QUAD
FM4
Tuner

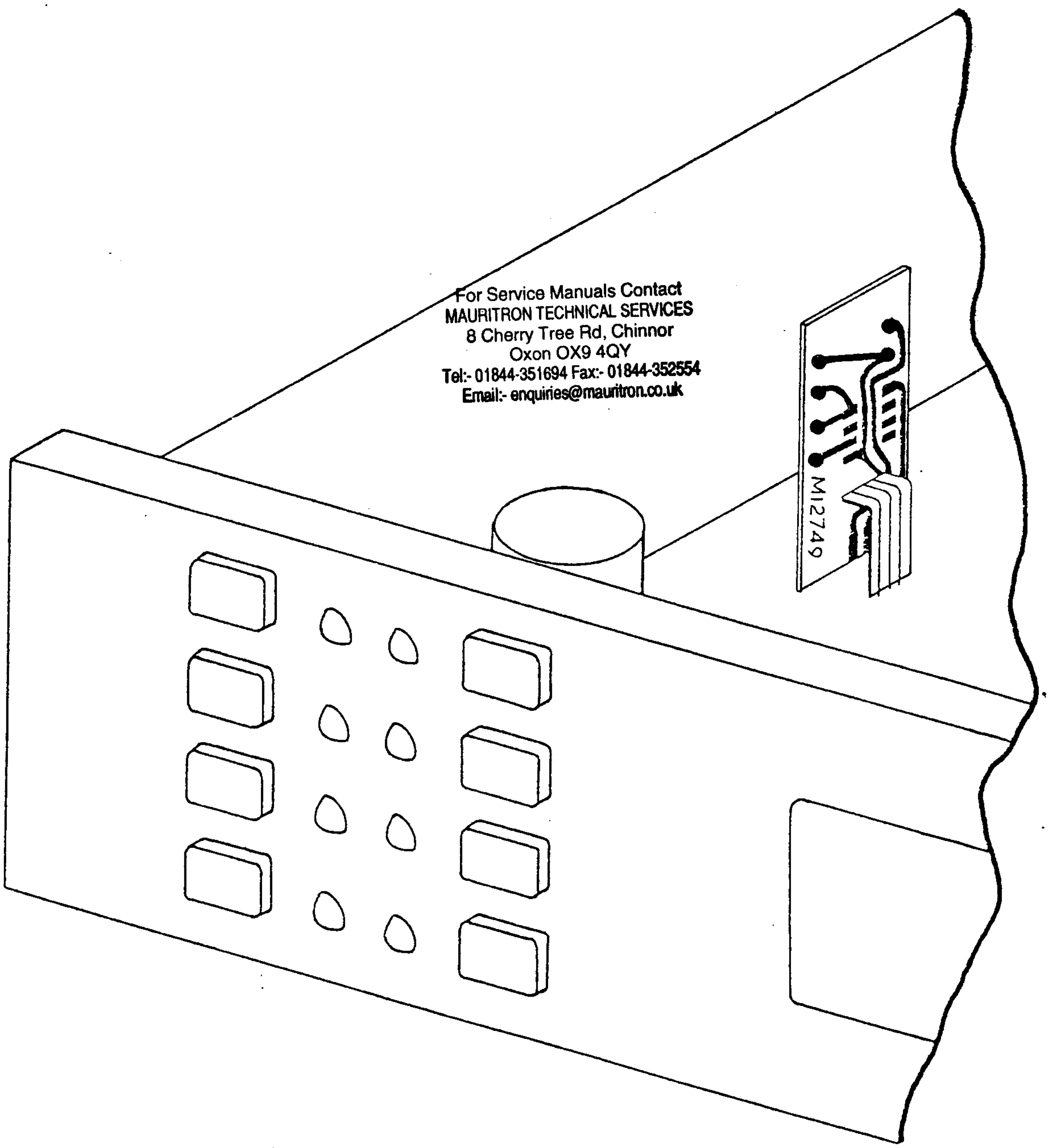
service data

QUAD FM4

The integrated circuit IC7 used as the IF amplifier in the FM4 has proved to be unreliable and has been replaced on later sets by a CA3053S.

We have developed a small printed circuit board incorporating a CA3053S which should be used as a replacement for the UA703.

The UA703 replacement can be ordered under stock number QF4IC7A.



February, 1983

QUAD FM4 Tuner service data

Contents **page**

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introduction

The Quad FM4 is a self powered stereo tuner covering the FM band (88 - 108 MHz) only and designed to be used in conjunction with Quad and similar high quality pre-amplifiers.
The entire operation of the tuner is controlled by a microprocessor so that the only controls on the tuner are an on/off switch, tuning knob, and pre-selector buttons.
Up to seven stations can be stored in the tuner's memory and recalled at the touch of a button.
Manual tuning is accomplished in the normal manner in the sense that the tuning knob is turned clockwise to move up the frequency band and vice versa. The frequency tuned is displayed digitally and a bar graph gives simultaneous indication of signal strength and centre channel tuning.

circuit description

SIGNAL PATH

Input is transformer coupled to an earthed base RF stage in IC4, thence via a band pass filter (L4, L5) to a balanced mixer also in IC4 thence via L10/L11 to an IF amplifier (IC7) which drives a ceramic filter (F1, F2). Discriminator IC10 completes the IF chain. Pin 13 of IC10 provides a d.c. voltage proportional to signal strength, pin 5 is the muting facility driven by IC1 and pins 6 and 7 carry an AFC correction voltage.
Audio from pin 6 of IC10 is passed through a 'birdie filter' (C32, RV5, L16, C36) with RV5 serving as a channel separation control, and on to a phase locked loop stereo decoder IC17. Audio output from IC17 is then filtered by L17, L18 and buffered by T15 and T16.
T18, T19, T20 and T21 form a clamp circuit to suppress switch off and on 'thumps'.

TUNING

Tuning is carried out by controlling the reverse voltage across varicap diodes within the tuned circuits. Tuning volts vary between two extremes, reference high and reference low which define the overall frequency range of the tuner. Ref. low is determined by the voltage across R23. This point is then buffered to pin 2 of IC5. Ref. high is fixed at 6.2V above ref. low by zener diode D24.
Ref. low hence ref. high will vary according to temperature and AFC correction. Temperature compensation is provided by T11 and R20. Fluctuations in temperature will vary the current through hence voltage across R23. Thus changing of the anchor point of the whole tuning range will compensate for temperature excited frequency drift of the tuned circuits. AFC compensation is carried out in much the same way but the correction current is derived from a separate circuit (see AFC).
Reference low volts are typically 2.0 on a hot day, making Ref. high 8.2V.

STATION SELECTION

The heart of the selection system is IC1. This is a custom programmed microprocessor whose function is to manage the select buttons and remember pre-set stations.
Tune volts may be controlled by 1 of 2 sources – the tune pot or a pre-set station. Upon selection the microprocessor will enable the appropriate 2 of four analogue switches contained in IC6.
When [TUNE] is selected then tune volts will be derived from the wiper of the tune pot and the AFC is turned off.
When a pre-set station is selected then tune volts will be derived from a digital code stored in the microprocessor memory representing the required station and the AFC is turned on.

Tune

Selection of [TUNE] initiates 2 separate actions.
(i) Pin 23 of IC1 will carry a logic 'high' illuminating D20 via the appropriate transistor switch.
(ii) Pin 12 of IC1 will also carry a logic 'high' enabling the two analogue switches to which it is connected. Under these conditions tune volts are controlled by the potentiometer RV4 via a buffer. The AFC correction circuit is bypassed.

Preset Stations

Selection of a pre-set station initiates 3 separate actions.
(i) The appropriate indicator LED is illuminated via a transistor switch.
(ii) A 12 bit binary code representing a particular tune voltage is taken from the microprocessor memory and output in serial form on pin 11 of IC1. Pin 10 of IC1 clocks the data into the serial input parallel output shift registers (IC2 and IC3) from where it is converted to an analogue voltage by the R-2R D to A converter N2. The voltage is then fed to pin 1 of one of the analogue switches of IC6 via a buffer.
(iii) Pin 13 of IC1 carries a logic high enabling two analogue switches. Tune volts are then set at the value on pin 1 of IC6 and AFC correction is applied to R23.

STATION LOADING

Having first selected (TUNE) the microprocessor starts off in the 'Tune' mode. Pressing the required pre-set button simultaneously initiates a comparison process.
The microprocessor sets up a binary code which is converted to a voltage by N2. This voltage is then compared to the manually selected voltage on pin 8 of IC5. Differences between pins 7 and 8 of IC5 will be amplified by the comparator, the output of which is connected to pin 1 of the microprocessor. As long as there is a difference voltage on pin 1, the microprocessor will continue to output various binary codes using a successive approximation method. The binary code which gives no difference voltage between pins 7 and 8 of IC5 will be stored. The microprocessor will then switch into the pre-set mode, switching on the AFC.

MUTING

During the execution of any selection commands, pin 14 of IC1 carries a short logic 'high' pulse. The 'high' is sustained by D25, C19, R17, R18 and applied to the muting pin on IC10.

Other Microprocessor Functions

C10 forms half of a differentiator circuit. Upon switch-on a positive spike is applied to pin 28 of IC1 which initiates the microprocessor cycle.
Upon switch off, the transition of ref. high to zero volts is transmitted to pin 4 of IC1 via D23. This instructs the microprocessor to shut down. Memory however is preserved by volts applied to pin 26 from B1.
When the tuner is on, the battery is recharged through D22 and R12. D21 prevents ref. high from damaging the battery.
When the tuner is off, volts are applied to pin 24 from B1 via D21. Under these conditions D22 prevents further loading of the battery.

FREQUENCY DISPLAY

Input to the frequency display system is derived from a loop situated close to the local oscillator. Hence a portion of local oscillator is fed via T10 and L9 to IC8 where the counting sequence begins.
The function of the display circuit is to subtract IF from local oscillator in order to extract tuned frequency. Tuned frequency should then be displayed and tracked. The complete process is repeated every 20mS, as shown below.

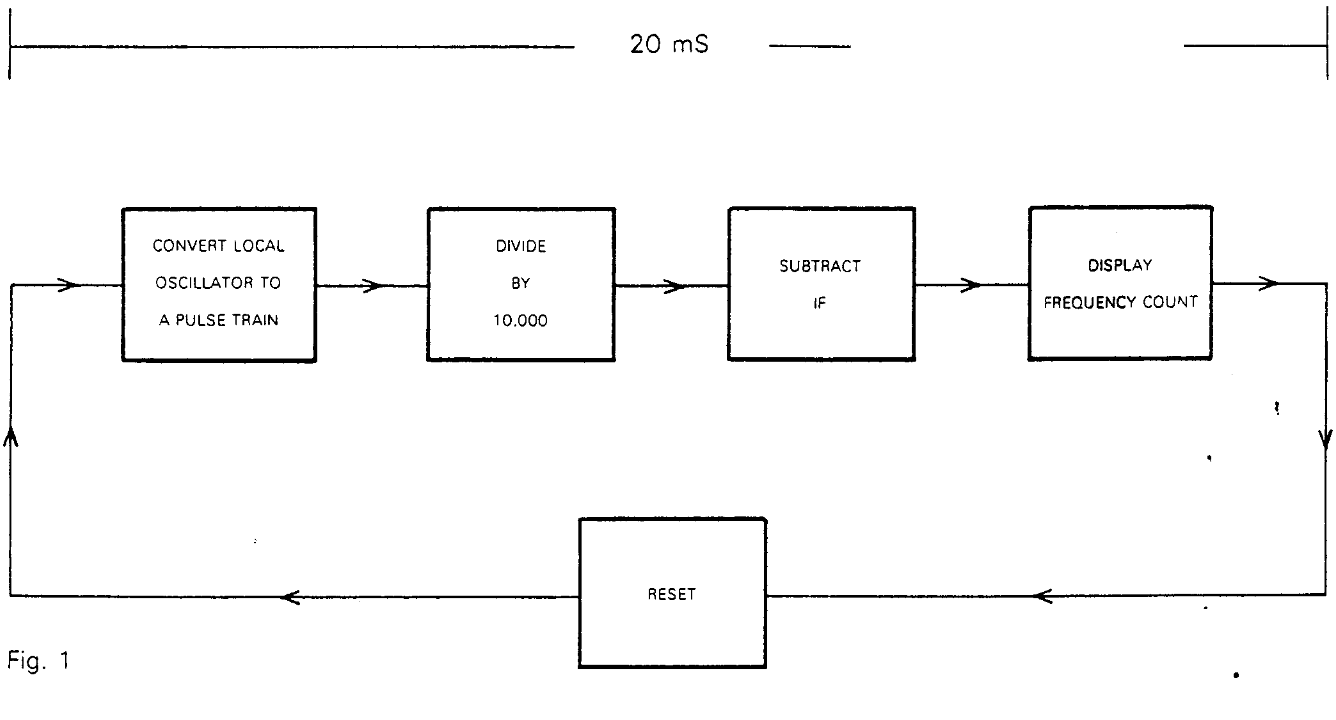
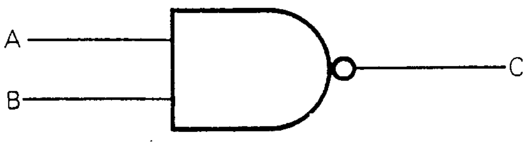


Fig. 1

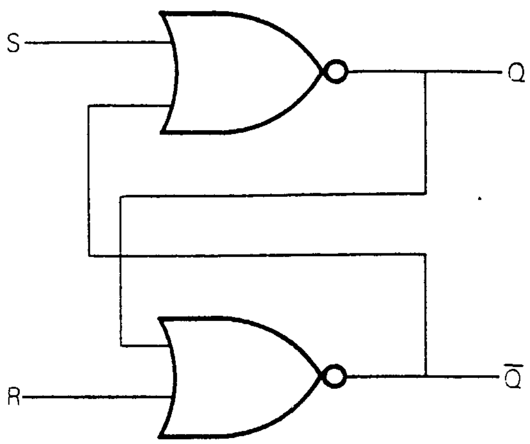
For example if the tuned frequency were 90MHz:
Local oscillator = 90MHz +10.7 MHz =100700000Hz
Dividing by 10,000 = 10070Hz
Subtracting (IF ÷ 10,000) = 10070Hz − 1070Hz = 9000Hz
If the decimal point is now physically placed centrally, displayed frequency is then tuned frequency. Writing MHz after this merely acknowledges the overall divide by 1,000,000.
Timing of the cycle is controlled by a 50Hz clock produced by IC22 and associated components, at pin 2. The clock cycle may be regarded as two 10 mS parts, the positive half cycle during which counting is carried out and the negative half cycle during which displaying is carried out.
Ultimate counting is carried out by IC21. Using logic circuitry to control the enable state of this counter separates the counting half cycle from the display half cycle.

Counting Half Cycle
The truth tables in Fig. 2 may assist in the understanding of the description below.

NAND GATE



NOR FLIP FLOP



A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

S	R	Q	$\overline{Q}$
0	0	INDETERMINATE	
0	1	1	0
1	0	0	1
1	1	0	0

Fig. 2

A transition from logic zero to logic 1 of the clock, (pin 2 of IC22) initiates the cycle. This transition results in a positive spike being applied to pin 8 of IC11, via the differentiator formed by C29 and R32, Fig. 3(b). The spike will be converted to a very short negative going pulse at the output of the NAND gate, pin 10 of IC11. This is then inverted to a positive pulse on pin 11 of IC11. The pulse resets counter IC13 directly and counter IC21 via the NOR gate latch of IC16. IC21 will remain inhibited until the latch is again set.

The divide by 10,000 is carried out in the following stage. IC8 converts local oscillator input into a pulse train and divides this by 100. The pulse train is then raised to CMOS level by T12. This is inverted and applied to one half of a NAND gate, pin 5 of IC11. Data is only conveyed from the NAND gate when the other input, to which clock is applied, is positive. Consequently pin 4 of IC11 carries 10 mS bursts of the pulse train, Fig. 3(e). This data is applied to the input of IC21, which remains inhibited. The count over this 10 mS period is in cycles per 1/100 of a second which is a further divide by 100 making the overall dividing factor 10,000.

Subtraction of IF is carried out simply by delaying the start of the main counter IC21, until a number of pulses corresponding to IF have occurred. The number of pulses are IF ÷ 10,000 which equals 1070. It is now simply necessary to detect when 1070 pulses have occurred since reset, after which the main counter may be enabled.

Immediately after reset IC13 proceeds to count the pulse train. The binary representation for 1070 is 10000101110. The five 1's of this pattern are grouped by the AND gate arrangement of IC15 such that when this pattern is set up and pin 3 of IC16 is also high, (latch in reset state), a set pulse will be applied to the latch which will switch, and enable main counter IC21, Fig. 3(f). Latch output timing is shown in Fig. 3(g). IC21 will continue counting until the end of the 10 mS period when the clock is on its negative half cycle and no more pulses appear at its input. The count is held for the next 10 mS.

Display half cycle
The count held by IC21 is decoded by IC20. IC20 drives the seven segment digits of the display via IC18 and IC19, which raise the logic outputs to levels suitable for driving the display.
Counter IC21, also has a multiplexed output facility which controls the grids of the digits and symbols on the display. As the grid of each segment is enabled the appropriate seven segment code is applied. Grids of indicators, (stereo, MHz and signal strength ladder) are linked to the digit grids. The multiplexer scan rate is derived from pin 13 of IC13.
Stereo will only be illuminated when its grid is enabled and, there is a positive output on pin 7 of IC17 (decoder).
Ladder segments are illuminated in accordance with data on the driver lines of N3, (see below), and when their grids are enabled.
During the positive half of the clock cycle when counting is carried out, the positive signal on pin 15 of IC21 disables the grid outputs leaving the display blanked.
On the negative half of the clock cycle counting ceases and the stored count on IC21 is multiplexed onto the display.

