

Rexroth SHL01 .1 Hall Sensor Box

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Edition 02

Functional Description



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SHL01.1

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Purpose of Documentation This documentation describes functions and application of the hall sensor box SHL01.1.

Record of Revisions

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DOK-SUPPL*-SHL*****-FK01-EN-P	07.2001	1 st edition
DOK-SUPPL*-SHL*****-FK02-EN-P	09.2001	reworked edition

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1 Introduction

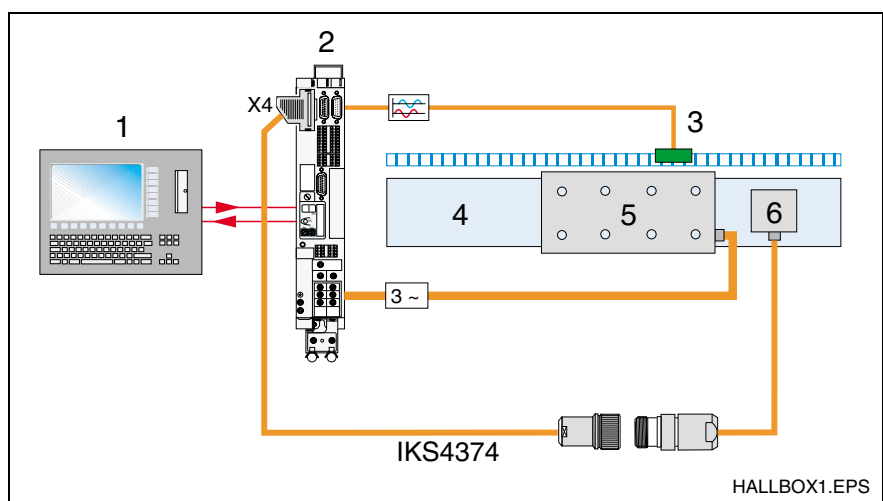
The hall sensor box SHL 01.1 is a supplemental component for ECODRIVE drive systems with synchronous linear motors LSF from BOSCH REXROTH.

A drive system with LSF motor and SHL box can perform a commutation procedure without the motor being moved.

Applications may involve:

- gantry axis systems or vertical axis arrangements
- mechanically braked axes
- drive systems where movements must be prevented during commutation processes.

1.1 Schematic setup



1:	Control system	4:	Secondary motor part
2:	Drive controller DKC	5:	Primary motor part
3:	Linear scale	6:	Hall sensor box with cable

Fig. 1-1: Schematic setup

A drive system with hall sensor box SHL may consist of:

- drive controller DKC with firmware
- drive controller programming software DRIVETOP
- synchronous linear motor from LSF series
- standard encoder cable IKS4374 to connect sensor box cable and drive controller
- linear scale system (supplied by scale system manufacturer)
- optionally master control system with visualization
- complete set of technical documentation about all products in use

Note: Other drive controllers than DKC are **NOT** compatible to SHL box. See compatibility list and other technical information in chapter "Application".

Always observe safety notes and guidelines from the drive system documentation.

1.2 Order information

A complete drive system consists of many different parts, as given above. The hall sensor box part of a customer's purchase order should list following items:

Pos.	Product	Material number	Note
1	SHL01.1-037-S	292551	Hall sensor box
2	IKS4374/X	277697	X = required cable length in meter
3	DOK-SUPPL*-SHL*****-FK01-EN-P	292537	EN = English documentation

Abb. 1-2: SHL order information

Note: Optional SHL type "SHL01.1-015-S" was not available when this document was published.

1.3 Documentation

This documentation gives only general application guidelines and descriptions for the hall sensor box SHL01.1. Further details about drive system components and instructions for drive system commissioning are given by the corresponding product documentation

Material No.:	Title / Description	Reference
00280107	DOK-ECODR3-DKC**..3****-PR04-EN-P "Project planning manual Ecodrive drive controllers..."	DKC
00288895	DOK-MOTOR*-LSF*****-GN02-EN-P ""Project planning manual LSF..."	LSF
00...	DOK-ECODR3-FGP-...VRS**-.-----EN-E DOK-ECODR3-SGP-...VRS**-.-----EN-E DOK-ECODR3-SMT-...VRS**-.-----EN-E Type code and material number depend on type of firmware used. Consult your local Rexroth Indramat representative for assistance to find the correct doc type.	Firmware
The index (e.g. ..02-..) indicates the published edition.		

Fig. 1-3: Drive system documentation

Your feedback

Your experience and expertise are essential parts in the process of improving product and documentation. Whether you discover any faults in the documentation or you just like to have something changed, we are thankful for your feedback.

Please send your comments to:

REXROTH INDRAMAT GmbH
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Bürgermeister-Dr.-Nebel-Strasse 2
97816 Lohr - Germany

Telefax +49 (0) 93 52 / 40-43 80

If you discover any faults in the documentation, please fax the corresponding page directly to the fax no. above.

