



# SATELLITE RECEIVER MODEL TRX2801

+ DECCA DRX-2851

For Service Manuals
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#### ILLUSTRATIONS:

Receiver Layout
Remote Control Hand Unit Circuit Diagram
Power Supply/Tuner Circuit Diagram
D-MAC Decoder/ACM Circuit Diagram

The receiver chassis consists of two main circuit boards. These are the Switch-mode power supply/tuner circuit board, and the D-MAC decoder circuit board. The Power Supply/Tuner board carries two daughter boards - the Front Display board, and the E7 De-emphasis board. The D-MAC decoder board carries one daughter board - the Access Control Module.

# 1. SAFETY AND ISOLATION

Under no circumstances should any form of repair or maintenance be attempted by any person other than a competent technician or engineer. Most of the circuitry on the chassis is isolated from the mains by T801, C811, C827, R815 and 6mm air gaps. To maintain this safety factor ensure that any gaps or leakage paths are not reduced by protruding wires, etc., after repair or component replacement.

WARNING: although the output supply paths from the power supply section are isolated from the incoming mains supply, the bridge rectifier and the control and regulation circuits are not isolated. Therefore, when servicing the power supply section of the chassis, the mains input should be connected via an isolating transformer of at least 200 watts rating.

The power supply section remains charged with respect to chassis for 30-60 seconds after switching off. Care should be taken to avoid touching the power supply area of the chassis during this time.

Components marked  $\triangle$  in the parts lists and on the circuit diagrams are safety approved types and should be replaced only with components supplied or approved by our Service Department. It is also recommended that components not marked with the safety symbol should be replaced with parts of the type originally fitted. This applies particularly to those resistors which are stood off the printed circuit boards.

HANDLING PRECAUTIONS - Static Electrical Charges

The receiver contains devices which may be damaged by static electrical charges during handling. To avoid damage, soldering irons should be earthed, and personnel should wear wrist straps earthed via a 1Mohm resistor. If the latter is not practical, they should discharge themselves by touching an earthed point.

Static sensitive devices should be packed in suitable conductive containers.

IMPORTANT: although the receiver chassis is isolated, the mains supply should be disconnected during service replacement of such static sensitive devices.

# 2. SWITCHED MODE POWER SUPPLY

# 2.1 Circuit Description

The self-oscillating switching converter circuit centres around IC801(TDA4605) which provides all the necessary control and protection functions. The operating frequency varies in the range 25-40kHz, depending upon the load conditions.

IC801 controls the MOS power transistor(TR801) which switches T801 primary winding across the rectified mains voltage stored in the reservoir capacitor (C808). AC voltages of +5V, +20V, +35V, and -12V, developed at taps on the secondary winding, are rectified/smoothed by separate diode/capacitor networks.

The TR801 drive from pin 5 of IC801 maintains constant secondary winding voltages regardless of input or load changes. A control voltage, derived from a T801 secondary winding, is rectified/smoothed by D808/C806. The attenuated control voltage is applied to IC801 pin 1 and is used to match pin 5 output pulse frequency to secondary load conditions.

R811 and C807 provide pin 2 of IC801 with a voltage proportional to TR801 drain current. This is used in the IC to control the pulse duty factor at pin 5.

R806 (SET +5V) adjusts the proportion of the control voltage fed to pin 1 of IC801 and thereby adjusts the output voltage.

The AC control voltage from T801 secondary is attenuated by R805 and fed to pin 8 of IC801 to ensure correctly timed drive pulses for TR801. The zero passage detector at pin 8 senses a zero crossing and thereby enables the control logic.

The supply to pin 6 of IC801 is developed by D807 and C803 from a secondary winding of T801. Start-up voltage is provided via R802 and R803 from a "half-wave" point on the mains rectifier bridge.

# 2.2 Voltage Adjustment

With the D-MAC decoder panel connected, and an LNB load (80-120 ohm, 4W resistor) attached across the tuner IF input, connect a suitable voltmeter across C709. Adjust R806 for a reading of  $+5V \pm 0.05V$ .

# 2.3 Voltage Measurements

Use a Digital Voltmeter (D.V.M.)

IMPORTANT: all S.M.P.S. voltages on IC801 are measured relative to pin 4 on the IC, NOT relative to the chassis. Pin 4 is approximately -330V relative to the chassis.

Integrated Circuit IC801 (TDA 4605)

| Pin | Voltage | Pin | Voltage |
|-----|---------|-----|---------|
| 1   | 0.4     | 5   | 1.8     |
| 2   | 1.2     | 6   | 10.5    |
| 3   | 1.5     | 7   | 3.1     |
| 4   | 0       | 8   | 0.44    |

# 3. TUNING SYSTEM AND AFC

Tuning of the required channel is controlled by the microprocessor on the D-MAC decoder panel. Tuning is by frequency-synthesis with AFC applied to compensate for any drift in the LNB local oscillator frequency.

Tuning voltage is controlled by two PWM (Pulse Width Modulated) outputs from the microprocessor. The PWM (coarse) control chops the 22V tuning supply via TR751 and associated components, to generate the 0-22V tuning voltage required. The PWM (fine) output has a 5V amplitude and is summed with the coarse control at the junction of R753 and R754. R753-R755, and C751-C753 form a low-pass filter which smooths the tuning voltage into the tuner (TU001, pin 4).

The tuner local oscillator frequency is determined by measuring the (±256) prescaler output from the tuner which is further divided, by a factor of 32, in ICO01. Any frequency adjustment necessary is made by the microprocessor which samples the prescaler output and corrects the tuning voltage directly.

AFC control is applied by measuring the amplitude of the data-burst portion of the baseband signal which has a fixed peak-to-peak amplitude. The data-burst window timing signal provided by the D-MAC decoder is used to gate the baseband signal, during the data burst only, through TR003 to R006 and C001. The voltage on C001 is compared with the threshold set by R007 in IC002. The output from IC002 is then sampled by the microprocessor, during the video portion of the baseband signal, to determine the amount of frequency correction needed. This correction is applied by the microprocessor directly to the tuning voltage outputs.

# 4. E1/E7 DE-EMPHASIS

The IF input from the aerial is controlled and conditioned by a complete tuner/demodulator (TU001) which provides a baseband signal output to the E7 deemphasis panel. The baseband signal is tailored by a network formed by R102,R103, and C102 to provide linear 'E1' de-emphasis, and amplified by a differential-pair transistor amplifier formed by the transistor array IC101. The signal is then low-pass filtered by FL101 to remove frequencies above the sample frequency of the D-MAC decoder, thus reducing the alias components which could otherwise be present in the receiver output.

The signal at pin 10 of the transistor array (IC101) is further de-emphasised by a non-linear de-emphasis circuit comprising IC151 and associated components. This circuit provides a progressively larger attenuation to video signal frequencies above 1MHz as the signal amplitude reduces. This reduces the effect of high frequency noise on picture content in poor signal conditions.