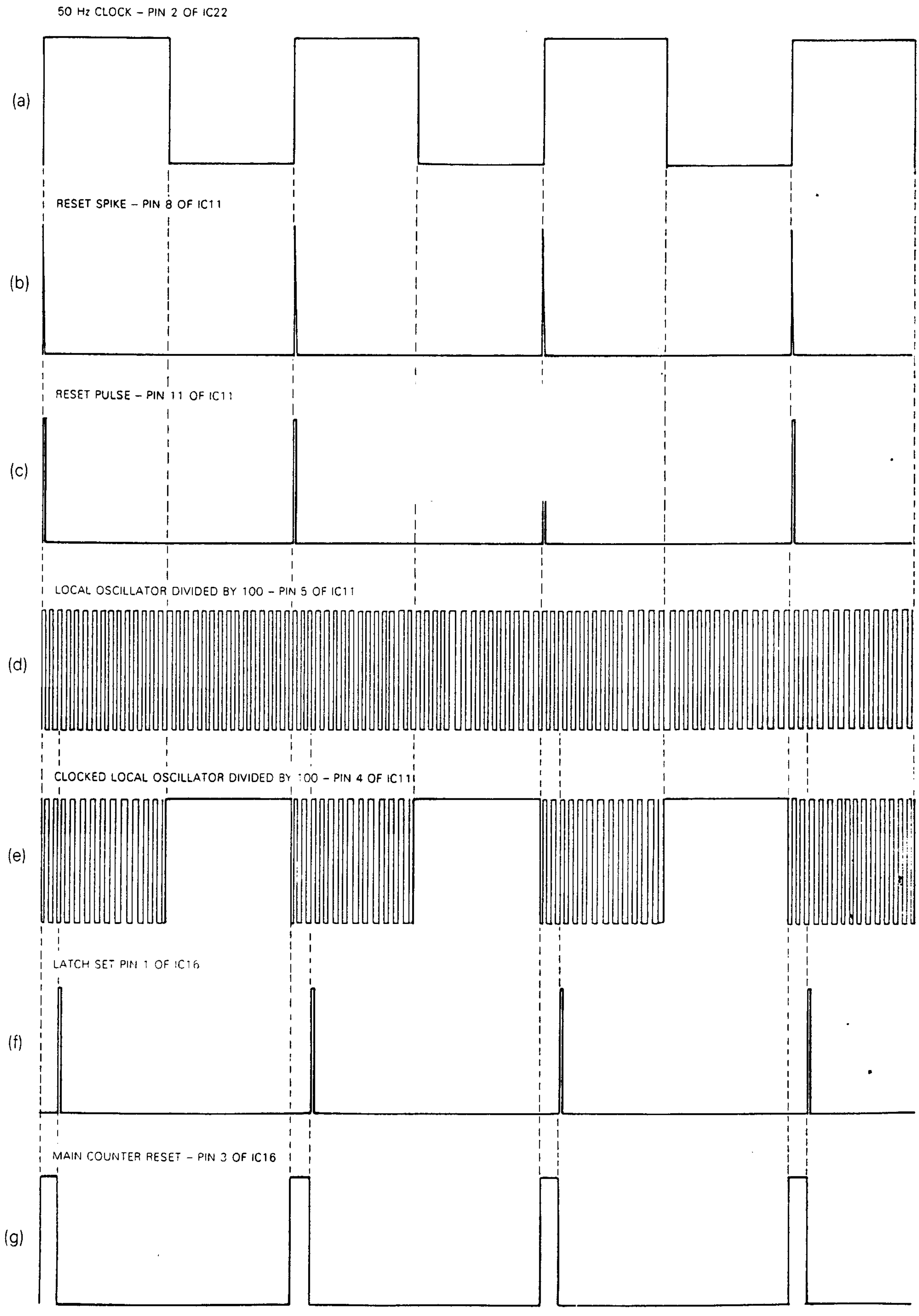

50 Hz CLOCK – PIN 2 OF IC22
(a)
RESET SPIKE – PIN 8 OF IC11
(b)
RESET PULSE – PIN 11 OF IC11
(c)
LOCAL OSCILLATOR DIVIDED BY 100 – PIN 5 OF IC11
(d)
CLOCKED LOCAL OSCILLATOR DIVIDED BY 100 – PIN 4 OF IC11
(e)
LATCH SET PIN 1 OF IC16
(f)
MAIN COUNTER RESET – PIN 3 OF IC16
(g)

Fig. 3

SIGNAL STRENGTH/CENTRE CHANNEL TUNING INDICATOR

When the FM4 is correctly tuned into a station there will be a dc voltage on pin 13 of IC10 which is proportional to signal strength. This is applied to the inverting input of the amplifier IC9.
Whilst IC9 is connected as a positive feedback amplifier, a further phase inversion within the feedback network itself makes the whole system behave as an amplifier with negative feedback.
Positive volts on pin 13 of IC10 are applied to pin 2 of IC9. This will cause a negative deviation of pin 6 of IC9 which will turn on some of the transistor driver devices of N3. As each device turns on, the appropriate segment on the signal strength ladder will illuminate and the current through hence volts across R33 and R34 will increase. When the volts across these resistors matches the volts on pin 2 of IC9, the output pin (6), will stop increasing hence no more devices will turn on.
Centre channel tuning information is derived from pins 6 (7 on pre-ISS 5 p.c.b.'s) and 10 of IC10. When on centre channel pins 6 and 10 are at the same dc offset, 5-6V. Pin 6 will fluctuate around this value according to the state of detune. Detune information is conveyed on the display by a shortening of one side of the signal strength ladder.
The grids of the two sides of the signal strength ladder, (left hand side and right hand side) are enabled alternatively by two of the multiplexed outputs of IC21. The same two points control the changeover switch formed by the analogue switches of IC12.
When pin 11 of IC21 is at logic high one side of the ladder will be illuminated and centre channel tuning data on pins 1, 8 and 4, 11 of IC12 will be transmitted to pins 3 and 2 respectively of the comparator in IC14. When pin 14 of IC21 is at logic high the other side of the ladder is illuminated and the data is forwarded to the comparator in reverse, i.e. data on pins 1, 8 is transmitted to pin 2 of the comparator and data on pins 4 and 11 is transmitted to pin 3 of the comparator.
The comparator output, pin 1, will normally be at 5.6V. When in a state of detune the potential difference across pins 6 and 10 of IC10 will cause the output of the comparator to deviate from its normal value. Deviation will be positive or negative for one half of the ladder and the opposite for the other half when the changeover switch operates.
Negative deviation of the comparator output will turn on and control the current through T13, hence changing the current through R34. Increased current through R34 will increase the volts on pin 3 of IC9. This will result in the extinguishing of a number of the signal strength segments proportional to the current passed through T13.
Positive deviation of the comparator output will have no effect on the signal strength segments. Hence the signal strength ladder is modified synchronously according to the state of detune.

AFC

The AFC circuit operates on pre-set stations only. AFC is derived from pins 6 (7 on pre-ISS 5 p.c.b.'s) and 10 of IC10. Pin 10 is usually at 5.6V, whilst pin 6 will fluctuate around this value according to the state of detune. The potential difference across pins 6 and 10 is applied to the comparator of IC14. The comparator amplifies the difference voltage which, via a potential divider and an analogue switch, modifies the reference volts across R23. This will change reference low, thence tune volts.
When [TUNE] is selected the analogue switches of IC6 operate. Now the voltage drop across the potential divider is fixed at 5.6V, derived directly from pin 10 of IC10. Under these conditions AFC correction is bypassed and ref. low is defined.

fault finding

Faults occurring on FM4's may be traced by using the flow diagram, see Fig. 4. The diagram is an effect(s) to cause guide based on common FM4 faults.

USING THE FLOW DIAGRAM

The diagram assumes fault conditions only and ignores time intervals associated with time dependant faults.
The chain of ordered questions inside the bold markings are the diverging points of the eleven main branches. In most cases the significance of these markings should be ignored, as the diagram will automatically lead to the correct diagnosis. In cases where questions give rise to ambiguity the complete chain should be consulted. A question should emerge as being the most likely branching point. Failure to do so may result in the fault finder trying one or two different branches.
Exit from the diagram will usually be at one of the diagnoses, each of which is clearly defined below. In cases where the terminating statement is FINISH, refer to 'other faults'.
Where a faulty microprocessor (IC1) is diagnosed, removal and replacement of the microprocessor from its holder may cure the fault. The microprocessor is susceptible to static and other forms of interference the effects of which can sometimes be cured only in this way. The inexpensive test is always worth carrying out prior to purchasing a relatively expensive new microprocessor.
Replacement of IC4 will necessitate front end re-alignment as described on page 13.

OTHER FAULTS

Faults which cannot be diagnosed by the flow diagram will be located by a more general approach.
Since much of the tuner is digitally controlled, voltages at many points in the circuit will be well defined for particular conditions, (see circuit description) hence simple voltage measurements may isolate faults. Following of the test procedure will further isolate faults.

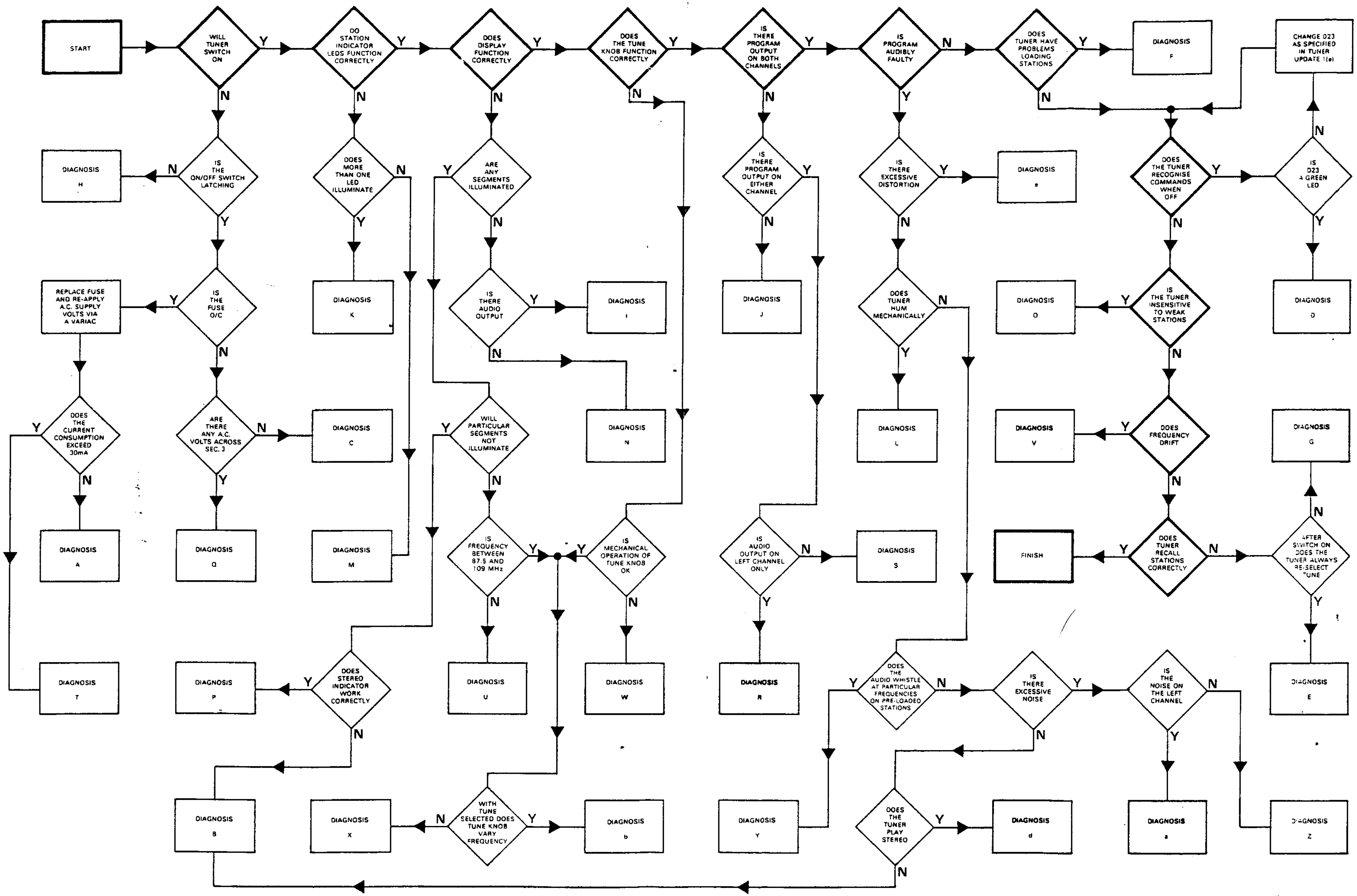

START
WILL TUNER SWITCH ON
DO STATION INDICATOR LEDS FUNCTION CORRECTLY
DOES DISPLAY FUNCTION CORRECTLY
DOES THE TUNE KNOB FUNCTION CORRECTLY
IS THERE PROGRAM OUTPUT ON BOTH CHANNELS
IS PROGRAM AUDIBLY FAULTY
DOES TUNER HAVE PROBLEMS LOADING STATIONS
DIAGNOSIS F
CHANGE D23 AS SPECIFIED IN TUNER UPDATE 1(a)
DIAGNOSIS H
IS THE ON/OFF SWITCH LATCHING
DOES MORE THAN ONE LED ILLUMINATE
ARE ANY SEGMENTS ILLUMINATED
IS THERE PROGRAM OUTPUT ON EITHER CHANNEL
IS THERE EXCESSIVE DISTORTION
DIAGNOSIS e
DOES THE TUNER RECOGNISE COMMANDS WHEN OFF
IS D23 A GREEN LED
REPLACE FUSE AND RE-APPLY A.C. SUPPLY VOLTS VIA A VARIAC
IS THE FUSE O/C
DIAGNOSIS K
IS THERE AUDIO OUTPUT
DIAGNOSIS I
DIAGNOSIS J
DOES TUNER HUM MECHANICALLY
DIAGNOSIS O
IS THE TUNER INSENSITIVE TO WEAK STATIONS
DIAGNOSIS D
DOES THE CURRENT CONSUMPTION EXCEED 30mA
ARE THERE ANY A.C. VOLTS ACROSS SEC. 3
DIAGNOSIS C
WILL PARTICULAR SEGMENTS NOT ILLUMINATE
DIAGNOSIS N
DIAGNOSIS L
DIAGNOSIS V
DOES FREQUENCY DRIFT
DIAGNOSIS G
DIAGNOSIS A
DIAGNOSIS Q
DIAGNOSIS M
IS FREQUENCY BETWEEN 87.5 AND 109 MHz
IS MECHANICAL OPERATION OF TUNE KNOB OK
IS AUDIO OUTPUT ON LEFT CHANNEL ONLY
DIAGNOSIS S
FINISH
DOES TUNER RECALL STATIONS CORRECTLY
AFTER SWITCH ON DOES THE TUNER ALWAYS RE-SELECT TUNE
DIAGNOSIS T
DIAGNOSIS P
DOES STEREO INDICATOR WORK CORRECTLY
DIAGNOSIS U
DIAGNOSIS W
DIAGNOSIS R
DOES THE AUDIO WHISTLE AT PARTICULAR FREQUENCIES ON PRE-LOADED STATIONS
IS THERE EXCESSIVE NOISE
IS THE NOISE ON THE LEFT CHANNEL
DIAGNOSIS E
DIAGNOSIS B
DIAGNOSIS X
WITH TUNE SELECTED DOES TUNE KNOB VARY FREQUENCY
DIAGNOSIS b
DIAGNOSIS Y
DOES THE TUNER PLAY STEREO
DIAGNOSIS d
DIAGNOSIS a
DIAGNOSIS Z
Y
N

Fig. 4

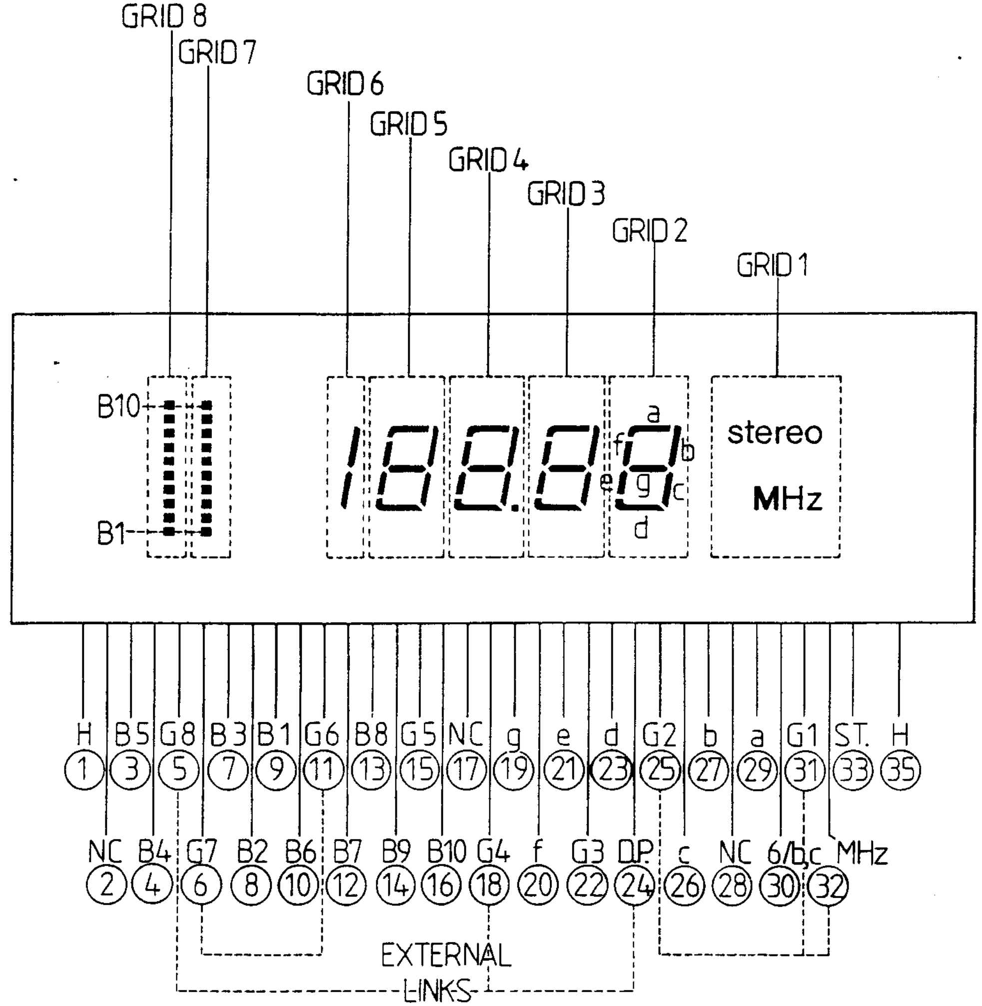

GRID 8
GRID 7
GRID 6
GRID 5
GRID 4
GRID 3
GRID 2
GRID 1
B10
B1
a
b
c
d
e
f
g
stereo
MHz
H B5 G8 B3 B1 G6 B8 G5 NC g e d G2 b a G1 ST. H
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35
NC B4 G7 B2 B6 B7 B9 B10 G4 f G3 DP. c NC 6/b,c MHz
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32
EXTERNAL
LINKS

Fig. 4a

diagnoses

DIAGNOSIS A
(i) Intermittent short circuit on the primary side of the transformer.
(ii) Fuse may have been blown by a spurious AC power supply spike.

DIAGNOSIS B
(i) Decoder is out of alignment. RV6 should be adjusted as in test 8.

DIAGNOSIS C
(i) Check wiring inside the power supply area.
(ii) Dry joint on the transformer.
(iii) O/C primary windings on the transformer.

DIAGNOSIS D
(i) Pin 15 of IC1 is not in the DIL holder. This means that the microprocessor is not dormant when the tuner is 'off' therefore loading the battery.

DIAGNOSIS E
(i) Battery drained. P.d. across the battery should be > 4 volts.
(ii) Battery not soldered.
(iii) Battery broken.

DIAGNOSIS F
(i) R39 O/C.

DIAGNOSIS G
(i) IC1 holder contacts O/C.
(ii) IC1 U/S.

DIAGNOSIS H
(i) Overall length of switch bar is too short. The cover should be removed (two screws). The switch bar should then be gently eased forward applying pressure at the kink. (Care should be taken not to damage the switch). The threaded nylon switch link can then be adjusted to increase the overall switch bar length. Replacement is a direct reverse of removal.

DIAGNOSIS I
No supply to display.
(i) Dry joint on the base of T22.
(ii) Dry joint on display heater connections, pins 1 and 35.
(iii) IC21 U/S.
(iv) IC22 U/S.

DIAGNOSIS J
(i) IC7 U/S. Remove and replace with Quad replacement part QF4IC7A. (See page 18).
(ii) IC4 O/C.

DIAGNOSIS K
(i) IC1 faulty.

DIAGNOSIS L
(i) Mechanical hum from rear of tuner due to a faulty transformer.

DIAGNOSIS M
If the fault is with one LED only diagnosis is as in (i) or (ii). If no LEDS will light diagnosis is as in (ii) or (iii).
(i) Indicator LED O/C.
(ii) Dry joint on the selector board.
(iii) Int. or faulty IC1.

DIAGNOSIS N
(i) T9 is getting too hot and dropping the HT volts from 12 to 6. Other typical symptoms are that the fault occurs after a period of time and may be temporarily cured by switching the tuner off, then on again. Cure will be to fit a heatsink to T9, it may also be necessary to replace T9 in order to accommodate the heatsink as the legs of fitted T9's may be too short. Bolt on heatsinks are available from Quad.
Replacement parts: T9 Stock Number D7812XA, Heatsink Stock Number M12578A.

DIAGNOSIS O

(i) IC4 low gain.

DIAGNOSIS P

(i) Dry joint in display soldering (see Fig. 4a).

DIAGNOSIS Q

(i) IC4 S/C.

