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SERVICE MANUAL

SERVICE MANUAL

APC 2

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CHAPTER 1
Safety information

Classification of the safety information

WARNING! The WARNING! safety indication refers to a risk of personal injury.

CAUTION! The CAUTION! safety indication refers to a risk of damage to property.

ATTENTION! The ATTENTION! safety indication refers to a risk which can cause equipment to become unserviceable.

IMPORTANT! The IMPORTANT! designation indicates application information and other particularly important information.

Knowledge of the User Manual

The User Manual for this unit constitutes an integral part of this Service Manual. For performing servicing activities it is assumed that the reader has knowledge of the User Manual, especially procedures for installation, putting into operation, and handling.

Protection from the risk of electric shock

WARNING! Disconnect the APC 2 from the electrosurgical unit (interconnection and ECB cable) before replacing parts inside the unit or cleaning the unit.

WARNING! Do not touch any unprotected wires or conductive surfaces while the unit is opened and under voltage.

WARNING! High-frequency voltages of over 1000 V are needed to ionize argon. Check that there is no damage to the electrical insulation of the applicators and all cords prior to use.

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Handling of argon pressure cylinders

WARNING! For some servicing work argon pressure cylinders must be connected to the APC 2. Before doing so, familiarize yourself with proper handling, in particular with the safety instructions for how to handle argon pressure cylinders. This information can be found in the user manual for the APC 2.

Electrostatically sensitive components

CAUTION! This unit contains electrostatically sensitive components. Work at an anti-static workplace while repairing the unit. Wear a grounding arm-band while working with electrostatically sensitive components. Hold the circuit boards by their non-conducting corners. Use an anti-static container for transporting electrostatically sensitive components and the circuit boards.

Liability and warranty

ATTENTION! Adjustments, tests, modifications, maintenance and repair work may only be performed by Erbe or persons trained by Erbe. If the work is not performed by trained persons, Erbe accepts no liability and warranty rights become void.

It is recommended that the technical safety check also be performed by Erbe or persons trained by Erbe.

ATTENTION! Only use original Erbe spare parts. The manufacturer accepts no liability and the warranty rights becomes void if original spare parts are not used.

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CHAPTER 2
Modifications

The changes relevant to APC 2 vary depending on which VIO electrosurgical unit (VIO D or VIO S) the APC 2 is connected to. They are therefore only described in the service manuals for the VIO electrosurgical units.

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CHAPTER 3
Controls

IMPORTANT! This chapter contains an overview of the controls of the unit(s). The relevant User Manual for the unit(s), knowledge of which is assumed for servicing work, provides detailed information about how to use the unit(s).

Controls at the front

Version 1.2.x

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Fig. 3-1

1 Purge button

2 Focus button

3 FiAPC socket

4 Pilot lamp „No ECB data link“ (Erbe Communication Bus)

5 Pilot lamps for footswitches

From version 1.3.x

IMPORTANT! As from V 1.3.x the APC module can take two sockets. One of these sockets must be a APC socket. The second socket can be either a HF socket or, as from V 1.4.x a second APC socket.

Fig. 3-2

1 Purge button

2 Focus button

3 Pilot lamps for footswitches

4 FiAPC socket

5 Pilot lamp „No ECB data link“ (Erbe Communication Bus)

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Controls at the rear

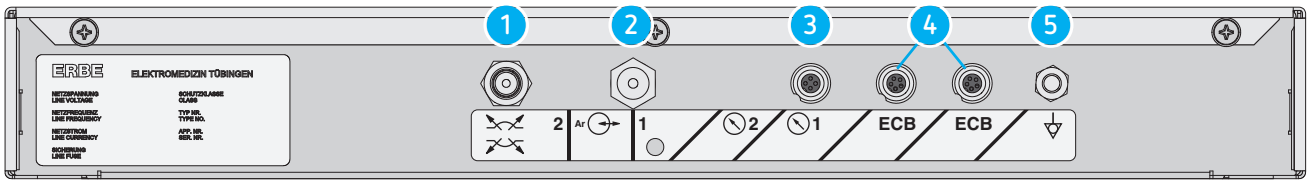

Fig. 3-3

1 Purge pin

2 Argongas connector

3 Pressure sensor terminal

4 ECB sockets (Erbe Communication Bus)

5 Potential equalization terminal

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CHAPTER 4
Technical Data

Connections	
Low voltage	via VIO electrosurgical unit
HF	via VIO electrosurgical unit
Terminal for potential equalisation	yes

Gas specification	
Type of gas	Argon
Argon minimum purity	Argon 4.8 (99.998% purity) or higher, e.g. argon 5.0.
Density (relative; air = 1)	1.38
Critical temperature	−122 °C
Color	Colorless gas
Odor	No warning by smell
Concentration of explosion limit (vol. % in air)	Non-combustible
Special risks	Heat/fire can result in an increase in pressure causing the pressure gas bottle to explode! Gas in high concentrations can be suffocating!

Gas-specific unit data			
Input pressure	$(5 \pm 2) \times 10^5$ Pa	5 ± 2 bar	72.5 ± 29 psi
Max. discharge pressure	$2 \times 10^5 \pm 4 \times 10^4$ Pa	2 ± 0.4 bar	29 ± 5.8 psi
Variable gas flow	0.1 - 8 l/min limited by the instrument attached, adjustable in 0.1 l increments		
Tolerance of the rated flow	(in range 0.2 - 5 l/min) ± 20 %		
Purging flow	Depending on the instrument (corresponds to the setpoint flow of the instrument which is currently connected)		
Purging time	3 sec.		
If you use a gas bottle, the residual volume display is activated at	7×10^5 Pa	7 bar	101.5 psi

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Gas-specific unit data			
Residual volume display	VIO display		
Residual pressure display	Pressure gauge		
The APC 2 switches off when the input pressure is	$<3 \times 10^5$ Pa	< 3 bar	<43.5 psi

Dimensions and weight	
Width x height x depth	410 x 80 x 370 mm
Weight	4.8 kg

Ambient conditions for transport and storage of unit	
Temperature	-40 °C to + 70 °C
Relative humidity	10% – 95%

Ambient conditions for operation of unit	
Temperature	+10 °C to + 40 °C
Relative humidity	15% – 80%, noncondensing

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Acclimatizing
If the unit has been stored or transported at temperatures below +10 °C or above +40 °C, the unit will require approx. 3 hours to acclimatize at room temperature.

Standards	
Classification according to EC Directive 93/42/EEC	IIb
Type as per EN 60 601-1	CF

CHAPTER 5
Circuit Descriptions

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Block diagram APC 2

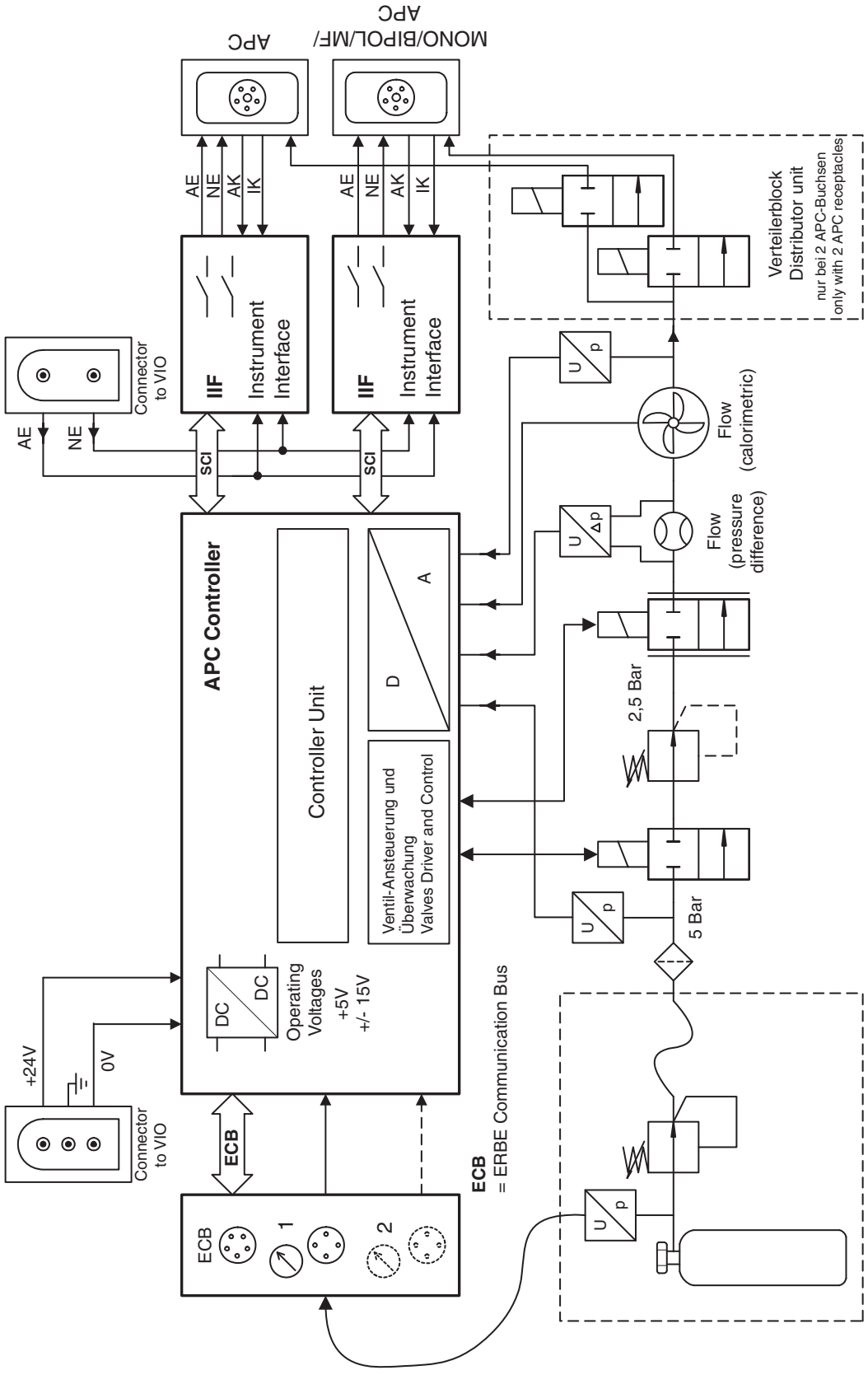

Fig. 5-1

Description of the various assemblies

Pneumatic system

The argon gas is extracted from the gas cylinder at approx. 200 bar. Downstream of the pressure reducer unit it is available at the APC unit with approx. 5 bar. The pressure reducer unit is equipped with a high-pressure sensor which can be used to identify the level of gas in the cylinder.

