Platinum by Elmo

Go Safer, Smarter, Smaller, Simpler.
Go Platinum.

Platinum Harmonica Digital Servo Drive Installation Guide

Functional Safety

Safety Capability: F, S, O

EtherCAT and CANopen

September 2025 (Ver. 2.023)

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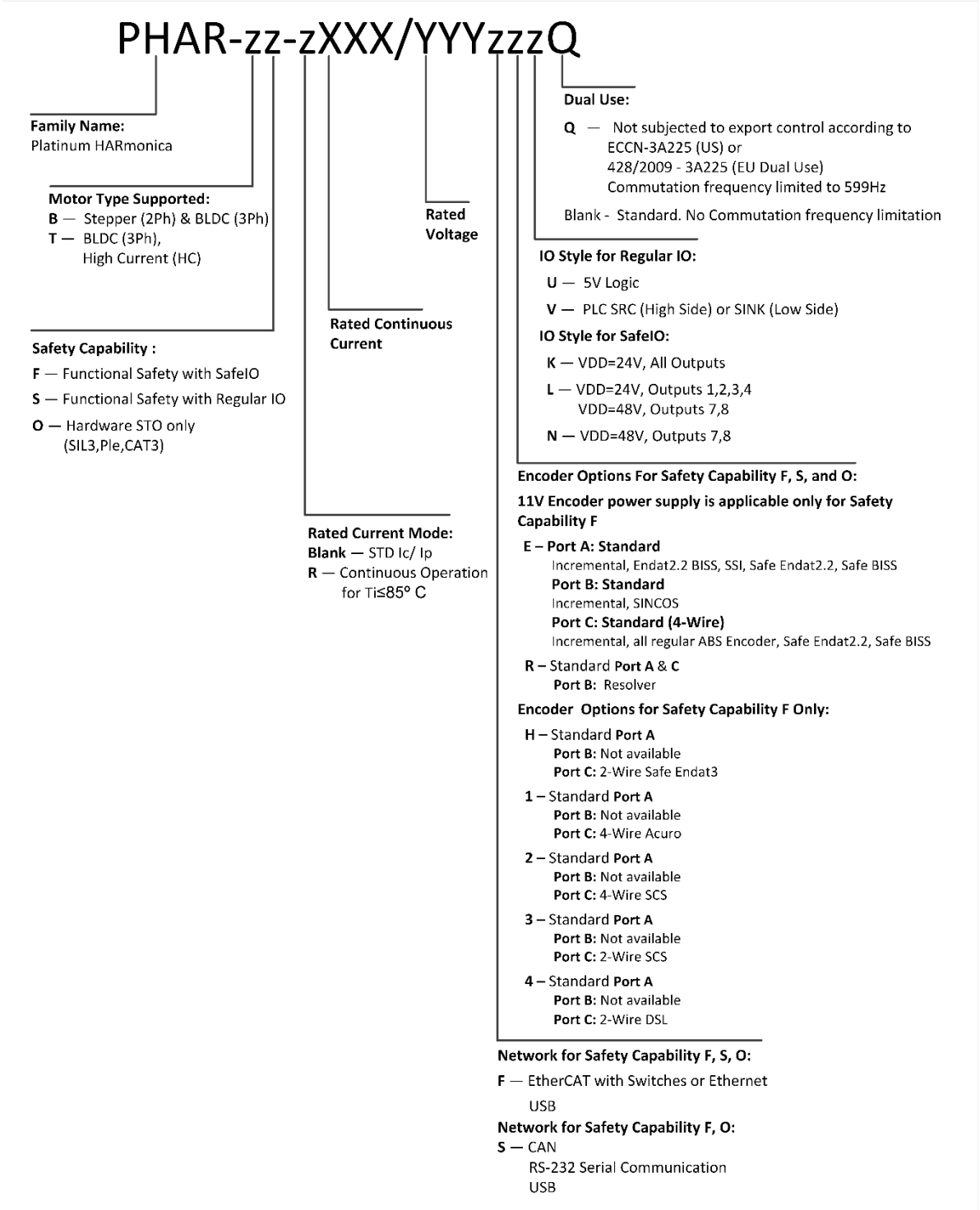

Revision History

Version	Date	Details	Version	Date	Details
Ver. 2.000	Oct 2020	Initial Release	**Ver. 2.010**	Feb 2022	Updated
Ver. 2.001	June 2021	Updated	**Ver. 2.011**	Mar 2022	Updated
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Ver. 2.008	Jan 2022	Updated	**Ver. 2.018**	Apr 2024	Updated CAN Connection diagrams in sections 8.2.5 to 8.2.8. Updated section 8.8.1.3 for Hiperface Updated PN and heading for sections 7.12 EtherCAT and 7.15 CAN connector pinouts
Ver. 2.009	Feb 2022	Updated			
Ver. 2.020	Aug 2024	Updated Over-Current and Short-Circuit Protection table in chapter 6.2			
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Ver. 2.022	Apr 2025	Updated sections 5.4.7 Digital Output, and 7.10.1 Safe IO. Also updated text and drawings in sections 8.8.2.3, 8.9.3 Digital Output,8.12.3.3, and links to Platinum Safety Manual.			
Ver. 2.023	Sep 2025	Corrected references to sections 7.10.1 SafeIO, 7.10.2 Regular IO, and 8.9.3 Digital Outputs			

Chapter 1: This Installation Guide

This installation Guide details the technical data, pinouts, and power connectivity of the Platinum Harmonica.

For a comprehensive specification and detailed description of the functions, refer to the Platinum Safety Drive.

Chapter 2: Functional Safety

The Platinum family of servo drives support Functional Safety. It is necessary to implement the instructions in the Platinum Safety Drive Manual 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 Harmonica, 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 Harmonica 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 Harmonica 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 Harmonica 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 10 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 Harmonica to an approved isolated control power 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 Harmonica, 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 Harmonica 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 Harmonica 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 time of installation, or 12 months from time of shipment, whichever comes first. 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 Platinum Harmonica is an integrated solution delivering up to **5.6 kW of continuous power** in a compact package (115 x 77 x 27.6 mm or 4.53 " x 3.03 " x 1.09"). It is designed to simply and efficiently connect Elmo's Platinum Harmonica servo drive directly to the application. The solution consists of the Platinum Harmonica together with a convenient connection interface which either eliminates or reduces development time and resources when designing an application's PCB board.

This advanced, high power density servo drive provides top performance, Functional Safety, advanced networking, as well as a fully featured motion controller and local intelligence.

The Platinum Harmonica is provided in three configurations:

- **Functional Safety with Safe IO (P-HAR-zF):** 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 (Fail Safe Over EtherCAT) or via the Safe I/O.
- **Functional Safety with Regular IO (P-HAR-zS):** 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.
- **STO Only (P-HAR-zO):** Servo drive with STO – The servo drive supports only STO.

The Platinum Harmonica is powered by dual isolated power supplies from the Main.

Main DC power: 10V – 95V for 100V model and 20V – 195V for 200V model

Control power supply: Safety Capability F, S: Max 60V for the logic; Safety Capability O: Max 95V for the logic.

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 Harmonica 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 languages. For more information about software, tools refer to the Elmo Application Studio (EASII) User Guide.

4.1 Accessories

The following Platinum Harmonica cable kits may be ordered:

- Catalog number: CBL-PHARKIT01 – (EtherCAT) Cable kit
- Catalog number: CBL-PHARKIT02 – (CAN) Cable kit

For further details, see the documentation for Platinum Harmonica cable kit (MAN-P-HAR-CBLKIT).

Chapter 5: Technical Information

5.1 Physical Specification

Feature	Units	All Types
General Mounting method		Bookshelf mounted
Degrees of protection		IP=00
Weight	g (oz.)	~285.2 g (~10.06 oz) (for Motor Type Support: B)
		~259.6 g (~8.84 0z) (for Motor Type Support: T)
Dimensions	mm (in)	115 x 77 x 27.6 mm (4.53” x 3.03” x 1.09”)

Table 1: Physical Specifications

5.2 Current/Voltage Technical Data

There are two Motor Type options that are supported:

Option	Feature
B	2-Phase Stepper and 3-Phase Brushless DC Motors (BLDC)
T	3-Phase Brushless DC Motors (BLDC), High Current (HC)

5.2.1 Motor Type Supported B: Technical Data

5.2.1.1 100V Model

Feature	Units	1/100	2.5/100	5/100	10/100	15/100	20/100	25/100
Minimum supply voltage	VDC	10						
Nominal supply voltage	VDC	85						
Maximum supply voltage	VDC	95						
Maximum continuous power output	W	80	200	400	800	1200	1600	2000
Efficiency at rated power (at nominal conditions)	%	> 99						
Maximum output voltage		> 95% of DC bus voltage at f = 22 kHz						
Amplitude sinusoidal/DC continuous current	A	1.0	2.5	5	10	15	20	25
Sinusoidal continuous RMS current limit (Ic)	A	0.7	1.8	3.5	7	10.6	14.1	17.5
Peak current limit	A	2 x Ic						

Table 2: Motor Type Supported B: Technical Data for 100VDC Version

Note (on current ratings):
The current ratings of the Platinum Harmonica are given in units of DC amperes (ratings that are used for trapezoidal commutation or DC motors). The RMS (sinusoidal commutation) value is the DC value divided by 1.41.

5.2.1.2 200V Model

Elmo now offers a 200 VDC maximum output rating selection of Platinum Harmonica, according to the following technical data:

Feature	Units	3/200	6/200	9/200
Minimum supply voltage	VDC	20		
Nominal supply voltage	VDC	170		
Maximum supply voltage	VDC	195		
Maximum continuous power output	W	480	960	1450
Efficiency at rated power (at nominal conditions)	%	> 99		
Maximum output voltage		> 95% of DC bus voltage at f = 22 kHz		
Amplitude sinusoidal/DC continuous current	A	3	6	9
Sinusoidal continuous RMS current limit (Ic)	A	2.1	4.2	6.3
Peak current limit	A	2 x Ic		

Table 3: Motor Type Supported B: Technical Data for 200VDC Version

5.2.2 Motor Type Supported T: Technical Data

Note: For all models, the Max Output current is guaranteed for $T_{Heat\text{-}Sink}$ <85°C.

5.2.2.1 100V Models

Feature	Units	25/100	35/100	50/100
Minimum supply voltage	VDC	10		
Nominal supply voltage	VDC	85		
Maximum supply voltage	VDC	95		
Maximum continuous power output	W	2000	2800	4000
Efficiency at rated power (at nominal conditions)	%	> 99		
Maximum output voltage		Up to 96% of DC bus voltage		
Ic, Amplitude sinusoidal/DC continuous current	A	25	35	50
Sinusoidal continuous RMS current limit (Ic)	A	17.7	24.7	35.35
Peak current limit	A	2 x Ic		

Table 4: Motor Type Supported T: Technical Data for 100VDC Version

5.2.2.2 R Type Models

Feature	Units	R50/100	R45/150	R15/200	R35/200
Minimum supply voltage	VDC	10		20	
Nominal supply voltage	VDC	85	115	170	
Maximum supply voltage	VDC	95	135	195	
Maximum continuous Electrical power output	W	4000	5000	2500	5600
Efficiency at rated power (at nominal conditions)	%	> 99			
Maximum output voltage		Up to 96% of DC bus voltage			
Amplitude sinusoidal/DC continuous current	A	50	45	15	35
Sinusoidal continuous RMS current limit (Ic)	A	35.3	32	10.6	24.7

Table 5: Motor Type Supported T: Technical Data for R Type Models

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

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 Options	USB	√	
	EtherCAT ***or***	√	
	CAN	√	
	RS-232	√	Available only for network S. Not applicable for EtherCAT.

5.4.4 Analog Input

Feature	Details	Resolution	Presence and No.
Analog Input for PHAR-Bz-XX/YYYzzzQ	Differential ±10V	12-bits	√
Analog Input for PHAR-Tz-XX/YYYzzzQ	Differential ±10V	14-bits	

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 = K, L, N, V	

5.4.6 Digital Input

I/O Style	Safe Input	U	V
Safety/Regular	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	K	L	N	U	V
Safety/Regular	Safe IO PLC	Safe IO PLC	Safe IO PLC	Regular IO 5V Logic	Regular IO PLC
Absolute Maximum Voltage	30V	30V – OUT1,2,3,4 60V – OUT7,8	60V – OUT7,8	30V	60V
Recommended: **VDD** **VDD_24** **VDD_48**	19.6 ÷ 30V	19.6 ÷ 30V 19.6 ÷ 53V	19.6 ÷ 53V	4 ÷ 30V	19 ÷ 53V
OUT1	250mA	250mA	N/A	15mA	1000mA
OUT2	250mA	250mA	N/A	15mA	1000mA
OUT3	250mA	250mA	N/A	N/A	N/A
OUT4	250mA	250mA	N/A	N/A	N/A
OUT7	1000mA	1000mA	1000mA	15mA	1000mA
OUT8 (PLC SINK)	1000mA	1000mA	1000mA	15mA	1000mA
Total Current[1]	**1500mA**	**1500mA**	**1500mA**		**1250mA**

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

5.5 Environmental Conditions

You can guarantee the safe operation of the Platinum Harmonica by ensuring that it is installed in an appropriate environment. The Functional Safety of the servo drive is certified according to the environmental conditions in the following table.

Feature	Details
Operating ambient temperature	0 °C to 55 °C (32 °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 Harmonica servo drive. For further details, refer to Chapter 23 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
IEC/EN 61800-5-1:2007/AMD1: 2016 **IEC/EN 61800-5-1:2007/A1: 2017**	Adjustable speed electrical power drive systems Part 5-1: Safety requirements – Electrical, thermal and energy
In compliance with **UL 61800-5-1**	Adjustable speed electrical power drive systems: Safety requirements – Electrical, thermal and energy
In compliance with **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 23.5 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

The Platinum Harmonica must be installed in a suitable environment and be properly connected to its voltage supplies and the motor.

6.1 Unpacking the Drive Components

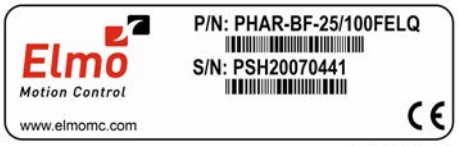
Before you begin working with the Platinum Harmonica, verify that you have all of its components, as follows:

- The Platinum Harmonica servo drive
- The Elmo Application Studio (EASII) software

The Platinum Harmonica is shipped in a cardboard box with Styrofoam protection.

To unpack the Platinum Harmonica:

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 Harmonica you have unpacked is the appropriate type for your requirements, locate the part number sticker on the side of the Platinum Harmonica. It looks like this:



P-HAR_V2-510G

4. Verify that the Platinum Harmonica type is the one that you ordered and ensure that the voltage meets your specific requirements.
5. 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 Over-Current and Short-Circuit Protection

A serial fuse or circuit breaker should be installed Rated for drive's continuous current rating**.**

PHAR–zz-zXXX/YYYzzz XXX = rated continues current [A]	Fuse	Circuit Breaker
1, 2.5, 5, 10, 15, 20 / 100V	Fast Acting	Type B
25, 35, 50 / 100V	Fast Acting Class J	Type B
45/150V	Fast Acting Class J	Type B
3, 6, 9, 15, 35 / 200V	Fast Acting	

PL/CL protection: Peak and Continues Limitation

The peak current of servo drive limit for a given application is programmed to the parameter **PL[1]** amperes.

PL[1]: Value for peak current limit protection. Please refer to the "Platinum Administrative Guide".

6.3 Motor Overload Protection

The Platinum Harmonica supports Electronic Motor Overload protection as required by IEC-61800-5-1 with the exception of thermal memory retention and speed sensitivity.

6.4 Mounting the Platinum Harmonica

The Platinum Harmonica can be wall-mounted or table-mounted.

6.4.1 Wall Mounting Platinum Harmonica

The Platinum Harmonica may be mounted via Wall mounting or Table mounting.

To wall-mount the Platinum Harmonica:

- For Rear-side wall-mount
  Mount the Platinum Harmonica (Motor Type Supported: B or T) with two M4 screws, see **Figure 1**
- For Bottom-side wall-mount (Motor Type Supported: B (PHAR-**B**z-zXXX/YYYzzz))
  Mount the Platinum Harmonica with four M4 screws.
- For Bottom-side wall-mount (Motor Type Supported: T (PHAR-**T**z-zXXX/YYYzzz))
  Mount the Platinum Harmonica with three M4 screws and in the lower left corner, one M4 low socket screw (DIN6912), as shown in **Figure 2**:

Figure 1:Rear-side wall-mounting Platinum Harmonica

Figure 2:Bottom-side wall-mounting Platinum Harmonica

You must always mount the device with the Elmo logo up; in this orientation, the open screw holes will always be at the bottom.

6.4.2 Table-Mounting Platinum Harmonica

Guidelines (Dimensional)

The Platinum Harmonica table mounting dimensional guidelines are shown in Figure 62: Platinum Harmonica – Dimensions.

Use the following table to table-mount the Platinum Harmonica:

Dimensions	Table Mounting
Distance between right and left screw holes	109 mm (4.29 ")
Distance between top and bottom screw holes closest to Platinum Harmonica's **rear** edge and the rear edge	10.5 mm (0.41 ")
Distance between top and bottom screw holes farthest from Platinum Harmonica's **rear** edge and the rear edge	64.5 mm (2.54 ")

To table-mount the Platinum Harmonica:

- For Table-mount (Motor Type Supported: B (PHAR-Bz-zXXX/YYYzzz))
  Mount the Platinum Harmonica with four M4 screws.
- For Table-mount (Motor Type Supported: T (PHAR-Tz-zXXX/YYYzzz))
  Mount the Platinum Harmonica with three M4 screws and one M4 low socket screw (DIN6912) in the left corner, as shown in Figure 3:

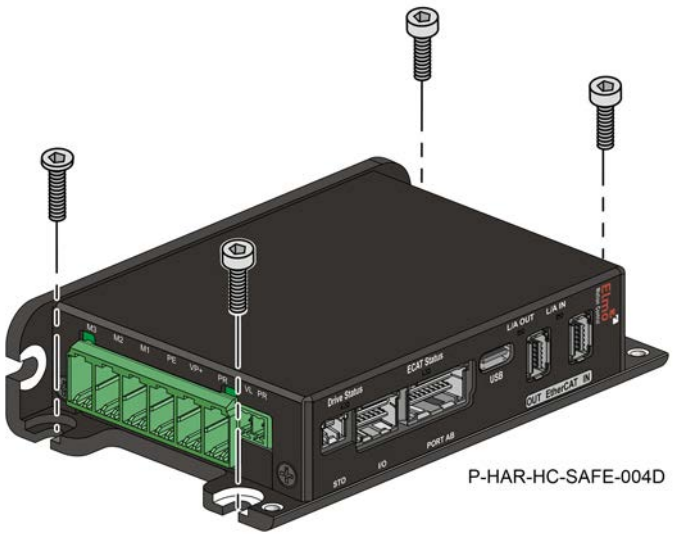


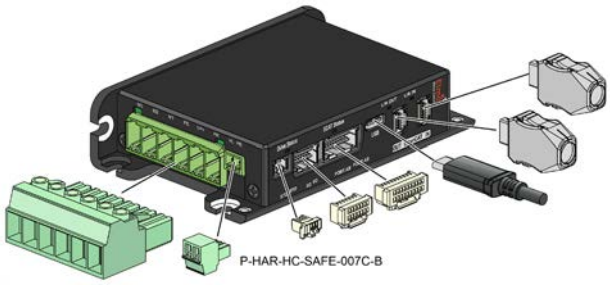
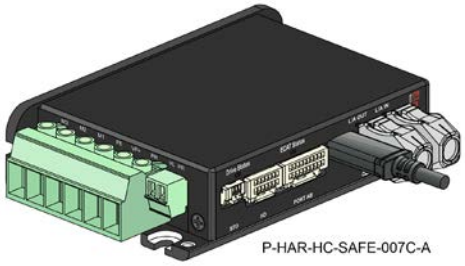
Figure 3: Table Mounting of Platinum Harmonica with Four M4 Screws

Chapter 7: Connector Types Pinouts, and LEDs

7.1 Connectors

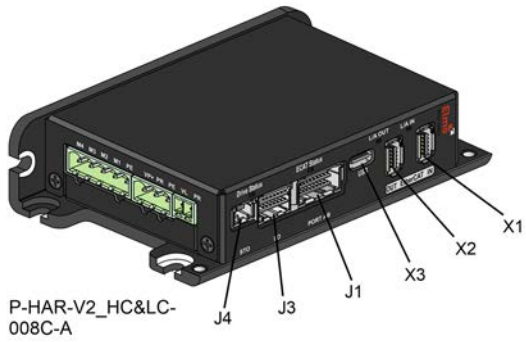
Port	No. Pins	Type		Function
Motor Type Supported: B (PHAR-Bz-zXXX/YYYzzz)				
M1 M1, M2, M3, M4, PE	5		Phoenix: CON TH TB 5.0mm pitch. Conductor cross-section is 30 up to 12 AWG	Motor phases
P1 VP+, PR, PE	3		Phoenix: CON TH TB 5.0mm pitch. Conductor cross-section is 30 up to 12 AWG	Power
Motor Type Supported: T (PHAR-Tz-zXXX/YYYzzz)				
P1 M1, M2, M3, PE, VP+, PR	6		Wurth: CON TH TB 7.62mm pitch. Conductor cross-section is 24 up to 8 AWG	Motor phases + power
All other connectors				
P2 PR, VL+	2	Phoenix: CON TH TB 3.81mm pitch. Conductor cross-section is 28 up to 16 AWG		Control Power
J1	2x10	Molex CLIK-Mate, 20 pins, 1.5 mm pitch		Feedback Port A/B
J2	2x6	Molex CLIK-Mate, 12 pins, 1.5 mm pitch		Feedback Port C
J3	2x7	Molex CLIK-Mate, 14 pins, 1.5 mm pitch		I/O
X3	24	USB Type C		USB
X4	5	Molex CLIK MATE 5 pins, 1.5mm pitch		RS-232 communication (available for Network: S)
J4	3	Molex CLIK-Mate, 3 pins, 1.5 mm pitch		STO
EtherCAT Version				
X1	10	Amphenol: CON SMT IX FE RA 10PIN P=0.5MM H=10MM TYPE A, Conductor cross-section is 28 up to 26 AWG		EtherCAT IN
X2	10	Amphenol: CON SMT IX FE RA 10PIN P=0.5MM H=10MM TYPE A, Conductor cross-section is 28 up to 26 AWG		EtherCAT OUT
CAN Version				
X1	10	Amphenol: CON SMT IX FE RA 10PIN P=0.5MM H=10MM TYPE A, Conductor cross-section is 28 up to 26 AWG		CAN
X2	10	Amphenol: CON SMT IX FE RA 10PIN P=0.5MM H=10MM TYPE A, Conductor cross-section is 28 up to 26 AWG		CAN

