Instruction Manual
PSx3xxIO

Revision overview

Version:	Date:	Author:	Amendments:
A	14.07.14	Re	Initial Revision
B	02.11.17	Ka	Additions process-data
C	05.05.20	Ka	Additions Thermoprotec
D	06.07.22	Me	Revision overview; UKCA; Pin assignment; Error Acknowledge; Readjustment; Referencing value; Mapping end; Manual turning; Decl. of conformity
E	17.08.22	RH	Chapter 1.5 and 3 software version number changed
F	29.09.22	Me	Chapter 3.2 Table of speed and torque parameters
G	05.12.22	Me	Chapter 3.2 Table of speed and torque parameters QR-code
H	08.08.23	Ts	revise manual, description of status-bits revised, QR code measurement technology, current consumption "Electrical data" corrected. New chapter Limitation of liability and cross-sections Power supply cables. Reference to axial and radial forces in chap. assembly.
I	21.05.24	Ts	Error corrections, safety topics, meaning of the operating instructions revised, intended and non-intended use added, limitation of liability revised, new product labeling, assembly chapter revised, vibration and noise emissions in Physical Data added.
J	19.06.24	Ts	Error corrections
K	07.08.24	Ts	Chapter 3.6 added protection for groups
L	21.01.25	Ts	Chapter 6.17 saving parameters added

Translation of the original instructions

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These operating instruction is part of the product. Read these instructions carefully, follow our instructions and pay particular attention to safety instructions. The instructions should be available at all times.

Purpose of instruction manual

This instruction manual describes the features of the PSx3xx positioning system and provides guidelines for its use.

Every person who is tasked with carrying out work on or with the appliance must have read and understood the operating instructions before starting work on the appliance. This also applies if the person concerned has already worked with such an appliance or a similar appliance or has been trained by the manufacturer.

These appliances can pose a risk to persons and property due to improper use and incorrect operation. For this reason, every person entrusted with handling the appliances must be trained and aware of the dangers. The operating instruction and in particular the safety instruction contained therein must be carefully observed.
Always contact the manufacturer if you do not understand any parts of these instructions.

Handle these operating instructions with care:
- It must be kept within easy reach for the entire service life of the appliances.
- It must be passed on to subsequent personnel.
- Any supplements issued by the manufacturer must be included.

The manufacturer reserves the right to further develop this device type without documenting this in each individual case. Your manufacturer will be happy to provide you with information on the current status of these operating instructions.

Conformity

This device is state of the art.
It complies with the statutory requirements of the EC and UK-directives.
This is documented by the CE and the UKCA mark being affixed.

CE
UKCA

Accessoires PSx3xx-CA series

We offer you the corresponding supply and data plugs for all unit types. Please contact our sales department, stating the complete type designation, at the following e-mail address

Vertrieb@halstrup-walcher.de

Contents

1 Safety precautions

This section provides an overview of all the important safety aspects for optimum protection of personnel and for safe and trouble-free operation.

1.1 Qualified personnel

These operating instructions are intended for qualified electricians and fitters who are authorized to install, electrically connect, commission and label devices and systems in accordance with safety standards, as well as for the operator and manufacturer of the system on which the drives are installed.
The personnel must be provided with all applicable accident prevention and safety regulations that arise during commissioning or installation of the system.
It must be ensured that the personnel are familiar with all applicable accident prevention and safety regulations.

1.2 Explanation of symbols

In these operating instructions, the following highlights are used to draw attention to the hazards described below when handling the system:

⚠ DANGER	DANGER! Indicates a situation of imminent danger, which will lead to a fatality or serious injuries if not prevented.
⚠ WARNING	WARNING! Indicates a potentially dangerous situation, which may lead to a fatality or serious injuries if not prevented.
⚠ CAUTION	CAUTION! Indicates a potentially dangerous situation, which may lead to minor/slight injuries if not prevented.
NOTICE	NOTICE Indicates a potentially harmful situation, which may lead to material damage if not prevented.

1.3 Appropriate use

Positioning systems are especially suitable for automatically setting tools, stops or spindles for wood-processing equipment, packing lines, printing equipment, filling units and other types of special machines.

PSx3xx positioning systems are not stand-alone devices and may only be used if coupled to another machine.

> ⚠ **WARNING**
>
> Personal injury and property damage due to incorrect use of the products!

The positioning systems are designed for use in an industrial environment and may only be used as intended. If they are not used as intended, situations may arise that result in damage to property and personal injury.

> **NOTICE**
>
> The device is used as intended if all instructions and information in these operating instructions are observed.

- Only operate the device in perfect technical condition
- When attaching to a machine, observe the current safety regulations.
- Do not operate the product in all installed state unless all necessary protective measures have been taken.
- Observe the relevant regulations for the prevention of accidents (e.g. accident prevention regulations).
- In order to avoid the risk of accidents due to contact with moving parts, appropriate separating or non-separating guards must be provided.
- Use appropriate protective equipment (e.g. safety helmet, safety goggles, safety shoes, protective gloves).
- Use appropriate assembly and transport equipment.
- Store and transport the product in its original packaging, reuse protective caps for plugs if necessary.
- Adequate ventilation must be provided at the point of use to avoid excessive heating.
- During project planning, ensure that the device is always operated within its specifications. See technical data in chapter 7. Technical data.
- If the device is equipped with a brake, it is not a safety brake that may be used for safety functions.
- In special areas of application such as the chemical, pharmaceutical or food sector, the positioning system in stainless steel design is possible.

1.4 Inappropriate use

The use of the positioning devices outside of the operating conditions and technical data and specifications described in the documentation is considered "improper".

The drives are designed for intended operation under normal ambient conditions (according to EN / IEC / UL 61010-1), with the exception of an extended temperature range.

- Operation inside buildings
- Operartion at altitudes up to 2000m above sea level
- Ambient temperatures deviating from standard: 0°C to 45°C
- Maximum relative humidity 80% at temperatures up to 31°C, decreasing linearly to 50% relative humidity at 45°C
- Fluctuations in the supply voltage up to ± 10% of the nominal voltage at 50% relative humidity at 45°C
- The IP-protection rating is a manufacturer specification.

Any use of the device that goes beyond the intended use and/or is used differently can lead to dangerous situations

- Underwater usage of the PSW is not allowed
- The positioning system cannot be used for certain applications, such as the tranport of people and animals or as a press-bending device for cold processing of metal.
- If the operation requirements stated in chapter 7. Technical data are exceeded, personal injury or property damage may occur.
- The positioning system cannot be used in hazardous areas.
- The holding brake must not be used to brake the motor.
- Under no circumstances may the housing cover be used for power transmission purposes, e.g. for supporting, climbing or similar.

1.5 Limitation of liability

The device may only be operated in accordance with these operating instructions. All information and instructions in these operating instructions have been compiled taking into account the applicable standards and regulations, the state of the art and our many years of experience and knowledge.

The manufacturer accepts no liability arising from improper or unintended use. Warranty claims also expire in this case:

- non-observance of the operating instructions
- improper use
- improper installation
- improper use
- Use by untrained personnel
- Modifications to the device
- Technical modifications
- Unauthorized modifications

The user is responsible for carrying out commissioning in accordance with the safety regulations of the applicable standards and all other relevant national or local regulations regarding conductor dimensioning and protection, grounding, circuit breakers, overcurrent protection, etc. The person who carried out the assembly or installation is liable for any damage caused during assembly or connection.

1.6 Faults, maintenance, repair, disposal

Faults or damage to the appliance must be reported immediately to the specialist personnel responsible for the electrical connection.

The appliance must be taken out of operation by the responsible specialist personnel until the fault has been rectified and secured against accidental use.

The appliance requires no maintenance.

Repair work that requires the housing to be opened may only be carried out by the manufacturer.

The electronic components of the appliance contain environmentally harmful substances and are also recyclable materials. The device must therefore be recycled after its final decommissioning. The environmental guidelines of the respective country must be observed.

1.7 Product labeling

Warning symbol	Meaning
	Reference to further documentation Read the operating instructions and safety instructions before transportation, installation or commissioning
	Warning of hot surface The appliance can become very hot during operation. Temperatures of over 70°C can occur. In the event of a fault, internal components may be overloaded. Use personal protective equipment or wait long enough for the appliance to cool down.
	Warning of dangerous electrical voltage Before working on the product, check that all power connections are de-energized!
	Disposal of batteries, electrical and electronic equipment - In accordance with international regulations, batteries, rechargeable batteries and electrical and electronic equipment must not be disposed of with household waste. - The owner is legally obliged to dispose of these devices properly at the end of their service life. - WEEE: This symbol on the product, its packaging or in this document indicates that a product is subject to these regulations.
CE	**CE marking** CE stands for "Conformité Européenne". The CE marking expresses the conformity of a product with the relevant EC directives.
UK CA	**UKCA marking** UKCA stands for "UK Conformity Assessed". The UKCA marking expresses the conformity of a product with all applicable legal requirements of the United Kingdom.
STO	**Safe torque off** Corresponds to stop category 0 in accordance with EN 60204-1. The power supply to the drive is interrupted immediately and the drive is brought to an uncontrolled standstill
	GROUNDING Chassis grounding (description in chapter 3.7.4 Electrical grounding (Chassis))

1.8 Differences between software versions

The changeover to the process data format "8-byte output data" and the possibility to delete some error bits by setting bit 14 in the control word is only implemented from software versions >= 249 on.
The relevant places in this manual are marked with **).
The software version of the PSE can be read out via ISDU 80.

2 Device description

2.1 Functional description

The PSx3xx positioning system, an intelligent, compact, complete solution for positioning auxiliary and positioning axes, consists of an EC motor, gear power amplifier, control electronics, absolute measuring system and IO-Link interface. The integrated absolute measuring system eliminates the need for a time-consuming reference run. Connecting to a bus system simplifies the wiring. A hollow shaft with adjustable collar makes assembly quite simple. The positioning system is especially suitable for automatically setting tools, stops or spindles for wood-processing equipment, packing lines, printing equipment, filling units and other types of special machines.

PSx3xx positioning systems convert a digital positioning signal into an angle of rotation.

NOTICE
If the device names are given without the diameter of the output shaft (8, 14), the relevant information is valid for all offered output shafts (applies throughout the document).   'x' in the device name stands for a number in the range 0...9. 'xx' in the device name stands for a number in the range 10...999.

3 Installation

3.1 Electrical connection

NOTICE
The following notes on the power supply should be observed.

Minimum cross-sections are required for connection to the power supply. For power cables mounted on the device, use only the cross-sections listed below. In order to minimize voltage drop on longer cables, we always recommend using the largest available cross-section.

Device	Cable cross-section
PSEx31 / PSx32 / PSx33	min. AWG20 or 0,5 mm^2
PSEx34	min. AWG18 or 1,0 mm^2
Fieldbus connections	min. AWG23 or 0,25 mm^2

If there are concerns about mechanical strength or where cables may be exposed to mechanical damage/stress, they must be protected accordingly. This can be ensured, for example, by a cable duct or a suitable armoured pipe.

If the power supply cables are laid in the immediate vicinity of the drives or other heat sources, make sure that the cables have a temperature resistance of at least 90°C. With suitable design measures, e.g. sufficient ventilation or cooling, lower temperatures are also permissible. This must be checked and determined by the customer.

Make sure that the flammability class of the cable for the USA is equivalent to UL 2556 VW-1, e.g. according to IEC 60332-1-2 or IEC 60332-2-2 depending on the cross-section. For Canada, the flammability class FT1 is required, FT4 exceeds this and is therefore also permissible. Cables for the North American market often meet both requirements.
However, the flammability class requirements only apply if you do not limit to Class 2 (e.g. certified power supply) or to <150 W according to UL 61010-1
→ 3.6 Powering the device by means of a suitable fuse.

When installing in North America, please observe the specifications in the National Electrical Code NFPA 70 and the Electrical Standard for Industrial Machinery NFPA 79 (USA) or the Canadian Electrical Code and C22.2 (Canada) in the respective valid version.

Note the limitations of liability →1.5 Limitation of liability.

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3.2 Assembly of the positioning system

⚠	**CAUTION**
The maximum permissible axial and radial forces (see chapter 7.3 Physical data) on the motor shaft must not be exceeded during transportation, installation or operation.	

⚠	**CAUTION**
Take the weight of the device into account when selecting the fastening screws! Tightening torques of the fixing screws according to the screw manufacturer's specifications!	

⚠	**WARNING**
Rotating and/or linearly moving components can cause serious injuries. If there is a risk of accidents during installation or operation, the moving parts must be fitted with guards or protective devices.	

NOTICE
Temperature overload
The PSx3xx positioning unit has a simple temperature measuring device to prevent thermal overload. If the temperature in the device exceeds the limit temperature set in the parameterization, this bit is set and repositioning is only possible after the device has cooled down ('Temperature exceeded' bit reset).

3.3 Hollow shaft

The PSx3xx is mounted on the machine by sliding it with the hollow shaft onto the spindle to be driven and fixing it with the clamping ring (recommended shaft diameter 8 h9 or 14 h9; tightening torque of the clamping ring screw with 3 mm hexagon socket: 1.5 Nm).

⚠	**CAUTION**
The depth of the hollow bore is 20 mm. For optimum operation, the pin of the shaft to be driven should correspond to this depth. Depending on the operating situation, significantly shorter pins (< 16 mm) may cause damage to the PSx3xx. When mounting the PSx3xx, it should only be pushed on until the foam rubber plate lies evenly on the bottom of the machine or is compressed to approx. half its thickness. Under no circumstances may the PSx3xx "hard" be screwed to the machine without an air gap.	

