Integrated Servo Drive IPS-060-30

GENERAL SPECIFICATIONS

Advanced Feature Set
- 32-bit Floating Point Filters
- Multiple Advanced Filters
- Frequency Analysis Tools

Control Modes
- Profile Position-Velocity-Torque, Interpolated Position (PVT), Homing
- CVM: Indexer GUI, Programming Language CPL
- Camming, Gearing

Command Interface
- CANopen Application Protocol
- ASCII and Serial Binary
- ±10 V Position/Velocity/Torque Command
- Master Encoder (Gearing/Camming)

Communications
- CANopen
- Serial

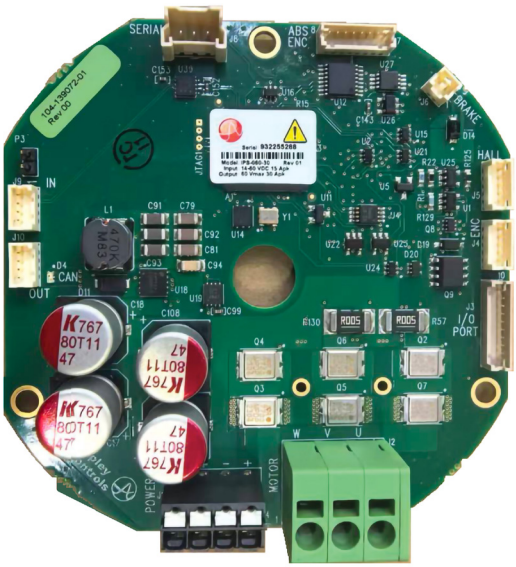
Feedback
Port 1: Differential
- Biss-C Unidirectional, Absolute Clock and Data
- SSI, Copley Serial Resolver

Port 2: Single-ended
- Digital Quad A/B/X

Halls:
- Digital U, V, W

I/O
- 1 Digital High-Speed Input
- 1 Analog Motor Overtemp Input
- 1 Analog Differential Input
- 1 Digital Brake Output
- 1 Digital Buffer Outputs

Dimensions: in [mm]
- 80 x 80 x 20 in [2.5 x 1.6 x .65 mm]
- Center cutout diameter 10 in [0.4 mm]
- Outer diameter 89.4 in [3.52 mm]



IPS-060-30

Model	Ic	Ip	Unit	Vdc
IPS-060-30	15	30	Adc	14~60 Vdc

DESCRIPTION

IPS-060-30 is a single-board servo drive. It is designed for mounting on motors or added in robotic joints.

On the drive, the center cutout is used to pass the power and network cables to the other devices.

WARNING	INSTALLATION REQUIREMENT
	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	IPS-060-30	Units
OUTPUT POWER		
Peak Current	30 (21.2)	Adc (Arms, sinusoidal)
Peak Time	1	Sec
Continuous Current	15 (10.6)	Adc (Arms, sinusoidal)
INPUT POWER		
HVmin to HVmax	+14 to +60	Vdc, transformer-isolated
Ipeak	30	Adc (1 sec) peak
Icont	15	Adc continuous
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 INPUTS		
CANopen:	CANopen Device Profile DS-402	
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	RS232, 9600~115,200 Baud, 3-wire, RxD, TxD, GND	
DIGITAL INPUTS		
Number	1	
IN1	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 the CME software.	
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 pull-up 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 to 115,200 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 402 121 Ω internal shunt can be activated with a 0 Ω jumper on P2.	
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 page 3.	
Halls	U,V,W. See FEEDBACK on page 3.	
Motemp	AIN1 analog input is programmable to disable the drive if the motor sensor voltage is greater or less than a programmed value.	
INDICATORS		
CANopen	D4-shown as CAN	
AMP	Status: Green, shows the drive status. Red, shows the 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 is 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 threshold triggers an overtemp warning and the second threshold 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 square with filleted corners. Length & width: 3.15 in [80 mm], Fillet radius: 1.77 in [45 mm] Center hole diameter: 0.4 in [10 mm], Height: ≤ 0.79 in [20 mm] with no heatsink	
Weight	1.6 oz [45 g]	
Ambient Temperature	Operating:0 to +70 ºC, Storage:-40º to +85 ºC in accordance with Standards IEC 60068-2-1 & 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

In accordance with EC Directive 2014/30/EU (EMC Directive)
IEC 61800-3

Product Safety
Directive 2014/35/EU (Low Voltage)
IEC 61800-5-1

Restriction of the Use of Certain Hazardous Substances (RoHS)
Directive 2011/65/EU (RoHS II)

Approvals
UL 61800-5-1

CE

All of the agency approvals are pending at this time.

CANOPEN COMMUNICATIONS

CAN

CANopen protocol is based on the CAN V2.0b physical layer, which is a robust, two-wire communication bus originally designed for automotive use where low-cost and noise-immunity are essential. CANopen adds support for motion-control devices and command synchronization. The result is a highly effective combination of data-rate and low cost for multi-axis motion control systems. Device synchronization enables multiple axes to coordinate moves as if they were driven from a single control card.

CAN COMMUNICATION

IPS uses the CAN physical layer signals CANH, CANL, and CAN_GND for connection.

It uses CANopen protocol for communication.

