Integrated Servo Drive IEL-060-15

GENERAL SPECIFICATIONS

Advanced Feature Set
- 32-bit floating point filters
- Multiple advanced filters
- Frequency analysis tools

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

Command Interface
- EtherCAT
- ASCII, Serial Binary, and discrete I/O
- Stepper or Quad A/B position commands
- PWM Velocity-Torque command
- Master encoder (Gearing, Camming)
- ±10 V Position-Velocity-Torque

Communications
- EtherCAT
- RS-232

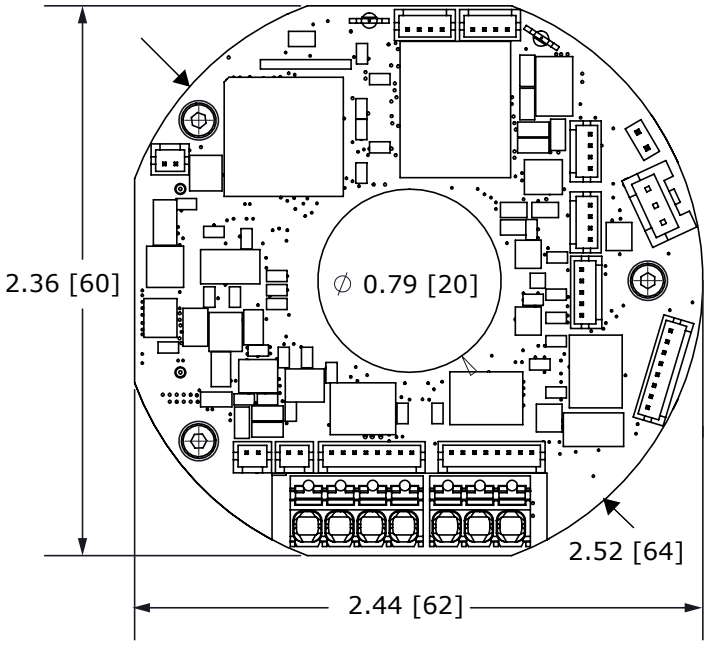
Feedback
- Primary Absolute
  BiSS-C Unidirectional
  SSI Absolute or Incremental
- Primary & Secondary Incremental
  Digital Quad A/B/X
- Digital Halls

I/O
- 2 Digital high-speed input
- 1 Analog motor overtemp input
- 1 Analog motor overtemp PT1000 input
- 1 Analog differential input
- 1 Digital PWM brake output
- 1 Digital general purpose output

Dimensions
- 60 x 62 x 22.78 [2.36 x 2.44 x 0.90] mm [in]
  Center cutout diameter 20 [0.79] mm [in]
  Outer diameter 64 [2.52] mm [in]

Actual Size

Model	Ic	Ip	Unit	Vdc
IEL-060-15	7.5	15	Adc	14~60 Vdc



Description
IEL-060-15 is a miniature dual-board servo drive designed for mounting on motors or in robotic joints. A large cutout in the center allows power, network, and other device cables to pass through.

WARNING	INSTALLATION
	This drive can only be installed by trained personnel

GENERAL SPECIFICATIONS

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

MODEL	IEL-060-15	
OUTPUT POWER		
Peak Current	15 (10.6)	Adc (Arms, sinusoidal)
Peak time	1	Sec
Continuous current	7.5 (5.3)	Adc (Arms, sinusoidal)
INPUT POWER		
HVmin to HVmax	+14 to +60	Vdc, transformer-isolated
Ipeak	15 (10.6)	Adc (1 sec) peak (Arms)
Icont	7.5 (5.3)	Adc continuous (Arms)
HV input power	2 W with no encoder and disabled, 6 W with no encoder and max continuous output current	
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	
Current loop update rate	16 kHz (62.5 µs)	
Current sense resolution	12 bits	
Position & Velocity loop update rate	4 kHz (250 µs)	
HV Compensation	Changes in HV do not affect bandwidth	
Minimum load inductance	100 µH line-line	
COMMAND INPUT		
EtherCAT:	CANopen application protocol over EtherCAT (CoE): Cyclic Synchronous Position/Velocity/Torque Profile Position/Velocity/Torque, Interpolated Position (PVT), Homing	
Stand-alone mode		
Digital position reference	Pulse/Direction, CW/CCW	Stepper commands (2 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	LVTTL, 9600~115,200 Baud, 3-wire, RxD, TxD, GND	
DIGITAL INPUTS		
Number	2	
IN1, IN2	High-speed Schmitt trigger with 100 ns RC filter, 10 kΩ pull-up to +5 Vdc, maximum input voltage = +12 Vdc RC time-constants assume active drive on inputs and do not include 10 kΩ pull-ups.	
ANALOG INPUTS		
Number	2	
AIN1	Motor temperature	4.99 kΩ pull-up to +5V, overtemp threshold programmable from CME
AIN2	General purpose	Differential, ±5 Vdc, 5.05 kΩ input impedance, ±10 Vdc range Sample-rate 4 kHz, 12 bits
DIGITAL OUTPUTS		
Number	2	
OUT1	MOSFET open drain, 1 kΩ pullup to +5V, functions programmable	
OUT2	Brake, MOSFET open-drain with flyback diode to +HV, programmable for other functions Rated voltage, holding voltage, delay to holding voltage, and PWM frequency programmable	
SERIAL COMMUNICATION PORT		
Signals	RxD, TxD, GND, TTL levels	
Mode	Full-duplex, DTE serial communication port for drive setup and control, 9,600~115,200 Baud	
Protocol	ASCII or Binary format	
Isolation	Non-isolated. Referenced to Signal Ground	
ETHERCAT PORT		
Format	100BASE-TX	
Signals	RX1+, RX1-, TX1+, TX1-, RX2+, RX2-, TX2+, TX2-, non-isolated, referenced to signal ground	
Protocol	EtherCAT, CANopen Application Protocol over EtherCAT (CoE)	
Isolation	Internal magnetics. Max voltage with respect to grounds: 32 Vdc	
DC POWER OUTPUT		
+5 Vdc	250 mA maximum, shared by dual encoders. Protected for overload or shorts	
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: 100 µH line-line	
Encoders	2 inputs. See FEEDBACK on p. 8	
Halls	U,V,W. See FEEDBACK on p. 8	
Motemp	AIN1 analog input is programmable to disable the drive if motor sensor voltage is greater or less than a programmed value	
INDICATORS		
EtherCAT	RUN: Green, shows the state of the EtherCAT State Machine ERR: Red, shows that an error condition exists L/A: Green, shows the state of the network on each port	
AMP	Status: Green shows the drive status, Red shows fault condition. Bicolor LEDs operate independently	