The rotation lock is made via the pin (in the picture below the hollow shaft) into a suitable bore as rotary torque support. This hole must be slightly larger than the diameter 6 h9 of the pin. An oblong hole or slot with a slightly larger width (recommended: 6.05...6.10 mm) than the dimension of the pin diameter is optimal. The backlash when changing the direction of rotation has a direct influence on the positioning accuracy and can lead to damage to the PSx3xx with very large backlash (a few mm) due to the impact load.

⚠ **CAUTION**

The PSx3xx must have a little gap on all sides when mounted, as it can move axially and/or radially during positioning if the hollow shaft and solid shaft are not 100% aligned. This "staggering" is not a defect of the PSx3xx and also has no influence on the function, as long as it can move freely. Please note the maximum permissible radial force and axial force in
chapter → 6.3 Physical data.
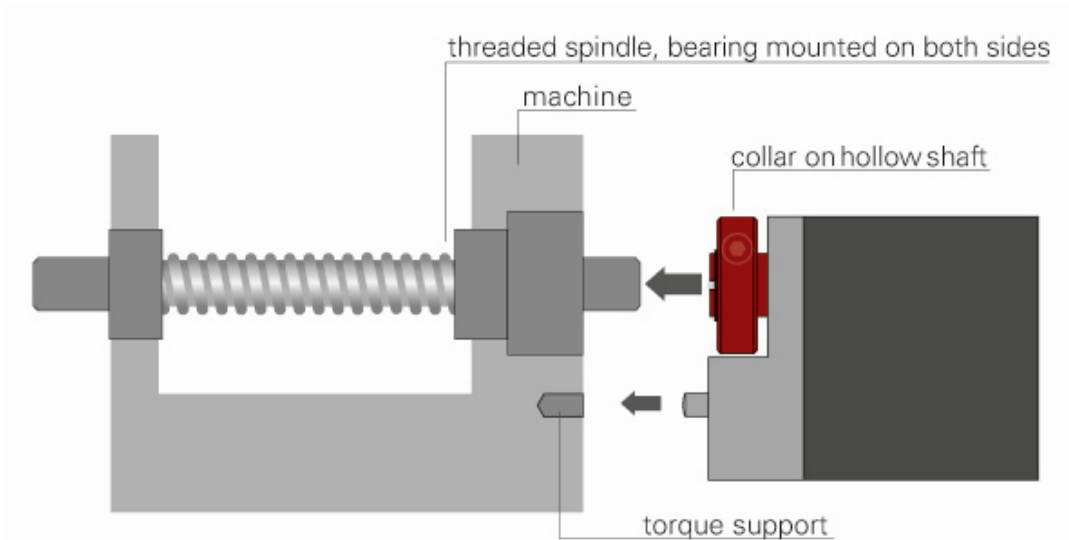
Versions with higher torques (from 10 Nm):
Here the force connection is made via a feather key DIN 6885-A5x5x12.
The clamping ring is not freely rotatable but consists of two halves, the fixed part of the hollow shaft and the loose clamping clamp. The keyway is located in the half that is fixed to the output shaft. When sliding onto the shaft to be driven with the key inserted, its angular position must be aligned with the keyway in the PSx3xx. After pushing on, the PSx3xx is fixed with the 2 screws in the flexible clamping ring half. Make sure that both screws are tightened as equally as possible (tightening torque of the screws with 3 mm hexagon socket: 1.5 Nm).

The information on torque support applies in the same way as described above.

For PSE30x-14, PSE32x-14, PSS30x-14 and PSS32x-14, the position of the anti-rotation lock can be set at greater distances by unscrewing the base cover, turning it 180° and then screwing it back on. When screwing on, make sure that the seal is correctly inserted in the floor.
For torques > 5 Nm we recommend to choose the greater distance.

3.4 Solid shaft

The PSx3xx is installed on the machine by mounting the drive to the axis to be driven using a coupling and an intermediate flange.
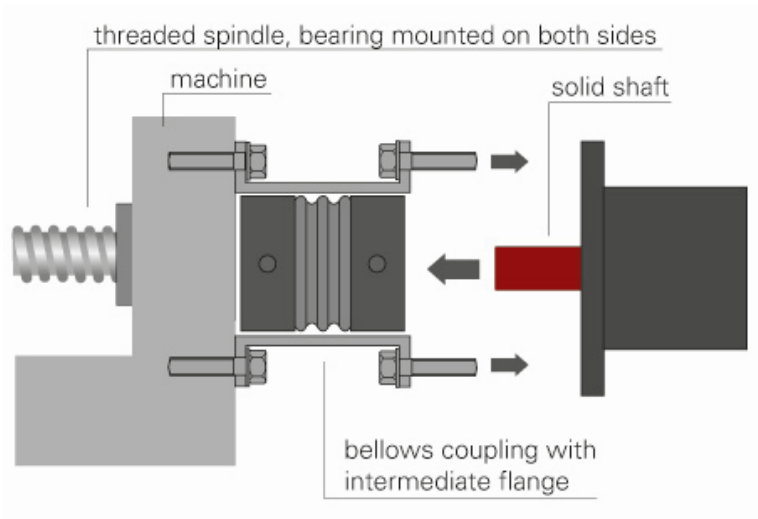
⚠	**CAUTION**

Under no circumstances may the housing cover be used for the purpose of the transmission of force.

⚠	**CAUTION**

Never apply force to the housing cover, e.g., for supporting weight.

⚠	**CAUTION**

Driving the PSx3xx rearward is prohibited (e.g. it's not allowed to turn the output shaft by an external force).

3.5 Disassembly

To remove the PSx3xx from the shaft, release the clamp (for versions with hollow shaft the clamping ring) and pull the PSx3xx off the shaft. If possible, the PSx3xx should only be pulled axially. Excessive bending back and forth can damage the output shaft!
For versions with brake, it is essential to observe the instructions in sections
6.12 Devices with optional snap brake and 6.13 Devices with optional holding brake!

3.6 Powering the device

⚠ CAUTION
For motor power use a single fuse with max. 3,5 A for each PSx3xx. For motor power use a single fuse with max. 10 A for each PSE34xx. For control power you can use a fuse with max. 2,0 A, so it is possible to power up to 10 units parallel with one fuse. It is strongly recommended to separate power cables to the PSx3xx from other power cables that might have dangerous voltage.

⚠ CAUTION
Underwater usage of the PSW is not allowed.

⚠ CAUTION
Please consider that the device might have a hot surface during operation!

3.6.1 Motor supply with group protection

When installing a group of drives, fusing the motor supply for PSx3xx (not PSE34xx) is possible and permissible under the following conditions:

- Cable protection ensured by fuse protection with max. 10 A
- Cross-section of copper conductor to drive min. 0.75 mm2
- Type of installation without bundling in closed cable ducts
- Cable length max. 20 m with 0.75 mm2
- The total motor current of all connected drives must not exceed 10 A in any operating mode
- Compliance with applicable regulations. See also chapter 1 Safety instructions.

Three drives per fuse can be operated simultaneously under nominal load (not PSE34).
If the drives are not operated at nominal load, more than three drives can be connected to one fuse. Pay particular attention to the holding and starting currents of the individual drives. Determining the total motor current in the application is therefore strongly recommended.
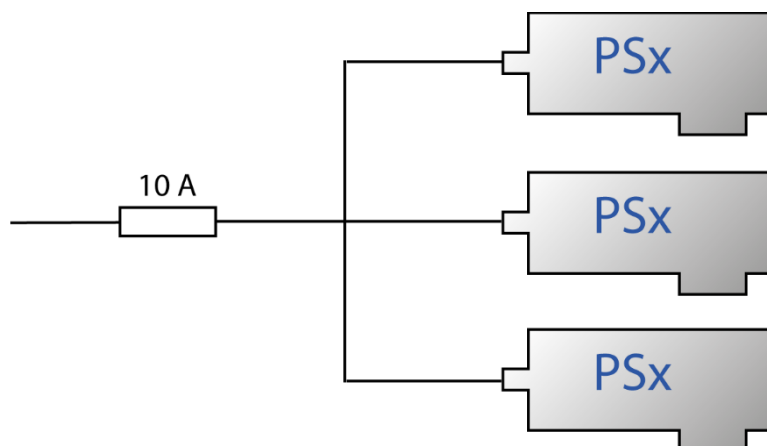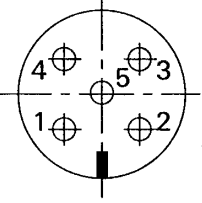
3.7 Pin assignment

⚠️ CAUTION
Please take care that the mating connectors and the used cables match the connectors in the PSx3xx and are mounted correctly, in order to achieve the protection class.
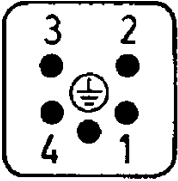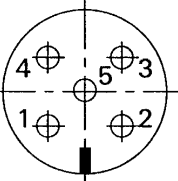
3.7.1 Pin assignment for the power supply and IO-Link PSx3xx

connector pattern (external top view)	assignment	type
	1. +24V control unit 2. +24V motor 3. GND Scontrol unit 4. I/O-Link C/Q 5. GND motor	M12 (A-cod.); 5-pol.
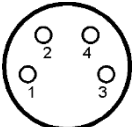
NOTICE
To prevent the ingression of fluids into the PSW-housing during cooldown, use a special cable with an airtube for pressure balancing of your PSW.

3.7.2 Pin assignment for the power supply and IO-Link for PSE34xx

connector pattern (external top view)	assignment	type
	1. +24V motor 2. GND motor 3. 4. 5. Housing	HAN4A, Harting
	1. +24V control unit 2. 3. GND control unit 4. I/O-Link C/Q 5.	M12 (A-cod.); 5-pol

3.7.3 Connector pin assignment for jog keys (Jog)

connector pattern (external top view)	assignment	type
	1. +24V (output) 2. forward key 3. reverse key 4. ground	M8; 4-pol.

3.7.4 Electrical grounding (Chassis)

Next to the connecting plugs there is a M4 stud bolt. It is recommended to connect the positioning system with a cable as short as possible to the machine base. The minimum conductor cross-section for this is 1.5mm².

3.8 Meaning of the LED's

The following LED's are under the transparent sealing plug:

- Green LED = RUN LED in accordance with IO-Link:
  - off: IO-Link communication not available
  - 90% on; 10% off: IO-Link communication available

- Orange LED = time stamp function
  - off: Process output data consist of control word, target speed (if applicable) **) and target position
  - on: Process output data contain time stamp (for an open C/Q-pin)

- Yellow LED = Display actuator voltage
  - off: no motor voltage present
  - Continuous lights: motor voltage present

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3.9 Commissioning

After applying the supply voltage, the PSx3xx may perform **no** initial reference loop before the first positioning. A positioning or manual drive order may be commenced immediately.

Process of the positioning operation (with loop)

The PSx3xx distinguishes between the following cases in a positioning process (assumption: The direction in which each target position is approached is forwards):

1. New position value is greater than current one: The position is approached directly.
2. New position value is less than current one: There is a reverse of 5/8 rotations and the exact position is approached in forward motion.
3. New position value is greater than the current one, but was previously a reverse without loop drive (e.g. a manual drive): Since the loop length > 0, the drive moves the position in all cases with a forward movement, whose length is at least the same as the loop length. In order to achieve this, the drive, if necessary, initially goes in the reverse direction, i.e. in the opposite direction to the desired direction of travel. The maximum length of this route is the loop length.

After reaching the target position, this position is compared with the internal absolute encoder position. In the event of a deviation, the status bit "ERROR" is set (Bit 9 in the status word).

In the delivery condition, the loop length is > 0, i.e. each target position is approached in forward direction.

NOTICE

A positioning on the upper limit (ISDU 129) with a loop length < 0 is not possible because the drive would have to overrun the end limit to achieve this. The same applies to the lower limit (ISDU 130) for a loop length > 0.

⚠ **CAUTION**

Underwater usage of the PSW is not allowed.

Process of the positioning operation without loop

The "positioning without loop" mode is used primarily for moving the small distances involved in fine adjustments. In this case, each position is approached directly. This does NOT eliminate any play present in the spindle in question. The PSx3xx internal gear backlash does not play a role in this case, as position data are acquired directly at the output shaft.

NOTICE

Drives which entail a block drive (e.g. reference drives to block) may only be started with a reduced torque (max. driving torque is a maximum of 10% of the rated torque or the smallest possible value).

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4 IO-Link

For the IO-Link interface, IEC 61131-9 Version 1.1.2 is used as the SDCI protocol.

The format of the output data can either be structured according to the Time Stamp Specification of the Sick company (consisting of a time stamp and two control bits), or they consist of a control word and a setpoint (process data; this is the delivery status). From software versions >= 249, there is a third process data output format which also contains the set speed.

