ITEM	DESCRIPTION	MANUFACTURER	QUANTITY	SEE NOTE	USED ON DRAWINGS
R.F. AMPLIFIER	A71	WATKINS-JOHNSON	1		005
R.F. AMPLIFIER	A54	WATKINS-JOHNSON	1		005
R.F. AMPLIFIER	GPD-402	AVANTEK	1		006
R.F. AMPLIFIER	GPD-403	AVANTEK	3		006,008
R.F. SPLITTER	113A	MERRIMAC	1		005
DOUBLE BALANCED MIXER	SRA-1	MINI-CIRCUITS LABORATORIES	1		006
DETECTOR DIODE	BD3, BACK DIODE	GENERAL ELECTRIC	2		008
CHIP RESISTOR	CR15, TYPE B, 5%, 27Ω	EMC TECHNOLOGY INC.	2		006
CHIP RESISTOR	CR15, TYPE B, 5%, 50Ω	EMC TECHNOLOGY INC.	1		008
CHIP RESISTOR	CR15, TYPE B, 5%, 10Ω	EMC TECHNOLOGY INC.	1	1	005
CHIP ATTENUATOR	AC0103, 3dB, 50Ω	EMC TECHNOLOGY INC.	3	2	006,008
CHIP ATTENUATOR	AC0105, 5dB, 50Ω	EMC TECHNOLOGY INC.	2	2	005,006
CHIP ATTENUATOR	AC0106, 6dB, 50Ω	EMC TECHNOLOGY INC.	2	2	005,006
TUNING CAPACITOR	AP14EI, WITH INSULATED SHAFT	VOLTRONICS	1		005
CAPACITOR	10pF S.MICA	R.S. COMPONENTS	1	3	005
CAPACITOR	220pF CERAMIC	R.S. COMPONENTS	4	4	007,008
CAPACITOR	1000pF CERAMIC	R.S. COMPONENTS	8	5	007,008,009
CAPACITOR	0.1µF CERAMIC	R.S. COMPONENTS	2	5	009
RESISTOR	150Ω THICK FILM	R.S. COMPONENTS	1	6	007
RESISTOR	220Ω THICK FILM	R.S. COMPONENTS	1	6	008
RESISTOR	330Ω THICK FILM	R.S. COMPONENTS	2	6,7	005
RESISTOR	2.2KΩ THICK FILM	R.S. COMPONENTS	12	6	007,008,009
RESISTOR	4.7KΩ THICK FILM	R.S. COMPONENTS	6	6	007,008
TRIMPOT	10KΩ, 3262W-1-103	BOURNS	2		007,008
DUAL OP.AMP	OP-10 EY	PRECISION MONOLITHICS INC.	2		007,008
OP.AMP	LF356N	NATIONAL SEMICONDUCTOR	2		009
R.F. INDUCTOR	10µH	R.S. COMPONENTS	2	8	012
LEAD THROUGH FILTER	1251-001, EMI SUPPRESSION	ERIE	14		011
SMA ~~SOCKET~~ JACK	R.125-403, 4 HOLE FLANGE SOCKET	RADIALL	3	9a	012
SMA PLUG	R.125-052, STRAIGHT SOLDER PLUG	RADIALL FRINGE	4	9b	014
MULTIWAY CONNECTOR	DB-25P	CANNON	1		010
MULTIWAY CONNECTOR	DB-25S	CANNON	1		014
SMA SOCKET JACK	2004-7985, STRAIGHT B'HEAD JACK	OMNI SPECTRA	1	9c	012
CABLE	BA50085, SEMI-RIGID	PRECISION TUBE	150 cms		011,014
LED	10mA @ 2V, TO FIT 4mm HOLE	R.S. COMPONENTS	1	10	012
CAPACITOR DRIVE	TYPE H	JACKSON BROS. ENGLAND	1	11	003
CAPACITOR DRIVE KNOB	412, MULTI-TURN, LOCKABLE	KILO	1		003
CAPACITOR DRIVE SLEEVE	RUBBER COUPLING		2 cms	12	012
SOLDER TAG	M3		1	13	012
SCREW	M2.5 x 6mm, CHEESE HEAD		65	13	012
SCREW	M2.5 x 16mm, C/SUNK HEAD		7	13	012
SCREW	M3 x 6mm, CHEESE HEAD		3	13	012
INTERCONNECTING WIRE	7/0.2mm, INSULATED COPPER				010,012
INTERCONNECTING WIRE	1/0.6mm, BARE COPPER		15 cms		005,006,012 / 007,008,009
SLEEVING	AS REQUIRED, FOR ABOVE				
SOLDER	LOW MELTING POINT, PASTE	MULTICORE		14	011
	TLC - PRB3				
REED SWITCH	MINI-2S, 7-12 AT	HAMLIN COMPANY WILL SEND 5 UNITS		15	004
SMA PHASE ADJUSTER	901-508, IN-LINE ADAPTOR	AMPHENOL	1		014
MODULE FRAME ASSY.	PTG/NMR/002				012
CAPACITOR DRIVE ASSY.	PTG/NMR/003				012
REED RELAY ASSY.	PTG/NMR/004				012
LEAD THROUGH B'HEAD ASSY.	PTG/NMR/011				012
STAR WASHER	9.5mm I/D, 17mm O/D (max)				012
WASHER	M2.5, PLAIN, BRASS		33		012
SCREW	M4 x 6mm, C/SUNK HEAD		1		002

DIMENSIONS IN: EXCEPT AS STATED
SURFACE TEXTURE: EXCEPT AS STATED
SYMBOLS TO BS ALLOW EXTRA THICKNESS FOR FINISHING ON FACES
TOLERANCES EXCEPT AS STATED
INTERNAL SURFACES PLUS TOL — EXTERNAL SURFACES PLUS TOL
MINUS TOL — CENTRES & CENTRES TO FACES PLUS OR
MINUS HALF TOL
CLEARANCE ON MACHINED DIMENSIONS
DRAWN
CHECKED
TRACED
CHECKED
APPROVED
PROJECT
TITLE
UNIVERSITY OF [illegible]
[illegible] DEPARTMENT
NMR RF MODULE
PARTS LIST
DRAWING NUMBER: PTG/NMR/001
ARRGT. DRG: -
SCALE: -
LATEST IS:

Note 1. This is a nominal value only. The final choice depends on the r.f. characteristics of the tuned circuit. This resistor could possibly be of the "thick film" type (see note 6) if these have a low inductance at the NMR frequency.

Note 2. These are nominal values only. The actual signal attenuation required depends on the r.f. characteristics of the tuned circuit and on the actual performance of the r.f. amplifiers used. Other values of attenuator (e.g. 2dB, 4dB, 7dB etc.) should be available for any necessary gain trimming during setting up.

Note 3. Or a component of similar specification to:-

SILVERED MICA : Solid wax impregnation with tough cement coating.
Tol. ±0.5pF, Temp. Coeff. Approx. 100 p.p.m./°C.
Dimensions 13mm x 8mm x 3.2mm
Lead Pitch 8.5mm

This is a nominal value only. The final choice depends on the r.f. characteristics of the tuned circuit.

Note 4. Or a component of similar specification to:-

SUB-MINIATURE PLATE CERAMIC : Metalised ceramic plate capacitor having close tolerance, high stability and low loss.
Tol. ± 2%
Dimensions 6.5mm x 2.5mm x 7.5mm
Lead Pitch 2.5mm

Note 5. Or a component of similar specification to:-

MONOLITHIC CERAMIC : Epoxy encapsulated plate ceramic capacitor, giving small physical size for a high capacity.
Tol. ± 10%
Dimensions 5.1mm x 5.1mm x 2.5mm (.001μF)
7.6mm x 7.6mm x 2.5mm (.1 μF)
Lead Pitch 5.1mm

Note 6. Or a component of similar specification to:-

0.5W THICK FILM : Cermet type film on ceramic substrate.
Tol. ± 2%, Temp.Coeff. ± 100 p.p.m./°C, noise level .1μV/V
Length 6.5mm, diameter 2.4mm
Lead Diameter 0.64mm

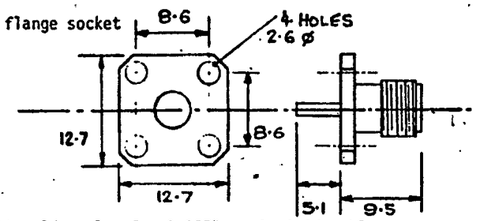
Note 7. This is a nominal value only. The final choice of constant current feed resistors depends on the r.f. characteristics of the tuned circuit.

Note 8. Or a component of similar specification to:-

R.F. INDUCTOR : Ferrite based coil former encapsulated in polypropylene outer case. Axial lead terminations.
Tol. ± 10%
Length 11.4mm, diameter 5.2mm
Lead Diameter 0.8mm

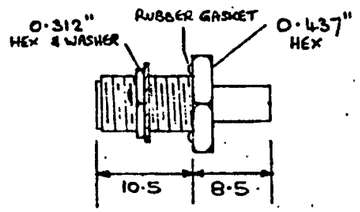
Note 9. Or similar SMA connectors to the following:-

a) 4 hole flange socket



b) straight solder plug for 0.085" semi-rigid cable

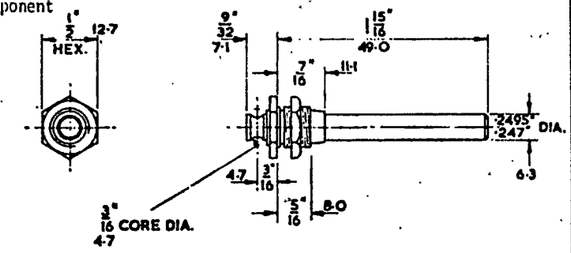
c) straight bulkhead cable jack for 0.085" semi-rigid cable



Note 10. Or a component of similar specification to:-

LED : Push fit into 4mm hole. 2v at typical forward current of 10mA.
Length 9mm, diameter 5.6mm

Note 11. See drawing no. PTG/NMR/003 for modifications to be made to this component



Note 12. Provided

Note 13. Or nearest locally available size. Specifications of metric threads are:-

SIZES IN MM's	ISO-METRIC COARSE THREADS											SIZES IN MM's
Nominal Size and Symbol	Pitch	Major Diameter	Effective Diameter	Minor Diameters: Ext. Thds. (Bolts) 'a' Class 4h	Ext. Thds. (Bolts) 'a' 6g	Ext. Thds. (Bolts) 'a' 8g	Int. Thds. (nuts) 'b' 5H,6H,7H	Section at Minor Diameter 'd'	Tensile Stress Area 'e'	Depth of External Thread 0·6134p	Tapping Drills: Recommended	Tapping Drills: Alternative	Clearance Drills
M1	0·25	1·000	0·838	0·693	0·675	—	0·729	0·377	0·460	0·1534	0·75	0·78	1·05
M1·1*	0·25	1·100	0·938	0·793	0·775	—	0·829	0·494	0·588	0·1534	0·85	0·88	1·15
M1·2	0·25	1·200	1·038	0·893	0·875	—	0·929	0·626	0·732	0·1534	0·95	0·98	1·25
M1·4*	0·30	1·400	1·205	1·032	1·014	—	1·075	0·837	0·982	0·1840	1·10	1·15	1·45
M1·6	0·35	1·600	1·373	1·170	1·151	—	1·221	1·08	1·27	0·2147	1·25	1·30	1·65
M1·8*	0·35	1·800	1·573	1·370	1·351	—	1·421	1·48	1·70	0·2147	1·45	1·50	1·85
M2	0·40	2·000	1·740	1·509	1·490	—	1·567	1·79	2·07	0·2454	1·60	1·65	2·05
M2·2*	0·45	2·200	1·908	1·648	1·628	—	1·713	2·13	2·48	0·2760	1·75	1·80	2·25
M2·5	0·45	2·500	2·208	1·948	1·928	—	2·013	2·98	3·39	0·2760	2·05	2·10	2·60
M3	0·50	3·000	2·675	2·387	2·367	—	2·459	4·47	5·03	0·3067	2·50	2·55	3·10
M3·5*	0·60	3·500	3·110	2·764	2·743	—	2·850	6·00	6·78	0·3681	2·90	2·95	3·60
M4	0·70	4·000	3·545	3·141	3·119	—	3·242	7·75	8·78	0·4294	3·30	3·40	4·10
M4·5*	0·75	4·500	4·013	3·580	3·558	—	3·688	10·1	11·3	0·4601	3·70	3·80	4·60
M5	0·80	5·000	4·480	4·019	3·995	3·995	4·134	12·7	14·2	0·4908	4·20	4·30	5·10
M6	1·00	6·000	5·350	4·773	4·747	4·747	4·917	17·9	20·1	0·6134	5·00	5·10	6·10
M7†	1·00	7·000	6·350	5·773	5·747	5·747	5·917	26·2	28·9	0·6134	6·00	6·10	7·20
M8	1·25	8·000	7·188	6·466	6·438	6·438	6·647	32·8	36·6	0·7668	6·80	6·90	8·20
M9†	1·25	9·000	8·188	7·466	7·438	7·438	7·647	43·8	48·1	0·7668	7·80	7·90	9·20
M10	1·50	10·000	9·026	8·160	8·128	8·128	8·376	52·3	58·0	0·9202	8·50	8·60	10·20
M11†	1·50	11·000	10·026	9·160	9·128	9·128	9·376	65·9	72·3	0·9202	9·50	9·60	11·20
M12	1·75	12·000	10·863	9·853	9·819	9·819	10·106	76·2	84·3	1·0735	10·20	10·40	12·20

Note 14. Or a similar solder cream. See recommendations of manufacturer of item "LEAD THROUGH FILTER" in parts list.

TLC 50/32/18 Sn/Pb/Cd Melting temp 145°C
P Paste
R Resin flux
B Powder mesh size 200
3 11 - 15% flux.

Note 15. This reed switch, together with a specially designed coil and former, is an optional item. When fitted it can be used to remove the r.f. voltage from the NMR tuned circuit.

DATE SEPT 80	DIMENSIONS IN EXCEPT AS STATED	TOLERANCES EXCEPT AS STATED	DRAWN	PROJECT NMR RF MODULE	ARRGT. DRG. -
SIG. DWG.	SURFACE TEXTURE EXCEPT AS STATED ▽ = ▽SYMBOLS TO BS. 1134 ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ▽	INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL. TOLERANCE ON MACHINED DIMENSIONS: 0-250mm TOL 0.25mm (0-10" TOL .010") OVER 250-500mm TOL 0.5mm (OVER 10-20" TOL .020") OVER 500-1000mm TOL 0.75mm (OVER 20-40" TOL .030") OVER 1000mm TOL 1mm (OVER 40" TOL .040")	CHECKED	TITLE PARTS LIST	SCALE
	SCREW THREADS EXCEPT AS STATED METRIC TO BS. 3643 6H/6g CLASS WHIT. FORM TO BS. 84 MEDIUM CLASS B.A. TO BS. 93 NORMAL CLASS WELDING SYMBOLS TO BS 499 DRAWING SYMBOLS, NOTES, ETC. TO BS. 308	TOL. ON UNMACHINED DIMS TWICE TOL FOR MACH. DIMS TOLERANCE ON ANGULAR DIMENSIONS ± 1°	TRACED		
			CHECKED		
A			APPROVED	UNIVERSITY OF LIVERPOOL OLIVER LODGE LABORATORIES DEPARTMENT OF PHYSICS	DRAWING NUMBER
DEDICATION					

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TELEX 348-415

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TEL. (714) 593-4626

USEFUL REFERENCES

1. "Thin Film Cascadable Amplifiers"
   Application Note by Watkins-Johnson, 100051-07A, August 1975

2. "Microwave Component Applications - Designing with Modular Amplifiers"
   by Avantek, 1976

3. "Designing With GPD Amplifiers"
   by Avantek, Second Edition 1975

4. "Mixer Applications Handbook"
   by Mini-Circuits Laboratory.

DATE SEPT. 80
SIG DWG.
APPLICATION

DIMENSIONS IN EXCEPT AS STATED
SURFACE TEXTURE EXCEPT AS STATED
▽ = ▽SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ▽
SCREW THREADS EXCEPT AS STATED
METRIC TO BS. 3643 6H/6g CLASS
WHIT. FORM TO BS. 84 MEDIUM CLASS
B.A. TO BS. 93 NORMAL CLASS
WELDING SYMBOLS TO BS. 499
DRAWING SYMBOLS, NOTES, ETC. TO BS. 308

TOLERANCES EXCEPT AS STATED
INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.
TOLERANCE ON MACHINED DIMENSIONS:
0-250mm TOL. 0,25mm (0-10" TOL. ·010")
OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020")
OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030")
OVER 1000mm TOL. 1mm (OVER 40" TOL 040")
TOL. ON UNMACHINED DIMS TWICE TOL FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1°

DRAWN
CHECKED
TRACED
CHECKED
APPROVED

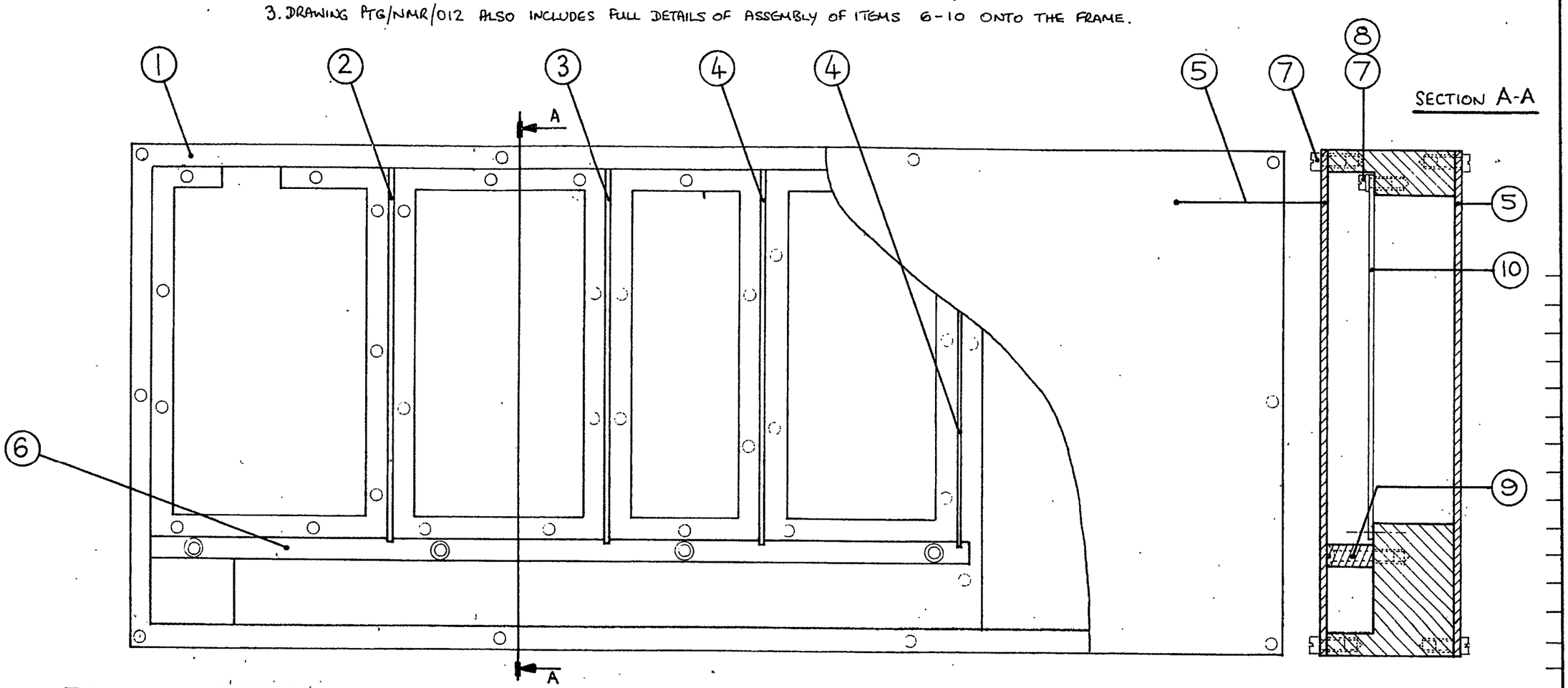
PROJECT NMR RF MODULE
TITLE PARTS LIST
ARRGT. DRG. –
SCALE –

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER PTG/NMR/001
SHEET 3 OF 3
LATEST ISSUE

DO NOT SCALE | THIRD ANGLE PROJECTION | REMOVE ALL BURRS AND SHARP EDGES

NOTES: 1. PRINTED CIRCUIT SIDE COVER CUT AWAY TO SHOW INTERIOR.
2. FIXING OF ADDITIONAL ELECTRICAL ITEMS SHOWN ON DRAWING PTG/NMR/012 (MODULE ASSEMBLY)
3. DRAWING PTG/NMR/012 ALSO INCLUDES FULL DETAILS OF ASSEMBLY OF ITEMS 6-10 ONTO THE FRAME.



						5	COVER	COPPER		PTG/NMR/002 SHEET 6	2
						4	BULKHEAD	COPPER		PTG/NMR/002 SHEETS 3 & 4	2
10	TYPICAL PRINTED CIRCUIT BOARD	–	SHOWN TO ILLUSTRATE FITTING ONLY.	–	–	3	BULKHEAD	COPPER			1
9	SCREW, M2.5 x 16mm CSK/HD	BRASS	SEE MODULE ASSEMBLY DWG., PTG/NMR/012, FOR FULL DETAILS AND FITTING	–	–	2	BULKHEAD	COPPER			1
8	WASHER, M2.5, PLAIN	BRASS		–	–	1	MODULE FRAME	COPPER	SEE MANUF. & ASSY. INSTRUCTION	PTG/NMR/002 SHEET 1	1
7	SCREW, M2.5 x 6mm CH/HD	BRASS		–	–	ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.
6	LEADTHROUGH BULKHEAD	COPPER	–	PTG/NMR/002 SHEET 5	1	PARTS LIST					

DIMENSIONS IN mm EXCEPT AS STATED

SURFACE TEXTURE EXCEPT AS STATED
√ = √SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED √

SCREW THREADS EXCEPT AS STATED
METRIC TO BS. 3643 6H/6g CLASS
WHIT. FORM TO BS. 84 MEDIUM CLASS
B.A. TO BS. 93 NORMAL CLASS
WELDING SYMBOLS TO BS. 499
DRAWING SYMBOLS, NOTES, ETC TO BS. 308

TOLERANCES EXCEPT AS STATED
INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.

TOLERANCE ON MACHINED DIMENSIONS:
0-250mm TOL. 0,25mm (0-10" TOL. ·010")
OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020")
OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030")
OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")

TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

DRAWN	DWG
CHECKED	
TRACED	
CHECKED	
APPROVED	

PROJECT: NMR RF MODULE
ARRGT. DRG.: –
TITLE: MODULE FRAME ASSEMBLY
SCALE: 1:1

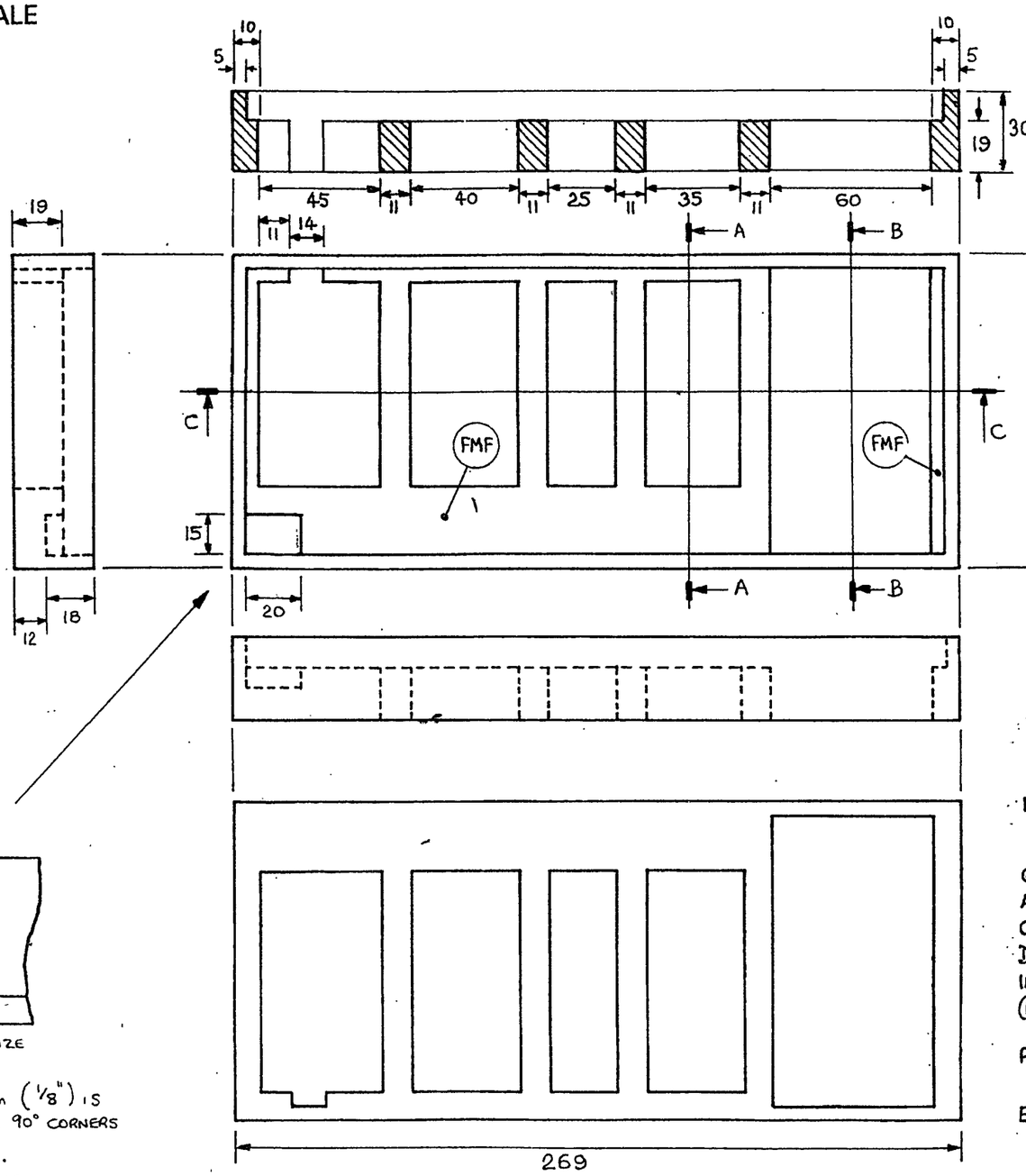
UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

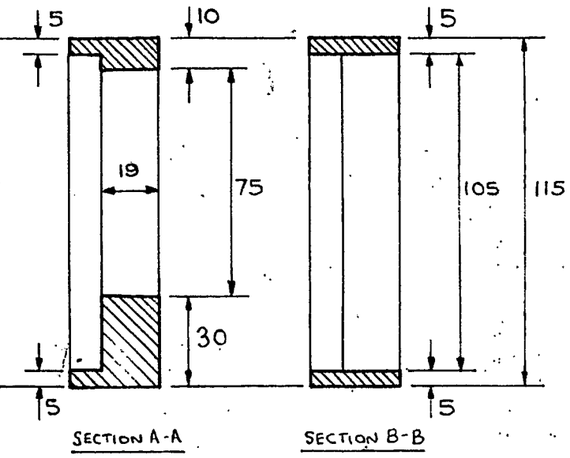
DRAWING NUMBER: PTG/NMR/002
SHEET 1 OF 9
LATEST ISSUE:

DATE Oct 80
DWG

DO NOT SCALE

REMOVE ALL BURRS AND SHARP EDGES

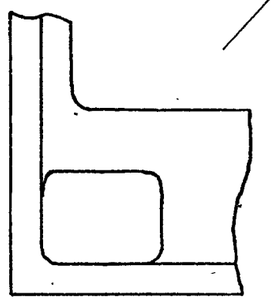




SECTION C-C

SECTION A-A

SECTION B-B



SCALE - FULL SIZE

A MAXIMUM RADIUS OF 3mm (1/8") IS ALLOWABLE ON ALL INSIDE 90° CORNERS SHOWN ON THE PLAN VIEW. AN EXAMPLE IS SHOWN ABOVE.

ITEM 1 - MODULE FRAME

MATERIAL : FREE MACHINING (~0·5% TELLURIUM) COPPER PLATE.
IT IS ESSENTIAL THAT THE MATERIAL USED HAS GOOD ELECTRICAL & THERMAL CONDUCTIVITY. WE HAVE USED BOTH A COPPER CASTING AND FREE MACHINING COPPER PLATE. BOTH WERE COMPLETELY SATISFACTORY, BUT OUR WORKSHOP HAD MORE DIFFICULTY WITH THE CASTING BECAUSE OF BLOW HOLES AND HARD INCLUSIONS. WE HAVE ALSO MANUFACTURED A BRASS FRAME (FROM PLATE) BUT THIS HAS NOT YET BEEN TESTED.