The signal path via C152,R153 has a nominally flat amplitude response which is summed at the base of TR152 with the output from the non-linear circuit formed by the transistor array IC151/A, IC151/B, IC151C, and IC151/D. The non-linear portion of the signal is inverted and is therefore subtracted from the flat response when E7 de-emphasis is selected. E7 de-emphasis is applied selectively to the analogue components of the baseband signal only and not to the data burst. The selection of E7 de-emphasis is controlled by a data-burst window signal provided by the D-MAC decoder panel. This drives TR154 into conduction during the data burst. Thus the non-linear part of the signal is grounded to a.c. signals and no subtraction takes place in the latter part of the de-emphasis circuit.

Note: the majority of the passive components used on this panel are close tolerance types, and selected temperature coefficients. To maintain the high performance required in this section of the receiver it is important that suitable replacements are carefully selected - see section 10 for further details.

#### 5. D-MAC DECODING AND DESCRAMBLING

The D-MAC panel is divided into a number of sections:

Microprocessor
Video Codec
MAC decoder
Descrambler
Audio mixer and filters
D-MAC clock generator
Access Control Module (ACM)
RGB and Sync buffers

# 5.1 Microprocessor

The microprocessor (IC701) is an 880C562 which controls the following functions:

Tuning
Remote control
LED display
D-MAC processing
Sound processing
Descrambling (with the ACM)
User settings
Non-volatile memory

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Control of the D-MAC chipset (DMA2280; DMA2285; AMU2485; VCU2133) and non-volatile memory IC704 (MDA2062) is effected via a 3-wire serial bus, the IM bus. This appears on pins 21, 22 and 23 of the microprocessor.

The programme and data for the microprocessor is held in an 82C257 EPROM. User and factory defaults are stored in non-volatile RAM, IC704 (MDA2062). This memory is accessed via the IM bus.

# 5.2 D-MAC Decoding

The de-emphasised and filtered video signal from the PSU/Tuner board is coupled to the Video Codec (<u>Coder/Decoder</u>), VCU2133, via an emitter follower. The VCU2133 digitises the video signal into 7-bit data which is passed on to the DMA2285 for descrambling, if necessary. The 8-bit descrambled output is fed to the D-MAC decoder for further processing.

The D-MAC decoder (DMA2280) processes both sound and vision data. The luminance and chrominance signals are decompressed, multiplexed and fed to the VCU for conversion to analogue RGB signals.

Pin 48 generates a clamp signal which removes the energy dispersal signal from the video input to the Video Codec, and clamps the signal to the d/a converter reference level.

The composite sync on pin 53 feeds the character generator in the ACM in order to synchronise the text display with the incoming video.

The DMA2280 also generates an 11 microsecond gating pulse which is used to switch out the E7 de-emphasis (on the power supply/tuner panel) during the data burst. The signal is also used by the microprocessor to control the action of the afc circuit, located on the power supply/tuner panel.

The 20.25MHz data clock is generated by IC506 (MCU2632). The device also contains a phase lock loop, to synchronise the oscillator to the incoming data clock.

# 5.3 Audio Processing

The audio data packets are processed within the DMA2280. The 18.432MHz crystal controlled audio clock is generated by the DMA2280. This is used internally and by the audio mixer (AMU2485). The packets are stored, and data is interleaved in the 64k DRAM, IC509.

The resulting decoded audio leaves the decoder on a serial audio bus (S-bus on pins 64, 66 and 67) and is fed to the audio mixer, IC508 (AMU2484). The audio mixer multiplexes the audio data, performs J17 de-emphasis and digital-to-analogue conversion. The resulting audio output is buffered and filtered to remove sampling frequencies.

# 5.4 RGB Outputs

The RGB outputs from the video codec are bandpass filtered to remove video sampling frequencies, and then buffered via emitter followers. The emitter followers then feed the signals to the SCART connector and to the PAL decoder on the power supply/tuner panel.

# 5.5 Access Control Module (ACM)

The ACM receives data from the microprocessor. This data is used to generate onscreen text and to determine if the receiver is authorised to receive a programme or programmes.

This is a non-serviceable module which *must* be returned to Tatung Service Division for replacement.

Warning: The ACM contains a lithium battery. Do not attempt to replace or recharge this battery as this can result in loss of data within the ACM, rendering it totally useless. There is also a risk of explosion if the device is not handled correctly.

# ACM Tracking Requirements

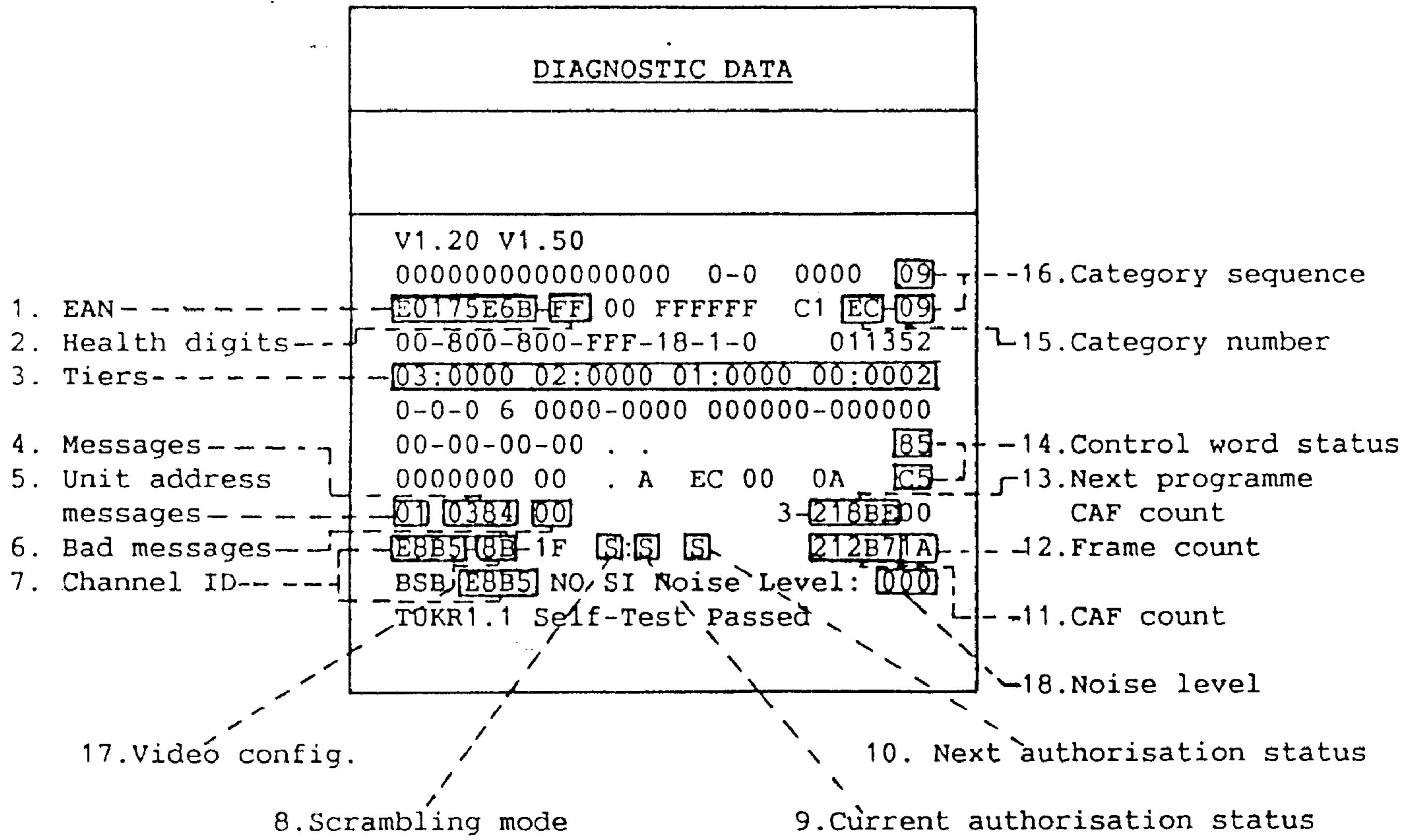
The ACM in this receiver is subject to strict controls to establish it's whereabouts at all times. These controls are necessary to comply with the US Government export licence conditions which apply to its use.

