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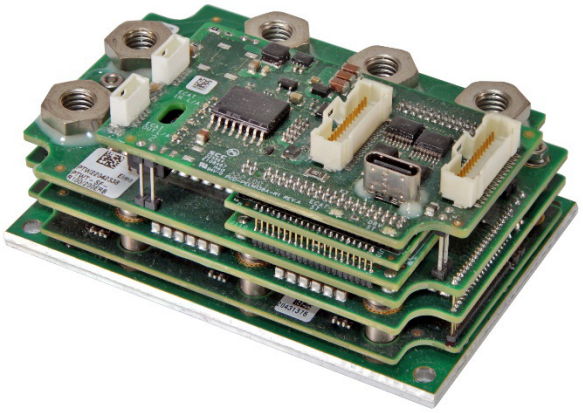
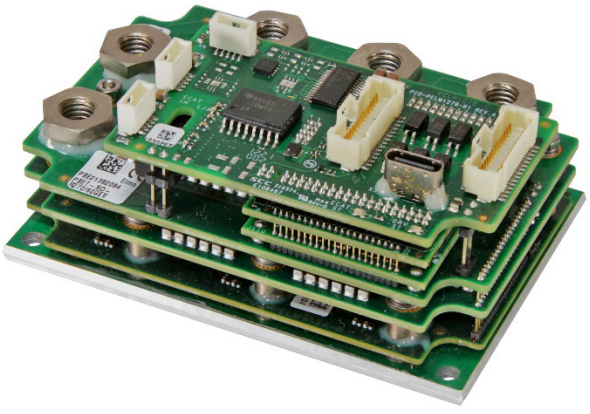
Platinum Solo Triple Bee Digital Servo Drive Installation Guide

Functional Safety with EtherCAT

Safety Capability: F, S, O





March 2025 (Ver. 1.019)

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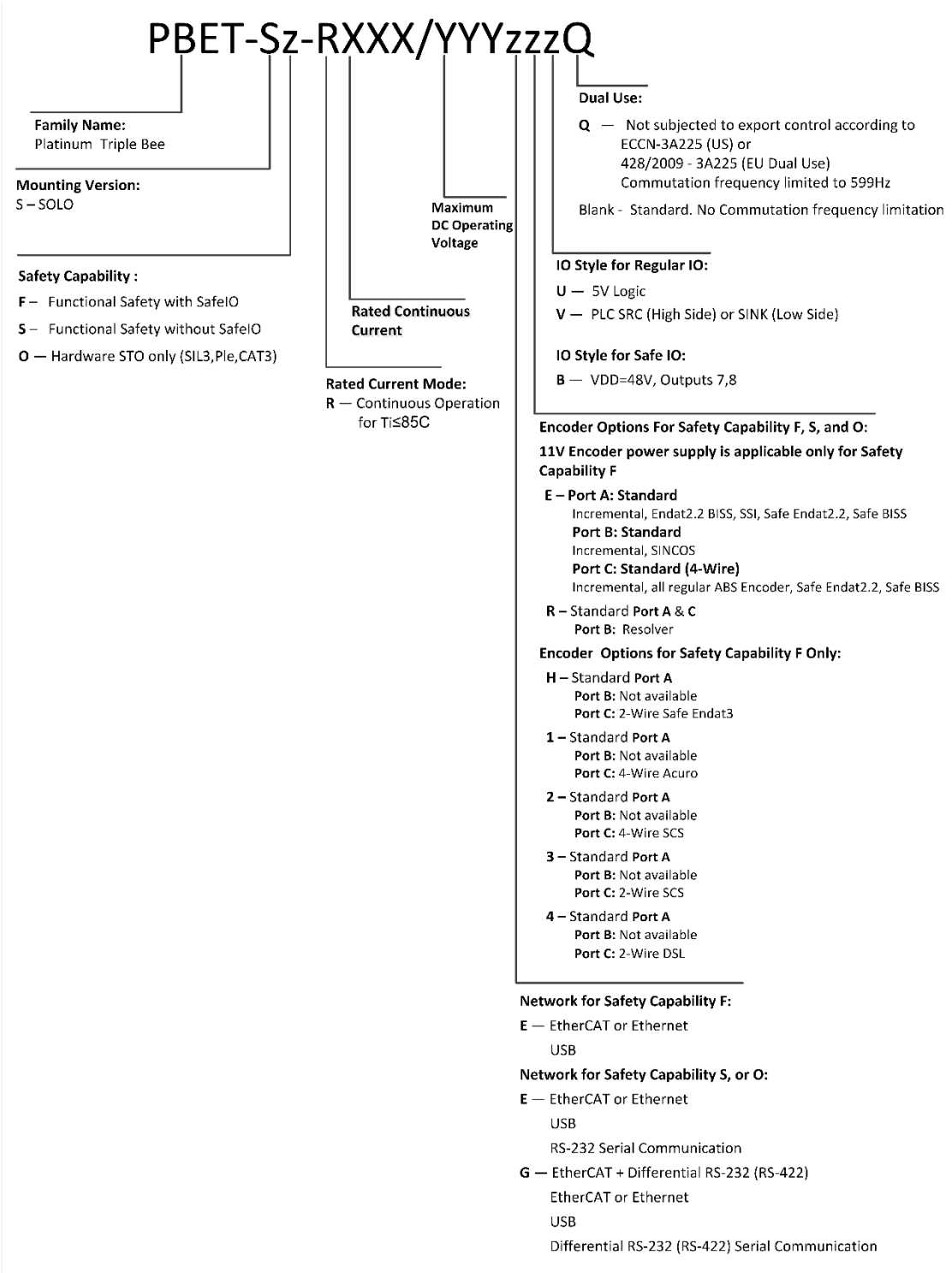
Catalog Number



Revision History

Version	Date	Details
Ver. 1.000	Dec 2020	Initial Release
Ver. 1.001	Jan 2021	Updated document with various changes
Ver. 1.002	Feb 2021	Updated document with various changes
Ver. 1.003	Mar 2021	Updated document with various changes including Safe IO
Ver. 1.004	June 2021	Various changes including changes to Catalog Number
Ver. 1.005	Sept 2021	Updated document with various changes
Ver. 1.006	Sept 2021	Corrected document with a single change
Ver. 1.007	Oct 2021	Updated document with single change
Ver. 1.008	Dec 2021	Corrected document with a small change
Ver. 1.009	Mar 2022	Corrected document with a small change
Ver. 1.010	Apr 2022	Corrected document with a small change
Ver. 1.011	June 2022	Corrected document with a small change
Ver. 1.012	June 2022	Corrected document with a small change
Ver. 1.013	Dec 2022	Updated document with various changes
Ver. 1.014	Feb 2023	Corrected document with a small change
Ver. 1.015	Mar 2023	Corrected document with a small change
Ver. 1.016	Dec 2023	Updated sections 5.4.6 and 5.4.7 to “Digital Input” and “Digital Output and Current”.
Ver. 1.017	Apr 2024	Small change to section 8.5.1.3 Hiperface text
Ver. 1.018	Sept 2024	Updated all drawings. Corrected (HW) drawing in section 8.5. Added new HW drawings to sections 8.6, 8.7, 8.8, 8.9.1, and 8.9.2. Update to VDD in table in section 5.4.7. Small update in section 9.2.
Ver. 1.019	Mar 2025	Changes to Part Number Hardware connection drawings in sections 8.5, 8.6, 8.7, and 8.8 removed

Chapter 1: This Installation Guide

This installation Guide details the technical data, pinouts, and power connectivity of the Platinum Solo Triple Bee. **For a comprehensive specification and detailed description of the functions, refer to the** Platinum Safety Drive Manual**.**

Chapter 2: Functional Safety

The Platinum family of servo drives support Functional Safety. It is necessary to implement the instructions in the Platinum Safety Manual (available upon request) regarding using STO, Feedbacks, IOs and Power supplies with Functional Safety.

Chapter 3: Safety Information

In order to achieve the optimum, safe operation of the Platinum Solo Triple Bee, it is imperative that you implement the safety procedures included in this installation guide. This information is provided to protect you and to keep your work area safe when operating the Platinum Solo Triple Bee and accompanying equipment.

Please read this chapter carefully before you begin the installation process.

Before you start, ensure that all system components are connected to earth ground. Electrical safety is provided through a low-resistance earth connection.

Only qualified personnel may install, adjust, maintain and repair the servo drive. A qualified person has the knowledge and authorization to perform tasks such as transporting, assembling, installing, commissioning and operating motors.

The Platinum Solo Triple Bee contains electrostatic-sensitive components that can be damaged if handled incorrectly. To prevent any electrostatic damage, avoid contact with highly insulating materials, such as plastic film and synthetic fabrics. Place the product on a conductive surface and ground yourself in order to discharge any possible static electricity build-up.

To avoid any potential hazards that may cause severe personal injury or damage to the product during operation, keep all covers and cabinet doors shut.

The following safety symbols are used in this and all Elmo Motion Control manuals:

Warning: This information is needed to avoid a safety hazard, which might cause bodily injury or death as a result of incorrect operation.

Hot Surface Warning:
To alert against surfaces that may reach high temperatures. The heatsink and wires may reach high temperatures.

Caution: This information is necessary to prevent bodily injury, damage to the product or to other equipment.

Important: Identifies information that is critical for successful application and understanding of the product.

The following symbols are used in this document:

Note: Information critical to the understanding and\or operating the feature.

Tip: Information that helps understanding a feature, is good practice or a possible different way of action.

3.1 Warnings

- To avoid electric arcing and hazards to personnel and electrical contacts, never connect/disconnect the servo drive while the power source is on.
- Power cables can carry a high voltage, even when the motor is not in motion. Disconnect the Platinum Solo Triple Bee from all voltage sources before servicing.
- The high voltage products within the Platinum Line range contain grounding conduits for electric current protection. Any disruption to these conduits may cause the instrument to become hot (live) and dangerous.
- STO, Safe I/O (Safety Capability "F") and EtherCAT (Safety Capability "F", "S") circuits are separated from power circuits by reinforced insulation and can be supplied by SELV power supply. Other Control and communication level circuits are separated from power circuits by functional insulation. These circuits shall have insulation to their surroundings and other control or communication circuits based on the Working Voltage and requirements of the end use application.

Capacitance Discharge
After shutting off the power and removing the power source from your equipment, wait at least 27 seconds before touching or disconnecting parts of the equipment that are normally loaded with electrical charges (such as capacitors or contacts). Measuring the electrical contact points with a meter, before touching the equipment, is recommended.

3.2 Cautions

- The maximum DC power supply connected to the instrument must comply with the parameters outlined in this guide.
- When connecting the Platinum Solo Triple Bee to an approved control supply, connect it through a line that is separated from hazardous live voltages using reinforced or double insulation in accordance with approved safety standards.
- Before switching on the Platinum Solo Triple Bee, verify that all safety precautions have been observed and that the installation procedures in this manual have been followed.
- Make sure that the Safe Torque Off is operational.

3.3 CE Marking Conformance

The Platinum Solo Triple Bee is intended for incorporation in a machine or end product. The actual end product must comply with all safety aspects of the relevant requirements of the European Safety of Machinery Directive 2006/42/EC as amended, and with those of the most recent versions of standards EN 60204-1 and EN ISO 12100 at the least, and in accordance with 2006/95/EC.

Concerning electrical equipment designed for use within certain voltage limits, the Platinum Solo Triple Bee meets the provisions outlined in 2006/95/EC. The party responsible for ensuring that the equipment meets the limits required by EMC regulations is the manufacturer of the end product.

3.4 Warranty Information

The products covered in this manual are warranted to be free of defects in material and workmanship and conform to the specifications stated either within this document or in the product catalog description. All Elmo drives are warranted for a period of 12 months from the date of shipment. No other warranties, expressed or implied — and including a warranty of merchantability and fitness for a particular purpose — extend beyond this warranty.

Chapter 4: Product Description

The Ultra High Current Platinum Solo Triple Bee which can deliver up to 270A @ up to 60VDC, 240A @ up to 80VDC, 210A @ up to 100VDC, and 100A @ up to 200VDC, are advanced high power density servo drives, delivering up to **17 kW power** in a 165.44 cm^3 (10.09 $Inch^3$) compact package
55 x 80 x 37.6 mm (2.16" x 3.15" x 1.48").

This advanced, high power density servo drive provides top performance, advanced networking and built-in safety, as well as a fully featured motion controller and local intelligence.

The Platinum Solo Triple Bee is provided in three configurations:

- **PBET-SO:** Servo drive with STO – The servo drive supports only STO.
- **PBET-SS:** Servo drive with Function Safety excluding Safe IO – This configuration of Servo drives includes regular Digital IO. This configuration permits operation of safety functions only via FSOE (Fail Safe Over EtherCAT).
- **PBET-SF:** Servo drive with Function Safety and Safe IO – This configuration of Servo drives includes safe Digital IO which support Safe Digital Inputs and Outputs including Brakes. This configuration supports the operation of the safety function either via FSOE or via the Safe I/O.

The Platinum Solo Triple Bee requires two isolated Power supplies/batteries: Main Power and Control supply.

The drive can operate as a stand-alone device or as part of a multi-axis system in a distributed configuration on a real-time network.

The Platinum Solo Triple Bee drive is easily set up and tuned using the Elmo Application Studio (EASII) software tools. As part of the Platinum product line, it is fully programmable with the Elmo motion control language. For more information about software tools refer to the Elmo Application Studio (EASII) User Guide.

The Platinum Solo Triple Bee is available in a variety of models. There are multiple power rating options, different communications options, a number of feedback options and different I/O configuration possibilities.

A cable kit is available for easy and fast operation of the Platinum Solo Triple Bee.

Chapter 5: Technical Information

5.1 Physical Specifications

Feature	Units	All Types
Weight	g (oz)	~210.0 g (7.41 oz)
EtherCAT Version Dimension	mm (in)	55 x 80 x 37.6 mm (2.16" x 3.15" x 1.48")
Mounting method		Panel Based Mounting
Degrees of protection		IP=00

Table 1: Physical Specifications

5.2 R Type Technical Data

Feature	Units	R270/60	R240/80	R210/100	R100/200
Minimum supply voltage	VDC	10			20
Nominal supply voltage	VDC	45	65	85	170
Maximum supply voltage	VDC	55	75	95	195
Maximum continuous Electrical power output	kW	12.5	15	17	16.5
Efficiency at rated power (at nominal conditions)	%	> 99			
Maximum output voltage		Up to 96% of DC bus voltage			
Amplitude sinusoidal/DC continuous current	A	270	240	210	100
3-Phase Sinusoidal continuous RMS current limit (Ic)	A	190	170	150	70
Current limit	A	Max Output current is guaranteed for $T_{Heat\text{-}Sink}$ <85°C			

5.3 Control Supply

Feature		Units	Details
Control supply for input voltage where the Safety Capability is F, S		**V**	**Isolated DC source:** 12 to 60
Control supply for input voltage where the Safety Capability is O		**V**	**Isolated DC source:** 12 to 95
24V Control supply input power consumption	Without Encoder	W	≤4
	With encoder up to 400mA@5V	W	≤6
	For Safety Capability F only With encoder up to 300mA@11V	W	≤7

Table 2: Control Supply

5.4 Product Features

5.4.1 Feedback

Feature	Details	Presence and No.
Feedback	Standard Port A, B, & C	√

5.4.2 Encoder Supply

Feature	Details
5V supply	5V Nominal, 4.75V÷5.25V up to 400mA
11V supply only with Safety Capability: F	11V Nominal, 10.6V÷11.5V up to 300mA

5.4.3 Communication

Feature	Details	Presence and No.	
Communication Option	USB	√	
	EtherCAT	√	
	RS-422 (Differential RS-232) Serial Communication	√	Available only for Network G
	RS-232 Serial Communication	√	Available only for Network E with safety capability S or O.

5.4.4 Analog Input

Feature	Details	Resolution	Presence and No.
Analog Input	Differential ±10V	14-bits	**1**
	Single ended ±10V	12-bits	**1**

5.4.5 STO

Feature	Details	Presence and No.
STO	5V Logic, Opto Isolated, for IO TYPE = U	√
	PLC source, Opto Isolated, for IO TYPE = V	
	PLC source, Opto Isolated, for IO TYPE = B	

5.4.6 Digital Input

I/O Style	Safe Input	U	V
Safety/Regular	Safe IO PLC Source, Isolated	Regular IO 5V Logic	Regular IO PLC Source or Sink
Input	IN1, IN2, IN3, IN4	IN1, IN2, IN3, IN4, IN5, IN6	

5.4.7 Digital Output

Refer to the Safety Capability in the P/N for the relevant IO capability.

I/O Style	B	U	V
Safety/Regular	Safe IO PLC	Regular IO	Regular IO
Voltage	24V – OUT1,2 48V – OUT7,8	5V Logic	PLC
Absolute Maximum Voltage	60V	30V	60V
Nominal Recommended VDD	24 to 48V ±10%	4 to 30V	24 to 48V ±10%
OUT1	30mA	15mA	1000mA
OUT2	30mA	15mA	1000mA
OUT7	1000mA	15mA	1000mA
OUT8 (PLC SINK)	1000mA	15mA	1000mA
Total Current[1]	1000mA		1000mA

[1] **NOTE**: The total output current of the four digital outputs must not exceed the values shown in this table.

5.5 Environmental Conditions

You can guarantee the safe operation of the Platinum Solo Triple Bee by ensuring that it is installed in an appropriate environment. Section 5.5.1 describes the extended environmental conditions. However, the Functional Safety of the ExtrIQ series servo drives is certified according to the environmental conditions in section 5.5.2.

Warning: During operation the Platinum Solo Triple Bee becomes hot to the touch (the heatsink and wires may heat up to 92 °C). Care should be taken when handling it.

5.5.1 ExtrIQ Conditions

Feature	Operation Conditions	Range
Ambient Temperature Range		-40 °C to +70 °C (-40 °F to 158 °F)
Storage temperature		-40 °C to +85 °C (-40 °F to +185 °F)
Altitude	Non-operating conditions	Unlimited
	Operating conditions	-400 m to 12,000 m (-1312 to 39370 feet)
Maximum Humidity	Non-operating conditions	Up to 95% relative humidity non-condensing at 35 °C (95 °F)
	Operating conditions	Up to 95% relative humidity non-condensing at 25 °C (77 °F), up to 90% relative humidity non-condensing at 42 °C (108 °F)
Vibration	Operating conditions	20 Hz to 2,000 Hz, 14.6 g

5.5.2 Functional Safety

Functional Safety of the ExtrIQ series servo drives is certified according to the following environmental conditions.

Feature	Details
Operating ambient temperature	-40 °C to 55 °C (-40 °F to 131 °F) **Remark:** Functional Safety is applicable to the above operating temperature.
Storage temperature	-40 °C to +85 °C (-40 °F to +185 °F)
Maximum non-condensing humidity according to IEC60068-2-78	95%
Maximum Operating Altitude	2,000 m (6562 feet) It should be noted that servo drives capable of higher operating altitudes are available on request.
Mechanical Shock according to IEC60068-2-27	15g / 11ms Half Sine
Vibration according to IEC60068-2-6	5 Hz ≤ f ≤ 10 Hz: ±10mm 10 Hz ≤ f ≤ 57 Hz: 4G 57 Hz ≤ f ≤ 500 Hz:5G
Pollution Degree	Pollution Degree 1

5.6 Standards and Certifications

The following table describes the Main Standards of the Platinum Solo Triple Bee servo drive. For further details refer to Chapter 22 in the Platinum Safety Drive Manual.

5.6.1 Functional Safety

Standard	Item
IEC 61800-5-2:2017	Adjustable speed electrical power drive systems – Safety requirements – Functional
EN ISO 13849-1:2015	Safety of machinery — Safety-related parts of control systems.
EN 61508-1:2010	Functional safety of electrical/electronic/ programmable electronic safety-related systems
EN 61508-2:2010	Functional safety of electrical/electronic/ programmable electronic safety-related systems
EN 61508-3:2010	Functional safety of electrical/electronic/ programmable electronic safety-related systems
IEC 61784-3:2016	Functional Safety Filed Bus - FSOE

5.6.2 Electrical Safety

Specification	Details
In compliance with IEC/EN 61800-5-1:2007	Adjustable speed electrical power drive systems Part 5-1: Safety requirements – Electrical, thermal and energy
UL 61800-5-1	Adjustable speed electrical power drive systems: Safety requirements – Electrical, thermal and energy
CSA C22.2 NO. 274-17	Adjustable speed drives

5.6.3 Electromagnetic Compatibility

Specification	Details
EN 61800-3:2004/A1:2011	Adjustable speed electrical power drive systems Part 3: EMC requirements and specific test methods
EN 61800-5-2: 2017 Annex E	Adjustable speed electrical power drive systems Part 5-2: Safety requirements – Functional

5.6.4 Environmental

Specification	Details
IEC60068-2-78	Damp heat, steady state
IEC60068-2-6	Vibration (sinusoidal)
IEC60068-2-2	Dry heat
IEC60068-2-27	Shock
IEC60068-2-1	Cold Test

5.6.5 Other Compliant Standards

For other compliant standards refer to the
Platinum Safety Drive Manual Section 22.5 or refer to the Elmo website:

https://www.elmomc.com/capabilities/standards-compliance/platinum-family/

5.6.6 Dual Use

No export license is required for the Platinum Line products signified with the suffix Q in the Part Number.

