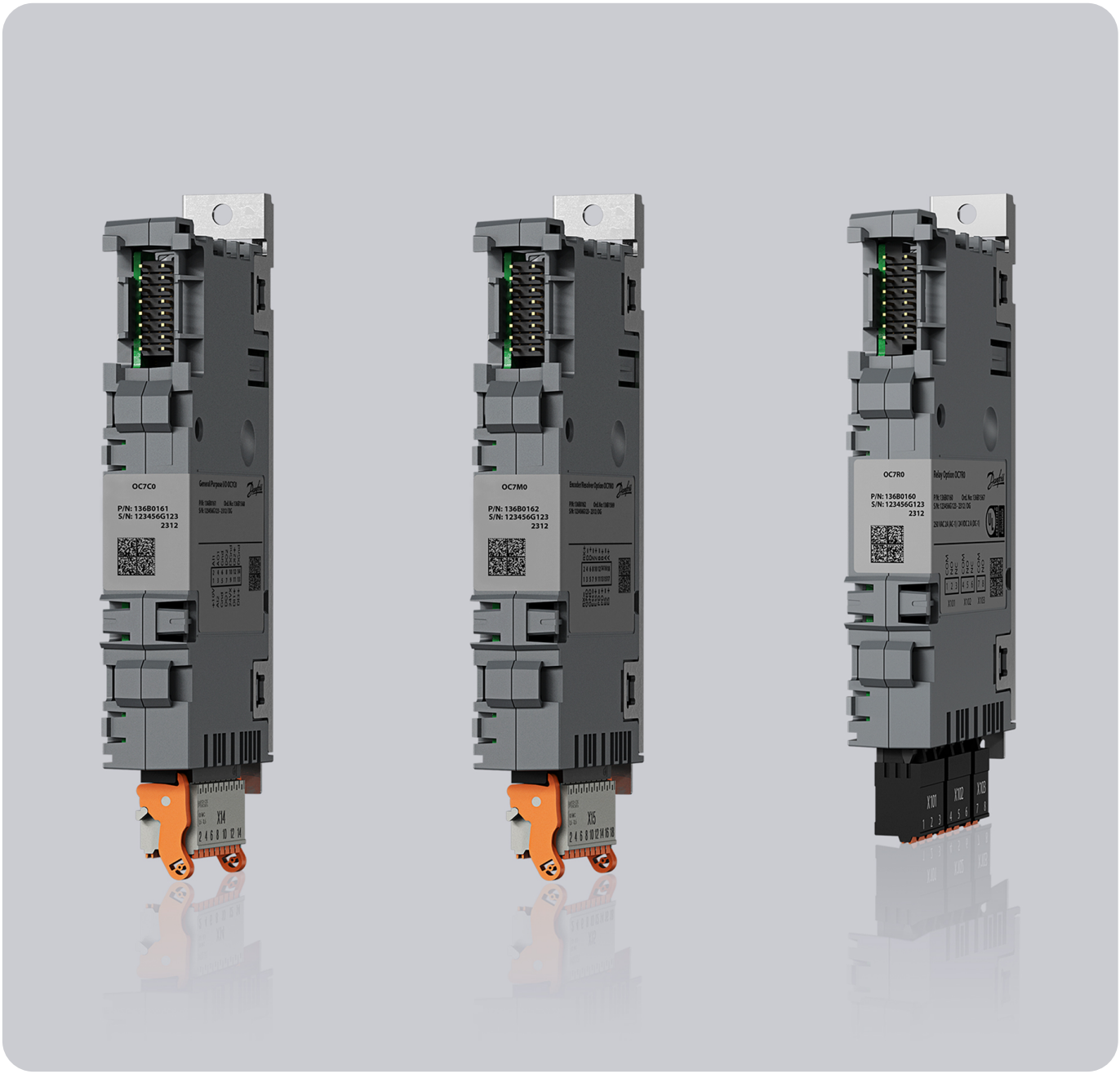
Operating Guide

B&P Elektromotoren
Functional Extension Options
iC7 Series



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1 Introduction

1.1 Purpose of the Operating Guide

This operating guide provides information for safe installation, commissioning, and operation of functional extensions used with iC7 drives.

This guide is intended for use by qualified personnel only. Read and follow the operating instructions to use the drive safely and professionally, and pay particular attention to the safety instructions and general warnings. Keep this operating guide available with the drive at all times.

1.2 Additional Resources

Additional resources are available to help understand the features, and safely install and operate the iC7 products:

- Safety guides, which provide important safety information related to installing iC7 drives.
- Installation guides, which cover the mechanical and electrical installation of drives, or functional extension options.
- Operating guides, which include instructions for control options and other components for the drive.
- Application guides, which provide instructions on setting up the drive for a specific end use. Application guides for application software packages also provide an overview of the parameters and value ranges for operating the drives, configuration examples with recommended parameter settings, and troubleshooting steps.
- *Facts Worth Knowing about AC Drives*, available for download on www.danfoss.com.
- Other supplemental publications, drawings, and guides are available at www.danfoss.com.

Latest versions of Danfoss product guides are available for download at www.danfoss.com/en/service-and-support/documentation/.

1.3 Version History

This guide is regularly reviewed and updated. All suggestions for improvement are welcome. The original language of this guide is English.

Table 1: Version History

Version	Remarks
AQ390830267692, version 1201	Updates regarding Encoder/Resolver Option OC7M0 features.
AQ390830267692, version 1101	Added information on configurations using digital inputs with PNP, NPN, and Pt100 sensors with General Purpose Option OC7C0. Added information on encoder termination and automatic readout of encoder data for Encoder/Resolver Option OC7M0.
AQ390830267692, version 1001	Added information on Digital 230 V AC Input OC7D0 option and on linear encoder support for Encoder/Resolver Option OC7M0.
AQ390830267692, version 0901	Information on support for more Encoder/Resolver device types added.
AQ390830267692, version 0801	Information on support for more Encoder/Resolver device types added.
AQ390830267692, version 0701	Information on option slot addressing in systems with modular control and on configuring Temperature Measurement OC7T0 added.
AQ390830267692, version 0601	Information on configuring General Purpose Option OC7C0 added. Information on support for more Encoder/Resolver device types added.
AQ390830267692, version 0501	Information on configuring Relay Option OC7R0 added.
AQ390830267692, version 0401	Information on support for SinCos encoders added.

Table 1: Version History - (continued)

Version	Remarks
AQ390830267692, version 0301	Updates regarding electrical specifications, and the default value and available selections of parameter ***9.6.6 BiSS/SSI Clock Rate***.
AQ390830267692, version 0201	Updates regarding Encoder/Resolver Option OC7M0 features.
AQ390830267692, version 0101	First version. The information in this version is valid for Encoder/Resolver Option OC7M0 installed in iC7-Automation frequency converters.

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2 Safety

2.1 Safety Symbols

The following symbols are used in Danfoss documentation and products.

⚠ DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates information considered important, but not hazard-related (for example, messages relating to property damage).

	ISO warning symbol for general warnings
	ISO warning symbol for hot surfaces and burn hazard
	ISO warning symbol for high voltage and electric shock
	Symbol for indicating the required discharge time of the capacitors in the product.
	ISO action symbol for referring to the instructions

2.2 Safety and Installation Awareness

Before starting installation, read all safety guidelines and precautions related to installing functional extensions.

For more information on functional extension selection and functional extension slots in the drives, see the product-specific design guides. Supplemental information and other iC7 guides can be downloaded from https://www.danfoss.com/en/service-and-support/documentation/.

3 Installation

3.1 Verifying the Shipment and the Contents

1. Make sure that the items supplied and the information on the product label correspond to the order confirmation.

   The product label is placed on the front and right side of the option casing.

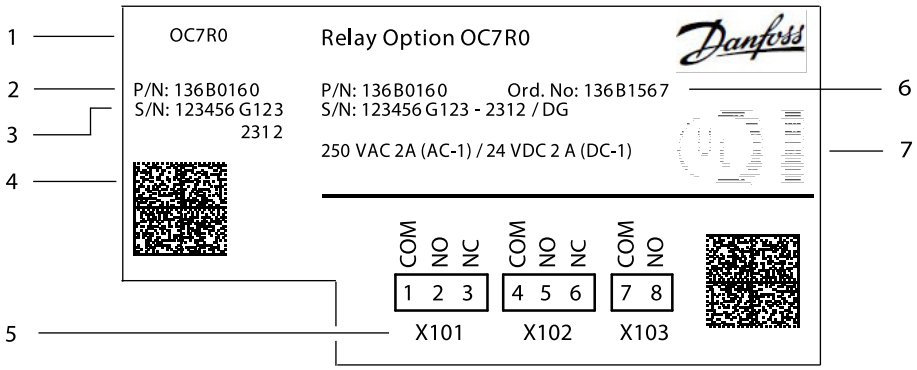


Figure 1: Example of a Product Label

1	Product name of the functional extension	2	Code number identifying the option
3	Serial number	4	2D code containing code number, serial number, production year and week, and product name.
5	Identification of I/O connections on the option	6	Order number identifying the option kit that was ordered
7	Compliance and approval markings (if not covered by drive approvals).		

3.2 Items Supplied

Functional extension options can be ordered as a preinstalled option by using the dedicated model code, or as a separate option for field mounting by using the code number.

When the option is not mounted at the factory, the following items are included in the shipment:

- Option board + connector(s)
- EMC plate
- Screw
- Option connector
- Metal clamp
- Installation guide

3.3 Required Tools

- Torx 20 screwdriver for mounting EMC plate Slot C-E.
- Slotted screwdriver (maximum 3 mm) for releasing the spring-loaded terminals of the plug connector.
- Wire crimpers may be needed for certain encoder cable types.

3.4 Installing Functional Extensions in Frequency Converters

The instructions in this chapter apply to frequency converters with an integrated control board.

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DANGER



SHOCK HAZARD FROM THE DRIVE

Touching electrical parts of the drive can cause death or serious injury even after the equipment has been disconnected from AC or DC supply.

- Perform the following steps before touching any internal components:

  Disconnect the AC or DC supply from the drive.

  Disconnect the devices from the drive output.

  If there is a brake option, disconnect the brake.

  If there is a load share/regeneration option, disconnect it.

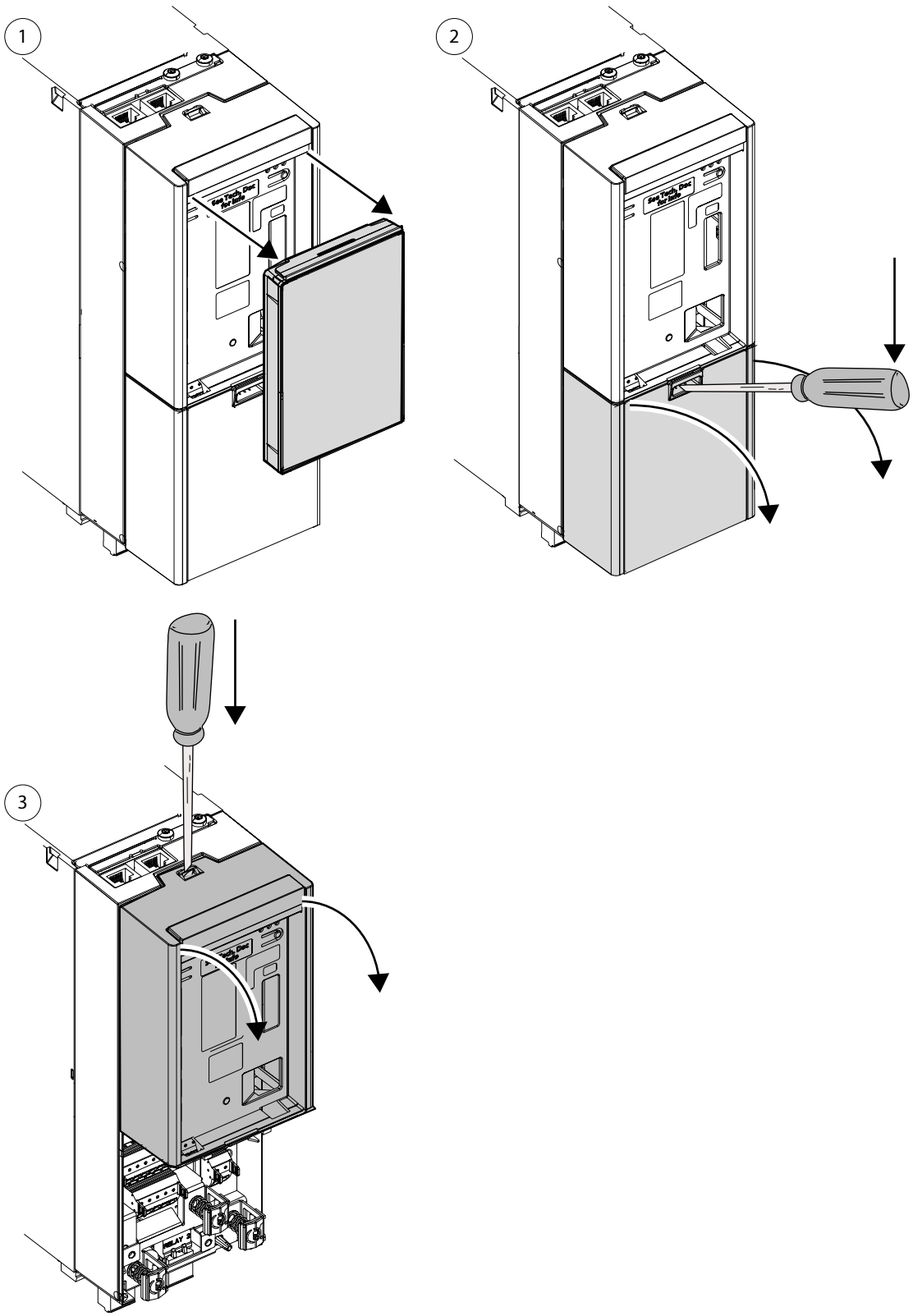
  Wait for the capacitors to discharge fully. Refer to the label on the drive for the correct discharge time.

  Use a voltage meter to ensure that the capacitors in the drive have discharged fully.

NOTE: The Encoder/Resolver Option OC7M0 must be installed in option slot A.

For more information on option slot locations in frequency converters, refer to the product-specific design guide. For information on slot identification in software, refer to the application guide.

1. Remove the control panel, terminal cover, and control panel cradle.



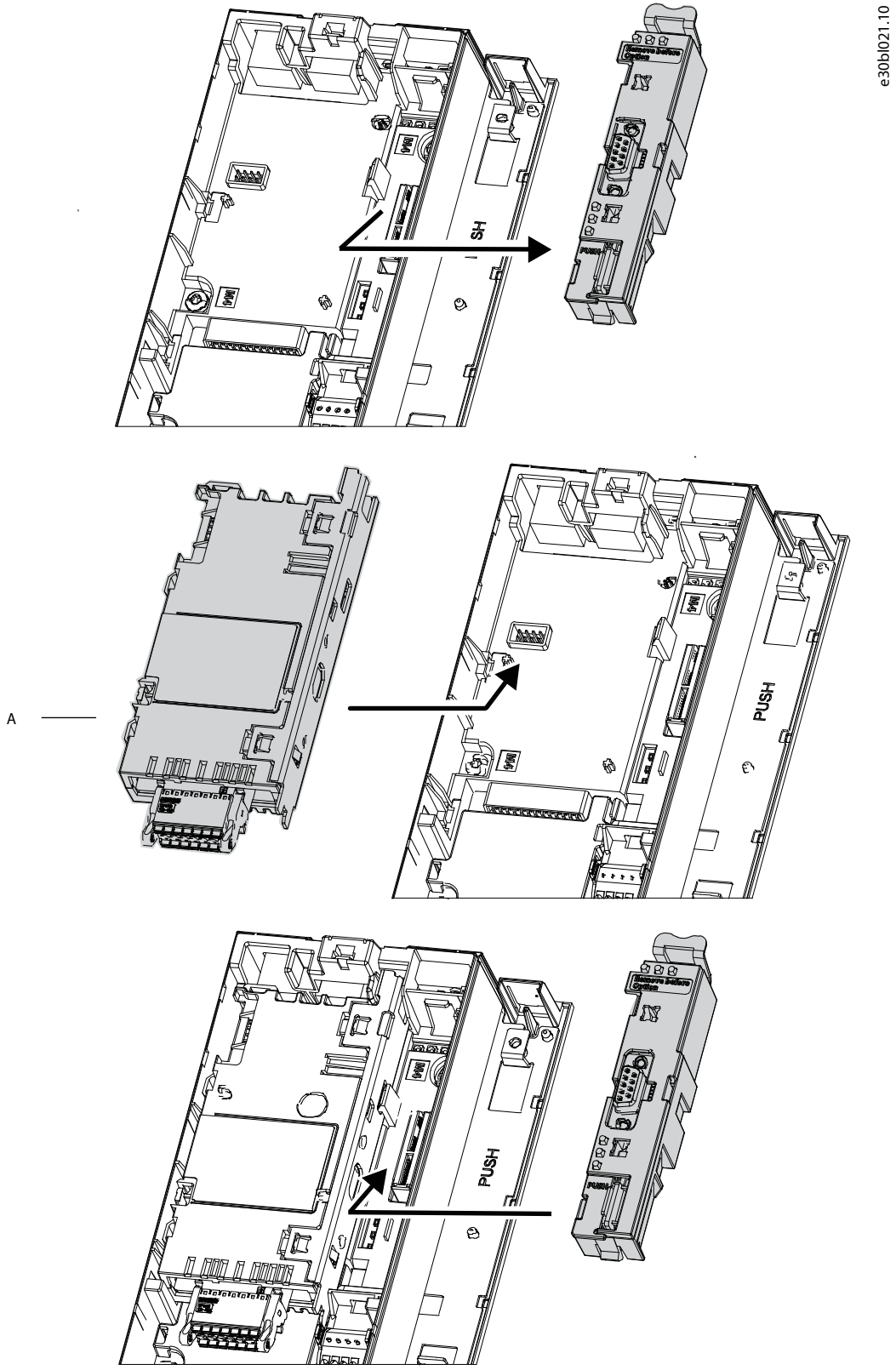
2. Remove the interface board, place the option board in the slot, and reinstall the interface board.

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NOTICE

The interface boards are not interchangeable between drives.

- The interface board must be reinstalled in the same drive it was removed from.



3.5 Installing Boards to the Modular Control Unit

Use these instructions to install a board, for example an option board, to the mounting plate of the modular control unit.

NOTICE

DAMAGE TO OPTION BOARDS

Do not install, remove, or replace option boards on the drive when the power is on. Doing this can cause damage to the boards.

- Switch off the drive before installing, removing, or replacing option boards on the drive.

1. Remove the screw that is pre-attached to the fixing point at the top of the mounting plate and keep it.
2. Slide the lower edge of the board to the mounting plate fixing point.

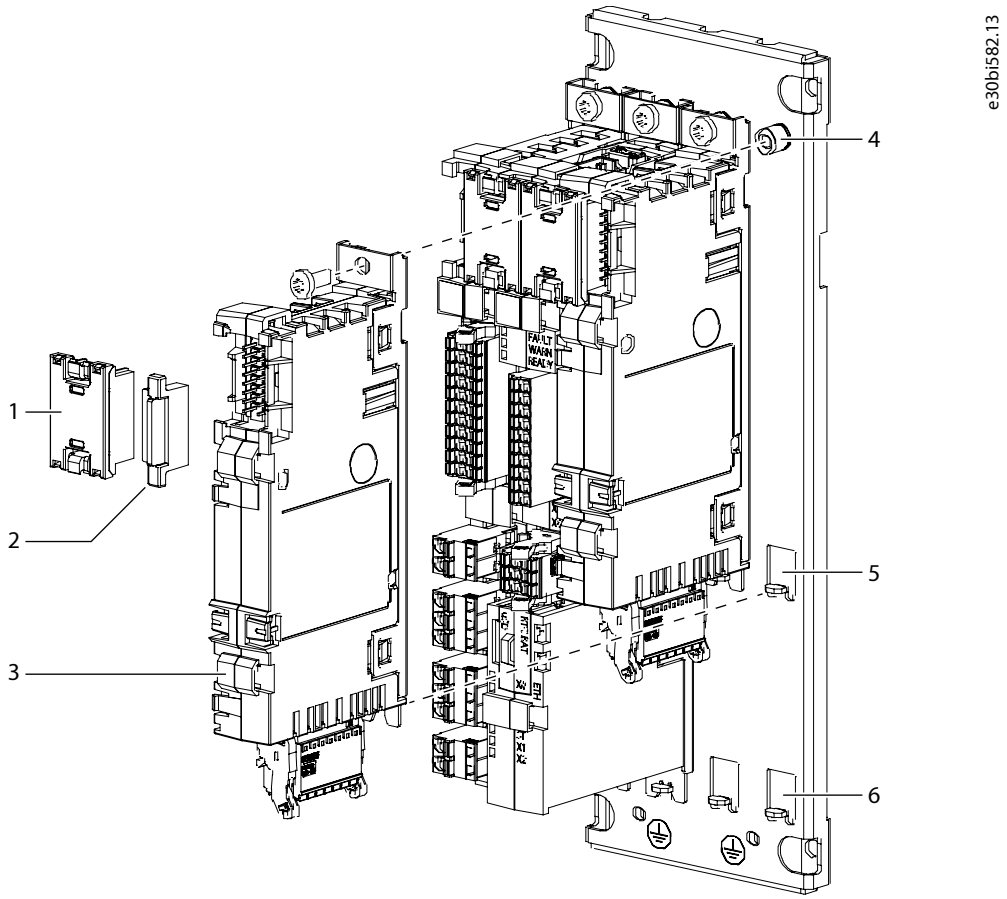


Figure 2: Installing a Board to the Modular Control Unit Mounting Plate

1	Option connector	2	Option terminal cover
3	Option board	4	Fixing point at the top
5	Fixing point at the middle	6	Fixing point at the bottom

3. Use the screw to attach the board to the fixing point at the top.
4. Attach an option connector to the newly installed board and the board next to it.
5. Attach option terminal covers to the empty terminals.

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4 Configuration

4.1 Overview

The parameters related to functional extensions are in parameter group 9, called ***I/O***. Parameters are dependent on the mounting and appear in the parameter menu after the functional extension has been mounted and wired.

4.2 Option Slot Addressing in Systems with Integrated Control

Functional extension options are positioned in the physical slots A, B, C, D, or E, depending on the drive frame as shown in Figure 3. When referred to in the software, the option uses a different name for the software address. The 1st slot position with an installed option is always addressed as 2.01, the 2nd position as 2.02, and so on, regardless of which option slot the 1st option is installed in.

Table 2: Physical Option Slot and Its Software Address in Systems with Integrated Control

Slots	Software address			
	2.01	2.02	2.03	2.04
A	A (2.01)	–	–	–
C	C (2.01)	–	–	–
AB	A (2.01)	B (2.02)	–	–
AC	A (2.01)	C (2.02)	–	–
CD	C (2.01)	D (2.02)	–	–
ABC	A (2.01)	B (2.02)	C (2.03)	–
ACD	A (2.01)	C (2.02)	D (2.03)	–
CDE	C (2.01)	D (2.02)	E (2.03)	–
ACDE	A (2.01)	C (2.02)	D (2.03)	E (2.04)

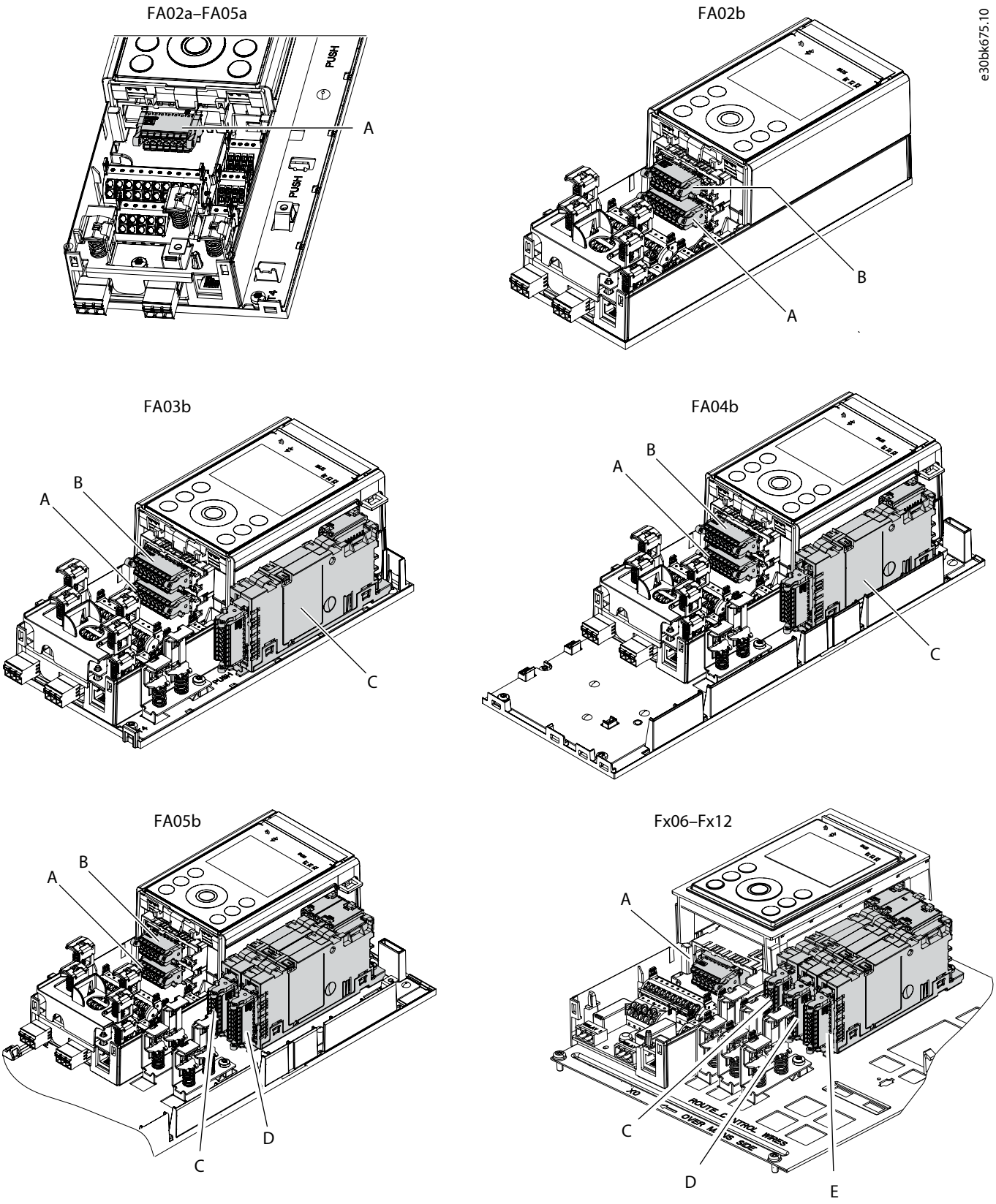


Figure 3: Option Slot Locations in iC7 Frequency Converters

4.3 Option Slot Addressing in Systems with Modular Control Unit

The physical slots 1 and 2 on the modular control unit are reserved for default control unit components. Functional extension options are positioned in the physical slots A–H as shown in Figure 4.

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When referred to in the software, the option uses a different name for the software address. The 1st slot position with an installed option is always addressed as 201, the 2nd position as 202, and so on, regardless of which option slot the 1st option is installed in. Software address 101 is reserved for default control unit components.

Table 3: Physical Option Slot and Its Software Address in Systems with Modular Control Unit

Software address	101	101	201	202	203	204	205	206	207	208
Slot	1	2	A	B	C	D	E	F	G	H

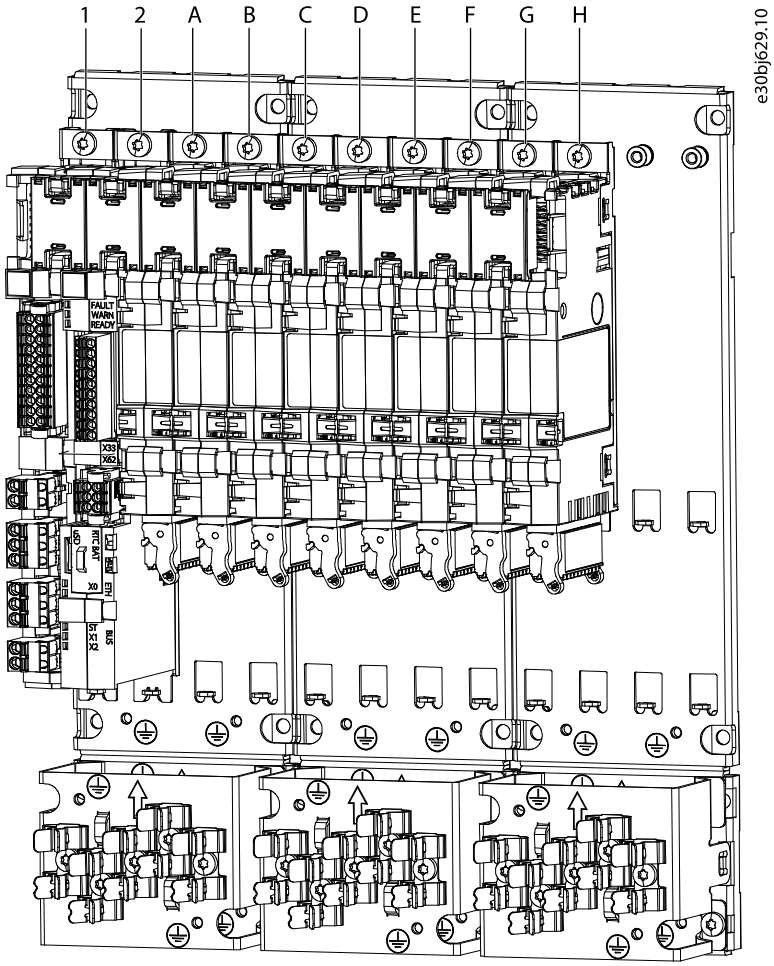


Figure 4: Option Slot Locations in Systems with Modular Control Unit

5 Encoder/Resolver Option OC7M0 Installation and Configuration

5.1 Overview

The OC7M0 Encoder/Resolver option supports various speed/position feedback or reference devices, including rotary and linear encoders, with the same signals and protocols. For detailed information on linear encoders, see 5.7.1 Overview.

It also has a TTL encoder output, which can be used to represent the position of device 1, virtual master, or position values such as ***Demanded*** or ***Actual Position*** provided by the drive. There are 4 tracks (A, B, Z, and D) which can be configured for the connection of 1 or 2 devices in different combinations. Valid combinations of devices are listed in Table 4. If an invalid combination is selected, the control panel and MyDrive® Insight show a pop-up message about the incompatibility of the selected devices.

Table 4: Encoder/Resolver Interface Configurations

Device 1 (parameter ***9.4.3 Interface Configuration for Device 1***)	Device 2 (parameter ***9.4.6 Interface Configuration for Device 2***)
Disabled	Virtual encoder output on A and B
Incremental encoder on A and B	• Disabled • Incremental (TTL) encoder on Z and D • Virtual output on Z and D
Incremental encoder on A, B, and Z	Disabled
Resolver on A and B	• Disabled • Incremental (TTL) encoder on Z and D • Device 1 mirrored as output on Z and D • Virtual output on Z and D
SinCos encoder on A and B	• Disabled • Incremental (TTL) encoder on Z and D • Device 1 mirrored as output on Z and D • Virtual output on Z and D
SinCos encoder an A, B, and Z	Disabled
SSI absolute encoder on Z and D	• Disabled • Incremental encoder on A and B • Resolver on A and B • SinCos encoder on A and B • Device 1 mirrored as output on A and B • Virtual output on A and B
SSI absolute encoder on Z and D with incremental or SinCos track on A and B	Disabled
EnDat absolute encoder on Z and D	• Disabled • Incremental encoder on A and B • Resolver on A and B • SinCos encoder on A and B • Device 1 mirrored as output on A and B • Virtual output on A and B
EnDat absolute encoder on Z and D with incremental or SinCos track on A and B	Disabled
HIPERFACE® absolute encoder on A, B, and D	Disabled

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Table 4: Encoder/Resolver Interface Configurations - (continued)

Device 1 (parameter ***9.4.3 Interface Configuration for Device 1***)	Device 2 (parameter ***9.4.6 Interface Configuration for Device 2***)
HIPERFACE DSL® absolute encoder on D	• Disabled • Incremental encoder on A and B • Incremental encoder on A, B, and Z • SinCos encoder on A and B • SinCos encoder on A, B, and Z • Device 1 mirrored as output on A and B • Virtual output on A and B
BiSS absolute encoder on Z and D	• Disabled • Incremental encoder on A and B • Resolver on A and B • SinCos encoder on A and B • Device 1 mirrored as output on A and B • Virtual output on A and B
BiSS absolute encoder on Z and D with incremental or SinCos track on A and B	Disabled

NOTE: Supported signals for incremental encoder are:

- TTL differential
- TTL single line
- HTL differential
- HTL single line

Adjustable encoder voltage supply is available 5–24 V with the possibility of feedback enabling monitoring and compensation for cable voltage drop. The voltage level is set with parameter ***9.4.1 Encoder Supply Voltage***.

NOTICE

Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.

Resolver supply/excitation is available with adjustable voltage and frequency by parameters ***9.7.1 Excitation Voltage*** and ***9.7.2 Excitation Frequency***.

5.2 Encoder Termination

Each of the 4 tracks (A, B, Z, and D) has a termination resistor, which is enabled or disabled depending on the selected interface configuration for device 1 (parameter ***9.4.3 Interface Configuration for Device 1***) and device 2 (parameter ***9.4.6 Interface Configuration for Device 2***). The termination is a 120 Ω resistor connected between + and – on each track.

The termination can also be enabled or disabled manually via parameters ***9.5.2 Encoder Termination for Device 1*** and ***9.5.4 Encoder Termination for Device 2***. Termination is enabled by default and must be disabled for HTL incremental encoders as voltage > 6.95 V overloads the termination resistor. If the voltage exceeds 6.95 V while termination is enabled, the termination is disabled and the drive issues a fault (***Feedback Option Fault***). Bits 8, 9, 10, and 11 of parameter ***9.1.9 Encoder Status Word*** indicate overload for tracks A, B, Z, and D, respectively.

With encoder termination enabled, a single wire break is detected for differential incremental signals (TTL), which means that encoder termination must be disabled for single-line TTL encoders.

When interconnecting several drives with a TTL encoder signal, for example, as a common master for synchronization, the termination can be disabled as shown in Figure 5 to avoid overloading the encoder output.



Figure 5: Disabling Encoder Termination

1	Termination on	2	Termination off

5.3 Signal Error Detection

5.3.1 Overview

The detection of wire breaks and short circuits depend on the device type.

5.3.2 Resolver and SinCos Encoder

A missing excitation signal is indicated by bit 2 of the Encoder Status Word shown in parameter ***9.1.9 Encoder Status Word***. Errors that can be detected on the sine and cosine tracks are listed in Table 5.

Table 5: Resolver/SinCos Signal Errors

Error	Standstill	In rotation
Single track open wire	No	Yes
Single track short to GND	No	Yes
Single track short to supply	No	Yes
Single track short between P and N wire	No	Yes
Both tracks open wire	Yes	Yes
Both tracks short to GND	Yes	Yes
Both tracks short to supply	Yes	Yes
Both tracks short between P and N wire	Yes	Yes

Signal errors are indicated by the following bits of the Encoder Status Word shown in parameter ***9.1.9 Encoder Status Word***:

- Bit 2: Resolver/SinCos signal error
- Bit 4: Signal error on track A (sine)
- Bit 5: Signal error on track B (cosine)

5.3.3 Incremental Encoder

Depending on encoder termination and signal type, short and open circuits can be detected on A, B, Z, and D tracks for:

- 2-track encoder on A and B
- 3-track encoder on A, B, and Z
- 2-track encoder on Z and D

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Table 6 shows the detectable errors when encoder termination is enabled (parameters ***9.5.2 Encoder Termination for Device 1*** and ***9.5.4 Encoder Termination for Device 2***) for differential TTL encoders.

