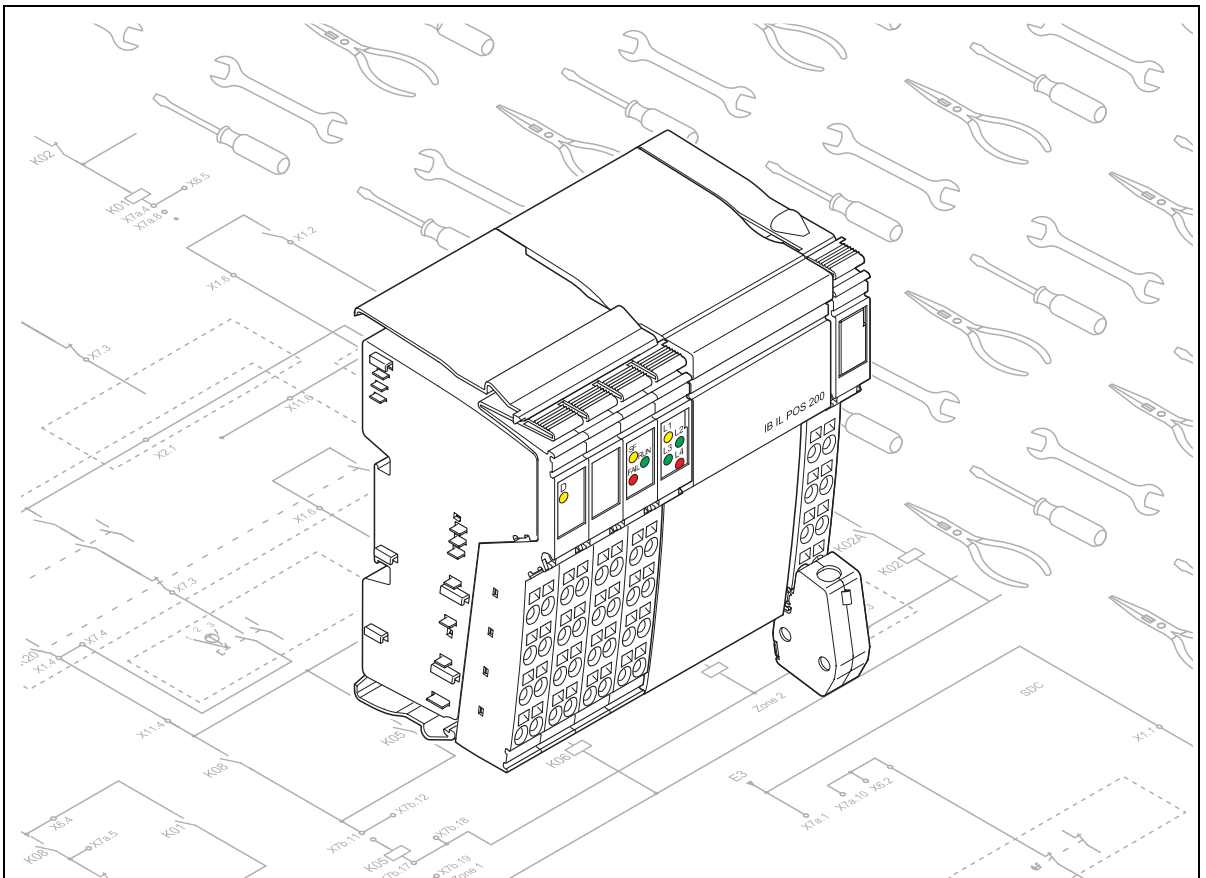


User Manual

IB IL POS 200 (-PAC) Positioning CPU

Bezeichnung: IB IL POS 200 UM E

Art.-Nr.: 26 98 08 3



User Manual

IB IL POS 200 (-PAC) Positioning CPU

Bezeichnung: IB IL POS 200 UM E

Revision: 01

Art.-Nr.: 26 98 08 3

Dieses Handbuch ist gültig für:

IB IL POS 200

28 19 33 8

IB IL POS 200-PAC

28 61 82 3

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657601



Please Observe the Following Notes:

In order to ensure the safe use of your device, we recommend that you read this manual carefully. The following notes provide information on how to use this manual.

User Group of This Manual

The use of products described in this manual is oriented exclusively to qualified electricians or persons instructed by them, who are familiar with applicable national standards. Phoenix Contact accepts no liability for erroneous handling or damage to products from Phoenix Contact or third-party products resulting from disregard of information contained in this manual.

Explanation of Symbols Used



The *attention* symbol refers to an operating procedure which, if not carefully followed, could result in damage to hardware and software or personal injury.



The *note* symbol informs you of conditions that must strictly be observed to achieve error-free operation. It also gives you tips and advice on the efficient use of hardware and on software optimization to save you extra work.



The *text* symbol refers to detailed sources of information (manuals, data sheets, literature, etc.) on the subject matter, product, etc. This text also provides helpful information for the orientation in the manual.

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About This Manual

Purpose of this manual This manual illustrates how to connect and operate the IB IL POS 200 (-PAC) positioning CPU to meet application requirements.

Who should use this manual Use this manual if you are responsible for installing and operating up to ten positioning CPUs within an Inline system. This manual is written based on the assumption that the reader possesses basic knowledge about INTERBUS and the Inline product range.

Related documentation For information on the Inline product range, please refer to the "Configuring and Installing the INTERBUS Inline Product Range" and "Automation Terminals of the Inline Product Range" User Manuals and for information on INTERBUS in general, please refer to the "Configuring and Installing INTERBUS" User Manual. For information on other bus systems, please refer to the user manual for the relevant bus terminal.

For information on PCP communication, please refer to the "Peripherals Communication Protocol (PCP)" User Manual.



User manuals and terminal-specific data sheets for other INTERBUS modules (e.g., IB IL INC-IN or IB IL SSI) are available on the Internet at www.phoenixcontact.com or can be ordered from Phoenix Contact.

Description	Order Designation	Order No.
Configuring and Installing the INTERBUS Inline Product Range	IB IL SYS PRO UM E	27 43 04 8
Automation Terminals of the Inline Product Range	IL SYS INST UM E	26 98 73 7
Configuring and Installing INTERBUS	IBS SYS PRO INST UM E	27 43 80 2
"Peripherals Communication Protocol (PCP)" User Manual	IBS SYS PCP G4 UM E	27 45 16 9

Latest documentation on the Internet Make sure you always use the latest documentation. Any changes or additions to present documentation can be found in the download area on the Internet at www.phoenixcontact.com. The Phoenix Contact homepage is updated daily.

Orientation in this manual

For easy orientation when looking for specific information the manual offers the following help:

- The manual starts with the main table of contents that gives you an overview of all the sections and their topics.
- On the left side of the pages within the sections you will see the topics that are covered in the section.
- Each manual section starts with an overview of the section topics.
- In the Appendix you will find a list of figures and a list of tables.
- In the Appendix you will also find explanations of typical INTERBUS terms, abbreviations, and symbols used in this manual.
- The index at the end of this manual helps you find the term you are looking for.

This user manual includes

An overview of the possible applications offered by the IB IL POS 200 (-PAC) positioning CPU. The following sections contain general information about working with the terminal. Topics are, for example:

- Terminal structure
- Installation and wiring
- Description of functions
- Explanation of parameter transmission (PCP)
- Explanation of process data operation
- Notes on parameterization and configuration
- Technical data

Validity of documentation

Phoenix Contact reserves the right to make any technical extensions and changes to the system that serve the purpose of technical progress. Up to the time that a new manual revision is published, any updates or changes will be documented in the download area on the Internet at www.phoenixcontact.com.

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Section 1

This section provides information about

- Fields of application and options
- The structure of the positioning CPU

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1 Function and Structure of the Positioning CPU



The IB IL POS 200 and IB IL POS 200-PAC only differ in the scope of supply (see "Ordering Data" on page 9-11). Their function and technical data are identical. For greater clarity, the Order Designation IB IL POS 200 is used throughout this user manual.

1.1 Function

The IB IL POS 200 terminal is part of the Inline product range and can be used to create modular positioning control systems. The terminal is a universal positioning CPU intended for use within an Inline station.

The positioning CPU and the relevant I/O terminals from the Inline system can be used to create scalable and bus-independent control solutions for point-to-point positioning according to the rapid/creeping speed principle (also known as switching axes) for one to ten axes. The positioning CPU controls movement to the destination. In positioning mode, the positioning CPU uses the rapid/creeping speed principle to directly switch off the drives, which can be run in "rapid motion" and "creeping motion", when the target position is reached. During positioning, the drive control is switched from rapid motion to creeping motion and then from creeping motion to stop at predefined positions. Accuracy of up to $\pm 1 \mu\text{m}$ can be achieved depending on the motor and the gears.

The IB IL POS 200 switches off the drives on reaching the target position, which means that the drives do not provide torque in the target position, unlike the drives of positioning control systems with position controllers. This positioning method is designed for applications in which the target position is retained mechanically (e.g., by a self-sustaining gear or holding brake). When compared with positioning control systems with position controllers, the rapid/creeping speed principle makes startup much easier. As there is no position controller, there is no need to enter parameters, which is not only time-consuming and prone to errors, but also means that the user requires the relevant knowledge of control systems.

A positioning CPU can control one to ten axes, which can be adapted to the controlled devices independently of one another using a separate Inline I/O terminal for position detection and a separate terminal for the drive control of each device. As various detection and output terminals are available for both functions, the required interfaces for the various encoders and drives can be combined flexibly for almost all positioning tasks.

The parameters for the input and output terminals and the positioning CPU can be set using PCP services according to DRIVECOM Profile 22. The user writes the necessary settings to the individual indices of the positioning CPU. The basic settings, which are required in the lower-level I/O terminals, are transferred to these terminals automatically by the positioning CPU. The parameters described in this user manual and a few specific basic settings for the IB IL DC AR 48/10A terminal are stored in the CPU so that they are still available when the system is shut down and restarted.

In addition to the point-to-point positioning method, the positioning CPU also supports other functions. In "Jog mode", a movement can be controlled manually. The drive travels until the relevant control bit is set. In "Step mode", the drive travels a predefined distance when the relevant control bit is set once.

Another function, "Homing mode", is available for position detection using relative detection systems, e.g., incremental encoders. This mode can be used to define limit switches as "reference points" or to set a specific position as the reference point.

Application examples

The IB IL POS 200 positioning CPU offers cost and operational advantages, in particular for the automation of less dynamic axes with speed reducers, e.g., for positioning:

- Transport equipment (conveyor belts, cranes, chain and monorail conveyors)
- Tools (spindles, saw blades, cutting and bending tools)
- Axes for format settings (setting limit stops, guideways or rollers)

The modular design of the point-to-point control system enables the use of several IB IL POS 200 CPUs, which means that any number of axes can be configured cost-effectively.

Up to ten axes can be automated using one positioning CPU, each with different actual position detection and drive control. The modern point-to-point positioning control system can be operated on INTERBUS or any other fieldbus, for which there is a Phoenix Contact Inline bus coupler, i.e., CANopen, PROFIBUS, Ethernet, or DeviceNet as well as INTERBUS.

1.2 Terminal Structure

1.2.1 Housing Dimensions

Small I/O stations are frequently installed in standard control boxes with a depth of 80 mm (3.150 in.). The Inline terminal is designed so that it can be used in this type of control box.

The IB IL POS 200 positioning CPU is an Inline terminal. The housing dimensions are determined by the dimensions of the electronics base and those of the connectors.

The electronics base for the terminal has an overall width of 109.8 mm (4.323 in.). This means that five connectors each with a width of 12.2 mm (0.480 in.) can be connected. With connectors, the terminal has a depth of 71.5 mm (2.815 in.) and a height of approx. 135 mm (5.315 in.).

Electronics base

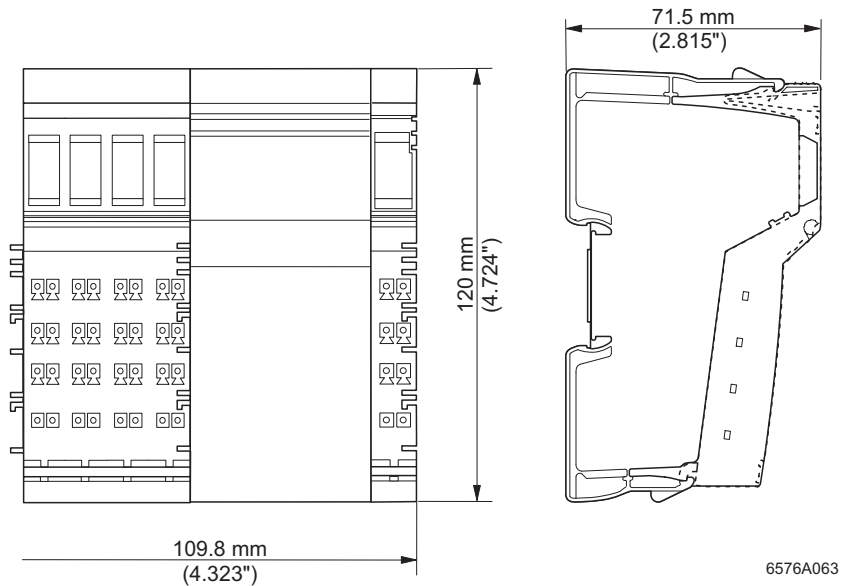


Figure 1-1 Electronics base dimensions

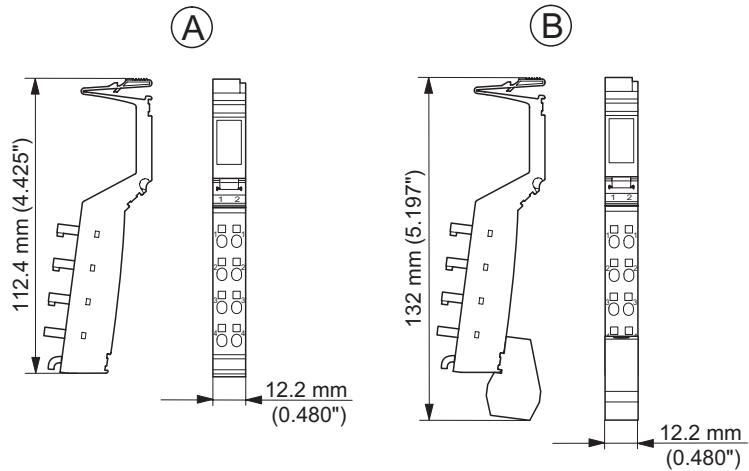
Connectors

Operation requires four IB IL SCN 8 connectors and one IB IL SCN-6 SHIELD shield connector, to which no cables are connected. Its task is to cover the contacts.

Connector 5 is only connected during parameterization via the RS-232 interface (see section "Terminal Point Assignment" on page 1-7).



Connect the Phoenix Contact parameterization software connection on connector 5 to the serial interface using the POS 200 CAB-V24 connecting cable (Order No. 28 19 53 2).



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Figure 1-2 Dimensions of the standard connector

A: Standard connector

B: Shield connector

The depth of the connector does not influence the overall depth of the terminal.

1.2.2 Terminal Point Assignment

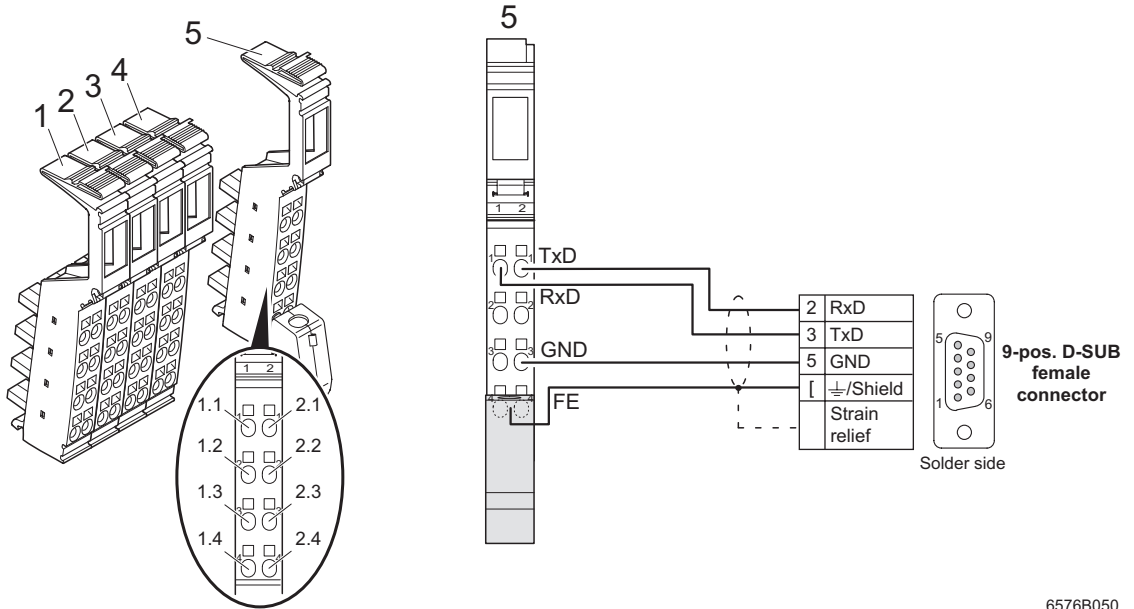



Figure 1-3 Assignment of terminal points for the positioning CPU



The terminal point assignment listed below only applies for parameterization. During normal operation, the connectors of the positioning CPU are not assigned.

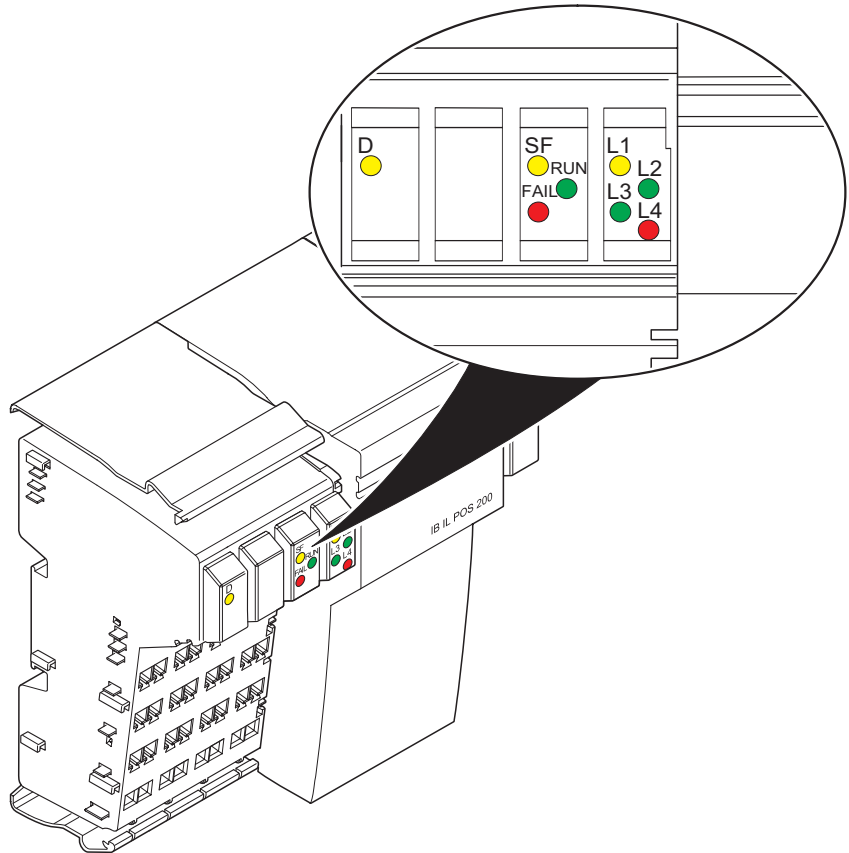
Table 1-1 Terminal point assignment

Terminal Point	Assignment		Remark
Connector 1	Reserved		
Connector 2	Reserved		
Connector 3	Reserved		
Connector 4	Reserved		
Connector 5	RS-232 (V.24) interface		
1.1	RxD	Receive data	Receive data
2.1	TxD	Transmit data	Transmit data
 <p>The RxD and TxD contacts must be connected crosswise during cable assembly (see Figure 1-3).</p>			
1.2	–		Reserved
2.2	CTS	Clear to send	Clear to send
1.3	DTR	Data terminal ready	Ready for communication
2.3	GND	Ground	Ground
1.4, 2.4	FE	Functional earth ground	Shield connection



Connect the Phoenix Contact parameterization software connection on connector 5 to the serial interface using the POS 200 CAB-V24 connecting cable (Order No. 28 19 53 2).

1.2.3 Local LED Diagnostic and Status Indicators



6576A002

Figure 1-4 Local LED diagnostic and status indicators

Table 1-2 Local LED diagnostic and status indicators

Des.	Color	Meaning
D	Yellow LED	Diagnostics for higher-level bus
	ON	Communications power present, module function error-free, bus active
	Flashing	
	0.5 Hz (slow)	Communications power present, bus not active
	2 Hz (medium)	Communications power present, I/O error
	4 Hz (fast)	Communications power present, cable interrupt before the module
	OFF	No communications power
SF	Yellow LED	System failure
	ON	The application CPU has run through a second reset after a power-on reset, check the application program
	OFF	No error
RUN	Green LED	Local bus LED (local bus running)
	ON	The lower-level bus is ready to operate and data is being transmitted
	Flashing	The lower-level bus is ready to operate but no data is being transmitted
	OFF	The lower-level bus is not ready to operate
FAIL	Red LED	Controller failure
	ON	<ul style="list-style-type: none"> – Error in the lower-level bus (bus error) – Invalid command from the application program (user error) – Internal controller error
	OFF	No error
L1	Yellow LED	Peripheral fault in the local bus
	ON	Peripheral fault in the local bus; bus can still be operated
	OFF	No peripheral fault
L2	Green LED	Transmit/receive PCP communication
	ON	PCP communication with the higher-level control system
	OFF	No PCP communication with the higher-level control system
L3	Green LED	Axis/axes ready to operate
	ON	At least one axis is configured and ready to operate
	OFF	No axis is configured or ready to operate

Table 1-2 Local LED diagnostic and status indicators (Continued)

Des.	Color	Meaning
L4	Red LED	Error in bus configuration
	ON	Error in bus configuration
	OFF	No error in bus configuration

This section provides information about

- Mounting and removing the positioning CPU
- Connecting the cables.

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2 Mounting/Removing the Positioning CPU and Connecting Cables

2.1 Installation Instructions

2.1.1 Unpacking a Terminal



ESD Regulations

Persons who handle Inline terminals must protect them by observing the ESD regulations before packing or unpacking the terminals, opening control boxes or control cabinets, and before touching the terminals.

Unpacking the Terminal

The terminal is supplied in an ESD box.



Only qualified persons should pack, unpack, mount, and remove a terminal while observing the ESD regulations.

2.1.2 Replacing Terminals



Do not replace terminals while the power is connected.

Before working on a terminal, removing a terminal from the station or inserting a terminal in the station, disconnect the power to the entire station. Make sure the entire station is completely reassembled before switching the power back on.

2.2 Mounting and Removing Terminals

The positioning terminals are designed for use within an Inline station.

An Inline station is set up by mounting the individual components side by side. No tools are required. Mounting the components side by side automatically creates potential and bus signal connections between the individual station components.

All Inline terminals are mounted on 35 mm (1.378 in.) standard DIN rails. The terminals are mounted perpendicular to the DIN rails. This ensures that they can be easily mounted and removed even within limited space.

After a station has been set up, individual terminals can be exchanged by pulling them out or plugging them in. Tools are not required.



Setting up an Inline station and the terminal mounting and removal procedure are described in the "Configuring and Installing the INTERBUS Inline Product Range" User Manual IB IL SYS PRO UM E and in the "Automation Terminals of the Inline Product Range" User Manual IL SYS INST UM E.

2.3 Voltage Supply

The terminals are supplied with power through the potential jumpers. No additional power connections are needed.

2.4 Connecting Cables



Connector 5 are only connected for parameterization.
During normal operation, the connectors of the positioning CPU are not assigned and are simply used to cover the contacts.

The terminal point assignment of the positioning CPU is described in section "Terminal Point Assignment" on page 1-7.



The connection of unshielded and shielded cables is described in the "Configuring and Installing the INTERBUS Inline Product Range" User Manual IB IL SYS PRO UM E and in the "Automation Terminals of the Inline Product Range" User Manual IL SYS INST UM E.

2.5 Structure of an Inline Station With IB IL POS 200

As shown in the typical structure (Figure 2-1 on page 2-8), the bus is supplied with power via a bus coupler (for INTERBUS, e.g., IBS IL BK-T/U). The positioning CPU is snapped onto this bus coupler, and any number of Inline I/O terminals can be inserted between the bus coupler and positioning CPU. This is known as the higher-level bus, which ends with the IB IL POS 200. To the right of the IB IL POS 200 is the lower-level bus, which includes the input and output terminals for actual position detection and drive control.

Various terminals can be used as input terminals, depending on the position detection system. The different drives and/or drive amplifiers are controlled by the relevant output terminals.

Input terminals

- Position detection terminal IB IL INC-IN
for connecting incremental encoders with symmetrical or asymmetrical square-wave signals set at 90° ranging from 4.5 V to 30 V
- Positioning control system/position detection terminal IB IL SSI + digital input terminal IB IL 24 DI 2
for connecting absolute encoders with SSI signals and up to 26-bit resolution

Output terminals

- Digital output terminal IB IL 24 DO 4
for drive control using 24 V digital signals (e.g., from asynchronous motors or pole-changing motors with contactors)
- Analog output terminal IB IL AO 2/U/BP + digital output terminal IB IL 24 DO 2
for controlling drive controllers

Operation with holding
brake:

The analog terminal outputs a defined speed with a signal from -10 V to +10 V for drives with variable speeds. The two digital terminals output an enable and brake signal.

Operation without holding
brake:

The analog terminal outputs a defined speed with a signal from 0 V to +10 V for drives with variable speeds. The two digital terminals output either an enable signal for the positive direction or an enable signal for the negative direction.

- DC drive controller IB IL DC AR 48/10A
for DC motors with brushgears up to 450 W power output

When setting up the input and output terminals for each axis, the order is not important because the terminal addresses that depend on the bus configuration can be stored in the IB IL POS 200 (see section 6.3, "Activation of Used Axes and Address Assignment for the Terminals").

To ensure easy operation and clarity in the system, we recommend inserting the input terminal(s) for each axis first and then positioning the output terminal(s) to the right of them.



The order numbers for the various input and output terminals can be found in the "Ordering Data" on page 9-11.

Typical structure

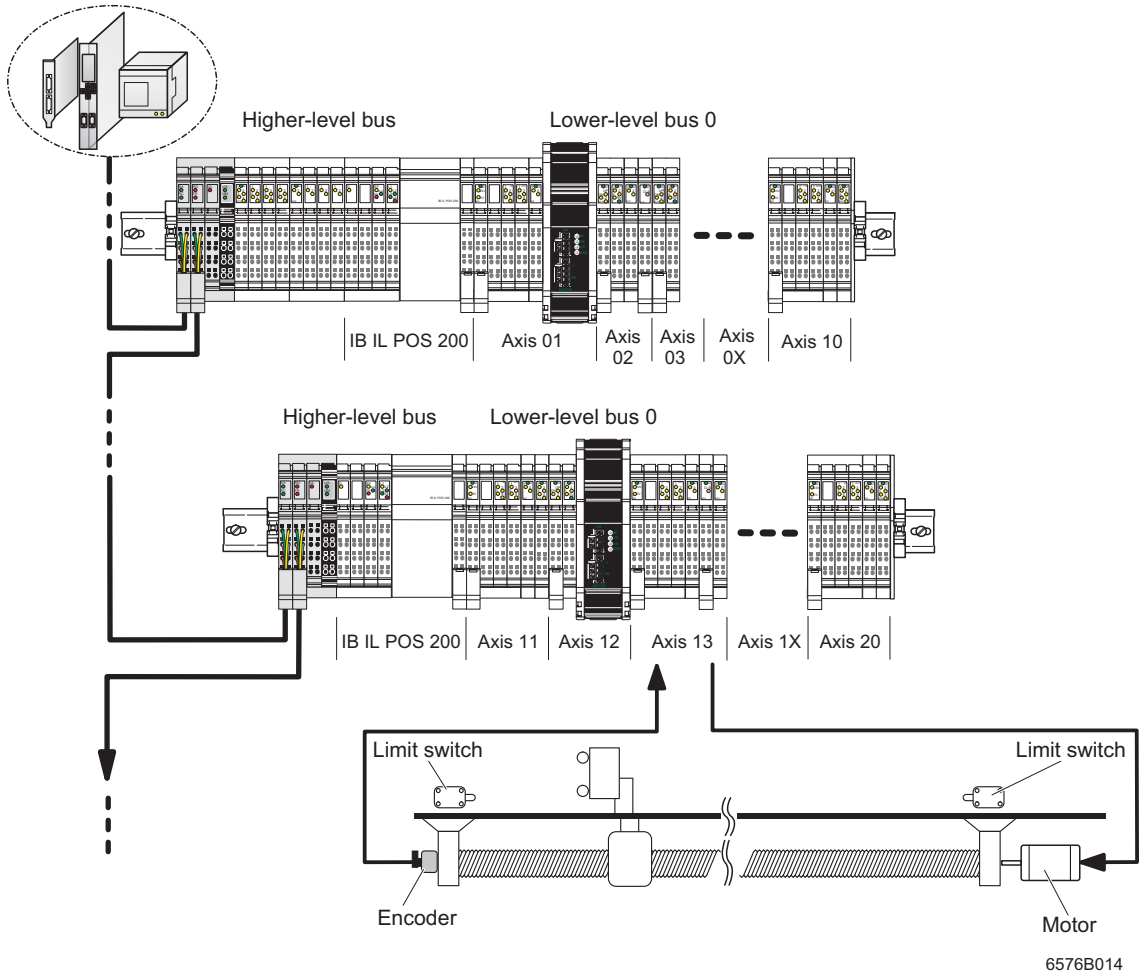
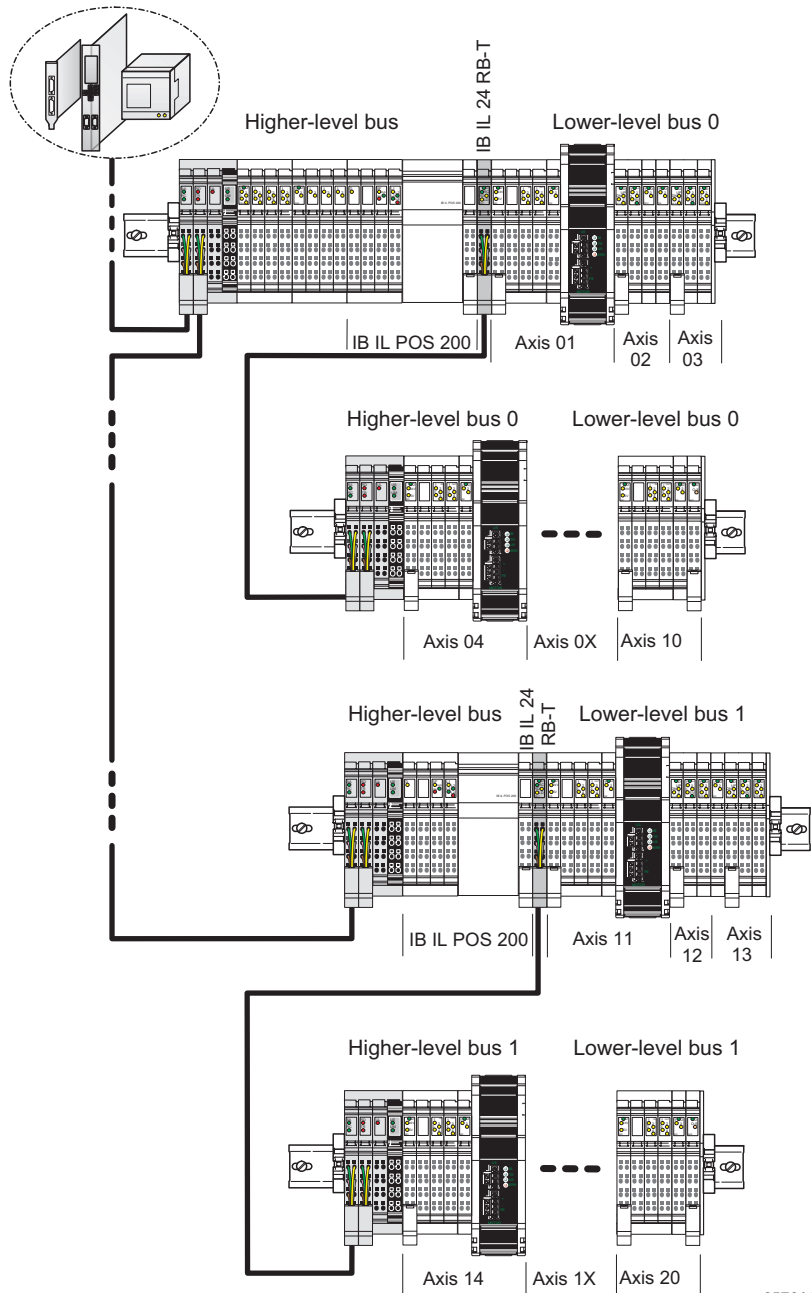


Figure 2-1 Typical architecture of an Inline station with IB IL POS 200 and all the different options for input and output terminals

2.6 Typical Architecture in the Control Cabinet

The Inline system and the IBS IL 24 RB-T branch terminal can be used to isolate the lower-level bus, so that it can be continued at a different location (see Figure 2-2 on page 2-10). This is a useful option if the required input and output terminals cannot be housed in one row. The IB IL POS 200 supports this function. It is also possible to use several branch terminals (e.g., IBS IL 24 RB-T) next to one another to branch to different DIN rails.



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Figure 2-2 Typical architecture in the control cabinet

2.7 Terminal Assignment for Input and Output Terminals When Operated With the IB IL POS 200



The order numbers for the various input and output terminals can be found in the "Ordering Data" on page 9-11.



The functions of the individual output versions are described in section 6, "Basic Parameterization".

2.7.1 Output Terminal IB IL AO 2/U/BP + IB IL 24 DO 2 Without Holding Brake

IB IL AO 2/U/BP

Terminal Point	Signal	Assignment
1.1	U1	Voltage output 1 (0 V to +10 V analog)
2.1	U2	Voltage output 2 (not used)
1.2, 2.2	–	Not used
1.3, 2.3	AGND	Voltage output ground
1.4, 2.4	Shield	Shield connection

IB IL 24 DO 2

Terminal Point	Assignment	Remark
1.1	Signal output (OUT1)	Enable positive motion
2.1	Signal output (OUT2)	Enable negative motion
1.2, 2.2	Segment voltage U_S for 4-wire termination Measuring point for the supply voltage	
1.3, 2.3	Ground contact (GND) for 2, 3, and 4-wire termination	
1.4, 2.4	FE connection for 2 and 3-wire termination	

2.7.2 Output Terminal IB IL AO 2/U/BP + IB IL 24 DO 2 With Holding Brake

IB IL AO 2/U/BP

Terminal Point	Signal	Assignment
1.1	U1	Voltage output 1 (-10 V to +10 V analog)
2.1	U2	Voltage output 2 (not used)
1.2, 2.2	–	Not used
1.3, 2.3	AGND	Voltage output ground
1.4, 2.4	Shield	Shield connection

IB IL 24 DO 2

Terminal Point	Assignment	Remark
1.1	Signal output (OUT1)	Enable
2.1	Signal output (OUT2)	Brake
1.2, 2.2	Segment voltage U_S for 4-wire termination Measuring point for the supply voltage	
1.3, 2.3	Ground contact (GND) for 2, 3, and 4-wire termination	
1.4, 2.4	FE connection for 2 and 3-wire termination	

2.7.3 Output Terminal IB IL 24 DO 4

IB IL 24 DO 4

Terminal Point	Assignment
1.1	Signal output (OUT 1)
2.1	Signal output (OUT 2)
1.2, 2.2	Ground contact (GND) for 2 and 3-wire termination
1.3, 2.3	FE connection for 3-wire termination
1.4	Signal output (OUT 3)
2.4	Signal output (OUT 4)
1.5, 2.5	Ground contact (GND) for 2 and 3-wire termination
1.6, 2.6	FE connection for 3-wire termination

2.7.4 Input Terminal IB IL SSI + IB IL 24 DI 2

IB IL SSI

Terminal Point	Assignment	Remark
Connector 1		
1.1	+24 V	+24 V encoder supply
1.2	GND	Reference ground for encoder supply
1.3	+5 V	+5 V encoder supply
1.4	Shield	Shield connection (high resistance and a capacitor to FE)
2.1, 2.2 2.3, 2.4	–	Not used
Connector 2		
1.1	T	Clock
1.2	\bar{T}	Clock inverted
1.3	D	Data
1.4	\bar{D}	Data inverted
2.1, 2.2 2.3, 2.4	–	Not used



Connectors 3 and 4 of the IB IL SSI terminal are not used when it is operated with the IB IL POS 200.

IB IL 24 DI 2

Terminal Point	Assignment	Remark
1.1	Signal input 1 (IN1)	Minimum hardware limit switch
2.1	Signal input 2 (IN2)	Maximum hardware limit switch
1.2, 2.2	Segment voltage U_S for 2, 3, and 4-wire termination	
1.3, 2.3	Ground contact (GND) for 3 and 4-wire termination	
1.4, 2.4	FE connection for 4-wire termination	

2.7.5 Input Terminal IB IL INC-IN

IB IL INC-IN

Terminal Point	Signal	Assignment	
		Symmetrical Encoder	Asymmetrical Encoder
Connector 1			
1.1, 2.1	A, \bar{A}	Channel A, channel A inverted	Channel A, free
1.2, 2.2	B, \bar{B}	Channel B, channel B inverted	Channel B, free
1.3, 2.3	Z, \bar{Z}	Channel Z, channel Z inverted	Channel Z, free
1.4, 2.4	Shield	Encoder cable shield	Encoder cable shield

Terminal Point	Signal	Assignment
Connector 2		
1.1	E1	Input for limit switch 1 (minimum hardware limit switch)
2.1	E2	Input for limit switch 2 (maximum hardware limit switch)
1.2, 2.2	24 V	24 V encoder/limit switch supply
1.3, 2.3	GND	0 V encoder/limit switch supply
1.4	E3	Input for homing position switch or NPN output
2.4	5 V	5 V encoder/limit switch supply
1.5, 2.5	24 V	24 V encoder/limit switch supply
1.6, 2.6	GND	0 V encoder/limit switch supply

This section provides information about
– The functions of the positioning CPU

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3 Functions of the Positioning CPU

The IB IL POS 200 positioning CPU supports three motion operating modes and homing mode (Ref mode) for each connected axis. Jog mode, step mode or positioning mode (Pos mode) can be selected, depending on the application. Homing mode and homing are required when using relatively operating position detection systems for positioning mode and step mode. These functions are selected and controlled via the control byte. The details are given in section 5, "State Machine".

Jog mode

In Jog mode, an axis is moved in a specific direction at a parameterizable speed (JogValue) as long as the relevant bit is set in the control byte. This function is used, for example, when setting up machines.

Step mode

In Step mode, the axis is moved a defined distance relative to the actual position. In this mode, the step speed and step distance can be parameterized.

Pos mode

In Pos mode (positioning mode) the higher-level control system sends an absolute target position to the positioning CPU. Positioning can be started by the higher-level control system via a control bit. The modular positioning CPU then carries out positioning automatically and confirms the result to the higher-level control system in the status byte (hand shaking between supervisor CPU and positioning CPU).

The positioning CPU uses the rapid/creeping speed principle for positioning. Positioning is started at rapid speed. In order to reach the target as precisely as possible, the drive is switched to creeping speed at a defined position and then switched off at the stop point. Once the target position is reached, the drive is switched off, which means that it does not provide torque in the target position.

Due to its fast-response logic, the positioning CPU can achieve a positioning accuracy in the μm range using this simple method. The actual position value can be read in every bus cycle.

Ref mode

Ref mode (homing mode) is used in relatively operating position detection systems to set the positioning counter to zero at a specific position. This is necessary because when the system is switched on the positioning counter is set to zero, but the axis is not necessarily at the zero point; it is at whatever position it was moved to before the system was shut down.

A selected hardware limit switch is used as the reference signal. For positioning counter homing, the positioning CPU offers either an automatic homing function or Jog mode, in which the axis is moved to a position at which a reference point is set via the control bit.

3.1 Jog Mode

In Jog mode, a control bit can be used to move the axis as long as this bit is active. There are separate control bits for "Right" and "Left". If the higher-level control system reads in the signal from pushbuttons, the drive can be moved in a specific direction using these pushbuttons.

