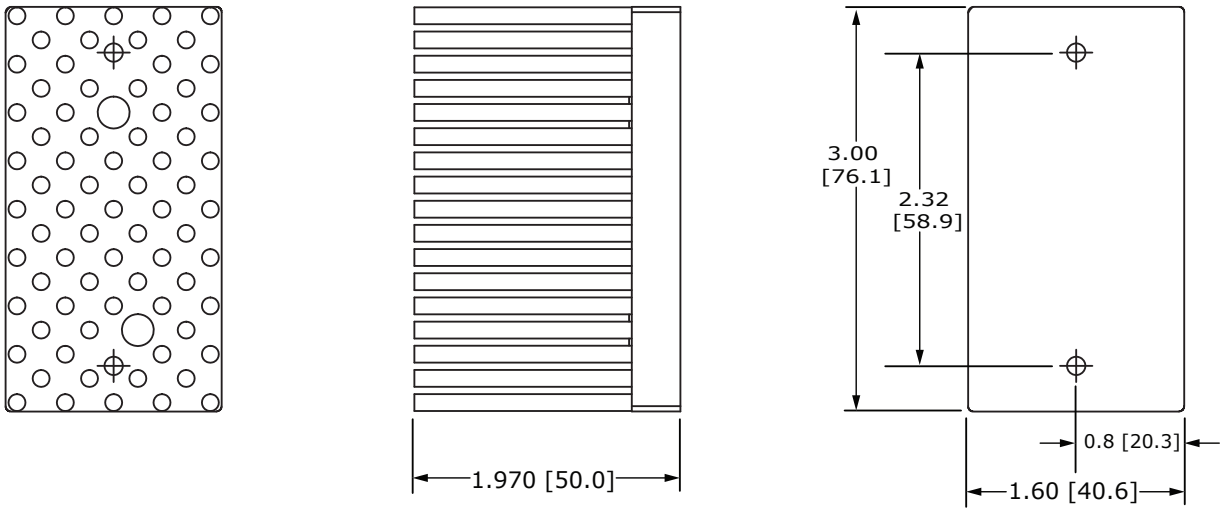
Note: Use the spacers and screws in the kit for socketed or half-socketed mounting.

For a soldered mounting, use 15 mm spacers and the screw length depends on the mounting board. These spacers and screws are supplied by the user.

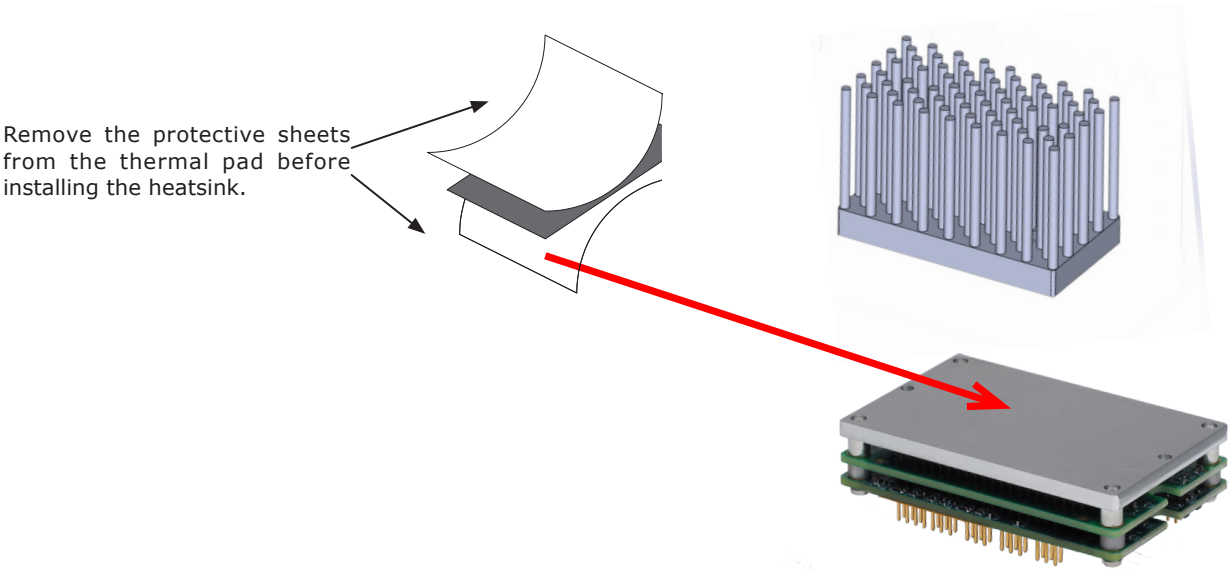
APV-THK HEATSINK KIT (DIMENSIONS, MOUNTING & PARTS)

APV-THK HEATSINK KIT

The APV-THK Kit contains a heatsink, thermal material, and hardware to mount it to the drive and the PC board.



