

# Service manual

Loop Testers LT310, LT320 & LT330

RCD Testers RCDT310, RCDT320 & RCDT330

Loop/RCD Testers LRCD200, LRCD210 & LRCD220



Issue 1

6172-901

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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.

When connected to a mains supply, the whole of the instrument must be considered hazardous live. If instrument is open and you are faultfinding, suitable precautions must be taken.

After tests, the power resistors and heatsink on the power board could be hot.

# Guide to Fault-Finding

## Basic Operation

Switching from OFF will cause the firmware version number to be shown for slightly less than one second. The backlight (if fitted) will turn on until the display has settled. Normally the supply voltage will be shown, and a test started by pressing the TEST button.

Pressing the backlight button enables the backlight. The backlight turns off after 20 seconds to save battery power.

The LT3x0, RCDT3x0 and LRCD2x0 are similar instruments with common circuits and functions - in fact the PCBs are largely common and instrument's identity is setup in manufacture/test - the only differences in the PCB Build are in the Power Board

	<b>LT</b>	<b>RCDT</b>	<b>LRCD</b>
<b>FET</b>	Fit TR46 (FQA11N90) Do not fit TR37	Fit TR37 (P6NK90) Do not fit TR46	Fit TR46 (FQA11N90) Do not fit TR37
<b>RL2</b>	Fitted	Not Fitted	Fitted
<b>R251</b>	100Ω	91Ω	100Ω

Switch the instrument on by rotating the switch.

The instrument carries out these primary functions. If a fault is suspected, these functions need to be investigated in this order.

### 1. Voltage/Frequency Measurement

**The voltages between the three terminals are continuously measured. The maximum voltage is displayed if this is greater than 25V a.c.**

The voltages are measured via 10Mohm resistances on the power board, connected before the fuses, and sampled by the processor. On some instruments, the frequency can also be displayed.

Note that as the voltages are measured before the fuses, the correct voltage will be displayed even if the fuse has blown.

### 2. 'Constant Current Source'

**A current source can be connected across the supply to draw between 4.75mA and 1050mA.** This is controlled by the microprocessor, and is used to drive a current to trip RCDs, or to drive a switched current to measure loop resistance.

In general, this current is not there long enough to measure with a multimeter. However, on an RCD tester the 'a.c. selective' type test can be used, and the test current will flow for 2s.

This current will be nominally 5% higher than the rated current, as EN61557 requires that this current is never lower than the rated current. The wave shape for the d.c. sensitive test will confuse most multimeters. The current used to measure loop resistance can never be

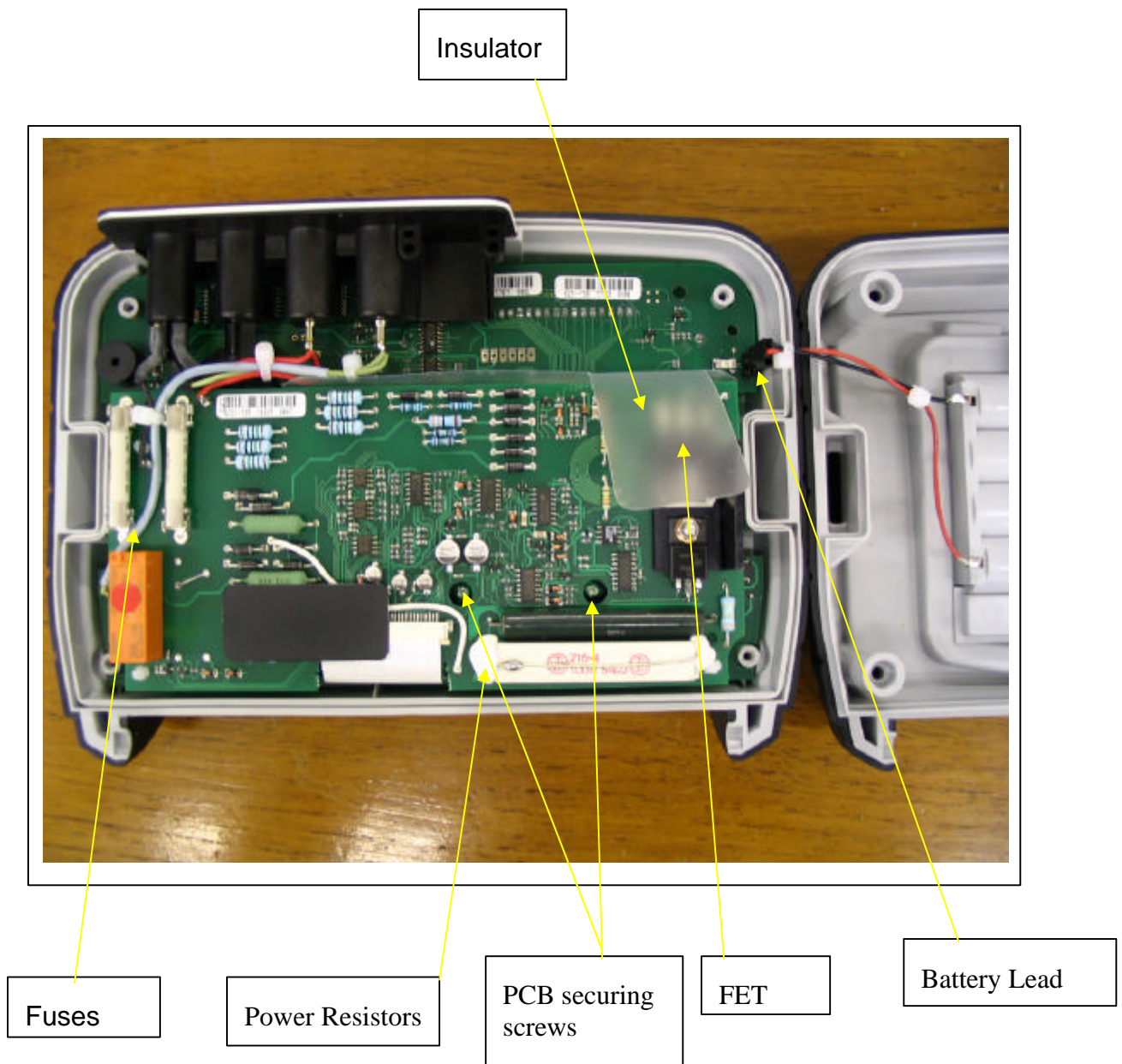
measured with a multimeter. Never use 'peak hold' on the multimeter - they are readily confused by switching transients.

A resistor and a FET are used, and both or either of these will get hot. The temperature is measured prior to (and during testing) and the test will be stopped if this is too high.

### 3. Difference Voltage measurement (Loop Resistance)

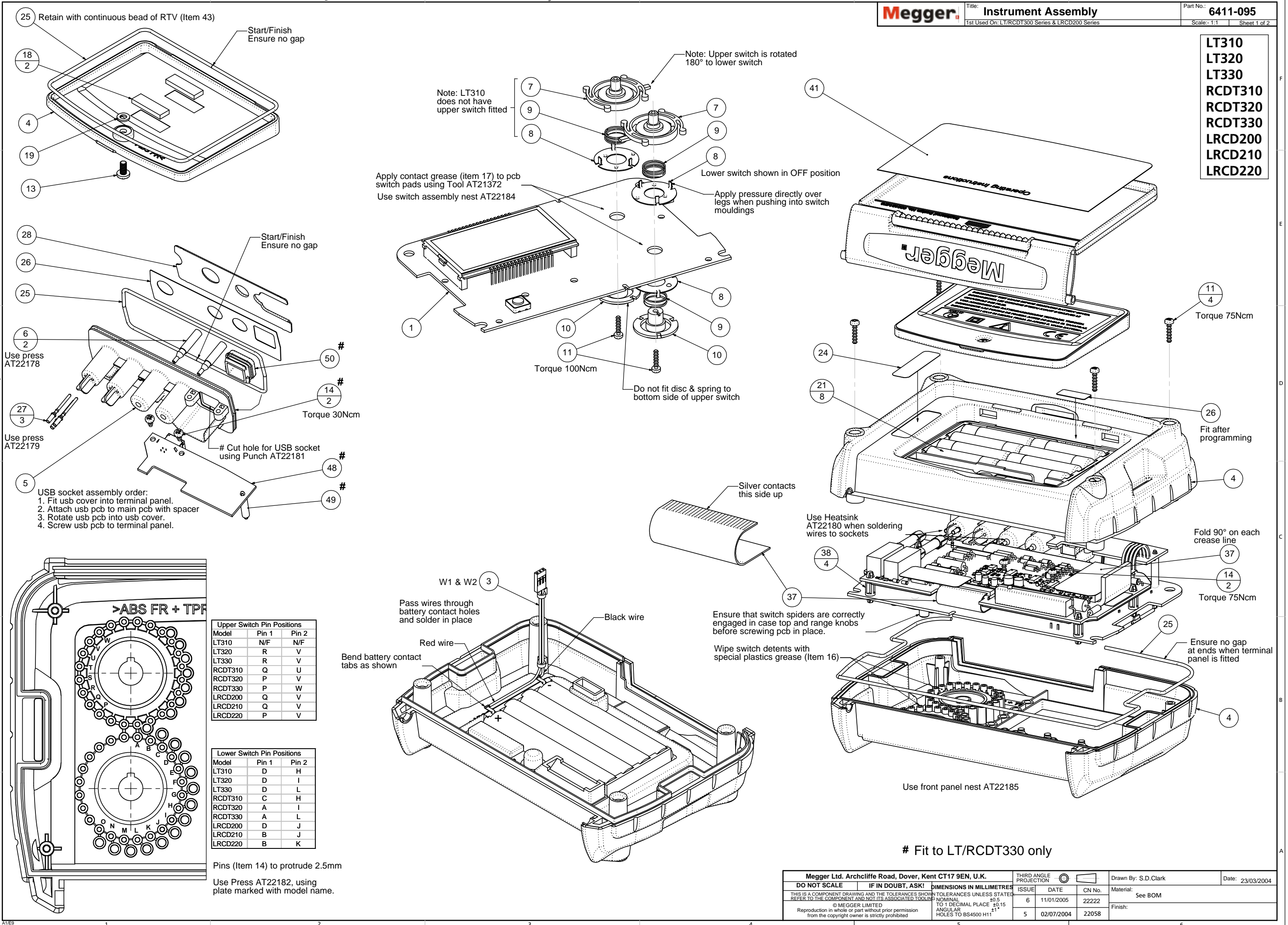
**To measure the loop resistance of a circuit the difference between the on load and off load voltages is measured. This is normally done several times and an average taken.**

