FARNELL
Part No.9HAMM2000

INSTRUCTION/SERVICE MANUAL

FOR

AMM2000

AUTOMATIC MODULATION METER

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C O N T E N T S

1. S A F E T Y

GENERAL

This equipment has been designed to meet the requirements of IEC publication 348, "Safety Requirements for Electronic Measuring Apparatus", and has left the factory in a safe condition.

The remainder of this section on safety provides information and warnings which must be followed by the user to ensure safe operation and to maintain the equipment in a safe condition.

AC POWER SUPPLY

If it is necessary to fit a suitable ac power plug to the power cable, the user must obseve the following colour code:-

LIVE terminal to BROWN lead
NEUTRAL terminal to BLUE lead
EARTH terminal to GREEN/YELLOW lead.

The user must also ensure that the protective earth lead would be the last to break should the cable be subject to excessive strain.

If the power cable electrical connection to the ac power plug is through screw terminals then, to ensure reliable connections, any solder tinning of the cable wires must be removed before fitting the plug.

WARNING! Any interruption of the protective earth conductor inside or outside the equipment or disconnection of the protective earth terminal is likely to make the equipment dangerous. Intentional interruption is prohibited.

Before switching on the equipment, ensure that it is set to the voltage of the local ac power supply.

ADJUSTMENT, REPLACEMENT OF PARTS, MAINTENANCE AND REPAIR

When the equipment is connected to the local ac power supply, internal terminals may be live and the opening of covers or removal of parts (except those to which access can be gained by hand) is likely to expose live parts.

The equipment must be disconnected from all voltage sources before it is opened for any adjustment, replacement, maintenance or repair.

Capacitors inside the equipment may still be charged even if the equipment has been disconnected from all voltage sources.

Any adjustment, maintenance and repair of the opened equipment under voltage must be carried out only by a skilled person who is aware of the hazards involved.

Ensure that only fuses with the required rated current and of the specified type are used for replacement. The use of makeshift fuses and the short-circuiting of fuse holders is prohibited.

HANDLING HAZARDS

Cathode ray tubes can implode if subject to excessive mechanical shock. Wear safety goggles if removing or replacing a cathode ray tube.

Any battery which is no longer serviceable should be disposed of intact and never incinerated. Replacement of lithium based batteries requires particular caution. Do not allow a new or used lithium battery to be short circuited, subject to any charging current or temperatures in excess of 70 degC.Insulate terminals before disposal.

EPROMs could lose data if exposed to direct sunlight for 1 week or room level fluorescent lighting for 3 years.

Many components contain polymers which will give rise to toxic fumes if incinerated.

STATIC ELECTRICITY

Where necessary, this manual contains a warning in the parts lists "*STATIC*", to alert service personnel to components which require handling precautions to avoid damage by static electricity discharge.

Before handling these components or printed circuit board assemblies containing these components, personnel should observe the following precautions:-

1. The work surface should be a conductive grounded mat.

2. Soldering irons must be grounded and tools must be in contact with a conductive surface to ground when not in use.

3. Any person handling static-sensitive parts must wear a wrist strap which provides a leaky path to ground, impedance not less than 1 megohm, and not greater than 100 megohm.

4. Components and printed circuit board assemblies must be stored in or on conductive foam or mat while work is in progress.

5. New components should be kept in the supplier's packaging until required for use.

2 SCHEDULE OF EQUIPMENT

The instrument has been carefully packed to prevent damage during transit. when removing the instrument from the packing box, ensure that all parts and accessories are removed from the packing material. Retain all the packing box and material.

The complete equipment comprises:-

DESCRIPTION	QTY.	PART NO.
Automatic Modulation Meter	1	17AMM2000
Detachable a.c. power lead	1	HC22V2
N type to BNC adapter	1	TR201A
BNC to BNC coaxial cable	1	HC0010
Instruction/Service manual	1	9HAMM2000
Three pin d.c. input plug	1	TG212
Extractor for power selector card	1	HW3114003
Six way auxiliary plug and loom	1	LB557

Any factory fitted options will be identified on the unit back panel.

NOTE:- In the event of damage in transit or storage in delivery separate notices in writing should be given to both carriers and Farnell Instruments Limited, or local agent if outside the UK, within three days of receipt of the goods, followed by a complete claim within five days. All goods which are the subject of any claim for damage in transit or missing items should be preserved intact as delivered, for a period of seven days after making the claim, pending inspection or instruction from Farnell Electronics

3. INTRODUCTION

The Farnell AMM2000 is a portable full featured modulation meter for use in the frequency range 250kHz to 2.4GHz. This range covers virtually all radio services in the MF, HF, VHF and UHF bands. Frequency locking on the strongest carrier is achieved fully automatically under microprocessor control in typically 750ms. Manual tuning using the keyboard is possible for specific tests for example with selective calling systems.

Designed to operate from any standard ac supply or from 12V dc (24V option) the compact lightweight unit is ideal for field, bench or system use.

AM, FM and PM measurement to a basic accuracy of better than 1% is achieved by using a built in digital self-calibration source. The modulation bandwidth is a full 10Hz to 300kHz (down to dc for FM) allowing measurements on high data rate systems. Maximum modulation capability is 99% AM, 500kHz pk FM and 50 rad PM. The large FM deviation capability is ideal for wideband telemetry systems. A low noise figure maximises the resolution for narrowband and unwanted modulation measurments. Comprehensive post carrier detection signal conditioning is provided as standard by 3 high pass and 4 low pass filters, FM de-emphasis and peak or true RMS level modes. External user filters may be incorporated. The display may be set to give absolute or relative values either linear or dB with a peak hold also available for burst capture. Digital averaging can be user selected where appropriate, for example when making residual noise measurements.

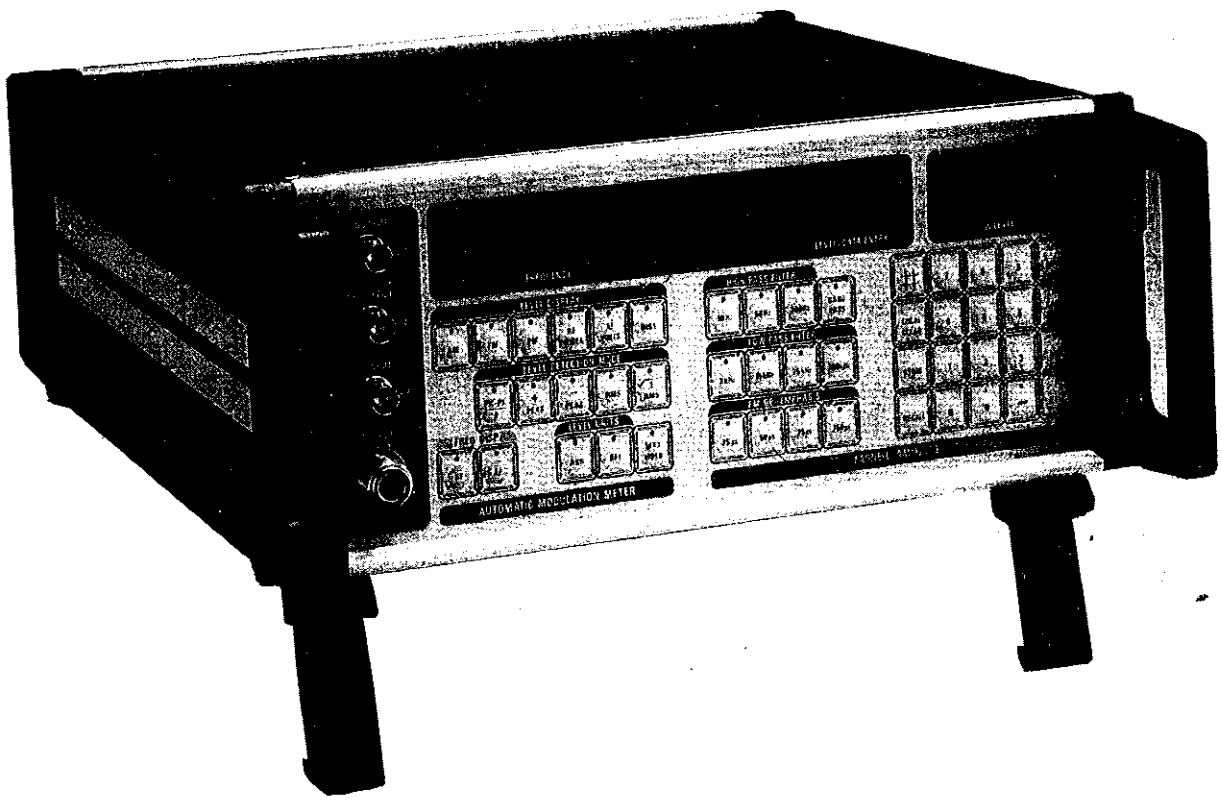
The unit performs well as a frequency counter over the RF and AF ranges to resolutions of 10Hz and 0.1Hz respectively. A front panel AF input enables the user to analyse the baseband signals for both level and frequency. A TCXO reference with an ageing rate of 2E-7 per month is fitted as standard.

Maximum sensitivity for modulation and frequency measurement is -30dBm and carrier level can be determined in dBm or mW over the range -6dBm to +20dBm. 25W excess power protection is provided, this facility operating down to 250mW. Below this level the input is protected continuously.

Manual operation is by a sealed tactile membrane front panel with RFI shield laminated in. 100 user defined setups and results may be stored in non-volatile RAM with a step facility enabling rapid switching between pre-determined tests. Individual memories are available for recall, store and protect. All measurements are shown on a high visibility 32 character alphanumeric LED. This together with a 20 segment analogue LED bar graph combine precision digital metering with the convenience of an analogue representation when viewing peaks, minima and trends.

GPIB (IEEE 488) interface is fitted as standard enabling the remote control of all measurement functions. The AMM2000 can input settings and output measurements which means it functions as both listener and talker. It is thus ideal for use in automatic test systems.

The low power consumption allows field operation when required from an optional re-chargeable add-on battery pack. Other options include a high stability frequency reference and auto-tracking baseband distortion/SINAD measurement including P53A, 468-3 bandpass, 150Hz notch and 300Hz low pass filters.



4. SPECIFICATION

RF INPUT

Frequency range	250kHz to 2.4GHz (useable underrange to 50kHz and overrange to 2.69GHz)
Input impedance	50ohms
Input VSWR	<1.5:1, 250kHz to 1GHz <3.0:1, 1GHz to 2.4GHz
Tuning	Selecting the AUTO key causes the unit to automatically search and lock the strongest signal. Lock time typically 750ms. Manual tuning is available for maximum sensitivity, maximum speed on GPIB, or maximum selectivity
Sensitivity	Automatic mode: 14mV rms (-24dBm), 250kHz to 1GHz 44mV rms (-14dBm), 1GHz to 2GHz 142mV rms (-4dBm), 2GHz to 2.4GHz Manual mode: 7mV rms (-30dBm), 250kHz to 1GHz 22mV rms (-20dBm), 1GHz to 2GHz 71mV rms (-10dBm), 2GHz to 2.4GHz
Excess power protection	Normal operation on peak carrier inputs up to +20dBm (+14dBm with 100% AM). Inputs greater than a nominal+23dBm (250mW) will trip a relay which protects against overload up to 25W.
High power input assembly	A 75W 30dB high power input attenuator assembly complete with with 0.5m flying lead for direct connection to AMM2000 is available as an accessory

AMPLITUDE MODULATION

Maximum level	99% (useable overrange to 105%)
Modulation rates	10Hz to 75kHz, carriers 6MHz to 2.4GHz 10Hz to 15kHz, carriers 250kHz to 6MHz
Resolution	0.3% of reading plus 0.01%AM

Accuracy	+/- 1% of reading +/- 0.01%AM, 1kHz rate up to 95% depth, carriers 250kHz to 500MHz. +/- 3% of reading +/- 0.01%AM, 50Hz to 50kHz rates up to 50% depth, carriers 250kHz to 500MHz. Effect of residual AM is not included.
AM distortion	<0.3%, 1kHz rate up to 80% depth, 50Hz to 15kHz bandwidth, carriers 6MHz to 500MHz. <0.6%, 50Hz to 15kHz rates up to 95% depth, 10Hz to 75kHz bandwith, carriers 6MHz to 500MHz. Residual AM is not included.
Residual AM	<0.03% rms in 300Hz to 3kHz bandwidth, carrier level greater than -10dBm.
FM rejection	<0.75% AM in 300Hz to 3kHz bandwidth for 50kHz FM deviation and carriers 6MHz to 500MHz.

FREQUENCY MODULATION

Maximum deviation	+/- 500kHz peak, carriers 6MHz to 2.4GHz (useable overrange to +/- 1MHz peak). +/_ 50kHz peak, carriers 250kHz to 6MHz.
Modulation rates	d.c./10Hz to 300kHz, carriers 6MHz to 2.4GHz. d.c./10Hz to 15kHz, carriers 250kHz to 6MHz.
Resolution	0.3% of reading plus 1Hz.
Accuracy	+/- 1% of reading +/- 1Hz at 1kHz rate, carriers 6MHz to 2.4GHz. +/- 3% of reading +/- 1Hz from 50Hz to 75kHz rates, carriers 6MHz to 2.4GHz. Effect of residual FM is not included.
FM distortion	<0.1% for deviations up to 100kHz and rates up to 15kHz, 50Hz to 75kHz bandwidth and carriers 6MHz to 2.4GHz. Residual FM is not included.

Residual FM	<15Hz rms in 300Hz to 3kHz bandwidth at 1GHz, increasing 6dB per octave increase in carrier and reducing 6dB per octave reduction in carrier, to noise floor <3Hz rms, carrier level greater than -10dBm
AM rejection	Typically 40Hz peak deviation in 300Hz to 3kHz bandwidth for 50% AM at 1kHz rate
De-emphasis	Off, 25us, 50us, 75us, 750us
Stereo separation	>46dB at 75kHz deviation and 1kHz rate, carrier frequencies 76MHz to 108MHz

PHASE MODULATION

Maximum deviation	+/- 50 radians peak, carriers 6MHz to 2.4GHz.
Modulation rates	50Hz to 15kHz, carriers 6MHz to 2.4GHz
Resolution	0.3% of reading plus 0.01 rad.
Accuracy	+/- 1% of reading +/- 0.01 rad at 1kHz rate, carriers 6MHz to 2.4GHz. +/- 3% of reading +/- 0.01 rad, 300Hz to 3kHz rates, carriers 6MHz to 2.4GHz. Effect of residual PM is not included.
Residual PM	< 0.02 rad rms in 300Hz to 3kHz bandwidth at 1GHz.

CARRIER FREQUENCY

Range	250kHz to 2.4GHz.
Resolution	10Hz, 250kHz to 1GHz 100Hz, 1GHz to 2.4GHz.
Accuracy	Standard: +/- 1E-6, 0degC to 55degC +/- 2E-7 per month +/- 1 count Option 0: +/- 2E-7, 0degC to 55degC +/- 1E-7 per month +/- 1 count

CARRIER LEVEL

Range	-6dBm to +20dBm. Display in mW or dBm.
Resolution	0.1dB plus 0.1mW
Accuracy	+/- 3dB, 250kHz to 1GHz +/- 6dB, 1GHz to 2GHz Typically -9dB at 2.4GHz

AF COUNTER

Range	50Hz to 300kHz
Resolution	0.1Hz, 50Hz to 3kHz 10Hz, 3kHz to 300kHz
Accuracy	Same as carrier frequency accuracy.

AF VOLTMETER

Range	10mV rms to 10V rms
Frequency range	50Hz to 100kHz
Resolution	0.3% of reading plus 1mV
Accuracy	+/- 1dB at 1kHz in 50Hz to 15kHz bandwidth. +/- 3dB, 50Hz to 100kHz in 10Hz to 300kHz bandwidth

AF DISTORTION AND EXTRA FILTERS (OPTION)

Distortion frequencies	Automatic tracking notch covers fundamental frequency range 100Hz to 10kHz
Resolution	0.3% of reading plus 0.01% distortion
Accuracy	+/- 1dB, 300Hz to 3kHz fundamental in 50Hz to 75kHz bandwidth
Residual fundamental, noise and distortion	< 0.2% in 50Hz to 15kHz bandwidth

Selectable filters	CCITT P53A, CCIR 468-3 for use in weighted residual noise measurements or weighted distortion at 1kHz only. 150Hz +/-2% 40dB notch filter for removal of 150Hz tone. 300Hz low pass filter to enable frequency count of sub-audible tones

MODULATION AND AF LEVEL DISPLAY

Display modes	Absolute level, relative level in % or dB, peak hold.
Detector response	Positive peak, negative peak, (Peak to peak)/2, rms, root2rms.
Accuracy	Specified accuracy is achieved after initiating the built in self-calibration procedure. Selecting rms detector response degrades level accuracy by an additional 2% of reading, from 50Hz to 75kHz rates.
Post-detection/AF filters	High pass 3 pole filters, -3dB (-1%) points nominal:10(20), 50(100), 300(600)Hz. Low pass 4 pole filters, -3dB (-1%) points nominal: 3(1.8), 15(9), 75(46), 300(100)kHz.

AUXILIARY INPUTS AND OUTPUTS

IF output	Output frequency same as carrier for 250kHz to 2MHz. Nominal 500kHz for carriers 2MHz to 6MHz. Nominal 1.5MHz for carriers 6MHz to 2.4GHz. Nominal output level 0 dBm into 50ohms.
AF output	Nominal full scale output level 1.7V rms with autoranging every rms with autoranging every 6dB change in level. Nominal output impedance <<50ohms
AF input	Nominal input impedance >9kohms a.c. coupled, 50V d.c. maximum coupled, 50V d.c. maximum
Reference input/output	Internal 10MHz reference output, 3V pk-pk minimum. External 10MHz reference input, 1Vrms minimum

External local oscillator input	0dBm into 50ohms. Requires external source with frequency range 24 to 48MHz. Useable for RF inputs between 100 and 2400MHz.
AF input/output	Multi-way connector and jumper to allow fitting of external filters and decoders.
Control outputs	Two outputs available from multi -way connector to control external add-ons.

GENERAL

Additional facilities	Secondary commands provide many additional facilities which include: Display test, GPIB address, self-calibration, clear/write-protection of stores, pre/post-display de-emphasis, autoranger up only, DCFM and digital level display averaging
Display	High efficiency 32 character alphanumeric and 20 segment analogue LED display.
Memory	100 front panel set-ups and measurements stored even after power removed.
Remote programming	GPIB(IEEE 488.1) Functions Supported: SH1, AH1, T6, TE0, L4 LE0, SR1, RL1, PP0, DC2, DT0, C0, E2.

POWER REQUIREMENT

A.C. input	100, 120, 220, 240V a.c. +/- 10%, 45 to 440Hz.
D.C. input	Standard: 11.5 to 15V d.c. Option A: 23 to 30V d.c.
Consumption	30VA approx.

ENVIRONMENTAL

Operating temperature	0degC to +55degC
Storage temperature	-40degC to +70degC
Relative humidity	95% to 40degC non-condensing
Vibration	5 to 150Hz at 2G sinusoidal, 15 minutes in each of 3 orthogonal planes.

Shock	10 off 25mm drops on each of 6 faces.
Safety	Designed to meet the requirements of IEC publication 348 (BS4743)
EMC compliance	Designed to meet the requirements of prEN50081-1 (emission) and prEN55101-3 (immunity)

MECHANICAL

Height (including feet)	145mm
Width	330mm
Depth	405mm
Weight	9kg

ACCESSORIES SUPPLIED	QUANTITY	PART NUMBER
A.C. power cable, 2 metres	1	HC22V2
D.C. power connector	1	TG212
N to BNC adaptor	1	TR201A
BNC to BNC Cable, 1 metre	1	HC0010
Instruction/service manual	1	9HAMM2000
Extractor for power selector	1	HW3114003
Six way auxiliary plug and loom	1	LB557

ORDER CODES, OPTIONS AND ACCESSORIES

Description	Order Code
AMM2000 Automatic Modulation Meter	17AMM2000
Factory fitted options:	
Option A: 23 to 30V d.c. input, add /A to order code	/A
Option F: RF output moved to rear panel, add /F	/F
Option O: High stability frequency reference, add /O	/O
Option Q: AF distortion and extra filters, add /Q	/Q
Accessories:	
Rechargeable 4Ah add-on battery pack	15S10100
Rack mounting kit	15A20100
Protective padded carrying case	15A20110
75W high power input assembly	15S30230

Farnell Instruments Limited reserves the right to amend Specifications without notification.

5. INSTALLATION

5.1 INITIAL SETTING UP - A.C. SOURCE

Check the power input setting is correct for the local supply by looking though the clear window adjacent to the power input socket on the rear panel. One of four alternative settings will be visible. Should it be necessary to change the setting, slide the window across, remove the fuse and then pull out the small selector card using the extractor provided. Re-insert the card in the appropriate alternative position so that the required voltage setting is visible when the card is fully replaced. Replace the fuse ensuring the rating is correct for the voltage to be used, and slide the window across. The fuse rating for 230V operation is 250mA T type and for 115V operation is 500mA T type.

Read the precautions listed in the SAFETY section at the start of this manual.
Connect a suitable plug to the power cable observing the following clour code:-

Live - BROWN
Neutral - BLUE
Earth - GREEN/YELLOW

Plug power cable into socket on rear of instrument and power source. Switch on using the power switch on the rear of the instrument.

5.2 INITIAL SETTING UP D.C. SOURCE

Apply a d.c. input via the three pin connector on the rear panel by correctly wiring the three pin plug supplied as part of the accessory package. The connections are as follows:-

Pin 1 - Instrument chassis earth
Pin 2 - D.C. Negative
Pin 3 - D.C. Positive

The d.c. supply must be within the range 11.5 to 15V (or 23 to 30V for the +24V d.c. option) with a current capability of 3 amps. Switch on using the power switch on the rear of the instrument. The instrument is fully protected against accidental d.c. polarity reversal. An internal relay is used to isolate the a.c. power input when a d.c. supply is present.

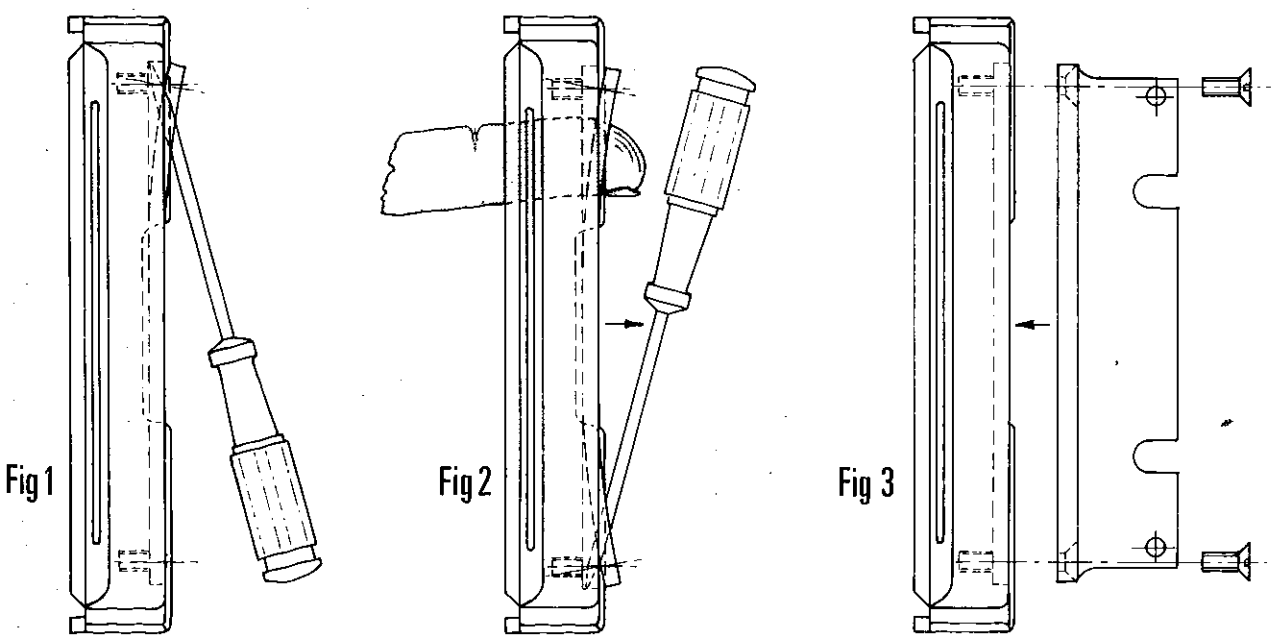
5.3 **RACK MOUNTING**

The instrument may be mounted in a standard nineteen inch rack using the kit available as an optional accessory (order code 15A20100).

For rack mounting applications the unit's support feet (located on the lower cover) must be removed as follows:-

Place the instrument with the lower cover facing upwards and hinge forward the front tilt feet. Remove the eight screws (four each side) securing the feet support bars to the lower cover and remove the support bars complete with feet. Retain the screws and support bars for future use.

To fit the rack mounting "ears", carefully prise out the insert in the outer face of both front handles (retain for future use). Fit each ear into the exposed recess, securing with the M4 x 10 CSK screws provided. It is important to ensure that some provision be made to support the rear of the unit when using the rack mounting ears.



PROCEDURE FOR ATTACHMENT OF RACK MOUNTING BRACKET

REF. FIG 1
Insert small screwdriver into thin gap between insert and handle body. Prise away one end slightly and hold in position with finger.
Note orientation of insert with styling cut-out opposite cut-out in handle.

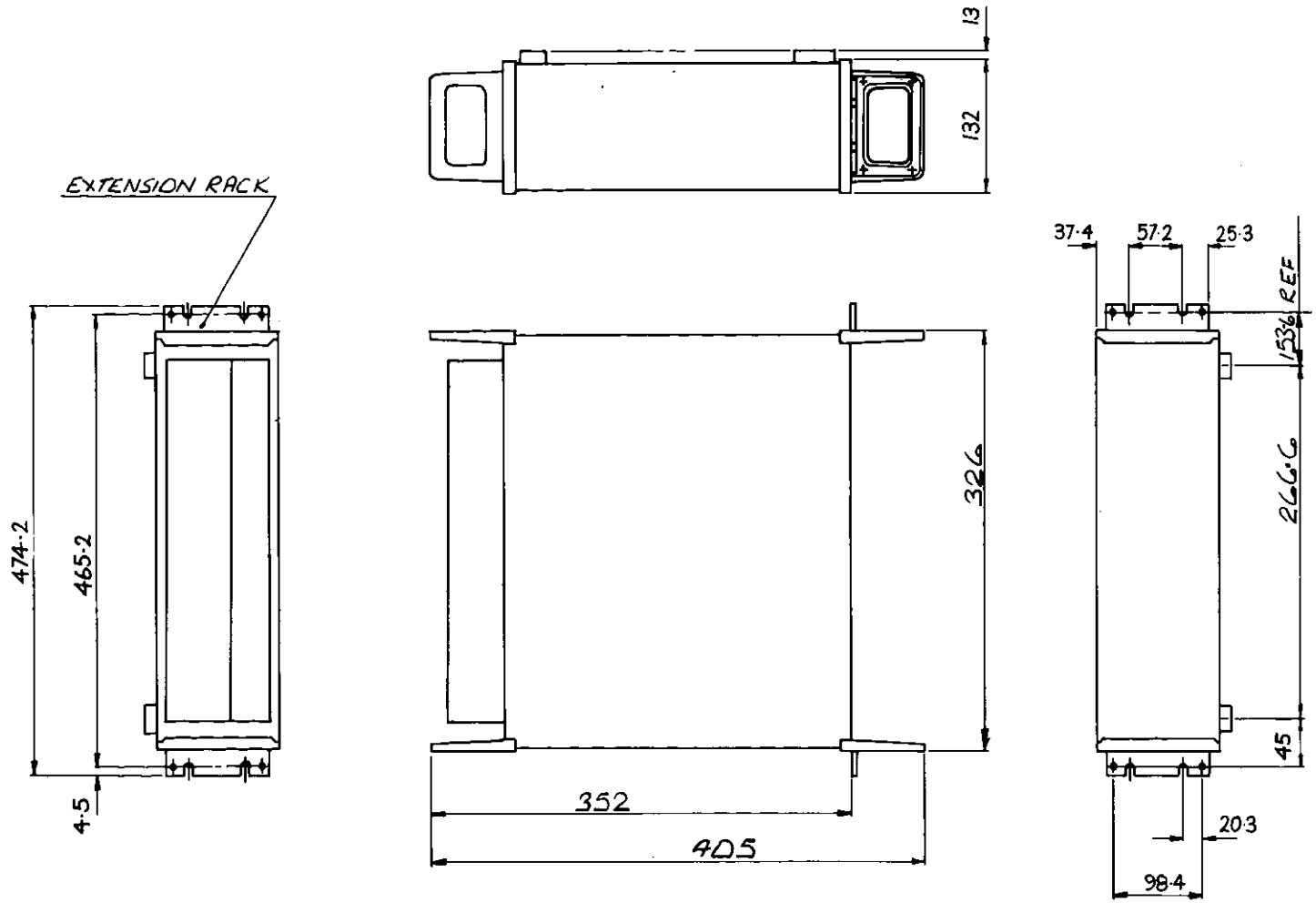
REF. FIG 2
Insert screwdriver into other end and repeat procedure. This will relieve the small tapered pins of the insert from the threaded holes in the handle. Remove insert in direction of arrow.

REF. FIG 3
Insert rack mounting bracket into recess in handle in attitude shown and secure firmly with 4 M4 x 10LG C'SK HD screws supplied.

DRAWING No. 3SZU0089

DO NOT SCALE

ALL ERRORS TO BE REPORTED TO DRAWING OFFICE
DRAWN IN ACCORDANCE WITH BS 308



				DRAWN AC.	USED ON:	GENERAL TOLERANCES UNLESS OTHERWISE STATED	HOLE SIZES	PROTECTIVE FINISH:	FARNELL INSTRUMENTS LTD. WETHERBY, YORKS.
						UP TO 200 ±	UP TO 70 ± 0·1		TITLE CASE & RACK 3U HX 3/4WX3/4D MOUNT DETAIL MASTER
				TRACED	NOTE: REMOVE ALL BURRS AND SHARP EDGES	200 TO 500 ±	70 → ± 0·2	MATL	DRAWING No. 3SZU0089
A	12·6·85					500 → ±	No STAMP PART No WHERE SHOWN		
ISS.	DATE	MOD. No.	CHECKED			SCALE: N.T.S	DIMENSIONS IN mm.	X X	BASED ON: SHEET OF SHEETS

FIMW3/84

5.4 AMM2000 BATTERY PACK

a) Installation

The battery pack (option order code 15S10100) is supplied with 2 off rack mounting ears to fix the pack to the AMM2000. Secure the mounting ears, one at each end, to the battery pack using the M4 x 10 pan head screws supplied.

The battery pack complete with mounting ears is then fixed to the R.H.S. of the AMM2000 utilizing the rack mounting fixings in the front and rear AMM2000 handles.

Carefully prise out the handle inserts (see section 5.3) and retain for future use. Align the battery pack (mains input connector facing the rear of the unit) with the exposed recess and secure with the M4 x 10 screws supplied.

b) Operation

Check the mains tap slider switch (top edge of the battery pack) is set to the correct setting for the local supply.

To charge the battery connect the battery dc power plug to the charger output socket and connect mains power to the charger mains input socket. For a completely flat battery the charge time is approximately 10 hours.

To operate the AMM2000 from the battery connect the battery d.c. power plug to the AMM2000 d.c. input socket. A fully charged battery will give approximately 2 hours of continuous use.

The use of nickel-cadmium batteries ensures a relatively flat discharge voltage versus time characteristics, with the nominal battery voltage of 12.5V decaying rapidly when charging is required.

6. OPERATING INSTRUCTIONS AND APPLICATIONS

6.1 FIRST TIME OPERATION

This section introduces the major measurement functions to the first time user. Throughout this section, lower case letters in brackets refer to the annotated drawing of the front panel at the end of this section on page 6-4.

Switch on the unit by operating the red push button switch located on the back panel. The instrument will display the software version number momentarily in the message display window (e) and (f). A functional check of the level and frequency measurement channels is then made and successful completion causes the message "Self-test pass" to be displayed. A full list of possible messages displayed and further explanation is given in section 6.3. In order to set the instrument into a pre-defined state, press the keys **#** **9** **9** in sequence to activate the memory clear function. (**WARNING!** This removes any previously stored settings in the instrument). Press the keys **#** **0** **7** to perform a self-calibration of AM and FM which takes approximately 20 seconds. Note that the current setting of the unit is indicated by the state of the LEDs incorporated into the keys. The following paragraphs should be followed in sequence to get a quick overview of the facilities provided.

a) Measuring carrier frequency

With no RF input, the unit will now be displaying the message "Searching" in the frequency display window (e) as it is trying to find a measurable carrier.

Select a suitable AM/FM signal generator as a test source (eg. Farnell PSG1000) and set this source to provide a carrier wave signal at 100MHz and at a level of 0dBm. Connect this source to the AMM2000 RF input (a). The "Searching" message will now be replaced by the measured carrier frequency of nominally 100MHz RF.

b) Measuring modulation

Set the test source to give 30% AM depth at a modulation rate of 1kHz. The level display window (f) will now indicate the modulation depth of nominally 30% AM.

c) Measuring modulation rate

The modulation rate can be measured by changing the frequency display to indicate audio frequency rather than carrier frequency. Pressing the **AF** key in the frequency display group (k) will cause the frequency display to indicate the modulation rate of nominally 1kHz. Press the **RF** key adjacent to the **AF** key to return to carrier frequency display.

d) **Measuring FM**

Set the test source to give 30kHz FM deviation at a modulation rate of 1kHz. Select the **FM** key from the level display group of keys (h). The level display window will now indicate the modulation deviation of nominally 30kHz FM.

e) **Measuring PM**

Select the **PM** key from the level display group of keys. The level display window will now indicate the modulation deviation of nominally 30 rad PM. Press the **FM** key to return to FM display.

f) **Measuring modulation distortion**

Select the **DIST** key in the level display group. If this option is not fitted a brief error message will warn the user and no further action will be taken. If the option is present, then the level display will indicate the modulation distortion in the range 0.1% to 10% dependent upon the quality of the test source. Press the **DIST** key a second time to toggle this function off.

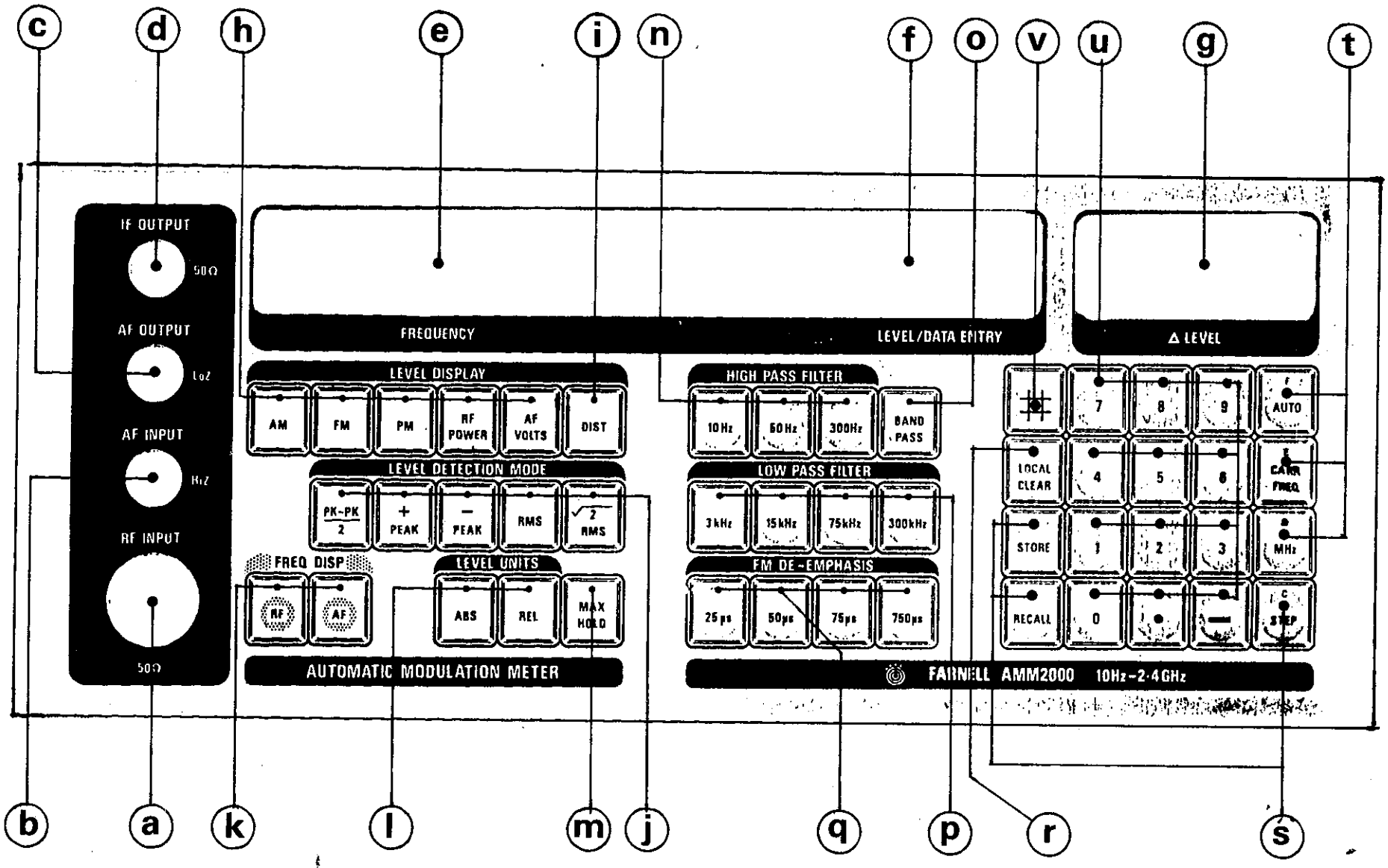
g) **Measuring RF power**

Select the **RF POWER** key from the level display group of keys. The level display window will now indicate the measured power of nominally 1.0mW RF.

h) **Measuring AF volts, frequency and distortion**

Disconnect the RF input. Select a suitable audio test source (eg. Farnell PSG1000 modulation output) and set this source to provide an audio frequency of 1kHz at a level of 1V rms. Connect this source to the AF input (b).
Select the **AFVOLTS** key from the level display group. Select the **RMS** key from the level detection mode group of keys (j).The level display window will now indicate a nominal 1.0V AF. The frequency display will indicate the nominal audio frequency of 1.0kHz AF. Press the **DIST** key to measure the audio distortion in the level display window if this option is fitted. Press the **DIST** key a second time to toggle this function off. Now reduce the level applied from the test source by approximately 10% and note that this change of level is clearly indicated in the level display window (g). This display always gives an analogue representation of the digital value indicated in the level display.

This completes an overview of the AMM2000 measurement functions. A full description of every function is given in section 6.2.


c
d
h
e
i
n
f
o
v
u
g
t
IF OUTPUT
50Ω
AF OUTPUT
600Ω
AF INPUT
1kΩ
RF INPUT
50Ω
FREQUENCY
LEVEL/DATA ENTRY
Δ LEVEL
LEVEL DISPLAY
AM
FM
PM
RF POWER
AF VOLTS
DIST
HIGH PASS FILTER
10Hz
50Hz
300Hz
BAND PASS
LEVEL DETECTION MODE
PK-PK/2
+PEAK
−PEAK
RMS
√2 RMS
LOW PASS FILTER
3kHz
15kHz
75kHz
300kHz
FREQ DISP
RF
AF
LEVEL UNITS
ABS
REL
MAX HOLD
FM DE-EMPHASIS
25μs
50μs
75μs
750μs
7
8
9
AUTO
LOCAL CLEAR
4
5
6
CARR FREQ
STORE
1
2
3
MHz
RECALL
0
STEP
AUTOMATIC MODULATION METER
FARNELL AMM2000 10Hz-2·4GHz
b
a
k
l
m
j
q
p
r
s

6.2) FRONT PANEL FACILITIES

All paragraph numbers below refer to the annotated drawing on page 6-4.

a) RF input connector

This input is fully protected against accidental overload. If the input power exceeds a safe level a continuous bleep is sounded and a warning message is displayed. The excess power protection circuit can be reset, once the source of power is removed, by pressing the **CLEAR** key. Note that with factory fitted option F the locations of front panel RF input and rear panel external local oscillator input are exchanged.

b) AF input connector

Allows the instrument to be used as a true rms AF voltmeter and distortion meter in addition to making modulation measurements.

c) AF output connector

Further processing of the demodulated signal is possible using this auto-ranged audio output. See section 6.6, Applications.

d) IF output connector

The down-converted carrier signal is available for viewing envelope shape or for feeding to external demodulators. See section 6.6, Applications.

e) Frequency display window

Input frequency is displayed in a 16 character field. If the user requires the fastest possible update rate of the carrier frequency, this can be achieved by turning off the level display. See paragraph h) and i).

f) Level display window

Input level is displayed in a 16 character field. This window is also used together with the frequency window to act as a keyboard buffer display or message display as required.

g) Delta level display

Changes in level can be viewed on the 20 segment bar graph display. If this feature is not required, it can be switched off. See section v), Secondary commands.

h) & i) **Level display keys**

This allows the user to measure either AM, FM, PM, RF Power or AF Volts on the level display. The level display can be turned off by toggling the active key, which allows maximum update rate of the carrier frequency display if required. RF Power can be displayed in either Watts or dBm. See section v), Secondary commands, to change between these power units.

The distortion key i) allows distortion measurement on modulation or audio sources but not RF Power. The unit will inform the user if this option is not fitted. The option provides automatic tracking of the fundamental signal. For fastest auto-tracking of the signal with many test frequencies, start at lowest frequency and work upwards.

j) **Level detection mode keys (not applicable for RF Power Level)**

Five choices are available when measuring modulation level and AF input level. Distortion readings use RMS detection only.

PK-PK/2, +PEAK and **-PEAK** detection are provided for routine AM, FM and PM measurements. **RMS** detection is provided for making residual noise measurements on modulation sources and also for measuring AF inputs. Note that **ROOT2RMS** enables rms detection but the display is peak calibrated, and a sinusoidal source will give nominally the same reading on **PK-PK/2** as on **ROOT2RMS**.

k) **Frequency display keys**

Choose between display of RF input frequency or audio frequency (which can be demodulated RF or an AF input).

If the user is measuring AF input level or distortion, it is not possible to simultaneously display a carrier frequency. The frequency display can be turned off if desired by toggling the active key. To change AF counter resolution, see paragraph p) below.

The audio frequency counter accuracy will degrade if the signal level is too low. Minimum levels for accurate audio frequency counting are 5% AM, 250Hz FM, and 200mV rms AF respectively. Signals below this level will cause the warning message "AF Low" to be displayed in the frequency counter window. If measuring PM, temporarily switch to FM demodulation to read the audio frequency.

l) **Level units keys**

Select **ABS**, absolute units, for normal operation. Pressing the **REL** key will change the current level reading to read 0dB or 100% in relative units and subsequent readings will be relative to their initial value. See section v), Secondary commands, to change between dB and % relative units.

m) **Maximum hold key**

Pressing the **MAXHOLD** key causes the level display to be updated only when a new level reading exceeds the current level displayed. To turn maximum hold off, press the **MAXHOLD** key again. The maximum hold state is also forced off by any subsequent key press, to avoid erroneous readings. Maximum hold is not allowed when reading distortion.

n) **High pass filter keys**

One of three filters selectable. For PM demodulation, only the 50Hz or 300Hz filters can be selected. The 10Hz filter setting slows the level display update rate and should therefore only be used where frequencies below 50Hz are of interest.

For FM demodulation only, it is possible to toggle the active high pass filter key off which provides a DCFM facility. This DCFM mode is provided so that signalling systems which contain very low frequency components can be successfully recovered from the AF output socket. The level display is not useable in DCFM mode. It is recommended that DCFM mode is only selected immediately before each applicable measurement period to minimise the effect of internal DCFM drift. The autoranger only ranges up when in DCFM mode.

o) **Band pass filter key**

Toggling this key switches the band pass filter in and out. A message is displayed if the required distortion option is not fitted. See section v), Secondary commands for details of switching between CCITT P53A band pass, CCIR 468 band pass and 300Hz CTCSS filter.

Note that the band pass filter is placed in series with any selected high or low pass filters for maximum flexibility. The band pass filters are intended for use in making weighted signal to noise measurements or weighted residual noise measurements. When making a distortion measurement in the range 800Hz to 1kHz, it is possible to use the CCITT P53A filter to advantage.

p) **Low pass filter keys**

One of four filters selectable. The highest filter selectable when measuring AM is 75kHz, and when measuring PM it is 15kHz. Selecting the 3kHz filter automatically changes the AF counter display resolution from 10Hz to 0.1Hz.

q) **FM de-emphasis keys**

These keys are only applicable to FM level and FM distortionmeasurements. FM de-emphasis is switched off by toggling the active key off. With the normal mode of post-display de-emphasis,the de-emphasis keys apply a weighting to the AF output socket only and not to the level display. See section v), Secondary commands for details of changing between post-display and pre-display de-emphasis.

r) **Local/Clear key**

Clears the keyboard buffer if in local mode (i.e. no activity on GPIB). Returns unit to local mode after GPIB or RS-232C activity. Resets excess power protection circuit if tripped.

s) **Memory function keys**

Current instrument state is always saved on power off. There are an additional 99 stores under used control. "**STORE 0 1**" will store current instrument state in store location 1. "**RECALL 0 2**" will change the instrument state to the state stored at some previous time in location 2. A message advises the user if the store is empty. "**STEP**" will recall the next memory location in sequence in ascending order. The display briefly annunciates the current location number being recalled. Any empty stores are skipped. Store location 1 is recalled after store location 99. See section 6.3 for details of non-volatile memory organistation, default settings and power on states.

t) **Automatic and manual tuning**

Press the **AUTO** key to select automatic tuning mode. While the unit is searching for a detectable RF carrier, it will display the message "Searching..." in the frequency display. Once it has successfully acquired a signal, it checks for a valid IF count and valid IF level approximately 4 times per second. This ensures that a subsequent loss of RF carrier or change in RF carrier frequency initiates a new acquisition. It is not therefore mandatory to press the **AUTO** key each time the frequency is changed. However, if a frequency change is completed in less than 250ms there is a small probability that the new IF count generayed will be the same as at the previous carrier frequency. In this case the RF frequency display will display a carrier frequency based upon the previous local oscillator harmonic number. Pressing the **AUTO** key will recover from this situation and produce the correct display.

Manual tuning is the preferred method in the following situations:

1. If a signal has excessive AM or FM components or is masked by other signals of similar level, then this can prevent auto-tuning.

2. If the user is working with carrier frequencies in the range 50kHz to 1.85MHz or 8.45MHz to 15.55MHz then manual tuning is faster than automatic tuning.