DIAGNOSIS R

(i) R52 O/C.

DIAGNOSIS S

(i) R53 O/C.

DIAGNOSIS T

(i) Transformer primaries S/C.

DIAGNOSIS U

(i) IC8 U/S.
Great care should be exercised when replacing IC8 to avoid contact with the device as it is highly susceptible to static.
(ii) L9 O/C.

DIAGNOSIS V

(i) T11 U/S.
(ii) D12 U/S.
(iii) D24 U/S.

DIAGNOSIS W

(i) Tune pot loose. Remove the cover (2 screws) and adjust the tune pot locking nut.
(ii) Tuning feels stiff. Remove the cover (2 screws) and adjust the shaft nut.
(iii) No end stops. RV4 U/S, remove and replace.

DIAGNOSIS X

(i) RV4 O/C contact.
(ii) Dry joint on ref. low or ref. high. Frequency will be fixed at the top or bottom of the band frequency respectively.
(iii) IC1 U/S. Pin 12 should be logic high to operate the analogue switch.
(iv) IC1 holder contacts intermittent.

DIAGNOSIS Y

(i) The whistles will be particularly noticeable on pre-loaded stations. Add C59, 47n as in tuner update 1J.

DIAGNOSIS Z

(i) R52 U/S.

DIAGNOSIS (a)

(i) R53 U/S.

DIAGNOSIS (b)

(i) RV4 U/S, track or contacts intermittent.

DIAGNOSIS (d)

(i) Re align tuner front end as in tests 2 and 6.

DIAGNOSIS (e)

(i) IC17 causing distortion.
(ii) Check alignment.

testing and alignment

Complete testing and alignment may most easily be carried out using the test equipment listed below and interconnecting these units as shown in Fig. 5. Switches shown in Fig. 5 are a diagrammatical representation of various connections. In practice it is easier to connect leads together directly.

TEST EQUIPMENT

Dual Beam Oscilloscope
Sound Technology 1000 (ST1000)
Digital Voltmeter
AC Microvoltmeter
10.7 MHz Oscillator

AC Power Supply
Pre-Amplifier
Power Amplifier
Loudspeakers

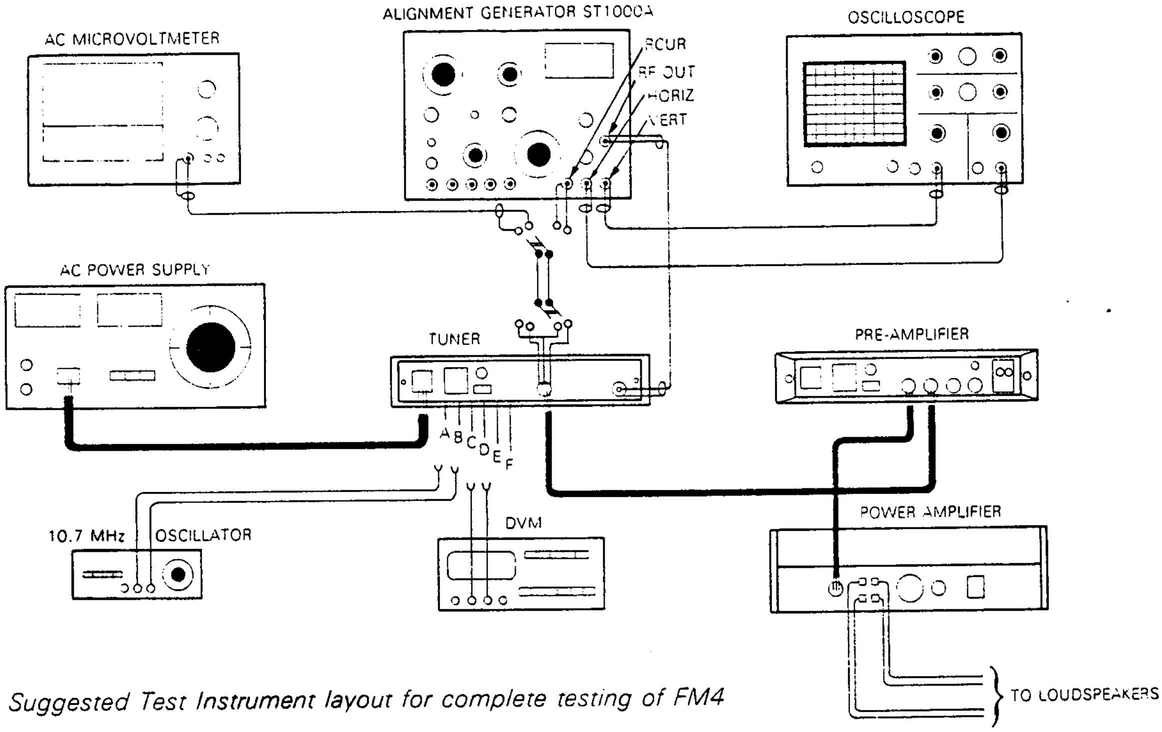
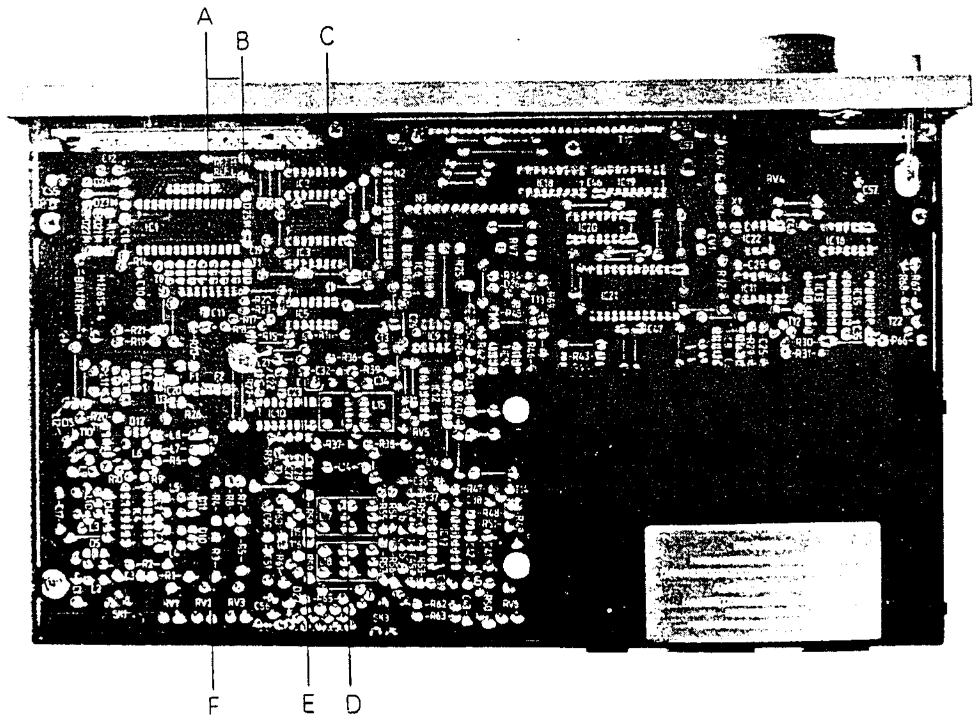


Fig. 5 *Suggested Test Instrument layout for complete testing of FM4*

Many of the tests involve making voltage measurements for which a digital voltmeter should be used. Solid bared wires should be soldered to the points shown below, making connections to the DVM easier.



QUAD FM4 Tuner service data

1. POWER

CONNECTIONS
AC supply power to tuner via variac

CONTROLS
Variac: Zero
Tuner: Power-on
Voltage Selector –240V

Increase the output from the variac to 240V whilst observing the tuner current consumption which should not exceed 30mA, (typically 28mA). The gradual increase in supply volts will leave the microprocessor dormant hence no LED will light and the display will indicate approximately 87.5MHz. Switching off and then on again will initiate microprocessor action which will have minimal effect on the current consumption.

2. REGULATION

CONNECTIONS
AC supply to tuner via variac

CONTROLS
Variac: Output – zero
Tuner: Power-on
Voltage selector –110V

Increase the output of the variac to 135V. The tuner display should be functioning normally. Failure of the display to do so indicates that the regulator under overloaded input conditions has cut its output from 12 to 6V. This occurs with some regulators because the device is functioning on the limit of its temperature range. A temporary cure is to simply switch the tuner off and allow the regulator to cool down before turning on again. A more permanent cure is to fit a heatsink to the regulator. Such a heatsink is available from Quad. It may also be necessary to replace T9 in order to accommodate the heatsink as the legs of fitted T9's may be too short. Stock numbers of replacement parts are as follows: Regulator – D7812XA, Heatsink – M12578A. Fixing is with an M3 nut and bolt.

3. TUNE VOLTS

CONNECTIONS
AC supply volts to tuner
DVM to point A

CONTROLS
Tuner: Power-on
Voltage selector –240V
DVM: Range – 0 to 10V

The voltmeter reading should be approximately 8.2V. Connect the DVM to point B where the reading should be approximately 2.0V. These are ref. high and ref. low values which define the tuning range. The values will fluctuate according to temperature but the difference should always be 6.2V.

4. TUNING RANGE

CONNECTIONS
AC supply to tuner

CONTROLS
Tuner: Power-on
Voltage selector –240V
Station – [TUNE]

With the tune knob turned fully anti-clockwise the display reading should be 87.5MHz. Adjustment of L6 will vary this. Rotate the tune knob fully clockwise. The display should count in an orderly manner up to approximately 109MHz as the tune knob is rotated.

5. IF ALIGNMENT

CONNECTIONS
AC supply to tuner
10.7MHz oscillator to tuner point F

CONTROLS
Tuner: Power-on
Voltage selector –240V

(a) The signal strength ladder should indicate 'centre channel'. Adjustment of the left hand side core of L15 will optimise this.
(b) Disconnect the 10.7MHz oscillator. Adjust controls and make connections as follows.

CONNECTIONS
Tuner left chanel o/p to ST1000 RCVR
ST1000 VERT to oscilloscope Y2
ST1000 HORIZ to oscilloscope Y1
ST1000 RF o/p to tuner

CONTROLS
ST1000: Function – dual sweep
Sweep width – 150KHz
Frequency – 87.5MHz
RF level – 600 μV
Oscilloscope: Timebase – XY
Y1 sensitivity – 5V/cm
Y2 sensitivity – 0.2V/cm
Tuner: Station – [TUNE]
Frequency –87.5 MHz

Adjust the ST1000 frequency dial until the tuner signal strength ladder indicates 'centre-channel'. Adjust the right hand side core of L15 such that the oscilloscope trace is flat topped, as in Fig. 6. If necessary readjust L6 as in (4), then re-check.

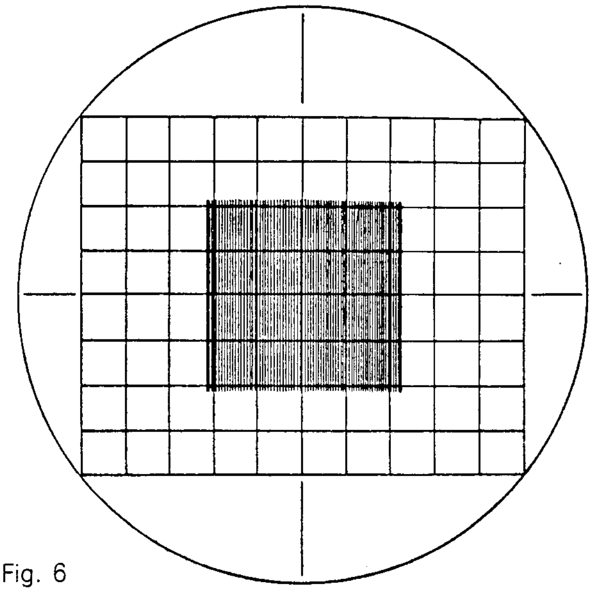


Fig. 6

6. RF ALIGNMENT

CONNECTIONS
AC supply to tuner
ST1000 RF o/p to tuner
DVM to tuner point D

CONTROLS

Tuner:	**Power-on**
	Voltage selector –240V
	Station – TUNE
	Frequency –87.5MHz
ST1000:	**Function – mono**
	Frequency –87.5MHz
	RF level – 100μV
DVM:	**Range – 0 to 10V**

CENTRE CHANNEL TUNING

Note the voltage reading at point D. Connect the DVM to point E and adjust the oscillator frequency until the voltage reading from E is the same as for D, correct to two decimal places. These are the AFC reference and correction volts and this ensures that the FM4 is on 'centre-channel'.
When on 'centre-channel' connect the DVM to point C on the tuner.
Adjust L2, L4 and L5 respectively to maximise the voltage reading. Tune tuner and ST1000 to 104MHz, again checking 'centre-channel' tuning by comparing AFC reference against AFC correction volts. Re-connect the DVM to point C and adjust RV1, RV2, RV3, L10 and L11 respectively, again for signal strength optimisation.

7. OUTPUT LEVEL

CONNECTIONS
AC supply to tuner
ST1000 RF o/p to tuner
Output from tuner L/C to AC microvoltmeter

CONTROLS

Tuner:	**Power-on**
	Voltage selector –240V
	Frequency –87.5MHz
	Station – TUNE
ST1000:	**Function – mono**
	Frequency –87.5MHz
	RF level – 1mV
	Modulation – 100%
AC Micro-voltmeter:	**Range – 0 to 500mV**

Check for 'centre-channel' tuning as described in test 6. The output level reading on the AC microvoltmeter should be 280-330mV. Connect the R/C tuner output to the AC microvoltmeter and repeat the check. The two output levels should be matched within 0.5dB.

8. DECODER ALIGNMENT

CONNECTIONS
AC supply to tuner
ST1000 RF o/p to tuner

CONTROLS

Tuner:	**Power-on** **Voltage selector –240V** **Frequency –87.5MHz** **Station – [TUNE]**
ST1000:	**Function – stereo** **Frequency –87.5MHz** **RF level –1mV** **Modulation –100%** **Modulate –L/C** **Pilot level –10%**

Observe the tuner display whilst adjusting RV6. Find the two extremes of travel on RV6 over which the decoder locks on to stereo and set RV6 approximately to the centre of these two extremes.

9. CROSSTALK

CONNECTIONS
AC supply to tuner
ST1000 RF o/p to tuner
O/p from tuner L/C to AC microvoltmeter

CONTROLS

Tuner:	**Power-on** **Voltage selector –240V** **Frequency –87.5MHz** **Station – [TUNE]**
ST1000:	**Function – stereo** **Frequency –87.5MHz** **RF level –1mV** **Modulation –100%** **Modulate – L/C** **Pilot level –10%**
AC Micro-voltmeter:	**Range – 0 to 500mV**

Note the reading on the AC microvoltmeter which should be approximately 280-330mV. Switch the ST1000 to modulate the R/C. The output level should drop by at least 40dB. Connect the o/p from tuner R/C to the AC microvoltmeter and modulate the L/C. Again the reading on the meter should be 40dB down on full output. Crosstalk may be optimised by adjusting RV5.

10. SIGNAL TO NOISE

CONNECTIONS
AC supply to tuner
ST1000 RF o/p to tuner
O/p from tuner L/C to AC microvoltmeter

CONTROLS

Tuner:	**Power-on** **Voltage selector –240V** **Frequency –98MHz** **Station – [TUNE]**
ST1000:	**Function – stereo** **Frequency –98MHz** **RF level –1mV** **Modulation –100%** **Modulate – L/C** **Pilot level –10%**
AC Micro-voltmeter:	**Range – 0 to 500mV**

Check for on 'centre-channel' as described in test 6. Note the output level, then switch the ST1000 function switch to carrier wave. The output-level of the tuner should drop by 73dB. Reduce the ST1000 RF level to 1 μV. The output level of the tuner should be 40dB down compared to full output.
Connect the right channel output from the tuner to the AC microvoltmeter and repeat the test.

11. FUNCTIONS

With the tuner connected into an audio system listen for any alien audibles. Check that the tuner will load and remember stations. Check that the tuner does not recognise station commands when it is switched off. This may be done by selecting a station say, [BBC1], then switching the tuner off. Select a different station then switch the tuner on again. The tuner should revert to BBC1. Failure to do so would indicate that the battery is being overloaded. (See fault finding).

modifications

APRIL 1982 **Approx Serial Number 1630**

1. C58, 3.3pf stock number C3P30CA added. This improves the accuracy of the display counter circuit over the frequency band.

2. R24, R25 change from 2M2 to 4M7, stock number R4M70JA. This reduces the AFC range.

3. R29 changed from 220Ω to 180Ω stock number R180RJ1. Display counter circuit is now less temperature sensitive.

4. R33 changes from 1K5 to 1K2, stock number R1K20J1. This alters the maximum setting of the signal strength ladder.

5. D23 changes from IS920 to a green LED stock number BL86NA5. This prevents excessive loading of the battery.

MAY 1982 **Approx Serial Number 2000**

Issue 3 printed circuit board introduced incorporating the following changes.

1. D27 and D28 stock number D1N4148 added to reduce distortion.

2. R69, 10K stock number R10K0J1 added. This improves the accuracy of the signal strength ladder.

3. The following components added: R66, 2K2 stock number R2K20J1, R67, 390R stock number R390RJ1, R68, 10R stock number R10R0J1, T22, ZTX450 stock number DZTX450, D29, VM18 stock number DVM18XX and C57 470μF stock number C470UZE.
   D6 and D7 removed. L1 secondary 1 turns increased. Transformer is now coded with a blue spot, stock number L12591B. These changes overcome display flicker particularly noticeable when used with 60Hz AC supply. Transformers fitted to ISS2 and ISS3 pcb's are not interchangeable.

JUNE 1982 **Approx Serial Number 2500**

Issue 4 printed circuit board introduced incorporating the following changes.

1. C44a and C45a, 560p stock number C560PKJ added. This improves the de-emphasis.

2. R33, 1K2 replaced by RV7, 2K2 stock number RP2K20A.

3. Pin 9 of IC21 is now linked to pin 2. This prevents a visible ripple through effect on the display.

4. IC7, 703 changes to a 3053 stock number DCA3053. R70, 47K stock number R47K0J1 added in conjunction with this.
   This modification was carried out because 703's proved to be unreliable. Faulty 703's should be replaced with 3053's, however the pinning and biassing of the two devices is different. A small printed wiring board incorporating changes to overcome these differences is available and may be ordered as stock number QF4IC7A.

Approx JULY 1982 **Approx Serial Number 3400**

1. L1 primary turns increased. The transformer now carries a red spot coding, stock number L12591B. Units fitted with earlier transformers were prone to losing regulation when AC supply volts were low.
   A heatsink is now fitted to the regulator device, T9.

NOVEMBER 1982 **Approx Serial Number 5100**

C1 and C55, 47n removed. In some cases these devices gave rise to hum.

FEBRUARY 1982 **Serial Number 6351**

Red tune button is now replaced by a brown button, stock number MBTUNEB.

MARCH 1983 **Serial Number 6712**

C59, 47n stock number C47N0ZL added. This overcomes whistles at particular frequencies.

APRIL 1983 **Serial Number 7045**

N3 component board is now replaced by a thick film package, stock number QF4N3AC. The two are interchangeable.

QUAD FM4 Tuner service data

MAY 1983 **Serial Number 7468**

Between serial number 7468 and the introduction of ISS5 printed circuit board different methods to optimise the coupling of L6 were used.

Consequently when replacing L6 on tuners fitted with pre-ISS5 printed circuit boards it will usually be necessary to modify the printed display pick up loop, situated beneath L6.

To do this, first remove the two wire links connecting the printed loop to the underside of the pcb. With the new coil in place, a short length of wire should be looped once around the coil former. The wire ends should be crossed and soldered to the underside points of the holes vacated by the printed loop links.

Approx DECEMBER 1983 **Serial Number 11000**

ISS 5 pcb introduced accommodating the following changes.