## Assembly Drawings

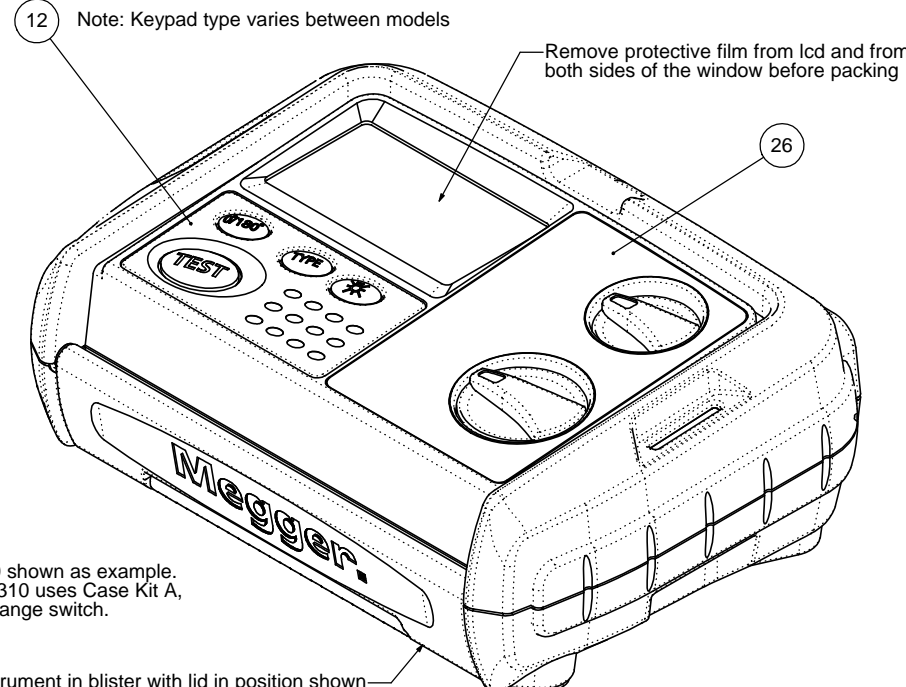




LT310  
LT320  
LT330  
RCDT310  
RCDT320  
RCDT330  
LRCD200  
LRCD210  
LRCD220

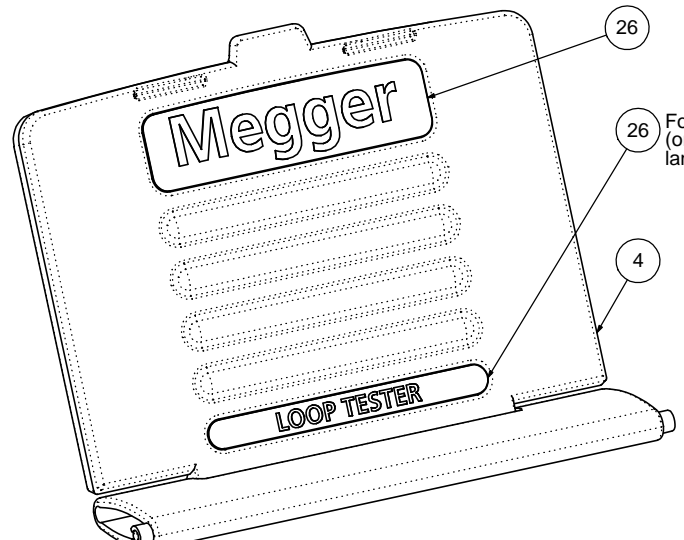


LT310  
LT320  
LT330  
RCDT310  
RCDT320  
RCDT330  
LRCD200  
LRCD210  
LRCD220



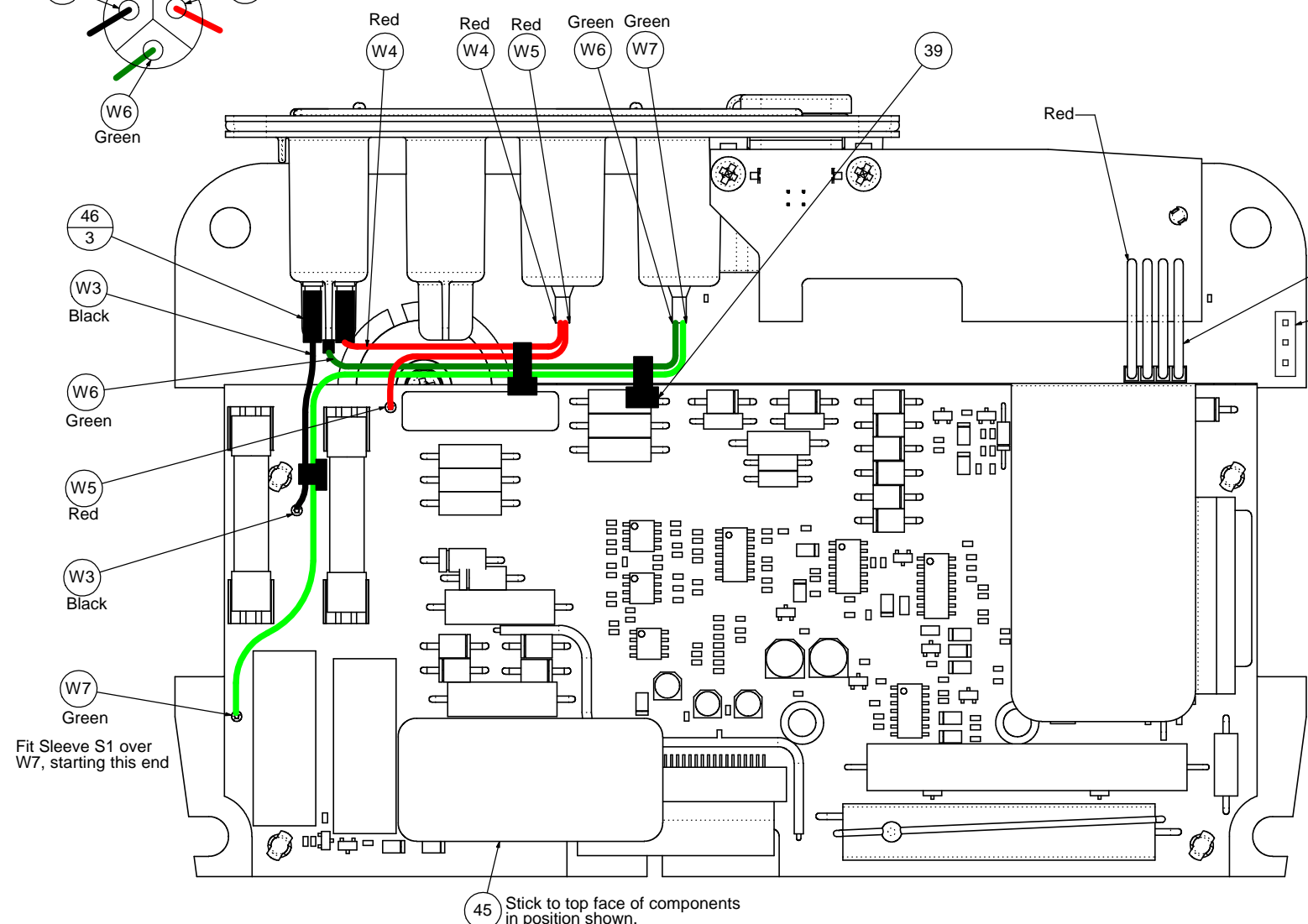
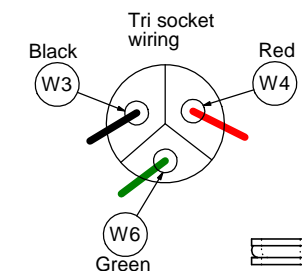
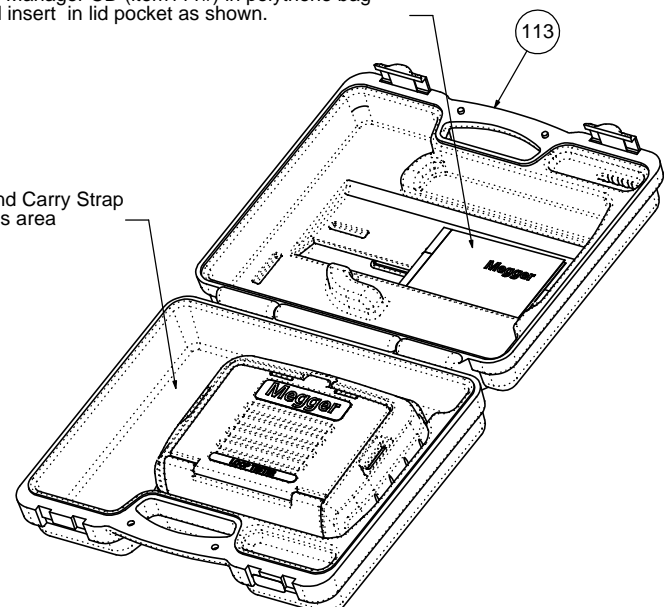
RCDT320 shown as example.  
Note - LT310 uses Case Kit A,  
with one range switch.

Pack instrument in blister with lid in position shown



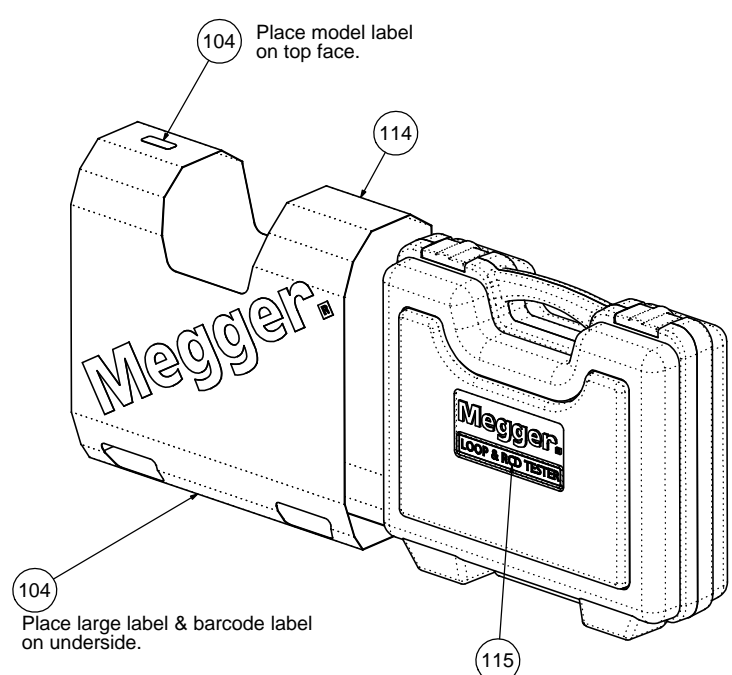
Place User guide CD (item 105), Warranty card (item 106),  
Safety warning sheet (item 112), Certificate of Test (item 44)  
and Download Manager CD (item 111#) in polythene bag  
(item 116) and insert in lid pocket as shown.

Pack Leads and Carry Strap  
(item 20) in this area

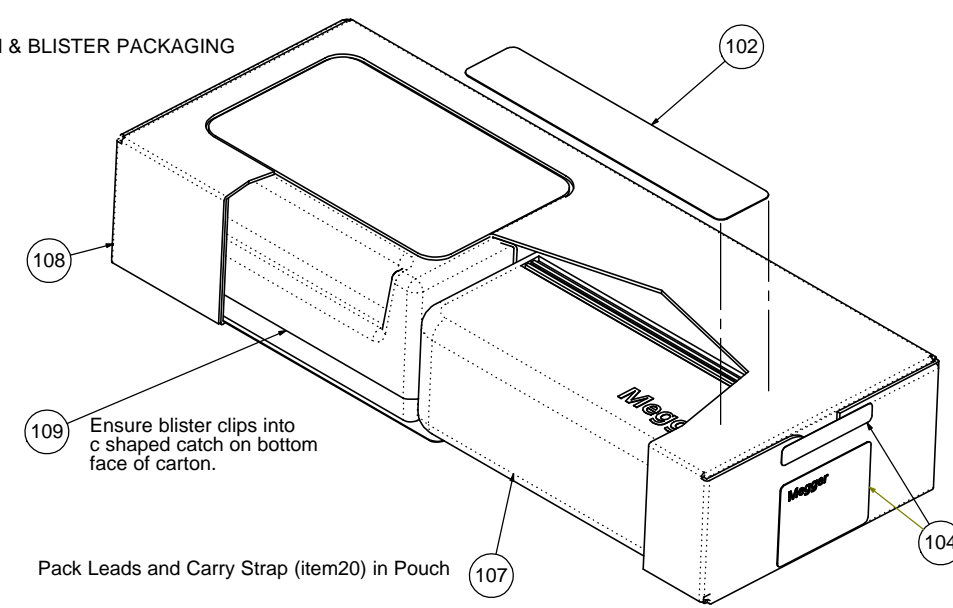


USB PCB  
Connection  
Battery connection  
(W1 & W2)

**CARRY CASE & SLEEVE PACKAGING**



**CARTON & BLISTER PACKAGING**



Place User guide CD (item 105), Warranty card (item 106), Safety warning sheet (item 112),  
Certificate of Test (item 44) and Download Manager CD (111#) in a polythene bag on top of the pouch.

Megger Ltd. Archcliffe Road, Dover, Kent CT17 9EN, U.K.				THIRD ANGLE PROJECTION		Drawn By: S.D.Clark		Date: 23/03/2004		
DO NOT SCALE		IF IN DOUBT, ASK!		DIMENSIONS IN MILLIMETRES		ISSUE		DATE	CN No.	Material:
THIS IS A COMPONENT DRAWING AND THE TOLERANCES SHOWN REFER TO THE COMPONENT AND NOT ITS ASSOCIATED TOOLING				TOLERANCES UNLESS STATED: NOMINAL ±0.5 TO 1 DECIMAL PLACE ±0.15 ANGULAR ±1° HOLES TO BS4500 H11		6		11/01/2005	22222	See BOM
© MEGGER LIMITED Reproduction in whole or part without prior permission from the copyright owner is strictly prohibited						5		02/07/2004	22058	Finish:

## 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 boards, unplug battery lead and remove the two securing screws (see picture page 5). Do not remove the screw in the centre of the rotary switch(s) (unless you want to take the switch apart).
5. Lift the terminal block and the pcbs will follow.
6. Note position of the rotary switch(s) (as shown in picture on page 9) so that it can be returned to this position for re-assembly.

**Note that to retain calibration, the printed circuit boards need to be replaced as a pair.**

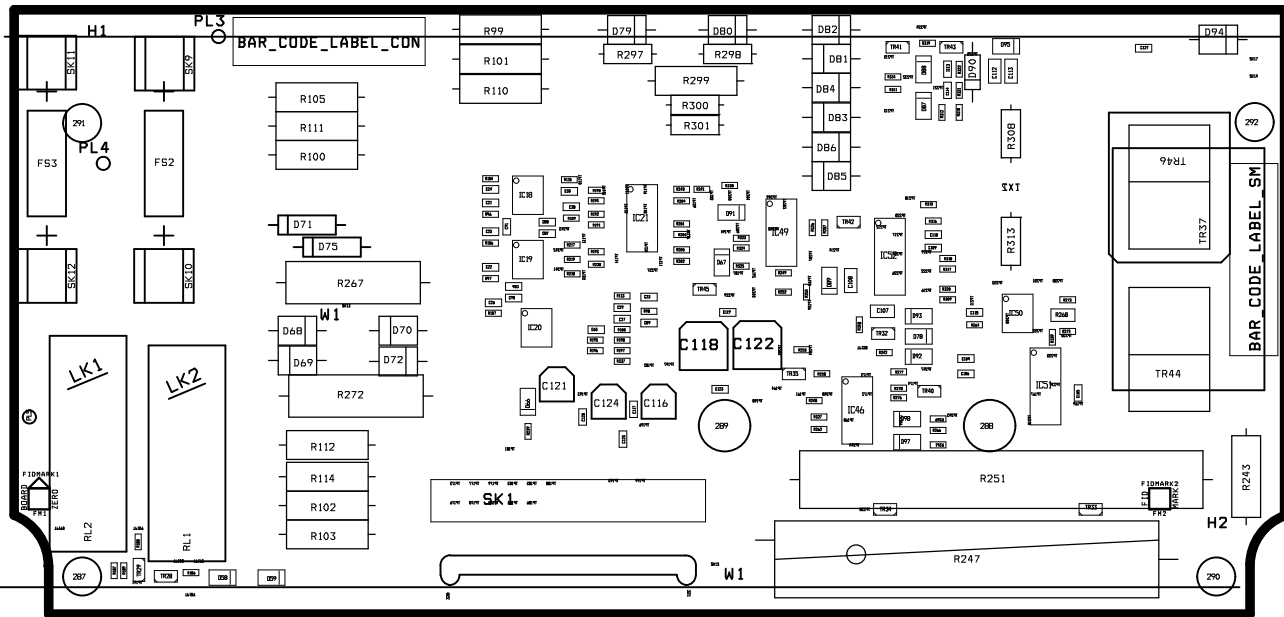
## Re-assembly

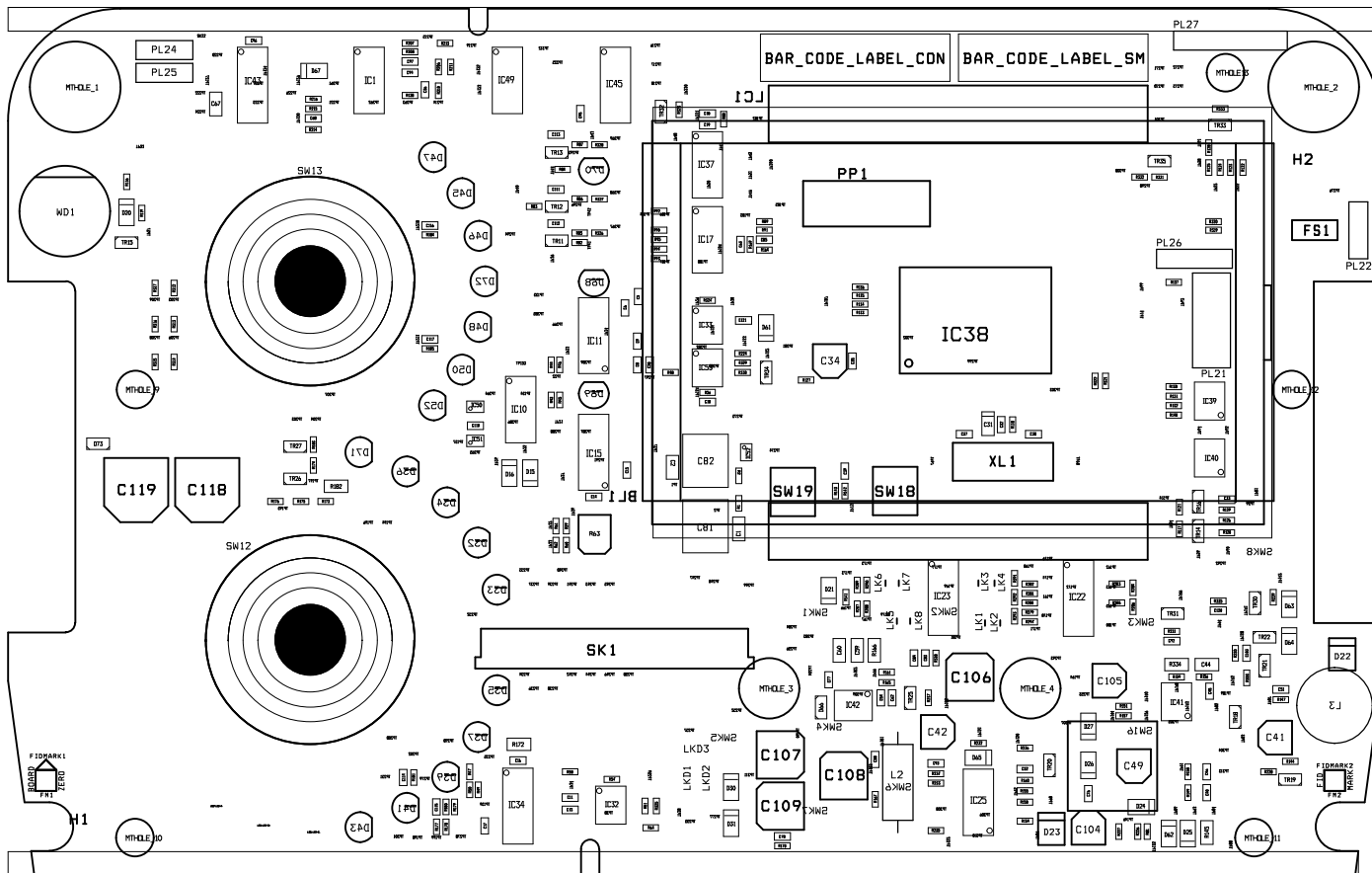
1. Ensure that the rotary switch and the knob are both in the 'OFF' position.
2. The battery connector can be fitted either way round since positive is the centre pin and negative is both outer pins.
3. Take care not to trap the battery lead.
4. Do not over tighten the four case screws; they screw into plastic.

## Miscellaneous notes

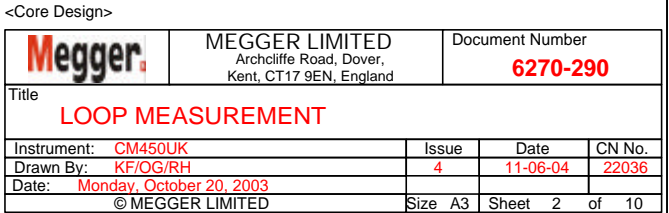
- Relays and Fuses are fitted only if required, depending on model.
- Replacement printed circuit board assemblies are available from Megger Sales. These board pairs are tested, calibrated and set up for specific models.