Under no circumstances should the ACM be destroyed, or disposed of by a third party. All faulty ACM's must be returned to Tatung (UK) Ltd. who are authorised to accept these and, where necessary, issue a replacement.

ACM's must not be returned direct to BSB. BSB will only accept ACM's returned by Tatung (U.K) Ltd.

For further information on ACM return/replacement please contact Tatung (U.K) Service Division, at the address shown on the cover page of this publication.

To help determine whether or not the ACM needs replacing, press [TEST] to show an ACM Diagnostic Data display on the screen (see below). The information shown is typical but note that some data is constantly changing. The notes which follow explain the meaning of the data.



## Notes:

All values not shown in key below are fixed or typical for normal operation.

| <u>KEY</u> | MEANING                        | <u>VALUES</u>   |
|------------|--------------------------------|---|
| 1          | Equipment authorisation number |   |
| 2          | ACM health check               | <pre>FF = o.k., FE = processor/ACM interface fault, all others = failed ACM</pre>   |
| 3          | Tiers .                        |   |
| 4          | Messages )                     | This information may be required by BSB   |
| 5          | Unit address messages )        | to aid problem solving.   |
| 6          | Bad messages )                 |   |
| 7          | Channel identification         | Both positions should have same data prog. 1 = E8B5 ) prog. 2 = 48B3 ) prog. 3 = 70B2 ) BSB off-air signals prog. 4 = D0B4 ) prog. 5 = 20B1 ) |
| 8          | Scrambling mode                | <pre>F = fixed key, S = conditional access U = undefined (free access)</pre>  |
| 9          | Current authorisation          | S = subscription  -XS = (ACM) hardware failure  -X+ = (ACM) hardware failure  -MU = not authorised  -CA = calculating authorisation           |
| 10         | Next authorisation             | As for current authorisation  |
| 1 1        | CAF count                      |   |

| 12 | Frame count              | Counts at frame rate (25Hz)                   |
|----|--------------------------|---|
| 13 | Next programme CAF count |   |
| 14 | Control word status      | May be required by BSB to aid problem solving |
| 15 | Category number          | Both positions should have same data          |
| 16 | Category sequence        | Both positions should have same data          |
| 17 | Video configuration      | First digit 2 = unscrambled                   |
|    |                          | 0,4 = free-access scrambled                   |
|    |                          | 8,A = conditional access scrambled            |
|    |                          | Second digit                                  |
|    |                          | 3,7 = 16:9 aspect ratio                       |
|    |                          | B,F = 4:3 aspect ratio                        |
| 1Ω | Noico lovol              | Frror count (low count=low noise level)       |

Contact Tatung (UK) Ltd., Service Division in case of difficulties.

#### 6. VIDEO ENCODER AND UHF MODULATOR OUTPUT

# 6.1 Composite Video Encoder.

The RGB output signals from the D-MAC decoder panel are encoded to composite video by IC201. The R,G, and B signals are first attenuated to 1V by R201-R203, and R206-R208 and fed to IC201 together with the composite sync. signal. The three colour inputs are matrixed in IC201 to produce the U and V colour difference signals and the (Y) luminance signal. The colour difference signals drive two double balanced modulators to produce a composite chroma output at pin 13, IC201. This composite chroma is fed to the chroma bandpass filter L201 and fed back into pin 10, IC201 to be added to the output signal. The chroma bandpass filter is adjusted by using a colour bar input signal and monitoring the composite video output (pin 9, IC201) on an oscilloscope. With the 'scope triggered on TV line sync. and adjusted to show the line in both fields, L201 should be adjusted for minimum jitter between alternate fields.

The colour sub-carrier frequency is generated by an on-chip crystal oscillator within IC201 (pins 17 and 18) in conjunction with XL201. Correct sub-carrier frequency is set by C210 which is adjusted for 4.4336 MHz ± 100Hz measured at pin 18 IC201 (a low capacitance probe must be used to avoid incorrect reading). The luminance signal is delayed by the external delay line L202 to give correct luma/chroma timing for the composite video output at pin 9. The composite sync. input, at pin 2 IC201, provides the timing for the sync. output, drives the black level clamps in the internal modulators and triggers a ramp generator to produce the colour burst and PAL switching signal. The colour burst timing is controlled by R210 and C201 attached to pin 1, IC201.

# 6.2 UHF modulator

The output from the video encoder (pin 9, IC201) has an overall (peak-to-peak) amplitude of 2.1V which is fed directly to an emitter-follower on the D-MAC decoder panel. It is fed to the UHF modulator after being divided down to 1V peak-to-peak by R214 and R215. L703, C224 and C225 form a low-pass filter to remove harmonics of the sub-carrier frequency. TR201 and associated components add the d.c. pedestal necessary for correct modulator operation.

The (mono) audio signal from the D-MAC decoder is fed directly to the UHF modulator.

## 6.3 Standby Mode

In this mode the 12V rail to the UHF modulator (but not the UHF loop-through part) is disabled by TR203. All other circuit functions are as for normal operation.

# 7. REMOTE CONTROL RECEIVER AND LED DISPLAY

#### 7.1 Infra-red Receiver

The infra-red receive circuit is part of the main chassis. Refer to the main circuit diagram when reading this description.