FINISH : FINE MACHINE FINISH ON ALL OUTSIDE FACES, AND ON INTERNAL SHELF FACE MARKED :- (FMF)
ELSEWHERE CAN BE ROUGH MACHINE FINISH.

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

DRAWN	DWG.	PROJECT	NMR RF MODULE
CHECKED			
TRACED		TITLE	MODULE FRAME ASSEMBLY.
CHECKED			
APPROVED			

ARRGT. DRG. SHEET 1

SCALE 1/2 SIZE

DRAWING NUMBER PTG/NMR/002

LATEST ISS

SHEET 2 OF 9

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DIMENSIONS IN mm EXCEPT AS STATED

SURFACE TEXTURE EXCEPT AS STATED
▽ = ▽SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ▽

SCREW THREADS EXCEPT AS STATED
METRIC TO BS. 3643 6H/6g CLASS
WHIT. FORM TO BS. 84 MEDIUM CLASS
B.A. TO BS. 93 NORMAL CLASS
WELDING SYMBOLS TO BS. 499
DRAWING SYMBOLS, NOTES, ETC. TO BS. 308

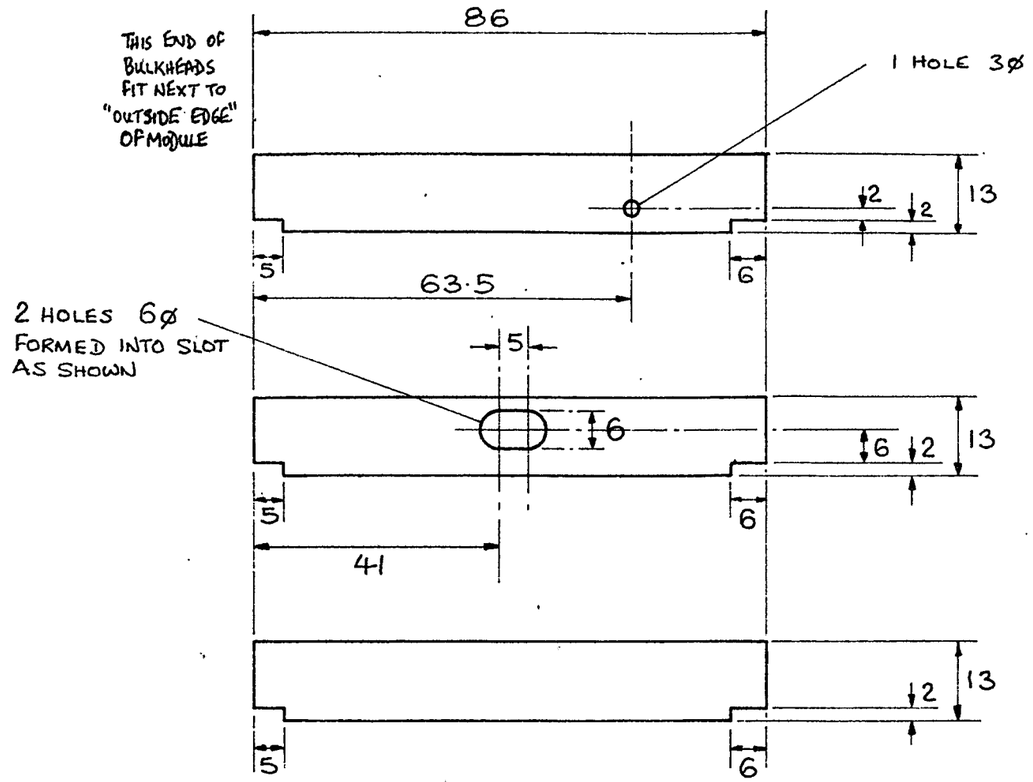
TOLERANCES EXCEPT AS STATED
INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.
TOLERANCE ON MACHINED DIMENSIONS:
0-250mm TOL. 0,25mm (0-10" TOL. ·010")
OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020")
OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030")
OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")
TOL. ON UNMACHINED DIMS TWICE TOL FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

A	DATE	SEPT 80
	SIG.	DWG.
MODIFICATION		

DO NOT SCALE

THIRD ANGLE PROJECTION

REMOVE ALL BURRS AND SHARP EDGES



ITEM 2 , 1 OFF

ITEM 3 , 1 OFF

ITEM 4 , 2 OFF

MATERIAL : HIGH CONDUCTIVITY COPPER SHEET
NOM. THICKNESS 1mm

FINISH : CLEAN

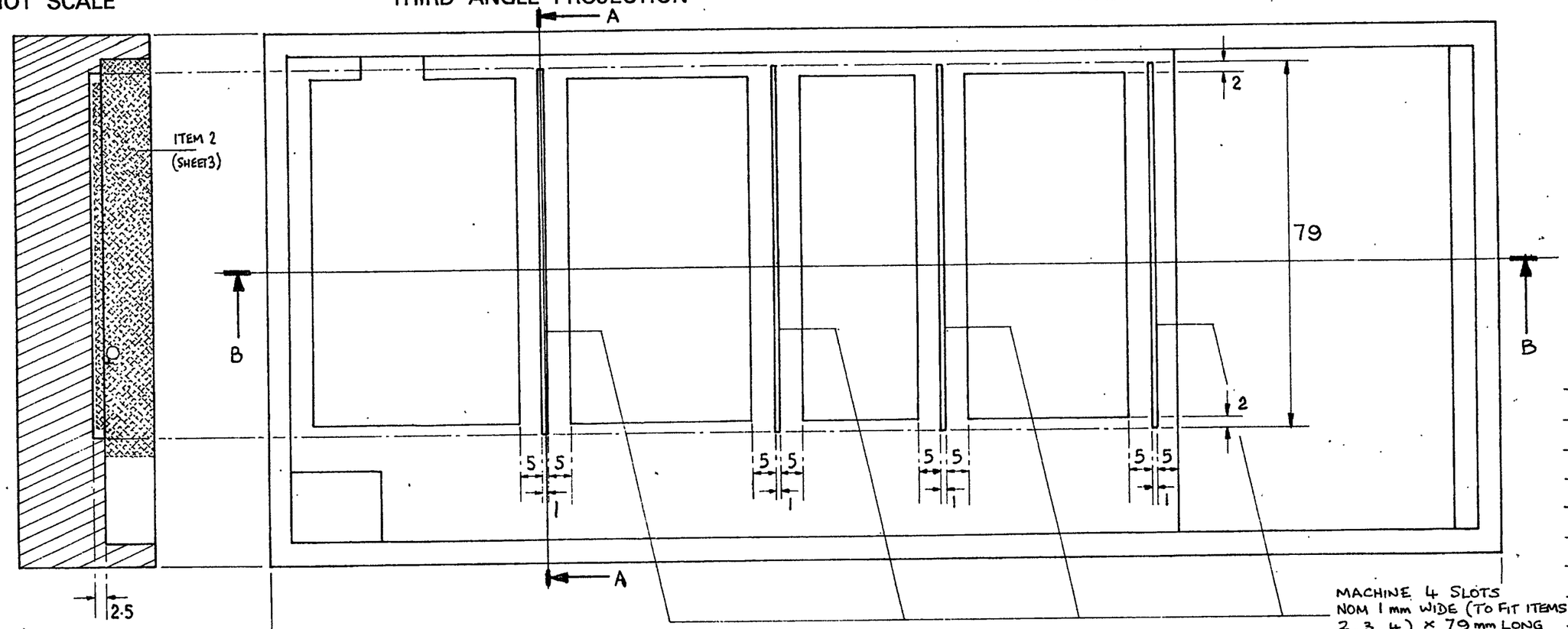
ITEMS 2,3,4 BULKHEADS

A DATE Oct 80 SIG. Dwg. MODIFICATION	DIMENSIONS IN mm EXCEPT AS STATED SURFACE TEXTURE EXCEPT AS STATED √ = √SYMBOLS TO BS. 1134 ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED √ SCREW THREADS EXCEPT AS STATED METRIC TO BS. 3643 6H/6g CLASS WHIT. FORM TO BS. 84 MEDIUM CLASS B.A. TO BS. 93 NORMAL CLASS WELDING SYMBOLS TO BS. 499 DRAWING SYMBOLS, NOTES, ETC. TO BS. 308	TOLERANCES EXCEPT AS STATED INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL. TOLERANCE ON MACHINED DIMENSIONS: 0-250mm TOL. 0,25mm (0-10" TOL. ·010") OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020") OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030") OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040") TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS. TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°	DRAWN DWG. CHECKED TRACED CHECKED APPROVED	PROJECT NMR RF MODULE TITLE MODULE FRAME ASSEMBLY UNIVERSITY OF LIVERPOOL OLIVER LODGE LABORATORY DEPARTMENT OF PHYSICS	ARRGT. DRG. SHEET 1 SCALE 1:1 DRAWING NUMBER PTG/NMR/002 SHEET 3 OF 9 LATEST ISSUE

DO NOT SCALE

THIRD ANGLE PROJECTION

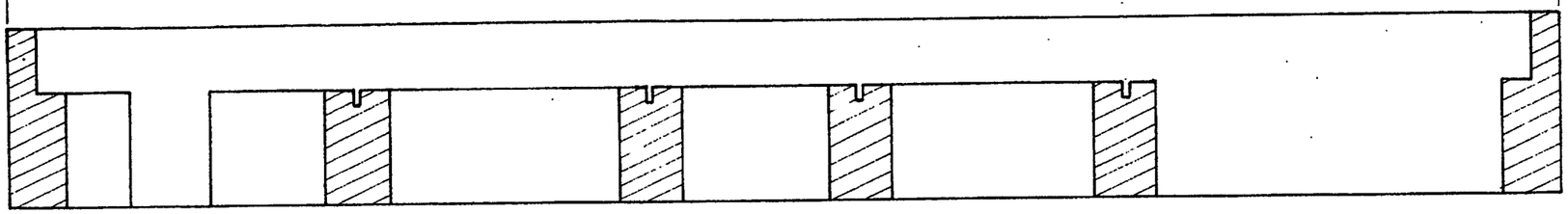
REMOVE ALL BURRS AND SHARP EDGES



SECTION A-A

(THROUGH TYPICAL MACHINED SLOT)

MACHINE 4 SLOTS NOM 1 mm WIDE (TO FIT ITEMS 2, 3, 4) × 79 mm LONG × 2.5 mm DEEP



SECTION B-B

BULKHEAD (ITEMS 2,3,4) FITTING

NOTES

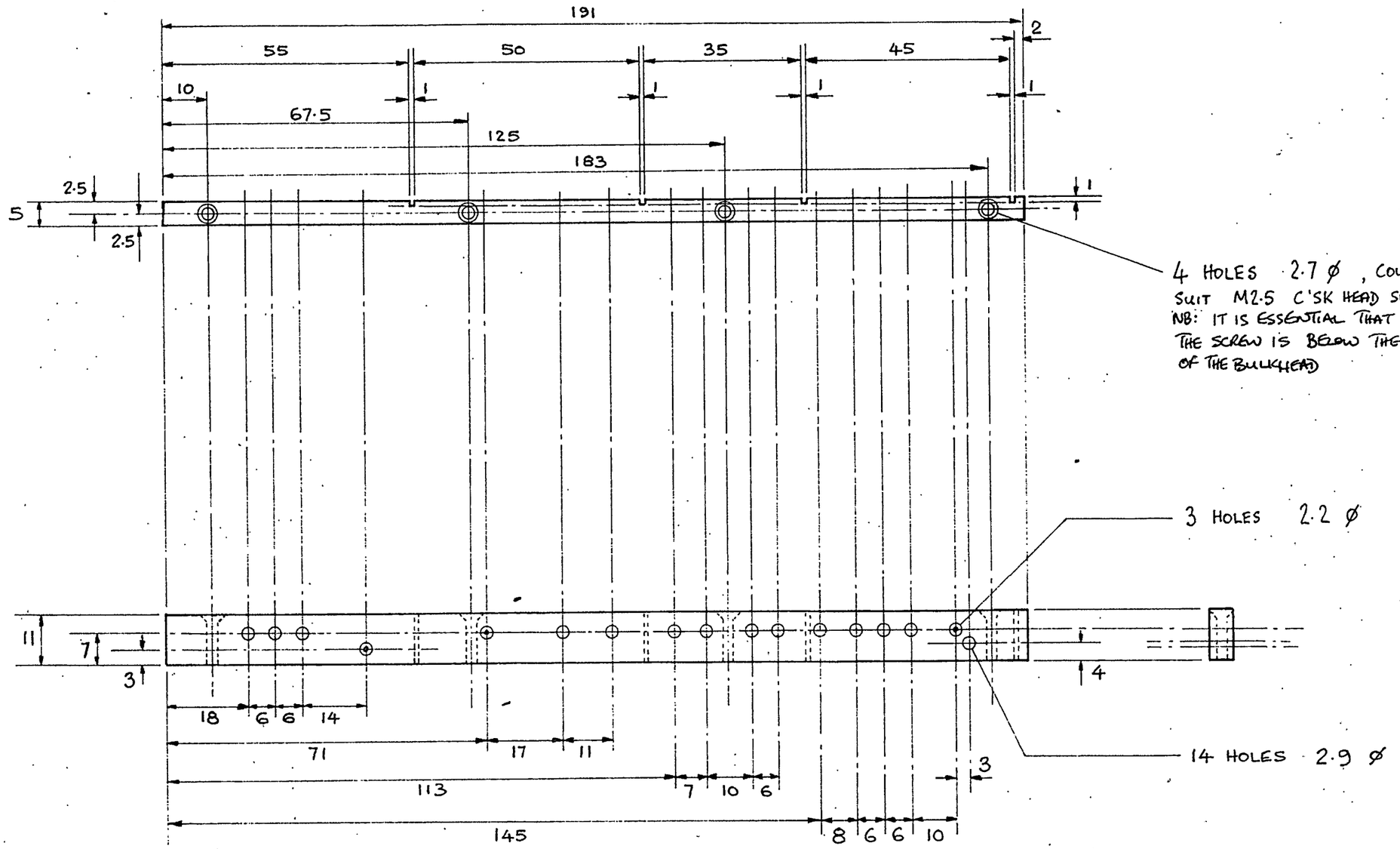
1. ITEMS 2,3,4 (SHEET 3) TO BE SOFT SOLDERED INTO RESPECTIVE MACHINED SLOTS AS SHOWN IN ASSEMBLY DRAWING (SHEET 1). ENSURE CORRECT ORIENTATION ("OUTSIDE EDGE" OF BULKHEAD AT TOP OF DRAWING)
2. FOR EASE OF ASSEMBLY THESE BULKHEADS CAN BE HELD IN THE CORRECT UPRIGHT POSITION BY THE LEAD THROUGH BULKHEAD (ITEM 6), PROVIDED THAT THE FIXING HOLES FOR ITEM 6 HAVE BEEN PREVIOUSLY DRILLED AND TAPPED.
   — IF THIS METHOD IS USED, CARE MUST BE TAKEN AS ON NO ACCOUNT SHOULD THE LEAD THROUGH BULKHEAD BE SOLDERED DOWN!
3. ITEM 2 HAS BEEN ADDED TO THE SECTION A-A, TO ILLUSTRATE FITTING

	DIMENSIONS IN mm EXCEPT AS STATED	TOLERANCES EXCEPT AS STATED	DRAWN Dwf	PROJECT NMR RF MODULE		ARRGT. DRG. SHEET 1
	SURFACE TEXTURE EXCEPT AS STATED ✓ = ✓SYMBOLS TO BS. 1134 ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ✓	INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL. TOLERANCE ON MACHINED DIMENSIONS: 0-250mm TOL. 0,25mm (0-10" TOL. ·010") OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020") OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030") OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")	CHECKED			SCALE 1:1
	SCREW THREADS EXCEPT AS STATED METRIC TO BS. 3643 6H/6g CLASS WHIT. FORM TO BS. 84 MEDIUM CLASS B.A. TO BS. 93 NORMAL CLASS WELDING SYMBOLS TO BS. 499 DRAWING SYMBOLS, NOTES, ETC. TO BS. 308	TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS. TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°	TRACED	TITLE MODULE FRAME ASSEMBLY		
A DATE OCT 80 SIG. Dwf MODIFICATION			CHECKED			
			APPROVED	UNIVERSITY OF LIVERPOOL OLIVER LODGE LABORATORY DEPARTMENT OF PHYSICS	DRAWING NUMBER PTG/NMR/002 SHEET 4 OF 9	LATEST ISSUE

DO NOT SCALE

THIRD ANGLE PROJECTION

REMOVE ALL BURRS AND SHARP EDGES



ITEM 6 - LEAD THROUGH BULKHEAD - 1 OFF

MATERIAL : HIGH CONDUCTIVITY, FREE MACHINING COPPER BAR.

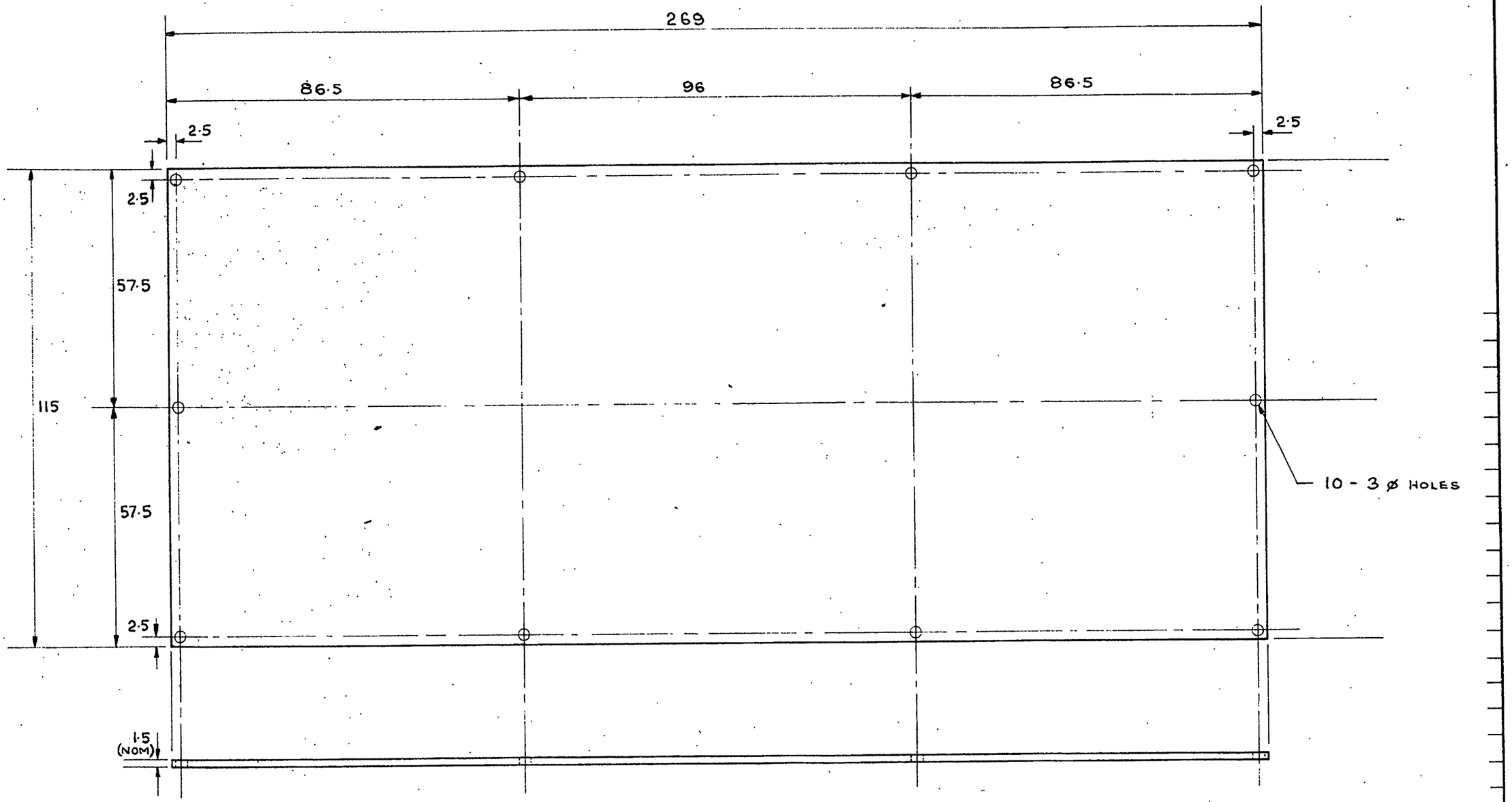
FINISH : CLEAN

A DATE Oct·80 SIG. Duf. MODIFICATION	DIMENSIONS IN mm EXCEPT AS STATED SURFACE TEXTURE EXCEPT AS STATED √ = √SYMBOLS TO BS. 1134 ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED √ SCREW THREADS EXCEPT AS STATED METRIC TO BS. 3643 6H/6g CLASS WHIT. FORM TO BS. 84 MEDIUM CLASS B.A. TO BS. 93 NORMAL CLASS WELDING SYMBOLS TO BS. 499 DRAWING SYMBOLS, NOTES, ETC. TO BS. 308	TOLERANCES EXCEPT AS STATED INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL. TOLERANCE ON MACHINED DIMENSIONS: 0-250mm TOL. 0,25mm (0-10" TOL. ·010") OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020") OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030") OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040") TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS. TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°	DRAWN DWG. CHECKED TRACED CHECKED APPROVED	PROJECT NMR RF MODULE TITLE MODULE FRAME ASSEMBLY UNIVERSITY OF LIVERPOOL OLIVER LODGE LABORATORY DEPARTMENT OF PHYSICS	ARRGT. DRG. SHEET 1. SCALE 1:1 DRAWING NUMBER PTG/NMR/002 SHEET 5 OF 9 LATEST ISSUE

DO NOT SCALE

THIRD ANGLE PROJECTION

REMOVE ALL BURRS AND SHARP EDGES



MATERIAL: HIGH CONDUCTIVITY COPPER SHEET
NOM. THICKNESS 1·5 mm

FINISH : CLEAN

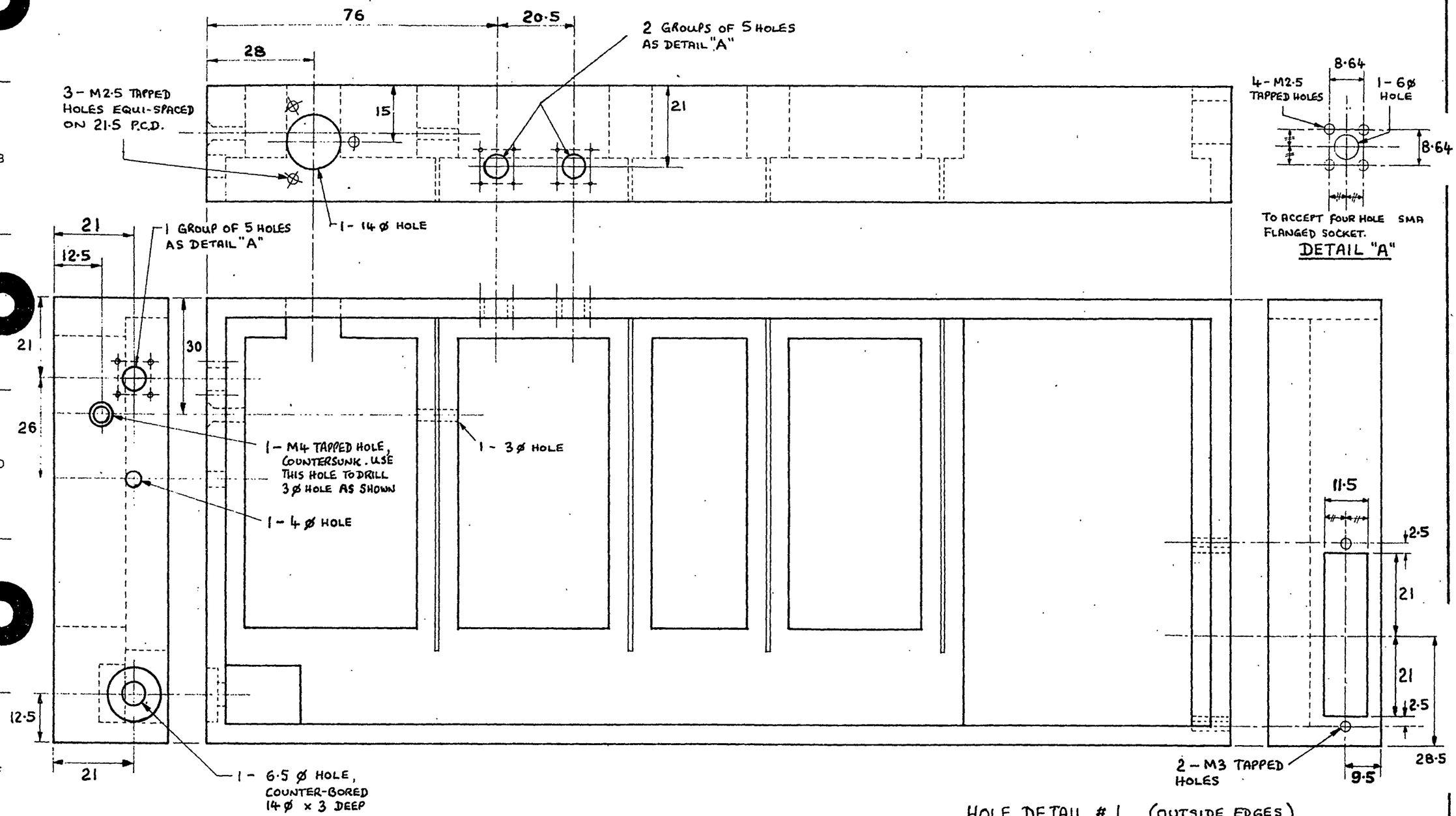
ITEM 5 - COVER - 2 OFF

A	DATE Oct 80	DIMENSIONS IN mm EXCEPT AS STATED	TOLERANCES EXCEPT AS STATED	DRAWN	DWG.	PROJECT NMR RF MODULE	ARRGT. DRG. SHEET 1
	SIG. DWG.	SURFACE TEXTURE EXCEPT AS STATED	INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.	CHECKED			
		∇ = ∇ SYMBOLS TO BS. 1134 ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ∇	TOLERANCE ON MACHINED DIMENSIONS: 0-250mm TOL. 0,25mm (0-10" TOL. ·010") OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020") OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030") OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")	TRACED		TITLE MODULE FRAME ASSEMBLY	SCALE 1:1
		SCREW THREADS EXCEPT AS STATED METRIC TO BS. 3643 6H/6g CLASS WHIT. FORM TO BS. 84 MEDIUM CLASS B.A. TO BS. 93 NORMAL CLASS	TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.	CHECKED			
		WELDING SYMBOLS TO BS. 499	TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°	APPROVED			
	MODIFICATION	DRAWING SYMBOLS, NOTES, ETC. TO BS. 308		UNIVERSITY OF LIVERPOOL OLIVER LODGE LABORATORY DEPARTMENT OF PHYSICS		DRAWING NUMBER PTG/NMR/002 SHEET 6 OF 9	LATEST ISSUE -

DO NOT SCALE

THIRD ANGLE PROJECTION

REMOVE ALL BURRS AND SHARP EDGES



TO ACCEPT FOUR HOLE SMA FLANGED SOCKET.