3. For GPIB control, manual tuning provides maximum speed provided that the nominal carrier frequency is known.

4. Manual tuning provides maximum sensitivity when this is needed.

To manually tune the instrument to a specific carrier frequency, follow the steps below:

1. Press the **CARRFREQ** key. The unit responds by placing either the last manual frequency entered or a default carrier frequency in the data entry window.

2. If the displayed frequency is the required frequency, simply terminate the entry by pressing the **MHz** key. If a new freqency is required, enter the value required to the nearest 10kHz, and this value will overwrite the displayed setting. Terminate the entry by pressing the **MHz** key. The unit is now in manual mode.

If the carrier frequency is now changed, the frequency display will track the change as long as it remains within capture range. If the carrier moves outside the capture range, the warning message "RF input off tune" is displayed. If the carrier is well outside range or is not present at all, the warning message "RF input low or off tune" is displayed. Manual mode state and nominal carrier frequency can be stored along with the rest of the instrument state. To return to automatic mode, press the **AUTO** key.

u) **Data entry keys**

These keys are used for manual frequency tuning, memory functions and secondary commands.

v) **Secondary commands**

All secondary commands are entered by using the # key together with the data keys. Note that when using these commands on GPIB that a space is mandatory between any prefix data and the gate command e.g. 1 #03

Key sequence	**Command action**
#00	Displays software version number.
#01	Display test. Exercises all front panel displays. Aborts if **CLEAR** key is pressed.
1 #03	Selects RF power level units to be dBm.
#03	Selects RF power level units to be mW.
#04	Displays most recent message
#05	Displays current GPIB
NN #05	Sets the GPIB address to NN.
1 #06	Selects external frequency reference.

	#06	Selects internal frequency reference.
	#07	Performs self-calibration of AM and FM demodulators using internal reference. The self-calibration factors are stored in non-volatile RAM. To achieve optimum performance on AM and FM measurements, the self-calibration function should be initiated imme diately prior to taking the measurements. **NOTE:** This function once initiated must continue to com pletion. It **cannot** be aborted.
1	#11	Selects 150Hz tone notch.
	#11	De-selects 150Hz tone notch.
1	#12	Selects relative level units to be %.
	#12	Selects relative level units to be dB.
2	#13	Selects bandpass filter to be 300Hz low pass for measurement of frequency of sub-audible tones.
1	#13	Selects bandpass filter type to conform to CCIR 468-3.
	#13	Selects bandpass filter type to conform to CCITT P35A.
1	#15	Selects pre-display de-emphasis. With pre-display de-emphasis the user must avoid measuring a modu- lating frequency which is greater than 6400, 3200, 2100 or 210Hz with the 25, 50, 75 or 750 microsec- ond de-emphasis time constants respectively since this will overload the audio system and distort the signal.
	#15	Selects post-display de-emphasis. Selected time constants affect the AF output but not the modulation level display.
1	#28	Sets autoranger into range up only mode. This facility allows the audio system to settle on to the correct range when dealing with transient signals such as speech. It can also be used to prevent the AF output from changing sensitivity.
	#28	Sets autoranger to normal ranging up and down.
1	#30	Selects external local oscillator input. See section 6.6, Applications.
	#30	Selects internal local oscillator.
1	#31	Sets control output A on back panel to a high level.
	#31	Sets control output A on back panel to a low level.

1	#32	Sets control output B on back panel to a high level.
	#32	Sets control output B on back panel to a low level.
1	#33	Switches the delta level analogue display off.
	#33	Switches the delta level analogue display on.
N	#66	Selects digital averaging of level display. Number of readings averaged is equal to 2 to the power N where N ranges between 0 and 7.
	#81	RS-232C self test. Not currently supported.
NN	#90	Removes write protection of Store NN.
NN	#91	Write protects Store NN. Prevents inadvertent erasure of a store except by a memory clear command.
	#99	Clears all store locations. WARNING! All instrument stores are cleared whether write protected or not. The current instrument state is changed to the default setting which is listed in section 6.3. This command also resets AM and FM self-calibration factors to default values. It is essential to initiate a self-calibration after this command before using the unit for calibrated measurements.

6.3 REFERENCE TABLES

The tables below cover all messages output by the system, default states and those states initialised on power on.

0.	No error	
1.	GPIB address out of range	Valid range is 0 to 30.
2.	0.05MHz < CarrFreq < 2690MHz	Manual tune over-range is allowed up to 2690MHz.
3.	Store write protected	
4.	Store number out of range	Valid range is 01 to 99.
5.	Gate (#) command not recognised	
6.	Option not fitted	
7.	Invalid command	The command is incompatible with the current state of the instrument.
8.	Store empty	The user cannot re-call an empty store.
9.	Invalid parameter for # command	
10.	Invalid remote command	
11.	String too long - maximum 80 characters	
12.	No carrier frequency found	
13.	Self calibration - AM failure	
14.	Self calibration - FM failure	
15.	GPIB time out	

b) **Information messages**

20.	Software Version N.N	Installed software version number.(See section 9, Calibration Procedure for details of how to upgrade installed software).
21.	GPIB address is NN	
22.	Self-test pass	
23.	Self test fail	Unit can still be operated after the CLEAR key is pressed

c) **Hardware messages**

32.	Excess RF input power	Disconnect source of excess power and then reset by pressing **CLEAR** key.
33.	RF input level too high	
34.	RF input level low or off tune	The user has entered manual carrier

frequency but no signal within I.F. range has been detected.

35. RF input off tune — The user has entered a manual carrier frequency but the actual carrier frequency is generating a I.F. which is out of range. Check the carrier frequency and re-enter manual tuning carrier frequency if neccessary.
36. RF Power <-10dBm
37. AF level overload

d) **Warnings**

50. Maximum hold in operation
51. DCFM in operation
52. Manual carrier frequency setting
54. External reference selected
56. Autoranger in range up only mode
57. Automatic mode restored
59. Normal autoranger restored
60. GPIB LLO state: Key disabled
61. Remote state: Keys disabled
62. Self calibrating ...

e) **Default states**

If the instrument memory is cleared using the appropriate secondary command, then the initial state is set as below:

AM, Distortion off, PK-PK/2, RF Display, ABS, MaxHold off, 50Hz HPF, BandPass off, 15kHz LPF, De-emphasis off, LOCAL, AUTO, all secondary commands inactive, Manual carrier frequency default = 1.5MHz.

f) **Initialised states**

Most states can be stored for later use. The exceptions are listed below, with their power on states:

Command	**Power on state**
MAX HOLD	OFF
DCFM	50Hz HPF
1 #28 (Autorange up only)	#28 (Normal autoranging)

6.4 REMOTE OPERATION VIA GPIB OR RS-232C

a) Functions supported

The following interface functions are supported on the GPIB:

SH1	Source handshake
AH1	Acceptor handshake
T6	Talker when addressed. Status byte returned on serial poll.
TE0	No talker with secondary addressing.
L4	Listener when adddressed
LE0	No listener with secondary addressing
SR1	Service request
RL1	Remote, local and local lockout
PP0	No parallel poll
DC0	No device clear
DT0	No device trigger
C0	No controller
E2	Tri-state drivers.

When addressed to listen, the instrument will recognize the end of a command string or strings on receipt of either **CR** or **LF** or EOI set true or any combination of the three.

When addressed to talk, the instrument completes a string with **CR** followed by **LF** coincident with EOI set true.

b) Listen functions

The software which controls the GPIB and RS-232C interface on the AMM2000 has been written to allow bus control of the instrument to be similar to normal front panel control. To control a function using the bus, the same entry sequence is followed as if using the front panel keys. Instead of pressing front panel keys in sequence, a series of ASCII strings corresponding to the legends on the keys are sent to the AMM2000 by the bus controller.

eg. To change the manual mode carrier frequency using the front panel keys, the key CARRFREQ is pressed, followed by the frequency, say 123.45, followed by the units terminator, MHz. To perform this operation remotely, the following line would be sent from the controller:-

CARRFREQ 123.45 MHz

The commands **MUST** be separated by at least one space:-

i.e. CARRFREQ (SPACE) 123.45 (SPACE) MHz

The recommended end of line terminator is a carriage return. Some of the front panel commands have a toggle action, i.e. pressed once they switch a function on, pressed a second time they turn the function off. Additional commands are provided to perform exclusive `on' or `off' action of these functions. Where there is no common ASCII character for the key legend, a suitable replacement has been found. The instrument bus interface is insensitive to the case of ASCII letters, the commands can be entered using upper and lower case. GPIB listen commands are listed below:-

GPIB command	**Comment**
AM, FM, PM, RFPOWER, AFVOLTS	Switch function on.
AM-OFF, FM-OFF, PM-OFF, RFPOWER-OFF, AFVOLTS-OFF	Switch function off.
DIST-ON, DIST-OFF	
PK-PK/2, +PEAK, -PEAK, RMS, R2RMS	
RF, AF	Switch appropriate frequency display on.
RF-OFF, AF-OFF	
ABS, REL	
MAXHOLD, MAXHOLD-OFF	
10Hz, 50Hz, 300Hz	

GPIB command	**Comment**

10Hz-OFF, 50Hz-OFF, 300Hz-OFF	To set DCFM mode, send 10Hz followed immediately by 10Hz-OFF.
3kHz, 15kHz, 75kHz, 300kHz	
BANDPASS, BANDPASS-OFF	
25US, 50US, 75US, 750US	
25US-OFF, 50US-OFF, 75US-OFF, 750US-OFF	
#, AUTO	
CARRFREQ, MHz	
STORE, RECALL, STEP	

c) **Talk functions**

The readings on the frequency and level display of the AMM2000 can be read on the GPIB by sending one of the following talk commands:-

GPIB command	**Comment**
FREQ?	Next talk string will be the current frequency display value expressed in fixed point format to one decimal place in units of 1Hz. Maximum string length is 14 characters inlcuding decimal point, **CR** and **LF**.
LEVEL?	Next talk string will be the current value of the level display expressed in fixed point format to two decimal places in units of %, Hz, rad, W or mV as appropriate. Maximum string length is 11 characters including decimal point, **CR** and **LF**.

GPIB command	Comment
ERROR?	Next talk string returns most recent error, information or warning message. Maximum string length is 34 characters including **CR** and **LF**.

On receipt of one of the above commands, the instrument will assert SRQ as soon as a talk string is available. This allows the controller to read data at the optimum rate if it handshakes by checking for SRQ before subsequently requesting the unit to talk.

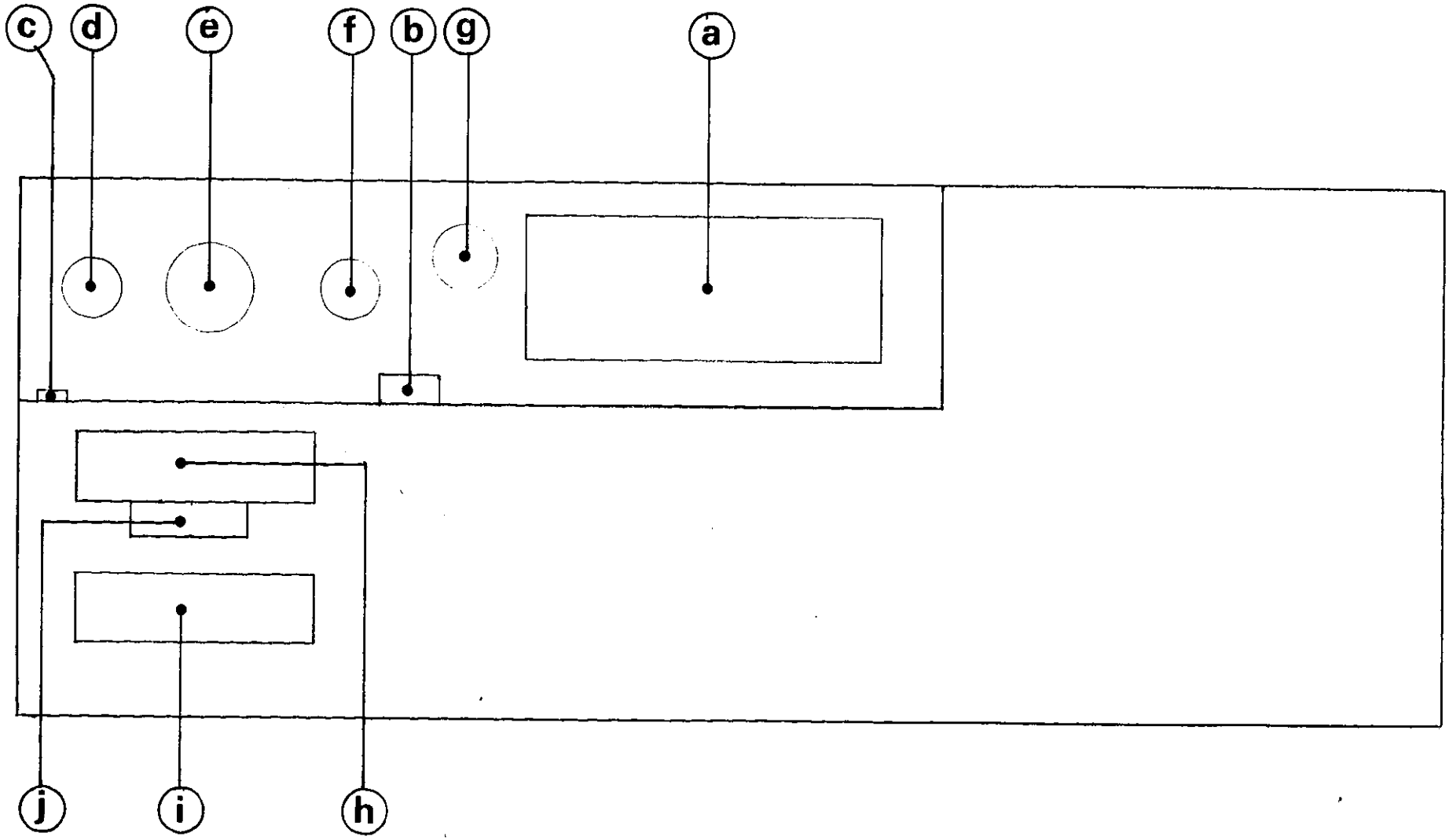
In each case above the talk string is terminated with a carriage return followed by line feed coincident with EOI set true. If the controller does not accept the talk string within 30 seconds, then the AMM2000 aborts and displays "GPIB time out" on the front panel. If any unrecognisable data is encountered during GPIB operation, the AMM2000 will assert SRQ, the service request function. If the user initiates a serial poll, the least significant six bits of the status byte contains the error number encountered. (See section 6.3, Error messages).

d) **Instrument driver software**

Farnell Instruments supports the use of IBM-PC or equivalent computers used with IEEE-488 cards and software drivers supplied by National Instruments Corp. In addition specific instrument driver modules, including one for the AMM2000, are available to support the LabWindows test and measurement software development environment. Contact your local agent or representative for further information.

e) **RS-232C interface**

The RS-232C interface is not currently supported.


c
d
e
f
b
g
a
j
i
h

6.5 BACK PANEL FACILITIES

Lower case letters below refer to the annotated drawing adjacent to this page.

a) Combined a.c. power inlet connector, RFI filter, voltage selector and fuse.

b) Combined a.c. and d.c. power input on/off switch.

c) Internal frequency reference adjustment. See section 9, Calibration Procedure, for details.

d) Internal reference output/external reference input. See section 6.2 paragraph v) to change function.

e) External local oscillator input. (RF input with factor fitted option F). See section 6.6 paragraph c) for details of use.

f) DC input connector.

g) DC input fuse.

h) RS-232C connector.

i) GPIB (IEEE-488) connector.

j) Six way auxiliary connector. See section 6.6 paragraph d) for details of use.

6.6 APPLICATIONS

a) Using the AF OUTPUT connector

The AF output on the front panel is a copy of the signal which is being measured in the level display (except when measuring RF Power). This signal is under control of an auto-ranging system which keeps the voltage level at all times below approximately 5V peak-peak (1.7V rms). Note that when measuring distortion, the unit makes a ratiometric measurement by measuring the total signal followed by the signal with the fundamental notched out. The AF output reflects this by alternately outputting these two signals.

The auto-ranging facility is extremely convenient if the output is used for minitoring waveshape on an oscilloscope or for spectrum analysis. However, if comparative amplitude measurements are required the auto-ranger will defeat this objective. The auto-ranger in this case must be set using a secondary command into the "range-up only" mode (see section 6.2) and the largest signal of interest used to force the system into the correct range, before attempting comparison with lower level signals.

To maximise signal to noise ratio, the user should always try to set the high pass and low pass filters to give the minimum pass band consistent with allowing the wanted signal(s) through un-attenuated.

b) Using the IF OUTPUT connector

The IF output on the front panel can be used for viewing carrier envelope shape or for modulation distortion analysis using a specturm analyser centered on the IF. The output level is gain controlled and remains at approximately 0dBm under normal operating conditions. The IF output varies with carrier frequency as shown below:-

Carrier frequency range	**IF range**
250kHz to 1.99MHz	250kHz to 1.99MHz
2MHz to 5.99MHz	500kHz $\pm$ 2.5kHz
6MHz to 2.4GHz	1.5MHz $\pm$ 165kHz

The IF output has a useful response to 10MHz. This allows the unit to be used as a down-convertor for signals with large amounts of FM. Under manual tuning control, the system normally adjusts the internal local oscillator to produce a harmonic at 1.5MHz above the carrier frequency, thus giving the correct IF. If the user enters the carrier frequency plus 3.5MHz, the system will output an IF of 5MHz. No internal measurements can be taken, but the IF output can now deliver signals with up to $\pm$ 5MHz deviation.

c) **Using the external local oscillator input**

The internal local oscillator of the AMM2000 is designed to give minimum phase noise for offsets of 10Hz to 300kHz from the carrier. However, if the user wishes to use the IF output for further direct modulation analysis using a spectrum analyser then a useful improvement in the phase noise for carrier frequencies above 100MHz may be achieved by using a high quality external signal source which is tuneable from 24MHz to 48MHz and whose output is obtained by digital division of its fundamental octave range.

The user must select the external local oscillator input using a secondary command, see section 6.2 v). The external source should be set to a nominal level of 0dBm and the source frequency calculated as below:-

Source frequency = (Carrier input frequency + 1.5MHz)/N
where N is a whole number chosen to give a source frequency as high as possible in the range 24 to 48MHz.

The carrier frequency displayed when using external local oscillator will not be valid. If the user has calculated the source frequency correctly then the dummy carrier frequency displayed will be 94.5 **MHz**.

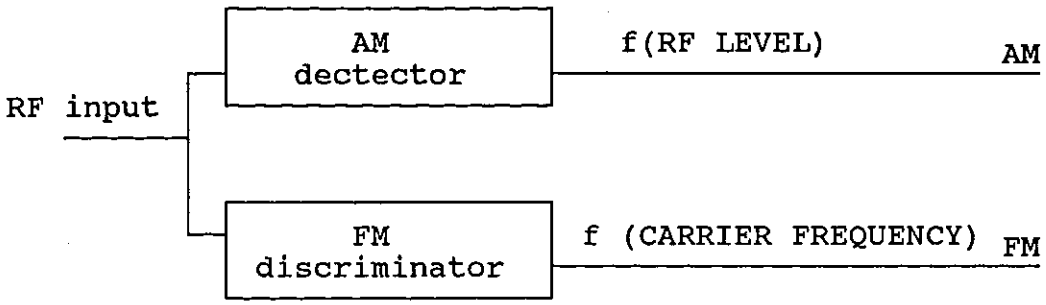
d) **Using the auxiliary connector**

The auxiliary connector allows the user to add on any further external audio filtering that may be required prior to taking a measurement. The audio level at this point is 5V peak to peak. **WARNING!** The unit is delivered with a shorting link between pins 2 and 3 as shown on the back panel to complete the audio circuit when no external processing is required. Removal of this link will result in loss of audio and modulation measurement. The control outputs are intended to control the external filters if fitted, or can be used for any convenient signalling purpose such as operating a relay with appropriate buffering. See Secondary Commands, section 6.2 v).

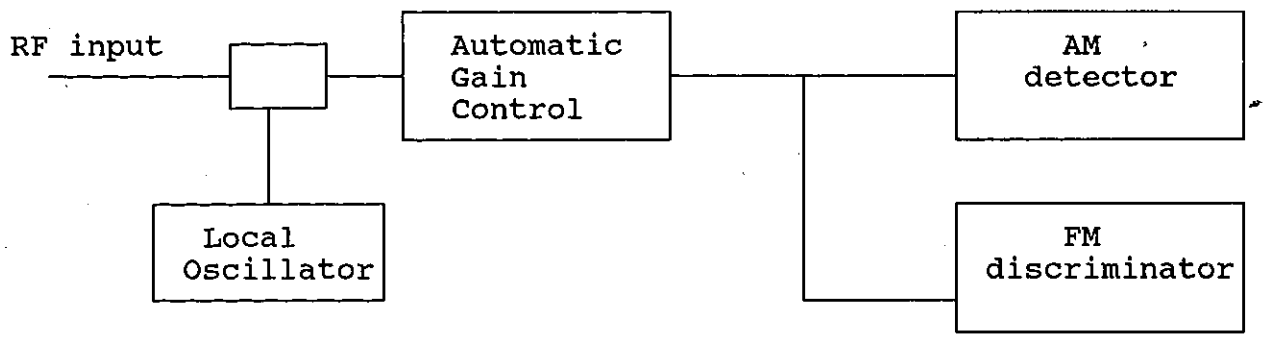
7. OVERALL BLOCK DIAGRAM AND THEORY OF OPERATION

7.1) INTRODUCTION

In order to recover modulation present on a RF carrier it is necessary to convert the information present in the sidebands down to a baseband signal. For amplitude modulated signals this can be achieved by using a diode, and for frequency modulated signals some form of frequency discrimination must be used. The simplest AM/FM modulation meter can therefore be built as below:-



This arrangement suffers from two drawbacks. The AM detetector will only be calibrated for one mean power input level. This can only be remedied by adding an AGC block to give a fixed RF level at the input to the AM detector. The FM discriminator will only be calibrated for one mean carrier frequency. This can be remedied by mixing the RF input with a local oscillator to produce a constant intermediate frequency. We now have a modulation meter which can deal with variable RF input level and variable carrier frequency:-



Early modulation meters based on the simple arrangement just described required a switched bank of local oscillators to cover the range required. Evrytime the carrier frequency changed, the operator had to re-tune the local oscillator to give the correct IF. A microprocessor based product can perform this tuning process automatically, and by using a sampling mixer in place of an ordinary mixer, many octaves of RF input frequency can be covered by a single octave local oscillator range.

7.2) Functional description of AMM2000 pcb's

Refer to block diagrams 3ZW10180232/242/243.

a) Reference board

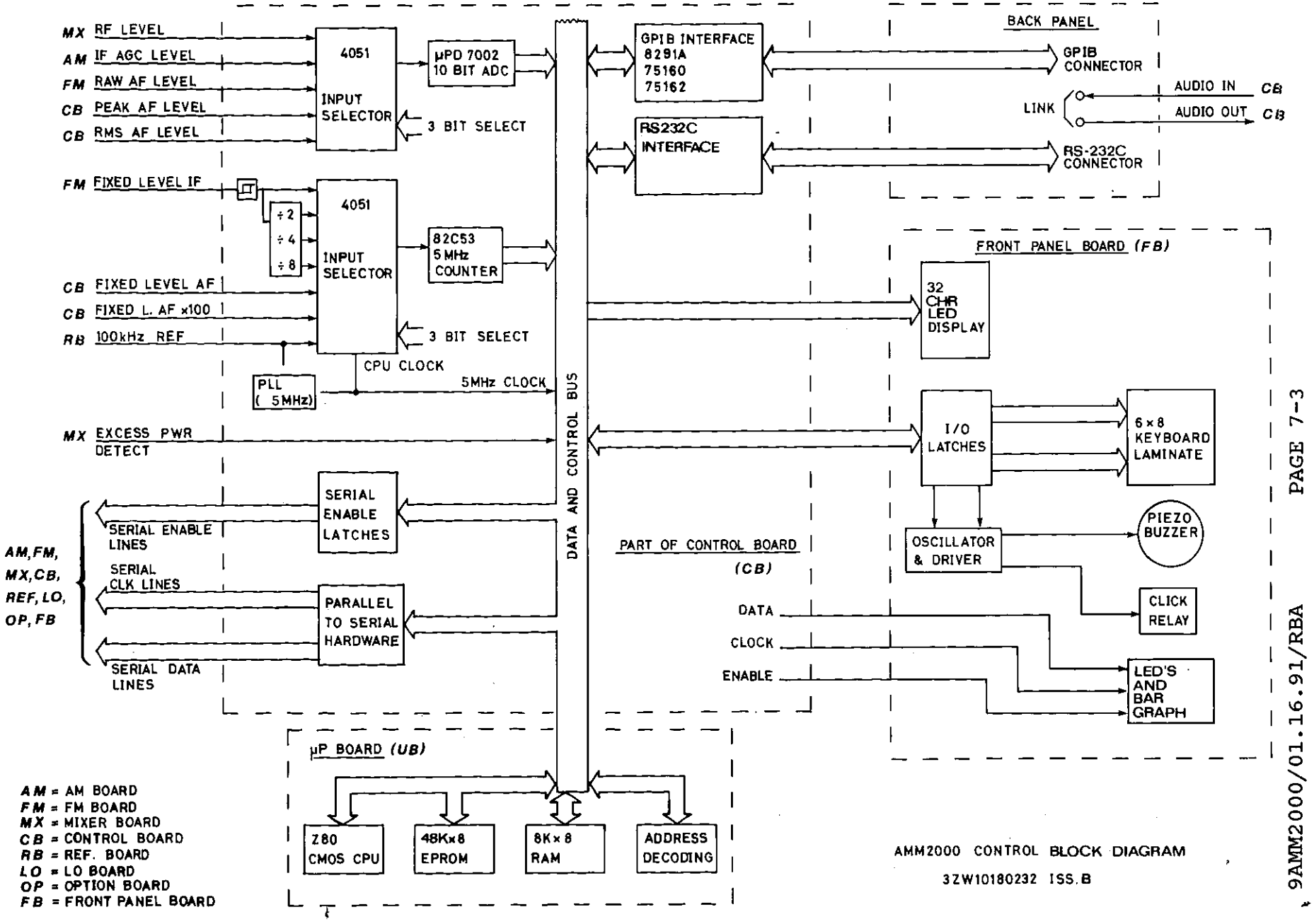
This board determines the accuracy with which it is possible to measure carrier input frequency and AM and FM level.

A 10MHz temperature compensated crystal oscillator provides a 100kHz reference frequency for the local oscillator board and for the control board IF counter chip. A switched attenuator is used to generate a known level of AM at a 1kHz rate and a variable modulus divider chain is switched to produce a known level of FM at a 1kHz rate. The AM and FM calibration signals are generated at a nominal frequency equal to the IF of 1.5MHz. The calibration signals are fed to the mixer board where they are substituted for normal input when in the calibrate mode.

b) LO board

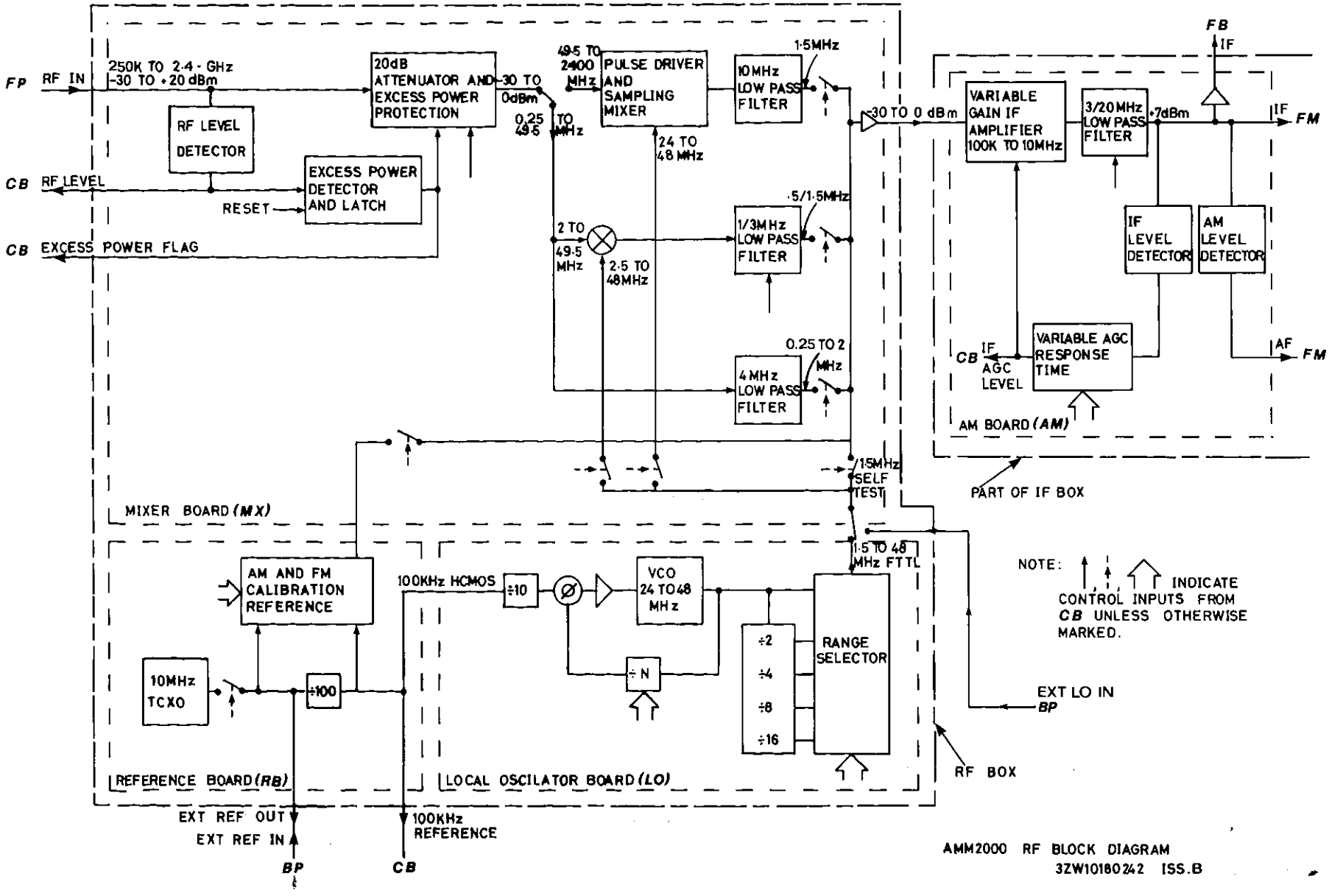
The local oscillator board contains an octave range oscillator which can output frequencies from 24MHz to 48MHz in 10kHz steps. When this signal is fed through the pulse generator on the mixer board, multiple harmonics of the LO frequency are generated up to at least 2.5GHz. Any RF input in the range 49.5MHz to 2.4GHz can therefore be mixed with the LO frequency or one of its harmonics to generate the required IF of 1.5MHz.

The range divider on the LO board provides frequencies required to mix with the RF input when this lies between 2MHz and 49.5MHz. The local oscillator is not used when the RF input is below 2MHz because the RF signal is used as the IF with no frequency translation.

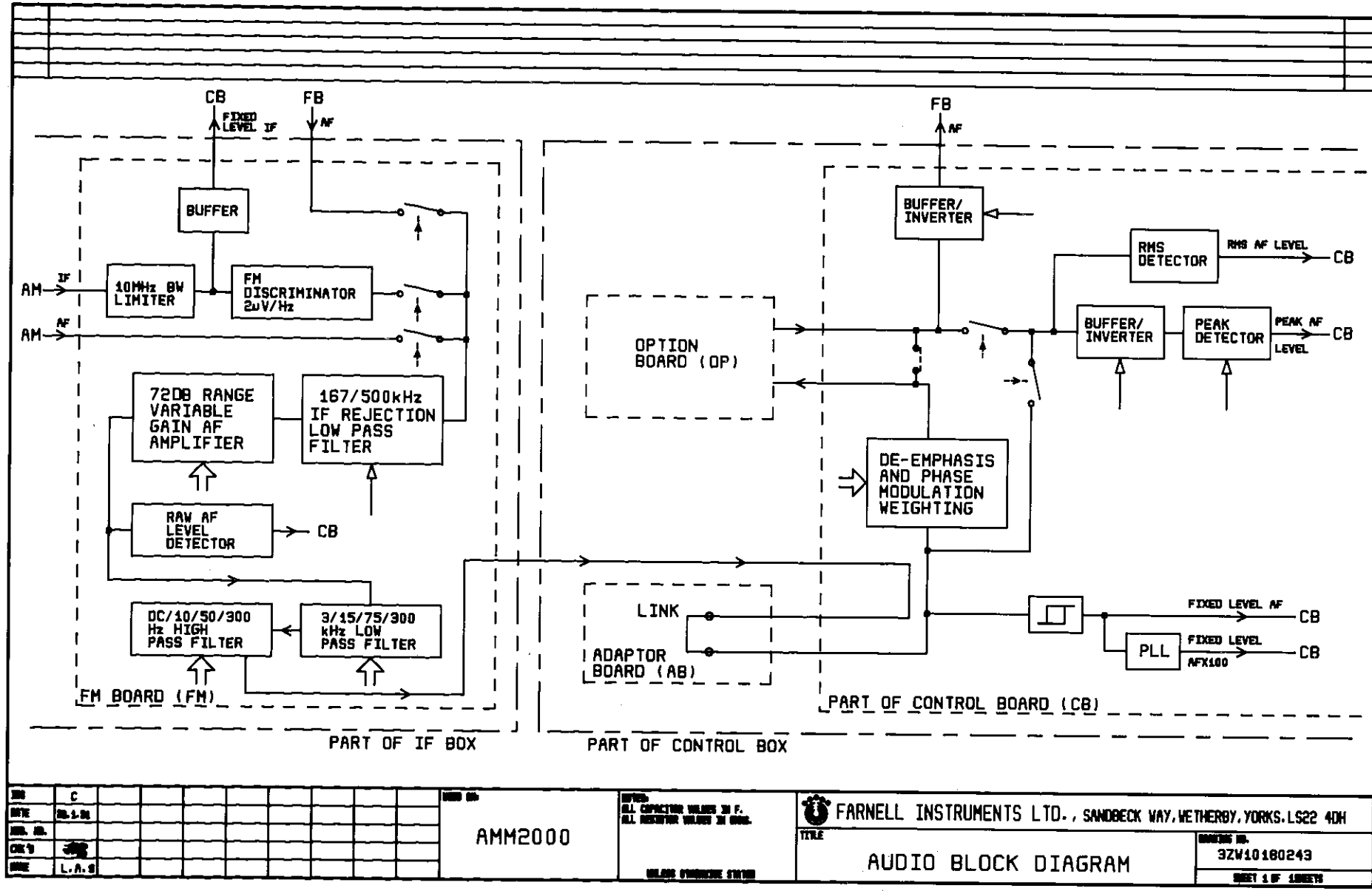


AMM2000 CONTROL BLOCK DIAGRAM

3ZW10180232 ISS.B



AMM2000 RF BLOCK DIAGRAM
3ZW10180242 ISS.B



ISS	C											
DATE	20.1.91											
ENG. NO.												
CHK'D												
DRWN	L.A.S											

AMM2000

ALL CAPACITOR VALUES IN F.
ALL RESISTOR VALUES IN OHMS.

VALVES SYMBOLISE STATES

FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH

TITLE: AUDIO BLOCK DIAGRAM

DRAWING NO. 3ZW10180243

SHEET 1 OF 1 SHEETS

c) **Mixer board**

The main function of the mixer board is to reduce the dynamic range of the signal to be measured and to translate the frequency. It must do this whilst adding negligible distortion and noise to the signal.

A detector diode across the RF input provides the control board with a dc level proportional to the RF input level. If the RF input level ever ecxeeds approximately +26dBm, an excess power protection circuit ensures that the RF input is open circuited to prevent damage to the instrument.

For RF input frequencis between 49.5MHz and 2.5GHz the IF is obtained by mixing the input with a harmonic of the local oscillator in a sampling mixer. For RF input frequencies between 2MHz and 49.MHz the IF is obtained by mixing the input with the LO or a sub-harmonic of the LO in a double balanced mixer. For RF inputs below 2MHz no frequency conversion is used, and the input is fed directly to the IF box.

d) **AM board**

Any short term variations in level are interpreted as AM and detected as such. The speed of response of the AGC loop is under program control to allow for differing requirements when the instrument is auto-tuning or measuring.

The IF AGC level is fed to the control board where its level relative to the RF input level and its absolute level are used as part of the auto-tuning process.

The IF level detector and AM detector are designed for optimum performance at 1.5MHz. However, the IF level detector must work from less than 100kHz to 10MHZ during the auto-tuning process, it must work at 500kHz for RF inputs between 2MHz and 6MHz and must work down to 250kHz for low frequency RF inputs. The AM audio output and the fixed level IF output are fed to the FM board for further processing.

e) **FM board**

The FM board includes an FM discriminator, a software programmable audio gain block used on AM, FM and AF input measurements, and some audio filters.

The limited IF signal is fed to the control board to allow frequency counting during auto-tuning and carrier frequency measurement.

f) **Control board audio section**

By the time the audio signal to be measured has reached the control board, the dynamic range has been reduced to about 6dB when in the auto-ranged state, and this reduces errors due to non-linearities in the peak and rms detectors to a very low level. The audio level is also limited and fed to the control board frequency counter chip either directly or through a x100 multiplier for frequencies below 3kHz.

g) **Option board**

Distortion is measured by calculating the ratio of signal with notch in to signal with notch out. In order to maintain level at the rms audio detector with a notch switched in, it is necessary to have an extra software programmable audio stage on this board.

h) **Control board digital section and front panel**

The control board communicates with the user via the front panel, GPIB or RS-232C interface. Most of the information gathered from the other boards is fed into the processor section by scanning the RF, IF and AF levels using one ADC chip and scanning IF and AF rates using one LSI counter chip. Commands sent to other boards are sent bit serially to reduce wiring between boards. The CPU clock is phase locked to the reference board crystal to eliminate the possibility of in band interference products being formed by mixing of these signals.

8. CIRCUIT DESCRIPTION

8.1 CONTROL BOARD

The control board is a double sided printed circuit board approximately 195 x 285 mm in size, mounted on a hinged aluminium tray on the underside of the instrument such that the component side of the board is accessible when the bottom cover of the instrument is removed. The control board performs all the measurement and internal control functions of the instrument and also some audio signal processing.

The heart of the control board is the Processor Core Module, itself a small PCB mounted `piggy-back` fashion on the control board. This module houses the Z80 microprocessor, non-volatile RAM, ROM and much of the memory decoding required by the processor system. Additional ROM is housed on the control board itself (U17). U18 and U19 are used to multiply the instrument`s 100kHz reference signal by fifty to obtain the 5MHz clock for the processor. U47-A, XTL-1 and U19 provide an alternative clock source when it is desired to test the control board in isolation. U49 is used to provide two divisions of the 5MHz clock required by certain peripherals on the control board, and also to slow down processor operation with the `WAIT` signal when communicating with U10, the analogue to digital converter. The power-on reset and non-volatile RAM protection functions are provided by U48. Buffer U30 decreases the load on the processor data bus by driving many of the data latches used on the board.

The AMM2000 being a measuring rather than a generating instrument is busy most of the time measuring, processing and displaying new data. Any activity apart from this, e.g. responding to a keypress is initiated by an interrupt to the processor. The various interrupt signals are OR`ed teogether by U2 to generate an active signal on the processor`s interrupt input. The processor responds by reading interrupt status latch U1 to determine the source of the interrupt and then taking the appropriate action.

Decoder IC U46 is used to further decode the memory map to provide select signals for the four intelligent displays and the keyboard latches on the front panel, and for some of the data latches on the control board.

The control board also contain the G IB interface comprising IC`s U20, U21, U22, and the RS232 interface comprising IC`s U44 and U45.

With the exception of the front panel board, all the communication between the control board and other boards in the instrument is performed using a serial communication system based on three signals, serial data, serial clock, and a strobe signal. The data and clock signals are common to all receiving devices, the strobe is specific, i.e. there is a separate strobe signal for every receiving device. This serial system reduces considerably both the amount of wiring in the instrument and the associated problems of taking signals into RF screened boxes. The serial interface is a `write-only` system, and comprises U24- 29 and U31-33. To reduce the amount of electrical noise in the instrument the serial data system is split into several channels on the control board, so the data and clock is sent only to the intended destination. The desired channel is enabled before a serial communication by writing a byte to serial-control-latch U25. The outputs of this latch enable the appropriate data and clock channels via AND gates U31-33. A data byte is then sent by writing the byte in the usual way to serial-data-latch U26. This action enables the counter U24 which selects each of the eight inputs of data selector U27 in sequence, sending each data bit to the data channels in synchronisation with the serial clock, also derived from U24. The last operation of the sequence is to send a `strobe` signal to the appropriate receiving device on the remote board by writing two bytes to serial-enable-latch 1, U28, or serial-enable-latch 2, U29. U29 is also used to control the bleeper oscillator U35, and to control one of the three counters used on the control board.

In order to obtain the required results, the control board measures various signal levels and frequencies. One of six level inputs is selected by analogue multiplexer U9 and the output is converted to a form that can be read by the microporcissor by 10- bit analogue to digital converter U10. In a similar way one of eight frequency inputs is selected by multiplexer U5 and the output measured by counters contained in U4. Of the three counters available in U4, counter-0 generates a specified gate period during which counter-1 counts the selected input frequency to obtain the result. The third counter, counter-2 is used to generate the baud rate clock for the RS232 UART U44.

The audio signal processing section contained on the control board comprises U8, U11, U12, U13, U43 and associated discrete components. U13 and U8-A provide the modulation weighting networks. U8-D buffers the resulting audio signal and U43-B and U8-B allow for the signal to be inverted if necessary before sending it to the audio output on the front panel of the instrument. U8-C buffers the signal again and U12 and U11-D will convert the audio signal to a true RMS level which can then be measured by the ADC via multiplexer U9. U11-A and U43-C will invert the signal if required depending on whether a positive or negative peak measurement is to be made, and U11-B and U11-C find the peak level itself which is taken to another input of the analogue muliplexer U9. The audio signal is also taken to Q2 and U40-C to obtain a fixed level frequency which can be measured by the frequency counters via multiplexer U5.

U15 and U16 multiply the audio frequency by 100, this signal is also taken to the frequency multiplexer to be measured by the counters when required.

8.2 FRONT PANEL BOARD

a) The AMM front panel consists of four main sections. These are the keyboard section, the intelligent display section, the bar graph section and the indicator LED section.

The keyboard section consists of a membrane keypad which is fixed to the false front of the unit. Key presses are decoded by two latches. These latches provide seven driver and eight read lines (U11 acts as driver, U10 reads lines).

Initially the outputs from the driver latch are set high. With a key press an interupt is generated by U12, this informs the processor that a key has been pressed. As a result of this the processor stops what it is doing and starts to look for the key that has been pressed. It does this by setting all the outputs from U11 low and then sets each output individually high, at the same time it checks the input latch U10. When it detects a change in state in one of the input lines the processor knows the unique code for the key that has been pressed.

In order to acknowledge that a key has been pressed the processor sets the click line low (using the 74HC374 latch U11) after a short period of time then sets the click line high. This results in an audible click from RL1.

b) The main part of the display section of the AMM consists of eight digit intelligent display modules. These act like memory locations, so data can be sent to be displayed by using an address and an ASCII code for each individual character of the display. Four display modules are used U1, U2, U3 and U4. The latch U7 is used to alter the timing of the modules to ensure compatability with bus timing.

The bar graph section of the display operates on a different principal, that of serial data transfer. Two HDSP-4820 10 segment bar graphs are used (U5, U6), these are driven by MM5450 serially loaded LED driver (U8). Data is sent in blocks of 34, a stream is initialized by sending a high bit before the main bulk of the data on the data line combined with a change in state in the enable line. The MM5440 offers the facility to control the brightness of the LED's it is driving.

The final section of the front panel is the indicator LED section. This works in a similar manner to the bar graph section, a similar MM5450 34 segment LED driver is utilized (U13) but instead of segment displays individual LED's are used next to their associated key.

8.3 POWER SUPPLY

a) Mains power is passed to the primary of transformer TX1 via the power switch SW1 and the integral mains filter/voltage selector.

There are three secondary outputs of TX1 to provide low voltage power for the full wave rectifiers D1, BR1 and BR2. D1 is a schottky diode rectifier for maximum efficiency. After smoothing of the rectified signals linear voltage regulators are utilized to provide stable low noise supplies of +5V, +12V and -15V for the instrument.

Regulator U1 provides +5V output, and U2 +12V output. An unregulated +5V supply is taken from the input of U1 to power the front panel displays. The -15V regulator, U3, is an adjustable design with P1 setting the output voltage.

The secondary output for the +12V supply is separately rectified by D2 and D3 to provide a fast responding advanced warning of power failure for the control circuit board.

b) The coil of relay RL1 is supplied from the dc input via the protection diode D12. When RL1 operates the mains input socket is isolated and switching power MOSFETS Q3 and Q4 are connected to the transformer inverter winding. Drive for Q3 and Q4 is provided by a 70Hz nominal frequency astable multivibrater comprising transistors Q1 and Q2 and associated circuitry. This drive level is routed to the control circuit board to provide battery level indication.

8.4 MIXER BOARD

a) The mixer's function is to convert RF input signals in the range 250kHz to 2.4GHz into an IF signal with identical modulation parameters to the RF input. This IF signal can then be processed by the rest of the instrument.

To cover the very wide input frequency range, two separate mixer ranges are unilized. A broad band sampling mixer covers the range 49.5MHz to 2.4GHz and a high level double balanced mixer the range 2MHz to 49.5MHz. Input frequencies in the range 250kHz to 2MHz are passed straight through without conversion.

b) The RF input is routed through an overload protection relay RLA, and switched 20dB attenuator relay RLB. Relay RLC connects the RF input either to the sampling mixer or the double balanced mixer.

Detector diode D1 senses the RF input level to provide level information for the control circuit board. The detected level is buffered by amplifiers U201-A and U201-C and passed to the control circuit board. Diode D4 provides temperature compensation for the detector diode D1, giving greater accuracy.

When the RF input level exceeds approximately 0dBm, the 20dB attenuator is switched in by relay RLB, thus keeping the input level to the mixer within acceptable limits. This arrangement allows an RF input level range of -30dBm to +20dBm to be accommodated.

If the input level exceeds approximately +26dBm, pin 7 of amplifier U201-B is set high, operating the overload protection latch U202. Drive transistor Q201 is turned off allowing relay RLA to open circuit the RF input. The inverter gate U202-D provides a flag to warn the control circuit board of an input overload condition.

c) The sampling mixer comprises the diode bridge D2 and D3 driven by a pulse generator, whose 300pS wide sampling pulses produce a comb line frequency spectrum at a repetition rate equivalent to the local oscillator drive frequency.