The operating frequency of the Platinum Line products is “factory limited” to ≤ 599 Hz, and therefore complies with the EU Dual Use Regulation 428/2009, 3A225, and the US Dual Use regulation EAR ECCN# 3A225.

This statement applies to all identical specimens and will become invalid if a change is made in the firmware.

Chapter 6: Installation

6.1 Unpacking the Servo Drive Components

Before you begin working with the Platinum Solo Triple Bee, verify that you have all of its components, as follows:

- The Platinum Solo Triple Bee servo drive
- The Elmo Application Studio (EASII) software and software manual

The Platinum Solo Triple Bee is shipped in a cardboard box with Styrofoam protection.

To unpack the Platinum Solo Triple Bee:

1. Carefully remove the servo drive from the box and the Styrofoam.
2. Check the drive to ensure that there is no visible damage to the instrument. If any damage has occurred, report it immediately to the carrier that delivered your drive.
3. To ensure that the Platinum Solo Triple Bee you have unpacked is the appropriate type for your requirements, locate the part number sticker on the top of the Platinum Solo Triple Bee. It looks like this:

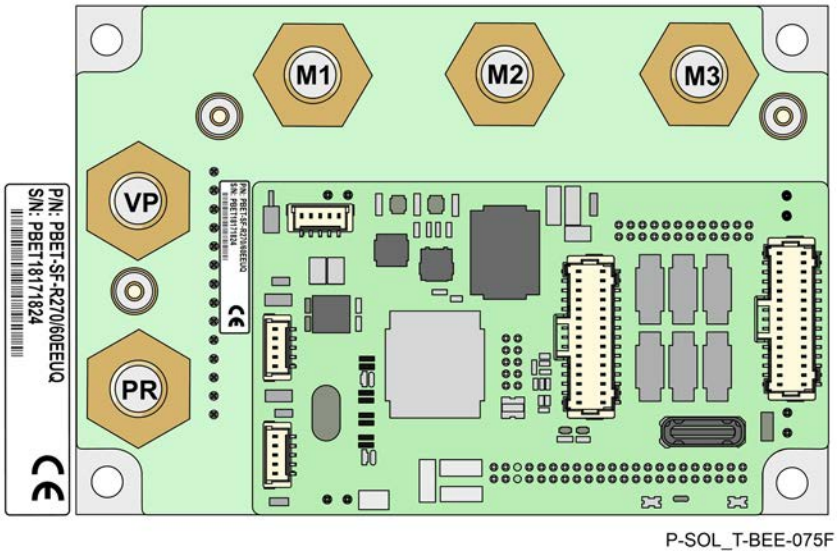


Figure 1: Part Number

4. Verify that the Platinum Solo Triple Bee type is the one that you ordered, and ensure that the voltage meets your specific requirements.

   The part number at the top provides the type designation. Refer to the appropriate part number in the section Catalog Number at the beginning of the installation guide.

6.2 Mounting the Platinum Solo Triple Bee to a Heat Sink

The selected heat sink must be screwed to the lower surface of the Platinum Solo Triple Bee.

To mount the heat sink:

1. Mount the heat sink under the base of the Platinum Solo Triple Bee.
2. Place the Thermal foil (PN IMT-TTWIALH purchased from Elmo) between the lower surface of the servo drive, and the upper surface of the heat sink
3. Use four M3 head cup Allen screws to secure the heat sink under the servo drive.
4. Tighten the screws to the relevant torque force applicable to an M3 stainless steel A2 screw.

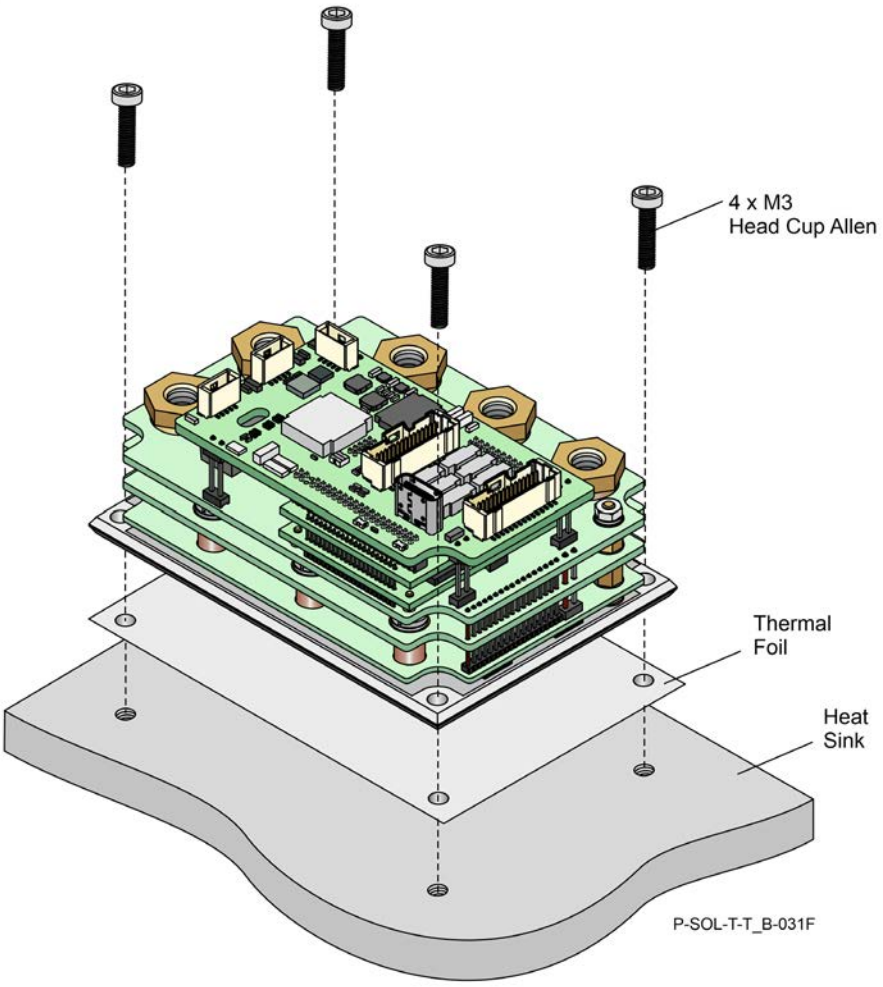
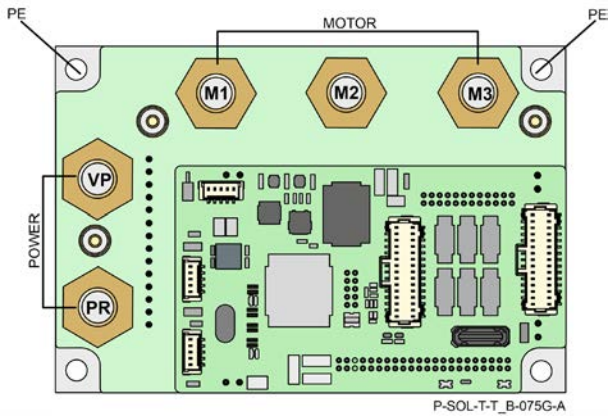


Figure 2: Mount the Platinum Solo Triple Bee to the Thermal Foil and the Heat Sink

Chapter 7: Connector Types

The Platinum Solo Triple Bee has the following types of connectors.

Type	Function	Port	Connector Location
Terminal Lug + M6 Flat Washer + M6 Spring Washer + M6 Screw	Power	VP+, PR	
	Motor	M1, M2, M3	
Terminal Lug + M3 Flat Washer + M3 Spring Washer + M3 screw	Earth Connec-tion	PE, PE	
Recommended for M6 screw		**Terminal Lug (FLEX) Stud hall size: M6**	
Connectors Location			

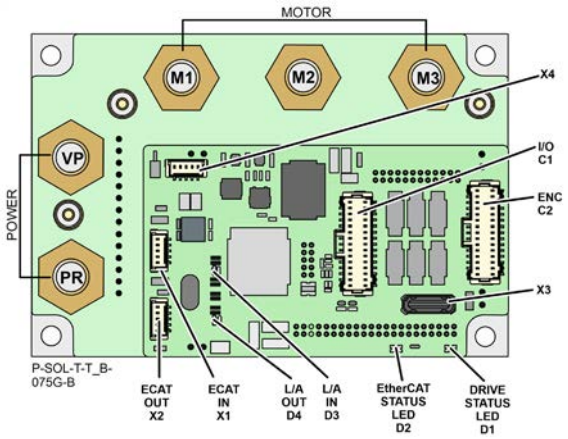


Figure 3: Connector Locations for Regular IO

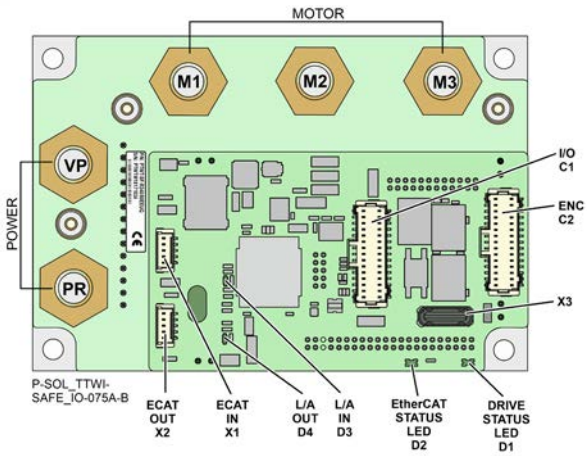


Figure 4: Connector Locations for Safe IO

Connector	Pins	Type	Function
	M6 / 6 depth	Redcube Terminal screw, M6 Flat Washer, M6 Spring Washer, and M6 Screw	Power, Motor
ENC C2	2 rows x 15 Pins	2 rows x 15 pins 1 mm pitch Conductor cross-section is 32 up to 28 AWG	VL & Feedback Ports
IO C1	2 rows x 15 Pins	2 rows x 15 pins 1 mm pitch Conductor cross-section is 32 up to 28 AWG	IO and STO
X4	1 row, 5 pins	1 x 5 pins 1 mm pitch Conductor cross-section is 32 up to 28 AWG	RS-232/RS-422 (for Safety Capability S or O)
X3	24 pins	USB Type C	USB Port
EtherCAT			
X1 ECAT IN	1 row, 5 pins	1 x 5 pins 1 mm pitch Conductor cross-section is 32 up to 28 AWG	EtherCAT IN Connector
X2 ECAT OUT	1 row, 5 pins	1 x 5 pins 1 mm pitch Conductor cross-section is 32 up to 28 AWG	EtherCAT OUT Connector

Table 3: Connector Types

7.1 Recommended Cable Lugs and Cabling

Elmo recommends the following cable lugs for motor and power depending on the cable to be installed. Refer to the specification drawings for the UL listed lug and cable application.

Copper Lug - One-Hole, Standard Flex Barrel

Current (A) (Up to)	Wire Type	Stud Size
270	#4 AWG	M6 (or ¼")
100	#8 AWG	M6 (or ¼")

Table 4: Cable Lugs and Cabling

For best noise immunity, twist the DC power wires, but do not twist or bundle the motor phase wires.

7.2 Mating Connectors, Wires, and Cables

Connector	Mating Connector Type	Mating Crimping Pins
ENC C2, VL & Feedback Ports	MOLEX 1.00mm "Pico-Clasp" 501189-3010	MOLEX 1.00mm crimp terminal 501193-3000
IO C1 IO and STO		
X1 ECAT IN, X2 ECAT OUT EtherCAT IN/OUT Communication	MOLEX 1.00mm "Pico-Clasp" 501330-0500	MOLEX 1.00mm crimp terminal 501334-0100
X4 Isolated RS-232/RS-422 Communication		
For the X3 USB Type C connector, use a standard cable.		

Table 5: Mating Connectors, Wires, and Cables

7.3 Main, Control, and Motor Power

This section describes the Main and Control supplies, and Motor Power connections. The Motor and Main Power interface uses lugs and cables defined in the section 7.1 Recommended Cable Lugs and Cabling.

7.3.1 Motor Power

For full details, see Section 10 in the manual: Platinum Safety Drive Manual**.**

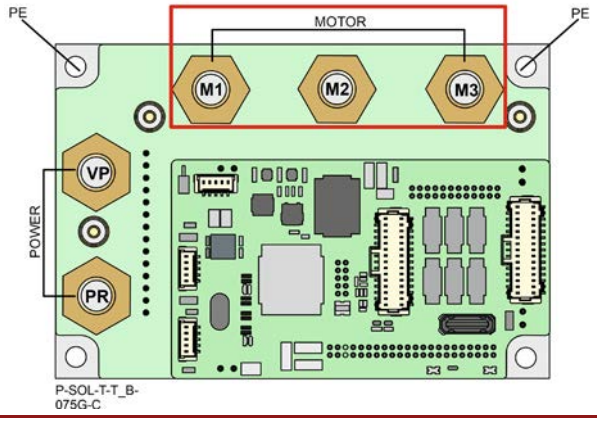
Pin	Function	Cable		Pin Positions
		Brushless Motor	Brushed DC Motor	
PE	Connection earth	Motor	Motor	
M1	Motor phase	Motor	Not Connected	
M2	Motor phase	Motor	Motor	
M3	Motor phase	Motor	Motor	

Table 6: Motor Terminals

7.3.2 Main Power and Control Supply

This section describes the Main Power and the Control supply connector.

7.3.2.1 Main Power/Battery

The isolated DC power source is not included with the Platinum Solo Triple Bee.

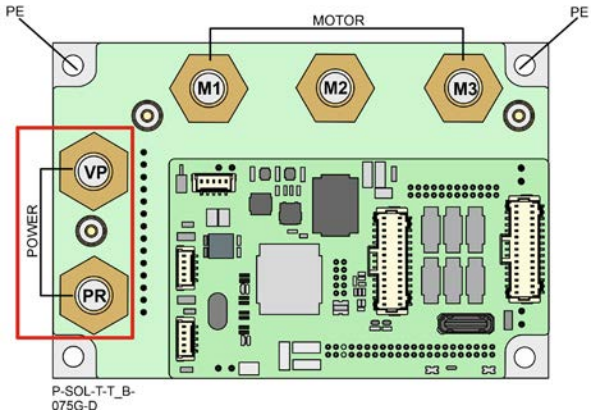
Pin	Function	Cable	Pin Positions
VP+	DC Pos. Power input	Power	
PR	Power return	Power	
PE	Connection earth	Power	

Table 7: Main Power Terminals

7.3.2.2 Control Supply (ENC C2)

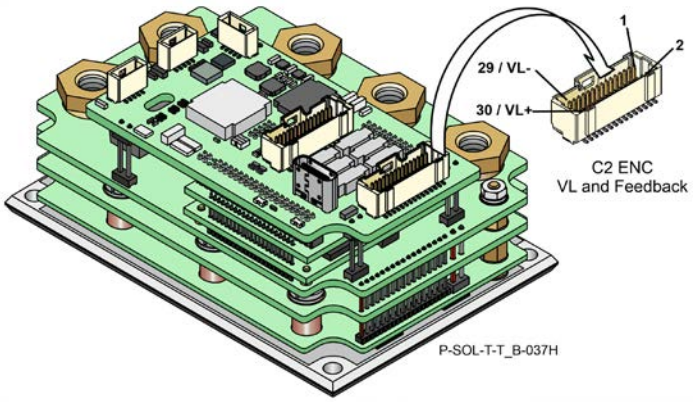
Pin	Signal	Function	Pin Positions
30	VL+	Control Supply Input	
29	VL-	Control Supply Return	
Input range: 12VDC – 60VDC Power consumption: • ≤4 W without external loading • ≤6 W with full external loading			

Table 8: Control Supply Pins

7.4 Drive Status Indicator

Figure 5 shows the position of the D1 red/green dual LED, which is used for immediate indication of the Initiation and Working states.

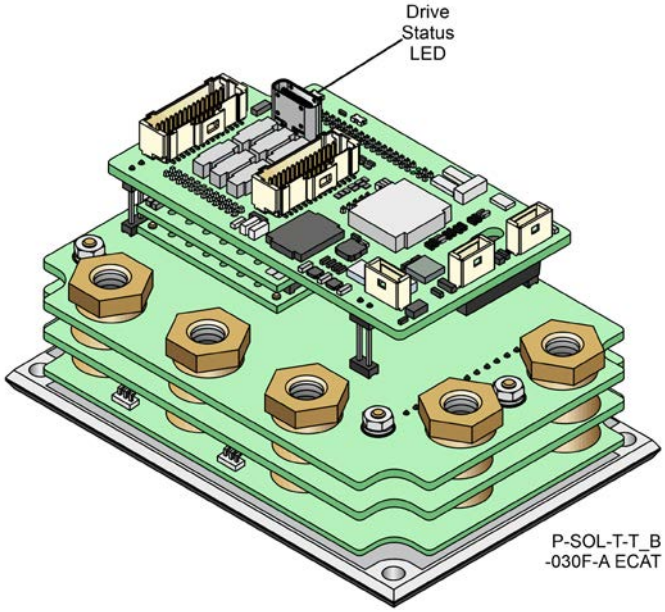


Figure 5: Drive Status Indicator in Platinum Solo Triple Bee model

The red/green dual LED is used for immediate indication of the following states:

STATES	LED \ Time [msec]	Explanation
INITIATION STATE	Blinking: Red 200, Off: 200	If flashing RED ON/OFF then drive error. Parameter process failed during power up (**CD** command)
	Blinking: Red 600, Off 200	If slow flashing RED ON/OFF then drive Safety error Drive in Safety error (**BZ[2]\BZ[3]**)
WORKING STATE	Steady Green	Drive ready to enable the motor
	Steady Red	Drive is in an amplifier failure state Power state error: over\under voltage, over temperature etc.
FIRMWARE DOWNLOAD STATE	Blinking: Red 200, Green 200 Red 600, Green 200	Flashing RED/GREEN during burn Slow flashing RED/GREEN indicates stages of Firmware burn-in or validation. Frequency depends on the stage of burn-in/validation and the CPLD/FPGA that is been burned-in.

7.5 ENC C2 VL and Feedback Connector

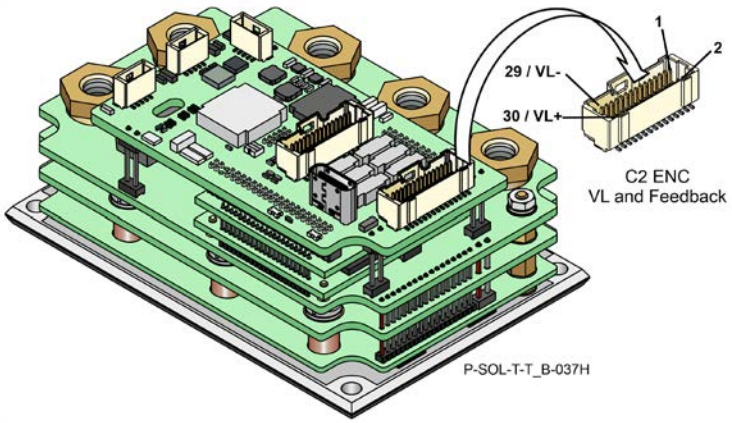


Figure 6: ENC C2 VL and Feedback Connector

Feedback A/B/C, Digital Halls – see Section 13 in the manual: Platinum Safety Drive Manual**.**

The following table describes the ENC C2 VL and Feedback connections to the 2 x 15 pins connector.

