

Operating Guide

Functional Extension Options

iC7 Series



Contents

1	Introduction	5
1.1	Purpose of the Operating Guide	5
1.2	Additional Resources	5
1.3	Version History	5
2	Safety	6
2.1	Safety Symbols	6
2.2	Safety and Installation Awareness	6
3	Configuration	7
3.1	Configuration Overview	7
3.2	Physical Location and Corresponding Software Address	7
4	Installation	9
4.1	Verifying the Shipment and Contents	9
4.2	Items Supplied	9
4.3	Installing Functional Extensions in Frequency Converters	9
4.4	Installing Boards to the Modular Control Unit	13
5	Encoder/Resolver Installation and Configuration	14
5.1	Encoder/Resolver Option OC7M0	14
5.2	Required Tools	14
5.3	Pin Assignment for Encoder/Resolver OC7M0	15
5.4	Encoder/Resolver Option OC7M0 Specifications	15
5.5	Setup and Connection Examples for Encoder/Resolver OC7M0	17
5.6	Parameter Descriptions for Encoder/Resolver	36
6	Relay Option Installation and Configuration	44
6.1	Relay Option OC7R0	44
6.2	Required Tools	44
6.3	Pin Assignment for Relay Option OC7R0	44
6.4	Relay Option OC7R0 Specifications	44
6.5	Setup and Connection Examples for Relay Option OC7R0	45
6.5.1	Wiring Diagrams for Different Operating Altitudes	46
6.6	Parameter Descriptions for Relay Option OC7R0	47
7	General Purpose I/O Installation and Configuration	49
7.1	General Purpose I/O OC7C0	49
7.2	Required Tools	44

7.3	Pin Assignment for General Purpose I/O	49
7.4	General Purpose I/O Specifications	49
7.5	Setup and Connection Examples for General Purpose I/O	52
7.6	Parameter Descriptions for General Purpose I/O	52

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.
- Design guides, which provide technical information to understand the capabilities of the iC7 drives for integration into motor control and monitoring systems.
- 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 <http://drives.danfoss.com/downloads/portal/>.

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 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 <i>9.6.6 BiSS/SSI Clock Rate</i> .
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 this guide:

⚠ D A N G E R ⚠

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

⚠ W A R N I N G ⚠

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

⚠ C A U T I O N ⚠

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

N O T I C E

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

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 www.danfoss.com/service-and-support.

3 Configuration

3.1 Configuration Overview

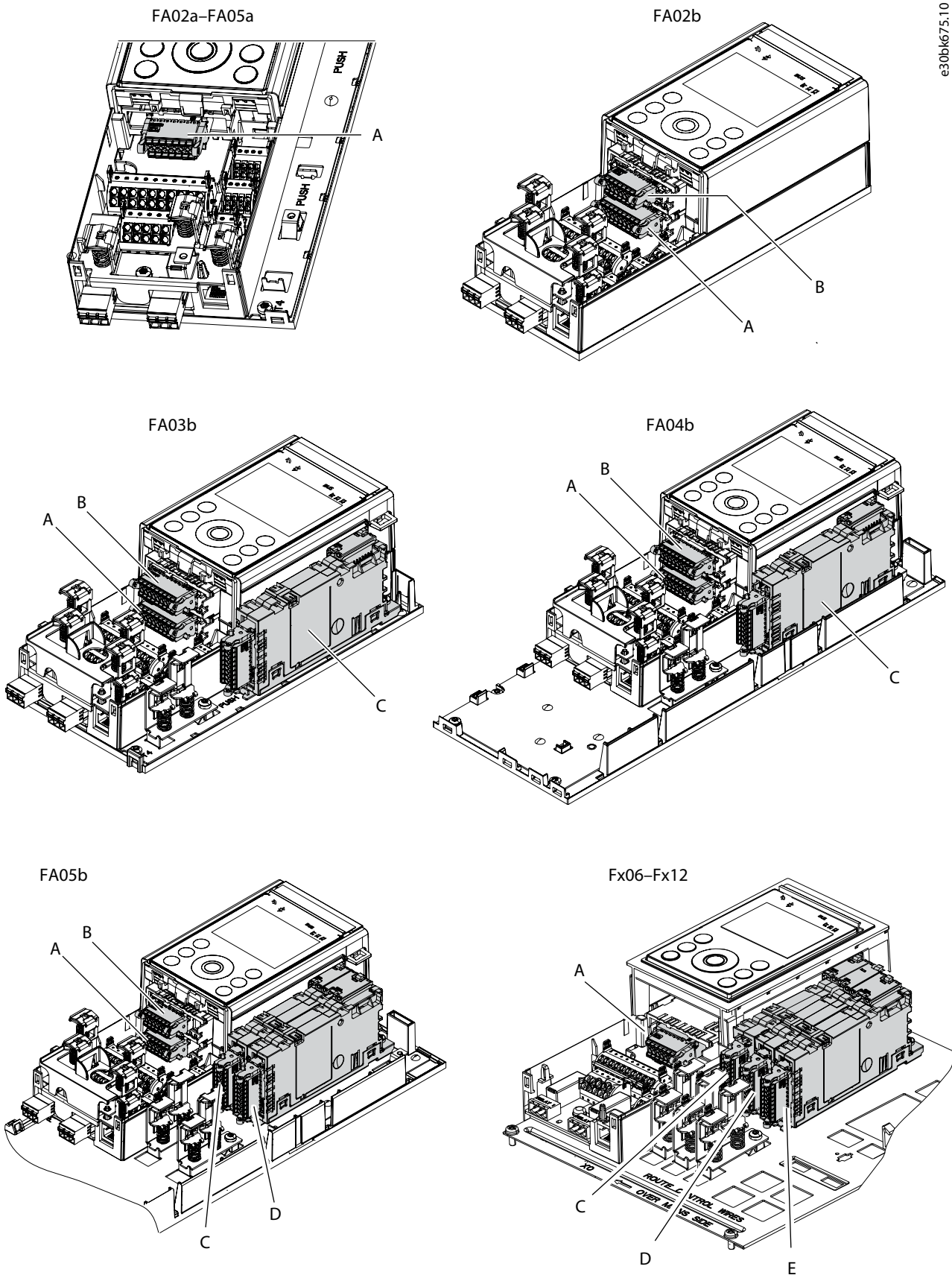
The parameters related to functional extensions are in parameter group 9, called I/O. Parameters are dependent on the mounting, and will appear in the parameter menu after the functional extension has been mounted and wired.

3.2 Physical Location and Corresponding Software Address

Functional extension options are positioned in the physical slots A, B, C, D, or E, depending on the drive frame as shown in [Illustration 1](#). 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

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)



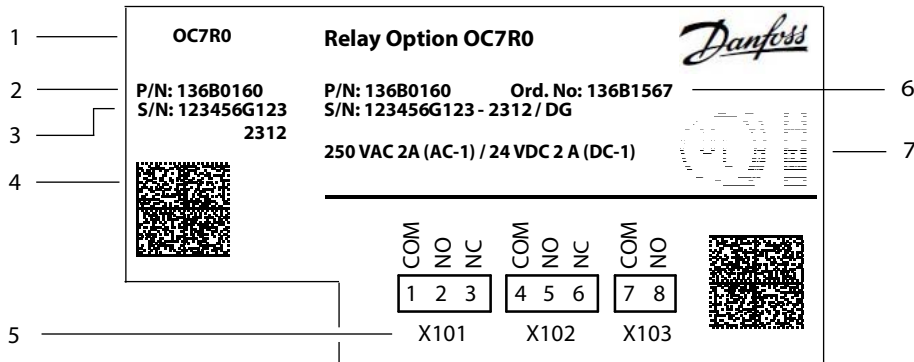
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Illustration 1: Option Slot Locations in iC7 Frequency Converters

4 Installation

4.1 Verifying the Shipment and Contents

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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Illustration 2: Example of a Product Label

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

4.2 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

4.3 Installing Functional Extensions in Frequency Converters

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

! D A N G E R !

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 power.

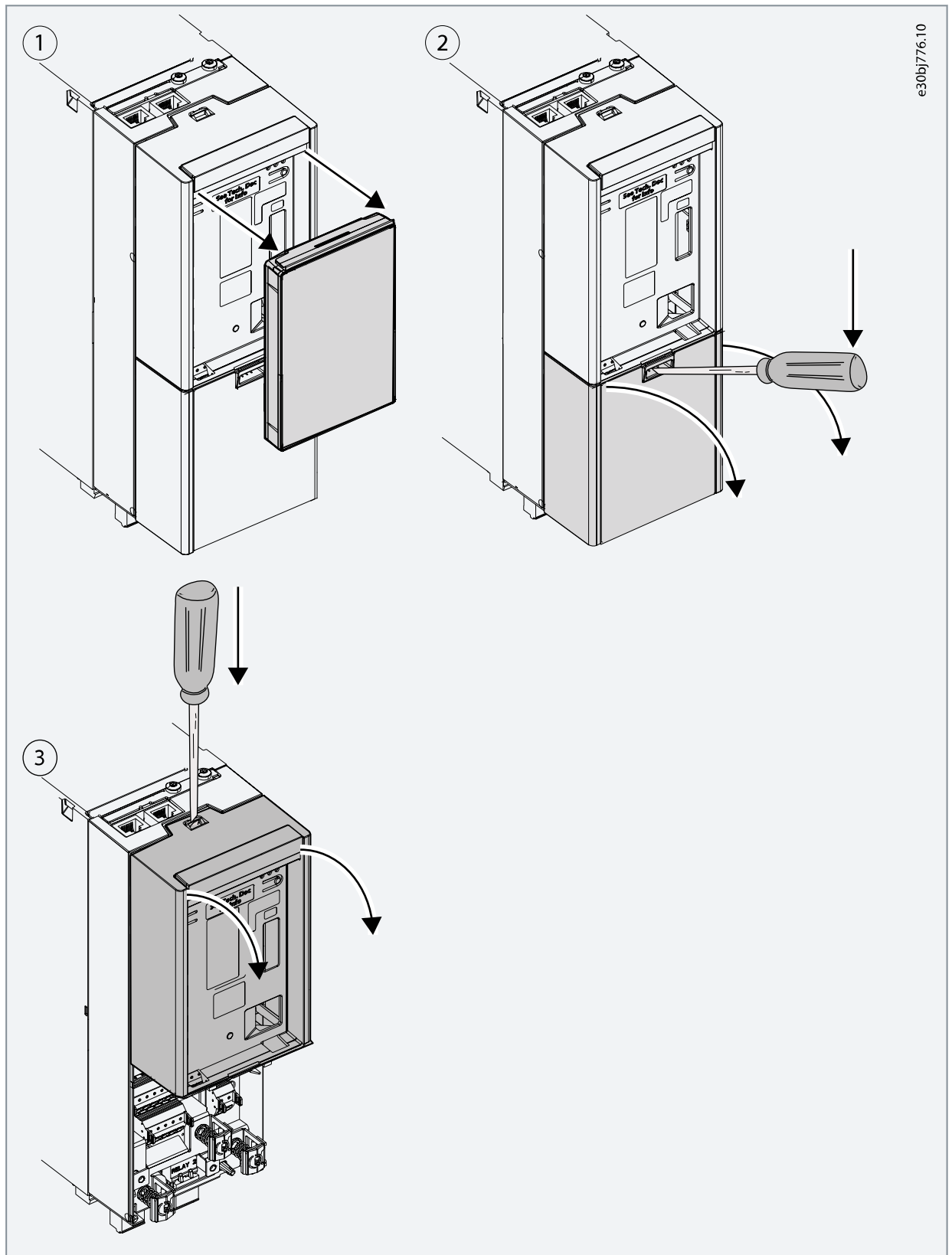
- Perform the following steps before touching any internal components:
 - Disconnect the mains power.
 - Disconnect the motor.
 - Disconnect external connections to the DC terminals of the drive.
 - Wait for the capacitors to discharge fully. Refer to the label on the drive for the correct discharge time.
 - Ensure that the DC-link capacitors have discharged fully by measuring the DC link with a voltage meter.