4.1 Table of the implemented object directory entries

Designation	ISDU Number	Function	Value range	Secu red	Deli very	R/W
IO-Link standard variables						
Direct Parameter 1	0	Sub 1: Master command	8 bit			W
		Sub 2: Master cycle time	8 bit			R/W
		Sub 3: Minimum cycle time	8 bit		68	R
		Sub 4: M-Sequence Capability	8 bit		43	R
		Sub 5: IO-Link version ID	8 bit		17	R
		Sub 6: Process data input length	8 bit		135	R
		Sub 7: Process data output length	8 bit		16	R
		Sub 8: Vendor ID 1	8 bit		2	R
		Sub 9: Vendor ID 2	8 bit		216	R
		Sub 10: Device ID 1	8 bit			R
		Sub 11: Device ID 2	8 bit			R
		Sub 12: Device ID 3	8 bit			R
		Sub 13: reserved	8 bit		0	R
		Sub 14: reserved	8 bit		0	R
		Sub 15: reserved	8 bit		0	R
		Sub 16: Standard command	8 bit			W
Standard command	2	To trigger specific commands Value Meaning 128 Reset device 130 Restore factory setting 160 Restore factory setting without changing the process data format 161 Save the parameters in EEPROM	8 bit			W

Designation	ISDU Number	Function	Value range	Secu red	Deli very	R/W
IO-Link standard variables (continuation)						
Device access locks	12	Bit 0: parameter (write) access lock Bit 1: data storage lock Bit 2: local parameterisation lock Bit 3: local user interface lock	16 bit	yes	0	R/W
Vendor name	16	halstrup-walcher GmbH	String			R
Vendor text	17	www.hwg.eu	String			R
Product name	18	depending on the gearbox type, e.g. "PSE312-8-IO"	String			R
Product-ID	19	"PSE"	String			R
Product text	20	"Positioning system"	String			R
Serial number	21	as a string of 5 characters, e.g. "00042"	String			R
Hardware version	22	e.g. "V1.0"	String			R
Firmware version	23	e.g. "V1.0"	String			R
Application specific. tag	24	any text (max. 16 characters).	String		""	R/W
Status requests						
Status	64	<u>Bit 0</u>: target position reached <u>Bit 1</u>: drag error <u>Bit 2</u>: reverse jog key active <u>Bit 3</u>: forward jog key active <u>Bit 4</u>: motor power present <u>Bit 5</u>: positioning run aborted <u>Bit 6</u>: drive is running <u>Bit 7</u>: temperature exceeded <u>Bit 8</u>: movement opposite loop direction <u>Bit 9</u>: error <u>Bit 10</u>: positioning error (block) <u>Bit 11</u>: manual displacement <u>Bit 12</u>: incorrect target value <u>Bit 13</u>: motor power was missing <u>Bit 14</u>: positive range limit <u>Bit 15</u>: negative range limit	0..FFFFh 16 bit			R
Actual rpm	65	Current speed in 1/min	±15 bit			R
Set actual value	66	If this par. is set to 0 and the subsequent write command affects the actual position (67), the writing of the actual position is suppressed.	0…1 8 bit	no	0	R/W

Designation	ISDU Number	Function	Value range	Secured	Delivery	R/W
Status requests (continuation)						
Actual value	67	Current actual position, value in 1/100 mm (for default settings of numerator ISDU 124 and denominator ISDU 125 and spindle pitch 4 mm) Writing onto this register causes the current position to be "referenced" onto the transferred value Changes only possible when at standstill	±31 bit	no		R/W
Actual torque	68	Current torque in cNm	16 bit			R
Maximum torque	69	Maximum torque on the last run (start phase during which the ISDU release torque applies, see ISDU 152/160, as well as brake phase are not taken into account) Value in cNm	16 bit			R
U control	70	Current supply voltage of the control in 0.1 V	16 bit			R
U motor	71	Current supply voltage of the motor in 0.1 V	16 bit			R
Device temperature.	72	Temperature inside the device in °C	16 bit			R
Production date	77	Year and week of manufacture (as integer number)	YYWW 16 bit			R
Serial number	78	Current device serial number	0...65535 16 bit			R
Device model	79	one of the following device types from the PSx range (indicate 5-digit numbers in the last 2 digits of the diameter of the output shaft): **PSE and PSS:** 30108, 30114, 30208, 30214, 30508, 30514, 31108, 31114, 31208, 31214, 315, 322, 325, 332, 335, 3110, 3125, 3410, 3418 **PSW:** 36108, 36114 (= 301-8/14) 36208, 36214 (= 302-8/14) 36508, 36514 (= 305-8/14) 37108, 37114 (= 311-8/14) 37208, 37214 (= 312-8/14) 375 (=315-8) 382 (=322-14) 385 (=325-14) 392 (=332-14) 395 (=335-14)	16 bit			R
Software version	80	Software version number	16 bit			R

Designation	ISDU Number	Function	Value range	Secured	Delivery	R/W
Run commands						
Set control word	109	If this par. is set to 0 and the subsequent write command affects the control word (110), the writing of the control word is suppressed.	0…1 8 bit	no	0	R/W
Control word	110	Bit 0: manual run to larger values Bit 1: manual run to smaller values Bit 2: transfer target values (for transferring the target values with the help of the process data, the positioning is only started if this bit is set.) Bit 3: release manual run in jog mode: If the bit is deleted, only individual steps are available in the jog mode Bit 4: release: The axis is only driven when the bit is set (except jog mode with buttons or with Bits 8/9). Bit 5: release jog operation with keys: For an existing IO-Link connection, the external buttons are only active when the bit is set. Bit 6: run without loop Bit 7: run initial reference loop Bit 8: jog to larger values Bit 9: jog to smaller values Bit 10: readjustment Bit 11: execute braking free run Bit 12: run with drag error correction Bit 14: clear error bits**) All other bits must be set to 0!	16 bit	no	0	R/W
Set target position	111	If this par. is set to 0 and the subsequent write command affects the target position (112), the writing of the control word is suppressed.	0…1 8 bit	no	0	R/W
Target position	112	Target position to be approached Value in 1/100 mm (for the default values of numerator ISDU 124 and denominator ISDU 125 and spindle pitch 4 mm)	±31 bit	no	0	R/W

Designation	ISDU Number	Function	Value range	Secu red	Delivery	R/W
"Bus communication" parameter group						
Process data format	116	0 → with time stamp function 1 → with 6 bytes of output data 2 → with 8 bytes of output data**) After saving and restarting, the device reports with the Device ID which corresponds to the gearbox type: with time stamp function → ID ends with 01 (e.g. 3120801) with 6 bytes of output data → ID ends with 02 (e.g. 3120802) with 8 bytes of output data**) → ID ends with 04 (e.g. 3120804)	0, 1 or 2**) 8 bit	yes	1	R/W
Communication timeout	118	Value in milliseconds If the value is 0, the communication timeout is disabled. A value > 0 defines the time within which the master must send a new message to maintain the connection. A timeout either results in a drive cancellation (value of ISDU 137 = 1) or a drive to the safety position defined by ISDU 138(value of ISDU 137 = 2).	0… 10000 16 bit	yes	0	R/W
Stack behaviour	119	Bit 0: Device sends diagnostic messages All other bits must be set to 0!	8 bit	yes	1	R/W

Designation	ISDU Number	Function	Value range	Secu red	Delivery	R/W
"Position values" parameter group						
Direction of rotation	123	0: clockwise (when looking at the output shaft) 1: counter clockwise Changes only possible when at standstill	0 or 1 8 bit	yes	0	R/W
Actual value assessment, numerator	124	With these values, any user resolution can be mapped on the drive. For a numerator factor 400, the spindle pitch / resolution is in the denominator factor e.g.: Spindle pitch 1.5mm with resolution 1/100 mm: numerator = 400, denominator = 150 Changes only possible when at standstill	1...10000 16 bit	yes	400	R/W
actual value assessment, denominator	125		1...10000 16 bit	yes	400	R/W
Write referencing value	126	If this par. is set to 0 and the subsequent write command affects the referencing value (127), the writing of the referencing value is suppressed.	0…1 8 bit	no	0	R/W
Referencing value	127	Value by which setpoints, actual values and limit values are corrected Changes only possible when at standstill	±31 bit	yes	0	R/W
Upper mapping end	128	Definition of the positioning range relative to the absolute value encoder permitted values: (1 + referencing value) ... (204800 * denominator/numerator - 1 + ref.value) Changes only possible when at standstill From software version V267, the par. no longer has a function; see chapter "Extended positioning range".	±31 bit	yes	102400	R/W
Upper limit	129	maximum permissible target position permitted values for SW versions < 267: (upper mapping end - 1200..101200 * denominator/numerator) permitted values for SW versions ≥ 267: see chapter "Extended positioning range" Changes only possible when at standstill	±31 bit	yes	101200	R/W
Lower limit	130	minimum permissible target position permitted values for SW versions < 267: (upper mapping end - 1200..101200 * denominator/numerator) permitted values for SW versions ≥ 267: see chapter "Extended positioning range" Changes only possible when at standstill	±31 bit	yes	1200	R/W
Positioning window	131	Permissible difference between the target and the actual value for the "Position reached" bit The maximum settable value changes in the same factor as the resolution	1...100 16 bit	yes	2	R/W

Loop length	132	Minimum number of steps in which the drive approaches a target in a predefined direction Value in steps (0 → no loop)	0.025…1 revolution or 0 32 bit	yes	250	R/W
Drag error	133	Maximum drag error before the "drag error" bit is set. Value is expressed in steps (at a resolution of 0.5 mm)	20...1000 16 bit	yes	40	R/W
Loop direction	134	0: with 5/8 turn forwards 1: with 5/8 turn backwards (5/8 revolutions is the default value, p. ISDU 132) Changes only possible when at standstill	0 or 1 8 bit	yes	0	R/W
Jog increment	135	The number of steps when briefly pressing the external buttons (or briefly activating a jog drive) Changes only possible when at standstill	1...100 16 bit	yes	1	R/W

Designation	ISDU Number	Function	Value range	Secu red	Delivery	R/W
"Position values" parameter group (continuation)						
Number breaking free steps	136	Number of steps for the brake release drive	1...50 16 bit	yes	*)	R/W
Configuration for connection timeout	137	Reaction of the drive to a connection failure 0 → reserved 1 → drive cancellation 2 → Drive to a safe position (see ISDU 138) (a connection failure is only detected for ISDU 118 > 0.)	16 bit	yes	1	R/W
save position for connection timeout	138	If the "Drive to safe position" is configured (see ISDU 137), the drive moves into this position in the event of a connection timeout.	±31 bit	yes	0	R/W
"Speed" parameter group						
Target rpm abs	142	Maximum speed to be used for position drives. Value in 1/min	*) 16 bit	yes	*)	R/W
Target rpm CCW	143	Value in 1/min	*) 16 bit	yes	*)	R/W
Target rpm CW	144	Value in 1/min	*) 16 bit	yes	*)	R/W
Target rpm jog	145	Maximum speed to be used for manual drives Value in 1/min	*) 16 bit	yes	*)	R/W
Rpm limit abort	146	Speed limit for drive cancellation Value in % of the target speed	30...90 16 bit	yes	60 PSE3110 and PSE3125 30 (all others)	R/W
Acceleration	147	Value in 1/min per sec.	*) 16 bit	yes	*)	R/W
Deceleration	148	Value in 1/min per sec.	*) 16 bit	yes	*)	R/W

*) Values are dependent on the gearbox type (see the following table).

Designation	ISDU Number	Function	Value range	Secured	Delivery	R/W
"Torque" parameter group						
Maximum start-up torque	152	Value in cNm	*) 16 bit	yes	*)	R/W
Maximum torque	153	Applies after the end of the start-up phase (during the start phase, the value from ISDU 152 applies); value in cNm	*) 16 bit	yes	*)	R/W
Max. holding torque at end of run	154	Value in cNm	*) 16 bit	yes	*)	R/W
Holding torque	155	Holding torque at standstill in cNm	*) 16 bit	yes	*)	R/W
"Time" parameter group						
time elapsed until speed falls below rpm limit for aborting run	159	Value in milliseconds	50...500 16 bit	yes	200	R/W
time period for start-up torque	160	Value in milliseconds	10...1000 16 bit	yes	200	R/W
duration of maximum holding torque at end of run	161	time period at end of run, in which the 'maximum holding torque at end of run' applies (value in milliseconds)	0..1000 16 bit	yes	200	R/W
idle period for direction change	162	Waiting time in milliseconds for reversal of direction of rotation	10... 10000 16 bit	yes	10	R/W
Wait time for manual drive	163	The time a manual drive button must be pressed (or a jog drive bit must be activated), so that a manual drive begins Value in steps of 5 msec Changes only possible when at standstill	20...2000 16 bit	yes	200	R/W
Wait time for brake (drive start)	164	Time period prior to the drive start in which the brake can be released without the engine moving (value in milliseconds)	0...2000 16 bit	yes	150	R/W
Wait time for brake (drive end)	165	Period of time after the drive end for which the brake remains released (value in milliseconds)	0...3000 16 bit	yes	1000	R/W
UMot filter	166	Average time for motor voltage measurement in steps of 5 msec	100... 1000 16 bit	yes	100	R/W

*) Values are dependent on the gearbox type (see the following table).

