

New as of:

10.2005



C2⁺, C3⁺, C4⁺, C5⁺, M1⁺

Service Manual

English

IMPORTANT:

- **In case of faults which you are unable to eliminate with the help of this manual, please contact our Customer Service Center.**
- **It is essential that you take this Service Manual along with you on every customer call.**

Furthermore, you must always have the spare parts list and wiring diagrams with you as well.

You can order additional copies of this Service Manual under the

- order number **58 77 977** from our department **DZL 1** in Bensheim.

See reverse side of manual for address.

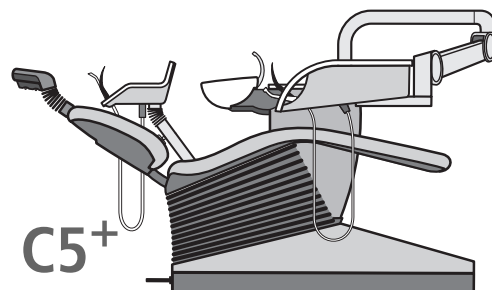
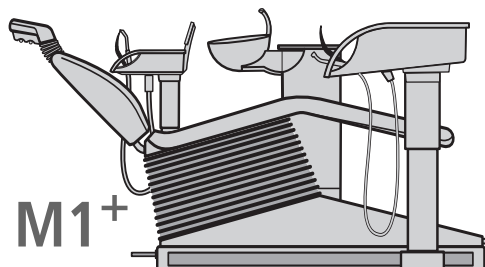
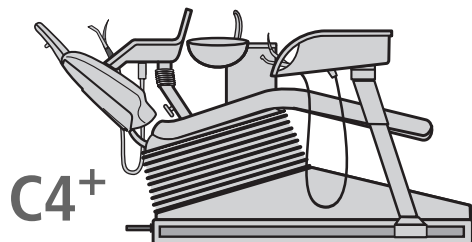
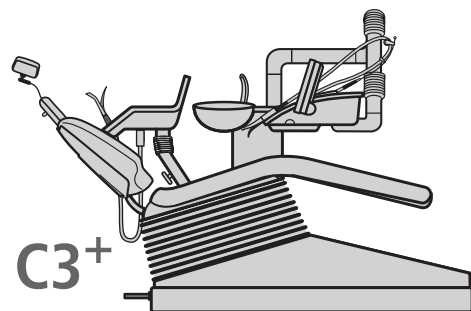
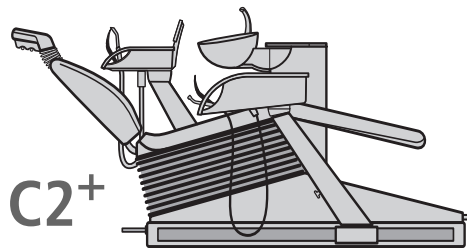
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Service Manual

English



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1 Important information

C2⁺, C3⁺, C4⁺, C5⁺, M1⁺

1 Important information

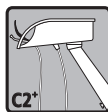
1.1 Technical data

Model designation	C2 ⁺ , C3 ⁺ , C4 ⁺ , C5 ⁺ , M1 ⁺ , M1 ⁺
Power supply	230V AC 50Hz, 115V AC 50/60Hz
Nominal current	4.5A at 230V 9.5A at 115V
Main unit fuse	for 230V AC: T 6.3A H , 250V AC, Order No. 10 77 452 for 100/115 V AC: T 10A H, 250V AC, Order No. 10 77 460

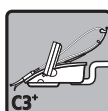
1.2 Warning and safety information

Caution!	Prior to opening the unit, connecting a measuring instrument or replacing parts: Switch the unit OFF.
Protective ground connection	The building water supply is at protective ground potential and must not touch the fuse box of the chair.
Warning!	If there is a protective ground contact, the patient or user may be exposed to tension in the event of a fault - risk of electric shock!
Operational reliability	To ensure operational reliability, the use of mobile telephones in the practice or hospital area must be prohibited.
Troubleshooting:	If you encounter difficulties, search in the error catalog first and proceed according to the instructions given there.

1.3 Symbols



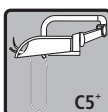
C2⁺ dentist element



C3⁺ dentist element



C4⁺ dentist element



C5⁺ dentist element



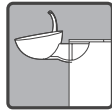
M1⁺ dentist element



Assistant element



Patient chair



Water unit

1.4 Abbreviations

Dent. el.	Dentist element
AK	Connection box
COM	Serial interface
EMC	Electromagnetic compatibility
PCB	Printed circuit board
FS	Foot switch
FT	Foot button
GND	Ground
Ass. el.	Assistant element
HW	Hardware
KL	Holder
L	Cable
LCD	Liquid Crystal Display
LED	Light Emitting Diode
PC	Personal Computer
S	Switch
SDI	Sirona Dental Interface (electrical, pneumatic, hydraulic plug connection)
ST	Patient chair
SW	Software
T	Transformer
TR	Support arm
VAC	AC voltage
VDC	DC voltage
WE	Water unit
X	Connector
+V _{ISO}	Galvanically isolated voltage


1 Important information





1.5 Minimum configuration

Component	PCB	Hardware version	Software version C2 ⁺	Software version C3 ⁺ /C4 ⁺	Software version C5 ⁺	Software version M1 ⁺
Dentist element	ADX	-	2.19	2.23	2.29	2.30
Dentist element	AL	-	4.0	4.0	4.0	4.0
Assistant element	HC	-	2.1	2.2	2.2	2.2
Water unit	WE	-	3.0	3.1	3.1	3.1

For PC networking	PCB	Hardware version	Software version C2 ⁺	Software version C3 ⁺ /C4 ⁺	Software version C5 ⁺	Software version M1 ⁺
Connection box	CJ	-	5.3	5.5	5.7	5.7
Dentist element	AP	-	5.2	5.4	5.7	10.2

1.6 Where to save user-specific data in the C2⁺, C3⁺, C4⁺, C5⁺, M1⁺

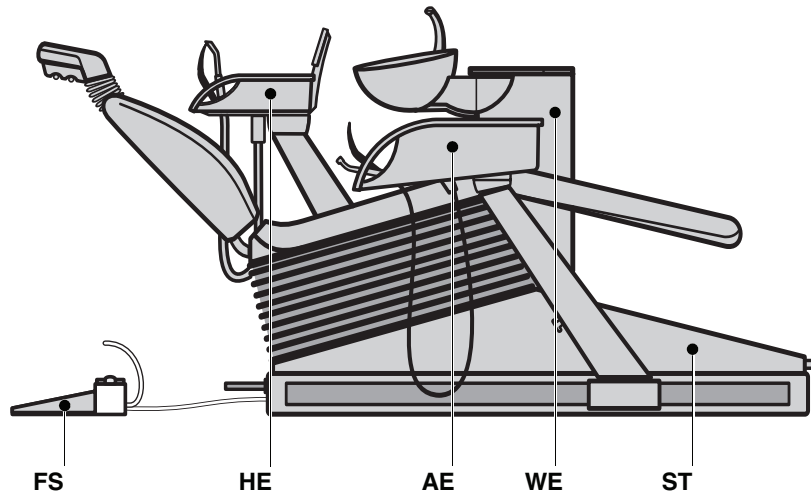
Board (Part no., designation)	Stored settings	Default value
Dentist element (42 00 221, ADX) 	Mode dialog: Language (Engl., D, I, F, E) Pressure indication (bar/PSI) Cursor control (On/Off) Foot switch mode (On/Off - adjustable) Purge time (60 sec. to 120 sec.) Service mode / Start - Stop Max. light voltage per instrument	-
	Cooling air for electric motor Saline pump (holders 2, 3, 4, 5, 6, Off) C2 ⁺ /M1 ⁺ Saline pump (holders 2, 3, 4, 5, Off) C3 ⁺ /C4 ⁺ /C5 ⁺ SIVISION (On/Off)	100% of input pressure OFF OFF OFF
	Instrument parameters: Instrument light (On/Off) Spray (On/Off) Direction of rotation (CW/CCW) <i>(storable, but is set to the default value the next time the treatment center is turned on for safety reasons)</i> US intensity Highspeed handpiece intensity Intensity of electric motor 1 Intensity of electric motor 2 HF intensity	OFF High-speed handpiece: ON Electric motor: OFF US: ON <i>(not programmable)</i> CW 20 3.5 ±0.1 bar 40,000 rpm 20,000 rpm 20
	Miscellaneous: Sprayvit ventilation (Yes/No)	NO

Board (Part no., designation)	Stored settings	Default value
Assistant element (42 00 650, ass. el.) 	Mode dialog: ----- miscellaneous: SPRAYVIT ventilation (Yes/No)	NO
Water unit (42 00 627, WE Air Water Sep.) (42 00 619, WE) 	Mode dialog: Tumbler filling with S program (On/Off) Cuspidor flushing with S program (On/Off) SIROLUX U-POS <i>(Sirolux switched on if dentist element is in place)</i> Miscellaneous: Tumbler filling time (2, 4, 6, 8, 10 sec.) Flushing time (20, 40, 60, 90, 150, 300, 360, 420 sec.) SIROLUX intensity (20, 40, 80, 90, 100%) Suction intensity (4 levels) SIROLUX status with chair programs: Program S (On/Off) Program 0 (On/Off) Program 1 (On/Off) Program 2 (On/Off)	OFF ON OFF 6 sec. 60 sec. 80% 100% OFF OFF ON ON
Chair connection box (58 63 480, CJ) 	Mode dialog: # key (switch/button) Miscellaneous: Chair programs 0, S, 1, 2, for users A and B; (Position of: lift, backrest, travel track, tilting part) User (A/B)	Switch Factory program A
Dentist panel (33 17 091, AP) 	The dentist panel is not used for saving any data!	

2 Overview of modules and PCBs

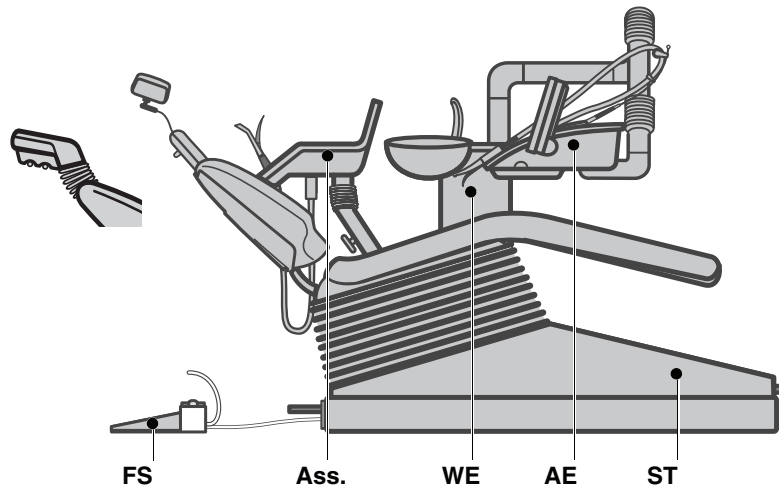
C2⁺, C3⁺, C4⁺, C5⁺, M1⁺

C2⁺



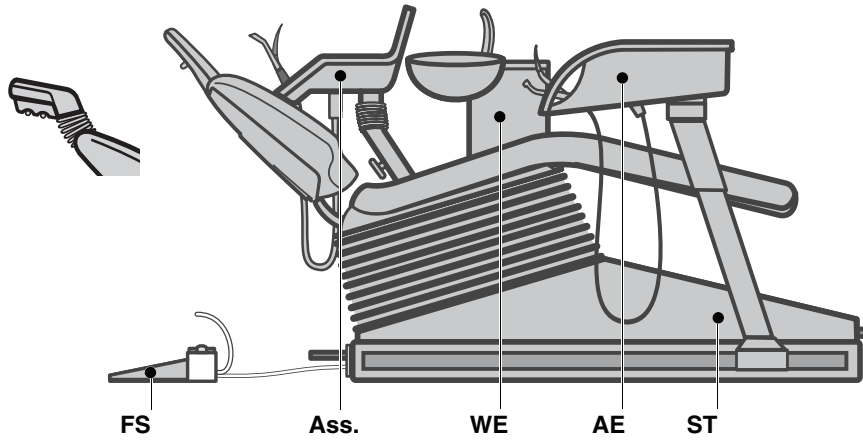
Component	PCB / module	
Dentist element (AE)	AP	= Control panel
	ADX	= Control PCB
	AL	= SIRONA motor SL module
	AU	= SIROSON module
	HF	= HF module
	PL	= Polylux
	MI	= Mini LED
	CC	= IR PCB
Assistant element (HE)	HEP	= Control panel
	HC	= Control PCB
	HP	= Power supply PCB
	HI	= Flexible PCB
	PL	= POLYLUX
	MI	= Mini LED
Water unit (WE)	WE	= Control PCB
Patient chair (ST)	DI	= SIROLUX
	CJ	= Control ST
	CF	= Fuse PCB
	SR	= Relay PCB
	CK	= Hand switch PCB
	SL	= Wiring PCB
	KS	= 4-way foot control
Foot switch (FS)	CFS	= Foot switch PCB

C3⁺



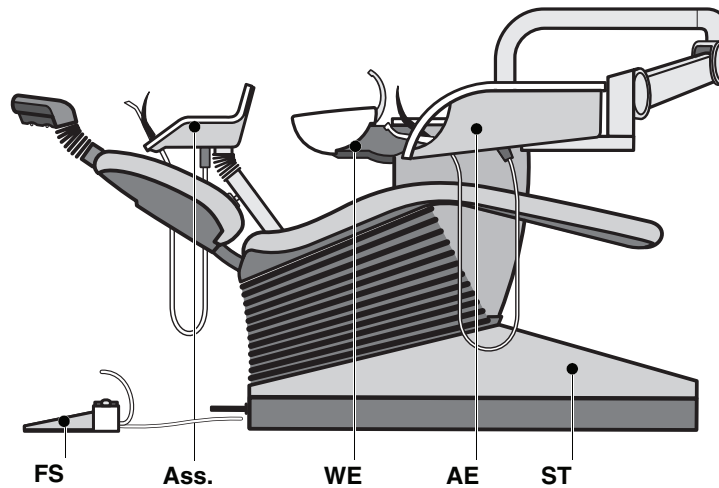
Component	PCB / module	
Dentist element (AE)	AP	= Control panel
	ADX	= Control PCB
	AL	= SIRONA motor SL module
	AU	= SIROSON module
	CC	= IR PCB
Assistant element (HE)	HEP	= Control panel
	HC	= Control PCB
	HP	= Power supply PCB
	RK	= IR PCB
	PL	= Polylux
	MI	= Mini LED
Water unit (WE)	WE	= Control PCB
Patient chair (ST)	DI	= SIROLUX
	CJ	= Control ST
	CF	= Fuse PCB
	SR	= Relay PCB
	SL	= Wiring PCB
	CK	= Hand switch PCB
	KS	= 4-way foot control
Foot switch (FS)	CFS	= Foot switch PCB

C4⁺



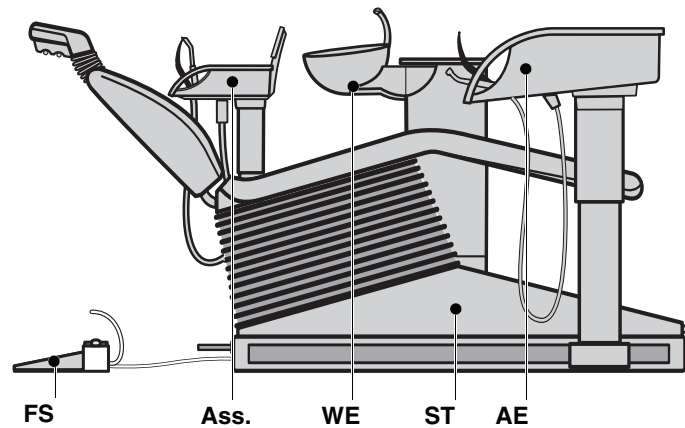
Component	PCB / module	
Dentist element (AE)	AP	= Control panel
	ADX	= Control PCB
	AL	= SIRONA motor SL module
	AU	= SIROSON module
	CC	= IR PCB
Assistant element (HE)	HEP	= Control panel
	HC	= Control PCB
	HP	= Power supply PCB
	RK	= IR PCB
	PL	= POLYLUX
	MI	= Mini LED
Water unit (WE)	WE	= Control PCB
Patient chair (ST)	DI	= SIROLUX
	CJ	= Control ST
	CF	= Fuse PCB
	SR	= Relay PCB
	SL	= Wiring PCB
	CK	= Hand switch PCB
	KS	= 4-way foot control
Foot switch (FS)	CFS	= Foot switch PCB

C5⁺



Component	PCB / module	
Dentist element (AE)	AP	= Control panel
	ADX	= Control PCB
	AL	= SIRONA motor SL module
	AU	= SIROSON module
	CC	= IR PCB
Assistant element (HE)	HEP	= Control panel
	HC	= Control PCB
	HP	= Power supply PCB
	RK	= IR PCB
	PL	= POLYLUX
	MI	= Mini LED
Water unit (WE)	WE	= Control PCB
	WV	= WE and video interface
	DI	= SIROLUX
Patient chair (ST)	CJ	= Control ST
	CF	= Fuse PCB
	SR	= Relay PCB
	SL	= Wiring PCB
	CK	= Hand switch PCB
	KS	= 4-way foot control
Foot switch (FS)	CFS	= Foot switch PCB

M1⁺



Component	PCB / module	
Dentist element (AE)	AP	= Control panel
	ADX	= Control PCB
	AL	= SIRONA motor SL module
	AU	= SIROSON module
	HF	= HF module
	PL	= Polylux
	MI	= Mini LED
	CC	= IR PCB
Assistant element (HE)	HEP	= Control panel
	HC	= Control PCB
	HP	= Power supply PCB
	HI	= Flexible PCB
	PL	= POLYLUX
	MI	= Mini LED
Water unit (WE)	WE	= Control PCB
Patient chair (ST)	DI	= SIROLUX
	CJ	= Control ST
	CF	= Fuse PCB
	SR	= Relay PCB
	CK	= Hand switch PCB
	SL	= Wiring PCB
	KS	= 4-way foot control
Foot switch (FS)	CFS	= Foot switch PCB

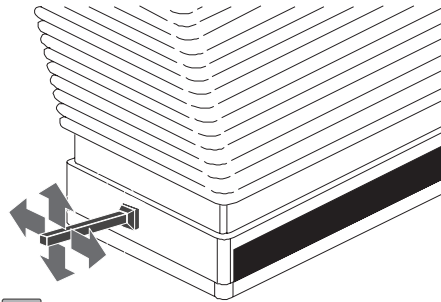
3 Points to observe during assembly

C2⁺, C3⁺, C4⁺, C5⁺, M1⁺

3 Points to observe during assembly

3.1 Patient chair

The patient chair can be moved without dentist element only if the 4-way foot control is installed.



3.2 Protective ground / electronic ground

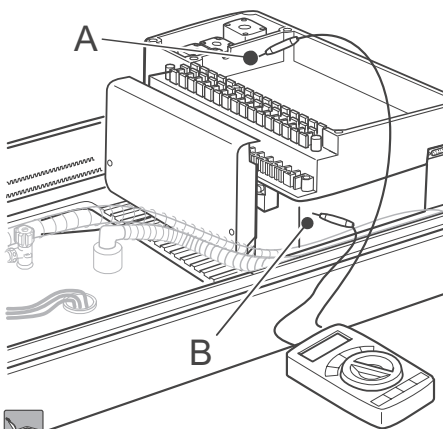
An equipotential bonding conductor must not be connected. If present, isolate it!!

Measure the protective ground against electronic ground.

Measure continuity from A to B:

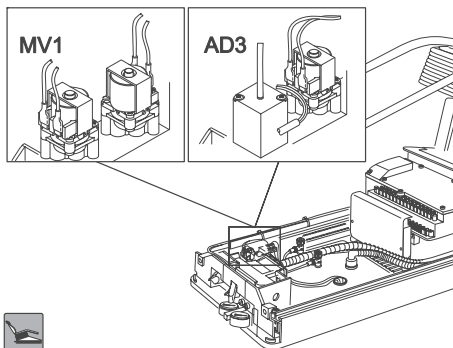
The continuity tester must not beep.

A meter must show a reading of $\infty \Omega$.



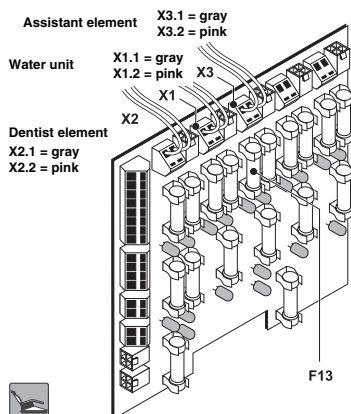
3.3 MV1 / AD3

During assembly, decide whether the MV1 (version with disinfection system) or pressure reducer AD3 (version without disinfection system) is to be installed (see installation instructions).



3.4 Connecting the water Unit/assistant element:

The 16V supply cables must be connected according to the color coding to terminals X1, X2 and X3 on PCB CF in the connection box.



3.5 Assistant element:



The 16VAC and 24VAC cables are interconnected at the neutral conductors. If the conductors are switched, there will be a short-circuit and fuse F 13 on PCB CF will blow. If no medium time-lag fuse is fitted, PCB HP in the assistant element may be destroyed.

General

Ensure proper installation of hoses and cables, do not allow them to be crushed.

If hoses are interchanged, water will penetrate into the air supply system. This may result in a failure of solenoid valves.

Crushed hoses and cables may cause failures on the entire treatment center. Check the position of cables and media hoses before tightening any nuts.

EMC installation work

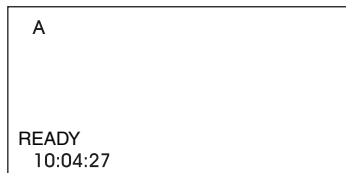
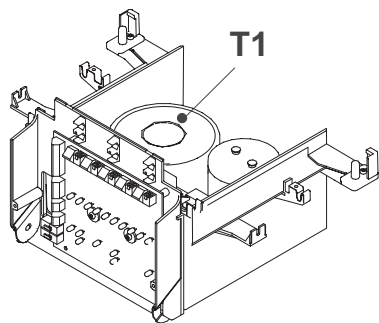
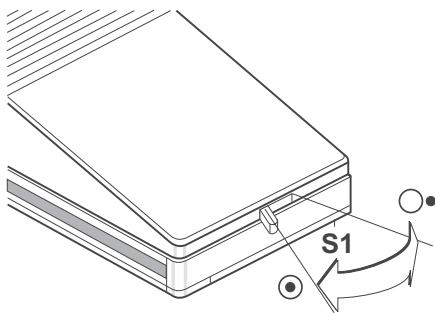
EMC work that has not been performed correctly may result in faults which are difficult to detect later on.

When all the installation work has been completed, measure the contact resistance between protective ground and electronic ground (see 3.2 or installation instructions).