Pin ENC C2	Signal	Function
1	PortA_A+	Port A Channel A+
2	PortB_A-/Sine-	Port B Channel A-/Sine-
3	PortA_A-	Port A Channel A-
4	PortB_A+/Sine+	Port B Channel A+/Sine+
5	PortA_B+	Port A Channel B+
6	PortB_B-/Cosine-	Port B Channel B-/Cosine-
7	PortA_B-	Port A Channel B-
8	PortB_B+ / Cosine+	Port B Channel B+ / Cosine+
9	PortA_INDEX+	Port A Index+
10	PortB_INDEX- / Analog_Index-	Port B Index- / Analog_Index-
11	PortA_INDEX-	Port A Index-
12	PortB_INDEX+ / Analog_Index+	Port B Index+ / Analog_Index+
13	HALL A	Hall sensor A
14	PortC_A-	Channel A-/Absolute encoder clock-/Emulated Output A-
15	HALL B	Hall sensor B
16	PortC_A+	Channel A+/Absolute encoder clock+/Emulated Output A+

Pin ENC C2	Signal		Function	
17	HALL C		Hall sensor C	
18	PortC_B-		Channel B- /Absolute encoder data -/Emulated Output B-	
19	+5V		**For Regular IO:** Encoder +5V supply with a total allowable maximum consumption of 400mA using Pins 19 or 26.	**For Safe IO:** Encoder +5V supply with a total allowable maximum consumption of 400mA
20	PortC_B+		Channel B+/Absolute encoder data+/Emulated Output B+	
21	COMRET		Common return	
22	PortC_INDEX-		Channel INDEX- / Emulated Output Index-	
23	COMRET		Common return	
24	PortC_INDEX+		Channel INDEX+ / Emulated Output Index+	
25	COMRET		Common return	
26	**For Regular IO:** +5V	**For Safe IO:** +11V	**For Regular IO:** Encoder +5V supply with a total allowable maximum consumption of 400mA using Pins 19 or 26.	**For Safe IO:** Encoder +11V supply with a total allowable maximum consumption of 300mA
27	COMRET		Common return	
28	COMRET		Common return	
29	VL-		Control 24V supply return	
30	VL+		Control 24V supply	

Table 9: Connector ENC C2 – VL & Feedback

7.6 I/O and STO Connector (C1)

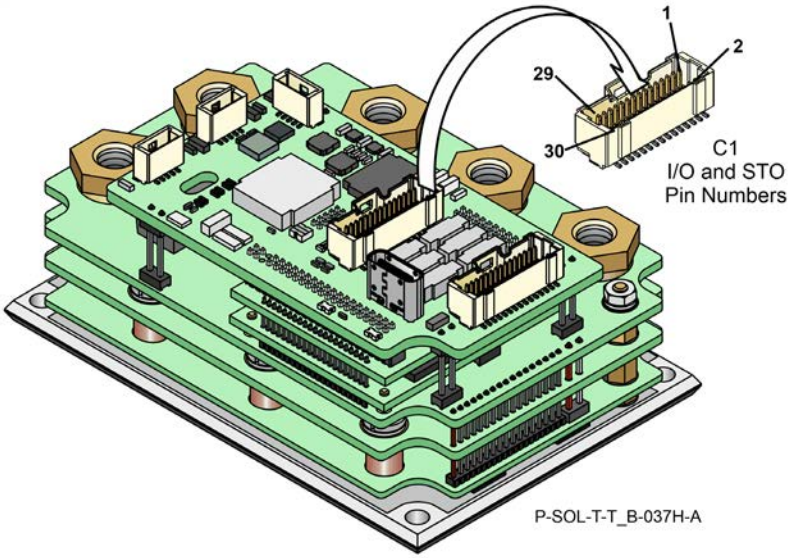


Figure 7: IO C1 I/O and STO Connector

Refer to Chapters 14 Safe Digital IO & 15 Regular Digital IO in the Platinum Safety Drive Manual for full details.

The following tables describe the C1 IO and STO connections to the 2 x 15 pins connector.

7.6.1 Safe IO: IO TYPE = B

The I/O and STO connector includes the following functions:

Pin (C1)	Signal	IO TYPE B
1	OUT8	Digital Output 8 (isolated)
2	IN1	Digital input 1 (isolated)
3	OUT7	Digital Output 7 (isolated)
4	IN2	Digital input 2 (isolated)
5	VDD_48V	VDD for Digital Outputs
6	IN3	Digital input 3 (isolated)
7	VDD_RET	VDD Return
8	IN4	Digital input 4 (isolated)
9	VDD_RET	VDD Return
10	Not Connected	
11	Not Connected	
12	Not Connected	
13	Not Connected	
14	VDD_RET	VDD Return
15	Not Connected	

16	OUT1_E	Digital Output 1 emitter (isolated)
17	Not Connected	
18	OUT2_E	Digital Output 2 emitter (isolated)
20	OUT1_C	Digital Output 1 collector (isolated)
22	OUT2_C	Digital Output 2 collector (isolated)

Table 10: Digital I/O for Safe IO: IO Type = B

7.6.2 Regular IO: IO TYPE = U, V

The Digital I/Os connector includes the following functions:

Pin (C1)	Signal	TYPE U	TYPE V
1	OUT8	Digital Output 8 (isolated)	
2	IN1	Digital input 1 (isolated)	
3	OUT7	Digital Output 7 (isolated)	
4	IN2	Digital input 2 (isolated)	
5	VDD	VDD for Digital Outputs	
6	IN3	Digital input 3 (isolated)	
7	VDD_RET	VDD Return	
8	IN4	Digital input 4 (isolated)	
9	VDD_RET	VDD Return	
10	IN5	Digital input 5 (isolated)	
11	Not Connected		
12	IN6	Digital input 6 (isolated)	
13	Not Connected		
14	IN_COM	Digital Input Return	**For Source:** Digital Input Return **For Sink:** Digital Input Power
15	Not Connected		
16	SRC or SINK CONTROL	Not Used	**For Source:** 0 - Source Control **For Sink:** VDD
17	Not Connected		
18	VDD_RET	VDD Return	
20	OUT1	Digital Output 1 (isolated)	
22	OUT2	Digital Output 2 (isolated)	

Table 11: Digital I/O for Regular IO: IO Types U, V

7.6.3 Analog I/O and STO

STO (safety): For full details on STO, see Chapter 12 in the Platinum Safety Drive Manual for full details.

The I/O and STO connector also includes the following functions:

Pin (C1)	Signal	All IO Types
19	ANALOG2+	Analog input 2
21	COMRET	Common return
23	COMRET	Common return
24	STO_RET	STO signal return
25	COMRET	Common return
26	STO_RET	STO signal return
27	ANALOG1-	Analog input 1 complement
28	STO1	STO 1 input opto isolated
29	ANALOG1+	Analog input 1
30	STO2	STO 2 input opto isolated

Table 12: Analog I/O and STO Pinouts

7.7 Isolated RS-232 and RS-422 Serial Communication (X4)

The following table describes the X4 Isolated Serial Communication to the 1 x 5 pins connector.

Note: Applicable only to Safety Capability **S** or **O**.

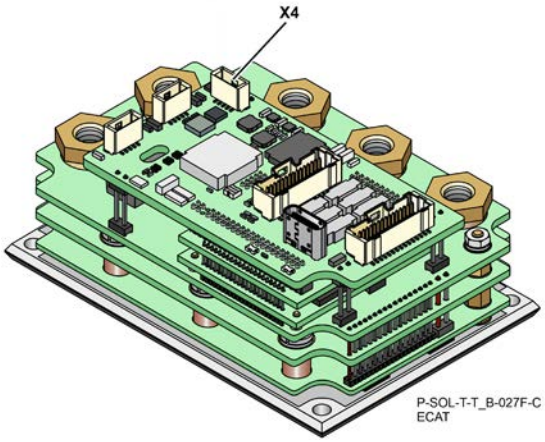
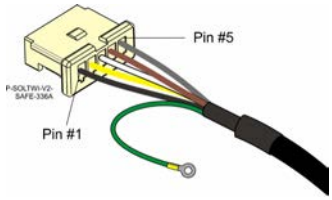
Pin X4	RS-232: Network: E		RS-422: Network: G	
	Signal	**Function**	**Signal**	**Function**
1	RS232_TX	RS232 Level	RS422_TX+	Differential RS232 Transmit Level
2	Not Connected		RS422_TX-	Differential RS232 Transmit Level
3	RS232_RX	RS232 Level	RS422_RX+	Differential RS232 Receive Level
4	Not Connected		RS422_RX-	Differential RS232 Receive Level
5	ISO_GND	Isolated Ground	ISO_GND	Isolated Ground
Pin Positions				**Cable Connector**
				 **X4 Connector**

Table 13: Platinum Solo Triple Bee Serial Communication

7.8 USB Connector (X3)

The following describes the pinouts of the USB connector of the Platinum Solo Triple Bee.

Refer to Chapter 17.1 USB in the Platinum Safety Drive Manual for full details.

Pin (X3)	Signal	Function
A1	COMRET	Common return
A2	Not Connected	
A3	Not Connected	
A4	USB_VBUS	USB VBUS 5 V
A5	Not Connected	
A6	USBD+	USB _P line
A7	USBD-	USB _N line
A8	Not Connected	
A9	USB_VBUS	USB VBUS 5 V
A10	Not Connected	

Pin (X3)	Signal	Function
A11	Not Connected	
A12	COMRET	Common return
B1	COMRET	Common return
B2	Not Connected	
B3	Not Connected	
B4	USB_VBUS	USB VBUS 5 V
B5	Not Connected	
B6	USBD+	USB _P line
B7	USBD-	USB _N line
B8	Not Connected	
B9	USB_VBUS	USB VBUS 5 V
B10	Not Connected	
B11	Not Connected	
B12	COMRET	Common return

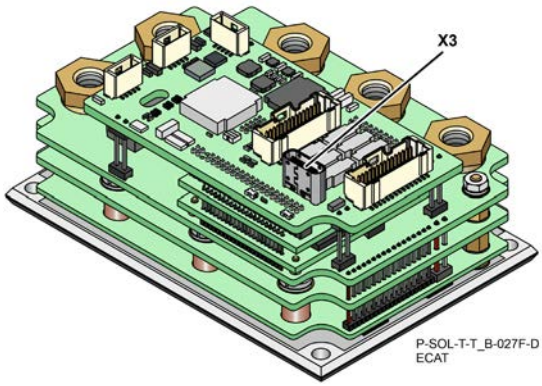
Pin Positions	Cable Connector
	 USB TYPE C CABLE

Table 14: X3 - USB Connector Device Type C

7.9 EtherCAT/Ethernet Communications (X1 and X2)

Fieldbus communications are industrial network protocols for real-time distributed control that allows connection of servo drives.

7.9.1 EtherCAT IN Connector (X1)

Refer to section 17.2 in the Platinum Safety Drive Manual for the electrical diagram.

The following table describes the EtherCAT IN connections to the 1 x 5 pin connector.

Pin X1	Signal	Function
1	EtherCAT_IN_TX+	EtherCAT in transmit +
2	EtherCAT_IN_TX-	EtherCAT in transmit -
3	EtherCAT_IN_RX+	EtherCAT in receive +
4	EtherCAT_IN_RX-	EtherCAT in receive -
5	EARTH	Shield drain wire

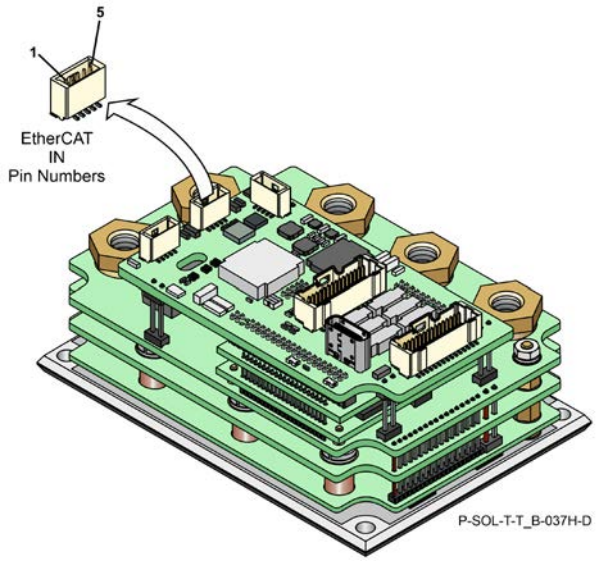
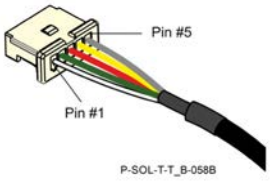
Pin Positions	Cable Connector
	

Table 15: EtherCAT IN Pin Assignments

7.9.2 EtherCAT OUT/Ethernet Connector (X2)

Refer to Section 17.2 in the Platinum Safety Drive Manual for the electrical diagram.

The following table describes the EtherCAT OUT/Ethernet connections to the 1 x 5 pin connector.

Pin X2	Signal	Function
1	EtherCAT_OUT_TX+/Ethernet_TX+	EtherCAT out /Ethernet transmit +
2	EtherCAT_OUT_TX-/Ethernet_TX-	EtherCAT out /Ethernet transmit -
3	EtherCAT_OUT_RX+/Ethernet_RX+	EtherCAT out /Ethernet receive +
4	EtherCAT_OUT_RX-/Ethernet_RX-	EtherCAT out /Ethernet receive -
5	EARTH	Shield drain wire

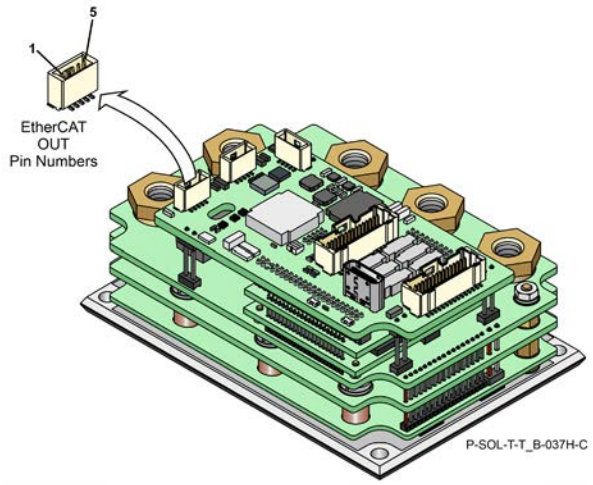
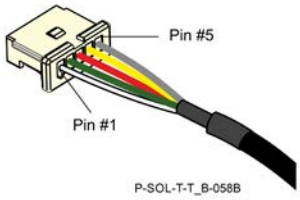
Pin Positions	Cable Connector
	

Table 16: EtherCAT OUT / Ethernet Pin Assignments

Chapter 8: Wiring

8.1 Wiring Legend

The following table legend describes the wiring symbols detailed in all installation guides.

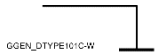
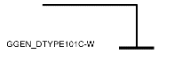
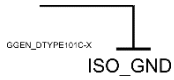
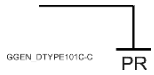
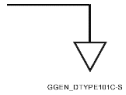
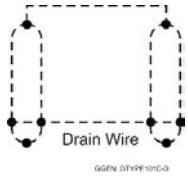
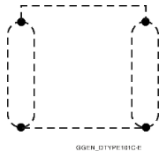
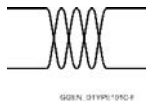
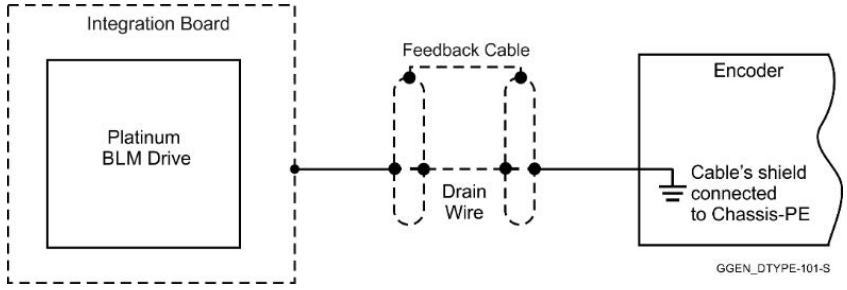
Wiring Symbol	Description
	Earth connection (PE)
	**User Side:** This symbol signifies that any type of grounding may be used on the user side
	VDD Return
	Isolated Ground
	Power Return
	COMRET Common at the Drive
	Shielded cable with drain wire. The drain wire is a non-insulated wire that is in direct contact with the braid (shielding). Shielded cable with drain wire significantly simplifies the wiring and earthing.
	Shielded cable braid only, without drain wire.
	Twisted-pair wires
	Encoder Earthing. The cable`s shield is connected to the chassis (PE) in the connector. The servo drive shield is connected to Earth.

Table 17: Wiring Symbols

8.2 The Platinum Solo Triple Bee Connection Diagrams

8.2.1 EtherCAT Connection Diagram with Safe IO (Safety Capability: F)

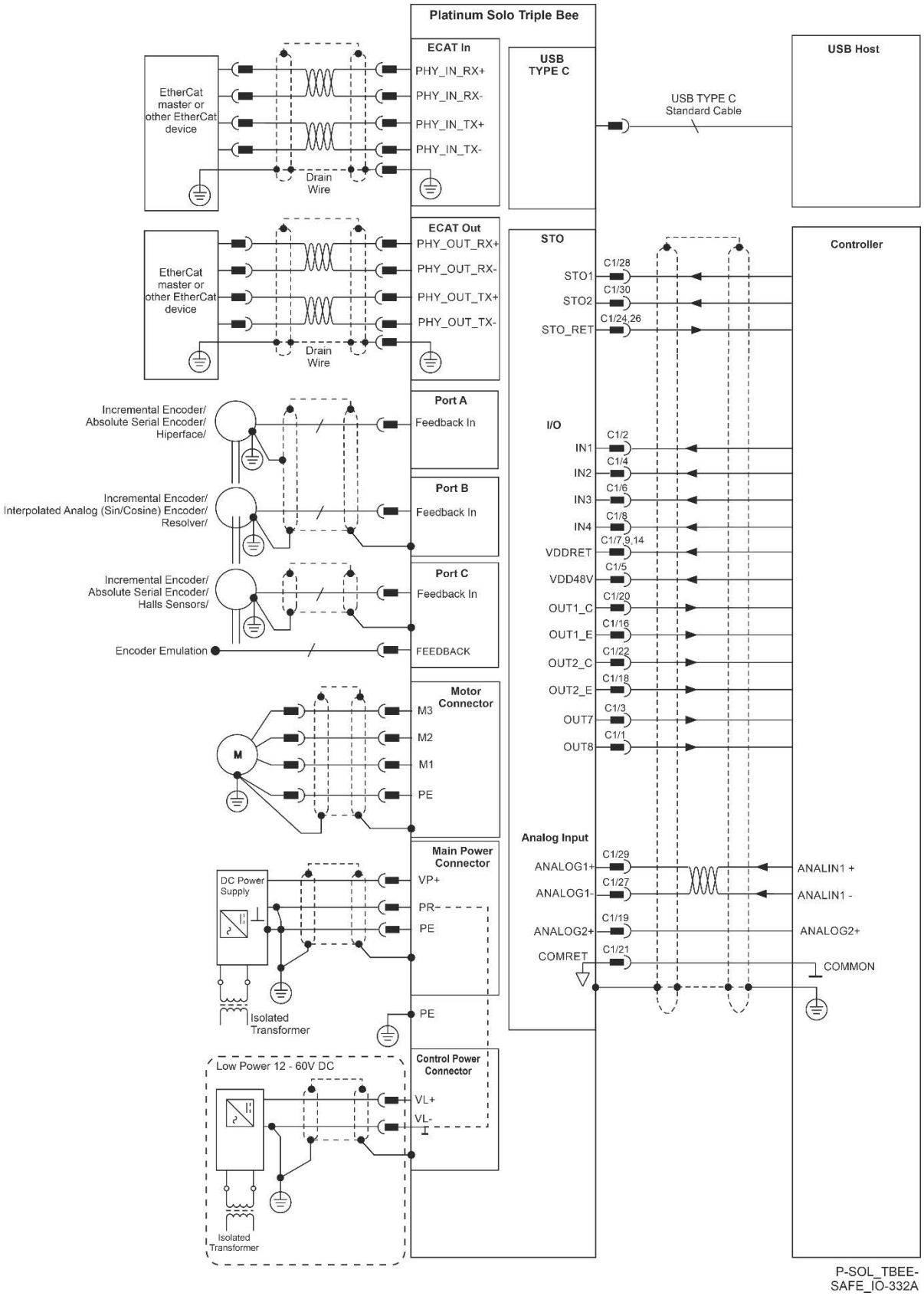


Figure 8: The Platinum Solo Triple Bee EtherCAT with Safe IO Connection Diagram

8.2.2 EtherCAT Connection Diagram with Regular IO (Safety Capability: S or O)

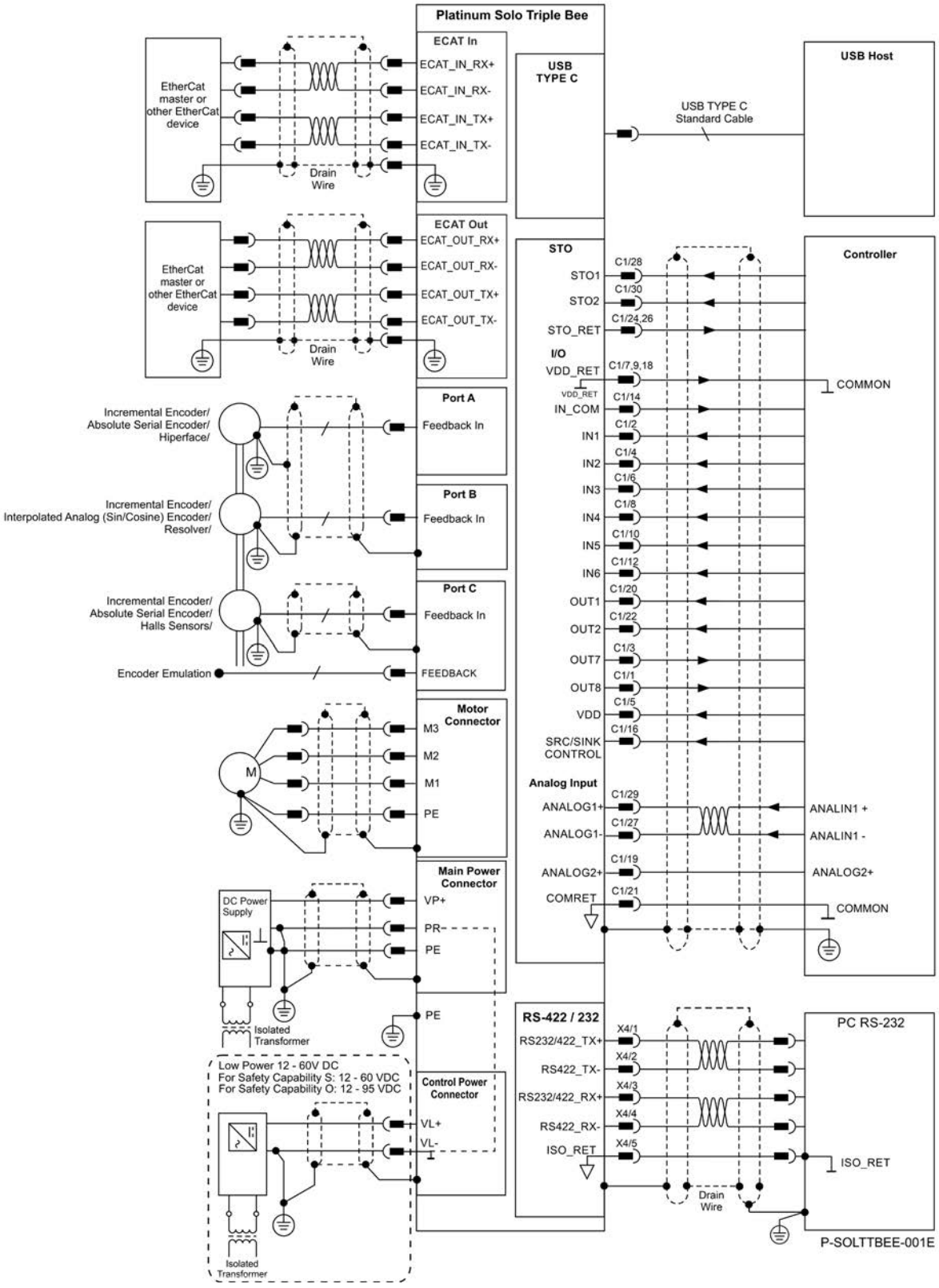


Figure 9: The Platinum Solo Triple Bee EtherCAT with Regular IO Connection Diagram