N O T I C E

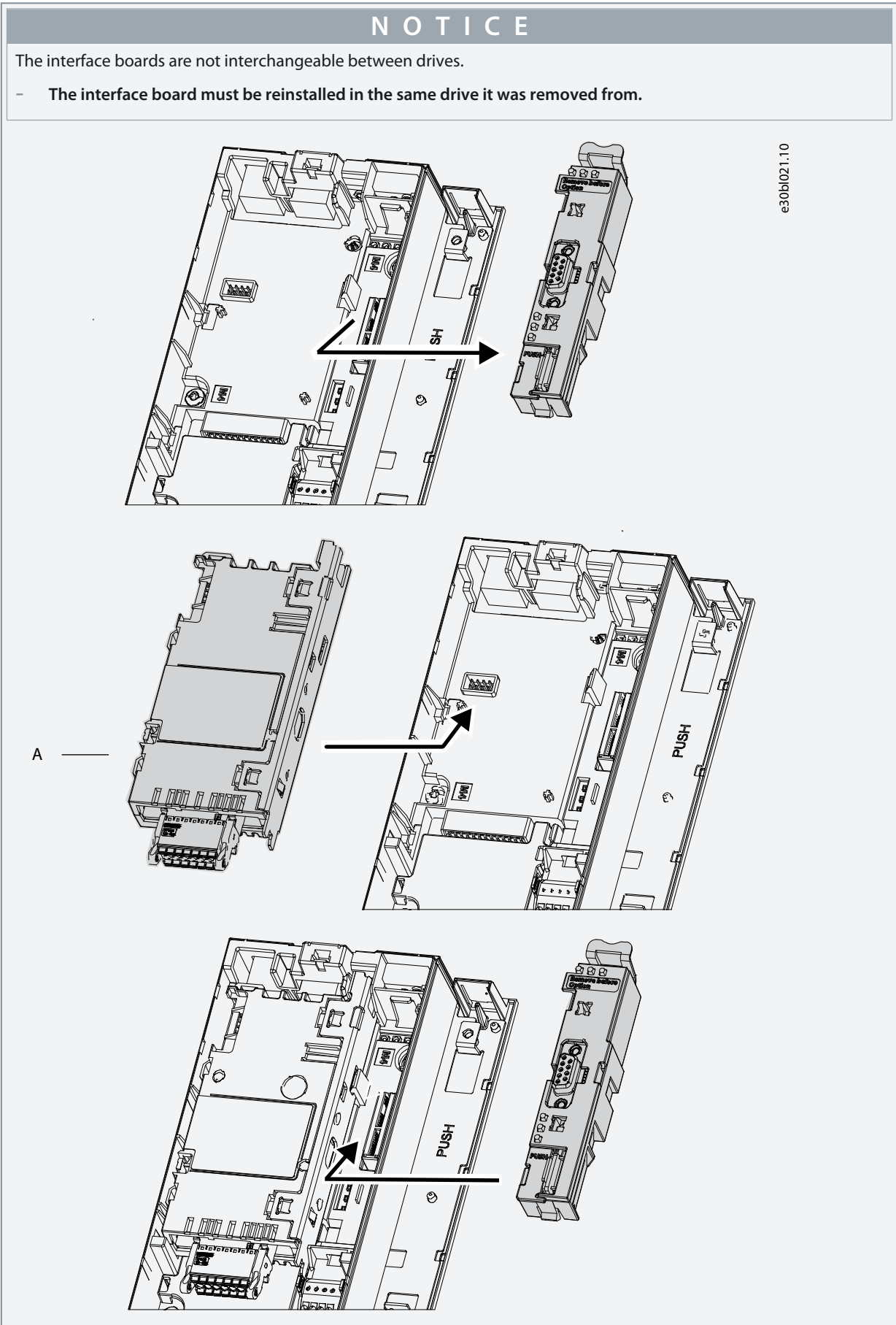
The Encoder/Resolver Option OC7M0 must be installed in **option slot A**.

- 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.



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



4.4 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.

⚠ CAUTION ⚠

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.

Procedure

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.

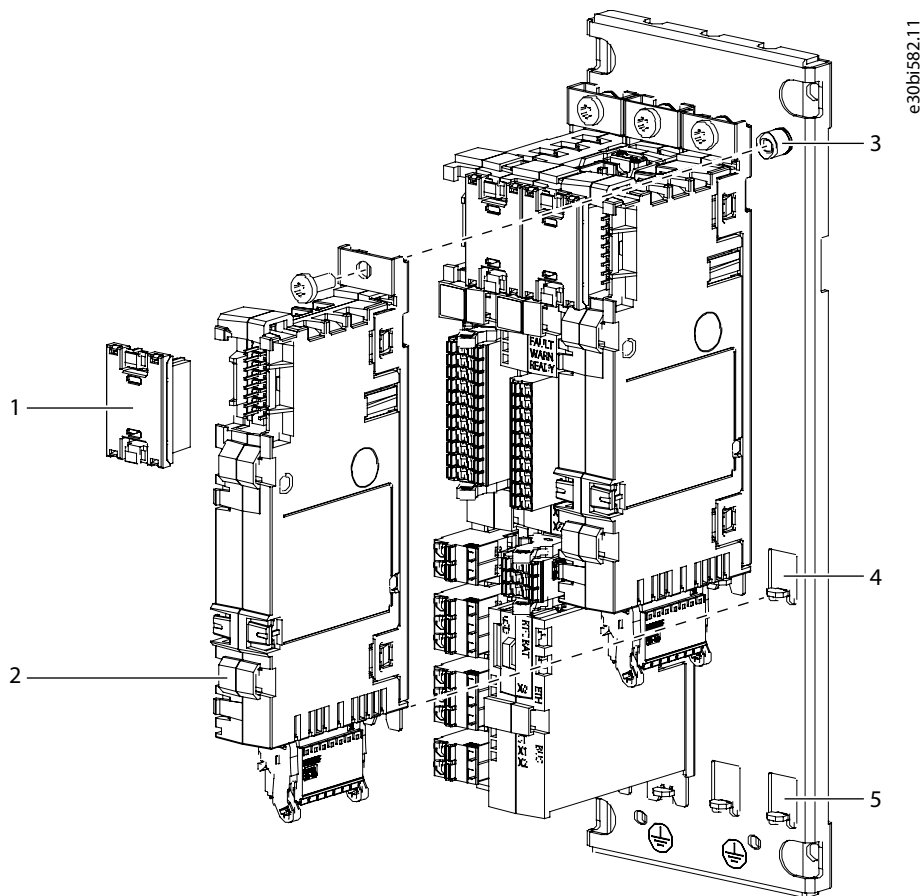


Illustration 3: Installing a Board to the Modular Control Unit Mounting Plate

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

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 Encoder/Resolver Installation and Configuration

5.1 Encoder/Resolver Option OC7M0

The Encoder/Resolver option supports connecting various devices as speed/position feedback or reference. It also has a TTL encoder simulation output, which can be used to mirror the resolver input signal.

There are 4 tracks (A, B, Z, and D) which can be configured for the connection of 1 or 2 devices in different combinations according to [Table 3](#).

Table 3: Encoder/Resolver Option Configurations

Channel 1	Channel 2
Incremental or SinCos encoder on A and B	–
Incremental encoder with zero pulse on A, B and Z	–
Incremental encoder on A and B	Incremental (TTL) encoder on Z and D
Resolver on A and B	–
Resolver on A and B	Resolver mirrored as incremental (TTL) output on Z and D
Resolver on A and B	Incremental (TTL) encoder on Z and D
SSI absolute encoder on Z and D	–
SSI absolute encoder on Z and D with incremental or SinCos track on A and B	–
SSI absolute encoder on Z and D	Incremental encoder on A and B
EnDat absolute encoder on Z and D	–
EnDat absolute encoder on Z and D	Incremental encoder on A and B
Hiperface absolute encoder on A, B and D	–
Hiperface DSL absolute encoder on D	–
Hiperface DSL absolute encoder on D	Incremental encoder on A and B
BiSS absolute encoder on Z and D	–
BiSS absolute encoder on Z and D with incremental or SinCos track on A and B	–
BiSS absolute encoder on Z and D	Incremental encoder on A and B

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 [9.4.4 Encoder supply voltage](#).

N O T I C E

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 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.

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.

N O T I C E

If the Plug detect connection is missing while the interface is activated (parameter *9.4.1 Interface configuration* ≠ "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 4: 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

N O T I C E

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 5: 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 6: 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	
HIPER-FACE DSL®	Maximum resolution	32 bit	–
	Maximum data length	64 bit	
	Baud rate	10 Mbps	
BiSS	Maximum resolution	32 bit	Both BiSS B and BiSS C are supported.
	Maximum data length	64 bit	

Device type	Specifications		Additional information
	Data	Value	
	Maximum clock frequency	8.33 MHz	
Resolver	Excitation voltage	2–8 V _{rms}	$\text{Max excitation voltage}_{\text{rms}} = \frac{7 \text{ V}}{\text{Resolver transformation ratio} \times \sqrt{2}}$
	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 7: 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 allowed cable length.

5.5 Setup and Connection Examples for Encoder/Resolver OC7M0

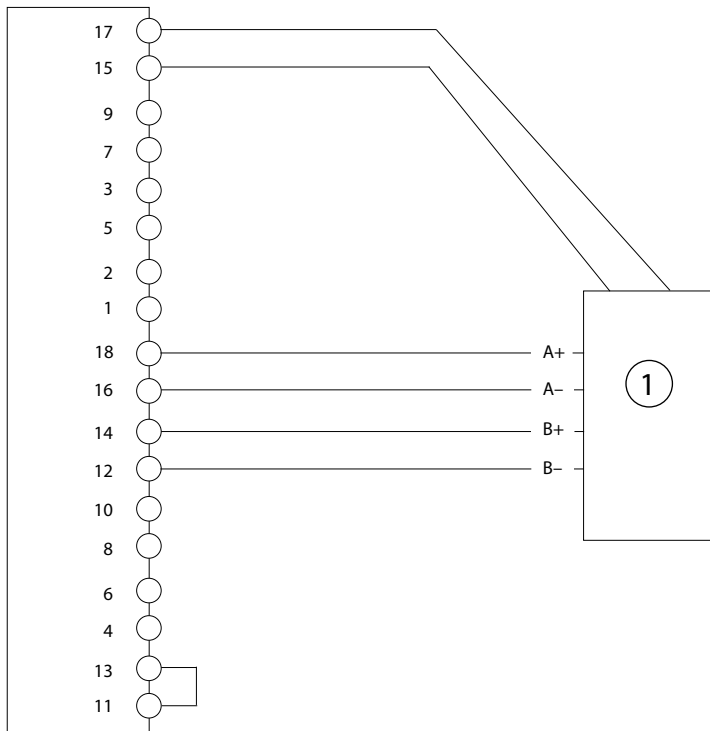
5.5.1 Incremental Encoder

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 8: Parameters for Incremental Encoder

Parameter	Setting
9.4.1 Interface configuration	Select according to the type of connected encoder: [1] 2 track Incremental A, B. [3] 3 track Incremental A, B, Z.
9.4.4 Encoder Supply Voltage	Set the appropriate supply voltage.

Parameter	Setting
	NOTICE
	Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
9.5.1 Resolution Device 1	Set the resolution of the encoder in pulses per revolution.