When incremental encoders are operated with the IB IL INC-IN terminal, there is no need to home the axis in advance.



Please note that the software limit switches do not limit the positioning range if the axis is not homed. In this case, the positioning range is only limited by the hardware limit switches.

3.1.1 Jog Speed (JogValue)

If drives with adjustable speed are used, the speed can be freely selected for both directions in Jog mode. For the IB IL AO 2/U/BP + IB IL 24 DO 2 and IB IL DC AR 48/10A output versions, the speed values are specified as a percentage of the maximum speed.

For the IB IL 24 DO 4 output version, the speeds specified by the contactor circuits in rapid or creeping motion are used (see section 4.6, "Effect of Speed Parameters on the IB IL 24 DO 4 Output Version").

3.2 Step Mode

In Step mode, the axis is moved a defined distance relative to the current position, i.e., a drive can be manually moved very small or even large predefined distances from the current value. For precise positioning with a high degree of accuracy, the use of positioning mode (absolute positioning) is recommended.



When incremental encoders are operated with the IB IL INC-IN terminal, ensure that the axis has been homed in advance.

3.2.1 Step Speed (StepSpeed)

If drives with adjustable speed are used, the speed can be freely selected for both directions in Step mode. For the IB IL AO 2/U/BP + IB IL 24 DO 2 and IB IL DC AR 48/10A output versions, the speed values are specified as a percentage of the maximum speed.

For the IB IL 24 DO 4 output version, the speeds specified by the contactor circuits in rapid or creeping motion are used (see section 4.6, "Effect of Speed Parameters on the IB IL 24 DO 4 Output Version").

3.2.2 Step Distance and Step Stop Window (StepUnit and StepStopWindow)

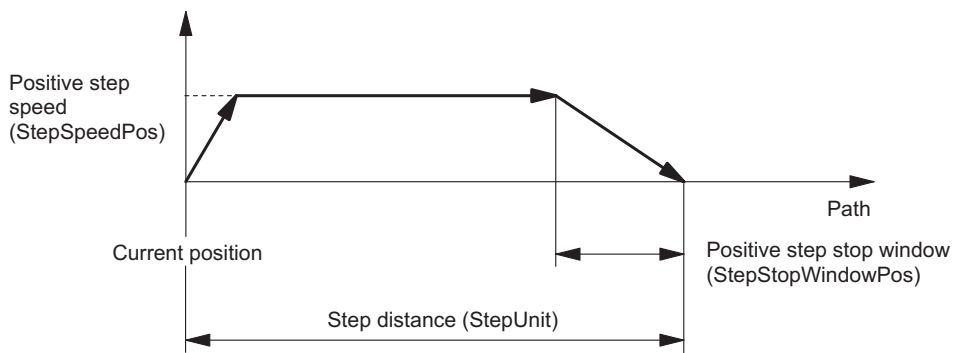
The desired step distance (StepUnit) can be parameterized and refers to the gear ratio. As the speeds can be freely parameterized, a stop window (StepStopWindow) must also be parameterized to provide the highest possible degree of positioning accuracy. The distance required by the axis to come to a stop after the drive is shut down is entered in this window. In step mode, one stop window can be parameterized for the positive direction and one for the negative direction.



Please note that if the speed is modified the stop window must also be adjusted.
When parameterizing the step distance, ensure that the drive is able to reach the set speed. Looping is not supported in this operating mode.

The drive is shut down at the value equal to the step distance minus the stop window. This takes the drive coasting range into account.

**Example of Jog mode
in a positive direction**



6576A013

Figure 3-1 Example of Jog mode in a positive direction

3.3 Positioning Mode (Absolute Positioning)

Positioning mode (Pos mode) can be used to move a drive with absolute position specifications to a target position, i.e., positioning mode can be used to precisely move a drive small or even large distances to a defined target position.



When incremental encoders are operated with the IB IL INC-IN terminal, ensure that the axis has been homed in advance.

Function

The positioning CPU uses the rapid/creeping speed principle for positioning. In this method, positioning starts at rapid speed. At a predefined point, the drive switches to creeping speed, which allows it to approach the target slowly (increased positioning accuracy). At the stop point, the drive then switches from creeping speed to stop.

During the positioning process, the positioning CPU controls the output signals for drive control once positioning has started. As soon as the axis exceeds the predefined position thresholds, the CPU first switches from rapid speed to creeping speed and then from creeping speed to stop. Once the target position is reached, the drive is shut down, i.e., it does not provide torque in the target position.

Due to its fast-reacting logic, the positioning CPU, used together with an input and output terminal, can achieve a positioning accuracy in the μm range using this simple method.

Logic

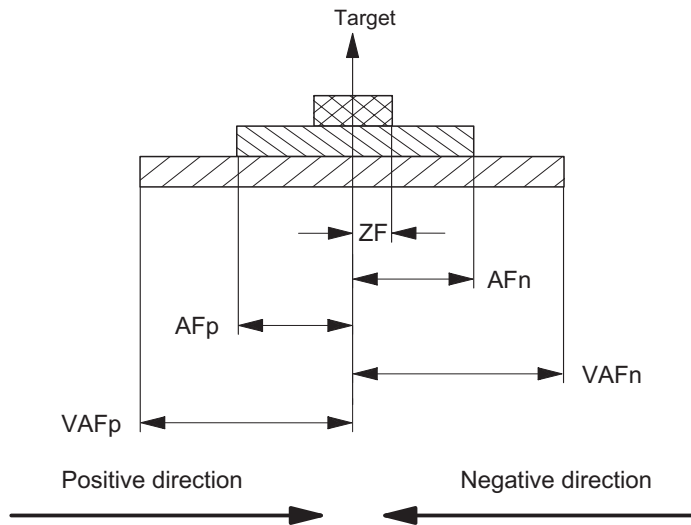
The IB IL POS 200 logic operates internally as follows:

The current position value is compared with the specified target position and the parameterized window limits. Depending on the result of the comparison, the direction of travel is determined and the relevant output bits or analog values for controlling the drive are sent to the I/O terminals for drive control.

For linear axes, the target is approached in a positive or negative direction, depending on whether the difference between the target position and actual position is positive or negative.

The position that is actually reached can be read via INTERBUS PCP under "CurrentPosition".

3.3.1 Definition of Parameters for the Target Area for Positioning



6576A047

Figure 3-2 Target area for positioning

Key:

VAFp

Positive pre-stop window (PreStopWindowPos)

This specifies the position at which the drive switches from rapid speed to creeping speed. This value applies for positioning in a positive direction.

VAFn

Negative pre-stop window (PreStopWindowNeg)

This specifies the position at which the drive switches from rapid speed to creeping speed. This value applies for positioning in a negative direction.

AFp	<p>Positive stop window (StopWindowPos)</p> <p>This value is the distance, which the drive travels after the motor is stopped. This value applies for positioning in a positive direction.</p>
AFn	<p>Negative stop window (StopWindowNeg)</p> <p>This value is the distance, which the drive travels after the motor is stopped. This value applies for positioning in a negative direction.</p>
ZF	<p>Target window for the position reached (TargetWindow)</p> <p>This window can be used to check the target position reached. If the position reached is not in this window, an error message is output. A \pm range is defined either side of the current target position.</p>

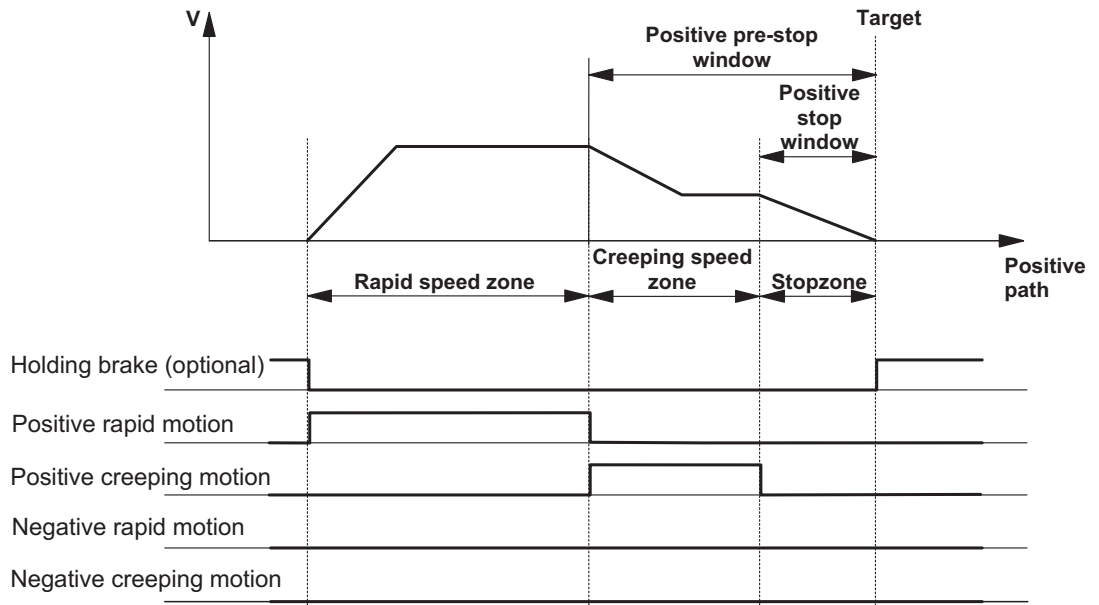
3.3.2 Positioning Sequence and Structure of Positioning Data Records

In order to approach the specified target position, the drive is controlled by the positioning CPU automatically, depending on the actual position.

The value for the target position and the parameters, which define the positions for changing speed are written to the positioning CPU by the higher-level control system. During positioning, the CPU recognizes the individual states (e.g., negative creeping speed) and controls the drive accordingly. Drives with the IB IL DC AR 48/10A and IB IL AO 2/U/BP + IB IL 24 DO 2 output version are controlled using the parameters for rapid and creeping speed. For the IB IL 24 DO 4 output version (e.g., for pole-changing motors, Dahlander circuit, etc.) the output bits for rapid and creeping speed are set accordingly.

Once positioning is complete, i.e., once the drive has been stopped, the positioning CPU checks whether positioning was successful and determines whether the axis position is in the target window. If it is in the target window, positioning is confirmed by a positive acknowledgment.

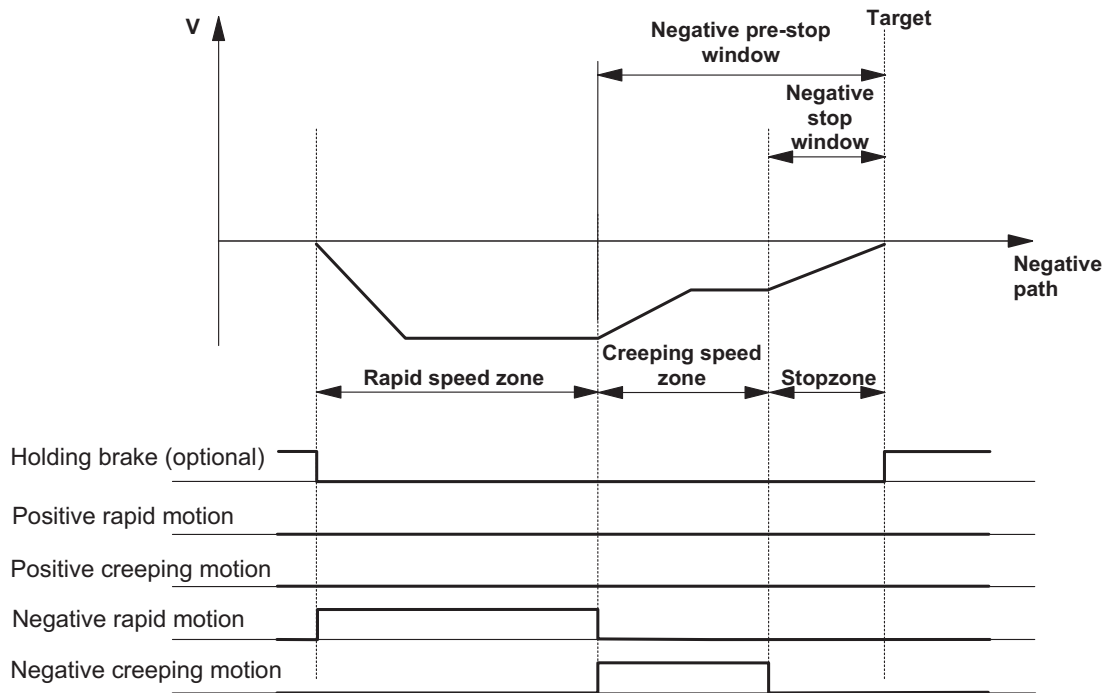
3.3.3 Sequence of Positioning in a Positive Direction



6576A015

Figure 3-3 Sequence of positioning in a positive direction

3.3.4 Sequence of Positioning in a Negative Direction



6576A016

Figure 3-4 Sequence of positioning in a negative direction

As can be seen in the diagrams, positioning begins directly with startup at rapid speed. At the start of positioning, if the difference between the target value and the current position value is less than the value of the pre-stop window, then the drive will loop at creeping speed. The stop window and creeping speed should be adjusted to ensure that the target window is reached.



Please note that the pre-stop window must be greater than the stop window.

3.3.5 Positioning Speed (RapidSpeed, CreepingSpeed)

If drives with adjustable speed are used, the speed can be freely selected for both directions in Positioning mode (Pos mode). For the IB IL AO 2/U/BP + IB IL 24 DO 2 and IB IL DC AR 48/10A output versions, the speed values are specified as a percentage of the maximum speed.

Four speeds must be parameterized in positioning mode:

- Rapid speed in a positive direction
- Rapid speed in a negative direction
- Creeping speed in a positive direction
- Creeping speed in a negative direction



Rapid speed must be greater than creeping speed.

For the IB IL 24 DO 4 output version, the speeds specified by the contactor circuits in rapid or creeping motion are used (see section 4.6, "Effect of Speed Parameters on the IB IL 24 DO 4 Output Version").

3.3.6 Looping

If the current position is within the pre-stop window but not yet in the target window, looping is always used to reach the target position.

The loop distance (LoopDistance) and the direction of travel (TargetDirection) must be parameterized for looping. Ensure that the loop distance is greater than or equal to the largest pre-stop window, otherwise an error message is displayed.

If the pre-stop window corresponds to the distance required to switch from rapid to creeping speed and the loop distance is equal to the pre-stop window, the target position may not be reached during looping. In this case, when the loop distance and pre-stop window are parameterized, the distance required by the drive to reach creeping speed on startup should be added. These two parameterized values are also valid for backlash compensation (see section 3.3.7, "Backlash Compensation").

The loop distance is the distance that is added to or subtracted from the target position depending on the direction of travel. Once this point is reached, the direction of travel changes and the target position is approached again (see examples 1 to 4).

This means that the drive passes the target position once and then changes direction when it reaches the "target position \pm loop distance" point, in order to approach the target position again.

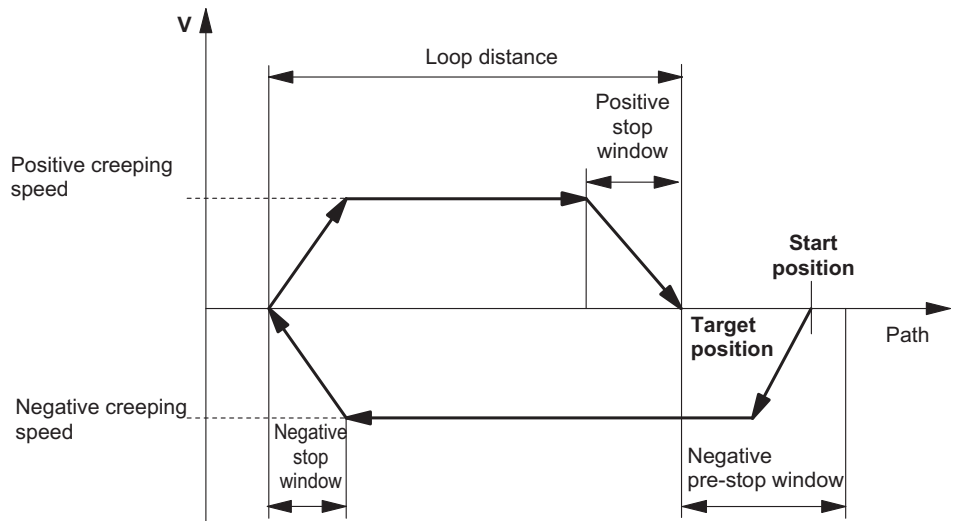
If the positioning process is close to the limit switches, a limit switch may be passed during looping. In this case, positioning is aborted at the limit switch and an error message is generated, even though the target position is in the defined range.

To solve this problem, change the looping direction, reduce the loop distance (if possible) or approach the target from a new initial position.



Looping is carried out completely at creeping speed.

Example 1

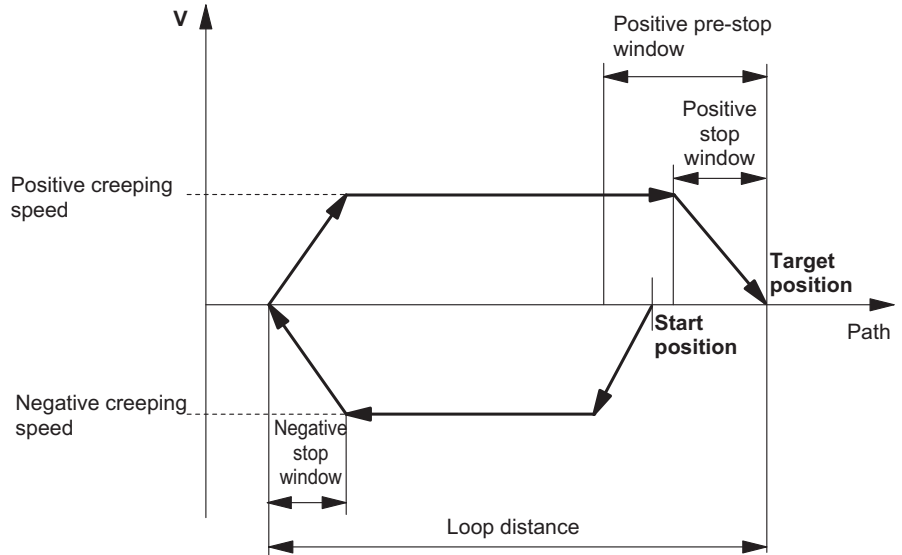


6576A017

Figure 3-5 Example 1: Looping

- Desired direction of travel when approaching the target (TargetDirection) is positive
- Start position > target position
- Negative pre-stop window > (start position \rightarrow target position)

Example 2

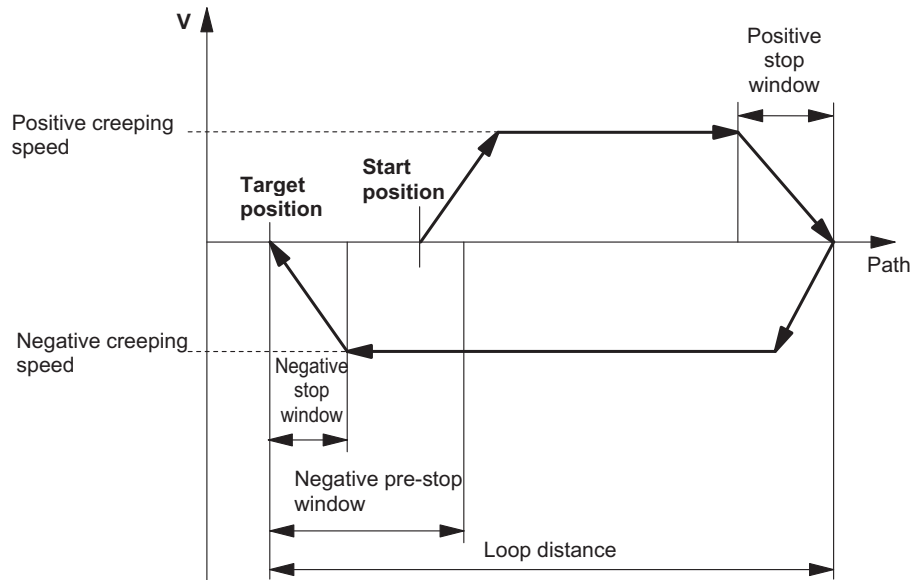


6576A018

Figure 3-6 Example 2: Looping

- Desired direction of travel when approaching the target (TargetDirection) is positive
- Start position < target position
- Positive pre-stop window > (target position → start position)

Example 3

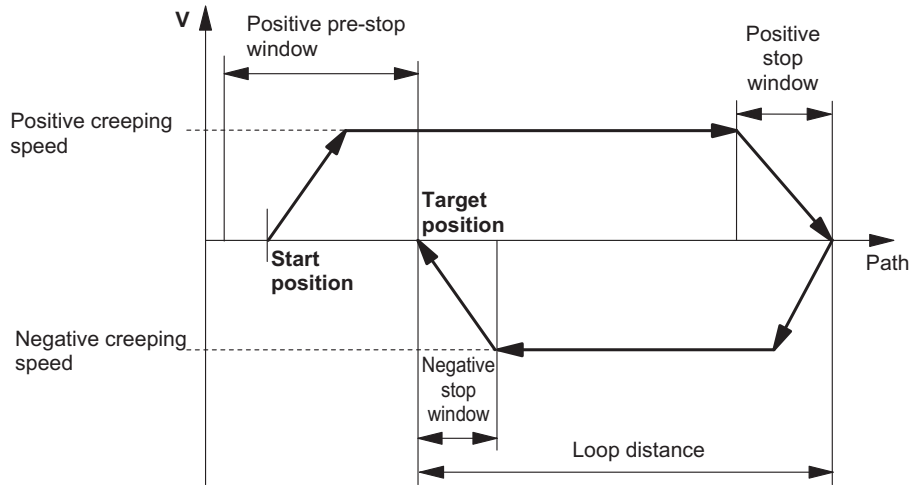


6576A019

Figure 3-7 Example 3: Looping

- Desired direction of travel when approaching the target (TargetDirection) is negative
- Start position > target position
- Negative pre-stop window > (start position → target position)

Example 4



6576A020

Figure 3-8 Example 4: Looping

- Desired direction of travel when approaching the target (TargetDirection) is negative
- Start position < target position
- Positive pre-stop window > (target position → start position)

3.3.7 Backlash Compensation

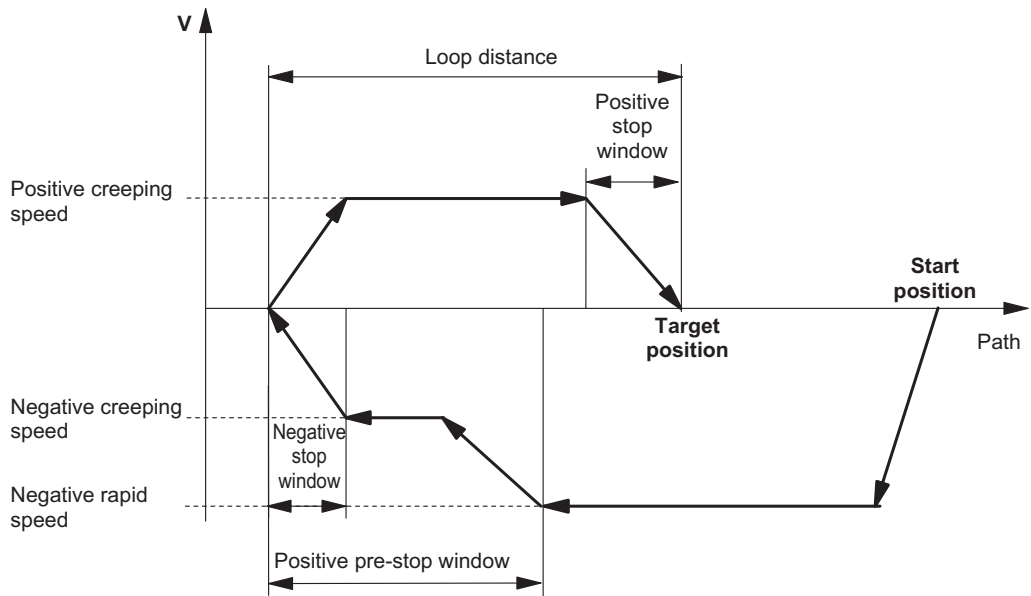
Usually, drive systems have clearance, called "backlash" in practice. Every time the direction changes, the backlash causes a motor rotation without changing the drive position. The connection of the position encoder with the motor axis leads to a reduction of the positioning accuracy. The positioning CPU enables you to compensate for the backlash by approaching all positions from one direction.

The backlash compensation function can be enabled during parameterization (EnableBacklashCompensation). If backlash compensation is enabled, this only has an effect if the start position → target position path does not correspond to the parameterized direction of travel for approaching the target (TargetDirection). In this case, the axis is first moved the loop distance value (LoopDistance) past the target, and then the target is approached from the desired direction (see "Example 1" on page 3-13 and "Example 2" on page 3-14).

If, due to active backlash compensation, the direction of travel must be changed to reach the target, a limit switch may be passed during looping. In this case, positioning is aborted at the limit switch and an error message is generated, even though the target position is in the defined range. If possible, the parameters (software limit switch, loop distance) should be modified so that limit switches are not passed, even during backlash compensation (for parameters, see page 7-7).

The approach from the correct target approach direction is carried out completely at creeping speed. The values for the change in direction are taken from the loop distance (LoopDistance) and direction of travel (TargetDirection) parameters (see section 3.3.6, "Looping").

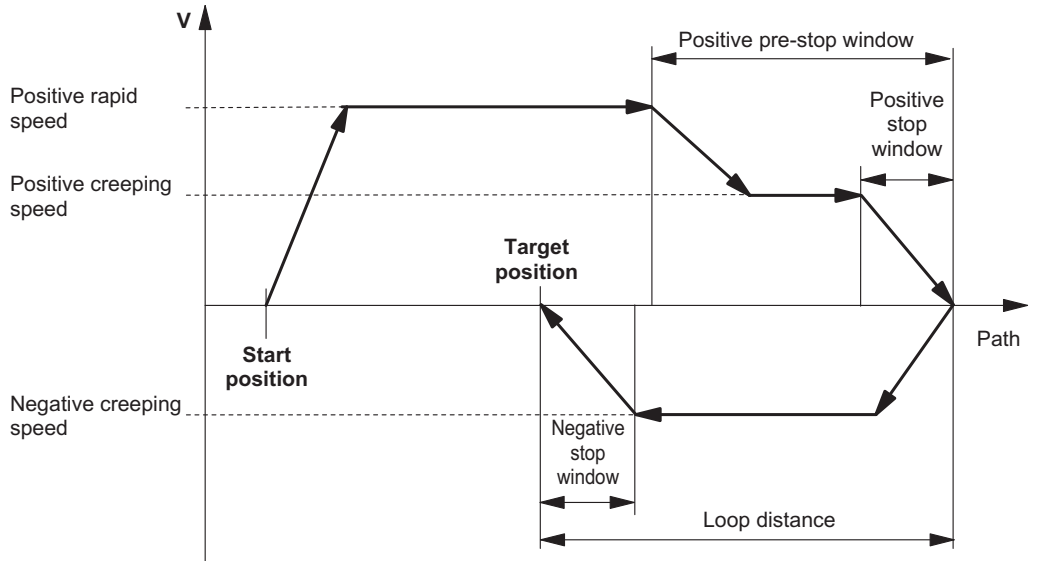
Example 1



6576A021

Figure 3-9 Sequence of positioning with backlash compensation (parameterized direction of travel when approaching the target: positive, Start position → target position path: negative)

Example 2



6576A022

Figure 3-10 Sequence of positioning with backlash compensation
 (parameterized direction of travel when approaching the target:
 negative, Start position → target position path: positive)

3.3.8 Positioning Accuracy

The positioning accuracy depends on the mechanics and the speed. The slower the drive approaches the target, the more precisely the target is reached. A positioning accuracy in the μm range can be achieved. The windows and speeds should be parameterized by the user according to the desired degree of accuracy.

The following parameters have a direct effect on the positioning accuracy:

- Creeping speed
- Stop window
- Target window

If the Creeping Speed Is Increased:

The stop window must be adjusted to the new creeping speed. If the creeping speed is increased, the stop window must also be increased because the drive requires a longer stop zone at a higher speed.

The higher the creeping speed, the more difficult it is to achieve a high degree of accuracy. If necessary, the target window can also be increased. This process is more dynamic, but less accurate.

If the Creeping Speed Is Reduced:

The stop window must be adjusted to the new creeping speed. If the creeping speed is reduced, the stop window must also be reduced because the drive requires a shorter stop zone at a lower speed.

The lower the creeping speed, the easier it is to achieve a high degree of accuracy. If necessary, the target window can be reduced. This process is less dynamic, but more accurate.

3.4 Homing Mode

Relatively operating position detection systems are read via input terminals, which operate using positioning counters. These positioning counters are set to zero when switched on. To read usable information from the positioning counter after switching it on, the axis must be moved to a specific position, at which the positioning counter can then be set to the relevant position value (e.g., zero). This is known as "homing". Homing can be carried out by the IB IL POS 200 using an automatic homing function or by setting the reference point to a position, which the axis has already reached using the Jog function.

3.4.1 Homing

During homing, the positioning CPU uses the hardware limit switches as the reference signal. It controls the drive so that the axis approaches the previously selected hardware limit switch (calibration limit switch) at rapid speed. When the hardware limit switch range is entered, a signal edge is generated, which shuts down the drive. Once the drive has stopped, the hardware limit switch range is exited in the opposite direction at creeping speed. Once the hardware limit switch range has been exited, the positioning counter is set to zero on the next Z signal. At this point, the drive is shut down and coasts until it stops at position X (see Figure 3-13 on page 3-23 and Figure 3-14 on page 3-24). The Z signal is used to set the reference point in order to increase the repeat accuracy of this homing function.

A separate home position switch without limit switch function is not supported by the positioning CPU and must not be connected when the IB IL INC-IN terminal is used.

Reference offset

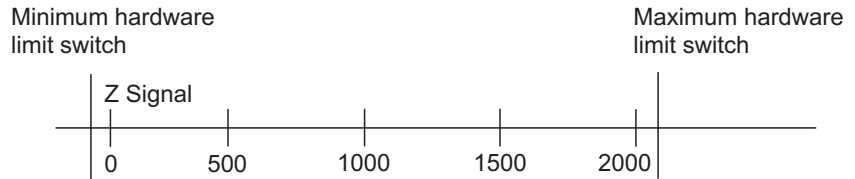
The reference offset can be used to assign a value other than "0" to the reference point (see Figure 3-11 and Figure 3-12).



Only use encoders with a Z signal if they use automatic homing.

Example 1

Reference Offset = 0

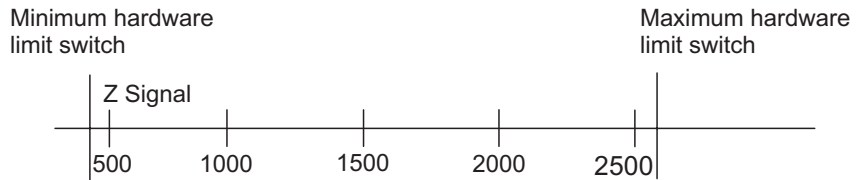


6576A027

Figure 3-11 Reference offset = 0

Example 2

Reference Offset = 500



6576A028

Figure 3-12 Reference offset = 500

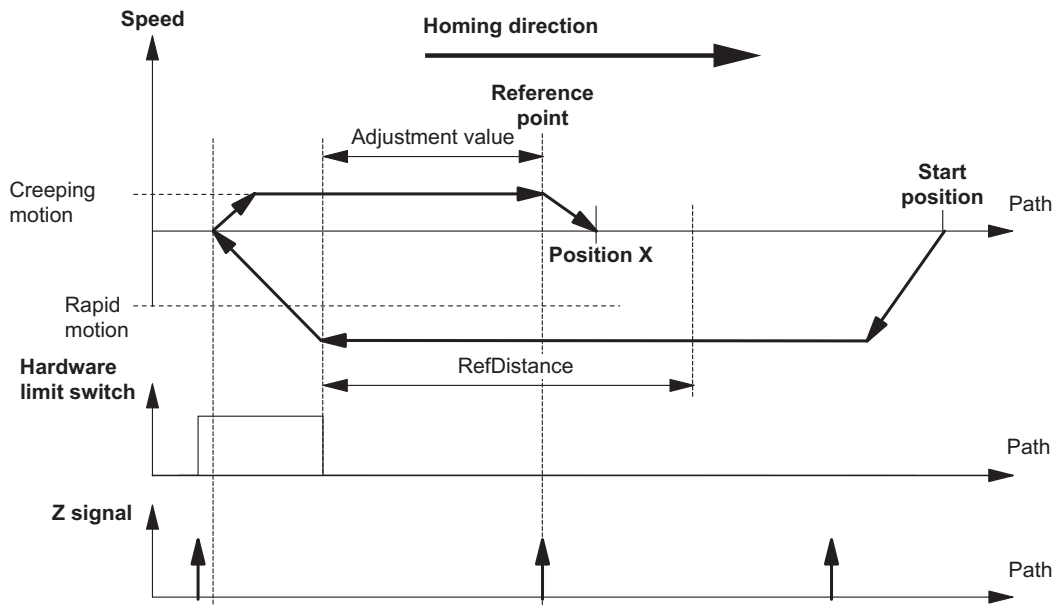
Selecting a Hardware Limit Switch as the Home Position Switch and the Associated Homing Direction

Parameters can be set to determine which limit switch should be approached and to specify the direction of homing to the Z signal.



For a positive homing direction, the minimum hardware limit switch must be selected (combination 1, Figure 3-13), and for a negative homing direction, the maximum hardware limit switch must be selected (combination 2, Figure 3-14).

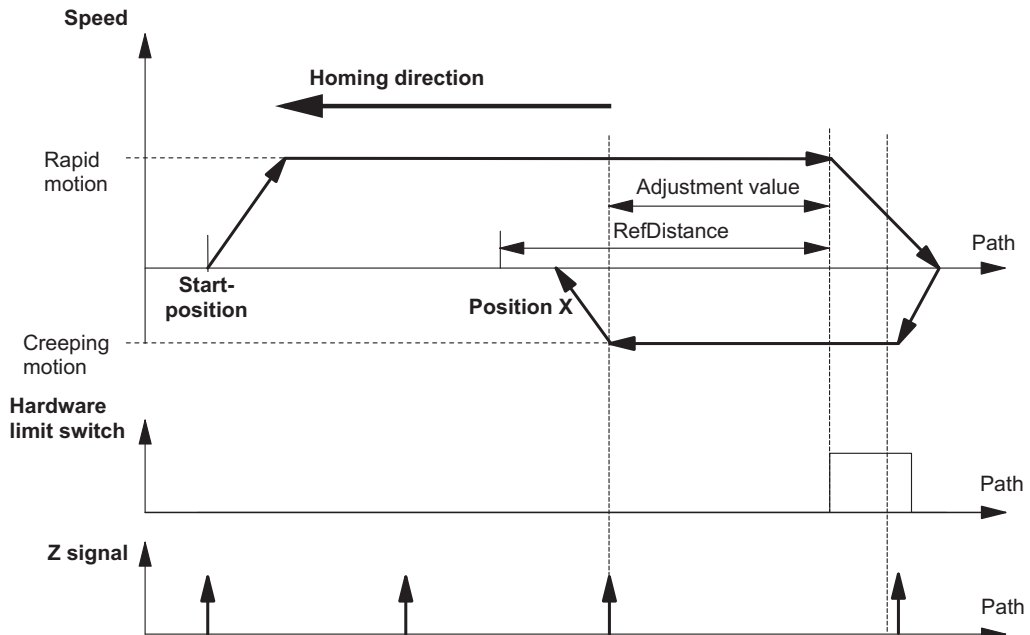
Homing Sequence Using Combination 1



6576A024

Figure 3-13 Homing sequence using combination 1

Homing Sequence Using Combination 2



6576A023

Figure 3-14 Homing sequence using combination 2

3.4.2 Setting the Reference Point (SetRef)

In order to set the reference point without homing, the user must move the axis to the desired position using the Jog function. The control byte is used to set the positioning counter at this position to the value stored in the "Reference offset" parameter.

3.4.3 Reference Speed (RefSpeed)

Homing is carried out at two speeds. Rapid speed is used until the hardware limit switch is reached. Creeping speed is used to exit the limit switch range in the opposite direction and to reach the next Z signal.

The parameterized creeping speed indirectly determines the distance between the position X and the Z signal: the higher the creeping speed, the greater the distance.

For the IB IL AO 2/U/BP + IB IL 24 DO 2 and IB IL DC AR 48/10A output versions, the speeds can be freely selected. However, rapid speed must be greater than creeping speed, otherwise an error message will be generated. The speed values are specified as a percentage of the maximum speed.

For the IB IL 24 DO 4 output version, the speeds specified by the contactor circuits in rapid and creeping motion are used (see section 4.6, "Effect of Speed Parameters on the IB IL 24 DO 4 Output Version").

3.4.4 Distance Between Hardware Limit Switch and Zero Point (RefDistance)

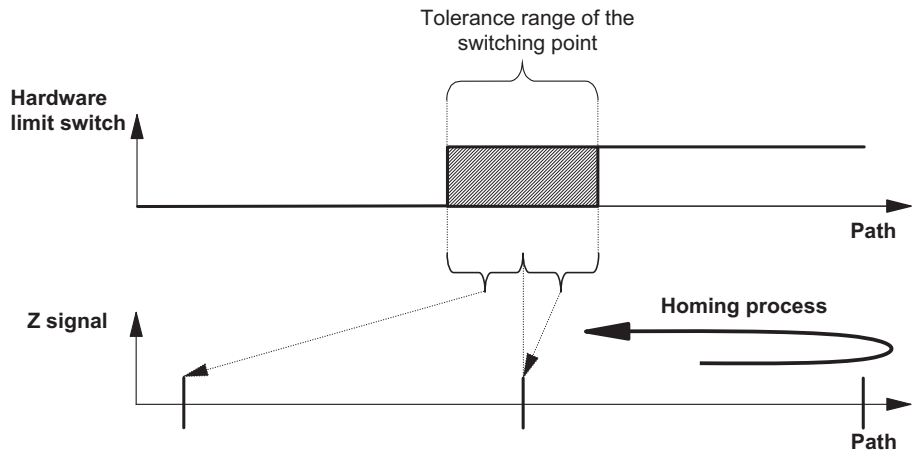
This distance defines the path within which the zero point (Z signal) must appear, i.e., the maximum permissible difference between the hardware limit switch and Z signal. If this difference is exceeded, homing is aborted with an error message.

3.4.5 Adjustment Value

In addition to the homing function itself, the homing process also provides the adjustment value. This describes the distance between the free hardware limit switch and the zero point (Z signal) of the encoder in increments (regardless of the gear ratio).

The response of a hardware limit switch may depend on external factors. For proximity switches, for example, the ambient temperature can affect the switching behavior. This leads to a tolerance window, within which the switch responds. If the tolerance window is on the Z signal of the encoder, a zero point step change may occur. This means that during homing this signal or the adjacent Z signal is sometimes accepted.

Zero point step change



6576B052

Figure 3-15 Zero point step change

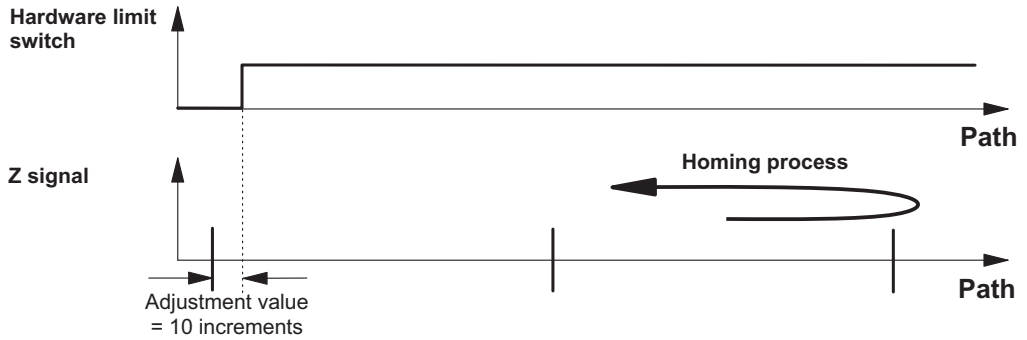
Adjustment value

The adjustment value is used to adjust the hardware limit switch so that its signal is not too close to the zero point (Z signal).