Table 7 shows the detectable errors when encoder termination is disabled (parameters ***9.5.2 Encoder Termination for Device 1*** and ***9.5.4 Encoder Termination for Device 2***) for differential HTL encoders.

Table 8 shows the detectable errors when encoder termination is disabled (parameters ***9.5.2 Encoder Termination for Device 1*** and ***9.5.4 Encoder Termination for Device 2***) for single-line TTL and HTL encoders.

A single wire break on each track is not detected as an error, because both single-wire and differential signals are supported.

Table 6: Differential TTL Encoder: Encoder Termination Enabled

Error	Standstill	In rotation
Single open wire	Yes	Yes
Single short to GND	Yes	Yes
Single short to supply	Yes	Yes
Both wires open	Yes	Yes
Both wires short to GND	Yes	Yes
Both wires short to supply	Yes	Yes
Short between P and N wire	Yes	Yes

Table 7: Differential HTL Encoder: Encoder Termination Disabled

Error	Standstill	In rotation
Single open wire	No	No
Single short to GND	No	Yes
Single short to supply	No	Yes
Both wires open	Yes	Yes
Both wires short to GND	Yes	Yes
Both wires short to supply	Yes	Yes
Short between P and N wire	Yes	Yes

Table 8: HTL and TTL Single Line Encoder: Encoder Termination Disabled

Error	Standstill	In rotation
Open wire	Yes	Yes
Short to GND	No	Yes
Short to supply	No	Yes

Signal errors are indicated by the following bits of the ***Encoder Status Word*** shown in parameter ***9.1.9 Encoder Status Word***:

- Bit 3: Short circuit on 1 or more of the 4 tracks
- Bit 4: Signal error on track A
- Bit 5: Signal error on track B
- Bit 6: Signal error on track Z
- Bit 7: Signal error on track D

5.3.4 SinCos Encoder

There is no direct detection of wire break and short circuit but the combined signal voltage level on A and B is monitored. Bit 14 of parameter ***9.1.4 Channel 1 Encoder Status Word*** or parameter ***9.1.8 Channel 2 Encoder Status Word*** is set to ***SinCos calibration/voltage error*** if the voltage level is too low at startup.

5.3.5 Absolute Encoder

There is no direct detection of wire break and short circuit. The error handling is protocol-specific and depends on the absolute encoder type. If the absolute protocol is able to detect errors, for example, by using checksums, bits 2, 3, 8, and 9 of parameter ***9.1.4 Channel 1 Encoder Status Word*** are set to the following values to indicate bad signals which could be caused by wiring, supply, or noise problems:

- Bit 2, 8: Absolute encoder error
- Bit 3: Absolute encoder timeout
- Bit 9: Invalid data/checksum error

5.4 Pin Assignment

The Plug detect feature, which monitors that pins 11 and 13 are connected, detects the unintentional disconnection of the plug connector.

NOTICE

If the Plug detect connection is missing while the interface is activated (parameter ***9.4.3 Interface Configuration for Device 1*** ≠ "Disabled"), the drive generates a fault.

- The fault is generated only when switching to closed-loop operation, not when selecting an encoder.
- The plug connector is delivered without a connection between pin 11 and 13.

Table 9: Pin Assignment and Function for Encoder/Resolver Option OC7M0

Numbering	Functions	Numbering	Functions
1	Resolver Excitation -	2	Resolver Excitation +
3	GND	4	Ch. D- (TTL, RS-485, HIPERFACE DSL®)
5	GND	6	Ch. D+ (TTL, RS-485, HIPERFACE DSL®)
7	Encoder Supply Sensor -	8	Ch. Z- (TTL, HTL, RS-485, R-)
9	Encoder Supply Sensor +	10	Ch. Z+ (TTL, HTL, RS-485, R+)
11	Plug Detect - (GND)	12	Ch. B- (TTL, HTL, RS-485, Analog B-)
13	Plug Detect +	14	Ch. B+ (TTL, HTL, RS-485, Analog B+)
15	Encoder Supply - (GND)	16	Ch. A- (TTL, HTL, RS-485, Analog A-)
17	Encoder Supply +	18	Ch. A+ (TTL, HTL, RS-485, Analog A+)

5.5 Specifications

NOTICE

Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.

The voltage is configured in parameter ***9.4.3 Encoder Supply Voltage***. For details, refer to 5.8.3 Configuration (Menu Index 9.4).

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Table 10: Electrical Specifications for Encoder/Resolver Option OC7M0

Encoder supply voltage [V DC]	Maximum current [mA]
24	125
15	150
12	150
8	225
5	300

If the available power is insufficient, it is possible to use an external power supply for the encoder.

Table 11: Device Type Specifications

Device type	Specifications		Additional information
	Data	Value	
TTL (A, B, Z)	Signal level	0–5 V	Differential signals are preferred, but single signals are also supported. For single signals, the trigger threshold is 0.33–0.4 times the encoder supply voltage.
	Maximum resolution	65535	
	Maximum frequency	750 kHz	
HTL (A, B, Z)	Signal level	0–24 V	
	Maximum resolution	65535	
	Maximum frequency	500 kHz	
SinCos	Signal level	1 V peak-peak	–
	Maximum resolution	65535	
	Maximum frequency	750 kHz	
SSI	Maximum resolution	32 bit	–
	Maximum data length	64 bit	
	Maximum clock frequency	2 MHz	
EnDat	Maximum resolution	32 bit	Both EnDat 2.1 and EnDat 2.2 are supported.
	Maximum data length	64 bit	
	Maximum clock frequency	8.33 MHz	
HIPERFACE DSL®	Maximum resolution	32 bit	–
	Maximum data length	64 bit	
	Baud rate	10 Mbps	
BiSS	Maximum resolution	32 bit	BiSS C is supported.
	Maximum data length	64 bit	
	Maximum clock frequency	8.33 MHz	
Resolver	Excitation voltage	2–8 V_{rms}	$Maxexcitationvoltage_{rms} = \frac{7V}{Resolvertransformationratio x \sqrt{2}}$
	Excitation frequency	2–20 kHz	
	Maximum number of poles	254	
	Maximum input voltage	7 V_{peak}	
	Maximum load	100 mA_{rms}	

Table 11: Device Type Specifications - (continued)

Device type	Specifications		Additional information
	Data	Value	
Encoder simulation (TTL Output)	Voltage level	Minimum: 1.5 V Typical: 2 V differential	–
	Maximum resolution	65535	
	Maximum frequency	750 kHz	
	Maximum load	60 mA	

Table 12: Cable Specifications for Encoder/Resolver Option OC7M0

Cable type	Cross-section [mm^2 (AWG)]	Minimum stripping length [mm (in)]
Flexible/rigid wire without cable end sleeves	0.2–1.5 (26–16)	10 (0.4)
Flexible wire with cable end sleeves with collar	0.2–0.75 (26–18)	

A standard RS485 interface supports cable lengths up to 1200 m (3940 ft) depending on signal frequency and cable type. Consult the documentation for the respective encoder or resolver for details on the allowed cable length.

5.6 Setup and Connection Examples

5.6.1 Virtual Encoder Output

Virtual encoder output can represent position values such as ***Virtual Master***, ***Demanded***, or ***Actual Position*** provided by the drive. The output is scaled by parameter ***9.5.2 Resolution Channel 2*** which represents 1 motor rotation.

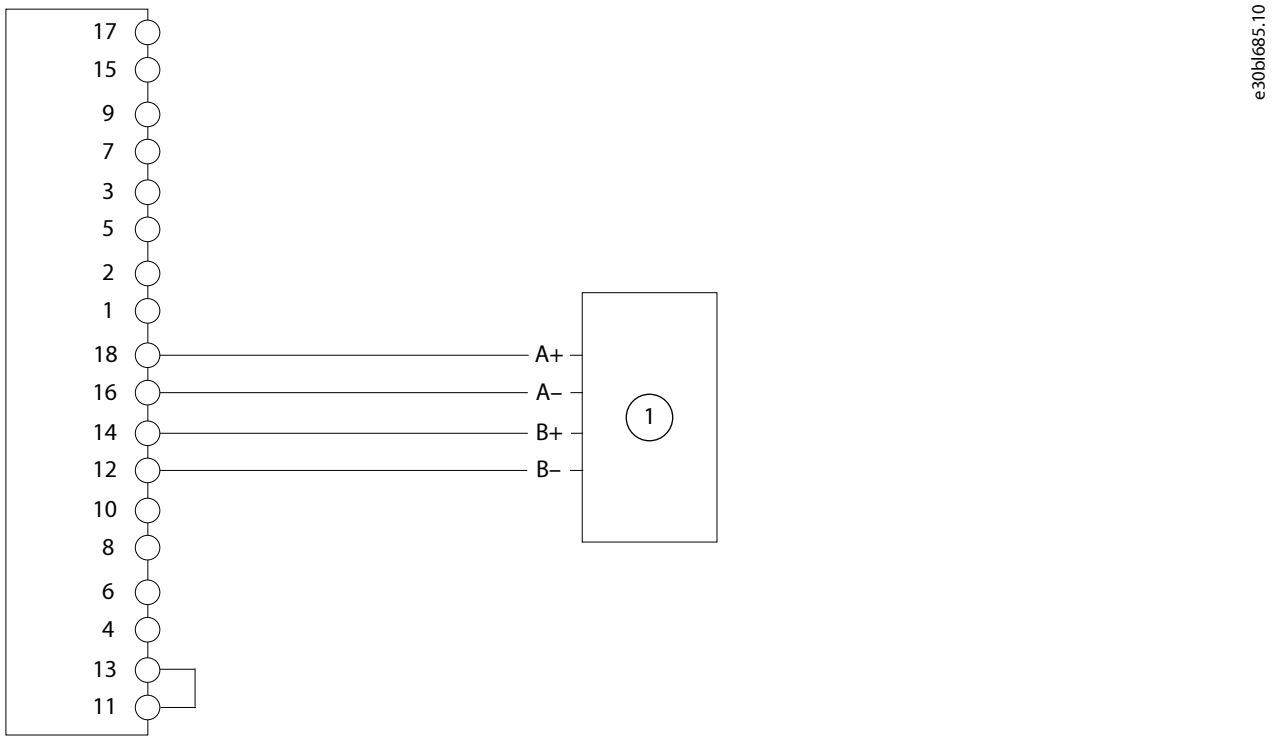
IMPORTANT: Virtual encoder output is supported only in the *Motion* application software for iC7-Automation.

Table 13: Parameters for Virtual Encoder Output

Parameter	Setting
9.4.3 Interface Configuration Device 1	Select ***[0] Disabled***.
9.4.6 Interface Configuration Device 2	Select ***[6] Virtual Out*** to represent the position of the source selected in parameter ***5.16.2.4 Virtual Output Source Selection***.(1)
9.5.2 Resolution Channel 2	Set the number of pulses per revolution of the virtual encoder representing 1 rotation of device 1 or the motor.

1) For more information on the parameter, see iC7 Series Motion Application Guide.

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1	Controller

Figure 6: Wiring Configuration for Virtual Encoder Output

5.6.2 Incremental Encoder

With TTL and HTL incremental encoders, the actual position is 0 after power-up, and encoder pulses are counted to increment or decrement the actual position. For improved resolution with TTL and HTL encoders, both the positive and negative edge of A and B pulses are detected giving 4 quad counts per encoder pulse.

Table 14: Parameters for Incremental Encoder

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate supply voltage. **NOTICE** Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
9.4.3 Interface Configuration for Device 1	Select according to the type of connected encoder: ***[1] 2 track incremental A,B*** ***[3] 3 track incremental A,B,Z***
9.5.1 Resolution Channel 1	Set the resolution of the encoder in pulses per revolution.

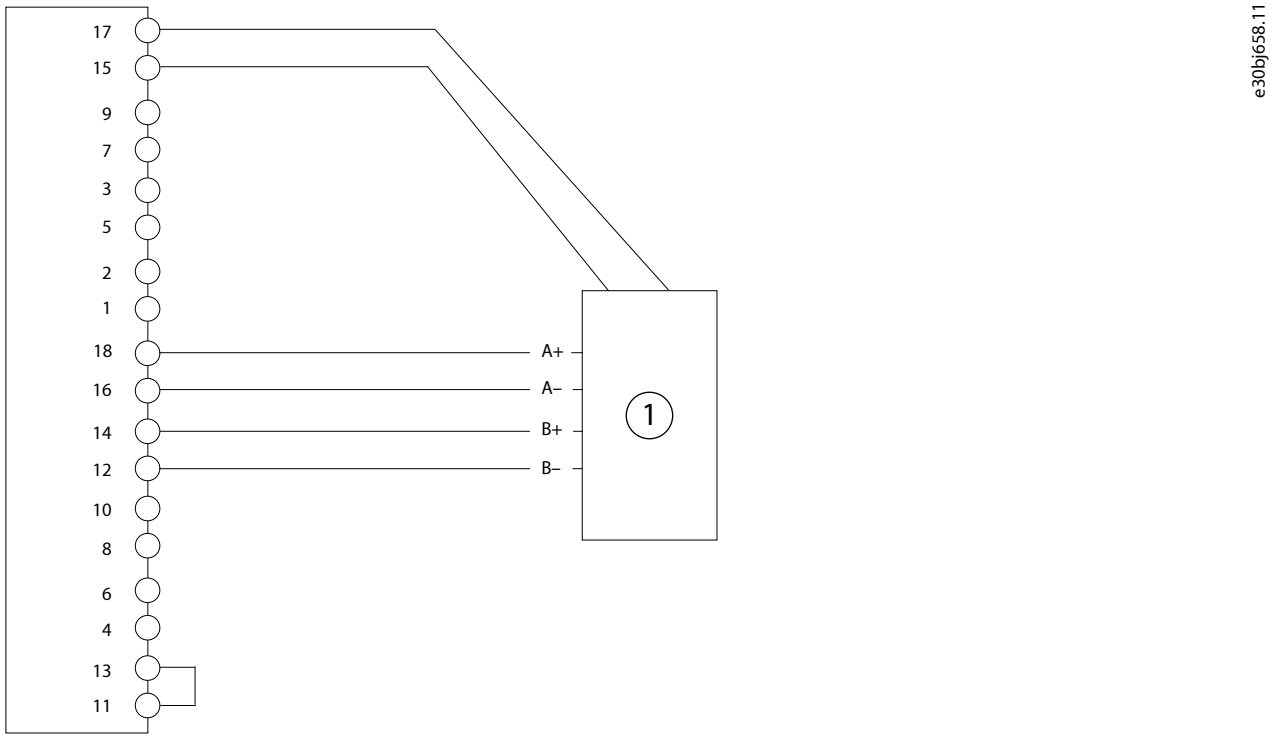


Figure 7: Wiring Configuration for Incremental Encoder, 2 Differential Tracks (TTL, HTL)

1	Incremental encoder

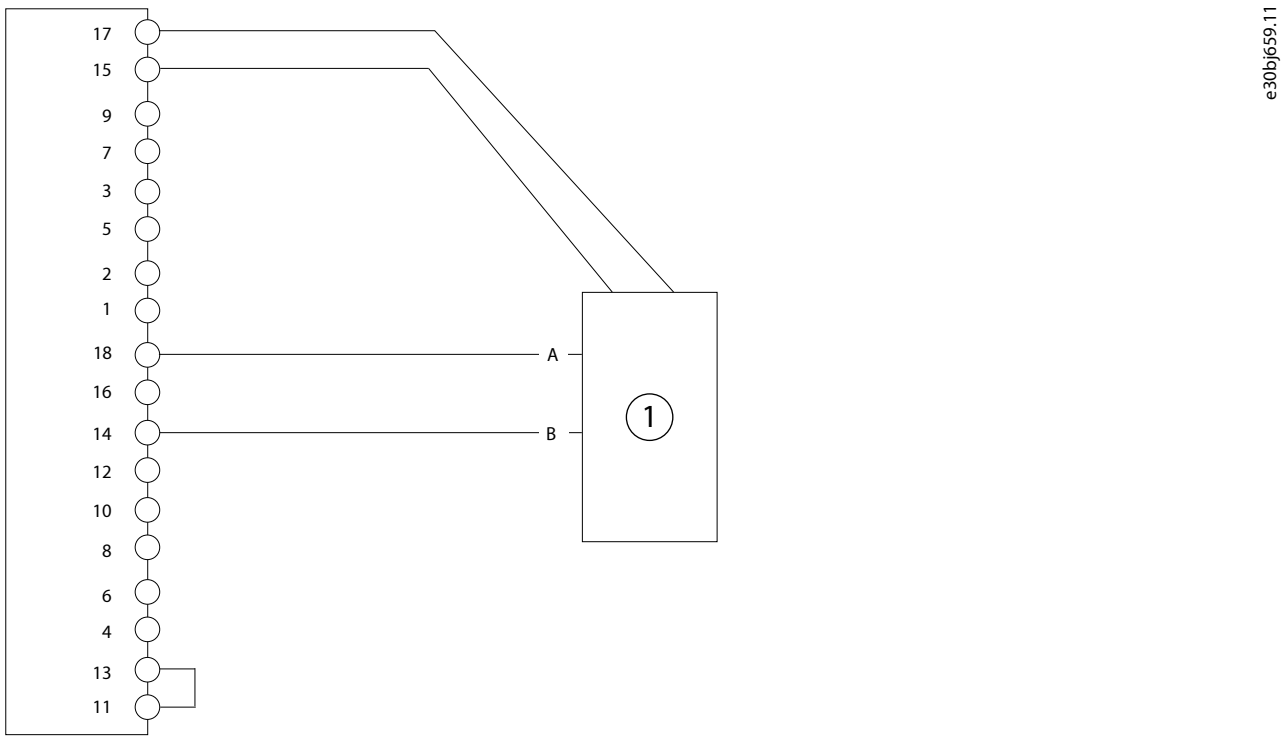


Figure 8: Wiring Configuration for Incremental Encoder, 2 Single Tracks (TTL, HTL)

1	Incremental encoder

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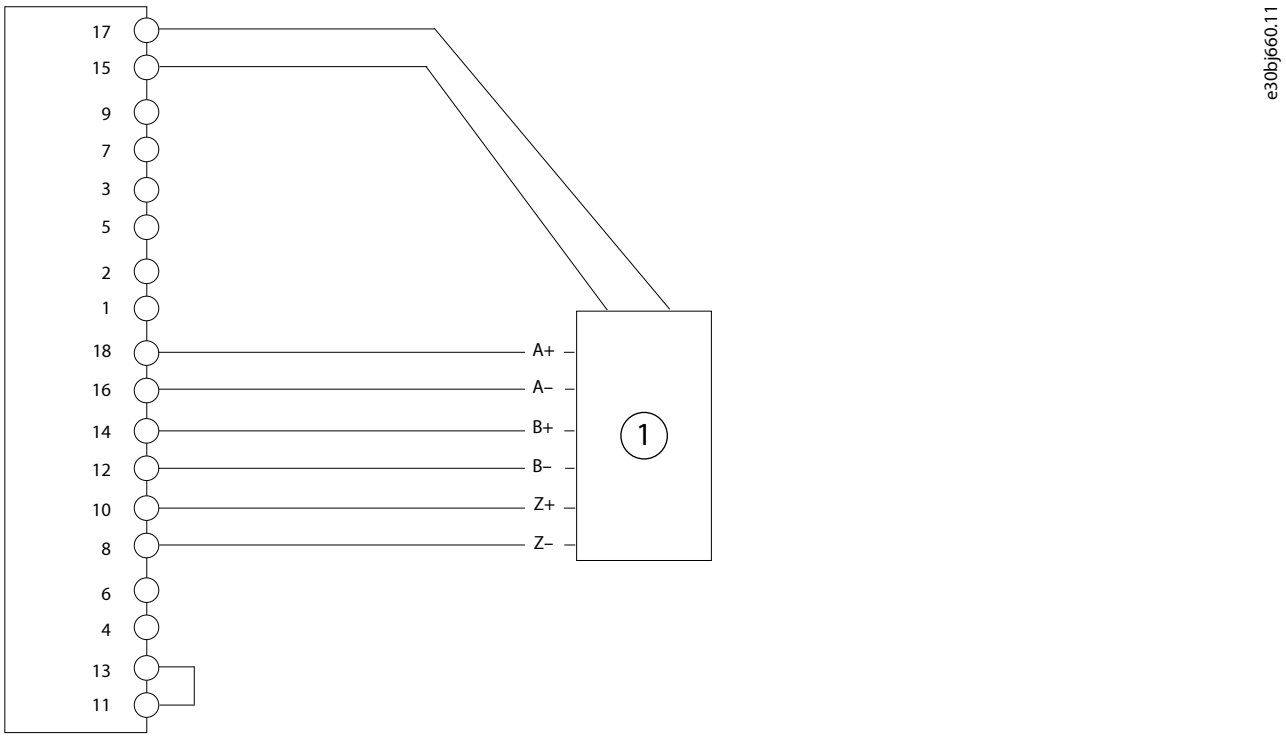


Figure 9: Wiring Configuration for Incremental Encoder, 3 Differential Tracks (TTL, HTL)

1	Incremental encoder

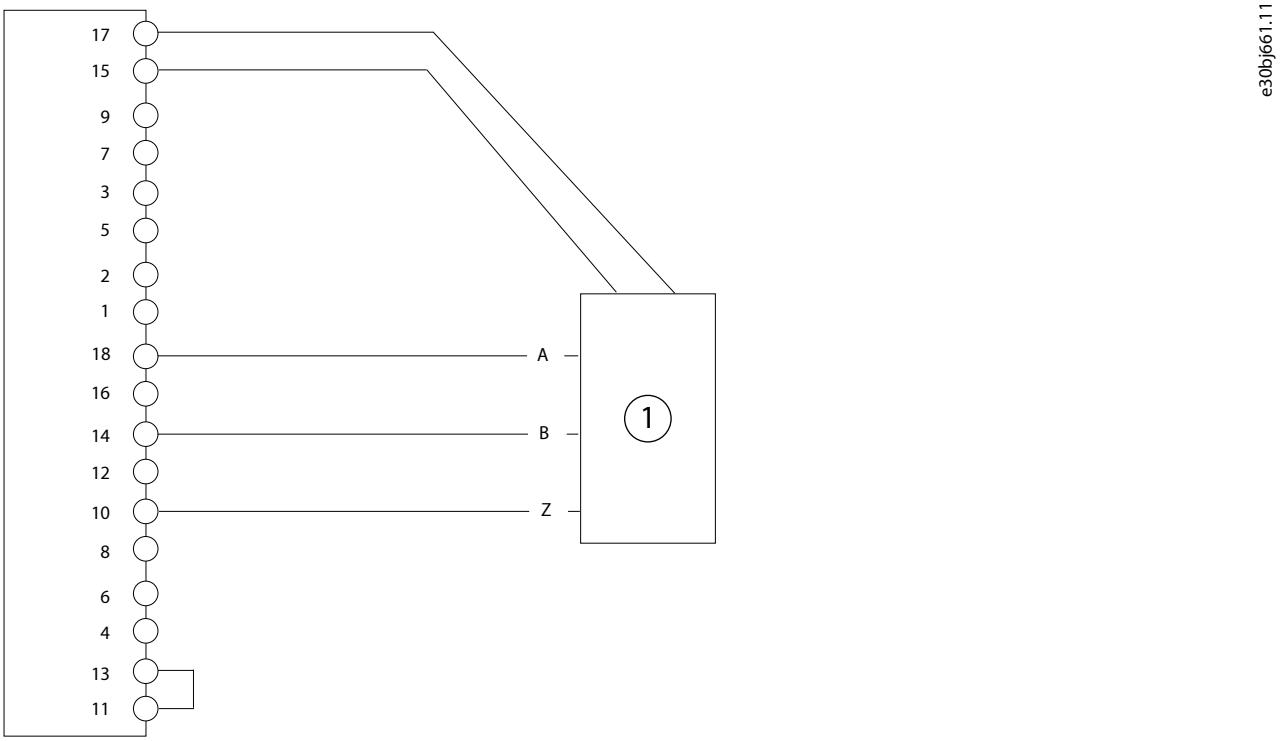


Figure 10: Wiring Configuration for Incremental Encoder, 3 Single Tracks (TTL, HTL)

1	Incremental encoder

5.6.3 Two Incremental Encoders

It is possible to connect 2 2-track incremental encoders where channel 1 (A, B) supports TTL and HTL, and channel 2 (Z, D) supports only TTL.

Table 15: Parameters for 2 Incremental Encoders

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate supply voltage. If the power requirement exceeds the maximum power of the internal supply, the 2nd encoder may require an external supply. **NOTICE** Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
9.4.3 Interface Configuration for Device 1	Select ***[1] 2 track incremental A,B***.
9.4.6 Interface Configuration for Device 2	Select ***[1] 2 track incremental***.
9.5.1 Resolution Channel 1	Set the resolution of the encoder connected to A and B in pulses per revolution.
9.5.2 Resolution Channel 2	Set the resolution of the encoder connected to Z and D in pulses per revolution.

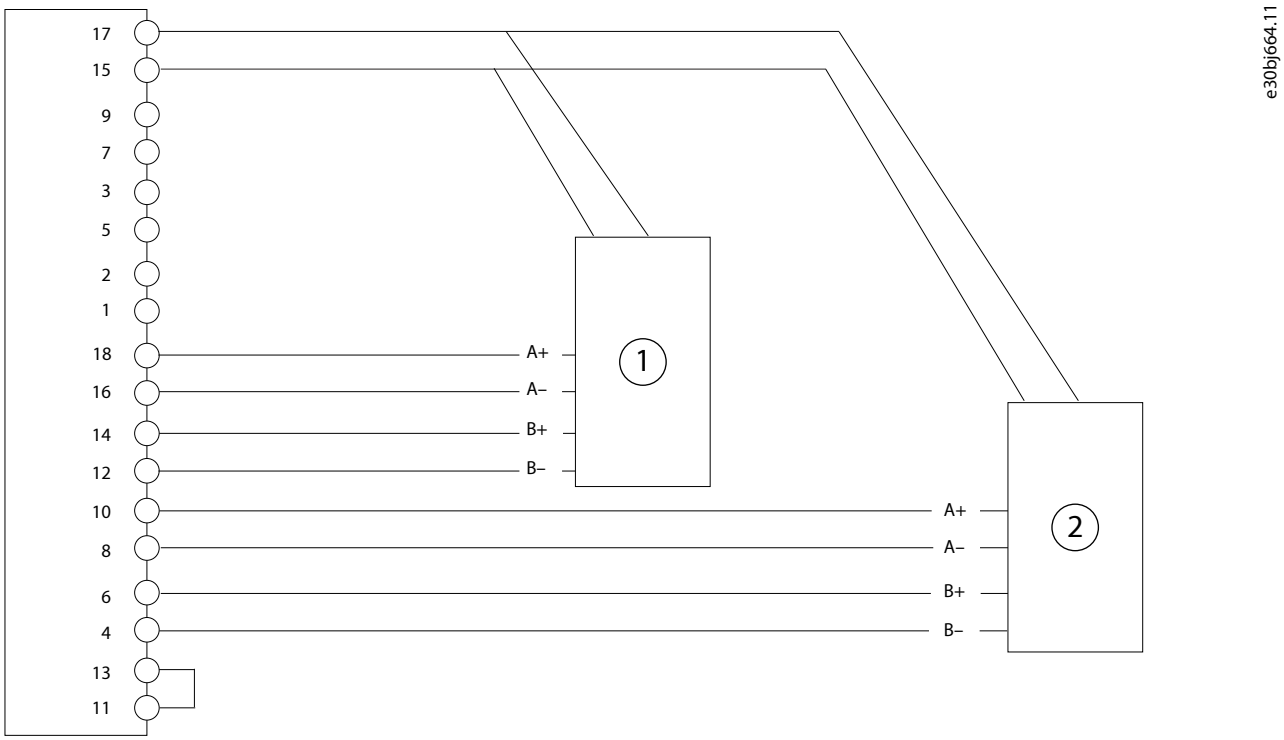


Figure 11: Wiring Configuration for 2 Incremental Encoders

1	Incremental encoder, 2 differential tracks (TTL, HTL)	2	Incremental encoder, 2 differential tracks (only TTL on Z and D). This encoder may require a separate supply.

5.6.4 Incremental Encoder with Virtual Output as Device 2

The encoder output as device 2 represents the position of device 1, the virtual master, or position values such as ***Demanded*** or ***Actual Position*** provided by the drive. The output is scaled by parameter ***9.5.2 Resolution Channel 2*** which represents 1 rotation of device 1 or 1 motor rotation for other position values.

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Table 16: Parameters for Incremental Encoder with Virtual Output as Device 2

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate voltage for the connected encoder.
9.4.3 Interface Configuration for Device 1	Select ***[1] 2 track incremental A,B***.
9.4.6 Interface Configuration for Device 2	Select 1 of the following options: ***[4] Device 1 Out*** to represent the position of the encoder or resolver connected as device 1. ***[6] Virtual Out*** to represent the position of the source selected in parameter ***5.16.2.4 Virtual Output Source Selection***[1].
9.5.1 Resolution Channel 1	Set the resolution of the encoder in pulses per revolution.
9.5.2 Resolution Channel 2	Set the number of pulses per revolution of the virtual encoder representing 1 rotation of device 1 or the motor.

1) For more information on the parameter, see iC7 Series Motion Application Guide.

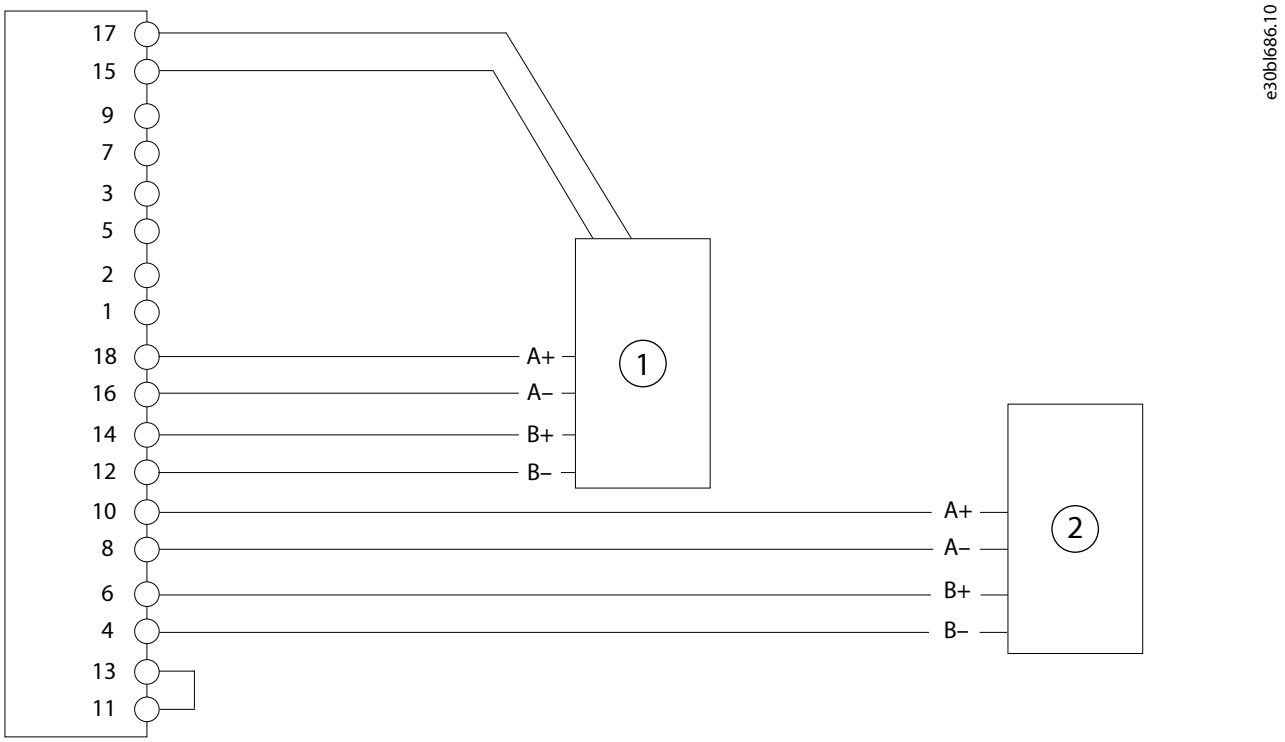


Figure 12: Wiring Configuration for Incremental Encoder with Virtual Output as Device 2

1	2-track incremental encoder (TTL, HTL)	2	Controller

5.6.5 Resolver

With a resolver, the actual position is set to the absolute value within 1 resolver pole pair based on the analog value of the sine and cosine signals. With a 2-pole resolver, this corresponds to the absolute position within 1 resolver revolution.

Table 17: Parameters for Resolver

Parameter	Setting
9.4.3 Interface Configuration for Device 1	Select ***[7] Resolver A,B***.
9.7.1 Excitation Voltage	Set the excitation voltage according to the resolver specifications.
9.7.2 Excitation Frequency	Set the excitation frequency according to the resolver specifications.
9.7.3 Number of Pole Pairs	Set the number of poles for the connected resolver.
9.7.4 Transformation Ratio	Set according to the resolver specifications. The transformation ratio is used for verification of the voltage level of the resolver signals.

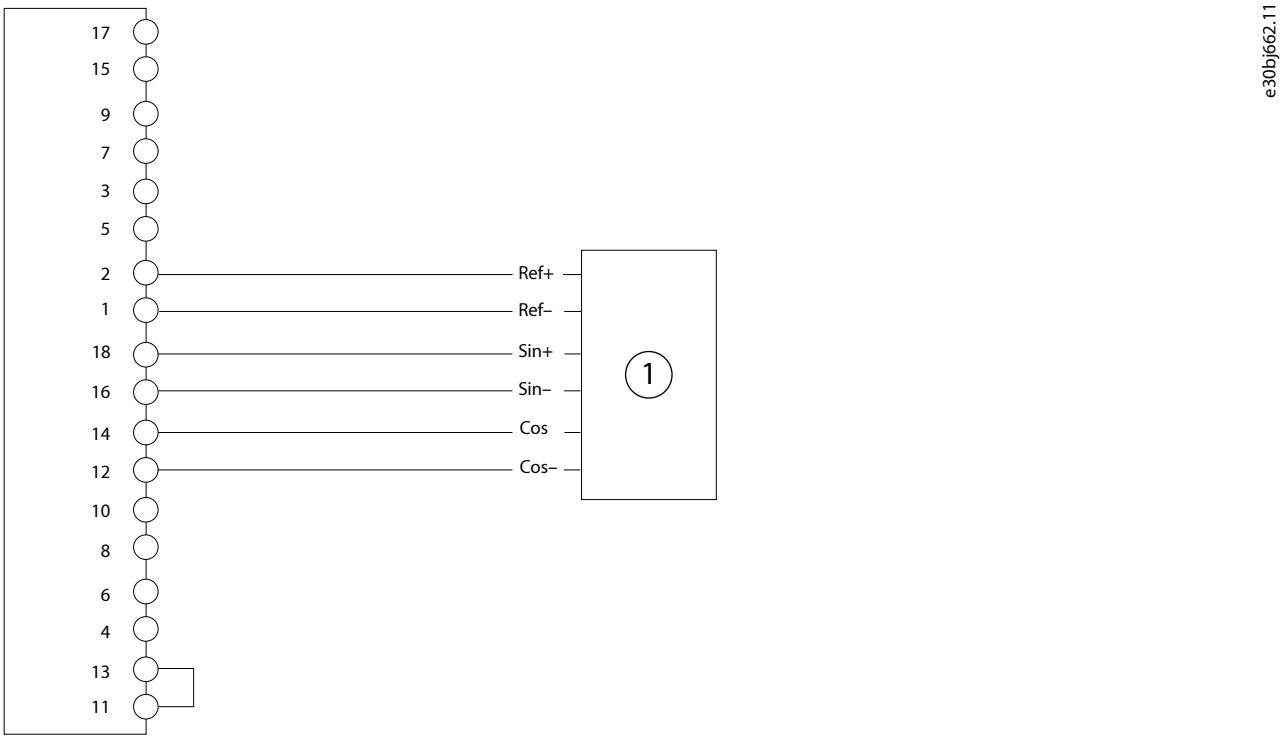


Figure 13: Wiring Configuration for Resolver

1	Resolver

5.6.6 Resolver with Virtual Output as Device 2

The encoder output as device 2 represents the position of device 1 or position values such as ***Virtual Master***, ***Demanded***, or ***Actual Position*** provided by the drive. The output is scaled by parameter ***9.5.2 Resolution Channel 2*** which represents 1 rotation of device 1, or 1 motor rotation for other position values.

