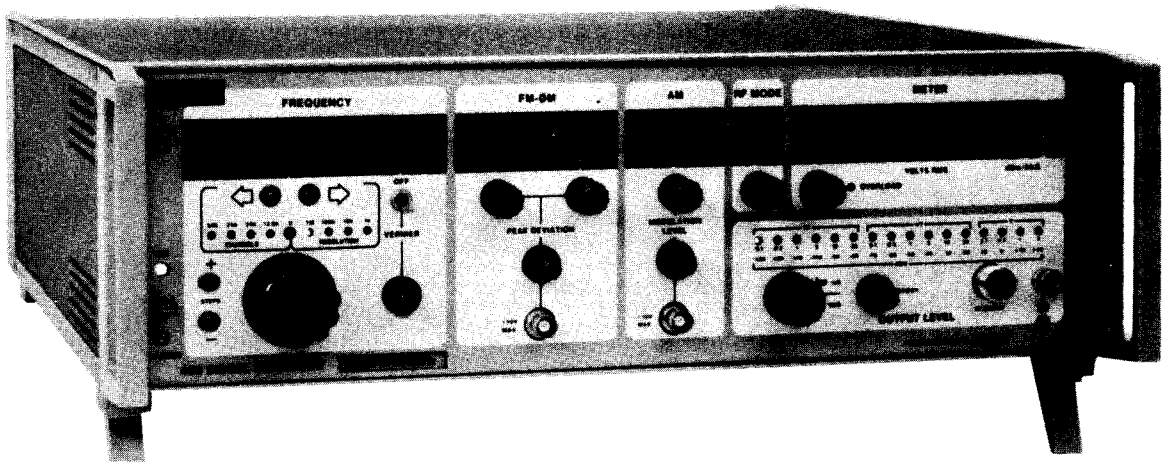
OPERATION AND MAINTENANCE MANUAL

AILTECH

460 FREQUENCY SYNTHESIZED SIGNAL GENERATOR

100 kHz TO 650 MHz/1300 MHz



FEBRUARY 1, 1980

EATON Advanced Electronics

Eaton Corporation
Electronic Instrumentation Division
Ronkonkoma, New York 11779

WARRANTY

This instrument is protected by a full one year warranty against defects in workmanship and materials, except for fuses which carry no warranty. Eaton Corporation, Electronic Instrumentation Division, in connection with equipment sold, agrees to correct any defect in workmanship or material which may develop during the period of one year from the date of shipment under proper or normal use and not in excess of the original manufacturer's life expectancy ratings, by its option to repair or replace, FOB point of shipment, the defective part or parts. Such correction shall constitute a fulfillment of all Eaton Corporation, Electronic Instrumentation Division liabilities in respect to said instrument.

SERVICE

Additional service information can be made available by calling AILTECH.

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SECTION 1

FUNCTIONAL DESCRIPTION

This section describes the functions of the 460 Signal Generator and the available options. It also sets out the technical specifications of the equipment.

1.1 GENERAL DESCRIPTION

The 460 Signal Generator is a high-performance instrument combining in one unit the basic features of the best free-running signal generators and frequency synthesizers.

The technology on which this instrument is based and its numerous facilities mean that the 460 is the first of a new generation of signal generators characterised by the combination of frequency synthesis and the operating principles of free-running generators. The combination of these two techniques and the use of a built-in microprocessor taking care of control functions are key design factors of the 460. See Figure 1-1.

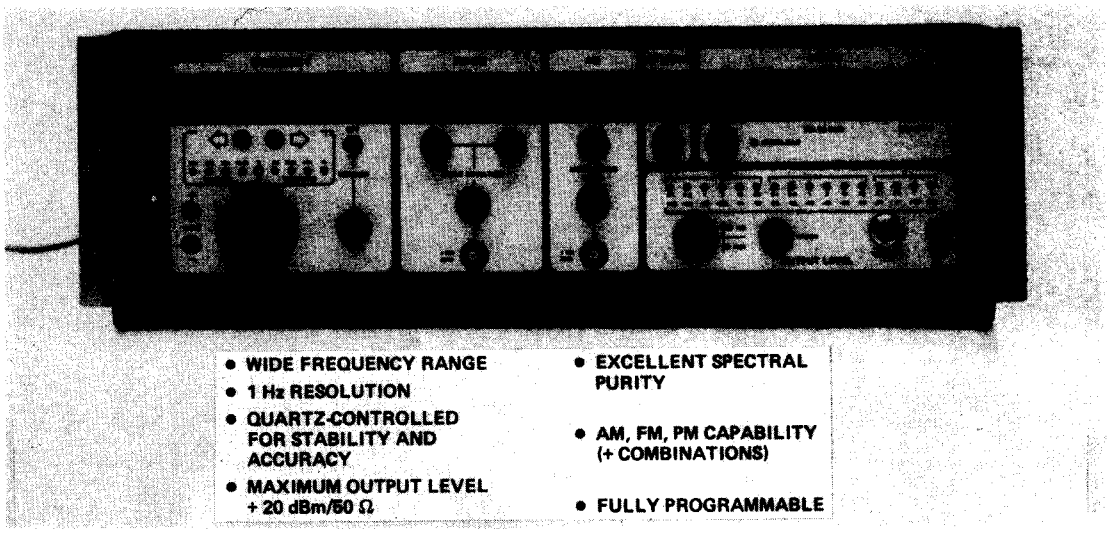


Figure 1-1. 460 Signal Generator and Principal Design Features

1.2 FREQUENCY RANGE

The instrument covers the frequency band from 300 kHz to 650 MHz in a single range, which can be extended to 1300 MHz by incorporating the internal frequency doubler option. The frequency is set by a spin-wheel driving an optical coding wheel, to a resolution of 1 kHz, 10 kHz, 100 kHz or 1 MHz, a vernier control being provided for resolution down to 1 Hz. The exact output frequency is displayed on a 9-digit LED display (10 digits when frequency doubler option included). The stability and accuracy of the frequency are determined by the internal quartz-controlled oscillator (5×10^{-9}/24 h).

To facilitate measurements on receivers, following calibration at a particular frequency, an internal timing circuit provides for incrementing the output frequency in discrete steps corresponding to the standard channel spacing (12.5 kHz, 20 kHz, 50 kHz, and 100 kHz). The instrument can also carry out a frequency scanning function, with steps of 1 kHz, 10 kHz, 100 kHz or 1 MHz.

1.3 SPECTRAL PURITY

The signal/phase noise ratio has a characteristic curve at frequencies close to the carrier frequency which is similar to that obtained with frequency synthesizers. Above 20 kHz, the signal/noise ratio is comparable with that obtained from the best resonant cavity signal generators.

Figure 1-2 shows the phase noise characteristic in a 1 Hz band at 160 and 560 MHz in CW mode:

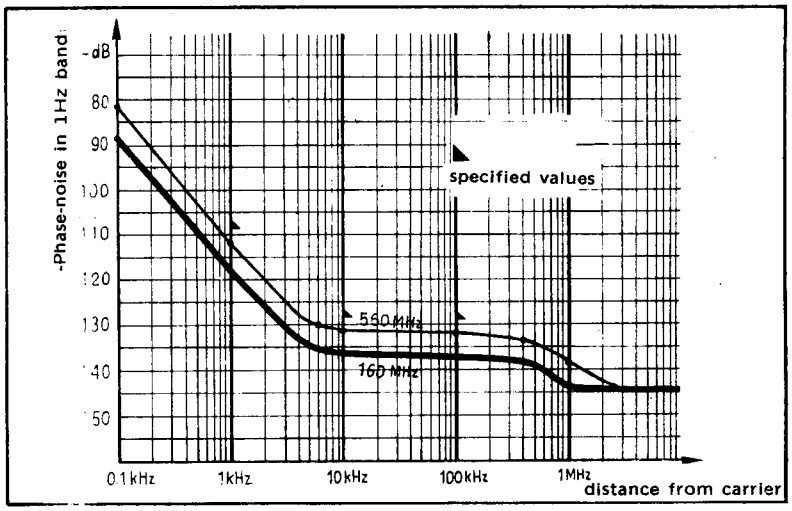


Figure 1-2. Signal/Phase Noise Characteristic of the 460

This excellent performance depends on two key design factors:

- the small frequency steps are generated by a varicap diode tuned oscillator comparable with a free-running oscillator with a very large overvoltage coefficient;

- the large frequency steps are generated by an oscillator controlled from an 80 MHz quartz crystal, with a phase noise at 10 kHz relative to the carrier of - 165 dB/1 Hz.

The frequency generator loops comprise low numbers of mixer circuits and arithmetic functions, the output oscillator reproducing with only slight noise degradation the output noise from the two oscillators, the inharmonic and subharmonic components being more than 100 dB down relative to the carrier.

The 460 is particularly suited to selectivity measurements on narrow-band VHF-UHF receivers.

1.4 OUTPUT LEVEL

The output level is variable from + 20 dBm to - 139 dBm, in steps of 1 dB in LOCAL mode, the single control knob also providing steps of 10 dB. This level is constant to within $\pm$ 0.5 dB over the full frequency range.

The maximum output level is + 10 dBm at frequencies above 650 MHz when the frequency doubler option is included, the resolution being 0.1 dB if the programming option is included.

A meter with automatic range switching capability displays signal levels in V, mV, V or dBm/50 Ω . Leakage is better than 5 mV, and the output circuits are protected to enable the instrument to be used for measurements on receivers and transmitter-receivers.

1.5 AMPLITUDE MODULATION

The amplitude modulation (AM) level is variable from 0 to 100 %, with a passband of 150 kHz, the modulation level being constant to within $\pm$ 5 % up to 100 kHz.

The modulating signal may be internal (two fixed frequencies) or external, with DC or AC coupling. The input sensitivity for 100 % modulation is approximately 200 mVrms/600 Ω . When the 460 is fitted with option 004, the AM level is programmable in steps of 1 %, the input signal in this case being set to 1 Vrms/ 600 Ω .

The modulation level is displayed on the front panel meter, the FSD automatically being switched to 30% for improved accuracy.

1.6 VOR-ILS MODULATION

The 460 has a "VOR" setting for testing short and medium-range aircraft navigation and instrument landing systems (VOR, ILS). This standard facility is obtained by increasing the time constant of the internal regulation loops so as to match the phase shift characteristics required for VOR-ILS operation (0.2° at 30 Hz).

1.7 FREQUENCY MODULATION

The maximum peak frequency modulation (FM) deviation is ± 3 kHz, ± 30 kHz, or ± 300 kHz over the whole frequency range. The modulating signal may be internal (two fixed frequencies) or external, with DC or AC coupling for a passband extending up to 150 kHz and an input sensitivity of approximately 1 Vrms/600 Ω, corresponding to a peak deviation of ± 1 kHz, ± 10 kHz, or ± 100 kHz, depending on the selected range.

When option 003 is included, the FM deviation is programmable in steps of 10 Hz, 100 Hz or 1 kHz, respectively, for the ranges ± 3 kHz, ± 30 kHz or ± 300 kHz, the input signal being set to 3 Vrms/600 Ω.

The FM deviation is indicated on the front-panel meter.

The FM distortion for modulating frequencies of 400 Hz and 1 kHz is better than 3 %, spurious amplitude modulation being less than 1 % over the 1 MHz to 650 MHz band.

1.8 PHASE MODULATION

The peak deviation of phase modulation of the output signal is variable between 0° and 300°. The choice of modulating signal is identical to that for FM, although the passband in external mode is limited to 60 kHz. The input sensitivity for 100° deviation is approximately 1 Vrms/600 Ω. When option 003 is included, the deviation is programmable with a resolution of 1°, the input signal being set to 3 Vrms/600 Ω.

1.9 SELF TEST FACILITY

This facility considerably speeds up troubleshooting faults on the 460, providing rapid identification of faulty sub-assemblies. The modular design of the instrument means that it can be immediately returned to service by replacing the faulty module.

The self-test system is controlled by the built-in microprocessor, and checks the main internal signal levels in the instrument and the control loops of the generator circuitry. The state of each point tested can be displayed on the front panel or fed out to an external controller when the programming option is included. The fault detection system also advises the user when he is attempting to operate the instrument under out of limit conditions.

1.10 OPTIONS

Option 001: PROTECTIVE FUSE

The internal cartridge fuse protects the output circuitry of the instrument against re-injection of HF signals at power levels of up to 50 W.

Option 002: FREQUENCY DOUBLER

The internal frequency doubler module expands the output frequency band of the instrument to 1300 MHz, with minimal degradation of the spectral purity characteristics and output level, all other specifications being met and the modulation and direct display calibrations being undisturbed.

Thus the AM accuracy and linearity characteristics are affected by the incorporation of the frequency doubler option, the maximum level being limited to + 10 dBm.

Option 003: IEEE PROGRAMMING

The generator is designed for programming of all functions under IEEE standard IEEE -488 (1975). Programming is facilitated by the use of unrestricted formats and "clear language", and is carried out using two additional options coupled to the instrument via the rear panel connectors. The local display remains active, providing a means of verifying the programs. An additional connector outputs 1 byte derived from the ASCII signal which may be used to control a peripheral device.

This option covers programming of the output frequency and level, the operating mode and the AM, FM or PM modulating signal. The acquisition time is better than 100 ms.

The 460 then operates as a true frequency synthesizer, the output frequency being programmable in steps of 1 Hz and entirely referred to the quartz-controlled reference frequency. Option 003 also covers programming of the AM level and FM and PM deviations.

1.11 TECHNICAL SPECIFICATIONS

FREQUENCY

RANGE:

0.3 MHz to 650 MHz in only one band

TUNING CONTROL:

- Main tuning by spin-wheel providing 100 steps variation per turn, with step value selectable between 1 kHz, 10 kHz, 100 kHz and 1 MHz.

Resolution	ΔF per turn
1 kHz	100 kHz
10 kHz	1 MHz
100 kHz	10 MHz
1 MHz	100 MHz

In this case, the 460 is a true frequency synthesizer with 1 kHz resolution.

