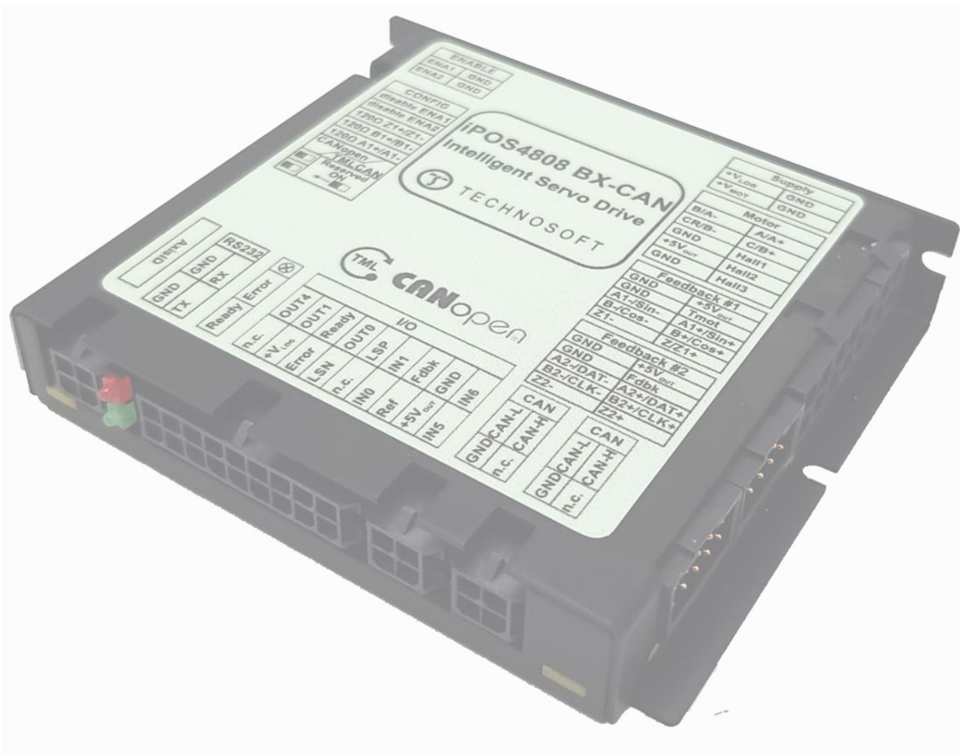
iPOS4808 BX-CAN / BX-CAN-STO

Intelligent Servo Drive for Step, DC, Brushless DC and AC Motors

T E C H N O S O F T

Intelligent Servo Drives



Technical Reference

P091.027.iPOS4808.BX.CAN.CAN-STO.UM.0523

Read This First

About This Manual

This book is a technical reference manual for:

Product Name	Part Number	Description
iPOS4808 BX-CAN-STO	P027.314.E201	Standard version that can support a differential encoder on Feedback #1, CAN, STO input
	P027.314.E701	Can support linear halls on Feedback #1, CAN, STO input
iPOS4808 BX-CAN	P027.214.E201	Standard version that can support a differential encoder on Feedback #1, CAN

In order to operate the **iPOS4808** drives, you need to pass through 3 steps:

- ❑ **Step 1 Hardware installation**
- ❑ **Step 2 Drive setup** using Technosoft **EasySetUp** software for drive commissioning
- ❑ **Step 3 Motion programming** using one of the options:
  - ❑ A **CANopen master**[1]
  - ❑ The drive's **built-in motion controller** executing a Technosoft Motion Language (**TML**) program developed using Technosoft **EasyMotion Studio** software
  - ❑ A **TML_LIB motion library for PCs** (Windows or Linux)
  - ❑ A **TML_LIB motion library for PLCs**
  - ❑ A **distributed control** approach which combines the above options, like for example a host calling motion functions programmed on the drives in TML

This manual covers **Step 1** in detail. It describes the **iPOS4808** hardware including the technical data, the connectors and the wiring diagrams needed for installation.

For Step 2 and 3, please consult the document ***iPOS Dual Loop drives Software reference***

(091.027.DL.Software.xxxx). It also includes the scaling factors between the real SI units and the drive internal units. For detailed information regarding the next steps, refer to the related documentation.

Notational Conventions

This document uses the following conventions:

- **iPOS4808 / iPOS4808 BX** – all products described in this manual
- **IU units** – Internal units of the drive
- **SI units** – International standard units (meter for length, seconds for time, etc.)
- **STO** – Safe Torque Off
- **TML** – Technosoft Motion Language

[1] when iPOS4808 is set in CANopen mode

Related Documentation

iPOS4808 BX-CAN-STO Datasheet (P027.314.E201.DSH)

– describes the hardware connections of the iPOS4808 BX-CAN-STO intelligent servo drive including the technical data and connectors.

iPOS family Safe Torque Off (STO) Operating instructions (091.099.STO.Operating.Instructions.xxxx)

– describes the principles of STO function, the applied standards, the safety-related data and the electrical data. It presents the requested information for installation and commissioning of STO function

iPOS Dual Loop drives Software reference (091.027.DL.Software.xxxx)

– describes the compatible software installation, drive software setup commissioning, introduction to TML motion programming, includes the scaling factors between the real SI units and the drive internal units.

Help of the EasySetUp software – describes how to use **EasySetUp** to quickly setup any Technosoft drive for your application using only 2 dialogues. The output of EasySetUp is a set of setup data that can be downloaded into the drive EEPROM or saved on a PC file. At power-on, the drive is initialized with the setup data read from its EEPROM. With EasySetUp it is also possible to retrieve the complete setup information from a drive previously programmed. **EasySetUp can be downloaded free of charge from Technosoft web page**

iPOS CANopen Programming **(part no. P091.063.iPOS.UM.xxxx)** – explains how to program the iPOS family of intelligent drives using **CANopen** protocol and describes the associated object dictionary for **CiA 301 v.4.2** application layer and communication profile, **CiA WD 305 v.2.2.13** layer settings services and protocols and **CiA DSP 402 v3.0** device profile for drives and motion control now included in IEC 61800-7-1 Annex A, IEC 61800-7-201 and IEC 61800-7-301 standards

Motion Programming using EasyMotion Studio (part no. P091.034.ESM.UM.xxxx) – describes how to use the EasyMotion Studio to create motion programs using in Technosoft Motion Language (TML). EasyMotion Studio platform includes **EasySetUp** for the drive/motor setup, and a **Motion Wizard** for the motion programming. The Motion Wizard provides a simple, graphical way of creating motion programs and automatically generates all the TML instructions. *With EasyMotion Studio you can fully benefit from a key advantage of Technosoft drives – their capability to execute complex motions without requiring an external motion controller, thanks to their built-in motion controller.* **A demo version of EasyMotion Studio (with EasySetUp part fully functional) can be downloaded free of charge from the Technosoft web page**

If you Need Assistance …

If you want to …	Contact Technosoft at …
Visit Technosoft online	World Wide Web: http://www.technosoftmotion.com/
Receive general information or assistance (see Note)	World Wide Web: http://www.technosoftmotion.com/ Email: sales@technosoftmotion.com
Ask questions about product operation or report suspected problems (see Note)	Tel: +41 (0)32 732 5500 Email: support@technosoftmotion.com
Make suggestions about, or report errors in documentation.	Mail: Technosoft SA Avenue des Alpes 20 CH-2000 Neuchatel, NE Switzerland

1 Safety information

Read carefully the information presented in this chapter before carrying out the drive installation and setup! It is imperative to implement the safety instructions listed hereunder.

This information is intended to protect you, the drive and the accompanying equipment during the product operation. Incorrect handling of the drive can lead to personal injury or material damage.

The following safety symbols are used in this manual:

WARNING!	***SIGNALS A DANGER TO THE OPERATOR WHICH MIGHT CAUSE BODILY INJURY. MAY INCLUDE INSTRUCTIONS TO PREVENT THIS SITUATION***

CAUTION!	***SIGNALS A DANGER FOR THE DRIVE WHICH MIGHT DAMAGE THE PRODUCT OR OTHER EQUIPMENT. MAY INCLUDE INSTRUCTIONS TO AVOID THIS SITUATION***

1.1 Warnings

WARNING!	***THE VOLTAGE USED IN THE DRIVE MIGHT CAUSE ELECTRICAL SHOCKS. DO NOT TOUCH LIVE PARTS WHILE THE POWER SUPPLIES ARE ON***

WARNING!	***TO AVOID ELECTRIC ARCING AND HAZARDS, NEVER CONNECT / DISCONNECT WIRES FROM THE DRIVE WHILE THE POWER SUPPLIES ARE ON***

WARNING!	***THE DRIVE MAY HAVE HOT SURFACES DURING OPERATION.***

WARNING!	***DURING DRIVE OPERATION, THE CONTROLLED MOTOR WILL MOVE. KEEP AWAY FROM ALL MOVING PARTS TO AVOID INJURY***

1.2 Cautions

CAUTION!	***THE POWER SUPPLIES CONNECTED TO THE DRIVE MUST COMPLY WITH THE PARAMETERS SPECIFIED IN THIS DOCUMENT***

CAUTION!	***TROUBLESHOOTING AND SERVICING ARE PERMITTED ONLY FOR PERSONNEL AUTHORISED BY TECHNOSOFT***

To prevent electrostatic damage, avoid contact with insulating materials, such as synthetic fabrics or plastic surfaces. In order to discharge static electricity build-up, place the drive on a grounded conductive surface and also ground yourself.

1.3 Quality system, conformance and certifications

qualityaustria Succeed with Quality IQNet	**IQNet** and **Quality Austria** certification about the implementation and maintenance of the Quality Management System which fulfills the requirements of Standard **ISO 9001:2015**.
	Quality Austria Certificate about the application and further development of an effective **Quality Management System** complying with the requirements of Standard **ISO 9001:2015**
REACH	**REACH Compliance -** TECHNOSOFT hereby confirms that this product comply with the legal obligations regarding Article 33 of the European REACH Regulation 1907/2006 (Registration, Evaluation, Authorization and Restriction of Chemicals), which came into force on 01.06.2007.
ROHS	**RoHS Compliance -** Technosoft SA here with declares that this product is manufactured in compliance with the RoHS directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
CE	Technosoft SA hereby declares that this product conforms to the following European applicable directives: **2014/30/EU** **Electromagnetic Compatibility (EMC) Directive** **2014/35/EU** **Low Voltage Directive (LVD)** **93/68/EEC** **CE Marking Directive**
CONFLICT MINERALS	**Conflict minerals statement -** Technosoft declares that the company does not purchase 3T&G (tin, tantalum, tungsten & gold) directly from mines or smelters... We have no indication that Technosoft products contain minerals from conflict mines or smelters in and around the DRC.
TÜV SÜD	**STO compliance** – TUV SUD certifies that this product is SIL 3 / Cat 3 / PL e compatible and is in conformity with the following safety – related directives: **EN ISO 13849-1:2015 Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design** **EN 61800-5-1:2007 Adjustable speed electrical power drive systems — Safety requirements — Electrical, thermal and energy** **EN 61800-5-2:2007 Adjustable speed electrical power drive systems - Safety requirements –Functional** **EN 61508:2010 Functional safety of electrical/electronic/programmable electronic safety-related systems** **EN ISO 13849-1:2008 Safety of machinery - Safety-related parts of control systems** **EN 61326-3-1:2008 - General industrial applications - EMC - Immunity requirements for functional safety**

For other certifications visit: https://technosoftmotion.com/en/quality/

2 Product Overview

2.1 Introduction

The **iPOS4808** is a family of fully digital intelligent servo drives, based on the latest DSP technology and they offer unprecedented drive performance combined with an embedded motion controller.

Suitable for control of brushless DC, brushless AC (vector control), DC brushed motors and step motors, the iPOS4808 drives accept as position feedback incremental encoders (quadrature or sine/cosine), absolute encoders (SSI, BiSS-C and EnDAT2.2[1]) and linear Hall signals[2].

All drives perform position, speed or torque control and work in single, multi-axis or stand-alone configurations. Thanks to the embedded motion controller, the iPOS4808 drives combine controller, drive and PLC functionality in a single compact unit and are capable to execute complex motions without requiring intervention of an external motion controller. Using the high-level Technosoft Motion Language (**TML**) the following operations can be executed directly at drive level:

- Setting various motion modes (profiles, PVT, PT, electronic gearing[1] or camming[3], etc.)
- Changing the motion modes and/or the motion parameters
- Executing homing sequences
- Controlling the program flow through:
  - Conditional jumps and calls of TML functions
  - TML interrupts generated on pre-defined or programmable conditions (protections triggered, transitions on limit switch or capture inputs, etc.)
  - Waits for programmed events to occur
- Handling of digital I/O and analogue input signals
- Executing arithmetic and logic operations
- Performing data transfers between axes
- Controlling motion of an axis from another one via motion commands sent between axes[4]
- Sending commands to a group of axes (multicast). This includes the possibility to start simultaneously motion sequences on all the axes from the group[2]

By implementing motion sequences directly at drive level you can really distribute the intelligence between the master and the drives in complex multi-axis applications, reducing both the development time and the overall communication requirements. For example, instead of trying to command each movement of an axis, you can program the drives using TML to execute complex motion tasks and inform the master when these tasks are done. Thus, for each axis control the master job may be reduced at: calling TML functions stored in the drive EEPROM and waiting for a message, which confirms the TML functions execution completion.

All iPOS4808 BX drives are equipped with a serial RS232 and a CAN 2.0B interface that can be set by hardware pins to operate in 2 communication protocol modes:

- **CANopen**
- **TMLCAN**

When **CANopen** mode is selected, the iPOS4808 conforms to **CiA 301 v4.2** application layer communication profile, the **CiA WD 305 v2.2.13** and **CiA DSP 402 v3.0** device profile for drives and motion control, now included in IEC 61800-7-1 Annex A, IEC 61800-7-201 and IEC 61800-7-301 standards. In this mode, the iPOS4808 may be controlled via a CANopen master. The iPOS drive offers the possibility for a CANopen master to call motion sequences/ functions, written in TML and stored in the drive EEPROM, using manufacturer specific objects. Also, the drives can communicate separately between each other by using non reserved 11 bit identifiers.

When **TMLCAN** mode is selected, the iPOS4808 behaves as standard Technosoft intelligent drive and conforms to Technosoft protocol for exchanging TML commands via CAN-bus. When TMLCAN protocol is used, it is not mandatory to have a master. Any iPOS4808 can be set to operate standalone, and may play

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[1] Availabile starting with F514K firmware version

[2] Available only with P027.314.E701

[3] Available if the master axis sends its position via a communication channel, or by using the secondary encoder input

[4] Available only for CAN drives

the role of a master to coordinate both the network communication/synchronization and the motion application via TML commands sent directly to the other drives.

When higher level coordination is needed, apart from a CANopen master, the iPOS4808 drives can also be controlled via a PC or a PLC using one of the **TML_LIB** motion libraries.

For iPOS4808 commissioning **EasySetUp** or **EasyMotion Studio** PC applications may be used.

EasySetUp is a subset of EasyMotion Studio, including only the drive setup part. The output of EasySetUp is a set of setup data that can be downloaded into the drive EEPROM or saved on a PC file. At power-on, the drive is initialized with the setup data read from its EEPROM. With EasySetUp it is also possible to retrieve the complete setup information from a drive previously programmed. EasySetUp shall be used for drive setup in all cases where the motion commands are sent exclusively from a master. Hence neither the iPOS4808 TML programming capability nor the drive camming mode are used. **EasySetUp can be downloaded free of charge from Technosoft web page.**

EasyMotion Studio platform includes EasySetUp for the drive setup, and a **Motion Wizard** for the motion programming. The Motion Wizard provides a simple, graphical way of creating motion programs and automatically generates all the TML instructions. *With EasyMotion Studio you can execute complex motions, thanks to their built-in motion controller*s. EasyMotion Studio, may be used to program motion sequences in TML. This is the iPOS4808 typical CAN operation mode when TMLCAN protocol is selected. EasyMotion Studio can also be used with the CANopen protocol, if the user wants to call TML functions stored in the drive EEPROM or to use the camming mode. With camming mode, EasyMotion Studio offers the possibility to quickly download and test a cam profile and also to create a **.sw** file with the cam data. The .sw file can be afterwards stored in a master and downloaded to the drive, wherever needed. **A demo version of EasyMotion Studio (with EasySetUp part fully functional) can be downloaded free of charge from Technosoft web page.**

2.2 Product Features

- Fully digital servo drive suitable for the control of rotary or linear brushless, DC brush, and step motors
- Very compact design
- Sinusoidal (FOC) or trapezoidal (Hall-based) control of brushless motors
- Open or closed-loop control of 2 and 3-phase steppers
- [1]STO: 2 safe torque-off inputs, safety integrity level (SIL3/Cat3/PLe) acc. to EN61800-5-1;-2/ EN61508-3;-4/ EN ISO 13849-1. When left not connected will disable the motor outputs. This provides a dual redundant hardware protection that cannot be overdriven by the software or other hardware components.
- [2]Separate ENABLE circuit: connect both ENA1 and ENA2 inputs to +24V, to allow motor PWM output operation
- Various modes of operation, including: cyclic synchronous position; torque, speed or position control; position or speed profiles, external analogue reference or sent via a communication bus
- Technosoft Motion Language (TML) instruction set for the definition and execution of motion sequences
- Standalone operation with stored motion sequences
- Communication:
  - RS-232 serial up to 115kbits/s
  - CAN-Bus up to 1Mbit/s
- Digital and analog I/Os:
  - 6 digital inputs: 12-36 V, programmable polarity: sourcing/NPN or sinking/PNP: 2 Limit switches and 4 general-purpose
  - 5 digital outputs: 5-36 V, with 0.5 A, sinking/NPN open-collector (Ready, Error and 3 general-purpose)
  - 2 analogue inputs: 12 bit, 0-5V: Reference and Feedback or general purpose
  - NTC/PTC analogue Motor Temperature sensor input
- Feedback devices (dual-loop support):

  Feedback #1 devices supported:
  - Incremental encoder interface (single ended or differential[3])
  - Pulse & direction interface (single-ended) for external (master) digital reference
  - Analog sin/cos encoder interface (differential $1V_{PP}$)
  - Digital Hall sensor interface (single-ended and open collector)
  - Linear Hall sensors interface[4]

  Feedback #2 devices supported:
  - Incremental encoder interface (differential)
  - Pulse & direction interface (differential) for external (master) digital reference
  - BiSS / SSI / EnDAT[5] encoder interface
- Various motion programming modes:
  - Position profiles with trapezoidal or S-curve speed shape
  - Position, Velocity, Time (PVT) 3rd order interpolation
  - Position, Time (PT) 1st order interpolation
  - Electronic gearing and camming
  - 35 Homing modes
- 16 h/w selectable addresses selectable by h/w rotary switch
- Two operation modes selectable by DIP switch:
  - **CANopen** – conforming with **CiA 301 v4.2, CiA WD 305 v2.2.13** and **CiA DSP 402 v3.0**
  - **TMLCAN** – intelligent drive conforming with Technosoft protocol for exchanging TML commands via CAN-bus
- 16K × 16 internal SRAM memory for data acquisition
- 16K × 16 E^2ROM to store TML programs and data
- PWM switching frequency up to 100kHz
- Motor supply: 12-50V
- Logic supply: 9-36V.Separate supply is optional

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[1] Availabile only for iPOS4808 BX-CAN-STO executions (p/n: P027.**3**14.Exxx)
[2] Available only for iPOS4808 BX-CAN (p/n: P027.214.E201)
[3] Differential Feedback #1 is not available with the p/n P027.314.E701
[4] Only available with the p/n P027.314.E701
[5] Available starting with F514K firmware version

- Output current: iPOS4808 BX-CAN: 8A[1] continuous; 20A peak
- Operating ambient temperature: 0-40°C (over 40°C with derating)
- Protections:
    - Short-circuit between motor phases
    - Short-circuit from motor phases to ground
    - Over-voltage
    - Under-voltage
    - Over-current
    - Over-temperature
    - Communication error
    - Control error