CANOPEN COMMAND INPUTS

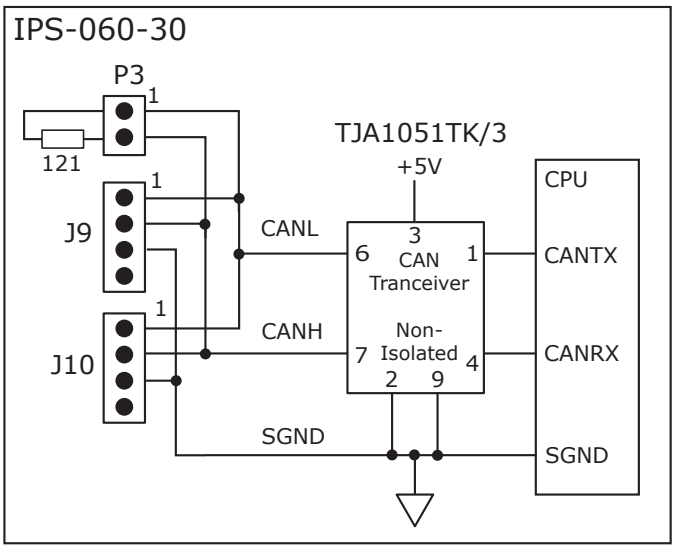
The diagram shows connectors in the IPS. If the IPS is the last node on a CAN bus, the internal terminator resistor can be used by adding a connection on the PC board as shown.

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

J9 and J10 accept the CAN network cables. Either connector can be the IN port. The OUT port connects to 'downstream' nodes. If the IPS is the last node on a network, only the IN port is used. A 121 Ω terminator is required on the OUT port. The CAN master will typically have an internal 121 Ω resistor. If not, it should be provided externally.

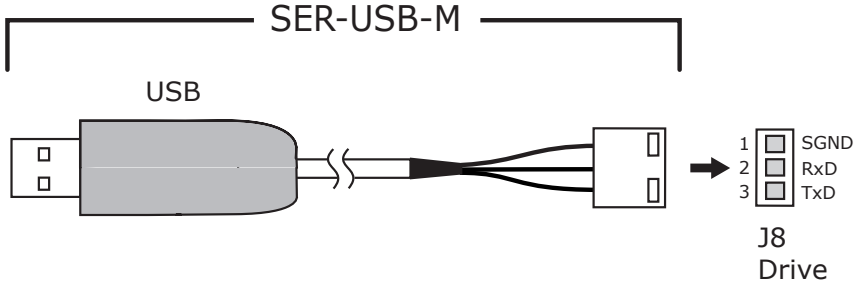
P3 connects to an internal 121 Ω resistor. Inserting a jumper between pins 1 & 2 connects the resistor as a terminator. In a CAN network, terminators are used on both ends to maintain the quality of the waveform.

J9 Signals	Pin	J10 Signals
CANL	1	CANL
CANH	2	CANH
SGND	3	SGND
N.C.	4	N.C.



SERIAL COMMUNICATIONS

Signal	J8 Pins
SGND	1
RxD	2
TxD	3



CANOPEN COMMUNICATIONS

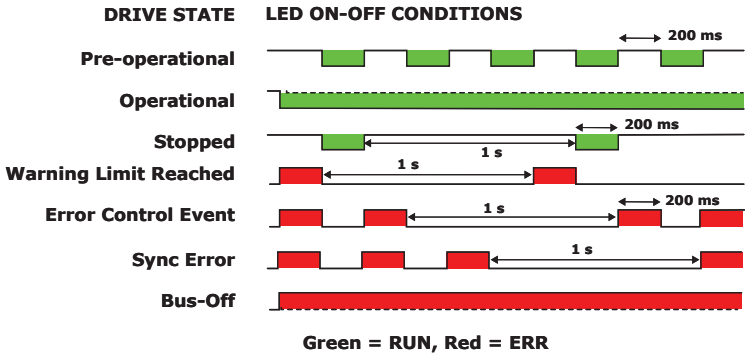
Dual RJ-45 sockets accept standard Ethernet cables. The IN port connects to a master, or to the OUT port of a device that is 'upstream' between the APV and the master.

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

CANOPEN LEDS

RUN - Green: Shows the state CANopen State Machine.	
Off	INIT
Blinking	Pre-operational
Single Flash	Stopped
On	Operational
ERR - Red: The Red LED "ERR" shows the status of the CAN physical layer and errors due to missing messages.	
On	Bus Off
Off	No Error
Single Flash	Warning Limit Reached
Double Flash	Error Control Event
Triple Flash	Sync Error
Note: Red & Green LED on-times do not overlap. The LED color may be Red, Green, Off, or Flashing of either color.	

CAN STATUS LEDS



AMP STATUS LED

A bi-color AMP LED displays the state of the drive. Colors do not alternate, and can be solid On or Blinking.

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

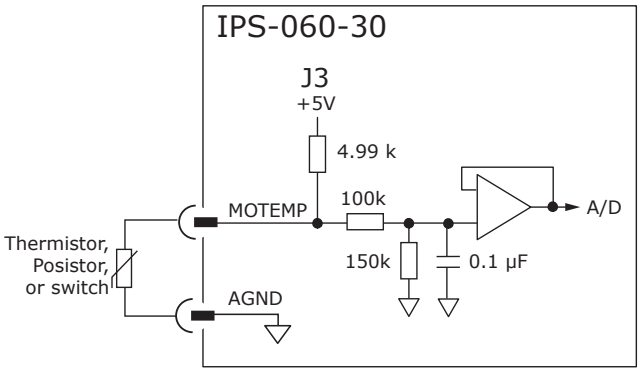
Default	Optional (Programmable)
Short Circuit (Internal or External)	Over-voltage
Drive Over-Temperature	Under-voltage
Motor Over-Temperature	Motor Phasing Error
Feedback Error	Command Input Lost
Following Error	Motor Wiring Disconnected
STO Active	Over Current (latched)

MOTEMP INPUT

The analog input [AIN1] Motemp is used with a motor overtemperature switch or sensor. The input voltage goes through a low-pass filter to a 12-bit A/D converter.

