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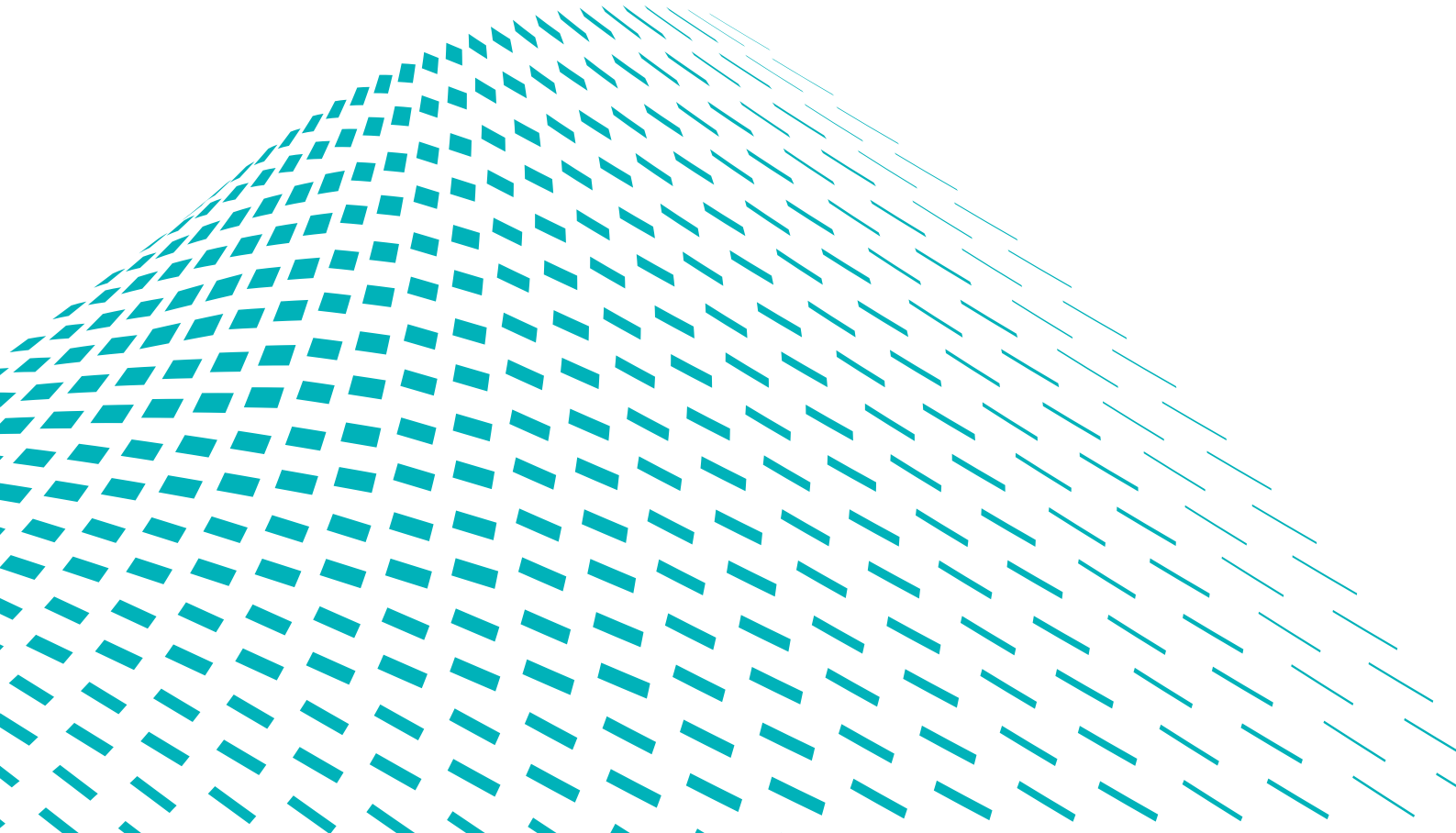
SCP System
Service Manual



SCP System • Service Manual

LIVANOVA DEUTSCHLAND GMBH
TSSI Department
Lindberghstrasse 25
D-80939 Munich, Germany

HLM-Hotline: +49 89 41 61 26 461
Telephone: +49 - (0)89 - 32301-0
Telefax: +49 - (0)89 - 32301-777

Service Manual
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1 Introduction

1.1 About this Service Manual

This Service Manual (in addition to the training courses run by LIVANOVA DEUTSCHLAND GMBH) is the basis for the maintenance and repair of your SCP System. This manual is intended only for suitably qualified service technicians. In the interest of the safety of patients and all operators:

Only service technicians trained and authorised by LIVANOVA DEUTSCHLAND GMBH may service the SCP System.

!

Please refer to the operating instructions for any information you need on operating the SCP System. This Service Manual contains references to the corresponding chapters in the operating instructions (if required).

1.1.1 Symbols used in this Service Manual

The symbols used in this manual are intended to help you find special text passages. The meaning of the symbols is as follows:

!	Danger! Failure to pay attention may endanger the patient's and/or the operator's life.
!	Warning! Failure to pay attention may cause damage to the machine or other equipment.
✓	A check list for a quick and safe follow up on whether operational steps have been carried out completely.
◗	Primary list (main groups)
➜	Secondary list (subgroups)

1.1.2 The chapters in this Service Manual

In chapter...		you will find the following information:
1	Introduction	➜ Symbols used in the Service Manual ➜ Overview of chapters (this table)
2	Safety	➜ Important safety instructions for the operation of the SCP System
3	System description	➜ A brief description of all the service-relevant components
4	Error messages and error diagnosis	➜ A list of all error messages and information on locating errors
5	Replacing components	➜ Information and instructions on the removal and installation of components
6	Appendix	➜ Technical data on all components ➜ Part numbers/spare parts

2 Safety

2.1 Approvals

Just as for development and production, the system must also be serviced in accordance with the following standards and legal regulations.

IEC 62353	– Recurrent test and test after repair of medical electrical equipment
IEC 60601-1-2	– EMC (Electromagnetic Compatibility)
MDD	– Medical Device Directive 93/42 EEC
DIN EN ISO 13485	– Quality Management System
UVV	– Regulations for Accident Prevention
UL 2601-1	– Standard for Medical and Dental Equipment
GMP	– Good Manufacturing Practice

2.2 Regulations and safety instructions

2.2.1 Usage in accordance with regulations

- The SCP System is solely intended for use with the Revolution® on and/or with a Stöckert/ Sorin HLM (S3/SC/S5/C5) or the SCPC System as a **centrifugal pump** during cardiopulmonary bypass. Any use beyond this specification is not in accordance with the regulations and LIVANOVA DEUTSCHLAND GMBH will not assume any liability for damage in such a case. Usage in accordance with regulations also includes compliance with the operating instructions, as well as repair and maintenance according to the maintenance instructions.

- Relevant accident prevention measures according to existing local policy and employees' health and safety regulations must be complied with. LIVANOVA DEUTSCHLAND GMBH will not assume any liability for damage due to non-compliance with these regulations.

- LIVANOVA DEUTSCHLAND GMBH will not assume any liability for injuries and/or damage caused by failure to observe the safety instructions or by the operator not taking due care. This applies even if the operator's duty to take due care has not been specifically expressed to the user.

2.2.2 General safety instructions

- The SCP System has been designed according to current state-of-the art technology and accepted safety standards. Although this may be the case, danger may arise for the patient, the user or for other equipment during operation.
- The SCP System must be operated and maintained by trained and qualified personnel only.
- The SCP System must not be operated near explosive substances.
- The SCP System may only be used when in fully operational condition and according to regulations and the operating instructions.
- The operating instructions must be available close to the SCP System at all times. Incomplete or illegible operating instructions must be replaced immediately.
- According to the **European Directive 93/42 EEC** and the national standards based on this directive, the SCP System must be subjected to **a regular maintenance checks** by an authorised service representative. The maintenance check for the SCP System must be performed after every **1000 operating hours** or **at least once every 12 months** (whichever comes first).
- In addition to the operating instructions, the relevant legal, general and binding regulations concerning the prevention of accidents must be observed.
- In order to take situations into account which are clinic-specific and outside of normal routines, e.g. certain working procedures, the operating instructions must be supplemented with relevant instructions (supervision and registration requirements, etc).
- Personnel operating the SCP System must have acquainted themselves thoroughly with the operating instructions prior to working with the machine.
- If you discover any safety-relevant modifications to the SCP System or its operating behaviour (outside of OP mode): Do not use the device and have it checked out by authorised service personnel.
- Do not perform any modifications or extensions to the device, unless they have been tested and approved by LIVANOVA DEUTSCHLAND GMBH. LIVANOVA DEUTSCHLAND GMBH cannot otherwise give any guarantee or assume liability.
- Keep the device clean. Doing so will prevent possible contact errors and faults due to dirt.

Usage in accordance with regulations: See page 7.

2.2.3 Operating safety

- Prior to working with the SCP System, you must have thoroughly read the operating instructions and have become familiar with the machine functions.
- The SCP System may only be used with the Revolution®. !
- Prior to mounting the Revolution®, you must have thoroughly read the separate operating instructions and have become familiar with the machine functions.
- For safety reasons, always have a spare Revolution® available.
- Please note that the SCP drive unit must be positioned at ≤ 45° to vertical (see operating instructions).
- Prior to operation, check all cables, tubing, connectors and other accessories to ensure correct connections, seals and proper function. Replace all damaged components immediately. !
- The SCP System may only be operated under constant supervision. Failure to comply with this obligation can result in danger to the patient. The safety features of the SCP System (alarm signals, etc.) provide support, but are no replacement for the operator. !
- The SCP System must not be operated in master-slave mode in conjunction with an S3/SC roller pump.
- Ensure that the tubing is straight and do not kink or twist the cables. Kinked or twisted cables can pose a hazard for personnel (causing them to stumble or catch on the tubing).
- For safety reasons, always have a haemostat/surgical clamp available and ensure that the arterial line is accessible when operating the electrical remote-controlled tubing clamp. !
- Prior to operating the tubing clamp, the user must have thoroughly read the operating instructions and have become familiar with the device functions.
- For the flow sensor, use only PVC tubes with a diameter of 3/8" x 3/32".
- Do not connect the flow sensor until you have read the separate operating instructions.
- Ensure optimum ventilation at the ventilation grills and the fan. Insufficient ventilation may result in excessive heating.
- The SCP connection cable, the cable of the drive unit and the cable of the flow sensor must be equipped with blocking ferrites.
- Modifications or extensions to the machine, as well as the use of spare parts, which have not been tested and approved by LIVANOVA DEUTSCHLAND GMBH, may have negative effects on the safety and function of the machine. LIVANOVA DEUTSCHLAND GMBH cannot accept any liability or responsibility.
- For safety reasons, keep the SCP emergency drive unit ready for use and familiarise yourself with the mounting and functioning of the emergency drive unit. !
- Use only as many connectors, tubes, etc., in the tubing system use are necessary for operation in accordance with the regulations. Additional couplings, etc., increase the risk of faults.
- Accessories and supplementary devices, which have not been tested and approved by LIVANOVA DEUTSCHLAND GMBH, must prove that their use does not pose a safety hazard.

2.2.4 Electrical safety

- Electrical installations must comply with DIN VDE 0107 (for Germany) or the corresponding, equivalent, local regulations and guidelines. Refer to the technical specifications in this respect.
- The pump control console must be totally powered down when switching on or off the SCP drive unit.
- Check the functional safety of all electrical connections, cables and sockets regularly.

2.2.5 Safety instructions for routine maintenance

- Routine maintenance work must only be performed by qualified personnel.
- Disconnect the device from the power supply completely before carrying out maintenance and cleaning work.
- Please adhere to the service and maintenance instructions given in these operating instructions as well as the recommended maintenance intervals.
- Ensure that no liquids or cleaning agents enter the machine housing through the vents or other openings.
- Use recommended cleaning agents.
- Repair work may only be carried out by authorised service technicians. Only original spare parts from LIVANOVA DEUTSCHLAND GMBH may be used in order to guarantee the proper functioning of the device.

2.3 Safety features of the device

- The SCP System performs a self-test during power-up. Check that all the LEDs, the 7-segment displays and the beep alarm function correctly.
- Visual and audible alarms indicate when an internal error has occurred.

3 System description

3.1 SCP System

Either a Stöckert/Sorin HLM (S3/SC/S5/C5) or the SCPC system is required to operate or supply the current for the SCP System. The following pages provide an overview of each of the components.

3.1.1 SCP System components

The SCP System consists of the following components:

◗ Pump control panel	➜ Operation and configuration of the SCP System
◗ Drive unit	➜ Revolution® drive by magnetic coupling
◗ Emergency drive unit	➜ Manual drive unit for Revolution®
◗ Flow sensor	➜ Measurement of blood flow and detection of bubbles

