

Operating Manual

PacDrive™ SCL-055

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	<p style="text-align: center;">Manufacturer's declaration According to the EC machine guidelines 2006/42/EC</p>	<p style="text-align: center;">ELN 121-00/08.03 Page 1/1</p>
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The product we delivered:

PacDrive SCL-055

is intended for installation in a machine.

Commissioning is forbidden until it is established that the machine in which this product is to be installed complies with the provisions of the EC guideline. The manufacturer guarantees that the product delivered was manufactured in accordance with the applied harmonized standards / specifications.

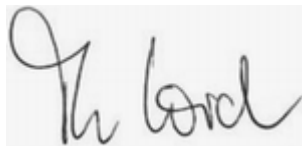
The following standards were applied:

- EN - 60204-1-(11/1998) Safety of machines - electrical equipment
- EN 50081-2 (3/1994) Electromagnetic compatibility. Generic emission standard
- EN 61000-6-2 (3/2000) Electromagnetic compatibility. Resistance to jamming

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1 About this manual

1.1 Introduction

Read this manual before you use the motor for the first time. Take particular note of the safety instructions. As described in section 2.4, only those persons who meet the selection and qualification of employees are allowed to work on this unit.

A copy of this manual must always be available for personnel who are entrusted to work on the motors.





This manual is designed to help you use the motor and its intended applications safely and properly.

Follow the instructions in this manual. Doing so helps avoid hazards, minimize repair costs and downtime, extend service life and increase reliability.


You must also observe the rules and regulations on accident prevention and environmental protection that apply in the country where the product is used and at the installation location.

1.2 Symbols, Designator and display format of safety notes

The safety notes in this manual are divided into various categories. The following table shows the hazard and possible consequences indicated by the symbol (pictogram) and the signal words.

Representation	Meaning
	General safety symbols: Safety instructions are presented at the relevant points. They are marked with this symbol.
 DANGER	Indicates an immediate hazardous situation that can lead to death or serious bodily injury if the safety regulations are not observed.
 WARNING	Indicates a potentially dangerous situation that may result in serious bodily harm or property damage if the safety instructions are not followed.
 CAUTION	Indicates a potentially dangerous situation that may result in minor bodily harm or property damage if the safety instructions are not followed.

The following symbols and designators are used in this document:

Representation	Meaning
NOTE	Information symbol: After this symbol, you will find instructions and useful tips on using the components.
	Information serving as an orientation aid regarding the section's contents follows this symbol.
Keyword	If the descriptive text contains technical terms (such as parameters), they are highlighted in bold.
<code>lBufSelect: AXIS_BUF_SELECTION; (* Buffer Auswahl *)</code>	Program code is written in a different font.
▪	First level bullet point
-	Second level bullet point.
▶	Activity symbol: The text after this symbol contains instructions. Follow them in sequence from top to bottom.
✓	Result symbol: The text after this symbol contains the result of an action.

2 General safety instructions

This section contains general requirements for safe work. Each person who uses or works on motors must read and follow these general safety notes. If activities involve residual risks, a specific note is made at the appropriate points. The note details the potential danger and describes preventative measures to avoid it.

2.1 Principle

The motors are state of the art and conform to recognized technical safety regulations. Nevertheless the use can present a hazard to life and limb or cause material damage, if:

- You do not use them as intended.
- Work on them is not performed by specialists or other trained personnel.
- You change or modify them inappropriately.
- You neglect to test the protective measures in use after the installation, commissioning or repair.
- You do not observe the safety notes and safety regulations.

The installation requires you to provide for appropriate safety devices in compliance with the local and national standards. Commissioning without appropriate safety devices is expressly forbidden.

Operate the motors only when they are in a flawless technical condition. Observe the regulations, act with safety and hazards in mind, and follow the instructions in this manual. In order for the motors to run perfectly and safely, they must be transported, stored, installed, and assembled correctly and serviced carefully.

If circumstances occur that impact safety or cause changes in the operating performance of motors, switch it off immediately and contact the responsible service staff. As a supplement to this description, please observe:

- The regulative, warning, and instruction signs as well as the warning instructions on the motors, the connected components, and all signs in the switching cabinet.
- The operating instructions of the other components.
- The generally applicable local and national safety and accident prevention regulations.
- The applicable laws and ordinances.

2.2 Selection and qualification of personnel

This description is geared exclusively toward technically qualified personnel, who have detailed knowledge in the field of automation technology. Only qualified personnel can recognize the importance of the safety instructions and implement them consistently.

The description is mainly for construction and application engineers from the engineering and electro-technics division as well as service and commissioning engineers.

Professional or training personnel

Work on the motor may only be carried out by qualified professional or by trained staff under the instruction and supervision of a qualified person in accordance with electrical regulations.

Qualified persons are only those persons who can perform the following tasks as a result of their training, knowledge, and experience:

- evaluate the transferred work,
- recognize possible hazards and
- take appropriate safety measures.

2.3 Proper use

The motor is intended to be installed in a machine or assembled with other components to form a machine or system. You may only use them in accordance with the installation and operating conditions described in the documentation. Use only the accessories and add-ons specified in the documentation. You may not use any third-party devices or components that are not expressly approved by ELAU.

The ELAU components must not be used in the following environments:

- In dangerous (explosive) atmospheres
- In mobile, movable or floating systems
- In life support systems
- In domestic appliances

The motor is part of the PacDrive System. The PacDrive System is the complete control system comprising of

- PacDrive Controller of C- or P-Series,
- PacDrive Servo amplifier MC-4 and
- PacDrive Motor

For proper use, you must also:

- Observe the operating instructions and other documents (see Appendix).
- Comply with the inspection and servicing instructions.

The operating conditions at the installation location must be checked and maintained in accordance with the required technical specifications (performance data and ambient conditions). Start-up is prohibited until it is guaranteed that the usable machine or system in which the motor is installed meets all requirements of the EC Directive 98/37/EC (machinery directive).

In addition, the following standards, directives and regulations are to be observed:

- DIN EN 60204 Safety of machinery: Electrical equipment of machines
- DIN EN 292 Part 1 and Part 2 Safety of machinery: Basic Concepts, General Principles for Design
- DIN EN 50178 Electronic equipment for use in power installations
- EMC directive 89/336/EEC : DINT

2.4 Residual Risks

Health risks arising from the motor have been reduced by means of safety technology and design engineering.

However a residual risk remains, since the motor works with electrical voltage and electrical currents.

Mounting and handling

WARNING

Risk of injury during handling!

Risk of bodily harm from crushing, shearing, cutting, and hitting!

- Observe the general construction and safety regulations for handling and installation.
- Use suitable installation and transport equipment correctly and use special tools if necessary.
- Prevent clamping and crushing by taking appropriate precautions.
- Wear suitable protective clothing (for example, safety goggles, safety boots, protective gloves).
- Do not stand under suspended loads.

Touching electrical parts

If parts have contact with voltages greater than 50 V, it can be a threat for personnel. When electrical devices are in operation, certain parts of these devices can necessarily carry dangerous voltages.

DANGER

High voltage!

Risk of death!

- Observe the general construction and safety regulations for working on high-current electrical systems.
- After installation, check the fixed connection of the ground conductor to all electrical units to ensure that connection complies with the connection diagram.
- Generally, and also for brief measurements and inspections, operation is only allowed using a fixed connection from the ground conductor to all electrical components.
- Disconnect the unit from the power supply before working on electrical parts with a voltage greater than 50 volts. Prevent the unit from being switched back on. Wait at least 5 minutes after shutting down before accessing the components. Check the voltage with a voltage meter before accessing the unit to be sure that the voltage is less than 50 volts.
- Do not touch the electrical connection points of the components when the unit is switched on.
- Before switching on the unit, safely cover the live components to prevent contact.
- The following provides protection against indirect contact (DIN EN 50178, Section 5.3.2).

High Leakage Current

⚠ DANGER

High leakage current! Risk of death!

- The leakage current is greater than 3.5 mA. This is why units require a fixed connection to the power supply network (in accordance to DIN EN 50178 - Equipping high-current electrical systems).

Touching hot surfaces



The housing temperature of the motor exceeds 70°C during nominal operation. As warning, the symbol shown here is affixed on the motor.

Dangerous Movements

There are several causes for hazardous activities:

- Wiring or cabling errors
- Software errors
- Module error in the components
- Error in the measured value and signal transmitter
- Operation error

Protection of personnel must be ensured via higher-level, line-side monitoring. Do not only rely on the internal monitoring of the drives components. Monitoring or other arrangements depend on the specific conditions of the installation and have to be done by the system manufacturer, according to the danger and error analysis. The safety regulations for the installation are included. Under no circumstances must the technical safety devices be removed. Do not make any modifications to a safety device that may put it out of operation. Protect existing work stations against unauthorized operation. Effectively restrict access to the control terminals to allow access only to authorized persons.

⚠ DANGER

Dangerous Movements!

Risk of death, serious injury or property damage!

- Prevent entry to a danger zone, for example with protective fencing, mesh guards, protective coverings, or light barriers.
- Ensure the protective devices are properly dimensioned.
- The EMERGENCY OFF switch must be located very close to the operator. The functionality of EMERGENCY OFF equipment should be checked before start-up and during maintenance periods.
- Prevent unintentional start-ups by disconnecting the power connection of the drive using the EMERGENCY OFF circuit or using a secure start-up lock out.
- Before accessing or entering the danger zone, safely bring the drives to a stop.
- While working on the system, de-energize the electrical equipment using the main switch and prevent it from being switched back on.
- Avoid operating high-frequency, remote control, and radio devices close to the unit and system electronics and their feed lines. If the use of such devices cannot be avoided, the system and the installation must be checked for possible malfunctions in all usage scenarios prior to the initial start-up. Where applicable, it is necessary to carry out a special EMC check of the system.

"Safe separated extra-low voltage"

PELV Protective Extra-Low Voltage

The signal voltage and control voltage of the PacDrive™ devices are <33 Volts. In this range and in accordance with IEC 60364-4-41, the specification as PELV system contains a protective measure to guard against direct and indirect contact with dangerous voltage through "safe separation" of the primary and secondary side in the system/machine. ELAU strongly recommends providing the system/machine with safe isolation.

⚠ DANGER

High voltage due to incorrect connection!

Risk of death or serious injury!

- Please ensure that only devices, electrical components or lines that have a sufficient, safe electrical separation from the connected circuits in accordance with the standards (EN 50178 / 1998 edition - Electronic equipment for use in power stations) are connected to the signal voltage connectors of this component.
- Ensure that the existing electrical separation is maintained throughout the entire circuit.

FELV Functional Extra-Low Voltage

When using ELAU components in systems that do not have safe separation as a protective measure against direct or indirect contact of dangerous voltages, all connections and contacts (e.g. PacDrive controller, Sub-D connector, serial interface) that do not meet the protection class IP2X require a permanent cover. The cover or the device connection of the connected device must be designed so that it can only be removed by using a tool. The protective measures have to be adhered on all connected devices.

Protection against magnetic and electromagnetic fields

Magnetic and electromagnetic fields that are in immediate environments of electrical conductors and permanent motor magnets represent a serious health hazard to persons with heart pacemakers, metal implants and hearing aids.

⚠ WARNING

Health risk posed by risk groups in the proximity of electrical equipment.

Do not allow personnel with pacemakers or similar sensitive implants to work on motors!