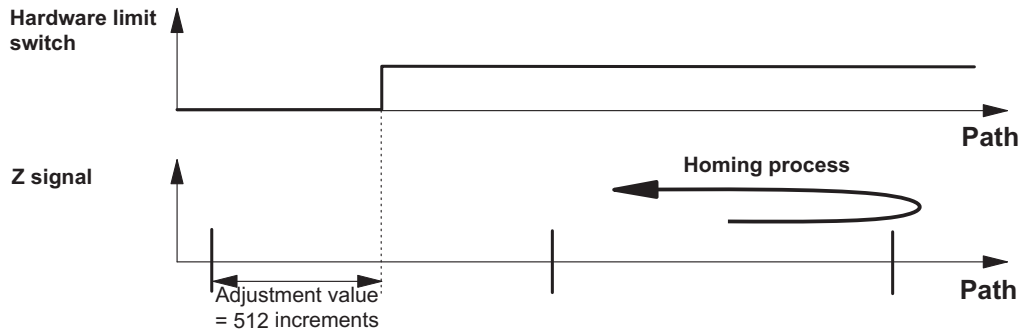
Figure 3-16 on page 3-27 provides an example of two critical reference points and the ideal reference point. A critical response occurs if the adjustment value is close to 0 or to the maximum value for the encoder resolution. If the adjustment value is about half the encoder resolution (e.g., adjustment value of approximately 500 with an encoder resolution of 1024 inc/rotation), the system will operate without problems.

Example Encoder With 1024 Increments

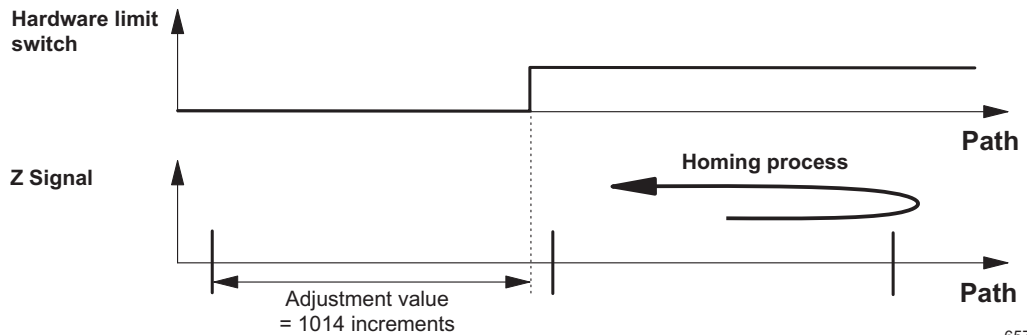
1st critical position of the Z signal



Ideal position of the Z signal



2nd critical position of the Z signal



6576B048

Figure 3-16 Adjustment value

Section 4

This section provides information about

- The positioning and setting functions of the positioning CPU.

Basic Settings.....	4-3
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4 Basic Settings

General notes

1. Byte rotation for Intel processors
All integer values are processed by the IB IL POS 200 in Motorola data format. This means that when Intel processors are used, the higher-level PC application must rotate the bytes.

Example:

The following data is in the IB IL POS 200 memory:

Address	Contents (hex)
000	12
001	34
002	56
003	78

Motorola double precision value: 12345678_{hex} (correct interpretation)

Intel double precision value: 78563412_{hex} (incorrect interpretation)

In order to interpret the memory contents correctly using an Intel processor, the bytes must be rotated.

2. Use of asymmetrical encoders
A symmetrical encoder is set by default. This means that an encoder error is indicated if an asymmetrical encoder is connected. This encoder error can be acknowledged once an asymmetrical encoder has been parameterized.
3. Bus error on initialization
The bus may crash, and error 1531_{hex} will be indicated. In this case, switch off the bus briefly and then switch it on again.
4. Use of incremental encoders
Incremental encoders with a Z signal (zero point) should be used.
5. Homing to limit switches
Homing can only be linked to the limit switches. A separate home position switch is not provided.

4.1 Axis Function (Linear Axes)

The positioning CPU can be used to carry out positioning with linear axes.

Linear axes

A linear axis is an axis with a limited positioning range (finite axis). The positioning range is limited by parameterized software limit switches (MinSwLimSwitch, MaxSwLimSwitch) and/or hardware limit switches (IN 1, IN 2).

The maximum positioning range for incremental encoders depends on the permissible value range for the target position of -2^{31} to $+2^{31}-1$ increments (gear ratio = 1). With absolute encoders, the positioning range depends on the encoder resolution.

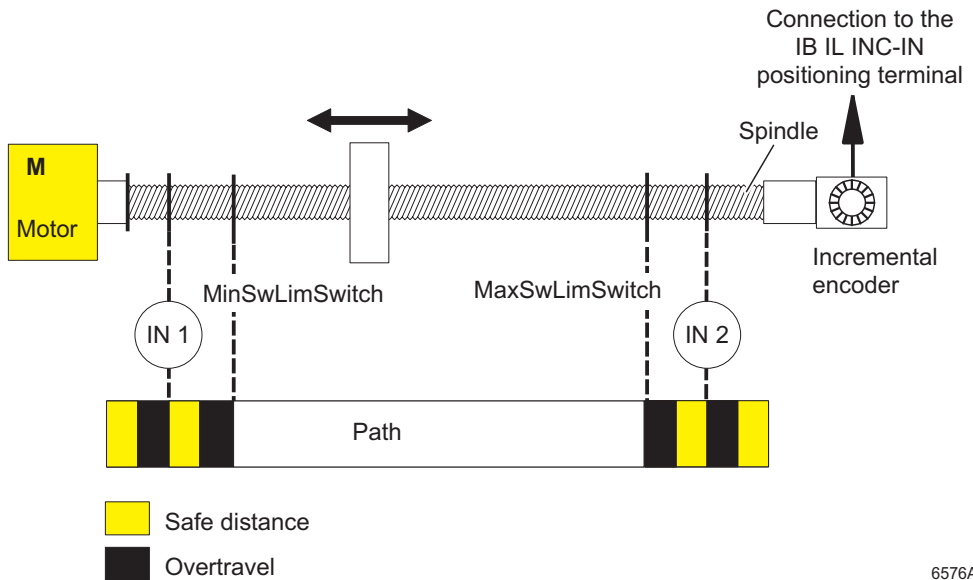


Figure 4-1 Example of a linear axis with incremental encoder

Key:

- IN 1 Limit position 1
- IN 2 Limit position 2
- MinSwLimSwitch Minimum software limit switch
- MaxSwLimSwitch Maximum software limit switch

4.2 Gear Ratio

By defining the gear ratio it is possible to move all distances in a desired unit of length (e.g., μm , mm) rather than in increments.

The gear ratio depends on the path (e.g., in mm), which corresponds to a specific number of increments. The numerator specifies the distance traveled in the desired unit of measurement, and the denominator specifies the number of increments corresponding to this distance.

Example

You want to enter the position parameters and the actual position in centimeters rather than increments. You know that a predefined path is 200 mm long and that this represents 4000 increments.

Path = 200 mm

Number of increments = 4000

$$\text{GR} = \frac{\text{Path}}{\text{Increments (counts)}} = \frac{\text{NumeratorGearRatio}}{\text{DenominatorGearRatio}} = \frac{200}{4000}$$

Where GR = Gear ratio

Once the gear ratio has been defined, the following values are specified and output in the new unit of measurement (s-unit):

- Actual position
- Target position
- Pre-stop window
- Stop window
- Target window
- Loop distance
- Step distance
- Reference offset
- Maximum permissible distance between limit switch and zero point
- Software limit switches

The user must determine the relationship between the numerator and denominator of the gear ratio using the encoder and gear data. This data can be used to calculate how many increments are traveled in a specific distance.

If this data is not available, it is also possible to set both the numerator and denominator for the gear ratio to 1 in order to travel a predefined distance. As the actual position is output in increments when the gear ratio = 1, it is then possible to determine the number of increments that corresponds to this distance by calculating the difference in the actual position before and after the movement. Using the above example, a traverse path of 200 mm would result in a difference in the actual position before and after the movement of 4000.

The gear ratios to be set must be in the following value ranges:

$$\frac{1}{1000} \leq \frac{\text{Path}}{\text{Increments (counts)}} \leq \frac{32767}{1}$$

For a resolution in μm , an encoder must be used at the axis, which provides at least 1 increment per μm . Otherwise it is not possible to set the desired resolution using the gear ratio.



Do not change the gear ratio during operation. If the values for the s-unit specified above were not defined for the set gear ratio, a modification will lead to positioning errors. When the gear ratio is changed, a new reference point must be defined for incremental encoders.

4.3 Downtime Monitoring and Limit Switches

4.3.1 Downtime Monitoring

If the IB IL POS 200 positioning CPU controls a drive, it can always check whether the drive is moving and whether the movement is in the correct direction.

Waiting times

Downtime and direction monitoring can be activated or deactivated. A waiting time can also be entered, which specifies how long the system should wait for downtime monitoring to be activated. Stop monitoring is activated when a distance of less than 1 increment is traveled in the defined time window (multiple of 60 ms).

Another waiting time can also be defined in ms, which specifies how long the system should wait for downtime monitoring to be activated after a change in direction.

For the IB IL 24 DO 4 output version, another time can also be parameterized, which takes the switch-over time for the contactors into account to avoid short circuits. This time is activated as soon as a contactor is switched. If a longer switch-over time has been parameterized for the IB IL 24 DO 4 output version, the drive may stop for longer on a change in direction than the setting made for downtime monitoring.

4.3.2 Hardware Limit Switches

Hardware limit switches are mounted on the axis or motor and specify the maximum traverse path for the axis in the relevant direction. The positioning CPU can process N/C contacts and N/O contacts because it is possible to switch between "active high" and "active low" during parameterization.

If a hardware limit switch is triggered during positioning, the drive stops and an error is indicated. Once the error message has been acknowledged, the Jog, Step or Pos function can be used to exit the limit position in the opposite direction.

4.3.3 Software Limit Switches

In addition to hardware limit switches, software limit switches can also be defined. These operate in a similar way to the limit switches mounted on the axis and abort a movement with an error message when the defined point of the software limit switch is reached. They can be used to set the positioning range within the required limits using the software. A minimum limit switch can be defined, which aborts the negative movement at the previously defined point. The same applies for the maximum software limit switch.



Please ensure that the value of the minimum software limit switch is less than the value of the maximum software limit switch.

Value Range for a Software Limit Switch With Incremental Encoders

This value range only applies for increments. If a gear ratio has been defined, this must be taken into account when defining the software limit switches.

The following condition applies (where GR = gear ratio):

- Value range for a software limit switch with incremental encoders for a gear ratio (GR) < 1:

$$-2^{31} \times GR \leq \text{Value} \leq (2^{31}-1) \times GR$$

$$(-2.147.483.648 \times GR \leq \text{Value} \leq 2.147.483.648 \times GR)$$

- Value range for a software limit switch with incremental encoders for a gear ratio (GR) ≥ 1:

$$-2^{31} \leq \text{Value} \leq 2^{31}-1$$

$$(-2.147.483.648 \leq \text{Value} \leq 2.147.483.648)$$

Example

Gear Ratio (GR)	Maximum Value for Software Limit Switch
1 μm / 1000 inc	2.147.483
1 μm / 100 inc	21.474.836
1 μm / 10 inc	214.748.364
1 μm / 1 inc	2.147.483.647
> 1	2.147.483.647

$$GR = \frac{\text{Path}}{\text{Increments (counts)}}$$

(see section 4.2, "Gear Ratio").

Value Range for a Software Limit Switch With Absolute Encoders

For absolute encoders, the value range of the IB IL POS 200 is not monitored in terms of resolution. The user must ensure the correct parameterization.

This value range only applies for increments. If a gear ratio has been defined, this must be taken into account when defining the software limit switches.

The following condition applies (where GR = gear ratio):

– Value range for a software limit switch with absolute encoders:

$$-2^{(\text{Resolution in bits}-1)} \times \text{GR} \leq \text{Value} \leq (-2^{(\text{Resolution in bits}-1)} - 1) \times \text{GR}$$

and

$$-2^{31} \leq \text{Value} \leq 2^{31}-1$$

Example

Example for an absolute encoder with a resolution of 25 bits:

$$-2^{24} \times \text{GR} \leq \text{Value} \leq (-2^{24}-1) \times \text{GR}$$

and

$$-2^{31} \leq \text{Value} \leq 2^{31}-1$$

4.4 Relationship Between Positioning Accuracy and Creeping Speed

The positioning accuracy of positioning CPUs, which operate using the rapid/creeping speed principle (such as the IB IL POS 200), depends on three factors:

- Cyclic reading of the actual position
- Modification of the creeping speed
- Modification of the braking response

Cyclic reading of the actual position

The best positioning accuracy that can be obtained is the path which is covered between two scans of the actual position at creeping speed. During this process, the positioning CPU wants to stop the drive when it passes the stop point and due to the time-dependent scanning it may respond to a stop point that has just been passed or even to a stop point from the previous scan.

The maximum positioning accuracy (Δs) can be calculated using the following formula:

$$\Delta s = \Delta s_{\text{Scan}} + \Delta s_{\text{Change in speed}} + \Delta s_{\text{Change in deceleration}}$$

Δs_{Scan} is the positioning accuracy which is caused by cyclically scanning the actual position. It is the path, which is covered between two scans of the actual position at creeping speed.

$$\Delta s_{\text{Scan}} = v \times t_{\text{Scan}}$$

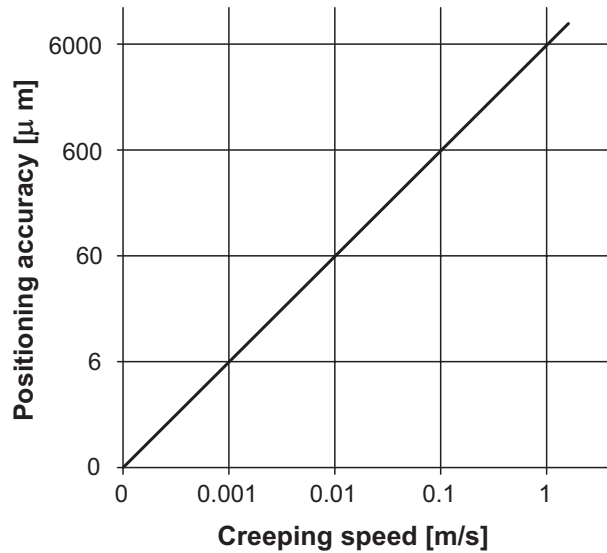
Where

Δs_{Scan} = Positioning accuracy

v = Creeping speed

t_{Scan} = Time between two scans of the actual position

The following diagram shows what occurs on a positioning error caused by cyclical scanning, i.e., the drive speed at which the positioning CPU reaches minimum positioning accuracy.



6576A007

Figure 4-2 Relationship between creeping speed and positioning accuracy

Modification of the creeping speed

When the creeping speed is modified, the length of the stop path also changes.

$\Delta s_{\text{Change in speed}}$ is the positioning accuracy which is caused by modifying the creeping speed:

$$\Delta s_{\text{Scan}} + \Delta s_{\text{Change in speed}} = v \times t_{\text{Scan}} + \Delta v \times t - \Delta v \times t + (v_1^2/2a - v_2^2/2a)$$

Where a is constant

Leads to:

$$\Rightarrow \Delta s_{\text{Change in speed}} = (v_1^2/2a - v_2^2/2a) \text{ where } a \text{ is constant}$$

$$= 1/2a \times (v_1^2 - v_2^2)$$

$$= 1/2a \times (v_1 + v_2) \times (v_1 - v_2)$$

$$= 1/2a \times (v + \Delta v + v - \Delta v) \times (2\Delta v)$$

$$= 1/2a \times 2v \times (2\Delta v)$$

$$\Rightarrow \Delta s_{\text{Change in speed}} = 2v \times \Delta v/a$$

Modification of the braking response

When the braking response of the mechanics (deceleration) is modified, the length of the stop path also changes.

delta s_{Change in deceleration} is the positioning accuracy which is caused by modifying the braking response of the mechanics (deceleration):

$$\Rightarrow \text{delta } s_{\text{Change in deceleration}} = v^2/2 \times (1/a_1 - 1/a_2) \text{ where } v \text{ is constant}$$

$$\Rightarrow \text{delta } s_{\text{Change in deceleration}} = v^2/2 \times [1/(a + \Delta a) - 1/(a - \Delta a)]$$

$$\Rightarrow \text{delta } s_{\text{Change in deceleration}} = v^2/2 \times 2a / (a^2 - \Delta a^2)$$

$$\Rightarrow \text{delta } s_{\text{Change in deceleration}} = v^2 \times a / (a^2 - \Delta a^2)$$

Example 1

Positioning accuracy which is caused by cyclically scanning the actual position.

$$v = 0.6 \text{ m/min}$$

$$t_{\text{Scan}} = 6 \text{ ms}$$

$$\text{delta } s_{\text{Scan}} = v \times t_{\text{Scan}}$$

$$= 0.6 \text{ m/min} \times 6 \text{ ms}$$

$$= 10 \text{ } \mu\text{m/ms} \times 6 \text{ ms}$$

$$\Rightarrow \text{delta } s_{\text{Scan}} = 60 \text{ } \mu\text{m}$$

Example 2

Positioning accuracy which is caused by modifying the creeping speed (+/-5%), with constant deceleration.

$$v = 0.6 \text{ m/min}$$

$$\Delta v = 0.03 \text{ m/min (5\%)}$$

$$a = 5 \text{ m/s}^2$$

$$\text{delta } s_{\text{Change in speed}} = 2v \times \Delta v/a \text{ where } a \text{ is constant}$$

$$= 2 \times 0.6 \text{ m/min} \times 0.03 \text{ m/min} / 5 \text{ m/s}^2$$

$$= 2 \times 10 \text{ } \mu\text{m/ms} \times 0.5 \text{ } \mu\text{m/ms} / 5 \text{ } \mu\text{m/ms}^2$$

$$\Rightarrow \text{delta } s_{\text{Change in speed}} = 2 \text{ } \mu\text{m/ms}$$

Example 3

Positioning accuracy which is caused by modifying the braking response of the mechanics (deceleration) (-20%).

$$v = 0.6 \text{ m/min}$$

$$a = 5 \text{ m/s}^2$$

$$\Delta a = 1 \text{ m/s}^2$$

$$\text{delta } s_{\text{Change in deceleration}} = v^2 \times a / (a^2 - \Delta a^2)$$

$$= (0.6 \text{ m/min})^2 \times 5 \text{ m/s}^2 / ([5 \text{ m/s}^2]^2 - [1 \text{ m/s}^2]^2)$$

$$= (10 \text{ } \mu\text{m/ms})^2 \times 5 \text{ } \mu\text{m/ms}^2 / ([5 \text{ } \mu\text{m/ms}^2]^2 - [1 \text{ } \mu\text{m/ms}^2]^2)$$

$$\Rightarrow \text{delta } s_{\text{Change in deceleration}} = 20.83 \text{ } \mu\text{m}$$

4.5 Stop Path When a Hardware Limit Switch Is Triggered

The stop path required by the positioning CPU to bring a drive to a stop in response to a triggered hardware limit switch can be determined as follows:

Response path + Braking path = Stop path

Where

Response path = Edge on the hardware limit switch until the drive is shut down

Braking path = Path traveled before the drive stops after shutdown

Response path

It takes four bus cycles for the positioning CPU to stop a drive in response to a hardware limit switch. As the bus cycle time for the IB IL POS 200 is fixed at 6 ms, the response path depends solely on the speed of the drive.

When considering "worst-case" scenarios, the maximum possible speed must be assumed.

$$s_{\text{Response}} = 4 \times v \times t_{\text{Scan}}$$

Where

s_{Response} = Response path

t_{Scan} = Time between two scans of the actual position

Braking path

The length of the braking path s_{Brake} depends on the speed v and the deceleration a :

$$s_{\text{Brake}} = v^2/2a$$

Examples

1. Response path:

$$t_{\text{Scan}} = 6 \text{ ms}$$

$$v = 0.6 \text{ m/min}$$

$$s_{\text{Response}} = 4 \times v \times t_{\text{Scan}}$$

$$= 4 \times 0.6 \text{ m/min} \times 6 \text{ ms}$$

$$= 4 \times 10 \text{ mm/s} \times 6 \text{ ms}$$

$$= 4 \times 10 \text{ } \mu\text{m/ms} \times 6 \text{ ms}$$

$$\Rightarrow s_{\text{Response}} = 240 \text{ } \mu\text{m}$$

2. Braking path

$$v = 0.6 \text{ m/min}$$

$$a = 5 \text{ m/s}^2$$

$$s_{\text{Brake}} = v^2/2a$$

$$= (0.6 \text{ m/min})^2 / (2 \times 5 \text{ m/s}^2)$$

$$= (10 \text{ } \mu\text{m/ms})^2 / (2 \times 5 \text{ } \mu\text{m/ms}^2)$$

$$\Rightarrow s_{\text{Brake}} = 10 \text{ } \mu\text{m}$$

4.6 Effect of Speed Parameters on the IB IL 24 DO 4 Output Version

The output version with the IB IL 24 DO 4 terminal is used to control drives using digital 24 V signals. In this version, the IB IL POS 200 cannot affect the speeds at which the connected drive travels in rapid or creeping motion. However, the indices for rapid and creeping motion must be set to meaningful values in this version so that drive control operates correctly.

This is due to the structure of the function blocks in the IB IL POS 200: The central function block determines how the drive should be controlled and generates a corresponding value (from 0% to 100%) at the output for positive or negative rapid motion, positive or negative creeping motion or stop. The function block takes this value from the indices for rapid or creeping speed.

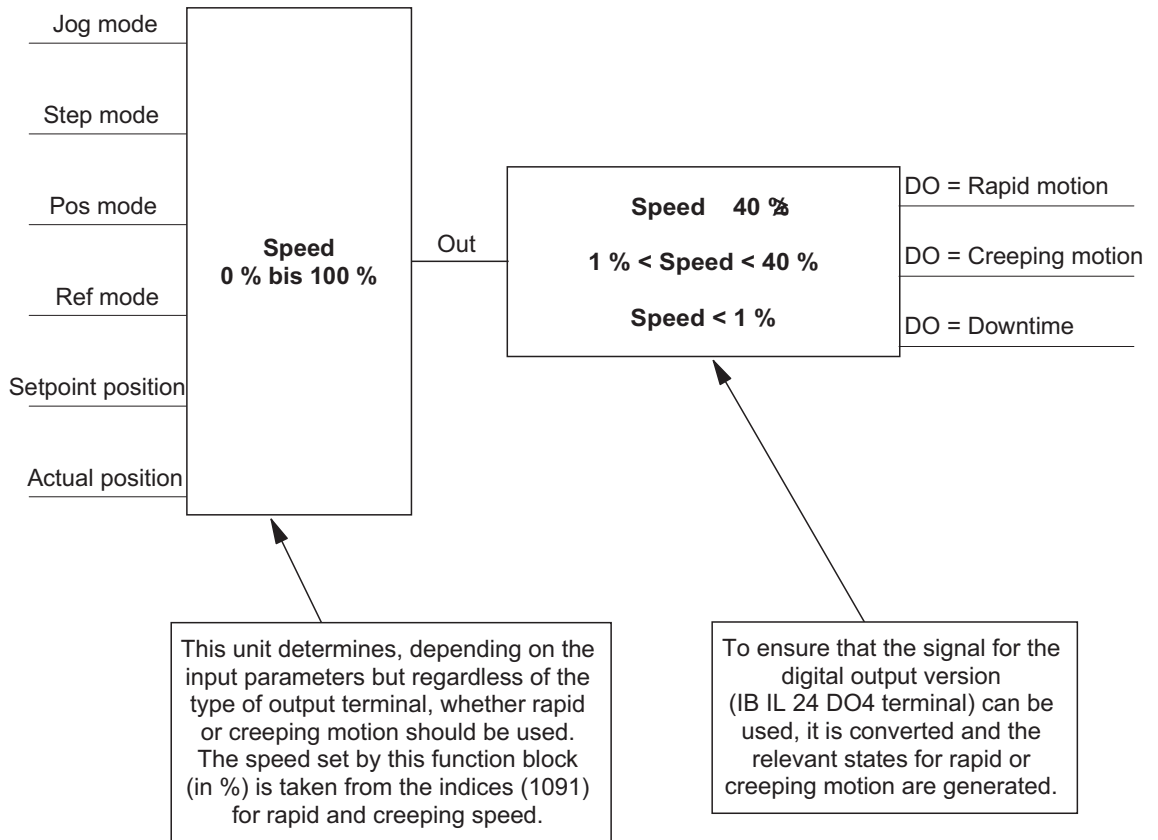
However, in the IB IL 24 DO 4 output version this output signal cannot be transferred to the connected drive. It is instead compared with fixed threshold values and transferred to the function block as the status "Rapid speed", "Creeping speed" or "Stop". The function block uses this status to generate the corresponding bit pattern for the digital outputs of the IB IL 24 DO 4 for the selected output function. The following threshold values are used:

Table 4-1 Setpoints for the speed indices

Output Value [%]	Status
0	Stop
1 - 39	Creeping motion
40 - 100	Rapid motion

To ensure that the threshold function can generate the correct output signals, the corresponding values must be parameterized in the indices for rapid and creeping motion.

Evaluation



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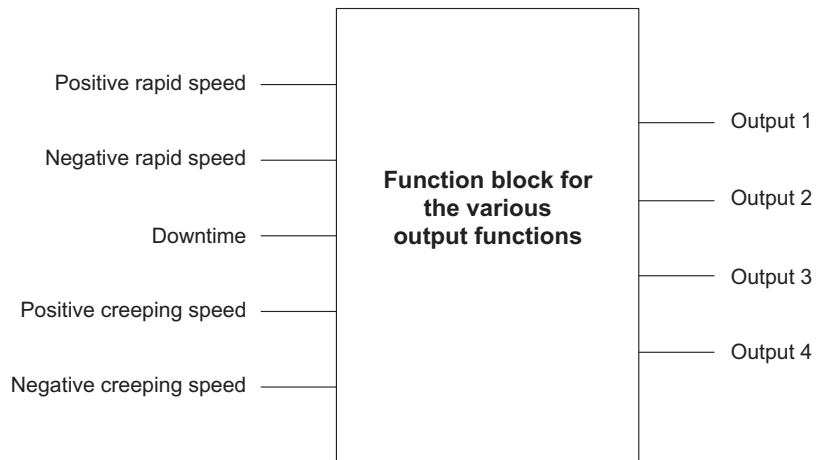
Figure 4-3 Evaluation

4.7 Output Functions in the IB IL 24 DO 4 Output Version for Various Drive Circuits

The output version with the IB IL 24 DO 4 terminal is used to control drives using up to four digital 24 V signals. The IB IL POS 200 supports various drive circuits by generating different bit patterns at the digital outputs. The following output functions are supported:

- Dahlander circuit
- Pole-changing circuit
- Control of drive amplifiers with four digital signals
- Control of drive amplifiers with three digital signals and one signal to control a holding brake

To support various output functions, the IB IL POS 200 contains a function block, which reads the states "Rapid speed", "Creeping speed" or "Stop" and then generates the necessary bit patterns.



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Figure 4-4 Function block

This section provides information about

- Startup
- Operating modes of the positioning CPU.

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5.1 Flowchart.....	5-5
5.2 Startup.....	5-13
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5.4 Pos Mode (Positioning Mode).....	5-19
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5 State Machine

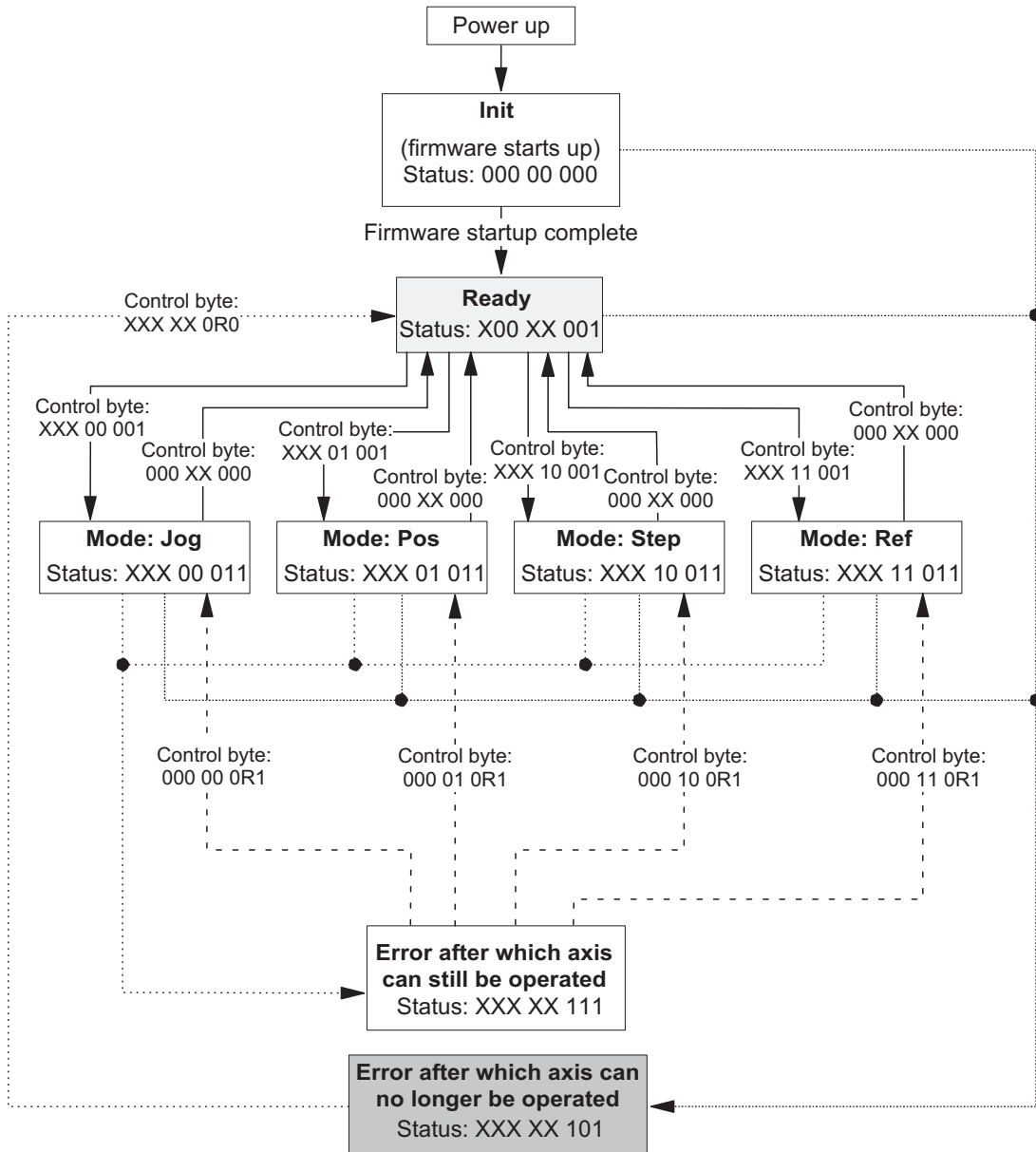
The IB IL POS 200 is a positioning CPU for one to ten independent axes. In terms of its functions, the IB IL POS 200 acts in the same way as up to ten single axis control systems. The state machine describes the behavior of each of these axis control systems. As all the axes are independent from one another, there are as many independent state machines as there are axes active on the IB IL POS 200.

The state machine illustrates the various states that are supported by the individual axes of the IB IL POS 200. The current status is externally visible via the bit pattern displayed in the boxes, which can be read in the status byte. This status is valid for a specific period of time. Events may cause the axis control system to change status. These events may be caused by internal functions or by external commands (control bits). The boxes are linked by arrows, which indicate which changes of status are possible and which command or event would trigger the changes.

The Flowchart

The flowchart is designed to help the user to understand the relationships between the individual states. It provides examples of how the individual axes can be controlled externally, i.e., by a higher-level system (PLC).

The flowchart therefore provides an example of a control program on the higher-level control system.



6576A029

Figure 5-1 State machine

Key	
R	Rising edge
X	Setting not relevant

5.1 Flowchart

Explanation of the Flowchart

The possibility of errors exists in all states. Consequently, the error bit must be requested continuously. If an error bit is set, indices 0161 sub 01/02 and 1059 sub 01/02 must be read for error analysis (see flowchart).

Analyzing errors

If there is an entry under index 0161, the error is a system error.

If there is an entry under index 1059, the error is an axis function error.

System Errors

System errors are based on bus or PCP errors and affect all axes. In this case, index 0161 sub 01/02 should be read.

Example of a possible system error:

- 1531 (bus crash)

System errors and their corresponding error messages can also be analyzed using error tables and their additional diagnostic codes (index 0161 sub 02).

Axis Function Errors

To remove these errors, refer to the error tables with their additional diagnostic code (index 0159 sub 02) and the function descriptions. They provide the user with error causes and starting points for error removal.

An axis function error may be one of the following errors, which only affect the selected axis. In this case, index 0159 sub 01 should be read (see also Appendix A 2 "Error Tables").

- FFA2 (error on IB IL SSI)
- FFA3 (error on IB IL INC-IN software driver)
- FFA4 (error on IB IL INC-IN)
- FFC0 (parameterization error: invalid parameters)
- FFC1 (I/O module not ready)
- FFC2 (direction of rotation and downtime monitoring has been triggered)
- FFC3 (error during homing)
- FFC4 (limit switch has been triggered)
- FFC5 (parameterization error: unknown version parameterized)
- FFE2 (error on IB IL 24 DO 4)
- FFE3 (error on IB IL AO 2/U/BP / IB IL 24 DO 2)
- FFE6 (error on IB IL DC AR 48/10A software driver)
- FFE7 (error on IB IL DC AR 48/10A)
- FF41 (parameterization error: invalid target position entered)
- FF42 (axis not homed)

For additional diagnostics, refer to the additional diagnostic code (index 1059 sub 02).

Acknowledging errors

Once the axis function error has been removed, the controller must be informed using the Quit bit in the control byte. It is set once to acknowledge the error and it enables the axis again once the error has been removed successfully.

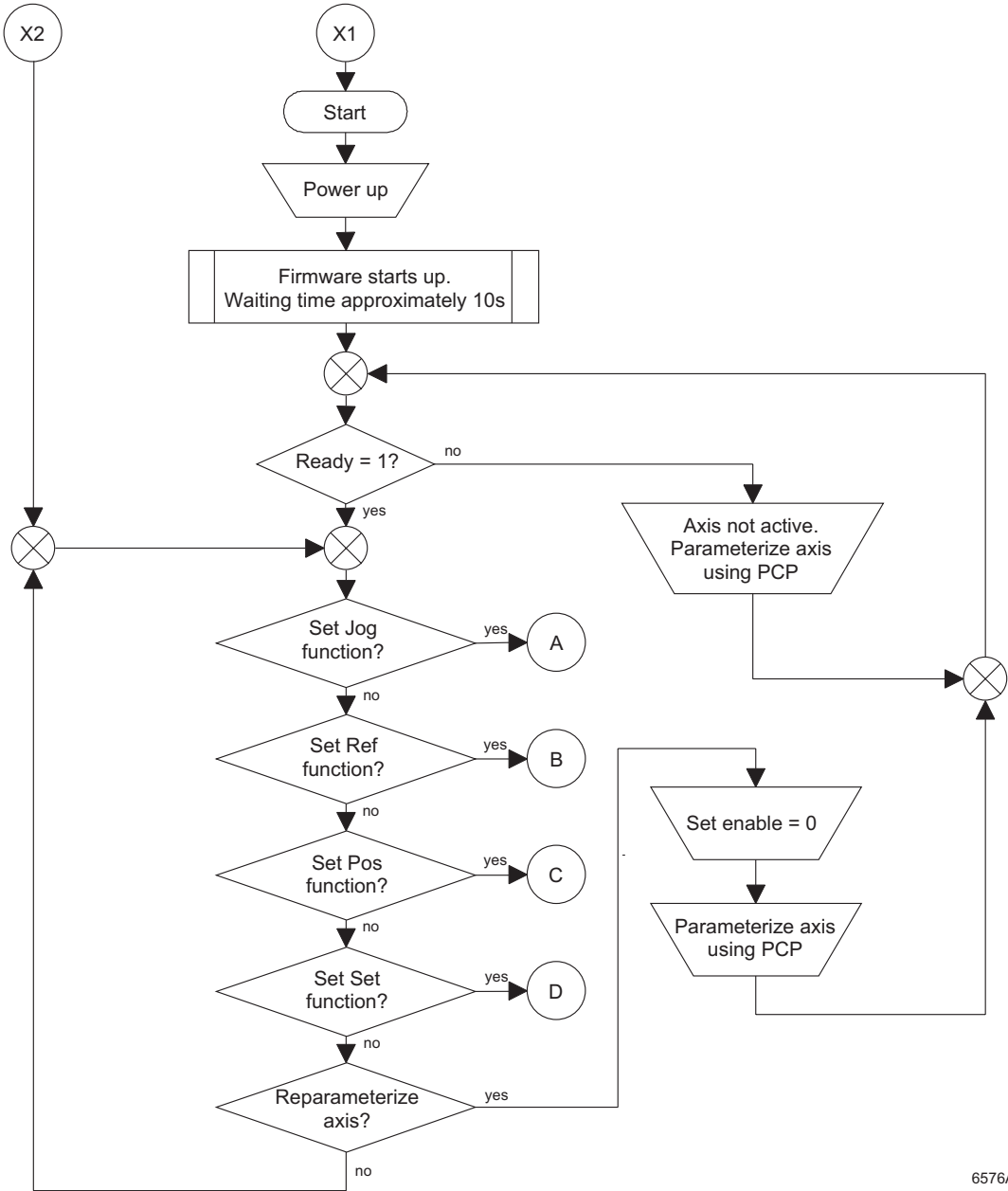
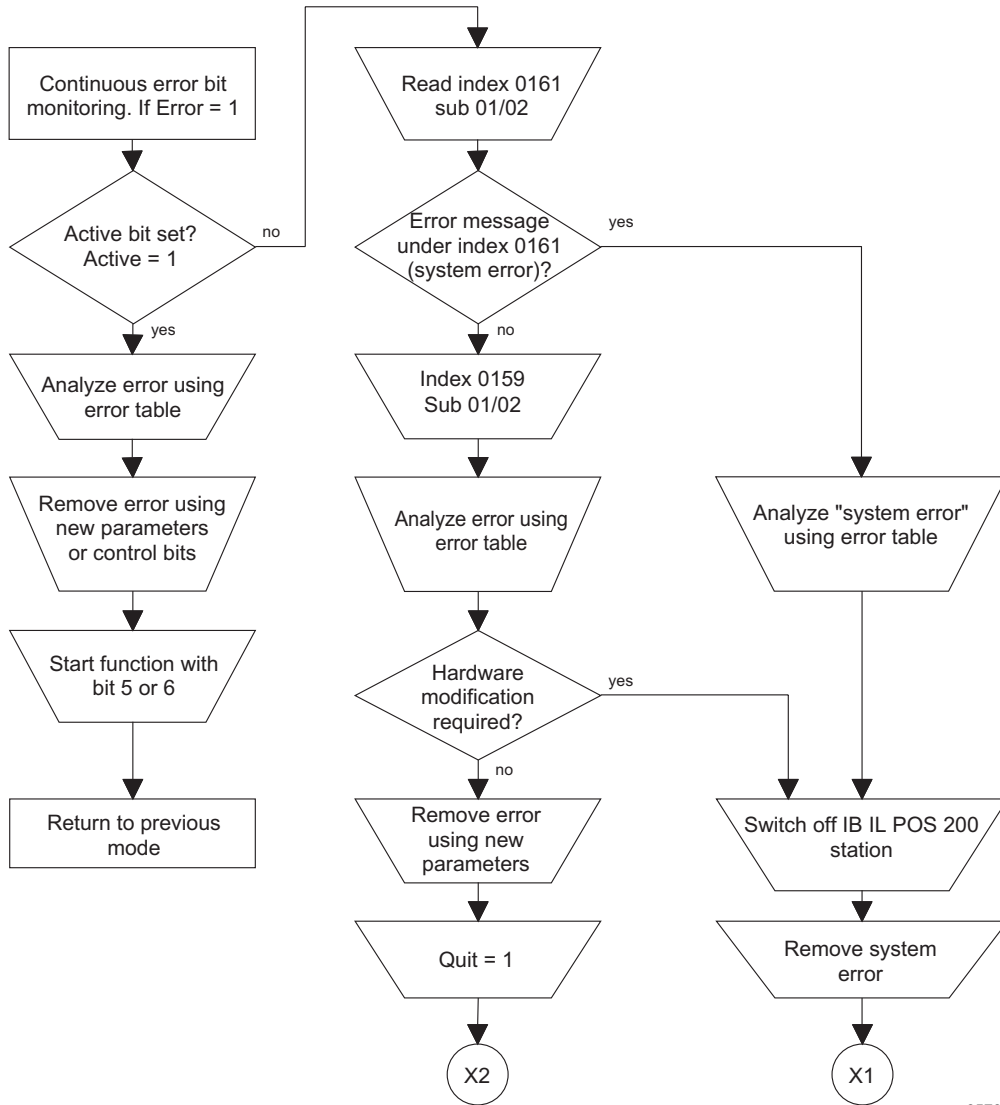