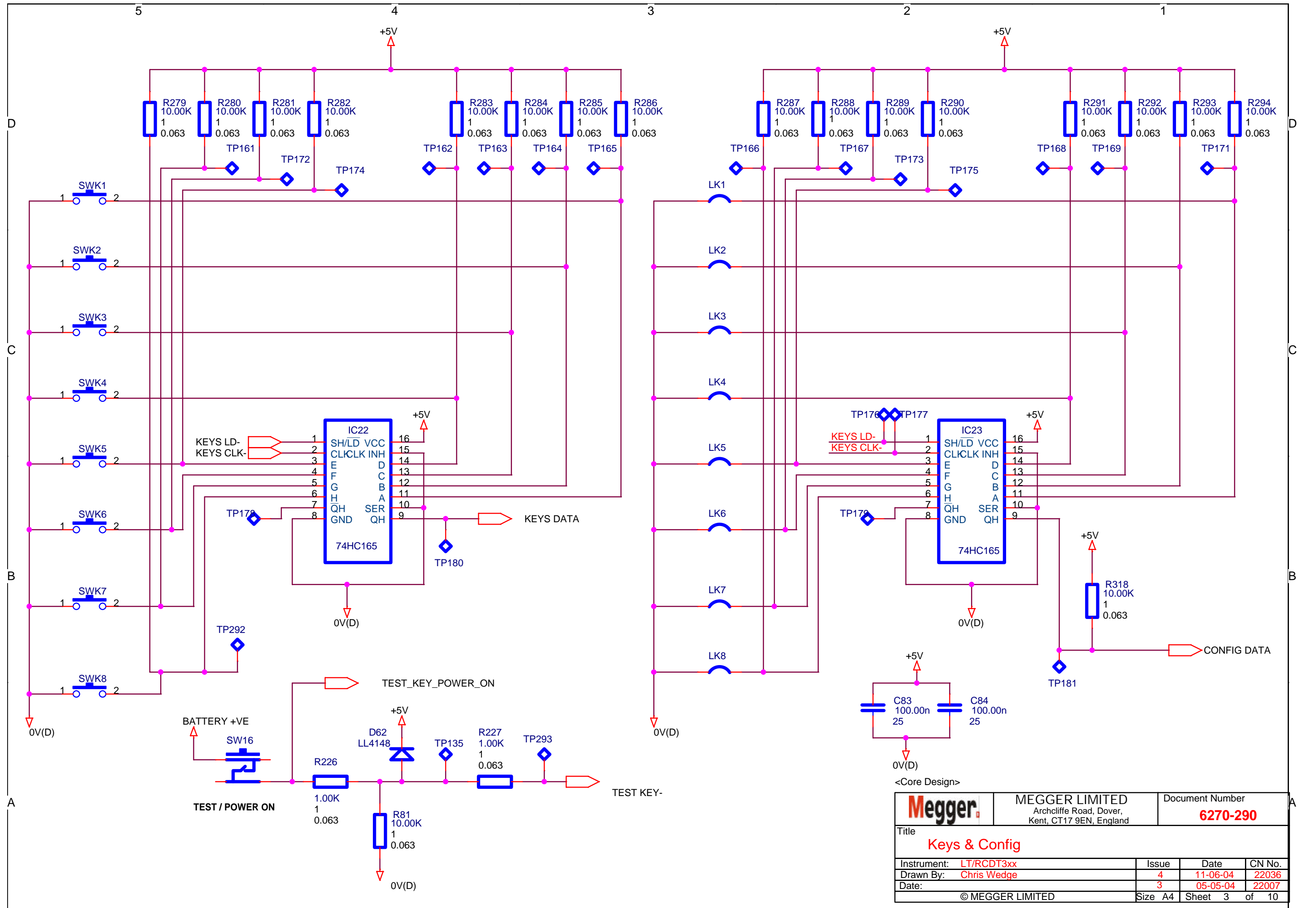







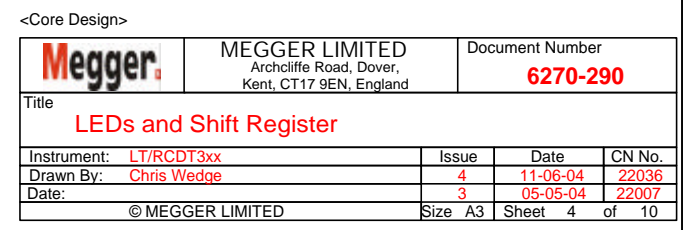


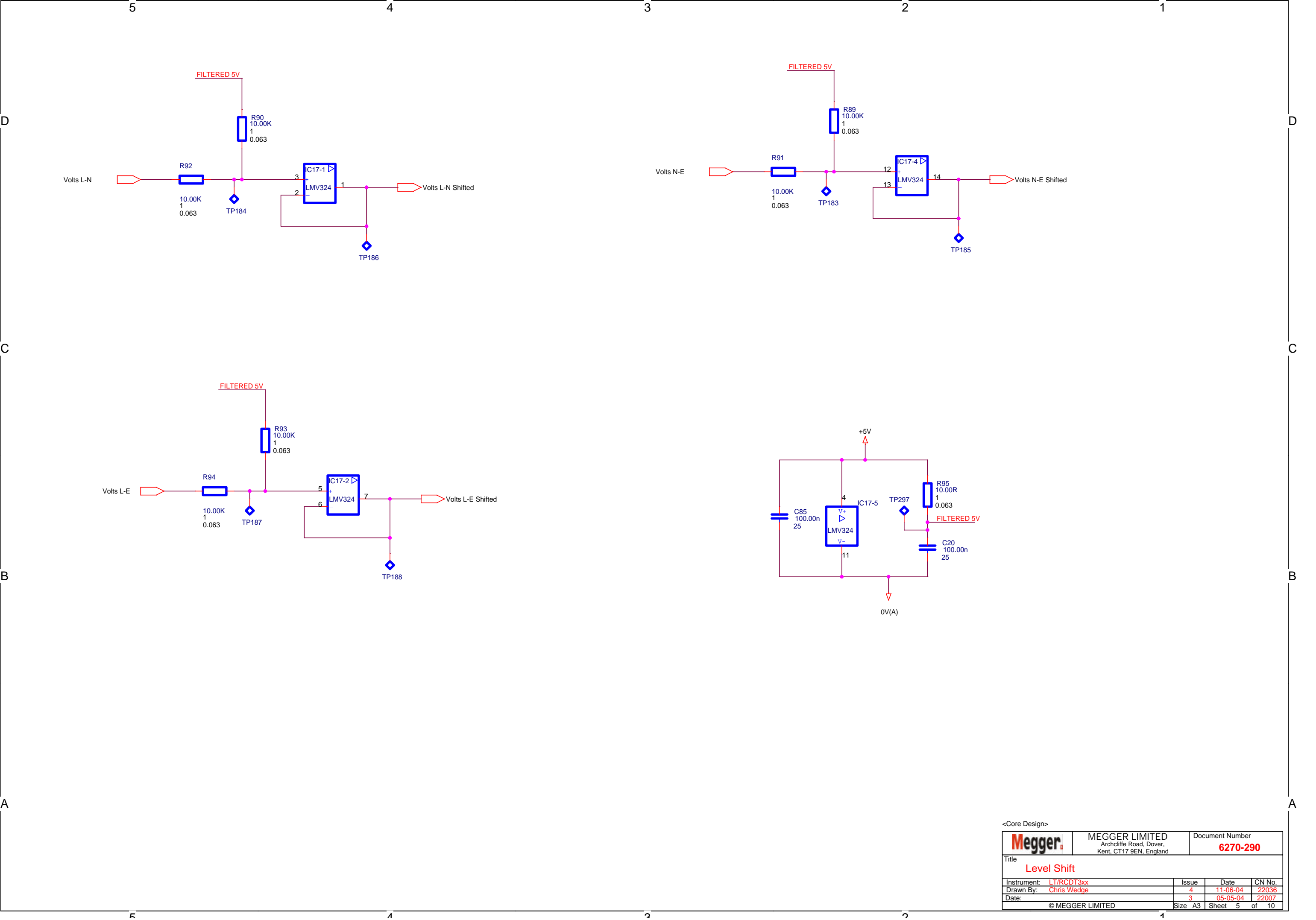




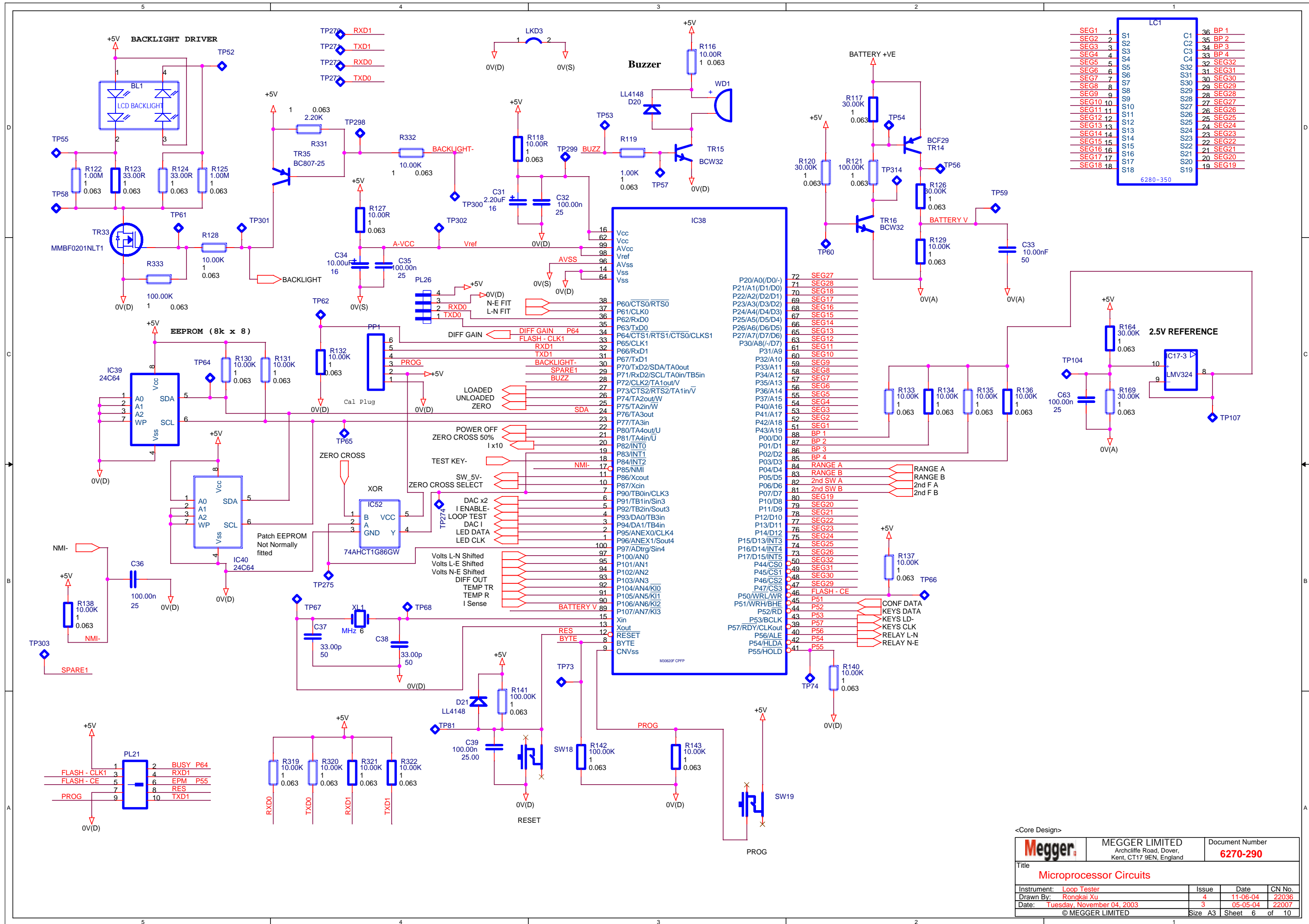
		MEGGER LIMITED Archcliffe Road, Dover, Kent, CT17 9EN, England		Document Number <b>6270-290</b>	
Title <b>Keys &amp; Config</b>					
Instrument: <b>LT/RCDT3xx</b>			Issue	Date	CN No.
Drawn By: <b>Chris Wedge</b>			<b>4</b>	<b>11-06-04</b>	<b>22036</b>
Date:			<b>3</b>	<b>05-05-04</b>	<b>22007</b>
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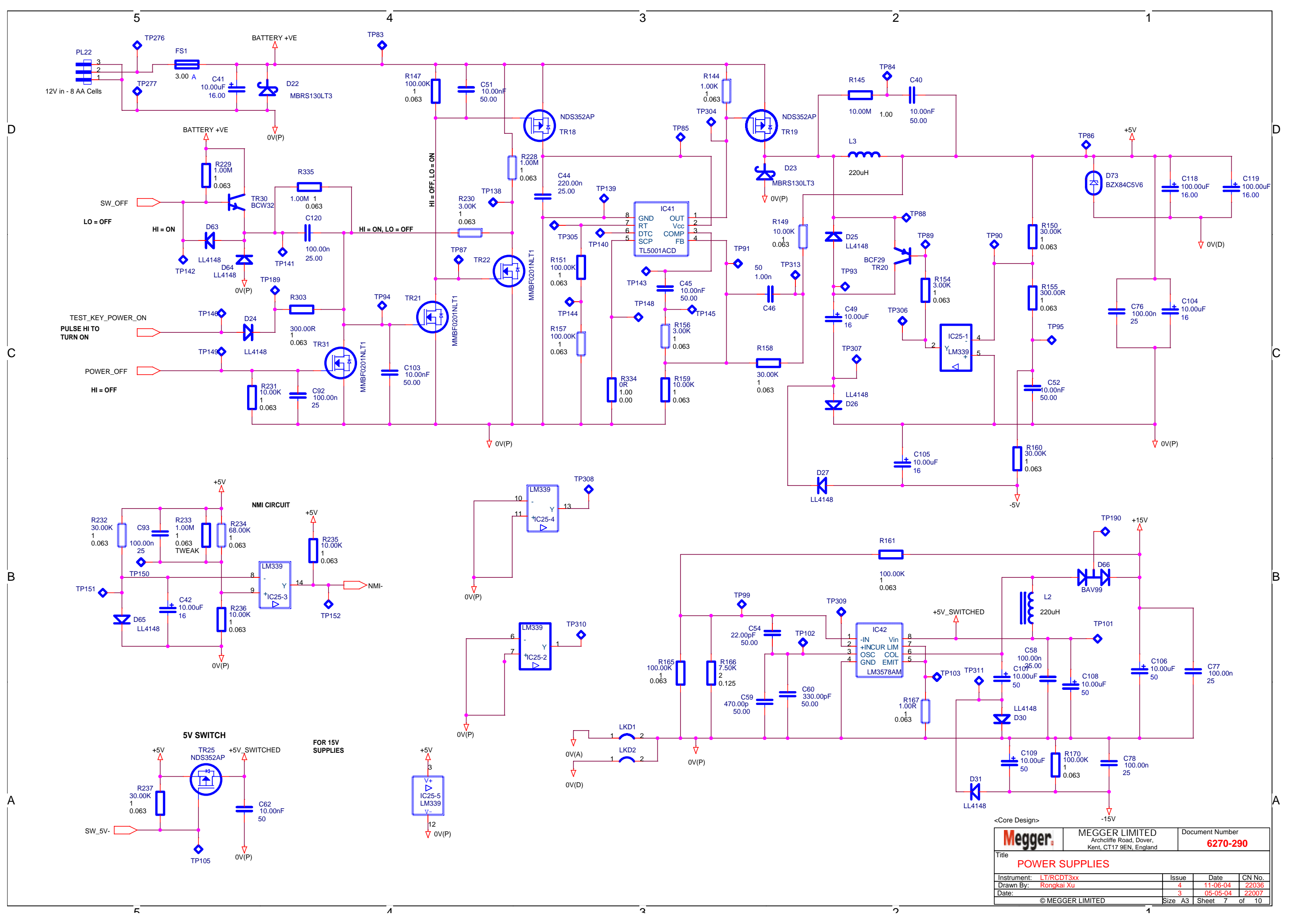