7.2 Mating Connectors

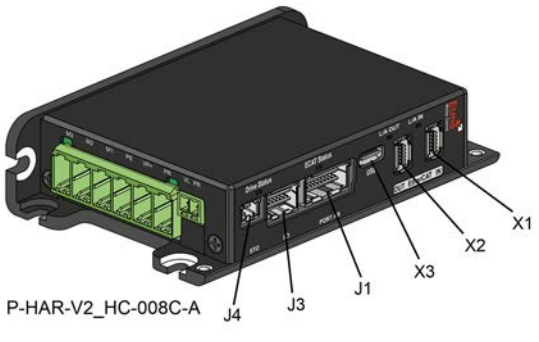
Connector	Type	P/N	Mating Crimp Terminal
Motor Type Supported: B (PHAR-Bz-zXXX/YYYzzz)			
P1 VP Power	CON TB HC FE 3 PIN (1X3) P=5MM SCREW WIRE 12-30#	PHOENIX 1926248 3-pin	
M1 Phases	CON TB HC FE 5 PIN (1X5) P=5MM SCREW WIRE 12-30#	PHOENIX 1926264 5-pins	
Motor Type Supported: T (PHAR-Tz-zXXX/YYYzzz)			N/A
P1 VP + Phases	CON TB FE 6PIN(1X6) P=7.62MM SCREW WIRE 8-24# 41A	WURTH - PWF1P7.62/6VE	
	Control Supply		
P2 VL Power	CON TB FE 2 PIN (1X2) P=3.81 SCREW WIRE 16-28#+PR	PHOENIX 1736638 2-pin	
	CLIK Mate		
J1 Port A/B	CON CLIK-MATE HOUSING FE 20 PIN (2X10) P=1.5MM	Molex 503149-2000 20-pin	
J2 Port C	CON CLIK-MATE HOUSING FE 12 PIN (2X6) P=1.5MM	Molex 503149-1200 12-pin	213029-1100
J3 Port I/O	CON CLIK-MATE HOUSING FE 14 PIN (2X7) P=1.5MM.	Molex 503149-1400 14-pin	
J4 STO	CON CLIK-MATE HOUSING FE 3 PIN (1X3) P=1.5MM	Molex 502578-0300 3-pin	
	X1, X2, X3, and X4		
X1 ECAT IN or CAN BUS	CON BODY IX MA STR 10PIN P=0.5MM TYPE A CRIMP	Amphenol ND9-AP74-00	N/A
X2 ECAT OUT or CAN BUS			
X3 USB	Standard USB type C cable		
X4 RS-232 communication	CON Pico-Clasp™ HOUSING FE 5PIN(1X5) P=1.5 mm pitch	MOLEX 502578-0500	213029-1100
Pin Positions and Cable Connectors			
			

7.3 Connector Locations

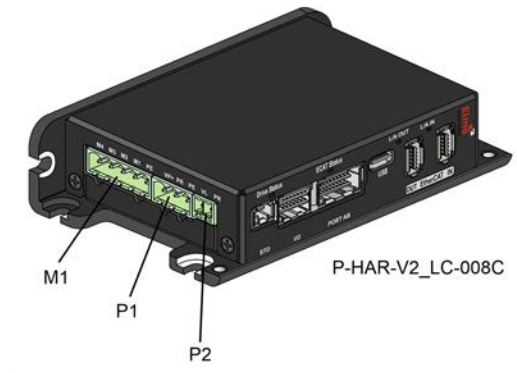
The Platinum Harmonica connector locations are shown in the following drawings.



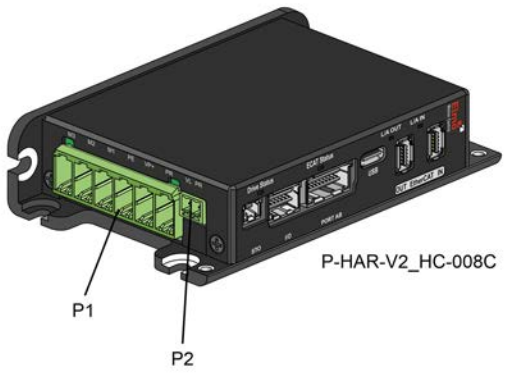
Motor Type Supported: B (PHAR-Bz-zXXX/YYYzzz)



Motor Type Supported: T (PHAR-Tz-zXXX/YYYzzz)

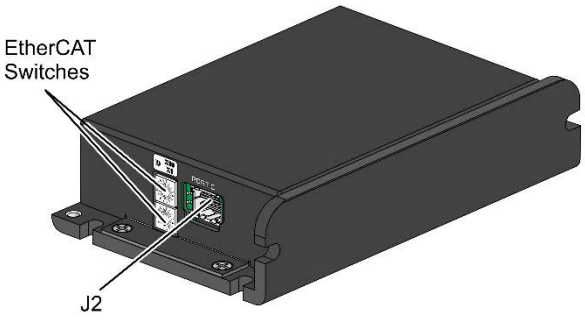


Motor Type Supported: B (PHAR-Bz-zXXX/YYYzzz)

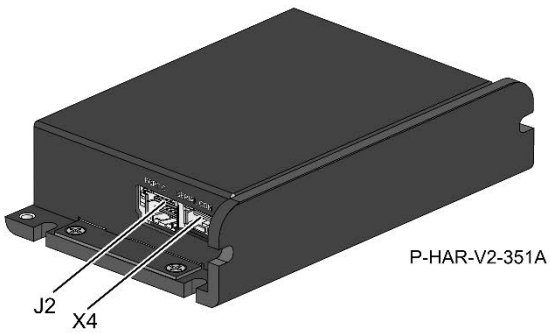


Motor Type Supported: T (PHAR-Tz-zXXX/YYYzzz)

Figure 4: Platinum Harmonica Front and Left Side Connectors



Motor Type Supported: both, with EtherCAT



Motor Type Supported: both, with CANopen

Figure 5: Platinum Harmonica Right Side Connectors

7.4 Motor & Main Power Connector Pinouts

The following sections describe the motor pinouts in the Platinum Harmonica connectors. There are two options for the Motor Type Supported shown in the Catalog Number. These are:

- **B** Stepper (2Ph) & BLDC (3Ph)
- **T** BLDC (3Ph), High Current (HC)

For further details, refer to Chapter 10 Input Power Supply in the Platinum Safety Drive Manual.

7.4.1 Motor Type: B - Motor & Main Power Connectors and Phases (M1, P1)

Pin #		Signal	Function
M1	1	M4	Phase
	2	M3	Phase
	3	M2	Phase
	4	M1	Phase
	5	PE	Protective Earth
P1	1	VP+	Supply, Power
	2	PR	Supply, Power Return
	3	PE	Protective Earth
Pin Positions			
 **Figure 6: Motor Power Pin Position**			 **Figure 7: Main Power Pin Position**

Table 6: Motor Type Supported: B, Main Power and Motor Connections

Note: For details of the pinout connections to specific motors, see 8.5.1.

7.4.2 Motor Type: T - Motor & Main Power Connectors and Phases (M1 and P1 combined)

Pin #	Signal	Function
1	M3	Phase
2	M2	Phase
3	M1	Phase
4	PE	Protective Earth
5	VP+	Supply, Power
6	PR	Supply, Power Return
Pin Positions		
 **Figure 8: Motor Power Pin Positions**		 **Figure 9: Main Power Pin Positions**

Table 7: Motor Type Supported: T, Main Power and Motor Connections

7.5 Control Power Supply Connector (P2)

Pin #	Signal	Function
1	VL	Supply, Power
2	PR	Supply, Power Return
Pin Positions		
 **Figure 10: Motor Type Supported T - Control Power Pin Position**		 **Figure 11: Motor Type Supported B - Control Power Pin Position**

Table 8: Control Supply Pins

7.6 Drive Status Indicator

Figure 12 shows the position of the red/green dual LED, which is used for immediate indication of the Initiation, Working and Firmware Download states.

Figure 12: Drive Status Indicator

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	Power stage 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 burning/validation and the CPLD/FPGA that is been burned

7.7 STO (Safe Torque Off) Connector (J4)

For further details, refer to Chapter 12 STO in the MAN-P Safety Drive Manual.

Pin (J4)	Signal	Function
1	STO1	Input, Isolated
2	STO2	Input, Isolated
3	STO_RET	Supply, Power Return

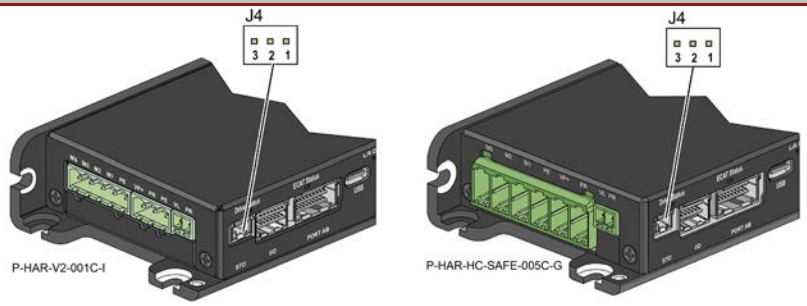
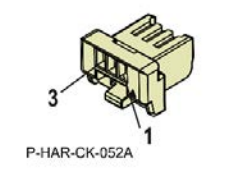
Pin Positions	*Cable Connector*
	

Table 9: STO Input Pin Assignments

7.8 Feedback Port A and Port B and Power Connector (J1)

For full details, refer to Chapter 13 Feedback in the MAN-P Safety Drive Manual.

7.8.1 J1 Port A

Pin (J1) Port A		Incremental Encoder	Absolute Serial Encoder
	Signal	***Function***	***Function***
5	PortA_A+	Channel A +	Absolute encoder clock+
7	PortA_A-	Channel A -	Absolute encoder clock-
9	PortA_B+	Channel B+	Absolute encoder data+
11	PortA_B-	Channel B -	Absolute encoder data -
13	PortA_Index+	Channel_Index+	Reserved
15	PortA_Index-	Channel_Index-	Reserved

Table 10: J1 Port A Pin Assignments

7.8.2 J1 Port B

Pin (J1) Port B		Incremental Encoder	Interpolated Analog Encoder	Resolver
	Signal	***Function***	***Function***	***Function***
		PHAR-zz-XXX/YYYzEz		PHAR-zz-XXX/YYYzRz
6	PortB_A+/SIN+	Channel A+	Sine+	Sine+
8	PortB_A-/SIN-	Channel A -	Sine-	Sine-
10	PortB_B+/ COS+	Channel B+	Cosine+	Cosine+
12	PortB_B-/COS-	Channel B-	Cosine-	Cosine-
14	PortB_INDEX+	Channel_Index+	Analog_Index+	RESOLVER_OUT+
16	PortB_INDEX-	Channel_Index-	Analog_Index-	RESOLVER_OUT-

Table 11: J1 Port B Pin Assignments

7.8.3 J1 Hall Sensors

Pin J1	Pin Name	Function
17	HA	Input, Hall sensor A
18	HB	Input, Hall sensor B
19	HC	Input, Hall sensor C

Table 12: J1 Hall Sensors

7.8.4 J1 Power Pins

J1 Power Pin	Signal	Function
1	+11V	Encoder +11V supply **Note:** +11V is only available for Safety Capability F
2	+5VE	Encoder +5V supply
3	COMRET	Common Return
4	COMRET	Common Return
20	COMRET	Common Return

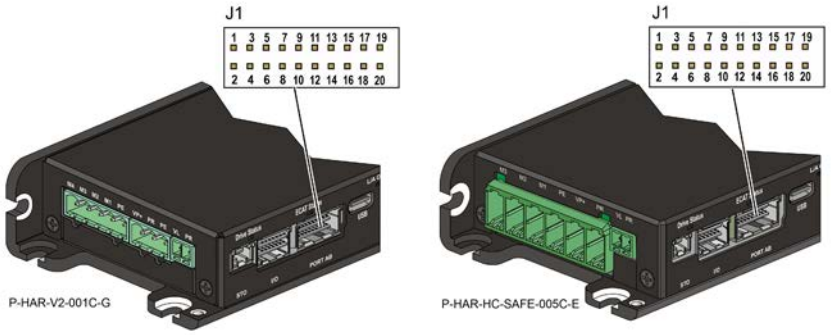
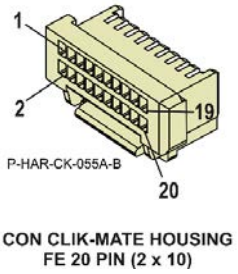
Pin Positions	Cable Connector
	 CON CLIK-MATE HOUSING FE 20 PIN (2 x 10)

Table 13: J1 Power Pin Assignments

7.9 Feedback Port C and Analog Inputs Connector Pinouts (J2)

The Feedback Port C and Analog Inputs connector includes the following functions:

- **Feedback Port C:** Refer to section 13.2.6 Port C in the Platinum Safety Drive Manual for full details.
- **Analog input:** Refer to Chapter 17 Analog Input in the Platinum Safety Drive Manual for full details.

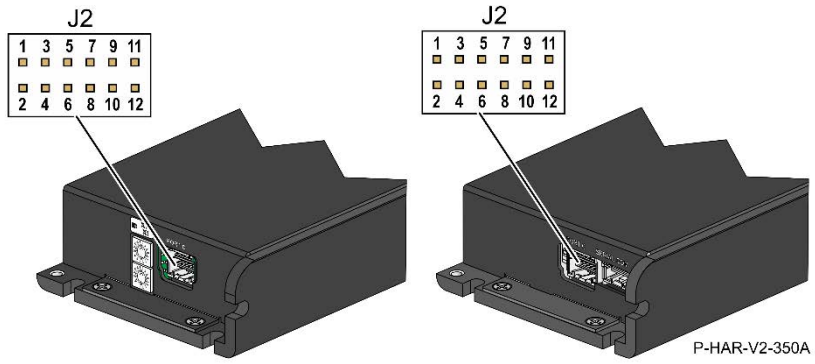
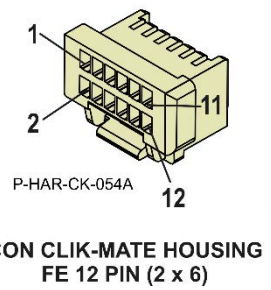
Pin (J2)	Signal	Function		
		Incremental Encoder	**Absolute Serial Encoder**	**General Outputs**
1	COMRET	Common return		
2	PortC_A+	Channel A +	Absolute encoder clock+	General Output A+
3	+5VE	Encoder +5V supply		
4	PortC_A-	Channel A -	Absolute encoder clock-	General Output A-
5	+11V	Encoder 11V Supply (for Safety Capability: F)		
6	PortC_B+	Channel B+	Absolute encoder data+	General Output B+
7	ANALOG1+	Analog Input		
8	PortC_B-	Channel B –	Absolute encoder data-	General Output B-
9	ANALOG1-	Analog Input complement		
10	PortC_Index+	Index+	Reserved	General Output Index+
11	COMRET	Common Return		
12	PortC_Index-	Index-	Reserved	General Output Index-
Pin Positions				**Cable Connector**
				 CON CLIK-MATE HOUSING FE 12 PIN (2 x 6)

Table 14 Port C Pin Assignments

7.10 Digital I/Os, Connector Pinouts (J3)

Refer to Chapters 15 Safe Digital IO and 16 Regular Digital IO in the Platinum Safety Drive Manual for full details.

7.10.1 Safe IO: IO TYPE = K, L, N

The Digital I/Os connector includes the following functions:

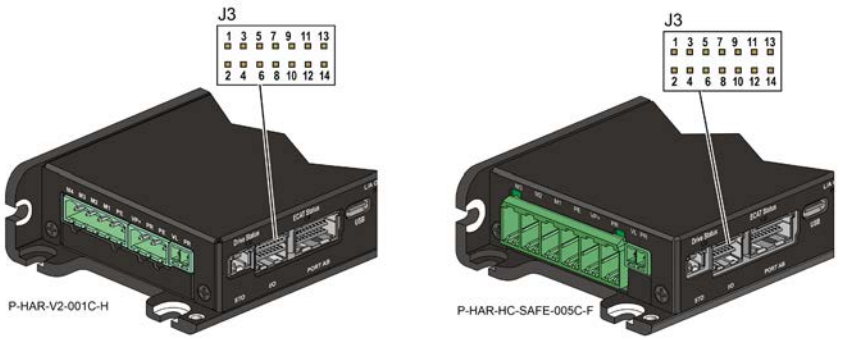
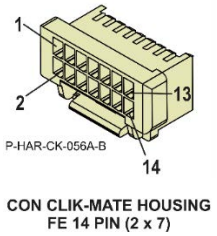
Pin (J3)	Signal	IO TYPE K	IO TYPE L	IO TYPE N
1	VDD_RET	VDD Return		
2	IN1	Input		
3	VDD_24V	Refer to section 5.4.7 Digital Output		Not Used
4	IN2	Input		
5	OUT4	Output		
6	IN3	Input		
7	VDD_48V	Not Used	Refer to section 5.4.7 Digital Output	
8	IN4	Input		
9	OUT7	Output		
10	OUT1	Output		
11	OUT8	Output		
12	OUT2	Output		
13	VDD_RET	VDD Return		
14	OUT3	Output		
Pin Positions				***Cable Connector***
				 CON CLIK-MATE HOUSING FE 14 PIN (2 x 7)

Table 15: Digital I/O for Safe IO: IO Types K, L, N

7.10.2 Regular IO: IO TYPE = U, V

The Digital I/Os connector includes the following functions:

Pin (J3)	Signal	TYPE U	TYPE V
1	VDD_RET	VDD Return	
2	IN1	Input	
3	VDD	Refer to section 5.4.7 Digital Output	
4	IN2	Input	
5	IN6	Input	
6	IN3	Input	
7	SRC or SINK CONTROL	Not Used	**For Source:** 0 - Source Control **For Sink:** VDD
8	IN4	Input	
9	OUT7	Output	
10	OUT1	Output	
11	OUT8	Output	
12	OUT2	Output	
13	IN_COM	Digital Input Return	**For Source:** Digital Input Return **For Sink:** Digital Input Power
14	IN5	Input	

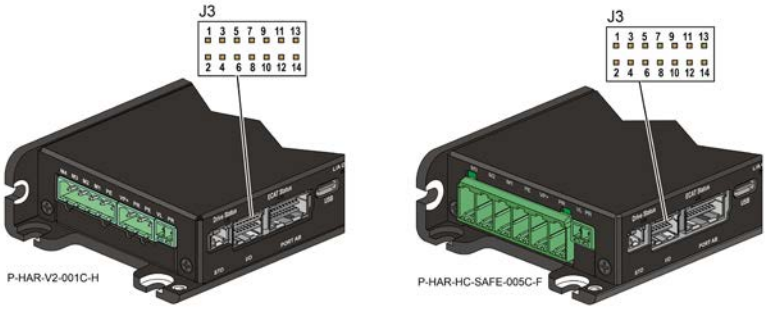
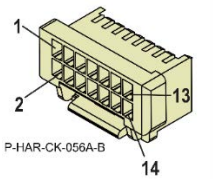
Pin Positions	*Cable Connector*
	 CON CLIK-MATE HOUSING FE 14 PIN (2 x 7)

Table 16: Digital I/O for Regular IO: IO Types U, V

7.11 USB 2.0 Connector Type C (X3)

Refer to section 18.1 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	Reserved	
A6	USBD+	USB _P line
A7	USBD-	USB _N line
A8	Not Connected	
A9	USB_VBUS	USB VBUS 5 V
A10	Not Connected	
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	Reserved	
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
	COMRET	Supply, Connector body

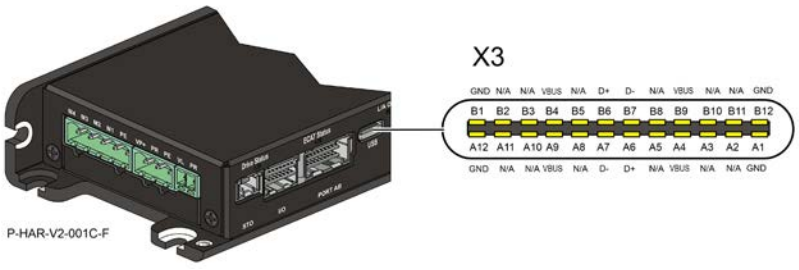
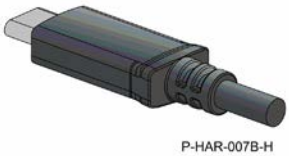
Pin Positions	***Cable Connector***
	

Table 17: USB Device Type C Pin Assignments

7.12 EtherCAT IN Connector Pinouts (X1) for Safety Capability: F, S, O

Fieldbus communications are industrial network protocols for real-time distributed control that allows connection of servo drives. The Platinum Harmonica supports the following EtherCAT fieldbus type industrial network protocol:

Fieldbus Type	Product Number
EtherCAT	PHAR-zz-zXXX/YYYFzzQ

Refer to section 18.2 EtherCAT/Ethernet in the Platinum Safety Drive Manual for full details.