- Fine tuning by vernier providing continuous frequency variation between 1 kHz steps.

- Fine tuning by external voltage:

± 3 kHz frequency variation for ± 3 V.

- Step-by-step variation by two pushbuttons providing frequency variation in 1 kHz - 10 kHz - 100 kHz 1 MHz steps and in 12.5 kHz - 20 kHz - 25 kHz -50 kHz steps corresponding to standard channel spacing.

A constant pressure during 3 seconds on either of these pushbuttons provides an uninterrupted frequency change.

FREQUENCY DISPLAY:

The output frequency is permanently displayed with 1 kHz resolution on a 6 digits LED display unit (7 digits with Doubler option). When the fine-turning vernier is used, 3 additional digits provide output frequency display with 1 Hz resolution.

DISPLAY ACCURACY:

Master Oscillator accuracy ± 1 Hz (with vernier).

FREQUENCY STABILITY:

Measured at 25° C ± 1°.

Factor	With vernier or DC coupled FM	Without vernier
Time	± 1 Hz per 10 mn after 30 min of operation with vernier	± 2.10^{-8} per day after 72 hours' continuous operation. ± 5.10^{-9} per day after 3 months' continuous operation.
Mains (± 10 %)	negligible	negligible
Temperature	± 0.2 Hz/°C	± 2.10^{-10}/°C
Output level	negligible	negligible
Output load	negligible	negligible

MASTER OSCILLATOR PHASE-LOCKING:

The crystal oscillator can be phase locked to an external standard through a built-in phase comparator.

Phase-locking display by two LEDS, Master Oscillator frequency adjustment by ten-turn potentiometer.

- Frequency: Any subharmonic of 10 MHz down to 1 MHz.
- Level: 0.2 Vrms to 1 Vrms/50 Ω .
- Master Oscillator output: 10 MHz, approximately 0.5 Vrms/50 Ω .

SPECTRAL PURITY

Measured in CW mode at + 13 dBm/50 Ω output level

HARMONIC SIGNALS:

<- 30 dBc (- 35 dBc typical).

SUBHARMONIC SIGNALS: <- 100 dBc.

SPURIOUS SIGNALS:

- Line related spurious:

  <- 50 dBc at 50 Hz or 60 Hz
  <- 60 dBc at 100 Hz or 120 Hz
  <- 70 dBc at 1 kHz

- Other spurious for 300 kHz to 80 MHz frequency range:

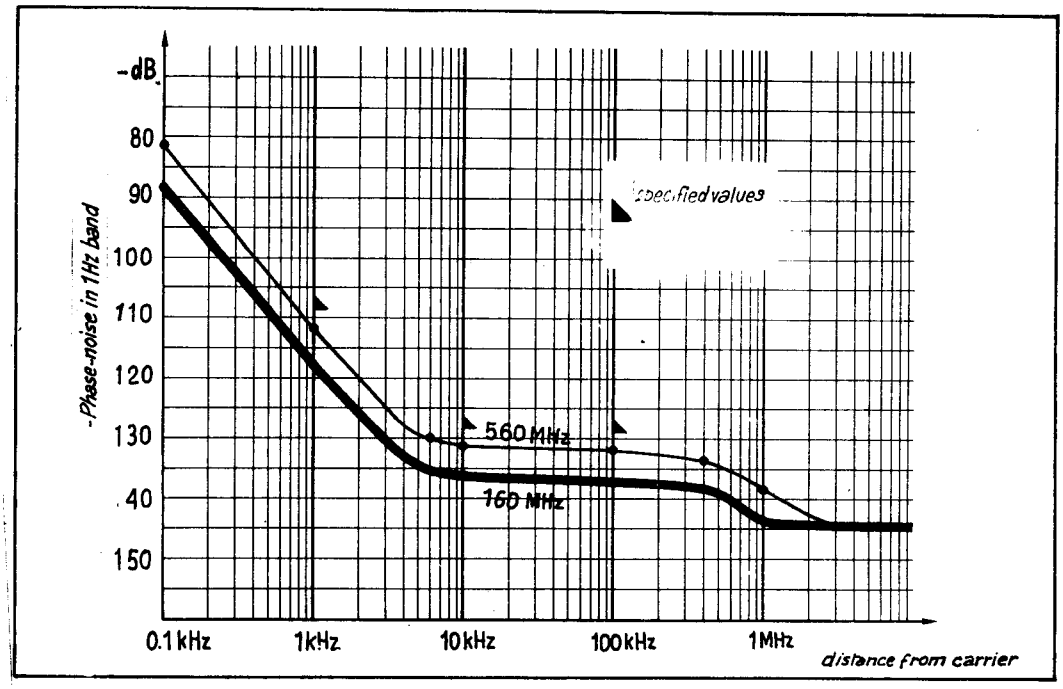
  <- 80 dBc except for fixed spurious at 400 MNz <-75 dBc.

- Other spurious for 80 MHz to 650 MHz frequency range:

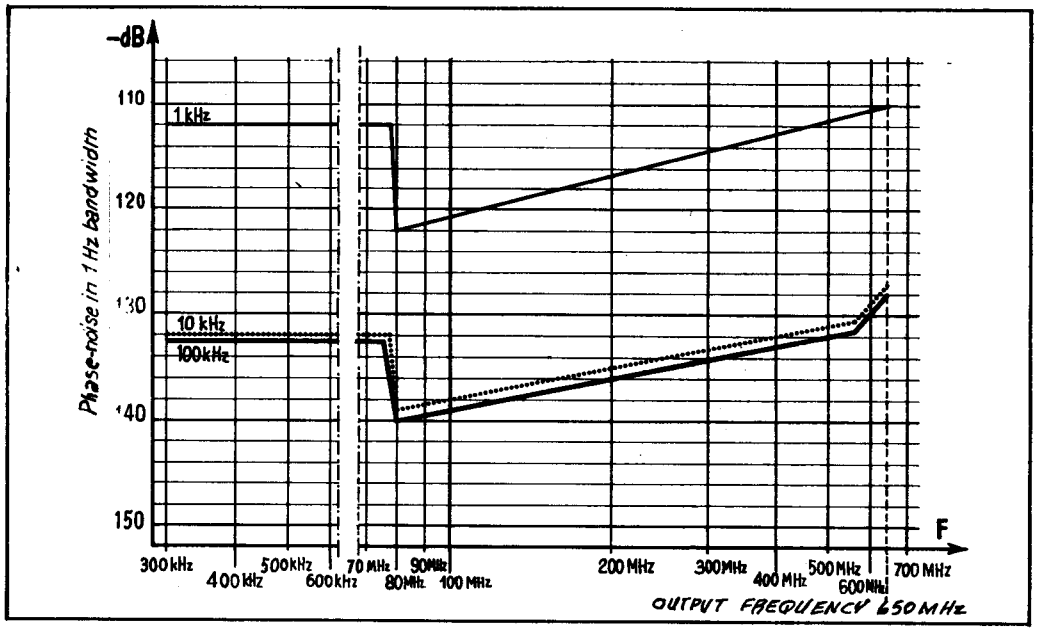
  <- 100 dBc beyond 15 kHz from carrier except for fixed spurious at 80 MNz <-85 dBc.

PHASE NOISE:

- In a 1 Hz bandwidth for a 160 MHz and 560 MHz carrier.



- In a 1 Hz bandwidth at 1 kHz, 10 kHz and 100 kHz from carrier (typical).



RESIDUAL AM:

<- 90 dBc in a 300 Hz to 3 kHz bandwidth (CCITT standard) over the entire frequency range.

<- 80 dBc in a 20 Hz to 15 kHz bandwidth (CCIR standard) over the entire frequency range.

RESIDUAL FM:

<1 Hz in a 300 Hz to 3 kHz bandwidth (CCITT standard) over the entire frequency range.

<10 Hz in a 20 Hz to 15 kHz bandwidth (CCIR standard) over the entire frequency range.

LEAKAGE:

(with all the outputs terminated properly):

Leakage limits are below those specified in MIL-I-6181 D. Furthermore, less than 3 μV is induced in a 2-turn, 1-inch diameter loop 1-inch away from any surface and measured into a 50 Ω receiver.

RF OUTPUT

OUTPUT LEVEL:

+ 20 dBm to - 140 dBm/50 Ω .

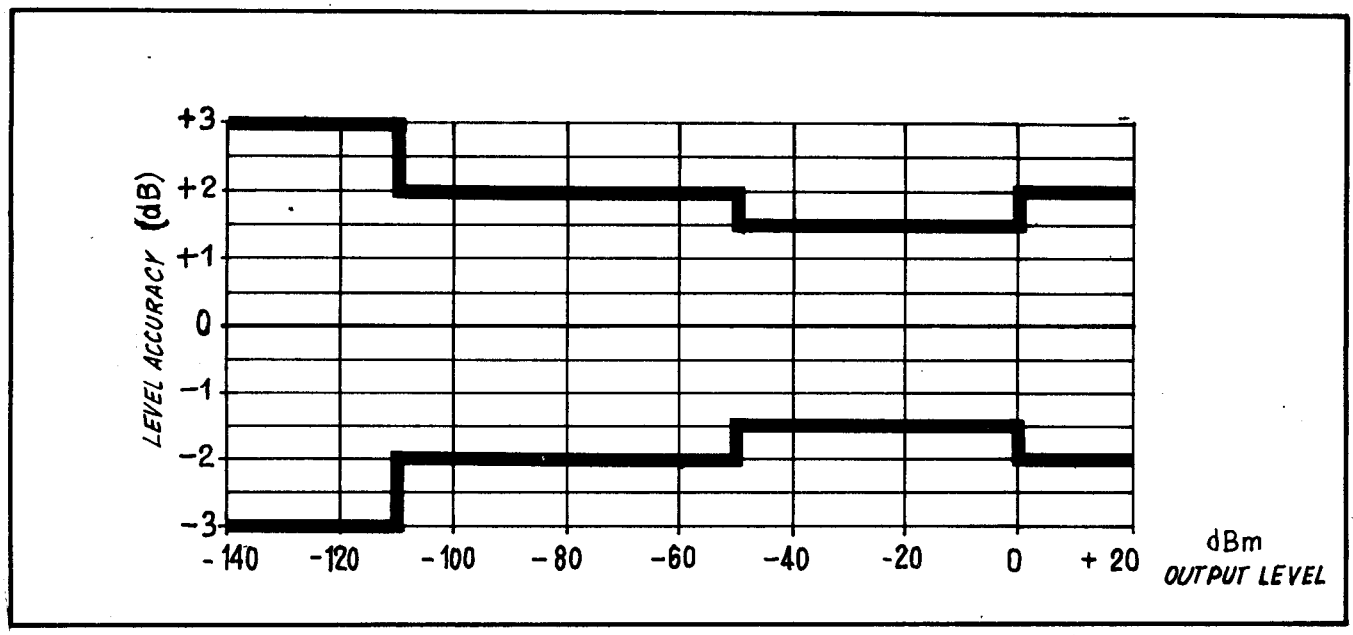
160 dB dynamic range: 10 dB and 1 dB steps by attenuator, - 1.2 dB to + 0.2 dB by vernier.

Output level display in volts and dBm/50 Ω by LED indicators and calibrated meter.

Overload indicator.

OUTPUT LEVEL ACCURACY (TYPICAL)

Including attenuator error and flatness.



- Output level accuracy at 0 dBm meter display:

  ± 0.2 dB for a 20 MHz frequency.

ATTENUATOR ACCURACY:

- 10 dB steps:

Output level	Accuracy
+ 20 to + 10 dBm	± 1.5 dB
0 to - 40 dBm	± 1 dB
- 50 to - 100 dBm	± 1.5 dB
- 110 to - 130 dBm	± 2.5 dB

- 1 dB steps:

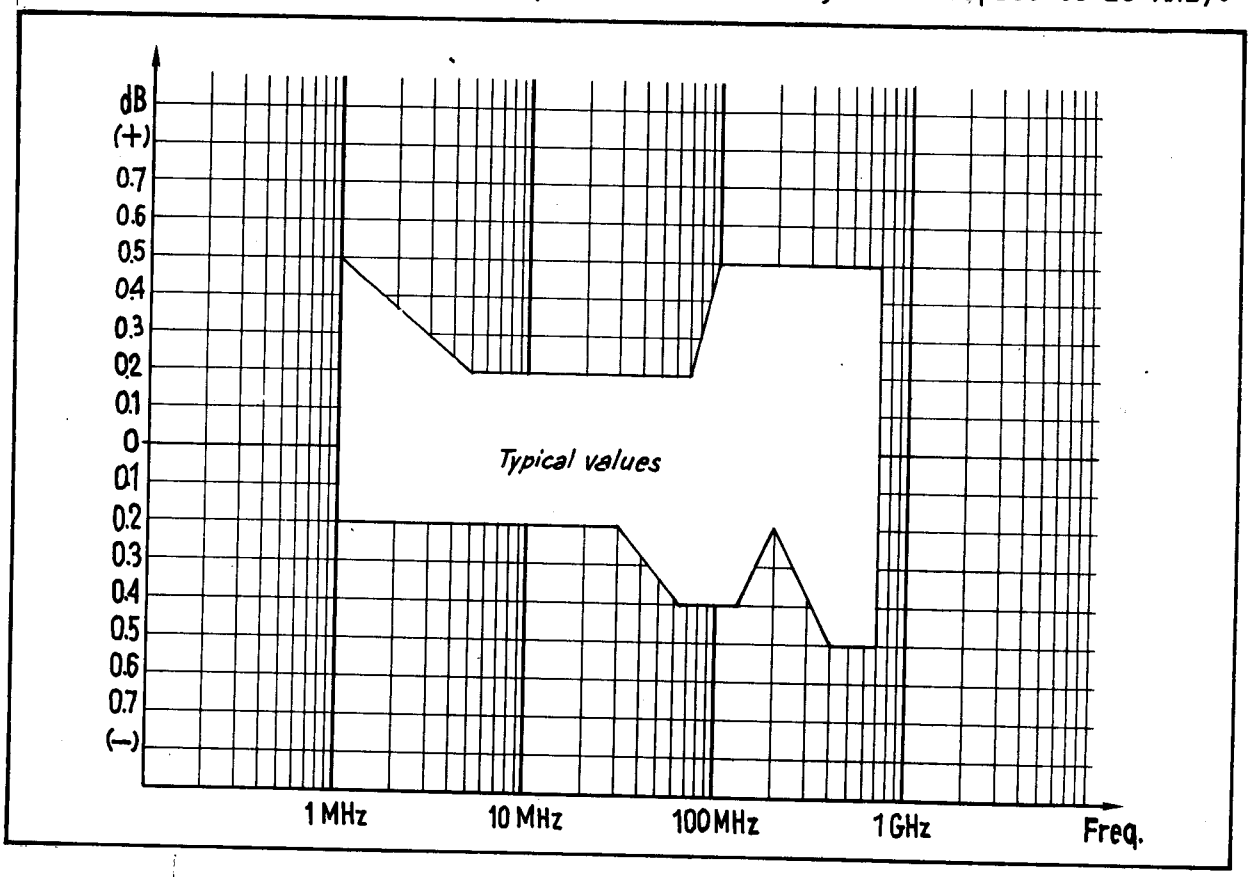
  ± 0.5 dB maximum error for ten 1 dB steps.