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<b>Megger</b>		MEGGER LIMITED Archcliffe Road, Dover, Kent, CT17 9EN, England	Document Number <b>6270-290</b>
Title <b>Level Shift</b>			
Instrument: <b>LT/RCDT3xx</b>		Issue: <b>4</b>	Date: <b>11-06-04</b>
Drawn By: <b>Chris Wedge</b>		3	05-05-04
Date:		Size: <b>A3</b>	Sheet: <b>5</b> of <b>10</b>
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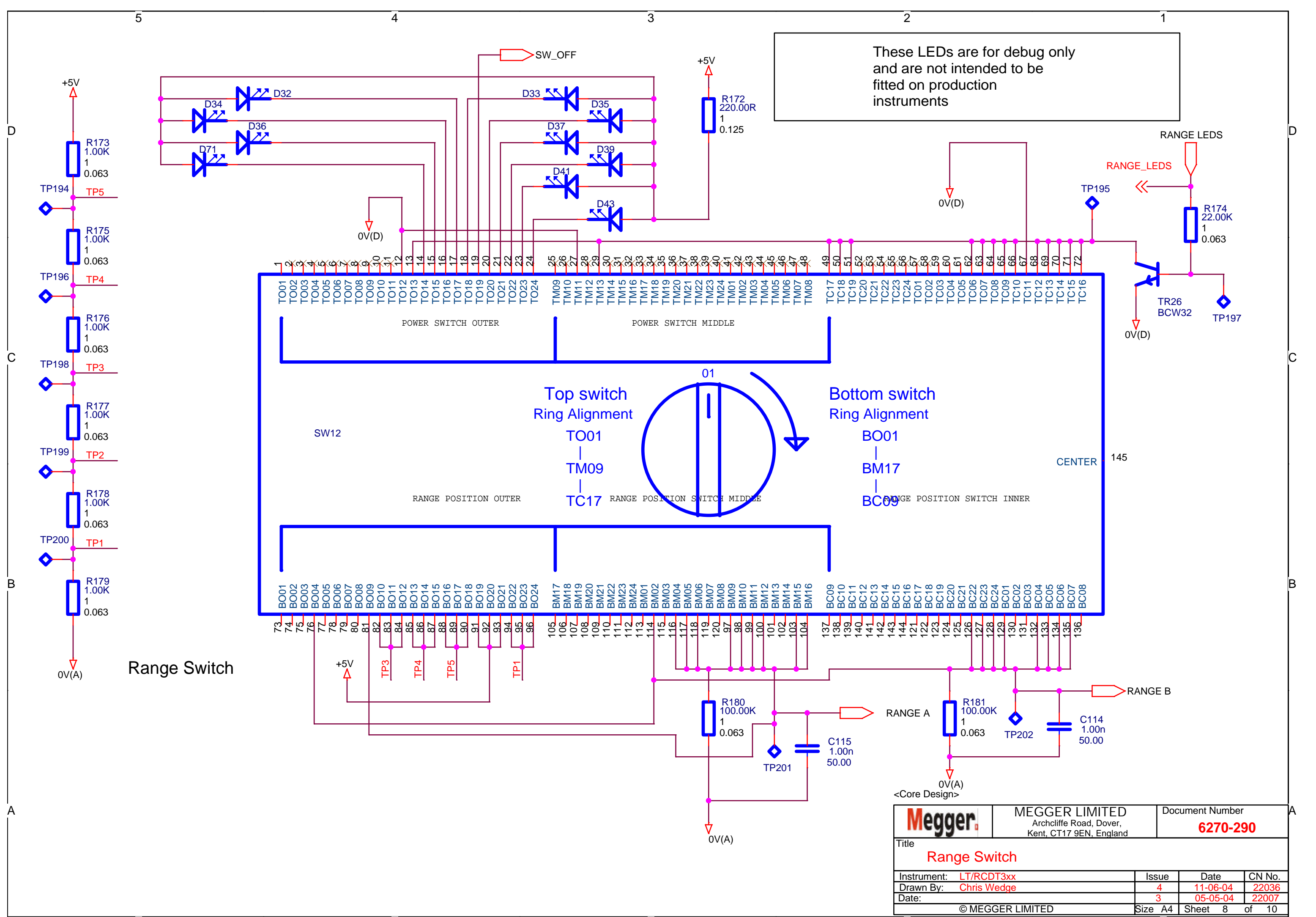



<Core Design>

<b>Megger</b>	MEGGER LIMITED Archcliffe Road, Dover, Kent, CT17 9EN, England	Document Number <b>6270-290</b>	
		Title <b>Microprocessor Circuits</b>	
Instrument: <b>Loop Tester</b>	Issue: <b>4</b>	Date: <b>11-06-04</b>	CN No.: <b>22036</b>
Drawn By: <b>Rongkai Xu</b>	3	05-05-04	22007
Date: <b>Tuesday, November 04, 2003</b>	© MEGGER LIMITED		
Size A3		Sheet 6	of 10



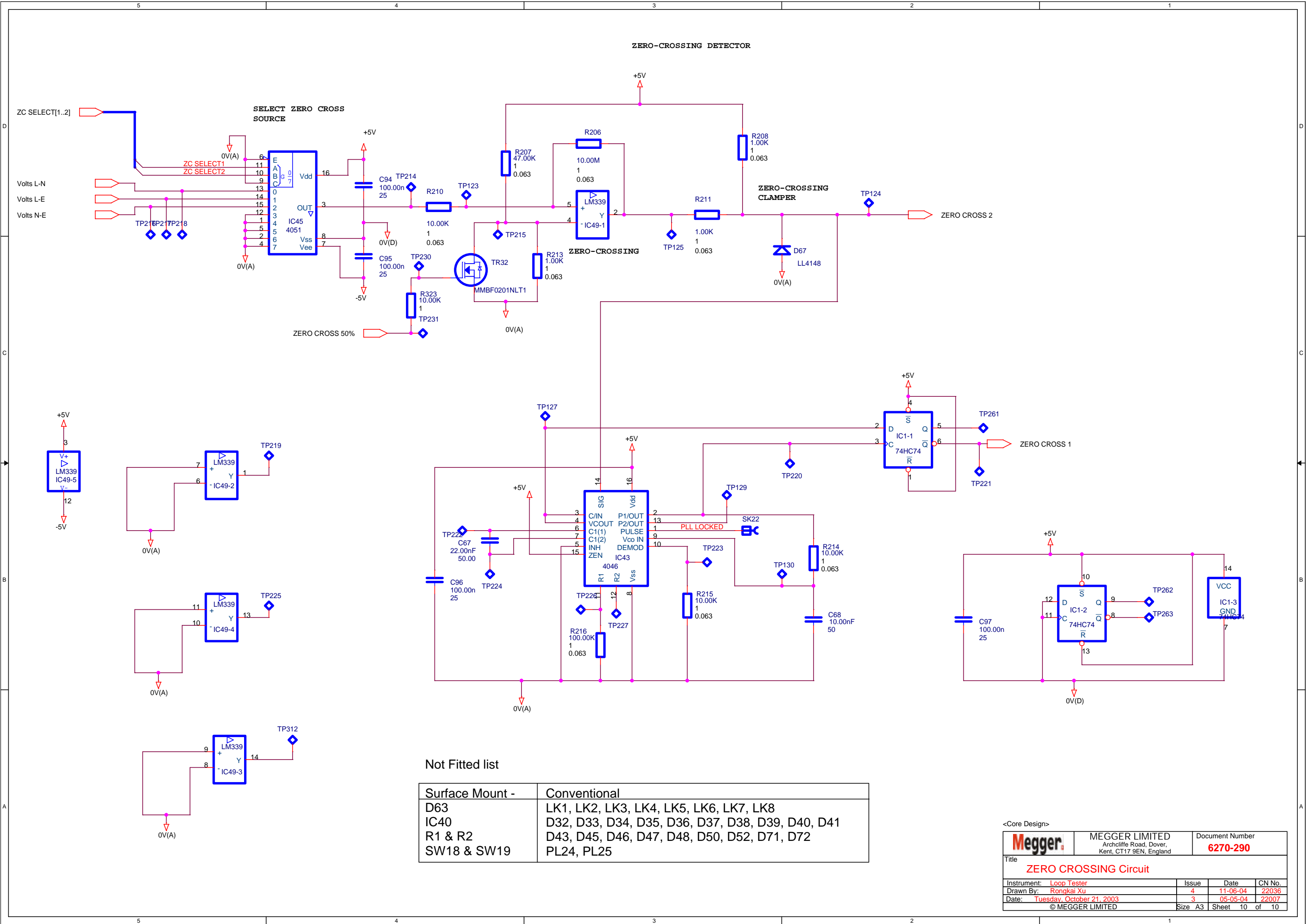
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Title <b>POWER SUPPLIES</b>									
Instrument: <b>LT/RCDT3xx</b>				Issue		Date			
Drawn By: <b>Rongkai Xu</b>				4		11-06-04			
Date:				3		05-05-04			
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		MEGGER LIMITED Archcliffe Road, Dover, Kent, CT17 9EN, England		Document Number <b>6270-290</b>	
Title <b>Range Switch</b>					
Instrument: <b>LT/RCDT3xx</b>			Issue	Date	CN No.
Drawn By: <b>Chris Wedge</b>			<b>4</b>	<b>11-06-04</b>	<b>22036</b>
Date:			<b>3</b>	<b>05-05-04</b>	<b>22007</b>
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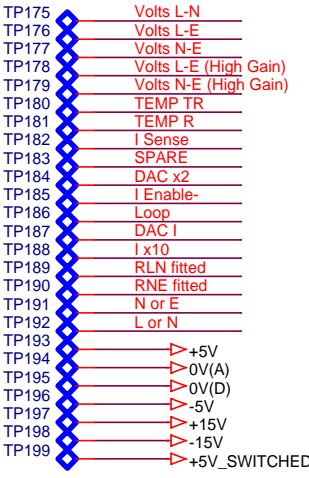
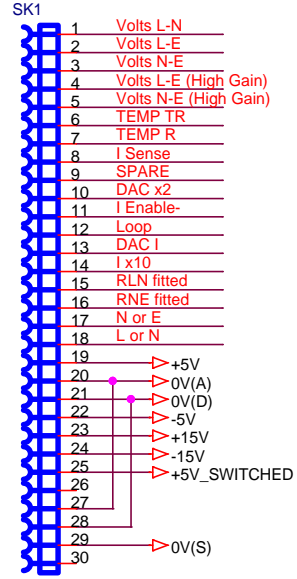
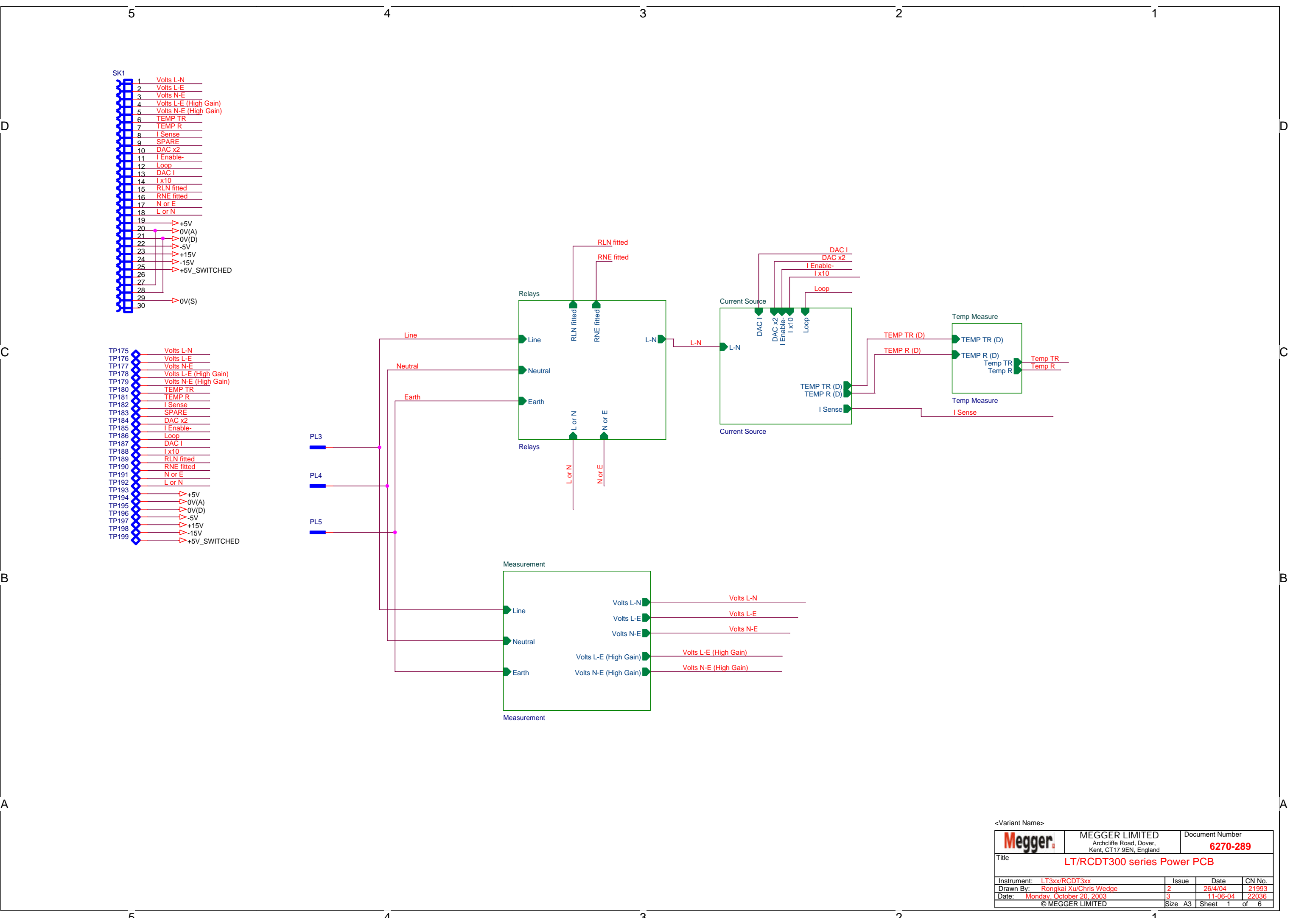




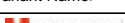
Not Fitted list

Surface Mount -	Conventional
D63	LK1, LK2, LK3, LK4, LK5, LK6, LK7, LK8
IC40	D32, D33, D34, D35, D36, D37, D38, D39, D40, D41
R1 & R2	D43, D45, D46, D47, D48, D50, D52, D71, D72
SW18 & SW19	PL24, PL25