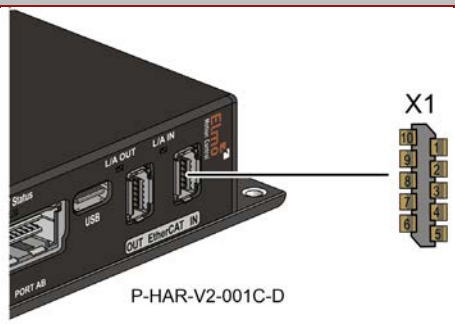
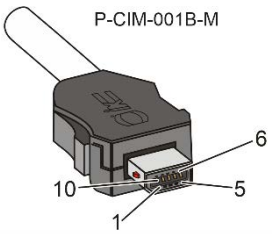
Pin (X1)	Signal	Function
1	ECAT_IN_TX+	Output, ECAT levels
2	ECAT_IN_TX-	Output, ECAT levels
3	Not Connected	
4	Not Connected	
5	Not Connected	
6	ECAT_IN_RX+	Input, ECAT levels
7	ECAT_IN_RX-	Input, ECAT levels
8	Not Connected	
9	Not Connected	
10	Not Connected	
	PE	Protective Earth
Pin Positions		***Cable Connector***
		

Table 18: EtherCAT IN Pin Assignments

7.13 EtherCAT OUT/Ethernet Connector Pinouts (X2) for Safety Capability: F, S, O

Refer to section 18.2 EtherCAT/Ethernet in the Platinum Safety Drive Manual for full details.

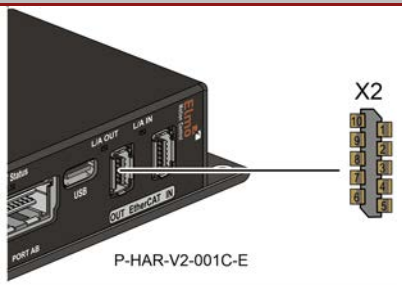
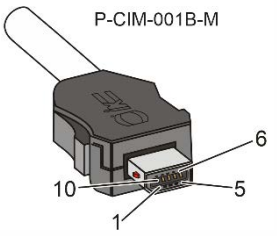
Pin (X2)	Signal	Function
1	ECAT_OUT_TX+ / Ethernet_TX+	Output, ECAT levels / Ethernet transmit +
2	ECAT_OUT_TX- / Ethernet_TX-	Output, ECAT levels / Ethernet transmit -
3	Not Connected	
4	Not Connected	
5	Not Connected	
6	ECAT_ OUT _RX+ / Ethernet_RX+	Input, ECAT levels / Ethernet receive +
7	ECAT_ OUT _RX- / Ethernet_RX-	Input, ECAT levels / Ethernet receive -
8	Not Connected	
9	Not Connected	
10	Not Connected	
	PE	Protective Earth
Pin Positions		***Cable Connector***
		

Table 19: EtherCAT OUT/Ethernet Pin Assignments

7.14 Connecting EtherCAT Mating Connectors to Connectors X1 and X2

Proper connecting of the mating EtherCAT connectors to the Platinum Harmonica X1 and X2 connectors is shown in the following drawing.

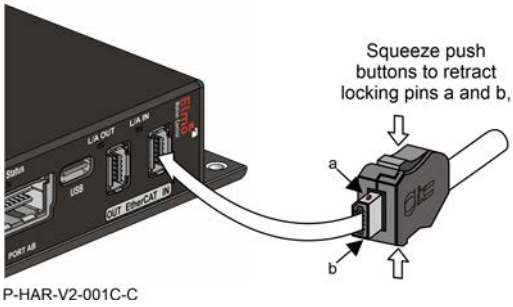


Figure 13: Connecting EtherCAT Mating Connectors to Platinum Harmonica X1 and X2 Connectors

7.15 CAN Connector Pinouts (X1, X2) for Safety Capability: F, O

Fieldbus communications are industrial network protocols for real-time distributed control that allows connection of servo drives. The Platinum Harmonica supports the following CAN fieldbus type industrial network protocol:

Fieldbus Type	Product Number
CAN	PHAR-zz-zXXX/YYY**S**zzQ

Note: It should be noted that all signals are isolated and the Grounding denoted ISO_GND throughout CAN connections.

The CAN Connector Pinouts are as follows:

Pin (X1, X2)	Signal	Function
1	Not Connected	
2	Not Connected	
3	Not Connected	
4	CAN_H	Bidirectional, CAN BUS
5	CAN_L	Bidirectional, CAN BUS
6	Not Connected	
7	Not Connected	
8	Not Connected	
9	ISO_RET	Isolation GND for CAN
10	ISO_RET	Isolation GND for CAN
	PE	Protective Earth

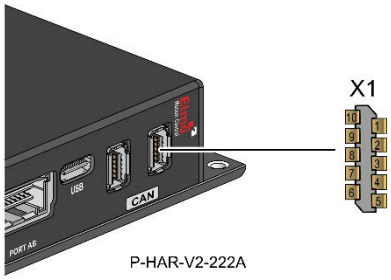
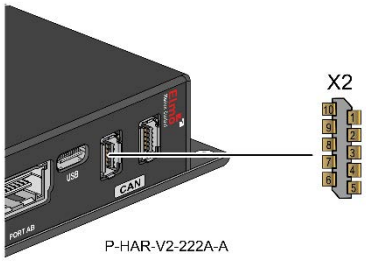
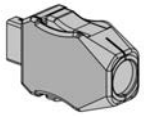
Pin Positions		***Cable Connector***
		

Table 20: CAN Connector Pin Assignments

7.16 RS-232 Serial Communication Connector Pinouts (X4)

Refer to section 18.3 and 18.4 RS-232 in the Platinum Safety Drive Manual for full details.

Network Type	Product Number
RS-232 Serial Communication	PHAR-zz-zXXX/YYYSzzQ

Note: It should be noted that all signals are isolated and the Grounding denoted ISO_GND throughout RS-232 connections.

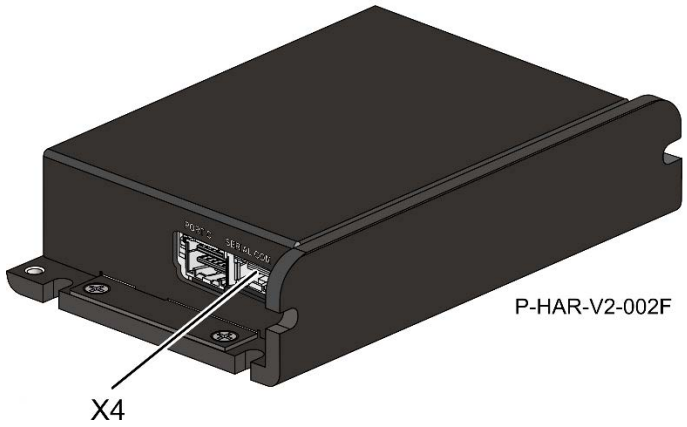
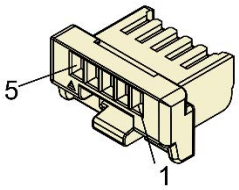
Pin (X4)	RS-232	
	Signal	**Function**
1	RS232_TX	RS232 Level
2	Not Connected	
3	RS232_RX	RS232 Level
4	Not Connected	
5	ISO_GND	Isolated Ground
Pin Positions		**Cable Connector**
		 P-HAR-CK-053A-A CLIK-MATE HOUSING FE 5PIN(1x5) P=1.5MM

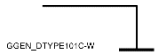
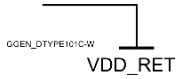
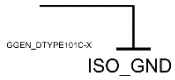
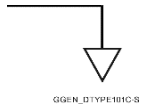
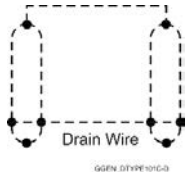
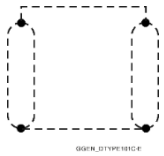
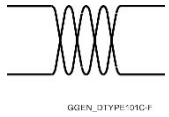
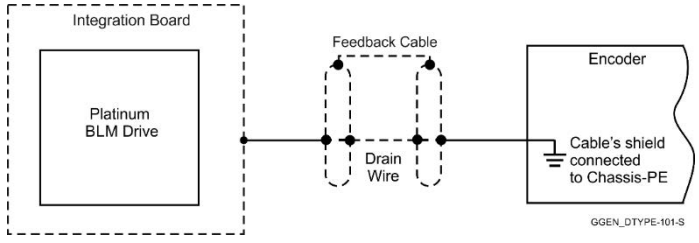
Table 21: RS-232 Pin Assignments

Chapter 8: Wiring

8.1 Wiring Legend

Once the product is mounted, you are ready to wire the device. Proper wiring, grounding and shielding are essential for ensuring safe, immune and optimal servo performance of the drive.

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.

8.2 The Platinum Harmonica Connection Diagrams

8.2.1 Motor Type Supported: B, EtherCAT (Safety Capability: F)

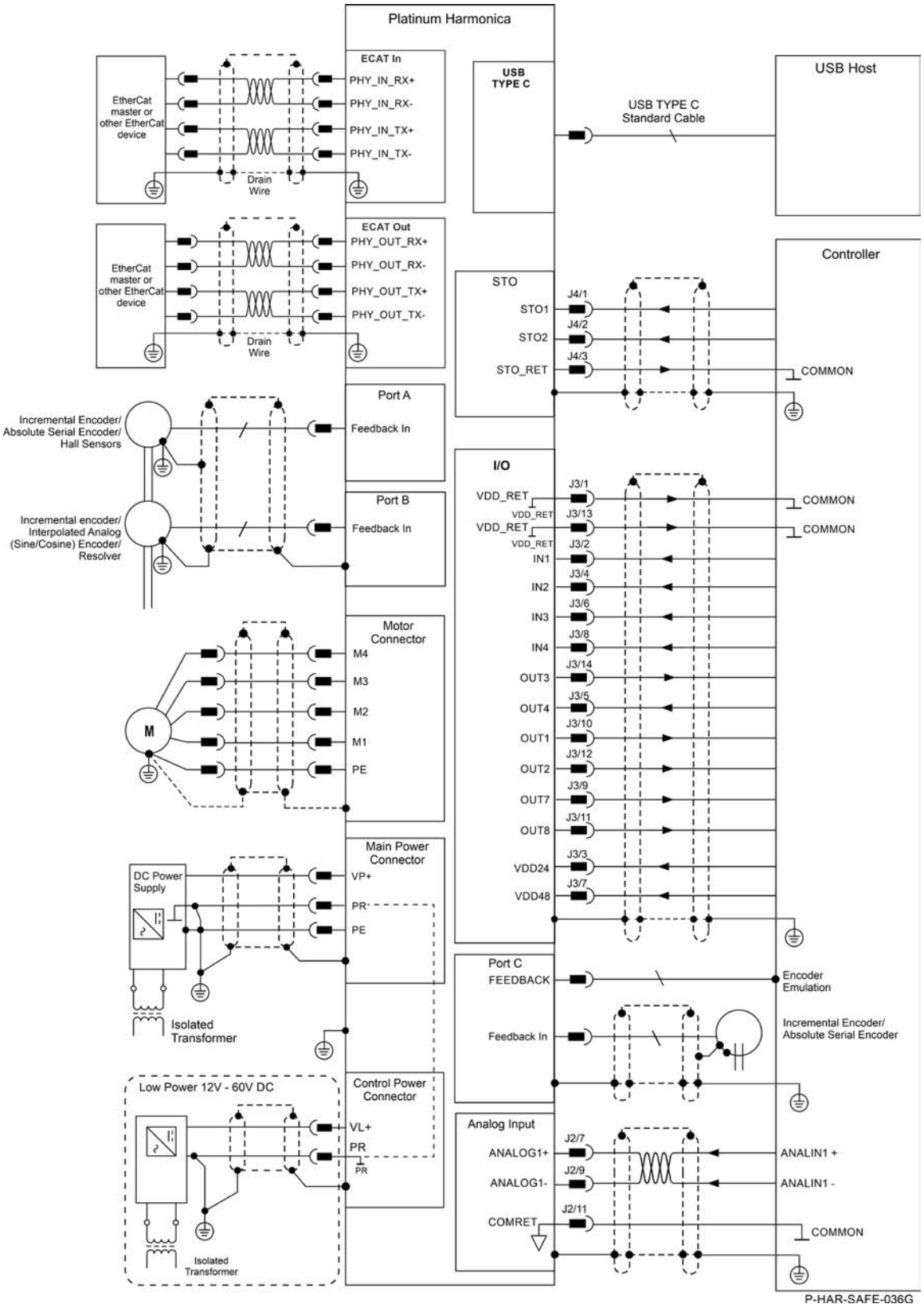


Figure 14: Platinum Harmonica EtherCAT Safe IO Connection Diagram
Motor Type Supported: B (PHAR-BF-zXXX/YYYFzz)

8.2.2 Motor Type Supported: T, EtherCAT (Safety Capability: F)

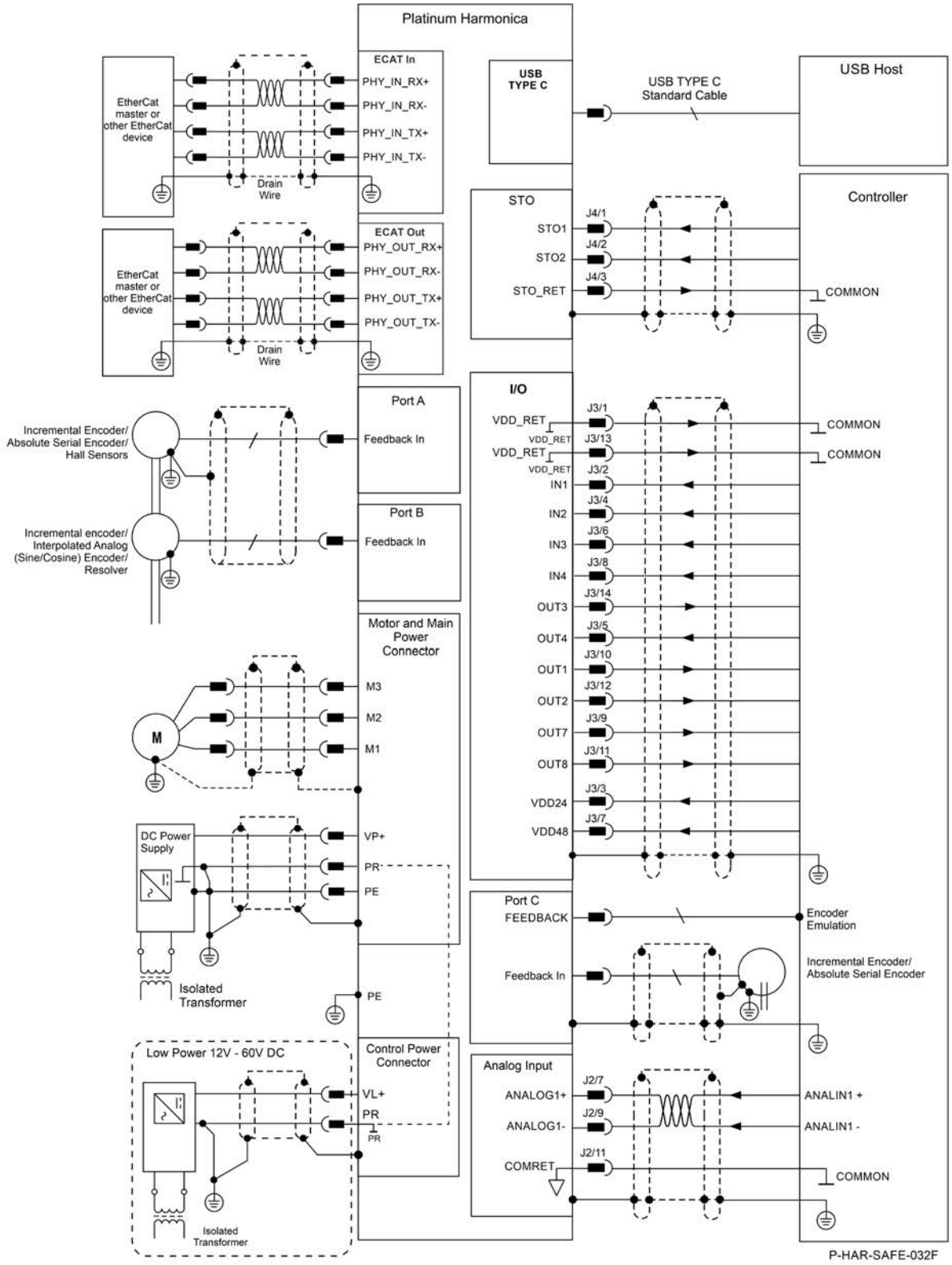


Figure 15: Platinum Harmonica EtherCAT Safe IO Connection Diagram
Motor Type Supported: T (PHAR-TF-zXXX/YYYFzz)

8.2.3 Motor Type Supported: B, EtherCAT (Safety Capability: S, O)

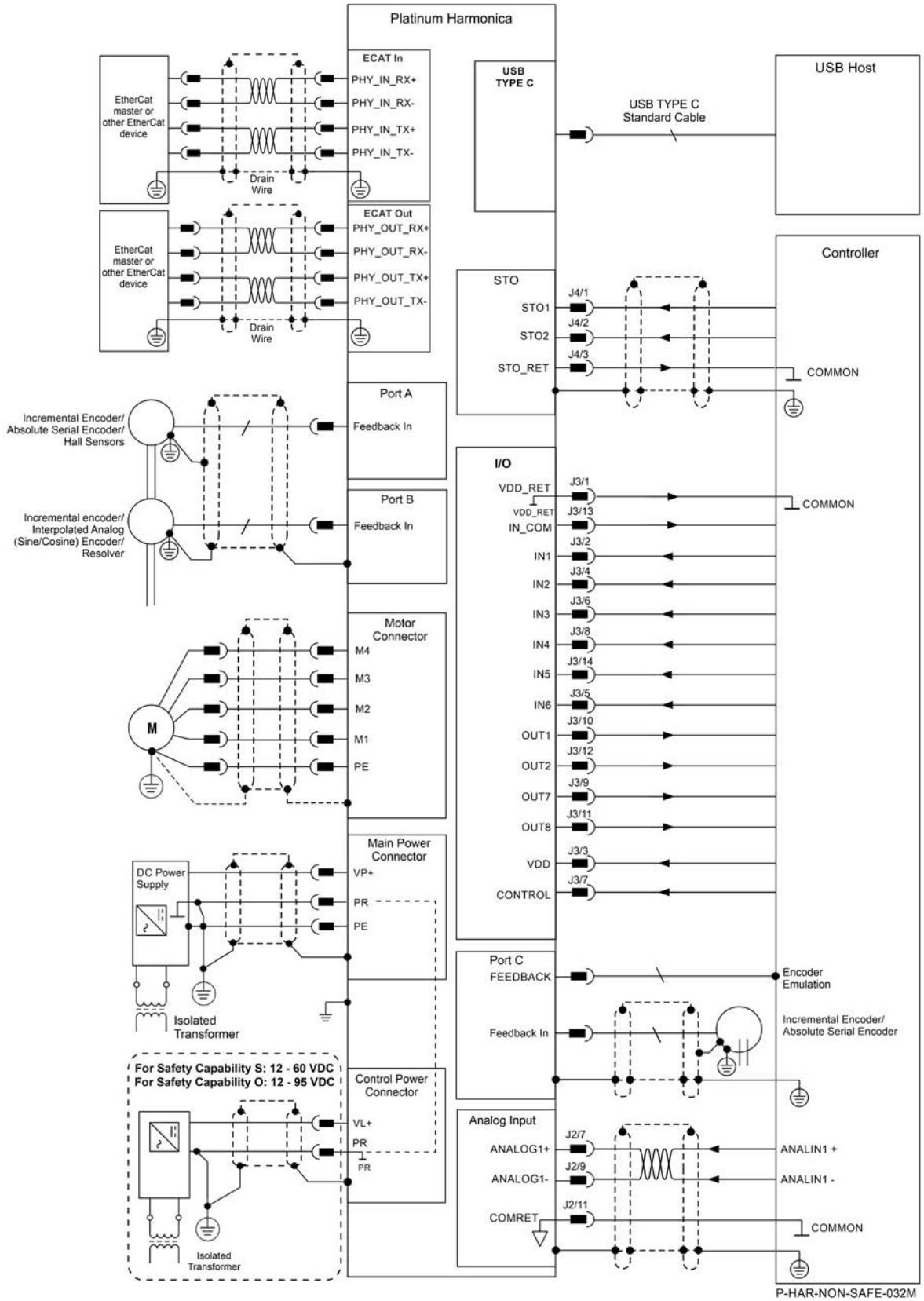


Figure 16: Platinum Harmonica EtherCAT Regular IO Connection Diagram
Motor Type Supported: B (PHAR-Bz-zXXX/YYYFzz)