In the unit itself the internal supply pressure sensor is downstream of the input filter. A switching valve is then used to switch the gas to the control unit. This consists of the internal pressure reducer, which reduces the pressure to 2.5 bar, a proportional valve and the flow sensors. For redundancy reasons the flow is measured using two sensors based on different physical principles. One is designed as a differential pressure sensor which measures the differential pressure occurring at a specified bottleneck. With the calorimetric flow sensor an electrically heated element is cooled by the gas flow. This cooling can be used to calculate the flow rate.

The output is also equipped with another pressure sensor which is used to control the pressure in the instrument. This allows a blockage to be detected and the gas pressure maintained at non-critical levels.

APC controller (open and closed-loop control)

A switched mode power supply unit housed on the "APC controller" generates the necessary supply currents of +5 V, +15 V and −15 V from the +24 V input voltage.

The processor controls the valves and also the flow according to the values measured by the sensors.

The control voltage of the switching valves is reduced as soon as they have been energized. This prevents the excitation coil from overheating when switched on for lengthy periods.

The "APC controller" receives its specified values from the control panel via the Erbe Communication Bus (ECB). The parameters for gas control are thus transmitted and the commands for switch-on and off issued before every activation.

If a button is pressed on the APC 2, the "APC controller" signals this to the control panel via the ECB. In return it is informed which LED indicators must be switched on.

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IIF (Instrument Interface)

The instrument interface assembly may be found up to four times in the VIO system: twice in the electrosurgical unit and twice in the APC 2 unit and VEM 2 unit respectively.

The IIF is used to provide the system with the key instrument information via an electrically isolated serial interface:

Activation recognition

The **activation recognition** checks whether one of the activation buttons (or ReMode button) has been pressed. It is designed to analyze the different coding systems (diode coding, resistor coding connected in parallel or series).

Socket recognition

The **socket recognition** can recognize the type of socket via the coding jumpers on the socket connectors.

Socket type	Type number	Pin 2 - Pin 6	Pin 1 - Pin 6
Bipolar	1	–	X
Monopolar	2	X	–
Multifunction (MF)[1]	3	X	X
APC	4	–	–

1. Only relevant for VIO 300 D or in conjunction with a VIO 300 D.

Instrument recognition (only relevant for multifunction and APC sockets)

The **instrument recognition** can identify instruments coded by resistance and read instruments equipped with an electronic memory, transmitting the relevant data to the system.

This data is converted to CAN using the "CPU + Sensors" and sent to the control panel.

The safety relays, which switch the HF voltage on activation to the instrument connected, are also located on the IIF assembly. The actual switching state of the relay is reported back to the system such that defective relays or incorrect switching states can be recognized.

There are two types of IIF:

- IIF ME: for monopolar instruments, equipped with a relay that can switch the activated electrode to the instrument.
- IIF BE: for bipolar instruments and multifunction instruments designed for bipolar use only. Each equipped with one relay for the activated electrode and patient plate.

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CHAPTER 6
Setup and Service settings

The setup and service settings relevant to the APC 2 are called up and changed from the VIO electrosurgical unit to which the APC 2 is connected.

The setup and service settings vary depending on which VIO electrosurgical unit (VIO D or VIO S) the APC 2 is connected to. They are therefore only described in the service manuals for the VIO electrosurgical units.

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CHAPTER 7
Test programs

The test programs relevant to the APC 2 are called up and used from the VIO electrosurgical unit to which the APC 2 is connected.

The test programs vary depending on which VIO electrosurgical unit (VIO D or VIO S) the APC 2 is connected to. They are therefore only described in the service manuals for the VIO electrosurgical units.

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CHAPTER 8
Adjustment

Personnel requirements

ATTENTION! Adjustments, technical tests, modifications, maintenance and repair work may only be performed by Erbe or persons trained by Erbe. If the work is not performed by trained persons, Erbe accepts no liability and warranty rights become void.

Temperature conditions

IMPORTANT! Measurement/adjustment should take place when the unit has warmed up (standby temperature). For this purpose, switch on the unit and wait until the temperature attains a constant value. This value is between +40 °C and +55 °C and is attained after approx. half an hour. (This value is displayed in the test program "TP generator", for example.)

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Test equipment

IMPORTANT! The following list contains the testing and measuring equipment recommended by Erbe for servicing. Where Erbe article numbers are specified, only original Erbe testing and measuring equipment should be used.

Erbe Art. No.	Description
–	PC/laptop WIN 98 or higher
–	VIO APC Adjustment Tool (software, on request)
20100-164	Service Support Hardware USB (only for internal use by Erbe)
30100-528	ITP Omega flowmeter (20 l/min)
20100-165	APC test hose
20134-XXX[1]	Pressure regulator
–	Argon gas bottle
20100-175	FiAPC test adapter (only if a FiAPC socket is available)

1. Depending on the bottle connection.

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Test setup

IMPORTANT! During adjustment of the APC 2 the APC 2 and the VIO electrosurgical unit must not under any circumstances be connected with one another via ECB.

IMPORTANT! Erbe recommends using an argon pressure cylinder to supply the argon gas to adjust the APC 2. In addition, original Erbe pressure reducers for APC 2 should be used. For article numbers see chapter "Testing and measuring equipment".

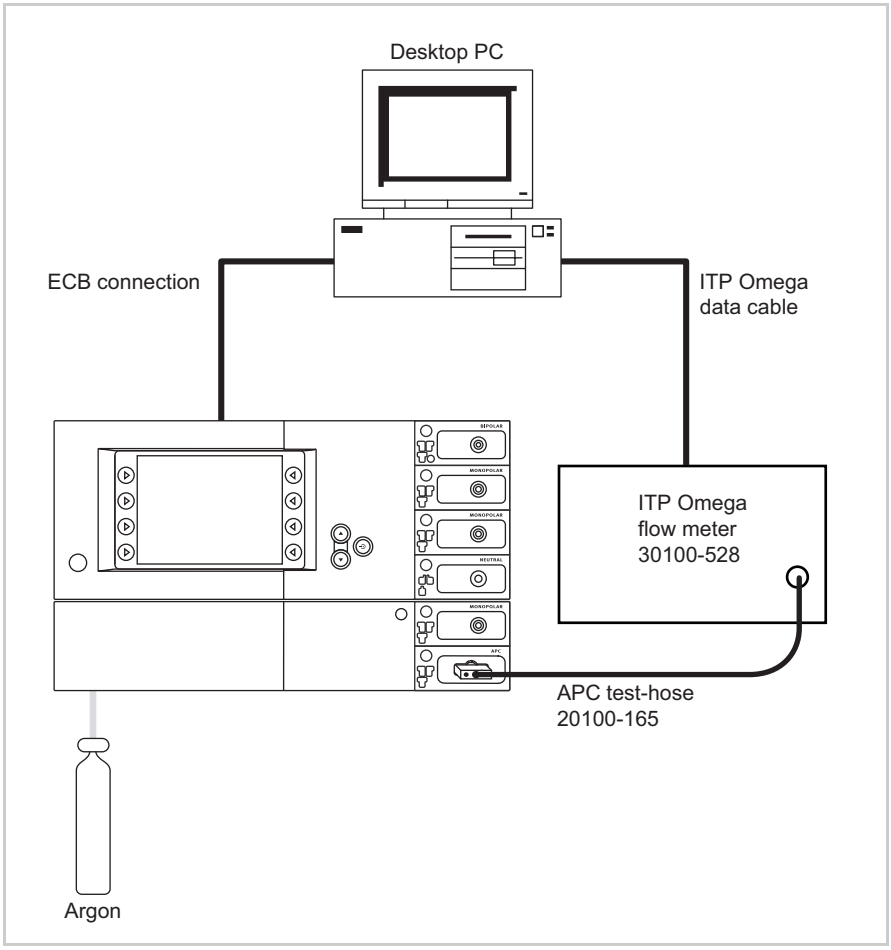

Fig. 8-1

- The test setup is designed as shown in the illustration above. In this case a unit combination comprised of APC 2 + VIO D serves as an example.
- On the PC the "VIO APC Adjustment Tool" software is installed.
- With FiAPC socket (see picture above): The FiAPC test adapter is connected to the FiAPC socket. The gas outlet of the test adapter is connected to the ITP flowmeter via the test hose.
- With APC socket (not illustrated): The gas outlet of the APC socket is connected to the ITP flowmeter via the test hose.

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Test procedure

ATTENTION! The voltage input of the APC 2 is not protected against reverse polarity. Connecting up the wrong way round will damage the unit.

1. Connect APC 2 to 24 V power supply. For this purpose connect the VIO HF surgical unit to the APC 2.
2. Switch on the VIO HF surgical unit.
3. Start the "VIO APC Adjustment Tool" software.
4. Commence the adjustment procedure by pressing the <Start adjustment> button.
5. For further test procedure follow the instructions in the software.

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CHAPTER 9
Troubleshooting

ERROR list

The error messages relevant to the APC 2 are displayed on the VIO electrosurgical unit to which the APC 2 is connected. They are accompanied by the abbreviation "A".