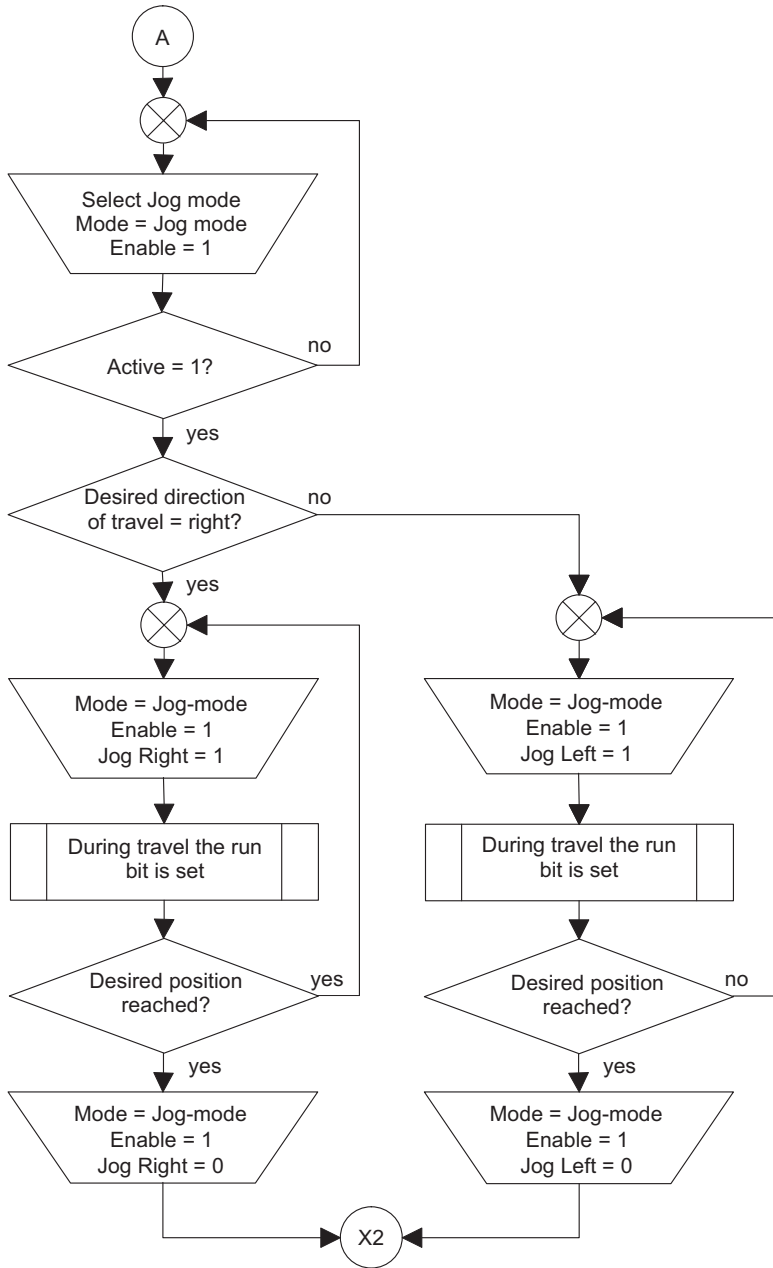
Figure 5-2 Flowchart (Startup)

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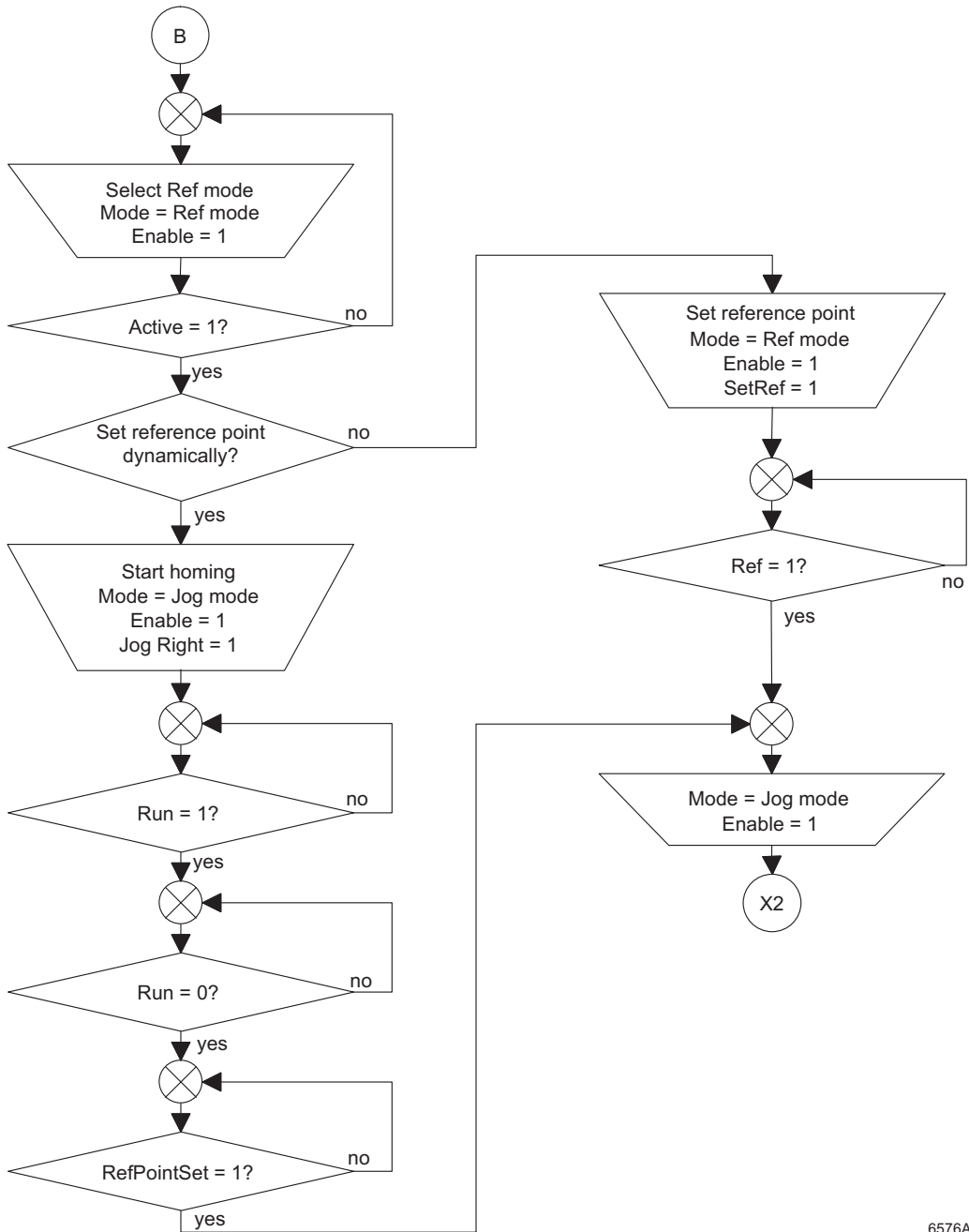
6576A057

Figure 5-3 Flowchart (Error removal)



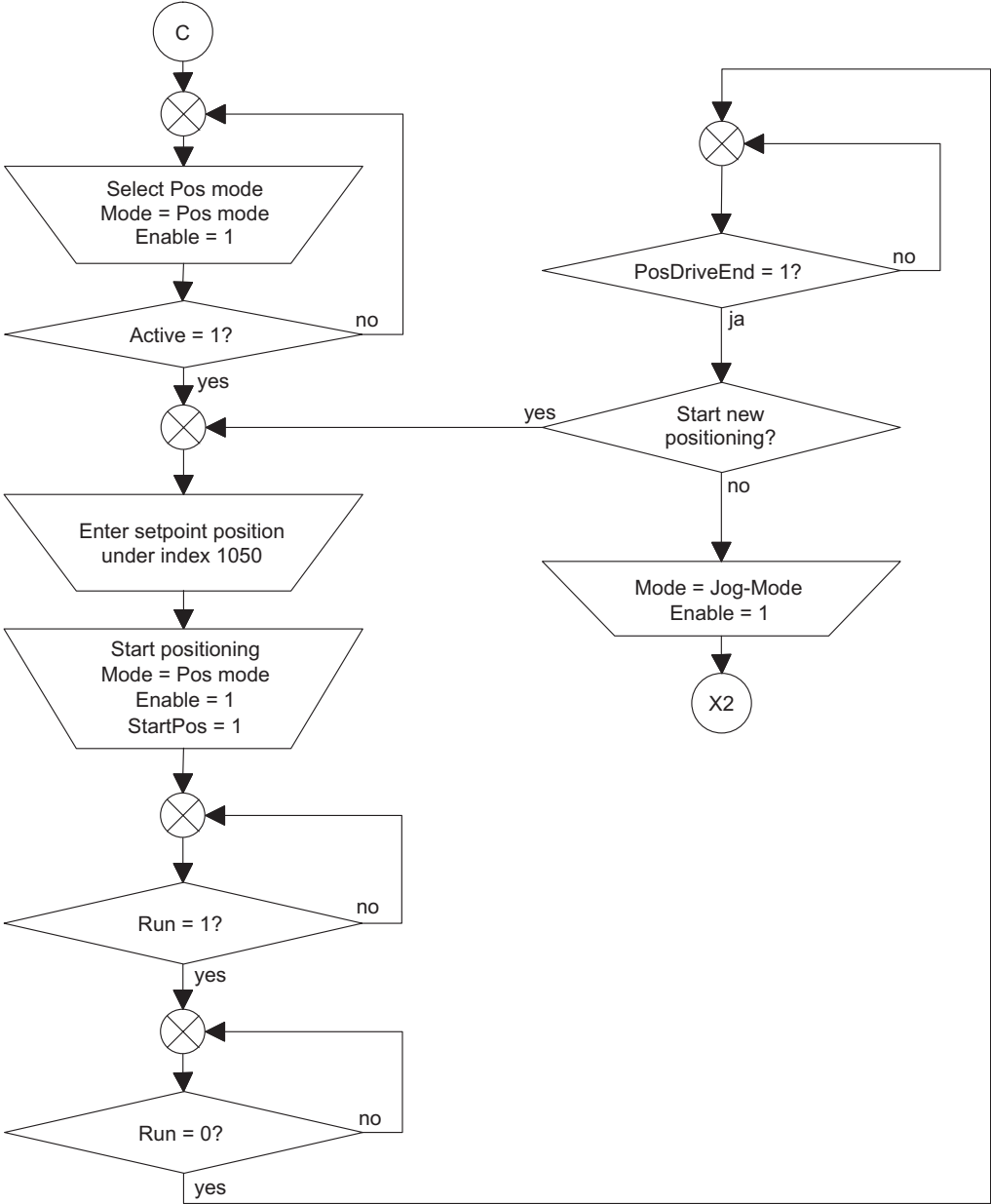
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Figure 5-4 Flowchart (Sequence A: Jog mode)



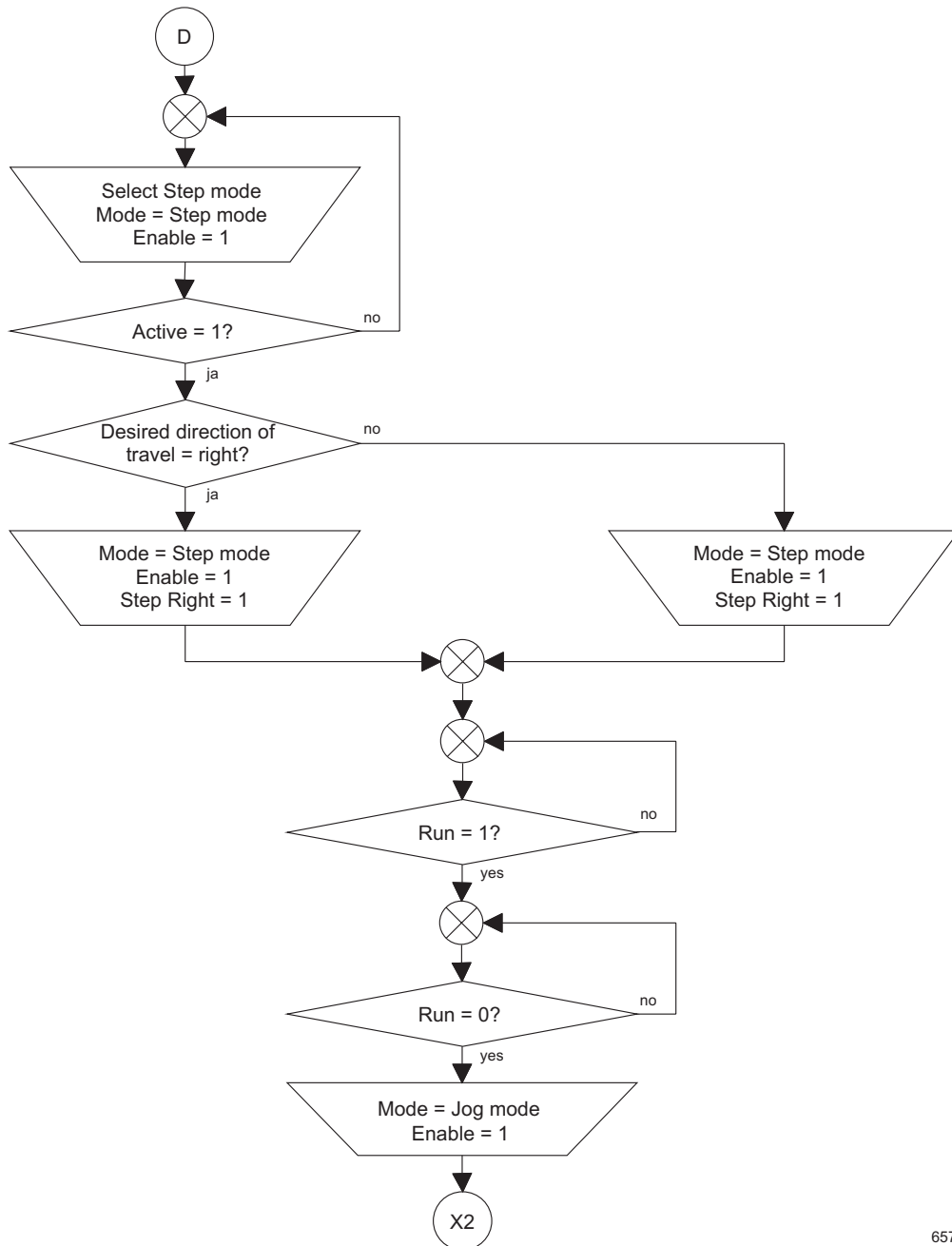
6576A059

Figure 5-5 Flowchart (Sequence B: Ref mode)



6576A060

Figure 5-6 Flowchart (Sequence C: Pos mode)



6576A061

Figure 5-7 Flowchart (Sequence D: Step mode)

5.2 Startup

The individual axes are controlled via process data. The process data contains eight control bits and eight status bits for each axis.

Control Byte

			Mode				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
—	Jog Left — Step Left SetRef	Jog Right StartPos Step Right StartRef	00 = Jog mode 01 = Pos mode 10 = Step mode 11 = Ref mode		Stop	Quit	Enable

Status Byte

			Mode				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
RefPointSet	— PosDriveEnd — —	Jog Run Pos Run Step Run Ref Run	00 = Jog mode 01 = Pos mode 10 = Step mode 11 = Ref mode		Error	Active	Ready

Bits 0 to 2 of the status byte indicate the status of the individual axis control system regardless of the operating mode. "Mode" indicates the set operating mode in bits 3 and 4. Bit 5 indicates whether the axis is moving and bit 6 indicates whether the axis is in the target window once positioning is complete. Bit 7 indicates whether the axis has been homed.

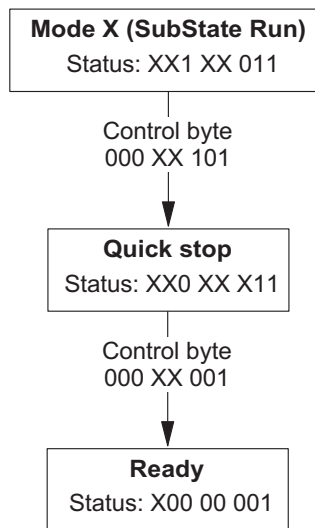
When it is switched on, the positioning CPU is in the "Init" state, which is indicated by the status byte 000 00 000. As soon as the axis has been parameterized (index 1030, VariantTF = 1), the firmware starts up automatically. Following startup, the state machine directly enters the "Ready" state. This is confirmed by the status byte X00 XX 001, and the ready bit of the general status bits is set.

From now on, the various different modes can be selected using the control byte. Details of the different modes are described below.

Before changing to another mode, the "Ready" status must first be selected by resetting the enable bit.

5.2.1 Quick Stop

In "Pos", "Step", and "Ref" operating modes, a stop signal can be generated, which interrupts the movement by setting the stop bit. As long as the stop bit remains set in the control byte, the motor brakes are applied. This is known as "active braking", i.e., the drive is not shut down for the IB IL DC AR 48/10A and IB IL AO 2/U/ BP + IB IL 24 DO 2 output versions, it is instead stopped with a zero current. It is only when the stop bit and enable bit are reset that the motor is shut down and the machine returns to the "Ready" state.



6576A030

Figure 5-8 Quick stop

5.2.2 Testing Aid

If there is no specific parameterization for an axis, i.e., index 1030, VariantTF = 0, the status byte returns the received control byte.

This is designed as a testing aid for use during startup, as it makes it easy to detect incorrect process data addressing (control byte/status byte).

5.2.3 Procedure in the Event of Errors

The possibility of errors exists in all states. In the event of an error, the positioning CPU enters the "Error" state. In this case, the error bit is set.

There are three different types of error:

1 Errors after which the axis can still be operated:

This type of error is triggered during a motion. This error is generated if:

- Direction of rotation and downtime monitoring is triggered
- An error occurs during homing
- A limit switch is triggered
- An invalid target position is entered
- The axis is not homed when the movement is started
- The target range is exceeded

The system indicates these errors by setting the ready bit, active bit, and error bit. A rising edge at the quit bit in the control byte is used to acknowledge the error. The mode to be used for further travel can also be set in the same control byte. However, the enable bit must be set and the movement must be started.

If the enable bit is not set, the machine enters the "Ready" state. A new control byte can be used to select the mode and set the enable bit.

2 Errors after which the axis can no longer be operated:

These are errors reported by the I/O devices or error messages, which indicate that the parameterized values do not correspond to the value ranges or to the terminals used.

The following errors may occur (see also Appendix A 2 "Error Tables"):

- Error on IB IL SSI
- Error on IB IL INC-IN software driver
- Error on IB IL INC-IN
- Parameterization error: invalid parameters
- I/O module not ready
- Direction of rotation and downtime monitoring has been triggered
- Error during homing
- Limit switch has been triggered
- Parameterization error: unknown version parameterized
- Error on IB IL 24 DO 4
- Error on IB IL AO 2/U/BP / IB IL 24 DO 2
- Error on IB IL DC AR 48/10A software driver
- Error on IB IL DC AR 48/10A

The system indicates these errors by setting the ready bit and error bit, but not the active bit. The affected axis can no longer be operated. A rising edge at the quit bit in the control byte is used to enable the axis again after removing the error. The control system then enters the "Ready" state.

3 System Errors

This type of error occurs if the bus crashes or a PCP error occurs. In this case, the error bit is set, and this bit cannot be acknowledged. The module must be switched off completely and then switched on again (reset). In this case, all axes can no longer be operated. The cause of the error is displayed in the relevant diagnostic code (index 1059) and also in the system diagnostic code (index 0161) for all axes.

5.3 Jog Mode

Control Byte

			Mode				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
—	Jog Left	Jog Right	00 = Jog mode		Stop	Quit	Enable

Status Byte

			Mode				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
RefPointSet	—	Jog Run	00 = Jog mode		Error	Active	Ready

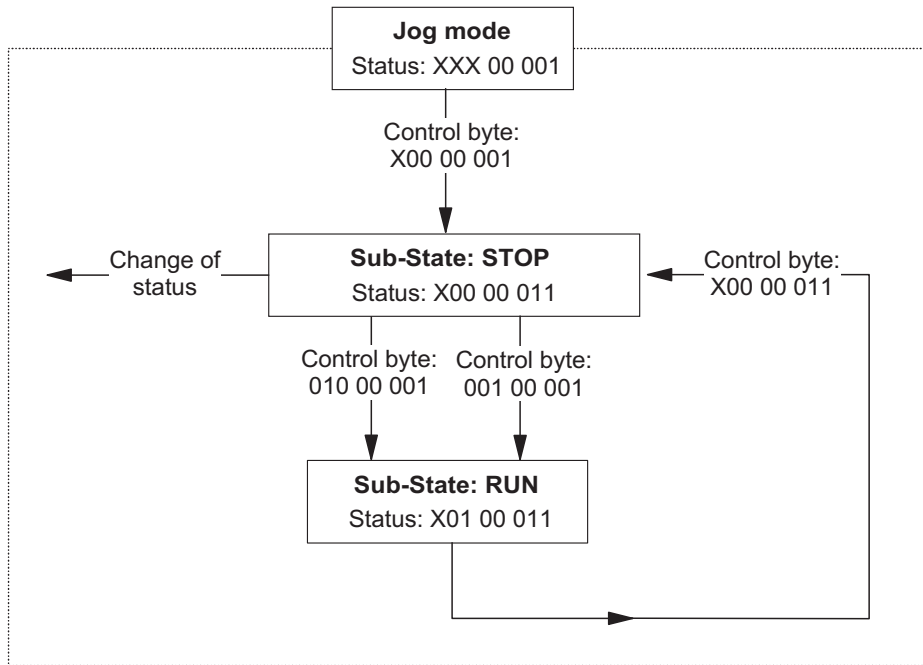
Jog mode is set by writing the control byte XXX 00 001 from the "Ready" state, i.e., selecting Jog mode (00) and also setting the enable bit. The positioning CPU acknowledges this command by displaying the active bit in the status byte.

The device remains in Jog mode as long as bits 3 and 4 in the control byte are set to "0" and the enable bit is set. If the Jog Left and Jog Right bits are not set, the device is in substate "RUN".

For a description of the Jog function, please refer to section 3.1, "Jog Mode".

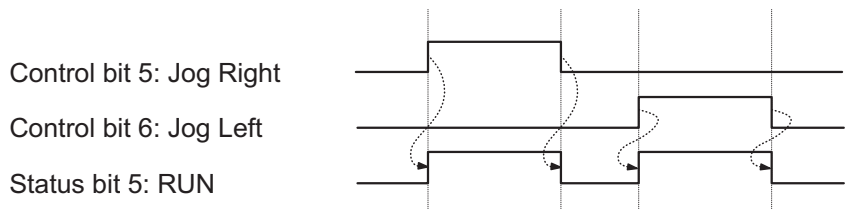
Substate "STOP": Jog mode is active, but no motion is underway. This status is indicated by the status byte X00 00 011.

Substate "RUN": To enter the "RUN" state, the control byte 010 00 001 or 001 00 001 must be written. The drive moves left until the Jog Left bit remains set or moves right until the Jog Right bit remains set. This status is indicated by the status byte X01 00 011 regardless of the direction.



6576A031

Figure 5-9 Jog mode



6576A032

Figure 5-10 Jog Right/Jog Left

5.4 Pos Mode (Positioning Mode)

Control Byte

			Mode				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
—	—	StartPos	01 = Pos mode		Stop	Quit	Enable

Status Byte

			Mode				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
RefPointSet	PosDriveEnd	Pos Run	01 = Pos mode		Error	Active	Ready

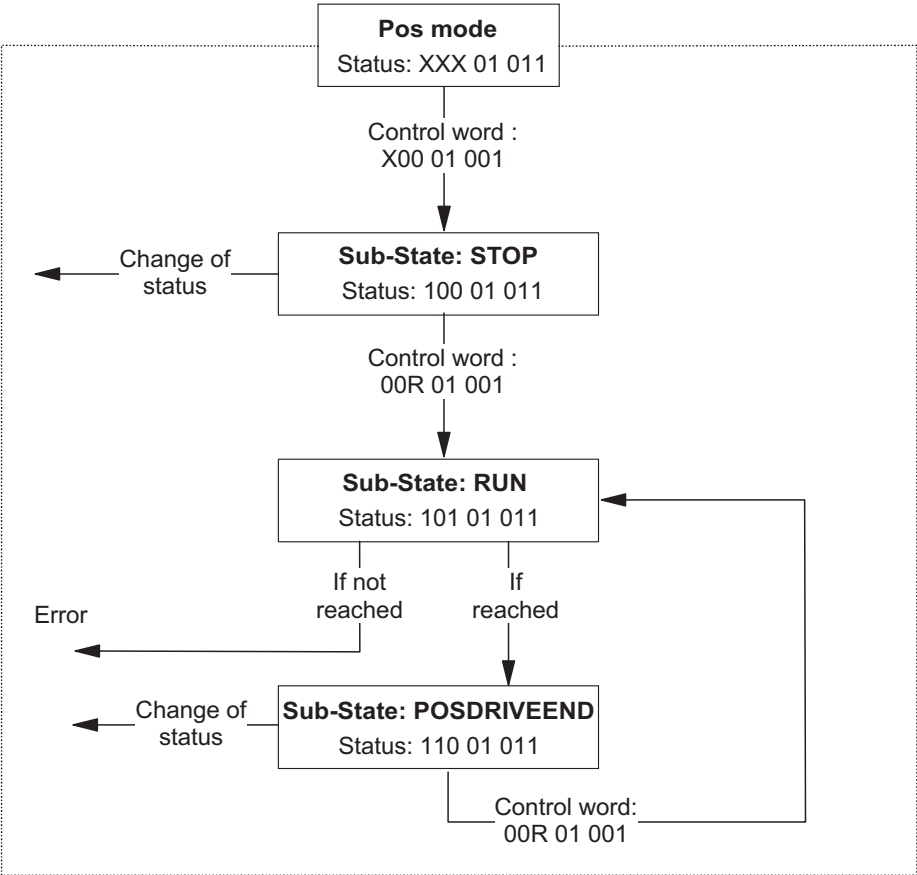
Positioning mode is set by writing the control word X00 01 001 from the "Ready" state, i.e., selecting Pos mode (01) and also setting the enable bit. The positioning CPU acknowledges this command by displaying the active bit in the status byte. The device remains in Pos mode as long as bits 3 and 4 in the control byte are set to "Pos mode" and the enable bit is set.

A rising edge at the StartPos bit in the control byte is also generated to enter substate "RUN", which starts positioning. When the target window at the end of automatic positioning is reached, the device directly enters substate "POSDRIVEEND". The device remains in this status until a new target position is approached.

Before movements can be made in Pos mode using relatively operating position detection systems, homing must be carried out. The RefPointSet bit in the status byte provides additional information. When absolute encoders are used, this bit is set automatically.

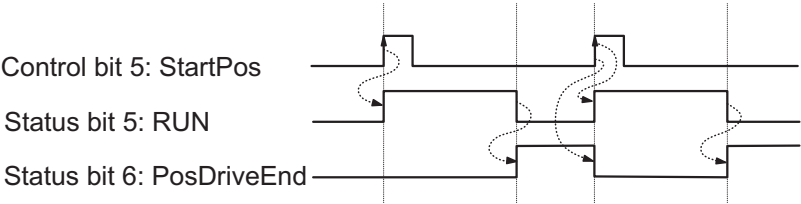
For a description of the positioning function, please refer to section 3.3, "Positioning Mode (Absolute Positioning)".

Substate "STOP":	Pos mode is active, but no motion is underway.
Substate "RUN":	When a positive edge is set at the StartPos bit, the drive moves taking the relevant parameters set under the positioning function into account. During positioning, the Pos-Run bit in the status byte remains set. In this status, changing the target position (TargetPosition) has no effect. If a new target position is transmitted, a new positioning process can be prepared.
Substate "POSDRIVEEND":	If the drive has reached the desired target position, the "PosDriveEnd" status bit is set automatically to indicate this state.



6576A033

Figure 5-11 Pos mode (positioning mode)



6576A034

Figure 5-12 StartPos/PosDriveEnd

5.5 Step Mode

Control Byte

			Mode				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
—	Step Left	Step Right	10 = Step mode		Stop	Quit	Enable

Status Byte

			Mode				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
RefPointSet	—	Step Run	10 = Step mode		Error	Active	Ready

Step mode is set by writing the control word XXX 10 001 from the "Ready" state, i.e., selecting Step mode (10) and also setting the enable bit. The positioning CPU acknowledges this command by displaying the active bit in the status byte.

The device remains in Step mode as long as bits 3 and 4 in the control byte are set to "Step mode" and the enable bit is set. If no rising edge is generated at the Step Left and Step Right bits, the device directly enters substate "STOP". If one of these bits is set, positioning begins and the device is in substate "RUN". Once the specified distance has been traveled for the step motion, this motion is completed and the machine returns to "STOP" state.

Before movements can be made in Step mode using relatively operating position detection systems, homing must be carried out. The RefPointSet bit in the status byte provides additional information. When absolute encoders are used, this bit is set automatically.

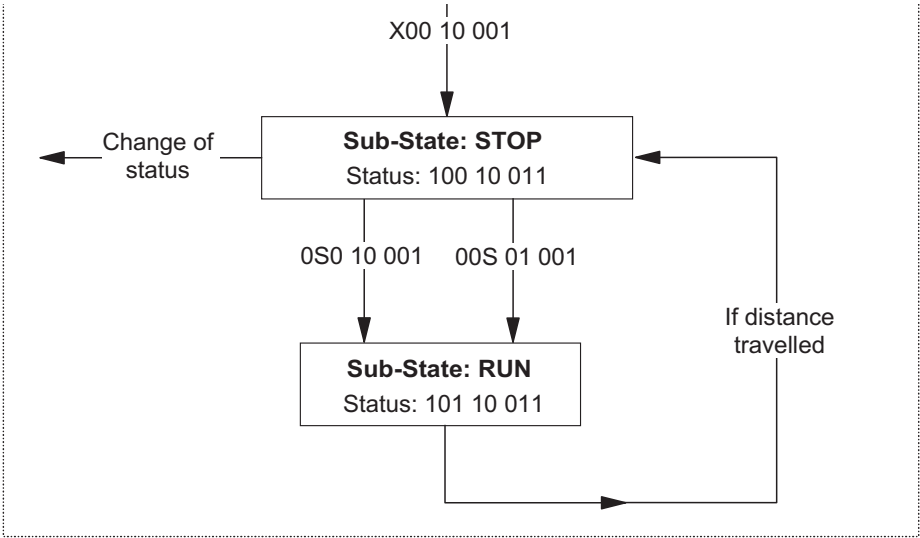
For a description of the Step function, please refer to section 3.2, "Step Mode".

Substate "STOP":

Step mode is active, but no motion is underway.

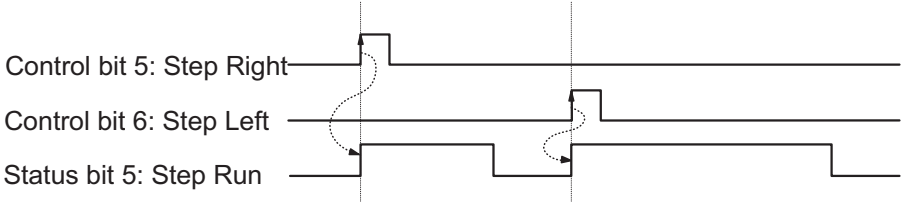
Substate "RUN":

When a positive edge is set at the Step Left or Step Right bit, the drive moves taking the relevant parameters set under the step function into account. During positioning, the Step-Run bit in the status byte remains set.



6576A035

Figure 5-13 Step mode



6576A036

Figure 5-14 Step Right/Step Left

5.6 Ref Mode (Homing Mode)

Control Byte

			Mode				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
—	SetRef	StartRef	11 = Ref mode		Stop	Quit	Enable

Status Byte

			Mode				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
RefPointSet	—	Ref Run	11 = Ref mode		Error	Active	Ready

This mode is required when relatively operating encoder systems, e.g., incremental encoders, are used because it provides a reference point for use during positioning.

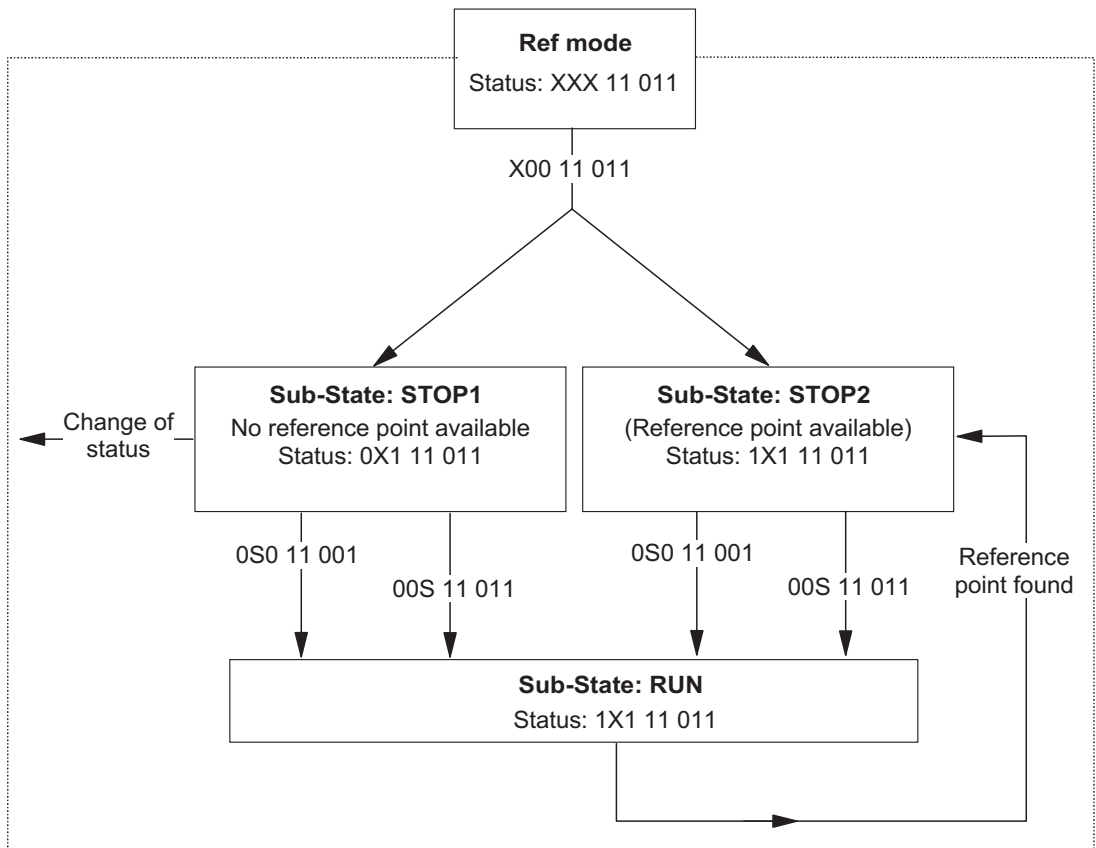
Homing mode is set by writing the control word XXX 11 001 from the "Ready" state, i.e., selecting Ref mode (11) and also setting the enable bit. The positioning CPU acknowledges this command by displaying the active bit in the status byte.

The device remains in Ref mode as long as bits 3 and 4 in the control byte are set to "Ref mode" and the enable bit is set. If no rising edge is generated at the StartRef and SetRef bits in the control byte, the device is in substate "STOP1", provided no reference point has been set or found. If a reference point has been set or found, the machine is in substate "STOP2". If a rising edge is also generated at the StartRef bit, homing begins and the device is in substate "RUN". If the SetRef bit is set, the reference point is defined as the position in which the drive is currently located. Once the reference point has been set or homing has been completed successfully, the machine returns to the "STOP2" state.

The RefPointSet bit in the status byte indicates whether a reference point has been found or set.

For a description of the homing function, please refer to section 3.4, "Homing Mode".

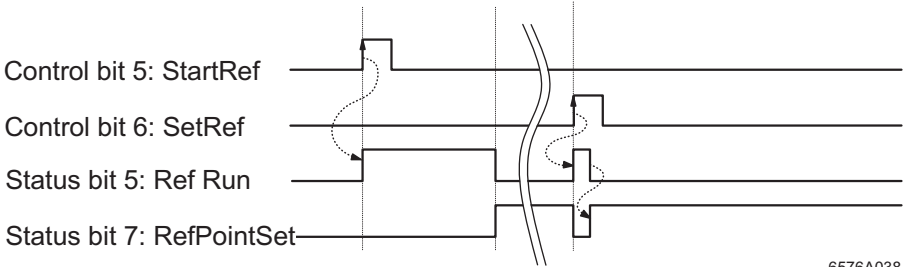
Substate "STOP1":	Ref mode is active, but no motion is underway and no reference point has been set or found.
Substate "STOP2":	Ref mode is active, but no motion is underway. A reference point has already been set or found.
Substate "RUN":	<p>When an edge is set at the StartRef bit of the control byte, homing is started taking the parameters set under the homing function into account. During the motion, the Ref-Run bit in the status byte remains set.</p> <p>Once an edge has been set at the SetRef bit, the device remains in substate "RUN" for a short while. No motion is required when setting a new reference point because the current position is used as the reference point.</p>



6576A037

Figure 5-15 Ref mode (homing mode)

The Ref-Run status bit indicates whether the drive is moving at present. The traversing direction is not displayed.



6576A038

Figure 5-16 StartRef/SetRef/Ref Run/RefPointSet

This section provides information about

- Parameterization
- Various parameters of the positioning CPU.

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6 Basic Parameterization

The parameters for the input and output terminals and for the positioning CPU can be set using PCP services. The user writes the necessary settings to the individual indices of the positioning CPU. The settings, which are required in the lower-level I/O terminals, are transferred to these terminals automatically by the positioning CPU, i.e., the individual functions of the positioning CPU and the I/O terminals are addressed via indices. Appendix A 1 "Index Tables" contains a list of the functions of the relevant indices.

The IB IL POS 200 has a memory, which stores all parameters even if the voltage supply fails. Writing a zero to index 1030 resets all parameters to their default values.

The positioning CPU can be fully parameterized during startup using the Phoenix Contact parameterization software, which is connected using the POS 200 CAB-V24 cable. The software supports the user with its menu-driven operation, and communicates via RS-232 or the bus system with the IB IL POS 200, which stores the parameters.

In normal operation, the IB IL POS 200 is controlled by a higher-level PLC or PC via a remote bus (INTERBUS, PROFIBUS, CANopen, DeviceNet™, Ethernet). The remote bus is typically used to transmit the target position (as a PCP parameter) and the status bits.

If INTERBUS and a PC are used as the remote bus, there is no need to establish an additional connection with the parameterization software via RS-232, the INTERBUS connection can be used. The other bus systems must be connected via the RS-232 interface.

6.1 Controlling Communication via RS-232 or Local Bus Interface

This section describes the procedure for switching between the local bus interface and the RS-232 interface.

Both interfaces have constant read access to all PCP objects (except for the lower-level IB IL DC AR 48/10A) and the status and control bytes.

However, only one of the interfaces has write authorization at any given time. During initialization, the local bus interface has write authorization. If the Phoenix Contact parameterization software is connected via the RS-232 interface, the individual functions (e.g., positioning) can also be carried out without a local bus connection.

"InterfaceWriteEnable" parameter

Index 0168_{hex} is used to transfer write authorization from the local bus interface to the RS-232 interface. It is only possible to switch between the RS-232 and local bus interface if no axes are moving, i.e., if the enable bits of all axes are set to zero or on a timeout (aborted communication) on the process data interface.

Write authorization can only be returned from the RS-232 interface to the local bus by the RS-232 interface or by triggering an initialization through a complete reset (switching the power off and then on again).

Table 6-1 "InterfaceWriteEnable" parameter (index 0168_{hex})

Invoke ID: 0						
Access Rights	Designation	Data Type	Description	Unit	PCP Index/Sub-index	
					Index	Sub
(W)/R	Interface-WriteEnable	USIGN16	Transfer write authorization 0 = No function 1 = Local bus interface towards the higher-level control system (default) 2 = RS-232 interface 3 to 65536 = No function		0168_{hex}	

6.2 Communication With Intelligent Input and Output Terminals

The IB IL POS 200 positioning CPU can be used to control up to ten axes. The PCP (PCP = Peripherals Communication Protocol) is used for communication when parameterizing the positioning CPU.