3.1.2 Overview

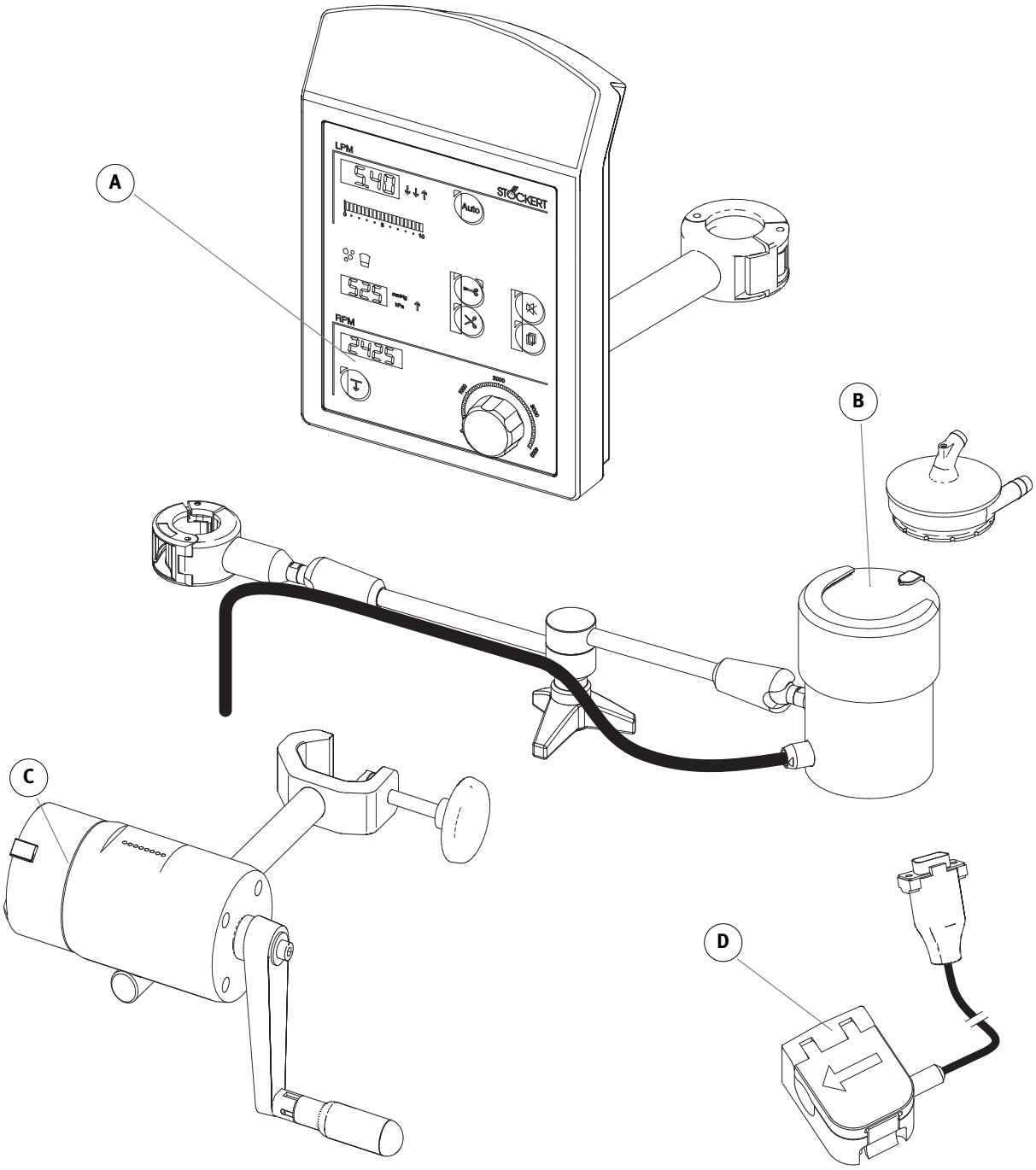

Fig. 1: Overview

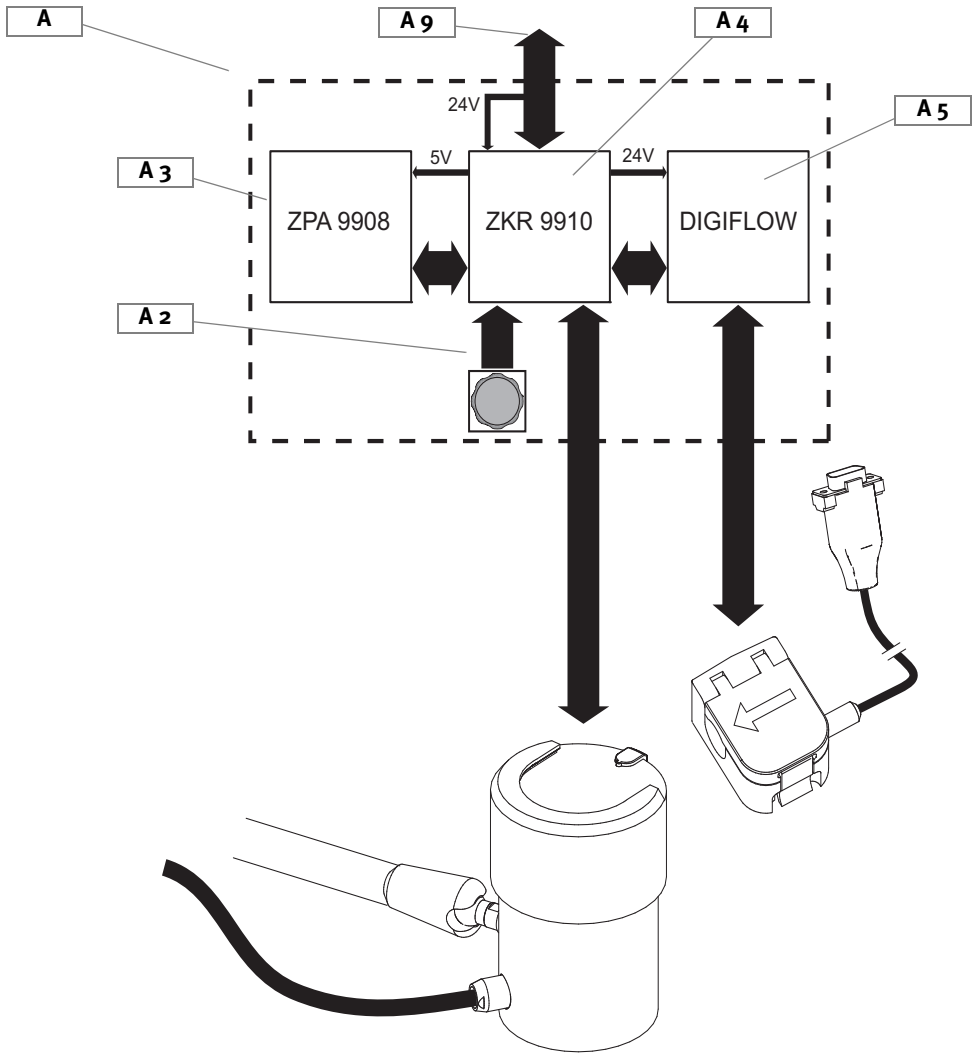

Fig. 2: Diagram of the SCP System

Mod.	Components	contains the following service-relevant modules/components:
A	Pump control panel	◗ *Display* board ZPA 9908 (**A 3**) ◗ *CPU* board ZKR 9910 (**A 4**) ◗ *Flow sensor* board DIGIFLOW (**A 5**) ◗ Shaft angle encoder (**A 2**) ◗ Fan ◗ HLM/SCPC connecting cable (**A 9**)
B	Drive unit	◗ *Motor control* board ZPR 9909 A ◗ Pump control panel connecting cable
C	Emergency drive unit	◗ None. In the event of a defect, replace the emergency drive unit.
D	Flow sensor	◗ None. In the event of a defect, replace the flow sensor.

See „Module overview - Pump control panel“ on page 15.

3.2 Service-relevant modules

As is apparent from the previous list of components, not all the modules in the SCP System can be repaired individually on site. Please consider the following before starting to service the system:

Pump control panel
On-site repairs can be performed by replacing boards or individual modules (e.g. shaft angle encoder, connecting cable). Service work on the boards themselves is not performed on site. The only exception to this is the replacement of the EPROM with the firmware necessary for operation (update).

Drive unit
Adjustment of the mechanical components requires precision tools and test instruments that are not available to the on-site service team. The following errors therefore cannot be eliminated directly and require the replacement of the whole drive unit:

- Defective motor
- Defective Hall sensor
- Mechanical errors (e.g. warehouse damage, unusual operating noises)

Emergency drive unit
The same restrictions apply to the emergency drive unit as to the drive unit; mechanical repairs and adjustment operations are not possible on site. The board for the speed display is only accessible after the drive unit mechanism has been partially disassembled, so that in this case also it is not possible to replace the board. Always therefore replace a defective emergency drive unit completely.

Flow sensor
The sensor does not contain any components that can be repaired and that are accessible for servicing. Always therefore replace a defective flow sensor completely.

3.2.1 Module overview - Pump control panel

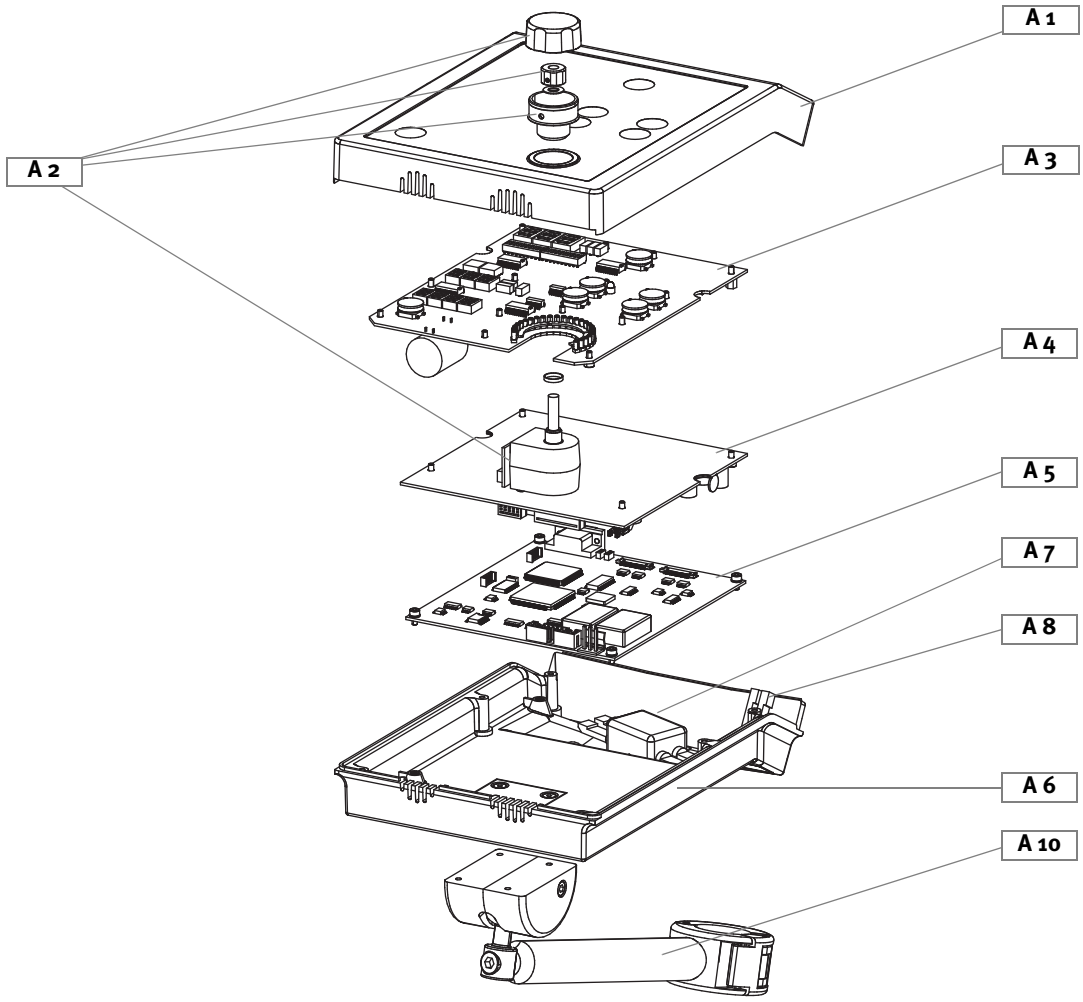

Fig. 3: Module overview of the pump control panel

Mod.	Item	Description	Number	SP number
A	1	Upper casing with adhesive foil		75-521-101 76-102-941
A	2	Shaft angle encoder with rotary knob and assembly parts		see page 37
A	3	*Display* board with pusher caps	ZPA 9908	see page 33
A	4	*CPU* board	ZKR 9910	90-305-190
A	5	*Flow sensor* board	DIGIFLOW	90-900-520
A	6	Lower casing		75-521-102
A	7	Mains filter		96-401-012
A	8	Toggle switch		96-121-209
A	9	Connecting cable to E/P pack, S3 Connecting cable to E/P pack, S5 (not kinked, firmly attached)		97-102-616 97-102-626
A	10	Holder (complete) for control panel		60-02-13

Display board (ZPA 9908)

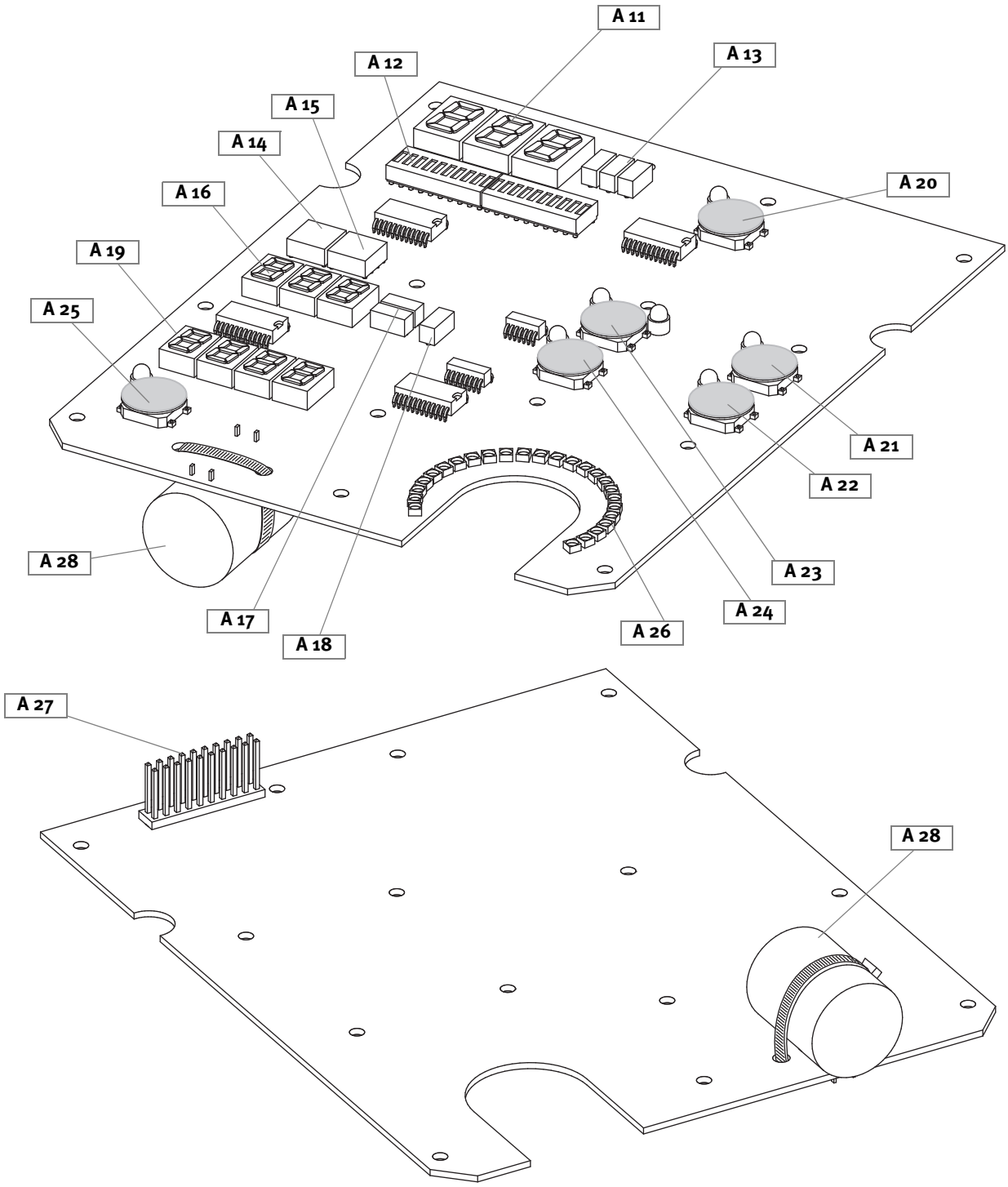

Fig. 4: Display board

Mod.	Item	Description	Number	Remark
A	**11**	7-segment display *Flow*		
A	**12**	LED bar graph display *Flow*		
A	**13**	LEDs (arrows) *Flow*		
A	**14**	LED *Bubble Detector*		
A	**15**	LED *Level Monitoring*		
A	**16**	7-segment display *Pressure*		
A	**17**	LEDs *Pressure Unit*		
A	**18**	LED (arrow) *Pressure*		
A	**19**	7-segment display *Actual Value* (speed)		
A	**20**	*Auto* key with with pusher cap (grey)		
A	**21**	*Audio Alarm Off* key with pusher cap (grey)		
A	**22**	*Menu* key with pusher cap (grey)		
A	**23**	*Clamp closed* key with pusher cap (grey)		
A	**24**	*Clamp open* key with pusher cap (grey)		
A	**25**	*Low RPM* key with pusher cap (grey)		
A	**26**	LED bar graph display *Actual Value* (speed)		
A	**27**	Connector to *CPU* board		
A	**28**	Fan		

CPU board (ZKR 9910)