3 Overview

3.1 PacDrive System

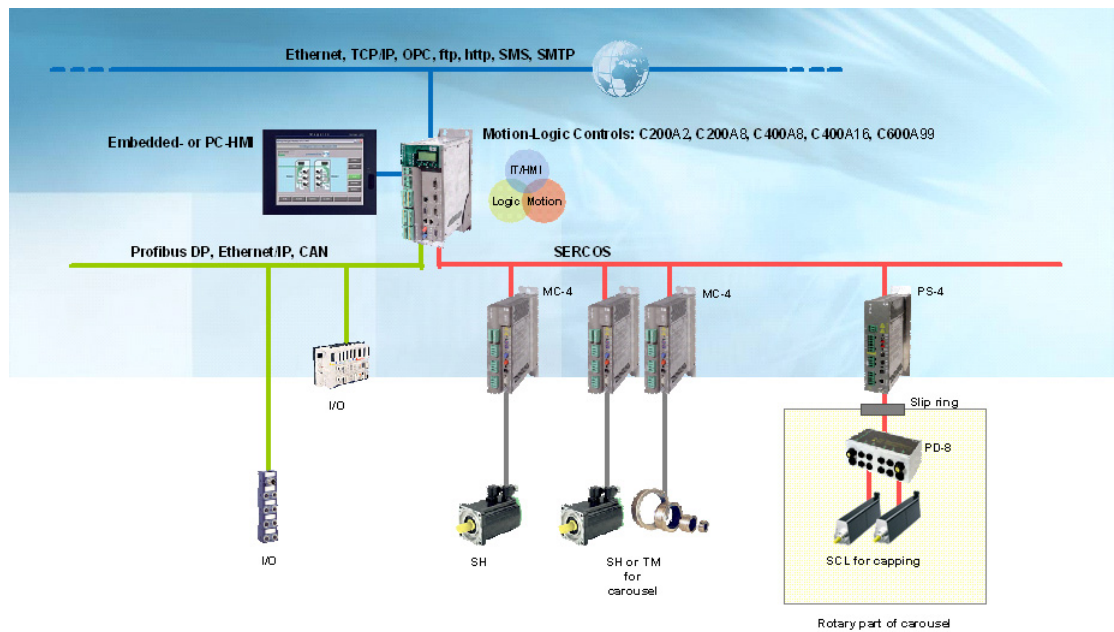


Figure 3-1: PacDrive System Overview

PacDrive controller family



The PacDrive controller, microprocessor-based control hardware with the VxWorks real-time operating system, centrally implements the PLC and motion functions. A PacDrive controller synchronizes, coordinates, and creates the motion functions for maximum

- 8 drives for the PacDrive controller C200
- 2 drives for the PacDrive controller C200 A2
- 16 drives for the PacDrive controller C400
- 8 drives for the PacDrive controller C400 A8
- 99 drives for the PacDrive controller MAX-4 / 99
- 99 drives for the PacDrive controller C600

of a food and packaging machine.

Different standard HMIs are used for the HMI tasks. Whether it is low cost, plain text or IPC, it is no problem for the flexible PacDrive controllers.

The PacDrive P600 controller is additionally equipped with a full-fledged PC. Due to its PC-based architecture, it can perform HMI tasks with no problem in addition to the usual motion functions.

PacDrive PS-4



The power supply unit PS-4 is characterized by a compact and autonomous structure for swapping housing installations with highly modern technology. All PacDrive SCLs are supplied power only through one connection via PacDrive PS-4, which can be installed quickly.

The highlights:

- 1 or 3 phase power supply
- Integrated network filter and bleeder
- 5 kW rated current / 10 kW peak current
- Direct current for up to 32 SCL-055
- Comprehensive diagnosis possibilities

PacDrive PD-8



The PacDrive PD-8 represents the combination of PS-4 and SCL-055. A distributor to the 1 to 8 SCL-055 can be connected. If more than 8 drives are to be operated, it can be easily expanded with one or more PD-8 distributors.

The highlights:

- 1 to 8 connections to the SCL-055
- Easily expandable
- Aseptic variants available

PacDrive SCL



The innovative SCL combines motor, final stages and the digital servo regulator for one axis in a space-saving housing. Its compact size combines motor and power electronics in the smallest space. It is excellent for decentral installations. The SCL is available with single or multi-turn encoders and configures itself with the help of the electronic type plate in the SCL itself.

The highlights:

- Integrated SERCOS interface
- High-resolution single or multi-turn encoder
- IP 65 / IP 67 protection class
- Superior reliability
- Trapezoid shape
- Aseptic variants IP67 (with positive pressure)
- Stainless steel housing

4 Indicators, control elements and diagnosis

The PacDrive™ system supports the user with its comprehensive diagnostic system.

The diagnostic messages can be read out with the Automation Toolkit **EPAS-4**. A PacDrive controller can be the field bus master or the slave.

Diagnostic messages are usually displayed by a control panel on the machine.

If an "error" occurs, read the message on this unit and then contact the machine manufacturer.

NOTE

You can find detailed diagnosis information in the Online Help of the Automation Toolkit **EPAS-4**.

4.1 Indicators and control elements

The PacDrive SCL is equipped with diagnostic LEDs for on-location diagnostics.

After removing the SERCOS address switch dust cap, an initial diagnosis is possible directly on the PacDrive SCL with the help of the LED's.

Green diagnostic LED

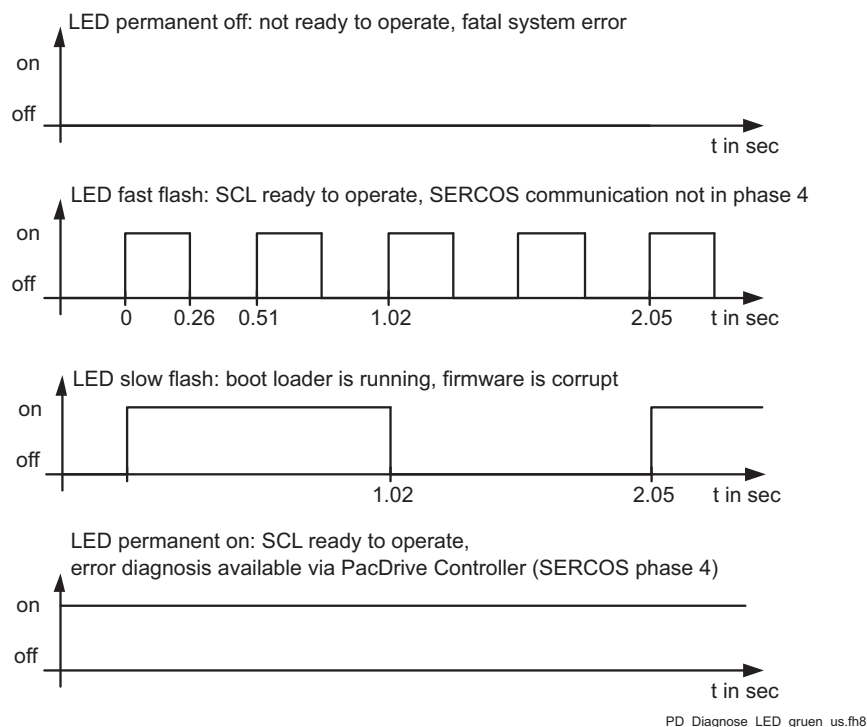


Figure 4-1: Status indicator of green diagnosis LED on SCL

Red diagnostic LED

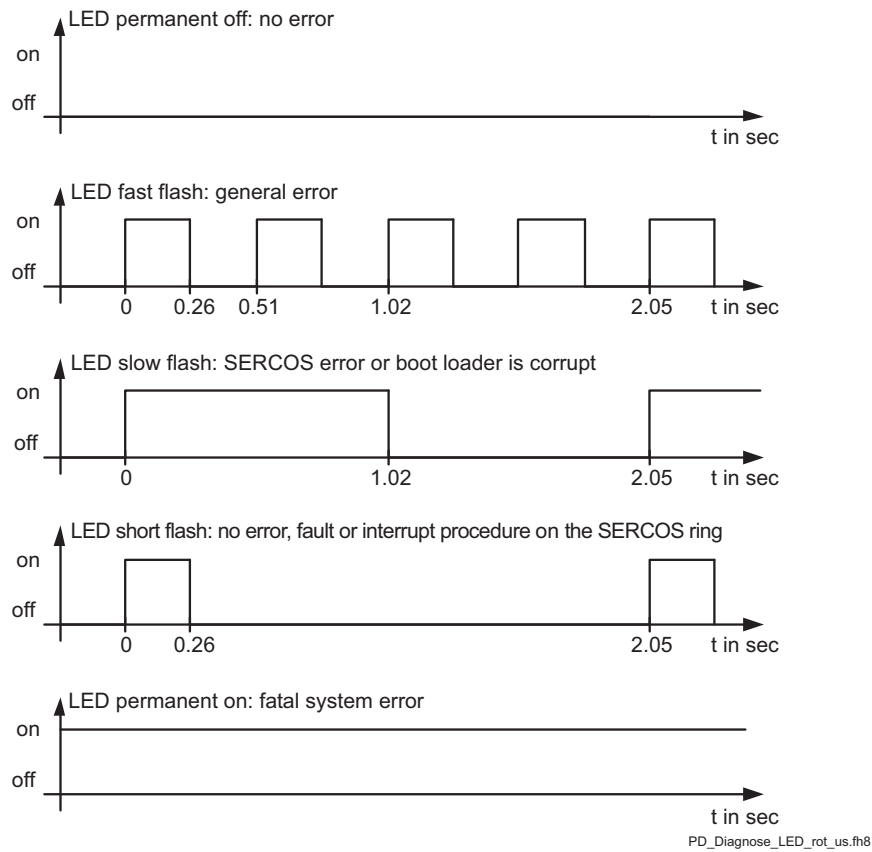


Figure 4-2: Status indicator of red diagnosis LED on SCL

SERCOS-Address Rotary Switch

With the S1 and S2 rotary switches you can set the SERCOS address (0 - 99) of the device; on Switch S1 the tens digits and on Switch S2 the units digits.

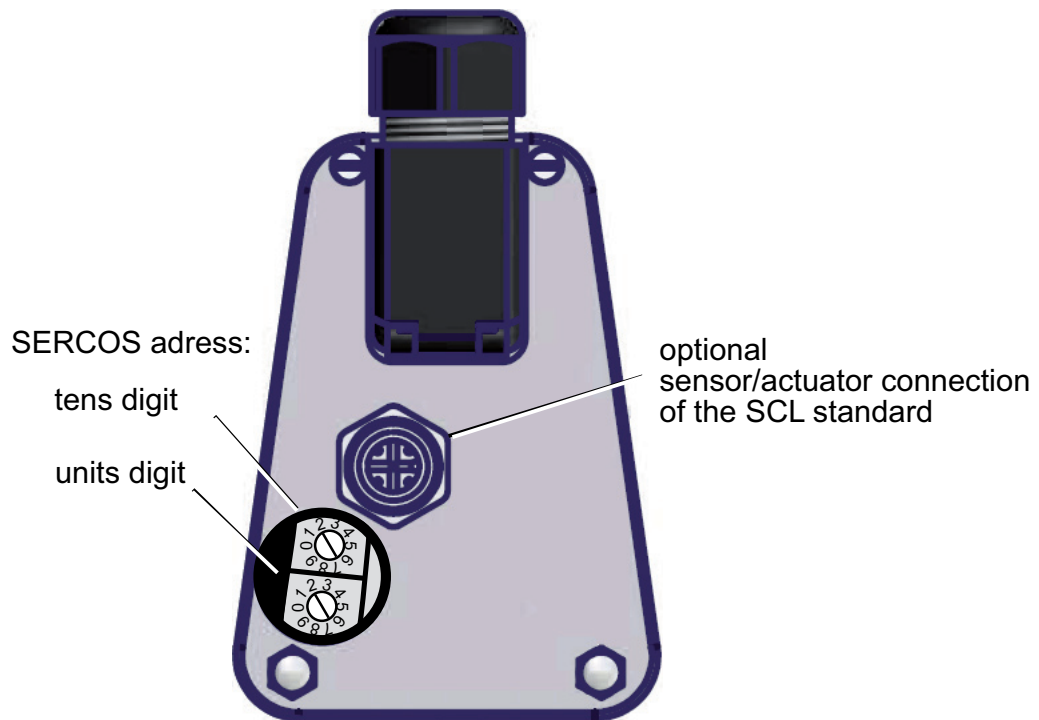


Figure 4-3: Rotary switch to set the SERCOS address

4.2 Example of a diagnostic message

The diagnostic message 121 "braking resistor temperature too high" is displayed.

Meaning of this:

- Class 2 error
- Diagnostic code 121

The meaning of the diagnostic code is more thoroughly explained in the online help section of the EPAS-4 automation toolkit.

121 braking resistor temperature too high

Diagnosis class (standard): 2

Reaction: B

The braking resistor is overloaded.

- The drive has incorrect dimensions.
 - ▶ Check drive sizing.
- Hardware error: The braking resistor or addressing is defective.
 - ▶ Contact ELAU customer service.

5 Transport, storage, unpacking

5.1 Transport

- Avoid heavy shocks and/or vibrations during transport.
- Check the units for visible transport damage and inform the shipping company immediately if necessary.