Designation	ISDU Number	Function	Value range	Secured	Delivery	R/W
"Other" parameter group						
General purpose	171-180	10 freely-usable registers	16 bit	yes	0	R/W
UMot limit	181	Voltage limit for Bit 'motor power present' in 0.1 V	180...240 16 bit	yes	185	R/W
Temperature limit	182	Temperature limit °C for overtemperature	10...70 16 bit	yes	70	R/W
Delivery state	193	<u>Writing a "-1"</u>: Sets the delivery state, without changing the process data format: Set all parameters to default values and save them in the EEPROM, execute an initial reference loop, then position to mid-range <u>Writing a "-2"</u>: Sets the delivery state: Set process data format ISDU 116 to 1, set all parameters to default values and save them in the EEPROM, execute an initial reference loop, then position to mid-range A new process data format is only active after a "Reset" command or a restart! <u>Writing a "1"</u>: Saves the parameters in EEPROM <u>Writing a "0"</u>: No action <u>Writing a "2"</u>: Sets the delivery state: Set process data format ISDU 116 to 1, set all parameters to default values and save them in the EEPROM. (without mid-position drive) A new process data format is only active after a "Reset" command or a restart! <u>Writing a "3"</u>: Sets the delivery state, without changing the process data format: set all parameters to default values and save them in the EEPROM - (without mid-position drive) <u>Read after booting</u>: 0 → memory contents correct 0 → memory contents incorrect <u>Read after saving</u>: 0 → Save successfully completed ≠ 0 → Save is still running or completed with error (saving can take up to 2000ms)	-2…3 (When writing) 0...2 (When reading) ±15 bit	no		R/W

4.2 Table of the speed and torque values for various models of gears

Device type PSE and PSS	ISDU No.	301-x 311-x	302-x 312-x	305-x 315-8	322-14 332-14	325-14 335-14
Name		Value range delivery				
Target speed	142	15...230 230	10...150 150	3...70 70	20...200 170	10...100 85
target speed for manual run	145	15...230 80	10...150 50	3...70 20	20...200 80	10...100 40
Target speed CCW	143	15...230 230	10...150 150	3...70 70	20...200 200	10...100 100
Target speed CW	144	15...230 230	10...150 150	3...70 70	20...200 200	10...100 100
Acceleration	147	97...600 600	50...400 400	23...130 130	97...525 525	44...260 260
Deceleration	148	97...600 600	50...400 400	23...130 130	97...525 525	44...260 260
Maximum torque	153	2...100 100	10...200 200	50...500 500	10...200 200	20...400 400
Maximum start-up torque	152	2...125 125	10...250 250	50...600 600	10...250 250	20...500 500
Maximum holding torque	155	0...90 30	0...150 50	0...300 100	0...100 35	0...200 70
Max. holding torque at end of run	154	0...180 60	0...300 100	0...600 200	0...200 70	0...400 140
Number of breaking free steps	136	1...50 4	1...50 4	1...50 3	1...50 4	1...50 4

Device type PSE and PSS	ISDU No.	3210-14 3310-14	3218-14
Name		Value range delivery	
Target speed	142	5...45 38	3...30 28
target speed for manual run	145	5...45 15	3...30 10
Target speed CCW	143	5...45 45	3...30 30
Target speed CW	144	5...45 45	3...30 30
Acceleration	147	20...117 117	11...70 70
Deceleration	148	20...117 117	11...70 70
Maximum torque	153	100...1000 1000	180...1800 1800
Maximum start-up torque	152	100...1200 1200	180...2200 2200
Maximum holding torque	155	0...500 175	0...900 300
Max. holding torque at end of run	154	0...1000 350	0...1800 600
Number of breaking free steps	136	1...50 3	1...50 3

Device model PSE		3110-14	3125-14	3325-14	3410-14	3418-14
Name	ISDU No.	Value range delivery				
Target speed	142	1…30 30	1…12 12	2...18 15	10...100 100	5...90 90
target speed for manual run	145	1…30 12	1…12 5	2...18 6	10...100 40	5...90 30
Target speed CCW	143	1…30 30	1…12 12	2...18 18	10...100 100	5...90 90
Target speed CW	144	1…30 30	1…12 12	2...18 18	10...100 100	5...90 90
Acceleration	147	9…50 50	4…20 20	8...45 45	20...350 350	10...315 315
Deceleration	148	9…50 50	4…20 20	8...45 45	20...350 350	10...315 315
Maximum torque	153	100...1000 1000	250...2500 2500	250...2500 2500	100...1000 1000	100...1800 1800
Maximum start-up torque	152	100...1200 1200	250...3000 3000	250...3000 3000	100...1200 1200	100...2000 2000
Maximum holding torque	155	0...600 200	0...1250 450	0...1250 450	0...300 200	0...450 300
Max. holding torque at end of run	154	0...1200 400	0...2500 900	0...2500 900	0...600 400	0...900 600
Number of breaking free steps	136	1...50 3	1...50 3	1...50 3	1...50 4	1...50 4

Device type PSW		301-x 311-x	302-x 312-x	305-x 315-8	322-14 332-14	325-14 335-14
Name	ISDU No.	Value range delivery				
Target speed	142	15...180 180	10...125 125	3...60 60	20...150 125	10...80 60
target speed for manual run	145	15...180 80	10...125 50	3...60 20	20...150 80	10...80 40
Target speed CCW	143	15...180 180	10...125 125	3...60 60	20...150 150	10...80 80
Target speed CW	144	15...180 180	10...125 125	3...60 60	20...150 150	10...80 80
Acceleration	147	97...600 600	50...400 400	23...130 130	97...525 525	50...260 260
Deceleration	148	97...600 600	50...400 400	23...130 130	97...525 525	50...260 260
Maximum torque	153	2...100 100	10...200 200	50...500 500	10...200 200	20...400 400
Maximum start-up torque	152	2...125 125	10...250 250	50...600 600	10...250 250	20...500 500
Maximum holding torque	155	0...90 30	0...150 50	0...300 100	0...100 35	0...200 70
Max. holding torque at end of run	154	0...180 60	0...300 100	0...600 200	0...200 70	0...400 140
Number of breaking free steps	136	1...50 4	1...50 4	1...50 3	1...50 4	1...50 4

Device type PSW		3210-14 3310-14	3218-14
Name	ISDU No.	Value range delivery	
Target speed	142	5…38 38	3...26 24
target speed for manual run	145	5…38 15	3...26 10
Target speed CCW	143	5…38 38	3...26 26
Target speed CW	144	5…38 38	3...26 26
Acceleration	147	20...117 117	11...70 70
Deceleration	148	20...117 117	11...70 70
Maximum torque	153	100...1000 1000	180...1800 1800
Maximum start-up torque	152	100...1200 1200	180...2200 2200
Maximum holding torque	155	0...500 175	0...900 300
Max. holding torque at end of run	154	0...1000 350	0...1800 600
Number of breaking free steps	136	1...50 3	1...50 3

4.3 Process Data Definition

4.3.1 Process output data (from the point of view of the IO-Link master)

Assignment for the variant "time stamp function":

Bit	Meaning	
0-1	Control bits	0 → abort run 1 → Manual drive to larger values 2 → Manual drive to smaller values 3 → Positioning drive to the target position previously set with ISDU 112
2-15	Time stamp	Time after which the drive should execute the command (value in 4µs) 0x3FFF = 16383 → No new time stamp

The base time is 4µs, i.e. the relevant time stamp value is calculated as follows from the desired delay time:

$$Timestampvalue = \frac{desired\_delaytime\,[\mu s]}{4\mu s}$$

Since the time stamp value must lie in the range [0…16368], the maximum possible delay time is 65.472ms.

A valid time stamp that is cyclically transmitted creates no response in the drive because the last time stamp becomes invalid when a new one is entered. Therefore, the intended action is only executed if the time stamp is inactive, i.e., accepts the value 16383.

Time stamp values < 2000 are executed immediately, since the delay time is then < 8 ms and is therefore less than the IO-Link cycle time.

The drive acknowledges the triggering of a time stamp with a 250ms-long dark phase of the orange LED. When the orange LED is permanently dark, the drive continuously receives valid time stamps.

Assignment for the variant "6 bytes of output data":

Bit	Byte	Meaning	Corresponding IO-Link parameters
0-15	0-1	Control word	110
16-47	2-5	Target position	112

Assignment for the variant "8 bytes of output data":**)

Bit	Byte	Meaning	Corresponding IO-Link parameters
0-15	0-1	target speed	142 (positioning drive) or 145 (manual drive)
16-31	2-3	Control word	110
32-63	4-7	Target position	112

The desired variant for the process output data is specified by ISDU 116 ("Process Data Format"), the default is "6 bytes of output data ".

4.3.2 Process input data (from the point of view of the IO-Link master)

Assignment:

Bit	Byte	Meaning	Corresponding IO-Link ISDU's
0-15	0-1	Status	64
16-31	2-3	Actual rpm (1/min)	65
32-63	4-7	Actual value	67

The assignments are not changeable.

> **NOTICE**
>
> Some IO-Link bus masters process the data in the opposite byte order, this applies to both the output and the input data. In practice, the order of the data can be easily determined by cyclically switching the motor voltage on and off when the bus connection is established and the drive is at standstill. Bit 4 of the status word ("Motor power present") then changes level cyclically accordingly, thus byte 0 of the status word can be identified.

4.4 Detailed description of the status bits

Bit 0:   target position reached
  set:
    - After a successful arrival to a transferred target position
    - If after the initial reference loop the actual value corresponds to the previously transferred target position
    - after manual displacement while at standstill, if readjustment is activated and the absolute value of the difference of actual and target value is smaller or equal to the positioning window again.

  reset:
    - after transfer of a target position if the difference to the actual value is greater than the positioning window ISDU is (131)
    - by a manual run
    - for a transfer of an invalid target position
    - for manual turning at standstill

Bit 1:   Drag error
  set:
    - If the set maximum speed is not reached after the end of the acceleration phase
  reset:
    - with each new run command

Bit 2:   Reverse jog key active
  set:
    - If Pin 3 of the key connector is connected with Pin 1 (+24V),
  reset:
    - If Pin 3 of the key connector is disconnected with Pin 1 (+24V),

Bit 3:   Forward jog key active
<u>set</u>:
  - If Pin 2 of the key connector is connected with Pin 1 (+24V),
reset:
  - If Pin 2 of the key connector is disconnected with Pin 1 (+24V),

Bit 4:   Motor power present
<u>set</u>:
  - If the motor supply voltage is above the Umot limit (ISDU 181) and below 30V
reset:
  - If the motor supply voltage is below the Umot limit or above 30V

Bit 5:   Positioning run aborted
<u>set</u>:
  - if a positioning run is cancelled by cancelling the release in the control word
reset:
  - when a new run command is sent

Bit 6:   Drive is running
<u>set</u>:
  - with rotating drive
reset:
  - at standstill

Bit 7:   Temperature exceedance
<u>set</u>:
  - If the temperature inside the device exceeds the limit value from ISDU 182
<u>deleted</u>:
  - If the temperature inside the device exceeds the limit value by 5°C

Bit 8:   Movement opposite loop direction
<u>set</u>:
  - for manual drive against the positioning direction (a subsequent manual travel in positioning direction no longer deletes this bit)
  - during a positioning operation against the loop direction
reset:
  - After a successful arrival to a transferred target position in loop direction
  - after a initial reference loop

Bit 9:   Error
<u>set</u>:
  - if an internal problem has been detected in the position calculation
    If the error bit is set, no drive orders are possible apart from the initial reference loop
reset:
  - If a initial reference loop is completed correctly

Bit 10:   Positioning error (block)
<u>set</u>:
  - If a positioning run has been cancelled as a result of overload (block, strong stiffness)
reset:
  - by ordering a positioning order
  - after a correctly-completed initial reference loop

Bit 11:   Manual displacement
        <u>set</u>:
          - If the drive, at a standstill, is rotated from the outside by more than the value
            set in the positioning window
        reset:
          - by ordering a positioning order
          - after a correctly-completed initial reference loop

Bit 12:   Incorrect target value
        <u>set</u>:
          - If a transferred target value is outside of the limit switch limits, also caused
            e.g. by the act. value of the referencing value (ISDU 127)
          - If a transferred target value is within the limit switch limits, but would leave
            the specified range through a necessary loop drive
        reset:
          - by sending a valid setpoint value

Bit 13:   Motor power was missing
        <u>set</u>:
          - if the motor voltage is under the ISDU Umot limit (181) or above 30V when
            ordering a positioning or initial reference loop
          - If, during the drive, the motor voltage leaves the specified corridor
        reset:
          - if the motor voltage is above the ISDU Umot limit (181) or below 30V when
            ordering a positioning or initial reference loop

Bit 14 / 15: Forward / reverse end limit is approached
        <u>set</u>:
          - if the end limit value is reached by manual drive (not if this is achieved by
            positioning drive)
          - If an end switch limit is changed so that the current position is outside
          - if, during standstill, the drive is moved by an external force to a position
            outside the range defined by the end switch limits
        reset:
          - At the start of a positioning, initial reference loop or manual drive

4.5 Detailed description of the control bits

Bit 0:   Manual run to larger values

Bit 1:   Manual run to smaller values

Bit 2:   Transfer target values: For transferring a target value with the help of the process data, the positioning is only started if this bit is set.

Bit 3:   Release for manual run in jog key mode: This bit must be set in order to switch from jog key mode (run activated via the keys, if bit 5 is set; or via command if bit 8 or 9 is set in the control word, if bits 4 and 5 are not set) to manual run mode by holding down a key (or a jog key bit is activated for a longer time). Single increments are the only option in jog key mode if this bit is reset.

Bit 4:   Release: Run commands are only executed when the bit is set (except jog mode with buttons or with Bits 8/9 of the control word).
        This bit must be set for positioning runs and manual runs, it may not be set for jog runs.
        If it is cleared during a run, this is cancelled and status bit 5 is set ("Positioning run aborted").

Bit 5:   Release jog operation with keys: If there is an existing IO-Link connection, jog mode via buttons is only possible if this bit is set and bit 4 is reset. For jog mode via IO-Link (bits 8 or 9 in the control word), this bit may not be set.

Bit 6:   Run without loop: If the bit is set, all targets positions are approached directly (without any loop).

Bit 7:   Initial reference loop: 5/8 turns against loop direction and then 5/8 in loop direction at manual drive speed.
        This command had to be executed after switch-on in previous versions. This is no longer the case.

Bit 8:   Jog to larger values: Functionally corresponds to a pressed button forward (Bit 3 in status). Bits 4 and 5 may not be set in this operating mode!

Bit 9:   Jog to smaller values: Functionally corresponds to a pressed button backward (Bit 2 in status). Bits 4 and 5 may not be set in this operating mode!

Bit 10:   Release readjustment: The drive only readjusts with a set bit, if it is pushed against the loop position after the end of a drive. If Bit 6 ("Run without loop") is set, the drive readjusts in both directions.

Bit 11:   Execute braking free run: At the start of the positioning, the brake is initially actuated and the "waiting time for brake (drive start)" is temporised (ISDU 164). In this time, the brake should move into the working position (in this brake position, the engine can move freely). After the end of the waiting period, a certain distance is driven in both directions to release any stuck brakes. This distance ("number of release steps") is set in ISDU 136. Bit 4 must be set at the same time for the execution of the command.