8.2.4 Motor Type Supported: T, EtherCAT (Safety Capability: S, O)

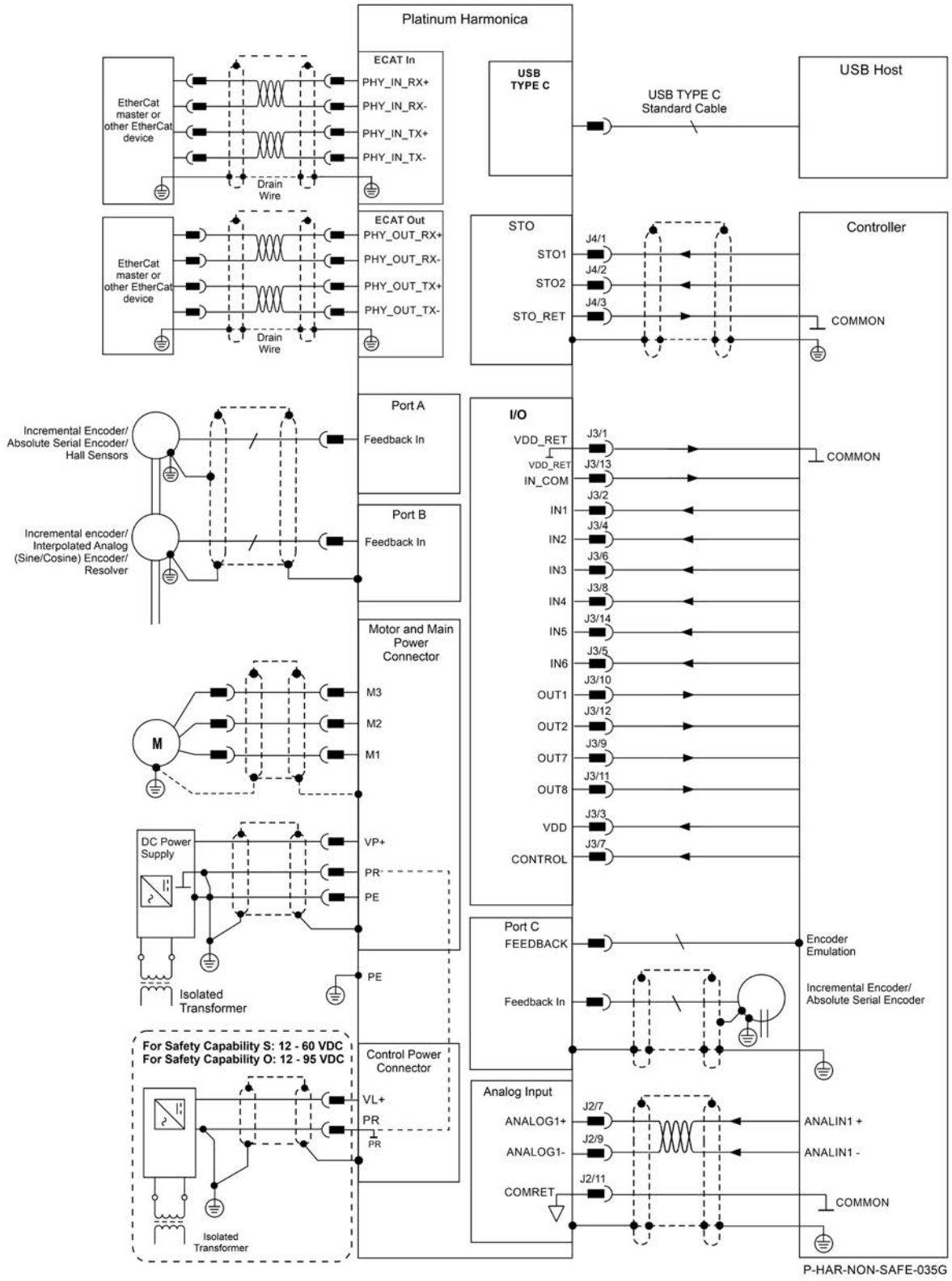


Figure 17: Platinum Harmonica EtherCAT Regular IO Connection Diagram
Motor Type Supported: T (PHAR-Tz-zXXX/YYYFzz)

8.2.5 Motor Type Supported: B, CAN (Safety Capability: F)

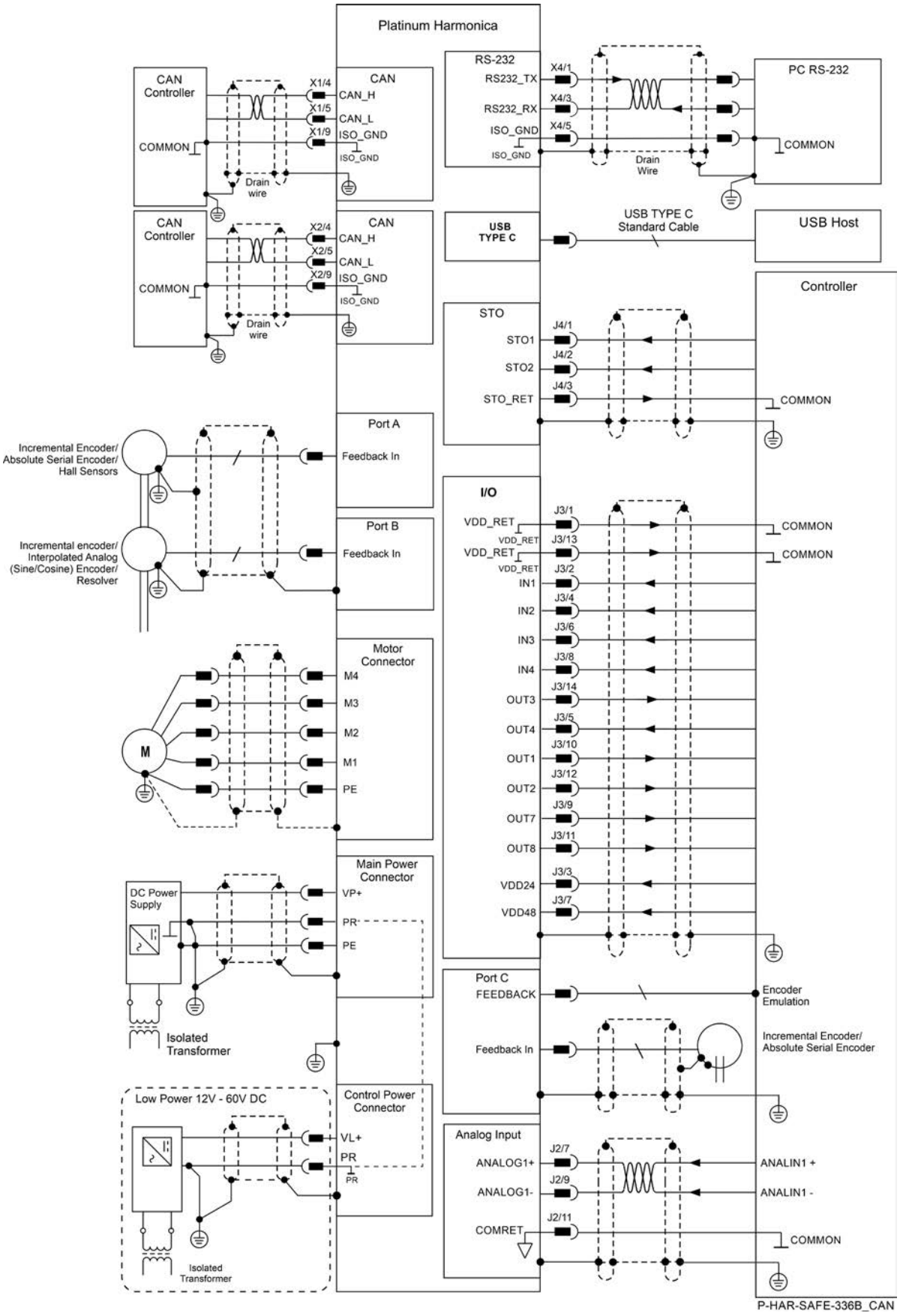


Figure 18: Platinum Harmonica CAN Safe IO Connection Diagram
Motor Type Supported: B (PHAR-BF-zXXX/YYYzzz)

8.2.6 Motor Type Supported: T, CAN (Safety Capability: F)

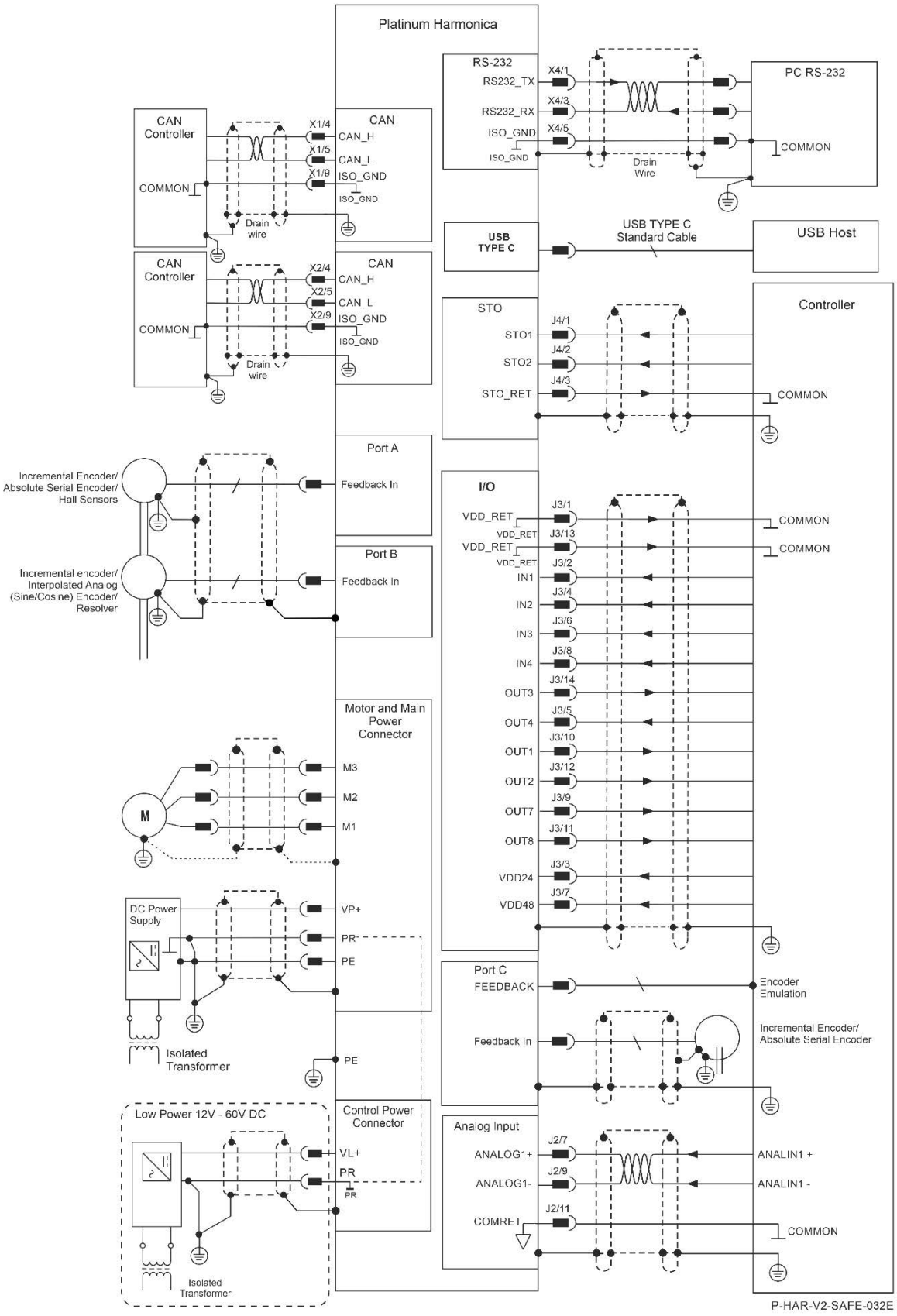


Figure 19: Platinum Harmonica CAN Safe IO Connection Diagram
Motor Type Supported: T (PHAR-TF-zXXX/YYYzzz)

8.2.7 Motor Type Supported: B, CAN (Safety Capability: O)

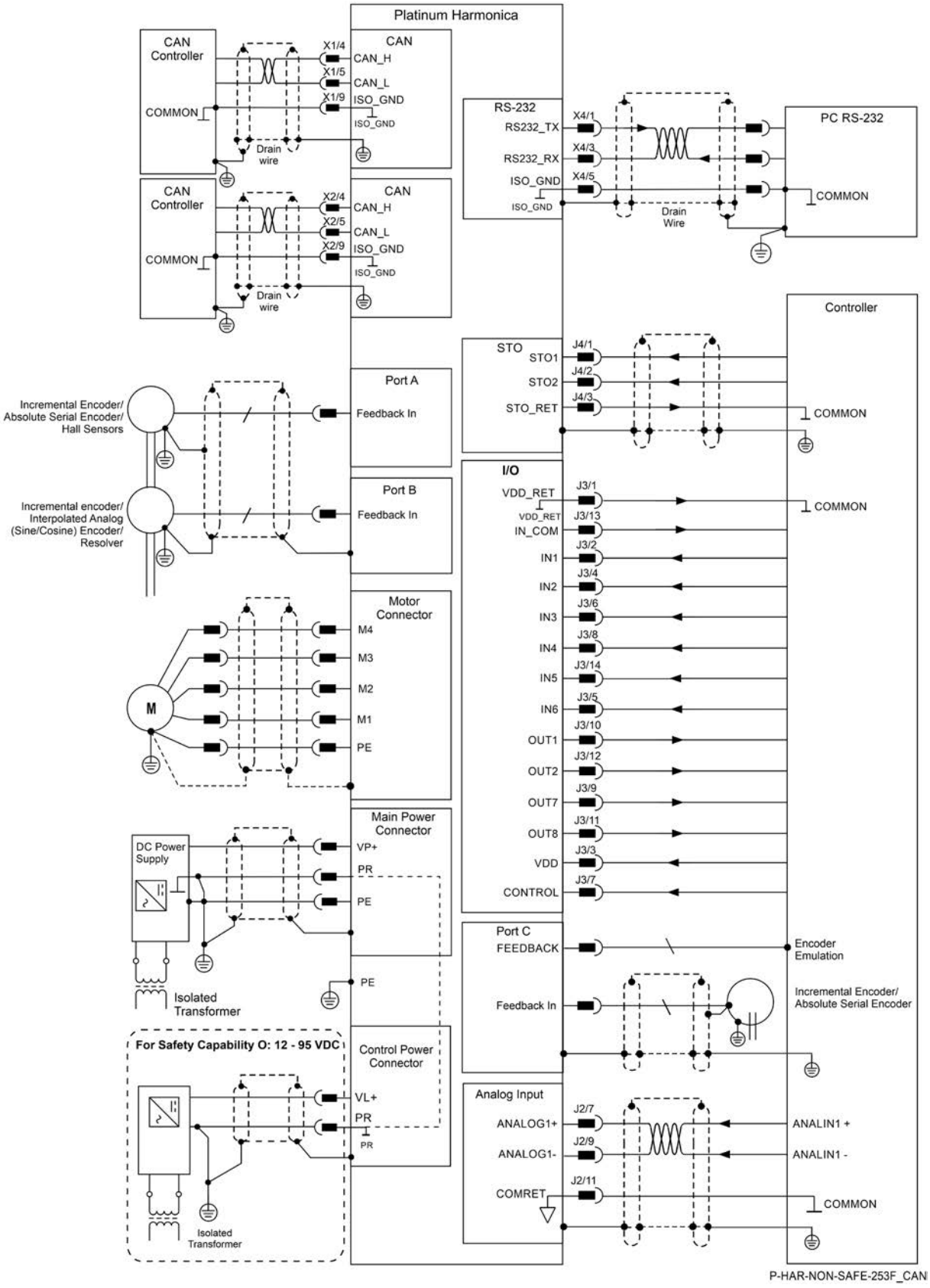


Figure 20: Platinum Harmonica CAN Regular IO Connection Diagram
Motor Type Supported: B (PHAR-BO-zXXX/YYYzzz)

8.2.8 Motor Type Supported: T, CAN (Safety Capability: O)

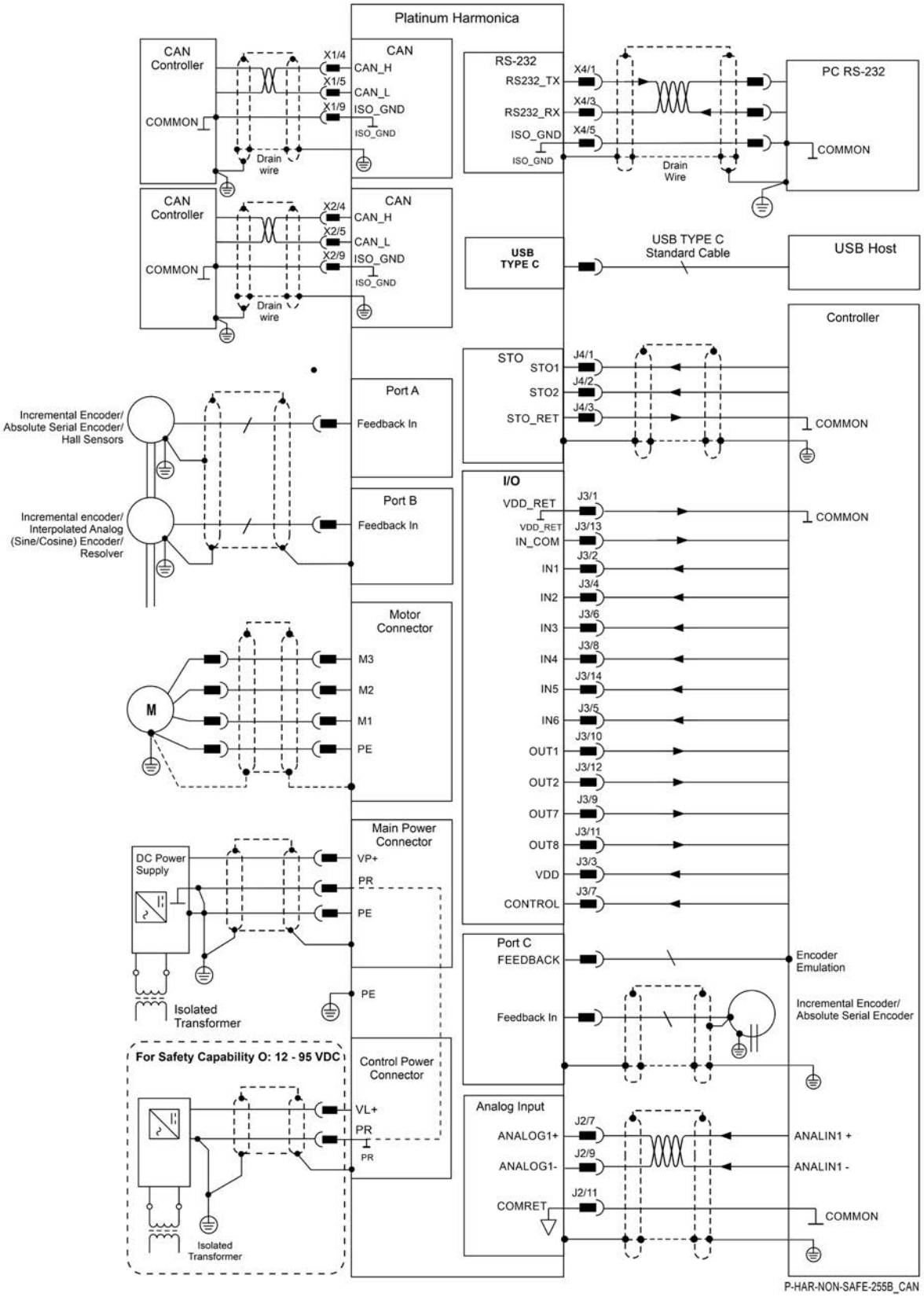


Figure 21: Platinum Harmonica CAN Regular IO Connection Diagram
Motor Type Supported: T (PHAR-TO-zXXX/YYYzzz)

8.3 Wiring the Female Connectors

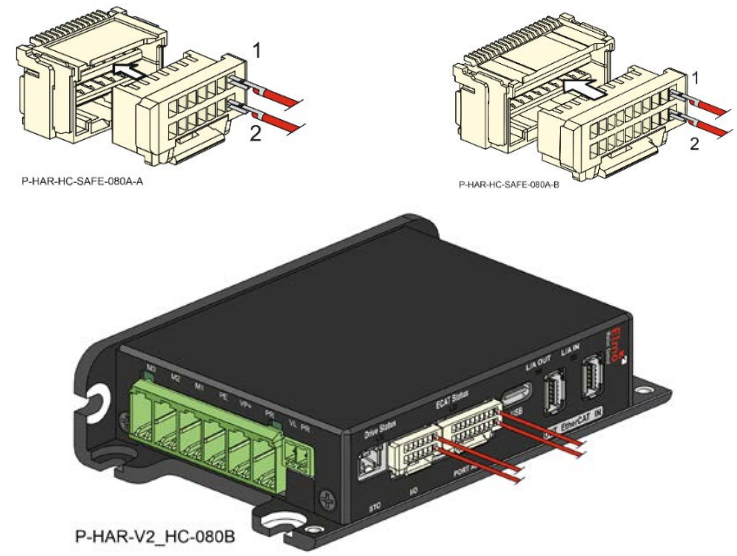
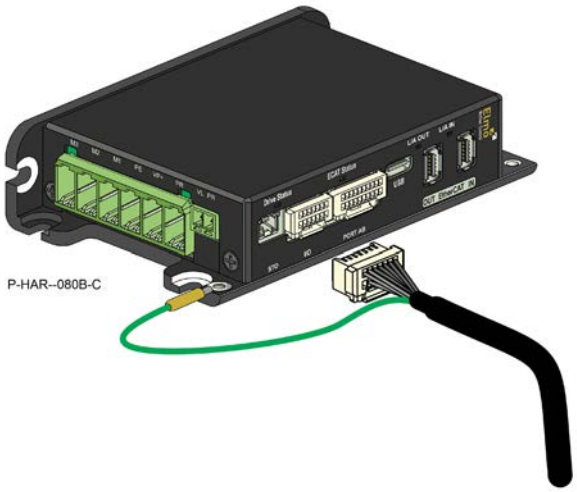


Figure 22: Inserting a wire/pin to the Female Connector

To insert a wire/pin into any of the female connectors J1, J2, J3, and J4, do the following:

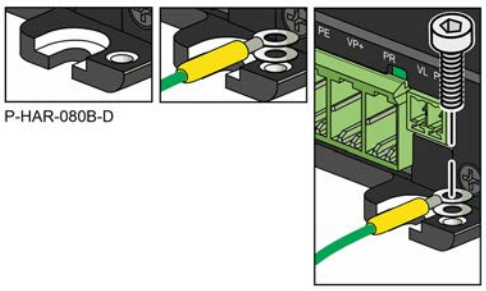
1. Select the relevantly colored wire to insert to a specific rectangular compartment on the female connector.
2. Use the appropriate Molex crimping plier (Molex P/N 63819-4600) to fasten a pin connector to the end of the wire.
3. Place the connector on a flat surface, in the orientation as shown in Figure 22.
   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 22. Make sure that the connector protrusion is inserted to the bottom of the rectangular slot.
5. Repeat the same procedure for any other wire connections.