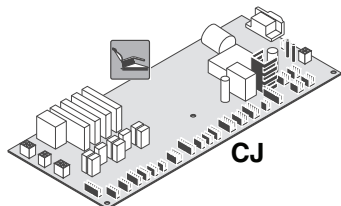
4 What happens after switch-on?

C2⁺, C3⁺, C4⁺, C5⁺, M1⁺

4 What happens after switch-on?



"READY" indicates that the treatment center is ready to operate. This does not mean, however, that the treatment center self-tests have been completed without errors.



Intensity key 1
SW version 5.4 and higher
in the AP

4.1 Sequence of events



The unit transformer **T1** is supplied with power via the unit main switch **S1**.

The transformer supplies a voltage of 25VAC which is then rectified. This results in a DC voltage (approx. + 35VDC).

Components AE, HE, WE and the chair (AK) are now supplied with + 35VDC via fuse PCB CF, i.e., the required voltages (e.g., + 5V for logic, + 24V for solenoid valves) are generated on the PCBs in the different components. The 16VAC and 24VAC voltages in the unit are used primarily to power the SPRAYVIT, water heater, camera supply and the halogen Polylight.

When the supply voltages are applied to the different components, the software on the PCBs powers up (**boot procedure**).

A **self-test** is performed on the treatment center in this phase, and is audible (for example, solenoid valves respond and relays trip).

Current is measured to detect whether any of the components (solenoid valve, relay, or motor) has 1. a short-circuit, 2. an open circuit.

These evaluations are written into the service info memory of the individual components AE, HE, WE and chair (AK).

CAUTION

A message relating to an open circuit does not necessarily indicate a fault. If an open circuit is detected and the component is nevertheless functioning completely, the current measurement is only out of tolerance.

When the self-test has been completed, the LCD indicates **READY**. The clock is also displayed

NOTE

The clock chip is located on PCB CJ in the connection box (chair). If the clock is functioning properly, CAN communication between the components is generally in order.

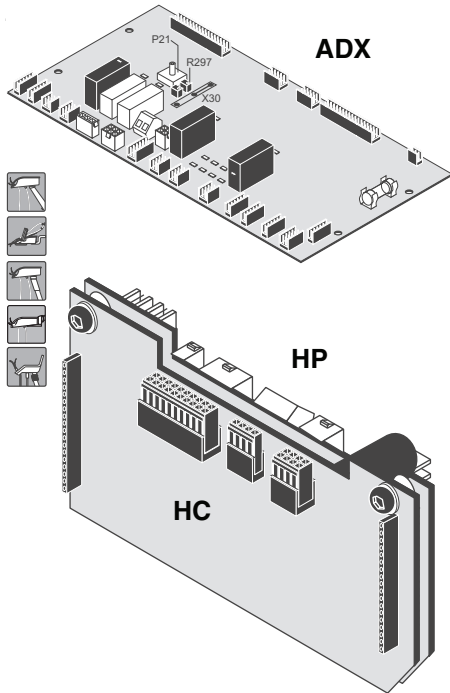
The software recognizes ... :

1. ... whether the treatment center is in a sanitation mode. This signal comes from the water unit, PCB WE, via CAN communication.

If this is the case, it must be terminated or properly interrupted.

Interrupt sanitizing by simultaneously pressing the **SPRAY ON/OFF** and **CHIP BLOWER** keys, **AP SW version 5.4 and higher** press **intensity key** for 3 sec. (assistant element:press the **SAN** key for 3 sec.).

4 What happens after switch-on?



2. ... whether the instrument configuration at the instrument flanges has changed since the last power ON. This is detected by the different instrument hoses and their coding.

If it is determined during power-up that the instrument configuration differs from the stored configuration (on the **ADX** PCB), the instrument values will be set as follows:

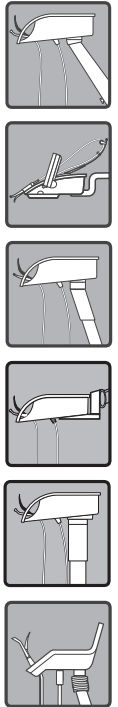
- Highspeed handpiece to full power
- 1. Motor to 40,000 rpm
- 2. Motor to 20,000 rpm
- Ultrasound to 20

CAUTION

The heater and the light in the SPRAYVIT remain turned off during initial start-up.

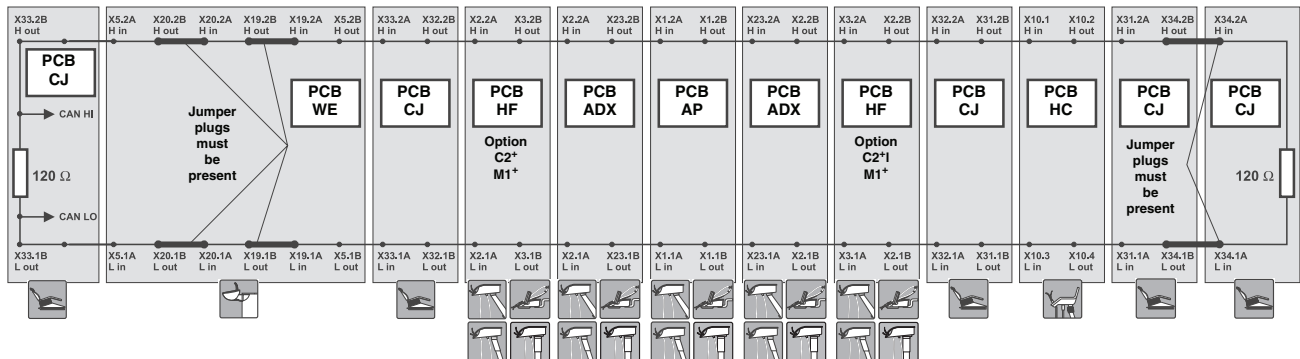
The water pump must execute at least 20 strokes before the heating and light are enabled. This applies to the SPRAYVIT both in the dentist element and in the assistant element.

*If the **ADX** PCBs in the dentist element and **HC** are replaced, the pump must execute an additional 20 strokes.*



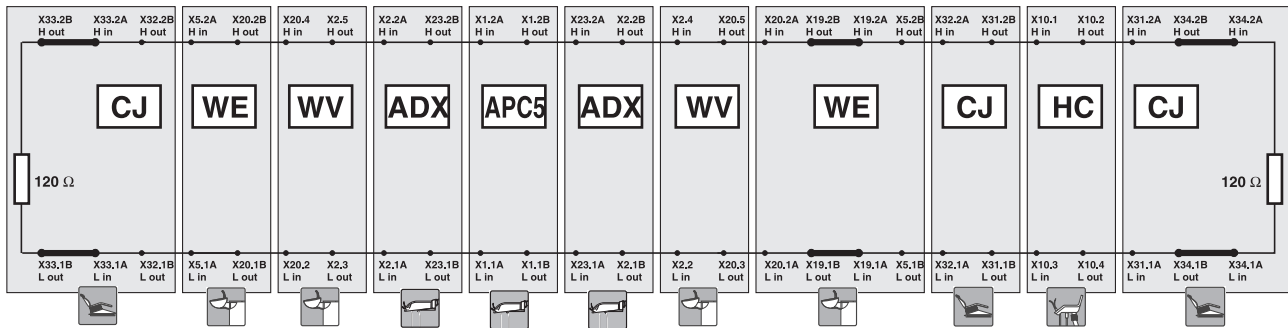
When the self-test has been completed, the individual components can communicate with each other via a data bus system. This system is called: "CAN BUS"

CAN BUS, data communication between PCB C2⁺, C3⁺, C4⁺, M1⁺,



4 What happens after switch-on?

CAN BUS, data communication between PCBs C5⁺

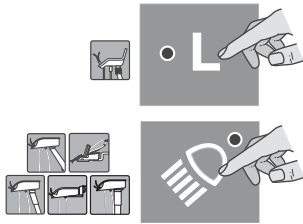
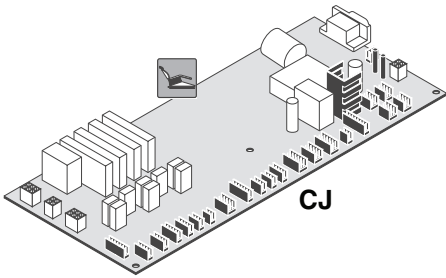


The four components **chair**, **dentist element**, **assistant element** and **water unit** are interconnected via a CAN serial interface.

The individual CAN drivers (transmitters and receivers for data communication) are arranged in the following order:

Chair	= board CJ
Water unit	= board WE
Assistant element	= board HF
Dentist element	= board ADX
Dentist element	= board AP
Assistant element	= board HC

The individual signals - for example, cuspidor flushing, tumbler filling, instrument motor ON and clock time - are transferred and relayed from component to component via this system.



4.2 Checking the CAN BUS

Is the clock running ?
If not, check whether the CAN connections are crushed, and check for short-circuits and loose pins on the connectors.

i NOTE

Tip: The clock chip is situated on PCB CJ in the chair (connection box).

Turn on SIROLUX FANTASTIC from the dentist side and from the assistant side.

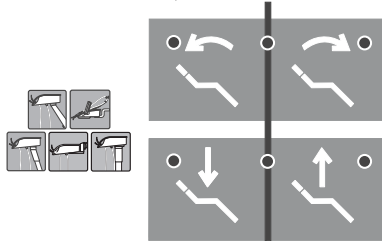
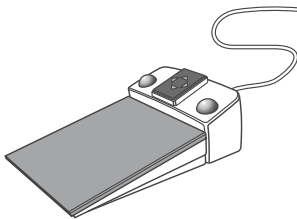
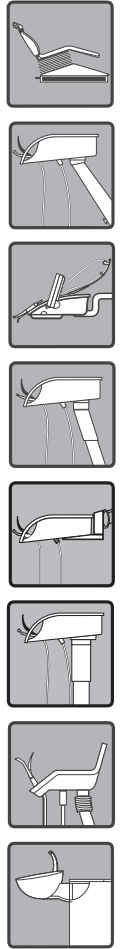
i NOTE

Tip: In this way you check the CAN cabling and the functioning of many PCBs.

The "Turn on SIROLUX" key information is passed from the dentist element panel (AP) to the connection box (CJ) and from there on to the water unit (WE).

Here PCB WE drives the SIROLUX dimmer PCB. It then turns the SIROLUX light on.

In addition, the relevant LEDs on the panels are activated by a CAN message from the water unit.



Check the CAN BUS using the foot switch.

Move the chair with the cursor.

In this way you can test the section between foot switch, chair (connection box) and panel.

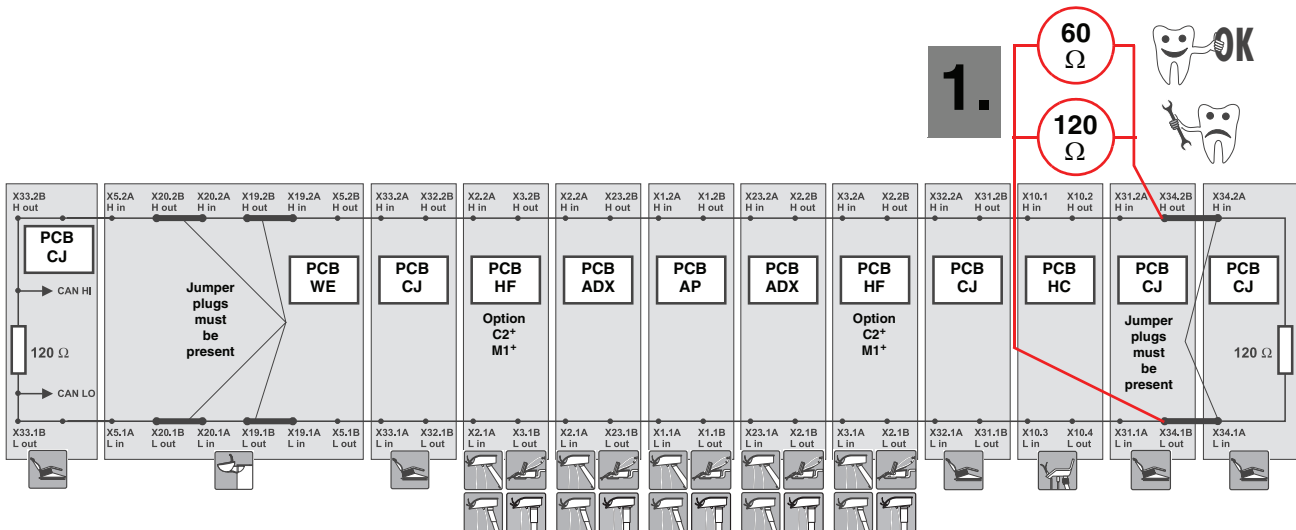
i NOTE

Information: You can move the chair with the 4-way foot control.

Tip: The 4-way foot control is not connected to the CAN; the chair also moves when communication is no longer possible.

4 What happens after switch-on?

Measurements on the CAN bus system, C2+ – C4+, M1+



If the functions of the dentist and assistant elements cannot be triggered, this is indicative of an open circuit in the CAN BUS system.

Turn the unit **OFF**.

1. Measure Ω :

If you measure approx. 60Ω between **X34.1B** and **X34.2B**, the **CAN circuit is OK**.

If you measure approx. 120Ω between **X34.1B** and **X34.2B**, the **CAN circuit is open-circuited**.

2. Locate the open circuit.

Measure the **CAN_High** and **CAN_LOW** circuits one after the other.

e.g.: Measure **CAN_High** between **X33.2B** and **X34.2A**

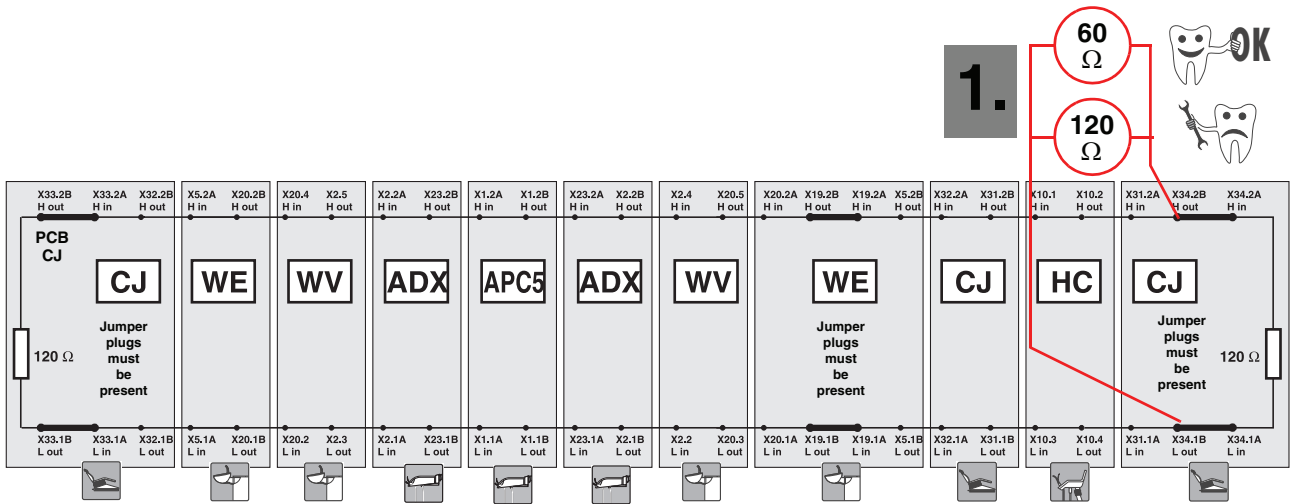
- If you read approx. $2 - 3\Omega$, this **circuit is OK**.
- If you read ∞ , both this **circuit** and **CAN_LOW** are **open-circuited**.
- If you read approx. 240Ω , this **circuit is open-circuited** and the **CAN_LOW** circuit is **OK!**

If an **open circuit** is found, it is now possible to individually check the **nodes** on **PCB CJ** in order to **locate the open circuit**.

Measure **X33.2B > X34.2B** >>> If there is an **open circuit**, then:
measure **X33.2B > X31.2B** >>> If no **open circuit** can be measured here, i.e. you measure approx. $2 - 3\Omega$, then the **open circuit** must be located in the **connection** to the **assistant element!**

At this point it is highly probable that the open circuit can be easily located by simply checking the cables and connectors, since the number of possible errors is greatly reduced.

Measurements on the CAN bus system, C5+



If the functions of the dentist and assistant elements cannot be triggered, this is indicative of an open circuit in the CAN BUS system.

Turn the unit **OFF**.

1. Measure Ω :

If you measure approx. 60Ω between **X34.1B** and **X34.2B**, the **CAN circuit is OK**.

If you measure approx. 120Ω between **X34.1B** and **X34.2B**, the **CAN circuit is open-circuited**.

2. Locate the open circuit.

Measure the **CAN_High** and **CAN_Low** circuits one after the other.

e.g.: Measure **CAN_High** between **X33.2B** and **X34.2A**

- If you read approx. $2 - 3\Omega$, this **circuit is OK**.
- If you read ∞ , both this **circuit** and **CAN_Low** are **open-circuited**.
- If you read approx. 240Ω , this **circuit is open-circuited** and the **CAN_Low** circuit is **OK!**

If an **open circuit** is found, it is now possible to individually check the **nodes** on **PCB CJ** in order to **locate** the **open circuit**.

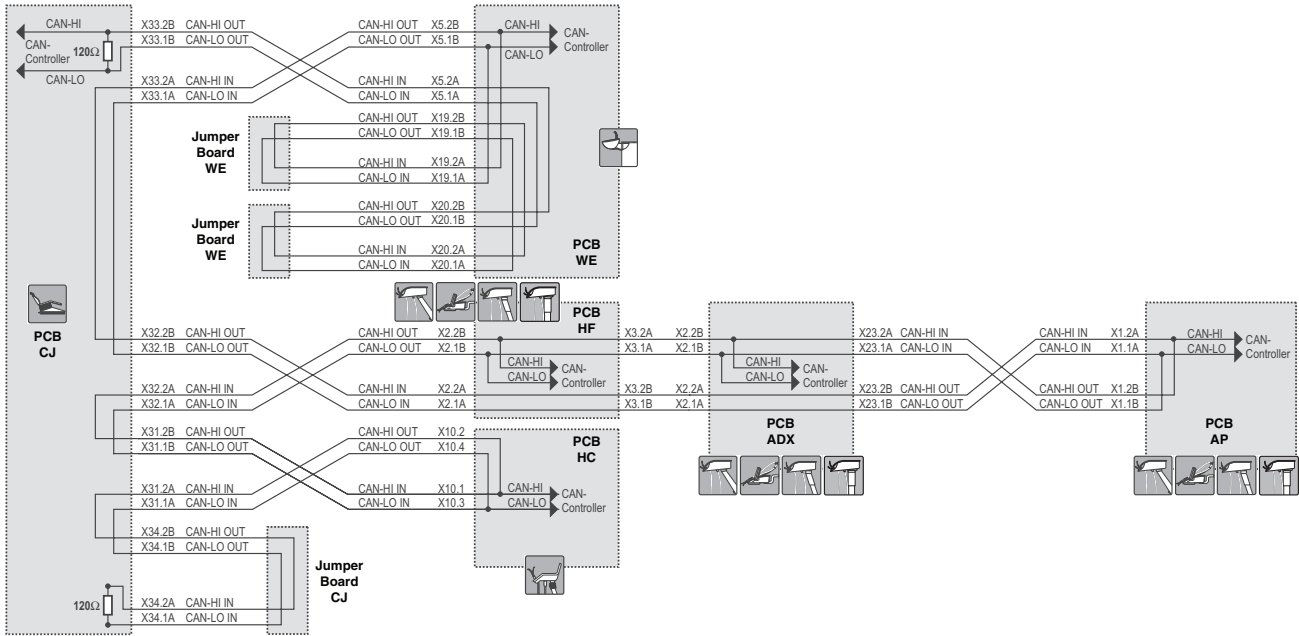
Measure **X33.2B > X34.2B** >>> If there is an **open circuit**, then:
 measure **X33.2B > X31.2B** >>> If **no open circuit** can be measured here, i.e. you measure approx. $2 - 3\Omega$, then the **open circuit** must be located in the **connection** to the **assistant element!**

At this point it is highly probable that the open circuit can be easily located by simply checking the cables and connectors, since the number of possible errors is greatly reduced.

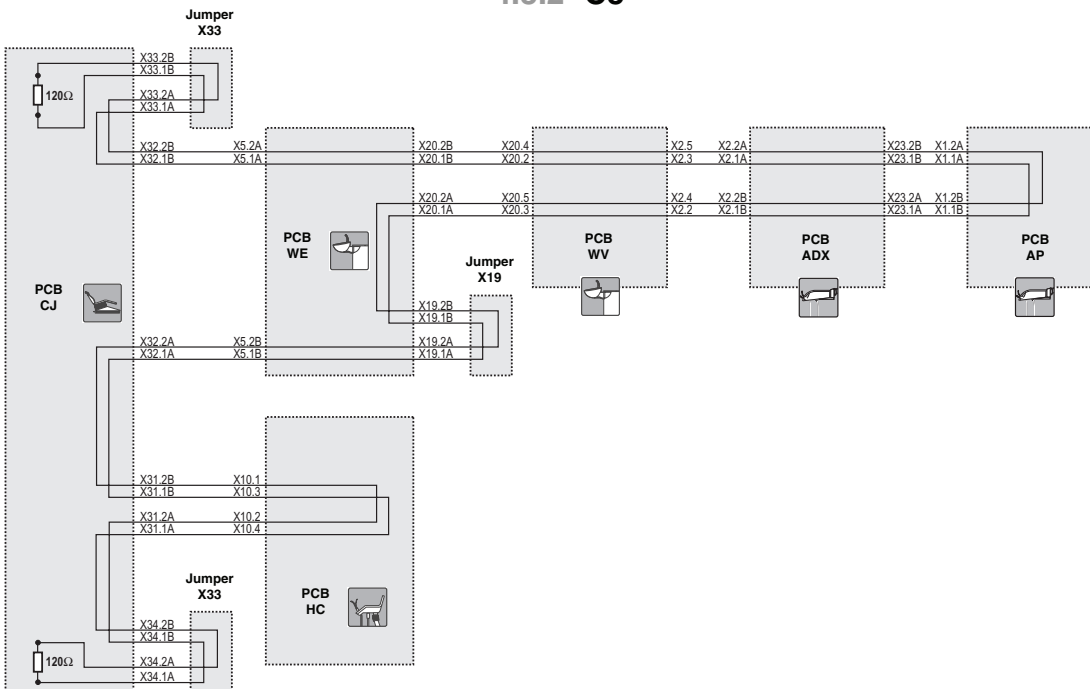
4 What happens after switch-on?