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Table 18: Parameters for Resolver with Virtual Output as Device 2

Parameter	Setting
9.4.3 Interface Configuration for Device 1	Select ***[7] Resolver A,B***.
9.4.6 Interface Configuration for Device 2	Select 1 of the following options: ***[4] Device 1 Out*** to represent the position of the encoder or resolver connected as device 1. ***[6] Virtual Out*** to represent the position of the source selected in parameter ***5.16.2.4 Virtual Output Source Selection***[(1)].
9.5.2 Resolution Channel 2	Set the required number of pulses for the encoder output representing 1 rotation of the resolver.
9.7.1 Excitation Voltage	Set the excitation voltage according to the resolver specifications.
9.7.2 Excitation Frequency	Set the excitation frequency according to the resolver specifications.
9.7.3 Number of Pole Pairs	Set the number of poles for the connected resolver.
9.4.7 Transformation Ratio	Set according to the resolver specifications. The transformation ratio is used for verification of the voltage level of the resolver signals.

1) For more information on the parameter, see iC7 Series Motion Application Guide.

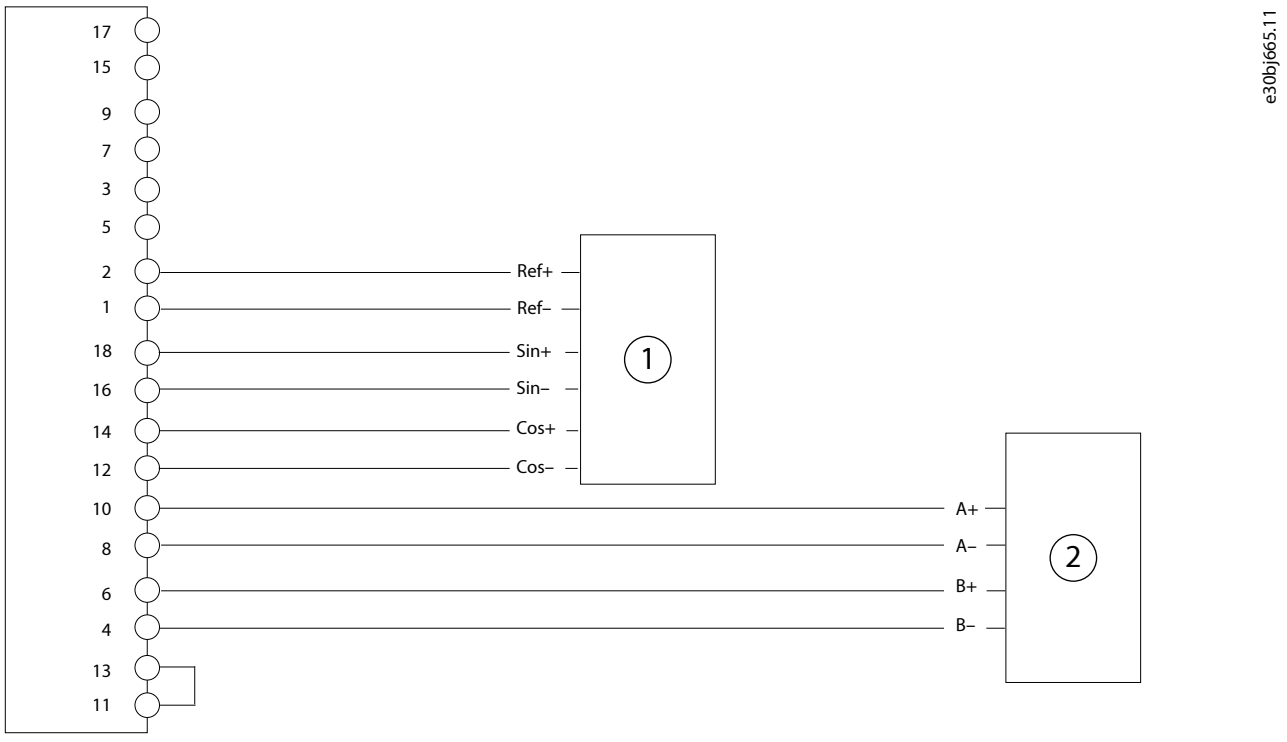


Figure 14: Wiring Configuration for Resolver with Mirror Out

1	Resolver	2	Controller or other device

5.6.7 Resolver and Incremental (TTL) Encoder

This example uses a resolver on A and B as channel 1 and a 2-track incremental TTL encoder on Z and D as channel 2. The internal supply of the option is used for resolver excitation. The encoder supply (pin 17) is inactive, so the incremental encoder must be supplied by an external power source.

Table 19: Parameters for Resolver and Incremental (TTL) Encoder

Parameter	Setting
9.4.3 Interface Configuration for Device 1	Select ***[7] Resolver A,B***.
9.4.6 Interface Configuration for Device 2	Select ***[1] 2 track incremental***.
9.5.2 Resolution Channel 2	Set the resolution of the encoder connected to Z and D in pulses per revolution.
9.7.1 Excitation Voltage	Set the excitation voltage according to the resolver specifications.
9.7.2 Excitation Frequency	Set the resolver excitation frequency according to the resolver specifications.
9.7.3 Number of Pole Pairs	Set the number of pole pairs for the connected resolver.
9.4.7 Transformation Ratio	Set according to the resolver specifications. The transformation ratio is used for verification of the voltage level of the resolver signals.

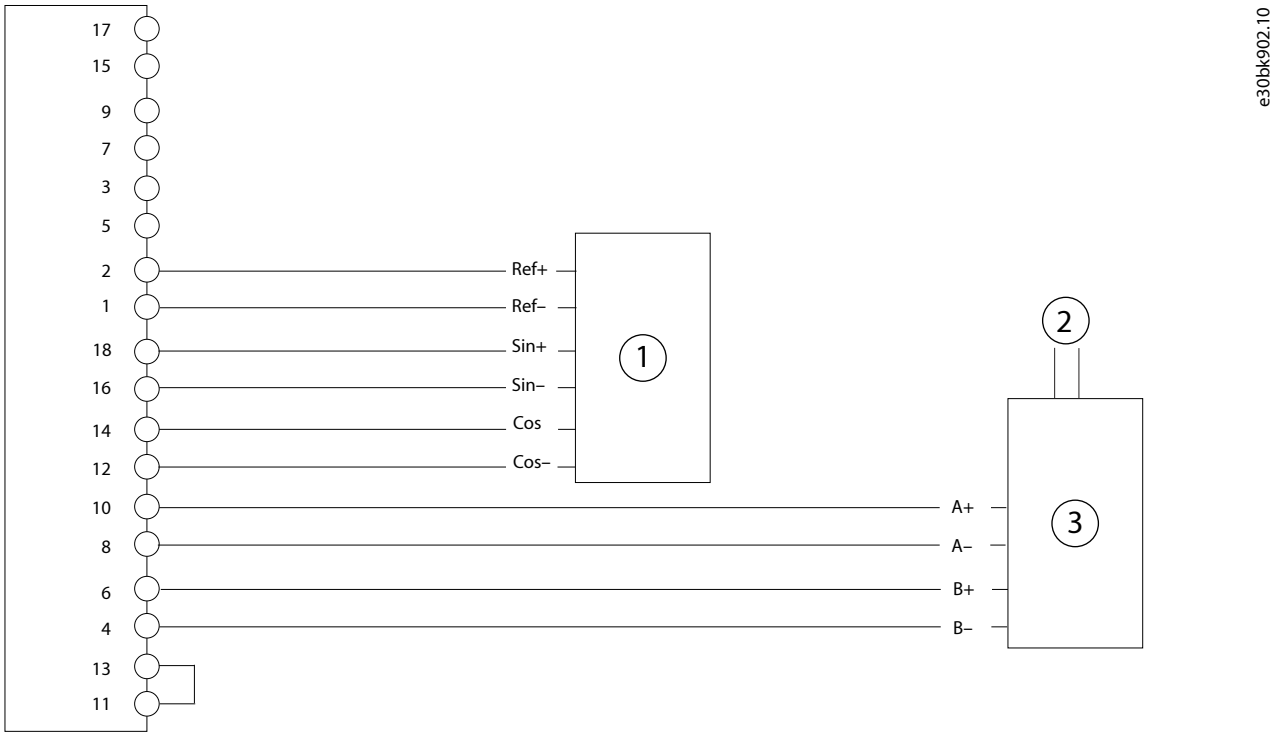


Figure 15: Wiring Configuration for Resolver and Incremental (TTL) Encoder

1	Resolver	2	External power supply
3	Incremental encoder (only TTL on Z and D)		

5.6.8 SinCos Encoder

This example shows the connection of a SinCos encoder on A and B as channel 1.

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Table 20: Parameters for SinCos Encoder

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate supply voltage. **NOTICE** Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
9.4.3 Interface Configuration for Device 1	Select ***[10] SinCos A,B***.
9.5.1 Resolution Device 1	Set the resolution of the encoder in pulses per revolution.

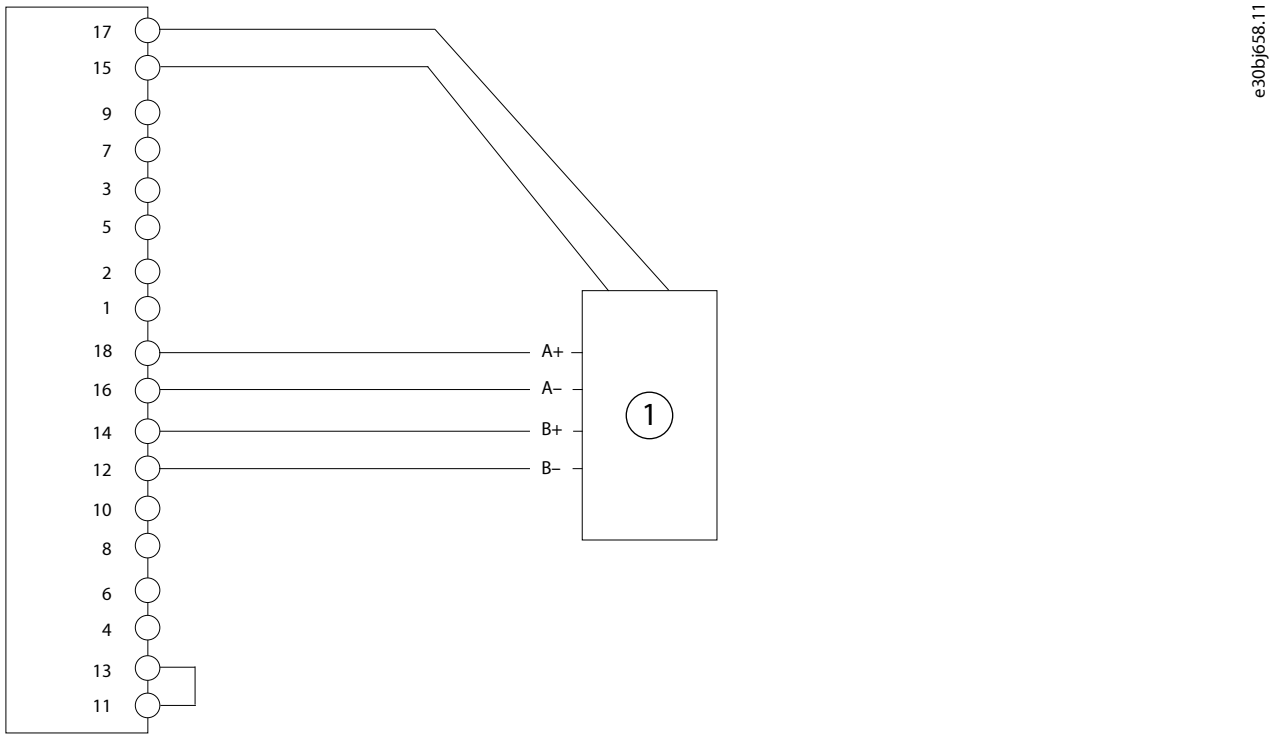


Figure 16: Wiring Configuration for SinCos Encoder

1	SinCos encoder

5.6.9 SinCos and Incremental (TTL) Encoder

This example shows the connection of a SinCos encoder on A and B as channel 1, and a 2 track incremental TTL encoder on Z and D as channel 2.

Table 21: Parameters for SinCos and Incremental (TTL) Encoder

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate voltage for 1 or more connected encoders. An external power supply might be needed if the power requirement exceeds the maximum power of the encoder supply (pin 17) or if the 2 encoders require different supply voltage.
9.4.3 Interface Configuration for Device 1	Select ***[10] SinCos A,B***.
9.4.6 Interface Configuration for Device 2	Select ***[1] 2 track incremental***.

Table 21: Parameters for SinCos and Incremental (TTL) Encoder - (continued)

Parameter	Setting
9.5.1 Resolution Channel 1	Set the resolution of the SinCos encoder connected to A and B in pulses per revolution.
9.5.2 Resolution Channel 2	Set the resolution of the TTL encoder connected to Z and D in pulses per revolution.

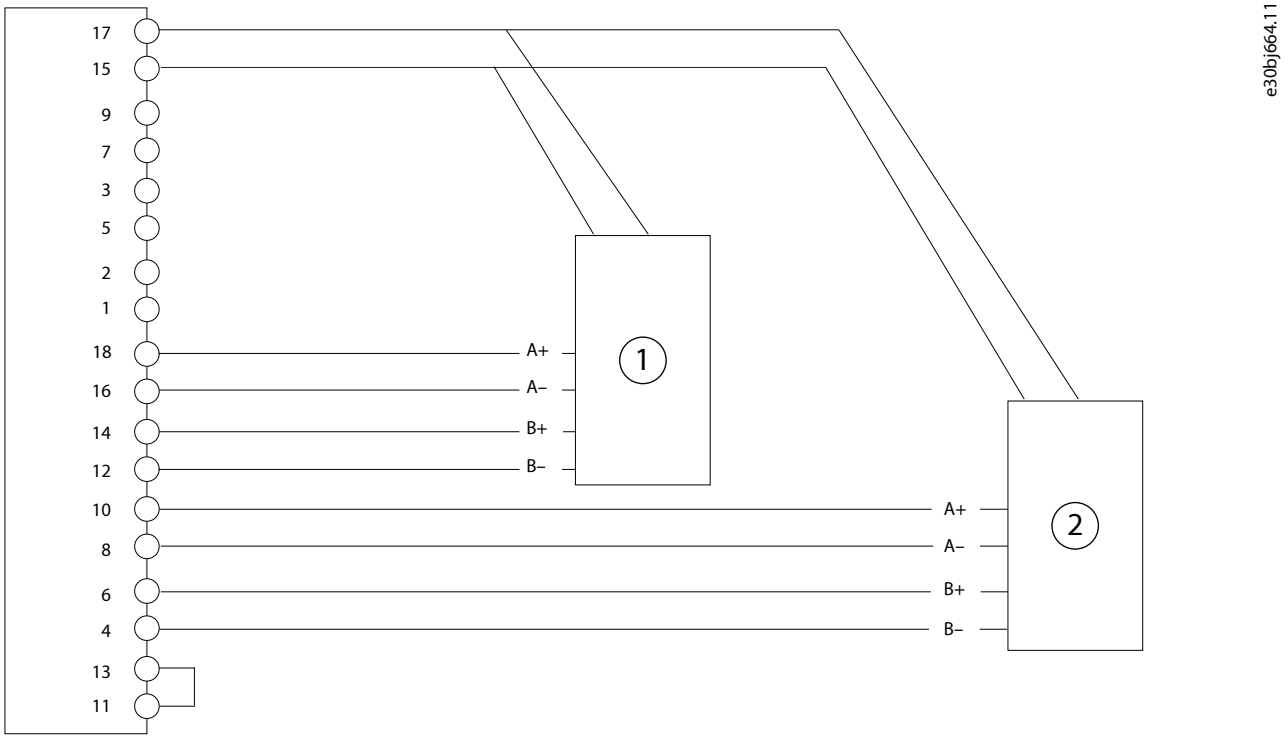


Figure 17: Wiring Configuration for SinCos and Incremental (TTL) Encoder

1	SinCos encoder	2	Incremental encoder, 2 differential tracks (only TTL on Z and D). This encoder may require a separate supply.

5.6.10 SinCos Encoder with Virtual Output as Device 2

The encoder output as device 2 represents the position of device 1 or position values such as ***Virtual Master***, ***Demanded***, or ***Actual Position*** provided by the drive. The output is scaled by parameter ***9.5.2 Resolution Channel 2*** which represents 1 rotation of device 1, or 1 motor rotation for other position values.

Table 22: Parameters for SinCos Encoder with Virtual Output as Device 2

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate voltage for the connected encoder.
9.4.3 Interface Configuration for Device 1	Select ***[10] SinCos A, B***.
9.4.6 Interface Configuration for Device 2	Select 1 of the following options: ***[4] Device 1 Out*** to represent the position of the encoder or resolver connected as device 1. ***[6] Virtual Out*** to represent the position of the source selected in parameter ***5.16.2.4 Virtual Output Source Selection***[(1)].

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Table 22: Parameters for SinCos Encoder with Virtual Output as Device 2 - (continued)

Parameter	Setting
9.5.1 Resolution Channel 1	Set the resolution of the encoder in pulses per revolution.
9.5.2 Resolution Channel 2	Set the number of pulses per revolution of the virtual encoder representing 1 rotation of Device 1 or the motor.

1) For more information on the parameter, see iC7 Series Motion Application Guide.

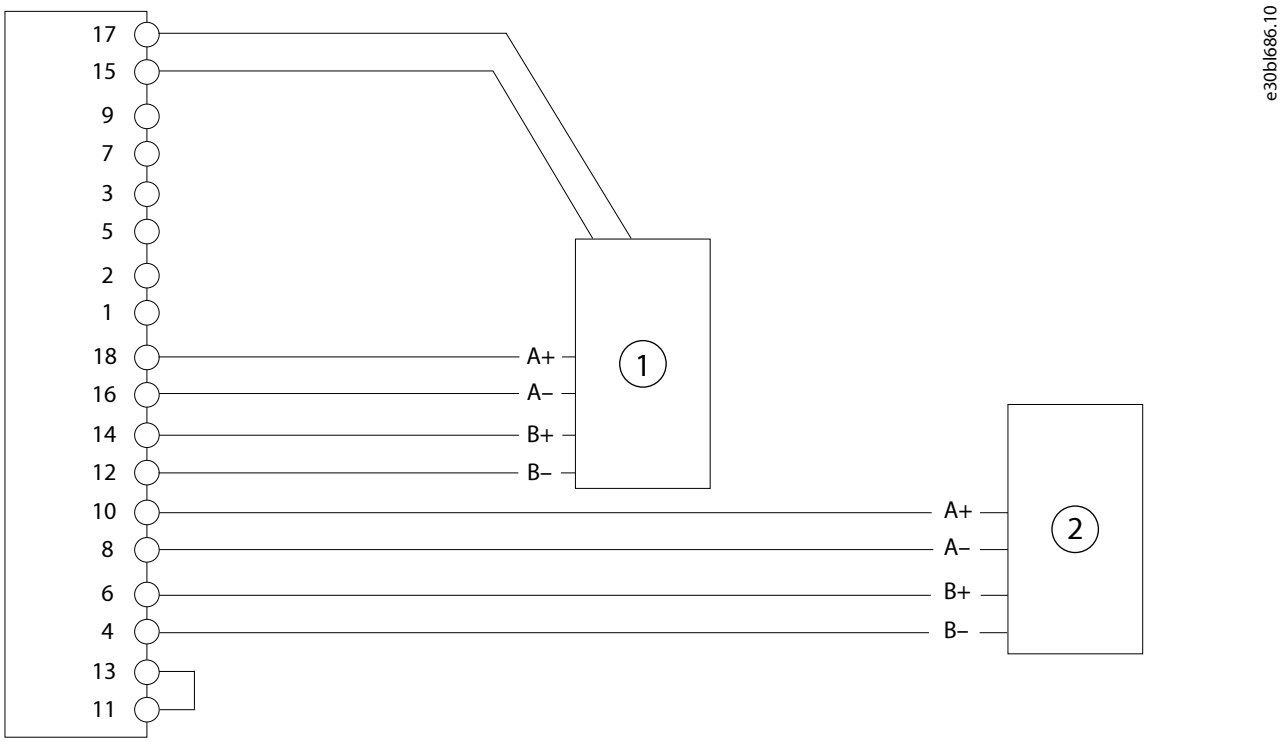


Figure 18: Wiring Configuration for SinCos Encoder with Virtual Output as Device 2

1	SinCos encoder	2	Controller

5.6.11 SSI Encoder

The absolute position is read from the encoder and used to set the actual position after power-up.

Table 23: Parameters for SSI Encoder

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate supply voltage. **NOTICE** Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
9.4.3 Interface Configuration for Device 1	Select ***[17] SSI Z,D***.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution.
9.6.2 Multiturn Resolution	Set the number of bits used for the revolution count.
9.6.5 BiSS/SSI Clock Rate	Set the clock rate used for SSI or BiSS.

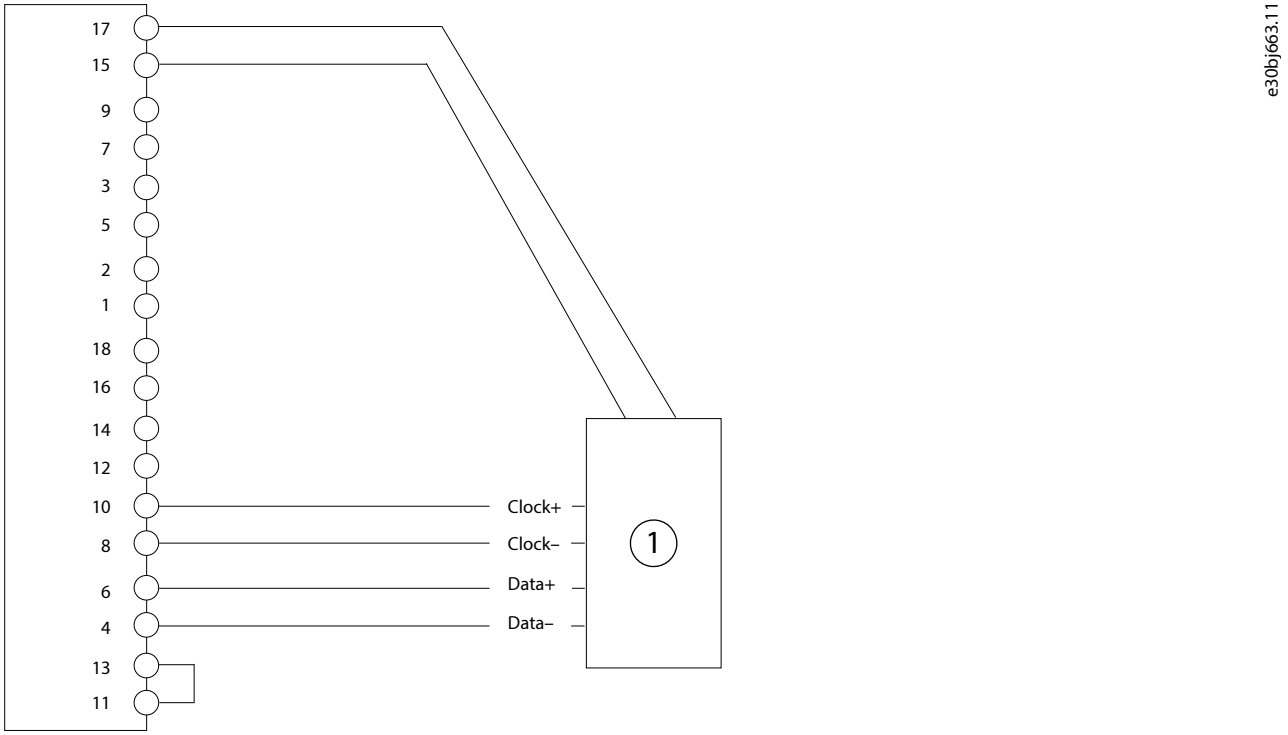


Figure 19: Wiring Configuration for 2-Track SSI Encoder

1	SSI encoder

5.6.12 SSI and Resolver

This example shows the connection of an SSI encoder on Z and D as channel 1, and a resolver on A and B as channel 2. The internal supply of the option is used for resolver excitation. The encoder supply (pin 17) is inactive, so the SSI encoder must be supplied by an external power source.

Table 24: Parameters for SSI and Resolver

Parameter	Setting
9.4.3 Interface Configuration for Device 1	Select ***[17] SSI Z,D***.
9.4.6 Interface Configuration for Device 2	Select ***[7] Resolver A,B***.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution of the connected SSI encoder.
9.6.2 Multiturn Resolution	Set the number of bits used for counting the revolutions of the connected SSI encoder.
9.6.4 SSI Data Format	Select the data format of the connected SSI encoder.
9.6.5 BiSS/SSI Clock Rate	Select the clock rate according to the specifications of the connected SSI encoder.
9.7.1 Excitation Voltage	Set the excitation voltage according to the specifications of the connected resolver.
9.7.2 Excitation Frequency	Set the resolver excitation frequency according to the specifications of the connected resolver.
9.7.3 Number of Pole Pairs	Set the number of pole pairs of the connected resolver.

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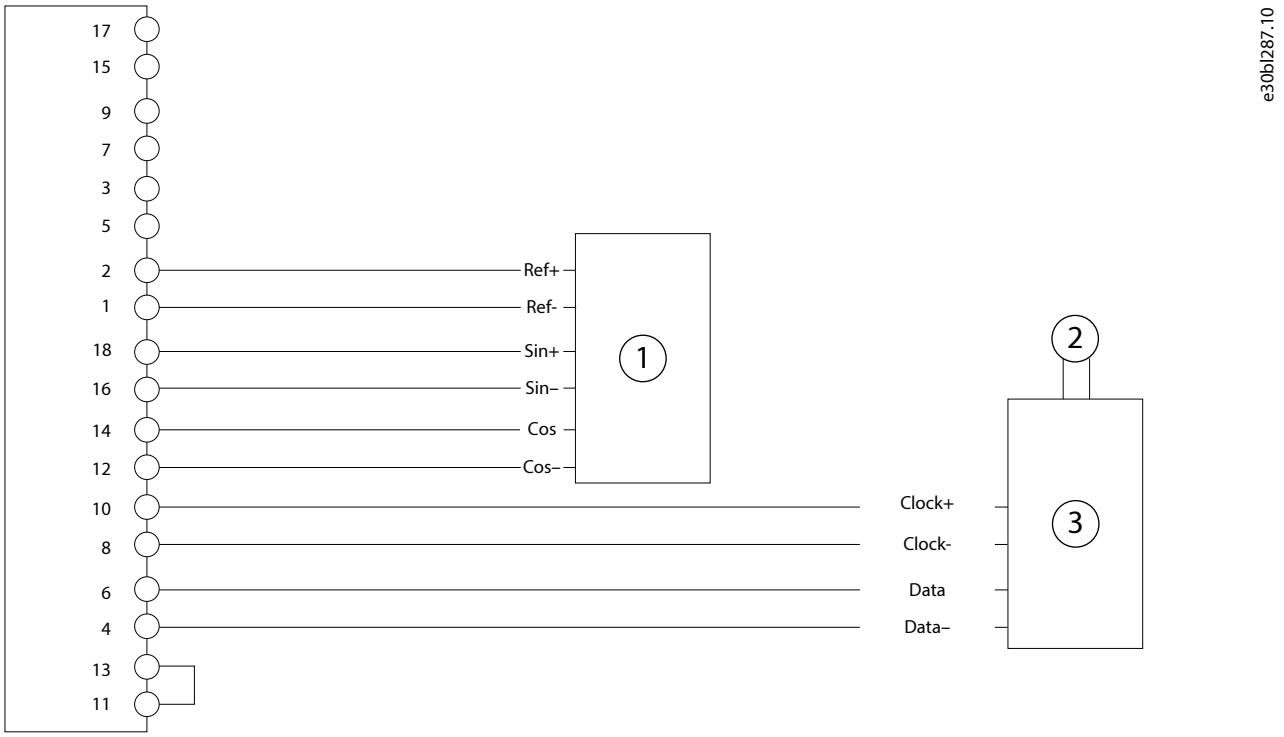


Figure 20: Wiring Configuration for SSI and Resolver

1	Resolver	2	External power supply
3	SSI encoder		

5.6.13 SSI and Incremental (TTL or HTL) or SinCos Encoder

This example shows the connection of an SSI encoder on Z and D as channel 1, and a 2-track incremental encoder or SinCos encoder on A and B as channel 2. An external supply may be needed if the power requirement exceeds the maximum power of the encoder supply (pin 17), or if the 2 encoders require different supply voltages.

Table 25: Parameters for SSI and Incremental (TTL or HTL) or SinCos Encoder

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate voltage.
9.4.3 Interface Configuration for Device 1	Select ***[17] SSI Z,D***.
9.4.6 Interface Configuration for Device 2	Select 1 of the following options: ***[1] 2 track incremental*** ***[10] SinCos A,B***
9.5.2 Resolution Channel 2	Set the resolution of the incremental or SinCos encoder connected to A and B in pulses per revolution.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution of the connected SSI encoder.
9.6.2 Multiturn Resolution	Set the number of bits used for counting the revolutions of the connected SSI encoder.
9.6.4 SSI Data Format	Select the data format of the connected SSI encoder.
9.6.5 BiSS/SSI Clock Rate	Select the clock rate according to the SSI encoder specifications.

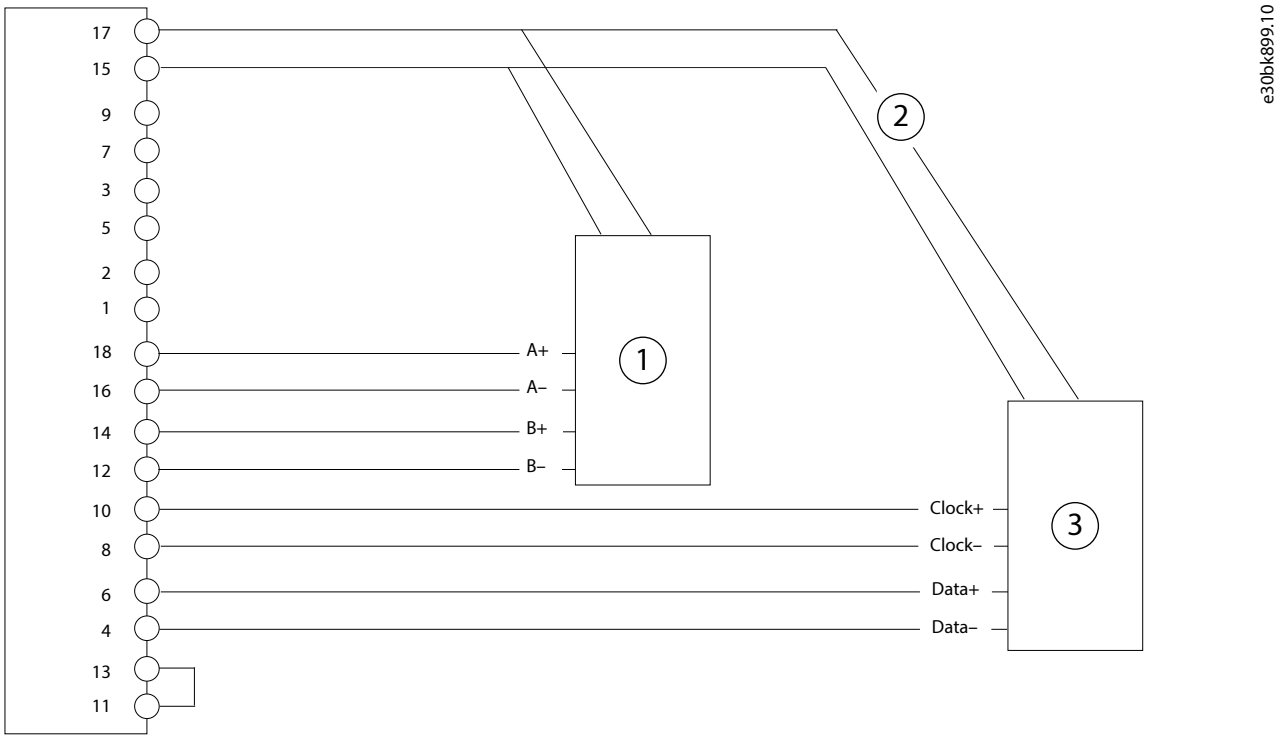


Figure 21: Wiring Configuration for SSI and Incremental (TTL or HTL) or SinCos Encoder

1	Incremental or SinCos encoder	2	External power supply
3	SSI absolute encoder		

5.6.14 SSI Encoder with Virtual Output as Device 2

The encoder output as device 2 represents the position of device 1 or position values such as ***Virtual Master***, ***Demanded***, or ***Actual Position*** provided by the drive. The output is scaled by parameter ***9.5.2 Resolution Channel 2*** which represents 1 rotation of device 1, or 1 motor rotation for other position values.

Table 26: Parameters for SSI Encoder with Virtual Output as Device 2

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate voltage for the connected encoder.
9.4.3 Interface Configuration for Device 1	Select ***[17] SSI Z,D***.
9.4.6 Interface Configuration for Device 2	Select 1 of the following options: • ***[4] Device 1 Out*** to represent the position of the encoder or resolver connected as device 1. • ***[6] Virtual Out*** to represent the position of the source selected in parameter ***5.16.2.4 Virtual Output Source Selection***[(1)].
9.5.2 Resolution Channel 2	Set the number of pulses per revolution of the virtual encoder representing 1 rotation of device 1 or the motor.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution of the connected SSI encoder.
9.6.2 Multiturn Resolution	Set the number of bits used for counting the revolutions of the connected SSI encoder.
9.6.4 SSI Data Format	Select the data format of the connected SSI encoder.
9.6.5 BiSS/SSI Clock Rate	Select the clock rate according to the specifications of the connected SSI encoder.

1) For more information on the parameter, see iC7 Series Motion Application Guide.

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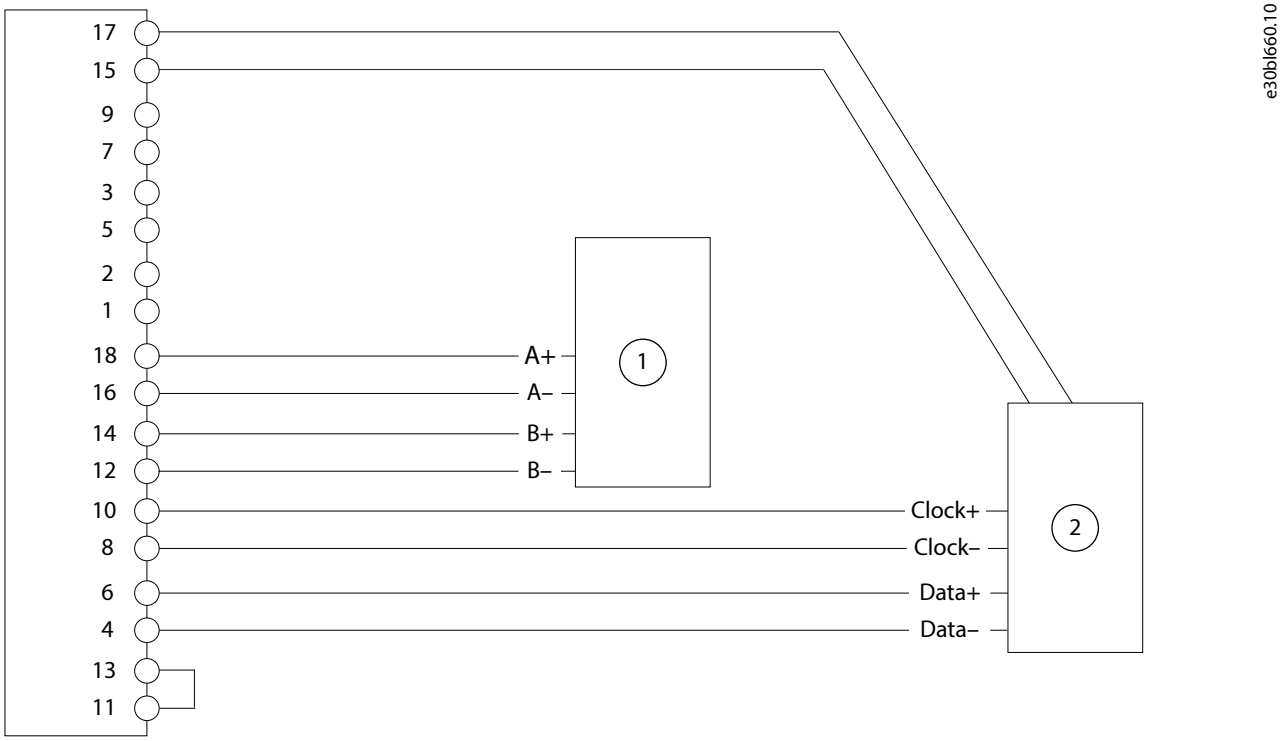


Figure 22: Wiring Configuration for SSI Encoder with Virtual output as Device 2

1	Controller	2	SSI absolute encoder

5.6.15 SSI Encoder with Incremental or SinCos Track

This example shows the connection of an SSI encoder with incremental (TTL, HTL) or SinCos track on Z and D, and A and B as channel 1. The absolute position is read from the encoder and used as the actual position. The incremental/SinCos track is used to compensate for communication delay and too few absolute position readings due to communication speed.