2 Technical Data

2.1 Data sheet SHL01.1

Designation	Symbol	Unit	Data
Supply voltage (drive controller internal supply)	U	V _{DC}	8
Max. output current (drive controller internal supply)	I	mA	250
Max. ambient temperature 1)	T _A	°C	0 ... 55
Class of protection			IP65
Connecting cable length		m	2
Weight (incl. cable & coupling)	m	kg	0.4

1) Since LSP and SHL are used together, this data corresponds to LSP specifications.

Fig. 2-1: SHL01.1 data sheet

2.2 Type code

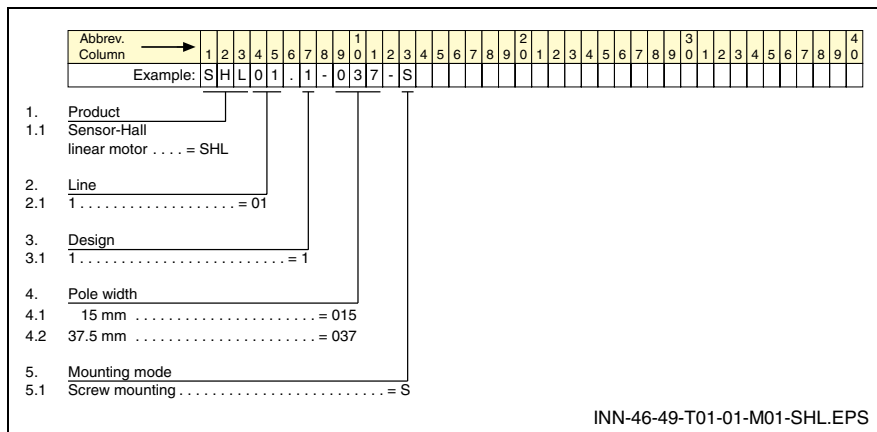


Fig. 2-2: SHL01.1 type code

Note: The selected "pole width" must correspond to the pole width of the motor. See motor type plate for pole width data.
SHL01.1 is generally delivered with 2 m ready-made cable & coupling.