DETAIL "A"

HOLE DETAIL # 1 (OUTSIDE EDGES)

DIMENSIONS IN mm EXCEPT AS STATED	TOLERANCES EXCEPT AS STATED	DRAWN	DWG.	PROJECT NMR RF MODULE	ARRGT. DRG. SHEET 1
SURFACE TEXTURE EXCEPT AS STATED ∇ = ∇ SYMBOLS TO BS. 1134 ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ∇	INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL. TOLERANCE ON MACHINED DIMENSIONS: 0-250mm TOL. 0,25mm (0-10" TOL. ·010") OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020") OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030") OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")	CHECKED			
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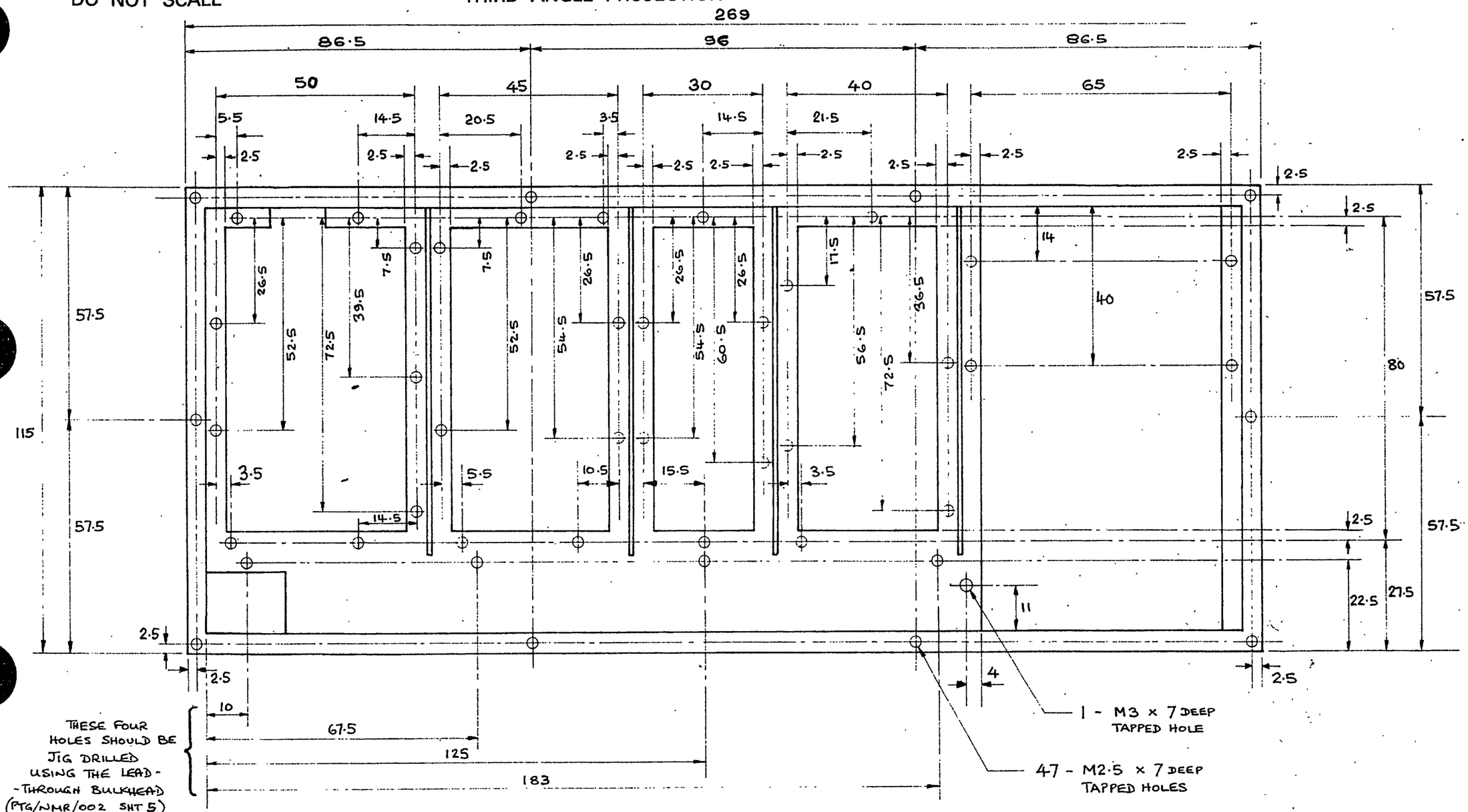
A DATE OCT 80 SIG. DWG. MODIFICATION		CHECKED			
		APPROVED		UNIVERSITY OF LIVERPOOL OLIVER LODGE LABORATORY DEPARTMENT OF PHYSICS	DRAWING NUMBER PTG/NMR/002 SHEET 7 OF 9 / LATEST ISSUE -

DO NOT SCALE

THIRD ANGLE PROJECTION

REMOVE ALL



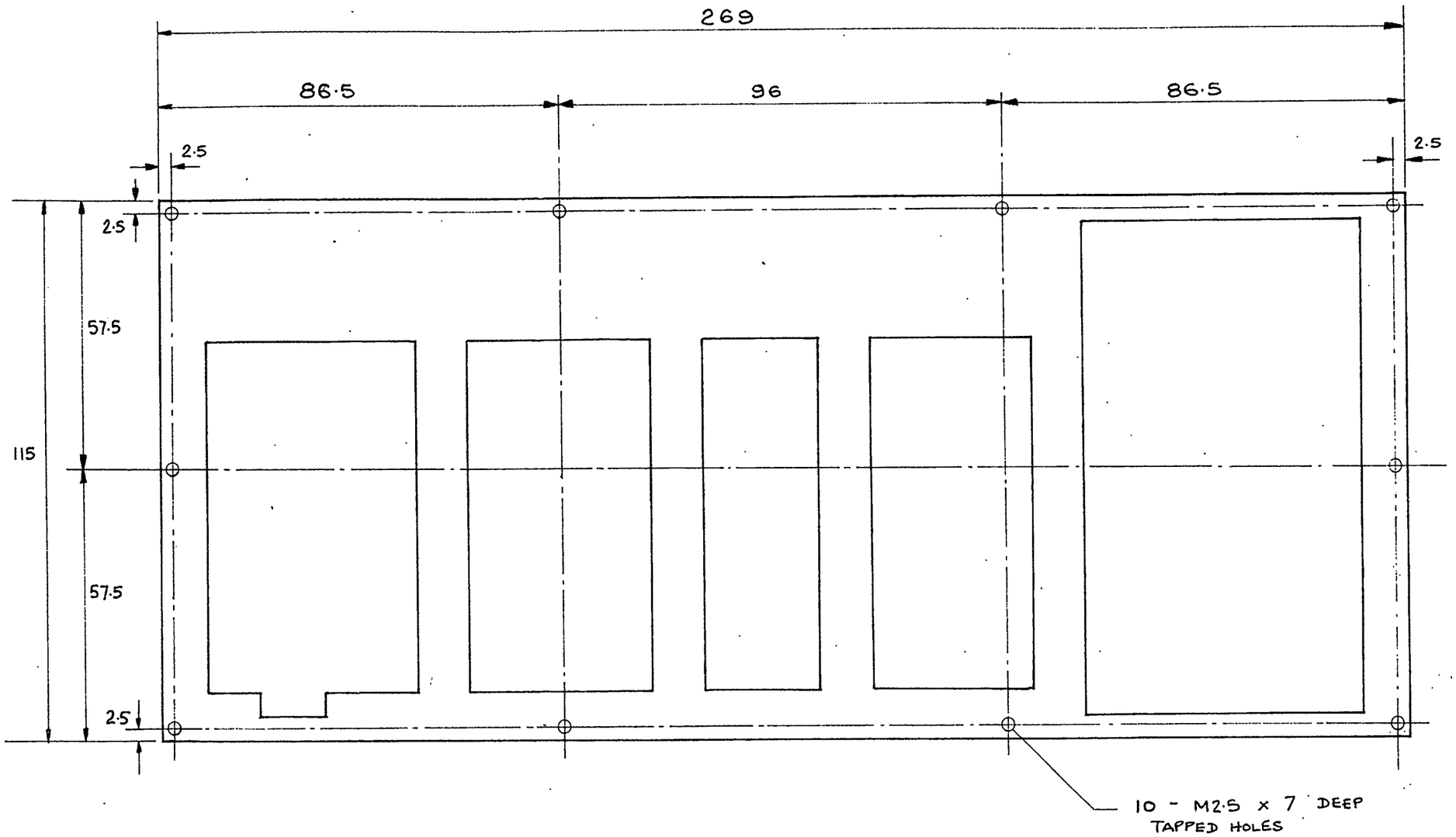
HOLE DETAIL-2 (PCB FACE)

A DATE 06/80 SIG. DWF MODIFICATION	DIMENSIONS IN mm EXCEPT AS STATED SURFACE TEXTURE EXCEPT AS STATED √ = √SYMBOLS TO BS. 1134 ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED √ SCREW THREADS EXCEPT AS STATED METRIC TO BS. 3643 6H/6g CLASS WHIT. FORM TO BS. 84 MEDIUM CLASS B.A. TO BS. 93 NORMAL CLASS WELDING SYMBOLS TO BS. 499 DRAWING SYMBOLS, NOTES, ETC. TO BS. 308	TOLERANCES EXCEPT AS STATED INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL. TOLERANCE ON MACHINED DIMENSIONS: 0-250mm TOL. 0,25mm (0-10" TOL. ·010") OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020") OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030") OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040") TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS. TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°	DRAWN DWG. CHECKED TRACED CHECKED APPROVED	PROJECT NMR RF MODULE TITLE MODULE FRAME ASSEMBLY UNIVERSITY OF LIVERPOOL OLIVER LODGE LABORATORY DEPARTMENT OF PHYSICS	ARRGT. DRG. SHEET 1 SCALE 1:1 DRAWING NUMBER PTG/NMR/002 SHEET 8 OF 9 LATEST ISSUE -

DO NOT SCALE

THIRD ANGLE PROJECTION

REMOVE ALL BURRS AND SHARP EDGES



HOLE DETAIL - 3 (COMPONENT FACE)

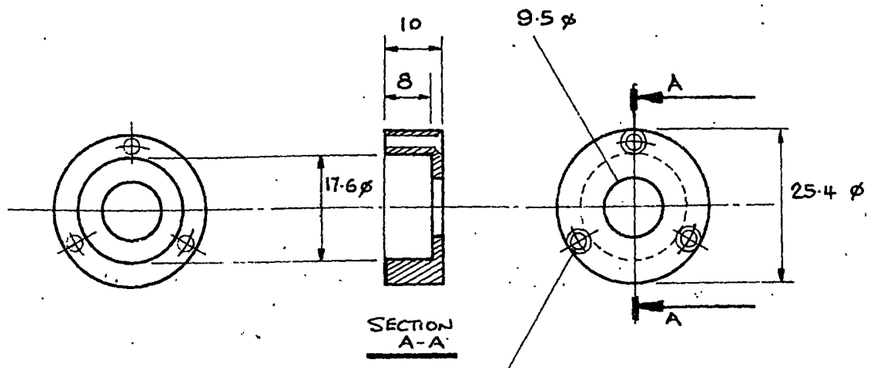
A DATE Oct 80 SIG. DWP MODIFICATION	DIMENSIONS IN mm EXCEPT AS STATED SURFACE TEXTURE EXCEPT AS STATED $\sqrt{}$ = $\sqrt{}$ SYMBOLS TO BS. 1134 ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED $\sqrt{}$ SCREW THREADS EXCEPT AS STATED METRIC TO BS. 3643 6H/6g CLASS WHIT. FORM TO BS. 84 MEDIUM CLASS B.A. TO BS. 93 NORMAL CLASS WELDING SYMBOLS TO BS. 499 DRAWING SYMBOLS, NOTES, ETC. TO BS. 308	TOLERANCES EXCEPT AS STATED INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL. TOLERANCE ON MACHINED DIMENSIONS: 0-250mm TOL. 0,25mm (0-10" TOL. ·010") OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020") OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030") OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040") TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS. TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°	DRAWN DWG. CHECKED TRACED CHECKED APPROVED	PROJECT NMR RF MODULE TITLE MODULE FRAME ASSEMBLY	ARRGT. DRG. SHEET 1 SCALE 1:1		
			UNIVERSITY OF LIVERPOOL OLIVER LODGE LABORATORY DEPARTMENT OF PHYSICS	DRAWING NUMBER PTG/NMR/002 SHEET 9 OF 9	LATEST ISSUE		

DO NOT SCALE

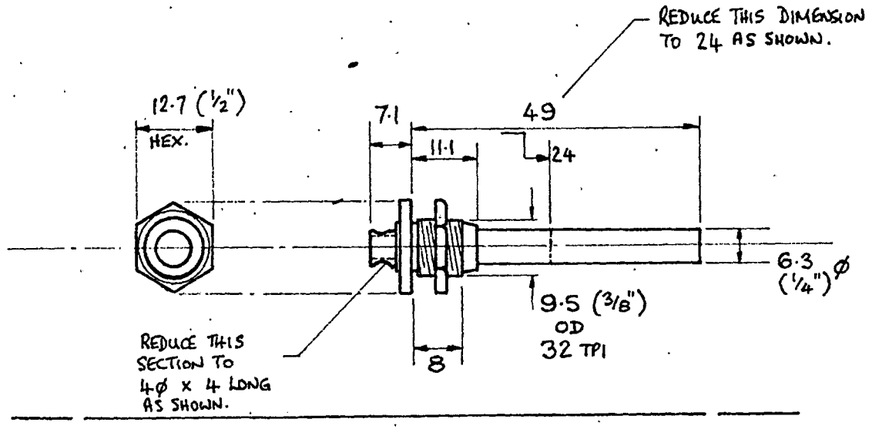
THIRD ANGLE PROJECTION

REMOVE ALL BURRS AND SHARP EDGES

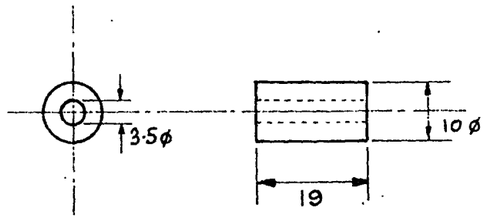
ITEM 1



ITEM 2

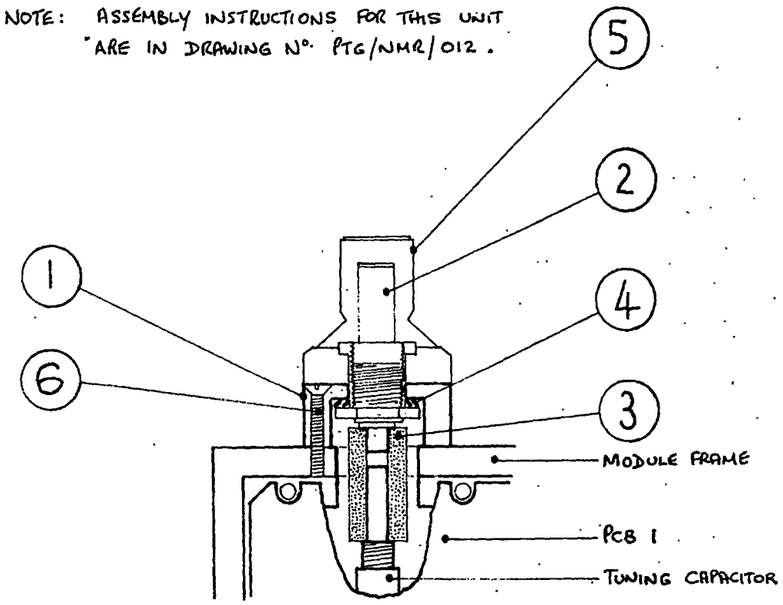


ITEM 3



SECTION THROUGH ASSEMBLED CAPACITOR DRIVE

NOTE: ASSEMBLY INSTRUCTIONS FOR THIS UNIT ARE IN DRAWING N° PTG/NMR/012.



ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.
6	SCREW, M2·5 x 16mm	BRASS	C'SK HEAD	-	3
5	KNOB, MULTI-TURN		TYPE 412, KILO ENGINEERING	-	1
4	STAR WASHER	STEEL	17·5mm o/D, 10mm I/D	-	1
3	RUBBER TUBE COUPLING	RUBBER	SUPPLIED BY LIVERPOOL	-	2cms
2	CAPACITOR DRIVE	BRASS	TYPE H, JACKSON BROS.	-	1
1	DRIVE MOUNTING BUSH	BRASS			1

PARTS LIST

A DATE 04 80 SIG. DWF MODIFICATION

DIMENSIONS IN mm EXCEPT AS STATED

SURFACE TEXTURE EXCEPT AS STATED
▽ = ▽SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ▽

SCREW THREADS EXCEPT AS STATED
METRIC TO BS. 3643 6H/6g CLASS
WHIT. FORM TO BS. 84 MEDIUM CLASS
B.A. TO BS. 93 NORMAL CLASS
WELDING SYMBOLS TO BS. 499
DRAWING SYMBOLS, NOTES, ETC. TO BS. 308

TOLERANCES EXCEPT AS STATED

INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.

TOLERANCE ON MACHINED DIMENSIONS:
0-250mm TOL. 0,25mm (0-10" TOL. ·010")
OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020")
OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030")
OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")

TOL. ON UNMACHINED DIMS TWICE TOL. FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

DRAWN	DWG.	PROJECT	NMR RF MODULE
CHECKED			
TRACED		TITLE	CAPACITOR DRIVE ASSEMBLY
CHECKED			
APPROVED			

ARRGT. DRG. -

SCALE 1:1

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER PTG/NMR/003

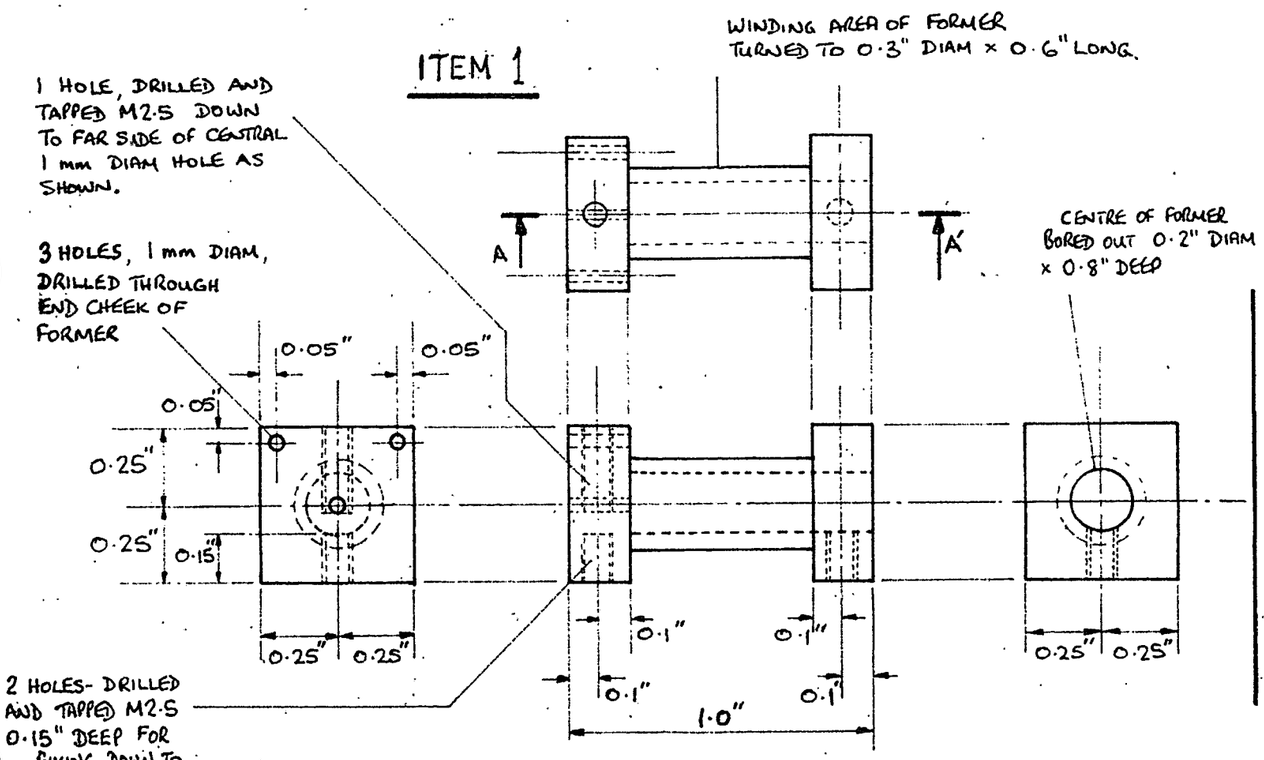
LATEST ISSUE -

SHEET 1 OF 1

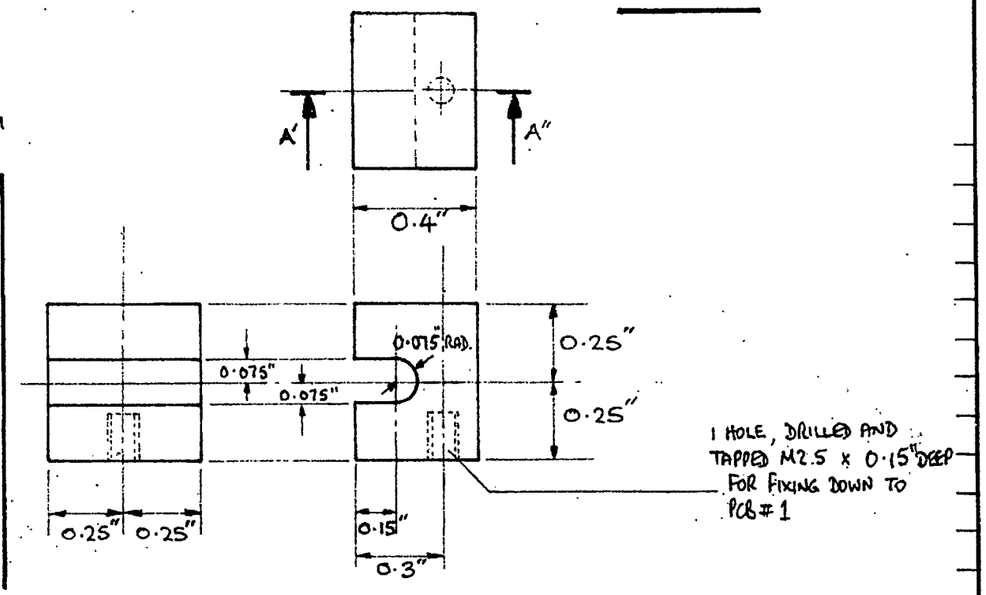
DO NOT SCALE | THIRD ANGLE PROJECTION | REMOVE ALL BURRS AND SHARP EDGES

NOTE : THIS ASSY. IS DIMENSIONED IN INCHES.
(IT IS THEN COMPATIBLE WITH ALL OTHER MAJOR PRINTED CIRCUIT BOARD COMPONENTS)

ITEM 1

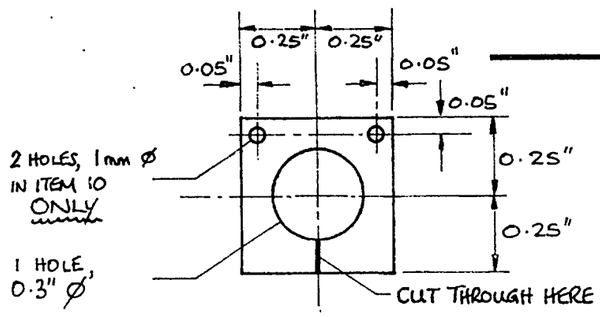


ITEM 2



SECTION A - A' - A"
REFERS TO ASSY. DRAWING ON SHEET 2.

ITEMS 10 & 11



ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

DRAWN	DWG.	PROJECT NMR RF MODULE	ARRGT. DRG. SHEET 2.
CHECKED			
TRACED		TITLE REED RELAY ASSEMBLY	SCALE 1:1
CHECKED			
APPROVED			

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER PTG/NMR/004
SHEET 1 OF 2

LATEST ISSUE

A | DATE Oct 80 | SIG. DWF | MODIFICATION

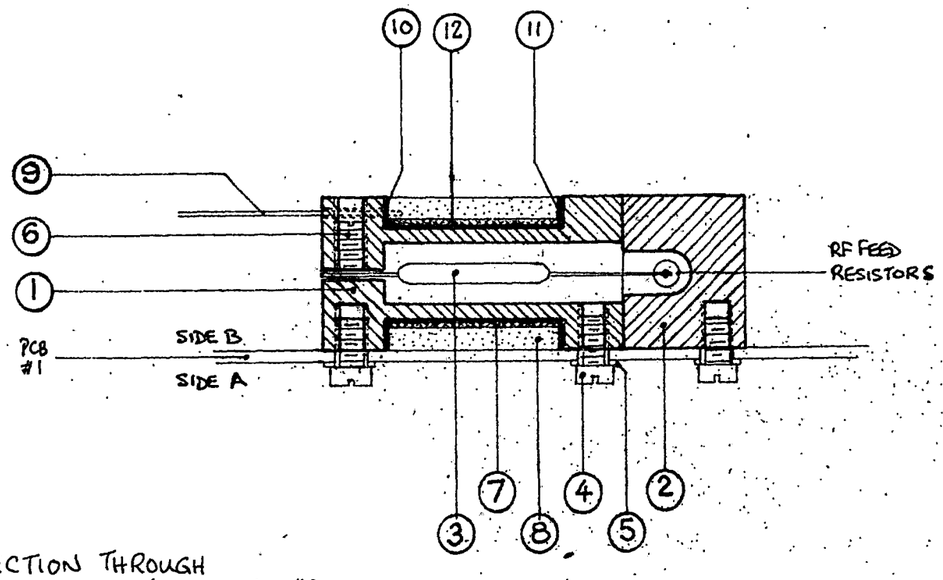
DIMENSIONS IN INCHES EXCEPT AS STATED
SURFACE TEXTURE EXCEPT AS STATED
▽ = ▽ SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ▽
SCREW THREADS EXCEPT AS STATED
METRIC TO BS. 3643 6H/6g CLASS
WHIT. FORM TO BS. 84 MEDIUM CLASS
B.A. TO BS. 93 NORMAL CLASS
WELDING SYMBOLS TO BS. 499
DRAWING SYMBOLS, NOTES, ETC. TO BS. 308

TOLERANCES EXCEPT AS STATED
INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.
TOLERANCE ON MACHINED DIMENSIONS:
0-250mm TOL: 0,25mm (0-10" TOL. ·010")
OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020")
OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030")
OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")
TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

DO NOT SCALE

THIRD ANGLE PROJECTION

REMOVE ALL BURRS AND SHARP EDGES



SECTION THROUGH COMPLETE ASSY (I.E. A-A'-A'' ON SHEET 1)

NB. SEE "PCB # 1 ASSEMBLY" PTG/NMR/005 & "MODULE ASSEMBLY" PTG/NMR/012 FOR ALL DETAILS OF ASSEMBLY INTO MODULE.

CONSTRUCTIONAL NOTES:-

1. THREAD ITEMS 10 & 11 OVER COIL FORMER & FASTEN IN PLACE WITH EPOXY ADHESIVE.
2. WIND SEVERAL TURNS OF THIN PTFE JOINTING TAPE OVER THE COIL FORMER, THUS PROVIDING A COMPLETELY INSULATED WINDING AREA.
3. WIND COIL WITH 2000 TURNS OF 44 SWG ENAMELLED COPPER WIRE (ITEM 7)
4. BARE THE ENDS OF TWO, 10 CMS LENGTHS OF LEAD IN WIRE (ITEM 9), AND THREAD THEM THROUGH THE TWO 1mm DIAM HOLES IN ONE CHEEK OF THE FORMER.
5. SOLDER THESE ENDS ONTO THE COIL ENDS. CHECK CONTINUITY (200Ω APPROX), AND THAT THERE IS NO SHORT TO THE FORMER.
6. FIX A SUITABLE SQUARE SLEEVE OVER THE WINDING AREA & POT WITH ITEM 8.
7. WHEN HARD, REMOVE THE SLEEVE & TRIM POTTED SECTION SQUARE TO MATCH THE END CHEEKS. CHECK COIL ELECTRICALLY AS IN 5.
8. INSERT THE REED SWITCH INTO THE FORMER AS SHOWN IN THE ASSEMBLY DIAGRAM & CLAMP IT IN POSITION WITH THE GRUB SCREW (ITEM 6). TRIM OFF THE EXCESS LEAD LENGTH PROTRUDING THROUGH THE 1mm HOLE.
9. TRIM BACK THE COIL LEAD IN WIRES TO 20 mm & PREPARE THE ENDS FOR SOLDERING INTO THE PRINTED CIRCUIT BOARD.