GENERAL SPECIFICATIONS

FEEDBACK		
Absolute encoder:		
BiSS (B&C) Unidirectional	MA+, MA- (X, /X), SL+, SL- (A, /A) signals, clock output from drive, data returned from encoder.	
SSI	Clk, /Clk, (X, /X), Data, /Data (A, /A) signals, clock output from drive, data returned from encoder Encoder data inputs and clock outputs are differential with internal 121 Ω terminators	
Incremental encoder:		
Quadrature A/B/X	A, B, X: single-ended (X Index signal not required) Schmitt trigger, 100 ns RC filter, 5 Vdc compatible, 10 kΩ pull-up to +5 Vdc 5 MHz maximum line frequency (20 M counts/sec)	
Digital Halls:		
	U, V, W: Single-ended, 120° electrical phase difference between U-V-W signals Schmitt trigger, 1 µs RC filter from active HI/LO sources, 24 Vdc compatible, 1.5 kΩ pull-up to +5 Vdc Vt+ = 2.5~3.5 Vdc, VT- = 1.3~2.2 Vdc, VH = 0.7~1.5 Vdc	
Encoder power	+5 Vdc ±2% @ 250 mAdc max, shared by dual encoders	
PROTECTIONS		
HV Overvoltage	+HV > +62 ±1 Vdc	Drive outputs turn off until +HV is < +62 ±1 Vdc
HV Undervoltage	+HV < +14 ±1 Vdc	Drive outputs turn off until +HV > +14 Vdc ±0.5 Vdc
Drive over temperature	PC Board > 95 ±3 ºC	Programmable as latching or temporary fault
Short circuits	Output to output, output to ground, output to +HV, internal PWM bridge faults Regen+ to GND, or regen- to +HV	
I^2T Current limiting	Programmable: continuous current, peak current, peak time for drive and motor	
Latching / Non-Latching	Programmable response to errors	
Motor Overtemperature	AIN1 has two programmable thresholds. The first one triggers an overtemp warning and the second one disables the drive. Expected thresholds are 100~200 ºC	
Loss of Feedback (BiSS encoders)	The PWM outputs are disabled until the feedback is restored. Selectable as either latching or non-latching	
MECHANICAL & ENVIRONMENTAL		
Size	Shape is round with flats Length & width: 60 x 62 mm (2.36 x 2.44 in) Center hole diameter: 20 mm (0.79 in), outer diameter 64 mm (2.52 in)	
Weight	45g	
Ambient temperature	0 to +70 ºC operating, -40 to +85 ºC storage in occordance to IEC 60068-2-1 and IEC 60068-2-2	
Humidity	0 to 95% RH, non-condensing per IEC 60068-2-78	
Altitude	≤ 2000 m (6,500 ft) per IEC 60068-2-13	
Vibration	2 *g* peak, 10~500 Hz (sine) per IEC 60068-2-6	
Shock	10 *g*, 10 ms, half-sine pulse per IEC 60068-2-27	
Contaminants	Pollution degree 2 per IEC 60664-1	

AGENCY STANDARDS CONFORMANCE

Standards and Directives

Product Safety

Directive 2014/35/EU (Low Voltage)

IEC 61800-5-1

EMC

Directive 2014/30/EU (EMC)

IEC 61800-3

Approvals

UL and cUL recognized component to:

UL 61800-5-1, E522139

IEC 61800-5-1

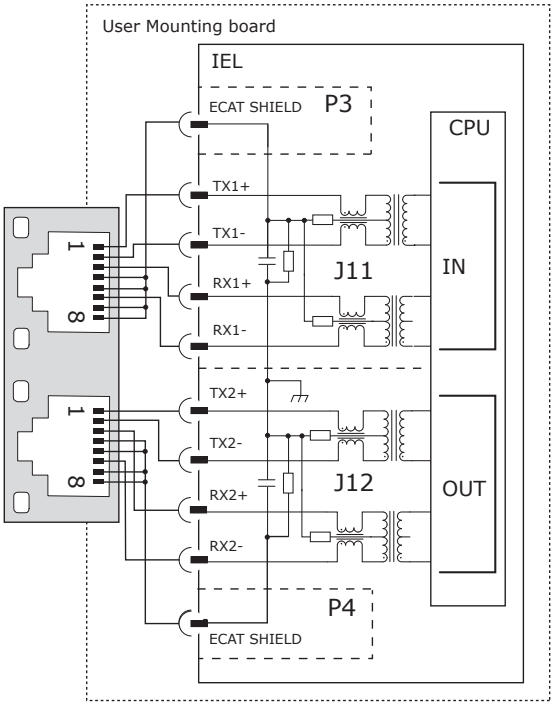
RoHS Directive 2011/65/EU is now part of the CE marking procedure

Restriction of the Use of Certain Hazardous Substances (RoHS)

Directive 2011/65/EU (RoHS II) and its amendments EU Directive 2015/863

ETHERCAT COMMUNICATIONS

EtherCAT is the open, real-time Ethernet network developed by Beckhoff based on the widely used 100BASE-TX cabling system. EtherCAT enables high-speed control of multiple axes while maintaining tight synchronization of clocks in the nodes. Data protocol is CANopen application protocol over EtherCAT (CoE) based on CiA 402 for motion control devices. More information on EtherCAT can be found on this web-site: *http://ethercat.org/default.htm*



The table below shows the standard EtherCAT connections to RJ-45 sockets connected as shown in the graphic.

J11 Signals	Pin	J12 Signals
TX1+	1	TX2+
TX1-	2	TX2-
RX1+	3	RX2+
RX1-	6	RX2-

P3 Signals	Pin	P4 Signals
CHASSIS	1	CHASSIS

AMP LED

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

ECAT LED

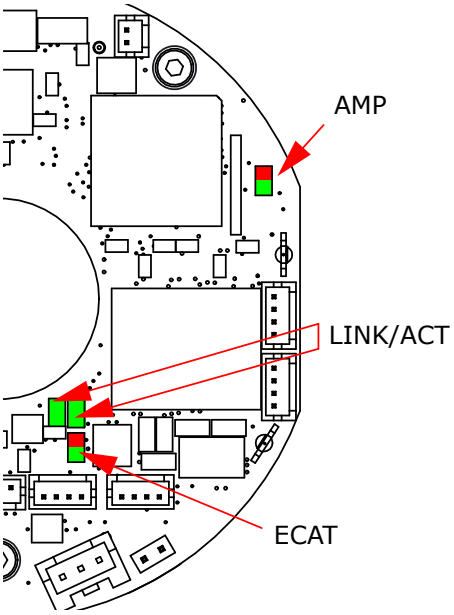
The bi-color STAT LED combines the functions of the RUN and ERR LEDs.
Green and red colors alternate, and each color has a separate meaning:

Green is "RUN" or EtherCAT State Machine:			Red is "ERR" indicator:		
Off	=	INIT	Blinking	=	Invalid configuration
Blinking	=	PRE-OPERATIONAL	Single Flash	=	Unsolicited state change
Single Flash	=	SAFE-OPERATIONAL	Double Flash	=	Application watchdog timeout
On	=	OPERATIONAL			

L/A (LINK/ACT) LED

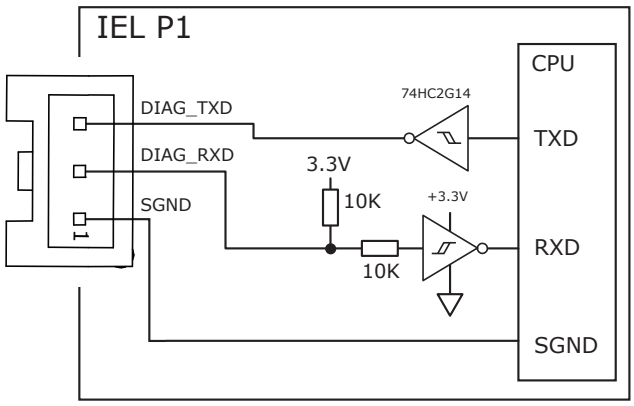
A green LED indicates the state of the EtherCAT network:

LED	Link	Activity	Condition
ON	Yes	No	Port Open
Flickering	Yes	Yes	Port Open with activity
Off	No	(N/A)	Port Closed

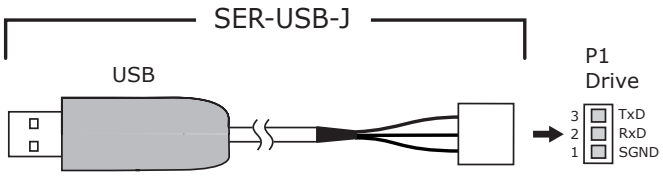


SERIAL COMMUNICATIONS

The serial port is a full-duplex, three-wire (RxD, TxD, SGND) type that operates from 9,600 to 115,200 Baud. It can be used by CME for drive configuration and setup or by external equipment sending ASCII commands.



Signal	P1 Pins
DIAG_TXD	3
DIAG_RXD	2
SGND	1



MOTION COMMAND MODES

Three modes are supported: Position, Velocity, and Torque (Current)
These can be controlled by:

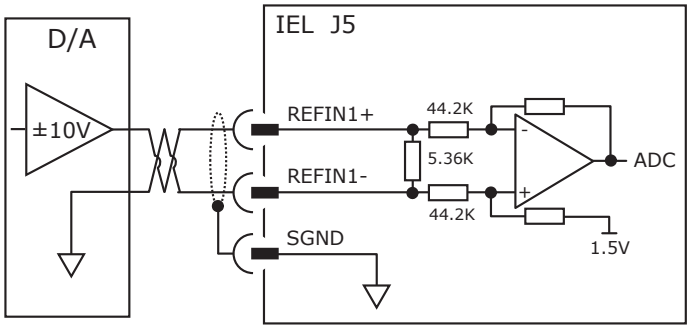
- Analog Command
- Function Generator
- Programmed Position
- EtherCAT Communication

Specifications	Data	Notes
Input Voltage	Vref	±10 Vdc
Input Resistance	Rin	5.05 kΩ
Resolution		12 Bit

ANALOG COMMAND (REFERENCE INPUT)

The analog input has a ±10 Vdc range and 12-bit resolution
The *scaling* of the input is programmable with CME.
Scaling is the number of counts which are in the +10V to -10V range

Signal	J5 Pins
REFIN1+	5
REFIN1-	6



FUNCTION	POS	VEL	CUR
Analog Command	√	√	√
EtherCAT	√	*Not available*	
Function Generator	√	√	√
Software Programmed	√	√	√

FUNCTION GENERATOR

This appears in the block-diagram in CME when the Command Source is Function Generator.
Functions: Sine Wave, Square Wave
Amplitude: Counts
Frequency: Hz (counts/sec)

PROGRAMMED POSITION

This appears in the block-diagram in CME when the Command Source is Software Programmed.
Programmed Command
Move: Relative, Absolute
Type: Trap, S-Curve
Distance: Counts

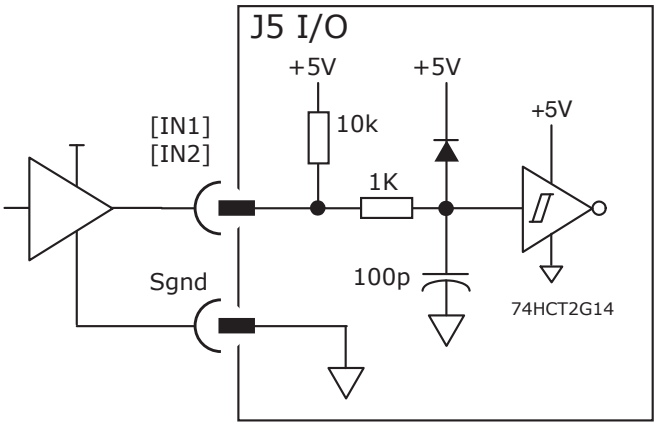
HIGH SPEED INPUTS

IN1 and IN2 are programmable to a selection of functions.
Each has a 100 ns RC filter when driven by active sources (CMOS, TTL, etc) and a 10 kΩ pull-up resistor to +5 Vdc.
In addition to the selection of functions, the active level is 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
- Trajectory Update
- High Speed Position Capture

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

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



Signal	J5 Pins
IN1_ENABLE	1
IN2_ENABLE	2
GND	8

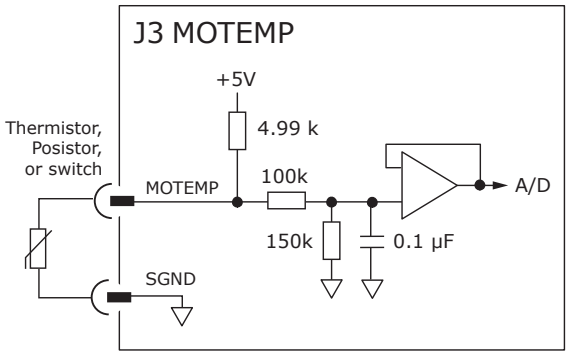
WARNING

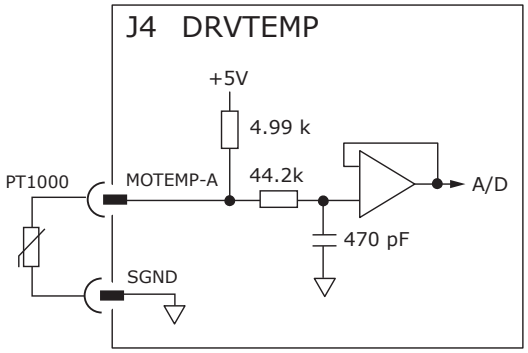
Consult Factory for Adapting 24V logic to 5V logic

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

MOTOR TEMP AND DRIVE TEMP INPUTS

The analog input J3 Motemp, is for use with a motor overtemperature switch or thermistor. The input voltage goes through a low-pass filter to a 12-bit A/D converter. Two thresholds are programmable. The first triggers an overtemp warning at 100 °C, the second will disable the drive at 200 °C. The J4 DRVTEMP is for PT1000 thermistors and disables the PWM outputs when they are 90 °C ±3 °C or greater. CME can select latching or non-latching modes for J4 DRVTEMP.