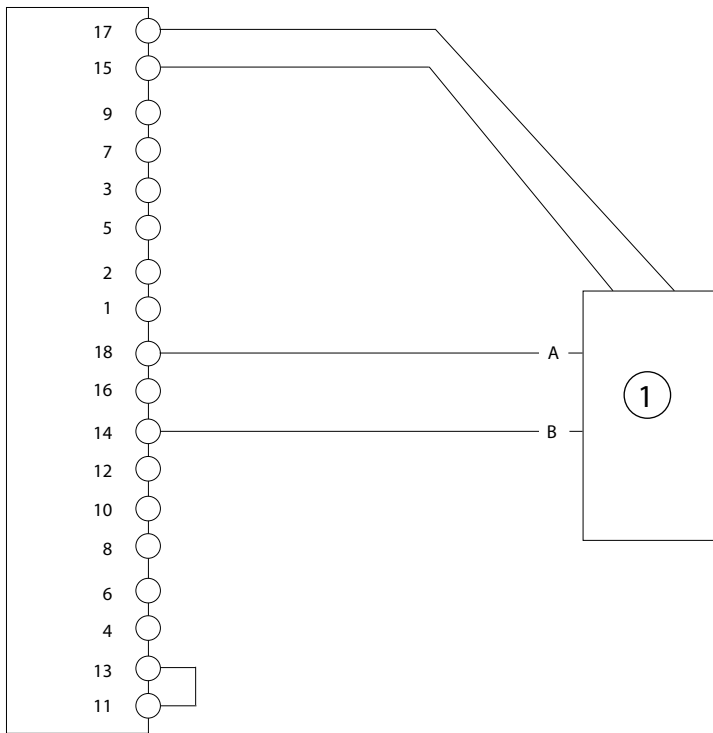


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Illustration 4: Wiring Configuration for Incremental Encoder, 2 Differential Tracks (TTL, HTL)

1	Incremental encoder
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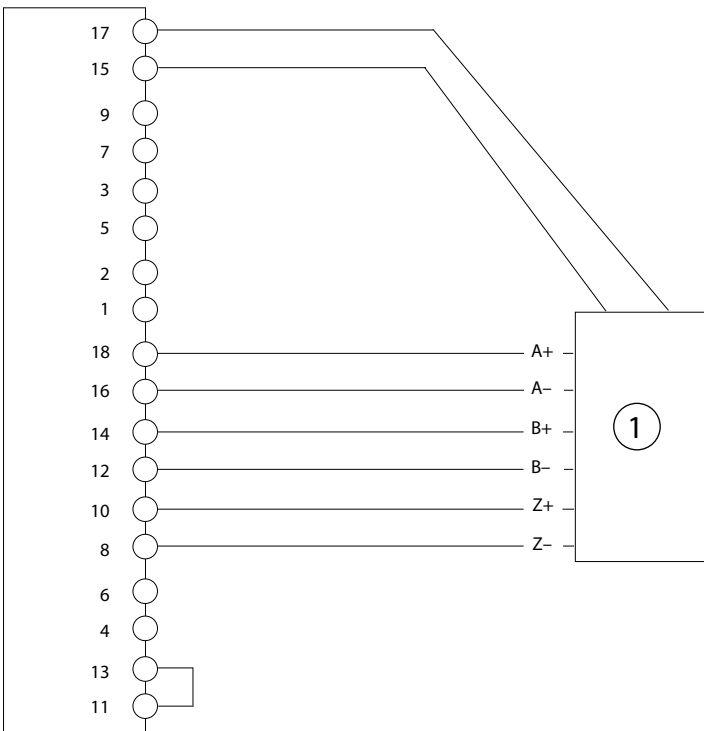
Operating Guide



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Illustration 5: Wiring Configuration for Incremental Encoder, 2 Single Tracks (TTL, HTL)

1	Incremental encoder
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Illustration 6: Wiring Configuration for Incremental Encoder, 3 Differential Tracks (TTL, HTL)

1	Incremental encoder
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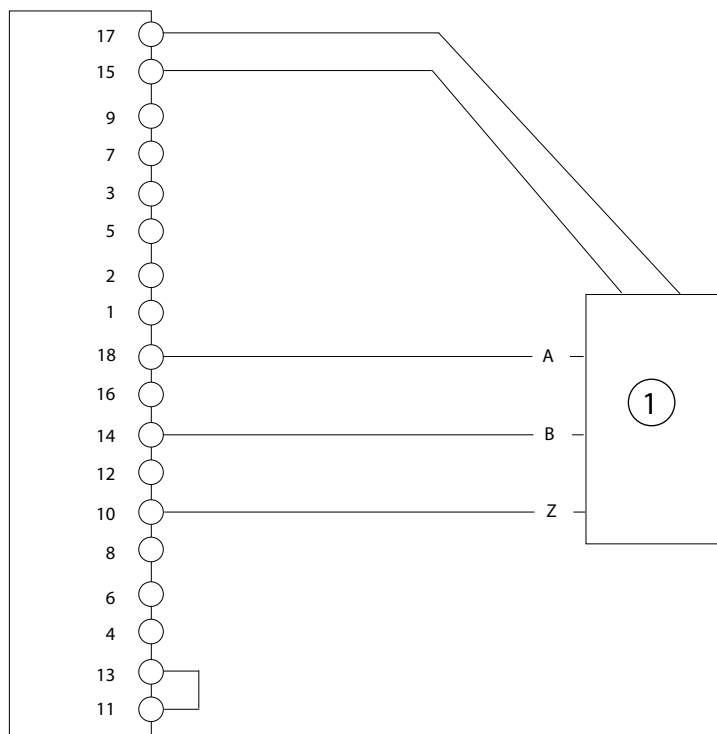


Illustration 7: Wiring Configuration for Incremental Encoder, 3 Single Tracks (TTL, HTL)

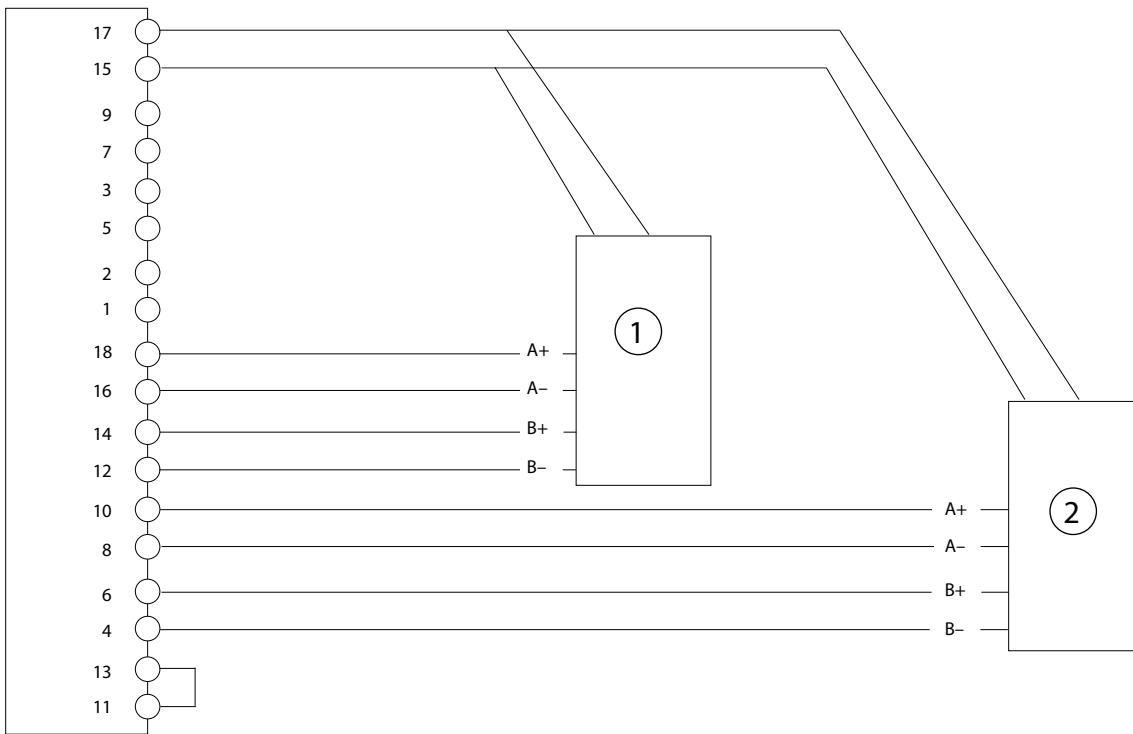
1	Incremental encoder
---	---------------------

5.5.2 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 9: Parameters for 2 Incremental Encoders

Parameter	Setting
9.4.1 Interface configuration	Select [5] 2 track Incremental A,B + 2 track incremental Z,D.
9.4.4 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 external supply. <div style="text-align: center; background-color: #cccccc; padding: 5px;">NOTICE</div> Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
9.5.1 Resolution Device 1	Set the resolution of the encoder connected to A and B in pulses per revolution.
9.5.2 Resolution Device 2	Set the resolution of the encoder connected to Z and D in pulses per revolution.



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Illustration 8: Wiring Configuration for 2 Incremental Encoders

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

5.5.3 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 10: Parameters for Resolver

Parameter	Setting
9.4.1 Interface configuration	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.

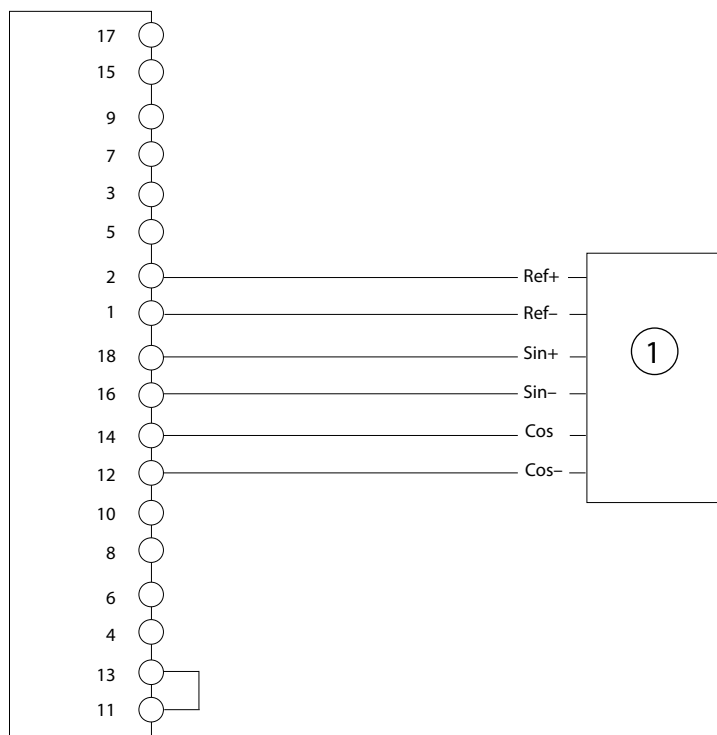


Illustration 9: Wiring Configuration for Resolver

1	Resolver
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5.5.4 Resolver with Mirror Out

When using a resolver, a TTL encoder signal can be generated to mirror the resolver signal. The mirroring enables transferring the shaft position to other devices for monitoring or further control. The encoder output signal can be scaled by defining the number of pulses representing 1 rotation of the resolver.

Table 11: Parameters for Resolver with Mirror Out

Parameter	Setting
9.4.1 Interface Configuration	Select [8] Resolver A,B + Mirror out Z,D.
9.5.2 Resolution Channel 2	Set the required number of pulses for the encoder output representing 1 rotation of the resolver.
9.7.1 Excitation Voltage	Set the excitation voltage according to the resolver specifications.
9.7.2 Excitation Frequency	Set the excitation frequency according to the resolver specifications.
9.7.3 Number of Poles	Set the number of poles for the connected resolver.