METER ACCURACY:

3 % of full scale

OUTPUT LEVEL FLATNESS:

± 0.5 dB from 1 MHz to 650 MHz (measured at 0 dBm, with respect to 20 MHz).



VSWR:

Measured with 50 load impedance:

Output level	VSWR
+ 20 to + 1 dBm	2
0 to - 12 dBm	1.3
- 13 to - 140 dBm	1.2

AMPLITUDE MODULATION

MODULATION DEPTH:

- Adjustable from 0 % to 100 % for up to + 14 dBm/50Ω output level. Above + 14 dBm average output level, overload indicator lights up if peak level exceeds + 20 dBm.
- AM depth adjustment by vernier, calibrated meter display with automatic scale switching.

ACCURACY up to 90 % modulation depth for 1 kHz internal modulating signals:

± 2 % of full scale
± 5 % of reading

INTERNAL MODULATING SIGNALS

- Frequency: 400 Hz or 1000 Hz (Master Oscillator stability)
- The internal modulating signals are available on a rear-panel connector with 2.5 Vrms/600 Ω output level.

EXTERNAL MODULATING SIGNALS

- AC or DC coupling
- Frequency:

Bandwidth	DC coupling	AC coupling
± 1 dB	0 Hz to 60 kHz	100 Hz to 60 kHz
- 3 dB	0 to 100 kHz	30 Hz to 100 kHz

- Input sensitivity:

Approximately 2 mVrms/600 Ω for 1 % modulation depth.

- Maximum input level: ± 10 V peak

AM DISTORTION

With 1 kHz internal modulating signal, from 1 MHz to 650 MHz.

1.2 % from 0 % to 30 %
2 % from 30 % to 50 %
3 % from 50 % to 80 %

INCIDENTAL PHASE MODULATION:

0.1 rd for 50 % modulation depth.

VOR-ILS MODULATION

- General characteristics identical to those of AM

ENVELOPE PHASE-SHIFT:

0.2° for a 30 Hz modulating signal.

FREQUENCY MODULATION

FREQUENCY DEVIATION

- Up to 300 kHz deviation in 3 ranges

Automatic scale switching of calibrated meter provides 3 subranges.

Range	Subrange
0 to ± 3 kHz	0 to ± 1 kHz
0 to ± 30 kHz	0 to ± 10 kHz
0 to ± 300 kHz	0 to ± 100 kHz

INTERNAL MODULATING SIGNALS

- Frequency: 400 Hz or 1000 Hz (Master Oscillator Stability)
- The internal modulating signals are available on a rear-panel connector with 2.5 Vrms/600 Ω output level.

EXTERNAL MODULATING SIGNALS

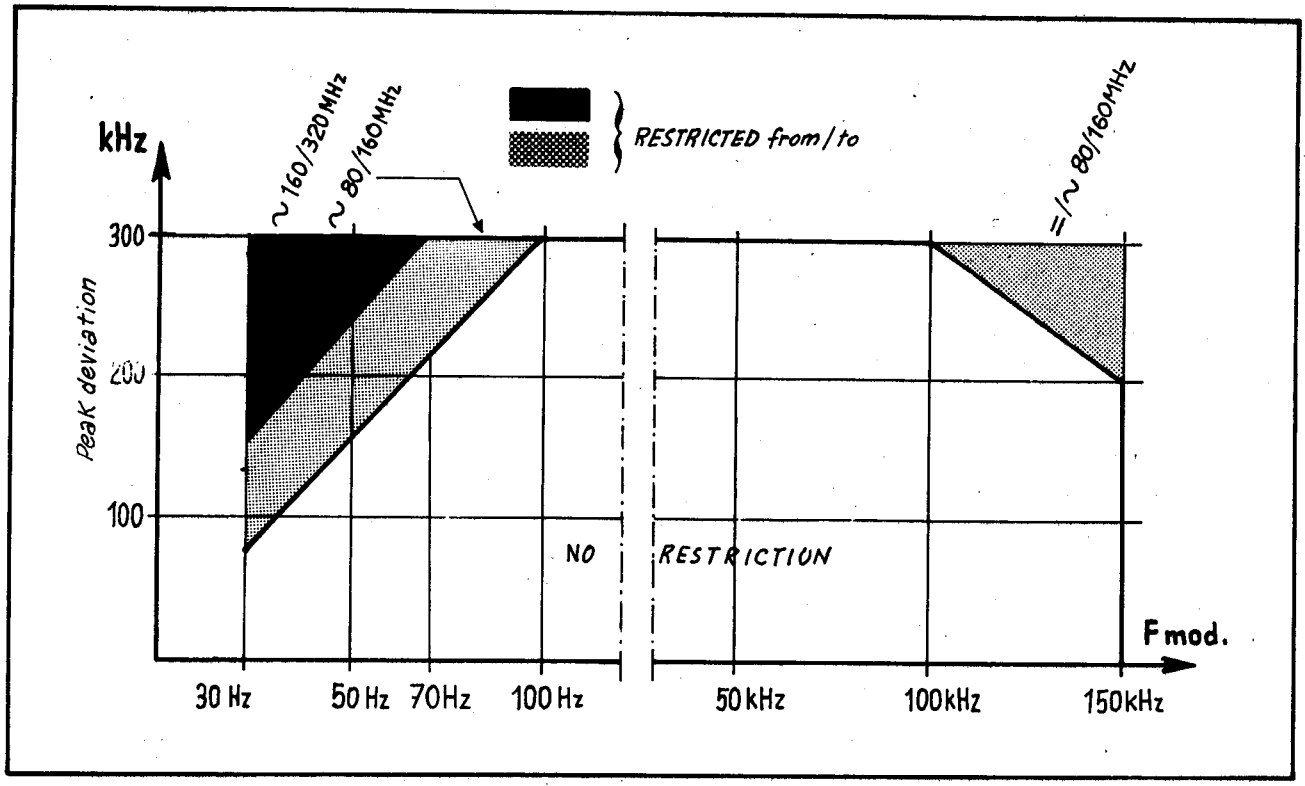
- AC or DC coupling
- 3 dB bandwidth

DC coupling: DC to 150 kHz

From 80 MHz to 160 MHz, the maximum FM deviation is reduced according to the figure below for modulating frequencies above 100 kHz.

AC coupling: 30 Hz to 150 kHz

From 80 MHz to 320 MHz, the maximum FM deviation is reduced according to the figure below for modulating frequencies below 100 Hz or above 100 kHz.



- Input sensitivity:

Approximately 1 Vrms/600 Ω for 1 kHz, 10 kHz or 100 kHz frequency deviation depending on the selected range.

- Maximum input level: ± 10 V peak

FREQUENCY DEVIATION CONTROL

Adjustment by vernier; calibrated meter display with automatic range switching. In DC coupled external modulation, the center frequency shift can be read on the front-panel frequency meter.

DISPLAY ACCURACY:

± 7 % of full scale

FM DISTORTION

With internal modulating signals

1 % up to 30 kHz frequency deviation
3 % up to 100 kHz frequency deviation

RESIDUAL AM

<1 % from 1 MHz to 650 MHz for a 1 kHz modulating signal with 75 kHz deviation.

PHASE MODULATION

PHASE DEVIATION

- Adjustable from 0° to 300° in two subranges.
- Adjustment by vernier calibrated meter display with automatic scale switching.

DISPLAY ACCURACY

± 10 % of full scale

INTERNAL MODULATING SIGNALS

- Frequency: 400 Hz or 1000 Hz (Master Oscillator stability)
- The internal modulating signals are available on a rear-panel connector with 2.5 Vrms/600 Ω output level.

EXTERNAL MODULATING SIGNALS

- AC or DC coupling
- 3 dB bandwidth:

  DC coupling: 0 to 50 kHz
  AC coupling: 30 Hz to 50 kHz

- Input sensitivity: approximately 1 Vrms/600 Ω for 100° phase deviation
- Maximum input level: ± 10 V peak

SIMULTANEOUS MODULATIONS

Simultaneous AM/FM or AM/PM capability with internal and external modulating signals.

POWER SUPPLY

Voltage: 115 V - 230 V + 15 %
Frequency: 50/60 Hz, 400 Hz optional
Power: 100 W.

Mechanical characteristics:

Adaptable to 19" rack.
Height: 132 mm (3 U), 5 1/4 in.
Width: 440 mm, 17 3/8 in.
Depth: 452 mm, 17 13/16 in.

Temperature range:

Operation: 0°C to + 50°C.
Storage: -20°C to + 70°C.

Weight: 23 kg.

OPTIONS

001 REVERSE POWER PROTECTION
002 FREQUENCY DOUBLER
003 IEEE BUS PROGRAMMING

SECTION 2

INSTALLATION

2.1 INTRODUCTION

This section covers the electrical installation of the instrument, the environmental conditions applicable to the use of the instrument, and the mounting of the instrument in a 19" rack.

2.2 INCOMING INSPECTION

The instrument is shipped in a cardboard box, protected by expanded polyurethane foam inserts. The carton contains the instrument indicated on the delivery note plus the appropriate mains power supply connection cable (EUROPAVIA type).

As the warranty covers damage occurring during transit from AILTECH, check that the instrument has suffered no mechanical damage in transit.

2.3 CONNECTION OF MAINS SUPPLY

The 460 signal generator is designed to operate from a mains supply at 115 or 230 Vrms $\pm$ 15 %, with a supply frequency of between 50 and 400 Hz. The maximum power consumption is 140 VA (100 W).

The instrument is set at the factory to operate from a supply of 115 Vrms, the input circuit protective fuse being rated at 2 A. The mains supply cable is plugged into the 3-pin connector on the "mains filter and voltage selector" unit on the rear panel, which also contains the mains fuse. Total safety is ensured in that access to these components is only available with the mains cord unplugged from the instrument.

When the instrument is not set up for the local mains voltage, proceed as outlined in Figure 2-1.

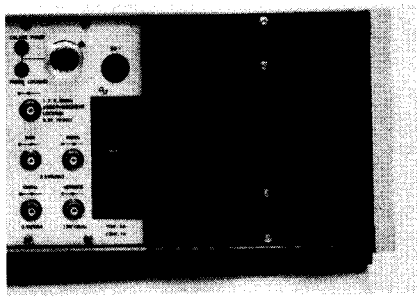
2.4 ENVIRONMENTAL CONDITIONS

The technical specifications for the instrument apply to an operating environment with a temperature of between 0 and + 50°C. The inside of the instrument is cooled by forced air guided by the careful arrangement of the internal modules. Air is drawn into the instrument through louvers in the right side panel and discharged through the rear panel. The modules are fabricated from light alloy, providing efficient dissipation of the heat generated by the internal circuitry.

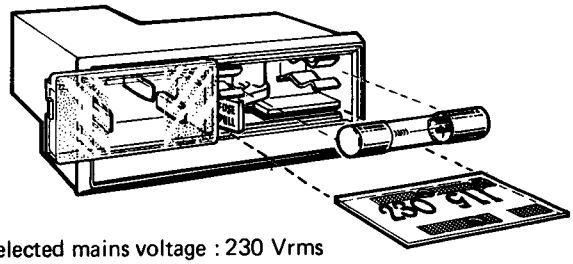
The instrument may be stored at temperatures of between - 20 and + 70°C, in a dry place.

POWER SUPPLY

1. Raise the transparent cover.
2. Raise the lever marked FUSE PULL and remove fuse from housing.
3. Withdraw voltage selector printed circuit from its housing and position as shown opposite so that the voltage of the local mains power supply is to the left.
4. Fit the fuse (1 A/230 V or 2 A/115 V) into the fuse-holder (the lever marked FUSE PULL should return to its initial position).
5. Replace the transparent cover. The supply voltage visible through the transparent cover should correspond to that of the local mains supply.



Rear view of 460



Selected mains voltage : 230 Vrms

Figure 2-1. Selection of Mains Supply Voltage

2.5 19" RACK MOUNTING

Two adaptors (height 3U) are available to order, and enable the 460 to be mounted in a standard 19" rack. The two metal brackets (AILTECH part number 297477) screw on to the side panels of the instrument (see Figure 2-2) using 4 countersunk screws.