2.3 Dimensions

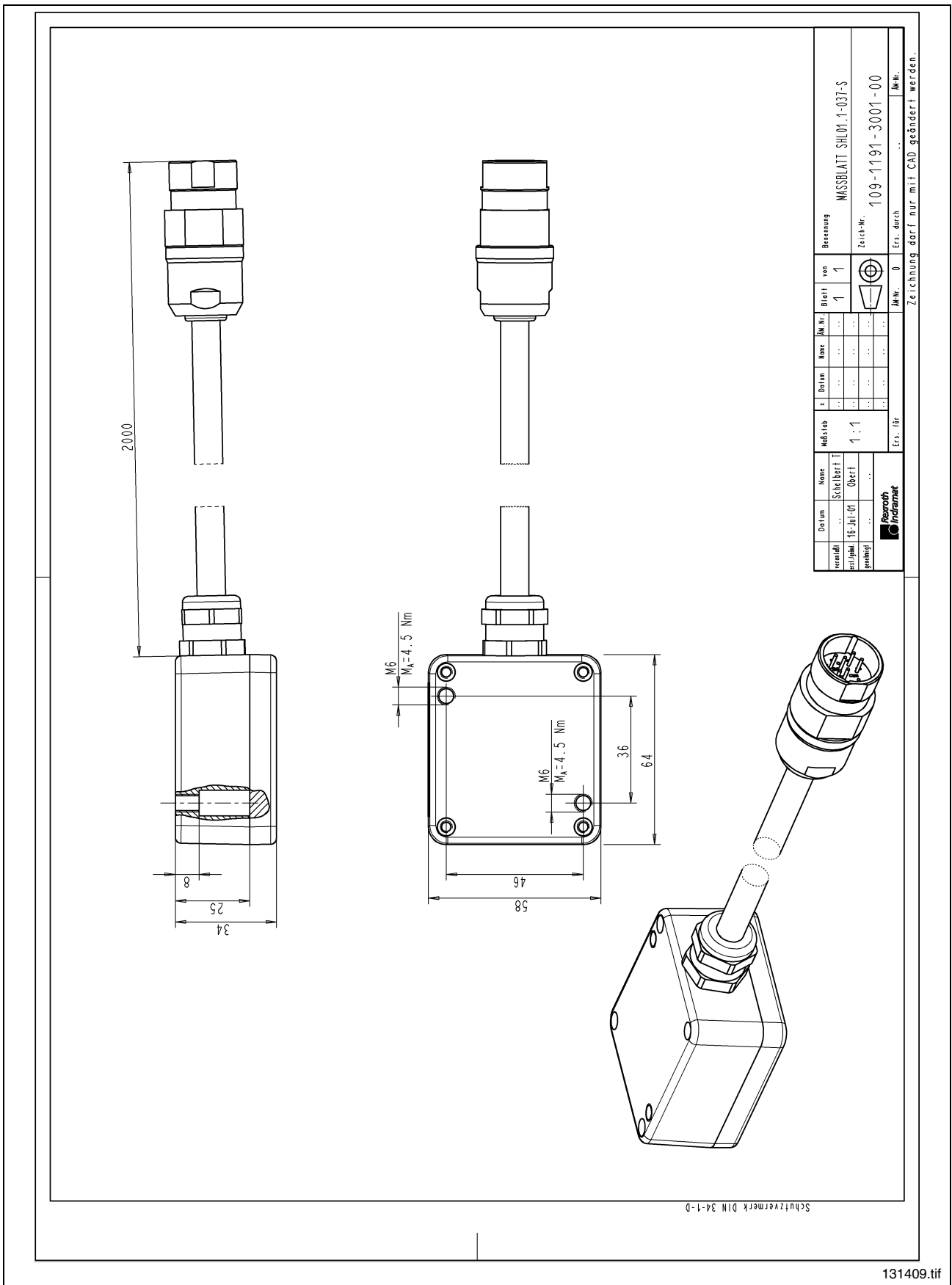


Fig. 2-3: Dimensions SHL

3 Application

This documentation gives only general application guidelines and descriptions. Handling instructions for each individual component as well as the drive system commissioning are given by the corresponding product documentation (see list in chapter 1).

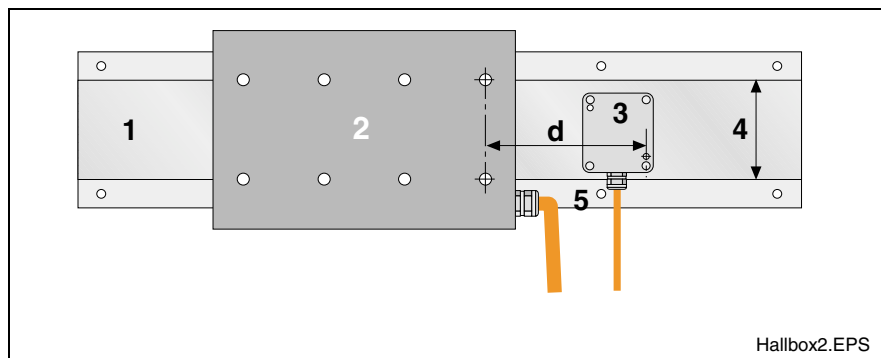


WARNING

Bodily harm and machine damage through faulty operation of motor and moved elements!

- ⇒ Collect and study the documentation of all drive components in use before carrying out any commissioning action.
- ⇒ Follow all safety notes and instructions given by these documents.

3.1 Arrangement



1:	Secondary part LSS	4:	Mounting range
2:	Primary part LSP	5:	Cable output fittings
3:	Hall sensor box SHL	d:	Mounting clearance

Fig. 3-1: General arrangement

The hall sensor box SHL must be installed in a defined distance to the side face of a synchronous motor's primary part (LSP), according to following specifications.

- The cable output fittings of both sensor box and primary part must be arranged in the same orientation due to the internal polarity arrangement (Example: both cable output fittings in Fig. 3-1 are arranged at the "bottom" of each unit).

Note: Cables could also lead in other directions, but cable output fittings are important to be observed for correct reference.

- The mounting range (4) corresponds to the size of secondary part magnets. The box must be installed within this mounting range.
- The specified mounting clearance (d) must be calculated individually for each machine due to influence on drive parametrization (see calculation instructions later in this chapter). Reference points for this clearance are always the same boring holes, as shown above.

Permitted arrangements

1. Hall sensor box SHL within mounting range + identical cable fitting location of both sensor box and motor primary part LSP.
2. Mounting on other motor side. Hall sensor box SHL within mounting range + identical cable fitting locations of both sensor box and motor primary part LSP.