1. Wire links removed and replaced by copper tracks which are an integral part of the printed circuit board.

2. Following components added: R71, 10K stock number R10K0J5; C61, 3p3 stock number C3P30CA; C62, 2µ2 stock number C2µ20KT; L20, 15.5 turns of W34TNAA; L21, 1µH stock number L4TIR0M. Oscillator coil (L6) and Aerial coil (L2) are now screened, stock number N219101.
   R9 is now fitted to the rear side of the pcb and changes in value to 68Ω, stock number R68R0KD. R1 changes in value to 10K, stock number R10K0J5.
   R10, C9, C15, L7 and L8 removed. These changes overcome IF whistles at certain frequencies.

3. R72, 68K stock number R68K0J1 and C63, 0.47µF stock number C470NMP added. R39 and C31 removed. AFC is now derived from hence muted with audio.

4. C59 is now fitted to the top side of the pcb.

5. C60, 47n stock number C47N0ZL added. This suppresses multiplexer noise.

6. Copper track around the AC supply area is modified resulting in re-positioning of the suppressor.

7. C1 re-instated.

COMPONENT ALTERNATIVES

L1, mains transformer must always be of stock number L12591A on ISS 2 pcb's. These transformers have no colour coding.

From ISS 3 pcb onwards the mains transformer must be of stock number L12591B. These transformers may be coded with a blue or red spot. In cases where the AC supply volts are prone to dropping by considerable amounts red spot transformers should be used.

IC7 – see notes on page 18.

led and tune button update

Early tuners were fitted with a red tune button and comparatively large LEDS. Current tuners are fitted with a brown tune button and smaller LEDS in a plastic bezel. To update tuners with respect to these changes the following KIT should be ordered and instructions followed.

1. Disconnect the tuner.
2. Remove the cover (two screws).
3. Remove the tune knob, M3 grubscrew.
4. Slacken off the screws securing the chassis to the tune bracket and the front of the pcb to the chassis.
5. Remove the six screws securing the front panel and slide the front panel free from the chassis.
6. Tilt the front panel forwards, giving access to the screws securing the button board and remove the screws. Pull the panel free from the button board and place it away from the working area.
7. Remove the buttons from the button board, noting their sequence.
8. Unsolder the existing LEDS. Extreme care should be taken to avoid lifting the copper track.
9. Solder the new pre-formed LEDS into the vacated holes, making sure that the red LED is in the correct place.
10. Refit the buttons with the brown tune button replacing the red one.
11. Fit the plastic bezel over the LEDS and refit the button board.
12. Replacement of the other components is a direct reverse of removal making sure to re-tighten the slackened screws.

KIT stock number QF4BEZA

replacing IC7

On units prior to approximately serial number 2500 the device used as the IF amplifier, IC7, was a μA703. This device proved to be unreliable and from ISS 4 pcb onwards was replaced by a CA3053.
When replacing a μA703 with a CA3053 it is necessary to use a specially developed pcb which overcomes the differences in pinning and biassing of the two devices. The pcb simply solders into the existing holes in the orientation shown below. The pcb may be ordered as QF4IC7A.

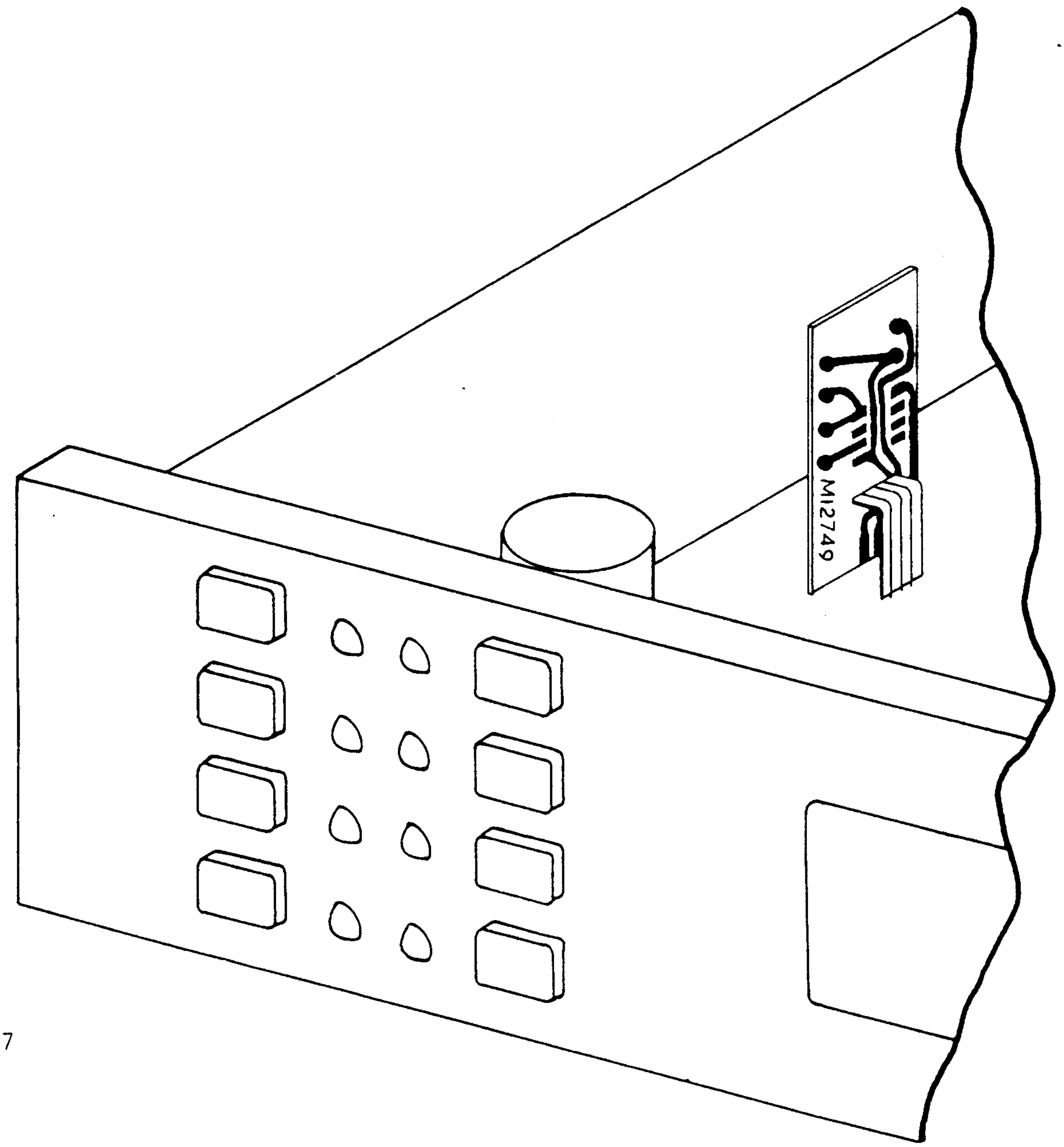


Fig. 7

standard tuner update

1. UNITS BEFORE APPROX SERIAL NUMBER 1630

(a) Add C58, 3.3p stock number C3P30CA. This should fit through the same holes and be soldered to the same pads as L9 alongside IC8.

(b) Change the values of R24 and R25 from 2M2 to 4M7 stock number R4M70JA.

(c) Change R29 from 220Ω to 180Ω, stock number R180RJ1.

(d) Change R33 from 1K5 to 1K2, stock number R1K20J1.

(e) Change D23 from IS920 to a green LED stock number BL86NA5. Also replace the battery stock number N4100DK.

(f) Add R69 10K stock number R10K0J1. This should be fitted to the reverse side of the board between HT (12V) and the junction of D26 with the base of T13.

(g) Add C44a and C45a 560p stock number C560PKJ. These should be soldered to the reverse side of the board and be parallel with R52 and R53 respectively.

(h) Replace IC7, μA703 with replacement part QF4IC7A. (See page 18).

(i) Remove C1 and C55.

(j) Add C59, 47n stock number C47N0ZL. This should be soldered to the reverse side of the board between pin 3 of IC5 and earth.

2. Units between Approx Serial Number 1630 and 2,000
Carry out modifications as in 1 (f), (g), (h), (i) and (j).

3. Units between Approx Serial Number 2,000 and 2,500
Carry out modifications as in 1 (g), (h), (i) and (j).

4. Units between Approx Serial Number 2,500 and 5100
Carry out modifications as in 1 (i) and (j).

5. Units between Approx. Serial Number 5100 and 6712
Carry out modifications as in 1 (j).

The following parts list covers all of the parts currently necessary to produce an FM4 tuner. Previous issue values are indicated where current component values differ from those used on previous issue and are not interchangeable. Values which have changed for optimisation are not indicated but may be found under modifications, page 15.

Component Ref.	Present Value	Stock Number	Previous Value	Stock Number	Comments
R1	10K	R10K0J5	47K	R47K0J1	Changed at ISS 5
R2	1K5	R1K50J1			
R3	47K	R47K0J1			
R4	47K	R47K0J1			
R5	68K	R68K0J1			
R6	1K	R1K00J1			
R7	33K	R33K0FN			
R8	68K	R68K0FN			
R9	68R	R68R0KD	33R	R33R0KD	Changed at ISS 5
R10			33R	R33R0KD	Removed at ISS 5
R11					
R12	2K2	R2K20J1			
R13	270R	R270RJ1			
R14	15K	R15K0J1			
R15	100K	R100KJ1			
R16	2M2	R2M20J1			
R17	330K	R330KJ1			
R18	330K	R330KJ1			
R19	470K	R470KJ1			
R20	1K5	R1K50FN			
R21	470R	R470RJ1			
R22	150K	R150KFN			
R23	22K	R22K0FN			
R24	4M7	R4M70JA			
R25	4M7	R4M70JA			
R26	330R	R330RJ1			
R27	330R	R330RJ1			
R28					
R29	180R	R180RJ1			
R30	4K7	R4K70J1			
R31	220K	R220KJ1			
R32	10K	R10K0J1			
R33			1K2	R1K20J1	Removed at ISS 4
R34	1K	R1K00J1			
R35	33K	R33K0J1			
R36	4K7	R4K70J1			
R37	15K	R15K0J1			
R38	2K7	R2K70J1			
R39			15K	R15K0J1	Removed at ISS 5
R40	100K	R100KJ1			
R41	100K	R100KJ1			
R42	4M7	R4M70JA			
R43	33K	R33K0J1			
R44	33K	R33K0J1			
R45	3K3	R3K30J1			
R46	1M	R1M00J1			
R47	10K	R10K0J1			
R48	1K	R1K00J1			
R49	22R	R22R0J1			
R50	10K	R10K0J1			
R51	1K	R1K00J1			
R52	6K8	R6K80J1			
R53	6K8	R6K80J1			
R54	4K7	R4K70J1			
R55	47K	R47K0J1			
R56	47K	R47K0J1			
R57	4K7	R4K70J1			
R58	4K7	R4K70J1			
R59	4K7	R4K70J1			
R60	2K2	R2K20J1			
R61	2K2	R2K20J1			
R62	1M	R1M00J1			
R63	1M	R1M00J1			
R64	10M	R10M0KB			
R65	22K	R22K0J1			
R66	2K2	R2K20J1			
R67	390R	R390RK1			

Component Ref.	Present Value	Stock Number	Previous Value	Stock Number	Comments
R68	10R	R10R0J1			
R69	10K	R10K0J1			
R70	47K	R47K0J1			
R71	10K	R10K0KD			
R72	68K	R68K0J4			
RV1	100K	RP100KA			
RV2	100K	RP100KA			
RV3	100K	RP100KA			
RV4	50K	RVF4TUB			
RV5	10K	RP10K0W			
RV6	5K	RP5K00A			
RV7	2K2	RP2K20A			
C1	47n	C47N0ZL			
C2	47n	C47N0ZL			
C3	47n	C47N0ZL			
C4	1000μ	C1K0UTA			
C5	1000μ	C1K0UTA			
C6	220μ	C220UZE			
C7	47n	C47N0ZL			
C8	330p	C330PKI			
C9			2μ2	C2U20KT	Removed at ISS 5
C10	1μ	C1U00KS			
C11	100μ	C100UME			
C12	100μ	C100UME			
C13	47n	C47N0ZL			
C14	47n	C47N0ZL			
C15			47n	C47N0ZL	Removed at ISS 5
C16	180p	C180PKJ			
C17	330p	C330PKJ			
C18	47n	C47N0ZL			
C19	1μ5	C1U50KT			
C20	47n	C47N0ZL			
C21	47n	C47N0ZL			
C22	47n	C47N0ZL			
C23	47n	C47N0ZL			
C24	47n	C47N0ZL			
C25	330p	C330PKJ			
C26	330p	C330PK1			
C27	47n	C47N0ZL			
C28	47n	C47N0ZL			
C29	33p	C33P0JJ			
C30	2μ2	C2U20KJ			
C31			2μ2	C2U20KJ	Removed at ISS 5
C32	47p	C47P0KJ			
C33	47n	C47N0ZL			
C34	100μ	C100UME			
C35	47n	C47N0ZL			
C36	180p	C180PKJ			
C37	2μ2	C2U20KJ			
C38	220n	C220NKS			
C39	6n8	C6N80JA			
C40	47n	C47N0ZL			
C41	470n	C470NKS			
C42	220n	C220NKS			
C43	220p	C220PKW			
C44b	6n8	C6N80JA			
C44a	560p	C560PKJ			
C45b	6n8	C6N80JA			
C45a	560p	C560PKJ			
C46	47n	C47N0ZL			
C47	47n	C47N0ZL			
C48	47n	C47N0ZL			
C49	47p	C47P0KJ			
C50	220n	C220NKS			
C51	220n	C220NKS			
C52	330n	C330NJS			
C53	47n	C47N0ZL			
C54	47n	C47N0ZL			
C55			47n	C47N0ZL	
C56	22μ	C22U0ZE			
C57	470μ	C470UZE			
C58	3p3	C3P30CA			
C59	47n	C47N0ZL			
C60	47n	C47N0ZL			

QUAD FM4 Tuner service data

Component Ref.	Present Value		Stock Number	Previous Value	Stock Number	Comments
C61	3p3		C3P30CA			
C62	2μ2		C2U20KT			
C63	470n		C470NLJ			
CV1	5/60p		CV60PTA			
L1	Mains Transformer		L12591B	Mains Transformer	L12591A	See alternatives page 1
L2	Aerial Coil		L11160A			
L3	RF Matching Coil	15.5 turns of	W34TNAA			
L4	RF Coil		L11130A			
L5	RF Coil		L11129A			
L6	Osc. Coil		L11041A			See notes page 16.
L7				2μ2	LS1222K	Removed at ISS 5
L8				2μ2	LS1222K	Removed at ISS 5
L9	Display Coupler		QF4L9AQ			
			ISHN65T			
			LB03131			
			WM110PB			
			WTM35AW			
L10	IF Xformer		L12606B			
L11	IF Xformer		L12606A			
L12	33UH		LS1333K			
L13	33UH		LS1333K			
L14	2μ2H		LS1222K			
L15	Discriminator		L12HF64			
L16	27mH		L10273J			
L17	Filter		LLPFS21			
L18	Filter		LLPFS21			
L19	33UH		LS1333K			
L20		15.5 turns of	W34TNAA			
L21	1μH		L4TIROM			
F1	Ceramic Filter		LSFE10R			
F2	Ceramic Filter		LSFE10R			
IC1	MP4480	Microprocessor	DMP4480			
IC2	4015	Shift Register	DCD4015			
IC3	4015	Shift Register	DCD4015			
IC4	1062	Front End	DDA1062			
IC5	094	Quad Comparator	DTL094X			
IC6	4066	Quad Transmission Gate	DCD4066			
IC7	3053	IF Amp	DCA3053	703	QF41C7A	See notes page 18.
IC8	8629	Pre-Scaler	DSP8629			
IC9	3140	OP Amp	DCA3140			
IC10	4441	IF/Discriminator	DKB4441			
IC11	4011	Quad Nand	DCD4011			
IC12	4066	Quad Transmission Gate	DCD4066			
IC13	4040	Binary Counter	DCD4040			
IC14	092	Dual Comparator	DTL092X			
IC15	4073	Triple Three Input AND Gate	DCD4073			
IC16	4001	Quad Nor	DCD4001			
IC17	4500	Stereo Decoder	D4500XA			
IC18	6128	Display Buffers	DN6128A			
IC19	6128	Display Buffers	DN6128A			
IC20	4543	Seven Segment Decoder	DEF4543			
IC21	4534	Counter	DEF4534			
IC22	706	Used to produce 50 Hz Clock	DM706BI			
D1	1N4148		D1N4148			
D2	1N4148		D1N4148			
D3	1N4148		D1N4148			
D4	1N4148		D1N4148			
D5	BB204		DBB204A			
D6				7V5 Zener	D887V5A	Removed at ISS 3
D7				7V5 Zener	D887V5A	Removed at ISS 3
D8	VM18		DVM18XX			
D9	VM18		DVM18XX			
D10	BB204		DBB204A			
D11	BB204		DBB204A			
D12	BB204		DBB204A			
D13	86NA5		BL86NA5			
D14	86NA5		BL86NA5			
D15	86NA5		BL86NA5			

Component Ref.	Present Value	Stock Number
D16	86NA5	BL86NA5
D17	86NA5	BL86NA5
D18	86NA5	BL86NA5
D19	86NA5	BL86NA5
D20	85NA2	BL85NA2
D21	1N4148	D1N4148
D22	1N4148	D1N4148
D23	86NA5	BL86NA5
D24	1N823	D1N823X
D25	1N4148	D1N4148
D26	7V5 Zener	D887V5A
D27	1N4148	D1N4148
D28	1N4148	D1N4148
D29	VM18	DVM18XX
T1	BC183L	DBC183L
T2	BC183L	DBC183L
T3	BC183L	DBC183L
T4	BC183L	DBC183L
T5	BC183L	DBC183L
T6	BC183L	DBC183L
T7	BC183L	DBC183L
T8	BC183L	DBC183L
T9	7812 Regulator	D7812XA
T10	BF256A	DBF256A
T11	LM334Z	DLM334Z
T12	BC184	DBC184X
T13	BC214C	DBC214C
T14	BC214C	DBC214C
T15	BC214C	DBC214C
T16	BC214C	DBC214C
T17	Display	DISPLAY
T18	BC184	DBC184X
T19	BC214C	DBC214C
T20	BC184	DBC184X
T21	BC214C	DBC214C
T22	ZTX450	DZTX450
B1	Battery	N4100DK
N1	Suppressor	NPMR20A
N2	R-2R Ladder Network	QF4N2AQ
N3	Display Driver Network	QF4N3AC
FS1	Fuse 63mA 100mA for 110V Sets	UM63MDA
PL1	Mains Inlet Plug	PPR0331
SK1	Aerial Socket	PS01070
SK2	Mains Outlet Socket	PSR472A
SK3	Output Socket	PS05DNB
S1	Selector Switch	S44INPA
S2	Selector Switch	S44INPA
S3	Selector Switch	S44INPA
S4	Selector Switch	S44INPA
S5	Selector Switch	S44INPA
S6	Selector Switch	S44INPA
S7	Selector Switch	S44INPA
S8	Selector Switch	S44INPA
S9	Mains Power Switch	SF40FFA
S10	Voltage Selector Switch	SVL1869
X1	3.2768 MHz Crystal	NX3M276

QUAD FM4 Tuner service data

Misc.