2.3 Identification Labels

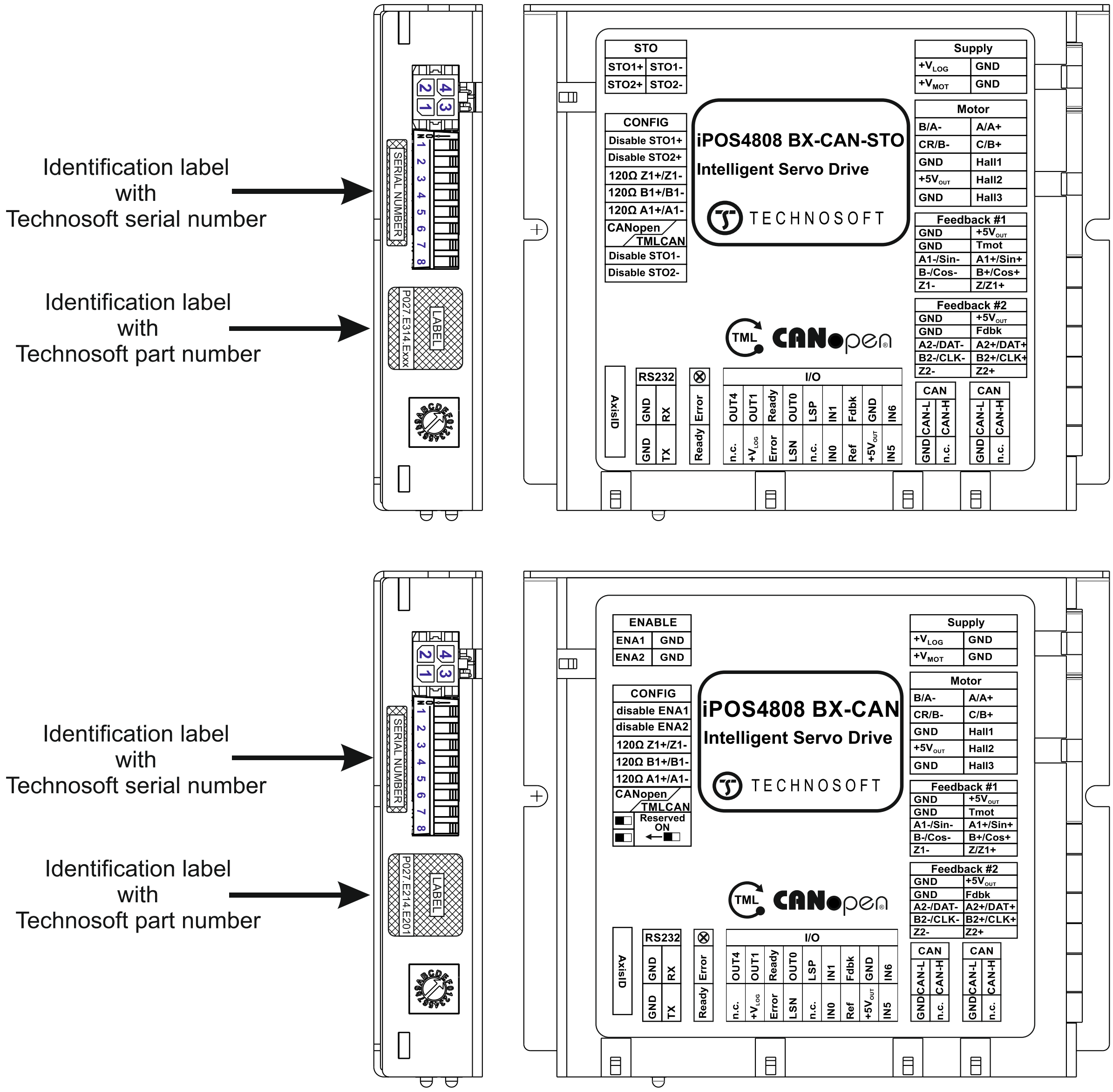


Figure 2.3.1. *iPOS4808 BX-CAN-STO identification labels*

The iPOS4808 BX can have the following part numbers and names on the identification label:

p.n. **P027.314.E201** name iPOS4808 BX-CAN-STO – standard CAN execution with STO

p.n**. P027.314.E701** name iPOS4808 BX-CAN-STO – Linear Hall CAN execution with STO

p.n. **P027.214.E201** name iPOS4808 BX-CAN- – standard CAN execution without STO

[1] 8A cont. with DC, step and BLDC motors (trapezoidal), 8A amplitude (5.66A$_{RMS}$) for PMSM (sinusoidal)

2.4 Supported Motor-Sensor Configurations

2.4.1 Single loop configurations

The position and/or speed are controlled using one feedback sensor. The other available feedback sensor input can be used for External reference Position or Velocity, Pulse and Direction, Electronic Gearing or Camming.

Sensor type (Sensor \ Motor)	Sensor location		Brushless PMSM	Brushless BLDC	DC Brush	Stepper 2 phase	Stepper 3 phase
Incr. encoder	FDBK #1 (single ended or diff.) FDBK #2 (diff.)		Yes	-	Yes	Yes	-
Incr. encoder + Digital Hall	FDBK #1 (single ended or diff[1]) FDBK #2 (diff.)	Digital halls interface	Yes	Yes	-	-	-
Digital halls only	Digital halls interface		Yes	-	-	-	-
Linear halls[2] (analogue)	Linear halls interface		Yes	-	-	-	-
SSI	FDBK #2 (diff.)		Yes	-	Yes	Yes	-
BiSS-C	FDBK #2 (diff.)		Yes	-	Yes	Yes	-
EnDAT[3]	FDBK #2 (diff.)		Yes	-	Yes	Yes	-
Analogue Sin/Cos	FDBK #1 (diff.)		Yes	-	Yes	Yes	-
Tacho	Analogue input: Feedback		-	-	Yes	-	-
Open-loop (no sensor)			-	-	-	Yes	Yes
Open-loop (with step loss detection using Incr. Encoder/ SinCos/ SSI/ BiSS/ EnDAT)	FDBK #1 (single ended or diff.) FDBK #2 (diff.)		-	-	-	Yes	Yes

2.4.2 Dual loop configurations

The motor speed control loop is closed on one feedback connected on the motor while the motor position control loop is closed on the other available feedback which is placed on the load. There is usually a transmission between the load and the motor.

Motor type	Feedback #1	Feedback #2
PMSM	• Incremental encoder (single-ended or differential[1]) • Analogue Sin/Cos encoder • Linear Halls[2] (only on motor)	• Incremental encoder (differential) • SSI/BiSS C/EnDAT[1] encoder
BLDC	• Incremental encoder (single-ended or differential) + Digital halls	• Incremental encoder (differential) + Digital Halls • SSI/BiSS C/EnDAT[1] encoder (only on load)
Stepper 2ph	• Incremental encoder (single-ended or differential) • Analogue Sin/Cos encoder	• Incremental encoder (differential) • SSI/BiSS C/EnDAT[1] encoder
DC Brush	• Incremental encoder (single-ended or differential) • Analogue Sin/Cos encoder • Analogue Tacho (only on motor)	• Incremental encoder (differential) • SSI/BiSS C/EnDAT[1] encoder

Each defined motor type can have any combination of the supported feedbacks either on motor or on load.

Examples: -PMSM motor with Incremental encoder (from feedback #1) on motor and Incremental encoder (from feedback#2) on load; -DC brush motor with SSI encoder (from feedback #2) on motor and Sin/Cos encoder (from feedback #1) on load.

[1] A differential encoder on Feedback #1 is available only with P027.314.E201 and P027.214.E201

[2] Linear hall sensors are compatible only with P027.314.E701

[3] Available starting with firmware version F514K

3 Hardware Installation

3.1 iPOS4808 BX-CAN / -STO Board Dimensions

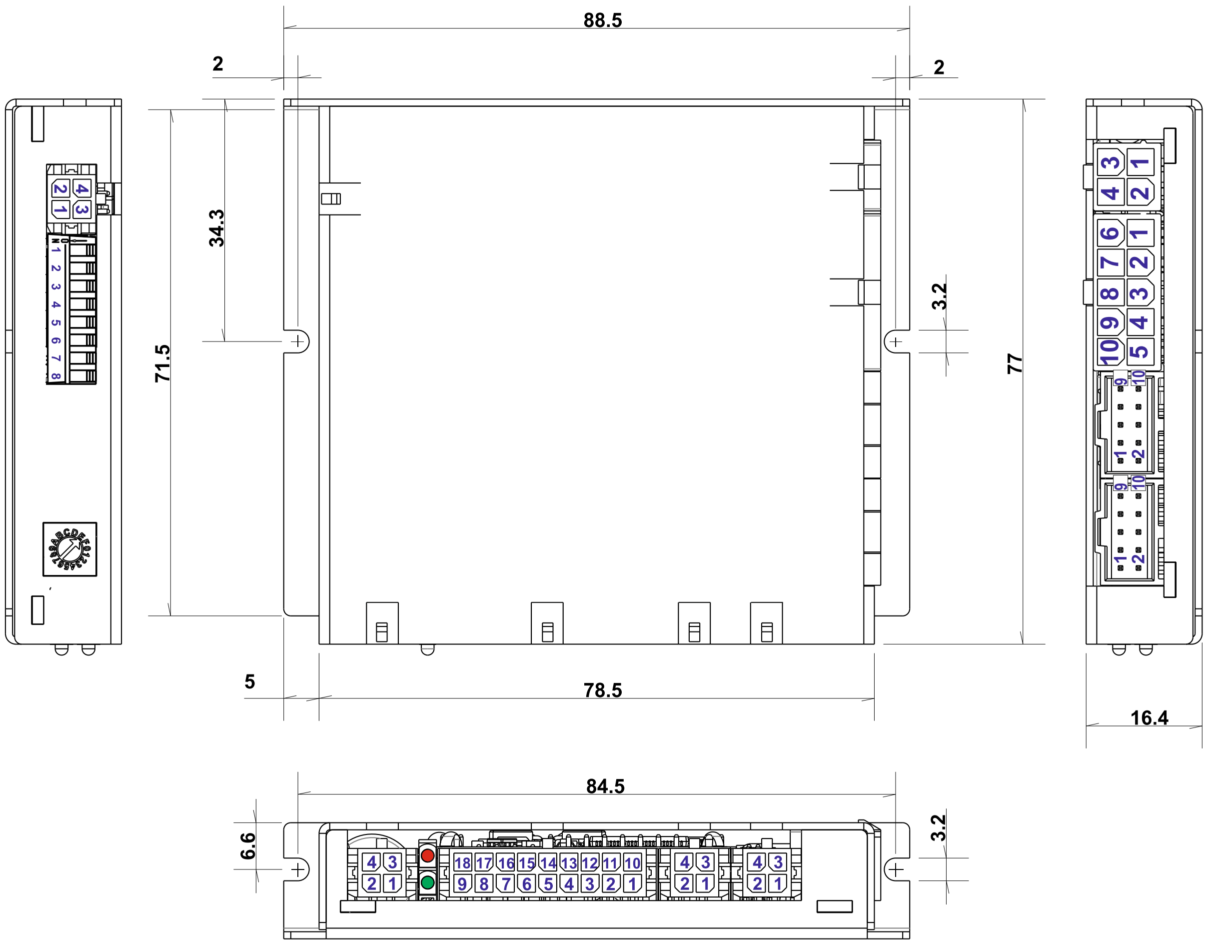


Figure 3.1.1. *iPOS4808 BX-CAN / -STO drive dimensions*

All dimensions are in mm. The drawings are not to scale.

3.2 Mechanical Mounting

The iPOS4808 drive is intended to be mounted vertically or horizontally on a on a metallic support using the provided mounting holes and the recommended mating connectors, as specified in chapter **"Mating connectors"**.

For thermal calculations, each iPOS4808 BX drive can be assumed to generate 1 Watt at idle, and up to 5 Watts (= 17 BTU/hour) worst case while driving a motor and using all digital outputs.

When the iPOS4808 BX is mounted vertically, its overall envelope (size) including the recommended mating connectors is shown in Figure 3.1. Fixing the iPOS4808 BX onto a support using the provided mounting holes is strongly recommended to avoid vibration and shock problems.

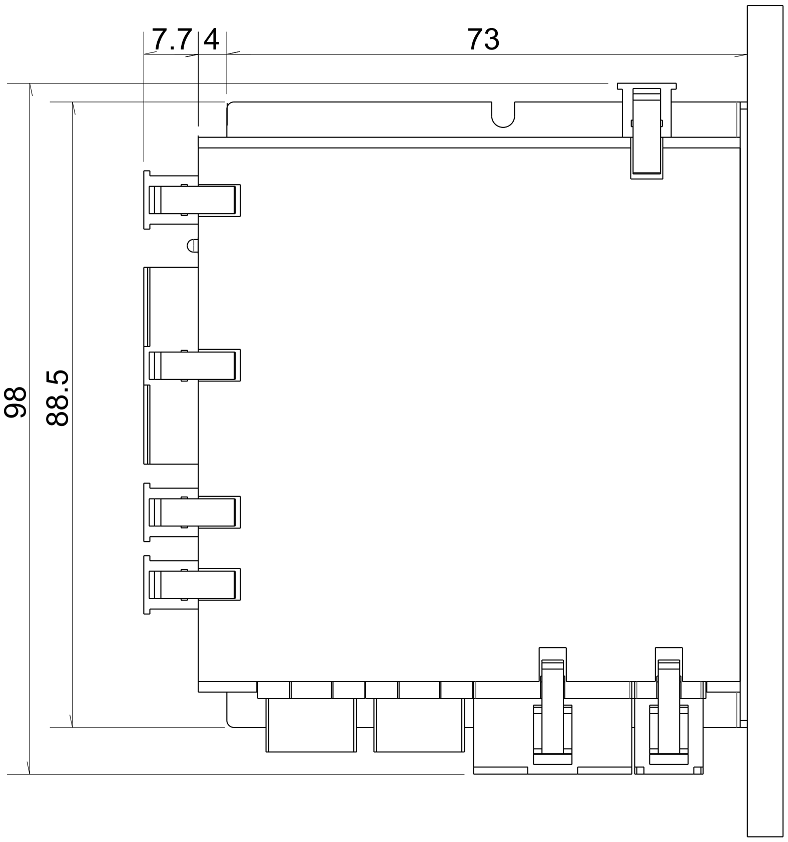


Figure 3.2.1. *iPOS4808 BXO dimensions with mating connectors*

The iPOS4808 BX-CAN drive(s) can be cooled by natural convection. The support shall be thermally conductive (metallic), and can be mounted vertically or horizontally.

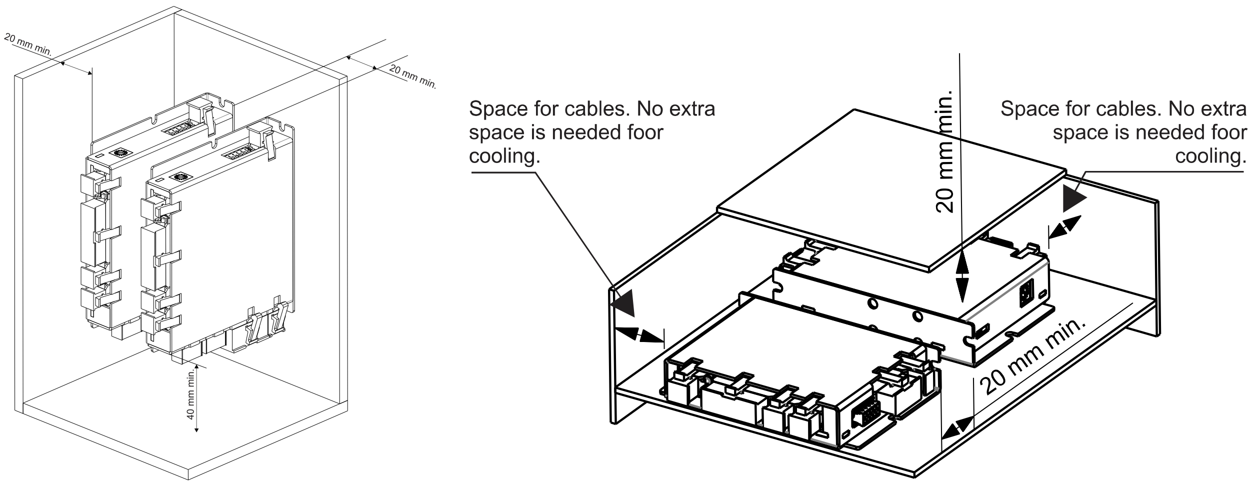


Figure 3.2.2. *Recommended spacing go vertical and horizontal mounting, worst case: non-metallic, closed box*

The figures above shows the minimum spacing to assure proper airflow by natural convection.

If closed completely in a box, ventilation openings shall be foreseen on the top and bottom sides.

If ventilation driven by natural convection is not enough to maintain the temperature surrounding the iPOS4808 BX drive(s), then alternate forced cooling methods must be applied.

Remark: *In case of using a metallic box, with ventilation openings, all spacing values may be reduced substantially. With proper ventilation, keeping the air surrounding the iPOS4808 BX inside the limits indicated, the spacing values may be reduced down to zero*.

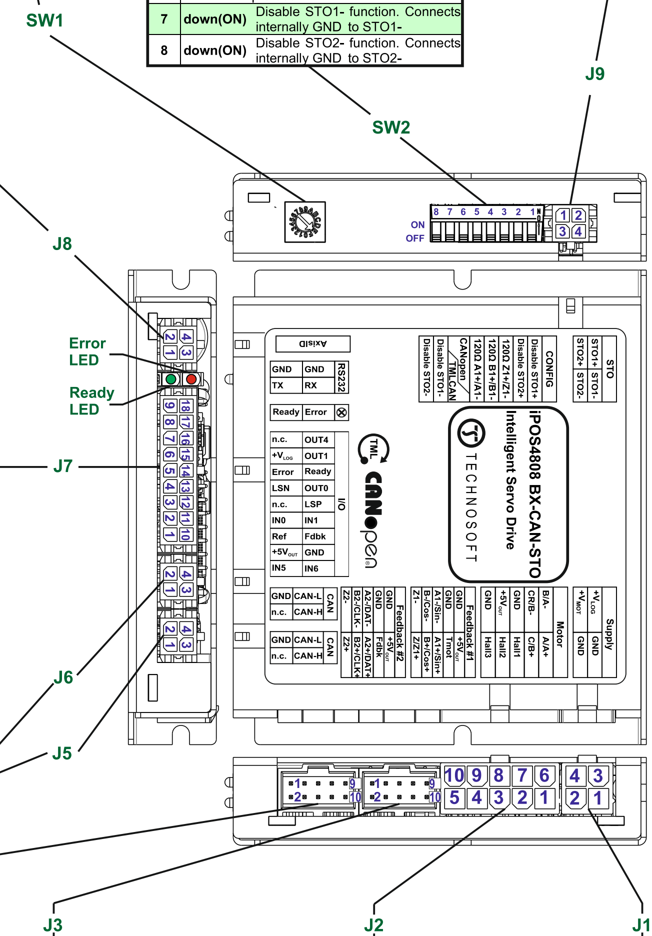
3.3 Connectors and Pinouts

3.3.1 Pinouts for iPOS4808 BX-CAN-STO

SW1 Axis ID selection		
Switch	Position	Description
SW1	0..F	H/W Axis ID = 1 to 15 when switch is 1 to F Exception: SW1 = 0 -->Axis ID = 255.

