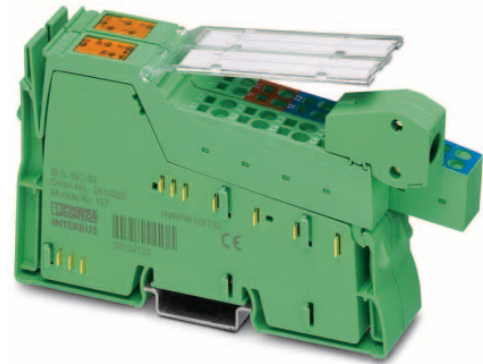# IB IL INC-IN ...

Inline terminal for incremental encoders

AUTOMATION

Data sheet
6390_en_07

1 Description

The terminal for incremental encoders is used to determine positions (lengths) or angular positions with relatively operating encoder systems, i.e., it reads position or angular information from incremental encoders with square-wave signals.

Both symmetrical encoders (RS-422) and asymmetrical encoders (5 V DC to 24 V DC) with square-wave signals can be connected to the IB IL INC-IN ... terminal. Rotary encoders or length measuring systems with or without Z pulse can be read.

In order to increase the operational reliability all encoder inputs are monitored for cable breaks. Using a special operating mode, the terminal supports distance encoded incremental encoders, which enable homing to be reduced to very small distances.

In addition to the input for the encoder signals, the terminal also has three digital 24 V DC inputs, one input for the home position switch, and two inputs for limit switches. Thus 2 or 3-wire sensors can be connected. Input I3 can also be used as an "open collector" output.

The terminal records the position values using a counter, which counts up or down depending on the phase angle of the A and B signals.

To read usable information from the positioning counter after switching it on, it must be set to a defined value on a particular point of the axis. The terminal requires a reference signal for this homing process. This signal can be set via the bus or generated by one of the digital inputs. Either the signal at the home position switch input or one of the two limit switch signals can be used.

To increase the accuracy of the homing function, "Homing on the edge at the Z pulse input" can also be selected on the terminal in addition to the "Homing on the edge at the home position switch input" function.

When homing with Z signal it is important that the encoder and the reference mark are adjusted in such a way that the position of the home position switch edge is in the center of the positions of the edges at the Z input. In the delta counting register the terminal provides a read function for this distance.

i	This data sheet is only valid in association with the IL SYS INST UM E user manual.

i	Make sure you always use the latest documentation. It can be downloaded at www.phoenixcontact.net/download.

i	This data sheet is valid for the products listed on the following page:

INSPIRING INNOVATIONS

2   Ordering data

Inline terminals

Description	Type	Order No.	Pcs./Pkt.
Inline terminal for incremental encoders; complete with accessories (connectors and labeling fields); transmission speed of 500 kbps	IB IL INC-IN-PAC	2861755	1
Inline terminal for incremental encoders; without accessories; transmission speed of 500 kbps	IB IL INC-IN	2819228	1
Inline terminal for incremental encoders; complete with accessories (connectors and labeling fields); transmission speed of 2 Mbps	IB IL INC-IN-2MBD-PAC	2819765	1
Inline terminal for incremental encoders; without accessories; transmission speed of 2 Mbps	IB IL INC-IN-2MBD	2819778	1

> **i**   The listed connector set is needed for the complete fitting of the IB IL INC-IN and IB IL INC-IN-2MBD terminals.

Accessories

Description	Type	Order No.	Pcs./Pkt.
Connector set comprising a shield connector with six connections and a connector with twelve connections	IB IL INC-IN-PLSET	2819710	1

Documentation

Description	Type	Order No.	Pcs./Pkt.
"Automation terminals of the Inline product range" user manual	IL SYS INST UM E	2698737	1

3   Technical data

General data	
Housing dimensions (width x height x depth)	24.4 mm x 140.5 mm x 71.5 mm (with connectors)
Weight	143 g (with connectors), 100 g (without connectors)
Operating mode	Process data mode with 2 words
Connection method for sensors	2 or 3-wire technology
Connection method for actuators	2-wire technology, single-ended
Permissible temperature (operation)	-25°C … +55°C
Permissible temperature (storage/transport)	-25°C … +85°C
Permissible humidity (operation/storage/transport)	10% to 95%, according to EN 61131-2
Permissible air pressure (operation/storage/transport)	70 kPa to 106 kPa (up to 3000 m above sea level)
Degree of protection	IP20 according to IEC 60529
Protection class	Class 3 according to EN 61131-2, IEC 611312-2
Connection data for Inline connectors	
Connection method	Spring-cage terminals
Conductor cross-section	0.08 mm^2 to 1.5 mm^2 (solid or stranded), 28 - 16 AWG

Interface	
Local bus	Via data routing

Transmission speed	
IB IL INC-IN, IB IL INC-IN-PAC	500 kbps
IB IL INC-IN-2MBD, IB IL INC-IN-2MBD-PAC	2 Mbps

Power consumption (500 kbps)	500 kbps	2 Mbps
Communications power U_L	7.5 V	7.5 V
Current consumption from U_L	70 mA, maximum	80 mA, maximum
Power consumption from U_L	525 mW	600 mW
I/O supply from U_M	24 V DC, typical	24 V DC, typical
Current consumption from U_M	340 mA, typical	340 mA, typical