Signal	J3 Pins
MOTEMP	2
SGND	1

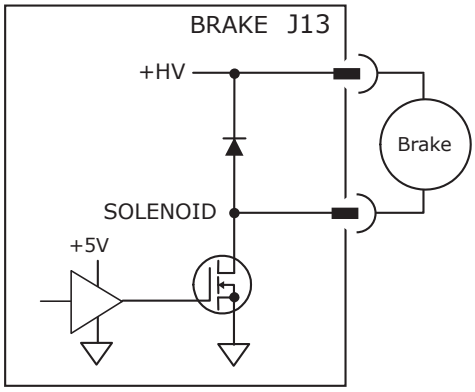
Signal	J4 Pins
DRVTEMP	2
SGND	1

MOTOR BRAKE SOLENOID OUTPUT

A MOSFET with flyback diode drives a brake solenoid powered from +HV which can be up to +60 Vdc. In order to drive brakes at their rated voltage, the output will PWM the +HV at 16 kHz to produce the desired DC voltage for release. When released, the voltage required to hold it is lower than the rated voltage. A programmable delay time will keep the rated voltage applied and then fold back to the holding voltage. Maximum holding current is 1 Adc

Programmable parameters are:

Output Voltage: 24 Vdc is default when +HV ≥24 Vdc. Programmable to voltages ≤ +HV
Hold time delay: 0~<msec> Default is 0 programmable in msec
Hold voltage: Vdc, 1~+HV Default is 24 Vdc. Programmable to voltages ≤ +HV



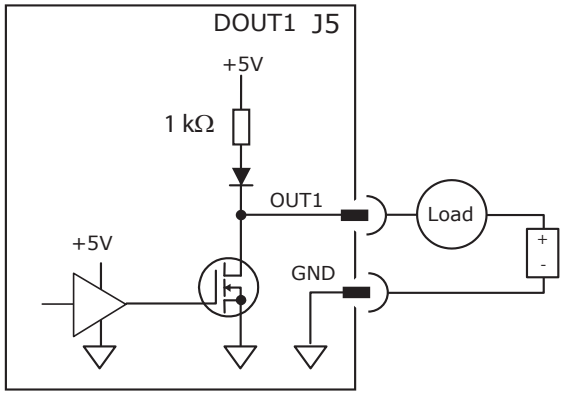
Signal	J13 Pins
+HV	2
SOLENOID	1

GENERAL PURPOSE OUTPUT

Digital output DOUT1 is an open-drain MOSFET with 1 kΩ pull-up resistor to +5V through a diode.
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



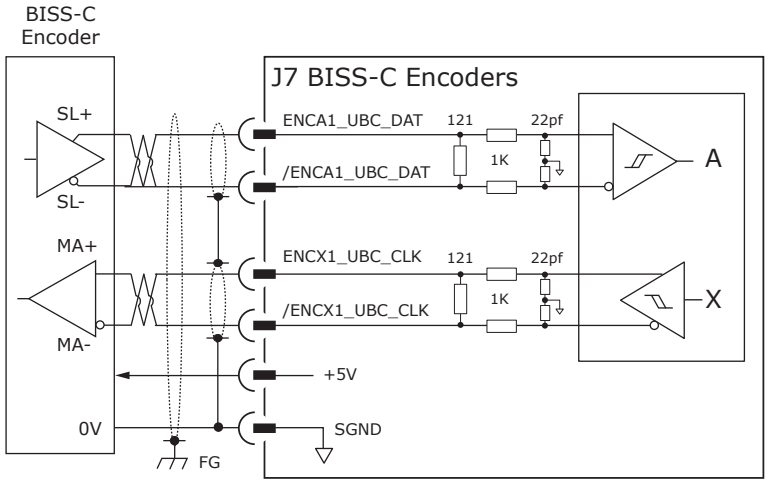
Signal	J5 Pins
DOUT1	3
GND	4

PRIMARY BISS-C 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 up to 64 bit per slave
- 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 C-protocol: Continuous mode

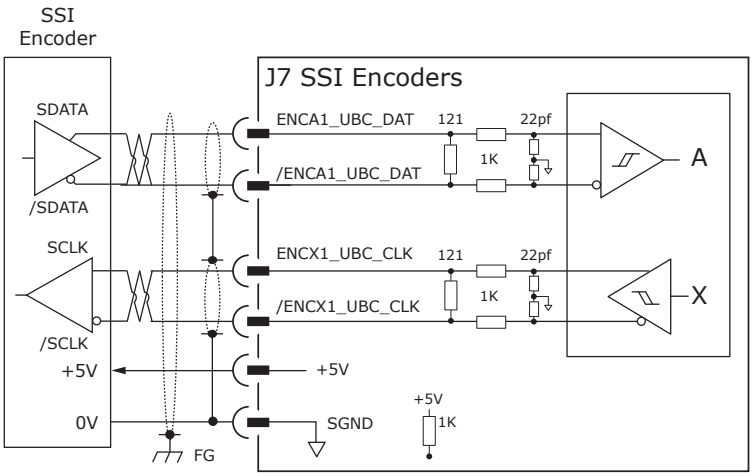
Signal	J7 Pins	BISS-C
SGND	1	SGND
+5V	2	+5V
/ENCA1_UBC_DAT	3	SL-
ENCA1_UBC_DAT	4	SL+
/ENCB1	5	n.c.
ENCB1	6	n.c.
/ENCX1_UBC_CLK	7	MA-
ENCX1_UBC_CLK	8	MA+



PRIMARY 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 IEL 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 clocked-in on the rising edge of the Master.

