Instruction Manual
PSE2xx-CA

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Revision overview

Version:	Date:	Author:	Content:
A	15.01.10	Re	Initial Version
B	15.04.10	Re	updated, extended and errors removed
C	02.02.11	Rf	singleturn and multiturn
D	03.05.13	Me	torque of the cover screw
E	17.07.17	Ka	torque of the cover screw 0.6Nm
F	22.09.23	Ts/Me	updated, extended and errors removed

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

Purpose of instruction manual

This original instruction manual describes the features of the PSE2xx positioning system and provides guidelines for its use.

Improper use of these devices or failure to follow these instructions may cause injury or equipment damage. Every person who uses the devices must therefore read the manual and understand the possible risks. The instruction manual, and in particular the safety precautions contained therein, must be followed carefully. **Contact the manufacturer if you do not understand any part of this instruction manual.**

Handle this manual with care:

- It must be readily available throughout the lifecycle of the devices.
- It must be provided to any individuals who assume responsibility for operating the device at a later date.
- It must include any supplementary materials provided by the manufacturer.

The manufacturer reserves the right to continue developing this device model without documenting such development in each individual case. The manufacturer will be happy to determine whether this manual is up-to-date.

Conformity

This device is state of the art. It complies with the legal requirements of EC directives. This is shown by the CE mark.

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1 Safety precautions

1.1 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.

PSE2xx positioning systems are not stand-alone devices and may only be used if coupled to another machine.

Always observe the operating requirements — particularly the allowed supply voltage — indicated on the rating plate and in the section → **5. Technical data** of this manual.

The device may only be handled as indicated in this manual. Modifications to the device are prohibited. The manufacturer is not liable for damages caused by improper use or failure to follow these instructions. Violations of this type render all warranty claims null and void.

1.2 Limitation of liability

The device may only be handled in accordance with these operating instructions.
All information and notes 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 for damage caused by the following circumstances. In this case, the warranty claims also expire:

- non-observance of the operating instructions
- improper use
- non-intended use
- Use of untrained personnel
- Modifications to the unit
- Technical modifications
- Unauthorised modifications

The user is responsible for carrying out commissioning in accordance with the safety regulations of the applicable standards and any other relevant state or local regulations concerning 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.

1.3 Shipping, assembly, electrical connections and start-up

Assembly and the electrical connections should only be handled by professionals. They should be given proper training and be authorized by the operator of the facility.

The device may only be operated by appropriately trained individuals who have been authorized by the operator of the facility.

Specific safety precautions are given in individual sections of this manual.

1.3.1 Minimum cross-section for connection to the device

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.

Connection	Cable cross-section
Supply	min. AWG20 resp. 0,5 mm^2
Fieldbus	min. AWG23 resp. 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.

Note the limitations of liability → **1.2 Limitation of liability**

1.4 Troubleshooting, maintenance, repairs, disposal

The individual responsible for the electrical connections must be notified immediately if the device is damaged or if errors occur.

This individual must take the device out of service until the error has been corrected and ensure that it cannot be used unintentionally.

This device requires no maintenance.

Only the manufacturer may perform repairs that require the housing to be opened.

The electronic components of the device contain environmentally hazardous materials and materials that can be reused. The device must therefore be sent to a recycling plant when you no longer wish to use it. The environment codes of your particular country must be complied with.

1.5 Symbols

The symbols given below are used throughout this manual to indicate instances when improper operation could result in the following hazards:

WARNING!
This warns you of a potential hazard that could lead to bodily injury up to and including death if the corresponding instructions are not followed.

CAUTION!
This warns you of a potential hazard that could lead to significant property damage if corresponding instructions are not followed.

INFORMATION!
This indicates that the corresponding information is important for operating the device properly.

CAUTION!
Surface can be hot.

2 Device description

2.1 Features

The PSE2xx positioning system, an intelligent, compact, complete solution for positioning auxiliary and positioning axes, consists of an DC motor, gear power amplifier, control electronics, absolute or partially absolute measuring system and CANopen interface.

Variants with partially absolute measuring system (“singleturn encoder”) indicate the position of the output shaft after power up without executing a movement. Additionally the number of turns is being loaded out of the flash memory, thus after power up the correct position of the output shaft will be indicated (assumed the shaft has been turned for less than half a turn while powered down).

Variants with absolute measuring system (“multiturn encoder”) also indicate the position of the output shaft after power up without executing a movement. To detect the number of turns, instead of a flash memory a measurement gearbox is used. So always the true position is indicated, even if the shaft has been moved while powered down. This eliminates the need for a time-consuming reference run.

Connecting to a bus system simplifies the wiring. A hollow shaft with adjustable collar or a solid shaft 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.

PSE2xx positioning systems convert a digital positioning signal into an angle of rotation.

2.2 Installation

PSE2xx with hollow shaft:
The PSE2xx is mounted onto the machine by sliding the hollow shaft of the positioning gear onto the axis to be driven and then securing it with an adjustable collar. The adjustable collar should be tightened only just to the point where it can no longer rotate freely.
Securing the pin under the hollow shaft into an appropriate bore will prevent further rotation (see drawing).

PSE2xx with solid shaft:
The PSE2xx has to be fixed at the four holes on the bottom plate.
The shaft has to be connected via a clutch to avoid forces caused by tensions that result on missing alignment from bottom plate and driven shaft.

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

Driving the PSE2xx rearward is prohibited (e.g. it’s not allowed to turn the output shaft by an external force).

2.3 Electrical connection

Open the cover, put the cable through glands and connect supply and bus to terminals. The PSE2xx has a 8-pin spring-type terminal for cable with a profile of maximum 1.5 mm^2.By turning the cover 90°, 3 different positions of the cable glands are possible (see drawing).
The maximum torque of the cover screw is 0,6 Nm.

