

This page is only an instruction for how the manual is produced, it shall not be included in the manual delivered with the power supply.

Pages included in the finished manual (sorted in this order):

The next 15 pages of this document.

Circuit diagram, front PC-board, document 210100003-C (5 pages).

Circuit diagram, power PC-board, document 210100037-C (3 pages).

PC-board layout, front PC-board, document 200100154-D (down-sized to A4).

PC-board layout, power PC-board, document 200100157-D (down-sized to A4).

Certificate of conformity (the last page of this document).

Special instructions:

The certificate of conformity must be signed by powerbox quality manager before manuals are printed.

Production of manual:

Make a ring binder of the printed manual with a transparent cover and a cardboard back.

LAB. POWER SUPPLY

POWERBOX 3100

USER'S MANUAL

powerbox

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SECTION 1

GENERAL DESCRIPTION

FEATURES

- Floating outputs
- Precision voltage setting
- LED volt-amp meter
- Toroidal transformer
- Low MTTR
- High isolation between output-case
- Constant voltage / Constant current mode
- Over range and over temperature indication

1.1 DESCRIPTION

Compact, easy to operate, and rugged, the POWERBOX 3100 laboratory supply is a handy source of precision regulated power for both digital and linear work.

The Model POWERBOX 3100 is a tripple output unit with one 0-7 V output and two 0-20V/0-40V outputs, which can easily be switched over from 0-20V to 0-40V by a switch at the rear of the power supply.

The current limit is set with a single-turn potentiometer which selects constant current limits between 0-100 % of the maximum rating and thereby provide the constant-current output mode for the power supply in addition to overload protection.

The 0-7V output, which is screwdriver adjustable, has a fixed current limit.

In addition to current limiting, the power supply also has self-resetting thermal overload protection built into the unit and replaceable fuses mounted at the rear of the unit.

Precision digital panel meters measure the load current and output voltage. The operational mode, constant-current (CC) or constant voltage (CV) is LED indicated.

All outputs are completely isolated from each other (and from the case), and may be connected in series in any polarity combination. Also the 0-20V/0-40V outputs may be paralleled with each other or with the 0-7V output when set to the same voltage.

The insulation voltage between the outputs and chassis (ground) is 500 VAC, the input to chassis withstand voltage is 2000 VAC.

A separate terminal is provided for a ground (chassis) connection.

The mean-time-to-repair (MTTR) is very low, approx. 30 minutes. High quality components are used where needed to keep voltage setting stable. Toriodal transformers keep flux leakage and EMI low. The power supply is not affected by RFI/EMI. and can be used in close proximity to radio transmitters.

1.2 SPECIFICATIONS

INPUT

Voltage	115 V AC, 230 V AC. Allowed fluctuation -10% to +10%
Current	3,6 A / 1,8 A
Frequency	47 to 63 Hz
Protection	Fuses in power inlet
Safety isolation	2000 VAC rms input to output (1 min.) 2000 VAC rms input to ground 500 VAC rms, output to ground according to EN61010-1:1993

OUTPUT

Power	65 W continuous, 128 W peak at 23 °C ambient, see figures on the two following pages, from a typical power supply.
Line regulation	All outputs: +/- 0.05 %
Load regulation	All outputs: 35 mV for 0 to 100 % load change
Transient response	Recovery time 250 µs at 10 - 100% load step with di/dt 0.1 A/µs Max. deviation 0.2 V

Output 1	Output 2	Output 3
0-7 V, 0 - 4 A	0 - 20 V, 0 - 2.5 A or 0 - 40 V, 0 - 1.25 A	0 - 20 V, 0 - 2.5 A or 0 - 40 V, 0 - 1.25 A

Ripple	All outputs: 3 mVp-p
Drift (8h)	All outputs : 0.05%, after 30 minutes warm up time
Overload protection	Yes, constant current
Thermal protection	Yes, by decreased output current
Temperature coefficient	All outputs : +/- 200 ppm /°C
Parallel operation	Yes
Series operation	Yes

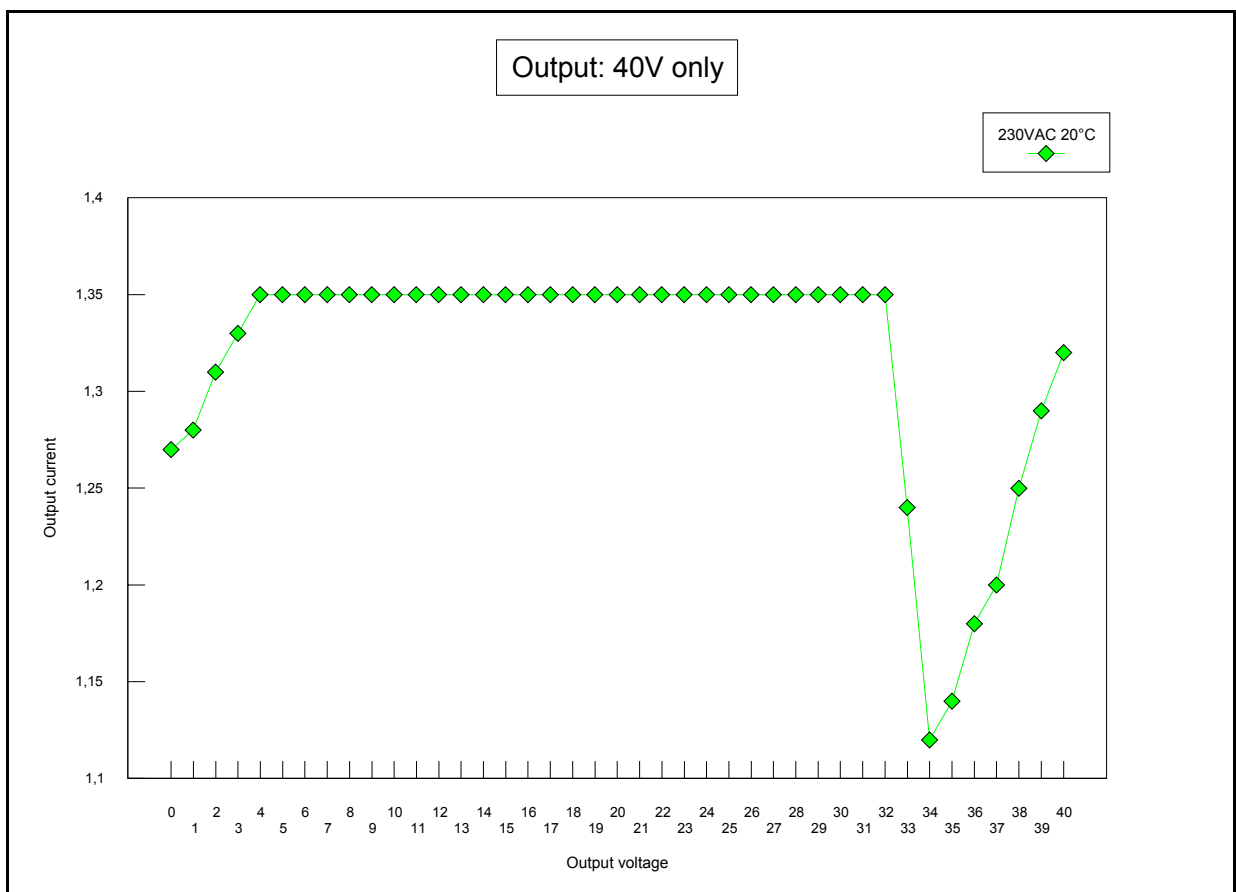
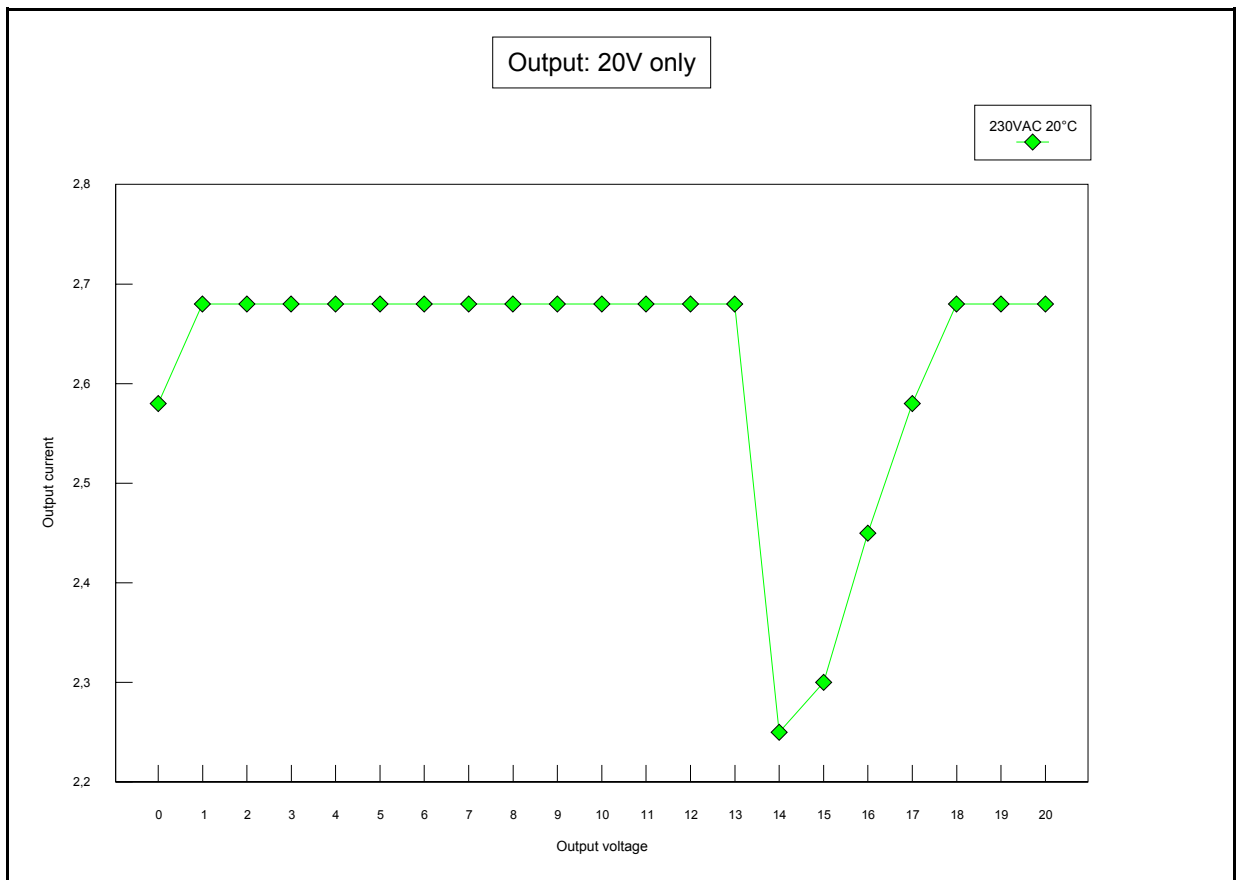
ENVIRONMENTAL

Operating temperature	-20 to +40 °C ambient
Storage temperature	-40 to +85 °C
Cooling	Convection and built in low speed fan.
Humidity	90 %, non condensing

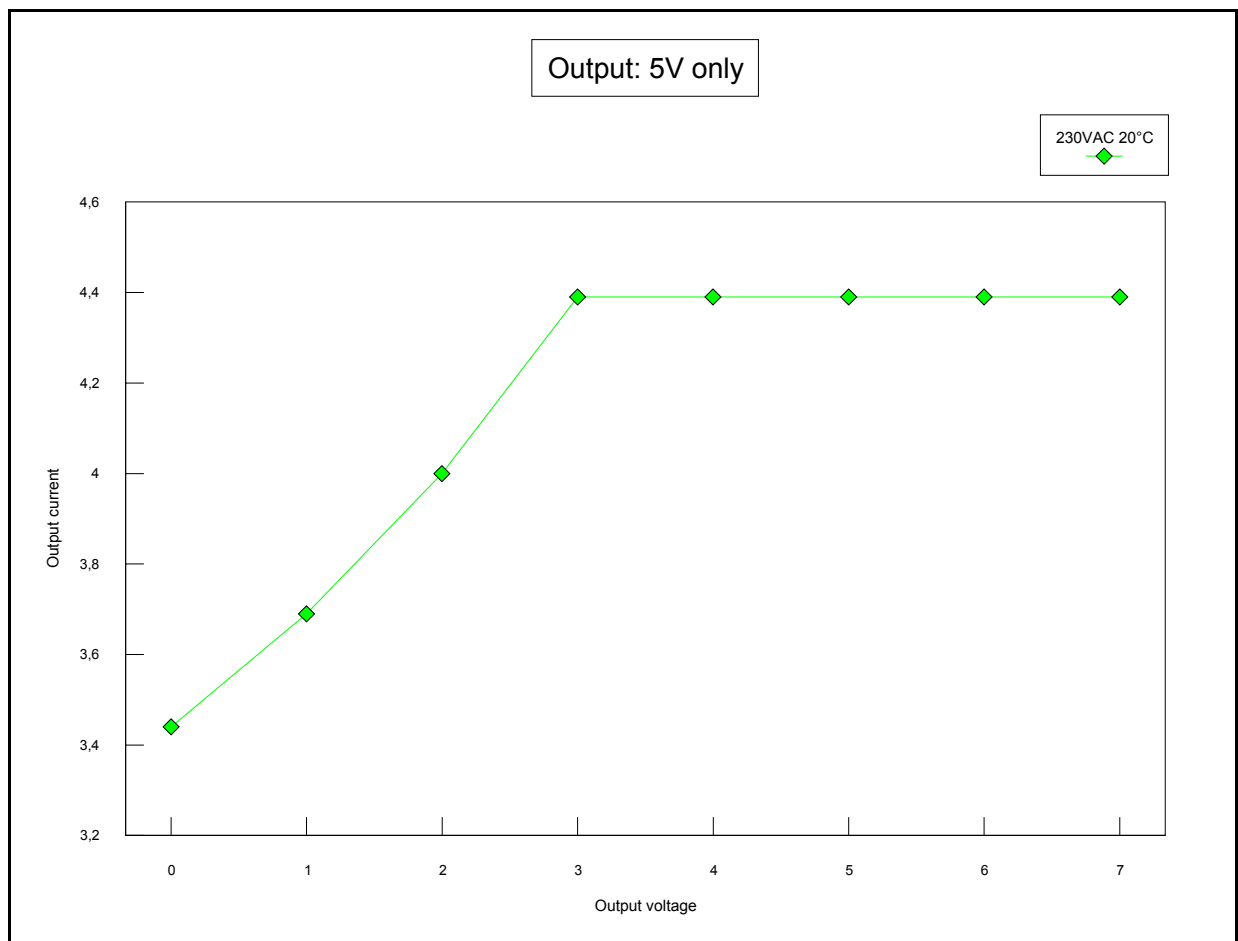
GENERAL

EMC standards	CE approved according to emission EN50081-1, immunity EN50082-1
Meters	Four meters, LED type, 3 digits
Indicators	LED for constant voltage and constant current mode Range, over range, over temperature indication
Dimension	185*132*280 mm (H*W*D)
Weight	6,5 kg

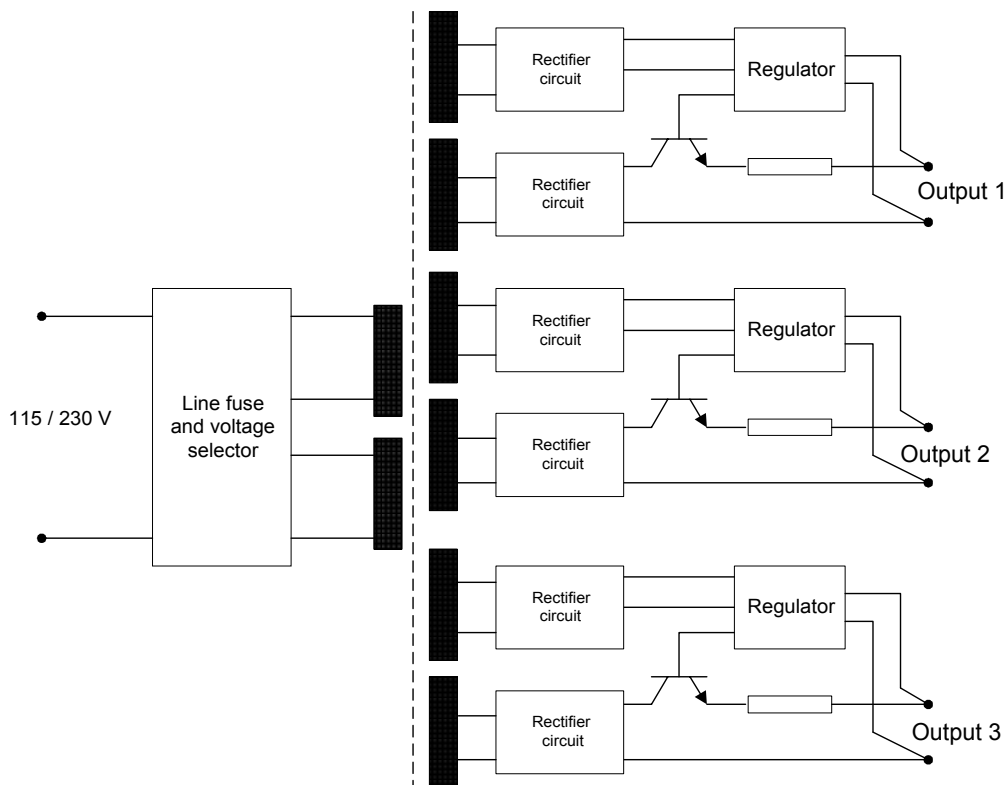
OUTPUT POWER



OUTPUT POWER



1.3 BLOCK DIAGRAM



MODES OF OPERATION

Voltage and current output can be independently set for the two 0-20V/0-40V outputs by means of two potentiometers on the front panel. The voltages are set by 10-turn potentiometers and the constant current are set by single turn potentiometers. The 0-7V output is set by a single turn screwdriver controlled potentiometer and it has a constant current limit characteristic.

Constant-voltage, constant-current modes

Two LED diodes mounted on the front panel indicates mode of operation - constant voltage (CV) or constant current (CC). When the load current is increased to the constant-current trip point (see figure 2 on next page), the unit automatically transfers to the constant-current mode and the CC LED lights. Below the CC trip point, the unit is working in the CV mode and the CV LED lights. The CC mode also provides protection by limiting load current during overload or short circuit. All outputs have the same constant-current characteristic.

Maximum output power limitation

The POWERBOX 3100 has a maximum peak output power of 128 W and a continuous output power of 65 W measured under normal temperature condition 23 °C.

The power supply is series regulated, this means that the power loss is depending on the output voltage and load current. With some combinations of output voltage and current (see graphs on previous pages) the unit may reach maximum allowable case temperature and the temperature control circuit will reduce the output current, this is indicated by the over temperature LED that will start to flash.

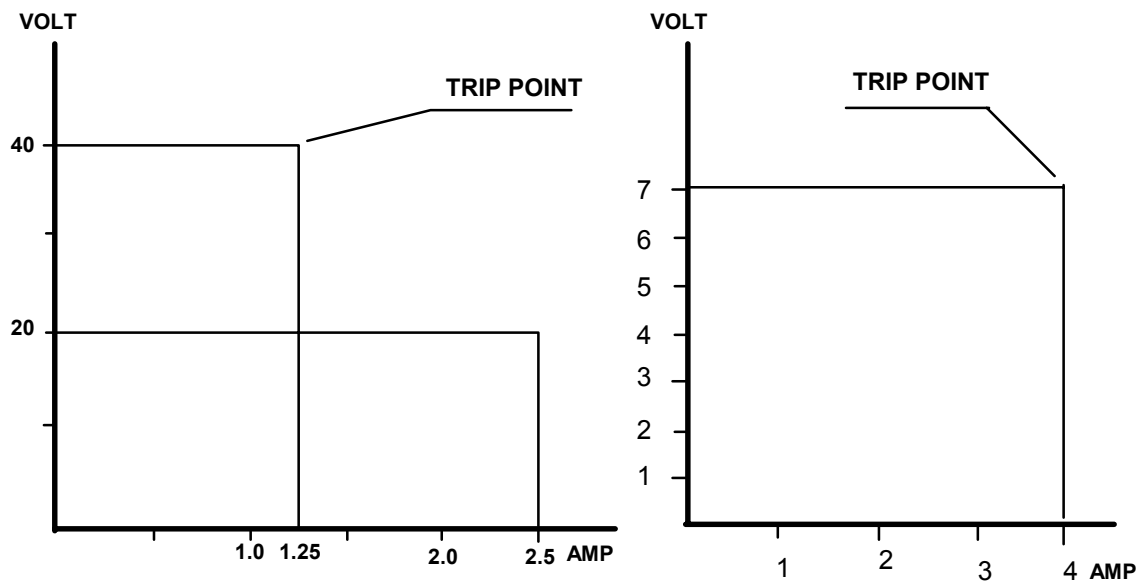


Figure 2

1.5 PARALLEL OPERATION

The outputs of the POWERBOX 3100 are fully isolated and independent of each other and may be connected in parallel without any limitations. However, voltage settings and cabling needs special attentions if you want current sharing.

1.6 SERIES OPERATION

Two or more outputs from POWERBOX 3100 may be connected in series. Series operation is allowed up 150V total voltage.

SECTION 2

INSTALLATION

2.1 UNPACKING & INSPECTION

After carefully unpacking the instrument, inspect external parts for damage to knobs, indicators, surface areas etc. If there is damage, file a claim with the carrier that transported the instrument. Retain the shipping container and packing material for use in case reshipment is required.

2.2 POWER REQUIREMENTS

Before connecting the instrument to the line power be sure that the 115/230 V switch is in the correct position. Also change the line fuse in accordance with the table below. Be sure that the plug on the power card is proper matched to the line receptacle.

Fuse :	115 VAC	2xT 6.3 AH, 250 V, slow, 5*20 mm
	230 VAC	2xT 3.15 AH, 250 V, slow, 5*20 mm

SECTION 3

CIRCUIT DESCRIPTION

3.1 GENERAL

The mains is connected to the 115/230 V input selector, which connects the transformers primary windings in series for 230 V and in parallel for 115 V. The power transformer, a toroid type, transforms the 115/230 V to secondary voltages suitable for the three independent outputs. The power supply is protected against overheating by output limiting circuits that senses the temperature on the heat sink.

Transient suppressers protects the unit from breakdown by voltage spikes generated by transmitters or inductive loads.

3.2 THE 0 - 20 V / 0 - 40 V OUTPUT (Channel 1 and 2)

These two channels are identical. The output voltage is set by a 10-turn potentiometer on the front of the unit. The temperature stabilised set voltage is compared to the output voltage in the regulator. The regulator controls the power transistors to give the correct output voltage at the output terminals.

The current limit is set by a 1-turn potentiometer on the front. The temperature stabilised reference voltage, representing the current limit, is compared in a regulator with the output current measured over a precision resistor. When the output current exceeds the set current limit the output goes into a constant current (CC) mode and the "CC" LED will light. The current limit can be set in the range 0-100 % of the maximum rated output current.

Each channel has two digital displays where the output voltage and current are monitored.

The power transistor temperature is measured for each channel and if the temperature exceeds 70 °C a control circuit will reduce the current from the overheated channel and the LED marked "Over Temp" will start to flash.

With a switch at the rear of the unit each channel can separately change the output range between 0-20 V and 0- 40 V. When the 0- 40 V is in operation the 40 V LED will light. If the output range 0 - 20 V is chosen and the voltage is set to a value higher than 20 V the LED "Over Range" will flash.

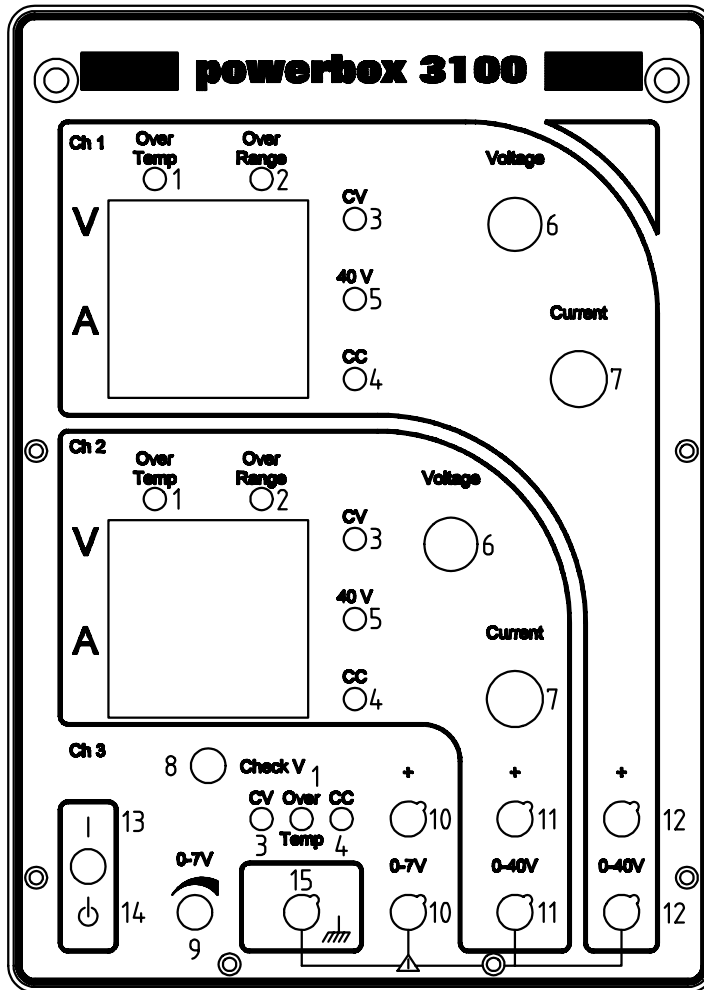
3.3 THE 0 -7 V OUTPUT (Channel 3)

The control circuit for the 0-7 V output works in exactly the same way as for 20 / 40 V output but the output is set by a 1-turn screwdriver controlled potentiometer on the front of the unit.

The current limit is for the 0-7 V output fixed to 4A. When the output current is equal to the maximum current the output goes into a constant current (CC) mode and the CC LED will light. The output will operate in the CC mode even when the output is short circuit.

The output voltage for Channel 3 (Ch 3) can be monitored on the voltage display for Channel 2 (Ch 2) by holding the switch marked "0-7 V" in the "Check V" position.

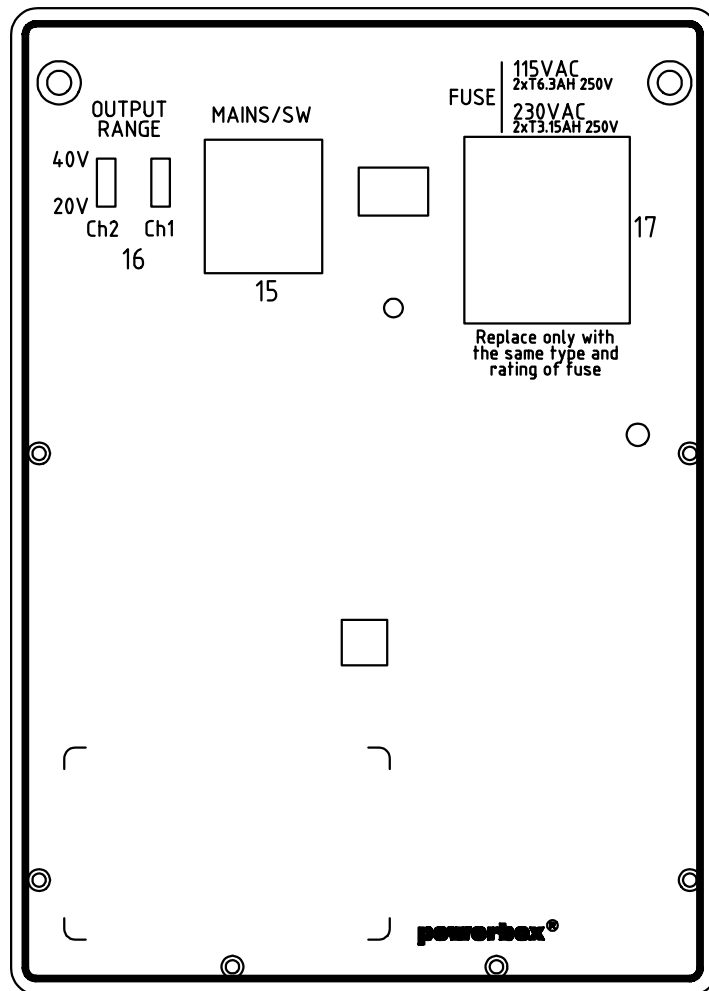
FRONT VIEW



1. LED: Over temperature indication for each channel.
2. LED: Over range indication for channel 1 and 2.
3. LED: The channel is in constant voltage mode.
4. LED: The channel is in constant current mode.
5. LED: Channel is working in 40 V range.
6. Potentiometer for voltage setting for channel 1 and 2.
7. Potentiometer for setting of current limit for channel 1 and 2.
8. Switch: Push right, voltage for channel 3 will show in display for channel 2.
9. Potentiometer for voltage setting for channel 3.
10. Output terminals for channel 3.
11. Output terminals for channel 2.
12. Output terminals for channel 1.
13. Switch in upper position: Voltage at the output terminals.
14. Switch in lower position: No voltage at the output terminals.
15. Earth terminal

 = Maximum allowed voltage between two outputs or one output to the earth terminal is 150 VDC

REAR VIEW



- 15. Main switch.
- 16. Switches for 20 V/40 V range selection for channel 1 and 2.
- 17. Main fuse.

SECTION 4

CALIBRATION AND MAINTENANCE

4.1 GENERAL

The power supply is burned-in and calibrated prior to shipment. Calibration should remain valid for a minimum of 1 year.

4.2 FACTORY REPAIR, FIELD SERVICE

Although the power supply is designed for easy diagnosis and repair with just basic test equipment, POWERBOX maintains both factory and field-repair services for those customers not possessing the necessary capability. When returned to POWERBOX for calibration or repair, the unit should be accompanied with a detailed description of the specific problems to help minimise turn-around time.

The internal fuses must only be replaced with the same type, Littlefuse or fuses according to Powerbox article number.

F1-F7	Littlefuse 25101.5	1,5 A	Powerbox No. 4501 00228
F8-F12	Littlefuse 473007	7,0 A	Powerbox No. 4501 00252

4.3 REQUIRED TEST INSTRUMENTS

A. Oscilloscope

100 MHz bandwidth. Sensitivity, minimum 50 mV

B. DMM

4 ½ digit. AC-DC voltage and current range. Min. 5A DC

C. Insulated and adjustable transformer

0-125 or 0-250 V, 1000 W or equivalent

D. Dynamic load

A dynamic load rated min 50 W, having the voltage and current range of the unit under the test.

E. DMM

3½ digit with AC-DC volt and current ranges.

WARNING

High voltage is present inside cover. Service and calibration by authorised personnel only.

4.4 CALIBRATION PROCEDURE

Calibration of reference voltages

1. Set the switch on the front in position "Stand by". Turn on the power to the unit.
2. Connect the DMM between 0V (J106:2) and J106:3. Adjust the voltage to +10V +/- 0,02 V with potentiometer R 134.
3. Connect the DMM between 0V (J106:9) and J106:10. Adjust the voltage to +10V +/- 0,02 V with potentiometer R 234.

4. Connect the DMM between 0V (J106:17) and J106:18. Adjust the voltage to +10V $\pm 0,02$ V with potentiometer R 319.

Calibration of instruments for Channel 1 (CH 1), 0-20/0-40V

- 5 Set all potentiometers on the front fully anti clockwise. The LED "CC" should light.
6. Set the main switch in the front in position "ON". Set the 20/40 V switch at the rear of the unit in position "40 V". The LED "40 V" should light. Short circuit the output terminals for CH 1.
7. Adjust with potentiometer R 419 until the current instrument for CH 1 shows +0,01 V.
8. Adjust with potentiometer R 403 until the voltage instrument for CH 1 shows +0,1 V. Remove the short circuit.
9. Set the current limit for CH 1 in the middle position. The LED "CV" should light. Measure the voltage on the terminals for CH1 with the DMM. Set the voltage to 40,00 V. Adjust with potentiometer R 407 until the voltage on instrument is 40,00 V ± 1 digit.
10. Set the 20/40 V switch at the rear of the unit in position "20 V". Set the voltage to 12,0 V. Apply a load of 2,5 A to the terminals of CH 1. Measure the current with DMM. Adjust with potentiometer R 423 so the value on the display for the current has the same value as the value on the DMM.

Calibration of instruments for Channel 2 (CH 2), 0-20/0-40V

- 11 Set all potentiometers on the front fully anti clockwise. The LED "CC" should light.
12. Set the main switch in the front in position "ON". Set the 20/40 V switch at the rear of the unit in position "40 V". The LED "40 V" should light. Short circuit the output terminals for CH 2.
13. Adjust with potentiometer R 451 until the current instrument for CH 2 shows +0,01 V.
14. Adjust with potentiometer R 435 until the voltage instrument for CH 2 shows +0,1 V. Remove the short circuit.
15. Set the current limit for CH 2 in the middle position. The LED "CV" should light. Measure the voltage on the terminals for CH 2 with the DMM. Set the voltage to 40,00 V. Adjust with potentiometer R 439 until the voltage on instrument is 40,00 V ± 1 digit.
16. Set the 20/40 V switch at the rear of the unit in position "20 V". Set the voltage to 12,0 V. Apply a load of 2,5 A to the terminals of CH 2. Measure the current with DMM. Adjust with potentiometer R 455 so the value on the display for the current has the same value as the value on the DMM.

4.5 MAINTENANCE

Periodically wipe the case with a damp cloth and detergent (do not use abrasives or solvents).

It is advisable to inspect the fan and interior regularly and if needed remove built up dust.

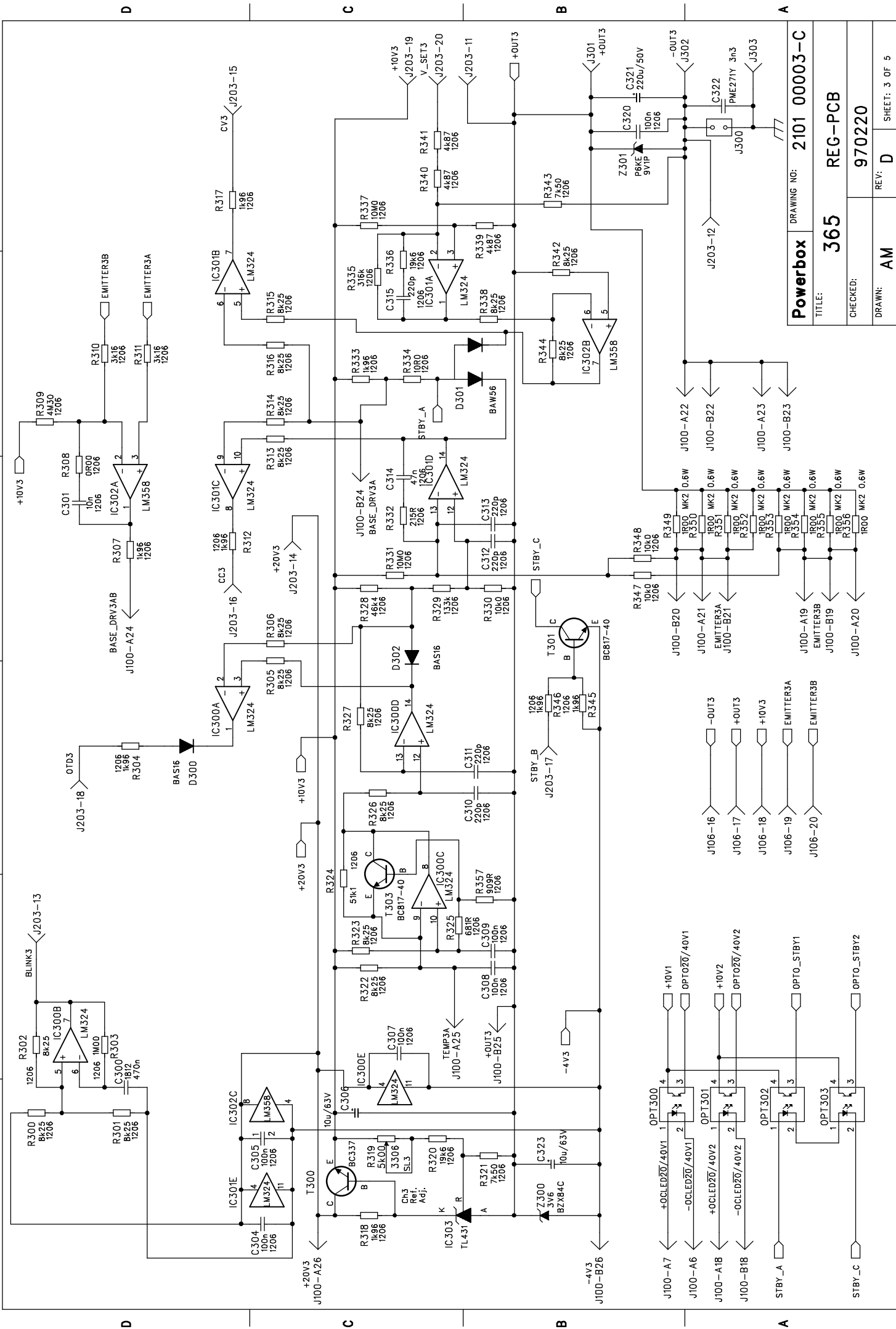
SECTION 5

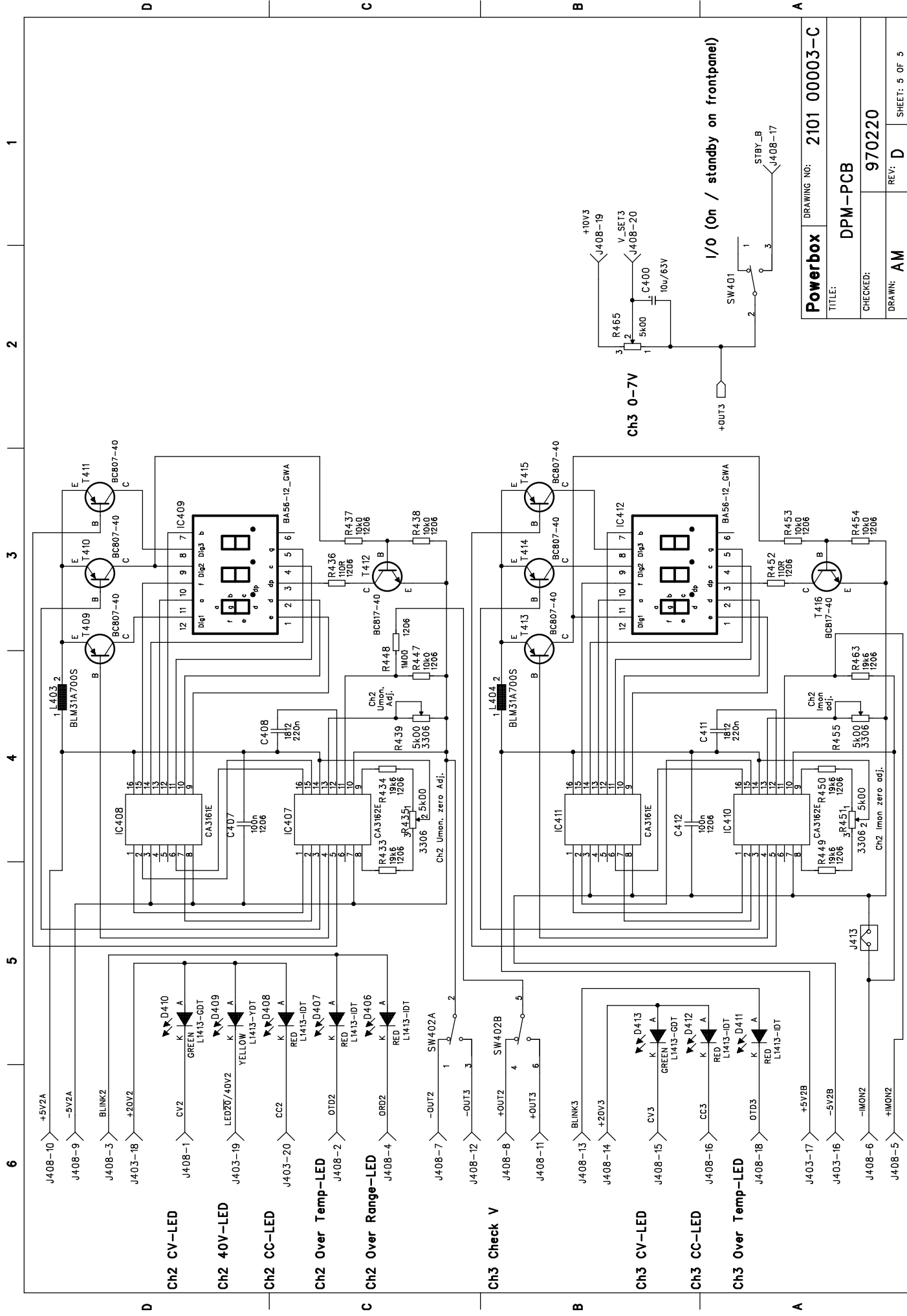
LIMITED WARRANTY

Each instrument manufactured and sold by POWERBOX, or its authorised agents, is warranted to be free from defects in material and workmanship and to perform within applicable specifications for a period of five (5) years after the original shipment date. POWERBOX's obligations under this guarantee is limited to repairing or replacing any instrument or parts thereof, which within five (5) years after delivery to the original purchaser shall be returned to POWERBOX with transportation charges prepaid, and shall be proved after POWERBOX's examination to be defective, and to have operated within specified limits.

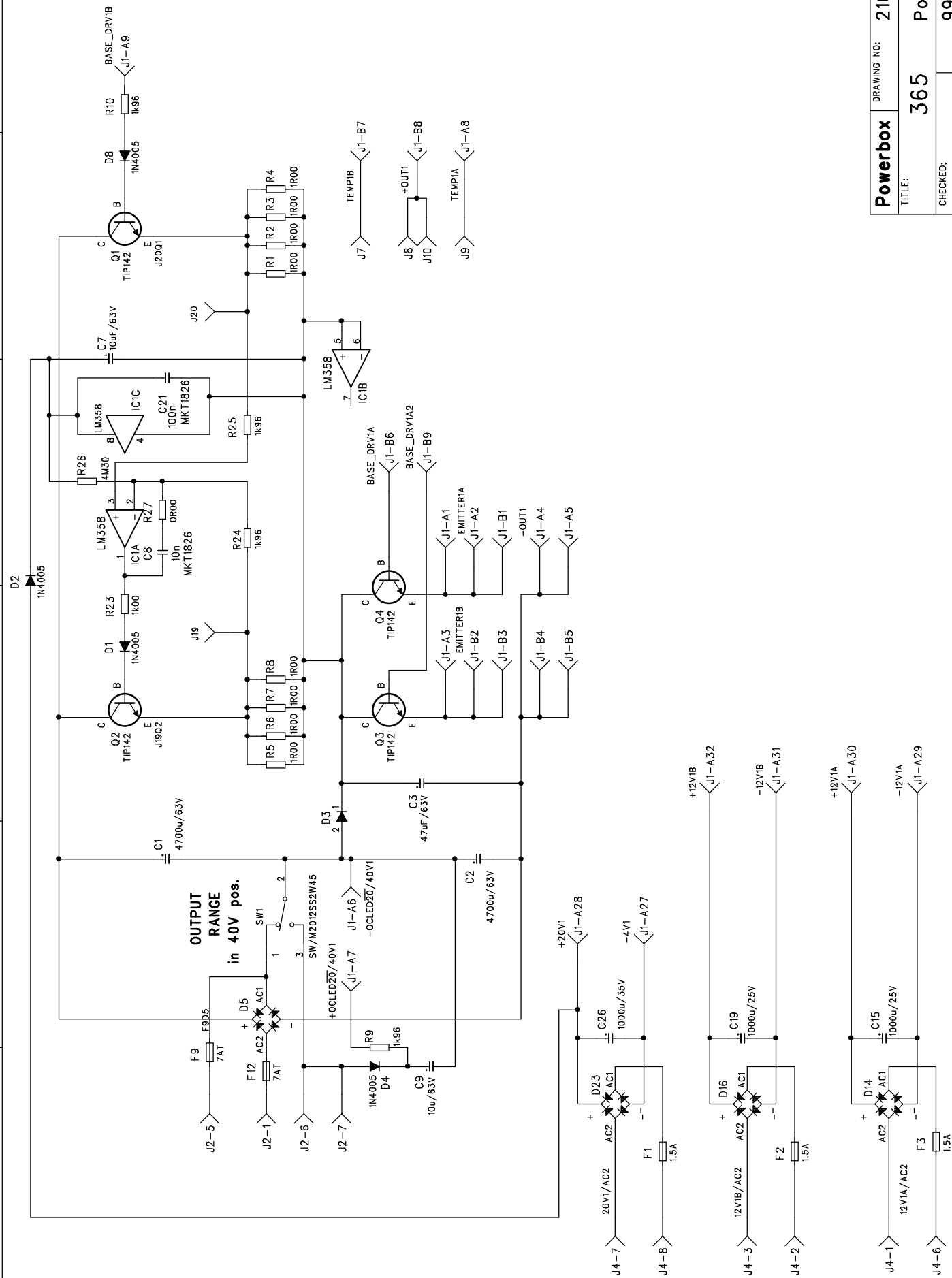
We reserve the right to discontinue instruments without prior notice, and to make modifications at any time without incurring any obligations to make sure modifications to instruments previously sold.

The instrument may not be used in another way or for other purposes than described in this manual.

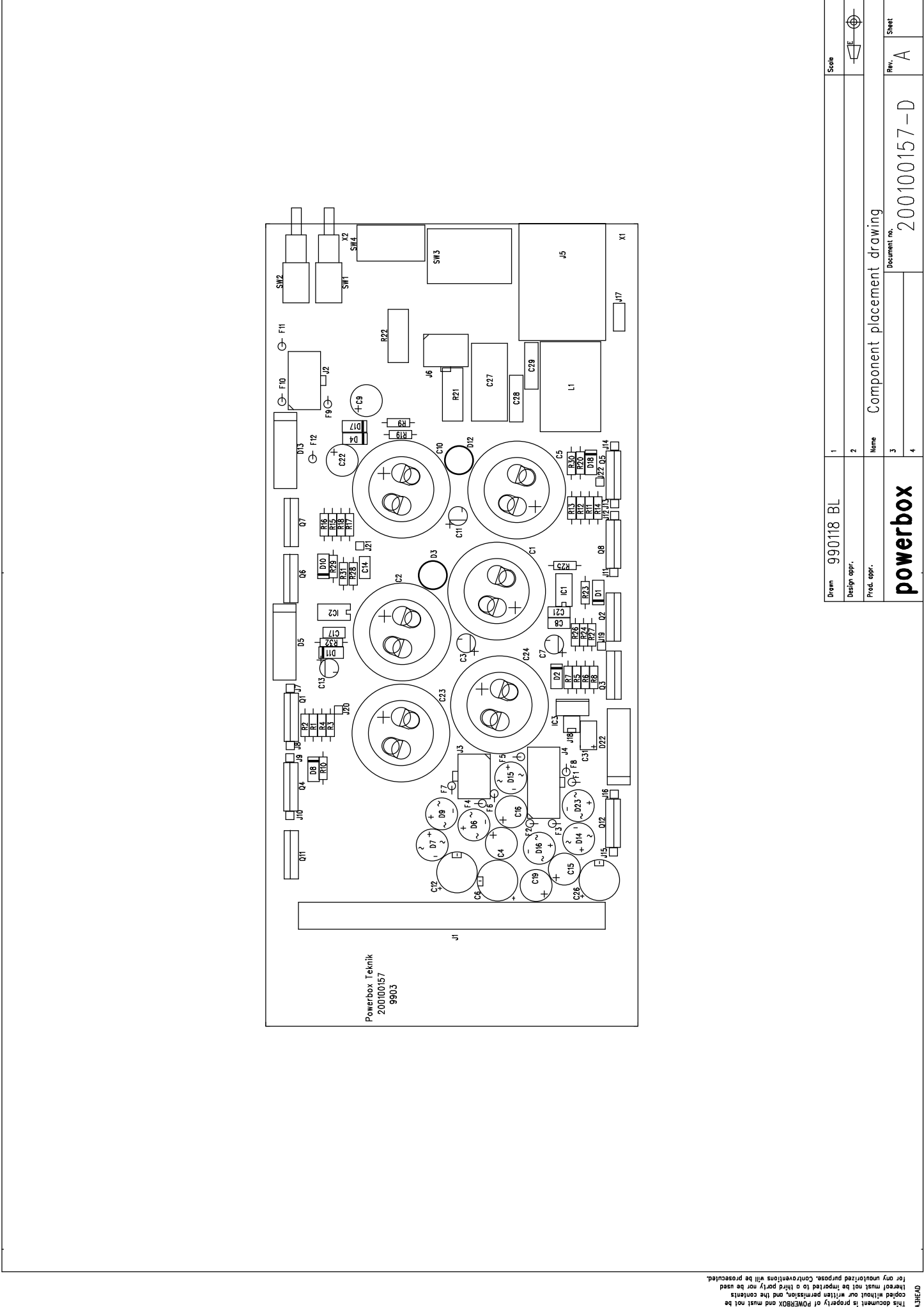




6 5 4 3 2 1



Powerbox	DRAWING NO: 210100037-C	
	TITLE: 365 Power-PCB	
CHECKED:	990118	
DRAWN: AM	REV: E	SHEET: 1 OF 3



Powerbox Teknik
200100157
9903

Scale 1:1

Legend:

- Capacitor: C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28
- Resistor: R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22
- Diode: D1, D2, D3, D4, D5, D6, D7, D8, D9, D10
- Transistor: Q1, Q2, Q3, Q4, Q5, Q6, Q7
- IC: IC1, IC2, IC3, IC4
- Connector: J1, J2, J3, J4, J5, J6, J7, J8, J9, J10, J11, J12, J13, J14, J15, J16, J17
- Switch: SW1, SW2, SW3, SW4
- Fuse: F1, F2, F3, F4, F5, F6, F7, F8, F9, F10, F11

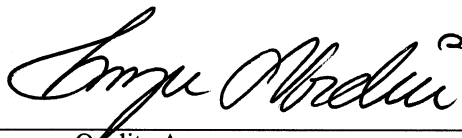
Certificate of Conformity

Lab. power supply

Powerbox 3100

Serial No. _____

We certify that this unit has been tested and manufactured to conform to the specifications as advised in this manual.



Manager, Quality Assurance

powerbox