Supply of the module electronics and I/O through bus coupler/power terminal	
Connection method	Through potential routing

Power dissipation	
Power dissipation of the housing P_{HOU}	1.4 W, maximum (within the permissible operating temperature)

Digital inputs	
Number	3
Input design	According to EN 661131-2, type 1
Definition of switching thresholds	
Signal range low	-30 V DC ... +5 V DC
Signal range high	15 V DC ... 30 V DC
Common potentials	I/O supply, ground
Nominal input voltage U_{IN}	24 V DC
Permissible range	$-30\ V < U_{IN} < +30\ V\ DC$
Nominal input current for U_{IN}	2.7 mA, typical
Delay time	< 1 ms
Permissible cable length to the sensor	< 30 m (to ensure conformance with EMC directive)

Digital outputs	
Number	1 (double assignment of input I3)
Output type	NPN (connected to ground)
Nominal residual voltage U_{OUT}	0.25 V DC
Nominal input current I_{NOM}	0.5 A
Tolerance of the nominal current	+10%

Incremental encoder inputs	
Number	1
Encoder signal	Two pulse trains (A and B, electrically shifted by 90°) and one reference signal (Z)
Signal connection method	Shielded cables

> **NOTE:**
> Unshielded cables may lead to erroneous results in environments with heavy noise.

Encoder types

Symmetrical incremental encoders

Signal	5 V DC (symmetrical pulse train (RS-422) with transversal track)
Encoder supply	5 V DC or 24 V DC
Signal connection method	A and $\overline{A}$, B and $\overline{B}$, Z and $\overline{Z}$
Signal voltage level	Differential signal (signal – inverted signal) ±0.5 V, minimum; ±6.0 V, maximum
Common mode range: signal – ground	-10 V ... +13.2 V
Input frequency	Up to 300 kHz
Cable length (for shielded cable)	< 30 m (to ensure conformance with EMC directive)

Asymmetrical incremental encoders

Signal	5 V DC ... 24 V DC (asymmetrical pulse train without transversal track)
Encoder supply	5 V DC or 24 V DC
Signal connection method	A*, B*, Z*
Signal voltage level	Low ≤ 2.5 V, high ≥ 3.5 V (27 V, maximum)
Input frequency	Up to 300 kHz
Cable length (for shielded cable)	< 30 m (to ensure conformance with EMC directive)

Encoder supply

5 V encoder supply

Voltage range	4.75 V ... 5.25 V
Short-circuit protection	Electronic and thermal
Current carrying capacity	250 mA, maximum

24 V encoder supply

Voltage range	19.2 V ... 30 V
Short-circuit protection	Electronic and thermal
Current carrying capacity	250 mA, maximum

> **i** The state of the encoder supplies (5 V/24 V) is indicated via two LEDs. If the internal voltage for the encoder electronics fails or is overloaded, an I/O error is generated. This error is indicated by the diagnostic LED flashing at 2 Hz and transmitted to the controller board.

Error messages to the higher-level control or computer system

Failure or overload of the encoder supply	Yes, I/O error message sent to the controller board
No encoder connected	Yes, I/O error message sent to the controller board
Wire break on an encoder cable	Yes, I/O error message sent to the controller board

Electrical isolation/isolation of the voltage areas

ℹ️ Electrical isolation of the logic level from the I/O area is ensured through the optocoupler.

Common potentials

The 24 V main voltage, 24 V segment voltage, and GND have the same potential. FE is a separate potential area.

Separate potentials in the system consisting of bus coupler/power terminal and I/O terminal

Test distance	Test voltage
7.5 V supply (bus logic)/ I/O	500 V AC, 50 Hz, 1 min.
7.5 V supply (bus logic)/functional earth ground	500 V AC, 50 Hz, 1 min.
24 V supply (I/O)/functional earth ground	500 V AC, 50 Hz, 1 min.

Conformance with EMC directive 2004/108/EC

Noise immunity test according to EN 61000-6-2

Electrostatic discharge (ESD)	EN 61000-4-2/IEC 61000-4-2	Criterion B 6 kV contact discharge 8 kV air discharge
Electromagnetic fields	EN 61000-4-3/IEC 61000-4-3	Criterion B Field strength: 10 V/m
Fast transients (burst)	EN 61000-4-4/IEC 61000-4-4	Criterion B Supply lines: 2 kV Signal/data lines: 2 kV
Conducted interference	EN 61000-4-6/IEC 61000-4-6	Criterion A Test voltage 10 V
Noise emission of housing	EN 55011	Class A

Approvals

For the latest approvals, please visit www.phoenixcontact.net/download.