2.3.1 Pin assignment

Pin	Function
1	CAN GND
2	CAN_L
3	GND control + motor
4	CAN_H
5	+24V control
6	+24V motor
7	GND control + motor
8	Case

2.4 Setting the device address and baud rate (Option)

The rotary switches for setting the device address at the bus and a 2-pin sliding switch for setting the baud rate are located behind the terminals.

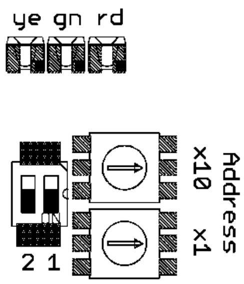
The rotary switches indicate the tens and ones places of the address selected. If the switches are resting in the positions 00 or 01 the address is set using the CAN bus with SDO #2026.

The delivery setting is 00, the PSE2xx reports to the bus with the address 1.

If the switches are used to set the address (i.e. the switch setting is > 01), this value cannot be changed via the CAN bus.

The yellow LED represents the state of the motor supply voltage, the red and yellow LEDs represent the CANopen state.

Switch configurations:



Setting the baud rate:

1	2	baud rate
OFF	OFF	baud rate is set via bus
OFF	ON	250 kBaud
ON	OFF	500 kBaud
ON	ON	125 kBaud

‘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.

2.5 Start-up

Positioning sequence (with loop)

The PSE2xx differs between the following steps of a positioning sequence (Presumption: the target position is always approached through forward motion):

1. New position value is larger than the current value: Position approached directly.
2. New position value is smaller than the current value: The device reverses an additional 5/8 of one rotation and approaches the exact position after resuming forward motion.
3. New position value after reverse run without loop: The device always approaches the position by moving in forward direction; if necessary, it will first reverse by 5/8 of a rotation.

Once the target position has been reached, the devices with multiturn encoder compare this position to the internal absolute encoder status. If a discrepancy is detected, the device then sets the “flash memory or encoder error” bit (bit 9 in the status word).
Positioning sequence (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 PSE2xx internal gear backlash does not play a role in this case, as position data are acquired directly at the output shaft.

Runs which involve specifically a block run (e.g. reference runs on block), may only be started with reduced torque (max. torque max. 10% of the nominal torque).

2.6 CAN Bus

CANopen (corresponding to CiA DS 301 Version 4.02) is used as the protocol at the CAN bus interface:

- one transmit and one receive SDO per device
- one asynchronous transmit and receive PDO, active by default
- one heartbeat object every 500 msec

  green LED = RUN-LED according CANopen:
    Single flashes: CAN stop
    Continuous flashing: CAN preoperational
    Continuously illuminated: CAN operational
  red LED = ERROR-LED according CANopen:
    Off: no error
    Single flashes: CAN-transmitter or -receiver has reached its warning limit
    Double flashes: Guard event has occurred
    Triple flashes: Sync failure
    Continuously illuminated: CAN-Bus-OFF
  yellow LED = Display actuator voltage
    Off: no motor power
    Continuously illuminated: Power available to the motor

2.6.1 Table of entries implemented from object dictionary

Name	Index number	Function	Range of value	Back up	Delivery State	R/W
device model	1000	returns a "0" when read	0		0	R
error register	1001	Bit 0: general error Bit 4: communication error	8 bit		0	R
error list	1003	sub index 0: quantity of indexes sub index 1 and 2: most recent emergency errors	8 bit 32 bit		0 0	R R
sync ID	1005	COB ID for the sync command	32 bit	no	80h	R/W
comm cycle	1006	communication cycle time	32 bit	no	0	R/W
sync window	1007	synchronous window time	32 bit	no	0	R/W
guard time	100C	guard time in msec 0 = off	16 bit	no	0	R/W
life time	100D	life time factor	8 bit	no	0	R/W
emcy ID	1014	COB ID for emergency message	32 bit		80h+ device address	R
emcy inhibit	1015	inhibit time for emergency message	16 bit	no	0	R/W
consumer heartbeat	1016	sub index 0: quantity of indexes (= 2) sub index 1 and 2: bit 15-0: Heartbeat time in msec bit 23-16: node ID of producer	8 bit 32 bit	 no	2 0	R R/W
producer heartbeat	1017	cycle time for heartbeat via PSE2xx 0 = off	16 bit	no	500	R/W
identity	1018	sub index 0: quantity of indexes (= 4) sub 1: Vendor-ID (= 0x000002D8) sub 2: Product code (= 0x30313334) sub 3: Revision number (= 0) sub 4: Serial number (= 0)	8 bit 32 bit 32 bit 32 bit 32 bit		4	R R R R R
receive PDO 1 communi-cation parameter	1400	sub index 0: quantity of indexes sub 1: COB ID of this PDO sub 2: PDO type	8 bit 32 bit 8 bit	 no no	0 200h+ device address 0xFF	R R/W R/W
receive PDO 1 mapping	1600	sub index 0: quantity of indexes (= 3) sub 1: 0x20240010 sub 2: 0x00000010 sub 3: 0x20010020	8 bit 32 bit 32 bit 32 bit		3	R R R R
transmit PDO 1 communi-cation parameter	1800	sub index 0: quantity of indexes sub 1: COB ID of this PDO sub 2: PDO type sub 3: inhibit time sub 5: event time	8 bit 32 bit 8 bit 16 bit 16 bit	 no no no no	0 180h+ device address 0xFF 1000 (100ms) 0	R R/W R/W R/W R/W
transmit PDO 1 mapping	1A00	sub index 0: quantity of indexes (= 3) sub 1: 0x20250010 sub 2: 0x20300010 sub 3: 0x20030020	8 bit 32 bit 32 bit 32 bit		3	R R R R