5.2 Storage

- Store devices in a clean, dry room.
- The air temperature at the storage location must be between - 25 °C and + 70 °C.
- Possible temperature variations at the storage location must be maximum 30 K per hour.

5.3 Unpacking

- Remove packaging.
- Check delivery for completeness.
- Check all units for transport damage.

5.4 Type plate

The type plate contains all important information:

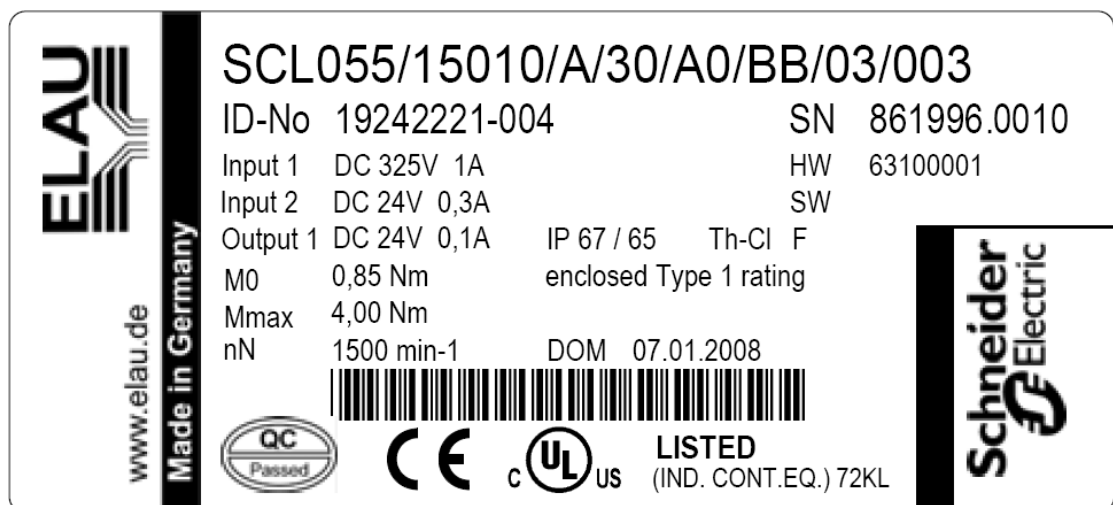


Figure 5-1: Type plate of the PacDrive SCL 15010

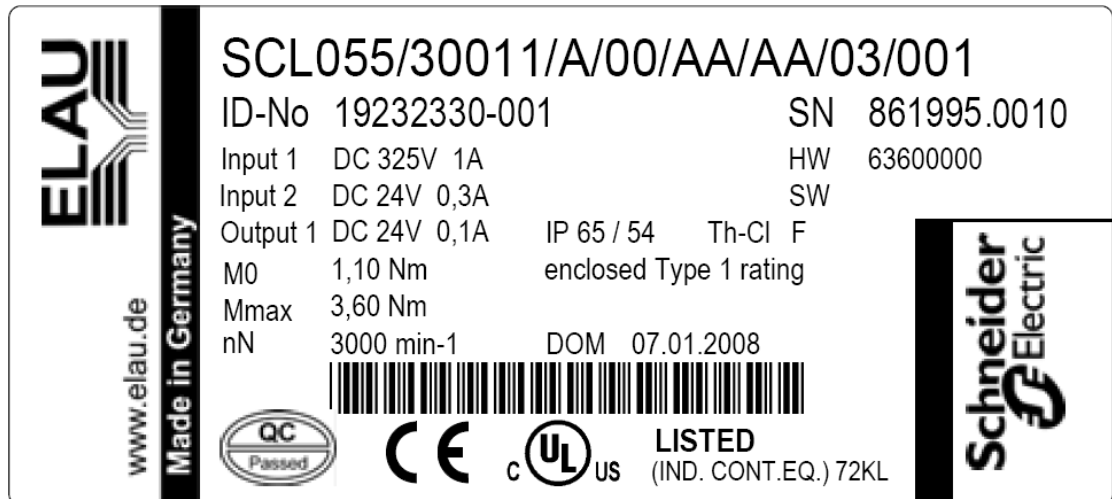


Figure 5-2: Type plate of the PacDrive SCL 30011

NOTE

The ready-made hybrid cable is already attached to the drive at the factory. (Order for each SCL-055!)

Check drive sizing.	Meaning
SCL055/30011/A/00/AA/AA/03/001	Device type, see type key
ID no.	Item no.
SN	Serial number
Input 1	Rated voltage and rated current of the power unit
Input 2	Rated voltage and rated current of the electronics
HW	Hardware version
SW	Software version
IP	Protection class
Th-CI	Insulation material class of the motor
M0	Dead-time torque
Mmax	Peak torque
nN	Nominal speed
DOM	Date of manufacture

Table 5-1: Explanation of the type plate

6 Installation and maintenance

We strongly recommend that you contact ELAU personnel for the initial start-up. This is not only for guarantee reasons, but also that:

- The equipment will be checked,
- The optimal configuration recorded and
- Operating staff can be instructed.

6.1 First Installation

This is how you proceed with the commissioning:

- Testing*
- ▶ Check device for sound condition.
Only operate undamaged devices.
 - ▶ Check data against type plates.

Refer also to chapter Packaging and Device Replacement.

High Leakage Current

DANGER

High leakage current! Risk of death!

- The leakage current is greater than 3.5 mA. This is why units require a fixed connection to the power supply network (in accordance to DIN EN 50178 - Equipping high-current electrical systems).

- SERCOS address*
- ▶ Remove the protective cap from the SERCOS address switch on the SCL.
 - ▶ Using an appropriate tool, on the back of the motor, set the specified SERCOS address (0-99) of the node according to the machine diagram.

NOTE

Be extremely careful not to assign an address more than once in a SERCOS ring. Each drive must have its own unique SERCOS address.

- ▶ Tighten dust cap and check that it is tight.

You receive the PacDrive SCL with prepackaged cable already attached on the motor side. Connect the cable to the PacDrive PD-8 as follows:

- Installation*
- ▶ Observe requirements for the installation location.
 - ▶ Observe requirements for the protection class and the EMC rules.
 - ▶ Install device.

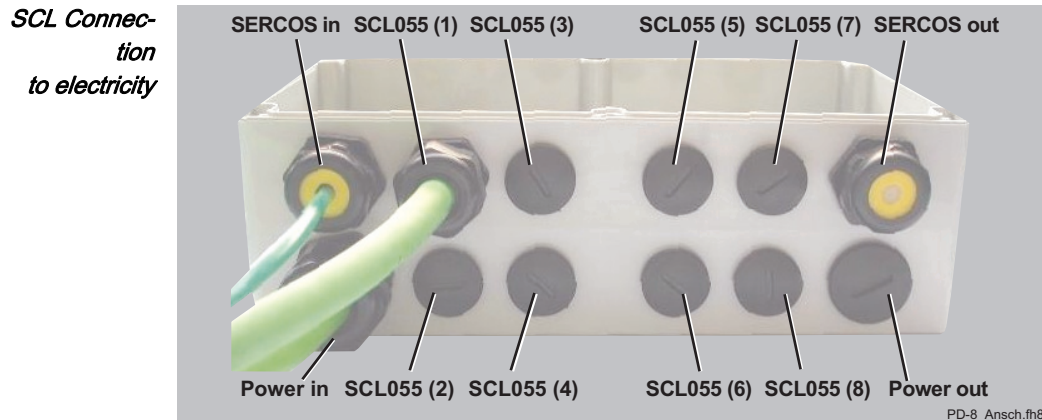


Figure 6-1: PD-8 cable glands

- ▶ Remove dust cap of cable gland on the PD-8.
- ▶ Push the cable of the first/next SCL-055 through the SCL-055 (1-8) opening. (For SCL-055 (1) connection, begin in ascending order up to SCL-055 (8). Observe sequence!)

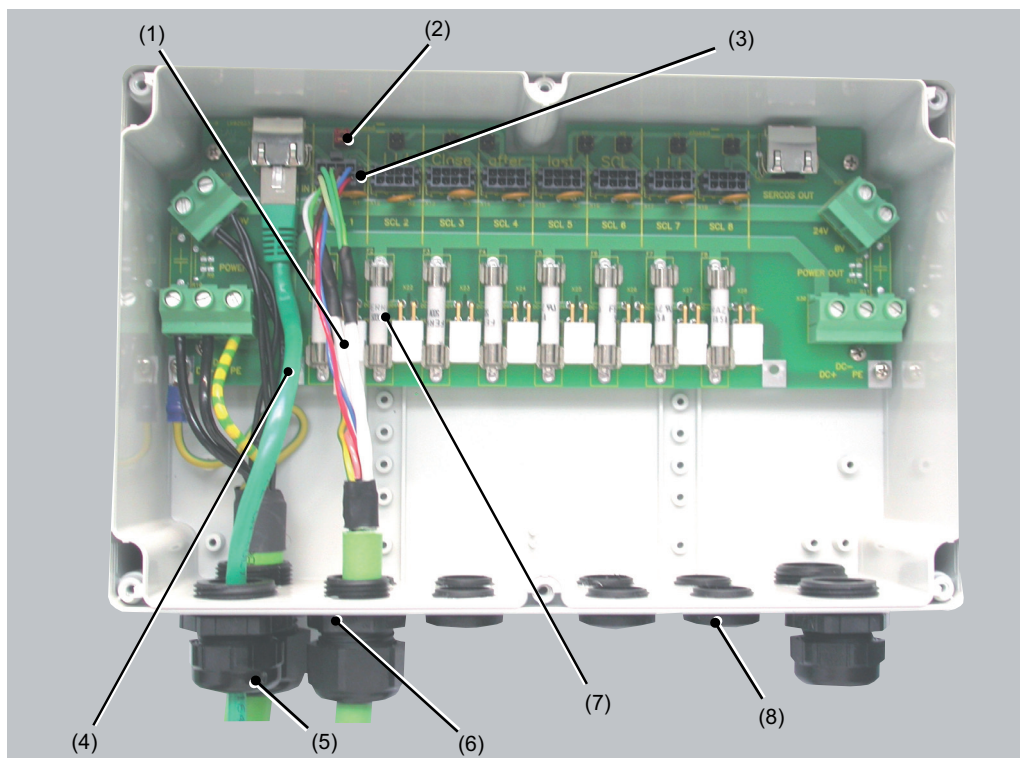


Figure 6-2: Connection of the SCL-055 to the PacDrive PD-8

(1)	Power supply
(2)	Jumper for scheduling
(3)	SERCOS connector (SCL)
(4)	SERCOS cable
(5)	Cap nut
(6)	Cable gland
(7)	Fuse

(8)	Dummy plug
-----	------------

- ▶ Connect power supply plug.
- ▶ Insert SERCOS connection plug into the SERCOS.
- ▶ If another SCL-055 is connected, repeat steps under "Connect to electricity" until all drives are connected as described.
- ▶ If no other SCL-055 is connected, terminate connection by inserting the two jumpers onto the plug-in bridge.

NOTE

The two jumpers (for termination) must be plugged-in at the "closed" position at the last PacDrive SCL-055 port via the SERCOS connecting plug, even if several PD-8 are used. This closes the SERCOS Ring, refer also to chapter Technical Data.

Information on the PacDrive PD-8 connection to the PacDrive PS-4 is available in the operating manual for "PacDrive PS-4 and PacDrive PD-8".

- Check safety functions & continue commissioning*
- ▶ Check safety functions such as EMERGENCY OFF end switch.
 - ▶ Resume system operation according to the operating manual (from the packaging machine manufacturer and servo amplifier).

6.1.1 The PacDrive SCL-055 with the "positive pressure" option

Operating a PacDrive SCL-055 in the aseptic area demands high requirements for protection against leaking fluids. The implementation of housing parts and screwed cable glands in compliance with IP67 is not adequate in many cases because this protection type only ensures that when immersing for minimum 30 minutes, no damaging quantity of water penetrates into the device.

However in practice, various fluids with creeping properties different from water are used. In addition, during the IP protection type test, it is not considered that there is high pressure in the housing due to the drive heating and low pressure during cooling, which favors the penetration of liquids.

- Positive pressure*
- Continuous protection against the penetration of liquids and gases is achieved when the housing is held under a slight overpressure with positive pressure. The compressed air must be dry and free of dust and oil. The air consumption is negligible since the system is closed.