8.4 Wiring the Grounding Wires



The grounding wires are 10 cm green wires with yellow terminal rings. Use an M4 screw and a serrated washer to mount the grounding wire. During the drive installation, to connect the grounding wire to ground, do the following:

1. For each connector with an attached grounding wire, select the nearest and most appropriate grounding hole to which to connect the wire.
2. Mount the screw, terminal ring, and washer, to the ground hole as shown below.



3. Carefully tighten the screw, to secure the terminal ring.

Note: There may be a need for more than four grounding wires. The grounding holes on the frame of the Harmonica are dedicated for Elmo's wires, but when more grounding wires are necessary, the grounding rings can be attached directly to the product.

8.5 Motor Power (M1)

When connecting several drives to several similar motors, all should be wired in an identical manner. This will enable the same settings to run on all drives.

This section consists of two separate procedures to connect the motor power:

- For Motor Type Supported: **B** (PHAR-Bz-zXXX/YYYzzzQ)
- For Motor Type Supported: **T** (PHAR-Tz-zXXX/YYYzzzQ)

8.5.1 Connecting Motor Type Supported: B

To connect the motor power for Motor Type Supported: B (PHAR-Bz-zXXX/YYYzzz)

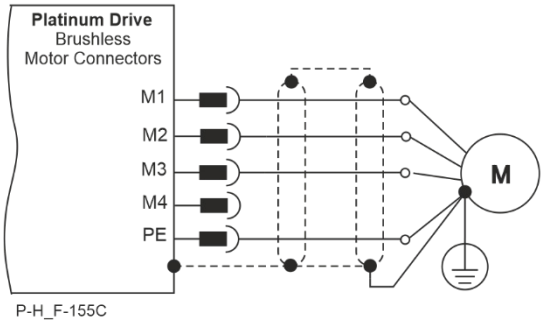


Figure 23: Brushless Motor Power Connection Diagrams

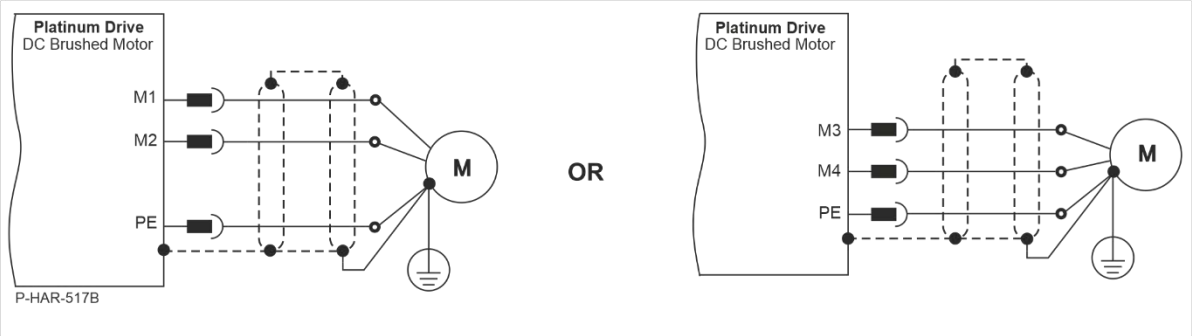


Figure 24: DC Brushed Motor Power Connection Diagrams

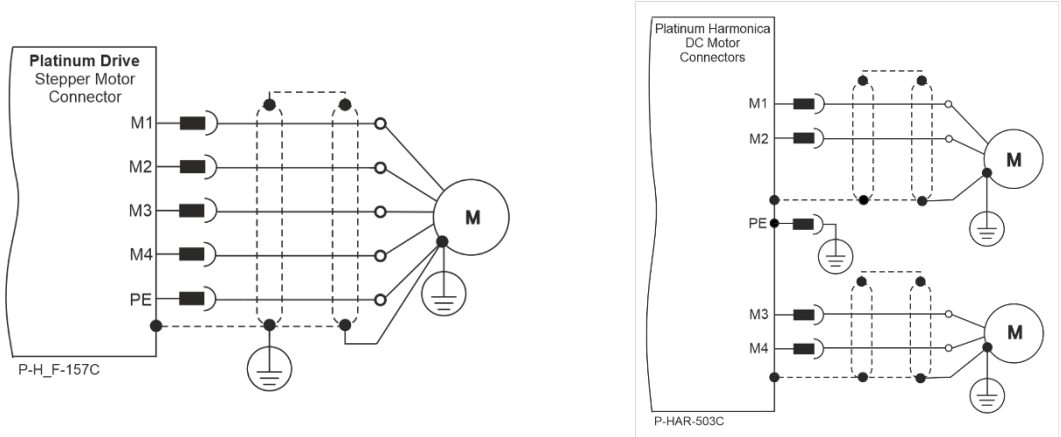


Figure 25: Stepper Motor and Two Motor Power Connection Diagrams

Note: In accordance with IEC/EN 618005-1 clause 4.3.5.4, it is recommended to use at least 2.5mm^2 wires (14 AWG) for the PE wire.

To connect the motor power:

1. Ensure that the motor chassis is properly earthed.
2. Connect the appropriate wire from the Motor Power cables to the terminals on the Platinum Harmonica.
   Connect the wires to M1, M2, M3, M4, and PE terminals. Make sure not to bundle the wires.
3. 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.
4. For high EMI environment, it is highly recommended to use a not twisted shielded wire cable for the motor connection. Use a 5-wire cable.
   The gauge is determined by the actual RMS current consumption of the motor.
   Connect the cable shield to the closest ground connection at the motor end.
5. For better EMI performance, the shield should be connected to Earth Connection (heat sink mounting holes).

8.5.2 Connecting Motor Type Supported: T

To connect the motor power for Motor Type Supported: T (PHAR-Tz-zXXX/YYYzzz)

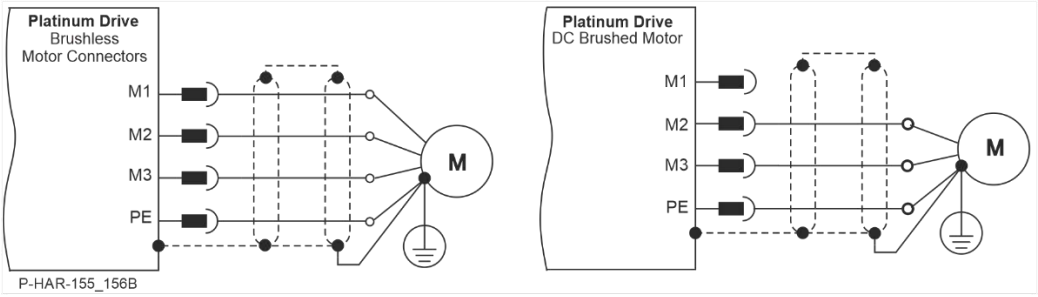


Figure 26: Brushless Motor P and DC Brushed Motor Power Connection Diagrams

Note: In accordance with IEC/EN 618005-1 clause 4.3.5.4, it is recommended to use at least 2.5mm^2 wires (14 AWG) for the PE wire.

1. Ensure that the motor chassis is properly earthed.
2. Connect the appropriate wire from the Motor Power cables to the terminals on the Platinum Harmonica. Connect the wires to the M1, M2, M3, and PE terminals.
   Make sure not to bundle the wires.
3. 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.
4. For high EMI environment, it is highly recommended to use a not twisted shielded wire cable for the motor connection. Use a 4-wire cable
   The gauge is determined by the actual RMS current consumption of the motor.
   Connect the cable shield to the closest ground connection at the motor end.
5. For better EMI performance, the shield should be connected to Earth Connection (heat sink mounting holes).

8.6 Main (P1) and Control Power (P2)

Refer to the Chapter 10 Input Power Supply, in the Platinum Safety Drive Manual for details, specification, and connections of the Main and Control Power for safety.

The Platinum Harmonica receives power from Main and Control supplies and delivers power to the motor.

8.6.1 Main Supply

There are two power ratings for the Platinum Harmonica:

- 10 to 95 VDC for the 100V Power Rating
- 20 to 195 VDC for the 200V Power Rating

For power rating 200V
Two DC power sources are required:

- a DC power source of 20 to 195V isolated from the Mains, and
- a control supply of:
  - 12V to 60V (for Safety Capability F, S) isolated from the Mains for the logic, or
  - 12V to 95V (for Safety Capability O) isolated from the Mains for the logic.

For power rating of 100V
Two DC Power sources are required:

- a DC power source of 10 to 95 VDC isolated from the Mains, and
- a control supply of:
  - 12V to 60V (for Safety Capability F, S) isolated from the Mains for the logic, or
  - 12V to 95V (for Safety Capability O) isolated from the Mains for the logic.

Note:
Both the 10V to 95V and 20V to 195V DC power sources must be isolated from the Mains.

Connect the DC power source cable to the VP+ and PR terminals on the main power connector.

Note:
In accordance with IEC/EN 618005-1 clause 4.3.5.4, it is recommended to use at least 2.5mm^2 wires (14 AWG) for the PE wire.

To connect the main power:

1. The DC power supply source must be isolated from the Mains.
2. For best immunity, it is highly recommended to use shielded cables for the DC power source.
   A 3-wire shielded cable should be used. The gauge is determined by the actual current consumption of the motor.
3. Connect the cable shield to the closest earth connection near the power supply.
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.

8.6.2 Control Supply

Regarding Control Power (VL) for Safety configuration, refer to the Safety Power Configuration and to Chapter 10 Input Power Supply in the Platinum Safety Drive Manual. For the Regular configuration, refer to **Chapter 7 Input Power Supply** in the **Platinum Drive Hardware Manual**.

To connect your integration board to the control supply:

1. The source of the control supply must be isolated from the Mains.
2. For safety reasons, connect the return (common) of the control supply source to the closest earth connection near the control supply source.
3. Connect the cable shield to the closest earth connection near the control supply source.
4. Before applying power, verify the polarity of the connection.

8.6.3 Dual Power Supply for Safety Configuration

Two DC power sources are required for functional Safety. Refer to the Chapter 10 Input Power Supply, in the Platinum Safety Drive Manual for details, specification, and connections.

- Main power isolated from the Mains:
  - Main power 20 to 195 V DC for 200 V module
  - Main power 10 to 95 V DC for 100 V 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**

The following figure describes the connection of main power and control.

Important:

CAPACITANCE IN: **For Platinum Harmonica modules 20/100 and above** must have a high DC Bus Capacitance of at least **900uF** connected between the VP+ and the PR as shown in Figure 27**.**

Elmo recommends:

- TAB-100, a DC Bus connection Hub with **2340uF** for 100V products
- TAB-200, a DC Bus connection Hub with **900uF** for 200V products

Please refer to the TABLA Installation Guide.

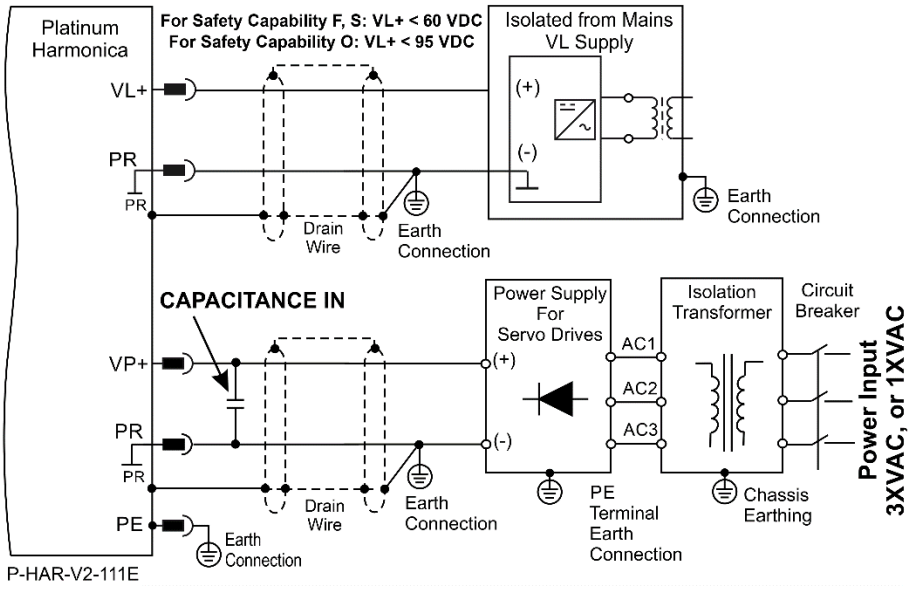


Figure 27: Power Supply Connection Diagram for Safety Configuration

Note: Make sure to connect the PR to the closest earth connection near the power supply.

8.7 STO (Safe Torque Off) (J4)

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

8.7.1 Source Mode – PLC Voltage Level

Refer to the diagrams below for the PLC Source option connection.

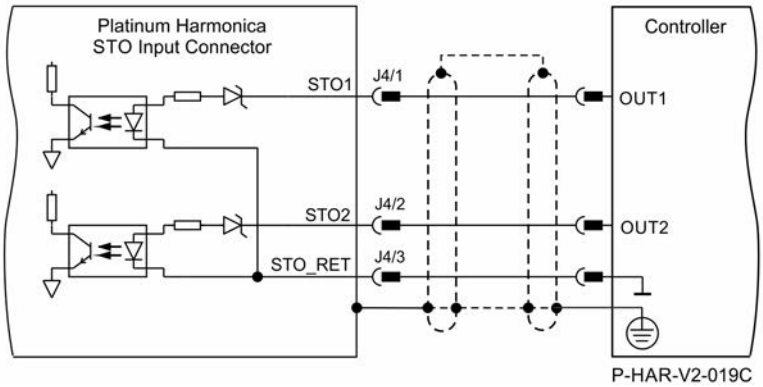


Figure 28: STO Type Connection – PLC Source Option

8.7.2 Source Mode – 5V Logic

Refer to the diagrams below for 5V Logic option connection.

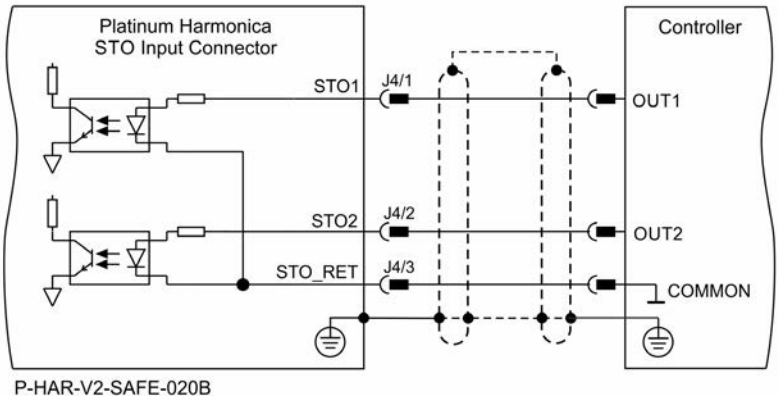


Figure 29: STO Input Connection – 5V Logic Option

8.8 Feedbacks

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

8.8.1 Feedback Port A

Port A supports the following sensors:

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

8.8.1.1 Incremental Encoder

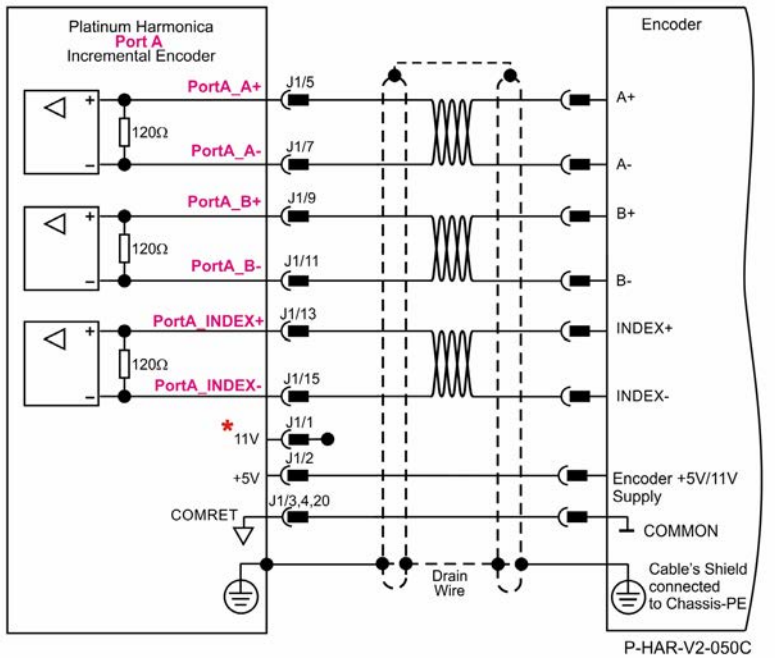


Figure 30: Port A Incremental Encoder Input – Recommended Connection Diagram

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

8.8.1.2 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:

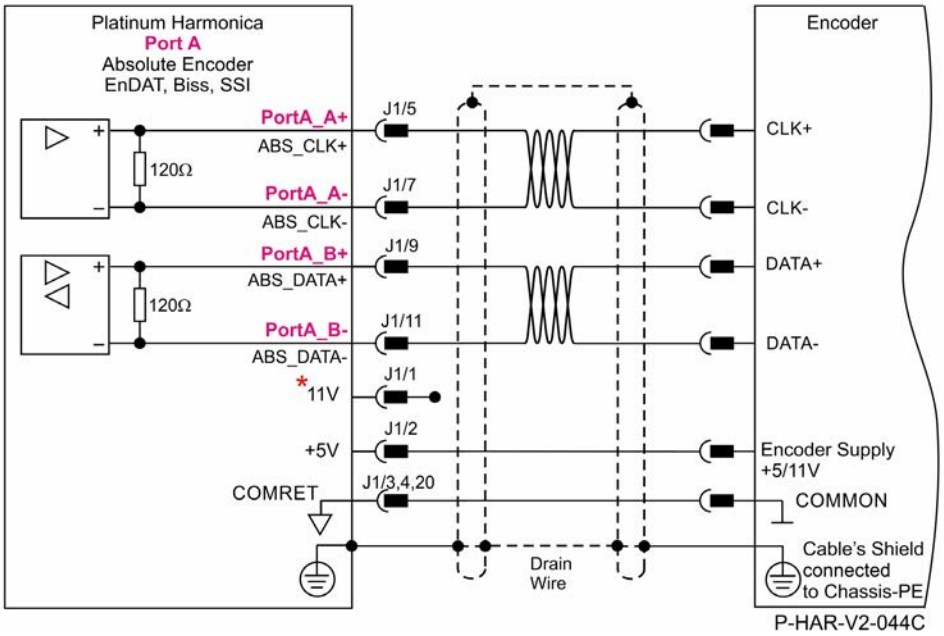


Figure 31: Absolute Serial Encoder – Recommended Connection Diagram for EnDat, Biss, SSI

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

8.8.1.3 Hiperface

8.8.1.3.1 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.