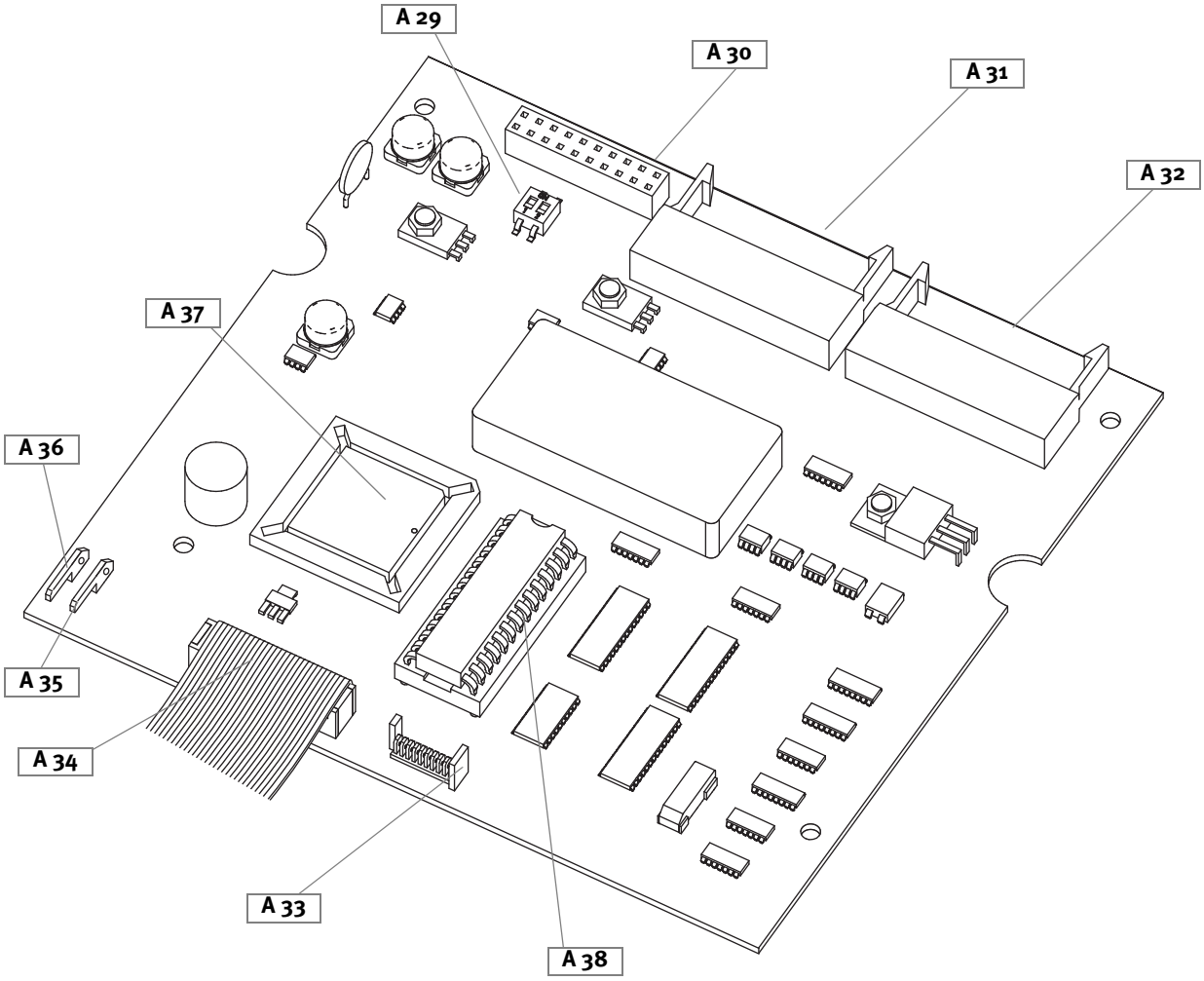

Fig. 5: CPU board

Mod.	Item	Description	Number	Remark
A	**29**	DIP switch (2 pole)	S1	on ZKR 9910 C and later
A	**30**	Connector to *display* board	CON 3	
A	**31**	*CAN/24V* connection	CON 1	
A	**32**	*Drive unit* connection	CON 2	
A	**33**	*Shaft angle encoder* connection	CON 4	
A	**34**	*Flow sensor* board connection	CON 5	
A	**35**	*Flow sensor, +24V* board connection	CON 6	
A	**36**	*Flow sensor, oV* board connection	CON 7	
A	**37**	Processor/CPU 80C196 KC	X 63	
A	**38**	EPROM (firmware)	X 62	

Flow sensor board (DIGIFLOW)

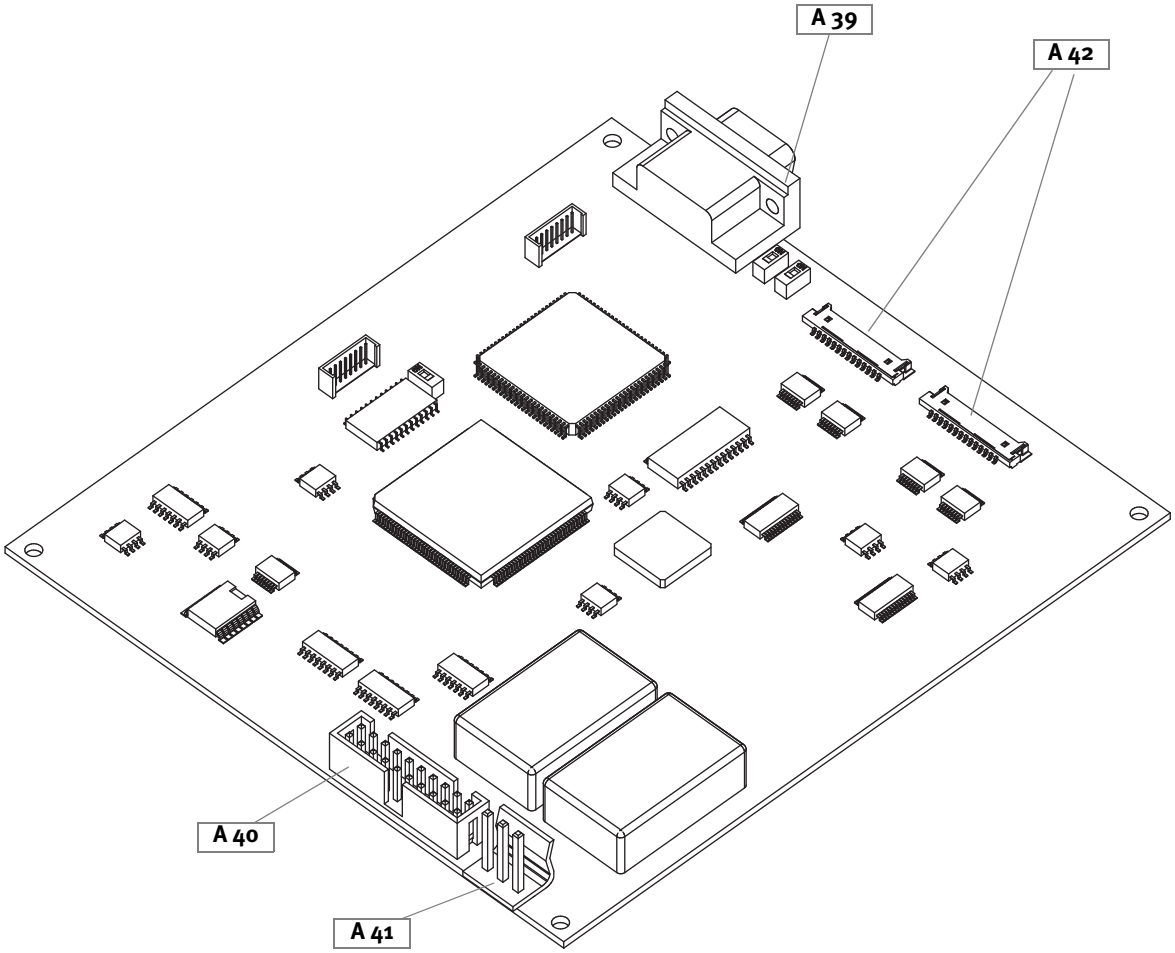

Fig. 6: Flow sensor board

Mod.	Item	Description	Number	Remark
A	**39**	*Flow sensor* connection (D-Sub 9f)	P2	not used
A	**40**	*CPU* board connection	J2	
A	**41**	Current supply +24V/0V connection	J3	
A	**42**	Flow sensor cable		97-101-898

3.2.2 Module overview - Drive unit

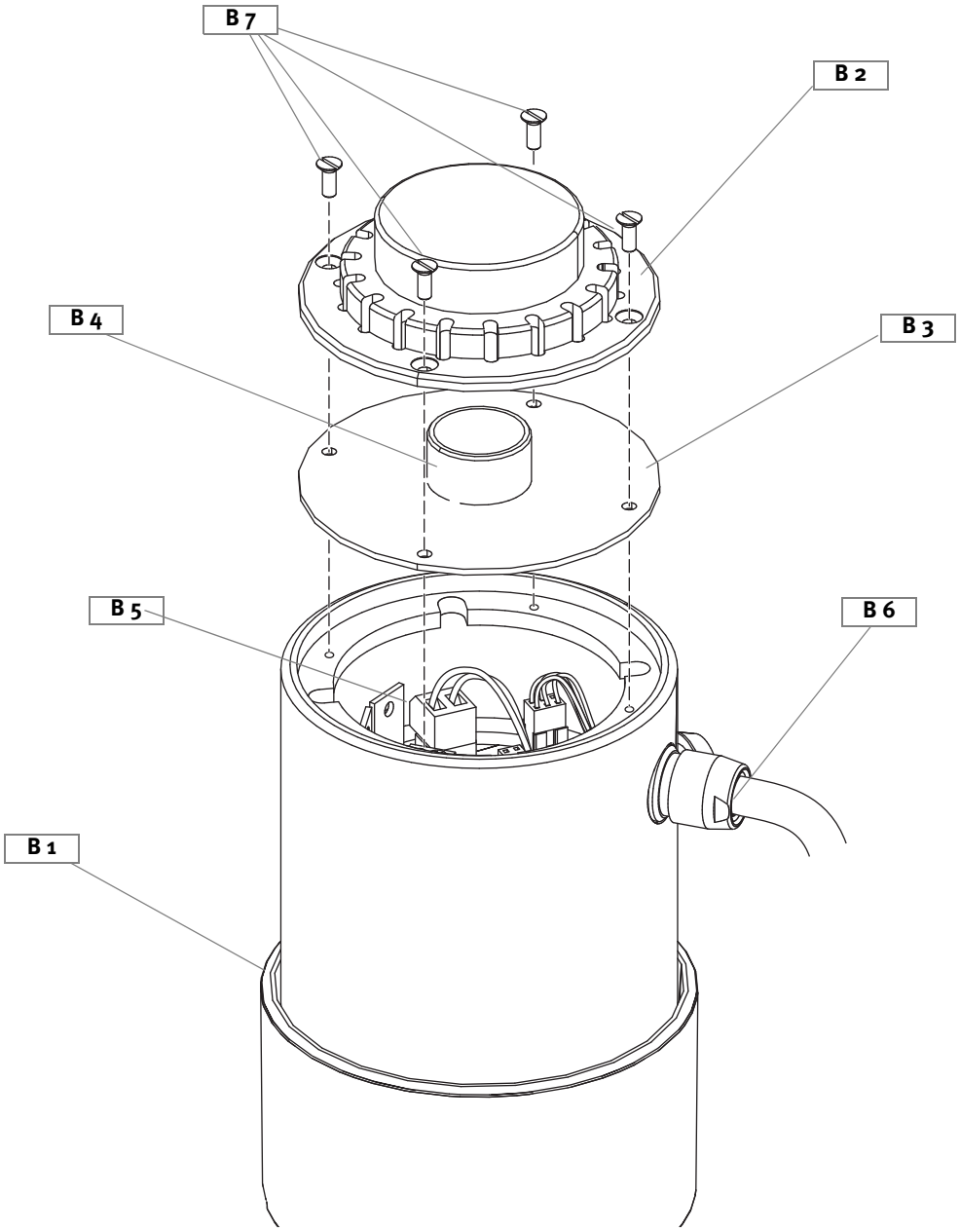

Fig. 7: Module overview - Drive unit

Mod.	Item	Description	Number	SP number
B	1	Drive casing with motor		
B	2	Base plate		see page 50 for details
B	3	Splash protection with		
B	4	Slide bearing		
B	5	*Motor control* board	ZPR 9909 A	90-305-185
B	6	Connecting cable to pump control panel		97-102-615
B	7	Countersunk head screw (slotted), DIN 963, M3x8		

Motor control board (ZPR 9909 A)

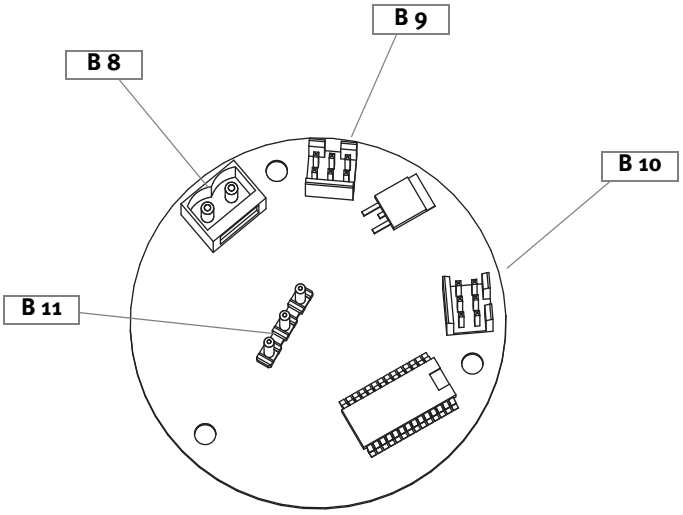

Fig. 8: Motor control board

Mod.	Item	Description	Number	Remark
B	**8**	*Current supply +24V/0V* connection	CON 1	
B	**9**	*Pump control panel* connection	CON 2	
B	**10**	*Hall sensor* connection (actual value)	CON 3	
B	**11**	*Motor* connection	CON 4	

3.2.3 Functional diagram of flow probe

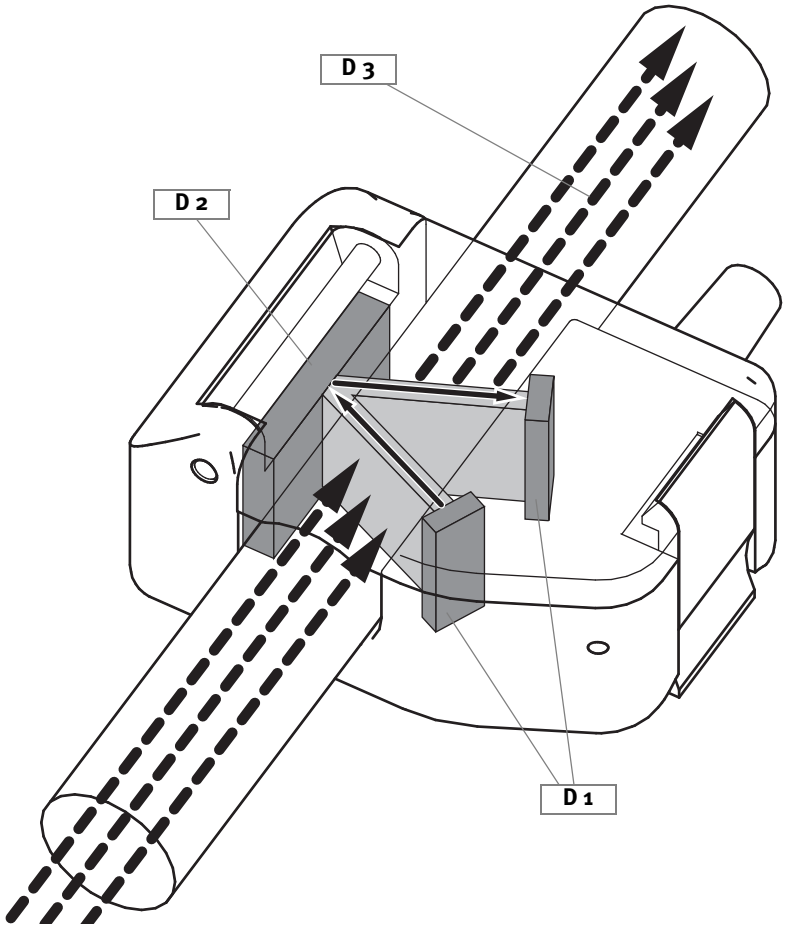

Fig. 9: Functional diagram of flow probe (1)

Mod.	Item	Description
D	**1**	Ultrasound transducers (2 x transmitter/ receiver)
D	**2**	Reflector
D	**3**	Inserted and filled tube

The flow rate is measured by two ultrasound transducers **D 1** in the flow probe. These emit an ultrasound signal twice in alternation, which passes through the tube **D 3** (i.e. the liquid contained) via a reflector **D 2**. Depending on the mean speed of the liquid, the ultrasound signal undergoes a change in the transit time (and thus produces a phase shift from the original signal).