When the RF input frequency is mixed with a harmonic multiple of the local oscillator frequency, an IF signal is produced. This IF signal is buffered by FET Q1 and amplified by Q2 to bring the IF level to the same level as the mixer RF input.

The pulse generator is driven by a local oscillator signal in the range 24MHz to 48MHz from the local oscillator circuit board. This signal is gated by U206 and applied to the buffer amplifier Q206.

If desired a very low noise external local oscillator may be used, which is buffered by Q214 and gated through with U206.

A differentiating circuit comprising C232 and R243 results in narrow positive going pulses at the collector of Q207. The darlington drive amplifier comprising Q208 and Q209 is normally off and is turned on rapidly by pulses from the collector of Q207.

Step recovery diode D212 is turned off rapidly by pulses from Q209 thus producting a very narrow sampling pulse 300pS wide.

Transformer TX1 is utilized to derive a complementary pulse for the diode bridge.

d) The sampling mixer IF output is passed to buffer amplifier Q204 followed by a 10MHz low pass filter comprising L201 to L204. This filter ensures only the wanted IF output if passed

The resulting IF signal of 1.5MHz is then routed via relay RL2 to the amplifier Q210 which provides the main IF output signal to the AM circuit board.

For RF input frequencies of less than 49.5MHz, the input is routed via relay RLC to the high level double balanced mixer, U203. When this mixer is enabled the power to the sampling mixer pulse generator is inhibited by the transistor switches Q212 and Q213.

The appropriate local oscillator signal is gated to mixer U203 via U206-A. Input signals of less than 2MHz bypass the mixer to a 4MHz low pass filter comprising L206, L207 and are routed via relay RL3 to amplfier Q210.

For input frequencies in the range 2MHz to 6MHz an IF signal of 0.5MHz is used. For this case the mixer output is passed through a 1MHz low pass filter comprising L210, L211 and routed via RL5 to the output.

When the input frequency is in the range 6MHz to 49.5MHz and IF signal of 1.5MHz is used. For this case the mixer output is passed through a 3MHz low pass filter comprisng L208, L209 and routed via relay RL4 to the output.

e) A 1.5MHz self test facility is incorporated by routing the local oscillator signal through relay RL6 to the IF output. Provision for modulation calibration is allowed by routing a calibration signal from the reference circuit board via relay RL1 to the IF output.

Control data for the mixer circuit board is fed serially to latches U204 and U205 which provide eleven latched data outputs D1 to D11.

8.5 LOCAL OSCILLATOR BOARD

a) This board provides the local oscillator signal required by the mixer board. It is essentially a microprocessor controlled frequency synthesizer with a fundamental range of 24MHz-48MHz in 10kHz steps. Programmable dividers on the output of the synthesizer, also under processor control, allow frequencies down to 1.5MHz to be generated.

The 100kHz reference for the board comes from the reference board, entering via S1 pin 5. This 100kHz signal is passed to the synthesizer IC, U9, where it is divided by 10 to provide a 10kHz reference to the phase detectors.

b) Q3, L1, C21-26, D1-4 and associated components form a Voltage controlled Oscillator, tuneable between 24MHz and 48MHz in eight ranges. The required range for the desired frequency is selected by switching capacitance in or out of the tuned circuit using pin diode switches under processor control. Q5, 6 and 7 are drivers for the pin diode switches. The oscillator output is tapped off L1 and buffered by U2 and U3a.

The oscillator output now follows two paths:- (i) via a programmable divider (U4, 5) to provide local oscillator to the mixer board and (ii) to a dual modulus (32/33) prescaler (U8) and hence to the synthesiser U9. In addition to phase detectors U9 contains three counter/dividers, `R`, `M` and `A`, each of which may be individually programmed. `R` is the reference divider, and as has already been mentioned is in this application set to 10 to give a 10kHz reference at the phase detectors. The `M` and `A` counters are programmed such that the V.C.O. output is, in the locked condition, divided down to 10kHz at the phase detectors.

A modulus control signal (U9 pin 18) derived from the `A` counter switches U8 to either 32 (A=0) or 33 (A > 1). This results in a total division ration of 32M + A.

In the unlocked condition the phase detector outputs (pins 1 and 2 of U9) force the output of the integrator (formed by U11 and associated components), which drives the V.C.O. into lock.

The time constant of the loop filter (integrator) can be switched between two values by changing the state of the analogue switches in U10. These also are under processor control to achieve optimum synthesiser performance.

c) The programmable divider formed by U4 and 5 allows division by 2, 4, 8 or 16 to give local oscillator frequencies down to 1.5MHz.

Q1 and 2 and associated components form active decouplers for the V.C.O. power supplies, to meet the required noise and spurious performance of the oscillator.

LD1 gives a visual indication of synthesiser locking, and a signal conveying this information is also sent to the control board (via S1 pin 6).

8.6 **AM BOARD**

a) IF signal enters the board from the mixer board, via connector S2. An automatic gain control loop, consisting of a voltage controlled amplifier (Q1-8), IF level detector (D2, D3) and variable AGC loop filter time constant (U1, RL2) reduces the signal dynamic range to a fixed mean level. The speed of response of the AGC loop is under mircoprocessor control to allow for differing requirements when the instrument is auto tuning. measuring FM, AM or low rate AM.

A scaled, level shifted version of the AGC control voltage is fed to the control board (via S1 pin 7) as an indication of the IF level. This information is used during auto tuning. the level shifting and scaling is carried out by U7, and is required to interface correctly with the control board.

The IF signal is then taken to the instrument front panel (for external measurement or processing) via a 50 ohm driver/buffer (Q9-12) and connector S3.

b) The Fixed level IF is also passed on to the FM board (via S3 and to the AM detector/demodulator (U2, U3)). AM detection is achieved by an active mixer (U3). IF (with AM) is mixed with amplitude limited IF, generated by a limiting amplifier (U2). The resulting signal is the demodulated audio required.

The AGC amplifier and AM detector are optimised for operation at an IF of 1.5MHz. However, during auto tune the AGC amplifier must operate between 100kHz and 10MHz. Further, during measurement with RF of between 2 and 6MHz the IF is 0.5MHz, and below RF of 2MHz the IF is equal to the RF.

c) Some residual harmonics of the IF are left on the audio signal. These are removed by one of the audio (IF blocking) filters. There are in fact two such filters but only one is selected at any time, the selection, under processor control, depending on RF (IF). One filter (RL5, U5, RL6) is selected if the RF is greater than 6MHz or between 1 and 2MHz and this filter is optimised for 1.5MHz IF and allows modulation rates up to 75kHz. The second filter (RL3, U4, RL4) is selected if RF is between 0.25 and 1 or betweem 2 and 6MHz and allows IF in the range 250kHz-1 1MHz with modulation rates up to 15kHz.

The audio signal is then fed to the FM board (via S5) for further processing.

8.7 FM BOARD

a) Three inputs are received on the FM board, FM, demodulated AM and audio signals. In the two latter cases the board is used in an audio processing capacity and in the former demodulation is performed in addition to audio processing.

The FM input is at a fixed carrier level and frequency between 250kHz and 2MHz. This input is limited by U2 which also squares the signal and rejects any amplitude modulation. U1 provides a buffered output for the control board. The FM discriminator consisting mainly of U3 produces pulses of equal width and depth and whose repitition is directly proportional to the frequency.

b) The frequency modulation is transformed into an audio signal on passing through the IF low pass rejection filter. This filter consists of a matched passive network with two selectable roll off points of 167/500kHz. The 500kHz filter is selected when the 75kHz or 300kHz LPF's are selected on the front panel The 500kHz filter is achieved with L1, L3 and C20, C23 with the 167kHz being implemented by switching in additional components L4, L5 and C25, C27. The DC level associated with the carrier frequency must be removed. This is usually done with the capacitor C24 but for slow modulation rates an offset null circuit is implemented. In normal operation relays RL9 and RL6 are held in with RL7 and RL5 out. This allows U4 to sample the DC level and when DCFM is selected the sampled voltage is held by C28. With the relays now in the reverse positions this voltage is buffered by U4 and inverted by U5 which allows the DC voltage to be offset.

c) The remaining circuitry provides the audio processing. A variable gain amplifier is implemented by U6 and U7 and allows gain of x1 to x1024 in x2 steps, selectable with the multiplexers U9 and U10. The output of the amplifier is monitored by the control board with a level detector consisting mainly of U13, D11, D12 and D13. U16 and U17 make up a low pass filter with selectable roll off points of 3/15/75/300khz and U18 provides a high pass filter with selectable roll off points of DC/10/50/300Hz.

8.8 REFERENCE BOARD

The main reference for the instrument is located on this board. In addition to providing the 100kHz reference signals for the local oscillator and control boards, calibrated AM and FM reference signals are supplied to the mixer board when required.

XTL is a 10MHz temperature compensated crystal oscillator, fine tuned by a back panel potentiometer. The instrument may be referenced from XTL or externally from a 10MHz source connected to the back panel input.

When internal reference is selected, pin 13 of U1 is set high. This gates the 10MHz signal from XTL to U2 via U9 a, b. U2 forms a divide by 100 which generates a 100khz reference signal which is buffered off to the local oscillator and control board via U8 a and b respectively.

For external reference U1 pin 13 is reset by the microprocessor low. This results in the back panel 10MHz reference signal being gated via D2, Q1, U9 d and b to U2, as for the internal reference.

AM and FM calibration signals are also derived from the 10MHz reference signal (either internal or external). The 100kHz reference already generated is further divided by U3 to produce a 1kHz modulating signal when u1 pin 12 is set low under microprocessor control. U4, U5 a, b and U6 a, form a programmable divider which either divides by 6 or 8 depending on the state of pin 6 U5. This divider is only active when CAL is enabled (U1 pin 4 high) and normally divides by 6 to give a signal of 1.67MHz. However, when FM is enabled (U1 pin 6 low) the 1kHz signal from U3 is gated to the control input of the divide 6/8 circuit and causes it to switch at 1kHz between divide by 6 and divide by 8, i.e. output frequencies of 1.67MHz and 1.25MHz to provide FM.

If instead AM is selected U4 etc. divides by 6 and the 1kHz tone is gated to a 45% AM modulator formed by P3, Z1 and associated components.

The calibration signal is passed to the mixer board via S1 pin 6.

All signal routing for the various modes is under control of the microprocessor.

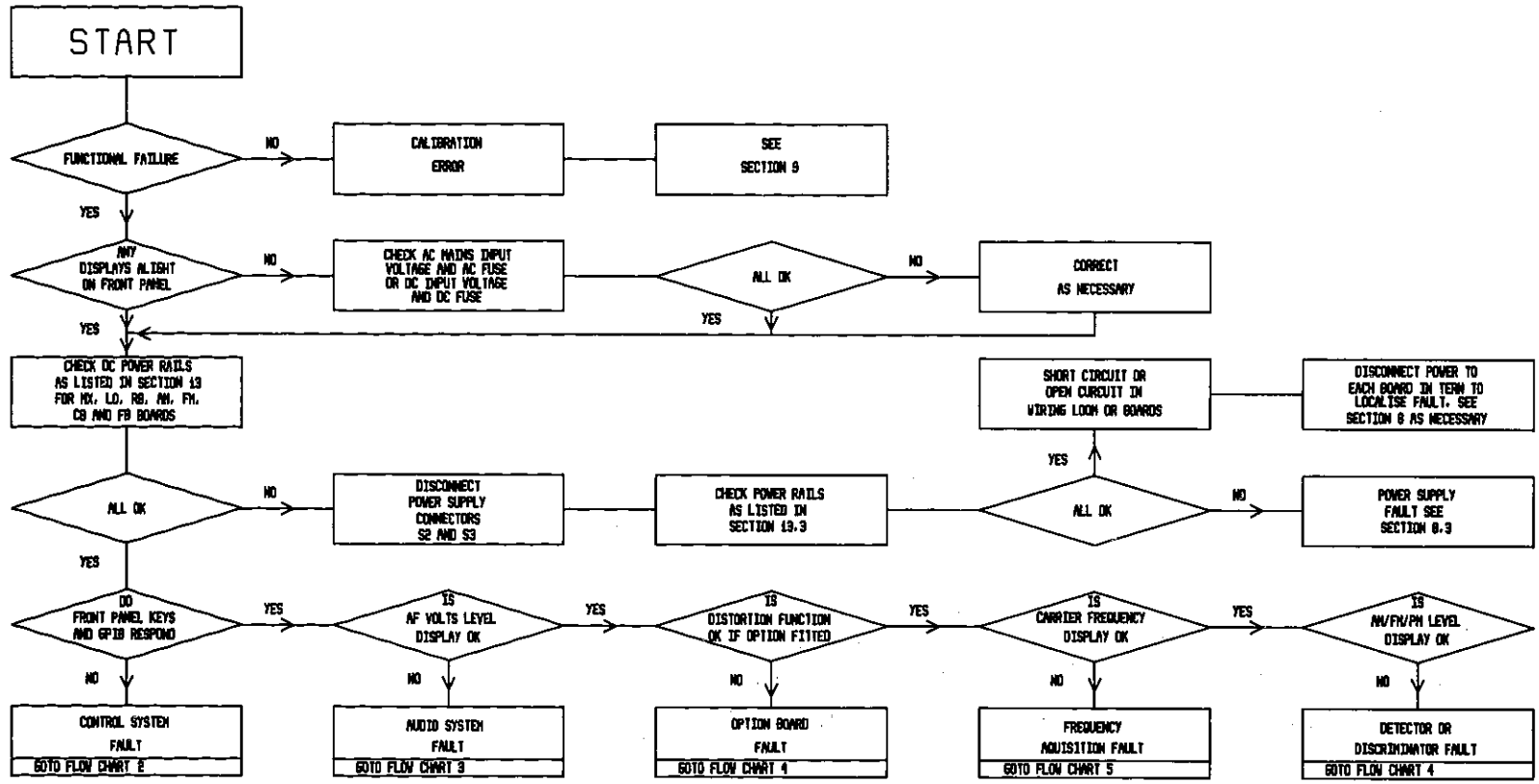
8.9 **OPTION BOARD**

a) The primary function of the option board is to measure distortion. This is achieved by means of a notch filter realised by U16. U16 is a dual switched capacitor filter and is configured to give the clock to notch frequency ratio of 500:1. Alignment of these two stages is controlled by P3 and P4. In order to keep the signal to noise ratio high an amplifier has been inserted between these two stages. This amplifier takes the form of U18, U19 and an resistor ladder R64 to R69 allowing 0 dB to 24 dB of gain in 6 dB steps. In addition, an anti aliasing filter is required between the stages owing to the sampled nature of the system. This is provided by U20a, U21a and associated components allowing two possible bandwidths (15kHz and 75kHz) to be selected. U20 band U21b provide similar filtering on the output of the notch filter. The clock for the switched capacitor filters is provided by U11, U12a, U13, U14 and U15, U11 and U12a limit any particular input signal and provide a compatible reference frequency for the phase detector inside U13 which also contains an oscillator. The output of which is fed to the other side of the phase detector via the dividers contained within U14 and U15. Hence, a clock frequency is generated for a range of possible input frequencies.

b) In addition to distortion measurement the option board allows various filtering options. CCITT (P53A) and CCIR (468-3) filter bandwidths are available in addition to a 300Hz low pass filter. The P53A filter consists of U5 and U6 whilst the 468-3 filter is made up from U3 and U4. The overall gains of the two filters can be adjusted by P1 and P2 respectively. The 300Hz low pass filter consists of U7. This filter has a passband gain of four to allow filtering of out-of-band tones whose amplitude is higher than those in-band. The inputs and outputs of these filters are multiplexed by U2.

c) A 150Hz fixed frequency notch filter is also provided on the option board. The filter is realised by U9 and associated components in a twin T configuration.

AMM2000 FAULT FINDING FLOW CHART 1



ISS	B										
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MOD. NO.	-										
CHK'D	RB										
NAME	SMC										

USED ON:

NOTES:
ALL CAPACITOR VALUES IN F.
ALL RESISTOR VALUES IN OHMS.

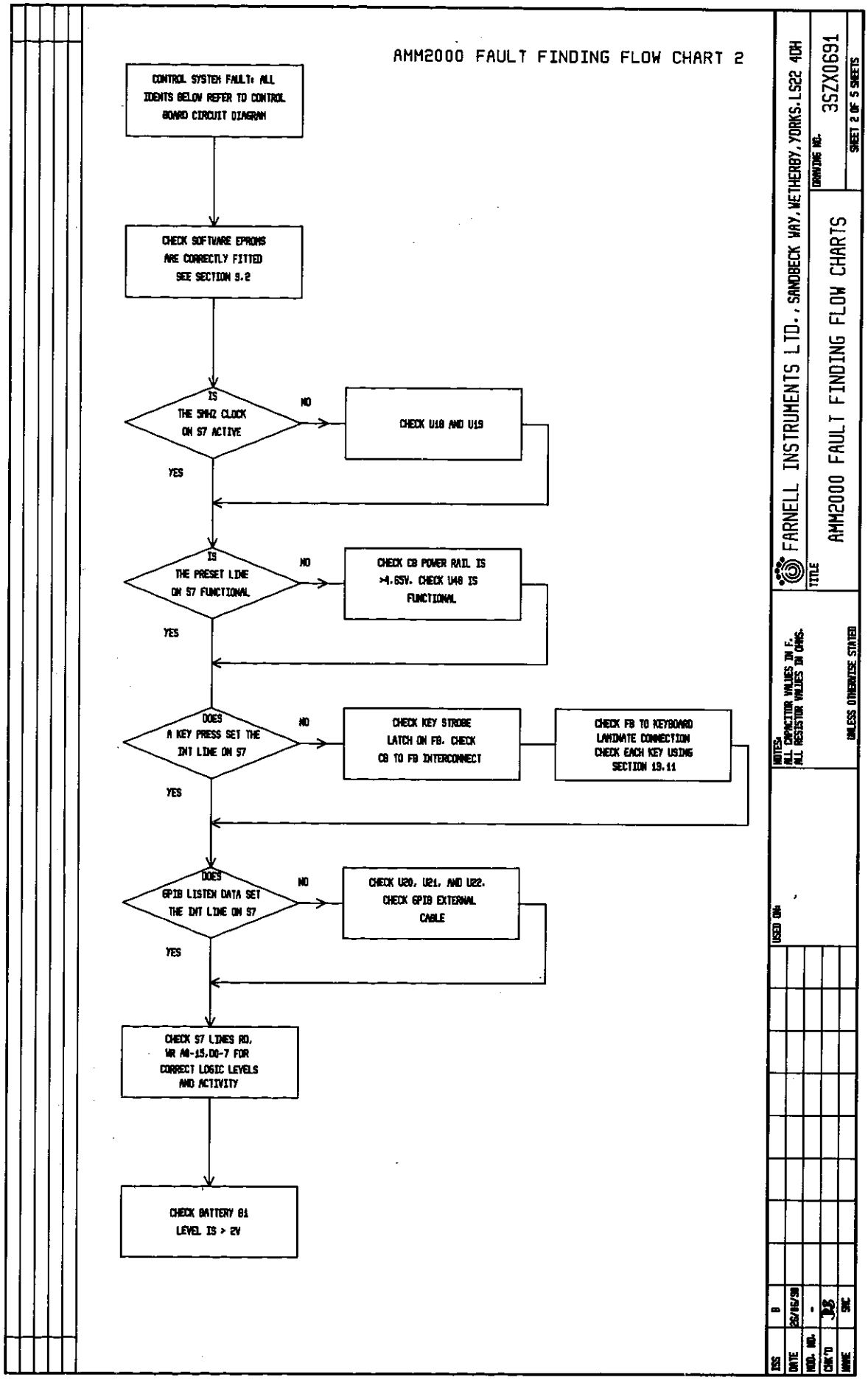
UNLESS OTHERWISE STATED

FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH

TITLE: AMM2000 FAULT FINDING FLOW CHARTS

DRAWING NO. 3SZX0691

SHEET 1 OF 5 SHEETS


AMM2000 FAULT FINDING FLOW CHART 2
CONTROL SYSTEM FAULT: ALL IDENTS BELOW REFER TO CONTROL BOARD CIRCUIT DIAGRAM
CHECK SOFTWARE EPROMS ARE CORRECTLY FITTED SEE SECTION 9.2
IS THE 5MHZ CLOCK ON S7 ACTIVE
NO
CHECK U18 AND U19
YES
IS THE PRESET LINE ON S7 FUNCTIONAL
NO
CHECK C8 POWER RAIL IS >4.65V. CHECK U48 IS FUNCTIONAL
YES
DOES A KEY PRESS SET THE INT LINE ON S7
NO
CHECK KEY STROBE LATCH ON F8. CHECK C8 TO F8 INTERCONNECT
CHECK F8 TO KEYBOARD LAMINATE CONNECTION CHECK EACH KEY USING SECTION 19.11
YES
DOES GPIB LISTEN DATA SET THE INT LINE ON S7
NO
CHECK U20, U21, AND U22. CHECK GPIB EXTERNAL CABLE
YES
CHECK S7 LINES RD, WR A0-15,D0-7 FOR CORRECT LOGIC LEVELS AND ACTIVITY
CHECK BATTERY B1 LEVEL IS > 2V
FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH
TITLE
AMM2000 FAULT FINDING FLOW CHARTS
DRAWING NO. 3SZX0691
SHEET 2 OF 5 SHEETS
NOTES: ALL CAPACITOR VALUES IN F. ALL RESISTOR VALUES IN OHMS.
UNLESS OTHERWISE STATED
USED ON:
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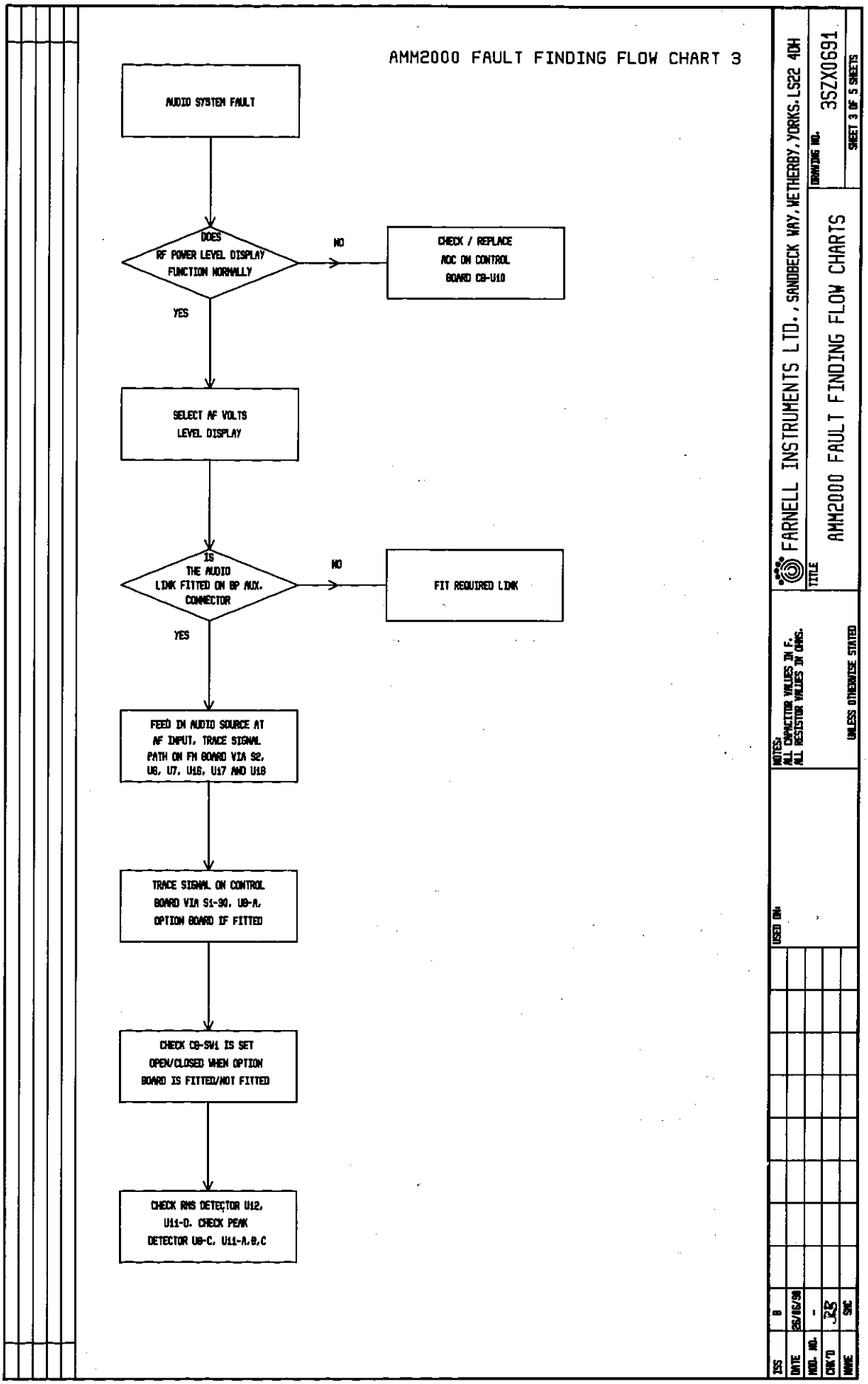
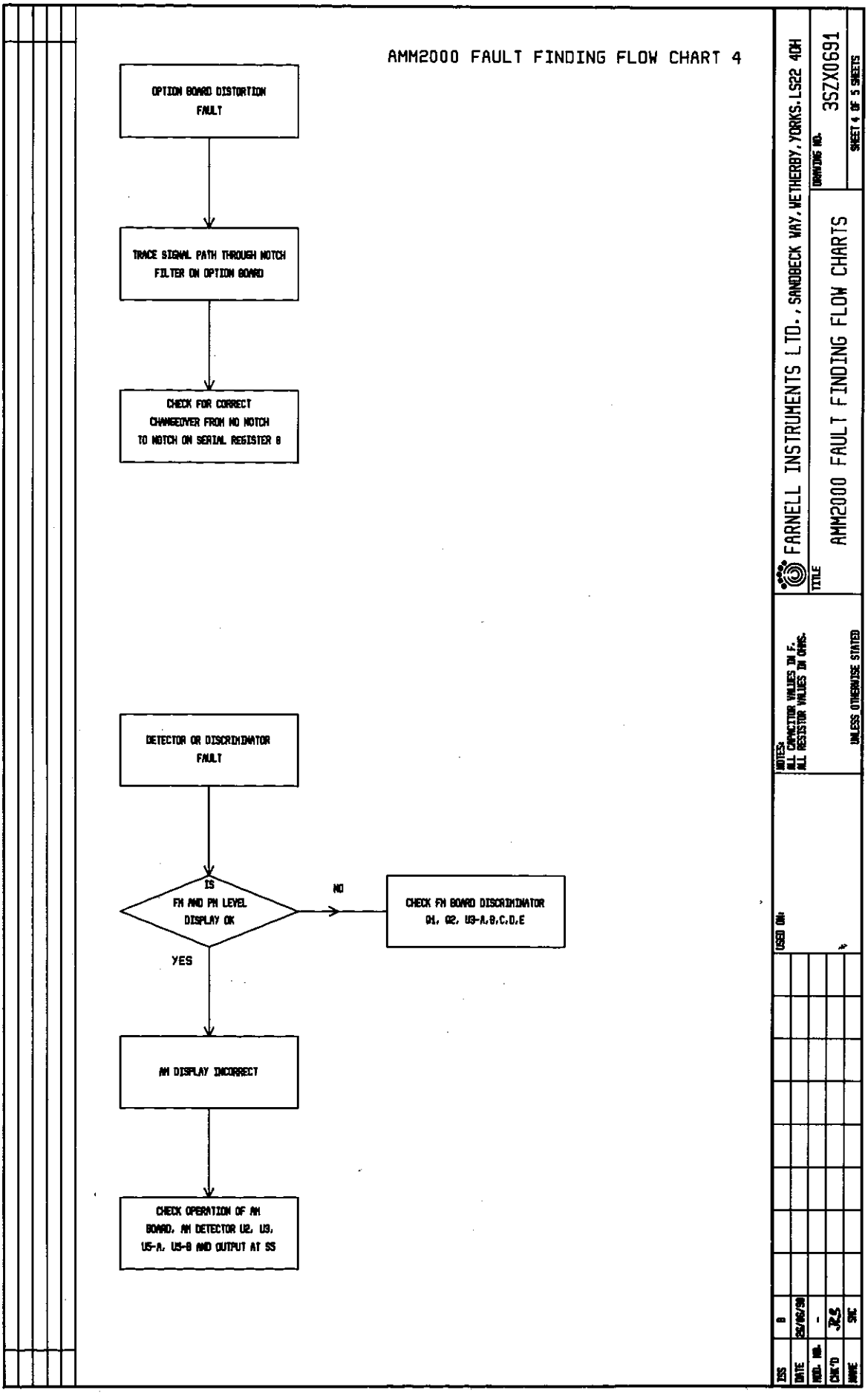
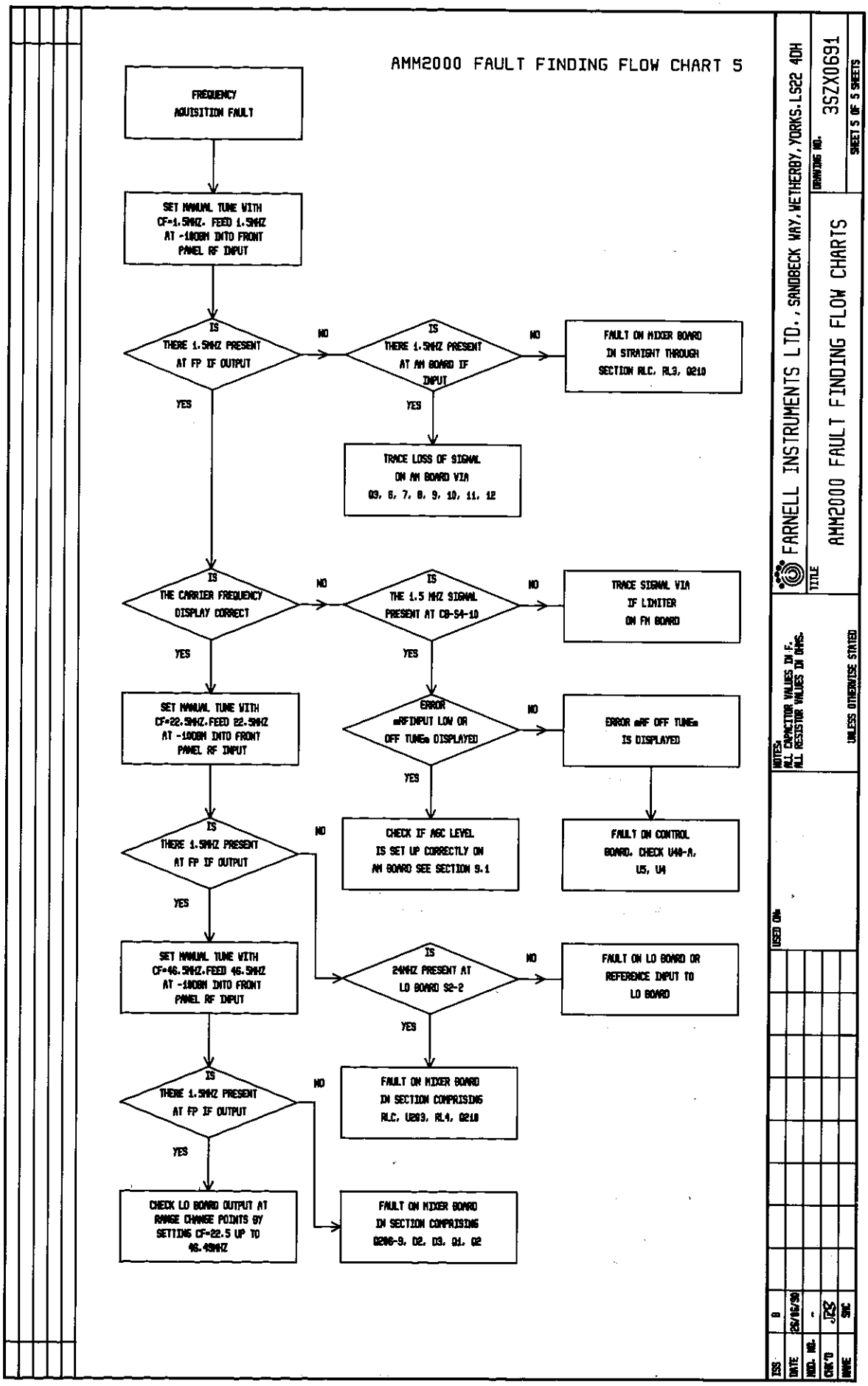
DATE 25/05/90
MOD. NO. -
CHK'D
NAME SMC


AMM2000 FAULT FINDING FLOW CHART 3
AUDIO SYSTEM FAULT
DOES RF POWER LEVEL DISPLAY FUNCTION NORMALLY
NO
CHECK / REPLACE AGC ON CONTROL BOARD CB-U10
YES
SELECT AF VOLTS LEVEL DISPLAY
IS THE AUDIO LINK FITTED ON RP AUX. CONNECTOR
NO
FIT REQUIRED LINK
YES
FEED IN AUDIO SOURCE AT AF INPUT. TRACE SIGNAL PATH ON FM BOARD VIA S2, U8, U7, U16, U17 AND U18
TRACE SIGNAL ON CONTROL BOARD VIA S1-30, U8-A. OPTION BOARD IF FITTED
CHECK CB-SW1 IS SET OPEN/CLOSED WHEN OPTION BOARD IS FITTED/NOT FITTED
CHECK RMS DETECTOR U12, U11-D. CHECK PEAK DETECTOR U8-C. U11-A,B,C
FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH
TITLE
AMM2000 FAULT FINDING FLOW CHARTS
DRAWING NO.
3SZX0691
SHEET 3 OF 5 SHEETS
NOTES:
ALL CAPACITOR VALUES IN F.
ALL RESISTOR VALUES IN OHMS.
UNLESS OTHERWISE STATED
USED ON
ISS
DATE
MOD. NO.
CHK'D
NAME
B
26/05/98
-
JAS
SMC


AMM2000 FAULT FINDING FLOW CHART 4
OPTION BOARD DISTORTION FAULT
TRACE SIGNAL PATH THROUGH NOTCH FILTER ON OPTION BOARD
CHECK FOR CORRECT CHANGEOVER FROM NO NOTCH TO NOTCH ON SERIAL REGISTER 8
DETECTOR OR DISCRIMINATOR FAULT
IS FM AND PM LEVEL DISPLAY OK
NO
CHECK FM BOARD DISCRIMINATOR D1, D2, U9-A,B,C,D,E
YES
AM DISPLAY INCORRECT
CHECK OPERATION OF AM BOARD, AM DETECTOR D2, U9, U5-A, U5-B AND OUTPUT AT S5
FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH
TITLE
AMM2000 FAULT FINDING FLOW CHARTS
DRAWING NO.
3SZX0691
SHEET 4 OF 5 SHEETS
NOTES:
ALL CAPACITOR VALUES IN F.
ALL RESISTOR VALUES IN OHMS.
UNLESS OTHERWISE STATED
USED ON:
ISS
DATE
MOD. NO.
CHK'D
NAME
B
25/06/90
-
JRS
SMC


AMM2000 FAULT FINDING FLOW CHART 5
FREQUENCY ACQUISITION FAULT
SET MANUAL TUNE WITH CF=1.5MHZ. FEED 1.5MHZ AT -10DBM INTO FRONT PANEL RF INPUT
IS THERE 1.5MHZ PRESENT AT FP IF OUTPUT
NO
IS THERE 1.5MHZ PRESENT AT AM BOARD IF INPUT
NO
FAULT ON MIXER BOARD IN STRAIGHT THROUGH SECTION RLC. RL3, Q210
YES
YES
TRACE LOSS OF SIGNAL ON AM BOARD VIA Q3, 6, 7, 8, 9, 10, 11, 12
IS THE CARRIER FREQUENCY DISPLAY CORRECT
NO
IS THE 1.5 MHZ SIGNAL PRESENT AT C8-S4-10
NO
TRACE SIGNAL VIA IF LIMITER ON FM BOARD
YES
YES
SET MANUAL TUNE WITH CF=22.5MHZ.FEED 22.5MHZ AT -10DBM INTO FRONT PANEL RF INPUT
ERROR =RFINPUT LOW OR OFF TUNE= DISPLAYED
NO
ERROR =RF OFF TUNE= IS DISPLAYED
YES
IS THERE 1.5MHZ PRESENT AT FP IF OUTPUT
NO
CHECK IF AGC LEVEL IS SET UP CORRECTLY ON AM BOARD SEE SECTION 9.1
FAULT ON CONTROL BOARD. CHECK U40-A, U5, U4
YES
SET MANUAL TUNE WITH CF=46.5MHZ.FEED 46.5MHZ AT -10DBM INTO FRONT PANEL RF INPUT
IS 24MHZ PRESENT AT LO BOARD S2-2
NO
FAULT ON LO BOARD OR REFERENCE INPUT TO LO BOARD
YES
IS THERE 1.5MHZ PRESENT AT FP IF OUTPUT
NO
FAULT ON MIXER BOARD IN SECTION COMPRISING RLC, U203, RL4, Q210
YES
CHECK LO BOARD OUTPUT AT RANGE CHANGE POINTS BY SETTING CF=22.5 UP TO 46.49MHZ
FAULT ON MIXER BOARD IN SECTION COMPRISING Q206-9, D2, D3, D1, D2
FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH
TITLE
AMM2000 FAULT FINDING FLOW CHARTS
DRAWING NO. 3SZX0691
SHEET 5 OF 5 SHEETS
NOTES: ALL CAPACITOR VALUES IN F. ALL RESISTOR VALUES IN OHMS. UNLESS OTHERWISE STATED
USED ON
ISS B
DATE 25/06/90
MOD. NO. -
CHK'D JRS
NAME SMC

9. CALIBRATION PROCEDURE

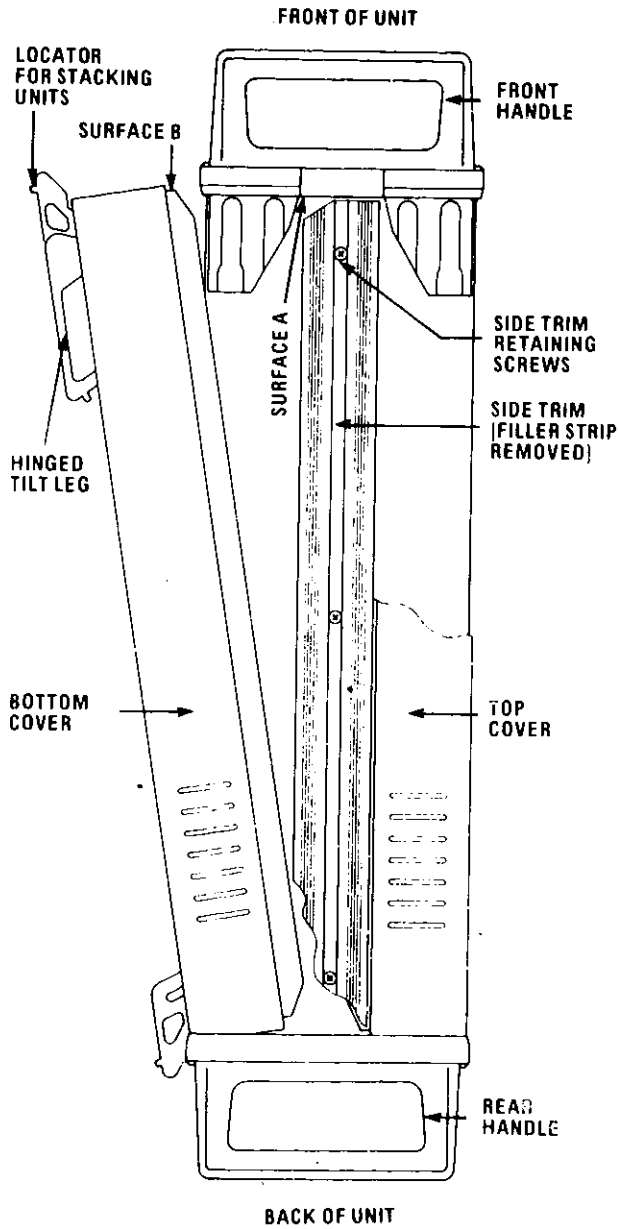


FIG 1

TO REMOVE COVERS (FIGURE 1)

1) Prise out plastic filler strips from the side trims.

2) Remove side trim retaining screws (4 screws). Remove side trims.

3) Working from front: for each cover, slide backwards to clear recess in front handles. Widen the front to clear the front handles. Hinge cover away from the unit to just clear front handles. Then pull forwards.

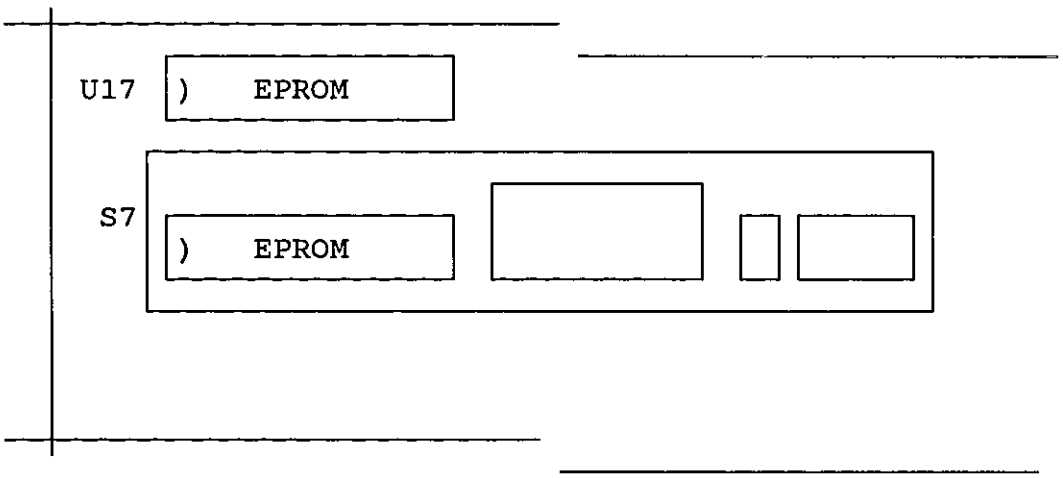
9.2 SOFTWARE UPGRADES

See section 6.2 v) for details of how to display the software version which is fitted.

WARNING! Refer to the safety section at the start of this manual which details handling precautions for static sensi tive parts if it is intended to change the system software.

The AMM2000 operating system software is contained in two EPROMS located on the control board which is immediately below the bottom cover of the unit.

The first EPROM is located on the small surface mounted board identified by S7 on the control board, and the second EPROM is identified by U17.



When replacing these devices, ensure that the replacements marked CB-S7 and CB-U17 are fitted to the correct sockets and that the pin orientation is correct as identified by the semi-circles in the above drawing.

9.3 **TEST EQUIPMENT**

The following equipment is recommended for calibration of the Farnell AMM2000. Substitutes must have equal or better specification to these instruments listed:-

Frequency standard with error not exceeding +/- 0.1 ppm
Farnell SSG2000 AM/FM 2GHz signal generator
Hewlett Packard 435B + 8482A Power Meter
Solartron Schlumberger 7150 Digital Multimeter
Farnell SFG25 Synthesized Function Generator
Hewlett Packard 339A Distortion Measurement Set
Memory card and/or software to download AM and FM calibration waveform to SFG25

Where captive limits are given in the following calibration procedure, those that relate to the instrument specification are suffixed (SPEC) while those that are for confidence monitoring only are marked (INT).

9.4 **DISPLAY BOARD**

Use gate function #99 to clear memory. Run the display test routine (gate function #01) and check all LED's light. After completion of routine, measure voltage across R1 on front panel board and adjust P2 for 0.4V ± 0.1V (INT).

9.5 **LOCAL OSCILLATOR BOARD**

Set P2 to mid-travel and adjust core of L1 with non-metallic adjustment tool to top of coil former.

Monitor L.O. o/p at S2 with 2 pin MOLEX to BNC lead connected to frequency counter. Select manual carrier frequency of 22.5MHz and slowly adjust core of L1 clockwise until lock indicator LD1 (on L.O. Bd.) lights and tune voltage at x2 is 10.05V ± 0.5V. (INT). Check o/p frequency on counter is 24MHz ± 1KHz (INT).

N.B. Use 10dB pad or 10:1 scope probe if necessary to reduce T.T.L. signal level to avoid counting harmonics of the L.O. o/p.

If LD1 fails to light or flashes then set one core of L1 to mid-travel and adjust P2 until LD1 lights continuously. Then repeat previous paragraph.

Select manual carrier frequency of 46.49MHz. LD1 should light, if not, adjust core of L1 anti-clockwise until LD1 lights. If LD1 still does not light, repeat previous two paragraphs and then this paragraph. Verify with the counter the output frequency is 47.99MHz ± 1kHz (INT).

9.6 **MIXER BOARD**

Input to AMM an R.F. Signal of 10MHz, Odbm. Select manual carrier frequency of 10MHz and check relay RL4 is energised by measuring D209 cathode for 4.5V ± 0.2V. (INT). Check TP3 for the I.F. output of 1.5MHz with oscilloscope, level should be 550mV pk-pk ± 50mV (INT), Monitor pin 4 of U203 with DVM and adjust P201 for +8.0V ± 0.1V. (INT).

Carrier level calibration

Measure o/p of SSG2000 set for +10dbm, 100MHz on HP4336A power meter using BNC-BNC cable. Set output level to give a reading of 10mW ± 0.1mW (INT). Input this signal to AMM and select RF Power level display. Adjust P202 on MIXER board for indicated reading of 10mV ± 0.1mW (SPEC.).

9.7 **AM BOARD**

N.B. This assumes a fully functional local oscillator, mixer and crystal reference board. Input from SSG2000 a signal of 100MHz,-35dbm, and select a manual carrier frequency of 100MHz. Adjust P4 on AM board so that the display just changes from indicating the carrier frequency to displaying the message, "RF INPUT LEVEL LOW OR OFF TUNE". Change i/p level to check the changeover occurs at -35dbm ± 0.5dbm (INT).

9.8 **FM BOARD**

Select FM level display and locate FM board. Set SSG2000 to 1.5MHz, Odbm, MOD off and input this signal to the AMM. Manually select a carrier frequency on the AMM of 1.5MHz and wait for correct display. Monitor the D.C. voltage at u17 pin 6 and adjust P4 (AF ZERO) for OmV ± 100mV (INT). (ALLOW 10 SECONDS TO SETTLE).

Select DCFM by toggling OFF the active HIGH PASS filter. Ground U4 pin 3 by shorting to U5 pin 3. Adjust P3 (D.C. NULL ZERO) for OV ± 1mV (INT) measured at U5 pin 6. Remove shorting link from U4 to U5.

