

Operating Guide

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 <https://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 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.
AQ390830267692, version 0301	Updates regarding electrical specifications, and the default value and available selections of parameter 9.6.6 BiSS/SSI Clock Rate .

Table 1: Version History (continued)

Version	Remarks
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.




2 Safety

2.1 Safety Symbols

The following symbols are used in Danfoss documentation.

 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).

The guide also includes ISO warning symbols related to hot surfaces and burn hazard, high voltage and electrical shock, and referring to the instructions.

	ISO warning symbol for hot surfaces and burn hazard
	ISO warning symbol for high voltage and electrical shock
	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.

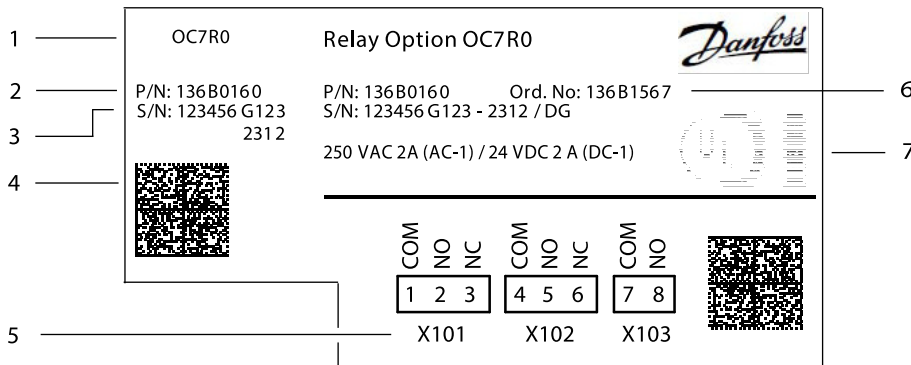
For more information on functional extension selection and functional extension slots in the drives, see the product-specific design guides. Supplemental information and other iC7 guides can be downloaded from <https://www.danfoss.com/en/service-and-support/documentation/>.

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.



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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.

 **DANGER****SHOCK HAZARD FROM THE AC 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.

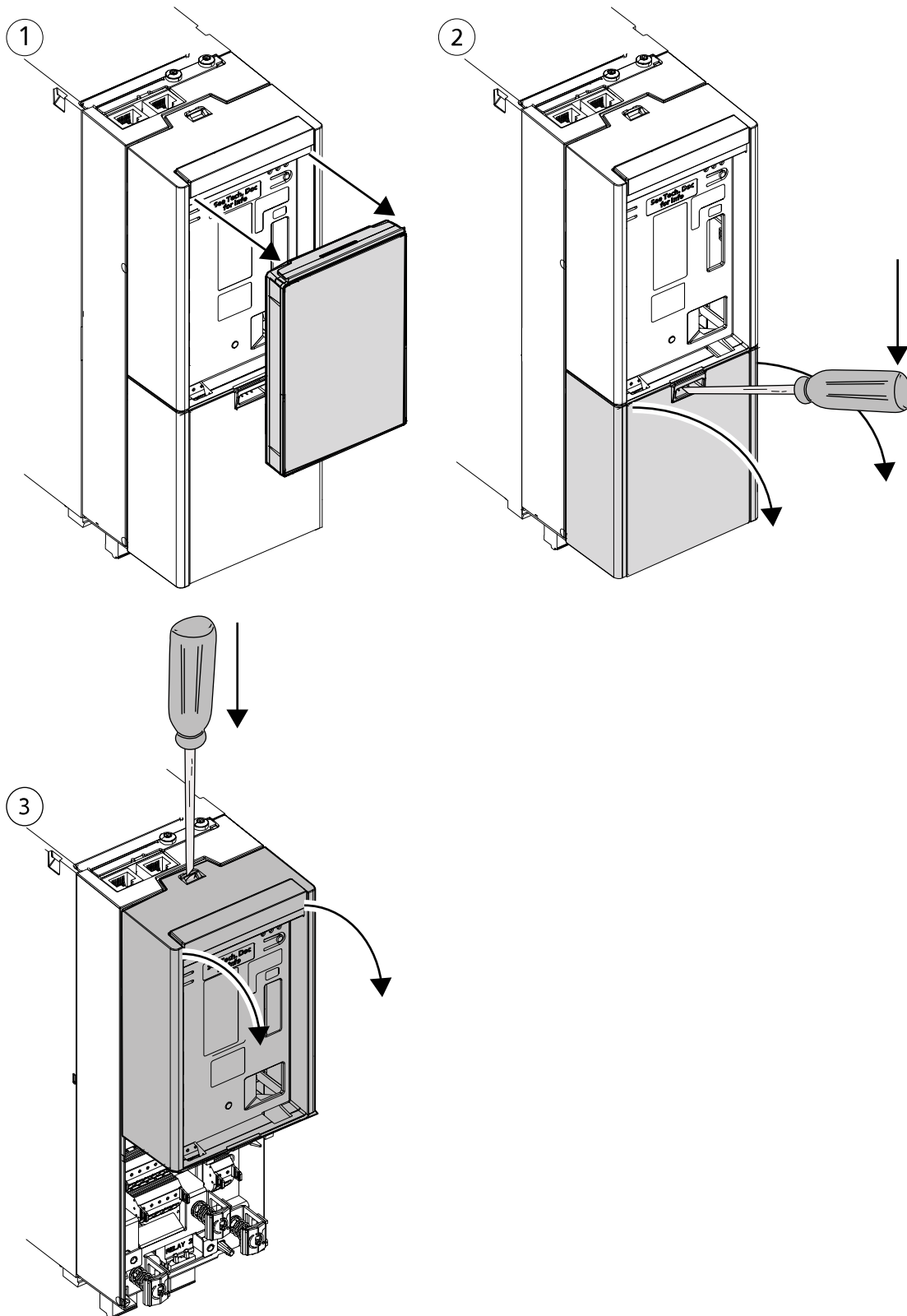
- Perform the following steps before touching any internal components:
 - Disconnect the AC or DC supply from the drive.
 - Disconnect the devices from the drive output.
 - If there is a brake option, disconnect the brake.
 - If there is a load share/regeneration option, disconnect it.
 - Wait for the 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.



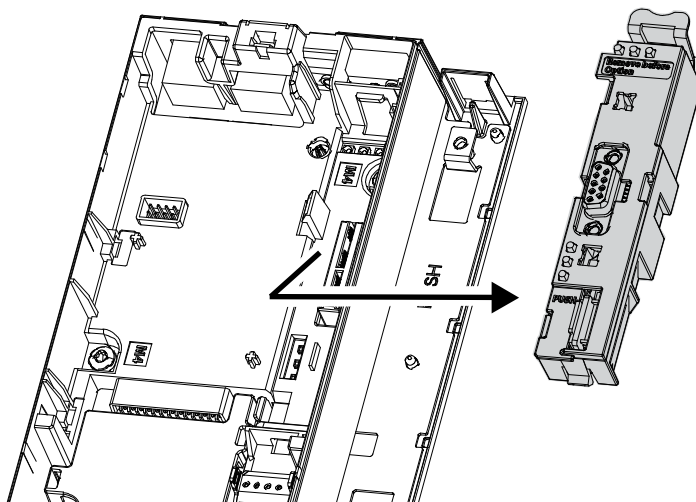
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2. Remove the interface board, place the option board in the slot, and reinstall the interface board.

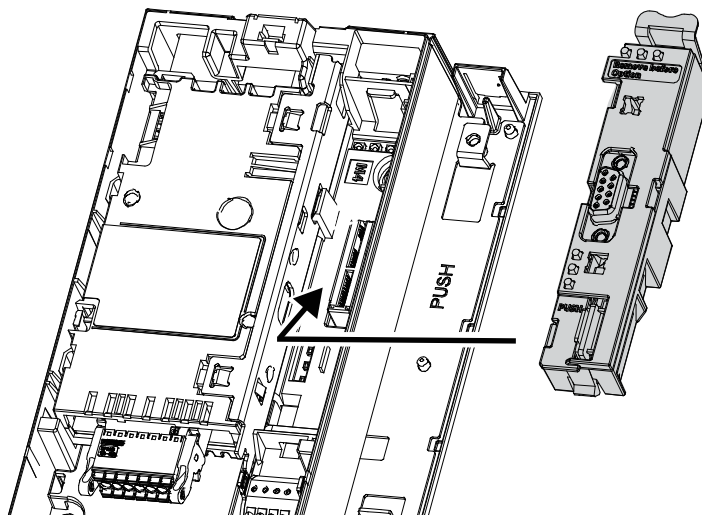
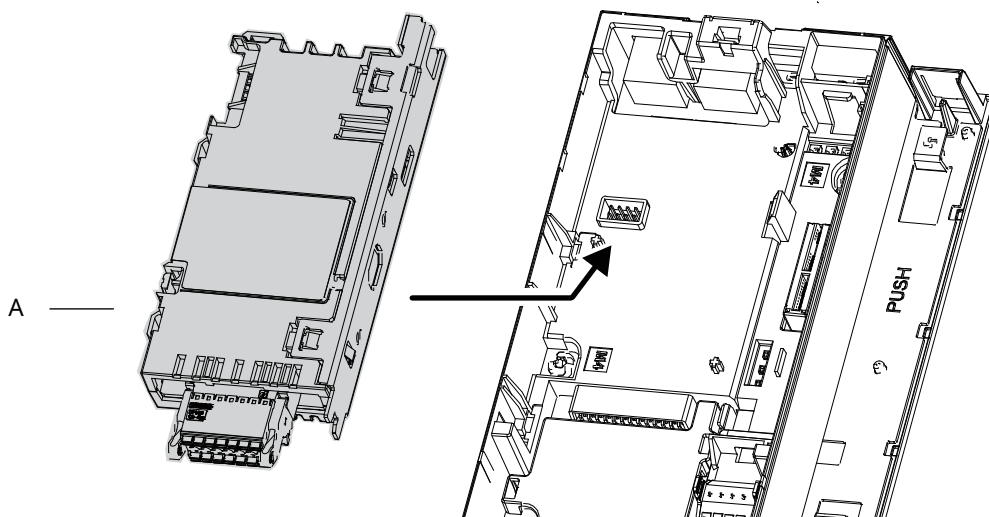
NOTICE

The interface boards are not interchangeable between drives.

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



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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 AC 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.

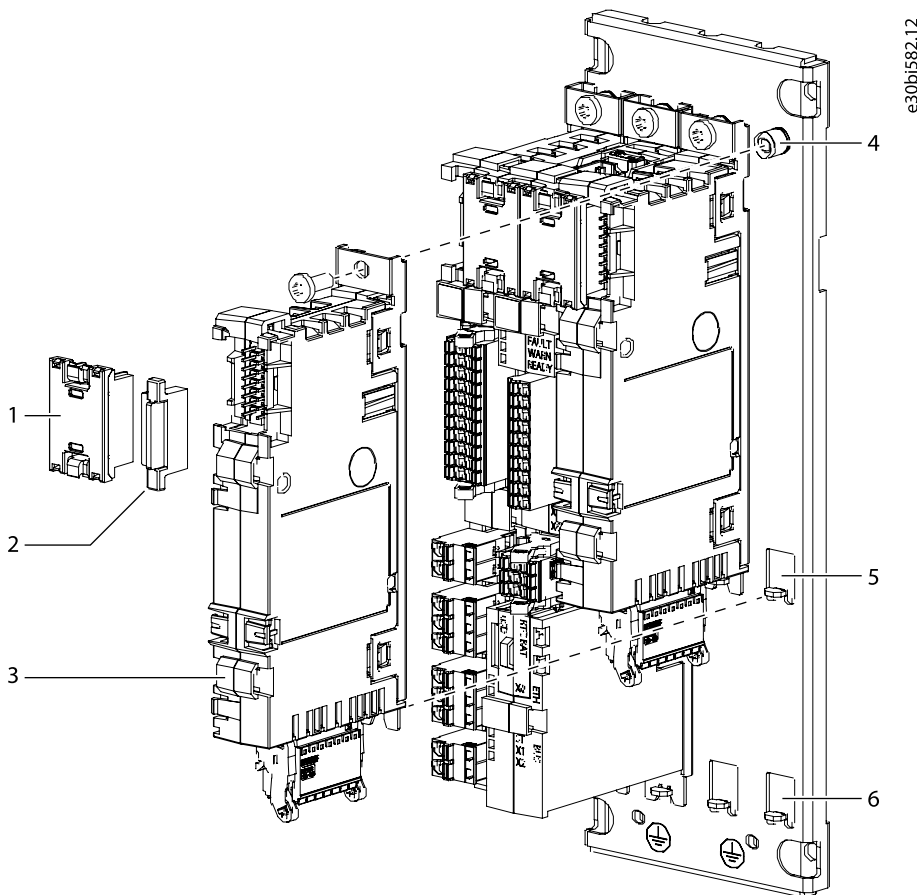


Figure 2: Installing a Board to the Modular Control Unit Mounting Plate

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.

4 Configuration

4.1 Configuration Overview

The parameters related to functional extensions are in parameter group 9, called I/O. Parameters are dependent on the mounting, and will 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)

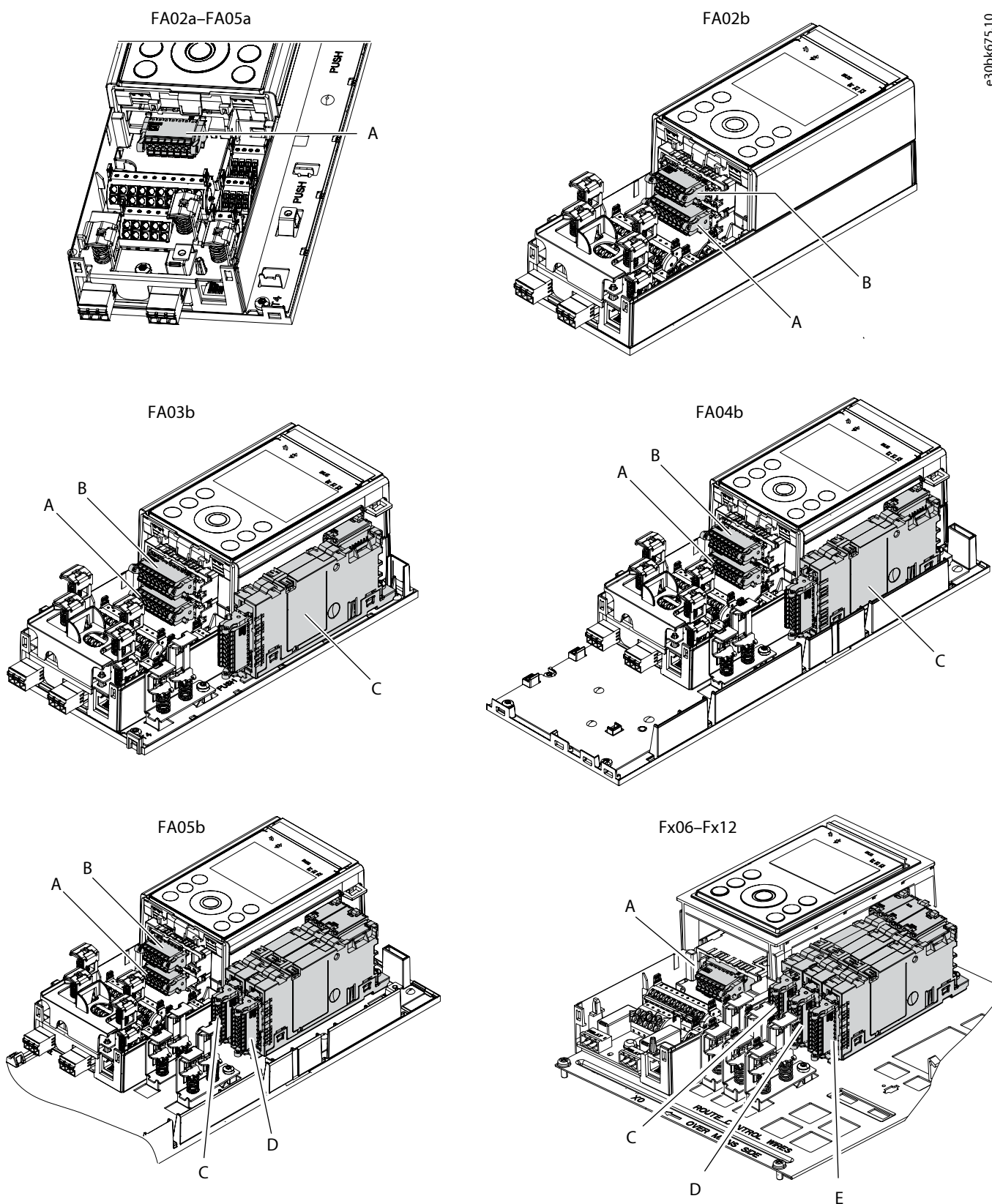


Figure 3: Option Slot Locations in iC7 Frequency Converters

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](#).