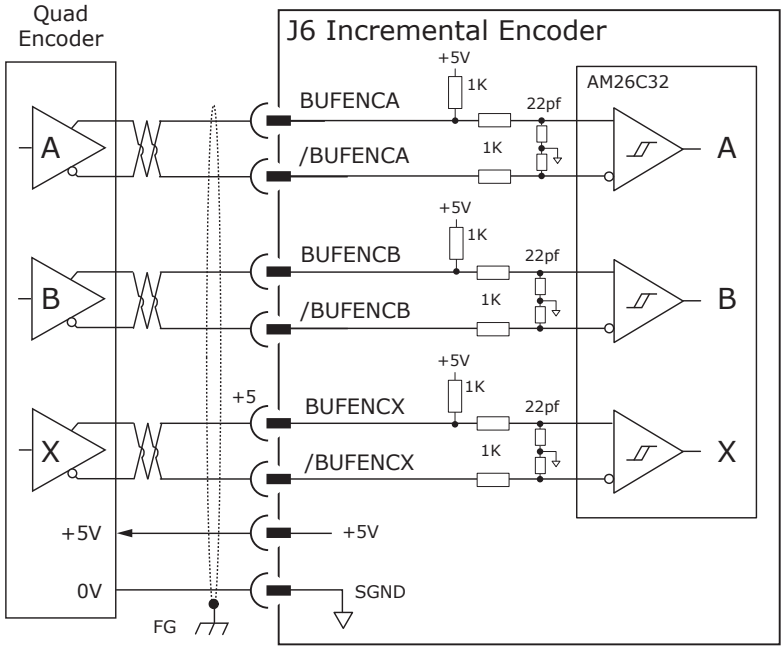
Signal	J7 Pins	SSI
SGND	1	SGND
+5V	2	+5V
/ENCA1_UBC_DAT	3	/SDATA
ENCA1_UBC_DAT	4	SDATA
/ENCB1	5	n.c.
ENCB1	6	n.c.
/ENCX1_UBC_CLK	7	/SCLK
ENCX1_UBC_CLK	8	SCLK



SECONDARY INCREMENTAL ENCODER

Quad A/B/X encoders have two signals that are 90° electrical separated producing four (quad) states of HI/LOW. They are also called *Incremental* because the states change as the motor moves but there is no indication of the absolute location of the motor. The X (index) signal pulses once in a rotation of the motor and is typically used with limit switches.
Driving the motor into a hard stop and coming out to the index pulse produces an absolute position commonly used for 'homing' the motor.

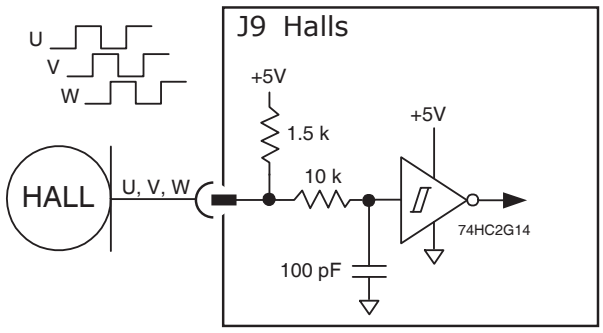
Signal	J6 Pins	QUAD
SGND	1	SGND
+5V	2	+5V
/ENCA1_UBC_DAT	3	/A
ENCA1_UBC_DAT	4	A
/ENCB1	5	/B
ENCB1	6	B
/ENCX1_UBC_CLK	7	/X
ENCX1_UBC_CLK	8	X



HALLS

Hall sensors in a brushless motor produce signals 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.

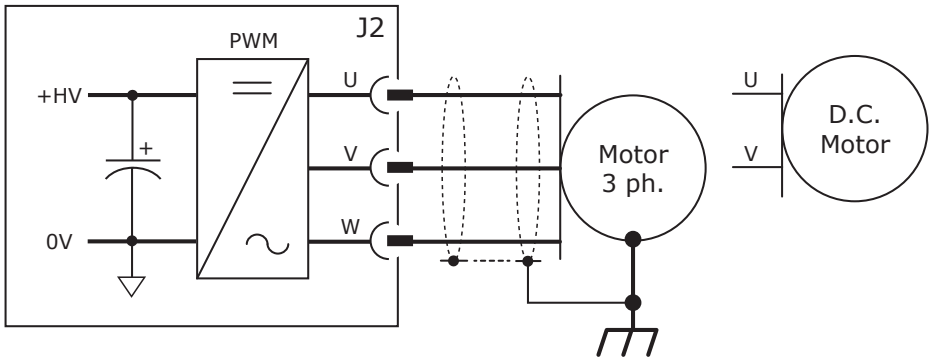
Signal	J9 Pins
HALLU	5
HALLV	4
HALLW	3
+5V	2
SGND	1



MOTOR CONNECTIONS

The drive output is a three-phase PWM inverter that converts the DC bus voltage (+HV) into three sinusoidal voltage waveforms that drive the motor phase-coils. Cable should be sized for the continuous current rating of the motor. Motor cabling should use twisted, shielded conductors for CE compliance, and to minimize PWM noise coupling into other circuits. The motor cable shield should connect motor frame and IEL frame for best results.

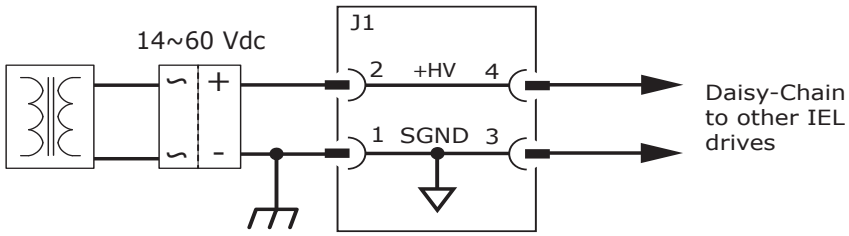
Signal	J2 Pin
Mot U	3
Mot V	2
Mot W	1



DC POWER CONNECTIONS

The power connector has two sets of +HV & GND contacts to facilitate daisy-chain wiring from drive to drive in a robot. These have ratings of 13.5 Adc so this should be considered when daisy-chaining.

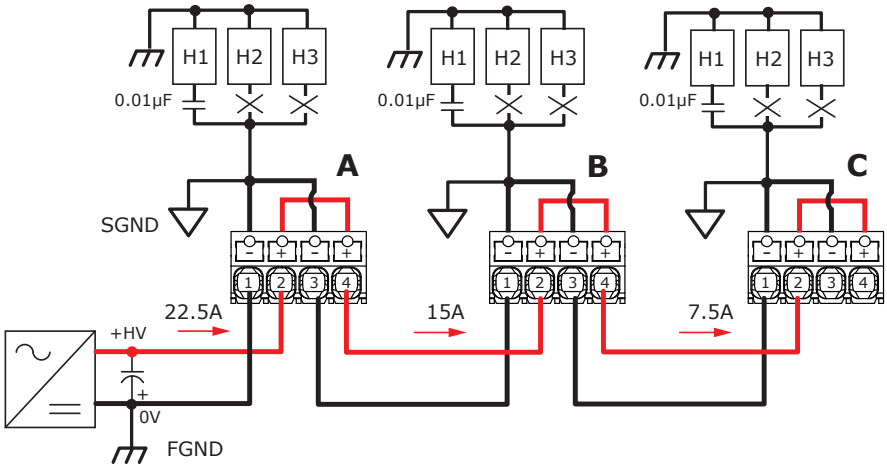
Signal	J1 Pin
+HV	4
SGND	3
+HV	2
SGND	1



WARNING	***Refer to the 16-125661 AN136 Accelnet External Regen Application Note***
	48V power is recommended. Do not exceed 65V.