De-select DCFM. Set SSG2000 to 1.5MHz, Odbm, 30KHz FM at 1KHz SYNTH rate, and input this signal to AMM. Select on AMM 50Hz - 15KHz BW filters and PK-PK/2 measurement and allow 30 seconds for the reading to settle. Select DCFM and allow 1 minute for reading to settle. Using BNC-BNC lead, monitor AF o/p on oscilloscope and check for sinewave o/p. Transfer the BNC lead to the DM141, set for D.C. volts measurement, and adjust P2 (D.C. NULL GAIN) for OV. ± 30mV (INT).

De-select DCFM and note displayed FM reading. Select PM measurement and locate P3 (CAL PM) on CONTROL BOARD. Adjust P3 to give the same level in RAD PM at that in FM ± 0.2 RAD (INT).

Select AF VOLTS level display and input a signal from HP339A of 1KHz rate. Adjust level of input to give a PK-PK/2 reading of 2 volts, ± 0.1V. (INT). (Note exact reading). Select ROOT 2 RMS and adjust P2 (CAL RMS) on control board for the same level as that noted for PK-PK/2 ± 0.01V. (INT).

Input a calibrated 1KHz/2V RMS ± 0.04V. (INT) signal from HP339A to A/F input on AMM. Select RMS measurement and adjust P1 (AF level) on FM board to give a displayed reading of 2.00V RMS ± 0.01V RMS (SPEC.). Monitor A/F output from AMM on HP339A set for distortion measurement and check distortion is <0.1% (INT).

9.9 **OPTION Q BOARD**

Skip this section if no option board fitted.

Input a calibrated 800Hz/1V RMS A/F signal from HP339A to the AMM A/F input Skt, and note the displayed A/F, level (1). Select the CCITT-P53A filter by using gate function #13 and BANDPASS. Adjust P1 on the OPTION board for the same displayed reading as in (1) ± 0.01V. (INT).

Change HP339A frequency to 1KHz and de-select BANDPASS. Note displayed level (2) and select CC1R- 468-3 filter by using gate function 1 #13, and BANDPASS. Adjust P2 (OPTION BD) for the same reading as in (2) ± 0.01V. (INT). De-select BANDPASS.

Select 50Hz high pass and 75kHz low pass filters. Fine adjust HP339A output to obtain maximum bar graph reading on AMM2000. Monitor U8 pin 3 on option board using voltmeter section of HP339A. Adjust P3 and then P4 for minimum level.

9.10 **CARRIER FREQUENCY, AM AND FM CALIBRATION**

N.B. SSG2000 MUST be EXTERNALLY referenced to RUBIDIUM standard.

Input 1GHz, Odbm from SSG to AMM. Set frequency reference adjust pot on back panel until AMM reads 1GHz ± 1KHz (SPEC).

For Option `O' units the frequency should be 1GHz ± 200Hz (SPEC).

Locate AM board and set P3 to mid-travel. Set SSG2000 to 6MHz, Odbm, 50% AM, 1KHz synth. rate. Input this signal to AMM set for RF freq., AM, PK-PK/2, 50Hz-15KHZ BW and select a manual carrier frequency of 6MHz. Note the displayed AM reading (1) then select a manual carrier frequency of 5.99MHz. Adjust P5 (GAIN BALANCE) for the same reading as in (1) ± 0.1% (INT).

Reset the self-calibration factors by using gate function #99 (MEMORY CLEAR). Input 1.5MHz, 50% AM @ 1KHz rate from SFG25 (i.e. Cal. Ref. signal on RAM Card - #20 recall 50). Set P1 (GAIN SET) on AM board for a reading of 50% ± 0.1% (INT).

Set P3 on AM board fully clockwise and monitor A/F output from AMM on HP339A set for distortion measurement. Adjust P3 for first minimum distortion observed. Recheck the 50% AM reading and adjust P1 if necessary. (Recheck distortion reading as P1 and P3 interact.).

Restore the self-calibration factors by using gate function #07. Adjust P3 on REFERENCE board anti-clockwise dependent of which way the error is about 50%, to give a reading of 50% ± 0.1% of reading (SPEC).

NOTE: If error is negative adjust P3 anti-clockwise 1/8th turn (reverse if POSITIVE). Repeat until correct.

Using SFG25, input 1.5MHz, 95% AM @ 1KHz rate (i.e. CAL. REF. signal on RAM card - RECALL 51). Adjust P2 (AM Bd.) for a reading of 95% AM ± 0.1% of reading (SPEC). Re-select gate function #07 and check 50% and 95% readings.
Repeat previous paragraph and this paragraph until correct.

Using SFG25, input 1.5MHz, 75KHz FM @ 1KHz rate (i.e. CAL. REF. signal on RAM card - #20 RECALL 50) to AMM. Select FM level display, Pk-Pk/2, 50Hz - 15KHz BW and adjust P5 (FM Bd.) for a reading of 75kHz ± 1% of reading (SPEC).

10. MAINTENANCE

10.1 GUARANTEE

The equipment supplied by Farnell Instruments Limited is guaranteed against defective material and faulty manufacture for a period of twelve months from the date of despatch. In the case of material or components employed in the equipment but not manufactured by us we allow the customer the period of any guarantee extended to us.

The equipment has been carefully inspected and submitted to comprehensive tests at the factory prior to despatch. If, within the guarantee period, any defect is discovered in the equipment in respect of material or workmanship and reasonably within our control, we undertake to make good the defect at our own expense subject to our standard conditions of sale. In exceptional circumstances and at the discretion of the Service Manager, a charge for labour and carriage costs incurred may be made.

Our responsibility is in all cases limited to the cost of making good the defect in the equipment itself. The guarantee does not extend to third parties, nor does it apply to defects caused by abnormal conditions of working, accident, misuse, neglect or wear and tear.

10.2 MAINTENANCE

In the event of difficulty or apparent circuit malfunction, it is advisable to telephone (or telex) the Service Department or your local Sales Engineer or Agent (if overseas) for advice before attempting repairs.

For repairs and recalibration it is recommended that the complete instrument be returned to:-

The Service Department
Farnell Instruments Limited
Osborn House
Sandbeck Way
Wetherby
West Yorkshire
LS22 4DN

Tel. (0937) 581961 Telex 557294 Fax. (0937) 586907.

When returning the instrument please ensure adequate care is taken with packing and arrange insurance cover against transit damage or loss. If possible re-use the original packing box, following the instructions below:-

Wrap the instrument in anti-static polythene and tape up then place into primary box ensuring the feet are next to the polystyrene supports. Wrap up accessories and instruction/service manual and place into the primary box in the space left between the polystyrene supports. Seal the primary box, fit the corner blocks and place into the outer box ensuring the corner blocks are positioned correctly. Finally, seal the outer box.

11. OPTIONS

11.1 23 TO 30V DC INPUT ORDER CODE 17AMM2000A

A factory fitted option that allows the dc power inlet to accept a voltage of 23 to 30V dc rather than the standard 11.5 to 15V dc.

11.2 RECHARGEABLE 4AH ADD-ON BATTERY PACK ORDER CODE 15S10100

Refer to section 5.4.

11.3 RACK MOUNTING KIT ORDER CODE 15A20100

Refer to section 5.3.

11.4 RF OUTPUT MOVED TO REAR PANEL ORDER CODE 17AMM2000F

A factory fitted option. The locations of the external local oscillator input (normally rear panel) and the RF input (normally front panel) are exchanged.

11.5 PROTECTIVE PADDED CARRYING CASE ORDER CODE 15A20110

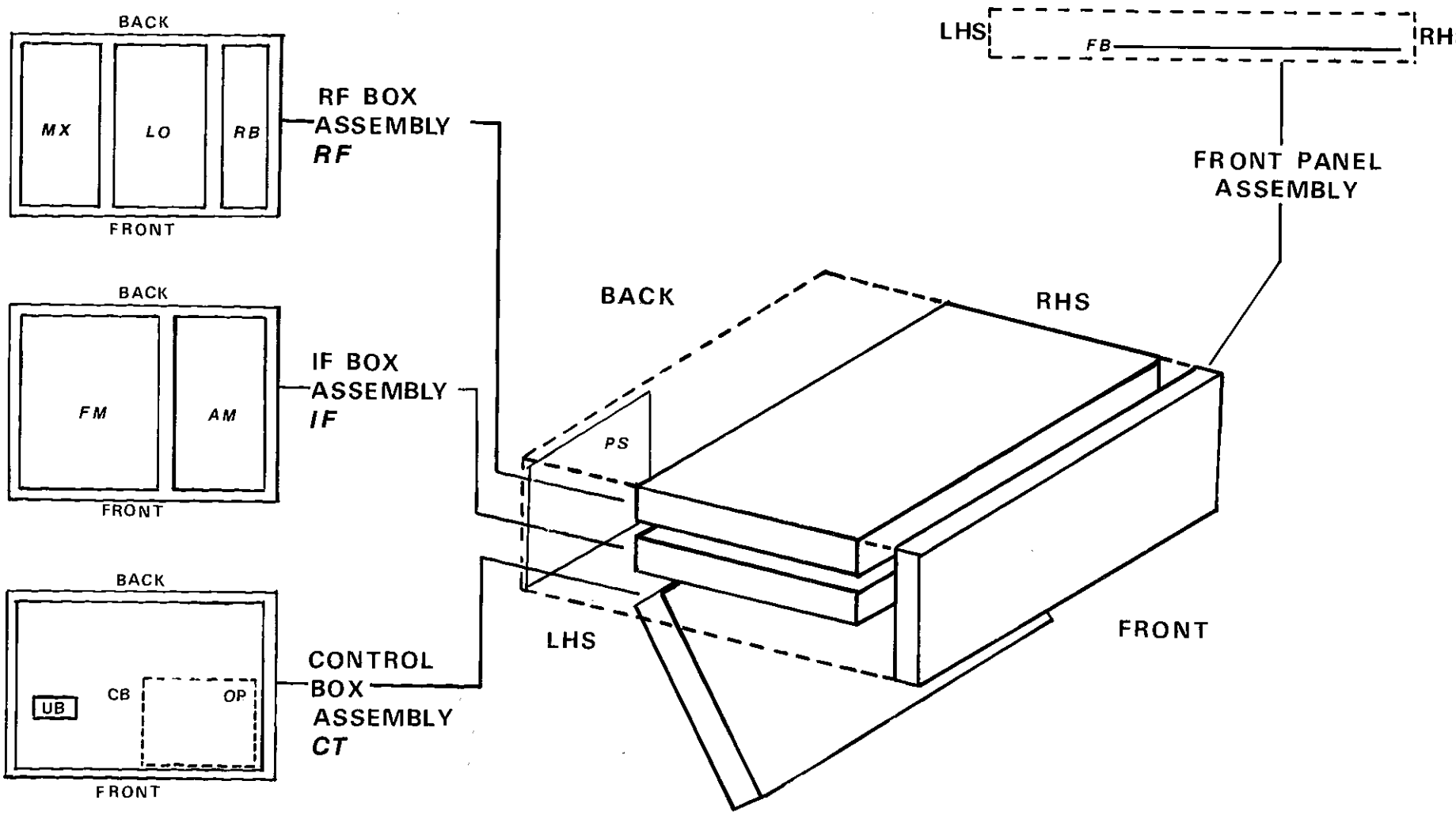
This padded case with shoulder strap includes a side pocket to carry cables and connectors.

11.6 HIGH STABILITY FREQUENCY REFERENCE ORDER CODE 17AMM2000O

A factory fitted option. Refer to section 4, SPECIFICATION, carrier frequency accuracy.

11.7 DISTORTION MEASUREMENT ORDER CODE 17AMM2000Q

A factory fitted option. Refer to section 4, SPECIFICATION, AF distortion option.



ASSEMBLY & BOARD LOCATION DIAGRAM 4ZU10180220ISS-B

13. CONNECTION LISTS

Note the use of the following codes in the connection lists:

I = Signal input
O = Signal output
IO = Bi-directional data
F = Via feedthrough capacitor type CD41K751214
L = Via leadthrough pin type CD12P00KMUR
NC = No connection
YP702 = 7 strand 0.2mm flexible wire
YP1602 = 16 strand 0.2mm flexible wire
YX178 = PTFE dielectric coaxial cable
FCEX = An example of a decoded hexadecimal address where X indicates a "don't care" state.

13.1 CONTROL BOARD (CB)

S1 40 way right angle IDC

Connects to: GPIB socket/RS232 socket/Adaptor board

PIN NO.	SIGNAL	I/O	SOURCE/DEST.	COMMENT
1	0V IEEE	-	GPIB socket	
2	SHIELD	-	GPIB socket	
3	GND 11	-	GPIB socket	
4	ATN	I	GPIB socket	
5	GND 10	-	GPIB socket	
6	SRQ	O	GPIB socket	
7	GND 9	-	GPIB socket	
8	IFC	I	GPIB socket	
9	GND 8	-	GPIB socket	
10	NDAC	IO	GPIB socket	
11	GND 7	-	GPIB socket	
12	NRFD	IO	GPIB socket	
13	GND 6	-	GPIB socket	
14	DAV	IO	GPIB socket	
15	REN	I	GPIB socket	
16	EOI	IO	GPIB socket	
17	DI08	IO	GPIB socket	
18	DI04	IO	GPIB socket	
19	DI07	IO	GPIB socket	
20	DI03	IO	GPIB socket	
21	DI06	IO	GPIB socket	
22	DI02	IO	GPIB socket	
23	DI05	IO	GPIB socket	
24	DI01	IO	GPIB socket	
25	GND	-	AB S2-1	
26	10MHz ADJUST	O	AB S2-2	TO RB VIA S5.6
27	GND	-	AB S2-3	
28	AUDIO O/P	-	AB S2-4	
29	GND	-	AB S2-5	
30	FILTERED AUDIO IN	-	AB S2-6	
31	GND	-	AB S2-7	
32	TTL O/PA	O	AB S2-8	FROM FM VIA S4.14
33	GND	-	AB S2-9	
34	TTL O/PB	I	AB S2-10	

S9 6 way molex RS-232C

1	TXD	O	RS-232C SOCKET PIN 2	
2	RXD	I	RS-232C SOCKET PIN 3	
3	RTS	O	RS-232C SOCKET PIN 4	
4	CTS	I	RS-232C SOCKET PIN 5	
5	0V	-	RS-232C SOCKET PIN 7	
6	NC	-		

Control Board (CB) continued

S2 34 way right angle IDC

Connects to: Front Panel Board (FB)

PIN NO.	SIGNAL	I/O	SOURCE/DEST.	COMMENT
1	BD0	IO	FB	BUFFERED uP DATA
2	BD1	IO	FB	
3	BD2	IO	FB	
4	BD3	IO	FB	
5	BD4	IO	FB	
6	BD5	IO	FB	
7	BD6	IO	FB	
8	BD7	IO	FB	
9	BRD	O	FB	BUFFERED uP RD
10	BWR	O	FB	BUFFERED uP WR
11	RESET	O	FB	
12	DISP0	O	FB	E000-E3FF
13	DISP1	O	FB	E400-E7FF
14	DISP2	O	FB	E800-EBFF
15	DISP3	O	FB	EC00-EFFF
16	Y14	O	FB	KEYBOARD FCEX
17	8K3	O	FB	INVERTED 8K3
18	A0	O	FB	
19	A1	O	FB	
20	A2	O	FB	
21	A3	O	FB	
22	A4	O	FB	
23	A5	O	FB	
24	SEN9	O	FB	LED`S (5450)
25	SEN7	O	FB	BARGRAPH (5450)
26	SDATA5	O	FB	
27	SCLK5	O	FB	
28	KEY	I	FB	HI ON KEY PRESS
29	NC	-	FB	
30	OV	-	FB	
31	NC	-	FB	
32	0V	-	FB	
33	NC	-	FB	
34	0V	-	FB	

S3 12 Way right angle MOLEX

CONNECTS TO: Option board (OB)

PIN NO.	SIGNAL	I/O	SOURCE/DEST.	COMMENT
1	SDATA4	O	OB S1-12	
2	SCLK4	O	OB S1-11	
3	SEN8	O	OB S1-10	+ve EDGE (4094)
4	AF2	I	OB S1-9	FROM OPTION BD.
5	GND	-	OB S1-8	SCREENED
6	+6V	O	OB S1-7	
7	AUDIO COUNT	I	OB S1-6	
8	-6V	O	OB S1-5	
9	0V	-	OB S1-4	
10	OB FITTED	I	OB S1-3	
11	GND	-	OB S1-2	TO OPTION BD.
12	AF1	O	OB S1-1	SCREENED

S4 16 way MOLEX

CONNECTS TO: IF box (AM/FM/FB)

PIN NO.	SIGNAL	I/O	SOURCE/DEST.	COMMENT
1	SDATA3	O	FMS5-7, AM S1-2	TO 2 FEED THRU'S
2	SCLK3	O	FMS5-8, AM S1-1	TO 2 FEED THRU'S
3	SEN4	O	AMS1-3	+ve EDGE (4904)
4	IF AGC LEVEL	I	AMS1-7	
5	NC	-	-	
6	NC	-	-	
7	SEN5	O	FM S5-6	+ve EDGE (4094)
8	SEN6	O	FM S5-5	+ve EDGE (4094)
9	NC	-	-	
10	FIXED LEVEL IF	I	FM S3-2	SCREENED
11	GND	-	FM S3-1	
12	RAW AF LEVEL	I	FM S5-3	
13	AUDIO O/P	I	FM S5-2	TO AB VIA S1.32
14	GND	-	FM S5-1	SCREENED
15	AF O/P	O	FB S3-4	SCREENED
16	GND	-	FB S3-3	

CONTROL BOARD (CB) CONTINUED

S5 16 way MOLEX

CONNECTS TO: RF box (RB/MX/LO)

PIN NO.	SIGNAL	I/O	SOURCE/DEST.	COMMENT
1	SDATA1	O	RB S1-10,MX S201-4	TO 2 FEED THRU'S
2	SCLK1	O	RB S1-9, MX S201-5	TO 2 FEED THRU'S
3	SEN0	O	RB S1-11	+ve EDGE (4094)
4	100kHz REF A	I	RB S1-3	SCREENED
5	GND	-	RB -	
6	10MHz ADJ	O	RB S1-1	FROM AB VIA S1.26
7	GND	-	RB -	SCREENED
8	SEN1	O	MX S201-6	+ve EDGE (4094)
9	RF LEVEL	I	MX S201-7	SCREENED
10	GND	-	MX -	
11	EXCESS RF POWER	I	MX S201-8	TTL ACTIVE HIGH
12	LO.LOCK	I	LO S1-6	TTL ACTIVE LOW
13	SDATA2	O	LO S1-3	
14	SCLK2	O	LO S1-2	
15	SEN2	O	LO S1-4	+ve EDGE (4094)
16	SEN3	O	LO S1-1	+ve EDGE (4094)

CONTROL BOARD (CB) CONTINUED

S6 8 way MOLEX

CONNECTS TO: Power Supply Board (PS)

PIN NO.	SIGNAL	I/O	SOURCE/DEST.	COMMENT
1	EXT. DC	I	PS S3-1	
2	NC	-		
3	NC	-	PS S3-6	
4	GND	-	CHASSIS	START POINT
5	-15V	I	PS S3-5	
6	+12V	I	PS S3-9	
7	0V	-	CHASSIS	STAR POINT
8	+5V	I	PS S2-3	

CONTROL BOARD (CB) CONTINUED

S7 64 way 0.9" pitch DIL socket

CONNECTS TO: UPCM10 (microprocessor core module)

PIN NO.	SIGNAL	I/O	SOURCE/DEST.	COMMENT
1	A12	I	UPCM10	
2	A7	I	UPCM10	
3	A6	I	UPCM10	
4	A5	I	UPCM10	
5	A4	I	UPCM10	
6	A3	I	UPCM10	
7	A2	I	UPCM10	
8	A1	I	UPCM10	
9	A0	I	UPCM10	
10	D0	IO	UPCM10	
11	D1	IO	UPCM10	
12	D2	IO	UPCM10	
13	A15	I	UPCM10	
14	INT	O	UPCM10	
15	NMI	O	UPCM10	FROM EXCESS RFPWR
16	HALT	I	UPCM10	
17	IORQ	I	UPCM10	
18	BUSACK	I	UPCM10	
19	WAIT	O	UPCM10	
20	BUSREQ	O	UPCM10	
21	RESET	O	UPCM10	
22	M1	O	UPCM10	
23	RFSH	I	UPCM10	
24	MREQ	I	UPCM10	
25	Y0	I	UPCM10	FC0X GPIB
26	Y1	I	UPCM10	FC1X RS232
27	Y2	I	UPCM10	FC2X COUNTER
28	Y3	I	UPCM10	FC3X A TO D
29	Y4	I	UPCM10	FC4X INT. RESET
30	Y5	I	UPCM10	FC5X SLEEP
31	Y6	I	UPCM10	FC6X LED OFF
32	Y7	I	UPCM10	FC7X LED ON

CONTROL BOARD (CB) CONTINUED

S7 Continued

IN NO.	SIGNAL	I/O	SOURCE/DEST.	COMMENT
33	Y8	I	UPCM10	FC8X SER. DATA 1
34	Y9	I	UPCM10	FC9X SEN1 LATCH
35	Y10	I	UPCM10	FCAX SEN2 LATCH
36	Y11	I	UPCM10	FCBX SER. CONT 1
37	Y12	I	UPCM10	FCCX STATUS LATCH
38	Y13	I	UPCM10	FCDX FORTH UART
39	Y14	I	UPCM10	FCEX KEYBOARD
40	Y15	I	UPCM10	FCFX SPARE
41	IO1	O	UPCM10	
42	RAM0	O	UPCM10	
43	8K3	I	UPCM10	DISPLAY AND IO
44	8K2	I	UPCM10	8K RAM COOO-DFFF
45	8K1	I	UPCM10	(16K ROM
46	8K0	I	UPCM10	(8000-BFFF
47	0V	-	UPCM10	
48	IO2	O	UPCM10	
49	VSTBY	O	UPCM10	
50	CLK	O	UPCM10	
51	D3	IO	UPCM10	
52	D4	IO	UPCM10	
53	D5	IO	UPCM10	
54	D6	IO	UPCM10	
55	D7	IO	UPCM10	
56	A10	I	UPCM10	
57	RD	I	UPCM10	
58	WR	I	UPCM10	
59	A11	I	UPCM10	
60	A9	I	UPCM10	
61	A8	I	UPCM10	
62	A13	I	UPCM10	
63	A14	I	UPCM10	
64	+5V	O	UPCM10	

S8 20 way vertical IDC

CONNECTS TO: FORTH UART link (not used in normal operation)

PIN NO.	SIGNAL	I/O	SOURCE/DEST.	COMMENT
1	D7	IO	FORTH LINK BOARD	
2	RD	O	FORTH LINK BOARD	
3	DO	IO	FORTH LINK BOARD	
4	Y13	O	FORTH LINK BOARD	FCDX FORTH UART
5	D6	IO	FORTH LINK BOARD	
6	0V	-	FORTH LINK BOARD	
7	D1	IO	FORTH LINK BOARD	
8	0V	-	FORTH LINK BOARD	
9	D5	IO	FORTH LINK BOARD	
10	0V	-	FORTH LINK BOARD	
11	D2	IO	FORTH LINK BOARD	
12	0V	-	FORTH LINK BOARD	
13	D4	IO	FORTH LINK BOARD	
14	0V	-	FORTH LINK BOARD	
15	D3	IO	FORTH LINK BOARD	
16	RESET1	-	FORTH LINK BOARD	
17	WR	O	FORTH LINK BOARD	
18	AO	O	FORTH LINK BOARD	
19	0V	-	FORTH LINK BOARD	
20	+5V	-	FORTH LINK BOARD	

13.2 **FRONT PANEL BOARD (FB)**

S1 34 pin right angle IDC header

CONNECTS TO: Control Board (CB)

PIN NO.	SIGNAL	I/O	SOURCE/DEST.	COMMENT
1	BD0	IO	CONTROL BOARD	BUFFERED uP DATA
2	BD1	IO	CONTROL BOARD	
3	BD2	IO	CONTROL BOARD	
4	BD3	IO	CONTROL BOARD	
5	BD4	IO	CONTROL BOARD	
6	BD5	IO	CONTROL BOARD	
7	BD6	IO	CONTROL BOARD	
8	BD7	IO	CONTROL BOARD	
9	BRD	I	CONTROL BOARD	BUFFERED uP READ
10	BWR	I	CONTROL BOARD	BUFFERED uP WRITE
11	RESET	I	CONTROL BOARD	
12	DISP0	I	CONTROL BOARD	E000-E3FF
13	DISP1	I	CONTROL BOARD	E400-E7FF
14	DISP2	I	CONTROL BOARD	E800-EBFF
15	DISP3	I	CONTROL BOARD	EC00-EFFF
16	Y12	I	CONTROL BOARD	KEYBOARD FCEX
17	8K3	I	CONTROL BOARD	INVERTED 8K3
18	A0	I	CONTROL BOARD	
19	A1	I	CONTROL BOARD	
20	A2	I	CONTROL BOARD	
21	A3	I	CONTROL BOARD	
22	A4	I	CONTROL BOARD	
23	A5	I	CONTROL BOARD	
24	SEN9	I	CONTROL BOARD	LEDS (5450)
25	SEN7	I	CONTROL BOARD	BARGRAPH (5450)
26	SDATA5	I	CONTROL BOARD	
27	SCLK5	I	CONTROL BOARD	
28	KEY	O	CONTROL BOARD	HI ON KEY PRESS
29	NC	-		
30	0V			
31	NC	-		
32	0V			
33	NC	-		
34	0V			

S2 14 way MOLEX right angle

CONNECTS TO: Front Panel keyboard laminate

PIN NO.	SIGNAL	I/O	SOURCE/DEST.	COMMENT
1	KBO1	O	FP KEYBOARD	
2	KBO2	O	FP KEYBOARD	
3	KBO3	O	FP KEYBOARD	
4	KBO4	O	FP KEYBOARD	
5	KBO5	O	FP KEYBOARD	
6	KBO6	O	FP KEYBOARD	
7	KBI1	I	FP KEYBOARD	
8	KBI2	I	FP KEYBOARD	
9	KBI3	I	FP KEYBOARD	
10	KBI4	I	FP KEYBOARD	
11	KBI5	I	FP KEYBOARD	
12	KBI6	I	FP KEYBOARD	
13	KBI7	I	FP KEYBOARD	
14	KBI8	I	FP KEYBOARD	

FRONT PANEL BOARD (FB) CONTINUED

S3 6 way vertical MOLEX

PIN NO.	SIGNAL	I/O	SOURCE/DEST.	COMMENT
1	SCREEN }		AM S3-1	
2	IF O/P }	O	AM S3-2	
3	SCREEN }		CB S4-16	
4	AF O/P }	O	CB S4-15	
5	SCREEN }		FM S2-1	
6	AF I/P }	I	FM S2-2	

S5 2 way right angle MOLEX

PIN NO.	SIGNAL	I/O	SOURCE/DEST.	COMMENT
1	0V	I	PS S2-6	
2	+7V	I	PS S2-4	

13.3 POWER SUPPLY BOARD (PS)

CONNECTOR	TITLE	I/O	F/L	SOURCE/ DEST.	COMMENT
S1-1	+5V SECONDARY	I	-	TX1	
S1-2	+5V SECONDARY	I	-	TX1	
S1-3	0V	I	-	TX1	
S1-4	+12V SECONDARY	I	-	TX1	
S1-5	+12V SECONDARY	I	-	TX1	
S1-6	-15V SECONDARY	I	-	TX1	
S1-7	-15V SECONDARY	I	-	TX1	
S1-8	NC	-	-	-	
S1-9	NC	-	-	-	
S1-10	INVERTER	-	-	TX1	
S1-11	RELAY COIL	-	-	RL1	
S1-12	INVERTER	-	-	RL1	
S1-13	BATTERY -ve	I	-	S4	
S1-14	INVERTER	-	-	RL1	
S1-15	BATTERY +ve	I	-	S4	

POWER SUPPLY BOARD (PS) CONTINUED

CONNECTOR	TITLE	I/O	F/L	SOURCE/ DEST.	COMMENT
S2-1	+5V	O	F	MX S201-1	} YP1602
			F	LO S1-7	} ON TO LO AND
			F	RB S1-12	} RB
S2-2	+5V	O	F	AM S1-6	} YP1602 TO AM
			F	AM S5-9	} AND ON TO FM
S2-3	+5V	O	-	CB S6-8	YP702
S2-4	+7V UNREGULATED	O	-	FB S5-2	YP702
S2-5	0V	O	-	CHASSIS	YP1602 TO STAR POINT
S2-6	0V	-	-	FB S5-1	24/.2

POWER SUPPLY BOARD (PS) CONTINUED

CONNECTOR	TITLE	I/O	F/L	SOURCE/ DEST.	COMMENT
S3-1	EXT DC	O	-	CB S6-1	YP702
S3-2	0V	O	-	CHASSIS	YP1602
S3-3	-15V	O	F	MX S201-3	} YP702 TO MX
			F	LO S1-8	} AND ON TO LO
S3-4	-15V	O	F	AM S1-5	} YP702 TO AM
			F	FM S5-10	} AND ON TO FM
S3-5	-15V	O	F	CB S6-5	YP702
S3-6	NC	-	-		
S3-7	+12V	O	F	MX S201-2	} YP702 TO MX
			F	LO S1-9	} AND ON TO LO
			F	RB S1-2	} AND RB
S3-8	+12V	O	F	AM S1-4	} YP702 TO AM
			F	FM S5-11	} AND ON TO FM
S3-9	+12V	O	-	CB S6-6	YP702
S3-10	0V	O	-	CHASSIS	YP1602 TO STAR POINT

13.4 MIXER BOARD (MX)

CONNECTOR	TITLE	I/O	F/L	SOURCE/ DEST.	COMMENT
S201-1	+5V	I	F	PS S2-1	
S201-2	+12V	I	F	PS S3-7	
S201-3	-15V	I	F	PS S3-3	
S201-4	SDATA1	I	F	CB S5-1	
S201-5	SCLK1	I	F	CB S5-2	
S201-6	SEN1	I	F	CB S5-8	
S201-7	RF LEVEL	O	F	CB S5-9	
S201-8	EXCESS RF POWER	O	F	CB S5-11	
S201-9	NC	-	-	-	
S201-10	NC	-	-	-	
S201-1	CAL SIGNAL	I	-	RB S1-6	} YX178 VIA } UT85
S201-2	SCREEN	-	-	RB S1-5	} ACROSS LO
S203-1	LO SIGNAL	I	L	LO S2-2	} YX178 VIA } SIDE
S203-2	SCREEN	-	-	LO S2-1	} PARTITION
S203-3	SCREEN	-	-	BACK PANEL	} YX178 TO N
S203-4	EXT LO	I	L	BACK PANEL	} TYPE } CONNECTOR
S204-1	IF SIGNAL	O	-	AM S2-2	YX178 VIA
S204-2	SCREEN	-	-	AM S2-1	UT85 AND FILTER BOX
	RF INPUT			FRONT PANEL	VIA SMA AND UT85

13.5 LOCAL OSCILLATOR BOARD (LO)

CONNECTOR	TITLE	I/O	F/L	SOURCE/ DEST.	COMMENT
S1-1	SEN3	I	F	CB S5-16	
S1-2	SCLK2	I	F	CB S5-14	
S1-3	SDATA	I	F	CB S5-13	
S1-4	SEN2	I	F	CB S5-15	
S1-5	100kHz REF B	I	L	RB S1-4	VIA SIDE PARTITION
S1-6	LO LOCK	O	F	CB S5-12	
S1-7	+5V	I	F	PS S2-1	
S1-8	-15V	I	F	PS S3-3	
S1-9	+12V	I	F	PS S3-7	
S1-10	NC	-	-	-	
S2-1	SCREEN	-	L	MX S203-2	) YX178 VIA
S2-2	LO SIGNAL	O	-	MX S203-1	) SIDE PARTITION

13.6 AM BOARD (AM)

CONNECTOR	TITLE	I/O	F/L	SOURCE/ DEST.	COMMENT
S1-1	SCLK3	I	F	CB S4-2	
S1-2	SDATA3	I	F	CB S4-1	
S1-3	SEN4	I	F	CB S4-3	
S1-4	+12V	I	F	PS S3-8	
S1-5	-15V	I	F	PS S3-4	
S1-6	+5V	I	F	PS S2-2	
S1-7	IF AGC LEVEL	O	F	CB S4-4	
S1-8	NC	-	-	-	
S2-1	SCREEN	-	-	MX S204-2	} YX178 VIA
S2-2	IF SIGNAL	I	-	MX S204-1	} UT85 AND } FILTER BOX
S3-1	SCREEN	-	-	FB S3-1	} YX178
S3-2	IF OUTPUT	O	L	FB S3-2	}
S4-1	SCREEN	-	-	FM S4-1	} YX178 VIA
S4-2	FM SIGNAL	O	L	FM S4-2	} SIDE } PARTITION
S5-1	SCREEN	-	-	FM S1-1	} YX178 VIA
S5-2	AM SIGNAL	O	L	FM S1-2	} SIDE } PARTITION

13.7 FM BOARD (FM)

CONNECTOR	TITLE	I/O	F/L	SOURCE/ DEST.	COMMENT
S1-1	SCREEN	-	-	AM S5-1	} YX178 VIA
S1-2	AM SIGNAL	I	L	AM S5-2	} SIDE
					} PARTITION
S2-1	SCREEN	-	-	FB S3-5	} YX178
S2-2	AF INPUT	I	L	FB S3-6	}
S3-1	SCREEN	-	-	CB S4-11	} YX178
S3-2	FIXED LEVEL IF	O	L	CB S4-10	}
S4-1	SCREEN	-	-	AM S4-1	} YX178 VIA
S4-2	FM SIGNAL	I	L	AM S4-2	} SIDE
					} PARTITION
S5-1	SCREEN	-	-	CB S4-14	} YX178
S5-2	AUDIO OUTPUT	O	L	CB S4-13	}
S5-3	RAW AF LEVEL	O	F	CB S4-12	
S5-4	NC	-	-	-	
S5-5	SEN6	I	F	CB S4-8	
S5-6	SEN5	I	F	CB S4-7	
S5-7	SDATA3	I	F	CB S4-1	
S5-8	SCLK3	I	F	CB S4-2	
S5-9	+5V	I	F	PS S2-2	
S5-10	-15V	I	F	PS S3-4	
S5-11	+12V	I	F	PS S3-8	
S5-12	NC	-	-	-	

13.8 REFERENCE BOARD (RB)

CONNECTOR	TITLE	I/O	F/L	SOURCE/ DEST.	COMMENT
S1-1	10MHz ADJUST	I	F	CB S5-6	
S1-2	+12V	I	F	PS S3-7	
S1-3	100kHz REF A	O	L	CB S5-4	
S1-4	100kHz REF B	O	L	LO S1-5	} VIA SIDE PARTITION
S1-5	SCREEN	-	-	MX S202-2	} YX178 VIA UT85
S1-6	CAL SIGNAL	O	-	MX S202-1	} ACROSS LO
S1-7	SCREEN	-	-	BACK PANEL	} YX178 TO BNC CONNECTOR
S1-8	REFERENCE	IO	L	BACK PANEL	
S1-9	SCLK1	I	F	CB S5-2	
S1-10	SDATA1	I	F	CB S5-1	
S1-11	SEN0	I	F	CB S5-3	
S1-12	+5V	I	F	PS S2-1	

13.9 OPTION BOARD (OP)

CONNECTOR	TITLE	I/O	F/L	SOURCE/ DEST.	COMMENT
S1-1	AF1	I	-	CB S3-12	} YX178
S1-2	SCREEN	-	-	CB S3-11	}
S1-3	OB FITTED	O	-	CB S3-10	
S1-4	0V	-	-	CB S3-9	
S1-5	-6V	I	-	CB S3-8	
S1-6	AUDIO COUNT	O	-	CB S3-7	
S1-7	+6V	I	-	CB S3-6	
S1-8	SCREEN	-	-	CB S3-5	} YX178
S1-9	AF2	O	-	CB S3-4	}
S1-10	SEN8	I	-	CB S3-3	
S1-11	SCLK4	I	-	CB S3-2	
S1-12	SDATA4	I	-	CB S3-1	

13.10 **ADAPTER BOARD (AB)**

CONNECTOR	TITLE	I/O	F/L	SOURCE/ DEST.	COMMENT
S1-1	OV GROUND	-	-	BP	} BACK PANEL
S1-2	AUDIO OUTPUT	O	-	BP	} AUXILLIARY
S1-3	AUDIO INPUT	I	-	BP	} INPUT/
S1-4	OV GROUND	-	-	BP	} OUTPUT
S1-5	CONTROL OUTPUT A	O	-	BP	} CONNECTOR
S1-6	CONTROL OUTPUT B	O	-	BP	}
S2-1	0V GND		-	CB S1-25	
S2-2	10MHz ADJUST		-	CB S1-26	
S2-3	0V GND		-	CB S1-27	
S2-4	AUDIO O/P		-	CB S1-28	
S2-5	0V GND		-	CB S1-29	
S2-6	FILTERED AUDIO I/P		-	CB S1-30	
S2-7	0V GND		-	CB S1-31	
S2-8	TTL O/P A		-	CB S1-32	
S2-9	0V GND		-	CB S1-33	
S2-10	TTL O/P B		-	CB S1-34	

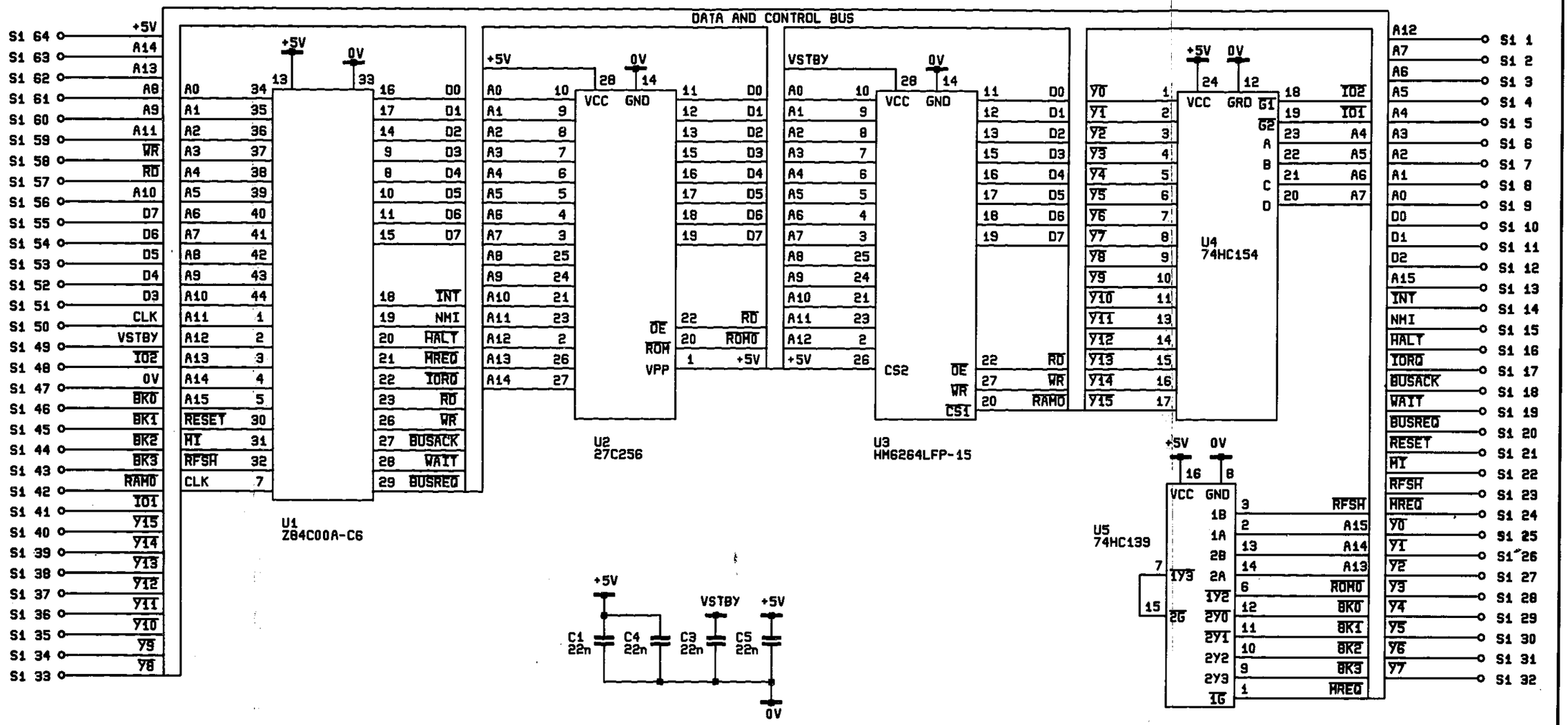
13.11 **KEYBOARD LAMINATE**

S1 16 way BERG connector connects to Front Panel Board (FB)

Key descriptions in the table below indicate the appropriate source and return pin number used for each key.