4 Features

– Three inputs for home position switch inputs or limit switch inputs
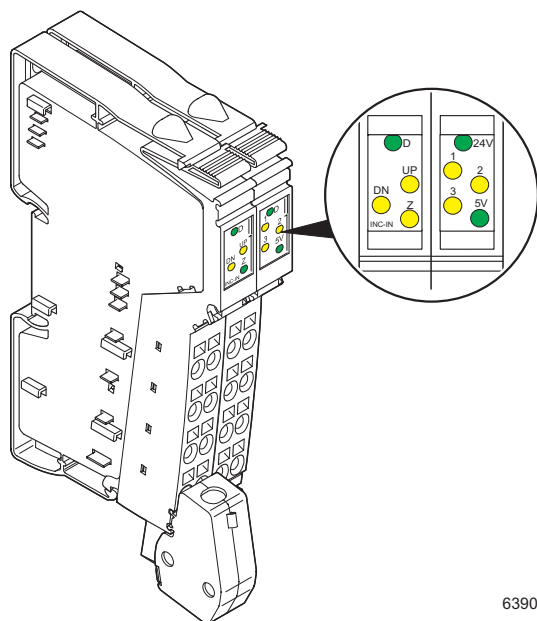– Diagnostic and status indicators

5 Applications

The following encoder types can be connected:
– Encoder with symmetrical data lines according to EIA standard RS-422
– Encoder with asymmetrical data lines (push/pull 10 V to 30 V)
– Distance encoded incremental encoder (quasi-absolute encoder)
– Encoder with 5 V or 24 V voltage supply
– Linear encoder
– Rotary encoders

6 Local diagnostic and status indicators and terminal point assignment

6.1 Local diagnostic and status indicators

6390C002

Figure 1   Local diagnostic and status indicators

Des.	Color	Meaning	
D	Green LED	Bus diagnostics	
	ON:	Bus active	
	Flashing:		
	0.5 Hz:	Communications power present, bus not active	
	2 Hz:	Communications power present, bus active, I/O error	
	4 Hz:	Communications power present, terminal before the flashing module failed, terminal after the flashing module not part of the configuration frame	
	OFF:	Communications power present, bus not active	
UP	Yellow LED	Positive direction of rotation	
	ON and "DN" LED OFF:	Module counting upwards	
	OFF and "DN" LED OFF:	Standstill	
DN	Yellow LED	Negative direction of rotation	
	ON and "UP" LED OFF:	Module counting downwards	
	OFF and "UP" LED OFF:	Standstill	
Z	Yellow LED	Z signal	In incremental encoders the encoder is set to Z signal.
	ON:	Z signal present	
	OFF:	Z signal not active	In absolute encoders the LED flashes or is permanently on (depending on the speed).
24V	Green LED	24 V encoder supply	
	ON:	24 V encoder supply present	
	OFF:	24 V encoder supply **not** present	
1, 2, 3	Yellow LED	Inputs	
	ON:	The corresponding input is set	
	OFF:	The corresponding input is **not** set	
5V	Green LED	5 V encoder supply	
	ON:	5 V encoder supply present	
	OFF:	5 V encoder supply **not** present	

6.2 Function identification

Orange

2 Mbps: 2 Mbps: White stripe in the vicinity of the D LED

6.3 Terminal point assignment
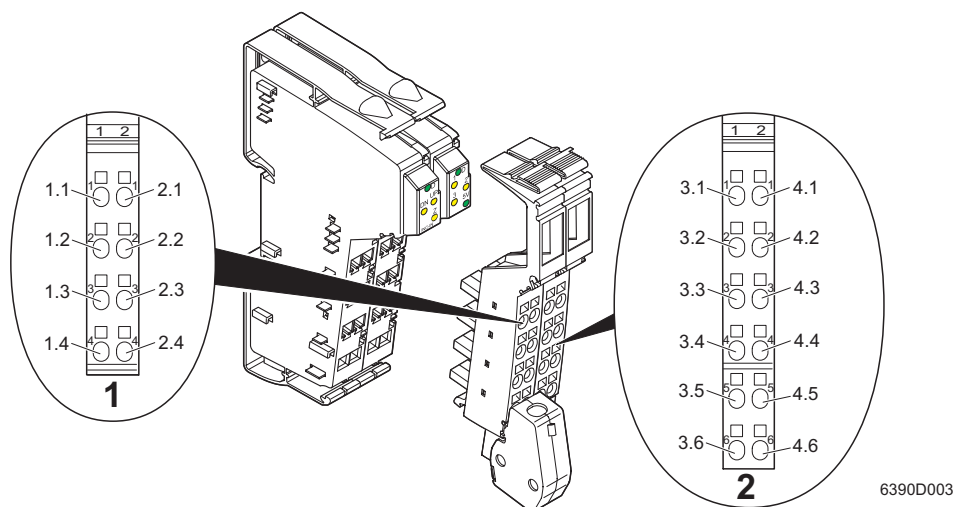
Figure 2   Inline terminal with appropriate connectors

6.4 Terminal point assignment of the shield connector (1)

Terminal point	Signal	Assignment	
		Symmetrical encoder	Asymmetrical encoder
1.1, 2.1	A, $\overline{A}$	Channel A, channel A inverted	Channel A, free
1.2, 2.2	B, $\overline{B}$	Channel B, channel B inverted	Channel B, free
1.3, 2.3	Z, $\overline{Z}$	Channel Z, channel Z inverted	Channel Z, free
1.4, 2.4	Shield	Encoder cable shield	Encoder cable shield

6.5 Terminal point assignment of the connector (2)

Terminal point	Signal	Assignment
3.1	E1	Input of limit switch 1
4.1	E2	Input of limit switch 2
3.2, 4.2	24 V	24 V encoder/limit switch supply
3.3, 4.3	GND	0 V encoder/limit switch supply
3.4	E3	Input for homing position switch or NPN output
4.4	5 V	5 V encoder/limit switch supply
3.5, 4.5	24 V	24 V encoder/limit switch supply
3.6, 4.6	GND	0 V encoder/limit switch supply

7   Function description

The IB IL INC-IN ... is a terminal from the Inline product range and is used to read position and angular information.