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.
12	INSULATION	PTFE (TEFLON)	JOINTIN TAPE		-
11	INSULATING WASHER	MYLAR	0.005" THICK SHEET	SHEET 1	1
10	INSULATING WASHER	MYLAR	0.005" THICK SHEET	SHEET 1	1
9	COIL LEAD IN WIRE		INSULATED, STRANDED COPPER, MAX O/D 0.95mm		200 mm
8	POTTING RESIN		AS REQUIRED		
7	SWITCHING COIL	ENAMELLED COPPER WIRE	44 SWG, 2000 TURNS		
6	GRUB SCREW	BRASS	M2.5 x 4 mm LONG		1
5	WASHER	BRASS	M2.5	ONLY SHOWN TO ILLUSTRATE	3
4	SCREW	BRASS	M2.5 x 4 mm LONG, CH/HD	MOUNTING. SEE PTG/NMR/005	3
3	REED SWITCH		HAMLIN, MINI-2S, 7-12 AT		1
2	RESISTOR COVER	COPPER	FINE MACHINE FINISH	SHEET 1	1
1	COIL FORMER	COPPER	FINE MACHINE FINISH	SHEET 1	1

PARTS LIST

DIMENSIONS IN INCHES EXCEPT AS STATED	TOLERANCES EXCEPT AS STATED
SURFACE TEXTURE EXCEPT AS STATED ▽ = ▽SYMBOLS TO BS. 1134 ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ▽	INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL. TOLERANCE ON MACHINED DIMENSIONS: 0-250mm TOL. 0,25mm (0-10" TOL. ·010") OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020") OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030") OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040") TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS. TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°
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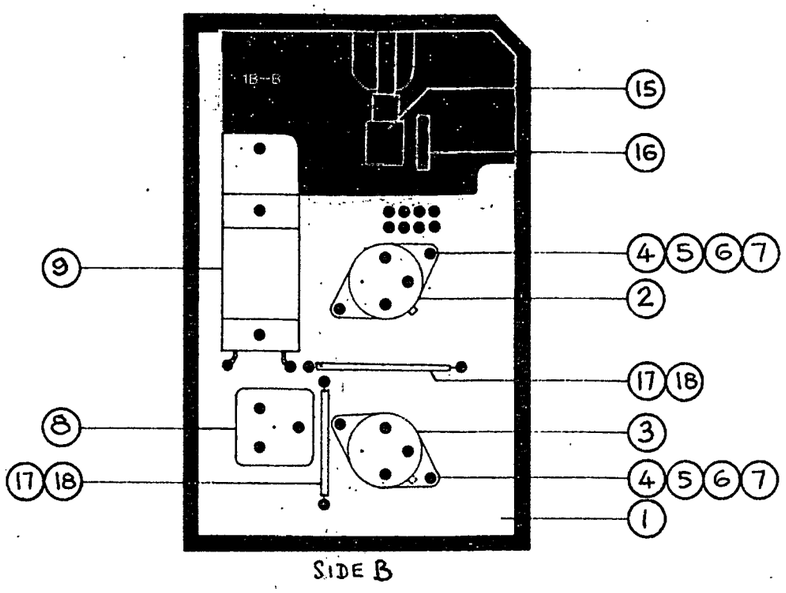
DRAWN	DWG.	PROJECT N.M.R RF MODULE	ARRGT. DRG. -
CHECKED			
TRACED		TITLE REED RELAY ASSEMBLY	SCALE 1:1
CHECKED			
APPROVED			

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

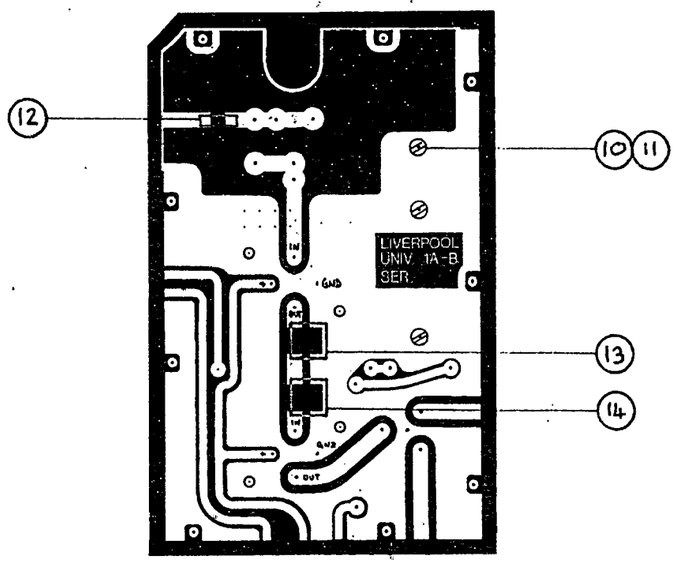
DRAWING NUMBER PTG/NMR/004 SHEET 2 OF 2

LATEST ISSUE

MODIFICATION	DATE	SIG.
A	OCT 80	DWJ.



SIDE B



SIDE A

ITEM	NAME	MANUFACTURER	DETAIL DRG.	QTY.
18	SLEEVING - TO SUIT ITEM 17			–
17	BARE COPPER WIRE, 1/0·6mm			–
16	SILVER MICA CAPACITOR, 10pF		PTG/NMR/001 NOTE 3	1
15	TUNING CAPACITOR, AP14EI	VOLTRONICS		1
14	CHIP ATTENUATOR, 50Ω, 5dB, AC0105	E.M.C. TECHNOLOGY	PTG/NMR/001 NOTE 2	1
13	CHIP ATTENUATOR, 50Ω, 6dB, AC0106	E.M.C. TECHNOLOGY		1
12	CHIP RESISTOR, 10Ω, CR15, TYPE B	E.M.C. TECHNOLOGY	PTG/NMR/001 NOTE 1	1
11	WASHER, M2·5, PLAIN, BRASS		PTG/NMR/001 NOTE 15	3
10	M2.5 x 4mm, CHEESE HEAD SET SCREW, BRASS			3
9	REED RELAY ASSEMBLY		PTG/NMR/004	1
8	R.F. SPLITTER, 113A	MERRIMAC		1
7	MOUNTING CLAMP, WASHER	SUPPLIED WITH ITEMS 2 & 3		4
6	MOUNTING CLAMP, NUT			4
5	MOUNTING CLAMP, SCREW			4
4	MOUNTING CLAMP PLATE			2
3	R.F. AMPLIFIER, AS4	WATKINS-JOHNSON		1
2	R.F. AMPLIFIER, A71	WATKINS-JOHNSON		1
1	PRINTED CIRCUIT BOARD # 1	UNIV. OF LIVERPOOL	PCB 1, MOD B	1

PARTS LIST

DIMENSIONS IN EXCEPT AS STATED

SURFACE TEXTURE EXCEPT AS STATED
▽ = ▽SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ▽

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B.A. TO BS. 93 NORMAL CLASS
WELDING SYMBOLS TO BS. 499
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OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")
TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

DRAWN	DWG	PROJECT NMR RF MODULE	ARRGT. DRG. –
CHECKED			
TRACED		TITLE PCB # 1 ASSEMBLY	SCALE 1:1
CHECKED			
APPROVED			

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER PTG/NMR/005
SHEET 1 OF 3

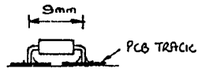
LATEST ISSUE

A	DATE 0280	
	SIG. DWG.	
MODIFICATION		

DO NOT SCALE | THIRD ANGLE PROJECTION | REMOVE ALL BURRS AND SHARP EDGES

COMPONENT MOUNTING INSTRUCTIONS

1. VISUALLY CHECK PRINTED CIRCUIT BOARD - ENSURE THERE ARE NO OBVIOUS DEFECTS.
2. INSERT ITEM 2 INTO PCB (SIDE B), OBSERVE CORRECT ORIENTATION, AND SECURE WITH MOUNTING CLAMP AND SCREWS (ITEMS 4-7). CHECK ORIENTATION.
3. INSERT ITEM 3 INTO PCB (SIDE B), OBSERVE CORRECT ORIENTATION, AND SECURE WITH MOUNTING CLAMP AND SCREWS (ITEMS 4-7). CHECK ORIENTATION.
4. SOLDER 4 CONNECTIONS OF EACH OF ITEMS 2 & 3 TO PCB (SIDE A) & TRIM LEADS.
5. INSERT ITEM 8 INTO PCB (SIDE B), ONLY CORRECT ORIENTATION IS POSSIBLE.
6. PRESS ITEM 8 DOWN ONTO PCB (SIDE B) WHILST SOLDERING 4 CONNECTIONS TO PCB (SIDE A).
7. INSERT TUNING CAPACITOR, ITEM 15, INTO PCB (SIDE B). MAKE SURE IT IS SITTING FIRMLY ONTO THE PCB & THE SHAFT AXIS IS PARALLEL TO THE PCB SURFACE AND PERPENDICULAR TO THE EDGE OF THE PCB. THIS WILL ENSURE THE CAPACITOR DRIVE LINES UP CORRECTLY LATER ON. SOLDER THE 3 PINS OF THE CAPACITOR ONTO PCB (SIDE A)
8. ATTACH DAMPING RESISTOR, ITEM 12. IF USING A "CHIP" RESISTOR, FOLLOW THE INSTRUCTIONS IN DRAWING PTG/NMR/013 "MOUNTING INSTRUCTIONS FOR CHIP COMPONENTS", OTHERWISE PROCEED AS FOLLOWS.
   FORM AND CUT BACK RESISTOR LEADS AS SHOWN :-



   HOLD RESISTOR IN AN UPRIGHT POSITION WITH TWEEZERS SO THAT IT STRADDLES THE GAP IN THE PRINTED CIRCUIT TRACK SYMMETRICALLY. SOLDER IN PLACE.
   THIS COMPONENT IS MOUNTED AND SOLDERED ON PCB (SIDE A).
   DURING SETTING UP THE FINAL NMR SYSTEM IT MAY BE NECESSARY TO CHANGE THIS RESISTOR, SEE PARTS LIST NOTE 1 (PTG/NMR/001, SHEET 2), AND INSTRUCTION MANUAL.
9. AT THIS STAGE DO NOT MOUNT FIXED CAPACITOR, ITEM 16. SEE PARTS LIST NOTE 3 (PTG/NMR/001, SHEET 2) AND INSTRUCTION MANUAL.
10. SOLDER CHIP ATTENUATORS, ITEMS 13 & 14, INTO PLACE ON PCB (SIDE A). FOLLOW INSTRUCTIONS IN DRAWING PTG/NMR/013, "MOUNTING INSTRUCTIONS FOR CHIP COMPONENTS".
11. CUT SLEEVING, ITEM 18, TO LENGTH FOR BOTH WIRE LINKS. MAKE UP INSULATED WIRE LINKS WITH ITEM 17. INSERT INTO PCB (SIDE B) AND SOLDER ON PCB (SIDE A). MAKE SURE THE LINKS DO NOT SHORT TO GROUND PLANE (SIDE B), PARTICULARLY AT THE ENDS.
12. IF THE RF SUPPRESSION RELAY, ITEM 9, IS BEING INSTALLED THEN PROCEED AS BELOW, OTHERWISE PRE-ASSEMBLY OF THIS BOARD IS COMPLETE.
13. TAKE REED RELAY COIL BODY (PART OF ITEM 9) WITH THE REED SWITCH INSERT ALREADY MOUNTED IN IT, SEE DRAWING PTG/NMR/004. FASTEN IT ONTO PCB (SIDE B) WITH ITS MOUNTING SCREWS AND WASHERS (ITEMS 10 & 11). PUSH CONNECTING WIRES THROUGH ADJACENT HOLES IN PCB (SIDE B) AND SOLDER ON PCB (SIDE A). FURTHER ASSEMBLY OF THIS ITEM WILL TAKE PLACE LATER.
14. PRE-ASSEMBLY OF THIS PRINTED CIRCUIT BOARD IS NOW COMPLETE.

NOTE READ RELEVANT MANUFACTURERS MOUNTING INSTRUCTIONS BEFORE MOUNTING RF AMPLIFIERS, ITEMS 2 & 3.

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

DRAWN	DWG.	PROJECT: NMR RF MODULE	ARRGT. DRG. SHEET 1
CHECKED			
TRACED		TITLE: PCB #1 ASSEMBLY	SCALE: -
CHECKED			
APPROVED			

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER: PTG/NMR/005
SHEET 2 OF 3

LATEST ISSUE

A	DATE 06/80	MODIFICATION
	SIG. DWG.	

DIMENSIONS IN EXCEPT AS STATED
SURFACE TEXTURE EXCEPT AS STATED
▽ = ▽ SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ▽
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WHIT. FORM TO BS. 84 MEDIUM CLASS
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DRAWING SYMBOLS, NOTES, ETC. TO BS. 308

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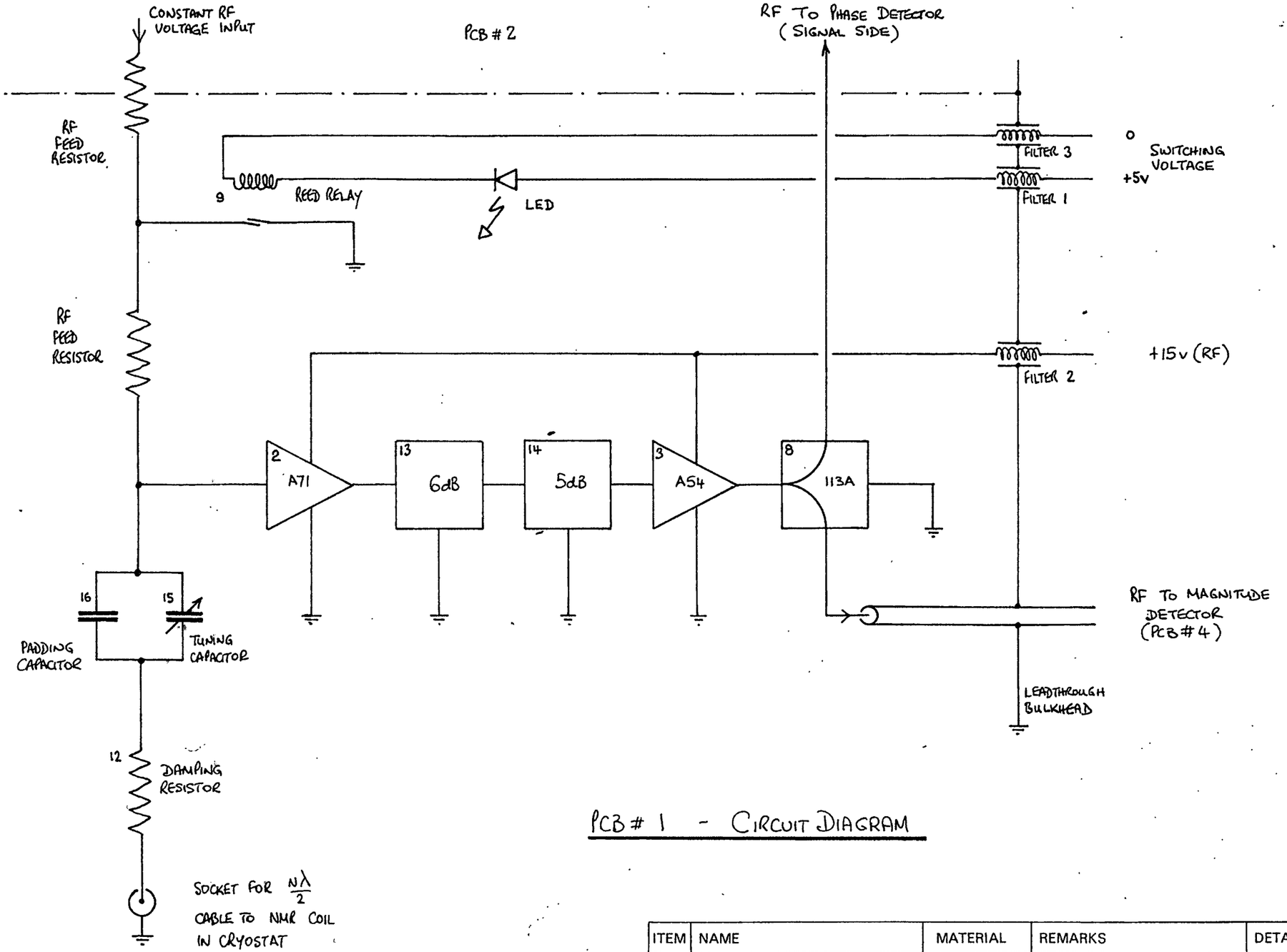
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

DO NOT SCALE

THIRD ANGLE PROJECTION

REMOVE ALL BURRS AND SHARP EDGES



PCB # 1 - CIRCUIT DIAGRAM

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

DIMENSIONS IN EXCEPT AS STATED

SURFACE TEXTURE EXCEPT AS STATED

$\sqrt{}$ = $\sqrt{}$ SYMBOLS TO BS. 1134
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TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

DRAWN	DWG	PROJECT	NMR RF MODULE
CHECKED			
TRACED		TITLE	PCB # 1 ASSEMBLY
CHECKED			
APPROVED			

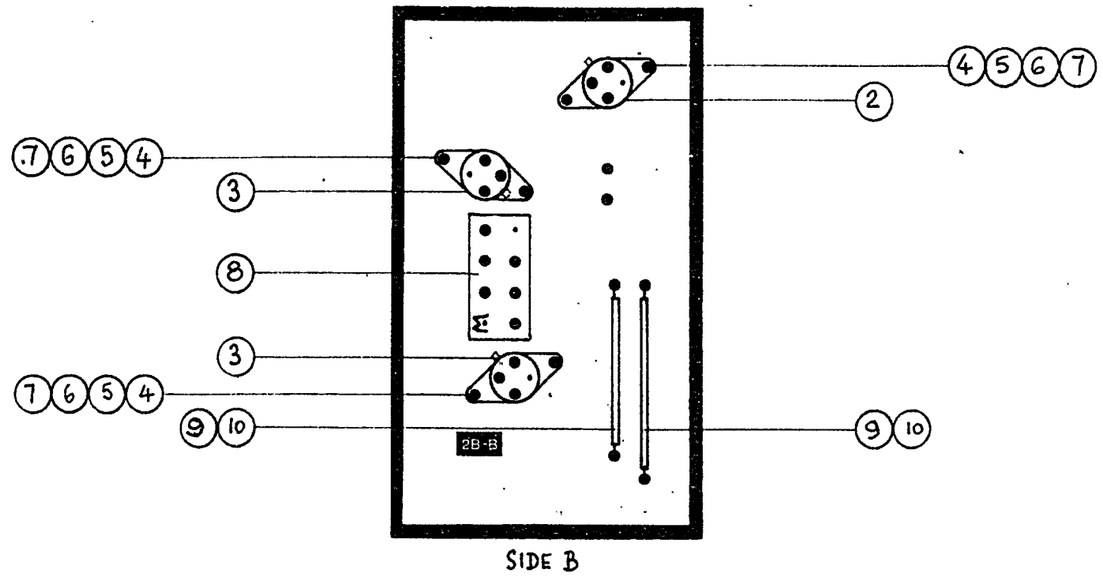
ARRGT. DRG. SHEET 1.
SCALE -

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

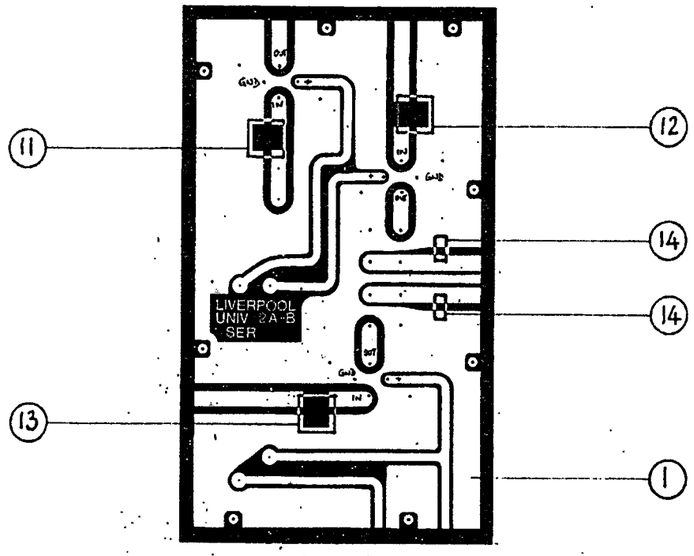
DRAWING NUMBER PTG/NMR/005
SHEET 3 OF 3

LATEST ISSUE

DATE Nov 80
SIG. DWG.
MODIFICATION



SIDE B



SIDE A

ITEM	NAME	MANUFACTURER	DETAIL DRG.	QTY.
14	CHIP RESISTOR, 27Ω, CRIS, TYPE B	EMC TECHNOLOGY		2
13	CHIP ATTENUATOR, 50Ω, 3dB, AC0103	〃	SEE PTG/NMR/001 NOTE 2	1
12	CHIP ATTENUATOR, 50Ω, 5dB, AC0105	〃		1
11	CHIP ATTENUATOR, 50Ω, 6dB, AC0106	〃		1
10	SLEEVING, TO SUIT ITEM 9			-
9	BARE COPPER WIRE, 1/0.6mm			-
8	DOUBLE BALANCED MIXER, SRA-1	MINICIRCUITS LABORATORIES		1
7	MOUNTING CLAMP, WASHER	SUPPLIED WITH ITEMS 2 & 3		6
6	MOUNTING CLAMP, NUT			6
5	MOUNTING CLAMP, SCREW			6
4	MOUNTING CLAMP PLATE			3
3	RF AMPLIFIER, GPD-403	AVANTEK		2
2	RF AMPLIFIER, GPD-402	AVANTEK		1
1	PRINTED CIRCUIT BOARD # 2	UNIV. OF LIVERPOOL	PCB 2, MOD B	1

PARTS LIST

DIMENSIONS IN . EXCEPT AS STATED
SURFACE TEXTURE EXCEPT AS STATED
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TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

DRAWN	DWG.	PROJECT NMR RF MODULE	ARRGT. DRG. -
CHECKED			
TRACED		TITLE PCB #2 ASSEMBLY	SCALE 1:1
CHECKED			
APPROVED			

DATE OCT 80
SIG. DWF
MODIFICATION

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER PTG/NMR/006
SHEET 1 OF 3

LATEST ISSUE

DO NOT SCALE | THIRD ANGLE PROJECTION | REMOVE ALL BURRS AND SHARP EDGES

COMPONENT MOUNTING INSTRUCTIONS.

✓1. VISUALLY CHECK PRINTED CIRCUIT BOARD - ENSURE THERE ARE NO OBVIOUS DEFECTS.

✓2. INSERT R.F. AMPLIFIERS (ITEMS 2 & 3) INTO PCB (SIDE B), OBSERVE THE CORRECT ORIENTATION, AND SECURE WITH MOUNTING CLAMPS AND SCREWS (ITEMS 4-7). CHECK ORIENTATION IS CORRECT.

✓3. SOLDER 4 CONNECTIONS OF EACH OF ITEMS 2 & 3 ONTO PCB (SIDE A), AND TRIM OFF EXCESS LEADS.

✓4. INSERT DOUBLE BALANCED MIXER (ITEM 8) INTO PCB (SIDE B). CORRECT ORIENTATION IS ESSENTIAL & IS DESIGNATED BY THE LETTER "M" OF MCL ON THE TOP COVER BEING IN THE POSITION SHOWN. PUSH MIXER FIRMLY DOWN ONTO PCB (SIDE B) & SOLDER THE 8 PINS ONTO THE PCB (SIDE A).

✓5. MAKE UP THE TWO WIRE & SLEEVING LINKS WITH ITEMS 9 & 10 AND INSERT THEM INTO THE PCB (SIDE B) ENSURING THAT NEITHER OF THEM SHORT TO THE GROUND PLANE, ESPECIALLY AT THE ENDS. SOLDER THEM ONTO THE PCB (SIDE A) AND TRIM OFF EXCESS LEADS.

✓6. USING THE TECHNIQUES DESCRIBED IN DRAWING PTG/NMR/013, "MOUNTING INSTRUCTIONS FOR CHIP COMPONENTS", MOUNT THE 3 CHIP ATTENUATORS (ITEMS 11, 12, 13) AND THE 2 CHIP RESISTORS (ITEM 14) IN THE POSITIONS SHOWN ON THE PCB (SIDE A).

✓7. PRE ASSEMBLY OF THIS PRINTED CIRCUIT BOARD IS NOW COMPLETE.

NOTE: READ RELEVANT MANUFACTURERS MOUNTING INSTRUCTIONS BEFORE MOUNTING RF AMPLIFIERS (ITEMS 2 & 3).

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

DRAWN	DWG.	PROJECT	NMR RF MODULE
CHECKED			
TRACED		TITLE	PCB # 2 ASSEMBLY
CHECKED			
APPROVED			

ARRGT. DRG. SHEET 1

SCALE -

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER PTG/NMR/006

SHEET 2 OF 3

LATEST ISSUE

DIMENSIONS IN EXCEPT AS STATED

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	SIG. DWL.	
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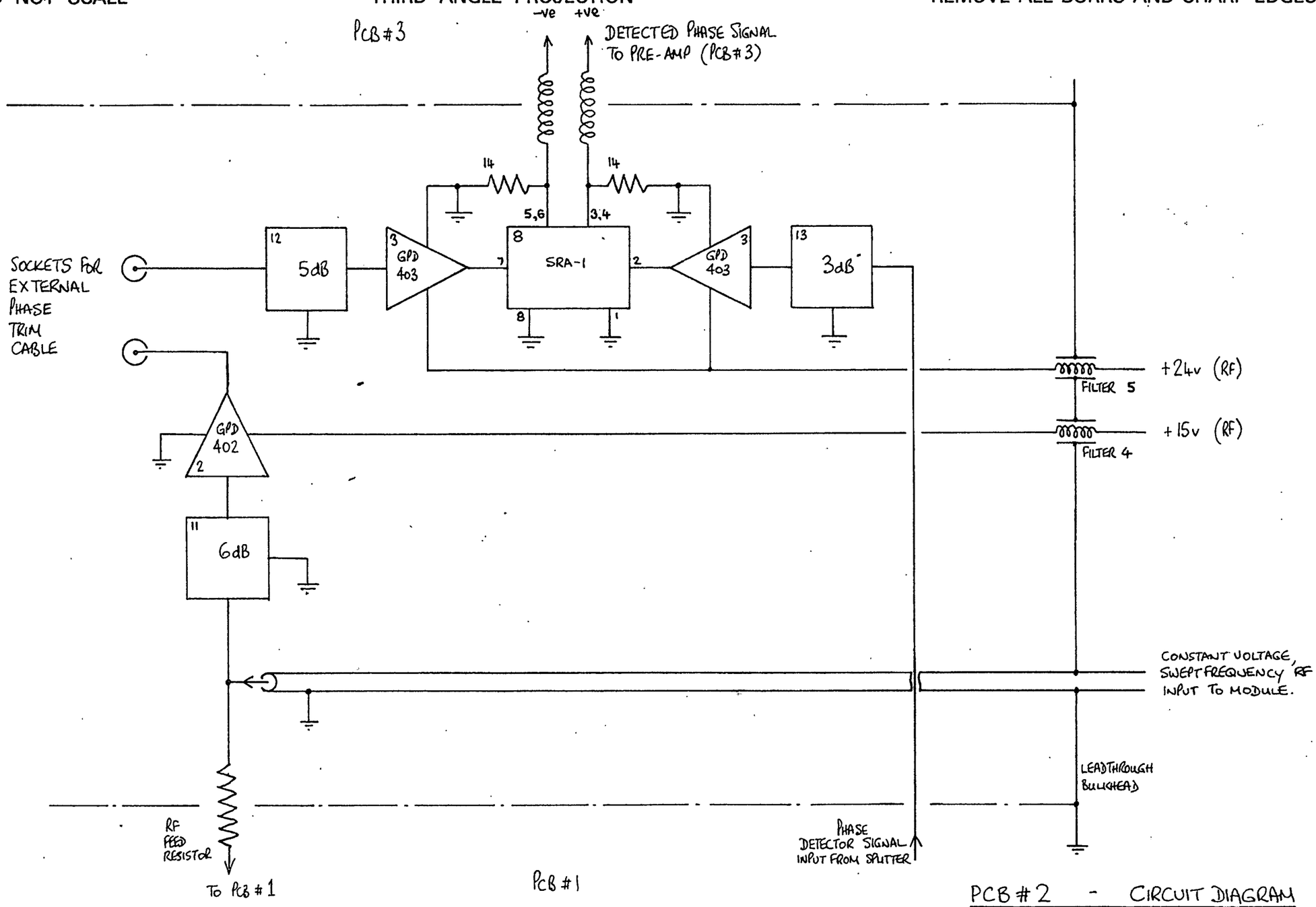


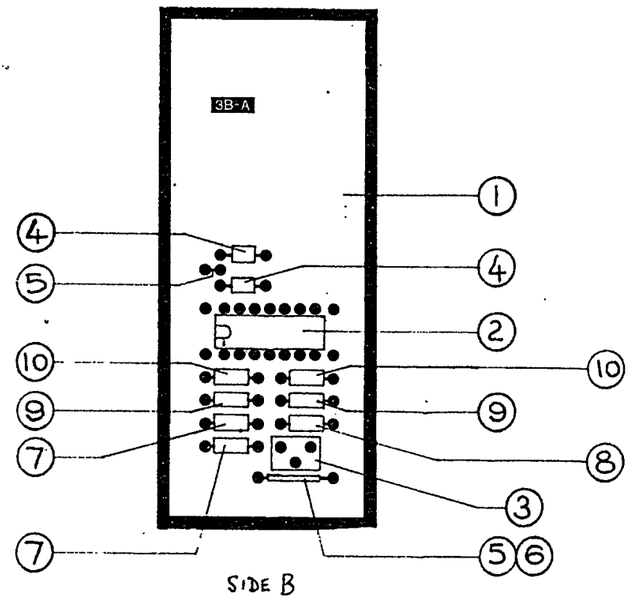
PCB # 2 - CIRCUIT DIAGRAM

DIMENSIONS IN EXCEPT AS STATED	TOLERANCES EXCEPT AS STATED	DRAWN	DWG	PROJECT NMR RF MODULE	ARRGT. DRG. SHEET 1
SURFACE TEXTURE EXCEPT AS STATED $\sqrt{}$ = $\sqrt{}$ SYMBOLS TO BS. 1134 ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ∇	INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL. TOLERANCE ON MACHINED DIMENSIONS: 0-250mm TOL. 0,25mm (0-10" TOL. ·010") OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020") OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030") OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")	CHECKED		TITLE PCB # 2 ASSEMBLY	SCALE -
SCREW THREADS EXCEPT AS STATED METRIC TO BS. 3643 6H/6g CLASS WHIT. FORM TO BS. 84 MEDIUM CLASS B.A. TO BS. 93 NORMAL CLASS WELDING SYMBOLS TO BS. 499 DRAWING SYMBOLS, NOTES, ETC TO BS 308	TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS. TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°	TRACED			
		CHECKED			
		APPROVED			

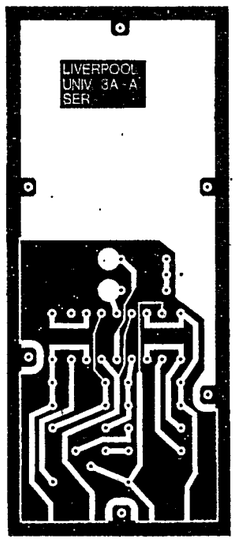
A | DATE Nov 60 | SIG. DWG | MODIFICATION

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER PTG/NMR/006 | SHEET 3 OF 3 | LATEST ISSUE



SIDE B



SIDE A

ITEM	NAME	MANUFACTURER	DETAIL DRG.	QTY.
10	CAPACITOR , 1000 pF	SEE PTG/NMR/001 NOTE 5		2
9	RESISTOR , 2·2 kΩ	SEE PTG/NMR/001 NOTE 6		2
8	RESISTOR , 150 Ω	— " —		1
7	RESISTOR , 4·7 kΩ	— " —		2
6	SLEEVING - TO SUIT ITEM 5			-
5	BARE COPPER WIRE , 1/0·6 mm			-
4	CAPACITOR , 220 pF	SEE PTG/NMR/001 NOTE 4		2
3	TRIMPOT , 10 kΩ , 3262W-1-103	BOURNS		1
2	DUAL OP-AMP, OP-10EY	PRECISION MONOLITHICS		1
1	PRINTED CIRCUIT BOARD # 3	UNIV. OF LIVERPOOL		1

PARTS LIST

DIMENSIONS IN mm EXCEPT AS STATED

SURFACE TEXTURE EXCEPT AS STATED
▽ = ▽SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ▽

SCREW THREADS EXCEPT AS STATED
METRIC TO BS. 3643 6H/6g CLASS
WHIT. FORM TO BS. 84 MEDIUM CLASS
B.A. TO BS. 93 NORMAL CLASS
WELDING SYMBOLS TO BS. 499
DRAWING SYMBOLS, NOTES, ETC. TO BS. 308

TOLERANCES EXCEPT AS STATED

INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.