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

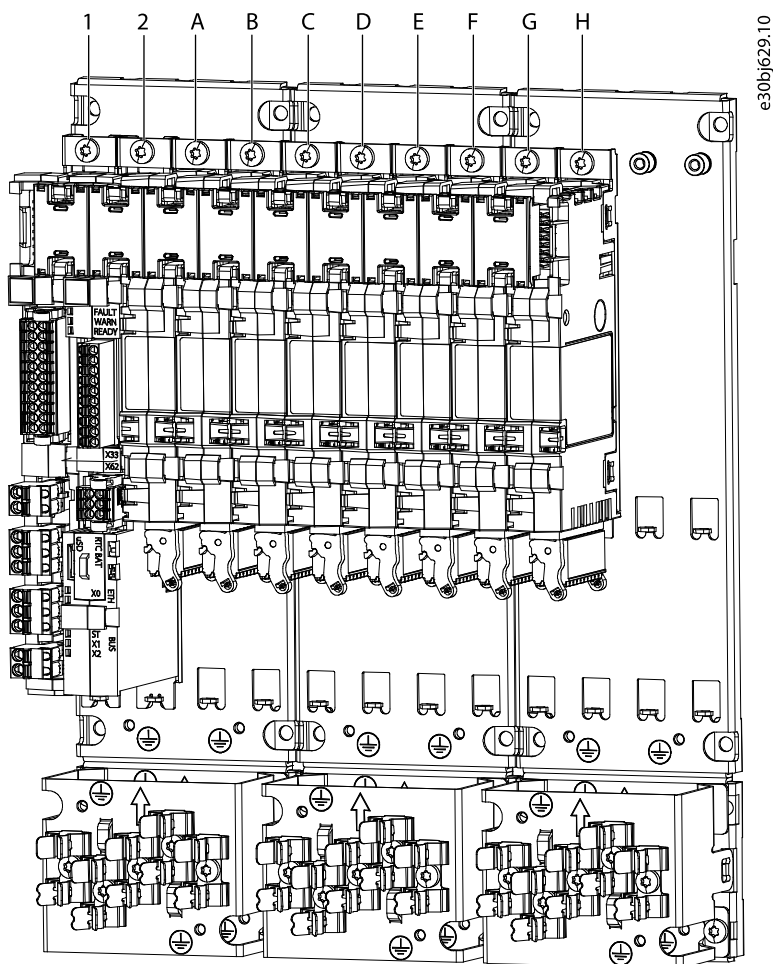


Figure 4: Option Slot Locations in Systems with Modular Control Unit

5 Encoder/Resolver Installation and Configuration

5.1 Encoder/Resolver Option OC7M0 Overview

The Encoder/Resolver Option OC7M0 supports connecting various devices as speed/position feedback or reference. It also has a TTL encoder output, which can be used to represent the position of device 1 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 9.4.1 Interface Configuration Device 1)	Device 2 (parameter 9.4.2 Interface Configuration Device 2)
Disabled	Virtual encoder output on A and B
Incremental encoder on A and B	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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, B, and Z	Disabled
SSI absolute encoder on Z and D	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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

Table 4: Encoder/Resolver Interface Configurations (continued)

Device 1 (parameter 9.4.1 Interface Configuration Device 1)	Device 2 (parameter 9.4.2 Interface Configuration Device 2)
HIPERFACE® absolute encoder on A, B, and D	Disabled
HIPERFACE DSL® absolute encoder on D	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 9.4.3 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 Signal Error Detection

5.2.1 Overview

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

5.2.2 Resolver

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

5.2.3 Incremental Encoder

The following errors 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

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

Table 6: Incremental Encoder Signal Errors

Error	Standstill	In rotation
Single open wire	Not an error	Not an error
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

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 one 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

5.2.4 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.

5.2.5 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

5.3 Pin Assignment for Encoder/Resolver OC7M0

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 **9.4.1 Interface Configuration 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 7: 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+)

5.4 Encoder/Resolver Option OC7M0 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 *9.4.4 Encoder Supply Voltage*. For details, refer to [5.6.2 Configuration \(Menu Index 9.4\)](#).

Table 8: 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 9: 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	

Table 9: Device Type Specifications (continued)

Device type	Specifications		Additional information
	Data	Value	
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}	$\text{Maxexcitationvoltage}_{\text{rms}} = \frac{7V}{\text{Resolvertransformationratio} \times \sqrt{2}}$
	Excitation frequency	2–20 kHz	
	Maximum number of poles	254	
	Maximum input voltage	7 V _{peak}	
	Maximum load	100 mA _{rms}	
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 10: 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.

5.5 Setup and Connection Examples for Encoder/Resolver OC7M0

5.5.1 Virtual Encoder Output

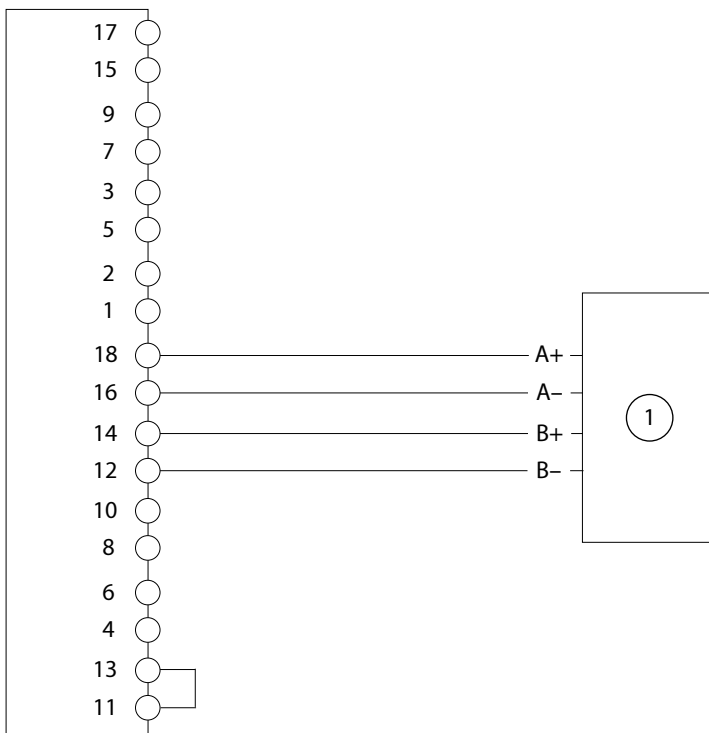
Virtual encoder output can represent position values such as *Demanded* or *Actual Position* provided by the drive. The output is scaled by parameter **9.5.2 Resolution Channel 2** which represents 1 motor rotation.

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

Table 11: Parameters for Virtual Encoder Output

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [0] Disabled.
9.4.2 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

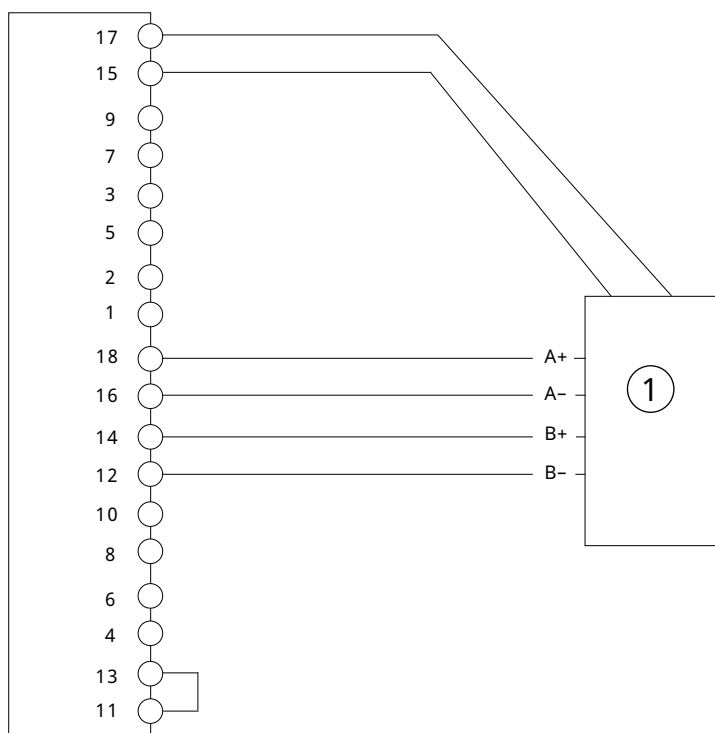
Figure 5: Wiring Configuration for Virtual Encoder Output

5.5.2 Incremental Encoder

With TTL and HTL incremental encoder, 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 12: Parameters for Incremental Encoder

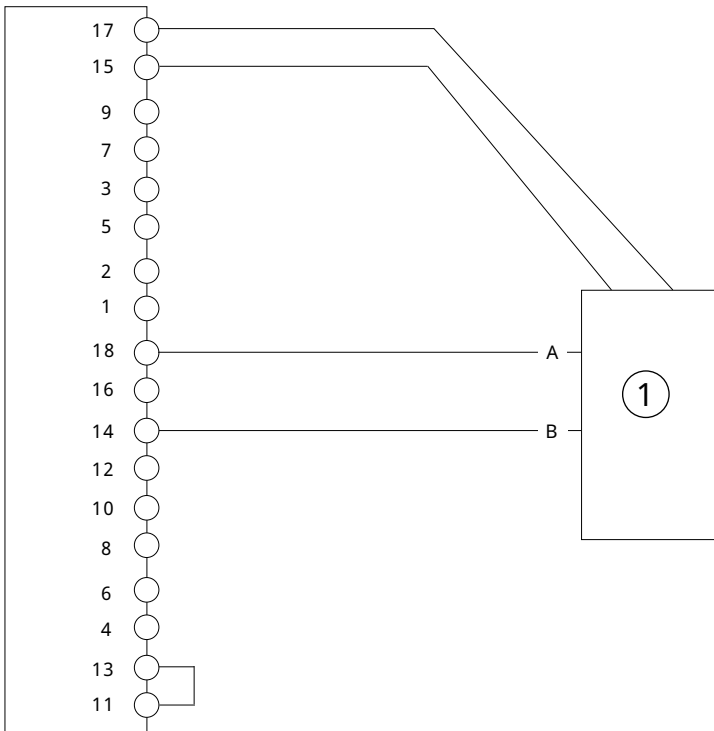
Parameter	Setting
9.4.1 Interface Configuration Device 1	Select according to the type of connected encoder: [1] 2 track incremental A,B [3] 3 track incremental A,B,Z
9.4.3 Encoder Supply Voltage	Set the appropriate supply voltage. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center; background-color: #0056b3; color: white; margin: 0;">NOTICE</p> <p style="margin: 0;">Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.</p> </div>
9.5.1 Resolution Channel 1	Set the resolution of the encoder in pulses per revolution.



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Figure 6: Wiring Configuration for Incremental Encoder, 2 Differential Tracks (TTL, HTL)

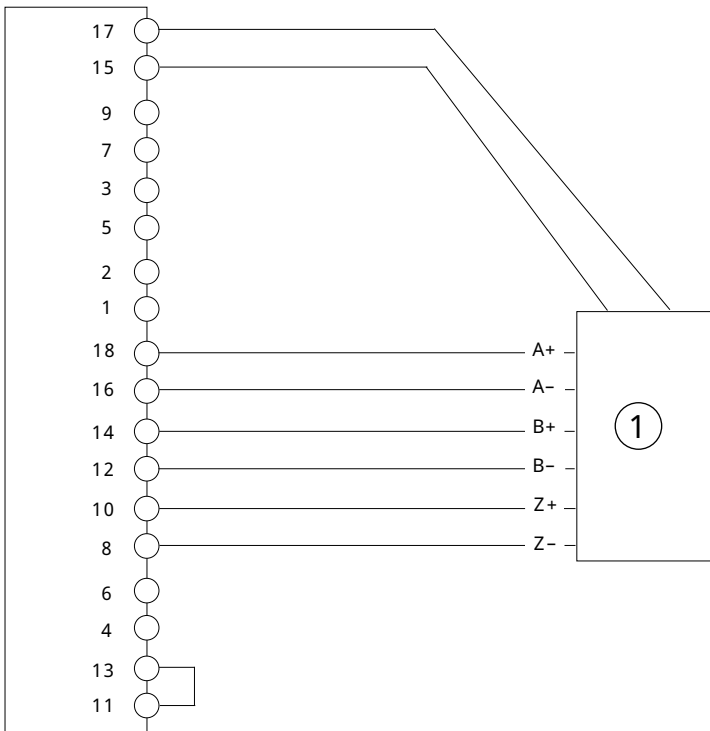
1 Incremental encoder



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

1	Incremental encoder
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Figure 8: Wiring Configuration for Incremental Encoder, 3 Differential Tracks (TTL, HTL)

1	Incremental encoder
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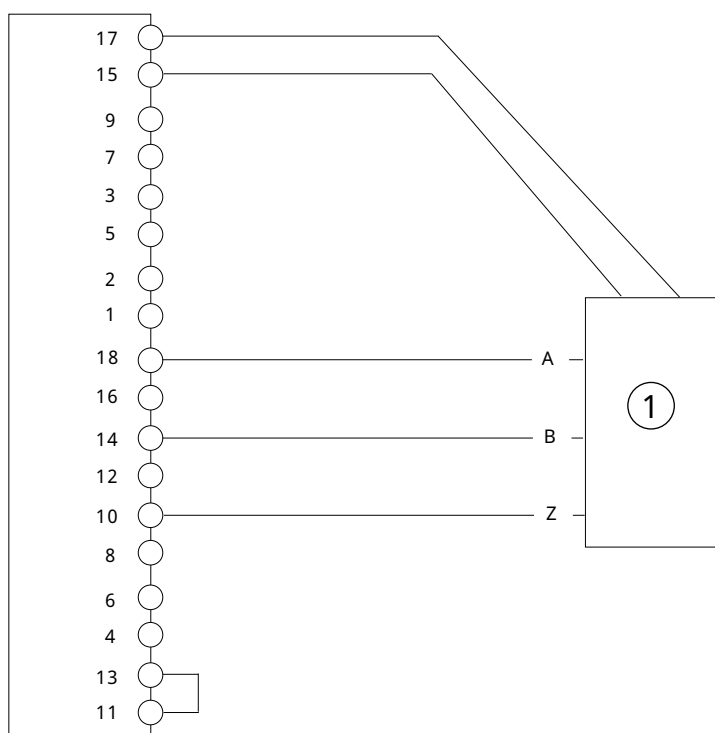


Figure 9: Wiring Configuration for Incremental Encoder, 3 Single Tracks (TTL, HTL)

1 Incremental encoder

5.5.3 Two Incremental Encoders

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

Table 13: Parameters for 2 Incremental Encoders

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [5] 2 track incremental A,B.
9.4.2 Interface Configuration Device 2	Select [1] 2 track incremental.
9.4.3 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.
<div style="background-color: #004a80; color: white; padding: 5px; margin-bottom: 5px;">NOTICE</div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 5px;">Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.</div>	
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.