4.3 CAN BUS wiring diagram

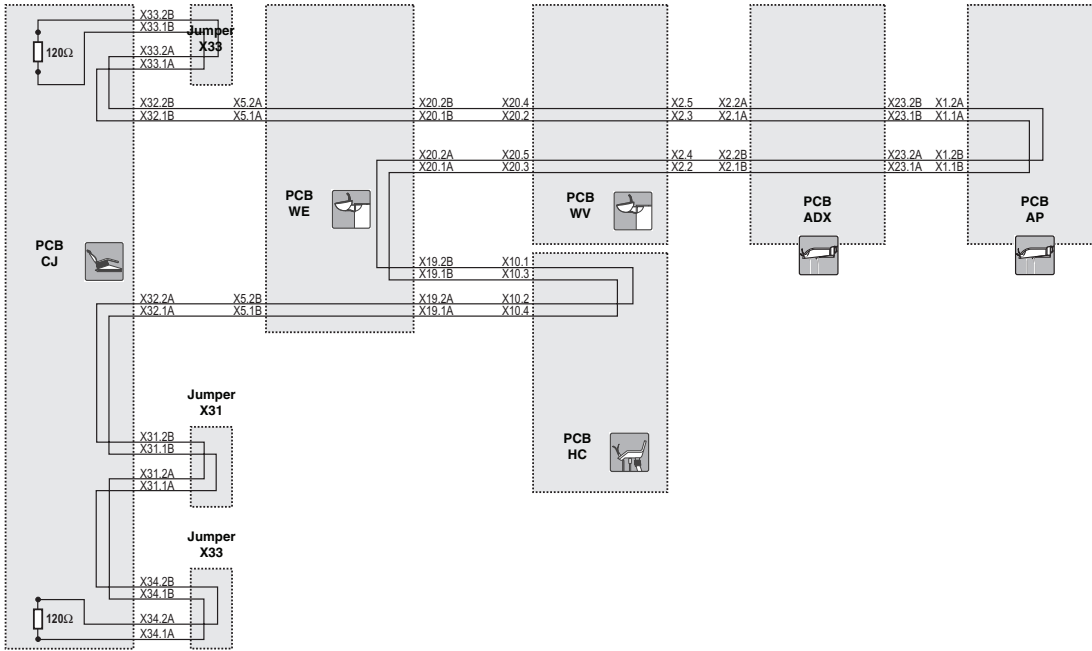
4.3.1 C2+ – C4+/M1+



4.3.2 C5+



4.3.3 C5⁺ Turn



5 Description of the functions of ...

C2⁺, C3⁺, C4⁺, C5⁺, M1⁺

5.1 Control panel / PCB AP

The panel control PCB [AP] in the C2+, C3+, C4+, C5+, M1+ and M1+ forwards the request to operate from the panel to the relevant components via the CAN cable.



Green LEDs on keys:

The green LEDs are status LEDs. The status (ON, OFF, FLASHING) is signaled back by the components concerned to the panel via the CAN cable. If the function is not activated, search locally in the respective components. It is possible that an interlock is active or that the option corresponding to the function has not been installed.

Exception: The LEDs of the manual chair adjustment keys are addressed directly by the panel.

Yellow cursor LEDs:

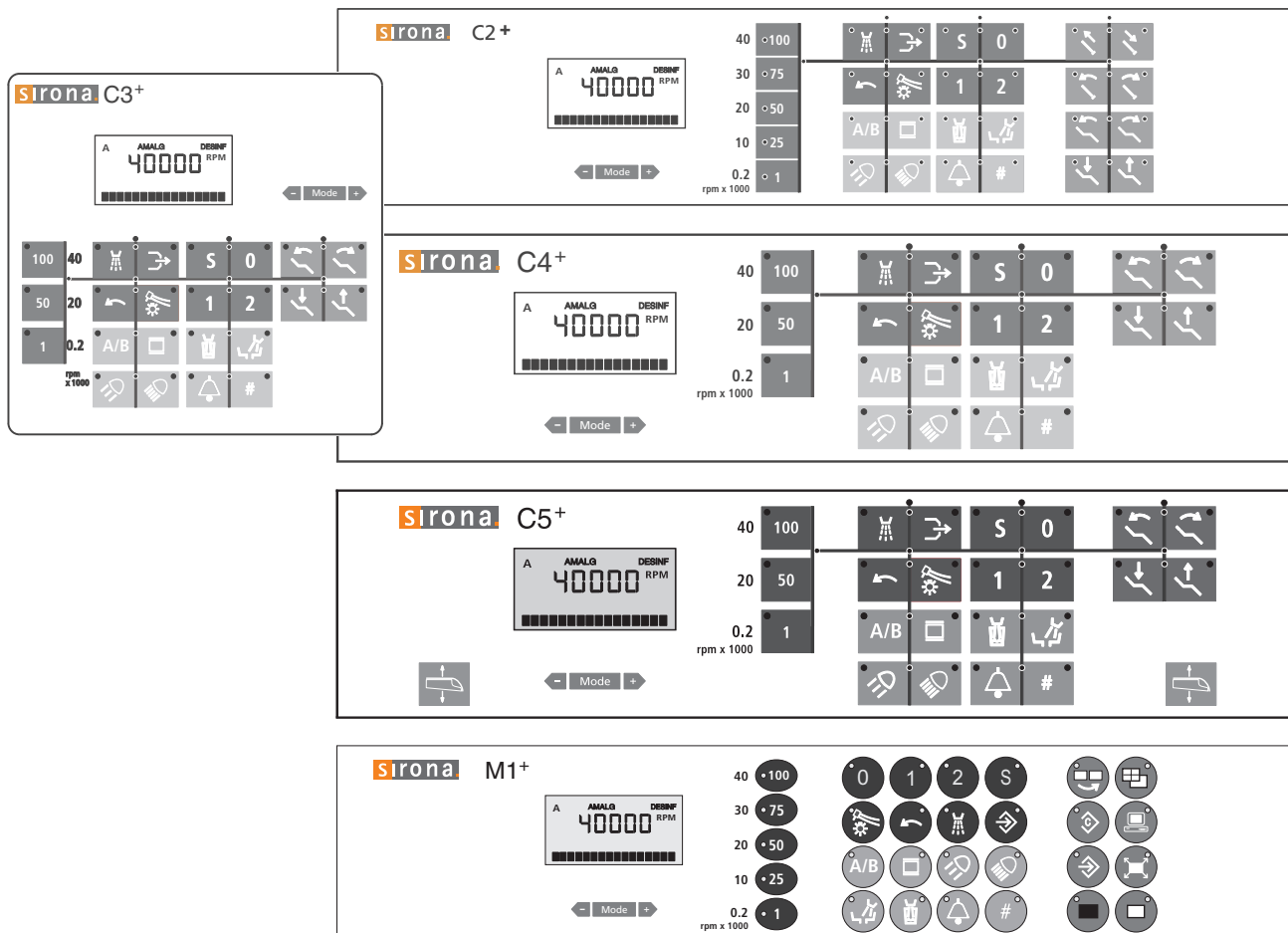
The yellow cursor LEDs indicate the location of the cursor positioned with the help of the foot switch.

This cursor control can be deactivated in the Mode dialog.

Key click:

Every key actuation on the panel and foot switch (exceptions: 4-way foot control and keys on the tilting part) is confirmed by a key click. This key click is generated on the panel.

If a key click is generated in response to a key operation, it can be assumed that the keyboard is in order.



Self-test program:

You can change the PCB to a self-test mode. When the operating voltage is turned on, the plus and minus keys must be pressed simultaneously.

- All display elements are visible.
- The hardware version is shown on the display.
- The cursor LEDs flash continuously in quick succession.
- The LEDs on the keys light up when the relevant key is pressed and the beeper generates a key click. There are no function LEDs for Mode, Plus and Minus. Here, the value of the 7-segment display is incremented on the display.
- Identification of the system: C2⁺, C3⁺, C4⁺, C5⁺ or M1⁺.
- The "service" LED flashes.
The test mode is terminated by turning off the operating voltage.

Service LEDs:

- Green LEDs must light up in normal operating mode.
- Yellow LEDs can light up.
- Red LEDs light up in the event of a fault or safety problem.

LEDs:

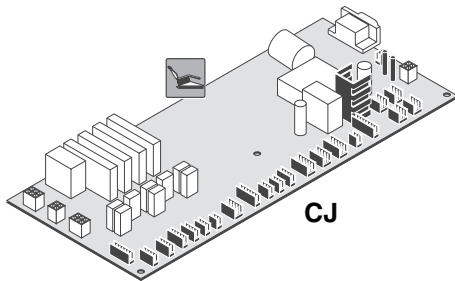
+5V	+5V power supply present (green)
Service	Flashes while the self-test program is running. Lights up if the X-ray image viewer output is activated.
Reset	The Reset LED lights up briefly when the unit is turned on.

Software update:

Software can be updated by replacing external memory J2.

Clock:

The clock is located on PCB CJ in the chair and is transmitted to the panel via the CAN cable.



5.2 Chair control/PCB CJ



Board CJ basically contains the following functional units:

- Powerful controller
- CAN communication
- Battery-backed real-time clock (RTC)
- Nonvolatile data memory
- Control of 3 DC motors
- Control of 2 AC motors
- Solenoid valve control
- Proportional valve control (currently not available)
- Relay PCB control
- LED control
- Digital inputs
- Safety switches
- Limit switch
- Analog inputs
- Sivation control
- RS232
- HE support arm safety switch

Power supply

PCB CJ always requires two power supplies:
approx. 35VDC and 115VAC.
Other voltages are derived from the 35V supply voltage.

5V, 600mA (short-circuit-proof) digital logic

24V, 5A (short-circuit-proof) power electronics

5Vref, 20mA (short-circuit-proof) external potentiometers

5.5V, 100mA RS232 and Sivation (with optical isolation)

A 4.0V reference voltage is made available at the analog input of the controller. This reference voltage is required for diagnostic purposes and for electronic control.

There are three green LEDs (+35V, +24V and +5V) for power supply monitoring.

The 115VAC voltage is required for driving the lift and backrest motors. The AC voltage is fed to the solid-state relays via a safety relay.

The freedom of movement of the motors is restricted by the potentiometers and limit switches. In addition, there are other safety switches which can interrupt the chair movement immediately. If a safety switch is active, the motor is blocked in a certain direction of travel.

The cuspidor safety switch is a special case. If this safety switch is active, the 115VAC are turned off by means of the safety relay and the red LED (115V relay) lights up. The two motors (lift and backrest) are blocked.

Controller

At the heart of the circuit is a powerful 16-bit controller (C167CS). The controller controls and regulates the complete range of functions on PCB CJ. The external oscillator frequency is 5MHz. A PLL boosts the operating frequency internally to 20MHz.

The reset signal is generated by a reset chip. If the voltage drops below 4.63V, reset is activated. The red RESET LED lights up during reset. When the controller has finished booting, the LED is switched off. There is a reset button on PCB CJ. This button can be actuated at any time to generate a reset.

The controller features a monitoring unit, known as watchdog. If the watchdog timer is not reset within a fixed timeout, the unit triggers a reset. This reset changes the on-chip I/O to the reset state. For monitoring the watchdog control, an external port (P3.2) is toggled every time the watchdog is reset.

The controller features an internal CAN controller. The CAN bus forms a network within the treatment center. All PCBs are connected to the CAN bus. Information can thus be exchanged between any two components via the CAN bus. The beginning and end of the CAN bus are located on PCB CJ.

A terminating resistance of 120 ohms is defined at either end of the CAN cable. 60 ohms are then measured during operation.

The DC motors (headrest motors and travel track) are driven with a PWM via the controller. The direction of rotation is determined by switching a relay. There are LEDs fitted at the output stages that indicate the direction of movement.

i NOTE

Both conventional solenoid valves and proportional valves can be fitted on the solenoid valve block.

A coding resistor in the MV cable enables electronics/software to decide which type of control must be used.

Currently not available.

The foot switch, 4-way foot control and controls on the headrest are coded. If a part is fitted while the unit is running, the configuration is updated immediately.

The yellow USER LED lights up when a switch is operated.

There is an RTC (real-time clock) on PCB CJ. The time on the treatment center is set by PCB AP.

Non-volatile data (such as error memory and chair parameters) are stored in the battery-buffered SRAM.

There is a resistor network on the PCB for identifying the hardware status.

Battery

The battery is a lithium type battery (Sonnenschein, type SL-350). These batteries are characterized by their high capacitance at a very low self-discharge rate. The battery voltage (VBAT) is 3.6V. When the unit is switched off, the battery supplies the RTC and the 32KB SRAM. Battery life: > 10 years.

Requirement:

Customer Service can recognize the production date of the battery to substitute the PCB or change the battery, as necessary.

Safety switches**Chair safety switches:**

The safety switches inhibit the respective hazardous directions of chair movement by means of hardware.

There are three safety switches associated with the chair:

Headrest SS (headrest HR), backrest SS (backrest BR) and toeboard SS (toeboard TB).

Cuspidor safety switch:

When the cuspidor is swung in, the lift and backrest motors are blocked.

HE support arm safety switch, C3⁺/C4⁺/C5⁺/M1⁺:

The chair motors are blocked during lifting or lowering of the support arm.

Emergency Stop

The movement stop of the lift and backrest motors can be activated by the EMERGENCY STOP signal.

The motorized chair movement is completely disabled.

If the emergency stop is active, the red **EMERGENCY STOP** LED lights up.

Diagnostics

When the supply voltage is applied, the green LEDs light up:

- +35VDC supply voltage (approx.)
- +24VDC supply voltage
- +5VDC supply voltage

The states of all inputs are indicated on PCB CJ by means of three LEDs: SS LED (all safety switches), LIMITS LED (all limit switches) and USER LED (all switches).

The error states of the outputs, relays, and solenoid and proportional valves are indicated by the D-ERROR (drive error) LED.

5 Description of the functions of ...

Red LEDs	The LEDs light up only in the event of a fault or safety problem.
Reset LED	System status: RSTOUT. The LED lights up while the reset button is held down.
SS LED	Permanently on while at least one of the following signals is active: SS TB, SS BR, SS HR, SS1 bowl, SS2 HE support arm C3 ⁺ /C4 ⁺ /C5 ⁺ /M1 ⁺ .
D-Error LED	The LED can light up (depending on the operating status of the system). Switched to statically "on" by the software in case of a driver stage error involving one of the following actuators: MV1, MV16, MV35, EXT relay, CALL relay, SUCTION relay, bowl MV, MVP1, MVP2, MVP3.
Definition of error cases:	<ol style="list-style-type: none">A channel to which an actuator is connected does not switch on (error in driver stage or overcurrent cutout)A channel to which an actuator is connected does not switch offA channel to which no actuator is connected receives an enable request
EMERGENCY STOP LED	Permanently on when EMERGENCY STOP becomes active.
115V RELAY LED	Permanently on when 115V relay is switched off because of safety switch. The AC motors are blocked.
SERVICE LED	Switched by software, any indication.
LIMITS LED	Permanently on while at least one of the following signals is active: <ul style="list-style-type: none">● LS-LIFT up● LS-LIFT down● LS-BR incline● LS-BR recline● LS-HR up● LS-HR down
USER LED	Permanently on while at least one of the following signals is active: <ul style="list-style-type: none">● Headrest switch signal● Foot switch signal or● 4-way foot control signal Motor activation is signaled by two yellow LEDs for each function. <ul style="list-style-type: none">● LIFT up and LIFT down LED (lift motor)● BR incline and recline LED (backrest motor)● HR output and input LED (headrest extension motor)● HR incline and recline LED (headrest incline/recline motor)● TRACK forward and backward LED (travel track motor)● CLUTCH LED (travel track clutch)

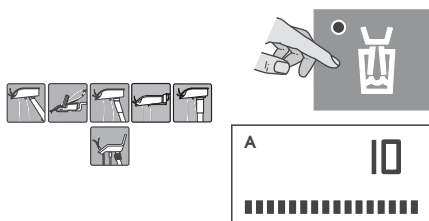
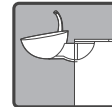
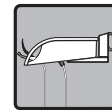
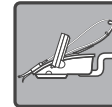
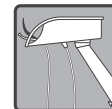
6 How it works ...

C2⁺, C3⁺, C4⁺, C5⁺, M1⁺

6.1 ... Water supply

Level sensor DS31, which is located in the mixing tank, sends a signal to PCB WE in the water unit when the water reaches a low level and indicates this by means of LED V76.

After the "Low water level" signal has been detected by PCB WE, pump P performs a precisely defined number of strokes after a load has been activated. PCB WE then generates a CAN data signal, which is received by PCB CJ in the chair. MV1 opens and water flows into the mixing tank. PCB WE then registers the time that elapses until DS31 is reactivated and calculates the time until the tank is filled. When the time has elapsed, PCB WE sends a CAN data signal to PCB CJ, and MV1 closes.



6.2 ... Tumbler filling

The tumbler filling function is activated on the membrane keyboard of the dentist element (PCB AP) or assistant element (PCB HEP).

The key signal generates a CAN data signal in the dentist element (PCB AP) and in the assistant element (PCB HC), which is sent to PCB WE, where it activates the tumbler filling function, with MV34 opening for the programmed time interval.

The opening time is stored on PCB WE.

When the time has elapsed or when the tumbler filling key is pressed again, MV34 closes.

If the tumbler filling key is pressed for more than 3 seconds, the settings dialog for the tumbler filling time appears.



6.3 ... Cuspidor flushing

The cuspidor flushing function is activated on the membrane keyboard of the dentist element (PCB AP) or assistant element (PCB HEP).

The key signal generates a CAN data signal in the dentist element (PCB AEP) and assistant element (PCB HC), which is sent to PCB WE in the water unit. The amalgam separator starts up. A CAN data signal to PCB CJ in the chair then activates MV35.

MV35 opens for the programmed time interval. The time interval is stored on PCB WE. When the time has elapsed or when the bowl flushing key is pressed again, MV35 closes. The flow can be set by means of regulating inductor RD35.

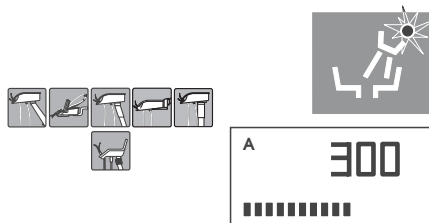
Monitoring function of water monitor DN30.

If water monitor DN30 is activated for more than 12 seconds, cuspidor flushing is interrupted.

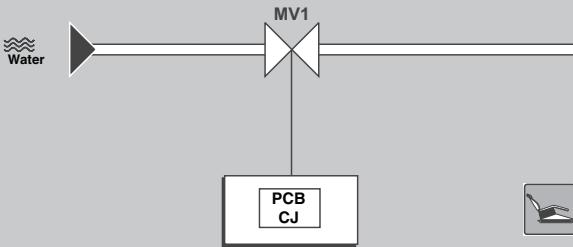
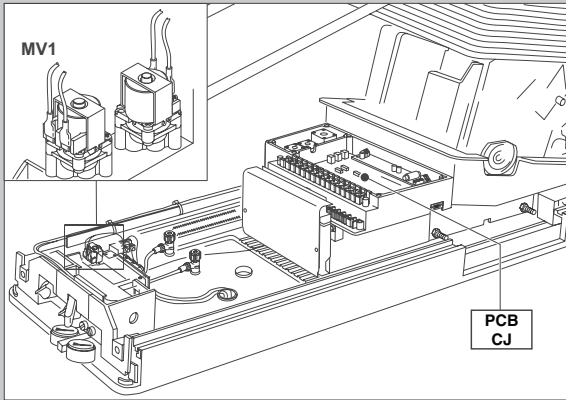
A CAN data signal to PCB CJ in the chair deactivates MV35. This status is written to the error memory.

While cuspidor flushing is active, the LEDs of the corresponding keys on both the dentist element panel and assistant element panel light up, irrespective of the panel from which the function was triggered.

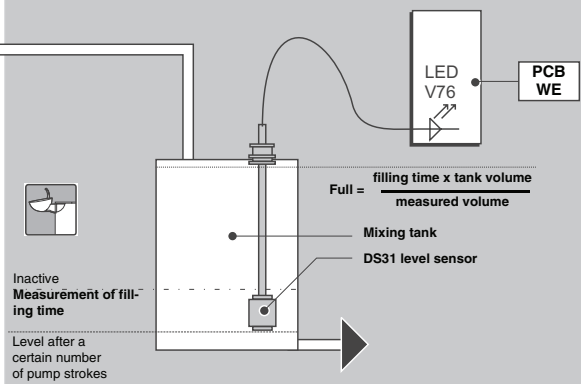
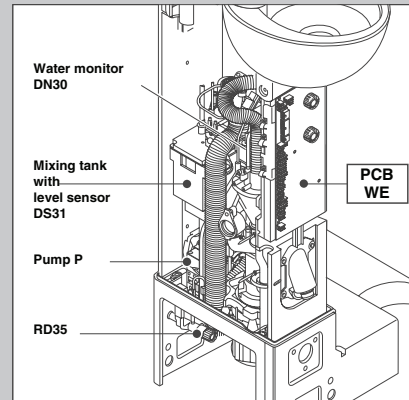
If the bowl flushing key is pressed for more than 3 seconds, the settings dialog for the bowl flushing time appears.



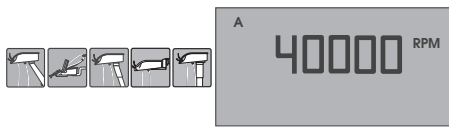
Connetion box / chair



Water unit



6.4 ... Motor SL / EL1



Remove the motor from its holder.

The motor setting appears on the LC display of the dentist element (only if PCB ADX in the dentist element detects that a Siromot module is present).

The solenoid valve module (MV21.1 to 4) assigned to the motor is activated (one of LEDs V69, V74, V79, V110 on PCB ADX lights up, depending on which module is activated).

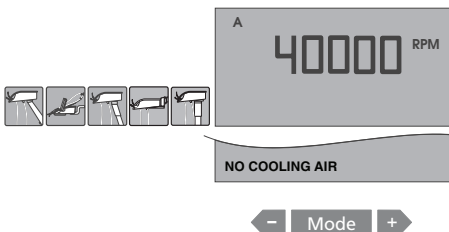
The relay for motor and instrument voltage assigned to the motor is activated (one of LEDs V57, V60, V63 on PCB ADX lights up, depending on which relay is activated).

Actuate foot switch S1.

PCB CJ in the connection box/chair then sends a CAN data signal to PCB ADX in the dentist element and starts the motor.



PCB ADX then sends a CAN data signal to PCB CJ and turns on the cooling air (MVP1) for the motor (if a proportional valve is installed, with the intensity preset under MODE).



If there is a problem with the CAN data communication, or if the solenoid valves are recognized as faulty, the motor is not started. In addition, the ADX software queries the cooling air pressure using pressure sensor P21.

If a cooling air pressure of < 0.5 bar is detected, ADX turns off the motor function.

The motor menu remains on the display and the display shows the message "NO COOLING AIR".