Bit 12:   Run with drag error correction: With a set bit, the drive attempts, under consideration of the set maximum current, to amend a tracking error that has occurred by controlling the speed at a value which is slightly above or below the specified target speed (ISDU 142). Drag error correction only takes place for positioning drives, i.e. not for manual or jog drives. It also only takes effect during acceleration or a drive at constant speed, not during deceleration. The speed setpoint for acceleration results from the speed at the start of the positioning as well as from the specified acceleration (ISDU 147).

Bit 13:   reserved, must be set to 0!

Bit 14:   Clear error bits:**)
On a 0 → 1 edge of this bit the error bits 1, 5, 10, 11. 12 and 13 are cleared

Bit 15:   reserved, must be set to 0!

5 Sequence of positioning
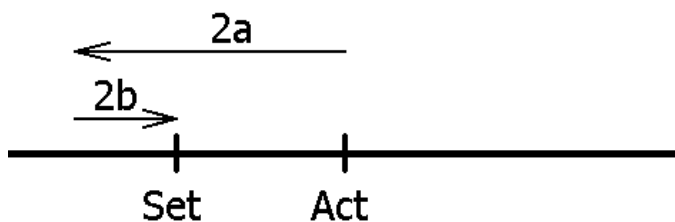
5.1 Positioning run

By default, the PSx3xx always approaches each setpoint from the same direction. If a target is located in the opposite direction to the loop direction, the setpoint is first overrun by the value of the loop length (ISDU 132) and only then finally approached. In this way, for example, the backlash of a driven spindle can be eliminated

The PSx3xx thus distinguishes the following cases during a positioning process: Assumption: Each target position is approached in forward direction, i.e. the loop length is 250 steps = 5/8 revolutions.

1. New setpoint position is greater than the current actual position: The target is approached directly.
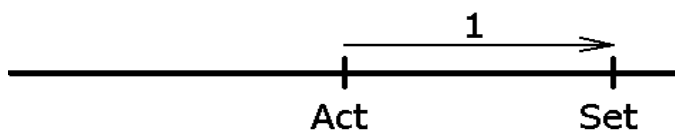

2. New setpoint position is smaller than the current actual position: The device is moved further back by the loop length (2a) and the final destination is then approached in forward motion (2b).

3. New setpoint position is only slightly larger than the current actual position and previously there was no positioning movement with loop (e.g. a manual movement):
   In all cases, the drive approaches the target with a forward movement whose length corresponds at least to the loop length. In order to achieve this, the drive first moves in reverse direction (3a), i.e. against the actually desired direction of travel, and then forwards the actual destination (3b).
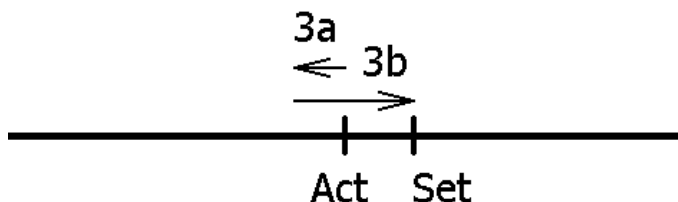
The maximum length of this distance is the loop length. If the setpoint differs from the current actual value by more than the loop length, it is approached directly.

5.2 Positioning run without loop

The "Positioning without looping" mode is mainly used to move small distances for fine corrections. Each position is approached directly. Any play in the driven spindle is NOT eliminated. The internal gear backlash of the PSx3xx does not appear in this case either, as the position detection takes place directly at the output shaft.

5.3 Positioning in "Time stamp" mode

NOTICE
This mode is active when the orange LED is permanently on with the C/Q pin open.

5.3.1 Positioning run

- to control the drive, it must first be switched to the IO-Link status "operate".
- disable time stamp (value 0x3FFF = 16383)
- transfer desired setpoint with ISDU 112
- control bits (from the process output data) at 0x03
- time stamp at the desired value, e.g. 10000 (the master now continuously sends new time stamps, which is why the drive order is never started in this state.)
- disable time stamp (value 0x3FFF = 16383)
  → The last time stamp remains valid.
  → Drive starts to move
- Cancellation of drive by withdrawing the release:
  Control bits at 0x00 with time stamp 0 → drive cancellation is executed immediately
- if a new target position is transferred during the positioning run, the new destination is approached immediately. If the direction of rotation does not need to be changed, this is done without interruption.
- if a manual run command is sent during a position run, the positioning run is interrupted (speed reduced to slow speed) and continued with the manual run.

5.3.2 Positioning run without loop

The sequence corresponds to a positioning run with loop. To perform a positioning run without a loop, Bit 6 must be set in the control word in addition to the release (Bit 4 in control word; set by the control bits in the process output data) ("Run without loop"). Before the positioning run, set the control word with the help of ISDU 110 to 0x40.

5.3.3 Manual run

- disable time stamp (value 0x3FFF = 16383)
- Transfer manual run: Control bits at 0x01 or 0x02): Drive starts to move
- time stamp at the desired value, e.g. 10000
- disable time stamp (value 0x3FFF = 16383) → Drive starts to move
- Ending of drive by withdrawing the release:
  Control bits at 0x00 with time stamp 0 → drive cancellation is executed immediately
- In the case of transfer of a target value during a manual run this is ended and the target position is approached immediately.

NOTICE
If the time stamp is permanently inactive in the process output data (value 0x3FFF - 16383), the drive can be completely controlled with the help of ISDU.

5.3.4 Positioning drive with inactivated time stamp

- target position transfer (control word, ISDU 110 = 0x10 and target position, ISDU 112): Drive starts to move
- Cancellation of drive by withdrawing the release (send control word = 0x00)
- if a new target position is transferred during the positioning drive, the new destination is approached immediately. If the direction of rotation does not need to be changed, this is done without interruption.
- if a manual run command is sent during a position run, the positioning run is interrupted (speed reduced to slow speed) and continued with the manual run.

The following sequence is also possible:
Initial situation:
- release is not set
- the target position has already been transferred
Set Release (Bit 4 in the control word): Drive starts to move

5.3.5 Positioning run without loop with inactivated time stamp

The sequence corresponds to a positioning run with loop. To perform a positioning run without a loop, Bit 6 ("run without loop") must be set in addition to the release (Bit 4 in control word).

5.3.6 Manual run with inactivated time stamp

- transfer manual run (send control word, ISDU 110 with value 0x11 or 0x12): Drive starts to move
- Exit the manual run by withdrawing the manual travel command (send control word with the value 0x10) or by cancelling the release (send control word with the value 0x00).
- In the case of transfer of a target value during a manual run, this is ended and the sent position is approached immediately.

5.4 Positioning in "6 byte output data" mode

NOTICE
If the orange LED is permanently dark when the C/Q pin is open, either the "6 byte output data" mode or the "8 byte output data" mode is active.

5.4.1 Positioning run

- to control the drive, it must first be switched to the IO-Link status "operate".
- transfer target position:
  Control word = 0x14 and the desired target position
  → Drive starts to move
- Cancellation of drive by withdrawing the release:
  Control word = 0x00
- if a new target position is transferred during the positioning run, the new destination is approached immediately. If the direction of rotation does not need to be changed, this is done without interruption.
- if a manual run command is sent during a position run, the positioning run is interrupted (speed reduced to slow speed) and continued with the manual run.
The following sequence is also possible:
Initial situation: Release is not set
- transfer target position:
  Control word = 0x04 and desired target position
- set release:
  Control word = 0x10
  → Drive starts to move

5.4.2 Positioning run without loop

The sequence corresponds to a positioning run with loop. To perform a positioning run without a loop, Bit 6 ("Run without loop") must be set in the in addition to the release (Bit 4) in control word.

5.4.3 Manual run

- transfer manual drive (control word = 0x11 or 0x12): Drive starts to move
- stop the manual run by withdrawing the manual run command (send control word 0x10) or by cancelling the release (send control word 0x00).
- In the case of transfer of a target position during a manual drive this is ended and the sent position is approached immediately (control = and desired target position value).

5.5 Positioning in "8 byte output data" mode

NOTICE
If the orange LED is permanently dark when the C/Q pin is open, either the "6 byte output data" mode or the "8 byte output data" mode is active.

5.5.1 Positioning run

- to control the drive, it must first be switched to the IO-Link status "operate".
- transfer target position:
  Control word = 0x14, desired target speed and the desired target position
  → Drive starts to move
- Cancellation of drive by withdrawing the release:
  Control word = 0x00
- if a new target position is transferred during the positioning run, the new destination is approached immediately. If the direction of rotation does not need to be changed, this is done without interruption.
- if a new target speed is transferred during the positioning run, it is immediately used
- if a manual run command is sent during a position run, the positioning run is interrupted (speed reduced to slow speed) and continued with the manual run.

The following sequence is also possible:
Initial situation: Release is not set
- transfer target position:
  Control word = 0x04, desired target speed and desired target position
- set release:
  Control word = 0x10
  → Drive starts to move

5.5.2 Positioning run without loop

The sequence corresponds to a positioning run with loop. To perform a positioning run without a loop, Bit 6 ("Run without loop") must be set in the in addition to the release (Bit 4) in control word.

5.5.3 Manual run

- transfer manual drive (control word = 0x11 or 0x12) and desired target speed:
  Drive starts to move
- stop the manual run by withdrawing the manual run command (send control word 0x10) or by cancelling the release (send control word 0x00).
- In the case of transfer of a target position during a manual drive this is ended and the sent position is approached immediately.

5.5.4 Special features for the target speed

During positioning and manual operation, the speed transmitted in the process data is used, the values in ISDU 142 (for positioning) or ISDU 145 (for manual operation) are then ignored. There are two exceptions:
- If the value 0 is also transmitted as speed, the speed setpoints from ISDU 142 for positioning movements or ISDU 145 for manual movements are still used.
- If an invalid speed setpoint is sent, e.g. PSE335 values < 0, values between 1...9 or values > 80, no movement is started and an active movement is aborted. In addition, bit 12 is set in the status "incorrect target value ".

The maximum speed values in ISDU 143 (maximum speed counterclockwise rotation) and ISDU 144 (maximum speed clockwise rotation) are still applied. This means that if the speed setpoint from the process data or ISDU 142 or 145 is greater than the value in ISDU 143 (for counterclockwise rotation) or ISDU 144 (for clockwise rotation), the smaller value from ISDU 143 or 144 is applied.

6 Special features

6.1 Speed, acceleration and deceleration

The initial reference loop and the manual run are performed at the maximum speed specified in ISDU 145, positioning runs with the maximum velocity from ISDU 142. For counter clockwise runs the maximum speed from ISDU 143 also applies, for clockwise runs the one from ISDU 144. The maximum acceleration from ISDU 147 and the maximum deceleration from ISDU 148 apply for all runs. At the drive end, the maximum delay is successively reduced during the approach to the destination to realise a harmonious transient response.

6.2 Maximum torque and maximum start-up torque

On ISDU 152 (max. start-up torque) and 153 (max. torque), can be set.
The sta-rting torque is active for the period in ISDU 160 after each start of travel. It should always be slightly higher than the driving torque, since the drive requires more torque for the acceleration phase than for constant driving.

The travel torque (ISDU 153) can be set at reduced nominal speed up to the value of the maximum permissible starting torque (maximum permissible value for ISDU 152). The larger value from posi or manual speed is used as nominal speed for this calculation.
The formula is: $M_{max} = M_{nom} * n_{max} / n_{nom}$

Example on a PSE335:

N_{nom}: 85 1/min, n_{max}: 100 1/min, M_{nom}: 400 Ncm
➔ M_{max} = 400 * 100 / 85 = 470 Ncm

NOTICE
If small torque limits are to be used, the following must be considered: Small torque values should not be used in combination with high speed specifications, as this can lead to unstable driving behaviour.

6.3 Behaviour of the drive in the case of blocking

If, during a run the achievable speed is lower than the limit value of 30% for longer than 200 ms (ISDU 159) of the selected maximum speed (ISDU 146) (these are the default values), a block is detected, the run is aborted and the bit 'positioning error' is set. The drive then waits with the set holding torque (ISDU 155).

New run commands can then be sent without further action i.e. the transfer of a new target position starts a new positioning procedure.

An exception is if the target value is the same as before. In this case, depending on the operating mode, you must proceed as follows:
1) "Time stamp" mode:
   - control bits (from the process output data) at 0x00
   - Time stamp at the desired value, e.g. 10000
   - Disable time stamp (value 0x3FFF = 16383)
   - control bits (from the process output data) at 0x03
   - time stamp at the desired value, e.g. 10000
   - Disable time stamp (the value 0x3FFF = 16383)
   → Drive starts to move

2) "Time stamp" mode with permanently-inactivated time stamp:
   First, the release must be withdrawn and then set again (Bit 4 in control word). The target position must be transferred again (ISDU 112).
   →Drive starts to move
3) "6 bytes of output data" mode:
   Withdraw the release and then set again (Bit 4 in control word). Bit 2 ("transfer target values") must also be set when setting the release bit.

6.4 Readjustment in case of manual displacement externally

If the PSx3xx at standstill is rotated against the loop direction by an external force after a correctly-completed positioning run (or manual run to a range limit) and the release bit (Bit 4) and the readjustment bit (Bit 10) are set in the control word, it tries to approach the previously-sent target position again (readjustment). After a successful readjustment Bit 0 will be set again. When rotating in the loop direction, no adjustment takes place, only Bit 11 in the status word ("manual displacement") is set and Bit 0 ("target position is reached") is reset. After successful readjustment bit 0 will be set again. If Bit 6 ("run without loop") is set, the drive readjusts in both directions.