8.3 Wiring the Female Connectors

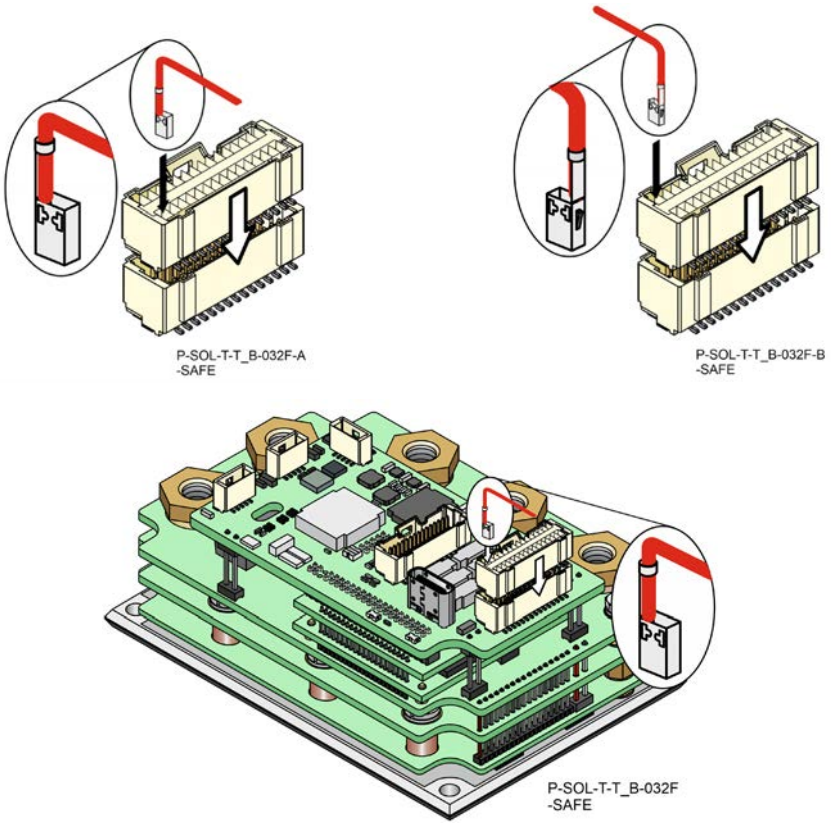


Figure 10: Inserting a wire/pin to the Female Connector

To insert a wire/pin to the female connectors of ENC C2, IO C1, RS-422/232, ECAT IN, and ECAT OUT do the following:

1. Select the relevantly colored wire to insert to a specific rectangular compartment on the female connector.
2. Use the appropriate Molex crimping plier (Molex P/N 63819-1500) to fasten a pin connector to the end of the wire.
3. Place the connector on a flat surface, in the orientation as shown in Figure 10.
   Notice that the rectangular slot has a niche at the bottom of the slot.
4. Insert the wire connector to the slot as shown in Figure 10. Make sure that the connector protrusion is inserted to the bottom of the rectangular slot.
   When inserting the wire connector to a slot in the second row, make sure to rotate the connector in the opposite orientation.
5. Repeat the same procedure for any other wire connections.

8.4 Main, Control, and Motor Power

This section describes the Main and Control supplies, and Motor Power connections. The Motor and Main Power interface uses lugs and cables defined in the section Recommended Cable Lugs and Cabling.

8.4.1 Connecting the DC Power and the Motor Power Wires

This section describes the installation of the wire terminal lugs for both the Main Power wires to VP+, PR, and PE terminals, and the Motor Power wires to the M1, M2, M3, and PE terminals on the Platinum Solo Triple Bee.

Note:
When connecting several identical motors, all the motor phases must be connected in an identical sequence in order to save repetition of the tuning process.

Step 1: PE Earth Connection

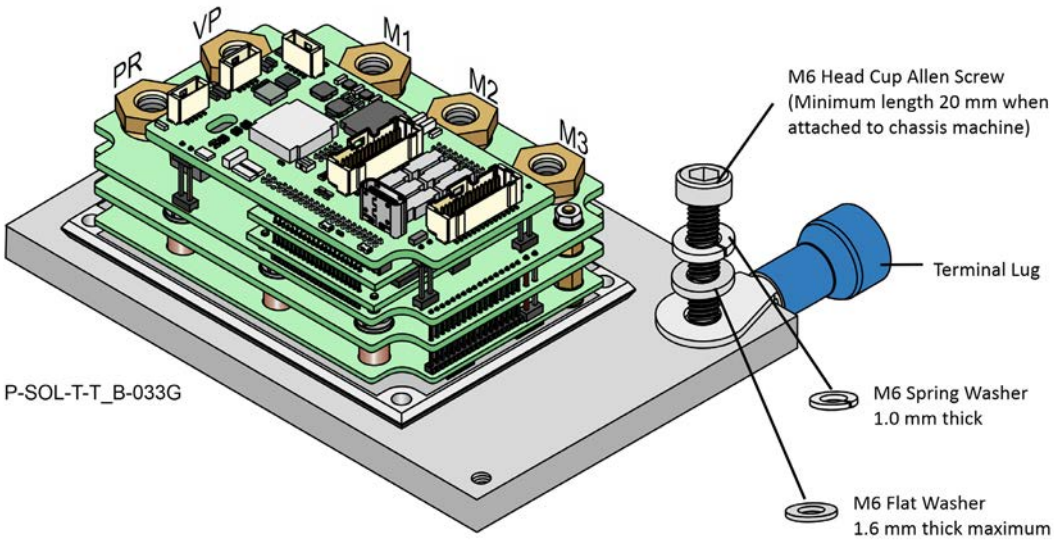
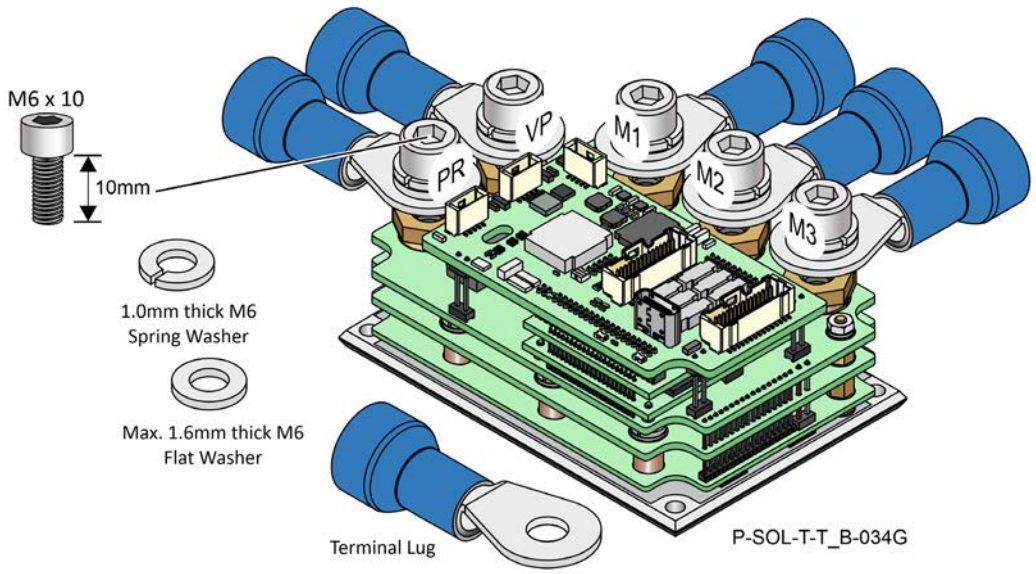


Table 18: Earth Connection

Tighten the screw to the relevant torque force applicable to an M6 stainless steel A2 screw.

Step 2: Power and Motor Connection



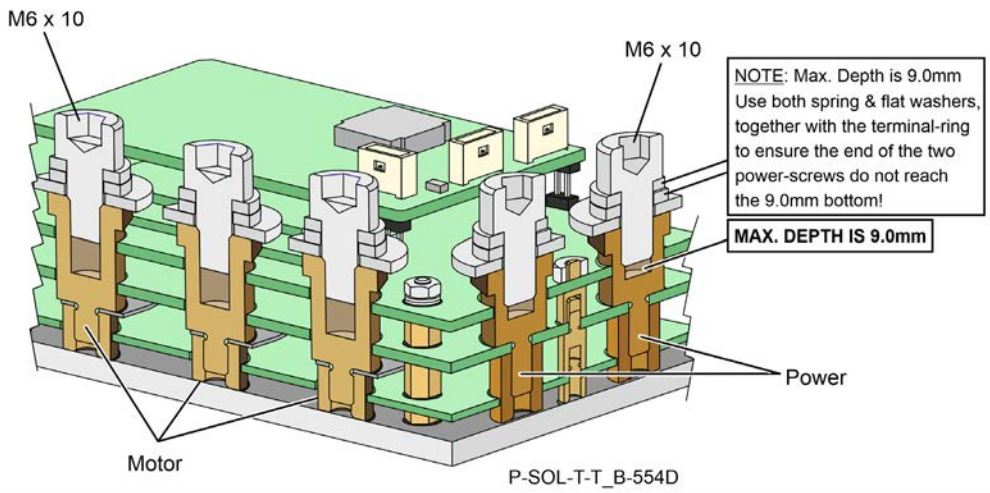


Table 19: Connecting the Main Power and Motor Cables

8.4.2 Motor Power Connections

1. Ensure that the motor chassis is properly earthed.
2. Connect the appropriate terminal lugs from the Motor Power cables to the M1, M2, M3, and PE terminals on the Platinum Solo Triple Bee.

   The phase connection is arbitrary as Elmo Application Studio (EAS II) will establish the proper commutation automatically during setup. When tuning a number of drives, you can copy the setup file to the other drives and thus avoid tuning each drive separately. In this case the motor-phase order must be the same as on the first drive.

   a. Install the motor cables to the drive using the recommended Terminal Lug (FLEX), M6 flat washer, M6 spring washer, and secure with an M6/10 head cup Allen screw (to the drive). The required M6/10 screw torque is typically 2 Nm.

Make sure that the screws do not insert to the maximum depth of 9.0 mm as shown in Figure 20 above.

b. Install the recommended PE wire to the drive, using the recommended Terminal Lug (FLEX), M6 flat washer, M6 spring washer, and secure with an M6/10 head cup Allen screw (to the drive). The required M6/10 screw torque is typically 2 Nm.

8.4.3 Motor Power

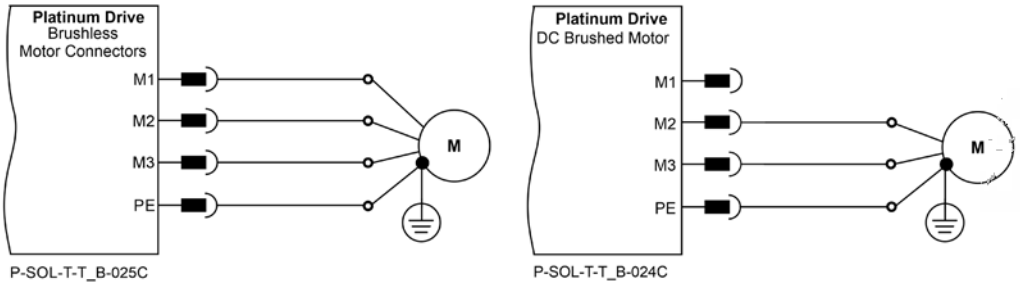


Figure 11: Brushless Motor Power and Brushed Motor Power Connection Diagram

Connect the motor power wires as shown in Figure 12. The Yellow wire is the Grounding wire.

Make sure not to bundle the wires.

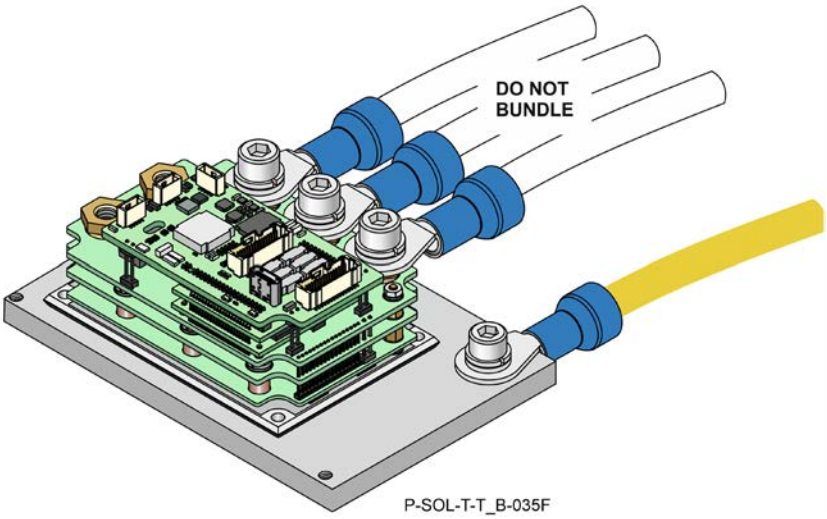


Figure 12: Connecting the Motor Power Wires

8.4.4 Main Power and Control Supply

This section describes the Main Power and the Control supply connector.

8.4.4.1 Main Power

The isolated DC power source is not included with the Platinum Solo Triple Bee.

Connect the DC power cable to the VP+ and PR terminals.

To connect the Platinum Solo Triple Bee to the DC power source:

1. The source of the VDC power supply/battery charger must be isolated from the Mains.
2. Verify that the rectified VDC is indeed within the range of the drive.

3. Connect the VP+ and PR wires to the terminals on the servo-drive as shown in Figure 13.
   It is highly recommended to twist the two DC main power cables at intervals of 10 cm.

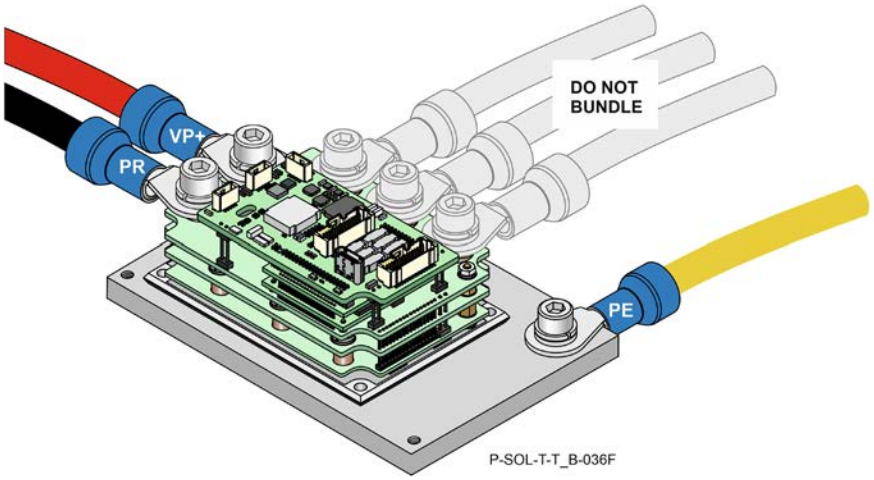


Figure 13: Connecting the Main Power Wires

4. Connect the PE to the closest earth connection near the power supply.
5. Connect the PR to the closest earth connection near the power supply.
6. Before applying power, first verify the polarity of the connection.

8.4.4.2 Control Supply (ENC C2)

Connect the VL+ and VL- pins on the Platinum Solo Triple Bee in the manner described in the procedure below.

Connect the VL+ and VL- terminals to the power supply Control Connector.

To connect the VL+ and VL- to the control supply:

1. The source of the control supply must be isolated from the Mains.
2. Connect the return (common) of the control supply source to the closest earth connection near the control supply source.
3. Connect the VL+ and VL- wires to the terminals on the servo-drive as shown in Figure 14.

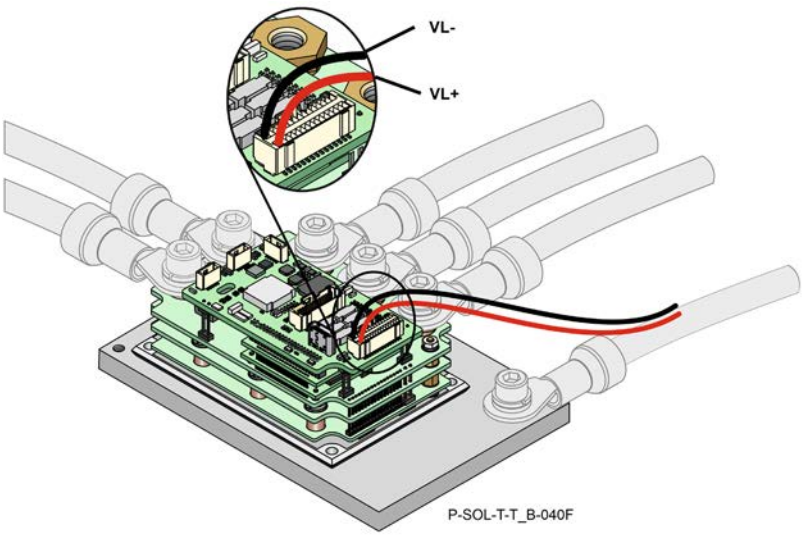


Figure 14: Connecting the Control Supply Wires

4. Before applying power, first verify the polarity of the connection.

8.4.4.3 Dual Power Supply for Safety

Two DC power sources are required for functional safety:

- Main power isolated from the Mains
  - Main power 20 to 195VDC for 200V module
  - Main power 10 to 95VDC for 100V module
  - Main power 10 to 75VDC for 80V module
  - Main power 10 to 55VDC for 60V module
- Control Power: Isolated DC Source supply
  - Control Power where Safety Capability is F, S: Maximum **60V for the logic**
  - Control Power where Safety Capability is O: Maximum **95V for the logic**

Both the Power and Logic supplies are required to be isolated-from-the-mains:

- A battery or main DC power source rectified from the Mains, according to specification
- A control supply for the logic (VL+, VL-)

The following figure describes an ordinary power supply for Servo drives with sufficient internal capacitance and shunt regulator to manage power flow in both directions to-and-from the motor.

Note:
The PR, COMRET, and VL- are connected internally in the Platinum Solo Triple Bee.

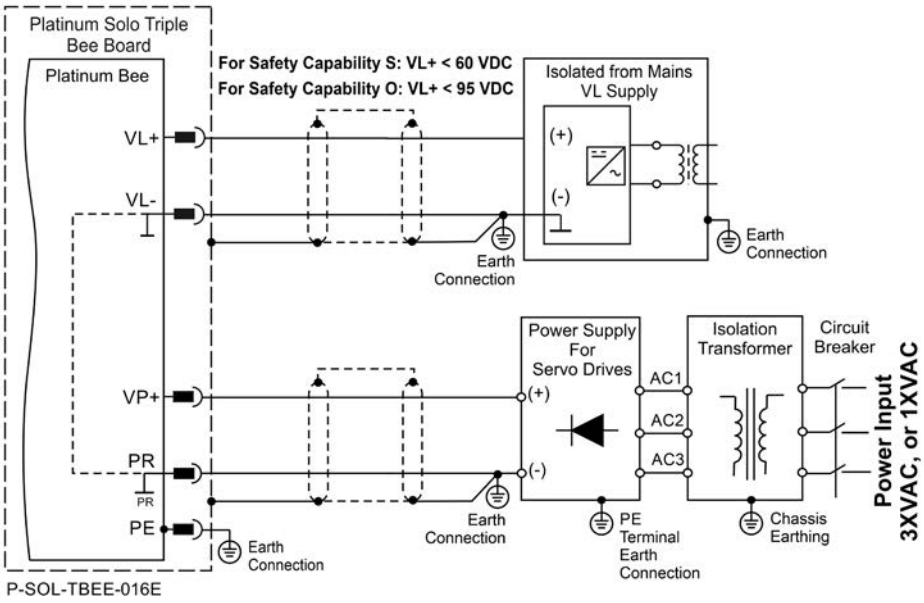


Figure 15: Separate VP and VL Power Supplies Connection Diagram

8.5 Feedback

Refer to the Chapter 13 Feedback, in the Platinum Safety Drive Manual for details, specification, and connections of the Feedback for safety.