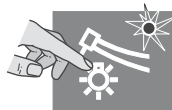
Spray preselection:



When the spray key is pressed (the LED of the corresponding key lights up), a CAN data signal is generated on PCB AP in the dentist element and is sent to PCB ADX. This in turn activates solenoid valve MVP3 for spray air on PCB CJ via CAN (if the foot switch is active).



Instrument light preselection:



When the light key is pressed (the LED of the corresponding key lights up), the light supply is activated on PCB ADX (if the foot switch is active).



Motor functions:

ON/OFF - adjustable, can be adjusted in the Mode menu.

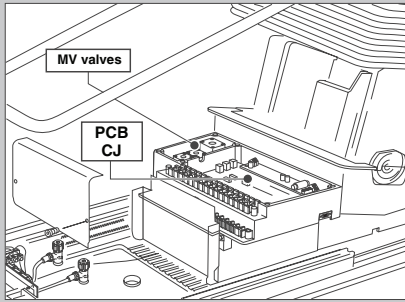
ON/OFF: The motor runs at the programmed speed when the foot switch is operated.

Adjustable: The motor speed is controlled in proportion to the position of the foot switch (gas pedal).
If the function is set as adjustable, boards CJ and ADX continuously exchange data on account of the foot switch position.

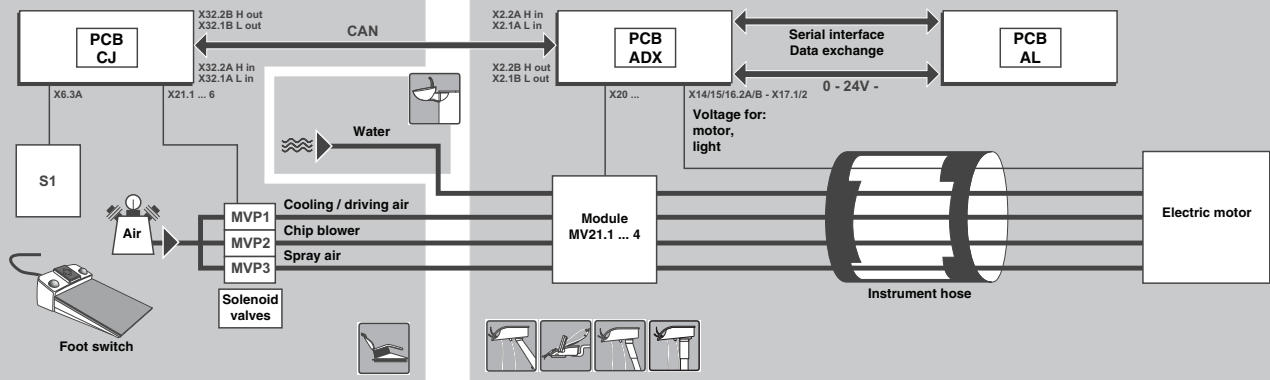
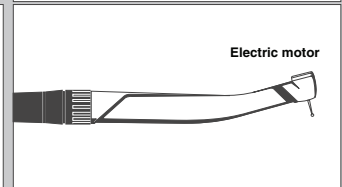
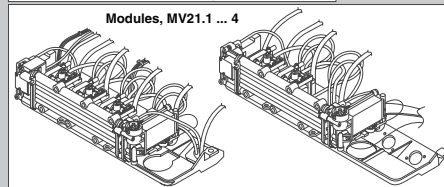
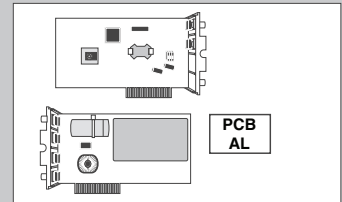
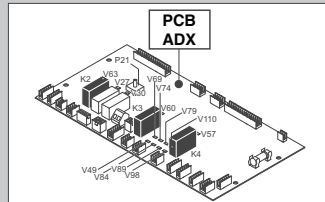
The motors obtain their supply voltage from the Siromot module, which is controlled by PCB ADX.

C2+
C3+
C4+
M1+

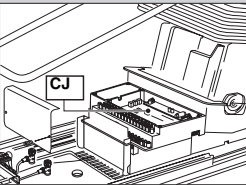
Connection box / chair



Dentist element



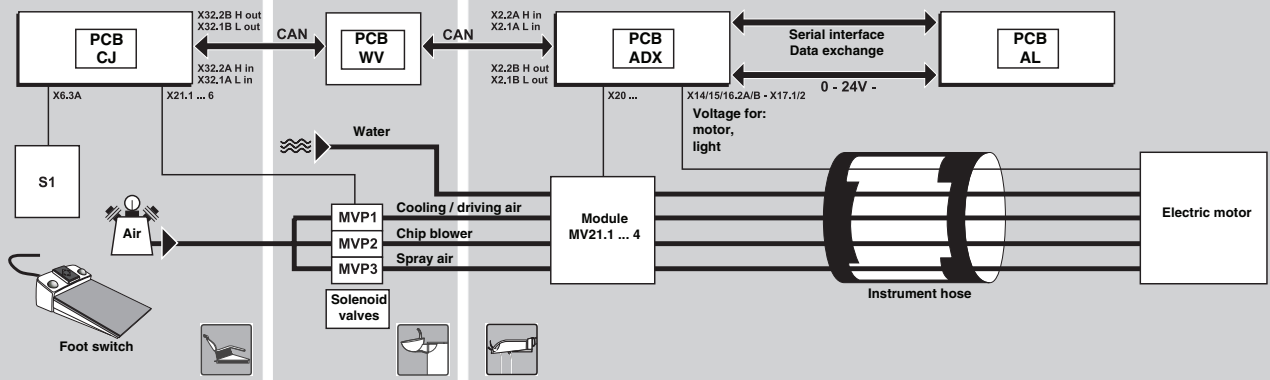
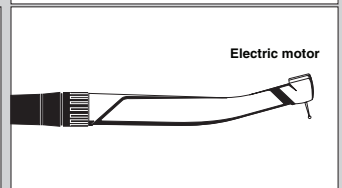
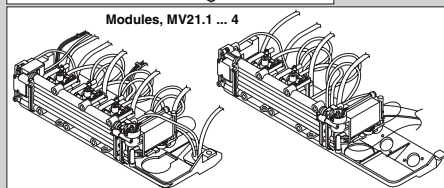
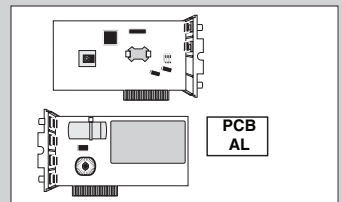
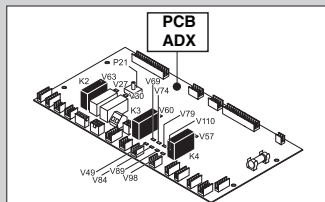
Connection box / chair



Water unit

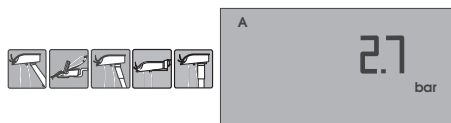


Dentist element



C5+

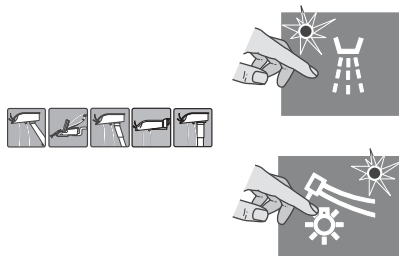
6.5 ... highspeed handpiece



Remove the highspeed handpiece from its holder.

The highspeed handpiece menu is displayed on the LC display of the dentist element.

The module assigned to the highspeed handpiece is not activated until the foot switch is actuated (one of LEDs V69, V74, V79, V110 on PCB ADX lights up, depending on which module is activated). Actuate foot switch S1. PCB CJ in the connection box/chair then sends a CAN data signal to PCB ADX in the dentist element and starts the highspeed handpiece function. Board ADX then sends a CAN data signal to board CJ and turns on the driving air (MVP1).



Spray preselection:

When the spray key is pressed (the LED of the corresponding key lights up), a CAN data signal is generated on PCB AEP in the dentist element and is sent to PCB ADX. This in turn activates solenoid valve MVP3 for spray air on PCB CJ via CAN (if the foot switch is active).

Instrument light preselection:

When the light key is pressed (the LED of the corresponding key lights up), the light supply is activated on PCB ADX (if the foot switch is active).



i NOTE

Highspeed handpiece functions:

Direct starter - variable, selectable in the Mode menu.

Direct starter:

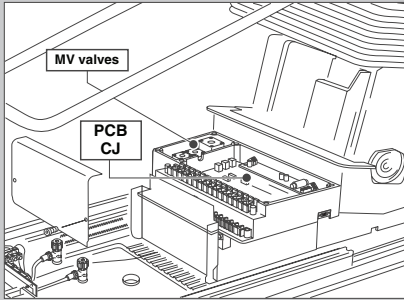
The highspeed handpiece runs at the programmed intensity when the foot switch is actuated.

Variable:

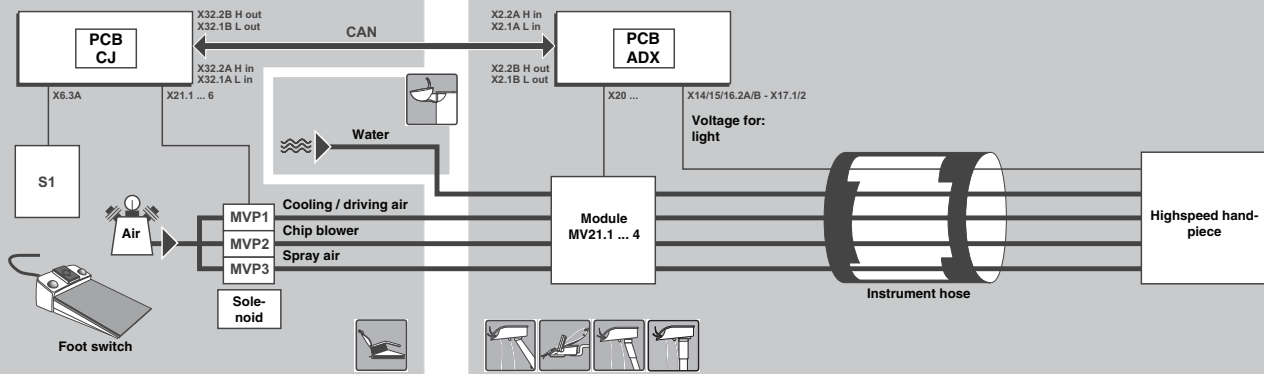
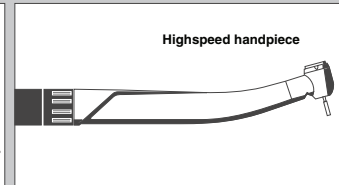
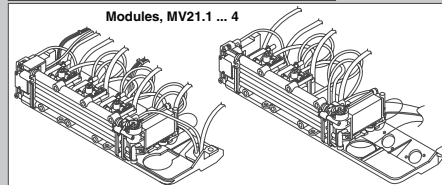
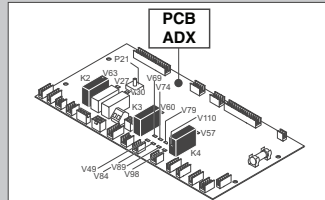
*The highspeed handpiece speed is controlled proportionally in relation to the position of the foot switch (accelerator). For both functions, PCB ADX sends a CAN data signal to PCB CJ for the preselected values of the proportional valves. **Currently not available.***

C2+
C3+
C4+

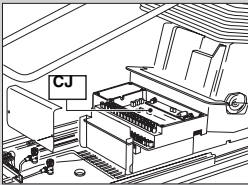
Connection box / chair



Dentist element



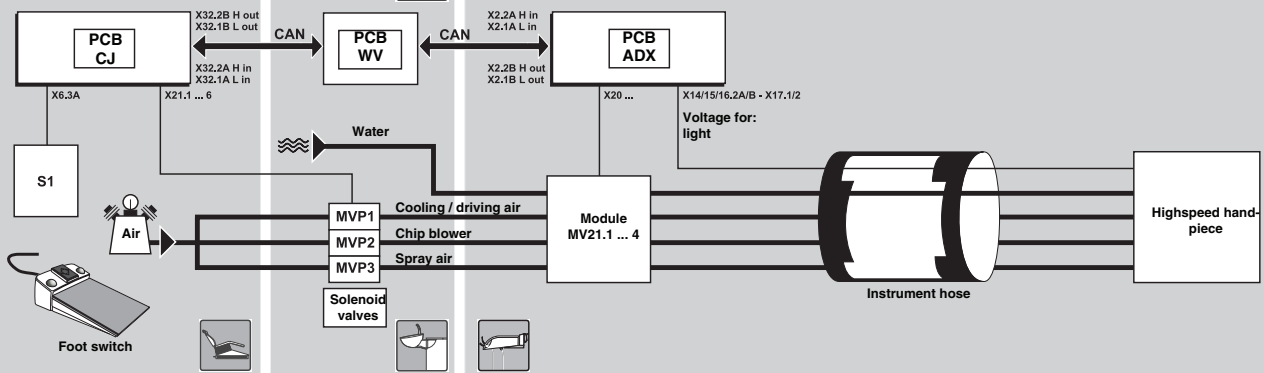
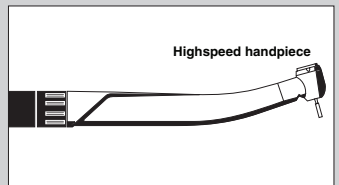
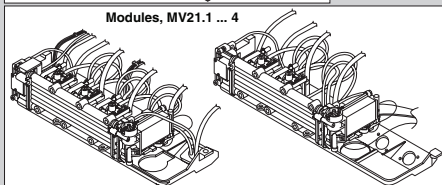
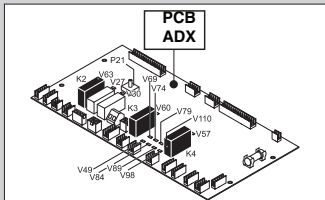
Connection box / chair



Water unit



Dentist element



C5+

6 How it works ...

6.6 ... ultrasound



Remove the ultrasonic handpiece from its holder. The ultrasound menu appears on the LC display (only if PCB ADX in the dentist element detects that an ultrasound module is present).

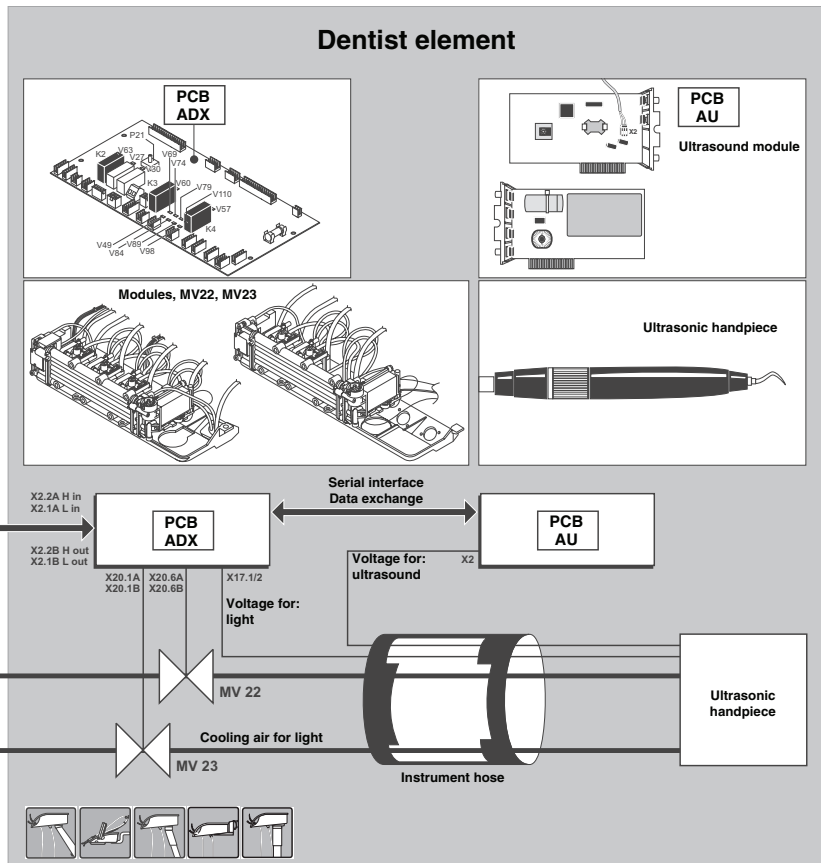
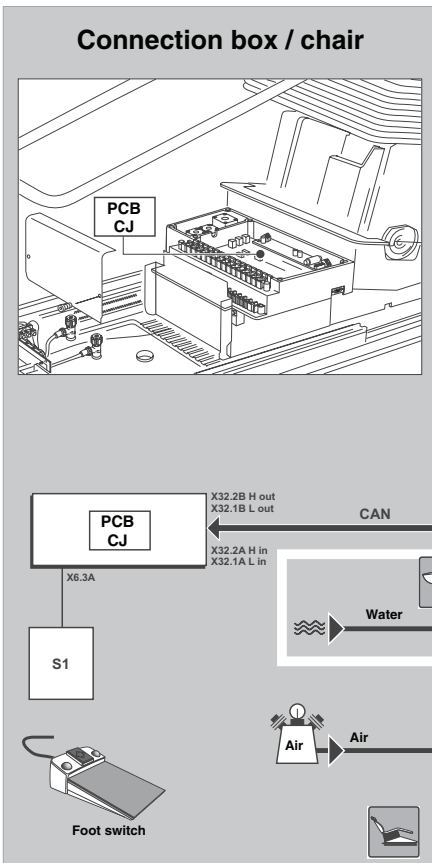
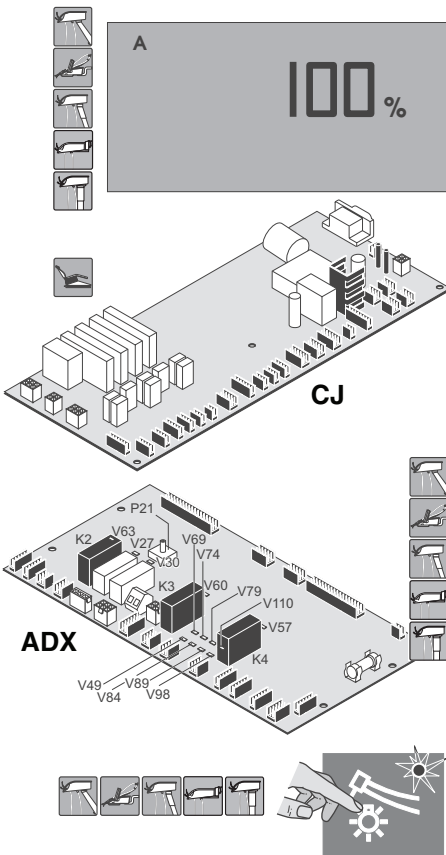
Actuate foot switch S1.

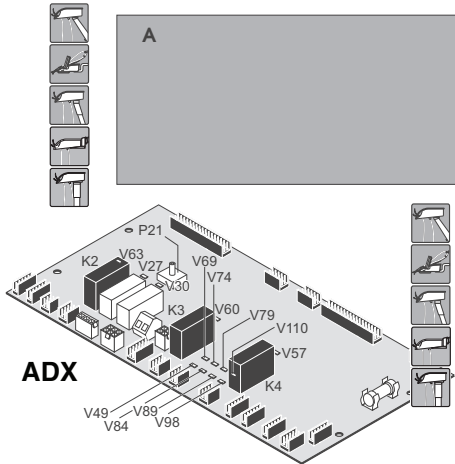
PCB CJ in the connection box/chair then sends a CAN data signal to PCB ADX in the dentist element and starts the ultrasound function.

Solenoid valves MV22 (water; LED V49 on PCB ADX lights up) and MV23 (air; LED V84 on PCB ADX lights up) are activated.

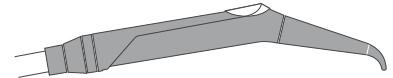
The resonant circuit, ultrasound module PCB AU and ultrasonic handpiece are activated.

When the light key is pressed (the LED of the corresponding key lights up), the light supply is activated on PCB ADX (if the foot switch is active).





6.7 ... Sprayvit



Remove the SPRAYVIT from its holder.
Only the preselected user - **A** or **B** - appears on the LC display.

Solenoid valves MV24 (water; LED V89 on PCB ADX lights up) and MV25 (air; LED V98 on PCB ADX lights up) are activated.

If instrument light is programmed, the LED of the corresponding key lights up. If the water or air key is pressed lightly, the instrument light is turned on. If the air key is pressed fully, voltage is applied to the heating cartridge in the handpiece and the air is heated.

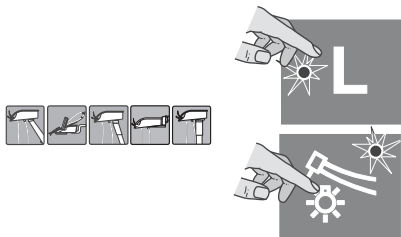
The heating voltage is switched via a relay on PCB ADX and indicated by LED V30.

If the water key is pressed fully, voltage is applied to the heating cartridge in the handpiece and the water is heated.

The heating voltage is switched via a relay on PCB ADX and indicated by LED V27.

! CAUTION

The heater and the light in the SPRAYVIT remain turned off during initial start-up. To vent the water pipes, the water pump must have performed at least 20 strokes before the heater and the light are enabled. This applies to the SPRAYVIT both in the dentist element and in the assistant element. When PCBs ADX in the dentist element and HC in the assistant element are replaced, another 20 pump strokes must be executed.



6.8 ... Polylight in the assistant element



Remove the Polylight from its holder.
The Polylight is operated with 16VAC from the power supply.

A switch-on pulse via the light button (if fitted on the assistant element) switches on the electronics.

The same pulse deactivates the electronics the second time. A checkback signal to the assistant element indicates whether the Polylight is still active.

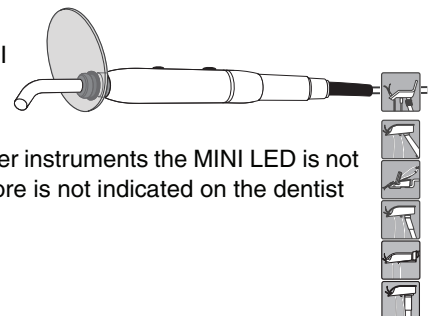
This signal is also used to turn off the heating voltage (SPRAYVIT and spray water heater); this protects the system from overload. The fan is driven by board PL.



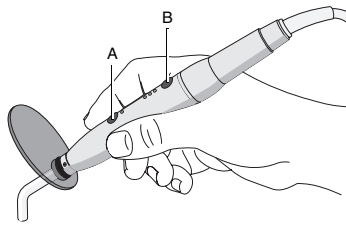
6.9 ... Polylight Mini LED in the assistant/dentist element

As soon as the treatment center is switched on, the MINI LED DC/DC module (MI) is supplied with a 35VDC voltage.