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Status of the ERROR list: 07.13

A/E-Errors

Recognizing module: A = APC 2, E = Extension module VEM 2				
Recognizing module	Error code	Additional information	Description	Action
A	1		Timeout of activation signal.	ECB communication interrupted. Check or troubleshoot ECB connecting cables.
A/E	2		Setup parameters invalid.	Reprogram unit. If the error occurs again, replace the APC 2 controller or VEM 2 controller assembly.
A/E	3		Position of safety relays IIF1.	Check IIF. If the error occurs again, replace the IIF assembly.
A/E	4		Safety relay IIF2 is addressed via relay 1+i.	Check IIF. If the error occurs again, replace the IIF assembly.
A/E	5		Button error socket 1.	Check the keyboard.
A/E	6		Button error socket 2.	Check the keyboard.
A	7		Valve error.	Check APC 2 controller connections, flow sensor and pneumatic block. If the error occurs again, replace the assembly.
A	8		Interruption - proportional valve.	Check APC 2 controller connections, flow sensor and pneumatic block. If the error occurs again, replace the assembly.
A	9		Short circuit - proportional valve	Check APC 2 controller and pneumatic block, replace defective assembly.
A	A		Control transistor - proportional valve.	Check APC 2 controller, replace defective assembly.
A/E	B		Error in test mode.	Possibly repeat adjustment.
A/E	C		IIF does not react.	Check connections. Check APC 2 controller or VEM 2 controller and IIF.

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Recognizing module: A = APC 2, E = Extension module VEM 2				
Recognizing module	Error code	Additional information	Description	Action
A/E	D		CAN error.	Reprogram unit (modules) Load compatible software.
A	10		Underpressure at selected gas input.	Check the gas supply (tank, pressure regulator) and hose connections. If the error persists, replace the APC 2 controller (pressure sensor) assembly.
A	11		Overpressure at selected gas input.	Check the gas supply (tank, pressure regulator) and hose connections. If the error persists, replace the APC 2 controller (pressure sensor) assembly.
A	12		Caloric and differential pressure sensor do not agree (wrong gas).	Check the gas supply (type of gas). If the error persists, readjust the unit or check the APC 2 controller, flow sensor and pneumatic block.
A	13		Differential pressure sensor measures less than half a setting (defective?).	Check APC 2 controller connections, flow sensor and pneumatic block. If the error occurs again, replace the assembly.
A/E	21		Undervoltage of a measurement circuit.	Check APC 2 controller or VEM 2 controller.
A/E	22		Overvoltage of a measurement circuit.	Check APC 2 controller or VEM 2 controller.
A/E	23		Combination of error messages A 21 and A 22.	Check APC 2 controller or VEM 2 controller.
A	30		Input 2 selected with partial complement.	Check APC 2 controller connections, keyboard PCB and IIF.
A/E	38		Type detection of socket 1 fails to agree with the stored value.	Check and save the socket configuration in the "Version List" test program. If the error occurs again, replace the IIF.

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Recognizing module: A = APC 2, E = Extension module VEM 2				
Recognizing module	Error code	Additional information	Description	Action
			The APC 2/VEM 2 first receives a one-second signal from the IES 2 and then from the VIO. The APC 2/VEM 2 interprets this condition as the availability of two master units. The conflict is resolved without intervention once the IES 2 has entered slave operation.	Information, no fault condition. Change the activation sequence of the units. First switch on the VIO followed by the IES 2.
A/E	39		Type detection of socket 2 fails to agree with the stored value.	Check and save the socket configuration in the "Version List" test program. If the error occurs again, replace the IIF.
			The APC 2/VEM 2 first receives a one-second signal from the IES 2 and then from the VIO. The APC 2/VEM 2 interprets this condition as the availability of two master units. The conflict is resolved without intervention once the IES 2 has entered slave operation.	Information, no fault condition. Change the activation sequence of the units. First switch on the VIO followed by the IES 2.
A	40		Flow specification not attained.	Check accessories. If the error persists, check hose connections, pneumatic block, APC socket and flow sensor.
A	41		Flow specification exceeded.	Readjust the unit or check APC 2 controller, flow sensor and pneumatic block.
A/E	7D		Program CRC test.	Reprogram unit (modules) Load compatible software. If the error occurs again, replace the APC 2 controller or VEM 2 controller.
A/E	7E		EEPROM not ready to read.	Reprogram unit (modules) Load compatible software. If the error occurs again, replace the APC 2 controller or VEM 2 controller.
A/E	7F		Operating system error.	Information, no fault condition.

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Recognizing module: A = APC 2, E = Extension module VEM 2				
Recognizing module	Error code	Additional information	Description	Action
A/E	80		Internal state incorrect.	Information, no fault condition.
A/E	81		Protocol violation CAN.	Reprogram unit (modules) Load compatible software.
A/E	82		Protocol violation SIO -> IIF.	Replace the IIF if the error occurs frequently.
A/E	83		Time exceeded SIO -> IIF.	Replace the IIF if the error occurs frequently.
A/E	85		Invalid resistance instrument number.	Check accessories. If the error persists, test all modules with instrument detection.
A	86		Gas underdose, e.g. hose blocked.	Check accessories. If the error persists, check hose connections, pneumatic block, APC socket and flow sensor.
A	90		Low pressure at cylinder 1.	Check the gas supply (tank, pressure regulator). If the error persists, replace the CAN APC 2 PCB.
A	91		Low pressure at cylinder 2.	Check the gas supply (tank, pressure regulator). If the error persists, replace the CAN APC 2 PCB.
A	A0		Calibration in EEPROM invalid.	Readjust the unit.

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CHAPTER 10
Maintenance and servicing

Who is allowed to perform servicing and maintenance work?

ATTENTION!

Adjustments, tests, modifications, maintenance and repair work may only be performed by Erbe or persons trained by Erbe. If the work is not performed by trained persons, Erbe accepts no liability and warranty rights become void.

It is recommended that the technical safety check also be performed by Erbe or persons trained by Erbe.

What is a technical safety check?

IMPORTANT!

The technical safety check is a preventive measure to examine whether the device is safe and ready for operation. In order to perform the various tests the current specifications and regulations of the particular country and the instructions in this service manual must be observed.

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How often does a technical safety check have to be performed?

IMPORTANT!

A technical safety check must be performed every time after maintenance, but at least once per year.

Testing and measuring equipment

IMPORTANT! The following lists contain the testing and measuring equipment recommended by Erbe for servicing. Where Erbe article numbers are specified, only original Erbe testing and measuring equipment should be used.

For APC sockets, and FiAPC sockets on the APC 2

Erbe Art. No.	Description
–	PC/laptop WIN 98 or higher
20100-108	Manometer
20100-165	APC test hose
30100-528	ITP Omega flowmeter (20 l/min)
20100-021	APC test box
20100-166	Variable pressure regulator, connection in accordance with CGA no. 580 m
20100-167	Variable pressure regulator, connection in accordance with BS 341-3 m
20100-168	Variable pressure regulator, connection in accordance with DIN 477-6 m
20100-169	Variable pressure regulator, connection in accordance with DIN 477-10 m
20100-170	Variable pressure regulator, connection in accordance with JIS B 8246 A1 W22 R
20134-001	Pressure regulator, connection in accordance with DIN 477-10
20134-002	Pressure regulator, connection in accordance with CGA no. 580
20134-003	Pressure regulator, connection in accordance with BS 341-3
20134-004	Pressure regulator, connection in accordance with DIN 477-6
20134-005	Pressure regulator, connection in accordance with JIS B 8246 A1 W22 R
–	Argon gas bottle
–	Metal panel with a viscose sponge soaked in a 0.9 % saline solution (as return electrode)
20100-022	Test hose
20100-037	APC measuring cable
20100-175	FiAPC test adapter (only if a FiAPC socket is available)
20132-200	VIO APC handle
20132-043	APC handle
20132-031	APC applicator
20132-221	FiAPC 2200 A probe (only if a FiAPC socket is available)
20194-070	Patient cable NE

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Erbe Art. No.	Description
20194-075	Patient cable NE, international
20100-033	Adapter cable NE
20189-303	Dual-pedal footswitch with ReMode
20100-039	NF cable – leakage current
20100-105	VIO test box pressure simulator (APC 2/Endo pressure simulator)
–	VIO APC Adjustment Tool (software, on request)
20100-164	Service Support Hardware USB (only for internal use by Erbe)

For HF sockets on the APC 2

Erbe Art. No.	Description
20190-045	Electrode handle ICC/ACC
20190-115	VIO ReMode electrode handle (only if an MF socket or an MF-2 socket is available)
20183-101	Bipolar adapter (only if an MF-2 socket is available)
20192-127	Patient cable AE
20192-110	Patient cable AE, international
20194-070	Patient cable NE
20194-075	Patient cable NE, international
20100-033	Adapter cable NE
20196-045	Bipolar cable
20196-053	Bipolar cable, international 2Pin 22
20100-034	Adapter cable bipolar
20100-152	BiClamp measuring cable (only if a MF socket is available)
20100-189	BiClamp MF-2 measuring cable (only if a MF-2 socket is available)
20100-102	VIO Testbox Auto Start/Auto Stop (bipolar start/stop)

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Technical safety check – step by step

For simplification the device to be tested is referred to below as the "test specimen".

Safety information

ATTENTION! In the event of a fault occurring in the test specimen or individual components during the technical safety check the test steps taken so far no longer apply.
Remedy the defect and repeat the technical safety check from the beginning.

IMPORTANT! For all tests the test specimen must be connected to a VIO HF surgical unit and be connected to the same via ECB. In the case of tests concerning grounded conductor resistance, ground leakage current, and patient leakage current it is always the device combination of VIO HF surgical unit and the actual test specimen (APC 2) which is tested because the test specimen does not have it own built-in power supply unit.

IMPORTANT! If the test specimen is also provided with an HF socket in addition to the APC socket, its function must be verified in accordance with the Safety Check instructions for the VIO electrosurgical unit connected to the test specimen.

IMPORTANT! If the test specimen is provided with two APC sockets, operation of *both* sockets must be verified in accordance with the Safety Check instructions.

IMPORTANT! It is assumed that the user knows how to operate the test specimen, the test equipment, the measuring equipment, and auxiliary test equipment. The test instructions only apply in conjunction with the relevant test steps.

IMPORTANT! Test equipment, measuring equipment, and auxiliary test equipment (cables, test boxes, etc.) are listed separately at the beginning of each test unit. Where Erbe article numbers are specified, only original Erbe test equipment, measuring equipment, and auxiliary test equipment may be used.

IMPORTANT! For this test only Erbe pressure reducers may be used. For article numbers see chapter "Testing and measuring equipment".

IMPORTANT! The test report for the technical safety check can be requested from Erbe Technical Service Tübingen. For the address see address sheet on last page.