1.	Microprocessor DIL Holder			PI8528A		
2.	Self Tappers for securing Aerial Socket		2	TC205PF		
3.	Self Tappers for securing Output Socket		3	TC205PF		
4.	Board Securing Screws	M3x6mm	5	TM306PA		
5.	Tune Pot Bracket Screws	M3x6mm	3	TM306PA		
6.	Front Panel Screws	M3x6mm	4	TM306PA		
7.	Button Board Screws	M3x6mm	4	TM306PA		
8.	Regulator Heatsink Screw	M3x6mm	1	TM306PA		
9.	Display Bracket Screw	M3x6mm	1	TM306PA		
10.	Board Screw	M3x6mm	1	TM306PG		
11.	Feet Screws	M4x5mm	4	TM405PA		
12.	Cover Screws	M4x16mm	2	TM416PA		
13.	Mains Cover PK Screws		4	TC406PC		
14.	Tune Pot Grub Screw		1	TM316GC		
15.	Cover Washers		2	TDM4SPA		
16.	Regulator Heatsink Nut		1	TM3FHPA		
17.	Tune Pot Washer		1	TD22010		
18.	Display Bracket Nut		1	TM3FHPA		
19.	Tune Pot Spindle Lock		1	N509816		
20.	3 Way Ribbon between Tune Pot and Board		6cm	WRM603B		
21.	7 Way Jumper Cable		12cm	M127117		
22.	8 Way Jumper Cable		13cm	M127118		
23.	Blue Wire		15cm	WM80136		
24.	Green/Yellow Wire		10cm	WM8013E		
25.	Brown Wire		15cm	WM80131		
26.	Wire for Links			WL3922A		
27.	PCB M12615 ISS 4			I12615C		
28.	Button PCB M12614 ISS 2			I12614A		
29.	Brown Rubber Strip		12cm	IGSMAAA		
30.	Fuseholder			PF5234A		
31.	Voltage Selector Shroud			M12579A		
32.	Display Bracket			M12595A		
33.	Display Bracket Sponge		2cm	IFVP6AA		
34.	Display Perspex			M12576A		
35.	Tune Bracket			M12569A		
36.	Buttons	ILR1		MBILR1Y		
		ILR2		MBILR2Y		
		BBC1		MBBBC1Y		
		BBC2		MBBBC2Y		
		BBC3		MBBBC3Y		
		BBC4		MBBBC4Y		
		Tune		MBTUNEB	Red Tune Button	MB TUNER
		BBCLR		MBBBCLY		
37.	Amber Filter			M12611A		
38.	Push-on-Fix Clips		4	FF123ZF		
39.	Front Panel			M12560A		
40.	LED Bezel			MM12710		
41.	On/Off Button			N36325A		
42.	Switch Bar			M12593A		
43.	Switch Coupling Link			N39159A		
44.	Darvic Display Spacer			M12717A		
45.	Black Tape for securing Amber Filter			IPMCSRA		
46.	Cover			M12573A		
47.	Cover Guides		2	M12562A		
48.	Ultrasonic Noise Damper		2	IPEDAMA		
49.	Feet Mouldings		4	M12620A		
50.	Stick on Feet		4	AFNOSLA		
51.	Mains Safety Cover			M12575A		
52.	W Buttons		2	FP70271		
53.	Transformer Cover			M12572A		
54.	Tuning Knob			M12589A		
55.	Caution Label			M12663A		
56.	Mains Transformer Screen			M12571A		
57.	Serial Number			M12621A		
58.	Regulator Heatsink			M12578A		
59.	Double Sided Sticky			IP55257		
60.	Polystyrene Pack			ZX43F4A		
61.	Carton			ZC43F4A		
62.	Accessory Pack – Standard			QF4ACP1		
63.	Instruction Manual			OIF42EC		
64.	Polythene Bag			ZEF434A		
65.	Chassis			M12568A		
66.	Mains Earth Screw M3x6mm			TM306PA		
67.	Mains Earth Nut M3			TM3FHPA		
68.	Mains Earth Soldertag			FTB6SS5		
69.	Mains Earth Shake Proof Washer			TDB6NLF		
70.	Coil Screening Can		2	M219101		

assembly diagram

No.	Description	Stock No.
1	Screw M4 x 16 mm	TM416PA
2	Washer M4	TDM4SPA
3	Chassis Guide	M12562A
4	Cover	M12573A
5	Foot	M12620A
6	Screw M4 x 5 mm	TM405PA
7	Non-Slip Pad	AFNOSLA
8	Screw 2Z x 3/16	TC205PF
9	Fuse T63mA	UM63MDA
10	Voltage Selector Shroud	M12579A
11	Fuseholder	PF5234A
12	Mains Out – Socket	PSR472A
13	Mains Transformer Screen	M12571A
14	Screw 4Z x ¼	TC406PC
15	Mains In – Plug	PPR0331
16	Warning Label	M12663A
17	Mains Transformer Cover	M12572A
18	Screw M3 x 6 mm	TM306PA
19	Washer M3	TDM3SPA
20	Soldertag	FTB6SS5
21	Nut M3	TM3FHPA
22	Chassis	M12568A
23	Mains Switch Link	M12593A
24	Link	N39159A
25	Push-on-Fix	FF123ZF
26	Display Bracket	
27	Display	DISPLAY
28	Amber Filter	M12611A
29	Tuning Pot	RVF4TUB
30	Tuning Pot Bracket	M12569A
31	Dished Washer	TD22010
32	Spindle Lock	N509816
33	Screw M3 x 6 mm SS	TM306PG
34	Display Gasket	M12717A
35	Display Perspex	M12576A
36	Mains Switch Knob	N36325A
37	Grubscrew M3 x 16 mm	TM316HC
38	Tune Knob	M12589A
39	Front Panel	M12560A
40	LED Bezel	M12710A
41	Button Board Assembled	
42	Brown PVC Strip	1GSMAAA
43	W Button	FP70271
44	Safety Cover	M12575A
45	PCB Assembled	
46	Aerial Socket Screw	TC205PF
47	Aerial Socket	PS01070
48	5 Pin DIN Socket	PS05DNB

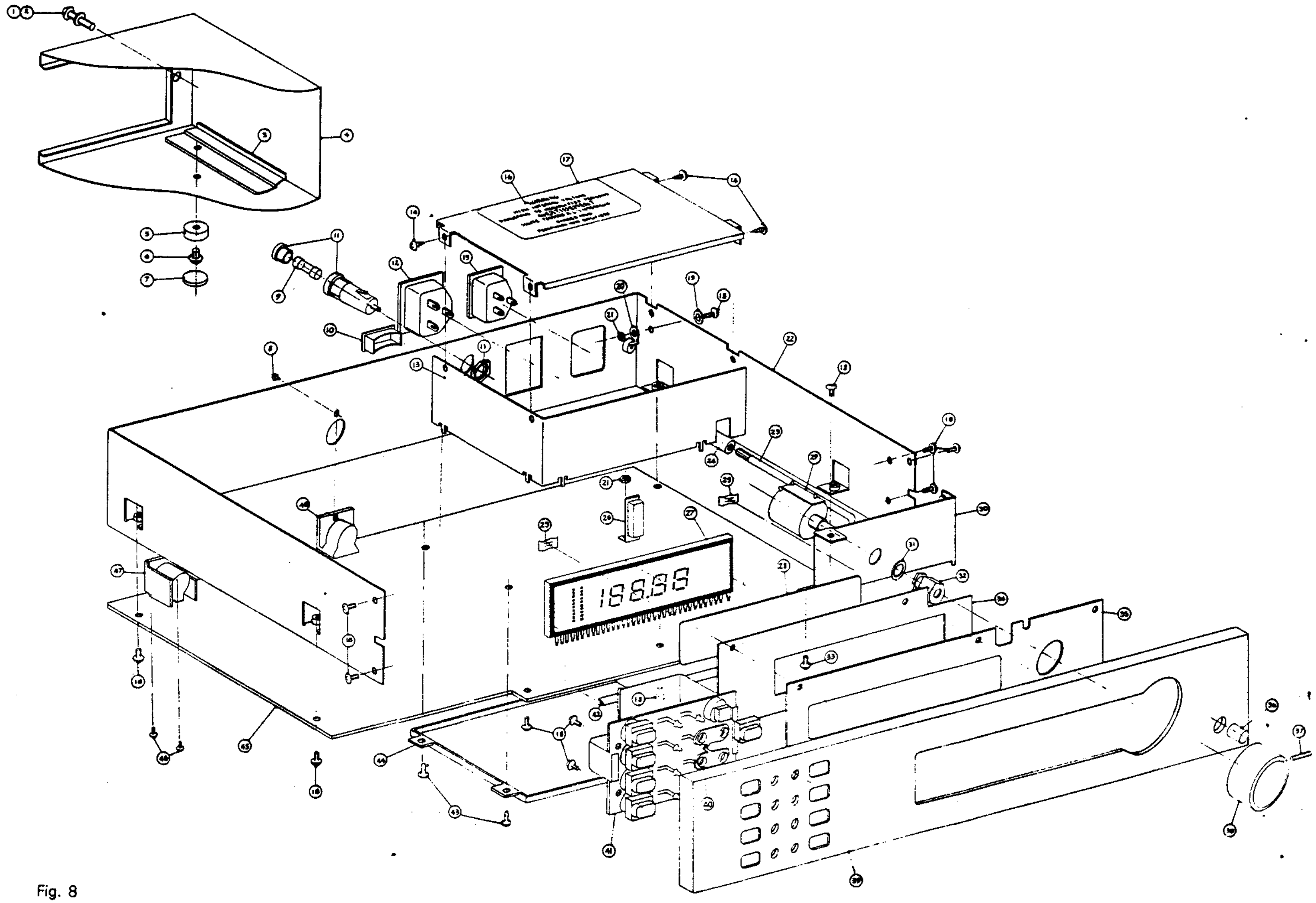
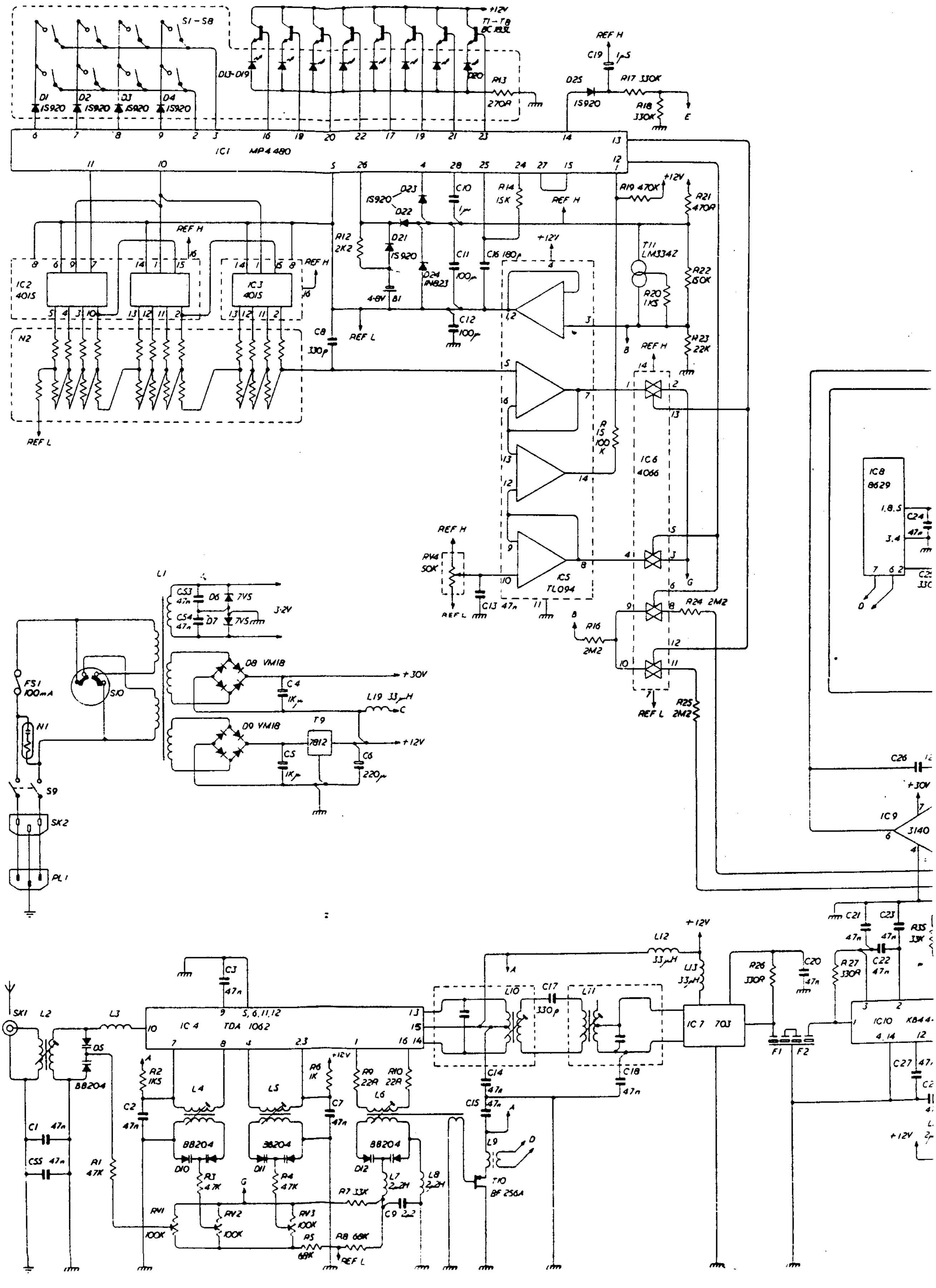


Fig. 8

circuit diagram

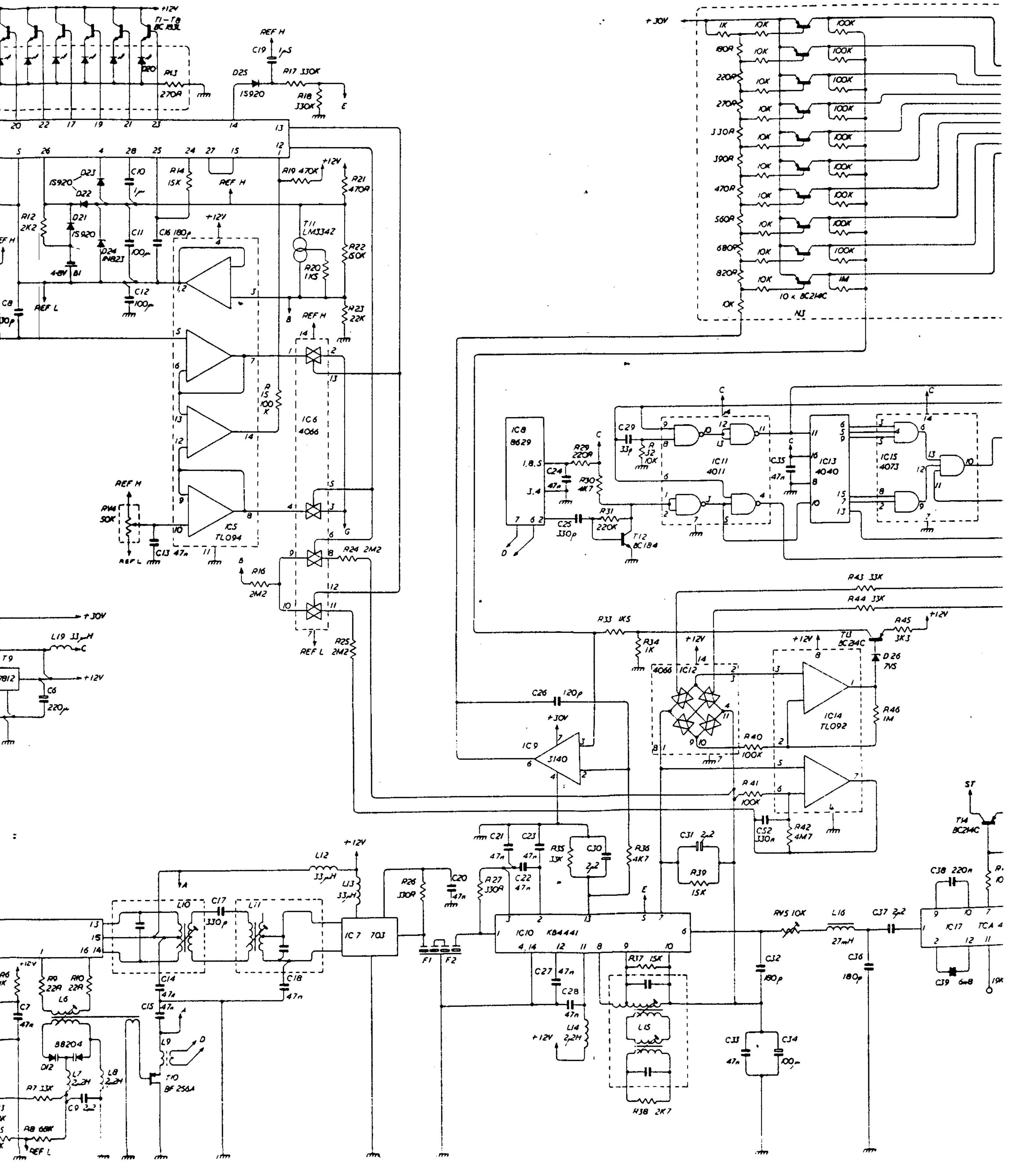
M12616 ISS 1

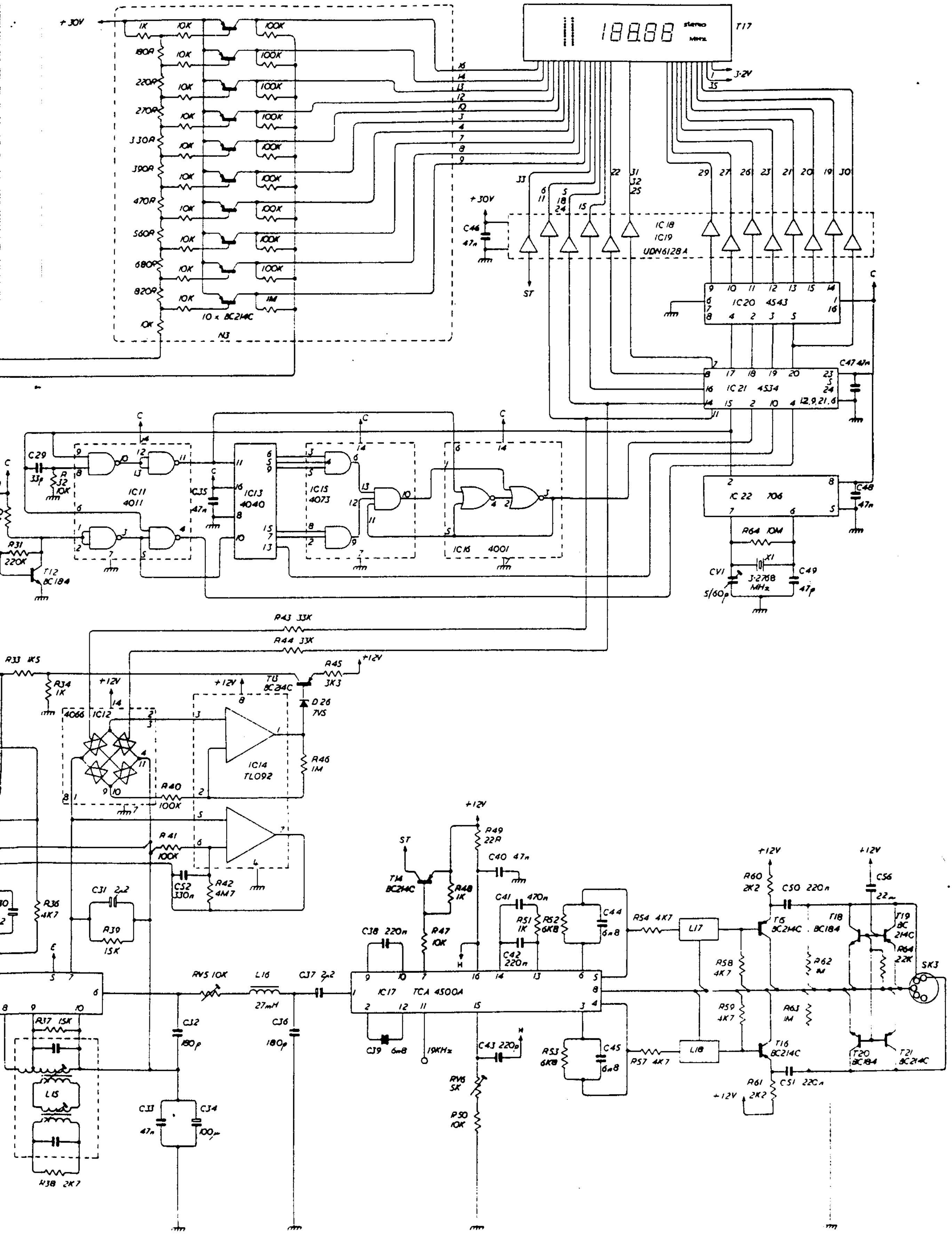
For use with Tuners up to approx Serial Number 2,000 PCB No. M12615 ISS 2