This dual transit is produced by alternating control of the transducers, once **with** and once **against** the direction of flow, generating different transit times for the reflected ultrasound signals. The absolute flow rate can be determined from these two values, but only the signals (which pass through the tube) with an actual change in the transit time are included in the evaluation. The flow rate can thus always be calculated correctly, irrespective of the tube diameter.

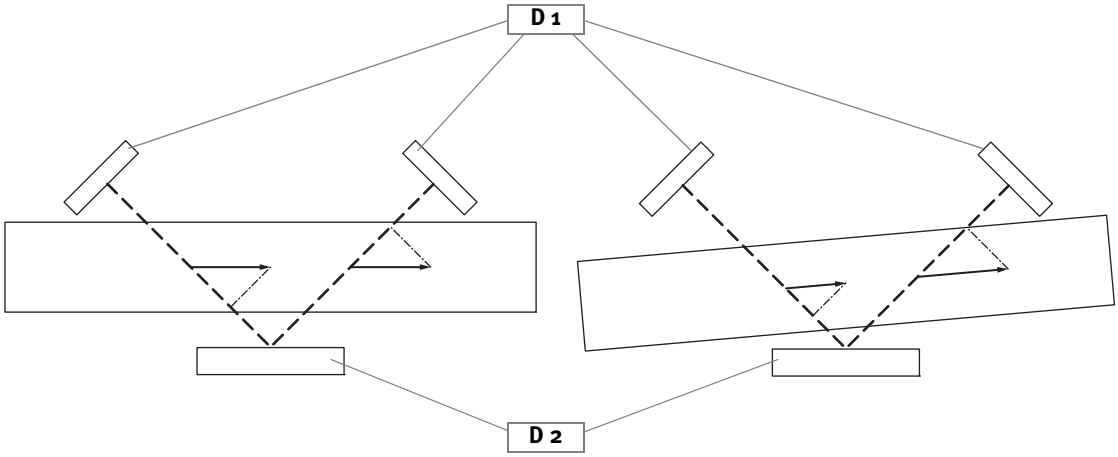

Fig. 10: Functional diagram of flow probe (2)

A particular feature is the lack of sensitivity to measurement errors that might be caused by different positions of the tube within the probe. The change of direction (and the subsequent change in transit time) of the ultrasound signal is dependent on the movement vector (vector components in the direction of flow) of the liquid:

- In the case of a tube that is aligned **straight** in the probe, the movement vector (the shift in the ultrasound signal according to the flow rate) is the same on both transits.
- If the tube runs **at an angle** through the probe, two different movement vectors arise, the sum of which corresponds to the original vectors. This thus ensures a correct measurement, irrespective of the exact position of the tube.

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4 Error messages and error diagnosis

The SCP System is subjected to continual monitoring. Errors that occur (e.g. a component breaks down) are displayed as **E**(rror) codes on the 7-segment displays.

4.1 Error messages

4.1.1 Non-specific error displays and operating errors

Error	Description/Possible causes	Corrective measures (please observe sequence)	
Display is dark	HLM/SCPC connecting cable defective	– Check/replace connecting cable	see page 35
	Switch defective	– Check/replace switch	
	Mains filter defective	– Check/replace mains filter	see page 35
	Contact error (*CPU* board, CON 3)	– Test connector between *CPU* board and *display* board, clean contacts – If the plug contacts are bent or broken, replace *display* board – If the socket contacts are broken or corroded, replace *CPU* board	
	Display board (ZPA 9908) defective	– Replace *display* board	see page 33
	CPU board (ZPA 9910) defective	– Replace *CPU* board	see page 32
	7-segment display “Flow”		
	Flow sensor not correctly connected or defective	– Test flow sensor connection – Replace flow sensor	
	Processor error (display flashes rapidly during operation)	– Replace *CPU* board	see page 32
	Display not “0.00” even though arterial line is clamped (operating error)	– Perform zero calibration according to operating instructions	
	7-segment display “Pressure”		
	No pressure control has been assigned (operating error)	– Assign the pressure control according to operating instructions	
	Incorrect pump no. (S3, SC, S5, C5,) or no display (SCPC)	– With S3/SC/S5/C5 the SCP is displayed as pump no. 6. However, with S5 and C5 the initial pump number 6 can be modified. – No connection to SCPC. Check the position of S1 on the CPU board ZKR 9910: – For S3, SC, or SCPC the S1 switch must be OFF. – For S5 and C5 the S1 switch must be ON.	see page 29

4.1.2 Error codes

The following error messages are only shown on the 7-segment display “Actual value” (RPM).

Error	Description/Possible causes	Corrective measures (please observe sequence)	
	RAM defective	– Replace *CPU* board	see page 32
	EPROM defective, checksum incorrect	– Replace EPROM or – Replace *CPU* board	see page 31 see page 32
	EEPROM defective	– Replace *CPU* board	see page 32
	Processor error	– Replace *CPU* board	see page 32
	Display error, either *Display* board or *CPU* board defective	– First replace *display* board; if the error display persists – Replace *CPU* board	see page 33 see page 32
	Processor error	– Replace *CPU* board	see page 32
	Difference set value-actual value of pump more than 250 RPM, drive unit error	– Replace *motor control* board	see page 40
	A/D converter: reference voltage outside tolerance limits	– Replace *CPU* board	see page 32
	Shut-off path test (on powering up) defective	– Replace *CPU* board	see page 32
	Difference set value-actual value of pump more than 1000 RPM, drive unit or *CPU* board error	– Replace *motor control* board; if the error display persists – Replace *CPU* board	see page 40 see page 32

Error	Description/Possible causes	Corrective measures (please observe sequence)	
E78	Pump continues running: Inconsistent actual value impulses	– Test Hall sensor/*motor control* board connection (CON 3), clean where necessary – If the error display persists (i.e. defective Hall sensor), replace drive unit completely	
	Pump stops: No actual value impulses	– Test Hall sensor/*motor control* board connection (CON 3), re-establish where necessary – Test *motor control* board/pump control panel connection (CON 2), test connecting cable/short circuit, where necessary replace connecting cable – Replace *motor control* board – Replace *CPU* board	see page 42 see page 40 see page 32
E80	Shaft angle encoder defective	– Replace shaft angle encoder (complete) – If the error display persists, replace *CPU* board	see page 37 see page 32
E81	Logical program run error	– Replace EPROM – If the error display persists, replace *CPU* board	see page 32
E82	Pump coding invalid	– Test CAN/24V connection to HLM (e.g. test with a roller pump) – Test *CAN/24V* connection in pump control panel (CON 1), test connecting cable/short circuit, where necessary replace connecting cable – Adjust DIP switch (1) on the circuit board *CPU* (ZKR 9910) to the correct setting: Switch setting ON: when operating with the S5 System Switch setting OFF: when operating with the S3 System	see page 35 see page 29
E87	Data transmission drive unit/pump control panel defective	– Test *motor control* board/pump control panel connection (CON 2), test connecting cable/short circuit, where necessary replace connecting cable. If the error display persists: – Replace *motor control* board – Replace *CPU* board	see page 35 see page 40 see page 32

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5 Replacing components

5.1 Pump control panel

5.1.1 Opening the pump control panel

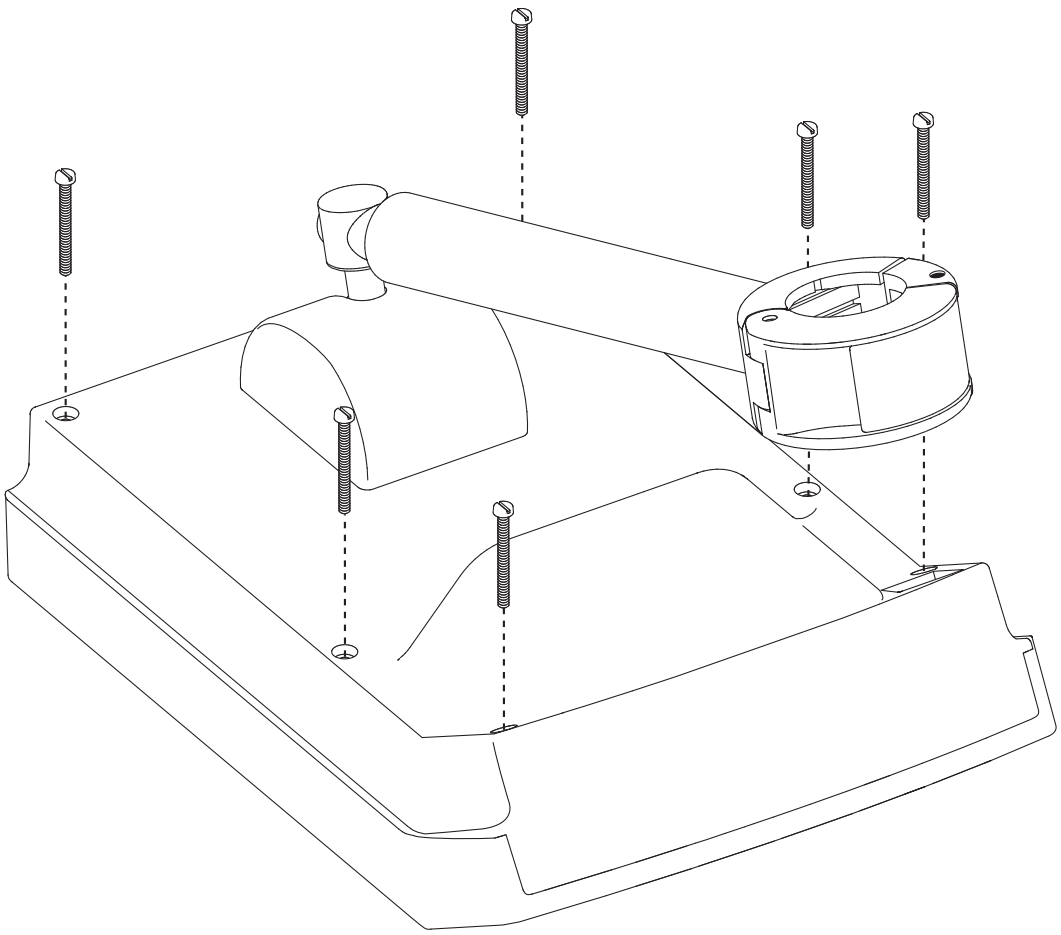

Fig. 11: Opening the casing (1)

To open the casing:

- Unscrew the six screws on the back panel (slotted screwdriver size 2).
- Turn the pump control panel over so that the front is pointing upwards.
- Carefully lift the front of the casing. **Caution**: The upper casing cannot be fully removed yet as the connections between the upper and lower casing must first be detached!

Operating with the S5/C5 or the S3/SC System

Open the pump control panel to assign the SCP System to the S5/C5 or the S3/SC System.

- Adjust DIP switch **A 29** on the circuit board *CPU* (ZKR 9910) to the correct setting:
  - Switch 1 / setting ON: when operating the SCP System with the S5 or the C5 System
  - Switch 1 / setting OFF: when operating the SCP System with the S3 or the SC System

Pump number "6" will be displayed on the corresponding HLM if the assignment was performed correctly.

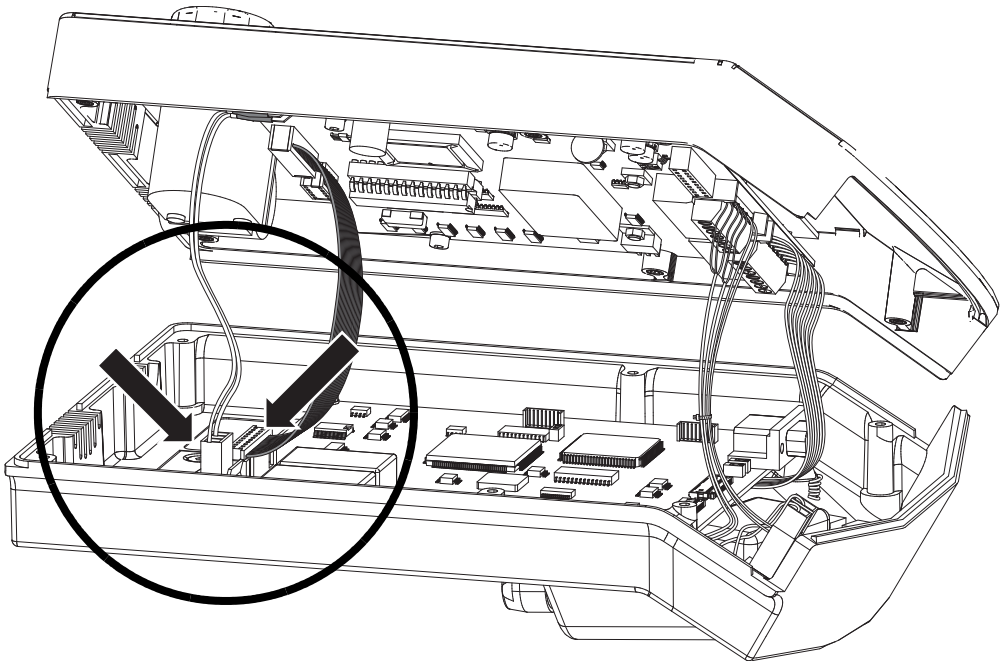

Fig. 12: Opening the casing (2)

- Release the two connectors indicated on the *flow sensor* board (*CPU* board connection **A 40** and current supply connection **A 41**).
- Now open up the casing lengthwise (over the upper casing).

Caution on subsequent re-assembly: Sharp edges on the shaft angle encoder board can damage the flat cable and/or its insulation. Ensure that the cables lie flat on the *CPU* board and do not touch the shaft angle encoder board.