Symmetrical or asymmetrical encoders can be connected for this.

The evaluating logic of the terminal detects the direction of rotation of the encoder using the pulse train and counts the pulses accordingly.

The data width in the bus system is 32 bits. The IN register has seven bits available for status indicators and messages and 25 bits available for actual position values. The OUT register has seven bits available for control commands and 25 bits available for setting the reference point value (see "Process data words" on page 14).

7.1   Peripheral fault

The terminal has the following monitoring mechanisms, which generate an I/O error message:

– Monitoring the encoder power supply (5 V or 24 V)
  If the encoder supply fails or is overloaded, an I/O error is triggered and a corresponding message code is generated.

– Monitoring the encoder signals
  The differential signal of a symmetrical encoder must be greater than 0.5 V.
  An asymmetrical encoder must actively set the inputs, biased at 3 V using resistors, below 2.5 V (0-level) or above 3.5 V (1-level).
  If these conditions are not met, an I/O error is triggered and a corresponding message code is generated. These errors are caused by no encoder being connected, an asymmetrical encoder not being parameterized as an asymmetrical encoder or a wire break in an encoder cable.

| i	If a symmetrical encoder without Z signal is used, input Z must be jumpered to 0 V (GND) and input $\overline{Z}$ must be jumpered to +5 V.
	If an asymmetrical encoder is used, input Z must be jumpered to 0 V (GND) and input $\overline{Z}$ remains open.

i	The encoders must have push/pull outputs to ensure error-free operation of the monitoring mechanisms.
	When using encoders with high-site switches each encoder signal must be set to 0 V (GND) using a pull-down resistor (see Figure 3 and Figure 4 on page 8).
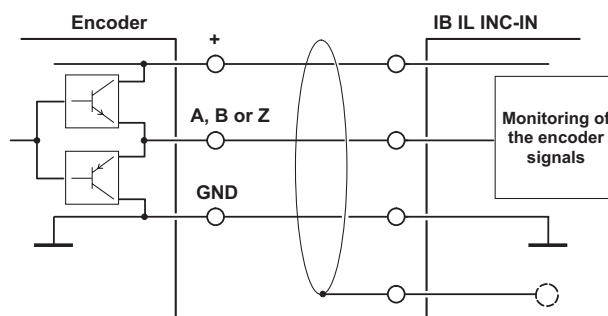
6390A011

Figure 3   Connection of asymmetrical encoders with push/pull outputs
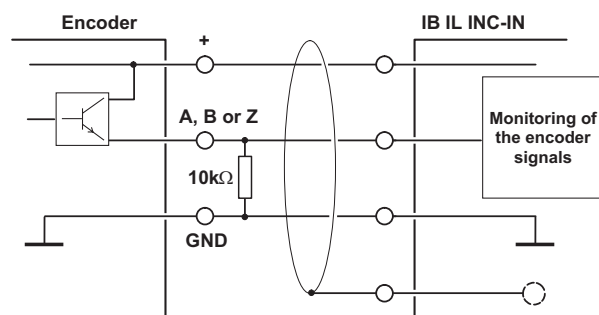
6390A012

Figure 4   Connection of asymmetrical encoders with high-site switch outputs

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7.2 Position detection

In order to start position detection after switching on the terminal, the control bits for the encoder type and the evaluation of OUT process data word OUT[0] are written to the terminal. The terminal then starts position detection with a random value in the positioning counter. As long as operating mode 0 ("Read actual position value") is not exited the actual position value only gives relative position values (without homing).

The control bits for the encoder type and evaluation must remain set as long as position detection is carried out. Changing the evaluation also requires new homing.

The terminal can only output an absolute position value if homing has been carried out on the terminal before. The homing function is used to set the positioning counter to the reference point value determined by OUT process data word OUT[0] on a specific point of an axis.

This homing process can be carried out by setting the reference point via the local bus (operating mode 1). During this process, the axis remains as still as possible or moves so slowly that the time delay, with which the signals are transmitted via the local bus, does not cause any major deviations.

Dynamic homing is also possible. In many applications, a higher level of precision is achieved through dynamic homing using a homing process.

The IB IL INC-IN ... terminal provides five different types of homing (operating modes 2 to 6) for dynamic homing. The terminal responds directly to the connected limit switch or home position switch signals or the Z signal (index pulse from the encoder) with a hardware circuit.

Homing function sequence:

1. Start homing

    The reference point value is written to OUT[0] and OUT[1]. Next, homing is started by means of writing one of the control codes for operating modes 1 to 5 to OUT[0].
    If the terminal has been homed the message code switches to "Device not homed".