The parameter data channel (or parameter channel for short) is used for the acyclic transfer of complex data structures between two devices. Two 8-bit words are transmitted per cycle. The data transmitted in the parameter channel usually has a low dynamic response and occurs relatively infrequently (e.g., the transmission of parameter records or control programs to "intelligent" bus devices).

The PCP software splits the parameter data into individual block slices and then recombines it.

Modules, which support a parameter channel, are also known as "PCP devices" or "intelligent modules" (e.g., the IB IL POS 200 positioning CPU or the IB IL DC AR 48/10A servo amplifier).

The Peripherals Communication Protocol (PCP) provides the user with a range of standardized services, which can be divided into various groups:

- User services
- Administration services
- Management services

(see section 8, "Peripherals Communication Protocol (PCP)").

Drivers

Driver functions are available as software for the use of PCP services. These drivers are an essential prerequisite for the use of the INTERBUS master board. They offer function calls for the PCP services (e.g. „Write“ service). In addition, function blocks for several PLC and bus systems (e.g. Siemens Step 7) are available for the entire control of the IB IL POS 200 positioning control system.

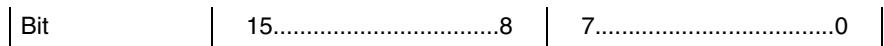
Example

"Write" Service

This example can be used to explain the meaning of the terms used in parameterization. The "Write" service can be used to overwrite the device parameters set for an object with new values.

Syntax: Write_Request (0082_{hex})

Word 1	Command_Code	
Word 2	Parameter_Count	
Word 3	Invoke_ID	Comm._Reference
Word 4	Index	
Word 5	Subindex	Length
Word 6	Data	
Word	
Word...	...	



Command_Code

Fixed number, which is specified for each command. For example, 0082_{hex} must be entered for the "Write" service. Additional services and their Command_Codes are described in section 8, "Peripherals Communication Protocol (PCP)" and in the PCP User Manual.

Parameter_Count

Specifies the number of subsequent data words (00xx_{hex}), each consisting of two bytes. If only one byte parameter occurs in a word, it is still counted as a word.

Invoke_ID

The Invoke ID can be used to address the parameter records of the individual axes and any PCP-compatible terminals located below the IB IL POS 200. For the positioning CPU, a separate Invoke ID is assigned to each axis function and each PCP-compatible terminal for drive control and position detection. This means that each axis and each PCP-compatible input and output terminal can access the entire index area. An intelligent (PCP-compatible) terminal can be parameterized directly via the relevant Invoke ID. Terminals, which cannot be parameterized via PCP (e.g., IB IL INC-IN), are parameterized via the axis function.

Table 6-2 Assignment of Invoke IDs in the IB IL POS 200

Invoke ID	Index	Axis No.	Addresses:
1	1000 _{hex} to 11FF _{hex}	1	Rapid/creeping speed positioning
2	Any	1	Intelligent input terminal with PCP
3	Any	1	Intelligent output terminal with PCP (e.g., IB IL DC AR 48/10A)
4	1000 _{hex} to 11FF _{hex}	2	Rapid/creeping speed positioning

Table 6-2 Assignment of Invoke IDs in the IB IL POS 200 (Continued)

Invoke ID	Index	Axis No.	Addresses:
5	Any	2	Intelligent input terminal with PCP
6	Any	2	Intelligent output terminal with PCP (e.g., IB IL DC AR 48/10A)
7	1000 _{hex} to 11FF _{hex}	3	Rapid/creeping speed positioning
8	Any	3	Intelligent input terminal with PCP
9	Any	3	Intelligent output terminal with PCP (e.g., IB IL DC AR 48/10A)
10	1000 _{hex} to 11FF _{hex}	4	Rapid/creeping speed positioning
11	Any	4	Intelligent input terminal with PCP
12	Any	4	Intelligent output terminal with PCP (e.g., IB IL DC AR 48/10A)
13	1000 _{hex} to 11FF _{hex}	5	Rapid/creeping speed positioning
14	Any	5	Intelligent input terminal with PCP
15	Any	5	Intelligent output terminal with PCP (e.g., IB IL DC AR 48/10A)
16	1000 _{hex} to 11FF _{hex}	6	Rapid/creeping speed positioning
17	Any	6	Intelligent input terminal with PCP
18	Any	6	Intelligent output terminal with PCP (e.g., IB IL DC AR 48/10A)
19	1000 _{hex} to 11FF _{hex}	7	Rapid/creeping speed positioning
20	Any	7	Intelligent input terminal with PCP
21	Any	7	Intelligent output terminal with PCP (e.g., IB IL DC AR 48/10A)
22	1000 _{hex} to 11FF _{hex}	8	Rapid/creeping speed positioning
23	Any	8	Intelligent input terminal with PCP
24	Any	8	Intelligent output terminal with PCP (e.g., IB IL DC AR 48/10A)

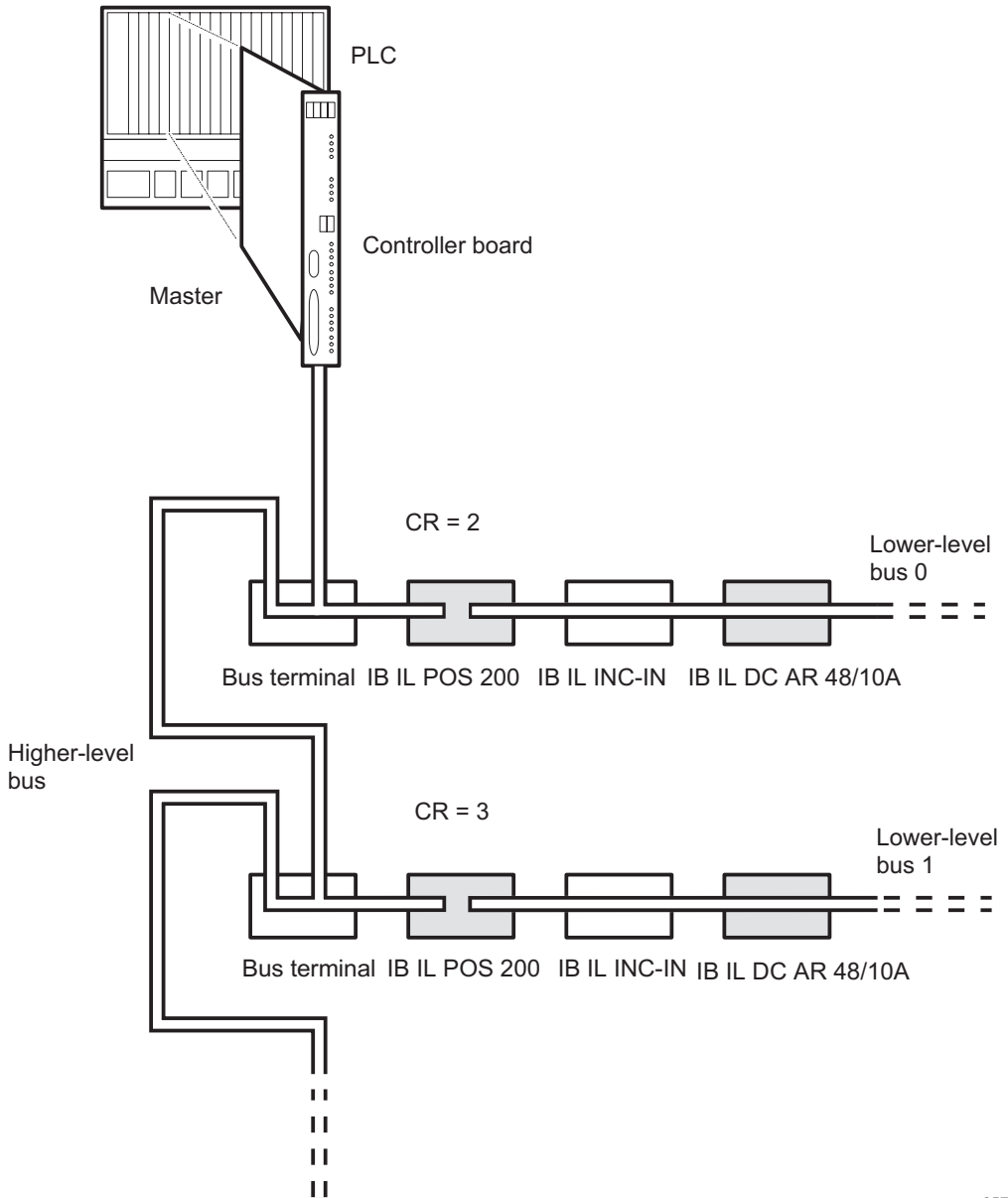
Table 6-2 Assignment of Invoke IDs in the IB IL POS 200 (Continued)

Invoke ID	Index	Axis No.	Addresses:
25	1000 _{hex} to 11FF _{hex}	9	Rapid/creeping speed positioning
26	Any	9	Intelligent input terminal with PCP
27	Any	9	Intelligent output terminal with PCP (e.g., IB IL DC AR 48/10A)
28	1000 _{hex} to 11FF _{hex}	10	Rapid/creeping speed positioning
29	Any	10	Intelligent input terminal with PCP
30	Any	10	Intelligent output terminal with PCP (e.g., IB IL DC AR 48/10A)

Comm._Reference

Number of the communication relationship between the controller board and PCP device. The communication relationships CR = 00_{hex} and CR = 01_{hex} are reserved. The communication relationship CR = 02_{hex} stands for the first PCP device, CR = 03_{hex} for the second PCP device, etc. The maximum value for the communication relationship is 63_{hex}.

The CPU IB IL POS 200 positioning CPU is addressed with a communication relationship (CR). The individual axes and any lower-level PCP devices (e.g., IB IL DC AR 48/10A) of the positioning CPU are addressed via the same CR and via an axis-specific Invoke ID.



6576A025

Figure 6-1 Communication relationship between the controller board and PCP devices

Index

The index is the logical address of an object. An object can have different data formats. These data formats are, for example, BOOL, INT32, USIGN8, USIGN16, USIGN32, bit, byte or array. Parameters are written to these data areas, and are addressed using the index.

Rapid/creeping speed positioning is defined by an implemented technology function. This function is assigned a specific index area, which must be under 6000_{hex}. The area above 6000_{hex} is used by the DRIVECOM standard.

In addition, the area above 6000_{hex} contains the standard DRIVECOM parameters, e.g., for device assignment for a technology function (addresses of the relevant input and output terminals, etc.). They can be used by the technology function.

Parameters for input and output terminals can be divided into two separate index areas:

1. General parameters (e.g., change of direction) are in the index area for the relevant technology function.
2. Specific parameters for intelligent (PCP-compatible) terminals are in a separate index area with a separate Invoke ID.

Table 6-3 Indices per axis function

Index	Contents	Meaning
1000 _{hex} to 102F _{hex}		Reserved for standard indices
1030 _{hex} to 104F _{hex}	System	Configuration: Technology type, terminal type, terminal addresses, etc.
1050 _{hex} to 10FF _{hex}	Axis function	Indices for the technology function (rapid/creeping speed positioning)
1100 _{hex} to 117F _{hex}	Input terminal	Configured input terminal (if NOT intelligent) (Intelligent (PCP-compatible) input terminals receive the entire index area with separate Invoke ID)
1180 _{hex} to 11FF _{hex}	Output terminal	Configured output terminal (if NOT intelligent) (Intelligent (PCP-compatible) output terminals receive the entire index area with separate Invoke ID)

Subindex	Every element of an object is assigned a subindex (logical sub-address). If the entire object is to be written, enter the subindex 00 _{hex} . If a single parameter is to be written, select an element from the data field, which is to be addressed. (01 _{hex} = first element, 02 _{hex} = second element, etc.).
Length	Number of following data bytes. This depends on the object being written, e.g., whether only one element or the entire object should be read (00 XX _{hex}).
Data	The actual user data is entered here, i.e., the new values to be written for the object.

6.3 Activation of Used Axes and Address Assignment for the Terminals

In order to operate axes on the IB IL POS 200, one input and one output terminal must be operated for each axis. The various options can be set using specific indices. The terminals must be assigned the addresses from the bus configuration.

Invoke ID

The Invoke ID always addresses the entire index areas of the individual axes. To make settings for a specific axis, select the relevant Invoke ID.

Table 6-4 Assignment of Invoke IDs to the individual axes

Axis Number	Invoke ID
1	1
2	4
3	7
4	10
5	13
6	16
7	19
8	22
9	25
10	28

To activate an axis, a "1" must be written to index 1030 of the relevant Invoke ID. If, for example, three axes are operated on the IB IL POS 200, then a "1" must be written to this index under Invoke IDs 1, 4, and 7.

A "0" is written for the remaining Invoke IDs (10, 13, etc.) belonging to the unused axes.

Table 6-5 "VariantTF" parameter (index 1030)

Invoke ID: 1,4,7,.....,28						
Access Rights	Designation	Data Type	Description	Modules/Other	PCP Index/Sub-index	
					Index	Sub
W/R	VariantTF	USIGN16	Axis activation 0 = Not active 1 = Activation of technology function (rapid/creeping speed positioning)		1030 _{hex}	

The following typical structure (without bus coupler in this example) shows various options for the individual input and output terminals.

Table 6-6 Typical structure

IB IL POS 200	IB IL INC-IN	IB IL DC AR 48/10A	IB IL SSI	IB IL 24 DI 2	IB IL DC AR 48/10A	IB IL INC-IN	IB IL 24 DO 4	IB IL INC-IN	IB IL AO 2/U/BP	IB IL 24 DO 2	IB IL INC-IN	IB IL DC AR 48/10A	...
	Input	Output	Input		Output	Input	Output	Input	Output		Input	Output	...
	Axis 1 (Invoke ID 1)		Axis 2 (Invoke ID 4)		Axis 3 (Invoke ID 7)		Axis 4 (Invoke ID 10)		Axis 5 (Invoke ID 13)		...		

The IB IL INC-IN and IB IL SSI + IB IL 24 DI 2 input terminals and the IB IL AO 2/U/BP + IB IL 24 DO2, IB IL 24 DO 4, and IB IL DC AR 48/10A output terminals can be used. The input terminal for the axis is selected under index 1032_{hex} (see Table 6-7).



Before you configure an Inline station, please make sure to consult the IB IL SYS PRO UM E User Manual (Order No. 27 43 04 8) or the Inline System Manual for your bus system!

Table 6-7 "VariantInput" parameter (index 1032_{hex})

Invoke ID: 1,4,7,.....,28								
Access Rights	Designation	Data Type	Description			Mod-ules/Oth-er	PCP Index/Sub-index	
							Index	Sub
W/R	VariantInput	USIGN16	Type of Position Detection (Input Terminal)				1032 _{hex}	
			Entry:	1st terminal	2nd terminal			
			3	IB IL SSI	IB IL 24 DI 2			
			5	IB IL INC-IN	—			

With reference to the typical structure, the following entries should be made in index 1032_{hex} for the individual axes:

Table 6-8 Entries in index 1032_{hex}

Axis Number	Invoke ID	Entry in Index 1032 _{hex}
1	1	5
2	4	3
3	7	5
4	10	5
5	13	5

Index 1036_{hex} can be used to select one of the various output terminals.

Table 6-9 "VariantOutput" parameter (index 1036)

Invoke ID: 1,4,7,.....,28								
Access Rights	Designation	Data Type	Description			Mod-ules/Othe-r	PCP Index/Sub-index	
							Index	Sub
W/R	VariantOutput	USIGN16	Type of Drive Control (Output Terminal)				1036 _{hex}	
			Entry:	1st Terminal	2nd Terminal			
			4	IB IL 24 DO 4	—			
			5	IB IL AO 2/U/BP	IB IL 24 DO 2			
			6	IB IL DC AR 48/10A	—			

With reference to the typical structure, the following entries should be made in index 1036_{hex} for the individual axes:

Table 6-10 Entries in index 1036_{hex}

Axis Number	Invoke ID	Entry in Index 1036 _{hex}
1	1	6
2	4	6
3	7	4
4	10	5
5	13	6

The terminals must be addressed under other indices. The bus configuration specifies which input and output terminals are expected at which positions. These specifications are compared with the connected hardware on power up. If modules other than the expected ones have been configured or if the bus configuration and parameterization do not correspond, the assignment is rejected and the user is informed by an error message.

When addressing individual terminals, the relevant number of words for each terminal must be observed. The following table provides information about the words reserved for each terminal:

Table 6-11 Reserved words

Terminal	Number of Words	Number of Used Bits	Remark
IB IL INC-IN	2	32	
IB IL SSI	2	32	
IB IL 24 DI 2	1	2	
IB IL DC AR 48/10A	2	32	
IB IL AO 2/U/BP	2	16+16	With the IB IL POS 200, only the first of the two channels is used.
IB IL 24 DO 2	1	4	
IB IL 24 DO 4	1	8	

The addresses of the input terminals are entered under index 1034_{hex} sub 01. The first terminal after the positioning CPU always has address 0. If an input terminal is connected to an additional input terminal (see Table 6-6, Axis 2 (IB IL SSI + IB IL 24 DI 2)), the address of this additional terminal should be stored under index 1034_{hex} sub 02.

Table 6-12 "AddressInput" parameter (index 1034_{hex})

Invoke ID: 1,4,7,.....,28						
Access Rights	Designation	Data Type	Description	Modules/Other	PCP Index/Sub-index	
					Index	Sub
W/R	Address-Input1	USIGN16	Address in the local bus structure for the first input terminal	*New Ref	1034 _{hex}	01
W/R	Address-Input2	USIGN16	Address in the local bus structure for the second input terminal	*New Ref	1034 _{hex}	02

With reference to the typical structure, the following entries should be made in index 1034_{hex} sub 01/02 for the individual axes:

Table 6-13 Entries in index 1034

Axis Number	Invoke ID	Entry in Index 1034 Sub 01	Entry in Index 1034 Sub 02
1	1	0	
2	4	4	6
3	7	9	
4	10	12	
5	13	17	

Due to the selected input version, no entries are expected for the empty fields of sub 02. This means that an address value is only required for input version IB IL SSI + IB IL 24 DI 2.

The addresses of the output terminals are entered under index 1038_{hex} sub 01. If an output terminal is connected to an additional output terminal, as for the IB IL AO 2/U/BP + IB IL 24 DO 2 output version (see Table 6-6, Axis 4), the address of the second module should be stored under index 1038_{hex} sub 02.

Table 6-14 "AddressOutput" parameter (index 1038_{hex})

Invoke ID: 1,4,7,.....,28						
Access Rights	Designation	Data Type	Description	Modules/ Other	PCP Index/Sub-index	
					Index	Sub
W/R	Address-Output1	USIGN16	Address in the local bus structure for the first output terminal	*New Ref	1038 _{hex}	01
W/R	Address-Output2	USIGN16	Address in the local bus structure for the second output terminal	*New Ref	1038 _{hex}	02

With reference to the typical structure, the following entries should be made in index 1038_{hex} sub 01/02 for the individual axes:

Table 6-15 Entries in index 1038_{hex}

Axis Number	Invoke ID	Entry in Index 1038 _{hex} Sub 01	Entry in Index 1038 _{hex} Sub 02
1	1	2	
2	4	7	
3	7	11	
4	10	14	16
5	13	19	

Due to the selected output version, no entries are expected for the empty fields of sub 02. This means that an address value is only required for output version IB IL AO 2/U/BP + IB IL 24 DO 2.

Overview

The following table provides a complete overview of the activation of used axes and address assignment of terminals for actual value detection and drive control for the typical structure:

Table 6-16 Overview

	Axis 1		Axis 2			Axis 3		Axis 4			Axis 5		..
IB IL POS 200	IB IL INC-IN (2 Words)	IB IL DC AR 48/10A (2 Words)	IB IL SSI (2 Words)	IB IL 24 DI 2 (1 Word)	IB IL DC AR 48/10A (2 Words)	IB IL INC-IN (2 Words)	IB IL 24 DO 4 (1 Word)	IB IL INC-IN (2 Words)	IB IL AO 2/U/BP (2 Words)	IB IL 24 DO 2 (1 Word)	IB IL INC-IN (2 Words)	IB IL DC AR 48/10A (2 Words)	..
	Input	Output	Input		Output	Input	Output	Input	Output		Input	Output	..
Address	0	2	4	6	7	9	11	12	14	16	17	19	..
	Invoke ID 1		Invoke ID 4			Invoke ID 7		Invoke ID 10			Invoke ID 13		..
Index 1030, VariantTF	1		1			1		1			1		
Index 1032, VariantInput	5		3			5		5			5		
Index 1034 Sub 01, AddressInput1	0		4			9		12			17		
Index 1034 Sub 02, AddressInput2	No entry required		6			No entry required		—			No entry required		
Index 1036, VariantOutput	6		6			4		5			6		
Index 1038 Sub 01, Address Output1	2		7			11		14			19		
Index 1038 Sub 02, Address- Output2	No entry required		No entry required			No entry required		16			No entry required		

Addressing When Using a Branch Terminal

A branch terminal can be used to isolate the bus and continue it at another location. During addressing, there is no need to take the branch terminal into account.

Addressing is continued as usual at the location at which the lower-level bus (local bus) is continued, determined by the position of the branch terminal.

Example

Table 6-17 Addressing when using a branch terminal

IBS IL BK-T/U		IB IL POS 200		IB IL INC-IN		IB IL DC AR 48/10A		IB IL SSI		IB IL 24 DI 2		IB IL DC AR 48/10A		IB IL INC-IN		IB IL 24 DO 4		IB IL INC-IN		IB IL AO 2/U/BP		IB IL 24 DO 2		IB IL INC-IN		IB IL DC AR 48/10A		IBS IL 24 RB-T	
Bus coupler	Positioning CPU	Input		Out-put	Input	Out-put	Input	Output	Input	Output	Input	Output	Input	Output	Input	Output	Input	Output	Input	Output	Input	Output	Input	Output	Input	Output	Branch terminal		
Address		0	2	3	6	7	9	11	12	14	16	17	19																
		Axis 1 (Invoke ID 1)		Axis 2 (Invoke ID 4)			Axis 3 (Invoke ID 7)			Axis 4 (Invoke ID 10)		Axis 5 (Invoke ID 13)																	

IBS IL BK-T/U		IB IL INC-IN		IB IL DC AR 48/10A		IB IL SSI		IB IL 24 DI 2		IB IL DC AR 48/10A		IB IL INC-IN		IB IL 24 DO 4		IB IL INC-IN		IB IL AO 2/U/BP		IB IL 24 DO 2		IB IL INC-IN		IB IL DC AR 48/10A	
Bus coupler	Input	Output	Input		Out-put	Input	Output	Input	Output	Input	Output	Input	Output	Input	Output	Input	Output	Input	Output	Input	Output	Input	Output	Input	Output
Address	21	23	25	27	28	30	32	33	35	37	38	40													
	Axis 6 (Invoke ID 16)		Axis 7 (Invoke ID 19)			Axis 8 (Invoke ID 22)			Axis 9 (Invoke ID 25)		Axis 10 (Invoke ID 28)														



Before you configure an Inline station, please make sure to consult the IB IL SYS PRO UM E User Manual (Order No. 27 43 04 8) or the Inline System Manual for your bus system!

Reconfiguration of the Axis Assignment

It is possible to reconfigure the axis assignment without resetting the entire frame.

Example

- Axis 1 to be addressed with the terminals previously used for Axis 2
- Axis 2 to be addressed with the terminals previously used for Axis 1
- Address entries only to be modified for the affected terminals
- Bus configuration not to be modified

Old configuration

Table 6-18 Reconfiguration of the axis assignment: old configuration

IB IL POS 200	IB IL INC-IN	IB IL DC AR 48/10A	IB IL SSI	IB IL 24 DI 2	IB IL DC AR 48/10A	IB IL INC-IN	IB IL 24 DO 4	IB IL INC-IN	IB IL AO 2/U/BP	IB IL 24 DO 2	IB IL INC-IN	IB IL DC AR 48/10A	..
	Input	Out-put	Input		Out-put	Input	Out-put	Input	Output		Input	Out-put	...
Address	0	2	4	6	7	9	11	12	14	16	17	19	
	Axis 1		Axis 2			Axis 3		Axis 4			Axis 5		...

New configuration

Table 6-19 Reconfiguration of the axis assignment: new configuration

IB IL POS 200	IB IL INC-IN	IB IL DC AR 48/10A	IB IL SSI	IB IL 24 DI 2	IB IL DC AR 48/10A	IB IL INC-IN	IB IL 24 DO 4	IB IL INC-IN	IB IL AO 2/U/BP	IB IL 24 DO 2	IB IL INC-IN	IB IL DC AR 48/10A	..
	Input	Out-put	Input		Out-put	Input	Out-put	Input	Output		Input	Out-put	...
Address	0	2	4	6	7	9	11	12	14	16	17	19	
	Axis 2		Axis 1			Axis 3		Axis 4			Axis 5		...

Procedure

1. Reset VariantTF (index 1030_{hex}) of the relevant axes to "0". This clears the old address entries for the relevant axes.
2. Enter the input and output versions and the new addresses.

Using the same example as before, this leads to the following parameterization:

Table 6-20 Parameterization for axis 1

Axis 1 (Invoke ID 1)		
Index	Designation	Entry
1030 _{hex}	VariantTF	1
1032 _{hex}	VariantInput	3
1034 _{hex} Sub 01	AddressInput1	4
1034 _{hex} Sub 02	AddressInput2	6
1036 _{hex}	VariantOutput	6
1038 _{hex} Sub1	AddressOutput1	7

Table 6-21 Parameterization for axis 2

Axis 2 (Invoke ID 4)		
Index	Designation	Entry
1030 _{hex}	VariantTF	1
1032 _{hex}	VariantInput	5
1034 _{hex} Sub 01	AddressInput1	0
1034 _{hex} Sub 02	AddressInput2	
1036 _{hex}	VariantOutput	6
1038 _{hex} Sub1	AddressOutput1	2

6.4 Parameterization of Drive Control

The IB IL POS 200 supports the individual use of a drive for each axis. This is specified by the selection of the relevant Inline terminal for drive control. Index 1036_{hex} informs the IB IL POS 200 which output version has been selected (see section 6.3, "Activation of Used Axes and Address Assignment for the Terminals"). The various output versions require different parameters and some also offer the choice of different output functions.

"Direction" parameter

All three output versions (IB IL DC AR 48/10A, IB IL 24 DO 4, IB IL AO 2/U/BP + IB IL 24 DO 2) offer the option of inverting the direction. However, it should be noted that when the direction is inverted the settings for the input versions, such as change in direction when using incremental encoders (index 1103_{hex} sub 03), are also affected.

Table 6-22 "Direction" parameter (index 1182_{hex})

Invoke ID: 1,4,7,.....,28					
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/Sub-index
					Index Sub
W/R	Direction	BOOL	Direction of travel 0 = Not inverted (default) 1 = Inverted		1182 _{hex} 01

6.4.1 Use of the IB IL DC AR 48/10A Output Version

The IB IL DC AR 48/10A servo amplifier can be used to operate DC motors with brushgears up to 450 W power output. The servo amplifier conforms to DRIVECOM Profile 22, whereby all parameters are read and written as indices using PCP services, as for the IB IL POS 200.

The IB IL DC AR 48/10A is operated as a lower-level bus device on the IB IL POS 200. All parameters are written to the IB IL POS 200 and then transferred transparently to the IB IL DC AR 48/10A via the PCP channel. All bus devices below the IB IL POS 200, including the servo amplifier, are addressed using an Invoke ID, which is not equal to zero.

To address the desired axes using the IB IL DC AR 48/10A, the following Invoke IDs should be selected:

Table 6-23 Invoke ID for IB IL DC AR 48/10A

Axis Number	Invoke ID for IB IL DC AR 48/10A
1	3
2	6
3	9
4	12
5	15
6	18
7	21
8	24
9	27
10	30

During parameterization, note that a waiting time of 2 to 3 seconds is added after writing the output version (index 1036_{hex}), the address (index 1038_{hex}), and the general output parameters (indices 1180_{hex}, 1182_{hex}, 1184_{hex}, 1185_{hex}, 1186_{hex}). This enables the IB IL POS 200 to transfer this data to the IB IL DC AR 48/10A and to await confirmation before further communication.

The IB IL POS 200 stores all parameters, including the parameters for the IB IL DC AR 48/10A, which does not have its own permanent memory. When the system is shut down and restarted, the IB IL POS 200 writes all parameters to the IB IL DC AR 48/10A again.

A few parameters must be set in order to adapt the mechanical properties of the motor and the axis to the speed controller. The lower the positioning speed, the greater the effect of these parameters. The aim of this parameterization is to reach the slowest possible creeping speed, as this increases the positioning accuracy considerably.

The following table can be used to set the most important parameters for adapting the open and closed-loop control to the gears and motor.

Table 6-24 Setting the indices for the IB IL DC AR 48/10A

Index	Data Type	Designation
010B	USIGN16	IxR factor (compensation)
0109	USIGN16	KP factor (speed controller)
0107	USIGN16	KP factor (current controller)

To adjust the controller, the IxR factor for compensation, KP factor for speed controller, and KP factor for current control parameters should be set as follows:

1. Increase IxR factor (compensation) until the motor runs irregularly.
2. Subtract about 10% to 20% from this value and enter this as the IxR factor (compensation).
3. Increase KP factor (speed controller) until the motor runs irregularly.
4. Subtract about 10% to 20% from this value and enter this as the KP factor (speed controller).
5. Increase KP factor (current controller) until the motor runs irregularly.
6. Subtract about 10% to 20% from this value and enter this as the KP factor (current controller).



For additional information on the configuration of the IB IL DC AR 48/10A, please refer to the IB IL DC AR 48/10A data sheet and user manual.

6.4.2 Use of the IB IL AO 2/U/BP + IB IL 24 DO 2 Output Version

The IB IL AO 2/U/BP analog output terminal and the IB IL 24 DO 2 digital output terminal are used together for controlling drive controllers. The analog output terminal is used to output an analog voltage as a setpoint for the speed of a connected drive amplifier, e.g., a frequency inverter. The digital output terminal outputs direction signals or enable and braking signals.

"OutputFunction" parameter

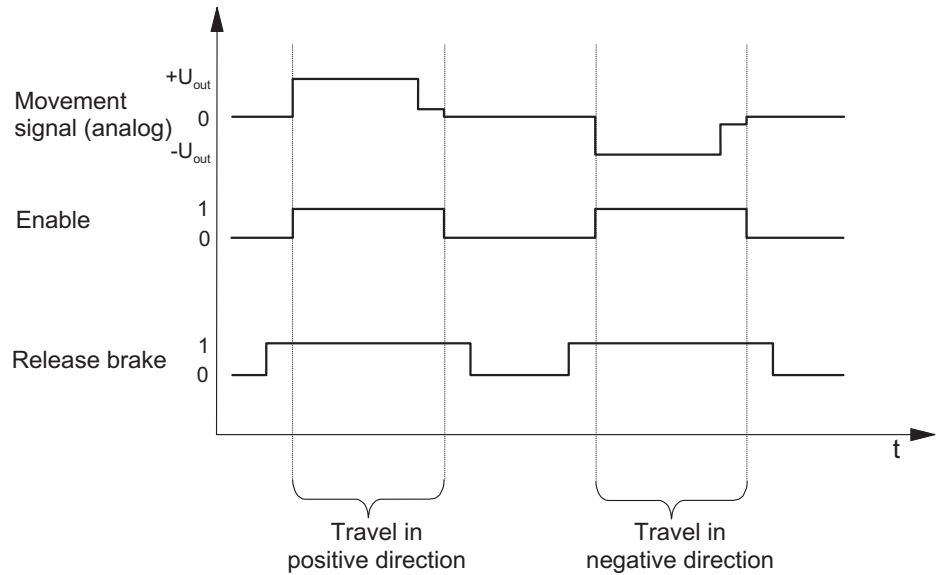
Index 1180_{hex} can be used in this output version to select one of two output functions.

Output function 1 offers a bipolar voltage of -10 V to +10 V at the analog output terminal, which enables the connected drive amplifier to select a speed between the maximum negative speed (-10 V) and the maximum positive speed (+10 V). An enable signal and a signal for controlling a holding brake are output at the digital output terminal.

Output function 2 outputs 0 V to +10 V at the analog output terminal and outputs enable signals for both the positive and negative direction at the digital output terminal.

IB IL AO 2/U/BP + IB IL 24 DO 2: Output Function 1 (With Holding Brake)

- ± 10 V analog output
 - $0 \text{ V} < U_{\text{out}} < +10 \text{ V} \Rightarrow$ positive direction
 - $-10 \text{ V} < U_{\text{out}} < 0 \text{ V} \Rightarrow$ negative direction
- Enable (digital output 1)
- Holding brake (digital output 2)

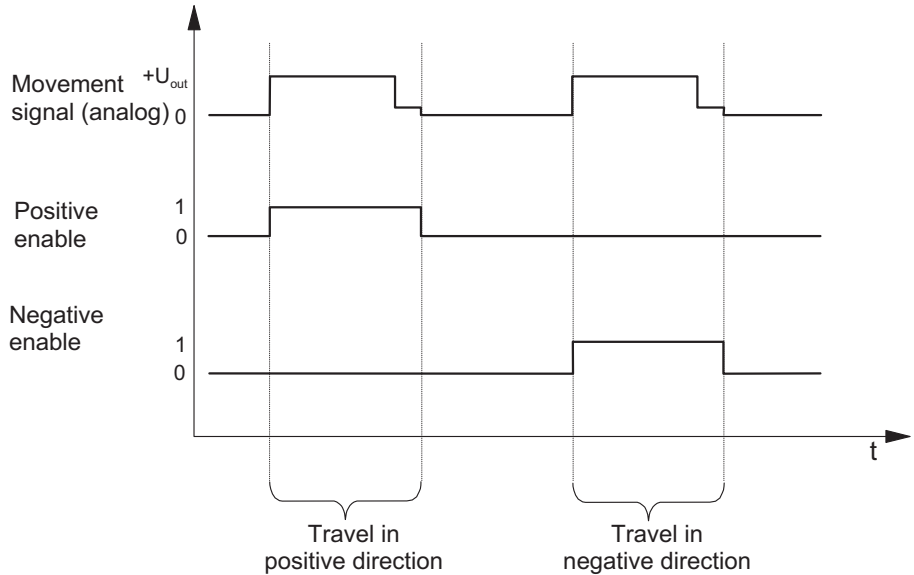


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Figure 6-2 Output function 1 (with holding brake)

IB IL AO 2/U/BP + IB IL 24 DO 2: Output Function 2 (Without Holding Brake)

- 0 V to +10 V analog output
- Enable — positive direction (digital output 1)
- Enable — negative direction (digital output 2)



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Figure 6-3 Output function 2 (without holding brake)

The output function is set under index 1180. For the IB IL AO 2/U/BP + IB IL 24 DO 2 output version, the entries have the following meanings:

Table 6-25 "OutputFunction" parameter (index 1180_{hex}) for IB IL AO 2/U/BP + IB IL 24 DO 2

Invoke ID: 1,4,7,.....,28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/Sub-index	
					Index	Sub
W/R	Output-Function (AO2+DO2)	USIGN16	0 = No function (default) 1 = With holding brake 2 = Without holding brake 3 to 65536 = No function		1180 _{hex}	

"Uout" parameter

To adapt and protect the connected drive amplifiers, which require, for example, an input voltage of 0 V to +5 V or -5 V to +5 V, a maximum output voltage can be defined for the IB IL AO 2/U/BP + IB IL 24 DO 2 output version. By default, a maximum value of +10 V is defined. Values, which should be below this value, can be entered under index 1186_{hex}. During IB IL POS 200 parameterization, speeds are always entered as percentage values, where 100% is the maximum output voltage U_{out}. If the maximum output voltage is modified, 100% corresponds to the modified maximum output voltage.

Table 6-26 "Uout" parameter (index 1186_{hex}) for IB IL AO 2/U/BP + IB IL 24 DO 2

Invoke ID: 1,4,7,.....,28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/Sub-index	
					Index	Sub
W/R	Uout	USIGN16	Desired maximum output voltage 0 = No function 1 to 10 = +1 V to +10 V (10 = default) 11 to 65536 = No function	V	1186 _{hex}	

6.4.3 Use of the IB IL 24 DO 4 Output Version

The IB IL 24 DO 4 digital output terminal is used to control drives with up to four digital 24 V input signals. This output version supports four output functions:

- Dahlander circuit
- Pole-changing circuit
- Control of drive amplifiers with four digital signals
- Control of drive amplifiers with three digital signals and one digital signal to control a holding brake

"OutputFunction" parameter

In this output version, it is possible to use the four digital outputs with different pre-defined output functions. The outputs should be assigned the relevant contactors, which control the motor at rapid or creeping speed and in reverse or forward running. The following output functions are defined:

IB IL 24 DO 4 Output Function 1 (Dahlander Circuit)

Table 6-27 Output assignment for output function 1

Status	Output 1	Output 2	Output 3	Output 4
	Rapid Motion	Enable	Positive Direction Signal	Negative Direction Signal
Downtime	0	0	0	0
Positive creeping motion	0	1	1	0
Positive rapid motion	1	1	1	0
Negative creeping motion	0	1	0	1
Negative rapid motion	1	1	0	1

IB IL 24 DO 4 Output Function 2 (Pole-Changing Circuit)

Table 6-28 Output assignment for output function 2

Status	Output 1	Output 2	Output 3	Output 4
	Rapid Motion	Creeping Motion	Positive Direction Signal	Negative Direction Signal
Downtime	0	0	0	0
Positive creeping motion	0	1	1	0
Positive rapid motion	1	0	1	0
Negative creeping motion	0	1	0	1
Negative rapid motion	1	0	0	1

IB IL 24 DO 4 Output Function 3 (Control of Drive Amplifiers With Four Digital Signals)

Table 6-29 Output assignment for output function 3

Status	Output 1	Output 2	Output 3	Output 4
	Positive Rapid Motion	Positive Creeping Motion	Negative Creeping Motion	Negative Rapid Motion
Downtime	0	0	0	0
Positive creeping motion	0	1	0	0
Positive rapid motion	1	0	0	0
Negative creeping motion	0	0	1	0
Negative rapid motion	0	0	0	1

IB IL 24 DO 4 Output Function 4 (Control of Drive Amplifiers With Three Digital Signals and One Digital Signal to Control a Holding Brake)

Table 6-30 Output assignment for output function 4

Status	Output 1	Output 2	Output 3	Output 4
	Positive Direction Signal	Negative Direction Signal	Rapid Motion	Release Brake
Positive creeping motion	1	0	0	1
Negative creeping motion	0	1	0	1
Positive rapid motion	1	0	1	1
Negative rapid motion	0	1	1	1
Downtime	0	0	0	0

The output function is set under index 1180_{hex}. For the IB IL 24 DO 4 output version, the entries have the following meanings:

Table 6-31 "OutputFunction" parameter (index 1180) for IB IL 24 DO 4

Invoke ID: 1,4,7,.....28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/ Subindex	
					Index	Sub
W/R	Output-Function (DO4)	USIGN16	0 = No function (default) 1 = Output function 1 2 = Output function 2 3 = Output function 3 4 = Output function 4 5 to 65536 = No function		1180 _{hex}	

"SwitchOverTime" parameter

To prevent the risk of short circuits in the IB IL 24 DO 4 output version when the contactors are switched over too quickly, switch-over times can be defined in the ms range. After the outputs are switched off, the specified time elapses before the next outputs are switched on. This means that the contactor response time can be taken into account. Index 1184 is used for this option.

When parameterizing the switch-over time, index 1063 sub 01 should also be taken into account. This index can be used to set another time, which affects the switch-over in terms of rotation and downtime monitoring. It is therefore possible that the delay time, if it is set to a high value, may exceed the value entered under index 1184_{hex} (switch-over delay time) when the drive changes direction.

Table 6-32 "SwitchOverTime" parameter (index 1184_{hex}) for IB IL 24 DO 4

Invoke ID: 1,4,7,.....28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/ Subindex	
					Index	Sub
W/R	SwitchOver-Time	USIGN16	Switch-over delay time (output contactor response time) Minimum: 0 (default) Maximum: 65535	ms	1184 _{hex}	

6.4.4 Use of an Output Version With Holding Brake

Operation with a holding brake is supported with the IB IL AO 2/U/BP + IB IL 24 DO 2 (output function 1) and IB IL 24 DO 4 (output function 4) output versions.

Two parameters can be set for rapid/creeping speed positioning with a holding brake.

"EarlyReleaseTime" parameter

This parameter is used to release the brake before the movement is started. The "EarlyReleaseTime" parameter describes the time between the early release of the brake and the connection of the motor. It is given in milliseconds.