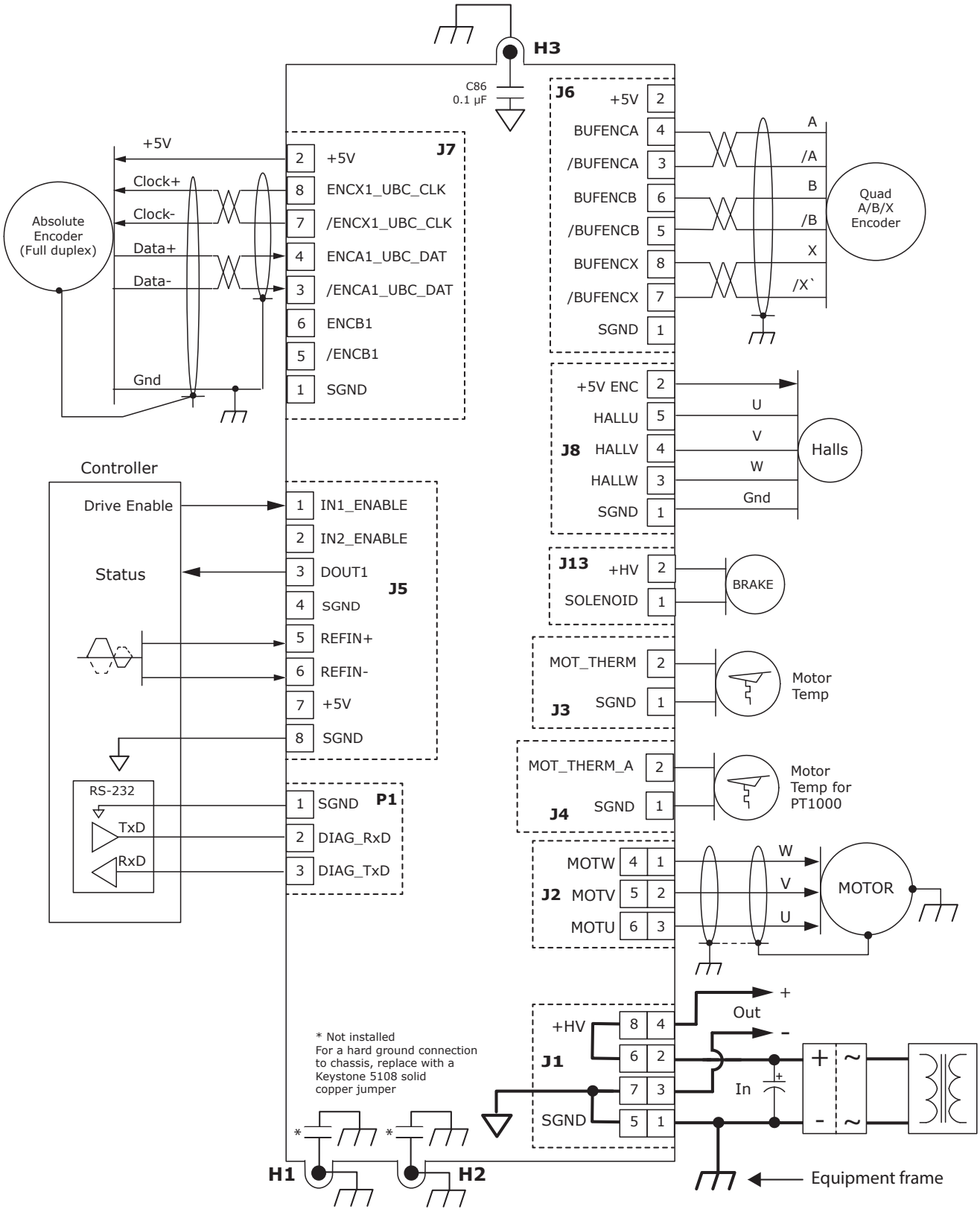
POWER AND GROUNDING

The three standoffs are shown but only one has a capacitor to provide a single-point AC ground. The standoffs are conductive aluminum providing an AC path to Frame Ground (FGND). MultIELe drives are shown as example of daisy-chain wiring of +HV and ground on J1. Note that J1 has a current rating of 13.5 Adc and the drive has a rating of 7.5 Adc. In practice it is not likely that the drives will be operating at their maximum continuous current. But, this should be taken into consideration so as not to damage the J1 connectors. If an installation requires multiple drives on a single drop from the power supply then a 'bus' of wires that can handle the total current should be used with taps for each drive sized for the individual currents.
AWG 13 with a rating of 7.4 A is the smallest wire that take the drive's continuous current. Many applications will use less current.