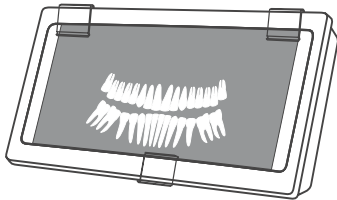
Located in the treatment center is a DC/DC converter which generates the 5VDC supply voltage for the MINI LED handpiece from the 35VDC voltage.



In contrast to all other treatment center instruments the MINI LED is not detected by the software, and therefore is not indicated on the dentist element display.



The complete control or control electronics of the MINI LED is located in the MINI LED handpiece.
The operating mode is activated and selected via keys **A (ON/OFF)** and **B (operating mode)** on the MINI LED handpiece.



6.10... X-ray image viewer

The X-ray image viewer is supplied with 12VDC from PCB ADX. The ground conductor is looped through panel control AP (connector X3).

When the X-ray image viewer key is pressed, the ground conductor is switched through to the X-ray image viewer or switched off again.

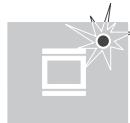
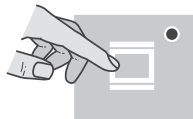
A yellow service LED (V52) lights up on PCB AP when the X-ray image viewer is active (visible through lateral EPROM opening).

Using the X-ray image viewer key with the C2⁺, C3⁺, C4⁺, C5⁺, M1⁺ or M1⁺, three different functions can be controlled simultaneously:

1. The X-ray image viewer on the tray support arm, controlled by PCB WE.

The PCB returns a status signal via the CAN bus. This signal causes the AP controller to activate the green LED on the X-ray image viewer key when PCB WE has switched on the X-ray image viewer.

2. With a PC connection of the camera or second monitor function, an RS232 command is sent via the interface of board CJ to the PC, which can generate a WHITE SCREEN (factory setting). No status feedback signal is generated, i.e. the green LED on the X-ray image viewer key does not light up.
3. X-ray image viewer on the dentist element (only C2⁺/C4⁺/C5⁺/M1⁺). Pressing the X-ray image viewer key always activates the output of panel control AP. No status feedback signal is generated, i.e. the green LED on the X-ray image viewer key does not light up.



i NOTE

If both an X-ray image viewer on the dentist element and a PC connection (or a second monitor) are available, the WHITE SCREEN is not required. The Mode dialog has an option WHITE SCREEN YES - NO (factory setting is YES).

This item must be set to NO in order to ensure that no alternating states will occur between the X-ray image viewer and the WHITE SCREEN.



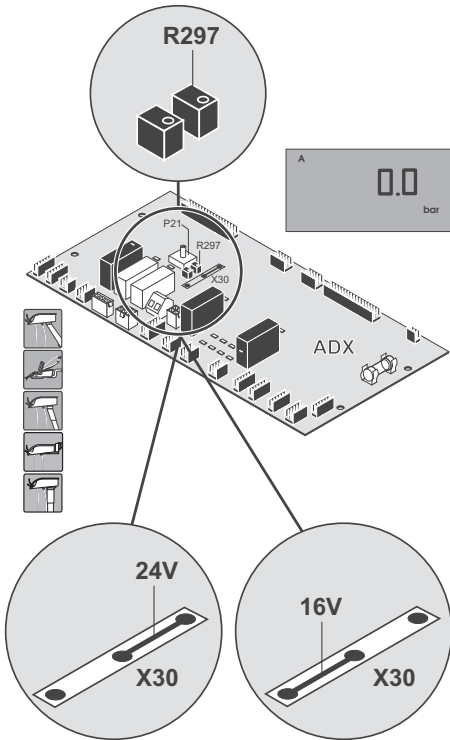
7 Points to observe when changing the ...

C2⁺, C3⁺, C4⁺, C5⁺, M1⁺

7.1 ...ADX/CJ board Serial No. \geq 70,000

Install only the following no.

PCB	Part No.	Spare Part No.	Repair Part No.	
ADX	59 71 234	60 28 992	59 71 267	
CJ	59 69 675	58 63 498	59 69 691	



7.2 ... ADX PCB in the dentist element

Set the air pressure indication / display for the highspeed handpiece:

Remove highspeed handpiece



Use resistor **R297** to set the value 0.0 on the display, if necessary.



7.3 ... Water heating voltage for Sprayvit

The heating voltage (water) for the Sprayvit is factory-set to 24V on PCB **ADX**.

You can reduce the heating voltage to 16V by resoldering the jumper at **X30**.

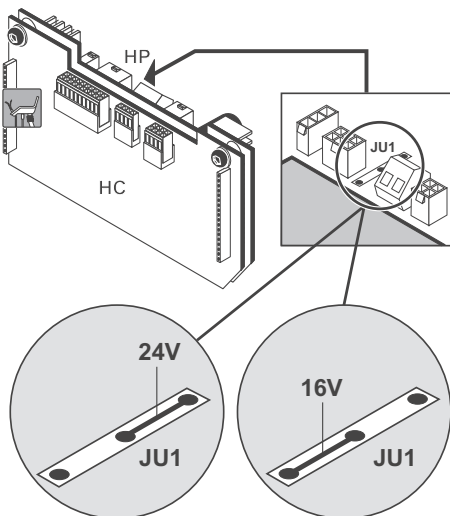
7.4 ... PCB HP in the assistant element



Water heating voltage for Sprayvit:

The heating voltage (water) for the Sprayvit is factory-set to **24V** on PCB **HP**.

You can reduce the heating voltage to **16V** by resoldering the jumper at **JU1**.





8 Service LEDs

C2⁺, C3⁺, C4⁺, C5⁺, M1⁺

8 Service LEDs

PCB	LED	Color	Function
Dentist element PC board ADX	V6	YE	NaCL pump ON
	V12	RD	Fuse F1 for NaCL pump defective
	V27	YE	Sprayvit water heater relay ON
	V30	YE	Sprayvit air heater relay ON
	V41	RD	Reset
	V49	YE	MV22 US water
	V57	YE	Holder relay K4 ON / motor voltage
	V60	YE	Holder relay K3 ON / motor voltage
	V63	YE	Holder relay K2 ON / motor voltage
	V69	YE	MV21.1 module solenoid valve, burr drive 1
	V74	YE	MV21.2 module solenoid valve, burr drive 2
	V79	YE	MV21.3 module solenoid valve, burr drive 3
	V84	YE	MV 23 solenoid valve, US air ON
	V89	YE	MV 24 solenoid valve, Sprayvit water ON
	V98	YE	MV 25 solenoid valve, Sprayvit air ON
	V110	YE	MV21.4 module solenoid valve, drill drive 4 ON
	V115	GN	+24V DC
	V116	GN	+5V DC
	V117	GN	+35V DC
	V134	GN	+15V DC
V135	GN	+8V DC	
V138	GN	+15V OP DC	
V141	YE	Spray water heater ON	
V145	YE	Polylight ON	
V146	YE	Polylight fan ON	
Dentist element PC board AP	V50	GN	+5V
	V51	RD	Reset, lights up briefly upon power up
	V52	YE	X-ray image viewer output is switched through or flashes while the self-test program is running
Dentist element PCB HF	V9	GN	HF output stage voltage
	V23	GN	5V DC
	V24	GN	Function check, flashes when software is OK
	V25	GN	HF active
	V26	GN	CAN monitoring, LED lights up in case of fault
	V27	RD	Reset, lights up briefly during power up
Dentist element PC board AL	V30	RD	Reset
	V31	GN	RUN flashes 1-2 sec. > PCB in operation, flashes ~ 3Hz foot switch in operation or FS signal active
	V32	RD	BLx = flash code (e.g. BL1 = flashes once)
			BL1: RAM error (internal RAM of microcontroller)
			BL2: EPROM checksum error
BL3: PWM generator defective			
		BL4: 12V driver voltage outside of tolerance (+/-15%)	
		BL5: 32V operating voltage outside of tolerance (+/-15%)	
		BL6: One of the logical inputs or open collector outputs is defective	
		BL7: Flashes permanently, motor line open circuit (current below min. level)	
V34	LG	+32VDC	
V35	GN	+8VDC	
Dentist element PC board AU	V1	RD	BLx = flash code (e.g. BL1 = flashes once)
			BL1: Handpiece not connected,
			BL2: Oscillation frequency less than 27kHz,
			BL3: Oscillation frequency exceeds 29kHz,
			BL4: Bandwidth less than 8kHz,
			BL5: Potentiometer not connected,
			BL6: EPROM checksum error,
			BL7: RAM in microprocessor defective

PCB	LED	Color	Function	
Dentist element PC board PL	V1	YE	+5V	DC CPU supply
	V39	YE	+12V	DC
	V40	YE	+5V	DC supply voltage
Dentist element PCB AKV	V106	GN	+20V	DC when supply voltage for AKV is present
	V107	GN	+5V	DC when supply voltage for digital circuitry is present
	V110	GN	12V	DC iso when camera is present
	V113	GN	5V	DC iso when power supply for camera electronics is present
	V114	YE	Status Out	when camera electronics report "CAMERA ACTIVE"
	V118	YE	CamIn	when power-on command for camera is sent by ADX
	V120	YE	Contin1	when control sample signal 1 for camera is sent by ADX
	V121	YE	Cont01	when control sample signal 1 is sent by AKV
	V122	YE	Contin2,	when control sample signal 2 for camera is sent by ADX
	V123	YE	Cont02	when control sample signal 2 is sent by AKV
	V200	YE	Tempsens	when overtemperature protection is active
	V202	YE	Lamp on	for internal test purposes only
	V203	YE	Power Lamp on,	for internal test purposes only
V304	GN	Lamp+	when supply voltage for lamp and fan is active	

PCB	LED	Color	Function	
Patient chair PC board CJ	V401	YE	Track backward	
	V403	YE	Track forward	
	V405	YE	Clutch travel track	
	V439	YE	HR recline	
	V440	YE	HR incline	
	V441	YE	HR in	
	V442	YE	HR out	
	V443	YE	BR incline	
	V444	YE	BR recline	
	V445	YE	Lift up	
	V446	YE	Lift down	
Patient chair PC board CJ	V447	YE	Limits lights up when: LS Lift up, LS Lift down, LS HR inc, LS HR rec, LS HR up, LS HR down	
	V448	YE	Service, shows the programming mode	
	V449	YE	User Input lights up when: headrest switch, unit foot switch, 4-way foot control	
	V450	RD	Emergency Stop	
	V451	RD	SS lights up when at least: SS-TB, SS-BR, SS-HR, SS1_Bowl or EMERGENCY STOP is active.	
	V452	RD	D-Error is turned on with defect of: MV1, MV16, MV35, Ext relay, Call relay, Suction rel., MV43, MVP1, MVP2 and MVP3. Fault scenarios: A Actuator does not switch on, fault in driver stage or overcurrent cutout B Channel of an actuator does not switch off. C Enable request to channel to which no actuator is connected.	
	V453	GN	+32V DC	
	V454	GN	+5V DC	
	V455	GN	+24V DC	
	V473	RD	LED lights up when: 115V RELAY is switched off when safety switches are active. Chair and backrest motors are turned off.	
V474	RD	Reset		

8 Service LEDs

PCB	LED	Color	Function
Patient chair PC board CF	V16	RD	WE F 1 35V DC
	V17	RD	AE F 2 35V DC
	V18	RD	HE F 3 35V DC
	V19	RD	AK F 4 35V DC
	V20	RD	NC F 5 35V DC
	V21	RD	WE F 6 24V AC
	V22	RD	AE F 7 24V AC
	V23	RD	HE F 8 24V DC
	V24	RD	AE F 12 16V AC
	V25	RD	NC F 10 24V AC
	V28	RD	HE F 13 16V AC
	V30	RD	NC F 15 16V AC
	V32	RD	WE F 11 16V AC
	V32	RD	Sirolux F 18 24V AC
	V35	RD	AK F 16 115V AC
	V35	RD	115V AC F 16
	V36	RD	115V AC F 17
	V36	RD	AK F 17 115V AC

PCB	LED	Color	Function
Water unit PC board WE	V40	YE	MV 33 Unit selector ON
	V41	YE	Tumbler heater heating
	V69	YE	Level switch DS 30, sep. tank empty
	V70	YE	Safety switch S 3, Amalgam rotor, tank closed
	V71	YE	LED ON = no water, pressure switch DN 30
	V72/73	YE	DS 33/34 reed contacts, water pump switch (flash alternately)
	V74	YE	LED ON = disinfectant tank full, level switch DS 32
	V75	YE	Not used
	V76	YE	LED ON = water tank full, level switch DS 31
	V77/78	YE	Not used
	V79	YE	Tumbler filling/for S1 only
	V80	YE	Cuspidor flushing/for S1 only
	V82	YE	Vacuum active
	V81/83	YE	Not used
	V84	YE	Heater code recognition
	V85	YE	MV 37 Solenoid valve of flow control valve
	V86	YE	MV 40 Solenoid valve, water pump
	V87	YE	MV 34 Solenoid valve, tumbler filling
	V88	YE	MV 3 Solenoid valve, disinfectant injection
	V89 -91	YE	Not used
	V92	YE	X-ray image viewer
	V101	RD	Reset
	V102	GN	Amalgam motor running
V103	GN	+5V DC	
V104	GN	+35V DC	
V105	GN	+24V DC	
V106	GN	+15V DC	
V107	GN	+5V DC Ref	
V109	YE	Not used	
Water unit PC board WV	V3	YE	Image off
	V4	GN	+10,5VDC



PCB	LED	Color	Function
Assistant element PC board HC	V7	GN	+5V DC
	V14	GN	+24V DC
	V22	RD	Reset
	V26	YE	Sprayvit light

9 Option list

C2⁺, C3⁺, C4⁺, C5⁺, M1⁺

9 Option list

The option list is output after the hardware (HW) and software (SW) version numbers during output of the service code list and should always be consulted in a fault scenario.

If an option is not detected (i.e. output) despite the fact that is installed, the fault (the MV, jumper, resistor, etc. required for detecting the option) can be located more quickly.

Possible options are listed below along with the corresponding MVs, jumpers, etc., by means of which the option is detected during start-up of the treatment center.

Service code memory	Contents of node AE	
Dentist element PCB	HW x.x SW x.x	
Siroson module PCB	HW x.x SW x.x	
Siromot module PCB	HW x.x SW x.x	
HF surgery PCB	HW x.x SW x.x	

If

HF surgery PCB	HW 0.0	SW 0.0 => HF is not installed or cannot be detected
Siroson module	Ultrasound	SIROSON module ID
Siromot module	Electric motor	SIROMOT module ID
Spray heater	Spray heater	Jumper X7.3 – X7.5
HF surgery	HF surgery	HF module ID
Saline pump	Saline solution pump	as soon as it is assigned to any holder in the Mode dialog

Service code memory	Contents of node HE	
Assistant element PCB	HW x.x SW x.x	
Sprayvit		Resistance in hose
Curing light	POLYLUX	Module ID

Service code memory	Contents of node WE	
Water unit PCB	HW x.x SW x.x	
Amalgam separator	Amalgam separator	MV37
Disinfection	Disinfection	MV3
Water pump	Water pump	MV40
Tumbler heater	Tumbler heater	Jumper X14.2 - X14.4
Cuspidor	Cuspidor	MV34

Service code memory	Contents of node AK	
Jbox PCB	HW x.x SW x.x	
Bowl movement	Swiveling cuspidor	MV43
Ext. relays	External relay PCB	K1, K2, K3
Disinfection	Disinfection	MV1
Cuspidor	Cuspidor	MV35

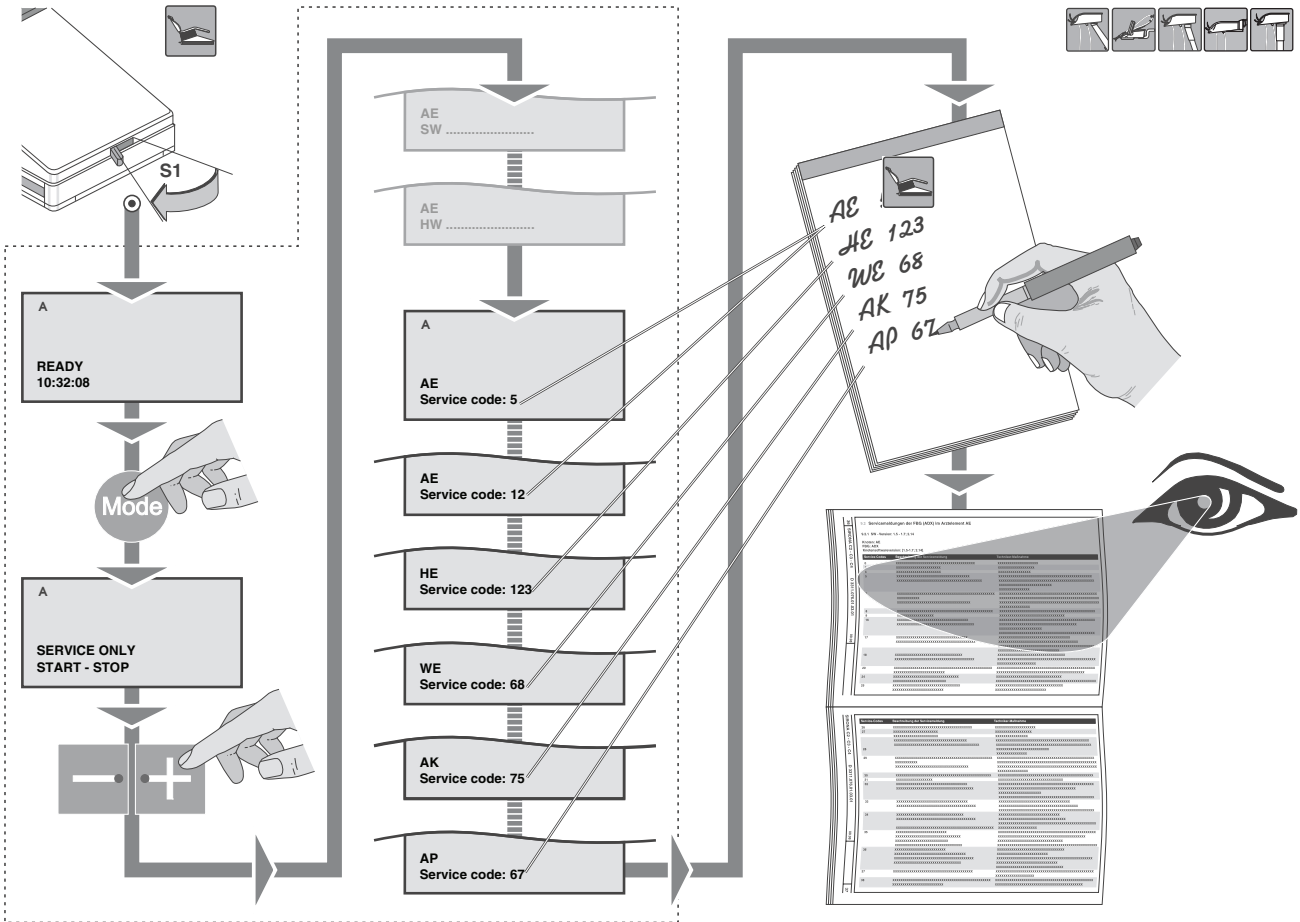
Service code memory	Contents of node AK	
Main foot pedal	Pedal-operated foot switch	Jumper X6.5A - X6.5B
Headrest keys	4-way switch on headrest	Jumper X70.6A - X70.6B
Joystick	4-way foot control	Jumper X12.1 - X12.4
Headrest	Tilting part	Load (motor 3) present
Sword	Sword	Load (motor 5) present
Track	Track	Load (motor AE) present
MV16	Ventilation valve if spray prop. valve is installed	Load (MV16) present
Driving air	Driving air solenoid valve	Load (MVP1) present
Chip air	Chip blower solenoid valve	Load (MVP2) present
Spray air	Spray air solenoid valve	Load (MVP3) present

Service code memory	Contents of node AP	
Dentist panel PCB	HW x.x SW x.x	

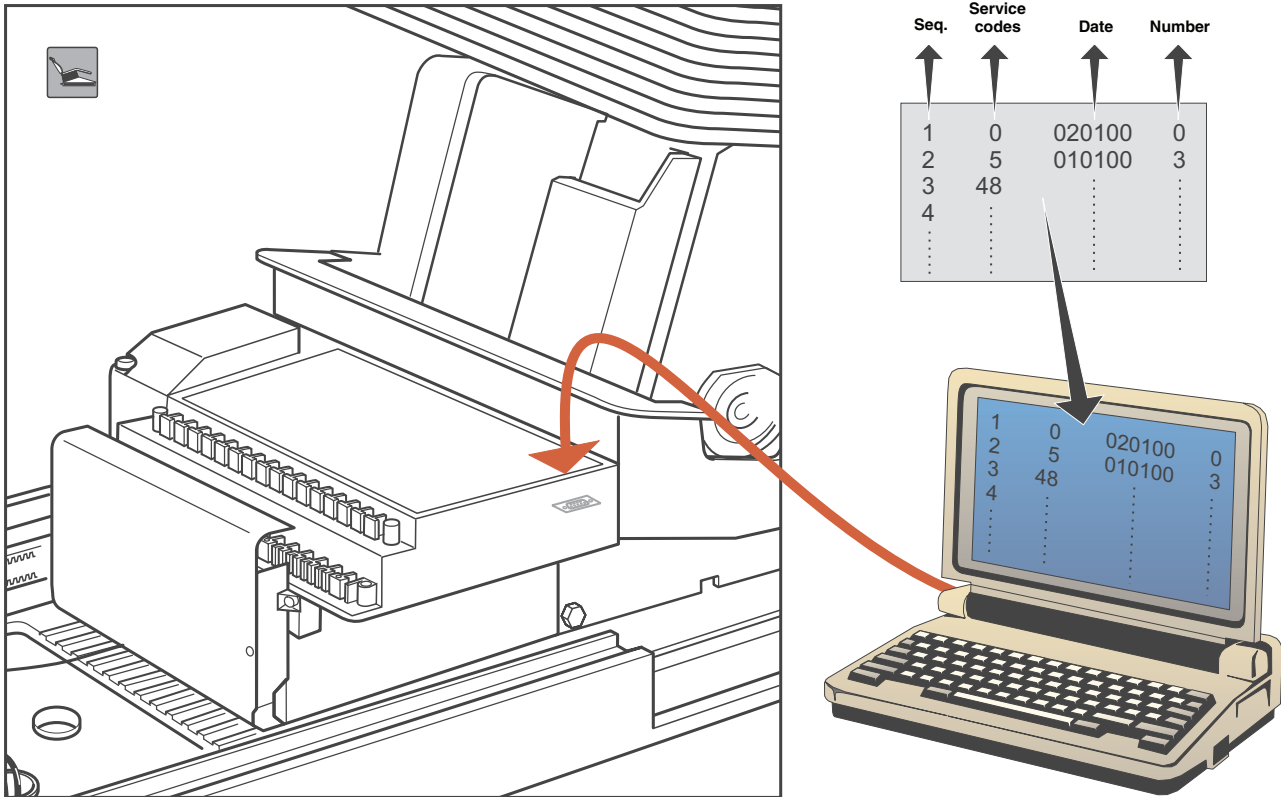
10 Reading out service codes ...