Signal	J3 Pins
MOTEMP	9
SGND	10

The active level of the input, Vset, is programmable to generate an over-temperature fault if the MOTEMP voltage is <Vset, or >Vset depending on the temperature coefficient of the sensor.



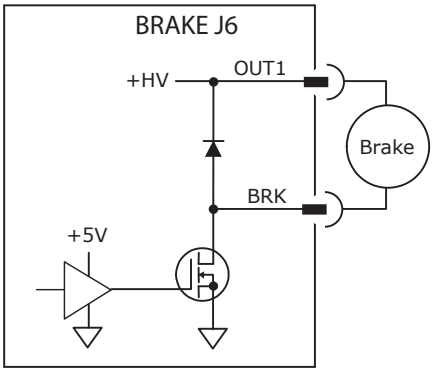
MOTOR BRAKE OUTPUT

A MOSFET with a flyback diode drives a brake powered from +HV. The brake is driven from +HV which can be up to 60 Vdc. 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 it is 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. The following table lists the Programmable parameters.

Parameter	Values	Description
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	J6 Pins
+HV	13
BRAKE	12



DIGITAL OUTPUT

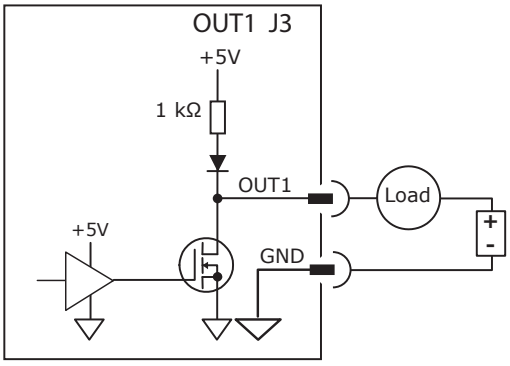
Digital output OUT1 is an open-drain MOSFET with 1 kΩ pull-up resistor to +5V through a diode.

In the diagram, 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	J3 Pins
DOUT1	3
GND	4



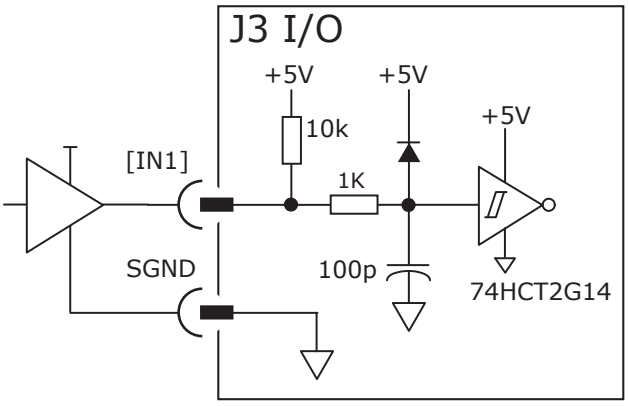
HIGH SPEED INPUT: IN1

IN1 is programmable to a selection of functions.
It 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

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



WARNING	***For information on Adapting 24V logic to 5V logic, consult the Factory.***
	5V logic. Do not exceed 6V. Do not connect a 24V logic to this input.

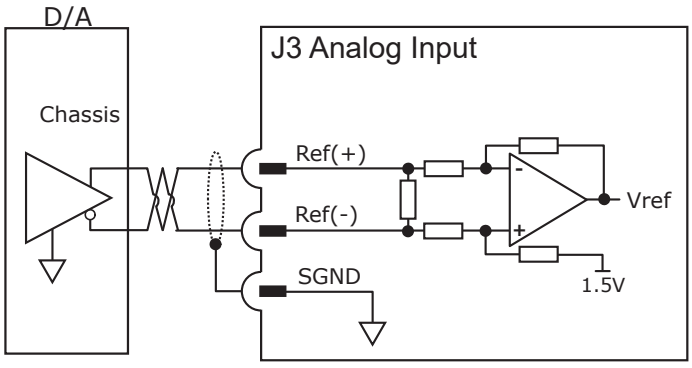
ANALOG INPUT: AIN1

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 a general-purpose analog input.

Specifications	Data	Notes
Input Voltage	Vref	±10 Vdc
Input Resistance	Rin	5 kΩ
Resolution		12 Bit

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

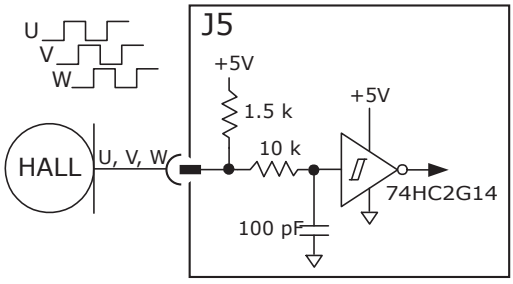


HALLS

Hall sensors in a brushless motor are produced from the magnetic field in the motor. The sensors provide commutation feedback without an encoder.