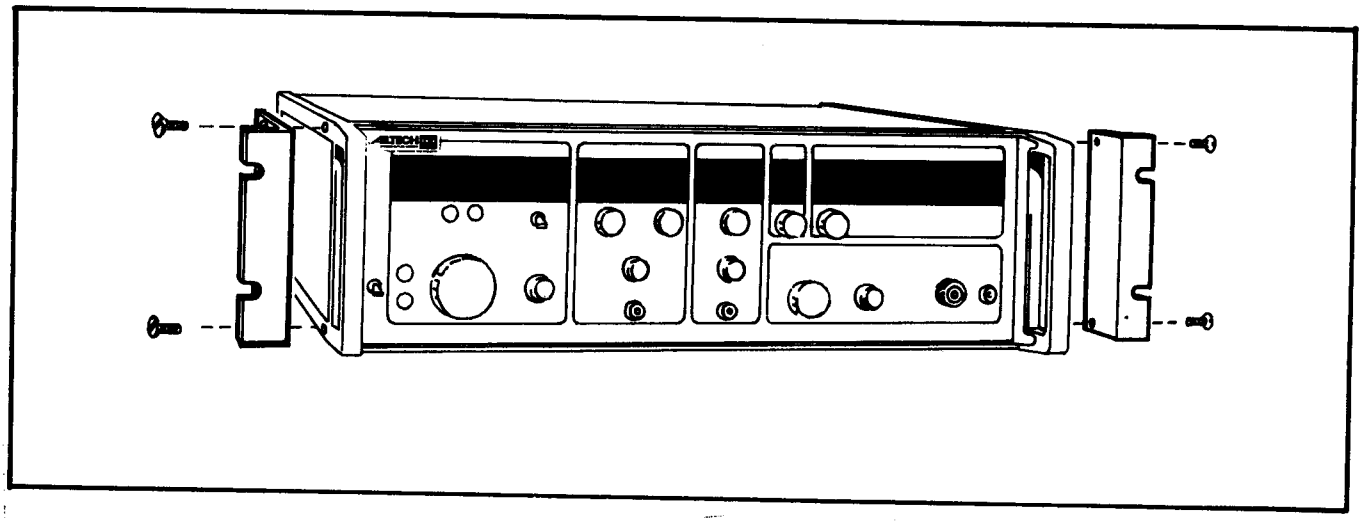


Figure 2-2. 19" Rack Mounting of the 460

SECTION 3

OPERATION

3.1 INTRODUCTION

This section describes the function of all the knobs, switches, indicator lamps, connectors and potentiometers on the FRONT and REAR panels of the 460-type generator. A description of a procedure for checking the principal controls, to verify the correct operation status of the instrument, is described before we go on to consider the determination of the output frequency and level and the selection of AM, FM or PM modulation. The manner in which the instrument is programmed is also described.

3.2 DESCRIPTION OF FRONT AND REAR PANELS

Figure 3-1 shows the controls, indicator lamps and connectors of the FRONT panel of the instrument. Figure 3-2 shows the connectors and other controls of the REAR panel. The programming facilities on the rear panel are described with reference to figure 3-3.

3.3 CHECK THE CONTROLS

Checking the controls merely involves confirming that the adjustment and local selection controls are operating correctly. The check-out procedure is described below with reference to figure 3-4.

3.4 OPERATING MODES

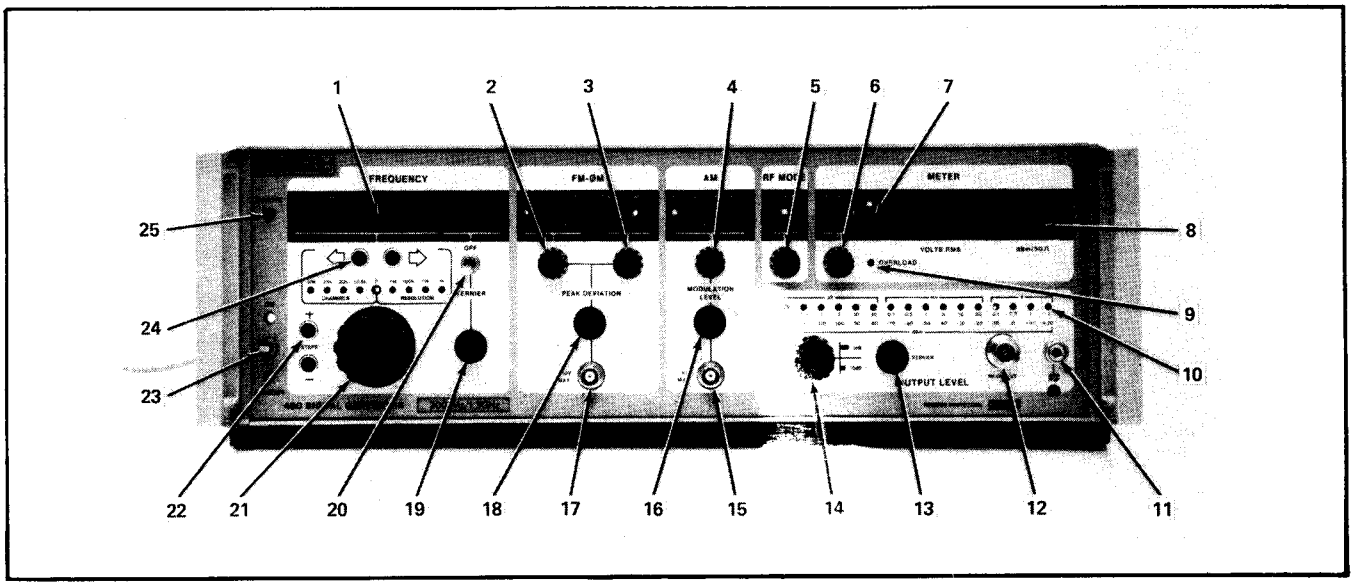
Figures 3-5 and 3-6 illustrate the procedure to be followed to set and display the frequency and the output level, and for adjustment of the AM, FM and PM modulation.

Control of the operation of the 460 in accordance with an external frequency reference and programming the various functions are described with reference to figures 3-7 and 3-8. The self-checking procedure is described with reference to figure 3-9.

3.5 FUSE REPLACEMENT

The fuse requires replacement if the AC supply voltage is changed or if the fuse blows. The mains supply input protection fuse is located in the connection module, close to the heatsink on the rear panel. To replace the fuse, disconnect the power cable from the 3-pin socket and push down the transparent cover. Press the level marked FUSE PULL and replace the fuse (rating 1A or 2A for mains supply voltages of 230 V and 115 V, respectively).

DESCRIPTION OF FRONT PANEL



(1) FREQUENCY STEP (10^0 to 10^8 Hz) DISPLAY AND SELECTOR

If the frequency-doubler option is included, the range of steps is 10^0 to 10^9.

The frequency is displayed on a 9-digit LED display (10-digit with frequency-doubler option), up to 650 MHz on the x 1 range or up to 1.3 GHz on the x 2 range.

The frequency resolution is 1 kHz, 10 kHz, 100 kHz or 1 MHz (without Vernier), or 1 Hz with Vernier (accuracy $\pm$ 1 digit).

NOTE: In FM mode with d.c. coupling, the carrier frequency shift due to the injected d.c. voltage is displayed.

Verification of the principal instrument levels on starting the self-checking routine is also obtained by displaying them on the three corresponding digits for steps 10^0 to 10^2 Hz:

- the two Right-hand digits (10^0 and 10^1 Hz) display a number from 1 to 10 representing the test point to be checked, and
- the third digit (10^2 Hz) indicates that the test is correct or incorrect.

(2) FREQUENCY OR PHASE MODULATION (FM or PM) SELECTOR

The modulation is selected by means of a switch.

OFF: disable FM or PM modulation
INT: internal FM or PM modulation source
0.4 k: 400 Hz
1 k: 1 kHz
EXT: external FM or PM modulation source
~ : a.c. coupling
= : d.c. coupling

The selected source of modulation is indicated by the red LED.

Figure 3-1. Front-Panel Description (Sheet 1 of 6)

DESCRIPTION OF FRONT PANEL

(3) FM or PM DEVIATION SELECTOR

This switch selects the PM or FM deviation.

PM (300°): Phase modulation with maximum peak deviation of 300°.

FM (3k, 30 k or 300 k): Frequency modulation with maximum peak deviation of ± 3 kHz, ± 30 kHz or ± 300 kHz.

The selected PM or FM deviation is indicated by a red LED.

(4) AM MODULATING SIGNAL SELECTOR

This switch selects the modulation source.

OFF: disable AM modulation
INT: internal AM modulation source
0.4 k: 400 Hz
1 k: 1 kHz
EXT: external AM modulation source
~ : a.c. coupling
= : d.c. coupling
VOR: AM phase-shift < 0,2° for a 30 Hz modulating signal.

The selected source of modulation is indicated by the red LED.

(5) OPERATING MODE SELECTOR

This switch selects the operating mode.

OFF: disable output signal (level < - 140 dBm)
CW: continuous pure output signal
MOD: output signal modulated in AM, FM, PM, AM-FM or AM-PM.

The selected operating mode is indicated by a red LED.

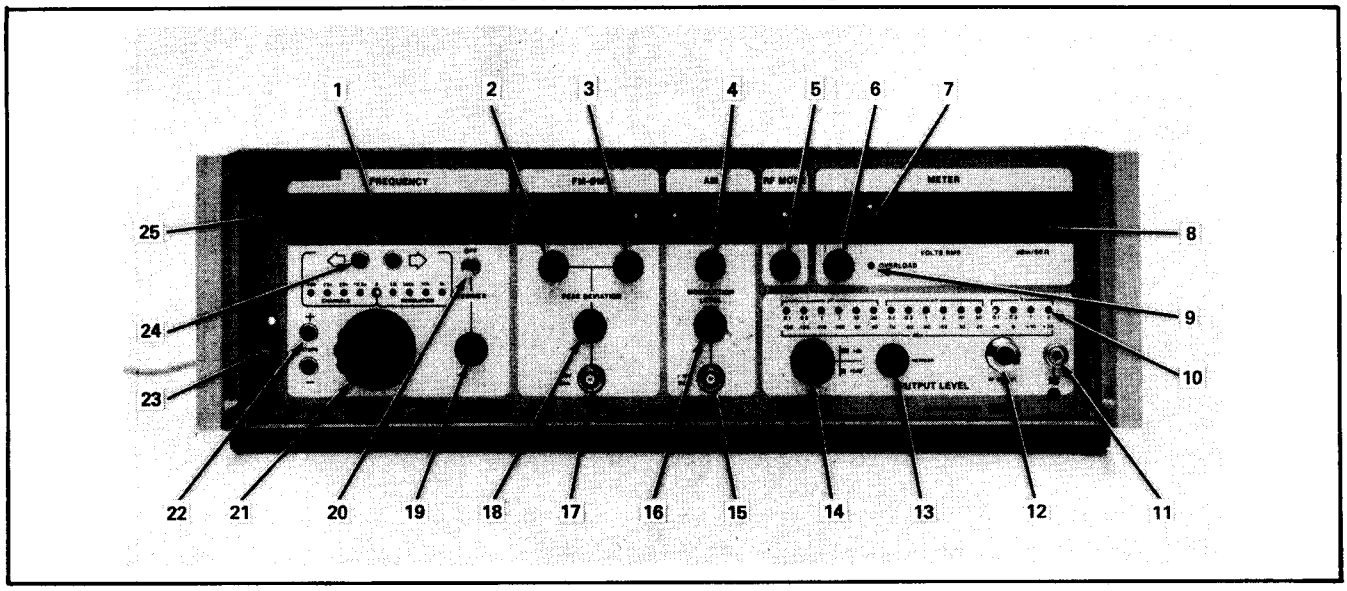
(6) METER READOUT MODE SELECTOR

FM: FM or PM deviation
AM: AM modulation depth
RF: output level.

The selected meter readout mode is indicated by a red LED.

Figure 3-1. Front-Panel Description (Sheet 2 of 6)

DESCRIPTION OF FRONT PANEL



(7) LED READOUT SCALE INDICATOR

The meter is automatically switched between the top and center scales:

1: read upper scale (0 to 1.0)
0.3: read center scale (0 to 3).

The scale which is applicable is indicated by a red LED.

(8) METER

The instrument includes a circuit which automatically switches between the top and center scales on the meter.

2 scales, calibrated 0 to 1.0 and 0 to 3 provide for reading levels in μV, mV and V/50Ω, depending on the selected range.

The bottom scale (- 10 to +3) indicates the output level in dBm/50 Ω , as appropriate to the selected range.

AM: the modulation depth is displayed on the two upper scales, which is automatically switched at 30 %.

Scale 0 to 3: AM depth 0 to 30 %.
Scale 0 to 1.0: AM depth 30 to 100 %.

FM-PM: the frequency or phase shift is displayed on the two upper scales, automatic switchover occurring at 1/3 of the selected maximum peak deviation.

Scale 0 to 1: deviation 0 to 1 kHz, 0 to 100 kHz or 0 to 100° (PM)
Scale 0 to 3: deviation 1 to 3 kHz, 10 to 30 kHz, 100 to 300 kHz or 100 to 300° (PM).

Figure 3-1. Front-Panel Description (Sheet 3 of 6)

DESCRIPTION OF FRONT PANEL

(9) LED OVERLOAD INDICATOR

This indicates that the permitted maximum peak power rating has been exceeded. This rating is:

- 20 dBm in CW mode,
- 14 dBm in AM mode for 100 % modulation,
- 10 dBm in CW mode above 650 MHz with frequency doubler option.

(10) LED LEVEL RANGE INDICATORS

These indicate the range of levels selected by the control knob.

The various ranges are expressed in μV, mV and V, in steps of 1, 3 and 10, or in dBm in steps of 10 dB (0.1 μV to 3 V and - 130 to + 20 dBm).

(11) GROUND SOCKET

This enables the instrument ground to be connected to an external ground.

(12) RF OUTPUT

The RF output is obtained from a type N socket, at an output impedance of 50 Ω .

(13) OUTPUT LEVEL VERNIER CONTROL

The Vernier is provided for fine adjustment of the output level.