NOTICE
If the drive loses its position continuously at a standstill, the adjustment attempt starts precisely when the actual position leaves the positioning window (assuming that all of the above conditions are met). At this point the motor power must be in the permissible range (i.e. Bit 4 is set in the status word). In case of missing motor power, no adjustment starts, instead, Bit 10 ("positioning error") and 13 ("motor power was missing") become active. If the motor voltage comes back into range after the exit of the positioning window, **no** new adjustment attempt starts. This prevents a situation in which a drive suddenly starts a movement when the engine voltage is turned on.

If a positioning or manual run in progress is interrupted by a stop command (release bit in control word at 0) the drive only adjusts when a new run command is sent and is correctly completed.

By removing the release and/or the readjustment bit, the readjustment can be completely prevented.

Drives with brakes have no adjustment function.

6.5 Calculation of the physical absolute position

NOTICE
This calculation only applies for software versions < 267. For the calculation of the physical absolute position for software versions ≥ 267 see chapter "Extended positioning range".

The actuator PSx3xx has an absolute measuring system with a measuring range of 250 revolutions. Therefore, the direction of rotation in which part of these 250 revolutions should be traversed can be defined.

The mapping of the desired positioning range to the physical positioning range is done with the help of the parameter "upper mapping end" (ISDU 128).

In the delivery state, the drive is at position 51200, upper limit switch is 101200, lower limit switch is 1200. The result is a traversing range of ±125 revolutions (±50000 steps). If the desired traversing range does not exceed ±125 revolutions none of the measures described below need to be taken in the delivery state to set the traversing range.

For the realization of any desired positioning range independent of the possible positioning range which is defined by the mounting situation (physical positioning range) there are the following two possibilities:

1) Move the axle (for example a spindle) to the desired position, then move the drive (with opened collar) to the position value which belongs to the physical position of the axle, only then close the collar.
   Examples:
   (a) Move the axle in middle position, then move the drive at no-load (with opened collar) also to middle position (position 51200), then close the collar. The drive is now capable of moving 125 rotations (±50000 increments by default) in each direction.
   (b) Move the axle completely to the left (resp. bottom), then move the drive at no-load (with opened collar) without loop to the lowest position (position 1200), then close the collar. The drive is now capable of moving 250 rotations (±100000 increments by default) to the right (resp. top).
   (c) Move the axle completely to the right (resp. top), then move the drive at no-load (with opened collar) to the highest position (position 101200), then close the collar. The drive is now capable of moving 250 rotations (±100000 increments by default) to the left (resp. bottom).

2) Mount the drive in any position on the axle, close the collar, then adjust the positioning range with the help of ISDU 128. ISDU 128 specifies the upper end of the positioning range. By default, the upper end position is at +256 revolutions (Position 102400). If the positioning range does not match the position currently displayed after the installation of the drive, this can be freely selected between -256 and 512 rotations.
   Examples:
   (a) After assembly, the displayed position is 51200 (which corresponds to the delivery state). The positioning range should show solely to the right (or above) →Set ISDU 128 to 152400.
   (b) After assembly, the displayed position is 100000. The positioning range should show solely to the right (or above) →Set ISDU 128 to 201200.
   (c) After assembly, the displayed position is 2000. The positioning range should show solely to the left (or down) →Set ISDU 128 to 3200.

Comments:
1) For the calculation of the upper mapping end (ISDU 128) (as in the above examples) a safety margin of 3 turns (default 1200 steps) must be complied with, because the maximum possible position value is 3 rotations underneath the top end mapping. The smallest possible position value is 253 1/min below the upper end mapping.
2) The specified step numbers or position values refer to the following settings, which correspond to the delivery condition:
(a) referencing value (ISDU 127) = 0
(b) actual value assessment, numerator (ISDU 124) = 400
(b) actual value assessment, denominator (ISDU 125) = 400
These 3 ISDUs influence the above step numbers or position values: With the reference value, an offset can be achieved, with the numerator/denominator assessment, a stretch or elongation (see below).
Notice: The special features described in the section "Special features when setting some parameters" also apply to software versions < 267.

6.6 Use of the "Upper mapping end" parameter

The following chapter illustrates the use of the parameter "upper mapping end" both graphically and by means of examples.

NOTICE
This illustration only applies for software versions < 267. From software version V267, the parameter "upper mapping end" is unnecessary (see also chapter "Extended positioning range").

6.6.1 Delivery state

In the delivery state ("DS"), the actual position is exactly in the middle of the positioning range. There is a safety margin of three rotations at the output shaft at both the lower and upper ends of the positioning range. The device with the error "Incorrect target value" rejects positioning runs that extend into these safety margins.
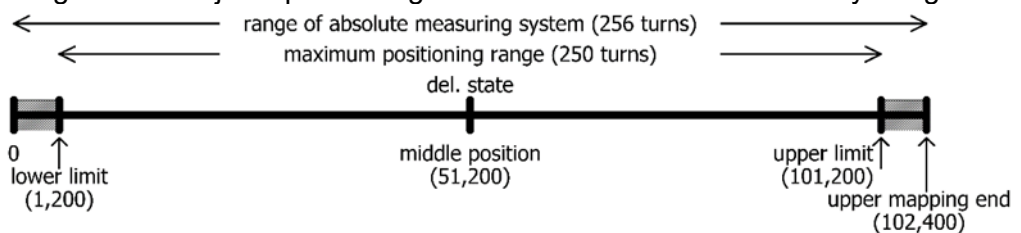
In the delivery state, the values from the following table result for the upper mapping end and the lower and upper limits:

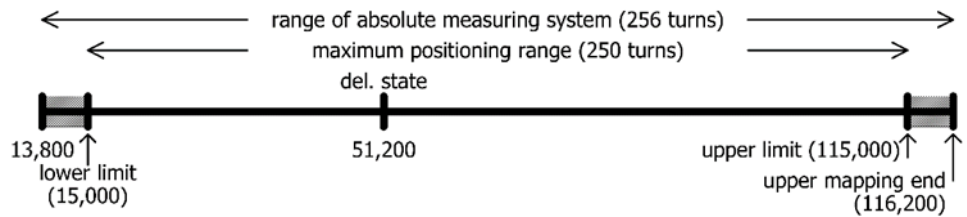| Upper mapping end	102,400
Lower limit	1,200
Upper limit	101,200

Positioning range symmetrical to 51,200

Starting from this state, the maximum possible positioning range can now be shifted upwards or downwards as required.

It is important to note that after the device has been installed, the available positioning range may not be sufficient in one of the two directions. The parameter "upper mapping end" now allows you to reduce the positioning range in one direction and increase it in the other direction.

6.6.2 Shifting the positioning range upwards starting from the delivery state

In the following example, starting from the DS, the maximum possible positioning range is shifted slightly upwards using the parameter "upper mapping end":
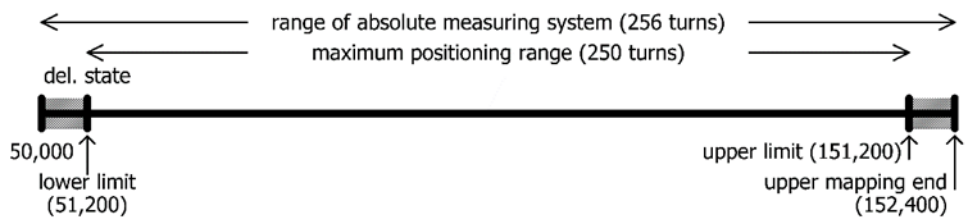

Here, the upper mapping end was increased from the value 102,400 to 116,200. Consequently, a higher proportion of the possible positioning range is above 51,200 and a smaller proportion below 51,200.

In the extreme case, the upper mapping end can be set so that the entire possible positioning range is at values ≥ 51,200. With standard scaling (numerator = denominator = 400, i.e. 1 step = 0.9°) and referencing value = 0, this special case results if the relevant value from the following table is selected for the upper mapping end. The device then automatically adjusts the lower and upper limits accordingly.

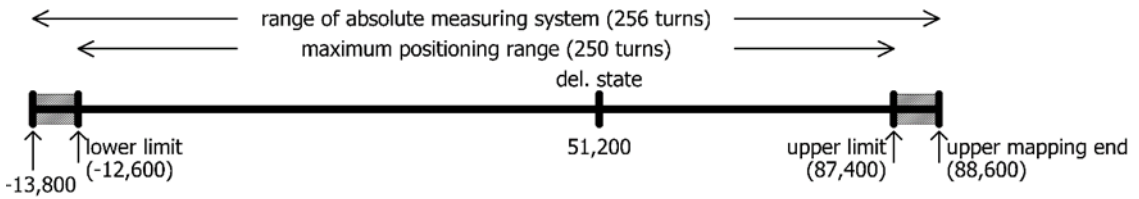| Upper mapping end	152,400
Lower limit	51,200
Upper limit	151,200

Positioning range starts at 51,200

NOTICE

The numerator factor and denominator factor can be used to map any spindle resolutions. Using the referencing value, you can shift the whole range of values.

6.6.3 Shifting the positioning range downwards starting from the delivery state

In the following example, starting from the DS, the maximum possible positioning range is shifted slightly downwards using the parameter "upper mapping end":


Here, the upper mapping end was decreased from the value 102,400 to 88,600. Consequently, a higher proportion of the possible positioning range is below 51,200 and a smaller proportion above 51,200.

In the extreme case, the upper mapping end can be set so that the entire possible positioning range is at values ≤ 51,200. With standard scaling (numerator = denominator = 400, i.e. 1 step = 0.9°) and referencing value = 0, this special case results if the relevant value from the following table is selected for the upper mapping end. The device then automatically adjusts the lower and upper limits accordingly.

Upper mapping end	52,400
Lower limit	-48,800
Upper limit	51,200

Positioning range <u>ends</u> at 51,200
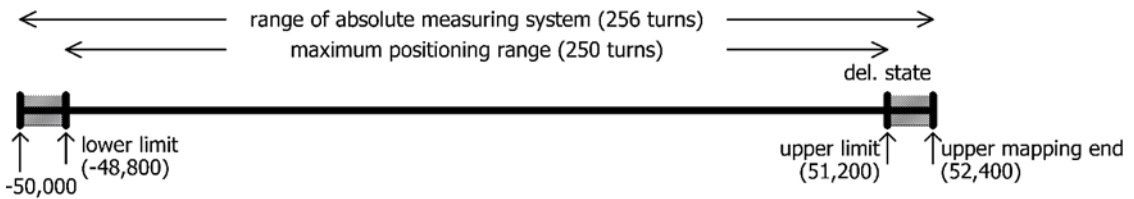
6.6.4 Shifting the positioning range depending on the actual position

If (in contrast to the examples above) the actual position is not in the delivery state (i.e. value 51,200), this is included in the calculation of the possible value range for the upper mapping end. The decisive factor is that the device only accepts values for the upper mapping end where the actual position is within the max. possible positioning range after the upper mapping end has been set (due to rounding effects with a max. difference of 1 step), i.e. the following applies after setting the upper mapping end:

[lower limit - 1] ≤ actual position ≤ [upper limit + 1]

Please note that the measurement range of the absolute encoder is 256 rotations at the output shaft. Together with the safety margins at the upper and lower end of the measurement range, the following value range results for the upper mapping end:

*Minimum value for upper mapping end = actual position + 1,200 * denominator / numerator*
*Maximum value for upper mapping end = actual position + 101,200 * denom. / numerator*

The following formulas result for the special case numerator = denominator:

Minimum value for upper mapping end = actual position + 1,200
Maximum value for upper mapping end = actual position + 101,200

(This is the case, e.g. for the delivery state where numerator = denominator = 400.)

NOTICE

Since the upper mapping end is an integer, the minimum and maximum values are obtained by rounding to the nearest integer
(applies only to the case numerator ≠ denominator).

NOTICE

If the actual position is no longer in the area
[upper mapping end - 256 rotations … upper mapping end]
after shifting the upper mapping end, the device then automatically adjusts the actual position accordingly. This is done by addition or subtraction of the number of steps which corresponds to 256 rotations. For the special case numerator = denominator this would be 102,400 steps.

Example:

- Spindle with 5 mm pitch, specified unit for target and actual values: 1µm
  → 1 rotation = 5mm = 5,000µm
  → Number of steps per rotation = 5,000
- Using the formula
  *Number of steps per rotation = 400 * denominator / numerator*
  the following result is obtained:
  numerator = 400; denominator = 5,000
- With these settings, the drive is mounted and run using manual positioning commands, to a defined physical position (e.g. a specific mark along the run path) at which the actual position is to assume a specific value, e.g. the value 0.
- In our case, the position after running to this defined physical position shows, for example, the value 300,000. In this position, the actual value is set to zero. The device uses this information to calculate the new referencing value at 300,000.
  → Referencing value = 300,000
- The drive has a positioning range of 250 rotations (see above: Measurement range of the absolute encoder minus a safety margin of three rotations at both ends of the measurement range).
- In our case, these 250 rotations are to be divided in such a way that the drive can run 10 rotations (= 10 * 5,000 steps = 50,000 steps) from the zero position, just defined, to smaller values and 240 rotations (= 240 * 5,000 steps = 1,200,000 steps) to larger values.
- To ensure that the position value 1,200,000 is at the upper end of the maximum possible positioning range, as specified (i.e. at the upper limit), we add the safety margin of three rotations to this value and thus obtain our value for the upper mapping end:
  upper mapping end = 1,200,000 + 3 * 5,000 = 1,215,000
- The device then recalculates the positioning range limits:
  lower limit = upper mapping end - 253 * 5,000 = -50,000
 upper limit = upper mapping end - 3 * 5,000 = 1,200,000
- This positioning range can then be restricted as required, i.e. the lower limit can be increased and the upper limit can be reduced.

6.6.5 Step-by-step instructions for determining the positioning range

The following section describes the procedure for determining those parameters that have an influence on the target and actual position as well as the positioning range. The individual steps must be carried out in the specified order.