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User manual and visual inspections

- Test specimen and accessories (where enclosed) undamaged externally.
- Pressure regulator externally intact with no leaks.
- User manual present.
- All labels on the test specimen (conformity declaration mark, rating plate, and all wording) present and readily legible.

Tests to be conducted in accordance with the national specifications and regulations

Grounded conductor test

- Ground terminal to chassis.
- Ground terminal to potential equalization pin.

Leakage current measurement

- Ground leakage current, normal condition (N.C.).
- Ground leakage current, single-fault condition (S.F.C.).

IMPORTANT! For the following tests close the output relays of the unit with the "TP relay" test program.

- Patient leakage current, normal condition (N.C.).
- Patient leakage current, single-fault condition (S.F.C.).

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Performance tests

Test setup

- The test specimen is connected to the power supply via a VIO electrosurgical unit.

Test procedure

Pushbuttons / acknowledgement tone when pressed

1. Check all pushbuttons (Focus buttons, Purge button) on the test specimen to make sure they are operating properly. Press each button at least twice. There must be an acoustic signal (= acknowledgement tone) every time a button is pressed.

Pressures

Testing and measuring equipment

IMPORTANT! For this test only Erbe pressure reducers may be used. For article numbers see chapter "Testing and measuring equipment".

Erbe Art. No.	Description
20100-108	Manometer
20134-XXX[1]	Pressure regulator
20100-XXX[1]	Variable pressure regulator
20132-200	VIO APC handle
–	Argon gas bottle
20100-105	VIO test box pressure simulator (APC 2 / Endo pressure simulator)
20100-175	FiAPC test adapter (only if a FiAPC socket is available)
20189-303	Two pedal footswitch with ReMode (only where APC 2 + VIO S are combined)

1. Depending on the bottle connection.

Vacuum / overpressure detection

Test setup

- The test specimen is connected to the power supply via a VIO electrosurgical unit.
- The argon gas bottle is connected to the test specimen via the variable pressure regulator.
- With APC socket: The VIO APC handpiece is electrically connected to the APC socket.
- With FiAPC socket: The Test adapter FiAPC is connected to the FiAPC socket.

Test procedure

1st test step

1. Reduce the input pressure on the test specimen slowly (from 5 bar) using the variable pressure regulator. When doing so, check the actual pressure on the pressure gauge.
2. Press the Purge button. Gas flow is generated and the actual pressure is reduced.
3. When the actual pressure drops to <2.5 bar, the test specimen must display the underpressure warning "A-10".

2nd test step

1. Increase the input pressure on the test specimen slowly (from 5 bar) using the variable pressure regulator. When doing so, check the actual pressure on the pressure gauge.
2. When the input pressure rises to >7.5 bar, the test specimen must display the overpressure warning "A-11".

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Shutdown at an output pressure of >2.0 bar ±0.4 bar

Test setup

- The test specimen is connected to the power supply via a VIO electrosurgical unit.
- The argon gas bottle is connected to the test specimen.
- With APC socket: The pressure gauge is connected to the gas output of the APC socket. The VIO APC handpiece is electrically connected to the APC socket.
- With FiAPC socket: The Test adapter FiAPC is connected to the FiAPC socket. The pressure gauge is connected to the gas output of the test adapter.

Test procedure

1. Press the Purge button. The gas flow generates a back pressure at the gas output.
2. Check output pressure with the pressure gauge.
3. When an output pressure of 2.0 bar ±0.4 bar has been reached, the test specimen must discontinue activation automatically and display the warning "A-40".

Bottle pressure detection APC 2 + VIO D

This test is performed in different ways depending on whether the APC 2 is connected to a VIO D or a VIO S electrosurgical unit.

Test setup

IMPORTANT!

From VIO-Version 1.5.x onward

The cylinder level display on the VIO HF surgical unit can be set to the maximum cylinder pressure of the argon gas bottle in use via the setting "max. APC cyl. pressure" (see Setup level 2).

- The test specimen is connected to the power supply via a VIO D HF surgical unit.
- The argon gas bottle is connected to the test specimen.
- The Testbox is connected to test specimen via the pressure sensor connection.
- With APC socket: The VIO APC handpiece is electrically connected to the APC socket.
- With FiAPC socket: The Test adapter FiAPC is connected to the FiAPC socket.

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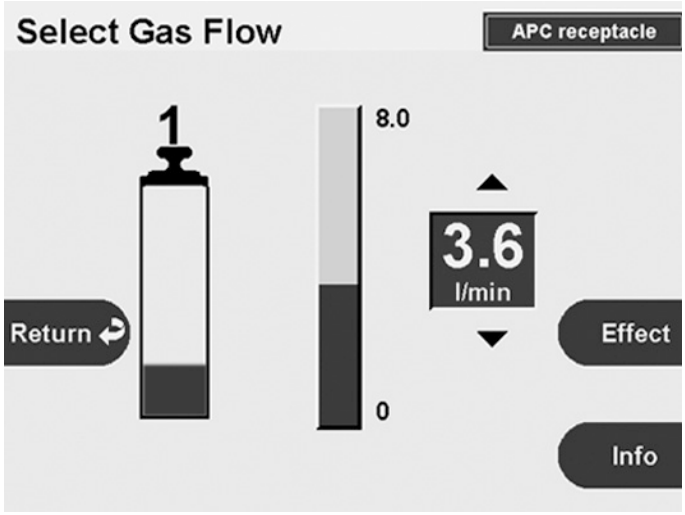
Test procedure

1st test step

1. Start testbox with switch set to 50 bar position.



2. On the VIO HF surgical unit, go to the window "Level Display". The test specimen must show the argon gas bottle to be approximately 1/4 full at a bottle pressure of 200 bar.

2nd test step

1. On the Testbox set the switch to 6 bar.
2. Press Purge button. The test specimen must display the warning "A-90".

Bottle pressure detection APC 2 + VIO S

This test is performed in different ways depending on whether the APC 2 is connected to a VIO D or a VIO S electrosurgical unit.

Test setup

- The test specimen is connected to the power supply via a VIO S HF surgical unit.
- The argon gas bottle is connected to the test specimen.
- The Testbox is connected to test specimen via the pressure sensor connection.
- The dual-pedal footswitch with ReMode is connected.
- With APC socket: The VIO APC handpiece is electrically connected to the APC socket.
- With FiAPC socket: The Test adapter FiAPC is connected to the FiAPC socket.

Test procedure

1st test step

1. Start Testbox with switch position 50 bar.
2. Activate FORCED APC with the footswitch for 5 s. The test specimen must not display a message.

2nd test step

1. On the Testbox set the switch to 6 bar.
2. Activate FORCED APC with the footswitch for 5 s. The test specimen must display the message "A-90".

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No leaks at 5 bar input pressure

Testing and measuring equipment

IMPORTANT! For this test only Erbe pressure reducers may be used. For article numbers see chapter "Testing and measuring equipment".

Erbe Art. No.	Description
20100-108	Manometer
20134-XXX[1]	Pressure regulator
–	Argon gas bottle
20100-175	FiAPC test adapter (only if a FiAPC socket is available)

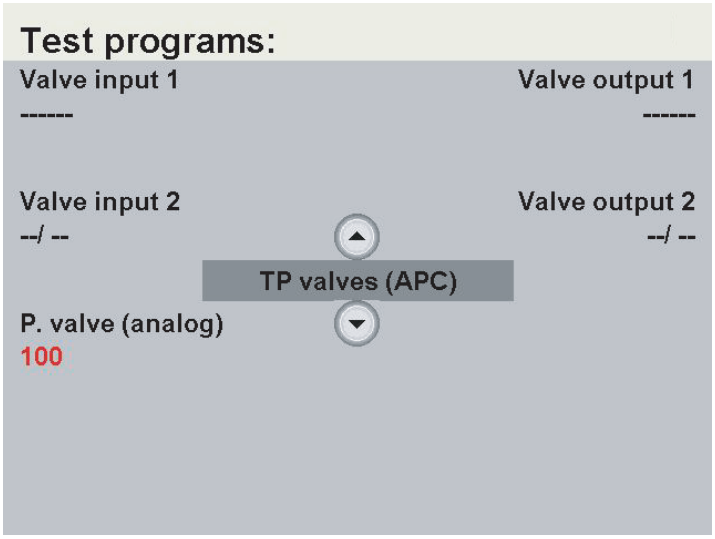
1. Depending on the bottle connection.

Test setup

- The test specimen is connected to the power supply via a VIO electrosurgical unit.
- The argon gas bottle is connected to the test specimen.
- With APC socket: The pressure gauge is connected to the gas output of the APC socket.
- With FiAPC socket: The Test adapter FiAPC is connected to the FiAPC socket. The pressure gauge is connected to the gas output of the test adapter.

Test procedure

1. Open the argon gas bottle valve.
2. Call up "TP valves (APC)" test program.



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3. In the test program (see picture above[1]) perform the following settings for the APC socket sealed with the pressure gauge. In the picture above a test is being conducted on socket 1:
   – Input valve (valve input 1) -> ------ (gas flow allowed)
   – Output valve (valve output 1) -> ------ (gas flow allowed)
4. Proportional valve (P. valve (analog)) -> 100 (open to maximum). To do so:
   – Press the selection button next to the P. valve (analog) repeatedly until the red value is shown (red = value can be modified).
   – Set the red value to 100 using the up and down buttons.
   – Press the selection button next to the P. valve (analog) again repeatedly until the black value is shown (black = value has been confirmed).
5. Close the argon gas bottle valve. The test specimen does not leak if the input pressure that can be read off the pressure gauge of the pressure regulator does not drop noticeably within 5 minutes.

Purge function

Testing and measuring equipment

IMPORTANT! For this test only Erbe pressure reducers may be used. For article numbers see chapter "Testing and measuring equipment".

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Erbe Art. No.	Description
20134-XXX[1]	Pressure regulator
20132-200	VIO APC handle
–	Argon gas bottle
20100-175	FiAPC test adapter (only if a FiAPC socket is available)

1. Depending on the bottle connection.

Test setup

- The test specimen is connected to the power supply via a VIO electrosurgical unit.
- The argon gas bottle is connected to the test specimen.
- With APC socket: The VIO APC handpiece is electrically connected to the APC socket.
- With FiAPC socket: The Test adapter FiAPC is connected to the FiAPC socket.