SW2 HW Config selection DIP switch		
Pin	Position	Description
1	down(ON)	Disable STO1+ function. Connects internally $+V_{LOG}$ to STO1+
2	down(ON)	Disable STO2+ function. Connects internally $+V_{LOG}$ to STO2+
3	down(ON)	Connect an 120Ω resistor between Z1+ and Z1- feedback pins
4	down(ON)	Connect an 120Ω resistor between B1+ and B1- feedback pins
5	down(ON)	Connect an 120Ω resistor between A1+ and A1- feedback pins
6	down(ON)	Select CANopen communication protocol
	up(OFF)	Select TMLCAN communication protocol
7	down(ON)	Disable STO1- function. Connects internally GND to STO1-
8	down(ON)	Disable STO2- function. Connects internally GND to STO2-

Pin	Name	Description
1	STO2+	Safe Torque Off input 2, positive input (opto-isolated, 18÷40V)
2	STO1+	Safe Torque Off input 1, positive input (opto-isolated, 18÷40V)
3	STO2-	Safe Torque Off input 2, negative return(opto-isolated, 18÷40V)
4	STO1-	Safe Torque Off input 1, negative return(opto-isolated, 18÷40V)



Pin	Name	Description
1	232TX	RS-232 Data Transmission
2	GND	Return ground for RS-232 pins
3	232RX	RS-232 Data Reception
4	GND	Return ground for RS-232 pins

Pin	Name	Description
1	IN5	12-36V general-purpose digital PNP/NPN input
2	$+5V_{OUT}$	5V output supply for I/O usage
3	REF	Analogue input, 12-bit, 0-5V. Used to read an analog position, speed or torque reference, or used as general purpose analogue input
4	IN0	12-36V general-purpose digital PNP/NPN input
5	n.c.	not connected
6	IN3/LSN	12-36V digital PNP/NPN input. Negative limit switch input
7	OUT2 /Error	12-36V 0.5A, drive Error output, active low, NPN open-collector/TTL pull-up. Also drives the red Error LED.
8	$+V_{LOG}$	Positive terminal of the logic supply: 9 to $36V_{DC}$. Also internally connected to J1 pin 3.
9	n.c.	not connected
10	IN6	12-36V general-purpose digital PNP/NPN input
11	GND	Return ground for I/O pins
12	FDBK	Analogue input, 12-bit, 0-5V. Used to read an analogue position or speed feedback (as tacho), or used as general purpose analogue input; Connected also to J4 pin 8.
13	IN1	12-36V general-purpose digital PNP/NPN input
14	IN2/LSP	12-36V digital PNP/NPN input. Positive limit switch input
15	OUT0	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
16	OUT3 /Ready	5-36V 0.5A, drive Ready output, active low, NPN open-collector/TTL pull-up. Also drives the green Ready LED.
17	OUT1	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
18	OUT4	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up

Pin	Name	Description
1	n.c.	not connected
2	GND	Return ground for RS-232 pins
3	CAN Hi	CAN-Bus positive line(dominant high)
4	CAN Lo	CAN-Bus negative line (dominant low)

J4

Pin	Name	Description
1	Z2-	Incr. encoder2 Z- diff. input; has 120Ω resistor between pins 1 and 2
2	Z2+	Incr. encoder2 Z+ diff. input ; has 120Ω resistor between pins 1 and 2
3	B2-/Dir-/CLK-/MA-	Incr. encoder2 B- diff. input, or Dir-, or Clock- for SSI, or Master- for BiSS; has 120Ω resistor between pins 3 and 4
4	B2+/Dir+/CLK+/MA+	Incr. encoder2 B+ diff. input, or Dir+, or Clock+ for SSI, or Master+ for BiSS; has 120Ω resistor between pins 3 and 4
5	A2- /Pulse-/ Data-/SL-	Incr. encoder2 A- diff. input, or Pulse-, or Data- for SSI, or Slave- for BiSS; has 120Ω resistor between pins 5 and 6
6	A2+/Pulse+ / Data+/SL+	Incr. encoder2 A+ diff. input, or Pulse+, or Data+ for SSI, or Slave+ for BiSS; has 120Ω resistor between pins 5 and 6
7	GND	Return ground for sensors supply
8	FDBK	Analogue input, 12-bit, 0-5V. Used to read an analogue position or speed feedback (as tacho), or used as general purpose analogue input; Also connected to J7 pin12.
9	GND	Return ground for sensors supply
10	$+5V_{OUT}$	5V output supply for sensors usage

J3

Pin	Name	Description
1	Z1-	Incr. encoder1 Z- diff. input
2	Z1+	Incr. encoder1 Z single-ended, or Z+ diff. input
3	B1-/Cos-	Incr. encoder1 B- diff. input, or analogue encoder Cos- diff. input
4	B1+/Cos+ /Dir	Incr. encoder1 B single-ended, or B+ diff. input, or Dir, or analogue encoder Cos+ diff. input
5	A1- /Sin-	Incr. encoder1 A- diff. input, or analogue encoder Sin- diff. input
6	A1+/Sin+/ Pulse	Incr. encoder1 A single-ended, or A+ diff. input, or Pulse, or analogue encoder Sin+ diff. input
7	GND	Return ground for sensors supply
8	Temp Mot	NTC/PTC input. Used to read an analog temperature value
9	GND	Return ground for sensors supply
10	$+5V_{OUT}$	5V output supply for I/O usage

J2

Pin	Name	Description
1	A/A+	**Phase A** for 3-ph motors, A+ for 2-ph steppers, Motor+ for DC brush motors
2	C/B+	**Phase C** for 3-ph motors, B+ for 2-ph steppers
3	Hall 1	Digital input Hall 1 sensor
4	Hall 2	Digital input Hall 2 sensor
5	Hall 3	Digital input Hall 3 sensor
6	B/A-	**Phase B** for 3-ph motors, A- for 2-ph steppers, Motor- for DC brush motors
7	CR/B-	**Chopping resistor** / Phase B- for step motors
8	GND	Negative return (ground) of the motor supply
9	$+5V_{OUT}$	5V output supply - internally generated
10	GND	Negative return (ground) of the motor supply

J1

Pin	Name	Description
1	GND	Negative return (ground) of the power supply
2	GND	Negative return (ground) of the power supply
3	$+V_{LOG}$	Positive terminal of the logic supply input: 9 to $36V_{DC}$
4	$+V_{MOT}$	Positive terminal of the motor supply: 11 to $50V_{DC}$.

3.3.2 Pinouts for iPOS4808 BX-CAN

SW1 Axis ID selection

Switch	Position	Description
SW1	0..F	H/W Axis ID = 1 to 15 when switch is 1 to F Exception: SW1 = 0 -->Axis ID = 255.

SW2 HW Configuration selection DIP switch

Pin	Position	Description
1	down(ON)	Disable ENA1 functionality. Connects internally $+V_{LOG}$ to ENA1
2	down(ON)	Disable ENA2 functionality. Connects internally $+V_{LOG}$ to ENA2
3	down(ON)	Connect an 120Ω resistor between Z1+ and Z1- feedback pins
4	down(ON)	Connect an 120Ω resistor between B1+ and B1- feedback pins
5	down(ON)	Connect an 120Ω resistor between A1+ and A1- feedback pins
6	down(ON)	Select CANopen communication protocol
	up(OFF)	Select TMLCAN communication protocol
7	down(ON)	Reserved. Must be left on down(ON) position.
8	down(ON)	

J9

Pin	Name	Description
1	ENA2	Enable circuit input2; connect ENA1&ENA2 to +24V to activate motor operation
2	ENA1	Enable circuit input1; connect ENA1&ENA2 to +24V to activate motor operation
3	GND	Return ground
4	GND	Return ground

J8

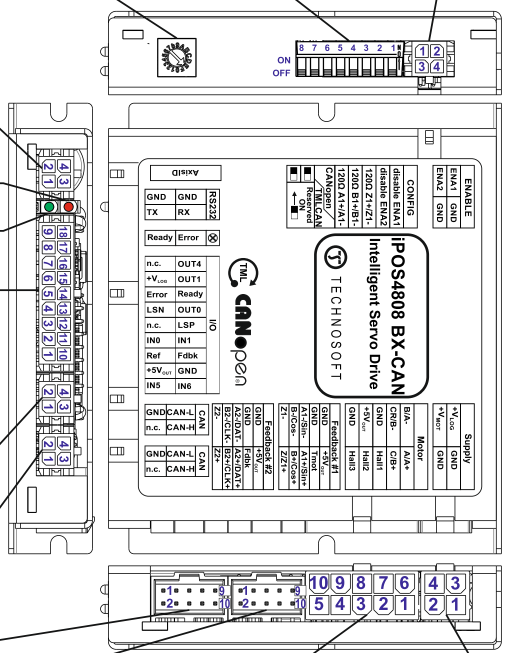
Pin	Name	Description
1	232TX	RS-232 Data Transmission
2	GND	Return ground for RS-232 pins
3	232RX	RS-232 Data Reception
4	GND	Return ground for RS-232 pins

J7

Pin	Name	Description
1	IN5	12-36V general-purpose digital PNP/NPN input
2	$+5V_{OUT}$	5V output supply for I/O usage
3	REF	Analogue input, 12-bit, 0-5V. Used to read an analog position, speed or torque reference, or used as general purpose analogue input
4	IN0	12-36V general-purpose digital PNP/NPN input
5	n.c.	not connected
6	IN3/LSN	12-36V digital PNP/NPN input. Negative limit switch input
7	OUT2 /Error	12-36V 0.5A, drive Error output, active low, NPN open-collector/TTL pull-up. Also drives the red Error LED.
8	$+V_{LOG}$	Positive terminal of the logic supply: 9 to $36V_{DC}$. Also internally connected to J1 pin 3.
9	n.c.	not connected
10	IN6	12-36V general-purpose digital PNP/NPN input
11	GND	Return ground for I/O pins
12	FDBK	Analogue input, 12-bit, 0-5V. Used to read an analogue position or speed feedback (as tacho), or used as general purpose analogue input; Connected also to J4 pin 8.
13	IN1	12-36V general-purpose digital PNP/NPN input
14	IN2/LSP	12-36V digital PNP/NPN input. Positive limit switch input
15	OUT0	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
16	OUT3 /Ready	5-36V 0.5A, drive Ready output, active low, NPN open-collector/TTL pull-up. Also drives the green Ready LED.
17	OUT1	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
18	OUT4	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up

J5 / J6

Pin	Name	Description
1	n.c.	not connected
2	GND	Return ground for RS-232 pins
3	CAN Hi	CAN-Bus positive line(dominant high)
4	CAN Lo	CAN-Bus negative line (dominant low)



J4

Pin	Name	Description
1	Z2-	Incr. encoder2 Z- diff. input; has 120Ω resistor between pins 1 and 2
2	Z2+	Incr. encoder2 Z+ diff. input ; has 120Ω resistor between pins 1 and 2
3	B2-/Dir-/CLK-/MA-	Incr. encoder2 B- diff. input, or Dir-, or Clock- for SSI, or Master- for BiSS; has 120Ω resistor between pins 3 and 4
4	B2+/Dir+/CLK+/MA+	Incr. encoder2 B+ diff. input, or Dir+, or Clock+ for SSI, or Master+ for BiSS; has 120Ω resistor between pins 3 and 4
5	A2- /Pulse-/ Data-/SL-	Incr. encoder2 A- diff. input, or Pulse-, or Data- for SSI, or Slave- for BiSS; has 120Ω resistor between pins 5 and 6
6	A2+/Pulse+ / Data+/SL+	Incr. encoder2 A+ diff. input, or Pulse+, or Data+ for SSI, or Slave+ for BiSS; has 120Ω resistor between pins 5 and 6
7	GND	Return ground for sensors supply
8	FDBK	Analogue input, 12-bit, 0-5V. Used to read an analogue position or speed feedback (as tacho), or used as general purpose analogue input; Also connected to J7 pin12.
9	GND	Return ground for sensors supply
10	$+5V_{OUT}$	5V output supply for sensors usage

J3

Pin	Name	Description
1	Z1-	Incr. encoder1 Z- diff. input
2	Z1+	Incr. encoder1 Z single-ended, or Z+ diff. input
3	B1-/Cos-	Incr. encoder1 B- diff. input, or analogue encoder Cos- diff. input
4	B1+/Cos+ /Dir	Incr. encoder1 B single-ended, or B+ diff. input, or Dir, or analogue encoder Cos+ diff. input
5	A1- /Sin-	Incr. encoder1 A- diff. input, or analogue encoder Sin- diff. input
6	A1+/Sin+/ Pulse	Incr. encoder1 A single-ended, or A+ diff. input, or Pulse, or analogue encoder Sin+ diff. input
7	GND	Return ground for sensors supply
8	Temp Mot	NTC/PTC input. Used to read an analog temperature value
9	GND	Return ground for sensors supply
10	$+5V_{OUT}$	5V output supply for I/O usage

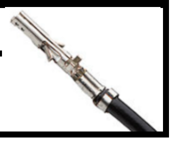
J2

Pin	Name	Description
1	A/A+	**Phase A** for 3-ph motors, A+ for 2-ph steppers, Motor+ for DC brush motors
2	C/B+	**Phase C** for 3-ph motors, B+ for 2-ph steppers
3	Hall 1	Digital input Hall 1 sensor
4	Hall 2	Digital input Hall 2 sensor
5	Hall 3	Digital input Hall 3 sensor
6	B/A-	**Phase B** for 3-ph motors, A- for 2-ph steppers, Motor- for DC brush motors
7	BR/B-	**Brake resistor** / Phase B- for step motors
8	GND	Negative return (ground) of the motor supply
9	$+5V_{OUT}$	5V output supply - internally generated
10	GND	Negative return (ground) of the motor supply

J1

Pin	Name	Description
1	GND	Negative return (ground) of the power supply
2	GND	Negative return (ground) of the power supply
3	$+V_{LOG}$	Positive terminal of the logic supply input: 9 to $36V_{DC}$
4	$+V_{MOT}$	Positive terminal of the motor supply: 11 to $50V_{DC}$.

3.3.3 Mating Connectors

Image	Connector	Description	Manufacturer	Part Number	Image
	J1	MINIFIT JR. receptacle housing, 2x2 way	MOLEX	39-03-9042	
	J2	MINIFIT JR. receptacle housing, 2x5 way	MOLEX	39-03-9102	
	J1,J2	CRIMP PIN, MINIFIT JR., 13A	MOLEX	45750-1111	
	J3, J4	C-Grid III™ Crimp Housing Dual Row, 10 Circuits, with ention	MOLEX	90142-0010	
	J3, J4	C-Grid III™ Crimp Housing Dual Row, 10 Circuits, without ention	MOLEX	90143-0010	
	J3, J4	C-Grid III™ Crimp Terminal	MOLEX	90119-0109	
	J7	MICROFIT RECEPTACLE HOUSING, 2x9 WAY	MOLEX	43025-1800	
	J5, J6, J8, J9	MICROFIT RECEPTACLE HOUSING, 2x2 WAY	MOLEX	43025-0400	
	J5, J6, J7, J8, J9	CRIMP PIN, MICROFIT, 5A	MOLEX	43030-0007	
	J1, J2	Hand Crimp Tool for Mini-Fit Jr. Male and Female Terminals, 18-24 AWG	MOLEX	63819-0901	
	J3, J4	Hand Crimp Tool For C-Grid III Female Crimp Terminals, 22-24 AWG	MOLEX	63825-8100	
	J5, J6, J7, J8, J9	Hand Crimp Tool for Micro-Fit 3.0 Terminals, 20-30 AWG	MOLEX	63819-0000	
	J1, J2	Pre-Crimped Lead Mini-Fit Female-to-Mini-Fit Female, Tin (Sn) Plating, 300.00mm Length, 18 AWG	MOLEX	79758-0009	
	J3, J4	Pre-Crimped Lead C-Grid III Female-to-C-Grid III Female, Tin (Sn) Plating, 300.00mm Length, 22 AWG	MOLEX	79758-2023	
	J5, J6, J7, J8, J9	Pre-Crimped Lead Micro-Fit 3.0 Female-to-Micro-Fit 3.0 Female, Tin (Sn) Plating, 300.00mm Length, 20 AWG	MOLEX	79758-0010	

3.4 Connection diagrams

3.4.1 iPOS4808 BX-CAN-STO connection diagram

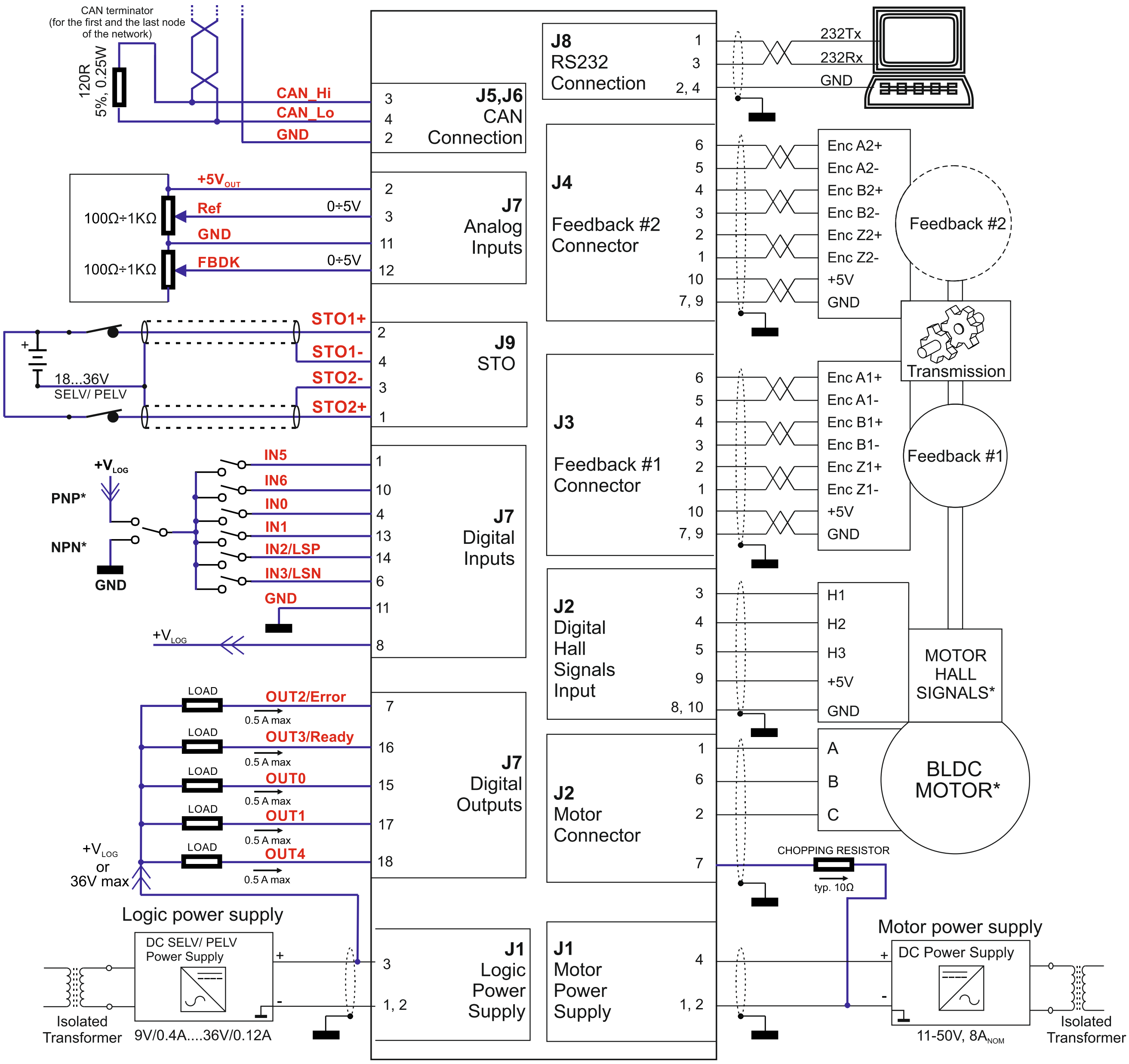


Figure 3.3. **iPOS4808 BX-CAN-STO Connection diagram**

* For other available feedback / motor options, check the detailed connection diagrams below