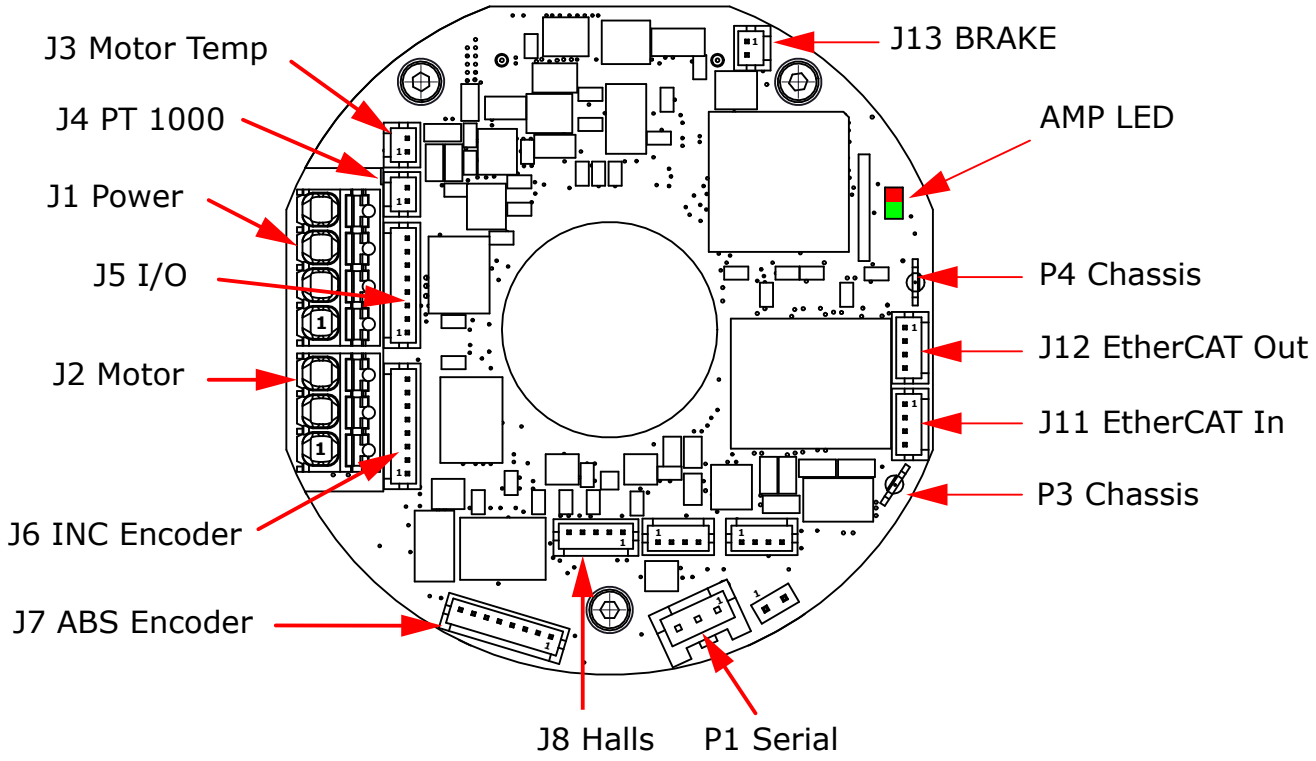


TYPICAL CONNECTIONS

NOTE: The capacitor on H1 can be replaced with a shunt which then connects Signal Ground to the standoff that is in contact with the equipment frame that has earth grounding. When the external power supply (-) is connected to earth near the drive it will provide SGND in all of the connected drives with a common potential.



CONNECTORS



J1: Power

Pin	Signal	Function
4	+HV	Power Output
3	GND	Power Return
2	+HV	Power Input
1	GND	Power Return

Phoenix: 1823214

J2: Motor

Pin	Signal	Function
3	MOT-U	Motor Phase U
2	MOT-V	Motor Phase V
1	MOT-W	Motor Phase W

Phoenix: 1823201

J7: Primary AbsoluteEncoder

Pin	Signal	Function
8	ENCX1_UBC_CLK	Biss C Clock, Incremental X
7	/ENCX1_UBC_CLK	Biss C /Clock, Incremental /X
6	ENCB1	Incremental B
5	/ENCB1	Incremental /B
4	ENCA1_UBC_DAT	Biss C Data, Incremental A
3	/ENCA1_UBC_DAT	Biss C /Data, Incremental /A
2	+5VENC	+5V Encoder Supply
1	GND	+5V Supply Return (0V)

Hirose: DF13-8P-1.25DSA

Notes
J1: Contacts are push-in spring type. Wire size 24~16 AWG, stripping length 8 mm.
Tool: slot-headed screwdriver 0.4 x 2.5 mm (~0.1").
J2: Contacts are push-in spring type. Wire size 24~16 AWG, stripping length 8 mm.
Tool: slot-headed screwdriver 0.6 x 3.5 mm (~1/8")

CONNECTORS

J6: Secondary Incremental Encoder

Pin	Signal	Function
8	BUFENCX	Incremental X (+)
7	/BUFENCX	Incremental X (-)
6	BUFENCB	Incremental B (+)
5	/BUFENCB	Incremental B (-)
4	BUFENCA	Incremental A (+)
3	/BUFENCA	Incremental A (-)
2	+5V	+5V Supply
1	GND	Ground

Hirose: DF13-8P-1.25DSA

J8: Halls

Pin	Signal	Function
1	GND	Signal Ground
2	+5V	+5V Output
3	HALLW	Hall W Input
4	HALLV	Hall V Input
5	HALLU	Hall U Input

Hirose: DF13-5P-1.25DSA

J5: I/O

Pin	Signal	Function
1	IN1_Enable	Digital Input 1
2	IN1_Enable	Digital Input 2
3	DOUT1	Digital Output 1
4	GND	Ground
5	REFIN1+	Analog Input (+)
6	REFIN-	Analog Input (-)
7	+5V	+5V Power output
8	AGND	Analog Ground

Hirose: DF13-8P-1.25DSA

P1: Serial Port

Pin	Signal	Function
1	GND	Signal Ground
2	DIAG_RXD	Serial Input
3	DIAG_TXD	Seral Output

J.S.T: B03B-PASK(LF)(SN)

J11 EtherCAT OUT

Pin	Signal
1	RX2+
2	RX2-
3	TX2+
4	TX2-

J12 EtherCAT IN

Pin	Signal
1	RX1+
2	RX1-
3	TX1+
4	TX1-

Hirose: DF13-4P-1.25DSA

P3: EtherCAT Shield

Pin	Signal	Function
1	Chassis	EtherCAT Drain

TE: 735187-2

P4: EtherCAT Shield

Pin	Signal	Function
1	Chassis	EtherCAT Drain

TE: 735187-2

J13: Brake

Pin	Signal	Function
1	BRAKE	PWM Brake control
2	+HV	Output

Hirose: DF13-2P-1.25DSA

J3: Motor Temp

Signal	J3 Pins
MOTOR_THERMISTOR	2
SGND	1

Hirose: DF13-2P-1.25DSA

J4: PT 1000

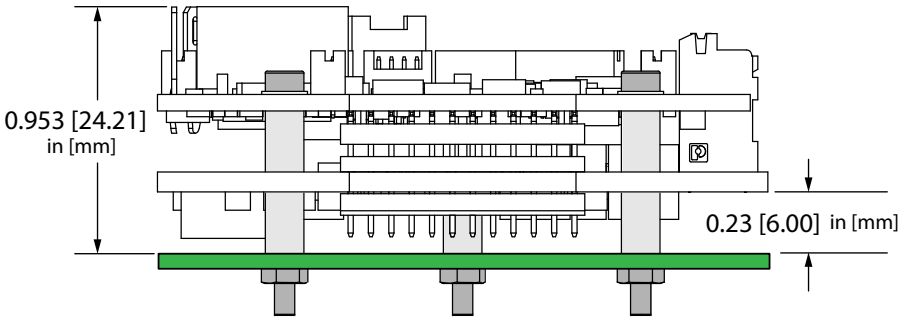
Signal	J4 Pins
MOTOR_THERMISTOR_A	2
SGND	1

Hirose: DF13-2P-1.25DSA

Notes:
Part numbers shown here are on the IEL-060-15.
Hirose parts are single-row headers, 1.25 mm pitch
TE parts are Faston tabs 2.8 mm (.11 in)
Molex part is a single-row header, 2.00 mm pitch
Mating cable connector part numbers are shown on page 16 in the IEL-CK table.