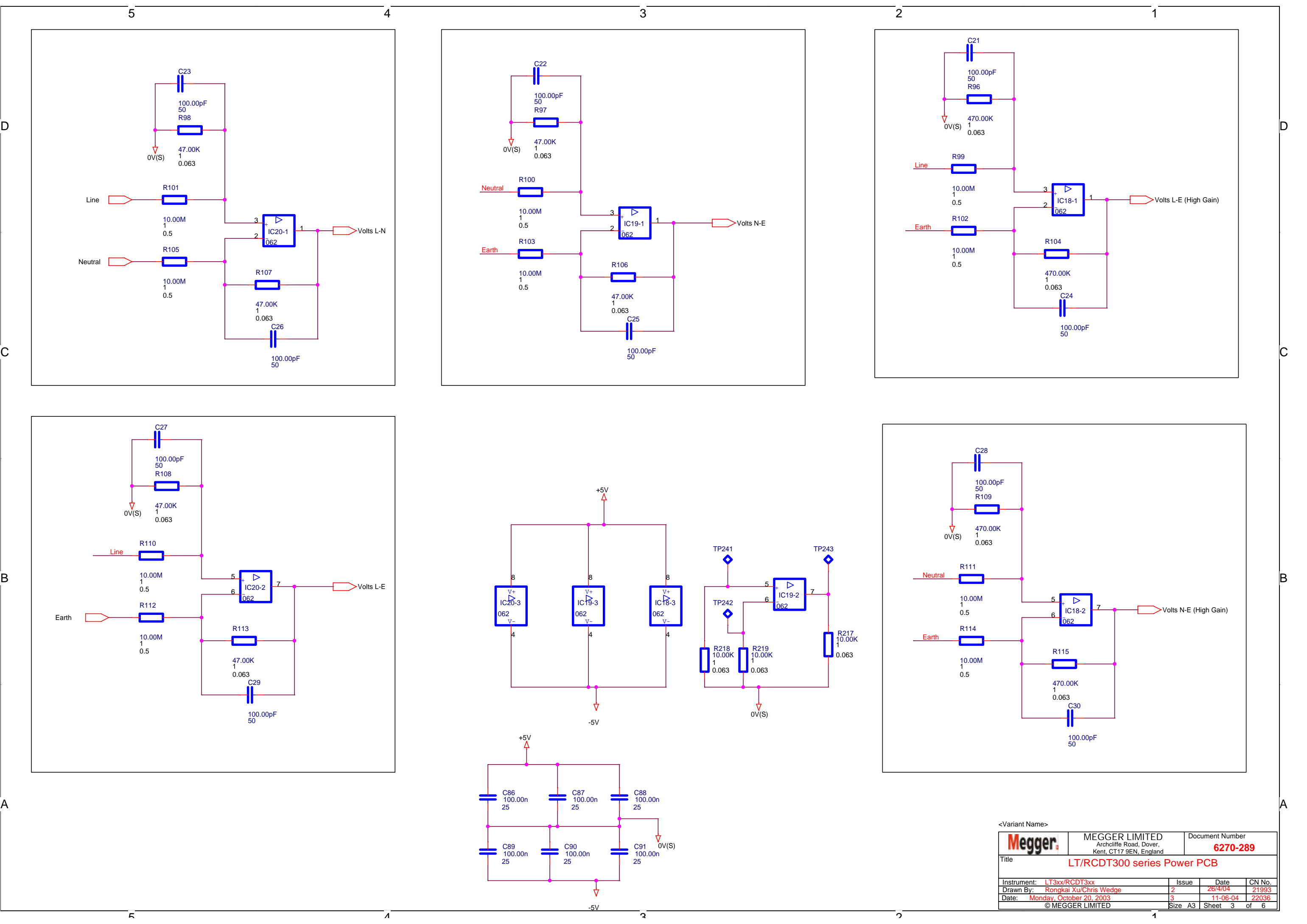
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Title <b>ZERO CROSSING Circuit</b>			
Instrument: <b>Loop Tester</b>	Issue: <b>4</b>	Date: <b>11-06-04</b>	CN No.: <b>22036</b>
Drawn By: <b>Rongkai Xu</b>	Issue: <b>3</b>	Date: <b>05-05-04</b>	CN No.: <b>22007</b>
Date: <b>Tuesday, October 21, 2003</b>	© MEGGER LIMITED		
Size <b>A3</b>		Sheet <b>10</b>	of <b>10</b>



<Variant Name>

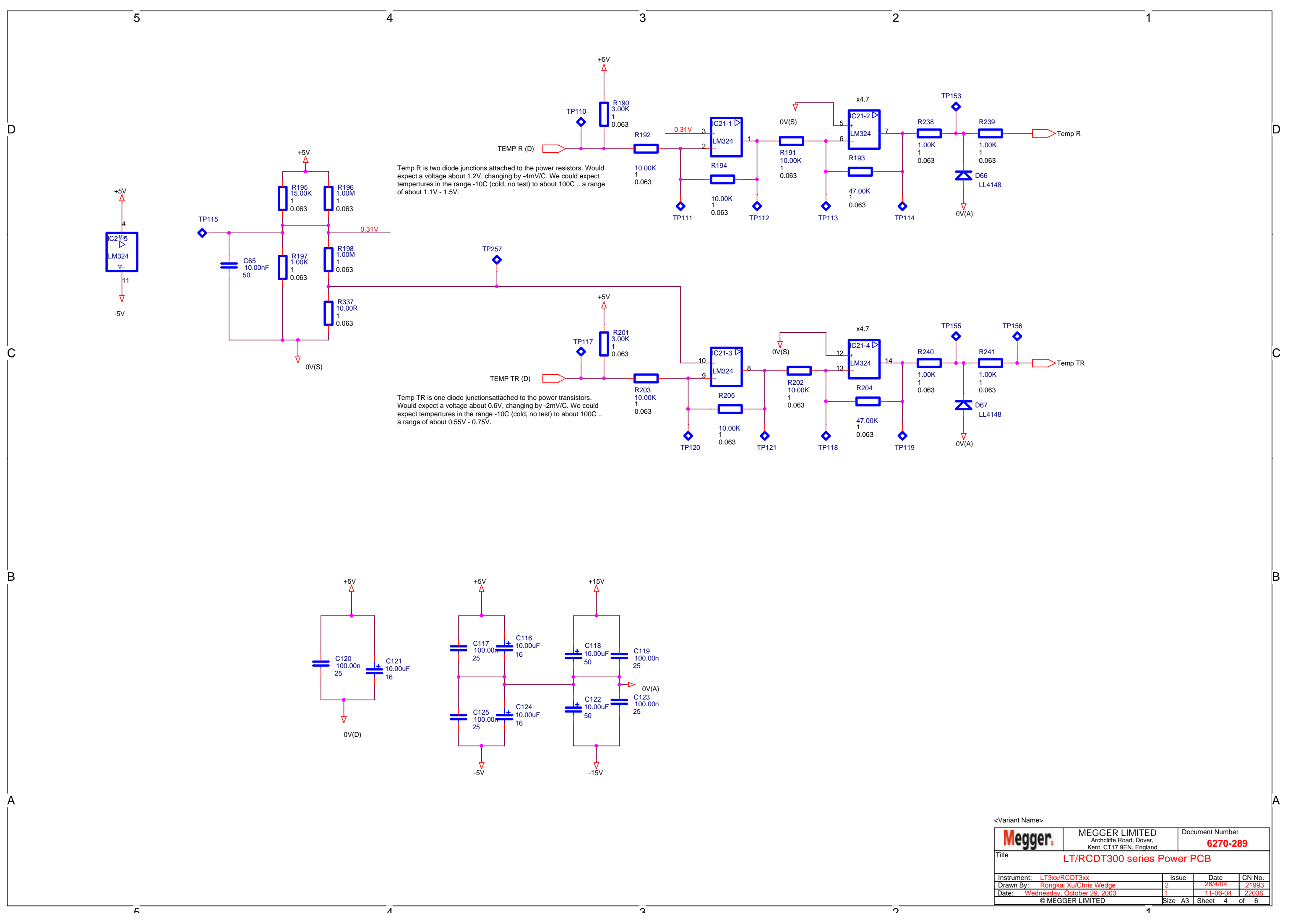
	MEGGER LIMITED Archcliffe Road, Dover, Kent, CT17 9EN, England	Document Number <b>6270-289</b>	
Title <b>LT/RCDT300 series Power PCB</b>			
Instrument: <b>LT3xx/RCDT3xx</b>	Issue	Date	CN No.
Drawn By: <b>Rongkai Xu/Chris Wedge</b>	2	26/4/04	21993
Date: <b>Monday, October 20, 2003</b>	3	11-06-04	22036
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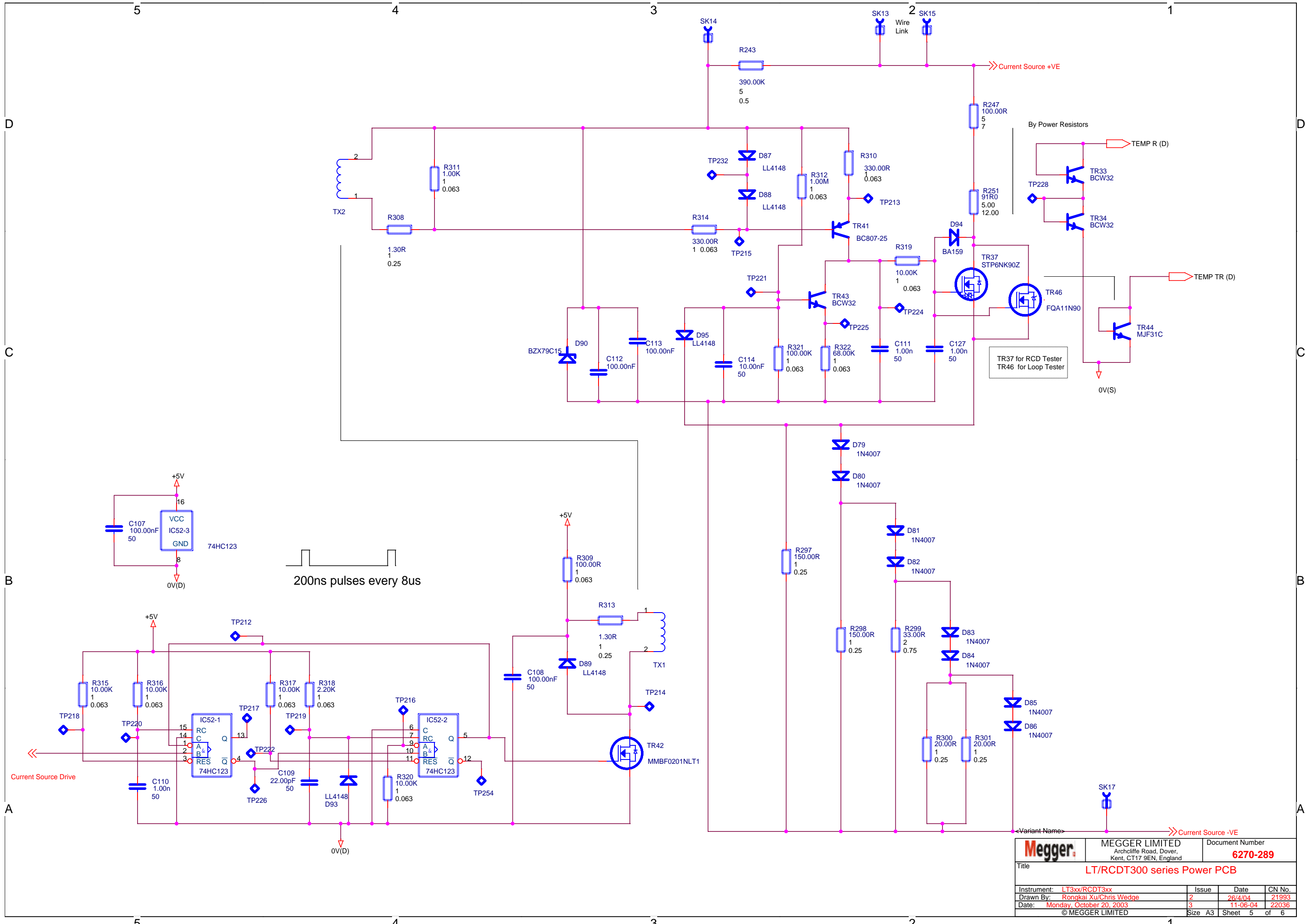



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Title <b>LT/RCDT300 series Power PCB</b>			
Instrument: <b>LT3xx/RCDT3xx</b>	Issue	Date	CN No.
Drawn By: <b>Rongkai Xu/Chris Wedge</b>	2	26/4/04	21993
Date: <b>Monday, October 20, 2003</b>	3	11-06-04	22036
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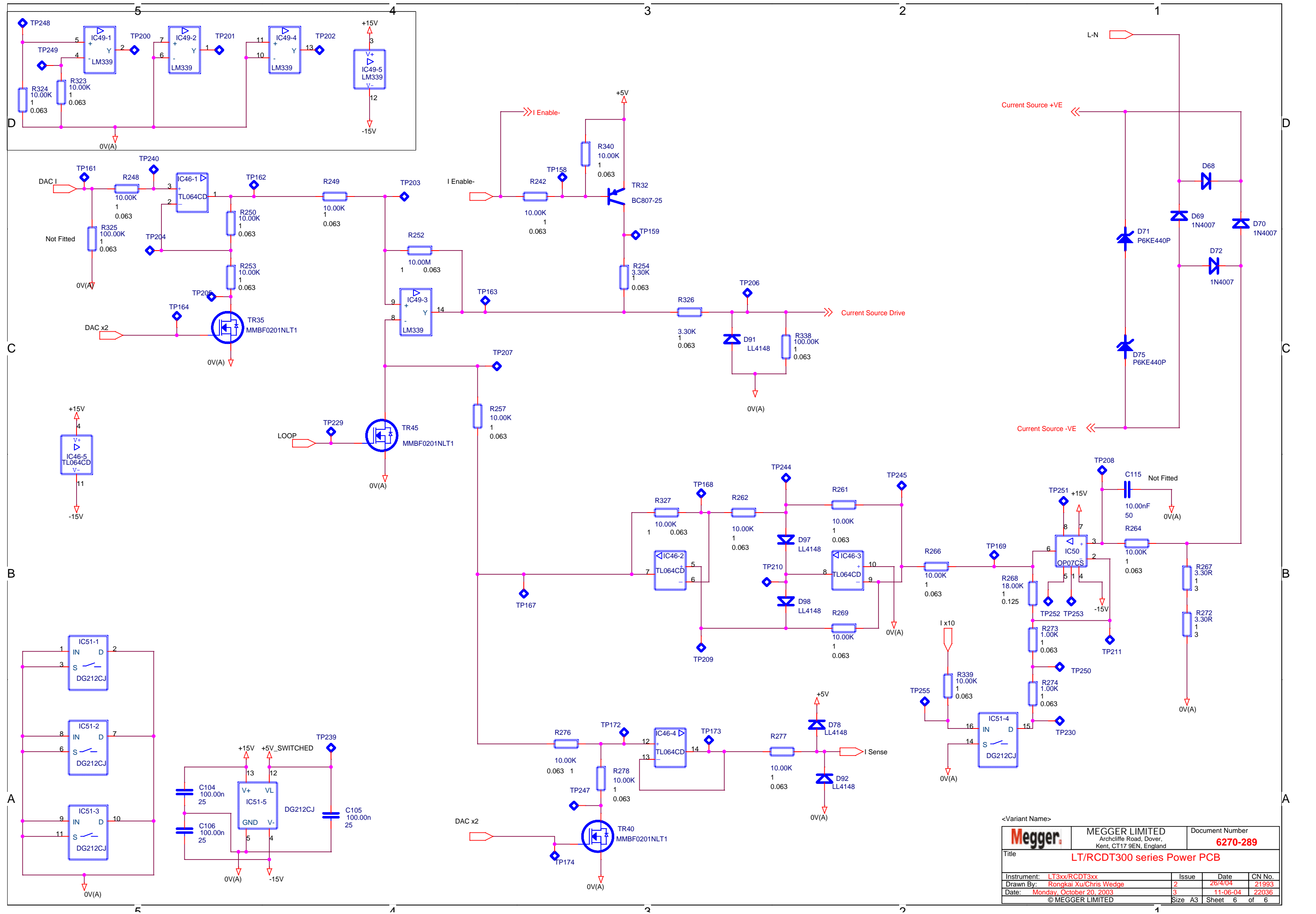





<Variant Name>			
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Title <b>LT/RCDT300 series Power PCB</b>			
Instrument: <b>LT3xx/RCDT3xx</b>	Issue	Date	CN No.
Drawn By: <b>Rongkai Xu/Chris Wedge</b>	2	26/4/04	21993
Date: <b>Wednesday, October 29, 2003</b>	1	11-06-04	22036
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		MEGGER LIMITED Archcliffe Road, Dover, Kent, CT17 9EN, England		Document Number <b>6270-289</b>	
Title <b>LT/RCDT300 series Power PCB</b>					
Instrument: <b>LT3xx/RCDT3xx</b>		Issue	Date	CN No.	
Drawn By: <b>Rongkai Xu/Chris Wedge</b>		2	26/4/04	21993	
Date: <b>Monday, October 20, 2003</b>		3	11-06-04	22036	
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<Variant Name>			
	MEGGER LIMITED Archcliffe Road, Dover, Kent, CT17 9EN, England	Document Number <b>6270-289</b>	
Title <b>LT/RCDT300 series Power PCB</b>			
Instrument:	LT3xx/RCDT3xx	Issue	Date
Drawn By:	Rongkai Xu/Chris Wedge	2	26/4/04
Date:	Monday, October 20, 2003	3	11-06-04
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## Bill of Materials