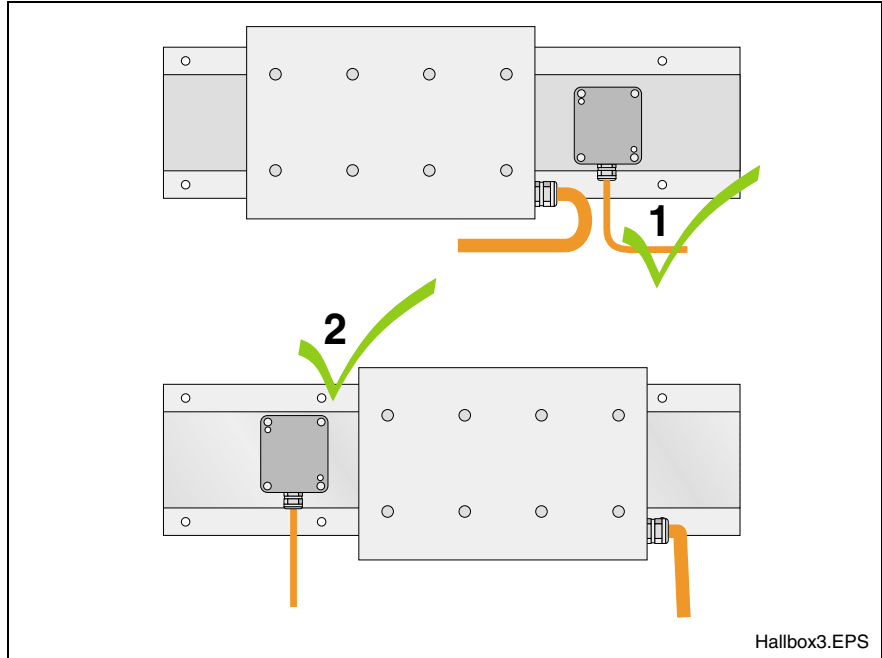


Fig. 3-2: Permitted arrangements

Forbidden arrangements

3. Hall sensor box SHL within mounting range, but cable fitting locations of sensor box and primary part are different.
4. Identical cable fitting locations of both sensor box and motor primary part LSP, but sensor box mounted out of mounting range.

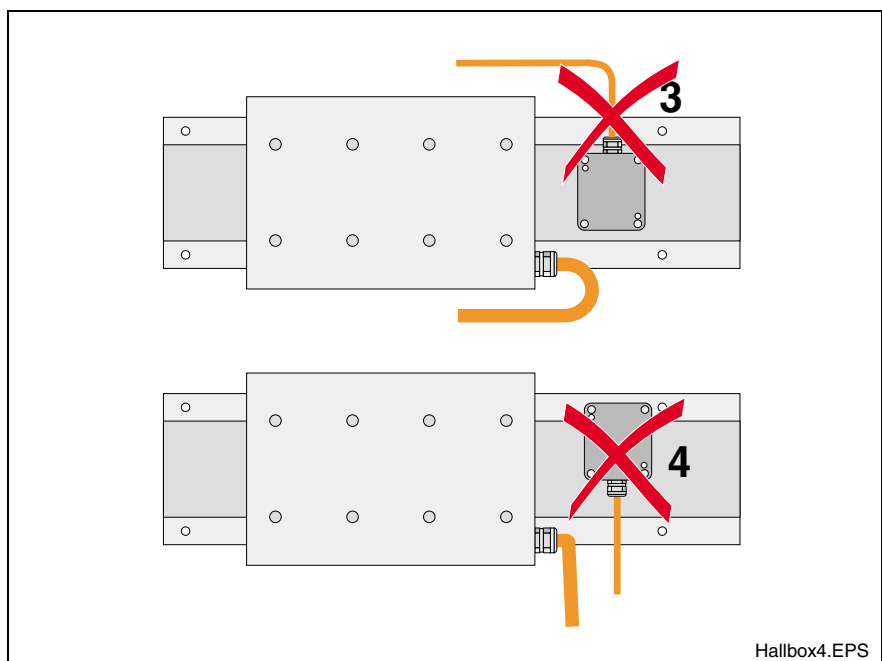
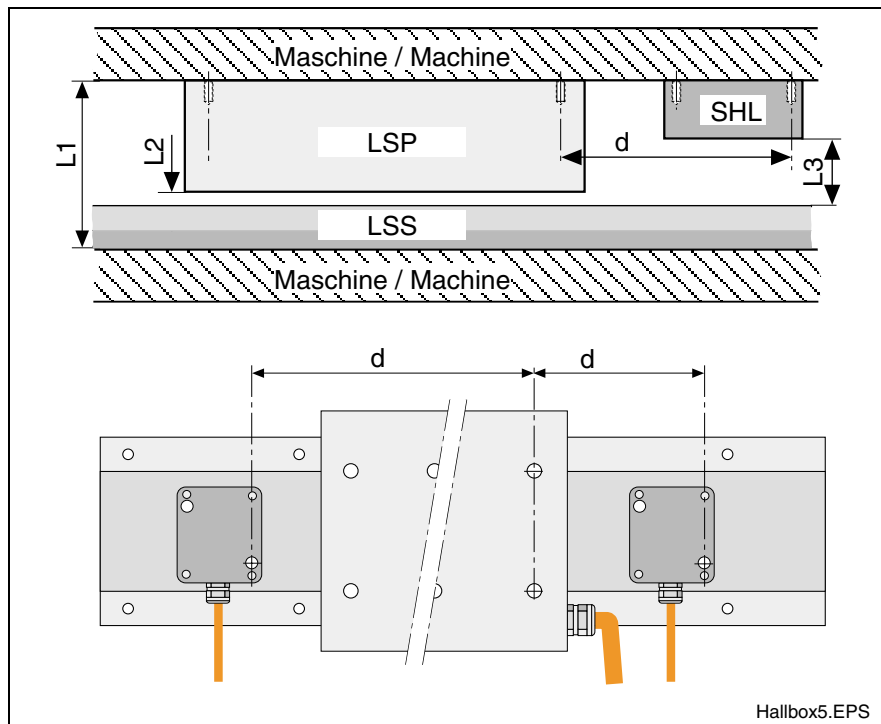


Fig. 3-3: Forbidden arrangements

3.2 Mounting position

The exact mounting position of the SHL sensor box is specified by several factors. These factors must be determined by the machine manufacturer individually for each installation.