Name	Index number	Function	Range of value	Back up	Deliver y State	R/W
10 general purpose registers	2000: 0...9	to archive any kind of data (e.g. the function of a drive within an installation)	16 bit	yes	0	R/W
target value	2001	target position to be achieved value in 1/100 mm (for default settings of numerator #2010 and denominator #2011)	±31 bit	yes	0	R/W
actual value	2003	current actual position value in 1/100 mm (for default settings of numerator #2010 and denominator #2011) Writing onto this index number causes the current position to be "referenced" onto the transferred value	±31 bit	no		R/W
referencing value	2004	correction factor for the target, actual and limit switch values	±31 bit	yes	0	R/W
drag error	2005	maximum drag error before the 'drag error' bit is set. Value given in increments (at a resolution of 0.5 mm)	20...1000 16 bit	yes	100	R/W
positioning window	2006	allowed difference between target and actual values for "position reached" bit The maximum value that can be set changes according to the same factor as the resolution	1...100 16 bit	yes	5	R/W
actual value assessment, numerator	2010	These values can be used to set a desired user resolution to the drive. For a numerator factor of 400, the denominator factor holds the spindle pitch per resolution e.g.: spindle pitch 1.5 mm with resolution 1/100 mm: numerator = 400, denominator = 150	1...10000 16 bit	yes	400	R/W
actual value assessment, denominator	2011		1...10000 16 bit	yes	400	R/W
target rpm posi	2012	maximum rpm to be used for positioning runs value in min-1	see table 16 bit	yes	see table	R/W
target rpm hand	2013	maximum rpm to be used for manual runs value in min-1	see table 16 bit	yes	see table	R/W
maximum torque	2014	Applies after completion of start phase (during start phase the value #2018 applies); value in cNm	see table 16 bit	yes	see table	R/W
upper limit	2016	maximum/minimum allowed target value allowed values for singleturn variants: $-2^{23}\dots2^{23}$ allowed values for multiturn variants: (upper mapping end - 800…26400 * denominator / numerator)	±31 bit	yes	2^{23} (singleturn) 26400 (multiturn)	R/W
lower limit	2017		±31 bit	yes	-2^{23} (singleturn) 800 (multiturn)	R/W
maximum start-up torque	2018	value in cNm	see table 16 bit	yes	see table	R/W

Name	Index number	Function	Range of value	Back up	Delivery State	R/W
time period for start-up torque	2019	value in msec	10...1000 16 bit	yes	200	R/W
rpm limit for aborting run	201A	value in % of the target rpm	10...90 16 bit	yes	30	R/W
time elapsed until speed falls below rpm limit for aborting run	201B	value in msec	50...500 16 bit	yes	200	R/W
acceleration	201C	value in min-1.	see table 16 bit	yes	see table	R/W
deceleration	201D	value in min-1.	see table 16 bit	yes	see table	R/W
length of loop	201F	minimum number of increments which the drive moves in a pre-defined direction when approaching a target position value in increments (value = 0 → no loop)	0.025…1 rotations (10…400 at del. state) or 0 32 bit	yes	250	R/W
maximum rpm, counter-clockwise	2020	value in min-1.	see table 16 bit	yes	see table	R/W
maximum rpm, clockwise	2021	value in min-1 per sec.	see table 16 bit	yes	see table	R/W
step width for single step	2022	number of increments when activating a jog run bit for a short-time	1...100 16 bit	yes	1	R/W
idle period for manual run	2023	Span of time which a jog run bit must be activated in order to begin a manual run value in steps of 5 msec	20...2000 16 bit	yes	200	R/W

Name	**Index number**	**Function**	**Range of value**	**Back up**	**Delivery State**	**R/W**
control word	2024	Bit 0: manual run to larger values Bit 1: manual run to smaller values Bit 2: transfer target value (when transferring a target value with the help of PDOs, a positioning run is only started if this bit is set) Bit 3: release for manual run in jog run mode: if this bit is not set, only single steps are possible in jog run mode Bit 4: release: the axle will only run if this bit is set (exception is the jog run mode with bits 8/9) Bit 6: run without loop Bit 7: start initial reference loop Bit 8: jog run to larger values Bit 9: jog run to smaller values Bit 10: release readjustment Bit 11: execute braking-free-run Bit 12: run with drag error correction All other bits must be set to 0!	16 bit	no	0	R/W
status word	2025	Bit 0: target position reached Bit 1: drag error Bit 2: reserved Bit 3: reserved Bit 4: motor power present Bit 5: positioning run aborted Bit 6: drive is running Bit 7: temperature exceeded Bit 8: movement opposite loop direction Bit 9: flash memory or encoder error Bit 10: positioning error (block) Bit 11: manual displacement Bit 12: incorrect target value Bit 13: motor power was missing Bit 14: positive range limit Bit 15: negative range limit	0..FFFFh 16 bit			R
CAN address	2026	address of drive (if set by CAN bus) This value cannot be changed if the address switches are used (i.e. the switch setting is > 01).	1...127 16 bit	yes	1	R/W

Name	Index number	Function	Range of value	Back up	Delivery State	R/W
baud rate	2027	0: 50 kBaud 1: 125 kBaud 2: 250 kBaud 3: 500 kBaud 4: 1000 kBaud This value cannot be changed if the baud rate switch is used (i.e. the switch setting is not OFF-OFF).	0...4 16 bit	yes	3	R/W
upper mapping end	2028	definition of the positioning range relative to the absolute measuring system allowed values: (1 + ref.value) … (54400 * denominator / numerator - 1 + ref.value) (object exists only in multiturn variants)	±31 bit	yes	27200	R/W
position consistent	202A	0: position is not consistent 1: position is consistent (object exists only in singleturn variants)	0 or 1 16 bit		1	R
direction of rotation	202C	0: clockwise (as seen at the output shaft) 1: counter-clockwise	0 or 1 16 bit	yes	0	R/W
running direction for approaching target positions	202D	0: with 5/8 forward rotation 1: with 5/8 reverse rotation (5/8 rotation is the default value, see #201F)	0 or 1 16 bit	yes	0	R/W
idle period	202E	idle period in msec when reversing the direction of rotation	10... 10000 16 bit	yes	10	R/W
actual rpm	2030	value in min-1.	16 bit			R
maximum torque	2031	maximum torque occurring during the most recent run (start phase, during which the maximum start-up torque applies, see SDOs #2018/2019, and the phase when the drive is braking down, are not considered) value in cNm	16 bit			R
actual torque	2033	value in cNm	16 bit			R
U control	203A	current supply voltage for control unit given in increments of 0.1 V	16 bit			R
U motor	203B	current supply voltage for motor given in increments of 0.1 V	16 bit			R
Umot limit	203C	voltage limit for bit ‘motor power present’ given in increments of 0.1 V	180...240 16 bit	yes	185	R/W
Umot filter	203D	average time for measuring current power to motor; given in 5 msec increments	100... 1000 16 bit	yes	100	R/W
temperature limit	203E	upper temperature limit in °C	10...70 16 bit	yes	70	R/W
device temperature	203F	internal device temperature in °C	16 bit			R