The wires should be inserted as detailed in section 8.3 Wiring the Female Connectors, according to the relevant Feedback Port sensors' pinouts as described in the next five subsections.

8.5.1 Port A

Port A supports the following sensors as described in the table below:

- Incremental Encoder or absolute serial Encoder
- Differential pulse-width modulation (PWM) signal input
- Differential Pulse & Direction signal inputs

Refer to section 13.1 in the Platinum Safety Drive Manual for further details of the Port A connections.

Pin (C2) Port A			Incremental Encoder	Absolute Serial Encoder
	Signal		**Function**	**Function**
1	PortA_A+		Channel A +	Absolute encoder clock+
3	PortA_A-		Channel A -	Absolute encoder clock-
5	PortA_B+		Channel B+	Absolute encoder data+
7	PortA_B-		Channel B -	Absolute encoder data -
9	PortA_INDEX+		Channel_Index+	
11	PortA_INDEX-		Channel_Index-	
19	+5V		**For Regular IO:** Encoder +5V supply with a total allowable maximum consumption of 400mA using Pins 19 or 26.	**For Safe IO:** Encoder +5V supply with a total allowable maximum consumption of 400mA
26	**For Regular IO:** +5V	**For Safe IO:** +11V	**For Regular IO:** Encoder +5V supply with a total allowable maximum consumption of 400mA using Pins 19 or 26.	**For Safe IO:** Encoder +11V supply with a total allowable maximum consumption of 300mA
21, 23, 25, 27, 28	COMRET		Common return	

8.5.1.1 Incremental Encoder

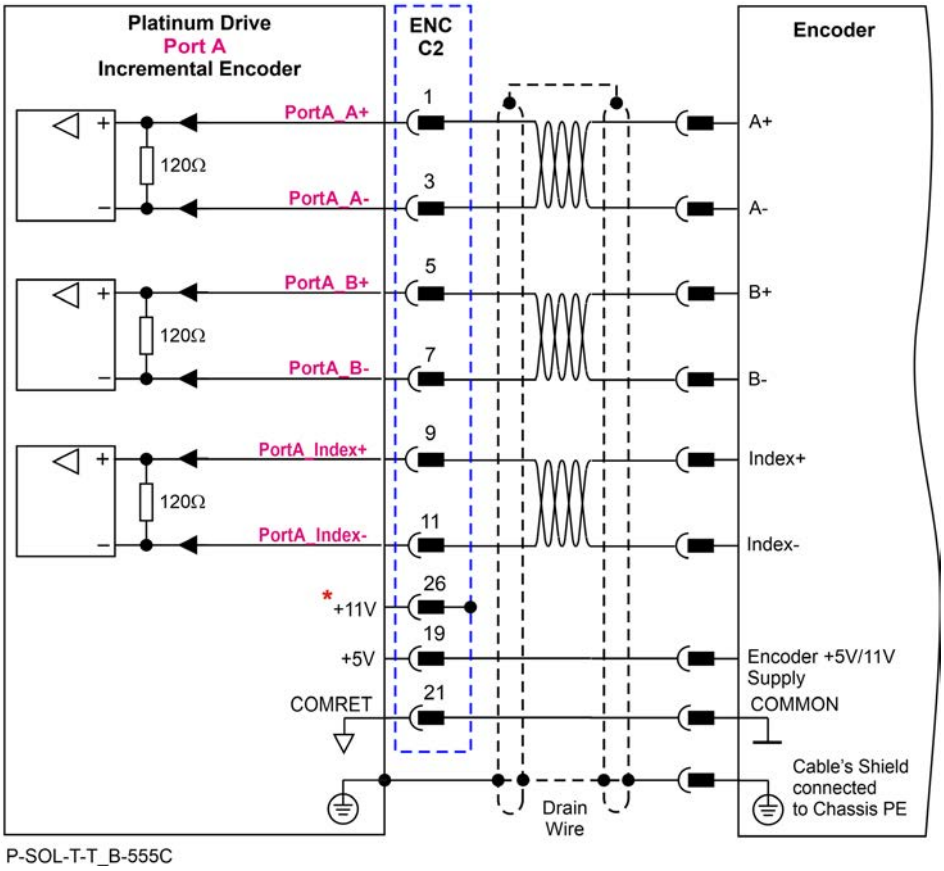


Figure 16: Port A Incremental Encoder Input – Recommended Connection Diagram

***Note:** **If the Encoder supports 11V, then for Safety Capability F, 11V is available.**

8.5.1.2 Absolute Serial Encoder

The following Absolute Encoder types are supported:

- EnDat 2.2, Safe EnDat 2.2
- Biss C and Biss B, Safe BISS
- SSI
- Hiperface

The following is the diagram connection of the EnDat, Biss, SSI:

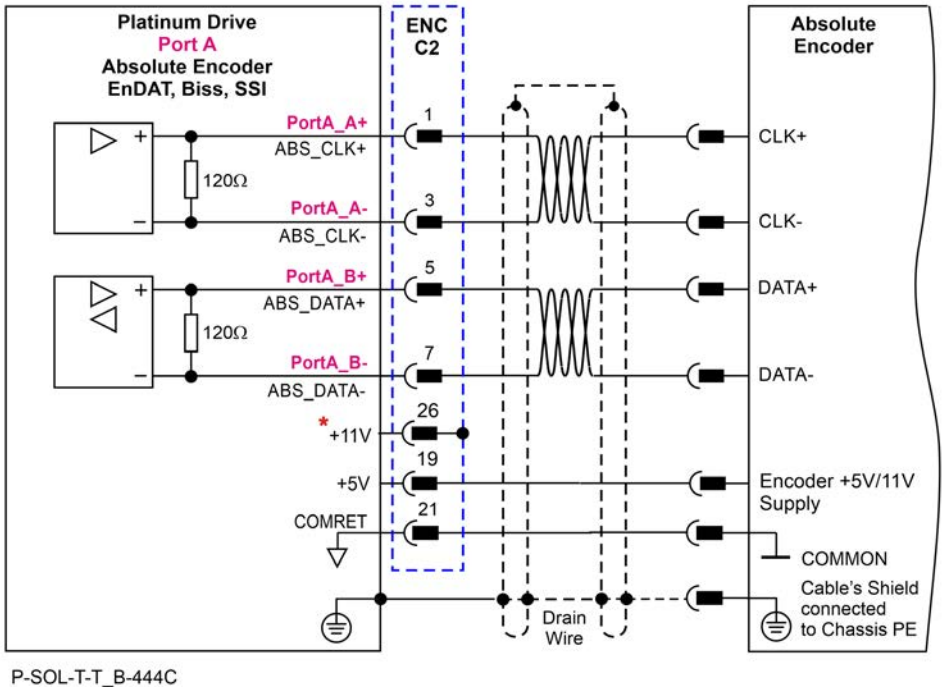


Figure 17: Absolute Serial Encoder – Recommended Connection Diagram for Sensors Supporting Data/Clock (e.g., Biss / SSI / EnDAT, etc.)

***Note:** **For Safety Capability F, 11V is available. Therefore, the encoder of 11V can be used.**

8.5.1.3 Hiperface

8.5.1.3.1 Hiperface for Safety Application (Safety Capability “F”)

Hiperface with Safety Capability “F” - for Safe IO which includes a power supply of 11V.
The following figure describes the connection diagram.

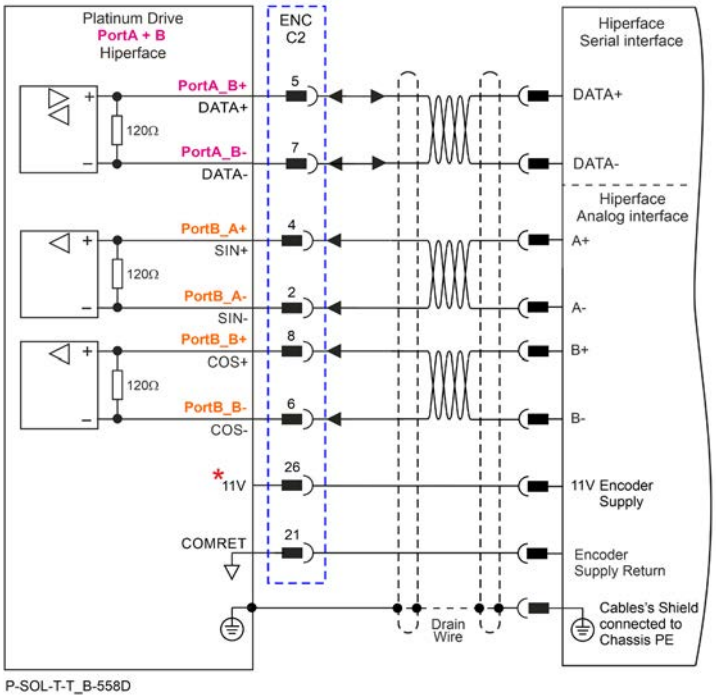


Figure 18: Absolute Serial Encoder – Recommended Connection Diagram for Hiperface – Safe IO

8.5.1.3.2 Hiperface for Non Safety Application

Hiperface that requires power of 7-12V can be used with external power supply for non-safety application.
The following figure describes the connection diagram.

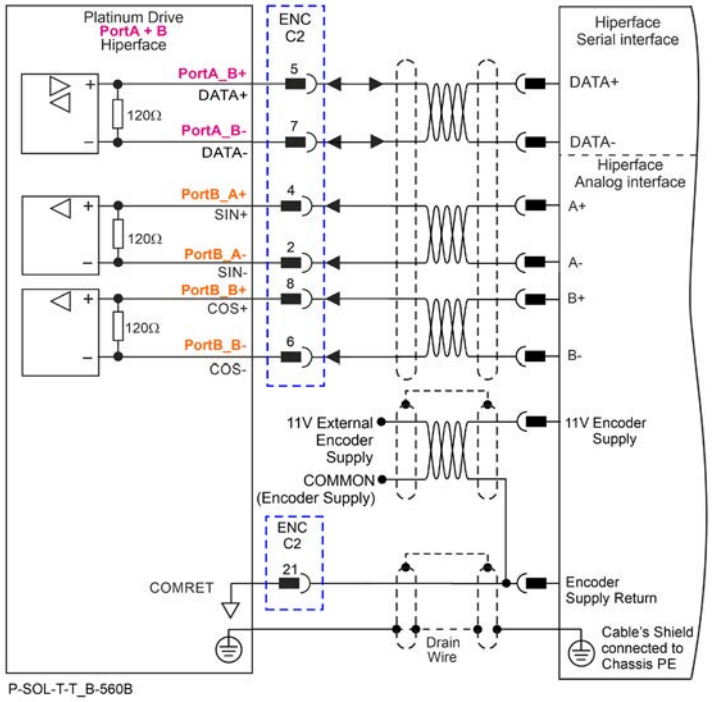


Figure 19: Absolute Serial Encoder – Recommended Connection Diagram for Hiperface – Regular IO

8.5.2 Port B

Refer to chapter 13.1 in the Platinum Safety Drive Manual for further details of the Port B connections.

Port B supports any of the following sensors:

- Incremental Encoder, interpolated analog Encoder or analog Hall sensors

Or

- Resolver (separate hardware option)

Pin (C2) Port B			Incremental Encoder	Interpolated Analog Encoder	Resolver
	Signal		**Function**	**Function**	**Function**
			PBET-Sz-RXXX/YYYzEzQ		PBET-Sz-RXXX/YYYzRzQ
2	PortB_A-		Channel A -	Sine-	Sine-
4	PortB_A+		Channel A+	Sine+	Sine+
6	PortB_B-		Channel B-	Cosine-	Cosine-
8	PortB_B+		Channel B+	Cosine+	Cosine+
10	PortB_INDEX-		Channel_Index-	Analog_Index-	RESOLVER_OUT- Vref complement f= 1/TS, 50 mA Max.
12	PortB_INDEX+		Channel_Index+	Analog_Index+	RESOLVER_OUT+ Vref f=1/TS, 50 mA Max.
19	+5V		**For Regular IO:** Encoder +5V supply with a total allowable maximum consumption of 400mA using Pins 19 or 26.		**For Safe IO:** Encoder +5V supply with a total allowable maximum consumption of 400mA
21,23	COMRET		Common return		
26	**For Regular IO:** +5V	**For Safe IO:** +11V	**For Regular IO:** Encoder +5V supply with a total allowable maximum consumption of 400mA using Pins 19 or 26.		**For Safe IO:** Encoder +11V supply with a total allowable maximum consumption of 300mA

8.5.2.1 Incremental Encoder

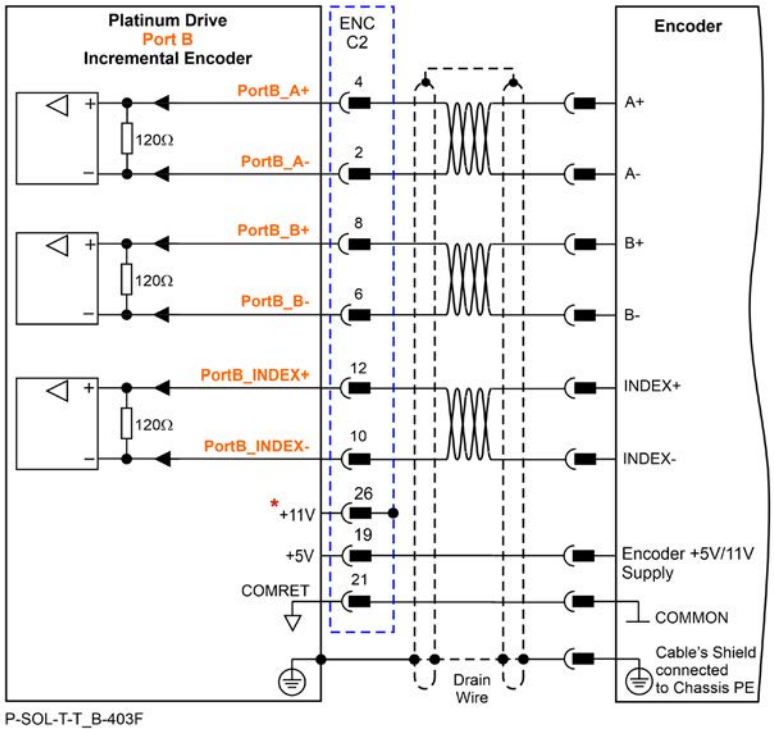


Figure 20: Port B Incremental Encoder Input – Recommended Connection Diagram

***Note:** If the Encoder supports 11V, then for Safety Capability F, 11V is available.

8.5.2.2 Interpolated Analog (Sine/Cosine) Encoder

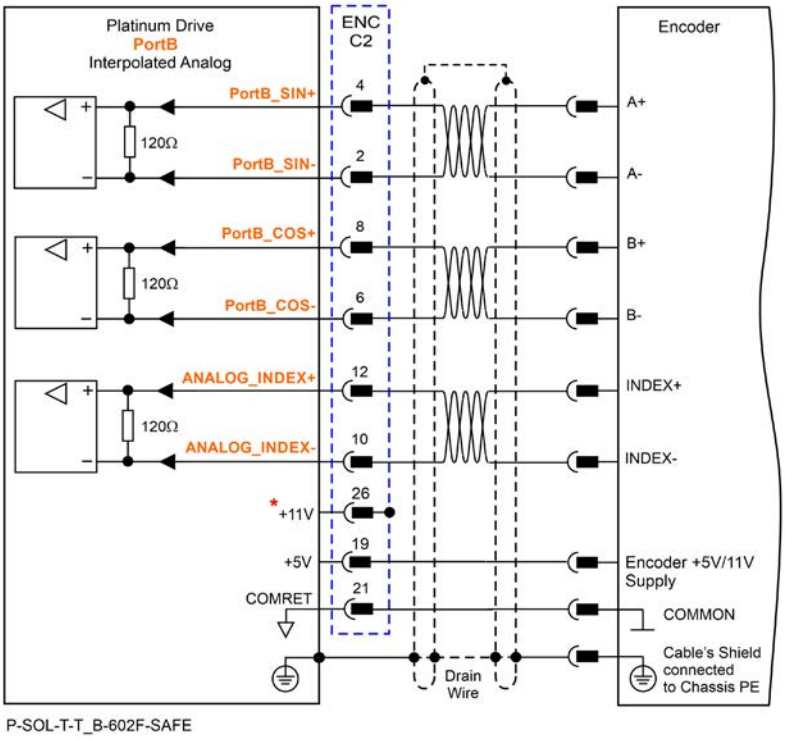


Figure 21: Port B - Interpolated Analog Encoder Connection Diagram

***Note:** If the Encoder supports 11V, then for Safety Capability F, 11V is available.

8.5.2.3 Resolver

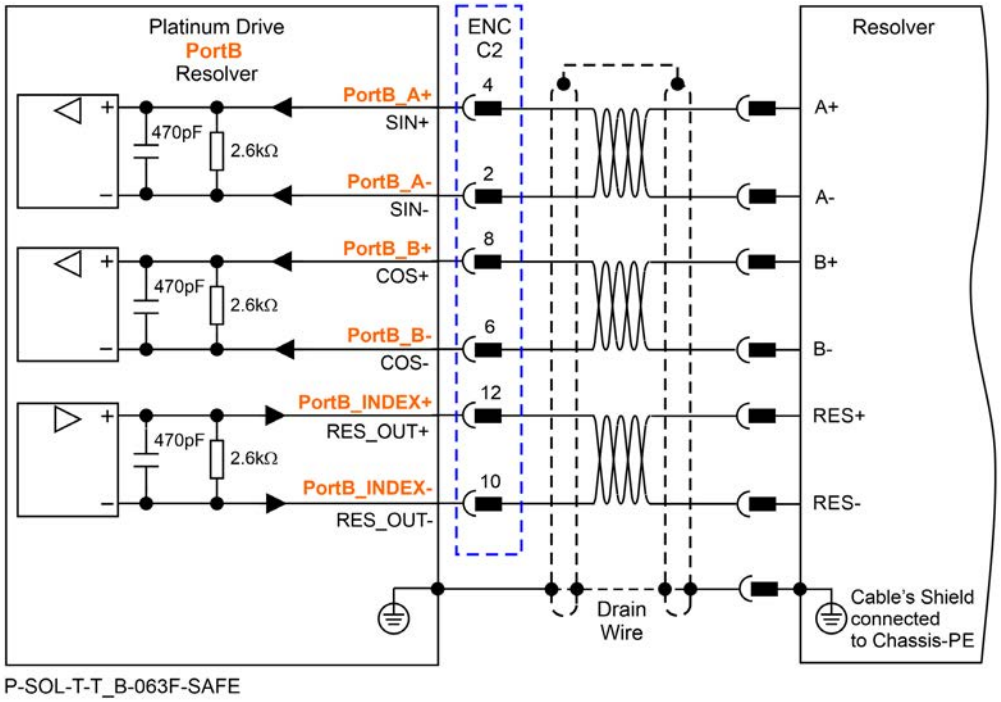


Figure 22: Port B – Resolver Connection Diagram

8.5.3 Port C

See Section 13.1 in the Platinum Safety Drive Manual for further details of Port C.