L1:	Motor installation gap	LSP:	Primary part
L2:	Motor air gap	LSS:	Secondary part
L3:	Sensor box air gap	SHL:	Hall sensor box
d:	Mounting clearance		

Fig. 3-4: Mounting position SHL

General Notes

1. The sensor box air gap between sensor box SHL and secondary part LSS must be maintained at a fixed value to assure proper sensor output signals during operation. The specified clearance is

$$\mathbf{L3 = 12.4 \text{ mm} \pm 0.5 \text{ mm}}$$

2. Mounting clearance "d" always refers to boring holes as shown above. Sensor box housing dimensions are fixed. See dimensional drawing in previous chapter "Technical data" for details. For dimensions of LSP boring holes see LSF-documentation.
3. The final vertical mounting position of the sensor box is relative to motor installation gap **L1**, which depends on LSF motor type. For details about **L1** and **L2** refer to chap. 6 of LSF documentation DOK-MOTOR*-LSF*****-GN02-**-P.
English edition: Order with material no. 288895
German edition: Order with material no. 287981
4. In order to achieve the appropriate sensor gap **L3** it could turn out that the SHL box must be mounted either with additional spacers or a mounting pocket must be machined into the machine part.

5. The dimensional sheet gives information about the depth and diameter of tapped boring holes and fixture screws.
The M6 threads in the SHL housing are designed for a maximum screwing torque $M_A = 4.5 \text{ Nm}$.
Secure screws with screw lock (e.g. Loctite 243).
6. Mounting clearance "d" has influence on drive parameter **P-0-508** ("commutation offset"). Read following description of P-0-0508 prior to further action.

3.3 Drive parameter settings

P-0-0074 "Feedback type"

In order to enable compatibility to the hall sensor box SHL01.1, drive parameter P-0-0074 must be set to value "14".

If the drive firmware does not accept the setting of this value, then the drive system is not compatible to SHL01.1. See firmware documentation for details.

P-0-0508 "Commutation offset"

For synchronous linear motors this parameter builds a reference between the primary part's electrical field and the secondary part's magnetic field.

The effective value must always be re-determined, if

- there is a change in the motor's linear scale system or
- changes in the mechanical arrangement of primary and secondary parts are carried out.

The value of parameter P-0-0508 is set between 0 and 1024.

For more information on P-0-0508 and drive parametrization details see the corresponding documentation of drive controller and firmware.

Calculation of P-0-0508

The calculation of P-0-0508 requires several product specific constants:

Constant	Value	Note
Base value of P-0-0508	1024	Base value 1024 = 1 revolution of electrical field = 360°
Pole width L_P	37.5 mm	Distance between poles on secondary part. See motor type plate.
Calculation constant P_K	Depends on motor type.	See following list.

Fig. 3-5: Calculation constants

See following list of motor-specific values for constant P_K .

LSF standard type	P _K	Note
LSP040K-RU2-●N	713	
LSP040L-RU2-●N	542	
LSP080K-RU2-●●	627	Example 1 (next page)
LSP080L-RU2-●●	969	
LSP080M-RU2-●●	627	
LSP080N-RU2-●●	969	
LSP120K-RU2-●●	627	
LSP120L-RU2-●●	969	
LSP120M-RU2-●●	627	
LSP120N-RU2-●●	969	Example 2
LSP140L-RU2-●N	713	
LSP140N-RU2-●N	201	
LSP160K-RU2-●N	627	
LSP160L-RU2-●N	286	
LSP160M-RU2-●N	627	
LSP160N-RU2-●N	286	
LSP160K-RU2-●K	627	Option "...●K" no longer available
LSP160L-RU2-●K	969	
LSP160M-RU2-●K	627	
LSP160N-RU2-●K	969	
LSP200K-RU2-●N	627	
LSP200L-RU2-●N	286	
LSP200M-RU2-●N	627	
LSP200N-RU2-●N	286	
LSP200K-RU2-●K	627	Option "...●K" no longer available
LSP200L-RU2-●K	969	
LSP200M-RU2-●K	627	
LSP200N-RU2-●K	969	
LSP240K-RU2-●N	627	
LSP240L-RU2-●N	969	
LSP240M-RU2-●N	627	
LSP240N-RU2-●N	969	

...-●... : Part of type code not relevant for calculation of constant P_K

LSF thermo-encapsulated type	P _K	Note
LSP080S-RU2-●●	600	
LSP080T-RU2-●●	600	
LSP080U-RU2-●●	600	
LSP080V-RU2-●●	600	
LSP120S-RU2-●●	600	
LSP120T-RU2-●●	600	
LSP120U-RU2-●●	600	
LSP120V-RU2-●●	600	
LSP160S-RU2-●●	600	
LSP160T-RU2-●●	600	
LSP160U-RU2-●●	600	
LSP160V-RU2-●●	600	
LSP200S-RU2-●●	600	
LSP200T-RU2-●●	600	
LSP200U-RU2-●●	600	
LSP200V-RU2-●●	600	
LSP240S-RU2-●●	600	
LSP240T-RU2-●●	600	
LSP240U-RU2-●●	600	
LSP240V-RU2-●●	600	