C2⁺, C3⁺, C4⁺, C5⁺, M1⁺

10.1 on the display of the dentist element



10.2... using a notebook link to the C2⁺, C3⁺, C4⁺, C5⁺, M1⁺



Up to CJ SW version 5.3

Start the error output using the Mode dialog.

To speed up the output when a notebook computer is connected, the complete service information is output to the notebook computer within a few seconds before output to the panel display commences.

Following this, output to the panel display starts at the customary slow rate to allow you to take notes if no notebook computer is available.

With CJ SW version 5.3 and higher

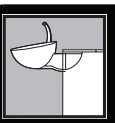
Starting with CJ SW version 5.3, the service code can be read in two ways:

1. Using the Mode dialog as described in section 10.1., service codes are only output on the dentist element display.
2. By pressing the ENTER key after the notebook computer/PC has been connected and the Hyperterminal program started.
The service codes are output to the notebook computer/PC only. It is not necessary to start the output via the Mode dialog of the AP.

Program: Hyperterminal

Settings

Bits per second: 9 600
 Stop bit: 1
 Data bits: 8
 Parity: None
 Protocol: None



11 Service code listings

C2+, C3+, C4+, C5+, M1+

11.1 Service messages of the connection box (AK)

11.1.1 Software version: 1.6 - 5.8, revision date 08.2004

Node: AK

Board (PCB): CJ

Serv. code	Description of service code	Corrective action (service engineer)
0	Zero error line, marks time of last power up	No action required
5	Powerfail input circuit defective according to self-test	? Can 32V be measured at MP (32V) and MP (GND) on PCB CJ in AK and/or does LED (+32V) light up ? YES: Ignore message NO: Check fuse F4 on PCB CF and 32V cable path/connectors to X1
7	CAN communication impossible/faulty, BUS OFF condition has been detected. If error persists: CAN module def., CAN cable def.	? Only once in a component YES: Fault exists NO: Check CAN cable/connector for continuity / try to establish connection to every component. HELP: Search through AK service codes for open circuits to other nodes
8	Processor monitoring (watchdog) error	Replace PCB CJ in AK
10	CAN connection to AE interrupted after communication has already been established. Possibly CAN cable defective or component disconnected/defective.	! Check function of dentist element OK: Error occurs frequently: Check CAN cable NO: Replace PCB ADX in AE
11	CAN connection to HE interrupted after communication has already been established. Possibly CAN cable defective or component disconnected/defective.	! Check functioning of assistant element OK: Error occurs frequently: Check CAN cable NO: Replace PCB HC in HE
12	CAN connection to WE interrupted after communication has already been established. Possibly CAN cable defective or component disconnected/defective.	! Check function of water unit OK: Error occurs frequently: Check CAN cable NO: Replace PCB in WE
15	CAN connection to AP interrupted after communication has already been established. Possibly CAN cable defective or component disconnected/defective.	! Check functioning of panel OK: Error occurs frequently: Check CAN cable NO: Replace dentist panel
16	24V supply voltage outside tolerance. Power supply failure, short-circuit, blown fuse, connector	? Can 32V be measured at MP (32V) and MP (GND) on PCB CJ in AK and/or does LED (+32V) light up ? NO: Check fuse F4 on PCB CF and 32V cable path/connectors to X1 YES: ? Can 24V be measured at MP (24V) and MP (GND) ? YES: Ignore message NO: PCB CJ
40	Lift motor turns in wrong direction.	Check potentiometer and motor connections; reverse their polarity if necessary
41	Backrest motor turns in wrong direction.	Check potentiometer and motor connections; reverse their polarity if necessary
42	Headrest motor turns in wrong direction.	Check potentiometer and motor connections; reverse their polarity if necessary
46	Lift motor potentiometer values outside permissible limits	? Check cable path CJ (AK) X9. 1,2,3 -> Lift potentiometer ? NO: ? Check potentiometer for proper fit ? NO: Replace potentiometer
47	Backrest motor potentiometer values outside permissible limits	? Check cable path CJ (AK) X4. 1B,2A,2B -> Check backrest potentiometer ? NO: ? Check potentiometer for proper fit ? NO: Replace potentiometer
53	Movement was interrupted by safety switch 1 (backrest).	? Safety switch SS1 activated (help: "SS" LED) ? YES: Check cable path CJ (AK) X4. 6 A+B -> check SS1, check adjustment of SS1 NO: Check adjustment of SS1
54	Movement was interrupted by safety switch 2 of toeboard.	? Safety switch SS2 activated (help: "SS" LED) ? YES: Check cable path CJ (AK) X4. 5 A+B -> Check SS2, check adjustment of SS2 NO: Check adjustment of SS2
55	Movement was interrupted by safety switch 3 (headrest).	? Safety switch SS3 activated (help: "SS" LED) ? YES: Check cable path CJ (AK) X51. 5+4 -> Check SS3, check adjustment of SS3 NO: Check adjustment of SS3



Serv. code	Description of service code	Corrective action (service engineer)
56	Movement was interrupted by safety switch 4 (cuspidor).	? Safety switch SS4 activated (help: "SS" LED) ? YES: Check cable path CJ (AK) X8. 1+3 -> Check SS4, check adjustment of SS4 NO: Check adjustment of SS4
60	Backup battery of real-time clock is discharged.	Replace PCB CJ in AK
61	EMERGENCY OFF not detected by AE.	Check EMERGENCY STOP cable NO: Replace PCB ADX in AE
64	EMERGENCY OFF not detected by AK (no motor movements possible).	Check EMERGENCY STOP cable NO: Replace PCB CJ in AK
66	AE sends no EMERGENCY STOP (no motor movements possible).	Check EMERGENCY STOP cable NO: Replace PCB CJ in AK
74	Cuspidor needs too long to swing out	In case of malfunction: Check cuspidor drive (air available ?, sluggish ?, check MV BOWL), cable path CJ (AK) X51. 5+4 --> SS4
75	Lift motor turns excessively long until reaching a position	In case of malfunction: check lift drive
76	Backrest motor turns excessively long before reaching a position	In case of malfunction: check backrest drive
77	Headrest motor turns excessively long before reaching a position	In case of malfunction: check headrest drive
78	Travel track motor turns excessively long before reaching a position	In case of malfunction: check travel track drive (sluggishness, motor, clutch)
79	Sword motor turns excessively long before reaching a position	In case of malfunction: check sword drive
80	Circuit for activating MV1 for water inlet: no load present	? Check circuit for MV1: PCB CJ X14. 3+4 -> MV1 ? NO: Replace MV1, ? MV1 can be activated (e.g. by filling tumbler several times) ? NO: Replace PCB CJ in AK
81	Circuit for activating MV1 for water inlet: overload condition	? Check circuit for MV1: PCB CJ X14. 3+4 -> MV1 (MV1 wrong polarity) ? NO: Replace MV1 ? MV1 can be activated (e.g. by filling tumbler several times) ? NO: Replace PCB CJ in AK
84	Circuit for activating MV16 for bleed valve: no load present	? Check circuit for MV16: PCB CJ X24. 1+2 -> MV16 ? NO: replace MV16, ? MV16 can be activated (e.g. by activating a burr instrument with spray) ? NO: Replace PCB CJ in AK
85	Circuit for activating MV16 for bleed valve: overload condition	? Check circuit for MV16: PCB CJ X24. 1+2 -> MV16 (MV16 wrong polarity) ? NO: replace MV16, ? MV16 can be activated (e.g. by activating a burr instrument with spray) ? NO: Replace PCB CJ in AK
88	Circuit for activating MV35 for cuspidor flushing: no load present	? Check circuit for MV35: PCB CJ X14. 1+2 -> MV35 ? NO: Replace MV35, ? MV35 can be activated (activate cuspidor flushing) ? NO: Replace PCB CJ in AK
89	Circuit for activating MV35 for cuspidor flushing: overload condition	? Check circuit for MV35: PCB CJ X14. 1+2 -> MV35 (MV35 wrong polarity) ? NO: Replace MV35, ? MV35 can be activated (activate cuspidor flushing) ? NO: Replace PCB CJ in AK
104	Circuit for activating external relay K2 (#): no load present	? Check circuit for K2: PCB CJ X18. 1A+2A -> PCB SR ? NO: Replace relay PCB SR, ? K2 can be activated (# key) ? NO: Replace PCB CJ in AK
105	Activation of external relay K2 (#): overload condition	? Check circuit for K2: PCB CJ X18. 1A+2A -> PCB SR ? NO: Replace relay PCB SR, ? K2 can be activated (# key) ? NO: Replace PCB CJ in AK
108	Circuit for activating external relay K1 (bell): no load present	? Check circuit for K1: PCB CJ X18. 1A+3A -> PCB SR ? NO: Replace relay PCB SR, ? K1 can be activated (call key) ? NO: Replace PCB CJ in AK
109	Activation of external relay K1 (bell): overload condition	? Check circuit for K1: PCB CJ X18. 1A+3A -> PCB SR ? NO: Replace relay PCB SR, ? K1 can be activated (bell key) ? NO: Replace PCB CJ in AK
112	Circuit for activating external relay K3 (suction device): no load present	? Check circuit for K3: PCB CJ X18. 1A+4A -> PCB SR ? NO: Replace relay PCB SR, ? K3 can be activated (suction) ? NO: Replace PCB CJ in AK

11 Service code listings

Serv. code	Description of service code	Corrective action (service engineer)
113	Activation of external relay K3 (suction device): overload condition	? Check circuit for K3: PCB CJ X18. 1A+4A -> PCB SR ? NO: Replace relay PCB SR, ? K3 can be activated (suction) ? NO: Replace PCB CJ in AK
116	Circuit for activating MV BOWL for cuspidor movement: no load present	? Check circuit for MV BOWL: PCB CJ X99. 1+3 -> MV BOWL ? NO: Replace MV_BOWL, ? MV BOWL can be activated ? NO: Replace PCB CJ in AK
117	Circuit for activating MV BOWL for cuspidor movement: overload condition	? Check circuit for MV BOWL: PCB CJ X99. 1+3 -> MV BOWL (MV BOWL wrong polarity ?) NO: Replace MV BOWL, ? MV BOWL can be activated ? NO: Replace PCB CJ in AK
121	Activation for pressure regulator MVP2 (chip blower air): Wrong load (overload or no load)	? Check circuit for MVP2: PCB CJ X21. 3+4 -> MVP2 (MVP2 wrong polarity ?) NO: Replace MVP valve block ? MVP2 can be activated ? NO: Replace PCB CJ in AK
123	Activation for pressure regulator MVP2 (chip blower air) faulty: OFF state current too high.	? Check circuit for MVP2: PCB CJ X21. 3+4 -> MVP2 ? NO: Replace MVP valve block ? MVP2 can be activated ? NO: Replace PCB CJ in AK
125	Activation for pressure regulator MVP3 (spray air): Wrong load (overload or no load)	? Check circuit for MVP2: PCB CJ X21. 1+2 -> MVP3 (MVP3 wrong polarity ?) NO: Replace MVP valve block ? MVP3 can be activated ? NO: Replace PCB CJ in AK
127	Activation for pressure regulator MVP3 (spray air) faulty: OFF state current too high.	? Check circuit for MVP2: PCB CJ X21. 1+2 -> MVP3 ? NO: Replace MVP valve block ? MVP3 can be activated ? NO: Replace PCB CJ in AK
129	Activation for pressure regulator MVP1 (driving air): Wrong load (overload or no load)	? Check circuit for MVP1: PCB CJ X21. 5+6 -> MVP1 (MVP1 wrong polarity ?) NO: Replace MVP valve block ? MVP1 can be activated ? NO: Replace PCB CJ in AK
131	Activation for pressure regulator MVP1 (driving air) faulty: OFF state current too high.	? Check circuit for MVP1: PCB CJ X21. 5+6 -> MVP1 ? NO: Replace MVP valve block ? MVP1 can be activated ? NO: Replace PCB CJ in AK
132	Configuration error: Coding of MVP valve block detected as invalid during start-up	Check circuit for MVP coding: PCB CJ X21. 6+7 -> MVP1, turn unit off (wait at least 10 sec.) and back on ? Error reported during power-up ? YES: Replace MVP valve block
133	Configuration error: MV1 not detected during start-up, although it should be activated.	? MV1 present ? NO: Install MV1 YES: Proceed as for error 80
134	Configuration error: MV16 not detected during start-up, although it should be activated.	? MV16 present ? NO: Install MV16 YES: Proceed as for error 84
135	Configuration error: MV35 not detected during start-up, although it should be activated.	? MV35 present ? NO: Install MV35 YES: Proceed as for error 88
136	Configuration error: Relay K2 (#) not detected during start-up, although it should be activated.	? Relay PCB SR present ? NO: Install relay PCB SR YES: Proceed as for error 104
137	Configuration error: Relay K1 (bell) not detected during start-up, although it should be activated.	? Relay PCB SR present ? NO: Install relay PCB SR YES: Proceed as for error 108
138	Configuration error: Relay K3 (suction machine) not detected during start-up, although it should be activated.	? Relay PCB SR present ? NO: Install relay PCB SR YES: Proceed as for error 112
139	Configuration error: MV BOWL not detected during start-up, although it should be activated.	? MV BOWL present ? NO: Install MV BOWL YES: Proceed as for error 116
141	Configuration error: MVP1 (driving air) not detected during start-up, although it should be activated.	? MVP1 present ? NO: Install MVP1 YES: Proceed as for error 121

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Serv. code	Description of service code	Corrective action (service engineer)
142	Configuration error: MVP2 (chip blower air) not detected during start-up, although it should be activated.	? MVP2 present ? NO: Install MVP2 YES: Proceed as for error 125
143	Configuration error: MVP3 (spray air) not detected during start-up, although it should be activated.	? MVP3 present ? NO: Install MVP3 YES: Proceed as for error 129
189	A switch on the headrest control was activated during start-up.	Check switch functions on the headrest control (presumably there is a short-circuit)
190	A switch on the 4-way foot control was activated during start-up.	Check switch functions on the 4-way foot control (presumably there is a short-circuit)
191	A switch on the foot switch was activated during start-up.	Check switch functions on the foot switch (presumably there is a short-circuit)
215	RS232 INPUT OVERRUN ERROR.	If the data transfer is interrupted repeatedly > Contact Customer Service.
222	NV memory: The program memory has been re-initialized completely.	? Software on PCB CJ has been replaced with a different version ? YES: No action required --> OK NO: ? Error occurs frequently YES: Replace PCB CJ in AK
223	NV memory error: The switching mode of relay K1 (bell) has been re-initialized.	? Error occurs frequently ? YES: Replace PCB CJ in AK
224	NV memory error: The switching mode of relay K2 (#) has been reinitialized.	? Error occurs frequently ? YES: Replace PCB CJ in AK
225	NV memory error: The sanitation status has been reinitialized.	? Error occurs frequently ? YES: Replace PCB CJ in AK
226	NV memory error: The user setting (A/B) has been reinitialized.	? Error occurs frequently ? YES: Replace PCB CJ in AK
230	NV memory error: Program (user A, P0) has been reinitialized.	? Error occurs frequently ? YES: Replace PCB CJ in AK
231	NV memory error: Program (user A, P1) has been reinitialized.	? Error occurs frequently ? YES: Replace PCB CJ in AK
232	NV memory error: Program (user A, P2) has been reinitialized.	? Error occurs frequently ? YES: Replace PCB CJ in AK
233	NV memory error: Program (user A, PS) has been reinitialized.	? Error occurs frequently ? YES: Replace PCB CJ in AK
234	NV memory error: Program (user B, P0) has been reinitialized.	? Error occurs frequently ? YES: Replace PCB CJ in AK
235	NV memory error: Program (user B, P1) has been reinitialized.	? Error occurs frequently ? YES: Replace PCB CJ in AK
236	NV memory error: Program (user B, P2) has been reinitialized.	? Error occurs frequently ? YES: Replace PCB CJ in AK
237	NV memory error: Program (user B, PS) has been reinitialized.	? Error occurs frequently ? YES: Replace PCB CJ in AK
999	The node has not reported.	Check whether this node is actually present in the system. If it is, check the connection to the serial interface of the treatment center.

11.2 Service messages of the dentist element (AE)

11.2.1 Software version: 1.5 - 2.37/3.37, revision date 01.2005

Node: AE

Board (PCB): ADX

Serv. code	Description of service code	Corrective action (service engineer)
0	Zero error line, marks time of last power up	No action required
3	EEPROM write error	Replace PCB ADX in AE
4	EEPROM write error	Replace PCB ADX in AE
5	Powerfail input circuit defective according to self-test; 35VDC monitoring in AE: 35V outside tolerance (<27.2V)	? Can at least 28VDC be measured at measuring point MP22 (+35V) and MP26 (GND) on PCB AE ? NO: Locate fault in cable path (35V) to connector X1 (PCB AE) (connector, cable, fuse F2) YES: Ignore message
7	CAN communication impossible/faulty, BUS OFF condition has been detected If error persists: CAN module def., CAN cable def.	? Only once in a component YES: Fault exists NO: Check CAN cable/connector for continuity / try to establish connection to every component. HELP: Search through AK service codes for open circuits to other nodes
8	No RESET by watchdog after discontinuation of triggering by uP	Replace PCB ADX in AE
9	CAN access not possible	Message cannot be evaluated, no action required
16	24V supply voltage outside tolerance. Power supply failure, short-circuit, blown fuse, connector	? Can 24V be measured at MP25 (24V) and MP27 (GND) on PCB ADX in AE? YES: Ignore message NO: ? Can 35V be measured at MP22 (35V) and MP26 (GND)? YES: Replace PCB ADX NO: Check fuse F2 and 35V cable path to X1, ADX
17	15V supply voltage outside tolerance. Power supply failure, short-circuit, blown fuse, connector	? Can 15V be measured at MP35 (15V) and MP28 (GND) on PCB ADX in AE? YES: Ignore message NO: ? Can 35V be measured at MP22 (35V) and MP26 (GND)? YES: Replace PCB ADX NO: Check fuse F2 and 35V cable path to X1, ADX
18	8V supply voltage outside tolerance. Power supply failure, short-circuit, blown fuse, connector	? Does error 16 occur? YES: refer to details there NO: ? Can 8V be measured at MP1 (8V) and MP28 (GND) on PCB ADX in AE? YES: Ignore message NO: Replace PCB ADX
20	A value stored in the EEPROM is outside the defined limits, re-initialization with factory settings	Software version < 1.7 ? YES: Use new software version, 2.x or higher NO: If fault occurs frequently, replace PCB ADX in AE
24	An instrument has been connected to holder 1 which must not be connected at this position.	Message cannot be evaluated, no action required
25	An instrument has been connected to holder 2 which must not be connected at this position.	Message cannot be evaluated, no action required
26	An instrument has been connected to holder 3 which must not be connected at this position.	Message cannot be evaluated, no action required
27	An instrument has been connected to holder 4 which must not be connected at this position.	Message cannot be evaluated, no action required
28	An instrument has been connected to holder 5 which must not be connected at this position.	Message cannot be evaluated, no action required
29	Ultrasonic instruments have been connected to both holder 5 and holder 6	Connect an ultrasonic instrument either to holder 5 or holder 6
30	During start-up, the IR receiver in holder 1 is detected as defective (instrument in holder)	Replace PCB ADX in AE
31	During start-up, the IR receiver in holder 2 is detected as defective (instrument in holder)	Replace PCB ADX in AE

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Serv. code	Description of service code	Corrective action (service engineer)
32	During start-up, the IR receiver in holder 3 is detected as defective (instrument in holder)	Replace PCB ADX in AE
33	During start-up, the IR receiver in holder 4 is detected as defective (instrument in holder)	Replace PCB ADX in AE
34	During start-up, the IR receiver in holder 5 is detected as defective (instrument in holder)	Replace PCB ADX in AE
35	During start-up, the IR receiver in holder 6 is detected as defective (instrument in holder)	Replace PCB ADX in AE
36	During start-up, the IR receiver in holder 1 is detected as defective (instrument removed)	Replace PCB ADX in AE
37	During start-up, the IR receiver in holder 2 is detected as defective (instrument removed)	Replace PCB ADX in AE
38	During start-up, the IR receiver in holder 3 is detected as defective (instrument removed)	Replace PCB ADX in AE
39	During start-up, the IR receiver in holder 4 is detected as defective (instrument removed)	Replace PCB ADX in AE
40	During start-up, the IR receiver in holder 5 is detected as defective (instrument removed)	Replace PCB ADX in AE
41	During start-up, the IR receiver in holder 6 is detected as defective (instrument removed)	Replace PCB ADX in AE
43	Siromot module is detected as not equipped during start-up	Message cannot be evaluated, no action required
44	US module is detected as not equipped during start-up	Message cannot be evaluated, no action required
50	Siromot module reports RAM error, Siromot functions are locked	Replace PCB AL in AE
51	Siromot module reports EPROM error, Siromot functions are locked	Replace PCB AL in AE
52	Siromot module reports HW error, Siromot functions are locked	Replace PCB AL in AE
53	Siromot module reports 12V supply voltage outside tolerance (+/-15%)	Motor functions OK? YES: Ignore message NO: Replace PCB AL
54	Siromot module reports 32V supply voltage outside tolerance (+/-15%)	32V (+/-15%) on large capacitor C5 on PCB AL ? YES: Ignore message NO: Can 35V be measured at MP22 (35V) and MP26 (GND) on PCB ADX? NO: Check fuse F2 and cable path to connector X1 (ADX) YES: Check connection X25 (ADX) to X1 (AL).
55	Siromot module reports I/O error	Message cannot be evaluated, no action required
56	AE has no connection to Siromot module	Error on PCB AE (send buffer is full), replace PCB ADX
58	Siromot module cannot be addressed, sends no reply	Check cable path X25.6A and X25.6B, PCB ADX, to Siromot module OK: Replace Siromot module
59	Siromot module error, checksum plausibility	Message cannot be evaluated, no action required
60	US module reports RAM error	Message cannot be evaluated, no action required
61	US module reports EPROM error	Replace PCB AU, ultrasound
62	US handpiece not connected	Connect handpiece
63	US module reports frequency error	Replace PCB AU, ultrasound
64	US module reports: window error	Replace PCB AU, ultrasound
65	AE has no connection to US module	Error on PCB ADX (send buffer is full), replace PCB ADX in AE
68	US module cannot be addressed, sends no reply	Check cable path X22.12A and X22.12B, PCB ADX, to US module OK: Replace PCB US
69	US module error, checksum plausibility	If fault occurs frequently, replace US module