e30bj664.1

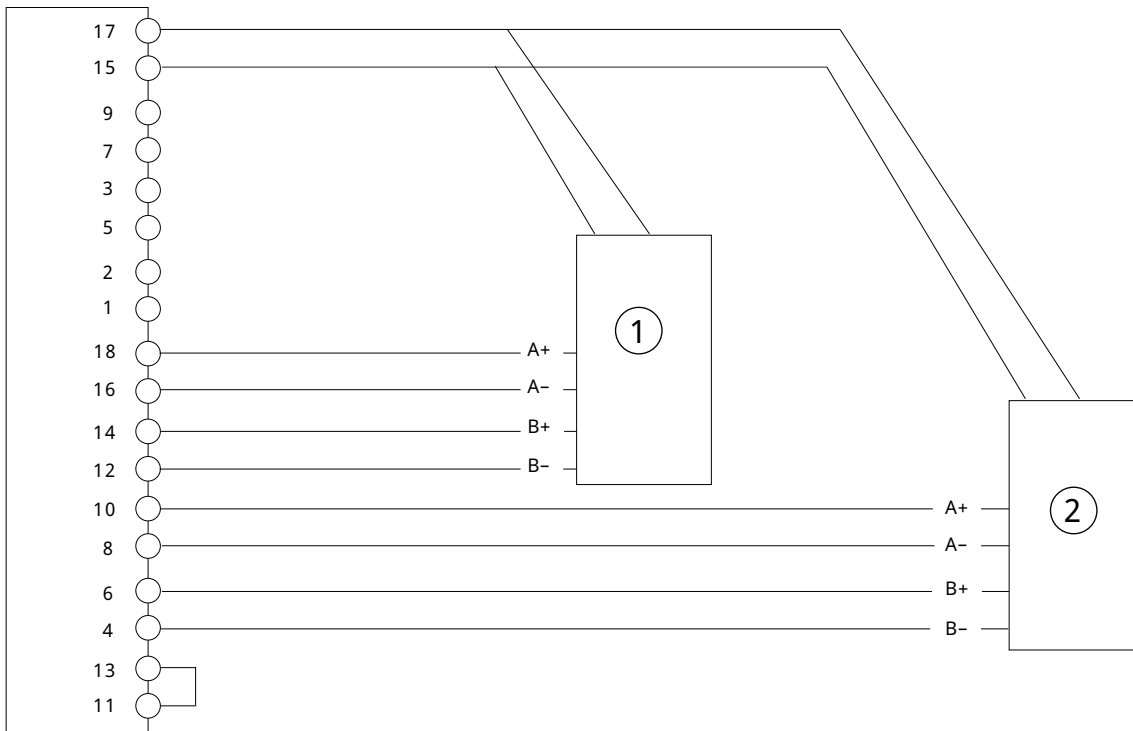


Figure 10: Wiring Configuration for 2 Incremental Encoders

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.
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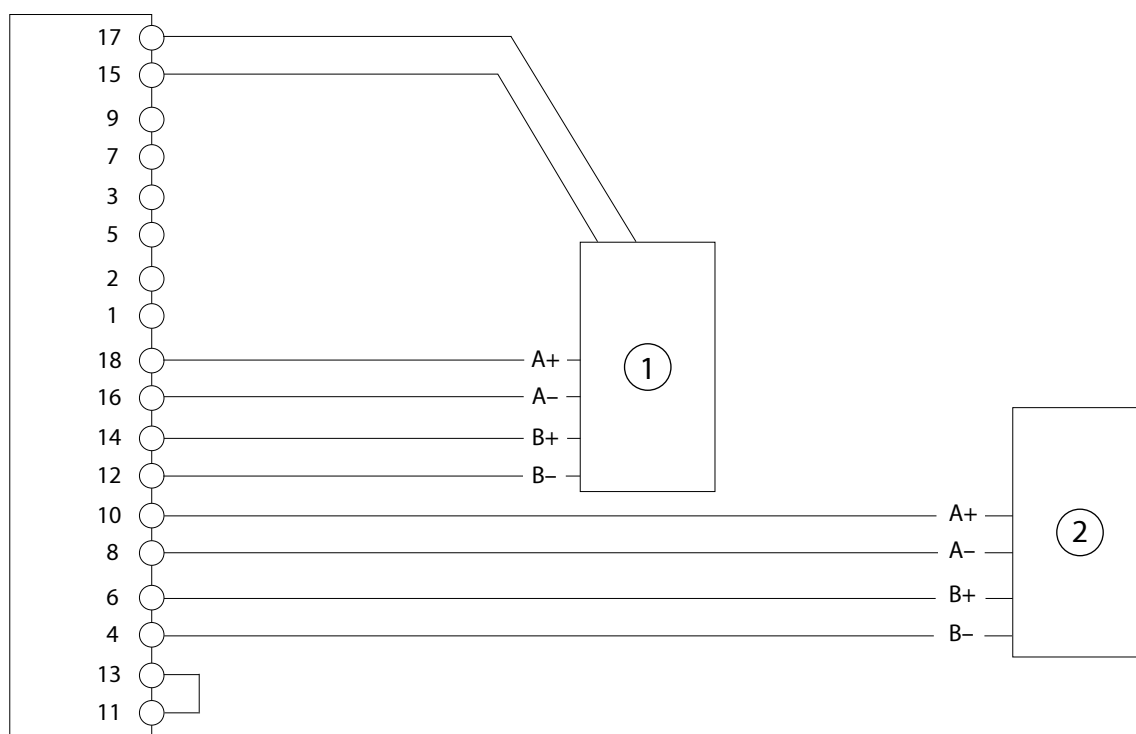
5.5.4 Incremental Encoder with Virtual Output as Device 2

The encoder output as device 2 represents the position of device 1 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 one rotation of Device 1 or one motor rotation for other position values.

Table 14: Parameters for Incremental Encoder with Virtual Output as Device 2

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [1] 2 track incremental A, B.
9.4.2 Interface Configuration Device 2	Select [4] Device 1 Out to represent the position of the encoder or resolver connected as device 1. Select [6] Virtual Out to represent the position of the source selected in parameter 5.16.2.4 Virtual Output Source Selection ⁽¹⁾ .
9.4.3 Encoder Supply Voltage	Set the appropriate voltage for the connected encoder.
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 one rotation of Device 1 or the motor.

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



e30bl686.10

Figure 11: Wiring Configuration for Incremental Encoder with Virtual Output as Device 2

1	2-track incremental encoder (TTL, HTL)	2	Controller
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5.5.5 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 15: Parameters for Resolver

Parameter	Setting
9.4.1 Interface Configuration 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 Poles	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.

e30bj662

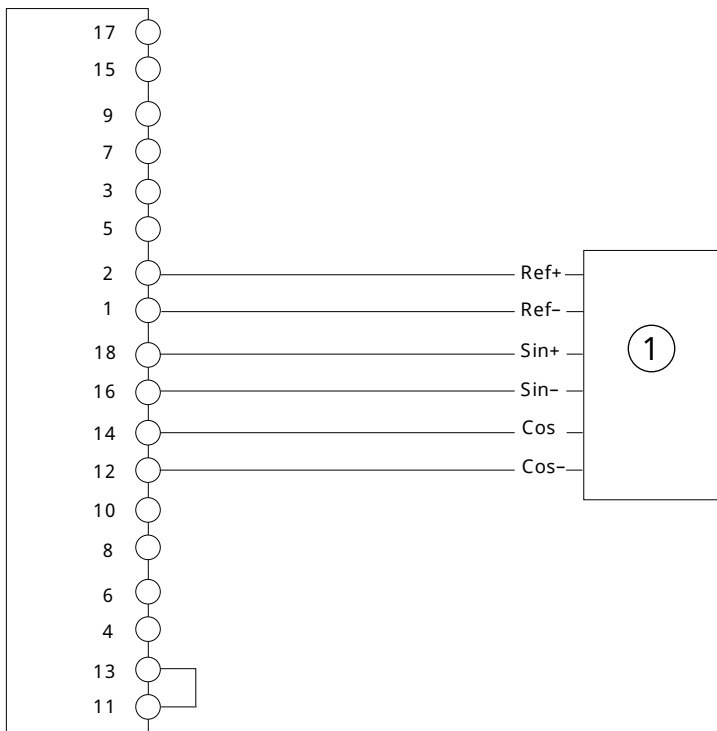


Figure 12: Wiring Configuration for Resolver

1	Resolver
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5.5.6 Resolver with Virtual Output as Device 2

The encoder output as device 2 represents the position of device 1 or position values such as **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.

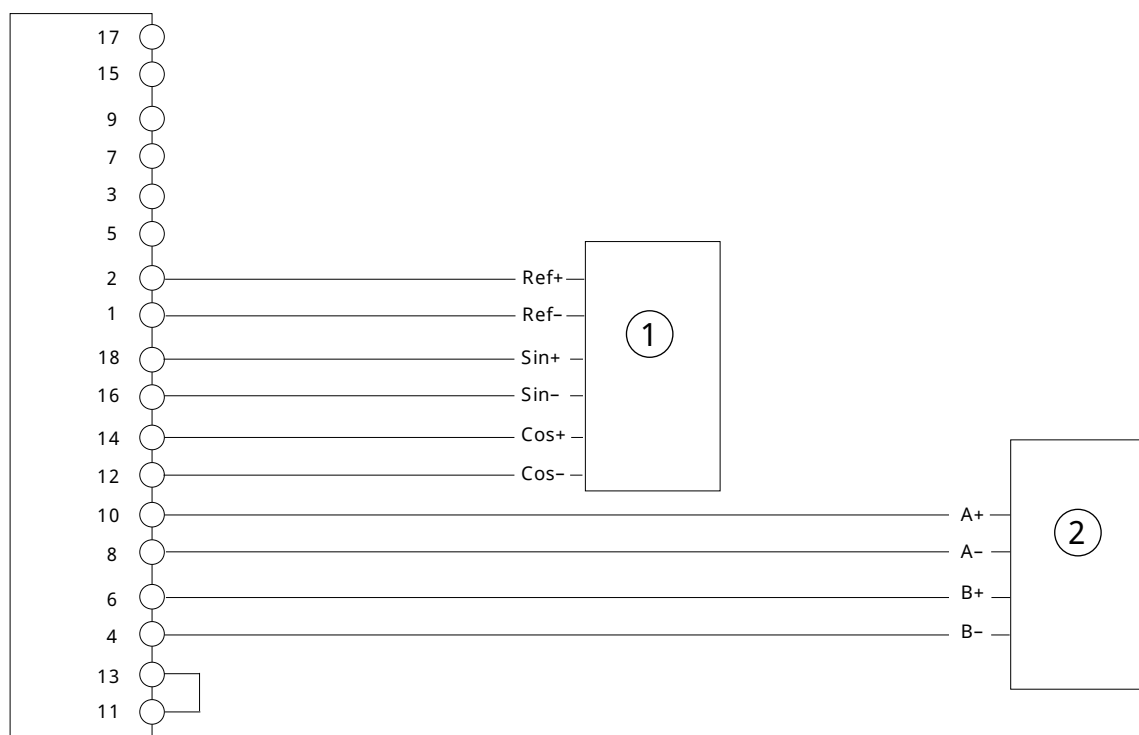
Table 16: Parameters for Resolver with Virtual Output as Device 2

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [8] Resolver A,B .
9.4.2 Interface Configuration Device 2	Select [4] Device 1 Out to represent the position of the encoder or resolver connected as device 1. 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 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.

Table 16: Parameters for Resolver with Virtual Output as Device 2 (continued)

Parameter	Setting
9.7.3 Number of Poles	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.



e30bj665.1

Figure 13: Wiring Configuration for Resolver with Mirror Out

1	Resolver	2	Controller or other device
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5.5.7 Resolver and Incremental (TTL) Encoder

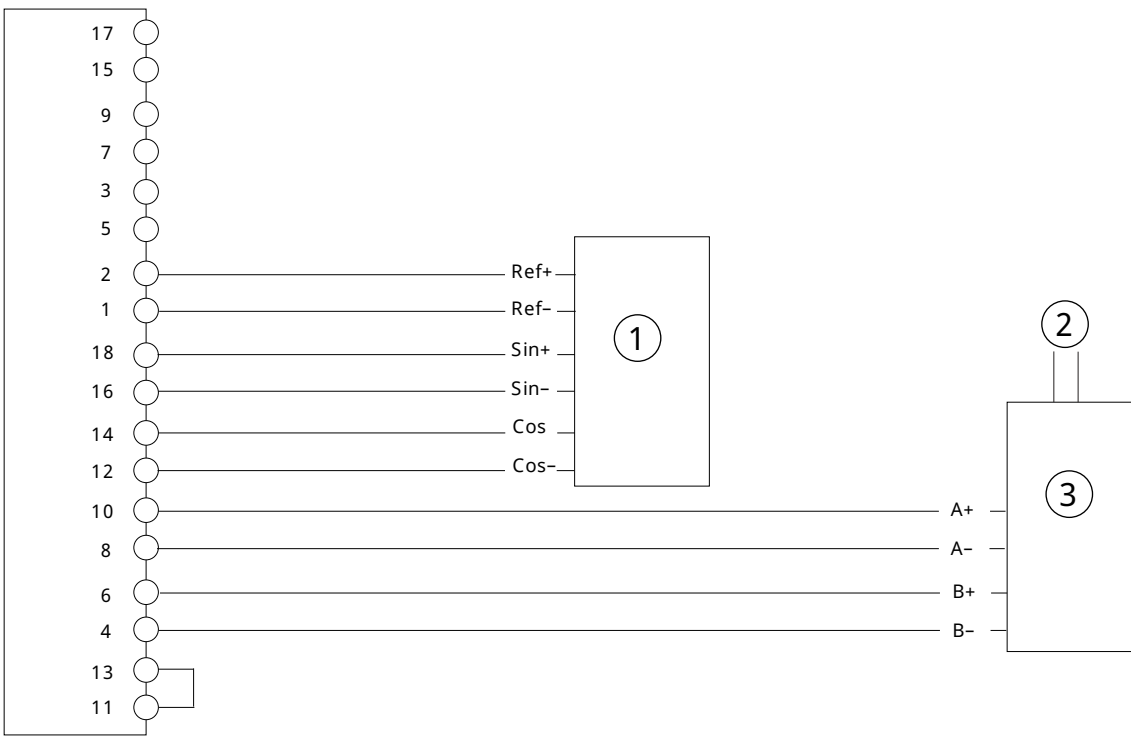
This example of a resolver on A and B as channel 1 and a 2-track incremental TTL encoder on Z and D as channel 2. The internal supply of the option is used for resolver excitation. The encoder supply (pin 17) is inactive, so the incremental encoder must be supplied by an external power source.

Table 17: Parameters for Resolver and Incremental (TTL) Encoder

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [9] Resolver A,B.
9.4.2 Interface Configuration 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.

Table 17: Parameters for Resolver and Incremental (TTL) Encoder (continued)

Parameter	Setting
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.



e30bk902.1

Figure 14: Wiring Configuration for Resolver and Incremental (TTL) Encoder

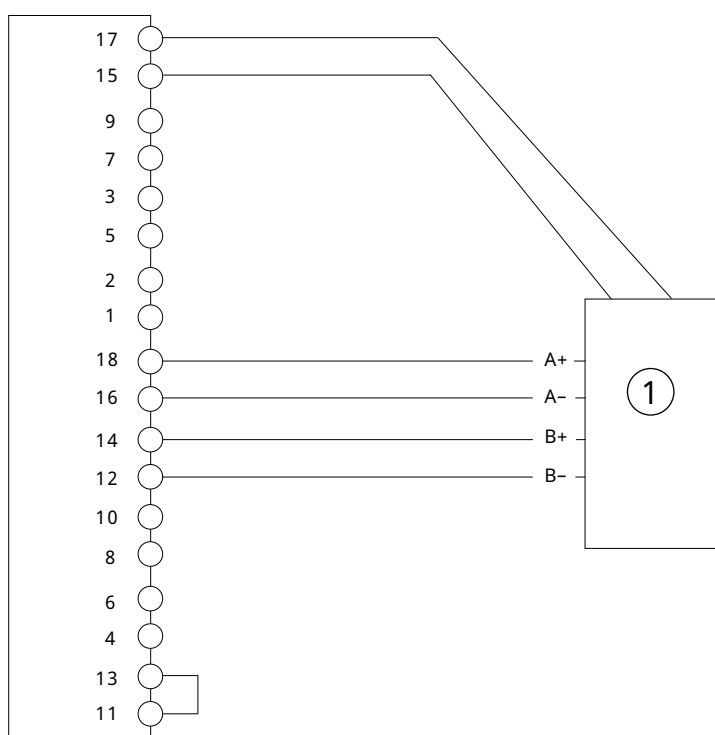
1	Resolver	2	External power supply
3	Incremental encoder (only TTL on Z and D)		

5.5.8 SinCos Encoder

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

Table 18: Parameters for SinCos Encoder

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [10] SinCos A,B.
9.4.3 Encoder Supply Voltage	Set the appropriate supply voltage. <div style="border: 1px solid black; padding: 5px; background-color: #e0e0e0;"> <p style="text-align: center; margin: 0;">NOTICE</p> <p style="margin: 0;">Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.</p> </div>
9.5.1 Resolution Device 1	Set the resolution of the encoder in pulses per revolution.