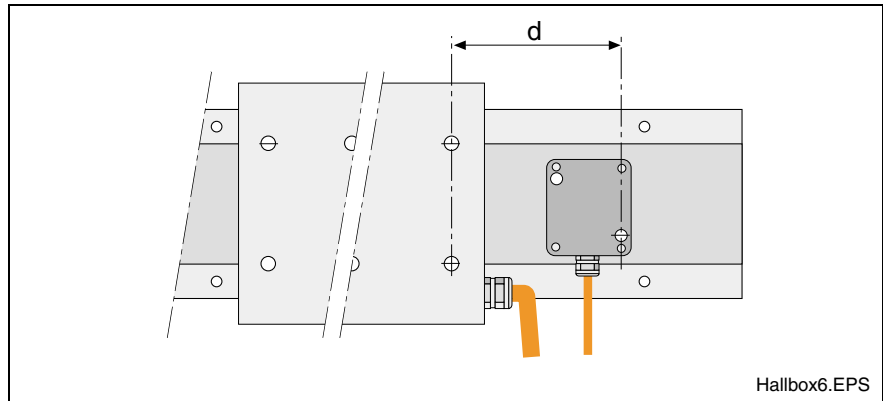
...-●... : Part of type code not relevant for calculation of constant P_K

Fig. 3-6: Calculation constants values



Option "...●K" is no longer available. But existing applications with LSF-motors of that type may still be retrofitted with the SHL box.

Example 1 A sensor box SHL is mounted on the **cable side** of a primary part LSP.



d: effective mounting clearance in the machine

Fig. 3-7: SHL mounting clearance (1)

$$P_{0508} = P_K - \frac{1024}{2 \cdot L_P} \cdot d$$

P_{0508} : Value for drive parameter P-0-0508
 P_K : Correcting constant (see chart above)
 L_P : Pole width of linear motor

Fig. 3-8: Parameter calculation (1)

- Example data**
- Primary part type LSP080K-RU2-●● from Fig. 3-6
 - mounting clearance $d = 146$ mm and pole width 37.5 mm

$$P_{0508} = 627 - [1024 / (2 \cdot 37.5 \text{ mm})] \cdot 146 \text{ mm}$$

$$P_{0508} = -1366.4$$

Parameter P-0-0508 must be set with a value between 0 and +1024 with no decimal place (standard rounding). If the calculation result is out of this range, you have to add or subtract 1024 as often as necessary to get in the appropriate value range.

$$P_{0508} = -1366.4 + 1024 + 1024$$

$$P_{0508} = 681.6$$

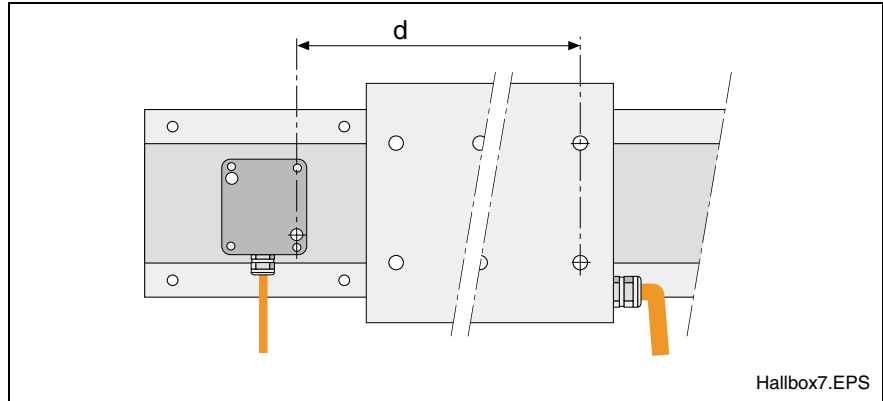
⇒ Final value for parameter **P-0-0508 = 682**

Note: For the mounting arrangement given in example 1 the calculation formula contains a **subtraction**.

Parameter P-0-0508 must be set within a range of 0 to 1024. Add or subtract 1024 as often as necessary to get in the appropriate range of value.

Decimal places cannot be programmed for parameter P-0-0508. Calculation results must be rounded to integral values.

Example 2 A sensor box is mounted on the **other side** of a primary part LSP.



d: effective mounting clearance given by machine design
 Fig. 3-9: SHL mounting clearance (2)

$$P_{0508} = P_K + \frac{1024}{2 \cdot L_P} \cdot d$$

P₀₅₀₈: Value for drive parameter P-0-0508
 P_K: Correcting constant (see chart above)
 L_P: Pole width of linear motor

Fig. 3-10: Parameter calculation (2)

- Example data**
- Primary part type LSP120N-RU2-●● from Fig. 3-6
 - mounting clearance d = 529.5 mm and pole width 37.5 mm

$$P_{0508} = 969 + [1024 / (2 \cdot 37.5 \text{ mm})] \cdot 529.5 \text{ mm}$$

$$P_{0508} = 8198.4$$

$$P_{0508} = 8198.4 - 1024 - 1024 - 1024 - 1024 - 1024 - 1024 - 1024 - 1024$$

$$P_{0508} = 6.4$$

⇒ Final value for parameter **P-0-0508 = 6**

Note: For the mounting arrangement given in example 2 the calculation formula contains an **addition**.
 Parameter P-0-0508 must be set within a range of 0 to 1024. Add or subtract 1024 as often as necessary to get in the appropriate range of value.
 Decimal places cannot be programmed for parameter P-0-0508. Calculation results must be rounded to integral values.