1. With this picture the "TP valves (APC)" test program is displayed on a VIO D unit. The same test program is displayed in a slightly different way if it is called up on a VIO S unit. However, the designations and symbols (e.g. for valve closed) are always the same.

Test procedure

1. Establish the set APC Purge Duration[2].
2. Press the Purge button. The test specimen must start the purge function, i.e. trigger gas flow for the duration of the set APC Purge Duration without HF activation.

Gas flow measurement

Testing and measuring equipment

IMPORTANT! For this test only Erbe pressure reducers may be used. For article numbers see chapter "Testing and measuring equipment".

Erbe Art. No.	Description
30100-528	ITP Omega flowmeter (20 l/min)
20100-022	Test hose
20134-XXX[1]	Pressure regulator
20132-200	VIO APC handle
–	Argon gas bottle
20100-175	FiAPC test adapter (only if a FiAPC socket is available)
20189-303	Two pedal footswitch with ReMode (only where APC 2 + VIO S are combined)

1. Depending on the bottle connection.

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2. The APC Purge Duration is set at setup level 2 in the case of the APC 2 + VIO D combination and in service level for the APC 2 + VIO S combination.

Test setup

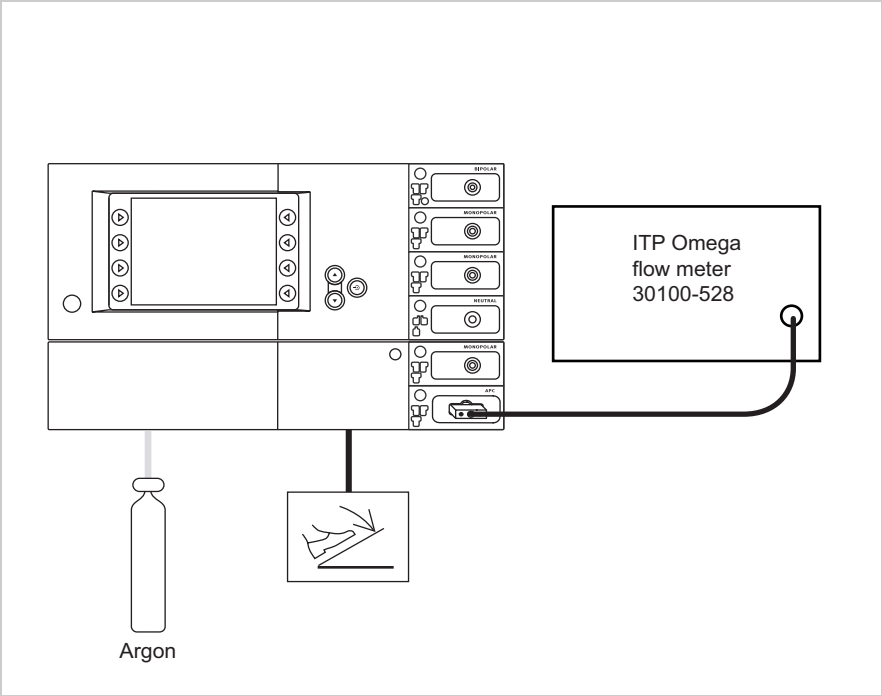

Fig. 10-1

- The test specimen is connected to the power supply via a VIO HF surgical unit. A VIO D unit serves as an example in this case.
- The argon gas bottle is connected to the test specimen.
- The dual-pedal footswitch with ReMode is connected.
- With FiAPC socket (see picture above): The FiAPC test adapter is connected to the FiAPC socket. The gas outlet of the test adapter is connected to the ITP flowmeter via the test hose.
- With APC socket (not illustrated): The gas outlet of the APC socket is connected to the ITP flowmeter via the test hose. The VIO APC handpiece is electrically connected to the APC socket.

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Test procedure

1. On the VIO HF surgical unit set the first flow setpoint of 0.2 l/min.
2. Activate test specimen via the footwitch.
3. Document the measured value.
4. Repeat the test with all the flow setpoints on the table below. All the measured values must be within the specified tolerance ranges.

Flow setpoint	Tolerance range
0.2 l/min	0.16 – 0.24 l/min
0.5 l/min	0.40 – 0.60 l/min
1.0 l/min	0.80 – 1.20 l/min
2.0 l/min	1.60 – 2.40 l/min
5.0 l/min	4.00 – 6.00 l/min

Instrument recognition APC socket

Testing and measuring equipment

Erbe Art. No.	Description
20100-037	APC measuring cable
20132-043	APC handle
20100-021	APC test box

Instrument recognition via resistance

Test setup

- The test specimen is connected to the power supply via a VIO electrosurgical unit.
- The APC measuring cable is connected to an APC socket on the test specimen.
- The red cable of the APC measuring cable is connected to the APC test box (red socket instrument detection).

Test procedure

1st test step

1. Insert the blue connector of the APC measuring cable into the 10 Ohm socket of the APC test box. The test specimen must detect that an instrument has been connected and display a corresponding advisory message.
2. Disconnect the resistance. The test specimen must detect and display instrument removal.

2nd test step

1. Insert the blue connector of the APC measuring line into the 90 Ohm socket of the APC test box. The test specimen must detect that an instrument has been connected and display a corresponding advisory message.
2. Disconnect the resistance. The test specimen must detect and display instrument removal.

Instrument recognition via EEPROM

Test setup

- The test specimen is connected to the power supply via a VIO electrosurgical unit.

Test procedure

1. Connect VIO APC handpiece to an APC socket on the test specimen. The test specimen must indicate instrument recognition with a message. The setting on the VIO HF surgical unit must switch to APC socket.
2. Remove VIO APC handpiece. The test specimen must recognize and indicate removal of the instrument.

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Instrument recognition FiAPC socket

Testing and measuring equipment

Erbe Art. No.	Description
20100-175	FiAPC test adapter

Instrument recognition via EEPROM

Test setup

- The test specimen is connected to the power supply via a VIO electrosurgical unit.

Test procedure

1. Connect test adapter to the FiAPC socket on the test specimen. The test specimen must indicate instrument recognition with a message. The setting on the VIO HF surgical unit must switch to APC socket.
2. Remove test adapter. The test specimen must recognize and indicate removal of the adapter.

Instrument recognition multifunction sockets

This test can only be performed with the following combination: APC 2 + VIO 300 D.

Testing and measuring equipment

Erbe Art. No.	Description
20100-152	BiClamp measuring cable (only if a MF socket is available)
20100-189	BiClamp MF-2 measuring cable (only if a MF-2 socket is available)

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Instrument recognition via resistance

Currently not available.

Instrument recognition via EEPROM

Test setup

- The test specimen is connected to the power supply via a VIO 300 D.

Test procedure

1. For an MF socket: Connect the measuring cable (art. no. 20100-152) to the MF socket of the test specimen. The test specimen must display instrument detection with an advisory message. The setting for COAG mode must switch to BiClamp.
2. For an MF-2 socket: Connect the measuring cable (art. no. 20100-189) to the MF-2 socket of the test specimen. The test specimen must display instrument detection with an advisory message. The setting for COAG mode must switch to BiClamp.

Fingerswitch activation APC 2 + VIO D

This test is performed in different ways depending on whether the APC 2 is connected to a VIO D or a VIO S electrosurgical unit.

Testing and measuring equipment

Erbe Art. No.	Description
20132-200	VIO APC handle
20132-043	APC handle
–	Metal panel with a viscose sponge soaked in a 0.9 % saline solution (as return electrode)
20132-031	APC applicator
20132-221	FiAPC 2200 A probe (only if a FiAPC socket is available)
20189-303	Two pedal footswitch with ReMode (only if a FiAPC socket is available)
20134-XXX[1]	Pressure regulator
–	Argon gas bottle

1. Depending on the bottle connection.

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Test on the APC socket (Activation CUT/COAG, ReMode)

Test setup

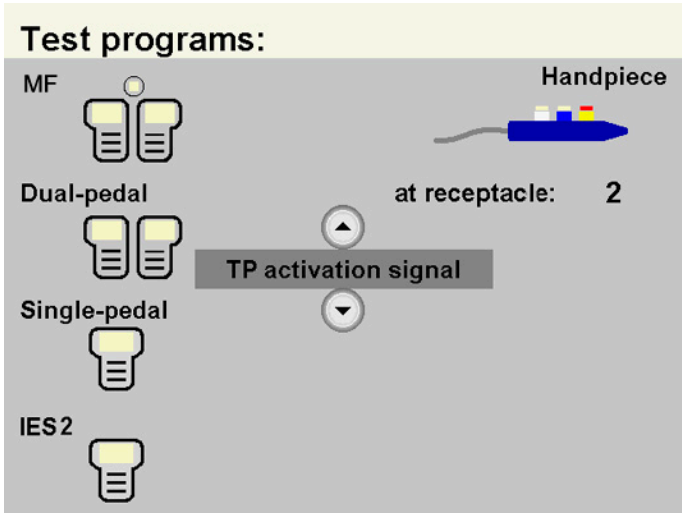

Fig. 10-2

- The test specimen is connected to the power supply via a VIO D HF surgical unit.
- The test program "TP activation signal" is selected.

Test procedure

1. Plug the MF connector of the **APC handpiece (20132-043)** into the test specimen.
2. Press the CUT button on the APC handpiece. The test program must confirm activation by lighting up the relevant field in color in the "Handpiece" icon.
3. Press COAG button on the APC handpiece. The test program must confirm activation by lighting up the relevant field in color inn the "Handpiece" icon.
4. Remove the APC handpiece.

1. Plug the MF connector of the **VIO APC handpiece (20132-200)** into the test specimen.
2. Press the CUT button on the VIO APC handpiece. The test program must confirm activation by lighting up the relevant field in color in the "Handpiece" icon.
3. Press COAG button on the VIO APC handpiece. The test program must confirm activation by lighting up the relevant field in color inn the "Handpiece" icon.
4. Press ReMode button on the VIO APC handpiece. The test program must confirm switchover by lighting up the relevant field in color in the "Handpiece" icon.
5. Remove the VIO APC Handgriff.

Test on APC and FiAPC sockets (Activation FORCED APC)

IMPORTANT!