e30bj658.1

Figure 15: Wiring Configuration for SinCos Encoder

1	SinCos encoder
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5.5.9 SinCos and Incremental (TTL) Encoder

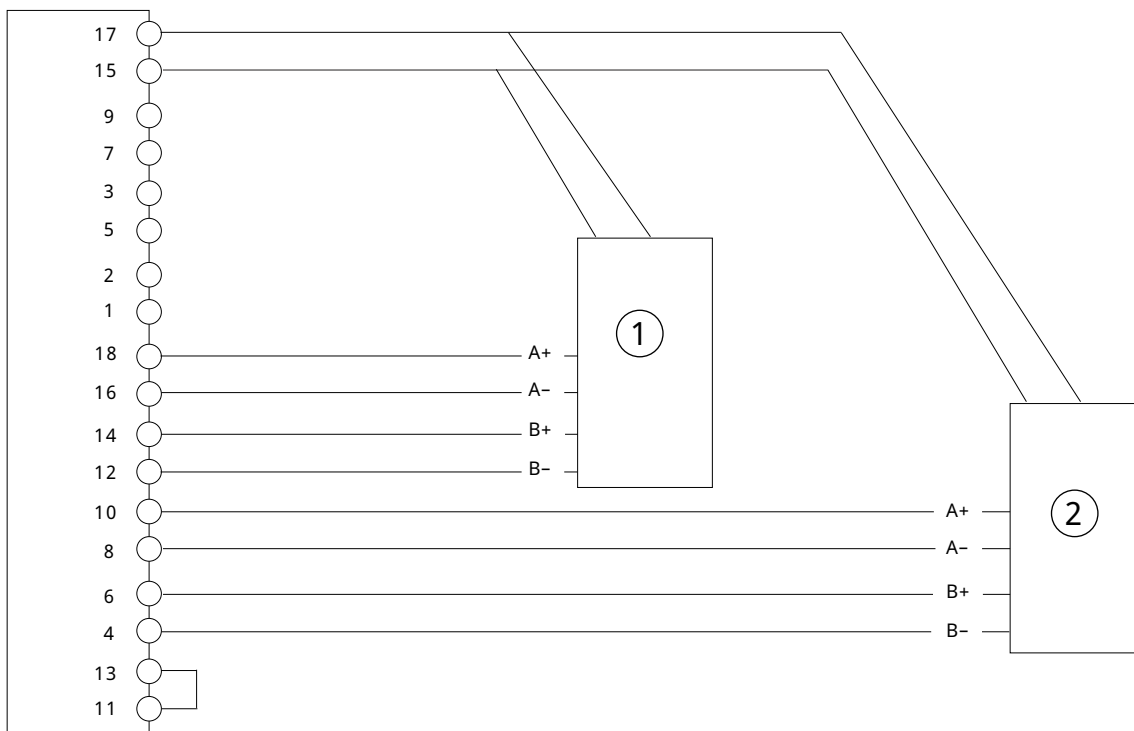
This example shows the connection of a SinCos encoder on A and B as channel 1, and a 2 track incremental TTL encoder on Z and D as channel 2.

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

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [12] SinCos A,B.
9.4.2 Interface Configuration Device 2	Select [1] 2 track incremental.

Table 19: Parameters for SinCos and Incremental (TTL) Encoder (continued)

Parameter	Setting
9.4.3 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.
9.5.1 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.



e30bj664.1

Figure 16: 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.
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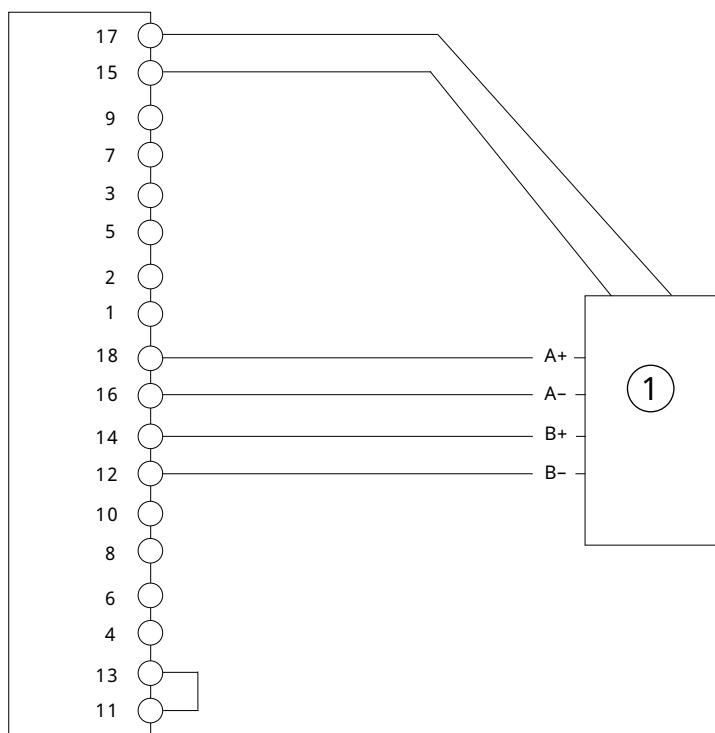
5.5.10 SinCos Encoder with Virtual Output as Device 2

The encoder output as device 2 represents the position of device 1 or position values such as *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 20: Parameters for SinCos Encoder with Virtual Output as Device 2

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

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



e30bj658.1

Figure 17: Wiring Configuration for SinCos Encoder with Virtual Output as Device 2

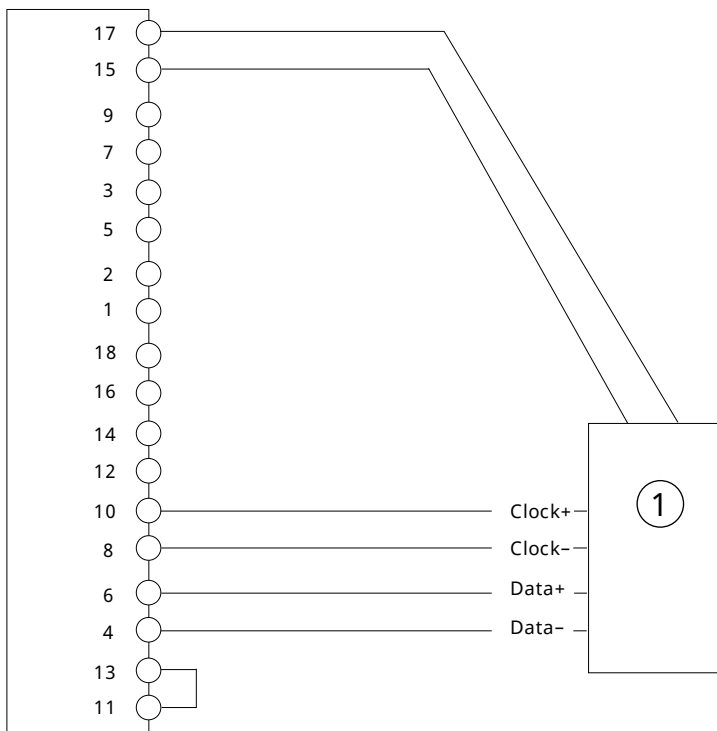
1	SinCos encoder	2	Controller
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5.5.11 SSI Encoder

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

Table 21: Parameters for SSI Encoder

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [17] SSI Z,D.
9.4.3 Encoder Supply Voltage	Set the appropriate supply voltage. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center; background-color: #0056b3; color: white; margin: 0;">NOTICE</p> <p style="margin: 0;">Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.</p> </div>
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 revolution count.
9.6.5 BiSS/SSI Clock Rate	Set the clock rate used for SSI or BiSS.



e30bj663.1

Figure 18: Wiring Configuration for 2-Track SSI Encoder

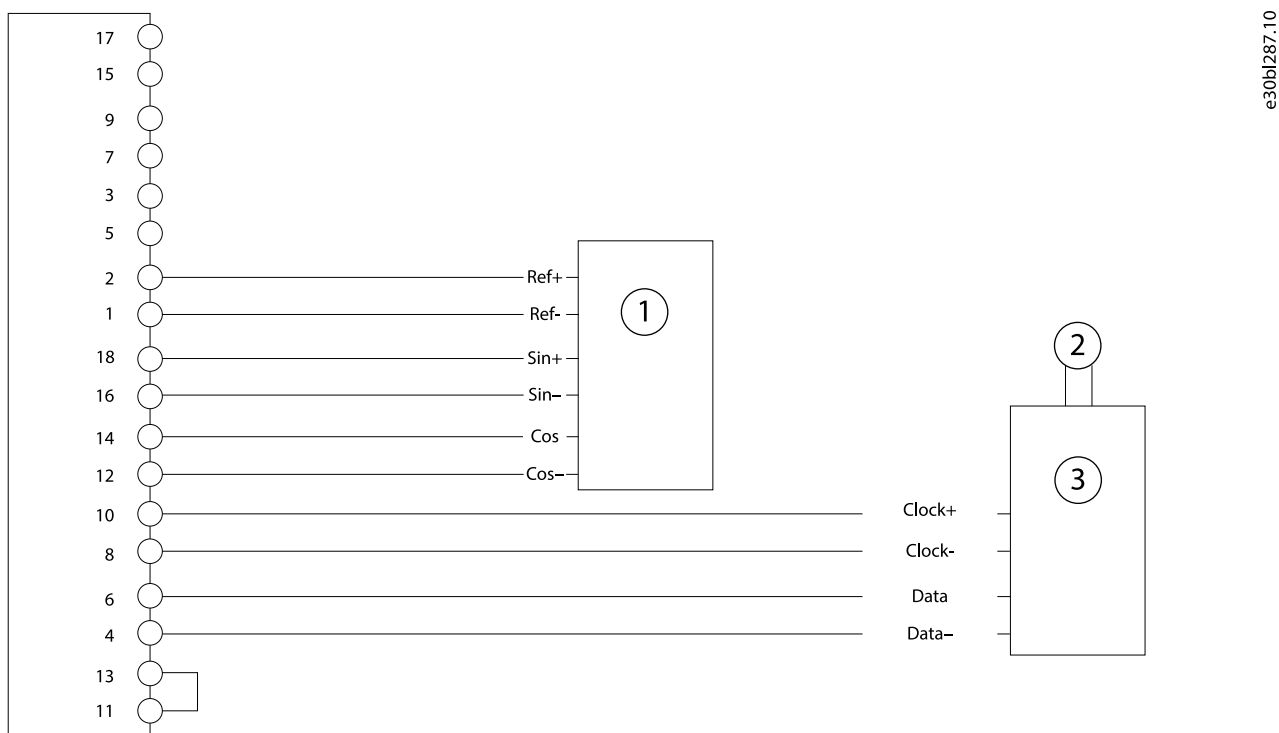
1 SSI encoder

5.5.12 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 22: Parameters for SSI and Resolver

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [18] SSI Z,D.
9.4.2 Interface Configuration 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.
9.6.5 SSI Data Format	Select the data format of the connected SSI encoder.
9.6.6 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.



e30bl287.10

Figure 19: Wiring Configuration for SSI and Resolver

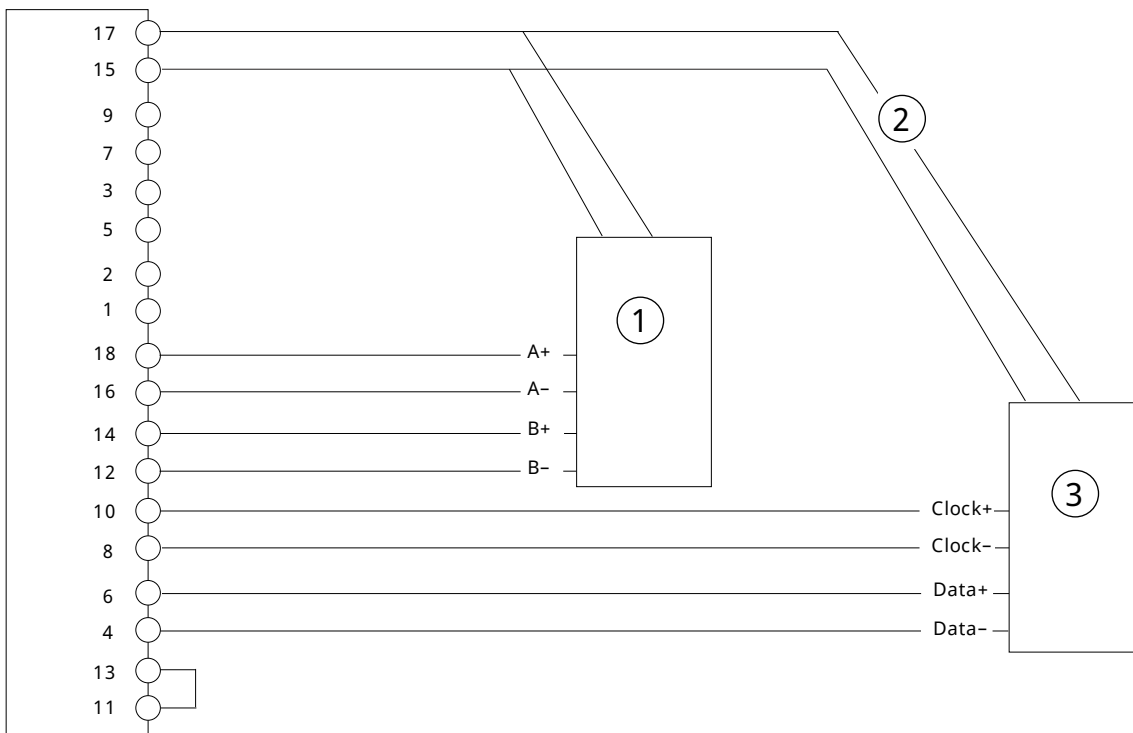
1	Resolver	2	External power supply
3	SSI encoder		

5.5.13 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 23: Parameters for SSI and Incremental (TTL or HTL) or SinCos Encoder

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [19] SSI Z,D .
9.4.2 Interface Configuration Device 2	Select the type of connected encoder: [1] 2 track incremental [10] SinCos A/B
9.4.3 Encoder Supply Voltage	Set the appropriate voltage.
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.



e30bk899.1

Figure 20: 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		

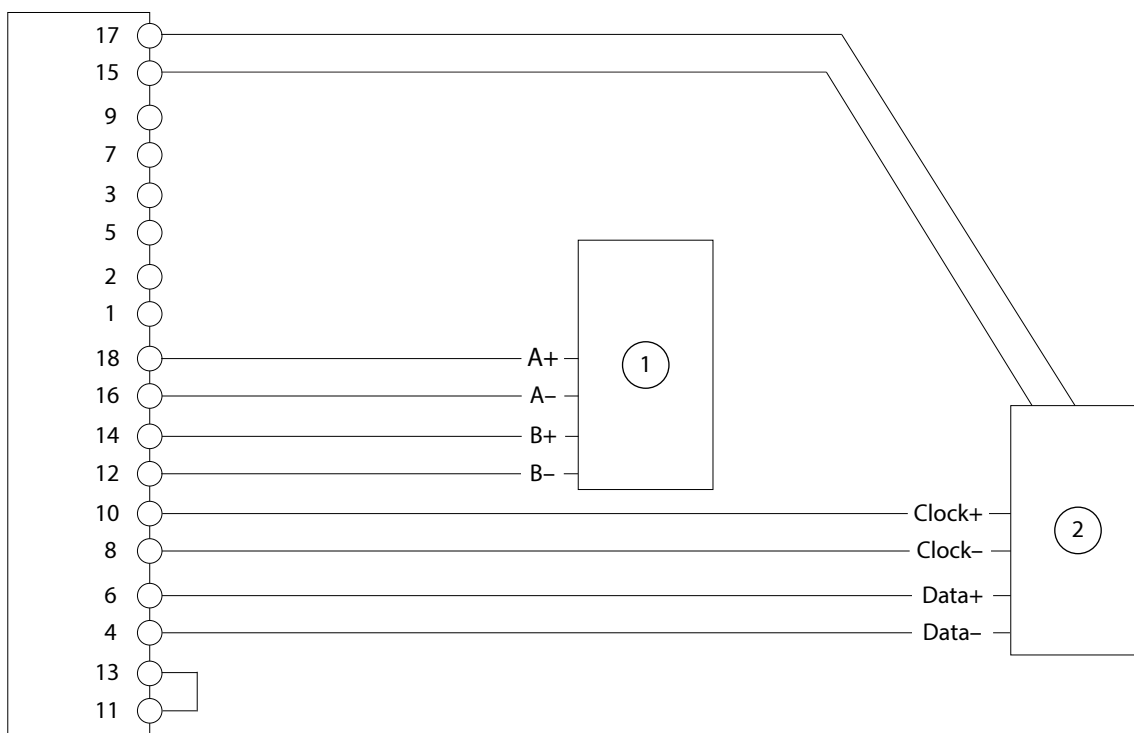
5.5.14 SSI Encoder with Virtual Output as Device 2