### Instrument Assembly – RCDT, LT, & LRCDS

Megger Part Number	Description		Qty
	LT310/320 PWR PCB ASSY (RE	PCB Assemblies <b>need to be exchanged as a pair.</b> Contact us with instrument serial number for further details	1
	LT320/RCDT320 DISPLAY PCB		1
6140-377	WACL LT/RCDT300 RANGE	Cut wires set	1
6231-723	CASE KIT B (2 SWITCHES) (1)	CASE KIT A (2 SWITCHES) to Drg. Iss. 3	1
5310-446	TERMINAL PANEL MIT/LT/RCDT	TERMINAL PANEL TO DRG. ISS.1	1
25965-099	SOCKET 4mm DIA.	SOCKET 4MM DIA. BRASS NICKEL PLATED	2
5310-357	INDEX SPIDER/SWITCH TOP**	INDEX SPIDER/SWITCH TOP DRG. ISSUE 2	2
5131-378	CONTACT DISC	Contact Disc to Drg. Iss. 1	3
5160-324	SPRING (ROTARY SWITCH)	SPRING (ROTARY SWITCH) DRG. ISSUE 1	3
5210-361	SWITCH BOTTOM **	SWITCH BOTTOM DRG. ISSUE 2	2
21264-227	SCREW PLASTITE No4 .5" PAN	NO.4 X 1/2" SELF-TAPPING SCREW	6
5210-461	KEYPAD LT320 (2)	Keypad to Drg. Iss.	1
21819-527	SCREW M4x8 PAN POZI ST.ZP&	SCREW M4 X 8MM, STEEL, ZINC	1
21277-018	SCREW PT 3x6mm PAN HD THRE	SCREW PT SIZE 3 PAN HD	2
21138-014	PIN DOWEL 2x5mm ST.STEEL D	STAINLESS STEEL DOWEL PIN 2x5mm DIN7 H8	4
17685-008	GREASE (PLASTICS) SPG3	GREASE FOR PLASTICS	0
17641-672	GREASE SILICONE MOLYKOTE 4	GREASE, SILICONE BASED	0
5140-930	FOAM STRIP 25x8x3	FOAM STRIP 25 x 8 x 3	2
21814-737	WASHER M4 LD-PE ANTI-LOSS	WASHER M4 ANTI-LOSS	1
6220-780	CARRY STRAP MIT/LT/RCDT30	CARRY STRAP TO DRG ISS. 1	1
25511-841	BATTERY 1.5V (AA) ALKALINE	BATTERY 1.5V (SIZE=AA) ALKALINE	8
6172-877	USER GUIDE CD MIT/LT/RCDT3	USER GUIDE CD MIT/LT/RCDT300 TO DRG ISS 4 SHEET 1	1
6172-059	WARRANTY CARD 3 YEAR MEG	WARRANTY CARD - 3 YEAR (EDITION 4)	1
18190-013	SLEEVING SILIC ID1.5,OD2.1	SILICONE RUBBER SLEEVING TO BS2848	1.2 m
5270-848	LABEL SET LT320 (3)		1
5152-273	PLUG CONTACT	PLUG CONTACT	3
5210-454	INTERLOCK MIT/LT/RCDT300 S	INTERLOCK TO DRG. ISS.1	1
6220-782	LEADSET RED/BLK/GRN 1.5M L	LEADSET RED/BLK/GRN 1.5M LT300 TO DRG. ISS. 2	1
6220-785	POUCH MIT300	CARRY BAG TO DRG. ISS. 2	1
6260-169	CARTON MIT/LT/RCDT300	CARTON MIT/LT/RCDT300 TO DRG. ISS 1	1
6260-170	BLISTER INSERT	BLISTER INSERT TO DRG. ISS. 1	1
5140-982	INSULATOR LT/RCDT300 SERIE		1
22420-084	SPACER-10LG SNAP FIT NYLON	SPACER, 10mm LONG, SNAP FIT, NYLON (PCB)	4
25274-417	CABLE TIE 100x2.5mm T18R	DESCRIPTION: CABLE TIE, NYLON	3
5174-171	SAFETY WARNING SHEET LT/RC	SAFETY WARNING SHEET LT/RCD300	1
5270-855	QUICKSTART LABEL LT300 (4)	QUICKSTART LABEL LT300 TO DRG ISS 4	1
13497-095	RIBBON CABLE 30-WAY 40LG F	RIBBON CABLE 30-WAY 40mm LONG 1mm PITCH	1
18760-013	ADHESIVE/SEALANT 744RTV 31	ADHESIVE/SEALANT 744RTV	0.25 ml
25132-017	CABLE SLEEVE NEOPR BLK 1.5	CABLE SLEEVE TO BS.3858, BLACK	3
21127-638	PIN COILED, 1/8"DIA X 9/16	DOWEL PIN 1/8" DIA X 9/16" LG TO ISO 8750	2

Note: LT310 only has 1 switch and uses Case Kit A (6231-722)

## Keypads and Labels

Instrument Type	Keypad	Instrument Label Set	Quick Start Label
LT310	5210-460	5270-847	5270-855
LT320	5210-461	5270-848	5270-855
LT330	5210-462	5270-849	5270-855
RCDT310	5210-463	5270-850	5270-856
RCDT320	5210-464	5270-851	5270-856
RCDT330	5210-465	5270-852	5270-856
LRCD200	5210-471	5270-873	5270-877
LRCD210	5210-471	5270-874	5270-877
LRCD220	5210-472	5270-875	5270-877

## Display PCB Assembly – LT, RCDT & LRCDs

Megger Part Number	Description		Qty
<b>6231-733</b>	<b>LT320/RCDT320 DISPLAY PCB</b>		
30000-023	IC MULTIPLEXER ANOLOG 40	INTEGRATED CCT. 4051 ANALOGUE MULTIPLEXER	2
30000-024	IC ANALOG SWITCH 3x2IN-PT	DESCRIPTION: IC 3x2 INPUT ANALOGUE SWITCH 4053	2
30000-050	IC FLIP FLOP DUAL 74HC7	DESCRIPTION: INTEGRATED CIRCUIT DUAL FLIP FLOPS	2
30000-052	IC OP-AMP J-FET 062	INTEGRATED CIRCUIT BASE NO.062 LOW POWER J-FET	1
30000-078	IC PHASE LOCK LOOP HEF4046	DESCRIPTION: IC PHASE LOCK LOOP	1
30000-087	IC OP-AMP AD622AR	IC INSTRUMENTATION OP-AMP	1
30000-102	IC EEPROM 8Kx8 24C64 SO8	IC 8Kx8 SERIAL EEPROM	1
6139-190	PROGRAMMED uP LT/RCD310/32		1
30000-180	IC SHIFT REG 8-BIT SIPO HC	IC SHIFT REGISTER 8-BIT 74HC164	1
30000-181	IC SHIFT REGISTR 8-BIT 74H	IC SHIFT REGISTER 8-BIT 74HC165	2
30200-036	IC OP-AMP QUAD LMV	IC OP-AMP QUAD RAIL-TO-RAIL LMV324	1
30200-037	IC PWM CONTROLLER TL5001	IC PWM CONTROLLER	1
30200-041	IC REGULATOR(SWICHING) LM3	IC SWITCHING REGULATOR LM3578	1
31000-001	TRANSISTOR NPN DRG 6180-39	TRANSISTOR	8
31000-002	DIODE SM LL4	DESCRIPTION: DIODE LL4148 75V 150mA	15
31000-004	TRANSISTOR PNP DRG 6180-39	TRANSISTOR	2
31000-005	IC COMPARITOR (TAPE) LM	DESCRIPTION: IC QUAD COMPARITOR	2
31000-021	DIODE SM SCHOT 1A MBRS130	1A SCHOTTKY POWER RECTIFIER DIODE	2
31100-007	*TRANSISTOR MOSFET N, MMBF	DESCRIPTION:	6
31100-010	TRANSISTOR MOSFET P, NDS35	TRANSISTOR MOSFET P-CHANNEL	3
31300-004	DIODE SM FAST DUAL BA	DESCRIPTION: HIGH SPEED DUAL SERIES DIODE	1
32000-001	CAP SMD CER 330pF 10% 12	SURFACE MOUNTED CERAMIC CAPACITOR □ □	1
32000-002	CAP SMD CER 470pF 10% 12	SURFACE MOUNTED CERAMIC CAPACITOR □ □	1
32000-013	CAP SMD TANT' 2.2uF 20% 1	CAPACITOR,TANTALUM,2.2UF,20%,	1
32000-017	CAP SMD CER- 220nF 10% 12	SURFACE MOUNTED CERAMIC CAPACITOR	1
32000-023	CAP SMD ELEC'- 10uF 16V 04	ALUMINIUM ELECTROLYTIC SMD (CHIP)	6
32000-025	CAP SMD CER- 10nF 10% 060	SURFACE MOUNTED CERAMIC MULTILAYER	11
32000-027	CAP SMD CER. 1nF 10% 060	SURFACE MOUNTED CERAMIC MULTILAYER CAPACITOR	5
32000-029	CAP SMD CER- 100nF -20+80%	SURFACE MOUNTED CERAMIC MULTILAYER	35
32000-031	CAP SMD CER 33pF 5% 060	SURFACE MOUNTED CERAMIC MULTILAYER	2



32000-037	CAP SMD ELEC"100uF 20% 08	ALUMINIUM ELECTROLYTIC SMD CAPACITOR LONG LIFE VERT	2
32000-041	CAP SMD CER- 22nF 10% 120	CAP SMD CER 22nF 10%	1
32000-043	CAP SMD CER 22pF 10% 060	CAP SMD CER 22pF 50Vdc 10%	1
32000-070	CAP SMD ELEC'- 10uF 50V 06	CAPACITOR SMD ELECTROLYTIC 10uF 50V	4
33000-020	RES SM- 7K5 MF 2% 1/8W 12	RESISTOR 7K5, 2%, 0.125W,	1
33000-027	RES SM; 10R MF 1% 0.063W	CHIP RESISTOR 10R 1% 0.063W	6
33000-028	RES SM; 33R MF 1% 0.063W	CHIP RESISTOR 33R 1% 0.063W	2
33000-031	RES SM- 1K MF 1% 0.063W	CHIP RESISTOR 1K 1% 0.063W	26
33000-037	RES SM- 10K MF 1% 0.063W	CHIP RESISTOR 10K 1% 0.063W	56
33000-038	RES SM- 22K MF 1% 0.063W	CHIP RESISTOR 22K 1% 0.063W	2
33000-039	RES SM- 33K MF 1% 0.063W	CHIP RESISTOR 33K 1% 0.063W 50V TC 100PPM	1
33000-040	RES SM- 47K MF 1% 0.063W	CHIP RESISTOR 47K 1% 0.063W	2
33000-041	RES SM- 68K MF 1% 0.063W	CHIP RESISTOR 68K 1% 0.063W	1
33000-042	RES SM-100K MF 1% 0.063W	CHIP RESISTOR 100K 1% 0.063W 50V	18
33000-044	RES SM' 1M MF 1% 0.063W	CHIP RESISTOR 1M 1% 0.063W 50V	11
33000-051	RES SM' 10M MF 1% 1/4W 12	RES SM 10M 1% 0.25W	1
33000-052	RES SM;220R MF 1% 1/8W 12	RES SM 220R 1% 0.125W	2
33000-068	RES SM;300R MF 1% 0.063W	RESISTOR SM 300R MF 1% 0.063W 50Vdc	4
33000-069	RES SM- 3K MF 1% 0.063W	RESISTOR SM 3K MF 1% 0.063W 50Vdc	3
33000-070	RES SM- 30K MF 1% 0.063W	RESISTOR SM 30K MF 1% 0.063W 50Vdc	12
33000-101	RES SM; 1R TF 1% 0.063W	RES SM 1R TF 1% 0.063W	1
33000-033	RES SM- 2K2 MF 1% 0.063W	CHIP RESISTOR 2K2 1% 0.063W 50V DC	1
34000-008	POT SMD 100K 25% 0.15W 4mm	POTENTIOMETER 100K-25%-0.15W 50V	1
35000-015	CRYSTAL, 6MHz HC49/4H	CRYSTAL 6MHz HC49	1
35400-002	FUSE, 3A (T)SMD. NANO. R45	SURFACE MOUNT FUSE NANO SMF 3AMP TIME DELAY	1
35965-009	SOCKET SM 30-WAY 1mm FFC (	SOCKET SM 30-WAY 1mm FFC (BOTTOM CONTACT)	1
5173-579	PCB BAR CODE LABEL		1
25995-013	LABEL(CUSTOM) 6,35X24mm	CUSTOM LABEL 6,35X24 MM. 3 LABELS PER ROW	1
5240-442	DISPLAY PCB LT/RCDDT300 SER	Display PCB to Drg. iss.1 A/W Ed.3	1
31000-039	IC XOR GATE SINGLE I/P 74A	IC XOR GATE SINGLE INPUT	3
32000-035	CAP SMD FILM, 1.0uF 5%	DESCRIPTION: SURFACE MOUNTED POLYESTER CAPACITOR	2
33000-035	RES SM- 4K7 MF 1% 0.063W	CHIP RESISTOR 4K7 1% 0.063W	4
33000-114	RES SM' 10M MF 1% 0.063W	RESISTOR SM 10M MF 1% 0.063W 50V 100PPM	1
30000-084	IC OP-AMP DUAL TLE2022CD	DUAL OP-AMP SMD	1
31400-008	ZENER SM 0.35W 5% 5.6V BZX	ZENER SM 0.35W 5% 5.6V BZX84	1
31500-003	TRANSISTOR PNP BC807-25	DESCRIPTION: TRANSISTOR SM BC807-25	1
33000-064	RES SM; 0R0 TF 1% 0W 1206	DESCRIPTION: RES SM 0R0 1% 0W 1206 JUMPER LINK	1
25960-045	HEADER 36-WAY	HEADER, 36-WAY,	0.2
25975-107	SWITCH PUSH SPNO PCB (NO P	SWITCH PUSH BUTTON TACTILE PCB MOUNT 12x12mm	1
27900-061	INDUCTOR-220uH 0.24A AXIAL	INDUCTOR 220uH 0.24A 10% Q=110 @ 500kHz	1
27920-011	BUZZER 1.5V 16ohm T	ELECTRO-MAGNETIC TRANSDUCER,	1
28920-098	LED RED HI-BRIGHT 600MCD 3	LED HIGH BRIGHT RED 600MCD 3mm	3
6280-350	LCD MIT300 SERIES	LCD MIT300 SERIES TO DRG. ISS. 1	1
6180-433	BACKLIGHT MFT1502	Backlight to Drawing Iss. 1	1
27900-059	INDUCTOR-220uH 0.6A 10% EL	INDUCTOR 220uH 0.6A 10% 0.29ohms	1
25925-004	WIRE LINK BARE 0.6mm DIA.	WIRE LINK 0.6mm DIA. CU. TINNED BANDOLIERED	1

#### Variations

LT310, RCDDT310, LRCD200 & LRCD210 have no backlight fitted.