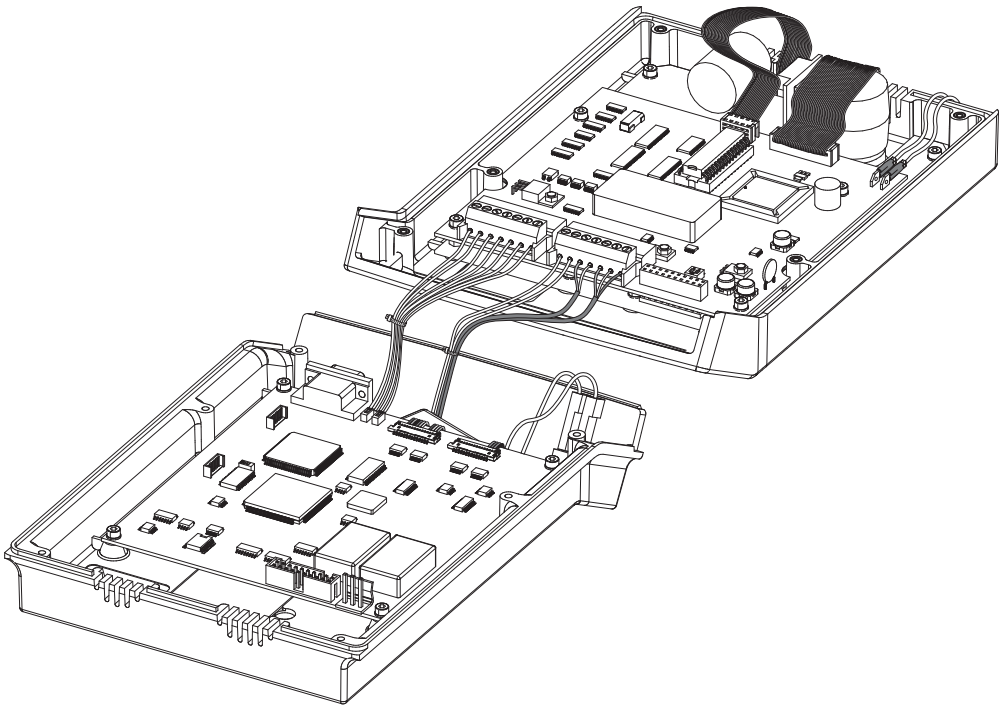

Fig. 13: Opening the casing (3)

5.1.2 Replacing pump control panel components

EPROM

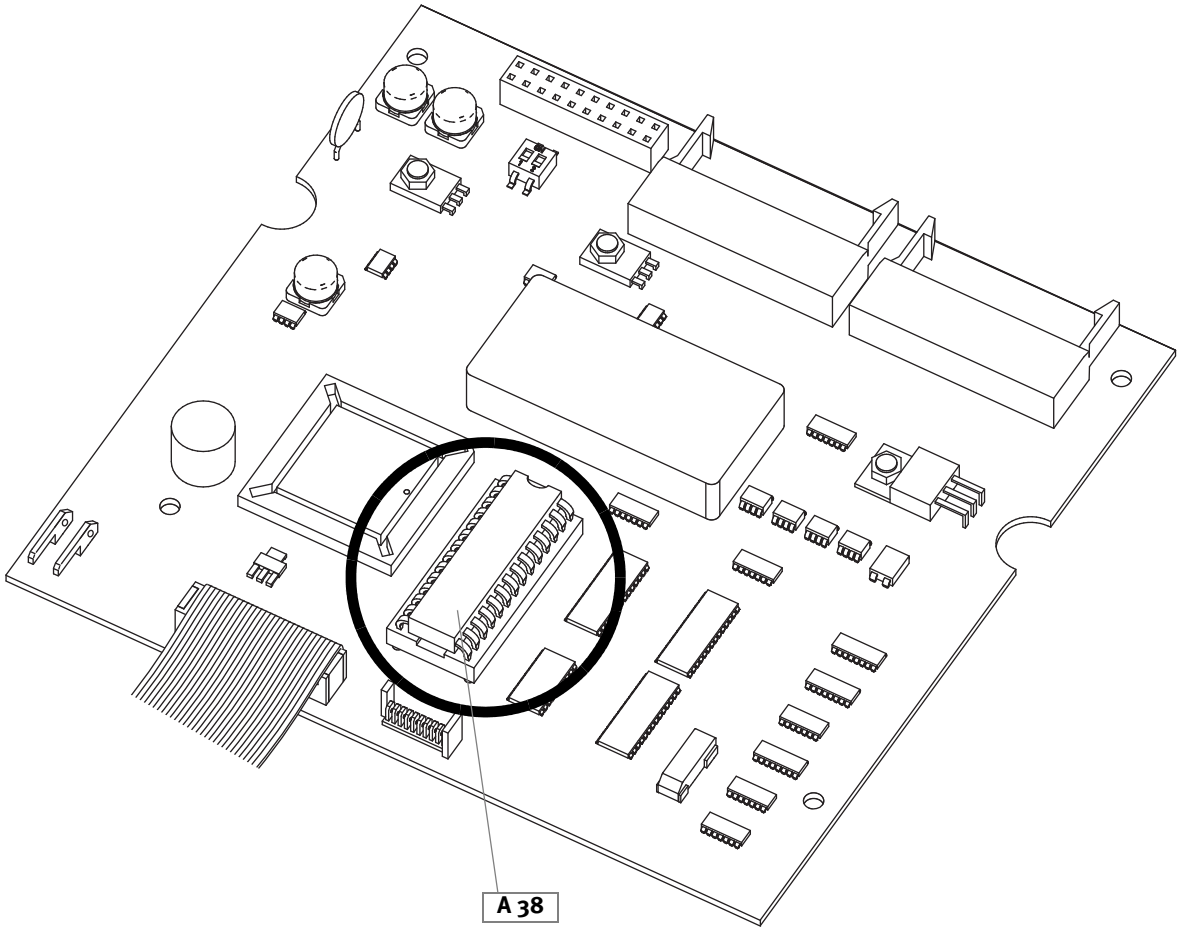

Fig. 14: Replacing the EPROM

The EPROM **A 38** contains the operating software (firmware) of the SCP System. Replacement is necessary in the following cases:

- To perform an update
- In the event of error messages that indicate a defect in the EPROM (E02, E81).

Observe the following instructions when replacing the EPROM:

- Always use suitable removal and insertion tools so as not to bend the contacts.
- Avoid static charging (and hence damaging the electronic components) by suitable earthing measures.
- When inserting the new EPROM, ensure the correct alignment (notch pointing towards centre of board).

CPU board (ZKR 9910)

Removal of the *CPU* board is necessary in the following cases:
- For removal of the *display* board ZPA 9908
- For replacement in the event of error messages that indicate a defect in this board (e.g. E01, E03 ... E06)

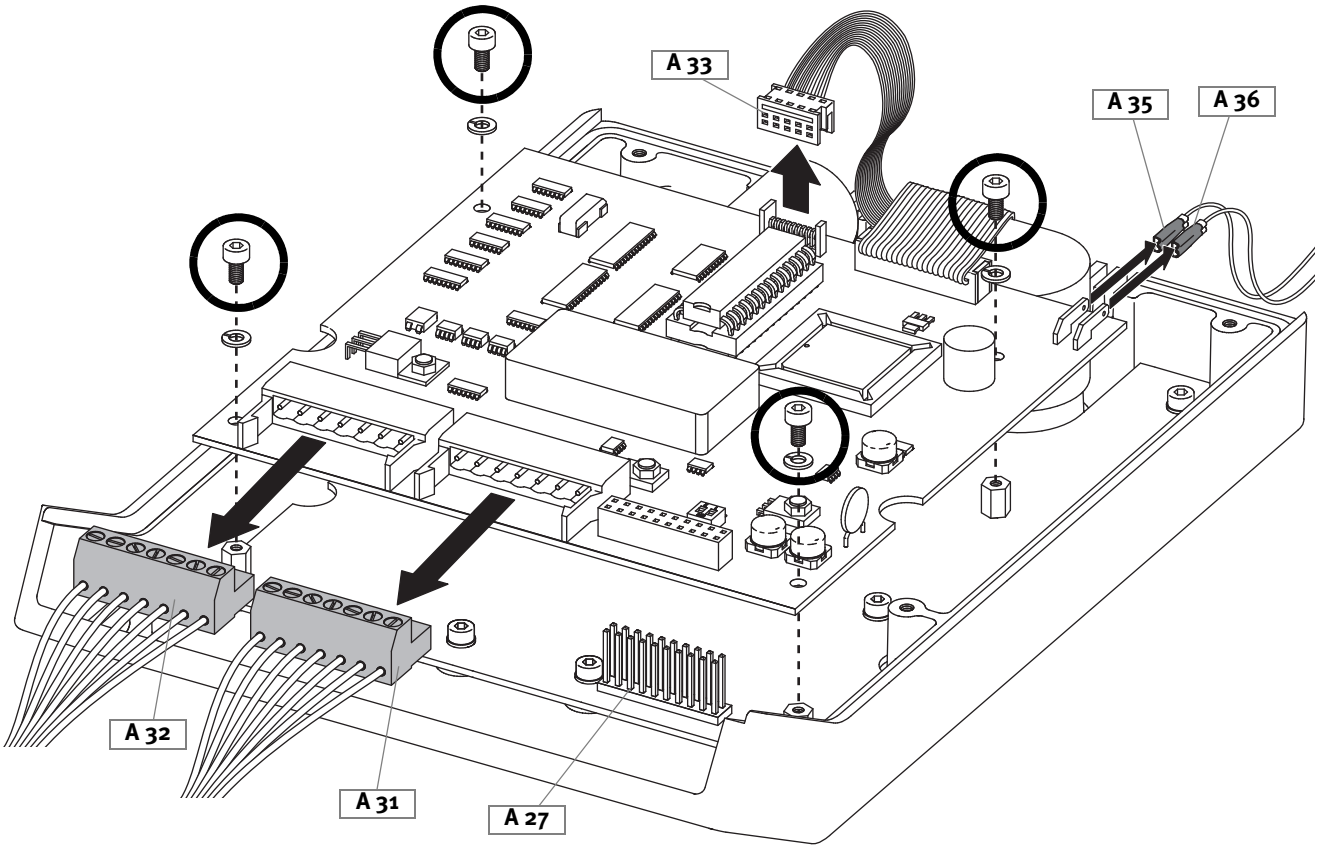

Fig. 15: Dismantling the CPU board

- Unplug the connectors.
  - ➜ **A 33** (*Shaft angle encoder* connection)
  - ➜ **A 35** and **A 36** (*flow sensor* board current supply)
    Note: Mind the polarity of the current supply to avoid confusing the plugs during reassembly.
  - ➜ **A 31** (*CAN/24V* connection) and **A 35** (*drive unit* connection)
- Unscrew the four screws indicated (Allen key size 2.5) including the washers.
- Carefully pull the board straight upwards. Ensure that the contacts of the connector **A 27** (*display* board) are not bent.

Then replace the board in the opposite order.

Display board (ZPA 9908)

Removal of the *display* board is necessary in the following cases:
- For replacement in the event of defective keys, LEDs or 7-segment displays
- For replacement in the event of a relevant error message (E08)
- For replacement in the event of a defective fan

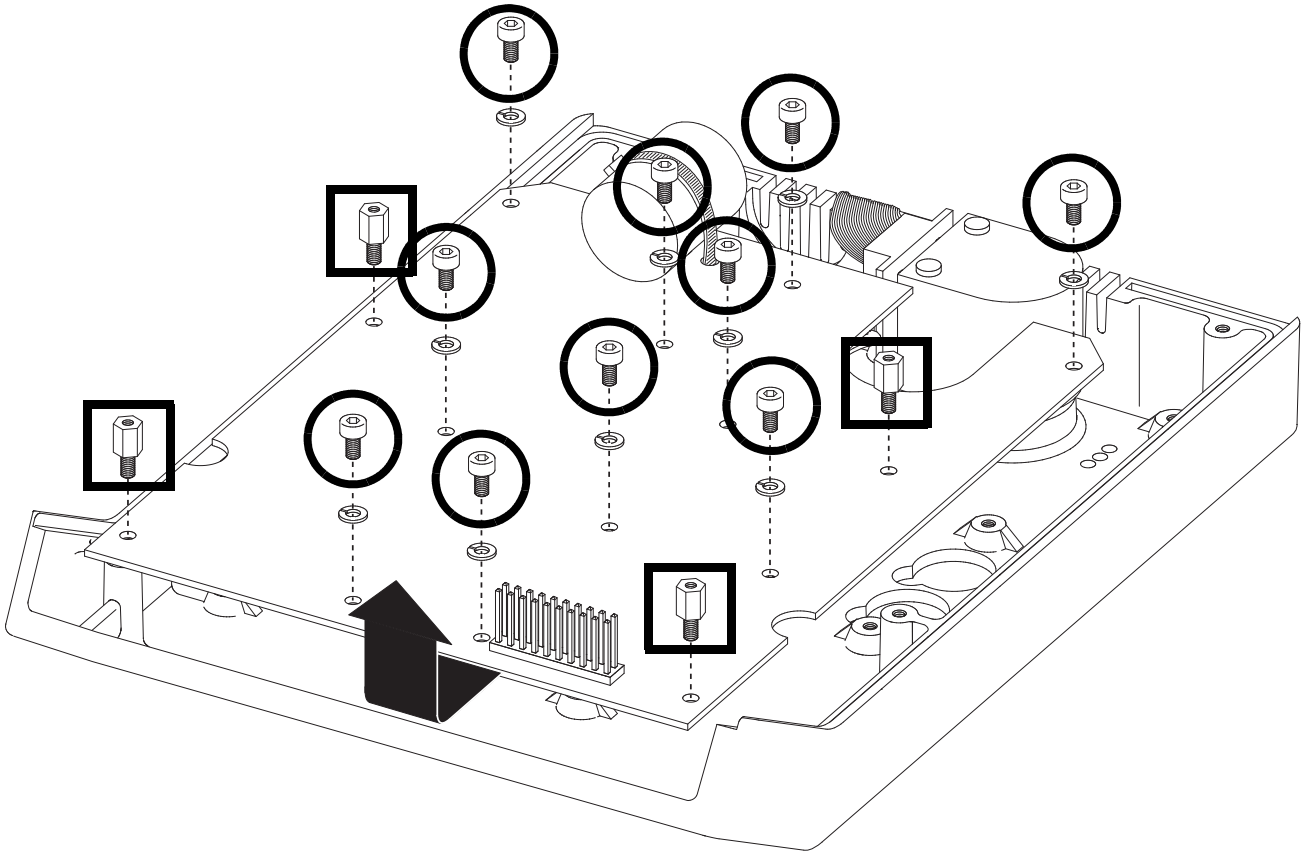

Fig. 16: Dismantling the CPU board

- Unscrew the ten screws indicated (Allen key 2.5) including the washers.
- Loosen the four mounting bolts indicated
- Pull out the board carefully
  - ➜ first from underneath the shaft angle encoder and
  - ➜ then upwards (see arrow in top diagram).

Then replace the board in the opposite order.

Note that the display board is part of a spare part kit (p/n 003-20-001) which also includes 6 pusher caps. Previous versions of the display board can still be used; use the pusher caps from the display board you are replacing. The old pusher caps do not fit on the current version of the display board.

Flow sensor board (DIGIFLOW)

Removal of the *flow sensor* board is necessary in the following cases:
- If there is no flow display despite the fact that the flow sensor is correctly connected and intact. There is no special error message (error code).
- For replacement of the mains filter and the connecting cable to the pump control panel.

Note that the Transonic FPT1004 flow sensor board has become obsolete. If the flow sensor is defective, installed Transonic FPT1004 flow sensor boards must be replaced with the DIGIFLOW flow sensor board (p/n 90-900-520).