Name	Index number	Function	Range of value	Back up	Delivery State	R/W
production date	2040	year and week of manufacturing (given as an integer)	YYWW 16 bit			R
serial number	2041	serial device number	0...65535 16 bit			R
device model	204D	One of the following device models of the PSE series (5-digit numbers show the diameter of the output shaft in their last 2 places): 21108, 21208, 23108, 23208	16 bit			R
version	204E	software version number	16 bit			R
delivery state	204F	writing '-1': generates the delivery state without modifying the CAN address and the baud rate (starts initial reference loop, then positioning to target value 0 if singleturn or to the middle of the measurement range if multiturn) writing '-2': generates the delivery state (sets CAN address SDO #2026 to 1, baud rate SDO #2027 to 500 kBaud, starts initial reference loop, then positioning to target value 0 if singleturn or to the middle of the measurement range if multiturn) A different CAN address or baud rate is only active after reset or reset communication! writing '1': saves all parameters in the EEPROM reading directly after boot: 0 → content of memory correct ≠ 0 → content of memory incorrect reading after saving: 0 → saving finished successfully ≠ 0 → saving is still in progress or is finished incorrectly (the time for saving is up to 2000 msec)	-1, -2 or 1 16 bit	no		R/W

2.6.2 Table of rated speed and torque values for various models of gears

	Device model	211-08	212-08	231-08	232-08
Name	Index number	value range delivery state			
target rpm posi	2012	6…60 50	6…30 25	6…120 100	6…60 50
target rpm hand	2013	6…60 15	6…30 8	6…120 30	6…60 15
maximum rpm, counter-clockwise	2020	6…60 50	6…30 25	6…120 100	6…60 50
maximum rpm, clockwise	2021	6…60 50	6…30 25	6…120 100	6…60 50
acceleration	201C	20…150 150	10…75 75	20…150 150	10…75 75
deceleration	201D	20…150 150	10…75 75	20…150 150	10…75 75
maximum torque	2014	2…100 100	4…200 200	2…100 100	4…200 200
maximum start-up torque	2018	2…125 125	4…250 250	2…125 125	4…250 250

2.6.3 PDO definition

1) Receive PDO (from the perspective of the PSE2xx)
Identifier: 200h + CAN address (possible values: 201h...27Fh)

Assignment (cannot be modified):

Bit	Byte	Description	corresponding SDO index number
0-15	0,1	control word	2024h
16-31	2,3	unused	
32-63	4,7	target value	2001h

2) Transmit PDO (from the perspective of the PSE2xx)
Identifier: 180h + CAN address (possible values: 181h...1FFh)

Assignment (cannot be modified):

Bit	Byte	Description	corresponding SDO index number
0-15	0,1	status	2025h
16-31	2,3	current rpm	2030h
32-63	4-7	actual value	2003h

2.6.4 Detailed description of status bits

Bit	description
0	**target position reached** This bit is set: - when a transferred target position has been reached successfully - after running an initial reference loop, when the actual value corresponds to the previously transferred target value This bit is reset: - after transferring a target position if the difference from the actual value is larger than the positioning window (SDO #2006) - by a manual run - if an invalid target value has been transferred - if rotated manually when on standstill
1	**drag error** This bit is set: - if, after the acceleration phase, the maximum speed setting has not been achieved This bit is reset: - with each new run command
2	**reserved**
3	**reserved**
4	**motor power present** This bit is set: - if the supply voltage to the motor is above the Umot limit (SDO #203C) This bit is reset: - if the supply voltage to the motor is below the Umot limit
5	**positioning run aborted** This bit is set: - if a positioning run is aborted because release in the control word has been withdrawn This bit is reset: - when a new run command is transmitted
6	**drive is running** This bit is set: - when the drive is rotating This bit is reset: - when the drive is on standstill
7	**temperature exceeded** This bit is set: - if the internal device temperature device exceeds the limit value (SDO #203E) This bit is reset: - if the internal device temperature falls below the limit value by 5°C

Bit	description
8	**movement opposite loop direction** This bit is set: - during a manual run in the direction opposite that of the loop direction (a subsequent manual run in the loop direction will not reset this bit) - during a positioning sequence in the direction opposite that of the loop direction This bit is reset: - when a transferred target position has been reached successfully (in the loop direction) - after the initial reference loop
9	**flash memory or encoder error** This bit is set: - if an unrecoverable error in flash memory occurred - if an internal problem is detected when calculating a position No run commands (except the initial reference loop) can be executed when the error bit is set! This bit is reset: - when an initial reference loop is completed correctly
10	**positioning error (block)** This bit is set: - if a positioning run is aborted because the device is overloaded (block, extreme difficulty while running) This bit is reset: - by transmitting a new positioning command - after an initial reference loop has been executed correctly
11	**manual displacement** This bit is set: - if, while on standstill, the drive is turned externally by more than the value in the positioning window This bit is reset: - by transmitting a new positioning command - after an initial reference loop has been executed correctly
12	**incorrect target value** This bit is set: - when a transferred target value lies outside of the limit switches; also caused, for instance, because of the actual value of the reference value (SDO #2004) - when a transferred target value lies inside of the limit switches; but because of a necessary loop run the specified interval would be left This bit is reset: - by transmitting a valid target value