Table 27: Parameters for SSI Encoder with Incremental or SinCos Track

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate voltage. **NOTICE** Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
9.4.3 Interface Configuration for Device 1	Select 1 of the following options: ***[33] SSI with 2 track incremental Z,D,A,B*** ***[34] SSI with SinCos Z,D,A,B***
9.5.1 Resolution Channel 1	Set the resolution of the incremental or SinCos encoder connected to A and B in pulses per revolution.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution of the connected SSI encoder.
9.6.2 Multiturn Resolution	Set the number of bits used for counting the revolutions of the connected SSI encoder.
9.6.4 SSI Data Format	Select the data format of the connected SSI encoder.
9.6.5 BiSS/SSI Clock Rate	Select the clock rate according to the SSI encoder specifications.

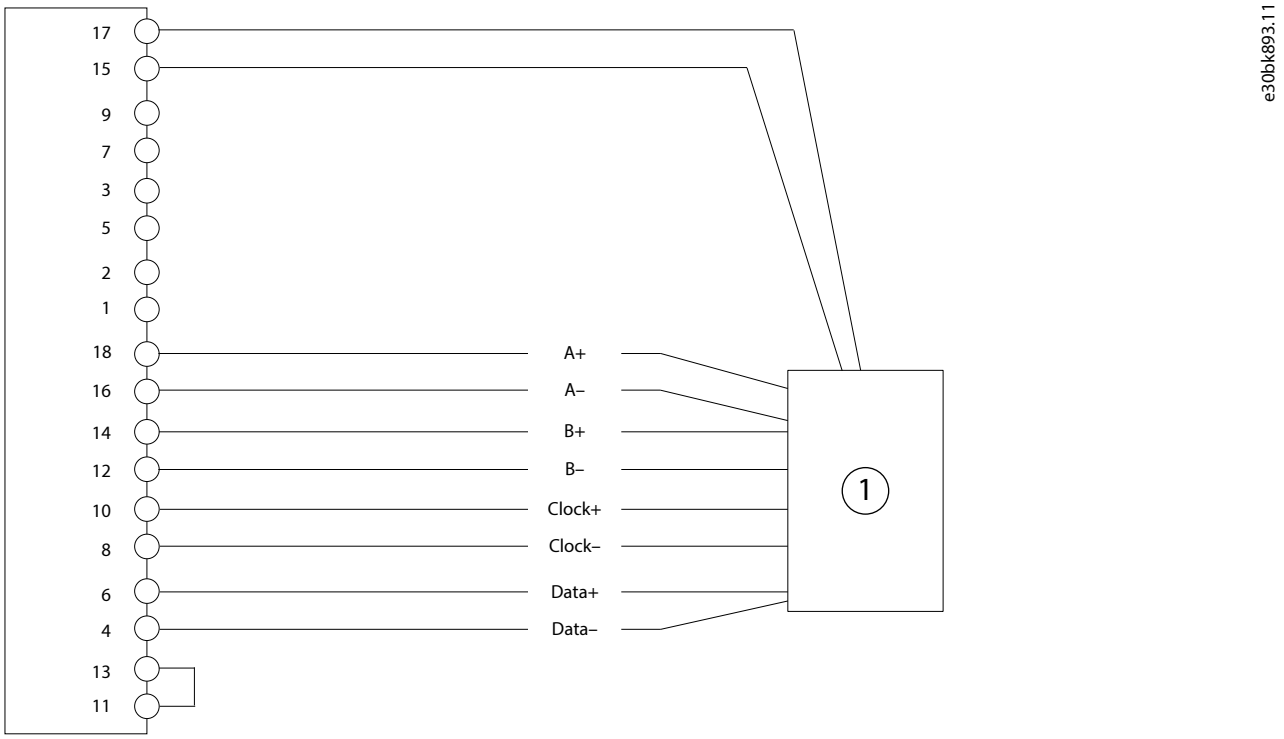


Figure 23: Wiring Configuration for SSI Encoder with Incremental or SinCos Track

1	Encoder

5.6.16 EnDat Encoder

The absolute position is read from the encoder and used to set the actual position after power-up.

Table 28: Parameters for EnDat Encoder

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate supply voltage. **NOTICE** Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
9.4.3 Interface Configuration for Device 1	Select ***[22] EnDat Z,D***.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution.
9.6.2 Multiturn Resolution	Set the number of bits used for the revolution count.
9.6.3 EnDat Clock Rate	Set the rate for the clock signal according to the encoder specifications.

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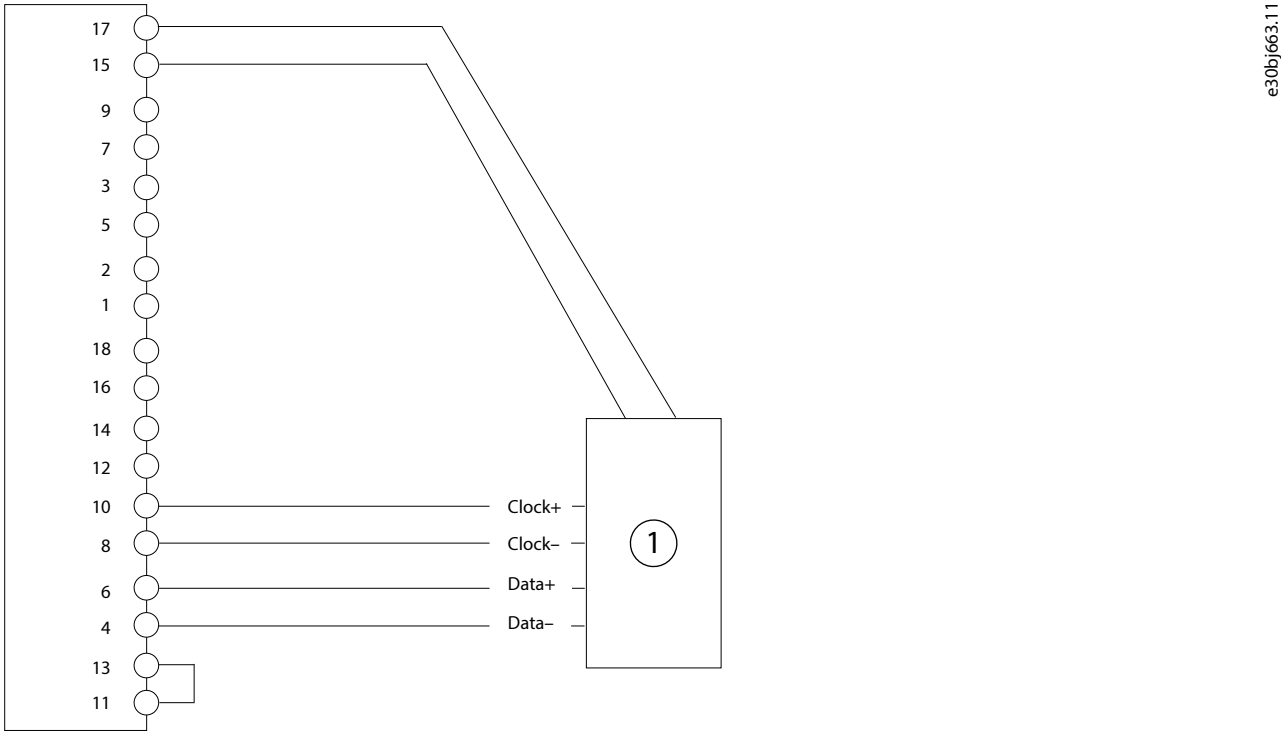


Figure 24: Wiring Configuration for 2-Track EnDat Encoder

1	EnDat encoder

5.6.17 EnDat and Resolver

This example shows the connection of an EnDat encoder on Z and D as channel 1, and a resolver on A and B as channel 2. The internal supply of the option is used for resolver excitation. The encoder supply (pin 17) is inactive, so the SSI encoder must be supplied by an external power source.

Table 29: Parameters for EnDat and Resolver

Parameter	Setting
9.4.3 Interface Configuration for Device 1	Select ***[22] EnDat Z,D***.
9.4.6 Interface Configuration for Device 2	Select ***[7] Resolver A,B***.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution of the connected EnDat encoder.
9.6.2 Multiturn Resolution	Set the number of bits used for counting the revolutions of the connected EnDat encoder.
9.6.3 EnDat Clock Rate	Select the clock rate according to the specifications of the connected EnDat encoder.
9.7.1 Excitation Voltage	Set the excitation voltage according to the specifications of the connected resolver.
9.7.2 Excitation Frequency	Set the resolver excitation frequency according to the specifications of the connected resolver.
9.7.3 Number of Pole Pairs	Set the number of pole pairs of the connected resolver.

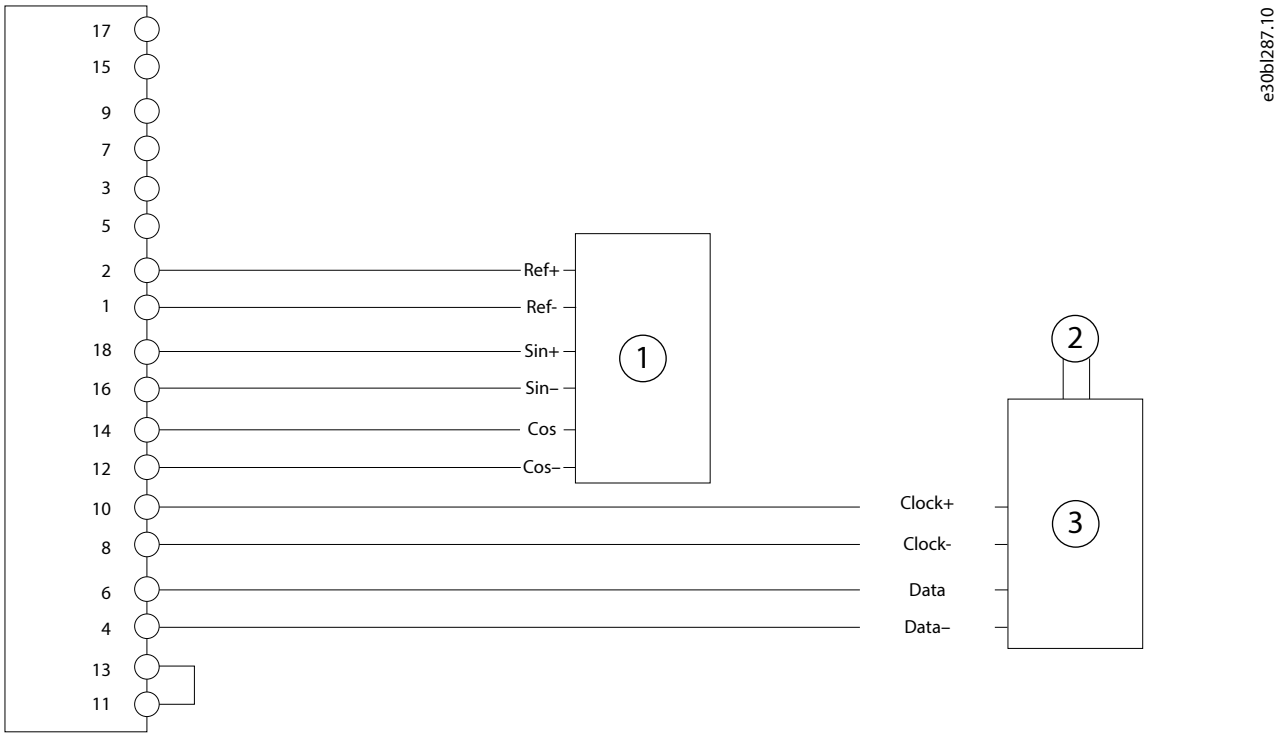


Figure 25: Wiring Configuration for EnDat and Resolver

1	Resolver	2	External power supply
3	EnDat encoder		

5.6.18 EnDat and Incremental (TTL or HTL) or SinCos Encoder

This example shows the connection of an EnDat encoder on Z and D as channel 1, and a 2-track incremental encoder or SinCos encoder on A and B as channel 2. An external supply may be needed if the power requirement exceeds the maximum power of the encoder supply (pin 17), or if the 2 encoders require different supply voltage.

Table 30: Parameters for EnDat and Incremental (TTL or HTL) or SinCos Encoder

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate voltage. **NOTICE** Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
9.4.3 Interface Configuration for Device 1	Select ***[22] EnDat Z,D***.
9.4.6 Interface Configuration for Device 2	Select 1 of the following options: ***[1] 2 track incremental*** ***[10] SinCos A,B***
9.5.2 Resolution Channel 2	Set the resolution of the incremental or SinCos encoder connected to A and B in pulses per revolution.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution of the connected EnDat encoder.

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Table 30: Parameters for EnDat and Incremental (TTL or HTL) or SinCos Encoder - (continued)

Parameter	Setting
9.6.2 Multiturn Resolution	Set the number of bits used for counting the revolutions of the connected EnDat encoder.
9.6.3 EnDat Clock Rate	Select the clock rate according to the encoder specifications.

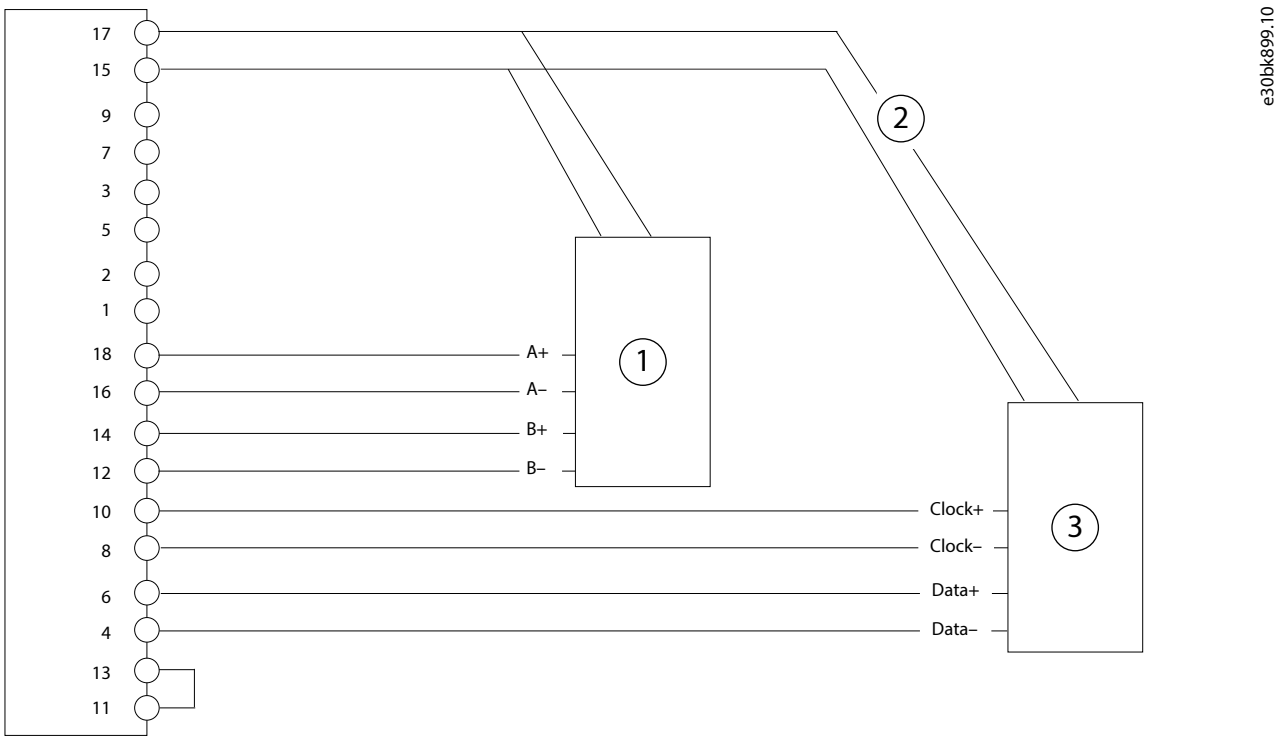


Figure 26: EnDat and Incremental (TTL or HTL) or SinCos Encoder

1	Incremental or SinCos encoder	2	External power supply
3	EnDat absolute encoder		

5.6.19 EnDat Encoder with Virtual Output as Device 2

The encoder output as device 2 represents the position of device 1 or position values such as ***Virtual Master***, ***Demanded***, or ***Actual Position*** provided by the drive. The output is scaled by parameter ***9.5.2 Resolution Channel 2*** which represents 1 rotation of device 1, or 1 motor rotation for other position values.

Table 31: Parameter Settings for EnDat Encoder with Virtual Output as Device 2

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate voltage for the connected encoder.
9.4.3 Interface Configuration for Device 1	Select ***[22] EnDat Z,D***.
9.4.6 Interface Configuration for Device 2	Select 1 of the following options: ***[4] Device 1 Out*** to represent the position of the encoder or resolver connected as device 1. ***[6] Virtual Out*** to represent the position of the source selected in parameter ***5.16.2.4 Virtual Output Source Selection***[(1)].

Table 31: Parameter Settings for EnDat Encoder with Virtual Output as Device 2 - (continued)

Parameter	Setting
9.5.2 Resolution Channel 2	Set the number of pulses per revolution of the virtual encoder representing 1 rotation of device 1 or the motor.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution of the connected SSI encoder.
9.6.2 Multiturn Resolution	Set the number of bits used for counting the revolutions of the connected SSI encoder.

1) For more information on the parameter, see iC7 Series Motion Application Guide.

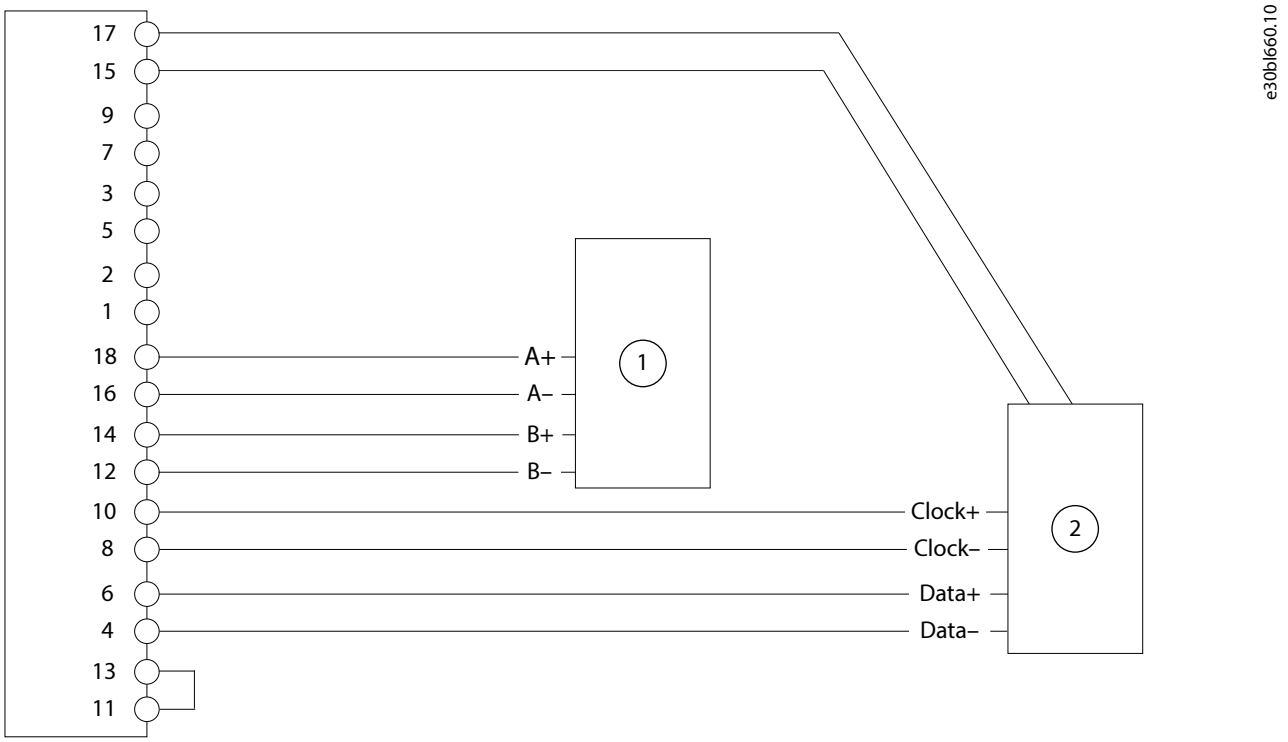


Figure 27: Wiring Configuration for EnDat Encoder with Virtual Output as Device 2

1	Controller	2	EnDat absolute encoder

5.6.20 EnDat with Incremental or SinCos Track

This example shows the connection of an SSI encoder with incremental (TTL, HTL) or SinCos track on Z and D, and A and B as channel 1. The absolute position is read from the encoder and used as the actual position. The incremental or SinCos track is used to compensate for communication delay and too few absolute position readings due to communication speed.

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Table 32: Parameters for EnDat with Incremental or SinCos Track

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate voltage for the connected encoder. **NOTICE** Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
9.4.3 Interface Configuration for Device 1	Select 1 of the following options: ***[21] EnDat with 2 track incremental Z,D,A,B*** ***[20] EnDat with SinCos Z,D,A,B***
9.5.1 Resolution Channel 1	Set the resolution of the incremental/SinCos track connected to A and B in pulses per revolution.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution of the connected EnDat encoder.
9.6.2 Multiturn Resolution	Set the number of bits used for counting the revolutions of the connected EnDat encoder.
9.6.3 EnDat Clock Rate	Select the clock rate according to the specifications of the connected EnDat encoder.

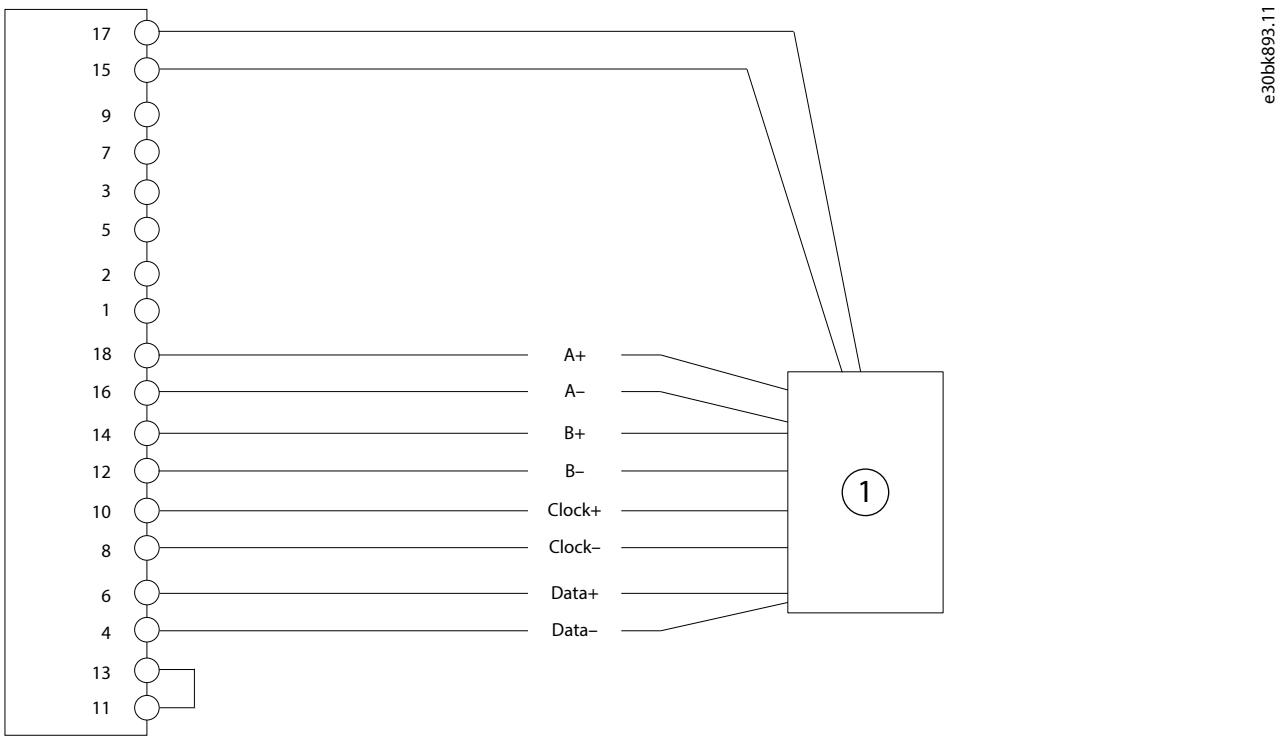


Figure 28: Wiring Configuration for EnDat with Incremental or SinCos Track

1	EnDat encoder

5.6.21 HIPERFACE®

This example shows the connection of a dual-channel HIPERFACE® with data channel on D, and SinCos channel on A and B.

Table 33: Parameters for HIPERFACE®

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate voltage. **NOTICE** Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
9.4.3 Interface Configuration for Device 1	Select ***[25] HIPERFACE A,B,D***.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution of the connected HIPERFACE® encoder.
9.6.2 Multiturn Resolution	Set the number of bits used for counting the revolutions of the connected HIPERFACE® encoder.
9.6.6 HIPERFACE Baud Rate	Select the appropriate baud rate.
9.6.7 HIPERFACE Parity	Select the appropriate parity.

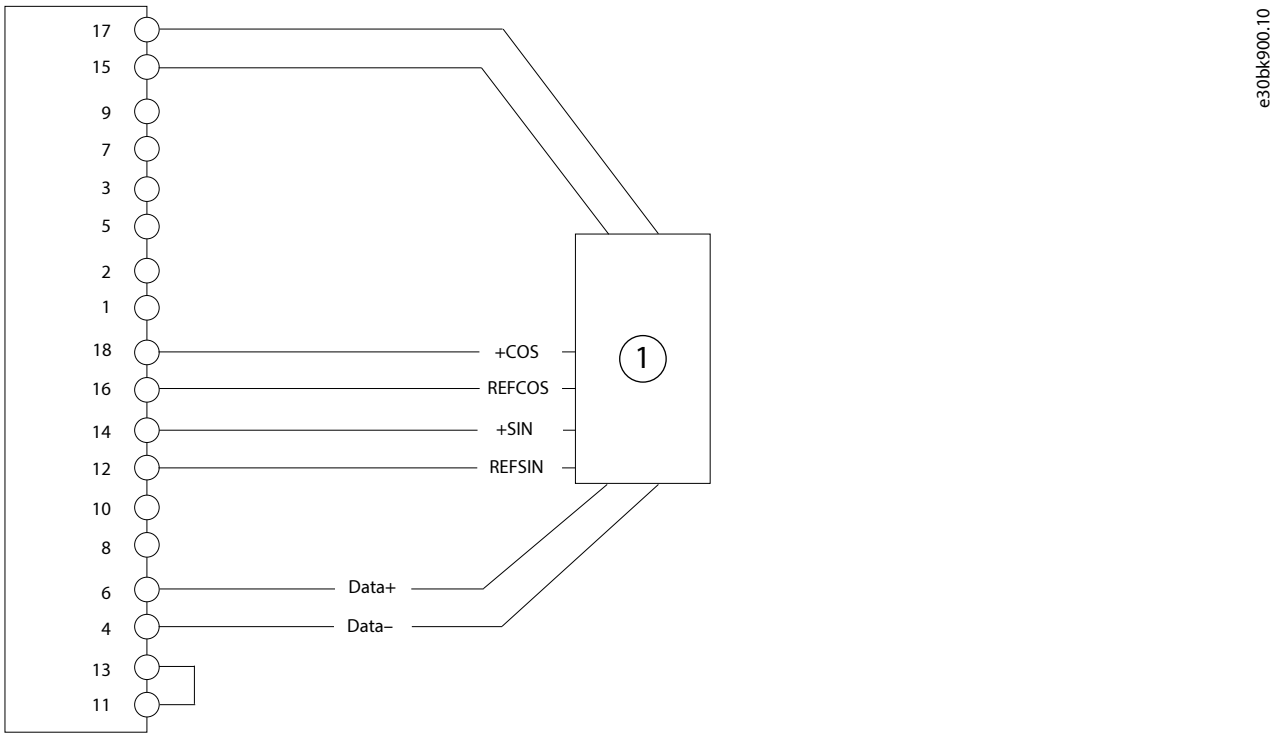


Figure 29: Wiring Configuration for HIPERFACE®

1	HIPERFACE® encoder

5.6.22 HIPERFACE DSL®

The absolute position is read from the encoder and used to set the actual position after power-up.

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Table 34: Parameters for HIPERFACE DSL®

Parameter	Setting
9.4.3 Interface Configuration for Device 1	Select ***[26] HIPERFACE DSL D***.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution.
9.6.2 Multiturn Resolution	Set the number of bits used for the revolution count.

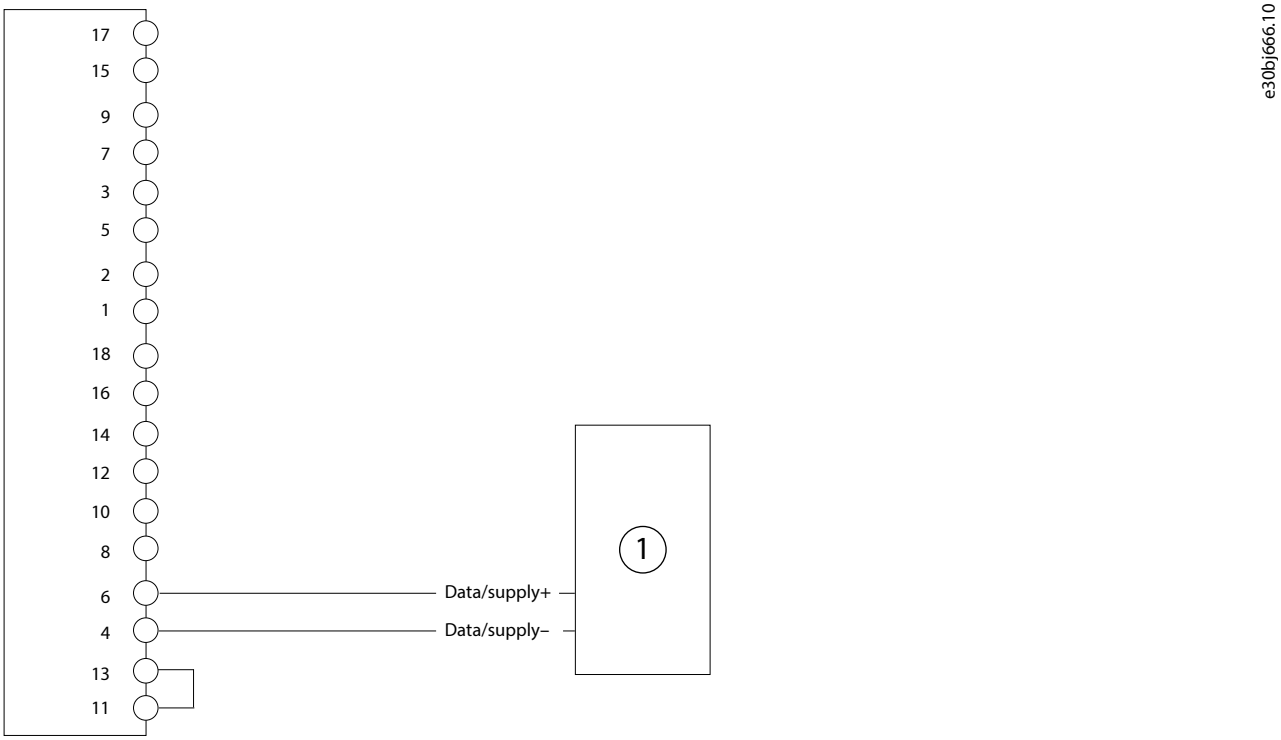


Figure 30: Wiring Configuration for HIPERFACE DSL® Encoder

1	HIPERFACE DSL® encoder

5.6.23 HIPERFACE DSL® and Incremental (TTL or HTL) or SinCos Encoder

This example shows the connection of a HIPERFACE DSL® encoder on D as channel/feedback device 1, and a 2-track or 3-track incremental encoder or SinCos encoder on A and B as channel/feedback device 2. The encoder supply (pin 17) is inactive, so the incremental or SinCos encoder must be supplied by an external power source.

Table 35: Parameters for HIPERFACE DSL® and Incremental (TTL or HTL) or SinCos Encoder

Parameter	Setting
9.4.3 Interface Configuration for Device 1	Select ***[26] HIPERFACE DSL D***.
9.4.6 Interface Configuration for Device 2	Select 1 of the following options: ***[1] 2 track incremental*** ***[3] 3 track incremental A,B,Z*** ***[10] SinCos A,B*** ***[14] SinCos A,B,Z***
9.5.2 Resolution Channel 2	Set the resolution of the incremental or SinCos encoder connected to A and B in pulses per revolution.

Table 35: Parameters for HIPERFACE DSL® and Incremental (TTL or HTL) or SinCos Encoder - (continued)

Parameter	Setting
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution of the connected HIPERFACE DSL® encoder.
9.6.2 Multiturn Resolution	Set the number of bits used for counting the revolutions of the connected HIPERFACE DSL® encoder.