Test setup

For this test only Erbe pressure reducers may be used. For article numbers see chapter "Testing and measuring equipment".

- The test specimen is connected to the power supply via a VIO D HF surgical unit.
- The argon gas bottle is connected to the test specimen.
- The NE socket of the VIO D is connected to one face of a metal panel. On the metal panel there is a viscose sponge soaked with a 0.9 % saline solution.
- With APC socket: The VIO APC handpiece with applicator is plugged into the test specimen.
- With FiAPC socket: The FiAPC probe is connected to the FiAPC socket. The dual-pedal footswitch with ReMode is connected to the VIO D.

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Test procedure

WARNING! Risk of injury due to electrically conductive objects and high voltage. Do not touch any electrically conductive objects with the instrument when it is activated. Under no circumstances should you touch the beam.

1. Set test specimen to:
   FORCED APC, 80 watts
   Flow 1.8 l/min
2. With APC sockets: Point the VIO APC handpiece at the metal panel with viscose sponge without touching the NE device. Activate the handpiece. The argon must ignite.
3. With FiAPC sockets: Point the FiAPC probe at the metal panel with viscose sponge without touching the NE device. Activate the probe with the footswitch. The argon must ignite.

Fingerswitch activation APC 2 + VIO S

This test is performed in different ways depending on whether the APC 2 is connected to a VIO D or a VIO S electrosurgical unit.

Testing and measuring equipment

Erbe Art. No.	Description
20132-200	VIO APC handle
20132-043	APC handle
20194-070 or 20194-075	Patient cable NE or Patient cable NE, international
20100-033	Adapter cable NE
–	Metal panel with a viscose sponge soaked in a 0.9 % saline solution (as return electrode)
20132-031	APC applicator
20132-221	FiAPC 2200 A probe (only if a FiAPC socket is available)
20189-303	Two pedal footswitch with ReMode (only if a FiAPC socket is available)
20134-XXX[1]	Pressure regulator
–	Argon gas bottle

1. Depending on the bottle connection.

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Test on APC socket (Activation CUT/COAG)

Test setup

- The test specimen is connected to the power supply via a VIO S HF surgical unit.
- The Basic Program is selected.
- The NE patient cable with the shorted adapter cable is connected to the NE socket of the VIO S.

Test procedure

1. Plug the MF connector of the **APC handle (20132-043)** into the test specimen.
2. Press CUT button on the APC handpiece. On the test specimen CUT must be activated.
3. Press COAG button on the APC handpiece. On the test specimen COAG must be activated.
4. Remove the APC handpiece.

1. Plug the MF connector of the **VIO APC handle (20132-200)** into the test specimen.
2. Press CUT button on the VIO APC handpiece. On the test specimen CUT must be activated.
3. Press COAG button on the VIO APC handpiece. On the test specimen COAG must be activated.
4. Remove the VIO APC handpiece.

Test on APC and FiAPC sockets (Activation FORCED APC)

Test setup

IMPORTANT!

For this test only Erbe pressure reducers may be used. For article numbers see chapter "Testing and measuring equipment".

- The test specimen is connected to the power supply via a VIO S HF surgical unit.
- The argon gas bottle is connected to the test specimen.
- The NE socket of the VIO S is connected to one face of a metal panel. On the metal panel there is a viscose sponge soaked with a 0.9 % saline solution.
- With APC socket: The VIO APC handpiece with applicator is plugged into the test specimen.
- With FiAPC socket: The FiAPC probe is connected to the FiAPC socket. The dual-pedal footswitch with ReMode is connected to the VIO S.

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Test procedure

WARNING! Risk of injury due to electrically conductive objects and high voltage. Do not touch any electrically conductive objects with the instrument when it is activated. Under no circumstances should you touch the beam.

1. Set test specimen to:
   FORCED APC, 80 watts
   Flow 1.8 l/min
2. With APC sockets: Point the VIO APC handpiece at the metal panel with viscose sponge without touching the NE device. Activate the handpiece. The argon must ignite.
3. With FiAPC sockets: Point the FiAPC probe at the metal panel with viscose sponge without touching the NE device. Activate the probe with the footswitch. The argon must ignite.

HF socket performance test

The performance test on an additional HF socket with which the APC 2 may be provided is dependent on the VIO electrosurgical unit (VIO D or VIO S) to which the APC 2 is connected. It is therefore only described in the service manual for the relevant VIO electrosurgical unit.

Monopolar / MF socket

1. With APC 2 + VIO D: Perform tests as described in the chapter "Fingerswitch activation", Service Manual VIO D.
2. With APC 2 + VIO S: Perform tests as described in the chapter "Fingerswitch activation", Service Manual VIO S.

Bipolar socket

1. With APC 2 + VIO D: Perform tests as described in the chapter "Automatic start mode", Service Manual VIO D.
2. With APC 2 + VIO S: Perform tests as described in the chapter "Automatic start mode", Service Manual VIO S.