(14) OUTPUT LEVEL CONTROL

The output level is adjustable in steps of 1 dB or 10 dB, over the whole dynamic range.

The 10 dB steps control is enabled by axial pressure.

(15) AM INPUT

This socket is provided for the connection of an external modulating signal:

- 3 dB bandwidth:

  0 to 100 kHz with d.c. coupling
  $\simeq$ 30 Hz to 100 kHz with a.c. coupling

- 1 dB bandwidth:

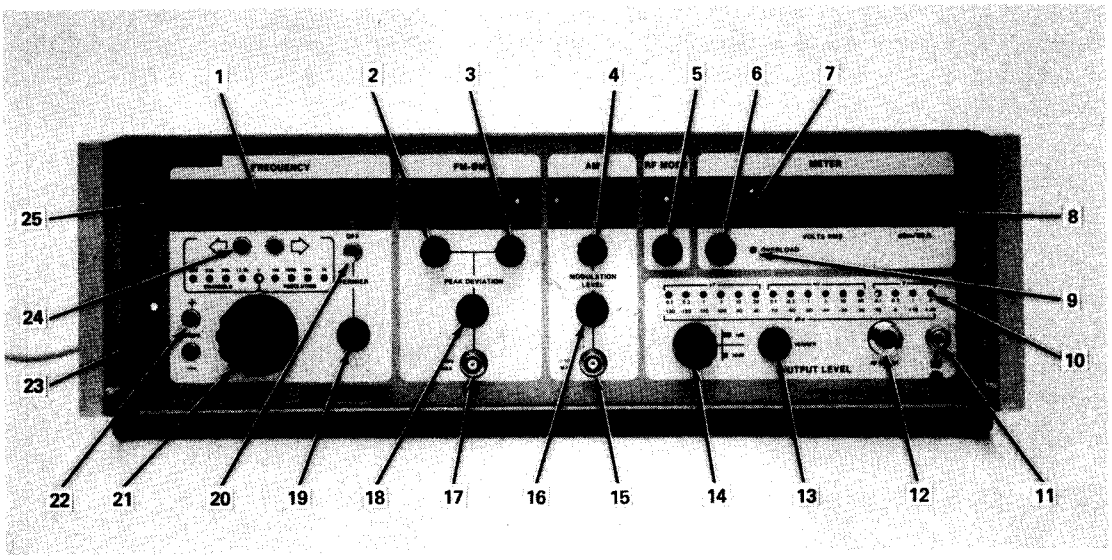
  0 to 60 kHz with d.c. coupling
  100 Hz to 60 kHz with a.c. coupling

- input impedance 600
- input level $\simeq$ 200 mV rms for 100 % modulation
- maximum permitted input level $\pm$ 10 V.

(16) AM MODULATION LEVEL CONTROL

Figure 3-1. Front-Panel Description (Sheet 4 of 6)

DESCRIPTION OF FRONT PANEL



(17) EXTERNAL FM or PM MODULATING SIGNAL INPUT

This socket is provided for the connection of an external modulating signal:

- 3 dB bandwidth

  0 to 150 kHz (FM) with d.c. coupling
  0 to 60 kHz (PM) with d.c. coupling
- 30 Hz to 150 kHz (FM) with a.c. coupling
- 30 Hz to 60 kHz (PM) with a.c. coupling
- input impedance 600 Ω
- 1 Vrms at 1 kHz, 10 kHz or 100 kHz depending on the selected maximum peak deviation (FM)
- 1 V rms at 100° (PM)
- Maximum permitted input level ± 10 V.

(18) FM or PM DEVIATION CONTROL

(19) OUTPUT FREQUENCY VERNIER CONTROL

The Vernier provides fine adjustment of frequency by approximately - 500 Hz to + 1500 Hz.

When using d.c. coupled FM on 30 kHz range, this adjustment is respectively multiplied by 10 or 100.

(20) VERNIER ENABLE SWITCH

OFF: Vernier disabled

VERNIER: Vernier enabled.

Figure 3-1. Front-Panel Description (Sheet 5 of 6)

DESCRIPTION OF FRONT PANEL

(21) OUTPUT FREQUENCY CONTROL

The frequency is selected by means of an optical coding wheel, providing increments (or decrements) of 100 steps per revolution, the size of the steps depending on the selected frequency resolution.

(22) STEP MODE SELECTOR

This provides for stepwise adjustment of the frequency in steps equal to the 4 possible frequency resolutions or to the standard channel spacing.

+ : output frequency incremented by selected step.
- : output frequency decremented by selected step.

A continuous pressure on one of these keys provides digital frequency sweep at a rate of approximately 7 steps/second.

(23) ON/STANDBY SWITCH

ON: instrument is ready for use
STANDBY: instrument functions on standby, with only pilot circuit powered up.

(24) RESOLUTION/CHANNEL STEP SELECTORS

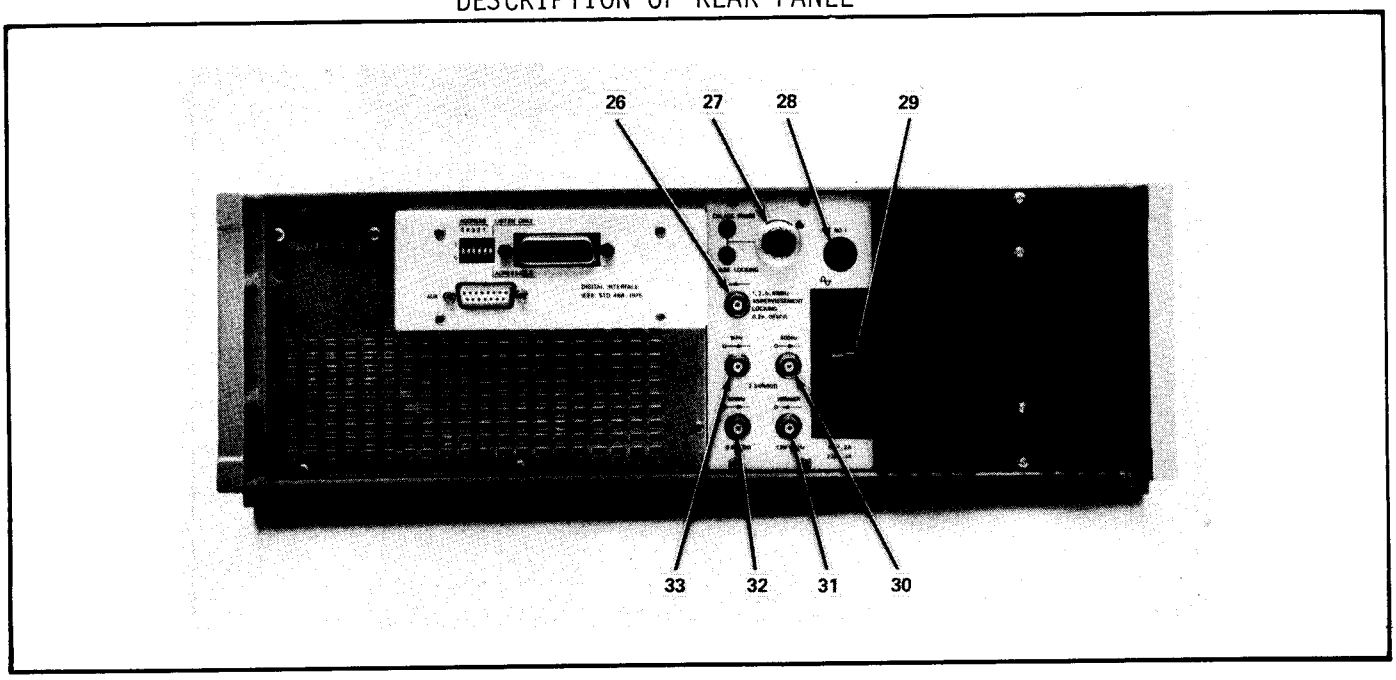
RESOLUTION: 1 kHz, 10 kHz, 100 kHz or 1 MHz
CHANNEL STEP: 12.5 kHz, 20 kHz, 25 kHz or 50 kHz.

NOTE: The center 0 position disables the frequency turning control knob.

(25) PROGRAMMED MODE DISPLAY

Figure 3-1. Front-Panel Description (Sheet 6 of 6)

DESCRIPTION OF REAR PANEL



(26) EXTERNAL FREQUENCY REFERENCE INPUT (1, 2, 5 or 10 MHz)

The internal pilot tone is locked on to an external reference at a level between 0.2 and 1 V rms across 50 Ω .

(27) PHASE LOCKING CONTROL AND INDICATOR

This knob operates a 10-turn precision potentiometer for adjusting the lock-on point, which is displayed by indicator lamps.

(28) POWER SUPPLY TO AUXILIARY EQUIPMENT

This 5-pin socket provides + 12 V, + 5 V and - 12 V supplies at approximately 50 mA.

(29) MAINS INPUT CONNECTION MODULE

This incorporates the mains input protection fuse and the mains supply voltage selectors:

- input voltage: 115 or 230 V rms ± 15 %.
- frequency: 50/60 Hz, 400 Hz optional.

(30) 400 Hz OUTPUT

This internal modulation signal is derived from the quartz-controlled pilot tone circuit. The output level is 2.5 V rms across 600 Ω .

(31) ± 3 V/3 kHz INPUT

This socket provides for external analog control of the output frequency.

Figure 3-2. Rear-Panel Description (Sheet 1 of 2)

DESCRIPTION OF REAR PANEL

(32) 10 MHz OUTPUT

This is a reference frequency derived from the quartz-controlled pilot tone generator, supplied at a fixed level of 0.5 V rms across 50 Ω.

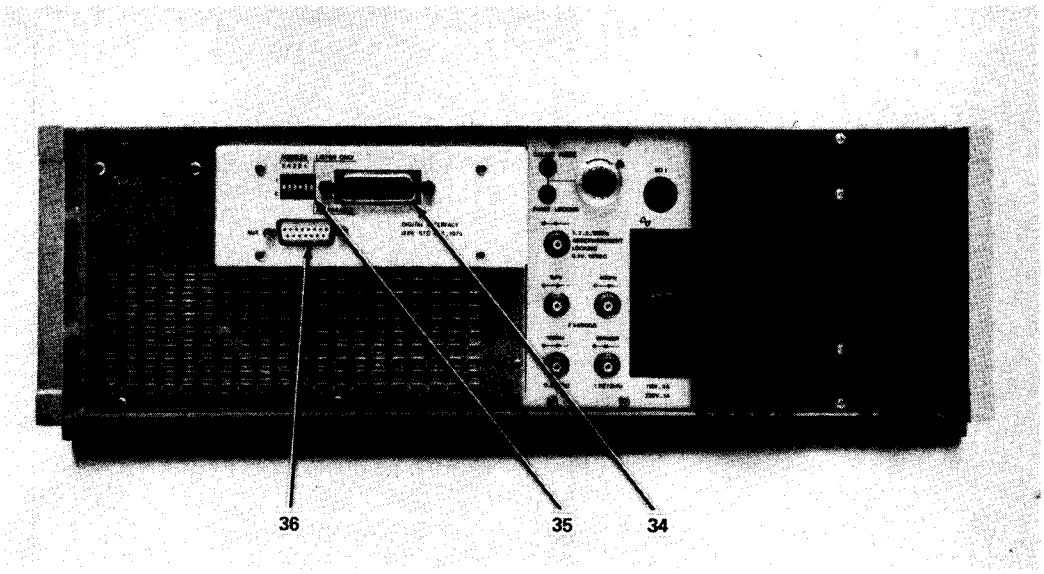
(33) 1 kHz OUTPUT

This internal modulation signal is derived from the quartz-controlled pilot tone circuit. The output level is 2.5 V rms across 600 Ω.

Figure 3-2. Rear Panel Description (Sheet 2 of 2)

DESCRIPTION OF REAR PANEL

PROGRAMMING OPTION



(34) IEEE BUS CONNECTOR

This connector provides the connection to the IEEE bus (IEEE Standard 488 of 1975).

(35) ADDRESS SELECTOR

The 460 is addressed by a number between 0 and 30 selected in binary code by a 5-decade switch (5-4-3-2-1). This identifying number is recognized when the 6th decade of the switch, marked LISTEN ONLY/ADDRESSABLE, is set to the "0" (down) position indicating ADDRESSABLE. In the LISTEN ONLY position ("1" or up), the 460 receives all data sent out by the controller.

(36) AUXILIARY CIRCUIT ENABLING SIGNAL CONNECTOR

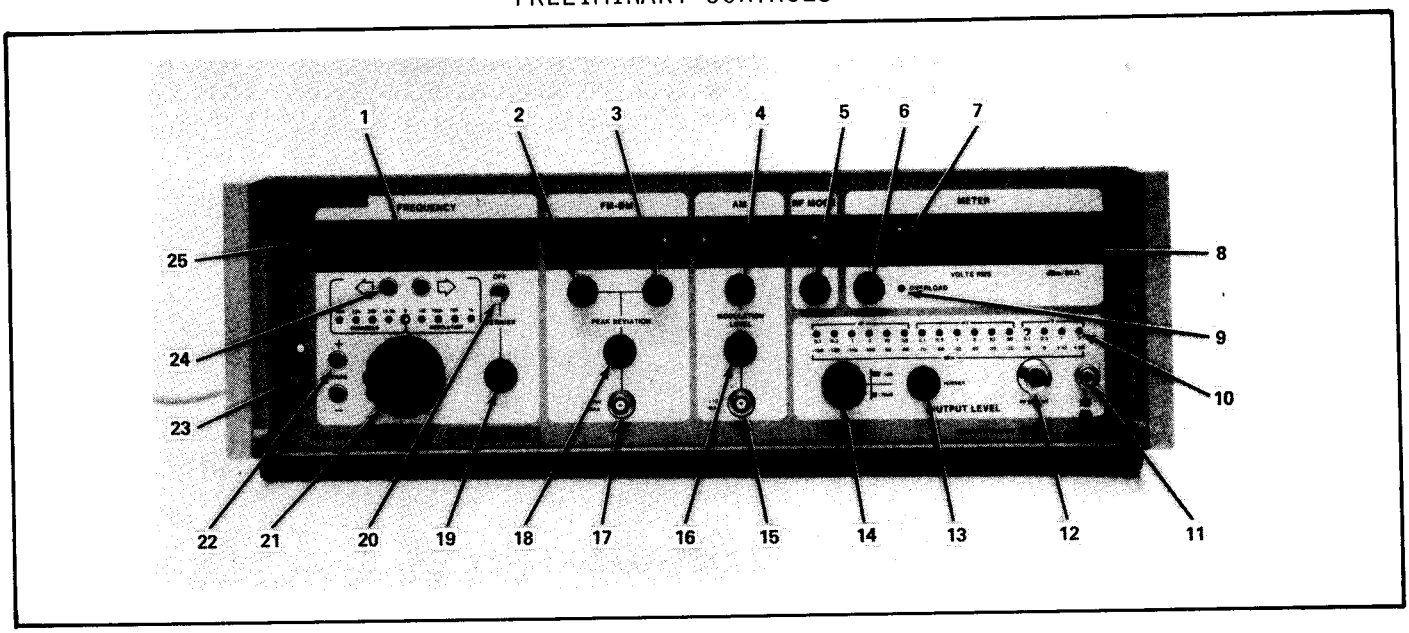
This connector makes it possible to program ancillary equipment (peripherals). It outputs a byte corresponding to a programmed decimal number between 0 and 99.