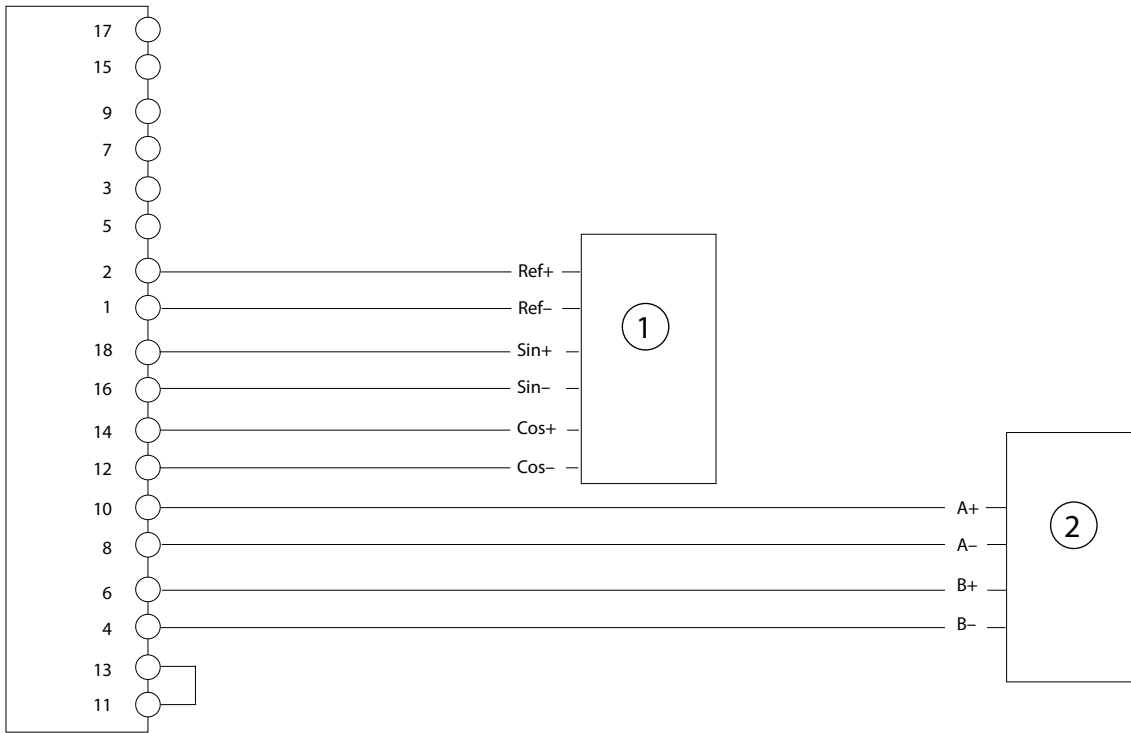


Illustration 10: Wiring Configuration for Resolver with Mirror Out

1	Resolver
2	Controller or other device

5.5.5 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 12: Parameters for Resolver and Incremental (TTL) Encoder

Parameter	Setting
9.4.1 Interface configuration	Select [9] Resolver A,B + 2 track incremental Z,D.
9.5.2 Resolution Channel 2	Set the resolution of the encoder connected to Z and D in pulses per revolution.
9.7.1 Excitation Voltage	Set the excitation voltage according to the resolver specifications.
9.7.2 Excitation Frequency	Set the resolver excitation frequency according to the resolver specifications.
9.7.3 Number of Pole Pairs	Set the number of pole pairs for the connected resolver.

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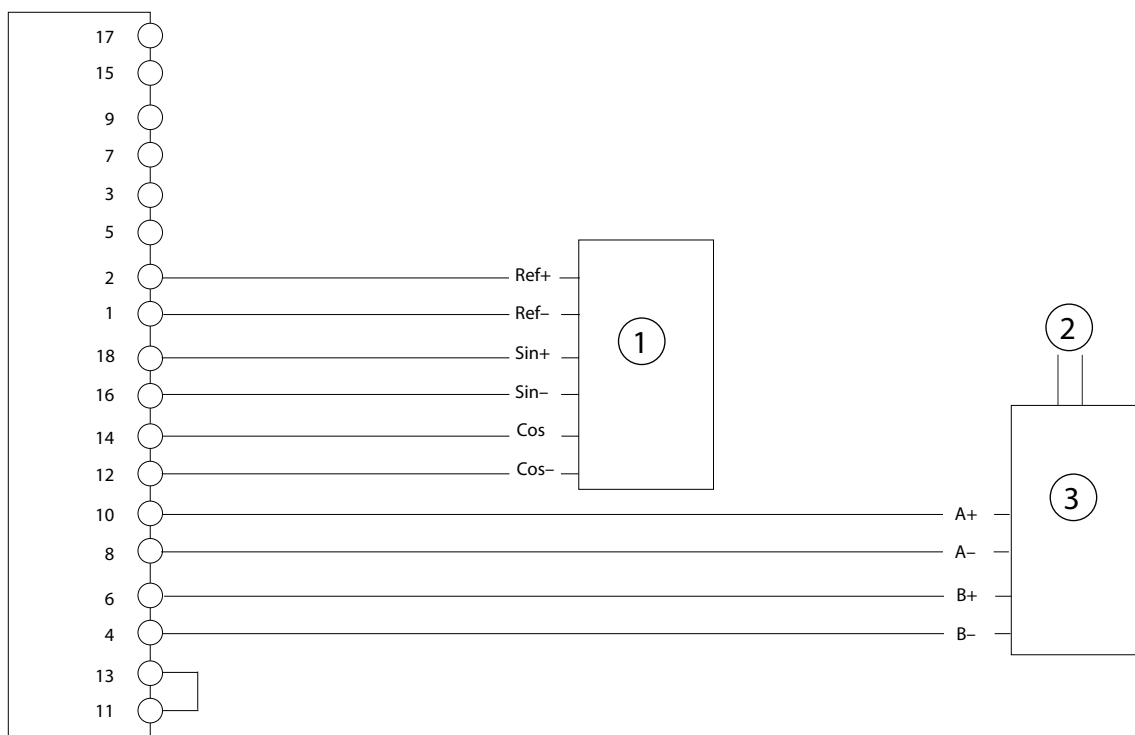


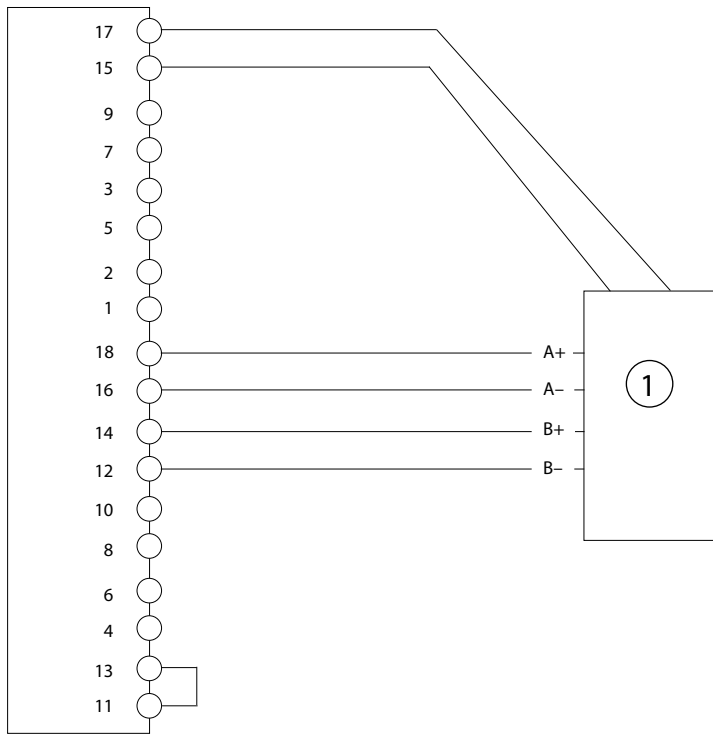
Illustration 11: Wiring Configuration for Resolver and Incremental (TTL) Encoder

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

5.5.6 SinCos Encoder

Table 13: Parameters for SinCos Encoder

Parameter	Setting
9.4.1 Interface configuration	Select [10] SinCos A,B.
9.4.4 Encoder Supply Voltage	Set the appropriate supply voltage. <div style="text-align: center; border: 1px solid black; padding: 5px;"> <p>NOTICE</p> <p>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.



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Illustration 12: Wiring Configuration for SinCos Encoder

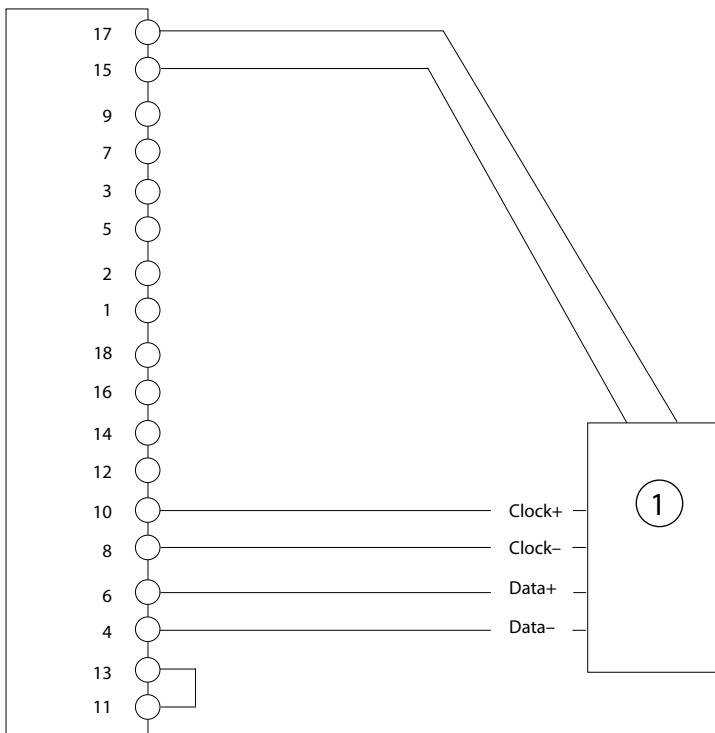
1	Encoder
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5.5.7 SSI Encoder

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

Table 14: Parameters for SSI Encoder

Parameter	Setting
9.4.1 Interface Configuration	Select [17] SSI Z,D.
9.4.4 Encoder Supply Voltage	Set the appropriate supply voltage. <div style="text-align: center; background-color: #cccccc; padding: 5px;">NOTICE</div> Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
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.