3.4.2 iPOS4808 BX-CAN connection diagram

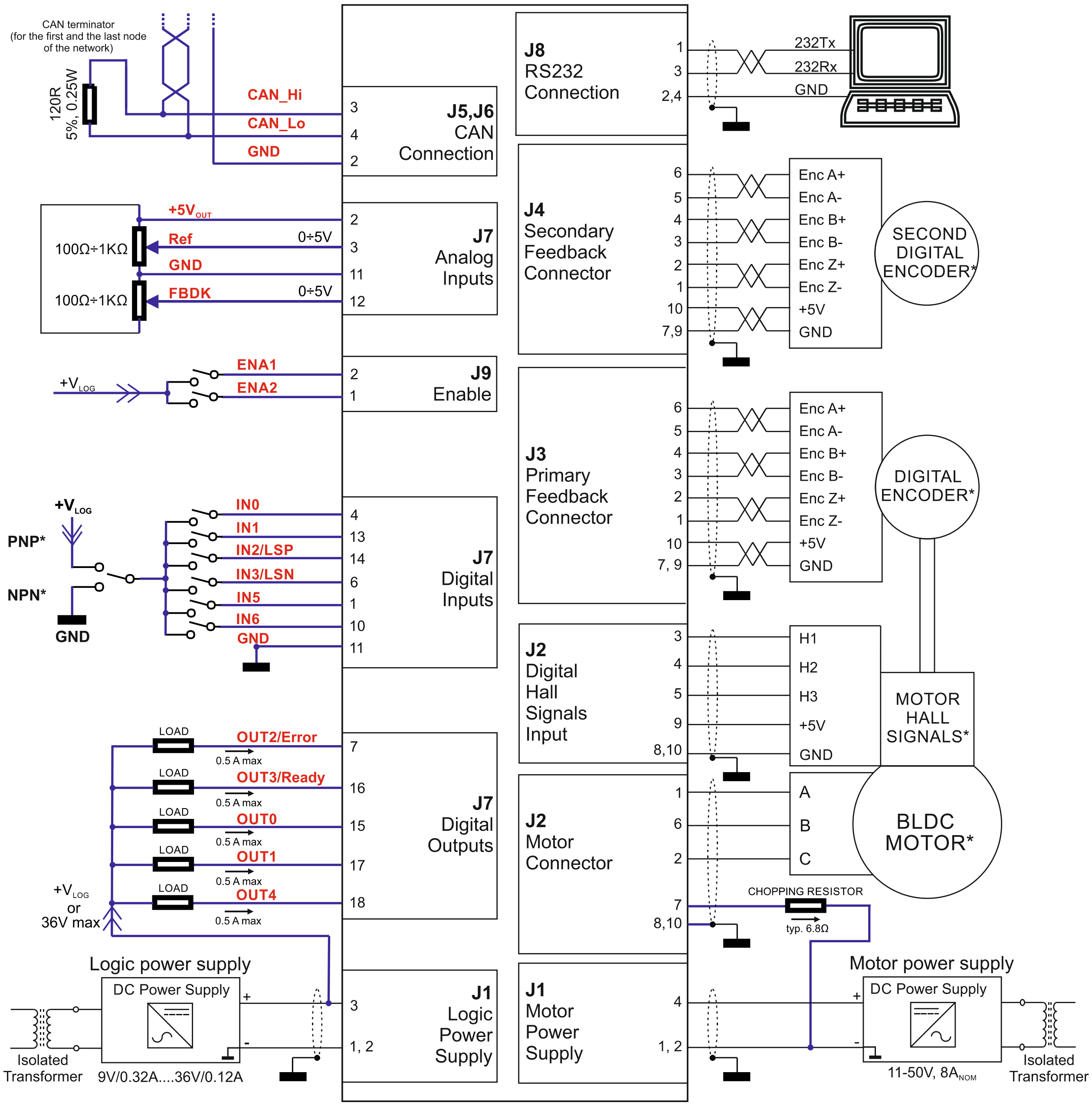


Figure 3.4. **iPOS4808 BX-CAN Connection diagram**

* For other available feedback / motor options, check the detailed connection diagrams below

3.4.3 24V Digital I/O Connection

3.4.3.1 PNP inputs

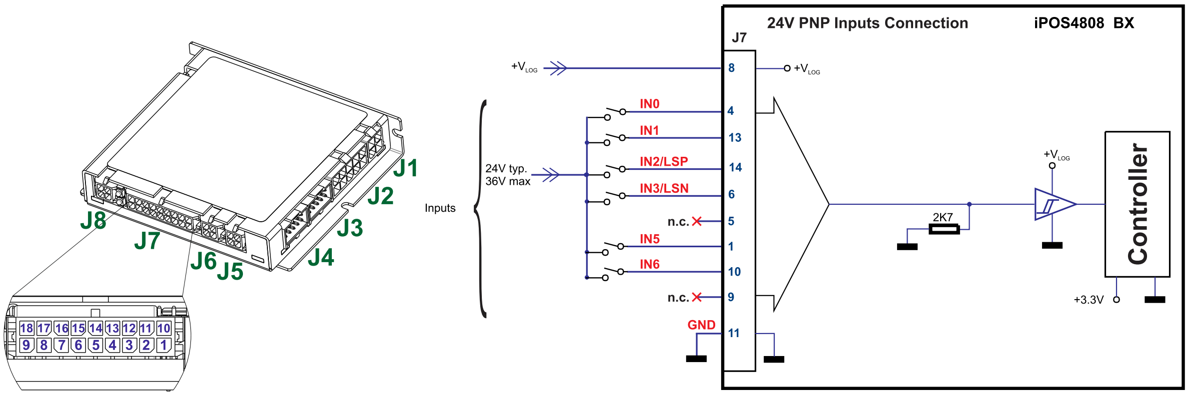


Figure 3.5. **24V Digital PNP Inputs connection**

Remarks:

1. *The inputs are selectable as PNP/ NPN by software.*
2. *The inputs are compatible with PNP type outputs (input must receive a positive voltage value (5-36V) to change its default state)*
3. *The length of the cables must be up to 30m, reducing the exposure to voltage surge in industrial environment.*

3.4.3.2 NPN inputs

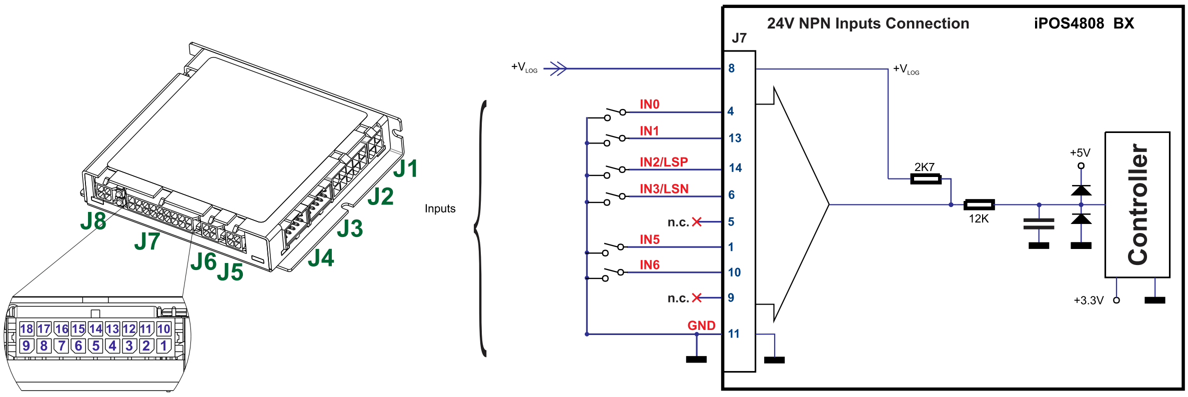


Figure 3.6. **24V Digital NPN Inputs connection**

Remarks:

1. *The inputs are selectable as PNP/ NPN by software.*
2. *The inputs are compatible with NPN type outputs (input must be pulled to GND to change its default state)*
3. *The length of the cables must be up to 30m, reducing the exposure to voltage surges in industrial environment.*

3.4.3.3 NPN outputs

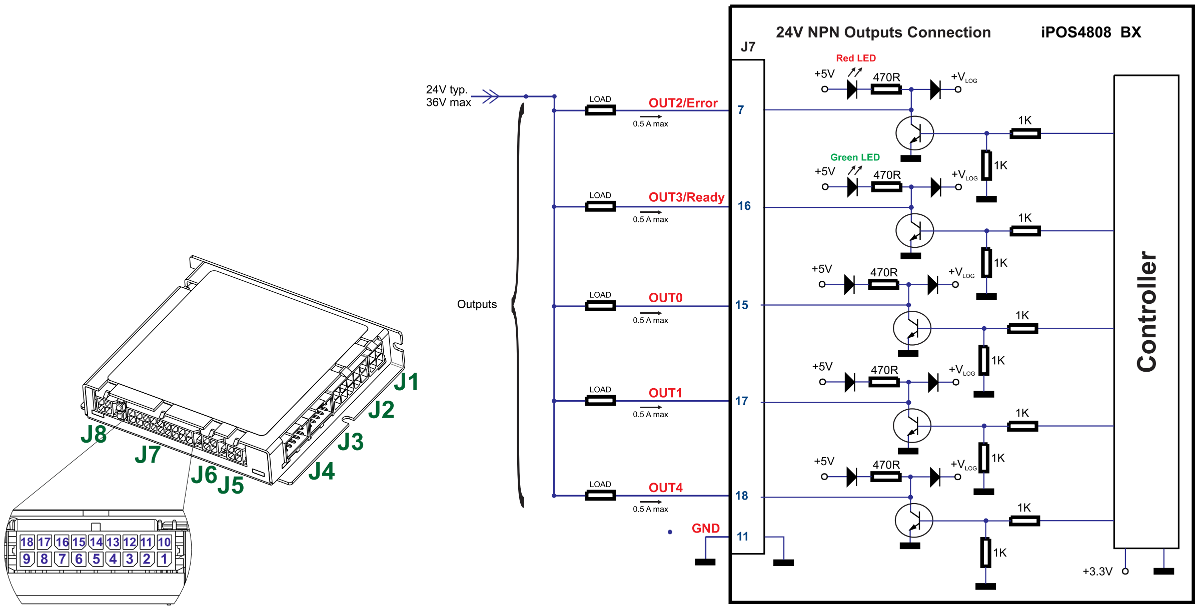


Figure 3.7. **24V Digital NPN Outputs connection**

Remark:

The outputs are compatible with NPN type inputs (load is tied to common +V_LOG, output pulls to GND when active and is floating when inactive)

3.4.4 5V Digital I/O Connection

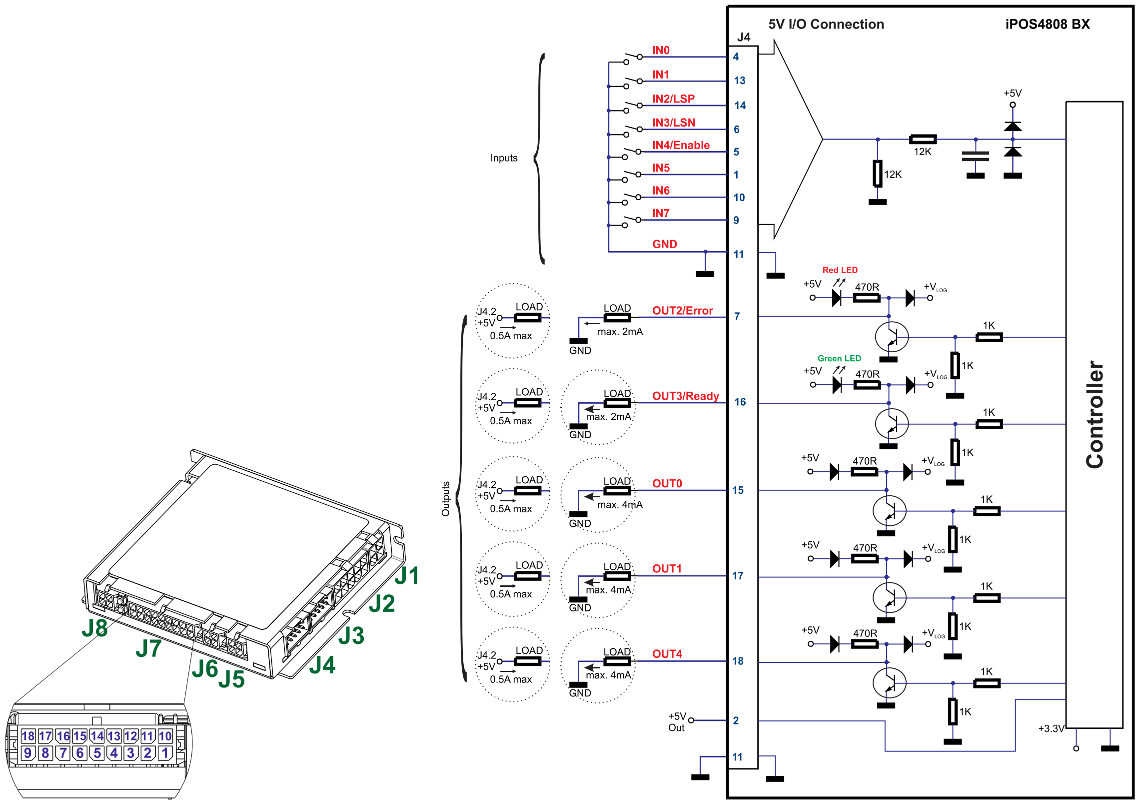


Figure 3.8. **5V Digital I/O connection**

Remarks:

1. *The inputs are selectable as PNP/ NPN by software. For the 5V connection they are selected as PNP. NPN is not compatible on a 5V connection.*
2. *The inputs are compatible with TTL(5V), LVTTL(3.3V), CMOS (3.3V-24V) outputs*
3. *The outputs are compatible with TTL (5V) and CMOS (5V) inputs*
4. *The length of the cables must be up to 30m, reducing the exposure to voltage surges in industrial environment.*

The output loads can be individually and independently connected to +5V or to GND.

3.4.5 Analog Inputs Connection

3.4.5.1 0-5V Input Range

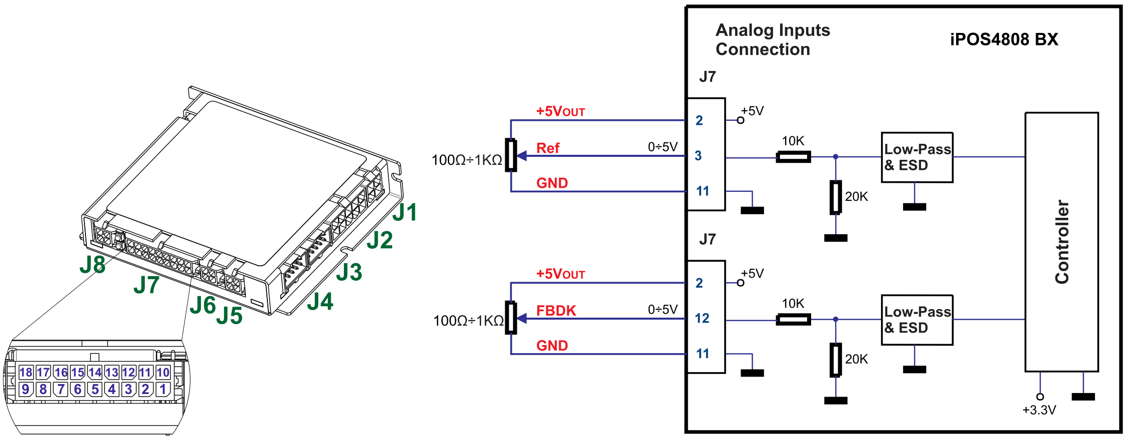


Figure 3.9. ***0-5V* Analog inputs connection**

Remarks:

1. *Default input range for analog inputs is 0÷5 V for REF and FBDK. For a +/-10 V range, see Figure 3.10.*
2. *The length of the cables must be up to 30m, reducing the exposure to voltage surges in industrial environment.*

3.4.5.2 +/- 10V to 0-5V Input Range Adapter

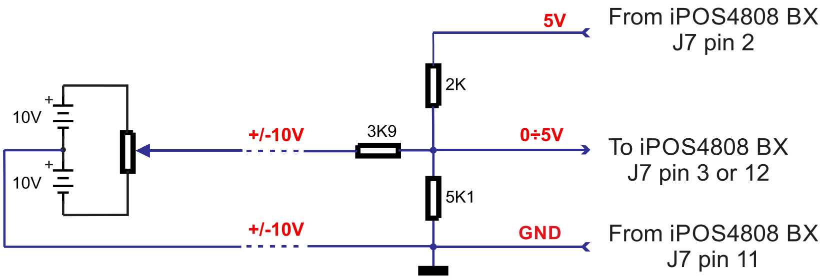


Figure 3.10. **+/-10V to 0-5V adapter**

Remark: *The length of the cables must be up to 30m, reducing the exposure to voltage surges in industrial environment.*

3.4.5.3 Recommendation for wiring

a) If the analogue signal source is single-ended, use a 2-wire twisted shielded cable as follows: 1st wire connects the live signal to the drive input; 2nd wire connects the source ground to the drive ground; shield will be connected to the drive ground terminal.

b) If the analogue signal source is differential and the signal source ground is isolated from the drive GND, use a 2-wire twisted shielded cable as follows: 1st wire connects the source plus (positive, in-phase) to the drive analogue input; 2nd wire connects the source minus (negative, out-of-phase) to the drive ground (GND). Shield is connected only at the drive side, to the drive GND, and is left unconnected at the source side.

c) If the analogue signal source is differential and the signal source ground is common with the drive GND, use a 2-wire shielded cable as follows: 1st wire connects the source plus (positive, in-phase) to the drive analogue input; 2nd wire connects the source ground to the drive ground (GND); shield is connected only at the drive side, to the drive GND, and is left unconnected at the source side. The source minus (negative, out-of-phase) output remains unconnected.