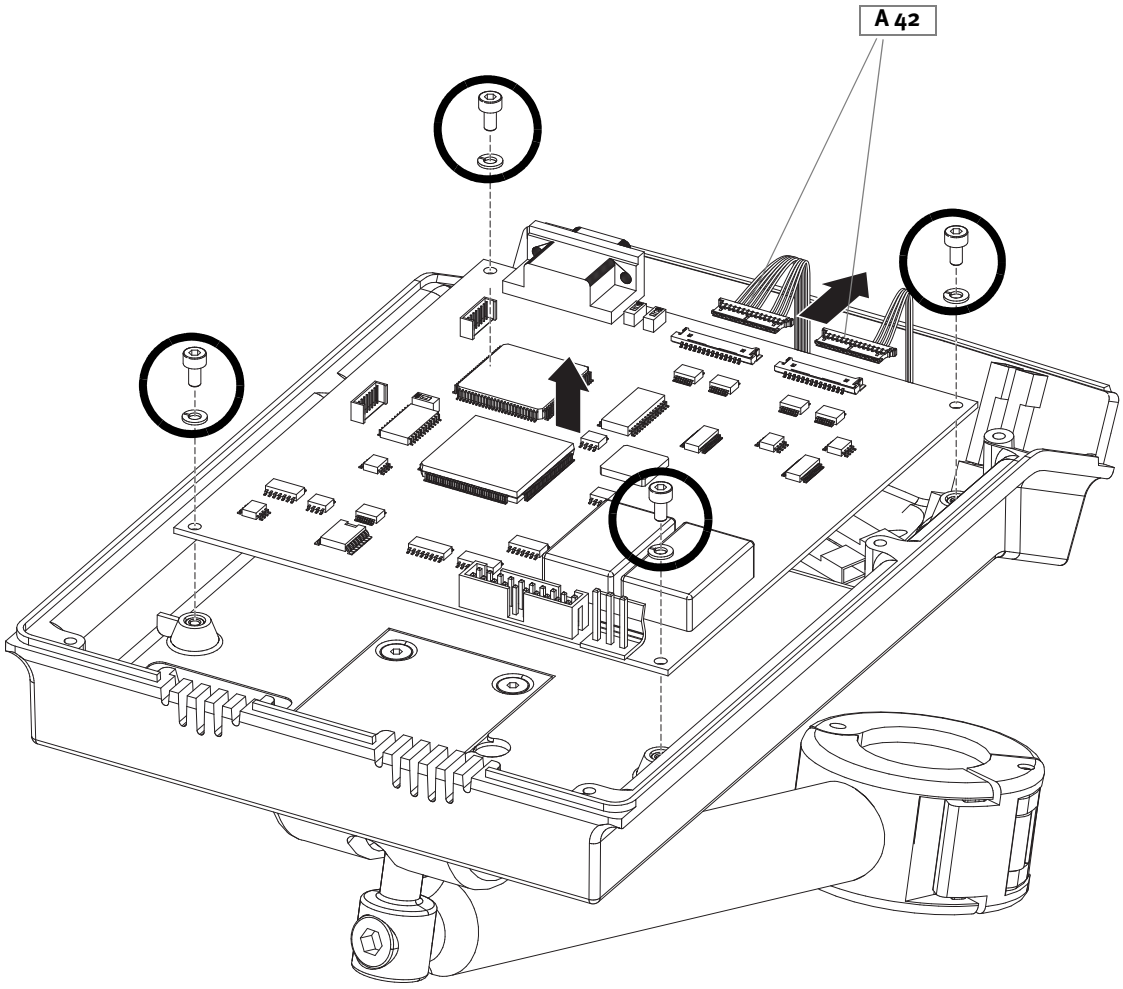

Fig. 17: Dismantling the flow sensor board

- Remove the two connectors of the flow sensor **A 42** cable from the flow sensor connections.
- Unscrew the four screws indicated (Allen key size 2.5) including the washers.
- Carefully pull the board upwards.

Then replace the board in the opposite order.

Connecting cable and/or mains filter

Before removing the connecting cable, the *flow sensor* board must first be dismantled (page 34).

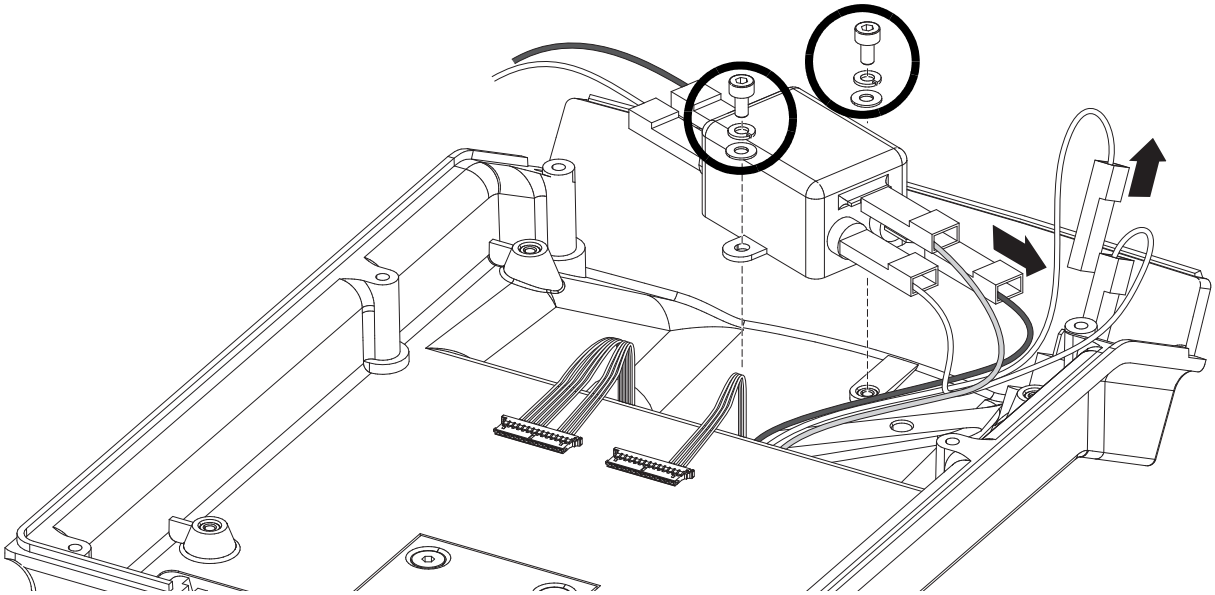

Fig. 18: Dismantling the connecting cable (1)

- Unscrew the two marked screws on the mains filter **A 7** (Allen key size 2.5) including the washers.
- Lift up the mains filter.
- Disconnect the connections on the connecting cable from the mains filter (brown cable) and from the toggle switch (white cable). If you only want to replace the mains filter, remove all connectors now and ignore the following steps for replacing the cable.
- Detach any cable clips that prevent the connecting cable from being removed.

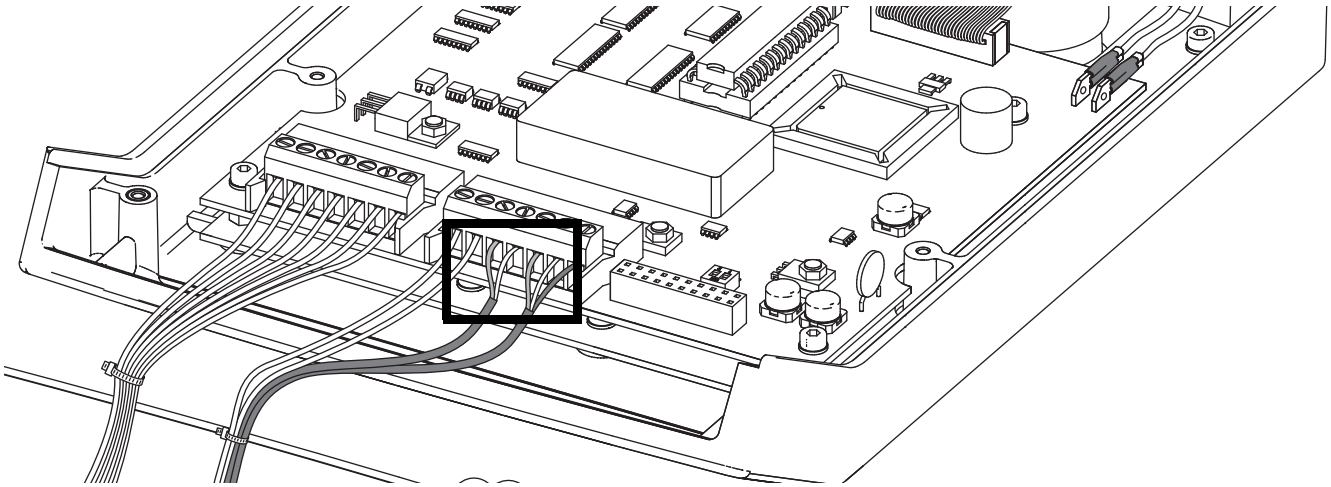

Fig. 19: Dismantling the connecting cable (2)

- Open the terminal screws at the CON1 connector for the two protected connecting cables (black, triple wire and twin wire).
- Pull the five cable ends out of the plug (black/yellow/green and yellow/green)

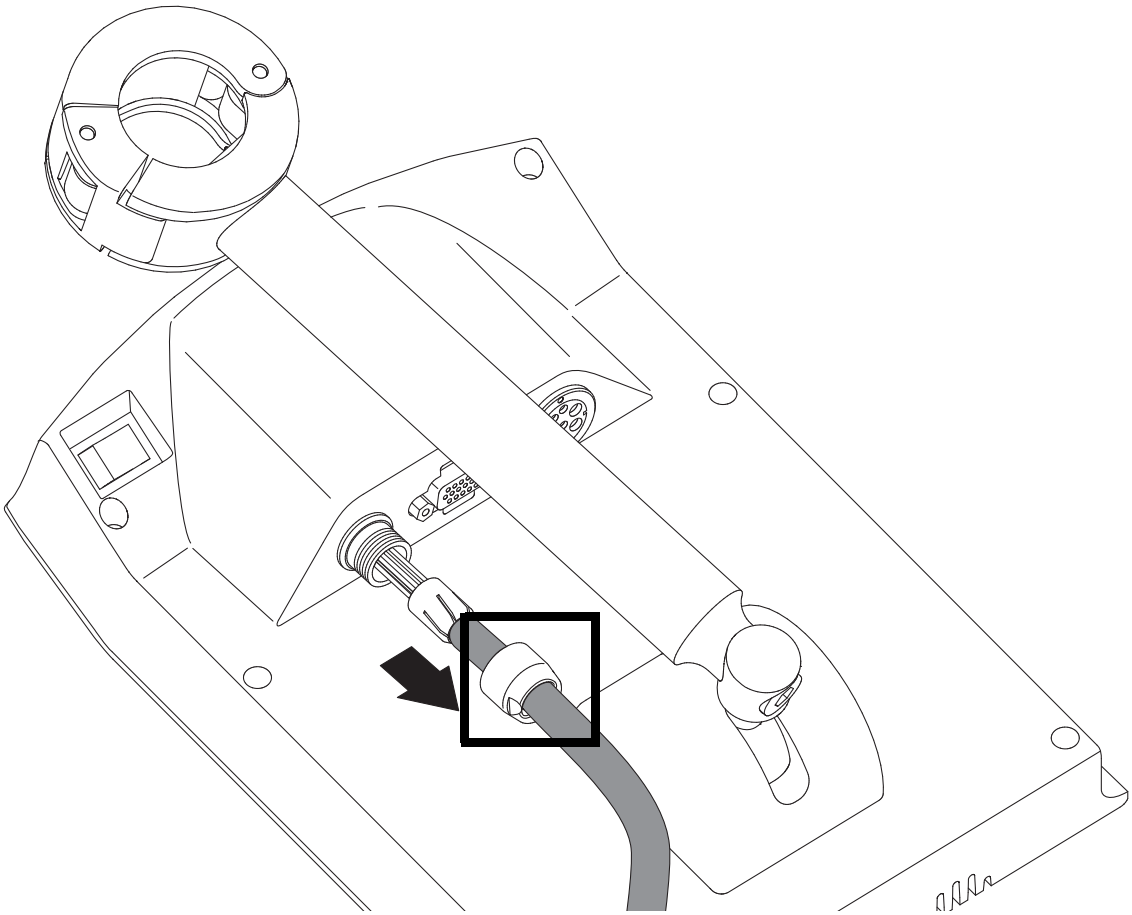

Fig. 20: Dismantling the connecting cable (3)

- Open the strain relief clamp on the rear of the casing and pull the cable out.
- Remove the two sheaths from the old cable. You will need these to re-attach the new cable.

When inserting the new cable (in the reverse order) ensure that the connections at the CON1 connector are correctly assigned:

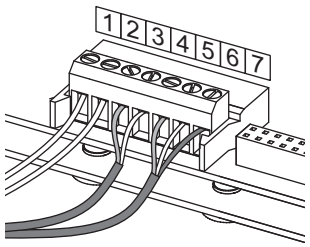

Fig. 21: CON1 connection configuration

1	White	Current supply from mains filter.
2	Brown	**Caution**: Do not transpose!
3	Green	from connecting cable (twin wire)
4	Yellow	
5	Green	from connecting cable (triple wire)
6	Yellow	
7	Black (sheath)	

Dismantling the shaft angle encoder (SAE)

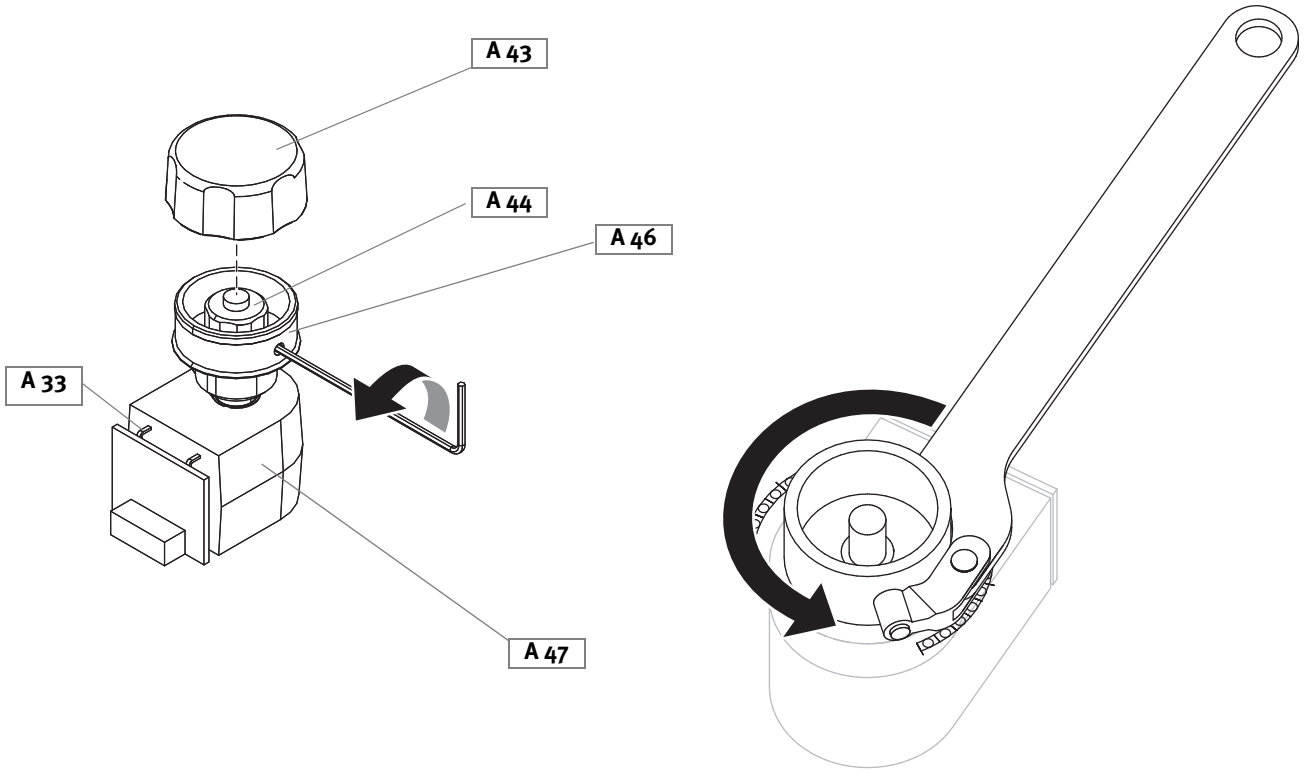

Fig. 22: Dismantling the shaft angle encoder

Mod.	Item	Description	Number	SP number
A	**43**	Rotary knob		96-190-057
A	**44**	Mounting nut		28-91-76
A	**45**	Washer PA 6.2 x 12.0 x 0.5 (see fig. 23)		71-120-514
A	**46**	Guide sleeve		60-02-02
A	**47**	Shaft angle encoder		97-103-603
		Threaded rod, M3x3		71-118-301
A	**48**	Washer (see fig. 23)		60-02-04
A	**49**	Mounting adapter		45-21-45

- Pull the rotary knob **A 43** upwards.
- Release the mounting nut **A 44** with an Allen key (size 1.5) and remove the mounting nut.
- Release the guide sleeve **A 46** by means of a suitable hinged pin wrench. Hold the shaft angle encoder assembly securely while removing the guide sleeve to prevent damage, e.g. by an unintentional movement of the shaft angle encoder body.
- Unplug the connector **A 33** of the shaft angle encoder.
- The shaft angle encoder **A 47** may now be removed.