1) Setting the direction of rotation:
   The direction of rotation determines with which direction of rotation of the output shaft the position values increase and with which direction of rotation of the output shaft the position values decrease.
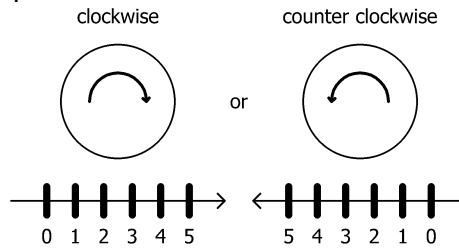
2) Setting numerator and denominator:
   The numerator and denominator determine the number of steps into which one rotation of the output shaft is divided.
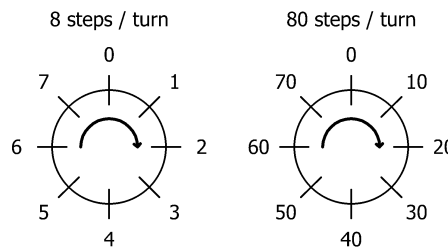
3) Setting referencing value:
   The referencing value is used to assign a specific value of the actual position to a specific physical position of the axle.
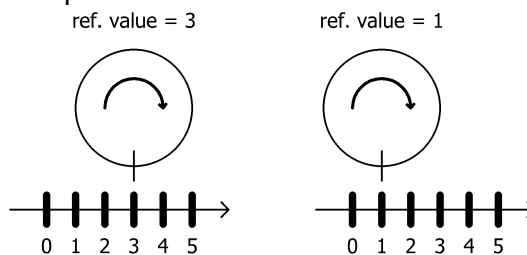
The referencing value is written either directly or by setting the actual position.

4) Setting upper mapping end:
   The parameter defines the location of the maximum possible positioning range, taking into account the scaling values and the referencing value.

5) <u>Setting upper and lower limits</u>:
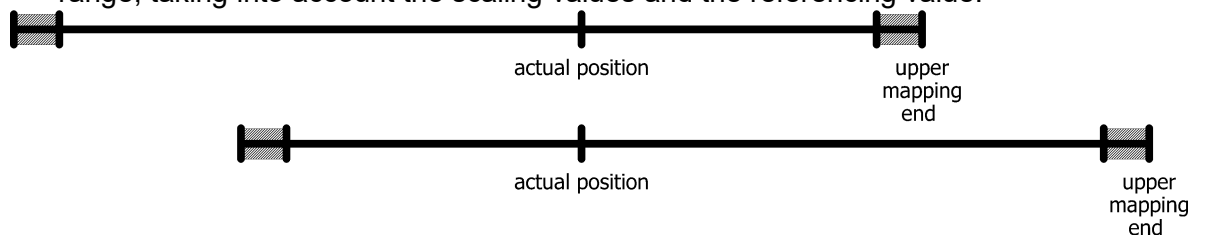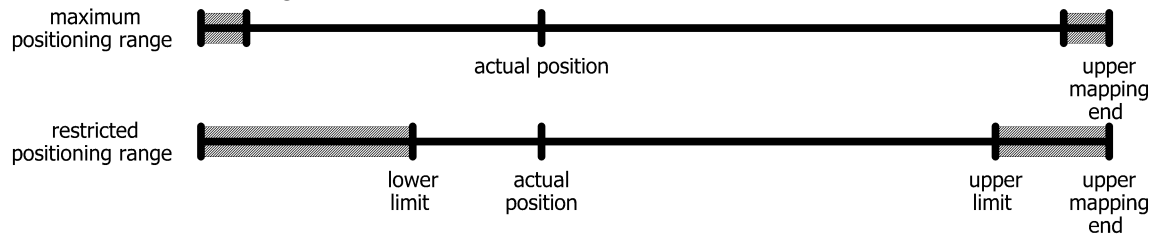If necessary, the maximum possible positioning range can be restricted to prevent incorrect target positions that lead to a collision.

maximum positioning range — actual position — upper mapping end

restricted positioning range — lower limit — actual position — upper limit — upper mapping end

6.7 Extended positioning range

Devices from software version V267 have the feature "Extended positioning range". **The positioning range can be freely selected (within the numerical limits) using the upper and lower limit (ISDUs 129/130).** This eliminates the restriction to the maximum possible positioning range of 250 revolutions.

The positioning range must be completely within the range $-2^{28}...+2^{28}$ steps. An additional boundary condition is that the internal position of the device must also be in the range $-2^{28}...+2^{28}$. This restriction is particularly limiting for high values of the referencing value and/or if the numerator to denominator ratio has a high value.

If one of the above conditions is not met when setting the upper and lower limits, the actual position or the referencing value, the device rejects the write operation with a corresponding error message.

When setting the lower limit, there is an additional condition that the value must be less than the current value of the upper limit. On the other hand, when setting the upper limit, the value of the lower limit is not relevant. However, the device corrects the value of the lower limit to the value [upper limit - 1] if the condition [upper limit > lower limit] is not met when the upper limit is set.

In the event of a movement when switched off (e.g. due to an external force), the absolute measuring system ensures that the device reports the correct position when it is switched on again. The following restrictions apply depending on the set positioning range and the actual position when switched off:

1) If the set positioning range is up to 250 revolutions <u>and</u> the actual position when switched off is in a range that is up to 128 revolutions away from the middle of the positioning range, the actual position may vary in exactly this range when switched off without the device reporting an incorrect position when switched on (i.e. middle of the positioning range ± 128 revolutions).

2) If the set positioning range is greater than 250 revolutions <u>or</u> if the actual position is in a range further away from the middle of the positioning range than 128 revolutions when the device is switched off, the actual position may vary in a range of 256 revolutions in total when the device is switched off without the device reporting an incorrect position when it is switched on. The division of this range depends on the course of the actual position before switching off and is at least 64 revolutions in each direction as seen from the actual position when switching off.

The parameter "upper mapping end" (ISDU 128) no longer has a function from software version V267. However, for reasons of compatibility, the upper and lower limit switches (ISDU 129 and 130) are set to delivery state when the upper mapping

end is changed. However, the actual value (both during operation and when switching on again) is not affected.

The use of all other parameters is not affected by the feature "Extended positioning range". When writing these values, the special features as described below apply.

6.8 Special features when setting some parameters

1) In the event of a change of the direction of rotation (ISDU 123), the referencing value (ISDU 127), the upper mapping end (ISDU 128) and the upper and lower limit (ISDU 129 and 130) are set to delivery state.
2) In the event of a change of the upper mapping end (ISDU 128) the upper and lower limit (ISDU 129 and 130) are set to delivery state.
3) When changing the actual value assessment numerator or denominator (ISDU 124 or ISDU 125), the target value, the actual value, the reference value, the upper mapping end, the upper and lower limit, the positioning window and the loop length are re-calculated.
4) In the event of a change in the referencing value (ISDU 127), the target position, the actual value, the upper mapping end as well as the upper and lower limits are re-calculated.
   If the values of the upper mapping end (ISDU 128; from software version V267 without function) and/or the limit switches (ISDU 129, 130) are sent by default each time the unit starts up, the new referencing value must be included in these values if necessary. This can be done, for example, by defining base values (which apply in the case of "referencing value = 0"), to which the respective current value of the referencing value is then added.
5) If the user wishes to avoid any automatic adjustment of values in the parameterisation of the drive, the optimal sequence when sending the parameters is the following:
   (a) direction of rotation (ISDU 123),
      actual value assessment, numerator (ISDU 124),
      actual value assessment, denominator (ISDU 125)
   (b) referencing value (ISDU 127)
   (c) upper mapping end (ISDU 128; from software version V267 without function)
   (d) upper limit (ISDU 129),
      lower limit (ISDU 130),
      positioning window (ISDU 131)
      length of loop (ISDU 132)
6) To save the settings permanently in the EEPROM, a "1" must be written in ISDU 193. As soon as the reading of ISDU 193 returns a 0, the save is finished.

Referencing value (ISDU 127)
With the referencing value (ISDU 127), a displacement of the entire value range can be achieved. The referencing affects all of the transferred values, i.e. the target position, the actual value, upper mapping end and upper and lower limits.
The referencing value can be set in two ways:
1) directly by writing the referencing value in ISDU 127.
2) indirectly by writing an actual value in ISDU 67. This allows any "real" actual value to be assigned to the current physical actual value. The resulting difference is then the referencing value. This value will immediately be included in calculations for each transferred value and can also be read via ISDU 127.
In the event of a change in the referencing value, the target position, the actual value, the upper mapping end as well as the upper and lower limits are automatically re-calculated.

NOTICE
The removal of the **motor** power supply has no influence on the internal measuring system.

6.9 Using actual value assessment factors to set the spindle pitch

On ISDU 124 (numerator factor) and 125 (denominator factor), any spindle resolutions can be mapped:

*Number of steps per revolution = 400 * (denominator / numerator)*

Both factors are set to a value of 400 by default, resulting in a resolution of 0.01 mm at a spindle pitch of 4 mm.

Spindle pitch and resolution can easily be set via the denominator factor.
The numerator factor is mainly used to set "manifold" resolutions.

Examples:

Spindle pitch	Resolution	Numerator factor	Denominator factor
4 mm	1/100 mm	400	400
1 mm	1/100 mm	400	100
2 mm	1/10 mm	400	20

The numerator and denominator factor must have a value between 1 and 10000.

6.10 Drag error

During a positioning run, the device compares the computed target position with the current actual value. If the difference is greater than the value of the "drag error" (ISDU 133), the corresponding bit is set in the status. This is particularly the case if the speed setpoint cannot be reached due to external influences (required torque, motor voltage too low).

6.11 Abort run in the event of failure of the master

If the connection to the master is interrupted during a positioning, a drive that has already started cannot be cancelled by the master.

In this case, there are three possible reactions:
1) If a positioning is in progress, the drive should end this positioning **as planned** and then start no new positioning, as long as there is no connection.
   → This behaviour is activated if ISDU 118 ("communication timeout") is at 0.
2) If a positioning is in progress, the drive should **end the run** and then start no new positioning, as long as there is no connection.
   → This behaviour is activated if ISDU 118 ("communication timeout") is at a value > 0. The value specifies the time in ms, within which a new master telegram must be received to maintain the link.
   In addition, ISDU 137 ("Configuration for connection failure") must be at 1 ("drive cancellation").
3) Regardless of whether the drive is at standstill or if a positioning is in progress, the drive should execute the **drive to** the **safety position**, defined with ISDU 138.
   → This behaviour is activated if ISDU 118 ("communication timeout") is > 0 AND ISDU 137 ("Configuration for connection failure") is 2 ("Travel to safe position").

6.12 Devices with "Jog keys" option

A manual run can be performed with the external keys under the following conditions:

1) with interrupted IO-Link connection:
   - always

2) with existing IO-Link connection:
   - if control word Bit 5 (release jog mode) is set, Bit 4 (release) is not set

Overall, the following assignment results:

Bus connected	Control word Bit 4	Control word Bit 5	Jog keys
no	X	X	Active
yes	X	0	inactive
yes	1	X	inactive
yes	0	1	active

Bit 5 (enable jog mode) and Bit 4 (release) cannot be set simultaneously. In the event of a change of the release (e.g. From "enable jog mode" to "release"), a drive in the other operating mode is cancelled.

The step width for brief key pressing can be adjusted via ISDU 135. A single step is executed when one of the external buttons is pressed. If the key is released before the single step has been completed, this is nevertheless brought to an end. If the same key remains pressed, a continual manual drive follows the single step after a brief waiting time as long as the key is pressed. This continuous manual drive is always active if the bus is not connected. If the bus is connected, Bit 3 must also be activated in the control word in addition to Bit 5 ("Release manual drive in jog mode"). If Bit 3 is reset, only one individual step is performed each time a key is pressed even if the same key is pressed for longer than the duration of the individual step.

The waiting time until the drive transfers to manual drive is set with ISDU 163. In manual drive, the drive moves to the respective end switch position (ISDU 129 and 130).

If both keys are pressed during a jog drive, the run is immediately cancelled. A new jog drive is only possible again if both keys have been released.
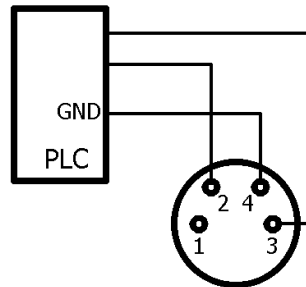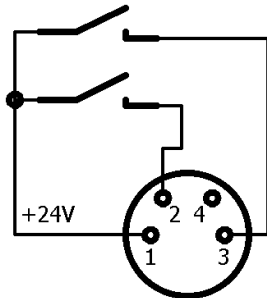
For activation, the respective key contact (Pin 2 or 3 of the 4-pin connector) must be connected with +24V (Pin 1). If the key signal is produced by a source galvanically separated from the control supply, GND (Pin 4) must be connected.

Switching the jog key inputs

The jog key inputs can be used in 2 different wiring modes:

potential-free switches   active signals e.g. from a PLC

Jog drives without external jog buttons:
Jog drives are also possible without external jog buttons: For this, Bit 8 ("Jog to larger values") and Bit 9 ("Jog to lower values") serve as the control word, the corresponding key presses simulate these.
Prerequisite: Bits 4 and 5 of the control word must be reset.

6.13 Manual turning with the adjustment facility

When mounting or dismounting a PSx3xx, it may be necessary to manually turn the output shaft to a certain position. For this purpose, the actuators are equipped with a manual adjustment facility:
First, the corresponding cover in the cover must be removed.
Then use a NW3 (PSx31x, PSx33x, or NW4 (PSx30x, PSx32x) hexagon key to disengage the brake by pressing it down and turn it simultaneously.
An electrical release of the brake via bus is not possible on its own (without travel job).