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CHAPTER 11
Spare parts

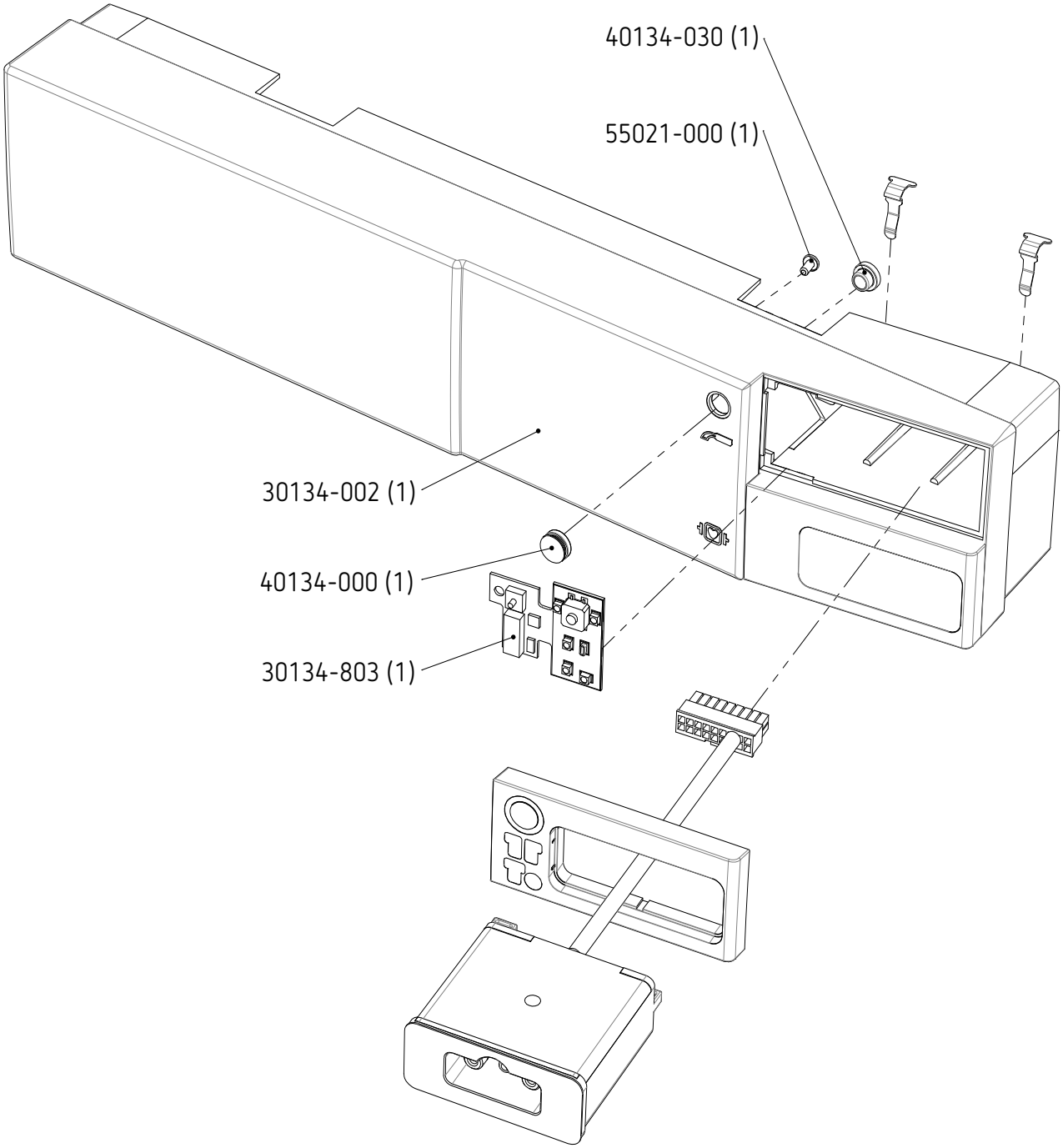

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Fig. 11-1

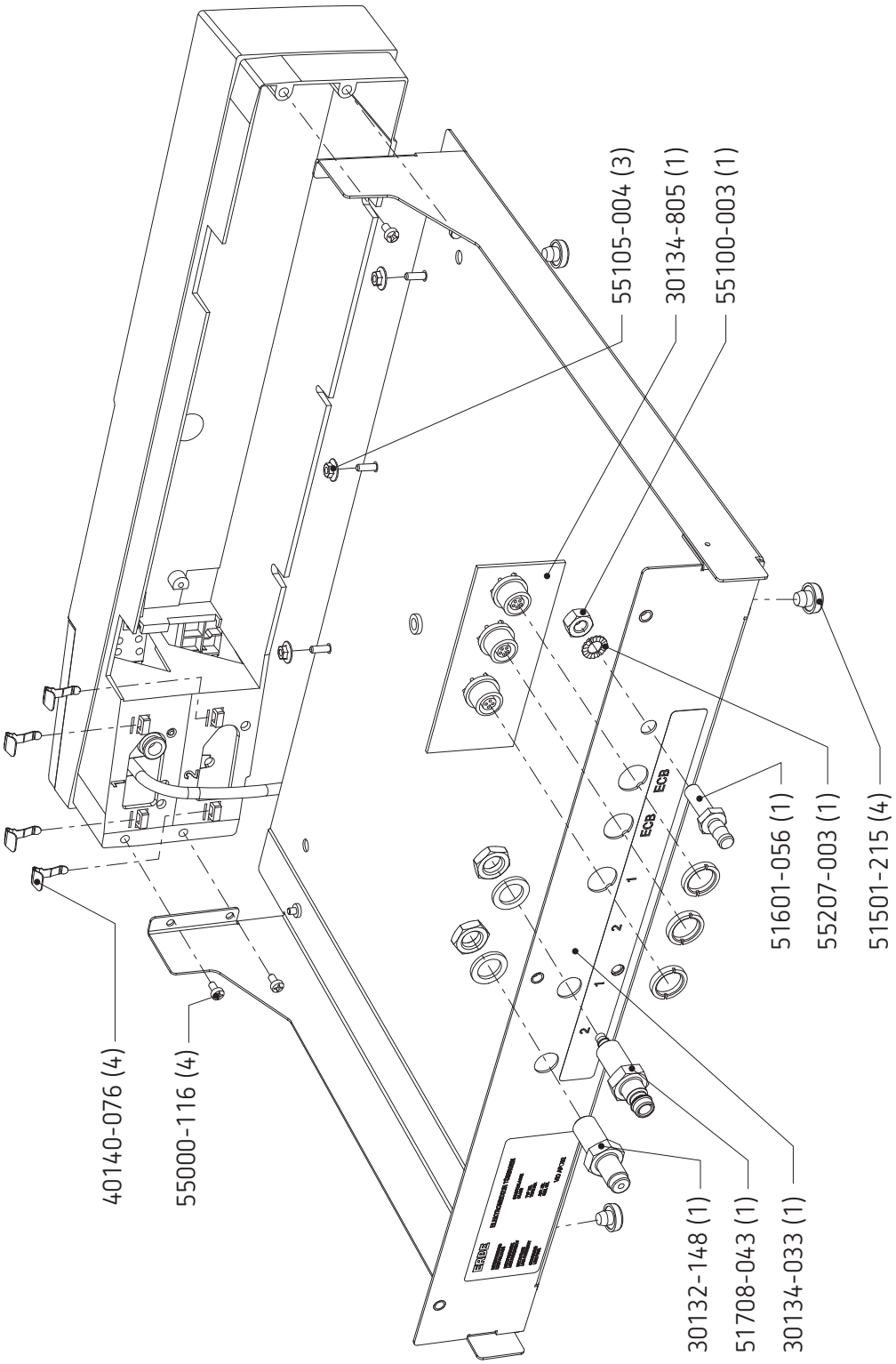
55105-004 (3)
30134-805 (1)
55100-003 (1)
51601-056 (1)
55207-003 (1)
51501-215 (4)
40140-076 (4)
55000-116 (4)
30132-148 (1)
51708-043 (1)
30134-033 (1)
ECB
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Fig. 11-2