Port C supports the following encoder feedbacks:

- Incremental Encoder feedbacks
- Absolute Serial Encoder feedbacks
- Emulated Encoder output derived from port A, port B feedback inputs, or from internal variables

Pin (C2) Port C			Incremental Encoder	Absolute Serial Encoder	Emulated Encoder
	Signal		**Function**	**Function**	**Function**
13	HALL A		Hall A Input		
15	HALL B		Hall B Input		
17	HALL C		Hall C Input		
14	PORTC_A-		Channel A -	Absolute encoder clock-	Emulated Output A-
16	PORTC_A+		Channel A +	Absolute encoder clock+	Emulated Output A+
18	PORTC_B-		Channel B –	Absolute encoder data -	Emulated Output B-
20	PORTC_B+		Channel B+	Absolute encoder data+	Emulated Output B+
22	PORTC_INDEX-		Index -	Reserved	Emulated Output Index-
24	PORTC_INDEX+		Index+	Reserved	Emulated Output Index+
19	+5V		**For Regular IO:** Encoder +5V supply with a total allowable maximum consumption of 400mA using Pins 19 or 26.	**For Safe IO:** Encoder +5V supply with a total allowable maximum consumption of 400mA	
21, 23	COMRET		Common return		
26	**For Regular IO:** +5V	**For Safe IO:** +11V	**For Regular IO:** Encoder +5V supply with a total allowable maximum consumption of 400mA using Pins 19 or 26.	**For Safe IO:** Encoder +11V supply with a total allowable maximum consumption of 300mA	

8.5.3.1 Incremental Encoder

The following Incremental Encoder types are supported:

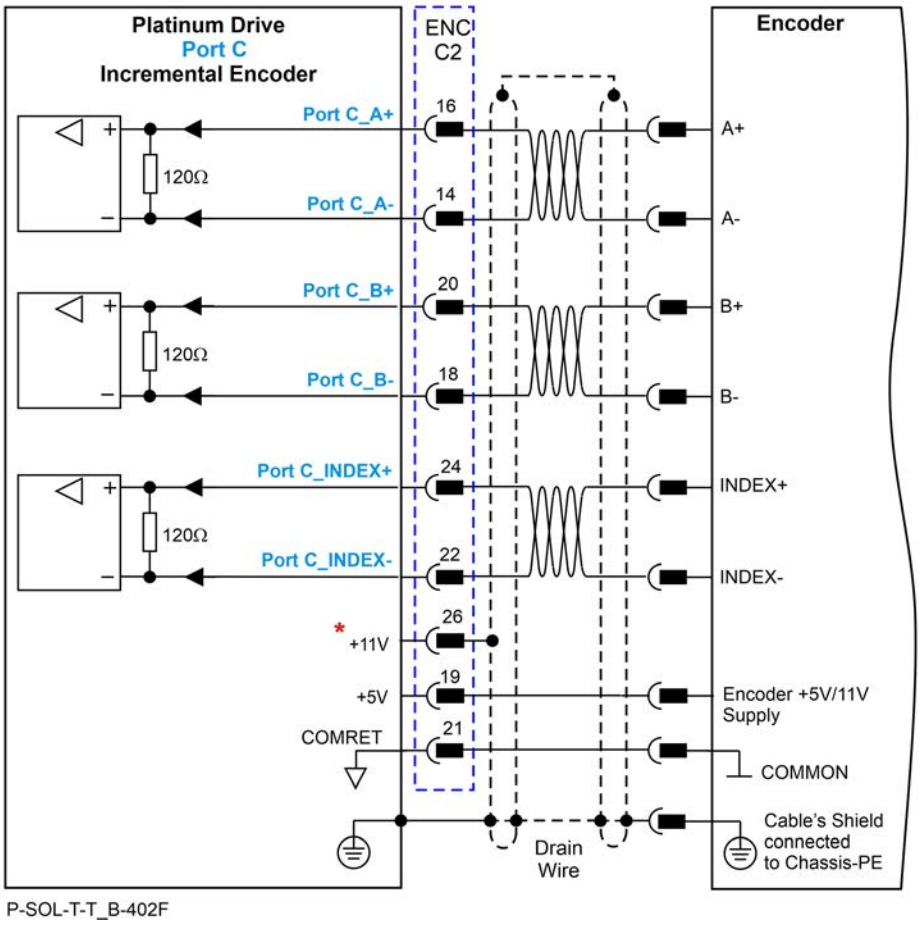


Figure 23: Port C Incremental Encoder Input – Recommended Connection Diagram

***Note: If the Encoder supports 11V, then for Safety Capability F, 11V is available.**

8.5.3.2 Absolute Serial Encoder

Port C supports three types of encoder wire connections:

- Encoder 6-Wires
- Encoder 4-Wires
- Encoder 2-Wires

8.5.3.2.1 Encoder 6-Wires

The following encoders are supported (Encoder Option E):

- EnDat 2.2, Safe EnDat 2.2
- Biss C and Biss B, Safe BISS
- SSI

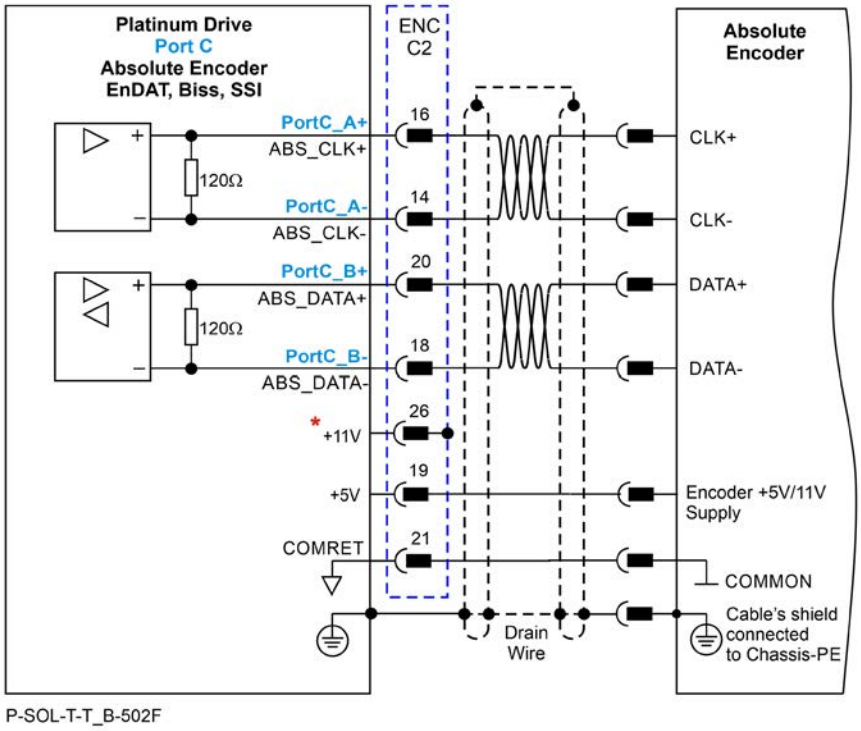


Figure 24: Absolute Serial Encoder– 6-Wires Connection Diagram Example

***Note: For Safety Capability F, 11V is available. Therefore, the encoder of 11V can be used.**

8.5.3.2.2 Encoder 4-Wires

The following encoders are supported:

- Pansonic (Encoder Option E)
- Tamagawa (Encoder Option E)
- Sanyo-Danki (Encoder Option E)
- Acuro Link (Safety Capability F and Encoder Option 1)
- SCS (Safety Capability F and Encoder Option 2)

The following is the feedback diagram connection:

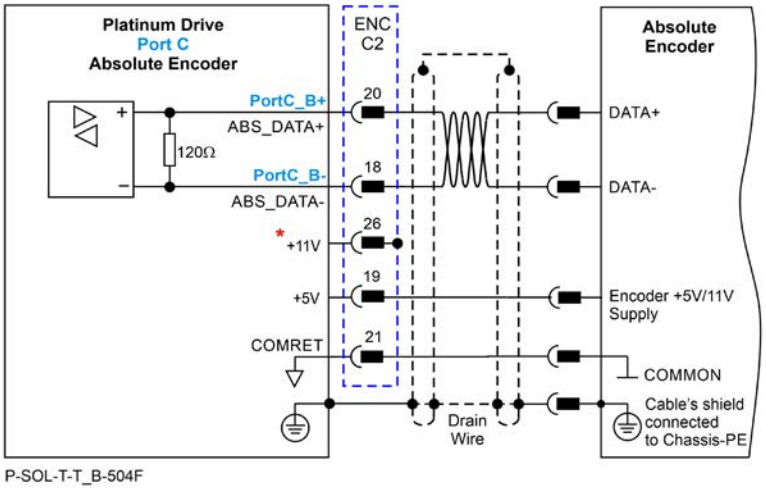


Figure 25: Absolute Serial Encoder – 4-Wires Connection Diagram Example

***Note: For Safety Capability F, 11V is available. Therefore, the encoder of 11V can be used.**

8.5.3.2.3 Encoder 2-Wires

The following encoders are supported:

- Endat3, Safe Endat3 (Safety Capability F and Encoder Option H)
- SCS Open link (Safety Capability F and Encoder Option 3)
- Hiperface DSL (Safety Capability F and Encoder Option 4)

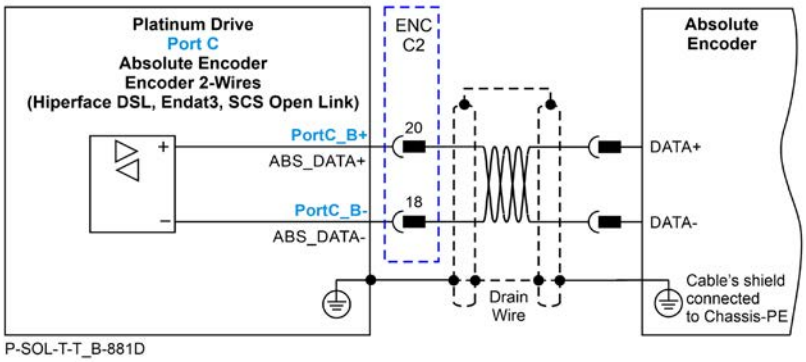


Figure 26: Absolute Serial Encoder – 2-Wires Connection Diagram Example

8.5.3.3 Emulated Encoder Output

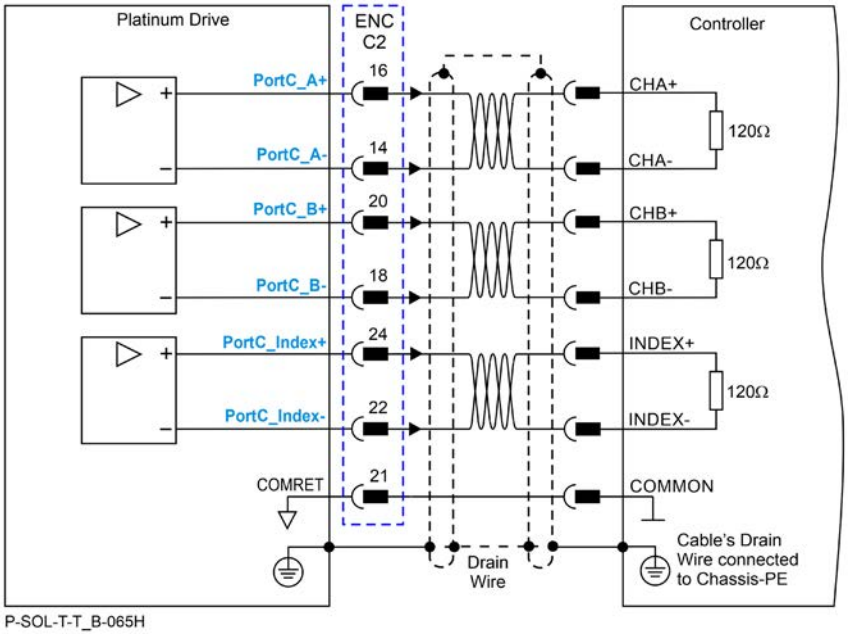


Figure 27: Emulated Encoder Differential Output – Recommended Connection Diagram

8.5.4 Hall Sensors

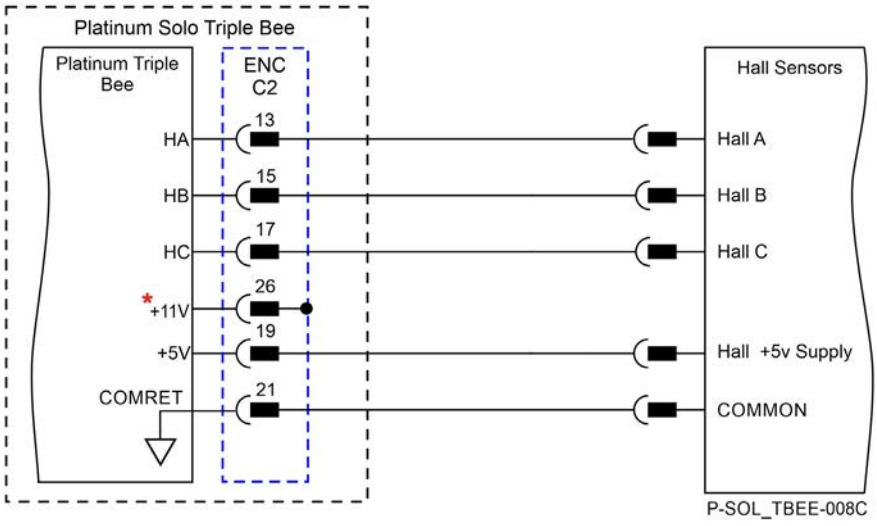


Figure 28: Hall Sensors Connection Diagram

***Note: If the Encoder supports 11V, then for Safety Capability F, 11V is available.**

8.6 Safe Digital I/Os (Safe IO Style: B) (C1)

The wires should be inserted as detailed in section 8.3 Wiring the Female Connectors.

Refer to the Chapter 14 Safe Digital IO section, in the Platinum Safety Drive Manual for details, specification and connection of IO for Safety.

The wires should be inserted as detailed in section 8.3 Wiring the Female Connectors, according to the relevant Safe Digital IO pinouts as described in the next two subsections.

8.6.1 Digital Outputs

The Platinum Solo Triple Bee supports four digital outputs:

- Two Safe Outputs: OUT7 – SRC and OUT8 SINK
- Two regular Outputs that can be used as regular output or test pulse outputs: OUT1 and OUT2

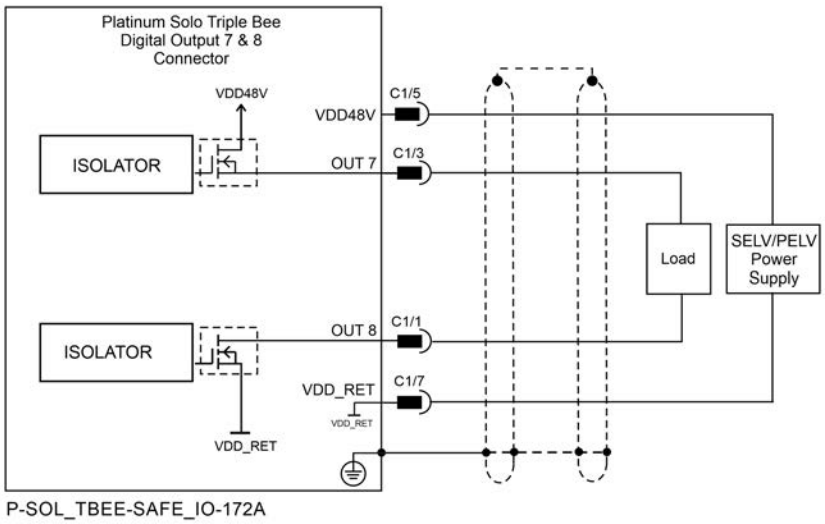


Figure 29: Digital Outputs with Safe IO Connection Diagram (OUT7 and OUT8)

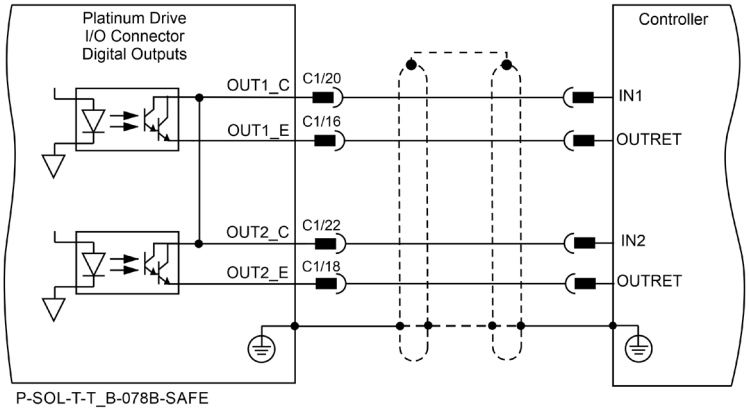


Figure 30: Digital Outputs for Regular Connection Diagram (OUT1 and OUT2)

8.6.2 Digital Inputs

The Platinum Solo Triple Bee supports up to four digital inputs:

- Two Safe inputs with Test Pulse (IN1 and IN2)
- Four OSSD Inputs (IN1, IN2, IN3, IN4)

8.6.2.1 Digital Input with Test Pulse

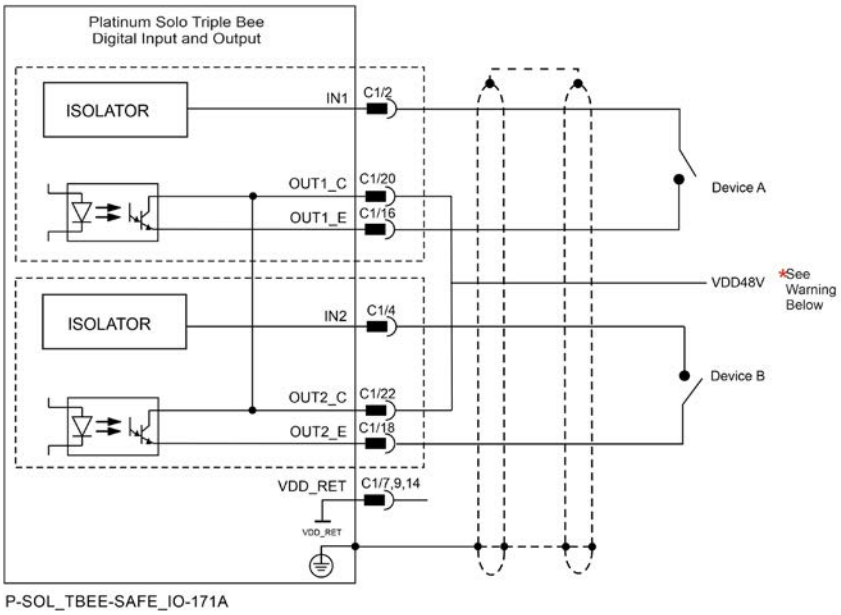


Figure 31: Digital Input with Test Pulse Connection Diagram (IN1 and IN2)

Warning:
The range of VDD is according to the table in 5.4.7 Digital Output. However, the external Device A, B must be tolerant to the VDD voltage.

8.6.2.2 OSSD Inputs

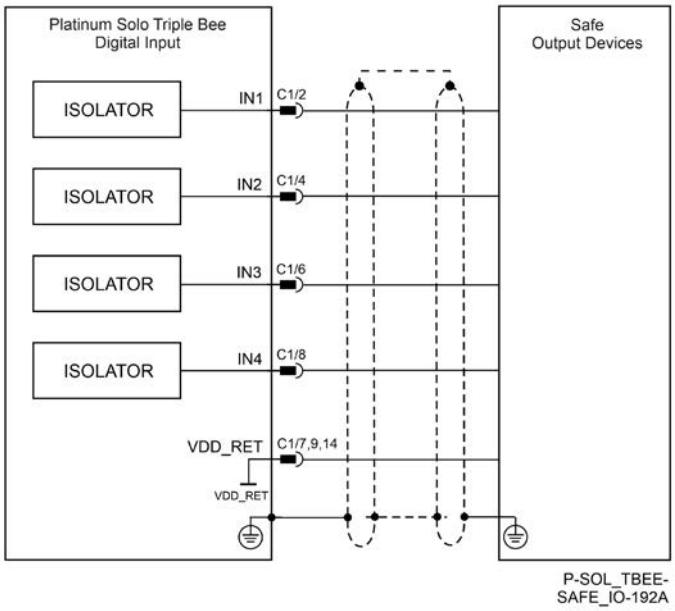


Figure 32: OSSD Digital Input Connection Diagram (IN1, IN2, IN3, IN4)

8.7 Regular Digital IOs (IO TYPE: U, V) (C1)

Refer to the Chapter 15 Regular Digital IO section, in the Platinum Safety Drive Manual for details, specification and connection of the Regular IO connections.

The wires should be inserted as detailed in section 8.3 Wiring the Female Connectors, according to the relevant Regular Digital IO pinouts as described in the following subsections.

8.7.1 Digital Input and Output 5V Logic Mode (IO Type: U)

The following figures describe the connections at the I/O Port for the Digital Input and Output 5V logic Mode:

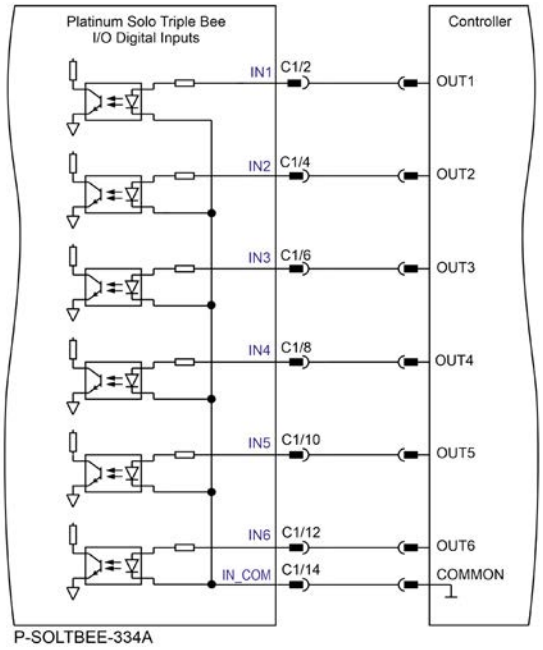


Figure 33: Regular Digital Input 5V Logic Mode Connection Diagram

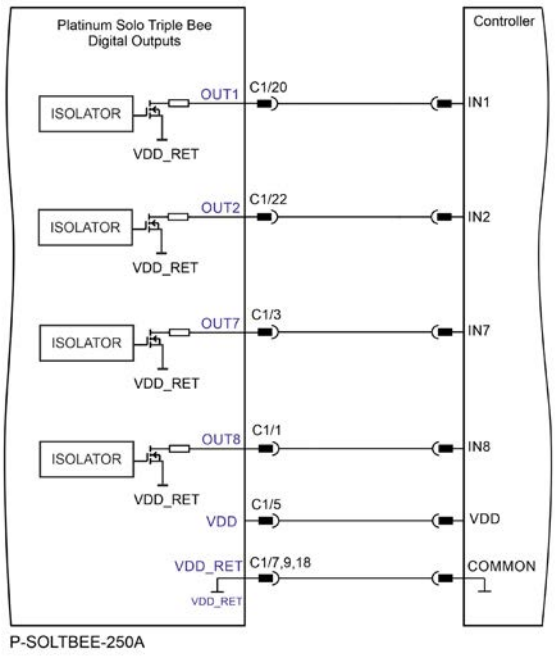


Figure 34: Regular Digital Output Connection Diagram – 5V Logic Option

8.7.2 Digital IO PLC Source and Sink Mode (IO Type: V)

8.7.2.1 Digital Input and Output PLC Source Mode

The following figures describe the connections at the I/O Port for the Digital Input and Output PLC Source Mode.