The coded infra-red signals are detected within the photo module IC751. IC751 incorporates the pre-amplifier and pulse stretcher which directly drive the microprocessor (IC701,pin 27). The pulse-stretched output, pin 4, is normally 'high' (>4.9V) and goes 'low' when an infra-red pulse is received.

# 7.2 LED Display

The LED is driven by the microprocessor (IC701) to provide user and service status information. The microprocessor output signals are buffered by transistors TR752-759 to drive the common-anode display.

The LED indications are as follows:

| Display | <u>Meaning</u>  |
|---------|---|
| 0       | Normal operation.   |
| H       | Homing (Standby).   |
| , ,     | Blank display is normal during power-up.  |
| S       | When SCART function and RGB switching are disabled, this is                             |
|         | displayed during MAIN MENU and for 3 seconds on pressing the VIEW key.                  |
| C       | Broadcast is in wide aspect ratio. Automatic 'panning' on normal aspect TV.             |
| P       | User 'panning' is available on normal aspect TV when broadcast is in wide aspect ratio. |
| A       | Time-out on reply from ACM (transient display).   |
| Ė       | Erroneous data found in a reply from ACM (transient display).                           |
| L       | When LNB under-current and absence of D-MAC signal occur together.                      |
| n       | Failure of NVRAM (displayed during power-up).   |
| d       | Dynamic RAM failure (displayed during power-up).  |

# 8. REMOTE CONTROL HAND UNITS (RB90, RB91, RB92)

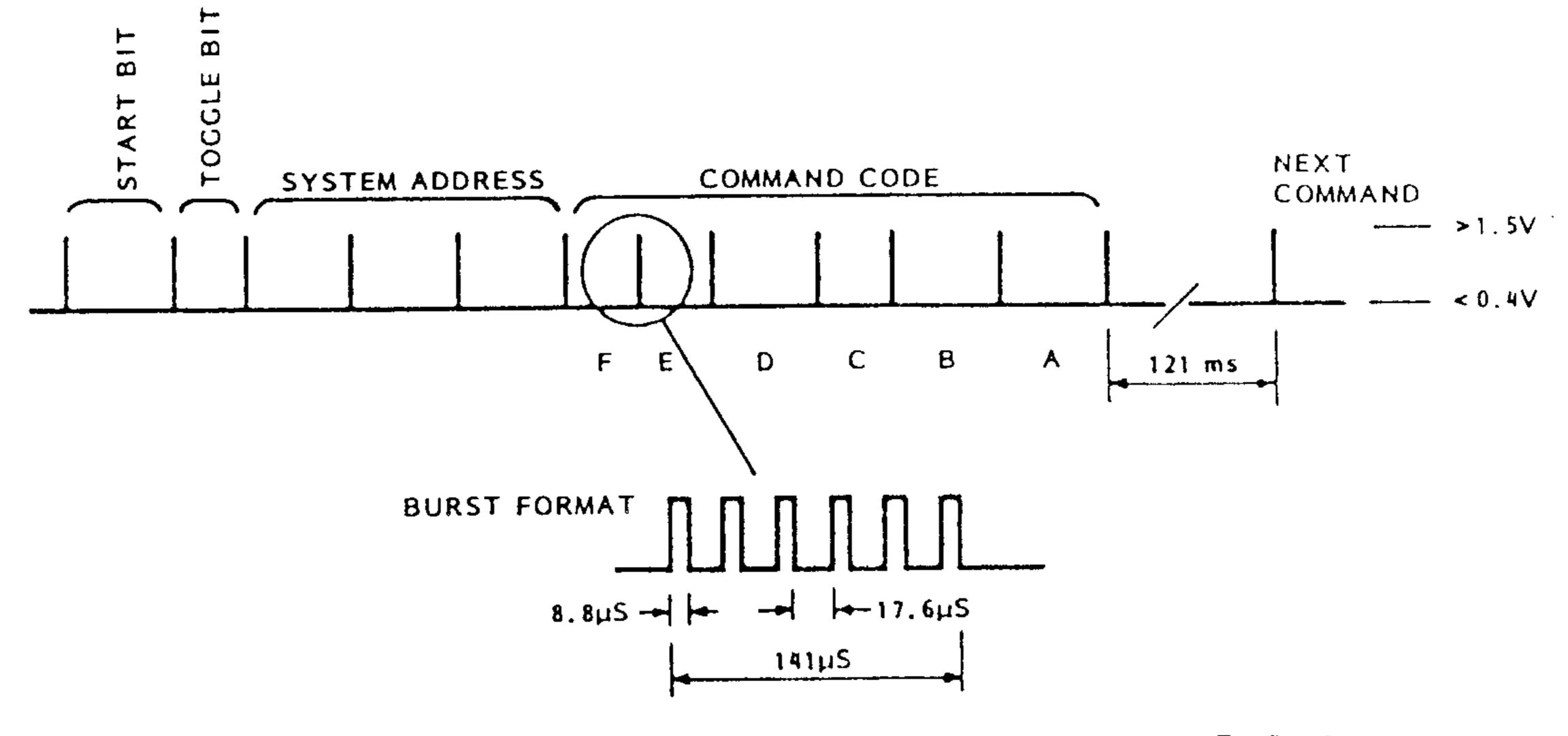
Each Remote Control Hand Unit is a self-contained battery operated device. Refer to the circuit diagram when reading the following description. The pin numbers quoted below refer to IC790 on RB90 units, and IC780 on RB91 and RB92 units.

The infra-red transmitter consists of a single IC which contains all the circuitry required to scan the membrane keyboard and produce a series of pulses to drive the infra-red transmitting diode.

In the rest state, with no keys depressed, the drive lines (pins 13-19) are held in the 'low' state and the sense lines (pins 2-9) are held in a 'high' state by internal pull-up devices. If a key on the matrix is closed the key position is detected and the corresponding command code is produced at the transmitter output (pin 1).