PIN NO.	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
1	AUTO	CARR FREQ	MHz	STEP	RF DISP	NC	AM	NC
2	9	6	3	-	AF DISP	PK-PK/2	FM	NC
3	8	5	2	.	NC	+PEAK	PM	NC
4	7	4	1	0	ABS	-PEAK	RF POWER	NC
5	#	LOCAL CLEAR	STORE	RECALL	REL	RMS	AF VOLTS	NC
6	BAND PASS	NC	300kHz	750uS	MAX HOLD	ROOT2 RMS	DIST	NC
7	300Hz	NC	75kHz	75uS	50uS	15kHz	50Hz	NC
8	NC	NC	NC	NC	25uS	3kHz	10Hz	NC

14. C I R C U I T D I A G R A M S



ISS	A									USED ON:	NOTES: ALL CAPACITOR VALUES IN F. ALL RESISTOR VALUES IN OHMS. UNLESS OTHERWISE STATED
DATE	23.2.90										
MOD. NO.											
CHK'D	DQ										
NAME	LAS										

FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH

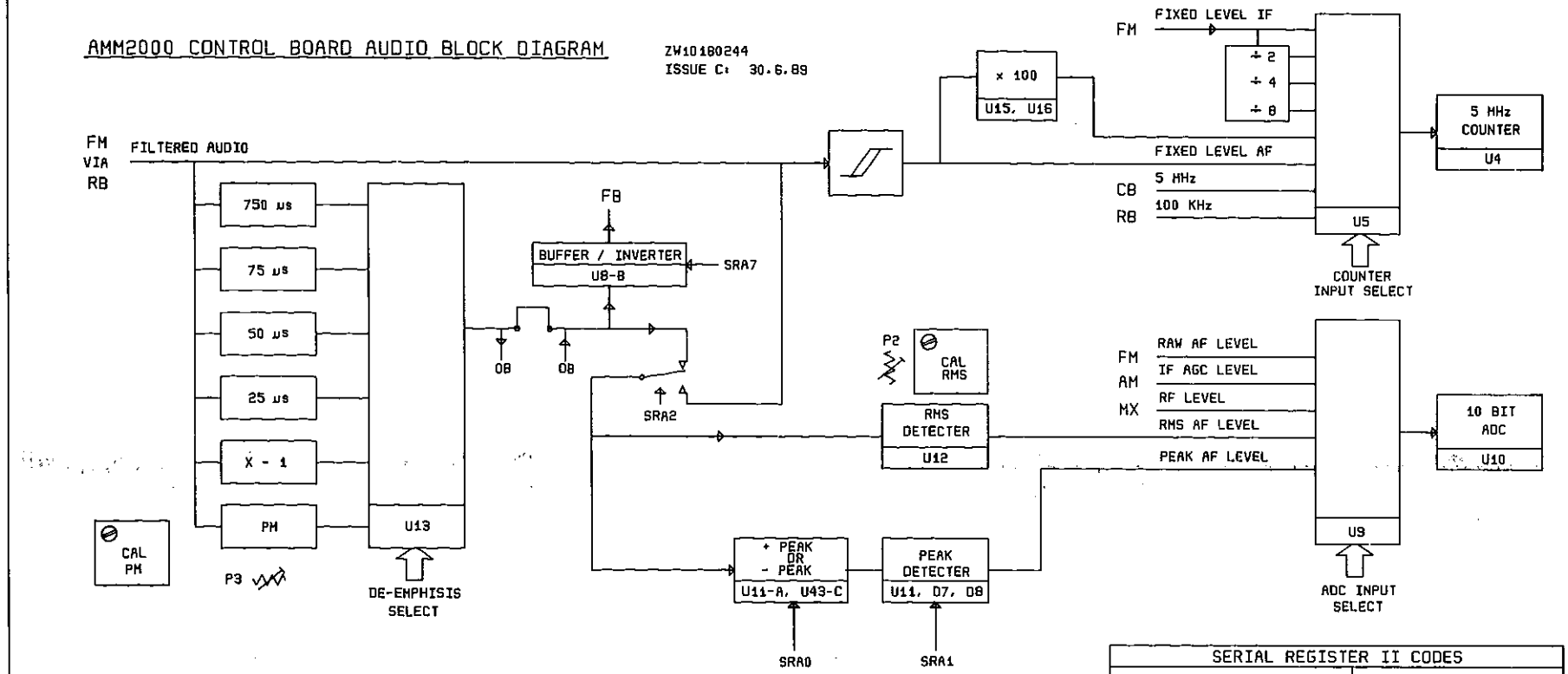
TITLE: PCM80 BOARD CIRCUIT DIAGRAM

DRAWING NO. RSZX0323

SHEET OF SHEETS

AMM2000 CONTROL BOARD AUDIO BLOCK DIAGRAM

ZW10180244
ISSUE C: 30.6.89

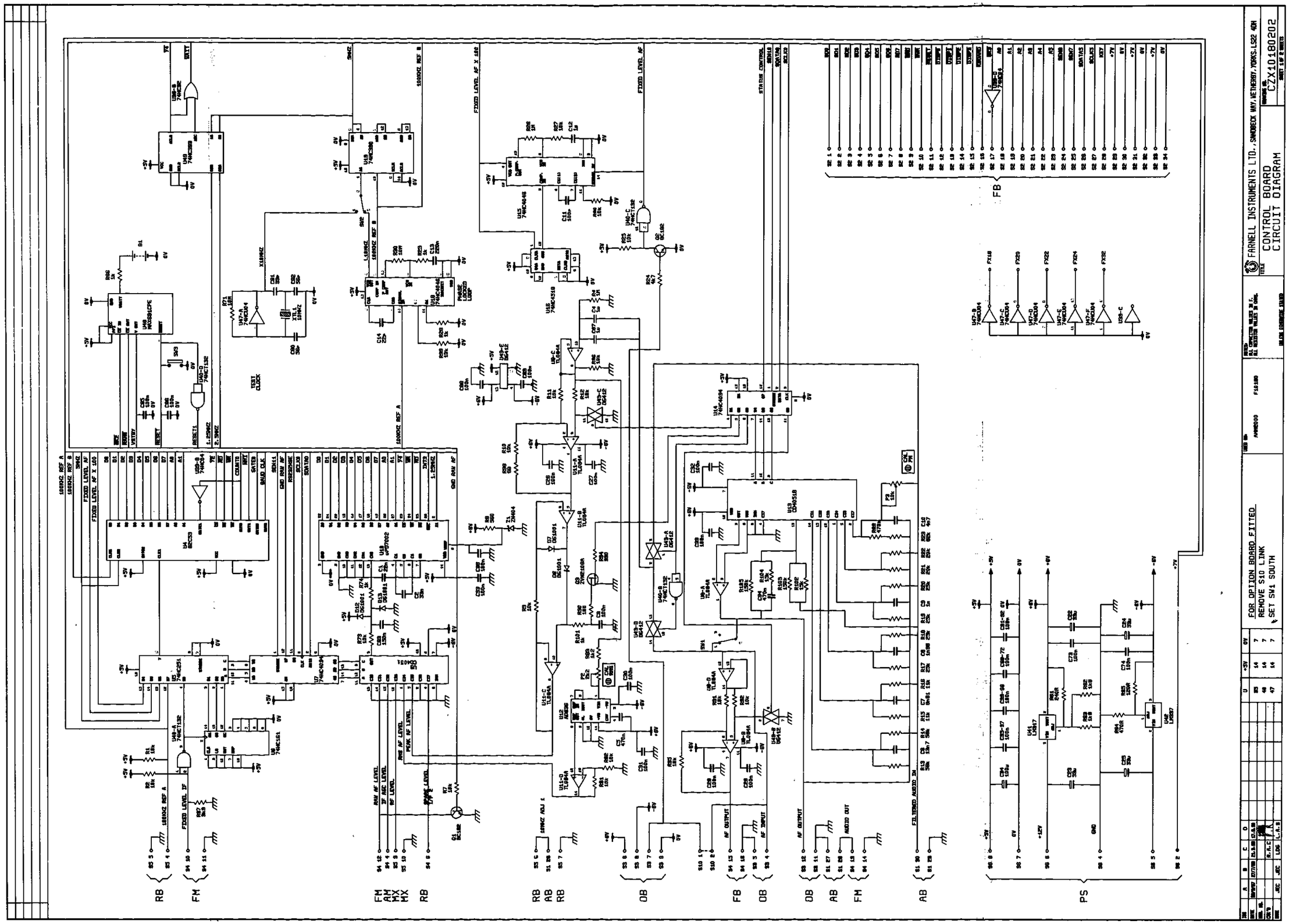


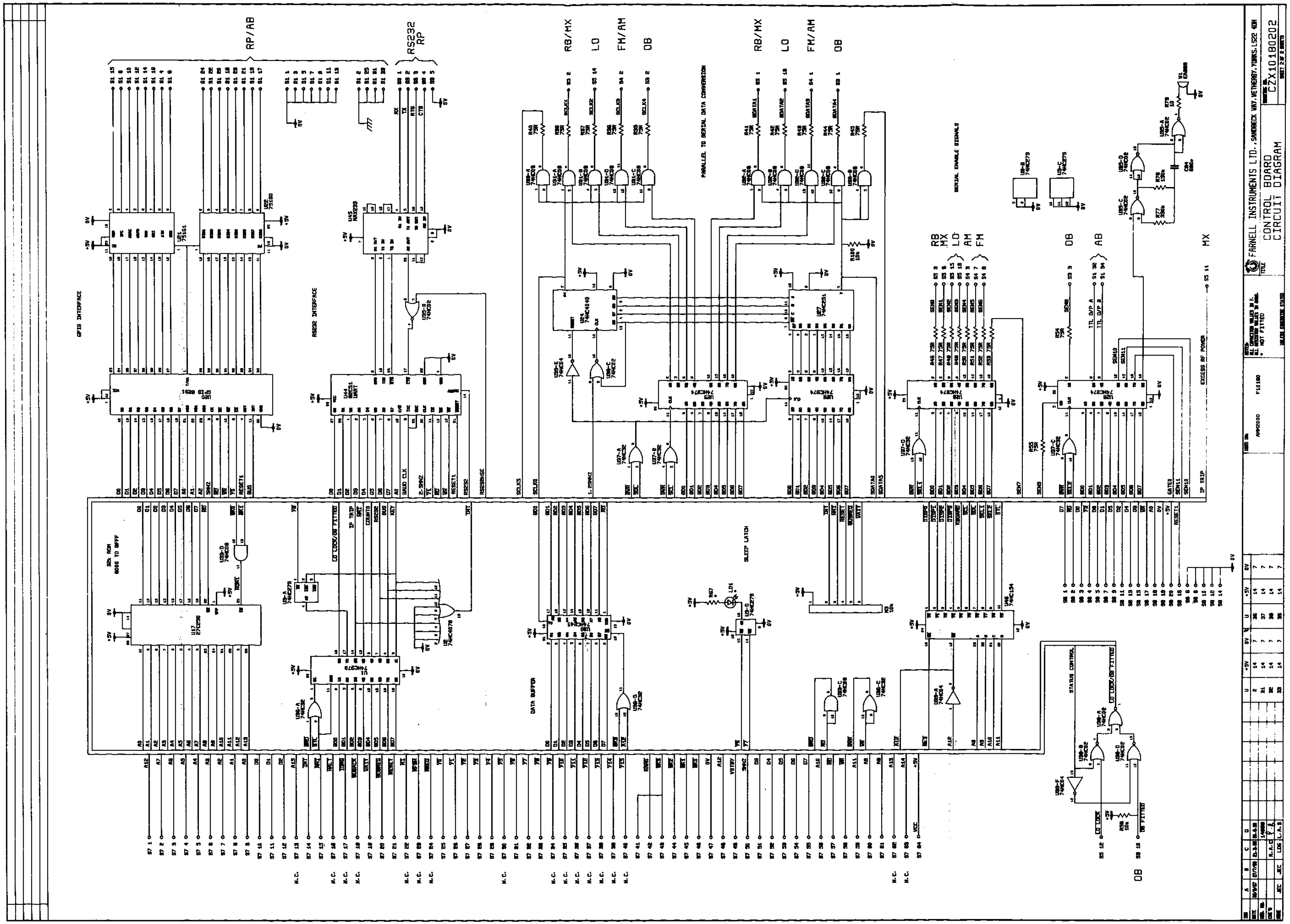
SERIAL REGISTER 10 CONTROL CODES

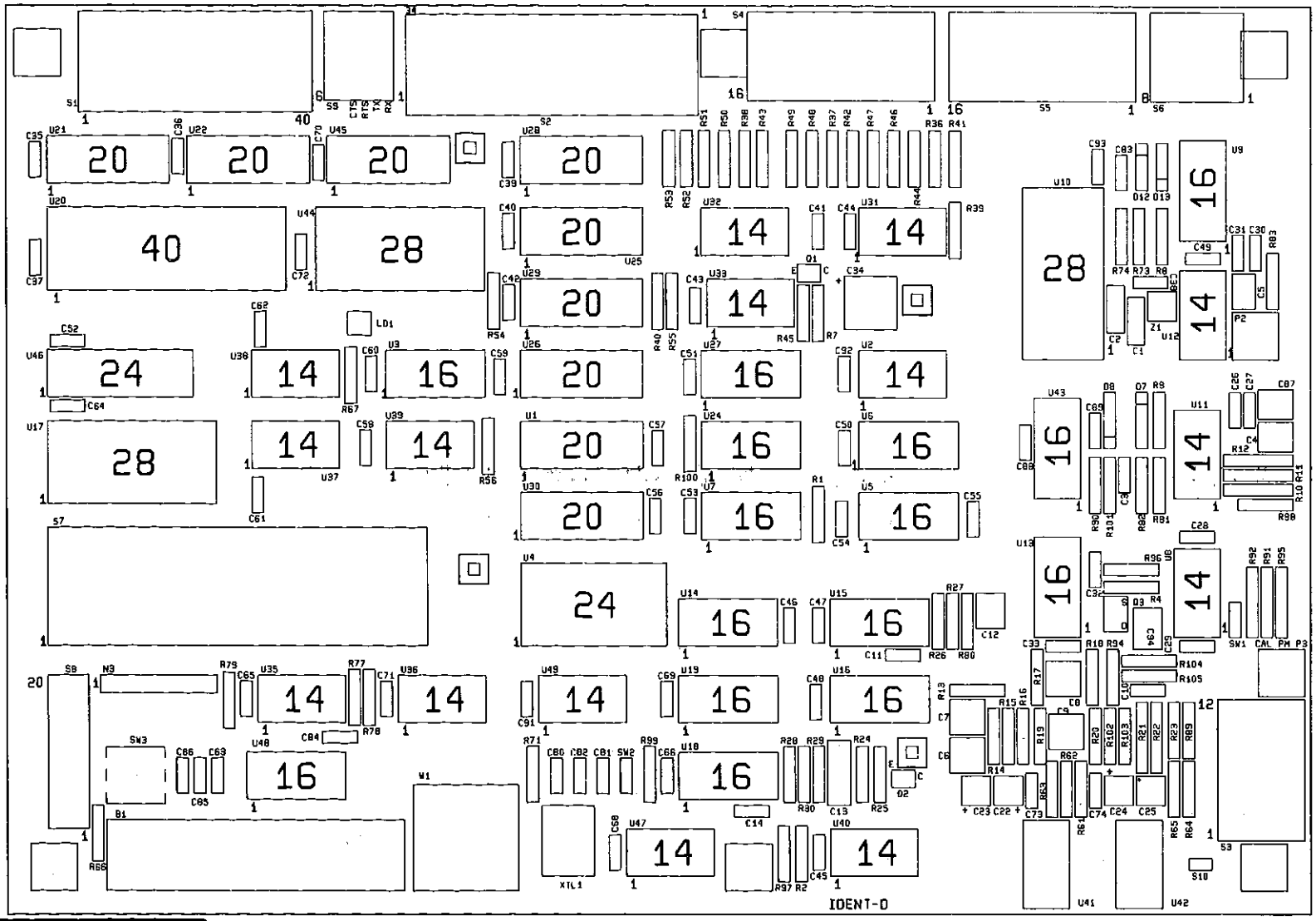
		SR OUTPUTS A7 A6 A5 A4 A3 A2 A1 A0 / Q8 Q7 Q6 Q5 Q4 Q3 Q2 Q1
ENABLE PEAK DETECTION		H
RESET PEAK DETECTER		H
POST-DISPLAY DE-EMPHISIS		H
DE-EMPHISIS SELECT	750 µs	L L H
	75 µs	L H L
	50 µs	L H H
	25 µs	H L L
	-1	H L H
	PM	H H L
MXHI FLAG IMAGE		H

SERIAL REGISTER II CODES

		SR OUTPUTS B7 B6 B5 B4 B3 B2 B1 B0 / Q7 Q6 Q5 Q4 Q3 Q2 Q1
COUNTER INPUT SELECT	IF	L L L
	IF ÷ 2	L L H
	IF ÷ 4	L H L
	IF ÷ 8	L H H
	AF * 100	H L L
	AF	H L H
	5 MHz	H H L
	100 kHz	H H H
ADC INPUT SELECT	RAW AF LEVEL	L L H
	IF AGC LEVEL	L H L
	RF LEVEL	L H H
	RMS AF LEVEL	H L L
	PEAK AF LEVEL	H L H
	GND RAW AF	H


FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH
TITLE
CONTROL BOARD
CIRCUIT DIAGRAM
DRAWING NO.
CZX10180202
SHEET 1 OF 2 SHEETS
FIXED LEVEL AF
STATUS CONTROL
FB
FOR OPTION BOARD FITTED
REMOVE S10 LINK
SET SW1 SOUTH
RB
FM
FM
AM
MX
MX
RB
RB
AB
RB
OB
FB
OB
OB
AB
FM
AB
PS


FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH
CONTROL BOARD
CIRCUIT DIAGRAM
RP/AB
RS232
RP
RB/MX
LO
FM/AM
OB
GPIB INTERFACE
RS232 INTERFACE
PARALLEL TO SERIAL DATA CONVERSION
SERIAL ENABLE SIGNALS
DATA BUFFER
SLEEP LATCH
STATUS CONTROL
EXCESS RF POWER
MX



FARNELL INSTRUMENTS LTD.
WETHERBY, WEST YORKSHIRE. LS22 4DN. ENGLAND.

GENERAL
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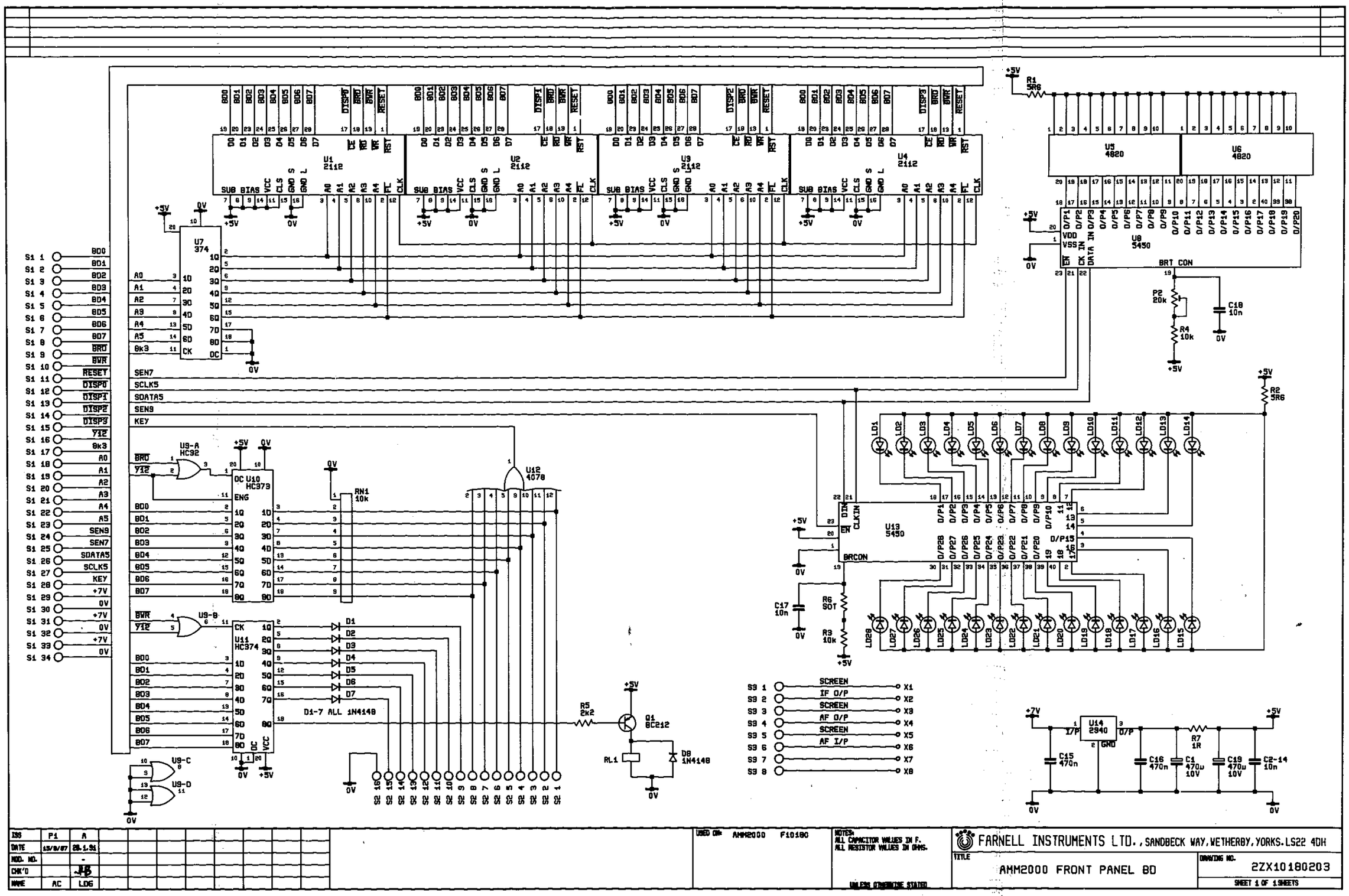
2) TO BE RETURNED PACKED FLAT, AS SOON AS POSSIBLE.
3) ORIGINAL ARTWORKS ARE IN ACCORDANCE WITH FARNELL D.O. PRACTICE DO-2000.

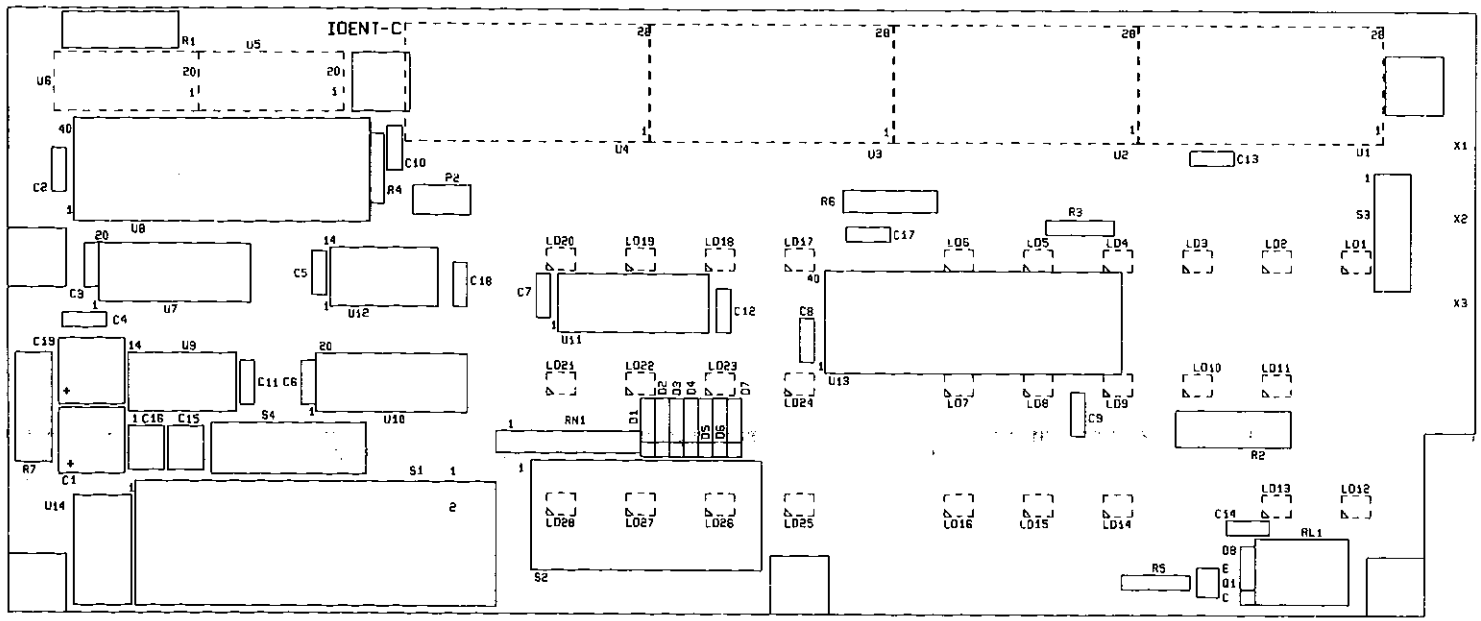
LOGOS
MANUFACTURERS LOGOS MUST NOT APPEAR ON THE FINAL PCB.

CODES
DATE AND/OR UL CODES, TO APPEAR ONLY WITHIN AREA SPECIFIED.

COPYRIGHT AND CHANGES
1) THE FINAL PCB IS TO CONFORM WITH THE PATTERN SHOWN.
2) NO CHANGE IS TO BE MADE TO THE ARTWORK.

USED IN ASSOCIATION WITH: 1R7RBT11270.1.2.6
TITLE AMM2000 CONTROL BD IDENT
ORIGINAL SCALE: 1:1
ALL DIMENSIONS IN mm
DRAWING NUMBER 1R7RBT11273


U1 2112
U2 2112
U3 2112
U4 2112
U5 4820
U6 4820
U7 374
U8 5450
U9-A HC32
U9-B
U9-C
U9-D
U10 HC373
U11 HC374
U12 4078
U13 5450
U14 2940
Q1 BC212
RL1
D1-7 ALL 1N4148
D8 1N4148
RN1 10k
R1 5R6
R2 5R6
R3 10k
R4 10k
R5 2k2
R6 50T
R7 1R
P2 20k
C1 470u 10V
C15 470n
C16 470n
C17 10n
C18 10n
C19 470u 10V
C2-14 10n
BRT CON
BRCON
SEN7
SCLK5
SDATA5
SEN9
KEY
SCREEN
IF O/P
AF O/P
AF I/P
FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH
AMM2000 FRONT PANEL BD
2ZX10180203
SHEET 1 OF 1 SHEETS
ISS P1 A
DATE 15/9/87 28.1.91
MOD. NO. -
CHK'D JB
NAME AC LDG
USED ON: AMM2000 F10180
NOTES: ALL CAPACITOR VALUES IN F. ALL RESISTOR VALUES IN OHMS. UNLESS OTHERWISE STATED



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GENERAL	LOGOS	COPYRIGHT AND CHANGES
1) THIS ORIGINAL ARTWORK IS THE PROPERTY OF THE ABOVE.	MANUFACTURERS LOGOS MUST NOT APPEAR ON THE FINAL PCB.	1 THE FINAL PCB IS TO CONFORM WITH THE PATTERN SHOWN.
2) TO BE RETURNED PACKED FLAT. AS SOON AS POSSIBLE.	CODES	
3) ORIGINAL ARTWORKS ARE IN ACCORDANCE WITH FARNELL D.O. PRACTICE DO-2000.	DATE AND OR ... CODE ... TO APPEAR ONLY WITHIN AREA SPECIFIED BY ORIGINATING ORG.	NO CHANGE IS TO BE MADE TO THE ARTWORK. ©

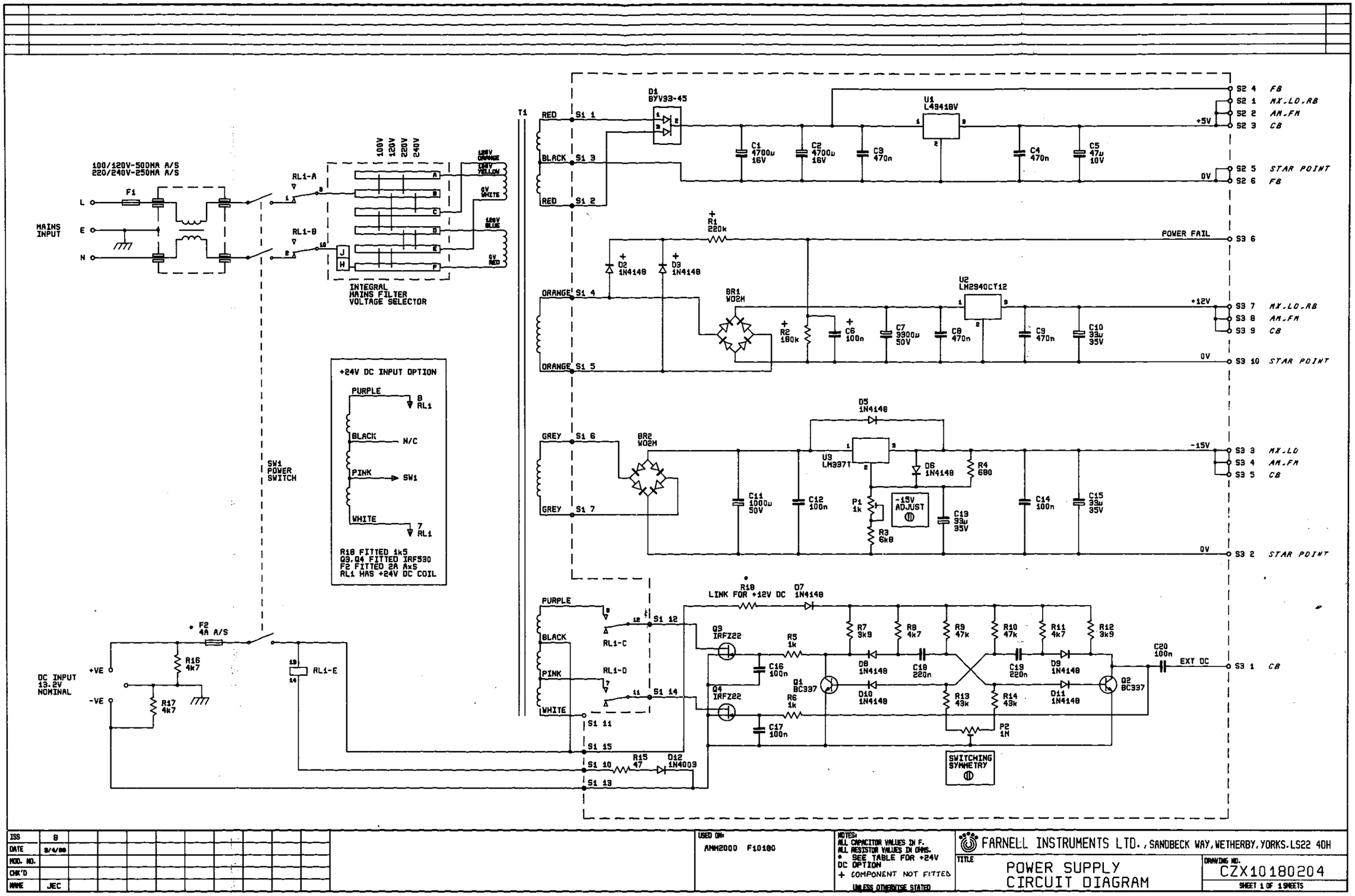
USED IN ASSOCIATION WITH: R7RBT1270,1,2,6

TITLE AMM2000 FRONT PANEL BOARD IDENT

ORIGINAL SCALE: 1:1
ALL DIMENSIONS IN mm

DRAWING NUMBER R7RBT12703

9AMM2000/01.16.91/RBA



ISS	B
DATE	8/4/88
MOD. NO.	
CHK'D	
NAME	JEC

USED ON
AMM2000 F10180

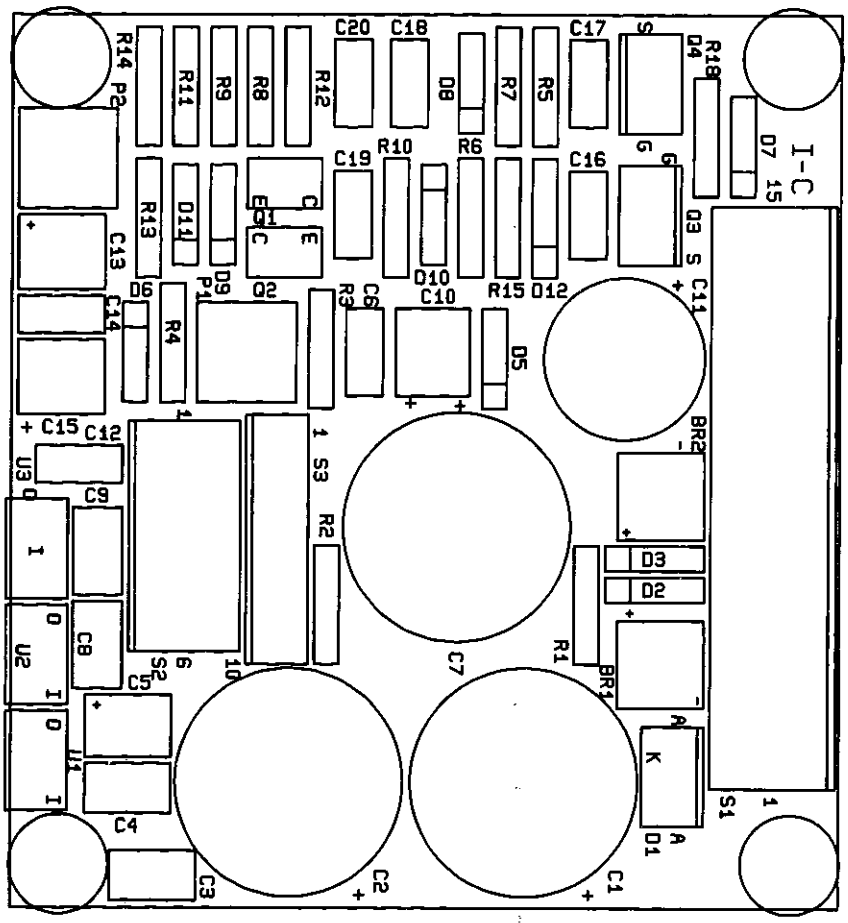
NOTES:
ALL CAPACITOR VALUES IN F.
ALL RESISTOR VALUES IN OHMS.
* SEE TABLE FOR +24V DC OPTION
+ COMPONENT NOT FITTED
UNLESS OTHERWISE STATED

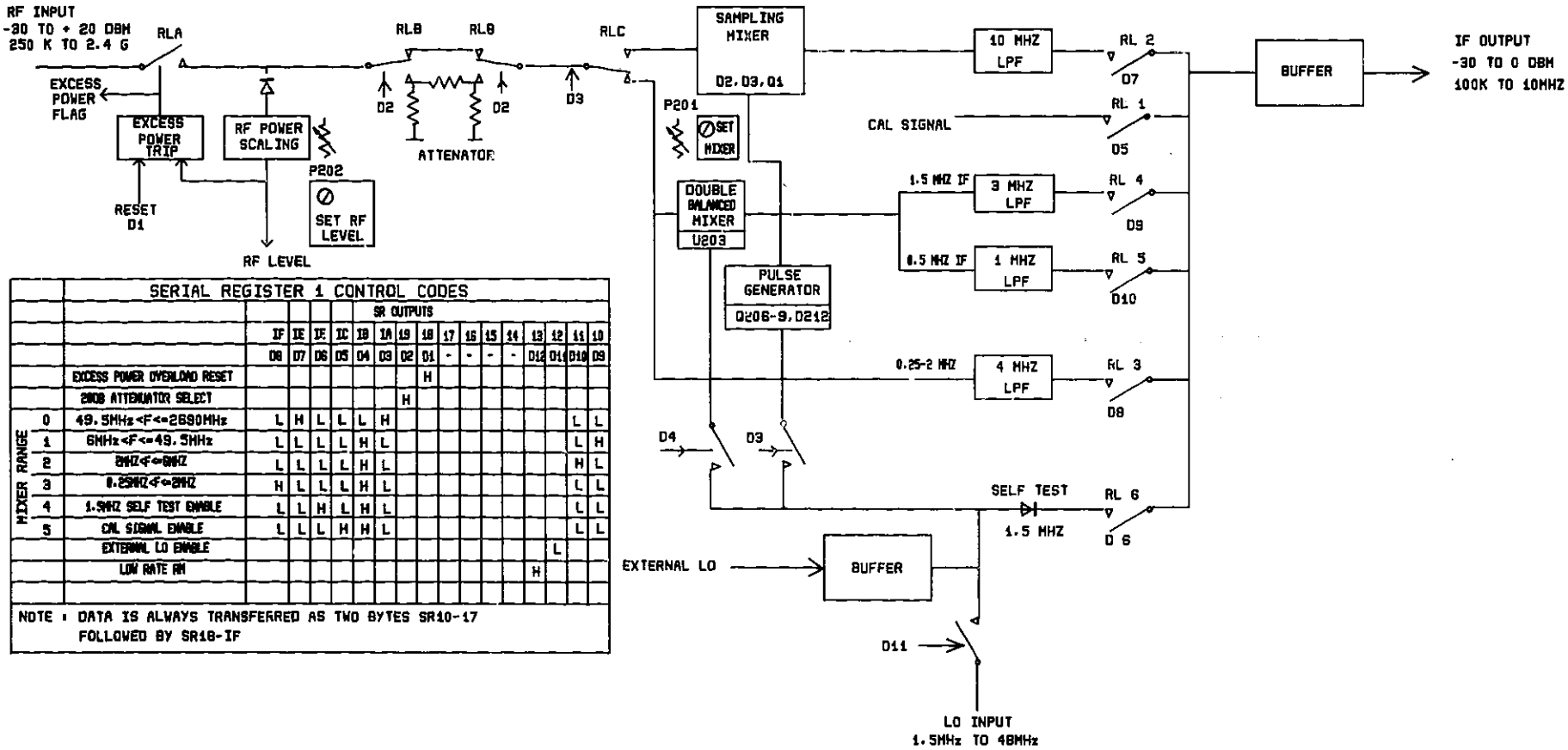
FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH

TITLE
POWER SUPPLY CIRCUIT DIAGRAM

DRAWING NO.
CZX10180204

SHEET 1 OF 1 SHEETS


R14
P2
R11
R9
R8
R12
C20
C18
D8
R7
R5
C17
S
D4
R19
D7
15
I-C
C19
R10
R6
C16
G
G
D3
S
C11
C13
C14
D6
R4
P1
Q2
R3
C6
C10
R15
D12
D5
+ C15
C12
BR2
U3
C9
S3
R2
D3
D2
C8
S2
C5
C7
R1
BR1
U2
A
K
D1
S1
C4
C3
C2
C1



SERIAL REGISTER 1 CONTROL CODES

			SR OUTPUTS															
			IF	IE	ID	IC	IB	IA	19	18	17	16	15	14	13	12	11	10
			D8	D7	D6	D5	D4	D3	D2	D1	-	-	-	-	D12	D11	D10	D9
		EXCESS POWER OVERLOAD RESET								H								
		20DB ATTENUATOR SELECT							H									
MIXER RANGE	0	49.5MHz<F<=2690MHz	L	H	L	L	L	H									L	L
	1	6MHz<F<=49.5MHz	L	L	L	L	H	L									L	H
	2	2MHZ<F<=6MHZ	L	L	L	L	H	L									H	L
	3	0.25MHZ<F<=2MHZ	H	L	L	L	H	L									L	L
	4	1.5MHZ SELF TEST ENABLE	L	L	H	L	H	L									L	L
	5	CAL SIGNAL ENABLE	L	L	L	H	H	L									L	L
		EXTERNAL LO ENABLE														L		
		LOW RATE RM													H			

NOTE : DATA IS ALWAYS TRANSFERRED AS TWO BYTES SR10-17
FOLLOWED BY SR18-IF

ISS	A										USED ON:
DATE	5 7 90										
MOD. NO.											
CHK'D	JB										
NAME	R A										

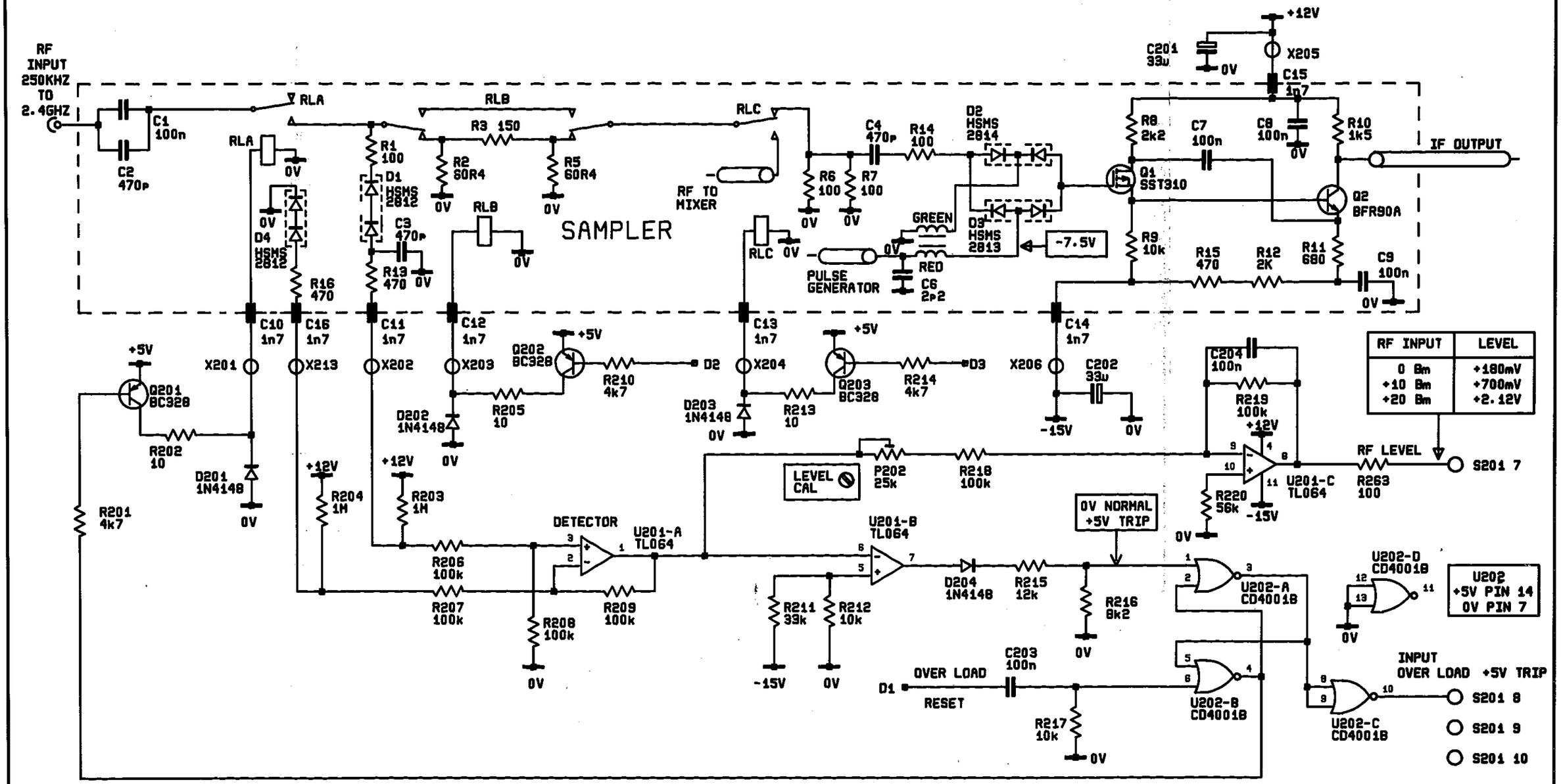
NOTES:
ALL CAPACITOR VALUES IN F.
ALL RESISTOR VALUES IN OHMS.
UNLESS OTHERWISE STATED

FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH

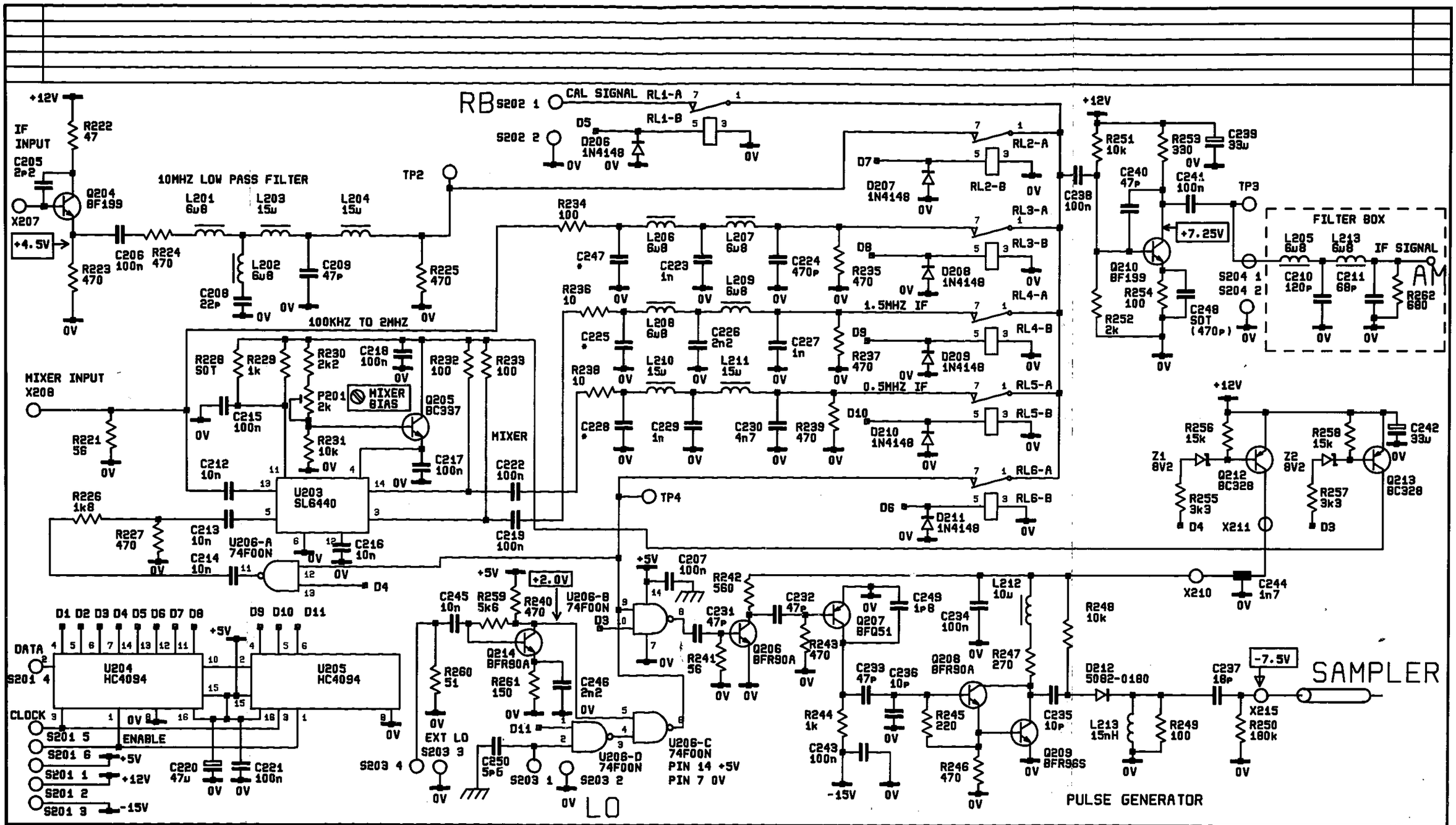
TITLE
MIXER BOARD BLOCK DIAGRAM

DRAWING NO.
3ZW10180235

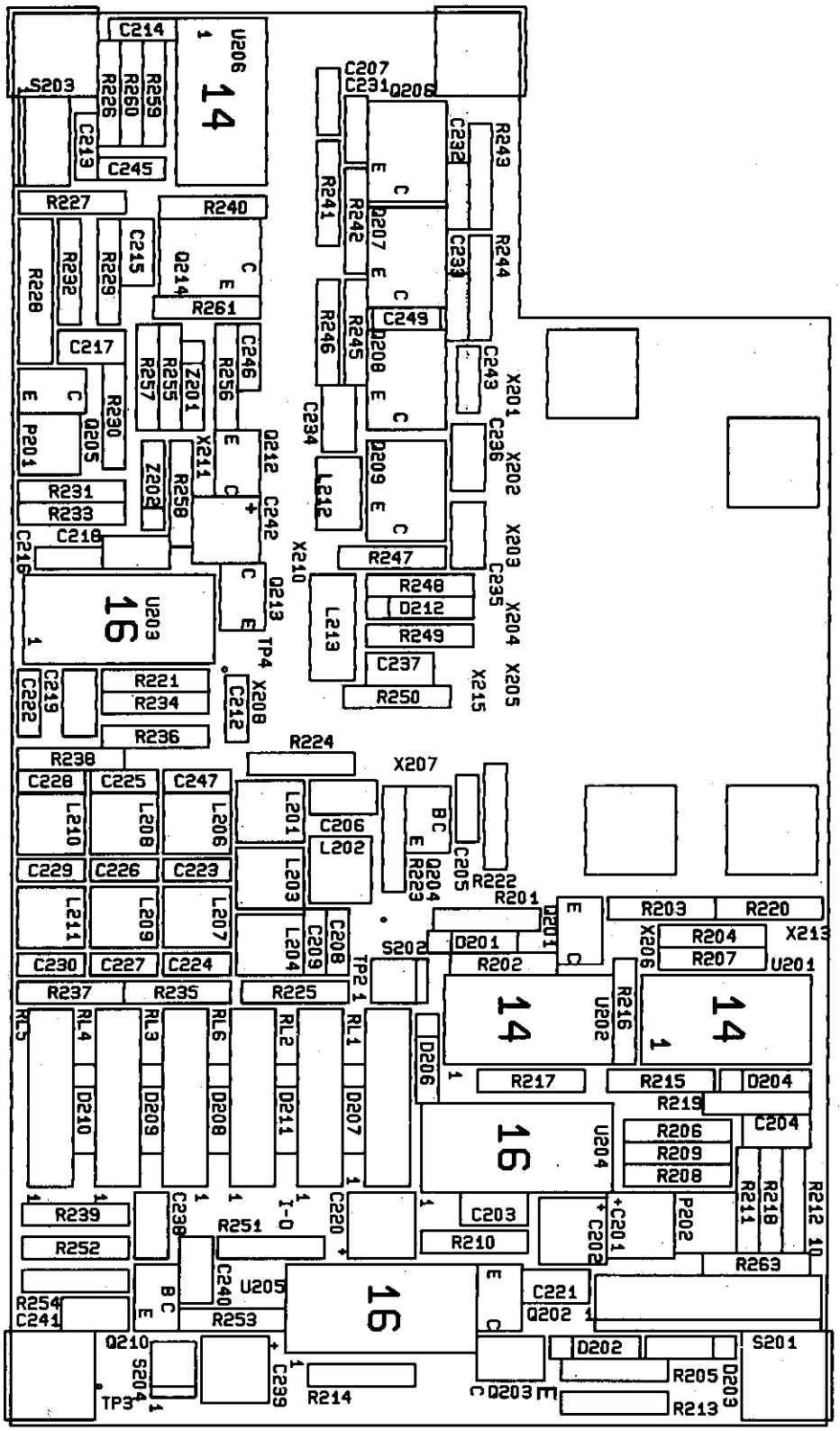
SHEET OF SHEETS



ISS	B	C	D	E						USED ON: AMM2000 F10180	NOTES: ALL CAPACITOR VALUES IN F. ALL RESISTOR VALUES IN OHMS. UNLESS OTHERWISE STATED	FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH	
DATE	5.5.88	28.9.88	31.8.89	9.10.90								TITLE: MIXER BOARD CIRCUIT DIAGRAM	DRAWING NO. RZX10180205
MOD. NO.			M14195	M14320									SHEET 2 OF 2 SHEETS
CHK'D			S.D	S P									
NAME	ALI	LDG	LDG	L.A.S									