The encoder output as device 2 represents the position of device 1 or position values such as *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 24: Parameters for SSI Encoder with Virtual Output as Device 2

Parameter	Setting
9.4.1 Interface configuration Device 1	Select [19] SSI Z,D.
9.4.2 Interface Configuration Device 2	Select [4] <i>Device 1 Out</i> to represent the position of the encoder or resolver connected as device 1. Select [6] <i>Virtual Out</i> to represent the position of the source selected in parameter 5.16.2.4 Virtual Output Source Selection ⁽¹⁾ .
9.4.3 Encoder Supply Voltage	Set the appropriate voltage for the connected encoder.
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 SSI Data Format	Select the data format of the connected SSI encoder.
9.6.6 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*.



e30bl660.10

Figure 21: Wiring Configuration for SSI Encoder with Virtual output as Device 2

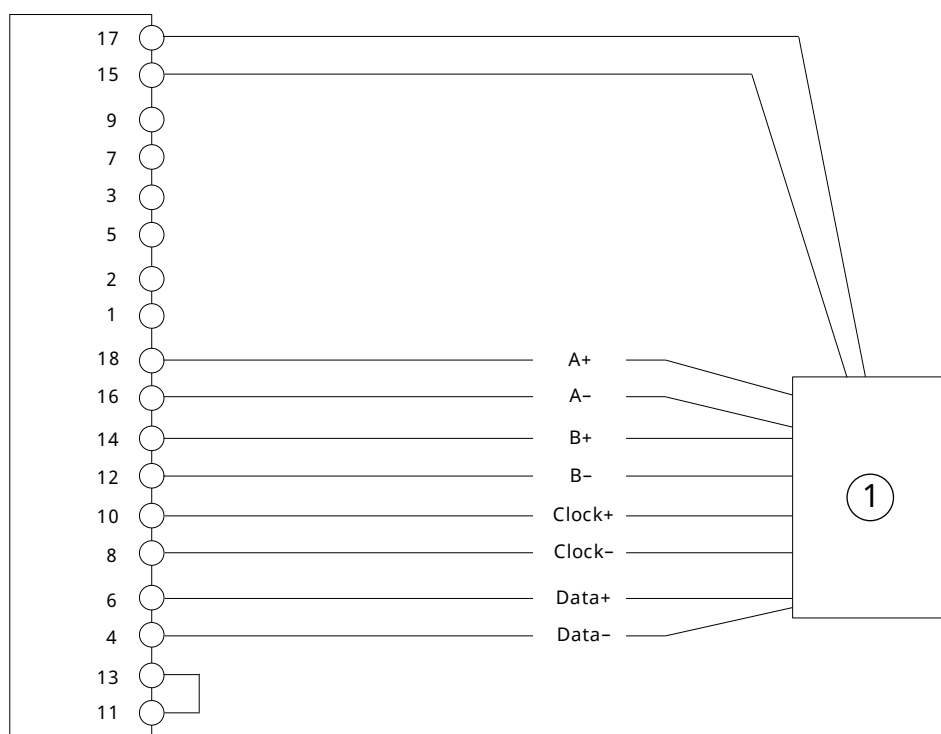
1	Controller	2	SSI absolute encoder
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5.5.15 SSI Encoder with Incremental or SinCos Track

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 25: Parameters for SSI Encoder with Incremental or SinCos Track

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select the type of connected encoder: [33] SSI with 2 track incremental Z,D,A,B [34] SSI with 2 track SinCos Z,D,A,B
9.4.3 Encoder Supply Voltage	Set the appropriate voltage. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center; background-color: #004a87; color: white; margin: 0;">NOTICE</p> <p style="margin: 0;">Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.</p> </div>
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.



e30bk893.1

Figure 22: Wiring Configuration for SSI Encoder with Incremental or SinCos Track

1 Encoder

5.5.16 EnDat Encoder

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

Table 26: Parameters for EnDat Encoder

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [22] <i>EnDat Z,D</i> .
9.4.3 Encoder Supply Voltage	Set the appropriate supply voltage. <div style="background-color: #004a87; color: white; text-align: center; padding: 5px;">NOTICE</div> <p>Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.</p>
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 revolution count.
9.6.3 EnDat Clock Rate	Set the rate for the clock signal according to the encoder specifications.

e30bj663.1

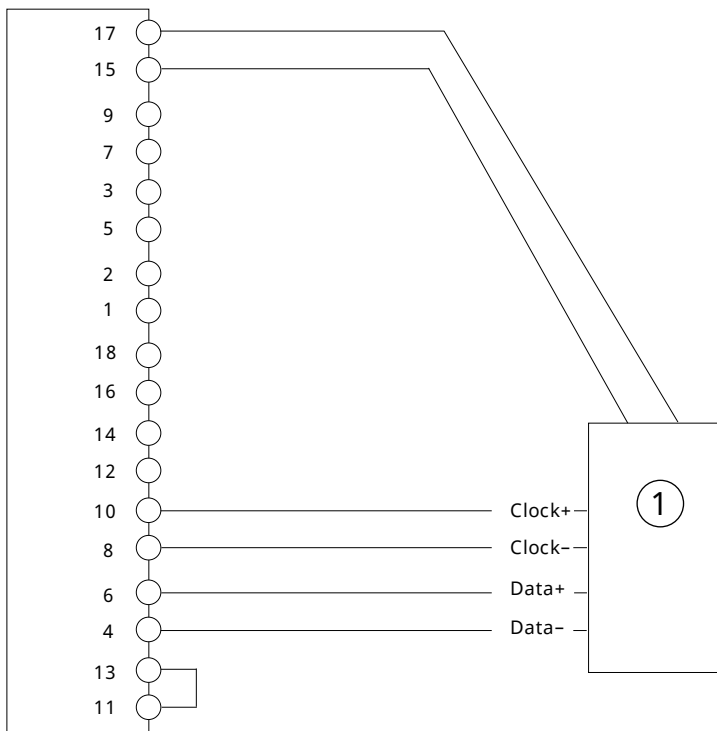


Figure 23: Wiring Configuration for 2-Track EnDat Encoder

1	EnDat encoder
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5.5.17 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 27: Parameters for EnDat and Resolver

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [38] EnDat Z,D.
9.4.2 Interface Configuration 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.

e30bl287.10

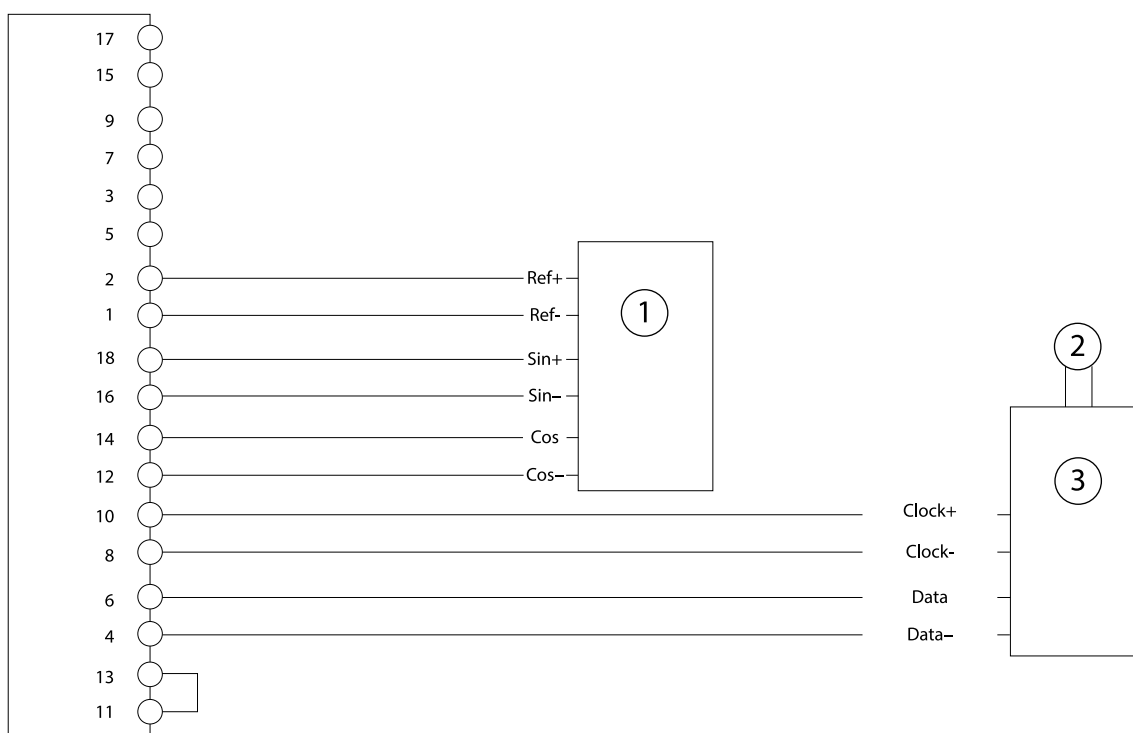


Figure 24: Wiring Configuration for EnDat and Resolver

1	Resolver	2	External power supply
3	EnDat encoder		

5.5.18 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 28: Parameters for EnDat and Incremental (TTL or HTL) or SinCos Encoder

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [23] EnDat Z,D.
9.4.2 Interface Configuration Device 2	Select according to the connected encoder: [1] 2 track incremental [10] SinCos A/B
9.4.3 Encoder Supply Voltage	Set the appropriate voltage. <div style="background-color: #0056b3; color: white; text-align: center; padding: 5px;">NOTICE</div> <p>Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.</p>
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.

Table 28: 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.

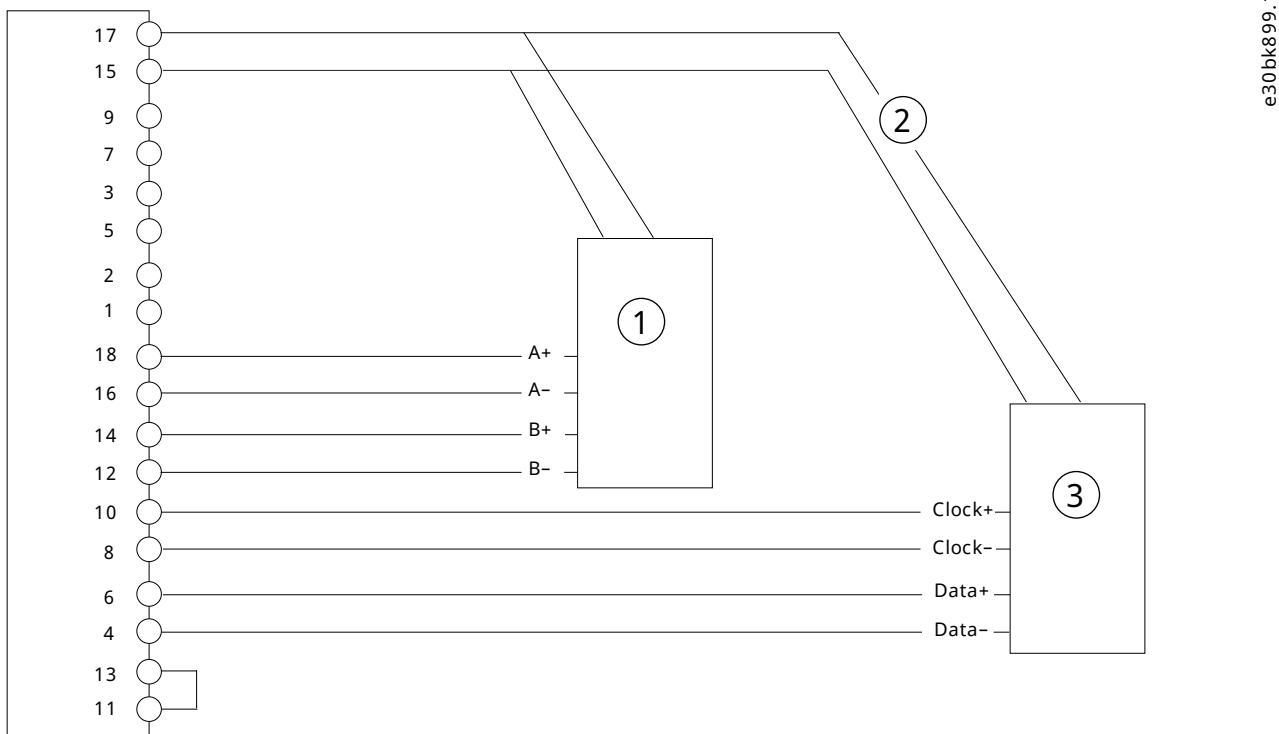


Figure 25: EnDat and Incremental (TTL or HTL) or SinCos Encoder

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

5.5.19 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 **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 29: Parameter Settings for EnDat Encoder with Virtual Output as Device 2

Parameter	Setting
9.4.1 Interface configuration Device 1	Select [23] EnDat Z,D.
9.4.2 Interface Configuration Device 2	Select [4] Device 1 Out to represent the position of the encoder or resolver connected as device 1. Select [6] Virtual Out to represent the position of the source selected in parameter 5.16.2.4 Virtual Output Source Selection ⁽¹⁾ .

Table 29: Parameter Settings for EnDat Encoder with Virtual Output as Device 2 (continued)

Parameter	Setting
9.4.3 Encoder Supply Voltage	Set the appropriate voltage for the connected encoder.
9.5.2 Resolution Channel 2	Set the number of pulses per revolution of the virtual encoder representing one 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.

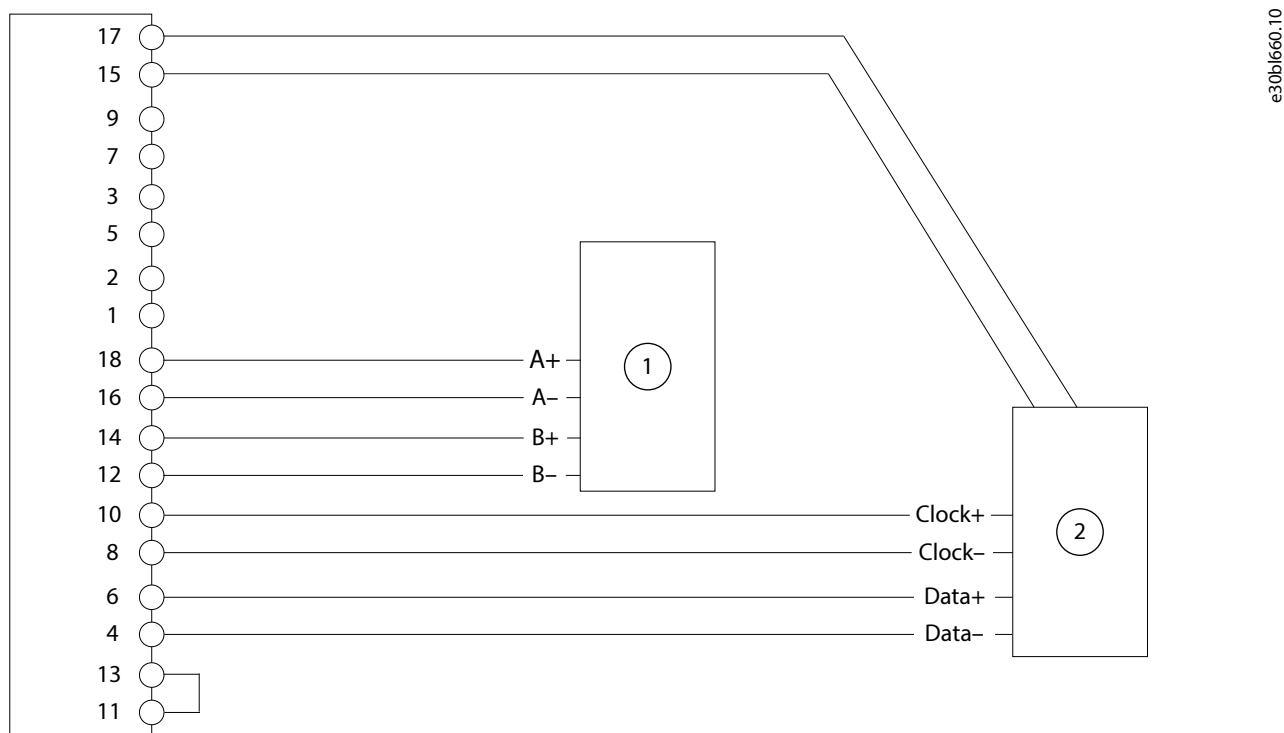


Figure 26: Wiring Configuration for EnDat Encoder with Virtual Output as Device 2

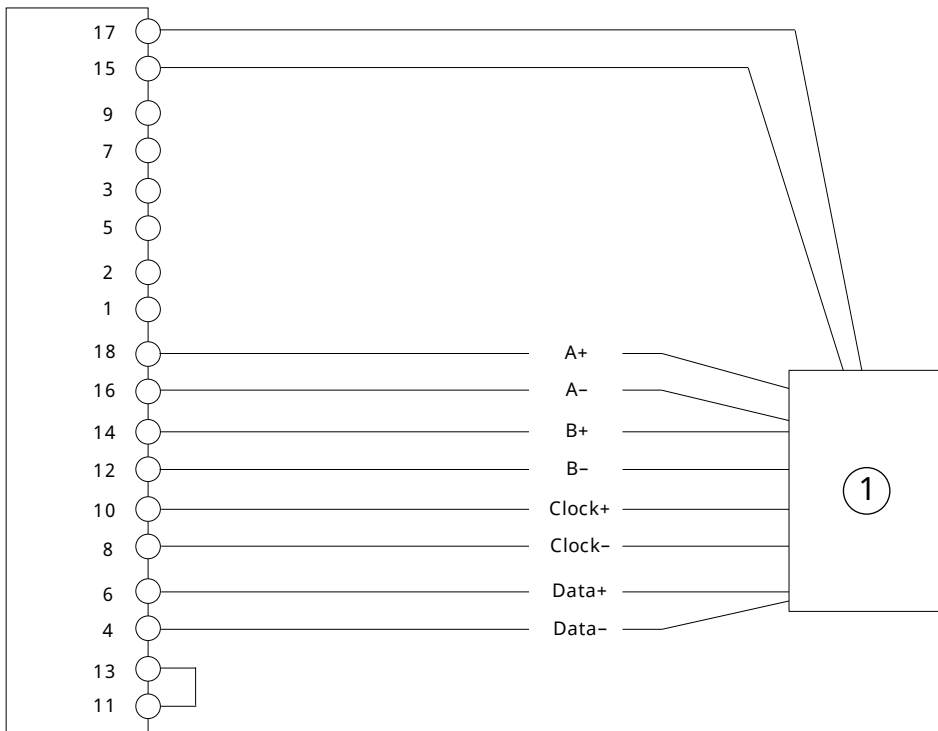
1	Controller	2	EnDat absolute encoder
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5.5.20 EnDat with Incremental or SinCos Track

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.