Properties	Value	Comment
Pressure	0.1...0.3 bar	recommended
Pressure	0.4 bar	max.
Operating conditions	Dust-free	using suitable micro filters
Operating conditions	Oil-free	using appropriate oil separators
Relative humidity	20...30 %	

Table 6-1: Operating conditions for the usage of positive pressure

- Positive pressure connection*
- Positive pressure is supplied to the SCL-055 through a pneumatic hose in the hybrid cable.

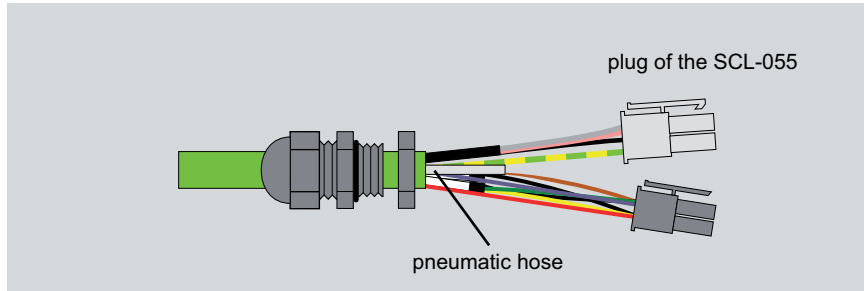


Figure 6-3: Hybrid connection cable with pneumatic hose

The distribution terminal is impinged with positive pressure. The high pressure automatically reaches the housing of all SCL drives that are connected to this distribution terminal via the open ends of the pneumatic hoses.

NOTE

The standard model of the PD -8 with plastic housing is not suitable for positive pressure. A **Power Distribution Box** variant made of stainless steel with pneumatic coupling for the compressed air supply is available on request under the Item No. 13130259-002. Order numbers of the individual components are given in the chapter Order Numbers.

6.1.2 Nodes in the SERCOS-Ring

Sequence of SERCOS nodes

All nodes in the SERCOS ring are connected with each other via the distribution box PacDrive PD-8. However, the physical sequence of SERCOS nodes in the ring is reversed like the numbering of the cable glands on the PacDrive PD-8. For example, if you have a PacDrive Controller MAx-4, one PacDrive PS-4 and four SCL-055 motors, the counting is as follows:

In all you get six nodes:

- First node -> last SCL-055 (fourth SCL-055)
- Second node -> third SCL-055
- ...
- Fifth node -> PacDrive PS-4
- Sixth node -> PacDrive Controller MAx-4

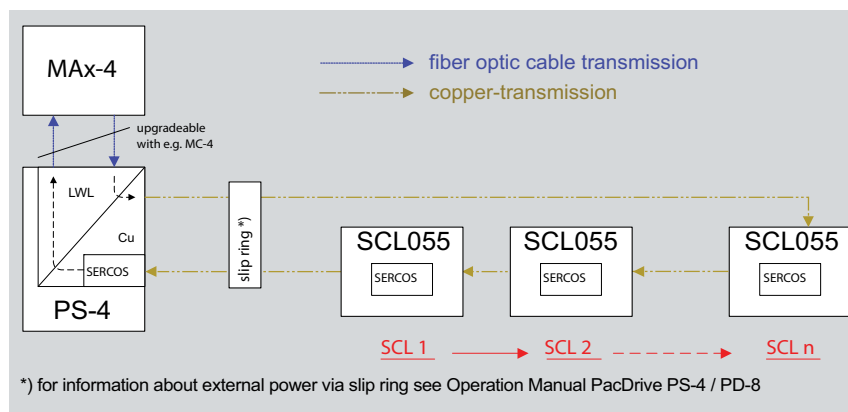


Figure 6-4: Signal transmission and numbering of SERCOS nodes

Change the number of nodes in the SERCOS ring

If the number of SERCOS nodes changes, you must carry out the termination as described for the PacDrive SCL-055 according to the chapter Commissioning.

NOTE

During commissioning, if certain circumstances result in a temporary change in the number of nodes, you need not remove all the cabled PacDrive SCL-055 again. Proceed as in the example below.

Example 24 SCL-055 motors are running on your system (already fully cabled). For test purposes, you want to reduce the number of slaves to 10 motors.

Proceed as follows:

- ▶ Remove the plug of the 11th SERCOS connection (this corresponds to the connection (3) of the second PacDrive PD-8 Box). This ensures that the physical connection to the subsequent SERCOS node is broken. Connect the power supply plug.
- ▶ Terminate the 10th SCL-055 motor by inserting the jumper.
- ▶ Remove the plug of the SERCOS connection from the SERCOS port that leads to the subsequent PacDrive PD-8 box.
- ▶ With that you have reduced the SERCOS ring to 10 motors.

NOTE

It is not enough to place the jumpers at the desired terminations; even no slave should be inserted on the next SERCOS plug-in slot!

6.2 Configuration and Calibration

The PacDrive™ system is adapted to your task using the EPAS-4 automation toolkit.

The system will be configured and programmed according to IEC 61131-3 in EPAS-4.

⚠ CAUTION**Complex functionality of the PacDrive™ system and the machine!**

Property damage possible!

- Program changes may only be carried out by trained personnel with detailed knowledge of the system. In other words, changes may only be carried out by your machine supplier or by ELAU employees. ELAU AG is not liable for damages caused by unauthorized program changes.

6.3 EMC Rules

To control and regulate the motors, the mains voltage is stored by rectification in the DC link of the servo amplifier. This stored energy is supplied to the motor by a targeted switching on and off using six semiconductor switches. The steep increase/decrease in voltage places considerable demands on the dielectric strength of the motor winding. An important additional aspect to observe is the **electromagnetic compatibility (EMC)** with other system components. The high rate of change of the clocked voltage generates harmonics of great intensity up into the high frequency range.

⚠ CAUTION**Electromagnetic fields!**

A interference or breakdown of the system possible!

- Observe the following rules during installation to eliminate excessive interference effects and their consequences as much as possible.
- During installation, select the earthing option with the lowest resistance for high frequency operation (e.g. unpainted sub plate in switch cabinet).
- Ensure largest contact surface area possible (skin effect). This ensures that the physical connection to the subsequent SERCOS nodes is broken.
- Lay the grounding in a star configuration from the central earthing point to the corresponding connections. Current loops of earthing are prohibited and can cause unnecessary interference.
- Use shielded cable only.
- Ensure large shielding transitions. (Connecting shielding via PIN contacts of plug-in connectors is not permitted.)
- It is necessary to observe the circuit suggestions.
- Shorten motor cable to minimum length.
- Do not lay any cable loops in the switching cabinet.
- In conjunction with electronic controllers, no inductive loads may be switched without suitable fault clearance.
- Appropriate interference suppression is achieved during direct current operation by using recovery diodes and by using protector type-based, industry-standard quenching circuits during alternating current activity.
- Only a fault clearance element placed directly at the inductivity serves the purpose. In some cases even more interference may be generated by the shock of the switching current on the interference suppression lines. It is far easier to avoid the source of interference than to eliminate the effects of existing interference.
- Contacts that do not switch suppressed inductive loads should never be arranged in a room with ELAU PacDrive components. The same applies for connection lines that do not lead suppressed, switched inductances and lines that run parallel to them. The controller must be separated from such "interferers" using a Faraday cage (own switch cabinet section).
- Mains filters and motor filters may be used depending on the combination of the servo amplifier/motor and the cable length. Delete files on the flash disk using an FTP client.
Mains filters and motor filters may be used depending on the combination of the servo amplifier/motor and the cable length. Delete files on the flash disk using an FTP client.

6.4 Maintenance, Repair, Cleaning

Quick detection and correction of faults during machine downtime help keep production downtime to a minimum.

The diagnosis messages of the PacDrive system, which can be queried using the Automation Toolkit EPAS, allow specific and effective fault location.

In the event of a breakdown it is possible to smoothly replace defective components to guarantee that the fault is quickly eliminated and operation can be resumed. These jobs may only be carried out by qualified maintenance personnel.

When returning a defective unit to the ELAU customer services, we request that you fill out the fault report in the appendix.

NOTE

To avoid damage in transport and to guarantee that the repair process goes smoothly, follow the method outlined in the chapter on "Device Replacement".

Cleaning

The standard cooling method of the motor is by natural convection. Therefore, keep the motor surfaces free from dirt build-up.

⚠ CAUTION**Improper cleaning****Property damage possible!**

- Program changes may only be carried out by trained personnel with in-depth knowledge of the system.
- Use cleaning processes appropriate to the protection class of the motor.

6.5 Spare Parts

Spares inventory

Keeping a stock of the most important components is an important prerequisite for equipment to function constantly and be ready for operation at all times.

NOTE

Note device compatibility.

Devices may only be replaced by devices with the same hardware configuration and software version.

Indicate the following information on the spare part order:

Item name:	e. g. PacDrive SCL-055:
Item no.:	e.g. SCL055/30011/A/00/AA/AA/03/001
Hardware code:	not specified
Software version:	not specified

You will find this information on the type plate and in the controller configuration of the PacDrive System.

6.6 Order numbers

Servo Drive SCL - Type code

SCL055 / 30 011 / A / 00 / AA / AA / 03 / 001

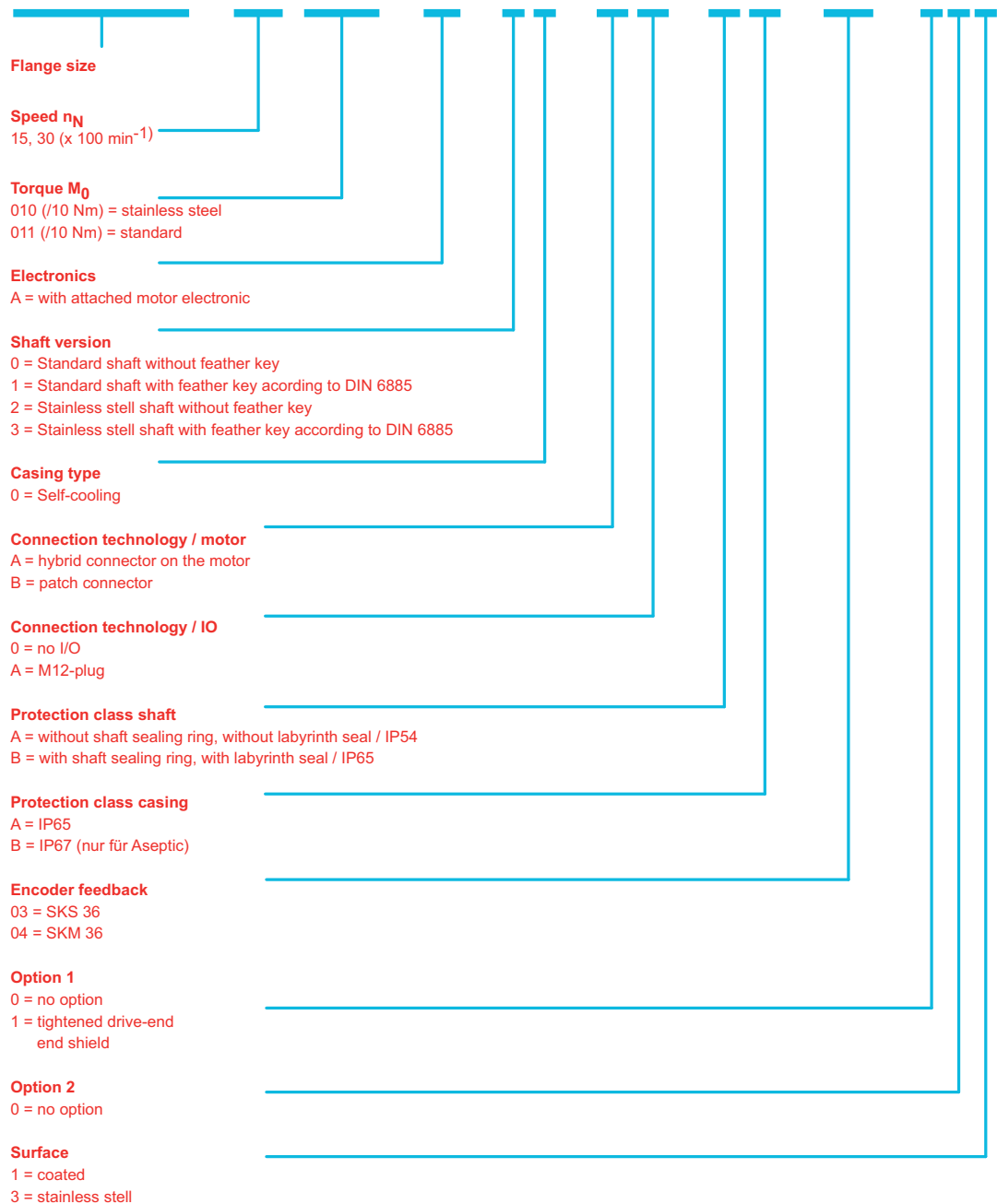


Figure 6-5: Type code legend of the PacDrive SCL

NOTE

The type key is only to translate the motor identification with its codes in plain text and vice versa. Never randomly combine the given options with each other because several options exclude each other. The combinations that are possible depend on the technical circumstances.