The command generated by IC790(RB90)/IC780(RB91 and RB92) is a sequence of twelve pulses which define 11 periods. It is the period which denotes a binary '0' or '1' to represent the command as a binary code. The diagram following gives details of the output format. Each of the twelve pulses consists of a burst of 38kHz carrier frequency. The pulse duration is 5.06ms to denote a logic '0', or 7.59ms to denote a logic '1'. The periods between the pulses represent, in order of transmission, the start bit, a toggle bit, three system address bits and a six-bit command code. The start bit and system address bits always have the same duration regardless of the command used. The toggle bit changes state when a new command is detected. The six bits for each command are shown in the following table.

| Function | Command Code Bits | Function | Command Code Bits |
|----------|-------------------|----------|-------------------|
|          | FEDCBA            |          | FEDCBA            |
| 1        | 0 0 1 0 0 0       | VIEW     | 0 0 0 0 1         |
| 2        | 0 0 1 0 0 1       | ENTER    | 0 0 0 0 1 0       |
| 3        | 0 0 1 1 1 1       | CANCEL   | 0 0 0 1 0 0       |
| 4        | 0 1 0 0 0 0       | HELP     | 0 0 0 1 0 1       |
| 5        | 0 1 0 0 0 1       | NEXT     | 0 0 0 1 1 0       |
| 6        | 0 0 1 0 1 0       | <        | 0 1 0 1 0 0       |
| 7        | 0 0 1 1 0 0       | >        | 0 1 0 1 0 1       |
| 8        | 0 0 1 1 0 1       | MENU     | 0 1 0 1 1 0       |
| 9        | 0 0 1 1 1 0       | STANDBY  | 0 1 0 1 1 1       |
| 0/10     | 0 1 0 0 1 0       |          |                   |



Infra-red Transmitter IC Output (pin 1)

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#### 9. SYSTEM TEST MODE

For service use the system Test Mode provides extra functions that are not available to the customer. All test functions are controlled using the remote-control hand-unit supplied.

Important Note: the majority of these tests have a direct impact on the receiver performance, with adjustments being performed in software via a special 'TEST MENU'. Setup must therefore be in accordance with these instructions for optimum performance. The adjustments allowed in this mode are programmed into the non-volatile memory for the devices installed (IC503, IC503, IC506). It should not be necessary to adjust these settings unless one of the devices has been changed (due to component failure).

# 9.1 Entering/Leaving Test Mode

The Test Mode is entered by holding down the TEST key on the local keypad whilst the chassis is powered 'ON'. Keep the TEST key depressed until the LED display steadies to show 'H', indicating that the receiver is in 'Standby' mode.

Press the STANDBY button to bring the receiver out of Standby into the Test Mode. *Note*: when in Test Mode, the receiver will display scrambled pictures when not authorised. This is intentional, and is to aid fault finding. <u>This mode</u> should not be disclosed to the user.

Press MENU to display the MAIN MENU. Select the TEST MENU, option 6 (note that this option is not shown on the screen and is only available from the Test Mode. This is to prevent accidental access by the user). The TEST MENU should now be superimposed over video.

The receiver will remain in Test Mode until it is reset by switching the power 'OFF' and then back 'ON' again.

9.2 System Test Functions.

The full TEST MENU is as follows:

# Test Menu

- 1 Set DMA2280 VCO
- 2 ACM Port Bit Test
- 3 Flag Status
- 4 UART Test
- 5 AFC Adjust
- 6 RGB Drive
- 7 RGB Cut-off

Select 1 - 7 or press VIEW to exit menu

#### 9.2.1 Set DMMA2280 VCO

A frequency meter capable of measuring  $20.25 \, \text{MHz}$  to an accuracy of better than +/- 10Hz is needed to set the D-MAC clock frequency.

Disconnect any signal sources from the aerial socket, and switch off the receiver. Connect a frequency meter to pin 16 of the ACM connector (PL705). Switch on the receiver into Test Mode as described earlier.

Select option 1 from the Test Menu. Using the  $\langle$  and  $\rangle$  keys, adjust the VCO frequency to 20.25MHz +/- 100Hz. It is important that this frequency should be set as accurately as possible.

# Control keys:

CANCEL Cancels change

ENTER Stores change and exits menu

MENU Returns to Test Menu and aborts changes

VIEW Returns to picture and aborts changes

NEXT Restores factory default settings

#### 9.2.2 ACM Port Test

Checks the processor/ACM interface. For factory use only.

# 9.2.3 Flag Status

This option enters the Status sub-menu. The status of the SCART function switch, Audience Survey (ASV), bad programme store and IMBUS are shown. Only the status of the SCART and ASV functions can be changed from this menu.

# SCART switching

Pressing '1' will toggle the state of SCART pins 8 and 16. The purpose of this feature (duplicated in the normal user menus) is to allow recording (from UHF) of BSB programmes whilst watching terrestrial programmes. This is for cases where the BSB receiver is connected to the TV via the SCART connector and the TV is unable to over-ride the effects of the function switching voltages on the SCART connector. Disabling the SCART switching will allow normal viewing of terrestrial programmes in such cases.

The function is automatically cancelled whenever there is a channel change on the BSB receiver, or the BSB receiver is switched to Standby. It can also be deliberately cancelled.

# Audience Survey Function

This indicates whether the AGB audience survey feature is enabled. Alteration of this flag should only be carried out with the agreement of AGB.

## Bad Programme Store

This is for information only. The non-volatile RAM holds data relating to the last used programme. All such non-volatile memory has a finite number of write cycles. This should, normally, exceed the life of the receiver. If the Flag Status indicates that the Bad Programme Store has been enabled, this means that that the permissible number of write cycles has been exceeded. It further indicates that the back-up location is in use to allow normal operation of the receiver to continue.

If the Bad Programme Store becomes enabled, the non-volatile RAM should be replaced.

IMBUS Status

This is for factory use only.

Control keys:

VIEW

Returns to picture

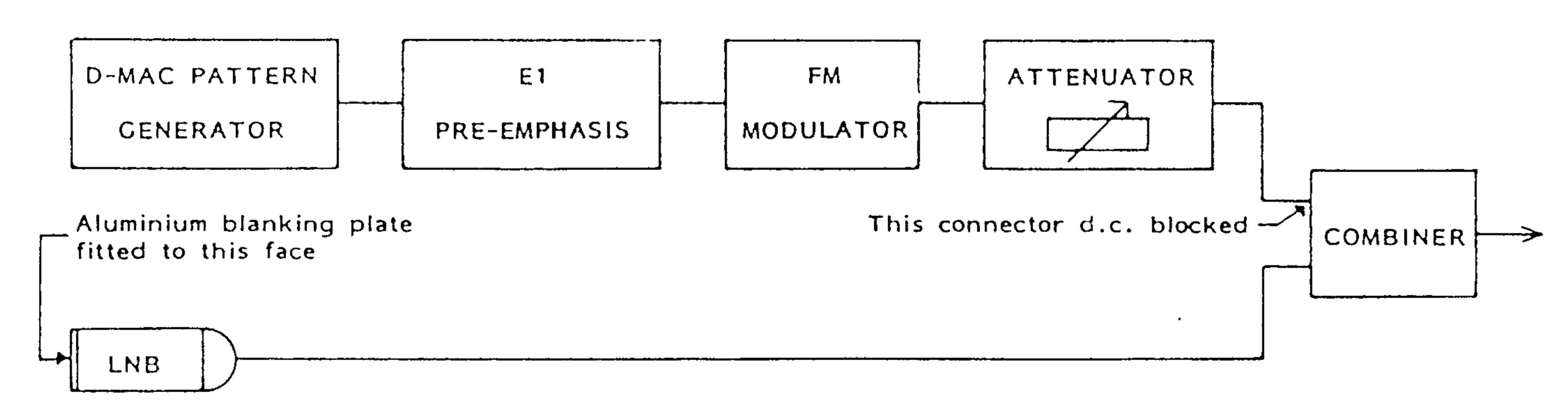
Menu

Returns to Test Menu

# 9.2.4 UART Test

Selecting this option causes ASCII characters  $21_{\rm h}$  to  $07_{\rm h}$  inclusive to be sent to the serial data port (when audience survey components are fitted). Protocol is 9600 baud, 1 start bit, 1 stop bit with no parity. Automatically returns to picture mode upon completion.