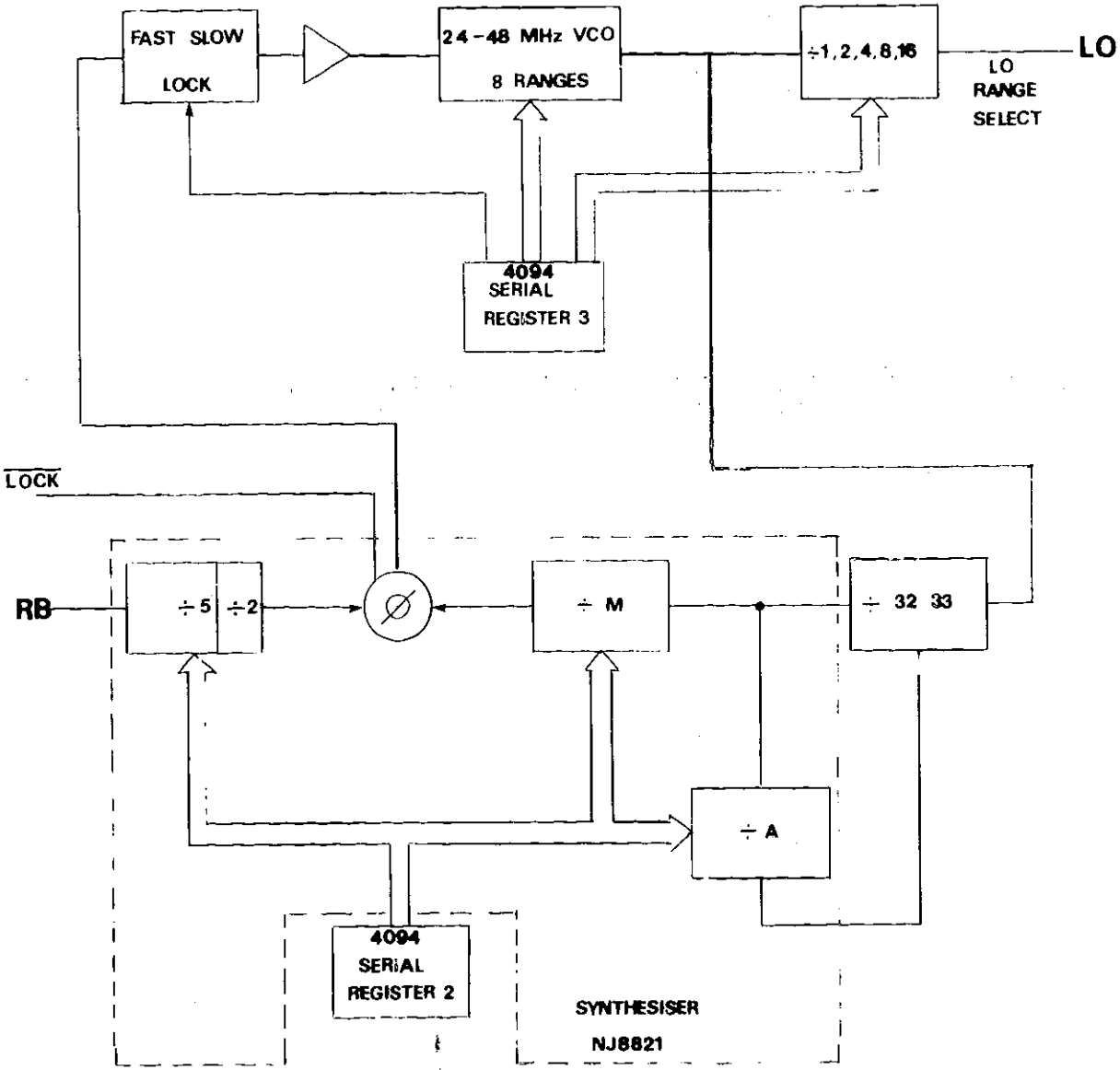


ISS	B	C	D	E						USED ON:	NOTES:	FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH	
DATE	4.5.88	27.9.88	31.8.89	14.8.90						AMM2000 F10180	ALL CAPACITOR VALUES IN F. ALL RESISTOR VALUES IN OHMS. * NOT FITTED	TITLE: MIXER BOARD CIRCUIT DIAGRAM	DRAWING NO. RZX10180205
MOD. NO.			M14135	M14328									SHEET 1 OF 2SHEETS
CHK'D	S.D	S.D	S.D	S.D							UNLESS OTHERWISE STATED		
NAME	ALI	LDG	LDG	L.A.S									


C214
U206
14
S203
R260
R259
R226
C213
C245
R227
R240
R232
R229
C215
Q214
R228
R261
C217
R230
Q205
P201
R231
R233
C218
C216
U203
16
C219
C222
R221
R234
R236
R238
C228
C225
C247
L210
L208
L206
C229
C226
C223
L211
L209
L207
C230
C227
C224
R237
R235
R225
RL5
RL4
RL3
RL6
RL2
RL1
D210
D209
D208
D211
D207
R239
R252
C238
R251
I-O
C220
C240
U205
R254
C241
R253
Q210
S204
TP3
C239
R214
C207
C231
Q206
C232
R243
R241
R242
D207
C233
R244
R246
R245
C249
D208
C243
X201
C234
C236
X202
L212
D209
X203
R247
C235
X210
Q213
L213
R248
D212
X204
X205
R249
C237
R250
X215
TP4
X208
C212
R224
X207
C206
L202
L201
L203
L204
C208
C209
TP2
S202
C205
Q204
R223
R222
R201
Q201
R203
R220
D201
R204
X213
X206
R207
U201
R202
R216
U202
14
14
1
D206
R217
R215
D204
R219
C204
R206
R209
R208
U204
16
R211
R218
R212
10
C203
R210
+C201
+C202
P202
R263
C221
Q202
E
C
R205
D202
D203
S201
Q203
R213
Q212
C242
Z201
R255
R257
R256
C246
Z204
R258
X211

LOCAL OSCILATOR BOARD BLOCK DIAGRAM

32W10180236 ISS A 3.89



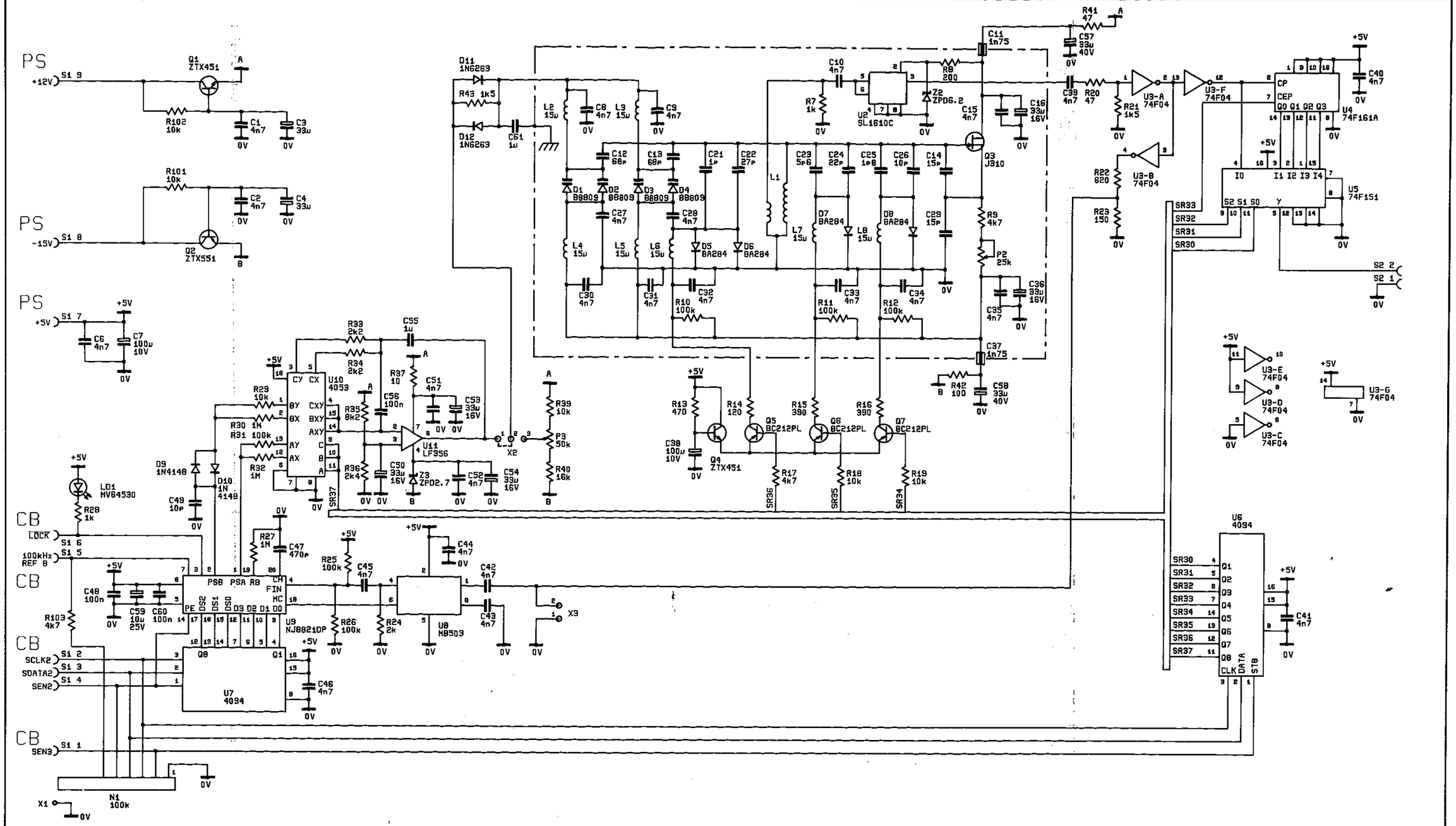
SERIAL REGISTER 3 CONTROL CODES

LO RANGE NO	MHz	SR OUTPUTS 37	36	35	34	33	32	31	30
0	24-48					L	L	L	L
1	12-24					H	L	L	H
2	6-12					H	L	H	L
3	3-6					H	L	H	H
4	1·5-3					H	H	L	L
5	OFF					H	H	L	H
VCO RANGE NO	MHz								
0	41-48		H	H	H				
1	36·5-41		H	H	L				
2	33·5-36·5		H	L	H				
3	31-33·5		H	L	L				
4	29-31		L	H	H				
5	27·5-29		L	H	L				
6	26-27·5		L	L	H				
7	24-26		L	L	L				
FAST LOCK		H							

SERIAL REGISTER 2 CONTROL CODES

FREQUENCY WORD NO	SR OUTPUTS 27	26	25	24	23	22	21	20
0	X	L	L	L	B6	B5	L	L
1	X	L	L	H	B10	B9	B8	B7
2	X	L	H	L	L	L	B12	B11
3	X	L	H	H	B3	B2	B1	B0
4	X	H	L	L	L	L	L	B4
5	X	H	L	H	L	H	L	H
6	X	H	H	L	L	L	L	L
7	X	H	H	H	L	L	L	L

NOTE: WORDS ARE TRANSFERED SERIALLY AND ALWAYS END WITH WORD 1 13 BIT FREQUENCY DATA IS B0 THOUGH TO B12



ISS	A	B
DATE	31/7/89	17/10/89
MOD. NO.	-	14195
CHK'D	PDT	PDT
APPR	LDG	JEC

USED ON: AMM2000 F10180

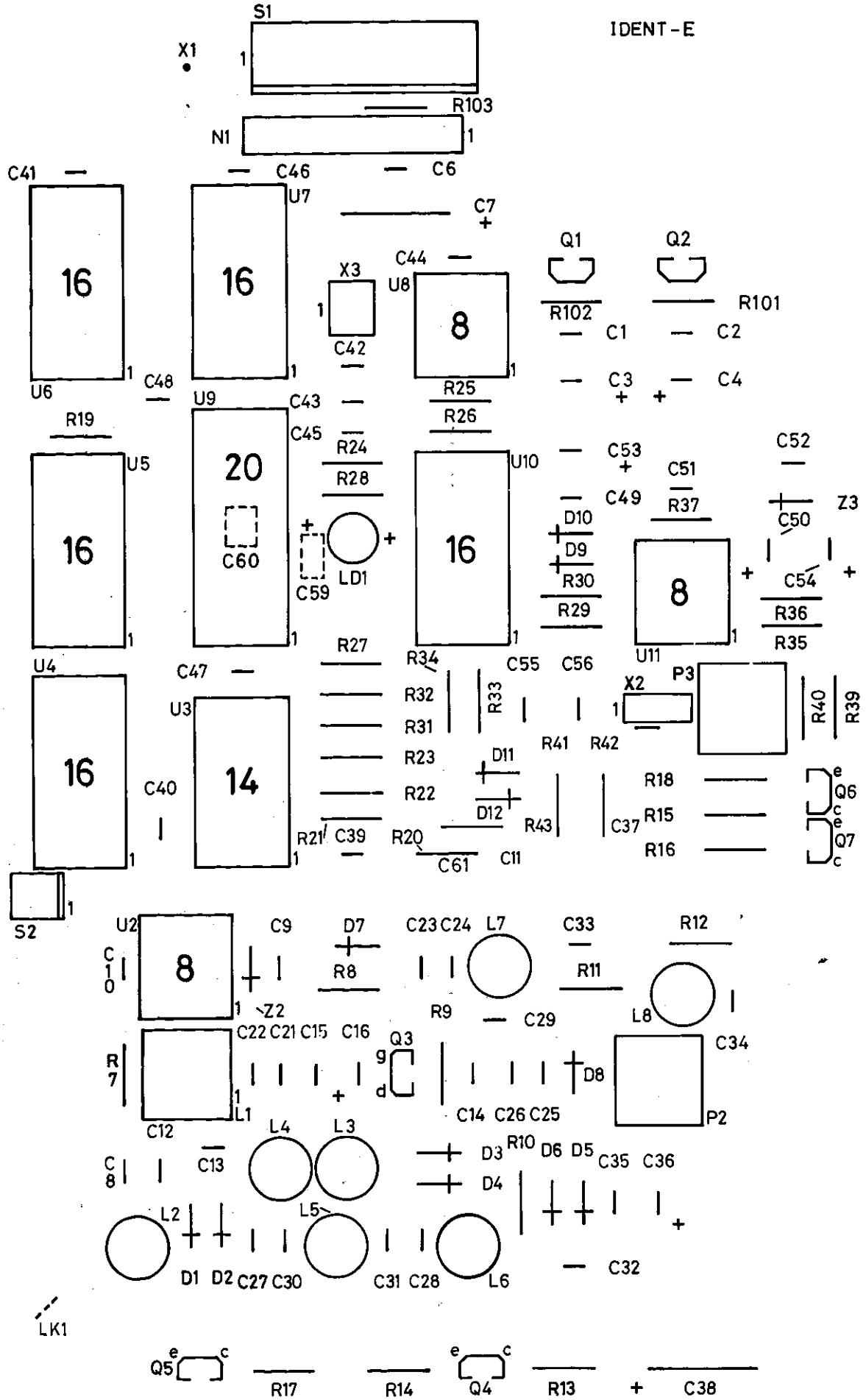
NOTES: ALL CAPACITOR VALUES IN F. ALL RESISTOR VALUES IN OHMS. UNLESS OTHERWISE STATED

FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH

TITLE: LOCAL OSCILLATOR BOARD CIRCUIT DIAGRAM — LO

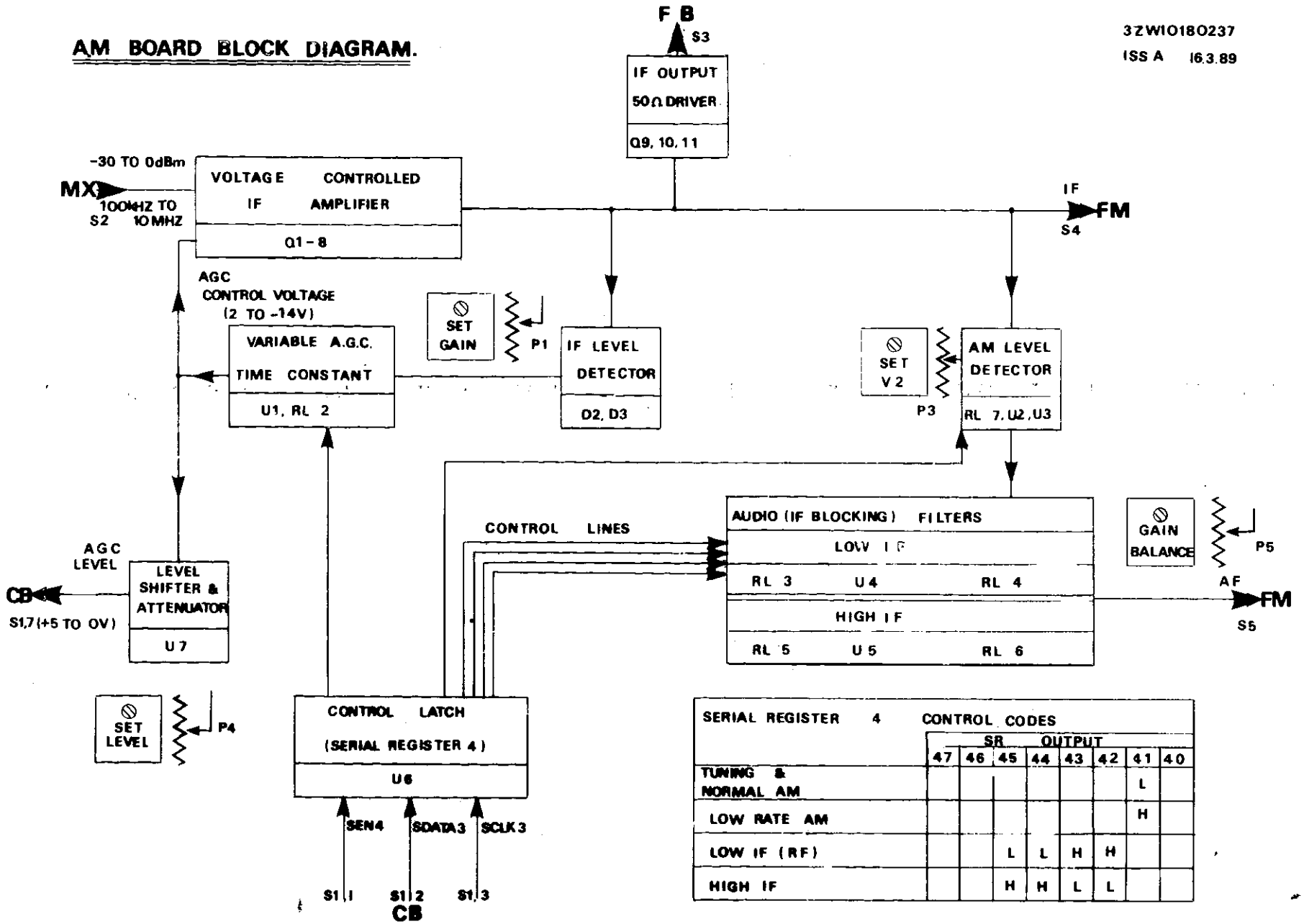
DRAWING NO. RZX10180206

SHEET 1 OF 1 SHEETS

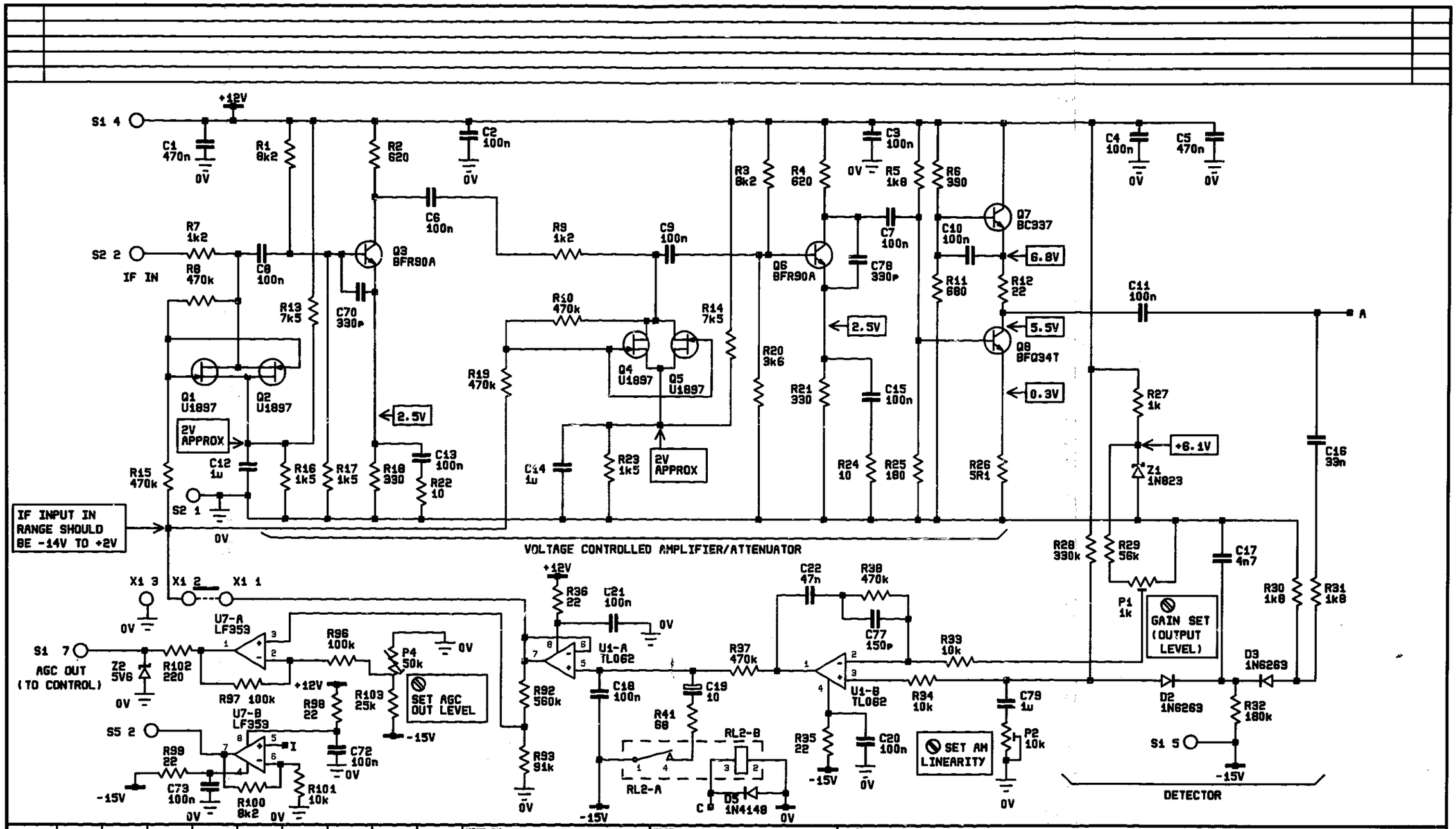

IDENT-E
S1
X1
R103
N1
C41
C46
C6
U7
C7
Q1
Q2
16
16
X3
C44
U8
8
R102
R101
C1
C2
C42
C48
R25
C3
C4
U6
U9
C43
R26
R19
C45
20
R24
C53
C52
U5
R28
U10
C51
C49
R37
Z3
C60
D10
C50
16
16
D9
C59
LD1
R30
8
C54
R29
R36
R35
U11
R27
R34
C55
C56
U4
C47
X2
P3
R32
R33
R40
R39
U3
R31
R41
R42
16
14
R23
D11
R18
Q6
C40
R22
R15
C37
R43
D12
C39
R20
R21
C61
C11
R16
Q7
S2
U2
C9
D7
C23 C24
L7
C33
R12
C10
8
R8
R11
Z2
R9
C29
L8
C22 C21 C15 C16
Q3
C34
R7
g
d
D8
L1
C14 C26 C25
P2
C12
L4
L3
R10
D6 D5
C35 C36
C8
C13
D3
D4
L2
L5
D1 D2 C27 C30
C31 C28
L6
C32
LK1
Q5
R17
R14
Q4
R13
C38

AM BOARD BLOCK DIAGRAM.

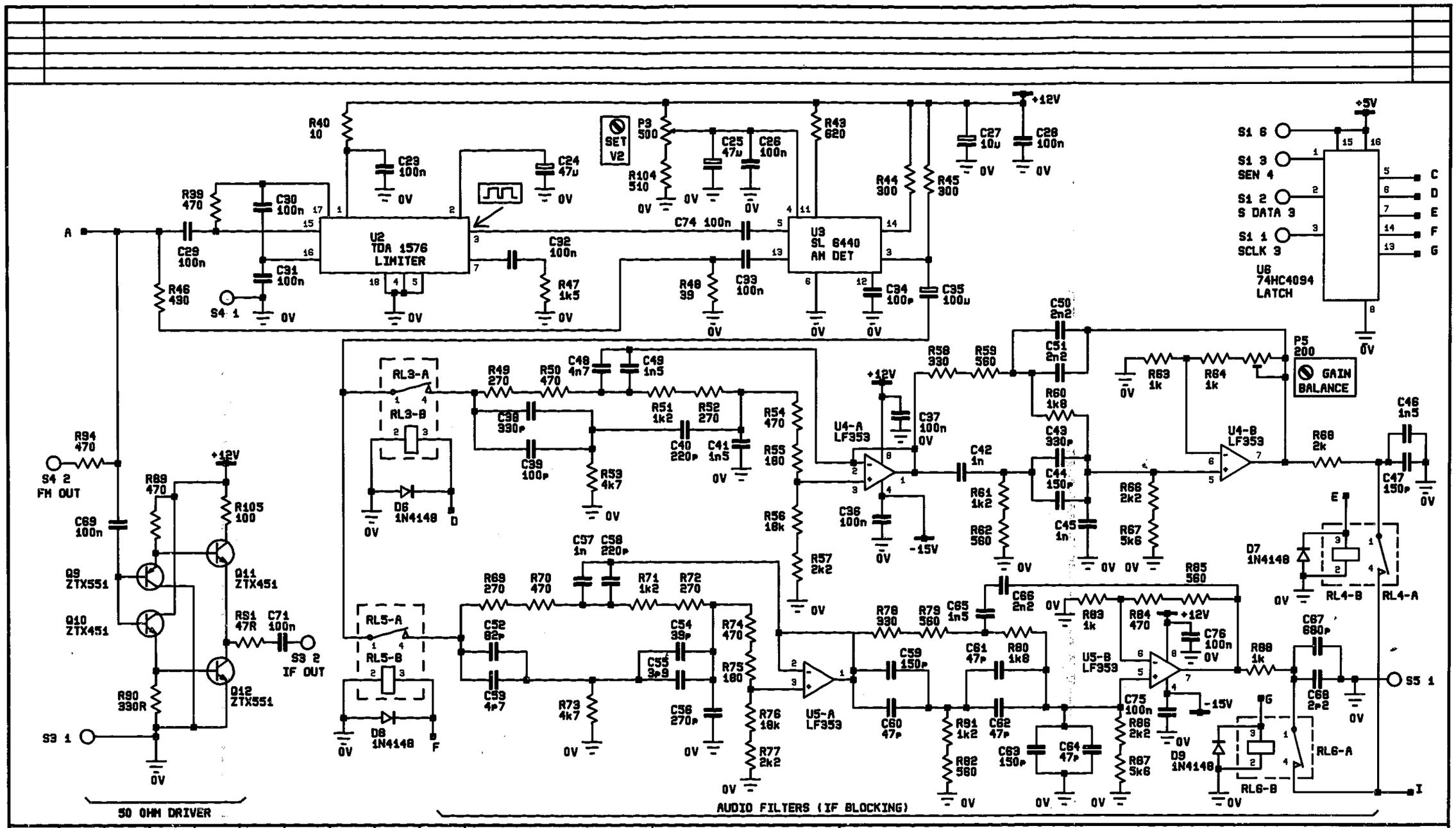
3ZW10180237
ISS A 16.3.89



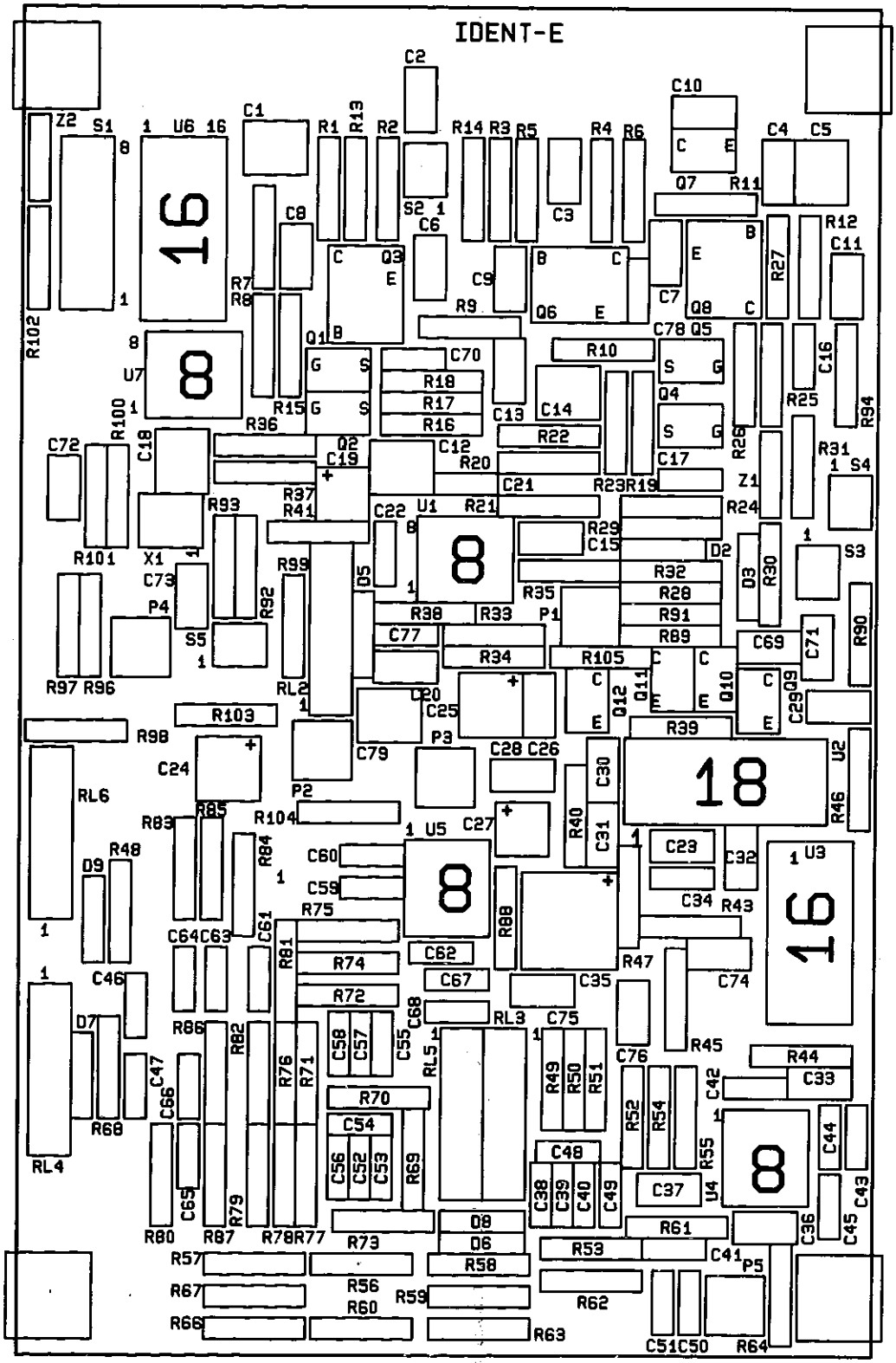
SERIAL REGISTER 4 CONTROL CODES	SR OUTPUT							
	47	46	45	44	43	42	41	40
TUNING & NORMAL AM							L	
LOW RATE AM							H	
LOW IF (RF)			L	L	H	H		
HIGH IF			H	H	L	L		



ISS	A	B	C	D						USED ON: AMM2000 F10180	NOTES: ALL CAPACITOR VALUES IN F. ALL RESISTOR VALUES IN OHMS. UNLESS OTHERWISE STATED	FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH	
DATE	8 11 87	4.10.88	15.9.89	14.8.90								TITLE: AM BOARD CIRCUIT DIAGRAM	DRAWING NO. RZX10180207
MOD. NO.			M14195	M14690									SHEET 1 OF 2SHEETS
CHK'D				PWS									
NAME	ALI	LDG	LDG	L.A.S									

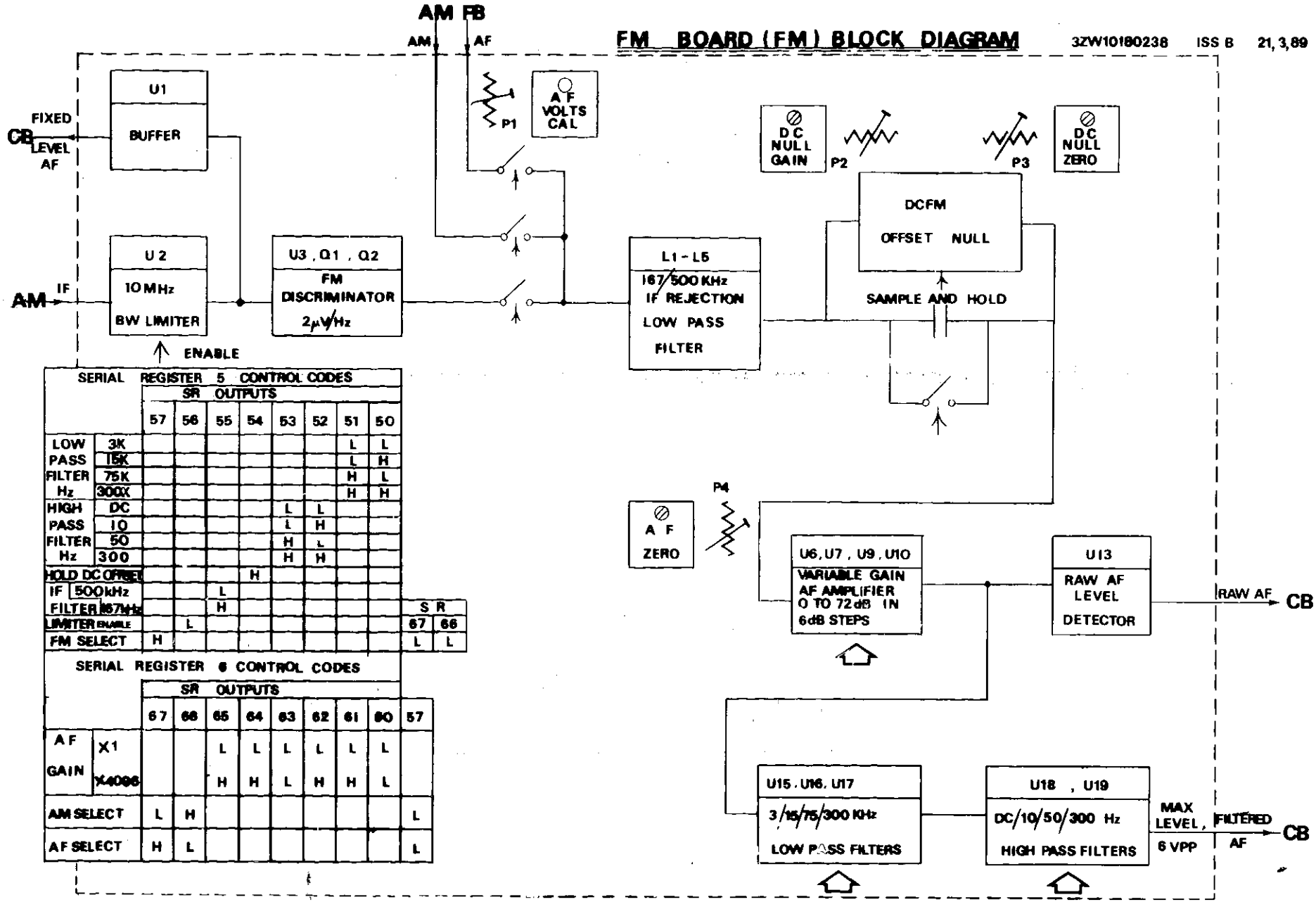


ISS	A	B	C	D						USED ON:	NOTES:	FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH
DATE	18 11 87	3.10.88	15.9.89	14.8.90						F10180	ALL CAPACITOR VALUES IN F. ALL RESISTOR VALUES IN OHMS.	TITLE: AM BOARD CIRCUIT DIAGRAM
MOD. NO.			M14195	M14559								DRAWING NO. RZX10180207
CHK'D				AB							UNLESS OTHERWISE STATED	SHEET 2 OF 2SHEETS
NAME	ALI	LDG	LDG	L.A.S								


IDENT-E

FM BOARD (FM) BLOCK DIAGRAM

3ZW10180238 ISS B 21,3,89

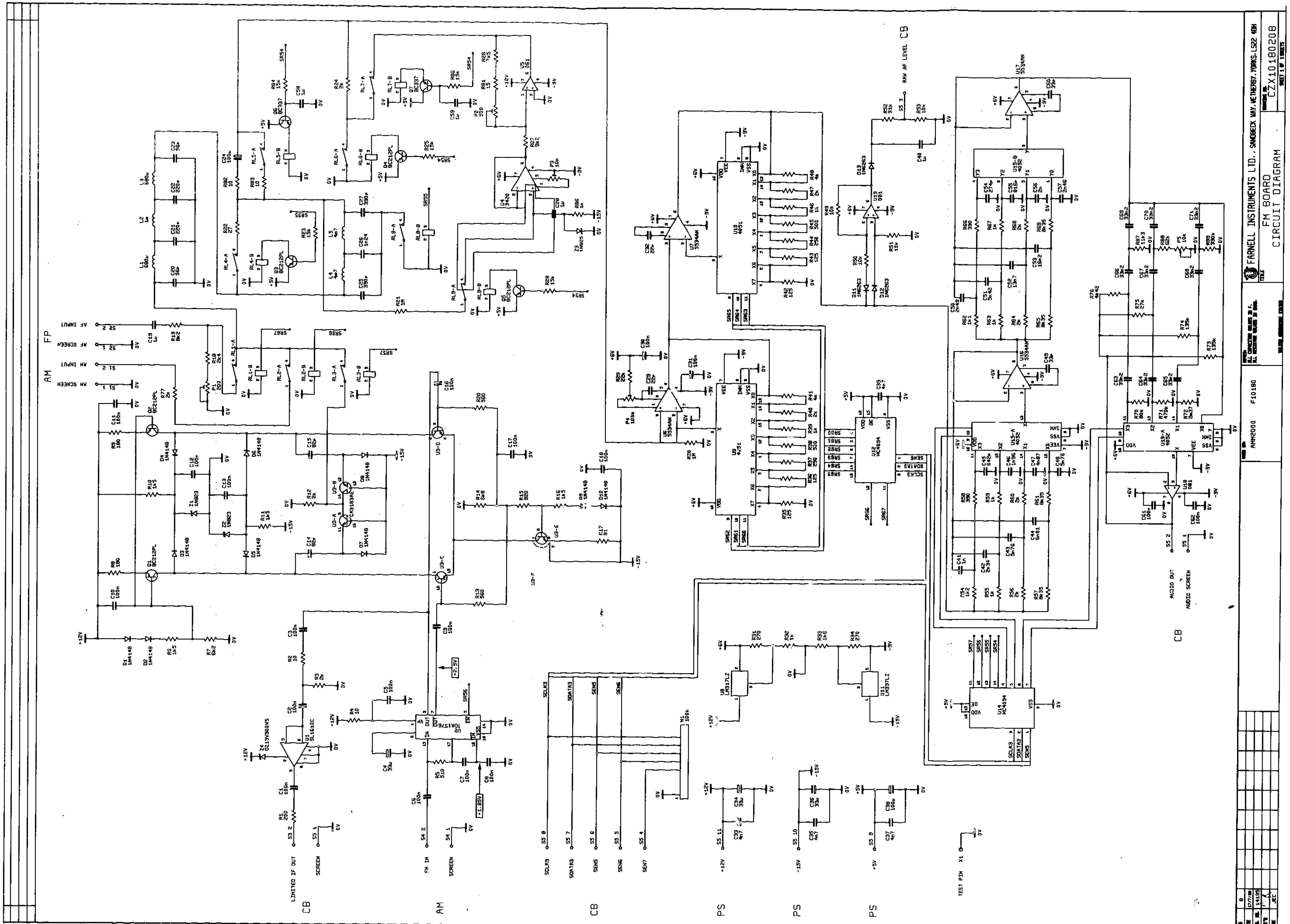


SERIAL REGISTER 5 CONTROL CODES

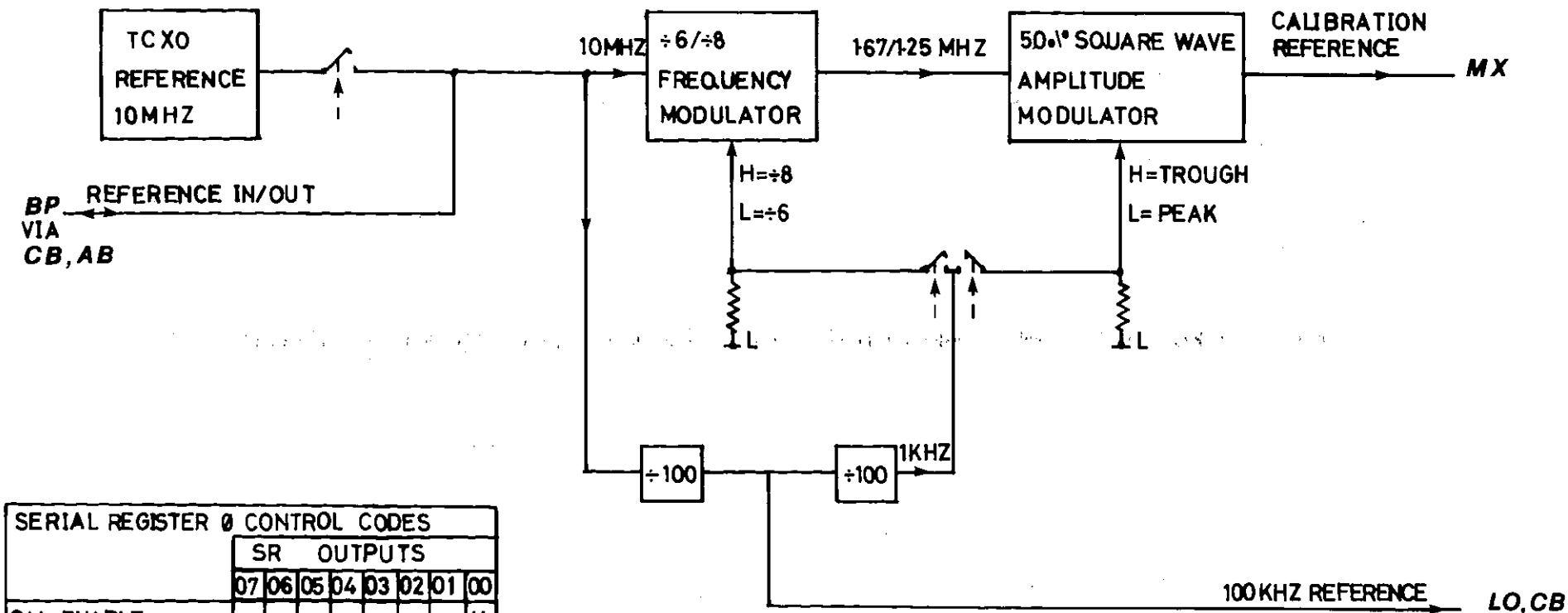
		SR OUTPUTS								S R	
		57	56	55	54	53	52	51	50		
LOW PASS FILTER	3K							L	L		
	15K							L	H		
	75K							H	L		
	300K							H	H		
HIGH PASS FILTER Hz	DC					L	L				
	10					L	H				
	50					H	L				
	300					H	H				
HOLD DC OFFSET					H						
IF FILTER	500kHz			L							
	167kHz			H							
LIMITER ENABLE			L							67	66
FM SELECT		H								L	L

SERIAL REGISTER 6 CONTROL CODES

		SR OUTPUTS								
		67	66	65	64	63	62	61	60	57
AF GAIN	X1			L	L	L	L	L	L	
	X4096			H	H	L	H	H	L	
AM SELECT		L	H							L
AF SELECT		H	L							L

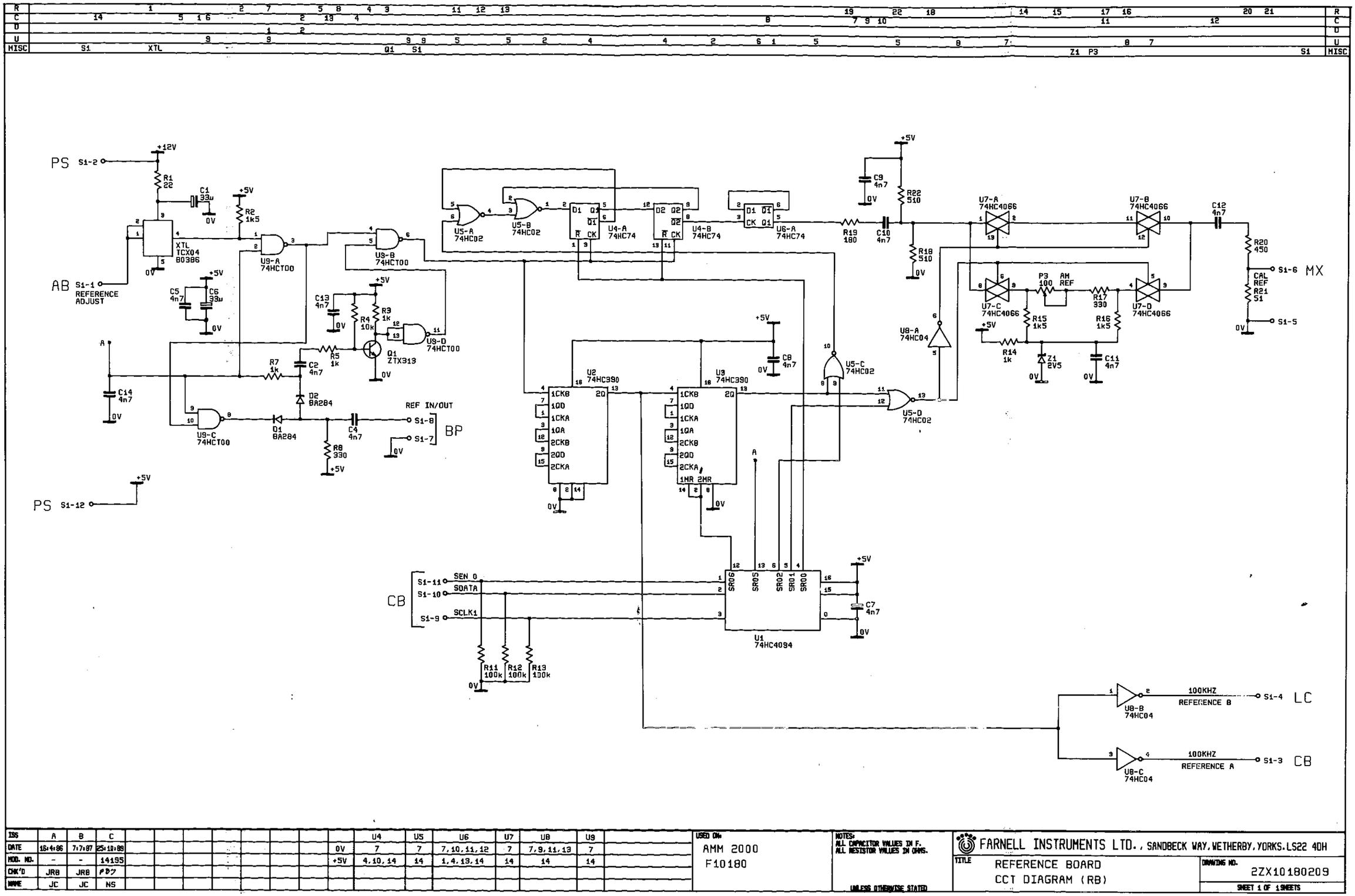

FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH
FM BOARD
CIRCUIT DIAGRAM
CZX10180208
AMM2000
F10180
RAW AF LEVEL CB
AUDIO OUT
AUDIO SCREEN
LIMITED IF OUT
TEST PIN X1