n

al Number 2,000 PCB No. M12615 ISS 2

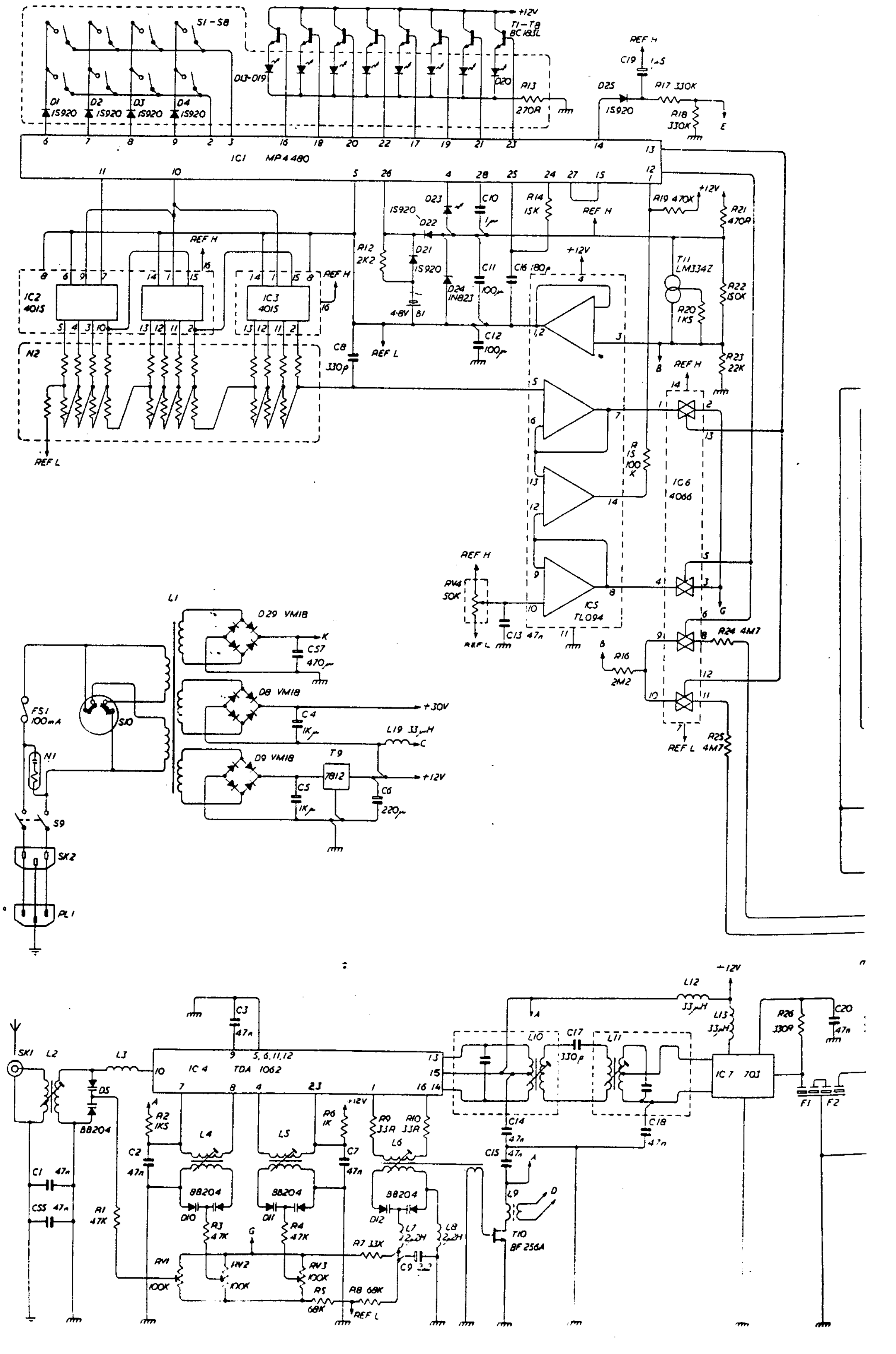



+30V
10 x BC214C
N3
T17
18888
stereo
MHz
3·2V
IC18
IC19
UDN6128A
+30V
C46
47n
ST
IC20 4543
IC21 4534
C47 47n
IC11
4011
C29
33p
R32
10K
R31
220K
T12
BC184
IC13
4040
C35
47n
IC15
4073
IC16 4001
IC22 706
C48
47n
R64 10M
X1
3·2768
MHz
CV1
5/60p
C49
47p
R43 33K
R44 33K
R33 1K5
R34
1K
+12V
4066 IC12
T13
BC214C
R45
3K3
D26
7V5
IC14
TL092
R46
1M
R40
100K
R41
100K
C52
330n
R42
4M7
C31 2u2
R39
15K
R36
4K7
R37 15K
L15
R38 2K7
RV5 10K
L16
27mH
C37 2u2
C32
180p
C36
180p
C33
47n
C34
100u
ST
T14
BC214C
R48
1K
R49
22R
C40 47n
C41 470n
R51
1K
R52
6K8
C44
6n8
C42
220n
C38 220n
R47
10K
IC17 TCA 4500A
C39 6n8
19KHz
C43 220p
RV6
5K
R50
10K
R53
6K8
C45
6n8
R54 4K7
R57 4K7
L17
L18
R60
2K2
C50 220n
T15
BC214C
T18
BC184
C56
22u
T19
BC
214C
R64
22K
SK3
R58
4K7
R62
1M
R59
4K7
R63
1M
T16
BC214C
R61
2K2
C51 220n
T20
BC184
T21
BC214C

circuit diagram

M12616 ISS 1(b)

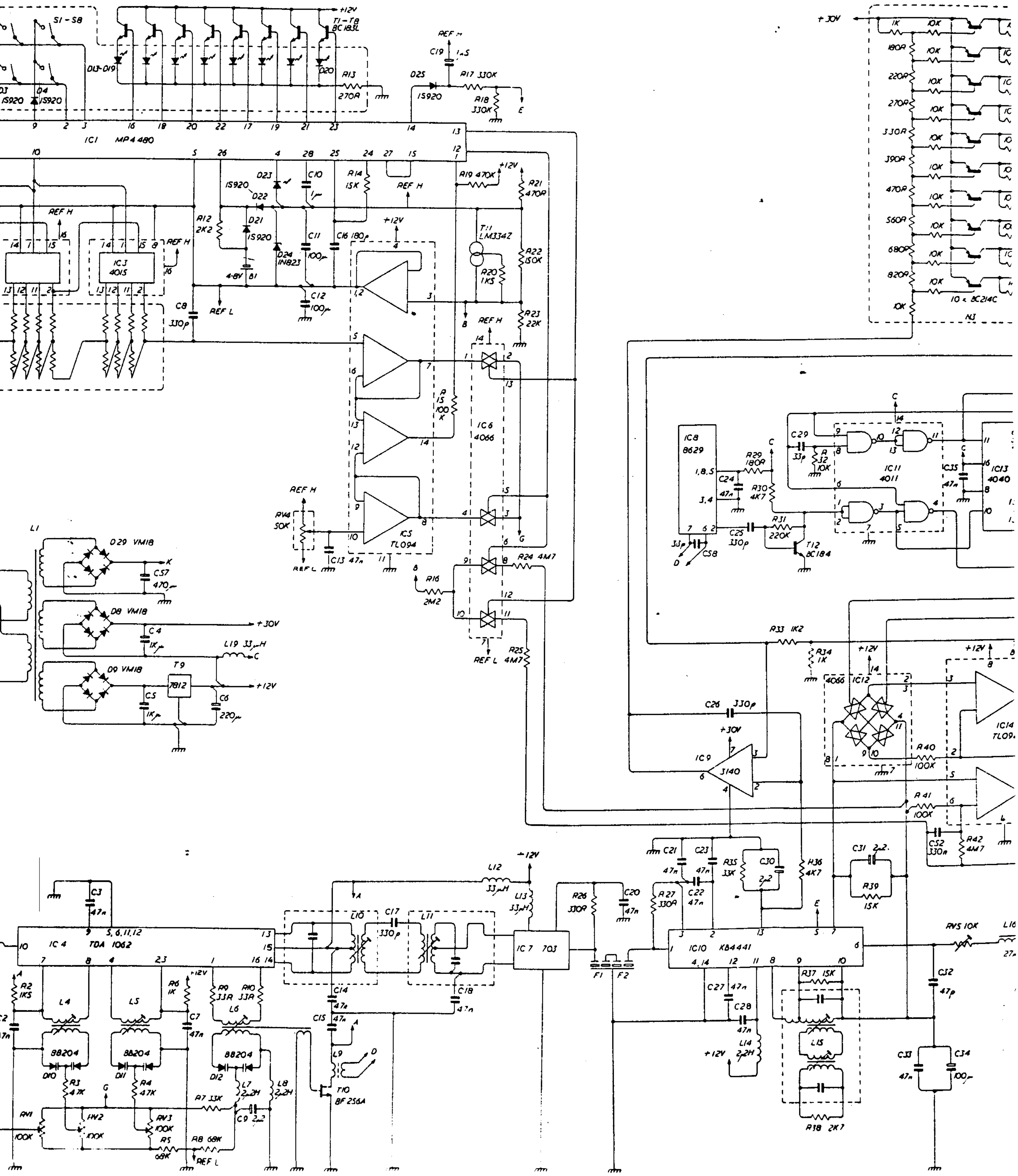
For use with Tuners from approx Serial Number 2,000 to approx 2,500 PCB No M12615 ISS 3

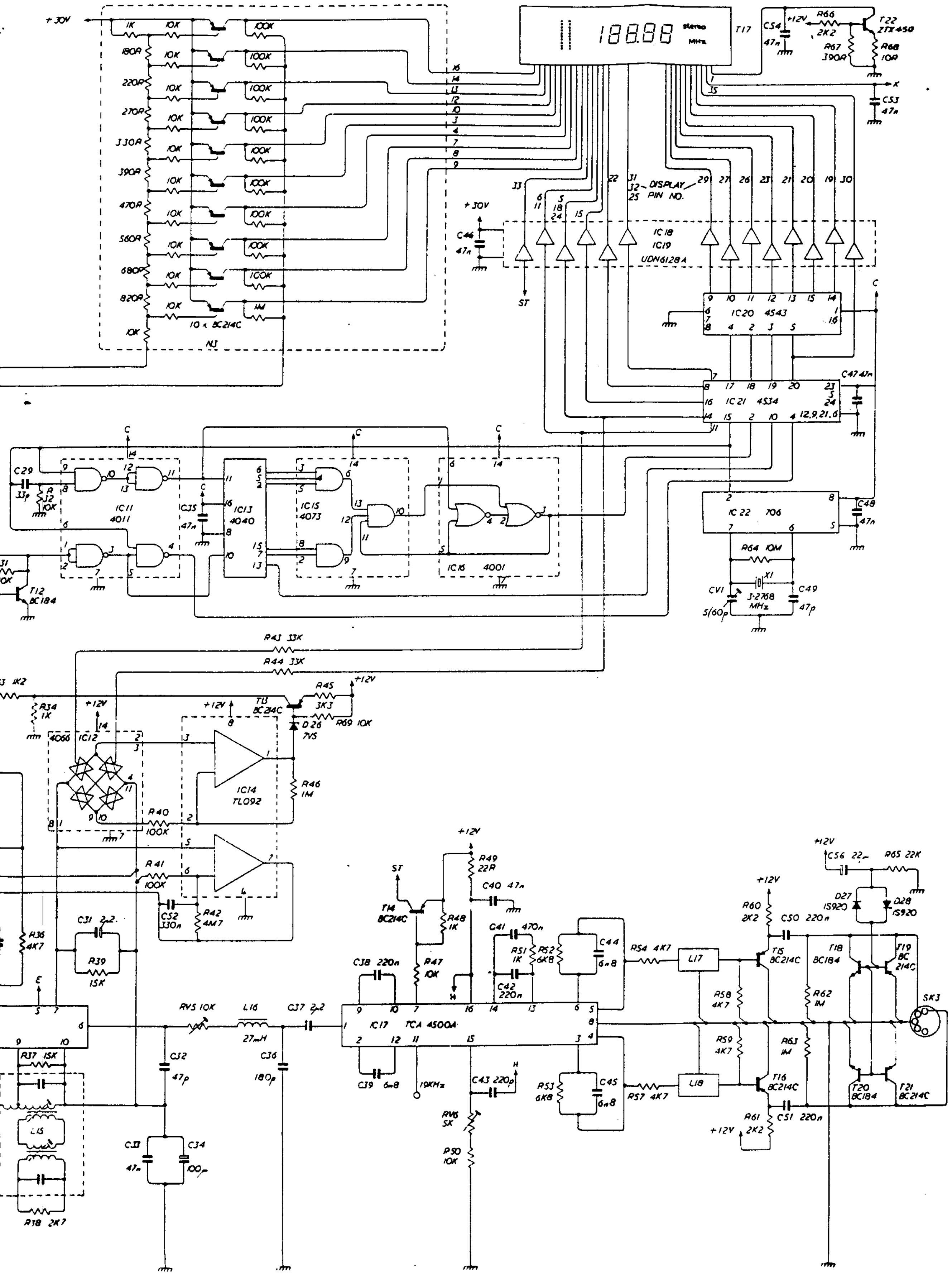


diagram

l (b)

ners from approx Serial Number 2,000 to approx 2,500 PCB No M12615 ISS 3

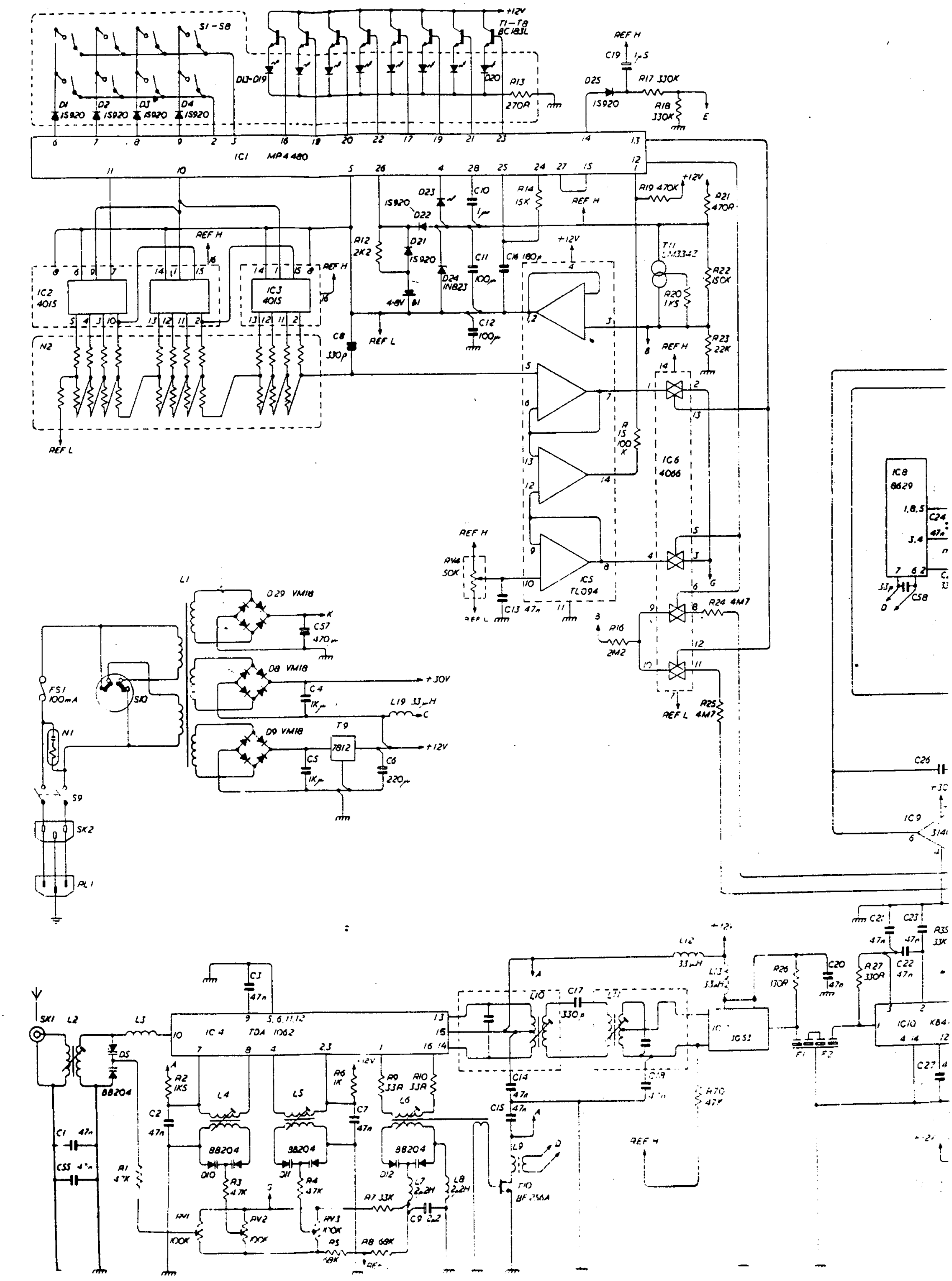



+30V
10 x BC214C
N3
18888 stereo MHz
T17
C54 47n
+12V
R66 2K2
R67 390R
T22 ZTX450
R68 10R
C53 47n
K
DISPLAY PIN NO.
+30V
C46 47n
IC18
IC19
UDN6128A
ST
IC20 4543
IC21 4534
C47 47n
C29 33p
IC11 4011
C35 47n
IC13 4040
IC15 4073
IC16 4001
IC22 706
C48 47n
R64 10M
X1 3·2768 MHz
CV1 5/60p
C49 47p
T12 BC184
R43 33K
R44 33K
R34 1K
+12V
4066 IC12
T13 BC214C
R45 3K3
R69 10K
D26 7V5
IC14 TL092
R46 1M
R40 100K
R41 100K
C52 330n
R42 4M7
C31 2μ2
R39 15K
R36 4K7
R37 15K
L15
R38 2K7
RV5 10K
L16 27mH
C37 2μ2
C32 47p
C36 180p
C33 47n
C34 100p
T14 BC214C
R49 22R
C40 47n
R48 1K
R47 10K
C38 220n
C41 470n
R51 1K
R52 6K8
C42 220n
C44 6n8
IC17 TCA 4500A
C39 6n8
19KHz
C43 220p
RV6 5K
R50 10K
R53 6K8
C45 6n8
R54 4K7
R57 4K7
L17
L18
R60 2K2
C50 220n
T15 BC214C
T16 BC214C
R58 4K7
R59 4K7
R61 2K2
C51 220n
R62 1M
R63 1M
C56 22μ
R65 22K
D27 1S920
D28 1S920
T18 BC184
T19 BC 214C
T20 BC184
T21 BC214C
SK3