"DelayedReleaseTime" parameter

This parameter is used to set the brake once the axis reaches the target. When setting this parameter, note the distance required by the axis to reach the target after the motor has been switched off (stop window). The "DelayedReleaseTime" parameter describes the time that elapses after the motor has been switched off before the brake is activated. It is specified in milliseconds.

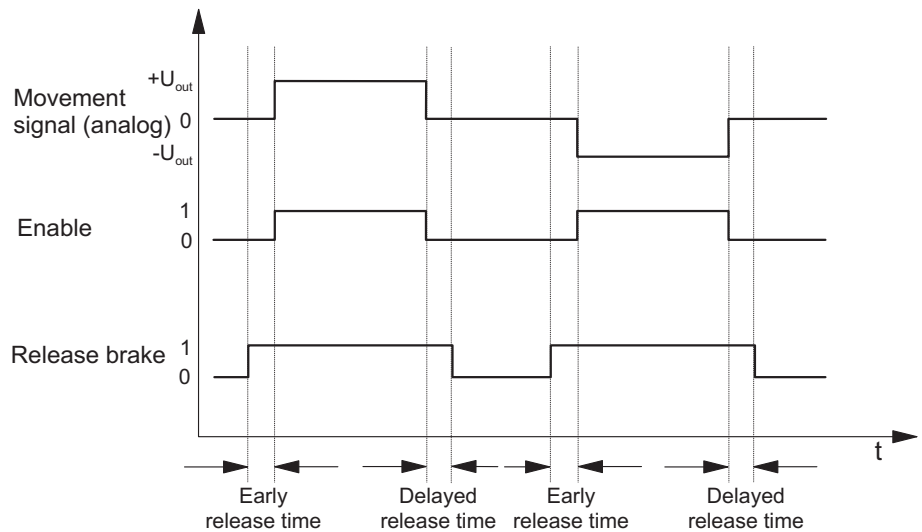
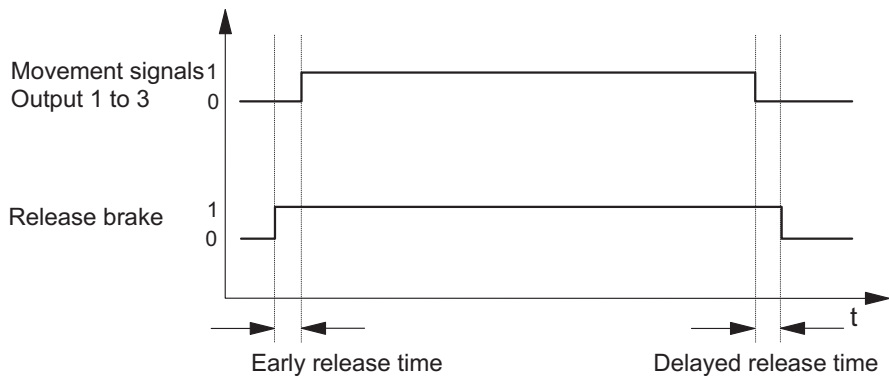


Figure 6-4 Sequence of signals for the IB IL AO 2/U/BP + IB IL 24 DO 2 output version with holding brake



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Figure 6-5 Sequence of signals for the IB IL 24 DO 4 output version with holding brake

Table 6-33 "EarlyReleaseTime" and "DelayedReleaseTime" parameters (index 1185_{hex})

Invoke ID: 1,4,7,.....28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/ Subindex	
					Index	Sub
W/R	EarlyRelease-Time	USIGN16	Clamping/brake, time for early release	ms	1185 _{hex}	01
W/R	Delayed-ReleaseTime	USIGN16	Clamping/brake, time for delayed release Minimum: 0 (default) Maximum: 65535	ms	1185 _{hex}	02

6.5 Parameterization of Position Detection (Encoders)

The IB IL POS 200 positioning CPU supports the selection of an actual value detection system for each axis. This uses index 1032_{hex} (VariantInput) for each axis. Once the input and output terminals have been set and addressed, the selected modules must be parameterized. The various input terminals require different parameters for the different encoder types. These settings also enable the user to influence the axis and its limit switches via the software, without having to make modifications to the terminal points of the terminals used.

6.5.1 Use of Incremental Encoders

Incremental encoders are operated together with the IB IL INC-IN input terminal. This terminal is suitable for the connection of symmetrical or asymmetrical encoders with square-wave signals from 4.5 V to 30 V. When making the necessary encoder settings for incremental encoders, the entry for index 1032_{hex} (VariantInput) must be 5 for the relevant axis.

The following parameters must be defined for an axis when using incremental encoders:

"Evaluation" (INC) parameter

The IB IL INC-IN can be used to detect encoder signals using either single, twofold or fourfold evaluation. The desired encoder signal evaluation should be set under index 1102_{hex} sub 01.

Table 6-34 "Evaluation" parameter (index 1102_{hex}) for IB IL INC-IN

Invoke ID: 1,4,7,.....28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/ Subindex	
					Index	Sub
W/R	Evaluation (INC)	USIGN8	0 = Single evaluation 1 = Twofold evaluation 2 = Fourfold evaluation	*New Ref	1102 _{hex}	01

Single Evaluation

Example

For an encoder, which provides 1024 pulses per rotation, the positioning counter counts 1024 increments (counts).

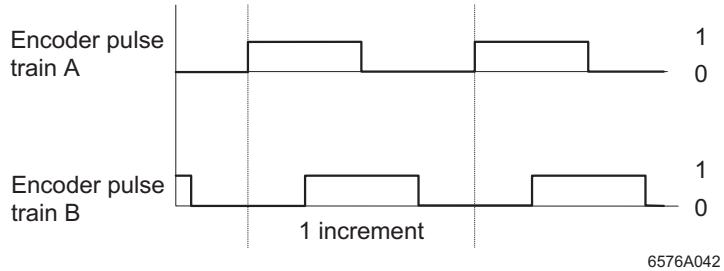


Figure 6-6 Single evaluation

Twofold Evaluation

Example

For an encoder, which provides 1024 pulses per rotation, the positioning counter counts 2048 increments (counts).

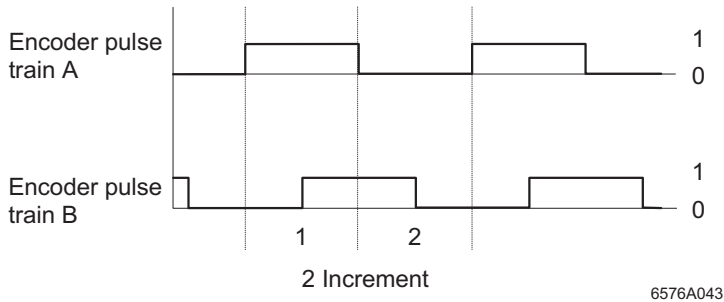


Figure 6-7 Twofold evaluation

Fourfold Evaluation

Example

For an encoder, which provides 1024 pulses per rotation, the positioning counter counts 4096 increments (counts).

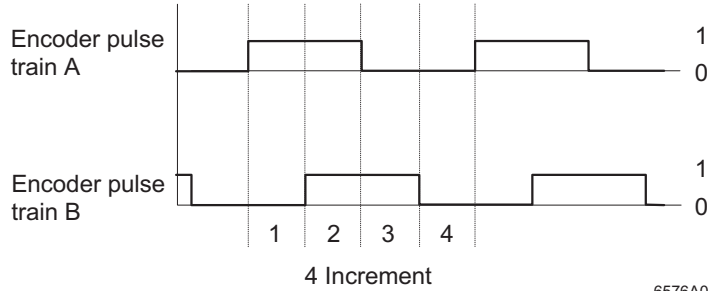


Figure 6-8 Fourfold evaluation

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"EncoderType" (INC) parameter

This parameter is used to specify whether the encoder provides asymmetrical or symmetrical signals.

The pulse image of an asymmetrical encoder is shown in Figure 6-9. It consists of signals A* and B* set at 90°, and the zero pulse Z*, which provides one pulse per encoder rotation. Output signals A* and B* comprise a pulse (180°) and a pause (180°).

Asymmetrical encoders with a 5 V or 24 V encoder supply can be connected to the IB IL INC-IN terminal.

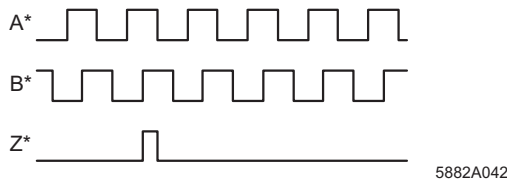


Figure 6-9 Pulse sequence of an asymmetrical encoder

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The pulse image of a symmetrical encoder is shown in Figure 6-10. An inverted signal (\bar{A} , \bar{B} , \bar{Z}) is output for every signal (A, B, Z) (RS-422 interface). Inverted signals increase the level of immunity to interference.

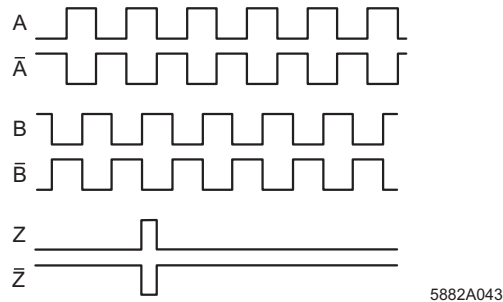


Figure 6-10 Pulse sequence of a symmetrical encoder

To ensure correct pulse evaluation, the right encoder type must be selected using an entry under index 1102_{hex} sub 04.

Table 6-35 "EncoderType" parameter (index 1102_{hex}) for IB IL INC-IN

Invoke ID: 1,4,7,.....28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/ Subindex	
					Index	Sub
W/R	Encoder-Type (INC)	BOOL	0 = Symmetrical 1 = Asymmetrical	*New Ref	1102 _{hex}	04

"InvertLimitSwitch" (INC) parameter

The limit switch can be inverted and activated or deactivated under index 1103_{hex} sub 01. When activated, the limit switches can be connected as N/O contacts and the signal is evaluated as "active high". When deactivated, the limit switches can be connected as N/C contacts and the signal is evaluated as "active low".

Table 6-36 "InvertLimitSwitch" parameter (index 1103_{hex} sub 01) for IB IL INC-IN

Invoke ID: 1,4,7,.....28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/ Subindex	
					Index	Sub
W/R	InvertLimit-Switch (INC)	BOOL	Invert limit switch (active high or low) IB IL INC-IN: 0 = Active low (N/C contact) 1 = Active high (N/O contact)	*New Ref	1103 _{hex}	01

"ChangeDirection" (INC) parameter

The counting direction for an encoder depends on its installation location. If the encoder is correctly connected to the input terminal, it should first generate the encoder pulse for channel A on a positive motion. If this is not the case, the direction of rotation/downtime monitoring will output an error. However, it is possible to change the direction of rotation of the encoder via the software regardless of the installation location. The "ChangeDirection" parameter can be used to mount the encoder on the axis regardless of its direction of rotation. It should be noted, however, that the direction of travel of the output terminal must correspond to the counting direction (see Table 6-22 on page 6-23).

If the encoder pulse for channel B is generated first on a positive motion, the change in direction should be activated with the entry 1 in index 1103_{hex} sub 03:

Table 6-37 "ChangeDirection" parameter (index 1103_{hex} sub 03) for IB IL INC-IN

Invoke ID: 1,4,7,.....28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/ Subindex	
					Index	Sub
W/R	Change-Direction (INC)	BOOL	0 = Not active 1 = Active	*New Ref	1103 _{hex}	03

"SwapLimitSwitches" (INC) parameter

It is also possible to swap the wired positive and negative limit switches via the software. Under normal circumstances, the negative limit switch for the IB IL INC-IN is wired to input E1 and the positive limit switch is wired to input E2. In this case, index 1103_{hex} sub 04 would have the value 0. If the value 1 is entered here without modifying the terminal assignment at the terminal points, the limit switches are swapped over.

Table 6-38 "SwapLimitSwitches" parameter (index 1103_{hex} sub 04) for IB IL INC-IN

Invoke ID: 1,4,7,.....28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/ Subindex	
					Index	Sub
W/R	SwapLimit-Switches (INC)	BOOL	0 = E1 = Negative limit switch E2 = Positive limit switch 1 = E1 = Positive limit switch E2 = Negative limit switch	*New Ref	1103 _{hex}	04

"RefVariant" (INC) parameter (type of encoder)

This parameter can be used to set the type of encoder (absolute or incremental encoder). To enable reference point setting when using incremental encoders, index 1084_{hex} must have the value 2.

Table 6-39 "RefVariant" parameter (index 1084_{hex}) for IB IL INC-IN

Invoke ID: 1,4,7,.....28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/ Subindex	
					Index	Sub
W/R	RefVariant (INC)	BOOL	Type of encoder 0 = Absolute encoder 1 = Reserved 2 = Incremental encoder	*New Ref	1084 _{hex}	

6.5.2 Use of Absolute Encoders

Absolute encoders are operated together with IB IL SSI + IB IL 24 DI 2 input terminals. The IB IL SSI supports the use of absolute encoders with a resolution of up to 26 bits. When making the necessary encoder settings for absolute encoders, the entry for index 1032_{hex} (VariantInput) must be 3 for the relevant axis.

The following parameters must be defined for an axis when using absolute encoders:

"EncoderResolution" (SSI) parameter

The various absolute encoders have different resolutions. This resolution can be entered under index 1100_{hex} sub 01. Absolute encoders with a resolution of between 8 and 26 bits should be used. The encoder resolution should be taken from the specific data sheet provided by the encoder manufacturer. When setting the resolution, refer to the following table:

Table 6-40 Resolution of the absolute encoder

Resolution of the encoder in bits	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Entry in index 1100 sub 01	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

Table 6-41 "EncoderResolution" parameter (index 1100_{hex} sub 01) for IB IL SSI

Invoke ID: 1,4,7,.....28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/ Subindex	
					Index	Sub
W/R	Encoder-Resolution (SSI)	USIGN16	Resolution of the encoder (in bits) 1 = 8 bits 2 = 9 bits ... 19 = 26 bits		1100 _{hex}	01

"EncoderOffset" (SSI) parameter

Especially when installing the encoder it may be that the encoder is not set to zero. If the encoder can move so far in a positive direction that it overruns, the positioning control system will have to abort the movement to the target because it cannot handle an overrun. This means that the encoder cannot travel across its entire increment range. The "EncoderOffset" parameter can be used to redefine the zero point.

Example

The absolute encoder used has 12-bit resolution, which provides a usable range of 4096 increments.

In the start position, the encoder provides the value of 1000 increments. This value can be read under index 1058_{hex} (CurrentPosition). To ensure that the value read at the axis zero point can be used for the encoder offset entry, the numerator and denominator for the gear ratio (index 1061_{hex} sub 01/02) must both be "1".

The aim is that the entire range from 0 to 4096 increments can be used, although the start position provides the absolute value "1000". To achieve this aim, the start position should have the value "0". The encoder could be removed and turned around. However, the positioning CPU offers the option of defining the zero point using the encoder offset (index 1100_{hex} sub 02). In this example, the value "1000" should be entered. The encoder offset is always specified in increments.

Table 6-42 "EncoderOffset" parameter (index 1100_{hex} sub 02) for IB IL SSI

Invoke ID: 1,4,7,.....28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/ Subindex	
					Index	Sub
W/R	EncoderOffset (SSI)	USIGN32	Encoder offset		1100 _{hex}	02

"Parity" (SSI) parameter

If you have configured a parity check for your encoder and the encoder supports this function, the parity check will be carried out when the current actual position is determined. The parity value "1" or "2" must be entered under index 1102_{hex} sub 02. If two errors occur one after another during this check, an INPUT error is output (see Appendix A 2.2 "INPUT Errors"). The encoder parity value, which is specified in the data sheet provided by the encoder manufacturer, is entered under index 1102_{hex} sub 02. If the value "0" is entered, a parity check is not carried out.

Table 6-43 "Parity" parameter (index 1102_{hex} sub 02) for IB IL SSI

Invoke ID: 1,4,7,.....28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/ Subindex	
					Index	Sub
W/R	Parity (SSI)	USIGN8	Encoder parity 0 = None 1 = Even 2 = Odd		1102 _{hex}	02

"Code" (SSI) parameter

The transmission code can be entered under index 1103_{hex} sub 01. Depending on the encoder, either binary or Gray code can be selected. A "0" specifies evaluation in binary code, and a "1" specifies evaluation in Gray code.

Table 6-44 "Code" parameter (index 1102_{hex} sub 03) for IB IL SSI

Invoke ID: 1,4,7,.....28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/ Subindex	
					Index	Sub
W/R	Code (SSI)	USIGN8	0 = Binary code 1 = Gray code		1102 _{hex}	03

"InvertLimitSwitch" (SSI) parameter

The limit switch can be inverted and activated or deactivated under index 1103_{hex} sub 01. When activated, the limit switches can be connected as N/C contacts and the signal is evaluated as "active low". When deactivated, the limit switches can be connected as N/O contacts and the signal is evaluated as "active high".

Table 6-45 "InvertLimitSwitch" parameter (index 1103_{hex} sub 01) for IB IL SSI

Invoke ID: 1,4,7,.....28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/ Subindex	
					Index	Sub
W/R	InvertLimit-Switch (SSI)	BOOL	Invert limit switch (active high or low) 0 = Active high (N/O contact) 1 = Active low (N/C contact)	*New Ref	1103 _{hex}	01

"RefVariant" (SSI) parameter (type of encoder)

When absolute encoders are used, there is no need to set a reference point. However, to set the Ref bit in the status byte to enable the drive, a "0" must be entered in index 1084_{hex}.

Table 6-46 "RefVariant" parameter (index 1084_{hex}) for IB IL SSI

Invoke ID: 1,4,7,.....28						
Access Rights	Designation	Data Type	Description	Unit/Other	PCP Index/ Subindex	
					Index	Sub
W/R	RefVariant (SSI)	USIGN16	Type of encoder 0 = Absolute encoder 1 = Reserved 2 = Incremental encoder	*New Ref	1084 _{hex}	

6.6 Use and Meaning of the Parameters

This section provides information about the parameterization and assignment of individual indices for the various operating modes and systems listed in the index table, (see also Appendix A 1 "Index Tables"). A brief summary of the function descriptions is provided here.

6.6.1 System Parameters

Note the assignment of the Invoke IDs (see section 6.2, "Communication With Intelligent Input and Output Terminals") to ensure that the desired axes are addressed using the individual indices.

Table 6-47 Assignment of Invoke IDs to the individual axes

Axis Number	Invoke ID
1	1
2	4
3	7
4	10
5	13
6	16
7	19
8	22
9	25
10	28

"SoftwareVersion POS200" parameter

The software version implemented by the IB IL POS 200 positioning CPU can be read from index 0160_{hex}.

Table 6-48 "SoftwareVersion POS 200" parameter (index 0160_{hex})

Invoke ID: 0							
Access Rights	Designation	Data Type	Description	Unit	Modules/ Other	PCP Index/ Subindex	
						Index	Sub
R	SoftwareVersion POS200	USIGN32	Software version			0160 _{hex}	

**"SystemDiagCode
POS200" and
"SystemAddDiagCode
POS200" parameters**

The system diagnostic code provides information about any system errors that might occur, which are caused by the local bus, the master interface or the CPU. Error evaluations can be found in Appendix A 2 "Error Tables". The error code can be read under index 0161_{hex} sub 01. Additional information is provided by the additional diagnostic code under index 0161_{hex} sub 02.

Table 6-49 Parameters for IB IL POS 200 diagnostic codes (index 0161_{hex})

Invoke ID: 0							
Access Rights	Designation	Data Type	Description	Unit	Modules/ Other	PCP Index/ Subindex	
						Index	Sub
R	SystemDiagCode POS200	USIGN16	System diagnos- tic code			0161 _{hex}	01
R	SystemAddDiagCode POS200	USIGN16	Additional system diagnostic code			0161 _{hex}	02

**"ProcessDataV24"
parameter**

When operation is via the V.24 interface instead of via the bus, the process data channel for the bus interface is no longer available. The control bytes for the ten axes are then transmitted via index 0169_{hex}.

Table 6-50 "ProcessDataV24" parameter (index 0169_{hex})

Invoke ID: 0							
Access Rights	Designation	Data Type	Description	Unit	Modules/ Other	PCP Index/ Subindex	
						Index	Sub
R/W	ProcessDataV24	Structure	Control bytes for the ten axes			0169 _{hex}	

"PDUSize" parameter For the IB IL POS 200, a PDU size (**P**eripherals **D**ata **U**nit, maximum size of transmitted PCP data objects) of 246 bytes is set by default. For masters with a PDU size that is limited to 64 bytes, the PDU size of the IB IL POS 200 must be adapted accordingly (e.g. when using PROFIBUS bus couplers).

This index is stored in the NV-RAM. The modified PDU size only takes effect after a reset.

Table 6-51 "PDUSize" parameter (index 016A_{hex})

Invoke ID: 0							
Access Rights	Designation	Data Type	Description	Unit	Modules/ Other	PCP Index/ Subindex	
						Index	Sub
R/W	PDUSize	USIGN16	PDU size setting for the IB IL POS 200 0000 _{hex} = 246 bytes (default) 0001 _{hex} = 64 bytes			016A _{hex}	

6.6.2 General Parameters for the Individual Axes

Software Limit Switches

"MaxSwLimSwitch" and "MinSwLim-Switch" parameters (software limit switches)

The software limit switches can be defined or read under index 1060_{hex} sub 01 and index 1060_{hex} sub 02.

Please ensure that the value of the minimum software limit switch (index 1060_{hex} sub 02) is less than the value of the maximum software limit switch (index 1060_{hex} sub 01).

This defined value range (INT32) applies for increments. If a gear ratio has been defined, this must be taken into account when defining the software limit switches.

$$GR = \frac{\text{Path}}{\text{Increments (counts)}}$$

(see section 4.2, "Gear Ratio").

Software limit switches for incremental encoders

- Value range for software limit switch with incremental encoders for a gear ratio (GR) < 1:

$$-2^{31} \times GR \leq \text{Value} \leq (2^{31}-1) \times GR$$

$$(-2.147.483.648 \times GR \leq \text{Value} \leq 2.147.483.648 \times GR)$$

- Value range for software limit switch with incremental encoders for a gear ratio (GR) ≥ 1:

$$-2^{31} \leq \text{Value} \leq 2^{31}-1$$

$$(-2.147.483.648 \leq \text{Value} \leq 2.147.483.648)$$

Example:

Gear Ratio (GR)	Maximum Value for Software Limit Switch
1 μm/1000 inc	2.147.483
1 μm/100 inc	21.474.836
1 μm/10 inc	214.748.364
1 μm/1 inc	2.147.483.647
> 1	2.147.483.647

Software limit switches for absolute encoders

– Value range for a software limit switch with absolute encoders:

$$-2^{(\text{Resolution in bits}-1)} \times \text{GR} \leq \text{Value} \leq (-2^{(\text{Resolution in bits}-1)} - 1) \times \text{GR}$$

and

$$-2^{31} \leq \text{Value} \leq 2^{31}-1$$

Example for an absolute encoder with a resolution of 25 bits:

$$-2^{24} \times \text{GR} \leq \text{Value} \leq (-2^{24}-1) \times \text{GR}$$

and

$$-2^{31} \leq \text{Value} \leq 2^{31}-1$$

Table 6-52 Parameters for software limit switches* (index 1060_{hex})

Invoke ID: 1,4,7,.....28							
Access Rights	Designation	Data Type	Description	Unit	Modules/Other	PCP Index/ Subindex	
						Index	Sub
W/R	MaxSwLimSwitch	INT32	Software limit switch in a positive direction	s-unit		1060 _{hex}	01
W/R	MinSwLimSwitch	INT32	Software limit switch in a negative direction	s-unit		1060 _{hex}	02

* Can only be written in "Ready" operating mode

"NumeratorGearRatio" and "DenominatorGearRatio" parameters (gear ratio)

The gear ratio can be specified using index 1061_{hex} sub 01/sub 02 (see section 4.2, "Gear Ratio"). When the gear ratio is changed, a new reference point must be defined for incremental encoders. The gear ratio is defined as follows:

$$GR = \frac{\text{Path}}{\text{Increments (counts)}} = \frac{\text{NumeratorGearRatio}}{\text{DenominatorGearRatio}} = \frac{\text{Index1061 Sub01}}{\text{Index1061 Sub02}}$$

The following value range (dec) should be observed:

$$\frac{1}{1000} \leq \frac{\text{Path}}{\text{Increments (counts)}} = \frac{\text{Index1061 Sub01}}{\text{Index1061 Sub02}} \leq \frac{32767}{1}$$

Table 6-53 Parameters for the gear ratio * (index 0161_{hex})

Invoke ID: 1,4,7,.....,28							
Access Rights	Designation	Data Type	Description	Unit	Mod-ules/Othe-r	PCP Index/ Subindex	
						Index	Sub
W/R	Numerator-GearRatio	USIGN16	Increment evaluation numerator (path)	s-unit	*New Ref	1061 _{hex}	01
W/R	Denominator-GearRatio	USIGN16	Increment evaluation denominator (counts)	s-unit	*New Ref	1061 _{hex}	02

* Can only be written in "Ready" operating mode

Waiting Time When Changing Direction

"DelayTimeReverse" parameter (waiting time when changing direction)

Index 1063_{hex} sub 01 can be used to enter a value, which specifies the waiting time until a change of direction is activated after the drive is shut down. The value range is from 0 ms to 5000 ms.

Direction of Rotation and Downtime Monitoring

Direction of rotation and downtime monitoring is activated if less than one increment is traveled in a defined period of time or if the traversing direction does not correspond to the parameterized direction.

"DelayTime-SupervisionDirection" parameter (waiting time until direction of rotation and downtime monitoring is active)

Index 1063_{hex} sub 02 can be used to activate the direction of rotation and downtime monitoring after a defined delay time. The value range is from 0 ms to 65535 ms.

"DisableSupervisionDirection" parameter (switch off direction of rotation and downtime monitoring)

Index 1064_{hex} sub 01 can be used to switch off monitoring completely, e.g., for test purposes (see section 4.3, "Downtime Monitoring and Limit Switches").

"TimeSlot-SupervisionDirection" parameter (time slot for direction of rotation and downtime monitoring)

To prevent the direction of rotation and downtime monitoring from continuously switching off axes that move with a jerk, a time slot can be set under index 1064_{hex} sub 02. The default value is 60 ms and the time can be increased in increments of 60 ms.

For the IB IL 24 DO 4 output version, index 1184_{hex} (SwitchOverTime) must be observed. Another time can be parameterized here, which delays the switch-over for the contactors to avoid short circuits. It is therefore possible that the delay time for the IB IL 24 DO 4 output version may stop the drive for longer on a change in direction than the setting made under index 1063_{hex} sub 01 (DelayTimeReverse).

Table 6-54 Parameters for direction of rotation and downtime monitoring * (index 0163_{hex} and 0164_{hex})

Invoke ID: 1,4,7,.....28							
Access Rights	Designation	Data Type	Description	Unit	Mod-ules/Oth-er	PCP Index/ Subindex	
						Index	Sub
W/R	DelayTimeReverse	USIGN16	Waiting time when changing direction 0 to 65535	ms		1063 _{hex}	01
W/R	DelayTime-SupervisionDirection	USIGN16	Waiting time until direction of rotation and downtime monitoring is active 0 to 5000 (0 = default)	ms		1063 _{hex}	02
W/R	DisableSupervision-Direction	BOOL	Switch off direction of rotation and downtime monitoring 0 = Monitoring active (default) 1 = Monitoring not active			1064 _{hex}	01
W/R	TimeSlotSuper- visionDirection	USIGN8	Time slot for direction of rotation and downtime monitoring 0: t = 60 ms (default) 1: t = 120 ms 2: t = 180 ms ... n: t = (n+1) x 60 ms			1064 _{hex}	02

* Can only be written in "Ready" operating mode

6.7 Use and Meaning of the Status Information

The axis-specific extended status information can be used to read the properties of the individual axes.

"CurrentPosition" parameter (actual position)

The actual position can be read under index 1058_{hex} at any time. This actual position depends on the set gear ratio and is output in the parameterized unit of measurement.

Table 6-55 "CurrentPosition" parameter (index 1058_{hex})

Invoke ID: 1,4,7,.....28							
Access Rights	Designation	Data Type	Description	Unit	Modules/Other	PCP Index/Subindex	
						Index	Sub
R	CurrentPosition	INT32	Actual position	s-unit		1058_{hex}	

"DiagCodeAxis" and "AddDiagCodeAxis" parameters

Indices 1059_{hex} sub 01/sub 02 provide information on axis-specific errors that occur. Error evaluations can be found in Appendix A 2 "Error Tables".

Table 6-56 "DiagCodeAxis" and "AddDiagCodeAxis" parameters (index 1059_{hex})

Invoke ID: 1,4,7,.....28							
Access Rights	Designation	Data Type	Description	Unit	Modules/Other	PCP Index/Subindex	
						Index	Sub
R	DiagCodeAxis	USIGN16	Diagnostic code			1059_{hex}	01
R	AddDiagCode-Axis	USIGN16	Additional diagnostic code			1059_{hex}	02

"Axis" parameter

A copy of the process data status byte from the positioning CPU can be read under index 105A_{hex}. Bits 0 to 7 are reserved for this (see also section 5, "State Machine"). Bits 8 to 11 indicate the states of the software and hardware limit switches. Bit 12 indicates whether the drive is enabled. Bits 13 and 14 indicate the drive direction. Bit 15: Reserved.

Table 6-57 "Axis" parameter (index 105A_{hex})

Invoke ID: 1,4,7,.....28						
Access Rights	Designation	Data Type	Description	Unit	Modules/Other	PCP Index/Subindex
						Index Sub
R	Axis	USIGN16	Bit image: Bits 0 to 7: Copy of the process data status byte: Bit 0: Ready Bit 1: Active Bit 2: Error Bits 3+4: (Current) mode Bit 5: Run Bit 6: PosDriveEnd Bit 7: SetPointRef Bits 8 to 15: Additional status of: Bit 8: SwLimitSwitchPos (positive software limit switch has been triggered) Bit 9: SwLimitSwitchNeg (negative software limit switch has been triggered) Bit 10: HwLimitSwitchPos (positive hardware limit switch has been triggered) Bit 11: HwLimitSwitchNeg (negative hardware limit switch has been triggered) Bit 12: Drive is enabled Result of direction of rotation and downtime monitoring: Bit 13: Drive moving in positive direction Bit 14: Drive moving in negative direction Bit 15: Reserved			105A _{hex}

Section 7

This section provides information about

- The parameters for the individual functions.

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7 Parameterization of Functions

7.1 Parameters for the "Positioning Individual Axes" Function



When parameterizing the positioning function, please also refer to section 3.3, "Positioning Mode (Absolute Positioning)".

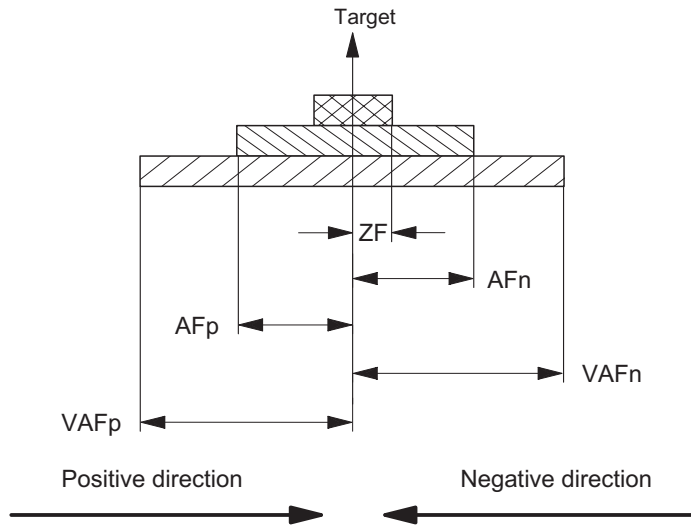
"TargetPosition" parameter

The absolute target position can be written without leaving the operating state. The value range, which depends on the encoder type (absolute encoder or incremental encoder), is between the values of the software and hardware limit switches and must remain within the range -2^{31} to $+2^{31}-1$. This value can be entered or read under index 1050_{hex} . The values entered refer to the gear ratio and should be specified in the unit of measurement parameterized by the gear ratio. Ensure that the values entered can also be achieved on the axis.

Table 7-1 "TargetPosition" parameter (index 1050_{hex})

Invoke ID: 1,4,7,.....28							
Access Rights	Designation	Data Type	Description	Unit	Modules/ Other	PCP Index/ Subindex	
						Index	Sub
W/R	TargetPosition	INT32	Target position (current setpoint value which can be written without leaving the operating state)	s-unit	No write protection	1050_{hex}	

The individual windows of index 1090_{hex} sub 01 to 05 are defined as follows:



6576A047

Figure 7-1 Index 1090_{hex} sub 01 to 05

"PreStopWindowPos"
parameter (positive
pre-stop window)

VAFp: Index 1090_{hex} Sub 01

This index specifies the window in which the drive moves at creeping speed before reaching the target. This value (dec) applies for positioning in a positive direction and must be greater than the value of the stop window in this direction. The maximum value is 2147483_{dec} and refers to the gear ratio.

"PreStopWindowNeg"
parameter (negative
pre-stop window)

VAFn: Index 1090_{hex} Sub 02

This index specifies the window in which the drive moves at creeping speed before reaching the target. This value (dec) applies for positioning in a negative direction and must be greater than the value of the stop window in this direction. The maximum value is 2147483_{dec} and refers to the gear ratio.

"StopWindowPos"
parameter (positive
stop window)

AFp: Index 1090_{hex} Sub 03

This value is the distance, which the drive travels after the motor is stopped. This value (dec) applies for positioning in a positive direction. The value must not exceed the value of the pre-stop window in this direction (index 1090_{hex} sub 01). It must also meet the following condition:

$$(GR \times \text{Value}) < 65535_{\text{dec}}$$

**"StopWindowNeg"
parameter (negative
stop window)**

AFn: Index 1090_{hex} Sub 04

This value is the distance, which the drive travels after the motor is stopped. This value (dec) applies for positioning in a negative direction. The value must not exceed the value of the pre-stop window in this direction (index 1090_{hex} sub 02). It must also meet the following condition:

$$(GR \times Value) < 65535_{dec}$$

**"TargetWindow"
parameter**

ZF: Index 1090_{hex} Sub 05

This window can be used to check the target position reached. If the position reached is not in this window, an error message is output. A ± range is defined either side of the current target position. The value must meet the following condition:

$$(GR \times Value) < 65535_{dec}$$

Table 7-2 Parameters for the pre-stop windows, stop windows, and target window (index 1090_{hex})

Invoke ID: 1,4,7,.....28							
Access Rights	Designation	Data Type	Description	Unit	Modules/ Other	PCP Index/ Subindex	
						Index	Sub
W/R	PreStop-WindowPos	USIGN32	Pre-stop window in a positive direction	s-unit		1090 _{hex}	01
W/R	PreStop-WindowNeg	USIGN32	Pre-stop window in a negative direction	s-unit		1090 _{hex}	02
W/R	StopWindowPos	USIGN32	Stop window in a positive direction	s-unit		1090 _{hex}	03
W/R	StopWindowNeg	USIGN32	Stop window in a negative direction	s-unit		1090 _{hex}	04
W/R	TargetWindow	USIGN16	Window for display of "Target position reached"	s-unit		1090 _{hex}	05

"RapidSpeedPos",
 "RapidSpeedNeg",
 "CreepingSpeedPos",
 and "Creeping-SpeedNeg" parameters
 (positioning speed)

Indices 1091_{hex} sub 01 to 04 define the individual speeds of the positioning function. They are defined so that two speeds are assigned to each direction. The value range is between 0 and +100. The values are percentages of the maximum permissible speed. Ensure that the values for rapid speed are always greater than the values for creeping speed.

Special remark: For the IB IL 24 DO 4 output version, the indices must have the following values:

- Rapid speed: Entry in index ≥ 40
- Creeping speed: $1 \leq$ Entry in index < 40

Table 7-3 Parameters for positioning speeds (index 1091_{hex})

Invoke ID: 1,4,7,.....28							
Access Rights	Designation	Data Type	Description	Unit	Modules/ Other	PCP Index/ Subindex	
						Index	Sub
W/R	RapidSpeedPos	USIGN16	Positioning speed for rapid motion in a positive direction 0 to 100	%		1091 _{hex}	01
W/R	RapidSpeedNeg	USIGN16	Positioning speed for rapid motion in a negative direction 0 to 100	%		1091 _{hex}	02
W/R	Creeping-SpeedPos	USIGN16	Positioning speed for creeping motion in a positive direction 0 to 100	%		1091 _{hex}	03
W/R	Creeping-SpeedNeg	USIGN16	Positioning speed for creeping motion in a negative direction 0 to 100	%		1091 _{hex}	04

**"LoopDistance",
"EnableBacklashCom-
pensation", and
"TargetDirection"
parameters
(loop distance, back-
lash compensation,
desired direction of
travel when approach-
ing the target)**

If the current position is so close to the target position that the value of the pre-stop window is not exceeded, looping is always carried out to reach the target position. Index 1093_{hex} sub 02 can be used to specify the direction from which the target should be approached in this case.

The loop distance is specified under index 1092_{hex}. Please note that this value must be greater than or equal to the largest pre-stop window and that the maximum value is 2147483_{dec}. If the pre-stop window corresponds to the distance required to switch from rapid to creeping speed and the loop distance is equal to the pre-stop window, the target position may not be reached during looping. In this case, when the loop distance and pre-stop window are parameterized, the distance required by the drive to reach creeping speed on startup should be added. The value of the loop distance refers to the gear ratio and is therefore specified in the unit of measurement defined by the gear ratio.

These two parameterized values for the direction and the loop distance are also valid for backlash compensation, which can be activated under index 1093_{hex} sub 01.

Value range for the loop distance:

$$(\text{Loop distance} \times \text{GR}) < 2.147.483$$

Table 7-4 Parameters for loop distance and backlash compensation (index 1092_{hex} and 1093_{hex})

Invoke ID: 1,4,7,.....28							
Access Rights	Designation	Data Type	Description	Unit	Modules/ Other	PCP Index/ Subindex	
						Index	Sub
W/R	LoopDistance	USIGN32	Loop distance	s-unit		1092 _{hex}	
W/R	EnableBacklash-Compensation	BOOL	Enable backlash compensation 1 = Enabled 0 = Not enabled (default)			1093 _{hex}	01
W/R	TargetDirection	BOOL	Desired direction of travel when approaching the target 0 = Positive (default) 1 = Negative			1093 _{hex}	02

7.2 Parameters for the "Jogging Individual Axes" Function



When parameterizing the jog function, please also refer to section 3.1, "Jog Mode".

"JogValuePos" and "JogValueNeg" parameters (Jog speed)

In Jog mode the speeds should simply be parameterized under index 1070_{hex} sub 01/sub 02. One speed should be defined for each direction. The value range is between 0 and +100. The values are specified as percentages and refer to the maximum permissible speed.

Special remark for the IB IL 24 DO 4 output version:

- Rapid speed: Entry in index ≥ 40
- Creeping speed: $1 \leq$ Entry in index < 40
- Downtime: Entry in index = 0

Table 7-5 Parameters for jog speed (index 1070_{hex})

Invoke ID: 1,4,7,.....28							
Access Rights	Designation	Data Type	Description	Unit	Modules/ Other	PCP Index/ Subindex	
						Index	Sub
W/R	JogValuePos	USIGN16	Jog speed in a positive direction	v-unit		1070 _{hex}	01
W/R	JogValueNeg	USIGN16	Jog speed in a negative direction	v-unit		1070 _{hex}	02

7.3 Parameters for the "Stepping Individual Axes" Function



When parameterizing the step function, please also refer to section 3.2, "Step Mode".

"StepSpeedPos" and "StepSpeedNeg" parameters (step speed)

One speed should be parameterized for each direction (index 1072_{hex} sub 01/ sub 02). The value range is between 0 and +100. The values are specified as percentages and refer to the maximum permissible speed.

Special remark for the IB IL 24 DO 4 output version:

- Rapid speed: Entry in index ≥ 40
- Creeping speed: 1 ≤ Entry in index < 40
- Downtime: Entry in index = 0

Table 7-6 Parameters for step speed (index 1072_{hex})

Invoke ID: 1,4,7,.....28							
Access Rights	Designation	Data Type	Description	Unit	Modules/ Other	PCP Index/ Subindex	
						Index	Sub
W/R	StepSpeedPos	USIGN16	Step speed in a positive direction	v-unit		1072 _{hex}	01
W/R	StepSpeedNeg	USIGN16	Step speed in a negative direction	v-unit		1072 _{hex}	02

"StepUnit" parameter (step distance)

The step distance to be entered refers to the gear ratio. The target position is calculated from the actual position + step distance (entry in index 1073_{hex}). Ensure that no limit switches are passed during the movement. This value must be greater than the largest stop window for the step function. The value for the step distance is entered under index 1073_{hex}. This value refers to the gear ratio and must be within the following value range:

$$(\text{Value} \times \text{GR}) \leq 65535$$

When defining the step distance, ensure that the drive is able to reach the parameterized speed, otherwise the target will not be reached accurately.