# 9.2.5 AFC Adjust



AFC Alignment Set-up

NOTE: The AFC alignment described in paragraphs (d) to (h) below can only be accurately set if a DMAC test signal generator and FM modulator are available. The pattern generator should be set to display colour bars and the modulator must be tuned to one of the BSB channel frequencies.

## Proceed as follows:

- (a) Select 'System Test Mode' on the receiver (see Section 9).
- (b) Ensure AFC gate is closed by connecting PL752 pin 27 to 0V. Adjust AFC preset R007 for  $2.5V \pm 0.1V$  on PL752 pin 33 (AFC out).

- (c) Select appropriate channel.
- (d) Monitor the SCART RGB output of the D-MAC panel with the TV in AV/RGB mode. Colour bars should be displayed.
- (e) Select menu AFC Adjust (this may not appear relevant, but actually increases the power and response speed of the AFC, to enable adjustment of R007 to be made).
- Switch into circuit an LNB noise source, consisting of a spare LNB with the waveguide covered by an aluminium blanking plate, and apply power to LNB. The signal level must then be set (independent of noise), using an in-line attenuator, to give a C/N at about 1dB above the threshold of the tuner i.e. about 9dB CNR.
- Picture should be noisy with "sparklies" and/or "darklies" appearing. These may appear more in the white bar (as dark spots) or more in the black bar (as white spots), if AFC is off tune.

Carefully re-adjust R007 for optimum balance between white and black spots.

(h) Further reduce C/N, to about 1dB below threshold (about 7dB) and repeat paragraph (g) to facilitate accurate setting.

## 9.2.6 RGB Drive

The RGB drive settings should only need to be altered if the video codec chip (VCU2133) or non-volatile memory has been replaced. An oscilloscope is necessary to set the drive levels. These adjustments should be performed before attempting to adjust RGB cut-off values.

Using a colour bar signal or the test reference waveforms in line 624, the RGB amplitudes (measured at the junctions of R509 and TR502 (R), R508 and TR501 (G), R510 and TR503 (B)) should be adjusted for 1.4V black-to-white for all three channels. It is important to maintain accurate balance between all three channels so as to avoid grey-scale tracking errors.

To adjust the drive levels, select option 6 from the Test Menu. Use keys 1-6 on the Remote Control Hand Unit to set the drive levels as shown below:

| <u>Key</u> | Effect         |
|------------|----------------|
| 1          | Red increase   |
| 2          | Green increase |
| 3          | Blue increase  |
| 4          | Red decrease   |
| 5          | Green decrease |
| 6          | Blue decrease  |

# Control keys:

| CANCEL | Cancels change                          |
|--------|---|
| ENTER  | Stores change and exits menu            |
| MENU   | Returns to Test Menu and aborts changes |
| VIEW   | Returns to picture and aborts changes   |
| NEXT   | Restores factory default settings       |

R,G and B Drive and Cut-off values are shown alternately at the bottom of the menu in the following form (the figures used are only examples):

215 200 221 186 214 200 R G G B B

#### 9.2.7 RGB Cut-off

The RGB cut-off settings should only need to be altered if the video codec chip (VCU2133) or NVRAM have been replaced. An oscilloscope is necessary when performing these adjustments.

RGB drive adjustments should be checked and, if necessary, corrected prior to adjusting cut-off values.

Using a colour bar signal or the test reference waveforms in line 624, the RGB black levels (measured at the junctions of R509 and TR502 (R), R508 and TR501 (G), R510 and TR503 (B)) should be set for 40mV for all three channels. It is important to maintain accurate balance between all three channels so as to avoid grey-scale tracking errors.

To adjust the cut-off levels, select option 7 from the Test Menu. Use keys 1 - 6 on the Remote Control Hand Unit to set the drive levels as shown below:

| <u>Key</u> | <u>Effect</u>  |
|------------|----------------|
| 1          | Red increase   |
| 2          | Green increase |
| 3          | Blue increase  |
| 4          | Red decrease   |
| 5          | Green decrease |
| 6          | Blue decrease  |

# Control keys:

| CANCEL | Cancels change                          |
|--------|---|
| ENTER  | Stores change and exits menu            |
| MENU   | Returns to Test Menu and aborts changes |
| VIEW   | Returns to picture and aborts changes   |
| NEXT   | Restores factory default settings       |

R,G and B Drive and Cut-off values are shown alternately at the bottom of the menu in the following form (the figures used are only examples):

215 200 221 186 214 200 R G G B B

## 10. LIST OF COMPONENTS

Components which are marked  $\triangle$  in the Parts List and on the circuit diagram are Safety Approved types and should be replaced only with components supplied or approved by our Service Department. It is also recommended that components not marked with the safety symbol should be replaced with parts of the type originally fitted. This applies particularly to those resistors which are stood off the printed circuit board.

Order replacements for the components listed by contacting Tatung Service Division at the address shown on the cover of this publication, quoting the Code Number given. The manufacturer reserves the right to modify the design of the receiver, and to use or supply such alternative components as may be deemed necessary.

The majority of components are fitted to all chassis. Those which are only fitted to some chassis are identified by the symbol \* alongside the circuit reference in the listings and/or on the circuit diagram.

# 10.1 Resistors and Capacitors

The majority of resistors are either 0.125W, 0.25W or 0.5W standard carbon film or metal film types which are readily available from component stockists. Replacements should be of the same tolerance and rating as the originals. Refer to the circuit diagrams for values.

Similarly, the majority of capacitors are standard off-the-shelf items.