2. Wait for acknowledgment (status bit A)

    The time it takes to receive acknowledgment varies depending on the homing mode. In operating mode 1, the acknowledgment bit (status bit A) appears immediately, in operating modes 2 to 6 the time it takes depends on the distance to the reference point and the speed at which the axis runs during homing (see page 14).
    The "Homed" acknowledgment bit is present until an error occurs or a new homing process is initialized.

3. Read adjustment value (only for the homing types in operating modes 4 and 5)

    In operating modes 4 and 5, the delta value (adjustment value) can be read in the "Actual position value" data field. This value indicates the distance between the position of the home position switch edge and the position of the Z pulse.
    This value is present in the "Actual position value" data field until switching to operating mode 0 ("Read actual position value"). Beginning from the Z pulse position the positioning counter internally starts position detection.

4. Switch back to "Read actual position value"

    Operating mode 0 ("Read actual position value") is selected in OUT[0]. The relevant positions can be read from the "Actual position value" data field in IN[0] and IN[1] (value range 0 to 2^{25} ... 1).

## 7.3 Homing for distance-encoded linear encoders

In addition to the counting tracks, distance encoded linear encoders are provided with a reference mark track with different increments. This results in fields between two reference marks, which differ in size. Each field only appears once in the linear system.

In order to detect the absolute position in the system only two reference marks must be overrun.

The process is carried out as follows (see Figure 5 and Figure 6): The slide position is unknown. In set operating mode 6 "110_{bin}" the slide is moved in any direction. When the slide reaches the first reference mark (Z) the internal counter is set to zero and the incoming increments of the counting track are added.

When the slide reaches the second reference mark the counter status determined between the two reference marks is output and the internal counter is set to zero again. At the same time, the "Acknowledgment, device homed" message code is output.

The output counter state corresponds to the increments of the overrun field and is present until switching to operating mode 0 "000_{bin}" ("Read actual position value"). After changing the operating mode, the counter state is displayed beginning from the second reference mark. The position corresponds to the position before or after the determined field depending on the counting and positioning directions.

Actual position value display: 960_{hex}
960_{hex} = 2400_{dec} increments in positive counting direction beside field 2515
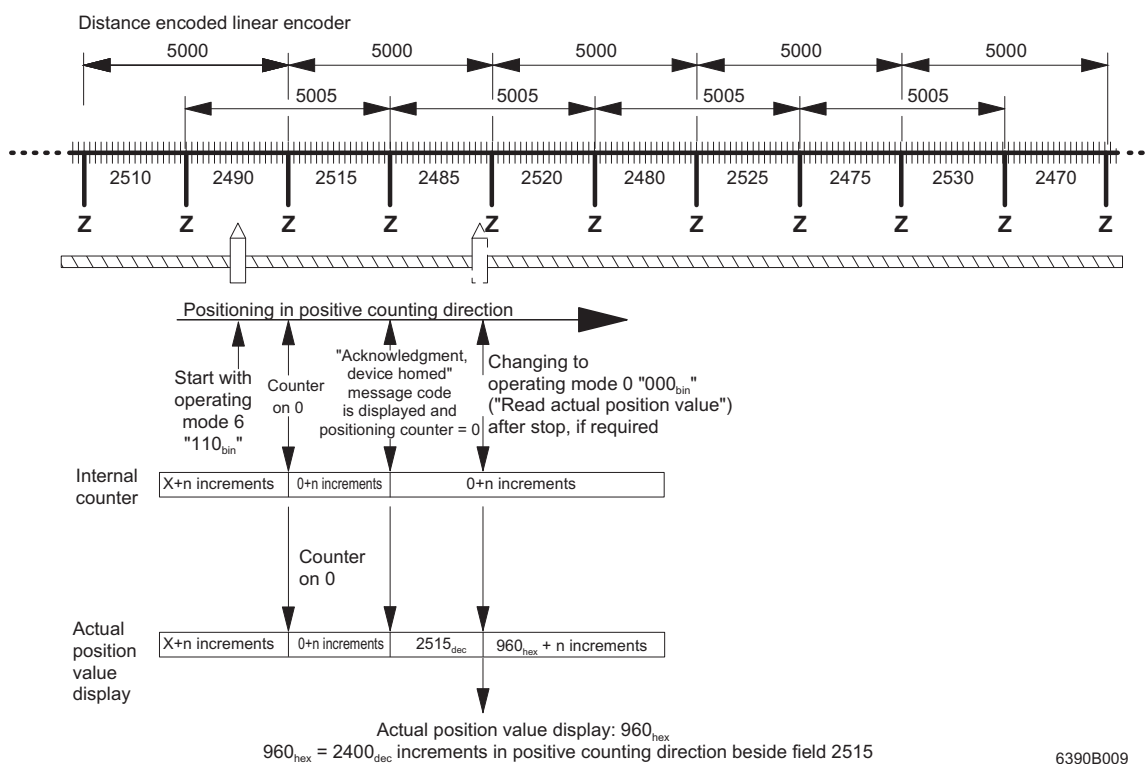
6390B009