Input	J5 Pins
Hall U	5
Hall V	4
Hall W	3
+5V	2
SGND	1

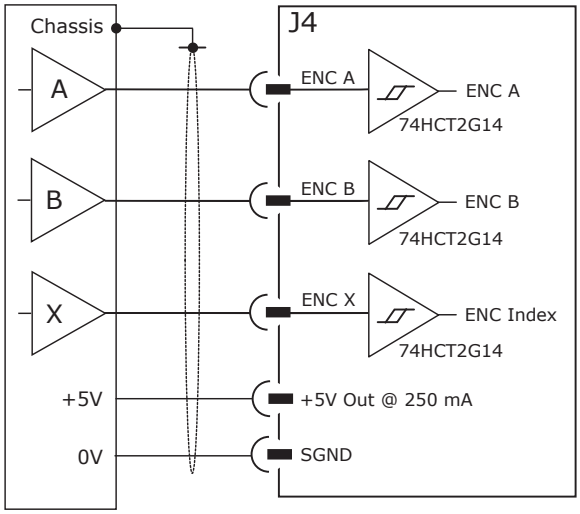
When the sensors are used with the incremental encoders, they enable the motor to operate without a phase-finding cycle.



INCREMENTAL ENCODER

Incremental Encoders have A and B Channels that are used for positioning. In addition, the encoders have an optional X Channel which outputs a pulse once per revolution. The Inputs are single-ended for all channels.

Signal	J4 Pins
ENC A	4
ENC B	3
ENC X	5
+5V	2
SGND	1

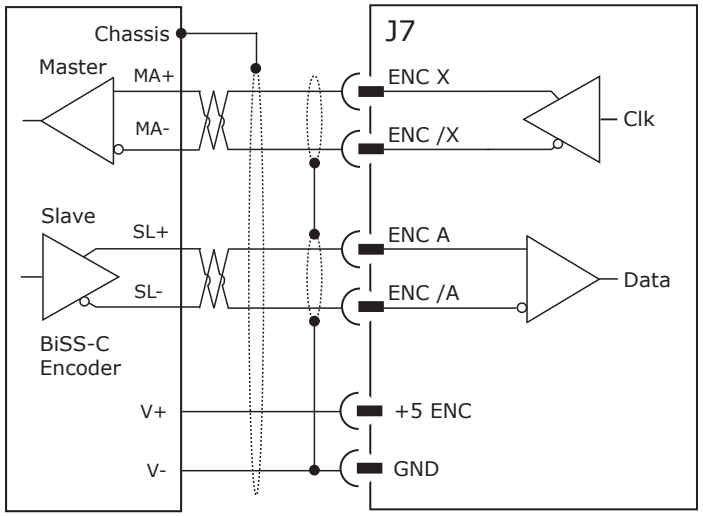


BISS-C ABSOLUTE ENCODER

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 C-protocol: Continuous Mode

Signal	J7 Pins
SL+	4
SL-	3
MA+	8
MA-	7
+5V	2
SGND	1

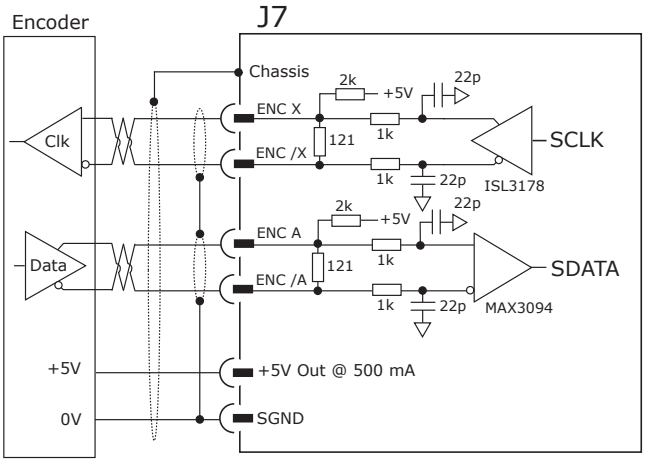


SSI ABSOLUTE ENCODER

The SSI (Synchronous Serial Interface) is an interface used to connect an absolute position encoder to a motion controller or connect to a control system. The IPS drive provides a train of clock signals transmitted 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).

Signal	J7 Pin
Clk	8
/Clk	7
Data	4
/Data	3
+5V	2
GND	1

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.

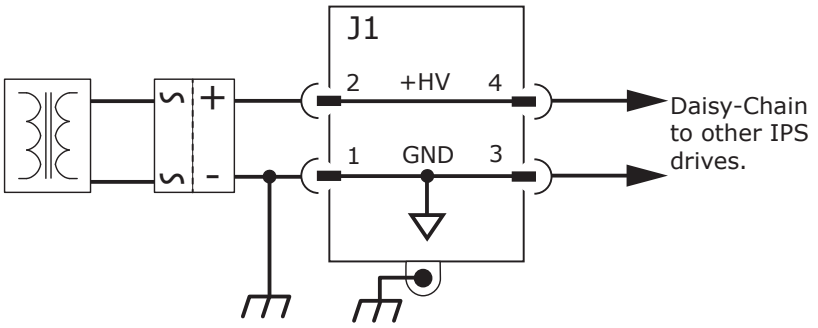


DC POWER CONNECTIONS

The power connector has two sets of +HV & GND contacts to facilitate daisy-chain wiring originating from the drive to another drive in a robot.

