SECTION 7 Parts List

This section contains detailed parts lists for each of the printed circuit boards fitted in the instrument. When ordering spare parts, it is essential to quote the instrument serial number, located on the rear panel, as well as the full description shown in the appropriate parts list.

COMPONENT PARTS LIST ABBREVIATIONS

CIRCUIT REFERENCES

AE	Aerial
B	Battery
C	Capacitor (μF)
CSR	Thyristor
D	Diode
FS	Fuse
IC	Integrated Circuit
L	Inductor
LP	Lamp (including Neon)
LK	Link
M	Motor
ME	Meter
MSP	Mains Selector Panel
PL	Plug
R	Resistor (Ω)
RE	Recording Instrument
RL	Relay
S	Switch
SK	Socket
T	Transformer
TP	Terminal Post (or Test Point)
TR	Transistor
V	Valve
X	Other Components

Also Used:-

RNL	Non Linear Resistor (Ω)
RV	Variable Resistor (Ω)

COMPONENT TYPES

Fixed Resistors		Variable Resistors		Capacitors	
Carbon Composition	CACP	Carbon Front Panel Multiturn	CAFM	Air	AIR
Carbon Film	CAFM	Carbon Front Panel Single Turn	CAFS	Aluminium Electrolytic	ALME
Cracked Carbon	CKCA	Carbon Preset Multiturn	CAPM	Aluminium Solid	ALMS
Metal Film	MEFM	Carbon Preset Single Turn	CAPS	Polycarbonate	CARB
Metal Oxide	MEOX	Cermet Front Panel Multiturn	CMFM	Ceramic	CERM
Power Wirewound	POWW	Cermet Front Panel Single Turn	CMFS	Polyester Foil	ESTF
Precision Wirewound	PRWW	Cermet Preset Multiturn	CMPM	Polyester Metallised	ESTM
Temperature Sensitive	TEMP	Cermet Preset Single Turn	CMPS	Glass	GLAS
Thick Film	TKFM	Wirewound Front Panel Multiturn	WWFM	Mica	MICA
Thin Film	TNFM	Wirewound Front Panel Single Turn	WWFS	Metallised Lacquer	MLAC
Voltage Sensitive	VOLT	Wirewound Preset Multiturn	WWPM	Paper Foil	PAPF
		Wirewound Preset Single Turn	WWPS	Paper Metallised	PAPM
				PTFE	PTFE
				Polypropylene Film	PYLN
				Polystyrene	STYR
				Tantalum Dry	TAND
				Tantalum Foil	TANF
				Tantalum Wet	TANW

PCB 1

Cct. Ref.	General Description				Solartron Part No.
R1 to R3	CACP	220k	1/4W	10%	172052200
R4	CACP	47k	1/4W	10%	172044700
R5	CACP	220k	1/4W	10%	172052200
R6	CACP	220k	1/4W	10%	172052200
R7 to R18	CACP	330k	1/4W	10%	172053300
R19	CACP	22k	1/4W	10%	172042200
R20	CACP	68k	1/4W	10%	172046800
R21 to R26	CACP	10k	1/4W	10%	172041000
D1	Zener	24V	0.4W	5%	300523930
D2	Zener	24V	0.4W	5%	300523930
D3	Zener	30V	0.4W	5%	300521430
D4	Zener	24V	0.4W	5%	300523930
TR1 to TR6	2N5401				300555470
V1 to V3	Display SP353				300730280
V4	Display SP354				300730290
V5 to V7	Neon Hivac 16H				300720300
V8 to V11	Neon, Hivac 23L				300720240
V12	Neon Hivac 1MH				300720460
SK1	16 pin DIL				300584860
SK2	16 pin DIL				300584860

Cct. Ref.	General Description	Solartron Part No.
TR1	BCY70	300553590
TR2	2N4303	300553160
TR3	BFY90	300553890
TR4	MPS-A42	300555460
IC1	SN7413N	510000710
IC2	SN74393N	510002150
IC3	SN74109N	510002120
IC4	SN74390N	510002140
IC6	SN7490AN	510000280
IC7	SN74175N	510001310
IC8	SN7442N	510000330
IC9	SN7404N	510000410
IC10	DI258N	510002160
IC11	DD700	510001600
IC12	DD700	510001600
IC13	SN7408N	510000830
IC14	SN74175N	510001310
IC15	SN7403N	510001200
IC16	DI258N	510002160
TP1 to TP10	Disconnect pins	355900550
SK1	16 pin DIL	300584860
SK2	16 pin DIL	300584860
SK3	14 pin DIL	300584680
SK4	14 pin DIL	300584680
SK5 to SK7	16 pin DIL	300584860
SK8	18 pin DIL	300584850
SK9	18 pin DIL	300584850
B1 to B28	Horizontal amp	352501700
L1 to L3	Choke, R.F.	305020630
S1	DPDT	375000510

PCB 2

Cct. Ref.	General Description				Solartron Part No.
R1	CACP	10k	1/2W	10%	172341000
R2	CACP	470	1/4W	10%	172024700
R3	CACP	1k	1/4W	10%	172031000
R4	CACP	220k	1/4W	10%	172052200
R5	CACP	1k	1/4W	10%	172031000
R6	CACP	220k	1/4W	10%	172052200
R7	CACP	680k	1/4W	10%	172056800
R8	CACP	2.7k	1/4W	10%	172032700
R9	CACP	82k	1/4W	10%	172048200
R10	CACP	1k	1/4W	10%	172031000
R11	CACP	220	1/4W	10%	172022200
R12	CACP	2.2k	1/4W	10%	172032200
R13	CACP	2.2k	1/4W	10%	172032200
R14	CACP	2.2k	1/4W	10%	172032200
R15	CACP	1.5k	1/4W	10%	172031500
R18	CACP	4.7k	1/4W	10%	172034700
R21 to R42	CACP	1M	1/4W	10%	172061000
R43	CACP	4.7k	1/4W	10%	172034700
C1	CERM	0.047	25V	+50% −25%	241944700
C2	TAND	100	10V	20%	265481000
C4	GLAS	2—24p	2000		290060020
C5	CERM	150p	500V	20%	241321500
C6	CERM	220p	500V	20%	241322200
C7	CERM	220p	500V	20%	241322200
C8 to C10	CERM	0.047	25V	+50% −25%	241944700
C11	TAND	15.0	20V	20%	265771500
C12	CERM	1000p	500V	20%	241331000
D1	Zener	4.7V	0.4W	5%	300521470
D2	SD3				300522160
D4	MV2107				300525020
D5	MV2107				300525020

PCB 3

Cct. Ref.	General Description				Solartron Part No.
R1 to R3	CACP	4.7k	1/4W	10%	172034700
R4 to R7	CACP	3.3k	1/4W	10%	172033300
R8	CACP	1k	1/4W	10%	172031000
R9 to R12	CACP	4.7k	1/4W	10%	172034700
R13 to R15	CACP	3.3k	1/4W	10%	172033300
R16	CACP	1k	1/4W	10%	172031000
R17 to R22	CACP	3.3k	1/4W	10%	172033300
R23	CACP	2.7k	1/4W	10%	172032700
R24	CACP	3.3k	1/4W	10%	172033300
R25	CACP	3.3k	1/4W	10%	172033300
R26 to R28	CACP	4.7k	1/4W	10%	172034700
R29	CACP	220	1/4W	10%	172022200
R30	CACP	4.7k	1/4W	10%	172034700
R31	CACP	1k	1/4W	10%	172031000
R32	CACP	120	1/4W	10%	172021200
R33	CACP	120	1/4W	10%	172021200
R34	CACP	470	1/4W	10%	172024700
R35	CACP	1k	1/4W	10%	172031000
R36	CACP	1k	1/4W	10%	172031000
R37	CACP	470	1/4W	10%	172024700
R38	CACP	4.7k	1/4W	10%	172034700
R39	CACP	4.7k	1/4W	10%	172034700
R40	CACP	1k	1/4W	10%	172031000

PCB 3 (Cont)

Cct. Ref.	General Description				Solartron Part No.
R41	CACP	4.7k	1/4W	10%	172034700
R42	CACP	4.7k	1/4W	10%	172034700
C1	CERM	220p	500V	20%	241322200
C2 to C7	CERM	0.047	25V	+50% −25%	241944700
C8 to C12	CERM	0.047	25V	+50% −25%	241944700
C13	TAND	15	20V	10%	265771500
D1	SD3				300522160
IC1	SN7474N				510000490
IC2	SN7405N				510002080
IC3	SN7407N				510000750
IC4	SN7403N				510001200
IC5	SN74175N				510001310
IC6	SN74175N				510001310
IC7	SN7404N				510000410
IC8	SN7402N				510000270
IC9	SN7400N				510000340
IC10	SN7403N				510001200
IC11	SN74390N				510002140
IC12	SN7442N				510000330
IC13	SN74165N				510001480
IC14	SN7404N				510000410
IC15	SN7405N				510002080
IC16	SN7403N				510001200
IC17	SN74191N				510000940
IC18	SN7412N				510002090
IC19	SN7400N				510000340
IC20	SN7410N				510000420
IC21	SN7402N				510000270
IC22	SN7427N				510001590
IC23	SN7474N				510000490
IC24	SN7474N				510000490
IC26	SN7404N				510000410
IC27	SN7400N				510000340
IC28	SN7402N				510000270
IC29	SN7400N				510000340
IC30	5082-4351 Opto Coup.				300540150
IC31	5082-4351 Opto Coup.				300540150
IC32	SN74393N				510002150
IC33	SN74390N				510002140
IC34	5082-4360 Opto Coup.				300540160
IC35	SN7403N				510001200
IC36	SN7422N				510002100
IC37	5082-4360 Opto Coup.				300540160
IC38	SN7400N				510000340
IC39	5082-4360 Opto Coup.				300540160
SW1	Twin DPDT (sample)				379600402
SW2	Twin DPDT (control)				379600101
SW3	Quintuplet DPDT (rate)				379613801
SW5	Quintuplet DPDT (mode)				379613201
SW6	Twin DPDT (self check)				379613101
SK1	14 pin DIL				300584680
SK2	16 pin DIL				300584860
SK3	16 pin DIL				300584860
SK4	16 pin DIL				300584860
SK5	16 pin DIL				300584860
SK6	16 pin DIL				300584860
SK8	14 pin DIL				300584680
B1 to B28	Berg Post				355501050
TP1 to TP10	Disconnect pins				355900550
	Test Hook				359600101
	Bus Bars				480090080

PCB 4

Cct. Ref.	General Description				Solartron Part No.
R1	CACP	470	1/4W	10%	172024700
R2	CACP	470	1/4W	10%	172024700
R3	CACP	2.7k	1/4W	10%	172032700
R4	CACP	2.7k	1/4W	10%	172032700
R5 to R12	CACP	4.7k	1/4W	10%	172034700
C1 to C6	CERM	0.047	25V	+50% −25%	241944700
C7	CERM	680p	500V	20%	241326800
C8	CERM	1000p	500V	20%	241331000
C9	CERM	330p	500V	20%	241323300
C10	CERM	330p	500V	20%	241323300
IC1	SN74393N				510002150
IC2 to IC4	SN74390N				510002140
IC5	SN74157N				510001280
IC6	SN7400N				510000340
IC8	SN74151N				510000850
IC9	SN74107N				510000810
IC10	SN7474N				510000490
IC11	SN74107N				510000810
IC12	SN7412N				510002090
IC13	SN7402N				510000270
IC14 to IC20	SN74190N				510000930
IC21 to IC24	SN74151N				510000850
IC25	SN74157N				510001280
IC26	SN7489N				510001300
IC27	SN7438N				510002110
IC28	SN7408N				510000830
IC29	SN7408N				510000830
IC30	SN7432N				510001510
IC31	SN7427N				510001590
IC32	SN7474N				510000490
IC33	SN7410N				510000420
IC34	SN7402N				510000270
IC35	SN7430N				510000430
IC36	SN7404N				510000410
IC37	SN7405N				510002080
IC38	SN7400N				510000340
TP1 to TP7	Disconnect Pins				355900550
SK1 to SK6	16 pin DIL				300584860

PCB 5

Cct. Ref.	General Description				Solartron Part No.
R1 to R4	CAPM	3.3M			169609102
R5	CAPM	100.05k			169609102
R7	CACP	470	1/4W	10%	172024700
R8	CACP	100k	1W	10%	172551000
R9	CACP	470	1/4W	10%	172024700
R10	CACP	100	1/4W	10%	172021000
R12	CACP	100k	1/4W	10%	172051000
R14	CACP	100	1/4W	10%	198221001
R102	CACP	1k	1/4W	10%	172031000
R107	WWPM	90k			169609001
R108	WWPM	9.3k			169609001
R109	WWPM	909			169609001
R110	WWPM	100.84			169609001
R111	WWPM	276.5k			169609001
R112	MEFM	82k	1/4W	0.5%	198248201
R113	MEFM	10k	1/4W	0.1%	198141001
R114	CACP	220	1/4W	10%	172022200
R116 to R120	CACP	47k	1/4W	10%	172044700
R121	CACP	10k	1/2W	10%	172341000
R122	CACP	10k	1/2W	10%	172341000
R123	CACP	470k	1/4W	10%	172054700
R124	MEFM	1.5k	1/2W	0.5%	198231501
R126	CACP	47M	1/2W	10%	160100105
R201	MEFM	114.35k		0.1%	169608602
R202	MEFM	50k		0.1%	169608602
R203	MEFM	12k	1/4W	0.5%	198241201
R205	MEFM	680k	1/4W	0.5%	192756802
R206	MEFM	47k	1/4W	0.5%	198244701
R207	MEFM	10	1/2W	0.5%	198211001
R208	MEFM	20k	1/4W	0.5%	198242001
R209	MEFM	10	1/4W	0.5%	198211001
R210	CACP	10k	1/4W	10%	172041000
R211	CACP	10k	1/4W	10%	172041000
R212 to R215	CACP	4.7k	1/4W	10%	172034700
R217	CACP	1k	1/4W	10%	172031000
R218	CACP	1k	1/4W	10%	172031000
R220	CACP	100k	1/4W	10%	172051000
R224	CACP	100k	1/4W	10%	172051000
R301	MEFM	620	1/4W	0.5%	198226201
R302	CACP	470	1/4W	10%	172024700
R303	CACP	330	1/4W	10%	172023300
R304	CACP	6.8k	1/4W	10%	172036800
R305	WWPM	44k			169607702
R306	WWPM	44k			169607702
R307	MEFM	22k	1/4W	0.5%	198242201
R308	CACP	470	1/4W	10%	172024700
R309	CACP	6.8k	1/4W	10%	172036800
R310	CACP	330	1/4W	10%	172023300
R311	MEFM	44.2	1/4W	0.5%	160400536
R312	MEFM	86.6	1/4W	1%	160400417
R313	MEFM	169	1/4W	1%	160400418
R314	MEFM	332	1/4W	1%	160400419
R315	MEFM	649	1/4W	1%	160400420
R316	MEFM	1.27k	1/4W	0.5%	198231271
R317	WWPM	2.438k	1/4W	0.1%	169603101
R318	WWPM	4.844k	1/4W	0.1%	169603001
R319	WWPM	9.624k	1/4W	0.1%	169602901
R320	WWPM	19.124k	1/4W	0.1%	169602801
R321	WWPM	43.4k			169607801
R322	WWPM	28.09k			169607801
R323	MEFM	330k	1/4W	0.5%	198253301
R324	MEFM	10	1/4W	0.5%	198211001
R401	CACP	100k	1/4W	10%	172051000
R403	MEOX	1k	1/4W	5%	195631000
R404	MEOX	1k	1/4W	5%	195631000
R405	MEFM	15k	1/4W	0.5%	198241501
R406	MEFM	15k	1/4W	0.5%	198241501
R407	MEOX	27k	1/4W	5%	195642700
R408	MEFM	1.5k	1/4W	0.5%	198231501
R409	MEFM	1.5k	1/4W	0.5%	198231501
R410	MEOX	18k	1/4W	5%	195641800
R414	MEOX	27k	1/4W	5%	195642700
R415	MEOX	3.3k	1/4W	5%	195633300