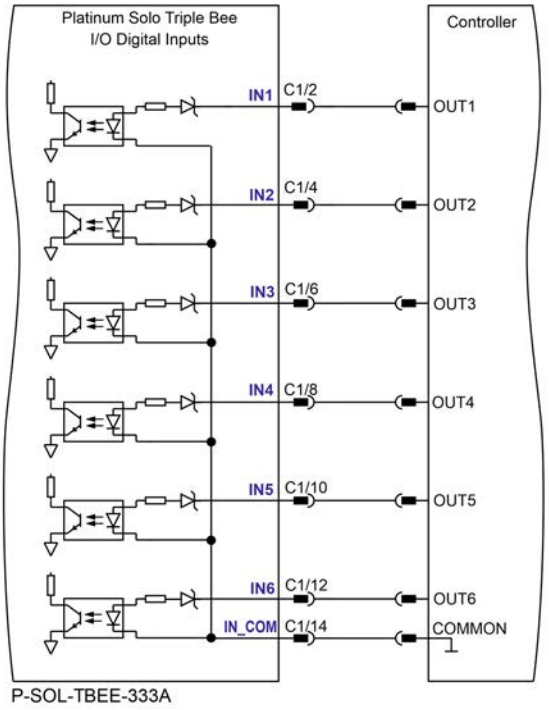


Figure 35: Regular Digital Input Connection Diagram – PLC Source Option

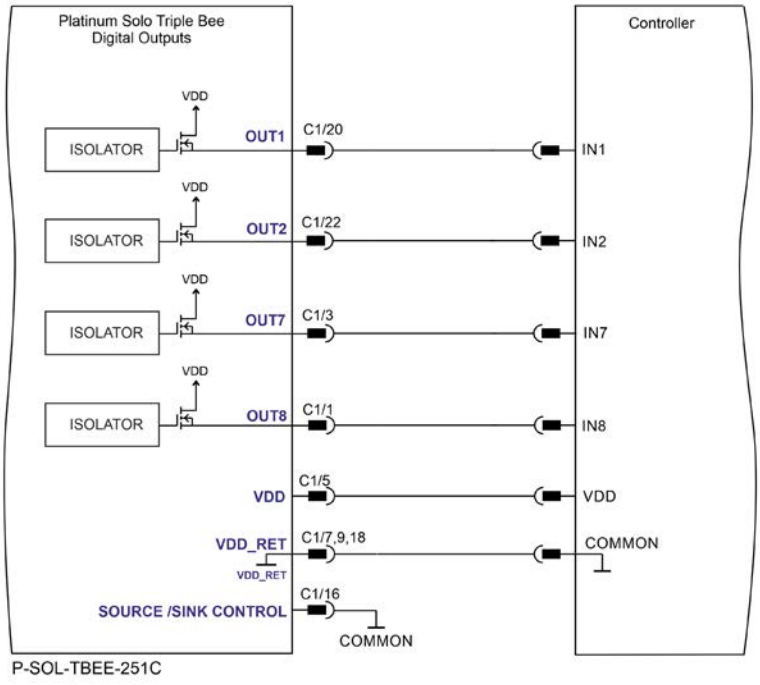


Figure 36: Regular Digital Output Connection Diagram – PLC Source Option

8.7.2.2 Digital Input and Output PLC Sink Mode

The following figures describe the connections at the I/O Port for the Digital Input and Output PLC Sink Mode.

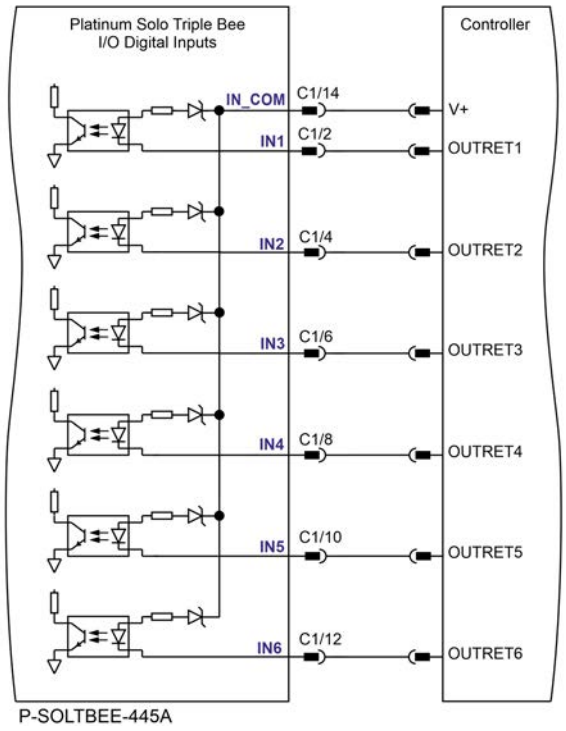


Figure 37: Regular Digital Input Connection Diagram – PLC Sink Option

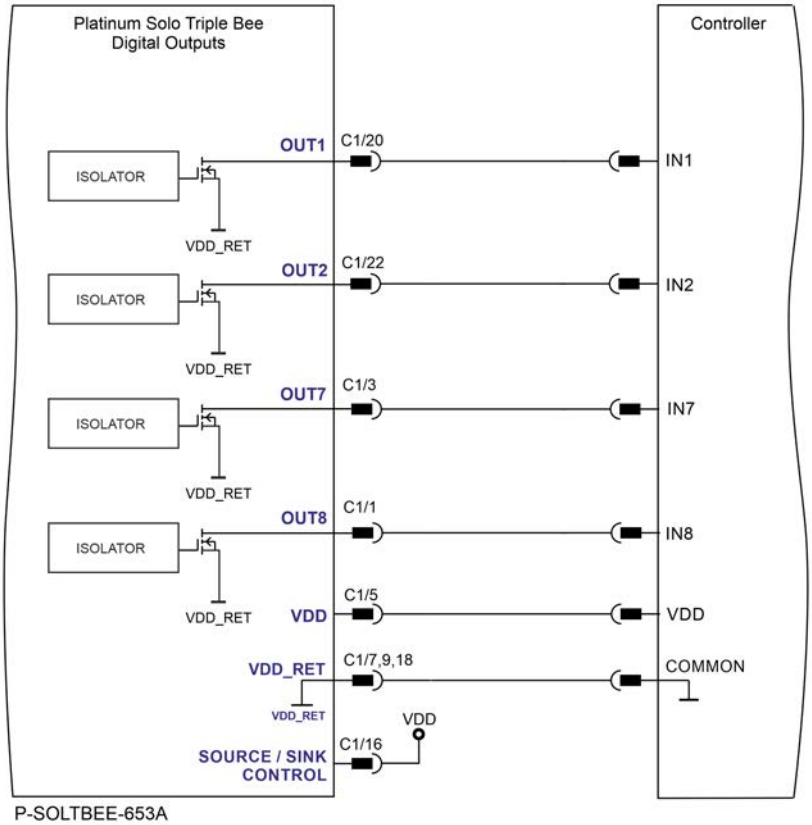


Figure 38: Regular Digital Output Connection Diagram – PLC Sink Option

8.8 STO (Safe Torque Off)

For full details on STO, see Chapter 12 in the Platinum Safety Drive Manual.

Refer to the Chapter 12 Safe Torque Off (STO) section, in the Platinum Safety Drive Manual for details, specification and connection of the STO.

The wires should be inserted as detailed in section 8.3 Wiring the Female Connectors, according to the relevant STO pinouts as described in the following subsections.

8.8.1 Source Mode – PLC Voltage Level

Refer to the diagram below for the PLC Source option connection

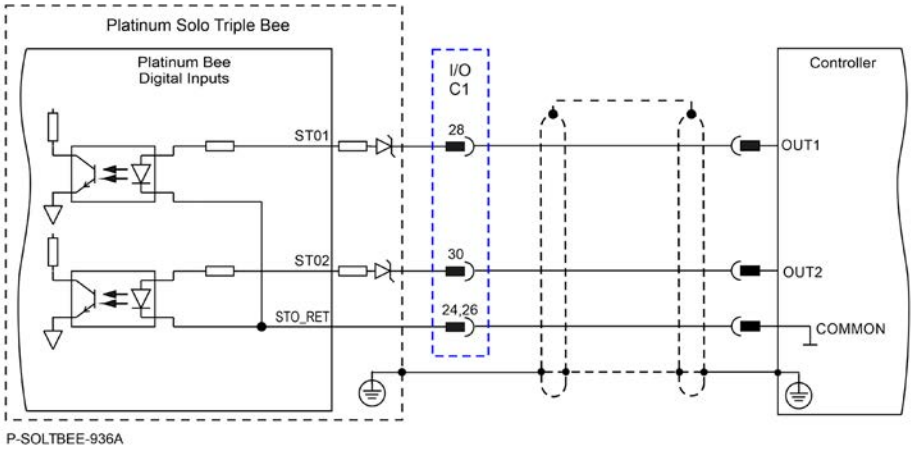


Figure 39: STO Input Connection – PLC Source (24V Logic)

8.8.2 TTL Mode – TTL Voltage Level

The TTL (5V Logic) option is only available for models:

- PBET-S**S**-zXXX/YYYzzU-zQ
- PBET-S**O**-zXXX/YYYzzU-zQ

Refer to the diagram below for the TTL option connection.

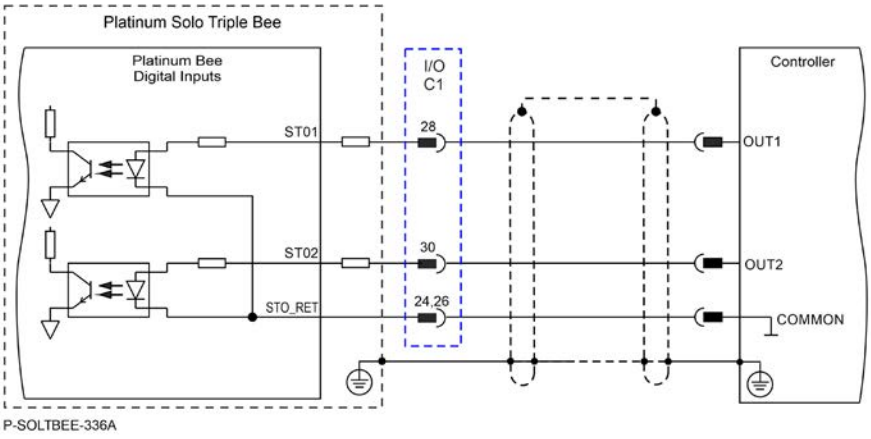


Figure 40: STO Input Connection – TTL Source 5V Logic

8.9 Analog Input

For full details on Analog Inputs, see section 16 in the Platinum Safety Drive Manual.

There are two possible types of Analog Inputs in the Platinum Solo Triple Bee:

- Analog Input 1 – Differential ±10 V
- Analog Input 2 – Single ended ±10 V

Refer to the Chapter 16 Analog Input section, in the Platinum Safety Drive Manual for details, specification and connection of the Analog Input.

8.9.1 Analog Input 1

The wires should be inserted as detailed in section 8.3 Wiring the Female Connectors, according to the Analog Input 1 pinouts as described below.
The following is the diagram connection of the Analog Input 1:

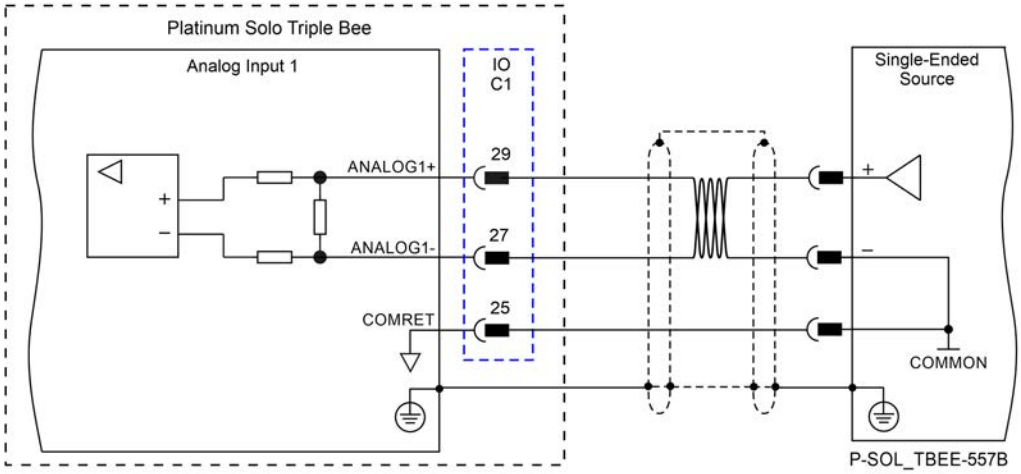


Figure 41: Analog Input 1

8.9.2 Analog Input 2

The wires should be inserted as detailed in section 8.3 Wiring the Female Connectors, according to the Analog Input 2 pinouts as described below.

The following is the diagram connection of the Analog Input 2:

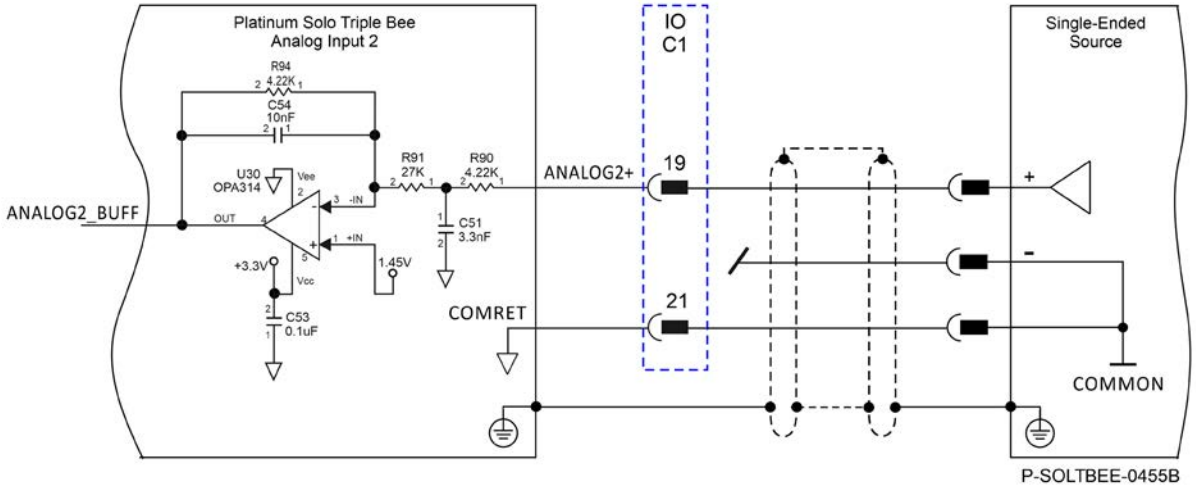
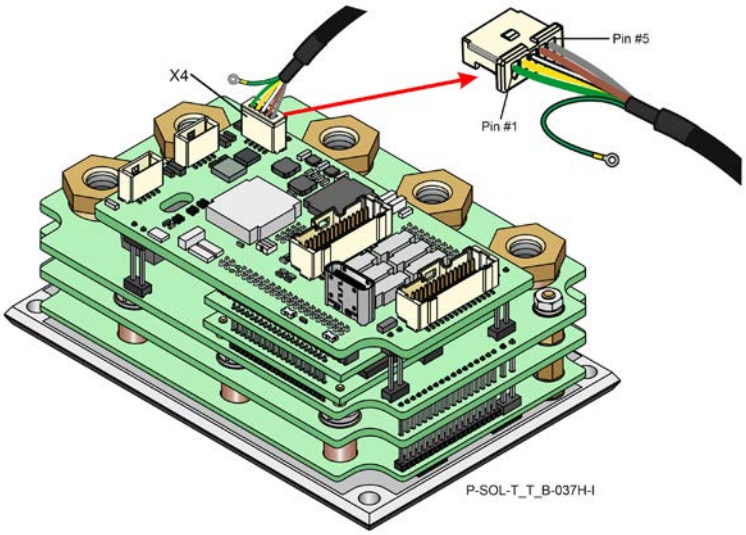


Figure 42: Analog Input 2

8.10 Isolated RS-232 and RS-422 Serial Communication (X4)



8.10.1 Isolated RS-232 Serial Communication

Note: Only available for Network Option E with safety capability S or O.

Figure 43 describes the Isolated RS-232 connection diagram.

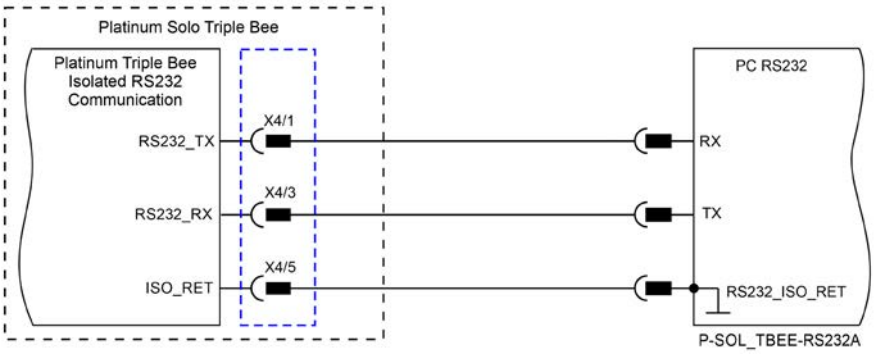


Figure 43: Isolated RS-232 Connection Diagram

8.10.2 Isolated RS-422 (Differential RS-232) Serial Communication

Note: Only available for Network Option G.

The following describes the RS-422 specification.

Specification	Details
Physical layer	Differential RS-232 Full duplex, serial communication
Interface	RS-422
Termination	120 Ohm It is required to connect termination of 120 ohm in the end of the TX signals (refer to the figure below)
Speed	Baud Rate of 0.0048 to 3.60 Mbps

Specification	Details
Protocols	For setup and control

Figure 44 describes the Isolated RS-422 (Differential RS-232) Serial Communication diagram:

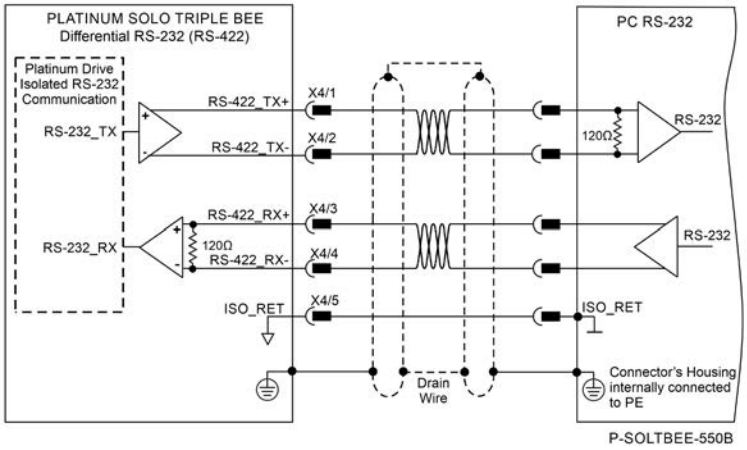


Figure 44: RS-422 Connection Diagram

8.11 USB 2.0 Communication Type C (X3)

For full details on USB communication, see sections 17.1 in the Platinum Safety Drive Manual.

8.12 EtherCAT (X1 and X2)

For full details on EtherCAT communication, see Section 17.2 in the in the Platinum Safety Drive Manual.

Note:
The EtherCAT OUT port can be configured to an Ethernet Port.

8.12.1 EtherCAT Communication

This section only describes the EtherCAT communication, and the pinout drawing of the connector.