3.4.6 Motor connections

3.4.6.1 Brushless Motor connection

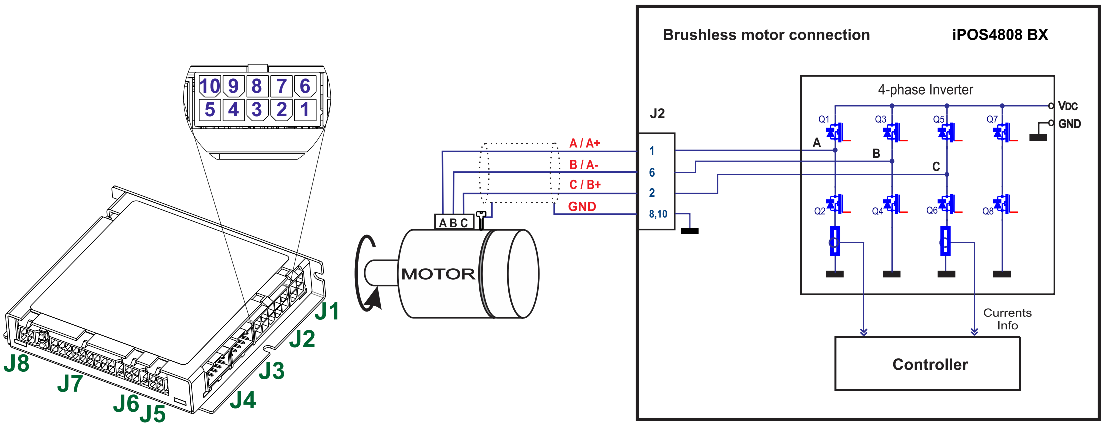


Figure 3.11. **Brushless motor connection**

3.4.6.2 2-phase Step Motor connection

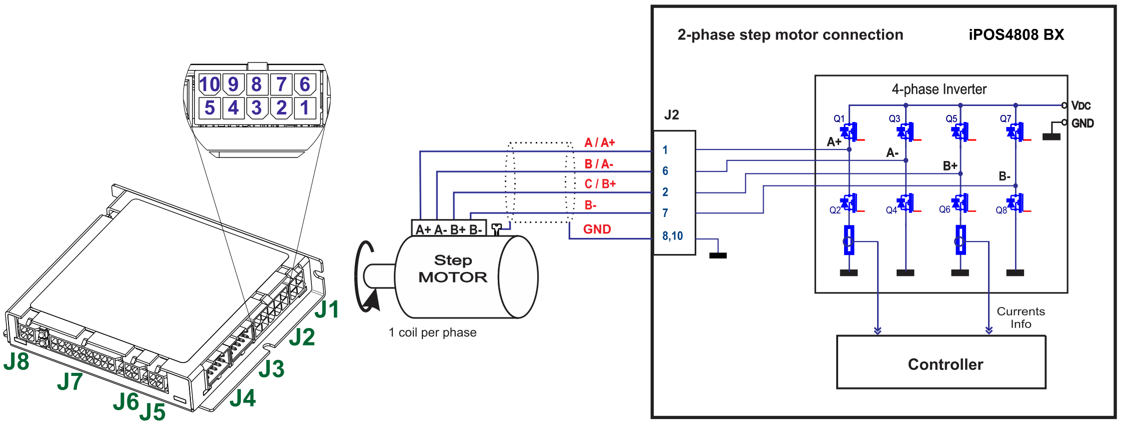


Figure 3.12. **2-phase step motor connection, one coil per phase**

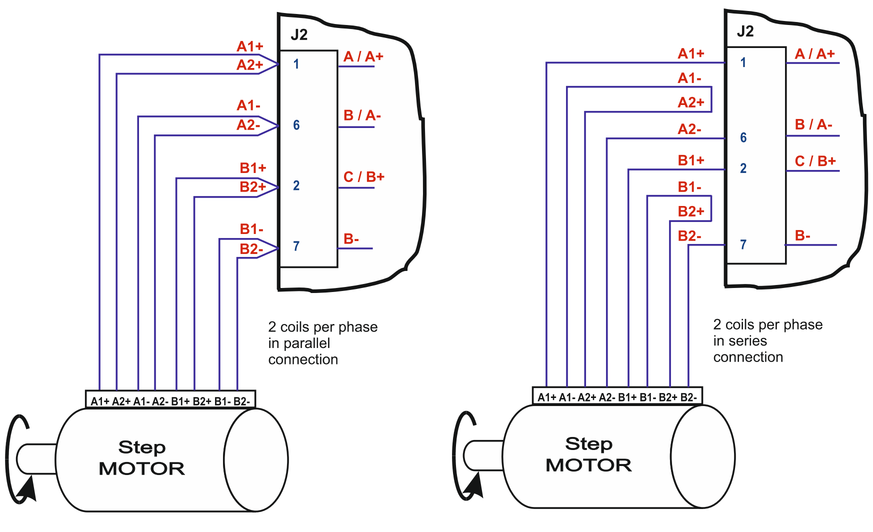


Figure 3.13. **2-phase step motor connection, two coils per phase**

3.4.6.3 3-Phase Step Motor connection

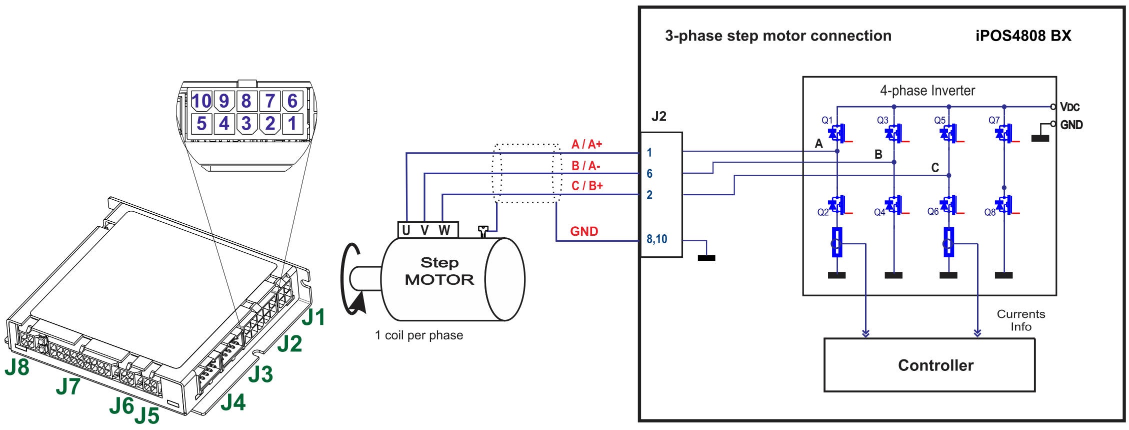


Figure 3.14. **3-phase step motor connection**

3.4.6.4 DC Motor connection

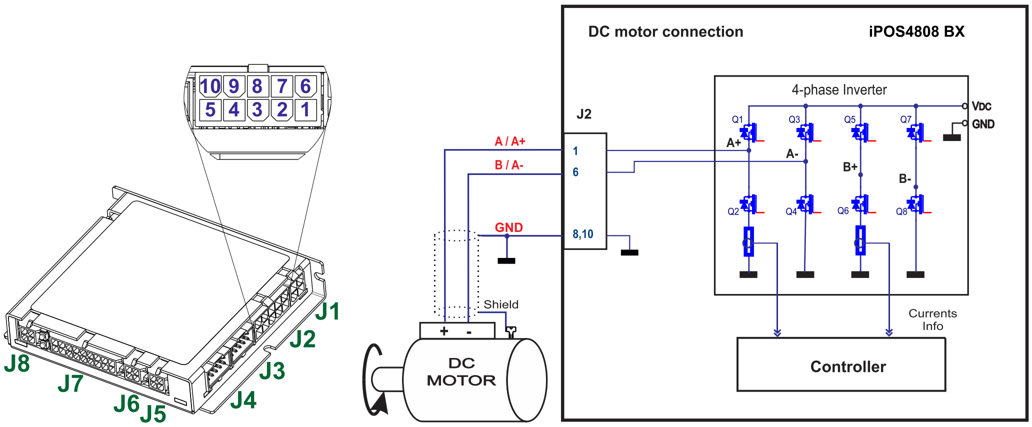


Figure 3.15. **DC Motor connection**

3.4.6.5 Recommendations for motor wiring

a) Avoid running the motor wires in parallel with other wires for a distance longer than 2 meters. If this situation cannot be avoided, use a shielded cable for the motor wires. Connect the cable shield to the iPOS4808 GND pin. Leave the other end disconnected.

b) The parasitic capacitance between the motor wires must not bypass 10nF. If very long cables (tens of meters) are used, this condition may not be met. In this case, add series inductors between the iPOS4808 outputs and the cable. The inductors must be magnetically shielded (toroidal, for example), and must be rated for the motor surge current. Typically the necessary values are around 100 μH.

A good shielding can be obtained if the motor wires are running inside a metallic cable guide.

3.4.7 Feedback connections

3.4.7.1 Single-ended Incremental Encoder #1 Connection

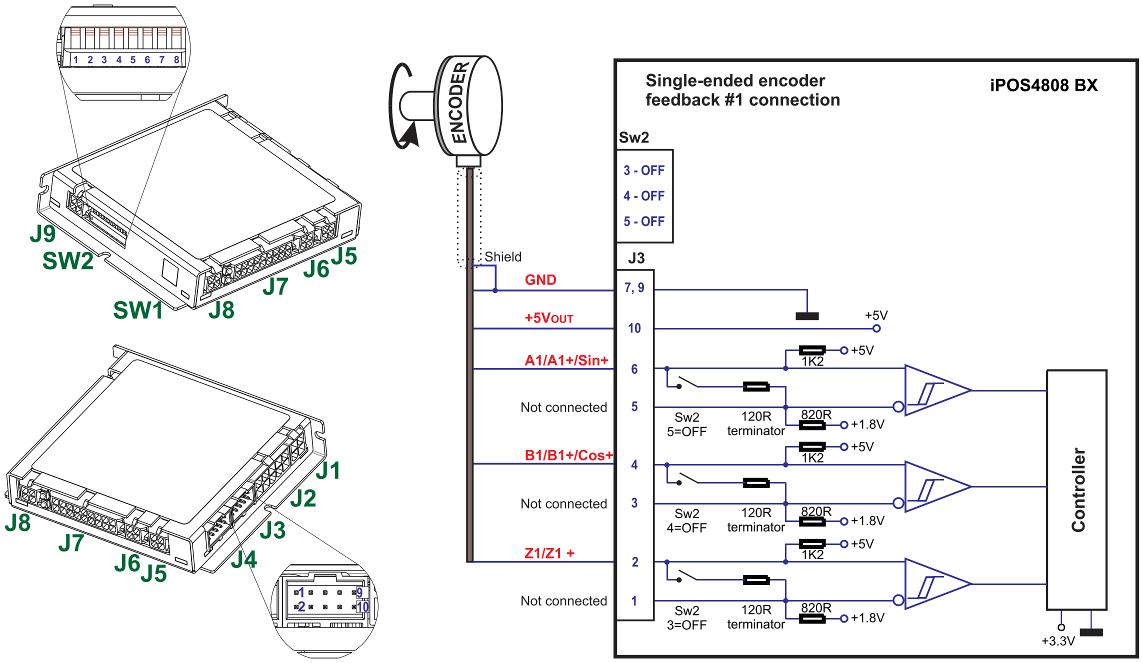


Figure 3.16. **Single-ended incremental encoder connection**

CAUTION!	***DO NOT CONNECT UNTERMINATED WIRES. THEY MIGHT PICK UP UNWANTED NOISE AND GIVE FALSE ENCODER READINGS.***

3.4.7.2 Differential Incremental Encoder #1 Connection

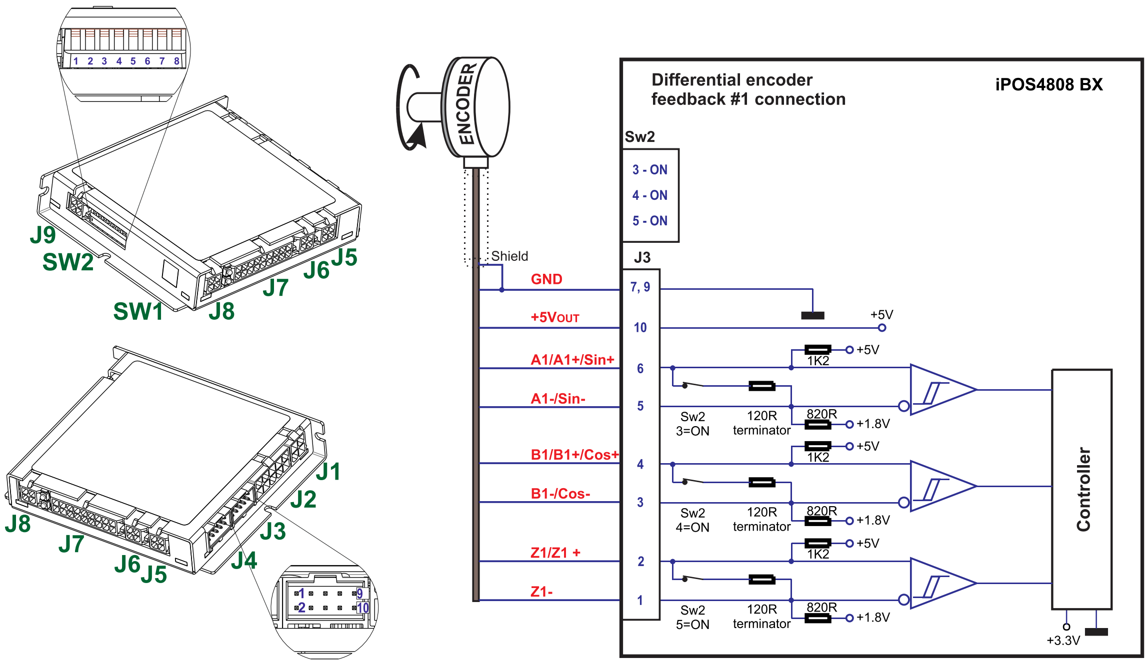


Figure 3.17. **Differential incremental encoder #1 connection**

Remark: *The length of the cables must be up to 30m, reducing the exposure to voltage surges in industrial environment.*

3.4.7.3 Pulse&Direction Encoder #1 Connection

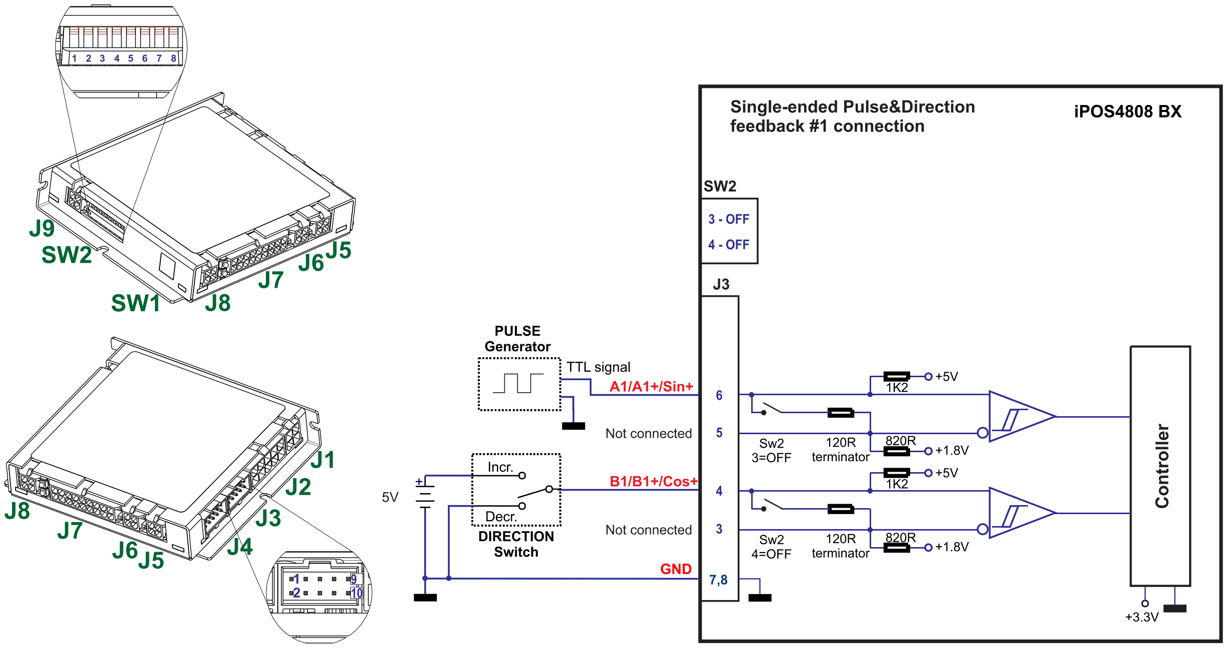


Figure 3.18. **Pulse&Direction encoder connection**

CAUTION!	***DO NOT CONNECT UNTERMINATED WIRES. THEY MIGHT PICK UP UNWANTED NOISE AND GIVE FALSE ENCODER READINGS.***

3.4.7.4 Differential Incremental Encoder #2 Connection

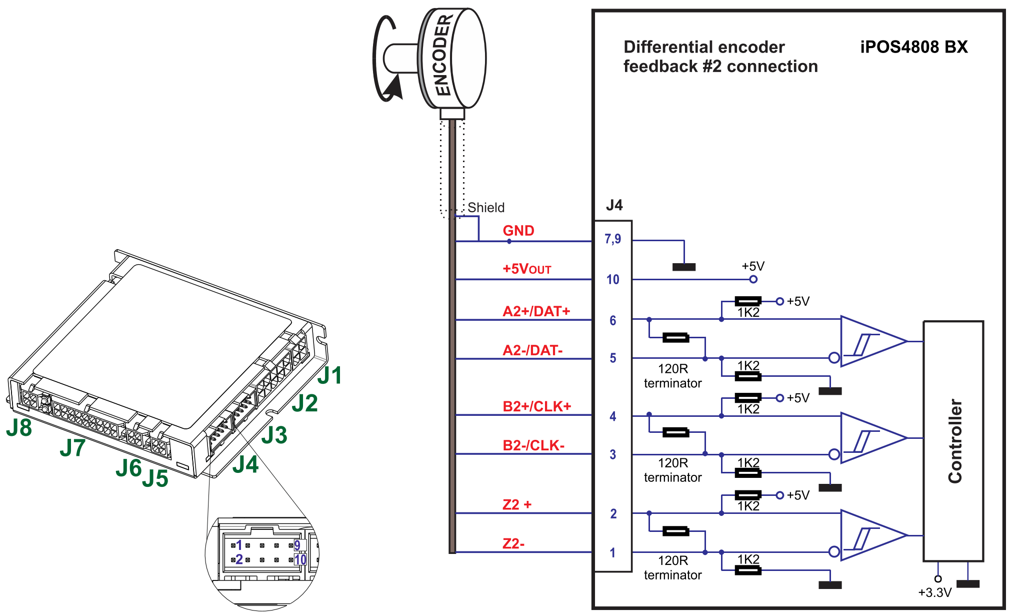


Figure 3.19. **Differential incremental encoder #2 connection**

Remarks:

1. *The encoder #2 input has internal terminators, equivalent to 120Ω (0.25W) , present in the drive.*
2. *The length of the cables must be up to 30m, reducing the exposure to voltage surges in industrial environment.*

3.4.7.5 SSI / EnDAT[1] Encoder #2 Connection

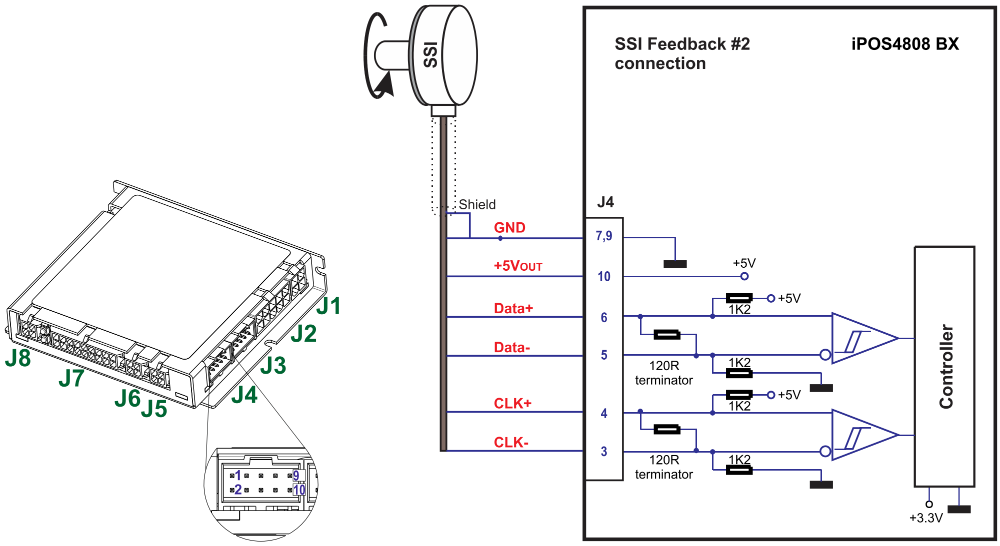


Figure 3.20. **SSI/ EnDAT[1] encoder #2 connection**

3.4.7.6 BiSS Encoder #2 Connection

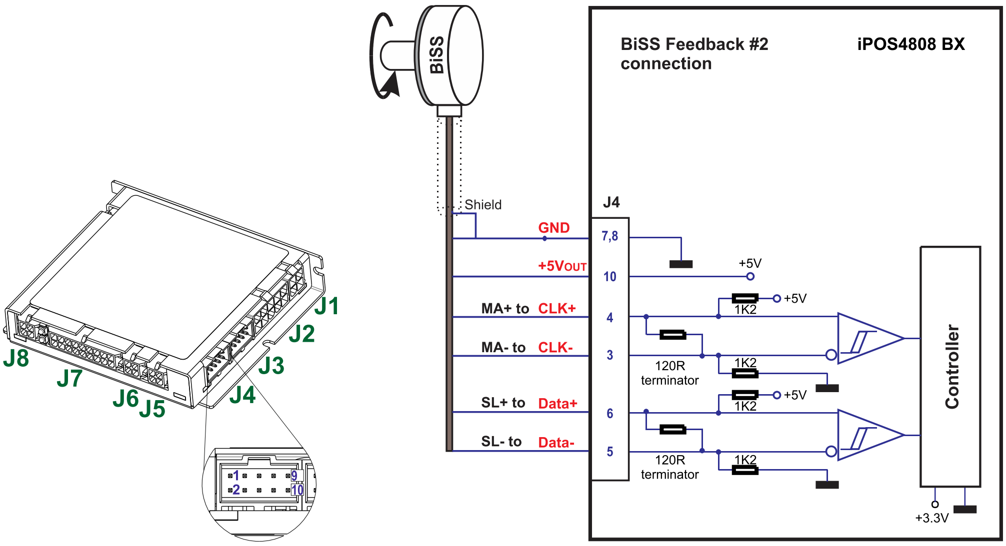


Figure 3.21. **BiSS-C encoder #2 connection**

Remarks:

1. *The encoder #2 input has internal terminators, equivalent to 120Ω (0.25W) , present in the drive.*
2. *The length of the cables must be up to 30m, reducing the exposure to voltage surges in industrial environment.*

[1] EnDAT2.2 protocol is available starting with F514K firmware version

3.4.7.7 Digital Hall Connection for Motor + Hall + Incremental Encoder

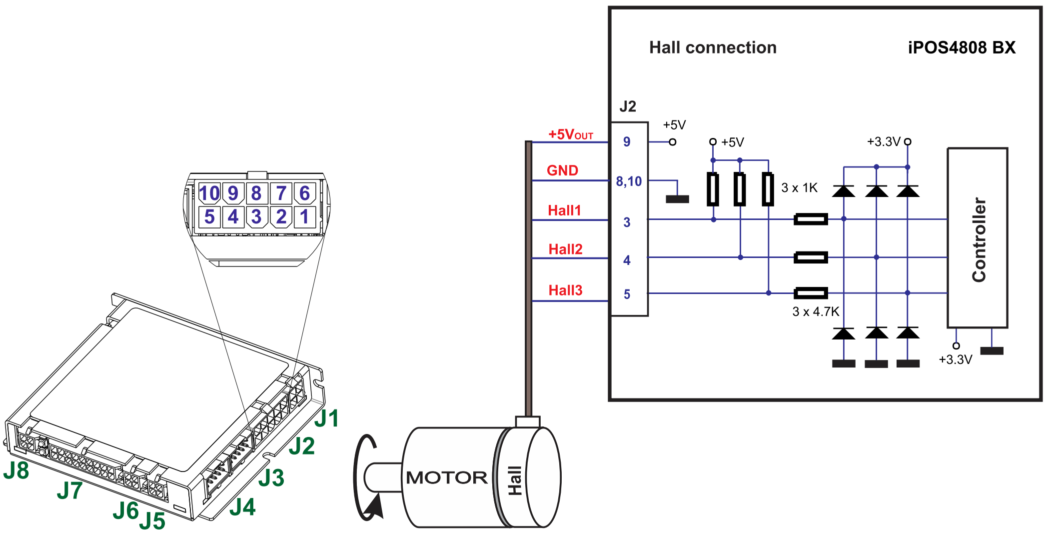


Figure 3.22. **Digital Hall connection**

Remarks:

1. *This connection is required when using Hall start method BLDC or PMSM and also for the Trapezoidal commutation method. The digital halls are not used in this case as a feedback measurement device. The actual motor control is done with an incremental encoder.*
2. *The length of the cables must be up to 30m, reducing the exposure to voltage surges in industrial environment.*

3.4.7.8 Digital Hall Connection for direct motor control without an encoder

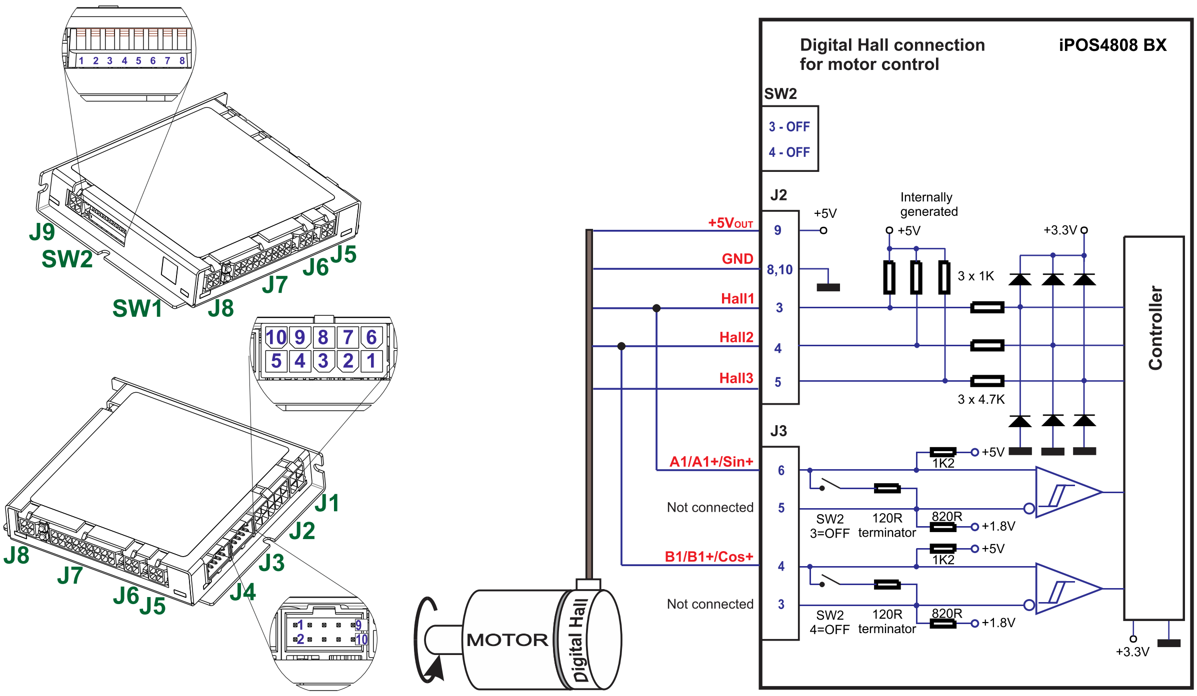


Figure 3.23. **Digital Hall connection**

Remarks:

1. *This connection is required when using only Digital hall signals as the main feedback device for motor control. In this case, no incremental encoder is needed.*
2. *The length of the cables must be up to 30m, reducing the exposure to voltage surges in industrial environment.*

3.4.7.9 Sine-Cosine Analog Encoder Connection

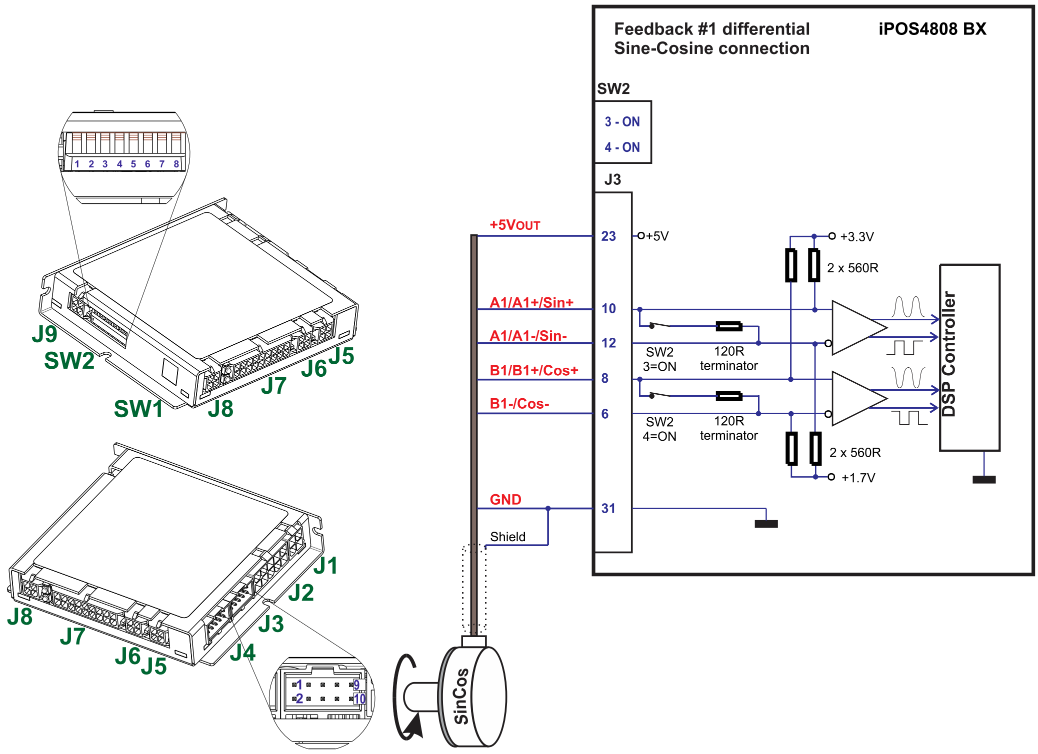


Figure 3.24. **Sine-Cosine analogue encoder connection**

3.4.7.10 Linear Hall Connection[1]

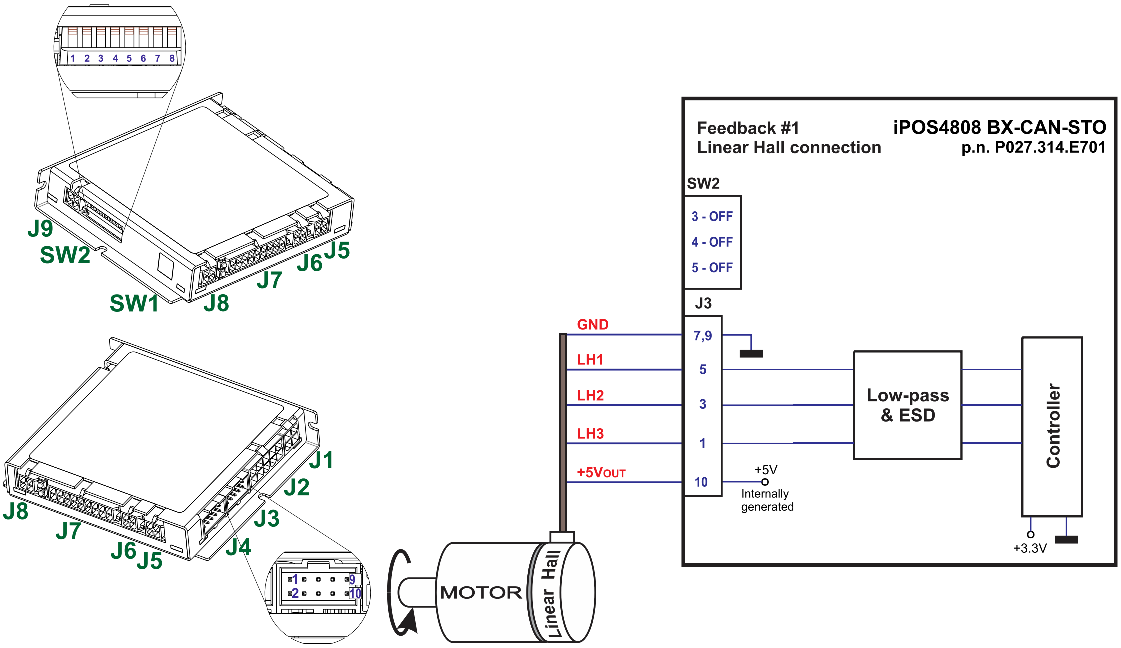


Figure 3.25. **Linear Hall connection**

3.4.7.11 Recommendations for wiring

a) Always connect both positive and negative signals when the position sensor is differential and provides them. Use one twisted pair for each differential group of signals as follows: A+/Sin+ with A-/Sin-, B+/Cos+ with B-/Cos-, Z+ with Z-. Use another twisted pair for the 5V supply and GND.

b) Always use shielded cables to avoid capacitive-coupled noise when using single-ended encoders or Hall sensors with cable lengths over 1 meter. Connect the cable shield to the GND, at only one end. This point

[1] A linear hall connection is possible only with the drive Product ID: P027.314.E701

could be either the iPOS4808 (using the GND pin) or the encoder / motor. Do not connect the shield at both ends.

c) If the iPOS4808 5V supply output is used by another device (like for example an encoder) and the connection cable is longer than 5 meters, add a decoupling capacitor near the supplied device, between the +5V and GND lines. The capacitor value can be 1...10 μF, rated at 6.3V.

3.4.8 Power Supply

3.4.8.1 Supply Connection and STO connection for iPOS4808 BX-CAN-STO

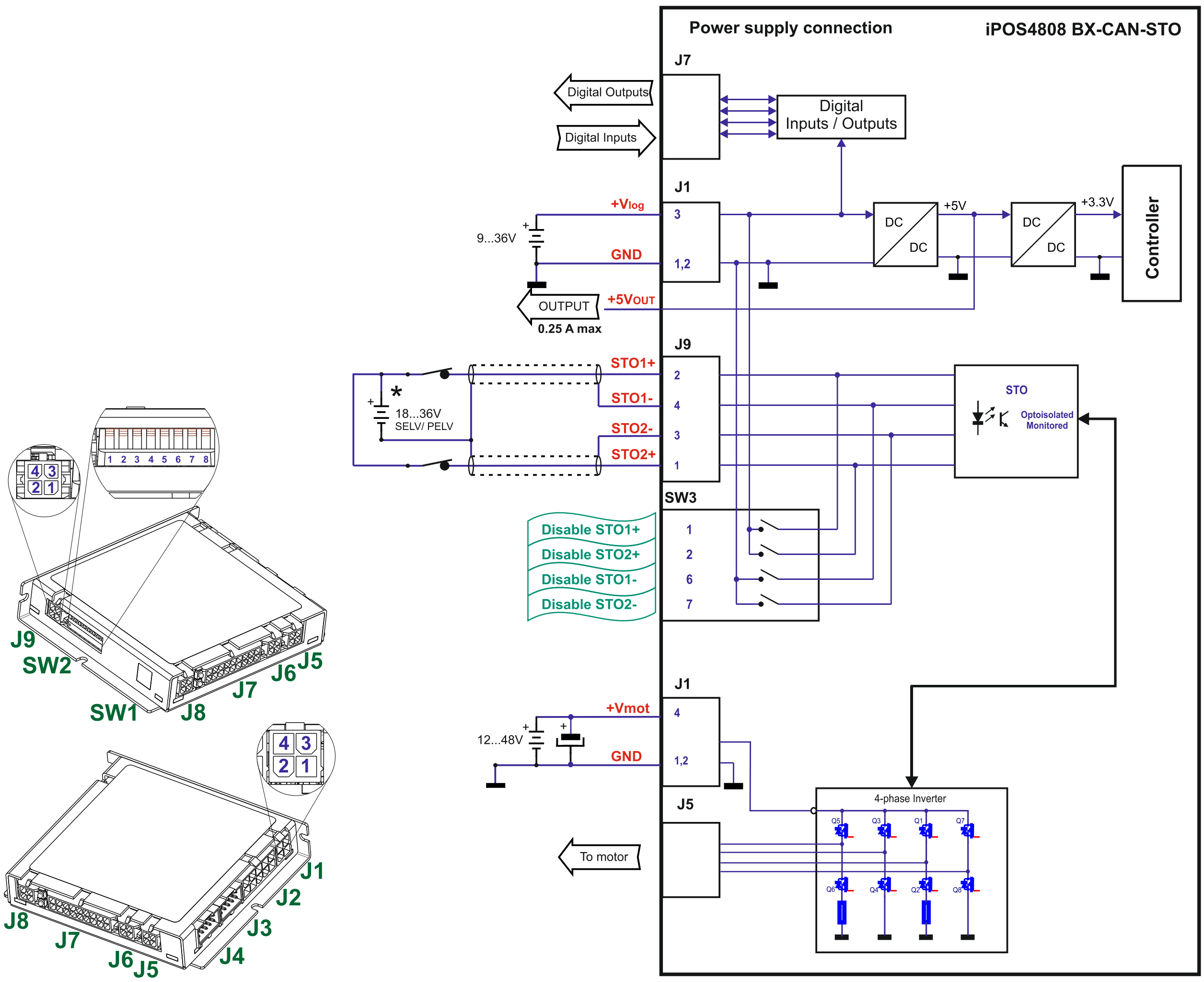
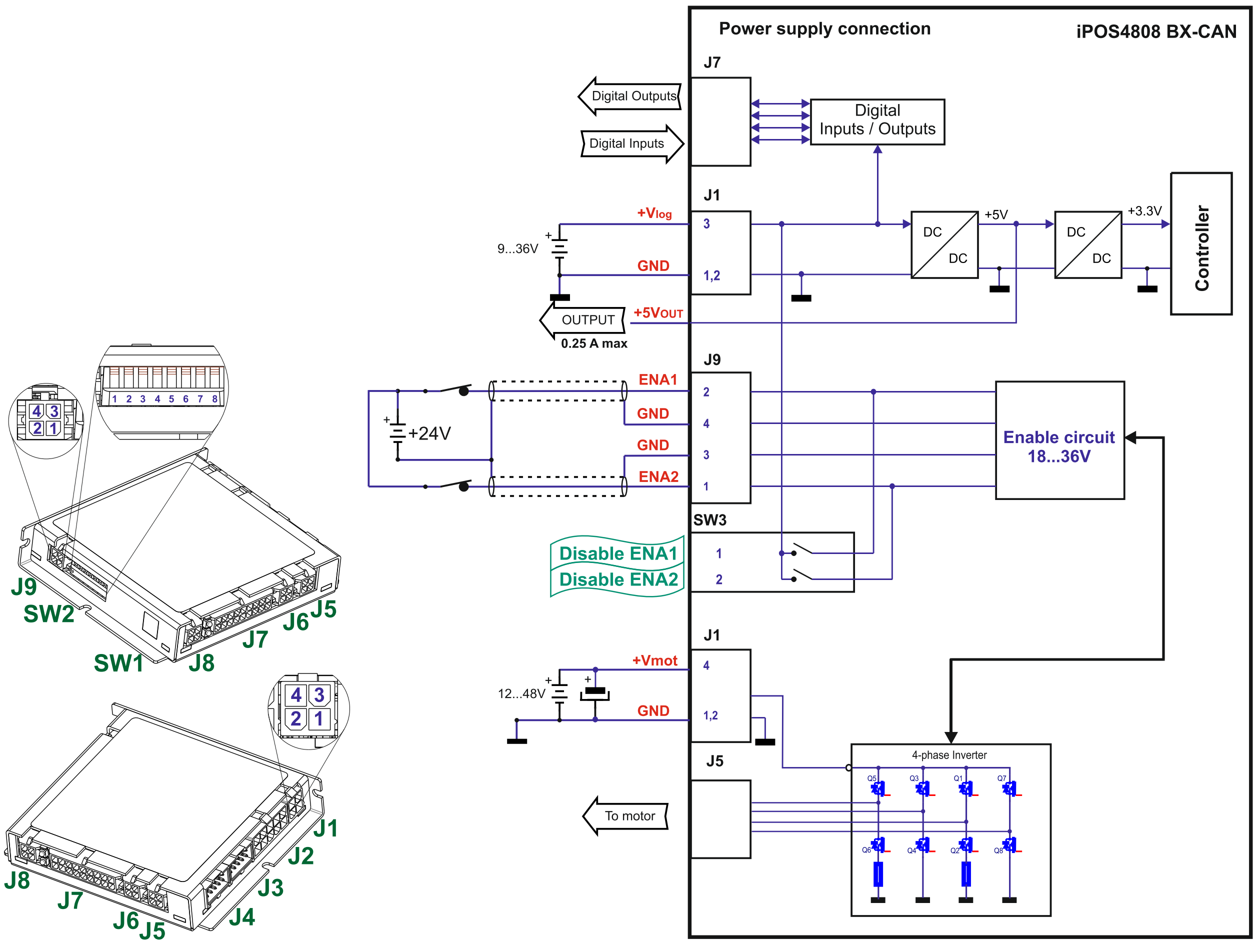


Figure 3.26. **Supply connection**

* The STO and +Vlog inputs can be supplied from the same power source as long as its output voltage is 18 to 36V DC from a SELV/ PELV power supply.

3.4.8.2 Supply Connection for iPOS4808 BX-CAN



* The ENA and +Vlog inputs can be supplied from the same power source as long as its output voltage is 18 to 36V DC from a power supply.

3.4.8.3 Recommendations for Supply Wiring

Always provide a nearby capacitor on the motor supply lines. The capacitor should be located within 10cm of the iPOS4808 connector, max. 20cm. The minimum recommended capacitance is 330µF for iPOS4808, always rated at the appropriate voltage.

Use short, thick wires between the iPOS4808 and the motor power supply. Connect power supply wires to all the indicated pins. If the wires are longer than 2 meters, use twisted wires for the supply and ground return. For wires longer than 20 meters, add a capacitor of at least 2,200µF (rated at an appropriate voltage) right on the terminals of the iPOS4808.

3.4.8.4 Recommendations to limit over-voltage during energy regeneration

During abrupt motion brakes or reversals the regenerative energy is injected into the motor power supply. This may cause an increase of the motor supply voltage (depending on the power supply characteristics). If the voltage bypasses 53V, the drive over-voltage protection is triggered and the drive power stage is disabled. In order to avoid this situation you have 2 options:

Option 1. Add a capacitor on the motor supply big enough to absorb the overall energy flowing back to the supply. The capacitor must be rated to a voltage equal or bigger than the maximum expected over-voltage and can be sized with the formula:

$$C \geq \frac{2 \times E_M}{U_{MAX}^2 - U_{NOM}^2}$$

where:

U_{MAX} = 53V is the over-voltage protection limit

U_{NOM} is the nominal motor supply voltage

E_M = the overall energy flowing back to the supply in Joules. In case of a rotary motor and load, E_M can be computed with the formula:

$$E_M = \underbrace{\frac{1}{2}(J_M + J_L)\varpi_M^2}_{\text{Kinetic energy}} + \underbrace{(m_M + m_L)g(h_{initial} - h_{final})}_{\text{Potential energy}} - \underbrace{3I_M^2 R_{Ph} t_d}_{\text{Copper losses}} - \underbrace{\frac{t_d \varpi_M}{2} T_F}_{\text{Friction losses}}$$

where:

J_M – total rotor inertia [kgm^2]

J_L – total load inertia as seen at motor shaft after transmission [kgm^2]

ϖ_M – motor angular speed before deceleration [rad/s]

m_M – motor mass [kg] – when motor is moving in a non-horizontal plane

m_L – load mass [kg] – when load is moving in a non-horizontal plane

g – gravitational acceleration i.e. 9.8 [m/s^2]

$h_{initial}$ – initial system altitude [m]

h_{final} – final system altitude [m]

I_M – motor current during deceleration [A_{RMS}/phase]

R_{Ph} – motor phase resistance [Ω]

t_d – time to decelerate [s]

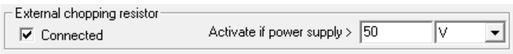
T_F – total friction torque as seen at motor shaft [Nm] – includes load and transmission

In case of a linear motor and load, the motor inertia J_M and the load inertia J_L will be replaced by the motor mass and the load mass measured in [kg], the angular speed ϖ_M will become linear speed measured in [m/s] and the friction torque T_F will become friction force measured in [N].