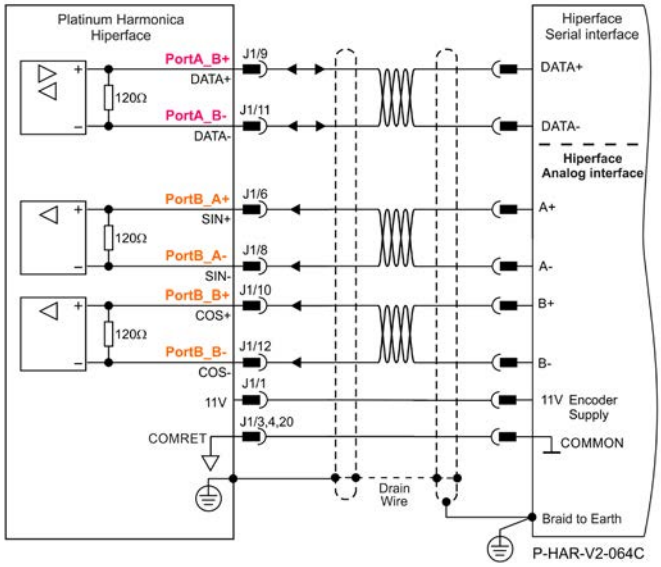


Figure 32: Absolute Serial Encoder – Recommended Connection Diagram for Hiperface – Safe IO

8.8.1.3.2 Hiperface for Non-Safety Application

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

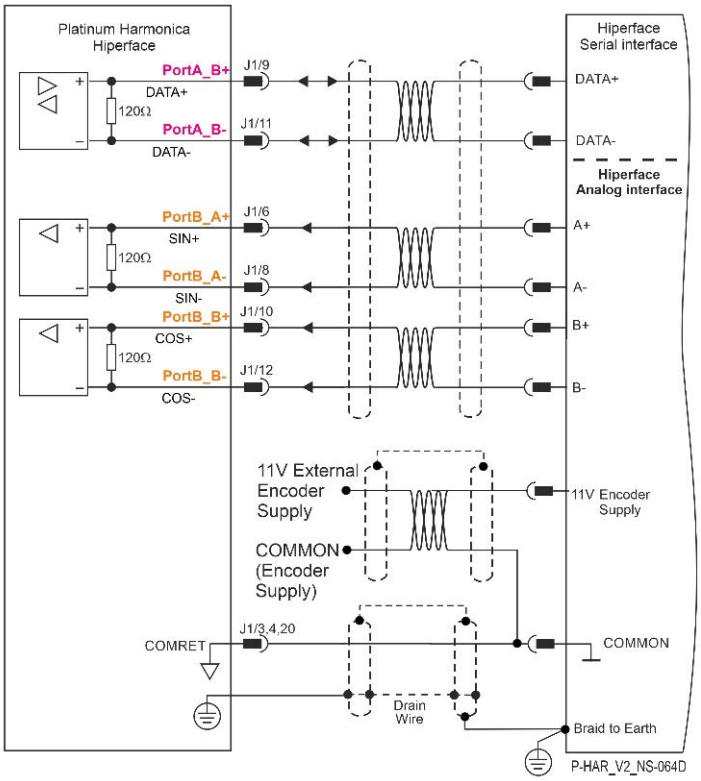


Figure 33: Absolute Serial Encoder – Recommended Connection Diagram for Hiperface – Regular IO

8.8.2 Feedback Port B

Port B supports any of the following sensors:

- Incremental Encoder, interpolated analog Encoder

Or

- Resolver (separate hardware option)

8.8.2.1 Incremental Encoder

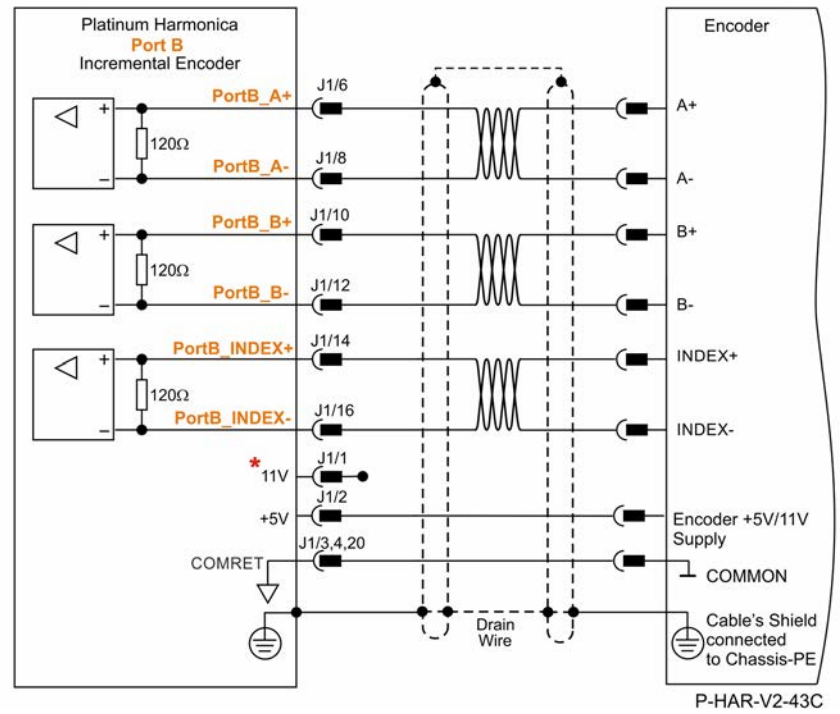


Figure 34: Port B Incremental Encoder Input – Recommended Connection Diagram

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

8.8.2.2 Interpolated Analog (Sine/Cosine) Encoder

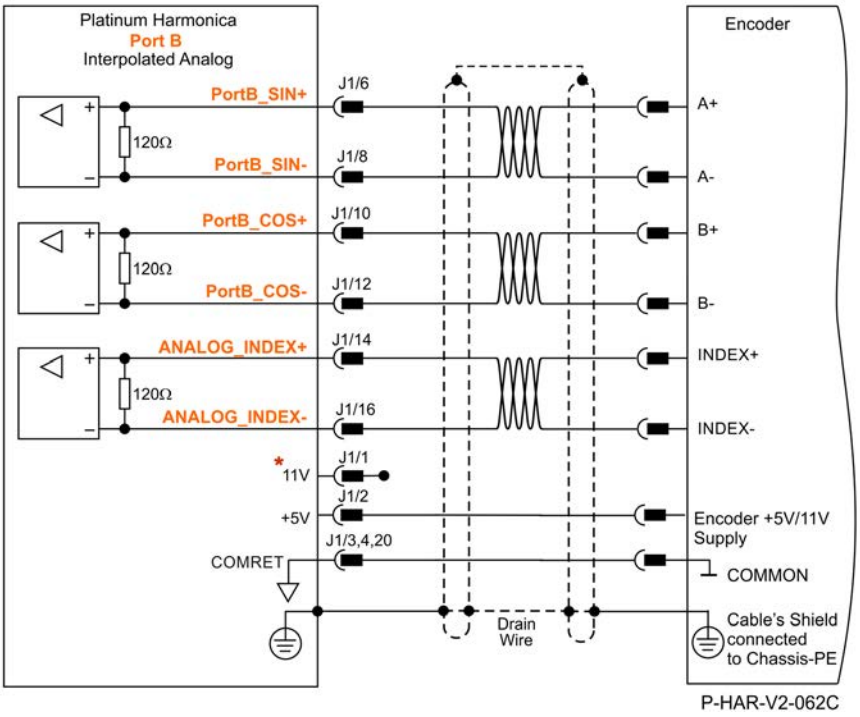


Figure 35: Port B - Interpolated Analog Encoder Connection Diagram

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

8.8.2.3 Resolver

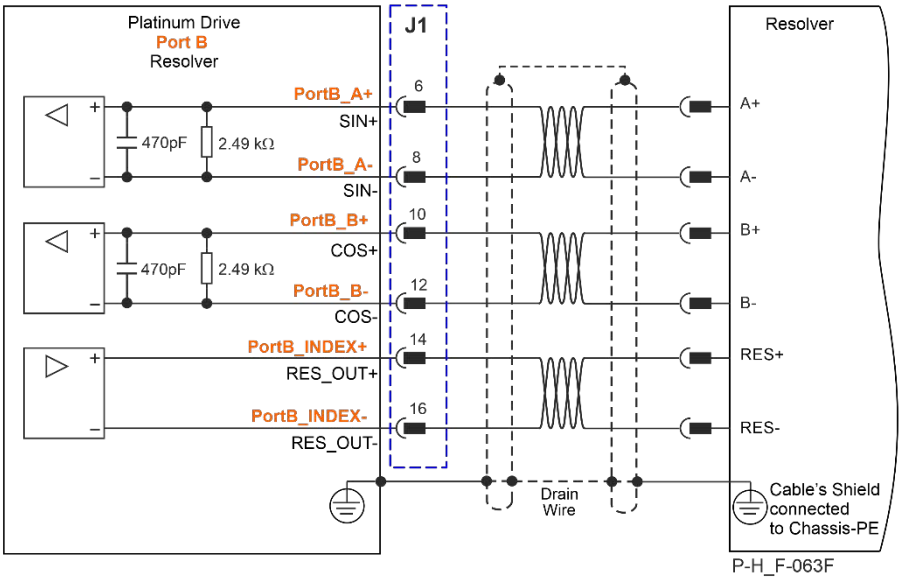


Figure 36: Port B – Resolver Connection Diagram

8.8.3 Feedback 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

8.8.3.1 Incremental Encoder

The following Incremental Encoder types are supported:

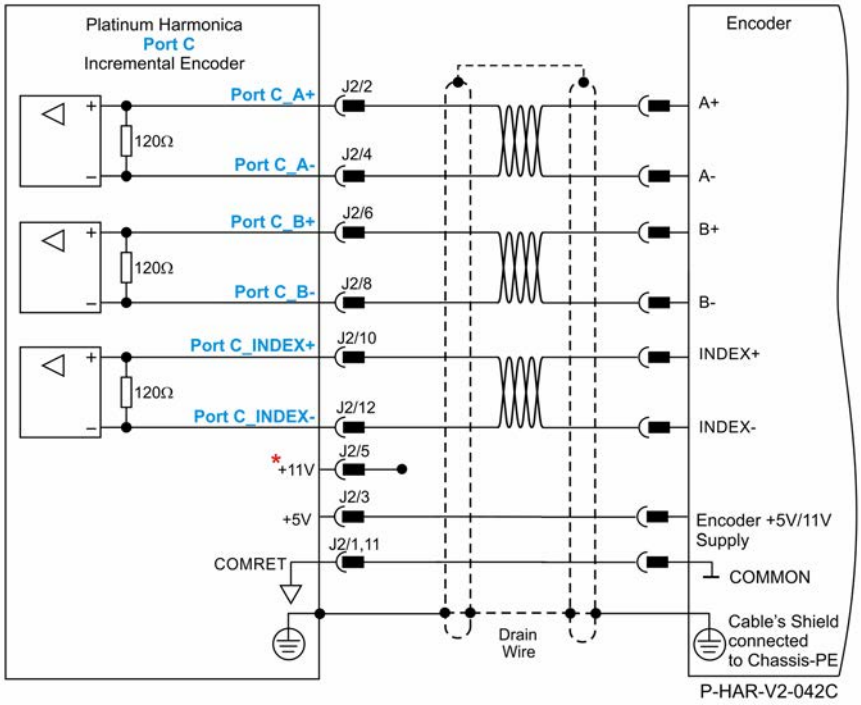


Figure 37: Port C Incremental Encoder Input – Recommended Connection Diagram

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

8.8.3.2 Absolute Serial Encoder

Port C supports three types of encoder wire connections:

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

8.8.3.2.1 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

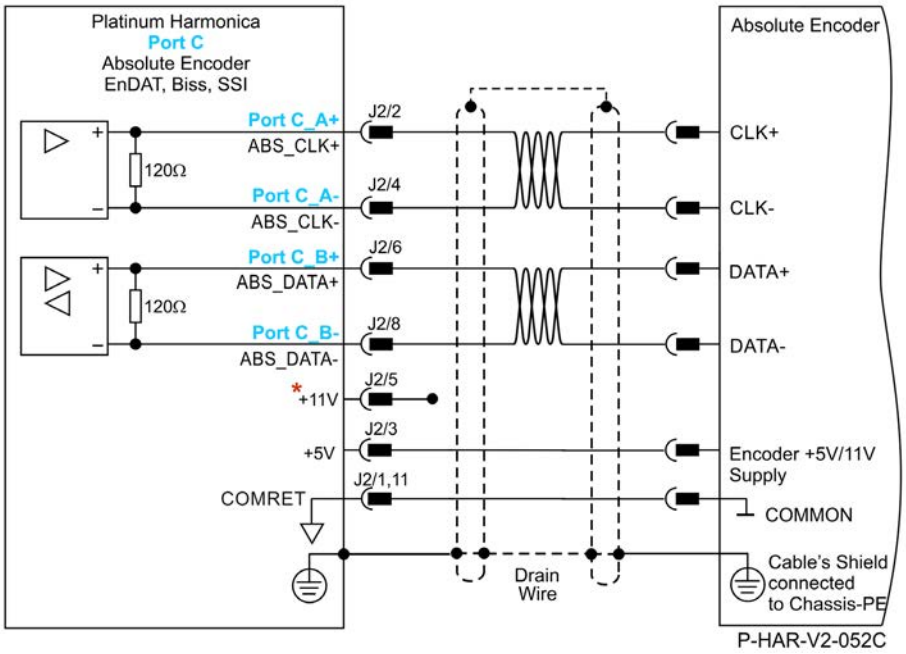


Figure 38: **Absolute Serial Encoder – 6-Wires Connection Diagram Example**

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

8.8.3.2.2 Encoder 4-Wires

The following encoders are supported:

- Panasonic (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 for Option E:

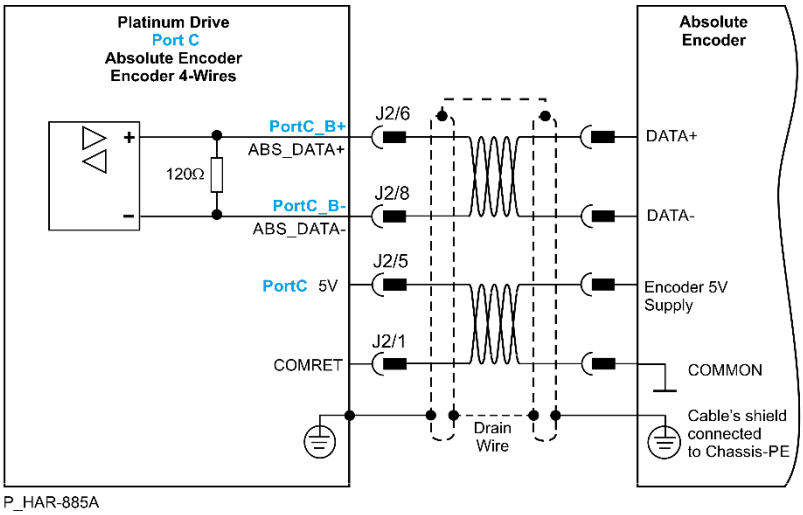


Figure 39: Absolute Serial Encoder - Option E – 4-Wires Connection Diagram Example

The following is the feedback diagram connection for Safety Capability F:

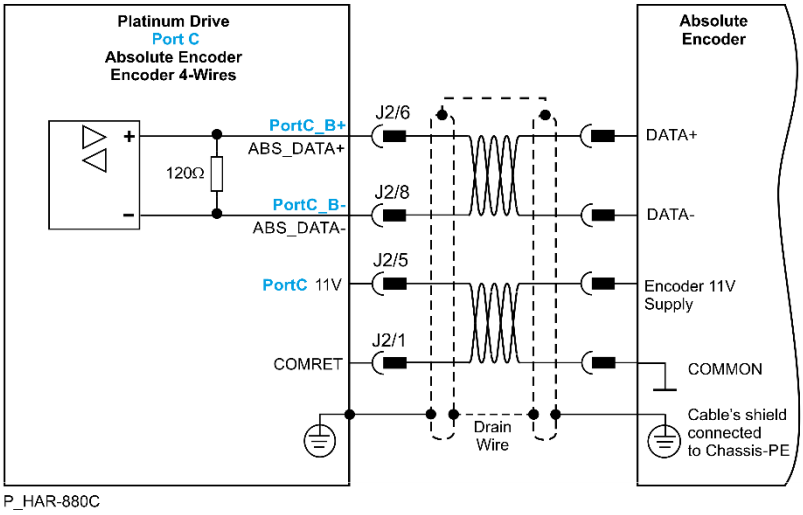


Figure 40: Absolute Serial Encoder for Safety Capability F – 4-Wires Connection Diagram Example

8.8.3.2.3 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)

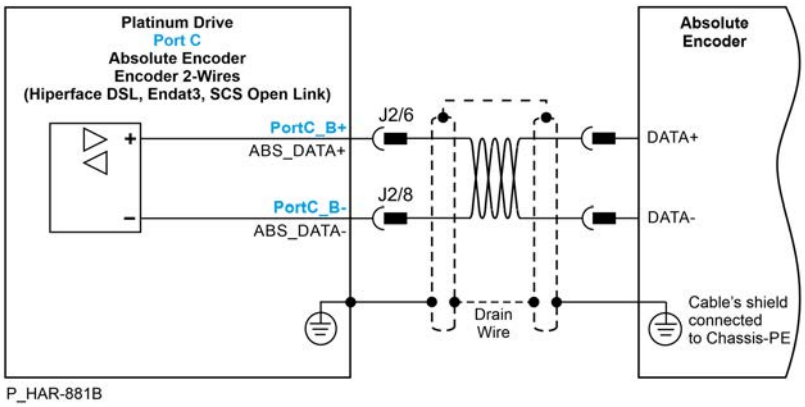


Figure 41: Absolute Serial Encoder – 2-Wires Connection Diagram Example

8.8.3.3 Emulated Encoder Output

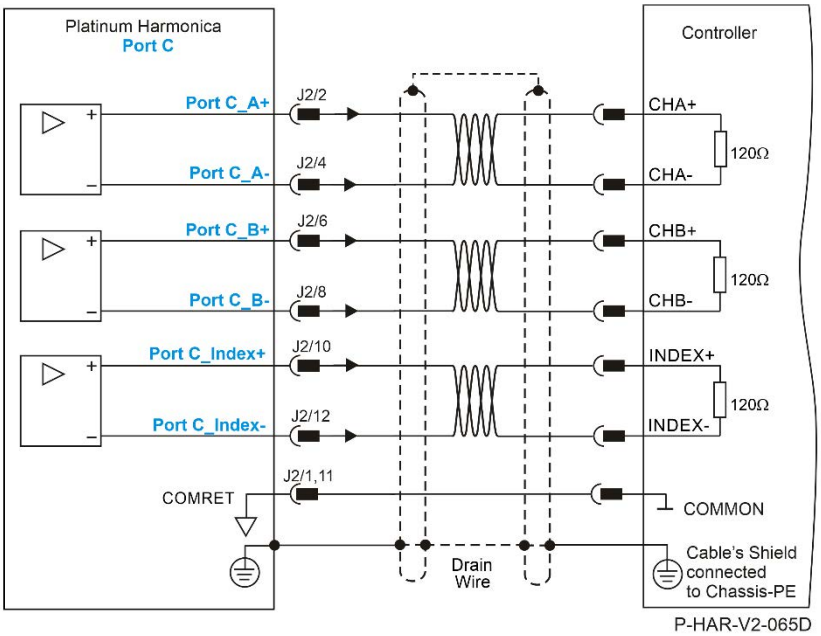


Figure 42: Emulated Encoder Differential Output – Recommended Connection Diagram

8.8.4 Feedback - Hall Sensors

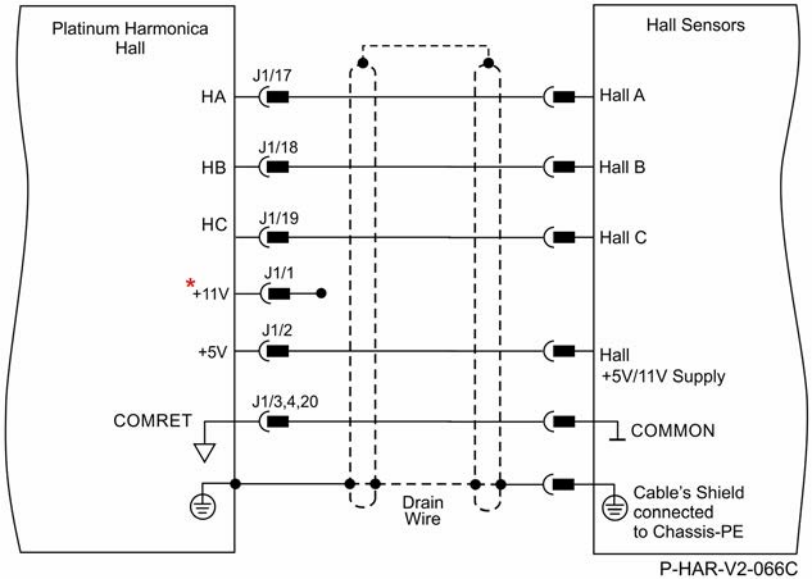


Figure 43**: Hall Sensors Connection Diagram**

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

8.9 Safe Digital I/Os

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

8.9.1 Digital Input with Test Pulse

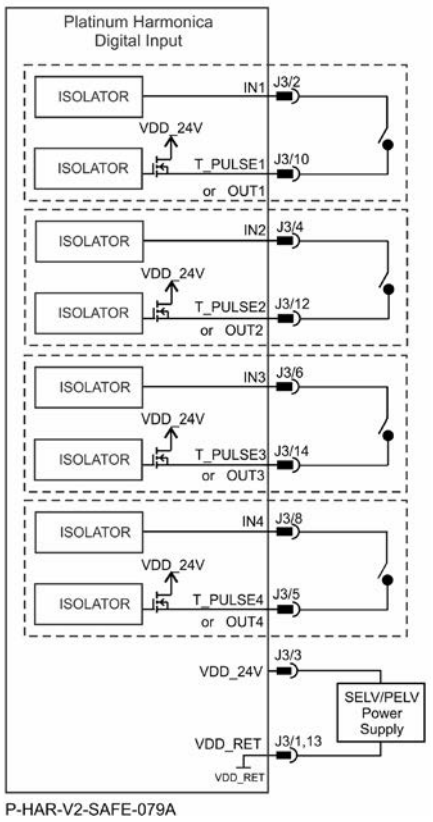


Figure 44: Digital input with Test Pulse

8.9.2 OSSD Digital Input

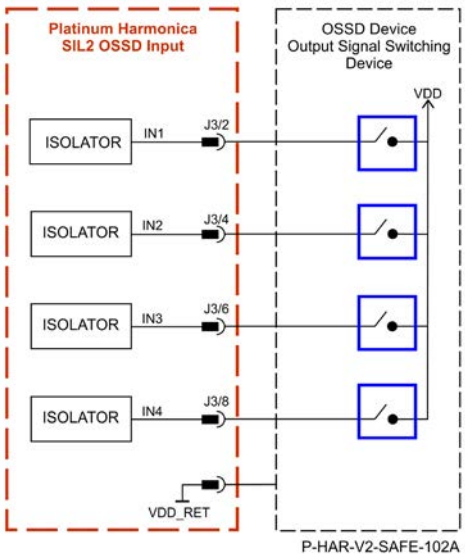


Figure 45: OSSD Digital input

8.9.3 Digital Output

The Platinum servo drive provides three configurations of the VDD connection as shown in the Catalog Number **K**, **L**, and **N**. Refer to section 5.4.7 Digital Output.