The items listed should only be replaced with components approved or supplied by our Service Department.

| Cct. Ref.             | Description   | <u>Code No.</u>               |
|-----------------------|---|-------------------------------|
| R011                  | Resistor 3R3, 5%, 4W, W/W   | 11-5103-3                     |
| R831 <u>^</u><br>R832 | Resistor 5R6, 5%, 3W, W/W fusible Resistor 2R7, 5%, 0.5W, Metal film, fusible | 11-5366-8<br>11-5384-6/P01-01 |
| C801.802 🔨            | Capacitor 220n, 20%, 250V a.c.  | 14-5163-4                     |

## 10.2 Integrated Circuits

| Cct. Ref. | Description/Type                     | Code No.       |
|-----------|--------------------------------------|----------------|
| IC001     | 74LS393                              | 19-8092-0      |
| IC002     | LM358N                               | 19-8356-3      |
| IC101,151 | CA3046A                              | 19-8391-1      |
| IC201     | MC1377                               | 19-8290-7      |
| IC501     | Video Processor (VCU2133 ITT)        | 19-8364-4      |
| IC502     | DMA2280                              | 19-8365-2      |
| IC503     | DMA2285                              | 19-8366-0      |
| IC504,509 | 64K x 1 DRAM                         | 19-8386-5      |
| IC506     | Clock Generator (MCU2600 ITT)        | 19-8370-9      |
| IC508     | Sound Processor (AMU2481 ITT)        | 19-8368-7      |
| IC701     | Microprocessor (80C562-16WP Philips) | 19-8418-7      |
| IC702     | ACM Module                           | 19-8371-7      |
| IC704     | Serial EEPROM (MDA2062 ITT)          | 19-8369-5      |
| IC705     | EPROM 87C257                         | 19-8419-5/PG01 |

# 10.2 Integrated Circuits (cont'd)

| Cct. Ref. | Type/Description | <u>Code No.</u> |
|-----------|------------------|-----------------|
| IC751     | TFMP2380         | 19-8337-2       |
| IC801     | TDA4605          | 19-8329-6       |
| IC802     | L7812Cy.         | 19-8374-1       |

# 10.3 Transistors, Diodes

| Cct. Ref.      | Type/Description                 | Code No.  |
|----------------|----------------------------------|-----------|
| TR154          | Transistor, FET 2N7000           | 19-8414-4 |
| #TR002,201,    |                                  |           |
| #202,501-505,  | Transistor, BC547 Philips        | 19-8414-4 |
| #508,701,751 J |                                  |           |
| D752           | LED, 7-segment (TLR333T Toshiba) | 19-8362-8 |
| D813           | Diode - B20V voltage regulator   | 19-8415-2 |
| D814           | Diode - 22V regulator            | 19-8373-3 |

# these general purpose transistors must be replaced with the Philips version which has been specially chosen for its preferred parameters.

# 10.4 Transformers, Coils, Filters, Delay Lines

| Cct. Ref.<br>T801 1 | <u>Description</u><br>Transformer, Switched Mode Power Supply | <u>Code No.</u><br>87-0018-4 |
|---------------------|---|------------------------------|
| FL101               | Filter, 8.4MHz  | 15-7675-5                    |
| FL201               | Chroma bandpass coil  | 85-9666-2                    |
| FL202               | Delay line, luminance, 250ns.                                 | 15-7676-3                    |

# 10.5 Crystals, Resonators

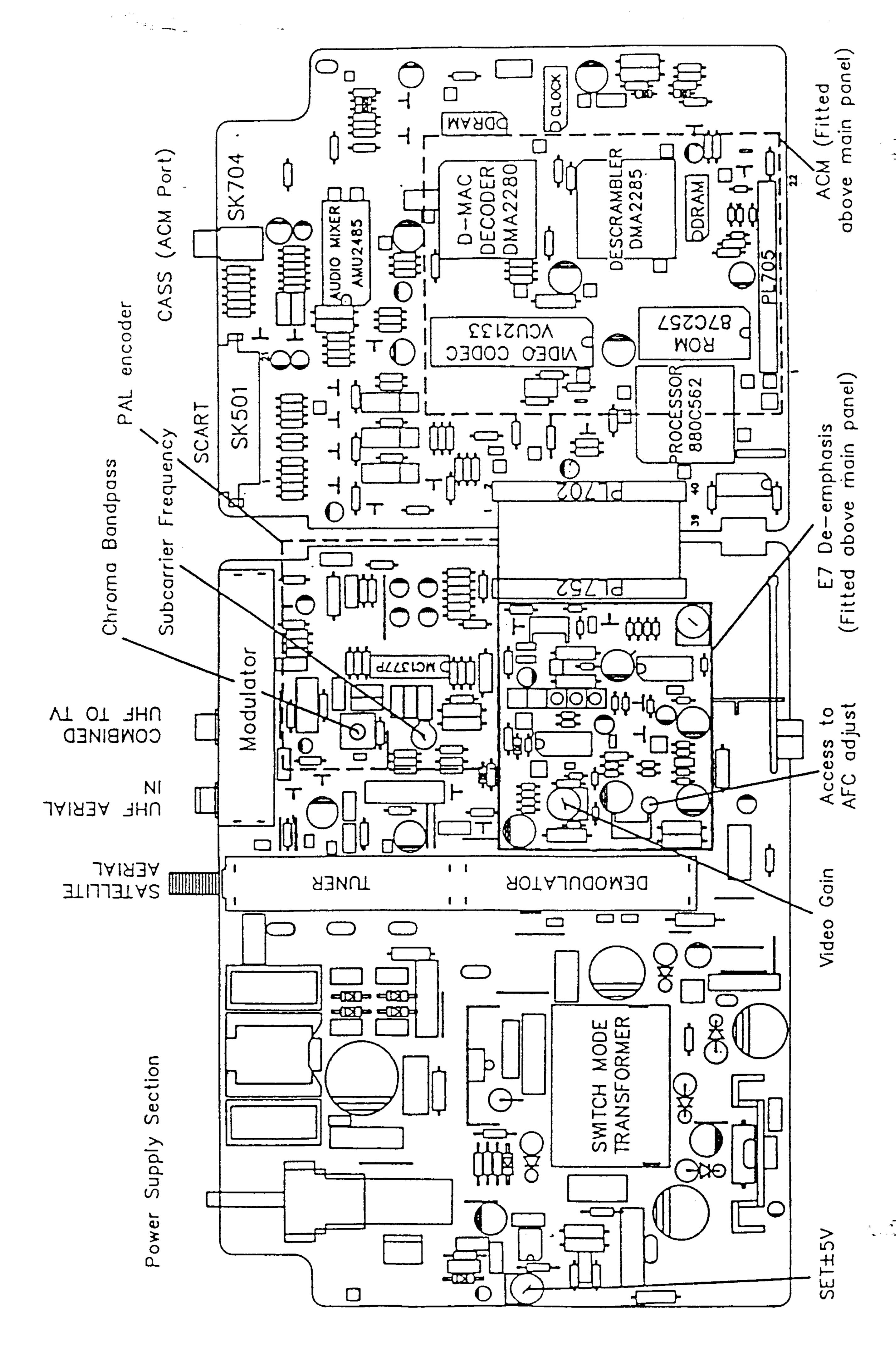
| Cct. Ref. | Description         | Code No.  |
|-----------|---------------------|-----------|
| XL201     | Crystal (4.43MHz)   | 16-1898-9 |
| XL501     | Crystal (18.432MHz) | 16-1914-4 |
| XL502     | Crystal (20.25MHz)  | 16-1915-2 |
| XL701     | Crystal (15MHz)     | 16-1916-0 |
| X790      | Resonator (455kHz)  | 15-7630-5 |