Order number	Item name:	Explanations
19 23 23 30-001	SCL055/30011/A/00/AA/AA/03/001	Standard shaft without feather key
19 23 23 30-010	SCL055/30011/A/10/BA/AA/03/001	Standard shaft with feather key, connector
19 24 22 21-004	SCL055/15010/A/30/A0/BB/03/003	Stainless steel shaft with feather key
19 24 22 21-008	SCL055/15010/A/30/A0/BB/04/003	Stainless steel shaft with feather key, multiturn

Table 6-2: Order numbers PacDrive SCL

Connection cable

Order number	Item name:	Explanations
15 15 45 01 - XXX	E-MO-101*)	Connection PD-8/SCL, standard, SCL angle connection 90°
15 15 45 03 - XXX	E-MO-103*)	Connection PD-8/SCL, standard, SCL connection straight)
15 15 45 05 - XXX	E-MO-105*)	Connection PD-8/SCL, stainless steel model, SCL connection straight
15 15 45 07 - XXX	E-MO-106*)	Connection PD-8/SCL, standard, SCL connection plug

*) Cable lengths up to 2 m in steps of 10 cm; cable lengths up to 5 m in steps of 50 cm

Table 6-3: Order numbers for connection cables

⚠ CAUTION**Observe bending radius for SCL hybrid cables!**

Potential cable damage.

- For fixed installed cables, do not exceed a bending radius of 5 times the cable diameter.
- For flexible cables, do not exceed a bending radius of 12 times the cable diameter.

SERCOS-Cable

Order number	Item name:	Explanations
KA 99 037 - XXX*)	Patch Cable Category 7	RJ45 Patch cable (Cat 7 / XXX dm)

*) Cable length in decimeter. Available lengths in decimeter: 005; 010; 020; 030; 050; 100; 150; 200
50 m total length of PS-4 up to last PD-8/PD-4 allowed only with following hardware codes. Otherwise only max. 20m total length!

- PacDrive PS-4 from hardware code E02020
- PacDrive SCL from hardware code 52600012
- PacDrive PD-8 from hardware code 300
- PacDrive PD-4 from hardware code 100

Table 6-4: Order numbers for SERCOS cable

Options

Order number	Item name	Explanations
15154410	Seal Set SCL-055	Seal set for 25 SCL motors
13140022	TSP-1 Test System Pressure	Test device - Leak test

Table 6-5: Order numbers of accessories

6.7 Device replacement

NOTE

In addition to the following instructions, you must observe the machine manufacturer's specifications when replacing the drive.

⚠ DANGER

High voltage!

Electric shock, fire or explosion!

- Open the master switch and secure it against switching on again before working on electrical machinery.
- Make sure that the drives are at a standstill because potentially fatal voltage can occur on the motor lines in generator operation.
- Disconnect the plug-in connectors that are not live.
- Disconnect and plug in power connector cables only when the system is deactivated.
- Before working on the unit, discharge the DC bus and use a voltage meter to make sure that there is no voltage.

⚠ CAUTION

Electrostatic discharge!

Damage to component possible!

- Touch circuit boards only on edges.
- Do not touch any of the circuit points or components.
- Discharge any present static charge by touching a grounded metallic surface such as a grounded housing.
- Prevent electrostatic charges; e.g., by wearing appropriate clothing.

This is how you replace the Antrieb:

- ▶ Take preliminary measures.
- ▶ Open master switch.
- ▶ Prevent main switch from being switched back on.

⚠ CAUTION

Mechanical force.

Potential damage to the encoder system

- Prevent impacts to the motor shaft when removing and attaching couplings to the motor shaft, as this could damage the encoder. Use appropriate tools, such as an extractor.
- Avoid mechanical damage to the motor housing coating. Cleaning fluid will damage the motor's aluminum housing.

⚠ WARNING**Unintended axis movements
Risk of accident.**

- The measuring reference is lost when exchanging motors with servo axes with indirect distance measuring systems using the motor encoder. The measuring reference for the machine coordinate system must be re-established after the exchange.
- ▶ Replace the drive according to the machine manufacturer's specifications.
 - ▶ Connect the earth cable and tighten it with a 2.8Nm torque.

⚠ DANGER**Insufficient shielding/grounding.
Hazard to the drive!**

- In general, operate the drive only with fixed cover and cable gland.

6.8 Cable replacement

The PacDrive SCL055 is available with three different cable variants:

- Fixed, angular motor cable connection (standard)
- Fixed, straight motor cable connection (standard, stainless steel)
- Plug connection, straight motor cable connection (standard, stainless steel)

Observe the following procedures during cable replacement for the different connection variants and the special safety instructions for these activities.

⚠ DANGER**High voltage!
Risk of death!**

- Disconnect or plug in power connector cables only when the system is deactivated.
- Disconnect or plug in the power connector only when the equipment is dry and clean.
- If you are using prefabricated cables which are not manufactured by ELAU, check that the assignment of the new cables complies with the connection diagram of the machine manufacturer.

⚠ CAUTION**Static charging of electronic components due to improper handling!
Damage to electronic components!**

- Always comply with the ESD regulations when opening the PacDrive SCL.

Replace cable (fixed, angular model)

- ▶ Open main switch and prevent against restart.

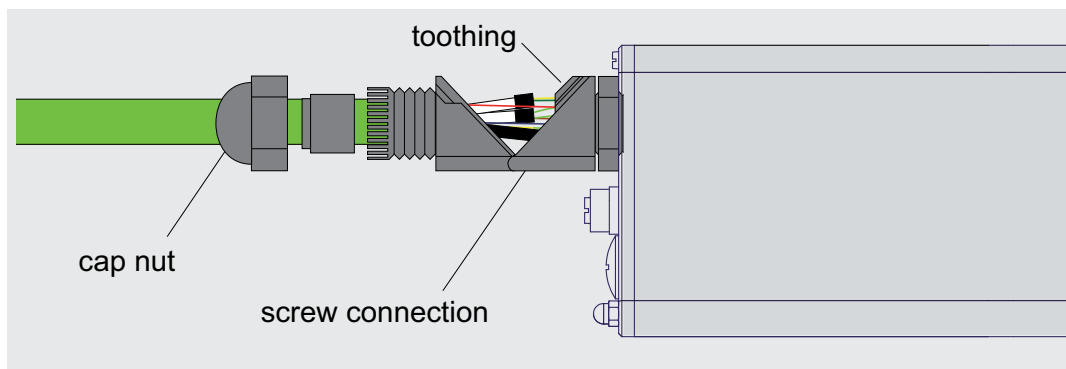


Figure 6-6: Detaching the motor cable

- ▶ Loosen cap nuts and pull away backwards from the cable gland.
- ▶ Press left and right tooth forming of the cable gland outwards.
- ▶ Swing open rectangular cable gland at 180°, until it is lying along the cable.

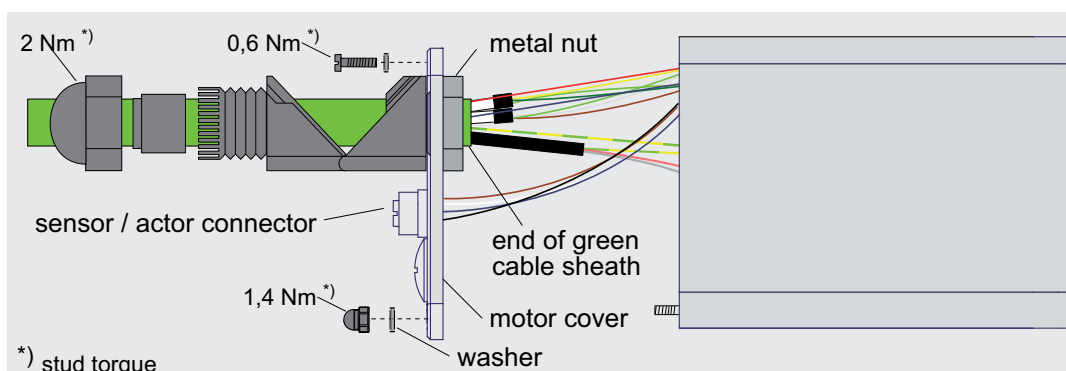


Figure 6-7: Open the SCL housing

- ▶ Open motor cover screw.

⚠ CAUTION

Improper removal of cable and plug! Damage to sockets due to tensile load!

- Do not expose the cables to tensile load.

- ▶ Press the cables through the cable gland in the direction of the motor opening, thereby hold the cable and push the motor cover from the motor housing through the cable until the green cable sleeve is visible on the inside of the motor cover.
- ▶ Loosen connector lock and remove the three plugs.
- ▶ Loosen inner metal nuts of the cable gland and remove cable from the cover.

NOTE

Always replace the cable fully (cable and cable glands). Dispose off defective or worn cables in an environmental-friendly manner. Do not work with used cables. This minimizes faults and defects.

- ▶ Assemble new cable in reverse order (make sure to use the specified tightening torques).

Replace cable (fixed, straight model)

- ▶ Open main switch and prevent against restart.

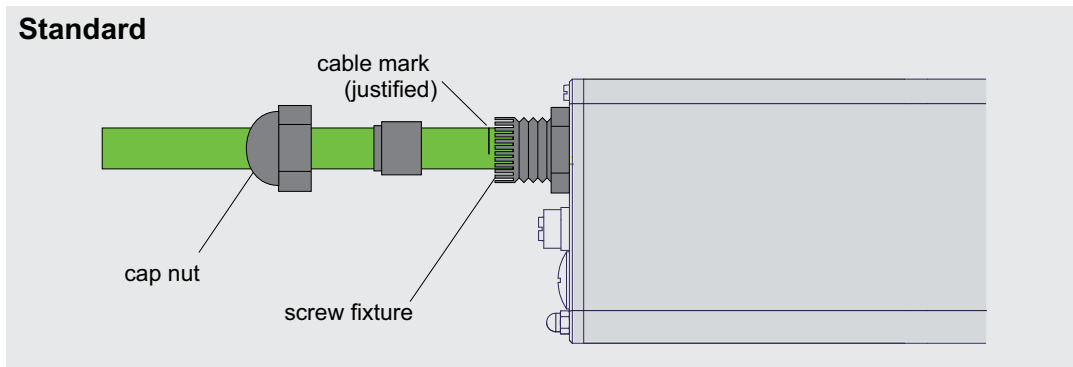


Figure 6-8: Detaching the motor cable

- ▶ Loosen cap nuts and pull away backwards from the cable gland.

NOTE

Observe the cable marking. When properly assembled, the cable marking must be aligned flushed with the cable gland so that it is just about visible. This way, the cable is under no strain during operation.