Bit	description
13	**motor power was missing** This bit is set: - if the motor power is less than the Umot limit (SDO #203C) when initiating a positioning run or an initial reference loop - if during a run the voltage falls below the Umot limit - if during a run an overcurrent error occurs This bit is reset: - if the motor power is above the Umot limit when initiating a positioning run or an initial reference loop
14 & 15	**positive / negative range limit** This bit is set: - if the limit value is reached during a manual run (but not if reached during a positioning run) - if a limit value is modified such that the current position lies beyond the limit - if, while on standstill, by means of an external force the drive is moved to a position which is outside the area which is defined by the range limits This bit is reset: - by initiating a positioning run, an initial reference loop or a manual run

2.6.5 Detailed description of control bits

Bit	description
0	manual run to larger values
1	manual run to smaller values
2	transfer target value: When transferring a target value with the help of PDOs, a positioning run is only started if this bit is set. When commanding a manual run or a jog run with the help of PDOs, this bit must not be set.
3	Release for manual run in jog run mode: This bit must be set in order to switch from jog run mode (bits 4 and 5 in the control word are not set; bit 8 or 9 set) to manual run mode if a jog run bit is activated for a longer time. Single increments are the only option in jog run mode if this bit is reset.
4	Release: Run commands will only be executed if this bit is set (exception is the jog run mode with bits 8/9 of the control word). This bit must be set for positioning runs, manual runs and must not be set for jog runs. If this bit is cleared during a run, the run will be aborted and status bit 5 will be set (‘positioning run aborted’).
5	reserved, must be programmed to 0
6	Run without loop: If this bit is set at the start of a positioning run, the target will be approached directly (without loop).
7	Start initial reference loop: the device performs 5/8 of one rotation opposite to the loop direction; it will then perform 5/8 of a rotation in loop direction at manual run speed. In earlier versions, this command had to be executed after switching on the device; that is no longer the case.
8	Jog run to larger values. Bits 4 and 5 must not be set in this mode!
9	Jog run to smaller values. Bits 4 and 5 must not be set in this mode!

Bit	description
10	Release readjustment: Only if this bit is set the drive readjusts when it is displaced out of its position in the direction opposite to that of the loop direction at the end of a run. If bit 6 (“Run without loop”) is set, the drive readjusts in both directions.
11	reserved, must be programmed to 0
12	Run with drag error correction: If the bit is set, the drive trys (under consideration of the configured maximum torque) to compensate a drag error which has been developped. By controling the rpm on a value which is slightly above or below the configured ‘target rpm posi’ (SDO #2012), the drag error decreases. The drag error correction operates only in positioning runs, i.e. not in manual runs or in jog run mode. Furthermore it operates only while accelerating and cruising with constant rpm, not while decelerating. The time-dependent setting value for the rpm while accelerating arises out of the rpm at beginning of the positioning as well as the acceleration setting (SDO #201C).
13	reserved, must be programmed to 0
14	reserved, must be programmed to 0
15	reserved, must be programmed to 0

3 Sequence of positioning

3.1 Positioning run

- The drive must be set to CANopen ‘operational mode’ before it can be controlled using PDOs.
- Transfer target value (PDO with control word = 0014h and target value, or target value to SDO #2001): drive begins run
- Abort run by resetting the release bit (transmit PDO with control word = 0000h or transmit SDO #2024 with value 0000h).
- If a new target value is transferred during a positioning run, the device will immediately proceed to the new target. There will be no interruption if the direction of rotation does not need to be altered.
- If a manual run is transmitted during a positioning run, the positioning run will be aborted (speed will be reduced to that of a manual run) and the device proceeds with the manual run.

The following sequence of steps is also possible:
Starting situation:
- release bit has not been set
- Target value has already been transferred (no release in the control word for PDO transfer)

Set release bit: drive begins run

3.2 Positioning run without loop

The sequence corresponds to that of a positioning run with loop; in addition to setting the release, however, bit 6 in the control word also has to be set to execute the run without loop.

3.3 Manual run

- start manual run (transmit PDO with control word = 0011h resp. 0012h or transmit SDO #2024 with value 0011h resp. 0012h): device begins to run
- End manual run by clearing the manual run command (transmit PDO with control word = 0010h or transmit SDO #2024 with value 0010h) or by deasserting release (transmit PDO with control word = 0000h or transmit SDO #2024 with value 0000h).
- Transferring a target value during a manual run will end the manual run and the device will immediately move on to the transmitted position.

4 Specials

4.1 Speed, acceleration and deceleration

The initial reference loop and the manual run are performed at the maximum speed specified in SDO #2013; positioning runs are performed at the maximum speed specified in SDO #2012. When the run is counter-clockwise, additionally the maximum speed in SDO #2020 applies, when the run is clockwise, the one in SDO #2021 applies. For all runs the maximum acceleration in SDO #201C and the maximum deceleration in SDO #201D apply. At the end of each run the maximum deceleration decreases during the approach to the destination successively in order to realize a harmonic transient behavior.

4.2 Response of drive in case of block or manual displacement

If during a run due to load the speed falls below the threshold parameter of 30% of the selected maximum speed (SDO #201A) for longer than 200 msec (SDO #201B), the device detects blocking, aborts the run and sets the ‘positioning error’ bit (here the default values are given).
New run commands can then be transmitted with no further steps to take. An exception is, if the run should go to the same target than before. In this case, deassert the release (bit 4 of the control word) and assert it again, then transfer the target position one more time (either by PDO or SDO).
If the PSE2xx is displaced by external force during standstill opposite to the loop direction and the release bit (bit 4) as well as the release readjustment bit (bit 10) in the control word are still set, the device will attempt to reach the previously transmitted target value once again (readjustment). The device does not attempt to readjust if rotated in the loop direction; it merely sets the ‘manual rotation’ bit. If bit 6 (“run without loop”) is set, the drive readjusts the position in both directions. Deasserting the release bit and/or the release readjustment bit can completely stop the readjustment process.