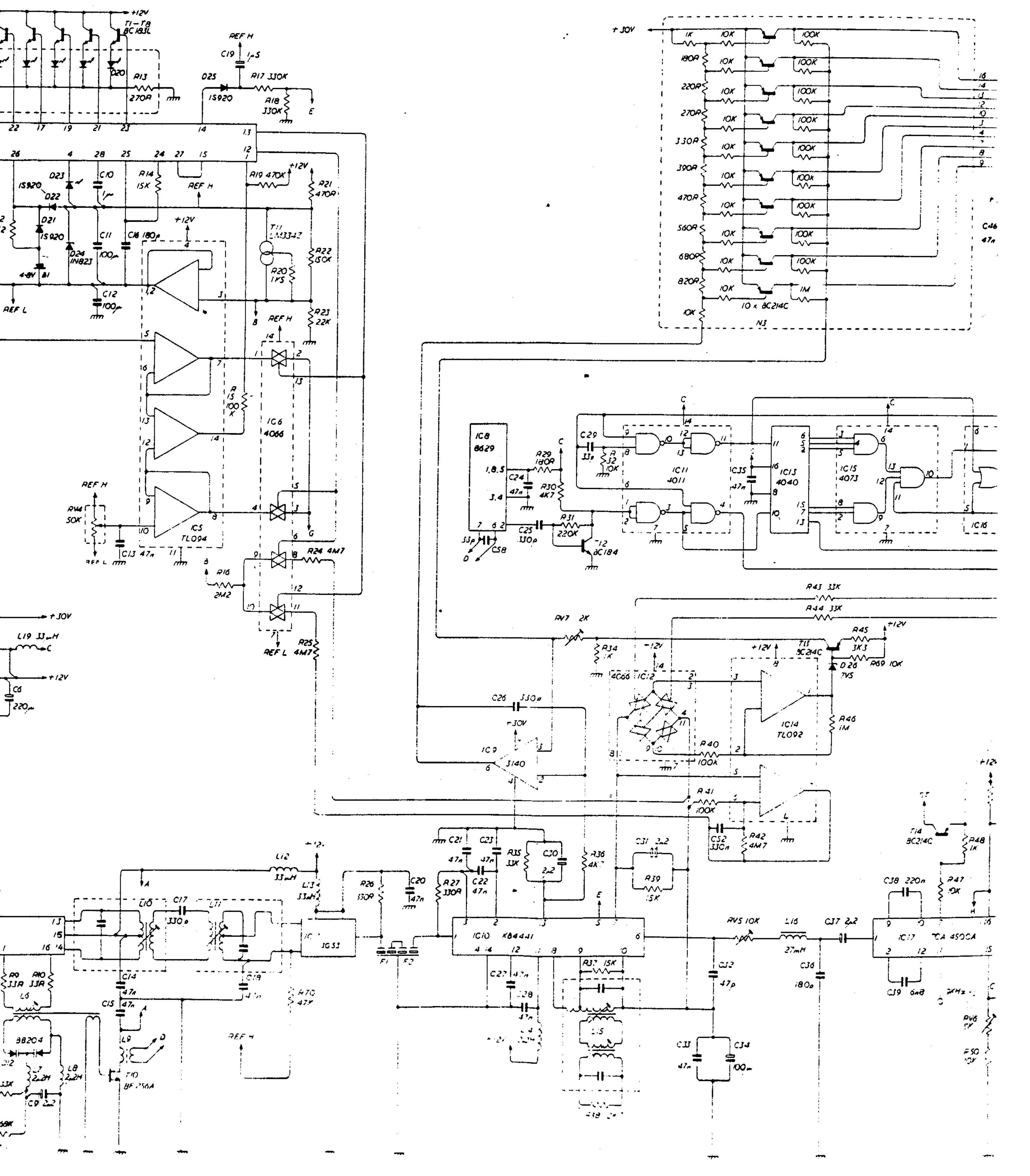
circuit diagram

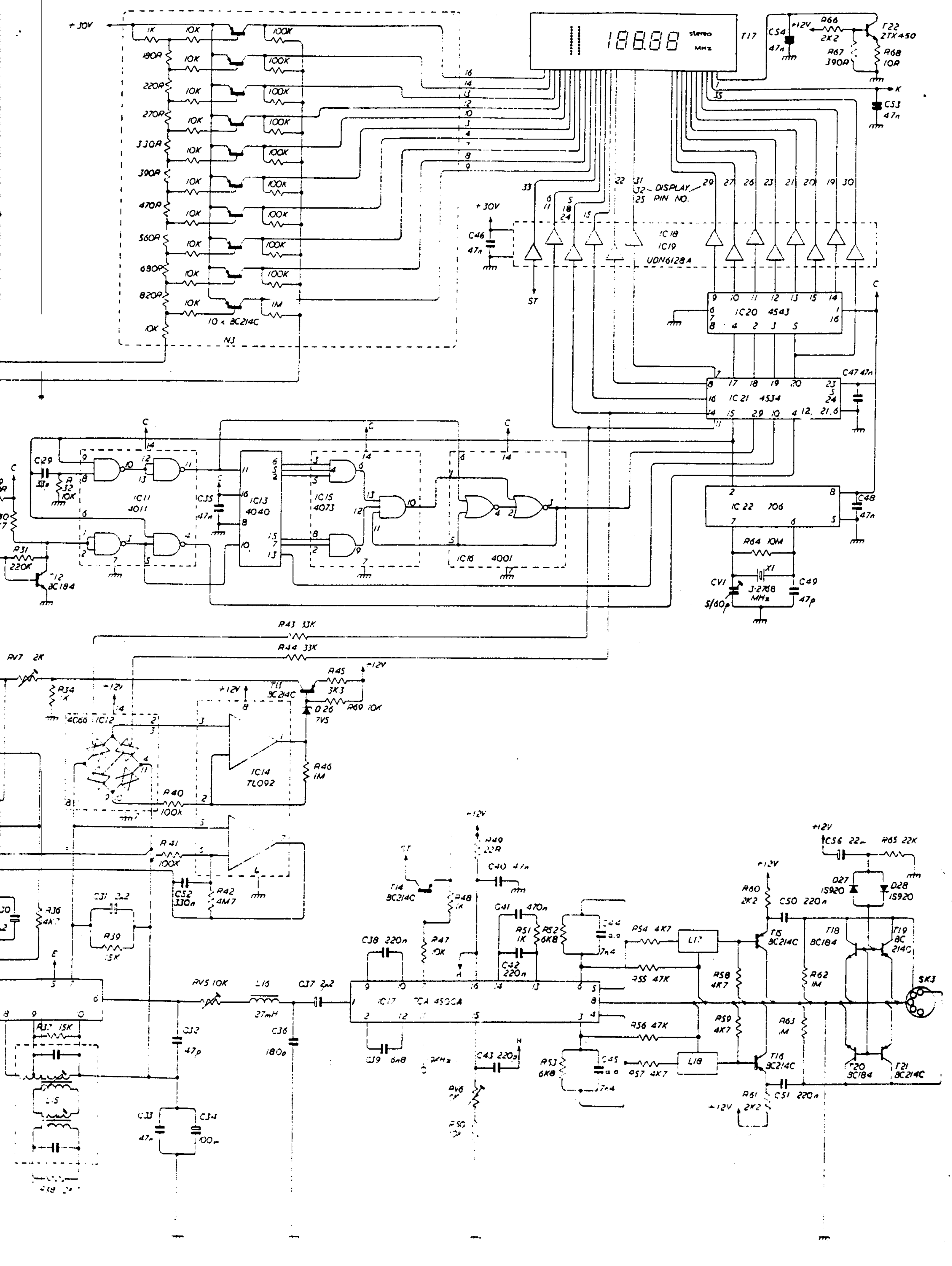
M12616 ISS 2

For use with Tuners from approx Serial Number 2,500 to 11,000 PCB No M12615 ISS 4



umber 2,500 to 11,000 PCB No M12615 ISS 4

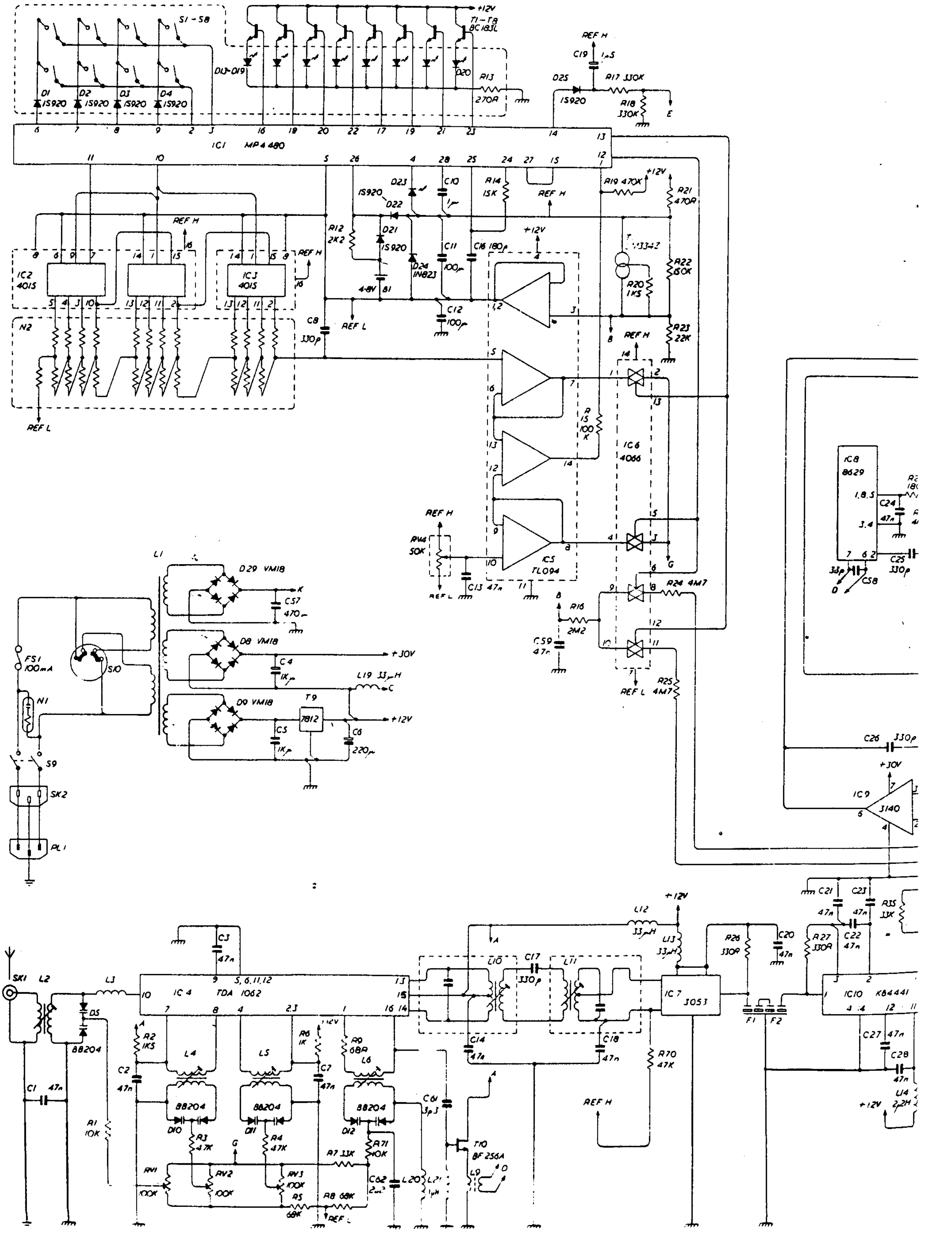



+30V
10 x BC214C
N3
18888
stereo
MHz
T17
C54 47n
+12V
R66 2K2
T22 ZTX450
R67 390R
R68 10R
C53 47n
DISPLAY PIN NO.
+30V
C46 47n
IC18
IC19
UDN6128A
ST
IC20 4543
IC21 4534
C47 47n
IC11 4011
IC13 4040
IC15 4073
IC16 4001
IC22 706
C48 47n
R64 10M
X1
3·2768 MHz
CV1 5/60p
C49 47p
C29 33p
R32 10K
C35 47n
R31 220K
T12 BC184
R43 33K
R44 33K
RV7 2K
R34 1K
R45 3K3
T13 BC214C
R69 10K
D26 7V5
IC12 4066
IC14 TL092
R46 1M
R40 100K
R41 100K
C52 330n
R42 4M7
R39 15K
RV5 10K
L16 27mH
C37 2μ2
C32 47p
C36 180p
C33 47n
C34 100n
IC17 TCA 4500A
C38 220n
C39 6n8
C40 47n
R49 22R
T14 BC214C
R48 1K
R47 10K
C41 470n
R51 1K
R52 6K8
C42 220n
C43 220n
R53 6K8
R54 4K7
R55 47K
R56 47K
R57 4K7
L17
L18
+12V
R60 2K2
C50 220n
T15 BC214C
T18 BC184
R58 4K7
R59 4K7
R62 1M
R63 1M
T16 BC214C
R61 2K2
C51 220n
C56 22μ
R65 22K
D27 IS920
D28 IS920
T19 BC214C
T20 BC184
T21 BC214C
SK3