Cct. Ref.	General Description				Solartron Part No.
R417	MEOX	10k	1/4W	5%	195641000
R418	MEOX	6.8k	1/4W	5%	195636800
R422	MEOX	15k	1/4W	5%	195641500
R431	CACP	100k	1/4W	10%	172051000
R432	CACP	100k	1/4W	10%	172051000
R433	CACP	10k	1/4W	10%	172041000
R435	MEOX	47k	1/4W	5%	195644700
R437	MEOX	47k	1/4W	5%	195644700
R438	MEOX	47k	1/4W	5%	195644700
R439	MEOX	10k	1/4W	5%	195641000
R440	MEOX	10k	1/4W	5%	195641000
R441	CACP	100k	1/4W	10%	172051000
R442	CACP	100k	1/4W	10%	172051000
R443	CACP	470k	1/4W	10%	172054700
R444	CACP	470k	1/4W	10%	172054700
R445	CACP	2.2k	1/4W	10%	172032200
R446	CACP	1M	1/4W	10%	172061000
R449	CACP	100	1/4W	10%	172021000
R450	CACP	100	1/4W	10%	172021000
R459	CACP	470	1/4W	10%	172024700
R501		1M	1/2W	0.02%	160300430
R502		1M	1/2W	0.02%	160300430
R503		699.5k	1/2W	0.02%	160300413
R504		699.5k	1/2W	0.02%	160300413
R507	MEFM	100K	1/4W	0.5%	198251001
R508	MEFM	10	1/4W	0.5%	198211001
R509	CACP	470	1/4W	10%	172024700
R510	CACP	330	1/4W	10%	172023300
R511	CACP	2.2k	1/4W	10%	172032200
R701	MEFM	990k	2W	0.1%	169600501
R702	MEFM	10k	1/4W	0.1%	198141004
R703	MEFM	1.2k	1/4W	0.1%	198131204
R704	MEFM	97k	1/4W	0.5%	198249704
R705	MEFM	14.5k	1/4W	0.5%	198241454
R706	MEFM	100k	1/4W	0.5%	198251001
R707	CACP	1M	1/4W	10%	172061000
R708	MEFM	1M	1/4W	1%	198361001
R709	CACP	10k	1/4W	10%	172041000
R710	CACP	10k	1/4W	10%	172041000
R711	CACP	10k	1/4W	10%	172041000
R712	CAFM	10M	1/2W	5%	170871000
R713	MEFM	1.179k	0.2W	0.02%	160400544
R714	MEFM	140.6	0.2W	0.02%	160400550
R715	MEFM	1.8k	1/4W	0.5%	198231801
R716	CACP	470	1/2W	10%	172324700
R717	CACP	10k	1/4W	10%	172041000
R718	MEFM	10k	1/4W	0.5%	172041000
R724	MEFM	10k	1/4W	0.5%	198241001
R738	CACP	100k	1/4W	10%	172051000
R744	CACP	10k	1/4W	10%	172041000
R745	CACP	10k	1/4W	10%	172041000
R746	CACP	100k	1/4W	10%	172051000
R748	CACP	10k	1/4W	10%	172041000
R749	CACP	10k	1/4W	10%	172041000
R751	CACP	100k	1/4W	10%	172051000
R752	MEFM	390k	1/4W	1%	198353901
R753	MEFM	12k	1/4W	0.5%	198241201
R754	CACP	56k	1/4W	10%	172045600
RV1	CMPM	5k		10%	130935000
RV101	CMPM	5k		10%	130935000
RV102	CMPM	20k		10%	130942000
RV103	CMPM	5k		10%	130935000
RV201	MEFM	20		5%	119601901
RV202	CMPM	100k		10%	130951000
RV203	CMPM	10k		10%	130941000
RV301	CMPM	100		10%	130921000
RV302	CMPM	100k		10%	130951000
RV501	CMPM	100k		10%	130951000
RV502	CMPM	1k		10%	130931000
RV503	CMPM	1k		10%	130931000
RV701	CMPM	2k		10%	130932000
RV702	CMPM	10k		10%	130941000
RV703	CMPM	1k		10%	130931000
RV704	CMPM	200		10%	130922000
RV705	CMPM	100k		10%	130951000
RV706	CMPM	2k		10%	130932000
C1	ESTF	1000p	160V	10%	210231000
C2	CERM	0.01	3kV	20%	208450085
C101	ESTF	100p	160V	10%	210221000
C103	CERM	0.047	25V	+50% −25%	241944700

Cct. Ref.	General Description				Solartron Part No.
C104	CERM	0.047	25V	+50% −25%	241944700
C201	CERM	0.047	25V	+50% −25%	241944700
C204 to C206	CERM	0.047	25V	+50% −25%	241944700
C208	ESTF	0.1	100V	10%	225451000
C209	ESTF	0.01	100V	10%	225441000
C210	ESTF	0.01	100V	10%	225441000
C211	ESTF	0.01	100V	10%	225441000
C212 to C214	CERM	0.047	25V	+50% −25%	241944700
C220	CERM	100p	500V	20%	241321000
C221	CERM	100p	500V	20%	241321000
C299	CERM	0.1	30V	+50% −25%	242051000
C302 to C303	CERM	0.047	25V	+50% −25%	241944700
C304	ESTF	0.1	100V	10%	225451000
C305	CERM	0.047	25V	+50% −25%	241944700
C307	CERM	0.047	25V	+50% −25%	241944700
C310	CERM	0.047	25V	+50% −25%	241944700
C312	CERM	0.047	25V	+50% −25%	241944700
C401	TAND	100	25V	10%	273581000
C402	TAND	100	25V	10%	273581000
C404	TAND	4.7	35V	20%	266064700
C405	CERM	1000p	500V	20%	241331000
C406	TAND	47	35V	20%	266074700
C407	TAND	47	35V	20%	266074700
C408	CERM	0.047	25V	+50% −20%	241944700
C409	STYR	1000p	400V	10%	210231000
C411	TAND	15	20V	10%	265771500
C412	TAND	15	20V	10%	265771500
C413	ESTF	0.047	100V	10%	225444700
C414	ESTF	0.047	100V	10%	225444700
C415	CERM	3,300p	500V	20%	241333300
C417	ESTF	0.1	100V	10%	225451000
C418	CERM	10p	200V	10%	240611000
C419	ESTF	2.2	63V	10%	225162200
C421	TAND	4.7	35V	20%	266064700
C422	CERM	150p	500V	20%	241321500
C424	TAND	4.7	35V	20%	266064700
C426	CERM	0.047	25V	+50% −25%	241944700
C428	TAND	15	20V	10%	265771500
C429	CERM	10p	500V	20%	241311000
C501	PYLN	0.033	200V	2%	208100184
C503	PYLN	0.033	200V	2%	208100184
C504 to C506	CERM	0.047	25V	+50% −25%	241944700
C701	ESTF	0.47	400V	20%	226154700
C702	ESTF	0.01	1000V	10%	222841000
C703	STYR	120p	125V	2.5%	210121200
C705	MICA	680p	350V	5%	250326800
C706	CERM	2.2p	200V	15%	240602200
C709	ESTF	0.01	100V	10%	225441000
C710	CERM	100p	500V	20%	241321000
C711	CERM	100p	500V	20%	241321000
C721	TAND	220	10V	20%	265482200
C722	ESTF	1	100V	10%	225461000
C723	ESTF	10	63V	10%	219971000
C725	ESTF	1	100V	10%	225461000
C736	Variable PTFE		TuT-7-V		290060080
D1	Zener	13V	0.4W	5%	300523920
D2	Zener	13V	0.4W	5%	300523920
D3	Light Emitting MA2801R				300750090
D4	Light Emitting MA2801R				300750090
D101	ZENER	4.7V	.4W	5%	300521470
D102	ZENER	4.7V	.4W	5%	300521470
D103	Zener	13V	0.4W	5%	300523920
D104	Zener	13V	0.4W	5%	300523920
D105 to D108	1N3595				300523590

Cct. Ref.	General Description				Solartron Part No.
D201	1N3595				300523590
D202	1N3595				300523590
D203	Zener	4.7V	0.4W	5%	300521470
D204	Zener	4.7V	0.4W	5%	300521470
D205	SD3				300522160
D206	SD3				300522160
D208	ZENER	12V		±5%	300521480
D301	USR 932	9.3V	0.4W	5%	300525610
D303	SD3				300522160
D401	1N3595				300523590
D402	1N3595				300523590
D403	Zener	8.2V	0.4W	5%	300521330
D404	Zener	8.2V	0.4W	5%	300521330
D405	Zener	5.6V	0.4W	5%	300521450
D406	SD3				300522160
D407	SD3				300522160
D408	Zener	8.2V	0.4W	5%	300521330
D419	Zener	5.6V	0.4W	5%	300521450
D701 to D703	SD3				300522160
D706	Zener	3.3V	0.4W	5%	300521860
D707	1N3595				300523590
D708	1N3595				300523590
D709	Zener	9.1V	1W	5%	300525410
D710	Zener	9.1V	1W	5%	300525410
D711	ZENER	2.7V		±5%	300523870
D712	ZENER	2.7V		±5%	300523870
D801	SD3				300522160
D803	SD3				300522160
D809 to D812	SD3				300522160
D814	SD3				300522160
TR1	WN807				300555380
TR2	WN807				300555380
TR3	U1899				300554320
TR4	U1899				300554320
TR101 to TR104	WN807				300555380
TR105	U1899				300554320
TR201	U1899				300554320
TR202	U1819				300553800
TR203	U1819				300553800
TR204	U1819				300553800
TR205	U1899				300554320
TR301	BC107				300553320
TR302	BCY70				300553590
TR401	2N2484				300552860
TR402	2N4303				300553160
TR403	Dual FET NDF9410/WD401				300555370
TR404	Dual FET U235				300553810
TR405	2N4303				300553160
TR408	Dual FET NDF9410/WD401				300555370
TR409	Dual FET NDF9410/WD401				300555370
TR410	2N2484				300552860
TR411	2N4303				300553160
TR501	BC107				300553320
TR701	3N163				300554530
TR702	BC107				300553320
TR703	3N163				300554530
TR704	Dual FET, U235				300553810
TR705	U1899				300554320
TR706	U1899				300554320
TR707	BC107				300553320
TR708	U1899				300554320
TR709	U1899				300554320
IC101	ADS06LH				510090260
IC201	Mono OP-07CJ				510090310
IC202	LM301AH				510000620
IC203	LM311H				510090050
IC204	LM311H				510090050
IC205	SN7474N				510000490
IC206	SN7474N				510000490
IC301	Mono OP-07CJ				510090310
IC302	Mono OP-07CJ				510090310
IC401	CA3183 AE.NPN Array				300555390
IC402	LM301AH				510000620
IC404	CA3084, PNP Array				300555360

PCB 5 (Cont.)

Cct. Ref.	General Description	Solartron Part No.
IC405	LM301AH	510000620
IC406	AD 506L	510090260
IC408	LM201AH	510090300
IC501	Mono OP-07CJ	510090310
IC701	LM318H	510090210
IC706	RMS-DC Converter	559600401
RLF1 to RLF3	MRA 500 Reed	300670120
RLA1	MRA-500 Reed 30AT	300670120
RLE1 to RLE3	MRA-500 Reed 30AT	300670120
RLB	Relay 2p C/O, 2p N/O Varley	301200805
RLC	Relay 2p C/O Varley	301201903
RLK	Relay 1p c/o R5-24V ITT	300651980
RLL	Relay 1p c/o R5-24V ITT	300651980
LDR1 to LDR4	NSL-364C	300540070
	Ceramic Beads 5.5mm length	470120060
	Reed Drive Coils 1.4k	309506702
	Disconnect pins	355900550
	TO5 Heatsinks	300584200
SKT1		300584680
SKT2 to SKT6	14 pin DIL	300584860
	Posts, Berg	355500980
	Oven D07 (80°C)	300584370
	Eyelet	356020050

PCB 6

Cct. Ref.	General Description				Solartron Part No.
R216	CACP	470	1/4W	10%	172024700
R219	CACP	4.7k	1/4W	10%	172034700
R220	CACP	1k	1/4W	10%	172031000
R221	CACP	10k	1/4W	10%	172041000
R223	CACP	33k	1/4W	10%	172043300
R228	CACP	33k	1/4W	10%	172043300
R229	CACP	470	1/4W	10%	172024700
R451	CACP	4.7k	1/4W	10%	172034700
R452	CACP	47k	1/4W	10%	172044700
R454	CACP	6.8k	1/4W	10%	172036800
R455	CACP	68k	1/4W	10%	172046800
R456	CACP	22k	1/4W	10%	172042200
R457	MEOX	390	1/4W	5%	195623900
R458	CACP	2.2k	1/4W	10%	172032200
R601	MEFM	68k	1/4W	0.5%	198246801
R602	WWPM	69.96k	1/2W	0.1%	169608501
R603	MEFM	44.2	1/4W	0.5%	160400536
R604	WWPM	82k	1/2W	0.1%	169608501
R605	WWPM	8.208k	1/4W	0.005%	169603405
R606	WWPM	910.6k	1/4W	0.005%	169603304
R607	WWPM	8.19M	1/4W	0.05%	160300450
R608	MEFM	10.96k	1/2W	0.1%	160400549
R610	POWW	5.6k	6W	5%	173735600
R611	CACP	10k	1/4W	10%	172041000
R612	CACP	6.8M	1/2W	10%	172366800
R613	MEFM	780k	1/4W	0.5%	198257801
R614	MEFM	6.96k	1/4W	0.1%	160400537
R803 to R807	CACP	10k	1/4W	10%	172041000
R809	CACP	10k	1/4W	10%	172041000
R811 to R814	CACP	10k	1/4W	10%	172041000
R816 to R819	CACP	10k	1/4W	10%	172041000
R820	CACP	2.2k	1/4W	10%	172032200
R821	CACP	10k	1/4W	10%	172041000
R822	CACP	33k	1/4W	10%	172043300
R825	CACP	2.2k	1/4W	10%	172032200
R826	CACP	2.2k	1/4W	10%	172032200
R828	CACP	120	1/2W	10%	172321200