4.3 Internal measuring system (applys for “singleturn” variants)

The singleturn variants of the PSE2xx actuator include a partial absolute measuring system. This means that the position within one turn is measured absolute und the turns are counted.
These ‘counted turns’ are stored in internal flash every time a run has been finished or if the actual position value changes during standstill. The value is available after power up without further commands.

There are two cases that cause the counted turns to be invalid:
1) The output shaft is externally displaced during control power off for more than 36°.
2) Control power is turned off while the PSE2xx is turning.

In these cases SDO #202A has value 0 (“actual position is not consistent”).

Now there are three possible ways to continue depending on the amount of displacement during control power off:
1) No special actions have to be taken if the displacement has been less than 180° (½ turn): The actual position value is still correct.
2) If the displacement has been more than 180° (½ turn), the correct actual position value has to be sent to the PSE2xx (by writing to SDO #2003).
3) First move to a reference position, then write the actual position value with SDO #2003 (if the displacement has been more than ½ turn and the actual position is not available otherwise).

The removal of the motor power supply has no affect on the internal measuring system.

Remarks:

1) The 3 SDOs referencing value (SDO #2004), actual value assessment, numerator (SDO #2010) and actual value assessment, denominator (SDO #2011) have an influence on the increment and position values: With the help of the referencing value a shift can be reached, with the help of the actual value assessment numerator and denominator a stretching or distension can be reached (see below).
2) When changing the direction of rotation (SDO #202C), the referencing value (SDO #2004) and the upper and lower limit (SDO #2016 and #2017) are set to delivery state.
3) When changing the actual value assessment numerator or denominator (SDO #2010 or #2011), the target value, the actual value, the referencing value, the upper and lower limit, the positioning window (SDO #2006) and the length of loop (SDO #201F) are re-calculated.
4) When changing the referencing value (SDO #2004), the target value, the actual value and the upper and lower limit are re-calculated.
5) If the user wants to go over any automatic re-calculation of values when setting up the device, the optimum order of transfering the parameter is the following:
   a) direction of rotation (SDO #202C),
      actual value assessment, numerator (SDO #2010),
      actual value assessment, denominator (SDO #2011)
   b) referencing value (SDO #2004)
   c) upper limit (SDO #2016),
      lower limit (SDO #2017),
      positioning window (SDO #2006),
      length of loop (SDO #201F)
6) In order to save the settings permanently in the EEPROM, write 1 to SDO #204F. As soon as reading of SDO #204F shows 0, the saving is finished.

Referencing value (SDO #2004):

The referencing process affects all transferred values, i.e., the target value, actual value and upper and lower limit.

There are two ways of setting the referencing value:

1) Directly, by writing the referencing value to SDO #2004.
2) Indirectly, by writing an actual value to SDO #2003. This makes it possible to assign any “true” actual value 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 SDO #2004.

When changing the referencing value, automatically the target value, the actual value and and the upper and lower limit are re-calculated.

4.4 Internal measuring system (applys for "multiturn" variants)

The multiturn variants of the PSE2xx actuator include an absolute measuring system with measurement range of 68 rotations. This allows the user to determine the direction of rotation for any desired portion of these 68 rotations.
The mapping of the desired positioning range to the physical positioning range is done with the help of the parameter 'upper mapping end' (SDO #2028).
In the delivery state, the drive is at position 13600, the upper limit switch is set to 26400 and the lower limit switch is set to 800, yielding a positioning range of ±32 rotations (±12800 increments). So if the desired positioning range doesn't exceed ±32 rotations, in delivery state none of the following actions to adjust the positioning range have to be taken.

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 13600), then close the collar. The drive is now capable of moving 32 rotations (±12800 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 800), then close the collar. The drive is now capable of moving 64 rotations (±25600 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 26400), then close the collar. The drive is now capable of moving 64 rotations (±25600 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 SDO #2028. SDO #2028 defines the upper end of the positioning range. By default, the upper end is at +68 rotations (position 27200). If the positioning range doesn't suit to the actual displayed position after mounting the drive, the upper end of the positioning range can be adjusted between -68 rotations and +136 rotations.
   Examples:
   a) After mounting the drive, the displayed position is 13600 (which corresponds the delivery state). But the positioning range shall solely spread to the right (resp. top) → Set SDO #2028 to 40000.
   b) After mounting the drive, the displayed position is 26400. But the positioning range shall solely spread to the right (resp. top) → Set SDO #2028 to 52800.
   c) After mounting the drive, the displayed position is 800. But the positioning range shall solely spread to the left (resp. bottom) → Set SDO #2028 to 1600.

Remarks:

1) When calculating the upper mapping end (SDO #2028), a security reserve of 2 rotations has to be kept in mind (800 increments by default, see the examples above), because the highest possible position value is 2 rotations below the upper mapping end. The lowest possible position value is 66 rotations below the upper mapping end.
2) The above given increment and position values relate to the following settings, which correspond to the delivery state:
   a) referencing value (SDO #2004) = 0

b) actual value assessment, numerator (SDO #2010) = 400
c) actual value assessment, denominator (SDO #2011) = 400
These 3 SDOs have an influence on the above given increment and position values: With the help of the referencing value a shift can be reached, with the help of the actual value assessment numerator and denominator a stretching or distension can be reached (see below).