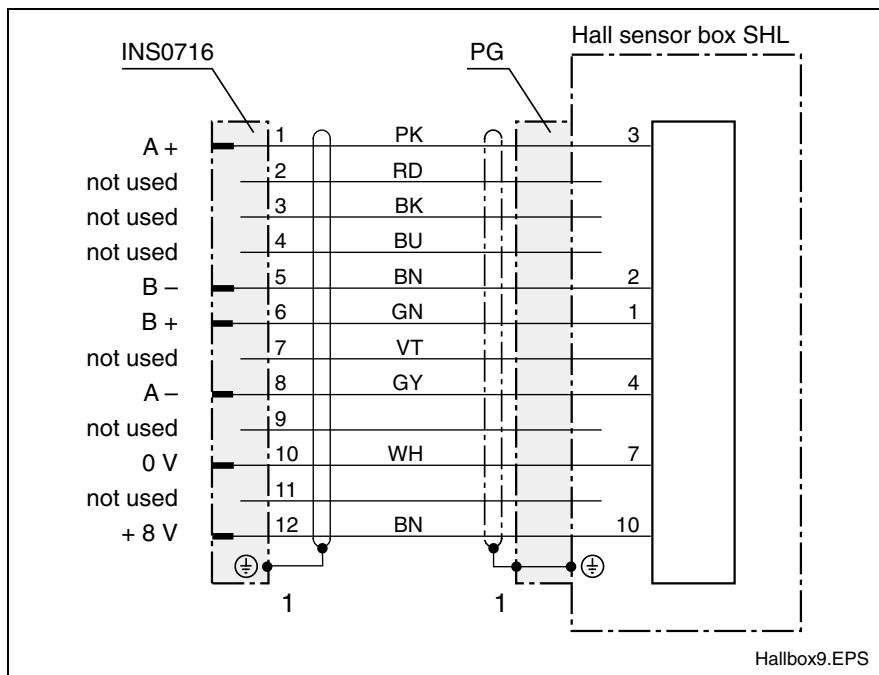
3.4 Compatibility

The hall sensor box SHL01.1 has limited compatibility and corresponds only with a small selection of drive system components.

List of compatible drive components (state at time of printing Sept. 2001)	
Drive controller	All types of series DKC01.3 - DKC02.3 - DKC03.3 - DKC04.3 - DKC05.3 - DKC06.3 - DKC11.3 - DKC21.3 with exception of controllers with 16 A rated current! All types of series HDC01.1
Firmware versions	FWA-DRIVE*-FGP-20VRS-MS FWA-DRIVE*-SGP-20VRS-MS FWA-DRIVE*-SMT-20VRS-MS FWA-ECODR3-FGP-02VRS-MS FWA-ECODR3-FGP-03VRS-MS FWA-ECODR3-SGP-03VRS-MS FWA-ECODR3-SMT-02VRS-MS

Fig. 3-11: Compatibility SHL 01.1

3.5 Electrical connection



1: Cable shield internally connected
Fig. 3-12: SHL electrical connection

Note: The SHL sensor box is delivered with 2 m cable length and a ready-made coupling INS0716.
Use standard encoder cable IKS4374 to connect the SHL cable to terminal X4 on drive controller DKC or HDC.

3.6 Output signal



The signal specifications given in this document section are only for general information.

The SHL hall sensor box is a plug-and-play device without any maintenance needs. Opening the sensor box housing may cause malfunction and in any case loss of warranty.