⚠ CAUTION
The drive must not be turned into another position with an electric screwdriver

⚠ CAUTION
Important: Always replace the protective cap after setting the address. This will prevent dust and contaminants from entering the instrument.

⚠ CAUTION
A "forced" turning of the drive without disengaging the brake leads to the destruction of the brake and thus of the drive!

manual adjustement
under cover

PSx31x-14, PSx33x-14   PSx30x-14, PSx32x-14
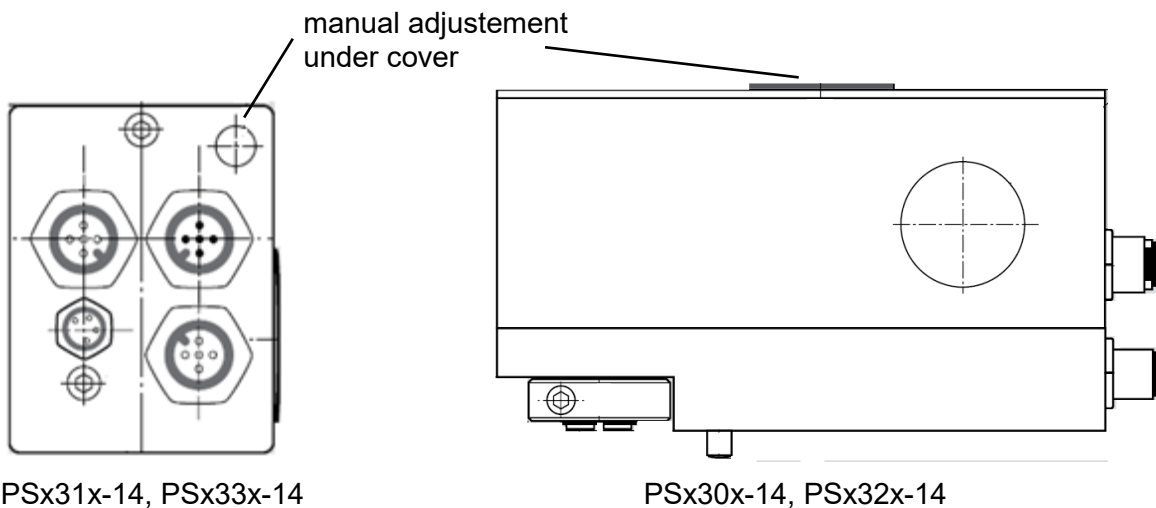
6.14 Devices with optional snap brake

The device models PSx30x-14, PSx31x-14, PSx32x and PSx33x can be supplied with an optional snap brake. This brake prevents the output shaft from turning when the power supply to the motor is removed, or, if the motor holding torque is too low, to a maximum of the level of the nominal torque. A small degree of rotation always occurs at the output, i.e. the brake cannot be used to hold the drive at a defined position (for this purpose, the holding torque must be increased with ISDU 155 and ISDU 154).

For drive orders, there is an initial wait for a short time for these devices for the brakes to release (standard time 0.15 sec. before drive start, ISDU 164) and some steps are travelled against the actual drive direction (number of steps: ISDU 136). At the end of each drive, the brake is released (standard time 1 sec. after drive end, ISDU 165). The advantage of this feature is, that in case of many subsequent runs the brake has not to be released each time.

To adjust the position of the drive manually, it is first necessary to remove the rubber-plug in the top cover. Then release the brake by pressing down and simultaneously turning using a hex wrench NW3 (PSx31x, PSx33x) or NW4 (PSx30x, PSx32x).

6.15 Devices with optional holding brake

The device type PSE34xx is optionally available with a holding brake. This brake prevents rotation of the output shaft in the absence of motor voltage or if the motor holding torque is too low.

A run command is not approached immediately but only after a short idle period to tighten the brake.
The brake releases at the end of every run.

To adjust the drive manually, it is first necessary to remove the corresponding rubber-plug in the top cover. Then the drive can be rotated with a hexagonal key NW4. This is relatively difficult, since in addition to any torque present, the friction brake force also needs to be overcome.
The brake is not damaged by manual rotation.

manual adjustment under cover
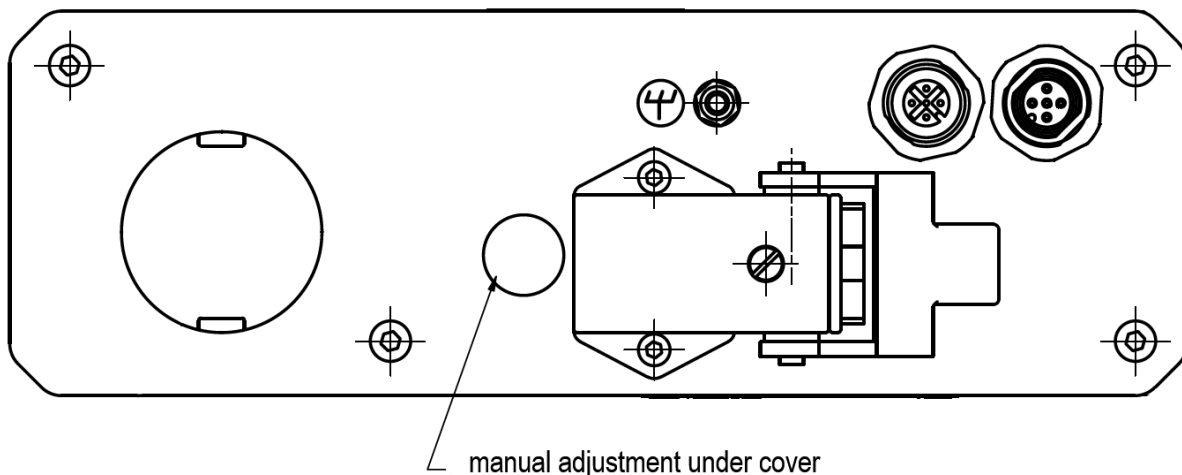
6.16 Reference runs

The Positioning System PSx3xx is equipped with an absolute measuring system, therefore no reference run is required when the drive is switched on. If, in certain cases, a reference drive to a hard block is still desired (e.g. once in the installation of the drive onto the machine), the procedure should be as follows:

1) Before ordering the reference drive, the following settings must be applied:
   - Set max. driving torque (ISDU 153) and maximum release torque (ISDU 152) to a maximum of 10% of the rated torque
   - Set holding torque (ISDU 155) and max. holding torque at end of run (ISDU 154) to 0.
   - Set speed limit for drive cancellation (ISDU 146) to 60.
   - Set time for going under the speed limit for drive cancellation (ISDU 159) to 100 (the period of time during which the drive tries to overcome the block is reduced: With the reduced values, the positioning is cancelled if the speed below 60% of the setpoint speed for more than 100ms. Standard is 200 ms and 30%).
   - Set the relevant end limit (ISDU 129 or 130) so that the block is clearly within the end limits in each case (otherwise there is the danger that the block lies within the positioning window and therefore will not be recognized.)
   - If necessary, reduce the setpoint speed for manual operation (ISDU 145)
2) now start the reference run as manual drive (set Bit 0 or 1 in the control word).
3) Wait until the drive moves (Bit 6 in the status word is set)
4) Wait until the drive is standing and a positioning error has occurred (Bit 6 is reset in the status word, bit 10 is set).
5) with the same settings, perform manual drive in the opposite direction (move a piece of the block away so that the drive can move freely).
6) now only apply desired settings of the above ISDUs for normal operation.

6.17 Saving parameters

Changes to parameters are not automatically saved in the drive. To retain the modified values after switching off and on again, a save command must be sent to the drive. This is possible by sending the standard command (ISDU 2) with value 161, or by writing value 1 to the delivery status (ISDU 193).

NOTICE
The automatic sending of default values after a restart must not be activated in the control unit!

6.18 Reverse drive

In vertical positioning with spherical roller spindles, pitches of approx. 4..10 mm and weights from 100 kg, it is possible that the PSx3xx does not consume any energy from the motor supply when travelling downwards, but rather generates some. This regenerative operation is permissible under certain conditions. The energy generated is fed back into the motor supply network via the internal regenerative circuit and must be drawn off there. The PSx3xx increases the voltage in the motor supply network until the additional energy is drawn off. However, the internal protection diode limits this voltage to max. 31 VDC.

The following cases should be considered:

1) If several PSx3xx and/or other loads are connected to the same power supply, regeneration is possible without any additional measures if several PSx3xx do not generate power simultaneously. The other devices then act as consumers of the energy generated by a PSx3xx.

2) If several PSx3xx are to use the regenerative circuit simultaneously, an overvoltage protection must be provided in the motor supply network.

If a PSx3xx is operated for more than 1-2 seconds in regenerative mode without consumer of the generated energy, this damages the internal protection diode and the PSx3xx is defective.

7 Technical data

For additional specifications and dimension drawings, please visit our website at
https://www.halstrup-walcher.de/en/products/drive-technology/

7.1 Ambient conditions

Ambient temperature	0 °C to +45 °C		
Storage temperature	-10 °C to +70 °C		
shock resistance according to DIN EN 60068-2-27	50 g 11 ms		
resistance to vibration according to DIN EN 60068-2-6	10 Hz to 55 Hz 1.5 mm 55 Hz to 1000 Hz 10 g 10 Hz to 2000 Hz 5 g		
EMC standards	CE		
Conformity	CE / UKCA		
protection class	PSE	IP 54 / IP 65	
	PSS	IP 65	
	PSW	IP 66 (in operation) IP 68 (at a standstill)	
Duty cycle	PSx	ED in %	Base time in sec.
	PSE34xx PSE30xx to 33xx PSS PSW	20 30 20 20 20	300 300 600 600 600

7.2 Electrical data

Nominal power output	PSx30x, PSx31x, PSE31xx	25 W with 30% duty cycle
	PSx32x, PSx33x	35 W with 30% duty cycle
	PSE34xx	100 W with 20 % duty cycle
Supply voltage	24 VDC ± 10% (supply voltage for motor and control unit are galvanically isolated) advice: use regulated power supplys	
Nominal current, control unit	0.1 A	
Nominal current, motor	PSx30x, PSx31x, PSE31xx	2.4 A
	PSx32x, PSx33x	3.1 A
	PSE34xx	7.8 A
Positioning resolution	0.9°	
Positioning accuracy	0.9°	
IO-Link protocol	SDCI in accordance with IEC 61131-9 Version 1.1.2	
Absolute value acquisition	optical - magnetic	

7.3 Physical data

Positioning range	250 usable revolutions, no mechanical limit The measuring system includes 256 revolutions, minus 3 revolutions security reserve on both range limits	
Torsional rigidity (angle of rotation when switching from operation without backlash to maximum torque)	max. 0.2°	
Gear backlash (without spindle compensation run)	max. 0.5°	
Spindle leeway adjustment	Automatic loop drive after each positioning drive (optional)	
Output shaft	PSE30x PSE31x	8H9 Hollow shaft with adjustable collar
	PSE30x-14, PSE31x14, PSE32x, PSE33x	14H7 Hollow shaft with adjustable collar
	PSE31xx-14 PSE34xx	14H7 Hollow shaft with clamp and feather key
	PSS3xx-8 PSW3xx-8	8H9 Hollow shaft with adj. collar or 8H8 solid shaft
	PSS3xx-14 PSW3xx-14	14H7 Hollow shaft with adj. collar or 14H8 solid shaft
Recommended spindle stud diameter	according to the hollow shaft diameter with an interference fit of H9	
Vibration emission	not in the harmful range	
Noise emission	not in the harmful range	
Max. permissible radial force	40 N	
Max. permissible axial force	20 N	
Dimensions (L x W x H)	See product catalogue online	
Weight (approx.)	PSx30x-8	650 g
	PSx30x-14, PSx32x	1200 g
	PSx31x-8	700 g
	PSx31x-14, PSx33x	700 g
	PSE31xx	1200 g
	PSE32xx	1350 g
	PSE33xx	1350 g
	PSE34xx	1900 g

8 Certificate of Conformity

halstrup walcher

CE

EU-Konformitätserklärung
EU Declaration of Conformity

Company   **halstrup-walcher GmbH, Stegener Str. 10, 79199 Kirchzarten**

erklärt als Hersteller in alleiniger Verantwortung, dass das Produkt
declares as manufacturer under sole responsibility, that the product

Product   **Positionierantriebe Baureihen PSE3xx, PSS3xx, PSW3xx**

Positioning Systems Series PSE3xx, PSS3xx, PSW3xx

Regulations   den folgenden Europäischen Richtlinien entspricht:
conforms to following European Directives:

EMC	2014/30/EU
RoHS	2011/65/EU

Standards   angewandte harmonisierte Normen:
applied harmonized standards:

EN IEC 61800-3:2018
EN IEC 63000:2018

Certification   EU Konformitätserklärung ausgestellt von
EC Type Examination Certificate issued by

Geschäftsführer   Managing Director

Kirchzarten,

14. Okt. 2020   14. Oct. 2020

UK Declaration of Conformity

Company **halstrup-walcher GmbH, Stegener Str. 10, 79199 Kirchzarten, Germany**

declares as manufacturer under sole responsibility, that the product

Product **Positioning System Models** **PSE3xx / PSS3xx / PSW3xx**

Regulations is in conformity with relevant statutory requirements:

EMC Electromagnetic Compatibility Regulations 2016 No. 1091
RoHS RoHS Regulations 2012 No. 3032

Standards applied standards:

EN 55011:2016+A1:2017; EN 61000-6-2:2005; EN 61800-3:2004/ A1:2012
EN IEC 63000:2018

Declaration signed for and on behalf of

Geschäftsführer Managing Director

Kirchzarten, 26. Jan. 2022

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