Assembling the shaft angle encoder

To assemble the shaft angle encoder you need:
- special mounting adapter for torque wrench (p/n 45-21-45)
- washer (p/n 60-02-04)
- a commercially available torque wrench with precision of ± 0.1 Nm

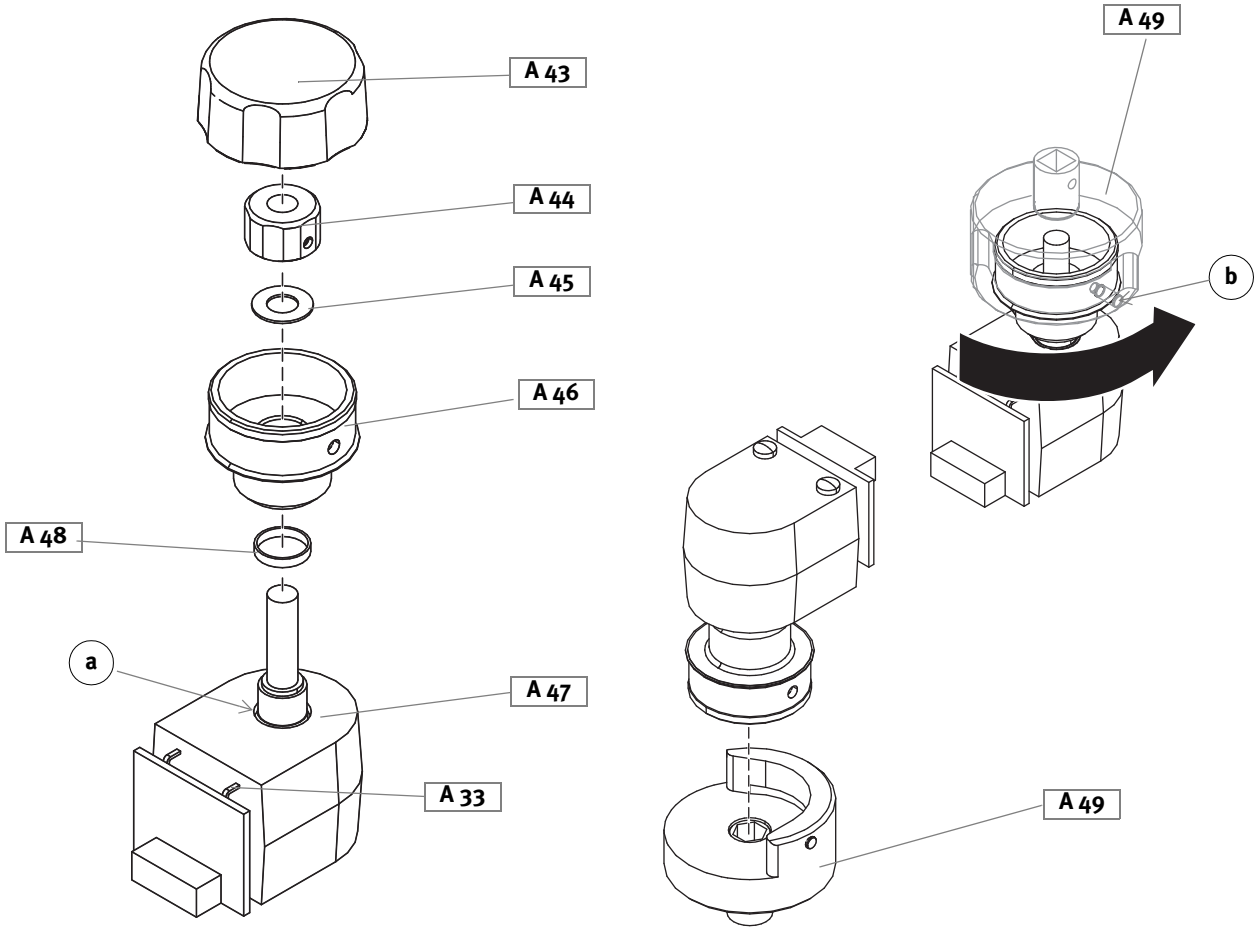

Fig. 23: Assembling the shaft angle encoder

- Use only tested shaft angle encoders (SAE) with a flat cable.
- Slide the washer **A 48** over the shaft of the SAE and place it into the groove **a**.
- From below, put the SAE through the opening of the pump control panel and hold on to it. Make sure that the SAE is seated correctly.
- Lightly screw the guide sleeve **A 46** onto the SAE.
- Place the mounting adapter on the guide sleeve.
- Using the torque wrench, tighten the guide sleeve with a **torque of maximum 1.5 ± 0.1 Nm**.
- Slide the PA washer **A 45** over the shaft of the SAE.
- Slide the mounting nut **A 44** onto the shaft of the SAE until it touches the guide sleeve.
- Position the mounting nut **A 44** with the two set screws **b straight** on the axis. Then check whether the shaft can be easily and smoothly rotated in both directions.
- Put the rotary knob **A 43** onto the mounting nut **A 44**, ensuring that the external sides (mounting nut) and internal sides (rotary knob) correspond to one another.
- Check whether the rotary knob can be easily and smoothly rotated in both directions.

- Reconnect the connector **A 33** to the *CPU* board.

5.2 Drive unit

Maintenance work on the drive unit is restricted to replacing the *motor control* board ZPR 9909 A and/or the connecting cable. In the event of errors requiring more extensive repairs, replace the whole drive unit.

5.2.1 Opening the drive system

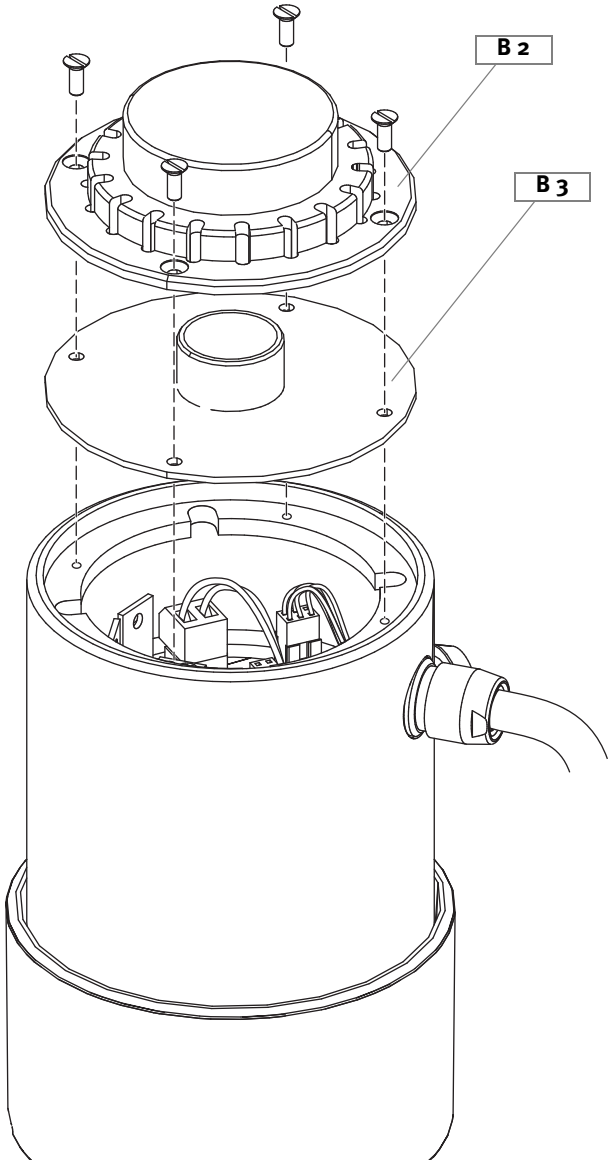

Fig. 24: Opening the drive unit casing

- Unscrew the four screws on the base plate **B 2** (slotted screwdriver size 2).
- Remove the base plate.
- Remove the splash protection **B 3**.

5.2.2 Replace drive unit components

Motor control board (ZPR 9909 A)

It is only necessary to dismantle the motor control board if relevant error messages are displayed (e.g. E62, E76)

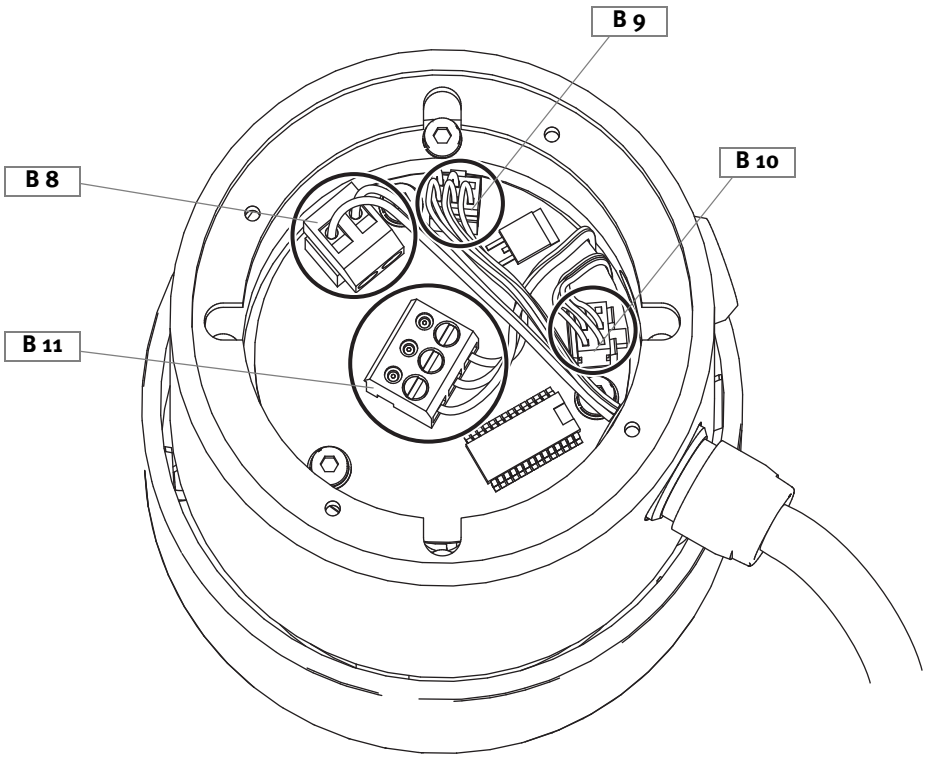

Fig. 25: Dismantling the motor control board (1)

Detach the following connectors:

- **B 8** *Current supply* connector (CON1)
- **B 9** *Pump control panel* connection (CON2)
- **B 10** *Hall sensor* connection (CON3)
- **B 11** *Motor* connection (CON4)

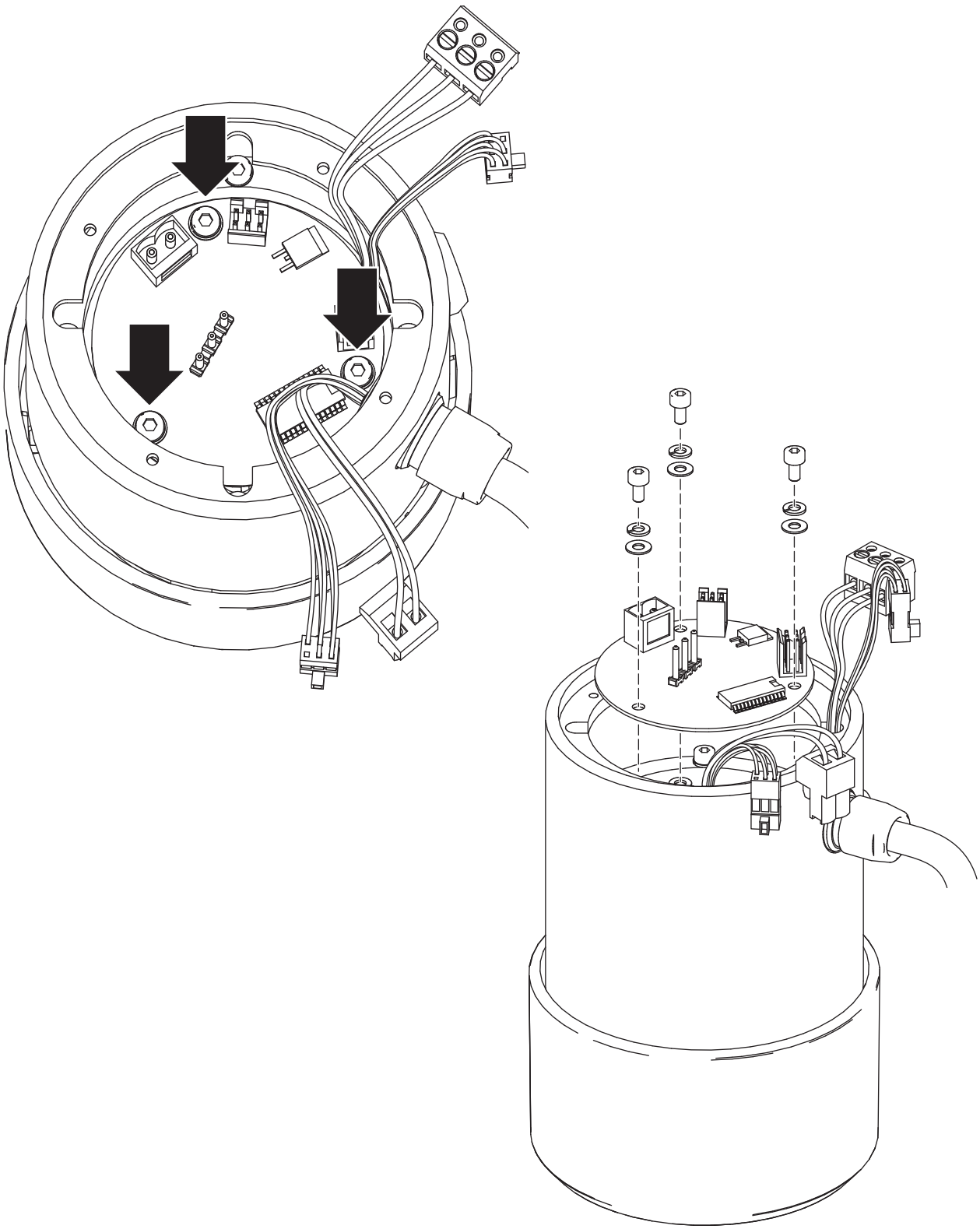

Fig. 26: Dismantling the motor control board (2)

- Unscrew the three marked screws (Allen key size 2.5) including the washers.
- Carefully pull the board out upwards.