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Illustration 13: Wiring Configuration for 2-Track SSI Encoder

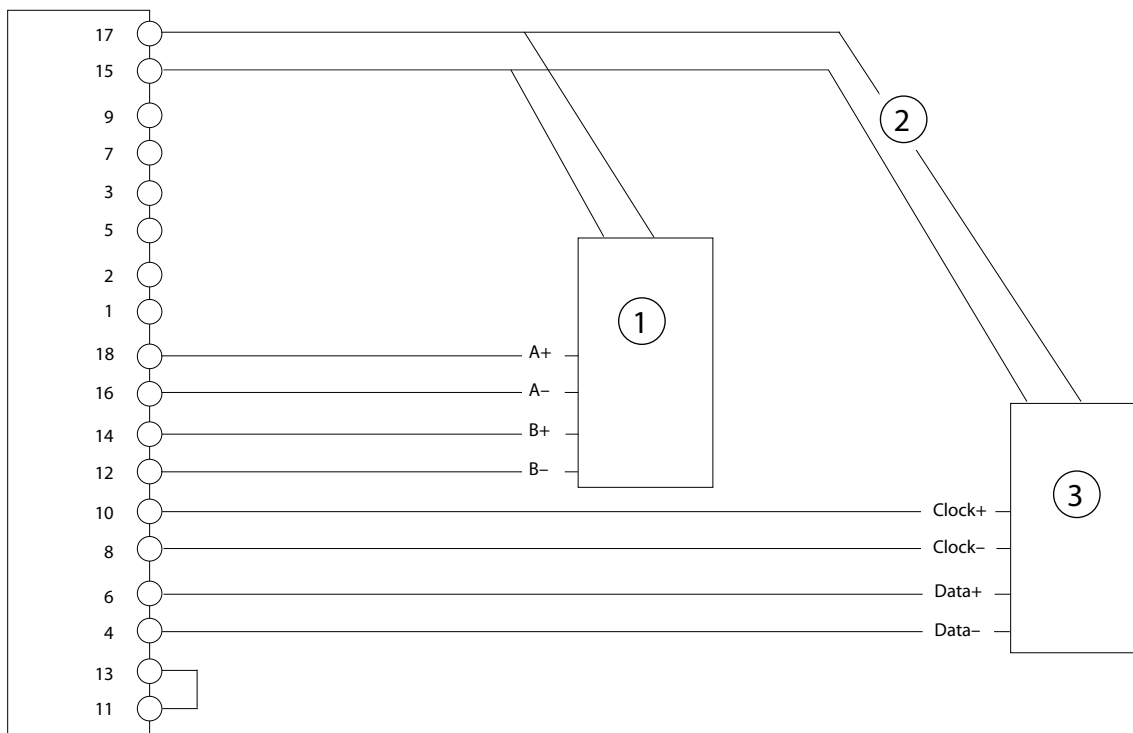
1	Encoder
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5.5.8 SSI and Incremental (TTL or HTL) Encoder

This example shows the connection of an SSI encoder on Z and D as channel 1 and a 2 track incremental 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 15: Parameters for SSI and Incremental (TTL or HTL) Encoder

Parameter	Setting
9.4.1 Interface configuration	Select [19] SSI Z,D + 2 track incremental A,B.
9.4.4 Encoder Supply Voltage	Set the appropriate voltage.
9.5.2 Resolution Channel 2	Set the resolution of the incremental 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.



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Illustration 14: Wiring Configuration for SSI and Incremental (TTL or HTL) Encoder

1	Incremental encoder	3	SSI absolute encoder
2	External power supply		

5.5.9 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,D and A,B as channel 1. The absolute position is read from the encoder and used as actual position. The incremental/SinCos track is used to compensate for communication delay and too few absolute position readings due to communication speed.

Table 16: Parameters for SSI Encoder with Incremental or SinCos Track

Parameter	Setting
9.4.1 Interface configuration	Select the type of connected encoder: [33] SSI Z,D with 2 track incremental A,B. [34] SSI Z,D with 2 track SinCos A,B.
9.4.4 Encoder Supply Voltage	Set the appropriate voltage.
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 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.

e30bk893.10

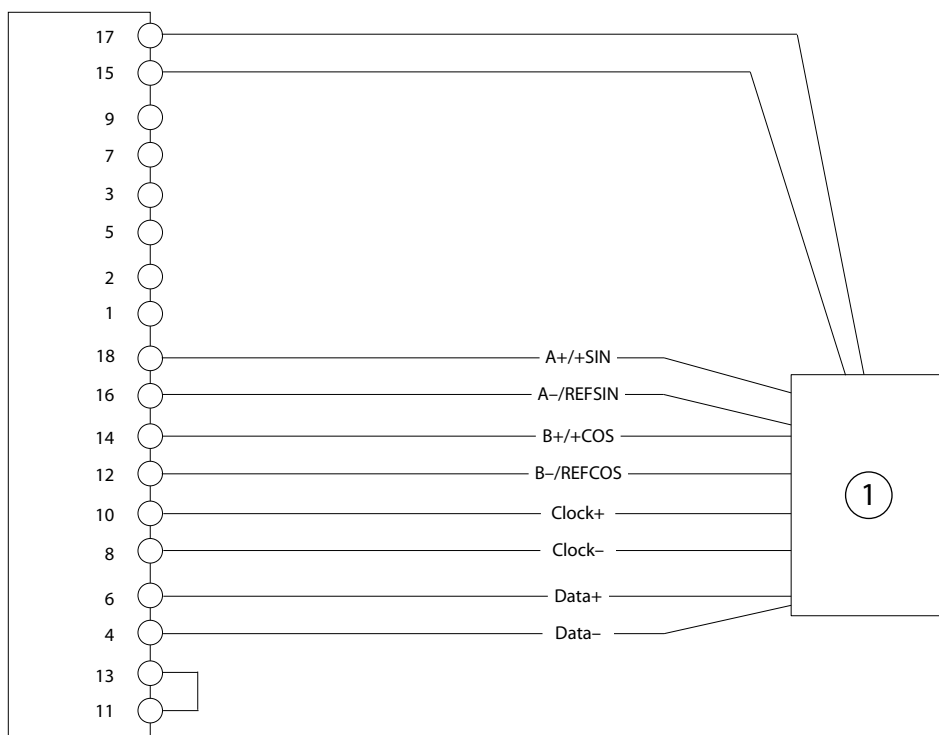


Illustration 15: Wiring Configuration for SSI Encoder with Incremental or SinCos Track

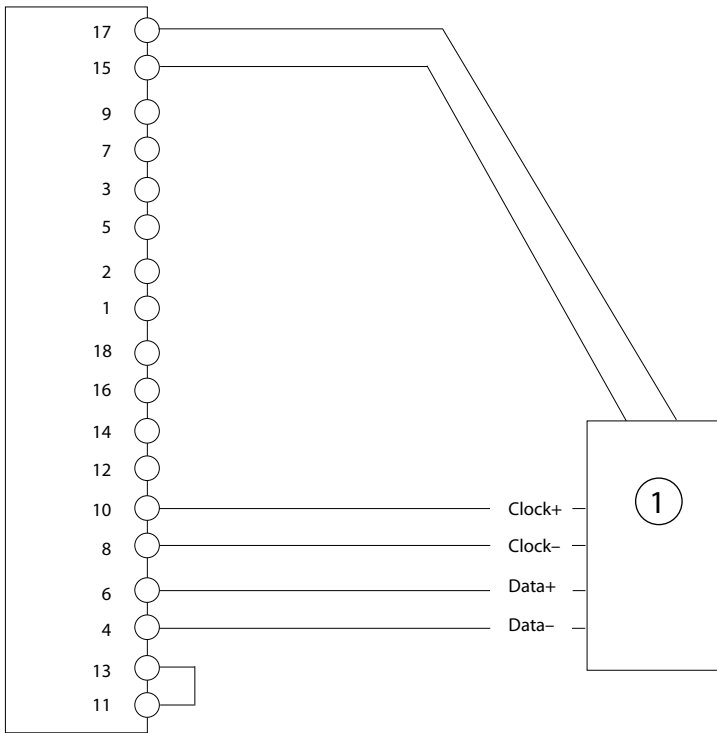
1	Encoder
---	---------

5.5.10 EnDat Encoder

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

Table 17: Parameters for EnDat Encoder

Parameter	Setting
9.4.1 Interface configuration	Select [22] EnDat Z,D.
9.4.4 Encoder Supply Voltage	Set the appropriate supply voltage. <div style="text-align: center; background-color: #cccccc; padding: 5px;">NOTICE</div> Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
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.



e30bj663.11

Illustration 16: Wiring Configuration for 2-Track EnDat Encoder

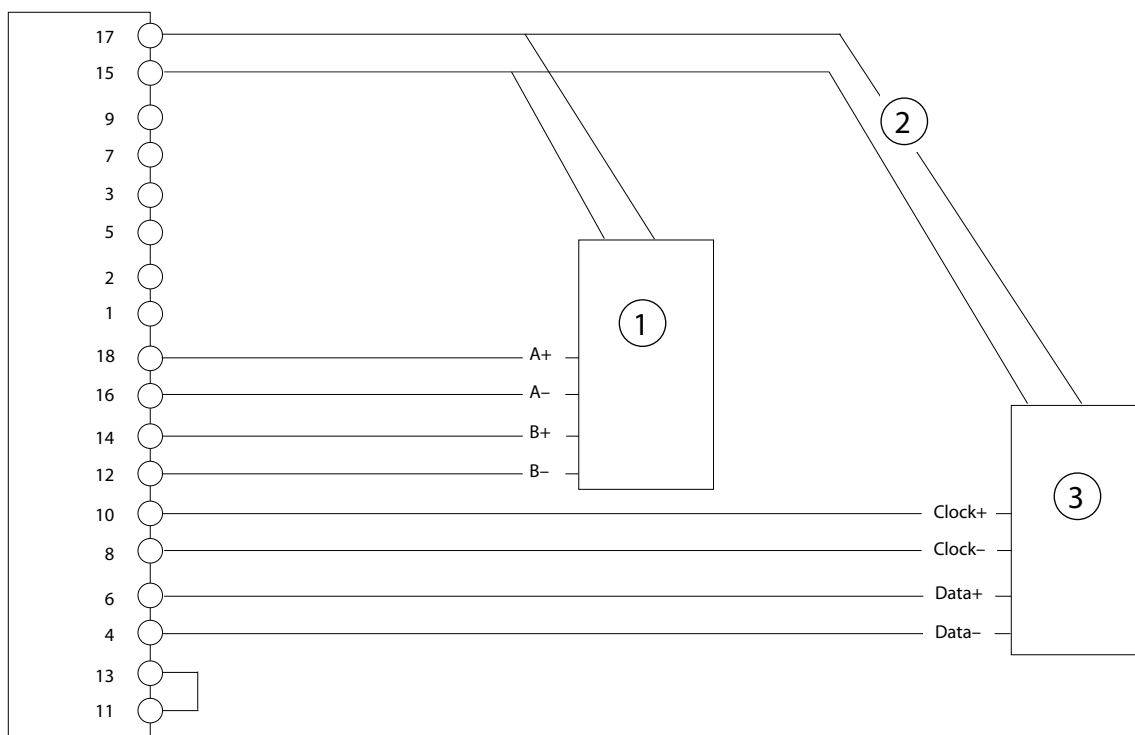
1	Encoder
---	---------

5.5.11 EnDat and Incremental (TTL or HTL) Encoder

This example shows the connection of an EnDat encoder on Z and D as channel 1 and a 2-track incremental 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 18: Parameters for EnDat and Incremental (TTL or HTL) Encoder

Parameter	Setting
9.4.1 Interface configuration	Select [23] EnDat Z,D + 2 track incremental A,B.
9.4.4 Encoder Supply Voltage	Set the appropriate voltage.
9.5.2 Resolution Channel 2	Set the resolution of the incremental encoder connected to A and B in pulses per revolution.
9.6.1 Singleturn Resolution	Set the number of bits used for one 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 encoder specifications.



e30bk899.10

Illustration 17: EnDat and Incremental (TTL or HTL) Encoder

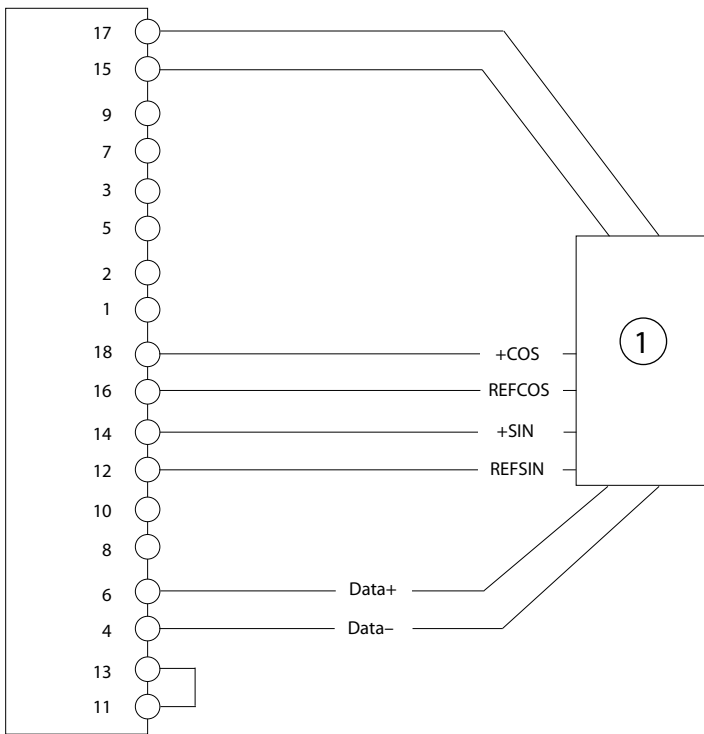
1	Incremental encoder	3	EnDat absolute encoder
2	External power supply		

5.5.12 HIPERFACE®

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

Table 19: Parameters for HIPERFACE®

Parameter	Setting
9.4.1 Interface Configuration	Select [25] Hiperface.
9.4.4 Encoder Supply Voltage	Set the appropriate voltage.
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.



e30bk900.10

Illustration 18: Wiring Configuration for HIPERFACE®

1	Encoder
---	---------

5.5.13 HIPERFACE DSL

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

Table 20: Parameters for HIPERFACE DSL^Æ

Parameter	Setting
9.4.1 Interface configuration	Select [26] Hiperface DSL D.
9.4.4 Encoder Supply Voltage	Set the appropriate supply voltage. <div style="text-align: center; background-color: #cccccc; padding: 5px;">NOTICE</div> Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
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.