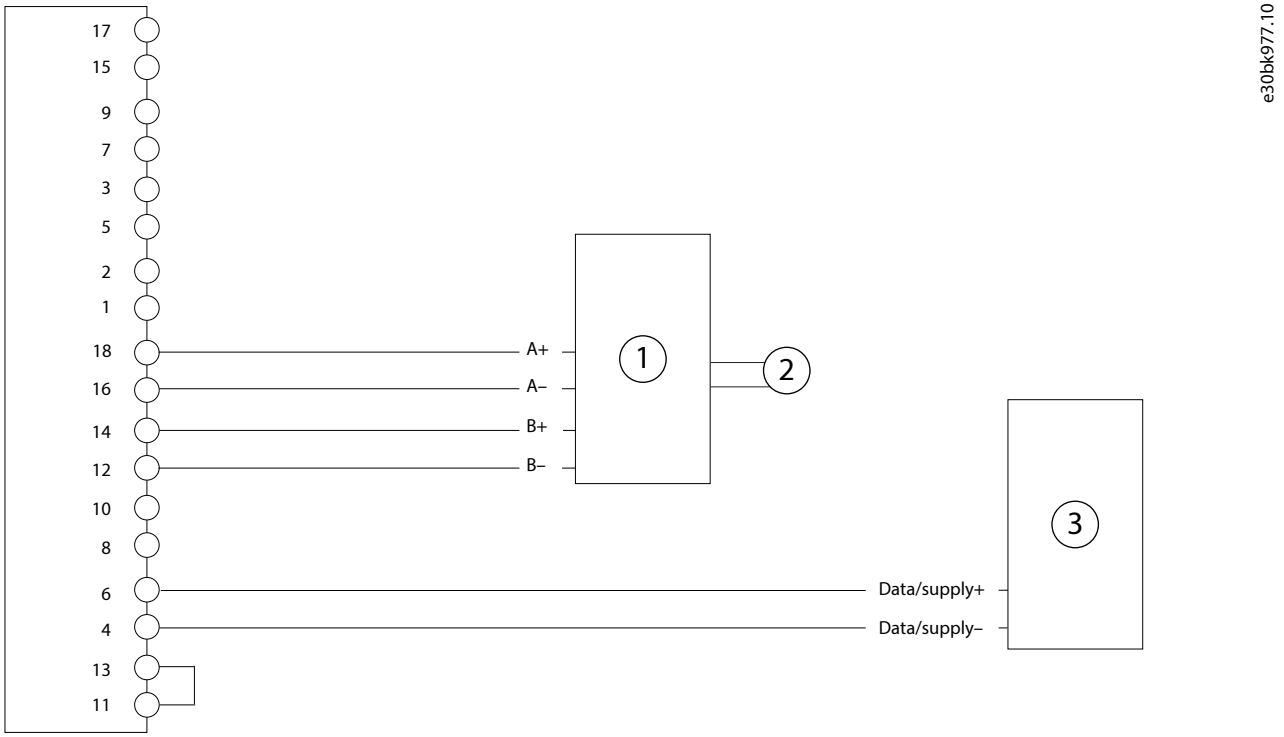


Figure 31: Wiring Configuration for HIPERFACE DSL® and Incremental (TTL or HTL) or SinCos Encoder

1	Incremental or SinCos encoder	2	External power supply
3	HIPERFACE DSL® encoder		

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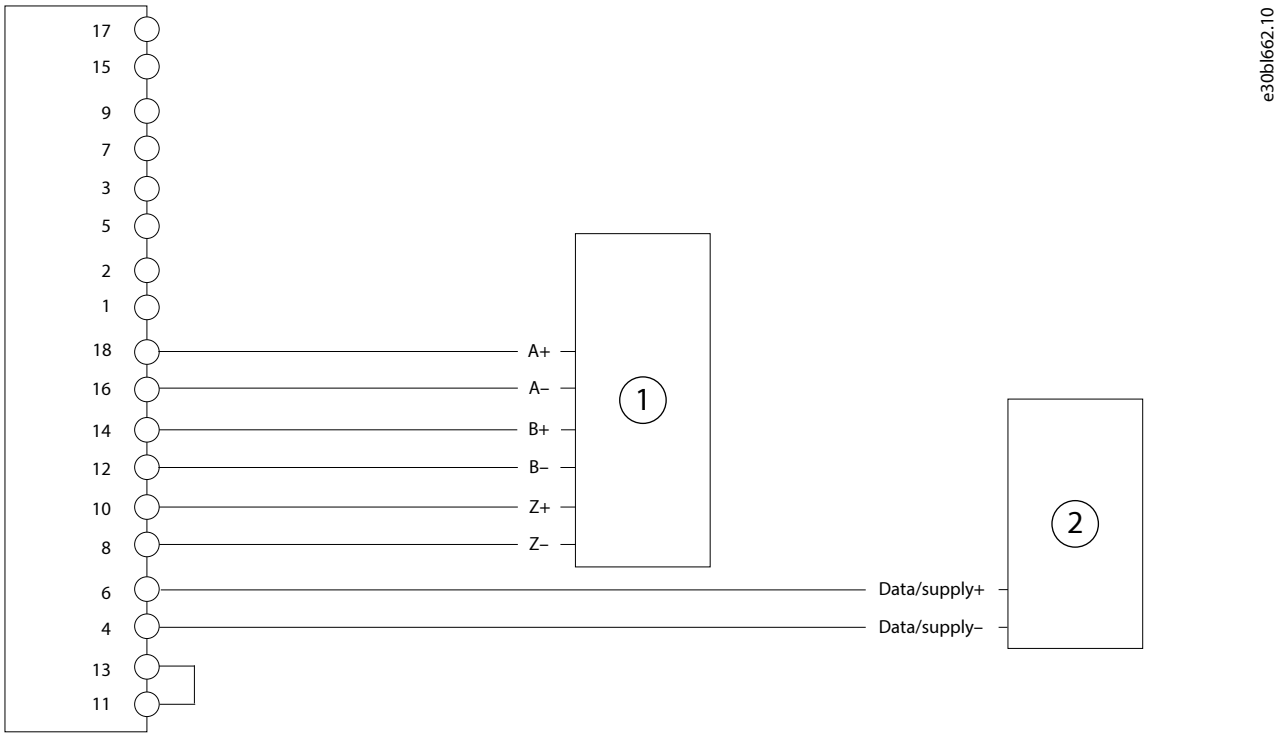


Figure 32: Wiring Configuration for HIPERFACE DSL® and 3-track Incremental or SinCos Encoder

1	3-track incremental or SinCos encoder	2	External power supply
3	HIPERFACE DSL® encoder		

5.6.24 HIPERFACE DSL® Encoder with Virtual Output as Device 2

The encoder output as device 2 represents the position of device 1 or position values such as ***Virtual Master***, ***Demanded***, or ***Actual Position*** provided by the drive. The output is scaled by parameter ***9.5.2 Resolution Channel 2*** which represents 1 rotation of device 1, or 1 motor rotation for other position values.

Parameter	Setting
9.4.3 Interface Configuration for Device 1	Select ***[26] HIPERFACE DSL D***.
9.4.6 Interface Configuration for Device 2	Select 1 of the following options: ***[4] Device 1 Out*** to represent the position of the encoder or resolver connected as device 1. ***[6] Virtual Out*** to represent the position of the source selected in parameter ***5.16.2.4 Virtual Output Source Selection***[(1)].
9.5.2 Resolution Channel 2	Set the number of pulses per revolution of the virtual encoder representing 1 rotation of device 1 or the motor.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution of the connected SSI encoder.
9.6.2 Multiturn Resolution	Set the number of bits used for counting the revolutions of the connected SSI encoder.

1) For more information on the parameter, see iC7 Series Motion Application Guide.

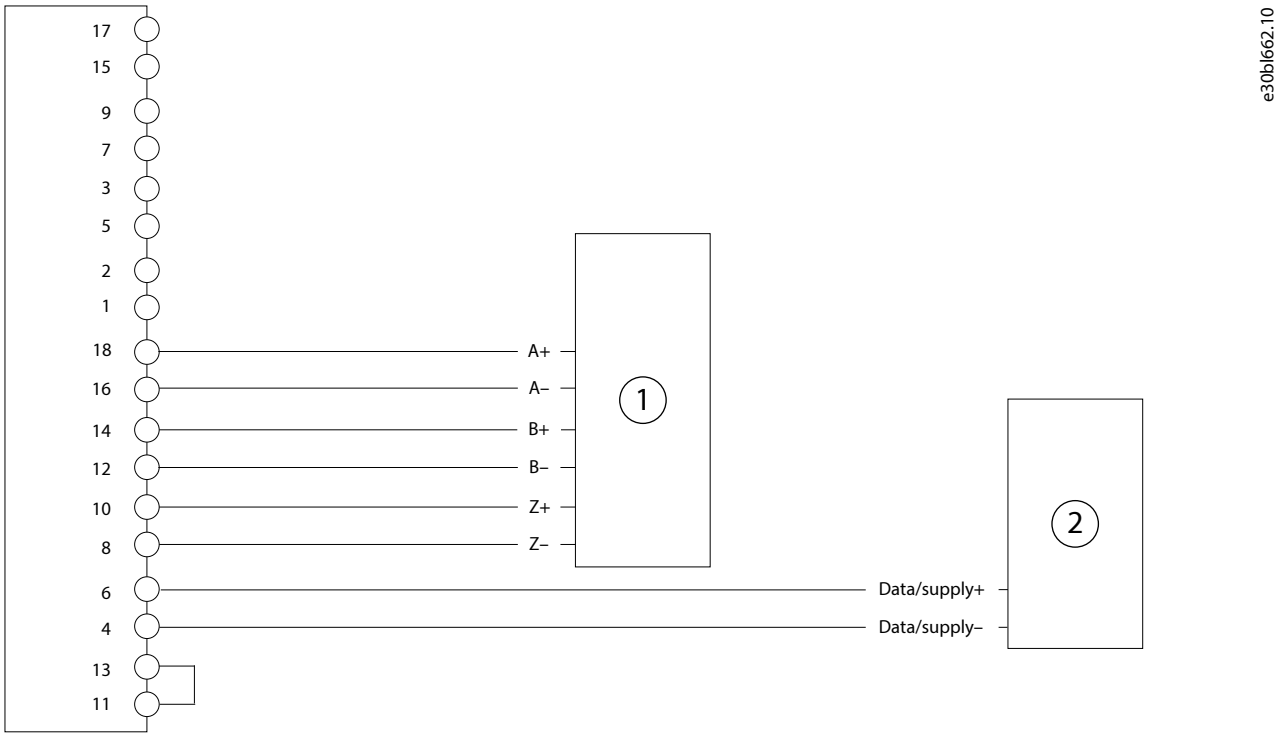


Figure 33: Wiring Configuration for HIPERFACE DSL® Encoder with Virtual Output as Device 2

1	Controller	2	HIPERFACE DSL® encoder

5.6.25 BiSS Encoder

The absolute position is read from the encoder and used to set the actual position after power-up.

Table 36: Parameters for BiSS Encoder

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate supply voltage. **NOTICE** Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
9.4.3 Interface Configuration for Device 1	Select ***[29] BiSS Z,D***.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution.
9.6.2 Multiturn Resolution	Set the number of bits used for the revolution count.
9.6.5 BiSS/SSI Clock Rate	Set the rate for the clock signal according to the encoder specifications.

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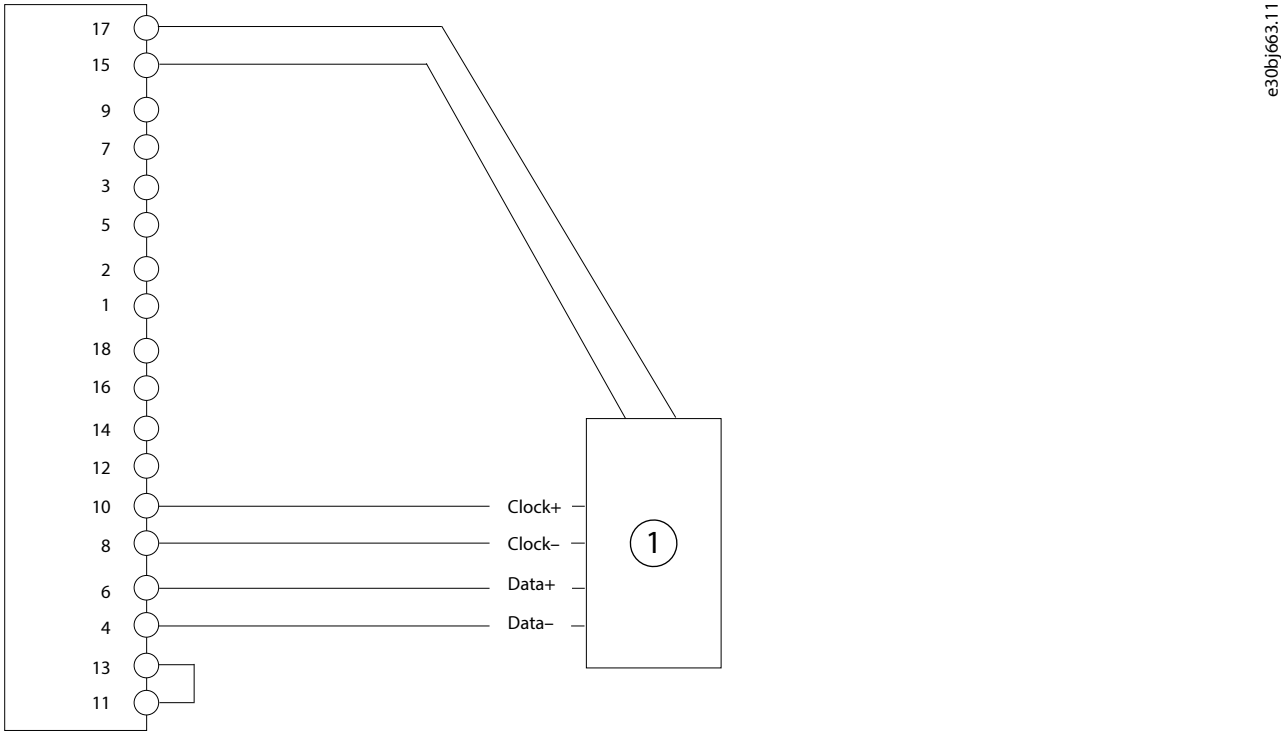


Figure 34: Wiring Configuration for 2-Track BiSS Encoder

1	BiSS encoder

5.6.26 BiSS and Resolver

This example shows the connection of a BiSS encoder on Z and D as channel 1, and a resolver on A and B as channel 2. The internal supply of the option is used for resolver excitation. The encoder supply (pin 17) is inactive, so the BiSS encoder must be supplied by an external power source.

Table 37: Parameters for BiSS and Resolver

Parameter	Setting
9.4.3 Interface Configuration for Device 1	Select ***[29] BiSS Z,D***.
9.4.6 Interface Configuration for Device 2	Select ***[7] Resolver A,B***.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution of the connected BiSS encoder.
9.6.2 Multiturn Resolution	Set the number of bits used for counting the revolutions of the connected BiSS encoder.
9.6.5 BiSS/SSI Clock Rate	Select the clock rate according to the specifications of the connected BiSS encoder.
9.7.1 Excitation Voltage	Set the excitation voltage according to the specifications of the connected resolver.
9.7.2 Excitation Frequency	Set the resolver excitation frequency according to the specifications of the connected resolver.
9.7.3 Number of Pole Pairs	Set the number of pole pairs of the connected resolver.

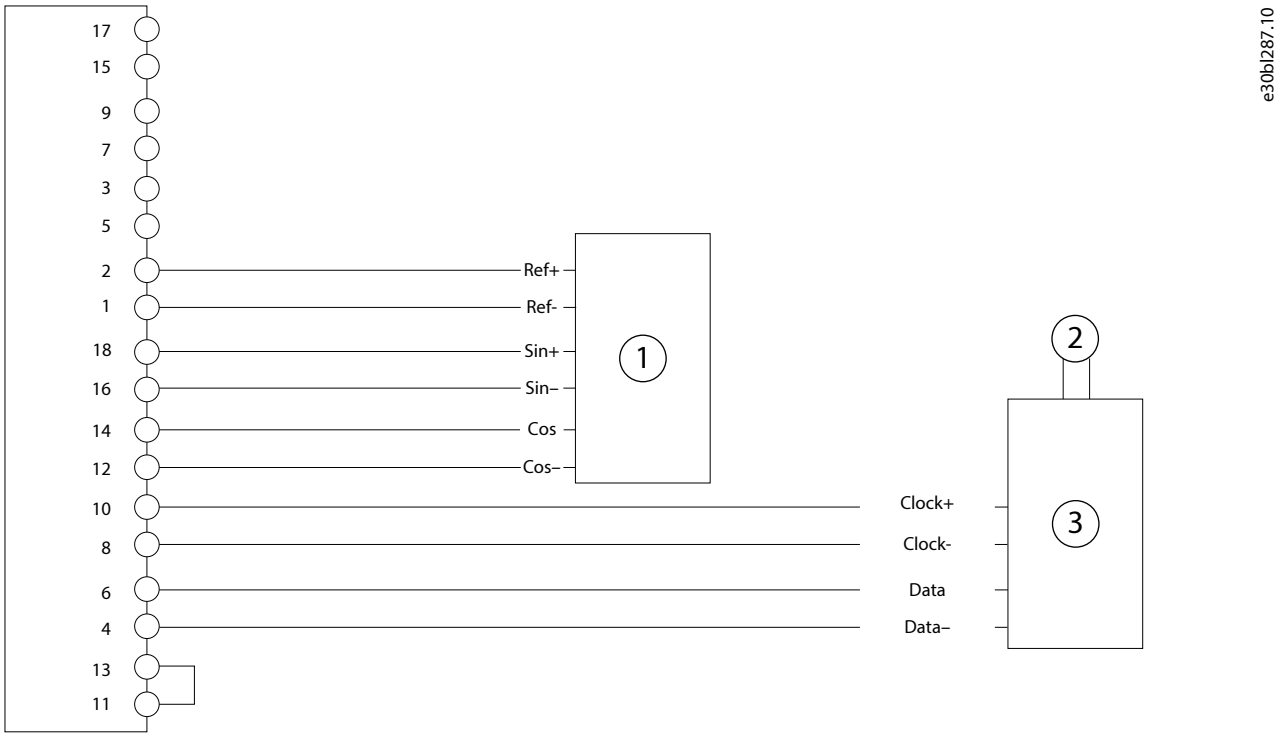


Figure 35: Wiring Configuration for BiSS and Resolver

1	Resolver	2	External power supply
3	BiSS encoder		

5.6.27 BiSS and Incremental (TTL or HTL) or SinCos Encoder

This example shows the connection of a BiSS encoder on Z and D as channel/feedback device 1, and a 2-track incremental encoder or SinCos encoder on A and B as channel/feedback device 2. An external supply might be needed if the power requirement exceeds the maximum power of the encoder supply (pin 17), or if the 2 encoders require different supply voltages.

Table 38: Parameters for BiSS and Incremental (TTL or HTL) or SinCos Encoder

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate voltage. **NOTICE** Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
9.4.3 Interface Configuration for Device 1	Select ***[29] BiSS Z,D***.
9.4.6 Interface Configuration for Device 2	Select 1 of the following options: ***[1] 2 track incremental*** ***[10] SinCos A,B***
9.5.2 Resolution Channel 2	Set the resolution of the incremental or SinCos encoder connected to A and B in pulses per revolution.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution of the connected BiSS encoder.

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Table 38: Parameters for BiSS and Incremental (TTL or HTL) or SinCos Encoder - (continued)

Parameter	Setting
9.6.2 Multiturn Resolution	Set the number of bits used for counting the revolutions of the connected BiSS encoder.
9.6.5 BiSS/SSI Clock Rate	Select the clock rate according to the encoder specifications.

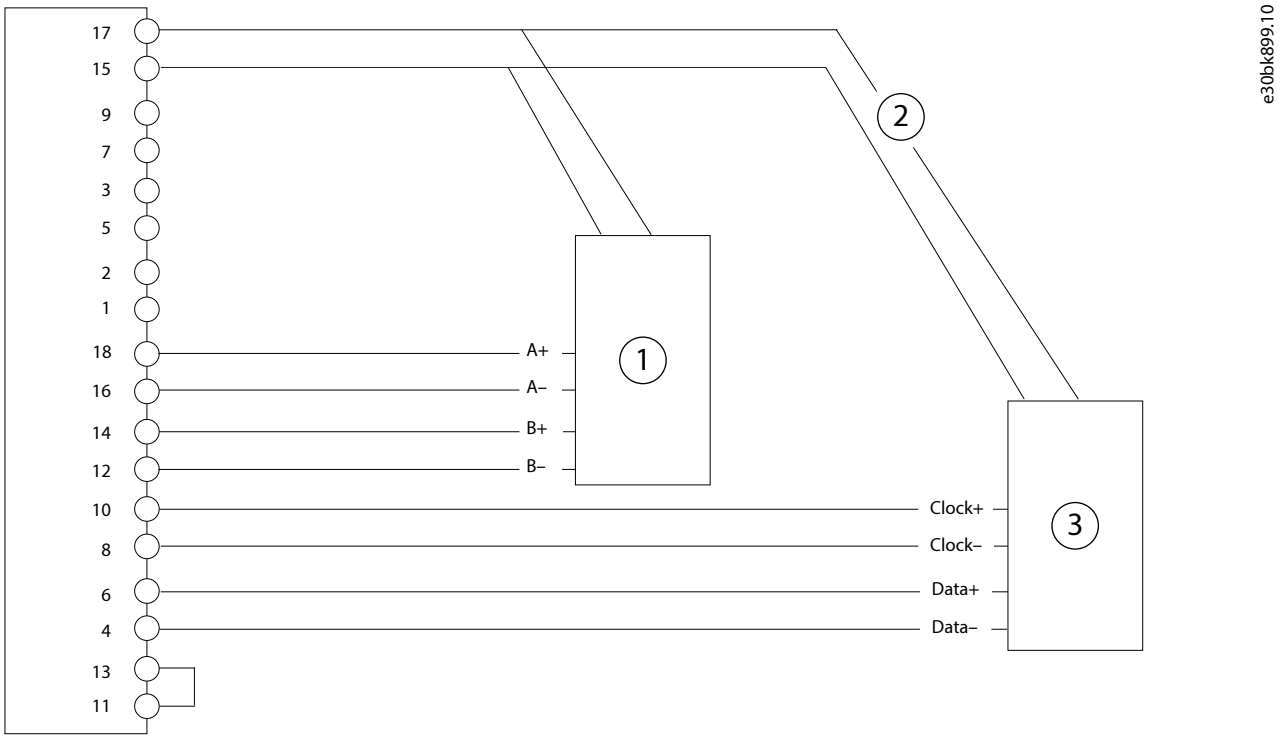


Figure 36: Wiring Configuration for BiSS and Incremental (TTL or HTL) or SinCos Encoder

1	Incremental or SinCos encoder	2	External power supply
3	BiSS absolute encoder		

5.6.28 BiSS Encoder with Virtual Output as Device 2

The encoder output as device 2 represents the position of device 1 or position values such as ***Virtual Master***, ***Demanded***, or ***Actual Position*** provided by the drive. The output is scaled by parameter ***9.5.2 Resolution Channel 2*** which represents 1 rotation of device 1, or 1 motor rotation for other position values.

Table 39: Parameters for BiSS Encoder with Virtual Output as Device 2

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate voltage for the connected encoder.
9.4.3 Interface Configuration for Device 1	Select ***[29] BiSS Z,D***.
9.4.6 Interface Configuration for Device 2	Select 1 of the following options: ***[4] Device 1 Out*** to represent the position of the encoder or resolver connected as device 1. ***[6] Virtual Out*** to represent the position of the source selected in parameter ***5.16.2.4 Virtual Output Source Selection***[(1)].

Table 39: Parameters for BiSS Encoder with Virtual Output as Device 2 - (continued)

Parameter	Setting
9.5.2 Resolution Channel 2	Set the number of pulses per revolution of the virtual encoder representing 1 rotation of device 1 or the motor.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution of the connected SSI encoder.
9.6.2 Multiturn Resolution	Set the number of bits used for counting the revolutions of the connected SSI encoder.
9.6.5 BiSS/SSI Clock Rate	Select the clock rate according to the specifications of the connected SSI encoder.

1) For more information on the parameter, see iC7 Series Motion Application Guide.

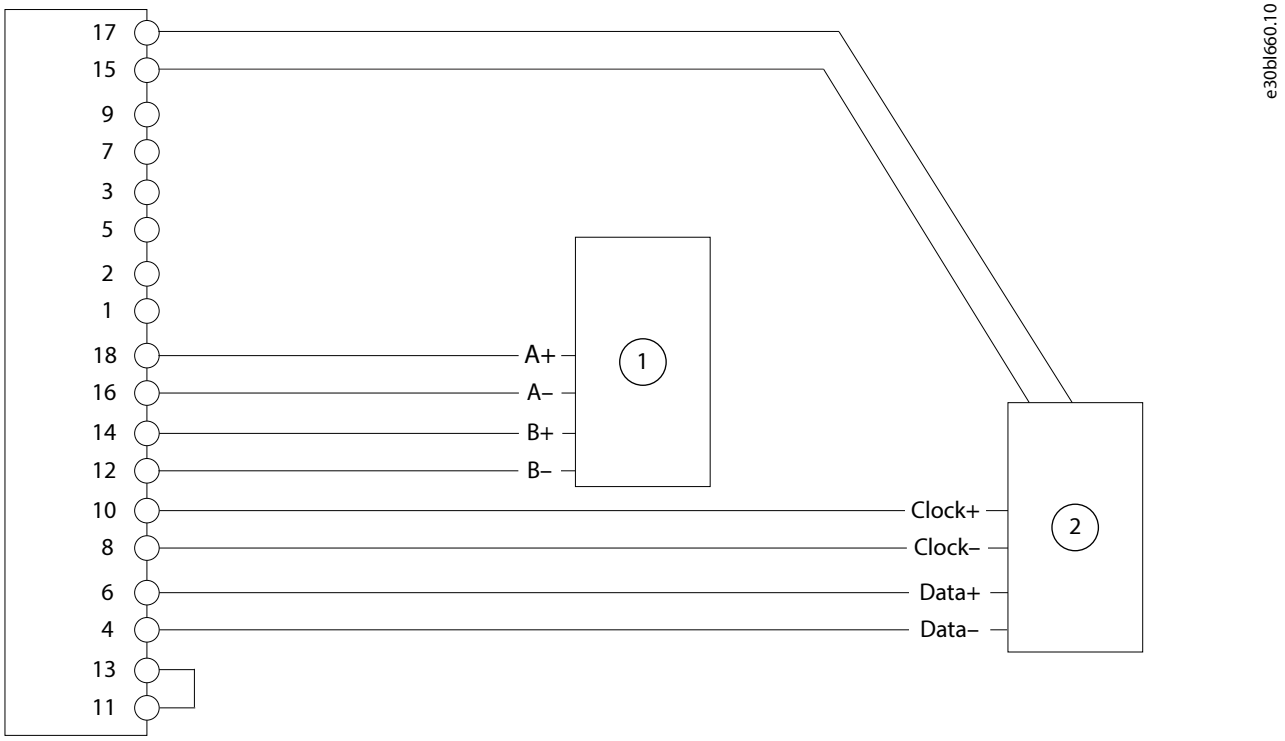


Figure 37: Wiring Configuration for BiSS Encoder with Virtual Output as Device 2

1	Controller	2	BiSS absolute encoder

5.6.29 BiSS Encoder with Incremental or SinCos Track

This example shows the connection of a BiSS encoder with incremental (TTL, HTL) or SinCos track on Z and D, and A and B as channel 1. The absolute position is read from the encoder and used as the actual position. The incremental/SinCos track is used to compensate for communication delay and too few absolute position readings due to communication speed.

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Table 40: Parameters for BiSS Encoder with Incremental or SinCos Track

Parameter	Setting
9.4.1 Encoder Supply Voltage	Set the appropriate voltage. **NOTICE** Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
9.4.3 Interface Configuration for Device 1	Select 1 of the following options: ***[31] BiSS with 2 track incremental Z,D,A,B*** ***[32] BiSS with SinCos Z,D,A,B***
9.5.1 Resolution Channel 1	Set the resolution of the incremental track connected to A and B in pulses per revolution.
9.6.1 Singleturn Resolution	Set the number of bits used for 1 revolution of the connected BiSS encoder.
9.6.2 Multiturn Resolution	Set the number of bits used for counting the revolutions of the connected BiSS encoder.
9.6.5 BiSS/SSI Clock Rate	Select the clock rate according to the encoder specifications.

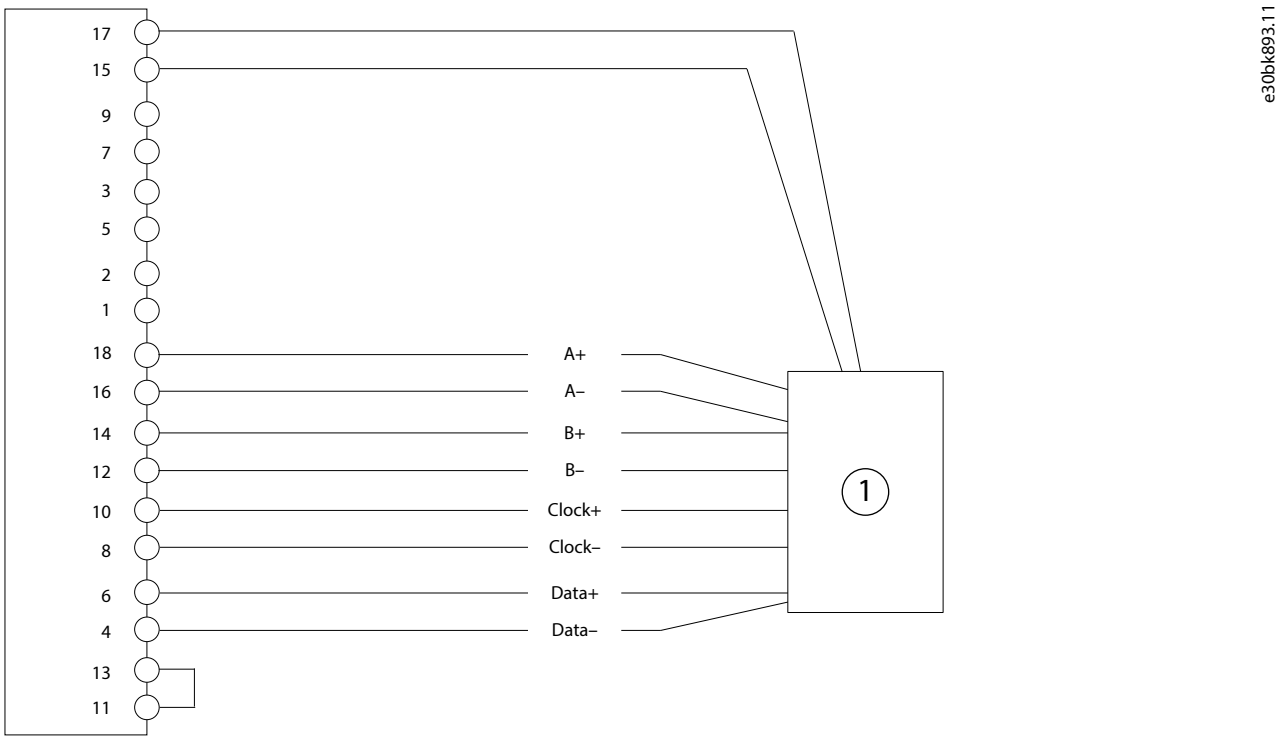


Figure 38: BiSS Encoder with Incremental or SinCos Track

1	BiSS encoder

5.7 Linear Encoders

5.7.1 Overview

Both incremental and absolute linear encoders are supported with the same signals and protocols as rotary encoders. Resolver and incremental encoders (TTL, HTL, and SinCos) with zero pulse are not supported as linear.

The encoder type is selected as rotary (default) or linear for device 1 and/or device 2 in parameters ***9.4.5 Encoder Type for Device 1*** and ***9.4.8 Encoder Type for Device 2***. Encoder wiring is determined by the selected interface configuration for device 1 and device 2. The same wiring configuration examples apply to both encoder types, but are configured with parameters in different parameter groups. Linear encoders are configured with the parameters in parameter group ***9.8 Linear Encoder Settings***. The parameter groups used for configuring rotary encoders, for example, ***9.5 Incremental Settings*** and ***9.6 Absolute Settings*** are inactive.

A linear encoder can be connected as device 1 or device 2, where device 1 can be incremental or absolute, whereas device 2 can only be incremental.

5.7.2 Incremental Encoder as Device 1

Table 41: Parameters for Incremental Linear Encoder as Device 1

Parameter	Setting
9.4.5 Encoder Type for Device 1	Select ***[1] Linear***.
9.8.1 Distance per Motor Revolution for Device 1	Set the distance of movement per motor revolution in mm. This is needed for the calculation of the correct speed based on the position feedback.
9.8.4 Incremental Encoder Range for Device 1	Set the measuring length for the encoder in meters.
9.8.5 Incremental Pulse Width for Device 1	Set the distance of movement in mm per encoder pulse/signal period.

NOTE: The incremental encoder range is limited to 2^{30} encoder pulses according to the formula $\frac{\text{EncoderRange}}{\text{PulseWidth}} \leq 2^{30}$.

5.7.3 Absolute Encoder as Device 1

Table 42: Parameters for Absolute Linear Encoder as Device 1

Parameter	Setting
9.4.5 Encoder Type for Device 1	Select ***[1] Linear***.
9.8.1 Distance per Motor Revolution for Device 1	Set the distance of movement per motor revolution in mm. This is needed for the calculation of the correct speed based on the position feedback.
9.8.2 Absolute Encoder Data Length	Set the number of data bits representing the absolute position.
9.8.3 Absolute Encoder Resolution	Set the distance per position step.

NOTE: If the data length exceeds 32 bits, only the 32 most significant bits are used resulting in reduced resolution.

5.7.4 Absolute Encoder with Incremental Channel as Device 1

Table 43: Parameters for Absolute Linear Encoder with Incremental Channel as Device 1

Parameter	Setting
9.4.5 Encoder Type for Device 1	Select ***[1] Linear***.
9.8.1 Distance per Motor Revolution for Device 1	Set the distance of movement per motor revolution in mm. This is needed for the calculation of the correct speed based on the position feedback.
9.8.2 Absolute Encoder Data Length	Set the number of data bits representing the absolute position.
9.8.3 Absolute Encoder Resolution	Set the distance per position step.
9.8.5 Incremental Pulse Width for Device 1	Set the distance of movement in mm per incremental pulse/signal period.

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NOTE: If data length exceeds 32 bits, only the 32 most significant bits are used resulting in reduced resolution. The incremental encoder range is limited to 2^{30} encoder pulses according to the formula $\frac{EncoderRange}{PulseWidth} < 2^{30}$.

5.7.5 Incremental Encoder as Device 2

In this example, the incremental linear encoder as device 2 is connected to track A and B, or track Z and D. The signal type for track A and B can be TTL, HTL, or SinCos. The signal type for track Z and D must be TTL.

Table 44: Parameters for Incremental Linear Encoder as Device 2

Parameter	Setting
9.4.8 Encoder Type for Device 2	Select ***[1] Linear***.
9.8.6 Distance per Motor Revolution for Device 2	Set the distance of movement per motor revolution in mm. This is needed for the calculation of the correct speed based on the position feedback.
9.8.7 Incremental Encoder Range for Device 2	Set the measuring length for the encoder in meters.
9.8.8 Incremental Pulse Width for Device 2	Set the distance of movement in mm per encoder pulse/signal period.

NOTE: The incremental encoder range is limited to 2^{30} encoder pulses according to the formula $\frac{EncoderRange}{PulseWidth} < 2^{30}$.

5.8 Parameter Descriptions

5.8.1 Automatic Readout of Absolute Encoder Data

If the connected encoder supports the readout of encoder data, the data is automatically read out when connecting an EnDat, HIPERFACE®, HIPERFACE DSL®, or BiSS absolute encoder. Automatic readout is only supported for rotary absolute encoders and cannot be used with linear encoders. The encoder type, rotary or linear, is detected and the parameter ***9.4.5 Encoder Type for Device 1*** is set accordingly.

The basic encoder type is selected in parameter ***9.4.3 Interface Configuration for Device 1***, and the appropriate supply voltage is set in parameter ***9.4.1 Encoder Supply Voltage***. The encoder data is then read out, and the corresponding parameters are updated with the value read from the connected encoder. Other relevant parameters must be set manually.

As some absolute encoders might not support automatic readout of data, settings must be verified after connecting the encoder. If the automatic readout is not possible, the configuration parameters are not updated, and must be set manually.

See Table 45 for the available data for automatic readout and corresponding parameters for each encoder type.

Table 45: Automatic Readout Parameters

Parameter ***9.4.3 Interface Configuration for Device 1***	Automatic setting	Manual setting
EnDat Z,D	***9.6.1 Singleturn Resolution*** ***9.6.2 Multiturn Resolution***	***9.4.1 Encoder Supply Voltage*** ***9.6.3 EnDat Clock Rate***
EnDat with 2 track incremental or SinCos Z,D,A,B	***9.6.1 Singleturn Resolution*** ***9.6.2 Multiturn Resolution*** ***9.5.1 Resolution for Device 1***	***9.4.1 Encoder Supply Voltage*** ***9.6.3 EnDat Clock Rate***

Table 45: Automatic Readout Parameters - (continued)

Parameter *9.4.3 Interface Configuration for Device 1*	Automatic setting	Manual setting
HIPERFACE A,B,D	*9.6.1 Singleturn Resolution* *9.6.2 Multiturn Resolution* *9.5.1 Resolution for Device 1* *9.6.6 HIPERFACE Baud Rate* *9.6.7 HIPERFACE Parity*	*9.4.1 Encoder Supply Voltage*
HIPERFACE DSL D	*9.6.1 Singleturn Resolution* *9.6.2 Multiturn Resolution*	–
BiSS Z,D	*9.6.1 Singleturn Resolution* *9.6.2 Multiturn Resolution*	*9.4.1 Encoder Supply Voltage* *9.6.5 BiSS/SSI Clock Rate*
BiSS with 2 track incremental or SinCos Z,D,A,B	*9.6.1 Singleturn Resolution* *9.6.2 Multiturn Resolution*	*9.4.1 Encoder Supply Voltage* *9.5.1 Resolution for Device 1* *9.6.5 BiSS/SSI Clock Rate*

5.8.2 Encoder/Resolver Status (Menu Index 9.1)

P 9.1.1 Channel 1 Singleturn Angle

Shows the raw singleturn angle of the encoder connected to channel 1. The value is scaled from 0 to 2^{32}-1.