Table 30: Parameters for EnDat with Incremental or SinCos Track

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select: [21] EnDat with 2 track incremental Z,D,A,B [20] EnDat with SinCos Z,D,A,B
9.4.3 Encoder Supply Voltage	Set the appropriate voltage for the connected encoder. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center; background-color: #0056b3; color: white; margin: 0;">NOTICE</p> <p style="margin: 0;">Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.</p> </div>
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 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 SSI Data Format	Select the data format of the connected SSI encoder.
9.6.6 BiSS/SSI Clock Rate	Select the clock rate according to the specifications of the connected SSI encoder.



e30bk893.1

Figure 27: Wiring Configuration for EnDat with Incremental or SinCos Track

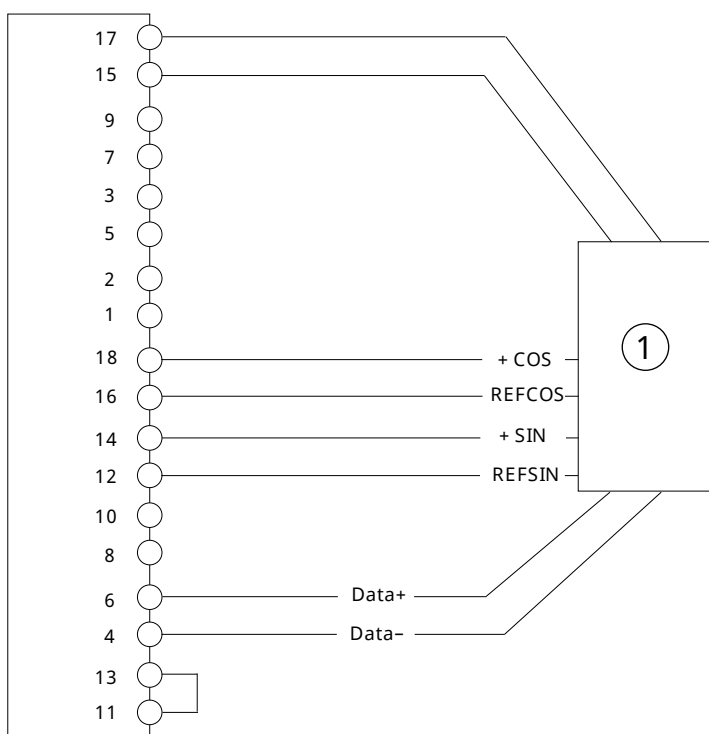
1	EnDat encoder
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5.5.21 HIPERFACE®

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

Table 31: Parameters for HIPERFACE®

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [25] Hiperface A,B,D.
9.4.3 Encoder Supply Voltage	Set the appropriate voltage. <div style="border: 1px solid black; background-color: #004a87; color: white; padding: 5px; text-align: center;">NOTICE</div> <p>Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.</p>
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.



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Figure 28: Wiring Configuration for HIPERFACE®

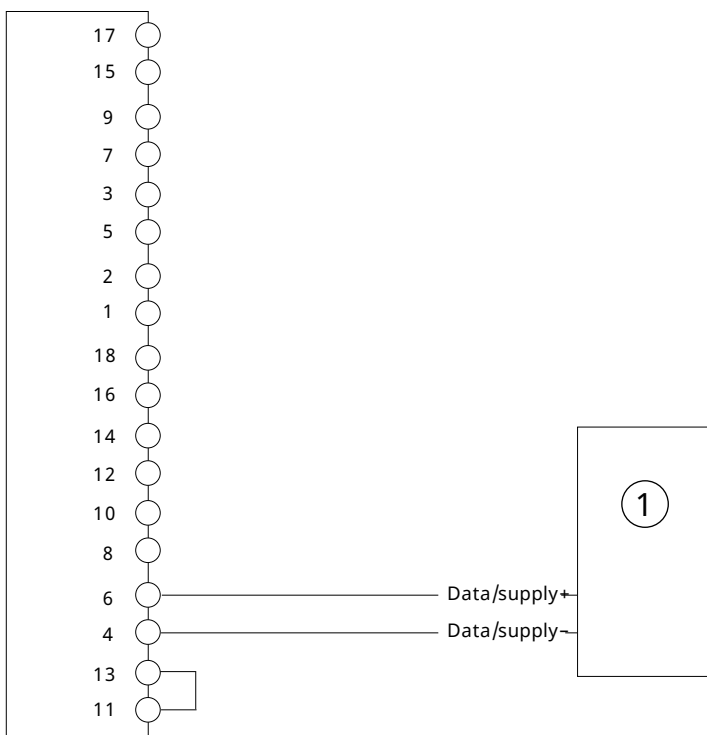
1 HIPERFACE® encoder

5.5.22 HIPERFACE DSL®

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

Table 32: Parameters for HIPERFACE DSL®

Parameter	Setting
9.4.1 Interface Configuration 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 revolution count.



e30bj666.1

Figure 29: Wiring Configuration for HIPERFACE DSL® Encoder

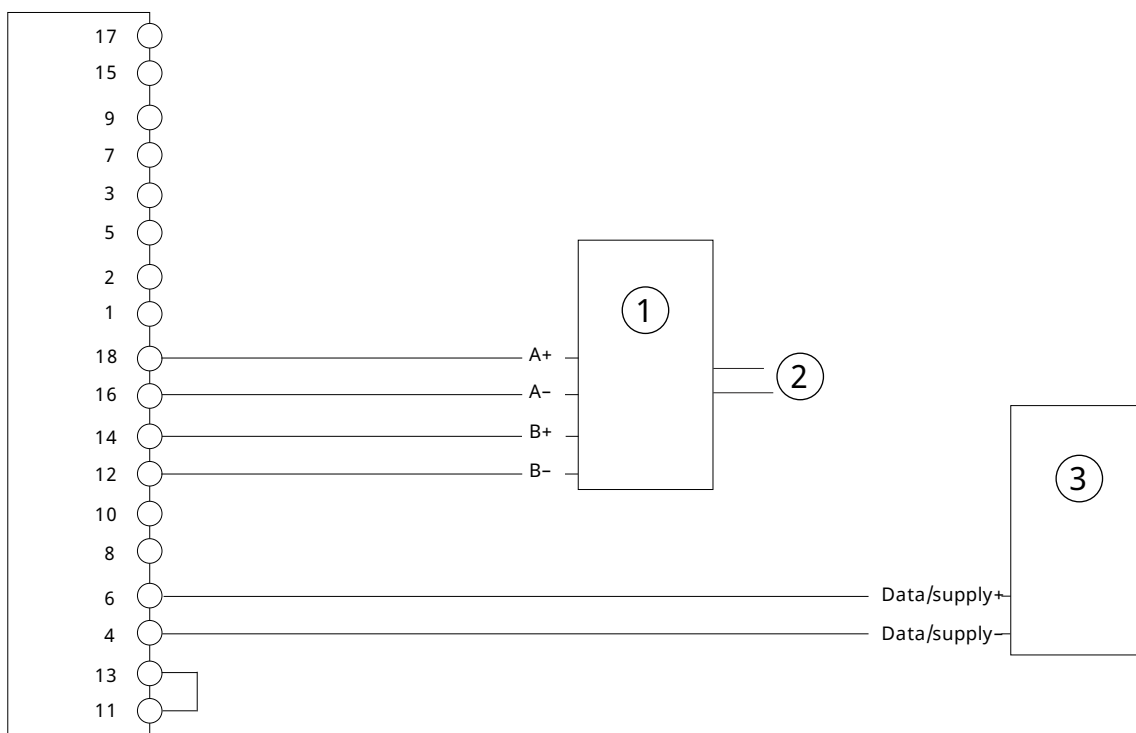
1	HIPERFACE DSL® encoder
---	------------------------

5.5.23 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 33: Parameters for HIPERFACE DSL® and Incremental (TTL or HTL) or SinCos Encoder

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [27] <i>HIPERFACE DSL D</i> .
9.4.2 Interface Configuration Device 2	Select the type of connected encoder: [1] <i>2 track incremental</i> [3] <i>3 track incremental A,B,Z</i> [10] <i>SinCos A,B</i> [14] <i>SinCos A,B,Z</i>
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 HIPERFACE DSL® encoder.
9.6.2 Multiturn Resolution	Set the number of bits used for counting the revolutions of the connected HIPERFACE DSL® encoder.



e30bk977.1

Figure 30: 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		

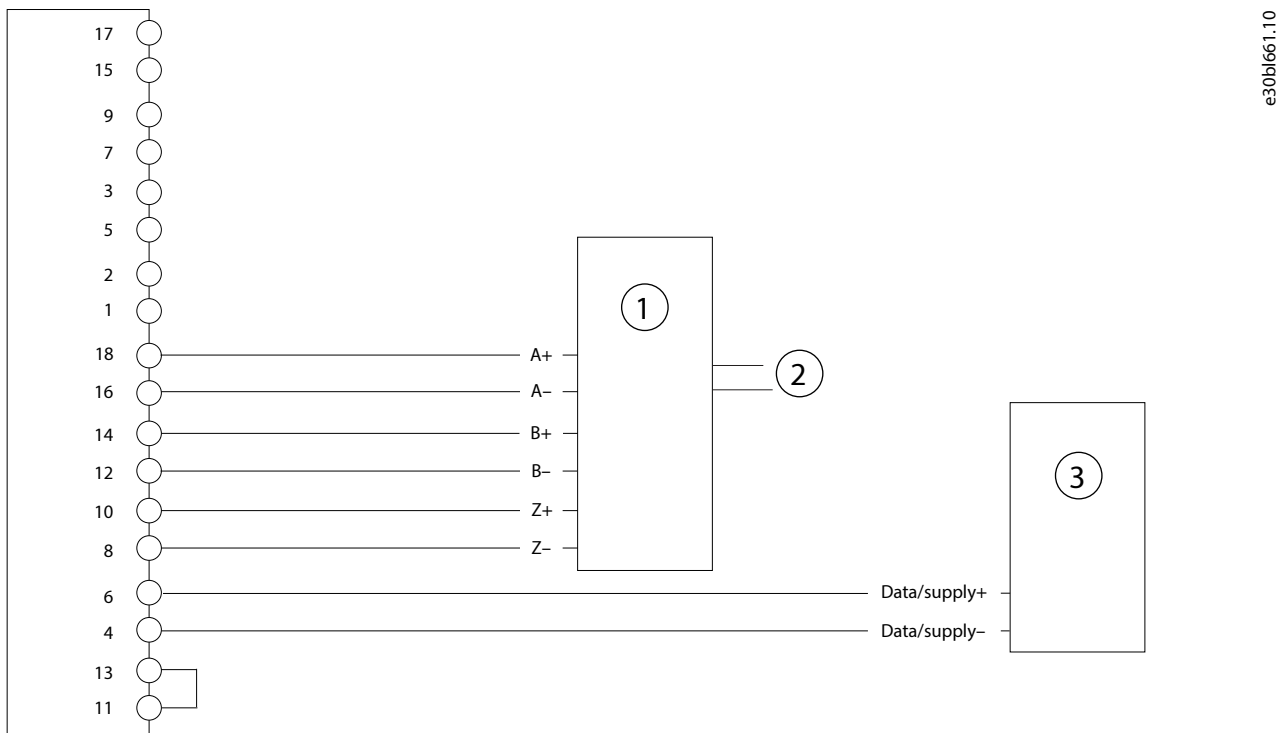


Figure 31: Wiring Configuration for HIPERFACE DSL® and 3-track Incremental or SinCos Encoder

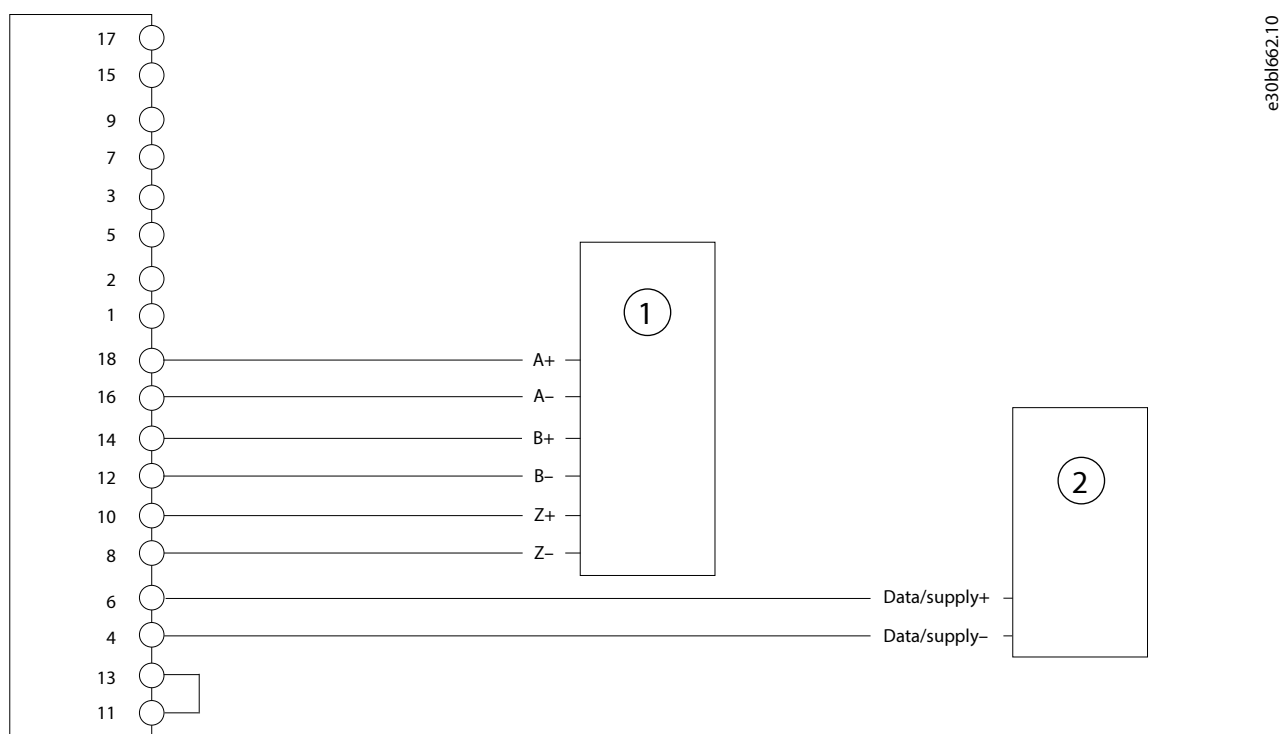
1	3-track incremental or SinCos encoder	2	External power supply
3	HIPERFACE DSL® encoder		

5.5.24 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 *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
9.4.1 Interface configuration Device 1	Select [27] HIPERFACE DSL D .
9.4.2 Interface Configuration Device 2	Select [4] Device 1 Out to represent the position of the encoder or resolver connected as device 1. 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.
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*.