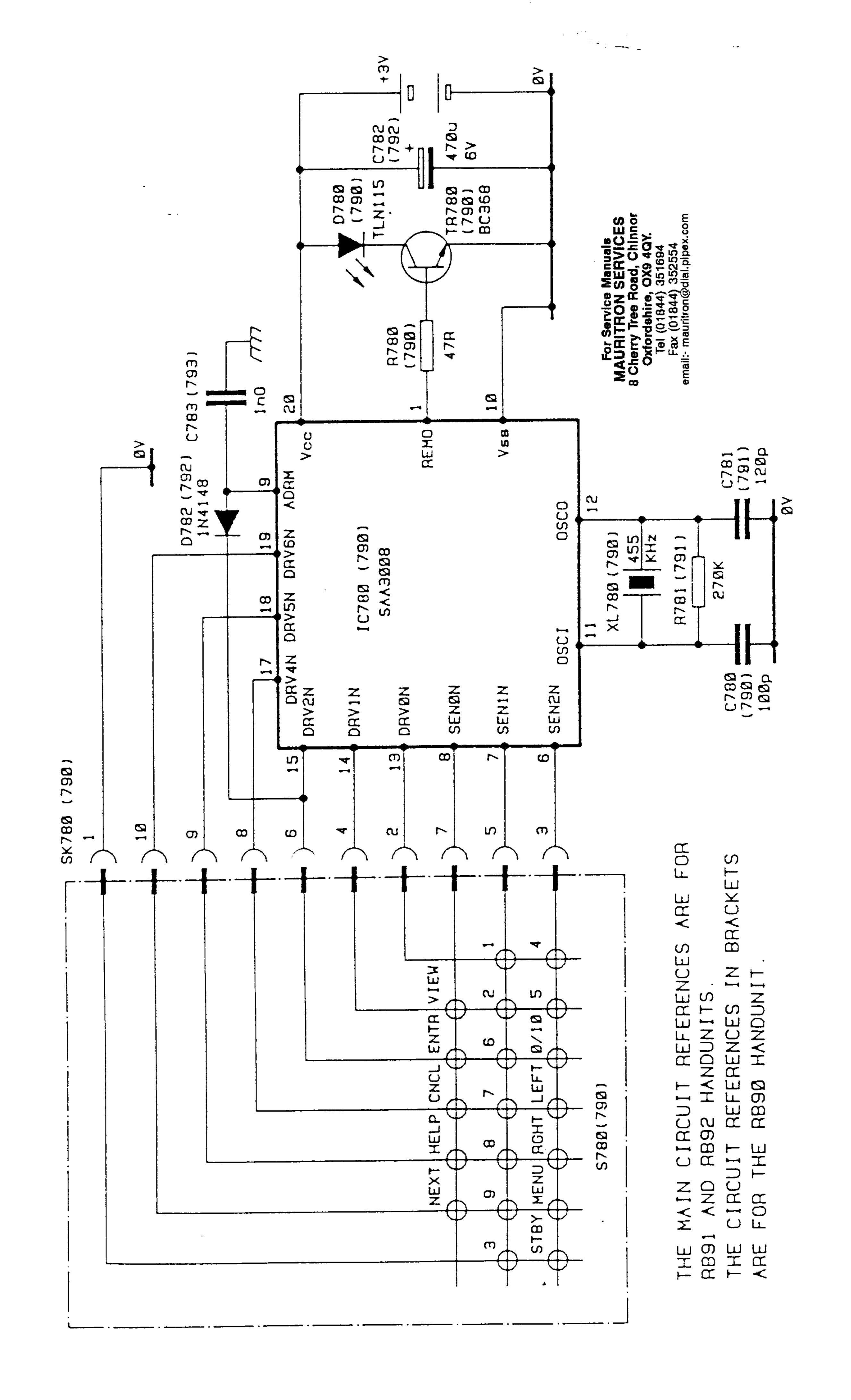
# 10.6 Connectors

| <pre>Cct. Ref. PL701,703,706 PL702</pre> | Description 1-way plug 40-way plug | Code No.<br>22-8253-4<br>22-8244-5 |
|--|------------------------------------|------------------------------------|
| PL705                                    | 22-way plug                        | 22-8230-5                          |
| PL752                                    | see paragraph 11.7 below           |                                    |
| PL801                                    | 2-way plug                         | 22-8218-6                          |
| SK101,151                                | 5-way socket                       | 22-8246-1                          |
| SK501                                    | 21-way socket (SCART)              | 22-8224-0                          |
| SK704                                    | Phono socket                       | 22-8109-0                          |
| SK790                                    | 10-way socket                      | 22-8211-9                          |

# 10.7 Miscellaneous

| Cct.Ref.     | <u>Description</u>            | Code No.        |
|--------------|-------------------------------|-----------------|
| FS801        | Fuse 1.25A, timelag           | 21-3665-1       |
| S801 A       | ON/OFF switch                 | 20-4074-3       |
|              | Power Supply/Tuner Assembly   | 05-4191-5       |
| <b>-</b>     | D-MAC Decoder Assembly        | 05-4190-7       |
| _            |                               | 05-4375-6       |
|              | E7 De-emphasis Panel Assembly | 21-3700-3       |
| TU001        | Tuner/Demodulator             | 21-3698-8       |
| TU201        | RF Modulator                  |                 |
| PL752        | 40-way interconnecting cable  | 83-3524-9       |
| _            | Cabinet base                  | 83-3042-5/20000 |
| -            | Cabinet cover                 | 83-3043-3/20000 |
| _            | Badge - Tatung                | 80-0320-3       |
| <del>-</del> | Moulded feet                  | 83-3601-6/19810 |
| <del></del>  | Rubber feet                   | 83-2829-3       |
| <b></b>      | Remote Control Hand Unit      |                 |
|              | - RB90 complete               | 05-4197-4       |
|              | - RB91 complete               | 05-4548-1       |
|              | - membrane (RB90)             | 83-3071-9/40110 |
|              | - membrane (RB91)             | 85-4933-8       |
|              | - battery cover (RB90)        | 83-2810-2/29800 |
|              | - battery cover (RB91)        | 85-3884-0/29800 |
|              |                               | 83-2808-0/29800 |
|              |                               | 85-3882-4/29800 |
|              | - top cover (RB91)            | 83-2809-9/29800 |
|              | - base cover (RB90)           | 85-3883-2/29800 |
|              | - base cover (RB91)           | 03-3003-2/23000 |





Remote Control Hand Unit - Circuit Diagram