Default Value:	NA	**Parameter Type:**	Range (0 — 4294967295)
Parameter Number:	4065	**Unit:**	–
Data Type:	UDINT	**Access Type:**	Read Only

P 9.1.2 Channel 1 Revolutions

Shows the number of multiturn revolutions for channel 1.

Default Value:	NA	**Parameter Type:**	Range (0 — 4294967295)
Parameter Number:	4066	**Unit:**	–
Data Type:	UDINT	**Access Type:**	Read Only

P 9.1.3 Channel 1 Zero Angle

Shows the raw singleturn angle at the latest zero pulse on channel 1. The value is scaled from 0 to 2^{32}-1.

Default Value:	NA	**Parameter Type:**	Range (0 — 4294967295)
Parameter Number:	4067	**Unit:**	–
Data Type:	UDINT	**Access Type:**	Read Only

P 9.1.4 Channel 1 Encoder Status Word

Shows a status indication for the encoder connected to channel 1.

Default Value:	NA	**Parameter Type:**	Range (* — *)
Parameter Number:	4068	**Unit:**	–

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Data Type:	WORD	**Access Type:**	Read Only

Table 46: Channel 1 Encoder Status Word Bit Descriptions

Bit	Description
0	Shows that a general problem has been detected, see parameter ***9.1.9 Encoder Status Word*** for details.
2	No valid position from the connected absolute encoder. Can be caused by supply voltage, wiring issues, electrical noise, or defective encoder. Check supply voltage, clock and data signals. Reducing clock/baud rate might help especially in case of long encoder cable.
3	No valid position from the connected absolute encoder. Can be caused by supply voltage, wiring issues, electrical noise, or defective encoder. Check supply voltage, clock and data signals. Reducing clock/baud rate might help especially in case of long encoder cable.
7	An absolute encoder has not yet been configured or encoder initialization is in progress. This is just a status bit showing that the encoder is not yet ready to provide valid position information.
8	Absolute encoder or resolver signal error. Check wiring and encoder.
9	Shows that invalid data has been received on the absolute channel. Check wiring and encoder, might be caused by electrical noise disturbing the data transmission.
10	No valid position from the connected absolute encoder. Can be caused by supply voltage, wiring issues, electrical noise, or defective encoder. Check supply voltage, clock and data signals. Reducing clock/baud rate might help especially in case of long encoder cable.
12	Shows that the absolute and incremental tracks count opposite on an absolute encoder with incremental track. Invert the incremental direction by swapping A and B.
13	Shows a mismatch between the incremental track and the absolute track or the zero pulse. Indicates that the set incremental resolution is wrong.
14	SinCos encoder signal error - indicates too low signal voltage. The combined voltage on A and B at standstill must be at least 0.35 V: $U_A^2 + U_B^2 \geq 0.35^2\ V^2$.
15	Shows that no zero pulse has been detected after moving a full rotation. Check wiring and encoder.

P 9.1.5 Channel 2 Singleturn Angle

Shows the raw singleturn angle of the encoder connected to channel 2. The value is scaled from 0 to 2^{32}-1.

Default Value:	NA	**Parameter Type:**	Range (0 — 4294967295)
Parameter Number:	4006	**Unit:**	–
Data Type:	UDINT	**Access Type:**	Read Only

P 9.1.6 Channel 2 Revolutions

Shows the number of multiturn revolutions for channel 2.

Default Value:	NA	**Parameter Type:**	Range (0 — 4294967295)
Parameter Number:	4007	**Unit:**	–
Data Type:	UDINT	**Access Type:**	Read Only

P 9.1.7 Channel 2 Zero Angle

Shows the raw singleturn angle at the latest zero pulse on channel 2. The value is scaled from 0 to 2^{32}-1.

Default Value:	NA	**Parameter Type:**	Range (0 — 4294967295)

Parameter Number:	4012	**Unit:**	–
Data Type:	UDINT	**Access Type:**	Read Only

P 9.1.8 Channel 2 Encoder Status Word

Shows a status indication for the encoder connected to channel 2.

Default Value:	NA	**Parameter Type:**	Range (* — *)
Parameter Number:	4018	**Unit:**	–
Data Type:	WORD	**Access Type:**	Read Only

Table 47: Channel 2 Encoder Status Word Bit Descriptions

Bit	Description
7	An absolute encoder has not yet been configured or encoder initialization is in progress. This is just a status bit showing that the encoder is not yet ready to provide valid position information.
12	Shows that the absolute and incremental tracks count opposite on an absolute encoder with incremental track. Invert the incremental direction by swapping A and B.
13	Shows a mismatch between the incremental track and the absolute track or the zero pulse. Indicates that the set incremental resolution is wrong.
14	SinCos encoder signal error - indicates too low signal voltage. The combined voltage on A and B at standstill must be at least 0.35 V: $U_A^2 + U_B^2 \geq 0.35^2\ V^2$
15	Shows that no zero pulse has been detected after moving a full rotation. Check wiring and encoder.

P 9.1.9 Encoder Status Word

Shows an overall status indication represented in the following bits: Bit 0: Plug detect; Bit 1: Encoder supply; Bit 2: Resolver; Bit 3: Short protect; Bit 15: Encoder data not ready.

Default Value:	NA	**Parameter Type:**	Range (* — *)
Parameter Number:	4019	**Unit:**	–
Data Type:	WORD	**Access Type:**	Read Only

Table 48: Encoder Status Word Bit Descriptions

Bit	Description
0	Shows that the “Plug Detect” connection between pin 11 and 13 is interrupted. Check the connection and that the plug is correctly inserted.
1	Shows that the encoder power supply is overloaded. Check the load connected to pin 7 and 9.
2	Shows that the resolver signal is missing or invalid. Check the resolver signal, might be a wiring problem or a defective resolver.
3	Shows that a short circuit has been detected on one or more of the 4 tracks A, B, Z and D. Check the wiring.
4	Signal error on track A. Might be open wire, short to GND, short to supply or short between A+ and A.-
5	Signal error on track B. Might be open wire, short to GND, short to supply or short between B+ and B-.
6	Signal error on track Z. Might be open wire, short to GND, short to supply or short between Z+ and Z-.
7	Signal error on track D. Might be open wire, short to GND, short to supply or short between D+ and D-.
8	Termination resistor overload track A. Reduce voltage or disable termination.

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Table 48: Encoder Status Word Bit Descriptions - (continued)

Bit	Description
9	Termination resistor overload track B. Reduce voltage or disable termination.
10	Termination resistor overload track C. Reduce voltage or disable termination.
11	Termination resistor overload track D. Reduce voltage or disable termination.
15	Shows that no valid data has been received from a connected absolute encoder. Check that the encoder configuration matches the encoder specifications. Next check the wiring and the encoder.

5.8.3 Configuration (Menu Index 9.4)

P 9.4.1 Encoder Supply Voltage

Set the supply voltage level according to the specifications of the connected encoder.

Default Value:	5	**Parameter Type:**	Range (3 — 24)
Parameter Number:	4002	**Unit:**	V
Data Type:	UINT	**Access Type:**	Read/Write

IMPORTANT: Encoder supply voltage is 24 V when the setting is 19 V and above.

P 9.4.2 Supply Sense

Enable power supply cable drop compensation.

Default Value:	False	**Parameter Type:**	Selection
Parameter Number:	4035	**Unit:**	–
Data Type:	BOOL	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Disabled	Disables the function.
1	Enabled	Enables the function.

P 9.4.3 Interface Configuration for Device 1

Select the required configuration of the interface for device 1.

Default Value:	0 (Disabled)	**Parameter Type:**	Selection
Parameter Number:	4000	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Disabled	Interface is inactive.
1	2 track incremental A,B	Incremental encoder (TTL, HTL).

Selection Number	Selection Name	Selection Description
3	3 track incremental A,B,Z	Incremental encoder with zero pulse (TTL, HTL).
7	Resolver A,B	Resolver.
10	SinCos A,B	SinCos encoder.
14	SinCos A,B,Z	SinCos encoder with zero pulse.
17	SSI Z,D	SSI encoder.
33	SSI with 2 track incremental Z,D,A,B	SSI encoder including 2 track incremental part.
34	SSI with SinCos Z,D,A,B	SSI encoder including SinCos part.
22	EnDat Z,D	EnDat encoder labelled EnDat21 or EnDat22.
21	EnDat with 2 track incremental Z,D,A,B	EnDat encoder labelled EnDatT or EnDatH.
20	EnDat with SinCos Z,D,A,B	EnDat encoder labelled EnDat01 or EnDat02.
25	HIPERFACE A,B,D	HIPERFACE encoder.
26	HIPERFACE DSL D	HIPERFACE DSL encoder.
29	BiSS Z,D	BiSS encoder.
31	BiSS with 2 track incremental Z,D,A,B	BiSS encoder including 2 track incremental part.
32	BiSS with SinCos Z,D,A,B	BiSS encoder including SinCos part.

P 9.4.4 Invert Direction for Device 1

Select whether the signal for device 1 is inverted. For dual output channel encoders, this parameter affects the entire encoder information (absolute and incremental parts).

Default Value:	False	**Parameter Type:**	Selection
Parameter Number:	4092	**Unit:**	–
Data Type:	BOOL	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Disabled	Disables the function.
1	Enabled	Enables the function.

P 9.4.5 Encoder Type for Device 1

Select the type of encoder connected to channel 1.

Default Value:	0 (Rotary)	**Parameter Type:**	Selection
Parameter Number:	4110	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Rotary	Rotary encoder.
1	Linear	Linear encoder.

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P 9.4.6 Interface Configuration for Device 2

Select the required configuration of the interface for device 2.

Default Value:	0 (Disabled)	**Parameter Type:**	Selection
Parameter Number:	4001	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Disabled	Interface is inactive.
1	2 track incremental	Incremental encoder (A,B: TTL, HTL; Z,D: TTL).
3	3 track incremental A,B,Z	Incremental encoder with zero pulse (TTL, HTL).
7	Resolver A,B	Resolver.
10	SinCos A,B	SinCos encoder.
14	SinCos A,B,Z	SinCos encoder with zero pulse.
4	Device 1 Out	Output: Reproduces device 1 as incremental output (TTL).
6	Virtual Out	Output: Application configured value as incremental output (TTL).

P 9.4.7 Invert Direction for Channel 2

Select whether the signal on channel 2 is inverted. For dual channel encoders, this parameter only affects the incremental part, to be used if the A and B signal inputs are switched.

Default Value:	False	**Parameter Type:**	Selection
Parameter Number:	4093	**Unit:**	–
Data Type:	BOOL	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Disabled	Disables the function.
1	Enabled	Enables the function.

P 9.4.8 Encoder Type for Device 2

Select the type of encoder connected to channel 2.

Default Value:	0 (Rotary)	**Parameter Type:**	Selection
Parameter Number:	4111	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Rotary	Rotary encoder.
1	Linear	Linear encoder.

5.8.4 Incremental Settings (Menu Index 9.5)

P 9.5.1 Resolution for Device 1

Set the resolution of the incremental encoder for device 1.

Default Value:	1024	**Parameter Type:**	Range (0 — 65535)
Parameter Number:	4008	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

P 9.5.2 Encoder Termination for Device 1

Termination resistors can be enabled or disabled for device 1.

Default Value:	1 (Enabled)	**Parameter Type:**	Selection
Parameter Number:	4160	**Unit:**	–
Data Type:	BOOL	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Disabled	Disables the function.
1	Enabled	Enables the function.

P 9.5.3 Resolution for Device 2

Set the resolution of the incremental encoder for device 2.

Default Value:	1024	**Parameter Type:**	Range (0 — 65535)
Parameter Number:	4009	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

P 9.5.4 Encoder Termination for Device 2

Termination resistors can be enabled or disabled for device 2.

Default Value:	1 (Enabled)	**Parameter Type:**	Selection
Parameter Number:	4161	**Unit:**	–
Data Type:	BOOL	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Disabled	Disables the function.
1	Enabled	Enables the function.

P 9.5.5 Output Filter

Moving average filter for the incremental output modes. Increase for smoother speed output at the cost of additional position latency.

Default Value:	1	**Parameter Type:**	Range (1 — 32)
Parameter Number:	4097	**Unit:**	ms

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Data Type:	UINT	**Access Type:**	Read/Write

5.8.5 Absolute Settings (Menu Index 9.6)

P 9.6.1 Singleturn Resolution

Set the number of bits used for 1 revolution.

Default Value:	13	**Parameter Type:**	Range (1 — 32)
Parameter Number:	4010	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

P 9.6.2 Multiturn Resolution

Set the number of bits used for counting the revolutions.

Default Value:	12	**Parameter Type:**	Range (0 — 32)
Parameter Number:	4011	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

P 9.6.3 EnDat Clock Rate

Select the clock rate used for EnDat.

Default Value:	13 (1 MHz)	**Parameter Type:**	Selection
Parameter Number:	4036	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	8.33 MHz	–
6	4.16 MHz	–
12	2.08 MHz	–
13	1 MHz	–
14	0.2 MHz	–
15	0.1 MHz	–

P 9.6.4 SSI Data Format

Select the SSI data coding according to the specifications of the connected SSI encoder.

Default Value:	1 (Gray)	**Parameter Type:**	Selection
Parameter Number:	4034	**Unit:**	–
Data Type:	BOOL	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Binary	Use binary coding.
1	Gray	Use gray coding.

P 9.6.5 BiSS/SSI Clock Rate

Select the clock rate used for SSI or BiSS.

Default Value:	18 (833 kHz)	**Parameter Type:**	Selection
Parameter Number:	4037	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
2	8.33 MHz	–
3	6.25 MHz	–
4	5.00 MHz	–
5	4.16 MHz	–
6	3.57 MHz	–
7	3.13 MHz	–
8	2.78 MHz	–
9	2.50 MHz	–
10	2.27 MHz	–
11	2.08 MHz	–
12	1.92 MHz	–
13	1.79 MHz	–
14	1.67 MHz	–
15	1.56 MHz	–
17	1.25 MHz	–
18	833 kHz	–
19	625 kHz	–
20	500 kHz	–
21	417 kHz	–
22	357 kHz	–
23	313 kHz	–
24	278 kHz	–
25	250 kHz	–
26	227 kHz	–
27	208 kHz	–
28	192 kHz	–

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Selection Number	Selection Name	Selection Description
29	179 kHz	–
30	167 kHz	–
31	156 kHz	–

P 9.6.6 HIPERFACE Baud Rate

Select the baud rate for the HIPERFACE encoder.

Default Value:	4 (9600 bits/s)	**Parameter Type:**	Selection
Parameter Number:	4094	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
4	9600 bits/s	–
5	19200 bits/s	–
6	38400 bits/s	–

P 9.6.7 HIPERFACE Parity

Select the HIPERFACE parity.

Default Value:	2 (Even)	**Parameter Type:**	Selection
Parameter Number:	4095	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	None	–
2	Even	–
3	Odd	–

5.8.6 Resolver Settings (Menu Index 9.7)

P 9.7.1 Excitation Voltage

Set the excitation voltage according to the specifications of the connected resolver (RMS).

Default Value:	5	**Parameter Type:**	Range (2 — 8)
Parameter Number:	4005	**Unit:**	V
Data Type:	UINT	**Access Type:**	Read/Write

P 9.7.2 Excitation Frequency

Set the excitation frequency according to the specifications of the connected resolver.

Default Value:	5000	**Parameter Type:**	Range (2000 — 20000)

Parameter Number:	4004	**Unit:**	Hz
Data Type:	UINT	**Access Type:**	Read/Write

P 9.7.3 Number of Pole Pairs

Set the number of pole pairs of the connected resolver.

Default Value:	1	**Parameter Type:**	Range (1 — 255)
Parameter Number:	4003	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

P 9.7.4 Tranformation Ratio

Set the transformation ratio according to the specification of the connected resolver.

Default Value:	0.5	**Parameter Type:**	Range (0.1 — 2)
Parameter Number:	4096	**Unit:**	–
Data Type:	REAL	**Access Type:**	Read/Write

5.8.7 Linear Encoder Settings (Menu Index 9.8)

P 9.8.1 Distance per Motor Revolution for Device 1

Set the linear distance per motor revolution.

Default Value:	0.000001	**Parameter Type:**	Range (-10000000 — 10000000)
Parameter Number:	4112	**Unit:**	mm
Data Type:	REAL	**Access Type:**	Read/Write

P 9.8.2 Absolute Encoder Data Length

Set the number of data bits representing the absolute linear position.

Default Value:	25	**Parameter Type:**	Range (1 — 64)
Parameter Number:	4118	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

P 9.8.3 Absolute Encoder Resolution

Set the resolution of the linear position in position units/bit.

Default Value:	0.000001	**Parameter Type:**	Range (0.000001 — 1000)
Parameter Number:	4119	**Unit:**	mm
Data Type:	REAL	**Access Type:**	Read/Write

P 9.8.4 Incremental Encoder Range for Device 1

Set the measurement range for the linear encoder.

Default Value:	0.000000001	**Parameter Type:**	Range (0.000000001 — 10000)
Parameter Number:	4114	**Unit:**	m
Data Type:	REAL	**Access Type:**	Read/Write

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P 9.8.5 Incremental Encoder Pulse Width for Device 1

Set the pulse width of the linear incremental/SinCos encoder.

Default Value:	0.000001	**Parameter Type:**	Range (0.000001 — 1000)
Parameter Number:	4116	**Unit:**	mm
Data Type:	REAL	**Access Type:**	Read/Write

P 9.8.6 Distance per Motor Revolution for Device 2

Set the linear distance per motor revolution.

Default Value:	0.000001	**Parameter Type:**	Range (-10000000 — 10000000)
Parameter Number:	4113	**Unit:**	mm
Data Type:	REAL	**Access Type:**	Read/Write

P 9.8.7 Incremental Encoder Range for Device 2

Set the measurement range for the linear encoder.

Default Value:	0.000000001	**Parameter Type:**	Range (0.000000001 — 10000)
Parameter Number:	4115	**Unit:**	m
Data Type:	REAL	**Access Type:**	Read/Write

P 9.8.8 Incremental Encoder Pulse Width for Device 2

Set the pulse width of the linear incremental/SinCos encoder.

Default Value:	0.000001	**Parameter Type:**	Range (0.000001 — 1000)
Parameter Number:	4117	**Unit:**	mm
Data Type:	REAL	**Access Type:**	Read/Write

6 Relay Option OC7R0 Installation and Configuration

6.1 Overview

The Relay Option OC7R0 makes it possible to extend relay functions with 3 relay outputs: 2 NO/NC and 1 NO rated for up to 250 V AC/2 A.

For detailed specifications, see 6.3 Specifications.

6.2 Pin Assignment

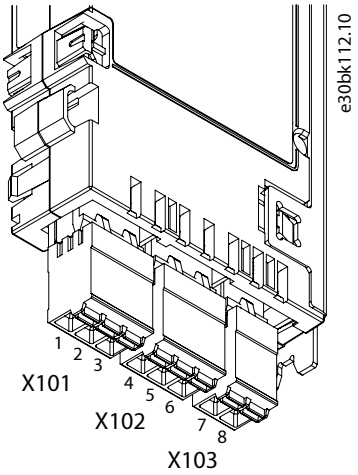


Figure 39: Relay Option OC7R0 Terminals

Table 49: Functions for Relay Option OC7R0 Terminals

Terminal X101 (Relay T2)		Terminal X102 (Relay T5)		Terminal X103 (Relay T8)	
Number	**Function**	**Number**	**Function**	**Number**	**Function**
1	Common	4	Common	7	Common
2	Normally Open (NO)	5	Normally Open (NO)	8	Normally Open (NO)
3	Normally Closed (NC)	6	Normally Closed (NC)		

The connectors are coded and cannot be exchanged in the control board.

See 6.4.1 Setup and Connection Examples for Relay Option OC7R0 for more information on wiring the option.

6.3 Specifications

Relays are PELV galvanic isolated from supply voltage and other high-voltage terminals, unless otherwise specified.

Table 50: Technical Specifications for Relay Option OC7R0

Functions	Data
Number of relay outputs	3 (2 NO/NC, 1 NO)
Maximum terminal load (AC-1): Resistive load	250 V AC, 2 A
Maximum terminal load (AC-15): Inductive load @ cos =0.4	250 V AC, 0.2 A
Maximum terminal load (DC-1): Resistive load	80 V DC, 2 A

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Table 50: Technical Specifications for Relay Option OC7R0 - (continued)

Functions	Data
Maximum terminal load (DC-13): Inductive load	24 V DC, 0.1 A
Minimum load	24 V DC, 10 mA
	24 V AC, 20 mA
Rated number of cycles (@2 A resistive load)	400 000 switchings
Cable type	Cu, 75 °C (167 °F)
Cable size	Solid: 0.2–2.5 mm^2 (24–14 AWG)
	Flexible: 0.2–2.5 mm^2 (24–14 AWG)
	Flexible with ferrule, without plastic sleeve: 0.25–2.5 mm^2 (24–14 AWG)
	Flexible without ferrule, with plastic sleeve: 0.25–2.5 mm^2 (24–14 AWG)
Maximum cable length	300 m (984 ft)
Maximum altitude	4400 m (14400 ft) NOTE: The operating altitude sets requirements on voltages. For the wiring diagrams for different operating altitudes, see 6.4.2 Wiring Diagrams for Different Operating Altitudes.
Ambient temperature	-30 °C...60 °C (-22 °F...140 °F)
Weight	0.12 kg (0.26 lb)
Environment	Overvoltage category III/pollution degree 2

6.4 Setup and Connection Examples

6.4.1 Setup and Connection Examples for Relay Option OC7R0

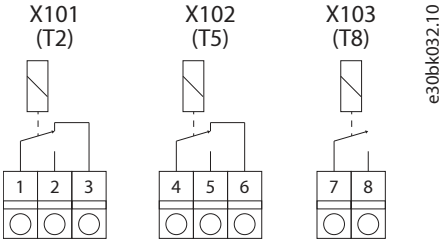


Figure 40: Wiring Configuration for Relay Option OC7R0

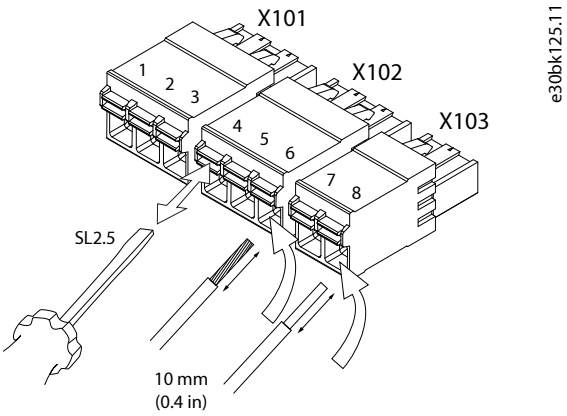


Figure 41: Inserting Wires into the Relay Option OC7R0 Connectors

6.4.2 Wiring Diagrams for Different Operating Altitudes

- Operation up to 2000 m (6560 ft) altitude: Each relay can operate at different phase voltages. See Figure 42.
- Operation above 2000 m (6560 ft) altitude: Operation with voltage above 50 V AC requires operation on the same phase voltage. See Figure 43.
- Operation with mixed voltage (24 V) and high voltage is possible. High voltage must be on the same phase. See Figure 44.



Figure 42: Operation up to 2000 m (6560 ft) Altitude

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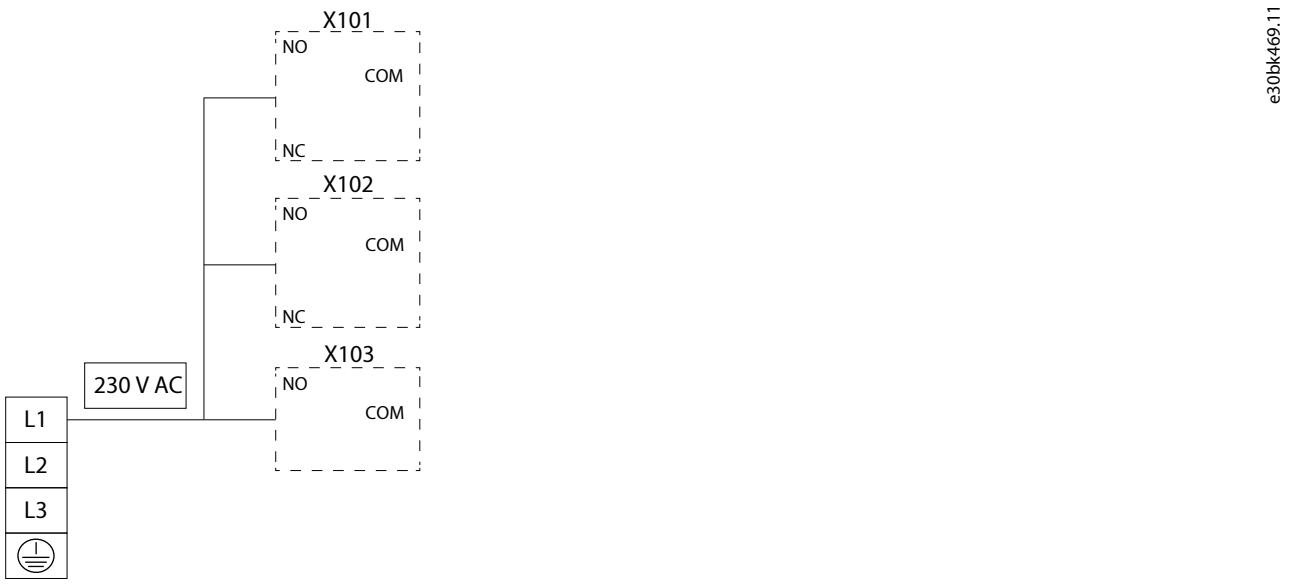


Figure 43: Operation above 2000 m (6560 ft) Altitude with Voltage above 50 V AC

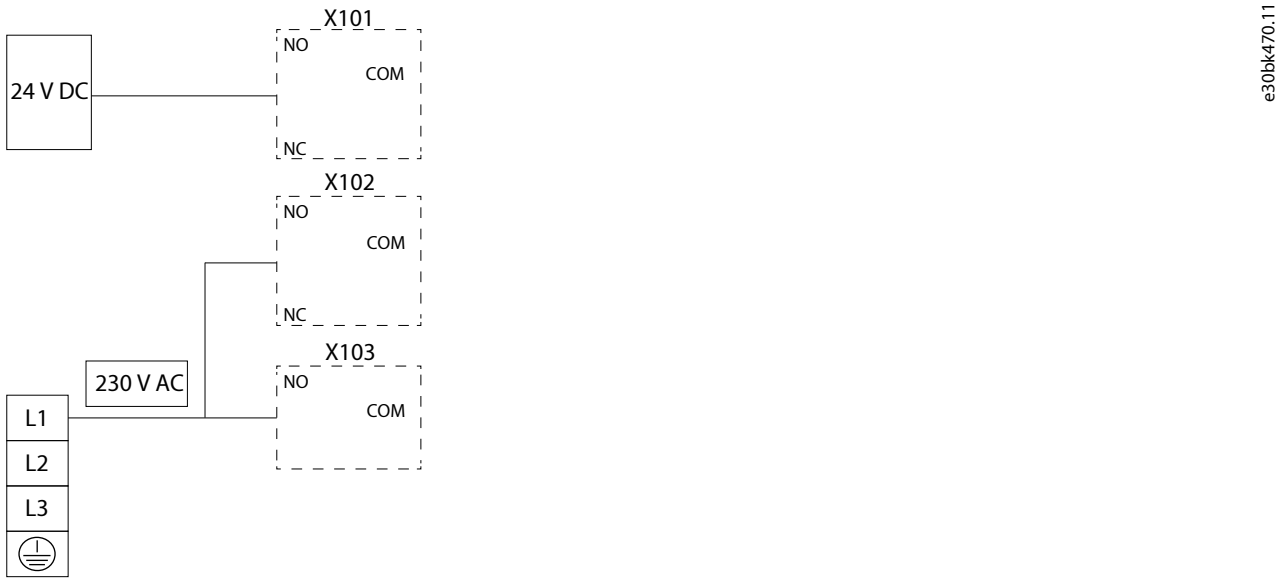


Figure 44: Operation above 2000 m (6560 ft) Altitude with Mixed Voltages

6.5 Parameter Descriptions

6.5.1 Relay Output Parameters

To set relay output, see parameter group ***5.26.1 General Digital Outputs***. For more information on the parameters and available selections, refer to the relevant application guide.

6.5.2 Status (Menu Index 9.3)

P 9.3.1 Digital Relay Bit Word

Description: Shows the digital relay word.

Default Value: NA	**Parameter Type:** Range (0 — 65535)	**Parameter Number:** 4909
Unit: -	**Data Type:** WORD	**Access Type:** Read Only

Table 51: Digital Output Mapping for Relay Option OC7R0

Bit number	Value
12	Relay X101
13	Relay X102
14	Relay X103

P 9.3.2 Relay 2 Counter

Description: Shows the number of relay switchings.

Default Value: 0	**Parameter Type:** Range (0 — 4294967295)	**Parameter Number:** 4910
Unit: -	**Data Type:** UDINT	**Access Type:** Read Only

P 9.3.3 Relay 5 Counter

Description: Shows the number of relay switchings.

Default Value: 0	**Parameter Type:** Range (0 — 4294967295)	**Parameter Number:** 4911
Unit: -	**Data Type:** UDINT	**Access Type:** Read Only

P 9.3.4 Relay 8 Counter

Description: Shows the number of relay switchings.

Default Value: 0	**Parameter Type:** Range (0 — 4294967295)	**Parameter Number:** 4912
Unit: -	**Data Type:** UDINT	**Access Type:** Read Only

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7 General Purpose I/O OC7C0 Installation and Configuration

7.1 Overview

The General Purpose I/O option adds 3 digital inputs, 2 digital outputs, 2 analog inputs, 1 analog output, and temperature measurement support.

For detailed specifications, see 7.3.1 General Purpose I/O OC7C0 Specifications.

7.2 Pin Assignment

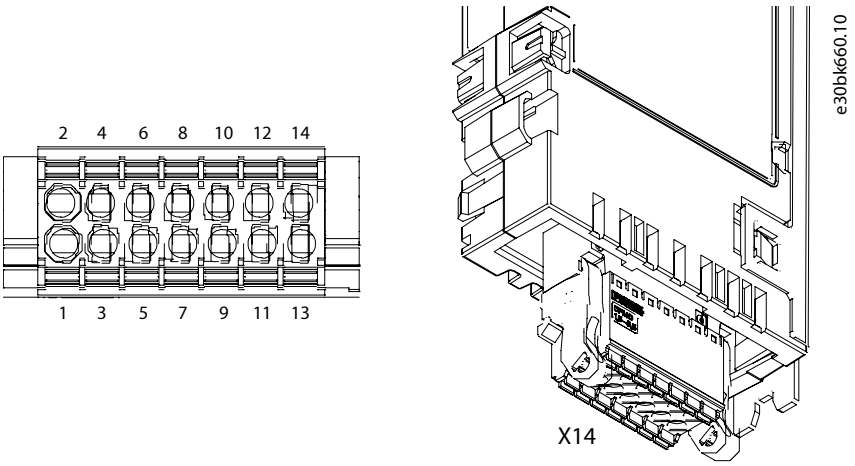


Figure 45: General Purpose I/O Option Terminals

Table 52: Pin Assignment and Function for General Purpose I/O

Numbering	Functions[1]	Numbering	Functions
1	+ 10 V	2	Analog input 1 (T2)
3	Analog input 2 (T3)	4	Analog output (T4)
5	GND	6	GND
7	Digital output 1 (T7)	8	Digital output 2 (T8)
9	24 V	10	DGND
11	Digital input 1 (T11)	12	Digital input 2 (T12)
13	Digital input 3 (T13)	14	DGND

1) The designations in brackets indicate terminal addressing in software.

7.3 Specifications

7.3.1 General Purpose I/O OC7C0 Specifications

Table 53: Technical Specifications for General Purpose I/O OC7C0

Functions	Data
Cable type	Cu, 75 °C (167 °F)
Flexible/rigid wire without cable end sleeves	0.2–1.5 mm² (24–16 AWG)
Flexible wire without cable end sleeves	0.2–1.5 mm² (24–16 AWG)
Maximum altitude	4400 m (14400 ft)
Protection rating	IP00/UL Open Type

Table 53: Technical Specifications for General Purpose I/O OC7C0 - (continued)

Functions	Data
Ambient temperature	-30 °C…60 °C (-22 °F…140 °F)
Weight	0.113 kg (0.25 lb)

7.3.2 I/O Specifications

7.3.2.1 Analog Input

Control inputs and outputs are PELV galvanically isolated from supply voltage and other high-voltage terminals, unless otherwise specified.

Table 54: Analog Input

Function	Data
Input modes	Current or Voltage[1]
Voltage mode	• Voltage range: -10 V to 10 V (scalable) • Input impedance: 10 kΩ • Maximum voltage: +12 V/-12 V
Current mode	• Current range: 0/4-20 mA (scalable) • Input impedance: 200 Ω • Maximum current: 24 mA
Resolution	0.1% of full scale
Accuracy	1% of full scale
Bandwidth	440 Hz
Reaction time	1 ms
Temperature sensor support[2]	Pt1000, Pt100, 2xPt100, 3xPt100, Ni1000, KTY81, KTY82, KTY84

1) The selection is made in the software. For more information, refer to the application guide.

2) External insulation of the sensor is required to comply with PELV. See 7.4 Setup and Connection Examples for the wiring configuration.

7.3.2.2 Analog Output

Control inputs and outputs are PELV galvanically isolated from supply voltage and other high-voltage terminals, unless otherwise specified.

Table 55: Analog Output

Function	Data
Output range: Current	0/4-20 mA
Minimum load resistor to GND	500 Ω
Resolution	0.1% of full scale
Accuracy	1% of full scale
Bandwidth	440 Hz
Reaction time	1 ms

7.3.2.3 Digital and Encoder/Pulse Input

Control inputs and outputs are PELV galvanically isolated from supply voltage and other high-voltage terminals, unless otherwise specified.

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Table 56: Digital and Encoder/Pulse Input

Function		Data
Digital input	Logic	PNP or NPN[1]
	Voltage levels	0/24 V
	PNP	• 0: <5 V DC • 1: >11 V DC
	NPN	• 0: >19 V DC • 1: < 13 V DC
	Maximum allowed voltage	30 V DC
	Input resistance	4.8 kΩ
Thermistor input	PTC[2]	1.5–4 kΩ
Pulse input	Pulse frequency range	0–110 kHz
	Minimum duty cycle	40%
	Accuracy	• Position resolution: 24 bit • Speed resolution: 24 bit
Encoder input	Signal type	24 V single line A and B
	Maximum frequency	110 kHz
	Maximum resolution	65535

1) PNP and NPN functionality depends on the wiring as shown in 7.4 Setup and Connection Examples.

2) External insulation of the sensor is required to comply with PELV. A series resistor must be used.

7.3.2.4 Digital and Pulse Output

Control inputs and outputs are PELV galvanically isolated from supply voltage and other high-voltage terminals, unless otherwise specified.