Cct. Ref.	General Description				Solartron Part No.
RV601	CERM	50		10%	130915000
RV602	CERM	1k		10%	130931000
RV603	CERM	20k		10%	130942000
RV604	CERM	100		10%	130921000
C217	MICA	390p	500V	5%	250323900
C218	MICA	390p	500V	5%	250323900
C425	ESTF	0.15	100V	10%	225451500
C427	CERM	0.047	25V	+50% −25%	241944700
C601	STYR	1000p	160V	10%	210231000
C604	CERM	100p	500V	20%	241321000
C605	CERM	33p	500V	20%	241313300
C801	CERM	0.047	25V	+50% −25%	241944700
C802	ESTF	0.01	100V	10%	225441000
C803	CERM	3,300p	500V	20%	241333300
C804	TAND	22	35V	10%	266072200
C805	CERM	0.047	25V	+50% −25%	241944700
C806	CERM	470p	500V	20%	241324700
C807	CERM	470p	500V	20%	241324700
D207	Zener	10V	0.4W	5%	300522760
D410	SD3				300522160
D411	SD3				300522160
D416	Zener	9.1V	0.4W	5%	300521340
D601	SD3				300522160
D606	1N4007				300524990
D802	SD3				300522160
D804 to D808	SD3				300522160
D813	SD3				300522160
D815 to D817	SD3				300522160
TR601	WN807				300555380
TR602	3N163				300554530
TR605	WN807				300555380
TR606	WN807				300555380
TR412	BC107				300553320
TR413	BC107				300553320
IC207	SN74123N				510000980
IC208	SN74393N				510002150
IC209	SN74390N				510002140
IC210	SN7406N				510000760
IC407	LM301AH				510000620
IC601	Mono OP-07CJ				510090310
IC602	AD506LH				510090260
IC603	LM301AH				510000620
IC802	SN74159N				510002180
IC803	SN7445N				510000900
IC804	SN74156N				510001270
IC805	D125BP				510002060
IC806	SN7445N				510000900
IC807	SN74156N				510001270
IC808	D125BP				510002060
IC809	SN7414N				510001990
IC810	SN7407N				510000750
IC811	SN74L00N				510001030
IC812	SN7406N				510000760
IC813	SN74L00N				510001030
IC814	SN74175N				510001310
IC815	SN74175N				510001310
IC816	SN74123N				510000980
IC818	SN74L00N				510001030
IC819	SN74164N				510001150
RLH1	Reed Relay				301202201
RLH2	Reed Relay				301202201
RLG1	Reed Relay				301202201
RLG2	Reed Relay				301202201
RLD1	Reed MRA500				300670120
RLD2	Reed MRA500				300670120
RLD	Reed Driver Coil				309506702
SK1 to SK8	14 pin DIL				300584680
SK	24 pin DIL				300584740
	Disconnect Pins				355900550
	T05 Heatsink				300584200
	Ceramic Beads 5.5mm length				470120060

PCB 7

Cct. Ref.	General Description				Solartron Part No.
R1	CACP	1k	1/4W	10%	172031000
R2	CACP	47k	1W	10%	172544700
R3	CACP	1M	1W	10%	172561000
R4	CACP	3.3k	3W	5%	172033300
R5	CACP	1k	1/4W	10%	172031000
R6	CACP	2.2k	1/4W	10%	172032200
R7	CACP	2.2k	1/4W	10%	172032200
R8	CACP	2.7k	1/4W	10%	172032700
R9	CACP	10k	1/4W	10%	172041000
R11	CACP	100k	1/4W	10%	195651000
R12	MEOX	22k	1/4W	5%	195642200
R13	CACP	4.7k	1/4W	10%	195634700
R14	CACP	22	1/2W	10%	172012200
R15	CACP	1k	1/4W	10%	172031000
R17	CACP	10k	1/4W	10%	172041000
R18	MEOX	390k	1/2W	1%	195453900
R19	MEFM	33k	1/8W	0.5%	192743301
R20	POWW	1.2k	6W	5%	173731200
R21	MEOX	100k	1/4W	5%	195651000
R22	CACP	820k	1/4W	10%	172058200
R23	MEOX	100k	1/4W	5%	195651000
R24	MEOX	68k	1/4W	5%	195646800
R25	MEOX	33k	1/4W	5%	195643300
R26	CACP	22	1/4W	10%	172012200
R27	CACP	22	1/4W	10%	172012200
R28	CACP	100	1/4W	10%	172021000
R29	CACP	33	1/4W	10%	172013300
R30	CACP	820	1/2W	10%	172328200
R31	CACP	1M	1/4W	10%	172061000
R32	CACP	8.2k	1/2W	10%	172038200
R33	MEOX	100k	1/4W	5%	195651000
RV1	CERM	10k	1/3W	10%	130641000
C1	ESTF	0.1	160V	10%	220351000
C2	CERM	3300p	500V	20%	241333300
C3	ESTF	3300p	160V	10%	221333300
C4	ESTF	0.1	100V	10%	225451000
C5	CERM	33p	500V	20%	241313300
C6	ESTF	0.015	100V	10%	225441500
C7	ESTF	3.3	100V	10%	225463300
C8	ESTF	680p	160V	10%	221326800
C9	ESTF	0.22	100V	10%	225452200
C10	ESTF	0.22	100V	10%	225452200
C11	CERM	0.1	25V	+50% −25%	242051000
C12 to C15	TAND	47	35V	10%	266074700
C16	TAND	220	10V	20%	265482200
C17	ALMS	4.7	350V	+50% −10%	274564700
C18	TAND	220	10V	20%	265482200
C19	CERM	0.1	25V	+50% −25%	242051000
C20	CERM	0.1	25V	+50% −25%	242051000
C21	CERM	100p	500V	20%	241321000
C23	ALMS	100	25V	+50% −20%	273581000
C24	ALMS	100	25V	+50% −20%	273581000
D1	1N3595				300523590
D2	SD3				300522160
D3	SD3				300522160
D4	Zener	15V	0.4W	5%	300524820
D5	Zener	15V	0.4W	5%	300524820
D6	Zener	30V	0.4W	5%	300521430
D7	MR856 Motorola				300525550
D8	Zener	5.6V	0.4W	5%	300521450
D9	SD3				300522160
D10	SD3				300522160
D11	MR856 Motorola				300525550
D12 to D19	BAY72				300524530
D20	MR850 Motorola				300525560
D21	MR850 Motorola				300525560
D24 to D25	MR856 Motorola				300525550
D26	IN5821				
D27	IN5821				
D28 to D31	SD3				300522160
D32	Zener	120V	5W	10%	300525580
D34	Zener	5.6V	0.4W	5%	300521450
D35	Zener	75V	5W	10%	
TR1	2N3439				300552670
TR2	BC107				300553320
TR3	BFT19B				300555440
TR4	U1897				300553800
TR5	BFT19B				300555440
TR6	TIP 54				300555350
TR8	2N3439				300552670
TR9	BC107				300553320
TR10	BCY70				300553590
TR11	TIP50				300555450
TR12	TIP50				300555450
IC1	LM318H				510090210
IC2	LM301AH				510000620
IC3	LM301AH				510000620
IC4	MC7818CP				510090340
IC5	MC7918CP				510090350
T1	Rm6				309608702
T2	45mm				309608804
L1	RM10 Choke				309508601
L2	RM10 Choke				309508601
L3	RM6 Choke				309507001
L4	RM6 Choke				309507001
	T05 Heatsinks				300584200
	Disconnect Pins				355900550
	Ceramic Beads				470120060

PCB 10

Cct. Ref.	General Description	Solartron Part No.
D1 to D4	MA2801R LED	300750090
SK	Bottom Entry Vertical PV	352501680

PCB 11

Cct. Ref.	General Description	Solartron Part No.
SK1	16 way DIL	300584860
	Cannon 50 way	352550110
SK5	16 way DIL	300584860
SK6	16 way DIL	300584860
	Disconnect Pins	355900550

PCB 12

Cct. Ref.	General Description				Solartron Part No.
R1	CACP	4.7k	1/4W	10%	172034700
R2	CACP	330	1/4W	10%	172023300
R3	CACP	150k	1/4W	10%	172051500
R4	CACP	47k	1/4W	10%	172044700
R5	CACP	4.7k	1/4W	10%	172034700
R6	CACP	470	1/4W	10%	172024700
R7	CACP	470	1/4W	10%	172024700
R8	CACP	4.7k	1/4W	10%	172034700
R9	CACP	330	1/4W	10%	172023300
R10	CACP	150k	1/4W	10%	172051500
R11	CACP	47k	1/4W	10%	172044700
R12	CACP	4.7k	1/4W	10%	172034700
R13	CACP	10k	1/4W	10%	172041000
R14	CACP	10k	1/4W	10%	172041000
R15	CACP	330	1/4W	10%	172023300
R16	CACP	4.7k	1/4W	10%	172034700
R17	CACP	47k	1/4W	10%	172044700
R18	CACP	68k	1/4W	10%	172046800
R19	CACP	47k	1/4W	10%	172044700
R20	CACP	47k	1/4W	10%	172044700

Cct. Ref.	General Description				Solartron Part No.
C1 to C5	CERM	220p	500V	20%	241322200
C6	CERM	10p	500V	20%	241311000
C7	CERM	10p	500V	20%	241311000
C8	CERM	0.047	25V	+50% −25%	241944700
C9	CERM	0.047	25V	+50% −25%	241944700
C10	CERM	33p	500V	20%	241313300
C11	CERM	10p	500V	20%	241311000
C12	CERM	100p	500V	20%	241321000
D1	SD3				300522160
D2	SD3				300522160
TR1	BCY70				300553590
TR2	BC107				300553320
TR3 to TR5	BCY70				300553590
TR6	BC107				300553320
TR7	BCY70				300553590
TR8	BC107				300553320
	Horizontal Amp Sockets				352501700

PCB 13

Cct. Ref.	General Description				Solartron Part No.
TH1	VA1104				161000024
C1	ALME	190	400V	+50% −25%	274882200
D1 to D4	IN4007				300524990
	Disconnect Pins				355900550

MAIN ASSEMBLY

Cct. Ref.	General Description		Solartron Part No.
R1	Zenamic Voltage Suppressor	Z10L471	110024080
SKA	Front Input		352105010
SKB	Rear Input		352105010
SKC	Mains Filter		550000990
FS1	800mA		360206010
SA	Mains On/Off		377000290
T1	Transformer		309610501
	Escutcheon		420610050
	Bush		419600101
	Ext. Ref. Terminal Post 4mm Red		355100510
	Ext. Ref. Terminal Post 4mm Black		355100500
	Fuse Link 20mm Slo-Blo		360106310
PL	14 way DIL		351314050
PL	16 way DIL		351316010
	14 way 3M Cable		480095330
	16 way 3M Cable		480095440

SECTION 8 Setting-up and Calibration

SETTING UP AND CALIBRATION

INTRODUCTION

This section provides a comprehensive setting-up and calibration procedure which may be necessary after rectification and/or a component replacement on the Digital Voltmeter.

It is divided into two parts as follows:-

1) Setting-Up Procedures

   These involve partial strip down of the instrument in order to effect initial adjustments of the circuit parameters.

2) Calibration Procedures

   The final adjustments provide an instrument performance which is compatible with the specification published in Part 1, Section 2 of this manual. For normal calibration only Part 2 of this section should be followed. Where an instrument fails a calibration, or has undergone rectification and/or a component replacement, it is advisable to carry out the full procedure detailed in this section.

NOTE: It is essential when carrying out setting-up or final calibration procedures that they be completed and carried out in the order given.

TEST EQUIPMENT

The test equipment used must have an accuracy/uncertainty equal to or better than that shown in the calibration tables.

The test equipment listed below should be available to perform the following procedures correctly.

a) Mains Isolation Transformer

b) Variac.

c) Digital Voltmeter (e.g. Type 7040).

d) Oscilloscope plus x 10 probe (e.g. A100).

e) D.C. Voltage Standard.

f) A.C. Voltage Standard (e.g. Hewlett Packard 745A).

g) Resistance Standard 100Ω to 10MΩ (e.g. ESI DB62 or ESI RS624 and separate 10MΩ Standard).

h) Voltage Divider (e.g. ESI RV722).

additional items required.

5-terminal input lead

Cannon plug (Connect pins 10, 12, 14 and 42 together).

PART 1– SETTING-UP PROCEDURES

PRELIMINARY

1. Prepare the instrument as follows:-

CAUTION: THE INSTRUMENT SHOULD BE DISCONNECTED FROM THE MAINS SUPPLY BEFORE ANY ATTEMPT IS MADE TO REMOVE THE TOP COVER.

BEWARE OF GUARD POTENTIAL ON THE GUARD PLATE WITH THE TOP COVER REMOVED.

BEWARE OF MAINS POTENTIAL ON THE POWER SUPPLY WITH THE TOP COVER REMOVED.

a) At the top corners, on the rear of the instrument, remove the screw securing each buffer.

b) Remove the two buffers.

c) Remove the top cover by sliding it away from the front panel.

2. Check that the correct fuse is fitted as indicated beside the fuse holder.

POWER SUPPLY SWITCHING WAVEFORM

1. Connect the 7075 to the mains isolating transformer, as shown in Fig 8.1

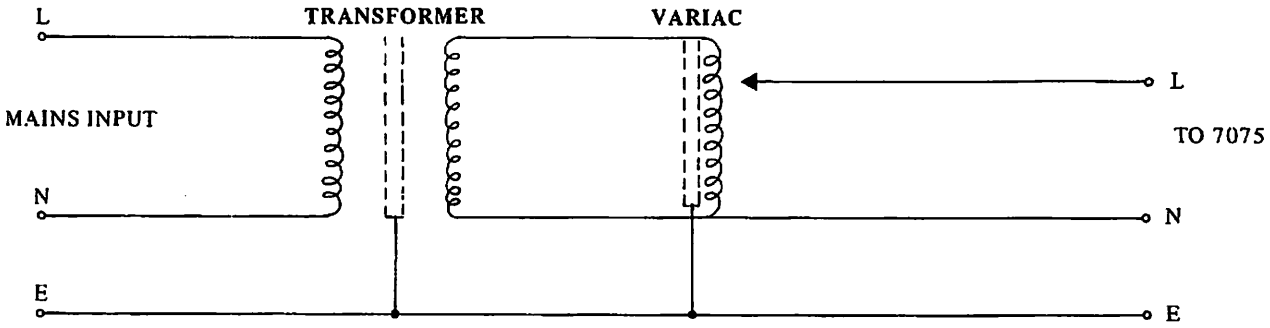


Fig 8.1

2. Set the variac for minimum output.

3. Connect a voltmeter between TP2 and input negative on pcb 7.

4. Connect an oscilloscope via a x 10 probe to TP3 on pcb 7 and input negative.

5. Switch on the instrument.

6. Adjust the variac for 60V input and check the following:.

   a) A display should begin to appear on the instrument under test.
   b) A reading of 50V ±15V on the voltmeter, and
   c) A 60V p/p amplitude waveform on the oscilloscope.

7. Adjust the variac for 120V input.

8. Check that the voltmeter reading is 60V ±10V.

9. Increase the input to 240V.

10. Check that the switching waveform is within the limits shown. (Fig 8.2)

FIG. 8.2 Switching Waveform

11 Disconnect the oscilloscope from TP3 and connect to TP4.

12. Check that the display is 30V p/p ±3V p/p and 46μs±5μs duration. The difference between two half cycles must not exceed 5μs.

13. Disconnect the oscilloscope from TP4.

14. Disconnect the voltmeter from TP2.

RAIL CHECKS

1. Connect a voltmeter to TP20 (+30V) and adjacent 0V pin on pcb 6.

2. Adjust RV1 on pcb 7 for a voltmeter reading of 30V ±0.1V

3. Vary the mains input between 120V and 260V.

4. Ensure that the reading does not change by more than ±0.2V from that in operation 2.

5. Adjust the mains input to 230V.

6. Switch off the instrument under test.

7. Disconnect the voltmeter from TP20 and the 0V pin.

The Table 8.1 below summarises the voltage rails in the instrument. These need not be checked unless a fault is suspect.