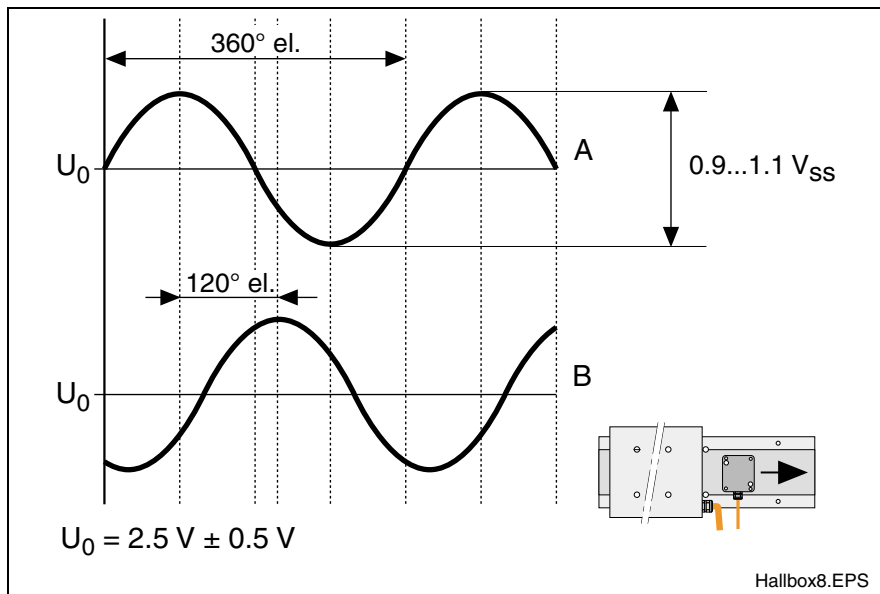


Fig. 3-13: SHL output signal

Note: The output signals A and B appear with the waveform shown only when the SHL sensor box and the primary part LSP move as shown above.

3.7 Type plate

A type plate sticker is fixed at one side of the SHL housing. A second type plate sticker comes with each SHL box to be attached to a remote position on the machine for easy access.

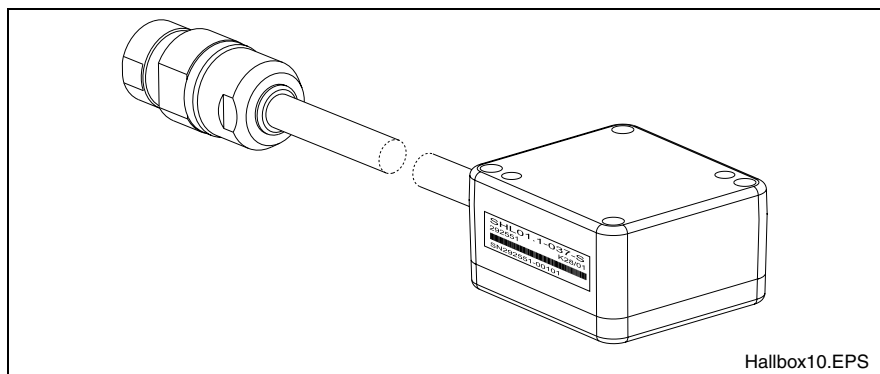


Abb. 3-14: SHL type plate

4 Service & Support

4.1 Helpdesk

Unser Kundendienst-Helpdesk im Hauptwerk Lohr am Main steht Ihnen mit Rat und Tat zur Seite. Sie erreichen uns

- telefonisch: **+49 (0) 9352 40 50 60**
über Service Call Entry Center Mo-Fr 07:00-18:00
- per Fax: **+49 (0) 9352 40 49 41**
- per e-Mail: **service@indramat.de**

Our service helpdesk at our headquarters in Lohr am Main, Germany can assist you in all kinds of inquiries. Contact us

- by phone: **+49 (0) 9352 40 50 60**
via Service Call Entry Center Mo-Fr 7:00 am - 6:00 pm
- by fax: **+49 (0) 9352 40 49 41**
- by e-mail: **service@indramat.de**

4.2 Service-Hotline

Außerhalb der Helpdesk-Zeiten ist der Service direkt ansprechbar unter

oder **+49 (0) 171 333 88 26**
+49 (0) 172 660 04 06

After helpdesk hours, contact our service department directly at

or **+49 (0) 171 333 88 26**
+49 (0) 172 660 04 06

4.3 Internet

Ergänzende Hinweise zu Service, Reparatur und Training sowie die **aktuellen** Adressen unserer Service- und Vertriebsbüros finden Sie unter **www.indramat.de** – einige Angaben in dieser Dokumentation können inzwischen überholt sein.

Außerhalb Deutschlands nehmen Sie bitte zuerst Kontakt mit Ihrem lokalen Ansprechpartner auf.

- Verkaufsniederlassungen
 Niederlassungen mit Kundendienst

Additional notes about service, repairs and training as well as the **actual** addresses of our sales- and service facilities are available on the Internet at **www.indramat.de** – some information in this documentation may meanwhile be obsolete.

Please contact the sales & service offices in your area first.

- sales agencies
 offices providing service

4.4 Vor der Kontaktaufnahme... - Before contacting us...

Wir können Ihnen schnell und effizient helfen wenn Sie folgende Informationen bereithalten:

1. detaillierte Beschreibung der Störung und der Umstände.
2. Angaben auf dem Typenschild der betreffenden Produkte, insbesondere Typenschlüssel und Seriennummern.
3. Tel./Faxnummern und e-Mail-Adresse, unter denen Sie für Rückfragen zu erreichen sind.

For quick and efficient help, please have the following information ready:

1. Detailed description of the failure and circumstances.
2. Information on the type plate of the affected products, especially type codes and serial numbers.
3. Your phone/fax numbers and e-mail address, so we can contact you in case of questions.

4.5 Kundenbetreuungsstellen - Sales & Service Facilities

Deutschland – Germany

vom Ausland:

(0) nach Landeskennziffer weglassen!

from abroad:

don't dial (0) after country code!

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