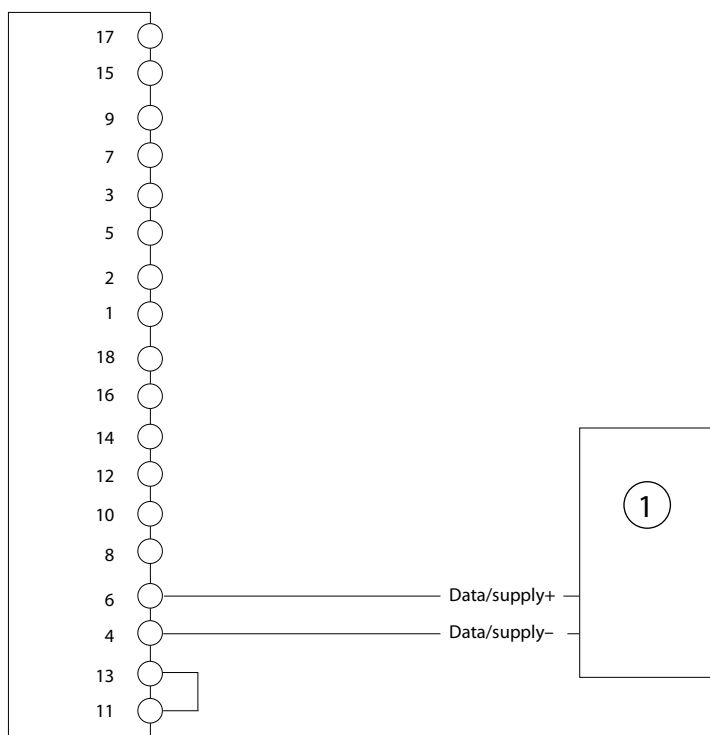


Illustration 19: Wiring Configuration for HIPERFACE DSL[®] Encoder

1	Encoder
---	---------

5.5.14 HIPERFACE DSL[®] and Incremental (TTL or HTL) Encoder

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

Table 21: Parameters for HIPERFACE DSL[®] and Incremental (TTL or HTL) Encoder

Parameter	Setting
9.4.1 Interface configuration	Select [27] Hiperface DSL D + 2 track incremental A,B
9.4.4 Encoder Supply Voltage	Set the appropriate voltage.
9.5.2 Resolution Channel 2	Set the resolution of the incremental 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.

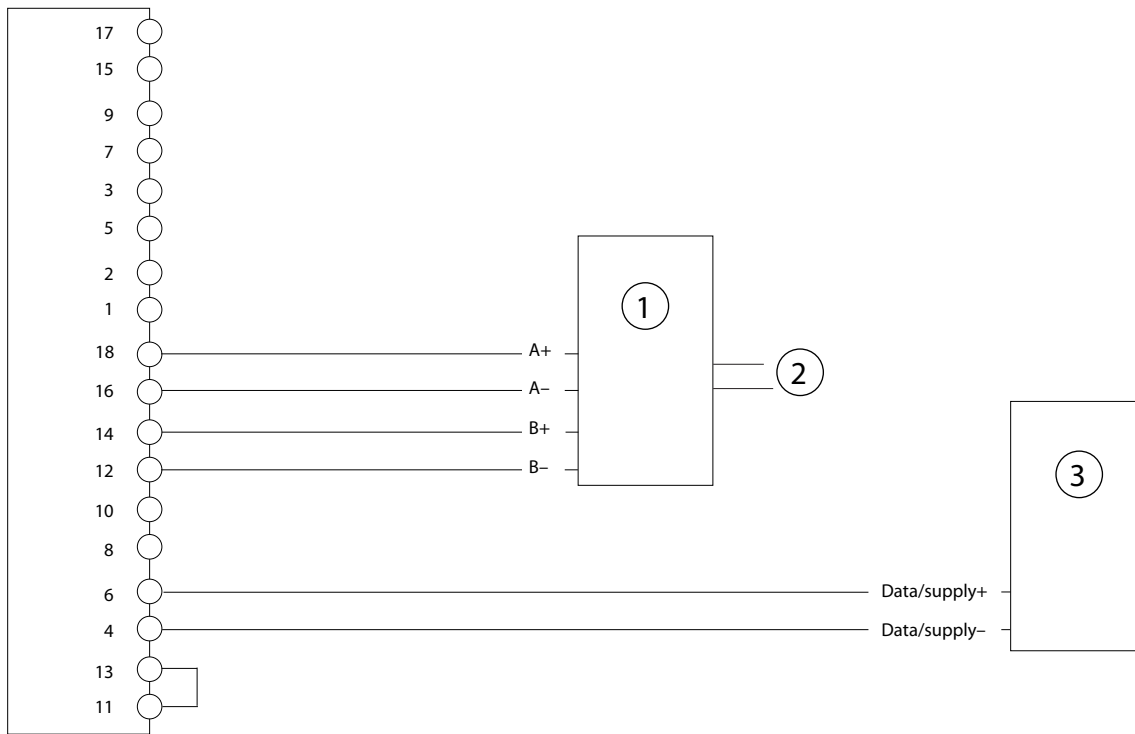


Illustration 20: Wiring Configuration for HIPERFACE DSL® and Incremental (TTL or HTL) Encoder

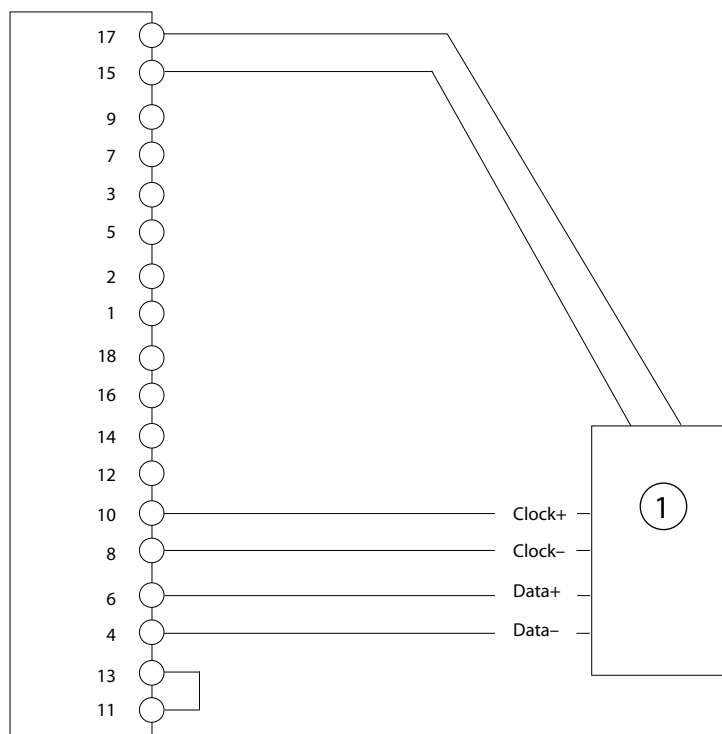
1	Incremental encoder	3	HIPERFACE DSL® encoder
2	External power supply		

5.5.15 BiSS Encoder

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

Table 22: Parameters for BiSS Encoder

Parameter	Setting
9.4.1 Interface configuration	Select [29] BiSS Z,D.
9.4.4 Encoder Supply Voltage	Set the appropriate supply voltage. <div style="text-align: center;">NOTICE</div> Voltage can be up to 24 V. Setting the voltage too high can damage the connected encoder.
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 rate for the clock signal according to the encoder specifications.



e30bj663.11

Illustration 21: Wiring Configuration for 2-Track BiSS Encoder

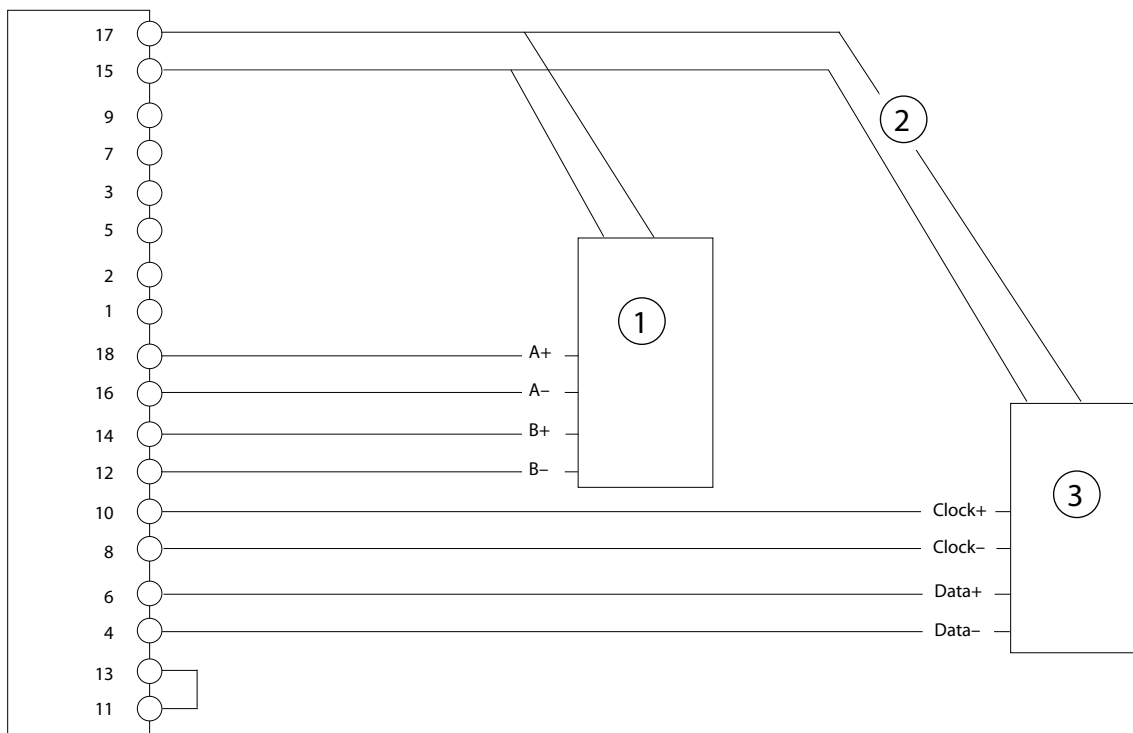
1	Encoder
---	---------

5.5.16 BiSS and Incremental (TTL or HTL) 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 on A and B as channel/feedback device 2. An external supply might be needed if 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 BiSS and Incremental (TTL or HTL) Encoder

Parameter	Setting
9.4.1 Interface Configuration	Select [30] BiSS Z,D + 2 track incremental A,B.
9.4.4 Encoder Supply Voltage	Set the appropriate voltage.
9.5.2 Resolution Channel 2	Set the resolution of the incremental 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.
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.



e30bk899.10

Illustration 22: Wiring Configuration for BiSS and Incremental (TTL or HTL) Encoder

1	Incremental encoder	3	BiSS absolute encoder
2	External power supply		

5.5.17 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,D and A,B as channel 1. The absolute position is read from the encoder and used as actual position. The incremental/SinCos track is used to compensate for communication delay and too few absolute position readings due to communication speed.