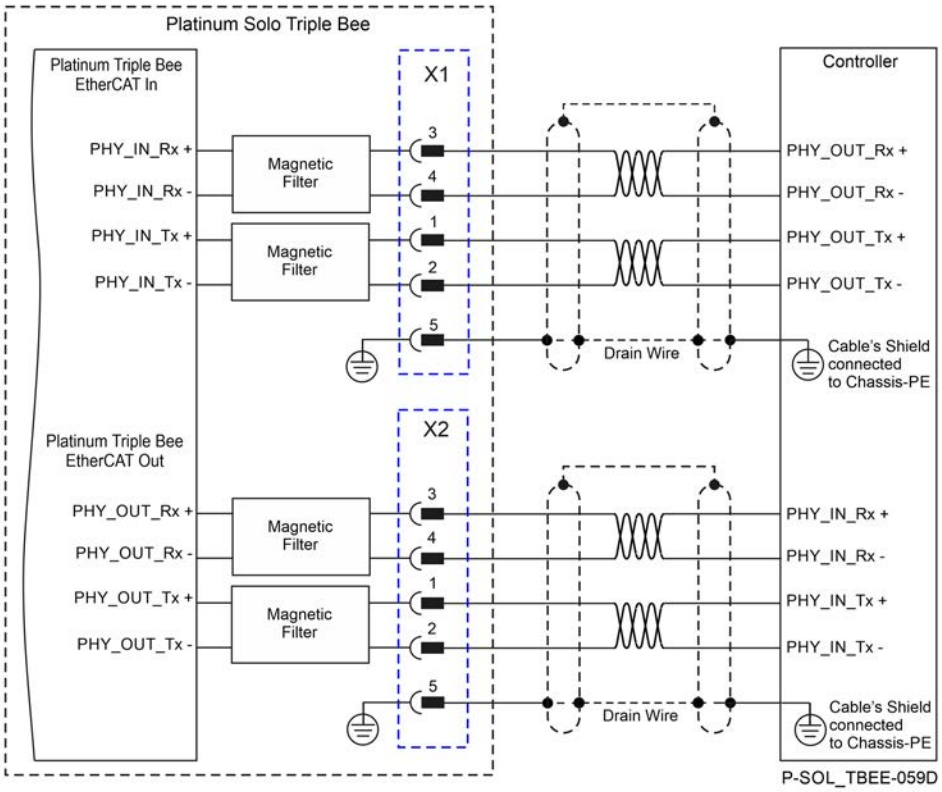


Figure 45: EtherCAT Connection Schematic Diagram

Note:
Always use CAT5e cables.

8.12.2 EtherCAT Status Indicator (D2)

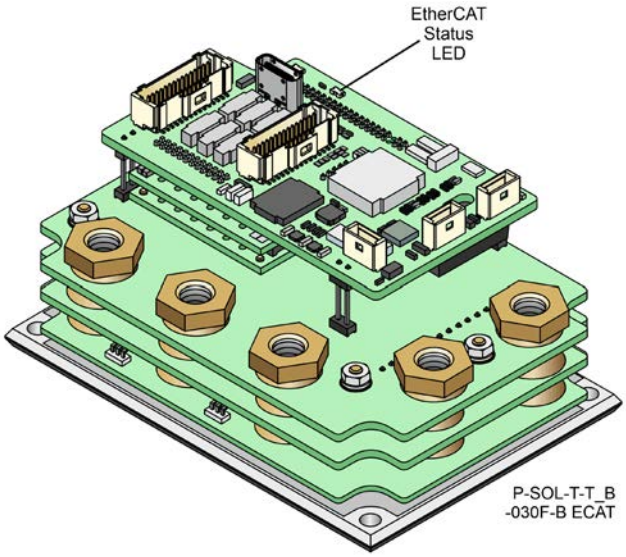


Figure 46: EtherCAT Status LED

The EtherCAT status indicator D2 is a single red/green dual bi-colored LED that combines the green RUN indicator and the red ERROR indicator of the EtherCAT state machine. For further details, see the EtherCAT Application Manual.

8.12.3 EtherCAT Link Indicators (D3, D4)

The Platinum Solo Triple Bee can serve as an EtherCAT slave device. For this purpose it has two ports, ECAT IN and ECAT OUT. Each of these Ports has a status LED; D3 EtherCAT In and D4 EtherCAT Out, which are shown in Figure 47.

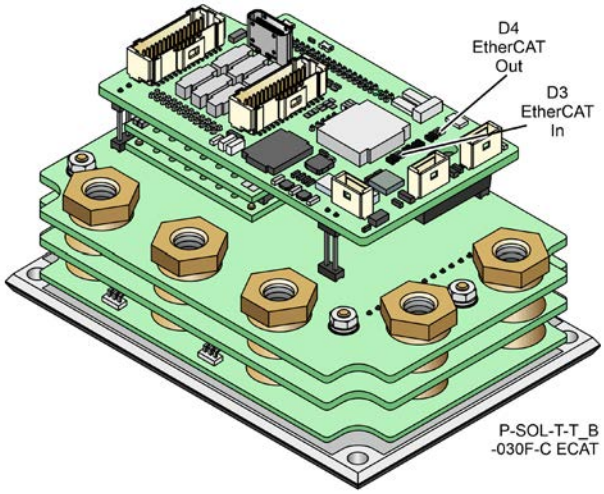


Figure 47: EtherCAT Connector LEDs

The green LEDs D3 and D4 are the link/activity indicators. They show the state of the applicable physical link and the activity on that link; blinking green, D3 for the Link Act IN, and D4 for the Link Act OUT.

Chapter 9: Powering Up

After the Platinum Solo Triple Bee is connected to its device, it is ready to be powered up.

Caution: Before applying power, ensure that the DC supply is within the specified range and that the proper plus-minus connections are in order.

9.1 Initializing the System

After the Platinum Solo Triple Bee has been connected and mounted, the system must be set up and initialized. This is accomplished using the *EASII*, Elmo's Windows-based software application. Install the application and then perform setup and initialization according to the directions in the *EASII User Manual*.

9.2 Heat Dissipation

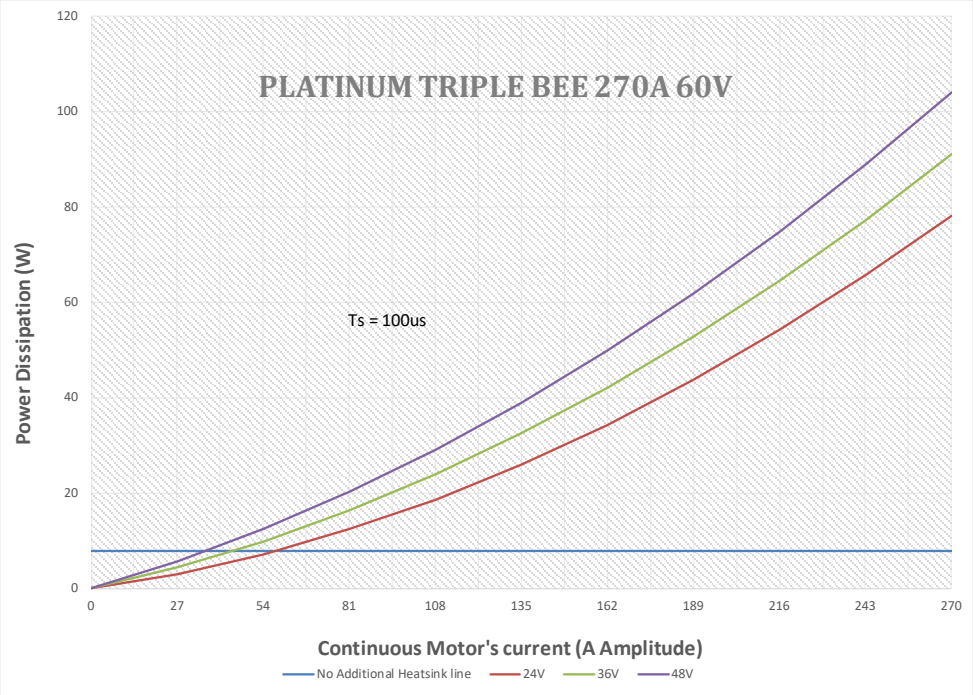
The best way to dissipate heat from the Platinum Solo Triple Bee is to mount it so that its heat-sink is attached to the machine chassis. If mounted with its heat-sink suspended, then for best results mount the servo drive faced upwards and leave approximately 10 mm of space between the Platinum Solo Triple Bee's heat-sink and any other assembly.

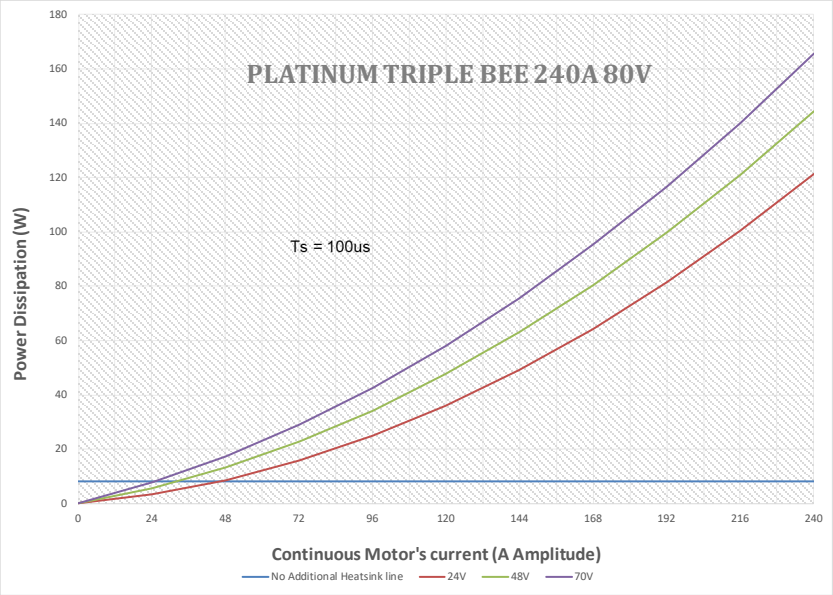
9.2.1 Heat Dissipation Data

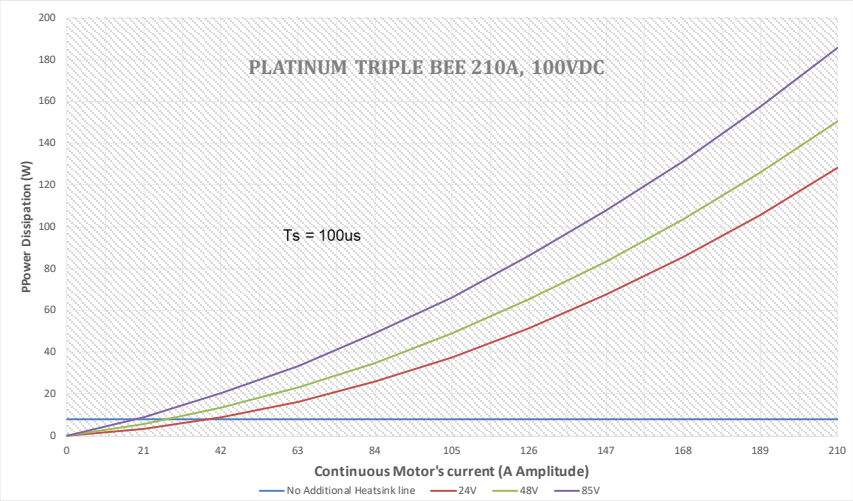
The Heat Dissipation shown graphically below is applicable for an ambient of 25°C.

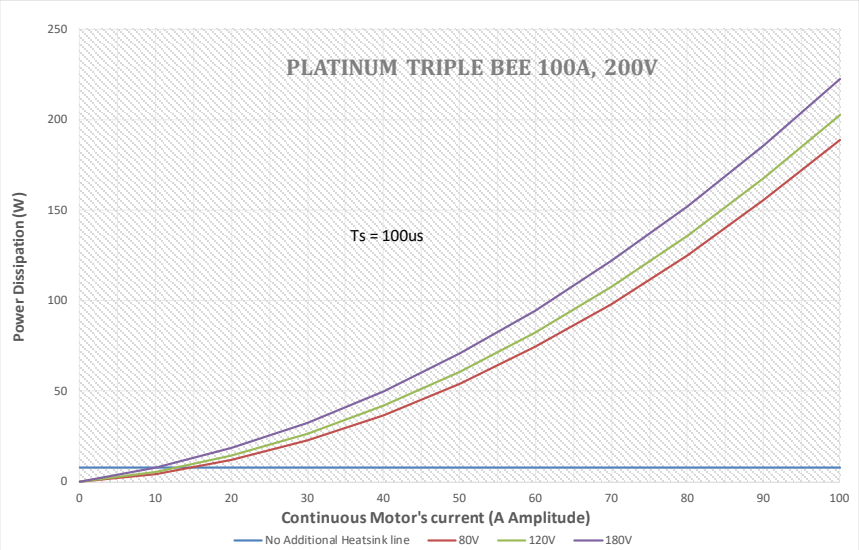
Heat Dissipation is shown graphically below.

It should also be noted that the Heat Sink can dissipate up to 8W.




PLATINUM TRIPLE BEE 240A 80V
Ts = 100us
Power Dissipation (W)
Continuous Motor's current (A Amplitude)
No Additional Heatsink line
24V
48V
70V


PLATINUM TRIPLE BEE 210A, 100VDC
Ts = 100us
PPower Dissipation (W)
Continuous Motor's current (A Amplitude)
No Additional Heatsink line
24V
48V
85V


PLATINUM TRIPLE BEE 100A, 200V
Ts = 100us
Power Dissipation (W)
Continuous Motor's current (A Amplitude)
No Additional Heatsink line
80V
120V
180V

9.2.2 How to Use the Chart

The charts above are based upon the theoretical worst-case scenario. The actual test results display a 20% - 30% lower power dissipation.

The above charts indicate the net power conversion losses and exclude the control losses.

To determine if your application heat dissipation requires a heat sink:

1. Determine the power dissipation according to the "continuous current" and the DC bus voltage curve.
   If the DC bus is not one of the three curves above, estimate the dissipation by interpolation. The estimation error is not critical.
2. The chart is calculated for continuous current operation, if the actual operation is pulsed current; add 25% to 30% to the power dissipation of the average (RMS) current.
3. When the Heat-Sink temperature reaches ≈ 85 °C, the Platinum Solo Triple Bee will shut down. Design the system for continuous operation so that the maximum Heat Sink temperature should be no higher than between 80°C to 82°C.
4. If the average heat dissipation is less than ≈8W to 10W (Average operating power of 600W to 750W) there will be no requirement for an additional external heat sink.
   If the average Heat dissipation is higher than 8W then an additional heat dissipation means is required, usually by connecting to an additional external heat-sink.
5. When an external Heat-Sink is required, calculate the thermal resistance of the heat sink according to:

$$Ø_{°C/W} = \frac{80°C - T_{Ambient}}{Heat\ Dissipation}$$

Chapter 10: Dimensions

This chapter provides detailed technical dimensions regarding the Platinum Solo Triple Bee.

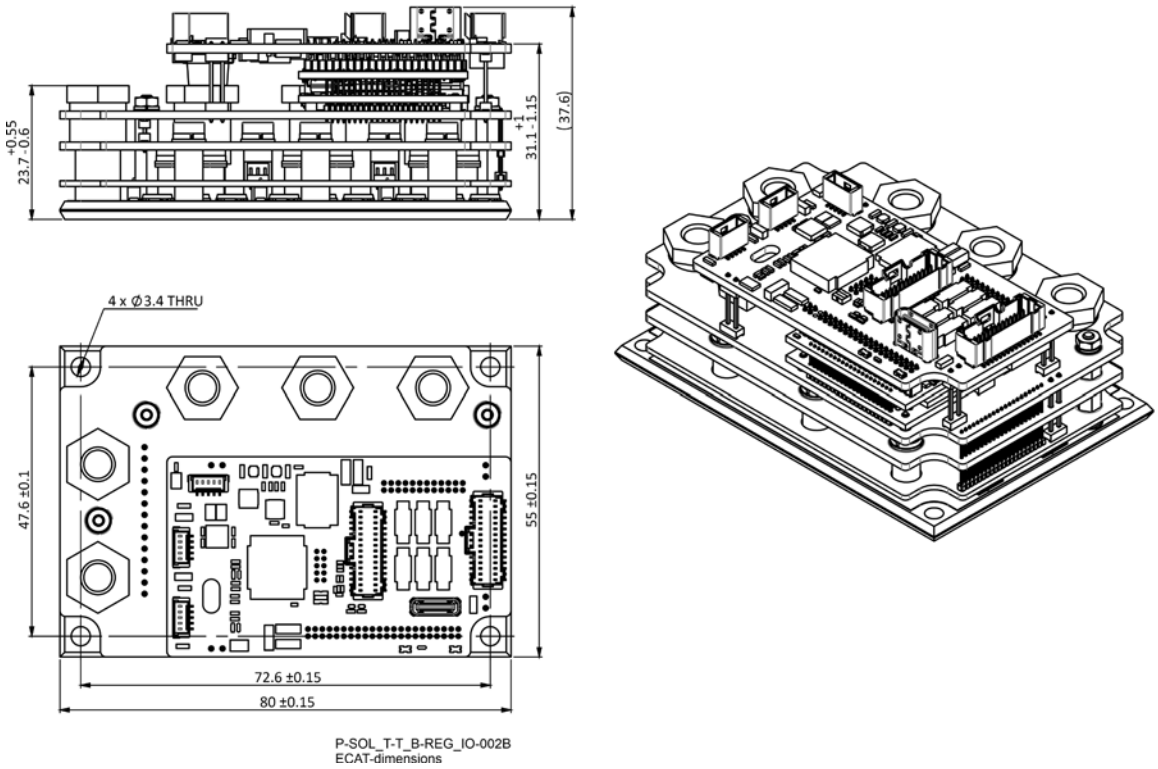


Figure 48: Platinum Solo Triple Bee –EtherCAT version - Regular IO

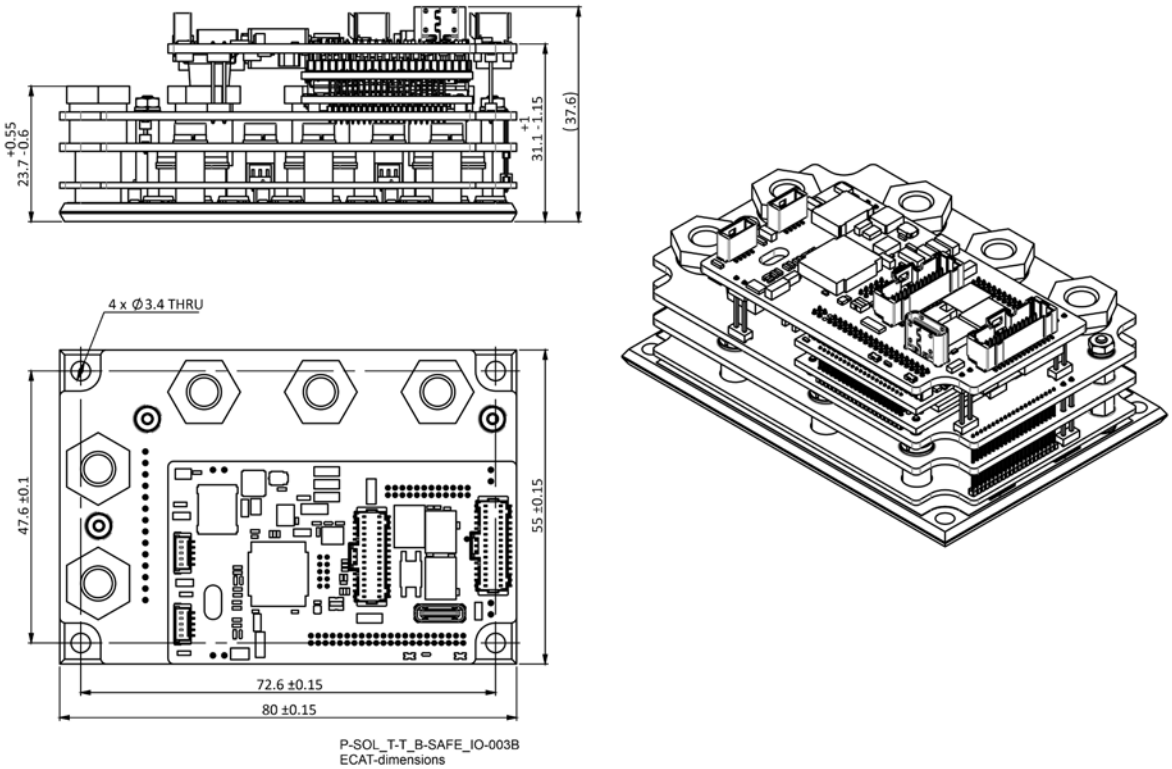


Figure 49: Platinum Solo Triple Bee –EtherCAT version - Safe IO

Chapter 11: Cables and Accessories

A Power cable kit can be purchased separately from Elmo for the Platinum Solo Triple Bee:

Part Number	Description (Gauge)
CBL-GSOLTWITPOWKIT03	Cable Kit 4 AWG

Table 20: Power Cable Kit

The following describes the accessory kits for communication and control available for the Platinum Solo Triple Bee.

Part Number	Description
CBL-PSOLTWIKIT02	Kit cable for EtherCAT model
CBL-PSOLTWIKIT03	CONNECTORS AND PINS KIT
CBL-PICOCLASP5P-1	RS-422/232 Communication Cable

Table 21: Accessory Kits for Communication and Control

A specific Crimping Tool (available for purchase from Elmo) is required to mount extra connecting pins on the wires. A number of wires are provided in the kit as pre-crimped for convenience:

Tool	Pins
	
Crimping Tool Molex P/N 63819-1500	**Pins for Single Row Connector:** MOLEX P/N 501334-0100
Elmo P/N TOOL-P000040	**Pins for Dual Row Connector:** MOLEX P/N 501193-3000

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