APV-THK Heatsink Dimensions Diagram



APV-THK Heatsink Installation Diagram

APV-THK Tall Pins Heatsink Kit

Qty	Description
1	Tall Pins Heatsink, 1.97 inch tall
1	Thermal material
2	Copley non-threaded spacer, 20.5 mm
2	Screw, M2.5-0.45 x 40 mm slotted drive cheese head
2	Nut, M2.5x0.45 DIN Zinc Plated Nylon Insert Lock

Note: Use the spacers and screws in the kit for socketed or half-socketed mounting.

For a soldered mounting, use 15 mm spacers and the screw length depends on the mounting board. These spacers and screws are supplied by the user.

ORDERING GUIDE

MICRO MODULES

Part Number	Description
R43-090-14	Accelnet Plus Micro Module R43 servo drive, 7/14 A, 90 Vdc
R43-090-30	Accelnet Plus Micro Module R43 servo drive, 15/30 A, 90 Vdc
R43-090-50	Accelnet Plus Micro Module R43 servo drive, 25/50 A, 90 Vdc
R43-090-50-C	Accelnet Plus Micro Module R43 servo drive 50/50 A, 90 Vdc
R43-180-10	Accelnet Plus Micro Module R43 servo drive, 5/10 A, 180 Vdc
R43-180-20	Accelnet Plus Micro Module R43 servo drive, 10/20 A, 180 Vdc

ACCESSORIES FOR MICRO MODULES

Part Number	Description
R43-EZ-090	EZ Board (Pluggable for 90V R43 modules, Not compatible with R43-090-50 or R43-090-50-C)
R43-EZ-180	EZ Board (Pluggable for 180V R43 modules)
APV-EZ-CK	EZ Board Connector Kit (see below)
APV-HK	Heatsink Kit, Accelnet Plus Micro Module (Pins heatsink, thermal pad, and hardware)
APV-THK	Tall Heatsink Kit, Accelnet Plus Micro Module (Tall Pins heatsink, thermal pad, and hardware)
SER-USB-RJ11	Serial Interface Cable: USB to RJ11

ORDERING GUIDE: EZ BOARD CONNECTOR KIT WITH SHELLS AND CRIMP SOCKETS

CONNECTOR KIT FOR EZ BOARD AND EZ DEVELOPMENT BOARD

	QTY	REF	NAME	DESCRIPTION	MFGR/PART NUMBER
R43-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, 16 pos	Hirose: DF11-16DS-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: DF11-2428-SCFA
	5	J8,J10	Crimp socket, 24~28 AWG, gold		Hirose: DF3-2428-SCC
	15	J4,J5,J6	White Flying Lead with contacts at both ends, 26 AWG, gold, 12"		Hirose: H3BBG-10112-W6
	2		Red Flying Lead with socket at both ends, 26 AWG, gold, 12"		Hirose: H3BBG-10112-R6
	3		Black Flying Lead with socket at both ends, 26 AWG, gold, 12"		Hirose: H3BBG-10112-B6
	1	J8,J10	Blue Flying Lead with socket at both ends, 26 AWG, gold, 12"		Hirose: H2BBG-10112-L6
	1		Red Flying Lead with socket at both ends, 26 AWG, gold, 12"		Hirose: H2BBG-10112-R6
	1		Black Flying Lead with socket 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	R43-EZ-STO	EZ board plug-in to J6 for disabling STO function	

Note: Specifications subject to change without notice.

16-127023 Document Revision History

Revision	Date	Remarks
00	May 6, 2020	First release
AA	May 25, 2021	Delete accessories, add reference to R43 datasheet. Pre-production revision - Changed revision to pre-production naming convention.
AB	October 27, 2021	Added warning notifications for overvoltage in several sections, and updated conformance section with RoHS message. Updated heatsink information to remove references to R43-HK and R43-THK and replace with APV-HK and APV-THK.
AC	April 14, 2023	Updated R43 Datasheet to include EZ board information.
01	January 15, 2024	Release to Production version.