Table 7-7 „StepUnit“ parameter (index 1073_{hex})

Invoke ID: 1,4,7,.....28							
Access Rights	Designation	Data Type	Description	Unit	Modules/ Other	PCP Index/ Subindex	
						Index	Sub
W/R	StepUnit	USIGN16	Step distance	s-unit		1073 _{hex}	

"StepStopWindowPos" and "StepStopWindowNeg" parameters (stop window)

The stop windows should also be parameterized in both directions. The value for the stop windows is entered under index 1074_{hex} sub 01/sub 02 and must be within the value range from 0 to the step distance. Logically, the value must be less than the step distance.

Table 7-8 Parameters for step stop window (index 1074_{hex})

Invoke ID: 1,4,7,.....28							
Access Rights	Designation	Data Type	Description	Unit	Modules/ Other	PCP Index/ Subindex	
						Index	Sub
W/R	StepStop-WindowPos	USIGN16	Step stop window in a positive traversing direction	s-unit		1074 _{hex}	01
W/R	StepStop-WindowNeg	USIGN16	Step stop window in a negative traversing direction	s-unit		1074 _{hex}	02

7.4 Parameters for the "Homing Individual Axes" Function



When parameterizing the homing (Ref) function, please also refer to section 3.4, "Homing Mode".

"RefPoint" parameter (reference offset)

An entry can be made in index 1080_{hex} to set the reference point to a value other than "0". The possible value range depends on the gear ratio and must be within the following value range:

$$-2^{32} \leq (\text{Value} \times \text{GR}) \leq +2^{32}-1$$

After the reference offset has been modified, a new parameterization is required.

Table 7-9 „RefPoint“ parameter (index 1080_{hex})

Invoke ID: 1,4,7,.....28							
Access Rights	Designation	Data Type	Description	Unit	Modules/ Other	PCP Index/ Subindex	
						Index	Sub
W/R	RefPoint	INT32	Reference offset	s-unit	*New Ref	1080 _{hex}	

"RefRapidSpeed" and "RefCreepingSpeed" parameters (reference speed)

In homing mode, only the speeds for rapid and creeping motion can be parameterized under index 1081_{hex} sub 01/sub 02. These speeds apply for both directions. The value range is between 0 and +100. The values are specified as percentages and refer to the maximum permissible speed.

Special remark for IB IL 24 DO 4 output version:

- Rapid speed: Entry in index ≥ 40
- Creeping speed: 1 \leq Entry in index < 40
- Downtime: Entry in index = 0

Table 7-10 Parameters for reference speed (index 1081_{hex})

Invoke ID: 1,4,7,.....28							
Access Rights	Designation	Data Type	Description	Unit	Modules/ Other	PCP Index/ Subindex	
						Index	Sub
W/R	RefRapid-Speed	USIGN16	Reference speed for rapid motion	v-unit	Optional	1081 _{hex}	01
W/R	RefCreeping-Speed	USIGN16	Reference speed for creeping motion	v-unit	Optional	1081 _{hex}	02

"RefLimitSwitch" and "DefRefPointDir" parameters (selection of home position switch, direction of homing)

It is possible to select the direction of homing and the limit switch to be used as the home position. The limit switch is selected under index 1083_{hex} sub 01 and the homing direction is selected under index 1083_{hex} sub 02.

For a positive homing direction, the minimum hardware limit switch should be selected (index 1083_{hex} sub 01 = 1, index 1083_{hex} sub 02 = 0) and for a negative homing direction, the maximum hardware limit switch should be selected (index 1083_{hex} sub 01 = 0, index 1083_{hex} sub 02 = 1).

Table 7-11 Parameters for home position switch and homing direction (index 1083_{hex})

Invoke ID: 1,4,7,.....28							
Access Rights	Designation	Data Type	Description	Unit	Modules/ Other	PCP Index/ Subindex	
						Index	Sub
W/R	RefLimit-Switch	BOOL	Home position switch 0 = Maximum limit switch 1 = Minimum limit switch		*New Ref	1083 _{hex}	01
W/R	DefRef-PointDir	BOOL	Direction of homing 0 = Positive 1 = Negative		*New Ref	1083 _{hex}	02

"RefDistance" and "AdjustmentValue" parameters

It is also possible to specify a value under index 1085_{hex}, which aborts homing if the distance between the home position switch and Z signal is too great. The value range (dec) is defined as follows:

$$1 \leq (\text{Value} \times \text{GR}) \leq 2.147.483.647$$

If homing was successful, the difference between the home position switch and zero pulse (Z signal) can be read under index 1120_{hex}. This value is the adjustment value, which is specified in increments regardless of the gear ratio.

Table 7-12 "RefDistance" and "AdjustmentValue" parameters (index 1085_{hex} and 1120_{hex})

Invoke ID: 1,4,7,.....28							
Access Rights	Designation	Data Type	Description	Unit	Mod-ules/ Other	PCP Index/ Subindex	
						Index	Sub
W/R	RefDistance	INT32	Distance to the limit switch, within which the zero pulse should appear. If this distance is exceeded (i.e., there is no zero pulse), homing is aborted with an error message.	s-unit		1085 _{hex}	
R	Adjustment-Value	USIGN16	Difference between home position switch and zero pulse	inc		1120 _{hex}	

Section 8

This section provides information about

- Communication and process data mode in the Peripherals Communication Protocol (PCP).

Peripherals Communication Protocol (PCP)	8-3
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8.1.1 Services Used.....	8-3
8.1.2 Principle of Communication	8-4
8.1.3 Description of General Parameters	8-5
8.1.4 Key PCP Services	8-6
8.2 Process Data Operation	8-16

8 Peripherals Communication Protocol (PCP)

Communication with the IB IL POS 200 positioning CPU is carried out in PCP mode (Peripherals Communication Protocol). Operation is only possible with PCP-compatible controller boards (for INTERBUS firmware Version 3.0 or later).

This section describes communication in the local bus (INTERBUS) with PCP software Version 2.0. This PCP version is designed for use with INTERBUS Generation 4 controller boards (firmware Version 4.0 or later).



For differences between this and previous versions and other additional information, please refer to the INTERBUS PCP User Manuals IBS PCP UM E (Order No. 27 53 93 1) or IBS SYS PCP G4 UM E (Order No. 27 45 16 9) and the user manual for your controller board.

8.1 Communication Mode

8.1.1 Services Used

The following PCP services are available on the module:

Table 8-1 PCP services used

Service	Meaning
Management services (context management)	
Initiate	Initiate a connection
Abort	Abort a connection
Read	Read a variable
Write	Write a variable

The "Initiate" and "Abort" services can be used to initiate and abort a communication relationship with the positioning CPU. The "Read" and "Write" services can be used to communicate with the positioning CPU.

8.1.2 Principle of Communication

There are various ways of establishing communication:

- Some controller boards have pre-defined function blocks, which are used to call the services. For all other controller boards, the required service calls should be integrated in the application program.
- The IBS CMD SWT G4 software tool from Phoenix Contact can be used for all Generation 4 host systems. This is the simplest way to establish and test a communication relationship using command codes.

This section introduces the **way in which communication works** using basic service operations, regardless of the tools used.

Communication phases

INTERBUS supports connection-oriented (one-to-one) communication relationships. Connection-oriented communication can be divided into three phases:

- Connection establishment
- Data transfer
- Connection release

Connection Establishment Phase

In the connection establishment phase a PCP device, acting as a client, tries to establish communication with another PCP device, acting as a server. During this process, the context conditions (connection parameters) specified in the communication relationship lists for both devices are checked. If the context conditions correspond, the data transfer phase is started. Otherwise the connection establishment attempt is aborted with an error message.

Data Transfer Phase

In the data transfer phase the PCP devices exchange data subject to the context conditions. The connection remains open until it is specifically aborted or aborted after a communication error.

Connection Abort Phase

Once the data exchange is complete, the connection can be aborted using the connection abort function. In the event of a communication error, the connection is aborted automatically. Data can now only be exchanged after a new connection has been established.

8.1.3 Description of General Parameters

This section lists the parameters for PCP services, which are used frequently. They are not listed again under the individual services.

Command_ Code	Fixed number, which is specified for each command.
Message_ Code	Fixed number, which is specified for each message.
Parameter_ Count	Number of subsequent data words, each two bytes. If only one byte parameter occurs in a word, it is still counted as a word.
Invoke_ID	Order number for parallel services. Each technology function (in this case rapid/creeping speed positioning) and each intelligent (PCP-compatible) I/O module is assigned a specific Invoke ID (1 to 255). This means that each technology function can access the entire index area.
CR/ Comm._ Referenz/ Communication_ Referenz	Number of the communication relationship between the controller board and PCP device. Communication relationships 00 _{hex} and 01 _{hex} are reserved. The communication relationship 02 _{hex} stands for the first PCP device, 03 _{hex} for the second PCP device, etc. The maximum value for the communication relationship is 63 _{hex} .
Index	The index of the object to be accessed is entered here. The index table is in Appendix A 1 "Index Tables".
Subindex	The Subindex parameter is used to address an element of the data field in the addressed object (01 _{dec} = first element, 02 _{dec} = second element, etc.). Subindex 00 addresses the entire object.
Result	Result of the PCP service processing. If the service was completed successfully, the parameter equals 00 _{hex} . If the service was not completed successfully, the parameter does not equal 00 _{hex} and contains a coded error message.
Error_Class/ Error_Code/ Additional_ Code	On a negative confirmation, these parameters indicate the error cause. A list of errors can be found in the PCP User Manual. An extract from the list is also given in section A 2, "Error Tables". "Error_Class" and "Error_Code" are stored together under index 0161 sub 01, and "Additional_Code" is stored under index 0161 sub 02.
Length	Number of following data bytes.
Data	Contains the actual data.

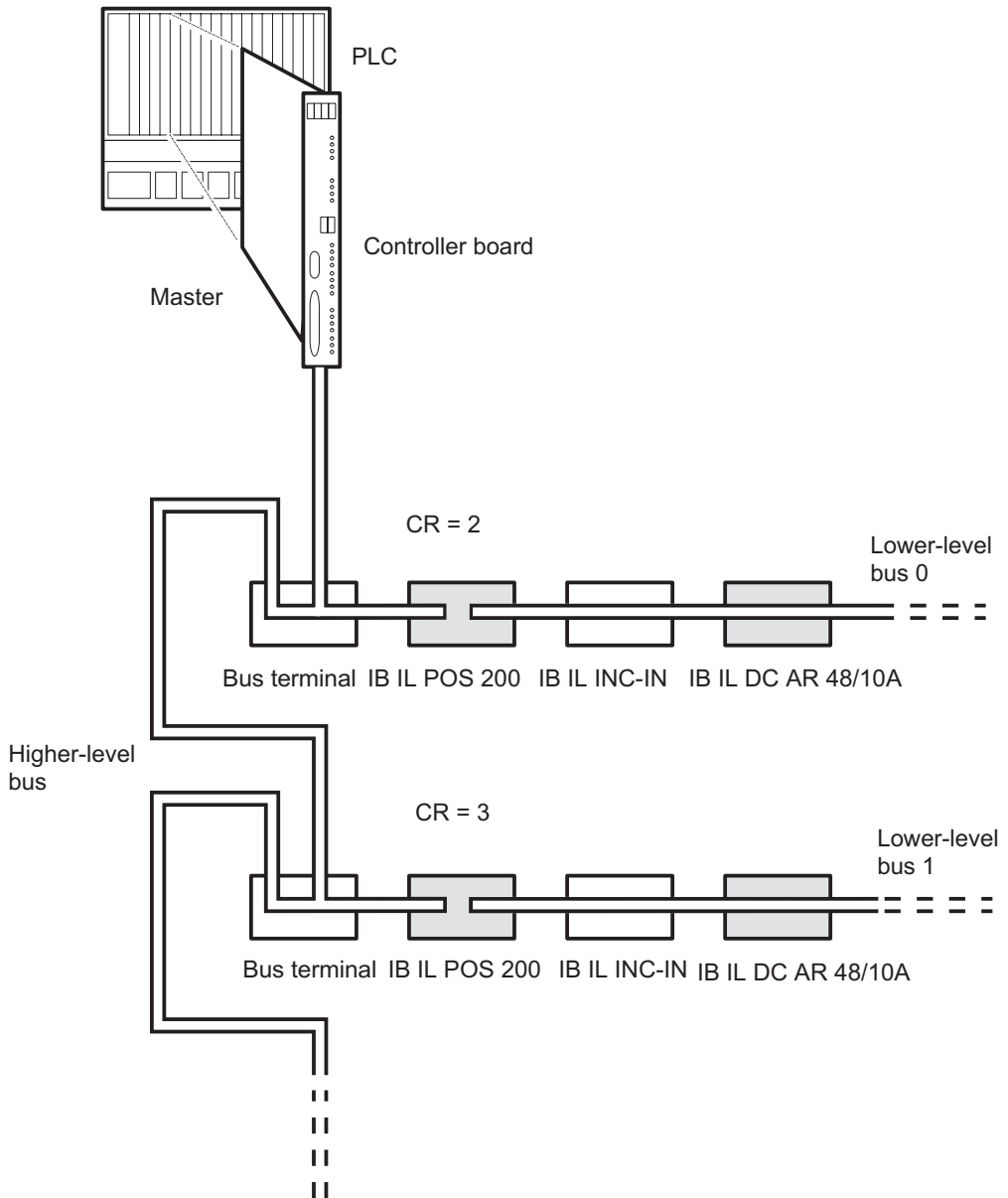
8.1.4 Key PCP Services

When communicating with the IB IL POS 200 positioning CPU, the services required most often are:

- Connection establishment (Initiate)
- Read and write parameter values (Read and Write)
- Connection release (Abort)

These services are listed below and values for the IB IL POS 200 positioning CPU are given for an example bus configuration. This example uses PCP Version 2.0.

The example uses a bus configuration consisting of two Inline terminals. Both terminals are positioning modules capable of PCP communication (IB IL POS 200). Control is either via a controller board (e.g., for SIMATIC S5) or an interface board (e.g., for the PC).



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Figure 8-1 Example bus configuration

The following examples describe

- Establishing a communication link to an IB IL POS 200 in the local bus (in this case to the first PCP module, which is why the value specified in the communication relationship is 02_{hex}),
- Configuring the module
- Reading data
- Sending data
- Aborting the connection between host and module

The values for the example are in the right-hand column of the description tables.



For additional notes on PCP operation, please refer to the INTERBUS PCP User Manuals IBS PCP UM E (Order No. 27 53 93 1) or IBS SYS PCP G4 UM E (Order No. 27 45 16 9) and the user manual for your controller board.

Initiate

This service is used to initiate the connection between the controller board and a local bus device capable of communications (PCP device). During connection establishment, the settings for the send and receive buffer sizes and the supported services for the two devices are checked for compatibility.

A request can be sent to the bus to receive feedback as to whether the connection was established successfully or whether an error occurred.

The right-hand columns in the following tables provide examples of the values that should be entered to establish a connection from the host to the first PCP module.

Table 8-2 Initiate_Request (Syntax)

Word 1	Command_Code	008B _{hex}
Word 2	Parameter_Count	0002 _{hex}
Word 3	—	0002 _{hex}
Word 4	Password	0000 _{hex}
Bit	15 8	7 0

Password

Password, which is defined for this communication relationship for accessing the device objects. In this case no password has been entered, so the value 00 must be used.

Access Groups Assignment of the controller board to a specific access group, which specifies access rights to the device objects (no access protection: 00).

Positive Confirmation If the connection is established successfully, the module sends a confirmation with the specified values.

Table 8-3 Initiate_Confirmation (positive) (Syntax)

Word 1	Message_Code		808B _{hex}
Word 2	Parameter_Count		0006 _{hex}
Word 3	—	Comm_Reference	0002 _{hex}
Word 4	Result (+)		0000 _{hex}
Word 5	Version OD		FFFF _{hex}
Word 6	Profile		0000 _{hex}
Word 7	Protection	Password	FF00 _{hex}
Word 8	Access_Groups	—	0000 _{hex}

Bit	15 8	7 0
-----	------------	-----------

Version OD Device-specific version number for the object dictionary (OD).

Profile Designation of the device profile, i.e., the number of the application-specific settings is specified.

Protection Contains the "Access Protection Supported" attribute from the device documentation. The parameter specifies whether access rights are checked when accessing device objects.

FF: Access rights are checked.
00: Access rights are not checked.

Password Manufacturer-specific, but generally not used (00).

Access Groups Manufacturer-specific, but generally not used (00).

Negative Confirmation If an error is detected during connection establishment, a negative confirmation with an error indication is entered in words 4 and 5.

Table 8-4 Initiate_Confirmation (negative) (Syntax)

Word 1	Message_Code		808B _{hex}
Word 2	Parameter_Count		0008 _{hex}
Word 3	—	Comm._Reference	0002 _{hex}
Word 4	Error_Class	Error_Code	xxxx _{hex}
Word 5	Additional_Code:		xxxx _{hex}
Word 6	Send_Buffer high	Send_Buffer low	00F6 _{hex}
Word 7	Receive_Buffer high	Receive_Buffer (low)	00F6 _{hex}
Word 8	Services_Supported (1)	Services_Supported (2)	0000 _{hex}
Word 9	Services_Supported (3)	Services_Supported (4)	0000 _{hex}
Word 10	Services_Supported (5)	Services_Supported (6)	3080 _{hex}

Bit	15	8	7	0
-----	----------	---	---------	---

Send_/Receive_Buffer Size of the buffers for the remote device. The buffer sizes for the positioning CPU are specified in the "low" send and receive buffers: 246 bytes each (F6_{hex}). The "high" send and receive buffers are not supported.

Services_Supported This parameter contains the services supported by the positioning CPU (see PCP User Manual).

In the event of an error, the properties of the PCP device (in this case the positioning CPU) must correspond to those of the controller board. They can be adapted using the Load_CRL_Attribute_Loc_Request command (see PCP User Manual).

Read

This service is used to read the value of objects of a PCP device. For arrays and records you can specify whether the entire object or only an element of the object is to be read.

The example shows a Read_Request service at the actual position (index 1058), in order to read the current position.

Table 8-5 Read_Request (Syntax)

Word 1	Command_Code		0081 _{hex}
Word 2	Parameter_Count		0003 _{hex}
Word 3	Invoke_ID	Comm._Reference	0102 _{hex}
Word 4	Index		1058 _{hex}
Word 6	Subindex	—	0000 _{hex}
Bit	15 8	7 0	



It is possible to send "Read_Requests" to several devices in succession without waiting for service confirmations. However, a second service request cannot be sent to the same device until a confirmation has been received for the first service request.

Once the service request has been processed, the system displays a message, which indicates whether the result was positive (Read_Confirmation, Result +) or negative (Read_Confirmation, Result -).

Positive Confirmation If the result is positive, the data bytes are sent. The data byte values given in the right-hand column of the table have been selected at random and are meant to stand for position 1000.

Table 8-6 Read_Confirmation (positive) (Syntax)

Word 1	Message_Code		8081 _{hex}
Word 2	Parameter_Count		0005 _{hex}
Word 3	Invoke_ID	Comm._Reference	0102 _{hex}
Word 4	Result (+)		0000 _{hex}
Word 5	—	Length	0004 _{hex}
Word 6	Data (1)	Data (2)	0000 _{hex}
Word 6	Data (3)	Data (4)	03E8 _{hex}

Bit	15 8	7 0
-----	------------	-----------

Negative Confirmation In the event of an error, information about the error is provided.

Table 8-7 Read_Confirmation (negative) (Syntax)

Word 1	Message_Code		8081 _{hex}
Word 2	Parameter_Count		0003 _{hex}
Word 3	Invoke_ID	Comm._Reference	0002 _{hex}
Word 4	Error_Class	Error_Code	0605 _{hex}
Word 5	Additional_Code		0000 _{hex}

Bit	15 8	7 0
-----	------------	-----------

In this case, an error in Class 6 (Error_Class 6) with error code 05hex (Error_Code 05) has occurred. This means that a service parameter, e.g., Length or Subindex in the Read_Request service, was not specified correctly. Check your entries and try to request the data again using the Read_Request service.



The meanings of other error messages can be found in the IBS SYS PCP G4 UM E PCP User Manual (Order No. 27 45 16 9).

Write

This service can be used to send a data field (Data) from your control system to a local bus device. For arrays and records, you can specify whether the entire object or only an element of the object is to be written.

Send a write service each time you want to write to an object.

The examples used here for sending a write service are for the definition of the loop distance for the positioning function on axis 1:

Table 8-8 Write_Request (Syntax)

Word 1	Command_Code		0082 _{hex}
Word 2	Parameter_Count		0004 _{hex}
Word 3	Invoke_ID	Comm._Reference	0102 _{hex}
Word 4	Index		1092 _{hex}
Word 5	Subindex	Length	0004 _{hex}
Word 6	Data (1)	Data (2)	0000 _{hex}
Word 7	Data (3)	Data (4)	03E8 _{hex}
Bit	15 8	7 0	

In the example, the number of increments (1000), which make up the loop distance is transmitted in words 6 and 7.

Positive Confirmation The positive Write_Confirmation contains only the communication relationship and the positive result.

Table 8-9 Write_Confirmation (positive) (Syntax)

Word 1	Message_Code		8082 _{hex}
Word 2	Parameter_Count		0002 _{hex}
Word 3	Invoke_ID	Comm._Reference	0102 _{hex}
Word 4	Result (+)		0000 _{hex}
Bit	15 8	7 0	

Negative Confirmation The negative confirmation contains the error class (Error_Class), error code (Error_Code), and a more detailed description of the error (Additional_Code).

Table 8-10 Write_Confirmation (negative) (Syntax)

Word 1	Message_Code		8082 _{hex}
Word 2	Parameter_CountComm._Reference		0003 _{hex}
Word 3	Invoke_ID	Comm._Reference	0102 _{hex}
Word 4	Error_Class	Error_Code	0800 _{hex}
Word 5	Additional_Code		XXXX _{hex}

Bit	15 8	7 0
-----	------------	-----------

For the example, this means:

An error occurred with Error_Class 08 and Error_Code 00. In this case it is a device-specific error message rather than a communication error (see Appendix A 2 "Error Tables").

Table 8-11 Device-specific error messages for the IB IL POS 200

Additional_Code	Meaning
FFFE _{hex}	Invalid number of axes
FFFD _{hex} *	No write access at present
FFFB _{hex}	Number of transmitted bytes does not correspond (Length)
FFFA _{hex}	Reserved
FFF9 _{hex}	No write access for the interface used (bus or V.24)
FFF8 _{hex}	No connection established with the lower-level IB IL DC AR 48/10A
FFF7 _{hex}	Lower-level IB IL DC AR 48/10A responds with invalid command code

* This error occurs, for example, if you try to write a new parameter record during operation (see section 5, "State Machine").

Abort

The Abort service can be used to abort a connection. It is an unconfirmed service, i.e., no abort confirmation is sent. The service is called using the Abort_Request command.

The Abort_Request contains only the communication reference for the connection to be aborted. The example in the right-hand column of the table shows the connection release for the positioning CPU with CR = 2.

Table 8-12 Abort_Request (Syntax)

Word 1	Command_Code		088D _{hex}
Word 2	Parameter_Count		0002 _{hex}
Word 3	—	Comm._Reference	0002 _{hex}
Word 4	Reason_Code	Abort_Detail_Length	0000 _{hex}
Bit	15 8	7 0	

Reason_Code Reason for the connection abort (default = 00_{hex}).

Abort_Detail_Length Not used. Entry is 00_{hex}.

8.2 Process Data Operation

Process Data Channel Assignment

The process image of the positioning CPU on the local bus ring comprises six data words. Of these six data words, the first word is the PCP channel. The remaining five data words are the process data channel.

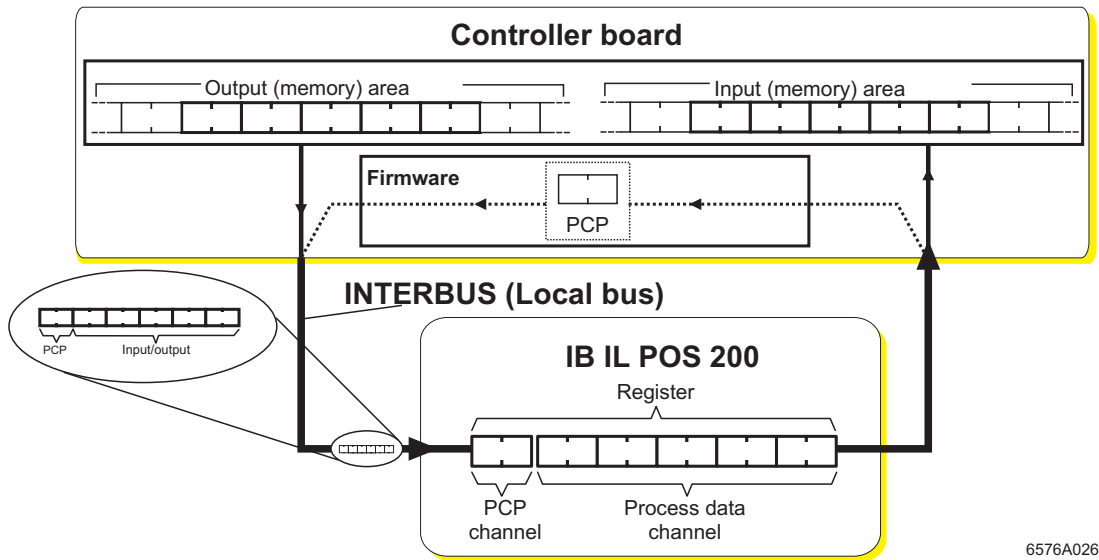


Figure 8-2 Process image in the I/O (memory) area of the controller board

The data words are in the process data (memory) area on the controller board.

The process data (memory) area comprises an output (memory) area and an input (memory) area. The two memory areas do not necessarily have to be different.

Definition

Direction of output data flow: From the controller board to the positioning CPU (control word)

Direction of input data flow: From the positioning CPU to the controller board (status byte)

In process data operation, data words are controlled and read using the relevant word address of the control word in the process data area. Terminals are controlled using the output (memory) area. The response of terminals to the control commands is provided in the input (memory) area.

Section 9

This section provides information about

- Programming data and technical data for the positioning CPU
- Ordering data for the positioning CPU, accessories, and documentation.

Technical Data and Ordering Data	9-3
9.1 Programming Data/Configuration Data	9-3
9.2 Process Data Words	9-4
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9 Technical Data and Ordering Data



The data is valid for the preferred mounting position (vertical).
The technical data does not claim to be complete. Technical modifications reserved.



For additional technical data on the Inline product range, please refer to the "Configuring and Installing the INTERBUS Inline Product Range" User Manual (IB IL SYS PRO UM E; Order No. 27 43 04 8) or the Inline System Manual for your bus system.

For additional technical data on the other product ranges of the INTERBUS system, refer to the "Configuring and Installing INTERBUS" User Manual (IBS SYS PRO INST UM E, Order No. 27 43 80 2).

9.1 Programming Data/Configuration Data

INTERBUS

ID code	223 _{dec} (DF _{hex})
Length code	05 _{hex}
Process data channel	5 words
Input address area	5 words
Output address area	5 words
Parameter channel (PCP)	1 word
Register length (bus)	6 words
Operating mode	PCP and process data mode with the higher-level controller board

Other Bus Systems



For the configuration data of other bus systems, please refer to the appropriate electronic device data sheet (GSD, EDS) at www.phoenixcontact.com.

9.2 Process Data Words

Process Data Representation

The Inline positioning CPU offers digital access to all drive parameters and functions via the local bus interface, i.e., the positioning CPU is parameterized and controlled via the local bus.

The positioning CPU is controlled via fast, cyclic process data. This process data channel can be used to control the functions of the IB IL POS 200. All axes are controlled separately, by one byte each. Examples of this are:

- Jog Right/Jog Left
- Enable
- Start positioning (StartPos)

At the same time, status bytes from the positioning CPU are read back via this channel, for example:

- Run
- Ready

The positioning CPU communicates with the higher-level control system via the local bus as well as via the fast, cyclic process data channel and the acyclic parameter channel (PCP, Peripherals Communication Protocol).

While process data is generally exchanged cyclically, the drive parameters can be read and written acyclically via the "Read" and "Write" PCP services. The parameters are stored permanently in the positioning CPU.

Process data

Process data is time-critical status information that changes continually and must be continuously updated. This information must be transmitted at short regular intervals. It is transmitted via the process data channel.

Parameter data

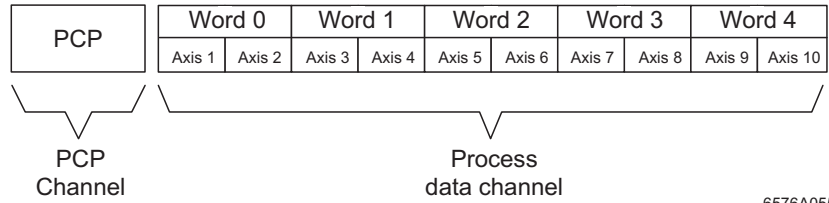
Parameter data is data that seldom changes and must therefore only be transmitted when required. It is transmitted via PCP communication.



In the following, only the INTERBUS-specific process data representation is described (Motorola data format).

Please note that bytes must be rotated when using an Intel processor (see section "Basic Settings" on page 4-3).

In the local bus ring, the positioning CPU occupies one word for the PCP channel and five words for process data words (not variable) for each data direction.



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Figure 9-1 Assignment of process data in the local bus



For a description of INTERBUS software configuration, please refer to the "Configuring and Installing the INTERBUS Inline Product Range" User Manual (IB IL SYS PRO UM E, Order No. 27 43 04 8).

For the assignment of the illustrated (byte.bit) view for your INTERBUS control or computer system, please refer to data sheet DB GB IBS SYS ADDRESS, Part No. 90 00 99 0.

Process Data Channel Assignment

	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
Word 0	Assignment	Axis 1							Axis 2								

	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 0							Byte 1								
	Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Word 1	Assignment	Axis 3							Axis 4								

	Word	Word 2															
	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
Word 2	Assignment	Axis 5							Axis 6								

	Word	Word 3															
	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
Word 3	Assignment	Axis 7							Axis 8								

	Word	Word 4															
	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
Word 4	Assignment	Axis 9							Axis 10								

9.2.1 INTERBUS OUT Process Data Words

The OUT process data words are "control words", which are transmitted from the controller board to the IB IL POS 200. For the positioning CPU, the axes are addressed using "control bytes" so that it is possible to address and/or control two axes with one word.

	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	Control byte for axis 1							Control byte for axis 2								

	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 0							Byte 1								
	Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
OUT[1]	Assignment	Control byte for axis 3							Control byte for axis 4								

	Word	Word 2															
	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[2]	Assignment	Control byte for axis 5							Control byte for axis 6								

	Word	Word 3															
	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[3]	Assignment	Control byte for axis 7							Control byte for axis 8								

	Word	Word 4															
	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[4]	Assignment	Control byte for axis 9							Control byte for axis 10								

Control Bytes for INTERBUS OUT Process Data Words OUT[1] to OUT[4]

			Mode				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Jog Left — Step Left SetRef	Jog Right StartPos Step Right StartRef	00 = Jog mode 01 = Pos mode 10 = Step mode 11 = Ref mode		STOP	Quit	Enable

9.2.2 INTERBUS IN Process Data Words

The IN process data words are "status bytes" for the individual axes, which are transmitted from the IB IL POS 200 to the controller board. For the positioning CPU, the states of the axes are indicated using "status bytes" so that it is possible to monitor two axes with one word.

	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	Status byte for axis 1							Status byte for axis 2								

	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 0							Byte 1								
	Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
IN[1]	Assignment	Status byte for axis 3							Status byte for axis 4								

	Word	Word 2															
	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[2]	Assignment	Status byte for axis 5							Status byte for axis 6								

	Word	Word 3															
	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[3]	Assignment	Status byte for axis 7							Status byte for axis 8								

	Word	Word 4															
	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[4]	Assignment	Status byte for axis 9							Status byte for axis 10								

Status Bytes for INTERBUS IN Process Data Words IN[1] to IN[4]

			Mode				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
RefPointSet	— PosDriveEnd	Jog Run Pos Run Step Run Ref Run	00 = Jog mode 01 = Pos mode 10 = Step mode 11 = Ref mode		Error	Active	Ready

9.3 Technical Data



All data relating to terminals in the INTERBUS Inline product range is listed in the "Configuring and Installing the INTERBUS Inline Product Range" User Manual. This section only contains the data that applies specifically to the IB IL POS 200 positioning CPU or differs from the general data.

General Data	
Order designation (order number)	IB IL POS 200 (28 19 33 8) IB IL POS 200 (-PAC) (28 61 82 3)
Dimensions (width x height x depth)	109.8 mm x 71.5 mm x 120 mm (4.323 x 2.815 x 4.724 in.)
Weight	400 g, approximately

Module Supply	
Communications Power (Potential Jumper)	
Nominal value	7.5 V DC
Tolerance	±5%
Ripple	±1.5%
Maximum current consumption	0.5 A

Bus Interface Lower-Level Bus	
Interface	Local bus
Electrical isolation	No
Maximum current of the bus terminal in the logic area	2 A
Number of devices of an Inline station	63, maximum
Number of I/O points	512
Number of PCP devices	10
Connection of Loop 2 devices	Via INTERBUS Loop 2 branch terminal

Optical Diagnostics	
INTERBUS	RUN, FAIL, D
Application processor	SF, L1, L2, L3, L4



Ambient Conditions (Deviations From the Inline Specifications)		
Degree of protection	IP 20 (EN 60529:1991)	
Temperature (according to EN 60204-1)	Operation: 0°C to +55°C (32°F to 131°F) (deviation from the Inline specifications) Storage and transport: -25°C to +75°C (-13°F to 167°F)	
Humidity (according to EN 60204-1)	Storage and operation: 75% on average, 85% occasionally, (EN 60204-1); no condensation	
Air pressure	Operation: 70 kPa to 108 kPa (up to 3000 m [9843 ft.] above sea level) Storage and transport: 66 kPa to 108 kPa (up to 3500 m [11483 ft.] above sea level)	
Mechanical Requirements		
Vibration	2g, criterion 1 according to IEC 60068-2-6 (deviation from the Inline specifications)	
Conformance With EMC Directive 89/336/EEC		
Noise Immunity Test According to EN 50 082-2		
Electrostatic discharge (ESD)	EN 61000-4-2/IEC 61000-4-2	Criterion B 6 kV contact discharge 8 kV air discharge
Electromagnetic fields	ENV 50140 IEC 61000-4-3	Criterion A 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	ENV 50141 IEC 61000-4-6	Criterion A Test voltage 10 V
Noise emission of housing	EN 55011	Class A

9.4 Ordering Data

Ordering Data for Terminals

Description	Order Designation	Order No.
Positioning CPU, with connectors and labeling fields	IB IL POS 200-PAC	28 61 82 3
Positioning CPU, without connectors and labeling fields	IB IL POS 200	28 19 33 8
INTERBUS Inline terminal for connecting a remote bus branch, with connectors and labeling fields	IBS IL 24 RB-T-PAC	28 61 44 1
INTERBUS Inline terminal for connecting a remote bus branch, without connectors and labeling fields	IBS IL 24 RB-T	27 27 94 1
Servo amplifier for DC motors with brushgears, including COMBICON connectors	IB IL DC AR 48/10A	28 19 28 6
Inline terminal for incremental encoders, with connectors and labeling fields	IB IL INC-IN-PAC	28 61 75 5
Inline terminal for incremental encoders, without connectors and labeling fields	IB IL INC-IN	28 19 22 8
Positioning terminal for absolute encoders, with connectors and labeling fields	IB IL SSI-PAC	28 61 86 5
Positioning terminal for absolute encoders, without connectors and labeling fields	IB IL SSI	28 36 34 0
Inline terminal with two digital inputs, with connectors and labeling fields	IB IL 24 DI 2-PAC	28 61 22 1
Inline terminal with two digital inputs, without connectors and labeling fields	IB IL 24 DI 2	27 26 20 1
Inline terminal with four digital inputs, with connectors and labeling fields	IB IL 24 DO 4-PAC	28 61 27 6
Inline terminal with four digital inputs, without connectors and labeling fields	IB IL 24 DO 4	27 26 25 6
Inline terminal with two analog voltage outputs, with connectors and labeling fields	IB IL AO 2/U/BP-PAC	28 61 46 7
Inline terminal with two analog voltage outputs, without connectors and labeling fields	IB IL AO 2/U/BP	27 32 73 2

Ordering Data for Connectors

Description	Order Designation	Order No.
 <p>Four standard connectors and one shield connector are required for the complete fitting of the IB IL POS 200 terminal.</p>		
Connector with eight terminals, spring-cage connection (green, w/o color print); pack of 10	IB IL SCN-8	27 26 33 7
Connector with six terminals, spring-cage connection and shield connection (green, w/o color print); for RS-232 connecting cable; pack of 10	IB IL SCN-6 SHIELD	27 26 35 3
 <p>The necessary connectors for the I/O terminals are described in the respective terminal-specific data sheet.</p>		

Ordering Data for Accessories

Description	Order Designation	Order No.
Coding profile (100 pcs./package)	IL CP	27 42 68 3
Zack markers for labeling terminals	ZBFM 6-... and ZBF 6-... see Phoenix Contact "CLIPLINE" Catalog	
Labeling field covering one connector	IB IL FIELD 2	27 27 50 1
DIN EN 50022 DIN rail, 2 meters (6.562 ft.) perforated	NS 35/ 7,5 GELOCHT METER	08 01 73 3
unperforated	NS 35/ 7,5 UNGELOCHT METER	08 01 68 1
Screwdriver according to DIN 5264, blade width 3.5 mm (0.138 in.)	SZF 1-0,6X3,5	12 04 51 7
RS-232 connecting cable for parameterization software	POS 200 CAB-V24	28 19 53 2

Ordering Data for Documentation

Description	Order Designation	Order No.
"Configuring and Installing the INTERBUS Inline Product Range" User Manual	IB IL SYS PRO UM E	27 43 04 8
"General Introduction to the INTERBUS System" User Manual	IBS SYS INTRO G4 UM E	27 45 21 1
"Configuring and Installing INTERBUS" User Manual	IBS SYS PRO INST UM E	27 43 80 2
"Automation Terminals of the INTERBUS Inline Product Range" User Manual	IL SYS INST UM E	26 98 73 7
"Peripherals Communication Protocol (PCP)" User Manual	IBS SYS PCP G4 UM E	27 45 16 9
"Inline Servo Amplifier for DC Motors With Brushgears" User Manual	UM EN IB IL DC AR 48/10A	26 99 19 2
CD-ROM with all automation data sheets	CD IBS DB ELDOC	27 45 60 6
CD-ROM with all automation manuals and data sheets	CD IBS UM/DB ELDOC	27 45 61 9



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A Tables

A 1 Index Tables

The index tables list all indices with their properties and a brief description. For additional information about parameterization, please refer to section 3 and section 5.

SystemDiagCode

System errors are errors in the bus configuration or errors, which are reported by the Inline CPU. The meaning of the error can be found in section A 2, "Error Tables".

s-unit

Indices with this designation are input and output in the unit of measurement defined by the gear ratio rather than in increments.

v-unit

Indices with this designation specify the speed as a percentage. This percentage refers to the maximum permissible speed.

*New Ref

When an index with this designation is modified, the axis must be homed again using an incremental encoder.

Write protection

All indices have write protection to ensure that they cannot be deleted or overwritten during operation. This means that parameter settings cannot be made in the "Active" state. To modify an index during operation:

1. Reset the enable bit (bit 0 in the control byte)
2. Write the new value
3. Set the enable bit again

Exception: Index 1050_{hex} (this can be read at any time)

inc

An entry in a parameter with this designation does not depend on the gear ratio and is specified in increments.

ms

An entry in a parameter with this designation is specified in ms.

The following parameters must be written for every axis. The parameter records for the individual axes are addressed via the Invoke IDs. The axes are assigned to the Invoke IDs as follows:

Table A-1 Assignment of Invoke IDs to the individual axes

Axis Number	Invoke ID
1	1
2	4
3	7

Table A-1 Assignment of Invoke IDs to the individual axes (Continued)

Axis Number	Invoke ID
4	10
5	13
6	16
7	19
8	22
9	25
10	28

The following index table is sorted according to the value of the index. The same indices may have different meanings for different encoder and output versions.