J1 Power

Signal	Pin
+HV	2
GND	1
+HV	4
GND	3



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

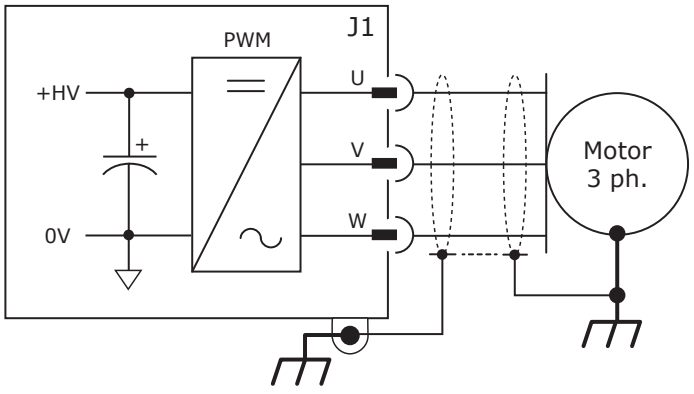
MOTOR CONNECTIONS

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.

J2 Motor

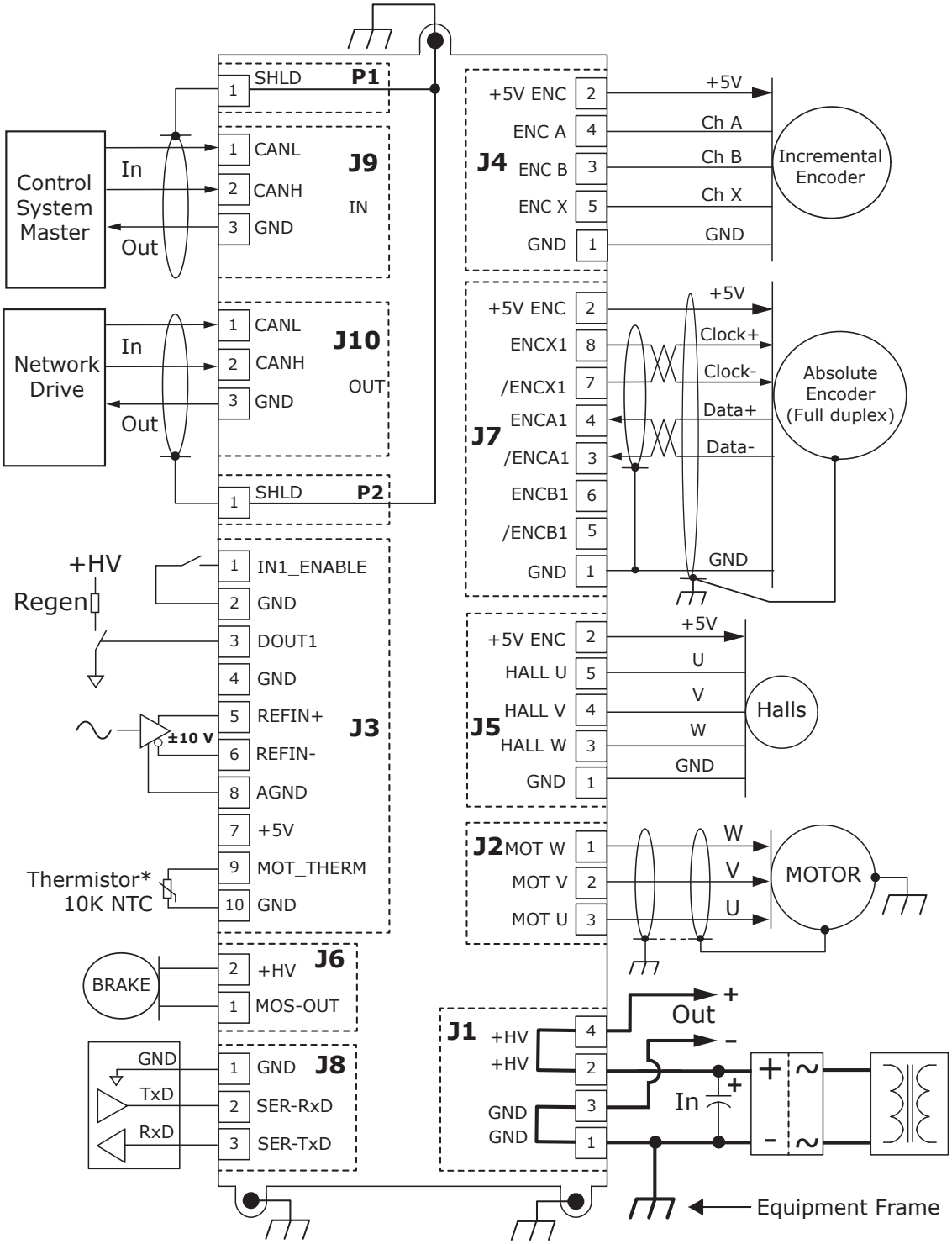
Signal	J2 Pin
Mot U	3
Mot V	2
Mot W	1

Motor cabling should use twisted, shielded conductors for CE compliance, and to minimize PWM noise coupling into other circuits. For best results, connect the motor cable shield to the motor frame and the IPS frame.



IPS-060-30 CONNECTIONS

In the following diagram, it shows the IPS-060-30 wiring connections.