LT330, RCDDT330 have programmed uP no. 6139-194

### Power PCB Assembly – LT, RCDT & LRCDS

<b>6231-735</b>	<b>LT310/320 PWR PCB ASSY (RE</b>		<b>1</b>
5240-443	POWER PCB LT/RCDT300 SERIE	POWER PCB TO DRG. ISS. 2 A/W Ed. A4	1
30000-015	IC DUAL MONO 74HC123 (NOT	DESCRIPTION: IC DUAL MONOSTABLE	1
30000-052	IC OP-AMP J-FET 062	INTEGRATED CIRCUIT BASE NO.062 LOW POWER J-FET	3
30000-055	IC OP-AMP PRECISION OP07CS	INTEGRATED CIRCUIT, PRECISION OP-AMP, BASE NO. 07	1
30100-017	IC ANALOG SWITCH SPSW DG21	DESCRIPTION: IC ANALOG SWITCH SPSW DG212BD	1
31000-001	TRANSISTOR NPN DRG 6180-39	TRANSISTOR	5
31000-002	DIODE SM LL4	DESCRIPTION: DIODE LL4148 75V 150mA	15
31000-003	IC OP-AMP QUAD (TAPE) LM	INTEGRATED CIRCUIT,QUAD OP-AMP	1
31000-005	IC COMPARITOR (TAPE) LM	DESCRIPTION: IC QUAD COMPARITOR	1
31000-018	IC OP-AMP JFET QUAD TL064	IC QUAD OP-AMP JFET TL064	1
31100-007	*TRANSISTOR MOSFET N, MMBF	DESCRIPTION:	4
31500-003	TRANSISTOR PNP BC807-25	DESCRIPTION: TRANSISTOR SM BC807-25	2
32000-004	CAP SMD CER- 100nF 10% 12	SURFACE MOUNTED CERAMIC CAPACITOR □ □	4
32000-023	CAP SMD ELEC'- 10uF 16V 04	ALUMINIUM ELECTROLYTIC SMD (CHIP)	3
32000-025	CAP SMD CER- 10nF 10% 060	SURFACE MOUNTED CERAMIC MULTILAYER	3
32000-027	CAP SMD CER. 1nF 10% 060	SURFACE MOUNTED CERAMIC MULTILAYER CAPACITOR	4
32000-029	CAP SMD CER- 100nF -20+80%	SURFACE MOUNTED CERAMIC MULTILAYER	14
32000-030	CAP SMD CER 100pF 5% 060	SURFACE MOUNTED CERAMIC MULTILAYER	10
32000-043	CAP SMD CER 22pF 10% 060	DESCRIPTION: CAP SMD CER 22pF 50Vdc 10%	1
32000-070	CAP SMD ELEC'- 10uF 50V 06	CAPACITOR SMD ELECTROLYTIC 10uF 50V	2
33000-027	RES SM; 10R MF 1% 0.063W	CHIP RESISTOR 10R 1% 0.063W	1
33000-029	RES SM;100R MF 1% 0.063W	CHIP RESISTOR 100R 1% 0.063W	1
33000-030	RES SM;330R MF 1% 0.063W	CHIP RESISTOR 330R 1% 0.063W	2
33000-031	RES SM- 1K MF 1% 0.063W	CHIP RESISTOR 1K 1% 0.063W	8
33000-033	RES SM- 2K2 MF 1% 0.063W	CHIP RESISTOR 2K2 1% 0.063W 50V DC	1
33000-034	RES SM- 3K3 MF 1% 0.063W	CHIP RESISTOR 3K3 1% 0.063W 50V DC	2
33000-037	RES SM- 10K MF 1% 0.063W	CHIP RESISTOR 10K 1% 0.063W	33
33000-040	RES SM- 47K MF 1% 0.063W	CHIP RESISTOR 47K 1% 0.063W	8
33000-041	RES SM- 68K MF 1% 0.063W	CHIP RESISTOR 68K 1% 0.063W	1
33000-042	RES SM-100K MF 1% 0.063W	CHIP RESISTOR 100K 1% 0.063W 50V	2
33000-044	RES SM' 1M MF 1% 0.063W	CHIP RESISTOR 1M 1% 0.063W 50V	5
33000-060	RES SM- 18K MF 1% 1/8W 12	DESCRIPTION: RES SM 18K 1% 0.125W 1206	1
33000-069	RES SM- 3K MF 1% 0.063W	DESCRIPTION: RESISTOR SM 3K MF 1% 0.063W 50Vdc	4
33000-100	RES SM-470K MF 1% 0.063W	RESISTOR 470K MF 1% 0.063W	4
33000-112	RES SM- 15K TF 1% 0.063 0	RESISTOR SM 15K TF 1% 0.063W RC22H	1
33000-114	RES SM' 10M MF 1% 0.063W	RESISTOR SM 10M MF 1% 0.063W 50V 100PPM	1
35965-010	SOCKET SM 30-WAY 1mm FFC (	SOCKET SM 30-WAY 1mm FFC (TOP CONTACT)	1
5173-579	PCB BAR CODE LABEL		1
25995-013	LABEL(CUSTOM) 6,35X24mm	CUSTOM LABEL 6,35X24 MM. 3 LABELS PER ROW	1
25413-306	FUSE, 2A(F)HBC 600V 50KA 3	FUSE, 2 AMP,(F) HBC. CERAMIC □ □	2
25955-028	FUSE CLIP 1 1/4" LOW PROFI	1 1/4" LOW PROFILE PCB MOUNT FUSE CLIP	4
25960-118	HEADER 1-WAY (CLIP-IN)	DESCRIPTION: HEADER, 1-WAY (CLIP-IN)	3
25980-056	RELAY SP C/O 250 VAC 8A 5V	RELAY SINGLE POLE C/O 250 VAC 8A 5V COIL	1
26836-077	RES; 33R MF 2% 0.75W	RESISTOR, METAL FILM.	1
26836-706	RES;100R WW 5% 12W		1
26837-116	RES;100R FUSIBLE 5% 7W	RESISTOR 100.00R TOL 5% 7.0 WATT WIRE WOUND	1
26837-130	RES' 10M0 MG 1% 0.5W	RESISTOR 10M 1% 0.5W 2500V METAL GLAZE	10
26837-134	RES-390K MG 5% 0.5W	RESISTOR 390K 5% 0.5W 400V	1
26837-175	RES; 3R3 WW 1% 3W P	RESISTOR WIREWOUND PRECISION	2
26900-008	RES; 20R0 MF 1% 0.25W	RESISTOR 20R 1% 0.25W	2
26900-029	RES;150R0 MF 1% 0.25W	RES MF 150R 1% .25W MFR4	2
26900-188	RES; 1R3 MF 1% 0.25W	RESISTOR, METAL FILM,	2

27920-039	ZENER TVS.600W 440V UniDir	TRANSIENT SUPPRESSOR 600W/MS VBR-440V CB417	2
28863-078	ZENER 0.4W 5%'15V DO35 BZX	ZENER DIODE 15V 0.4W	1
28863-082	DIODE,1N4007 1A-1000V		12
28863-160	DIODE,1A 1000V BA159	DIODE ,	1
29650-006	TRANSISTOR NPN MJF31C	TRANSISTOR NPN N-CHANNEL MJF31C	1
25925-004	WIRE LINK BARE 0.6mm DIA.	WIRE LINK 0.6mm DIA. CU. TINNED BANDOLIERED	1
13489-326	WIRE 1/0.6 PTFE WHITE TYP	1/0.6MM H.C.COPPER WIRE,	0.08
21189-015	STUD M3x12LG SELF CLINCHIN	STUD M3x12LG SELF CLINCHING	2
21813-304	WASHER M3 CRINKLE BER.Cu	M3 CRINKLE WASHER TO BS.4463,	2
21810-601	NUT M3 FULL STEEL N.P	M3 FULL NUT, HEXAGONAL, TO	2
18760-013	ADHESIVE/SEALANT 744RTV 31	ADHESIVE/SEALANT 744RTV	0.5
5131-418	HEATSINK 2mm LT300	HEATSINK TO DRG. ISS. 1	1
29550-009	TRANSISTOR MOSFET N, FQA11	TRANSISTOR MOSFET N-CHANNEL	1

Variations:

Relays:

If no relays are fitted, only one fuse (FS2) needs to be fitted

Transistor TR46 29550-009 is fitted to LTs and LRCDs

Transistor TR37 29550-008 is fitted to RCDTs

Resistor 91Ω 26836-214 fitted to RCDTs

Resistor 100Ω 26836-706 fitted to LTs and LRCDs

## Appendix 1 - Display Messages

A2d – diagnostic test ad converter  
AC – ac rcd test selected  
AC.S – ac selective rcd test selected  
ALL – with dEL, delete all  
bAT – diagnostic test battery  
bXY – (distribution) board number XY  
CAL – calibrate mode selected  
CAL – diagnostic test, read calibration constants  
CAL – calibration was successful  
cAL – calibration flag status, instrument is calibrated  
CEN – diagnostic test keys, centre button pressed  
CH.O – checksum flag status, checksum OK  
CH.F – checksum flag status, checksum failed  
CH.F – checksum failed warning at start-up  
chk - check connections, no current detected, test could not be performed  
chk (+ warning triangle) -  
chX – diagnostic test ad converter, channel number (0 – 7)  
CON – diagnostic test, contrast on display  
CUS – customer mode selected  
cXY – circuit number XY  
dC – dc rcd test selected  
dc.S – dc selective rcd test selected  
dEb – debug mode selected  
dEC – decalibration was successful  
dEC – decalibrate mode selected  
dEC – decalibration warning  
dEL – delete  
diA – diagnostics mode selected  
EAS – diagnostic test keys, east (right) key pressed  
ESC – escape fomr storage screen  
EEP – diagnostic test eeprom, transmit contents  
EXY – error number XY (2 digit error number)  
eXY – error number (XY + 100) \*\*\*  
Hot – FET too hot for test to proceed  
hot – resistors too hot for test to proceed  
INV – invalid result which cannot be stored  
kEy – diagnostic test, keys  
LEF – diagnostic test keys, left-hand key pressed  
LIN – diagnostic test. Links  
L-L – line-line connection  
L-N – line-neutral connection  
L+L – LN swap setting, LN swap tests allowed  
L+N – LN swap setting, LN swap tests not allowed

NEU – neutral fault  
NOC – no calibration (calibration failed)  
NOR – diagnostic test keys, north (up) key pressed  
NOS – no shutdown mode selected  
noS – noise on supply  
nXY – wire number  
N-E – neutral-earth connection  
oFF – diagnostic test, switch-off  
OFF – switch off imminent  
OK – ok, acknowledge of result stored or deleted  
Pot – diagnostic test, balance pot set-up  
PX – phase number  
PXY – diagnostic test ad converter, port number  
REF – reference value not set before doing 'R1+R2' loop test  
RIg – diagnostic test keys, right-hand key pressed  
RS.P – diagnostic test, rotary switch, primary  
RS.S – diagnostic test, rotary switch, secondary  
Snd – send  
SEt – set-up menu  
SOU – diagnostic test keys, south (down) key pressed  
SPA – diagnostic test keys, spare key pressed  
tES – test mode selected  
tFE – diagnostic test, temperature of fet  
trE – diagnostic test, temperature of resistors  
trP – supply tripped unexpectedly  
t X – auto rcd test phase  
uNC - calibration flag status, instrument is uncalibrated  
UNC – uncalibrated warning at start-up  
USb – usb mode selected  
VES – diagnostic test keys, west (left) key pressed  
VX.Y – firmware version number at start-up  
>25V – contact voltage limit exceeded  
>50V – contact voltage limit exceeded  
<xyzV – insufficient supply voltage for test to begin  
->xyz – job number xyz

## Appendix 2 - Manual Test Procedure

### Loop Testers (and Loop Test functions on Loop/RCD testers).

In the Dover factory, instruments are calibrated and tested automatically using a PC. Manual calibration is not possible, contact [ukrepairs@megger.com](mailto:ukrepairs@megger.com) for details of the options available.

This is a Manual test procedure for the LT310, LT320 and LT330 instruments, and for the loop test functions on LRCDs. Note that some instruments allow for Neutral and Line to be swapped, and the tests need to be repeated in this configuration.

Switch instrument on, battery voltage = 12V, measure battery drain < 50mA after 5s.

Switch instrument to V, connect voltages as indicated and read display

L-N, L-PE = 230V 50Hz	230 +/- 6V
L-N, L-PE = 440V 50Hz	440 +/- 10V
L-N, N-E = 240V 50Hz	240 +/- 6V

Switch to the indicated range. Switch the 2<sup>nd</sup> function switch to the 'Z' position, if present. Connect to loop resistance close to suggested value and press the test button.

Hi Current Loop Test	953	+/- 50 digits
	165	+/- 14 digits
	90	+/- 5 digits
	20	+/- 1.5 ohms
	10	+/- 1 ohm
	1	+/- 8 digits
	0	+/- 3 digits

No Trip Loop Test	953	+/- 50 digits
	165	+/- 14 digits
	90	+/- 5 digits
	20	+/- 1.5 ohms
	10	+/- 1 ohm
	1	+/- 8 digits
	0	+/- 3 digits

## Checking No Trip Loop Test Current.

The No-trip loop current is intermittent and cannot be measured directly with a multimeter. However, the magnitude of the current is the same as that used during a 30mA  $\frac{1}{2}$  I rcd test.

On an LT310, this check cannot be performed.

On an LRCD210 or LRCD220 select '1/2 I' and '30mA' directly on the rotary switches.

On an LRCD200 or LT320, proceed as follows:

- 1). Switch the instrument 'on', while simultaneously holding down the 'TEST' button, the upper left-hand button and the upper right-hand button.
- 2). The instrument should display 'CUS'. Release the buttons.
- 3). Press the 'TEST' button. The instrument should display a 3-digit code, e.g. 'L2R'
- 4). Press the upper left-hand button until the code is 'R1R'
- 5). Turn the main rotary switch to accept the new code. Do not switch OFF.
- 6a). On an LRCD200, select 'I' and '30mA'.
- 6b). On an LT320, select 'No Trip' and 'Z'.

Now perform the measurement:

- 1). Connect an a.c. current meter to measure the current flowing in the circuit Line to PE.

- 2). Connect the instrument to a mains supply.  
The current meter should read about 0.5-0.75mA.

- 3). Press the test button.

The instrument will now do a 15mA test of 2 seconds duration.

The reading on the current meter will vary until it stabilizes at about 14mA. This should be less than 15mA. **Do not use peak hold.**

Switch instrument OFF to restore to normal operation.



## Final Checks

1. Fit blank grey label to hole in battery compartment.
2. Insert batteries and secure battery compartment
3. Open case by folding lid to the back and clicking it into position.
4. Visually check external appearance. Check the gap between the two halves of the case.
5. Turn on to V. Observe the version number (e.g. V1.0), and the three L-PE, L-N and N-PE LEDs light briefly.
6. Instrument should say --- V, arc should be display with pointer at 0, and battery indicator should show full.
7. Press backlight button (if applicable) and check backlight works.
8. Press PFC, <0°/180°> <Lock> and <TEST> buttons (if applicable) and check and beep.
9. Rotate main switch through ranges and check for end stops and correct display – i.e.

V	arc and ---V
Hz	--- Hz
No Trip	---V and closed switch
Hi (if present)	---V and open switch

10. Check end stops work on 2<sup>nd</sup> function switch (if fitted).
11. Switch to OFF and watch display go out.

### RCD Testers (and RCD Test functions on Loop/RCD testers).

In the Dover factory, instruments are calibrated and tested automatically using a PC. Manual calibration is not possible, contact [ukrepairs@megger.com](mailto:ukrepairs@megger.com) for details of the options available.

This is a Manual test procedure for the RCDT310, RCDT320, RCDT330, LRCD200, LRCD210 & LRCD220 instruments. Note that some instruments allow for Neutral and Line to be swapped, and the tests need to be repeated in this configuration.

Switch instrument on, battery voltage = 12V, measure battery drain < 50mA after 5s.

Switch instrument to V, connect voltages as indicated and read display

L-N, L-PE = 230V 50Hz	230 +/- 6V
L-N, L-PE = 440V 50Hz	440 +/- 10V
L-N, N-E = 240V 50Hz	240 +/- 6V

### Test Currents

The no-trip (1/2I) current can be measured (not LRCD200) as follows:

- 1) Connect a.c. current meter to measure the current following in the circuit Line to PE.
- 2) Select the RCD Rating and 1/2I RCD Test.
- 3) Meter should read about 0.5-0.75mA. Press the test button and the reading on the current meter will vary until it stabilizes to a reading. **Do not use peak hold.**

The 'trip' (I) current can be measured as follows

- 1) Connect a.c. current meter to measure the current following in the circuit Line to PE.
- 2) Select the RCD Rating and I RCD Test.
- 3) Press the 'type' button and the display should brief display 'AC.S'. Since the instrument is now set to selective, the test current will flow for two seconds.
- 4) The meter should read about 0.5-0.75mA. Press the 'TEST' button once to start the test, and then again when the count begins. The reading on the current meter will vary until it stabilizes to a reading. **Do not use peak hold.**

RCD Rating	1/2I (mA)	I (mA)
10mA	4.6-4.9	10.2-10.8
30mA	13.8-14.7	30.6-32.4
100mA	46-49	102-108
300mA	138-147	306-324
500mA	230-245	510-540
1000mA	460-490	1020-1080

It is not possible to measure the 5I test currents or the ramp test currents, but this is all generated from the same circuit as used for the 1/2I and I test currents. Similarly dc-sensitive test current cannot be measured.

The contact voltage can also be checked. This is a measurement of the loop resistance, but displayed as a voltage. It is the voltage that would be expected to be dropped across the loop resistance if the rated current of the RCD was flowing in the circuit.

Therefore

$$V = I_{dn} * R_{loop}$$

In most installations this needs to be less than 50V; in agricultural installations 25V.

