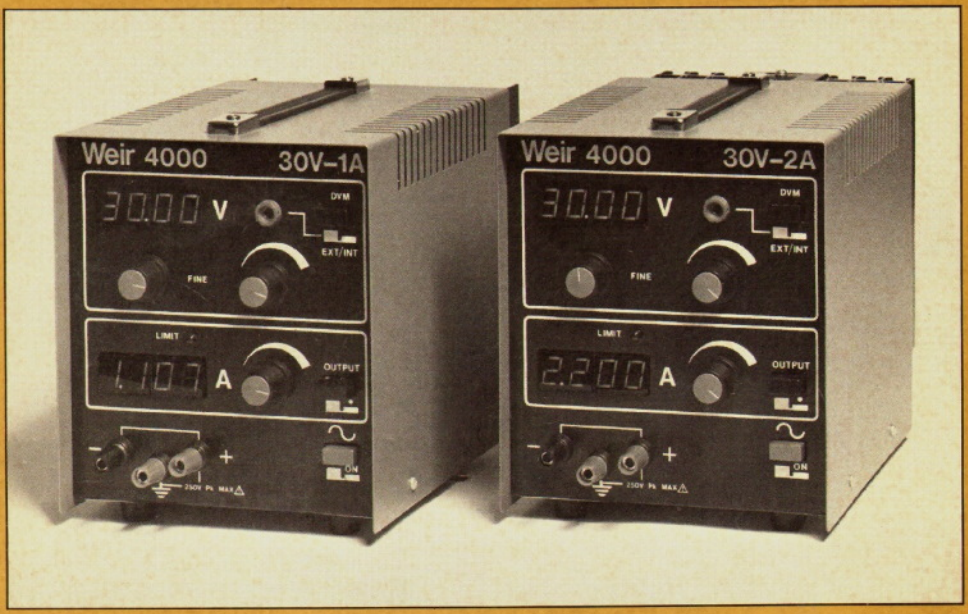
Weir

Laboratory Power Supplies



Type 4000 30V1A
Type 4000 30V2A

Fig 6. Twinpack 4000 30V1A /30V2A

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1. INTRODUCTION

The type 4000 laboratory power supplies exploit the latest LSI semi-conductor technology to provide true constant voltage constant current operation with two precision digital meters each with a scale length of 4000 digits for simultaneous monitoring of output voltage and current: separate high gain regulators are used for the voltage and current control modes and automatic crossover between modes is indicated by a front panel LED. Output ranges for the two different type 4000 units are 0 — 30V, 0 — 1A, and 0 — 30V, 0 — 2A with generous overrange capability to enable maximum settings to be easily achieved even under worst case conditions. So that voltage and current can both be set without disconnecting the load from the front panel terminals a front panel push button switch is used to interrupt the power supply output. A further push button switch provides a changeover from internal to external connection for the digital voltmeter input, for measurement of external voltages on the internal meter.

The user is requested to read the operating instructions in this technical manual and particular attention is drawn to the section referring to safety which should be read carefully by operating and maintenance staff before attempting to use or service the power supply unit.

2. USING THE TYPE 4000 POWER SUPPLIES

Upon receiving the power supply carefully remove the unit from its packing and inspect it to ensure that no transit damage has occurred. Provided that this inspection is satisfactory an appropriate line connector may now be fitted to the 3 core captive mains lead ensuring that the brown conductor is connected to live, the blue to neutral and the green/yellow to earth.

Fuse Selection table — AC Line Fuse FSI △

AC line volts	4000 30V1A	4000 30V2A
110/220	2A	4A
220/240	1A	2A

△ Normally the unit will be set up at the factory for operation on 240V AC. The mains selector is internal and consists of a linked Molex connector with a polarising key mounted on a circuit panel above the transformer. The position of the polarising key shows clearly which of the four line voltages 110, 120, 220 or 240V is selected. The line fuse is mounted in a cradle type fuse holder on the same circuit panel. In order to inspect the fuse and voltage selector it is necessary to remove the cover. This is accomplished by removing the two screws from the ends of the handle and the two screws at each side. Ensure that the unit is not connected to the line supply before removing the cover. After ensuring that the correct line voltage is selected and the fuse is also correct replace the cover and connect the line supply. There is an indicator for line voltage setting on the rear panel consisting of a cover plate held in position by a central fixing screw. This plate may be rotated or reversed to show the appropriate line voltage. IT IS IMPERATIVE THAT THIS PANEL INDICATES THE CORRECT INTERNAL SETTING and therefore must be adjusted or checked each time the internal line voltage setting is adjusted or checked. The power supply is then ready for use. DO NOT UNDER ANY CIRCUMSTANCES OPERATE THE POWER SUPPLY WITHOUT FIRST ENSURING THAT THE EARTH CONNECTION IS CORRECTLY MADE.

The front panel layout is self explanatory, with voltage and current controls in separate distinctly marked groups.

The upper push button switch is the DVM EXT/INT control. When latched 'IN' the DVM measures the output voltage of the power supply, when 'OUT' the positive input to the DVM is connected to the 4mm socket adjacent to the switch. This enables voltages in the range zero to 39.99 volts to be measured on the DVM, where zero is the negative output terminal of the power supply. Since the output of the power supply is fully floating this negative terminal may be earthed, or at any other desired potential, provided it does not exceed 250V w.r.t. earth.

The push button switch within the current group fulfils two important function 1) when 'OUT' it disconnects the positive output of the power supply from the positive front panel terminal. This enables safe output voltages to be set up without the need for disconnecting the load. 2) Also when 'OUT' the DCM input is connected directly to the current control enabling safe current limits, or safe output currents in the current control mode, to be set up without the need for disconnecting the load from the front panel terminals.

N.B. It is always advisable to switch the power supply ON when a load is connected *only* after ensuring that the output

push button switch is 'OUT' and the DVM push button switch 'IN'.

△These power supplies are fully protected for series or parallel operation, also they may be floated up to 250V with respect to earth. When using them in this way the front panel output terminals will be at hazardous potentials so must in no way be touched when energised. When making connections to the terminals for applications where the output terminals exceed 42V w.r.t. earth it is advised that all equipment in use is disconnected from mains and all other sources of high potentials.

Natural convection provides adequate cooling for these power supplies for normal laboratory bench applications up to the maximum ambient working temperature noted in the specification. It is recommended that airflow around the units is not restricted, particularly by placing other equipment or papers on top of the units, when they are operational.

3. CIRCUIT DESCRIPTION

3.1 General Principles

The block schematic Fig. 1 shows the principle of operation and the main elements of the power supply. The transformer has two secondary windings, one supplying the power supply output and the other, a centre tapped winding, is used to provide positive and negative low fixed voltages for internal use.

The series regulator transistor is connected in the negative output and controls current flowing into the output to maintain the output voltage constant so that the current fed back through the voltage control potentiometer balances the current produced by the reference voltage at the V amplifier input. However, when the output current increases to a value such that the voltage dropped across the current sense resistor produces an input to the I amplifier in excess of the input produced by the reference supply via the current control potentiometer then the power supply crosses over into the current control mode. A comparator connected to the V and I amplifier outputs turns the LED 'on' when in current control.

The +5V auxiliary supply is stabilised by a three terminal regulator, whereas the −5V supply which has a much lower load is zener stabilised. A further zener diode circuit is used to produce the internal negative reference voltage −V Ref which is used as the reference input for the voltage and current regulator amplifiers, and an inverting buffer amplifier produces a positive reference voltage +V Ref for the internal digital meters. An output switch disconnects the positive output terminal so that the output voltage can be set without disconnecting the load. This switch also controls the input selection circuit to the current meter. This meter measures the voltage dropped across the current sense resistor to display actual output current when the output is connected, or the voltage from the current setting control to set the current limit when the output is disconnected.

3.2 Detailed Circuit Description

3.2.1 Input and Transformer Circuits and Auxiliary Supplies

Switch SW1 is a double pole on/off switch through which line and neutral are connected to the transformer primary. FS1 is a protection fuse fitted between SW1 and the transformer in the line side. An 0.1 uF suppression capacitor is connected across the primary. The transformer primary is split into two windings with taps to enable various line voltages to be accommodated by simple linking.

The main secondary output which is approximately 36 volts RMS on full load is rectified by diode bridge D1 — D4 and smoothed by C1 giving raw DC of approximately 40 volts on full load.

The other secondary which is centre tapped and gives approximately 10 volts per side feeds diode bridge DB 101 via protection fuses FS 101 and FS 102. These fuses are fitted because an overload in this circuit does not generate sufficient primary current to rupture FS1. The positive output from the bridge is filtered by C 103 and C 102 and then regulated to +5V by three terminal regulator IC 105. The negative output from the bridge is filtered by C 104 and dropped to a stable −5.6V by R 108 and zener diode D 101 with further smoothing provided by C 108. R132 provides a shunt discharge for C 104.

3.2.2 Voltage Regulating Circuit Fig. 2

The voltage regulating amplifier is one half of a dual operational amplifier IC 1a. This drives the base of output Darlington TR1 (and TR2 for 30V 2A), via gating diode D10. Output voltage is sensed at the positive output terminal and fed back via the coarse and fine voltage controls to the positive input of IC 1a. The stabilised −5V supply is further zener stabilised by D5 to give a highly stable reference supply of −2.45V which is

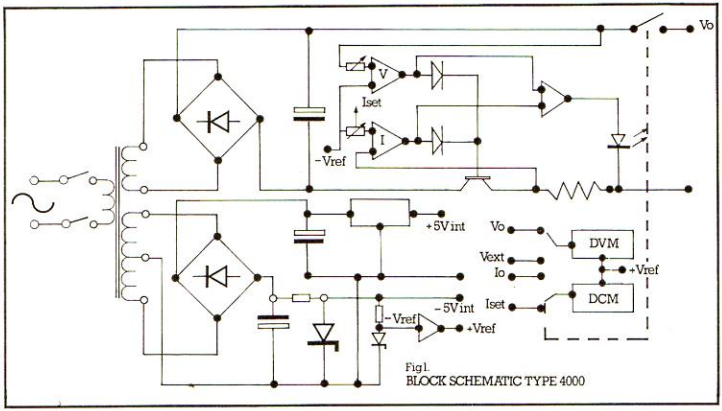


Fig1.
BLOCK SCHEMATIC TYPE 4000

fed via R9 into the same input. To set the maximum voltage that can be obtained with the fine and coarse voltage controls both fully clockwise a proportion (set by RV2) of the reference voltage is also connected to the summing point via R8. Vo is therefore forced to a value such that the current produced by it through the voltage control resistors exactly equals that produced by the reference voltage through R9 and RV2 and R8.

$$\frac{Vo}{RV5+RV6} = \frac{V\ Ref}{R9} + \frac{kV\ Ref}{R8}$$

where k is the effective setting of RV2

To ensure that the output is always zero when the voltage controls are set to zero a small offset voltage is produced by R4 and R3 and connected to the negative input of IC 1a. D7 prevents the output of IC 1a going more than slightly positive and C2 is fitted to provide compensation at H.F. The positive input of IC 1a is protected from large excursions by R31 and back to back diodes D6, D8. C3 and R15 provide low frequency stabilisation of the voltage regulating loop.

3.2.3 Current Regulating Circuit Fig. 2

The current control potentiometer is fed by a stable negative voltage derived from reference zener diode D5 via resistor network R6, RV1 and R5. The wiper voltage from the current potentiometer is then fed via R12 into the positive input of IC 2a thus ensuring that the output of this amplifier is negative, so that D11 is non-conducting and the power supply is under voltage control. R10 provides loading for the current control potentiometer to improve the resolution at low settings, whilst R11 and C6 improve output current ripple. When the current through output series resistor R27 rises the voltage fed back via R13 into the negative input of IC 2a also goes up. When this rises to a value high enough to overcome the effect of the current setting potentiometer the output of IC 2a will go positive tending to turn off the series regulator, thus limiting the output current to a value where the voltage across R27 equals the voltage at the wiper of the current control potentiometer (because R12 equals R13). The power supply is then under current control.

RV3, which is symmetrically connected across −V Ref and +V Ref via resistive attenuators (R18, R19 and R25, R20), provides null control to IC 2a via R14. C4 is fitted for H.F. compensation.

3.2.4 Reference Buffer and Current Limit Comparator Fig. 2

The negative reference voltage is inverted in IC 2b to provide a buffered positive reference voltage +V Ref for use in the measurement circuits.

IC 1b is connected as a comparator with the positive input driven from the current control amplifier IC 2a and the negative input driven from the voltage control amplifier IC 1a. Thus under voltage control the output of IC 1b is forced negative resulting in no current through the LED and under current control the output is forced positive (by the positive output of IC 2a) causing current to flow in the LED, thus illuminating it. R17 limits the LED current.

3.3 Measuring Circuits

Both meters are digital voltmeters using virtually identical circuits. The principle of operation is that a reference voltage charges an RC circuit until the voltage across the C equals the voltage to be measured. This is implemented by a comparator driving a flip flop which in turn drives a switch. Therefore the duty cycle of the flip flop will be proportional to Vin. Pulses produced by an internal clock are accumulated in a counter during this duty cycle and the counter output displayed, the displayed number is then proportional to the input voltage, and with suitable scaling is equal to it.

IC 101 and IC 103 are the DVM circuits (N.S. ADD 3701) and IC 102 and IC 104 are LED digital display buffers.

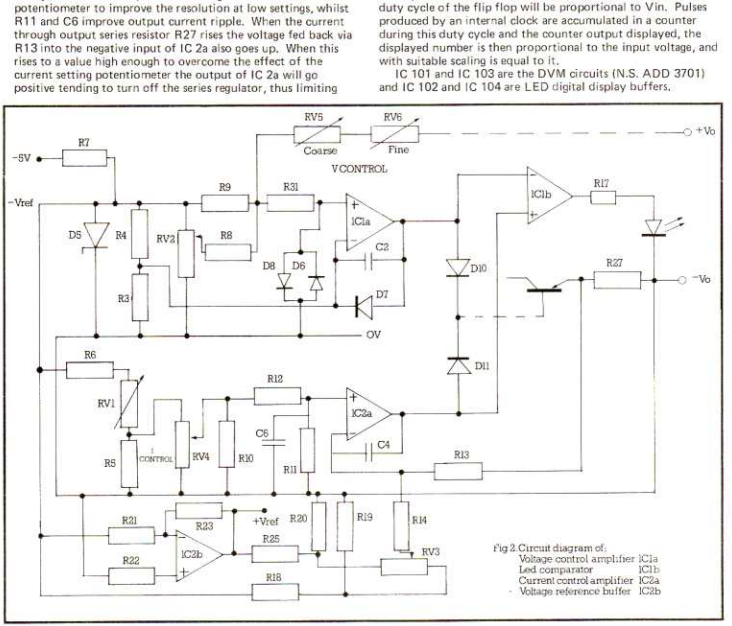


Fig 2 Circuit diagram of:
- Voltage control amplifier IC1a
- Led comparator IC1b
- Current control amplifier IC2a
- Voltage reference buffer IC2b

Power for the measuring circuits comes fromthe +5V three terminal regulator IC 105 and the OV is the power supply negative Output terminal.

3.3.1 Voltage Measuring Circuit

Input to the digital voltmeter is selected by SW3 to be either the power supply positive output or the external input socket. IN EACH CASE MEASUREMENT IS SINGLE ENDED AND IS WITH RESPECT TO POWER SUPPLY NEGATIVE OUTPUT TERMINAL.

The functions of the components external to the DVM integrated circuit IC 101 are as follows:—
R101 Input resistance
R105, R103, and RV104 Input attenuator and input scaling
RV102 and R104 Offset control
R107 and C105 Internal clock frequency setting
R106 and C106 Feedback RC network
C109 Filter capacitor
C107 Provides decoupling
The segments and decimal point are driven directly from IC 101 through resistors R110 to R117, and the digits are buffered by IC 102.

3.3.2 Current Measuring Circuit Fig. 3

Input to the digital current meter (DCM) is selected by the quad analogue switch IC3 and the position of the output switch SW2. Note that IC3 is connected between OV and —5V.

When SW2 disconnects the output of the power supply from the output terminal, R30 is connected to +Vo and the junction of R30 and D13 goes positive. This provides a +ve control signal to IC 3a and IC 3c which switches them to 'CONDUCT'. When IC 3a conducts the junction of R1 and IC 3a goes towards —5V which switches IC 3b and IC 3d to 'NON-CONDUCT'. In this mode IC 3c connects the wiper of the current setting potentiometer to the input of the DCM and IC 3d isolates the current monitor line (one side of R27) from this input. Conversely when SW1 is in the alternate state the junction of R30 and D13 is pulled down to the —5V line by R2, turning IC 3a and IC 3c to 'NON-CONDUCT'. The control inputs of IC 3b and IC 3d then go to OV and they revert to the 'CONDUCT' state. The output current monitor line is then connected to the DCM input by IC 3d whereas IC 3c isolates the wiper of the current potentiometer.

The functions of the components external to the DVM integrated circuit IC 103 are as follows:

R118, R113 input resistance
C115 input smoothing so that rapid current fluctuations are not registered on the DCM
RV103, R120 Offset control
R122, C110 internal clock frequency setting
RV101, R121, C111 Feedback RC network (RV101 adjusts meter scaling).
C114, C112 Decoupling capacitors

3.4 Power Supply Output Circuits

TR1 and TR2, the output series regulators are Darlingtons; TR1 only is fitted for the Type 4000 30V 1A unit and both for the 30V 2A version. R28 and R29 are current sharing resistors and are only fitted in the 30V 2A unit. C5, the output bucket capacitor keeps the output impedance low at high frequencies thereby improving transient response. This capacitor is protected by diode D14 against possible reverse voltages. R26 provides an internal bleed load when there is no output load and when SW2 is used to switch off the output load, D9 is a catching diode to provide a 'sense' connection during SW2 changeovers.

The series regulator(s) are protected by diode D12 against damage which can arise from reverse base emitter voltages when connecting the power unit to an external parallel source (for battery charging or connecting two supplies in parallel for example).

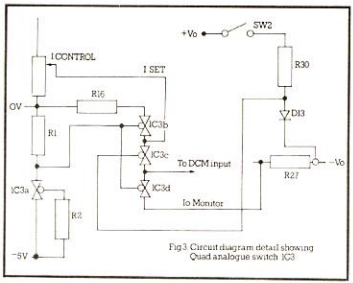


Fig.3. Circuit diagram detail showing Quad analogue switch IC3

4. SETTING UP PROCEDURE

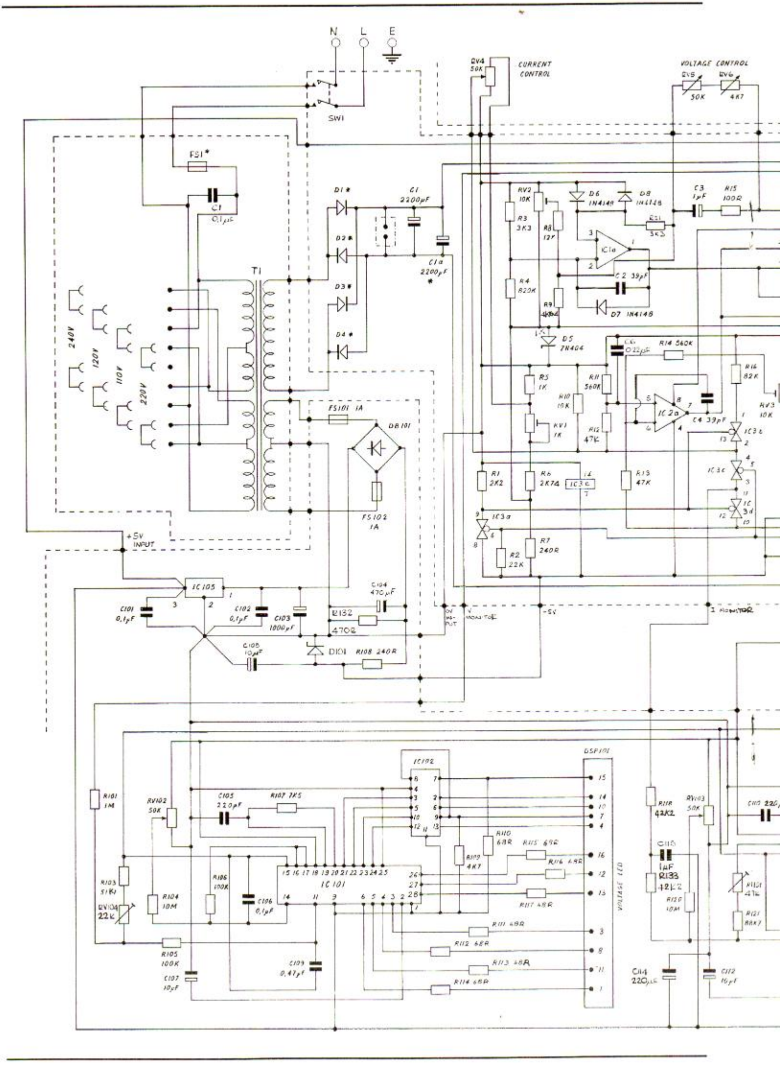
4.1 Dismantling

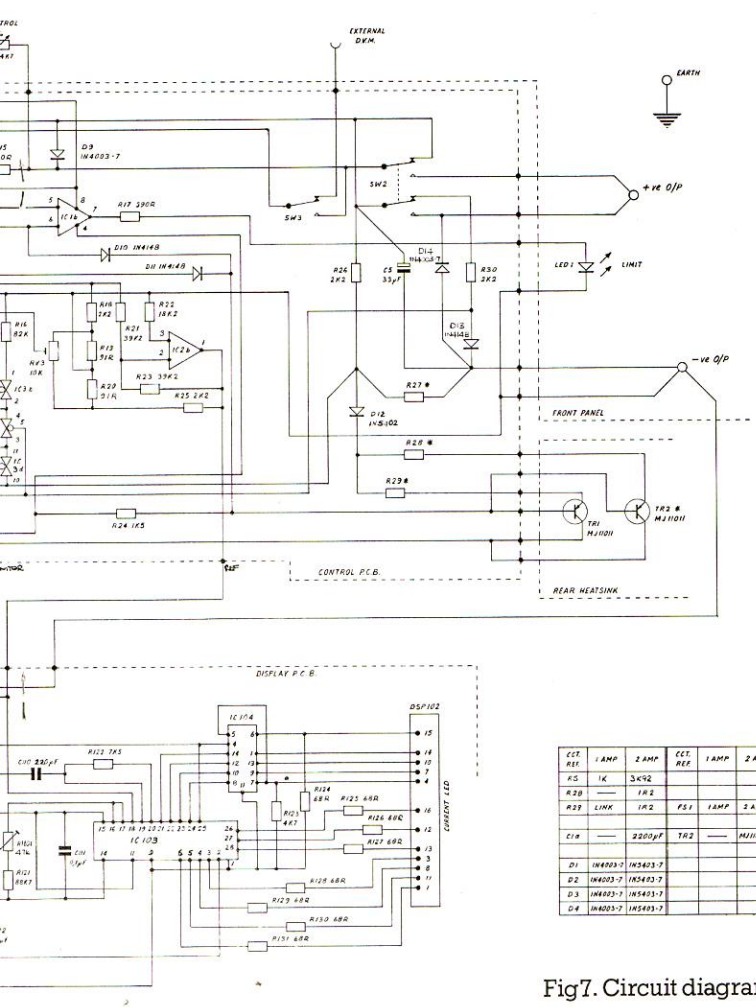
Fault finding, repair and recalibration should only be carried out by personnel who are qualified and competent to work on precision electronic circuits. Otherwise it is advised that the unit is returned to Weir Electronics or an appointed distributor or agent for this work to be undertaken.

Only suitably skilled personnel who are fully aware of the hazards of working with AC line powered equipment must be allowed to dismantle the unit. When dismantling or rebuilding, the unit must be disconnected from the line power source and only reconnected when absolutely essential for fault isolation, carrying out electrical adjustments and retest.

Removing the cover is described under section 2 of this handbook. This then gives good access to AC line selector, line fuse, transformer connections and the track side of the two main printed circuit boards. The front panel can be folded down (Fig. 4), without disturbing any connections by removing the following screws:—
2 front feet and the central screw between them.
2 rear screws fixing PCB's to rear panel (bottom rear for left hand PCB and top rear for right hand PCB).
If better access to the front panel or PCB components is required then the other four screws retaining the PCB's, (two at each front edge), can be removed and the PCB's then splayed as shown in Fig. 5.

Fig 4. Front panel assembly tilted forwards


N
L
E
SW1
RV4 50K
CURRENT CONTROL
VOLTAGE CONTROL
RV5 50K
RV6 4K7
FS1*
C1 0,1μF
T1
240V
120V
110V
220V
D1*
D2*
D3*
D4*
C1 2200pF
C1a 2200pF
FS101 1A
DB101
FS102 1A
+5V INPUT
IC105
C101 0,1μF
C102 0,1μF
C103 1000μF
C104 470μF
R132
470R
C108 10μF
D101
R108 240R
RV2 10K
R3 3K3
R8 12F
R4 820K
R9 4K64
D6 1N4148
D8 1N4148
D7 1N4148
D5 ZN404
IC1a
C2 39pF
C3 1μF
R15 100R
RS1 3K3
C6 0,22μF
R14 560K
R5 1K
R10 10K
R11 560K
R12 47K
RV1 1K
IC2a
C4 39pF
R16 82K
RV3 10K
IC3b
IC3c
IC3d
R1 2K2
R6 2K74
R13 47K
IC3a
R2 22K
R7 240R
0V INPUT
V MONITOR
-5V
I MONITOR
IC102
DSP101
R101 1M
RV102 50K
C105 220pF
R107 7K5
R110 68R
R115 68R
R116 68R
R117 68R
R109 4K7
R103 51K1
RV104 22K
R104 10M
R106 100K
C106 0,1μF
IC101
R105 100K
C107 10μF
C109 0,47μF
R111 68R
R112 68R
R113 68R
R114 68R
VOLTAGE LED
R118 42K2
RV103 50K
C115 1μF
R133 42K2
R120 10M
C114 220μF
C112 16μF
R121 88K7
R131 47K



CCT. REF.	1 AMP	2 AMP	CCT. REF.	1 AMP	2 AMP
R5	1K	3K92			
R28	——	1R2			
R29	LINK	1R2	FS1	1 AMP	2 AMP
C18	——	2200pF	TR2	——	MJ11011
D1	IN4003-7	IN5403-7			
D2	IN4003-7	IN5403-7			
D3	IN4003-7	IN5403-7			
D4	IN4003-7	IN5403-7			

Fig7. Circuit diagram

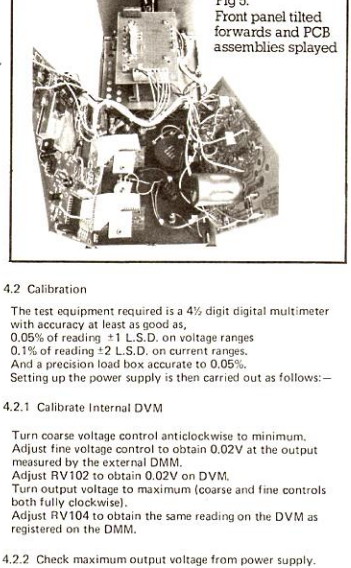


Fig 5.
Front panel tilted forwards and PCB assemblies splayed

4.2 Calibration

The test equipment required is a 4½ digit digital multimeter with accuracy at least as good as,
0.05% of reading ±1 L.S.D. on voltage ranges
0.1% of reading ±2 L.S.D. on current ranges.
And a precision load box accurate to 0.05%.
Setting up the power supply is then carried out as follows:—

4.2.1 Calibrate Internal DVM

Turn coarse voltage control anticlockwise to minimum.
Adjust fine voltage control to obtain 0.02V at the output measured by the external DMM.
Adjust RV102 to obtain 0.02V on DVM.
Turn output voltage to maximum (coarse and fine controls both fully clockwise).
Adjust RV104 to obtain the same reading on the DVM as registered on the DMM.

4.2.2 Check maximum output voltage from power supply.

Turn fine and coarse voltage controls fully clockwise and check that the output voltage is 31 volts (approximately) if not adjust RV2 until it is.

4.2.3 Calibrate Internal DCM

With the output voltage set to 30.00V connect the load box across the output terminals. Set the load box to 15kΩ and adjust RV103 until the DCM reads .002A. Connect the DMM across the output and select the 2A range then adjust the current control to obtain a reading of approximately 1A on the DMM. Adjust RV101 to obtain exactly the same reading on the internal DCM.

4.2.4 Set Maximum Current Output

With the current control set to a maximum (fully clockwise), adjust RV1 to give an output current of 1.100 ± .010A or 2.2 ± .020A depending on whether the unit is 4000 30V 1A or 4000 30V 2A.

SAFETY REGULATIONS

IEC 348

IEC Clause

63 1. The apparatus described in this manual is safety class 1 (IEC Classification).
Accessible metal parts which are connected to the protective earth terminal indirectly are:—
The cover and the heat sink.

64.1 2. The apparatus has been designed and type tested according to IEC Publication 348, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. The present instruction manual contains information and warnings which shall be followed by the user to ensure safe operation and to retain the apparatus in safe condition.

64.2(a) 3. If the unit is to be connected to the main supply by fixed wiring, rather than via a mains plug, then the protective earth wire in the 3-core mains lead shall be connected to a protective conductor before any other connection is made.

64.3(a) 4. Before switching on the apparatus, make sure that it is set to the voltage of the mains supply.

64.3(c) 5. Ensure that an appropriate mains plug is correctly connected to the captive 3-core cable provided with the unit. Connections are:— brown = live, green/yellow = earth and blue = neutral. Then ensure that the mains socket to be used has a correctly connected protective earth contact. Do not use extension cords without protective earth conductors.

64.3(a) 6(a) If the unit is to be used with live measuring or load circuits which have protective earth terminals, ensure that all protective earth terminals are connected to a protective conductor (the front panel green terminal may be used for this purpose) prior to switching on.

64.3(e) 6(b) If the unit is to be used with live measuring or load circuits which do not have protective earth terminals, ensure that the unit mains plug is inserted before making connections between the unit output terminals and such circuits.

64.4(a) 7. WARNING
(a) Any interruption of the protective conductor inside or outside the unit, or disconnection of the protective earth connection, is likely to render the apparatus dangerous. Intentional interruption is prohibited.

64.4(b) (b) The output of the power supply unit is fully floating and it may be used in series with other power supply units to generate high DC voltages up to 300V DC.
Such voltages are exceedingly hazardous and great care should be taken to shield the output terminals for such use. On no account should the output terminals be touched when the unit is switched on under such use. All connections to the terminals must be made with the power switched off.

64.5(a) 8(a) Ensure that the unit is disconnected from the mains supply (switching off the unit by the front panel ON/OFF switch is not sufficient) before the cover is removed for the purposes of maintenance or setting up — otherwise dangerous voltages are accessible.
Unless unavoidable, do not reconnect the unit to the mains supply until the repair is complete and the cover replaced.
It is recognised that, for fault finding and setting up, the mains supply will require reconnection and the unit will be switched on — thus, this work may only be carried out by a skilled person who is aware of the hazard involved. When this work is completed, disconnect the mains supply before replacing the cover.

64.5(c) (c) Use only the correctly rated fuses as specified in the parts list for replacement. On no account use mended fuses or short circuited fuse holders.

64.6 9. If the apparatus is defective or if it has been subjected to abnormal mechanical stresses, it is likely that the safety protection may be impaired, in which case, the unit should be withdrawn from use and returned to the factory for recheck and repair.
This is aparticularly important if there are external signs of mechanical damage.

6. SPECIFICATIONS

Line Supply 110, 120, 220, 240V ±10% 48–63Hz

Voltage Mode

Line regulation	≤ ±0.01% for ±10% line voltage change
Load regulation	< 0.05% for 100% load change
Ripple & Noise	< 2mV peak to peak
Output Impendance	< 10mΩ at 1 kHz
Temperature Co-efficient	< 0.01%/°C typically
Transient Response :	recovers to < 50mV of setting within 30μ secs after full load step change
Transient Excursion :	±0.5V maximum for full load step change

Note:
All voltage mode specifications apply when the output voltage is set to maximum.

Current Mode

Variation of output current	< ±0.1% for ±10% line voltage change
Variation of output current	< ±1mA for 0–30V output voltage change
Output resistance	> 30kΩ when voltage control is set to maximum
Current ripple	< 1mA pk – pk

Note:
All current mode specifications apply when output current is set to a maximum, and voltage control is set to a maximum.

Voltmeter

Display	: 12.5mm LED 4 digit
Range	: 0 to 39.99 volts
Accuracy	: ±0.1% of reading ±2 L.S.D. at 23°C
Conversion Rate	: 4 per second approximately
Input Impedance	: ≥ 1MΩ

Input Protection:
No damage will result by inadvertent connection to 240V AC line voltage
Voltage Measurement:
External measurement of voltages is possible in the range 0 to 39.99 volts positive with respect to power supply 'negative' output terminal.

Current Meter

Display	12.5mm LED 4 digit
Range	0 to 3.999 Amps
Accuracy	±0.2% of reading ±4 L.S.D. at 23°C
Conversion Rate	4 per second approximately.

General
Operating temperature range:
0° to 45°C
Storage temperature range:
–10°C to 80°C

Output Isolation:
Output may be operated up to 250V with respect to chassis
Output Protection:
External reverse voltages will not cause damage provided current generated does not exceed half full load current
RFI:
BS800
Applicable Safety Standard:
These units have been designed to conform to the relevant provisions of IEC 348
Dimensions and Weight (approx):

	H	W	D	WT
30V 1A	180 x	153 x	240mm	4.4kg
30V 2A	180 x	153 x	260mm	4.7kg

7. PARTS LIST

The following parts list is not a complete manufacturing parts list but is a list of all circuit components which may require replacement in the event of damage or faulty operation.

7.1 FRONT PANEL SUB ASSEMBLY

	CCT REF	WEIR PART No.	DESCRIPTION	MANUFACTURERS' REF
	RV6	074051 VS	Potentiometer 1KR 20%	Radio P20C–A Round shaft
	RV4 (delete 4000T)	076170 VW	Potentiometer 50KR 1W 10%	Colv CLR 1106/11
	RV5	076170 VW	Potentiometer 50KR 1W 10%	Colv CLR 1106/11
	LED 1	065144 DL	LED RED 20mA	LITR RL2000 with RLC201
4000T	RV4	076210 VS	Pot 10–turn 50KR 2W 5%	Beckman 7276

7.2 HEATSINK

	CCT REF	WEIR PART No.	DESCRIPTION	MANUFACTURERS' REF
	TR1	059068 TP	Darlington PNP TO3 30A	TCSF BDX 66A
30V 2A	TR2	059068TP	Darlington PNP TO3 30A	or MOTO MJ 11011

7.3 BASE PLATE

	CCT REF	WEIR PART No.	DESCRIPTION	MANUFACTURERS' REF
	T1	383300 XT or	Transformer	Weir 383350 A2
30V 2A		383400 XT	Transformer	Weir 383450 A2
	FS1	081180 FX or	Fuse 20mm 1A	F286
30V 2A		081280FX	Fuse 20mm 2A	F286
	C1	048141 CF	250V Film Capacitor 0.1uF 20%	BESW TDC 123 RIFA PME 271M610

7.4 CONTROL PCB

CCT REF	WEIR PART No.	DESCRIPTION	MANUFACTURERS' REF
R2	027100 RF	Res Car Film 22KR 0.25W 5%	PIHE PR25
R1	026220 RF	Res Car Film 2.2KR 0.25W 5%	PIHE PR25
R3	026260 RF	Res Car Film 3.3KR 0.25W 5%	PIHE PR25
R4	030081 RF	Res Car Film 820KR 0.33W 5%	MULD CR25
R5	015498IRM	Res Met Film 1KR 0.4W 1%	MULD MR25
30V 2A	014220 RM	Res Met Film 3.92KR 0.4W 1%	MULD MR25
R6	014245 RM	Res Met Film 2.74KR 0.25W 1%	MULD MR25
R7	026119 RF	Res Car Film 240R 0.25W 5%	PIHE PR25
R10 (delete 4000T)	014240 RM	Res Met Film 10KR 0.4W 1%	MULD MR25
R8	027070 RF	Res Car Film 12KR 0.25W 5%	PIHE PR25
R11	030072 RF	Res Car Film 560KR 0.33W 5%	MULD CR25
R12	027130 RF	Res Car Film 47KR 0.25W 5%	PIHE PR25
R14	030072 RF	Res Car Film 560KR 0.33W 5%	MULD CR25
R16	030031 RF	Res Car Film 82KR 0.25W 5%	PIHE PR25
R13	027130 RF	Res Car Film 47KR 0.25W 5%	PIHE PR25
R18	026220 RF	Res Car Film 2.2KR 0.25W 5%	PIHE PR25
R19	026071 RF	Res Car Film 91R 0.25W 5%	PIHE PR25
R20	026071 RF	Res Car Film 91R 0.25W 5%	PIHE PR25
R21	033022 RM	Res Met Film 39.2KR 0.25W 1%	VTM 471
R15	026090 RF	Res Car Film 100R 0.25W 5%	PIHE PR25
R17	026142 RF	Res Car Film 390R 0.33W 5%	MULD CR25
R22	014819 RM	Res Met Film 18.2KR 0.4W 1%	MULD MR25
R23	033022 RM	Res Met Film 39.2KR 0.25W 1%	VTM 471
R25	026220 RF	Res Car Film 2.2KR 0.25W 5%	PIHE PR25
R24	026205 RF	Res Car Film 1.5KR 0.25W 5%	PIHE PR25
R26	028506 RF	Res Car Film 2.2KR 0.5W 5%	MULD CR37
R30	028506 RF	Res Car Film 2.2KR 0.5W 5%	MULD CR37
R27	035000 RW	Res WW 0.47R 2.5W 5%	HUGS CR6
30V 2A R28	037040 RW	Res WW 1.2R 3W 5%	CGS C3A
30V 2A R29	037040 RW	Res WW 1.2R 3W 5%	CGS C3A
RV2	075280 VP	Pot Trim Car 1 Trn 10KR 0.15W 20%	PIHE PT10V
RV1	074284 VC	Pot Trim Cer 1 Trn 1KR 0.5W 10%	BOUR 3389H-1-102
RV3	075280 VP	Pot Trim Car 1 Trn 10KR 0.15W 20%	PIHE PT10V
IC1	063999 JL	Int Cct Op Amp Dual 5–30V DIL 8PL	TCSF TDB0158DP
IC2	063999 JL	Int Cct Op Amp Dual 5–30V DIL 8PL	TCSF TDB0158DP
IC3	065122 JC	Int Cct Mos Quad Analog SW DIL14P	MOTO MC14066BCP
30V 2A D1	067182 DX	Diode Misc	MR504 1N5402
30V 2A D2	067182 DX	Diode Misc	MR504 1N5402
30V 2A D3	067182 DX	Diode Misc	MR504 1N5402
30V 2A D4	067182 DX	Diode Msc	MR504 1N5402
D5	069035DZ	Diode Zen Ref 2.45V 0.3W ±OR ±10%	FERR ZN 404
D6	069130 DS	Diode SI 75V 75MA D035	MOTO GI 1N4148
D7	069130 DS	Diode SI 75V 75MA D035	MOTO GI 1N4148
D8	069130 DS	Diode SI 75V 75MA D035	MOTO GI 1N4148
D10	069130 DS	Diode SI 75V 75MA D035	MOTO GI 1N4148
D11	069130 DS	Diode SI 75V 75MA D035	MOTO GI 1N4148
D9	069123 DS	Diode SI 200V 1A D015	MOTO GI 1N4003
D13	069130 DS	Diode SI 75V 75MA D035	MOTO GI 1N4148
D12	067180 DX	Diode Misc	MR 501
D14	069123 DS	Diode S1 200V 1A D015	MOTO GI 1N4003
C1	057063 CE	Cap Alum Elect 2200uF 63V −10 + 50%	LORL MD
30V 2A C1A	057063 CE	" "	LORL MD
C2	042051 CC	Cap Cer 39PF 100V	MULD 632-34399
C4	042051 CC	Cap Cer 39PF 100V	MULD 632-34399
C3	051041 CE	Cap Alum Elect 1uF 63V −10 +50%	MULD 015-18108
C5	053170 CE	Cap Alum Elect 33uF 40V −10 +50%	MULD 016-17339
R9	014241 RM	Res Met Film 4.64KR 0.4W 1%	MULD MR25
C6	048240 CF	Cap Film 0.22uF 100V 10%	MULD 344-21224
R31	026260 RF	Res Car Film 3.3KR 0.25W 5%	PIHE PR25
30V 1A D1–D4	069123 DS	Diode SI 200V 1A D015	MOTO GI 1N4003
SW1			
SW2	383000 XX	PB Switch Assy	LIPA & ISOSTAT MO3477M
SW3			

7.5 DISPLAY PCB

CCT REF	WEIR PART No.	DESCRIPTION	MANUFACTURERS' REF
R101	011150 RX	Res Met OX 1MR 0.5W 1%	ESIL C5
R103	014844 RM	Res Met Film 51.1KR 0.4W 1%	MULD MR25
R104	030190 RF	Res Car Film 10MR 0.5W 5%	PIHE PR50
R105	027160 RF	Res Car Film 100KR 0.25W 5%	PIHE PR25
R106	027160 RF	Res Car Film 100KR 0.25W 5%	PIHE PR25
R107	029251 RF	Res Car Film 7.5KR 0.25W 5%	PIHE PR25
R108	026118 RF	Res Car Film 240R 0.5W 5%	MULD CR37
R109	027020 RF	Res Car Film 4.7KR 0.25W 5%	PIHE PR25
R110	026069 RF	Res Car Film 68R 0.5W 5%	MULD CR25
R111	026069 RF	Res Car Film 68R 0.5W 5%	MULD CR25
R112	026069 RF	Res Car Film 68R 0.5W 5%	MULD CR25
R113	026069 RF	Res Car Film 68R 0.5W 5%	MULD CR25
R114	026069 RF	Res Car Film 68R 0.5W 5%	MULD CR25
R115	026069 RF	Res Car Film 68R 0.5W 5%	MULD CR25
R116	026069 RF	Res Car Film 68R 0.5W 5%	MULD CR25
R117	026069 RF	Res Car Film 68R 0.5W 5%	MULD CR25
R118	014832 RM	Res Met Film 42.2KR 0.5W 1%	MULD MR30
R120	030190 RF	Res Car Film 10MR 0.5W 5%	PIHE PR50
R121	033193 RM	Res Met Film 88.7KR 0.25W 1%	VTM 471
R122	029251 RF	Res Car Film 7.5KR 0.25W 5%	PIHE PR25
R123	027020 RF	Res Car Film 4.7KR 0.25W 5%	PIHE PR25
R124	026069 RF	Res Car Film 68R 0.5W 5%	MULD CR25
R125	026069 RF	Res Car Film 68R 0.5W 5%	MULD CR25
R126	026069 RF	Res Car Film 68R 0.5W 5%	MULD CR25
R127	026069 RF	Res Car Film 68R 0.5W 5%	MULD CR25
R128	026069 RF	Res Car Film 68R 0.5W 5%	MULD CR25
R129	026069 RF	Res Car Film 68R 0.5W 5%	MULD CR25
R130	026069 RF	Res Car Film 68R 0.5W 5%	MULD CR25
R131	026069 RF	Res Car Film 68R 0.5W 5%	MULD CR25
RV101	076142 VC	Pot Trim Cer 1 Trn 50 KR 0.5W 10%	BOUR 3389H-1-503
RV102	076140 VP	Pot Trim Car 1 Trn 47KR 0.15W 20%	PIHE PT10V
RV103	076140 VP	Pot Trim Car 1 Trn 47KR 0.15W 20%	PIHE PT10V
RV104	076123 VC	Pot Trim Cer 1 Trn 22KR 0.5W 10%	BECK 72X
IC101	065059 JT	Int Cct TTL 3.75 DIG DVM 28 Pin	NATS ADD3701CCN
IC102	064260 JL	Int Cct Misc	DN75492N
IC103	065059 JT	Int Cct TTL 3.75 DIG DVM 28 pin	NATS ADD3701CCN
IC104	064260 JL	Int Cct Misc	DM75492N
IC105	064288 JR	Int Cct Reg 5V	TCSF SFC-2805-EC
D101	066210 DZ	Diode Zener 5.6V 0.4W 5%	MULD BZY 88 C5V6
DB101	067174 DB	Diode Bridge	TCSF 110B1
C101	047140 CF	Cap Film 0.1uF 100V 10%	MULD 344-25104
C102	047140 CF	Cap Film 0.1uF 100V 10%	MULD 344-25104
C103	056150 CE	Cap Alum Elect 1000 uF 16V −10 +50%	ITT EN 12/12
C104	056011 CE	Cap Alum Elect 470uF 16V −10 + 50%	ITT EN 12/12
C105	042097 CC	Cap Cer 220PF 100V 10%	MULD 632-58221
C106	047140 CF	Cap Film 0.1uF 100V 10%	MULD 344-25104
C107	052188 CE	Cap Alum Elect 10uF 16V −10 + 50%	ITT EN 12/35
C108	052195 CE	Cap Alum Elect 10uF 25V −10 + 50%	MULD 015-16109
C109	049255 CF	Cap Film 0.47uF 100V 10%	WIMA MKS
C110	042097 CC	Cap Cer 220PF 100V 10%	MULD 632-58221
C111	047140 CF	Cap Film 0.1uF 100V 10%	MULD 344-25104
C112	052188 CE	Cap Alum Elect 10uF 16V −10 + 50%	ITT EN 12/35
DSP101	067175 DL	Digital Display 7 Segment	NATS NSB5881
DSP102	067175 DL	Digital Display 7 Segment	NATS NSB5881
FS 101	081132 FF	Fuse FB 1A 20mm 5mm	LTLF 19195 1A
FS 102	081132 FF	Fuse FB 1A 20mm 5mm	LTLF 19195 1A
C115	051070 CF	Cap Film 1uF 100V 10%	WIMA MKS
C114	055096 CE	Cap Alum Elect 220uF 6.3V −10 + 50%	EEC SLVB
R132	028300 RF	Res Car Film 470R 0.5W 5%	MULD CR37
R133	014832 RM	Res Met Film 42.2KR 0.5W 1%	MULD MR30

Weir Electronics Ltd.

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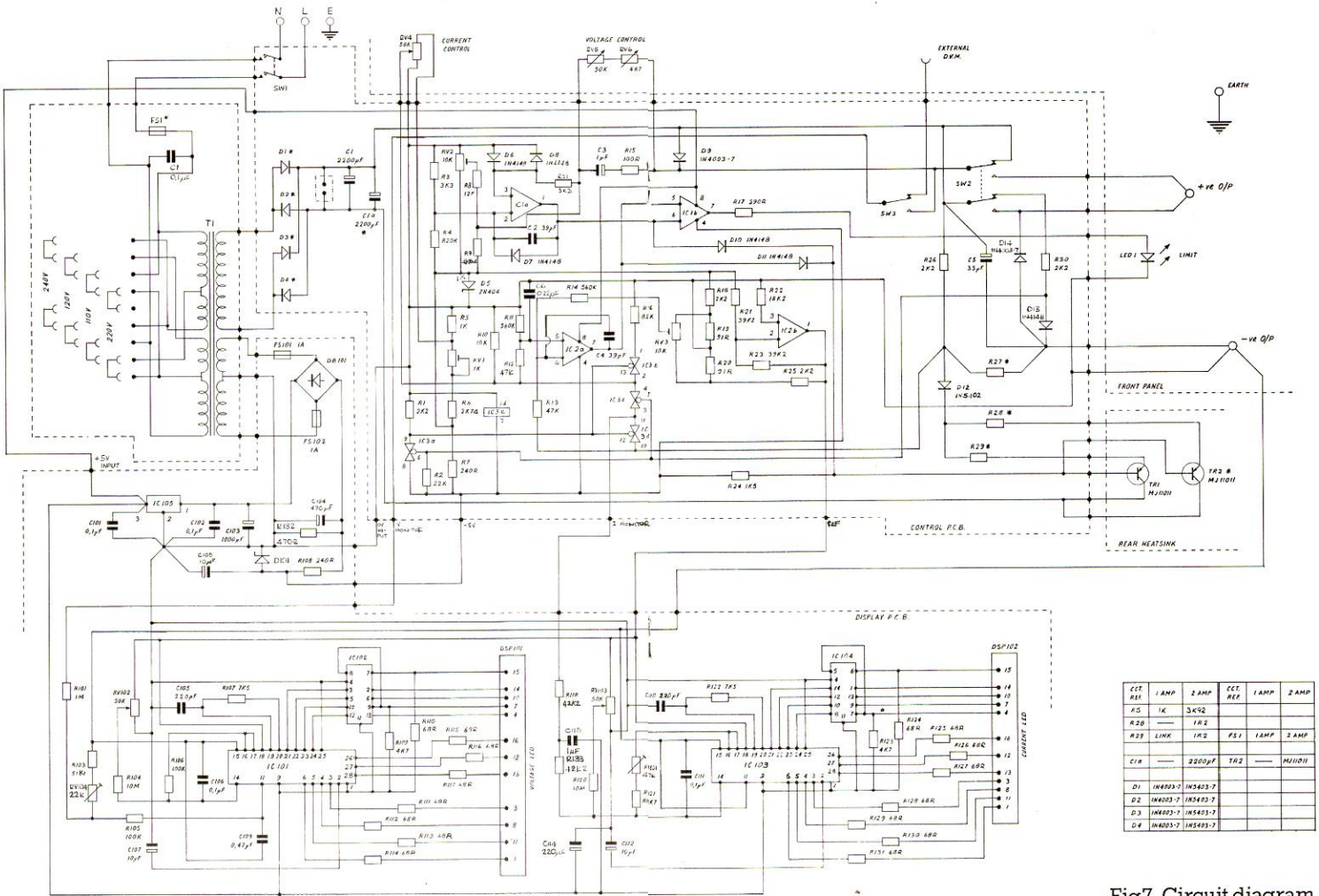

CCT. REF.	1 AMP	2 AMP	CCT. REF.	1 AMP	2 AMP
R5	1K	3K92			
R28	——	1R2			
R29	LINK	1R2	FS1	1 AMP	2 AMP
			C18	——	2200pF
TR2	——	MJ11011			
D1	IN4003-7	IN5403-7			
D2	IN4003-7	IN5403-7			
D3	IN4003-7	IN5403-7			
D4	IN4003-7	IN5403-7			

Fig7. Circuit diagram

Weir

Laboratory Power Supplies

- ☐ **Simultaneous digital metering of output voltage and current**
- ☐ **Constant voltage and constant current operating modes**
- ☐ **Automatic mode crossover indication**
- ☐ **Digital measurement of external voltages**

Type 4000 30 V 1 A and Type 4000 30 V 2 A

These 30 and 60 watt stabilised bench power supplies featuring continuous voltage and current controls have true constant voltage/constant current characteristics with mode crossover indication, and simultaneous display of output current and voltage on high resolution digital meters.
The superb specifications enable them to be used both as general purpose laboratory power supplies and as high power semi-precision DC voltage/current sources in R & D and test applications.

Meters

Two single range 4000 bit digital meters with bright 12.5 mm LED displays are incorporated. Full scale reading on the voltmeter is 39.99 volts and on the current meter is 3.999 amps.

Design

The latest LSI technology has been employed throughout the control and measurement circuitry to optimise performance but at the same time keep component count and costs low. Separate linear high gain regulators are used for the control of voltage and current giving excellent performance in both current and voltage modes. Crossover between modes is automatic and is indicated by a front panel LED. Generous over-range capability (to approximately 1.1 A and 2.2 A), allows full specified outputs to be maintained indefinitely under worst case conditions of load and ambient operating temperature.

Voltage Control

To enable full use to be made of the 10.0 mV resolution of the digital voltmeter, voltage is set by coarse/fine controls. A push-button switch interrupts the internal connections to the front panel terminals so that output voltage can be accurately set without disconnecting the load circuits.

Current Control

The constant current limit is set by a single turn potentiometer which has a non-linear characteristic to improve the setting resolution at low currents. The push-button switch which internally disconnects the output circuits also connects the current limit control to the internal current meter. This allows current limits to be safely and accurately set without disconnecting the load.

Multi-Turn Current Control Option

A factory fitted option of a 10-turn current setting potentiometer can be specified to make full use of the high resolution of the digital current meter. To order this option specify 'T' version, i.e. 4000T 30 V 1 A or 4000T 30 V 2 A.

Measurement of External Voltages

The internal DVM can be used to measure external voltages up to 39.99 volts. This is particularly valuable for rapid and accurate checking of voltages around the load circuits. The DVM input socket is front panel mounted together with an associated internal/external switch.

Twinpacks

The Twinpack concept, pioneered by Weir, putting two separate power supplies together in a dual bench case is continued with the 4000 series, so the following combinations can be specified.

Twinpack 4000 30 V 1 A/30 V 1 A
Twinpack 4000 30 V 2 A/30 V 2 A
Twinpack 4000 30 V 2 A/30 V 1 A

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Weir

Specifications

Line Supply	110, 120, 220, 240 V ±10% 48–63 Hz

Voltage Mode

Line regulation	< ±0.01% for ±10% line voltage change
Load regulation	< 0.05% for 100% load change
Ripple & Noise	< 2 mV peak to peak
Output Impedance	< 10 mΩ at 1 kHz
Temperature Co-efficient	< 0.01%/°C typically
Transient Response	recovers to < 50 mV of setting within 30 μsecs after full load step change
Transient Excursion	±0.5 V maximum for full load step change

Note:
All voltage mode specifications apply when the output voltage is set to maximum.

Current Mode

Variation of output current	< ±0.1% for ±10% line voltage change
Variation of output current	< ±1 mA for 0–30 V output voltage change
Output resistance	> 30 kΩ when voltage control is set to maximum
Current ripple	< 1 mA pk–pk

Note:
All current mode specifications apply when output current is set to a maximum and voltage control is set to maximum.

Dimensions and Weight (approx)

	H	W	D	Weight
30 V 1 A	180	153	240 mm	4.4 kg
30 V 2 A	180	153	260 mm	4.7 kg

Voltmeter

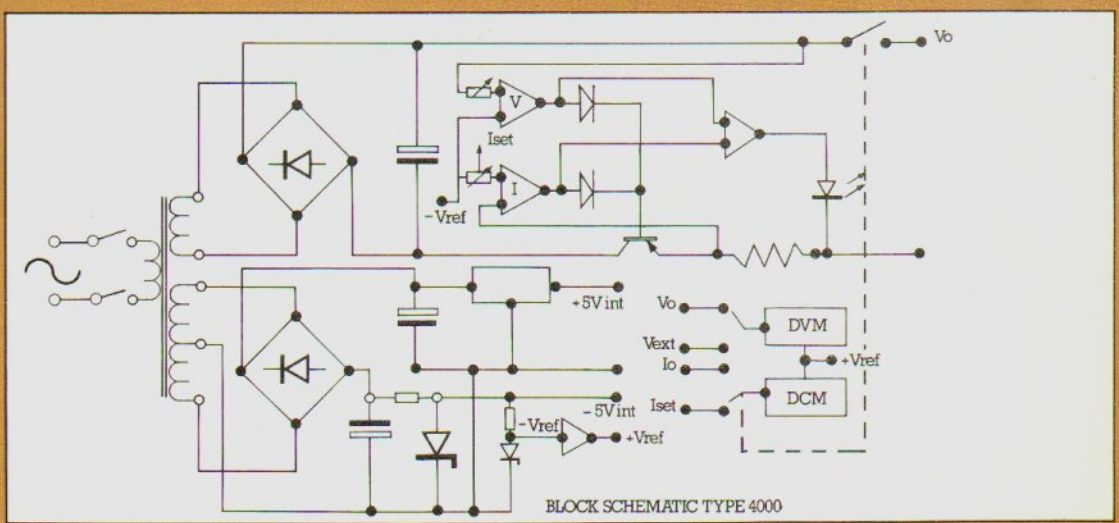
Display	12.5 mm LED 4 digit
Range	0 to 39.99 volts
Accuracy	±0.1% of reading ±2 L.S.D. at 23°C
Conversion Rate	4 per second approx
Input Impedance	> 1 MΩ
Input Protection	No damage will result by inadvertent connection to 240 V AC line voltage
Voltage Measurement	External measurement of voltages is possible in the range 0 to 39.99 volts positive with respect to power supply 'negative' output terminal

Current Meter

Display	12.5 mm LED 4 digit
Range	0 to 3.999 Amps
Accuracy	±0.2% of reading ±4 L.S.D. at 23°C
Conversion Rate	4 per second approx

General

Operating temperature range	0° to 45°C
Storage temperature range	–10°C to 80°C
Output Isolation	Output may be operated up to 250 V with respect to chassis
Output Protection	External reverse voltages will not cause damage provided current generated does not exceed half full load current
RFI	BS800
Applicable Safety Standard	These units have been designed to conform to the relevant provisions of IEC 348



BLOCK SCHEMATIC TYPE 4000