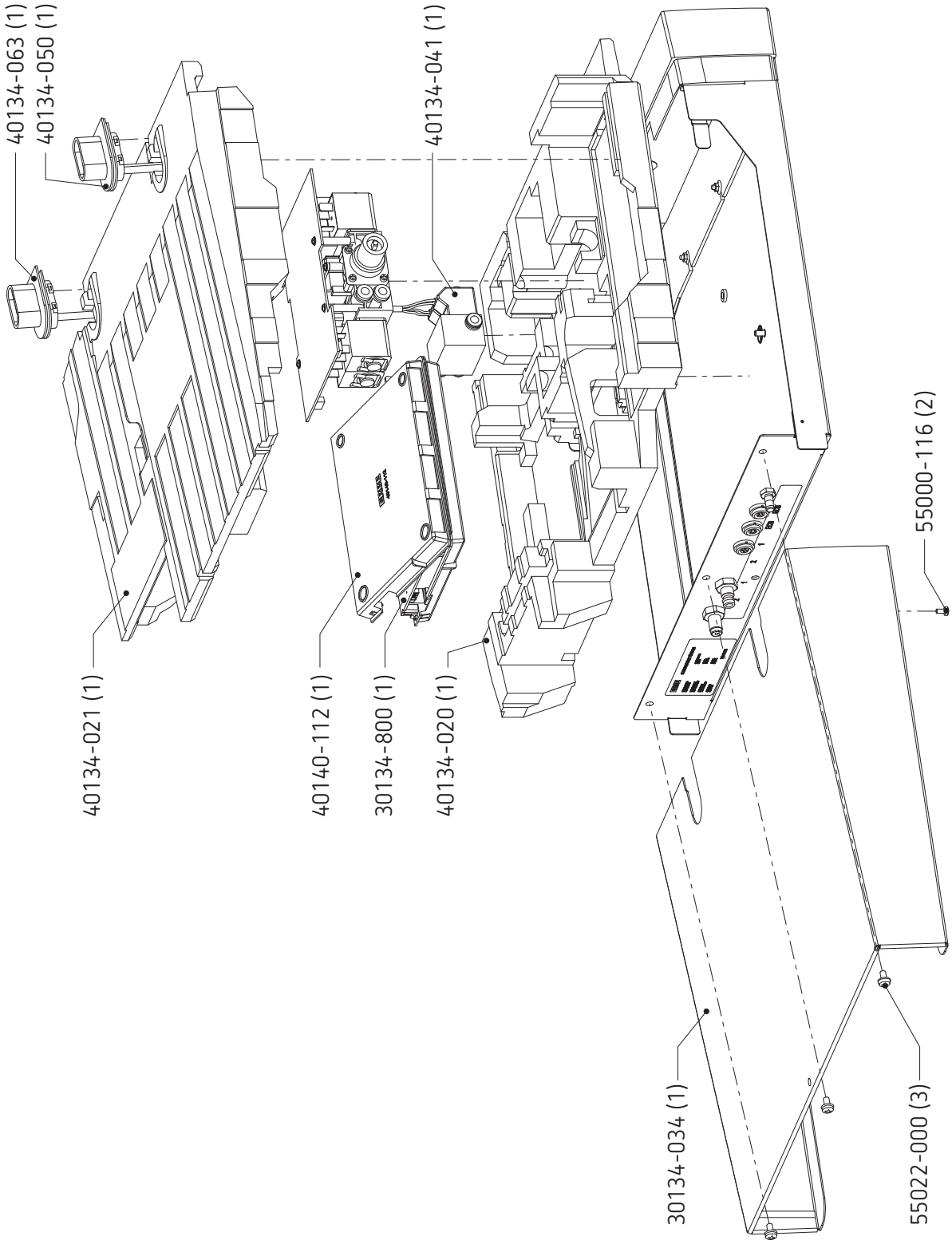

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Fig. 11-3

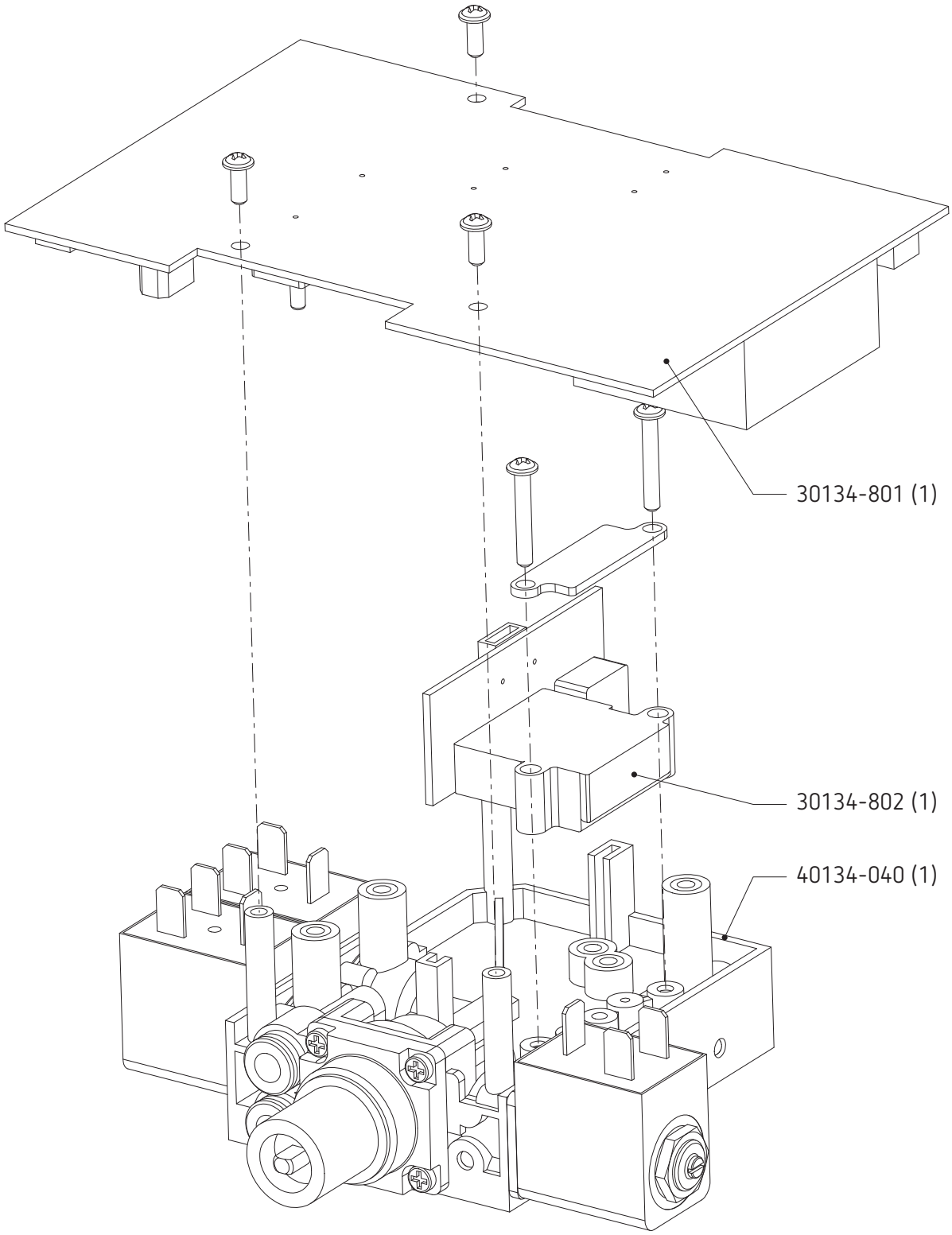

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Fig. 11-4

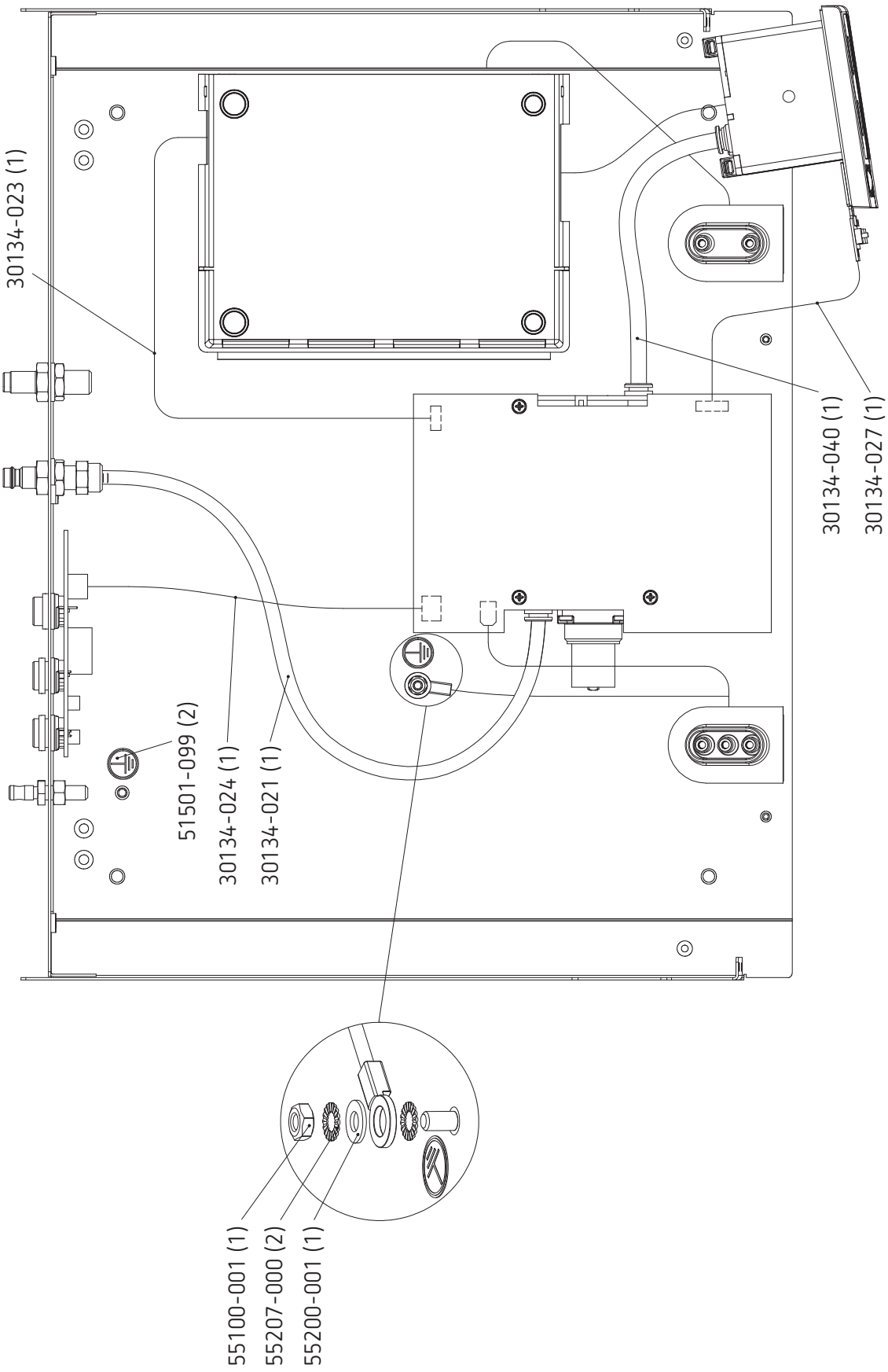

Fig. 11-5

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Circuit Boards

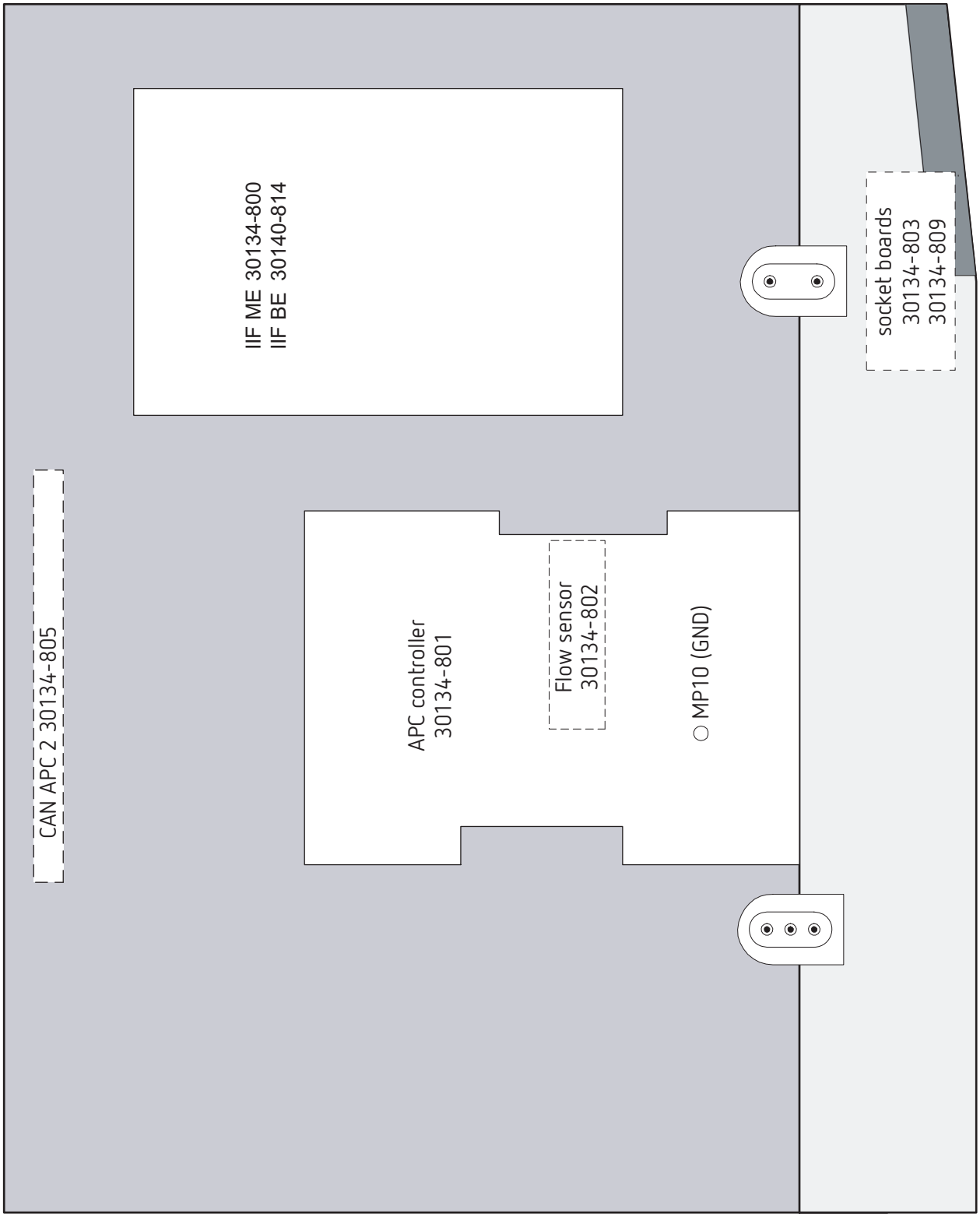

Fig. 11-6

Socket modules

IMPORTANT! As from V 1.3.x the APC module can take two sockets. One of these sockets must be a APC socket. The second socket can be either a HF socket or, as from V 1.4.x a second APC socket.

APC sockets

Erbe Art. No. 20134-651 Socket module FiAPC

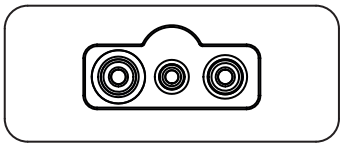

Fig. 11-7

Bipolar sockets

Erbe Art. No. 20140-610 Socket module BI 8/4

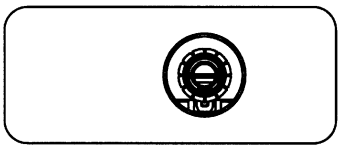

Fig. 11-8

Erbe Art. No. 20140-613 Socket module BI 2Pin 22–28, 8/4

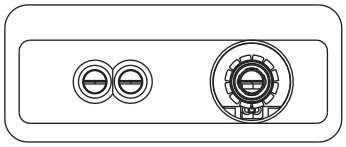

Fig. 11-9

Monopolar sockets

Erbe Art. No. 20140-622 Socket module MO 3Pin-Bovie

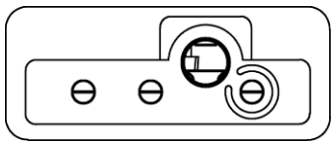

Fig. 11-10

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Erbe Art. No. 20140-623 Socket module MO 3Pin, 9/5

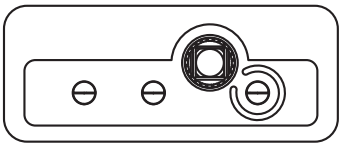

Fig. 11-11

Multifunction sockets

Erbe Art. No. 20140-630 Socket module MF 0

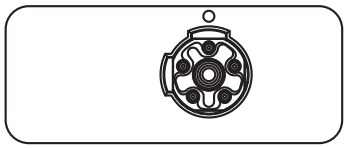

Fig. 11-12

Erbe Art. No. 20140-633 Socket module MF-2

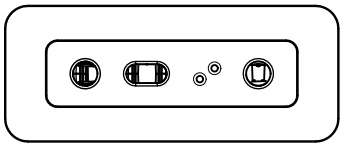

Fig. 11-13

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