8.9.3.1 Option K Configuration VDD_30

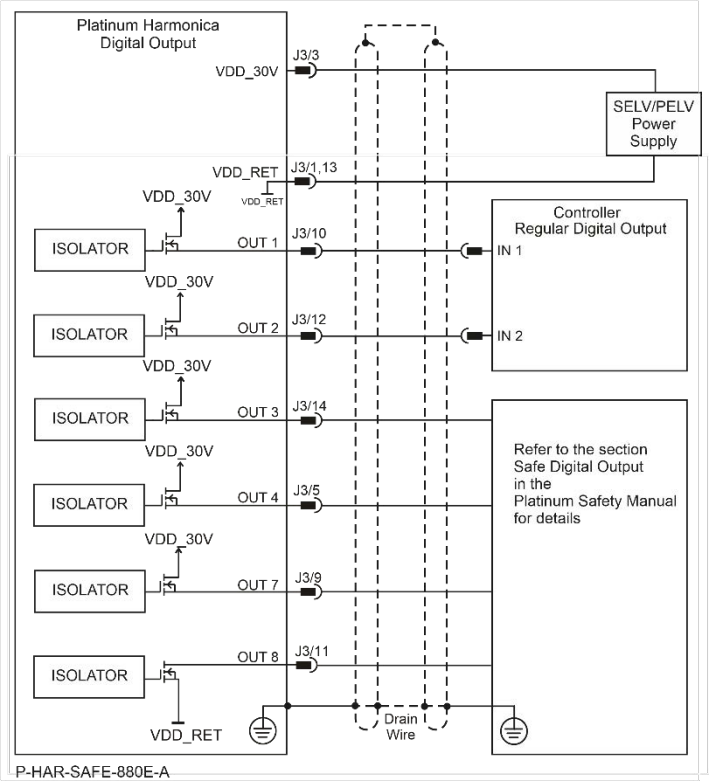


Figure 46: Digital Outputs for Option K Configuration

8.9.3.2 Option L Configuration VDD_30 & VDD_53

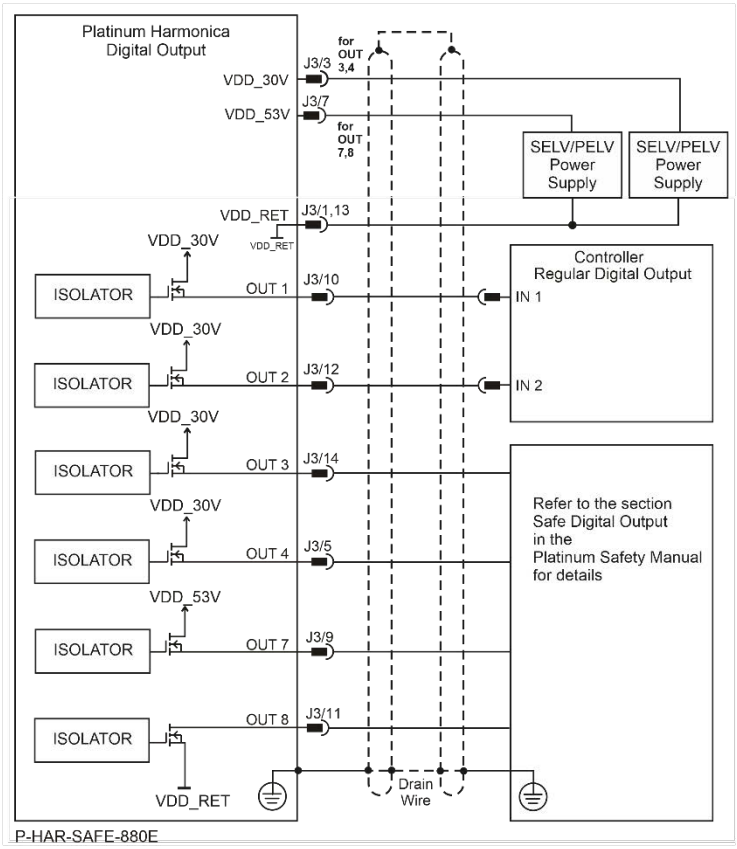


Figure 47: Digital Outputs for Option L Configuration

8.9.3.3 Option N Configuration VDD_53

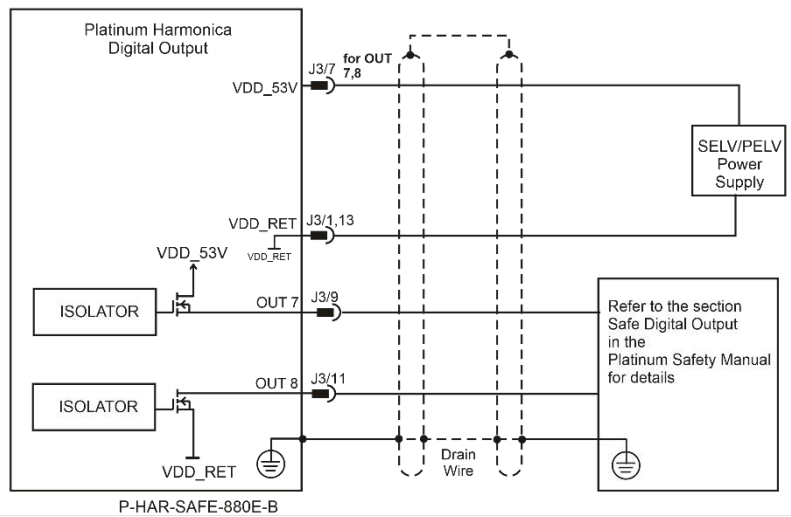


Figure 48: Safe Digital Outputs for Option N Configuration

8.10 Regular Digital I/Os

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

8.10.1 Digital IO 5V Logic (IO Type: U)

The following figures describe the connections at the I/O Port for the Digital Input and Output 5V Logic.

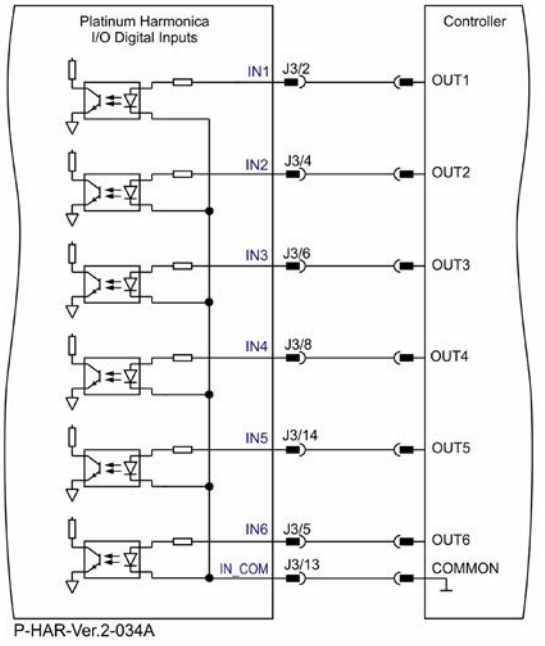


Figure 49: Regular Digital Input 5V Logic Connection Diagram

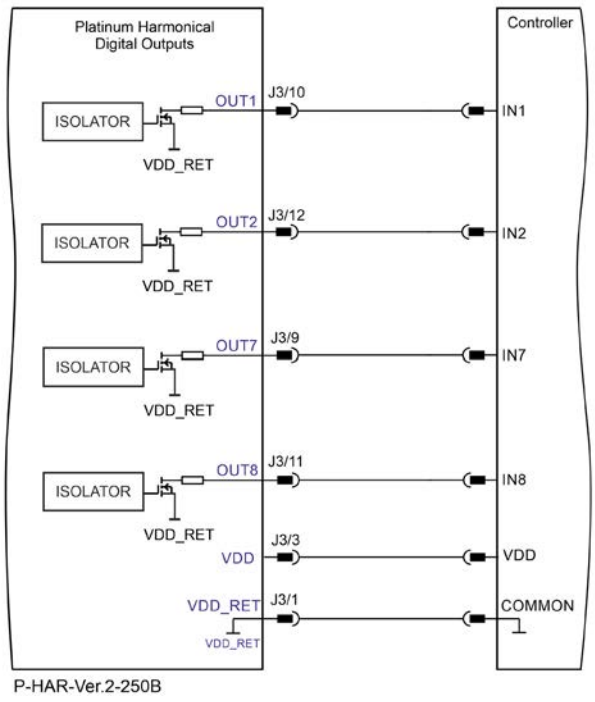


Figure 50: Regular Digital Output Connection Diagram – 5V Logic Option

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

8.10.2.1 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 Mode.

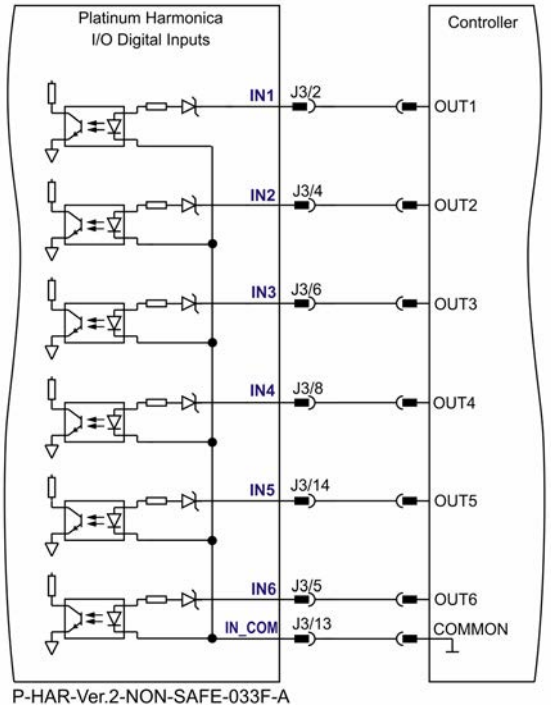


Figure 51: Regular Digital Input Connection Diagram – PLC Source Option

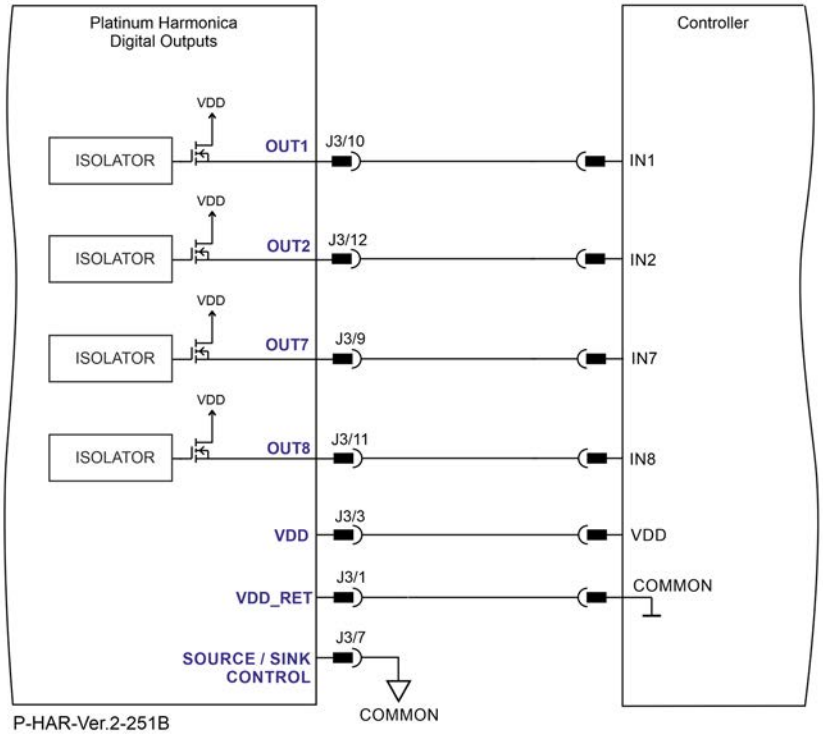


Figure 52: Regular Digital Output Connection Diagram – PLC Source Option

8.10.2.2 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.

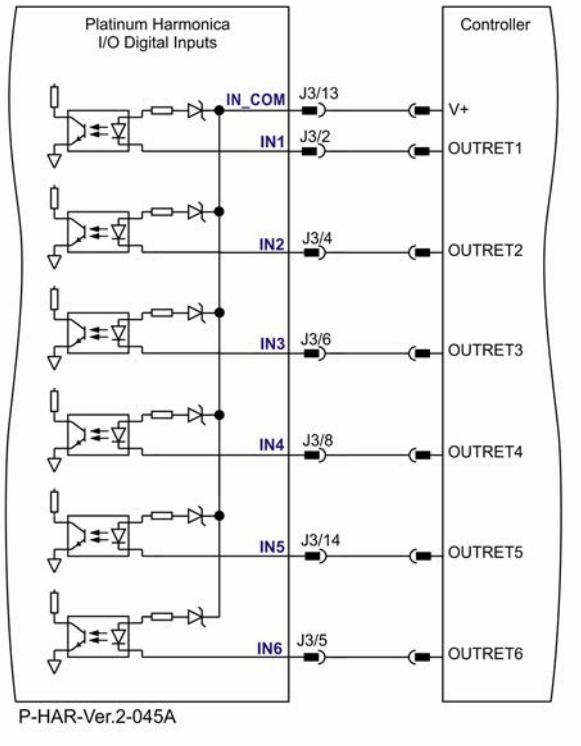


Figure 53: Regular Digital Input Connection Diagram – PLC Sink Option

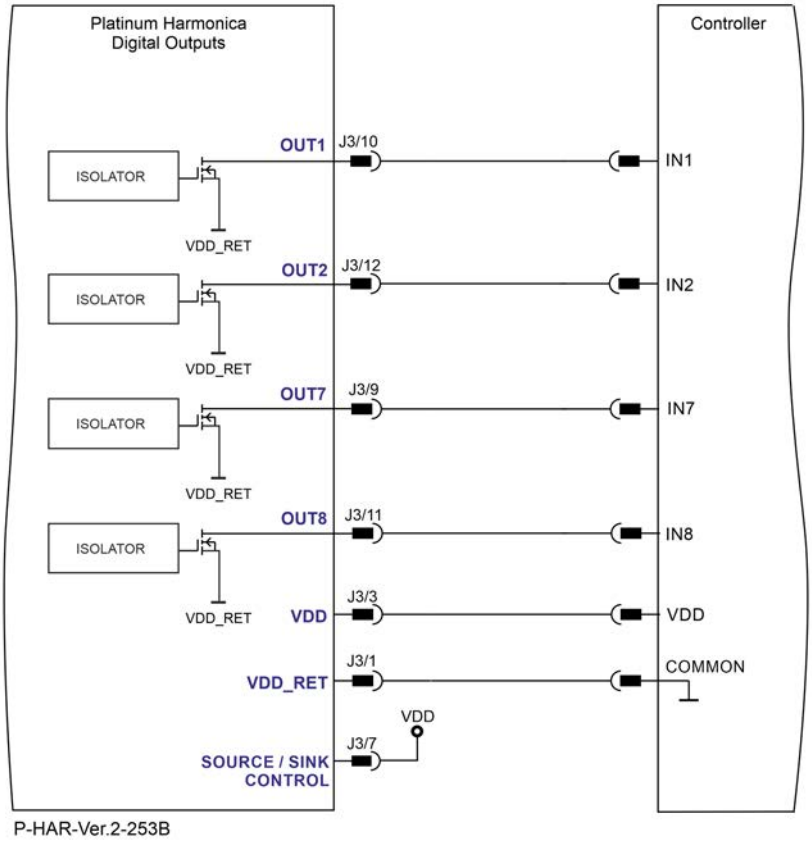


Figure 54: Regular Digital Output Connection Diagram – PLC Sink Option

8.11 Analog Input (J2)

There is one possible type of Analog Input in the Platinum Harmonica:

- Analog Input 1 – Differential ±10 V

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

8.11.1 Analog Input1 –Differential (J2)

The following circuit describes the internal interface of the Analog input.

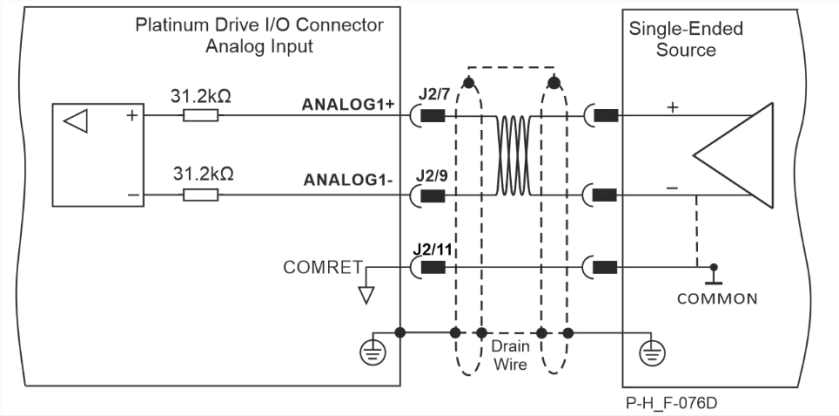


Figure 55: Differential Analog Input

8.12 Communication (X1, X2, X3, and X4)

8.12.1 USB 2.0 (X3)

Use a standard USB 2.0 Type C cable and connector to connect the USB. Refer to section 15.1 in the Platinum Safety Drive Manual.

8.12.2 RS-232 Serial Communication (X4)

The X4 connector is optionally for RS-232 communication.

The following describes the RS-232 specification.

Specification	Details
Physical layer	Signals: RS232_Rx, RS232_Tx, ISO_GND Full duplex, serial communication
Interface	RS-232
Speed	Baud Rate of 4,800 bit/sec to 3.9M bit/sec
Protocols	For setup in the Elmo Application Studio (EAS) software and control

The following are RS-232 signals:

Signal	Function
RS-232_RX	RS-232 Receive
RS-232_TX	RS-232 Transmit
ISO_GND	Isolated Ground

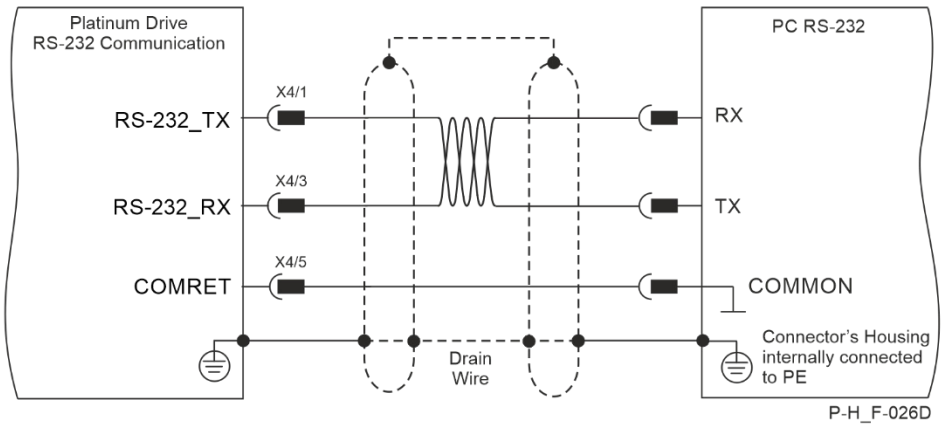


Figure 56: RS-232 Connection Diagram

8.12.3 EtherCAT (X1 and X2)

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

8.12.3.1 EtherCAT Connection

The following drawing describes the EtherCAT communication, and the pinout drawing of the connector.

The Platinum Harmonica can serve as an EtherCAT slave device. For this purpose, it has two Ports X1 and X2, which are designated as EtherCAT In and EtherCAT Out.

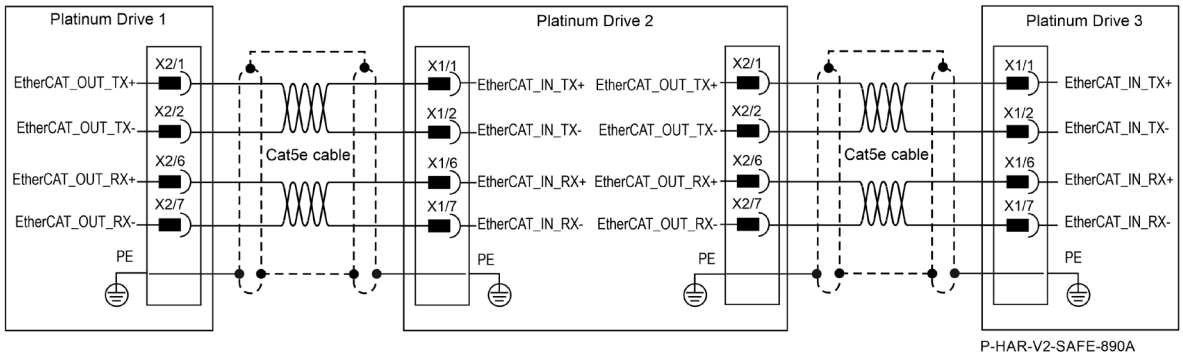


Figure 57: EtherCAT Connection Schematic Diagram

8.12.3.2 EtherCAT Status Indicator

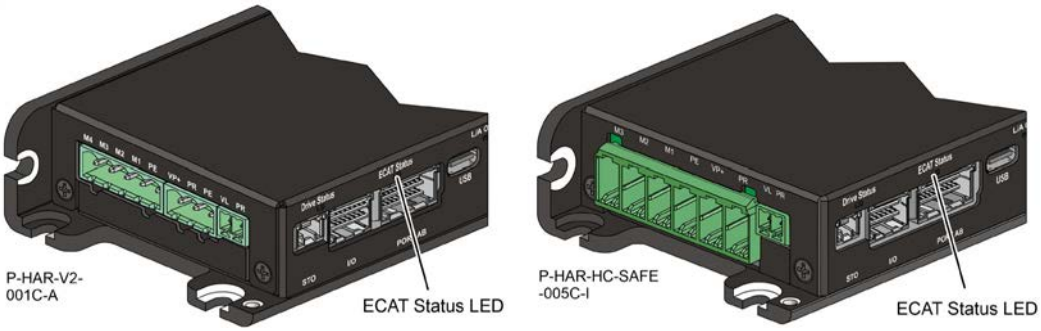


Figure 58: EtherCAT Status LED

The EtherCAT Ports have a status LED. The EtherCAT status indicator 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.