Table 57: Digital and Pulse Output (24 V)

Function	Data
Voltage level	0/24 V
Maximum output load (sink/source)	50 mA
Frequency range - Pulse output	1–100 kHz
Maximum load	1 kΩ
Maximum capacitive load at maximum frequency	10 nF
Pulse output accuracy	0.1% of full scale
Resolution of pulse output	>12 bit

7.4 Setup and Connection Examples

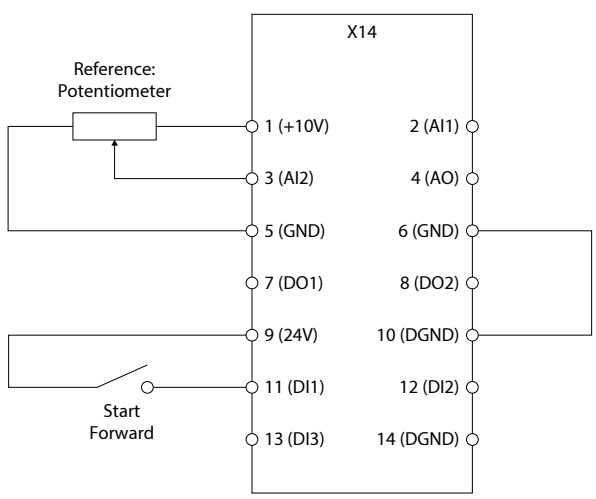


Figure 46: Wiring Configuration for General Purpose I/O Option OC7C0, Terminal X14

The digital input is isolated from the analog signal. If used with common ground, the connection is made between GND and DGND.

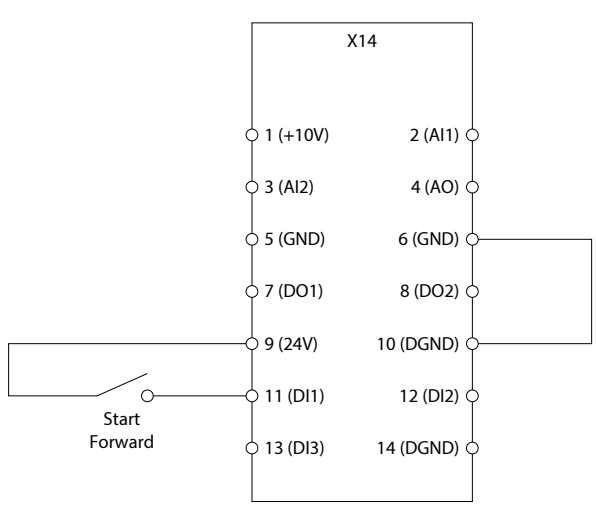


Figure 47: Wiring Configuration for General Purpose I/O Option Using Digital Input with PNP Configuration

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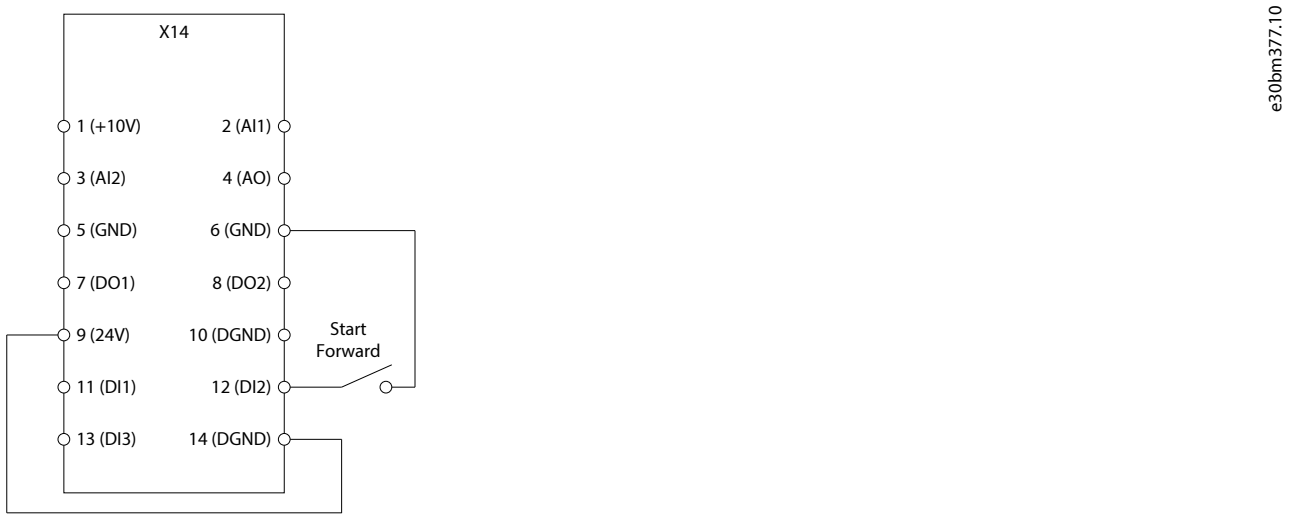


Figure 48: Wiring Configuration for General Purpose I/O Option Using Digital Input with NPN Configuration

When using digital input with NPN configuration, DGND is connected to pin 9 (24 V).

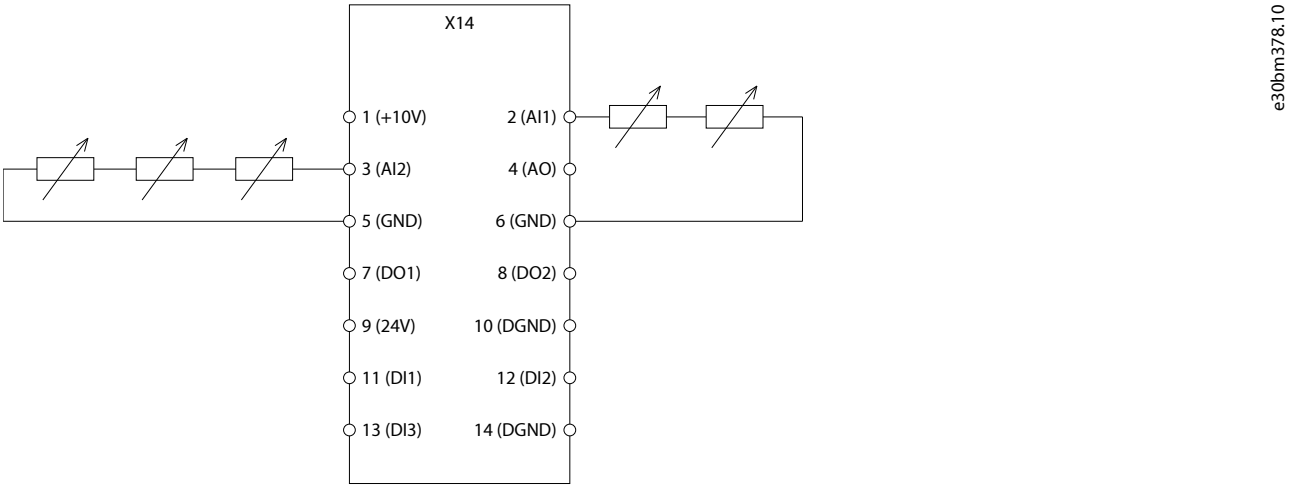


Figure 49: Wiring Diagram for General Purpose I/O Option with Connections for Pt100 Sensors

7.5 Parameter Descriptions

7.5.1 I/O Status (Menu Index 9.3)

P 9.3.1 Digital Input Status

Description: Shows the digital input I/O word. Each bit represents the status of a digital input.

Default Value: NA	**Parameter Type:** Range (0 — 65535)	**Parameter Number:** 1614
Unit: -	**Data Type:** WORD	**Access Type:** Read Only

Table 58: Bit Descriptions for Digital Input

Bit number	Bit name	Description
0	DigIn1 (T11)	Digital Input T11
1	DigIn2 (T12)	Digital Input T12

Table 58: Bit Descriptions for Digital Input - (continued)

Bit number	Bit name	Description
2	DigIn3 (T13)	Digital Input T13
3–15	Not in use	–

P 9.3.2 Digital Output Status

Description: Shows the digital output I/O word. Each bit represents the status of a digital output.

Default Value: NA	**Parameter Type:** Range (0 — 65535)	**Parameter Number:** 1615
Unit: -	**Data Type:** WORD	**Access Type:** Read Only

Table 59: Bit Descriptions for Digital Output

Bit number	Bit name	Description
0	DigOut07 (T7	Digital Output T7
1	DigOut08 (T8)	Digital Output T8
2–15	Not in use	–

P 9.3.3 T2 Analog Input Value

Description: Shows the actual value of the terminal.

Default Value: NA	**Parameter Type:** Range (-20 — 20)	**Parameter Number:** 1620
Unit: -	**Data Type:** REAL	**Access Type:** Read Only

P 9.3.4 T3 Analog Input Value

Description: Shows the actual value of the terminal.

Default Value: NA	**Parameter Type:** Range (-20 — 20)	**Parameter Number:** 1621
Unit: -	**Data Type:** REAL	**Access Type:** Read Only

P 9.3.5 T4 Analog Output Value

Description: Shows the actual value of the terminal.

Default Value: NA	**Parameter Type:** Range (0 — 20)	**Parameter Number:** 1622
Unit: -	**Data Type:** REAL	**Access Type:** Read Only

P 9.3.6 T2 Temperature Value

Description: Shows the measured temperature of the terminal.

Default Value: NA	**Parameter Type:** Range (-1000 — 1000)	**Parameter Number:** 4966
Unit: °C	**Data Type:** REAL	**Access Type:** Read Only

P 9.3.7 T3 Temperature Value

Description: Shows the measured temperature of the terminal.

Default Value: NA	**Parameter Type:** Range (-1000 — 1000)	**Parameter Number:** 4967
Unit: °C	**Data Type:** REAL	**Access Type:** Read Only

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7.5.2 Input T2 (Menu Index 9.4.1)

P 9.4.1.1 T2 Terminal Mode

Description: Select the mode for the terminal.

Default Value: 0 [Inactive]	**Parameter Type:** Selection	**Parameter Number:** 4915
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

Selection number	Selection name
0	Inactive
6	Analog Input
7	Temperature input

P 9.4.1.2 T2 Terminal Type

Description: Select the type of the terminal. If voltage is selected, the unit is V. If current is selected, the unit is mA.

Default Value: 1 [Voltage]	**Parameter Type:** Selection	**Parameter Number:** 4916
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

Selection number	Selection name
1	Voltage
2	Current

P 9.4.1.3 T2 Minimum Value

Description: Set the voltage or current representing 0% of the signal.

Default Value: 0	**Parameter Type:** Range (-20 — 20)	**Parameter Number:** 4917
Unit: -	**Data Type:** REAL	**Access Type:** Read/Write

P 9.4.1.4 T2 Maximum Value

Description: Set the voltage or current representing 100% of the signal.

Default Value: 10	**Parameter Type:** Range (-20 — 20)	**Parameter Number:** 4918
Unit: -	**Data Type:** REAL	**Access Type:** Read/Write

P 9.4.1.5 T2 Filter Time

Description: Set the filter time for the terminal.

Default Value: 0	**Parameter Type:** Range (0 — 60000.00)	**Parameter Number:** 4919
Unit: ms	**Data Type:** REAL	**Access Type:** Read/Write

P 9.4.1.6 T2 Live Zero Threshold Value

Description: Set the live zero threshold value for the terminal. The response to a live zero event is defined with parameter "5.2.15.2 Live Zero Response".

Default Value: -10	**Parameter Type:** Range (-20 — 20)	**Parameter Number:** 4920
Unit: -	**Data Type:** REAL	**Access Type:** Read/Write

P 9.4.1.7 T2 Live Zero Timeout Value

Description: Set the live zero timeout value for the terminal. The response to a live zero event is defined with parameter "5.2.15.2 Live Zero Response".

Default Value: 0.0	**Parameter Type:** Range (0.0 — 60.0)	**Parameter Number:** 4921
Unit: s	**Data Type:** REAL	**Access Type:** Read/Write

P 9.4.1.8 T2 Temperature Sensor type

Description: Select which type of temperature sensor is connected to the terminal.

Default Value: 0 [No sensor]	**Parameter Type:** Selection	**Parameter Number:** 4922
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

Selection number	Selection name
0	No sensor
1	Pt100
2	2xPt100
3	3xPt100
4	Pt1000
5	Ni1000Tk5000
6	Ni1000Tk6180
7	KTY84-1x0
10	KTY81/82-1x0
11	KTY81/82-121
12	KTY81/82-122

7.5.3 Input T3 (Menu Index 9.4.2)

P 9.4.2.1 T3 Terminal Mode

Description: Select the mode for the terminal.

Default Value: 0 [Inactive]	**Parameter Type:** Selection	**Parameter Number:** 4925
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

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Selection number	Selection name
0	Inactive
6	Analog Input
7	Temperature input

P 9.4.2.2 T3 Terminal Type

Description: Select the type of the terminal. If voltage is selected, the unit is V. If current is selected, the unit is mA.

Default Value: 1 [Voltage]	**Parameter Type:** Selection	**Parameter Number:** 4926
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

Selection number	Selection name
1	Voltage
2	Current

P 9.4.2.3 T3 Minimum Value

Description: Set the voltage or current representing 0% of the signal.

Default Value: 0	**Parameter Type:** Range (-20 — 20)	**Parameter Number:** 4927
Unit: -	**Data Type:** REAL	**Access Type:** Read/Write

P 9.4.2.4 T3 Maximum Value

Description: Set the voltage or current representing 100% of the signal.

Default Value: 10	**Parameter Type:** Range (-20 — 20)	**Parameter Number:** 4928
Unit: -	**Data Type:** REAL	**Access Type:** Read/Write

P 9.4.2.5 T3 Filter Time

Description: Set the filter time for the terminal.

Default Value: 0	**Parameter Type:** Range (0 — 60000.00)	**Parameter Number:** 4929
Unit: ms	**Data Type:** REAL	**Access Type:** Read/Write

P 9.4.2.6 T3 Live Zero Threshold Value

Description: Set the live zero threshold value for the terminal. The response to a live zero event is defined with parameter "9.1.2 Live Zero Response".

Default Value: -10	**Parameter Type:** Range (-20 — 20)	**Parameter Number:** 4930
Unit: -	**Data Type:** REAL	**Access Type:** Read/Write

P 9.4.2.7 T3 Live Zero Timeout Value

Description: Set the live zero timeout value for the terminal. The response to a live zero event is defined with parameter "9.1.2 Live Zero Response".

Default Value: 0.0	**Parameter Type:** Range (0.0 — 60.0)	**Parameter Number:** 4931
Unit: s	**Data Type:** REAL	**Access Type:** Read/Write

P 9.4.2.8 T3 Temperature Sensor type

Description: Select which type of temperature sensor is connected to the terminal.

Default Value: 0 [No sensor]	**Parameter Type:** Selection	**Parameter Number:** 4932
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

Selection number	Selection name
0	No sensor
1	Pt100
2	2xPt100
3	3xPt100
4	Pt1000
5	Ni1000Tk5000
6	Ni1000Tk6180
7	KTY84-1x0
10	KTY81/82-1x0
11	KTY81/82-121
12	KTY81/82-122

7.5.4 Output T4 (Menu Index 9.4.3)

P 9.4.3.1 T4 Terminal Mode

Description: Select the mode for the terminal.

Default Value: 0 [Inactive]	**Parameter Type:** Selection	**Parameter Number:** 4045
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

Selection number	Selection name
0	Inactive
5	Analog Output

P 9.4.3.2 T4 Terminal Type

Description: Select the type of the terminal. If voltage is selected, the unit is V. If current is selected, the unit is mA.

Default Value: 0 [Off]	**Parameter Type:** Selection	**Parameter Number:** 4936
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

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Selection number	Selection name
0	Off
1	Voltage
2	Current

P 9.4.3.3 T4 Minimum Value

Description: Set the voltage or current representing 0% of the signal.

Default Value: 0	**Parameter Type:** Range (0 — 20)	**Parameter Number:** 4937
Unit: -	**Data Type:** REAL	**Access Type:** Read/Write

P 9.4.3.4 T4 Maximum Value

Description: Set the voltage or current representing 100% of the signal.

Default Value: 10	**Parameter Type:** Range (0 — 20)	**Parameter Number:** 4938
Unit: -	**Data Type:** REAL	**Access Type:** Read/Write

7.5.5 Output T7 (Menu Index 9.5.1)

P 9.5.1.1 T7 Terminal Mode

Description: Select the mode for the terminal.

Default Value: 0 [Inactive]	**Parameter Type:** Selection	**Parameter Number:** 4940
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

Selection number	Selection name
0	Inactive
1	Digital Output
2	Pulse Output

P 9.5.1.2 T7 Digital Output Type

Description: Select the operating logic for the digital output.

Default Value: 0 [Tri state]	**Parameter Type:** Selection	**Parameter Number:** 4941
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

Selection number	Selection name
0	Tri state
1	Open collector sink (NPN)
2	Open collector source (PNP)
3	Push pull

P 9.5.1.3 T7 Pulse Out Min. Frequency

Description: Set the frequency representing 0% of the signal.

Default Value: 0	**Parameter Type:** Range (0 — 100000)	**Parameter Number:** 4942
Unit: Hz	**Data Type:** REAL	**Access Type:** Read/Write

P 9.5.1.4 T7 Pulse Out Max. Frequency

Description: Set the frequency representing 100% of the signal.

Default Value: 100000	**Parameter Type:** Range (0 — 100000)	**Parameter Number:** 4943
Unit: Hz	**Data Type:** REAL	**Access Type:** Read/Write

7.5.6 Output T8 (Menu Index 9.5.2)

P 9.5.2.1 T8 Terminal Mode

Description: Select the mode for the terminal.

Default Value: 0 [Inactive]	**Parameter Type:** Selection	**Parameter Number:** 4944
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

Selection number	Selection name
0	Inactive
1	Digital Output
2	Pulse Output

P 9.5.2.2 T8 Digital Output Type

Description: Select the operating logic for the digital output.

Default Value: 0 [Tri state]	**Parameter Type:** Selection	**Parameter Number:** 4945
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

Selection number	Selection name
0	Tri state
1	Open collector sink (NPN)
2	Open collector source (PNP)
3	Push pull

P 9.5.2.3 T8 Pulse Out Min. Frequency

Description: Set the frequency representing 0% of the signal.

Default Value: 0	**Parameter Type:** Range (0 — 100000)	**Parameter Number:** 4946
Unit: Hz	**Data Type:** REAL	**Access Type:** Read/Write

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P 9.5.2.4 T8 Pulse Out Max. Frequency

Description: Set the frequency representing 100% of the signal.

Default Value: 100000	**Parameter Type:** Range (0 — 100000)	**Parameter Number:** 4947
Unit: Hz	**Data Type:** REAL	**Access Type:** Read/Write

7.5.7 Input T11 (Menu Index 9.5.3)

P 9.5.3.1 T11 Terminal Mode

Description: Select the mode for the terminal.

Default Value: 0 [Inactive]	**Parameter Type:** Selection	**Parameter Number:** 4948
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

Selection number	Selection name
0	Inactive
3	Digital input
4	Pulse input

P 9.5.3.2 T11 Signal Inversion

Description: Select whether the signal of the terminal is inverted.

Default Value: 0 [Non-Inverted]	**Parameter Type:** Selection	**Parameter Number:** 4949
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

Selection number	Selection name
0	Non-Inverted
1	Inverted

P 9.5.3.3 T11 Fast Debounce Filtering Time

Description: Set the fast debounce filtering time for the terminal.

Default Value: 0	**Parameter Type:** Range (0 — 63.50)	**Parameter Number:** 4950
Unit: µs	**Data Type:** REAL	**Access Type:** Read/Write

P 9.5.3.4 T11 Standard Debounce Filtering Time

Description: Set the standard debounce filtering time for the terminal.

Default Value: 0	**Parameter Type:** Range (0 — 127.00)	**Parameter Number:** 4951
Unit: ms	**Data Type:** REAL	**Access Type:** Read/Write

P 9.5.3.5 T11 Pulse Min Frequency

Description: Set the frequency representing 0% of the signal.

Default Value: 0	**Parameter Type:** Range (0 — 100000)	**Parameter Number:** 4952
Unit: Hz	**Data Type:** REAL	**Access Type:** Read/Write

P 9.5.3.6 T11 Pulse Max Frequency

Description: Set the frequency representing 100% of the signal.

Default Value: 100000	**Parameter Type:** Range (0 — 100000)	**Parameter Number:** 4953
Unit: Hz	**Data Type:** REAL	**Access Type:** Read/Write

7.5.8 Input T12 (Menu Index 9.5.4)

P 9.5.4.1 T12 Terminal Mode

Description: Select the mode for the terminal.

Default Value: 0 [Inactive]	**Parameter Type:** Selection	**Parameter Number:** 4053
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

Selection number	Selection name
0	Inactive
3	Digital input
4	Pulse input

P 9.5.4.2 T12 Signal Inversion

Description: Select whether the signal of the terminal is inverted.

Default Value: 0 [Non-Inverted]	**Parameter Type:** Selection	**Parameter Number:** 4955
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

Selection number	Selection name
0	Non-Inverted
1	Inverted

P 9.5.4.3 T12 Fast Debounce Filtering Time

Description: Set the fast debounce filtering time for the terminal.

Default Value: 0	**Parameter Type:** Range (0 — 63.50)	**Parameter Number:** 4956
Unit: µs	**Data Type:** REAL	**Access Type:** Read/Write

P 9.5.4.4 T12 Standard Debounce Filtering Time

Description: Set the standard debounce filtering time for the terminal.

Default Value: 0	**Parameter Type:** Range (0 — 127.00)	**Parameter Number:** 4957
Unit: ms	**Data Type:** REAL	**Access Type:** Read/Write

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P 9.5.4.5 T12 Pulse Min. Frequency

Description: Set the frequency representing 0% of the signal.

Default Value: 0	**Parameter Type:** Range (0 — 100000)	**Parameter Number:** 4958
Unit: Hz	**Data Type:** REAL	**Access Type:** Read/Write

P 9.5.4.6 T12 Pulse Max. Frequency

Description: Set the frequency representing 100% of the signal.

Default Value: 100000	**Parameter Type:** Range (0 — 100000)	**Parameter Number:** 4959
Unit: Hz	**Data Type:** REAL	**Access Type:** Read/Write

7.5.9 Input T13 (Menu Index 9.5.5)

P 9.5.5.1 T13 Terminal Mode

Description: Select the mode for the terminal.

Default Value: 0 [Inactive]	**Parameter Type:** Selection	**Parameter Number:** 2015
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

Selection number	Selection name
0	Inactive
3	Digital input
4	Pulse input

P 9.5.5.2 T13 Signal Inversion

Description: Select whether the signal of the terminal is inverted.

Default Value: 0 [Non-Inverted]	**Parameter Type:** Selection	**Parameter Number:** 2291
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter

Selection number	Selection name
0	Non-Inverted
1	Inverted

P 9.5.5.3 T13 Fast Debounce Filtering Time

Description: Set the fast debounce filtering time for the terminal.

Default Value: 0	**Parameter Type:** Range (0 — 63.50)	**Parameter Number:** 2285
Unit: µs	**Data Type:** REAL	**Access Type:** Read/Write

P 9.5.5.4 T13 Standard Debounce Filtering Time

Description: Set the standard debounce filtering time for the terminal.

Default Value: 0	**Parameter Type:** Range (0 — 127.00)	**Parameter Number:** 2024
Unit: ms	**Data Type:** REAL	**Access Type:** Read/Write

P 9.5.5.5 T13 Pulse Min. Frequency

Description: Set the frequency representing 0% of the signal.

Default Value: 0	**Parameter Type:** Range (0 — 100000)	**Parameter Number:** 2027
Unit: Hz	**Data Type:** REAL	**Access Type:** Read/Write

P 9.5.5.6 T13 Pulse Max. Frequency

Description: Set the frequency representing 100% of the signal.

Default Value: 100000	**Parameter Type:** Range (0 — 100000)	**Parameter Number:** 2028
Unit: Hz	**Data Type:** REAL	**Access Type:** Read/Write

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8 Temperature Measurement OC7T0 Installation and Configuration

8.1 Overview

The Temperature Measurement OC7T0 option adds 5 temperature sensor inputs to measure and monitor application temperatures or to protect the motor from being overheated by monitoring the temperature of 2 motor bearings and 3 motor windings.

Temperature Measurement option features:

- Sensor inputs: 5 channels
- Sensor connection: 2-wire, 3-wire, or 4-wire
- Sensor support: Pt100, Pt1000, Ni1000, KTY types
- Support for 2 x Pt100 and 3 x Pt100 in series in the same measurement channel
- Temperature range: -50 °C...200 °C (-58 °F...392 °F)

NOTICE

SUPPLEMENTARY INSULATION REQUIRED

Temperature Measurement OC7T0 has basic isolation for system voltages smaller than or equal to 600 V and reinforced isolation for system voltages smaller than or equal to 300 V (OVC III 3000 m).

- Supplementary insulation is needed to provide additional basic isolation for the temperature sensor when using system voltages smaller than or equal to 600 V, and if temperature measurement inputs exceed 800 V_{rms} voltages to CHGND when there is an active fault or warning in the drive.

8.2 Pin Assignment

NOTICE

TEMPERATURE ACCURACY

The ±1°C accuracy is for all sensor wiring types and for the full temperature range.

- If the connection type is 4-wire, the accuracy is ±0.5 °C for the full temperature range.

Table 60: Definition of Pins for Temperature Measurement OC7T0

Terminal	Signal	Technical information
1	Return 1	Temperature sensor input 1, -50…200°C, accuracy ±1°C
2	Source 1	
3	Sensor 1 -	
4	Sensor 1 +	
5	Return 2	Temperature sensor input 2, -50…200°C, accuracy ±1°C
6	Source 2	
7	Sensor 2 -	
8	Sensor 2 +	
9	Return 3	Temperature sensor input 3, -50…200°C, accuracy ±1°C
10	Source 3	
11	Sensor 3 -	
12	Sensor 3 +	

Table 60: Definition of Pins for Temperature Measurement OC7T0 - (continued)

Terminal	Signal	Technical information
13	Return 4	Temperature sensor input 4, -50…200°C, accuracy ±1°C
14	Source 4	
15	Sensor 4 -	
16	Sensor 4 +	
17	Return 5	Temperature sensor input 5, -50…200°C, accuracy ±1°C

8.3 Specifications

Table 61: Cable Specifications for Temperature Measurement OC7T0

Cable type	Cross section [mm2 (AWG)]	Minimum stripping length [mm (in)]
Flexible/rigid wire without cable end sleeves	0.2–1.5 (26–16)	10 (0.4)
Flexible wire with cable end sleeves with collar	0.2–0.75 (26–18)	

8.4 Setup and Connection Examples

For better EMC protection, use shielded cables, and connect the cable shield to the grounding clamp in the drive. The allowed sensor configurations for Temperature Measurement OC7T0 are:

- 2-wire configuration
- 3-wire configuration
- 4-wire configuration

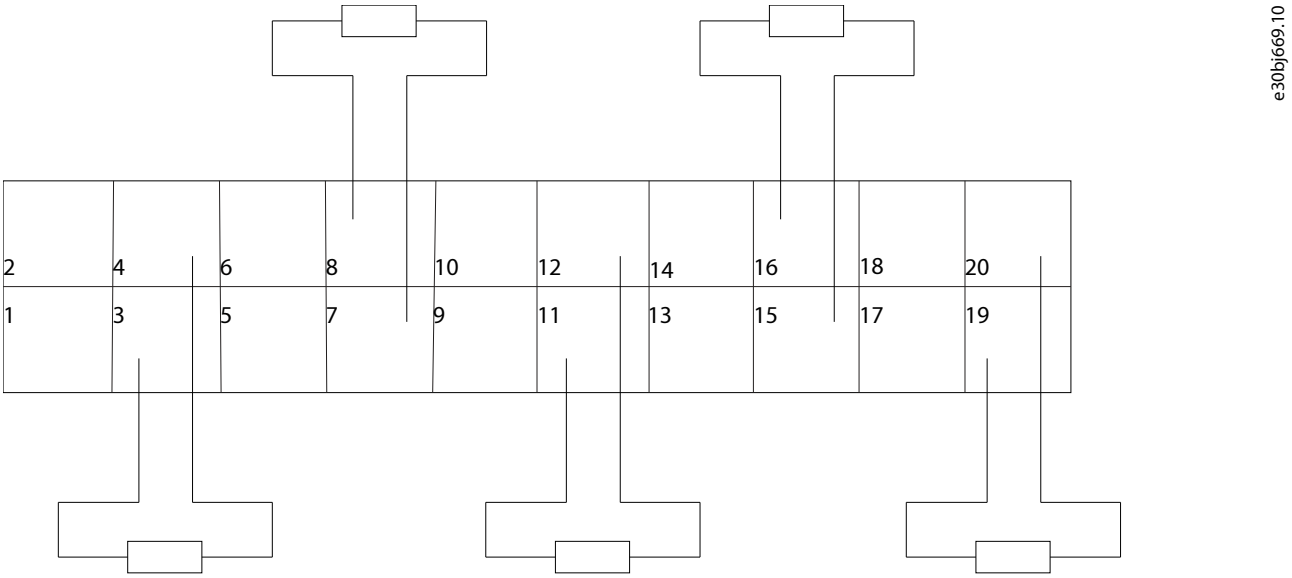


Figure 50: 2-wire Configuration for Temperature Measurement OC7T0

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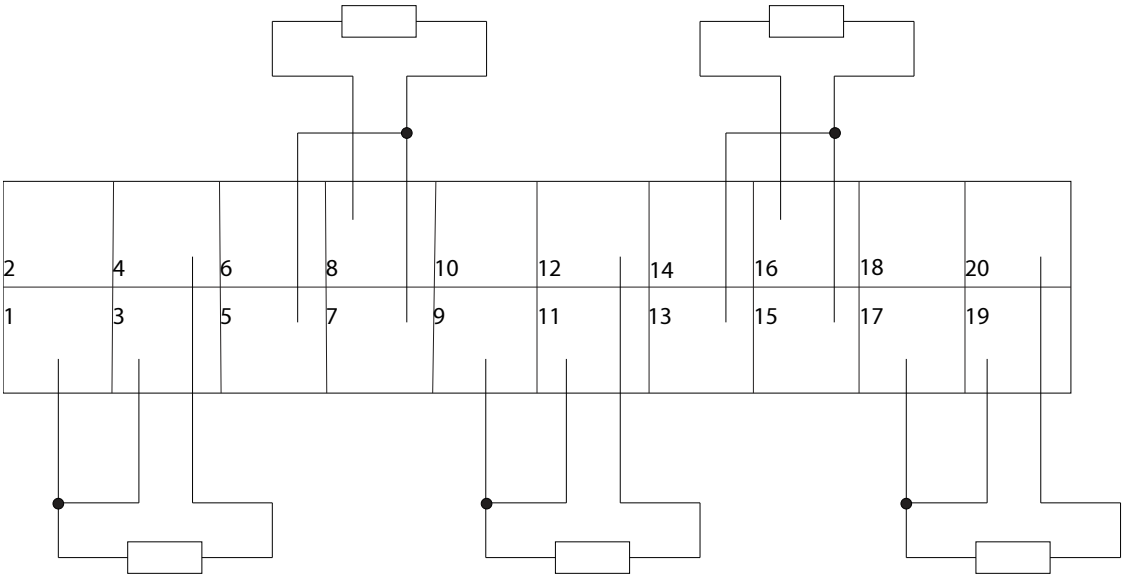


Figure 51: 3-wire Configuration for Temperature Measurement OC7T0

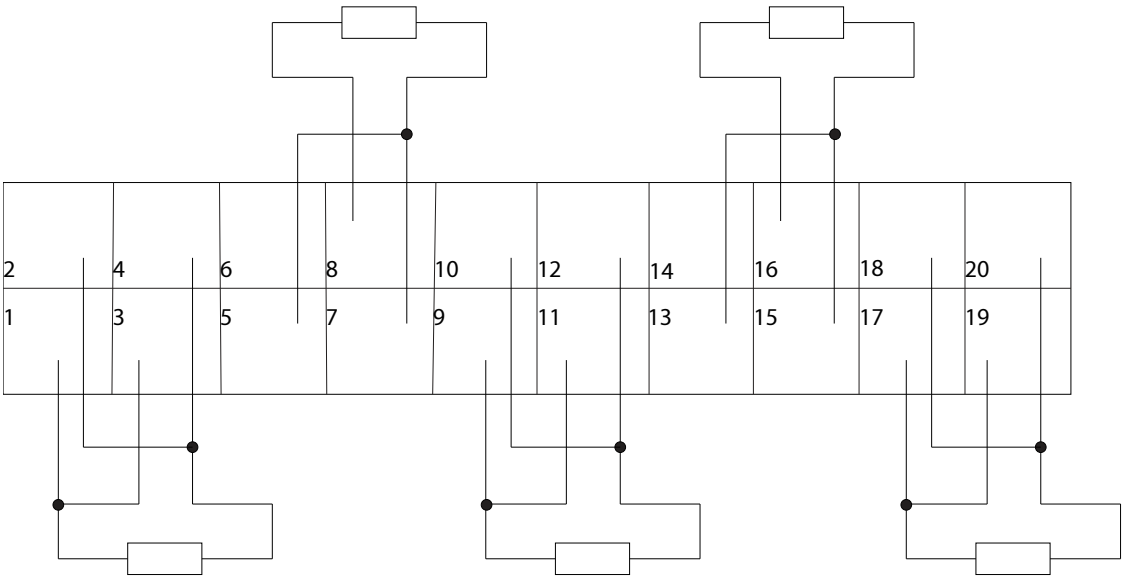


Figure 52: 4-wire Configuration for Temperature Measurement OC7T0

8.5 Parameter Descriptions

8.5.1 Status (Menu Index 9.3)

P 9.3.2 T4 Temperature Value

Description: Shows the measured temperature of the terminal.

Default Value: NA	**Parameter Type:** Range (-1000 — 1000)	**Parameter Number:** 4040
Unit: °C	**Data Type:** REAL	**Access Type:** Read Only

P 9.3.3 T8 Temperature Value

Description: Shows the measured temperature of the terminal.

Default Value: NA	**Parameter Type:** Range (-1000 — 1000)	**Parameter Number:** 4041
Unit: °C	**Data Type:** REAL	**Access Type:** Read Only

P 9.3.4 T12 Temperature Value

Description: Shows the measured temperature of the terminal.

Default Value: NA	**Parameter Type:** Range (-1000 — 1000)	**Parameter Number:** 4042
Unit: °C	**Data Type:** REAL	**Access Type:** Read Only

P 9.3.5 T16 Temperature Value

Description: Shows the measured temperature of the terminal.

Default Value: NA	**Parameter Type:** Range (-1000 — 1000)	**Parameter Number:** 4043
Unit: °C	**Data Type:** REAL	**Access Type:** Read Only

P 9.3.6 T20 Temperature Value

Description: Shows the measured temperature of the terminal.

Default Value: NA	**Parameter Type:** Range (-1000 — 1000)	**Parameter Number:** 4044
Unit: °C	**Data Type:** REAL	**Access Type:** Read Only

8.5.2 Input T4 (Menu Index 9.4.1)

P 9.4.1.1 T4 Terminal Mode

Description: Select the mode for the terminal.

Default Value: 0 [Inactive]	**Parameter Type:** Selection	**Parameter Number:** 4045
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Inactive	
7	Temperature input	Configures the terminal as temperature sensor input.

P 9.4.1.2 T4 Connection Type

Description: Select the connection type for the sensor.

Default Value: 0 [No sensor]	**Parameter Type:** Selection	**Parameter Number:** 4046
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	No sensor	No sensor selected.
2	2-wire	2-wire connection to sensor.

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Selection Number	Selection Name	Selection Description
3	3-wire	3-wire connection to sensor.
4	4-wire	4-wire connection to sensor.

P 9.4.1.3 T4 Temperature Sensor Type

Description: Select which type of temperature sensor is connected to the terminal.