Output levels:

"0": 0.45 V maximum, maximum current drain + 8 mA;
"1": 2.4 V minimum, maximum current output - 2.6 mA.

Figure 3-3. Rear-Panel Description (Programming Options)

PRELIMINARY CONTROLS



a) Connect the instrument to the mains power supply. If switch (23) is in the lower position, the STANDBY indicator lights up while all the other displays are off.

SWITCHING ON

b) Set switch (23) to the ON position (indicator comes on). The display (1) indicates 300 MHz and indicator lamp (10) comes on to indicate the - 140 dBm range and a frequency resolution of 1 MHz ((24)).

c) Adjust the frequency using knob (22) and the level range by pushing in and rotating knob (14) . The resolution is adjusted by means of the pushbuttons (24) .

FREQUENCY

d) Press the pushbuttons (24) and check that the indicator lamps come on in succession, corresponding to the successive frequency resolution steps and standard channel spacing.

e) Switch on the 1k indicator lamp and then press the right-hand pushbutton (24) . The center 0 indicator lamp should come on. Repeat this operation with the 50 k indicator lamp and the left-hand pushbutton (24) .

f) Check that the frequency indicated by the display (1) cannot go below 250 kHz or above 649.999 MHz (direct range) or 1299.999 MHz if the frequency-doubler option is included. This check is carried out using the pushbutton (24) and knob (21) .

Figure 3-4. Preliminary Controls (Sheet 1 of 3)

PRELIMINARY CONTROLS

g) Select the 1 MHz resolution step (pushbuttons (24)) and press pushbuttons (22) . The indicated frequency should vary in steps of 1 MHZ, the indication varying continuously if the pushbutton is held down.

h) Set switch (20) to VERNIER and check that potentiometer (19) varies the frequency by - 500 Hz to + 1500 Hz.

OUTPUT LEVEL

i) Switch on the RF indicator lamp using switch (6) .

j) Press in and rotate all switches (14) and check that:

- the indicator lamps (10) come on in succession;
- the range of the meter (8) is automatically switched over (indicator lamp (7)).

k) Check that operating the VERNIER (13) varies the level by + or - 1.5 dB. Set the Vernier to the extreme right-hand end of its travel.

l) Switch on the + 20 dBm indicator lamp (10) using switch (14) . Then set the pointer of meter (8) to the "0" graduation on the bottom scale by rotating knob (14) .

m) Increase the output level by rotating knob (13) and check that indicator lamp (9) comes on.

AM MODULATION

n) Operate the switches (4) and check that the indicator lamps above the switches come on in succession. Check the "1 k" indicator lamp.

o) Switch on the "MOD" lamp by rotating knob (5) and the "AM" indicator lamp by rotating knob (6) .

p) Set potentiometer (16) to the extreme left-hand end of its travel and then turn it slowly clockwise checking that the range switching (indicator lamp (7)) for the meter (8) occurs at graduation "3" on the center scale (allowing for hysterisis effects). In this case, the pointer is against graduation "0.3" on the upper scale.

q) Switch on the "RF" indicator lamp by rotating knob (6) and the "CW" indicator lamp by rotating knob (5) .

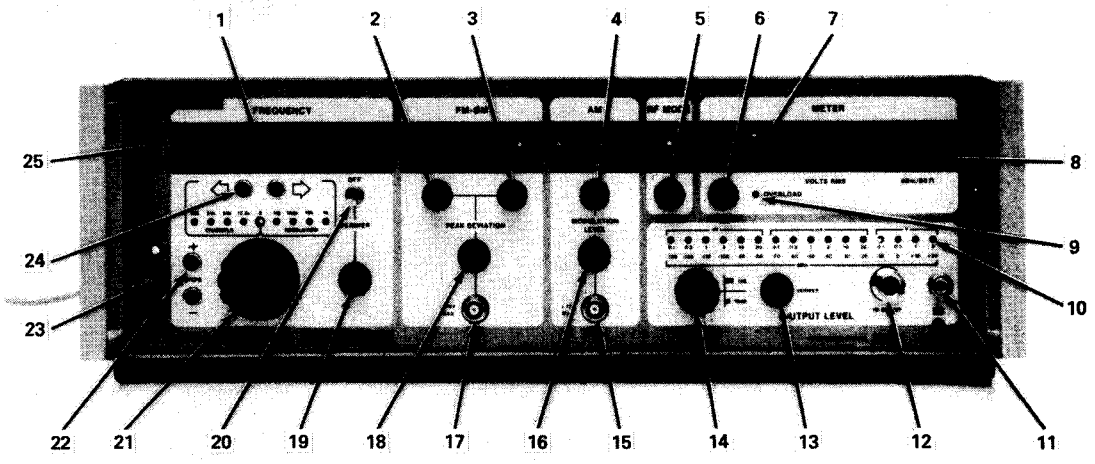
r) Switch on the "+ 20 dBm" indicator lamp (10) by pushing in and rotating knob (14) . Release the knob and rotate it to set the meter pointer to the "- 6 " graduation on the lower scale. Use the VERNIER control knob (13) if necessary.

s) Switch on the "AM" indicator lamp by rotating knob (6) and the "MOD" indicator lamp by rotating knob (5) . Using potentiometer (16) , set the meter pointer to the "1.0" graduation on the upper scale.

t) Rotate potentiometer (16) clockwise until indicator lamp (9) comes on.

Figure 3-4. Preliminary Controls (Sheet 2 of 3)

PRELIMINARY CONTROLS



FM or PM MODULATION

u) Operate switches (2) and (3) and check that the indicator lamps above them come on. Check the "1 k" and "30 k" indicator lamps.

v) Switch on the "MOD" indicator lamp by rotating knob (5) and the "FM" indicator lamp by rotating knob (6) .

w) Operate potentiometer (18) and check that the automatic range switching for the meter (indicator lamp (7)) occurs on the "1.0" graduation on the upper scale (neglecting hysterisis effects). The pointer should be aligned with the "1" graduation on the center scale.

Figure 3-4. Preliminary Controls (Sheet 3 of 3)

FREQUENCY AND OUTPUT LEVEL DISPLAY

FREQUENCY

a) Use the pushbuttons (24) to select frequency resolution steps of 1 kHz, 10 kHz, 100 kHz and 1 MHz, in direct and frequency-doubling mode (where applicable).

b) Rotate knob (21) until the required frequency is indicated on the display (1), remembering that this knob increments or decrements the frequency by 100 steps per revolution. The following table sets out, as a function of the selected resolution step, the number of rotations required to cover the whole frequency range of the instrument (with and without the frequency-doubler option).

Resolution step	Revolutions for full frequency range (without frequency) doubler option)	Revolutions for full frequency range (with frequency doubler option)
1 kHz	6500	13000
10 kHz	650	1300
100 kHz	65	130
1 MHz	6.5	13

c) Set switch (20) to the VERNIER position and use potentiometer (19) to set and display the units, tens and hundreds digits for the frequency in Hertz on display (1).

NOTE: The Vernier varies the frequency by approximately - 500 Hz to + 1500 Hz, in direct and frequency-doubling modes.

d) The output frequency is modified as described above, using the pushbuttons (22) to vary the frequency in steps of a size determined by the pushbutton (24). The frequency step may be equal to one of the 4 resolution steps (1 kHz, 10 kHz, 100 kHz or 1 MHz) or to one of the 4 standard channel spacings (12.5 kHz, 20 kHz, 25 kHz or 50 kHz).

NOTE: Selecting one of the standard channel spacings automatically disables knob (21). The 500 Hz of the 12.5 kHz spacing is displayed as the hundreds digit.

e) Hold down one of the pushbuttons (22) to produce continuous variation of the output frequency.

f) As soon as the working frequency is obtained, the knob (21) and the pushbuttons (22) may be disabled by using the pushbuttons (24) to switch on the central "0" indicator lamp.

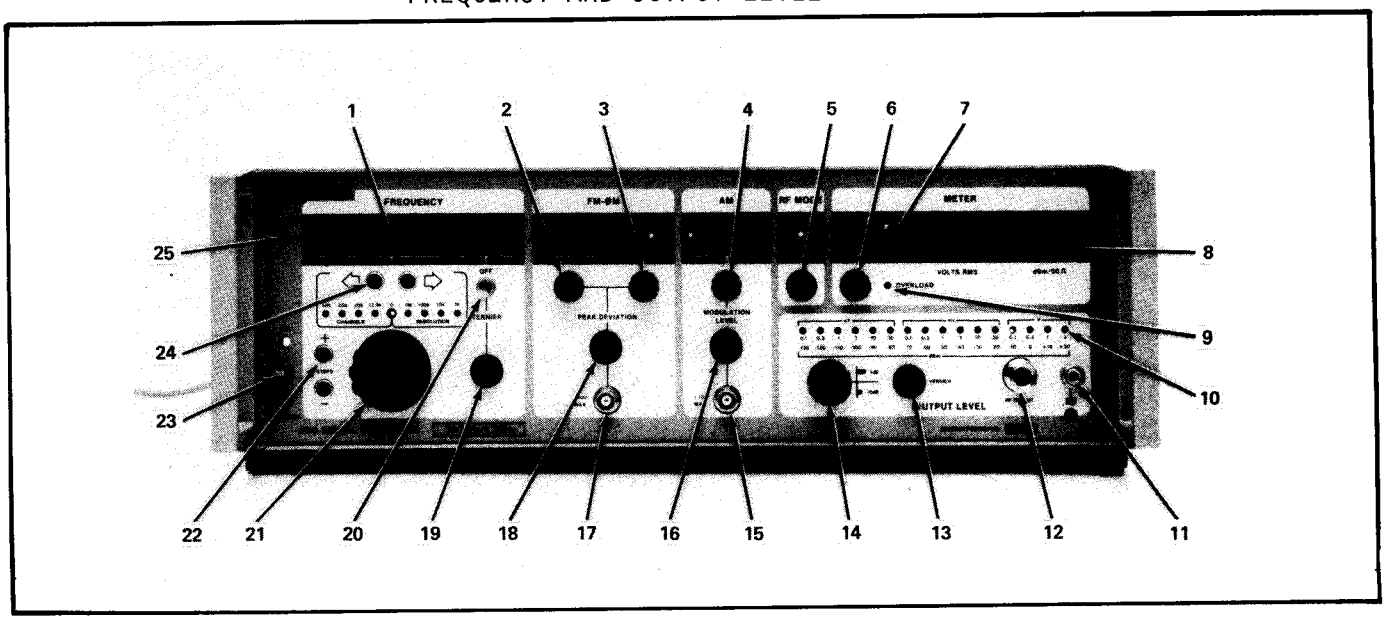
LEVEL

a) Switch on the "CW" indicator lamp by rotating knob (5).

b) Switch on the "RF" indicator lamp by rotating knob (6).

Figure 3-5. Frequency and Output Level Display (Sheet 1 of 3)

FREQUENCY AND OUTPUT LEVEL DISPLAY



c) Press in and rotate knob (14) to switch on the indicator lamp (10) corresponding to the required level range (the ranges 1, 3 and 10 are indicated on the front panel in V, mV, V and dBm).

NOTE: Pressing knob (14) varies the output level in steps of 10 dB.

d) Release and then rotate knob (14) to set the required level of the meter (8), the variation this time being in steps of 1 dB.

NOTE: Variation of the output level in steps of 1 dB is possible over the full 160 dB dynamic range of the instrument. For this reason, and to enable the threshold adjustments to be measured, the range switching (10) varies with the direction. After centering the VERNIER knob (13), the 1 dB steps causing the level to vary progressively by - 140 to + 20 dBm are indicated on the lower scale (- 6 to + 13) between successive changes of range. Where the level is attenuated by + 20 to - 140 dBm, the 1 dB steps vary by + 12 to - 7 on the lower scale between successive changes of range.

e) According to the selected range, read the level from the meter (8) in μV, mV or V, from the scale indicated by lamp (7), or in dBm on the lower scale.

f) Carry out the adjustment using the VERNIER knob (13) (1.5 dB). The output signal is obtained at the type N connector (12), into an impedance of 50 Ω.

g) The OVERLOAD indicator (9) comes on to indicate that the permitted peak power rating (+ 20 dBm) has been exceeded.

h) Switch on the OFF indicator lamp by rotating knob (5) to disable the output signal level (< - 140 dBm).

CENTRING THE LEVEL VERNIER

a) Set the VERNIER knob (13) to the extreme right-hand end of its travel.

b) Select the + 20 dBm range using knob (14) and then select the maximum level in steps of 1 dB.