Connecting cable

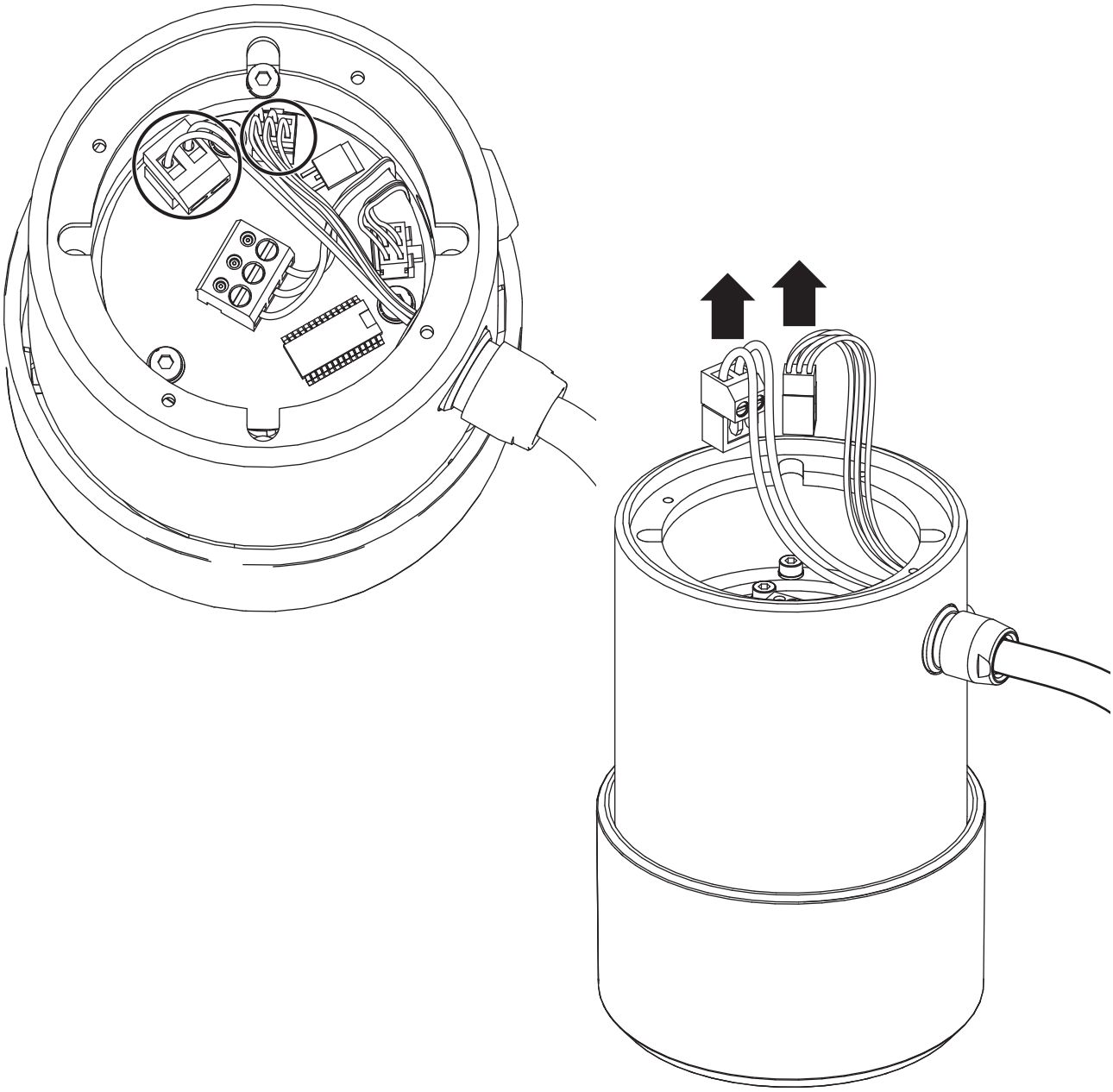

Fig. 27: Dismantling the connecting cable (1)

Unplug the two connectors.

- **B 8** *Current supply* connector (CON1)
- **B 9** *Pump control panel* connection (CON2)

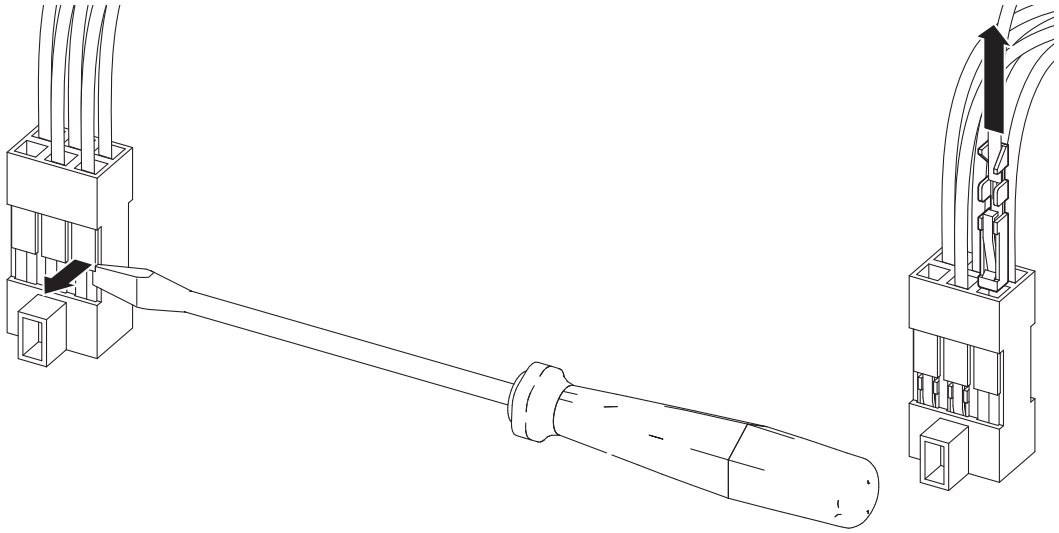

Fig. 28: Dismantling the connecting cable (2)

- Release the screw clamps on the *current supply* **B 8** connection (CON1) and pull the cable out.
- Bend the holding clips on *pump control panel* connection **B 9** e.g. with a suitable small screwdriver **gently** forwards and pull the cable with the crimp contacts out of the casing. Ensure that the holding clips are not damaged.

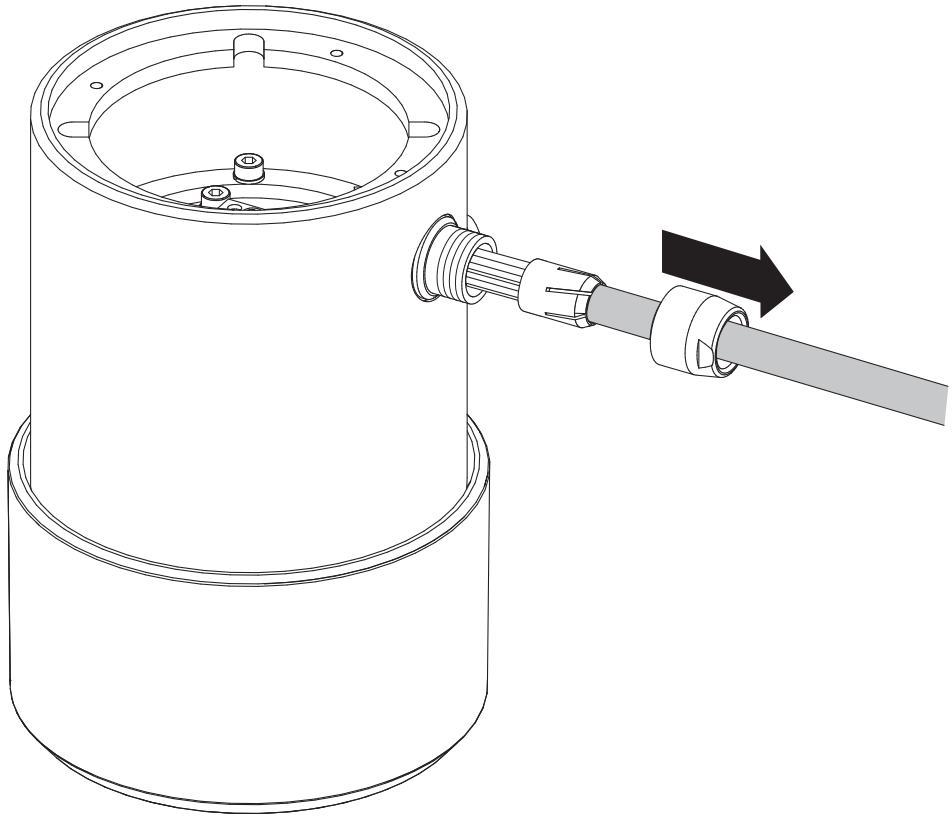

Fig. 29: Dismantling the connecting cable (3)

- Open the strain relief clamp on the rear of the casing and pull the cable out.
- Remove the two sheaths from the old cable. You will need these to re-attach the new cable.

When inserting the new cable (in the reverse order) ensure that the connections are correctly assigned:

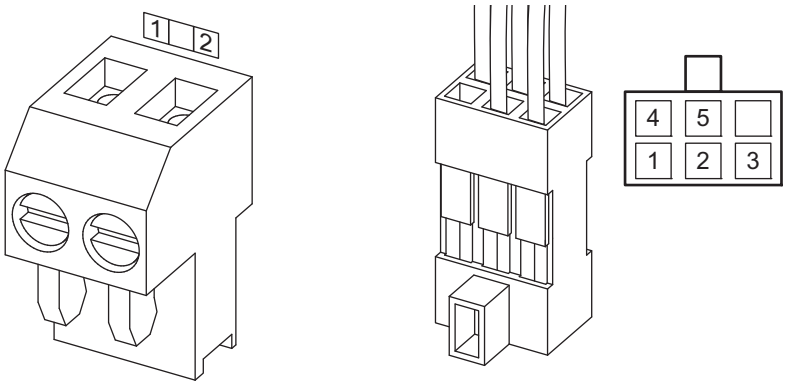

Fig. 30: CON1 and CON2 connection configuration

Current supply connection (CON1)		
1	White	Current supply
2	Brown	**Caution**: Do not transpose!
Pump control panel connection (CON2)		
1	Yellow	from connecting cable (**triple** wire)
2	Green	
3	Green	from connecting cable (**twin** wire)
4	Yellow	
5	Black (sheath)	from connecting cable (**triple** wire)

6 Appendix

6.1 Technical data

6.1.1 Dimensions, weights, operating conditions

SCP Pump control panel	
Width	180 mm/ 7.1 in.
Height	270 mm/ 10.6 in.
Depth	75 mm/ 3 in. (without mast holder)
Weight	3.5 kg/ 7.7 lbs (with mast holder)

SCP Drive unit	
Diameter	96 mm/ 3.8 in. (without mast holder)
Height	135 mm/ 5.3 in.
Weight	3.0 kg/ 6.6 lbs.

SCP Emergency drive unit	
Diameter emergency drive unit	100 mm/ 3.9 in. (without mast holder)
Height	250 mm/ 9.8 in.
Weight	3.5 kg/ 7.7 lbs.
Height hand crank	115 mm/ 4.5 in.
Diameter hand crank	26 mm/ 1 in.

Operating conditions	
Operating temperature	+10 °C /50 °F through +40 °C/104 °F
Storage temperature	0 °C /32 °F through +40 °C /104 °F
Relative humidity (operation and storage)	30% through 75%

6.1.2 Electrical specifications

SCP Pump control panel	
Drip-proof	IPX2
Input voltage	24 V-supplied via heart-lung machine/ SCPC System
Input current	6 A
Power consumption	120 W max.

SCP Drive unit	
Drip-proof	IPX2
Input voltage	min.: 20 V_{DC} nom.: 24 V_{DC} max.: 32 V_{DC}

6.1.3 General data

Pump data	
Range of speed	0 through 3500 RPM
Speed accuracy	±10 RPM

Displays	
Range of RPM display	0 through 3500 RPM
Resolution of the displayed actual value	1 RPM
Resolution of the adjusted set value	1 RPM

Measurement range: Flow	-10 through +10 LPM
Resolution of the 7-segment display of the flow rates	0.1 LPM ‹ 0 LPM 0.01 LPM › 0 LPM
Accuracy of the measured flow	±10% of the actual value and/or ± 0.1 LPM, whichever is greater
Alarm limits of the displayed flow	Flow too high: 0.5 through +10.0 LPM Flow too low: 0.0 through 5.0 LPM Retrograde flow: 0.0 through 1.0 LPM

Pressure display	
Range of display	-99 through +999 mmHg
Resolution	1 mmHg
Accuracy of the measured values	±5 mmHg

Emergency drive unit	
Speed display	7 LEDs
Resolution	500 RPM per LED (starting at 1000 RPM)
Displayed range of speed	1000 through 4000 RPM
Accuracy	±250 RPM

6.2 Labelling

Designations and icons on the nameplates:

	Attention! Please refer to documentation.
	Follow instructions for use (white symbol on blue background)
	Follow the operating instructions
IPX2	Drip proof
REF	Purchase order number
SN	Serial number
	Date of manufacture
	Manufacturer
Rx ONLY	Only applies in the U.S.A.: Sale (and prescription) is restricted to physicians

6.3 Part numbers, standard components and accessories

SCP System complete, consists of:	**60-00-00**
SCP Drive unit (cable supplied)	**60-01-00**
with blocking ferrite (designation: 742 712 21)	**96-530-110**
Pump control panel (with holder)	**60-02-15**
24 V Connection cable (for S3/SC/SCPC System)	**45-11-02**
with blocking ferrite (designation: 742 712 21)	**96-530-110**
Flow Measurement Sensor Stöckert 3/8" x 3/32"	**96-414-120**
with blocking ferrite (designation: 742 711 4)	**96-530-112**
Emergency drive unit (complete)	**60-01-50**
Cable for connection to the S5 System (including blocking ferrite)	**45-12-00**
Accessories	
Revolution®	**96-490-501**
SCP System (for S5 System exclusively) complete, consists of:	**60-00-50**
SCP drive unit (cable supplied)	**60-01-00**
with blocking ferrite (designation: 742 712 21)	**96-530-110**
Pump control panel (with holder)	**60-02-50**
Connection cable with S5 system plug	**45-12-02**
with blocking ferrite (designation: 742 712 21)	**96-530-110**
Flow Measurement Sensor Stöckert 3/8" x 3/32"	**96-414-120**
with blocking ferrite (designation: 742 711 4)	**96-530-112**
Emergency drive unit (complete)	**60-01-50**

6.4 Accessories

The safety of the overall system (in accordance with MDD 93/42 Annex I/Essential Requirements) is certified when using the SCP System in combination with the Revolution® and tubings manufactured by LivaNova. All safety checks and functional checks must be carried out in accordance with the respective separate instructions for use.

When using disposables from other manufacturers, it is incumbent upon the user to provide proof of the safe operation of the overall system.

6.5 Service component part numbers

These part numbers refer to parts and components that are used exclusively for service purposes.

6.5.1 Pump control panel

Mod. Item	Description	Number	SP number
A 1	Upper casing		75-521-101
	Foil for (**A 1**)		76-102-941
A 2	Shaft angle encoder, consisting of		see page 37
	Rotary knob **A 43**		96-190-057
	Mounting nut **A 44**		28-91-76
	Washer PA 6.2 x 12.0 x 0.5 **A 45**		71-120-514
	Guide sleeve **A 46**		60-02-02
	Shaft angle encoder **A 47**		97-103-603
	Threaded rod, M3x3		71-118-301
	Washer **A 48**		60-02-04
A 3	Kit PCB ZBA board with pusher caps – *Display* board – Pusher caps (6 pieces)	ZPA 9908	003-20-0001
A 4	*CPU* board	ZKR 9910	90-305-190
A 5	*Flow sensor* board	DIGIFLOW	90-900-520
A 6	Lower casing		75-521-102
A 7	Mains filter		96-401-012
A 8	Toggle switch		96-121-209
A 9	Connecting cable to E/P pack, S3 Connecting cable to E/P pack, S5		97-102-616 97-102-626
A 10	Holder (complete) for control panel		60-02-13
A 38	EPROM (firmware)	ZKR V2.2	93-484-232
A 42	Flow sensor cable		97-101-898

6.5.2 Drive unit

Mod. Item	Description	Number	SP number
A 9	Connecting cable to E/P pack, S3 Connecting cable to E/P pack, S5		97-102-616 97-102-626
B 5	*Motor control* board	9909	90-305-185
B 6	Connecting cable to pump control panel		97-102-615
	Kit - Splash protection SCP, consisting of		003-20-0002
B 2	– Base plate		
	– Countersunk head screws (hex head screw), DIN 7991, M3x8 (4 pieces)		
B 3/**B 4**	– Splash protection with slide bearing		

Notes: