

# Service manual

## Insulation Testers

MIT300, MIT310, MIT320, MIT330



Issue 2  
CN22156  
11 Oct 2004  
6172-897  
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## Safety Warnings

**Safety Warnings and Precautions must be read**  
and understood before the instrument is used.  
They **must** be observed during use. Please read  
the special hazards for the service engineer  
below.

Replacement fuses **must** be of the correct type and rating. Failure to fit the correctly rated fuse may result in a safety hazard and may cause damage to the instrument in the event of an overload.

The instrument terminals normally produce up to 1100 volts, current limited to 1.5mA. This is reasonably safe if it is not connected to a capacitor. However, a faulty instrument can produce up to 2000 volts and currents up to 20mA.

Under normal conditions, high voltage cannot be produced unless the TEST button has been pressed. (There is an electronic interlock so that the microprocessor cannot turn on the high voltage on its own.) The yellow 47nF capacitor is automatically discharged at the end of a test. If an instrument is faulty, these safety features may not operate.

When operating with the case removed, beware of the yellow 47nF capacitor (see section 3: Assembly Drawings) and the area around it.

Disconnecting the battery lead will normally make the unit safe to work on. To be sure, short-circuit the yellow 47nF capacitor.

# Guide to Fault-Finding

## Basic Operation

Switching from off to ohms or a Meg-ohms position will cause the firmware version number to be shown for slightly less than one second followed by the analogue pointer moving from left to right. The backlight (if fitted) will turn on until the display has settled.

1. Ohms, buzzer and kilo-ohms ranges operate constantly without the test button being pressed. When the terminals are open circuit, the display will show the correct result (e.g.  $>100\text{ohms}$  or  $>1000\text{kohms}$ ) but the instrument will not be performing a full measurement. When the terminals connect to something (with a resistance less than  $1\text{M}\Omega$ ), the internal relay will close and proper measurements will be made. If the relay fails to close, refer to section on ‘Voltage/Contact Detector’.
2. Meg-ohms ranges only operate when the ‘TEST’ button is pressed. When the test button is not being pressed, the analogue pointer disappears off scale (because high voltage is not being generated and the resistance across the terminals is not known) and the digits will be either blank or show the last test result. The last test result clears after one minute.
3. Backlight is enabled by pressing the backlight button. The backlight turns off after 20 seconds to save battery power. Backlight and rotary switch function illuminators operate simultaneously. (MIT320 & MIT330 only)

## Preliminary checks and circuit operation

**The text in bold type is a quick test to establish correct functionality.** (The text that follows is a detailed explanation of operation.) After performing these tests, refer to the block diagram and identify what circuit block is most likely to be at fault. The page numbers on the block diagram refer to the sheet number on the full circuit diagram. The circuit layout is divided up into areas relating to the block diagram to assist locating components. The microprocessor area (circuit diagram sheet 1) is not labelled but it is fairly obvious, being all the components around IC5.

The following tests can be performed using a multimeter. It will be useful to have three resistors to hand:  $12\Omega$ ,  $1\text{k}\Omega$  and  $100\text{k}\Omega$ . If these resistors are  $\pm 1\%$  they can be used to spot check calibration accuracy in addition to functional testing.

**For all ranges, except Volts, open circuit terminals measure 4.5 volts ( $\pm 0.3\text{V}$ ).**

## **1. Voltage/Contact Detector**

Note that the contact icon in the display operates in synchronism with the audible buzzer, closing its contact when the buzzer sounds. If the buzzer has been disabled, the icon will operate but no sound will be heard.

**Select buzzer mode. Contact icon in the display opens after one second.**

**Connect terminals together and the contact icon will close immediately.**

Operation of the contact detector is essential to initiate  $k\Omega$ , Buzzer or  $\Omega$  ranges. Operation of the voltage detector is essential to initiate the voltage range. The top right-hand corner of the Block Diagram (page 16) shows a simplified circuit diagram of the combined Voltage/Contact Detector. The BIAS line (driven from the microprocessor) is set to 0V for voltage detection (as used in the voltage range) and set to +5V for continuity detection (as used in  $k\Omega$ , Buzzer or  $\Omega$  ranges).

Consider this circuit to be a current sensor, triggered by a current greater than  $2\mu A$ , one end connected to the positive terminal via  $750k\Omega$  and the other connected to either 0V or +5V.

When in buzzer mode, BIAS is at +5V and this causes the positive terminal to be around +4.5V. When the terminals make contact, a current of about  $5\mu A$  ( $4V/750k$ ) flows and this causes the CONTACT signal to rise. The microprocessor responds within a few milliseconds by closing the contact icon and sounding the buzzer.

This circuit operates as a voltage detector at all times. If BIAS is set to 0V, the HV signal will operate for terminal voltages from 2-volts upwards (ac or dc). If BIAS is set to +5V, HV will not operate on terminal voltages less than about 7-volts.

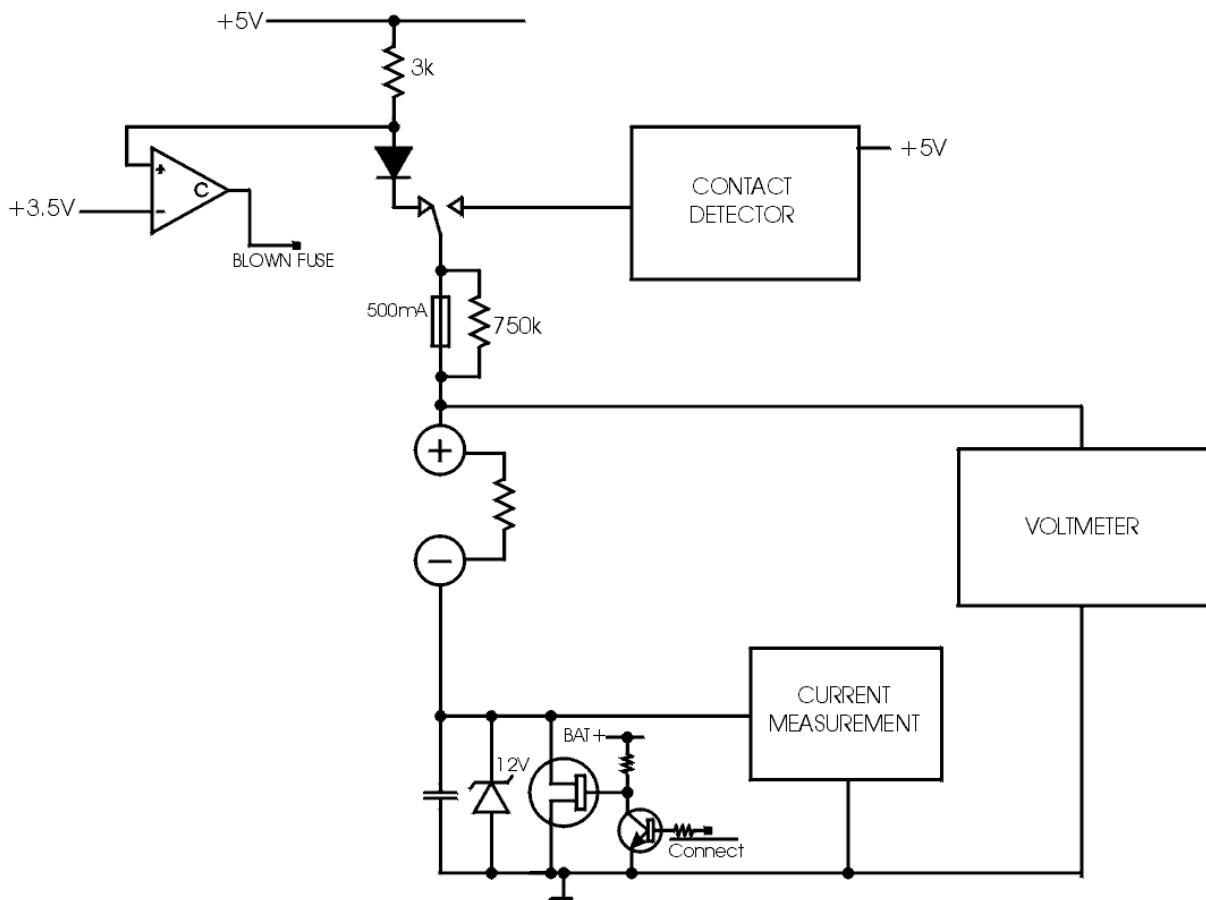
## 2. $k\Omega$

**Short circuit the terminals and the display should read  $0.00k\Omega$ . Terminal current should be  $1.5mA$  ( $\pm 0.3mA$ ). Also check at  $1k\Omega$  and  $100k\Omega$ .**

The  $k\Omega$  range has two modes of operation. The positive terminal is always supplied from  $+5V$  in series with  $3k\Omega$  plus a diode.

For measurements from zero to  $3k\Omega$ , the negative terminal is connected to ground and the voltmeter measures the voltage on the positive terminal. The measured voltage gives the microprocessor sufficient information to calculate the current and calculate the terminal resistance.

For measurements from  $3k\Omega$  to  $1M\Omega$ , the negative terminal current is measured and the terminal voltage is calculated as  $5V$  minus the voltage drop across  $3k\Omega$  plus diode.



The BLOWN FUSE signal being high and the voltmeter measuring less than 2 volts indicate a blown fuse (or there may be something else open circuit in series with the fuse).

### 3. Buzzer

**Connect the terminals and the buzzer should sound immediately and continuously.**

**Note 1:** The buzzer range uses the same circuitry as the  $\Omega$  range but test current is set at 20mA and the filter in the voltmeter is switched off. For difficult buzzer faults, check  $\Omega$  operation first (using a resistor of more than 10 $\Omega$  to ensure that it is working at 20mA).

**Note 2:** It is possible to silence the buzzer on the MIT320 and MIT330. If the buzzer has been silenced, the switch icon in the display will close when the terminals are connected but no sound will be made. See SETUP instructions (in Appendix) to enable the buzzer.

When the buzzer is selected (using the rotary switch) the buzzer will sound for one second (regardless of what is connected to the terminals).

Buzzer operation requires the Voltage/Contact Detector to be working. When in buzzer mode, BIAS is at +5V and this causes the positive terminal to be around +4.5V. When the terminals make contact, a current of about 5 $\mu$ A (4V/750k) flows and this causes the CONTACT signal to rise. The microprocessor responds within a few milliseconds by closing the contact icon and sounding the buzzer.

After about 500ms the internal relay will close (a click can usually be heard) and the ohms measuring circuit will check that the terminal resistance is less than the limit (normally 5 $\Omega$ ).

If the resistance at the terminals is greater than the set threshold limit (normally 5 $\Omega$ ) the buzzer will operate for about one second and then either stop buzzing or buzz intermittently. If the resistance is lower than the set threshold a continuous buzz will be heard and the limit will appear on the display (e.g. <5.00 $\Omega$ ).

Terminals will deliver 20mA ( $\pm$ 3mA) short circuit. This may be difficult to measure in buzzer mode if the resistance of your multimeter is higher than 5 $\Omega$ .

### 4. $\Omega$

**Measure short circuit current to be 205mA ( $\pm$ 5mA). Shorting the test leads should produce a reading of 0.00 $\Omega$  to 0.05 $\Omega$ .** (Pressing ‘TEST’ will set the zero reading to exactly 0.00 $\Omega$ .) The current is provided by a constant current source and will operate if the resistance across the terminals is less than 10 $\Omega$ . At greater than 10 $\Omega$  (when the internal voltmeter measures more than 2V) the current is reduced to 20mA. The 20mA current can be tested by connecting an ammeter in series with a resistor greater than 10 $\Omega$  (and less than 100 $\Omega$ ).

## **5. OFF**

**Manual or automatic switch-off causes the message ‘OFF’ to appear on the display for about one second,** then TR44 disconnects the battery. Automatic switch off occurs after ten minutes of non-use.

## **6. MΩ**

**Press ‘TEST’ button to initiate MΩ test.**

**If connected to a 10MΩ voltmeter, the display should read 10MΩ and the voltmeter will show the output voltage (250V+, 500V+ or 1000V+). Short circuit current should be 1.5mA ±0.3mA.**

To check output power, select 1kV, connect a 1MΩ resistor (or a 1.1MΩ resistor in parallel with a 10MΩ voltmeter) and check that output voltage is at least 1kV.

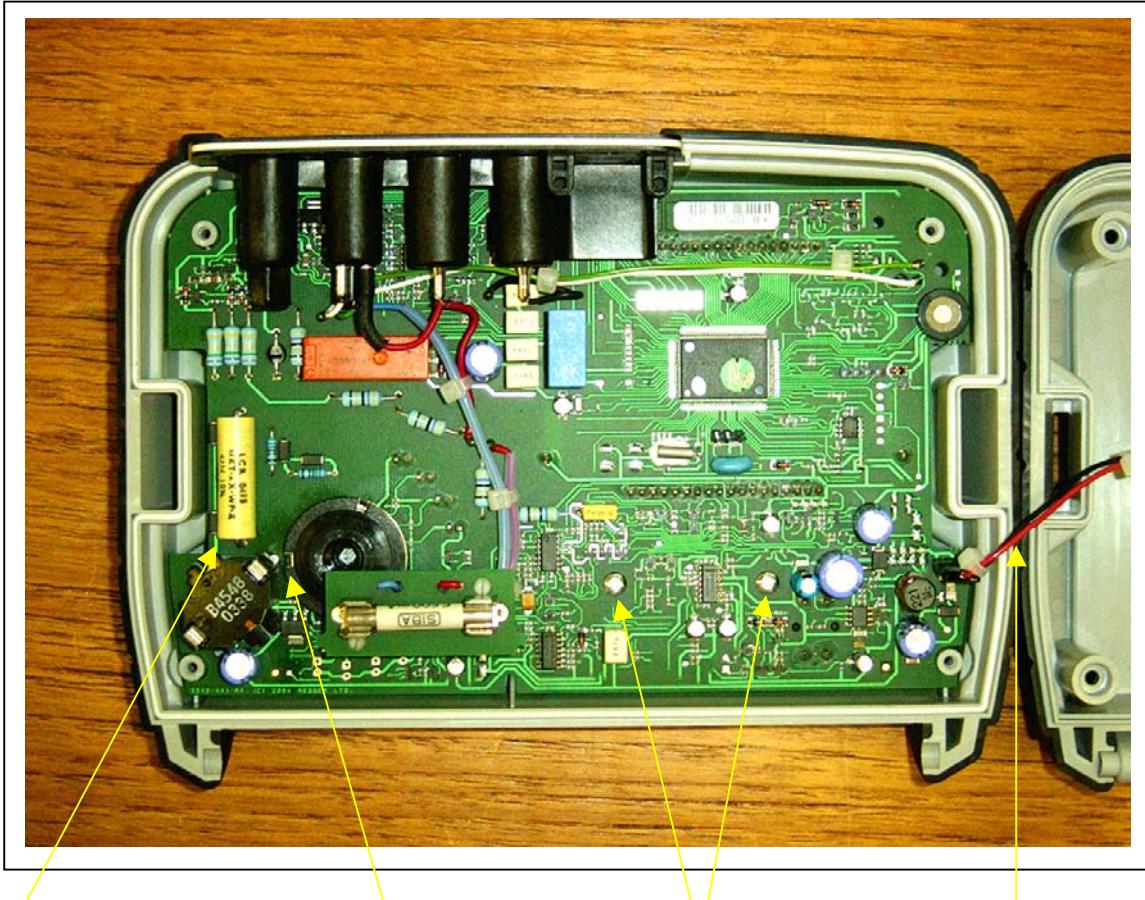
If 1kV range is not available, select 500V and use a 500kΩ resistor (or 525kΩ in parallel with a 10MΩ voltmeter).

## **7. V (Voltage)**

**With terminals open circuit or short circuit the display should show 0V. Applying more than 2 volts (ac or dc) should be sufficient to trigger the voltage detector. This will start the voltage measurement and the display will show the terminal voltage.**

This is the only range that does not operate the internal relay.

## Assembly Drawings



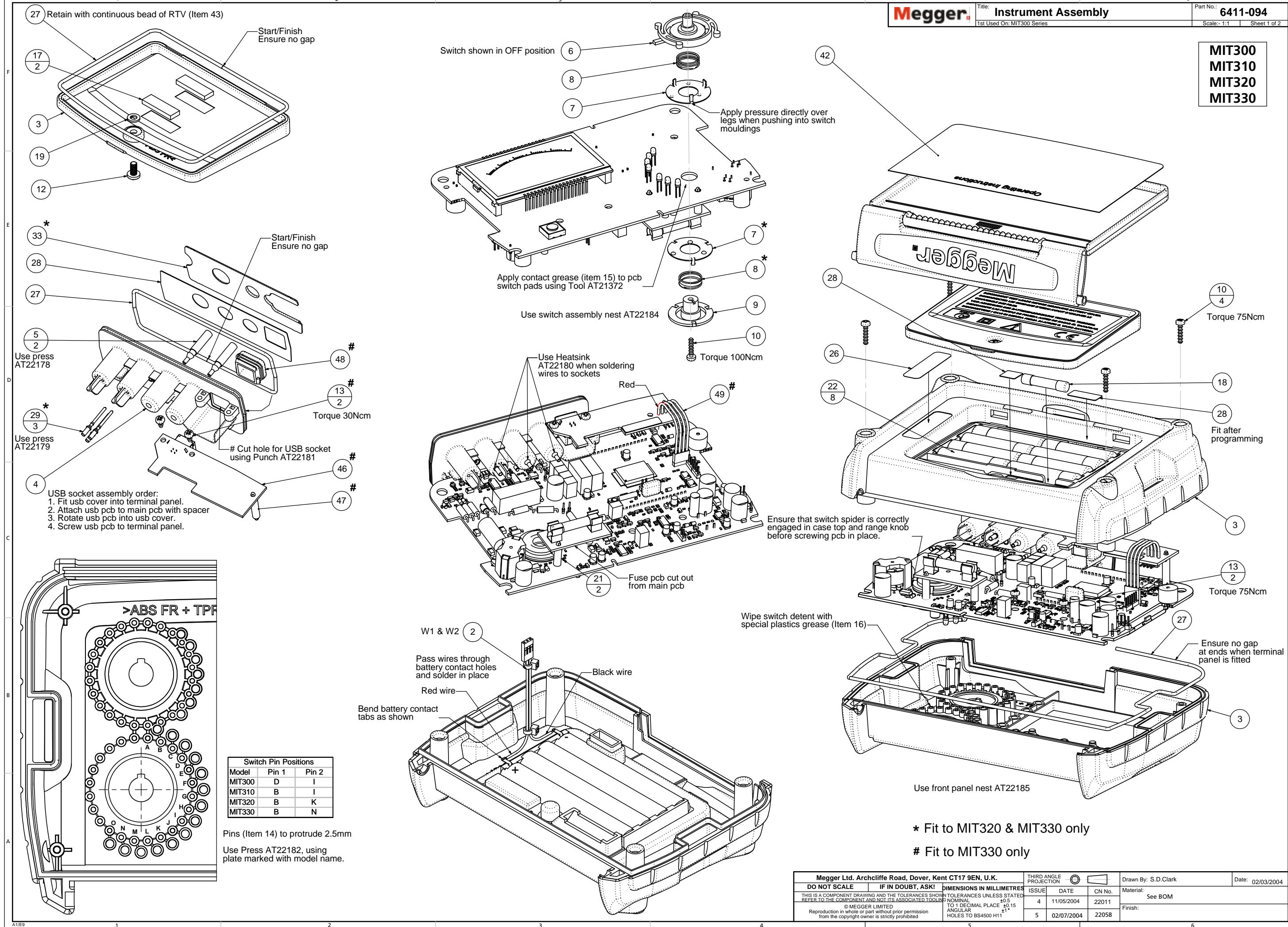
High Voltage  
Capacitor

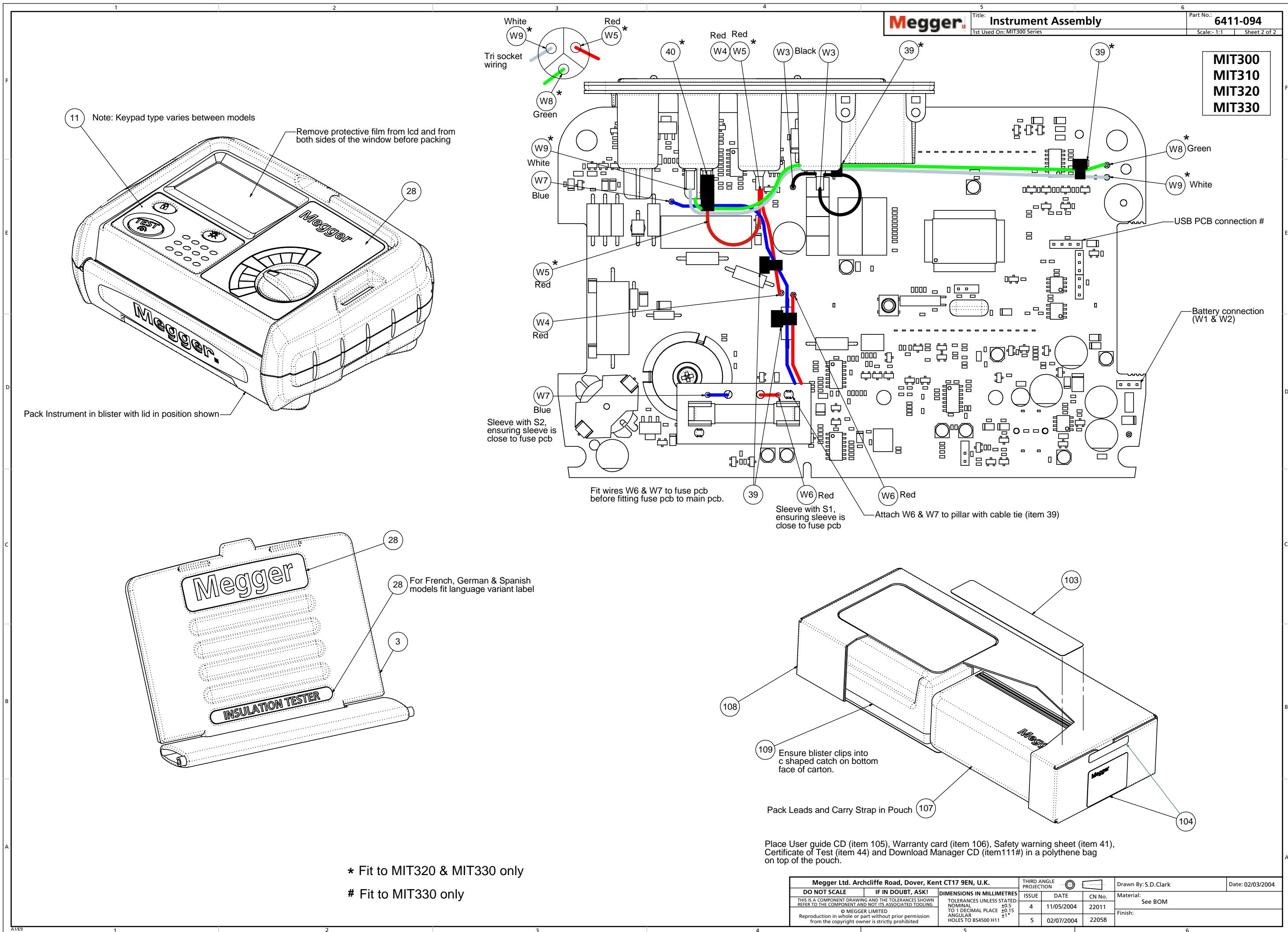
PCB securing screws

Rotary switch in OFF position  
(Also see Instrument Assembly  
drawing item 6 on next page)

Battery lead

**MIT300  
MIT310  
MIT320  
MIT330**





## Disassembly

1. Turn switch to OFF position.
2. Remove four corner screws in the base.
3. Keeping instrument upside down, separate the bottom from the top, taking care not to damage the battery lead.
4. To remove the printed circuit board, unplug battery lead and remove the two securing screws (see picture page 8). Do not remove the screw in the centre of the rotary switch (unless you want to take the switch apart).
5. Lift the terminal block and the pcb will follow.
6. Note position of the rotary switch (as shown in picture on page 9) so that it can be returned to this position for re-assembly.

## Re-assembly

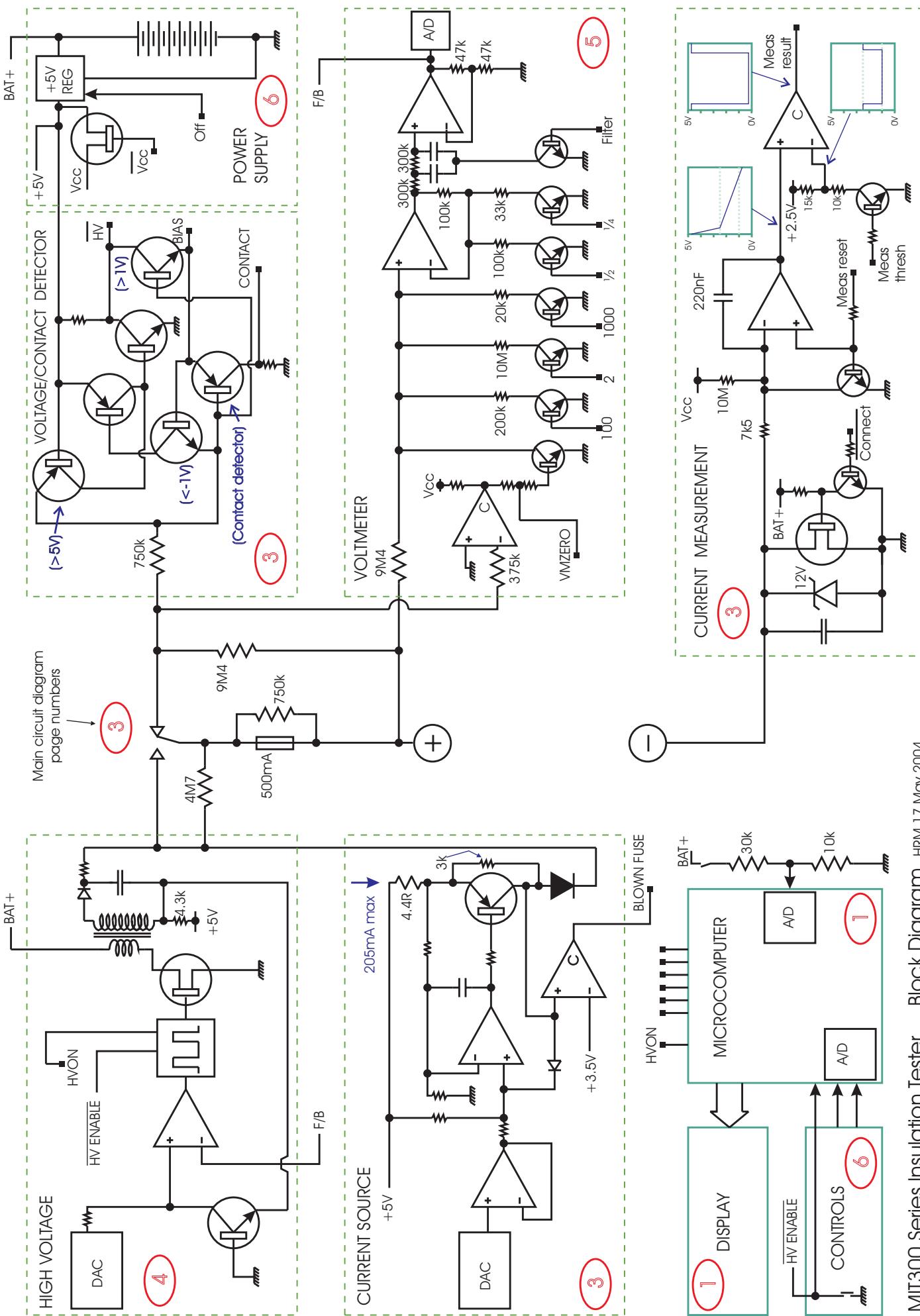
1. Ensure that the rotary switch and the knob are both in the ‘off’ position.
2. The battery connector can be fitted either way round since positive is the centre pin and negative is both outer pins.
3. When fitting the back cover, ensure the fuse does not foul on the case since this can damage the fuse clips. (Remove the battery cover to improve visibility.)
4. Take care not to trap the battery lead.
5. Do not over tighten the four case screws; they screw into plastic.

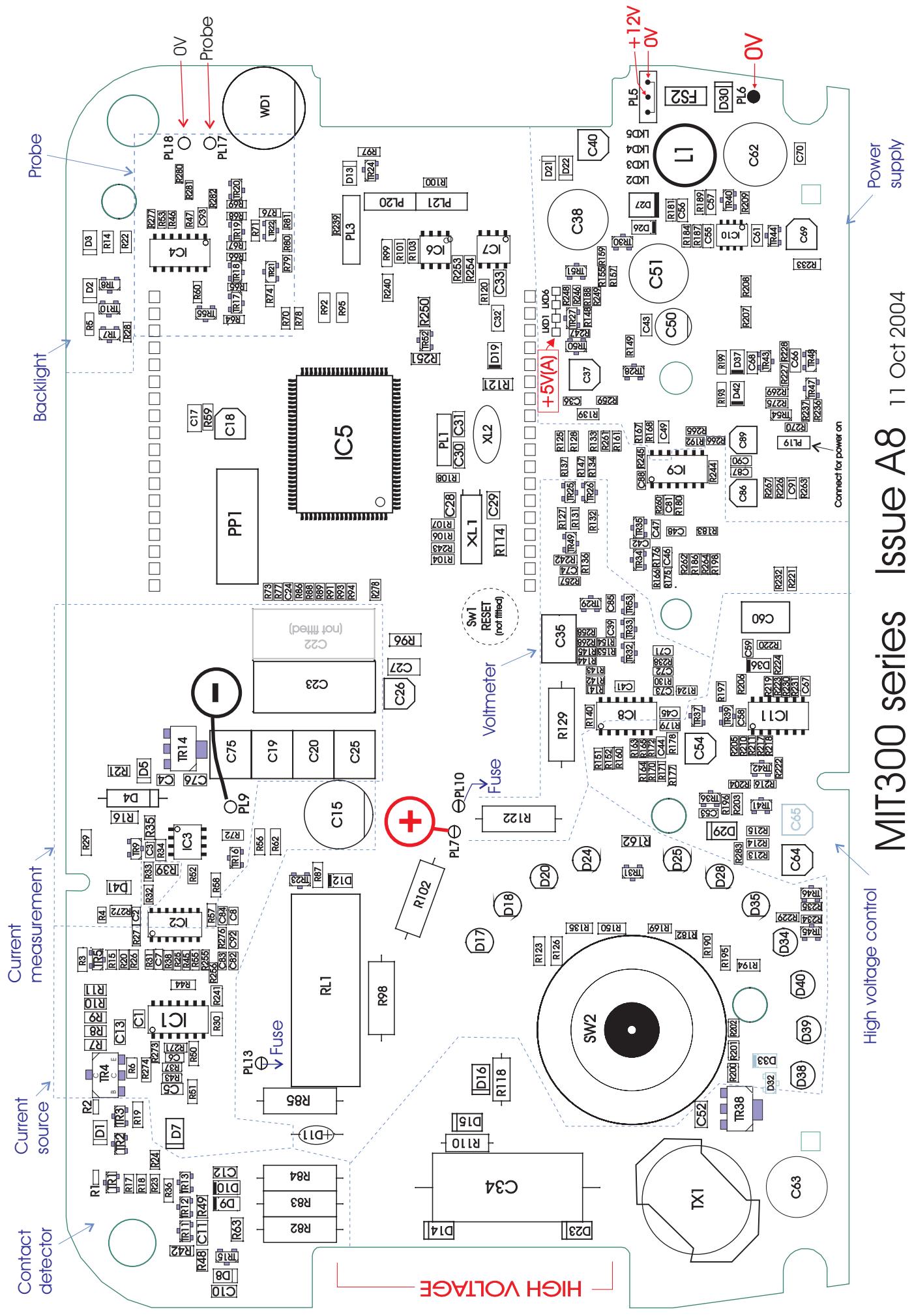
### **Typical battery currents**

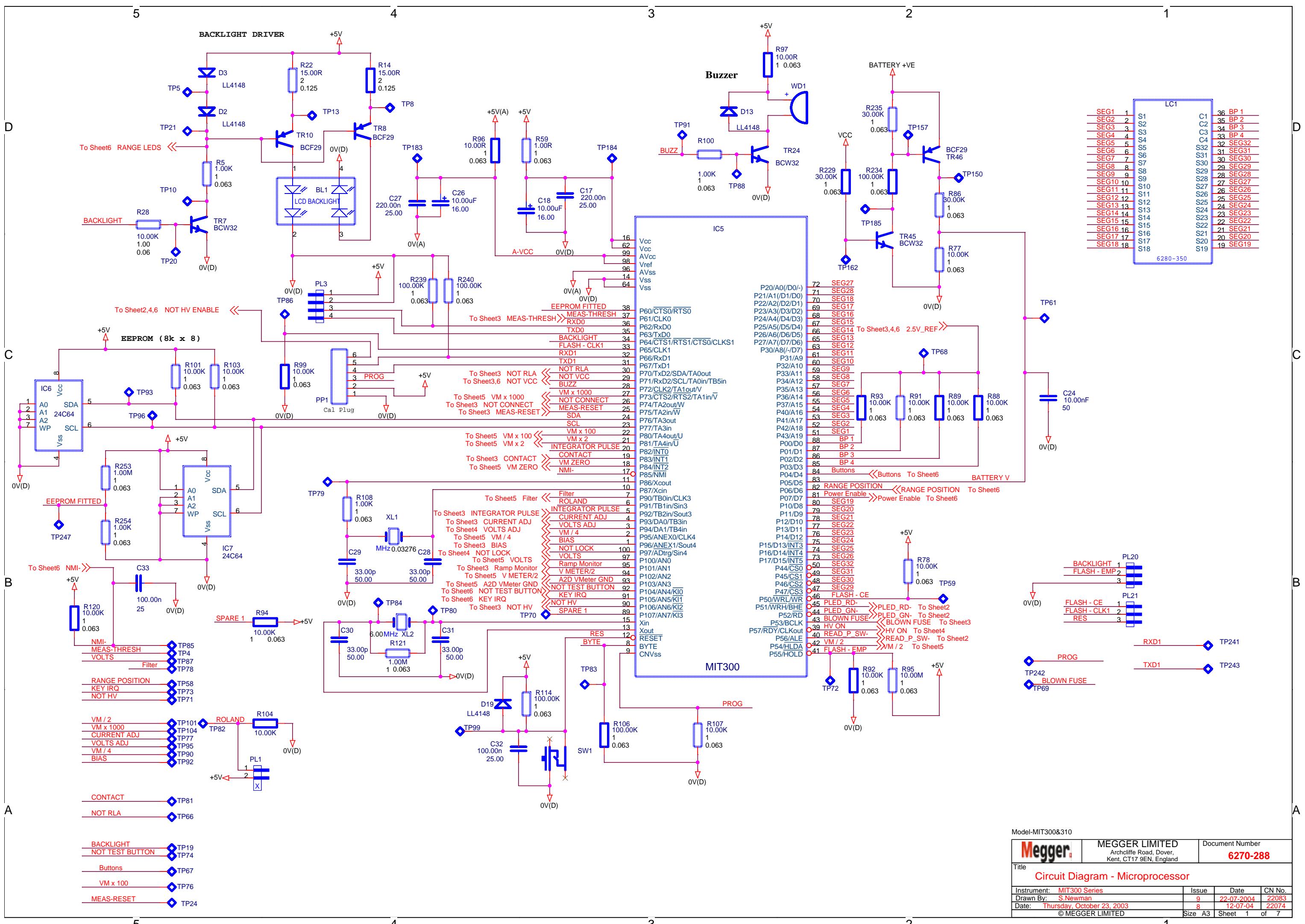
1. Insulation test short circuit current	1.4mA
2. Battery current, 1,000V on o/c. (Battery =12V)	80mA
3. Battery current, 1,000V on $1M\Omega$ . (Battery =12V)	190mA
4. Battery current, 1,000V on $1M\Omega$ . (Battery =8V)	270mA
5. Battery current, 500V on $0\Omega$ .	70mA
6. Battery current, 500V on $500k\Omega$ .	110mA
7. Battery current continuity-short circuit. (Battery =12V)	140mA
8. Battery current continuity-short circuit. (Battery =6V)	300mA
9. Backlight operation (Battery =12V) adds:	40mA
10. Battery current between tests (no backlight).	20mA
11. Battery current after auto shut down or when switched off.	70 $\mu$ A

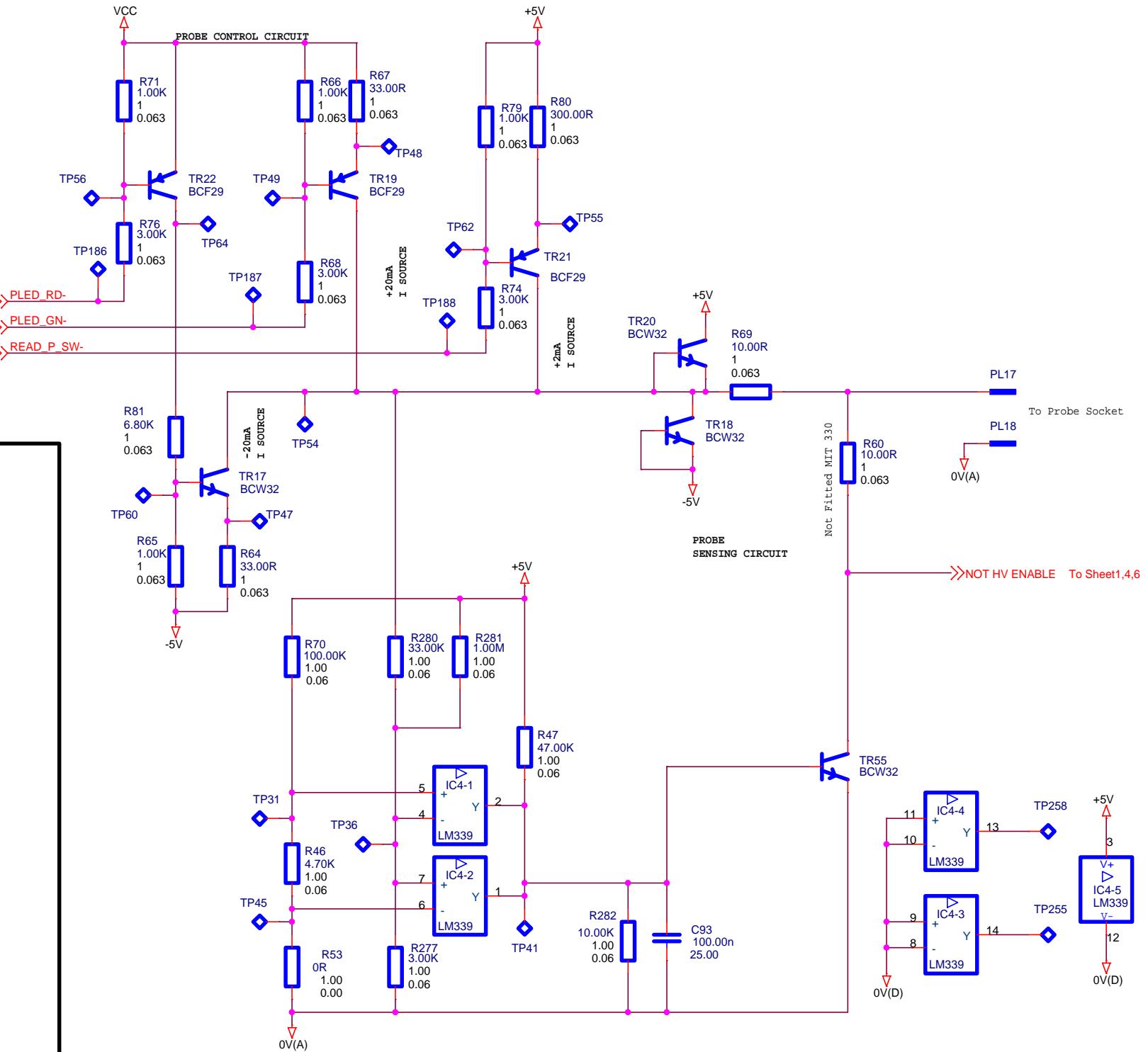
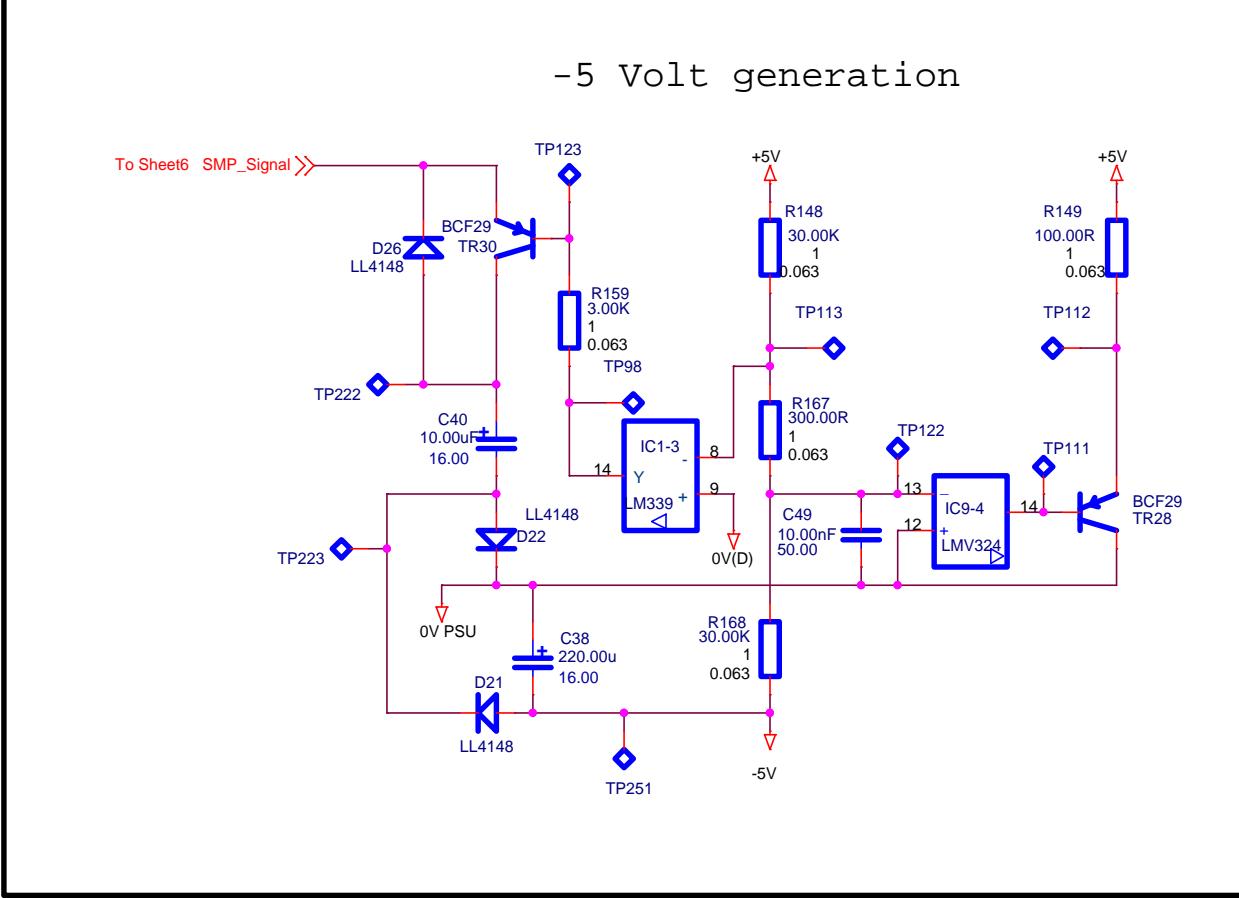
### **Miscellaneous notes**

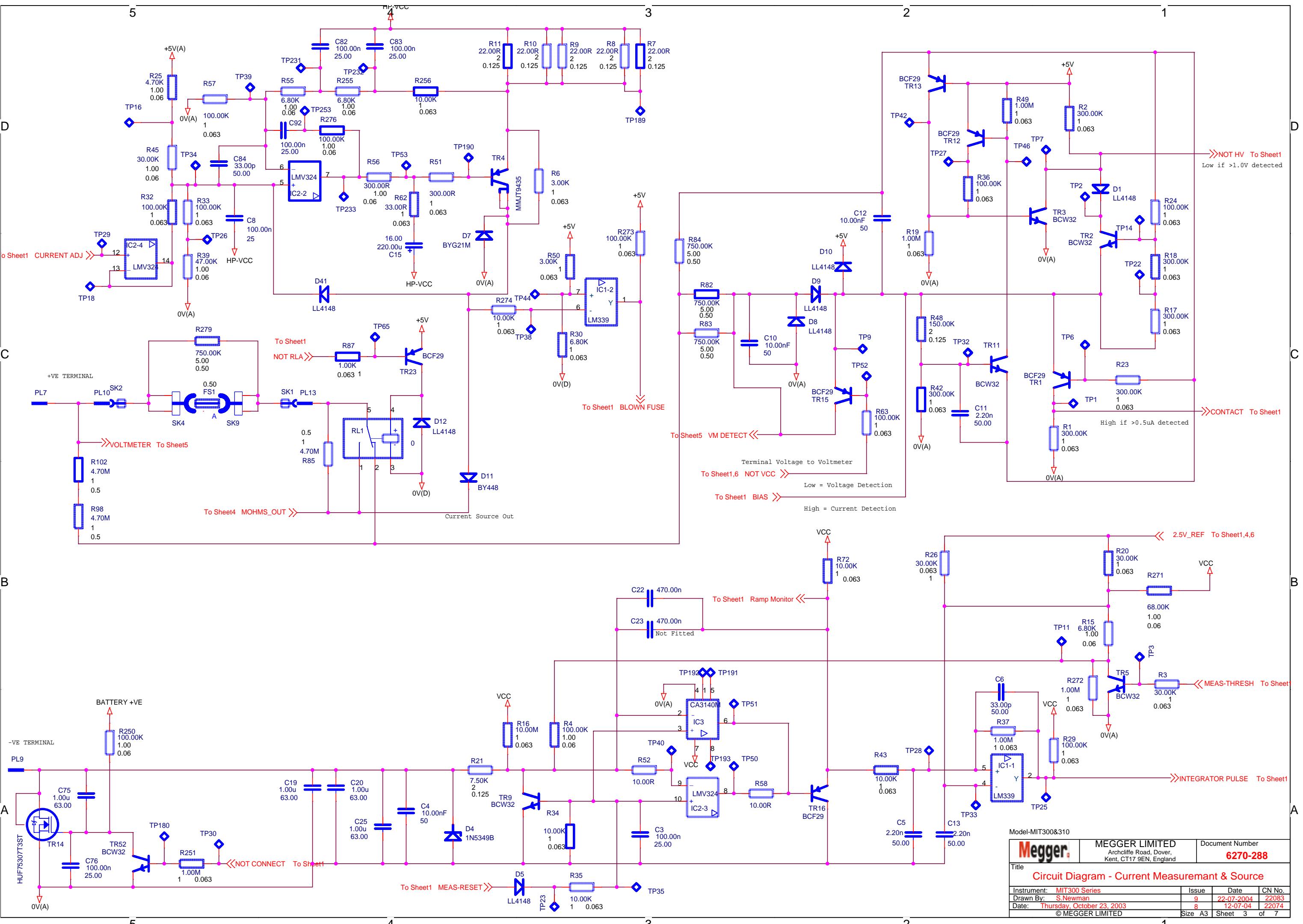
- [Sheet 1] Crystal XL1 is not used and normally is not fitted.
- [Sheet 2] The -5volt supply and probe drive circuit are only fitted for MIT320 and MIT330.
- To disable automatic power down, hold lock button down and switch from OFF to  $k\Omega$ . After ten seconds, Pdd will appear on the display and power will remain permanently on. Automatic power down is restored after switching off.
- Circuit diagram sheet 2 shows a -5V supply and a circuit for driving red and green lamps on the probe and detecting the probe TEST button. These parts are only included on the MIT330.
- Replacement printed circuit boards are available from Megger Sales. These boards are tested, calibrated and set up for specific models MIT300, MIT310, MIT320 or MIT330.

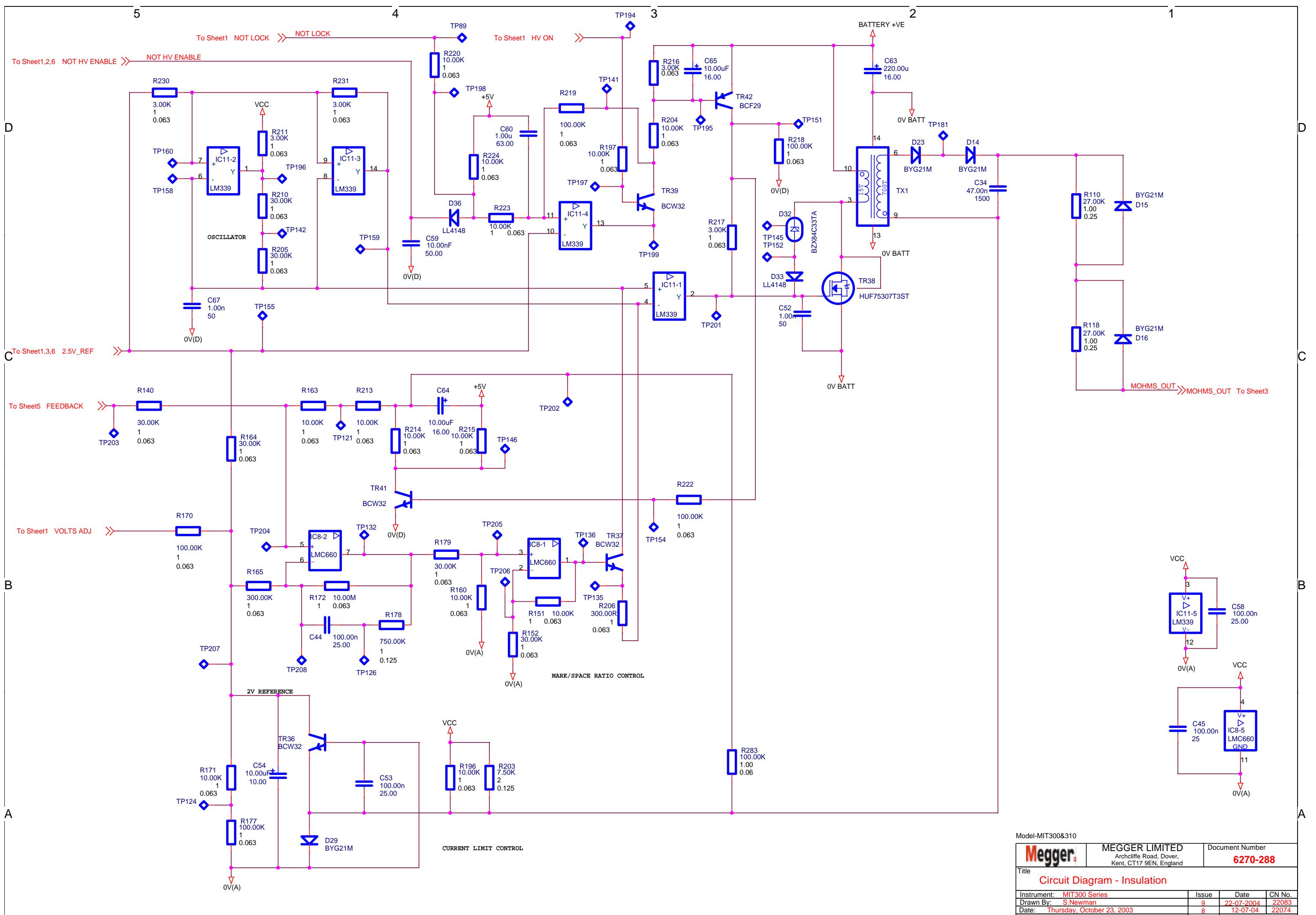


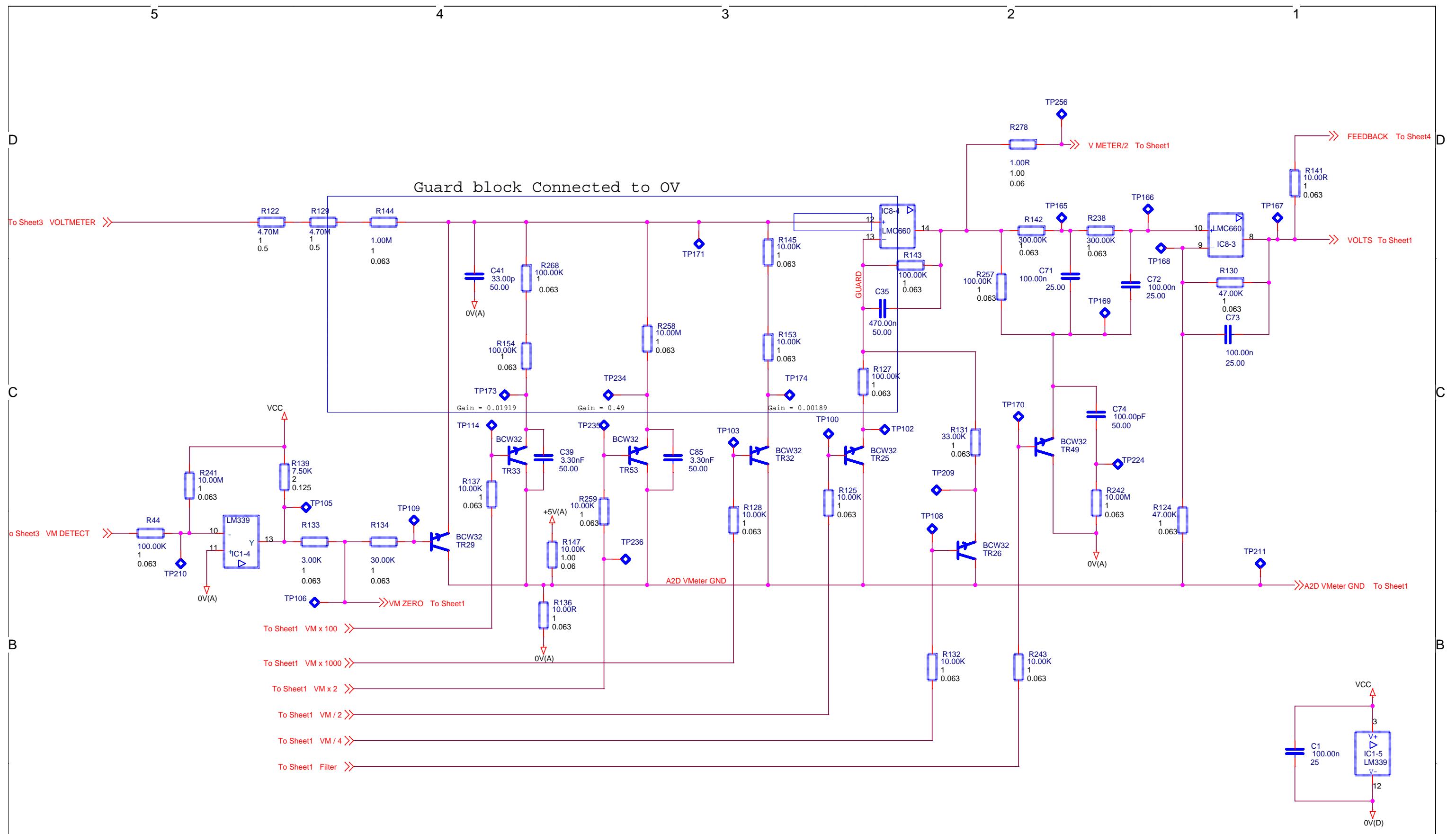






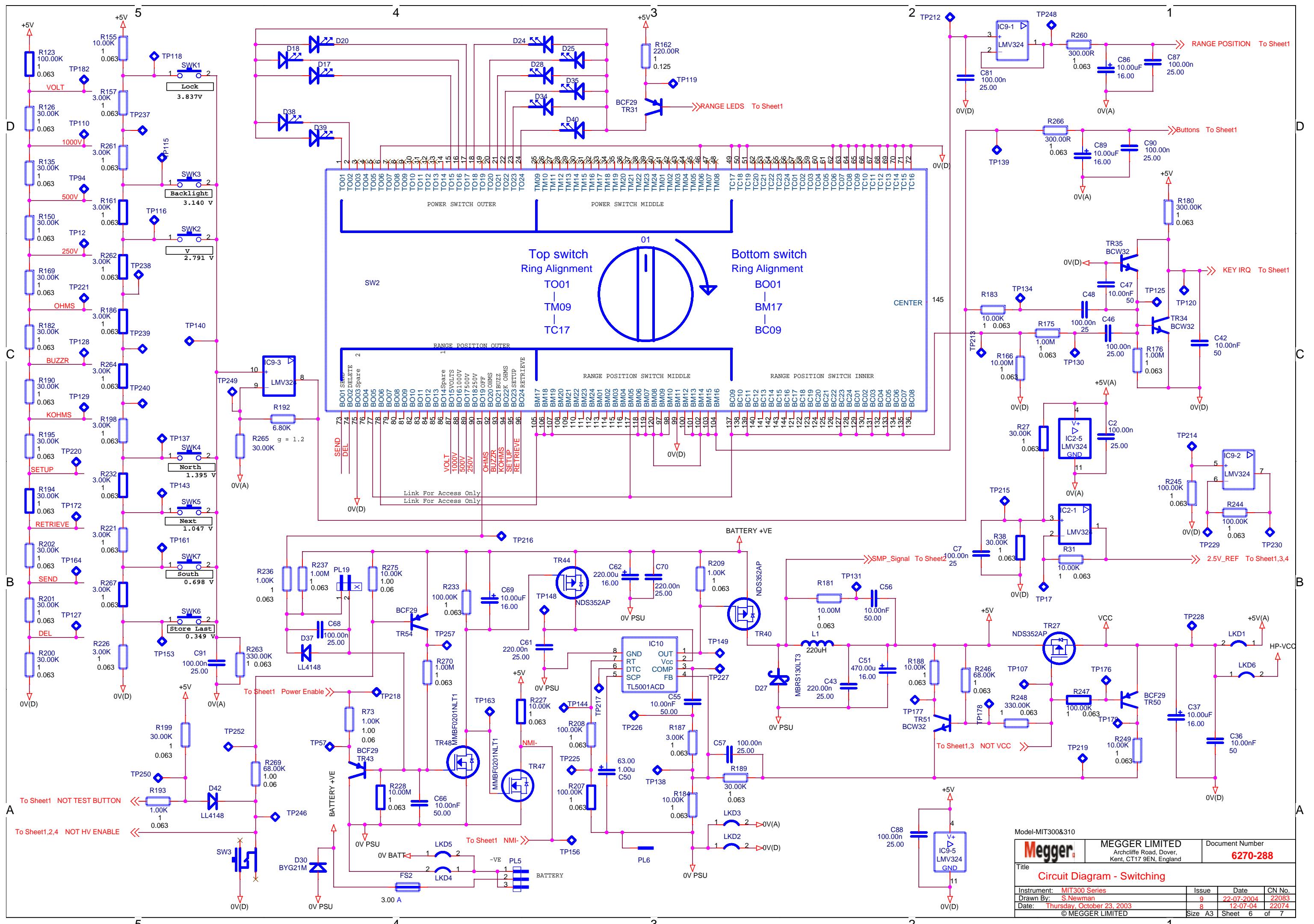






This Block to be close to Sheet 4 Blocks

Model-MIT300&310			
<b>Megger</b>		MEGGER LIMITED Archcliffe Road, Dover, Kent, CT17 9EN, England	Document Number <b>6270-288</b>
Title <b>Circuit Diagram - Voltmeter</b>			
Instrument: MIT300 Series	Issue	Date	CN No.
Drawn By: S.Newman	9	22-07-2004	22083
Date: Thursday, October 23, 2003	8	12-07-04	22074
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Ref	Part No.	MIT300 and 310	MIT320	MIT330	Ref	Part No.	MIT300 and 310	MIT320	MIT330
BL1	6180-433	NF			R46	33000-040	NF	NF	
C3	32000-029	NF	NF	NF	R47	33000-040	NF	NF	
C22	26970-148	NF	NF	NF	R53	33000-035	NF	NF	
C38	27889-869	NF	NF		R60	33000-027	NF		NF
C40	32000-023	NF	NF		R64	33000-028	NF	NF	
C49	32000-029	NF	NF		R65	33000-031	NF	NF	
C65	32000-023	NF	NF	NF	R66	33000-031	NF	NF	
C93	32000-029	NF	NF		R67	33000-028	NF	NF	
D2	31000-002	NF			R68	33000-069	NF	NF	
D3	31000-002	NF			R69	33000-027	NF	NF	
D17	28920-099	NF			R70	33000-041	NF	NF	
D18	28920-099	NF			R71	33000-031	NF	NF	
D20	28920-099	NF			R74	33000-069	NF	NF	
D21	31000-002	NF	NF		R76	33000-069	NF	NF	
D22	31000-002	NF	NF		R79	33000-031	NF	NF	
D24	28920-099	NF			R80	33000-068	NF	NF	
D25	28920-099	NF			R81	33000-036	NF	NF	
D26	31000-002	NF	NF		R148	33000-070	NF	NF	
D28	28920-099	NF			R149	33000-029	NF	NF	
D32	31000-014	NF	NF	NF	R159	33000-069	NF	NF	
D33	31000-002	NF	NF	NF	R162	33000-052	NF		
D34	28920-099	NF	NF	NF	R253	33000-044	NF	NF	NF
D35	28920-099	NF			R277	33000-037	NF	NF	
D38	28920-099	NF	NF	NF	R280	33000-039	NF	NF	
D39	28920-099	NF	NF	NF	R281	33000-044	NF	NF	
D40	28920-099	NF	NF	NF	R282	33000-037	NF	NF	
IC3	30000-013	NF	NF	NF	SW1	35975-001	NF	NF	NF
IC4	31000-005	NF	NF		TR7	31000-001	NF		
IC5	6139-189	6139-189	6139-193		TR8	31000-004	NF		
IC6	30000-102	30000-102	30000-168		TR10	31000-004	NF		
IC7	30000-102	NF	NF	NF	TR17	31000-001	NF	NF	
PL6	25960-118	NF	NF	NF	TR18	31000-001	NF	NF	
PL17	25960-118	NF			TR19	31000-004	NF	NF	
PL18	25960-118	NF			TR20	31000-001	NF	NF	
PL19	25960-045-03K	NF	NF	NF	TR21	31000-004	NF	NF	
PL20	25960-045-03	NF	NF	NF	TR22	31000-004	NF	NF	
PL21	25960-045-03	NF	NF	NF	TR28	31000-004	NF	NF	
R5	33000-031	NF			TR30	31000-004	NF	NF	
R14	33000-048	NF			TR55	31000-001	NF	NF	
R22	33000-048	NF			XL1	28863-342	NF	NF	NF
R28	33000-037	NF							

Model-MIT300&amp;310

<b>Megger</b>	MEGGER LIMITED Archcliffe Road, Dover, Kent, CT17 9EN, England	Document Number <b>6270-288</b>
Title <b>Circuit Diagram - Variant List</b>		
Instrument: MIT300 Series	Issue	Date
Drawn By: S.Newman	9	22-07-2004 22083
Date: Thursday, October 23, 2003	8	12-07-04 22074
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# MIT320 Bill of Material

**Safety critical components marked \***

<b>Part number</b>	<b>Item description</b>	<b>Quantity</b>
6231-727	MIT320 PCB ASSEMBLY	1
6231-728	MIT320 PCB SMD ASSEMBLY	1
5240-441	MIT300 SERIES MAIN PCB	1
30000-025	IC OP-AMP QUAD CMOS LMC660	1
30000-102	IC EEPROM 8Kx8 24C64 SO8	1
6139-189	PROGRAMMED uP MIT300 SERIES	1
30200-036	IC OP-AMP QUAD LMV324	2
30200-037	IC PWM CONTROLLER TL5001ACD	1
31000-001	TRANSISTOR NPN DRG 6180-396	23
31000-002	DIODE SM LL4148	14
31000-004	TRANSISTOR PNP DRG 6180-395	14
31000-005	IC COMPARATOR (TAPE) LM339	2
31000-021	DIODE SM SCHOT 1A MBR130LT3	1
31000-031	TRANSISTOR MOSFET N, 75307	2
31100-007	TRANSISTOR MOSFET N, MMBF0201	2
31100-010	TRANSISTOR MOSFET P, NDS352AP	3
31300-015	DIODE SM 1000V FAST-REC BYG21	7
31500-010	TRANSISTOR PNP MMJT9435T1	1
32000-006	CAP SMD CER. 2.2nF 10% 1206	3
32000-017	CAP SMD CER- 220nF 10% 1206	5
32000-023	CAP SMD ELEC'- 10uF 16V 0405	7
32000-025	CAP SMD CER- 10nF 10% 0603	12
32000-026	CAP SMD CER. 3.3nF 10% 0603	2
32000-027	CAP SMD CER. 1nF 10% 0603	3
32000-029	CAP SMD CER- 100nF -20+80%0603	24
32000-030	CAP SMD CER 100pF 5% 0603	1
32000-031	CAP SMD CER 33pF 5% 0603	7
33000-017	RES SM-150K MF 2% 1/8W 1206	1
3000-020	RES SM- 7K5 MF 2% 1/8W 1206	3
33000-027	RES SM; 10R MF 1% 0.063W 0603	7
33000-028	RES SM; 33R MF 1% 0.063W 0603	1
33000-031	RES SM- 1K MF 1% 0.063W 0603	9
33000-036	RES SM- 6K8 MF 1% 0.063W 0603	5

33000-037	RES SM- 10K MF 1% 0.063W 0603	50
33000-039	RES SM- 33K MF 1% 0.063W 0603	1
33000-040	RES SM- 47K MF 1% 0.063W 0603	3
33000-041	RES SM- 68K MF 1% 0.063W 0603	2
33000-042	RES SM-100K MF 1% 0.063W 0603	34
33000-043	RES SM-330K MF 1% 0.063W 0603	2
33000-044	RES SM' 1M MF 1% 0.063W 0603	12
33000-048	RES SM; 15R MF 2% 1/8W 1206	2
33000-049	RES SM; 22R MF 2% 1/8W 1206	5
33000-052	RES SM;220R MF 1% 1/8W 1206	1
3000-068	RES SM;300R MF 1% 0.063W 0603	6
33000-069	RES SM- 3K MF 1% 0.063W 0603	15
33000-070	RES SM- 30K MF 1% 0.063W 0603	31
33000-071	RES SM-300K MF 1% 0.063W 0603	11
33000-093	RES SM-750K MF 1% 1/8W 1206	1
33000-101	RES SM; 1R TF 1% 0.063W 0603	2
33000-114	RES SM' 10M MF 1% 0.063W 0603	9
35400-002	*FUSE, 3A (T)SMD. NANO. R452003	1
33000-035	RES SM- 4K7 MF 1% 0.063W 0603	1
5173-579	PCB BAR CODE LABEL	1
25995-013	LABEL(CUSTOM) 6,35X24mm	1
32000-038	CAP SMD TANT'- 10uF 20% 3528	1
6231-729	MIT320 PCB KIT	1
26837-066	RES-750K MG 5% 0.5W VR37	1
25418-217	FUSE CLIP 6.3mm 15A PCB 102071	2
25950-056	*FUSE-500mA(F) 600V 50kA 32mm	1
25960-045	HEADER 36-WAY	0.28
25960-118	HEADER 1-WAY (CLIP-IN)	6
25975-107	SWITCH PUSH SPNO PCB (NO PIP)	1
25980-056	RELAY SP C/O 250 VAC 8A 5V	1
26836-005	*RES' 4M7 MO 1% 0.50W VR37	5
26837-066	*RES-750K MG 5% 0.5W VR37	3
26970-075	CAP ELEC' 1uF 63Vdc 20%	1
26970-087	CAP FILM-- 47nF 1500Vdc 20%	1
26970-148	CAP FILM-'470nF 250Vdc 5% 15R	1
27889-868	CAP FILM-'470nF 50Vdc 20%	1
27889-869	CAP ELEC"220uF 16Vdc	3
27889-996	CAP FILM' 1.0uF 63Vdc 5% 5R	5
27900-059	INDUCTOR-220uH 0.6A 10% ELC08D	1
27920-055	BUZZER 1.5V 42ohm TR12BL	1

28900-031	RESONATOR, 6MHZ	1
28920-064	DIODE,1500V FAST RECOV. BY448	1
28920-074	ZENER 5.0W 5%'12V 1N5349B	1
28920-095	LED GRN LOW CURRENT 3MM 179	7
6131-767	TX ASSY BM200/1/4 BM400s	1
6180-433	BACKLIGHT MFT1502	1
6280-350	LCD MIT300 SERIES	1
26900-138	RES- 27K0 MF 1% 0.25W MFR4	2
27890-012	CAP ELEC"470uF 16Vdc 20%	1
5173-579	PCB BAR CODE LABEL	1
25995-013	LABEL(CUSTOM) 6,35X24mm	1
6140-378	WACL MIT320	1
25965-001	CRIMP RECEPTACLE BERG 47217-00	2
25965-011	HOUSING, 1 X 3, BERG	1
13489-003	WIRE 7/0.2 PTFE TYP C RED	.09m
13489-006	WIRE 7/0.2 PTFE TYP C BLACK	.09m
13489-196	WIRE 1/0.6 PVC BK THK TYP 3	.05m
13489-195	WIRE 1/0.6 PVC RED THK TYP 3	.16m
13489-215	WIRE 1/0.6 PVC BLUE THK TYP 3	.13m
13489-090	WIRE 1/0.6 PVC GREEN TYP 2	.16m
13489-092	WIRE 1/0.6 PVC WHITE TYP 2	.16m
18274-733	SLEEVING PTFE 2mm NAT.	.145m
25274-417	CABLE TIE 100x2.5mm T18R	2
6231-722	CASE KIT A (1 SWITCH)	1
5131-405	BATTERY CONTACT AA (+VE)	
5131-406	BATTERY CONTACT AA (-VE)	
5131-407	BATTERY CONTACT AA (+VE/-VE)	
5131-408	BATTERY CONTACT AA (+VE/-VE)RV	
5140-979	WINDOW MIT300	
140-980	GASKET (WINDOW) MIT300	
5210-452	BATTERY LID MIT300	
5210-453	RANGE KNOB 36mm MIT300	
5310-444	COVER MIT300	
5310-445	HINGE MIT300	
5410-396	CASE TOP (1 SWITCH) MIT300	
5410-398	CASE BOTTOM MIT300	
24800-011	O RING 10mm I/D 1.5mm SECTION	
5310-446	TERMINAL PANEL MIT/LT/RCDT300	
25965-099	SOCKET 4mm DIA.	2
5310-357	INDEX SPIDER/SWITCH TOP	1

5131-378	CONTACT DISC	2
5160-324	SPRING (ROTARY SWITCH)	2
5210-361	SWITCH BOTTOM	1
21264-227	SCREW PLASTITE No4 .5" PAN Hd	5
210-458	KEYPAD MIT320	1
21817-008	SCREW M4x8 PAN HD POZI ST.ZP.	1
21277-018	SCREW PT 3x6mm PAN HD THREDFM	2
21138-014	PIN DOWEL 2x5mm ST.STEEL DIN7	2
17685-002	TREATMENT GREASE	
17685-008	GREASE (PLASTICS) SPG35SL	
5140-930	FOAM STRIP 25x8x3	2
5950-056	*FUSE-500mA(F) 600V 50kA 32mm	1
21814-737	WASHER M4 LD-PE ANTI-LOSS	1
6220-780	CARRY STRAP MIT/LT/RCDT300	1
22420-111	SPACER-14.3LG SNAP FIT NYLON	2
25511-841	BATTERY 1.5V DURACELL MN1500	8
6220-779	*LEADSET RED/BLK MEGGER MIT300	1
6172-877	USER GUIDE CD MIT/LT/RCDT300	1
6172-059	WARRANTY CARD 3 YEAR MEGGER	1
174-082	SERIAL NO. LABEL MEGGER	1
18190-013	SLEEVING SILIC ID1.5,OD2.1 WHT	1.20m
5270-845	LABEL SET MIT320	1
18900-043	POLYESTER SHT 406x305x0.175mm	
17525-018	TAPE DS/ADH 305mm 3M-467	0.10m
5152-273	PLUG CONTACT	3
6220-781	SP3 SET,RED,3-PIN,IN POLY BAG	1
210-454	INTERLOCK MIT/LT/RCDT300 SERIE	1
6220-785	POUCH MIT300	1
6260-169	CARTON MIT/LT/RCDT300	1
6260-170	BLISTER INSERT	1
25274-417	CABLE TIE 100x2.5mm T18R	5
25132-017	CABLE SLEEVE NEOPR BLK 1.5x20L	1
5174-170	SAFETY WARNING SHEET MIT300	1
5270-853	QUICKSTART LABEL MIT300	1
18760-013	ADHESIVE/SEALANT 744RTV 310ml	ML .25
6171-651	CERTIFICATE OF TEST - MEGGER	1
5174-174	CARTON LABEL MIT320-EN	1

# Test and Calibration

## Test Specification

1. Connect a battery or power supply at 8 to 12V.
2. Select range, connect resistor as per table, press TEST and read display and terminal volts/current as indicated.

Range	Connect	Read display	Measure volts	Measure current
MΩ 250V	0Ω	0.00MΩ ( $\pm 0$ digits)		1.5mA $\pm 0.5$ mA
	250kΩ	250kΩ $\pm 30$ kΩ	250 to 300V	
MΩ 500V	500kΩ	500kΩ $\pm 30$ kΩ	500 to 600V	
	450MΩ	450MΩ $\pm 15$ MΩ		
MΩ 1000V	1MΩ	1MΩ $\pm 0.05$ MΩ	1000 to 1200V	
	10MΩ	10MΩ $\pm 0.3$ MΩ		
V	Open circuit	0V $\pm 0$ V		
	0V	0V $\pm 0$ V		
	3V 50Hz	1V to 5V ac		
	30V 50Hz	30V ac $\pm 2$ V		
	250V 50Hz	250V $\pm 4$ V		
	595V 50Hz	595V $\pm 8$ V		
	100V dc	100V $\pm 3$ V		

3. Select range, connect resistor as per table, (do not press TEST unless instructed) and read display and terminal volts/current as indicated.

Range	Connect	Read display	Measure volts	Measure current
Ω	0Ω + leads	0.00Ω to 0.05Ω	(Note: Leads = 0.04Ω $\pm 0.01$ Ω)	
Press TEST momentarily		0.00Ω $\pm 0$ Ω		
	2Ω	2.00Ω $\pm 0.08$ Ω		205mA $\pm 5$ mA
	50Ω	50.0Ω $\pm 1.7$ Ω		
kΩ	0Ω	0.00kΩ $\pm 0$ kΩ		
	1.5kΩ	1.5kΩ $\pm 0.07$ kΩ		
	5kΩ	5kΩ $\pm 0.17$ kΩ		
	400kΩ	400kΩ $\pm 14$ kΩ		
Buzzer	Open circuit	No buzz		
	0Ω	Buzzes in <50ms		
Off	Powers down within 3 seconds; battery current <200uA			

## Final inspection

1. Check fuse is tight in its clips.
2. Insert batteries and secure battery compartment.
3. Open case by folding the lid to the back and clicking it into position.
4. Visually check external appearance. The gap between the two halves of the case should be less than 1.5mm.
5. Turn on to 250V, observe version number (e.g.V1.0) and that the pointer moves from left to right hand side of display.
6. Battery indicator (top right-hand side of display) should show full.
7. (MIT320/330 only) Press backlight button and observe that backlight works.
8. (MIT320/330 only) Rotate switch through all ranges to check that the range position illuminators work. (No illumination is expected for OFF or SETUP.)
9. Rotate switch through all ranges again to check that they each show the correct display. (i.e. Symbols V, MΩ, Ω and kΩ should appear in the bottom right-hand corner of the display when each of these positions is selected on the rotary switch. When the buzzer position is selected, the buzzer must sound.) Also check that switch end stops work.
10. **Without test leads connected**, select 250V, hold TEST button down, press LOCK button and then release both buttons. Observe LOCK symbol is on and display shows ' $>1000_{M\Omega}$ '. Press TEST and observe LOCK symbol goes out.
11. Switch to OFF and watch display go out.

## **Calibration**

Calibration requires a computer with a calibration program, a set of calibration resistors, calibrated voltage source and a 6-pin connector for PP1. Calibration constants are stored in EEPROM. Since calibration does not rely on potentiometer settings, re-adjustment is unlikely to be required during the life of the instrument.

Minor repairs are unlikely to require re-calibration.

The one component which may change calibration is the integrator capacitor C22. If this is changed, it is likely to shift calibration of MΩ and kΩ readings. If calibration equipment is not available, operation within specification ( $\pm 3\%$ ) can be achieved by selecting the value of this capacitor. This is made easy by the provision of C23 position, which allows a second capacitor to be placed in parallel.

Stored calibration constants are as shown below.

- A1 Output volts fine adjust for insulation test 250V.
- A2 Output volts fine adjust for insulation test 500V.
- A3 Output volts fine adjust for insulation test 1000V.
- B Continuity current adjust, nominally 205mA.
- C Continuity current adjust, nominally 20mA.
- D Voltmeter zero offset (set this using 250V range).
- E Voltmeter gain for 250V range.
- F Voltmeter gain for 500V range.
- G Voltmeter gain for 1000V range.
- H AC voltmeter form factor correction, theoretically 2.22.
- I Insulation ‘current gain’ adjustment. Nominally 1.0 (typically set at 50MΩ).
- J Insulation infinity set (or  $\mu$ A zero adjust).
- K kΩ zero adjust.
- L Low kΩ source voltage calibration.
- M High kΩ low resistance (approx. 3.9kΩ).
- N High kΩ high resistance (approx. 400kΩ).
- O 10 Ohms default zero
- P 10 Ohms gain adjust, (set 5Ω @200mA)
- Q 100 Ohms gain adjust, (set 50Ω @200mA)

For training – Contact [ukrepairs@megger.com](mailto:ukrepairs@megger.com)

## Appendix 1 – Common faults

Fault	Possible cause
Buzzer not sounding	MIT320 and MIT330: Buzzer has been disabled using SETUP.  Select SETUP on the rotary switch. Click the TEST button to display buZ (flashing). Hold TEST button down to toggle from buZ/OFF to buZ/ON. Press LOCK.
	Faulty buzzer
Displays E17 or unc	E17 means the instrument is not set to any specific type (e.g. MIT300, MIT310 etc.) and unc means uncalibrated. Either message will prevent operation. The data in the EEPROM is either lost or inaccessible. The instrument must be connected to a computer to set instrument type or perform calibration. Connecting the link PL1 (located by the microprocessor IC5) to run in ‘Engineering Mode’ allows faultfinding regardless of these error messages.
Locking button not working	The locking button can be disabled by setting the rotary switch to OFF, holding the button down and then selecting 500V. Continue to hold the button down for ten seconds. The display will show the lock symbol and the word OFF.  Repeat the above procedure to turn locking back on.
	Button fault or Control Circuit fault
$\Omega$ range in error and short circuit current is not 205mA	Current source fault. See page 13.

## Appendix 2 – Firmware error codes

1:	RIC Event Queue Full	21:	Error Illegal Pinstate Set
2:	RIC Event Queue Empty	22:	Illegal Display Segment
3:	RIC Timeout Heap Full	23:	Display Reading Overrange
4:	RIC Timenout Not Found	24:	Decimal Point Overrange
5:	RIC Infinite Null Transitions	25:	Char Not Printable
6:	RIC Too Many Null Configs	26:	EEPROM Error
7:	RIC Too Few Null Configs	27:	EEPROM Send Fail
8:	RIC Null Destination	28:	EEPROM Receive Fail
9:	RIC Event Discarded	29:	Error Illegal Ohms Range
10:	RIC Allocating Another Mem Pool	30:	Error Illegal Offset
11:	Lost Event	31:	Error Integrator Reset
12:	A2d Not Ready	32:	Error Buzzer Drive Unstable
13:	EEPROM No Ack	33:	Error Buzzer Drive Pulldown
14:	EEPROM Near End	34:	Battery Reading Low
15:	Pointer Num	35:	Battery Reading High
16:	Invalid Voltage	36:	Too Many Objects to Transfer
17:	No Type (Model number not defined)	37:	Pointer Config Corrupt
18:	Illegal Voltage Set	38:	Pointer Segment Not in Table
19:	Bad Character	39:	Too Many Misses
20:	Checksum Fail		

## Appendix 3 – Firmware updates

V1.0 Original version

V1.1 Issued September 2004, Enables use on MIT330 and clears backlight bug.

## Appendix 4 – Hardware updates

PCB A4: Initial production pcb issue

PCB A5: Position for resistor added to fuse pcb and one test point added.

C57 (was 1nF) changed to 100nF to remove 5V supply overshoot at switch-on. 13/05/04

PCB A8: Modify probe drive circuit adding TR55. Add R283 for better output volts control.