IDENT-D



SERIAL REGISTER Ø CONTROL CODES	SR OUTPUTS							
	07	06	05	04	03	02	01	00
CAL ENABLE								H
AM ENABLE							L	
FM ENABLE						L		
EXT REF ENABLE			L					
CAL ENABLE		L						

Reference Board
Block Diagram 4ZW10180239 ISS-A



ISS	A	B	C
DATE	15:4:86	7:7:87	25:10:89
MOD. NO.	-	-	14195
CHK'D	JRB	JRB	PBP
NAME	JC	JC	NS

	U4	U5	U6	U7	U8	U9
0V	7	7	7,10,11,12	7	7,9,11,13	7
+5V	4,10,14	14	1,4,13,14	14	14	14

USED ON: AMM 2000 F10180

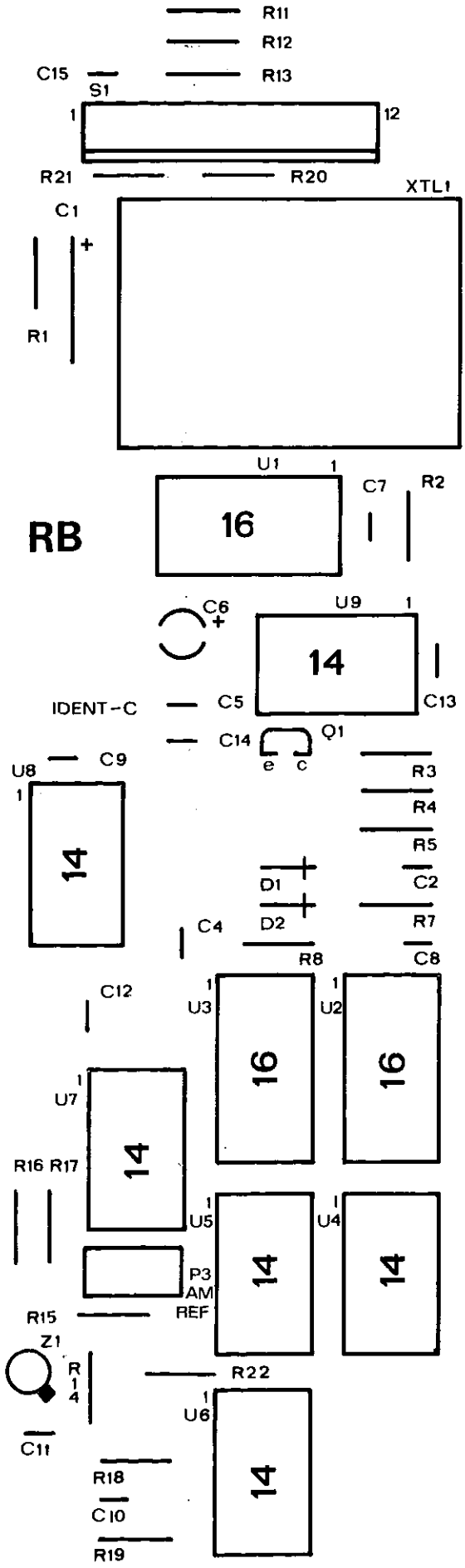
NOTES: ALL CAPACITOR VALUES IN F. ALL RESISTOR VALUES IN OHMS. UNLESS OTHERWISE STATED

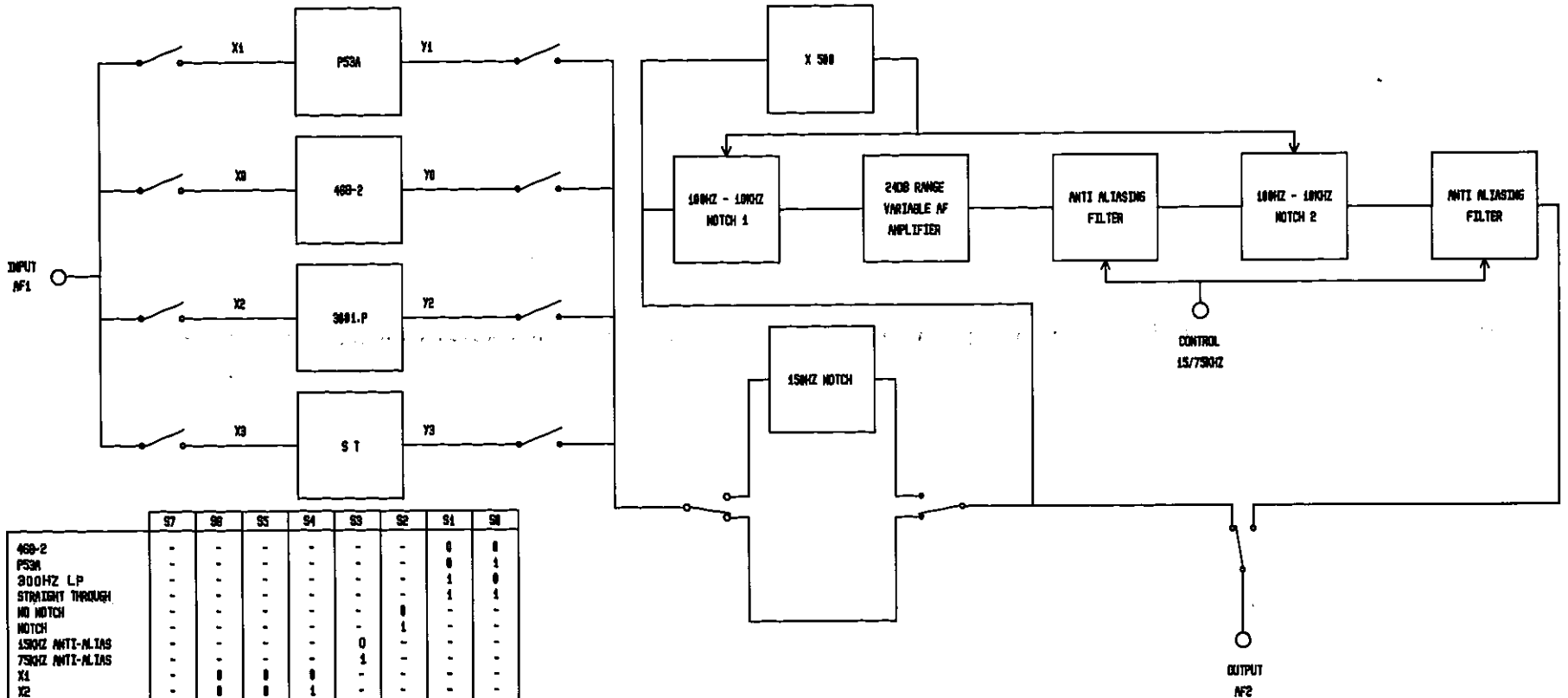
FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH

TITLE: REFERENCE BOARD CCT DIAGRAM (RB)

DRAWING NO. 2ZX10180209

SHEET 1 OF 1 SHEETS


R11
R12
C15
R13
S1
1
12
R21
R20
XTL1
C1
+
R1
U1
1
C7
R2
RB
16
C6
+
U9
1
14
IDENT-C
C5
C13
C14
Q1
e
c
U8
C9
R3
1
R4
14
R5
D1
C2
C4
D2
R7
R8
C8
C12
1
U3
1
U2
16
16
1
U7
14
R16 R17
1
U5
1
U4
14
14
P3
AM
REF
R15
Z1
R
1
4
R22
1
U6
C11
14
R18
C10
R19



	S7	S6	S5	S4	S3	S2	S1	S0
469-2	-	-	-	-	-	-	0	0
P53A	-	-	-	-	-	-	0	1
300HZ LP	-	-	-	-	-	-	1	0
STRAIGHT THROUGH	-	-	-	-	-	-	1	1
NO NOTCH	-	-	-	-	-	0	-	-
NOTCH	-	-	-	-	-	1	-	-
15KHZ ANTI-ALIAS	-	-	-	-	0	-	-	-
75KHZ ANTI-ALIAS	-	-	-	-	1	-	-	-
X1	-	0	0	0	-	-	-	-
X2	-	0	0	1	-	-	-	-
X4	-	0	1	0	-	-	-	-
X8	-	0	1	1	-	-	-	-
X16	-	1	0	0	-	-	-	-
X32	-	1	0	1	-	-	-	-
15KHZ NOTCH OUT	0	-	-	-	-	-	-	-
15KHZ NOTCH IN	1	-	-	-	-	-	-	-

ISS	B	C
DATE	4.7.90	28.1.91
MOD. NO.		-
CHK'D		JR
NAME	SMC	LOG

USED ON:

NOTES:
ALL CAPACITOR VALUES IN F.
ALL RESISTOR VALUES IN OHMS.

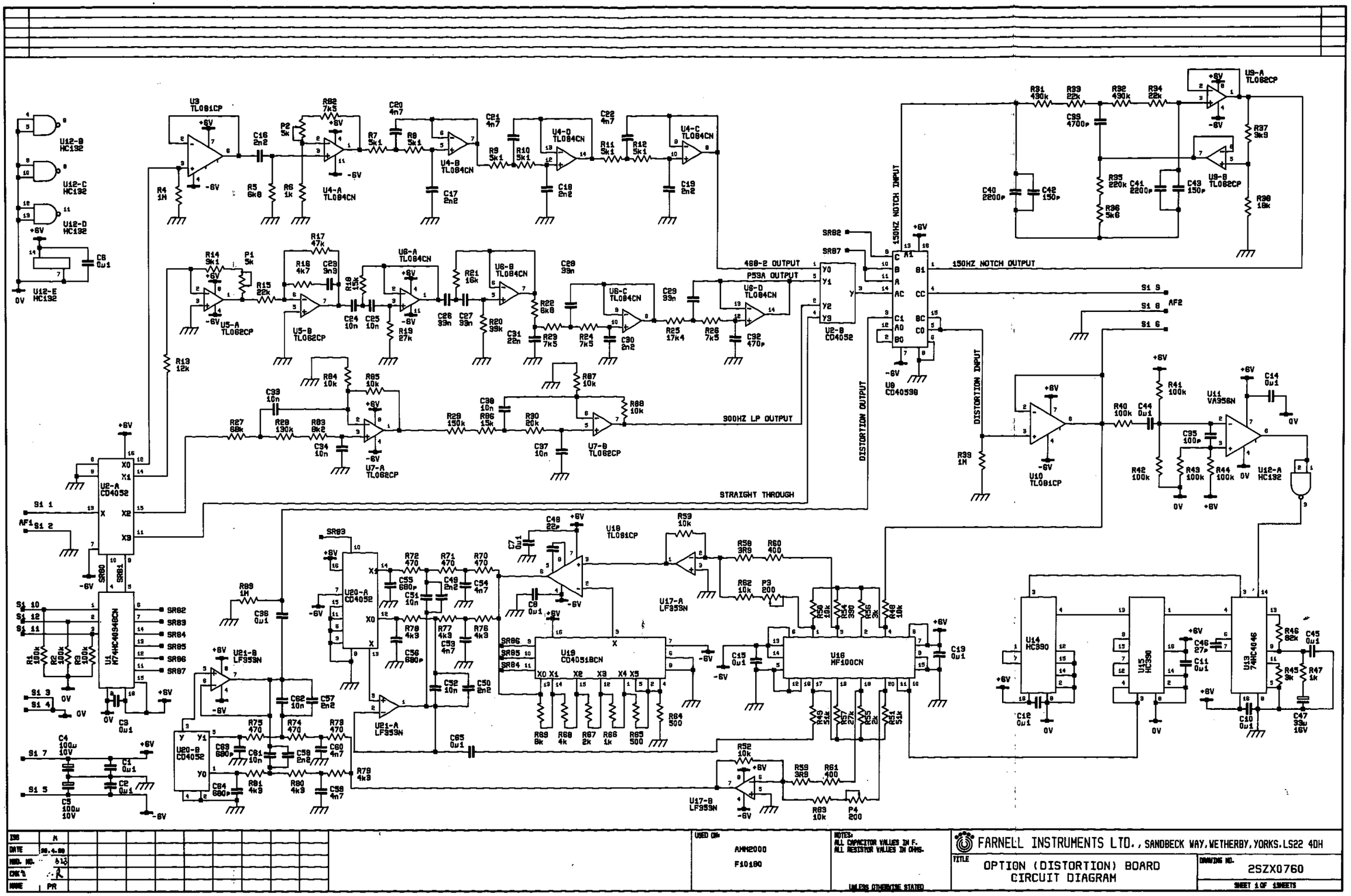
UNLESS OTHERWISE STATED

FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH

TITLE
AMM2000 OPTION BOARD
BLOCK DIAGRAM

DRAWING NO.
3ZW10180240

SHEET 1 OF 1 SHEETS



ISS	A
DATE	26.4.89
MOD. NO.	513
CHK'D	
NAME	PR

USED ON: AMM2000, F10180

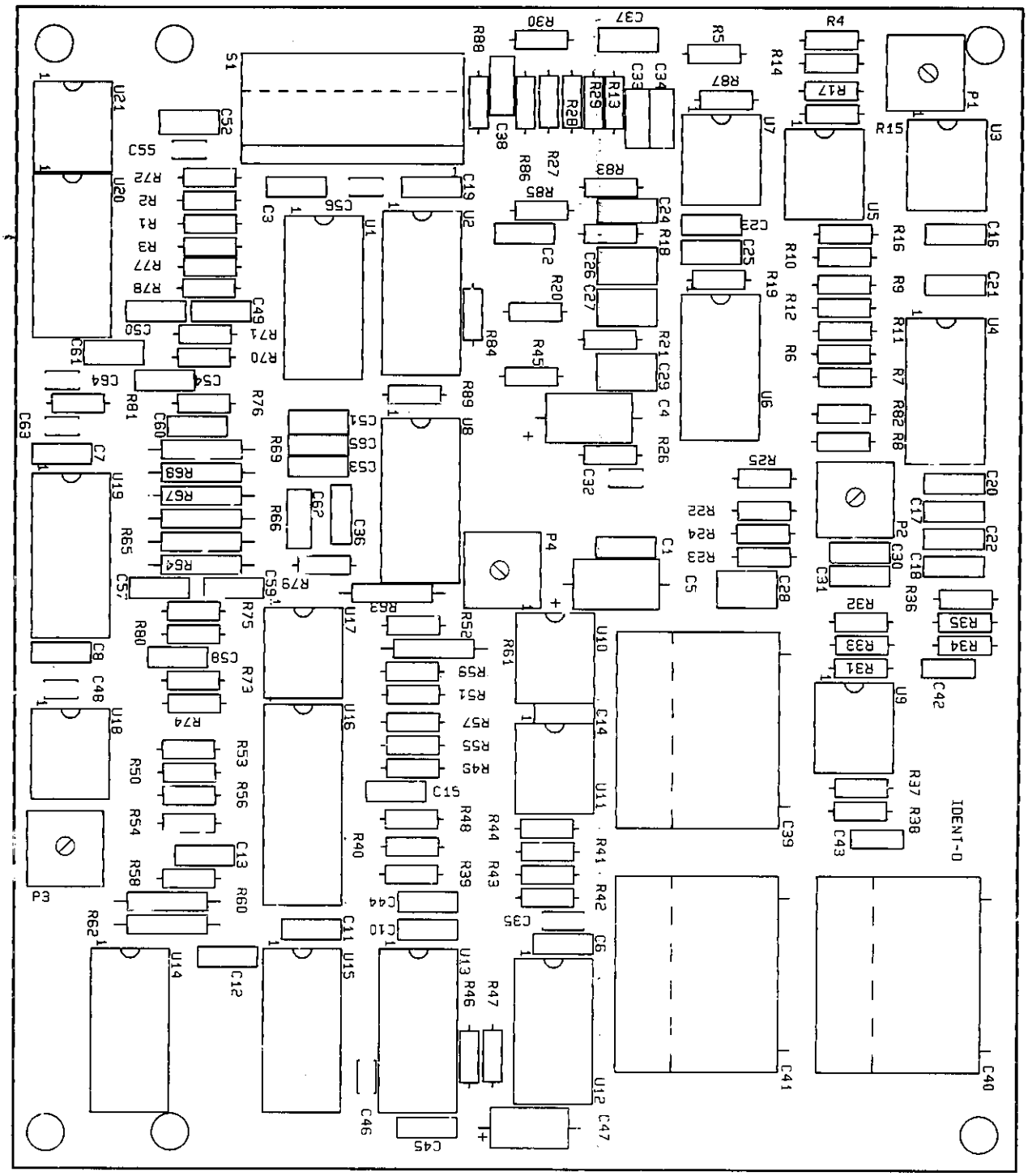
NOTES: ALL CAPACITOR VALUES IN F. ALL RESISTOR VALUES IN OHMS. UNLESS OTHERWISE STATED

FARNELL INSTRUMENTS LTD., SANDBECK WAY, WETHERBY, YORKS. LS22 4DH

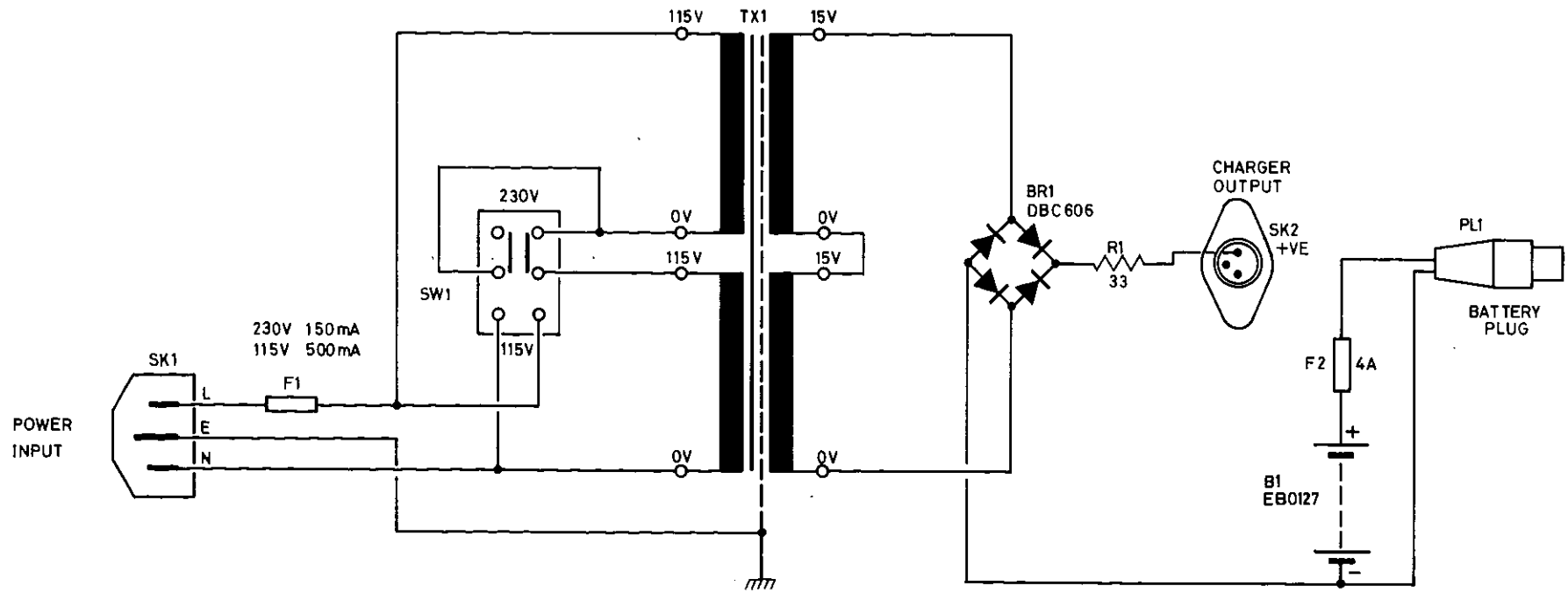
TITLE: OPTION (DISTORTION) BOARD CIRCUIT DIAGRAM

DRAWING NO. 2SZX0760

SHEET 1 OF 1SHEETS


IDENT-D

R												
MISC	SK1	F1	SW1	TX1	R1	BR1	SK2	B1	F2	PL1		



TRACED	ISS.	DATE	MOD. No.	ISS.	DATE	MOD. No.	USED ON
CHECKED SD							F10059
DRAWN AC	A	7.12.87					

NOTE:
CAPACITOR VALUES GIVEN IN µF
RESISTOR VALUES IN Ω
UNLESS OTHERWISE STATED.

FARNELL INSTRUMENTS LTD. WETHERBY, YORKS.

TITLE RE CHARGEABLE BATTERY OPTION

DRAWING No. 3ZX10059100

SHEET 1 OF 1 SHEETS

AARQUE 9255784

QTY.		SHT. OF	DWG. 4	ML 10052 002
USED ON	PSG1000A F10052	ASSEMBLY TITLE 24/28VDC INPUT OPTION		
		TO BE KIT BY MARSHALLED	KIT MARSHALLED ON	

FARNELL INSTRUMENTS LTD. | No. OFF | F | DRAWN LDG | CHECKED

ITEM No.	REF. No.	ORIGIN OF PART	DESCRIPTION	PART No.	ISSUE	QUANTITY PER	QUANTITY TOTAL	QUANTITY ISSUED
1	RL1	BOF	24V RELAY	SRHC424		1		
3	R18	BOF	1K5Ω MRS25	RM41K502S		1		
5	Q3	BOF	HEXFET IRF530	VF530		1		
6	Q4	"	" "	"		1		

ISSUE	A
DATE	14.5.87
MOD. No	—

UNIT KEY

FARNELL INSTRUMENTS LTD.

TYPE	COMPUTER No.	Sht	of	Shts	
PSG1000E	~~17PSG1000E~~ 15A20100	1	1		UK10053

	DRAWING No.	COMPUTER No.	DESCRIPTION	QTY	ISS	MODIFICATION REF
1	2SUDC2529	HB2529	HANDLE BKT	1	A	2
2	2SUDC2530	HB2530	HANDLE BKT EXT	1	A	2
3	—	KC4MB	M4x8mm C/S SCREWS	8	-	
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

REF	1	2	3	4	5	6	7	8	9	10
ISSUE	A	B	C							
DATE	14.5.87	23/2/89	30/11/90							
MOD	—	M13811								
DRAWN	11	12	13	14	15	16	17	18	19	20
DATE										

QTY.		SHT. 1 OF 1	DWG. 4	ML. 17PSG1000O
USED ON	PSG 1000 'O'	ASSEMBLY TITLE: HIGH STABILITY FREQ REFERENCE		
		TO BE KIT BY MARSHALLED	KIT MARSHALLED ON	

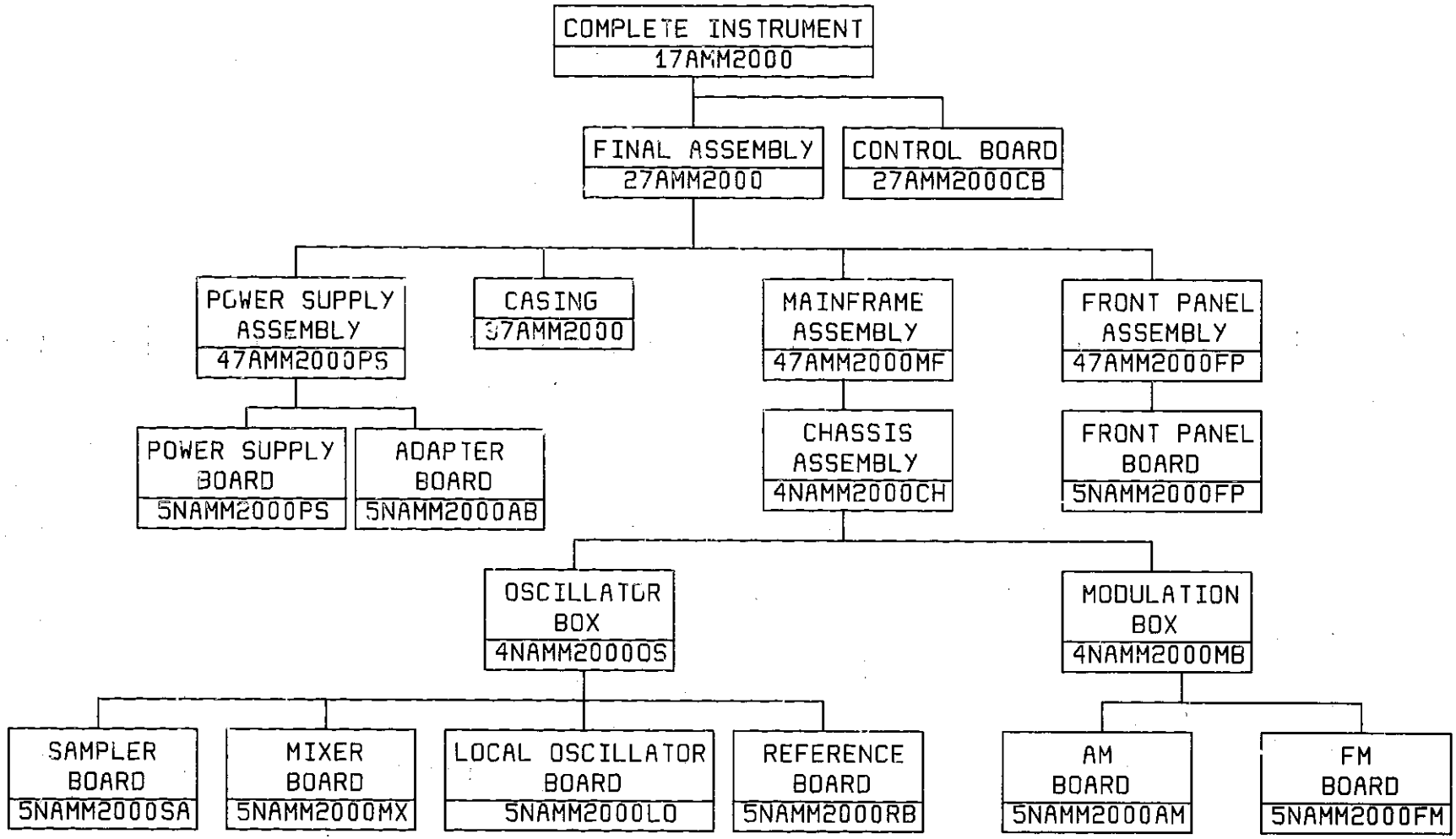
FARNELL INSTRUMENTS LTD.	No. OFF	F	DRAWN	CHECKED
			LDG	

ITEM No.	REF. No.	ORIGIN OF PART	DESCRIPTION	PART No.	ISSUE	QUANTITY PER	QUANTITY TOTAL	QUANTITY ISSUED
1	XTL1	BOF	STC K1270	VX10MK1270		1		

ISSUE	A
DATE	23.2.89
MOD. No	—

NOTE: 5N ARE CIRCUIT BOARD NUMBERS
4N AND 47 ARE ASSEMBLY NUMBERS

DRAWING NUMBER RZW10180245



F A R N E L L I N S T R U M E N T S L T D

DATE : 2/21/91 P A R T S L I S T PAGE NO : 1

MAIN UNIT ITEM NUMBER : 17AMM2000 DESCRIPTION : TEL/I *AMM2000 *0180

IMPORTANT EXPLANATION - PLEASE READ BEFORE ORDERING PARTS.
DUE TO LIMITATIONS IN THE NUMBER OF CHARACTER SPACES AVAILABLE THE INFORMATION IN THE CIRCUIT REFERENCE FIELD HAS BEEN ABBREVIATED AND THE FOLLOWING NOTES ARE PROVIDED AS A GUIDE TO IT'S INTERPRETATION:

1. WHERE A COMPONENT IS USED MORE THAN ONCE ON AN ASSEMBLY THE ALPHABETIC PORTION OF THE CIRCUIT REFERENCE FOR ITS SECOND AND SUBSEQUENT LOCATIONS HAS BEEN OMITTED; EG. THE CIRCUIT REFERENCE INFORMATION FOR A COMPONENT LOCATED AT R1 AND R6 WILL APPEAR AS R1 6
2. THE CIRCUIT REFERENCE NUMBERS ARE PRESENTED IN ASCENDING DECADE BLOCKS DELIMITED BY COLONS: SECOND AND SUBSEQUENT NUMBERS WITHIN A DECADE BLOCK REPRESENT ONLY THE UNIT VALUE OF THE LOCATION (THE TENS AND HUNDREDS VALUES BEING IMPLIED); EG. FOR A COMPONENT LOCATED AT R54,R57,R59,R82,R87,R102,R110, AND R112 THE CIRCUIT REFERENCE ENTRY WILL BE R54 7 9:82 7:102:10 2
3. WHERE COMPONENTS ARE USED IN A SERIES OF NEIGHBOURING CIRCUIT REFERENCE LOCATIONS THE CIRCUIT REFERENCE NUMBERS ARE REPRESENTED AS INCLUSIVE BLOCKS USING A HYPHEN; EG. A COMPONENT LOCATED AT R16,R19,R21,R24,R25,R26,R31,R37,R38,R39,R40,R44 AND R46 WILL BE REPRESENTED AS R16 9:21 4-6:31 37-40 4 6 (AN EXCEPTION TO THE RULES OCCURS WHEN A SERIES CROSSES A DECADE BLOCK IN WHICH CASE THE TENS VALUE IS INSERTED.
4. COMMENTS ARE PRECEDED BY A SEMICOLON.

WHEN ORDERING REPLACEMENT PARTS PLEASE BE SURE TO QUOTE THE PART NUMBER PROVIDED.

FARNELL PART NUMBER	DESCRIPTION	CIRCUIT REFERENCE
27AMM2000		END ITEM: FIN/C *FINAL ASSY
37AMM2000		CASING: CAS/C *CASING
7SU2438	1DB/A *TOP COVER A	
AAS2C	ALUM SHT 20SWG S1C1/2H	
7SU2439	1DB/B *BOTTOM COVER A	
AAS2C	ALUM SHT 20SWG S1C1/2H	
NC3M1ZC	PSM PS-4-40-1 M3TAP	
7SU2440	2DA/A *FOOT RETNR	
NC3M1ZC	PSM PS-4-40-1 M3TAP	
ASS2CZ	ZINTEC STEEL 20SWG	
7SX2519	200/A *SIDE TRIM	
AXC057	3SX/A *SIDE TRIM	
HFC067	2SV/C *MOULDED FOOT	
HFCJ7C	4SV/A *FOOT INSERT	
HFC011	3ZT/A *FOOT & LEG ASM	
3RC053	4SX/B *S/TRIM INSERT	
JPC019	3SJ/A *PSG1000	
T3212	SKT 3W RPC212P3C	
HW3114003	40C/A *EXTRACTOR	
HCC01C	4SC/A *COAX ASM	
HC22V2	PLUG & LEAD 22/V/2	
TR201A	BNC ADPT US201A/U RAD	
T3M2506HP	6W 6471-1-22-01-2065	
9HAMM2000	MANUAL	9
47AMM2000PS		ASSEMBLY: FIN/C *POWER SUPPLY
5NAMM2000PS		CCT BOARD: CPS/E *POWER SUPPLY
RM247R025	47R 1% MRS25 REEL	R15
RM3680R25	680R 1% MUL MRS25	R4
RM41K0025	1KOP 1% MRS25 REEL	R5 6

MAIN UNIT ITEM NUMEER : 17AMM2000 DESCRIPTION : TEL/I *AMM2000 *0180

FARNELL PART NUMBER	DESCRIPTION	CIRCUIT REFERENCE
RM43K9025	3K9R 1% MUL MRS25 REEL	R7:12
RM44K7025	4K7R 1% MRS25 REEL	R8:11
RM46K8025	6K8R 1% MUL MRS25	R3
RM543K025	43KR 1% MRS25/SMA0207	R13 4
RM547K025	47KR 1% MRS25 REEL	R9:10
CE233U0IEK	33UF 35V KMVB ECC	C10 3 5
CE247U0DFC	47UF 10V KMVB 5 PITCH	C5
CE41K00KE	1K0UF 50V KMVB ECC	C11
CE44K70FTM	4K7UF 16V TSU TAG MNT	C1 2
CFCU100LMKS	0.1UF 63V WIM MKS2MIN	C12 4 6 7:20
CFCU220LMKS2	0.22U 63V MKS2 10%	C18 9
CF0U470LMKS2	0.47UF 63V 10% MKS2	C3 4 8 9
DG3345	DIODE BYV133-45	D1
DG4148	DIODE 1N4148 REEL	D5-11
DG4003	DIODE 1N4003	D12
DBW02M	BRIDGE REDT W02G	BR1 2
DACMIT	DIODES OMITTED	D2-4
VA337T	INT CCT LM337T NAT	U3
PM41K0063P	1KOR SPL o3P	P1
PM71M00o3P	1MOR SPL 63P	P2
TBM3910P0	10w 26-20-2101	S1
TBM3905PS	5W 5238-39-28-1055	SX
TBM3906PS	6W 5238-39-28-1065	S2
TBM2510PS	10W 6410-22-27-2101	S3
VF22	HEXFET IRFZ22 *STATIC	Q3 4
VA2940CT12	VOLT REG LM2940CT12	U2
CE43K30GB	3K3UF 25V ALC20A	C7
VA4941	VOLTS REG L4941BV	U1
BC1129	S /C *AMM2000 PS*7PAT	B
VTNLGP	2N2222A BC337 TO92	Q1 2
MC1	CERAMIC BEAD IPB1 MET	BR1 2
MF2368	400/A *SIL PAD TO3P	U3
MBC017	4SV/F *M2.5 INS BUSH	
NF3M	NUT FULL M3	
NF25M	NUT FULL M2.5	
KP3M08S	SLTD M3 X 8 PAN	
KC25M8	POZI M2.5 X 8 CSK	
WS3M	WASHER SPRING M3	
WF25M	WASHER FLAT M2.5	
WS25M	WASHER SPRING M2.5	
RAOMIT	RESISTORS OMITTED	R1 2
CACMIT	CAPACITORS OMITTED	C6
RLINK24	24 SWG TC LINK	R18
5NAMM2000AB		CCT BOARD: CPS/B *ADAPTOR CB
BC1136	3 /C *AMM2000 *7PBA	B
PM510K043P	10KR SPL 43P	P1
TBM25C6PS	6W 6410-22-27-2061	S1
TIH2510NT3S	10w HEAD M52-1210-750	S2
SA5000A	SW TERM COVER 5000 SER	
SA35093RD	RED BUT 035093-001	
SB5020	6W P/B PBMS5020 4A 250	
SRHC4	RELAY HC4 12V DC	
SRHC4B	RL BASE HC4 SS	
TR35004	JACK SOR 35004C24H BNC	
TR30001	JACK CAP&CHAIN GE30001	
TGCJ4	MAINS FILTER VS/F 6J4	

MAIN UNIT ITEM NUMBER : 17AMM2000 DESCRIPTION : TEL/I *AMM2000 *0180

FARNELL PART NUMBER	DESCRIPTION	CIRCUIT REFERENCE
TK212	PLUG 3 POLE RPC212R83P	
FT4A00S503	4AMP A/S S503	F2
FH20C2	FUSE HOLDER L20C2	F
7SX2511	3DA/B *HEATSINK	
AX5D	EXTRN MAR 5D	
7SU2512	3DA/B *TRANS COVER KA	
NC3M1ZC	PSM PS-4-40-1 M3TAP	
NC3M8FH	PEMSTUD FH-M3-8-CI	
AAS181X1	ALUM SHT 18SWG 1M X 1M	
7SU2513	4BA/B *REG BRACKET KA	
NC3M1ZC	PSM PS-4-40-1 M3TAP	
AAS161X1	ALUM SHT 16SWG 1M X 1M	
7SU2514	1YA/E *PSU B/PANEL A	
AAS16	ALUM SHT 16SWG S1C1/2H	
NC3M8FH	PEMSTUD FH-M3-8-CI	
7SX2516	2BA/A *REAR XM TOP	
AX0058	3CI/B *REAR X MEMBER	
7SX2517	2BA/A *REAR XM BTM	
AX0058	3CI/B *REAR X MEMBER	
7SU2436	3CB/B *SWITCH BRKT KA	
NC3M1ZC	PSM PS-4-40-1 M3TAP	
ASS18	B/M STEEL 18SWG	
7SU3198	3DA/C *PSU B/PNL END K	
NC3M1ZC	PSM PS-4-40-1 M3TAP	
AAS181X1	ALUM SHT 18SWG 1M X 1M	
ZRC307	2SR/A *TOR TRX AMM2000	TX1
7ZF2843	4DD/A *TOR ANCHOR WSH	
AFS332	FIBGLASS SHT 3/32 THK	
99CF	COMP COST FACTOR	
TGD25	25W D CONNECTOR MALE	
TR161320	W SKT RADIAL R161320	
R444K7025	4K7R 1% MRS25 . REEL	R16 7
FT25CM11	250MA A/S TDC11	F1
TBM2506HP	ow o471-1-22-01-2065	B/P-C2
HR20418	SCREW LOK ED20418-2/TB	
7SU2841	4DA/A *TRANSFORMER PLT	
ASS162	ZINTEC STEEL 16SWG	
4CC162	4SC/B *24WAY CABEL ASS	
TK57F20	24w 57F20240-2C	
99CF	COMP COST FACTOR	
NR3M12TH	SPCR R10001oC 5-AF HAR	
47AMM2000MF		ASSEMBLY: SUB/C *MAIN FRAME ASSY
4NAMM2000CH		ASSEMBLY: SUB/A *CHASSIS ASSY
4NAMM20000S		ASSEMBLY: SUB/C *OSCILLATOR BOX
5NAMM20005A		CCT BOARD: CPS/A *SAMPLER CB
RUM2604FC0	60R4 1% MINI-MELF	R102 5
RUM3100GA0	100R 2% 1206	R101 6 7:14
RUM4150GA0	1K5R 2% 1206	R110
URM4150GA0	1K5R 2% 1206	
RUM4220GA0	2K2F 2% 1206	R108
RUM5100GA0	10KR 2% 1206	R109
URM5100GA0	10KR 2% 1206	
CUC3470JA0KC	470PF 5% 50V 1206 C0G	C102-104
UCC3470JA0KC	470PF 5% 50V 1206 C0	
CUC6100KA0KX	0U1F 10% 50V 1206 X7R	C101 7-9
UCC6100KA0KX	0U1F 10% 50V 1206 X7	

MAIN UNIT ITEM NUMBER : 17AMM2000 DESCRIPTION : TEL/I *AMM2000 *0180

FARNELL PART NUMBER	DESCRIPTION	CIRCUIT REFERENCE
CC12P20N642	2P2F 100V 663-09228	C106
VTR9CA	BFR90A/02 SOT37	Q102
SR1725	RELAY 172-5	RLA-RLC
RUM4200GA0	2K0R 2% 1206	R112
URM4200GA0	2K0R 2% 1206	
RM3470R25	470R 1% MRS25 REEL	R116
FUFNPC310	SST320 *25V* A024	Q101
BC1274	3 /B *MIXER 2 CB*7DKK	B
RUM3680GA0	680R 2% 1206	R111
URM3680GA0	680R 2% 1206	
ZF31	FER CORE 28-002-31	T101
RUM3150GA0	150R 2% 1206	R103
CI41K75L	1K75PF 100V 1214-001	C110-116
DUG2812	HSMS2812 DIODE	D101 4
DUG2813	HSMS2813	D103
DUG2814	HSMS2814	D102
SNAMM2000MX		CCT BOARD: CPS/D *MIXER C.B.
RM21CR025	10R 1% MRS25 REEL	R202 5:13:36 8
RM247R025	47R 1% MRS25 REEL	R222
RM251R025	51R 1% MUL MRS25	R260
RM31C0R25	100R 1% MRS25 REEL	R232-4:49:54:63
RM3150R25	150R 1% MUL MRS25	R261
RM3270R25	270R 1% MRS25 REEL	R247
RM3470R25	470R 1% MRS25 REEL	R223-225 7:35 7 9:43 6
RM3560R25	560R 1% MRS25 REEL	R242
RM41K0025	1K0R 1% MRS25 REEL	R229:44
RM41K8025	1K8R 1% MUL MRS25	R226
RM43K3025	3K3R 1% MRS25 REEL	R255 7
RM44K7025	4K7R 1% MRS25 REEL	R201:10 4
RM45K0025	5K0R 1% MUL MRS25	R259
RM48K2025	8K2R 1% MRS25 REEL	R216
RM51CK025	10KR 1% MRS25 REEL	R212 7:31:48:51
RM512K025	12KR 1% MRS25 REEL	R215
RM515K025	15KR 1% MRS25 REEL	R256 8
RM533K025	33KR 1% MUL MRS25	R211
RM556K025	56KR 1% MUL MRS25	R220
RM6100K25	100K 1% MRS25 REEL	R206-209:15 9
RM6180K25	180K 1% MUL MRS25	R250
RM71M0025	1M0R 1% MRS25 REEL	R203 4
FASOT	**** SELECT ON TEST **	R228
D34148	DIODE 1N4148 REEL	D201-204 206-211
DS0180	DIODE 5082-0180 HP	D212
DZ18V200W5	ZPD8.2 ITT	Z1 2
PM42K00o7	2K0R SPL M67 SERIES	P201
PM525K0o7T	25KR SPEC 67T	P202
VT328	BC328 NO NEW DES (PGP)	Q201-203:12 3
VTBF199	BF199 TO-92G	Q204:10
VT337	BC337 NO NEW DES (NGP)	Q205
VTR90A	BFR90A/02 SOT37	Q206 5:14
VT51	BF451 MUL ONLY SOT-37	Q207
VAC64CN	IC TL064CN *STATIC	U201
VA6440CDP	INT CCT SL6440CDP	U203
VD4001BCN	IC CD4001BE *STATIC	U202
VD74HC4094	IC M74HC4094BCN*STATIC	U204 5
T3M2510PS	10w 6410-22-27-2101	S201
T3M2502PS	2w 6410-22-27-2021	S202 4

MAIN UNIT ITEM NUMBER : 17AMM2000 DESCRIPTION : TEL/I *AMM2000 *0180

FARNELL PART NUMBER	DESCRIPTION	CIRCUIT REFERENCE
TBM2504PS	4W 6410 22-27 2041	S203
ZC15U10	CHOKE 15UH SC10 ITT	L203 4:10 1
ZC0290	3SR/C *YE315S 4 TURNS	L212
YE0315S	.315 BS4520/1 RED GD2	
ZF1115	FER BEAD FX1115 MUL	
SR161A	REED RELAY 161A-1	RLA-RLF
VTR96S	BFR96S MUL SOT37	Q209
7NU10180514	300/A *RF MIXER BOX	
ASS23T	TIN PLATE 23SWG	
RM3330R25	330R 1% MRS25 REEL	R240:253
BC1130	R /D *MIXER 1 CB*7RBT	B
ZC6U8	CHK SC10 6.8UH AMM2000	L201 2 206-209
RM256R025	56R 1% MUL MRS25	R221:41
RM42K2025	2K2R 1% MRS25 REEL	R230
RM42K0025	2K0R 1% MUL MRS25	R252
CC222P0N642	22PF 100V 683-34229	C208
CC247P0N642	47PF 100V 683-34479	C209:31-33:40
CC12P20N642	2P2F 100V 683-09228	C205
CC210P0N642	10PF 100V 683-10109	C235 6
CC218P0N642	18PF 100V 683-10189	C237
CC3470PN6306	470PF 100V 630-19471	C224
CE233U0IEK	33UF 35V KMVB ECC	C201 2:39:42
CE247U0FEK	47UF 16V KMVB ECC	C220
CF0U100LMKS	0.1UF 63V WIM MKS2MIN	C203 4 6 7:15 17-19:21 2:34 8:41 3
CF41K00NFKS2	1K0PF 100V WIM FKS2	C223
CF41K00NFKS5	1K0PF 100V FKS2 5%	C227 9
CF43K30NFKS5	3K3PF 100V 5% FKS2MIN	C230
CF44K70NFKS5	4K7PF 100V FKS2MIN 5%	C230
CF510K0N2MIN	10KPF 100V 20% FKS2MIN	C212-214 6:45
VD74F00PC	IC 74F00PC *STATIC	U6
KP3MC8S	SLTD M3 X 8 PAN	
NF3M	NUT FULL M3	
WW3M	WASHER WAVEY M3	
VS14L	IC SKT 703-1314-010410	U201 2 6
VS10L	IC SKT 703-1310-010410	U203-205
7SL3320	400/8 *MIXER SCREEN	
ASS23T	TIN PLATE 23SWG	
CC42K20N030	2K2PF 100V 630-19222	C246
CC11P80N642	1P8F 100V 683-09188	C249
CASOT	CAP SELECT ON TEST	C248
CF42K20NFKS5	2K2PF 100V 5% FKS2MIN	C226
CACMIT	CAPACITORS OMITTED	C210:25 8:47
RM3220R25	220R 1% MUL MRS25	R245
CC15P60N642	5P6F 100V 683-09568	C250
CI41K75L	1K75PF 100V 1214-031	C244
5NAMM2000L0		CCT BOARD: CPS/0 *LOW OSCILLATOR
BC1131	2 /E *LOCAL OSC *7RBA	B
RM21CR025	10R 1% MRS25 REEL	R37
RM247R025	47R 1% MRS25 REEL	R20:41
RM3100R25	100R 1% MRS25 REEL	R42
RM3150R25	150R 1% MUL MRS25	R23
RM3180R25	180R 1% MUL MRS25	R14
RM3200R25	200R 1% MUL MRS25	R8
RM3390R25	390R 1% MRS25 REEL	R15 6
RM3470R25	470R 1% MRS25 REEL	R13
RM3620R25	620R 1% MUL MRS25	R22