8.12.3.3 EtherCAT Link Indicators

Each Port has LED; EtherCAT In and EtherCAT Out, which are shown in Figure 59.

Figure 59: Ethernet Connector LEDs

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

8.12.3.4 EtherCAT Address Switches

The Platinum Harmonica has two rotary switches that allow the user to define a unique node ID to the slave. EtherCAT address switches set the ECAT address (LOW (x1) is ADD low, HIGH (x10) is ADD high). The two rotary switches offer up to 255 addresses, with the 0-setting referring to No alias address.

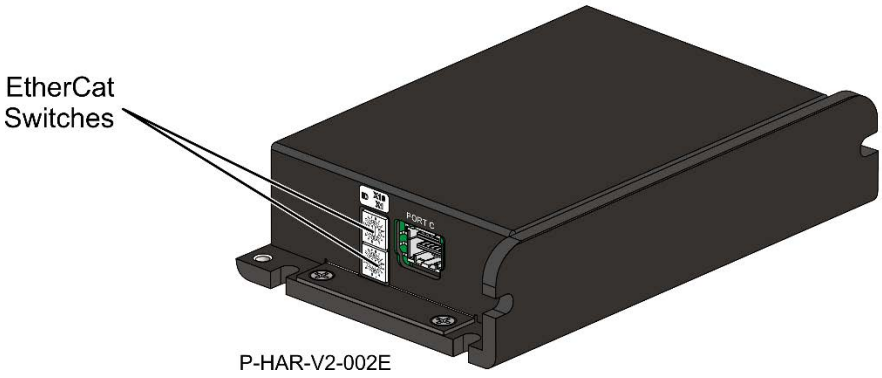


Figure 60: EtherCAT Address Switches

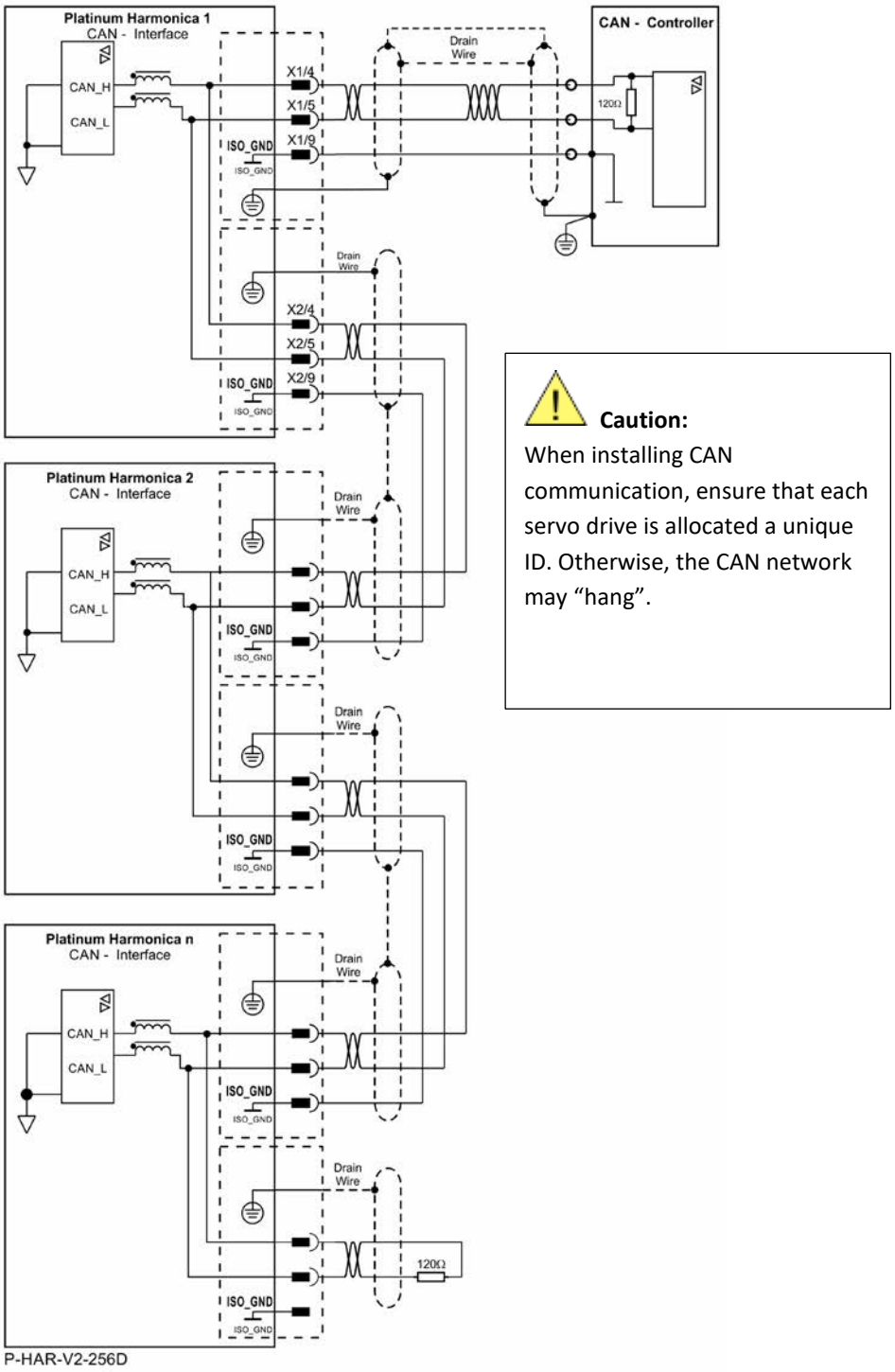
Figure 60 displays the switches available in the EtherCAT Version. Refer to section 17.2.5 EtherCAT Switches in the Platinum Safety Drive Manual for full details.

The positions of the switches on the drive are shown in Figure 60. Use a screwdriver to set the low and high bytes values of the drive EtherCAT address. This address is only retrieved after power-up.

8.12.4 CANopen (X1 and X2)

Note: It should be noted that all signals are isolated and the Grounding denoted ISO_GND throughout CAN connections.

CAN Wiring:



Caution:
When installing CAN communication, ensure that each servo drive is allocated a unique ID. Otherwise, the CAN network may "hang".

Figure 61: CAN Network Diagram – Drop Off Topology

Chapter 9: Powering Up

After the Platinum Harmonica 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 Harmonica 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 Harmonica is to bottom-side wall-mount it (see Figure 2:Bottom-side wall-mounting Platinum Harmonica). For best results leave approximately 10 mm of space between the Platinum Harmonica's heat sink and any other assembly.

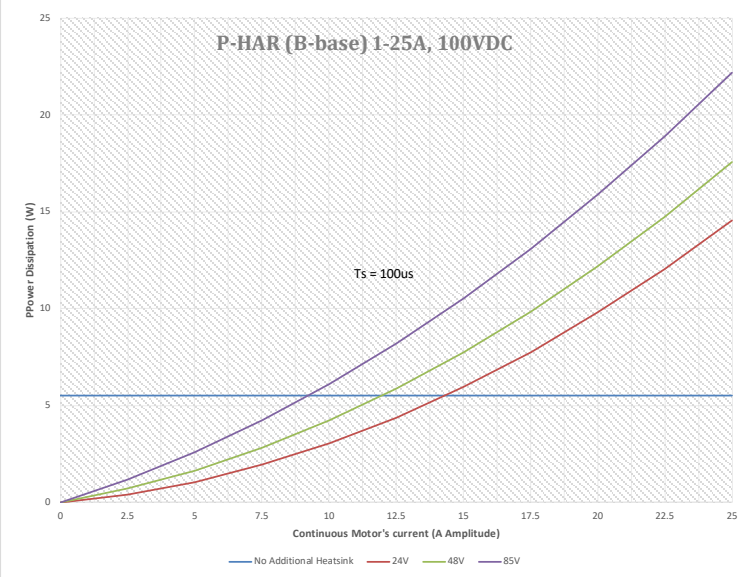
9.2.1 Thermal Data

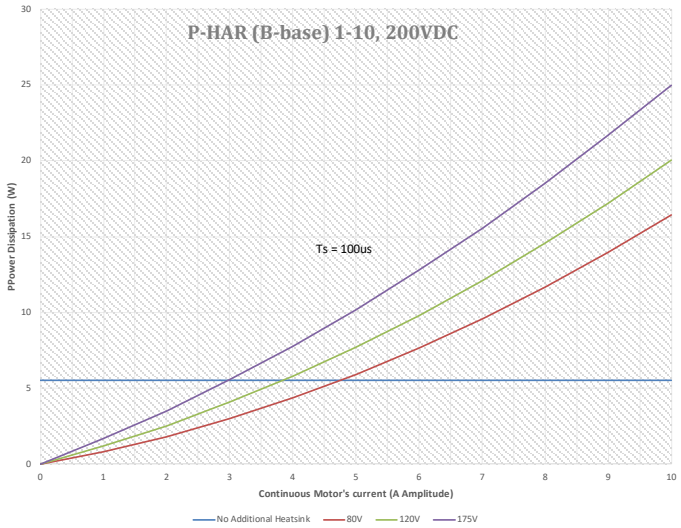
- Heat dissipation capability (θ): Approximately 4 °C/W
- Shut-off temperature: 86 °C to 88 °C (measured on the heat sink)

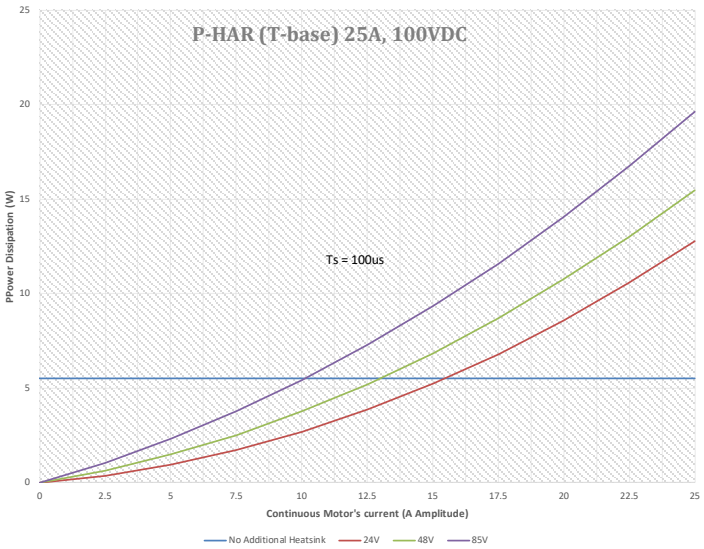
Note: The heat dissipation capability is non-linear at low currents.

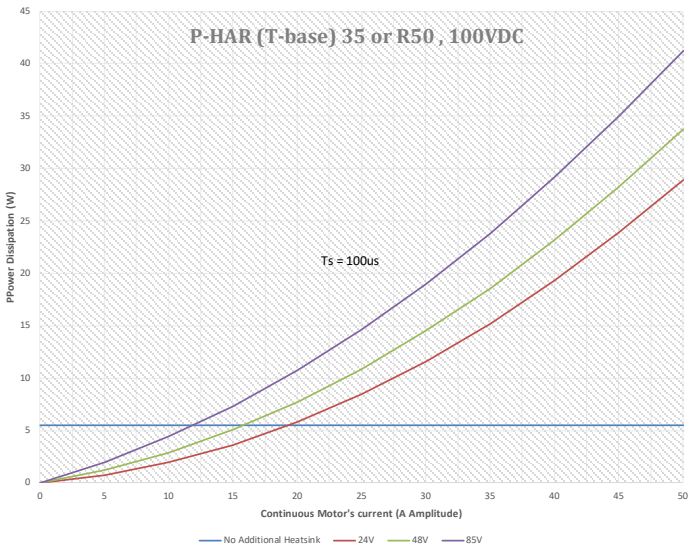
9.2.2 Heat Dissipation Data

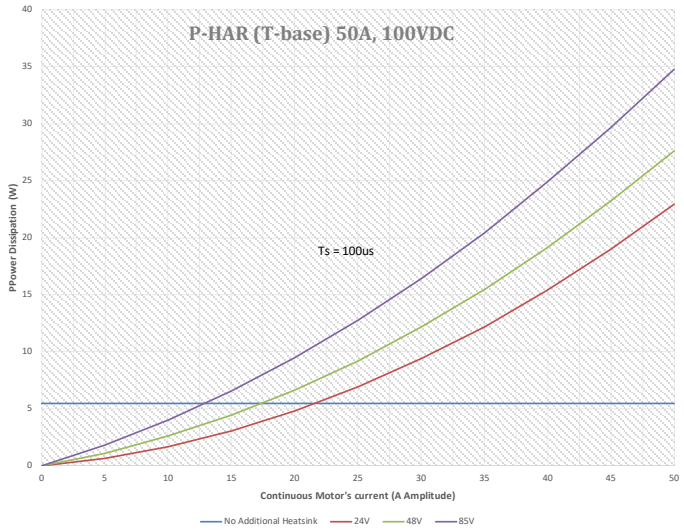
Heat dissipation is shown graphically below:

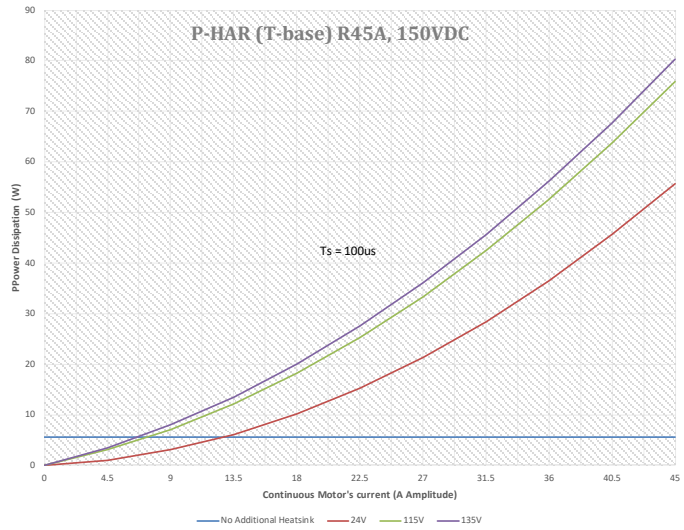


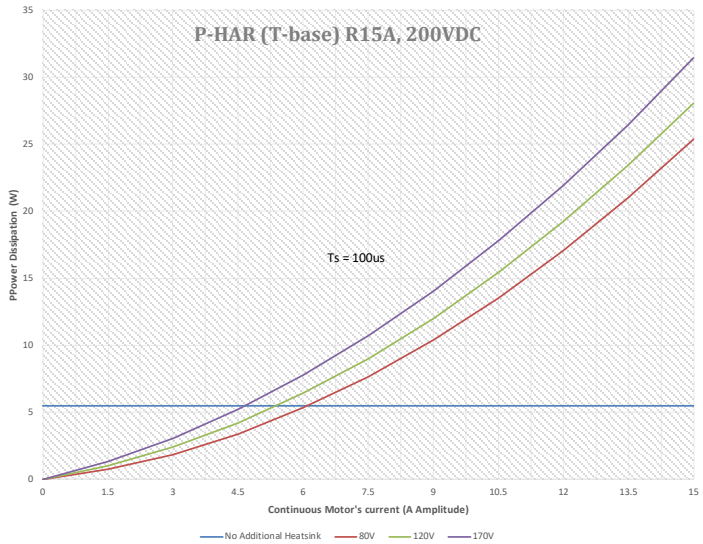

P-HAR (B-base) 1-10, 200VDC
PPower Dissipation (W)
Ts = 100us
Continuous Motor's current (A Amplitude)
No Additional Heatsink
80V
120V
175V

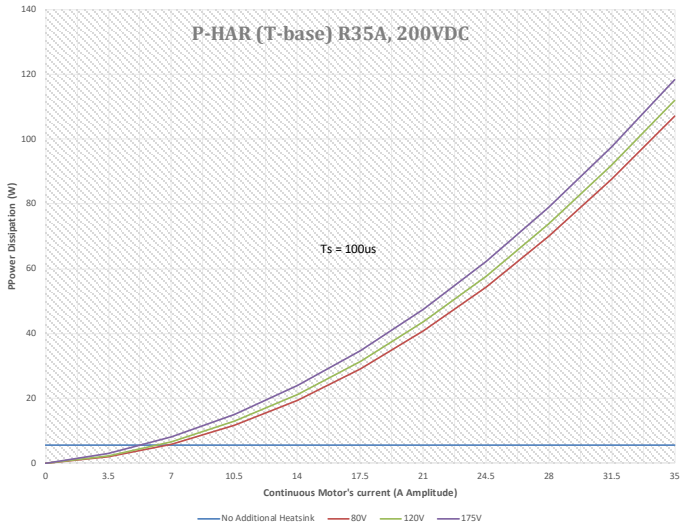

P-HAR (T-base) 25A, 100VDC
PPower Dissipation (W)
Ts = 100us
Continuous Motor's current (A Amplitude)
No Additional Heatsink
24V
48V
85V


P-HAR (T-base) 35 or R50 , 100VDC
PPower Dissipation (W)
Ts = 100us
Continuous Motor's current (A Amplitude)
No Additional Heatsink
24V
48V
85V


P-HAR (T-base) 50A, 100VDC
PPower Dissipation (W)
Ts = 100us
Continuous Motor's current (A Amplitude)
No Additional Heatsink
24V
48V
85V


P-HAR (T-base) R45A, 150VDC
PPower Dissipation (W)
Ts = 100us
Continuous Motor's current (A Amplitude)
No Additional Heatsink
24V
115V
135V


P-HAR (T-base) R15A, 200VDC
PPower Dissipation (W)
Ts = 100us
Continuous Motor's current (A Amplitude)
No Additional Heatsink
80V
120V
170V



9.2.3 How to Use the Charts

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

To determine if your application heat dissipation requires an additional heat sink:

1. Determine the power dissipation according to the motor type support, "continuous current", and the DC bus voltage curve.
2. If the DC bus is not one of the curves above, estimate the dissipation by interpolation. The estimation error is not critical.
3. 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.
4. When the Heat-Sink temperature reaches ≈ 85 °C, the Platinum Harmonica 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.
5. For model **PHAR-zz-zXXX/YYYzzzQ**
   If the average heat dissipation is less than ≈5.5W, there will be no requirement for an additional external heat sink.
   If the average Heat dissipation is higher than 5.5W, then an additional heat dissipation means is required, usually by connecting to an additional external heat-sink.
6. When an external Heat-Sink is required, calculate the thermal resistance of the heat sink according to:

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

Chapter 10: Dimensions

This chapter provides the Platinum Harmonica device dimensions.

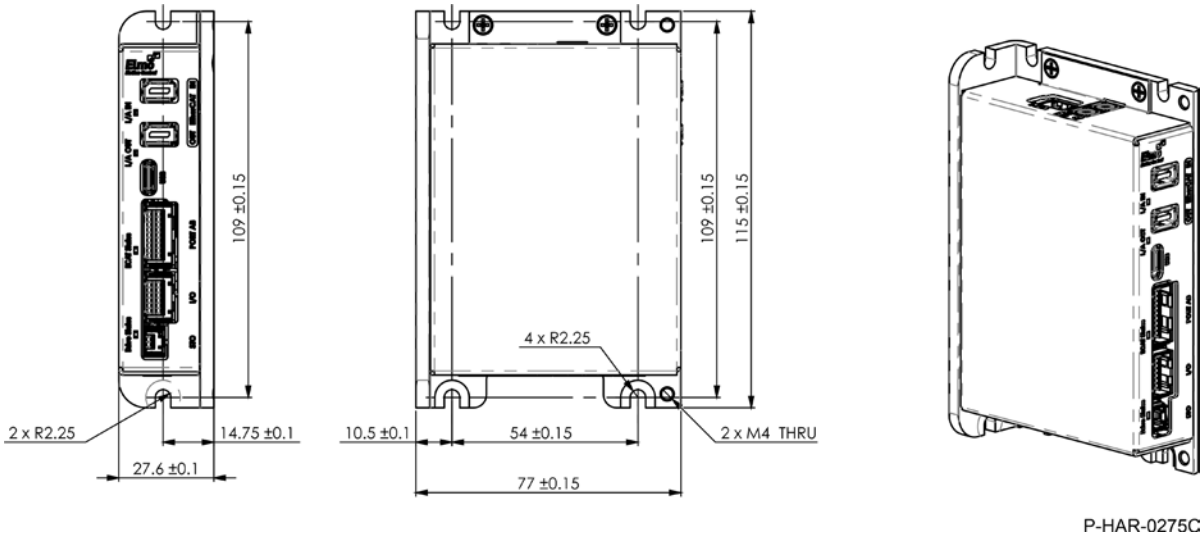


Figure 62: Platinum Harmonica – Dimensions

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