3) When changing the direction of rotation (SDO #202C), the referencing value (SDO #2004), the upper mapping end (SDO #2028) and the upper and lower limit (SDO #2016 and #2017) are set to delivery state.
4) When changing the upper mapping end (SDO #2028), the upper and lower limit (SDO #2016 and #2017) are set to delivery state.
5) When changing the actual value assessment numerator or denominator (SDO #2010 or #2011), the target value, the actual value, the referencing value, the upper mapping end, the upper and lower limit, the positioning window (SDO #2006) and the length of loop (SDO #201F) are re-calculated.
6) When changing the referencing value (SDO #2004), the target value, the actual value, the upper mapping end and the upper and lower limit are re-calculated.
   If the values of the upper mapping end (SDO #2028) and/or the limit switches (SDO #2016+ SDO #2017) 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.
7) If the user wants to go over any automatic re-calculation of values when setting up the device, the optimum order of transfering the parameter is the following:
   a) direction of rotation (SDO #202C),
      actual value assessment, numerator (SDO #2010),
      actual value assessment, denominator (SDO #2011)
   b) referencing value (SDO #2004)
   c) upper mapping end (SDO #2028)
   d) upper limit (SDO #2016),
      lower limit (SDO #2017),
      positioning window (SDO #2006),
      length of loop (SDO #201F)
8) In order to save the settings permanently in the EEPROM, write 1 to SDO #204F. As soon as reading of SDO #204F shows 0, the saving is finished.

<u>Referencing value (SDO #2004)</u>:
The referencing process affects all transferred values, i.e., the target value, actual value, upper mapping end and upper and lower limit.
There are two ways of setting the referencing value:
1) Directly, by writing the referencing value to SDO #2004.
2) Indirectly, by writing an actual value to SDO #2003. This makes it possible to assign any “true” actual value 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 SDO #2004.

When changing the referencing value, automatically the target value, the actual value, the upper mapping end and the upper and lower limit are re-calculated.

The removal of the motor power supply has no affect on the internal measuring system (applys for signleturn and multiturn variants).

4.5 Using actual value assessment factors to set the spindle pitch

SDO #2010 (numerator factor) and #2011 (denominator factor) can be used to modify the device's spindle resolutions to any desired numerical value.
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 be set via the denominator factor.
The numerator factor is mainly used to set odd-numbered 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 factors may be set to values between 1 and 10000.

4.6 Drag error

During a positioning run, the device compares the computed target position with the current actual value. If the difference is larger than the 'drag error' value (SDO #2005), the device sets the corresponding bit in the status word. This situation is especially likely to occur if external factors (required torque, voltage to motor too low) prevent the device from achieving the target rpm.

4.7 Abort run when the master fails

If the connection to the master is interrupted during a positioning run, the master cannot abort an actual run. There are two ways of generating an automatic run abort in a case like this: node guarding und heartbeat consumer.
In the first case (node guarding), guard time and life time factors must be programmed into the drive. The master then must cyclically transmit the heartbeat to the drive as a remote object.
In the second case (heartbeat consumer), node ID and cycle time of the master heartbeat must be sent to the device as consumer heartbeat. The master must then cyclically transmit this heartbeat.
The second option generates less bus load, because the master needs only to transmit an unconfirmed master heartbeat (only one message for all consumers).

4.8 Jog run mode

With the help of the jog run bits in the control word (bit 8 for "jog run to larger values" and bit 9 for "jog run to smaller values") a manual run can be performed, provided that bit 4 (release) is inactive. The release of positioning runs and manual runs (control word bit 4) and the control word bits for jog runs (bits 8 and 9) cannot be set simultaneously. Changing the control word bits while running (for example from positioning run to jog run) aborts a run in the other operation mode.

The step width for a short activation time of a jog run bit can be set via SDO #2022. Such a single step is being executed if one of the jog run bits is being activated. If the jog run bit is being deasserted before the end of the single step, it will be completed nevertheless. If the same jog run bit stays active further on, after a short waiting time a continuous manual run might join the single step under some circumstances. This continuous manual run will run as long as the jog run bit stays activated. For this, additionnally to the activation of the jog run bit also bit 3 ('release for manual run in jog run mode') has to be activated. If bit 3 is not set, each activation of a jog run bit results in a single step, even if the jog run bit is activated longer than the duration of the single step.

The idle period before the drive switches into manual run is specified with SDO #2023. In manual run the drive runs maximum to the specified limit switch position (SDO #2016 resp. #2017).

If during an jog run both jog run bits are being activated, the run is aborted immediately. A new jog run is only possible if both jog run bits are deasserted.

4.9 Reference runs

The PSE2xx positioning system is equipped with an absolute or partially absolute measuring system, therefore there's no need for a reference run when powering on the drive. However, if in certain cases a reference run onto a hard block should be desired (e.g. uniquely when installing the drive at a machine), the course of action should be the following:

1) Before commanding the reference run the following settings have to be carried out:
   - set the maximum torque (SDO #2014) and the maximum start-up torque (SDO #2018) to max. 10% of the nominal torque
   - set the rpm limit for aborting run (SDO #201A) to 60
   - set the time elapsed until speed falls below rpm limit for aborting run (SDO #201B) to 100
     (The span of time in which the drive trys to get over the block, decreases: With the reduced values the positioning will be aborted if the speed stays below 60% of the target speed for longer than 100ms. By default, these values are 30% and 200ms.)
   - set the corresponding upper and lower limit (SDO #2016 or #2017) in a way that the block location lays considerable within the area between the upper and lower limit
     (Otherwise there's the danger that the block is located within the positioning window and consequently won't be recognized.)
   - Where appropriate, reduce the target speed for manual run (SDO #2013).
2) Now start the reference run as manual run (set bit 0 or 1 in the control word).
3) Wait for the drive moving (bit 6 in the status word is set).
4) Wait for the drive has stopped and a positioning error has appeared (bit 6 in the status word is cleared, bit 10 is set).
5) Start a manual run in the opposite direction with the same settings (move a certain distance away from the hard stop in order the drive can move freely).
6) Only now adjust the desired settings of the adove mentioned SDOs for normal operation.