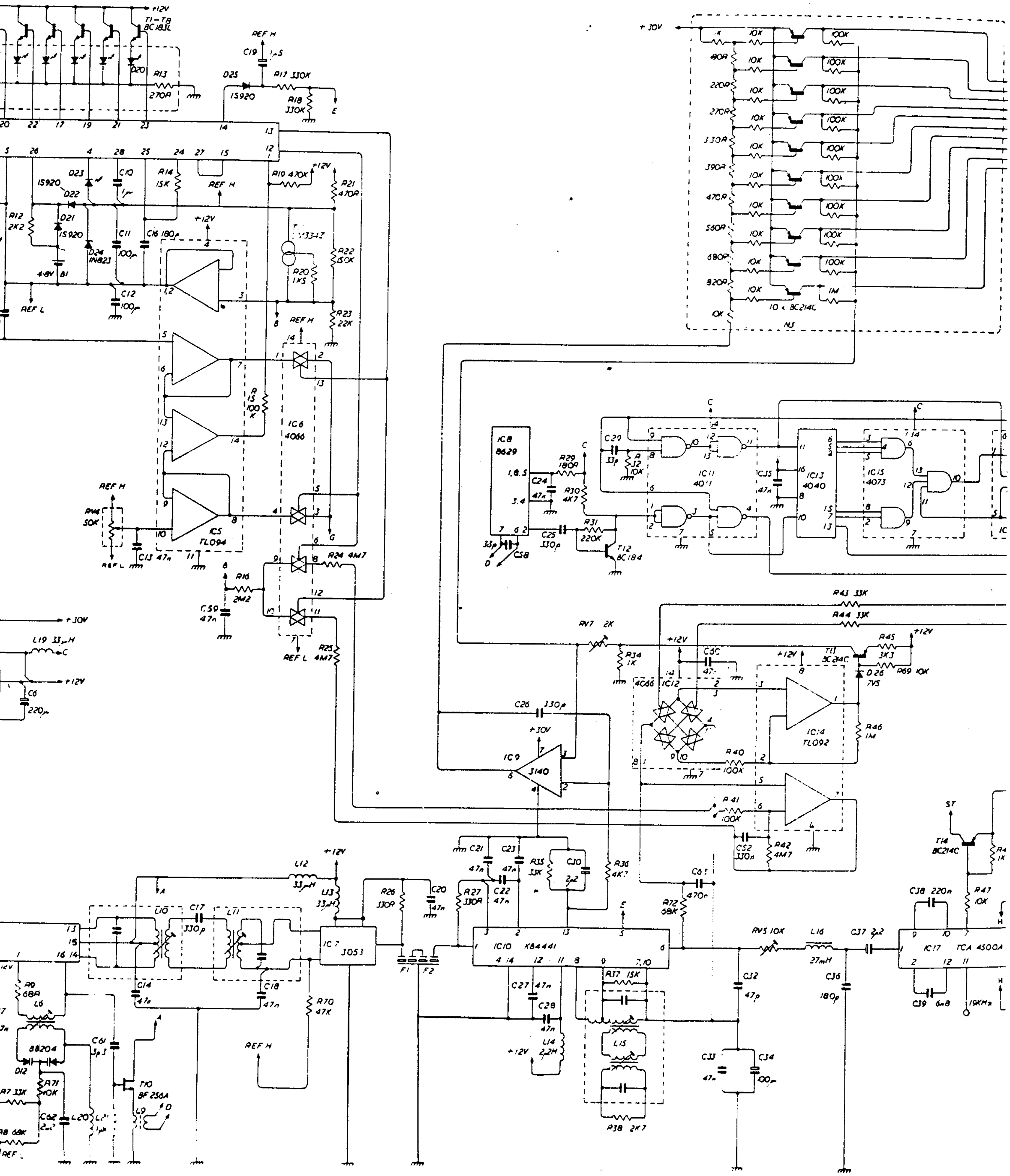
circuit diagram

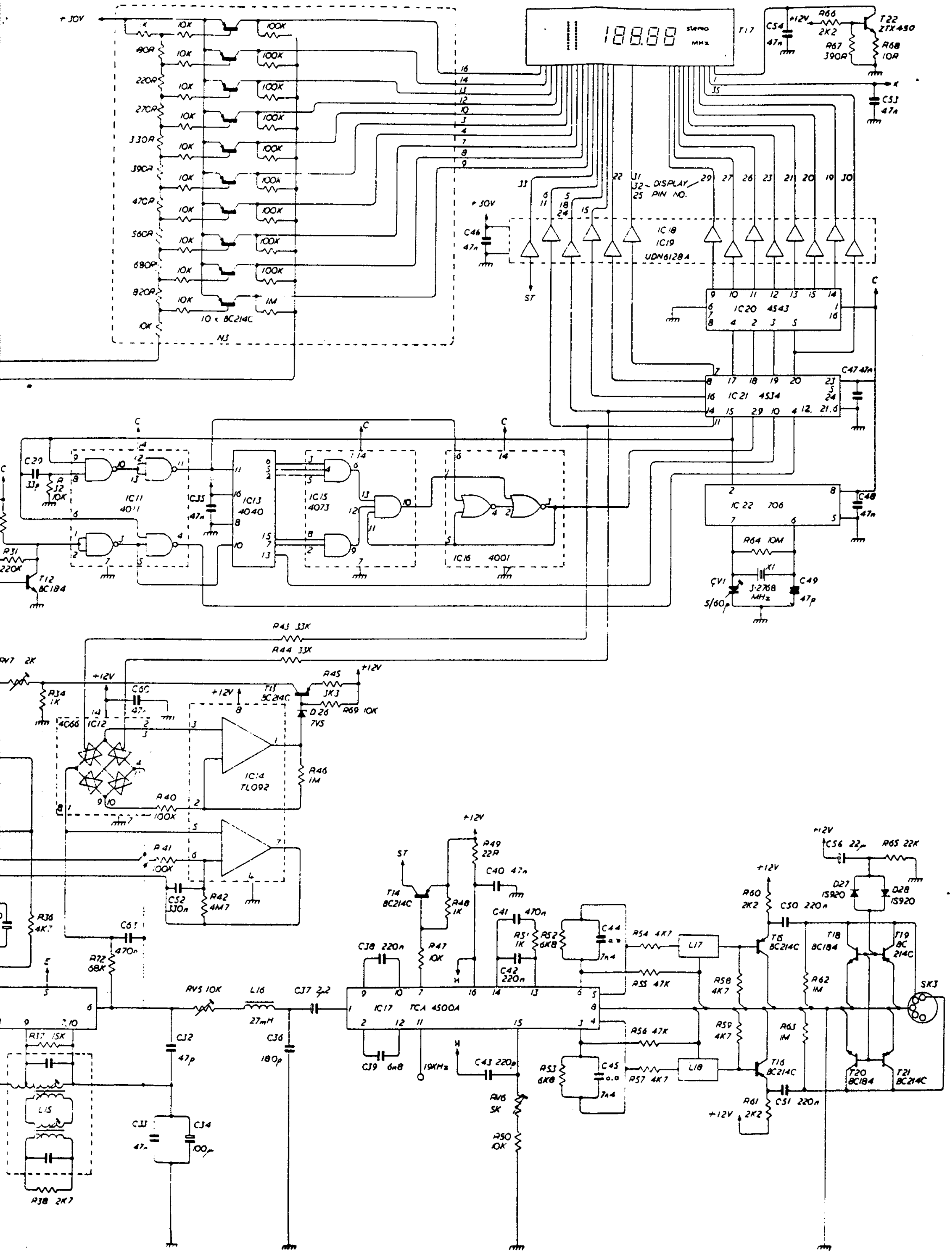
M12616 ISS 3

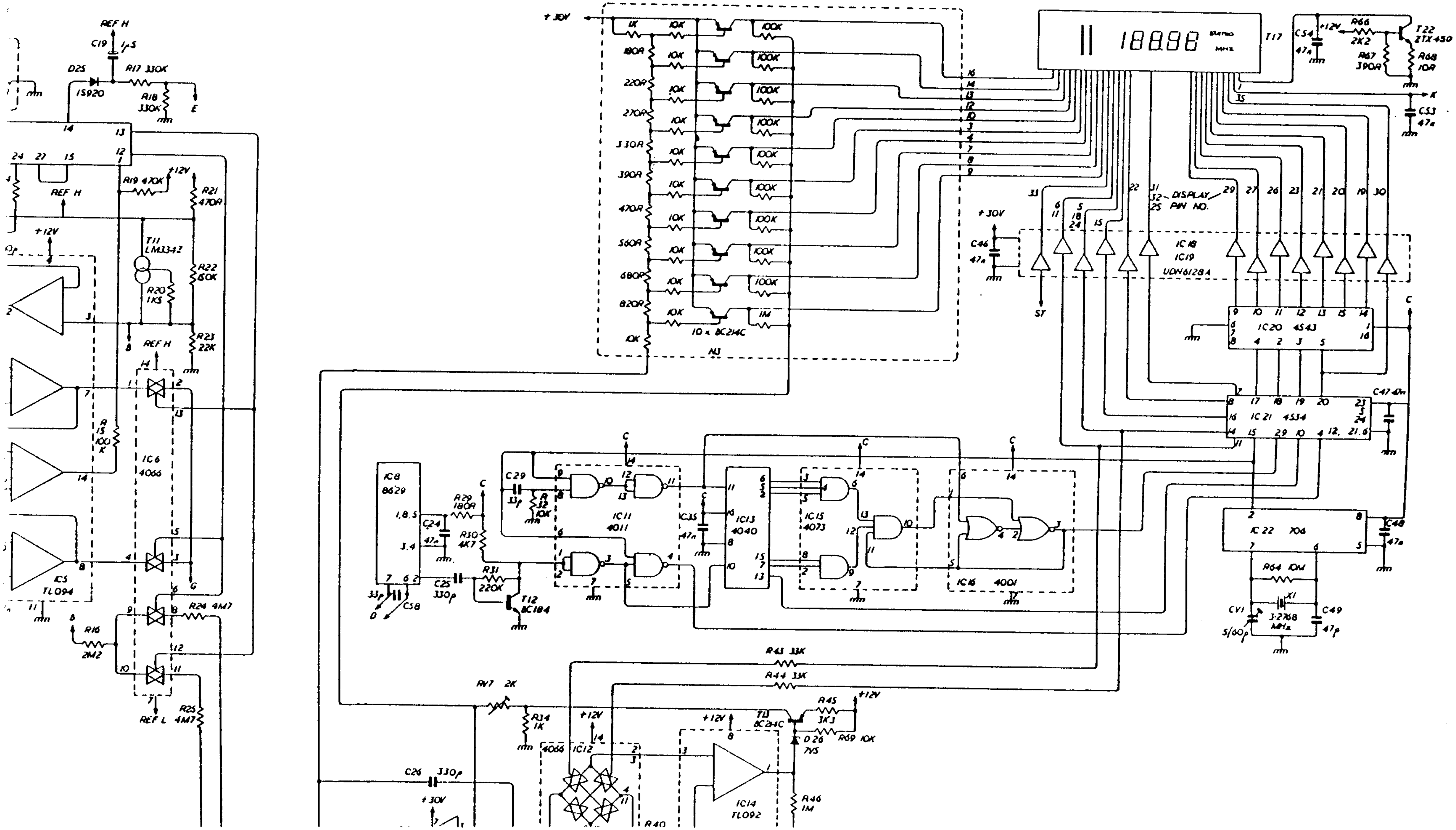
For use with Tuners from Serial Number 11,000 onwards PCB No M12615 ISS 5



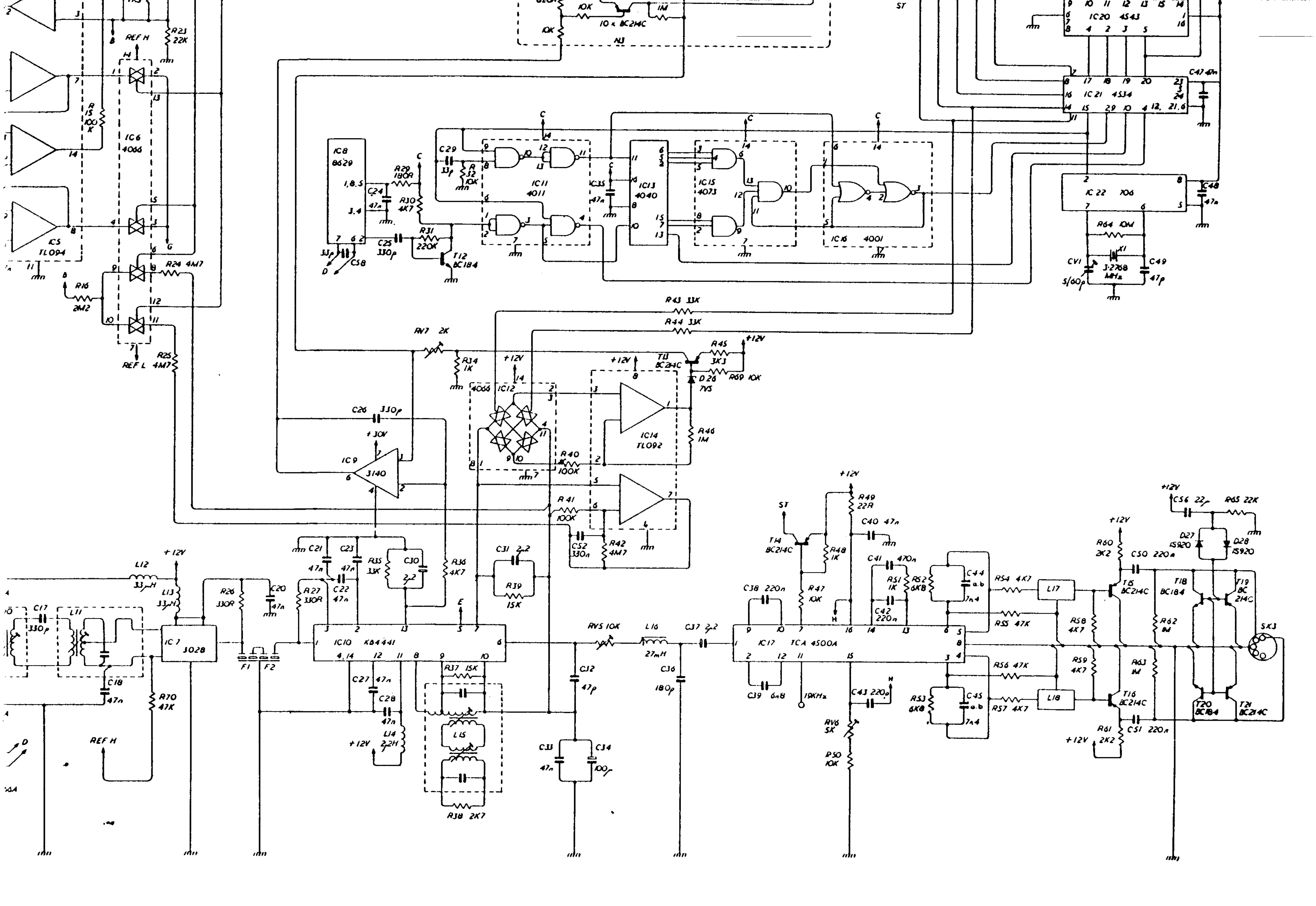
er 11,000 onwards PCB No M12615 ISS 5



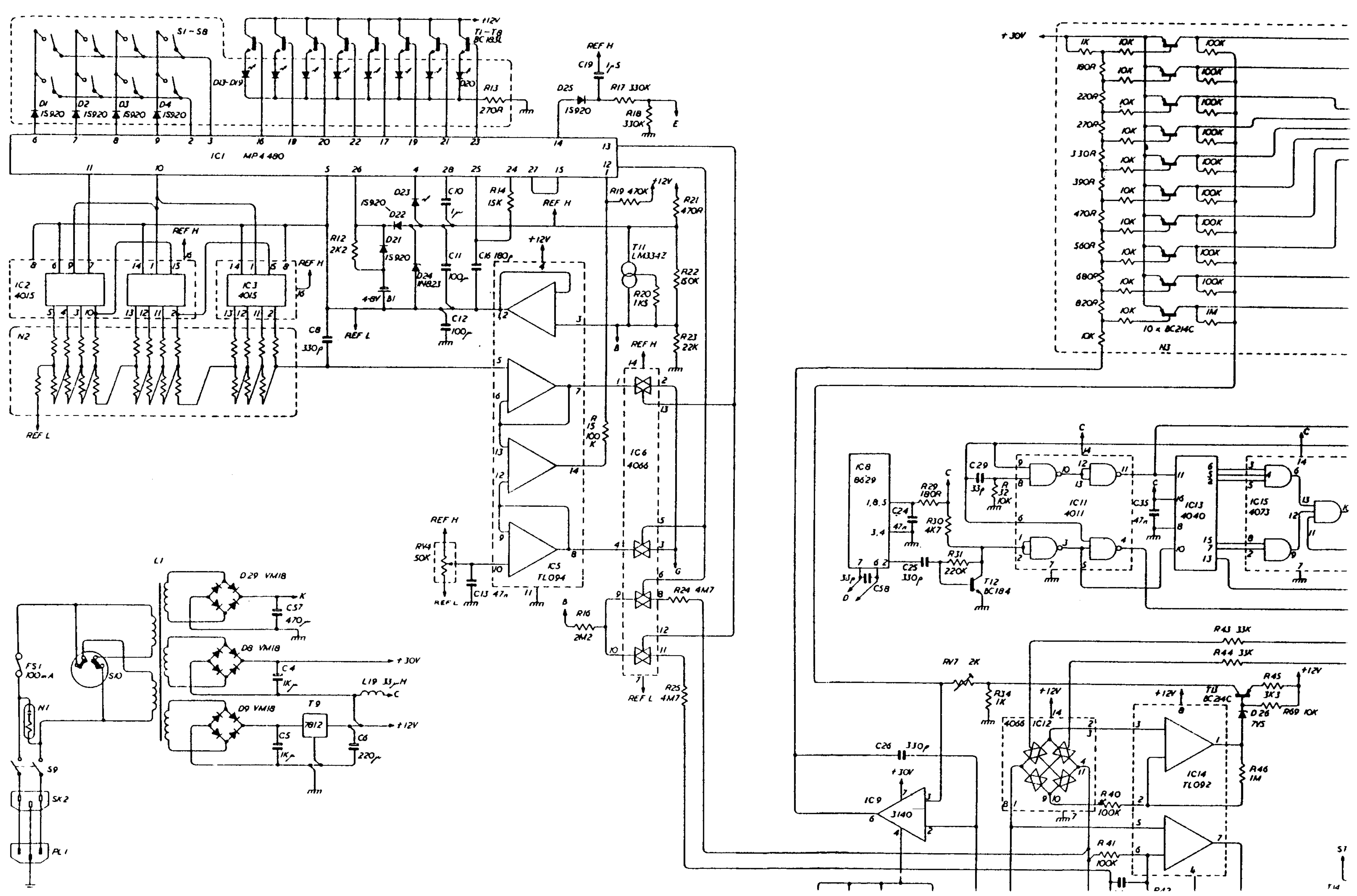

+30V
10K
100K
180R
220R
270R
330R
390R
470R
560R
680R
820R
1M
10 x BC214C
N3
18888 stereo MHz
T17
C54 47n
+12V
R66 2K2
T22 ZTX450
R67 390R
R68 10R
C53 47n
DISPLAY PIN NO.
+30V
C46 47n
IC18
IC19
UDN6128A
ST
IC20 4543
IC21 4534
C47 47n
IC22 706
C48 47n
R64 10M
X1 3·2768 MHz
CV1 5/60p
C49 47p
C29 33p
R32 10K
IC11 4011
C35 47n
IC13 4040
IC15 4073
IC16 4001
R31 220K
T12 BC184
R43 33K
R44 33K
RV7 2K
R34 1K
+12V
C60 47n
T13 BC214C
D26 7V5
R45 3K3
R69 10K
4066 IC12
IC14 TL092
R46 1M
R40 100K
R41 100K
C52 330n
R42 4M7
R36 4K7
C61 470n
R72 68K
RV5 10K
L16 27mH
C37 2µ2
C32 47p
C36 180p
C33 47n
C34 100µ
R37 15K
L15
R38 2K7
R49 22R
C40 47n
T14 BC214C
R48 1K
R47 10K
C38 220n
C39 6n8
IC17 TCA 4500A
19KHz
C41 470n
R51 1K
R52 6K8
C42 220n
C43 220p
RV6 5K
R50 10K
R53 6K8
C44 7n4
C45 7n4
R54 4K7
R55 47K
R56 47K
R57 4K7
L17
L18
R60 2K2
C50 220n
T15 BC214C
T16 BC214C
R58 4K7
R59 4K7
R61 2K2
C51 220n
R62 1M
R63 1M
T18 BC184
T19 BC 214C
T20 BC184
T21 BC214C
C56 22µ
R65 22K
D27 1S920
D28 1S920
SK3



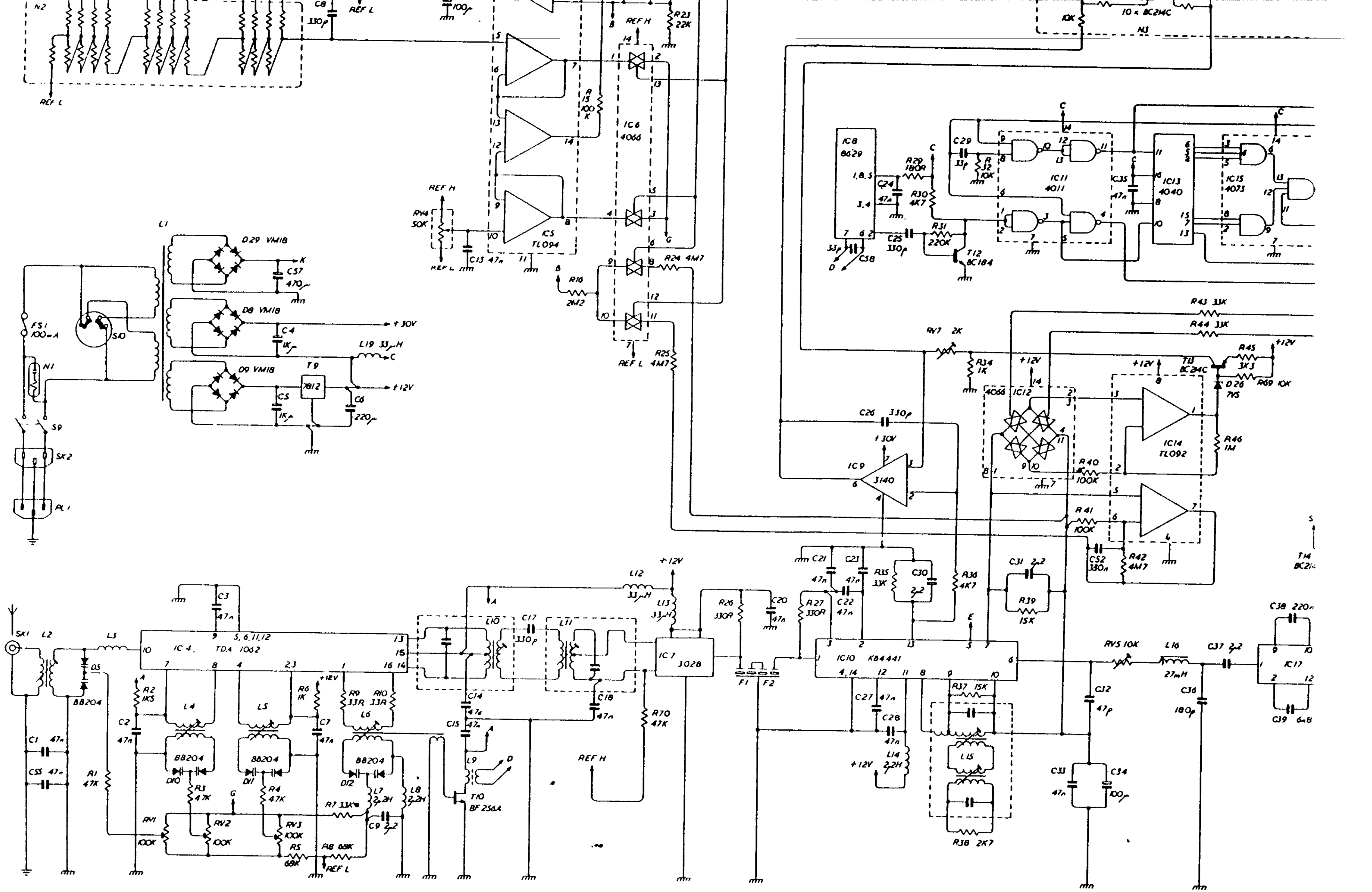
IC20 4543
IC21 4534
IC22 706
IC18
IC19
UDN6128A
DISPLAY PIN NO.
IC11 4011
IC13 4040
IC15 4073
IC16 4001
IC8 8629
IC12 4066
IC14 TL092
IC6 4066
IC5 TL094
T11 LM334Z
T12 BC184
T13 BC214C
T22 ZTX450
T17
10 x BC214C
3.2768 MHz
REF H
REF L
+30V
+12V



QUAD FM4 TUNER CIRCUIT DIAGRAM DRG M12616 ISS 2



S1-S8
D1 1S920
D2 1S920
D3 1S920
D4 1S920
D13-D19
D20
T1-T8 BC183L
+12V
R13 270R
IC1 MP4480
REF H
C19 1μ5
D25 1S920
R17 330K
R18 330K
E
IC2 4015
IC3 4015
N2
REF L
R12 2K2
D21 1S920
D22 1S920
D23
D24 IN823
4·8V B1
C8 330p
C10 1μ
C11 100μ
C12 100μ
C16 180p
R14 15K
R19 470K
R21 470R
R22 150K
R23 22K
T11 LM334Z
R20 1K5
R15 100K
IC5 TL094
IC6 4066
RV4 50K
C13 47n
R16 2M2
R24 4M7
R25 4M7
L1
D29 VM18
C57 470μ
D8 VM18
C4 1Kμ
+30V
D9 VM18
T9 7812
C5 1Kμ
C6 220μ
L19 33μH
+12V
FS1 100mA
N1
S10
S9
SK2
PL1
+30V
1K
180R
220R
270R
330R
390R
470R
560R
680R
820R
10K
100K
1M
10 x BC214C
N3
IC8 8629
C29 33p
R32 10K
C24 47n
R29 180R
R30 4K7
R31 220K
C25 330p
T12 BC184
C58 33p
IC11 4011
C35 47n
IC13 4040
IC15 4073
R43 33K
R44 33K
RV7 2K
R34 1K
C26 330p
IC9 3140
IC12 4066
R40 100K
R41 100K
IC14 TL092
T13 BC214C
D26 7V5
R45 3K3
R69 10K
R46 1M
S1
T14



QUAD FM4 TUNER CIRCUIT DIAGRAM DRG