Table 24: Parameters for BiSS Encoder with Incremental or SinCos Track

Parameter	Setting
9.4.1 Interface configuration	Select according to the encoder type: [31] BiSS Z,D with 2 track Incremental A,B. [32] BiSS with 2 track SinCos A,B.
9.4.4 Encoder Supply Voltage	Set the appropriate voltage.
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.

e30bk893.10

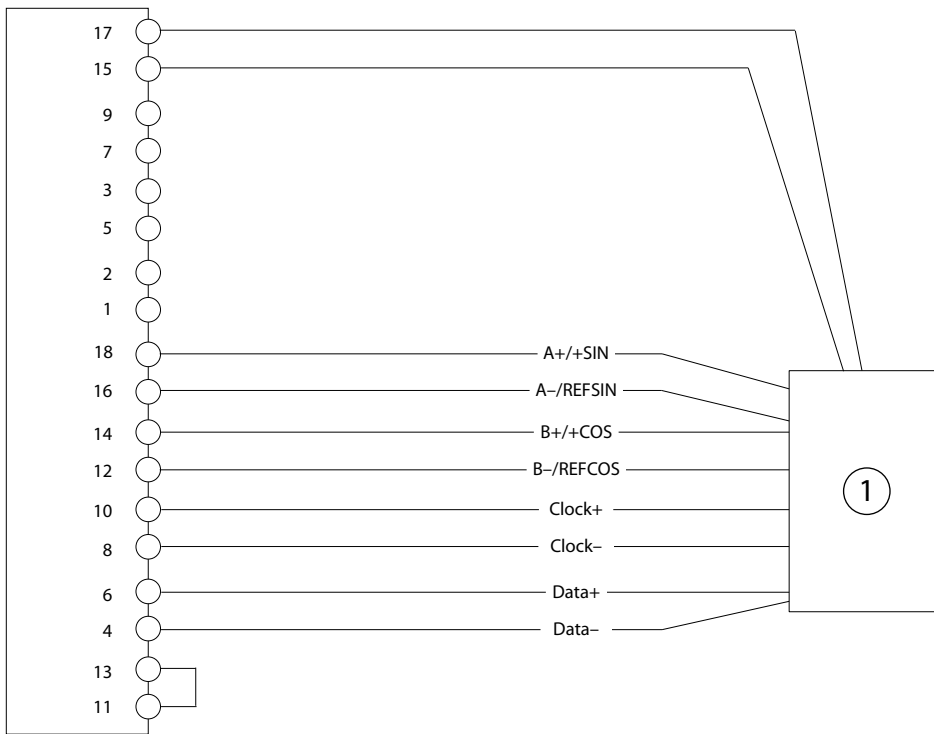


Illustration 23: BiSS Encoder with Incremental or SinCos Track

1	Encoder
---	---------

5.6 Parameter Descriptions for Encoder/Resolver

5.6.1 Status (Menu Index 9.1)

P 9.1.1 Channel 1 Singleturn Angle

Description: Shows the raw singleturn angle of 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

Description: 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

Description: Shows the raw singleturn angle at latest zero pulse at 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

Description: Shows a status indication for encoder connected to channel 1.

Default Value : NA	Parameter Type: Range (0 — 65535)	Parameter Number: 4068
Unit: -	Data Type: WORD	Access Type: Read Only

Following are the bits and description.

Bit	Description
0	Shows that a general problem has been detected, see parameter 9.1.9 <i>Encoder Status Word</i> for details.
2	No valid position from the connected absolute encoder. Can be caused by supply voltage, wiring issues, electrical noise, or defective encoder. Check supply voltage, clock and data signals. Reducing clock/ baud rate might help especially in case of long encoder cable.
3	No valid position from the connected absolute encoder. Can be caused by supply voltage, wiring issues, electrical noise, or defective encoder. Check supply voltage, clock and data signals. Reducing clock/ baud rate might help especially in case of long encoder cable.
7	An absolute encoder has not yet been configured or encoder initialization is in progress. This is just a status bit showing that the encoder is not yet ready to provide valid position information.
8	Absolute encoder or resolver signal error. Check wiring and encoder.
9	Shows that invalid data has been received on the absolute channel. Check wiring and encoder, might be caused by electrical noise disturbing the data transmission.
10	No valid position from the connected absolute encoder. Can be caused by supply voltage, wiring issues, electrical noise, or defective encoder. Check supply voltage, clock and data signals. Reducing clock/ baud rate might help especially in case of long encoder cable.
12	Shows that the absolute and incremental tracks count opposite on an absolute encoder with incremental track. Invert the incremental direction by swapping A and B.
13	Shows a mismatch between the incremental track and the absolute track or the zero pulse. Indicates that the set incremental resolution is wrong.
14	SinCos encoder signal error - indicates too low signal voltage. The combined voltage on A and B at standstill must be at least 0.875 V: $U_A^2 + U_B^2 \geq 0.8752 V^2$.
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

Description: Shows the raw singleturn angle of 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

Description: 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

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

Default Value : NA	Parameter Type: Range (0 — 4294967295)	Parameter Number: 4012
Unit: -	Data Type: UDINT	Access Type: Read Only

P 9.1.8 Channel 2 Encoder Status Word

Description: Shows a status indication for encoder connected to channel 2.

Default Value : NA	Parameter Type: Range (0 — 65535)	Parameter Number: 4018
Unit: -	Data Type: WORD	Access Type: Read Only

Following are the bits and description.

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.
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.
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 0.875 V: $U_A^2 + U_B^2 \geq 0.875^2 V^2$
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

Description: 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 (0 — 65535)	Parameter Number: 4019
Unit: -	Data Type: WORD	Access Type: Read Only

Following are the bits and description.

Bit	Description
0	Shows that the Plug Detect connection between pin 11 and 13 is interrupted. Check the connection and that the plug is correctly inserted.
1	Shows that the encoder power supply is overloaded. Check the load connected to pin 7 and 9.
2	Shows that the resolver signal is missing or invalid. Check the resolver signal, might be a wiring problem or a defective resolver.
3	Shows that a short circuit has been detected on one or more of the 4 tracks A, B, Z and D. Check the wiring.
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

Description: Select the required configuration of the interface consisting of 4 tracks A, B, Z and D. The interface offers various combinations of 1 or 2 devices.

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
0	Disabled
1	2 track incremental A,B
3	3 track incremental A,B,Z
5	2 track incremental A,B + 2 track incremental Z,D

Selection number	Selection name
7	Resolver A,B
8	Resolver A,B + mirror out Z,D
9	Resolver A,B + 2 track incremental Z,D
10	SinCos A,B
17	SSI Z,D
19	SSI Z,D + 2 track incremental A,B
33	SSI with 2 track incremental Z,D,A,B
34	SSI with SinCos Z,D,A,B
22	EnDat Z,D
23	EnDat Z,D + 2 track incremental A,B
25	HIPERFACE A,B,D
26	HIPERFACE DSL D
27	HIPERFACE DSL D + 2 track incremental A,B
29	BiSS Z,D
30	BiSS Z,D + 2 track incremental A,B
31	BiSS with 2 track incremental Z,D,A,B
32	BiSS with SinCos Z,D,A,B

P 9.4.2 Encoder Supply Voltage

Description: 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 9.4.3 Supply Sense

Description: Enable power supply cable drop compensation.

Default Value : 0 [Disabled]	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
0	Disabled
1	Enabled

P 9.4.4 Invert Direction Channel 1

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

Default Value : 0 [Disabled]	Parameter Type: Selection	Parameter Number: 4092
Unit: -	Data Type: BOOL	Access Type: Read/Write

Operating Guide

The following are the selections for the parameter.

Selection number	Selection name
0	Disabled
1	Enabled

P 9.4.5 Invert Direction Channel 2

Description: Select if signal on channel 2 shall be 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 : 0 [Disabled]	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
0	Disabled
1	Enabled

5.6.3 Incremental Settings (Menu Index 9.5)

P 9.5.1 Resolution Channel 1

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

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

P 9.5.2 Resolution Channel 2

Description: 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

5.6.4 SSI/EnDat/BiSS/HIPERFACE Settings (Menu Index 9.6)

P 9.6.1 Singleturn Resolution

Description: 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

Description: 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

Description: Select the clock rate used for EnDat.

Default Value : 13 [1 MHz]	Parameter Type: Selection	Parameter Number: 4036
Unit: -	Data Type: UINT	Access Type: Read/Write

The following are the selections for the parameter.

Selection number	Selection name
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

Description: 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
0	Binary
1	Gray

P 9.6.5 BiSS/SSI Clock Rate

Description: 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
2	8.33 MHz
3	6.25 MHz
4	5.00 MHz
5	4.16 MHz
6	3.57 MHz
7	3.13 MHz
8	2.78 MHz
9	2.50 MHz
10	2.27 MHz
11	2.08 MHz
12	1.92 MHz
13	1.79 MHz
14	1.67 MHz

Selection number	Selection name
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

Description: 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
4	9600 bits/s
5	19200 bits/s
6	38400 bits/s

P 9.6.7 HIPERFACE Parity

Description: 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
0	None
2	Even
3	Odd

5.6.5 Resolver (Menu Index 9.7)

P 9.7.1 Excitation Voltage

Description: 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

Description: 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

Description: 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

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 [6.4 Relay Option OC7R0 Specifications](#).

6.2 Required Tools

- Torx 20 screwdriver for mounting the option and EMC plate.
- Slotted screwdriver (maximum 3 mm) for releasing the spring-loaded terminals of the plug connector.

6.3 Pin Assignment for Relay Option OC7R0

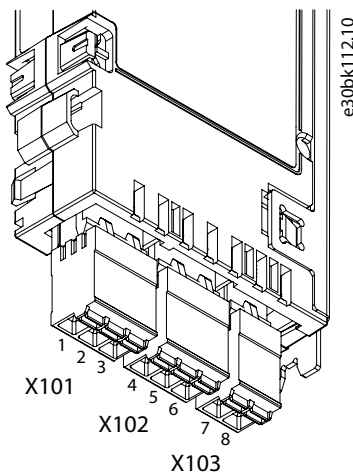


Illustration 24: Relay Option OC7R0 Terminals

Table 25: Functions for Relay Option OC7R0 Terminals

Terminal X101 (Relay T2)		Terminal X102 (Relay T5)		Terminal X103 (Relay T8)	
Numbering	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 [6.5 Setup and Connection Examples for Relay Option OC7R0](#) for more information on wiring the option.