In some cases the display of this voltage will need to be turned on. This can be done by:

- 1). With the instrument switched OFF, hold down the 'TEST' button and turn the range knob to any ON position.
- 2). Keep the button held down until the instrument displays the 'SET' warning.
- 3). Now release the 'TEST' button.
- 4). Press the 'TEST' button twice to view the current settings for the touch voltage. The display shows the fault voltage limit, '25 V' or '50 V'.  
If the fault-voltage display is active, a bar-graph display will also appear.
- 5). Press the 'TYPE' button to turn bar-graph display ON or OFF. Switch ON.
- 6). Press the 'TEST' button to exit from the set-up menu.

The normal test is with a loop resistance of 900Ω on the 30mA rated current setting. This will give a calculated contact voltage of 27V, or a display of 28 to 31V. (+5% to +15%).

### **Appendix 3 – LT3X0/RCDT3X0/LRCD2X0 Error Numbers**

03	No acknowledgement from eeprom
.	
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.	
16	Unstable data from keys or configuration links
17	Unstable data from rotary switches
18	Invalid data from range switch
19	Invalid data from secondary switch
20	Unstable data from battery measurement
.	
.	
.	
39	Resistor temperature is out of range
40	Fet temperature is out of range
.	
42	Input frequency is too high
43	Battery voltage is too high
44	Battery voltage is too low
.	
.	
.	
53	Shutdown failed, power has not turned off
.	
.	
.	
58	Instrument. type incompatible with hardware configuration
.	
.	
.	
75	Eeprom error during result storage.

## Appendix 4 - Diagnostic Tests

There are several ways to access diagnostics - choose the most convenient method.  
In each case, the display shows the message 'diA'.

It is usually possible (but not always) to exit diagnostics by turning the turn the range switch to OFF.

### Method 1. (disassembled instrument)

Fit link LK3

When viewing the display board from the display side, locate the position of the middle switch in the row of three. LK3 is the closest link at the upper left. The orientation is north-south.

### Method 2. (disassembled instrument)

Move the range switch to the diagnostics position  
This is located beyond the normal operating positions.  
The exact location depends on instrument type.

### Method 3. (assembled or disassembled instrument)

Send the serial command 'W'

### Method 4. (fully assembled instrument)

Use the 'secret' menus.

With the instrument switched OFF, hold down the TEST button, the top left-hand button and the top right-hand button, then turn the range knob to any ON position. Keep the buttons held down until the instrument displays the current operating mode, normally 'CUS' (customer mode). Now release the buttons.  
Press the 'LOCK/DEGREE' button until the display shows 'NOS'.  
Hold down the top right-hand key and then press the left-hand key.  
The display shows 'diA'  
Press the TEST button to begin the first diagnostic test.

## Diagnostic test sequence

### Test 1 - Display

All display segments, backlight, led 'neons', and all power supplies are turned 'on'.

Hold down any button except the TEST button to sound the buzzer.  
Press the TEST button to step to the next test.

### Test 2 – Keys

Message - 'KEY'.

The neons and +/-15V supplies are turned off.

Hold down any key.

The display shows a code according to which button is pressed

Top row left – LEF

Top row centre – CEN

Top row right – RIG

North – NOR

South – SOU

East – EAS

West – VES

Test – TES

Press the TEST button and one other to step to the next test.

### Test 3 – Battery voltage

Message - 'bAt'.

The battery voltage and battery symbol are displayed

The data is also transmitted via the serial interface

Press the TEST button to step to the next test.

### Test 4 – FET temperature sensor

Message - 'tFE'

The temperature reading in Celsius is displayed, along with the '0°' symbol.

The data is also transmitted via the serial interface

Press the TEST button to step to the next test.

Note: There is a shortcut to this procedure from the 'diA' screen. Hold down the top right-hand button and press the centre button.

### Test 5 – Power resistors temperature sensor

Message - 'trE'

The temperature reading in Celsius is displayed, along with the '0°' symbol.

The data is also transmitted via the serial interface

Press the TEST button to step to the next test.

### Test 6 – A/d converter

Message - 'A2d'

Display shows 'P0', then 'ch0' to identify Port 0 channel 0, then shows the actual a/d reading. This is the average of 100 readings with sample and hold 'on'. The converter is used in 10-bit mode, so the range of the reading is 0 – 1023.

Press the 'LOCK/DEGREE' key to step sequentially through all the ad channels. After channel 7 the test moves on through the Port 2 channels and then through Port 10 channels.

Since port 2 and half of port 0 are used for the display, the display driving is suspended for a short time while these channels are sampled. They should return values near zero.

Press the TEST button at any point to step to the next test.

### Test 7 – Primary rotary switch (Range switch)

Message - 'RS.P'

Shows the numbers of the 'a' and 'b'appings as read from the range switch.  
Led neons are turned off.

The display shows tapping 'b' number on the left, and tapping 'a' number on the right, with 'P+' in the centre to identify the Primary switch. Note that the instrument cannot be switched off during this test.

Press the TEST button to step to the next test.

### Test 8 – Secondary rotary switch (Second switch)

Message - 'RS.S'

Shows the numbers of the 'a' and 'b'appings as read from the second switch.  
Led neons are turned on as an indicator to the second switch.

The display shows tapping 'b' number on the left, and tapping 'a' number on the right, with 'S+' in the centre to identify the Secondary switch.

Press the TEST button to step to the next test.

### Test 9 – Mode links

Message - 'LIN'

Shows the status of mode links LK1 to LK8

The display shows the data as 'LXY' where 'XY' is a hexadecimal byte in which 'Y' represents LK1 – LK4, and 'X' represents LK5 – LK8.

Press the TEST button to step to the next test.



### Test 10 – Display Contrast

Message - 'CON'

Show/modify the display contrast.

The display shows a number accompanied by the '0°' symbol, to indicate the contrast as a percentage of the maximum. This is also represented on the bargraph display. The default setting is 44%.

PFC/TYPE button - increase contrast  
NORTH/UP button – increase contrast

LOCK/DEGREE button - reduce contrast  
SOUTH/DOWN button - reduce contrast

WEST/LEFT button - set to minimum contrast  
EAST/RIGHT button - set to maximum contrast

SPARE button - reset contrast to default 44%

Press the TEST button to step to the next test.

### Test 11 – Calibration constants

Message - 'CAL'

Transmits all the data via the serial interface, and then displays the calibration constants one-by-one.

Displays '0' followed by the value of calibration constant 0.

Press the LOCK/DEGREE button to step to the next constant. There are 64 altogether.

The default setting is 1.000 for constants 0 – 31, and 0.000 for constants 32-63.

Press the TEST button at any time to step to the next test.

### Test 12 - Pot adjust

Message - 'Pot'

For correct measurement of loop resistances, the time-constants of the two branches in the '2-armed' circuit need to be closely matched. This is done by adjusting the series resistance in one of the arms using a potentiometer. This diagnostic procedure provides a way of performing the adjustment. Tests are carried out as a pair, each test measuring the voltage difference between the two capacitors. Alternating tests reverse the roles of the capacitors - each one being either unloaded or loaded (15mA). The displayed reading is a rolling average of the difference in the pairs of readings.

An input of at least 50V a.c. must be applied. If this is not present, the display shows 'Vol'. After a few seconds, the display gives the result in both analog and digital formats, along with an arrow showing which way to turn the pot (as viewed from the pot side of the board).

Adjust R63 for a minimum reading (less than +/-10 counts).

Press the TEST button at any time to step to the next test.

Note: There is a shortcut to this procedure from the 'diA' screen. Hold down the top right-hand button and press the left-hand button. (Not available on the 310). The pot adjust routine begins automatically. Another shortcut is to fit LK7, which allows the procedure to be executed immediately after the start-up sequence.

### Test 13 – EEPROM

Message - 'EEP'

The entire content of the eeprom is transmitted via the serial interface. It is arranged as hex bytes and formatted into rows and columns, with addresses at the start of each row. The led neons show progress via a pattern which changes every kilobyte.

Press the TEST button at any time to step to the next test.

### Test 14 – Power down

Message - 'oFF'

The microcontroller continuously asserts the 'POWER OFF' signal. The instrument should switch off after a couple of seconds.

## Appendix 5 - Common Faults

## Appendix 6 - Firmware updates

310/320	330	Details
V1.0		used for first 50 loop testers
V1.1		Improvements in automatic cal and test
V1.2		first RCD testers
V1.3	V2.0	fixed bugs in variants (switched RCD, Spanish) and improvements in automatic cal and test
V1.4	V2.1	Fixed problems with 50V-0-50V supplies
V1.5	V2.2	Fixed false 'noise' indication on some RCD/RCBOs
V1.6	V2.3	LRCD range introduced

## Appendix 7 - Hardware updates

RCD Testers only: Change R251 to 91 ohms because a number of instruments were failing low on 1A test.

## LT330 and RCDT330 instruments

These instruments benefit from a USB connection, allow download of stored results to a PC

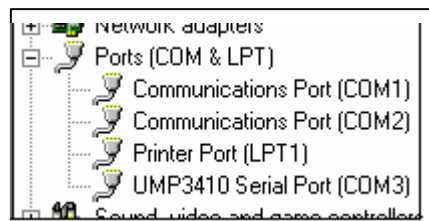
They differ in that a different microprocessor is fitted, and also a bigger EEPROM in which the results are stored. Also an extra board is fitted containing an isolated USB interface.

The USB interface uses the Texas Instrument TUSB3410. To use this, 'driver' software is required on the PC, and this is available for Microsoft Windows XP, 2000, ME and 98SE. This software is supplied with the instrument on the Download Manager CD, or can be downloaded free of charge from the Texas Instruments website. (Go to [www.ti.com](http://www.ti.com), and search for TUSB3410VCP and follow the instructions to download the latest version.)

Install this software BEFORE connecting the instrument.

### Basic fault-finding

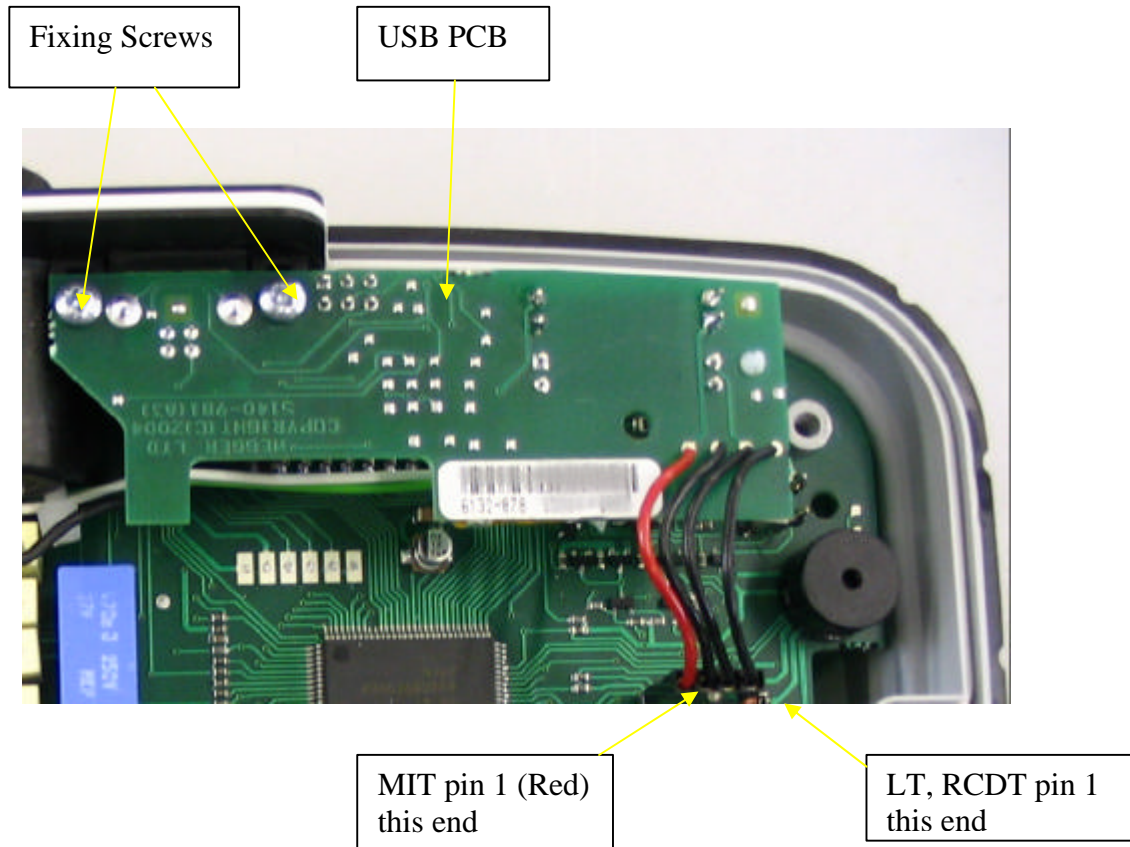
Operation of the interface board can be checked by installing the driver software on a PC and then looking at the System Properties (Settings->Control Panel->System and then the System Properties tab). Check on the 'Ports COM and LPT'. Connecting an instrument will give you an extra COM port labelled UMP3410 Serial Port COMxx



To further check the interface board, run HyperTerminal or other RS232 interface program, and select the COM port labelled above (Connect the instrument FIRST) Change the configuration to 9600 baud, 8 bits, no parity, 1 stop bit and no flow control. Switch to any (on) position other than send and type in a 's', and the message "Select SEND on instrument" will be received.

### Assembly and Disassembly

The USB Board is fitted in one corner of the case, and connected to the display board by four wires. A replacement PCB is available, order from Service at Dover ([ukrepairs@megger.com](mailto:ukrepairs@megger.com)).



# BOM

Megger Part Number	Description		Qty
5140-981	USB PCB MIT/LT/RCDT3	ARTETCH CIRCUITS LTD	1
30000-102	IC EEPROM 8Kx8 24C64 SO8	ARROW ELECTRONICS LTD	1
30200-004	IC REGULATOR 3.3V LM117DTX	MICROMARK ELECTRONICS LTD	1
31000-001	TRANSISTOR NPN DRG 6180-39	EURODIS HB ELECTRONICS	2
31000-002	DIODE SM LL4	EURODIS HB ELECTRONICS	1
32000-018	CAP SMD CER- 100nF 10% 18	MICROMARK ELECTRONICS LTD	3
32000-038	CAP SMD TANT'- 10uF 20% 35	MICROMARK ELECTRONICS LTD	2
32000-043	CAP SMD CER 22pF 10% 060	ANGLIA	4
32000-044	CAP SMD TANT' 1uF 20% 222	MICROMARK ELECTRONICS LTD	1
33000-005	RES SM' 10M MF 10% 1/8W 1	WELWYN COMPONENTS LTD	2
33000-028	RES SM; 33R MF 1% 0.063W	WELWYN COMPONENTS LTD	3
33000-031	RES SM- 1K MF 1% 0.063W	WELWYN COMPONENTS LTD	5
33000-032	RES SM- 1K5 MF 1% 0.063W	WELWYN COMPONENTS LTD	1
33000-037	RES SM- 10K MF 1% 0.063W	WELWYN COMPONENTS LTD	3
33000-042	RES SM-100K MF 1% 0.063W	WELWYN COMPONENTS LTD	2
33000-044	RES SM' 1M MF 1% 0.063W	WELWYN COMPONENTS LTD	1
33000-070	RES SM- 30K MF 1% 0.063W	ARROW ELECTRONICS LTD	1
33000-103	RES SM;220R TF 1% 0.063 0	MICROMARK ELECTRONICS LTD	4
35000-013	CRYSTAL,12MHz HC49/4H	ARROW ELECTRONICS LTD	1
30000-188	IC USB TO SERIAL CONVERTER	EBV ELECTRONIK GMBH	1
5173-579	PCB BAR CODE LABEL		1
25995-013	LABEL(CUSTOM) 6,35X24mm	TYCO ELECTRONICS UK LIMITED	1
33000-029	RES SM;100R MF 1% 0.063W	WELWYN COMPONENTS LTD	1
25960-066	HEADER 72-PIN DIL	TOBY ELECTRONICS LTD	0.072
25965-178	SOCKET USB B-TYPE PCB MTG	ARROW ELECTRONICS LTD	1
29350-002	OPTO ISOLATOR 10KV OPI1	FARNELL ELEC COMPS LTD	2
6140-381	WACL USB TO MAIN PCB MIT/L		1