Table 8.1

AREA	RAIL	VALUE
FLOATING RAILS PCB 6 (measure with respect to OV floating)	+30V	+30V ± 0.1V
	+20V	+20.5V ± 1.5V
	+21V	+21V ± 1V
	+18V	+18V ± 1V
	-18V	-18V ± 1V
	-21V	-21V ± 1V
	-20V	-20V ± 1V
	-30V	-30V ± 1V
	+5V	+5V ± 0.5V
EARTHY RAILS PCB 7 (measure with respect to OV)	+180V	+175V ± 5V
	+5V	+5V ± 0.5V
	-18V	-18V ± 3V

EARTHY LOGIC CHECKS

1. Remove the plug from SK7 on pcb 6.
2. Switch on the instrument.
3. Select the following modes: D.C., LOCAL, 20ms, REP.
4. The display should read ±0.000000V.

CLOCK OSCILLATOR ADJUSTMENTS

1. Switch S1 to 50Hz operation.
2. Connect a voltmeter between TP7 (+ve) and TP10 (-ve) 0V on pcb 2.
3. Adjust C4 on pcb 2 for a reading of 2.2V ±100mV on the voltmeter.
4. Disconnect the voltmeter from TP7 and TP10.

CONVERSION TO 60Hz OPERATION (operate instrument from a 60Hz supply)

1. On pcb 2 link TP8 to TP10.
2. Connect a voltmeter between TP7 (+ve) and TP10 (-ve).
3. Adjust C4 on pcb 2 for a reading of 2.2V ±100mV on the voltmeter.
4. Reset the forcing waveform as in operation 8 of the floating checks.

INTEGRATION TIMES

1. Press the TEST button on the instrument front panel, the display should read 00.000V.

On selection of the integration rate buttons the appropriate readings should be displayed:-

Integration time	Display reading
1mS	±00.00V
20mS	±00.000V
100mS	±00.0000V
1s	±00.00000V
10s	±00.000000V *

* It may be necessary to wait up to 10s before the last zero appears.

ANNUNCIATOR CHECKS

1. Release the TEST button.
2. Select the 1s integration time.

3. Press the SINGLE SAMPLE button once.

4. The BUSY annunciator should illuminate for approximately 1 second.

5. Select REP.

6. Select RATIO, check that the RATIO annunciator is illuminated.

7. Release RATIO.

8. Select AC, check that the AC annunciator is illuminated.

9. Select Ω , check that the kΩ annunciator is illuminated.

10. Select RATIO, check that the RATIO annunciator is NOT illuminated. (with Ω selected)

11. Release the RATIO button.

12. Switch off the instrument.

13. Reconnect the plug to SK7 on pcb 6.

FLOATING CHECKS **Self-check system and forcing waveform**

1. Switch on the instrument.

2. Select the 100ms integration time and D.C. mode.

3. Select TEST. The display should read 07.0000V ±0.1V.

4. Press the STEP button. The display should now read 00.0000V ±20mV.

5. Adjust RV202 (10V ZERO) on pcb 5 as necessary for a reading of 00.0000V ±1mV.

6. Set RV203 on pcb 5 fully clockwise.

7. Connect an oscilloscope between TP5 and TP7 (0V) on pcb 6.

8. Adjust RV203 until the waveform is 20μs ±2μs duration.

9. Disconnect the oscilloscope from TP5 and TP7.

10. Press the STEP button. The display should read 10.0000V ±3V.

11. Press the STEP button again. The display should now read 10.0000kΩ ±200Ω.

12. Press the STEP button once more.

13. All the bars in all the positions should be displayed, (a row of 8's).

14. Release the TEST button.

INPUT AMPLIFIER

1. Select the 1s integration time button.

2. Fit the 2-terminal cables to the front panel input socket and short circuit the leads.

3. The display should read within the limits ±20μV.

4. Check that the μV zero control can be adjusted to obtain a reading within the limits ± 8μV.

5. Finally adjust the μV zero control for a reading of zero, or as near zero as possible.

6. Remove the short circuit.

7. Connect a 1MΩ resistor across the input terminals.

8. The display should settle to less than ± 70μV. Disconnect the 1MΩ resistor from the input terminals.

   NOTE: If available, the use of a 1MΩ resistor enclosed in an input plug removes the effects of movement near the input cable.

9. Connect a voltmeter to TP14 and 0V on pcb 6.

10. Apply -10V to the 7075 input noting the voltmeter reading at TP14.

11. Apply +10V to the instrument input. Ensure that the voltmeter reading does not exceed that in operation 10., above, by more than 15mV.

12. Disconnect the voltmeter from TP14 and 0V.

13. Note the instrument display reading.

14. Connect a 1MΩ resistor in series with the high input and the DC source.

15. The display reading should be within ±50 bits of that in operation 13.

16. Repeat operations 13, 14, 15 at the rear input socket on the instrument with a negative voltage.

17. Remove the DC source.

18. Remove the input lead from the rear socket.

19. Disconnect the resistor fitted in operation 14.

20. Connect the input lead to the front panel input socket.

NOISE CHECK

1. Ensure the 1s integration rate is selected.

2. Short circuit the input leads and adjust the μV zero control for a reading as near to zero as possible.

3. Select the 100ms rate.

4. The display should not exceed ±1 bit for 10 seconds.

5. Select the 20ms rate.

6. The display should not exceed ±2 bits for 10 seconds.

REFERENCE ADJUSTMENTS

A DC Standard should be used for the reference and ratio checks.

1. Fit the Cannon plug to the systems interface socket SK1 at the rear panel of the instrument to command the 10V range remotely. (refer to additional Test Equipment, see page 8.2)

2. Select the 1s integration ratio.

3. Adjust RV202 (10V zero) on pcb 5 for a display reading of zero ±5 bits.

4. Remove the short circuit from input leads.

5. Apply -10V to the input

6. Adjust RV301 (-10V Cal) for a reading of -10.0000V ±20 bits.

The total scatter on readings with ±10V input to the instrument should not exceed 4 bits. If RV301 does not have enough adjustment, links A to K will require re-adjustment. Normally adjustment of links A, B or C will be sufficient. However if the Zener D301 has been changed it may be necessary to adjust some of the other links; this is best done by successive approximation bearing in mind the weighting of each link (see Fig. 6.9).

RATIO CALIBRATION

1. Select RATIO and the 100ms integration rate buttons.

2. Apply the voltages in Table 8.2 to the external reference terminals located on the rear panel of the instrument and to the input socket on the front panel.

Table 8.2

TEST	INPUTS		OPERATION	READING	± BITS	NOISE ± BITS
	EXT REF TERMINALS	FRONT PANEL INPUT				
1	+ 10V	− 10V	RV503 (RATIO CMR)	− 10.0000V	3	1
2	+ 2V	− 2V	RV501 (RATIO ZERO)	− 10.0000V	5	3
3	Repeat tests 1 and 2 as necessary					
4	+ 10V	+ 10V	RV502 (RATIO CAL)	+ 10.0000V	3	1
5	+ 2V	+ 2V	RV302 (RATIO CAL BAL)	+ 10.0000V	5	3
6	Repeat tests 4 and 5 as neccssary					

3. Release the RATIO button.

4. Remove the DC source.

5. Remove the external reference leads.

6. Remove the 10V range command plug from SK1.

COMMON MODE

DC REJECTION

1. Connect the instrument as shown in Fig . 8.3

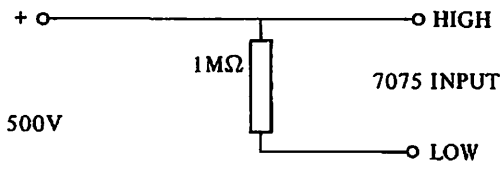
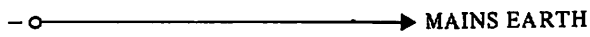


Fig 8.3  MAINS EARTH

2. Apply 500V to the instrument.

3. The reading on the display should not exceed 10mV.

4. Remove the DC source.

5. Disconnect the 1MΩ resistor.

DC RANGE CALIBRATION

10V RANGE

1. Select the 1s integration rate.

2. Command the 10V range remotely.

3. Short circuit the input leads.

4. Adjust RV202 (10V ZERO) for a reading of 0.00000V ±1 bit.

5. Remove the short circuit from the input leads.

6. Apply -10V to the input.

7. Adjust RV301 (-10V Cal) for a reading of -10.00000V ±5 bits.

8. Apply +10V to the input.

9. Adjust RV201 (+10V Cal) for a reading of 10.00000V ±5 bits.

Repeat operations 6 to 9 as necessary.

LINEARITY

1. With the 10V range commanded and the 10V DC Standard and Decavider connected to the input terminals, check the linearity in accordance with Table 8.3

Table 8.3

INPUT	READING	TOLERANCE (bits)
10V	10.00000V	± 3
9V	9.00000V	± 3
8V	8.00000V	± 3
7V	7.00000V	± 3
6V	6.00000V	± 3
5V	5.00000V	± 3
4V	4.00000V	± 3
3V	3.00000V	± 3
2V	2.00000V	± 3
1V	1.00000V	± 3
0.1V	0.10000V	± 2
0.01V	0.01000V	± 2
0.001V	0.00100V	± 2
0V	0.00000V	± 2

2. Repeat for negative values using the same voltage source.

3. Increase the DC source to the Decavider to +100V, adjusting the Decavider for a display reading of +10.00000V ±1 bit on the instrument under test.

4. Change the Decavider output to 13.90000V.

5. Ensure the 7075 display reading is 13.90000V ±3 bits.

6. Repeat operation 3 to 5 for negative polarity.

7. Remove DC source.

8. Remove the 10V range command plug from SK1.

10mV AND 1V RANGE CALIBRATION

1. Select the 1s integration rate.
2. Short out the input leads.
3. Adjust the μV zero control for a zero reading on the display.
4. Remove the short circuit.
5. Apply the voltages as per table 8.4., using a DC standard and Decavider.

Table 8.4

TEST	INPUT	OPERATION	READINGS	
			VALUE	± bits
1	– 10 mV	RV 103 (10mVDC)	0.010000V	1
2	– 100mV	RV 102 (100mVDC)	0.100000V	2
3	– 1V	RV 101 (1V DC)	1.000000V	5
4	Repeat tests 1 to 3 as necessary			

6. Apply similar positive inputs and check that the readings obtained for the two polarities do not differ by more than:

   a) 1μV on the 10mV range.

   b) 4μV on the 100mV range.

   c) 24μV on the 1V range.

100V AND 1000V RANGE CALIBRATION

1. Apply -100V to the 7075 input direct from the DC source.
2. Adjust RV1 on pcb 5 (100V DC) for a reading of −100,0000V ± 20 bits
3. Increase the input to -1000V. The display should settle to -1000.000V ±50 bits.
4. The drift after 1 minute should be less than ±5 bits.
5. Remove the DC source.

AC CALIBRATION

1. Connect the AC standard to the instrument.

2. Select the AC and 20ms modes.

3. Apply the voltages in Table 8.5

Table 8.5

TEST	INPUT	FREQUENCY	OPERATION	READING	
				VALUE	± bits
1	1V	1 kHz	RV706 (1V LF)	1.0000V	3
2	0.15V	1 kHz	RV705 (AC ZERO)	0.1498V	1
3	0. 5V	1 kHz	Check	0.5000V	5
4	1V	10 kHz	"	1.0000V	10
5	1V	100 kHz	"	1.0000V	30
6	0.15V	100 kHz	"	0.1500V	20
7	0. 1V	1 kHz	RV704 (100mV LF)	0.10000V	3
8	0.01V	1 kHz	Check	0.01000V	5
9	0. 1V	100 kHz	"	0.10000V	30
10	10V	1 kHz	RV702 (10V L.F)	10.000V	5
11	10V	100 kHz	C736 (SET HF)	10.000V	30
12	10V	10 kHz	Check	10.000V	10
13	100V	1 kHz	"	100.00V	10
14	100V	100 kHz	"	100.00V	50
15	100V	10 kHz	"	100.00V	15
16	800V	1 kHz	RV703 (1000V LF)	800.00V	8
17	500V	100 kHz	Check	500.00V	50
18	150V	10 kHz	"	150.00V	10

Repeat tests 1 and 2 as necessary

4. Remove the AC source.

5. Short circuit the input leads.

6. The display should be less than 50 bits .

7. Remove the short circuit.

8. Select the 1s integration time.

9. Apply 1V at 10Hz.

10. The display should be 1.00000V ±350 bits.

11. Select the 20ms integration time.

12. Press the TEST button.

13. Press the STEP button twice.

14. The AC self check reading should be displayed.

15. Adjust RV701 (10V AC SELF CHECK) on pcb 5 as necessary for a reading of 10.000V ±50 bits.

16. Release the TEST button.

17. Disconnect the input lead from the instrument.

OHMS CALIBRATION

1. Select the OHMS mode.

2. Connect the 5 terminal lead to the front panel input socket.

3. Short circuit 4 terminals (Leaving the DC low "black" terminal floating).

4. Adjust RV604 (OHMS ZERO) on pcb 6 for a reading of less than 1Ω.

5. Remove the short circuit.

OHMS RANGE CALIBRATION

1. Connect the resistance standard to the instrument and carry out checks as per Table 8.6

Table 8.6

TEST	INPUT	OPERATION	READINGS	
			VALUE	± bits
1	10 kΩ	RV601 (SET 10 kΩ)	10.00000 kΩ	10
2	10 MΩ	RV603 (SET 10 MΩ)	10000.00 kΩ	30
3	1 MΩ	RV602 (SET 1 MΩ)	1000.000 kΩ	10
4	Repeat tests 1 to 3 as necessary			
5	1kΩ	Check	1.000000 kΩ	20
6	13.9 kΩ	"	13.90000 kΩ	25
7	100 kΩ	"	100.0000 k Ω	70

2. Repeat test 6 of Table 8.6 using the rear input socket

3. Disconnect the resistance standard from the instrument.

4. Disconnect the input lead.

5. Switch off the instrument.

This concludes the setting up of the DVM and it should now be followed by a full calibration.

PART 2 - CALIBRATION PROCEDURES

INTRODUCTION

The following calibration is basically the final calibration to which all instruments are subjected prior to despatch from the factory.

For the greatest accuracy the DVM top cover should be removed and its calibration cover, Part No. 70759D, fitted. Failing this, allowances must be made for variations in the working temperatures.

See Appendix for details of calibration cover.

PRELIMINARY PROCEDURE

For the following checks the DVM will have its top cover removed and be fitted with its calibration cover (if available).

1. Prepare the instrument as follows:-

CAUTION: THE INSTRUMENT SHOULD BE DISCONNECTED FROM THE MAINS SUPPLY BEFORE ANY ATTEMPT IS MADE TO REMOVE THE TOP COVER.

BEWARE OF GUARD POTENTIAL ON THE GUARD PLATE WITH THE TOP COVER REMOVED.

BEWARE OF MAINS POTENTIAL ON THE POWER SUPPLY WITH THE TOP COVER REMOVED.

a) At the top corners on the rear of the instrument, remove the screw securing each buffer.

b) Remove the two buffers.

c) Remove the top cover by sliding it away from the front panel.

2. Check that the correct fuse is fitted as indicated beside the fuse holder:

For calibration procedures to be carried out at 20°C, it is essential that the following test equipment or its equivalent is available.

TEST EQUIPMENT

a) Guildline Standard Cell plus stand-by power supply.

b) Cambridge Potentiometer with 2V and 4V primary cells.

c) Sullivan Volts ratio box.

d) Cropico Null Detector.

e) DC Source (COHU)

f) Resistance standard 10Ω to 10MΩ.

g. Temperature control conditions.

additional items required.

5-terminal input lead

Cannon plug (Connect pins 10, 12, 14 and 42 together).

It should be noted that if the calibration equipment used does not meet the uncertainty specification of the items listed, the Limits of Error specified in Section 2 of this manual will not be achieved. Measurements made with the dvm after such recalibration therefore, while exhibiting errors no worse than those specified, *will be related to the calibration equipment* rather than to the internationally agreed volt.