Figure 5   Example 1: Positioning in positive counting direction
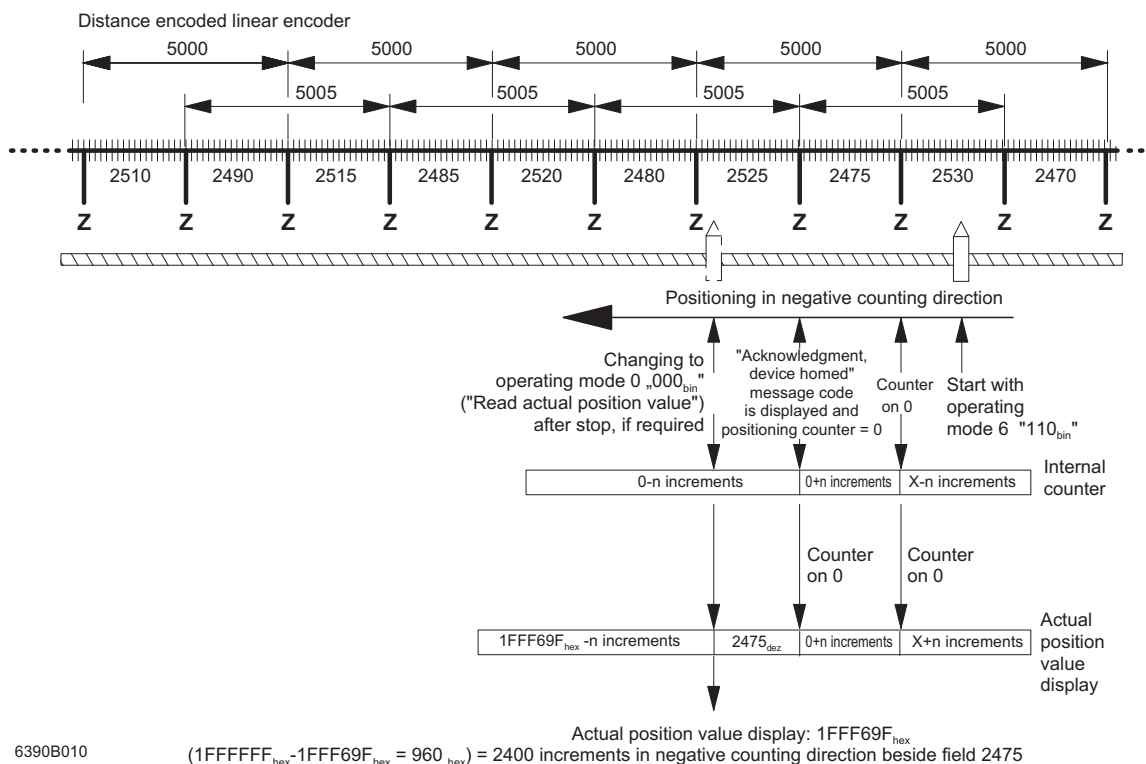
Figure 6   Example 2: Positioning in negative counting direction
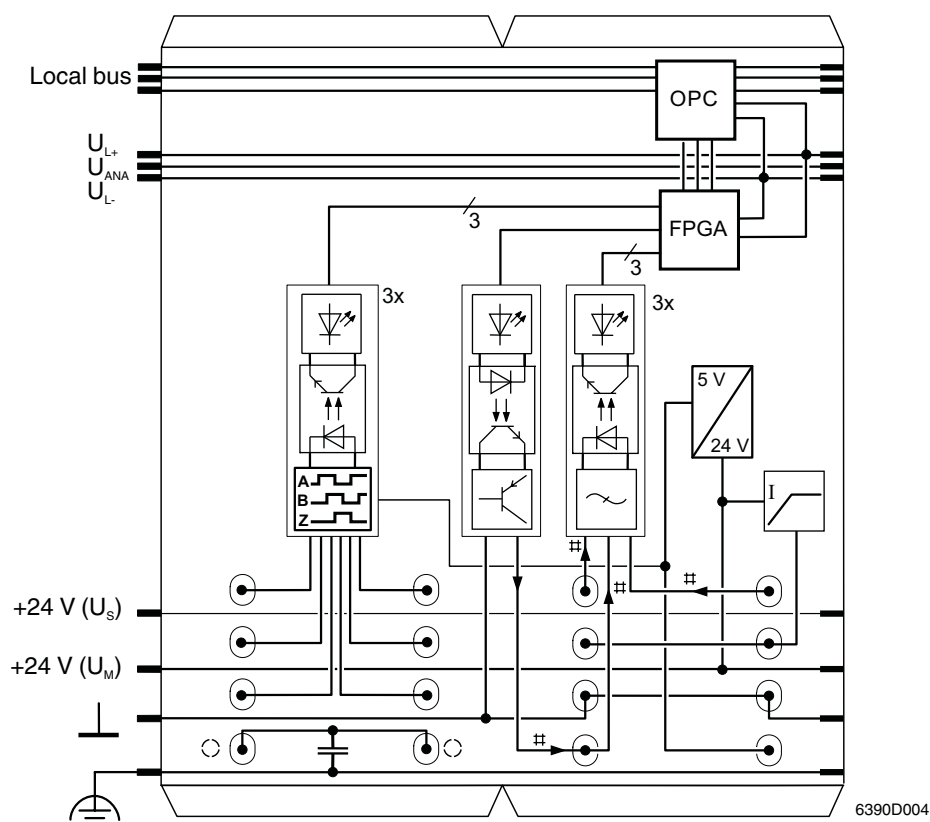
8   Basic circuit diagram