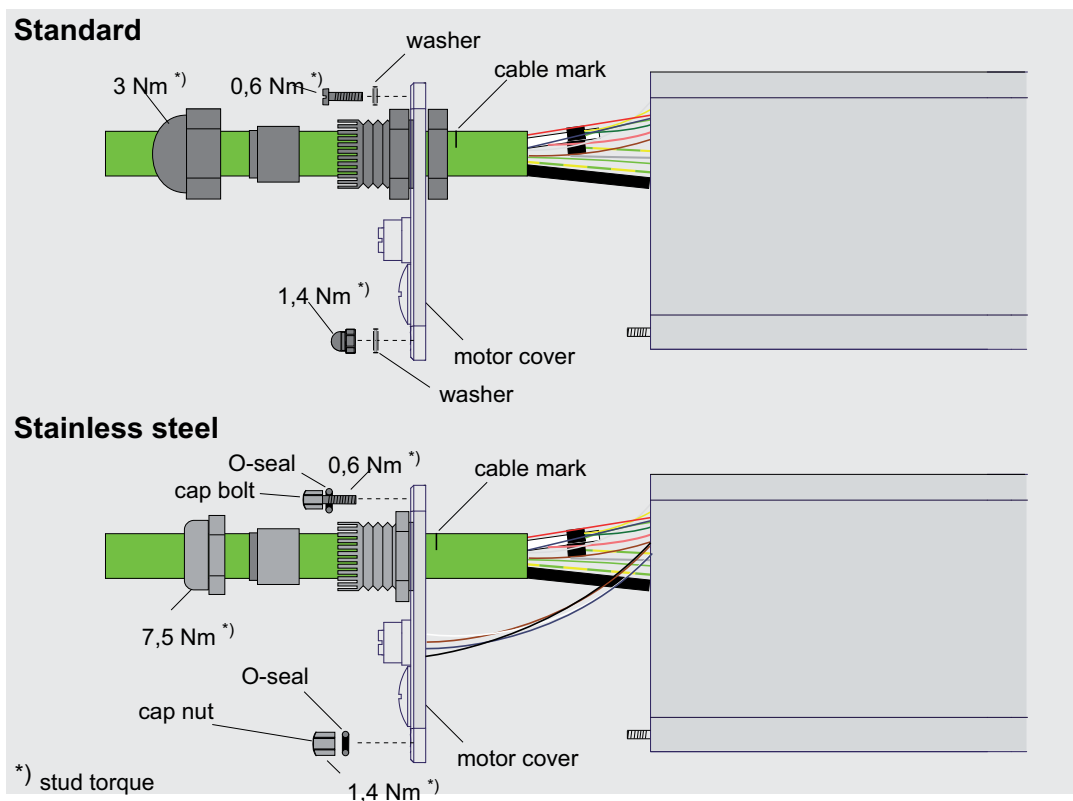


Figure 6-9: Open the SCL housing

- ▶ Open motor cover screw.

⚠ CAUTION**Improper removal of cable and plug! Damage to sockets due to tensile load!**

- Do not expose the cables to tensile load.

- ▶ Hold cable and push motor cover away from the motor housing through the cable.
- ▶ Loosen connector lock and remove the three plugs.
- ▶ Loosen inner metal nuts of the cable gland and remove cable from the cover. (Aseptic variant: cable gland is screwed directly into the cover)

⚠ CAUTION**Leaking fluid due to improper installation! Motor damage! Installation of the SCL-055 stainless steel:**

- While installing the motor cover new O-rings must be mounted (seal set SCL-055, 25 available (Order No. 15154410).
- Before replacement, the O-rings and the motor cover seal must be greased with suitable lubricants approved for foodstuff (e.g: Klüber Lubrication, PARALIQ GTE 703).
- Remove excess grease after installation.
- For the stainless steel variant, use only the cable with the Item No. E-MO-105.
- Dispose off defective or worn cables in an environmental-friendly manner and never reuse.
- Always replace the cable fully (cable and cable glands).

- ▶ Assemble new cable in reverse order (make sure to use the specified tightening torques, see figure "Open the SCL housing").
- ▶ Perform a leak test.

NOTE

In the SCL-055 stainless steel variant, a leak test is mandatory to ensure that the motor is always protected from leaking liquids. The PacDrive TSP-1 (Item No. 13140022) test device is available for the test. The exact procedure is given in the PacDrive TSP-1 operating manual.

Replace cable (jumper, standard)

- ▶ Open main switch and prevent against restart.

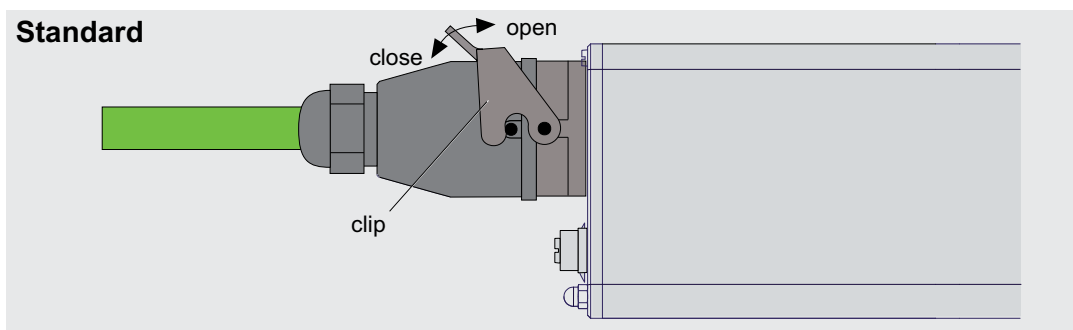


Figure 6-10: Detaching the motor cable

- ▶ Press strap in direction of motor housing to unlock the plug, see figure.
- ▶ Install new cable in reverse order.

7 Technical data

7.1 General

Technical Data - PacDrive SCL-055 - Controller

Parameters	Value
Power supply - Rated connecting voltage/ current - DC circuit capacity	DC 325 V / 1 A 33 μ F
Electronics supply - Control voltage/ current - Input capacity	DC 24 V / 0.3 A 40 μ F
Touch probe inputs (Sensor/Actuator)	Number: 2 (IEC61131-2) Range U_{IN} 0 Voltage: DC 0 ... 5 V Range U_{IN} 1 Voltage: DC 15 ... 35 V Input current: $I_{IN} = 5$ mA at $U_{IN} = 24$ V polarized yes Input filter: 100 μ s polarized yes Input filter: 100 μ s
Digital outputs (Sensor/Actuator)	Number: 1 (IEC61131-2) Output voltage: low 0 to 5 V, high > 21 V $I_{Lnom.}$: 250 mA Start-up current: $I_{emax} < 0.7$ A for 1 s Idle current: 0.3 μ A Short-circuit proof: yes
Weight	See Tech. Data SCL 055 - Motor data
Ventilation	Natural convection
Ambient conditions - Protection class - Ambient temp. during operation - During storage and transport - Excess voltage category - Radio interference level - Insulation material class	IP65, IP67 +5 ... +40 $^{\circ}$ C -25 $^{\circ}$ C ... +70 $^{\circ}$ C, $\Delta T/\Delta t = \text{max. } 30$ K/h K II, (DIN VDE 0110) Class A EN 55011 / EN 61800 - 3 F
Approval	CE, UL (available from KW42), cUL

Table 7-1: Technical Data - SCL055 - Controller

NOTE

The PacDrive SCL in the stainless steel model can be operated only with Firmware version V00.16.33.

Technical Data - PacDrive SCL-055 30 011 and SCL-055 15 010

Reference data	Abbreviation [unit]	SCL-055 30 011 Standard	SCL-055 15 010 Stainless steel
Dead-time torque	M_0 [Nm]	1.09	1.05
Rated motor speed	n_N [min ⁻¹]	3000	1500
Peak torque (20 °C)	M_{max} [Nm]	3.6	3.5
Physical Data			
Max. mechanical limit velocity	n_{limit} [rad/s]	420	420
Rotor moment of inertia The rotor inertia refers to a motor without brake.	J_M [kgcm ²]	0.11	0.146
Weight ¹⁾ (incl. electronics):	m [kg]	3.2	4.3
Thermal data			
Response limit thermal contact	T_{TK} [°C]	130	130
Thermal time constant	t_{th} [min]	44	44
Electrical data			
Number of poles	PZ	6	6
Motor coils circuit		Y	Y
Torque constant (20 °C)	K_{T20} [Nm/A]	0.89	1.54
Torque constant (120 °C)	K_{T120} [Nm/A]	0.81	1.40
Winding resistance (20 °C)	R_{20} [Ohm]	19.9	38.1
Winding inductance	L [mH]	45.5	87.3
EMF at 1000 [min ⁻¹]	EMF [V]	50	78
Standstill current (Cu = 120 °C)	I_0 [A]	1.35	0.75
Peak current (Cu = 120 °C)	I_{max} [A]	5.0	3.8
¹⁾ Weight without cable (cable weight per meter = 0.18 kg)			

Table 7-2: Technical Data - SCL-055

7.1.1 Definitions

Abbreviation	Unit	Explanations
I_0	[A _{rms}]	Standstill current Standstill current Effective value of the motor current at standstill torque M_0
I_N	[A _{rms}]	Rated current Effective value of the motor current at rated torque M_N
I_{max}	[A _{rms}]	Maximum current Effective value of the motor current at peak torque M_{max} Effective value of the motor current at peak torque M_{max}
J_M	[kgcm ²]	Rotor moment of inertia The rotor inertia refers to a motor without brake. The rotor inertia refers to a motor without brake.
k_T	[Nm/A _{rms}]	Torque constant Quotient from standstill torque M_0 and standstill current I_0 (at 120 °C winding temperature)
m	[kg]	Mass Motor mass without brake and without fan Motor mass without brake and without fan
M_0	[Nm]	Standstill torque; continuous torque (100% ED) at 5 min ⁻¹ At an ambient temperature of 40 °C and a winding temperature of 120 °C

Abbreviation	Unit	Explanations
M_N	[Nm]	Rated torque, continuous torque (100% ED) at n_N Due to motor speed-dependent losses less than M_0 . At an ambient temperature of 40 °C and a winding temperature of 120 °C.
M_{max}	[Nm]	Peak torque The maximum torque that the servo motor can briefly deliver to the output shaft.
n_N	[min ⁻¹]	Rated motor speed
n_{max}	[min ⁻¹]	Mechanical limit velocity
P_N	[kW]	Mechanical rated power (power delivered to the shaft) At the rated motor speed and load with the rated torque
$R_{U-V, 20}$	[Ω]	Winding resistance Resistance between two phases at a winding temperature of 20 °C.
L_{U-V}	[mH]	Winding inductance between two phases
k_E	[V _{rms} /kmin ⁻¹]	Voltage constant; induced voltage between two phases at 1000 min ⁻¹
V	[m/s ²]	Maximum vibration (all directions)
Y	[m/s ²]	Maximum shock (all directions)
T_{TK}	[°C]	Response limit temperature sensor
t_{th}	[min]	Thermal time constant
p		Pole pair number

Table 7-3: Physical sizes with units and explanations

7.1.2 Installation and Protection class

The drive protection class depends on the installation. The mounting flange for all drive types is designed in such a way that the installation type is possible according to the types of construction. By the IM B14, IM V18 and IM V19 DIN IEC 34-7 the drives can be mounted to the machine according to the following listing types.:

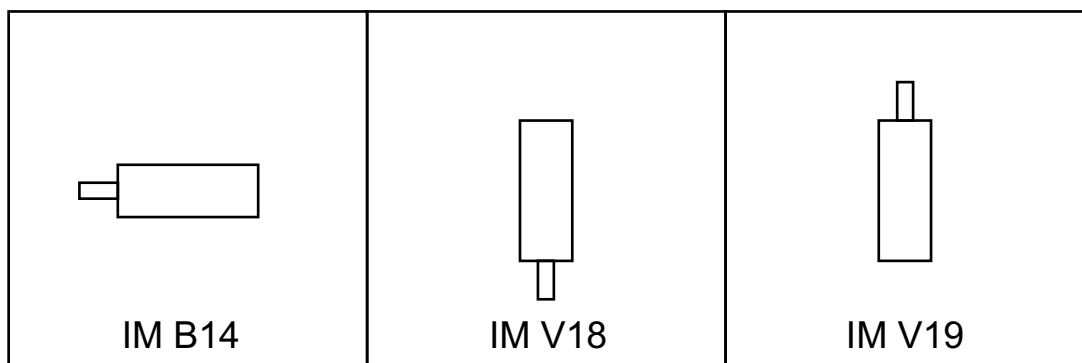


Figure 7-1: Drive installations

⚠ CAUTION

Mounting position not allowed.

Penetrating liquids cause motor damage.

- Liquids penetrating the drive cause motor damage. Therefore, **while using the PacDrive SCL in installation IM V19** make sure to use a drive with radial shaft seal + labyrinth seal (stainless steel).

Motor part	Protection class	Mounting position
Shaft	IP 50	IM V19
	IP 54	IM B14, IM V18
	IP 65	IM V19 (shaft sealing ring)
Surface/connections	IP 65	IM B14, IM V18, IM V19

Table 7-4: Protection class of SCL-Motor

7.1.3 Motor shaft and bearings

Design of the shaft end

Smooth shaft end With a non-positive connection, torque transmission must be achieved only by surface pressure. This ensures safe power transmission without backlash.