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Figure 32: Wiring Configuration for HIPERFACE DSL®Encoder with Virtual Output as Device 2

1	Controller		2	HIPERFACE DSL® encoder
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5.5.25 BiSS Encoder

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

Table 34: Parameters for BiSS Encoder

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [29] BiSS Z,D.
9.4.3 Encoder Supply Voltage	Set the appropriate supply voltage. <div style="background-color: #0056b3; color: white; text-align: center; padding: 5px;">NOTICE</div> <p>Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.</p>
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.

e30bj663.1

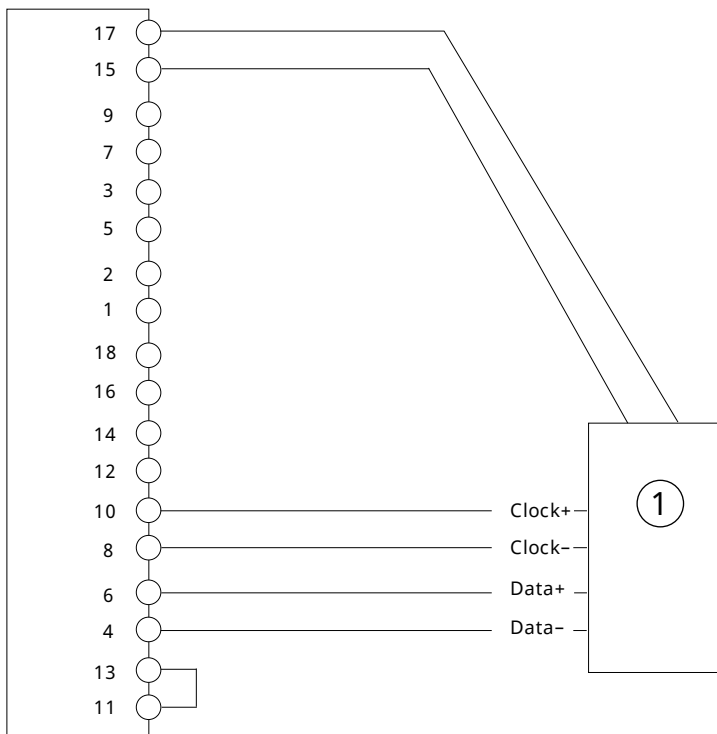


Figure 33: Wiring Configuration for 2-Track BiSS Encoder

1	BiSS encoder
---	--------------

5.5.26 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 35: Parameters for BiSS and Resolver

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [36] BiSS Z,D.
9.4.2 Interface Configuration 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.
9.6.6 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.

e30bl287.10

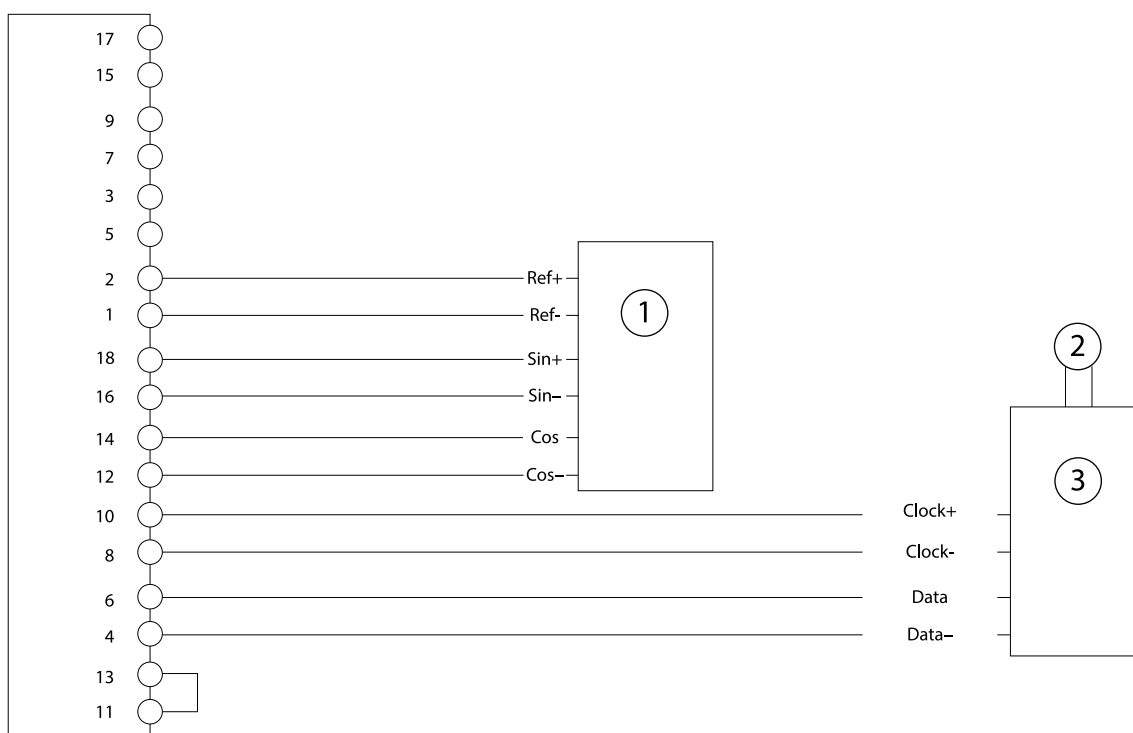


Figure 34: Wiring Configuration for BiSS and Resolver

1	Resolver	2	External power supply
3	BiSS encoder		

5.5.27 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 36: Parameters for BiSS and Incremental (TTL or HTL) or SinCos Encoder

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select [30] BiSS Z,D.
9.4.2 Interface Configuration Device 2	Select the type of connected encoder: [1] 2 track incremental [10] SinCos A/B
9.4.3 Encoder Supply Voltage	Set the appropriate voltage. <div style="background-color: #0056b3; color: white; text-align: center; padding: 5px;">NOTICE</div> <p>Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.</p>
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.

Table 36: 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.

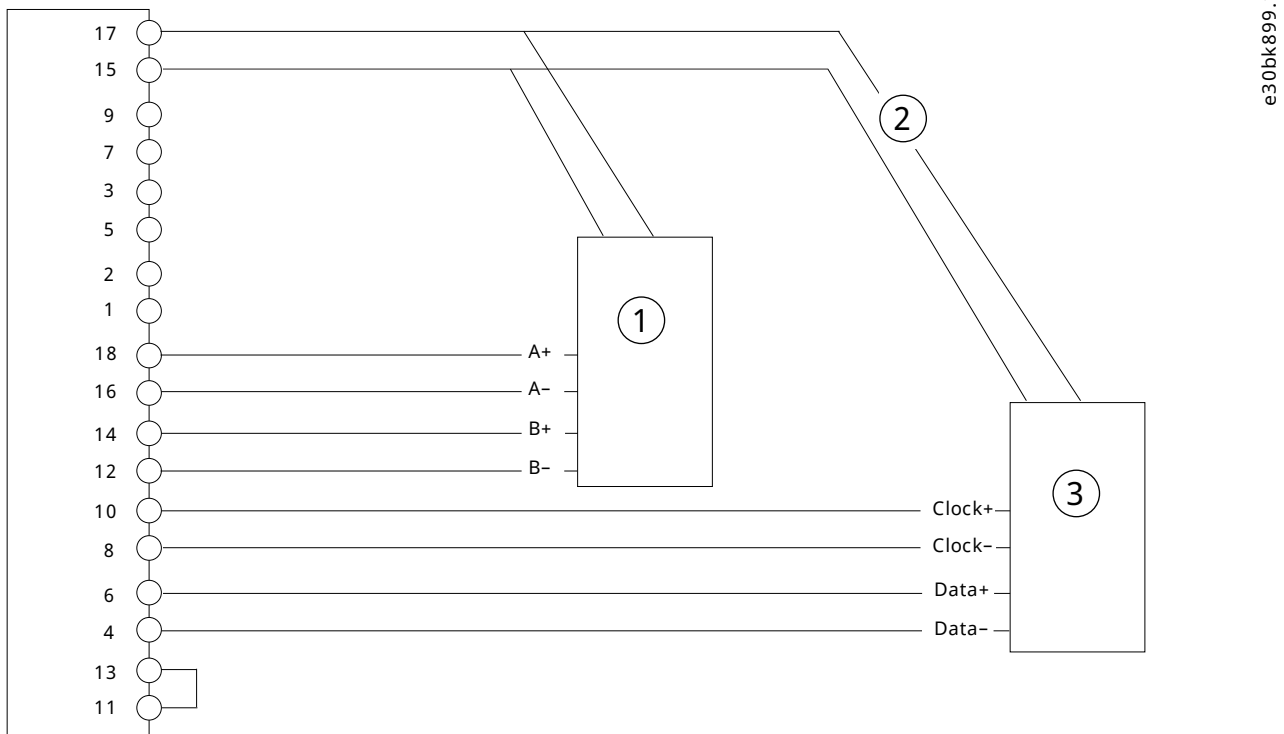


Figure 35: Wiring Configuration for BiSS and Incremental (TTL or HTL) or SinCos Encoder

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

5.5.28 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 **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.

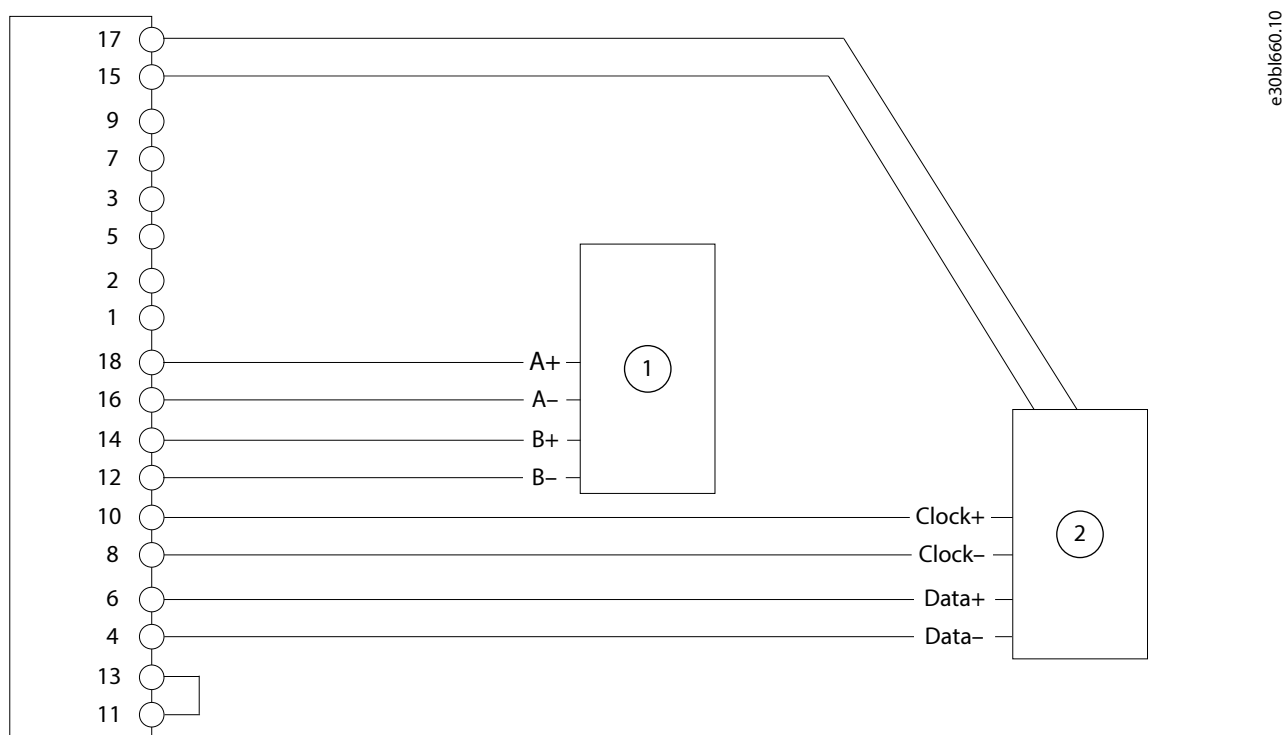
Table 37: Parameters for BiSS Encoder with Virtual Output as Device 2

Parameter	Setting
9.4.1 Interface configuration Device 1	Select [30] BiSS Z,D.
9.4.2 Interface Configuration Device 2	Select [4] Device 1 Out to represent the position of the encoder or resolver connected as device 1. Select [6] Virtual Out to represent the position of the source selected in parameter 5.16.2.4 Virtual Output Source Selection ⁽¹⁾ .

Table 37: Parameters for BiSS Encoder with Virtual Output as Device 2 (continued)

Parameter	Setting
9.4.3 Encoder Supply Voltage	Set the appropriate voltage for the connected encoder.
9.5.2 Resolution Channel 2	Set the number of pulses per revolution of the virtual encoder representing one 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.
9.6.6 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 36: Wiring Configuration for BiSS Encoder with Virtual Output as Device 2

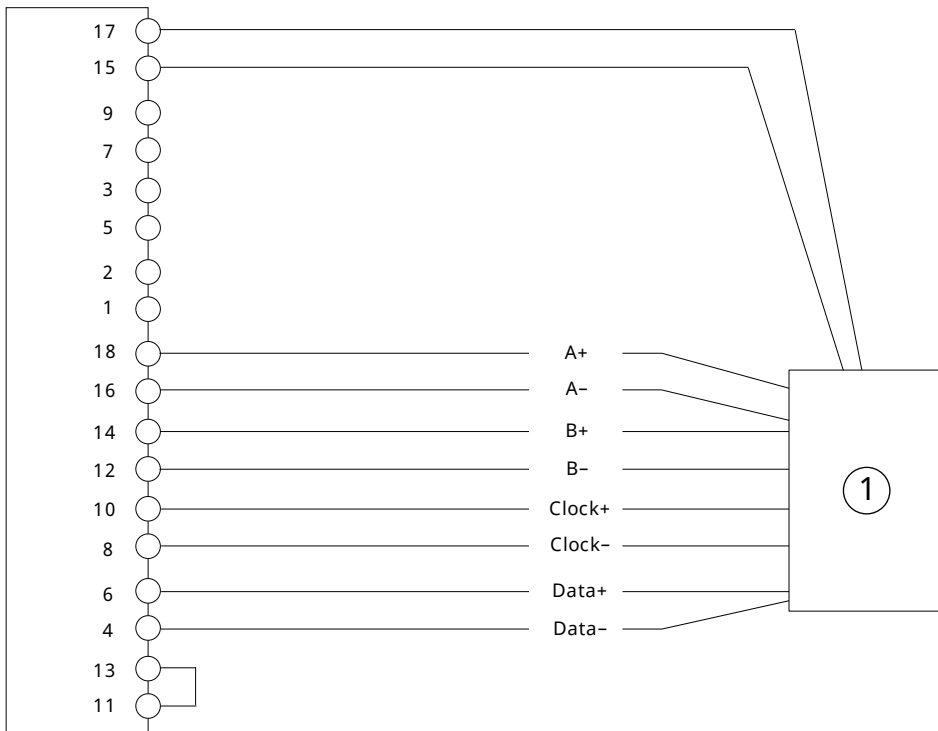
1	Controller	2	BiSS absolute encoder
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5.5.29 BiSS Encoder with Incremental or SinCos Track

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.

Table 38: Parameters for BiSS Encoder with Incremental or SinCos Track

Parameter	Setting
9.4.1 Interface Configuration Device 1	Select according to the encoder type: [31] BiSS with 2 track incremental Z,D,A,B [32] BiSS with SinCos Z,D,A,B
9.4.3 Encoder Supply Voltage	Set the appropriate voltage. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center; background-color: #004a87; color: white; margin: 0;">NOTICE</p> <p style="margin: 0;">Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.</p> </div>
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.



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Figure 37: BiSS Encoder with Incremental or SinCos Track

1	BiSS encoder
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5.6 Parameter Descriptions

5.6.1 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:	–
Data Type:	WORD	Access Type:	Read Only

Table 39: 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.