MAIN UNIT ITEM NUMBER : 17AMM2000 DESCRIPTION : TEL/I *AMM2000 *0180

FARNELL PART NUMBER	DESCRIPTION		CIRCUIT REFERENCE
RM41K0025	1K0R 1% MRS25	REEL	R7:28
RM41K5025	1K5R 1% MRS25	REEL	R21:43
RM42K0025	2K0R 1% MUL MRS25		R24
RM42K2025	2K2R 1% MRS25	REEL	R33 4
RM42K4025	2K4R 1% MRS25	REEL	R36
RM44K7025	4K7R 1% MRS25	REEL	R9:17:101 3
RM48K2025	8K2R 1% MRS25	REEL	R35
RM510K025	10KR 1% MRS25	REEL	R18 9:29:39
RM516K025	16KR 1% MUL MRS25		R40
RM6100K25	100K 1% MRS25	REEL	R10-12:25 6:31
RM71M0025	1MOR 1% MRS25	REEL	R27:30 2
RN6100KEQ8	N/WORK 100K SIL EQ8		N1
CC11P00N683	1PF 100V 68303108		C21
CC11P80N642	1P8F 100V 683-09188		C25
CC15P60N642	5P6F 100V 683-09568		C23
CC210P0N642	10PF 100V 683-10109		C26:49
CC215P0N642	15PF 100V 683-10159		C14:29
CC222P0N642	22PF 100V 683-34229		C24
CC227P0N642	27PF 100V 683-34279		C22
CC268P0N642	68PF 100V 683-34689		C12 3
CC3470PN6306	470PF 100V 630-19471		C47
CC44K70N630	4K7PF 100V 630-19472		C1 2 6 8-10 5:27 8:30-35 39-46:51 2
CE233U0FES	33UF 16V SMVB ECC		C3 4:16:36:50 3 4
CE233U0JM	33UF 40V MUL 030 37339		C57 8
CE3100UDM	100UF 10V 030 34101		C7:38
CFQU100LMKS	0.1UF 63V WIM MKS2MIN		C48:56
UCC6100KA1KX	0U1F 10% 50V 1812 X7		C60
UCC7100KA2KX	1UF 10% 50V 2220 X7R		C59
CACMIT	CAPACITORS OMITTED		C17-20
DG809	DIODE BB809		D1-4
DG284	DIODE BA284		D5-8
DG4148	DIODE 1N4148	REEL	D9:10
DG10C1	INo263 HP SCHOTTKY		D11 2
DZ12V700W5	ZENER ZPD2.7	REEL	Z3
PM525K063P	25KR SPL 63P		P2
PM550K063P	50KR SPL 63P		P3
ZC15U10	CHOKE 15UH SC10 ITT		L2-8
LD134G	LED GRN T1 3/4 MV64530		LED1
VT212PL	BC212PL NO NEW USE PLG		Q5-7
VF31CS	J310 SILICONIX *STATIC		Q3
VA503	IC MC503		U8
VA8821DP	IC NJ8821DP		U9
VA356TC	IC UAF356TC/LF356N		U11
VD74F161APC	IC 74F161APC *STATIC		U4
VD74F151	IC N74F151N *STATIC		U5
VD74HC4094	IC M74HC4094BCN*STATIC		U6 7
VD4053B	IC CD4053B *STATIC		U10
TBM2510PS	10W 6410-22-27-2101		S1
TBM2502PS	2W 6410-22-27-2021		S2
TBM2503P0	3W 4030 22-03-2031		X2
TBM2502P0	2W 4030-22-03-2021		X3
TL2W	2W TERM LINK 15-38 102		LX1
TP15080	C6 PIN MR15080 TUC		X1
HW3122A	COVER 3122-121-311-22		
VS8P	IC SKT 703-1308-010410		U2 8:11
VS16L	IC SKT 703-1316-010410		U4-7:10

MAIN UNIT ITEM NUMBER : 17AMM2000 DESCRIPTION : TEL/I *AMM2000 *0180

FARNELL PART NUMBER	DESCRIPTION	CIRCUIT REFERENCE
VS20L	IC SKT 703-1320-010410	U9
7NU10180515	300/A *OSC. SCREEN 'A'	
ASS23T	TIN PLATE 23SWG	
7NU1C180516	300/A *OSC. SCREEN 'B'	
ASS23T	TIN PLATE 23SWG	
VD74F04N	IC 74F04N *STATIC	U3
ZC026	CHK 0.26MH 35-11170	L1
CF11U00LMKS2	1UF 63V 20% MKS2	C55
VTX451K	ZTX451 60V 1A T092	Q1 4
VTX551K	ZTX551 60V 1A P	Q2
VS14L	IC SKT 703-1314-010410	U3
RAOMIT	RESISTORS OMITTED	R1 2
UCT2100MSGG	100UF 20% 25V 293D	C61
DZ16V200W5	ZPD6.2 ITT 2%	Z2
VA610C	SL610CCM	U2
RM3220R25	220R 1% MUL MRS25	R102
CFA1U00KK	1UF 10% 63V MKS2	C61
CI41K75L	1K75PF 100V 1214-001	C11:37
5NAMM2000R8		CCT BOARD: CPS/B *REFERENCE C8
BC1134	2 /C *REF AMM2 *7RBA	B
RM222R025	22R 1% MUL MRS25	R1
RM251R025	51R 1% MUL MRS25	R21
RM3180R25	180R 1% MUL MRS25	R19
RM3510R25	510R 1% MUL MRS25	R18:22
RM41K0025	1K0R 1% MRS25 REEL	R3 5 7:14
RM41K5025	1K5R 1% MRS25 REEL	R2:15 6
RM44K7025	4K7R 1% MRS25 REEL	R8
RM510K025	10KR 1% MRS25 REEL	R4
RM6100K25	100K 1% MRS25 REEL	R11 2 3
CE233U0FM	33UF 16V MUL 030 35339	C1
CE233U0GD	33UF 25V K3325 DUB	C6
CF44K70NFKS2	4K7PF 100V WIM FKS2	C2 4 5 7-14 5
DG284	DIODE BA284	D1 2
DZ12V500W3	ZN404 FER	Z1-FIT ON PAD VP1A
PM3100R64W	100R TYPE 64W	P3
TBM2512PS	12W 6410-22-27-2121	S1
VD74HC4094	IC M74HC4094BCN*STATIC	U1
VD74HC390N	IC 74HC390N *STATIC	U2 3
VD74HC74N	IC 74HC74N *STATIC	U4 6
VD74HC02	IC 74HC02 *STATIC	U5
VD74HC4066	IC M74HC4066 *STATIC	U7
VD74HC04	IC M74HC04 *STATIC	U8
VXC386	CRYSTAL TCXO4-30386	XTL
RM3470R25	470R 1% MRS25 REEL	R20
VD74HCT00	IC 74HCT00 *STATIC	U9
VTX313KCR	ZTX313 15V A5 500M N	Q1
VP1A	TRANSITOR PAD TW1A	Z1
VS14L	IC SKT 703-1314-010410	
VS16L	IC SKT 703-1316-010410	
RM3360R25	360R 1% MUL MRS25	R17
7NU1C180503	100/B *R.F. BOX	
ASS23T	TIN PLATE 23SWG	
7NU1C180504	300/B *SIDE FLANGE"E"	
ASS23T	TIN PLATE 23SWG	
7NU1C180506	300/B *R.F.DIVN MIXER	
ASS23T	TIN PLATE 23SWG	

MAIN UNIT ITEM NUMBER : 17AMM2000 DESCRIPTION : TEL/I *AMM2000 *0180

FARNELL PART NUMBER	DESCRIPTION	CIRCUIT REFERENCE
7NU10180507	300/B *R.F.DIVISION LO	
ASS23T	TIN PLATE 23SWG	
7SU2525	200/A *SIDE FLNG C	
ASS23T	TIN PLATE 23SWG	
7SU2526	300/A *SIDE FLNG B	
ASS23T	TIN PLATE 23SWG	
7SU3213	200/A *FLANGE	
TR1820	SMA R/ANG PLG 42162006	
7SU3944	300/A *RF BOX S/FLANGE	
ASS23T	TIN PLATE 23SWG	
GR2326	GROMMET HV2326	
TBM2502HP	2W 6471-22-01-2025	MX LO
TBM2504HP	4W 6471-22-22-01-2045	MX
TBM2510HP	10W 6471-1 22-01 2105	MX LO
TBM2512HP	12W 6471 22 01 2125	RB
TR50675	F/THR 50/675 ALT 65153	
HR31212	RECEPT 312/12 CAM	
CI12P00J	2PF 50V DF331-805-SL02	
CI41K75L	1K75PF 100V 1214-001	CX22
4NAMM2000MB		ASSEMBLY : SUB/B *MODULATION BOX
5NAMM2000AM		CCT BOARD: CPS/D *AMPLITUDE MOD
BC1132	1 /E *AM BOARD *7RB1	B
RM15R1025	5R1 1% MRS25 REEL	R26
RM210R025	10R 1% MRS25 REEL	R22 4:40
RM222R025	22R 1% MUL MRS25	R12:35 6:98 9
RM239R025	39R 1% MUL MRS25	R48
RM247R025	47R 1% MRS25 REEL	R91
RM3180R25	180R 1% MUL MRS25	R25:55:75
RM3220R25	220R 1% MUL MRS25	R102
RM3270R25	270R 1% MRS25 REEL	R49:52:69:72
RM3300R251	300R 1% MRS25 REEL	R44 5
RM3330R25	330R 1% MRS25 REEL	R18:21:58:78:90
RM3390R25	390R 1% MRS25 REEL	R6
RM3430R25	430R 1% MUL MRS25	R46
RM3470R25	470R 1% MRS25 REEL	R39:50 4:70 4:84 9:94
RM3560R25	560R 1% MRS25 REEL	R59:62:79:82 5
RM3620R25	620R 1% MUL MRS25	R2 4:43
RM3680R25	680R 1% MUL MRS25	R11
RM41K0025	1K0R 1% MRS25 REEL	R27:63:83 8
RM41K2025	1K2R 1% MRS25 REEL	R7 9:51:61:71:81
RM41K5025	1K5R 1% MRS25 REEL	R16:23:47
RM41K8025	1K8R 1% MUL MRS25	R5:30 1:60:80
RM42K0025	2K0R 1% MUL MRS25	R68
RM42K2025	2K2R 1% MRS25 REEL	R57:66:77:86
RM43K6025	3K6R 1% MUL MRS25	R17:20
RM44K7025	4K7R 1% MRS25 REEL	R53:73
RM45K6025	5K6R 1% MUL MRS25	R67:87
RM47K5025	7K5R 1% MUL MRS25	R13 4
RM48K2025	8K2R 1% MRS25 REEL	R1 3:100
RM510K025	10KR 1% MRS25 REEL	R33 4:101
RM518K025	18KR 1% MRS25 REEL	R56:76
RM556K025	56KR 1% MUL MRS25	R29
RM6180K25	180K 1% MUL MRS25	R32
RM6330K25	330K 1% MRS25 REEL	R28
RM6470K25	470K 1% MUL MRS25	R8:10 5 9:37 8
CC12P20N042	2P2F 100V 083-09228	C08

MAIN UNIT ITEM NUMBER : 17AMM2000 DESCRIPTION : TEL/I *AMM2000 *0180

FARNELL PART NUMBER	DESCRIPTION	CIRCUIT REFERENCE
CC13P9ON642	3P9F 100V 683-09398	C55
CC14P7ON642	4P7F 100V 683-09478	C53
CC239PON642	39PF 100V 683-34399	C54
CC247PON642	47PF 100V 683-34479	C60-62 4
CC282PON642	82PF 100V 683-34829	C52
CC3100PN642	100PF 100V 683-34101	C34 9
CC3150PN642	150PF 100V 683-34151	C44 7:59:63:77
CC3220PN683	220PF 100V 683-58221	C40:58
CC3270PN642	270PF 100V 683-58271	C56
CC3330PN642	330PF 100V 683-58331	C38:43:70 8
CC3680PN630	680PF 100V 630-19681	C67
CC44K70N630	4K7PF 100V 630-19472	C17
CE210U0KE	10UF 50V KMVB	C19:25 7
CE247U0FEK	47UF 16V KMVB ECC	C24
CE3100UIEK	100UF 35V KMVB ECC	C35
CF0U100LMKS	0.1UF 63V WIM MKS2MIN	C2-4 6-11 3 5:20 1 3 6 28-33 6 7:69:71-76
CF0U470LMKS2	0.47UF 63V 10% MKS2	C1 5
CF41K00NFKS2	1K0PF 100V WIM FKS2	C42 5:57
CF41K50NFKS2	1K5PF 100V WIM FKS2	C41 6 9:65
CF42K20NFKS2	2K2PF 100V WIM FKS2MIN	C50 1:66
CF44K70NFKS2	4K7PF 100V WIM FKS2	C48
CF533K0LMKS2	33KPF 63V WIM MKS2	C16
CF547K0LMKS2	47KPF 63V MKS2 20%	C22
DG4148	DIODE 1N4148 REEL	D5-9
DG1001	IN6263 HP SCHOTTKY	D2 3
DZ16V200W4	IN823 MOT	Z1
PM41K0067T	1K0R TYPE 67T	P1
VF1897	FET U1897 *STATIC	Q1 2 4 5
VTR9CA	BFR90A/02 SOT37	Q3 6
VT337	BC337 NO NEW DES (NGP)	Q7
VAC62	IC TL062CP *STATIC	U1
VA1576	IC FM RADIO TDA1576	U2
VA6440CDP	INT CCT SL6440CDP	U3
VA353N	IC LF353N *STATIC	U4 5 7
VD74HC4094	IC M74HC4094BCN*STATIC	U6
SR161A	REED RELAY 161A-1	RL2-6
TBM2503PS	SW 6410-22-27-2031	S1
TBM2502PS	2W 6410-22-27-2021	S2-5
TBM2503PO	3W 4030 22-03-2031	X1
TL2W	2W TERM LINK 15-38 102	LK1
VS8P	IC SKT 703-1308-010410	U1 4 5 7
VS16L	IC SKT 703-1316-010410	U6
VS18L	IC SKT 703-1318-010410	U2
CF11U00LMKS2	1UF 63V 20% MKS2	C12 4 8:79
VTX551K	ZTX551 60V 1A P	Q9:12
VTX451K	ZTX451 60V 1A TO92	Q10 1
HSIC16P	H/SINK 16PIN IC16H	U3
VT34T	BFQ34T SOT 37	Q8
RM268R025	68R 1% MUL MRS25	R41
RM591K025	91KR 1% MUL MRS25	R93
RM6560K25	560K 1% MUL MRS25	R92
PM510K067T	10KR TYPE 67T	P2
DZ15V600W5	ZPD5.6 ITT 2%	Z2
RM3510R25	510R 1% MUL MRS25	R104
PM35C0R67	500R SPL M67 SERIES	P3 5
RM3100R25	100R 1% MRS25 REEL	R105

MAIN UNIT ITEM NUMBER : 17AMM2000 DESCRIPTION : TEL/I *AMM2000 *0180

FARNELL PART NUMBER	DESCRIPTION		CIRCUIT REFERENCE
PM550K067T	50KR TYPE 67T		P4
RM525K025	25KR 1% MUL MRS25		R103
RM71M0025	1M0R 1% MRS25	REEL	R96 7
RM3820R25	820R 1% MRS25	REEL	R64
5NAMM2000FM			CCT BOARD: CPS/D *FREQUENCY MOD
RM210R025	10R 1% MRS25	REEL	R2 4:82 3
RM227R025	27R 1% MUL MRS25		R22
RM291R025	91R 1% MUL MRS25		R17
RM3180R25	180R 1% MUL MRS25		R8 9
RM3270R25	270R 1% MRS25	REEL	R31 4
RM3500RH825	500R .1% 25PPM H8		R38:45
RM3510R25	510R 1% MUL MRS25		R5
RM3560R25	560R 1% MRS25	REEL	R13:20
RM3820R25	820R 1% MRS25	REEL	R15
RM41K0025	1K0R 1% MRS25	REEL	R32:55 9:63 7:86
RM41K00H8	1K0R 0.1% 25PPM H8		R39:46
RM41K5025	1K5R 1% MRS25	REEL	R6:10 1 6
RM41K6025	1K6R 1% MRS25	REEL	R33
RM42K0025	2K0R 1% MUL MRS25		R3:12:24:56:60 4 8:77
RM42K00H825	2K0R .1% 25PPM H8		R40 7
RM44K00H825	4K0R .1% 25PPM H8		R41 8
RM44K4225	4K42 1% MUL MRS25		R76
RM46K2025	6K2R 1% MRS25	REEL	R7
RM46K8025	6K8R 1% MUL MRS25		R14
RM47K5025	7K5R 1% MUL MRS25		R26
RM48K2025	8K2R 1% MRS25	REEL	R19:27
RM48K35H8	8K35R 1% 50PPM H8		R57:61 5 9
RM510K025	10KR 1% MRS25	REEL	R49-51 3
RM511K3251	11K3 1% MUL MRS25		R87
RM515K025	15KR 1% MRS25	REEL	R23 5 8:64 5
RM522K025	22KR 1% MUL MRS25		R29
RM527K025	27KR 1% MRS25	REEL	R75
RM580K0H8	80KR 0.1% 50PPM H8		R70
RM591K025	91KR 1% MUL MRS25		R52
RM6135KH8	135KR 1% 50PPM H8		R73 4
RM6330K25	330K 1% MRS25	REEL	R39
RM6470K25	470K 1% MUL MRS25		R71
RM71M0025	1M0R 1% MRS25	REEL	R21:30
RM72M37H8	2M37 1% 100PPM H8		R72
RN6100KEQ8	N/WORK 100K SIL EQ8		N1
CC222P0N642	22PF 100V 683-34229		C29:32
CC233P0N642	33PF 100V 683-34339		C49:60
CC256P0N642	56PF 100V 683-34569		C20 3
CC282P0N642	82PF 100V 683-34829		C14 5
CC44K70N030	4K7PF 100V 030-19472		C33 5 7 9
CE233U0FES	33UF 16V SMVB ECC		C4:34 6
CE3100UDM	100UF 10V 030 34101		C38
CFCU100LMKS	0.1UF 63V WIM MKS2MIN		C1-3 5-13 16-18:30 1:58 9:61 2
CF3220PQ225	220PF 200V 1% PFE225		C21 2
CF3274PQ225	274PF 200V 1% PFE225		C54
CF3390PL443	390PF 63V 44383901		C25 7
CF3642PQ225	642PF 200V 1% PFE225		C45
CF3816PQ225	816PF 200V 1% PFE225		C55
CF41K00Q225	1K0PF 200V 1% PFE225		C41
CF41K24L443	1K24PF 63V 44381242		C26
CF42K34N225	2K34PF 100V 1% PFE225		C42

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FARNELL PART NUMBER	DESCRIPTION	CIRCUIT REFERENCE
CF42K46N225	2K46PF 100V 1% PFE225	C50 7
CF44K87N225	4K87PF 100V 1% PFE225	C47
CF45K42N225	5K42PF 100V 1% PFE225	C51
CF45K76N225	5K76PF 100V 1% PFE225	C43 8
CF46K81N225	6K81PF 100V 1% PFE225	C44
CF513K7N225	13K7PF 100V 1% PFE225	C52
CF533K2L443	33K2PF 63V 44343323	C63-71
DG4148	DIODE 1N4148 REEL	D1-10
DG10C1	INo263 HP SCHOTTKY	D11-13
DZ16V200W4B	IN825 MOT	Z1-3
PM350OR67	500R SPL M67 SERIES	P2
PM510K067T	10KR TYPE 67T	P3 5
PM6100K67T	100K TYPE 67T	P4
VA1576	IC FM RADIO TDA1576	U2
VA3183AE	IC CA3183AE *STATIC	U3
VA061	IC TL061CP *STATIC	U5
VA5534AN	INT CCT NE5534AN	U6 7:16 7
VA317LZ	VOLT REG LM317LZ	U8
VA337LZ	VOLT REG LM337LZ	U11
VD4051B	IC CD4051BCN *STATIC	U9:10
VD74HC4094	IC M74HC4094BCN*STATIC	U12 4
VD4052B	IC CD4052B *STATIC	U15 9
ZC680UH	CHK 680 B78108-S1684-J	L1-3
ZC4M7	CHOKE 4M7	L4 5
SR161A	REED RELAY 161A-1	RL1-9
TBM2502PS	2W 6410-22-27-2021	S1-4
TBM2512PS	12W 6410-22-27-2121	S5
TP15080	CB PIN MR15080 TUC	X1
VS8P	IC SKT 703-1308-010410	U1 4 5 6 7:1o 7 8
VS16L	IC SKT 703-1316-010410	U3 9:10 2 4 5 9
VS18L	IC SKT 703-1318-010410	U2
CF41K98N225	1K98PF 100V 1% PFE225	C46:56
CF11U00LMKS2	1UF 63V 20% MKS2	C19:28:40
VA3420E	INT CCT CA3420E RCA	U4
BC1133	C /D *FM BOARD *7RBT	B
RM3125RH8	125R 0.1% 25PPM H8	R35 6:42 3
RM3250RH8	250R 0.1% 25PPM H8	R37:44
VTNLGP	2N2222A BC337 TO92	Qo 7
DZ13V300W5	ZENER ZPD3.3 REEL	Z4
VACMIT	TRANSISTORS/ICS OMITTE	U13
CE222U0DM	22UF 10V MUL 030 24229	C24
CF516K2L225	1oK2PF 63V 1% PFE225	C53
RM41K1025	1K1R 1% MUL MRS25	R62
RM41K2025	1K2R 1% MRS25 REEL	R54
RM390R25	390R 1% MRS25 REEL	R58:66
RM200R25	200R 1% MUL MRS25	R1
RM215R025	15R 1% MRS25 REEL	R81
RM42K4025	2K4R 1% MRS25 REEL	R18
RM562K025	o2KR 1% MRS25 REEL	R88
PM3200R67T	200R TYPE 67T	P1
VA356TC	IC UAF356TC/LF356N	U18
VA610C	SL610CCM	U1
VT212PL	BC212PL NO NEW USE PLS	Q1-5
ZC220U10	CHK SC10 220UH	L6
?NU1C180508	100/C *I.F. BOX	
ASS23T	TIN PLATE 23SWG	

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FARNELL PART NUMBER	DESCRIPTION	CIRCUIT REFERENCE
7NU1C180509	300/B *T.F.DIVISION	
ASS23T	TIN PLATE 23SWG	
7NU1C180510	300/A *I.F.SIDE FLANGE	
ASS23T	TIN PLATE 23SWG	
7SU3228	300/B *IF S/FLANGE 'D'	
ASS23T	TIN PLATE 23SWG	
TBM2502HP	2W 6471-22-01-2025	FM AM
TBM2508HP	8W 6471-22-01-2085	AM
TBM2512HP	12W 6471 22 01 2125	FM
NR3M10TH	SPACER M3X10 R6074 HAR	
HR31212	RECEPT 312/12 CAM	
CI12P00J	2PF 50V DF331-805-SL02	
CI41K75L	1K75PF 100V 1214-001	CX15
RM3680R25	680R 1% MUL MRS25	R262
CC268PON642	68PF 100V 683-34689	C211
ZC6U8	CHK SC10 6.8UH AMM2000	L205:13
TBM2510HP	10W 6471-1 22-01 2105	LB572
TBM3902HS	2 WAY 3069 09-91-0200	LB572
TBM3915HS	15 WAY 3069 09-91-1500	PS
TBM3906HS	6 WAY 3069 09-91-0600	LB572
TBM2508HP	8W 6471-22-01-2085	LB572
TBM2516HP	16W 6471-22-01-2165	LB572
HR28S14	STUD 28S1/4 CAM	
7SU2520	3BA/A *BOX BRKT'A'	
AAS16	ALUM SHT 16SWG S1C1/2H	
NC3M8FH	PEMSTUD FH-M3-S-CI	
NC3M1ZC	PSM PS-4-40-1 M3TAP	
7SU3210	400/A *FILTER BOX	
ASS23T	TIN PLATE 23SWG	
7SU3211	400/B *CENTRE PIECE	
ASS23T	TIN PLATE 23SWG	
CC3120PN642	120PF 100V 683-34121	C210
TR1820	SMA R/ANG PLG 42182006	
TS6B388	SOL TAG STAR 6BA 388	
47AMM2000FP		ASSEMBLY: FIN/C *FRONT PANEL ASM
SNAMM2000FP		CCT BOARD: CPS/B *FRONT PANEL
RM51CK025	10KR 1% MRS25 REEL	R3 4
RN510K0850	N/WORK 10K 350/91 SIL	N1
CFDJ470LMKS2	0.47UF 63V 10% MKS2	C15 6
CFS1CKON2MIN	10KPF 100V 20% FKS2MIN	C2-14 7 8
DG4148	DIODE 1N4148 REEL	D1-8
PM52CK063X	20KR SPL 63X	P2
LD13C1RED	LED HLMP-1301 RED	L1-28
VT212PL	BC212PL NO NEW USE PLG	Q1
VD74HC374N	IC 74HC374N *STATIC	U7:11
VD74HC32	INT CCT 74HC32 *STATIC	U9
VD74HC373	IC TC74HC373P *STATIC	U10
VD74HC4078	IC M74HC4078 *STATIC	U12
VA5450N	MM5450N/M5450B7*STATIC	U6:13
SRG2V5	G2E 5V ORM	RL1
TIH2534NR1L	34W HEAD M52-1234-460	S1
TBM2516PT	16W 4094-22-05-2161	S2
TBM2508PS	8W 6410-22-27-2081	S3
TP15080	CB PIN MR15080 TUC	X1-10
VS14L	IC SKT 703-1314-010410	U9:12
VS20L	IC SKT 703-1320-010410	U5-7:10 1

MAIN UNIT ITEM NUMBER : 17AMM2000 DESCRIPTION : TEL/I *AMM2000 *0180

FARNELL PART NUMBER	DESCRIPTION	CIRCUIT REFERENCE
VS40L	IC SKT 703-1340-010410	U8:13
RW15R602901	5R6 5% 2W KP290-1	R1 2
LD2112J	LED HDSP2112J	U1-4
LD4830	LED BAR HDSP4830	U5 6
BC1270	R /C *F/P AMM2K *7RBT	B
TBM3902PR	2W 5180-39-28-0028	S4
VA4941	VOLTS REG L4941BV	U14
RM42K2025	2K2R 1% MRS25 REEL	R5
RW11R0021	1R0 5% WEL W21/74ER	R7
RLINK24	24 SWG TC LINK	R6
CE3470UFEK	470UF 16V KMVB ECC	C1:19
VS28L	28W 703-1328-01-04-10	U1-4
CEC470UDM	470UF 20% 10V KMVB	C1:19
TR1094	BNC SKT UG1094/BU RAD	S1-3
TR10942	N B/HEAD UT085 SK1094/	S4
HW0115	2SC/A *FRONT PANEL AMM	
HW0132	3SC/A *TITLE INSERT	
7NU10180502	1BA/B *FALSE F/PANEL A	
AAS16	ALUM SHT 16SWG S1C1/2H	
NC4M1ZC	PEMINSERT CM4-1	
NC3M1AS	PEMINS FLOAT AS-M3-I	
NC3M1ZC	PSM PS-4-40-1 M3TAP	
HW1878	400/B *RFI SCREEN	
7SF3280	400/A *BNC INS WASHER	
AFS116	FIBGLASS SHT 1/16 THK	
NR3M06TH	SPACER M3X6 R6072 HAR	
6NAMM2000	WPA/A *F10180	6
YP702BK	BLACK 7/0.2 PVC	
YP702GN	GREEN 7/0.2 PVC	
YP702GY	GREY 7/0.2 PVC	
YP702OR	ORANGE 7/0.2 PVC	
YP702PK	PINK 7/0.2 PVC	
YP702RD	RED 7/0.2 PVC	
YP702VI	VIOLET 7/0.2 PVC	
YP702WH	WHITE 7/0.2 PVC	
YP702YL	YELLOW 7/0.2 PVC	
YP1602BKV	BLACK 16/0.2 VX	
YP1602BLV	BLUE 16/0.2 VX	
YP1602BNV	BROWN 16/0.2 VX	
YP1602GYV	GREY 16/0.2 VX	
YP1602ORV	ORANGE 16/0.2 VX	
YP1602RDV	RED 16/0.2 VX	
YP1602WHV	WHITE 16/0.2 VX	
YP1602YLV	YELLOW 16/0.2 VX	
YP2402BKV	BLACK 24/0.2 VX	
YP2402GNV	GRNYEL 24/0.2 VX	
YP7150WH	WHITE 24AWG UL1429	
YX178	COAX CABLE RG178BU	
YD301	IDENT BRN 1 H030 HEL	
YD302	IDENT RED 2 H030 HEL	
YD303	IDENT ORG 3 H030 HEL	
YD304	IDENT YEL 4 H030 HEL	
TCM25	2.5P 4809-0850-0031	
TCM39	3.9/5 OP 2478-08500105	
7SX2518	200/A *TOP+BTM TRM	
AX0056	3SX/B *TOP/BOT EXT	

MAIN UNIT ITEM NUMBER : 17AMM2000 DESCRIPTION : TEL/I *AMM2000 *0180

FARNELL PART NUMBER	DESCRIPTION		CIRCUIT REFERENCE
7SU2521	2BA/A *RH SIDE PNL A		
NC3M1AS	PEMINS FLOAT AS-M3-I		
NC3M4SO	PEMSTDOFF SO-M3-4-CI		
NC4M1ZC	PEMINSERT CM4-1		
AAS161X1	ALUM SHT 16SWG 1M X 1M		
7SU2522	2BA/A *LH SIDE PNL A		
NC3M1AS	PEMINS FLOAT AS-M3-I		
NC3M4SO	PEMSTDOFF SO-M3-4-CI		
NC4M1ZC	PEMINSERT CM4-1		
AAS161X1	ALUM SHT 16SWG 1M X 1M		
7SU3214	100/D *I.F. BOX COVER		
ASS23T	TIN PLATE 23SWG		
7SU3215	100/D *R.F. BOX COVER		
ASS23T	TIN PLATE 23SWG		
7SU3199	300/B *COVER SIDES		
ASS23T	TIN PLATE 23SWG		
HA0065	1SV/H *HANDLE SSG1000		
HA0066	2SV/E *HANDLE INSERT		
GR0055	4SX/B *TOP+BOT INSERT		
7SU3943	2BA/D *CONTROL BD KITA		
AAS18	ALUM SHT 18SWG S1C1/2H		
HC0187	4SC/B *34WAY CABEL ASS		
47AMM2000CB			ASSEMBLY: FIN/E *CONTROL CCT BD
BC1127	1 /D *CONTROL *7RBT		B
CAOMIT	CAPACITORS OMITTED		C21:80-82
CC3100PN642	100PF 100V 683-34101		C11
CC3680PN630	680PF 100V 630-19681		C84
CE233U0FES5	33UF 16V SMVB 5MM PITC		C22-25
CE3100UIEK	100UF 35V KMVB ECC		C34
CF44K70NFKS5	4K7PF 100V FKS2MIN 5%		C10
CF522K0NFKS3	22KPF 100V FKS3 20%		C1
CF533K0LMKS2	33KPF 63V WIM MKS2		C2
CFCU100LMKS	0.1UF 63V WIM MKS2MIN		C3:26-33 35-74:83 5 6 88-92 3
CF0U220NMKS4	0.22U 100V MKS4 20%		C13
CF0U470LMKS2	0.47UF 63V 10% MKS2		C5:94
CF11U00LMKS2	1UF 63V 20% MKS2		C4:12:87
CF41K00Q225	1K0PF 200V 1% PFE225		C9
CF41K98N225	1K98PF 100V 1% PFE225		C8
CF46K81N225	6K81PF 100V 1% PFE225		C7
CF513K7N225	13K7PF 100V 1% PFE225		C6
DG1001	IN6263 HP SCHOTTKY		D7 8:12 3
DZ12V500W3	ZN404 FER		Z1
MMT0220	ALUM OX WASH AOS220		
PM42K0063P	2K0R SPL 63P		P2
PM51CK0o3P	10KR SPL 63P		P3
RACMIT	RESISTORS OMITTED		R3 5 6:33:67:71:84-88:93
RC71M0025	1M0R 5% MUL CR25		R4
RC81CM025	10MR 10% MUL CR25		R26:30
RM21CR025	10R 1% MRS25	REEL	R79
RM268R025	68R 1% MUL MRS25		R98
RM275R025	75R 1% MUL MRS25		R36-55
RM3100R25	100R 1% MRS25	REEL	R90
RM3120R25	120R 1% MRS25	REEL	R65
RM3240R25	240R 1% MUL MRS25		R61
RM333JR25	330R 1% MRS25	REEL	R94
RM3470R25	470R 1% MRS25	REEL	R28:64

MAIN UNIT ITEM NUMBER : 17AMM2000 DESCRIPTION : TEL/I *AMM2000 *0180

FARNELL PART NUMBER	DESCRIPTION		CIRCUIT REFERENCE
RM3560R25	56OR 1% MRS25	REEL	R8
RM41K0025	1KOR 1% MRS25	REEL	R29:66:74:101
RM41K2025	1K2R 1% MRS25	REEL	R83
RM41K8025	1K8R 1% MUL MRS25		R62 3
RM43K9025	3K9R 1% MUL MRS25	REEL	R97
RM44K7025	4K7R 1% MRS25	REEL	R24
RM510K0H85	10KR 0.1% 50PPM H8		R10-12:91 2 5
RM510K025	10KR 1% MRS25	REEL	R1 2 7 9:25 7:56:73:80-82:96 9:100
RM511K025	11KR 1% MUL MRS25		R15 6
RM520K025	20KR 1% MUL MRS25		R21 2
RM525K025	25KR 1% MUL MRS25		R17-20
RM556K025	56KR 1% MUL MRS25		R13 4
RM582K025	82KR 1% MRS25	REEL	R23
RM6150K25	150K 1% MRS25	REEL	R78:103 5
RM6330K25	330K 1% MRS25	REEL	R77
RM6470K25	470K 1% MUL MRS25		R89
RN51CK0850	N/WORK 10K 850/91 SIL		N3
SB4PCB	P/B SW SKHCAA		SW3
SS2WSP	SL SW 2WAY 090320102		SW1 2
TBM2506PT	6W 4094A 22-05-2061		S9
TBM2508PT	8W 4094-22-05-2081		S6
TBM2512PT	12W 4094 22 05 2125		S3
TBM2516PT	16W 4094-22-05-2161		S4 5
TG6092027	HEADER 20W 609-2027		S8
TIH2534NR1S	34W 8289-034-004-243		S2
TIH2534NT1E	34W HEAD SIDE EJECT		S1
VAC54A	IC TL054ACM TEX		U8:11
VA317T	INT CCT LM317T		U41
VA337T	INT CCT LM337T NAT		U42
VA636JD	INT CCT AD636JD		U12
VAOMIT	TRANSISTORS/ICS OMITTE		S7:Q4:U47:XTL1
VD233	IC MAX233CPP	*STATIC	U45
VD27C256	IC MMC27C256Q25	*STATIC	U2:17
VD4046BCN	IC CD4046BCN/BE	*STATIC	U15
VD4051B	IC CD4051BCN	*STATIC	U9:13
VD412DJ	IC DG412DJ SIL		J43
VD691	IC MAX691CPE	*STATIC	U48
VD70C2C	IC UPD70C2C		U10
VD7210C	IC UPD7210C IEEE		U20
VD74HC02	IC 74HC02	*STATIC	U35 8
VD74HC04	IC M74HC04	*STATIC	U39
VD74HC08N	IC MM74HC08N	*STATIC	U31-33
VD74HC154N	MM74HC154N 0.3"	*STATIC	U46
VD74HC161	IC 74HC161	*STATIC	J6
VD74HC245	IC TC74HC245P	*STATIC	U30
VD74HC251	IC MM74HC251	*STATIC	U5:27
VD74HC279	IC TC74HC279P	*STATIC	U3
VD74HC32	INT CCT 74HC32	*STATIC	U36 7
VD74HC373	IC TC74HC373P	*STATIC	U1
VD74HC374N	IC 74HC374N	*STATIC	U25 6 8 9
VD74HC390N	IC 74HC390N	*STATIC	U19
VD74HC393	IC TC74HC393P	*STATIC	U49
VD74HC4040	IC MM74HC4040N	*STATIC	U24
VD74HC4046P	IC 74HC4046	*STATIC	U18
VD74HC4078	IC M74HC4078	*STATIC	U2
VD74HC4094	IC M74HC4094BCN	*STATIC	U7:14

MAIN UNIT ITEM NUMBER : 17AMM2000 DESCRIPTION : TEL/I *AMM2000 *0180

FARNELL PART NUMBER	DESCRIPTION	CIRCUIT REFERENCE
VD74HC4518	IC 74HC518 *STATIC	U16
VD74HCT132	IC 74HCT132	U40
VD75160AN	INT CCT SN75160AN-9N	U22
VD75161AN	INT CCT SN75161BN	U21
VD82C51AT	IC M5M82C51AT *STATIC	U44
VD82C53	IC MSM82C53/5RS	U4
VFN2106A	ZVN2106A/60V/2R*STATIC	Q3
VS14L	IC SKT 703-1314-010410	U2 8:11 2:31-33 35-40 7 9
VS16L	IC SKT 703-1316-010410	U3 5-7 9:13-16 8 9:24 7:43 8
VS20L	IC SKT 703-1320-010410	U1:21 2 5 6 8 9:30:45
VS24L	IC SKT 703-1324-010410	U4
VS24LMIN	IC SKT 24W 0.3 PITCH	U46
VS28L	28W 703-1328-01-04-10	U10 7:44
VS40L	IC SKT 703-1340-010410	U20
VT182PL	BC182PL NO NEW USE NLG	Q1 2
EA889	BUZZER 889/IS21A	WD1
5NPCM80		CCT BOARD: CPS/A *PCM80
VS28C	28W CARRIER 612-92-628	
HE3000	LEAD FRAME BA3000/040	
5UPCM80		CCT BOARD: SMD/A *PCM80
UBC1195	S /B *PCM80 *7NCT	
UCC5220KA0KX	22NF 10% 50V 1206 X7	C1-4
UIDP474HC139	IC 74HC139 SO-14*STATI	U5
UIDP474HC154	74HC154 SO-24 *STATIC	U4
VD4464	IC UPD4464 G15L*STATIC	U3
VD84C0006	IC Z84C0006VEC *STATIC	U1
CC222P0N642	22PF 100V 683-34229	C14
RM515K025	15KR 1% MRS25 REEL	R102 4
EB6117	LYTH BAT 6117501501	
GCNX4	P CLIP NX4 INS	
GT23	CTY001/NT20 75C UL	
MB4205	4 /C *M4 INS BUSH	
TS307	STRIP WIRE TAG T307	

F A R N E L L I N S T R U M E N T S L T D

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MAIN UNIT ITEM NUMBER : 27AMM2000Q DESCRIPTION : CPS/B *OPTION 'Q' CB

IMPORTANT EXPLANATION - PLEASE READ BEFORE ORDERING PARTS.
DUE TO LIMITATIONS IN THE NUMBER OF CHARACTER SPACES AVAILABLE THE INFORMATION IN THE CIRCUIT REFERENCE FIELD HAS BEEN ABBREVIATED AND THE FOLLOWING NOTES ARE PROVIDED AS A GUIDE TO IT'S INTERPRETATION:

1. WHERE A COMPONENT IS USED MORE THAN ONCE ON AN ASSEMBLY THE ALPHABETIC PORTION OF THE CIRCUIT REFERENCE FOR ITS SECOND AND SUBSEQUENT LOCATIONS HAS BEEN OMITTED; EG. THE CIRCUIT REFERENCE INFORMATION FOR A COMPONENT LOCATED AT R1 AND R6 WILL APPEAR AS R1 6
2. THE CIRCUIT REFERENCE NUMBERS ARE PRESENTED IN ASCENDING DECADE BLOCKS DELIMITED BY CCLONS: SECOND AND SUBSEQUENT NUMBERS WITHIN A DECADE BLOCK REPRESENT ONLY THE UNIT VALUE OF THE LOCATION (THE TENS AND HUNDREDS VALUES BEING IMPLIED); EG. FOR A COMPONENT LOCATED AT R54,R57,R59,R82,R87,R102,R110, AND R112 THE CIRCUIT REFERENCE ENTRY WILL BE R54 7 9:82 7:102:10 2
3. WHERE COMPONENTS ARE USED IN A SERIES OF NEIGHBOURING CIRCUIT REFERENCE LOCATIONS THE CIRCUIT REFERENCE NUMBERS ARE REPRESENTED AS INCLUSIVE BLOCKS USING A HYPHEN; EG. A COMPONENT LOCATED AT R16,R19,R21,R24,R25,R26,R31,R37,R38,R39,R40,R44 AND R46 WILL BE REPRESENTED AS R16 9:21 4-6:31 37-40 4 6 (AN EXCEPTION TO THE RULES OCCURS WHEN A SERIES CROSSES A DECADE BLOCK IN WHICH CASE THE TENS VALUE IS INSERTED.
4. COMMENTS ARE PRECEDED BY A SEMICOLON.

WHEN ORDERING REPLACEMENT PARTS PLEASE BE SURE TO QUOTE THE PART NUMBER PROVIDED.

FARNELL PART NUMBER	DESCRIPTION		CIRCUIT REFERENCE
5NAMM2000Q			CCT BOARD: CPS/A *CCT BD AMM2000Q
BC1135	N /B *AMM2000 OP*7RBT		B
RM61C0K25	10OK 1% MRS25	REEL	R1-3:40-44
RM71M0025	1MOR 1% MRS25	REEL	R4:39
RM46K8025	6K8R 1% MUL MRS25		R5:22
RM41K0025	1KOR 1% MRS25	REEL	R6:47
RM45K1025	5K1R 1% MUL MRS25		R7-12
RM512K025	12KR 1% MRS25	REEL	R13
RM522K025	22KR 1% MUL MRS25		R15:33 -
RM44K7025	4K7R 1% MRS25	REEL	R16
RM547K025	47KR 1% MRS25	REEL	R17
RM527K025	27KR 1% MRS25	REEL	R19:57
RM515K025	15KR 1% MRS25	REEL	R18:86
RM516K025	16KR 1% MUL MRS25		R21
RM539K025	39KR 1% MUL MRS25		R20
RM47K5025	7K5R 1% MUL MRS25		R23 4 6:82
RM517K4251	17K4 1% MUL MRS25		R25
RM518K025	18KR 1% MRS25	REEL	R38
RM582K025	82KR 1% MRS25	REEL	R46
RM43K0025	3KOR 1% MUL MRS25		R45:56
RM510K025	10KR 1% MRS25	REEL	R48:50 2 3:84 5 7 8
RM3390R25	390R 1% MRS25	REEL	R54
RM3400RH8	400R 0.1% 50PPM H8		R60 1
RM13R9025	3R9 1% MUL MRS25		R58 9
RM510K0H85	10KR 0.1% 50PPM H8		R62 3
RM48K2025	8K2R 1% MRS25	REEL	R33
RM568K025	68KR 1% MRS25	REEL	R27
RM6150K25	150K 1% MRS25	REEL	R29

MAIN UNIT ITEM NUMBER : 27AMM2000Q DESCRIPTION : CPS/B *OPTION 'Q' CB

FARNELL PART NUMBER	DESCRIPTION	CIRCUIT REFERENCE
RM52CK025	20KR 1% MUL MRS25	R30
RM6430K25	430KR 1% MUL MRS25	R31 2
RM6220K25	220K 1% MUL MRS25	R35
RM45K6025	5K6R 1% MUL MRS25	R36
RM43K9025	3K9R 1% MUL MRS25 REEL	R37
RM48K00H825	8KOR .1% 25PPM H8	R69
RM44K00H825	4KOR .1% 25PPM H8	R68
RM42K00H825	2KOR .1% 25PPM H8	R67
RM41K00H8	1KOR 0.1% 25PPM H8	R66
RM3500RH825	500R .1% 25PPM H8	R64 5
RM3470R25	470R 1% MRS25 REEL	R70-75
RM44K3025	4K3R 1% MUL MRS25	R76-81
RM551K025	51KR 1% MUL MRS25	R49:51
RM42K0025	2KOR 1% MUL MRS25	R55
RM49K1025	9K1R 1% MUL MRS25	R14
RM6130K25	130KR 1% MRS25	R28
CE3100UDM	100UF 10V 030 34101	C4 5
CF0U100LMKS	0.1UF 63V WIM MKS2MIN	C1-3 6-8:10-15:44 5:65
CF42K2ONFKS5	2K2PF 100V 5% FKS2MIN	C16-19:30:57 8
CF44K7ONFKS5	4K7PF 100V FKS2MIN 5%	C20-22:53 4 9:60
CF43K3ONFKS5	3K3PF 100V 5% FKS2MIN	C23
CF510KONFKS2	10KPF 100V 5% WIM FKS2	C24 5:33 4 7 8:51 2:61 2
CF533KOLMKS2	33KPF 63V WIM MKS2	C26-29
CF522KOL2MIN	22KPF 63V WIM MKS2MIN	C31
CC3470PN6306	470PF 100V 630-19471	C32
CS42K2OS976	2K2PF 350V 1% 124-976	C40 1
CC3150PN642	150PF 100V 083-34151	C42 3
CS44K7OS008	4K7PF 350V 1% 125-008	C39
CE233UOFM	33UF 16V MUL 030 35339	C47
CC227PON642	27PF 100V 683-34279	C46
CC222PON642	22PF 100V 083-34229	C48
CC3080PN630	080PF 100V 630-19681	C55 6:63 4
CF42K2ONFKS2	2K2PF 100V WIM FKS2MIN	C49:50
CC3100PN642	100PF 100V 083-34101	C35
TBM2512PT	12w 4094 22 05 2125	S1
VD74HC4094	IC M74HC4094BCN*STATIC	U1
VD40528	IC CD40528 *STATIC	U2:20
VAO81CP	IC TL081CP *STATIC	U3:10 3
VA084CN	IC TL084CN TEX *STATIC	U4 6
PM45K0063P	5KOR SPL 63P	P1 2
VA062	IC TL062CP *STATIC	U5 7 9
VD40538	IC CD4053B *STATIC	U8
VA356TC	IC UAF356TC/LF356N	U11
VD74HC132	IC M74HC132 *STATIC	U12
VD74HC4046P	IC 74HC4046 *STATIC	U13
VD74HC390N	IC 74HC390N *STATIC	U14 5
VD40518	IC CD4051BCN *STATIC	U19
VA100CCN	H/P CMOS DUAL SW FILT	U16
VA353N	IC LF353N *STATIC	U17:21
PM3200R63P	200R SPL 63P	P3 4
VS8P	IC SKT 703-1308-010410	
VS14L	IC SKT 703-1314-010410	
VS16L	IC SKT 703-1316-010410	
VS20L	IC SKT 703-1320-010410	

16. A D D E N D U M

There are no amendments or addenda