Figure 3-5. Frequency and Output Level Display (Sheet 2 of 3)

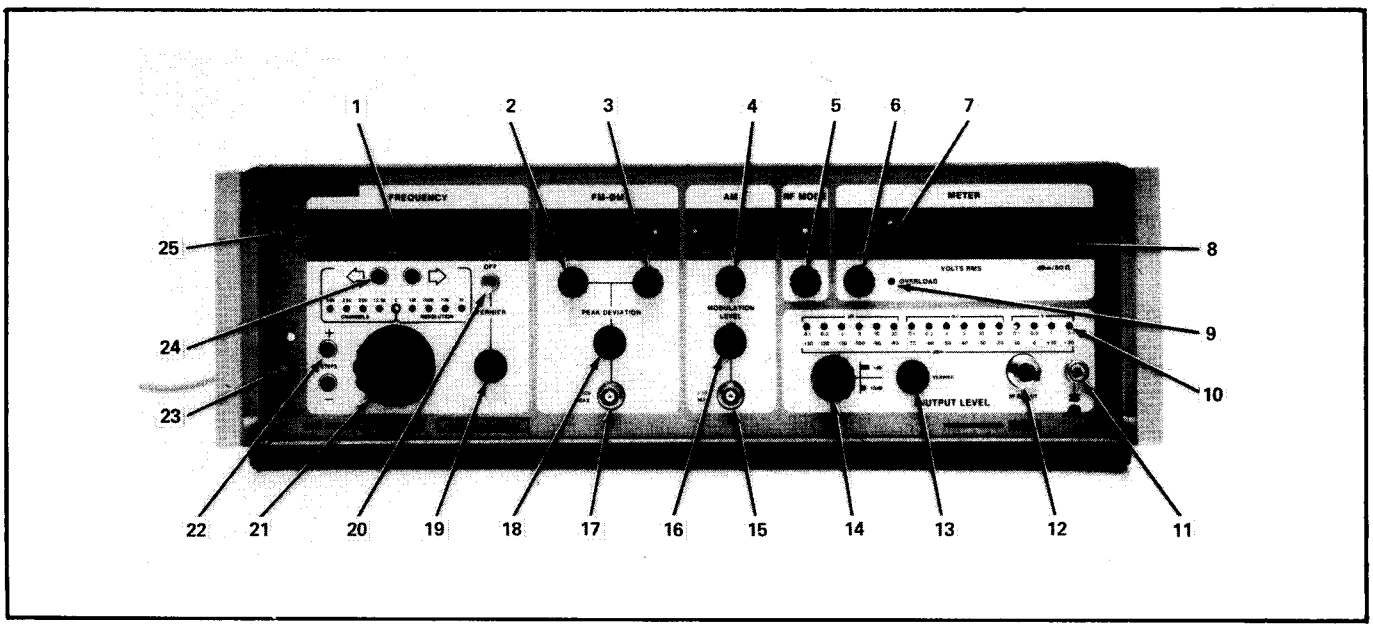
FREQUENCY AND OUTPUT LEVEL DISPLAY

c) Using the VERNIER knob (13) , set the meter pointer to graduation "3" on the lower scale. The output level is thus + 23 dBm, corresponding to the maximum value obtained by operating knob (14) (10 dB and 1 dB steps).

d) Reduce the level to + 20 dBm and check that the VERNIER allows to set the level down to + 19 dBm.

Figure 3-5. Frequency and Output Level Display (Sheet 3 of 3)

AM.FM.PM MODULATION



AMPLITUDE MODULATION

a) Switch on the "MOD" indicator lamp by rotating knob (5) .

b) Switch on the "AM" indicator lamp by rotating knob (6) .

c) Select the source of modulation using switch (4) .

d) When switched to INTERNAL, there are two fixed modulation frequencies of 400 Hz and 1 kHz, derived from the quartz-controlled pilot tone frequency.

NOTE: These frequencies of 400 Hz and 1 kHz are available at connectors (33) and (30) on the rear panel of the instrument. The source impedance is 600Ω and the fixed output level is 2.5 V rms.

e) When switched to EXTERNAL, the modulating signal may be a.c. or d.c. coupled or specific to the requirements for testing radio-navigation systems (VOR - ILS).

f) Connect the modulating signal to the 600Ω input impedance connector. 100 % modulation requires the application of the minimum level of 200 mV rms, the input sensitivity being 2 mV rms per %.

NOTE: The indication "± 10 V max" adjacent the input connectors shows the maximum input voltage which can be tolerated without damaging the instrument.

g) Set the modulation level using potentiometer (16) and meter (8) .

h) Take the meter reading from the scale indicated by lamp (7) , the automatic switching action occurring at a value of 30 % (ignoring hysterisis).

i) Reduce the modulation level or output level as soon as the OVERLOAD indicator lamp (9) comes on. For 100 % modulation, the output level must not exceed + 14 dBm.

Figure 3-6. AM-FM-PM Modulation (Sheet 1 of 2)

j) To cancel amplitude modulation, switch on the OFF indicator lamp using switch (4) or the "CW" indicator lamp using switch (5) .

k) To disable the output signal, switch on indicator lamp OFF using switch (5) .

FREQUENCY OR PHASE MODULATION

a) Switch on the "MOD" indicator lamp by rotating knob (5) .

b) Switch on the "FM" indicator lamp by rotating knob (6) .

c) Select the source of modulation using switch (2) .

d) When switched to INTERNAL, there are two fixed modulation frequencies of 400 Hz and 1 kHz, derived from the quartz-controlled pilot tone frequency.

NOTE: These frequencies of 400 Hz and 1 kHz are available at connectors (33) and (30) on the rear panel of the instrument. The source impedance is 600Ω and the fixed output level is 2.5 V rms.

e) When switched to EXTERNAL, the frequency or phase modulation may be obtained by a.c. or d.c. coupling.

NOTE: In FM mode with d.c. coupling, the carrier shift resulting from the connection of a d.c. component to input (17) is allowed for in deriving the frequency meter display:

- 1 Hz resolution for the ± 3 kHz range;
- 10 Hz resolution for the ± 30 kHz range;
- 100 Hz resolution for the ± 300 kHz range.

If the modulating frequency is greater than 30 Hz, the displayed value corresponds to the average value or fluctuates around the instantaneous value with a period of 0.25 second.

f) Select the maximum peak FM or PM deviation using switch (3) (± 3 kHz; ± 30 kHz; ± 300 kHz or 300°).

g) Connect the modulating signal to connector (17) (input impedance: 600Ω). The maximum peak FM deviation or full phase deviation requires a minimum input level of 3 V rms (approximately 4.29 V peak). The input sensitivity is 1 Vrms for a deviation of 1 kHz, 10 kHz, 100 kHz or 100°, depending on the range.

NOTE: The indication "± 10 V max" adjacent the input connectors shows the maximum input voltage which can be tolerated without damaging the instrument.

h) Set the frequency or phase deviation using potentiometer (18) and meter (8) .

i) Take the meter reading from the scale indicated by lamp (7) , the automatic switching occurring at 1 kHz, 10 kHz, 100 kHz or 100°.

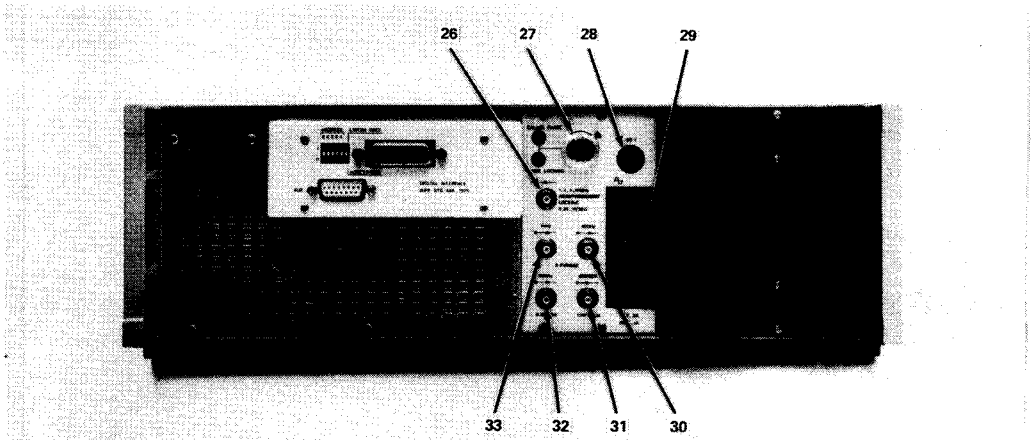
j) To cancel the frequency or phase modulation, switch on the OFF indicator lamp using switch (2) or the "CW" indicator lamp using switch (5) .

COMBINED MODULATION MODES

The instrument provides for simultaneous AM + FM or AM + PM modulation, the procedure being as described above. The internal modulating frequency of 400 Hz and 1 kHz can be used for either type of modulation, or for both.

Figure 3-6. AM-FM-PM Modulation (Sheet 2 of 2)

PILOT FREQUENCY LOCK-ON



a) Connect the frequency reference signal (1, 2, 5 or 10 MHz) via connector (26) . The permitted range of input levels is from 0.2 to 1 V rms across 50 Ω.

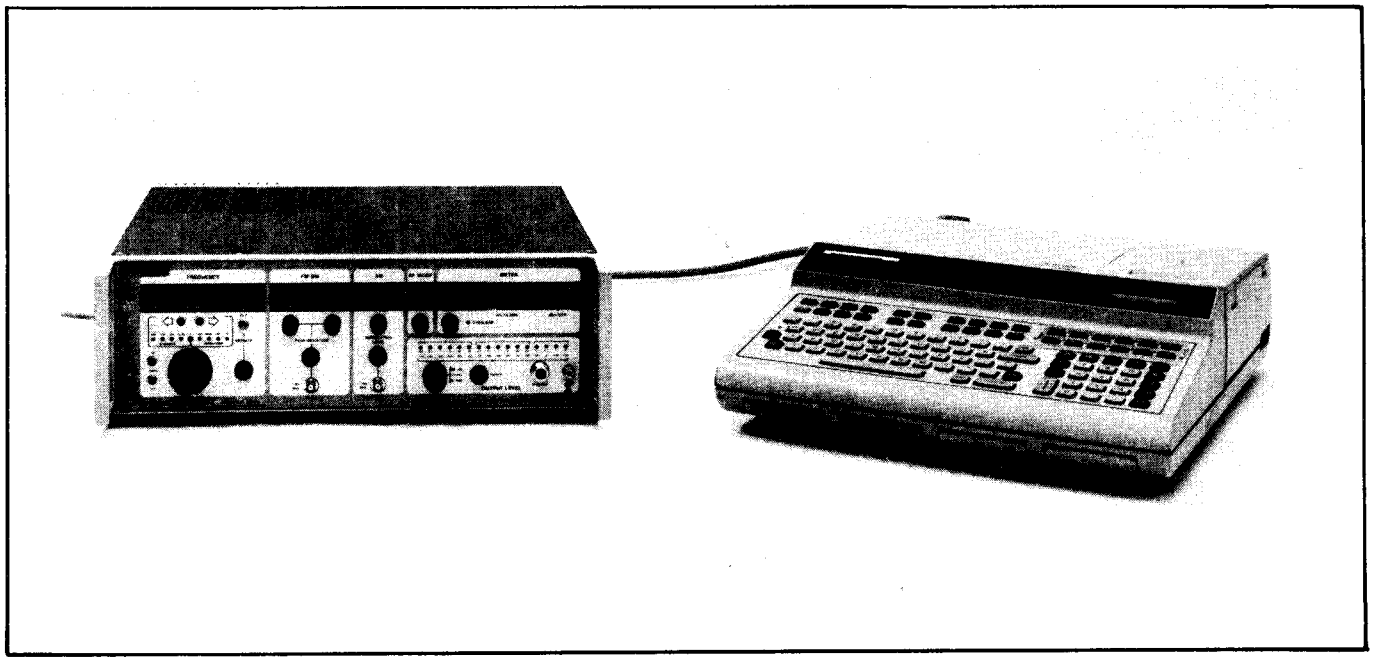
b) Release potentiometer (27) and rotate it until the indicator lamps to its left go out. This shows that the internal pilot frequency is phase-locked to the external frequency reference, so that the stability of the instrument is set by the stability of the external frequency standard.

c) Lock potentiometer (27) .

NOTE: The internal pilot frequency is available at connector (32) . It is supplied at a level of 0.5 Vrms across 50 Ω . The external reference accuracy must be better than $\pm 10^{-6}$. Otherwise, the internal pilot phase-locking could induce an instability of the output frequency, indicated by a flashing sign "-" at the left of the frequency display.

Figure 3-7. Pilot Frequency Lock-On

FUNCTION PROGRAMMING



Programming via the IEEE bus is in conformity with IEEE Standard No. 488 (1975). Programming is a simple procedure because:

- it uses CLEAR LANGUAGE and a FREE FORMAT;
- it uses a MNEMONIC PREFIX corresponding to each front panel function;
- it uses a numerical code appended to each mnemonic prefix to indicate a frequency, output level or modulation level, or the selected AM, FM and PM modulation control (modulation source, coupling, range).

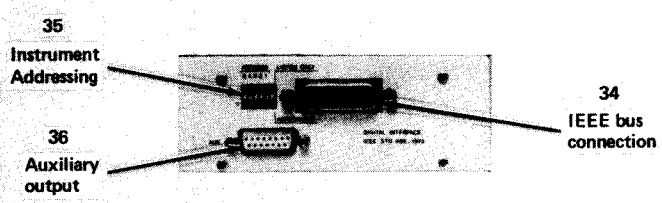
The instrument is programmed via the rear panel connectors, using programming options 003 (see page 3-21).

The front panel displays remain enabled in programmed mode, allowing the control data to be verified.