Table A-2 Parameters

Axis Selection: Axis 1 = Invoke ID 1, Axis 2 = Invoke ID 4, etc.							
Access Rights	Designation	Data Type	Description	Unit	Mod-ules/Othe-r	PCP Index/Subindex	
						Index	Sub
R	Software-Version POS200	USIGN32	Software version (Invoke ID = 0)			0160 hex	
R	System-DiagCode POS200	USIGN16	System diagnostic code (Invoke ID = 0)			0161 hex	01
R	SystemAdd-DiagCode POS200	USIGN16	Additional system diagnostic code (Invoke ID = 0)			0161 hex	02
(W)/R	Interface-WriteEnable	USIGN16	Transfer write authorization 0 = No function 1 = Local bus interface towards the higher-level control system (default) 2 = RS-232 interface 3 to 65535 = No function (Invoke ID = 0)			0168 hex	

Table A-2 Parameters (Continued)

Axis Selection: Axis 1 = Invoke ID 1, Axis 2 = Invoke ID 4, etc.									
Access Rights	Designation	Data Type	Description			Unit	Mod-ules/Othe-r	PCP Index/ Subindex	
								Index	Sub
R/W	ProcessDataV24	Structure	Control bytes for the ten axes					0169 hex	
R/W	PDUSize	USIGN16	PDU size setting for the IB IL POS 200 0000 _{hex} = 246 bytes (default) 0001 _{hex} = 64 bytes					016A hex	
W/R	VariantTF	USIGN16	Axis activation 0 = Not active 1 = Activation of technology function (rapid/creeping speed positioning)					1030 hex	
W/R	VariantInput	USIGN16	Type of Position Detection (Input Terminal)					1032 hex	
			Entry:	1st Terminal	2nd Terminal				
			3	IB IL SSI	IB IL 24 DI 2				
			5	IB IL INC-IN	—				
W/R	AddressInput1	USIGN16	Address in the local bus structure for the first input terminal (entry only required if a "3" is entered under index 1032)				*New Ref	1034 hex	01
W/R	AddressInput2	USIGN16	Address in the local bus structure for the second input terminal (entry only required if a "3" is entered under index 1032)				*New Ref	1034 hex	02

Table A-2 Parameters (Continued)

Axis Selection: Axis 1 = Invoke ID 1, Axis 2 = Invoke ID 4, etc.									
Access Rights	Designation	Data Type	Description			Unit	Modules/Other	PCP Index/Subindex	
								Index	Sub
W/R	VariantOutput	USIGN16	Type of Drive Control (Output Terminal)					1036 hex	
			Entry:	1st Terminal	2nd Terminal				
			4	IB IL 24 DO 4	—				
			5	IB IL AO 2/U/BP	IB IL 24 DO 2				
			6	IB IL DC AR 48/10A	—				
W/R	AddressOutput1	USIGN16	Address in the local bus structure for the first output terminal (entry only required if a "3" is entered under index 1032)				*New Ref	1038 hex	01
W/R	AddressOutput2	USIGN16	Address in the local bus structure for the second output terminal (entry only required if a "3" is entered under index 1032)				*New Ref	1038 hex	02
R	Software-VersionInput	USIGN16	Example 0101 _{hex} => Version 1.1					1040 hex	
R	Software-VersionOutput	USIGN16	Example 0101 _{hex} => Version 1.1					1041 hex	
R	Software-VersionTF	USIGN16	Example 0101 _{hex} => Version 1.1					1042 hex	
W/R	TargetPosition	INT32	Target position (current setpoint value, which can be written without leaving the operating state)			s-unit	No write protection	1050 hex	
R	CurrentPosition	INT32	Actual position			s-unit		1058 hex	
R	DiagCodeAxis	USIGN16	Diagnostic code					1059 hex	01
R	AddDiag-CodeAxis	USIGN16	Additional diagnostic code					1059 hex	02

Table A-2 Parameters (Continued)

Axis Selection: Axis 1 = Invoke ID 1, Axis 2 = Invoke ID 4, etc.							
Access Rights	Designation	Data Type	Description	Unit	Modules/Other	PCP Index/Subindex	
						Index	Sub
R	Axis	USIGN16	Bit image: Bits 0..7: Copy of the process data status byte: Bit 0: Ready Bit 1: Active Bit 2: Error Bits 3+4: (Current) mode Bit 5: Run Bit 6: PosDriveEnd Bit 7: RefPointSet Bits 8..15: Additional status of: Bit 8: SwLimitSwitchPos Bit 9: SwLimitSwitchNeg Bit 10: HwLimitSwitchPos Bit 11: HwLimitSwitchNeg Bit 12: Drive is enabled Result of direction of rotation and downtime monitoring: Bit 13: Drive moving in positive direction Bit 14: Drive moving in negative direction Bit 15: Reserved			105A hex	
W/R	MaxSwLim-Switch	INT32	Software limit switch in a positive direction	s-unit		1060 hex	01
W/R	MinSwLim-Switch	INT32	Software limit switch in a negative direction	s-unit		1060 hex	02
W/R	Numerator-GearRatio	USIGN16	Increment evaluation numerator (path)	s-unit	*New Ref	1061 hex	01
W/R	Denominator-GearRatio	USIGN16	Increment evaluation denominator (counts)	s-unit	*New Ref	1061 hex	02
W/R	DelayTime-Reverse	USIGN16	Waiting time when changing direction 0 to 65535	ms		1063 hex	01

Table A-2 Parameters (Continued)

Axis Selection: Axis 1 = Invoke ID 1, Axis 2 = Invoke ID 4, etc.							
Access Rights	Designation	Data Type	Description	Unit	Modules/Other	PCP Index/Subindex	
						Index	Sub
W/R	DelayTime-Supervision-Direction	USIGN16	Waiting time until direction of rotation and downtime monitoring is active 0 to 5000 (0 = default)	ms		1063 hex	02
W/R	Disable-Supervision-Direction	BOOL	Switch off direction of rotation and downtime monitoring 0 = Monitoring active (default) 1 = Monitoring not active			1064 hex	01
W/R	TimeSlot-Supervision-Direction	USIGN8	Time slot for direction of rotation and downtime monitoring 0: t = 60 ms (default) 1: t = 120 ms 2: t = 180 ms ... n: t = (n+1) x 60 ms			1064 hex	02
W/R	JogValuePos	USIGN16	Jog speed in a positive direction	v-unit		1070 hex	01
W/R	JogValueNeg	USIGN16	Jog speed in a negative direction	v-unit		1070 hex	02
W/R	StepSpeedPos	USIGN16	Step speed in a positive direction	v-unit		1072 hex	01
W/R	StepSpeedNeg	USIGN16	Step speed in a negative direction	v-unit		1072 hex	02
W/R	StepUnit	USIGN16	Step distance	s-unit		1073 hex	
W/R	StepStop-WindowPos	USIGN16	Step stop window in a positive direction	s-unit		1074 hex	01
W/R	StepStop-WindowNeg	USIGN16	Step stop window in a negative direction	s-unit		1074 hex	02
W/R	RefPoint	INT32	Reference offset	s-unit	*New Ref	1080 hex	

Table A-2 Parameters (Continued)

Axis Selection: Axis 1 = Invoke ID 1, Axis 2 = Invoke ID 4, etc.								
Access Rights	Designation	Data Type	Description	Unit	Modules/Other	PCP Index/Subindex		
						Index	Sub	
W/R	RefRapidSpeed	USIGN16	Reference speed for rapid motion	v-unit	Optional	1081 hex	01	
W/R	RefCreeping-Speed	USIGN16	Reference speed for creeping motion	v-unit	Optional	1081 hex	02	
W/R	RefLimitSwitch	BOOL	Home position switch 0 = Maximum limit switch 1 = Minimum limit switch		*New Ref	1083 hex	01	
W/R	DefRefPointDir	BOOL	Direction of homing 0 = Positive 1 = Negative		*New Ref	1083 hex	02	
W/R	RefVariant (INC)	BOOL	Type of encoder 0 = Absolute encoder 1 = Reserved 2 = Incremental encoder		*New Ref	1084 hex		
W/R	RefVariant (SSI)	USIGN16	Type of encoder 0 = Absolute encoder 1 = Reserved 2 = Incremental encoder		*New Ref	1084 hex		
W/R	RefDistance	INT32	Distance to the limit switch, within which the zero pulse should appear. If this distance is exceeded (i.e., there is no zero pulse), homing is aborted with an error message.	s-unit		1085 hex		
W/R	PreStop-WindowPos	USIGN32	Pre-stop window in a positive direction	s-unit		1090 hex	01	
W/R	PreStop-WindowNeg	USIGN32	Pre-stop window in a negative direction	s-unit		1090 hex	02	
W/R	StopWindowPos	USIGN32	Stop window in a positive direction	s-unit		1090 hex	03	
W/R	StopWindowNeg	USIGN32	Stop window in a negative direction	s-unit		1090 hex	04	

Table A-2 Parameters (Continued)

Axis Selection: Axis 1 = Invoke ID 1, Axis 2 = Invoke ID 4, etc.							
Access Rights	Designation	Data Type	Description	Unit	Modules/Other	PCP Index/Subindex	
						Index	Sub
W/R	TargetWindow	USIGN16	Window for display of "Target position reached"	s-unit		1090 hex	05
W/R	RapidSpeedPos	USIGN16	Positioning speed for rapid motion in a positive direction 0 to 100	%		1091 hex	01
W/R	RapidSpeedNeg	USIGN16	Positioning speed for rapid motion in a negative direction 0 to 100	%		1091 hex	02
W/R	Creeping-SpeedPos	USIGN16	Positioning speed for creeping motion in a positive direction 0 to 100	%		1091 hex	03
W/R	Creeping-SpeedNeg	USIGN16	Positioning speed for creeping motion in a negative direction 0 to 100	%		1091 hex	04
W/R	LoopDistance	USIGN32	Loop distance	s-unit		1092 hex	
W/R	EnableBacklash-Compensation	BOOL	Enable backlash compensation 1 = Enabled 0 = Not enabled			1093 hex	01
W/R	TargetDirection	BOOL	Desired direction of travel when approaching the target 0 = Positive 1 = Negative			1093 hex	02
W/R	Encoder-Resolution (SSI)	USIGN16	Resolution of the encoder (in bits) 1 = 8 bits 2 = 9 bits ... 19 = 26 bits			1100 hex	01
W/R	EncoderOffset (SSI)	USIGN32	Encoder offset			1100 hex	02

Table A-2 Parameters (Continued)

Axis Selection: Axis 1 = Invoke ID 1, Axis 2 = Invoke ID 4, etc.							
Access Rights	Designation	Data Type	Description	Unit	Modules/Other	PCP Index/Subindex	
						Index	Sub
W/R	Evaluation (INC)	USIGN8	0 = Single evaluation 1 = Twofold evaluation 2 = Fourfold evaluation		*New Ref	1102 hex	01
W/R	Parity (SSI)	USIGN8	Encoder parity 0 = None 1 = Even 2 = Odd			1102 hex	02
W/R	Code (SSI)	USIGN8	0 = Binary code 1 = Gray code			1102 hex	03
W/R	EncoderType (INC)	BOOL	0 = Symmetrical 1 = Asymmetrical		*New Ref	1102 hex	04
W/R	InvertLimit-Switch (INC)	BOOL	Invert limit switch (active high or low) 0 = Active low (N/C contact) 1 = Active high (N/O contact)		*New Ref	1103 hex	01
W/R	InvertLimit-Switch (SSI)	BOOL	Invert limit switch (active high or low) 0 = Active high (N/O contact) 1 = Active low (N/C contact)		*New Ref	1103 hex	01
Reserved						1103 hex	02
W/R	Change-Direction (INC)	BOOL	0 = Not active 1 = Active		*New Ref	1103 hex	03
W/R	SwapLimit-Switches (INC)	BOOL	0 = E1 = Negative limit switch E2 = Positive limit switch 1 = E1 = Positive limit switch E2 = Negative limit switch		*New Ref	1103 hex	04
R	Adjustment-Value	USIGN16	Difference between home position switch and zero pulse	inc		1120 hex	

Table A-2 Parameters (Continued)

Axis Selection: Axis 1 = Invoke ID 1, Axis 2 = Invoke ID 4, etc.							
Access Rights	Designation	Data Type	Description	Unit	Modules/Other	PCP Index/Subindex	
						Index	Sub
W/R	OutputFunction (DO4)	USIGN16	0 = No function (default) 1 = Output function 1 2 = Output function 2 3 = Output function 3 4 = Output function 4 5 to 65536 = No function			1180 hex	
W/R	OutputFunction (AO2+DO2)	USIGN16	0 = No function (default) 1 = With holding brake 2 = Without holding brake 3 to 65536 = No function			1180 hex	
W/R	Direction (DO4, DCAR, AO2+DO2)	BOOL	Direction of travel 0 = Not inverted (default) 1 = Inverted			1182 hex	01
W/R	SwitchOver-Time (DO4)	USIGN16	Switch-over delay time (output contactor response time) Minimum: 0 (default) Maximum: 65535		ms	1184 hex	
W/R	EarlyRelease-Time (DO4, AO2+DO2)	USIGN16	Clamping/brake, time for early release (only relevant if index 1180 = 4)		ms	1185 hex	01
W/R	Delayed-ReleaseTime (DO4, AO2+DO2)	USIGN16	Clamping/brake, time for delayed release (only relevant if index 1180 = 4) Minimum: 0 (default) Maximum: 65535		ms	1185 hex	02
W/R	Uout (AO2+DO2)	USIGN16	Desired maximum output voltage 0 = No function 1 to 10 = +1 V to +10 V (10 = default) 11 to 65536 = No function			1186 hex	

A 2 Error Tables

There are several different types of error:

- System errors (see section "System Errors" on page A-11),
- INPUT errors (see section "INPUT Errors" on page A-18),
- POSI errors (see section "POSI Errors" on page A-21),
- OUTPUT errors (see section "OUTPUT Errors" on page A-26), and
- Other errors (see section "Other Errors" on page A-30)

A 2.1 System Errors

In the event of a system error, read the **DiagCode** under index 0161_{hex} sub 01 and the **AddDiagCode** under index 0161_{hex} sub 02.

System errors indicate errors in the bus system. In the event of a system error, the system must be completely restarted by switching the supply voltage off and on again. Some error codes provide information about the bus device at which the error has occurred. In this case, the relevant bus terminal should be checked and replaced if necessary.

Table A-3 System errors (lower-level bus, master interface)

DiagCode	AddDiag-Code	Meaning	Cause Index	Error Removal
FF01 _{hex}		System errors (lower-level bus, master interface)		Completely restart the system by switching the supply voltage off and on again.
	FFFF _{hex}	Timeout on reading the bus configuration		
	FFFE _{hex}	Too many devices (on reading bus configuration)		Check the number of devices (40, maximum).
	FFFD _{hex}	Negative confirmation when reading bus configuration		Check that the correct terminal is being used.
	FFFC _{hex}	Invalid length code (when reading bus configuration)		Check that the correct terminal is being used.
	FFFB _{hex}	Too many PCP devices (on reading bus configuration)		Check the number of devices (40, maximum).

Table A-3 System errors (lower-level bus, master interface) (Continued)

DiagCode	AddDiag-Code	Meaning	Cause Index	Error Removal
FF02 _{hex}				
	FFFF _{hex}	Timeout on bus cycle (bus cycle was not completed). All movements were stopped by a long bus reset. May be caused by bus interrupt or interference.		Completely restart the system by switching the supply voltage off and on again.
	FFFE _{hex}	More than three invalid bus cycles in succession. All movements were stopped by a long bus reset. May be caused by bus interrupt or interference.		Completely restart the system by switching the supply voltage off and on again.

Table A-4 System errors (reported by the positioning CPU)

DiagCode	Meaning	Add_Error_Info	Error Removal
1511 to 157D		Reported by the positioning CPU	
1511 _{hex}	Errors, which are generated by modules imported by G4 firmware. They can only occur during the boot process of the controller.	G4 firmware error code	Replace faulty positioning CPU.
1512 _{hex}	An untreated exception has been initiated.	Vector offset of the initiated exception	
1513 _{hex} , 1514 _{hex} , 1515 _{hex} , 1516 _{hex}	The hardware properties specified for the boot and main firmware do not correspond.	—	Replace faulty positioning CPU.
1517 _{hex}	Notification of data cycle end/startable was set by the user both via TPU channels and via DPM interrupts.	—	Replace faulty positioning CPU.
1518 _{hex}	Notification of data cycle end/startable via DPM interrupt was terminated by timeout.	DPM interrupt code \$1 Data cycle startable notification was interrupted \$2 Data cycle end notification was interrupted	Replace faulty positioning CPU.
1519 _{hex}	The hardware properties specified for the boot and main firmware do not correspond.	—	Replace faulty positioning CPU.
1521 _{hex}	More PCP devices have been detected on the lower-level bus than is permitted.	—	
1522 _{hex}	A PCP device not supported by the firmware has been detected.	Number of the PCP device not supported (counting from 1).	Only PCP devices with a PCP data width of 1, 2, or 4 words should be installed.
1523 _{hex}	More devices have been detected on the lower-level bus than is permitted.	—	Check the number of devices (40, maximum).

Table A-4 System errors (reported by the positioning CPU) (Continued)

DiagCode	Meaning	Add_Error_Info	Error Removal
1524 _{hex} , 1525 _{hex} , 1526 _{hex}	The memory provided is not sufficient to manage all devices.	—	Replace faulty positioning CPU or remove excess terminals.
1531 _{hex}	The last cycle was terminated with an error and the bus crashed.	This code is mapped by both error registers of the IPMS-3 (ERROR, ERROR_2):	
		Bit 15	The CRC detected an error on the bus transmission path.
		Bit 14	The CRC detected an error on the transmission path from the last bus device to the controller.
		Bit 13	A CR signal error was detected during the last cycle.
		Bit 12	A SL signal error was detected during the last cycle.
		Bit 11	The last bus cycle was terminated by a loop-back word error.
		Bit 10	The last bus cycle was terminated by a timeout.
		Bit 9	The last bus cycle was terminated by an external signal.
		Bit 8	Overflow of the data IN FIFO in the IPMS.

Table A-4 System errors (reported by the positioning CPU) (Continued)

DiagCode	Meaning	Add_Error_Info	Error Removal	
		Bit 7	An error was detected in the data frame (group message).	
		Bit 6	An asynchronous state change was identified as an error on the SL line.	
		Bit 5	Cycles were still running after the cycle end.	
		Bit 4	The IBRUN bit in the IMPS status register was still set at the cycle end.	
		Bit 3	The ENDCY bit in the IPMS status register was not set at the cycle end.	
		Bit 2	Reserved	
		Bit 1	A faulty stop bit was detected.	
		Bit 0	A faulty start bit was detected.	
1532 _{hex}	The cycle time monitoring timer has expired (the length of the bus cycle is too long).	MSB internal state code	If the system is still in INIT state, this indicates that the bus length is not permitted (0 or greater than the maximum number of devices that can be operated).	
1533 _{hex}	The ID code of a device has changed.	Number of the changed device (counting from 1).		
1534 _{hex} , 1535 _{hex} , 1536 _{hex}	An unexpected event has occurred internally.	Internal code		
1537 _{hex}	The activation of a module error bit for a device has been detected.	Number of the device	Check the terminal with the indicated number (e.g., check cable connection, replace terminal if required).	

Table A-4 System errors (reported by the positioning CPU) (Continued)

DiagCode	Meaning	Add_Error_Info	Error Removal
1538 _{hex}	The deactivation of a module error bit for a device has been detected.	Number of the device	
1541 _{hex}	The user has sent a service with an unknown code.	—	Replace faulty positioning CPU. If necessary, call the Phoenix Contact hotline.
1542 _{hex}	The user has sent a service with an invalid length.	—	
1543 _{hex}	The user has sent a service with an invalid parameter.	—	
1544 _{hex}	The user has sent a service, which is not permitted in the current state.	—	
1545 _{hex}	The user has sent a non-time-related service, while another (also non-time-related) service is being processed.	—	
1551 _{hex}	The unit of length (bits 15 and 16) specified in the set slave ID code is not permitted.	—	
1552 _{hex}	The lengths specified in the set slave ID code are not permitted (0 or greater than the data width that can be set by the slave chip).	—	
1553 _{hex}	The firmware does not support the ID code set by the user.	—	
1554 _{hex}	Initialization of the slave chip (OPC) has failed.	—	
1571 _{hex}	During the application download, a PCP write service was received with an index not equal to 5FFE _{hex} .	—	

Table A-4 System errors (reported by the positioning CPU) (Continued)

DiagCode	Meaning	Add_Error_Info	Error Removal
1572 _{hex}	During the application download, a PCP write service was received in which the lengths (ParaCount, Length, BlockLen) do not correspond.	—	
1573 _{hex}	During the application download, a PCP write service was received containing a command with a length parameter that is not permitted (not equal to 2).	—	
1574 _{hex}	During the application download, a PCP write service was received containing an unexpected command.	—	
1575 _{hex}	The command mode is undefined (= 0).	—	
1576 _{hex}	The Mode and SectNr in the LeadOut command do not correspond to the previous LeadIn command.	—	
1577 _{hex}	The user has tried to write to the boot sector.	—	
1578 _{hex}	A PCP write service, which contains download data, is not expected in the current state.	—	
1579 _{hex}	The data block type is not expected.	—	
157A _{hex}	The data block BlockNum is not expected.	—	
157B _{hex}	Download data with checksum error.	—	
157C _{hex}	Unknown Flash type	—	
157D _{hex}	Flash programming has failed.	—	

A 2.2 INPUT Errors

In the event of an input error, read the **DiagCode** under index 0159 sub 01 and the **AddDiagCode** under index 0159 sub 02.

INPUT errors indicate errors in the input terminal, e.g., IB IL SSI. The "Cause Index" column indicates the indices that should be corrected in order to remove the error (index.sub). In the event of address conflicts, the addresses of the individual axes should be compared and then corrected.

Table A-5 INPUT errors

DiagCode	AddDiag-Code	Meaning	Cause Index (Hex)	Error Removal
FFA2_{hex}		Error on IB IL SSI		
	0001 _{hex}	Incorrect operating mode		If necessary, call the Phoenix Contact hotline.
	0003 _{hex}	Timeout: IB IL SSI is not responding.		
	F101 _{hex}	Address error on IB IL SSI: Address or module error.	1034.01	Correct the entry in index 1032 _{hex} and index 1034 _{hex} sub 01 for the relevant axis.
	F102 _{hex}	Address error on IB IL SSI: ID code error.	1034.01	Correct the entry in index 1032 _{hex} and index 1034 _{hex} sub 01 for the relevant axis.
	F103 _{hex}	Address error on IB IL SSI: Length code error.	1034.01	Correct the entry in index 1032 _{hex} and index 1034 _{hex} sub 01 for the relevant axis.
	F104 _{hex}	Same address already assigned to another axis.	1034.01	Compare the entry in index 1034 _{hex} sub 01 with the address entries for the other axes and correct if necessary.
	F201 _{hex}	Address error on IB IL 24 DI 2: Address or module error.	1034.02	Correct the entry in index 1032 _{hex} and index 1034 _{hex} sub 02 for the relevant axis.
	F202 _{hex}	Address error on IB IL 24 DI 2: ID code error.	1034.02	Correct the entry in index 1032 _{hex} and index 1034 _{hex} sub 02 for the relevant axis.
	F203 _{hex}	Address error on IB IL 24 DI 2: Length code error.	1034.02	Correct the entry in index 1032 _{hex} and index 1034 _{hex} sub 02 for the relevant axis.

Table A-5 INPUT errors (Continued)

DiagCode	AddDiag-Code	Meaning	Cause Index (Hex)	Error Removal
	F204 _{hex}	Same address already assigned to another axis.	1034.02	Compare the entry in index 1034 _{hex} sub 01 with the address entries for the other axes and correct if necessary.
	FE01 _{hex}	Incorrect "Parity" parameter	1102.02	Check the entry in index 1102 _{hex} sub 02.
	FE02 _{hex}	Incorrect "EncoderResolution" parameter	1102.01	Check the entry in index 1102 _{hex} sub 01.
	FE03 _{hex}	Incorrect "Code" parameter	1102.03	Check the entry in index 1102 _{hex} sub 03.
	FFXX_{hex}	Firmware-dependent error code from IB IL SSI (see IB IL SSI UM E User Manual) (Error message is sent from the IB IL SSI to the IB IL POS 200)		
	FF00 _{hex}	No error occurred.		
	FF01 _{hex}	The module is in hand-held operator panel mode. ⇒ Cannot be controlled via the bus.		
	FF02 _{hex}	Output driver overload or short circuit and module error.		
	FF03 _{hex}	Encoder supply fault and module error ⇒ No encoder supply or short circuit		Check encoder supply.
	FF04 _{hex}	The encoder configuration is invalid.	1100.01	Check the entry in index 1100 _{hex} sub 01 of the relevant axis.
	FF05 _{hex}	A parity error has occurred. ⇒ Connection to the sensor is defective or sensor is configured incorrectly.		Check connection to the sensor or its configuration.

Table A-5 INPUT errors (Continued)

DiagCode	AddDiag-Code	Meaning	Cause Index (Hex)	Error Removal
	FF06 _{hex}	The initiator or switching output configuration is invalid.		
	FF14 _{hex}	Bus reset		
	FF15 _{hex}	Invalid system configuration.		
FFA3_{hex}		Error on IB IL INC-IN software driver		
	0001 _{hex}	Invalid operating mode		If necessary, call the Phoenix Contact hotline.
	0002 _{hex}	Invalid change of operating mode		
	8XXX _{hex}	Warning: increment limit exceeded XXX = Number of increments		
	F101 _{hex}	Address error on IB IL INC-IN: Address or module error.	1034.01	Check the entry in index 1034 _{hex} sub 01 of the relevant axis.
	F102 _{hex}	Address error on IB IL INC-IN: ID code error.	1034.01	Check the entry in index 1034 _{hex} sub 01 of the relevant axis.
	F103 _{hex}	Address error on IB IL INC-IN: Length code error.	1034.01	Check the entry in index 1034 _{hex} sub 01 of the relevant axis.
	F104 _{hex}	Same address already assigned to another axis.	1034.01	Compare the entry in index 1034 _{hex} sub 01 with the address entries for the other axes and correct if necessary.
FFA4_{hex}		Error on IB IL INC-IN		
	0001 _{hex}	Unknown parameter		If necessary, call the Phoenix Contact hotline.
	0002 _{hex}	Homing initiated several times		
	0003 _{hex}	Reserved		
	0004 _{hex}	Actual position value invalid (voltage supply)		Replace the terminal.
	0005 _{hex}	Actual position value invalid (encoder error)		
	0006 _{hex}	Homing not possible, evaluation not set		If necessary, call the Phoenix Contact hotline.
	0007 _{hex}	Actual value invalid, as evaluation adjusted during operation		

A 2.3 POSI Errors

In the event of a POSI error, read the **DiagCode** under index 0159_{hex} sub 01 and the **AddDiagCode** under index 0159_{hex} sub 02.

POSI errors indicate errors during positioning. The "Cause Index" column indicates the indices that should be corrected in order to remove the error (index.sub). The entries in the relevant indices must be checked. The value range specified by the data format must not be exceeded. The values defined for the rapid/creeping speed method must also be observed, e.g., speeds and window sizes.

Table A-6 POSI errors

DiagCode	AddDiag-Code	Meaning	Cause Index (Hex)	Error Removal
FFC0 _{hex}		Invalid parameter		Check the entry with defined value range of the relevant index.
	0000 _{hex}	An attempt was made to activate the axis using enable bit 0 before parameterization has been executed successfully.		
	0001 _{hex}	MaxSwLimSwitch (Maximum software limit switch)	1060.01	
	0002 _{hex}	MinSwLimSwitch (Minimum software limit switch)	1060.02	
	0003 _{hex}	RefPoint (Reference offset)	1080	
	0004 _{hex}	NumeratorGearRatio (Increment evaluation numerator)	1061.01	
	0005 _{hex}	DenominatorGearRatio (Increment evaluation denominator)	1061.02	
	0006 _{hex}	PreStopWindowPos (Pre-stop window in a positive direction)	1090.01	
	0007 _{hex}	PreStopWindowNeg (Pre-stop window in a negative direction)	1090.02	
	0008 _{hex}	StopWindowPos (Stop window in a positive direction)	1090.03	

Table A-6 POSI errors (Continued)

DiagCode	AddDiag-Code	Meaning	Cause Index (Hex)	Error Removal
	0009 _{hex}	StopWindowNeg (Stop window in a negative direction)	1090.04	
	000A _{hex}	TargetWindow (target window)	1090.05	
	000B _{hex}	JogValuePos (Jog speed in a positive direction)	1070.01	
	000C _{hex}	JogValueNeg (Jog speed in a negative direction)	1070.02	
	000D _{hex}	StepSpeedPos (Step speed in a positive direction)	1072.01	
	000E _{hex}	StepSpeedNeg (Step speed in a negative direction)	1072.02	
	000F _{hex}	StepUnit (Step distance)	1073	
	0010 _{hex}	StepStopWindowPos (Step stop window in a positive direction)	1074.01	
	0011 _{hex}	StepStopWindowNeg (Step stop window in a negative direction)	1074.02	
	0012 _{hex}	RapidSpeedPos (Positioning speed for rapid motion in a positive direction)	1091.01	
	0013 _{hex}	RapidSpeedNeg (Positioning speed for rapid motion in a negative direction)	1091.02	
	0014 _{hex}	CreepingSpeedPos (Positioning speed for creeping motion in a positive direction)	1091.03	
	0015 _{hex}	CreepingSpeedNeg (Positioning speed for creeping motion in a negative direction)	1091.04	
	0016 _{hex}	StartRampPos	1098.01	
	0017 _{hex}	StartRampNeg	1098.02	

Table A-6 POSI errors (Continued)

DiagCode	AddDiag-Code	Meaning	Cause Index (Hex)	Error Removal
	0018 _{hex}	StopRampPos	1098.03	
	0019 _{hex}	StopRampNeg	1098.04	
	001A _{hex}	RefVariant (Type of encoder)	1084	
	001B _{hex}	RefDistance (Distance between home position switch and Z signal)	1085	
	001C _{hex}	RefRapidSpeed (Reference speed for rapid motion)	1081.01	
	001D _{hex}	RefCreepingSpeed (Reference speed for creeping motion)	1081.02	
	001E _{hex}	LoopDistance (Loop distance)	1092	
	001F _{hex}	Reserved	1090.06	
	0020 _{hex}	DelayTimeReverse (Waiting time when changing direction)	1063.01	
	0021 _{hex}	DelayTimeSupervisionDirection (Waiting time until direction of rotation/downtime monitoring detection is active)	1063.02	
FFC1_{hex}		Input/output terminal not ready		
	0001 _{hex}	Input terminal not ready		Acknowledge and wait to see if another error follows.
	0002 _{hex}	Output terminal not ready		Acknowledge and wait to see if another error follows.
	0003 _{hex}	Input and output terminals not ready		Acknowledge and wait to see if another error follows.

Table A-6 POSI errors (Continued)

DiagCode	AddDiag-Code	Meaning	Cause Index (Hex)	Error Removal
FFC2_{hex}		Direction of rotation and downtime monitoring		
	1XXX _{hex}	Error during desired movement in a positive direction XXX= Number of accumulated pulses Example: 1000 _{hex} = Desired movement positive, 0 pulses detected 1FFF _{hex} = Desired movement positive, 1 pulse detected in negative direction		Check encoder is connected correctly.
	2XXX _{hex}	Error during desired movement in a negative direction XXX= Number of accumulated pulses Example: 2000 _{hex} = Desired movement negative, 0 pulses detected 2001 _{hex} = Desired movement negative, 1 pulse detected in positive direction		Check encoder is connected correctly.
FFC3_{hex}		Homing		
	0001 _{hex}	Movement to limit switch (no Z signal)		Check encoder is configured and connected correctly.
	0002 _{hex}	RefDistance exceeded (no Z signal)		Check encoder is configured and connected correctly.
FFC4_{hex}		Limit switch has been triggered		
	0001 _{hex}	Positive software limit switch has been triggered.		
	0002 _{hex}	Negative software limit switch has been triggered.		
	0003 _{hex}	Positive hardware limit switch has been triggered.		
	0004 _{hex}	Negative hardware limit switch has been triggered.		

Table A-6 POSI errors (Continued)

DiagCode	AddDiag-Code	Meaning	Cause Index (Hex)	Error Removal
FFC5_{hex}		Unknown version parameterized		
	0001 _{hex}	Unknown input version	1032	Correct the entry in index 1032 _{hex} for the relevant axis.
	0002 _{hex}	Unknown positioning version	1030	Correct the entry in index 1030 _{hex} for the relevant axis.
	0003 _{hex}	Unknown output version	1036	Correct the entry in index 1036 _{hex} for the relevant axis.
FFC6_{hex}		Timeout		
	0001 _{hex}	Timeout for process data via the slave interface		Check connector.
	0002 _{hex}	Timeout for control bytes via the RS-232 interface		Check connector.

A 2.4 OUTPUT Errors

In the event of an output error, read the **DiagCode** under index 0159 sub 01 and the **AddDiagCode** under index 0159 sub 02.

OUTPUT errors indicate errors in the output terminal, e.g., IB IL 24 DO 4. The "Cause Index" column indicates the indices that should be corrected in order to remove the error (index.sub). In the event of address conflicts, the addresses of the individual axes should be compared and then corrected.

Table A-7 OUTPUT errors

DiagCode	AddDiag-Code	Meaning	Cause Index (Hex)	Error Removal
FFE2_{hex}		Error on IB IL 24 DO 4		
	0001 _{hex}	Incorrect operating mode		If necessary, call the Phoenix Contact hotline.
	0002 _{hex}	Incorrect output function during operation	1180	Correct the entry in index 1180 _{hex} for the relevant axis.
	F101 _{hex}	Address error on IB IL 24 DO 4: Address or module error.	1038.01	Correct the entry in index 1038 _{hex} sub 01 of the relevant axis.
	F102 _{hex}	Address error on IB IL 24 DO 4: ID code error.	1038.01	Correct the entry in index 1038 _{hex} sub 01 of the relevant axis.
	F103 _{hex}	Address error on IB IL 24 DO 4: Length code error.	1038.01	Correct the entry in index 1038 _{hex} sub 01 of the relevant axis.
	F104 _{hex}	Same address already assigned to another axis.	1038.01	Compare the entry in index 1038 _{hex} sub 01 with the address inputs for the other axes and correct if necessary.
	FE01 _{hex}	Incorrect output function during initialization	1180	Correct the entry in index 1180 _{hex} for the relevant axis.
FFE3_{hex}		Error on IB IL AO 2/U/BP + IB IL 24 DO 2		
	0001 _{hex}	Incorrect operating mode		If necessary, call the Phoenix Contact hotline.
	0002 _{hex}	Incorrect output function	1180	Correct the entry in index 1180 _{hex} for the relevant axis.

Table A-7 OUTPUT errors (Continued)

DiagCode	AddDiag-Code	Meaning	Cause Index (Hex)	Error Removal
	0003 _{hex}	Terminal is not responding	1038.01	Correct the entry in index 1038 _{hex} sub 01 of the relevant axis or replace terminal, if necessary.
	F101 _{hex}	Address error on IB IL AO 2/U/BP: Address or module error.	1038.01	Correct the entry in index 1038 _{hex} sub 01 of the relevant axis.
	F102 _{hex}	Address error on IB IL AO 2/U/BP: ID code error.	1038.01	Correct the entry in index 1038 _{hex} sub 01 of the relevant axis.
	F103 _{hex}	Address error on IB IL AO 2/U/BP: Length code error.	1038.01	Correct the entry in index 1038 _{hex} sub 01 of the relevant axis.
	F104 _{hex}	Same address already assigned to another axis.	1038.01	Compare the entry in index 1038 _{hex} sub 01 with the address inputs for the other axes and correct if necessary.
	F201 _{hex}	Address error on IB IL 24 DO 2: Address or module error.	1038.02	Correct the entry in index 1038 _{hex} sub 02 of the relevant axis.
	F202 _{hex}	Address error on IB IL 24 DO 2: ID code error.	1038.02	Correct the entry in index 1038 _{hex} sub 02 of the relevant axis.
	F203 _{hex}	Address error on IB IL 24 DO 2: Length code error.	1038.02	Correct the entry in index 1038 _{hex} sub 02 of the relevant axis.
	F204 _{hex}	Same address already assigned to another axis.	1038.02	Compare the entry in index 1038 _{hex} sub 02 with the address inputs for the other axes and correct if necessary.
	FE01 _{hex}	Incorrect output function	1180	Correct the entry in index 1180 _{hex} for the relevant axis.
	FE02 _{hex}	Invalid output voltage	1186	Check the entry with defined value range of the relevant index.
	FF01 _{hex}	Voltage at DAC (digital-to-analog converter) exceeds permissible value.		
	FF02 _{hex}	Terminal faulty		Replace the terminal.

Table A-7 OUTPUT errors (Continued)

DiagCode	AddDiag-Code	Meaning	Cause Index (Hex)	Error Removal
FFE6_{hex}		Error on IB IL DC AR 48/10A software driver		
	0001 _{hex}	Invalid operating mode		If necessary, call the Phoenix Contact hotline.
	0002 _{hex}	Invalid change of operating mode	1036	Correct the entry in index 1036 _{hex} for the relevant axis.
	0003 _{hex}	Timeout		
	0004 _{hex}	PCP initialization error		
	0005 _{hex}	No PCP confirmation from the IB IL DC AR 48/10A		
	0006 _{hex}	No error code for IB IL DC AR 48/10A error		
	F101 _{hex}	Address error on IB IL DC AR 48/10A: Address or module error.	1038.01	Correct the entry in index 1038 _{hex} sub 01 of the relevant axis.
	F102 _{hex}	Address error on IB IL DC AR 48/10A: ID code error.	1038.01	Correct the entry in index 1038 _{hex} sub 01 of the relevant axis.
	F103 _{hex}	Address error on IB IL DC AR 48/10A: Length code error.	1038.01	Correct the entry in index 1038 _{hex} sub 01 of the relevant axis.
	F104 _{hex}	Same address already assigned to another axis.	1038.01	Compare the entry in index 1038 _{hex} sub 01 with the address inputs for the other axes and correct if necessary.

Table A-7 OUTPUT errors (Continued)

DiagCode	AddDiag-Code	Meaning	Cause Index (Hex)	Error Removal
FFE7_{hex}		Firmware-dependent error code from IB IL DC AR 48/10A (see user manual for IB IL DC AR 48/10A) (Error message is sent from the IB IL DC AR 48/10A to the IB IL POS 200)		
	0000 _{hex}	No error		
	1000 _{hex}	Generic error in the device		
	2340 _{hex}	Short circuit on motor output		
	3211 _{hex}	Surge voltage of the power section supply		
	3221 _{hex}	Undervoltage of the power section supply		
	4210 _{hex}	Overtemperature of the output stage		
	6010 _{hex}	Software reset (Watchdog)		
	6100 _{hex}	Firmware check sum		
	7500 _{hex}	Initialization SUP1		
	8100 _{hex}	Communication		

A 2.5 Other Errors

Table A-8 Other errors

DiagCode	AddDiag Code	Meaning	Cause Index (Hex)	Error Removal
FF41_{hex}		Invalid target position		
	0001 _{hex}	Error during positioning. Possible error cause: <ul style="list-style-type: none"> – Position to be approached is out of the permissible range or is not defined. – Looping is not possible, as software limit switches would be overrun. 	1050	Correct the entry in index 1050 _{hex} for the relevant axis.
	0002 _{hex}	Error during stepping. Possible error cause: <ul style="list-style-type: none"> – Position to be approached is out of the permissible range or is not defined. 		
	0003 _{hex}	Backlash function is not possible, as software limit switches would be overrun.		
FF42_{hex}		Axis not homed		
FF43_{hex}		Target window not reached		
	0000 _{hex}	Target range could not be reached. The position is outside the target range.	1090.01 to 1090.05	Check pre-stop window and stop window. Check pre-stop window and stop window. Correct the entry in index 1090 _{hex} sub 01 to index 1090 _{hex} sub 05 for the relevant axis.

Table A-8 Other errors (Continued)

DiagCode	AddDiag Code	Meaning	Cause Index (Hex)	Error Removal
FF44_{hex}		Axis not enabled		
	0001 _{hex}	Positive edge on bit 5, although axis not in "Operating" state		First set the axis to "Operating" state and then initiate the function.
	0002 _{hex}	Positive edge on bit 6, although axis not in "Operating" state		

B Appendices

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