5 Technical data

5.1 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 msec
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 declaration of conformity available upon request
protection class	IP 54
duty cycle	30%, base time: 300 s

5.2 Electrical data

nominal power output	PSE21x	4 W with 30 % duty cycle
	PSE23x	8 W with 30 % duty cycle
supply voltage	24 VDC ±10 % advice: use regulated power supplies	
nominal current, control unit	0.1 A	
nominal current, motor	0.7 A	
positioning resolution	0.9°	
positioning accuracy	0.9°	
CAN protocol	CANOpen (CiA DS 301) CAN address setting via decade switch (option): addresses 1...99 CAN address setting via bus: addresses 1...127 baud rate setting via sliding switch (option): 125 kBaud, 250 kBaud, 500 kBaud baud rate setting via bus: 50 kBaud, 125 kBaud, 250 kBaud, 500 kBaud, 1MBaud	
absolute value acquisition “singleturn”	magnetic within one turn, turns are counted and automatically stored in flash memory	
absolute value acquisition “multiturn”	magnetic with gearbox	
electrical connection	spring-type terminal max. 1,5 mm^2	

5.3 Physical data

positioning range “singleturn” (Variants with partially absolute measuring system)	value range for positions: $-2^{23}...2^{23}$ no mechanical limits	
positioning range “multiturn” (Variants with absolute measuring system)	64 rotations no mechanical 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 lash compensation	automatic loop after every positioning run (can be switched off)	
output shaft	PSE2xx-H	8H9 hollow shaft with adjustable collar
	PSE2xx-V	8h8 solid shaft
recommended diameter of the spindle head	according to the hollow shaft diameter with an interference fit of h9	
maximum radial force	40 N	
maximum axial load	20 N	
dimensions (l x w x h)	**See 6. Dimension drawings**	
weight (approx.)	600 g	

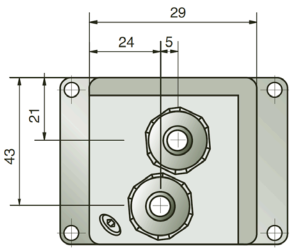
For additional specifications and dimension drawings, please visit our website at
https://www.halstrup-walcher.de/en/products/drive-technology/

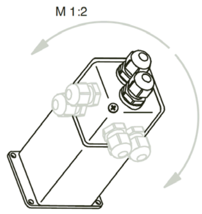
6 Dimension drawings

PSE 21_/23_-8

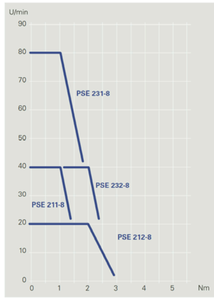
Dimension drawing

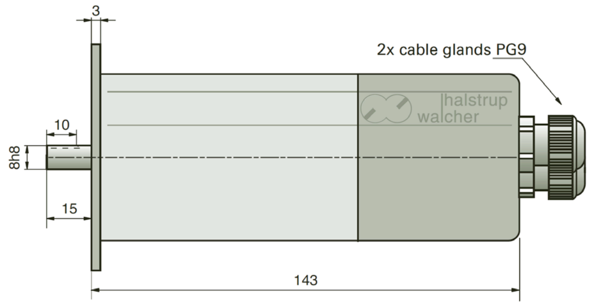
Characteristic line

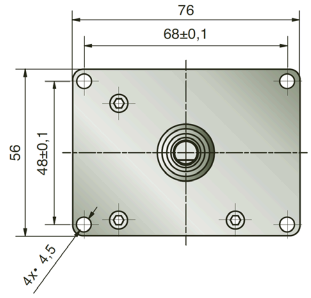




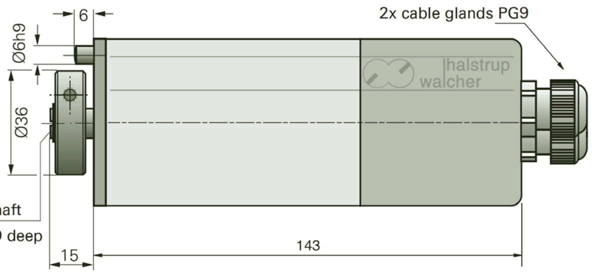
By turn of the cover around 90° are different positions of the cable glands possible

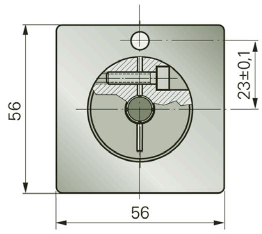






optional hollow shaft





7 Certificate of Conformity

halstrup walcher

CE

EU-Konformitätserklärung
EU Declaration of Conformity

Firma / ***Company***
halstrup-walcher GmbH, Stegener Str. 10, 79199 Kirchzarten, DE
erklärt als Hersteller in alleiniger Verantwortung, dass das Produkt
declares as manufacturer under sole responsibility, that the product

Produkt / ***Product***
Positioniersystem / ***Positioning System*** — **PSE2xx**

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

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

Normen / ***Standards***
angewandte harmonisierte Normen:
applied harmonized standards:

EN 60204-1:2019
EN IEC 61000-6-2:2019
EN IEC 63000:2018

Erklärung / ***Declaration***
EU Konformitätserklärung ausgestellt von
EC Type Examination Certificate issued by

Geschäftsführer *Managing Director*

Kirchzarten, 28 Aug. 2020

halstrup-walcher GmbH
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79199 Kirchzarten

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Geschäftsführer / *Managing directors*: Jürgen Walcher, Christian Sura
Handelsregister / *Reg.of companies*: Amtsgericht Freiburg HRB 2209
Umsatzsteuer-ID-Nr. / *VAT-ID-No*: DE 811169901

Notes

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