CALIBRATION

The calibration sequence must be carried out in the order given. Calibration should be carried out at an ambient temperature 20°C ±1°C after a warm-up period of at least 2 hours with the calibration cover fitted.

CALIBRATION AT 20°C

1. Fit the 7075 with its calibration cover.
2. Switch on the instrument at least 2 hours before commencing calibration.
3. Command the 10V range remotely, via the rear connector socket SK1.
4. Select 1s integration rate, DC and REP.
5. Connect the 2-terminal lead to the front panel input socket.
6. Short circuit the input leads.
7. Adjust RV202 (10V zero) for a reading of zero ±1 bit.
8. Remove the short circuit.
9. Apply -10V to the input lead.
10. Adjust RV301 (-10V) for a reading of -10.00000V ±3 bits.
11. Apply +10V to the input.
12. Adjust RV201 (+10V) for a reading of 10.00000V ±3 bits.
13. Repeat operations 9 to 12. as necessary until the readings meet the limits specified.
14. Select RATIO.
15. Apply the voltages as per Table 8.7

    Allow time for the 7075 readings to stabilize after each change of reference voltage.

Table 8.7.

TEST	INPUTS		OPERATION	READING	± BITS	NOISE ± BITS
	EXT REF TERMINALS	FRONT PANEL INPUT				
1	+ 10	– 10V	RV503 (RATIO CMR)	– 10.00000V	20	4
2	+ 2	– 2V	RV501 (RATIO ZERO)	– 10.00000V	50	20
3	Repeat test 1 and 2 as necessary					
4	+ 10V	+ 10V	RV502 (RATIO CAL)	+ 10.00000V	20	4
5	+ 2V	+ 2V	RV302 (RATIO CAL BAL)	+ 10.00000V	50	20
6	Repeat test 4 and 5 as necessary					

16. Remove the external reference leads.

17. Release RATIO.

18. Recheck tests 6 to 12, allowing time for the display readings to stabilize.

19. Remove the 10V range command plug from socket SK1.

D.C. RANGE - CALIBRATION

1. Connect the 7075 low input terminal to earth.
2. Short circuit the input leads.
3. Adjust the μV zero control for a display reading of zero.
4. Remove the short circuit.
5. Apply the voltages as per Table 8.8

Table 8.8

TEST	INPUT	OPERATION	READING	
			VALUE	± bits
1	– 10mV	RV103 (100mV DC)	-- 0.010000V	1
2	+ 10mV	Check	0.010000V	1
3	– 100mV	RV102 (100mV DC)	– 0.100000V	2
4	+ 100mV	Check	0.100000V	2
5	–1V	RV101 (IVDC)	– 1.000000V	4
6	+ 1V	Check	1.000000V	4
7	Repeat tests 1 to 6 as necessary			
8	– 1000V	RV1 (100V DC)	– 1000.000V	5
9	+ 1000V	Check	1000.000V	5
10	– 100V	Check	-- 100.0000V	8
	+ 100V	Check	100.0000V	8

6. Disconnect the input lead from the instrument.

Note: Adjust for equal readings. Share any deviations equally between readings.

OHMS RANGE CALIBRATION

1. Connect the 5-terminal lead to the front panel input socket.
2. Select the OHMS mode.
3. Apply the resistance values as per Table 8.9

Table 8.9

TEST	INPUT	OPERATION	READINGS	
			VALUE	± bits
1	10kΩ*	RV 601 (SET 10kΩ)	10.00000KΩ	5
2	10MΩ	RV 603 (SET 10MΩ)	10000.00KΩ	10
3	1MΩ	RV 602 (SET 1MΩ)	1000.000KΩ	5
4	Repeat tests 1 to 3 as necessary			
5	100 kΩ		100.0000KΩ	20
6	1 kΩ		1.000000KΩ	
7	10 Ω		0.010000KΩ	

* Note: Allow 5 minutes for 7075 reading to stabilize.

4. Disconnect the cable fitted in operation 1.

AC RANGE CALIBRATION

1. Connect the 2-terminal lead to the front panel input socket.
2. Select AC and the 100ms integration rate.
3. Apply the voltages as per Table 8.10

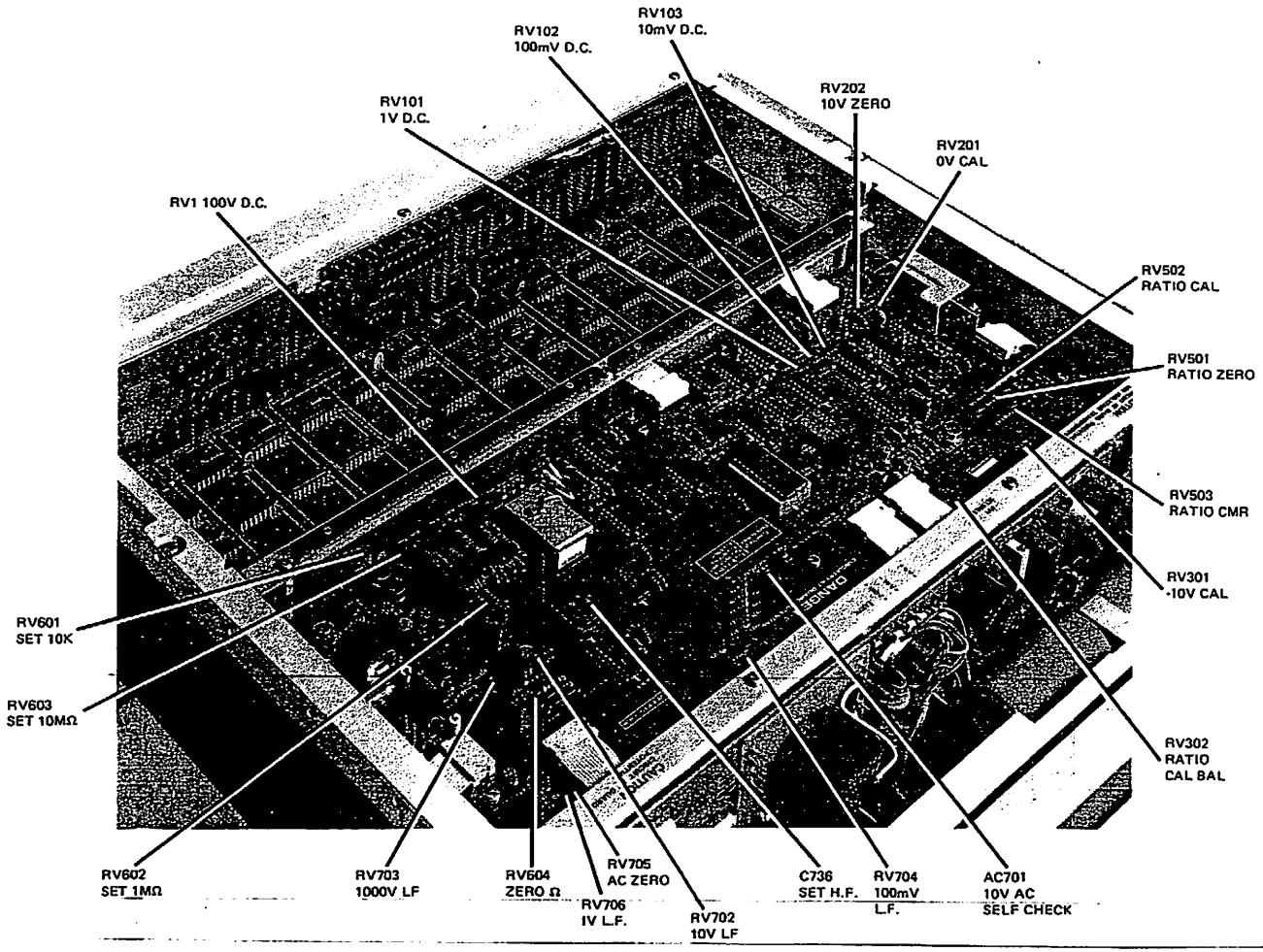
Table 8.10

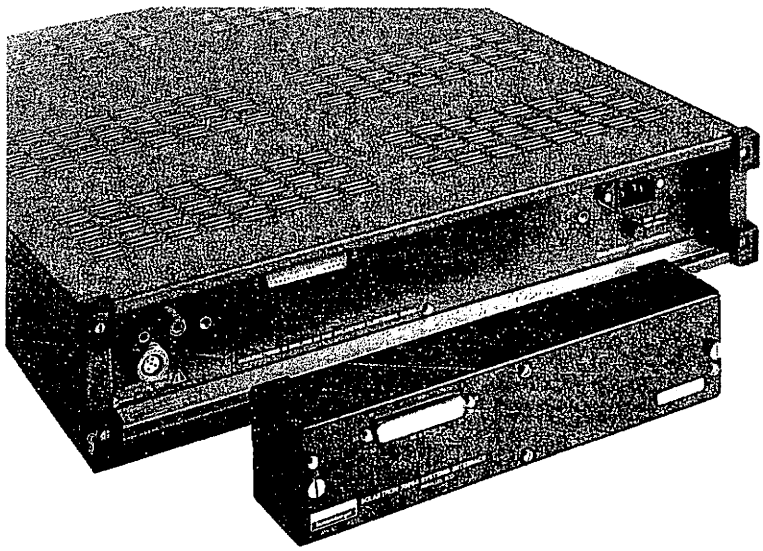
TEST	INPUT	FREQUENCY	OPERATION	READING	
				VALUE	± bits
1	1V	1 KHZ	RV 706 (1U L.F)	1.00000V	20
2	0.15V	1 KHZ	RV 705 (AC ZERO)	0.14980V	10
3	Repeat tests 1 and 2 as necessary				
4	1V	10 KHZ		1.00000V	100
5	1V	100 KHZ		1.00000V	300
6	0.15V	100 KHZ		0.15000V	150
7	0. 1V	1 KHZ	RV 704 (100 mV L.F)	0.100000V	20
8	0. 1V	100 KHZ		0.100000V	400
9	0.01V	1 KHZ		0.010000V	50
10	10V	1 KHZ	RV 702 (10V L.F)	10.0000V	20
11	10V	100 KHZ	C736 (SET H.F)	10.0000V	400
12	10V	10 KHZ		10.0000V	100
13	1. 5V	10 KHZ		1.5000V	50
14	100V	1 KHZ		100.000V	20
15	100V	10 KHZ		100.000V	100
16	100V	100 KHZ		100.000V	300
17	15V	10 KHZ		15.000V	50
18	750V	1 KHZ	RV 703 (1000V L.F)	750.00V	20
19	750V	10 KHZ		750.00V	100
20	200V	100 KHZ		200.00V	200
21	150V	10 KHZ		150.00V	50
22	10V	100 KHZ		10.0000V	300

Notes:

1. Test 18, allow time for reading to settle.
2. Test 11. Adjust C736 as necessary for best overall frequency response.
3. Test 22. Check Test 18 does not produce any significant changes to Test 11 readings.

This concludes the calibration of the DVM.


RV103
10mV D.C.
RV102
100mV D.C.
RV202
10V ZERO
RV101
1V D.C.
RV201
0V CAL
RV1 100V D.C.
RV502
RATIO CAL
RV501
RATIO ZERO
RV503
RATIO CMR
RV301
-10V CAL
RV601
SET 10K
RV603
SET 10MΩ
RV302
RATIO
CAL BAL
RV602
SET 1MΩ
RV703
1000V LF
RV604
ZERO Ω
RV705
AC ZERO
RV706
1V L.F.
RV702
10V LF
C736
SET H.F.
RV704
100mV
L.F.
AC701
10V AC
SELF CHECK



Rear Panel showing Interface Unit 70754.

SECTION 9 Parallel BCD Interface Unit 70754

SYSTEMS USE

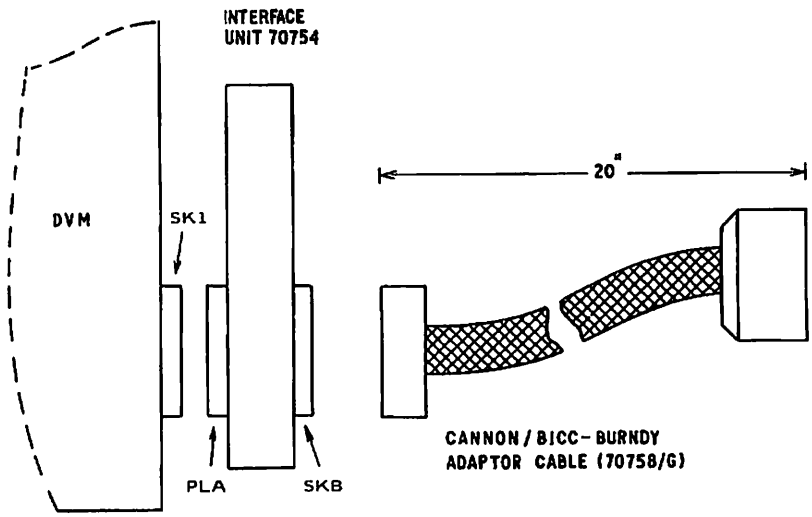
The addition of a Parallel BCD Interface Unit (70754) permits the use of the dvm in a data logging or automatic test system. Full remote control of the front panel controls (except POWER) is possible and the interface provides display information and the various control signals necessary in such systems.

The interface can be considered as a two-part unit. One section enables the external system to command all measurement decisions, obviating the need for manual selection. The other section, primarily concerned with the output of measurement data, also generates gating and steering signals to control the use of the data within the external system.

CONNECTION

The Parallel BCD Interface Unit mates directly with the dvm rear Cannon socket, being secured by two captive screws (see illustration on facing page). In the ensuing notes all pin designations refer to the Interface Unit **SKB**. For those users with systems based on the Solartron Master Series of instruments, a Cannon/BICC Burndy adaptor cable (70758G) is available as an optional accessory. Connection details for **SKB** and for the adaptor cable, are given in the table at the end of this Section.

Note: If a Parallel BCD Interface Unit is fitted but not connected to an external system, front panel selection of REMOTE will cause the instrument to revert to 10s integration, dc volts operation (100ms if 70758G is fitted).



LOGIC LEVELS

All signals unless otherwise stated conform to the following logic levels:

Input:

High	(Logic '1')	= + 2.4V < '1' < + 5V at 100μA
Lo	(Logic '0')	= −0.5V < '0' < + 0.5V at 5mA 'sink'

Output:

High	(Logic 1)	+ 2.4V < '1' < + 6V from 6kΩ source
Low	(Logic 0)	−0.5V < '0' < + 0.5V at 10mA sink.

SAMPLE

A measurement is initiated by one of two SAMPLE commands originating in the external system. These are:-

CONTACT SAMPLE	Contact closure between pins 39 and 37 (0V) with < 2ms contact bounce.
PULSE SAMPLE	A positive pulse applied to pin 40, of amplitude between +3V and +8V and duration $> 10\mu$s.

SAMPLE occuring during a measurement cycle will have no effect.

Note: If FRONT PANEL LOCKOUT command has not been received but the instrument is in Remote operation as a result of selection of the REMOTE push button, the SAMPLE push buttons are still effective. Selection of REP in this instance will inhibit any remote SAMPLE commands.

At the end of scan the channel lines are usually open circuit. Depending on the last operating range, either Commanded or Autorange, the display at this time may 'flash'. This is not necessarily an indication of instrument overload but merely warns the user that the displayed reading (i.e. the last digitised measurement) is no longer representative of the signal present at the input terminals. This should not cause any concern, the next SAMPLE Command automatically updating the display but the effect can be prevented by connecting a 10MΩ resistor across the input terminals. However if measurements of resistance or of voltages having a high source impedance are being made, the effect of this extra resistance must be taken into account.