Table 39: Channel 1 Encoder Status Word Bit Descriptions (continued)

Bit	Description
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)
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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 40: 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 41: 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.

Table 41: Encoder Status Word Bit Descriptions (continued)

Bit	Description
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-
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.

5.6.2 Configuration (Menu Index 9.4)

P 9.4.1 Interface Configuration 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).
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.

Selection Number	Selection Name	Selection Description
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 9.4.2 Interface Configuration 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 9.4.3 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

P 9.4.4 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 9.4.5 Invert Direction Channel 1

Select if signal on channel 1 is inverted. For dual output channel encoders this parameter affects the entire encoder information (absolute and incremental part).

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 9.4.6 Invert Direction Channel 2

Select if 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.

5.6.3 Incremental Settings (Menu Index 9.5)

P 9.5.1 Resolution Channel 1

Set the resolution of the incremental encoder connected to channel 1.

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

P 9.5.2 Resolution Channel 2

Set the resolution of the incremental encoder connected to channel 2.

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

P 9.5.3 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
Data Type:	UINT	Access Type:	Read/Write

5.6.4 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
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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	

Selection Number	Selection Name	Selection Description
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	
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	

5.6.5 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 Transformation 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

6 Relay Option Installation and Configuration

6.1 Relay Option OC7R0

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 Relay Option OC7R0 Specifications](#).

6.2 Pin Assignment for Relay Option OC7R0

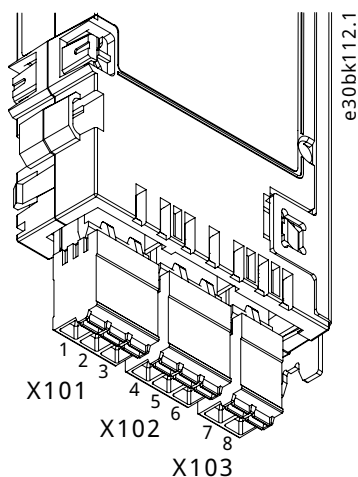


Figure 38: Relay Option OC7R0 Terminals

Table 42: 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 Relay Option OC7R0 Specifications

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

Table 43: 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

Table 43: Technical Specifications for Relay Option OC7R0 (continued)

Functions	Data
Maximum terminal load (DC-1): Resistive load	80 V DC, 2 A
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 for Relay Option OC7R0

6.4.1 Setup and Connection Examples for Relay Option OC7R0

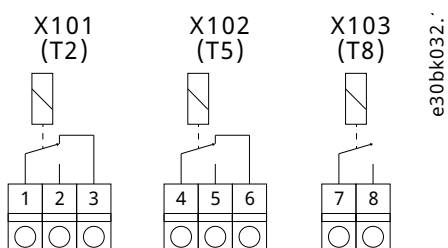


Figure 39: Wiring Configuration for Relay Option OC7R0

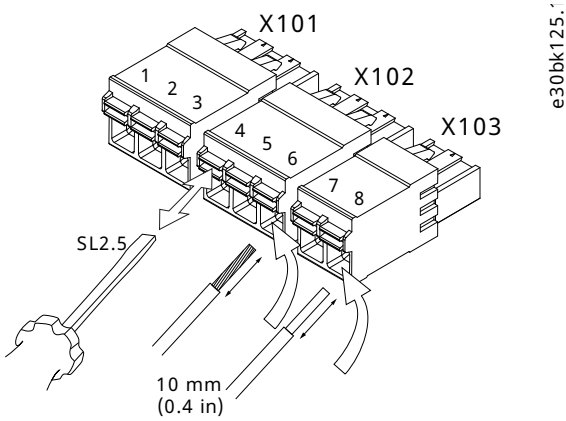


Figure 40: Inserting Wires into the Relay Option OC7R0 Connectors

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 41](#).
- Operation above 2000 m (6560 ft) altitude: Operation with voltage above 50 V AC requires operation on the same phase voltage. See [Figure 42](#).
- Operation with mixed voltage (24 V) and high voltage is possible. High voltage must be on the same phase. See [Figure 43](#).

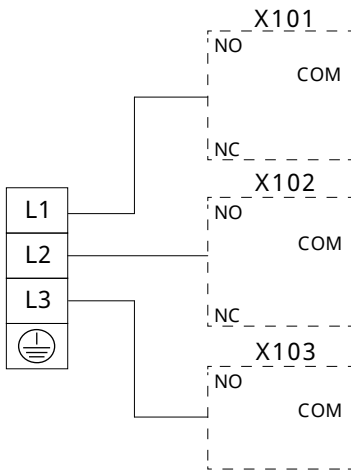
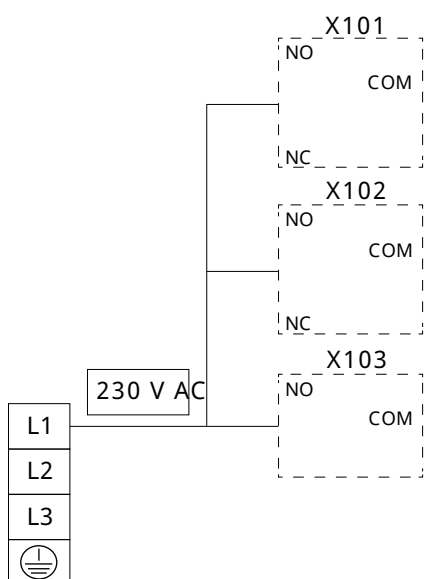


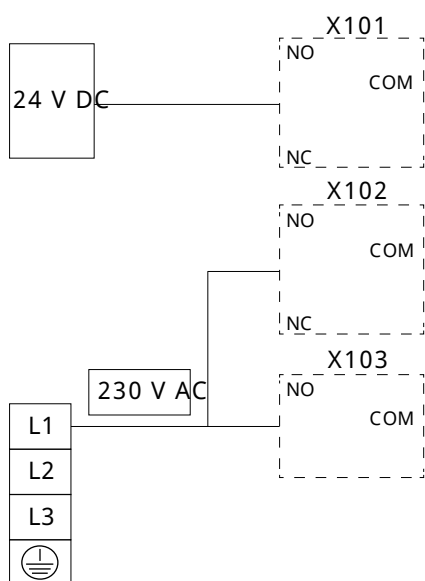
Figure 41: Operation up to 2000 m (6560 ft) Altitude

e30bk468.



e30bk469.

Figure 42: Operation above 2000 m (6560 ft) Altitude with Voltage above 50 V AC



e30bk470.

Figure 43: 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 44: 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

7 General Purpose I/O OC7C0 Installation and Configuration

7.1 General Purpose I/O OC7C0

The General Purpose I/O option adds 3 digital inputs, 2 digital outputs, 2 analog inputs, 1 analog output, and temperature measurement support (Pt1000, Ni1000, and KTY81).

For detailed specifications, see [7.3.1 General Purpose I/O OC7C0 Specifications](#).

7.2 Pin Assignment for General Purpose I/O OC7C0

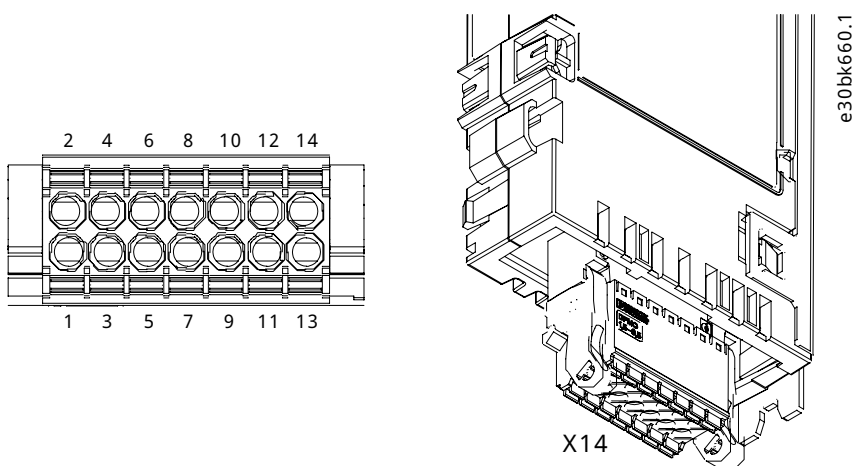


Figure 44: General Purpose I/O Option Terminals

Table 45: 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 46: 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 mm ² (24–16 AWG)

Table 46: Technical Specifications for General Purpose I/O OC7C0 (continued)

Functions	Data
Flexible wire without cable end sleeves	0.2–1.5 mm ² (24–16 AWG)
Maximum altitude	4400 m (14400 ft)
Protection rating	IP00/UL Open Type
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 47: 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	<ul style="list-style-type: none"> 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	
Temperature sensor support ⁽²⁾	Pt1000, Ni1000, KTY81, KTY82, KTY84, PTC

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.

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 48: Analog Output

Function	Data
Output range: Current	0/4-20 mA
Minimum load resistor to GND	500 Ω

Table 48: Analog Output (continued)

Function	Data
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.

Table 49: Digital and Encoder/Pulse Input

Function	Data	
Digital input	Logic	Selectable PNP or NPN
	Voltage levels	0/24 V
	PNP	<ul style="list-style-type: none"> "0": <5 V DC "1": >11 V DC
	NPN	<ul style="list-style-type: none"> "0": >19 V DC "1": < 13 V DC
	Maximum allowed voltage	30 V DC
	Input resistance	4.8 kΩ
Thermistor input	PTC ⁽¹⁾	1.5–4 kΩ
Pulse/encoder input	Pulse frequency range	0–110 kHz
	Minimum duty cycle	40%
	Accuracy	<ul style="list-style-type: none"> Position resolution: 24 bit Speed resolution: 24 bit

1) External insulation of the sensor is required to comply with PELV.

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.

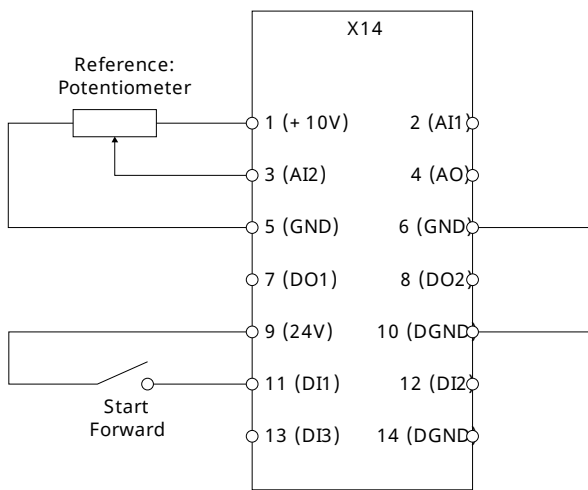
Table 50: Digital and Pulse Output (24 V)

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

Table 50: Digital and Pulse Output (24 V) (continued)

Function	Data
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 for General Purpose I/O OC7C0



e30bk52.1

Figure 45: 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.

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 51: Bit Descriptions for Digital Input

Bit number	Bit name	Description
0	DigIn1 (T11)	Digital Input T11
1	DigIn2 (T12)	Digital Input T12
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 52: 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

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

Selection number	Selection name
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

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

Selection number	Selection name
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

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)

Selection number	Selection name
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

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: μ s	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

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

8 Temperature Measurement OC7T0 Installation and Configuration

8.1 Temperature Measurement OC7T0

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

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 for Temperature Measurement OC7T0

NOTICE

The $\pm 1^\circ\text{C}$ accuracy is for all sensor wiring types and for the full temperature range.

- If the connection type is 4-wire, the accuracy is $\pm 0.5^\circ\text{C}$ for the full temperature range.

Table 53: Definition of Pins for Temperature Measurement OC7T0

Terminal	Signal	Technical information
1	Return 1	Temperature sensor input 1, -50...200°C, accuracy $\pm 1^\circ\text{C}$
2	Source 1	
3	Sensor 1 -	
4	Sensor 1 +	
5	Return 2	Temperature sensor input 2, -50...200°C, accuracy $\pm 1^\circ\text{C}$
6	Source 2	
7	Sensor 2 -	
8	Sensor 2 +	
9	Return 3	Temperature sensor input 3, -50...200°C, accuracy $\pm 1^\circ\text{C}$
10	Source 3	
11	Sensor 3 -	
12	Sensor 3 +	

Table 53: 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 Temperature Measurement OC7T0 Specifications

Table 54: 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 Temperature Measurement OC7T0

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.

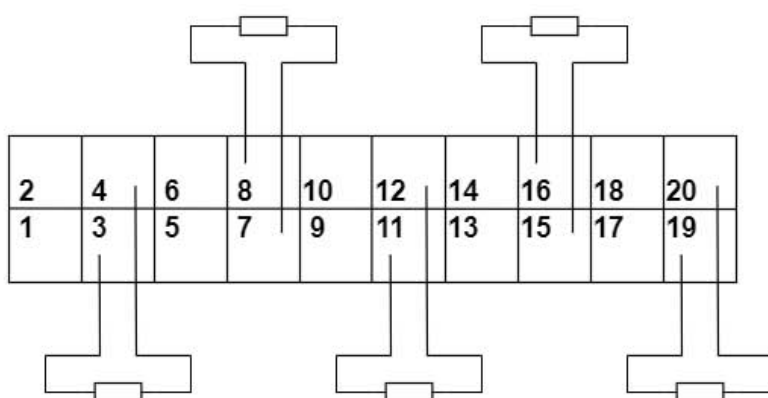
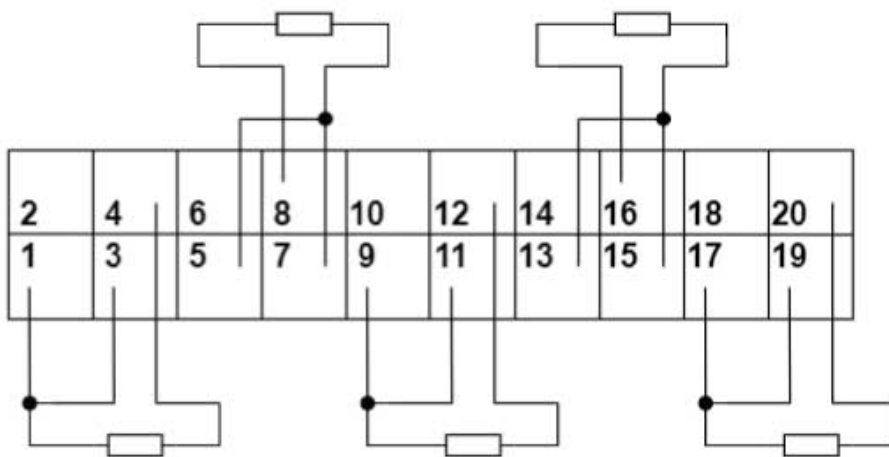
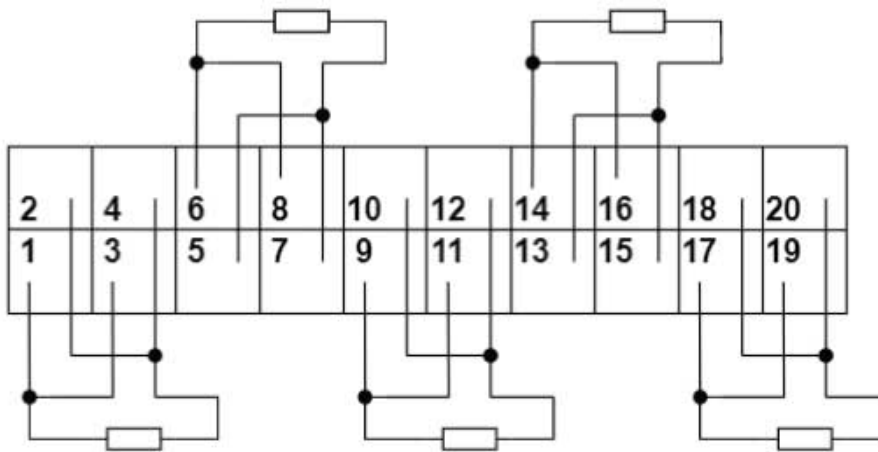


Figure 46: 2-wire Configuration for Temperature Measurement OC7T0



e30bj670.1c

Figure 47: 3-wire Configuration for Temperature Measurement OC7T0



e30bj671.1c

Figure 48: 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.
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.

Selection Number	Selection Name	Selection Description
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 9.4.1.4 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

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.

Selection Number	Selection Name	Selection Description
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.
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.

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 9.4.3.4 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.

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.

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 9.4.5.4 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

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