Option 2. Connect a chopping resistor R_{CR} between phase CR/B- and ground, and activate the software option of dynamic braking (see below).

This option is not available when the drive is used with a step motor.

The chopping resistor option can be found in the Drive Setup dialogue within EasyMotion / EasySetup.



The chopping will occur when DC bus voltage increases over U_{CHOP}. This parameter (U_{CHOP}) should be adjusted depending on the nominal motor supply. Optimally (from a braking point of view), U_{CHOP} should be a few volts above the maximum nominal supply voltage. This setting will activate the chopping resistor earlier, before reaching dangerous voltages – when the over-voltage protection will stop the drive. Of course, U_{CHOP} must always be less than U_{MAX} – the over-voltage protection threshold.

Remark: *This option can be combined with an external capacitor whose value is not enough to absorb the entire regenerative energy E_M but can help reducing the chopping resistor size.*

Chopping resistor selection

The chopping resistor value must be chosen to respect the following conditions:

1. to limit the maximum current below the drive peak current I_{PEAK} = 0.9A

$$R_{CR} > \frac{U_{MAX}}{I_{PEAK}}$$

2. to sustain the required *braking power*:

$$P_{CR} = \frac{E_M - \frac{1}{2}C(U_{MAX}^2 - U_{CHOP}^2)}{t_d}$$

where C is the capacitance on the motor supply (external), i.e:

$$R_{CR} < \frac{U_{CHOP}^2}{2 \times P_{CR}}$$

3. to limit the average current below the drive nominal current I_{NOM}=0.9A

$$R_{CR} > \frac{P_{CR} \times t_d}{t_{CYCLE} \times I_{NOM}^2}$$

where t_{CYCLE} is the time interval between 2 voltage increase cycles in case of repetitive moves.

4. to be rated for an average power $P_{AV} = \frac{P_{CR} \times t_d}{t_{CYCLE}}$ and a peak power $P_{PEAK} = \frac{U_{MAX}^2}{R_{CR}}$

Remarks:

1. *If* $\frac{U_{MAX}}{I_{PEAK}} > \frac{U_{CHOP}^2}{2 \times P_{CR}}$ *the braking power* P_{CR} *must be reduced by increasing either* t_d *– the time to decelerate or C – the external capacitor on the motor supply*
2. *If* $\frac{P_{CR} \times t_d}{t_{CYCLE} \times I_{NOM}^2} > \frac{U_{CHOP}^2}{2 \times P_{CR}}$ *either the braking power must be reduced (see Remark 1) or* t_{CYCLE} *– the time interval between chopping cycles must be increased*

	WARNING!	***THE CHOPPING RESISTOR MAY HAVE HOT SURFACES DURING OPERATION.***

3.4.9 Serial RS-232 connection

3.4.9.1 Serial RS-232 connection

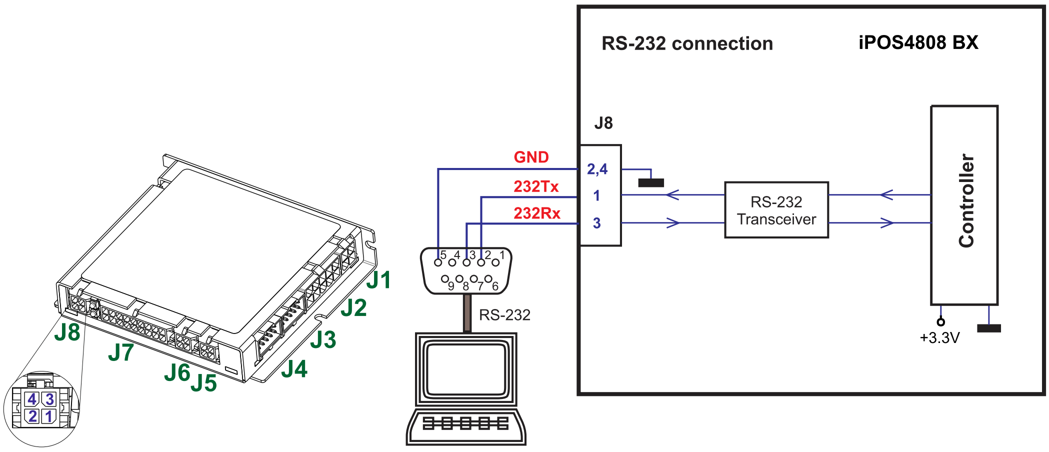


Figure 3.27. **Serial RS-232 connection**

3.4.9.2 Recommendation for wiring

a) If you build the serial cable, you can use a 3-wire shielded cable with shield connected to BOTH ends. Do not use the shield as GND. The ground wire must be included inside the shield, like the 232Rx and 232Tx signals
b) Always power-off all the iPOS4808 supplies before inserting/removing the RS-232 serial connector
c) Do not rely on an earthed PC to provide the iPOS4808 GND connection! The drive must be earthed through a separate circuit. Most communication problems are caused by the lack of such connection

3.4.10 CAN-bus connection

3.4.10.1 CAN connection

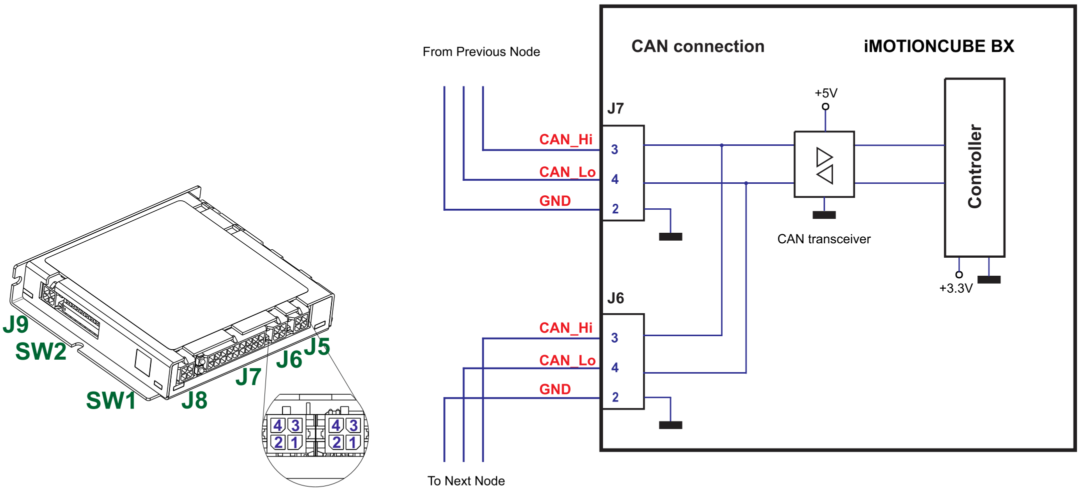


Figure 3.28. **CAN connection**

Remarks:

1. *The CAN network requires a 120-Ohm terminator. This is not included on the board. **Figure 3.29** shows how to connect it on your network*
2. *CAN signals are not insulated from other iPOS4808 circuits.*

3.4.10.2 Recommendation for wiring

a) Build CAN network using cables with twisted wires (2 wires/pair), with CAN-Hi twisted together with CAN-Lo. It is recommended but not mandatory to use a shielded cable. If so, connect the shield to GND. The cable impedance must be 105 ... 135 ohms (120 ohms typical) and a capacitance below 30pF/meter.

b) The 120Ω termination resistors must be rated at 0.2W minimum. Do not use winded resistors, which are inductive.

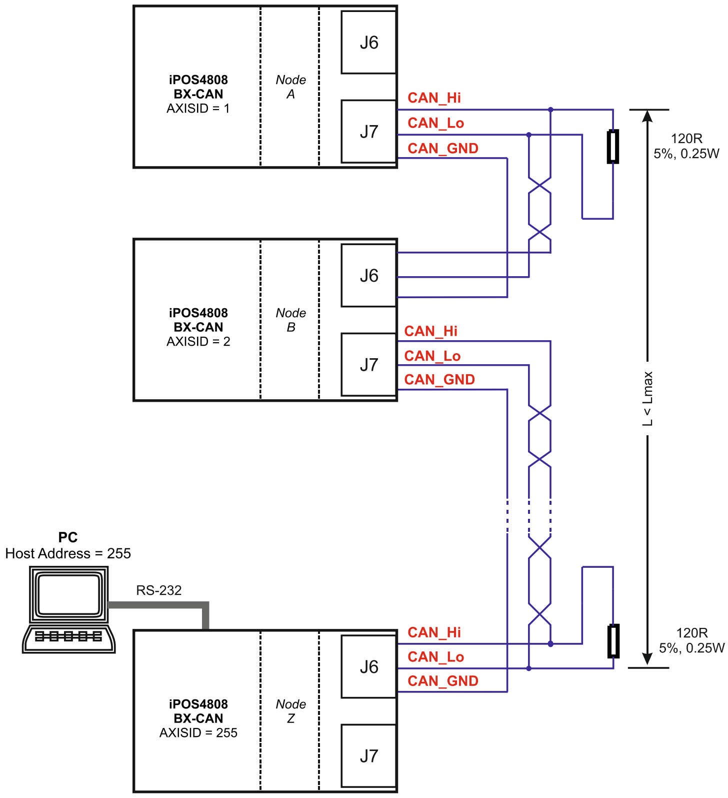


Figure 3.29. Multiple-Axis CAN network

3.4.11 Disabling Autorun

When an iPOS4808 BX-CAN is set in TMLCAN operation mode, by default after power-on it enters automatically in *Autorun* mode. In this mode, if the drive has in its local EEPROM a valid TML application (motion program), this is automatically executed as soon as the motor supply V_{MOT} is turned on.

In order to disable *Autorun* mode, there are 2 methods:

a) Software - by writing value 0x0001 in first EEPROM location at address 0x4000

b) Hardware1 – set the drive temporarily in CANopen mode. While in CANopen state, no motion will autorun. Set SW1 pin1 in down position.

c) Hardware2 – by temporary connecting all digital Hall inputs to GND, during the power-on for about 1 second, until the green LED is turned on, as shown in ***Figure 3.30***. This option is particularly useful when it is not possible to communicate with the drive.

After the drive is set in *non-Autorun/slave* mode using 2nd method, the 1st method may be used to invalidate the TML application from the EEPROM. On next power on, in absence of a valid TML application, the drive enters in the *non-Autorun/slave* mode independently of the digital Hall inputs status..

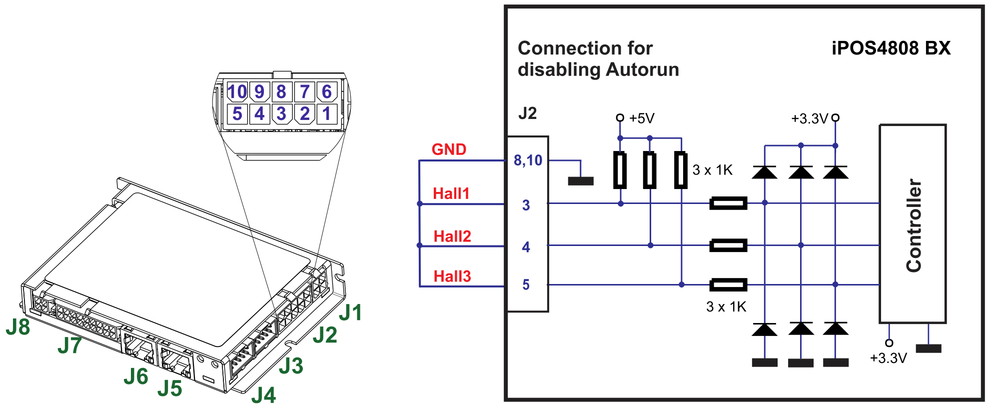
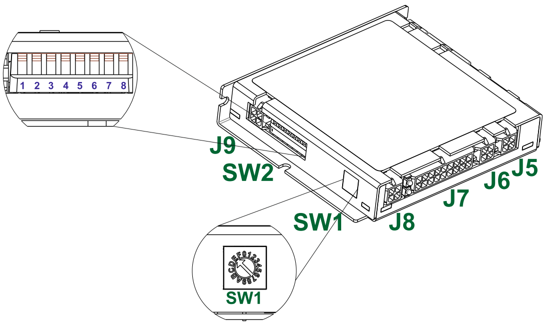


Figure 3.30. **Temporary connection during power-on to remove the drive from** Autorun **mode**

3.5 CAN Operation Mode and Axis ID Selection



3.5.1 Selection of the Operation Mode

On iPOS4808 BX-CAN, the selection of the operation mode CANopen or TMLCAN is done by setting the SW2 position 6 switch:

- CANopen mode, SW2 pin6 = ON (down position)
- TMLCAN mode, SW2 pin6 = OFF (up position)

3.5.2 Selection of the Axis ID

The Hardware Axis ID selection is done through the hex switch SW1. It contains numbers from 0x0 to 0xF. Depending on SW1 position, the axis ID will be:

SW1 position	AxisID in TMLCAN mode	AxisID in CANopen mode
0x0	255	LSS non-configured state
0x1	1	1
0x2	2	2
0x3	3	3
0x4	4	4
0x5	5	5
0x6	6	6
0x7	7	7
0x8	8	8
0x9	9	9
0xA	10	10
0xB	11	11
0xC	12	12
0xD	13	13
0xE	14	14
0xF	15	15

Note: LSS "non-configured" state, is a state in which the drive does not have assigned an active Axis ID while connected to the CAN network. In this mode the Axis ID for RS232 communication is 255. The Axis ID can be configured via a LSS master using CiA-305 protocol, which can set and save a new unique value. While the drive has a non-configured Axis ID, it cannot communicate with other drives in the network.

3.5.3 LED indicators

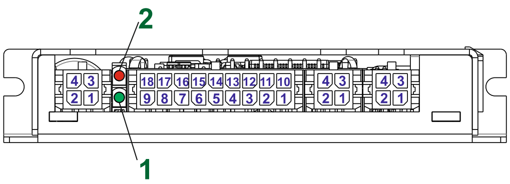


Figure 3.31. **LED indicators**

Table 3.1 – ***LED indicators***

LED no.	LED name	LED color	Function
1	Drive Ready	green	Lit after power-on when the drive initialization ends. Turned off when an error occurs.
2	Drive Error	red	Turned on when the drive detects an error condition or when OUT2/Error is set to +Vlog with OUT(2)=0 TML instruction.

3.6 Electrical Specifications

All parameters measured under the following conditions (unless otherwise specified):

- T_{amb} = 0…40°C, V_{LOG} = 24 V_{DC}; V_{MOT} = 48V_{DC}; Supplies start-up / shutdown sequence: -*any*-
- Load current (sinusoidal amplitude / continuous BLDC,DC,stepper) = 8A

3.6.1 Operating Conditions

		Min.	Typ.	Max.	Units
Ambient temperature[1]		0		+40	ºC
Ambient humidity	Non-condensing	0		90	%Rh
Altitude / pressure[2]	Altitude (referenced to sea level)	-0.1	0 ÷ 2.5	[2]	Km
	Ambient Pressure	0 [2]	0.75 ÷ 1	10.0	atm

3.6.2 Storage Conditions

		Min.	Typ.	Max.	Units
Ambient temperature		-40		105	ºC
Ambient humidity	Non-condensing	0		100	%Rh
Ambient Pressure		0		10.0	atm
ESD capability (Human body model)	Not powered; applies to any accessible part			±0.5	kV
	Original packaging			±15	kV

3.6.3 Mechanical Mounting

		Min.	Typ.	Max.	Units
Airflow		natural convection[3], closed box			

3.6.4 Environmental Characteristics

		Min.	Typ.	Max.	Units
Size (Length x Width x Height)	Without mating connectors		88.5 x 77 x 16.4		mm
			~3.48 x 3.03 x 0.65		inch
	With recommended mating connectors.		98 x 85 x 19.5		mm
			~3.86 x 3.35 x 0.77		inch
Weight	Without mating connectors		104		g
Power dissipation	Idle (no load)		3.4		W
	Operating		8.5		W
Efficiency			98		%
Cleaning agents	Dry cleaning is recommended		Only Water- or Alcohol- based		
Protection degree	According to IEC60529, UL508		IP20		-

3.6.5 Logic Supply Input (+V_{LOG})

		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	9		36	V_{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters	8		40	V_{DC}
	Absolute maximum values, continuous	-0.6		42	V_{DC}
	Absolute maximum values, surge (duration ≤ 10ms) †	-1		+45	V
	+V_{LOG} = 12V		130		mA
	+V_{LOG} = 24V		90	280	mA
	+V_{LOG} = 40V		85		mA

3.6.6 Motor Supply Input (+V_{MOT})

			Min.	Typ.	Max.	Units
Supply voltage	Nominal values		11		50	V_{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters		9		52	V_{DC}
	Absolute maximum values, continuous		-0.6		54	V_{DC}
	Absolute maximum values, surge (duration ≤ 10ms) †		-1		57	V
Supply current	Idle			1	5	mA
	Operating	iPOS4808	-20	±8	+20	A
	Absolute maximum value, short-circuit condition (duration ≤ 10ms) †	iPOS4808			26	A

[1] Operating temperature at higher temperatures is possible with reduced current and power ratings

[2] iPOS4808 can be operated in vacuum (no altitude restriction), but at altitudes over 2,500m, current and power rating are reduced due to thermal dissipation efficiency.