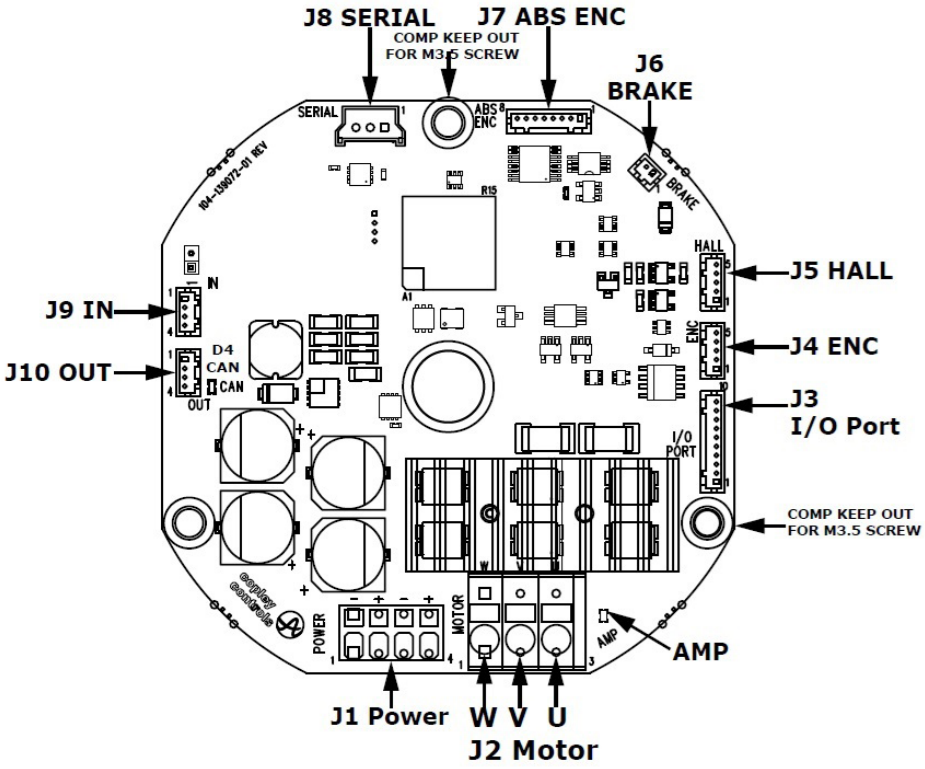


IPS-060-30 Wiring Connections Diagram

IPS-060-30 CONNECTORS

The IPS-060-30 Connectors diagram shows the jumper locations and descriptions. The tables include the jumpers, pins, signals and the functions.

For information on the jumpers J6, J5, J4, J3, J9, J10 and P1/P3, refer to the next page.



IPS-060-30 Connectors Diagram

J7: Differential Encoder		
Pin	**Signal**	**Function**
1	GND	+5V Supply Return (0V)
2	+5VENC	+5V Encoder Supply
3	/ENCA1_UBC_DAT	Biss C /Data, Incremental /A
4	ENCA1_UBC_DAT	Biss C Data, Incremental A
5	/ENCB1	Incremental /B
6	ENCB1	Incremental B
7	/ENCX1_UBC_CLK	Biss C /Clock, Incremental /X
8	ENCX1_UBC_CLK	Biss C Clock, Incremental X
Hirose: DF13-8P-1.25DSA		

J8: Serial Port		
Pin	**Signal**	**Function**
1	GND	Signal Ground
2	DIAG_RXD	Serial Input
3	DIAG_TXD	Seral Output
Molex: 35362-0350		

J1[1]: Power		
Pin	**Signal**	**Function**
1	GND	Power Return
2	+HV	Power Input
3	GND	Power Return
4	+HV	Power Output
Phoenix: 1823214		

J2[2]: Motor		
Pin	**Signal**	**Function**
1	MOT-W	Motor Phase W
2	MOT-V	Motor Phase V
3	MOT-U	Motor Phase U
Phoenix: 1823201		

Notes:

Note[1]: 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").

Note[2]: J2: Contacts are push-in spring type. Wire size 24~12 AWG, stripping length 8 mm. Tool: Slot-headed screwdriver 0.6 x 3.5 mm (~1/8")

IPS-060-30 CONNECTORS

The following tables identify the signals, pins and functions for the IPS-060-30 connectors shown in the diagram on page 11.

J6: Brake		
Pin	**Signal**	**Function**
1	Brake	PWM Brake Control
2	+HV	Output
Hirose: DF13-2P-1.25DSA		

J5: Halls		
Pin	**Signal**	**Function**
1	GND	Signal Ground
2	+5V	+5V Output
3	HALL-W	Hall W Input
4	HALL-V	Hall V Input
5	HALL-U	Hall U Input
Hirose: DF13-5P-1.25DSA		

J4: Single-Ended Encoder		
Pin	**Signal**	**Function**
1	GND	Signal Ground
2	+5V	+5V Output
3	ENC-B	Encoder B Input
4	ENC-A	Encoder A Input
5	ENC-X	Encoder X Input
Hirose: DF13-5P-1.25DSA		

J3: I/O		
Pin	**Signal**	**Function**
1	IN1_Enable	Digital Input 1
2	GND	Ground
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
9	MOTEMP	Motor Temperature Sensor
10	AGND	Analog Ground
Hirose: DF13-10P-1.25DSA		