Manufacturer	Designation
VMA Verbindungs-, Meß- und Antriebstechnik Fliederweg 2 D-63814 Mainaschaff Tel.: (06021) 79020 Fax: (06021) 790220 E-Mail: info@vma-nc.de	Compensating coupling with clamping-hub ASK Type BB

Table 7-5: Manufacturer's non-positive connections

Permissible shaft load

In case of technical correct use, the life of drives is limited by the bearing life. The customer may not replace the bearing, as the measuring systems integrated in the drive must then be reinitialized.

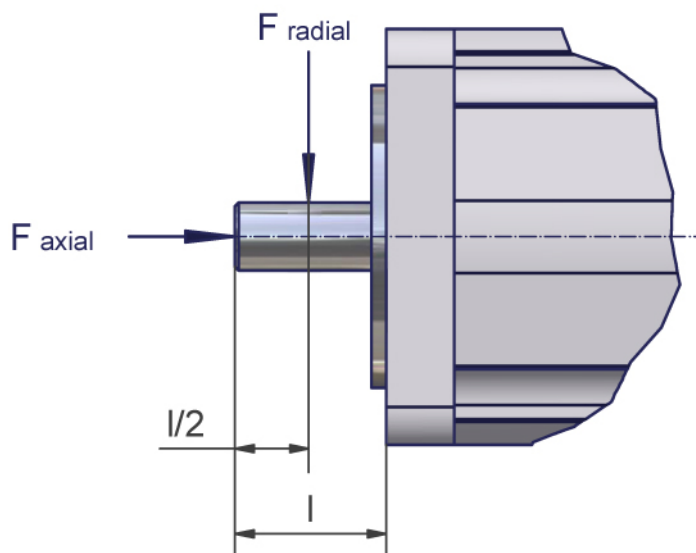


Figure 7-2: Definition of shaft load

Speed [min ⁻¹]	1000	1500	2000	3000
Radial force F_{Radial} [N]	330	330	310	270

Table 7-6: Permitted radial force F_{radial} [N] depends on the drive speed of SCL-055

Radial and axial limit loads must not be simultaneous.

⚠ CAUTION

Mechanical force.

Possible hazard to the motor!

- Do not exceed a maximum permissible pressing force of 165 N on the shaft end.

Basis for calculation:

The permissible axial force F_{radial} [N] is calculated according to:

$$F_{\text{axial}} = 0.2 \times F_{\text{radial}}$$

- Nominal bearing life $L_{10h} = 20,000$ h for a shaft without feather key nut (for operating hours at a 10% failure probability)
- Ambient temperature = 40 °C (approx. 100 °C storage temperature)
- Peak torque = 10 % ED
- Nominal torque = 100 % ED

7.1.4 Encoder

SinCos encoder

Parameters	SKS/SKM 36	Unit
Number of sine-cosine periods per revolution	128	
Moment of inertia of the rotor	4.5	gcm ²
Measuring step according to the arc tangent with 12bit resolution	2.5	Arcsecond
Number of steps per revolution "SRS Singleturn"	4096	
Number of steps per revolution "SRM Multiturn"	16.777.216 = 4096 x 4096	
Resistance to shocks in mounted condition according to DIN IEC 68 Part 2-27	100/6	g/ms
Resistance to vibration in mounted condition according to DIN IEC 68 Part 2-6	50/10 ... 2000	g/Hz

Table 7-7: Technical data of the SinCos encoder (SKS/SKM)

7.1.5 Torque/speed characteristic curves

The torque-speed characteristic curve represents the following characteristics:

- The permissible permanent torque (operating type S 1)
- The peak torque when the mains voltage = 230 V 3 AC

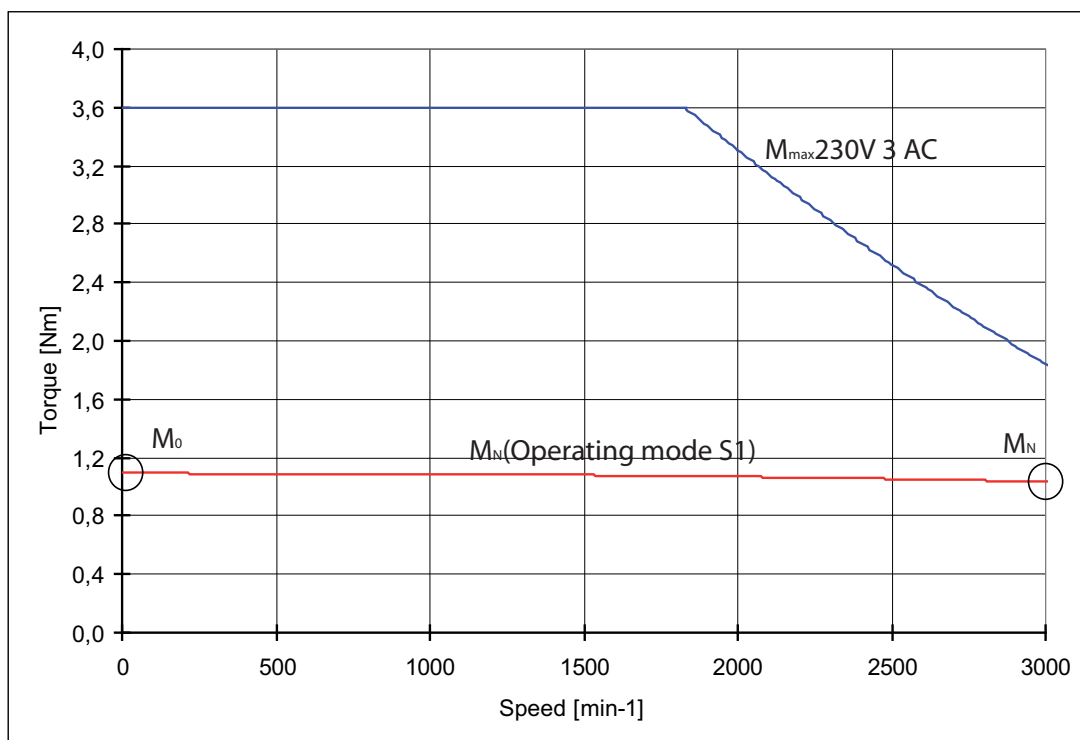


Figure 7-3: Example of a torque-speed characteristic curve

The characteristic curves refer to an ambient temperature of 40°C and a maximum winding temperature of 120°C.

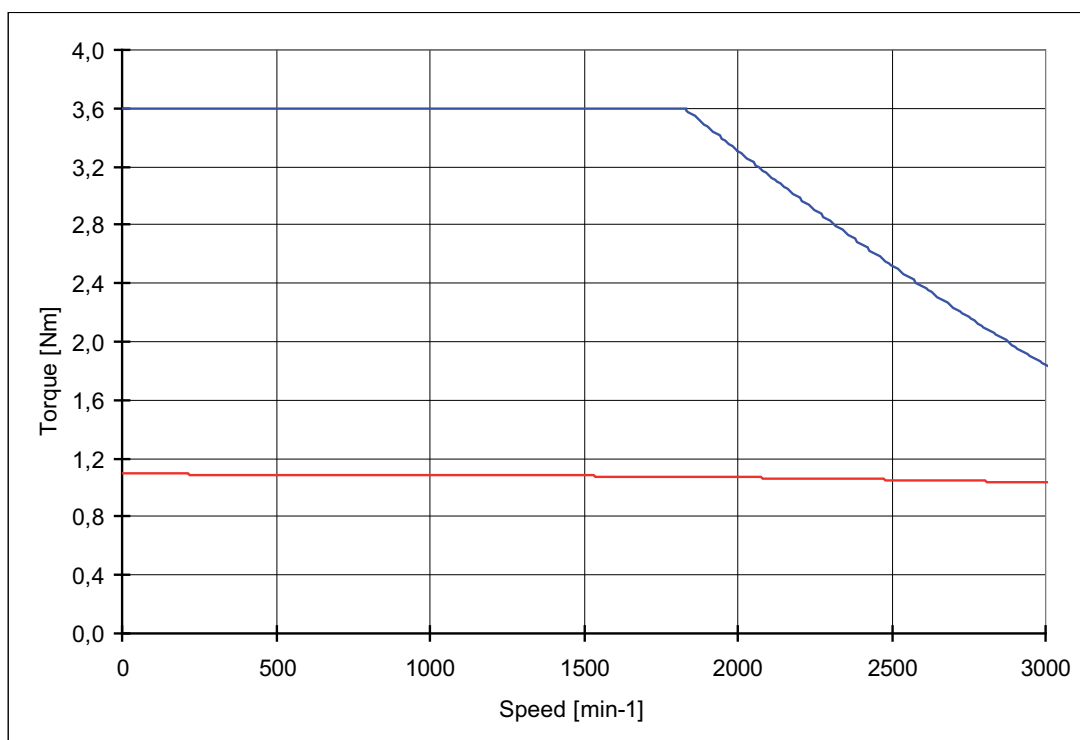


Figure 7-4: Torque/speed characteristic curve SCL 055/30011 Standard

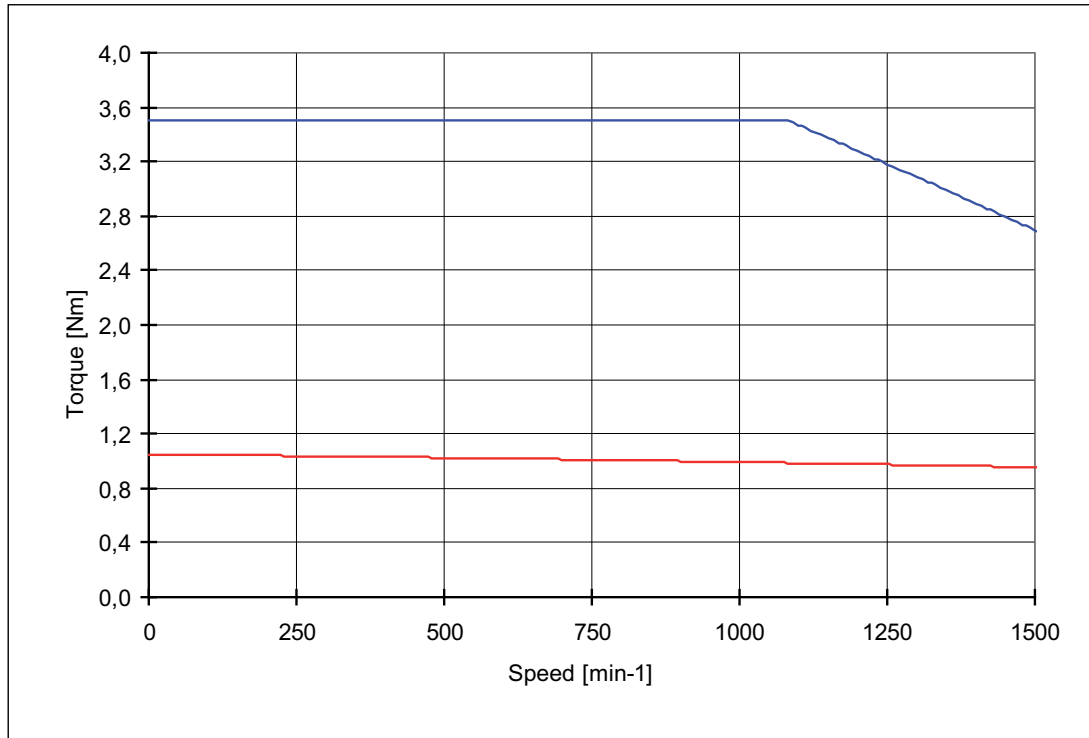


Figure 7-5: Torque - speed characteristic line SCL 055/15010, stainless steel design

7.2 Electrical Connections

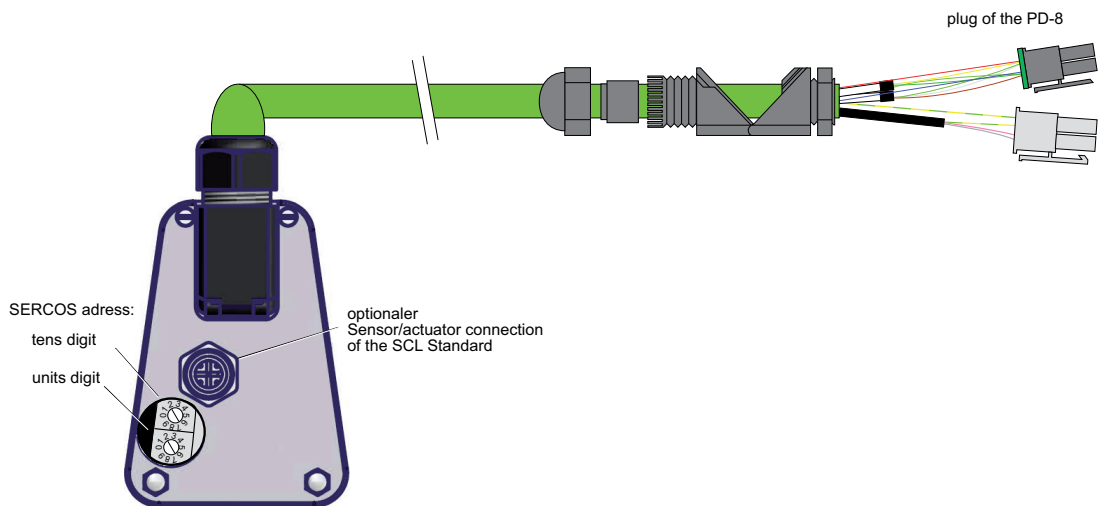


Figure 7-6: Connection overview - PacDrive SCL

Sensor/actuator connection

No sensor/actuator connection is available for the stainless steel variant.