6.4 Relay Option OC7R0 Specifications

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

Table 26: Technical Specifications for Relay Option OC7R0

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

Operating Guide

Functions	Data
Maximum terminal load (DC-13) : Inductive load	24 V DC, 0.1 A
Minimum load	24 V DC, 10 mA
	24 V AC, 20 mA
Rated number of cycles (@2 A resistive load)	400 000 switchings
Cable type	Cu, 75 °C (167 °F)
Cable size	Solid: 0.2–2.5 mm ² (24–14 AWG)
	Flexible: 0.2–2.5 mm ² (24–14 AWG)
	Flexible with ferrule, without plastic sleeve: 0.25–2.5 mm ² (24–14 AWG)
	Flexible without ferrule, with plastic sleeve: 0.25–2.5 mm ² (24–14 AWG)
Maximum cable length	300 m (984 ft)
Maximum altitude	4400 m (14400 ft)
	<div style="background-color: #cccccc; padding: 5px; margin-bottom: 5px;">NOTICE</div> <p>The operating altitude sets requirements on voltages.</p> <ul style="list-style-type: none"> For the wiring diagrams for different operating altitudes, see 6.5.1 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

6.5 Setup and Connection Examples for Relay Option OC7R0

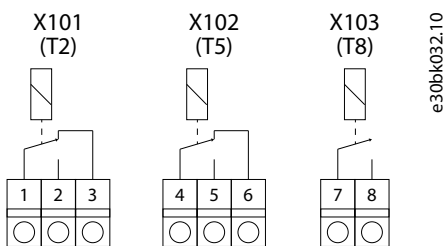


Illustration 25: Wiring Configuration for Relay Option OC7R0

Operating Guide

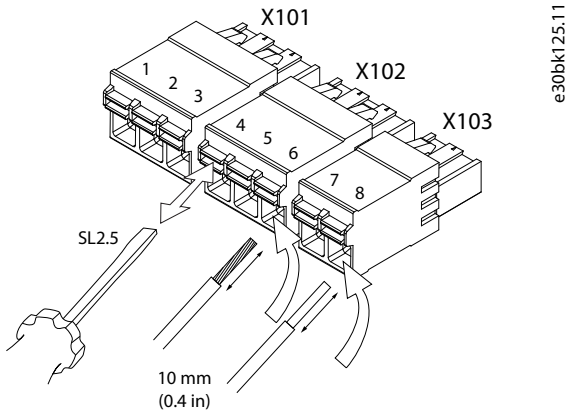


Illustration 26: Inserting Wires into the Relay Option OC7R0 Connectors

6.5.1 Wiring Diagrams for Different Operating Altitudes

- Operation up to 2000 m (6560 ft) altitude: Each relay can operate at different phase voltages. See [Illustration 27](#).
- Operation above 2000 m (6560 ft) altitude: Operation with voltage above 50 V AC requires operation on the same phase voltage. See [Illustration 28](#).
- Operation with mixed voltage (24 V) and high voltage is possible. High voltage must be on the same phase. See [Illustration 29](#).

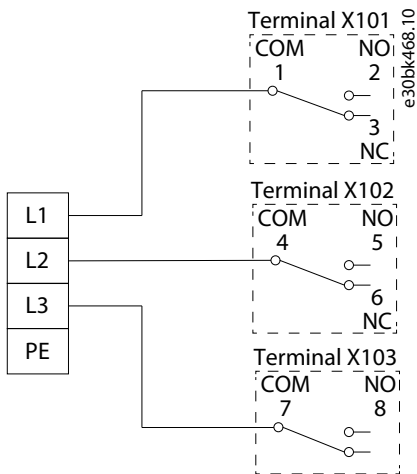


Illustration 27: Operation up to 2000 m (6560 ft) Altitude

Operating Guide

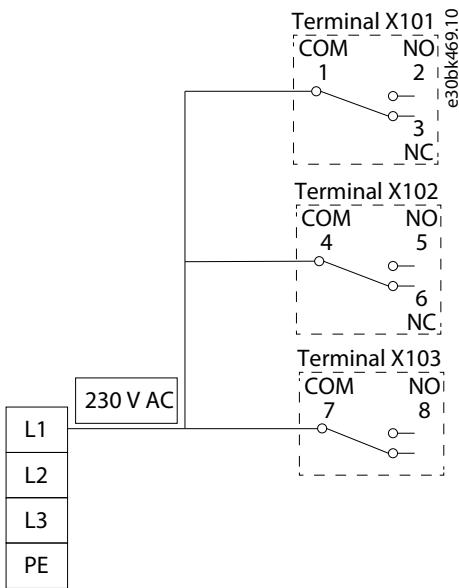


Illustration 28: Operation above 2000 m (6560 ft) Altitude with Voltage above 50 V AC

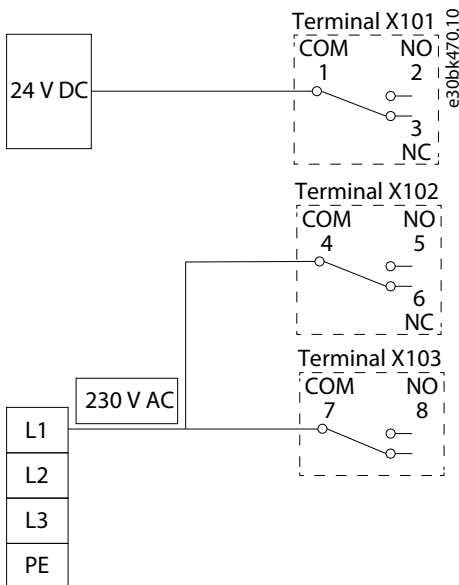


Illustration 29: Operation above 2000 m (6560 ft) Altitude with Mixed Voltages

6.6 Parameter Descriptions for Relay Option OC7R0

To set Relay output, see parameter group 5.26.1 *General Digital Outputs*.

6.6.1 Status (Menu Index 9.3)

P 9.3.1 Digital Relay 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 27: Digital Output Mapping for Relay Option OC7R0

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

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 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 [7.4 General Purpose I/O Specifications](#).

7.2 Required Tools

- Torx 20 screwdriver for mounting the option and EMC plate.
- Slotted screwdriver (maximum 3 mm) for releasing the spring-loaded terminals of the plug connector.

7.3 Pin Assignment for General Purpose I/O

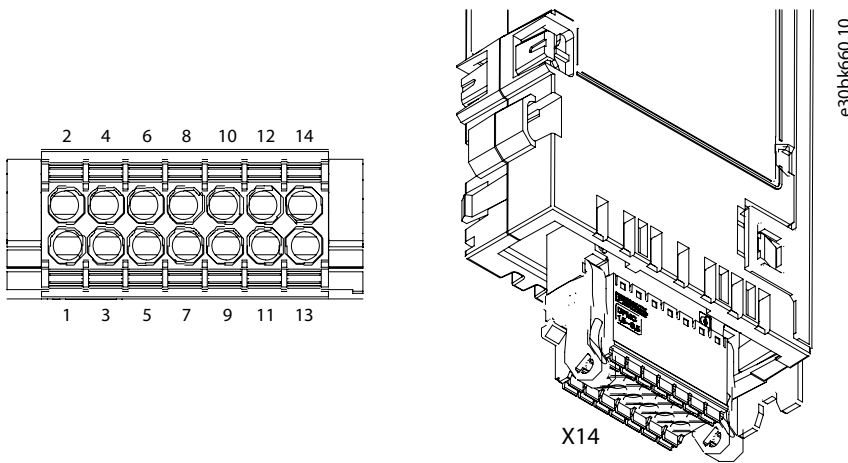


Illustration 30: General Purpose I/O Option Terminals

Table 28: 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.

7.4 General Purpose I/O Specifications

Table 29: 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)
Flexible wire without cable end sleeves	0.2–1.5 mm ² (24–16 AWG)

Operating Guide

Functions	Data
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)

7.4.1 I/O Specifications

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

Analog Input

Table 30: Analog Input

Function	Data
Input modes	Current or voltage ⁽¹⁾
Voltage mode	<ul style="list-style-type: none"> 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
Reaction time	< 1 ms
Temperature sensor support ⁽²⁾	1xPt100, 2x Pt100, 3xPt100, Pt1000, Ni1000 (A/B), KTY81, KTY82, KTY84

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

² External insulation of the sensor is required to comply with PELV.

Analog Output

Table 31: Analog Output

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

Operating Guide

Digital and Pulse Input

Table 32: Digital and Encoder/Pulse Input

Function		Data
Digital input	Logic	PNP
	Voltage levels	0/24 V
	PNP	<ul style="list-style-type: none"> "0": <5 V DC "1": >11 V DC
	Maximum allowed voltage	30 V DC
	Input resistance	4.8 k Ω
Thermistor input	PTC ⁽¹⁾	1.5–4 k Ω
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

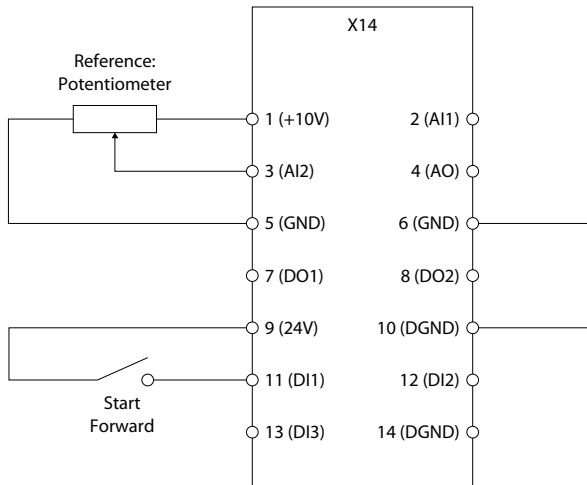
¹ External insulation of the sensor is required to comply with PELV.

Digital and Pulse Output

Table 33: Digital and Pulse Output

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

7.5 Setup and Connection Examples for General Purpose I/O



e30bk552.10

Illustration 31: 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.

7.6 Parameter Descriptions for General Purpose I/O

7.6.1 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 34: 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 35: 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	–

Operating Guide

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

7.6.2 Analog Inputs/Outputs (Menu Index 9.4)

7.6.2.1 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

Operating Guide

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: 0.00	Parameter Type: Range (0.00 — 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

Operating Guide

Selection number	Selection name
6	Ni1000Tk6180
7	KTY84-1x0
10	KTY81/82-1x0
11	KTY81/82-121
12	KTY81/82-122

7.6.2.2 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.

Operating Guide

Default Value: 0.00	Parameter Type: Range (0.00 — 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 "5.2.15.2 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 "5.2.15.2 Live Zero Response".

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

P 9.4.2.8 T3 Temperature Sensor type

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

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

The following are the selections for the parameter:

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

7.6.2.3 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

Operating Guide

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

7.6.3 Digital Inputs/Outputs (Menu Index 9.5)

7.6.3.1 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

Operating Guide

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

7.6.3.2 Output T8 (Menu Index 9.5.2)

P 9.5.2.1 T8 Terminal Mode

Description: Select the mode for the terminal.

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

The following are the selections for the parameter

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

P 9.5.2.2 T8 Digital Output Type

Description: Select the operating logic for the digital output.

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

The following are the selections for the parameter

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

P 9.5.2.3 T8 Pulse Out Min. Frequency

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

Operating Guide

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

7.6.3.3 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: 0.00	Parameter Type: Range (0.00 — 63.50)	Parameter Number: 4950
Unit: μ s	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: 0.00	Parameter Type: Range (0.00 — 127.00)	Parameter Number: 4951
Unit: ms	Data Type: REAL	Access Type: Read/Write

P 9.5.3.5 T11 Pulse Out 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

Operating Guide

P 9.5.3.6 T11 Pulse Out 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

7.6.3.4 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: 0.00	Parameter Type: Range (0.00 — 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: 0.00	Parameter Type: Range (0.00 — 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.

Operating Guide

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

7.6.3.5 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: 0.00	Parameter Type: Range (0.00 — 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: 0.00	Parameter Type: Range (0.00 — 127.00)	Parameter Number: 2024
Unit: ms	Data Type: REAL	Access Type: Read/Write

P 9.5.5.5 T13 Pulse Min. Frequency

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

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

P 9.5.5.6 T13 Pulse Max. Frequency

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

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

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