J10 CANopen OUT

Pin	Signal
1	CANL
2	CANH
3	GND

Hirose: DF13-4P-1.25DSA

J9 CANopen IN

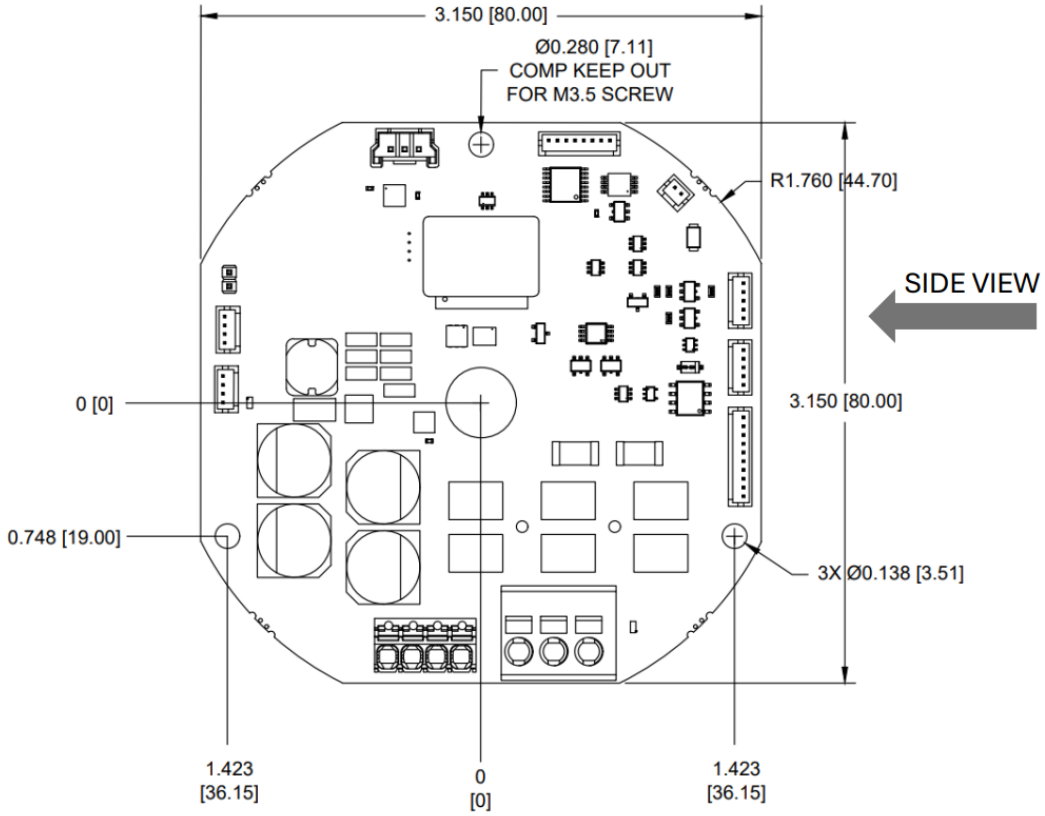
Pin	Signal
1	CANL
2	CANH
3	GND

NOTES:
In the tables on this page, the part numbers displayed are placed on the IPS-060-30.
-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 15 in the IPS-CK table.

IPS-060-30 DIMENSIONS

Top View (No Heatsink)

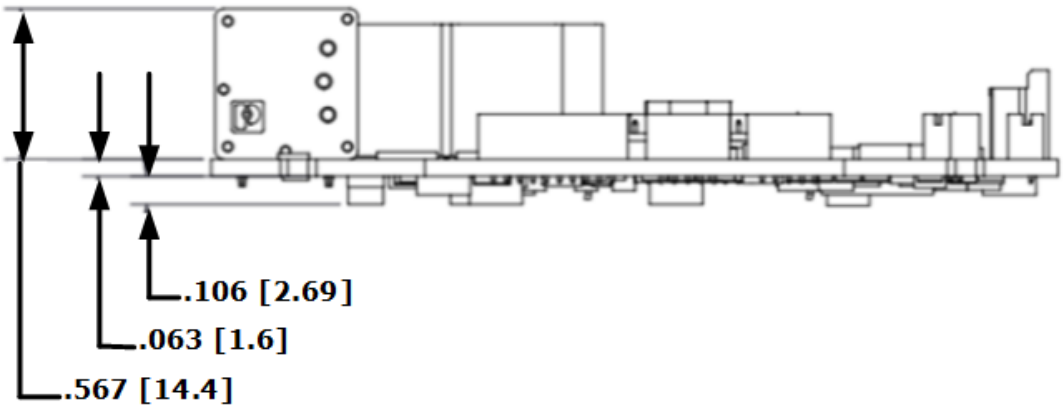
The following diagram shows the dimensions of the IPS-060-30 drive (top view-without the heatsink). The dimensions are measured in inches [mm].



IPS-060-30 Drive (Top View-without Heatsink) Diagram

Side View (No Heatsink)

The following diagram shows the dimensions of the IPS-060-30 drive (side view-without the heatsink). The dimensions are measured in inches [mm].