TOLERANCE ON MACHINED DIMENSIONS:
0-250mm TOL. 0,25mm (0-10" TOL. ·010")
OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020")
OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030")
OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")

TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

DRAWN	DWG	PROJECT	NMR RF MODULE
CHECKED			
TRACED		TITLE	PCB # 3 ASSEMBLY
CHECKED			
APPROVED			

ARRGT. DRG. -

SCALE 1:1

A	DATE 007.80
	SIG. DWF.
	MODIFICATION

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER PTG/NMR/007

LATEST ISSUE

SHEET 1 OF 3

DO NOT SCALE | THIRD ANGLE PROJECTION | REMOVE ALL BURRS AND SHARP EDGES

COMPONENT MOUNTING INSTRUCTIONS.

1. VISUALLY CHECK PRINTED CIRCUIT BOARD – ENSURE THERE ARE NO OBVIOUS DEFECTS.
2. INSERT WIRE LINK, ITEM 5 ONLY, INTO PCB (SIDE B) AND SOLDER IN POSITION ON SIDE A.
3. INSERT 2, 220pF CAPACITORS, ITEM 4, INTO PCB (SIDE B). PUSH THEM WELL DOWN ONTO THE BOARD SO AS TO KEEP THE LEADS REASONABLY SHORT. SOLDER ONTO PCB (SIDE A) AND TRIM OFF EXCESS LEADS.
4. INSERT TRIMPOT (ITEM 3) INTO PCB (SIDE B), OBSERVE THE CORRECT ORIENTATION. PUSH IT HARD DOWN ONTO SIDE B AND SOLDER THE PINS ON SIDE A. TRIM OFF EXCESS LEAD LENGTH.
5. MAKE UP LINK WITH ITEMS 5 & 6 AND INSERT INTO PCB (SIDE B), ENSURING THAT THERE ARE NO SHORTS TO THE GROUND PLANE, ESPECIALLY AT THE ENDS. SOLDER ONTO PCB (SIDE A) AND TRIM OFF EXCESS LEAD LENGTH REMAINING.
6. MOUNT THE REMAINING RESISTORS AND CAPACITORS (ITEMS 7, (8), 9, (10)) IN THE NORMAL WAY ON PCB (SIDE B). SOLDER THE LEADS ON SIDE A AND TRIM OFF EXCESS LEAD LENGTH.
7. FINALLY INSERT THE DUAL OP-AMP INTO THE PCB (SIDE B). NOTE THAT THERE ARE TWO AS YET UN-USED PAIRS OF HOLES IN THIS VICINITY, ONE AT EACH END OF THE AMPLIFIER. SOLDER THE AMPLIFIER PINS ONTO THE PCB (SIDE A)
8. PRE-ASSEMBLY OF THIS PRINTED CIRCUIT BOARD IS NOW COMPLETED.

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

DRAWN	DWG	PROJECT: NMR RF MODULE	ARRGT. DRG. SHEET 1
CHECKED			
TRACED		TITLE: PCB # 3 ASSEMBLY	SCALE: -
CHECKED			
APPROVED			

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER: PTG/NMR/007
SHEET 2 OF 3

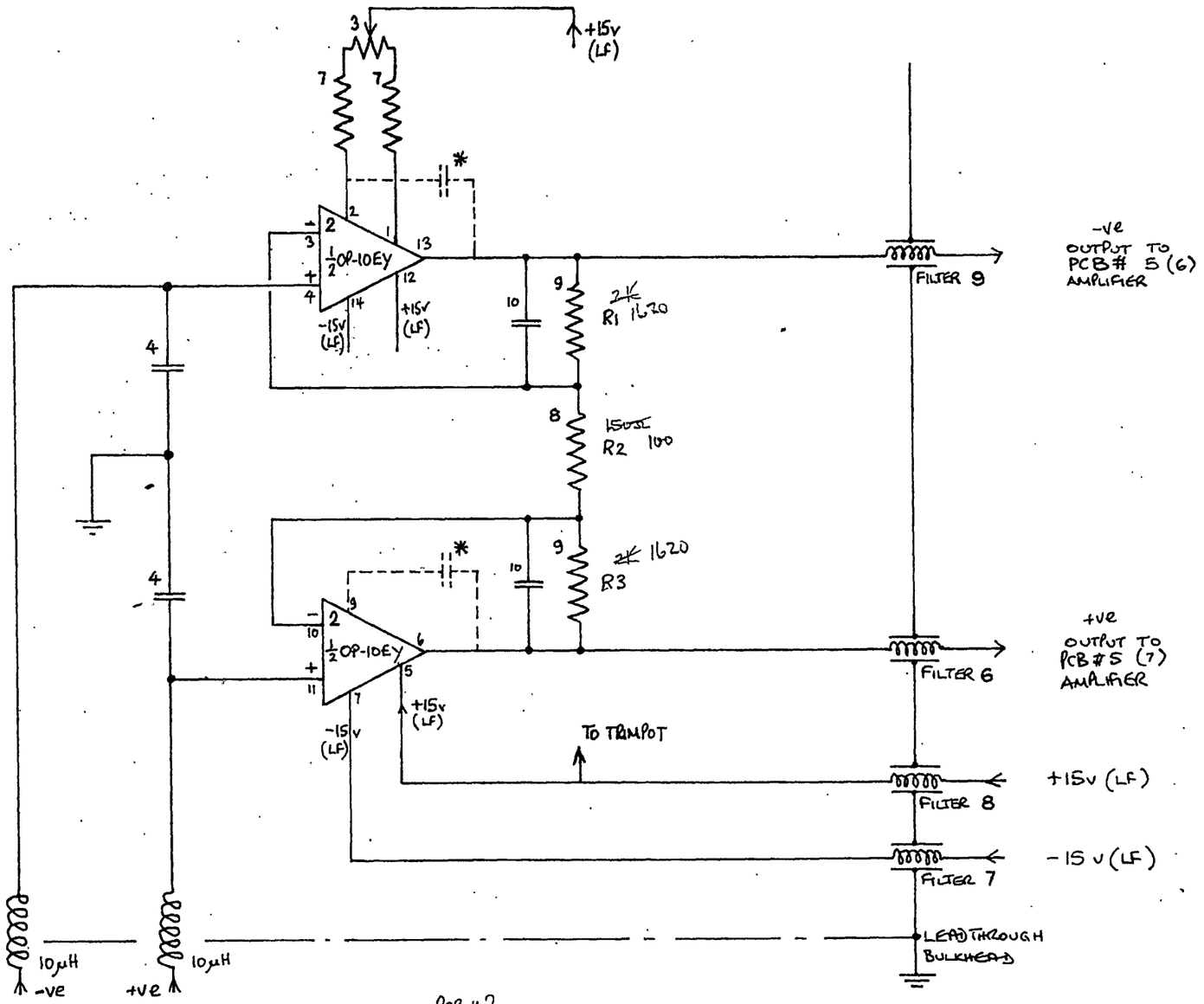
LATEST ISSUE:

A | DATE Nov 80 | SIG. DWJ. | MODIFICATION

DIMENSIONS IN - EXCEPT AS STATED
SURFACE TEXTURE EXCEPT AS STATED
√ = √SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED √
SCREW THREADS EXCEPT AS STATED METRIC TO BS. 3643 6H/6g CLASS WHIT. FORM TO BS. 84 MEDIUM CLASS B.A. TO BS. 93 NORMAL CLASS
WELDING SYMBOLS TO BS. 499
DRAWING SYMBOLS, NOTES, ETC. TO BS. 308

TOLERANCES EXCEPT AS STATED
INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.
TOLERANCE ON MACHINED DIMENSIONS:
0-250mm TOL. 0,25mm (0-10" TOL. ·010")
OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020")
OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030")
OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")
TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

DO NOT SCALE | THIRD ANGLE PROJECTION | REMOVE ALL BURRS AND SHARP EDGES



VOLTAGE GAIN OF STAGE

$$= 1 + \frac{R_1 + R_3}{R_2}$$

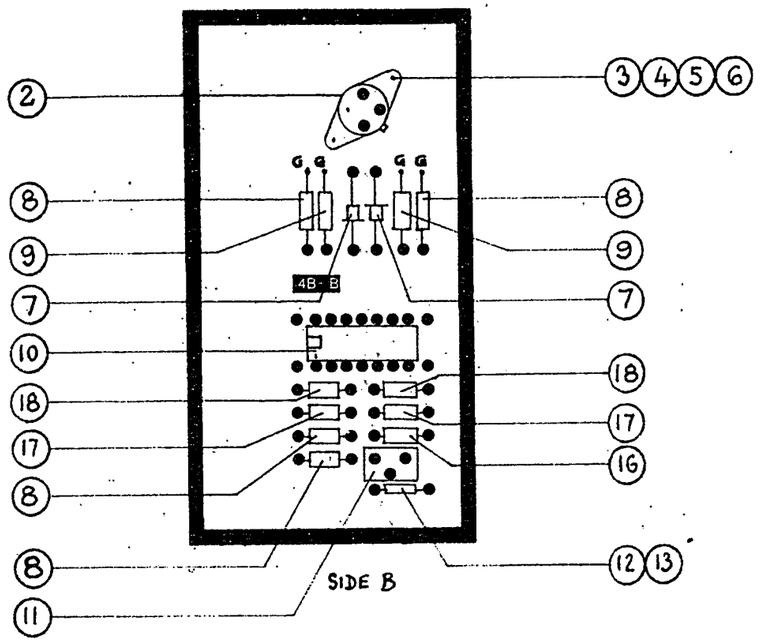
* 1 OF THESE CAPACITORS CAN BE ADDED (5pF → 100pF) TO MAXIMISE IN CMRR OF THE AMPLIFIER.

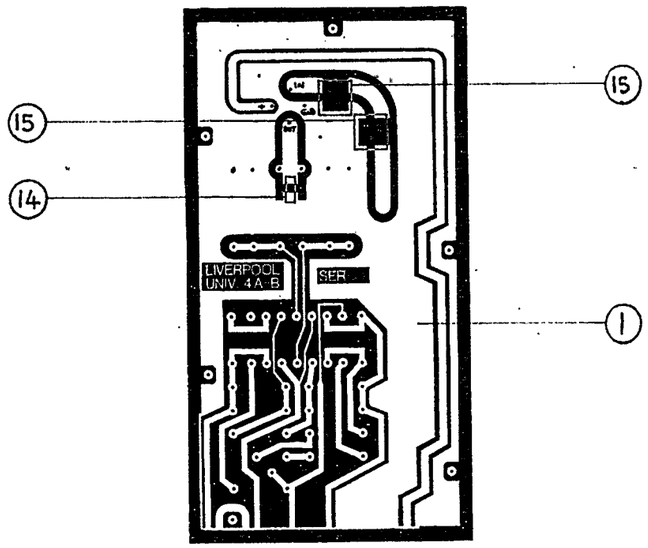
PCB#2

PCB # 3 - CIRCUIT DIAGRAM

DIMENSIONS IN EXCEPT AS STATED	TOLERANCES EXCEPT AS STATED	DRAWN DWG	PROJECT NMR RF MODULE	ARRGT. DRG. SHEET
SURFACE TEXTURE EXCEPT AS STATED	INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.	CHECKED		
∇ = ∇ SYMBOLS TO BS. 1134 ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ∇	TOLERANCE ON MACHINED DIMENSIONS: 0-250mm TOL. 0,25mm (0-10" TOL. ·010") OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020") OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030") OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")	TRACED	TITLE PCB # 3 ASSEMBLY	SCALE -
SCREW THREADS EXCEPT AS STATED METRIC TO BS. 3643 6H/6g CLASS WHIT. FORM TO BS. 84 MEDIUM CLASS B.A. TO BS. 93 NORMAL CLASS WELDING SYMBOLS TO BS. 499 DRAWING SYMBOLS, NOTES, ETC. TO BS. 308	TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS. TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°	CHECKED		
		APPROVED	UNIVERSITY OF LIVERPOOL OLIVER LODGE LABORATORY DEPARTMENT OF PHYSICS	DRAWING NUMBER PTG/NMR/007 SHEET 3 OF 3

A | DATE Nov 80 | SIG. DWJ | MODIFICATION





"G" 4 COMPONENT LEADS MARKED THUS ARE SOLDERED TO THE GROUND PLANE OF THE PRINTED CIRCUIT BOARD

ITEM	NAME	MANUFACTURER	DETAIL DRG.	QTY.
18	CAPACITOR, 1000 pF	SEE PTG/NMR/001 NOTE 5		2
17	RESISTOR, 2.2 kΩ	SEE PTG/NMR/001 NOTE 6		2
16	RESISTOR, 220 Ω	——— // ———		1
15	CHIP ATTENUATOR, 50Ω, 3dB, AC0103	EMC TECHNOLOGY		2
14	CHIP RESISTOR, 50Ω, CR15, TYPE B	——— // ———		1
13	SLEEVING TO SUIT ITEM 12			-
12	BARE COPPER WIRE, 1/0.6mm			-
11	TRIMPOT, 10 kΩ, 3262W-1-103	BOURNS		1
10	DUAL OP-AMP, OP-10EY	PRECISION MONOLITHICS		1
9	CAPACITOR, 220 pF	SEE PTG/NMR/001 NOTE 4		2
8	RESISTOR, 4.7 kΩ	SEE PTG/NMR/001 NOTE 6		4
7	DETECTOR DIODE, BD3	GENERAL ELECTRIC		2
6	MOUNTING CLAMP, WASHER	SUPPLIED WITH ITEM 2		2
5	MOUNTING CLAMP, NUT			2
4	MOUNTING CLAMP, SCREW			2
3	MOUNTING CLAMP PLATE			1
2	R.F. AMPLIFIER, GPD-403	AVANTEK		1
1	PRINTED CIRCUIT BOARD # 4	UNIV. OF LIVERPOOL	PCB 4, MOD B	1

PARTS LIST

DIMENSIONS IN mm EXCEPT AS STATED

SURFACE TEXTURE EXCEPT AS STATED
▽ = ▽SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ▽

SCREW THREADS EXCEPT AS STATED
METRIC TO BS. 3643 6H/6g CLASS
WHIT. FORM TO BS. 84 MEDIUM CLASS
B.A. TO BS. 93 NORMAL CLASS
WELDING SYMBOLS TO BS. 499
DRAWING SYMBOLS, NOTES, ETC TO BS 308

TOLERANCES EXCEPT AS STATED

INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.

TOLERANCE ON MACHINED DIMENSIONS:
0-250mm TOL. 0,25mm (0-10" TOL. ·010")
OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020")
OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030")
OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")

TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

DRAWN	DWG.	PROJECT NMR RF MODULE	ARRGT. DRG. -
CHECKED			
TRACED		TITLE PCB # 4 ASSEMBLY.	SCALE 1:1
CHECKED			
APPROVED			

A	DATE OCT 80
	SIG. DWP.
	MODIFICATION

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER PTG/NMR/008
SHEET 1 OF 3

LATEST ISSUE

DO NOT SCALE | THIRD ANGLE PROJECTION | REMOVE ALL BURRS AND SHARP EDGES

COMPONENT MOUNTING INSTRUCTIONS

1. VISUALLY CHECK THE PRINTED CIRCUIT BOARD – ENSURE THERE ARE NO OBVIOUS DEFECTS.
2. INSERT THE R.F. AMPLIFIER (ITEM 2) INTO THE PCB (SIDE B), OBSERVE THE CORRECT ORIENTATION, AND SECURE WITH MOUNTING CLIP AND SCREWS (ITEMS 3-6). CHECK THE ORIENTATION IS CORRECT.
3. SOLDER 4 CONNECTIONS TO ITEM 2 ONTO PCB (SIDE A) AND TRIM OFF EXCESS LEADS.
4. FORM THE LEADS OF TWO OFF OF EACH OF ITEM 8 & (9) AND INSERT THEM INTO THE PCB (SIDE B) AS SHOWN. SOLDER ONTO PCB (SIDE A). ALSO SOLDER ONE END OF EACH COMPONENT ONTO THE GROUND PLANE ON PCB (SIDE B) AS INDICATED BY THE LETTER "G" ON SHEET 1.
5. INSERT THE DETECTOR DIODES (ITEM 7) INTO THE PCB (SIDE B) AND SOLDER ONTO PCB (SIDE A). ENSURE THAT THE DIODE BODIES STAND OFF THE GROUND PLANE BY BETWEEN 1 AND 2 MM.
6. INSERT TRIMPOT (ITEM 11) INTO PCB (SIDE B), OBSERVE THE CORRECT ORIENTATION. PUSH IT HARD DOWN ONTO SIDE B AND SOLDER THE PINS ON SIDE A. TRIM OFF EXCESS LEAD LENGTH.
7. MAKE UP LINK WITH WIRE AND SLEEVING (ITEMS 12 & 13) AND INSERT INTO PCB (SIDE B). ENSURE THAT THERE ARE NO SHORTS TO THE GROUND PLANE, ESPECIALLY AT THE ENDS. SOLDER ONTO PCB (SIDE A) AND TRIM OFF EXCESS LEAD LENGTH REMAINING.
8. MOUNT THE REMAINING RESISTORS AND CAPACITORS (ITEMS 8, 16, 17 (18)) IN THE NORMAL WAY ON PCB (SIDE B). SOLDER THE LEADS ON PCB (SIDE A) AND TRIM OFF EXCESS LEAD LENGTH.
9. INSERT THE DUAL OP-AMP (ITEM 10) INTO THE PCB (SIDE B). NOTE THAT THERE ARE TWO AS YET UN-USED PAIRS OF HOLES IN THIS VICINITY, ONE AT EACH END OF THE AMPLIFIER. SOLDER THE AMPLIFIER PINS ONTO THE PCB (SIDE A).
10. USING THE TECHNIQUES DESCRIBED IN THE DRAWING PTG/NMR/013 "MOUNTING INSTRUCTIONS FOR CHIP COMPONENTS", MOUNT THE ONE CHIP RESISTOR AND TWO CHIP ATTENUATORS (ITEMS 14 & 15) IN THE POSITIONS SHOWN ON PCB (SIDE)
11. PRE-ASSEMBLY OF THIS PRINTED CIRCUIT BOARD IS NOW COMPLETE.

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

DRAWN	DWG	PROJECT	NMR RF MODULE
CHECKED			
TRACED		TITLE	PCB # 4 ASSEMBLY
CHECKED			
APPROVED			

ARRGT. DRG. SHEET 1 | SCALE –

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER: PTG/NMR/008 | LATEST ISSUE

SHEET 2 OF 3

A | DATE NOV 80 | SIG. DWJ | MODIFICATION

DIMENSIONS IN – EXCEPT AS STATED

SURFACE TEXTURE EXCEPT AS STATED
√ = √ SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED √

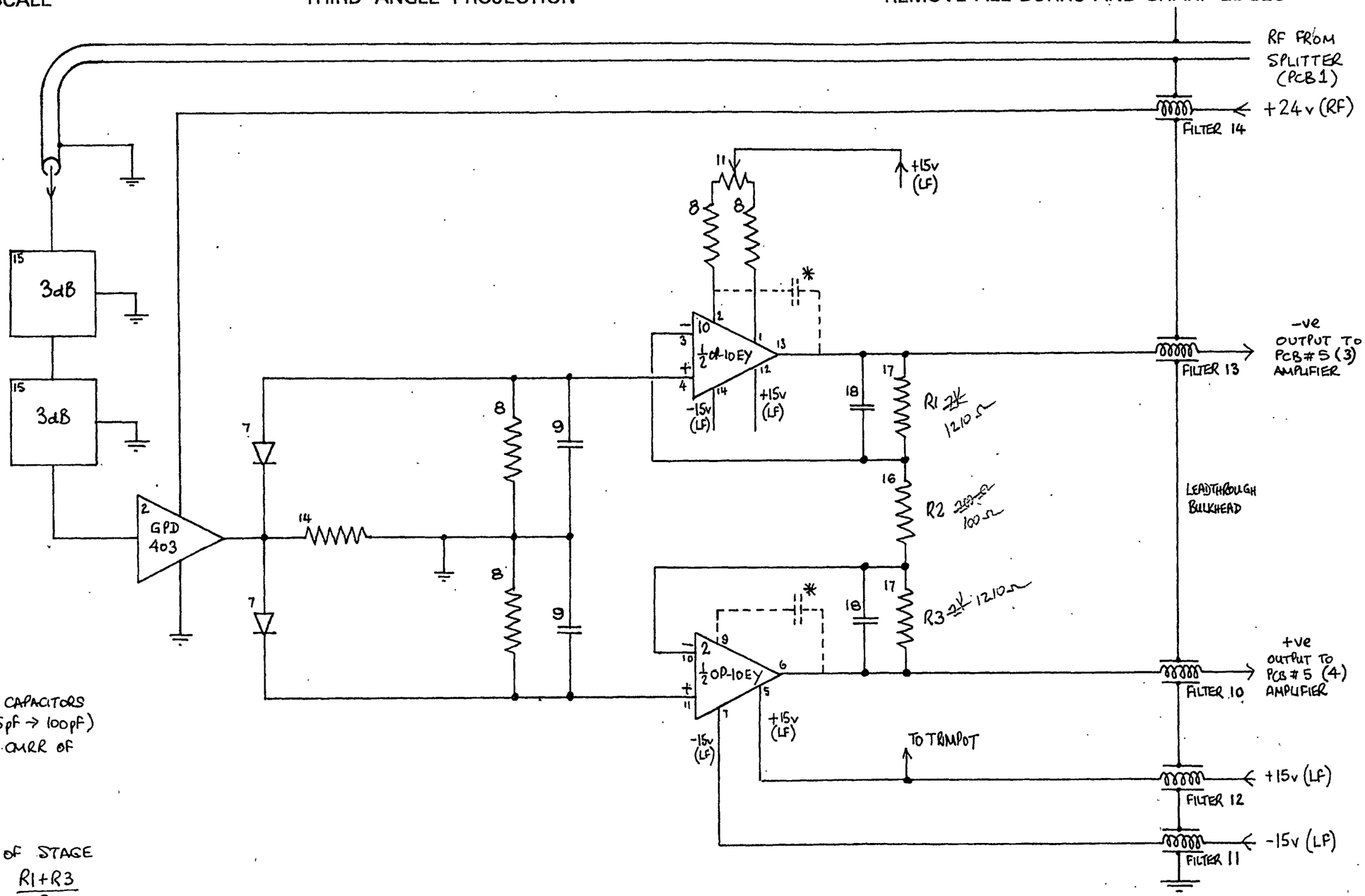
SCREW THREADS EXCEPT AS STATED
METRIC TO BS. 3643 6H/6g CLASS
WHIT. FORM TO BS. 84 MEDIUM CLASS
B.A. TO BS. 93 NORMAL CLASS
WELDING SYMBOLS TO BS. 499
DRAWING SYMBOLS, NOTES, ETC. TO BS. 308

TOLERANCES EXCEPT AS STATED
INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.
TOLERANCE ON MACHINED DIMENSIONS:
0-250mm TOL. 0,25mm (0-10" TOL. ·010")
OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020")
OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030")
OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")
TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

DO NOT SCALE

THIRD ANGLE PROJECTION

REMOVE ALL BURRS AND SHARP EDGES



* 1 OF THESE CAPACITORS CAN BE ADDED (5pf → 100pf) TO MAXIMISE THE CMRR OF THE AMPLIFIER

VOLTAGE GAIN OF STAGE

$$\cdot = 1 + \frac{R1+R3}{R2}$$

PCB# 4 - CIRCUIT DIAGRAM

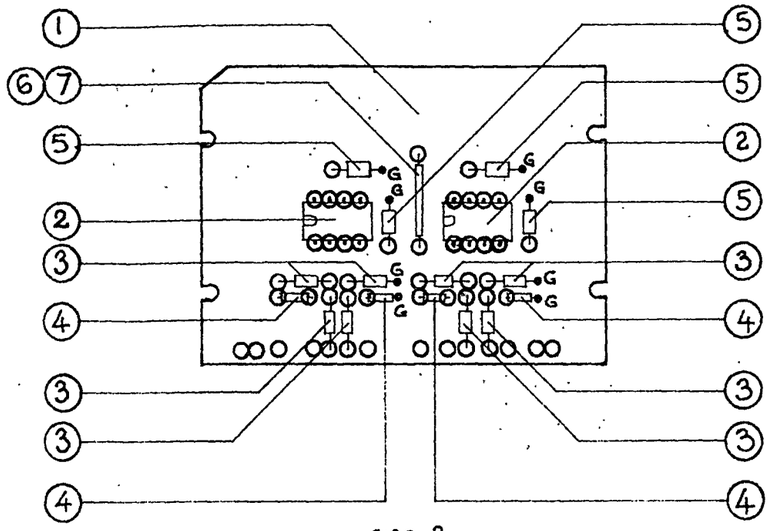
DIMENSIONS IN EXCEPT AS STATED	TOLERANCES EXCEPT AS STATED	DRAWN	DWG.	PROJECT NMR RF MODULE	ARRGT. DRG. SHEET 1
SURFACE TEXTURE EXCEPT AS STATED	INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES	CHECKED			
✓ = ✓SYMBOLS TO BS. 1134	MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR	TRACED		TITLE PCB # 4 ASSEMBLY	SCALE -
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ✓	MINUS HALF TOL.	CHECKED			
SCREW THREADS EXCEPT AS STATED	TOLERANCE ON MACHINED DIMENSIONS:	APPROVED			
METRIC TO BS. 3643 6H/6g CLASS	0-250mm TOL. 0,25mm (0-10" TOL. ·010")			UNIVERSITY OF LIVERPOOL	DRAWING NUMBER PTG/NMR/008
WHIT. FORM TO BS. 84 MEDIUM CLASS	OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020")			OLIVER LODGE LABORATORY	LATEST ISSUE
B.A. TO BS. 93 NORMAL CLASS	OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030")			DEPARTMENT OF PHYSICS	SHEET 3 OF 3
WELDING SYMBOLS TO BS. 499	OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")				
DRAWING SYMBOLS, NOTES, ETC. TO BS. 308	TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.				
	TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°				

A	DATE NOV 80
	SIG. DWF
MODIFICATION	

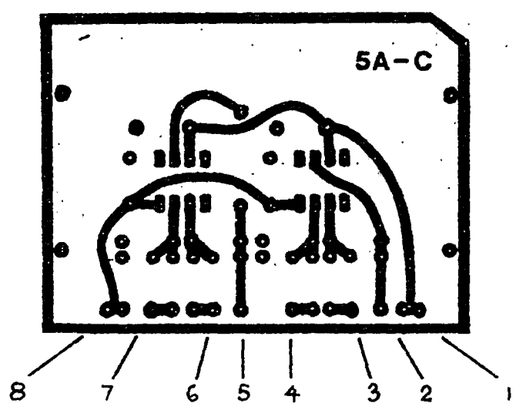
DO NOT SCALE

THIRD ANGLE PROJECTION

REMOVE ALL BURRS AND SHARP EDGES



SIDE B



SIDE A

"G" 8 COMPONENT LEADS MARKED THUS ARE SOLDERED TO THE GROUND PLANE OF THE PRINTED CIRCUIT BOARD.