Figure 7   Internal wiring of the terminal points

Key:

OPC	Protocol chip (bus logic including voltage conditioning)
FPGA	Field-programmable gate array
	LED with function information
	Optocoupler
	Power supply unit
	Receiver for encoder signals

	Transistor
	Filter
	Encoder supply with short-circuit protection
	Input
	Coupling capacitor
	Output

9 Connection example
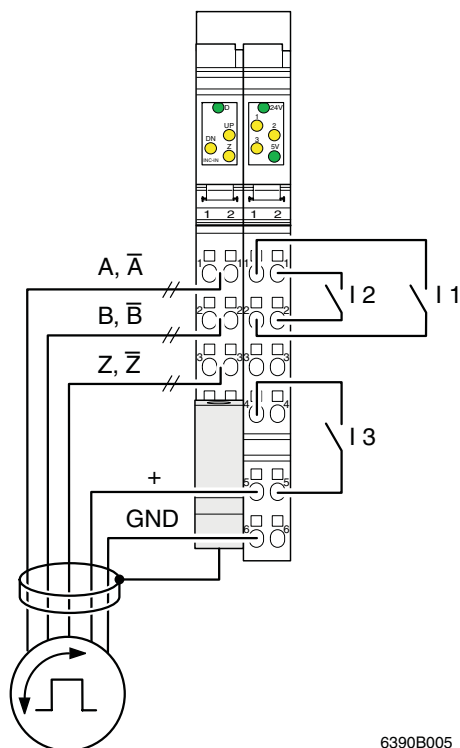
Figure 8   Typical connection with 24 V DC encoder supply

Key

Encoder/incremental encoder

10 Connection notes

> Encoders should always be connected using **shielded** twisted pair cables. Unshielded cables may lead to erroneous results in environments with heavy noise. On the terminal side, the shield is capacitively connected to functional earth ground (FE) via the shield connector. On the encoder side, the shield must be connected with the grounded encoder housing.
>
> If the encoder does not have a shield connection, the shield can also be directly connected in the control cabinet to functional earth ground via an additional shield connection clamp.

> For information on shielding and connecting shielded cables, please refer to the IB IL SYS PRO UM E user manual or the Inline system manual for your bus system.

> Please also observe the manufacturer's installation instructions for the incremental encoder.

11 Programming data/ configuration data

11.1 Local bus (INTERBUS)

ID code	$7F_{hex}$ (127_{dec})
Length code	02_{hex}
Process data channel	32 bits
Input address area	2 words
Output address area	2 words
Parameter channel (PCP)	0 bytes
Register length (bus)	2 words

11.2 Other bus systems

> For the configuration data of other bus systems, please refer to the corresponding electronic device data sheet (e.g., GSD, EDS).

12 Process data words

12.1 IN process data words

(Word.bit) view	Word	Word 0															
	Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
(Byte.bit) view	Byte	Byte 0								Byte 1							
	Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
IN[0]	Assignment	Error/message code				I3	I2	I1	Actual position value								

(Word.bit) view	Word	Word 1															
	Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
(Byte.bit) view	Byte	Byte 2								Byte 3							
	Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
IN[1]	Assignment	Position actual value															

Error/message code:	See Table "Error/message code" on page 14
Status bit I1:	Status input 1
Status bit I2:	Status input 2
Status bit I3:	Status input 3
Actual position value:	Contents of the positioning counter (25 bits)

12.2 Error/message code

IN[0] Bit				Description
15	14	13	12	
0	0	0	1	Acknowledgment, device homed
0	0	0	0	No error, device not (yet) homed
0	0	1	0	Test mode activated
0	1	0	0	Homing initiated several times If the set operating mode 1 to 6 for a homing function is changed before the terminal has output the "Device homed" acknowledgment, the "Homing initiated several times" error code is generated.
1	0	0	0	Actual position value invalid (voltage supply)
1	0	1	0	Actual position value invalid (encoder error)
1	1	0	0	Homing not possible, as evaluation not set
1	1	1	0	Actual position value invalid/evaluation changed during operation

After successful execution of the homing process status bit 12 (IN[0]) "Acknowledgment, device homed" is set. It is present until an error occurs or a new homing process is initialized.

12.3 OUT process data words

The process data output words specify the output values in each cycle.

(Word.bit) view	Word	Word 0															
	Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
(Byte.bit) view	Byte	Byte 0								Byte 1							
	Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
OUT[0]	Assignment	Operating mode			Evaluation and encoder type			OB	Reference point value for homing function							

(Word.bit) view	Word	Word 1															
	Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
(Byte.bit) view	Byte	Byte 2								Byte 3							
	Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
OUT[1]	Assignment	Reference point value for homing function															

Operating mode:	See Table "Control codes for selecting the operating mode" on page 16
Evaluation and encoder type:	See Table "Control codes for selecting the evaluation and encoder type"
OB control bit:	Set output bit (activates the "open collector" output of I3). Terminal point I3 can be used as the 24 V input or as the output with negative logic. The output connects terminal point I 3 to GND when the OB control bit is set.
Reference point value for homing function:	During homing, this value is transferred to the positioning counter, i.e., from this point onwards the reference point value forms the output value for position detection (value range 0 to 2^{25} ... 1).