DISPLAY DATA

The numerical display data, 6½ decades in BCD form, is available for use at the 50 way output socket. For details of pin connections reference should be made to the throw-clear connection table at the end of this Section. Output data full scale is normally 1400000 but this can be reduced to 999999, if required, by means of a link in the Interface Unit. When operating on the shorter integration times unused decades are presented as zeroes.

POLARITY

The polarity of a reading is coded on pins 26 and 27 of the connector, with the following significance:-

Pin 26	Pin 27	Polarity
0	1	Negative (–)
1	0	Positive (+)
0	0	AC/Ω (Polarity not applicable)

RANGE

There are two possible types of Range Output codes, one of which is related to the range input code:

RANGE OUTPUT CODE

(4) Pin 30	(2) Pin 31	(1) Pin 32	V DC	V AC	OHMS
0	0	0	1000V	1000V	10MΩ
0	0	1	100V	100V	1MΩ
0	1	0	10V	10V	100kΩ
0	1	1	1V	1V	10kΩ
1	0	0	100mV	100mV	1kΩ
1	0	1	10mV	*	100Ω
1	1	0	*	*	10Ω
1	1	1	*	*	*

* Code not applicable

The other type is arranged such that the integer value of the displayed data (6½ decades) is related to the measurement as in the following, where N is the output code decimal value:-

$$\text{Measurement} = \text{Reading (as an integer)} \times 10^{-n}\text{V or k}\Omega.$$

INPUT INFORMATION

The following input commands can be accepted from the external system. Command signals enter the instrument via the 50 way rear panel connector while either front or rear input socket may be used for the measurement leads.

CONTROL

External commands are effective only when the instrument is in REMOTE operation, either as a result of selection of the REMOTE push button or on receipt of FRONT PANEL LOCKOUT command from the external system - the latter overriding any selection made with the push-button. FRONT PANEL LOCKOUT is effected as follows:-

Pin 38	FRONT PANEL LOCKOUT
0	Yes
1	No

When FRONT PANEL LOCKOUT is commanded all front panel controls (except POWER) are disabled.

FUNCTION

The measurement mode is commanded on pins 42, 43 as follows:-

Pin 43	Pin 42	FUNCTION
1	1	DC
0	1	AC (RMS)
1	0	Ω
0	0	CHECK

RATIO OPERATION

Ratio measurement in DC or AC (RMS) mode (not available on Ω) is programmed on pin 41. (An external reference must be applied to the rear input terminals as normal).

Pin 41	RATIO COMMANDED
0	Yes
1	No

INTEGRATION TIME

The pins employed for Command Integration Time are 44, 45 and 46, selection being made with a 1 2 4 BCD code as follows:

(4) Pin 44	(2) Pin 45	(1) Pin 46	COMMANDED INTEGRATION TIME	
0	1	1	1ms	(3 × 9's)
1	0	0	20ms	(4 × 9's)
1	0	1	100ms	(5 × 9's)
1	1	0	1s	(6 × 9's)
1	1	1	10s	(7 × 9's)

Other codes will give 1ms integration time.

On AC (RMS) codes 110, 111 give the stated integration time but resolution remains at 5 × 9's as for code 101.

RANGING

Autorange can be inhibited by setting pin 47 High, while Command Range signals, in 124 BCD form, are applied to pins 48, 49 and 50 as shown in the table.

It should be noted that when operating on command range overload protection is as stated in the tables in Section 2, the instrument's ability to autorange out of trouble being inhibited.

INPUT RANGE COMMAND CODES

Pin 47	(4) Pin 50	(2) Pin 49	(1) Pin 48	V DC	V AC	OHMS
1	0	0	0	1000V	1000V	10MΩ
1	0	0	1	100V	100V	1MΩ
1	0	1	0	10V	10V	100kΩ
1	0	1	1	1V	1V	10kΩ
1	1	0	0	100mV	100mV	1kΩ
1	1	0	1	10mV	100V	100Ω
1	1	1	0	AUTORANGE		10Ω
1	1	1	1	AUTORANGE		

If a Low is applied to pin 47, Autorange is enabled and Command Range signals will have no effect. A SAMPLE Command is, however, necessary to initiate an Autorange sequence.

The 6½ decade range output BCD is given in the following table:-

(4) Pin 30	(2) Pin 31	(1) Pin 32	Voltage Range	Resistance Range	N
0	1	0		10 000kΩ	2
0	1	1	1000V	1 000kΩ	3
1	0	0	100V	100kΩ	4
1	0	1	10V	10kΩ	5
1	1	0	1V	1kΩ	6
1	1	1	100mV	100Ω	7
0	0	0	10mV	10Ω	(8)

If a full scale of 5½ decades has been selected, the value of N can be reduced by 1, maintaining the above relationship, by means of a link in the Interface Unit.

This is illustrated in the modified (5½ decade) table:-

(4) Pin 30	(2) Pin 31	(1) Pin 32	Voltage Range	Resistance Range	N
0	0	1		10 000kΩ	1
0	1	0	1000V	1 000kΩ	2
0	1	1	100V	100kΩ	3
1	0	0	10V	10kΩ	4
1	0	1	1V	1kΩ	5
1	1	0	100mV	100Ω	6
1	1	1	10mV	10Ω	7

FUNCTION

The Output mode code is identical to that for Command mode, the relevant pins being 28 and 29.

Pin 28	Pin 29	FUNCTION
1	1	DC
0	1	AC (RMS)
1	0	Ω
0	0	CHECK

PRINT COMMAND PULSE (Pin 33)

At the end of a measurement pin 33 goes High for between 10 and 30μs, providing an alternative PRINT command for those systems requiring a pulse input.

Both PRINT command pins are held at logic level '0' when REP is selected.

PRINT COMMAND LEVEL (Pin 34)

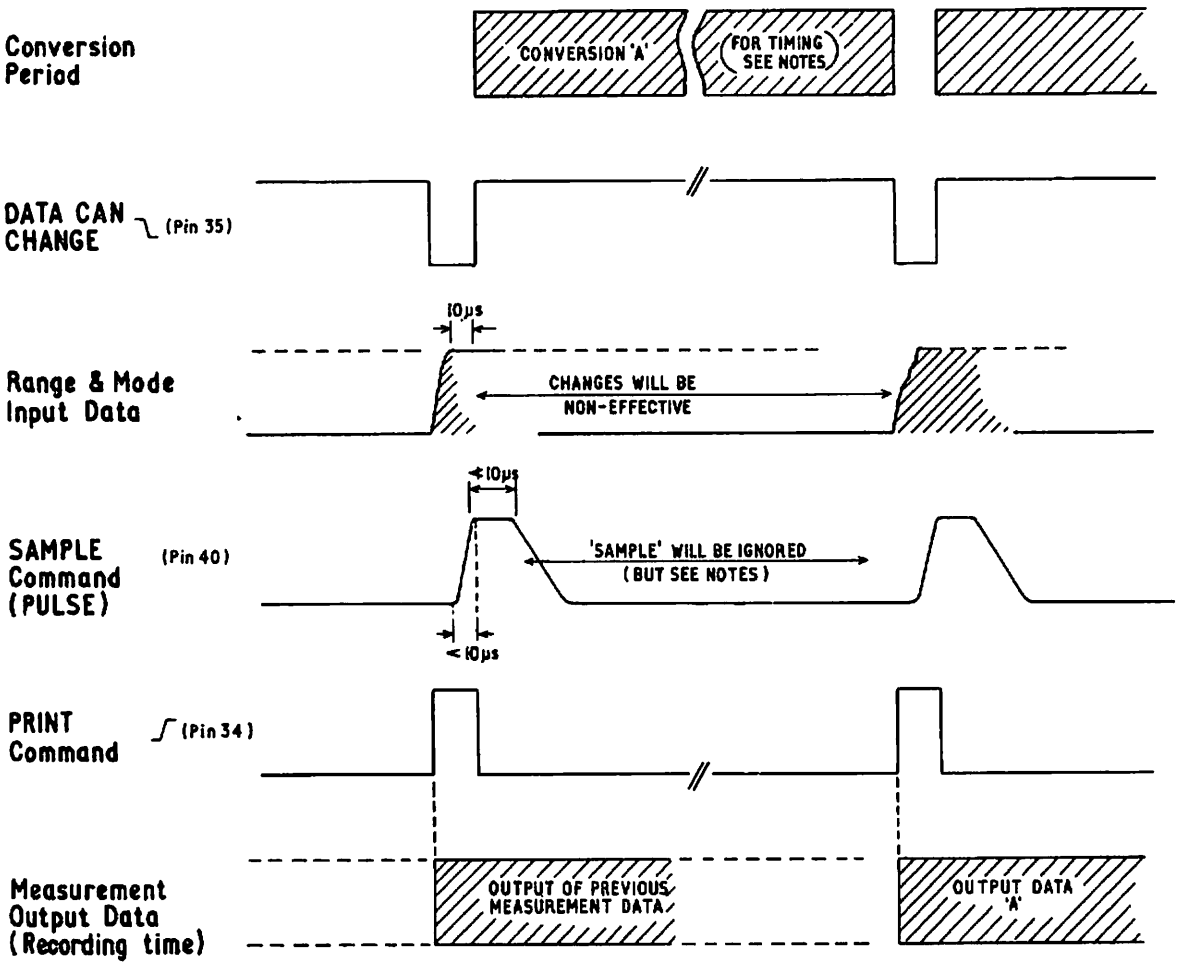
During a measurement pin 34 is Low, having been set to '0' after SAMPLE command. After the measurement is complete and the output information is updated pin 34 is set High as PRINT command to the external system.

The logic inverse on pin 35 is used as DATA CAN CHANGE, a logic '0' informing the external system that a change in command data can be accepted.

NOTE: No separate DATA IS CHANGED input command is required, comparison being carried out by circuits within the voltmeter.

Timing Information

Analogue and digital information can be applied simultaneously with SAMPLE command, all necessary settling delays being provided automatically by the instrument.



CONVERSION TIMING

1. Basic delay = Integration time + 4ms (DC, Ω)
   + 800ms (AC)

2. Mode change* = 20ms

3. Range change* = 21ms range-up (or down) per range (3 × 9's DC, Ω)

   21ms range-up
   40ms range-down
   } per range (4 × 9's to 7 × 9's; DC, Ω)

   = 800ms per range (AC)

*These delays are additive if on Autorange operation, parallel if operating on Commanded range.

NOTES

1. To avoid the slowing down effect of range hunting when Autorange is remotely commanded, receipt of a SAMPLE Command is necessary for autorange to occur. When in LOCAL operation however, detection of an overload causes an immediate Autorange upwards, independent of the receipt of SAMPLE Command.
2. Should a SAMPLE Command occur during a self-protecting autorange sequence it will be stored, to be obeyed once the overload condition no longer exists. With the foregoing exception SAMPLE Command occuring at any time other than after a PRINT Command output, will be ignored.

CONNECTION TABLE

SKB Pin No.	FUNCTION		SKB Pin No.	FUNCTION	
1	1×10^6		26	+ ve POLARITY	
2	8×10^5		27	− ve Output code	
3	4×10^5		28	FUNCTION output code 0 for A.C.	Both 0 for CHECK
4	2×10^5		29	0 for Ω	Both 0 for CHECK
5	1×10^5		30	(4)	
6	8×10^4		31	(2) RANGE Output	
7	4×10^4		32	(1)	
8	2×10^4		33	PULSE PRINT Command	
9	1×10^4		34	LEVEL (Output signal)	
10	8×10^3		35	DATA CAN CHANGE Output	
11	4×10^3	Staticised	36	OVERLOAD (Output signal)	
12	2×10^3	BCD output	37	EARTH/Logic '0' level	
13	1×10^3	data	38	FRONT PANEL LOCKOUT	
14	8×10^2		39	SAMPLE Command - CONTACT	
15	4×10^2		40	SAMPLE Command - Pulse	
16	2×10^2		41	RATIO Command	
17	1×10^2		42	FUNCTION Command 0 for AC	Both 0 for CHECK
18	8×10^1		43	(DC, AC (RMS or Ω) 0 for Ω	Both 0 for CHECK
19	4×10^1		44	(4)	
20	2×10^1		45	(2) INTEGRATION TIME	
21	1×10^1		46	(1) Command	
22	8×10^0	Not available	47	AUTORANGE Command	
23	4×10^0	when using	48	(1)	
24	2×10^0	Adaptor	49	(2) RANGE Command	
25	1×10^0	Cable.	50	(4)	

Systems Interface 50-way Cannon Socket Connections.

CONNECTION TABLE 2.

BICC - BURNDY Pin designation	CANNON (SK.B) Pin Number
A	21
B	20
C	19
D	18
E	17
F	16
H	15
J	14
K	13
L	12
M	11
N	10
P	9
R	8
S	7
T	6
U	5
V	4
W	3
X	2
Y	1
Z	(Note 1.)
a	(Note 1.)
b	(Note 1.)
c	41

BICC - BURNDY Pin designation	CANNON (SK.B) Pin Number
d	26
e	27
f	32
h	31
j	30
k	– (Note 2)
m	48
n	49
p	50
r	38
s	39
t	40
u	33
v	34
w	– (Note 2)
x	35
y	47
z	– (Note 2)
AA	42
BB	43
CC	28 (Note 4)
DD	29 (Note 4)
EE	46
FF	44
HH	45 (Note 3)

Notes:

1. Pins Z, a, b are connected to Earth at Pin HH.
2. Pins k, w, z are not used.
3. Pin HH is connected to Earth holding Cannon pin 45 Low.
4. The outputs on CC and DD are the complement of Master Series DVM outputs.

Bicc - Burndy Extension Connector Pin Connections. (70758G)

(Master Series Compatible).

PARALLEL BCD INTERFACE UNIT
Circuit Description

Board 1 Diag 9.1

Commands from board 2 arrive on cable S and are fed directly to the 7075 via PLA.

FRONT PANEL LOCKOUT is OR-ed with REMOTE from the front panel to disable all front panel buttons except SAMPLE.

FRONT PANEL LOCKOUT disables the SAMPLE buttons directly (PLA pin 48).

SAMPLE commands (PULSE or CONTACT) on cable S pin 15 are passed by IC1c if:–

a. The instrument is in SINGLE SAMPLE

or b. cable S pin 16 FRONT PANEL LOCKOUT is active (Low).

PRINT COMMAND on pin 21 of PLA is transmitted to board 3 via IC1a if the instrument is in the SINGLE SAMPLE mode.

Command data and an eight pulse strobe signal arrive on pins 27 and 25 of PLA respectively, soon after a SAMPLE command is given. IC8a compares this information as it is transferred into the shift register IC3, with that already present and being shifted out from the previous transfer. IC6b provides a signal DATA IS CHANGED which is output on PLA pin 45 to the DVM. This contributes to the delay before a measurement is started. For an unconditional 20ms delay link SP1 may be broken.

The final information on IC3 is used for the mode and range output information. SP2, 3 and 5, the range output codes, control the adder IC4. The final code appears on cable T pins 11, 12 and 13, the mode output information on cable T pins 9 and 10. When PRINT COMMAND is active (High) IC10a inhibits transfers, thus protecting the output information.

Measurement data from the 7075 arrives bit-parallel, word-serial on pins 2, 4, 6 and 8 of PLA and is converted to bit serial, word-serial by the multiplexer IC5. The timing lines on pin 3 and 5 of PLA count from 0-3 while each BCD word is present, selecting each bit in sequence and applying it to cable T pin 1. Data is always present and the relevant 8 BCD words are selected by IC9a which gates shift clock pulses through to board 3 *only* during STAT (IC9a pin 1 High) and IC9a pin 2 High (a slow timing line). This results in a burst of 32 pulses in phase with the serial bits on cable T pin 1 at the end of each measurement.

For non-BCD characters on pins 2, 4, 6 and 8 of PLA, IC9b forces IC 5 pin 6 high, causing zero's to appear on the outputs of board 3. The most significant 1 BCD character is present at the beginning of this sequence and is clocked into IC6a from pin 12 on PLA. This is normally applied to board 3 via IC8b.

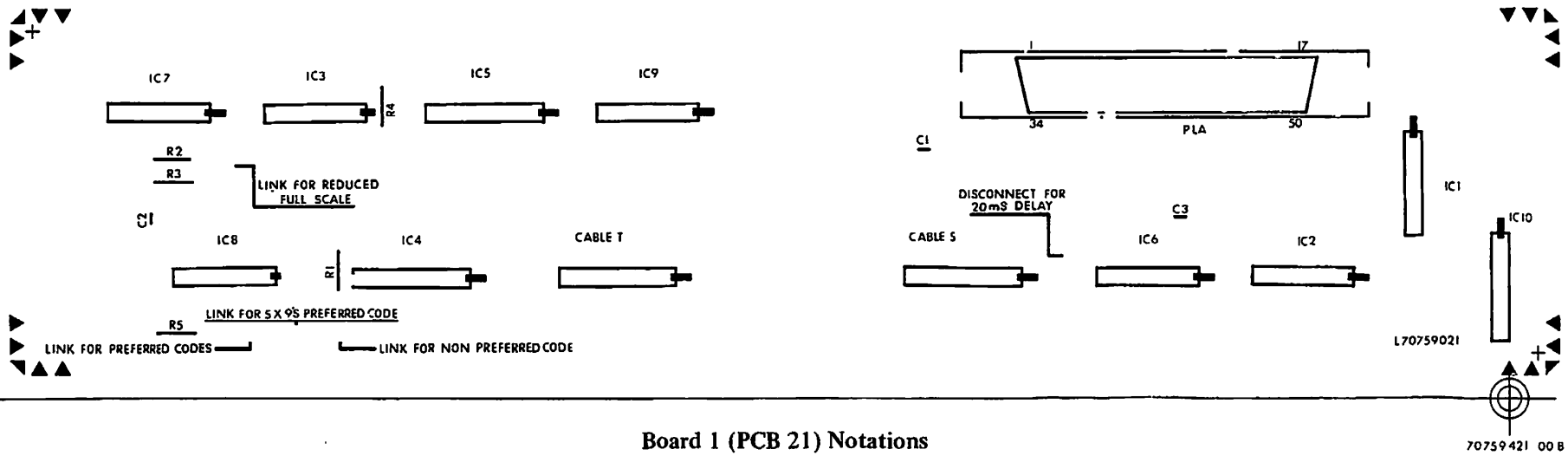
Overload (cable T pin 2) is normally active (High) for a most significant 1 on IC6a pin 6 and a "4" in the second BCD word on board 3 outputs (cable T pin 6 = high) i.e. a full scale reading of 1400000.

If link SP4 is made, full scale is reduced to 999999.

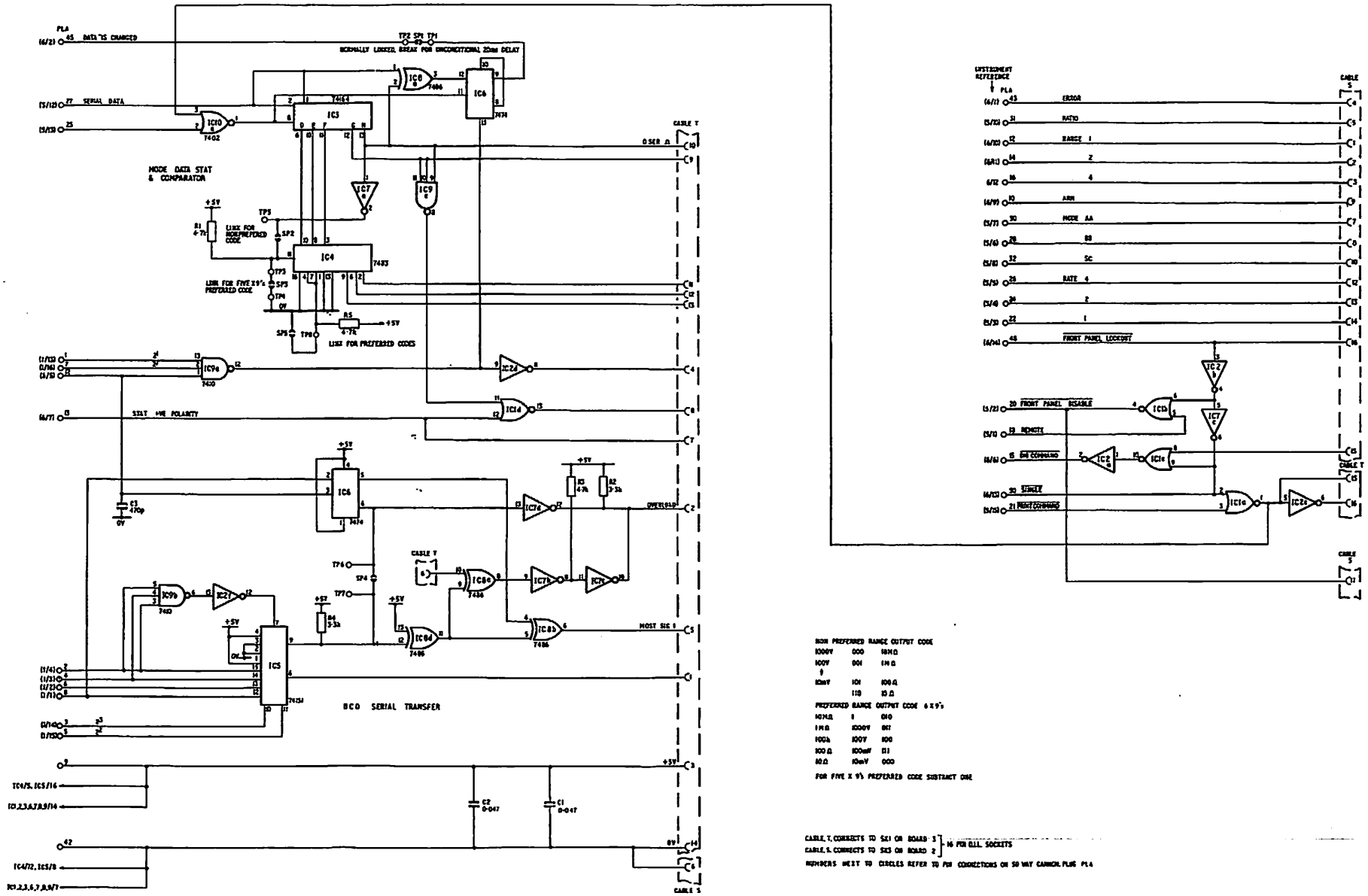
A most significant 1 detected by IC6a pin 6 forces IC5 pin 9 Low selecting, for the rest of the transfer, the BCD word 9 present on IC5 inputs 4. 3, 2, 1. This word is fed in place of the input data to board 3. Overload is than active for readings above 999999. Cable T pin 6 will be low and overload is directly determined by IC6a. Cable T pin 5 is also held at a Low.

PCB 21 Notations

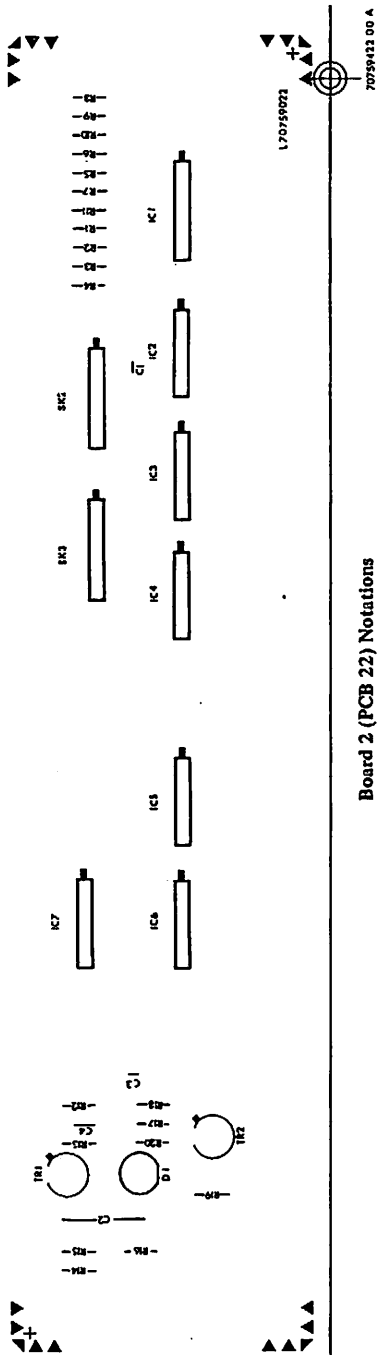
Interface Unit



Board 1 (PCB 21) Notations



Board 1 Dwg. 9.1



Board 2 (PCB 22) Notations

Board 2 Diag 9.2

RANGE COMMAND codes applied to IC1 are converted to internal codes, by incrementing by 1 for the OHMS mode and 2 for the VOLTS DC/AC mode.

IC3a, b and d disable these range commands if:–

1. ERROR is detected by the instrument on SK3 pin 4 (IC 6 pin 1 goes low).

2. in Local operation, IC7 pin 1 high→IC6 pin 6 high →IC6 pin 2 low.

3. in the Self Check mode, SK3 pin 10 low.

RATIO COMMAND (Low at SK2 pin 1) is transmitted to the instrument via SK3 pin 5 unless:–

1. It is in the OHMS mode (IC 5 pin 4 not low)

or 2. in the Self Check mode (IC 6 pin 4 low)

or 3. in Local operation (IC 7 pin 1 high).

MODE codes on SK2 pins 9 and 10 are transmitted to the instrument unless:–

1. It is the Self Check mode

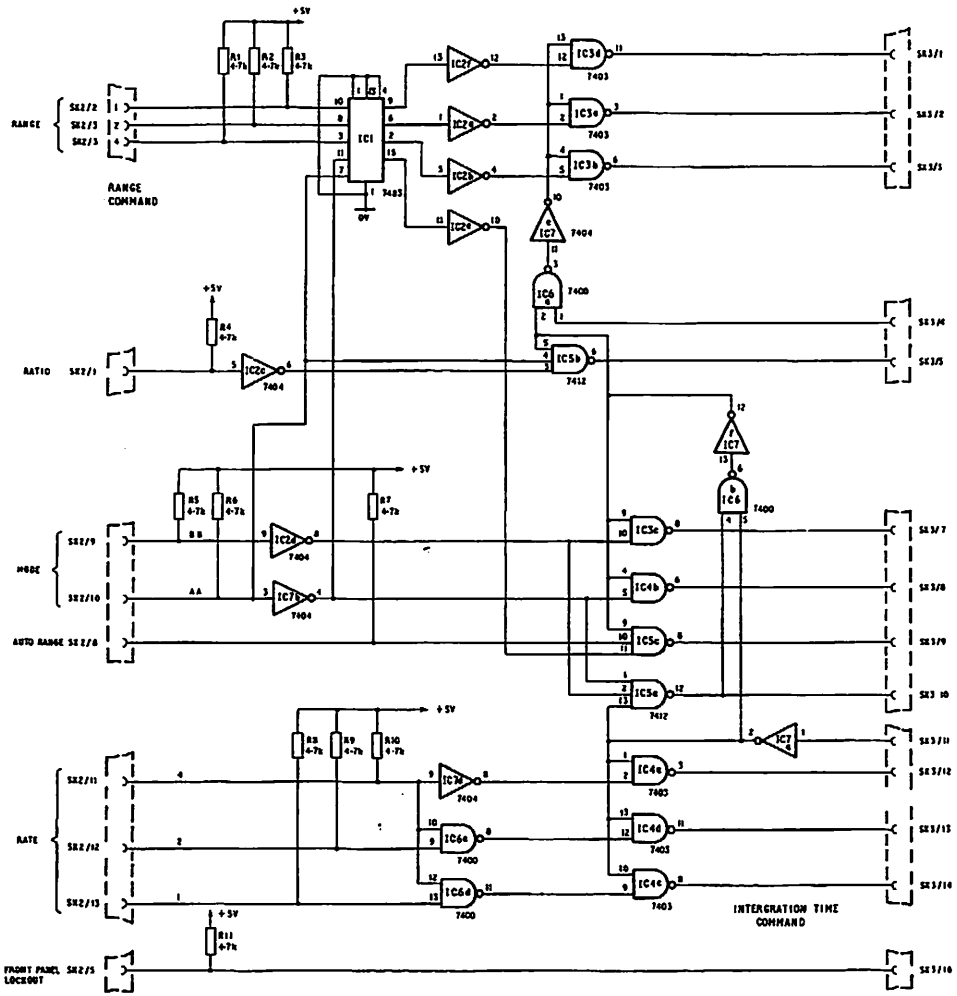
or 2. in Local operation when IC3c and IC4b will block commands.

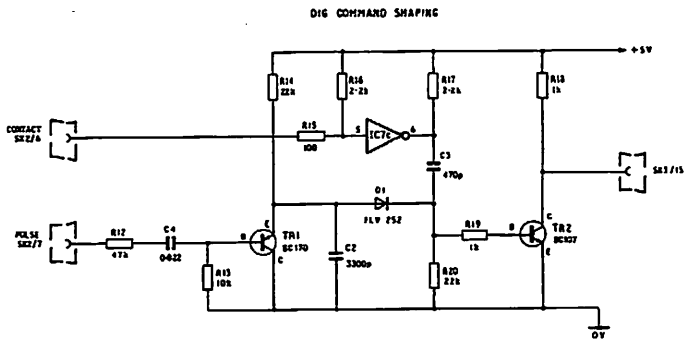
RATE COMMANDS on SK2 pins 11, 12 and 13 are transmitted to the instrument via SK3 pins 12, 13 and 14 unless it is in Local operation, when the commands will be blocked by IC4 a, c and d.

IC6c and d force code 0 on SK3 pins 12, 13 and 14 for input commands 0, 1, 2, 3. Input commands 4, 5, 6, 7 are unaffected.

CONTACT and PULSE SAMPLES are filtered for optimum noise rejection and OR-ed together to produce a low on SK3 pin 15. The specifications for these inputs are given in this section of the manual.

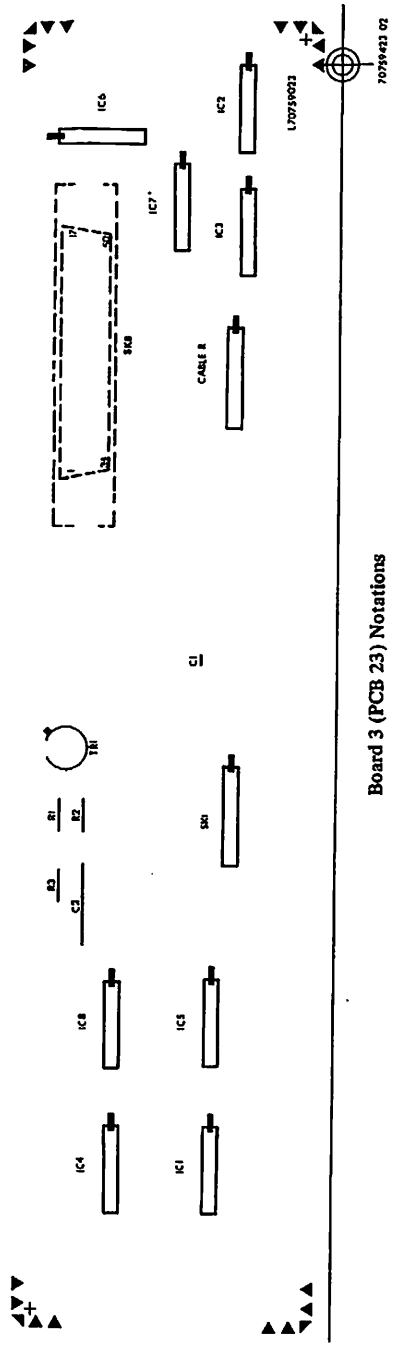
← PCB 22 Notations





SK2 CONNECTS TO CABLE A ON BOARD 3
SK3 CONNECTS TO CABLE 5 ON BOARD 1
16 PIN D.I.L. SOCKETS

Board 2 Diag. 9.2



Board 3 (PCB 23) Notations

Board 3 Diag 9.3

Input Commands on SKB are passed directly to board 2 via cable R.

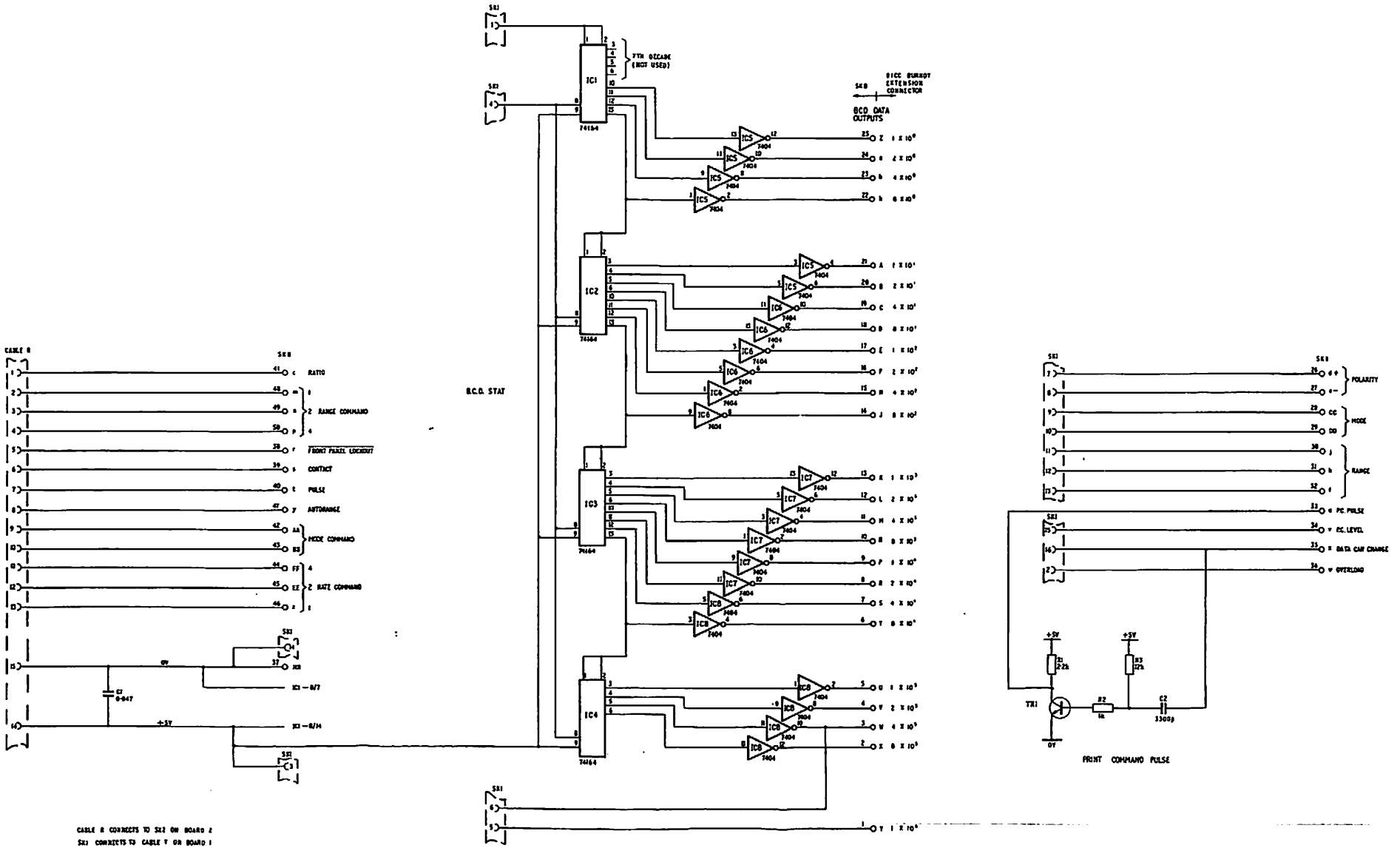
Output information from board 1 is applied directly to SKB.

A PRINT COMMAND PULSE of 12μs duration is produced by TR1 when DATA CAN CHANGE goes low.

32 clock pulses are applied to the clock inputs of shift registers IC's 1 to 4 at 800 kHZ while the serial information is applied to IC1 pins 1 and 2. The transfer lasts for 40μs. IC's 5 to 8 invert and buffer the outputs.

Note. Current jumper lead notations refer to modules ser no 000161 onwards. On modules prior to this serial number:
Cable R was annotated T.
Cable S was annotated R.
Cable T was annotated S.

← PCB 23 Notations



Board 3 Diag. 9.3

PARTS LIST

This section contains detailed parts lists for each of the printed circuit boards fitted in the Interface Unit. When ordering spare parts, it is essential to quote the instrument serial number, located on the rear panel, as well as the full description shown in the appropriate parts list.

COMPONENT PARTS LIST ABBREVIATIONS

CIRCUIT REFERENCES

AE	Aerial
B	Battery
C	Capacitor (μF)
CSR	Thyristor
D	Diode
FS	Fuse
IC	Integrated Circuit
L	Inductor
LP	Lamp (including Neon)
LK	Link
M	Motor
ME	Meter
MSP	Mains Selector Panel
PL	Plug
R	Resistor (Ω)
RE	Recording Instrument
RL	Relay
S	Switch
SK	Socket
T	Transformer
TP	Terminal Post (or Test Point)
TR	Transistor
V	Valve
X	Other Components

Also Used:-

RNL	Non Linear Resistor (Ω)
RV	Variable Resistor (Ω)

COMPONENT TYPES

Fixed Resistors		Variable Resistors		Capacitors	
Carbon Composition	CACP	Carbon Front Panel Multiturn	CAFM	Air	AIR
Carbon Film	CAFM	Carbon Front Panel Single Turn	CAFS	Aluminium Electrolytic	ALME
Cracked Carbon	CKCA	Carbon Preset Multiturn	CAPM	Aluminium Solid	ALMS
Metal Film	MEFM	Carbon Preset Single Turn	CAPS	Polycarbonate	CARB
Metal Oxide	MEOX	Cermet Front Panel Multiturn	CMFM	Ceramic	CERM
Power Wirewound	POWW	Cermet Front Panel Single Turn	CMFS	Polyester Foil	ESTF
Precision Wirewound	PRWW	Cermet Preset Multiturn	CMPM	Polyester Metallised	ESTM
Temperature Sensitive	TEMP	Cermet Preset Single Turn	CMPS	Glass	GLAS
Thick Film	TKFM	Wirewound Front Panel Multiturn	WWFM	Mica	MICA
Thin Film	TNFM	Wirewound Front Panel Single Turn	WWFS	Metallised Lacquer	MLAC
Voltage Sensitive	VOLT	Wirewound Preset Multiturn	WWPM	Paper Foil	PAPF
		Wirewound Preset Single Turn	WWPS	Paper Metallised	PAPM
				PTFE	PTFE
				Polypropylene Film	PYLN
				Polystyrene	STYR
				Tantalum Dry	TAND
				Tantalum Foil	TANF
				Tantalum Wet	TANW

PCB 21

Cct. Ref.	General Description				Solartron Part No.
R1	CACP	4.7k	1/4W	10%	172034700
R2	CACP	3.3k	1/4W	10%	172033300
R3	CACP	4.7k	1/4W	10%	172034700
R4	CACP	3.3k	1/4W	10%	172033300
R5	CACP	4.7k	1/4W	10%	172034700
C1	CERM	0.047	25V	+50% −20%	241944700
C2	CERM	0.047	25V	+50% −20%	241944700
C3	CERM	470p	500V	+50% −20%	241324700
IC1	SN7402N				510000270
IC2	SN7404N				510000410
IC3	SN74164N				510001150
IC4	SN7483N				510000840
IC5	SN74151N				510000850
IC6	SN7474N				510000490
IC7	SN7405N				510002080
IC8	SN7486N				510000650
IC9	SN7410N				510000420
IC10	SN7402N				510000270
PLA	50 way Cannon Plug DD-50P-OL1				

PCB 22

Cct. Ref.	General Description				Solartron Part No.
R1 to R12	CACP	4.7k	1/4W	10%	172034700
R13	CACP	10k	1/4W	10%	172041000
R14	CACP	2.2k	1/4W	10%	172032200
R15	CACP	100	1/4W	10%	172021000
R16	CACP	2.2k	1/4W	10%	172032200
R17	CACP	2.2k	1/4W	10%	172032200
R18	CACP	1k	1/4W	10%	172031000
R19	CACP	1k	1/4W	10%	172031000
R20	CACP	2.2k	1/4W	10%	172032200
C1	CERM	0.047	25V	+50% −20%	241944700
C2	ESTF	3300p	160V	10%	222333300
C3	CERM	470p	500V	+50% −20%	241324700
C4	ESTF	0.022	100V	10%	225442200
D1	LED	FLV252			300750090
TR1	BCY70				300553590
TR2	BC107				300553320
IC1	SN7483N				510000840
IC2	SN7404N				510000410
IC3	SN7403N				510001200
IC4	SN7403N				510001200
IC5	SN7412N				510002090
IC6	SN7400N				510000340
IC7	SN7404N				510000410
SK2	16 pin DIL				300584860
SK3	16 pin DIL				300584860

PCB 23

Cct. Ref.	General Description				Solartron Part No.
R1	CACP	2.2k	1/4W	10%	172032200
R2	CACP	1k	1/4W	10%	172031000
R3	CACP	12k	1/4W	10%	172041200
C1	CERM	0.047	25V	+50% −20%	241944700
C2	ESTF	3300p	160V	10%	222333300
TR1	BC107				300553320
IC1 to IC4	SN74164N				510001150
IC5 to IC8	SN7404N				510000410
SK1	16 pin DIL				300584860
SKB	50-way Cannon				352550110

APPENDIX

This section contains specialised selection procedures and/or test equipment to facilitate servicing.

CONTENTS

CALIBRATION COVER 70759D

INTRODUCTION

In order to achieve the greatest accuracy during a calibration it is essential that the operating temperatures affecting circuit components are as near as possible to those experienced within the instrument case during normal operation.

The calibration cover 70759D enhances the calibration accuracy by allowing access for adjustments whilst the instrument is functioning under normal working conditions.

GENERAL DESCRIPTION

The Calibration cover is basically a normal instrument top cover with holes drilled in convenient positions allowing access to the potentiometers. Fig. A1, shows the calibration cover with the access holes and the relevant potentiometers.

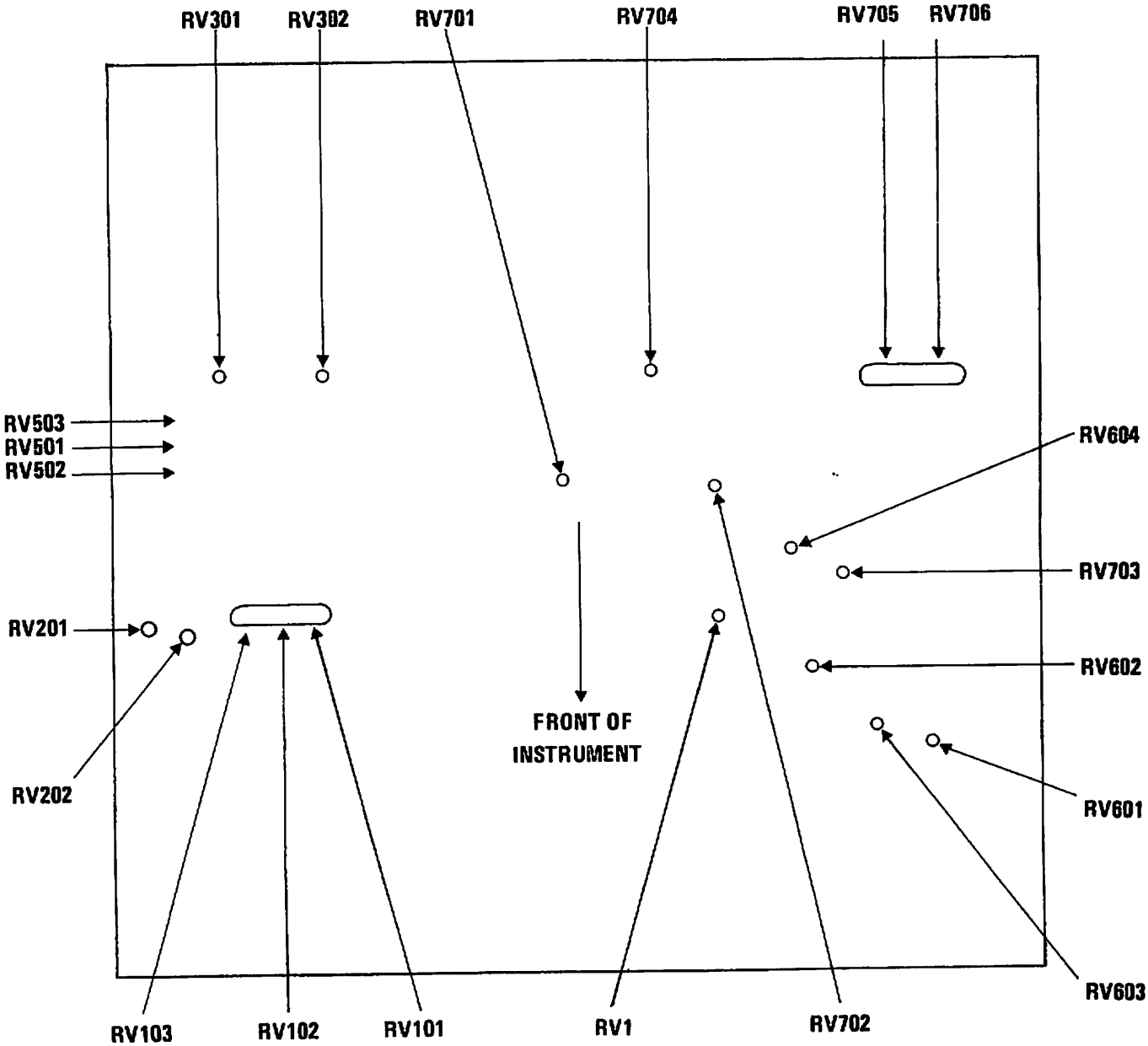


FIG. A1 View of Calibration Cover showing potentiometer access holes.