ITEM	NAME	MANUFACTURER	DETAIL DRG.	QTY.
7	SLEEVING - TO SUIT ITEM 6			-
6	BARE COPPER WIRE, 1/0.6 mm			-
5	CAPACITOR, 0.1 μF	SEE PTG/NMR/001 NOTE 5		4
4	CAPACITOR, 1000 pF	SEE PTG/NMR/001 NOTE 5		4
3	RESISTOR, 2.2 kΩ	SEE PTG/NMR/001 NOTE 6		8
2	OP-AMP, LF 356N			2
1	PRINTED CIRCUIT BOARD #5	UNIV. OF LIVERPOOL	PCB#5, MOD C	1

PARTS LIST

DIMENSIONS IN EXCEPT AS STATED

SURFACE TEXTURE EXCEPT AS STATED
√ = √ SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED √

SCREW THREADS EXCEPT AS STATED
METRIC TO BS. 3643 6H/6g CLASS
WHIT. FORM TO BS. 84 MEDIUM CLASS
B.A. TO BS. 93 NORMAL CLASS
WELDING SYMBOLS TO BS. 499
DRAWING SYMBOLS, NOTES, ETC. TO BS. 308

TOLERANCES EXCEPT AS STATED

INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.

TOLERANCE ON MACHINED DIMENSIONS:

0-250mm TOL. 0,25mm	(0-10" TOL. ·010")
OVER 250-500mm TOL. 0,5mm	(OVER 10-20" TOL. ·020")
OVER 500-1000mm TOL. 0,75mm	(OVER 20-40" TOL. ·030")
OVER 1000mm TOL. 1mm	(OVER 40" TOL. ·040")

TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

DRAWN	DWG	PROJECT	NMR RF MODULE
CHECKED			
TRACED		TITLE	PCB #5 ASSEMBLY
CHECKED			
APPROVED			

ARRGT. DRG. -

SCALE -

MODIFICATION	DATE	SIG.
A	NOV 80	DWL

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER PTG/NMR/009

SHEET 1 OF 3

LATEST ISSUE

DO NOT SCALE | THIRD ANGLE PROJECTION | REMOVE ALL BURRS AND SHARP EDGES

COMPONENT MOUNTING INSTRUCTIONS

1. VISUALLY CHECK PRINTED CIRCUIT BOARD - ENSURE THERE ARE NO OBVIOUS DEFECTS.
2. INSERT 4, 0·1 µF CAPACITORS (ITEM 5) INTO PCB (SIDE B) AND SOLDER LEADS ON PCB (SIDE A). ALSO SOLDER ONE LEAD OF EACH CAPACITOR ONTO THE GROUND PLANE ON PCB (SIDE B) AT THE POINTS DESIGNATED WITH THE LETTER "G" ON SHEET 1. TRIM OFF EXCESS LEAD LENGTH REMAINING.
3. MOUNT THE REMAINING RESISTORS AND CAPACITORS (ITEMS 3 & 4) IN THE NORMAL WAY ON THE PCB (SIDE B). SOLDER THE LEADS ON SIDE A AND TRIM OFF ANY EXCESS LEAD LENGTH REMAINING. ALSO SOLDER ONTO PCB (SIDE B) AT THE FOUR REMAINING POINTS INDICATED BY THE LETTER "G".
4. MAKE UP LINK WITH WIRE & SLEEVING (ITEMS 6 & 7) AND INSERT INTO PCB (SIDE B). ENSURE THAT THERE IS NO SHORT TO THE GROUND PLANE, ESPECIALLY AT THE ENDS OF THE LINK. SOLDER ONTO PCB (SIDE A) AND TRIM OFF ANY EXCESS LEAD LENGTH REMAINING.
5. INSERT THE TWO OP-AMPS (ITEM 2) INTO THE PCB (SIDE B). OBSERVE CORRECT ORIENTATION. SOLDER PINS ONTO PCB (SIDE A).
6. PRE-ASSEMBLY OF THIS PRINTED CIRCUIT BOARD IS NOW COMPLETE.

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

DIMENSIONS IN – EXCEPT AS STATED
SURFACE TEXTURE EXCEPT AS STATED
▽ = ▽ SYMBOLS TO BS. 1134
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WELDING SYMBOLS TO BS. 499
DRAWING SYMBOLS, NOTES, ETC. TO BS. 308

TOLERANCES EXCEPT AS STATED
INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.
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TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

DRAWN	DWG.	PROJECT	NMR RF MODULE
CHECKED			
TRACED		TITLE	PCB #5 ASSEMBLY
CHECKED			
APPROVED			

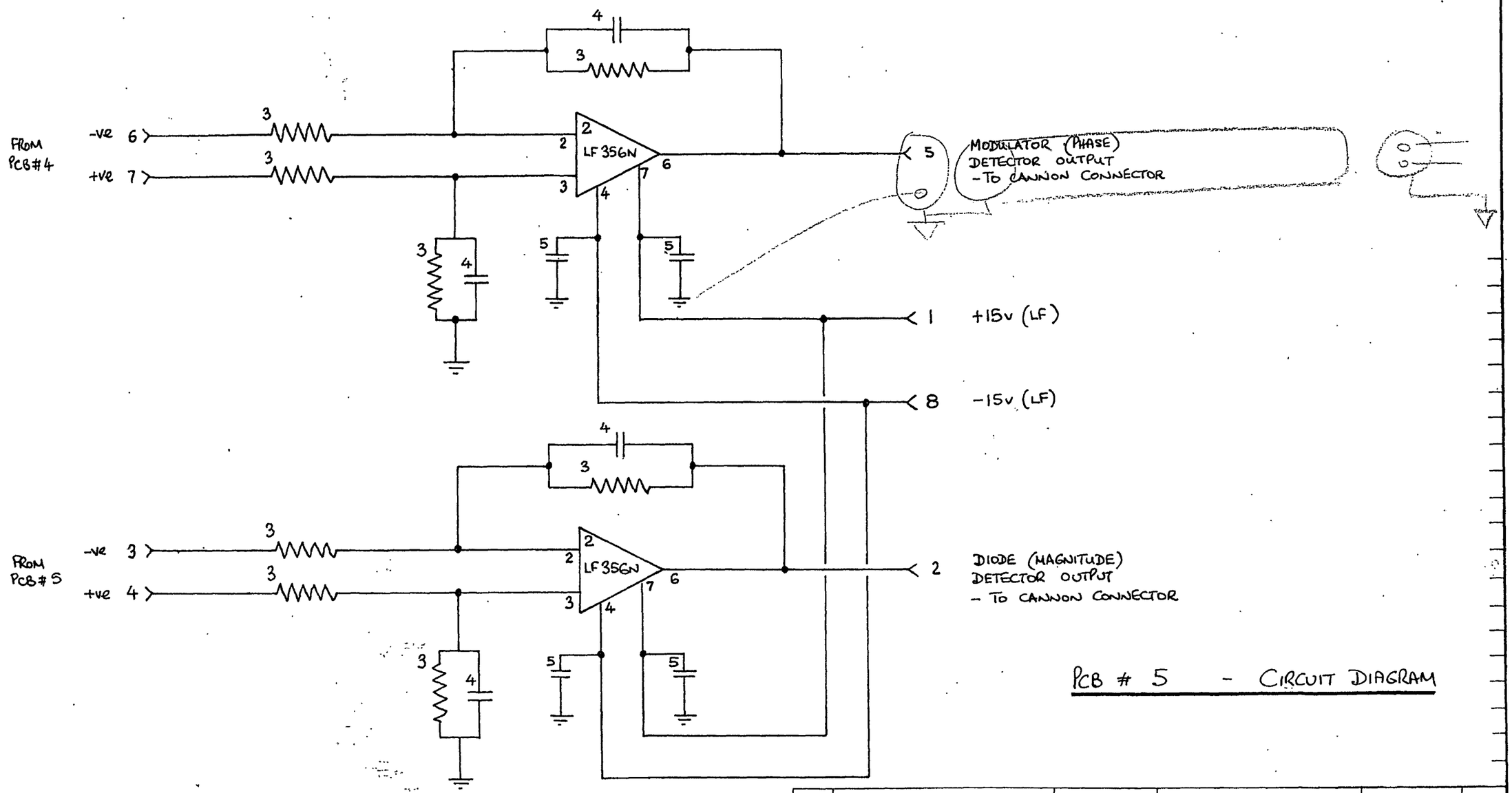
ARRGT. DRG. SHEET 1
SCALE –

A | DATE Nov 80 | SIG. DWG | MODIFICATION

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER PTG/NMR/009
SHEET 2 OF 3
LATEST ISSUE

DO NOT SCALE | THIRD ANGLE PROJECTION | REMOVE ALL BURRS AND SHARP EDGES



PCB # 5 - CIRCUIT DIAGRAM

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

DRAWN	DWG	PROJECT	NMR RF MODULE
CHECKED			
TRACED		TITLE	PCB # 5 ASSEMBLY
CHECKED			
APPROVED			

ARRGT. DRG. SHEET 1 | SCALE -

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER: PTG|NMR|009 | LATEST ISSUE

SHEET 3 OF 3

A | DATE NOV 80 | SIG. DWL | MODIFICATION

DIMENSIONS IN EXCEPT AS STATED
SURFACE TEXTURE EXCEPT AS STATED
▽ = ▽SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ▽
SCREW THREADS EXCEPT AS STATED
METRIC TO BS. 3643 6H/6g CLASS
WHIT. FORM TO BS. 84 MEDIUM CLASS
B.A. TO BS. 93 NORMAL CLASS
WELDING SYMBOLS TO BS. 499
DRAWING SYMBOLS, NOTES, ETC. TO BS. 308

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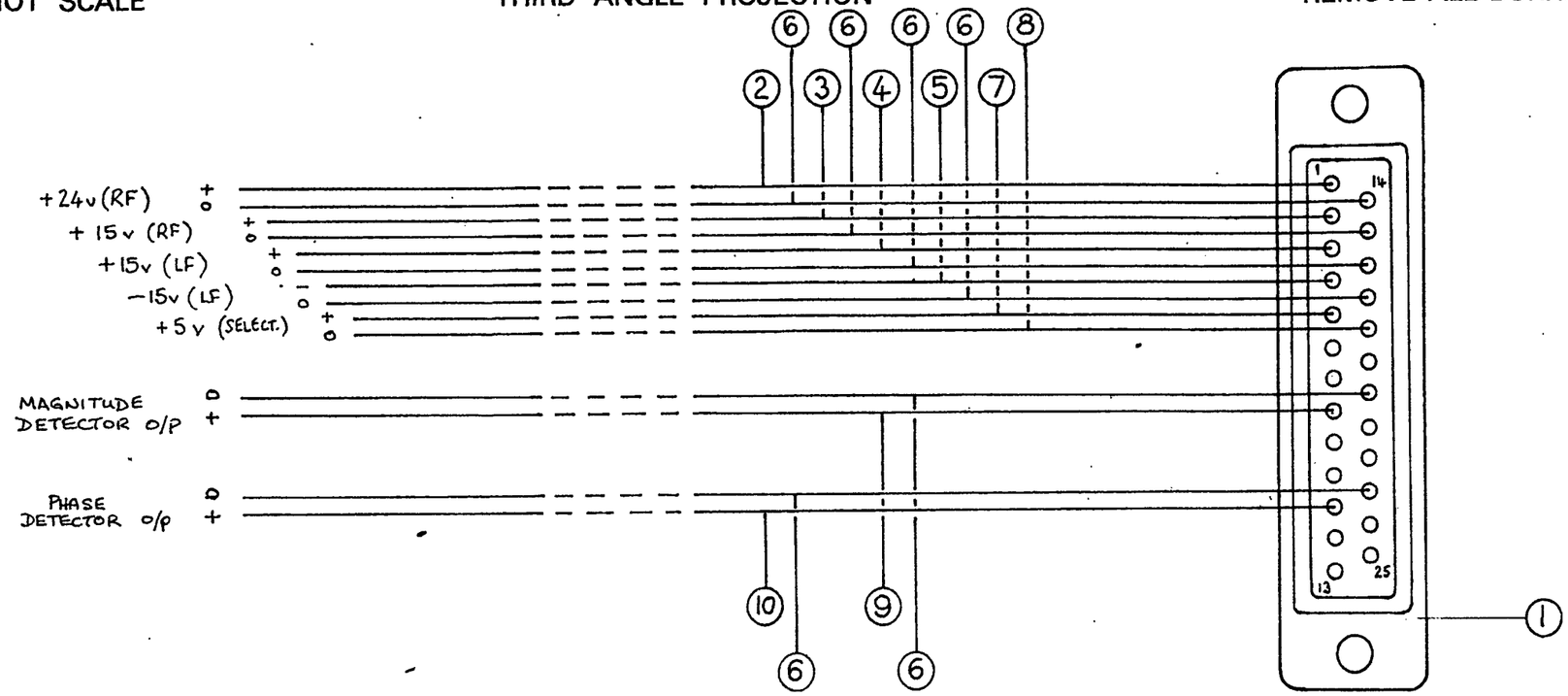
DO NOT SCALE

THIRD ANGLE PROJECTION

REMOVE ALL BURRS AND SHARP EDGES



NOTES:

CUT ALL WIRES TO 300 mm LONG – THEY CAN BE TRIMMED TO THE CORRECT LENGTH DURING ASSEMBLY OF THE CONNECTOR INTO THE MODULE FRAME (SEE DRAWING N° PTG/NMR/012).

USE SLEEVING LENGTHS (ITEM 11) TO COVER SOLDERED JOINT BETWEEN CANNON CONNECTOR & WIRE

TO REDUCE "BULK" OF WIRES INSIDE THE COMPLETED MODULE, IT IS PREFERABLE TO USE A WIRE WITH AN EXTERNAL DIAMETER OF LESS THAN ABOUT 1 mm. TEFLON INSULATION IS RECOMMENDED.

ITEM	NAME	MATERIAL	QTY.
11	SLEEVING	TO FIT ITEMS 2-10, AS REQUIRED OVER CONNECTIONS	–
10	WIRE, PHASE o/p	INSULATED COPPER, 7/0.2 mm, PURPLE	300
9	WIRE, MAGNITUDE o/p	——— // ———, GREY	300
8	WIRE, 0v (SWITCH)	——— // ———, WHITE	300
7	WIRE, +5v (SWITCH)	——— // ———, GREEN	300
6	WIRE, 0v	——— // ———, BLACK	1800
5	WIRE, −15v (LF)	——— // ———, BLUE	300
4	WIRE, +15v (LF)	——— // ———, RED	300
3	WIRE, +15v (RF)	——— // ———, ORANGE	300
2	WIRE, +24v (RF)	——— // ———, PINK	300
1	CONNECTOR	CANNON, DB-25P	1

PARTS LIST

DIMENSIONS IN mm EXCEPT AS STATED	TOLERANCES EXCEPT AS STATED
SURFACE TEXTURE EXCEPT AS STATED ▽ = ▽ SYMBOLS TO BS. 1134 ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ▽	INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL. TOLERANCE ON MACHINED DIMENSIONS: 0-250mm TOL. 0,25mm (0-10" TOL. ·010") OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020") OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030") OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040") TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS. TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°
SCREW THREADS EXCEPT AS STATED METRIC TO BS. 3643 6H/6g CLASS WHIT. FORM TO BS. 84 MEDIUM CLASS B.A. TO BS. 93 NORMAL CLASS WELDING SYMBOLS TO BS. 499 DRAWING SYMBOLS, NOTES, ETC. TO BS. 308	

DRAWN	DWG.	PROJECT	NMR RF MODULE
CHECKED			
TRACED		TITLE	CANNON CONNECTOR ASSEMBLY
CHECKED			
APPROVED			

ARRGT. DRG. –

SCALE –

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER PTG/NMR/010

LATEST ISSUE

SHEET 1 OF 1

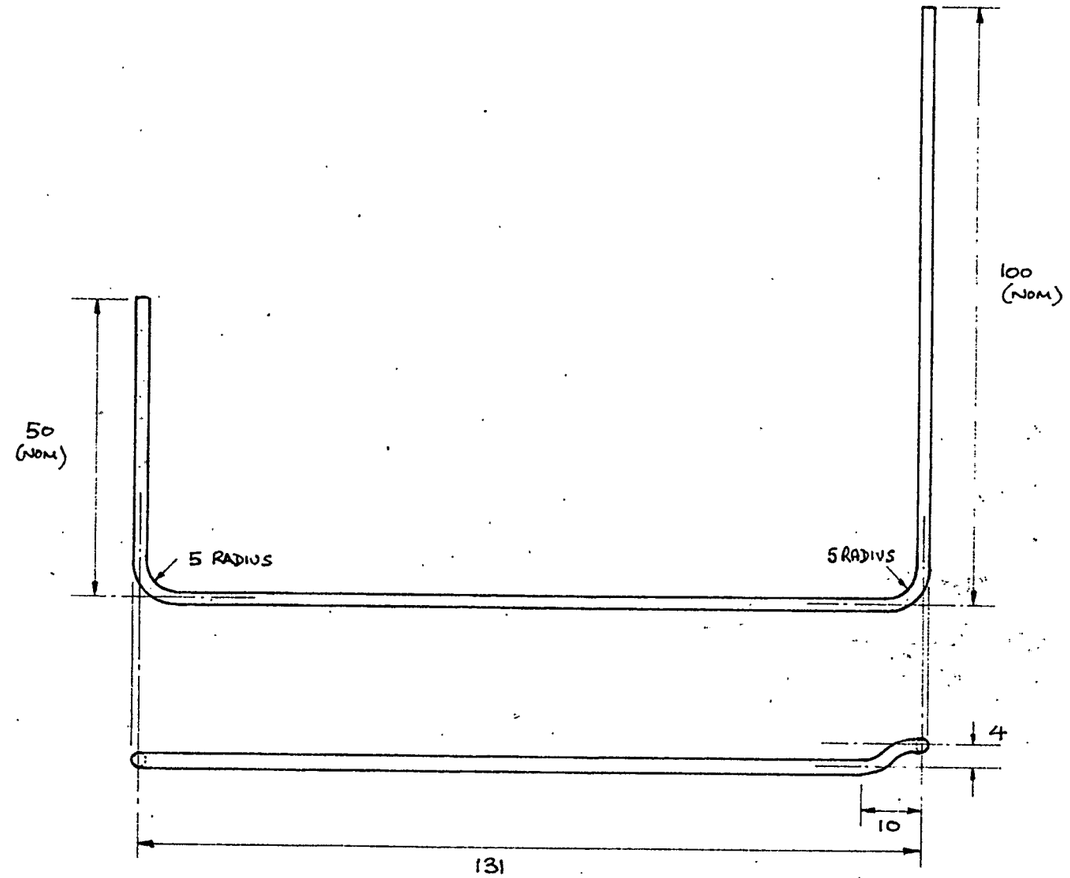
A DATE Oct 80 SIG. DWG

MODIFICATION

DO NOT SCALE

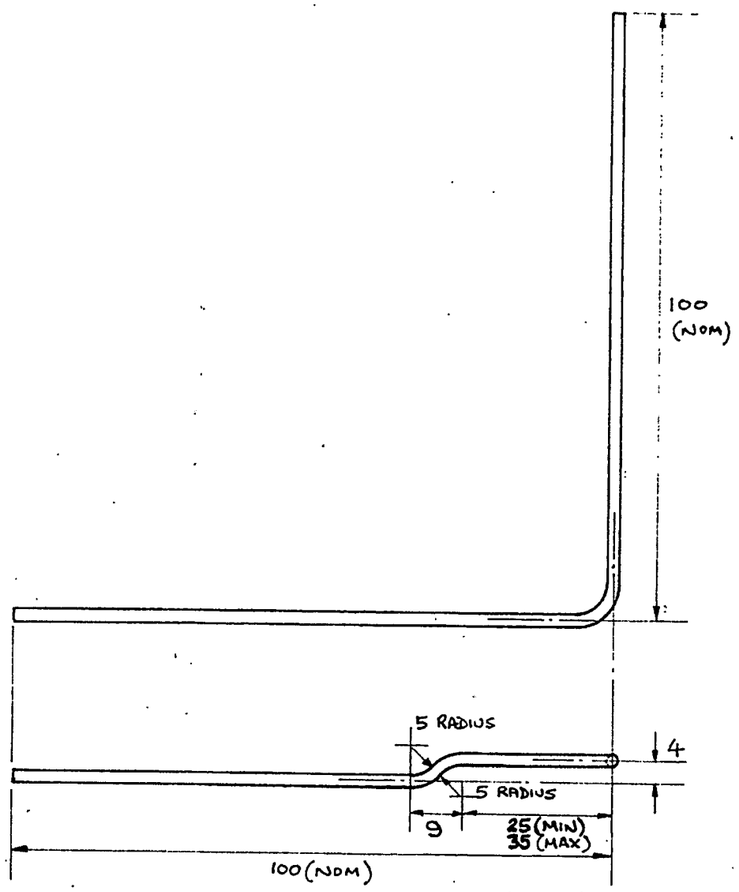
THIRD ANGLE PROJECTION

REMOVE ALL BURRS AND SHARP EDGES



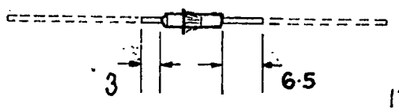
ITEM 1

FORM CABLE AS ABOVE



ITEM 2

FORM CABLE AS ABOVE



ITEM 3

REDUCE LEAD LENGTHS TO THOSE SHOWN ABOVE.

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

DRAWN	DWG	PROJECT: NMR RF MODULE	ARRGT. DRG.
CHECKED			
TRACED		TITLE: LEADTHROUGH BULKHEAD ASSEMBLY	SCALE: 1:1
CHECKED			
APPROVED			

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER: PTG/NMR/011

SHEET 1 OF 3

LATEST ISSUE

A	DATE NOV 80
	SIG. DWJ.
MODIFICATION	

DIMENSIONS IN mm EXCEPT AS STATED

SURFACE TEXTURE EXCEPT AS STATED
$\sqrt{}$ = $\sqrt{}$ SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED $\sqrt{}$

SCREW THREADS EXCEPT AS STATED
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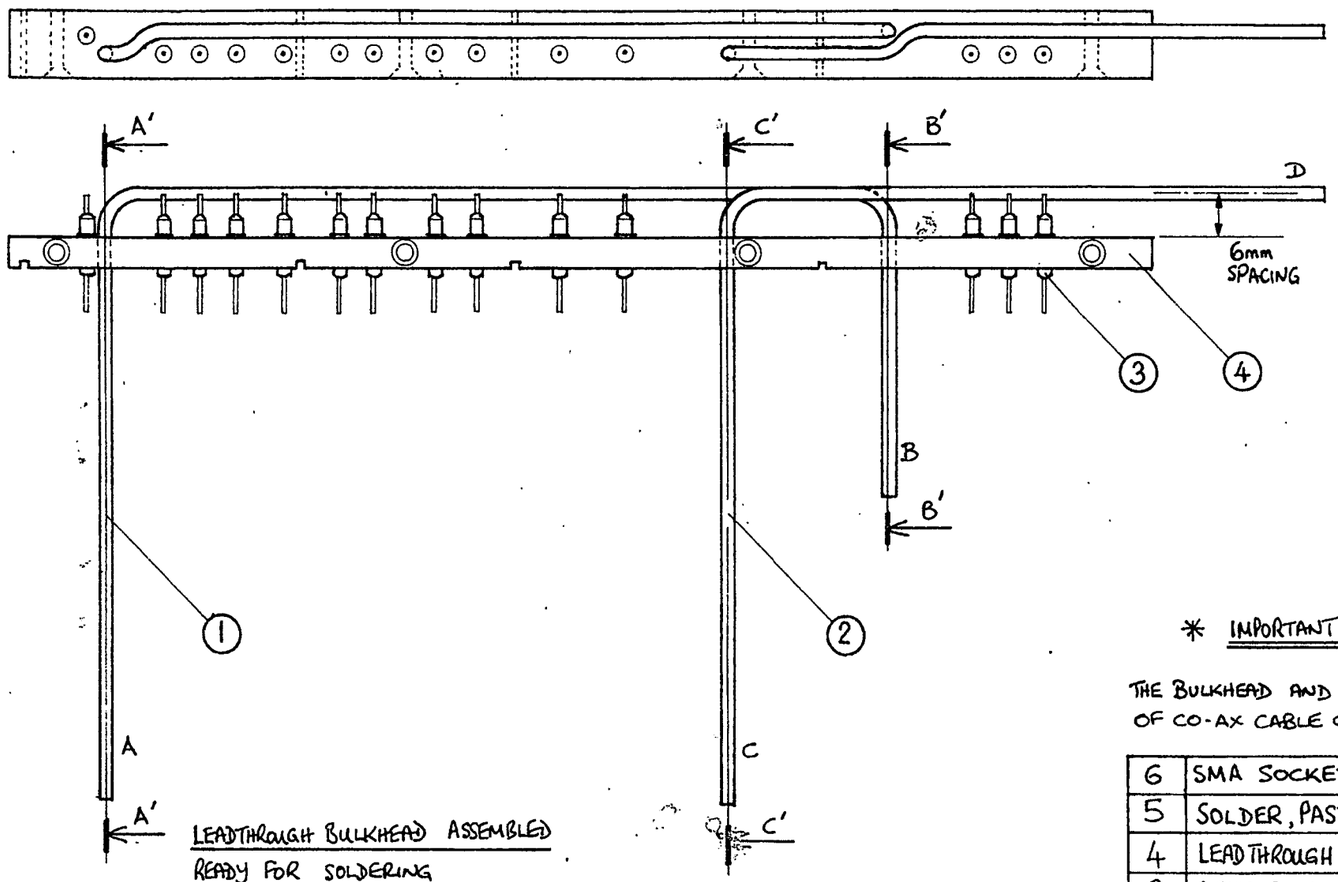
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

DO NOT SCALE | THIRD ANGLE PROJECTION | REMOVE ALL BURRS AND SHARP EDGES



LEADTHROUGH BULKHEAD ASSEMBLED READY FOR SOLDERING

NOTE: THE FOUR "ENDS" OF THE SEMI-RIGID CO-AX CABLE ARE DESIGNATED A, B, C, & D. THEY ARE REFERRED TO ON SHEET 3 DURING FINAL PREPARATION OF THIS ASSEMBLY BEFORE BEING INCORPORATED INTO THE MODULE.

INSTRUCTIONS FOR MOUNTING ITEMS 1, 2, & 3 INTO THE LEADTHROUGH BULKHEAD, ITEM 4.

1. ENSURE ITEM 4 IS CLEAN AND FREE FROM ANY CONTAMINATION THAT WOULD HINDER SOLDERING
2. APPLY A SMALL QUANTITY OF SOLDER CREAM TO EACH OF THE HOLES OF ITEM 4 THAT IS TO RECIEVE A COMPONENT.
3. INSERT THE 14 FILTERS INTO THE CORRECT HOLES OF THE BULKHEAD, FROM THE TOP OF THE BULKHEAD AS VIEWED IN THE ADJACENT DRAWING.
4. CHECK THAT THERE IS THE CORRECT AMOUNT OF SOLDER CREAM ABOUT EACH FILTER.
5. CLEAN THE COPPER OUTER SHEATH OF THE SEMI-RIGID CO-AX CABLE ITEMS, AND INSERT THEM INTO THE BULKHEAD AS SHOWN.
6. PLACE SEVERAL PACKING PIECES BETWEEN THE CABLE AND THE BULKHEAD TO MAINTAIN THE CORRECT POSITIONING OF THE CABLE DURING SOLDERING.
7. CHECK THAT THERE IS THE CORRECT AMOUNT OF SOLDER CREAM ABOUT EACH CO-AX CABLE JOINT.
8. TRANSFER THE UNIT TO A SMALL OVEN, TAKING CARE NOT TO DISTURB THE POSITIONS OF THE TWO CABLE SECTIONS.
9. WITH THE OVEN TEMPERATURE SET A LITTLE ABOVE THE SOLDER MELTING POINT, SATISFACTORY SOLDERING SHOULD TAKE PLACE AFTER A FEW MINUTES
10. CONTINUE WITH FINAL CABLE TRIMMING AS DESCRIBE ON SHEET 3 OF THIS DRAWING.

* IMPORTANT : IT IS ADVISABLE TO HAVE ONE OR TWO "TRIAL" ASSEMBLIES, USING A SMALL PIECE OF COPPER OF SIMILAR SECTION TO THE BULKHEAD AND DRILLED WITH A FEW OF THE CORRECT SIZE HOLES. SMALL SECTIONS OF CO-AX CABLE CAN BE USED. THIS WILL ENSURE SATISFACTORY SOLDERING IS POSSIBLE.

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.
6	SMA SOCKET	2004-7985	STRAIGHT B'HEAD CABLE JACK	AMERICON	1
5	SOLDER, PASTE,	TLC-PRB3	SEE PTG/NMR/001 NOTE 14		-
4	LEADTHROUGH BULKHEAD			PTG/NMR/002 SHT 5	1
3	LEADTHROUGH FILTER	1251-001	ERIE		14
2	INPUT RF CABLE	BA50085	PRECISION TUBE		200mm
1	MAGNITUDE RF CABLE	BA50085	PRECISION TUBE		280mm

PARTS LIST

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SURFACE TEXTURE EXCEPT AS STATED
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ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ▽

SCREW THREADS EXCEPT AS STATED
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TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

MODIFICATION	DATE	SIG.
A	Nov 80	Dwg

DRAWN	Dwg.	PROJECT NMR RF MODULE	ARRGT. DRG.
CHECKED			
TRACED		TITLE LEADTHROUGH BULKHEAD ASSEMBLY	SCALE 1:1
CHECKED			
APPROVED			

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

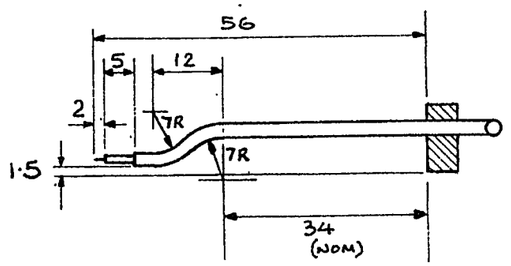
DRAWING NUMBER: PTG/NMR/011 | LATEST ISSUE

SHEET 2 OF 3

DO NOT SCALE

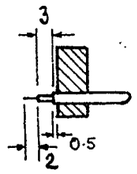
THIRD ANGLE PROJECTION

REMOVE ALL BURRS AND SHARP EDGES



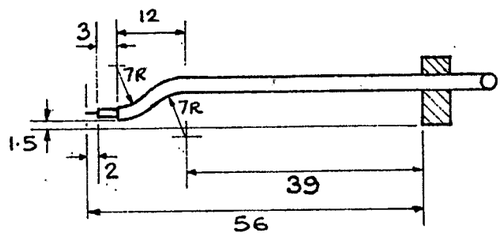
SECTION A'A'

(SHOWING FINAL FORM OF END A)



SECTION B'B'

(SHOWING FINAL FORM OF END B)

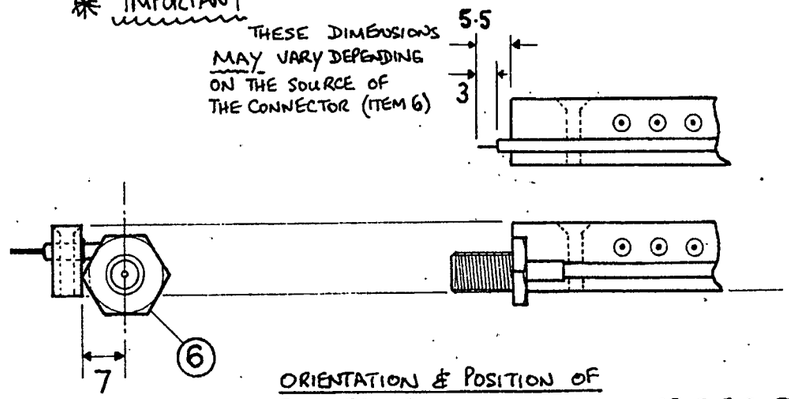


SECTION C'C'

(SHOWING FINAL FORM OF END C)

* IMPORTANT

THESE DIMENSIONS MAY VARY DEPENDING ON THE SOURCE OF THE CONNECTOR (ITEM 6)



ORIENTATION & POSITION OF SMA RF INPUT CONNECTOR ON CABLE END D

FINAL PREPARATION OF SEMI-RIGID CABLE ENDS.

1. END A
   i) FORM CABLE INTO SHAPE SHOWN IN SECTION A'A'.
   ii) CUT CABLE TO FINISHED LENGTH, PREFERABLY WITH FINE SAW OR VERY SHARP KNIFE.
   iii) SCORE OUTER COPPER SHEATH 7 mm BACK FROM CUT END, AND CRACK IT OFF. PULL DETACHED OUTER PORTION AWAY FROM CABLE.
   iv) TRIM TEFLON INSULATION BACK 2 mm, LEAVING END OF CABLE AS SHOWN IN THE SECTION.

2. END B
   i) REMOVE OUTER COPPER SHEATH, AND TRIM BACK TEFLON INSULATION TO DIMENSIONS SHOWN IN SECTION B'B'. USE SAME TECHNIQUES AS FOR END A, i) → iv)

3. END C
   i) FORM CABLE INTO SHAPE SHOWN IN SECTION C'C'.
   ii) CUT CABLE TO LENGTH AND TRIM END USING THE SAME TECHNIQUES AS BEFORE.

4. END D
   i) CUT CABLE BACK TO A PROTRUDING LENGTH OF 5·5 mm AS SHOWN.
   ii) MOUNT CONNECTOR (ITEM 6) IN THE ORIENTATION SHOWN. FOLLOW MANUFACTURERS INSTRUCTIONS FOR THIS.

* IMPORTANT: IT IS ADVISABLE TO DO SOME TRIAL CABLE TRIMMING & CONNECTOR MOUNTING BEFORE ATTEMPTING THE ABOVE. A MISTAKE AT THIS STAGE COULD NECESSITATE A COMPLETE RE-MAKE OF THIS ASSEMBLY!

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

DRAWN	DWG	PROJECT	NMR RF MODULE
CHECKED			
TRACED		TITLE	LEADTHROUGH BULKHEAD ASSEMBLY
CHECKED			
APPROVED			

ARRGT. DRG. SHEET 2

SCALE 1:1

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER PTG/NMR/011

SHEET 3 OF 3

LATEST ISSUE

DIMENSIONS IN MM EXCEPT AS STATED

SURFACE TEXTURE EXCEPT AS STATED
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TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

A	DATE	NOV 80
	SIG.	DWG
MODIFICATION		

DO NOT SCALE | THIRD ANGLE PROJECTION | REMOVE ALL BURRS AND SHARP EDGES

SUB-ASSEMBLY MANUFACTURE

i) MANUFACTURE "MODULE FRAME ASSEMBLY" AS DESCRIBED IN PTG/NMR/002 .
ii) MANUFACTURE THE COMPONENTS OF THE "CAPACITOR DRIVE ASSEMBLY", PTG/NMR/003.
iii) IF YOU REQUIRE THE FACILITY OF SWITCHING THE RF LEVEL TO THE NMR COIL, MANUFACTURE THE "REED SWITCH ASSEMBLY", PTG/NMR/004.
iv) ASSEMBLE THE 5 PRINTED CIRCUIT BOARDS AS DESCRIBED IN THE DRAWINGS PTG/NMR/005 - /009 .
v) MAKE UP THE "CANNON CONNECTOR ASSEMBLY", PTG/NMR/010. .
vi) ASSEMBLE THE 'LEADTHROUGH BULKHEAD' MANUFACTURED IN "MODULE FRAME ASSEMBLY", PTG/NMR/002 , TOGETHER WITH THE FEEDTHROUGH ITEMS DESCRIBED IN PTG/NMR/011

INSTALLATION OF PRINTED CIRCUIT BOARDS INTO MODULE FRAME

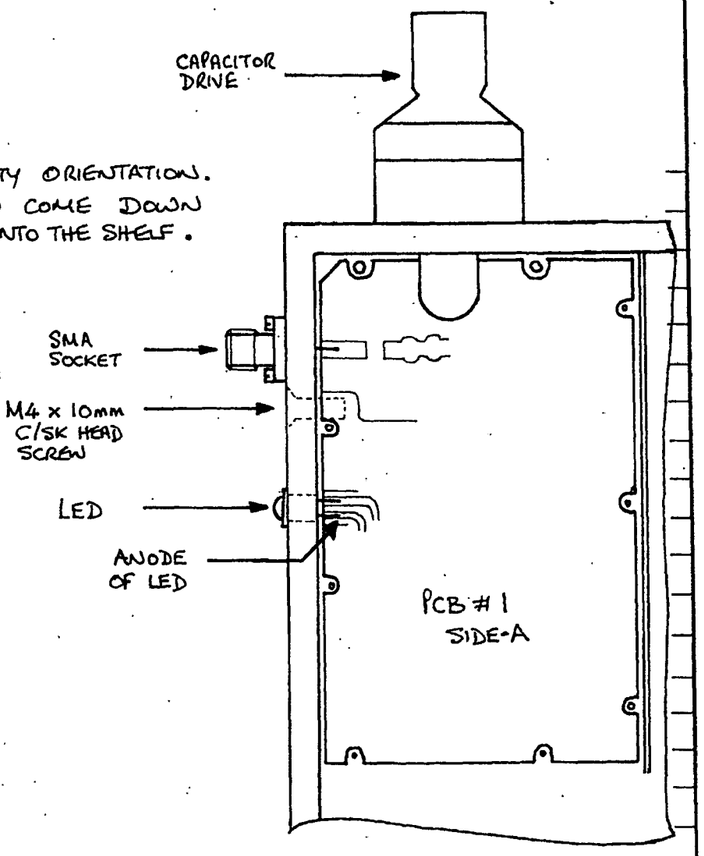
PCB#1

i) PRESS SWITCHING INDICATOR LED INTO 4 mm HOLE IN THE SIDE OF THE MODULE. SEE ILLUSTRATION FOR CORRECT POLARITY ORIENTATION. BEND THE LEADS SLIGHTLY UPWARDS, AWAY FROM THE INTERNAL SHELF TO ALLOW THE PRINTED CIRCUIT BOARD TO COME DOWN ONTO THE SHELF.

ii) TAKE THE COMPONENTS OF THE CAPACITOR DRIVE ASSEMBLY, PTG/NMR/003, AND ASSEMBLE THEM AS SHOWN IN THAT DRAWING IN THE FOLLOWING ORDER.
USING THE 3, M2·5 x 16 mm C/SK HEAD SCREWS FASTEN THE DRIVE MOUNTING BUSH TO THE MODULE FRAME. DISCARD THE BRASS NUT SUPPLIED WITH THE CAPACITOR DRIVE. PLACE THE STAR WASHER OVER THE DRIVE SHAFT SPINDLE AND INSERT THE DRIVE SPINDLE THROUGH THE HOLE IN THE FRAME INTO THE RECESS OF THE MOUNTING BUSH. PUSH IT RIGHT IN SO THAT THE THREADED PORTION OF THE DRIVE PROTRUDES OUT OF THE PLAIN FACE OF THE MOUNTING BUSH. PLACE THE OUTER PORTION OF THE KILO DRIVE KNOB OVER THE PROTRUDING DRIVE AND SCREW ON THE SPECIAL FASTENING NUT SUPPLIED WITH THE KNOB. ROTATE THE KNOB OUTER TO SET THE LOCKING LEVER INTO THE DESIRED POSITION AND FINALLY TIGHTEN DOWN THE FASTENING NUT. SLIDE THE CONTROL PORTION OF THE KNOB ONTO THE DRIVE SPINDLE & TIGHTEN THE SMALL SOCKET SCREW. CHECK THE LOCKING LEVER OPERATES.

iii) TAKE THE PRE-ASSEMBLED PCB #1. PUSH THE RUBBER COUPLING TUBE FROM THE CAPACITOR DRIVE ASSEMBLY OVER THE TRIMMER CAPACITOR DRIVE SHAFT. PUT THE MODULE FLAT ON THE BENCH IN FRONT OF YOU WITH THE INTERNAL SHELF UPPERMOST AND THE CAPACITOR DRIVE AWAY FROM YOU. NOW GENTLY INSERT PCB #1 (SIDE A UPPERMOST) INTO THE MODULE. GUIDE THE RUBBER COUPLING THROUGH THE HOLE IN THE MODULE FRAME TO ENGAGE WITH THE DRIVE SPINDLE AND AT THE SAME TIME AVOIDING THE LEADS TO THE LED. WHEN THE COUPLING IS FULLY ENGAGED THE BOARD SHOULD BE FLAT ON THE INTERNAL SHELF. MAKE SURE IT IS AND NOTHING IS WEDGED UNDER IT! FASTEN THE BOARD DOWN WITH 9, M2·5 x 6mm CH/HEAD SCREWS AND WASHERS (ITEMS 3 & 4).

---- CONTINUED ON SHEET 2.



ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

DIMENSIONS IN mm EXCEPT AS STATED	TOLERANCES EXCEPT AS STATED
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DRAWN	DWG	PROJECT	NMR RF MODULE
CHECKED			
TRACED		TITLE	MODULE ASSEMBLY INSTRUCTIONS
CHECKED			
APPROVED			

ARRGT. DRG. SHEET 6
SCALE -

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER PTG/NMR/012
SHEET 1 OF 6
LATEST ISSUE

A	DATE Nov 80	
	SIG. DWG.	
MODIFICATION		

DO NOT SCALE | THIRD ANGLE PROJECTION | REMOVE ALL BURRS AND SHARP EDGES

CHECK THAT THE CAPACITOR DRIVE OPERATES SATISFACTORILY. BEND DOWN THE TWO LEADS TO THE LED SO THAT THEY LIE FLAT ON SIDE A OF THE PCB ONTO THEIR RESPECTIVE CONNECTING TRACKS AND SOLDER THEM DOWN.

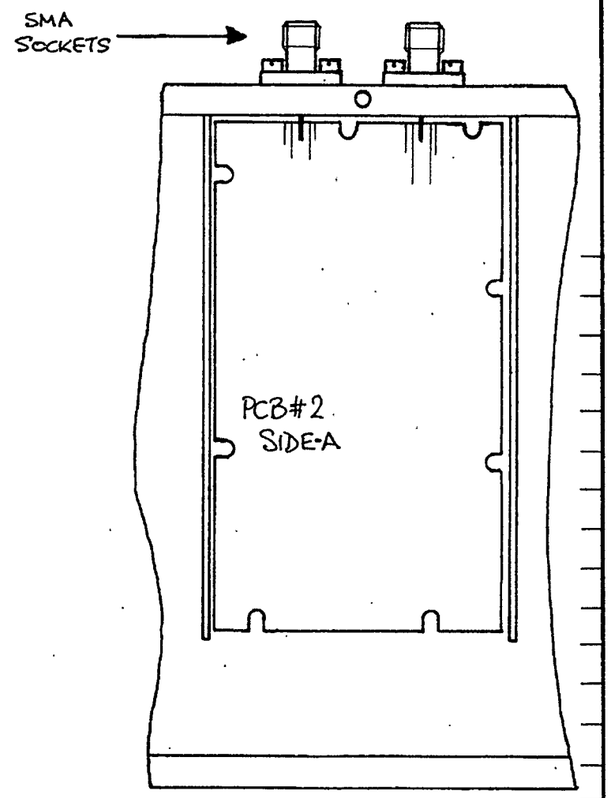
iv) SOLDER ~1 CMS OF SOLID COPPER WIRE 1/0.6 mm (ITEM 1) INTO THE CENTRE PIN OF AN SMA FLANGED SOCKET (ITEM 2). USING 4, M2·5 x 6mm CH/HEAD SCREWS (ITEM 3), FASTEN THE SOCKET TO THE MODULE FRAME AS SHOWN IN THE ILLUSTRATION ON SHEET 1. TRIM THE CONNECTING WIRE TO LENGTH AND SOLDER IT DOWN TO THE PRINTED CIRCUIT TRACK.

v) INSERT THE M4 x 10 mm C/SK HEAD SCREW (ITEM 5) INTO THE TAPPED HOLE IN THE END OF THE MODULE.

PCB#2

i) TAKE THE PRE-ASSEMBLED PCB # 2 AND PLACE IT ONTO THE INTERNAL SHELF WITH SIDE A UPPERMOST AS SHOWN IN THE ILLUSTRATION. FASTEN THE BOARD DOWN WITH 8, M2.5 x 6mm CH/HEAD SCREWS AND WASHERS (ITEMS 3 & 4).

ii) SOLDER ~1 CMS OF SOLID COPPER WIRE 1/0.6mm (ITEM1) INTO THE CENTRE PINS OF 2 SMA FLANGE SOCKETS (ITEM 2). USING 8, M2.5 x 6mm CH/HEAD SCREWS (ITEM 3), FASTEN THE SOCKETS TO THE MODULE FRAME AS SHOWN IN THE ILLUSTRATION. TRIM THE CONNECTING WIRES TO LENGTH AND SOLDER THEM DOWN TO THE PRINTED CIRCUIT TRACKS.



PCB#3

i) TAKE THE PRE-ASSEMBLED PCB # 3 AND PLACE IT ONTO THE INTERNAL SHELF WITH SIDE A UPPERMOST. FASTEN THE BOARD DOWN WITH 6, M2.5 x 6mm CH/HEAD SCREWS AND WASHERS (ITEMS 3 & 4). SEE ASSEMBLY DRAWING ON SHEET 6 FOR COMPARTMENT IDENTIFICATION.

PCB#4

i) TAKE THE PRE-ASSEMBLED PCB # 4 AND PLACE IT ONTO THE INTERNAL SHELF WITH SIDE A UPPERMOST. FASTEN THE BOARD DOWN WITH 6, M2.5 x 6mm CH/HEAD SCREWS AND WASHERS (ITEMS 3 & 4). SEE ASSEMBLY DRAWING ON SHEET 6 FOR COMPARTMENT IDENTIFICATION.

PCB#5

i) TAKE THE PRE-ASSEMBLED PCB #5 AND PLACE IT ONTO THE INTERNAL SHELF WITH SIDE A UPPERMOST. FASTEN THE BOARD DOWN WITH 4, M2.5 x 6mm CH/HEAD SCREWS AND WASHERS (ITEMS 3 & 4). SEE ASSEMBLY DRAWING ON SHEET 6 FOR COMPARTMENT IDENTIFICATION.

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

DIMENSIONS IN mm EXCEPT AS STATED

SURFACE TEXTURE EXCEPT AS STATED
▽ = ▽SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ▽

SCREW THREADS EXCEPT AS STATED
METRIC TO BS. 3643 6H/6g CLASS
WHIT. FORM TO BS. 84 MEDIUM CLASS
B.A. TO BS. 93 NORMAL CLASS
WELDING SYMBOLS TO BS. 499
DRAWING SYMBOLS, NOTES, ETC. TO BS. 308

TOLERANCES EXCEPT AS STATED

INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.

TOLERANCE ON MACHINED DIMENSIONS:
0-250mm TOL. 0,25mm (0-10" TOL. ·010")
OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020")
OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030")
OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")

TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

DRAWN	DWG
CHECKED	
TRACED	
CHECKED	
APPROVED	

PROJECT: NMR RF MODULE
ARRGT. DRG.: SHEET 6
TITLE: MODULE ASSEMBLY INSTRUCTIONS
SCALE: -

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER: PTG/NMR/012
LATEST ISSUE:
SHEET 2 OF 6

MODIFICATION	DATE	SIG.
A	Nov 80	DWG

DO NOT SCALE | THIRD ANGLE PROJECTION | REMOVE ALL BURRS AND SHARP EDGES

INSTALLATION OF LEADTHROUGH BULKHEAD ASSY. INTO MODULE FRAME.

i) PLACE THE MODULE FRAME ON THE BENCH IN FRONT OF YOU, WITH THE INTERNAL SHELF CARRYING THE PRINTED CIRCUIT BOARDS UPPERMOST, AND WITH THE CAPACITOR DRIVE AWAY FROM YOU.
TAKE THE COMPLETED LEADTHROUGH BULKHEAD ASSEMBLY (PTG/NMR/011) AND VISUALLY CHECK IT. MAKE SURE THE UNDERSIDE AND SLOTS ARE FREE FROM ANY FOREIGN MATERIAL.
REMOVE THE SECURING NUT AND SPRING WASHER FROM THE SMA CONNECTOR ON CABLE END "D", BUT LEAVE THE 'O' RING IN PLACE.
INSTAL THE BULKHEAD BY FIRST ENTERING THIS SMA CONNECTOR INTO THE HOLE PREPARED FOR IT IN THE MODULE FRAME.
AS THIS CONNECTOR COMES AGAINST THE INSIDE EDGE OF THE MODULE FRAME PUSH THE BULKHEAD FORWARDS SO THAT THE FOUR SLOTS CUT IN ITS "PCB SIDE" FACE LOCATE ONTO THE THIN BULKHEAD SECTIONS (ITEMS 2,3,4 OF PTG/NMR/002).
INSERT THE 4, M2.5 × 16 mm CSK/HEAD SCREWS (ITEM 21) THROUGH THE BULKHEAD AND FASTEN IT DOWN FIRMLY ONTO THE MODULE FRAME. IT IS ESSENTIAL THAT THESE SCREW HEADS DO NOT PROTRUDE OUT OF THE LEADTHROUGH BULKHEAD – IF THEY DO THE COVER WILL NOT FIT DOWN CORRECTLY.

ii) BEND EACH OF THE PRINTED CIRCUIT BOARD SIDE OF THE 14 FILTERS DOWN SO THAT THEY CONTACT THE PRINTED CIRCUIT BOARD TRACKS BENEATH EACH OF THEM, SEE ASSEMBLY DRAWING ON SHEET 6 FOR TRACK IDENTIFICATION.

iii) SLIGHTLY BEND EACH OF THE 3 CO-AX CABLE CONNECTIONS AS REQUIRED SO THAT THE CENTRE WIRE CONTACTS THE CIRCUIT BOARD TRACK AS SHOWN IN THE ASSEMBLY DRAWING. THE COPPER SCREEN OF THE CO-AX SHOULD BE IN CONTACT WITH THE GROUND PLANE IN THE CASE OF PCB #2 AND PCB #4 – MAKE SURE IT IS AND IS NOT BRIDGING THE GROUND PLANE TO ANYWHERE ELSE.

iv) SOLDER EACH OF THE 14 FILTER CONNECTIONS TO THE RELEVANT PRINTED CIRCUIT BOARD TRACK.

v) SOLDER THE CENTRE CORE OF EACH OF THE 3 CO-AX CABLE ENDS A, B, C (SEE PTG/NMR/011 FOR IDENTIFICATION)

vi) SOLDER THE OUTER COPPER SHEATH OF THE CO-AX CABLE ENDS A AND C TO THE PRINTED CIRCUIT BOARD GROUND PLANE AT THE POINT WHERE THESE CABLES COME DOWN TO MEET THE BOARD JUST BEFORE THE OUTER FINISHES.

vii) REPLACE SPRING WASHER AND NUT ONTO SMA CONNECTOR AND TIGHTEN – MAKE SURE THE CONNECTOR BODY DOESN'T TURN.

INSTALLATION OF CANNON CONNECTOR ASSEMBLY INTO MODULE FRAME.

i) INSERT THE BUNDLE OF WIRES ALREADY ATTACHED TO THE CONNECTOR AS ASSEMBLY PTG/NMR/010, THROUGH THE HOLE CUT IN THE END OF THE MODULE SO THAT THE CONNECTOR SITS AGAINST THE OUTSIDE FACE OF THE FRAME. SEE ILLUSTRATION OF MODULE ASSEMBLY DRAWING ON SHEET 6. NOTE THAT PIN 1 OF THE CONNECTOR SHOULD BE AT THE TOP, i.e. NEAREST PCB #5.
SECURE THE CONNECTOR TO THE FRAME WITH 2, M3 × 6mm CH/HEAD SCREWS (ITEM 6).

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

DRAWN	DWG	PROJECT	NMR RF MODULE
CHECKED			
TRACED		TITLE	MODULE ASSEMBLY INSTRUCTIONS
CHECKED			
APPROVED			

ARRGT. DRG. SHEET 6 | SCALE –

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER: PTG/NMR/012 | LATEST ISSUE

SHEET 3 OF 6

DIMENSIONS IN mm EXCEPT AS STATED
SURFACE TEXTURE EXCEPT AS STATED
▽ = ▽SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ▽
SCREW THREADS EXCEPT AS STATED
METRIC TO BS. 3643 6H/6g CLASS
WHIT. FORM TO BS. 84 MEDIUM CLASS
B.A. TO BS. 93 NORMAL CLASS
WELDING SYMBOLS TO BS. 499
DRAWING SYMBOLS, NOTES, ETC. TO BS. 308

TOLERANCES EXCEPT AS STATED
INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.
TOLERANCE ON MACHINED DIMENSIONS:
0-250mm TOL. 0,25mm (0-10" TOL. ·010")
OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020")
OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030")
OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")
TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

A	DATE	NOV 80
	SIG.	DWJ
MODIFICATION		

DO NOT SCALE | THIRD ANGLE PROJECTION | REMOVE ALL BURRS AND SHARP EDGES

ii) SEPARATE OUT THE 6 BLACK WIRES, THE 0v POWER SUPPLY LINES AND THE 0v REFERENCE FOR THE TWO OUTPUT SIGNALS. CUT, STRIP AND SOLDER THEM ALL TO THE M3 SOLDER TAG (ITEM 7) AT THE END OF THE LEADTHROUGH BULKHEAD.

iii) NOW COMMENCE TO CONNECT UP THE POWER SUPPLY DISTRIBUTION. NOTE THAT THE FEEDTHROUGH FILTERS ARE NUMBERED 1–14 ON THE CIRCUIT DIAGRAMS. THESE IDENTIFICATIONS ARE SHOWN ON THE ASSEMBLY DRAWING, SHEET 6, AND WILL BE USED TOGETHER WITH THE CANNON CONNECTOR PIN NUMBERS, AND THE PAD NUMBERS ON PCB #5 TO IDENTIFY WIRING POINTS.

iv) +24v RF:
PINK WIRE FROM CANNON DB-25P, PIN 1 TO FILTER 14.
FILTER 14 TO FILTER 5

v) +15v RF:
ORANGE WIRE FROM CANNON DB-25P, PIN 2 TO FILTER 4.
FILTER 4 TO FILTER 2

vi) +15v LF:
RED WIRE FROM CANNON DB-25P, PIN 3 TO PCB #5, PAD 1.
PCB #5, PAD 1 TO FILTER 12
FILTER 12 TO FILTER 8

vii) −15v LF:
BLUE WIRE FROM CANNON DB-25P, PIN 4 TO PCB #5, PAD 8.
PCB #5, PAD 8 TO FILTER 11
FILTER 11 TO FILTER 7

viii) 5v SWITCHING SUPPLY:
GREEN WIRE FROM CANNON DB-25P, PIN 5 TO FILTER 1
WHITE WIRE FROM CANNON DB-25P, PIN 18 TO FILTER 3

ix) MAGNITUDE (DIODE) DETECTOR O/P:
GREY WIRE FROM CANNON DB-25P, PIN 8 TO PCB #5, PAD 2

x) PHASE (MODULATOR) DETECTOR O/P:
PURPLE WIRE FROM CANNON DB-25P, PIN 11 TO PCB #5, PAD 5

xi) MAGNITUDE (DIODE) DETECTOR PRE-AMP O/P:
TWISTED PAIR GREY/WHITE (ITEM 18)
GREY: FILTER 10 TO PCB #5, PAD 4
WHITE: FILTER 13 TO PCB #5, PAD 3

xii) PHASE (MODULATOR) DETECTOR PRE-AMP O/P:
TWISTED PAIR PURPLE/WHITE (ITEM 19)
PURPLE: FILTER 6 TO PCB #5, PAD 7
WHITE: FILTER 9 TO PCB #5, PAD 6

GENERAL NOTES ON iv) TO xii)

ALL WIRES SHOULD BE CUT BACK TO A LENGTH SUCH THAT THE FINISHED WIRING IS NEAT & TIDY WITH A MINIMUM OF EXCESS WIRE IN CIRCUIT.

A SUITABLE METHOD FOR CONNECTING TO THE FILTERS IS TO WRAP THE CONNECTING WIRE 1½ TIMES AROUND THE PROTRUDING FILTER CONNECTION. THIS GIVE ADEQUATE SPACE FOR 2 SUCH CONNECTIONS, AND THE FIRST WILL NOT COME OFF WHILST MAKING THE SECOND!

IF THE EXTERNAL DIAMETER OF THE WIRE USED IS SUFFICIENTLY SMALL, THE COMPLETE BUNDLE OF WIRES WILL FIT SNUGLY BETWEEN THE SEMI-RIGID CO-AX AND THE BASE OF THE LEADTHROUGH BULKHEAD, UNDER NEATH THE FILTERS.

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

A	DATE Nov 80
	SIG. DWJ.
MODIFICATION	

DIMENSIONS IN mm EXCEPT AS STATED
SURFACE TEXTURE EXCEPT AS STATED
▽ = ▽SYMBOLS TO BS. 1134
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SCREW THREADS EXCEPT AS STATED METRIC TO BS. 3643 6H/6g CLASS WHIT. FORM TO BS. 84 MEDIUM CLASS B.A. TO BS. 93 NORMAL CLASS
WELDING SYMBOLS TO BS. 499
DRAWING SYMBOLS, NOTES, ETC. TO BS. 308

TOLERANCES EXCEPT AS STATED
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OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")
TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

DRAWN	DWG	PROJECT	NMR RF MODULE
CHECKED			
TRACED		TITLE	MODULE ASSEMBLY INSTRUCTIONS
CHECKED			
APPROVED			

ARRGT. DRG. SHEET 6
SCALE –

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER: PTG/NMR/012
LATEST ISSUE:
SHEET 4 OF 6

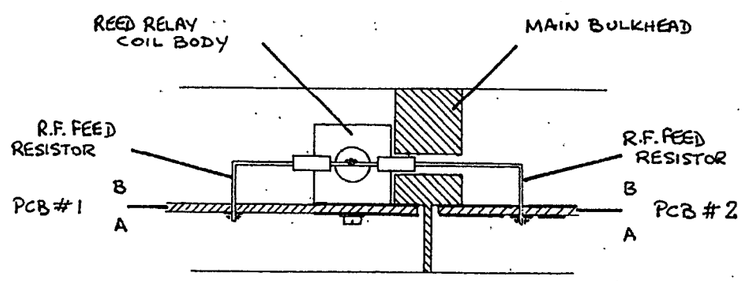
FINAL MISCELLANEOUS COMPONENTS

i) INSERT THE SHORT WIRE LINK BETWEEN PCB # 1 AND PCB # 2. THIS IS ON SIDE A OF BOTH BOARDS AND IS THROUGH THE 3 mm DIAMETER HOLE IN THE THIN PORTION OF THE BULKHEAD (ITEM 2 OF PTG/NMR/002, SHEET 3) THE WIRE SHOULD PASS THROUGH THE CENTRE OF THE HOLE AND BE SOLDERED TO THE BOARDS AT EACH SIDE AS SHOWN IN THE ASSEMBLY DRAWING ON SHEET 6.

ii) MOUNT THE 2 INDUCTORS, ITEM 17, THAT JOIN PCB # 2 (SIDE A) TO PCB # 3 (SIDE A) THROUGH THE THIN PORTION OF THE BULKHEAD BETWEEN THEM, (ITEM 3 OF PTG/NMR/002, SHEET 3). SEE ASSEMBLY DRAWING ON SHEET 6 FOR APPROXIMATE SOLDERING AND POSITIONING INFORMATION.

iii) MOUNT THE 2 RF FEED RESISTORS BETWEEN THE COMPONENT SIDES (SIDE B) OF PCB # 1 AND PCB # 2. THE REED SWITCH BODY AND REED INSERT SHOULD BE ALREADY MOUNTED ON PCB # 1 (SIDE B), SEE PTG/NMR/005. ONE RF FEED RESISTOR IS CONNECTED FROM THE RF INPUT TRACK ON PCB # 2, THROUGH THE 3mm DIAMETER HOLE IN THE 11 mm THICK PORTION OF THE BULKHEAD TO THE REED SWITCH INSERT. THE SECOND RF FEED RESISTOR IS CONNECTED FROM THAT POINT TO THE INPUT OF THE FIRST RF AMPLIFIER ON PCB # 1, JUST BEHIND THE TUNING CAPACITOR. IT IS ESSENTIAL THAT THE 3 COMPONENT CONNECTION OF 2 RESISTORS AND THE REED SWITCH IS KEPT NEAT AND COMPACT SO THAT IT DOES NOT SHORT TO THE COVER (ITEM 2 OF PTG/NMR/004) WHEN THIS IS FITTED.
WHEN THESE 3 COMPONENTS ARE SATISFACTORILY CONNECTED INTO POSITION. FIT THE COVER AND FASTEN IT IN POSITION WITH THE M2.5 × 4 mm CH/HEAD SCREW THAT IS PART OF THE REED SWITCH ASSEMBLY. SEE DRAWING PTG/NMR/004, SHEET 2 FOR A SECTIONAL VIEW THROUGH THE ASSEMBLED RELAY, AND THE ADJACENT SKETCH SHOWING A SECTION THROUGH PCB # 1 / PCB # 2.

NOTE: IF THE REED SWITCH IS NOT BEING FITTED, INSERT ONLY THE RESISTORS AS DESCRIBED ABOVE. IN THIS CASE THERE IS JUST A STRAIGHT RESISTOR - RESISTOR CONNECTION TO MAKE.



SECTION THROUGH BULKHEAD SHOWING INSTALLATION OF RF FEED RESISTORS (ITEM 20). NOTE:- COVER HAS BEEN REMOVED TO SHOW SOLDER CONNECTION THE CENTRE OF THE COIL BODY.

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

DIMENSIONS IN EXCEPT AS STATED	TOLERANCES EXCEPT AS STATED
SURFACE TEXTURE EXCEPT AS STATED ∇ = ∇ SYMBOLS TO BS. 1134 ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED ∇	INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.
SCREW THREADS EXCEPT AS STATED METRIC TO BS. 3643 6H/6g CLASS WHIT. FORM TO BS. 84 MEDIUM CLASS B.A. TO BS. 93 NORMAL CLASS WELDING SYMBOLS TO BS. 499 DRAWING SYMBOLS, NOTES, ETC. TO BS. 308	TOLERANCE ON MACHINED DIMENSIONS: 0-250mm TOL. 0,25mm (0-10" TOL. ·010") OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020") OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030") OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040") TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS. TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

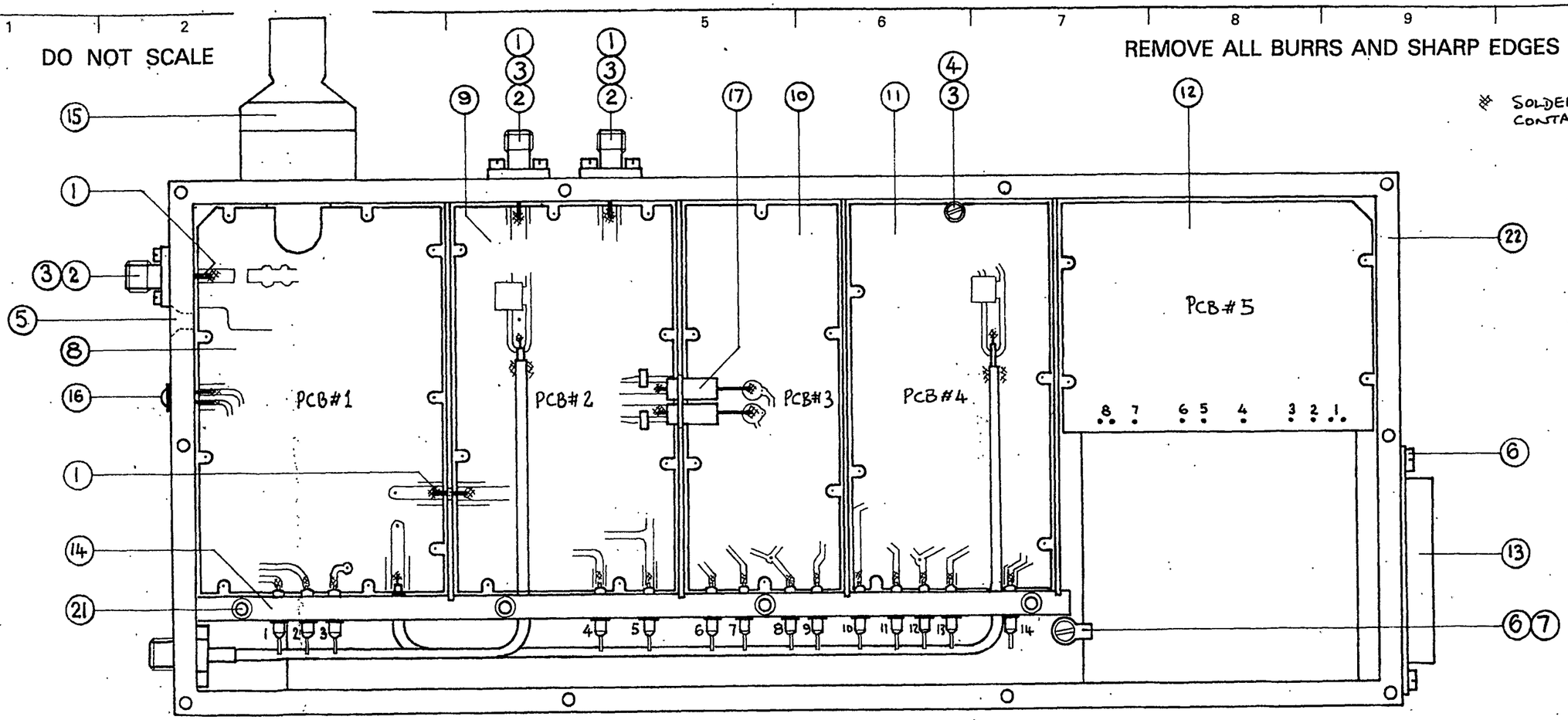
DRAWN	DWG.	PROJECT NMR RF MODULE	ARRGT. DRG. SHEET 6
CHECKED			
TRACED		TITLE MODULE ASSEMBLY INSTRUCTIONS	SCALE 1:1
CHECKED			
APPROVED			

A	DATE Nov 80	UNIVERSITY OF LIVERPOOL OLIVER LODGE LABORATORY DEPARTMENT OF PHYSICS	DRAWING NUMBER PTG/NMR/012 SHEET 5 OF 6
	SIG. DWG.		LATEST ISSUE
MODIFICATION			

DO NOT SCALE

REMOVE ALL BURRS AND SHARP EDGES

※ SOLDER CONTACT.



ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.
22	MODULE FRAME ASSY	COPPER		PTG/NMR/002	1
21	SCREW	BRASS	M2.5 x 16mm CSK/HD		4
20	RESISTOR - RF FEED 330Ω	THICK FILM	SEE PTG/NMR/001 NOTE 7		2
19	WIRE - TWISTED PAIR	PURPLE / WHITE	2 x 1/0.6mm	SAME AS SPECIFIED ON	200mm
18	WIRE - TWISTED PAIR	GREY / WHITE	2 x 1/0.6mm	PTG/NMR/010	200mm
17	INDUCTOR, 10μH		SEE PTG/NMR/001 NOTE 8		2
16	LED		SEE PTG/NMR/001 NOTE 10		1
15	CAPACITOR DRIVE ASSY			PTG/NMR/003	1
14	LEAD THROUGH BULKHEAD ASSY			PTG/NMR/011	1
13	CANNON CONNECTOR ASSY			PTG/NMR/010	1
12	PCB #5 ASSY.			PTG/NMR/009	1
11	PCB # 4 ASSY.			PTG/NMR/008	1
10	PCB # 3 ASSY.			PTG/NMR/007	1
9	PCB # 2 ASSY			PTG/NMR/006	1
8	PCB # 1 ASSY			PTG/NMR/005	1
7	SOLDER TAG		M3		1
6	SCREW	BRASS	M3 x 6mm CH/HD		3
5	SCREW	BRASS	M4 x 10mm CSK/HD		1
4	WASHER	BRASS	M2.5		33
3	SCREW	BRASS	M2.5 x 6mm CH/HD		65
2	SMA 4 HOLE FLANGE SOCKET		RADIALL R125-403		3
1	BARE COPPER WIRE		1/0.6 mm		-

PARTS LIST

DIMENSIONS IN EXCEPT AS STATED

SURFACE TEXTURE EXCEPT AS STATED

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TOLERANCES EXCEPT AS STATED

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OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")

TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

A	DATE Nov 80	DRAWN	DWG
	SIG. DWF	CHECKED	
MODIFICATION		TRACED	
		CHECKED	
		APPROVED	

PROJECT: NMR RF MODULE

ARRGT. DRG.

TITLE: MODULE ASSEMBLY INSTRUCTIONS

SCALE: 1:1

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

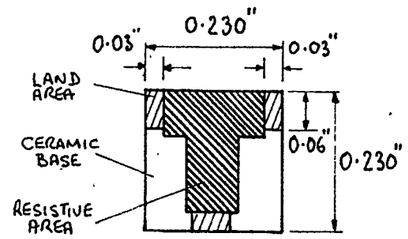
DRAWING NUMBER: PTG/NMR/012

SHEET 6 OF 6

LATEST ISSUE

DO NOT SCALE | THIRD ANGLE PROJECTION | REMOVE ALL BURRS AND SHARP EDGES

* IMPORTANT :- DIMENSIONS IN INCHES



SCALE 4:1

FIG.1. AC0100 SERIES ATTENUATOR

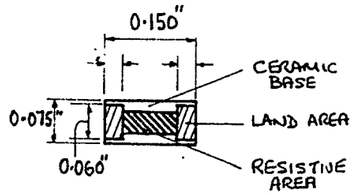
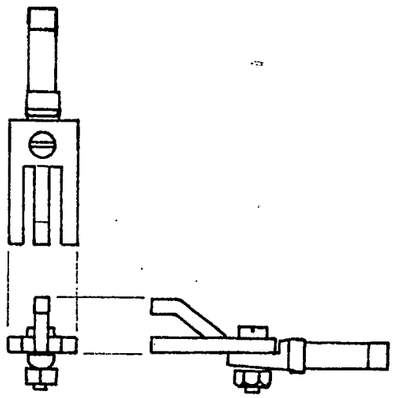
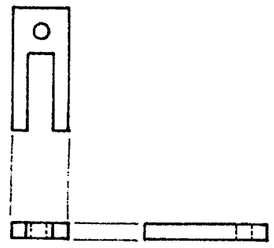


FIG.2. CR15 TYPE B RESISTOR



SCALE 1:1

3 LEG SOLDERING IRON TIP WITH MODIFIED IRON TIP INSERT



2 LEG SOLDERING IRON TIP

SCALE 1:1

SOLDERING IRON TIPS IN POSITION AROUND CHIPS

1. THE "EMC TECHNOLOGY INC." MICROWAVE COMPONENTS CATALOGUE CONTAINS THEIR RECOMMENDATIONS FOR MOUNTING THE DEVICES, AND IS ESSENTIAL FIRST READING.
2. THE MOUNTING METHOD USED AT LIVERPOOL IS VERY SIMILAR TO THE "FLIP CHIP" MANNER, I.E. SOLDER LAND AREAS DOWN ONTO THE PCB SURFACE, SPECIFIED BY EMC. HOWEVER AS THIS APPLICATION REQUIRES THAT ATTENUATOR VALUES MIGHT HAVE TO BE CHANGED DURING SETTING UP, IT WAS NECESSARY FOR US TO DEVISE A METHOD OF REMOVING THE CHIPS WITHOUT DESTROYING THEM. FOR THIS PURPOSE THE SPECIAL SOLDERING IRON TIPS SHOWN IN FIGS. 3 & 4 WERE PRODUCED, IN OUR CASE FOR USE WITH A WELLER TCP-1 IRON
   THE IRON TIP TEMPERATURE IS ~ 700°F, HIGHER THAN EMC SUGGEST BUT ALLOWING VERY RAPID SOLDERING.
3. LIGHTLY TIN THE SOLDER LAND AREAS ON THE CHIP USING STANDARD ELECTRICAL MULTICORE SOLDER (~ SWG). IT MAY BE NECESSARY TO HOLD THE CHIP DOWN WHILST DOING THIS.
4. TIN THE CONTACT AREAS ON THE PRINTED CIRCUIT BOARD.
5. THE FOLLOWING PROCEDURE IS FOR MOUNTING AN ATTENUATOR, IT IS EXACTLY THE SAME FOR A RESISTOR BUT THERE ARE ONLY 2 CONTACTS TO COPE WITH!
   PLACE THE CHIP – CORRECTLY ORIENTATED – FACE DOWN ONTO THE PRINTED CIRCUIT BOARD, ("FLIP-CHIP" MOUNTING), AND WITH THE 3 LEGGED SOLDERING IRON TIP SIMULTANEOUSLY HEAT THE THREE TINNED AREAS OF THE BOARD AROUND THE EDGE OF THE CHIP. IT WILL BE NECESSARY TO EXERT A LITTLE DOWNWARD PRESSURE WITH, FOR EXAMPLE, A PENCIL ON THE BACK OF THE CHIP TO HELP IT SETTLE DOWN EVENLY ONTO THE BOARD. ENSURE IT IS CORRECTLY POSITIONED (SEE PRINTED CIRCUIT BOARD ASSEMBLY DRAWINGS - SHEET 1 FOR CORRECT MOUNTING POSITION WITH RESPECT TO BOARD PATTERN) AND REMOVE SOLDERING IRON. THIS WHOLE PROCEDURE SHOULD TAKE NO MORE THAN ABOUT 5 SECONDS.
6. WRITE THE ATTENUATOR (RESISTOR) VALUE ON THE BACK OF THE CHIP IN PENCIL SO YOU'LL KNOW WHAT IT IS!

ITEM	NAME	MATERIAL	REMARKS	DETAIL DRG.	QTY.

PARTS LIST

DRAWN	DWG	PROJECT: NMR RF MODULE	ARRGT. DRG.
CHECKED			
TRACED		TITLE: MOUNTING INSTRUCTIONS FOR "CHIP" COMPONENTS	SCALE 4:1 & 1:1
CHECKED			
APPROVED			

UNIVERSITY OF LIVERPOOL
OLIVER LODGE LABORATORY
DEPARTMENT OF PHYSICS

DRAWING NUMBER: PTG/NMR/013 | LATEST ISSUE

SHEET 1 OF 1

A	DATE Nov 80	
	SIG. DWG.	
MODIFICATION		

DIMENSIONS IN INCHES EXCEPT AS STATED
SURFACE TEXTURE EXCEPT AS STATED
√ = √ SYMBOLS TO BS. 1134
ALLOW EXTRA THICKNESS FOR MACHINING ON FACES MARKED √
SCREW THREADS EXCEPT AS STATED
METRIC TO BS. 3643 6H/6g CLASS
WHIT. FORM TO BS. 84 MEDIUM CLASS
B.A. TO BS. 93 NORMAL CLASS
WELDING SYMBOLS TO BS. 499
DRAWING SYMBOLS, NOTES, ETC. TO BS. 308

TOLERANCES EXCEPT AS STATED
INTERNAL SURFACES PLUS TOL. EXTERNAL SURFACES MINUS TOL. CENTRES & CENTRES TO FACES PLUS OR MINUS HALF TOL.
TOLERANCE ON MACHINED DIMENSIONS:
0-250mm TOL. 0,25mm (0-10" TOL. ·010")
OVER 250-500mm TOL. 0,5mm (OVER 10-20" TOL. ·020")
OVER 500-1000mm TOL. 0,75mm (OVER 20-40" TOL. ·030")
OVER 1000mm TOL. 1mm (OVER 40" TOL. ·040")
TOL. ON UNMACHINED DIMS. TWICE TOL. FOR M/C DIMS.
TOLERANCE ON ANGULAR DIMENSIONS ± 1/2°

ARGONNE NATIONAL LABORATORY

ENGINEERING NOTE

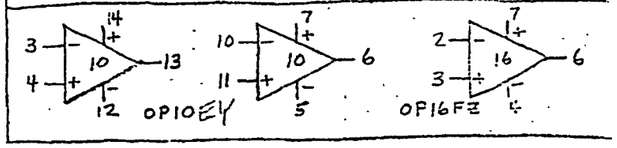
DIVISION	PROJECT	FILE NO.	PAGE
	E-704		

SUBJECT: SIGNAL CONDITIONER

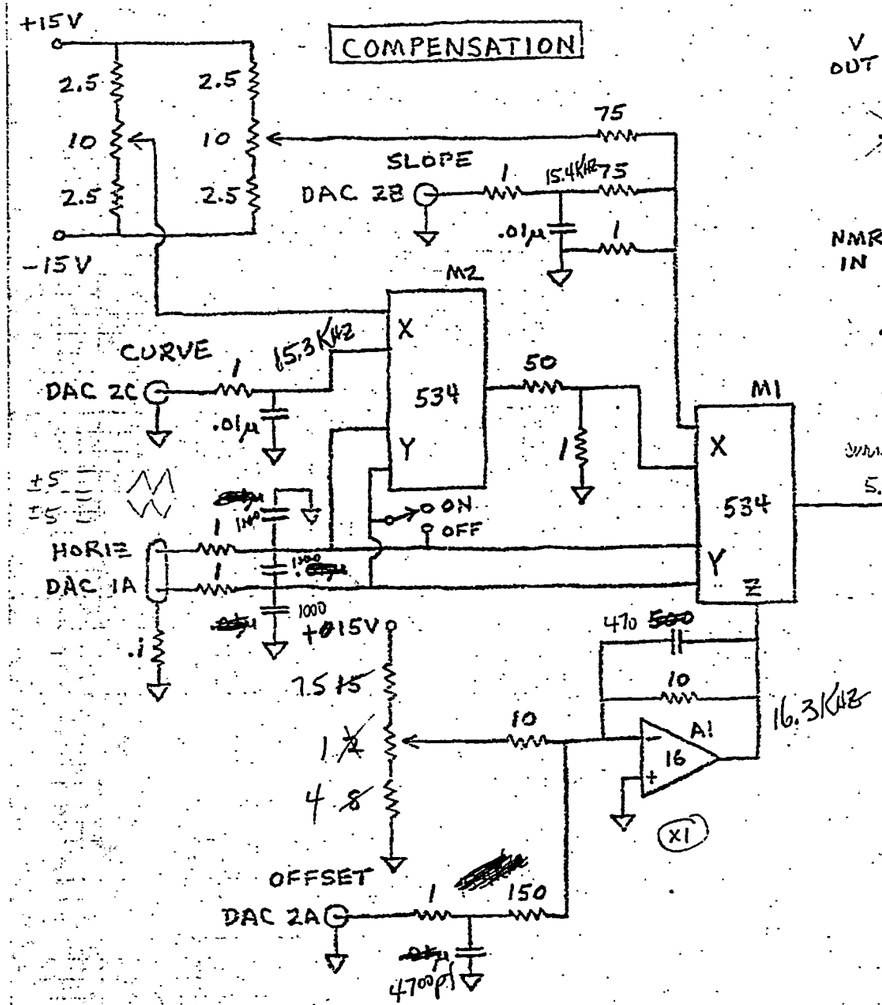
NAME: T. KASPRZYK / D. HILL

DATE: 3-7-84

R's in KΩ, C's in pf, except as noted.

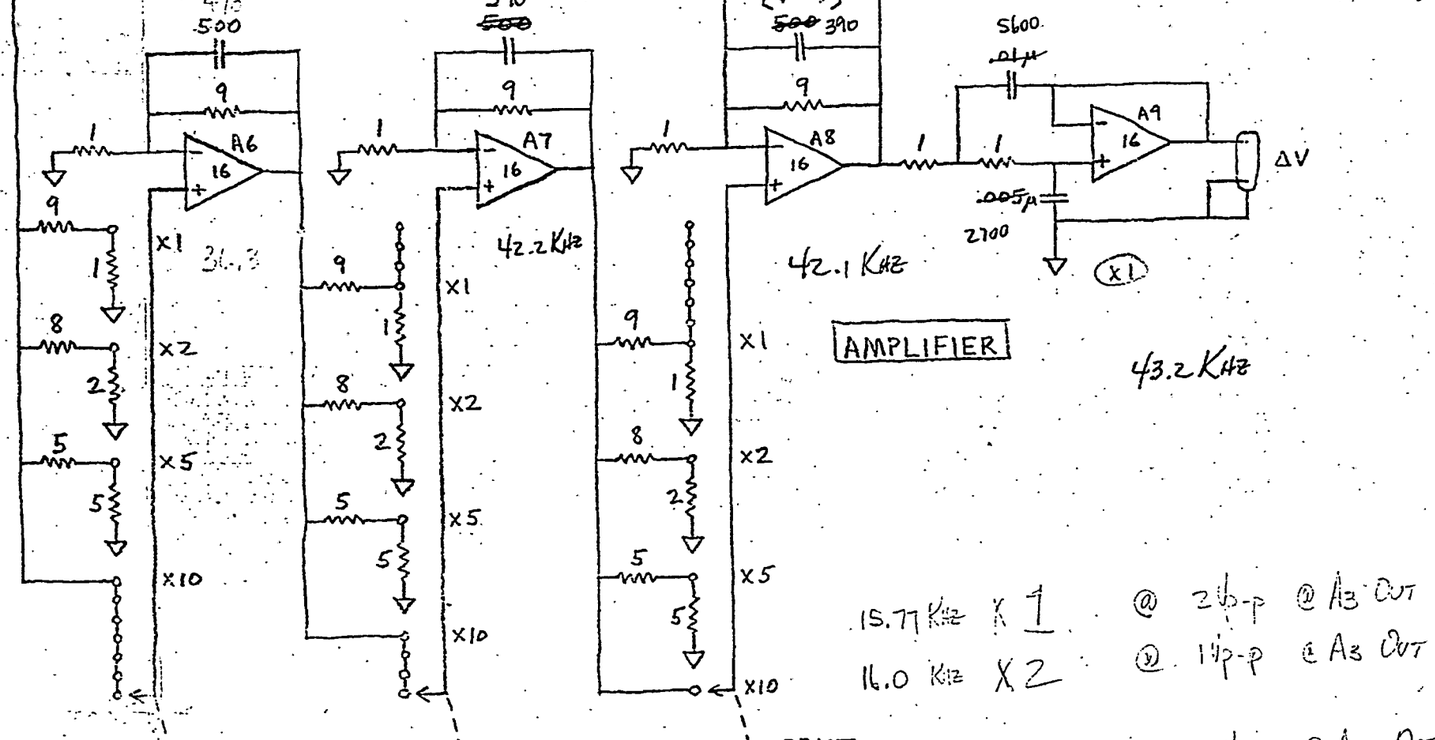


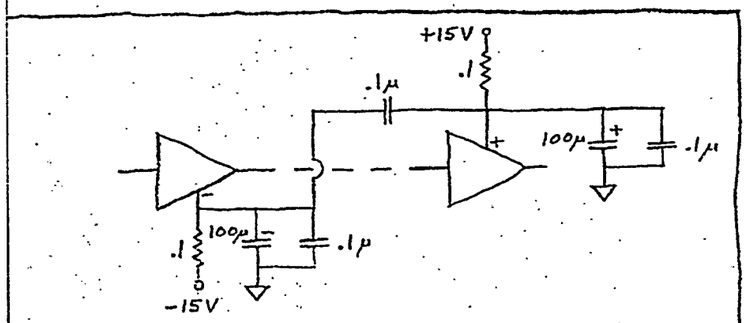
COMPENSATION



PREAMPLIFIER

AMPLIFIER





TYPICAL POWER FILTERING AND ISOLATION

FOLD