Default Value: 0 [No sensor]	**Parameter Type:** Selection	**Parameter Number:** 4047
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	No sensor	No sensor selected.
1	Pt100	Pt100 temperature sensor connected.
2	2xPt100	2 x Pt100 temperature sensors connected.
3	3xPt100	3 x Pt100 temperature sensors connected.
4	Pt1000	Pt1000 temperature sensor connected.
5	Ni1000Tk5000	Ni1000Tk5000 temperature sensor connected.
6	Ni1000Tk6180	Ni1000Tk6180 temperature sensor connected.
7	KTY84-1x0	KTY84-1x0 temperature sensor connected.
8	KTY84-151	KTY84-151 temperature sensor connected.
9	KTY84-152	KTY84-152 temperature sensor connected.
10	KTY81/82-1x0	KTY81/82-1x0 temperature sensor connected.
11	KTY81/82-121	KTY81/82-121 temperature sensor connected.
12	KTY81/82-122	KTY81/82-122 temperature sensor connected.
13	KTY81/82-151	KTY81/82-151 temperature sensor connected.
14	KTY81/82-152	KTY81/82-152 temperature sensor connected.
15	KTY81/82-2x0	KTY81/82-2x0 temperature sensor connected.
16	KTY81/82-221	KTY81/82-221 temperature sensor connected.
17	KTY81/82-222	KTY81/82-222 temperature sensor connected.

Selection Number	Selection Name	Selection Description
18	KTY81/82-251	KTY81/82-251 temperature sensor connected.
19	KTY81/82-252	KTY81/82-252 temperature sensor connected.

P 9.4.1.4 T4 Offset

Description: Set the offset of the temperature measured.

Default Value: 0	**Parameter Type:** Range (-50 — 50)	**Parameter Number:** 4048
Unit: °C	**Data Type:** REAL	**Access Type:** Read/Write

8.5.3 Input T8 (Menu Index 9.4.2)

P 9.4.2.1 T8 Terminal Mode

Description: Select the mode for the terminal.

Default Value: 0 [Inactive]	**Parameter Type:** Selection	**Parameter Number:** 4049
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Inactive	
7	Temperature input	Configures the terminal as temperature sensor input.

P 9.4.2.2 T8 Connection Type

Description: Select the connection type for the sensor.

Default Value: 0 [No sensor]	**Parameter Type:** Selection	**Parameter Number:** 4050
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	No sensor	No sensor selected.
2	2-wire	2-wire connection to sensor.
3	3-wire	3-wire connection to sensor.
4	4-wire	4-wire connection to sensor.

P 9.4.2.3 T8 Temperature Sensor Type

Description: Select which type of temperature sensor is connected to the terminal.

Default Value: 0 [No sensor]	**Parameter Type:** Selection	**Parameter Number:** 4051
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

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The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	No sensor	No sensor selected.
1	Pt100	Pt100 temperature sensor connected.
2	2xPt100	2 x Pt100 temperature sensors connected.
3	3xPt100	3 x Pt100 temperature sensors connected.
4	Pt1000	Pt1000 temperature sensor connected.
5	Ni1000Tk5000	Ni1000Tk5000 temperature sensor connected.
6	Ni1000Tk6180	Ni1000Tk6180 temperature sensor connected.
7	KTY84-1x0	KTY84-1x0 temperature sensor connected.
8	KTY84-151	KTY84-151 temperature sensor connected.
9	KTY84-152	KTY84-152 temperature sensor connected.
10	KTY81/82-1x0	KTY81/82-1x0 temperature sensor connected.
11	KTY81/82-121	KTY81/82-121 temperature sensor connected.
12	KTY81/82-122	KTY81/82-122 temperature sensor connected.
13	KTY81/82-151	KTY81/82-151 temperature sensor connected.
14	KTY81/82-152	KTY81/82-152 temperature sensor connected.
15	KTY81/82-2x0	KTY81/82-2x0 temperature sensor connected.
16	KTY81/82-221	KTY81/82-221 temperature sensor connected.
17	KTY81/82-222	KTY81/82-222 temperature sensor connected.
18	KTY81/82-251	KTY81/82-251 temperature sensor connected.
19	KTY81/82-252	KTY81/82-252 temperature sensor connected.

P 9.4.2.4 T8 Offset

Description: Set the offset of the temperature measured.

Default Value: 0	**Parameter Type:** Range (-50 — 50)	**Parameter Number:** 4052
Unit: °C	**Data Type:** REAL	**Access Type:** Read/Write

8.5.4 Input T12 (Menu Index 9.4.3)

P 9.4.3.1 T12 Terminal Mode

Description: Select the mode for the terminal.

Default Value: 0 [Inactive]	**Parameter Type:** Selection	**Parameter Number:** 4053
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Inactive	
7	Temperature input	Configures the terminal as temperature sensor input.

P 9.4.3.2 T12 Connection Type

Description: Select the connection type for the sensor.

Default Value: 0 [No sensor]	**Parameter Type:** Selection	**Parameter Number:** 4054
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	No sensor	No sensor selected.
2	2-wire	2-wire connection to sensor.
3	3-wire	3-wire connection to sensor.
4	4-wire	4-wire connection to sensor.

P 9.4.3.3 T12 Temperature Sensor Type

Description: Select which type of temperature sensor is connected to the terminal.

Default Value: 0 [No sensor]	**Parameter Type:** Selection	**Parameter Number:** 4055
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	No sensor	No sensor selected.
1	Pt100	Pt100 temperature sensor connected.
2	2xPt100	2 x Pt100 temperature sensors connected.
3	3xPt100	3 x Pt100 temperature sensors connected.
4	Pt1000	Pt1000 temperature sensor connected.
5	Ni1000Tk5000	Ni1000Tk5000 temperature sensor connected.

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Selection Number	Selection Name	Selection Description
6	Ni1000Tk6180	Ni1000Tk6180 temperature sensor connected.
7	KTY84-1x0	KTY84-1x0 temperature sensor connected.
8	KTY84-151	KTY84-151 temperature sensor connected.
9	KTY84-152	KTY84-152 temperature sensor connected.
10	KTY81/82-1x0	KTY81/82-1x0 temperature sensor connected.
11	KTY81/82-121	KTY81/82-121 temperature sensor connected.
12	KTY81/82-122	KTY81/82-122 temperature sensor connected.
13	KTY81/82-151	KTY81/82-151 temperature sensor connected.
14	KTY81/82-152	KTY81/82-152 temperature sensor connected.
15	KTY81/82-2x0	KTY81/82-2x0 temperature sensor connected.
16	KTY81/82-221	KTY81/82-221 temperature sensor connected.
17	KTY81/82-222	KTY81/82-222 temperature sensor connected.
18	KTY81/82-251	KTY81/82-251 temperature sensor connected.
19	KTY81/82-252	KTY81/82-252 temperature sensor connected.

P 9.4.3.4 T12 Offset

Description: Set the offset of the temperature measured.

Default Value: 0	**Parameter Type:** Range (-50 — 50)	**Parameter Number:** 4056
Unit: °C	**Data Type:** REAL	**Access Type:** Read/Write

8.5.5 Input T16 (Menu Index 9.4.4)

P 9.4.4.1 T16 Terminal Mode

Description: Select the mode for the terminal.

Default Value: 0 [Inactive]	**Parameter Type:** Selection	**Parameter Number:** 2298
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Inactive	
7	Temperature input	Configures the terminal as temperature sensor input.

P 9.4.4.2 T16 Connection Type

Description: Select the connection type for the sensor.

Default Value: 0 [No sensor]	**Parameter Type:** Selection	**Parameter Number:** 4058
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	No sensor	No sensor selected.
2	2-wire	2-wire connection to sensor.
3	3-wire	3-wire connection to sensor.
4	4-wire	4-wire connection to sensor.

P 9.4.4.3 T16 Temperature Sensor Type

Description: Select which type of temperature sensor is connected to the terminal.

Default Value: 0 [No sensor]	**Parameter Type:** Selection	**Parameter Number:** 4059
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	No sensor	No sensor selected.
1	Pt100	Pt100 temperature sensor connected.
2	2xPt100	2 x Pt100 temperature sensors connected.
3	3xPt100	3 x Pt100 temperature sensors connected.
4	Pt1000	Pt1000 temperature sensor connected.
5	Ni1000Tk5000	Ni1000Tk5000 temperature sensor connected.
6	Ni1000Tk6180	Ni1000Tk6180 temperature sensor connected.
7	KTY84-1x0	KTY84-1x0 temperature sensor connected.
8	KTY84-151	KTY84-151 temperature sensor connected.
9	KTY84-152	KTY84-152 temperature sensor connected.
10	KTY81/82-1x0	KTY81/82-1x0 temperature sensor connected.
11	KTY81/82-121	KTY81/82-121 temperature sensor connected.

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Selection Number	Selection Name	Selection Description
12	KTY81/82-122	KTY81/82-122 temperature sensor connected.
13	KTY81/82-151	KTY81/82-151 temperature sensor connected.
14	KTY81/82-152	KTY81/82-152 temperature sensor connected.
15	KTY81/82-2x0	KTY81/82-2x0 temperature sensor connected.
16	KTY81/82-221	KTY81/82-221 temperature sensor connected.
17	KTY81/82-222	KTY81/82-222 temperature sensor connected.
18	KTY81/82-251	KTY81/82-251 temperature sensor connected.
19	KTY81/82-252	KTY81/82-252 temperature sensor connected.

P 9.4.4.4 T16 Offset

Description: Set the offset of the temperature measured.

Default Value: 0	**Parameter Type:** Range (-50 — 50)	**Parameter Number:** 4060
Unit: °C	**Data Type:** REAL	**Access Type:** Read/Write

8.5.6 Input T20 (Menu Index 9.4.5)

P 9.4.5.1 T20 Terminal Mode

Description: Select the mode for the terminal.

Default Value: 0 [Inactive]	**Parameter Type:** Selection	**Parameter Number:** 4017
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Inactive	
7	Temperature input	Configures the terminal as temperature sensor input.

P 9.4.5.2 T20 Connection Type

Description: Select the connection type for the sensor.

Default Value: 0 [No sensor]	**Parameter Type:** Selection	**Parameter Number:** 4062
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	No sensor	No sensor selected.
2	2-wire	2-wire connection to sensor.
3	3-wire	3-wire connection to sensor.
4	4-wire	4-wire connection to sensor.

P 9.4.5.3 T20 Temperature Sensor Type

Description: Select which type of temperature sensor is connected to the terminal.

Default Value: 0 [No sensor]	**Parameter Type:** Selection	**Parameter Number:** 4063
Unit: -	**Data Type:** UINT	**Access Type:** Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	No sensor	No sensor selected.
1	Pt100	Pt100 temperature sensor connected.
2	2xPt100	2 x Pt100 temperature sensors connected.
3	3xPt100	3 x Pt100 temperature sensors connected.
4	Pt1000	Pt1000 temperature sensor connected.
5	Ni1000Tk5000	Ni1000Tk5000 temperature sensor connected.
6	Ni1000Tk6180	Ni1000Tk6180 temperature sensor connected.
7	KTY84-1x0	KTY84-1x0 temperature sensor connected.
8	KTY84-151	KTY84-151 temperature sensor connected.
9	KTY84-152	KTY84-152 temperature sensor connected.
10	KTY81/82-1x0	KTY81/82-1x0 temperature sensor connected.
11	KTY81/82-121	KTY81/82-121 temperature sensor connected.
12	KTY81/82-122	KTY81/82-122 temperature sensor connected.
13	KTY81/82-151	KTY81/82-151 temperature sensor connected.
14	KTY81/82-152	KTY81/82-152 temperature sensor connected.
15	KTY81/82-2x0	KTY81/82-2x0 temperature sensor connected.
16	KTY81/82-221	KTY81/82-221 temperature sensor connected.
17	KTY81/82-222	KTY81/82-222 temperature sensor connected.

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Selection Number	Selection Name	Selection Description
18	KTY81/82-251	KTY81/82-251 temperature sensor connected.
19	KTY81/82-252	KTY81/82-252 temperature sensor connected.

P 9.4.5.4 T20 Offset

Description: Set the offset of the temperature measured.

Default Value: 0	**Parameter Type:** Range (-50 — 50)	**Parameter Number:** 4064
Unit: °C	**Data Type:** REAL	**Access Type:** Read/Write

9 Digital 230 V AC Input OC7D0 Installation and Configuration

9.1 Overview

The Digital 230 V AC Input OC7D0 option adds 5 galvanically isolated 42–240 V AC digital inputs.

For detailed specifications, see 9.3.1 Digital 230 V AC Input OC7D0 Specifications.

9.2 Pin Assignment

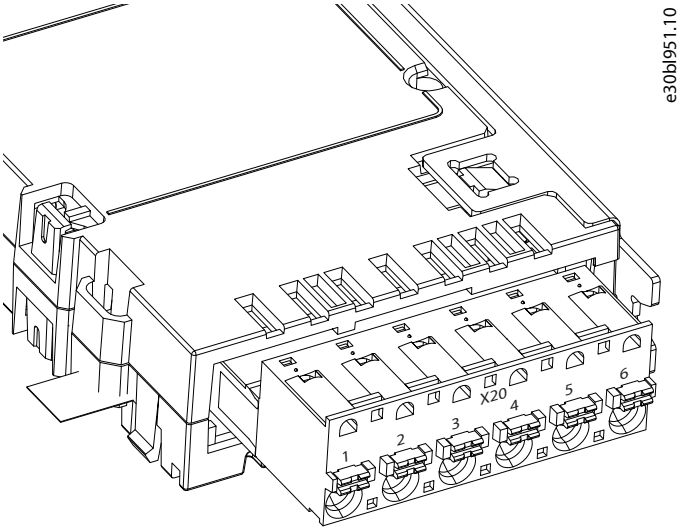


Figure 53: Digital 230 V AC Input OC7D0 Terminals

Table 62: Functions for Digital 230 V AC Input OC7D0 Terminal X20

Number	Function
1	Digital input 1 (T1)
2	Digital input 2 (T2)
3	Digital input 3 (T3)
4	Digital input 4 (T4)
5	Digital input 5 (T5)
6	Common

For more information on wiring the option, see 9.4.1 Wiring Configuration for Digital 230 V AC Input OC7D0.

9.3 Specifications

9.3.1 Digital 230 V AC Input OC7D0 Specifications

Digital inputs are galvanically isolated from supply voltage and other high-voltage terminals.

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Table 63: Technical Specifications for Digital 230 V AC Input OC7D0

Function		Data
Number of digital inputs		5
Digital input	Type	Single-ended/common ground
	Voltage level	42–240 V AC
	Voltage level, logic 0	<33 V AC
	Voltage level, logic 1	>35 V AC
	Maximum voltage on input	300 V AC
	Frequency range	50/60 Hz
	Reaction time	10/8.3 ms
	Input current	5 mA < Ic < 10 mA
	Isolation	Control to high-voltage digital input: Reinforced
		Channel to channel: Functional
Cable type		Cu, 75 °C (176 °F)
Cable size	Solid	0.2–2.5 mm^2(24–14 AWG)
	Flexible	0.2–2.5 mm^2(24–14 AWG)
	Flexible with ferrule, without plastic sleeve	0.25–2.5 mm^2(24–14 AWG)
	Flexible without ferrule, with plastic sleeve	0.25–2.5 mm^2(24–14 AWG)
Ambient temperature		-30...60 °C (-22...140 °F)
Weight		0.12 kg (0.26 lb)
Environment		Overvoltage category III/pollution degree 2
Maximum altitude		4400 m (14400 ft) The operating altitude sets requirements on the digital input configuration. For the wiring diagrams for different operating altitudes, see 9.4.2 Wiring Diagrams for Different Operating Altitudes.

9.3.2 Fuses

For proper protection of the installation cable and the option, fuses with appropriate fuse holder must be used. If a short circuit occurs, fuses protect the installation cable and limit the damage to the option.

Table 64: Recommended IEC Fuse Ratings

Function	Data
Fuse class	aR
Minimum interrupting rating	100 KA
Minimum AC voltage rating	250 V
Ampere rating	1 A
Recommended fuse P/N	FWX-1A-14F or equivalent

Table 65: Recommended UL Fuse Ratings

Function	Data
UL class	RK1
Fuse overload characteristic	Current limiting
Minimum interrupting rating	100 KA
Minimum AC voltage rating	250 V
Ampere rating	1 A
Recommended fuse P/N	KTN-R-1 or equivalent

9.4 Setup and Connection Examples for Digital 230 V AC Input OC7D0

9.4.1 Wiring Configuration for Digital 230 V AC Input OC7D0

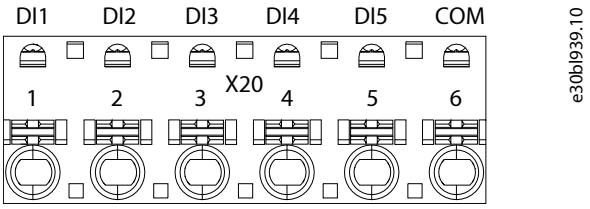


Figure 54: Wiring Configuration for Digital 230 V AC Input OC7D0

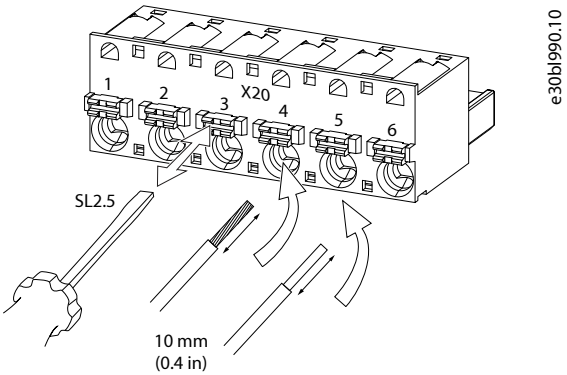


Figure 55: Inserting Wires into the Digital 230 V AC Input OC7D0 Connectors

9.4.2 Wiring Diagrams for Different Operating Altitudes

Functionality at altitudes above 2000 m (6560 ft) sets certain requirements on the wiring configuration. See Table 66 for the number of allowed inputs for different operating altitudes.

Table 66: Digital Inputs at Different Operating Altitudes

Altitude	Number of allowed inputs	Digital input designations	Wiring configuration
2000 m (6560 ft)	5	DI1, DI2, DI3, DI4, DI5	See Figure 56.
4400 m (14400 ft)	3	DI1, DI3, DI5	See Figure 57.
	5	DI1, DI2, DI3, DI4, DI5	See Figure 58.
	5	DI1, DI2, DI3, DI4, DI5	See Figure 59.

- Operation up to 2000 m (6560 ft) altitude: All 5 digital inputs can be used, and the same phase must be used for all inputs. See Figure 56.

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- Operation at 2000–4400 m (6560–14400 ft) altitude:
  - Inputs 1, 3, and 5 must be used, and the same phase must be used for all inputs. See Figure 57.
  - All 5 inputs can be used, if the inputs are connected to 230 V or floating, and the same phase must be used for all inputs. Inputs must not be connected to alternate or neutral phase. See Figure 58.
  - All 5 inputs can be used, if the supply is from auxiliary supply and not from mains. In this case, a control transformer must be used between the power supply and the digital inputs. See Figure 59.

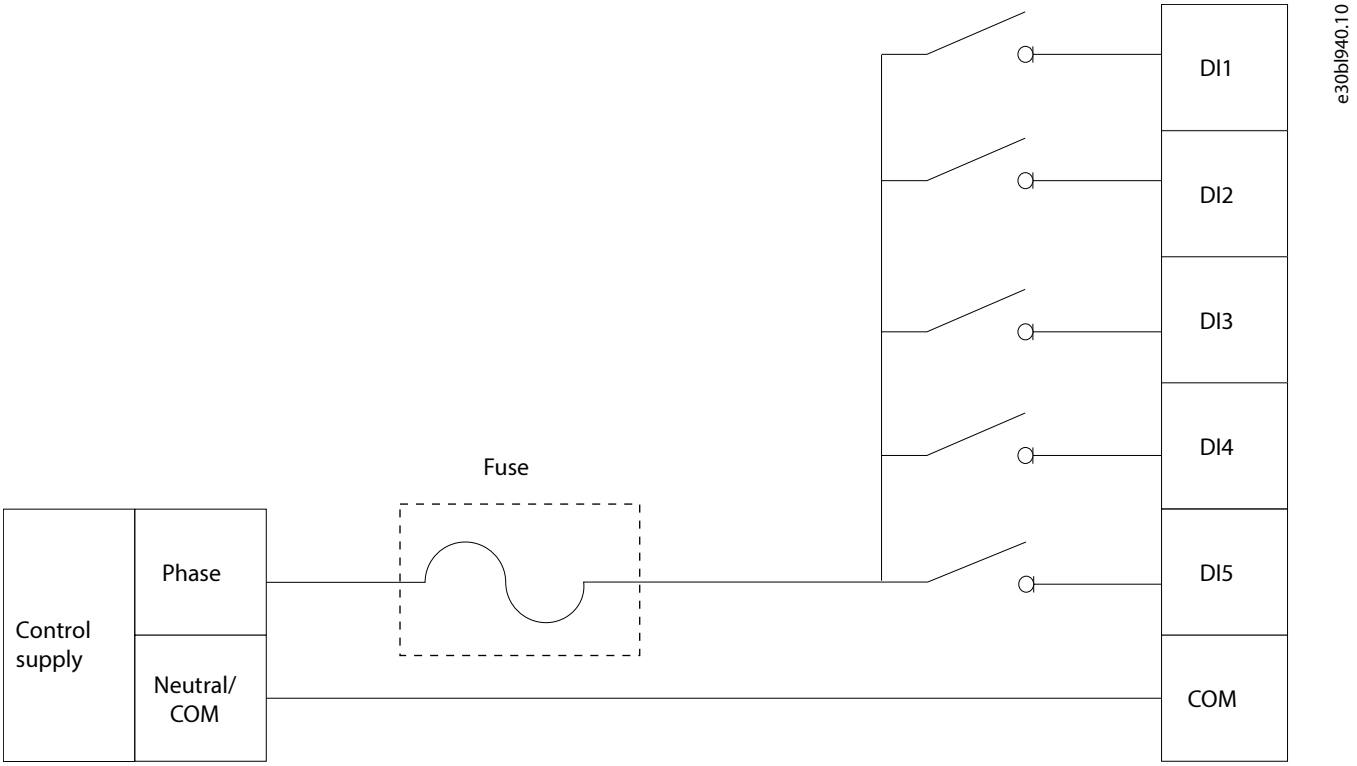


Figure 56: Wiring Configuration for Operation up to 2000 m (6560 ft) Altitude

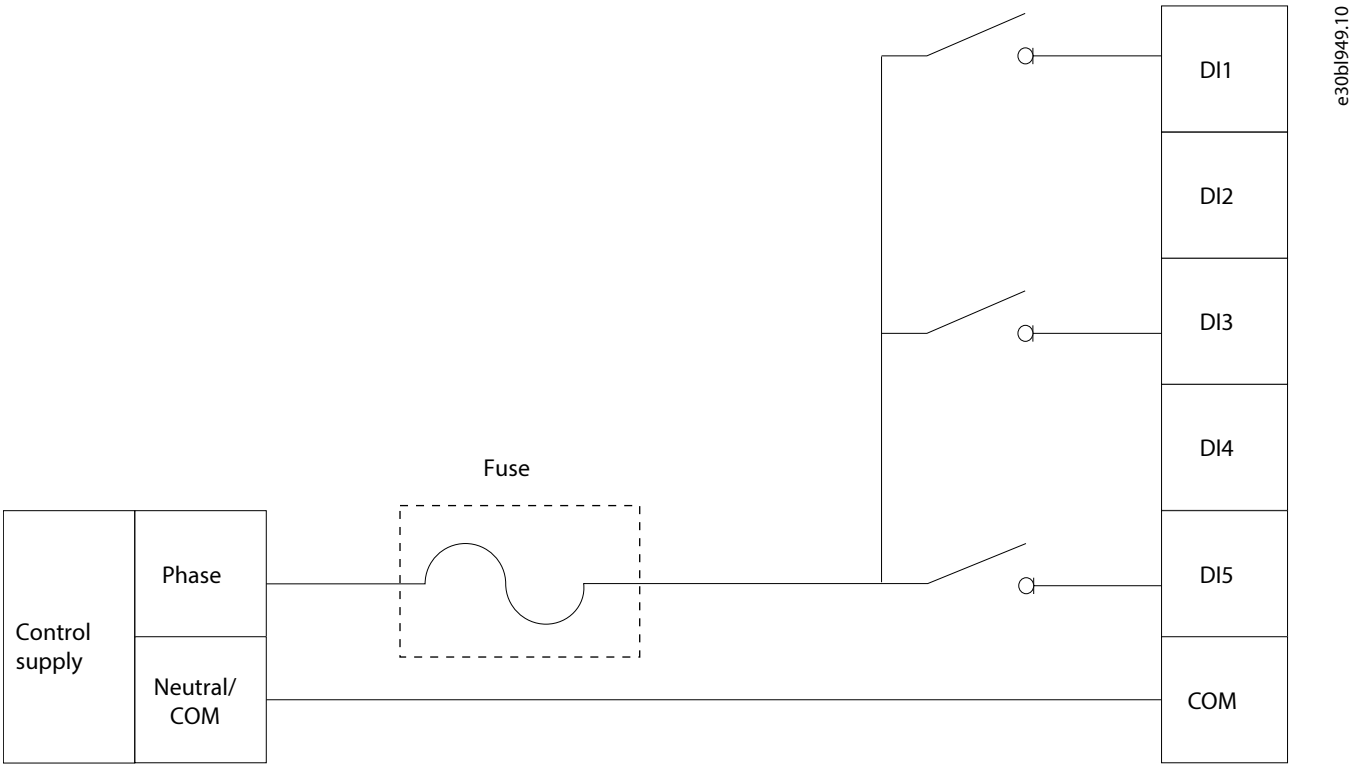


Figure 57: Wiring Configuration for Operation at 2000–4400 m (6560–14400 ft) Altitude using 3 Inputs

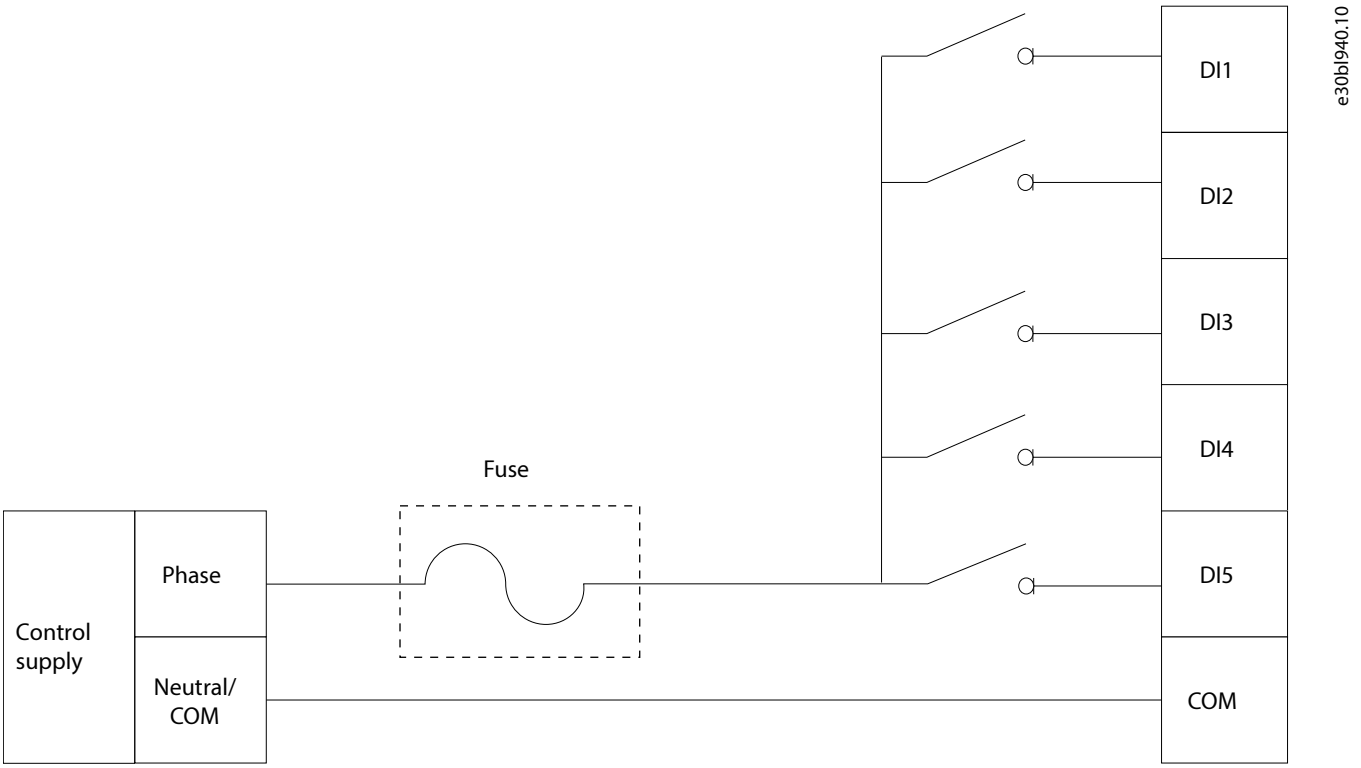


Figure 58: Wiring Configuration for Operation 2000–4400 m (6560–14400 ft) Altitude using 5 Inputs

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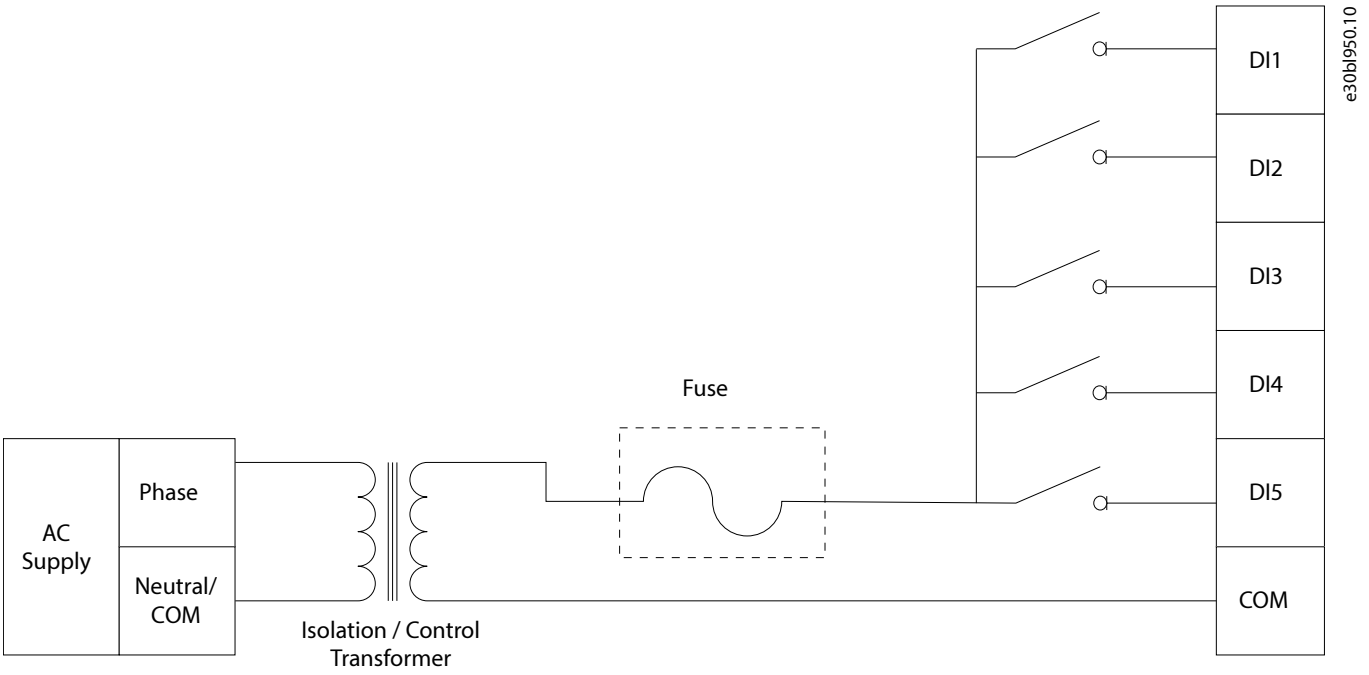


Figure 59: Wiring Configuration for Operation above 2000 m (6560 ft) Altitude using 5 Inputs and a Control Transformer

See Table 67 for the control transformer specifications.

Table 67: Isolation/Control Transformer Ratings

Functions	Data
Rated primary voltage	48–690 V AC
Rated secondary voltage	48–230 V AC
Rated secondary current	100 mA
Rated frequency	50/60 Hz
Minimum VA rating	5–25 VA

9.5 Parameter Descriptions

9.5.1 Digital Input Status (Menu Index 9.3)

P 9.3.1 Digital Input Bit Word

Shows the bitwise status of each digital input of this card.

Default Value:	NA	**Parameter Type:**	Range (* — *)
Parameter Number:	1614	**Unit:**	–
Data Type:	WORD	**Access Type:**	Read Only

Table 68: Bit Descriptions for Digital Input

Bit number	Bit name	Description
0	Not in use	–
1	Dig in 1 (T1)	Digital Input T1
2	Dig in 2 (T2)	Digital Input T2

Table 68: Bit Descriptions for Digital Input - (continued)

Bit number	Bit name	Description
3	Dig in 3 (T3)	Digital Input T3
4	Dig in 4 (T4)	Digital Input T4
5	Dig in 5 (T5)	Digital Input T5
6–15	Not in use	–

9.5.2 Digital Inputs (Menu Index 9.4)

9.5.2.1 Input T1 (Menu Index 9.4.1)

P 9.4.1.1 T1 Terminal Mode

Select the mode for the terminal.

Default Value:	0 (Inactive)	**Parameter Type:**	Selection
Parameter Number:	3900	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Inactive	The terminal is not used.
3	Digital input	Read the state of a digital input.

P 9.4.1.2 T1 Signal Inversion

Select whether the signal of the terminal is inverted.

Default Value:	0 (Non-Inverted)	**Parameter Type:**	Selection
Parameter Number:	3901	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Non-Inverted	The signal is not inverted.
1	Inverted	The signal is logically inverted.

9.5.2.2 Input T2 (Menu Index 9.4.2)

P 9.4.2.1 T2 Terminal Mode

Select the mode for the terminal.

Default Value:	0 (Inactive)	**Parameter Type:**	Selection
Parameter Number:	4915	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

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Selection Number	Selection Name	Selection Description
0	Inactive	The terminal is not used.
3	Digital input	Read the state of a digital input.

P 9.4.2.2 T2 Signal Inversion

Select whether the signal of the terminal is inverted.

Default Value:	0 (Non-Inverted)	**Parameter Type:**	Selection
Parameter Number:	3902	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Non-Inverted	The signal is not inverted.
1	Inverted	The signal is logically inverted.

9.5.2.3 Input T3 (Menu Index 9.4.3)

P 9.4.3.1 T3 Terminal Mode

Select the mode for the terminal.

Default Value:	0 (Inactive)	**Parameter Type:**	Selection
Parameter Number:	4925	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Inactive	The terminal is not used.
3	Digital input	Read the state of a digital input.

P 9.4.3.2 T3 Signal Inversion

Select whether the signal of the terminal is inverted.

Default Value:	0 (Non-Inverted)	**Parameter Type:**	Selection
Parameter Number:	3903	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Non-Inverted	The signal is not inverted.
1	Inverted	The signal is logically inverted.

9.5.2.4 Input T4 (Menu Index 9.4.4)

P 9.4.4.1 T4 Terminal Mode

Select the mode for the terminal.

Default Value:	0 (Inactive)	**Parameter Type:**	Selection
Parameter Number:	4045	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Inactive	The terminal is not used.
3	Digital input	Read the state of a digital input.

P 9.4.4.2 T4 Signal Inversion

Select whether the signal of the terminal is inverted.

Default Value:	0 (Non-Inverted)	**Parameter Type:**	Selection
Parameter Number:	3904	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Non-Inverted	The signal is not inverted.
1	Inverted	The signal is logically inverted.

9.5.2.5 Input T5 (Menu Index 9.4.5)

P 9.4.5.1 T5 Terminal Mode

Select the mode for the terminal.

Default Value:	0 (Inactive)	**Parameter Type:**	Selection
Parameter Number:	3905	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

Selection Number	Selection Name	Selection Description
0	Inactive	The terminal is not used.
3	Digital input	Read the state of a digital input.

P 9.4.5.2 T5 Signal Inversion

Select whether the signal of the terminal is inverted.

Default Value:	0 (Non-Inverted)	**Parameter Type:**	Selection
Parameter Number:	3906	**Unit:**	–
Data Type:	UINT	**Access Type:**	Read/Write

The following are the selections for the parameter.

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