> (!) **NOTE: Misinterpretation of values when the data consistency is violated**
>
> Ensure a data consistency of two words to prevent the possibility of misinterpretation of the values.

12.4 Control codes for selecting the evaluation and encoder type

OUT[0] Bit			Description
12	11	10	
0	0	0	No evaluation (no function)
0	0	1	Twofold evaluation, symmetrical encoder signals
0	1	0	Fourfold evaluation, symmetrical encoder signals
0	1	1	Single evaluation, symmetrical encoder signals
1	0	0	No evaluation (no function)
1	0	1	Twofold evaluation, asymmetrical encoder signals
1	1	0	Fourfold evaluation, asymmetrical encoder signals
1	1	1	Single evaluation, asymmetrical encoder signals

12.5 Control codes for selecting the operating mode

Operating mode	OUT[0]			Description
	Bit			
	15	14	13	
0	0	0	0	**Read actual position value**
				The positioning counter is continuously displayed in the actual position value (IN process data words 0 and 1).
1	0	0	1	**Set counter to reference point value (standstill homing)**
				The reference point value is loaded to the positioning counter and the counter immediately starts to count the incoming pulses. The "Acknowledgment, device homed" message code is displayed.
				The homing function is exited by changing to operating mode 0 ("Read actual position value"). In this mode, the positioning counter is continuously displayed.
2	0	1	0	**Homing on the next positive edge of input I1, I2 or I3* without Z**
				The reference point value is loaded in the counting register with a positive edge from one of the inputs and the "Acknowledgment, device homed" message code is displayed.
				The homing function is exited by changing to operating mode 0 ("Read actual position value"). In this mode, the positioning counter is continuously displayed.
3	0	1	1	**Homing on the next negative edge of input I1, I2 or I3* without Z**
				The reference point value is loaded in the counting register with a negative edge from one of the inputs and the "Acknowledgment, device homed" message code is displayed.
				The homing function is exited by changing to operating mode 0 ("Read actual position value"). In this mode, the positioning counter is continuously displayed.
4	1	0	0	**Homing on Z after positive edge of input I1, I2 or I3***
				The delta counting register is set to "0" with a positive edge from one of the inputs. The position value gives a positive count value, which indicates the difference between the input edge and the next positive edge of Z (adjustment value). When Z is reached, the "Acknowledgment, device homed" message code is displayed and the reference point value is loaded in the counting register. The delta value is displayed until the operating mode is changed to "Read actual position value".
				The homing function is exited by changing to operating mode 0 ("Read actual position value"). In this mode, the positioning counter is continuously displayed.

Operating mode	OUT[0] Bit			Description
	15	14	13	
5	1	0	1	**Homing on Z after negative edge of input I1, I2 or I3***
				The delta counting register is set to "0" with a negative edge from one of the inputs. The position value gives a positive count value, which indicates the difference between the input edge and the next positive edge of Z (adjustment value). When Z is reached, the "Acknowledgment, device homed" message code is displayed and the reference point value is loaded in the counting register. The delta value is displayed until the operating mode is changed to "Read actual position value".
				The homing function is exited by changing to operating mode 0 ("Read actual position value"). In this mode, the positioning counter is continuously displayed.
6	1	1	0	**Homing distance encoded incremental encoders**
				The delta counting register is set to zero with the first positive edge of the Z signal. The position value gives a positive count value, which indicates the delta between the two Z signals with the second positive edge of the Z signal. When the second Z signal is reached, the "Acknowledgment, device homed" message code is displayed and the reference point value is loaded in the counting register. The delta value is displayed until the operating mode is changed to "Read actual position value".
				The positioning counter is continuously displayed when changing to operating mode 0 ("Read actual position value").
7	1	1	1	**Test mode**
				The delta counting register is set to "0" with a positive edge from the Z signal. The delta counting register is again set to "0" with a second positive edge of Z and the position value gives a positive count value, which indicates the delta between the last two Z signals.

* Terminal point I3 can be used as the 24 V input or as the output with negative logic.

The output connects terminal point I3 to GND, when output bit OUT[0], bit 9 is set. In order for I3 to be used as an input, output bit OUT[0], bit 9 must be equal to 0.

Application example: A 0 V enable signal is required for the Z index pulse in an incremental length measuring system (ELGO Electric, Rielasingen, Germany).

Ensure that the difference between the limit switch and the first Z edge is always specified as a positive value, even if the direction of rotation or the traversing direction is negative.

NOTE:

Inputs I1 to I3 are active at the same time for the homing function in modes 2 to 5. If I3 is used as an "open collector" output, the following should be observed:

To ensure the input edges of I3 are not misinterpreted during homing, do not change output bit OUT[0], bit 9 after activating homing modes 2 to 5.