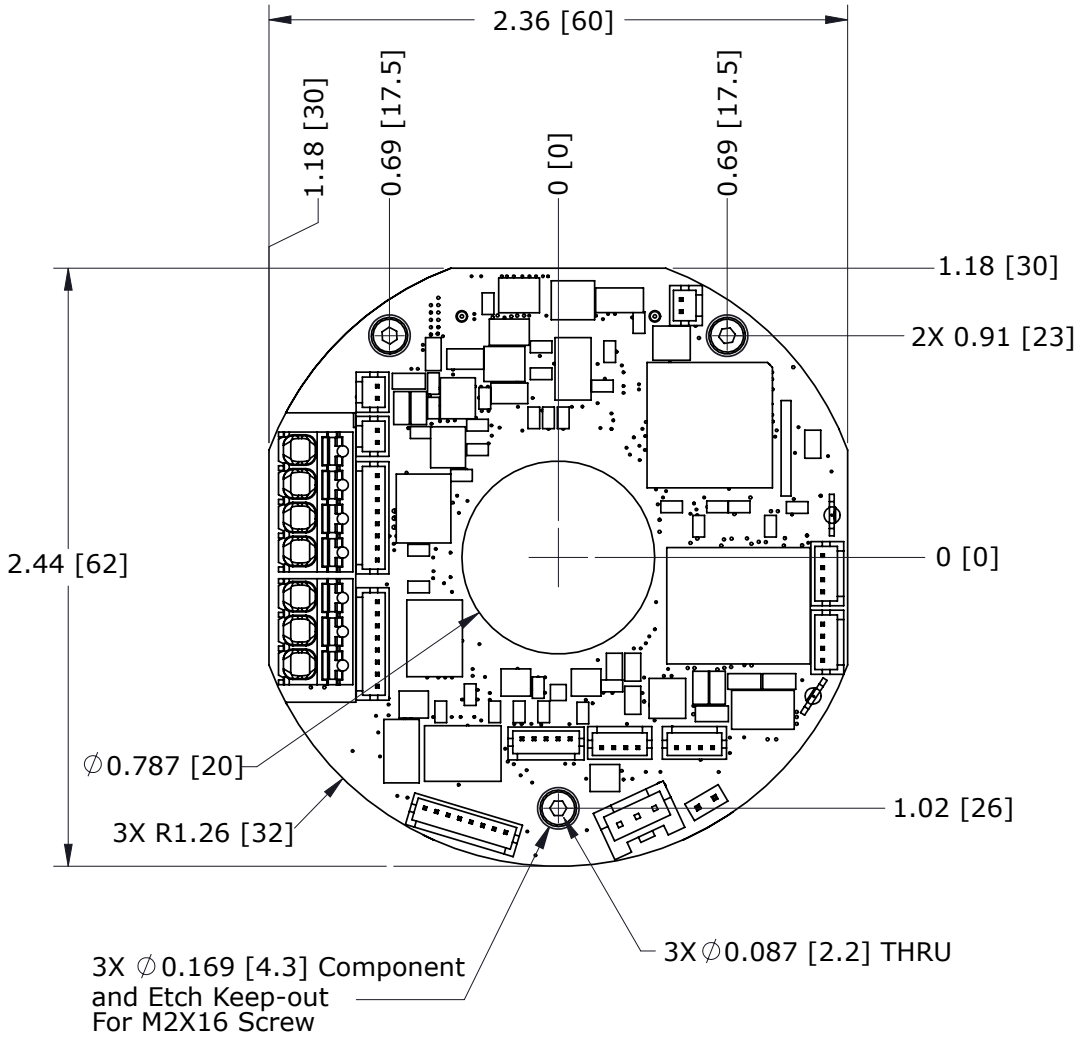
DIMENSIONS IN [MM]

This shows panel mounting of the drive with 6.00 mm spacers.



3X Customer supplied M2X16 Screws and nuts

Top view of drive with dimensions:



THIS PAGE
LEFT BLANK
INTENTIONALLY

ORDERING GUIDE

INTEGRATED SERVO DRIVE

IEL-060-15	Integrated EtherCAT Servo Drive, 15 A, 14~60 V

EtherCAT®

ACCESSORIES

IEL-CK	Connector Kit
SER-USB-J	USB to Serial Cable Kit

ORDERING GUIDE: CONNECTOR KIT WITH SHELLS, CRIMP CONTACTS, & FLYING LEADS

CONNECTOR KIT: IEL-CK

	QTY	REF	NAME	DESCRIPTION	MFGR: PART NUMBER
IEL-CK Connector Kit	1	J1,J2	Motor, Power	Tool	Wago: 106388
	3	J5, J6, J7	I/O,Encoder 1 Abs, Encoder 2 Inc	Connector, socket, single row, 1.25 mm, 8 pos	Hirose: DF13-8S-1.25C
	1	J8	Halls	Connector, socket, single row, 1.25 mm, 5 pos	Hirose: DF13-5S-1.25C
	3	J3, J4, J13	Motor Temp, PT1000, Brake	Connector, socket, single row, 1.25 mm, 2 pos	Hirose: DF13-2S-1.25C
	2	J11,J12	EtherCAT IN,OUT	Connector, socket, single row, 1.25 mm, 4 pos	Hirose: DF13-4S-1.25C
	43	J3, J4, J5, J6 J7, J8, J11, J12, J13	Crimp socket, 26~30 AWG, gold		Hirose: DF13-2630SCFA
	16		White Flying Lead with socket at both ends, 26 AWG, gold, 12”		Hirose: H4BBG-10112-W6
	3		Red Flying Lead with socket at both ends, 26 AWG, gold, 12”		Hirose: H4BBG-10112-R6
	4		Black Flying Lead with socket at both ends, 26 AWG, gold, 12”		Hirose: H4BBG-10112-B6
	1		Blue Flying Lead with socket at both ends, 26 AWG, gold 12”		Hirose: H4BBG-10112-L6
	1	P1	Serial Port	Connector, 3 pin	J.S.T: PAP-03V-S
	3			CONTC SKT CRMP 26-22GA SN	J.S.T: SPHD-001T-P0.5
	2	P3, P4	EtherCAT Shields	Faston, 22~26 AWG	TE: 7-520366-2

16-127915 Document Revision History

Revision	Date	Remarks
00	July, 2 2020	Initial release
01	March, 19 2021	Changed all references from IES to IEL. Changed document name from IES-60-15 to IEL-60-15.
AA	July 23, 2021	Pre-production revision-Changed revision to pre-production naming convention, removed certifications section. Updated graphics on p. 11, added several warnings for overvoltage.
AB	June 8, 2022	Changed Serial Cable reference to SER-USB-J. Added frame grounds to p. 11 Changed P3 & P4 names to Chassis on p. 12

Note: Specifications subject to change without notice