11 Service code listings

Serv. code	Description of service code	Corrective action (service engineer)
70	Spray heater is heating although it is turned off.	?Does service code 71 occur? YES: Refer to details there NO: Replace PCB ADX in AE
71	Spray heater sensor circuit defective	Search for open circuit in sensor circuit (X7.5-6), PCB ADX (connector, cable, sensor defective) NO: Temp. > 75 degrees was detected -> spray safety disconnection
72	Spray heater requires too much time in the start-up phase to reach the specified temperature.	Look for open circuit in heater circuit (X7.1-3), PCB ADX (plug-in contact, cable, heater defective or wrong heater)
73	An open circuit has been detected at the Sprayvit air button. (pot/switch high impedance or open circuit possible)	Check cable path X6.4 + X6.5 (ADX) -> Sprayvit OK: Replace Sprayvit
74	An open circuit has been detected at the Sprayvit water button. (pot/switch high impedance or open circuit possible)	Check cable path X6.4 + X6.6 (ADX) -> Sprayvit OK: Replace Sprayvit
75	Sprayvit air button was detected as pressed during removal.	Deposit Sprayvit in holder and remove it again without pressing the buttons. OK: No action required Not OK: Pot/switching resistors have possibly become conductive in OFF state due to humidity or Sprayvit defective.
76	Sprayvit water button was detected as pressed during removal.	Deposit Sprayvit in holder and remove it again without pressing the buttons. OK: No action required Not OK: Pot/switch resistors have possibly become conductive in OFF state due to humidity or Sprayvit defective.
77	Sprayvit air button defective. (pot/switch low impedance or short-circuit, start-up phase)	Check cable path X6.4 + X6.6 (ADX) -> Sprayvit OK: Replace Sprayvit
78	Sprayvit water button defective. (pot/switch low impedance or short-circuit, start-up phase)	Check cable path X6.4 + X6.6 (ADX) -> Sprayvit OK: Replace Sprayvit
79	Sprayvit heater switched off due to "no pump function" error message of the water unit.	No action required in dentist element! Read out the water unit service information for further troubleshooting.
80	EMERGENCY STOP input circuit defective. EMERGENCY STOP cannot be generated.	Replace PCB ADX in AE
81	EMERGENCY STOP input circuit defective. EMERGENCY STOP cannot be switched off.	Replace PCB ADX in AE
85	Instrument light voltage too high.	?Instrument light in order? YES: Ignore message NO: Activate all instruments with light one after the other. Does the message appear for all other instruments with light? YES: Replace PCB ADX NO: Replace instrument (for which message occurs)
90	Message from AK: operating air proportional valve defective.	See AK service codes (operating air proportional valve)
91	Message from AK: chip blower proportional valve defective.	See AK service codes (chip blower proportional valve)
92	Message from AK: spray proportional valve defective.	See AK service codes (spray proportional valve)
93	Cooling air/driving air pressure measured by sensor lower than 0.5 bar, instrument motor is locked	Error in driving air/cooling air supply, is the highspeed handpiece functioning? NO: Check driving air supply up to AE!, If OK: Replace PCB ADX in AE; YES: Check cooling air supply in AE up to instrument motor
100	The software version number stored in the EEPROM is not the current one. It will be updated.	Note: Service code appears on PCB ADX after software has been updated
101	The error stack has been re-initialized.	Note: The error memory area was destroyed and has been reinitialized
102	The instrument assignment has been changed since the last period of operation	Note, no action required
110	Wrong EEPROM value	Message cannot be evaluated, no action required
111	EEPROM value for language is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.

11 Service code listings

Serv. code	Description of service code	Corrective action (service engineer)
112	EEPROM value for operating pressure of instruments is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.
113	EEPROM value for flushing time is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.
114	EEPROM value for NaCl holder is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.
115	EEPROM value for maximum permissible instrument speed is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.
116	Incorrect SL motor parameters in EEPROM	If service code occurs more than once, replace PCB ADX in AE.
117	Incorrect ELMO motor parameters in EEPROM	If service code occurs more than once, replace PCB ADX in AE.
118	Wrong EEPROM contents for video mode	If service code occurs more than once, replace PCB ADX in AE.
119	Wrong EEPROM contents for WHITE SCREEN settings	If service code occurs more than once, replace PCB ADX in AE.
120	Wrong EEPROM value	Message cannot be evaluated, no action required
121	EEPROM value for maximum instrument light voltage is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.
122	EEPROM value for instrument detection is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.
123	EEPROM value for motor cooling air is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.
127	EEPROM value for activating the third-party camera is outside the defined limits.	If service code occurs more than once, replace board ADX in dentist element.
128	EEPROM value for maintenance date is outside the defined limits.	If service code occurs more than once, replace board ADX in dentist element.
129	EEPROM value for operating pressure of instruments is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.
130	EEPROM value for user selection is outside the defined limits.	Message cannot be evaluated, no action required
131	EEPROM value for set motor speed is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.
132	The value in the EEPROM for the set ultrasound intensity is outside the defined limits.	Is SW version 1.7 on PCB ADX in the AE? YES: Use new SW vers. 2.x NO: If the service code occurs more than once, replace PCB ADX in the AE.
133	The value in the EEPROM for the set driving air (highspeed handpiece) is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.
134	The value in the EEPROM for the foot-switch cursor control is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.
135	The value in the EEPROM for the foot-switch variable/fixed control is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.
136	EEPROM value for set light intensity is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.
137	EEPROM value for set light intensity is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.
138	EEPROM value for set chip blower intensity is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.
139	The value in the EEPROM for the set HF surgery is outside the defined limits.	If service code occurs more than once, replace PCB ADX in AE.
140	EEPROM value for torque setting is outside the defined limits.	If service code occurs more than once, replace board ADX in dentist element.
150	HF surgery: Foot switch signal FS (plausibility check, hardware signal and CAN message)	Check FS cable from the AK, PCB CJ, (X32.3B) to the HF module, PCB HF, (X2.3B). OK: Check CAN connection from HF module to AE
151	HF surgery voltage monitoring: 5V (plausibility check) outside tolerance when HF is active	Replace PCB HF

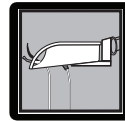


11 Service code listings

Serv. code	Description of service code	Corrective action (service engineer)
152	HF surgery voltage monitoring: UH (plausibility check) outside tolerance when HF is active	Replace PCB HF
153	HF surgery voltage monitoring: UP (plausibility check) outside tolerance	Replace PCB HF
154	HF surgery voltage monitoring: KT (limit value check) heat sink temperature of power transistor too high, will be switched off	HF output stage overloaded, if this occurs several times despite brief operation, replace PCB HF
155	HF surgery: CAN communication monitoring, timing problem on CAN bus	If error occurs several times, replace PCB HF
156	HF surgery: HF hardware monitoring error (self-test module, startup)	Replace PCB HF
159	HF surgery: Error due to watchdog RESET, which was triggered, restarted the controller and then performed reinitialization	Replace PCB HF
160	AE detects that HF module does not respond (stand-by operation)	Check CAN bus connection from AE to HF module
161	AE detects a communication problem with the HF module when HF is active (interference on CAN BUS, intensity values sent and received do not match)	Check CAN bus connection from AE to HF module OK: Replace HF module
162	AE detects missing or defective acknowledgement of previously sent HF start command	Check CAN bus connection from AE to HF module OK: Replace HF module
163	AE detects that there is no correct software in the AP and AK (HF is not initialized)	Use software versions 2.x in AP and AK
170	SIVISION 2 message No acknowledgement from camera.	?Camera connected? YES: Check connections / camera connector to PCB AD (Cobra) / voltage supply to PCB AD (Cobra) / connections to PCB ADX OK: PCB AD (Cobra) or SIROCAM 2 defective.
171	SIVISION 3 message No acknowledgement from camera.	With SIROCAM 2 camera Check connections / camera connector to PCB AD2 / voltage supply to PCB AD2 / connections to PCB ADX OK: PCB AD2 defective. With SIROCAM C camera ?Camera connected? YES: Check connections / camera connector to PCB A7C or AC7 / voltage supply to PCB A7C or AC7 / connections to PCB ADX OK: PCB A7C/AC7 or SIROCAM C defective. NO: OK, no action required
172	Communication error with camera (SIROCAM C) or PCB AD2 SIROCAM 2).	Error may be due to interference. If error occurs frequently, contact Customer Service.
174	SIVISION3 misconfiguration of treatment center: Galvanic isolation of camera has not been achieved (noticeable due to cyclical resets of ADX and panel) !	Combination of AC7 (in dentist element) and SVC/SVI (in connection box) is not compatible. Contact hotline.
300	Start-up: Switching transistor V34 (relay K9 Sprayvit water heater) was activated but has not switched	?Function of Sprayvit water heater OK? YES: Ignore message NO: Press Sprayvit key (water) up to stop, does yellow LED V27 on PCB ADX light up? NO: Replace PCB ADX in AE; YES: Look for fault in the Sprayvit circuit (X5)
301	Open circuit in the Sprayvit water heater relay control circuit	Fault cannot be evaluated, contact hotline
302	Short circuit in the Sprayvit water heater relay control circuit	Fault cannot be evaluated, contact hotline
303	Start-up: Switching transistor in the instrument light relay control circuit was activated but has not switched	Fault cannot be evaluated, contact hotline
304	Open circuit in the instrument light relay control circuit	Fault cannot be evaluated, contact hotline

11 Service code listings

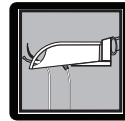
Serv. code	Description of service code	Corrective action (service engineer)
305	Short circuit in the instrument light relay control circuit	Fault cannot be evaluated, contact hotline
306	Start-up: Switching transistor V142 (spray water heater) was activated but has not switched	?Function of spray water heater OK? YES: Ignore message NO: Undo connector X7.1 on PCB ADX, does yellow LED V141 on AE PCB light up continuously (> 1 min.)? NO: Replace PCB ADX YES: Look for fault in spray/water heater circuit (X7)
307	Open circuit in relay 8 for SV water heater relay control circuit	Fault cannot be evaluated, contact hotline
308	Short circuit in relay 8 for SV water heater relay control circuit	Fault cannot be evaluated, contact hotline
309	Start-up: Switching transistor V35 (relay K8 Sprayvit air heater) was activated but has not switched	?Function of Sprayvit air heater OK? YES: Ignore message NO: Press Sprayvit key (air) up to the stop, does yellow LED V30 on PCB ADX light up? NO: Replace PCB ADX in AE; YES: Look for fault in the Sprayvit circuit (X5)
310	Open circuit in relay 9 for Sprayvit air heater control circuit	Fault cannot be evaluated, contact hotline
311	Short circuit in relay 9 for Sprayvit air heater control circuit	Fault cannot be evaluated, contact hotline
312	Start-up: Switching transistor V21 (relay K7 NaCl pump) was activated but has not switched	?Function of the NaCl pump OK? YES: Ignore message NO: Activate instrument with NaCl function, does yellow LED V6 on PCB ADX light up? NO: Replace PCB ADX in AE; YES: Look for fault in the NaCl pump motor circuit (X24)
313	Open circuit in relay 7 for NaCl activation control circuit	Fault cannot be evaluated, contact hotline
314	Short circuit in relay 7 for NaCl activation control circuit	Fault cannot be evaluated, contact hotline
315	A current flows in the holder relay control circuit when the switching transistor is in the OFF state	Fault cannot be evaluated, contact hotline
316	Open circuit in the holder relay control circuit	Fault cannot be evaluated, contact hotline
317	Short circuit in the holder relay control circuit	Fault cannot be evaluated, contact hotline
318	A current flows in the MV 21.1 control circuit when the switching transistor is in the OFF state	Unplug connector X20 on ADX PCB, does yellow LED V69 on PCB ADX light up? YES: Replace PCB ADX in AE; NO: Ignore message
319	MV 21.1 current too low. External open circuit	!Remove instrument from holder 2, measure voltage between X20.A2 and X20.B2, PCB ADX ! ? U=24V: Check circuit for MV21.1 ? U=0V: Replace PCB ADX in AE
320	Overload, MV 21.1 current limitation active, external short circuit	! Unplug connector X20, PCB ADX, does fault still occur after instrument is removed from holder 2? YES: Replace PCB ADX in AE; NO: Check circuit X20.A2 - B2 for MV 21.1
321	A current flows in the MV 21.2 control circuit when the switching transistor is in the OFF state	Unplug connector X20 on ADX PCB, does yellow LED V74 on PCB ADX light up? YES: Replace PCB ADX in AE; NO: Ignore message
322	MV 21.2 current too low. External open circuit	!Remove instrument from holder 3, measure voltage between X20.A3 and X20.B3, PCB ADX ! ? U=24V: Check circuit for MV21.2 ? U=0V: Replace PCB ADX in AE
323	Overload, MV 21.2 current limitation active, external short circuit	! Unplug connector X20, PCB ADX, does fault still occur after instrument is removed from holder 3? YES: Replace PCB ADX in AE; NO: Check circuit X20.A3 - B3 for MV 21.2
324	A current flows in the MV 21.3 control circuit when the switching transistor is in the OFF state	Unplug connector X20 on ADX PCB, does yellow LED V79 on PCB ADX light up? YES: Replace PCB ADX in AE; NO: Ignore message
325	MV 21.3 current too low. External open circuit	Holder 4 occupied? NO: Ignore message YES: !Remove instrument from holder 4, measure voltage between X20.A4 and X20.B4, PCB ADX ! ? U=24V: Check circuit for MV21.3 ? U=0V: Replace PCB ADX in AE



11 Service code listings

Serv. code	Description of service code	Corrective action (service engineer)
326	Overload, MV 21.3 current limitation active, external short circuit	! Unplug connector X20, PCB ADX, does fault still occur after instrument is removed from holder 4? YES: Replace PCB ADX in AE; NO: Check circuit X20.A4 - B4 for MV 21.3
327	A current flows in the MV 21.4 control circuit when the switching transistor is in the OFF state	Unplug connector X20 on ADX PCB, does yellow LED V110 on PCB ADX light up? YES: Replace PCB ADX in AE; NO: Ignore message
328	MV 21.4 current too low. External open circuit	Holder 5 occupied? NO: Ignore message YES: !Remove instrument from holder 5, measure voltage between X20.A5 and X20.B5, PCB ADX ! ? U=24V: Check circuit for MV21.4 ? U=0V: Replace PCB ADX in AE
329	Overload, MV 21.4 current limitation active, external short circuit	! Unplug connector X20, PCB ADX, does fault still occur after instrument is removed from holder 5? YES: Replace PCB ADX in AE; NO: Check circuit X20.A5 - B5 for MV 21.4
330	A current flows in the MV 22 (US water) control circuit when the switching transistor is in the OFF state	Fault cannot be evaluated, contact hotline
331	MV 22 (US water) current too low. External open circuit	Ultrasound (US) configured? NO: Ignore message YES: ! Activate US, measure voltage between X20.A6 and X20.B6, PCB ADX. ? U>12V: Check circuit for MV22 ? U=0V: Replace PCB ADX in AE
332	Overload, MV 22 (US water): Current limitation active, external short circuit	! Unplug connector X20, PCB ADX, ; does fault still occur after US instrument is removed from holder? YES: Replace PCB ADX in AE; NO: Check circuit X20.A6 - B6 for MV 22
333	A current flows in the MV 23 (US air) control circuit when the switching transistor is in the OFF state	Fault cannot be evaluated, contact hotline
334	MV 23 (US air) current too low. External open circuit	Ultrasound (US) configured? NO: Ignore message YES: ! Activate US, measure voltage between 20.A1 and X20.B1, PCB ADX. ? U>12V: Check circuit for MV23 ?U=0V: Replace PCB ADX in AE
335	Overload, MV 23 (US air): Current limitation active, external short circuit	! Unplug connector X20, PCB ADX, ; does fault still occur after US instrument is removed from holder? YES: Replace PCB ADX in AE; NO: Check circuit X20.A1 - B1 for MV 23
336	Start-up: Switching transistor V96 (Sprayvit water) was activated but has not switched	?Function of Sprayvit water OK? YES: Ignore message NO: Remove Sprayvit, does yellow LED V89 on PCB ADX light up? NO: Replace PCB ADX in AE; YES: Look for fault in the Sprayvit circuit MV24 (X19.5-6)
337	MV 24 (Sprayvit water) current too low. External open circuit	Sprayvit configured? NO: Ignore message YES: ! Remove Sprayvit, measure voltage between X19.5 and X19.6, PCB ADX. ? U>12V: Check circuit for MV24 ?U=0V: Replace PCB ADX in AE
338	Overload, MV 24 (Sprayvit water): Current limitation active, external short circuit	! Unplug connector X19, PCB ADX, ; does fault still occur after Sprayvit is removed from holder? YES: Replace PCB ADX in AE; NO: Check circuit X19.5-6 for MV 24
339	Start-up: switching transistor V105 (Sprayvit air) was activated but has not switched	?Function of Sprayvit air OK? YES: Ignore message NO: Remove Sprayvit, does yellow LED V98 on PCB ADX light up? NO: Replace PCB ADX in AE; YES: Look for fault in the Sprayvit circuit (X19.3-4)
340	MV 25 (Sprayvit air) current too low. External open circuit	Sprayvit configured? NO: Ignore message YES: ! Remove Sprayvit, measure voltage between X19.3 and X19.4, PCB ADX. ? U>12V: Check circuit for MV25 ?U=0V: Replace PCB ADX in AE
341	Overload, MV 25 (Sprayvit air): Current limitation active, external short circuit	! Unplug connector X19, PCB ADX, ; does fault still occur after Sprayvit is removed from holder? YES: Replace PCB ADX in AE; NO: Check circuit X19.3-4 for MV 25
390	Current is flowing through some transistor even though it is turned off.	Ignore message

Serv. code	Description of service code	Corrective action (service engineer)
400	A current flows in the relay 1 control circuit when the switching transistor is in the OFF state	Fault cannot be evaluated, contact hotline
401	Open circuit in the relay 1 control circuit	Fault cannot be evaluated, contact hotline
402	Short circuit in the relay 1 control circuit	Fault cannot be evaluated, contact hotline
403	A current flows in the relay 2 control circuit when the switching transistor is in the OFF state	Fault cannot be evaluated, contact hotline
404	Open circuit in the relay 2 control circuit	Fault cannot be evaluated, contact hotline
405	Short circuit in the relay 2 control circuit	Fault cannot be evaluated, contact hotline
406	A current flows in the relay 3 control circuit when the switching transistor is in the OFF state	Fault cannot be evaluated, contact hotline
407	Open circuit in the relay 3 control circuit	Fault cannot be evaluated, contact hotline
408	Short circuit in the relay 3 control circuit	Fault cannot be evaluated, contact hotline
409	A current flows in the relay 4 control circuit when the switching transistor is in the OFF state	Fault cannot be evaluated, contact hotline
410	Open circuit in the relay 4 control circuit	Fault cannot be evaluated, contact hotline
411	Short circuit in the relay 4 control circuit	Fault cannot be evaluated, contact hotline
412	A current flows in the relay 5 control circuit when the switching transistor is in the OFF state	Fault cannot be evaluated, contact hotline
413	Open circuit in the relay 5 control circuit	Fault cannot be evaluated, contact hotline
414	Short circuit in the relay 5 control circuit	Fault cannot be evaluated, contact hotline
415	A current flows in the relay 6 control circuit when the switching transistor is in the OFF state	Fault cannot be evaluated, contact hotline
416	Open circuit in the relay 6 control circuit	Fault cannot be evaluated, contact hotline
417	Short circuit in the relay 6 control circuit	Fault cannot be evaluated, contact hotline
999	The node has not reported.	Check whether this node is actually present in the system. If it is, check the connection to the serial interface of the treatment center.



11.3 Service messages of the dentist panel (AP)

11.3.1 C2⁺– C5⁺: Software version: 1.7 - 5.8, revision date 08.2004

M1⁺: Software version 10.3 , revision date 08.2004

Node: AP

Board (PCB): AP

Serv. code	Description of service code	Corrective action (service engineer)
999	The node has not reported.	Check whether this node is actually present in the system. If it is, check the connection to the serial interface of the treatment center.