IPS-060-30 Drive (Side View-without Heatsink) Diagram

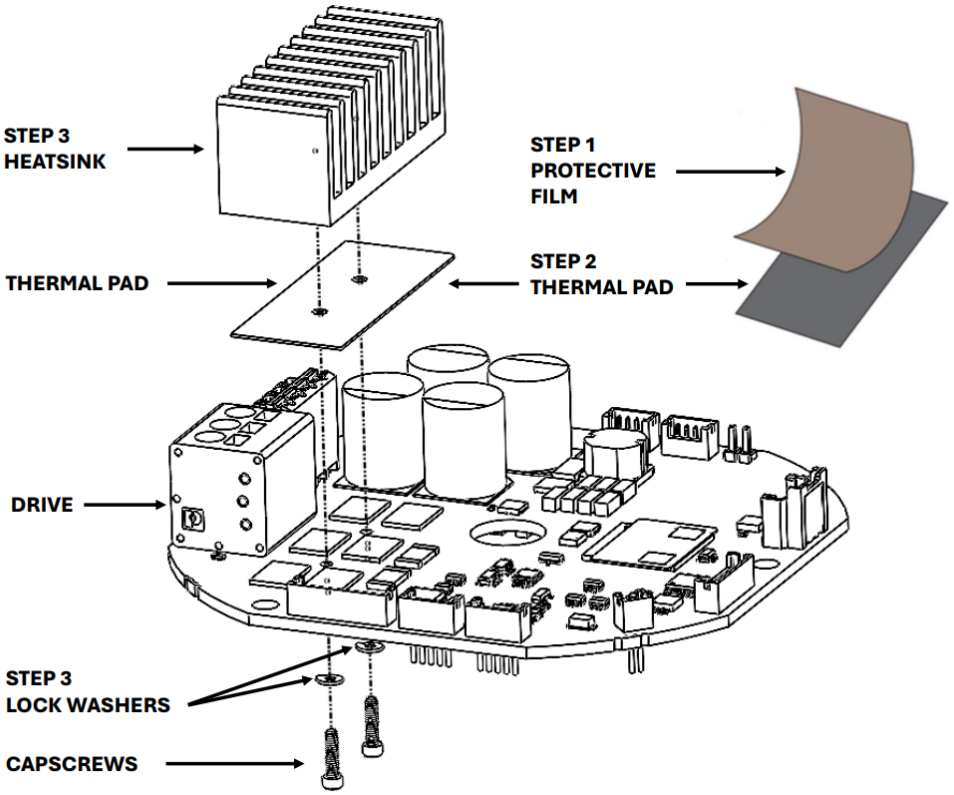
IPS-HK HEATSINK KIT

In the following diagram, it shows the IPS-HK Heatsink installation. To install the IPS-HK Heatsink onto the drive, refer to the following steps.

1. Remove the protective film from the thermal pad to expose the adhesive (See Step 1).
2. Place the thermal pad, adhesive side facing towards the heatsink. Align the thermal pad to the mounting holes and carefully press the thermal pad onto the heatsink. (See Step 2).
3. Place the heatink onto the mosfets. To secure the heatsink to the drive, secure with the mounting screws. (See Step 3).

Notes:

1. Screws are 0-80 max. torque 1 lb-in (0.11 N-M).
2. Torque dry with no lubricant.
3. Tighten to flatten the lock washer.
4. If you overtighten the screws, it may stress the mosfets and the PC board.



IPS-HK Heatsink Installation Diagram

IPS-HK CONTENTS	
Qty	**Part**
2	Socket capscrew, 18-8 stainless steel, #0-80 x 1/4”, 0.05” hex drive.
2	Lock washer, 18-8 stainless steel, #0, 0.062” ID
1	Heatsink 6-82984-01
1	Thermal pad

ORDERING GUIDE

INTEGRATED SERVO DRIVE

Part Number	Description
IPS-060-30	Integrated CAN Servo Drive, 30 A, 14~60 V
ACCESSORIES	
Part Number	**Description**
IPS-HK	Heatsink Kit
IPS-CK	Connector Kit
SER-USB-M	USB to Serial Cable Kit

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

CONNECTOR KIT: IPS-CK

	QTY	REF	NAME	DESCRIPTION	MDFGR: PART NUMBER
IPS-060-30 Connector Kit	1	J1,J2	Motor, Power	Tool	Wago: 106388
	1	J3	I/O	Connector, socket, single row, 1.25 mm, 10 pos	Hirose: DF13-10S-1.25C
	1	J7	Encoder 1 Abs	Connector, socket, single row, 1.25 mm, 8 pos	Hirose: DF13-8S-1.25C
	1	J4	Encoder 2 Inc	Connector, socket, single row, 1.25 mm, 5 pos	Hirose: DF13-5S-1.25C
	1	J5	Halls	Connector, socket, single row, 1.25 mm, 5 pos	Hirose: DF13-5S-1.25C
	1	J6	Brake	Connector, socket, single row, 1.25 mm, 2 pos	Hirose: DF13-2S-1.25C
	2	J9,J10	CANopen IN,OUT	Connector, socket, single row, 1.25 mm, 4 pos	Hirose: DF13-4S-1.25C
	38	J3, J4, J5, J6, J7, J9, J10	Crimp socket, 26~30 AWG, gold		Hirose: DF13-2630SCFA
	13		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	J8	Serial Port	Connector, 3 pin	Molex: 355070300
	3			Crimp contact, 24~30 AWG	Molex: 50212-8000
NOTE: Specifications subject to change without notice.					

16-141933 Document Revision History

Revision	Date	Remarks
AA	October 30, 2025	Pre-production revision
AB	December 29, 2025	Modify with the following. -Add new photo and 2 (dimensions & IPS heatsink) drawings on pages 12 & 13. -Update wiring connectors on page 10 & part numbers (where applicable). -In Feedback section (pg 1), add Copley Serial Resolver (CSR). -Remove CSP, CSV, CST & CSTA on page 1 & CAN Device ID on page 5. -Update the CANopen Network Status ERR descriptions to comply with the DR-303 LED indicator standard. Add new LED Status diagram on pg. 5. -Update nomenclature (replace frame ground with chassis) in text and diagrams. (where applicable).