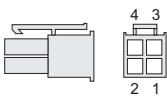
Pin	Designation	Meaning	Range
1	OUT 0	Standard output 0 ¹⁾	DC 20 ... 30 V / 0.1 A

Pin	Designation	Meaning	Range
2	IN 1	Standard input 1 touch test of input 1 ^{*)}	DC 20 ... 30 V
3	0V GND	Ground	
4	IN 0	Standard input 0 touch test of input 0 ^{*)}	DC 20 ... 30 V
5	PE	Ground conductor/ Shield	

*) can also be used for the power supply of external sensors
**) from Firmware version V00.20.00

Table 7-8: Connection socket - Sensor/actuator on SCL

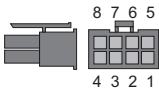
Power supply



Pin	Designation	Meaning	Range
1	PE	Ground conductor	
2	PE	Shielding	
3	DC-	DC circuit -	DC 270 ... 370 V
4	DC+	DC circuit +	DC 270 ... 370 V

Table 7-9: Power supply connection plug

SERCOS Connection



Pin	Designation	Meaning	Range
1	24 V	Control voltage 24 V	-15 % ... +25 %
2	SERCOS Out +	SERCOS Transmit +	
3	Shielding	SERCOS shield Out	
4	SERCOS In +	SERCOS Receive +	
5	0 V	Control voltage 0 V	
6	SERCOS Out -	SERCOS Transmit -	
7	Shielding	SERCOS shield In	
8	SERCOS In -	SERCOS Receive -	

Table 7-10: SERCOS Connection

7.3 Dimensions

Dimensions of the PacDrive SCL

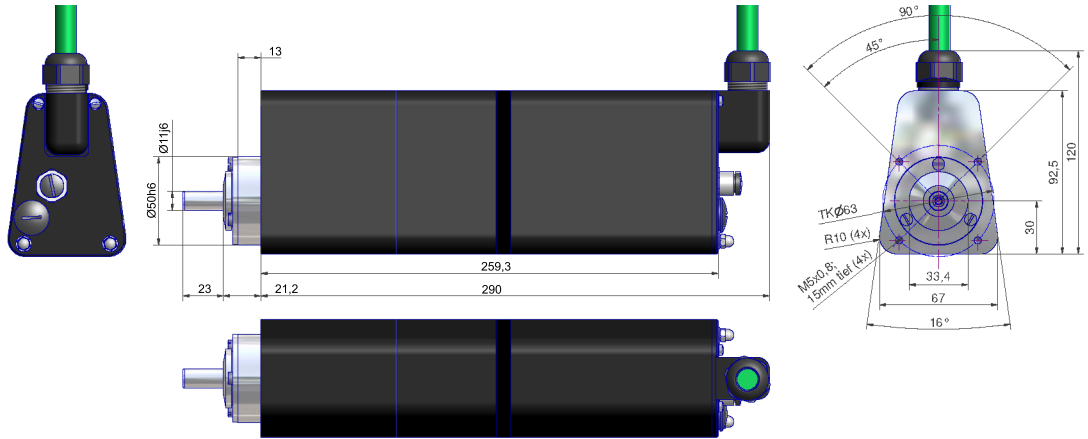


Figure 7-7: Dimension drawing SCL-055 / Standard design, angular cable

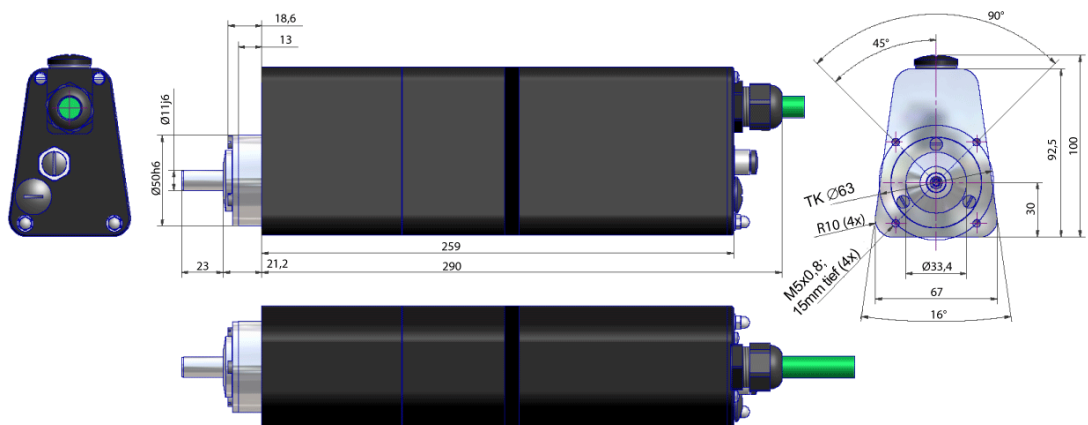


Figure 7-8: Dimension drawing SCL-055 / Standard design, straight cable

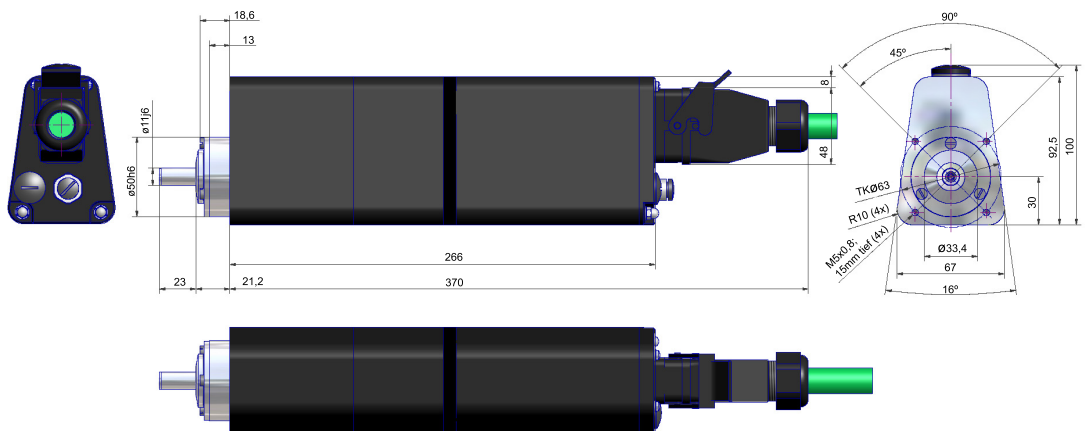


Figure 7-9: Dimension drawing SCL-055 / Standard design, connector

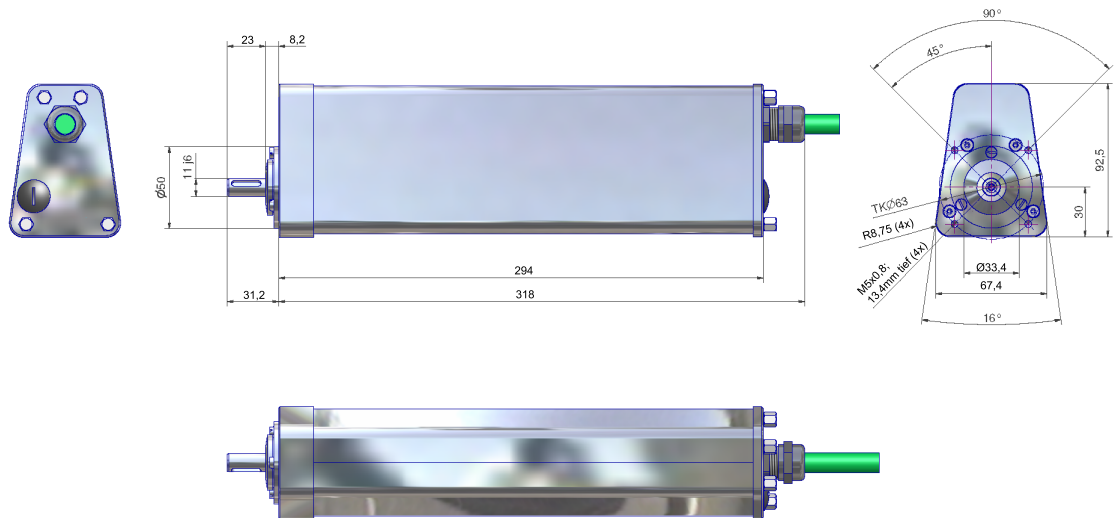


Figure 7-10: Dimension drawing SCL-055 / stainless steel design, straight cable

8 Appendix

8.1 Contact addresses

Trademark

PacDrive is a registered trademark of ELAU AG.

All other trademarks named in this documentation are the sole property of their respective manufacturer.

ELAU AG Deutschland

Dillberg 12
97821 Marktheidenfeld, Germany
Tel.: +49 (0) 9391 / 606 - 0
Fax: 09391/606-300
E-mail: info@elau.de
Internet: www.elau.de

ELAU AG Customer Service

Postfach 1255 -97821 Marktheidenfeld, Germany
97821 Marktheidenfeld, Germany
Tel.: +49 (0) 9391 / 606 - 142
Fax: +49 (0) 9391 / 606 - 340
E-mail: info@elau.de
Internet: www.elau.de

NOTE

Check the ELAU homepage (www.elau.de) for additional contact addresses.

8.2 Product Training Courses

We also offer a number of training courses about our products.

Our seminar leaders with several years of experience will help you take advantage of the extensive possibilities offered by the PacDrive™ system.

NOTE

Check the ELAU homepage (www.elau.de) for further information and our current seminar schedule.

8.3 Changes

NOTE

The latest product documentation, application notes and the change service are always available on the ELAU homepage.

07/2003

- New edition of the operating manual

12/2004

- Addition of Chapter SERCOS slaves
- Addition of chapter Aseptic variants
- Various error eliminations and additions
- Layout change

01/2007

- Addition of stainless steel variant

03/2008

- Extension SCL-Type 30011
- Changeover of type plates
- Operating manual limited to SCL Standard and stainless steel variants
- Chapter - Overview revised
- Chapter - Installation & Maintenance revised
- Type codes adjusted
- Characteristic curves adjusted
- Dimensional drawings revised

8.4 Fault report form

This error report is required without fail to enable efficient processing.

Send the error report to your ELAU AG-representativ or to:

ELAU AG
 Customer Service Department Dillberg 97828 Marktheidenfeld, Germany Fax: +49 (0)
 93 91 / 606 - 340
 Dillberg12
 97828 Marktheidenfeld
Fax: +49 (0) 93 91 / 606 - 340

Return address:

Company:	City:	Date:
Department:	Name:	Tel.:

Specifications regarding product in question

Item name:

Item no.:

Serial number:

Software version:

Hardware code:

Parameters included Yes No

IEC - Program included: Yes No

Information about machine on which the error occurred:

Machine manufacturer:

Type:

Operating hours:

Machine no.:

Date of commissioning:

Manufacturer / Type of machine control:

.....

How did the error present:

.....

.....

.....

Additional information:

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