11.4 Service messages of the assistant element (HE)

11.4.1 Software version: 1.4 - 2.3, revision date 10.2004

Node: HE

Board (PCB): HC

Serv. code	Description of service code	Corrective action (service engineer)
0	Zero error line, marks time of last power up	No action required
3	EEPROM write error	Replace PCB HC
4	EEPROM write error	Replace PCB HC
5	Powerfail input circuit defective according to self-test	Message cannot be evaluated, no action required
6	CAN communication error	Message cannot be evaluated, no action required
7	CAN communication impossible/faulty, BUS OFF condition has been detected. If error persists: CAN module def., CAN cable def.	? Only once in a component YES: Fault exists NO: Check CAN cable/connector for continuity / try to establish connection to every component. HELP: Search through AK service codes for open circuits to other nodes
8	No RESET by watchdog after discontinuation of triggering by uP	Replace PCB HC
9	uP access to BCAN controller not possible	Replace PCB HC
10	CAN connection to AE interrupted after communication has already been established. Possibly CAN cable defective or component disconnected/defective.	Message cannot be evaluated, no action required
12	CAN connection to WE interrupted after communication has already been established. Possibly CAN cable defective or component disconnected/defective.	! Check function of water unit OK: Error occurs frequently: Check CAN cable NO: Replace PCB WE
13	CAN connection to AK interrupted after communication has already been established. Possibly CAN cable defective or component disconnected/defective.	Message cannot be evaluated, no action required
14	CAN connection to ST interrupted after communication has already been established. Possibly CAN cable defective or component disconnected/defective.	Message cannot be evaluated, no action required
15	CAN connection to AP interrupted after communication has already been established. Possibly CAN cable defective or component disconnected/defective.	Message cannot be evaluated, no action required
16	24V supply voltage outside tolerance. Power supply failure, short-circuit, blown fuse, connector	Can 24V be measured at MP3 (24V) and MP1 (GND) on PCB HC? YES: Ignore message NO: Unplug connector X1, ? On supply cable to connector X1: Can 35V be measured at pin 1 (35V) and pin 2 (GND)? YES: Replace PCB HP NO: Check fuse F2 and 35V cable path to X1
19	The EEPROM was reinitialized with default values.	No action required, service information only
30	During start-up, the IR receiver in holder 1 is detected as defective.	Replace PCB HC
31	During start-up, the IR receiver in holder 2 is detected as defective.	Replace PCB HC
32	During start-up, the IR receiver in holder 3 is detected as defective.	Replace PCB HC
33	During start-up, the IR receiver in holder 4 is detected as defective.	Replace PCB HC



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Serv. code	Description of service code	Corrective action (service engineer)
35	A key was actuated during start-up	Was a key actuated during start-up ? NO: Replace keyboard NO: Check cable path X12 (HC) to the panel NO: Replace PCB HC
36	A key was actuated during start-up	Was a key actuated during start-up ? NO: Replace keyboard NO: Check cable path X12 (HC) to the panel NO: Replace PCB HC
37	A key was actuated during start-up	Was a key actuated during start-up ? NO: Replace keyboard NO: Check cable path X12 (HC) to the panel NO: Replace PCB HC
38	A key was actuated during start-up	Was a key actuated during start-up ? NO: Replace keyboard NO: Check cable path X12 (HC) to the panel NO: Replace PCB HC
39	Suction device was detected in limit during start-up	Message cannot be evaluated, no action required
40	MV39 for activating the Sprayvit air defective. ON state current too low.	Remove the Sprayvit, 24V at X2.2A and X2.2B HP? OK: Search for open circuit in MV39 circuit NO: Replace PCB HP
41	MV39 for activating the Sprayvit air defective. ON state current too high.	Unplug connector X2, PCB HP, does fault still occur after instrument is removed from holder? YES: Replace PCB HP NO: Check circuit X2.2A and X2.2B (short circuit)
42	MV39 for activating the Sprayvit air defective. OFF state current too high.	Unplug connector X2, PCB HP, does fault still occur after instrument is removed from holder? YES: Replace PCB HP NO: Check circuits X2.2A and X2.2B
44	MV38 for activating the Sprayvit water defective. ON state current too low.	Remove the Sprayvit, 24V at X2.1A and X2.1B HP? OK: Search for open circuit in MV33 circuit NO: Replace PCB HP
45	MV38 for activating the Sprayvit water defective. ON state current too high.	Unplug connector X2, PCB HP, does fault still occur after instrument is removed from holder? YES: Replace PCB HP NO: Check circuits X2.1A and X2.1B (short circuit)
46	MV38 for activating the Sprayvit water defective. OFF state current too high.	Unplug connector X2, PCB HP, does fault still occur after instrument is removed from holder? YES: Replace PCB HP NO: Check circuits X2.1A and X2.1B
48	MV31 for activating the saliva ejector defective. ON state current too low.	Remove the saliva ejector, suction OK? YES: Ignore message NO: 24V at X2.5A and X2.5B HP? YES: Search for open circuit in MV31 circuit NO: Replace PCB HP
49	MV31 for activating the saliva ejector defective. ON state current too high.	Unplug connector X2, PCB HP, does fault still occur after instrument is removed from holder? YES: Replace PCB HP NO: Check circuits X2.5A and X2.5B (short circuit)
50	MV31 for activating the saliva ejector defective. OFF state current too high.	Unplug connector X2, PCB HP, does fault still occur after instrument is removed from holder? YES: Replace PCB HP NO: Check circuits X2.5A and X2.5B
52	MV32 for activating the suction hose defective. ON state current too low.	Remove the suction hose, suction OK? YES: Ignore message NO: 24V at X2.4A and X2.4B HP? YES: Search for open circuit in MV32 circuit NO: Replace PCB HP
53	MV32 for activating the suction hose defective. ON state current too high.	Unplug connector X2, PCB HP, does fault still occur after instrument is removed from holder? YES: Replace PCB HP NO: Check circuits X2.4A and X2.4B (short circuit)
54	MV32 for activating the suction hose defective. OFF state current too high.	Unplug connector X2, PCB HP, does fault still occur after instrument is removed from holder? YES: Replace PCB HP NO: Check circuits X2.4A and X2.4B
56	MV36 for activating the optional 3rd suction hose defective. ON state current too low.	Remove optional 3rd suction hose, suction OK? YES: Ignore message NO: 24V at X2.3A and X2.3B HP? YES: Search for open circuit in MV36 circuit NO: Replace PCB HP

11 Service code listings

Serv. code	Description of service code	Corrective action (service engineer)
57	MV36 for activating the optional 3rd suction hose defective. ON state current too high.	Unplug connector X2, PCB HP, does fault still occur after instrument is removed from holder? YES: Replace PCB HP NO: Check circuits X2.3A and X2.3B (short circuit)
58	MV36 for activating the optional 3rd suction hose defective. OFF state current too high.	Unplug connector X2, PCB HP, does fault still occur after instrument is removed from holder? YES: Replace PCB HP NO: Check circuits X2.3A and X2.3B
60	Sprayvit light defective. ON state current too low.	Activate Sprayvit with light, function OK? YES: Ignore message NO: Approx. 2-5V at X6.1 and X6.2 HP? YES: Search for open circuit in Sprayvit light circuit (connector, lamp) NO: Replace PCB HP
61	Sprayvit light defective. ON state current too high.	Unplug connector X6 on PCB HP, does fault still occur after instrument is removed from holder? YES: Replace PCB HP NO: Check circuits X6.1A and X6.2B (short circuit)
62	SV light defective. OFF state current too high.	Replace PCB HP
64	Relay K2 for activating the Sprayvit air heater defective. ON state current too low.	Replace PCB HP
65	Relay K2 for activating the Sprayvit air heater defective. ON state current too high.	Replace PCB HP
66	Relay K2 for activating the Sprayvit air heater defective. OFF state current too high.	Replace PCB HP
68	Relay K1 for activating the Sprayvit water heater defective. ON state current too low.	Replace PCB HP
69	Relay K1 for activating the Sprayvit water heater defective. ON state current too high.	Replace PCB HP
70	Relay K1 for activating the Sprayvit water heater defective. OFF state current too high.	Replace PCB HP
200	During start-up, MV39 (Sprayvit air) is detected as not being available.	? MV39 present? NO: For information only, no action required YES: Search for open circuit in MV39 circuit (X2.2A-X2.2B)
201	During start-up, MV38 (Sprayvit water) is detected as not being available.	? MV38 present? YES: Search for open circuit in MV38 circuit (X2.1A-X2.1B)
202	During start-up, MV31 (saliva ejector) is detected as not being available.	? MV31 present? YES: Search for open circuit in MV31 circuit (X2.5A-X2.5B)
203	During start-up, MV32 (suction hose) is detected as not being available.	? MV32 present? YES: Search for open circuit in MV32 circuit (X2.4A-X2.4B)
204	During start-up, MV36 (surgical cannula) is detected as not being available.	? MV36 present? YES: Search for open circuit in MV36 circuit (X2.3A-X2.3B)
205	During start-up, the Sprayvit light is detected as not being available.	? Light present? YES: Search for open circuit in Sprayvit light circuit (X6.1-X6.2)
206	During start-up, Sprayvit air heater relay is detected as not being available.	Replace PCB HP
207	During start-up, Sprayvit water heater relay is detected as not being available.	Replace PCB HP
210	The actual voltage at the Sprayvit light output (X6.1-2, HP) does not correspond to the required voltage	Replace PCB HP
211	Driver stage of the IR LEDs is detected as defective during start-up	Replace PCB HC
212	Driver of the keyboard LEDs in column 0 defective	Service code appears together with codes 213 + 214? YES: Replace PCB HP NO: Replace PCB HC
213	Driver of the keyboard LEDs in column 1 defective	Service code appears together with codes 212 + 214? YES: Replace PCB HP NO: Replace PCB HC



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Serv. code	Description of service code	Corrective action (service engineer)
214	Driver of the keyboard LEDs in column 2 defective	Service code appears together with codes 212 + 213? YES: Replace PCB HP NO: Replace PCB HC
215	Keyboard input circuit detected as defective during the self-test	Assistant panel keyboard functions OK? YES: Ignore message NO: Replace PCB HC
216	Sprayvit water key defective. (Pot low resistance or short circuit detected)	Check cable path X6.4 + X6.6 (HP) -> Sprayvit OK: Replace Sprayvit
217	Sprayvit air key defective (pot low resistance or short circuit detected)	Check cable path X6.4 + X6.5 (HP) -> Sprayvit OK: Replace Sprayvit
218	An open circuit has been detected with the Sprayvit water key. (potentiometer high impedance or open circuit possible)	Check cable path X6.4 + X6.6 (HP) -> Sprayvit OK: Replace Sprayvit
219	An open circuit has been detected with the Sprayvit air key. (potentiometer high impedance or open circuit possible)	Check cable path X6.4 + X6.5 (HP) -> Sprayvit OK: Replace Sprayvit
220	Sprayvit water key was detected as actuated during removal.	Deposit Sprayvit in holder and remove it again without pressing the key. OK: No action required. NO: Pot/switch resistors possibly conductive in OFF state due to humidity or Sprayvit defective
221	Sprayvit air key was detected as actuated during removal.	Deposit Sprayvit in holder and remove it again without pressing the key. OK: No action required. NO: Pot/switch resistors possibly conductive in OFF state due to humidity or Sprayvit defective
999	The node has not reported.	Check whether this node is actually present in the system. If it is, check the connection to the serial interface of the treatment center.

11.5 Service messages of the water unit (WE)

11.5.1 Software version: 1. - 3.2, revision date 08.2005

Node: WE

Board (PCB): WE

Serv. code	Description of service code	Corrective action (service engineer)
0	Zero error line, marks time of last power up	No action required
3	EEPROM write error	Replace PCB WE
4	EEPROM write error	Replace PCB WE
5	Powerfail input circuit defective according to self-test	Message cannot be evaluated, no action required
6	CAN communication error (access to CAN controller not possible)	Replace PCB WE
7	CAN communication impossible/faulty, BUS OFF condition has been detected. If error persists: CAN module def., CAN cable def.	? Only once in a component YES: Fault exists NO: Check CAN cable/connector for continuity / try to establish connection to every component. HELP: Search through AK service codes for open circuits to other nodes
8	No RESET by watchdog after discontinuation of triggering by uP	Replace PCB WE
9	Access to CAN controller not possible	Message cannot be evaluated, no action required
16	24V supply voltage outside tolerance. Power supply failure, short-circuit, blown fuse, connector	? Can 35V be measured at MP7 (35V) and MP3 (GND) on PCB WE or does v104 light up? NO: Check fuse F1 and 35V cable path/connectors to X1 YES: ? Can 24V be measured at MP8 (24V) and MP9 (GND)? YES: Ignore message NO: Replace PCB WE
17	15V supply voltage outside tolerance. Power supply failure, short-circuit, blown fuse, connector	? Can 35V be measured at MP7 (35V) and MP3 (GND) on PCB WE or does v104 light up? NO: Check fuse F1 and 35V cable path/connectors to X1 YES: ? Can 15V be measured at MP5 (15V) and MP6 (AGND)? YES: Ignore message NO: Replace PCB WE
19	The EEPROM was reinitialized with default values.	No action required, service information only
23	EEPROM checksum error	EEPROM is defective, replace PCB
24	Pump running at no load, mixing tank is empty, water inlet to mixing tank clogged	? Filter in AK clogged NO: Check water inlet (connection box -> mixing tank)
25	Timeout during water tank filling operation. Water inlet, filter clogged.	? Filter in AK clogged NO: Check water inlet (connection box -> mixing tank) NO: Ignore message
26	In sanitation mode (flow test phase): water is requested although all valves are switched to inactive.	Search for leak in solenoid valves carrying mixing water (MV34, etc.)
27	A reed contact was active longer than 500ms	Check reed contact and cable routes MV40 -> X6, Check MV40, Replace MV40 or pump, if needed.
28	Both reed contacts are active	LED V72 and V73 on the WE board must be out in non-operative mode. Check cable routes. Check air supply, replace pump, if needed.
29	Water flow to tumbler outlet is too low	Possible causes: too little pressure, lime deposits in the line, check MV34
30	Level sensor DS31 is not activated after 50 pump strokes.	Check DS31, replace if needed
31	After an MV1 opening time of 15s, DS31 still reports no water	Check DS31, replace if needed, Check MV1, replace if needed
32	Pump has no water, although the DS31 signals that the tank is not empty.	Check DS31, replace if needed
34	The temperature of the tumbler filling is outside the tolerance limits.	Check temperature sensor R2 NO: Check the water heater cable path from X14.5/6 (short circuit or open circuit) NO: Replace PCB WE



11 Service code listings

Serv. code	Description of service code	Corrective action (service engineer)
40	MV37, flow control valve, open circuit. ON state current too low.	Activate MV (water in cuspidor), function OK? YES: Ignore message NO: 24V at X8.1 and 8.2 of PCB WE? YES: Search for open circuit in MV37 circuit (X8.1-2) NO: Replace PCB WE
41	MV37, flow control valve, current limitation active. ON state current too high.	! Unplug connector X8 on PCB WE; Does error still occur after activation of MV37 ? YES: Replace PCB WE NO: Check MV37 circuit X8.1 -2 (short-circuit)
42	MV37, flow control valve defective. OFF state current too low.	Message cannot be evaluated, no action required
43	MV37, flow control valve defective. OFF state current too high.	MV37 permanently active? YES: Replace PCB WE NO: Check circuit X8.1-2
44	MV40 for activation of driving air for water pump, open circuit. ON state current too low.	Activate MV (activate tumbler filling), function OK? YES: Ignore message NO: 24V at X6.3 and 6.4 (cyclically short-time in each case) of PCB WE? YES: Search for open circuit in MV40 circuit NO: Replace PCB WE
45	MV40 for activation of the driving air for water pump, current limitation active. ON state current too high.	! Unplug connector X6 on PCB WE; Does error still occur after activation of MV40 ? YES: Replace PCB WE NO: Check MV40 circuit X6.3-4 (short circuit)
46	MV40 for activation of the driving air for water pump defective. OFF state current too low.	Message cannot be evaluated, no action required
47	MV40 for activation of the driving air for water pump. OFF state current too high.	MV40 permanently active? YES: Replace PCB WE NO: Check circuit X6.3-4
48	MV34 for activation of the tumbler filling, open circuit. ON state current too low.	Activate MV, 24V at X11.1 and 11.4 of PCB WE? YES: Search for open circuit in MV34 circuit NO: Replace PCB WE
49	MV34 for activation of the tumbler filling, current limitation active. ON state current too high.	! Unplug connector X11 on PCB WE; Does error still occur after activation of MV34 ? YES: Replace PCB WE NO: Check MV34 circuit X11.1 -4 (short circuit)
50	MV34 for activation of the tumbler filling defective. OFF state current too low.	Message cannot be evaluated, no action required
51	MV34 for activation of the tumbler filling. OFF state current too high.	MV34 permanently active? YES: Replace PCB WE NO: Check circuit X11.1-4
52	MV3 for activation of Dentosept, open circuit. ON state current too low.	Activate MV (empty mixing tank), 24V at X10.1A and 10.1B of PCB WE briefly on filling? YES: Search for open circuit in MV3 circuit NO: Replace PCB WE
53	MV3 for activation of Dentosept, current limitation active. ON state current too high.	! Unplug connector X10 on PCB WE; Does error still occur after activation of MV3 (empty and then automatically refill tank) ? YES: Replace PCB WE NO: Check MV3 circuit X10.1A - 1B (short circuit)
54	MV3 for activation of Dentosept defective. OFF state current too low.	Message cannot be evaluated, no action required
55	MV3 for activation of Dentosept. OFF state current too high.	MV3 permanently active? YES: Replace PCB WE NO: Check circuit X10.1A-1B
56	MV53 for activation of the water outlet valve on tank 2 (ozone) defective. ON state current too low.	Ozonization present ? NO: Ignore message YES: Activate MV, 24V at X10.2A and 10.2B of PCB WE? YES: Search for open circuit in MV53 circuit NO: Replace PCB WE
57	MV53 for activation of the water outlet valve on tank 2 (ozone) defective. ON state current too high.	! Unplug connector X10 on PCB WE; Does error still occur after activation of MV53 ? YES: Replace PCB WE NO: Check MV53 circuit X10.2A -2B (short circuit)
58	MV53 for activation of the water outlet valve on tank 2 (ozone) defective. OFF state current too low.	Message cannot be evaluated, no action required

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Serv. code	Description of service code	Corrective action (service engineer)
59	MV53 for activation of the water outlet valve on tank 2 (ozone) defective. OFF state current too high.	MV53 permanently active? YES: Replace PCB WE NO: Check circuit X10.2A-2B
60	MV54 for activation of the ozone inlet valve on tank 1 defective. ON state current too low.	Activate MV, 24V at X10.3A and 10.3B of PCB WE? YES: Search for open circuit in MV54 circuit NO: Replace PCB WE
61	MV54 for activation of the ozone inlet valve on tank 1 defective. ON state current too high.	! Unplug connector X10 on PCB WE; Does error still occur after activation of MV54 ? YES: Replace PCB WE NO: Check MV54 circuit X10.3A-3B (short circuit)
62	MV54 for activation of the ozone inlet valve on tank 1 defective. OFF state current too low.	Message cannot be evaluated, no action required
63	MV54 for activation of the ozone inlet valve on tank 1 defective. OFF state current too high.	MV54 permanently active? YES: Replace PCB WE NO: Check circuit X10.3A-3B
64	MV55 for activation of the ozone inlet valve on tank 2 defective. ON state current too low.	Activate MV, 24V at X10.4A and 10.4B of PCB WE? YES: Search for open circuit in MV55 circuit NO: Replace PCB WE
65	MV55 for activation of the ozone inlet valve on tank 2 defective. ON state current too high.	! Unplug connector X10 on PCB WE; Does error still occur after activation of MV55 ? YES: Replace PCB WE NO: Check MV55 circuit X10.4A -4B (short circuit)
66	MV55 for activation of the ozone inlet valve on tank 2 defective. OFF state current too low.	Message cannot be evaluated, no action required
67	MV55 for activation of the ozone inlet valve on tank 2 defective. OFF state current too high.	MV55 permanently active? YES: Replace PCB WE NO: Check circuit X10.4A-4B
68	Image viewer, open circuit. ON state current too low.	? Activate image viewer, 24V at X15.2A and X15.2B WE OK: Search for open circuit in image viewer circuit NO: Replace PCB WE
69	Image viewer, current limitation active. ON state current too high.	! Unplug connector X15 on PCB WE; Does error still occur after activation of image viewer ? YES: Replace PCB WE NO: Check image viewer circuit X15.2A -2B (short circuit)
70	Image viewer defective. OFF state current too low.	Message cannot be evaluated, no action required
71	Image viewer. OFF state current too high.	? Image viewer permanently active YES: Replace PCB WE NO: Check circuit X15.2A-2B
92	Centrifuge does not achieve required speed (start-up phase), acoustic signal audible	Centrifuge full, check blocking and/or sluggishness of rotor NO: Check light barrier NO: Replace PCB WE
93	Centrifuge speed unstable during operating phase (stable running), acoustic signal audible	Centrifuge full, check blocking and/or sluggishness of rotor NO: Replace PCB WE
96	Centrifuge taken into operation without rotor	Insert rotor
97	Cuspidor water monitor DN30 permanently active	If simultaneously with 92, 93 or 99, see there Otherwise: Check flow control valve and sensor DN30 OK: Check cable path of X8.3 and X8.4
99	Separating sensor DS30 was active for more than 3 minutes.	Search for fault in drain system (backpressure). OK: Pump defective, replace.
110	MV33, open circuit. ON state current too low.	Activate MV (remove suction hose), function OK? YES: Ignore message NO: 24V at X12.1 and 12.4 of PCB WE? YES: Search for open circuit in MV33 circuit NO: Replace PCB WE
111	MV33, current limitation active. ON state current too high.	! Unplug connector X12 on PCB WE; Does error still occur after activation of MV33 (activate suction) ? YES: Replace PCB WE NO: Check MV33 circuit X12.1 -4 (short circuit)
112	MV33 defective. OFF state current too low.	Message cannot be evaluated, no action required
113	MV33; OFF state current too high.	MV33 permanently active? YES: Replace PCB WE NO: Check circuit X12.1-4
114	Centrifuge activation defective. ON state voltage too low.	Message cannot be evaluated, no action required



11 Service code listings

Serv. code	Description of service code	Corrective action (service engineer)
115	Centrifuge activation defective. ON state voltage too high.	Message cannot be evaluated, no action required
116	Centrifuge activation defective. OFF state voltage too low.	Message cannot be evaluated, no action required
117	Centrifuge activation defective. OFF state voltage too high.	Message cannot be evaluated, no action required
118	Centrifuge activation defective. ON state current too low.	Message cannot be evaluated, no action required
119	Centrifuge activation defective. ON state current too high.	Message cannot be evaluated, no action required
120	Centrifuge activation defective. OFF state current too low.	Message cannot be evaluated, no action required
121	Centrifuge activation defective. OFF state current too high.	Message cannot be evaluated, no action required
130	DS30 input circuit (separating sensor) defective.	Replace PCB WE
131	S3 input circuit (bayonet switch) defective.	Replace PCB WE
132	DN30 input circuit (water monitor switch) defective.	Replace PCB WE
133	DS33 input circuit (Reed switch 1) defective.	Replace PCB WE
134	DS34 input circuit (Reed switch 2) defective.	Replace PCB WE
135	DS32/DS51 input circuit (disinfectant level) defective.	Replace PCB WE
136	DS32/DS51 input circuit (level tank 1 switch, bottom) defective.	Replace PCB WE
137	DS31/DS53 input circuit (level tank 1 switch, top) defective.	Replace PCB WE
138	MG3 input circuit (rotor sensor) defective	Replace PCB WE
139	DS52 input circuit (level tank 2 switch, bottom) defective.	Replace PCB WE
140	DS54 input circuit (level tank 2 switch, top) defective.	Replace PCB WE
200	During start-up, MV37 is detected as not being available.	MV37 present (version with amalgam separator)? NO: For information only, no action required YES: Search for open circuit in MV37 circuit (X8.1-2, PCB WE)
201	During start-up, MV40 is detected as not being available.	MV40 present (version with disinfection)? NO: For information only, no action required YES: Search for open circuit in MV40 circuit (X6.3-4, PCB WE)
202	During start-up, MV34 is detected as not being available.	MV34 present (version with tumbler filling)? NO: For information only, no action required YES: Search for open circuit in MV34 circuit (X11.1-4)
203	During start-up, MV3 Dentosept is detected as not being available. (Interlocking of pump + MV1 in AK)	MV3 present (version with disinfection)? NO: For information only, no action required YES: Search for open circuit in MV3 circuit (X10.1A-1B, PCB WE)
204	During start-up, MV53 is detected as not being available.	MV53 (ozonization) present? NO: For information only, no action required YES: Search for open circuit in MV53 circuit (X10.2A-2B, PCB WE)
205	During start-up, MV54 is detected as not being available.	MV54 (ozonization) present? NO: For information only, no action required YES: Search for open circuit in MV54 circuit (X10.3A-3B, PCB WE)
206	During start-up, MV55 is detected as not being available.	MV55 (ozonization) present? NO: For information only, no action required YES: Search for open circuit in MV55 circuit (X10.4A-4B, PCB WE)
207	During start-up, the image viewer is detected as not being available.	Image viewer present? NO: For information only, no action required YES: Search for open circuit in image viewer circuit (X15.2A-2B, PCB WE)
999	The node has not reported.	Check whether this node is actually present in the system. If it is, check the connection to the serial interface of the treatment center.

We reserve the right to make any alterations which may be required due to technical improvements.

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