[3] In case of forced cooling (conduction or ventilation) the spacing requirements may drop down to mechanical tolerances as long as the ambient temperature is kept below the maximum operating limit

3.6.7 Motor Outputs (A/A+, B/A-, C/B+, CR/B-)

			Min.	Typ.	Max.	Units
Nominal output current, continuous	for DC brushed, steppers and BLDC motors with Hall-based trapezoidal control				8	A
	for PMSM motors with FOC sinusoidal control (sinusoidal amplitude value)				8	
	for PMSM motors with FOC sinusoidal control (sinusoidal effective value)				5.67	
Motor output current, peak	maximum 2.5s		-20		+20	A
Short-circuit protection threshold			±22	±26	±30	A
Short-circuit protection delay			5	10		μs
On-state voltage drop	Nominal output current; including typical mating connector contact resistance			±0.3	±0.5	V
Off-state leakage current				±0.5	±1	mA
Motor inductance (phase-to-phase)	Recommended value, for ripple ±5% of measurement range; $+V_{MOT}$ = 48 V	F_{PWM} = 20 kHz	330			μH
		F_{PWM} = 40 kHz	150			
		F_{PWM} = 60 kHz	120			
		F_{PWM} = 80 kHz	80			
		F_{PWM} = 100 kHz	60			
	Absolute minimum value, limited by short-circuit protection; $+V_{MOT}$ = 48 V	F_{PWM} = 20 kHz	120			μH
		F_{PWM} = 40 kHz	40			
		F_{PWM} = 60 kHz	30			
		F_{PWM} = 80 kHz	15			
		F_{PWM} = 100 kHz	8			
Motor electrical time-constant (L/R)	Recommended value, for ±5% current measurement error due to ripple	F_{PWM} = 20 kHz	250			μs
		F_{PWM} = 40 kHz	125			
		F_{PWM} = 60 kHz	100			
		F_{PWM} = 80 kHz	63			
		F_{PWM} = 100 kHz	50			
Current measurement accuracy (FS = Full Scale)				±4	±8	%FS

3.6.8 Digital Inputs (IN0, IN1, IN2/LSP, IN3/LSN, IN5, IN6)[1]

		Min.	Typ.	Max.	Units
Mode compliance		PNP			
Default state	Input floating (wiring disconnected)	Logic LOW			
Input voltage	Logic "LOW"	-10	0	2.2	V
	Logic "HIGH"	6.3		36	
	Floating voltage (not connected)		0		
	Absolute maximum, continuous	-10		+39	
	Absolute maximum, surge (duration ≤ 1s) †	-20		+40	
Input current	Logic "LOW"; Pulled to GND		0		mA
	Logic "HIGH"		1.3	2	
		Min.	**Typ.**	**Max.**	**Units**
Mode compliance		NPN			
Default state	Input floating (wiring disconnected)	Logic HIGH			
Input voltage	Logic "LOW"	-10		2.2	V
	Logic "HIGH"	6.3		36	
	Floating voltage (not connected)		3		
	Absolute maximum, continuous	-10		+36	
	Absolute maximum, surge (duration ≤ 1s) †	-20		+40	
Input current	Logic "LOW"; Pulled to GND	-1.6	0.6	1	mA
	Logic "HIGH"; Pulled to +24V	0	0	0.3	
Input frequency		0		150	kHz
Minimum pulse width		3.3			μs
ESD protection	Human body model	±2			kV

3.6.9 Digital Outputs (OUT0, OUT1, OUT2/Error, OUT3/ Ready, OUT4)

			Min.	Typ.	Max.	Units
Mode compliance	All outputs (OUT0, OUT1, OUT2/Error, OUT3/Ready)		NPN 24V			
Default state	Not supplied ($+V_{LOG}$ floating or to GND)		High-Z (floating)			
	Immediately after power-up	OUT0, OUT1,OUT4	Logic "HIGH"			
		OUT2/Error, OUT3/ Ready	Logic "LOW"			
	Normal operation	OUT0, OUT1, OUT2/Error, OUT4	Logic "HIGH"			
		OUT3/Ready	Logic "LOW"			
Output voltage	Logic "LOW"; output at nominal current				0.8	V
	Logic "HIGH"; output current = 0, no load	OUT2/Error, OUT3/ Ready	2.9	3	3.3	
		OUT0, OUT1, OUT4	4	4.5	5	
	Logic "HIGH", external load to $+V_{LOG}$			V_{LOG}		
	Absolute maximum, continuous		-0.5		$V_{LOG}+0.5$	
	Absolute maximum, surge (duration ≤ 1s) †		-1		$V_{LOG}+1$	
Output current	Logic "LOW", sink current, continuous OUT0, OUT1, OUT2, OUT3, OUT4				0.5	A
	Logic "LOW", sink current, pulse ≤ 5 sec. OUT0, OUT1, OUT2, OUT3, OUT4				1	A
	Logic "HIGH", source current; external load to GND; V_{OUT} >= 2.0V	OUT2/Error, OUT3/ Ready			2	mA
		OUT0, OUT1			4	mA
	Logic "HIGH", leakage current; external load to $+V_{LOG}$; $V_{OUT} = V_{LOG}$ max = 40V			0.1	0.2	mA
Minimum pulse width			2			μs
ESD protection - Human body model			±15			kV

[1] The digital inputs are software selectable as PNP or NPN

3.6.10 Digital Hall Inputs (Hall1, Hall2, Hall3)

		Min.	Typ.	Max.	Units
Mode compliance		TTL / CMOS / Open-collector			
Default state	Input floating (wiring disconnected)	Logic HIGH			
Input voltage	Logic "LOW"		0	0.8	V
	Logic "HIGH"	2	5		
	Floating voltage (not connected)		4.4		
	Absolute maximum, surge (duration ≤ 1s) †	-10		+15	
Input current	Logic "LOW"; Pull to GND			1.2	mA
	Logic "HIGH"; Internal 1KΩ pull-up to +5	0	0	0	
Minimum pulse width		2			μs
ESD protection	Human body model	±5			kV

3.6.11 Encoder #1 Inputs (A1+, A1-, B1+, B1-, Z1+, Z1-,)[1]

		Min.	Typ.	Max.	Units
Single-ended mode compliance	Leave negative inputs disconnected	TTL / CMOS / Open-collector			
Input voltage, single-ended mode A/A+, B/B+	Logic "LOW"			1.6	V
	Logic "HIGH"	1.8			
	Floating voltage (not connected)		3.3		
Input voltage, single-ended mode Z/Z+	Logic "LOW"			1.2	V
	Logic "HIGH"	1.4			
	Floating voltage (not connected)		4.7		
Input current, single-ended mode A/A+, B/B+, Z/Z+	Logic "LOW"; Pull to GND		5.5	6	mA
	Logic "HIGH"; Internal 2.2KΩ pull-up to +5	0	0	0	
Differential mode compliance	For full RS422 compliance, see [2]	TIA/EIA-422-A			
Input voltage, differential mode	Hysteresis	±0.06	±0.1	±0.2	V
	Differential mode	-14		+14	
	Common-mode range (A+ to GND, etc.)	-11		+14	
Input impedance, differential	A1+, A2+, B1+, B2+, Z1+, Z2+		2.2		kΩ
	A1-, A2-, B1-, B2-, Z1-, Z2-		1.6		
	Differential mode	0		10	MHz
	Differential mode	50			ns
ESD protection	Human body model	±1			kV

3.6.12 Encoder #2 Inputs (A2+, A2-, B2+, B2-, Z2+, Z2-)[3]

		Min.	Typ.	Max.	Units
Differential mode compliance		TIA/EIA-422-A			
Input voltage, differential mode	Hysteresis	±0.06	±0.1	±0.2	V
	Differential mode	-14		+14	
	Common-mode range (A+ to GND, etc.)	-11		+14	
Input impedance, differential			120		Ω
	Differential mode	0		10	MHz
	Differential mode	50			ns
ESD protection	Human body model	±1			kV

3.6.13 Linear Hall Inputs (LH1, LH2, LH3) [4]

		Min.	Typ.	Max.	Units
Input voltage	Operational range	0	0.5÷4.5	4.9	V
	Absolute maximum values, continuous	-7		+7	
	Absolute maximum, surge (duration ≤ 1s) †	-11		+14	
Input current	Input voltage 0…+5V	-1	±0.9	+1	mA
Interpolation Resolution	Depending on software settings			11	bits
Frequency		0		1	kHz
ESD protection	Human body model	±1			kV

3.6.14 Sin-Cos Encoder Inputs (Sin+, Sin-, Cos+, Cos-)[5]

		Min.	Typ.	Max.	Units
Input voltage, differential	Sin+ to Sin-, Cos+ to Cos-		1	1.25	V_{PP}
Input voltage, any pin to GND	Operational range	-1	2.5	4	V
	Absolute maximum values, continuous	-7		+7	
	Absolute maximum, surge (duration ≤ 1s) †	-11		+14	
Input impedance	Differential, Sin+ to Sin-, Cos+ to Cos-	4.2	4.7		kΩ
	Common-mode, to GND		2.2		kΩ
Resolution with interpolation	Software selectable, for one sine/cosine period	2		10	bits
Frequency	Sin-Cos interpolation	0		450	kHz
	Quadrature, no interpolation	0		10	MHz
ESD protection	Human body model	±2			kV

[1] Encoder #1 differential input pins needs termination resistors connected across; set SW2 pins 3,4 and 5 to ON
[2] For full RS-422 compliance, 120Ω termination resistors must be connected across the differential pairs, set SW2 pins 3,4 and 5 to ON. See Differential Incremental Encoder #1 Connection chapter
[3] Encoder #2 differential input pins have internal 120Ω termination resistors connected across
[4] Linear hall inputs are available only with P027.314.E701
[5] For many applications, a termination resistor should be connected across SIN+ to SIN-, and across COS+ to COS-. This can be achieved by setting SW2 pins 3,4 and 5 to ON. Please consult the feedback device datasheet for confirmation.

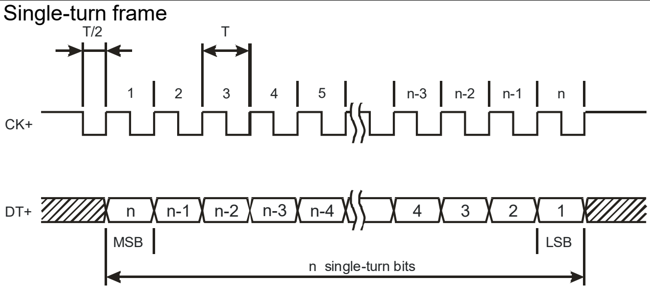
3.6.15 CAN-BUS

		Min.	Typ.	Max.	Units
Standards compliance		ISO11898, CiA 301v4.2, CiA WD 305 v2.2.13, CiA DSP402v3.0			
Bit rate	Depending on software settings	125		1000	Kbps
Bus length	1Mbps			25	m
	500Kbps			100	
	≤ 250Kbps			250	
Number of CAN nodes/drives				125	-
Termination resistor	Between CAN-Hi, CAN-Lo	none on-board			
Node addressing	Hardware: by Hex switch (SW1)	1 ÷ 15 & LSS non-configured (CANopen); 1-15 & 255 (TMLCAN)			
	Software	1 ÷ 127 (CANopen); 1- 255 (TMLCAN)			
Voltage, CAN-Hi or CAN-Lo to GND		-26		-26	V
ESD protection	Human body model	±15			KV

3.6.16 SSI / EnDAT[1] encoder interface

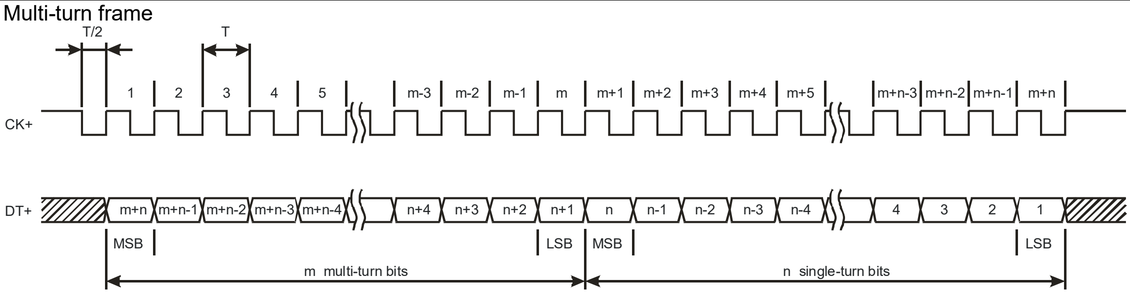
		Min.	Typ.	Max.	Units
Differential mode compliance (CLOCK, DATA) [1]		TIA/EIA-422			
CLOCK Output voltage	Differential; 50Ω differential load	2.0	2.5	5.0	V
	Common-mode, referenced to GND	2.3	2.5	2.7	
CLOCK frequency	Software selectable	1000, 2000, 3000			kHz
DATA Input hysteresis	Differential mode	±0.1	±0.2	±0.5	V
Data input impedance	Termination resistor on-board		120		Ω
DATA Input common mode range	Referenced to GND	-7		+12	V
	Absolute maximum, surge (duration ≤ 1s) †	-25		+25	
DATA format	Software selectable	Binary / Gray			
		Single-turn / Multi-turn			
		Counting direction			
DATA resolution	Total resolution (single turn or single turn + multi turn)			31	bit

Single-turn frame



CK- and DT- signals have the same form with CK+ and DT+, but with opposite polarity.

Multi-turn frame



CK- and DT- signals have the same form with CK+ and DT+, but with opposite polarity.

3.6.17 BiSS Encoder Interface

		Min.	Typ.	Max.	Units
Differential mode compliance (CLOCK, DATA)		TIA/EIA-422			
CLOCK Output voltage	Differential; 50Ω differential load	2.0	2.5	5.0	V
	Common-mode, referenced to GND	2.3	2.5	2.7	
CLOCK frequency	Software selectable	1000, 2000, 3000, 4000			kHz
DATA Input hysteresis	Differential mode	±0.1	±0.2	±0.5	V
Data input impedance	Termination resistor on-board		120		Ω
DATA Input common mode range	Referenced to GND	-7		+12	V
	Absolute maximum, surge (duration ≤ 1s) †	-25		+25	
	Software selectable	Single-turn / Multi-turn			
		Counting direction			
DATA resolution	Total resolution (single turn or single turn + multi turn)			31	bit
Protocol		BiSS C mode (sensor mode)			

[1] EnDAT 2.2 protocol available starting with F514K firmware version

3.6.18 Analog 0…5V Inputs (REF, FDBK)

		Min.	Typ.	Max.	Units
Input voltage	Operational range	0		5	V
	Absolute maximum values, continuous	-12		+18	
	Absolute maximum, surge (duration ≤ 1s) †			±36	
Input impedance	To GND		30		kΩ
Resolution			12		bits
Integral linearity				±2	bits
Offset error			±2	±10	bits
Gain error			±1%	±3%	% FS[1]
Bandwidth (-3dB)	Software selectable	0		1	kHz
ESD protection	Human body model	±2			kV

3.6.19 RS-232

		Min.	Typ.	Max.	Units
Standards compliance		TIA/EIA-232-C			
Bit rate	Depending on software settings	9600		115200	Baud
Short-circuit protection	232TX short to GND	Guaranteed			
ESD protection	Human body model	±2			kV

3.6.20 Supply Output (+5V)

		Min.	Typ.	Max.	Units
+5V output voltage	Current sourced = 250mA	4.8	5	5.2	V
+5V output current	iPOS4808 BX-CAN-STO	200	250		
Short-circuit protection		Yes			
Over-voltage protection		NOT protected			
ESD protection	Human body model	±2			kV

3.6.21 [2]Safe Torque OFF (STO1+; STO1-; STO2+; STO2-)

		Min.	Typ.	Max	Units
Safety function	According to EN61800-5-2	STO (Safe Torque OFF)			
EN 61800-5-1/ -2 and EN 61508-5-3/ -4 Classification	Safety Integrity Level	safety integrity level 3 (SIL3)			
	PFHd (Probability of Failures per Hour - dangerous)	$8*10^{-10}$	$hour^{-1}$ (0.8 FIT)		
EN13849-1 Classification	Performance Level	Cat3/PLe			
	MTTFd (meantime to dangerous failure)	377	years		
Mode compliance		PNP			
Default state	Input floating (wiring disconnected)	Logic LOW			
Input voltage	Logic "LOW" (PWM operation disabled)	-20		5.6	V
	Logic "HIGH" (PWM operation enabled)	18		36	
	Absolute maximum, continuous	-20		+40	
Input current	Logic "LOW"; pulled to GND		0		mA
	Logic "HIGH", pulled to +Vlog		5	13	
Repetitive test pulses	Ignored high-low-high			5	ms
				20	Hz
Fault reaction time	From internal fault detection to register DER bit 14 =1 and OUT2/Error high-to-low			30	ms
PWM operation delay	From external STO low-high transition to PWM operation enabled			30	ms
ESD protection	Human body model	±2			kV

3.6.22 [3] Enable circuit (ENA1, ENA2)

		Min.	Typ.	Max	Units
Enable function	Disables motor power when either ENA1 or ENA2 is disconnected from the power source				
Mode compliance		PNP			
Default state	Input floating (wiring disconnected)	Logic LOW			
Input voltage	Logic "LOW"	-36	0	8	V
	Logic "HIGH"	18	24	36	
	Absolute maximum, continuous	-50		+50	
Input current	Logic "LOW"; pulled to GND		0		mA
	Logic "HIGH", pulled to +24V		2	2.5	
Pulse duration	Ignored low-high-low			TBD	ms
	Ignored high-low-high			TBD	
	Accepted pulse	TBD			
ESD protection	Human body model	±2			kV

† Stresses beyond values listed under "absolute maximum ratings" may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

[1] "FS" stands for "Full Scale"
[2] STO inputs are available only for iPOS4808 BX-CAN-STO
[3] ENABLE inputs are available only for iPOS4808 BX-CAN

3.6.23 iPOS4808 BX-CAN / -STO Derating curves

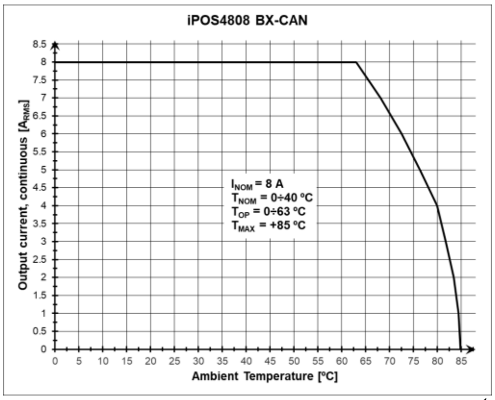


Figure 1. *iPOS4808 BX De-rating with ambient temperature*[1]

C

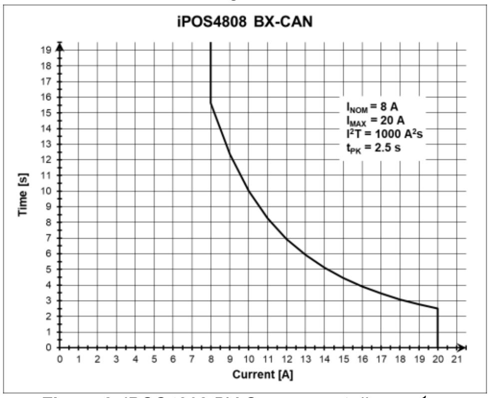


Figure 2. *iPOS4808 BX Over-current diagram*[1]

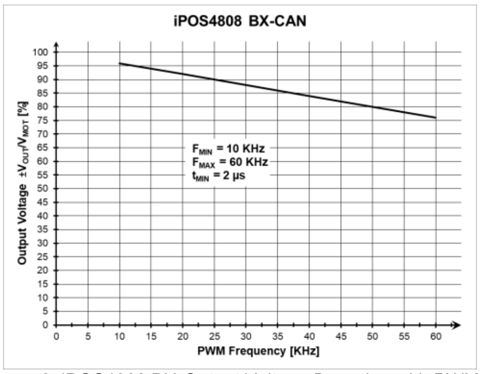


Figure 3. iPOS4808 BX *Output Voltage De-rating with PWM frequency*[1]

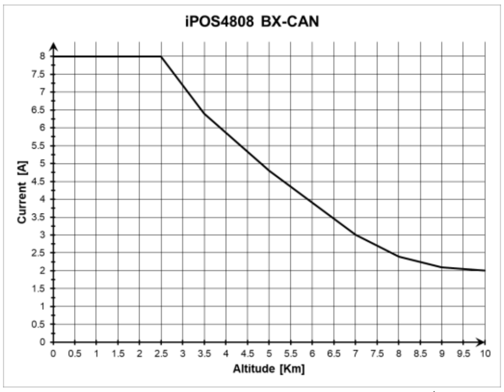


Figure 4. iPOS4808 BX *De-rating with altitude*[1]

4 Memory Map

iPOS4808 BX-CAN has 2 types of memory available for user applications: 16K×16 SRAM and up to 16K×16 serial E^{2}ROM.

The SRAM memory is mapped in the address range: C000h to FFFFh. It can be used to download and run a TML program, to save real-time data acquisitions and to keep the cam tables during run-time.

The E^{2}ROM is mapped in the address range: 4000h to 7FFFh. It is used to keep in a non-volatile memory the TML programs, the cam tables and the drive setup information.

Remark: *EasyMotion Studio handles automatically the memory allocation for each motion application. The memory map can be accessed and modified from the main folder of each application*

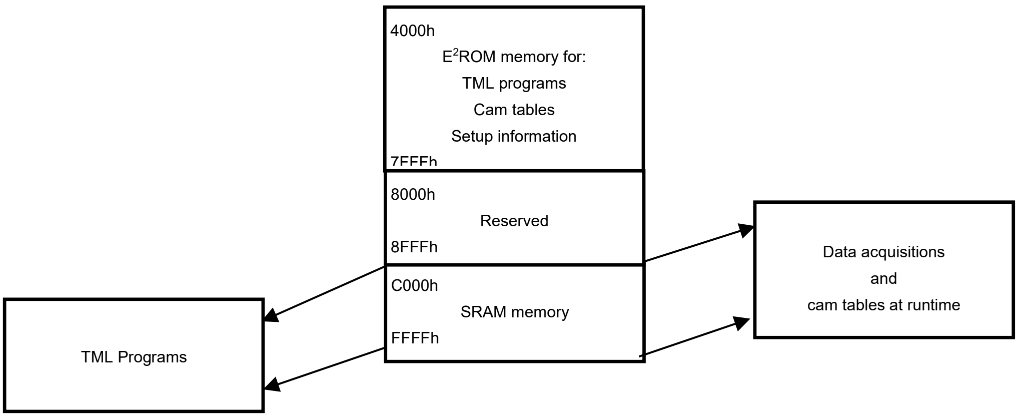


Figure 7.1. *iPOS4808 BX-CAN Memory Map*

[1] Measured under the following conditions: BLDC; Vmot=48V, Vlog=24V, PWM=20kHZ

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