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1 INTRODUCTION

This chapter gives an overview of the PV 101+ and PV 102+ devices and the service manual.

WARNING!

This product must be:

- **subjected to regular service, maintenance and control and any applicable upgrades, in accordance with BREAS service instructions;**
- **repaired and/or modified in accordance with BREAS service manuals, technical bulletins and any special service instructions, by service technicians that have been authorised after BREAS PV 101+/PV 102+ service training, or have an equivalent technical knowledge on medical respiratory devices.**

Deviation from these service instructions may lead to risk of personal injury!

1.1 About the PV 101+ and PV 102+

The PV 101+ and PV 102+ are intended for use in homes, while travelling or in institutions. They are bi-level devices, which means that the expiration pressure (EPAP) can be set lower than the inspiration pressure (IPAP).

1.1.1 Intended use of the PV 101+

The BREAS PV 101+ device is intended for treatment of obstructive sleep apnoea.

1.1.2 Intended use of the PV 102+

The BREAS PV 102+ device is intended for treatment of obstructive and central sleep apnoea, hypopnea and other forms of sleep-related breathing problems. The back-up rate is adjustable, as well as the rise time, which makes it possible to customise the time for the pressure to change from EPAP to IPAP.

1.1.3 Design and function

The PV 101+ and PV 102+ are based on a blower which is driven by an electronically controlled servomotor. The microprocessor-based electronics calculates, from the set pressure, rate, rise time etc., the correct motor speed. The set pressure and trigger sensitivity is continuously monitored.

An audible alarm is immediately given in the event of a power failure.

1.1.4 Service personnel’s training requirements

Service personnel working with the PV 101+ and PV 102+ devices should have medical/technical training and a good knowledge of the construction and function of respiratory devices. Authorisation by BREAS PV 101+/PV 102+ service training is recommended.

Always contact your BREAS representative if you have any questions or if training is required.

1.2 About this manual

1.2.1 Scope

All the maintenance checkpoints and the additional service actions for the PV 101+/ PV 102+ are described in this manual. It contains all documentation required for maintaining and servicing the machines, such as enlarged drawings, wiring diagrams, component location guides and so on.

BREAS Medical reserves the right to make changes to the products and/or the contents of this manual without any prior notice.

1.2.2 Intended audience

This service manual is intended for service technicians who have medical/technical training and who have a good knowledge of the construction and function of respiratory devices.

The service manual is NOT intended for clinic personnel or patients, who can find all the information they need in the PV 101+ and PV 102+ Operating Manuals.

1.2.3 Icons

Icons are used in this manual to highlight specific types of information. The meaning of each icon is explained in the table below.

Icon	Explanation
	Warning! Risk of death and serious personal injury.
	Caution! • Risk of minor or moderate injury. • Risk of equipment damage, loss of data, extra work or unexpected results.
	Note Information that may be valuable but is not of critical importance, tips.
	Reference Reference to other manuals with additional information on a specific topic.

2 MAINTENANCE SERVICE INSTRUCTIONS

This chapter describes all the routine checks and additional service instructions for the PV 101+ and PV 102+.

WARNING!

This product must be:

- **subjected to regular service, maintenance and control and any applicable upgrades, in accordance with BREAS service instructions;**
- **repaired and/or modified in accordance with BREAS service manuals, technical bulletins and any special service instructions, by service technicians that have been authorised after BREAS PV 101+/PV 102+ service training, or have an equivalent technical knowledge on medical respiratory devices.**

Deviation from these service instructions may lead to risk of personal injury!

For information about fault tracing, parts drawings, board schematics and so on, refer to the respective chapter in this service manual.

The patient and/or care provider should follow the function checks described in the chapter “CHECKS BEFORE USE” in the PV 101+/PV 102+ Operating Manual.

2.1 Purpose of the maintenance

The PV 101+ and PV 102+ are designed to give the users many years of trouble-free assistance, provided that preventive maintenance is carried out at the intervals specified in this manual. Well-performed maintenance will considerably increase the life of the machine.

It is also important to check any peripheral equipment at the same time as services are carried out.

2.2 Introduction

Before you start the maintenance service, read the safety precautions and make sure you have a new service record and all the necessary equipment, tools and replacement parts at hand.

2.2.1 Service check schedule

The schedule below lists the recurrent service checks of the PV 101+/PV 102+'s components and the intervals at which they should be performed. The reference numbers refer to chapters and sections in this manual that contain more detailed instructions.

A complete maintenance service, as described in this chapter, must be carried out at least every 12 months.

Interval	Service check	See section
Every 12 months	Complete maintenance check	2
	Check the electrical safety limit values.	7.5
	Calibrate the pressure, flow and high pressure limit sensors.	4
Every 15,000 operating hours or when required	Replace the blower unit.	3.5
	Calibrate the pressure, flow and high pressure limit sensors.	4

2.2.2 Safety precautions

Follow the safety precautions below when working with the PV 101+/PV 102+:

- Do not work on the device with the casing removed and any power supply connected unless the instructions in this manual clearly say so.
- Always use caution when working with the device connected to the mains and the casing removed.
- Make sure that all precautions to prevent electrostatic discharge (ESD) have been taken. Follow all the regulations regarding ESD.
- Explosive gases and liquids must not be kept or used near the PV 101+/PV 102+.

The PV 101+/PV 102+ Operating Manual contains an extended list of safety precautions.

2.2.3 Service record

See section 9, "APPENDICES" for the BREAS service record.

- Copy the service record and use it for noting the service checks while performing the yearly service.

2.2.4 Inspection equipment and tools

Before servicing the PV 101+/PV 102+, make sure you have the following equipment at hand:

- Test lung
- Multimeter
- Measuring equipment for pressure 0–70 mbar
  (Thommen HM 28 digital manometer is recommended, BREAS part no. 001934)
- Flow meter
- Screwdrivers TX10, TX25, Phillips 1
- Box socket wrenches M3, M4
- Allen key 2, 5x25

For the equipment required when calibrating the device, see section 4.2.

2.2.5 Replacement parts

The following parts should be available when servicing the device:

Description	BREAS part no.
Patient tube	000245
Patient air filter, washable (2 pcs)	000996
Patient air filter, disposable (if used)	001259
Air filter, internal cooling	001121
Blower unit assembly, 15.000 hours	003110

2.3 Preparing inspection

2.3.1 Verifying the components and the installed software

- Check section 9.1, “Engineering change history – PV 101+” or section 9.2, “Engineering change history – PV 102+” to find out what changes have been made to the device and from which serial number they were implemented.

If in any doubt about the circuit board revisions or upgrades that may have been made that have not been recorded, check the component designations on the circuit boards.

2.3.2 Initial recording

1 Copy a new service record (see section 9, “APPENDICES”).

2 Identify the PV 101+/PV 102+; note the model and serial number and any inventory number, if applicable, on the service record.

3 Check earlier actions and events recorded on any previous service records.

4 Note the current patient settings.

5 Note the total number of operating hours.

2.3.3 Markings

Check that the following markings are legible:

- Make, model designation, serial number
- Warning texts
- Any inventory markings
- Any other texts on the external equipment and accessories

2.3.4 Information from the patient/user

Before starting the service, check the following with the patient/clinic:

- Has the PV 101+/PV 102+ functioned without any problems? If not, what were they?
- How does the patient/care provider check the function of the device? How often?
- How often are the filters changed?
- How many filters will be required before the next service?
- Other observations?

2.3.5 Validity of the documentation

1 Check that the documentation used by the patient is valid and up to date.

2 Check if any modification or revision of the PV 101+/PV 102+ needs to be done at the same time as the service.

2.4 External inspection

2.4.1 Visual inspection for external damage and wear

1 Clean the cover of the PV 101+/PV 102+ using a mild detergent.

2 Check for visible damage to the cover and other components.

3 Check that all external parts are tightened and secured.

2.4.2 Checking the power supply connection

1 Check the plug, power cord and mains power socket.

2 Make sure the strain-relief clamp for the power cord is not damaged.

3 Check the power supply to the machine.

4 If the PV 101+ does not operate from the mains power, check the fuses.

2.4.3 Short function check

1 Connect the power cord to the power socket of the PV 101+/PV 102+.

2 Connect the patient circuit.

3 Start the PV 101+/PV 102+ and check that it functions normally.

4 Disconnect the power cord and check that the power failure alarm sounds. Reconnect the power cord. The alarm should be silenced.

5 Switch on the PV 101+/PV 102+. Upon starting, all the LEDs on the front panel should be lit and the trigger settings should be indicated on the bar graph. The entire bar graph should then become yellow for 2 seconds before the device starts functioning normally.

6 (PV 102+ only) Switch on the PV 102+ and wait for 15 seconds for the leakage alarm to be activated.

7 Switch off the device.

2.5 Internal inspection

Disconnect the power supply before removing the casing of the machine.

2.5.1 Opening the casing

- For instructions, see section 3.2, “Removing and reassembling the upper casing”.

2.5.2 Cleaning the inside of the machine

- Remove any dust or dirt that has collected in the machine.

2.5.3 Inspecting the internal wiring

- Inspect all wiring and the connectors for damage. Make sure that no wires or cables are pinched.

2.5.4 Securing the components

- Make sure that all the internal components, such as the motor unit, the circuit boards, the connectors and so on, are properly secured.

2.5.5 Checking the power supply

1 Check that the power inlet socket is undamaged and that it is properly fastened.

2 Make sure the power board is properly fastened.

3 Check the wiring to and from the power board.

2.5.6 Checking the electrical safety values

- For instructions, see section 7.5, “Electrical safety measurements”.

2.5.7 Calibrating the pressure sensor

- For instructions, see section 4.3, “Calibrating the pressure sensor”.

2.5.8 Calibrating the flow sensor

- For instructions, see section 4.5, “Calibrating the flow sensor”.

2.5.9 Calibrating the high pressure limit

- For instructions, see section 4.6, “Calibrating the high pressure limit”.

2.5.10 Reassembling the casing

- For instructions, see section 3.2, “Removing and reassembling the upper casing”.

2.6 Final inspection before delivery

2.6.1 Function check

1 Connect the power cord to the power socket of the PV 101+/PV 102+.

2 Connect the patient circuit.

3 Start the PV 101+/PV 102+ and check that it functions normally.

4 Disconnect the power cord and check that the power failure alarm sounds. Reconnect the power cord. The alarm should be silenced.

5 Switch on the PV 101+/PV 102+. Upon starting, all the LEDs on the front panel should be lit and the trigger settings should be indicated on the bar graph. The entire bar graph should then become yellow for 2 seconds before the device starts functioning normally.

6 (PV 102+ only) Switch on the PV 102+ and wait for 15 seconds for the leakage alarm to be activated.

7 Switch off the device.

2.6.2 Checking the low pressure leakage alarm (PV 102+)

1 Adjust the pressure settings to:

IPAP 10 mbar
EPAP 10 mbar

2 Make sure that the alarm LED is lit and that an audible alarm is heard.

2.6.3 Checking the trigger function

1 Adjust the pressure settings to:

IPAP 10 mbar
EPAP 4 mbar

2 Connect the patient tube without a mask.

3 Block the air outlet on the tube. When you remove the blockage, a triggered breath should be initiated.

2.6.4 Checking the pressure and rate

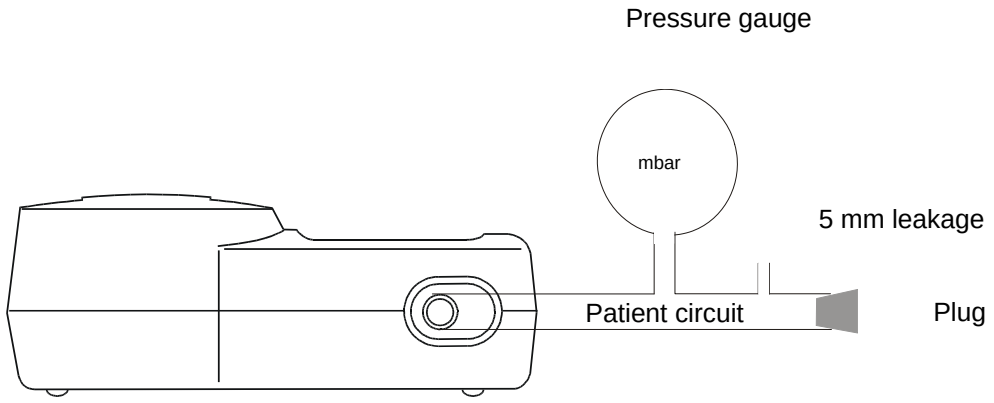
Pressure

The measurement should be made using a blocked patient circuit with leakage provided (see figure below).

1 Adjust the pressure settings to:

IPAP 10 mbar
EPAP 10 mbar

2 Measure the pressure and check that it is correct (tolerance: ±4% of the maximum value and ±8% of the current pressure value).



Rate

3 Adjust the settings to:

IPAP	10 mbar
EPAP	4 mbar
Back-up rate	8 BPM (PV 102+ only)

The PV 101+ back-up rate is fixed to 6 BPM.

4 Measure the rate and check that it is correct.

2.6.5 Replacing the filters

The patient air filters are located in the filter holder under the carrying handle of the device. The internal cooling filter is located in the lower casing.

1 Replace the washable grey air filter.

2 Replace the disposable white filter, if used.

3 Replace the internal cooling filter from underneath the machine.

2.6.6 Checking the accessories

1 Inspect the patient circuit. Replace it if necessary.

2 Inspect any other accessories.

2.6.7 Adjusting the settings for the patient

- Adjust all the patient settings to the prescribed values.

3 REMOVING/REPLACING THE MAIN COMPONENTS

This chapter describes how to install, remove and/or replace the main components of the PV 101+/PV 102+.

3.1 Tools

Before disassembling the PV 101+/PV 102+, make sure you have the following tools at hand:

- Screwdriver TX10
- Screwdriver TX25
- Screwdriver Phillips 1
- Box socket wrench M4
- Box socket wrench M3

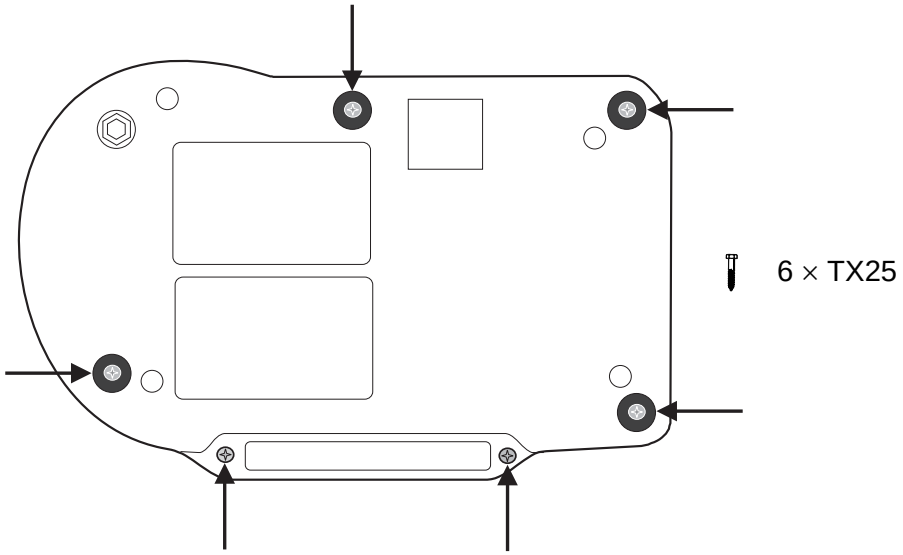
3.2 Removing and reassembling the upper casing

Disconnect the power supply before removing the casing of the machine.

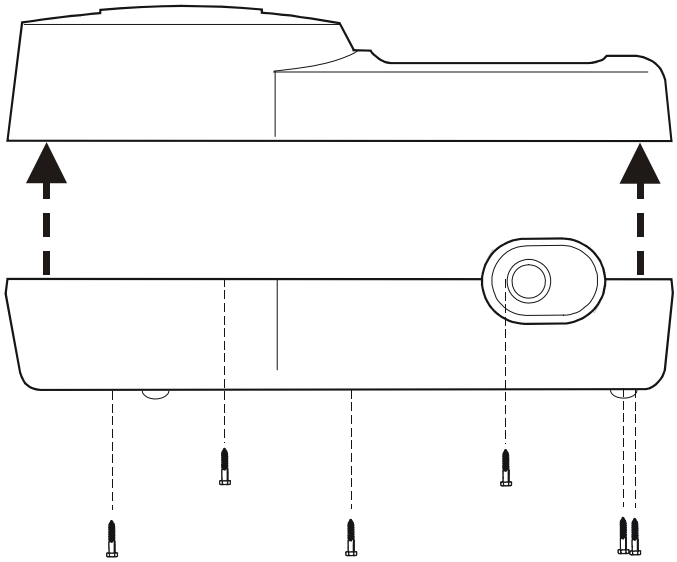
To remove the casing:

1 Remove the mains power cord.

2 Turn the PV 101+/PV 102+ upside down. Remove the four screws placed in the four holes underneath the lower casing and the two screws placed underneath the handle.



3 Lift up the upper casing. Disconnect the CPU board's ribbon cable from the MDA board. Put the upper casing aside.



To reassemble the casing:

- Reassemble in reverse order.

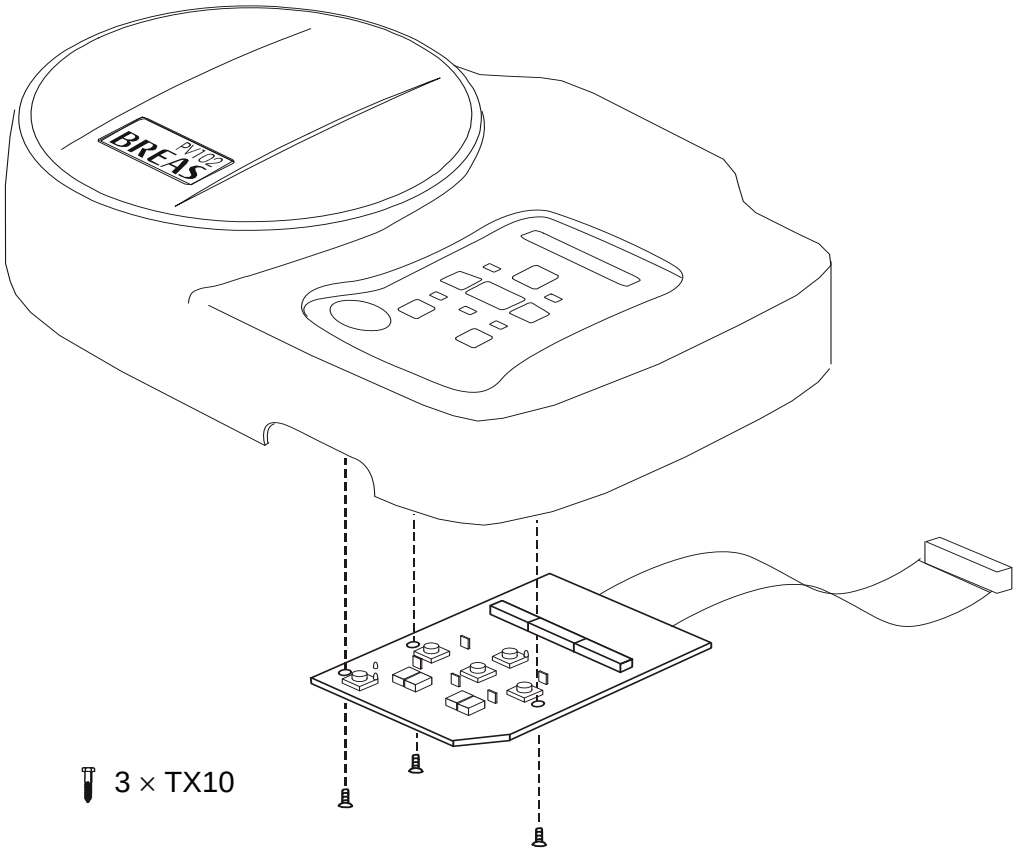
3.3 Removing and replacing the CPU board

To remove the CPU board:

1 Remove the upper casing (See section 3.2).

2 Turn it upside down and remove the three Torx screws placed underneath the CPU board.

3 Remove the CPU board.



To reassemble the CPU board:

- Reassemble in reverse order. Fit the components to the holes for the display panel controls and screw the CPU board back in place.

3.4 Removing and reassembling the main assembly

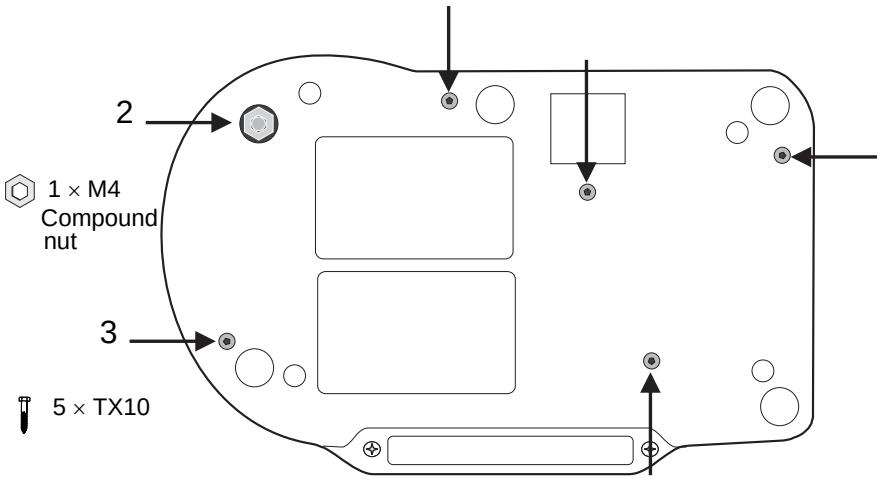
All the main internal components – blower unit, power board and MDA board – are mounted on the base plate.

To remove the main assembly:

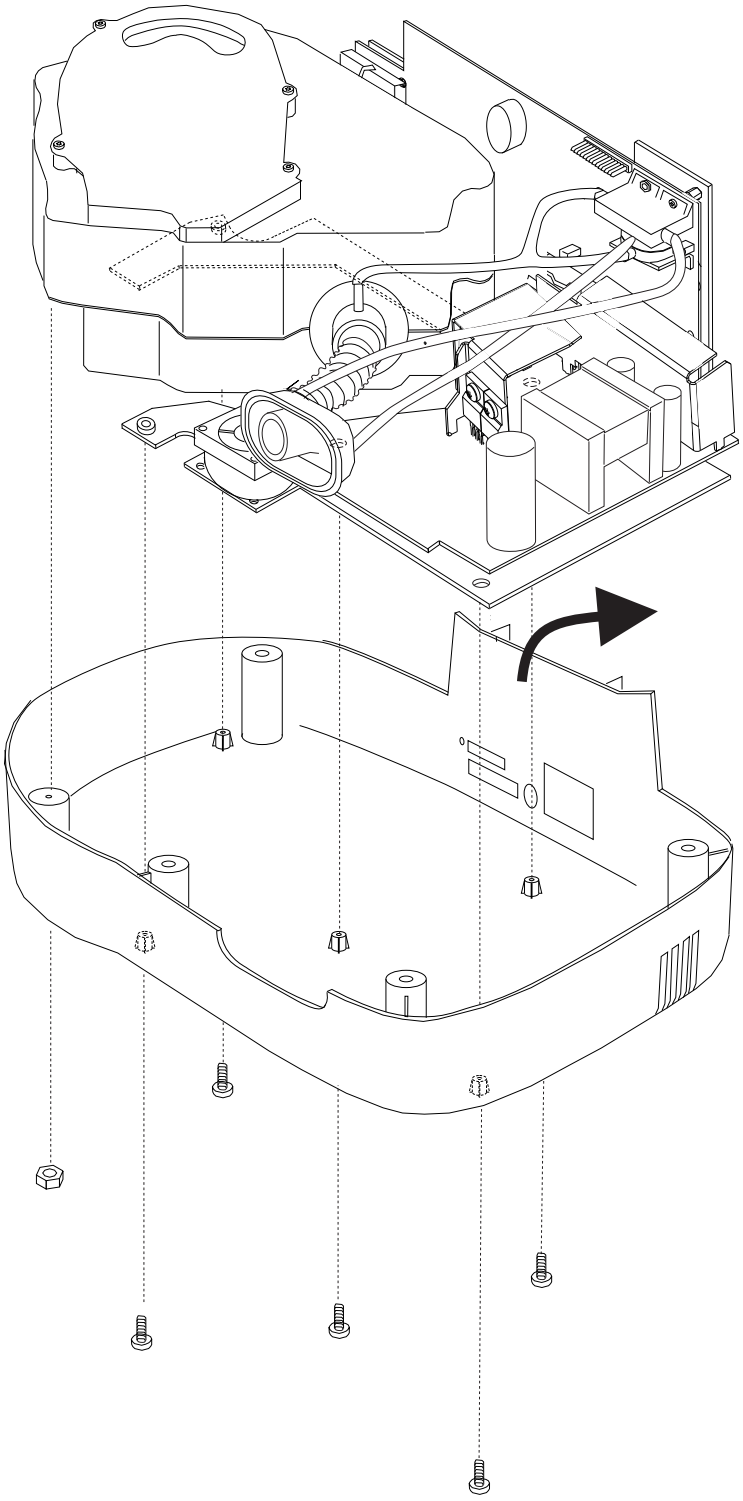
1 Remove the upper casing (See section 3.2).

2 Turn the PV 101+/PV 102+ upside down. Remove the M4 nut that fastens the blower unit rubber mount.

3 Remove the five screws on the lower casing that hold the base plate.



4 Press the rear panel side of the lower casing outwards to release the connectors and lift out the main assembly.



To reassemble the main assembly:

- Reassemble in reverse order. Make sure the connectors on the rear panel are properly fitted in their holes.

3.5 Removing and replacing the blower unit

To remove the blower unit:

1 Remove the upper casing (See section 3.2).

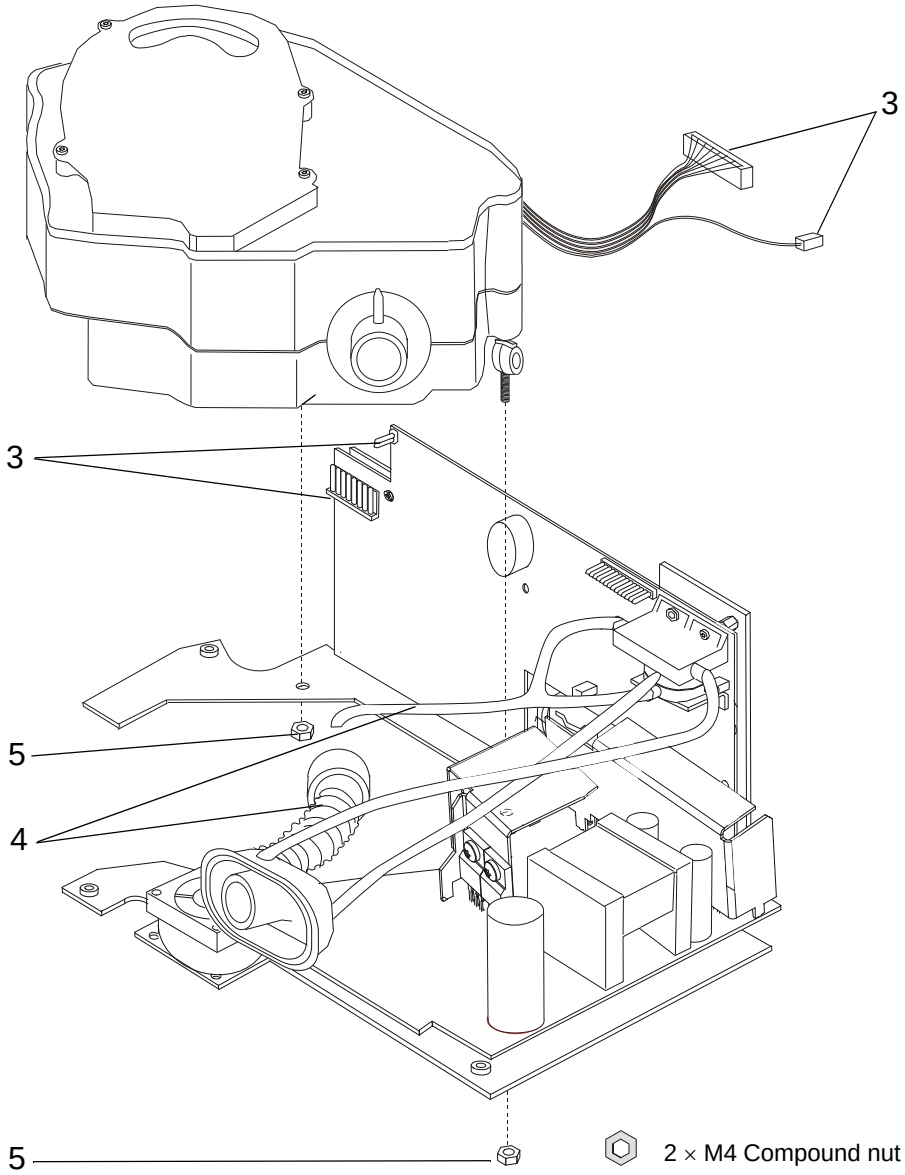
2 Remove the main assembly (See section 3.4).

3 Disconnect the motor connectors from the MDA board.

4 Disconnect the flex tube from the blower unit's air outlet. Disconnect the red sensor tube from the blower unit's sensor connector.

5 Remove the remaining two nuts that hold the blower unit's rubber mounts from underneath the base plate.

6 Lift away the complete blower unit.



To reassemble the blower unit:

- Reassemble in reverse order.

3.6 Removing and replacing the power board

To remove the power board:

1 Remove the upper casing (See section 3.2).

2 Remove the main assembly (See section 3.4).

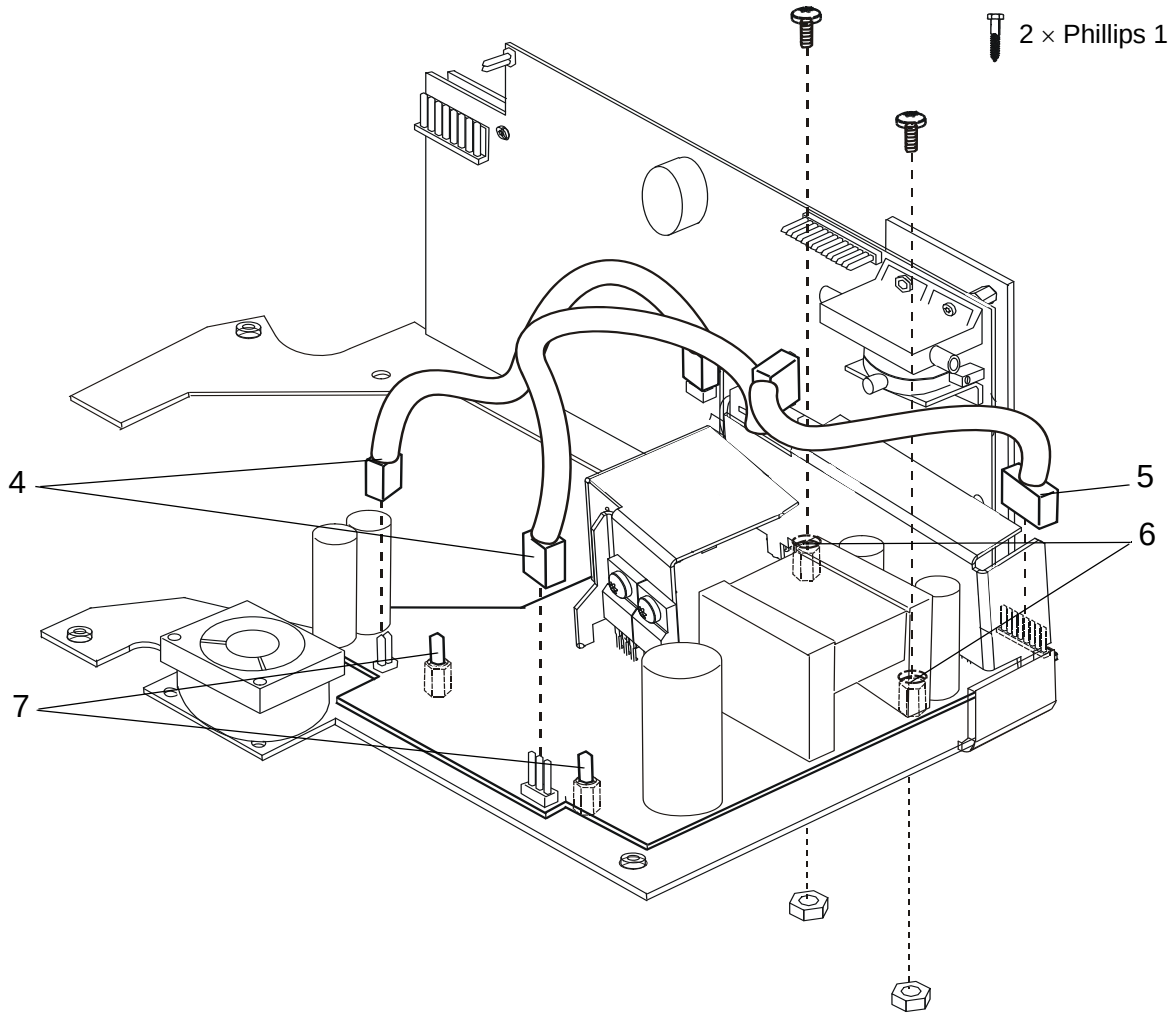
3 Remove the blower assembly (See section 3.5).

4 Move aside the patient air and sensor tubing. Disconnect the power cables to the external DC and mains supplies on the MDA board.

5 Disconnect the DC control cable from the PSU board.

6 Unscrew the two screws that hold the rear part of the power board, and remove the two nuts under the base plate.

7 Pinch the two securing pins on the front part of the power board, e.g. by using a screwdriver, and lift up the power board from the base plate.



To reassemble the power board:

- Reassemble in reverse order.

3.7 Removing and replacing the MDA board

To remove the MDA board:

1 Remove the upper casing (See section 3.2).

2 Remove the main assembly (See section 3.4).

3 Remove the blower assembly (See section 3.5).

4 Remove the power board (See section 3.6).

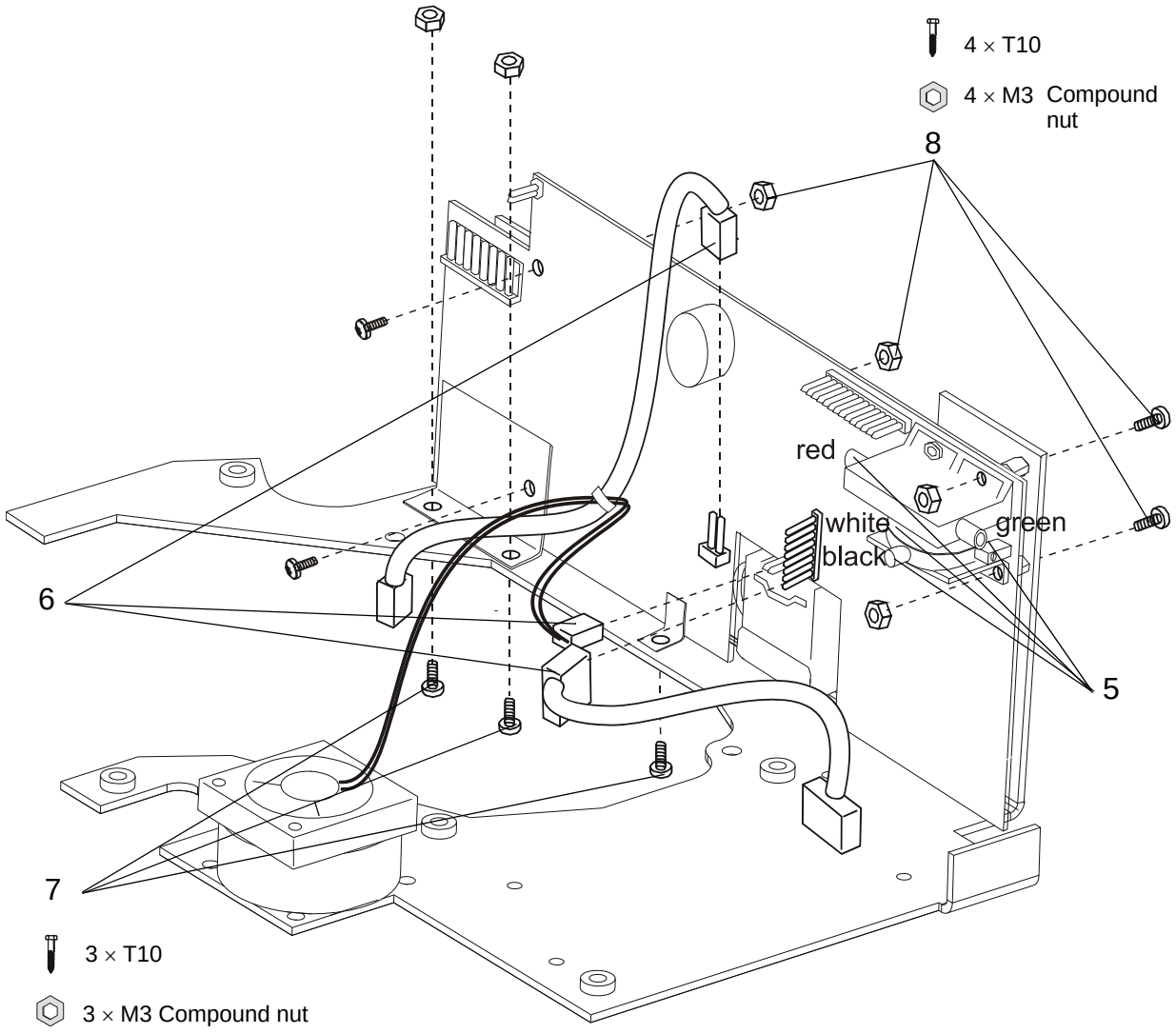
5 Disconnect the patient air and sensor tubing from the sensor connectors on the MDA board.

6 Disconnect the external DC cable, the fan cable and the DC control cable from the MDA board.

7 Turn the base plate upside down and remove the 3 screws that fix the MDA board to the bottom of the plate.

8 Remove the 4 screws that fix the MDA board to the rear part of the base plate.

9 Lift up the MDA board from the base plate.



To reassemble the MDA board:

- Reassemble in reverse order.

4 CALIBRATION INSTRUCTIONS

This chapter describes how to adjust and verify the pressure, flow and high pressure limit sensors of the PV 101+/PV 102+ device.

4.1 Requirements

- The calibration should be made every 12 months or after 15,000 operating hours.
- Keep the power cord of the PV 101+/PV 102+ connected to the mains power during the calibration.

Always use caution when working with the device connected to the mains and the casing removed.

Always check and adjust the patient settings to the prescribed values after you have calibrated the PV 101+/PV 102+.

4.2 Equipment

Make sure you have the following equipment to hand:

- Screwdriver for the calibration screws (∅ 1 mm)

Pressure calibration

- Flow restrictor nipple 6 mm, BREAS part number 000997
- Flow restrictor nipple 5 mm, BREAS part number 003311
- Voltmeter
- Syringe with a y-piece tube
- Pressure gauge, 0–70 mbar

Flow calibration

- Flow restrictor 6 mm, BREAS part number 000997
- Voltmeter

High pressure limit calibration

- Flow restrictor nipple 4 mm, BREAS part number 003312
- Fan control unit, BREAS part number 003302
- Pressure gauge, 0–70 mbar

4.3 Calibrating the pressure sensor

1 Start the PV 101+/PV 102+ device by pressing the I/O button and the **+** button at the same time.

2 Remove the casing (see section 3.2). Keep the CPU board connected to the MDA board.

3 Use the voltmeter to measure the voltage on pin 9 on the analogue/digital output connector on the rear panel of the PV 101+/PV 102+.

4 Adjust the screw on the P203 (Offset) potentiometer on the MDA board until the voltage is 1V.

5 Connect the pressure gauge to the syringe and the y-piece tube. Remove the black tube from the pressure sensor on the MDA board. Connect the free end of the y-piece tube to the pressure sensor.

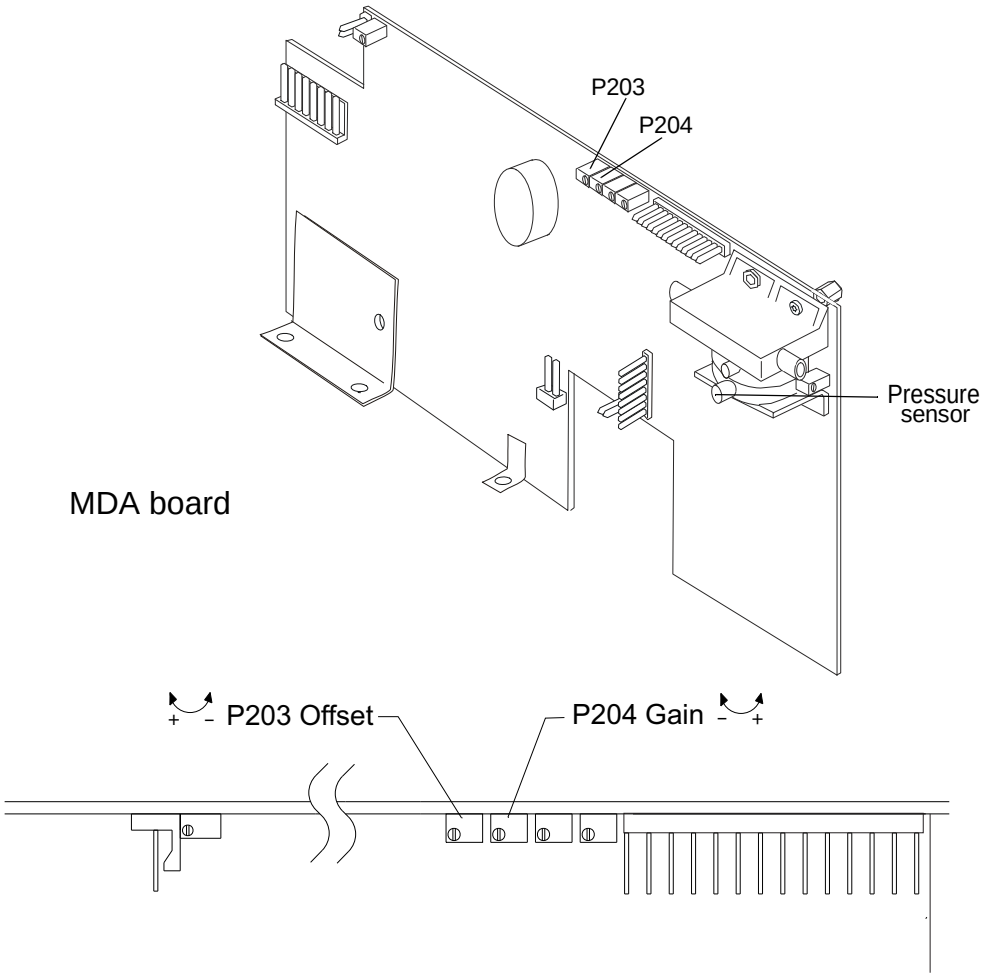
6 Use the syringe to create a pressure of 30 mbar ±0.5 mbar.

7 Adjust the screw on the P204 (Gain) potentiometer on the MDA board until the voltage is 4 V.

8 Remove the y-piece tube from the MDA board's pressure sensor and reconnect the black tube.

9 Repeat step 4 to 8 until no further adjustment is necessary.

10 Remove the equipment. Continue with the pressure verification procedure (see section 4.4).



4.4 Verifying the pressure calibration

1 Start the PV 101+/PV 102+.

2 Remove the casing (see section 3.2).

3 Connect a pressure gauge to the patient air inlet and arrange a leakage with a 5 mm flow restrictor (see diagram below).

4 Set both the IPAP and EPAP pressure to 20 mbar.

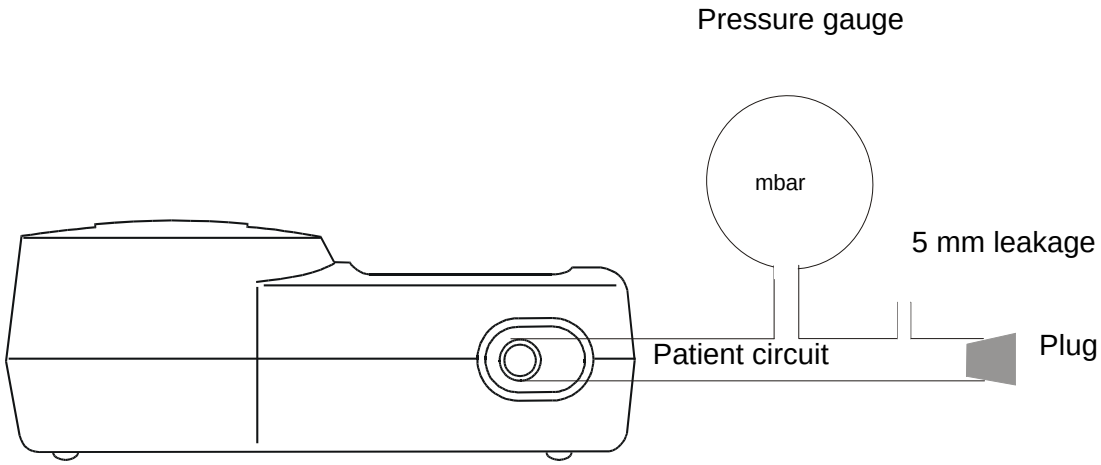
5 Check that the pressure rises to 20 mbar ±1 mbar. If not, the P204 potentiometer must be adjusted.

6 Set both the IPAP and EPAP pressure to 4 mbar.

7 Check that the pressure rises to 4 mbar ±0.5 mbar. If not, the P203 potentiometer must be re-adjusted.

8 If necessary, repeat the pressure calibration procedure (see section 4.3).

9 Remove the equipment and reassemble the casing (see section 3.2).

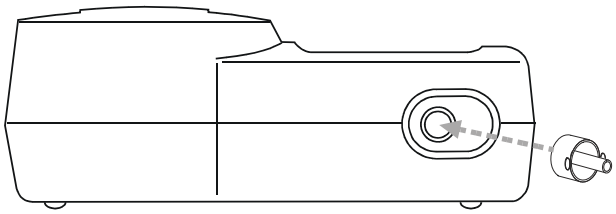


4.5 Calibrating the flow sensor

Always calibrate the pressure sensor before you calibrate the flow sensor. Calibrating the flow sensor first may lead to unreliable results.

1 Start the PV 101+/PV 102+ device by pressing the I/O button.

2 Plug the patient air outlet with a 6 mm flow restrictor nipple.



3 Set both the IPAP and EPAP pressure to 12 mbar.

4 Remove the casing (see section 3.2). Keep the CPU board connected to the MDA board.

5 Use the voltmeter to measure the voltage on pin 8 on the analogue/digital output connector on the rear panel of the PV 101+/PV 102+.

6 Adjust the screw on the P201 (Gain) potentiometer on the MDA board until the voltage is 2.15 V (±0.15 V).

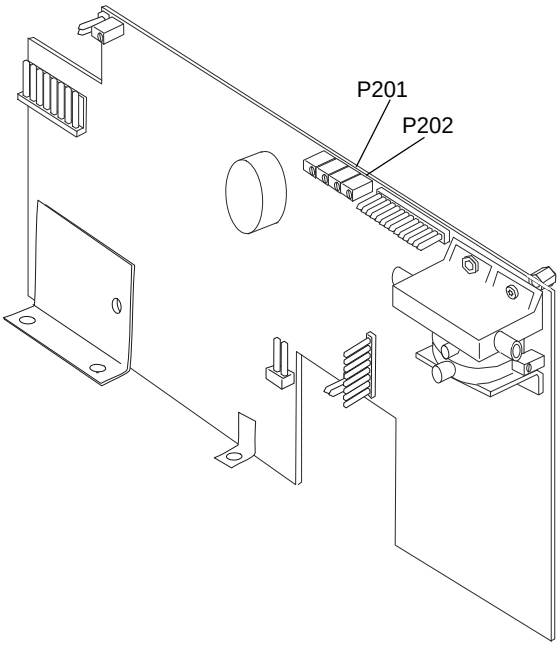
7 Block the air outlet to completely stop the air flow.

8 Adjust the screw on the P202 (Offset) potentiometer on the MDA board until the voltage is 0.5 V (±0.05 V).

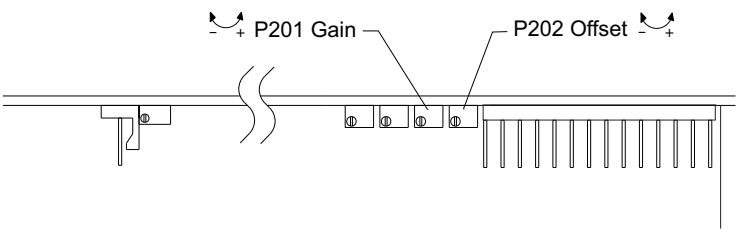
9 Remove the air flow blockage.

10 Repeat step 6 to 9 until no further adjustment is necessary.

11 Remove the equipment and reassemble the casing.



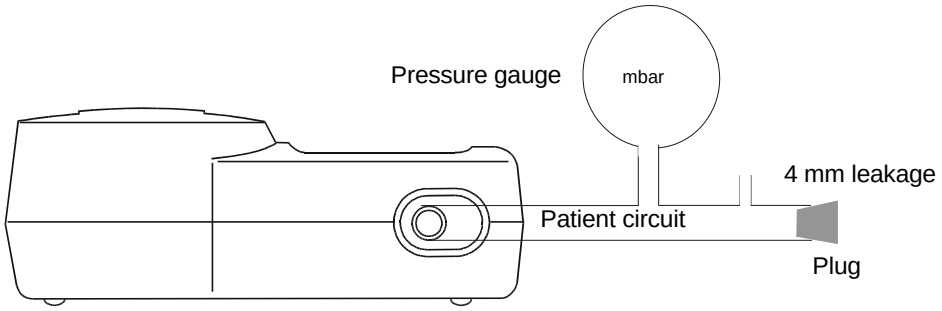
MDA board



4.6 Calibrating the high pressure limit

1 Start the PV 101+/PV 102+ by pressing the I/O button.

2 Connect a pressure gauge to the patient air inlet and arrange a leakage with a 4 mm flow restrictor nipple (see figure).



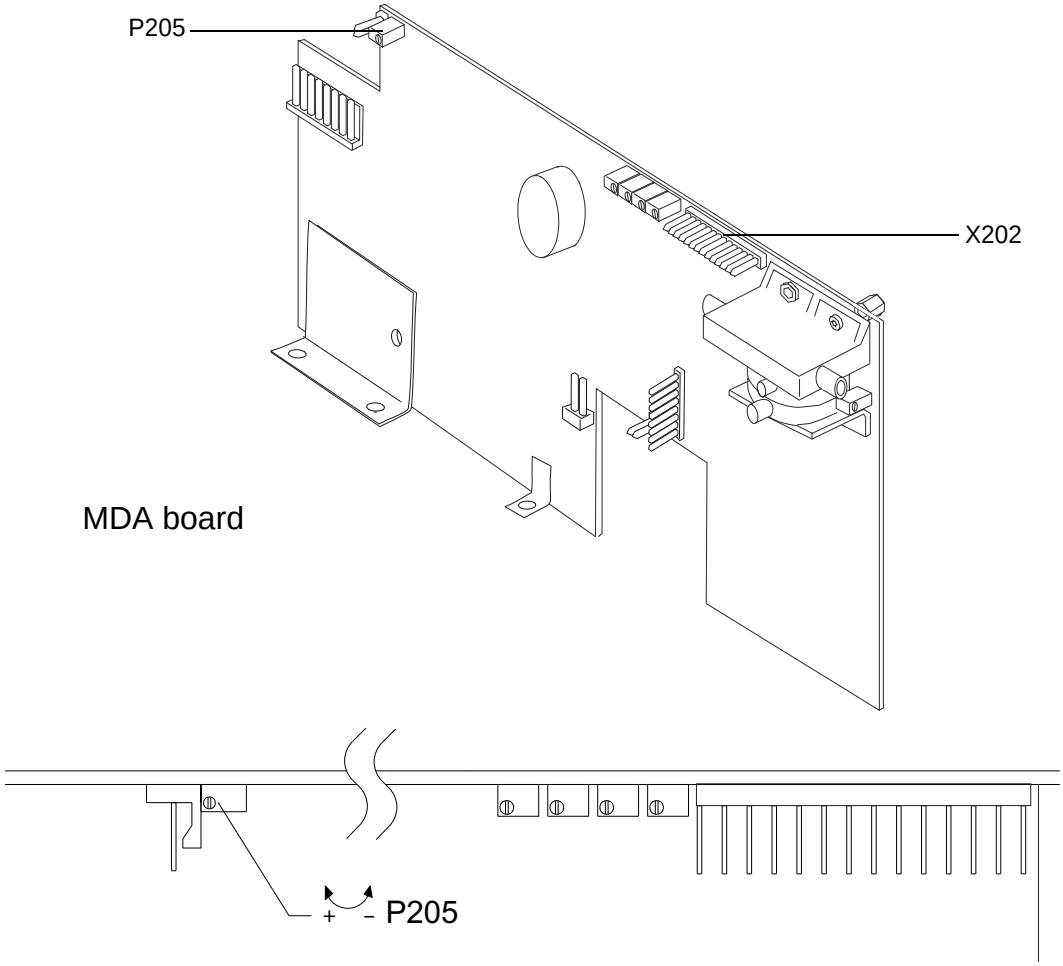
3 Remove the casing (see section 3.2). Disconnect the CPU board from the MDA board.

4 Connect the manual fan control unit to the X202 connector on the MDA board.

5 Use the fan control unit to start the PV 101+/PV 102+ blower at full speed.

6 Adjust the screw on the P205 potentiometer on the MDA board until the pressure measured on the pressure gauge is 40 mbar (±1 mbar).

7 Remove the equipment and reassemble the casing.

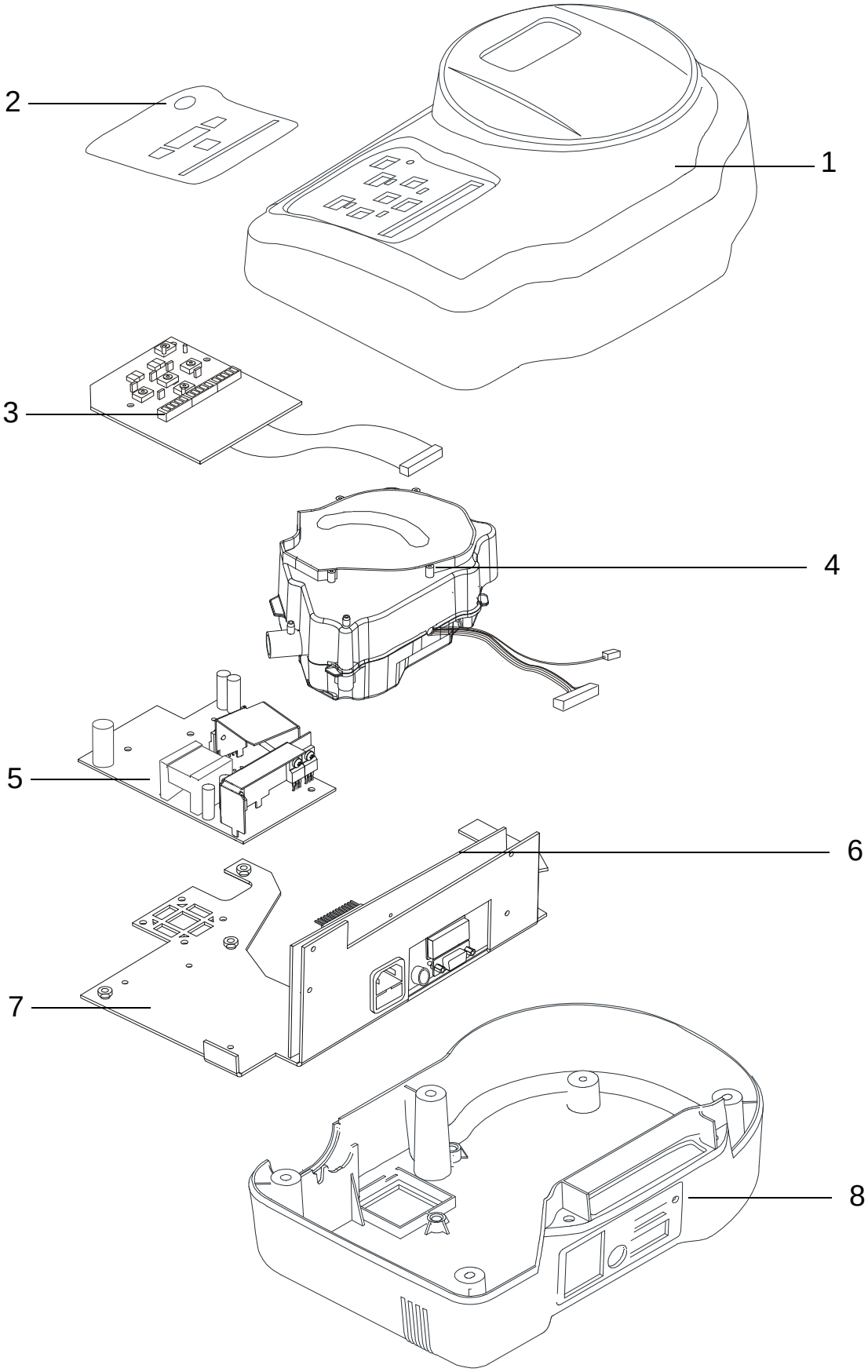


5 PARTS DRAWINGS AND PART-NUMBER LISTS

This chapter contains enlarged drawings and part-number lists of the PV 101+/PV 102+. The main components of the device are displayed at the beginning of the chapter.

Some of the listed parts can be ordered as replacement parts from BREAS. Please contact your BREAS supplier for more information.

5.1 Overview – Main components

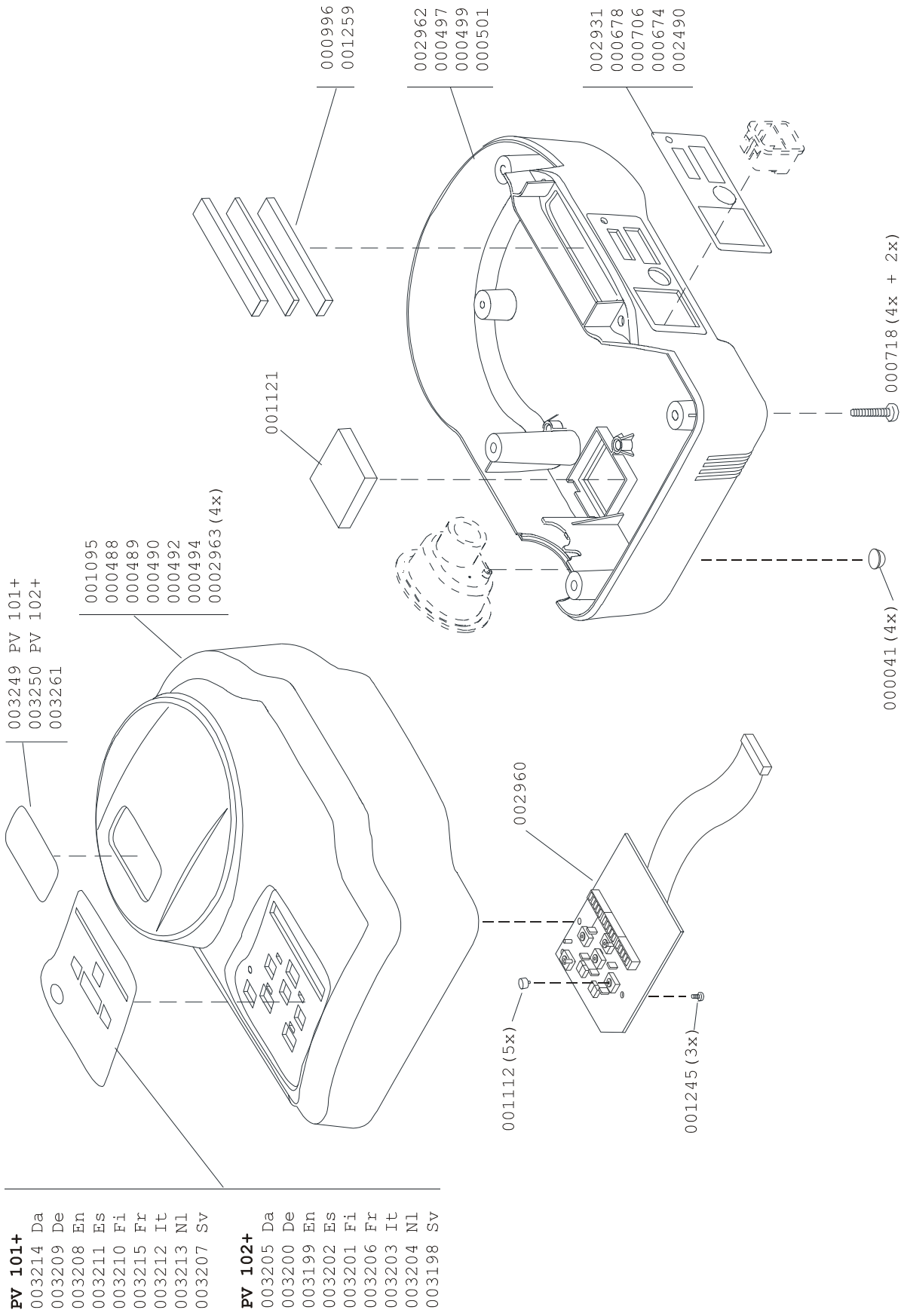


No	Description	Location
1	Upper casing	
2	Push-button overlay	On the upper casing
3	CPU board	In the upper casing
4	Blower unit, incl. motor	Mounted on base plate
5	Power board	Mounted to bottom of base plate
6	MDA board	Mounted to rear of base plate
7	Base plate	In the lower casing
8	Lower casing	

5.2 Parts drawings

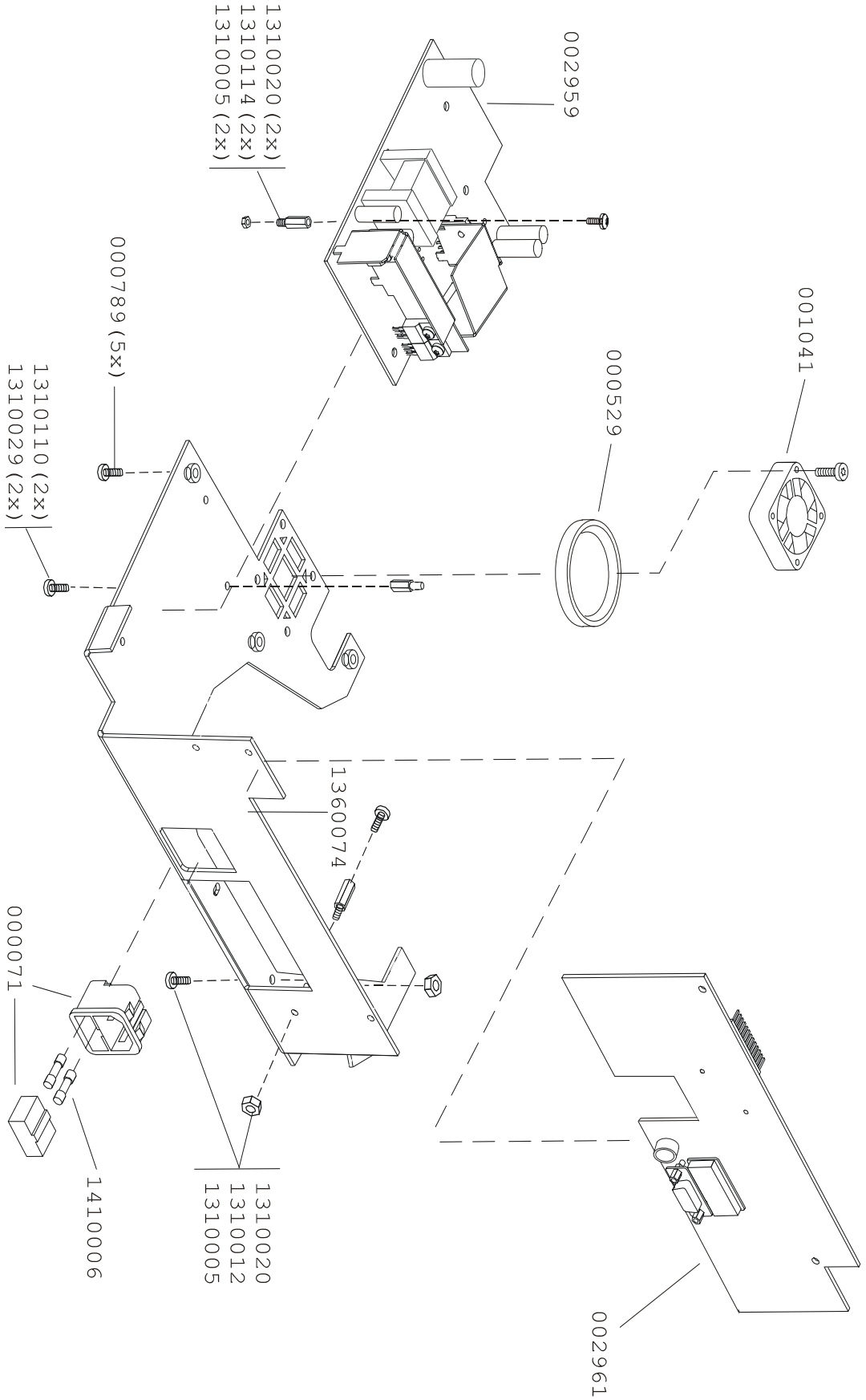
5.2.1 Parts drawing – Upper and lower casing

For definitions of the part numbers, refer to the list in section 5.3.1.



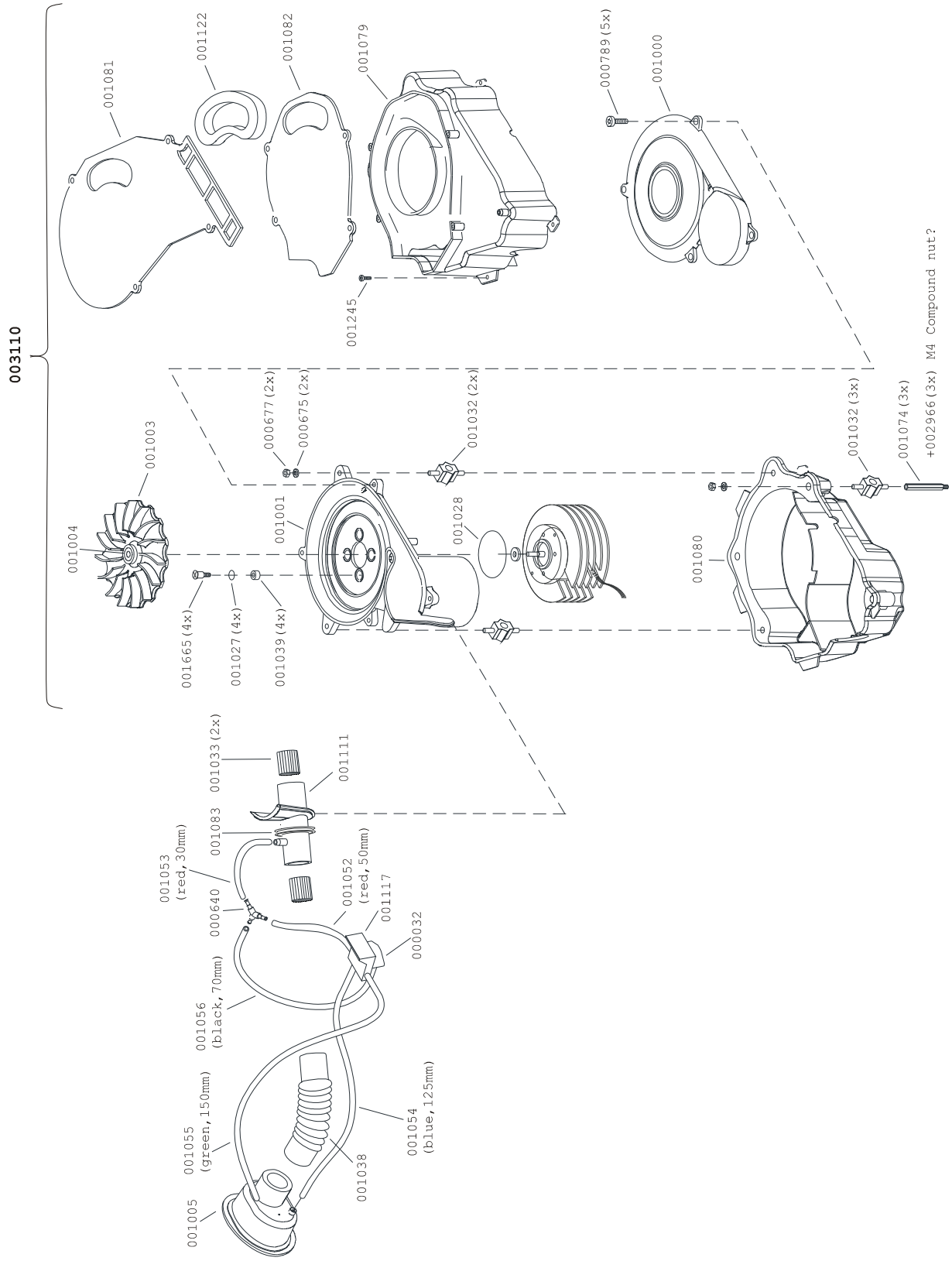
5.2.2 Parts drawing – Main assembly

For definitions of the part numbers, refer to the list in section 5.3.2.



5.2.3 Parts drawing – Blower unit and patient air outlet

For definitions of the part numbers, refer to the list in section 5.3.3.



5.3 Part-number lists

5.3.1 Part-number list – Upper and lower casing

BREAS Part no.	Definition
000041	Rubber mount
000488	Absorbent, dwg 10646-1 (T2), outer edge upper casing push-buttons
000489	Absorbent, dwg 10646-2 (T2), outer edge inlet bend
000490	Absorbent, dwg 10646-3 (T2), outer edge inlet
000492	Absorbent, dwg 10646-5 (T2), outer edge outer wall
000494	Absorbent, dwg 10646-7 (T2), outer edge upper casing inlet
000497	Absorbent, dwg 10647-3 (T2) outer edge lower casing outer wall
000499	Absorbent, dwg 10647-5 (T2) outer edge lower casing outer wall
000501	Absorbent, dwg 10647-7 (T2) outer edge lower casing outer wall
000674	M4, wing nut
000678	M4, lock nut
000706	Power cord strain relief
000718	Screw, MRX steel M5 x 12 fzb POZ
000996	Filter PV 101+/PV 102+, washable (2 pcs)
001095	Outer casing, upper
001112	Button for CPU board
001121	Filter 45 x 45 x 10 for cooling fan
001245	Screw, RX-PT 4-20*6 fzb
001259	Filter, disposable (5 pcs)
002490	Screw Mrt M4x14 fzb
002931	Overlay, back panel PV 101+/PV 102+
002960	CPU board PV 101+/PV 102+
002962	Lower casing PV 101+/PV 102+
002963	Screw Rts St 3.5 X 6.5, PV 101+/PV 102+
003198	Overlay, PV 102+ setting panel, Swedish
003199	Overlay, PV 102+ setting panel, English
003200	Overlay, PV 102+ setting panel, German
003201	Overlay, PV 102+ setting panel, Finnish
003202	Overlay, PV 102+ setting panel, Spanish
003203	Overlay, PV 102+ setting panel, Italian
003204	Overlay, PV 102+ setting panel, Dutch

BREAS Part no.	Definition
003205	Overlay, PV 102+ setting panel, Danish
003206	Overlay, PV 102+ setting panel, French
003207	Overlay, PV 101+ setting panel, Swedish
003208	Overlay, PV 101+ setting panel, English
003209	Overlay, PV 101+ setting panel, German
003210	Overlay, PV 101+ setting panel, Finnish
003211	Overlay, PV 101+ setting panel, Spanish
003212	Overlay, PV 101+ setting panel, Italian
003213	Overlay, PV 101+ setting panel, Dutch
003214	Overlay, PV 101+ setting panel, Danish
003215	Overlay, PV 101+ setting panel, French
003249	Decal, PV 101+ logo
003250	Decal, PV 102+ logo
003261	Sticker “Plus”

5.3.2 Part-number list – Main assembly

BREAS Part no.	Definition
000071	Mains input socket
000529	Spacer cooling fan PV 101+/PV 102+
000789	Bolt MRX-H-M4x12H fzb
001041	Fan (cooling air PV 101+/PV 102+)
002959	Power board PV 101+/PV 102+
002961	MDA board PV 101+/PV 102+
1310005	(Eribel part no) M3 Compound nut
1310011	(Eribel part no) DSS M3050x8 Spacer
1310012	(Eribel part no) 5 mm DSUB Spacer
1310020	(Eribel part no) MRXZ 3x6 Steel Screw
1310029	(Eribel part no) RXS-Z ST2, 9x9, 5 Screw
1310110	(Eribel part no) Spacer with securing pin, 10 mm
1310114	(Eribel part no) DSS M3050x10 Spacer
1360074	(Eribel part no) Base plate PV 101+/PV 102+
1410006	Mains power fuse, 110–220V, 1A T 5x29 mm

5.3.3 Part-number list – Blower unit and patient outlet

BREAS Part no.	Definition
000032	Pressure sensor - MPX 10 DP
000640	Y-connector
000675	M4, Serrated washer
000677	Nut, M6M M4 Metal fzb
000789	Bolt MRX-H-M4x12H fzb
001000	Blower cover, upper
001001	Blower cover, lower with silencer
001003	Blower fan wheel
001004	Bushing, blower fan wheel
001005	Patient air inlet
001027	O-ring 7.66 x 1.78
001028	O-ring 38 x 1
001032	LF isolator
001033	Honeycomb material
001038	Flex tube ∅ 22 x 15 mm
001039	Silicon tube, 5 x 8 mm (blue/green)
001052	Silicon tube, 50 mm (red)
001053	Silicon tube, 30 mm (red)
001054	Silicon tube, 125 mm (blue)
001055	Silicon tube, 150 mm (green)
001056	Silicon tube, 70 mm (black)
001074	Spacer DSSM4070x25
001079	Blower casing, upper
001080	Blower casing, lower
001081	Sealing cover for upper casing
001082	Sealing cover for upper blower casing
001083	Rubber bushing
001111	Blower casing outlet 22 mm
001117	Flow sensor AWM2100V
001122	Seal for upper blower casing
001245	Screw, RX-PT 4-20*6 fzb
001665	Shoulder screw M4 4,3
002966	Compound nut M4, PV 101+/PV 102+

BREAS Part no.	Definition
003110	Turbine Exchange kit PV 101+/PV 102+

5.3.4 Part-number list – Miscellaneous

BREAS Part no.	Definition
000245	Hytrel patient tube
000491	Absorbent, dwg 10646-4 (T2) outer edge outer wall
000503	Absorbent, dwg 10648-1 (T2) inner edge upper casing outer wall
000504	Absorbent, dwg 10648-2 (T2) inner edge upper casing round
000505	Absorbent, dwg 10648-3 (T2) inner edge upper casing U
000506	Absorbent, dwg 10648-4 (T2) inner edge upper casing bottom
000507	Absorbent, dwg 10648-5 (T2) inner edge upper casing outer
000508	Absorbent, dwg 10648-6 (T2) inner edge upper casing outer
000509	Absorbent, dwg 10648-7 (T2) inner edge upper casing outer
000510	Absorbent, dwg 10648-8 (T2) inner edge upper casing outer
000511	Absorbent, dwg 10649-1 (T3) inner edge lower casing inner
000512	Absorbent, dwg 10649-2 (T3) inner edge lower casing inner
000522	Absorbent dwg 10665-1 silencer 1001 round
000523	Absorbent dwg 10665-2 silencer 1001 inside
000711	Cable tie 71 mm
000997	Flow restrictor nipple 6 mm
001073	Washer, 12 x 5 x 2
001934	Thommen HM 28 digital manometer
002965	Screw Mrt M5 X 12 Torx, PV 101+/PV 102+
002973	PV 101+ Operating manual, Swedish
002974	PV 101+ Operating manual, German
002975	PV 101+ Operating manual, Finnish
002976	PV 101+ Operating manual, English
002977	PV 101+ Operating manual, Norwegian
002978	PV 101+ Operating manual, Spanish
002979	PV 101+ Operating manual, Italian
002980	PV 101+ Operating manual, Dutch
002981	PV 101+ Operating manual, Danish

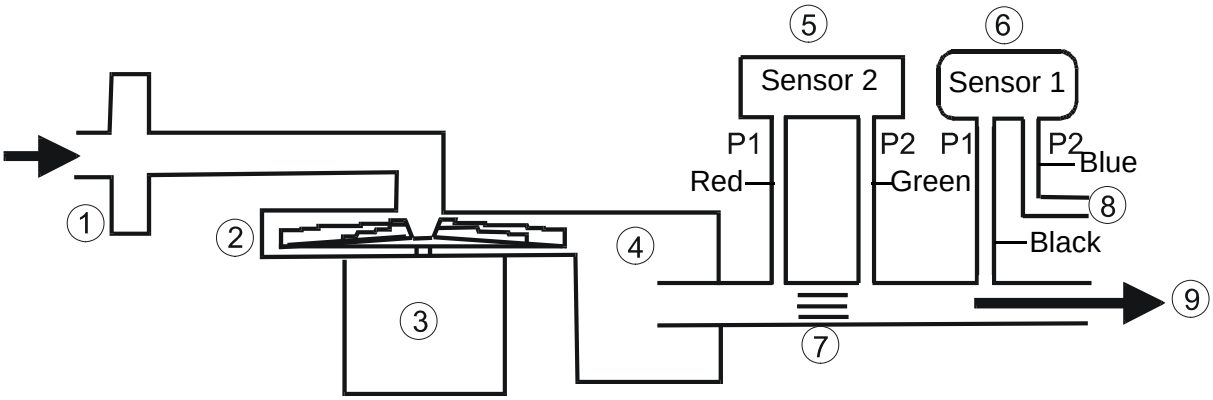
BREAS Part no.	Definition
002983	PV 101+ Operating manual, Portuguese
002982	PV 101+ Operating manual, French
002984	PV 101+ Operating manual, Greek
002985	PV 101+ Operating manual, Polish
002986	PV 102+ Operating manual, Swedish
002987	PV 102+ Operating manual, German
002988	PV 102+ Operating manual, Finnish
002989	PV 102+ Operating manual, English
002990	PV 102+ Operating manual, Norwegian
002991	PV 102+ Operating manual, Spanish
002992	PV 102+ Operating manual, Italian
002993	PV 102+ Operating manual, Dutch
002994	PV 102+ Operating manual, Danish
002995	PV 102+ Operating manual, French
002996	PV 102+ Operating manual, Portuguese
002997	PV 102+ Operating manual, Greek
002998	PV 102+ Operating manual, Polish
003036	EMC-protection, Flow meter
003116	Screw K6sf M4x16mm
003220	Connector
003221	Connector element
003243	PV 101+ Operating manual, Japanese
003244	PV 102+ Operating manual, Japanese
003259	PV 101+/PV 102+ Service manual, English
003302	Fan control unit
003311	Flow restrictor nipple 5 mm
003312	Flow restrictor nipple 4 mm

6 FUNCTIONAL DIAGRAMS

This chapter contains a diagram of the pneumatic system of the ventilator and a block diagram of the PV 101+/PV 102+'s functions.

6.1 Pneumatic diagram

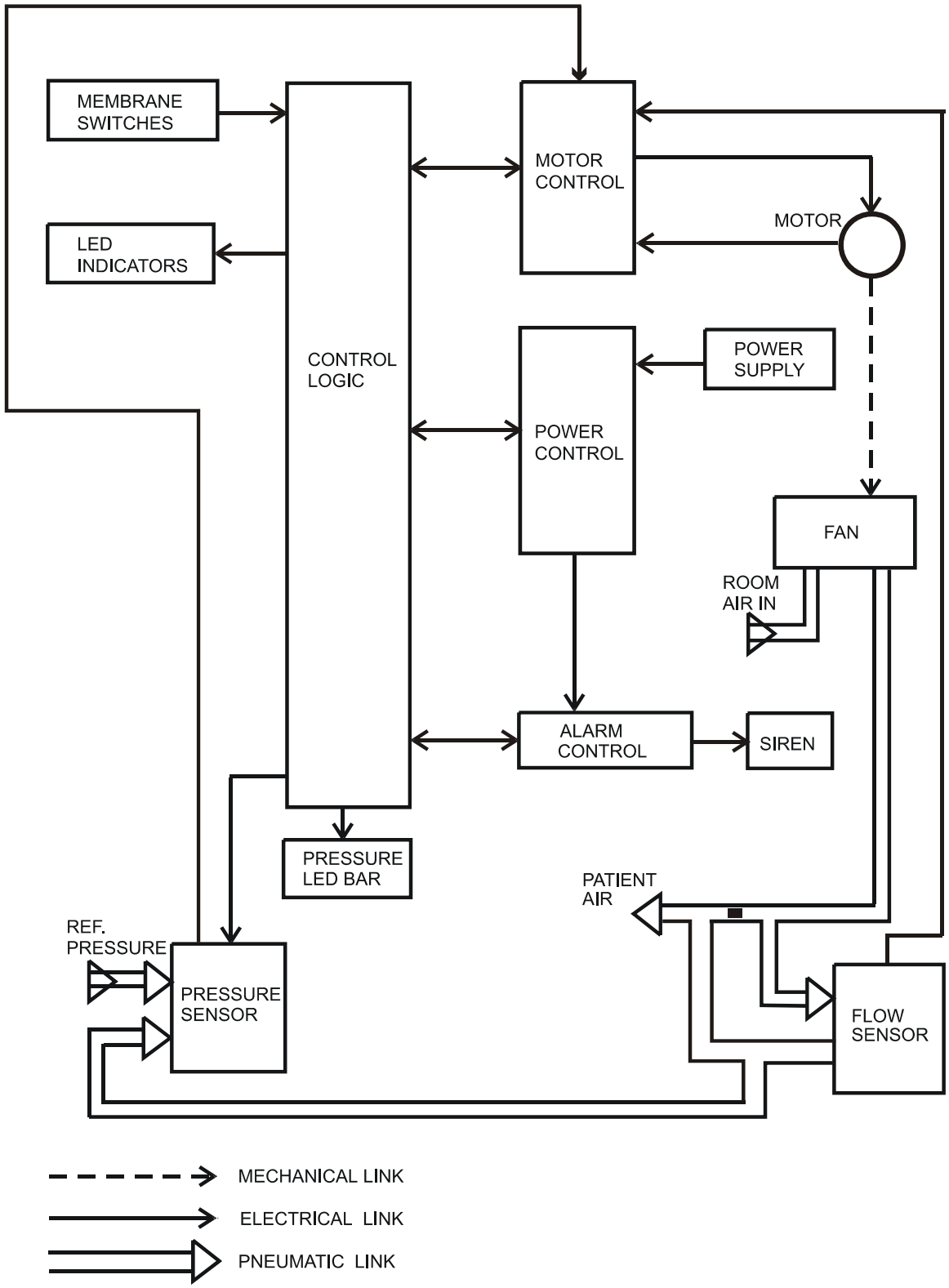
The pneumatic diagram shows the pneumatic components of the air circulation system of the PV 101+/PV 102+.



No.	Description
1	Patient air inlet (through air filter)
2	Blower
3	Motor
4	Silencer
5	Flow sensor (2)
6	Pressure sensor (1)
7	Honeycomb material
8	Reference pressure tube
9	Patient air tube

6.2 Functional block diagram

The block diagram below shows how the electronics are designed and how they are connected to the other components.

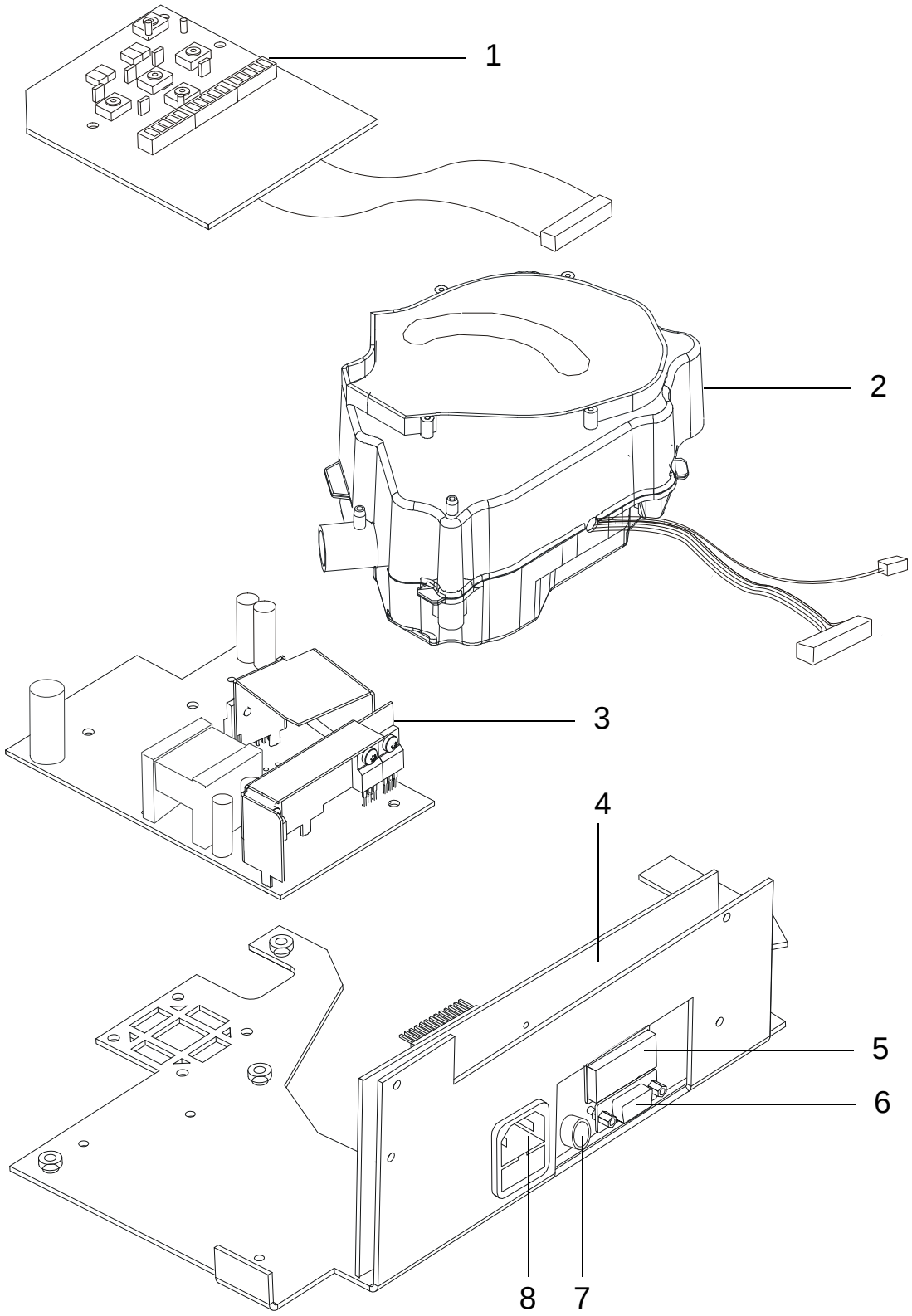


7 ELECTRONICS

This chapter describes in detail the electronics of the PV 101+/PV 102+. It also contains circuit diagrams and component location drawings for the circuit boards of the machine.

7.1 Electronics – Main components

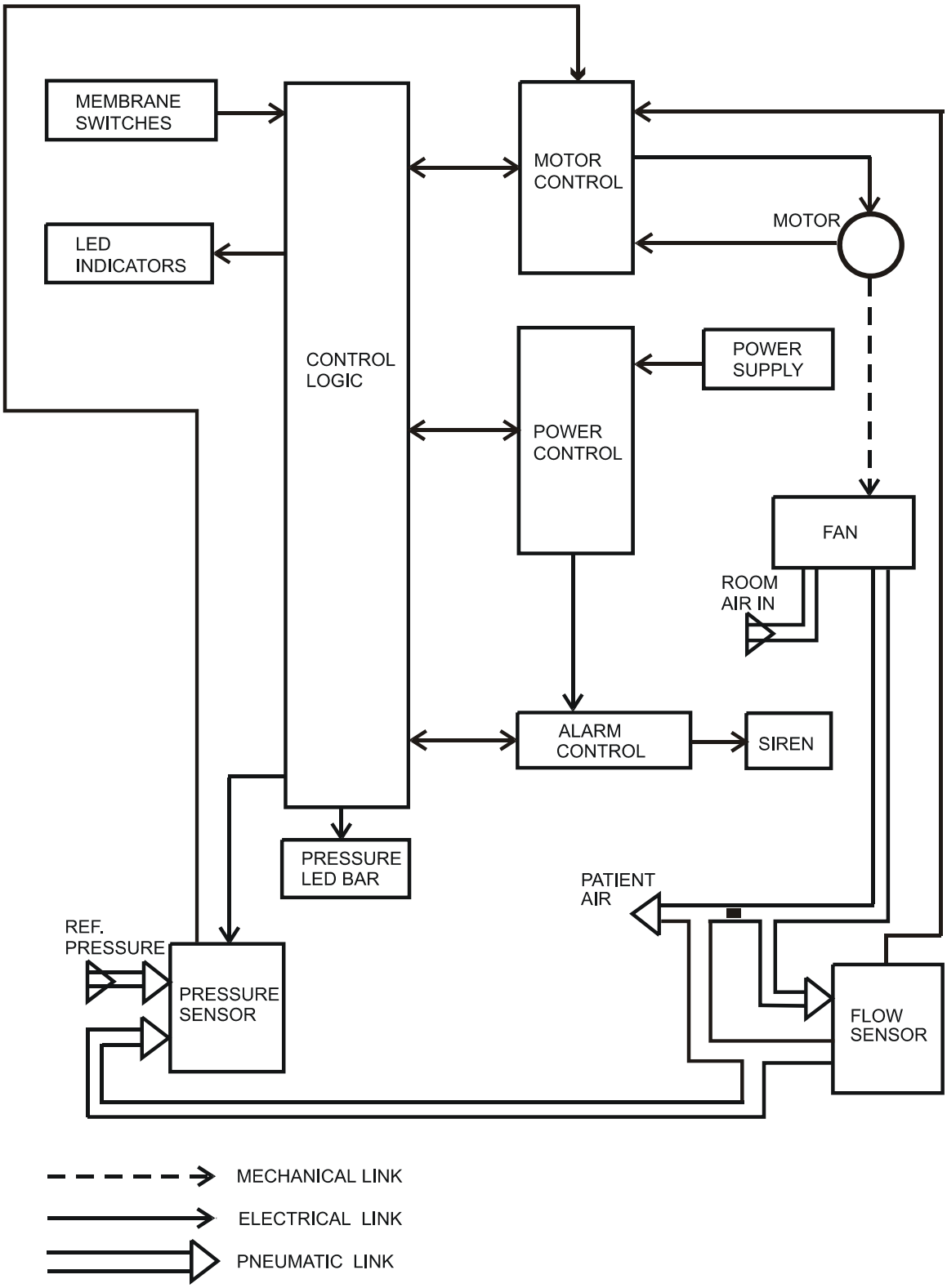
The electronics in the PV 101+ and the PV 102+ comprises a blower unit and three printed circuit boards: the CPU board, the power board and the MDA board.



No	Description	Location
1	CPU board	In the upper casing
2	Blower unit, incl. motor	Mounted on base plate
3	Power board	Mounted to bottom of base plate
4	MDA board	Mounted to rear of base plate
5	Hour counter	Mounted to MDA board
6	Analogue/digital connection	Mounted to MDA board
7	Battery connection	Mounted to rear of MDA board
8	Power connection	Mounted to rear of base plate

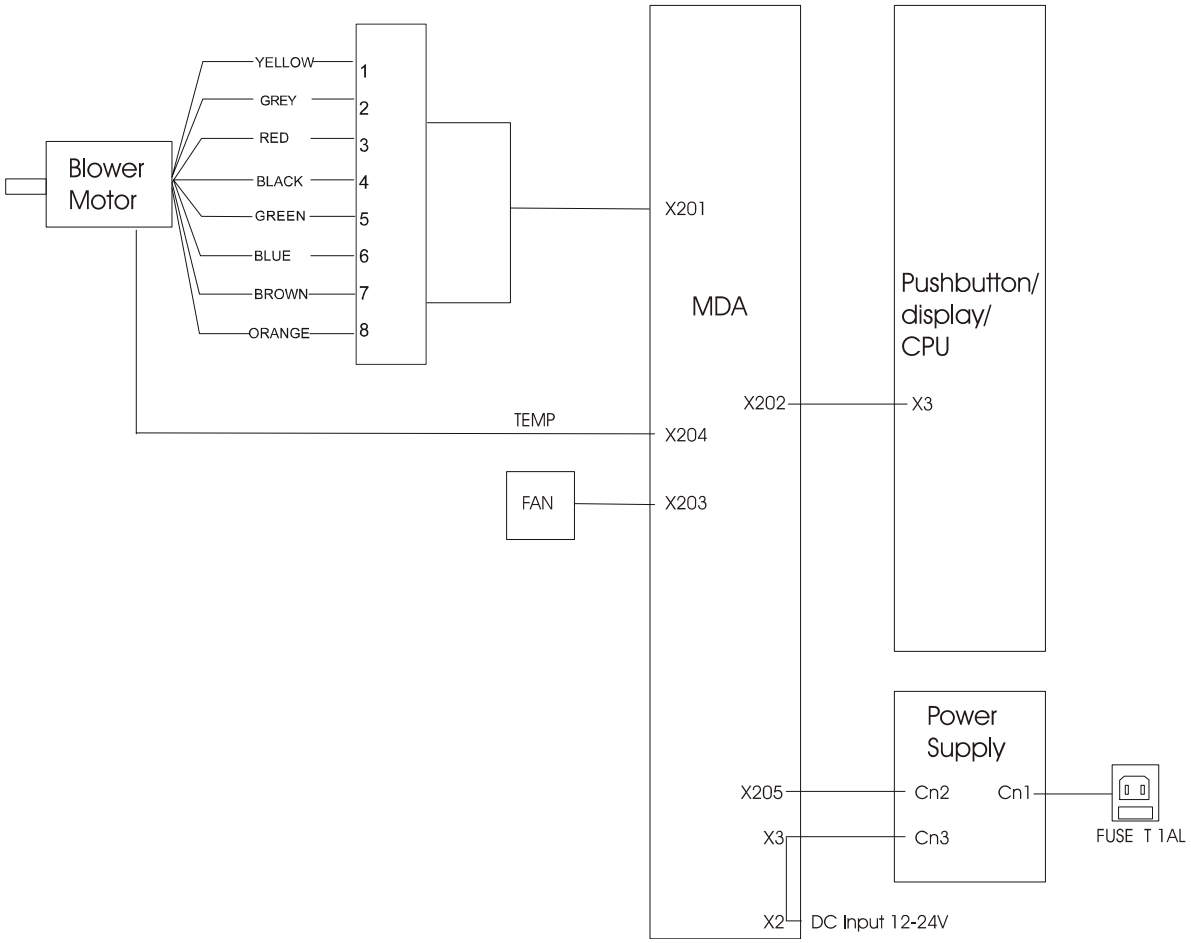
7.2 Functional block diagram

The block diagram below shows on an overall level how the electronics are designed and how they are connected to the other components.



7.3 Internal wiring diagram

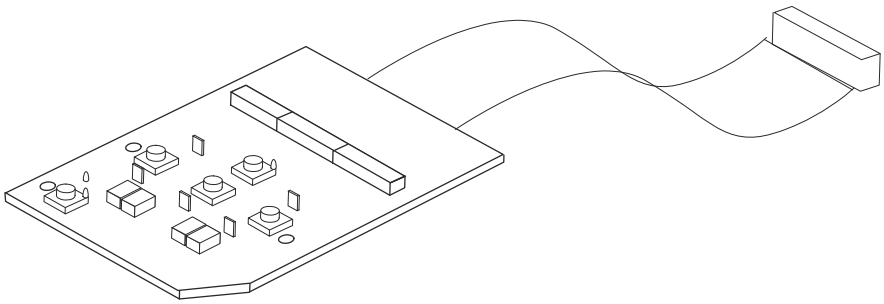
The wiring diagram displays the internal cabling and connections of the electronics.



7.4 Circuit board descriptions

This section contains detailed descriptions and figures of the PV 101+/PV 102+'s circuit boards.

7.4.1 CPU board

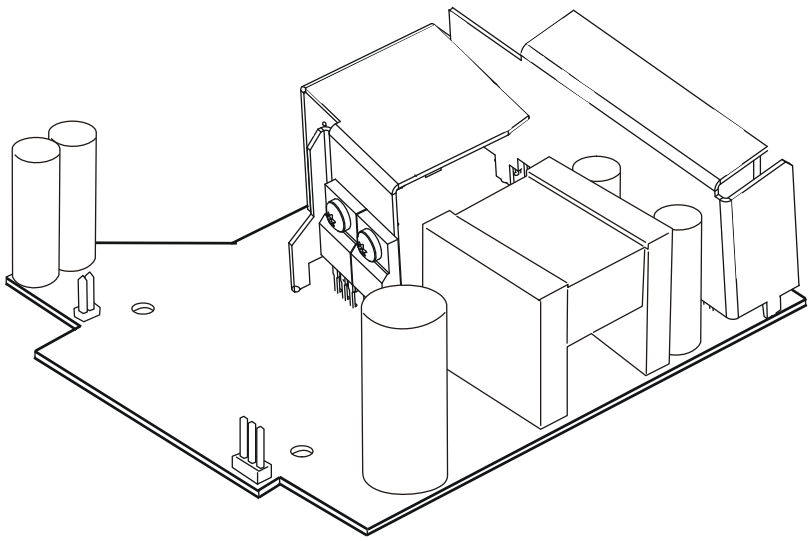


All the push-buttons are mounted on the CPU board together with the LEDs and the three bar-graphs for pressure display. Also mounted here is the four 7-segment displays for the rise time and backup rate displays (PV 102+).

The microprocessor with its software is also located here, as well as an internal memory (DALLAS) for the logging and storage of the patient usage data.

Refer also to the circuit diagrams (See section 7.6.1, 7.6.2, 7.6.3, 7.6.4 and 7.6.5) and component location drawings (See section 7.7.1).

7.4.2 Power board

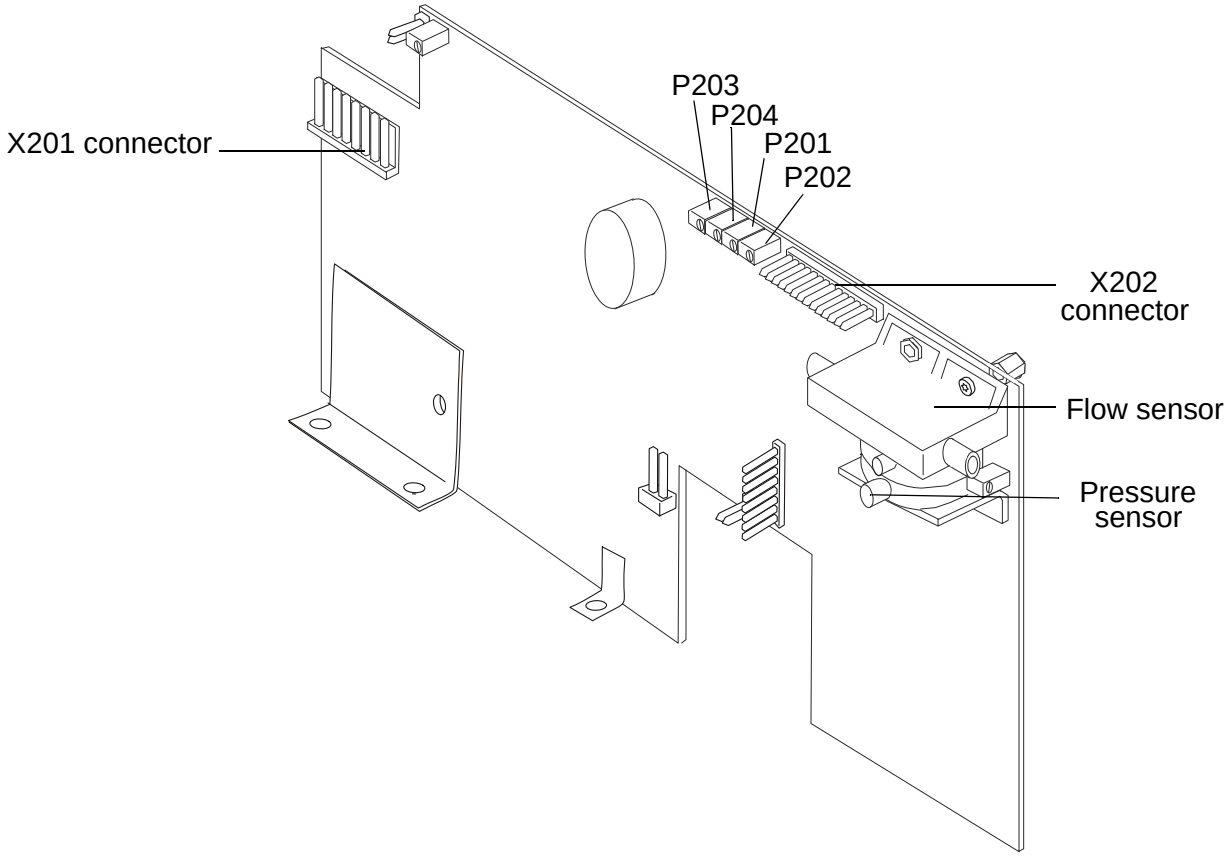


The power supply unit is fed primarily with mains power via the mains power inlet to the internal AC/DC converter. Secondly, the power board can be fed with 12–24 DC via the external battery input.

Refer also to the circuit diagrams (See section 7.6.6 and 7.6.7) and component location drawings (See section 7.7.2 and 7.7.3).

The power supply has mains power as soon as the power cord is connected.

7.4.3 MDA board



The MDA (motor drive assembly) board comprises the driver stage for the blower motor, the pressure sensor, the flow sensor, the hour counter and the D-shell connector for serial communication.

The driver stage is built around the U205 control circuit and the Q205–Q210 transistors.

The P21 buzzer is powered by the C221 supercap if the mains power supply should fail.

The pressure sensor, which is of the semi-conductor type, is amplified by U201. The off-set and gain can be adjusted using the P200 and P201 potentiometers. The signal is used for regulating the pressure.

The flow sensor is also of the semi-conductor type, a mass flow meter. The flow that passes the sensor is proportional to the flow through the flow resistance in the air tube from the blower. The offset and gain can be adjusted using the P202 and P203 trim potentiometers. The signal is used for initiating the trigger and the mask-off function.

Refer also to the circuit diagrams (See section 7.6.8, 7.6.9 and 7.6.10) and component location drawings (See section 7.7.4).

7.5 Electrical safety measurements

Electrical safety measurements must be made in accordance with EN 60 601-1. However, you can make an insulation resistance measurement instead of the voltage test specified by the standard. The measurements can be made using an automatic electrical safety tester. All tests must be performed in accordance with class II type BF.

Supply voltage

- Note the power voltage reading.

The voltage must be noted for each service check, as the currents measured are directly in relation to the supply voltage. This allows all measurements made on the same machine to be compared with measurements made on different occasions.

Insulation

- Measure the insulation resistance using a 500V DC power supply.

The most suitable method is to connect the plus lead to the two ventilator power socket pins and the minus lead to the casing or patient air connector.

The measurements made during the delivery inspection can be used as reference values for measurements made during future services. If no reference values are available, the value for the insulation resistance should be >20MΩ.

Leakage currents

- Measure the leakage currents at different parts of the ventilator using an RC circuit to ground.

The measurements are made partly at normal case (NC) and at the single fault condition (SFC). Reverse the polarity of the power supply and note the highest value.

The leakage currents to ground must not exceed the stated limit values.

Leakage currents from the casings

- Measure the leakage current of the casing at an unpainted point, for example, the head of a screw.

Limit values:	NC	< 0.1mA
	SFC	< 0.5mA

Break neutral for SFC.

Patient leakage currents

- Measure the patient leakage currents between the patient connector and ground.

Limit values:	NC	< 0.1mA
	SFC	< 0.5mA

Break neutral for SFC.

Leakage currents with mains power supply at the patient connected part

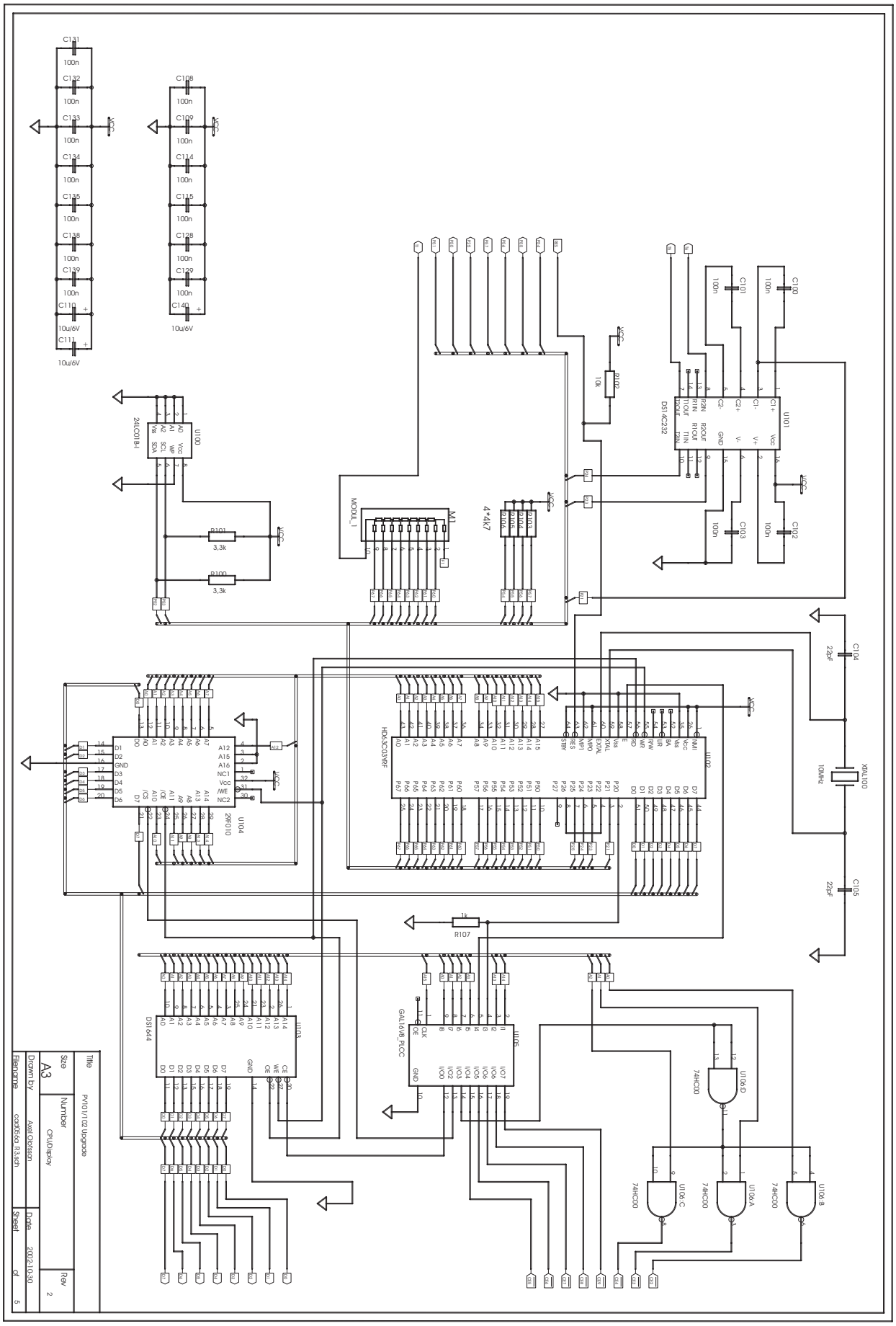
- Perform this test using an automatic electrical safety tester with this function.

See the safety instructions for the tester.

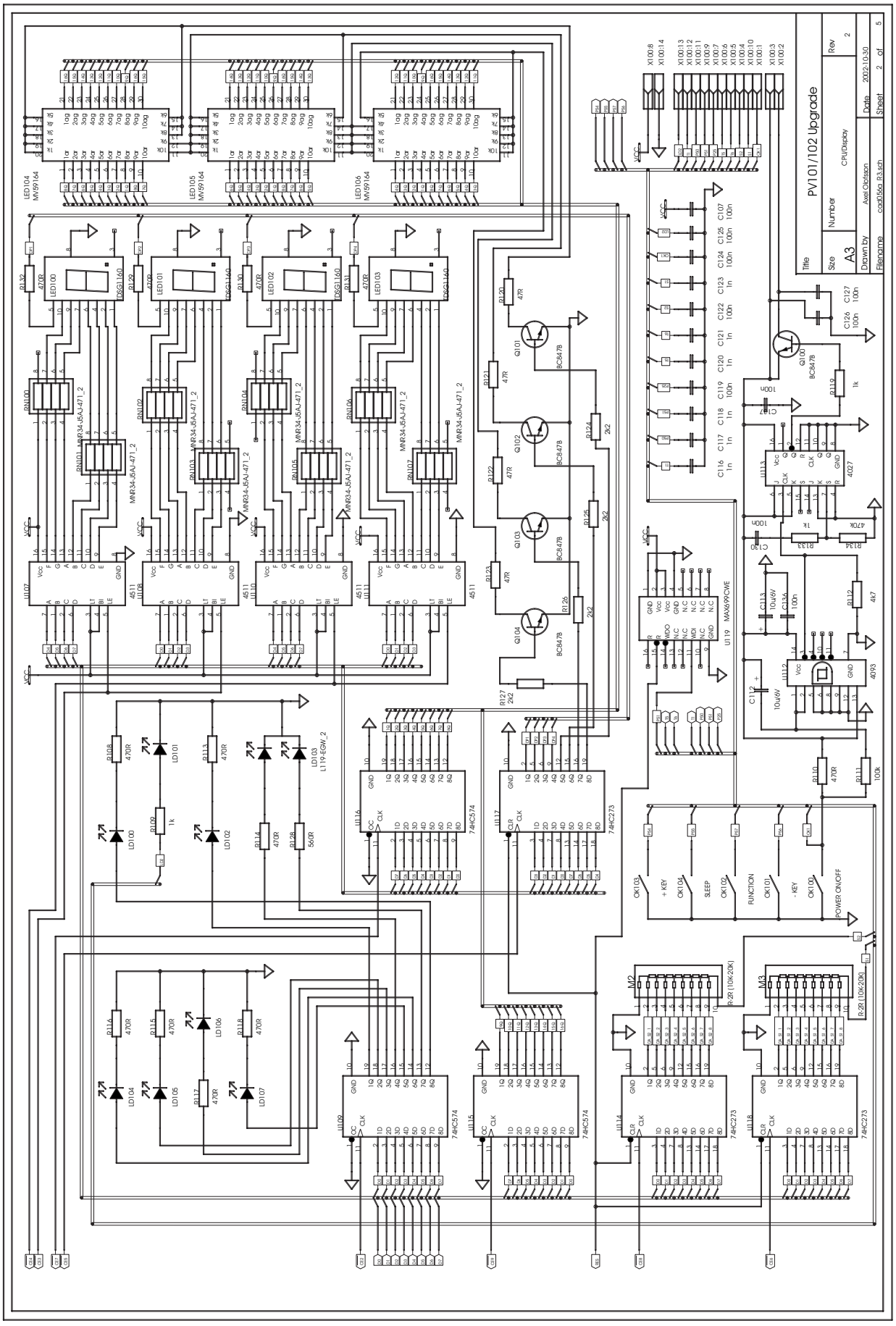
Limit value:	SFC	< 5mA

7.6 Circuit diagrams – Circuit boards

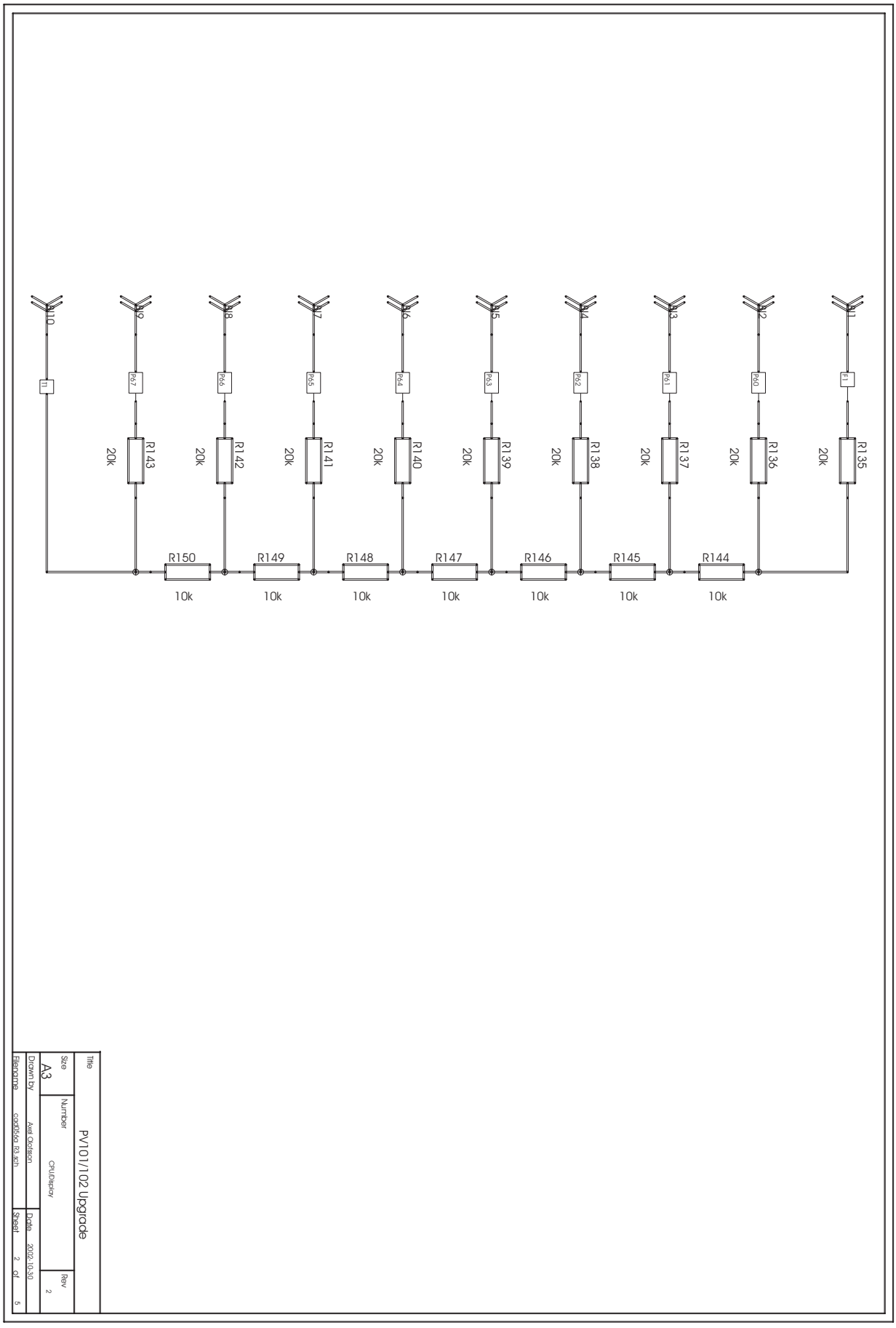
7.6.1 Circuit diagram – CPU board 1, rev 2



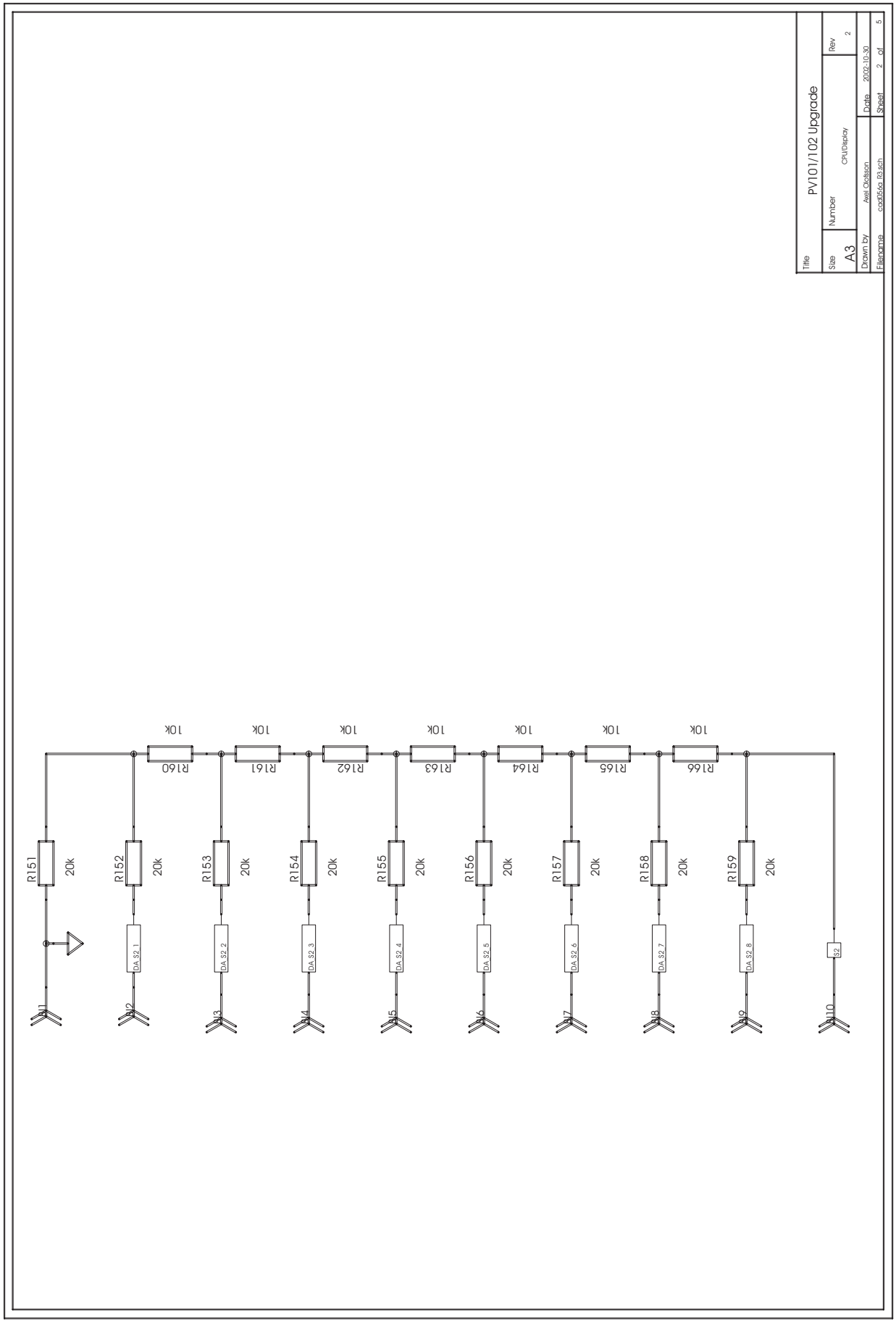
7.6.2 Circuit diagram – CPU board 2, rev 2



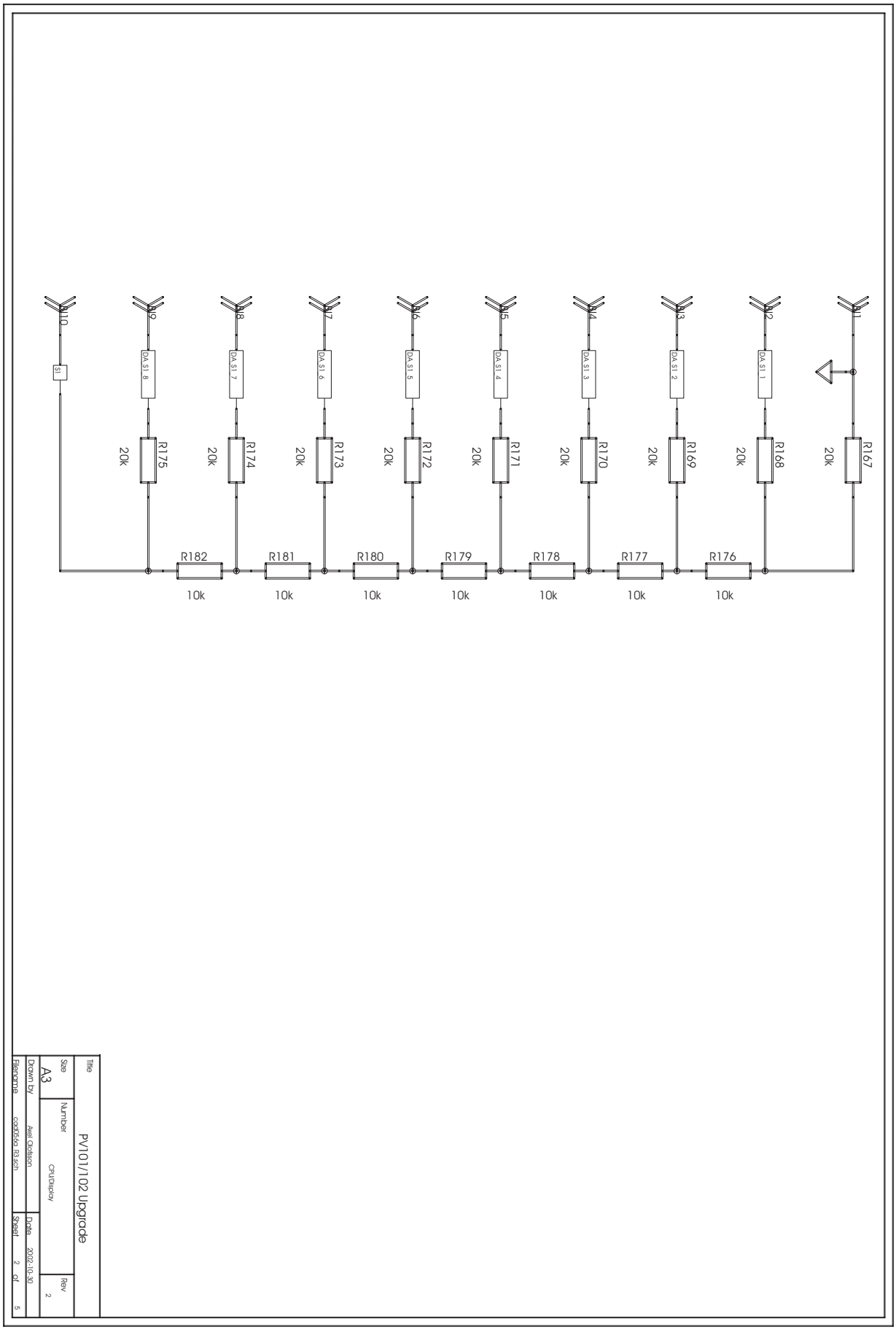
7.6.3 Circuit diagram – CPU board 3, rev 2



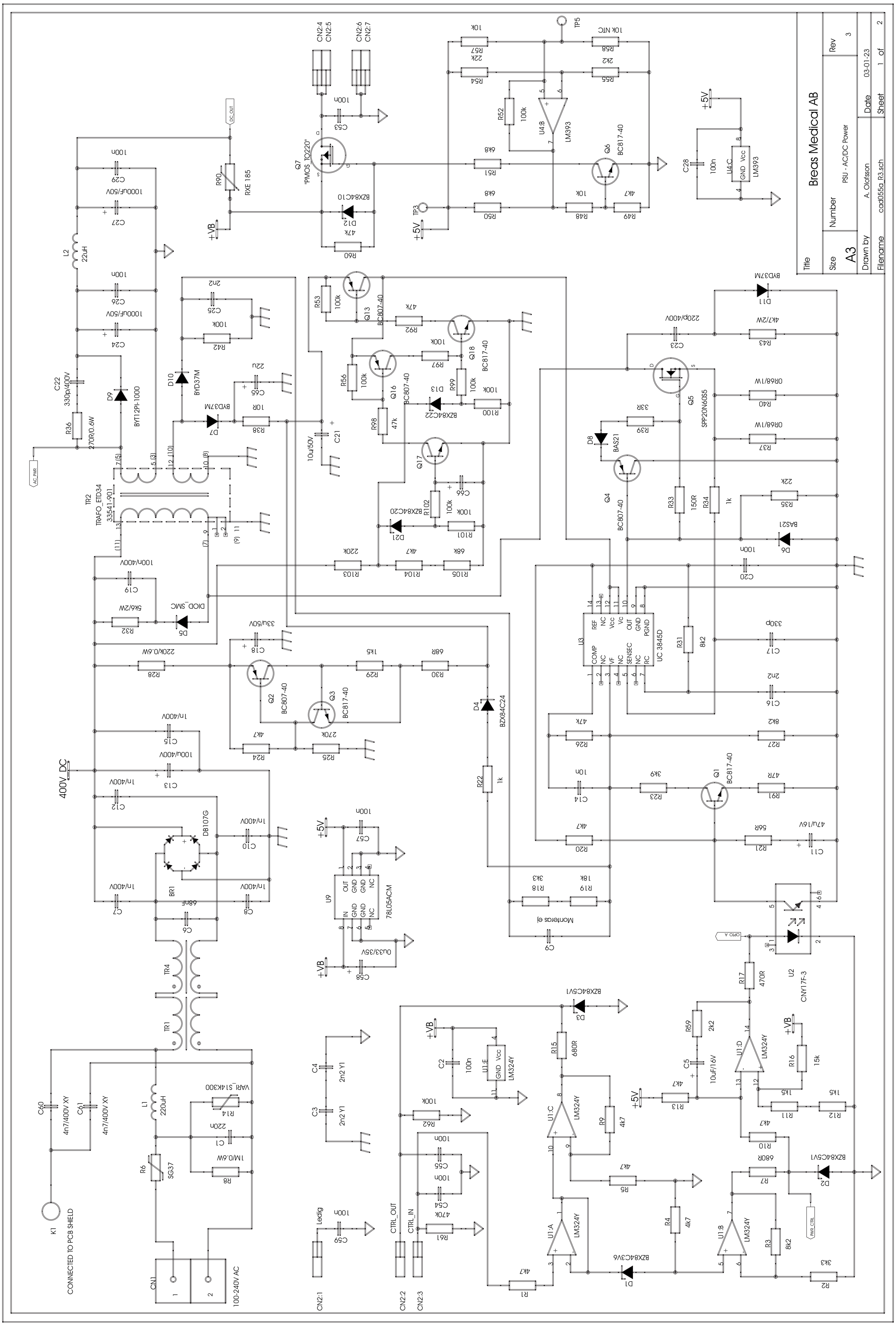
7.6.4 Circuit diagram – CPU board 4, rev 2



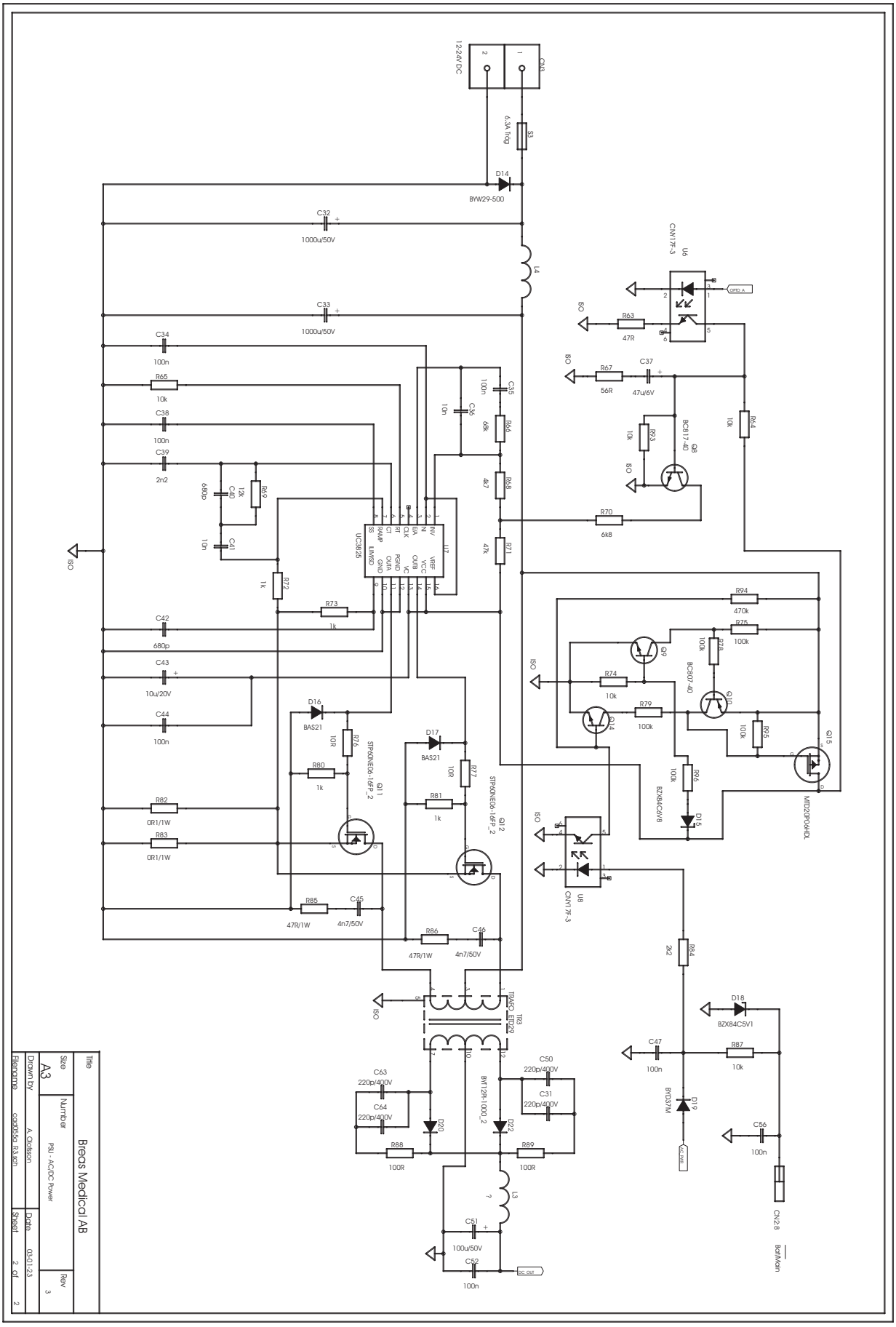
7.6.5 Circuit diagram – CPU board 5, rev 2



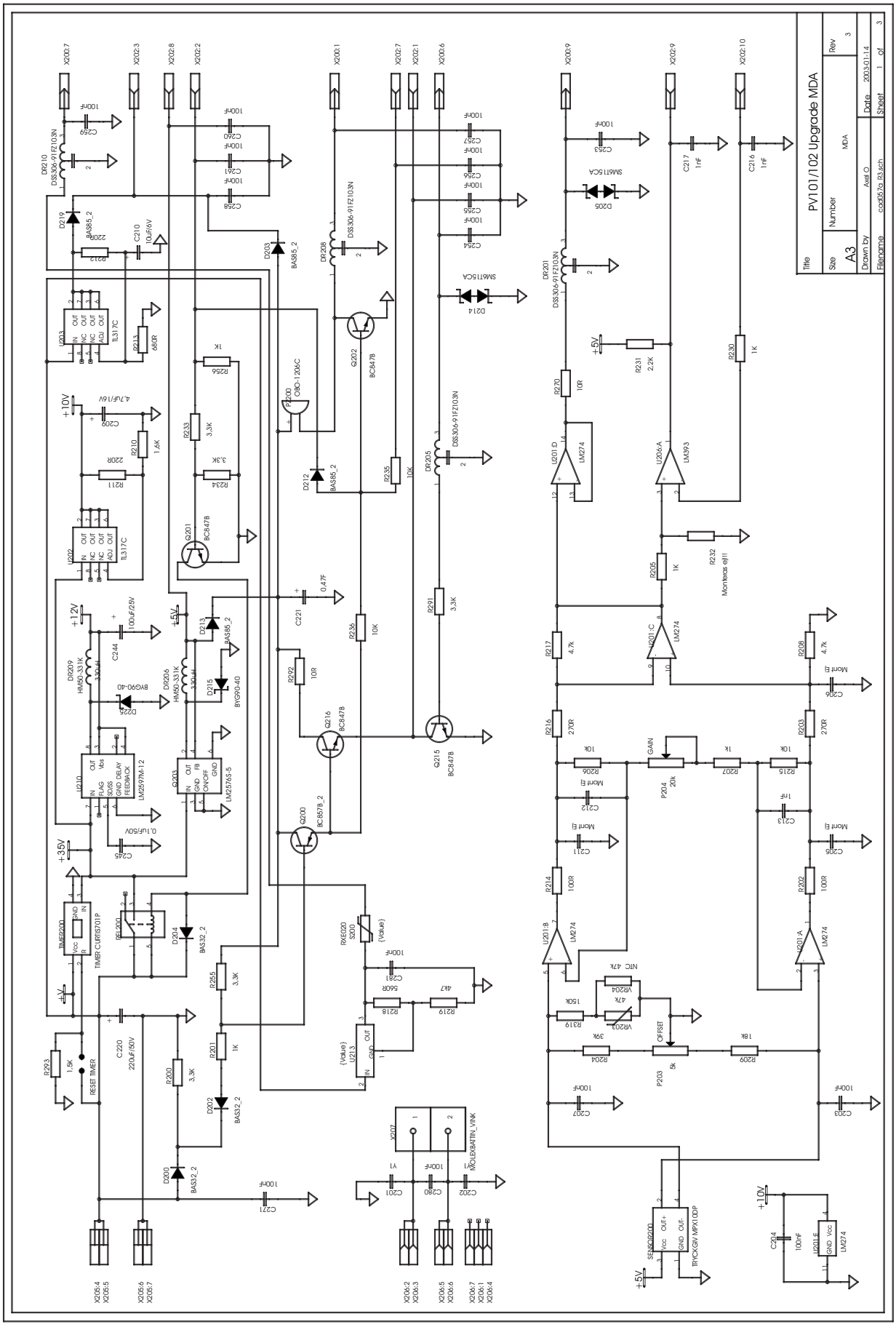
7.6.6 Circuit diagram – Power board 1, rev 3



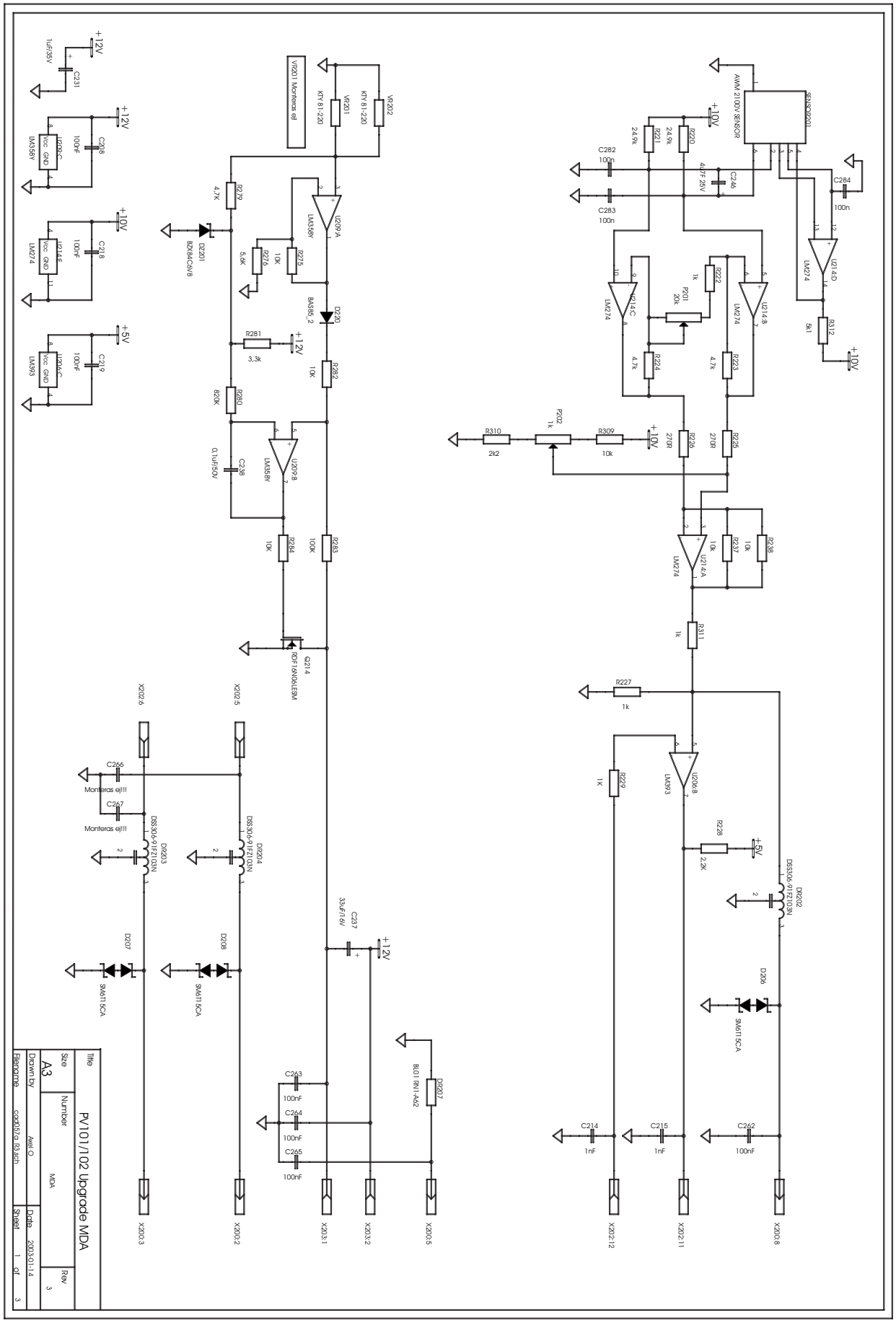
7.6.7 Circuit diagram – Power board 2, rev 3



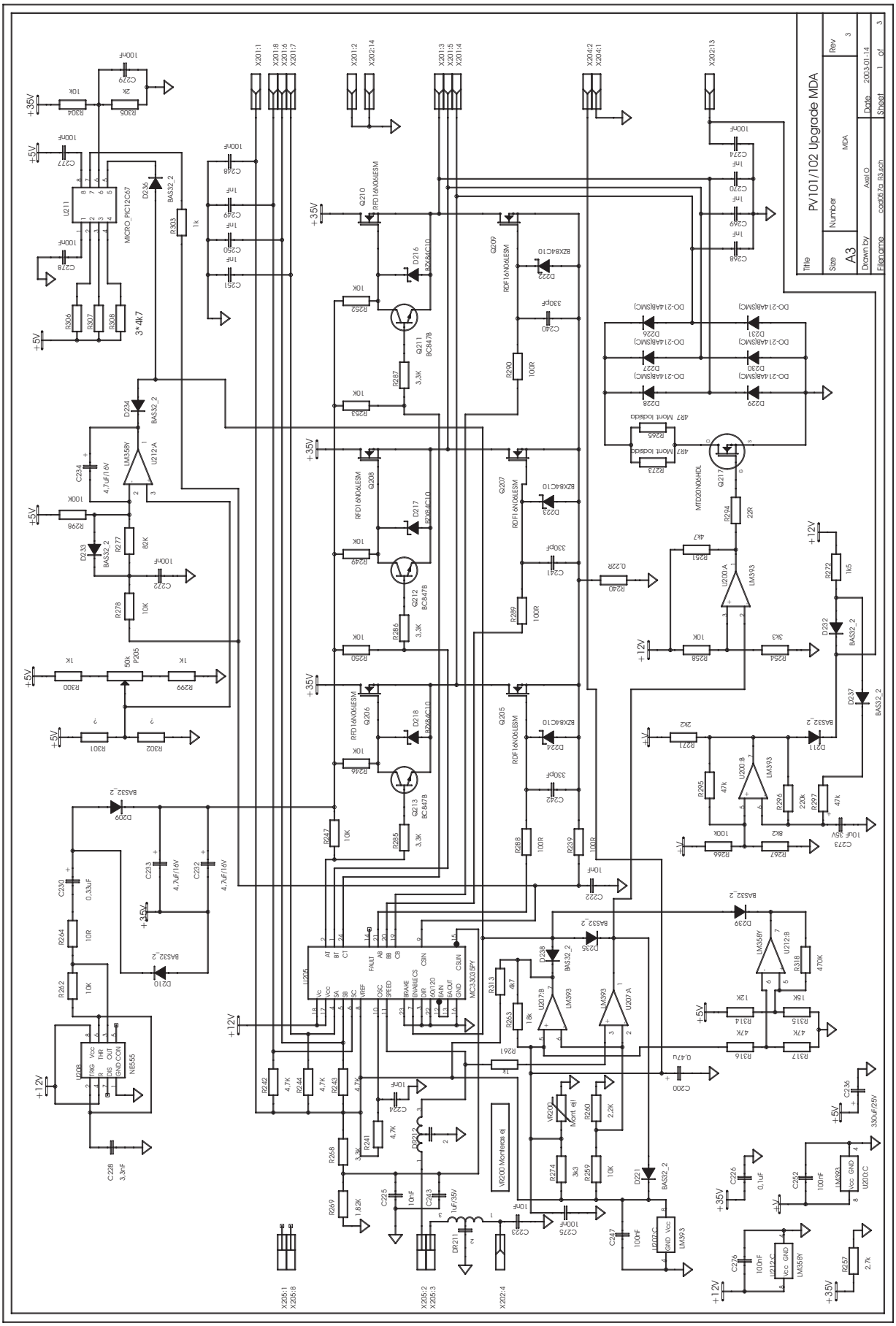
7.6.8 Circuit diagram – MDA board 1, rev 3



7.6.9 Circuit diagram – MDA board 2, rev 3



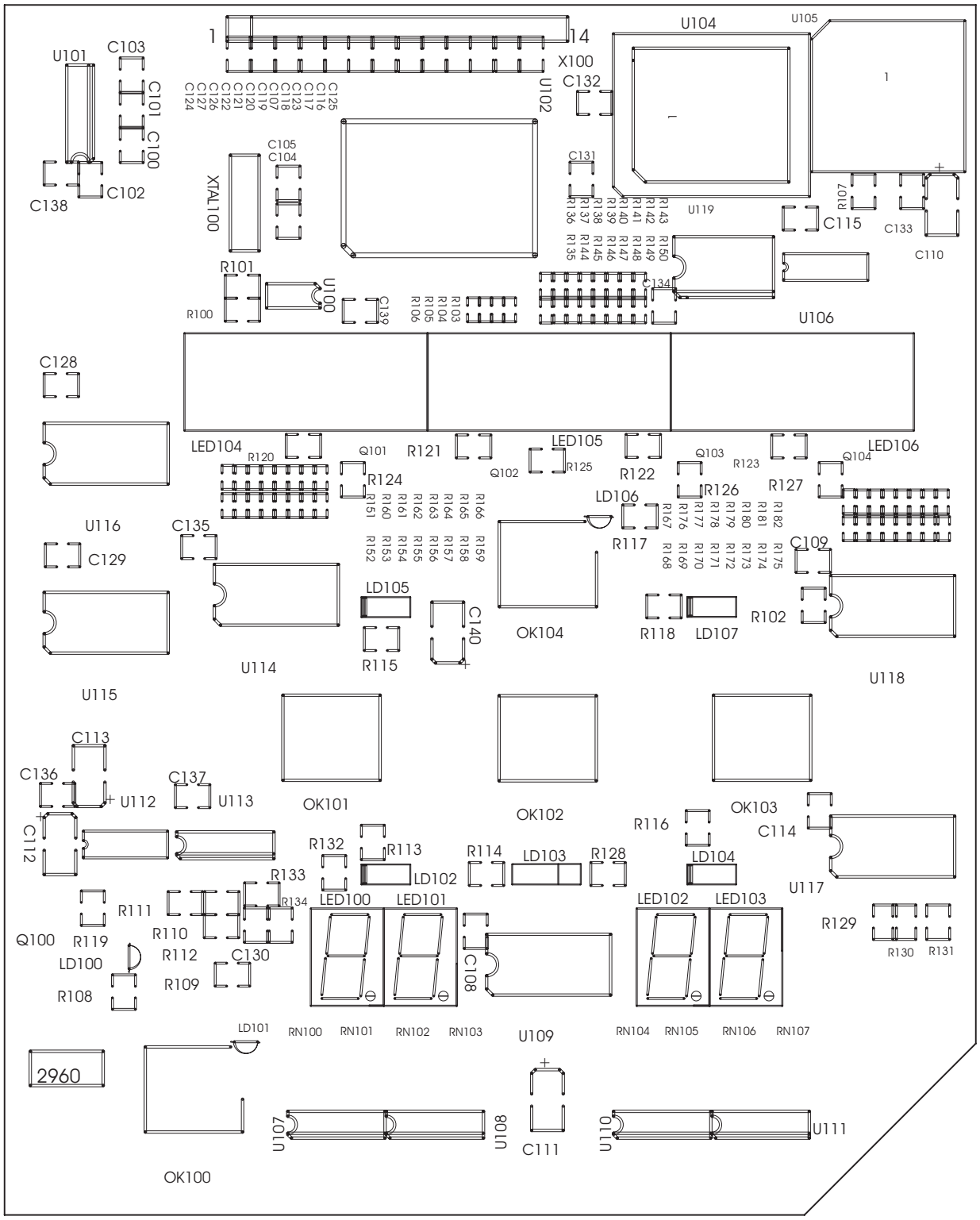
7.6.10 Circuit diagram – MDA board 3, rev 3



7.7 Component location drawings – Circuit boards

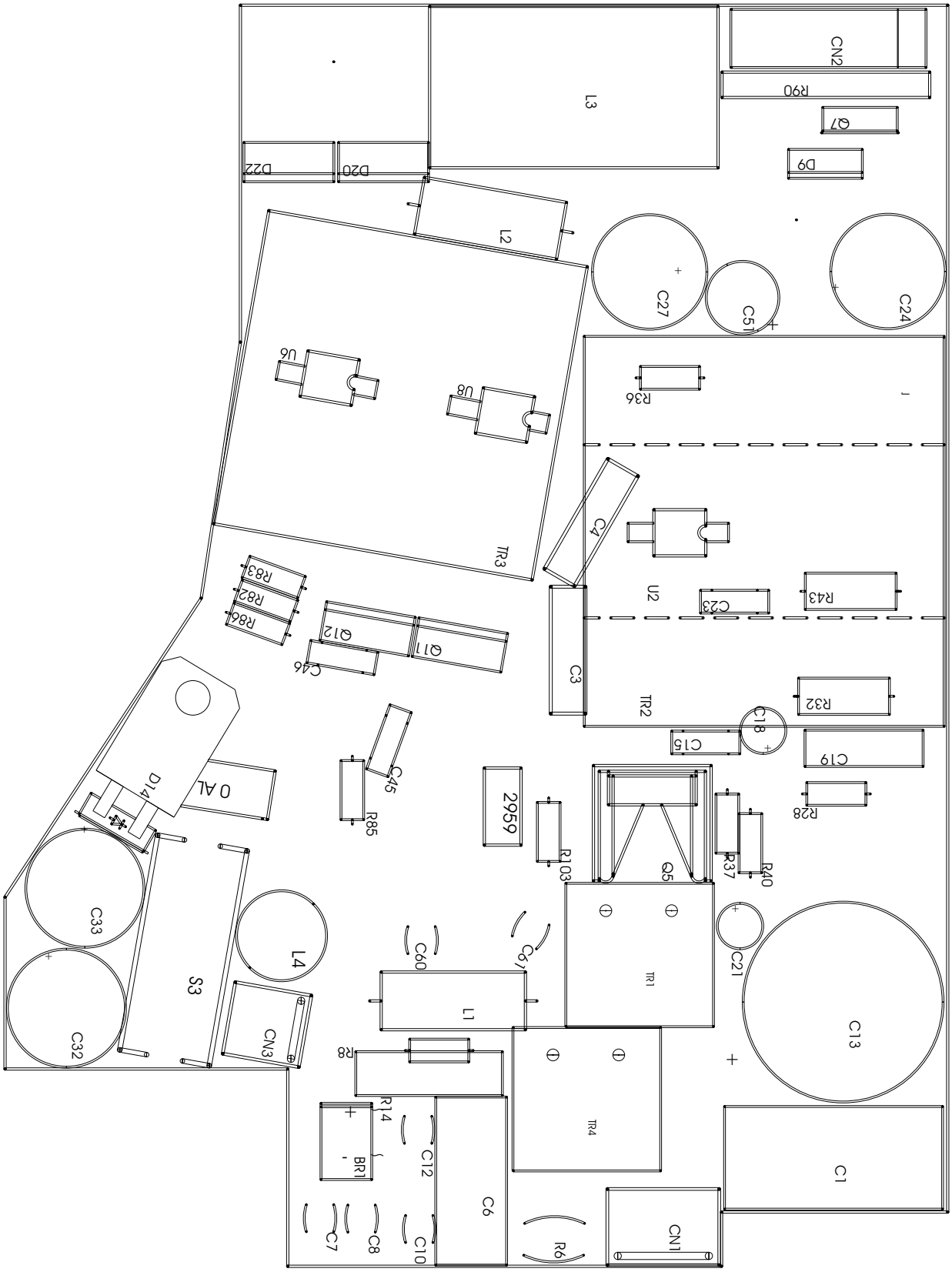
7.7.1 Component location drawing – CPU board

For component lists, refer to section 7.8.1.



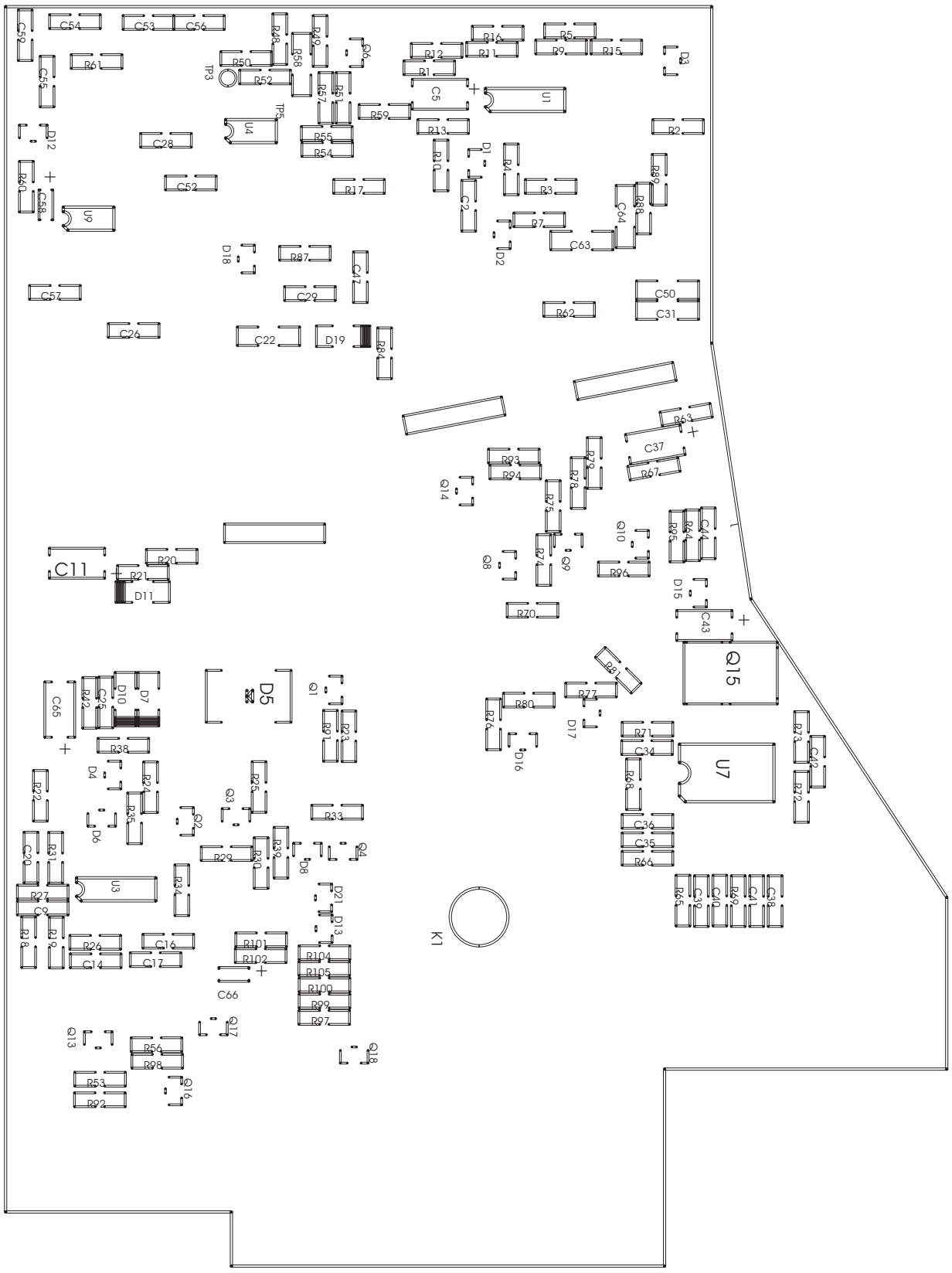
7.7.2 Component location drawing – Power board, upper side

For component lists, refer to section 7.8.2.



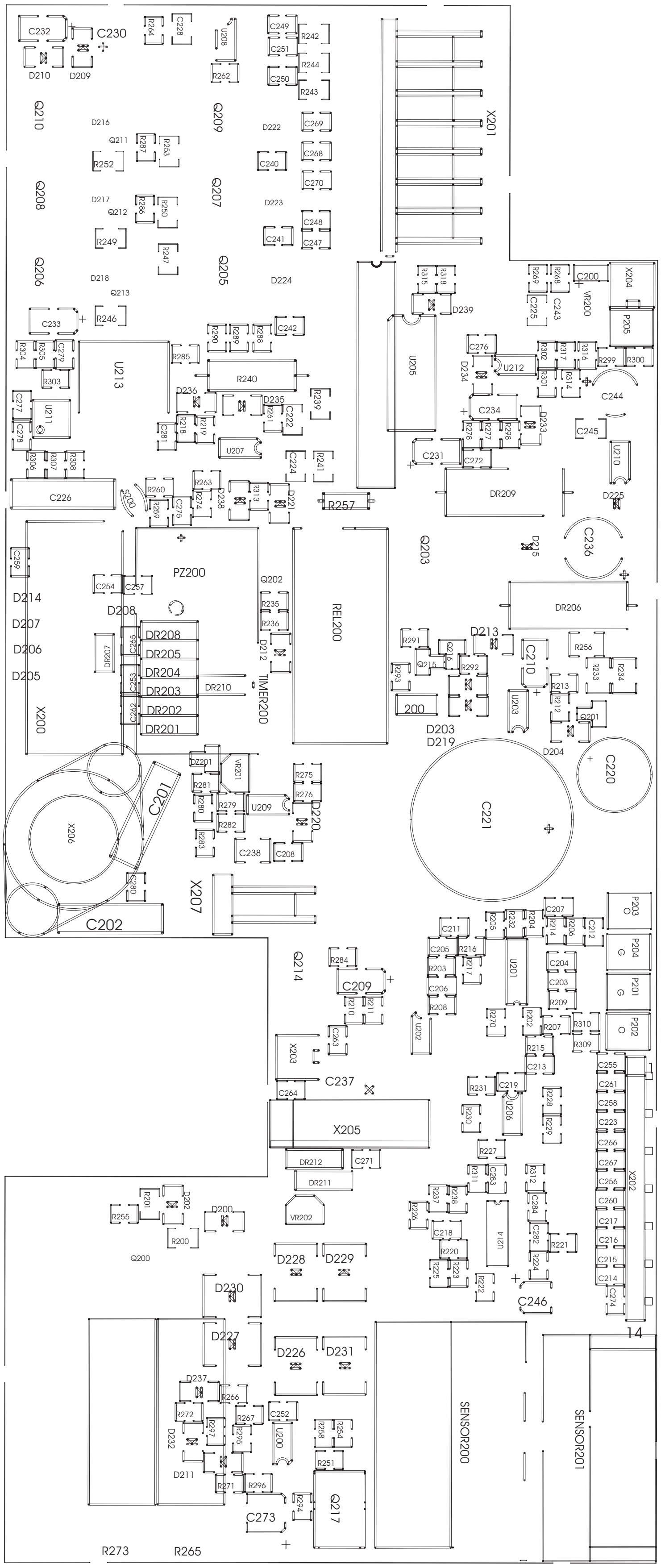
7.7.3 Component location drawing – Power board, under side

For component lists, refer to section 7.8.2.



7.7.4 Component location drawing – MDA board

For component lists, refer to section 7.8.3.



7.8 Component lists – Circuit boards

7.8.1 Component list – CPU board

Reference	Description	Quantity
C100-103, 107-109	CAPACITOR 100 nF X7R	27
C104, 105	CAPACITOR 22 pF NPO	2
C110-113, 140	CAPACITOR 10 uF/6V	5
C116-118, 120, 121	CAPACITOR 1 nF NPO	6
LD100	LED Red 3mm	1
LD101, 106	LED Green 3mm	2
LD102, 104, 105, 107	LED Green L113GDT 2x5mm	4
LD103	LED Red/Green Circular	1
LED100-103	TDSG1160 7-seg.	4
LED104, 105, 106	Bargraph PV 101+/PV 102+	3
OK100-104	SWITCH 3ESH9-10,4	5
Q100-104	TRANSISTOR BC847B	5
R100, 101	RESISTOR 3k3 1%	2
R102	RESISTOR 10k 1%	1
R103-106	RESISTOR 4K7 1%	4
R107, 109, 119, 133	RESISTOR 1k 1%	4
R108, 110, 113-118	RESISTOR 470R 1%	12
R111	RESISTOR 100k 1%	1
R112	RESISTOR 4k7 1%	1
R120-123	RESISTOR 47R 1%	4
R124-127	RESISTOR 2k2 1%	4
R128	RESISTOR 560R 1%	1
R134	RESISTOR 470K 1%	1
R135-143, 151-159	RESISTOR 20k 1%	27
R144-150, 160-166	RESISTOR 10K 1%	21
RN100-107	RN RESNET MNR34-J5AJ-471	8
U100	IC 24LC01 WSOITR	1
U101	IC DS14C232CWM SO16W (232CB)	1
U102	IC HD63C03YRF	1
(U104)	IC PLCC32 SMD	1
U105	IC GAL16V8H-25SC/4	1

Reference	Description	Quantity
U106	IC 74HC00	1
U107, 108, 110, 111	IC 4511	4
U109, 115, 116	IC 74HC574	3
U112	IC 4093	1
U113	IC 4027	1
U114, 117, 118	IC 74HC273	3
U119	IC MAX699CWE	1
XTAL100	XTAL 10 MHz HC49/4H	1

7.8.2 Component list – Power board

Reference	Description	Quantity
BR1	BRIDGE DB154G	1
C1	CAPACITOR 220nF PME271	1
C2, 20, 26, 28, 29, 34	CAPACITOR 100nF X7R	17
C3, 4	CAPACITOR 2,2nF Y1 DE1210E222M	2
C5	CAPACITOR 10u/16V	1
C6	CAPACITOR 68nF PME271	1
C7, 8, 10, 12, 15	CAPACITOR 1nF/400V	5
C11, 37	CAPACITOR 47u/16V	2
C13	CAPACITOR 100uF 400V	1
C14, 36, 41	CAPACITOR 10nF X7R	3
C16, 25, 39	CAPACITOR 2,2nF X7R	3
C17	CAPACITOR 330pF NPO	1
C18	CAPACITOR 33u/50V	1
C19	CAPACITOR 100nF/400V	1
C21	CAPACITOR 10uF 50V 1MOD RSH	1
C22	CAPACITOR 330p/500V	1
C23	CAPACITOR 220pF 400V	1
C24, 27, 32, 33	CAPACITOR 1000uF 50V	4
C31, 50, 63, 64	CAPACITOR 220pF 500V	4
C40, 42	CAPACITOR 680p NPO	2
C43	CAPACITOR 10u/20V	1
C45, 46, 60, 61	CAPACITOR 4,7nF 500V XY	4
C51	CAPACITOR 100u/50V	1

Reference	Description	Quantity
C58	CAPACITOR 0,33u/35V	1
C65	CAPACITOR 22u/10V	1
C66	CAPACITOR 4,7uF/16V	1
CN1	CONNECTOR 3P	1
CN2	CONNECTOR 8P	1
CN3	CONNECTOR 2P	1
D1	DIODE BZX84C3V6	1
D2, 3, 18	DIODE BZX84C5V1	3
D4	DIODE BZX84C24	1
D5	DIODE RS3K SMC	1
D6, 8, 16, 17	DIODE BAS21	4
D7, 10, 11, 19	DIODE BYD37M	4
D9, 20, 22	DIODE BYT12PI-1000	3
D12	DIODE BZX84C10	1
D13	DIODE BZX84C22	1
D14	DIODE BYW29F200	1
D15	DIODE BZX84C6V8	1
D21	DIODE BZX84C20	1
L1	INDUCTOR 220uH HM50-221K	1
L2	INDUCTOR 22uH HM50-220K	1
L3	INDUCTOR 330uH KM5	1
L4	INDUCTOR TSL1112RA	1
Q1, 3, 6, 8, 9, 14, 17, 18	TRANSISTOR BC817-40	5
Q2, 4, 10, 13, 16	TRANSISTOR BC807-40	5
Q5	TRANSISTOR SPP20N60S5	1
Q7	TRANSISTOR IRF5305 TO220	1
Q11, 12	TRANSISTOR IRFIZ44N TO-220	2
Q15	TRANSISTOR MTD20P06HDL	1
R1, 4, 5, 9, 10, 13, 20,	RESISTOR 4k7 1%	11
R2, 18	RESISTOR 3k3 1%	2
R3, 27, 31	RESISTOR 8K2 1%	3
R11, 12, 29	RESISTOR 1K5 1%	3
R14	VARISTOR S14K300	1
R16	RESISTOR 15K 1%	1
R17	RESISTOR 470R 1%	1

Reference	Description	Quantity
R19	RESISTOR 18K 1%	1
R21, 67	RESISTOR 56R 1%	2
R22, 34, 72, 73,	RESISTOR 1k 1%	6
R23	RESISTOR 3k9 1%	1
R25	RESISTOR 270k 1%	1
R26, 60, 71, 92, 98	RESISTOR 47k 1%	5
R28, 103	RESISTOR 220k 0,6W	2
R30	RESISTOR 68R 1%	1
R32	RESISTOR 5K6 2W	1
R33	RESISTOR 150R 1%	1
R35, 54	RESISTOR 22k 1%	2
R36	RESISTOR 270R 0,6W	1
R37, 40	RESISTOR 0R68 1W PR01	2
R38, 76, 77	RESISTOR 10R 1%	3
R39	RESISTOR 33R 1%	1
R42, 52, 62, 75, 78, 79	RESISTOR 100k 1%	15
R43	RESISTOR 4K7 2W	1
R48, 57, 64, 65, 87	RESISTOR 10k 1%	7
R50, 51, 70	RESISTOR 6K8 1%	3
R55, 59, 84	RESISTOR 2k2 1%	3
R58	RESISTOR 10k NTC B57621C103	1
R6	RESISTOR B57236-S200-M NTC	1
R61, 94	RESISTOR 470K 1%	2
R63, 91	RESISTOR 47R 1%	2
R66, 105	RESISTOR 68k 1%	2
R69	RESISTOR 12K 1%	1
R7, 15	RESISTOR 680R 1%	2
R8	RESISTOR 1M 0,6W	1
R82, 83	RESISTOR 0R1 0,6W	2
R85, 86	RESISTOR 47R O,6W	2
R88, 89	RESISTOR 100R 1%	2
R90	RESISTOR RXE185 / 3.5 A fuse (wire type)	1
S3	FUSE HOLDER Schurter 5x20m	1
TR1	TRANSFORMER 12uH PLA10	1
TR2	TRANSFORMER ETD34-3F3	1

Reference	Description	Quantity
TR3	TRANSFORMER ETD29	1
TR4	TRANSFORMER 7uH PLA10A7720R7D02	1
U1	IC LM324Y	1
U2, 6, 8	IC CNY17F-3 DIL6	3
U3	IC UC 3845D	1
U4	IC LM393D	1
U7	IC UC3825DW	1
U9	IC LM78L05ACM	1

7.8.3 Component list – MDA board

Reference	Description	Quantity
C200	CAPACITOR 0,47u/25V	1
C201, 202	CAPACITOR 2,2nF Y1 DE1210E222M	2
C209, 232-234	CAPACITOR 4,7uF/16V	4
C210	CAPACITOR 10uF/6V	1
C213-217, 249-251	CAPACITOR 1nF NPO	11
C220	CAPACITOR 220u/50V	1
C221	CAPACITOR 0,47F FSOH	1
C222, 224, 225	CAPACITOR 10nF X7R	3
C223	CAPACITOR 10nF X7R	1
C226	CAPACITOR 0,1uF/100V MKT	1
C228	CAPACITOR 3,3nF X7R	1
C230	CAPACITOR 1uF/50V	1
C231, 243	CAPACITOR 1uF/35V	2
C236	CAPACITOR 330uF/25V CV-GX	1
C237	CAPACITOR 33uF/16V	1
C238, 245	CAPACITOR 0,1uF/50V X7R	2
C240-242	CAPACITOR 330pF NPO	3
C244	CAPACITOR 100uF/25V CV-GX	1
C246	CAPACITOR 4,7uF/35V ELYT D55	1
C273	CAPACITOR 10uF/50V MVKF55	1
C282-284, 203, 204	CAPACITOR 100nF X7R	35
D200, 202, 204, 209	DIODE BAS32	15
D203, 212, 213, 219	DIODE BAS85	5

Reference	Description	Quantity
D205-208, 214	DIODE SM6T15CA	5
D215, 225	DIODE BYS10-45	2
D216-218, 222-224	DIODE BZX84C10	6
D226-231	DIODE RS3K SMC	6
DR201-205, 208	INDUCTOR DSS306-91FZ103N100	9
DR206, 209	INDUCTOR 330uH HM50-331K	2
DR207	INDUCTOR BL01 RN1-A62	1
DZ201	ZENER DIODE BZX84C6V8	1
P201, 204	POTENTIOMETER 20K TYP3224J	2
P202	POTENTIOMETER 1K TYP3224J	1
P203	POTENTIOMETER 5K TYP3224J	1
P205	POTENTIOMETER 50K TYP3224J	1
PZ200	BUZZER OBO-1206C	1
Q200	TRANSISTOR BC857B	1
Q201, 202, 211-213	TRANSISTOR BC847B	7
Q203	TRANSISTOR LM2575S-5	1
Q205-210, 214	TRANSISTOR RFD16N06LESM	7
Q217	TRANSISTOR MTD20N06HDL	1
R200, 233, 234	RESISTOR 3k3 1%	3
R201, 256	RESISTOR 1k 1%	2
R202, 214, 288-290	RESISTOR 100R 1%	5
R203, 216, 225, 226	RESISTOR 270R 1%	4
R204	RESISTOR 39K 1%	1
R205, 222, 227, 229	RESISTOR 1k 1%	11
R206, 215, 235-238	RESISTOR 10k 1%	15
R210	RESISTOR 1k6 1%	1
R211, 212	RESISTOR 220R 1%	2
R213	RESISTOR 680R 1%	1
R218	RESISTOR 560R 1%	1
R220, 221	RESISTOR 24K9	2
R228, 231, 260, 271, 310	RESISTOR 2k2 1%	5
R239	RESISTOR 100R 1%	1
R240	RESISTOR 0,22R 3W AC03	1
R241-244	RESISTOR 4k7 1%	4
R246, 247, 249, 250	RESISTOR 10k 1%	6

Reference	Description	Quantity
R255, 268, 281, 285	RESISTOR 3k3 1%	12
R257	RESISTOR 2k7 1/2W 5%	1
R263, 209	RESISTOR 18K 1%	2
R264, 270, 292	RESISTOR 10R 1%	3
R266, 283, 298	RESISTOR 100k 1%	3
R267	RESISTOR 8K2 1%	1
R269	RESISTOR 1k82 1%	1
R276	RESISTOR 5k6 1%	1
R277	RESISTOR 82k 1%	1
R279, 219, 251, 313	RESISTOR 4k7 1%	8
R280	RESISTOR 820k 1%	1
R293, 272	RESISTOR 1K5 1%	2
R294	RESISTOR 22R 1%	1
R295, 297, 316, 317	RESISTOR 47k 1%	4
R296	RESISTOR 220k 1%	1
R305	RESISTOR 2k 1%	1
R312	RESISTOR 5k1 1%	1
R314	RESISTOR 12K 1%	1
R315	RESISTOR 15K 1%	1
R318	RESISTOR 470K 1%	1
REL200	RELAY RT114024	1
S200	POLYFUSE RXE020	1
U200, 206, 207	IC LM393D	3
U201, 214	IC TLC274CDR	2
U202, 203	IC LM317LM	2
U205	IC MC33035DW	1
U208	IC NE555	1
U209, 212	IC LM358D	2
U210	IC LM2597M-12	1
U213	IC LM317	1
VR202	SENSOR KTY81-220	1
X201	CONNECTOR ANGLED 8P	1
X202	CONNECTOR 1x14POLE	1
X203, 204	CONNECTOR 2P	2
X205	CONNECTOR 8P	1

Reference	Description	Quantity
X207	CONNECTOR ANGLED 2P	1

8 FAULT TRACING

This chapter contains a fault-tracing table that may be used when trouble-shooting the device.

8.1 Fault-tracing table

If the PV 101+/PV 102+ does not work properly try to identify the problem in the table below. Check the possible causes and carry out the suggested remedial actions.

Symptom	Possible cause	Remedial action	See ref.
The device alarms at start-up.	• The power cord is not properly connected.	• Connect the power cord.	2.4.2
	• Mains fuse has blown.	• Replace the fuse.	7.1
The ventilator does not give adequate pressure/volume.	• Leakage from patient circuit/ mask.	• Check the tubes and mask for leakage.	2.6.6
	• Internal leakage.	• Check the tubes inside the machine.	2.5.3
	• Dirty filters.	• Replace or wash the filters.	2.6.5
	• Pressure sensor faulty.	1 Adjust voltage to transformer. 2 Replace MDA board or pressure sensor.	4.3 3.7
The PV 101+/ PV 102+ does not trigger.	• Trigger settings not correct.	• Adjust settings.	See PV 101+/ PV 102+ Operating manual
	• Tube to flow sensor has worked loose.	• Check tube and connectors.	7.4.3
	• Flow sensor faulty. • MDA board faulty.	1 Adjust voltage to pressure sensor. 2 Replace MDA board or flow sensor.	4.5 3.7
Alarms for mask-off (PV 102+ only).	• Leakage from patient circuit/ mask.	• Check the tubes and mask for leakage.	2.6.6

9 APPENDICES

This chapter contains the engineering change history of the PV 101+ and the PV 102+. Included in the chapter is also a service record and a service report. These pages can be copied and used for completing the reports.

9.1 Engineering change history – PV 101+

The table below lists the engineering changes made to the PV 101+ by serial number.

From serial no.	Changes
R060334	Software rev 3. Hardware MDA rev. 2, PSU rev. 3, CPU rev. 3 Production start.
R090177	Software upgrade rev 4. Ref. internal improvement no. 337: The PV 101+ incorrectly turned itself off 15 seconds after ramp activation when there was no patient circuit leakage.
R250001 (mandatory field upgrade from R020296 to R230389)	Replacement of the R90 component on the power board (ref. TBD33). A 3.5 A fuse (wire link type) has replaced the former PTC fuse, in order to avoid risk of disturbances due to ambient temperature.

9.2 Engineering change history – PV 102+

The table below lists the engineering changes made to the PV 102+ by serial number.

From serial no.	Changes
R060335	Software rev 3. Hardware MDA rev. 2, PSU rev. 3, CPU rev. 3 Production start.
R090279	Software upgrade rev 4. Ref. internal improvement no. 337: The PV 102+ incorrectly turned itself off 15 seconds after ramp activation when there was no patient circuit leakage.
R250001 (mandatory field upgrade from R020296 to R230389)	Replacement of the R90 component on the power board (ref. TBD33). A 3.5 A fuse (wire link type) has replaced the former PTC fuse, in order to avoid risk of disturbances due to ambient temperature.

Service Record for BREAS PV 101+/PV 102+

Use a photocopy of this service record for the maintenance inspection described in chapter 2 in this service manual. Use the reverse side for comments and notes.

Service Record No:_____

Registration

Model:..... Serial No...... Inventory No. .....

Accessories: .....

Delivery date:..... No. of operating hours: .....

Service started:..... Signature: .....

Service completed: ..... Signature: .....

Delivered, date: ..... Signature: .....

	See instruction ref.	Check OK
Preparing inspection		
Verifying the components and the installed software	2.3.1	.....
Initial recording	2.3.2	.....
Markings	2.3.3	.....
Information from the patient/user	2.3.4	.....
Validity of the documentation	2.3.5	.....
External inspection		
Visual inspection for external damage and wear	2.4.1	.....
Checking the power supply connection	2.4.2	.....
Short function check	2.4.3	.....
Internal inspection		
Cleaning the inside of the machine	2.5.2	.....
Inspecting the internal wiring	2.5.3	.....
Securing the components	2.5.4	.....
Checking the power supply	2.5.5	.....
Checking Electrical safety measurements	7.5	.....
Blower Assembly (15,000 hours)		
Checking if blower unit should be replaced	3.5	.....
Calibration (12 months/15,000 hours)		
Calibrating the pressure sensor	4.3	.....
Calibrating the flow sensor	4.5	.....
Calibrating the high pressure limit	4.6	.....

Continued on next page

	See instruction ref.	Check OK
Final inspection before delivery		
Function check	2.6.1	.....
Checking the low pressure leakage alarm (PV 102+)	2.6.2	.....
Checking the trigger function	2.6.3	.....
Checking the pressure and rate	2.6.4	.....
Replacing the filters	2.6.5	.....
Checking the accessories	2.6.6	.....
Adjusting the settings for the patient	2.6.7	.....

Notes

9.3 Returning products to BREAS

You may need to return the device or any components or accessories to BREAS, for example, for service, warranty, upgrade or repair. If so, follow the instructions below to ensure that the correct action is taken and to avoid unnecessary delays.

1 Pack the product in its original packaging. If this is not available pack the product in packaging suitable for transporting the product to BREAS.

2 Take a photocopy of the delivery report on the next page.

3 Fill out the Customer information part of the service report and pack it together with the product to be returned. The service report will be completed by BREAS and returned with the product.

Product damage caused by poor packaging or during transport is not covered by the factory warranty.

Service Report for BREAS PV 101+/PV 102+

BREAS Ref. No:_____

Customer information

Customer name:.....

Customer address:.....

.....

Phone:.....

Reference person:.....

Customer reference number: .....

Product information

Model: ..... Serial No:..... Operating hours: .....h

Error /Complaint / Accessories

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Information from BREAS

Date received by BREAS:..... Signature .....

Repair **Warranty** **Update** **Charge** **Other**

Action taken:

_____

_____

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_____

_____

_____

Parts used: **Pcs:** **Price:**

_____

_____

_____

_____

Operating hours from BREAS:_____h

Date returned to customer: _____ Signature:_____

Notes:

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Notes

Notes

10 PV 101+ OPERATING MANUAL

11 PV 102+ OPERATING MANUAL