All instrument functions are programmable except the switching of the meter (8), which is always obtained by switch (6).

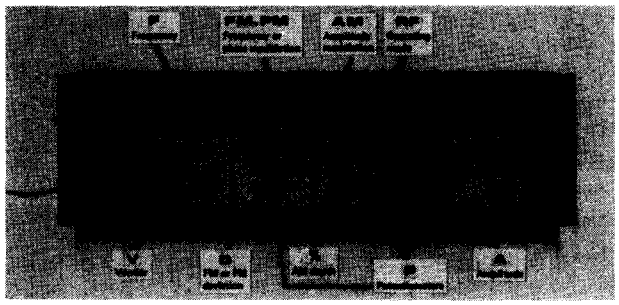
Figure 3-8. Function Programming (Sheet 1 of 15)

FUNCTION PROGRAMMING

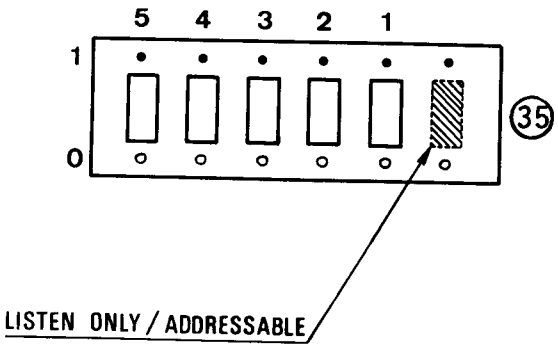


003 OPTION

- Frequency: 1 Hz resolution
- AM level: %
- FM deviation: 10 Hz, 100 Hz or 1 kHz resolution depending on the range
- PM deviation: per degree
- Enabling of AM, FM, PM and level potentiometers.
- Level: 0.1 dB resolution
- Operating mode: -CW/MOD/INHIB
  -AM-FM-PM modulating signal
  -FM deviation range



460 ADDRESSING



a) Set the "LISTEN ONLY/ADDRESSABLE" switch decade (35) to "ADDRESSABLE".

NOTE: In the "LISTEN ONLY" position, the 460 receives all data sent out by the controller.

Figure 3-8. Function Programming (Sheet 2 of 15)

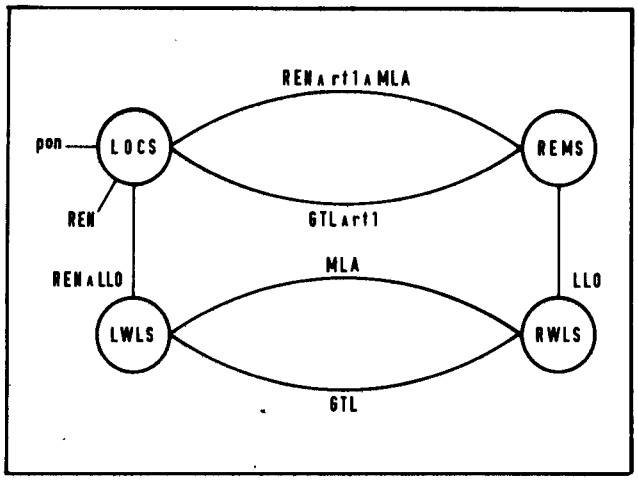
b) Set decades 1 to 5 of switch (35) to "1" or "0", in accordance with the binary digit corresponding to the selected decimal address (between 0 and 30).

c) Connect the controller to the instrument via the 24-pin connector (34) .

LOCAL/REMOTE MODE

The 460 meets conditions RL2 of IEEE Standard No. 488, which stipulates that the programmed mode may be LOCAL or REMOTE, with the facility for locking the operation of the instrument.

This RL2 function is represented schematically in the following diagram, which is accompanied by its mnemonic table.



CONTROL MESSAGES

pon: power on
rtl: return to local
REN: remote enable
LLO: local lockout
GTL: go to local
MLA: my listen address

MODES

LOCS: local state
LWLS: local with lockout state
REMS: remote state
RWLS: remote with lockout state.

NOTE: The message rtl is output by the transient position of the ON/STANDBY switch on the instrument.

When the controller is connected to the rear panel connector (34) and the IEEE bus is active (REN line at 0 V), the switch (23) can no longer be used to set the apparatus to STANDBY, whether in local or remote mode.

a) Switching to REMOTE mode:

The REMOTE mode is obtained on first selecting LISTEN ONLY addressing, provided that the REN line is active (REN = 0 V).

b) Return to LOCAL mode with or without lockout:

When the apparatus is in REMOTE mode (LISTEN ONLY addressing), the return to LOCAL mode is obtained by a command from the controller (GTL: Go To Local), or by manual operation of switch (23) of the 460. This manual control can be disabled by the controller, by sending out the command LLO (Local Lockout). After this, only the controller can order the return to LOCAL mode. The lockout condition is only interrupted if the bus returns to its idle state (REN - 1 V).

Figure 3-8. Function Programming (Sheet 3 of 15)

FUNCTION PROGRAMMING

Programming example

The following example is based on the use of a HP 9825 controller.

INITIAL OPERATING MODE \ PROGRAM OPERATING MODE	LOCAL STATE	REMOTE STATE	REMOTE WITH LOCKOUT STATE	LOCAL WITH LOCKOUT STATE
LOCAL STATE		wrt 7xx or rem 7xx	1107	✸
REMOTE STATE	lcl7 or lcl7xx or manual		✸	1107
LOCAL WITH LOCKOUT STATE	lcl7	✸		rem7xx or wrt7xx
REMOTE WITH LOCKOUT STATE	lcl7	✸	lcl7xx (but not manual)	

✸ impossible xx 460 address

CONTROL STATUS ON SWITCHING TO REMOTE MODE

On switching on and first selecting REMOTE mode, the main instrument functions are in the following states:

- the displays of frequency (F), amplitude (A), operating mode (RF) and modulation (FM and AM) are the same as apply in LOCAL mode;
- the frequency adjustment VERNIER is disabled (V0) or enabled (V2);
- the AM level, FM/PM deviation and level Vernier potentiometers are enabled (P1).

On return to LOCAL mode, the frequency and amplitude still correspond to the programmed values. The modulation (AM/FM), operating mode (RF) and frequency Vernier (V) correspond to the local control applicable before switching to REMOTE mode.

Figure 3-8. Function Programming (Sheet 4 of 15)

FUNCTION PROGRAMMING

FREQUENCY

a) Program the MNEMONIC PREFIX "F or f" followed, in free format, by the frequency in Hertz.

   For example, a frequency of 559.480 MHz may be programmed in various ways:

   - "F 599480000"
   - "F 599.48 e 6"
   - "F 5.9948 e 8"

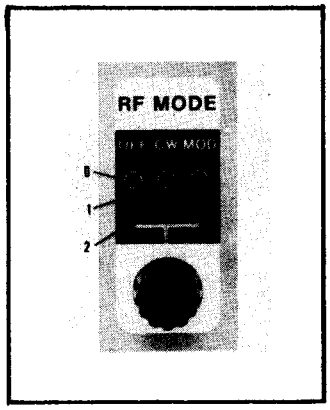
b) The frequency resolution may be as low as 1 Hz if the frequency Vernier control is programmed (V1). Refer to the corresponding section below.

c) The display (1) indicates the output frequency corresponding to the programmed frequency (or to the rounded off frequency).

OPERATING MODE

a) Program the MNEMONIC PREFIX "RF" followed by the digit specifying the required mod (0 to 2):

   "RF0": disable
   "RF1": CW
   "RF2": MOD



VERNIER

a) Program the MNEMONIC PREFIX "V or v" followed by a digit (0 to 2) indicating if the Vernier is disabled, remotely variable, or manually variable:

   "V0": Vernier disabled, frequency resolution is 125 Hz, 250 Hz, 500 Hz or 1 kHz depending on the frequency range selected.

   "V1": Vernier programmed to provide frequency resolution of 1 Hz. This command is incompatible with FM command F41, F42 or F43.

   "V2": manual control of Vernier and rear panel analog controls enable.

Figure 3-8. Function Programming (Sheet 5 of 15)

NOTE: For the "V2" situation, the output frequency can also be set by an analog control voltage input via connector (31) on the rear panel. The range of frequency variation obtained by manual control of the Vernier, analog control via the rear panel connector or frequency modulation with d.c. coupling must not exceed ± 3 kHz.

For the "V0" situation, the set frequency can only be varied by the frequency shift introduced in FM mode by injection of the d.c. component at the modulating signal input.

In the "V1" situation, the inadvertent programming of parameters "V1" and "FM41", "FM42", "FM43" modifies the output data, as shown in the table below. The output equivalence in fact depends on the order in which the two parameters are programmed.

Parameter programming order	Equivalent to
FM41 V1	FM31 V1
FM42 V1	FM32 V1
FM43 V1	FM33 V1
V1 FM41	V0 FM41
V1 FM42	V0 FM42
V1 FM43	V0 FM43

AMPLITUDE

a) Program the MNEMONIC PREFIX "A or a" followed by, in free format, the level expressed in dBm. For levels below 0 dBm (224 mV rms), the value indicating the level should be preceded by the symbol "-":

"A18" = + 18 dBm
"a -135.8": -135.8 dBm
"A - 4.63 e 1": - 46.3 dBm

NOTE: The 0.1 dB resolution is obtained only if the potentiometer is disabled (refer to corresponding section on page 3-28).

b) A level may be read off from meter (8) after switching on the "RF" indicator lamp using switch (6) .

c) The OVERLOAD indicator lamp (5) comes on to indicate that the maximum permitted peak power rating has been exceeded:

+ 20 dBm in the direct range, or
+ 10 dBm in the frequency-doubling range.

Figure 3-8. Function Programming (Sheet 6 of 15)

FUNCTION PROGRAMMING

AMPLITUDE MODULATION

a) Program the MNEMONIC PREFIX "AM or am" followed by a digit (0 to 5) corresponding to the required modulation mode:

"AM0": function disabled

"AM1": AM by internal 400 Hz signal

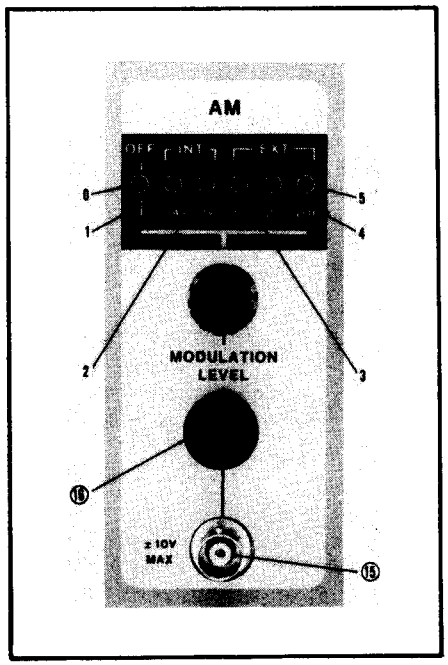
"AM2": AM by internal 1 kHz signal

"AM3": AM by external a.c.-coupled signal

"AM4": AM by external d.c.-coupled signal

"AM5": external VOR.

NOTE: In AM mode with d.c. coupling, the d.c. component modifies the level and therefore results in a discrepancy relative to the programmed value: the actual mean level is then indicated by the meter.



b) The AM level is determined by programming the MNEMONIC PREFIX "%" followed by a number between 0 and 100 (resolution x 1 %). The input level of the modulating signal at socket 15 must be set to 1 V rms into 600

NOTE: The AM level can only be programmed if potentiometer control is disabled (refer to corresponding section on page 3-28). If not, the AM level is adjusted by potentiometer (16), the input sensitivity being 200 mV rms for 100 % modulation.

c) The AM level may be read off from meter (8), indicator lamp (9) indicating if the permitted maximum peak power rating is exceeded.

d) The OVERLOAD indicator lamp (9) comes on to indicate that the permitted maximum peak output level has been exceeded. Decrease the modulation level or the output level until this lamp goes out.

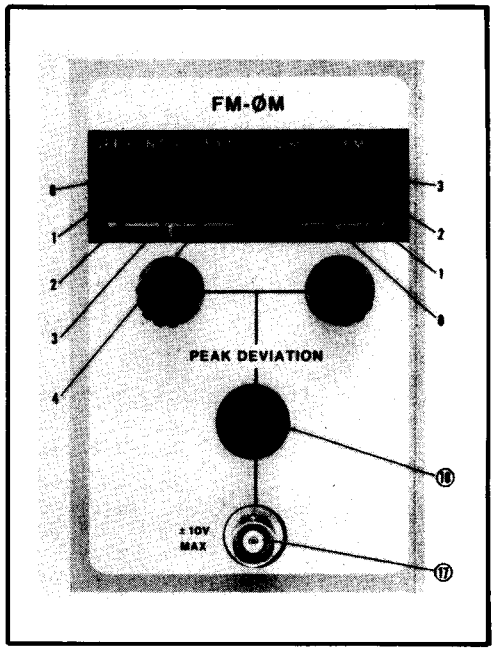
Figure 3-8. Function Programming (Sheet 7 of 15)

FREQUENCY OR PHASE MODULATION

a) FREQUENCY MODULATION: Program the MNEMONIC PREFIX "FM or fm" followed by two digits specifying the required modulation and deviation:

"FM1x": FM by internal 400 Hz signal
"FM2x": FM by internal 1 kHz signal
"FM3x": FM by a.c.-coupled external signal
"FM4x": FM by d.c.-coupled external signal

→ (X)= 1: deviation ± 3 kHz
2: deviation ± 30 kHz
3: deviation ± 300 kHz



NOTE: In FM mode with d.c. coupling, the frequency Vernier cannot be programmed (V1) and vice versa (refer to section on the VERNIER on page 3-25).

b) PHASE MODULATION: Program the MNEMONIC PREfix "PM or pm" followed by a digit (1 - 4) specifying the modulation mode:

- "PM1": PM by internal 400 Hz signal
- "PM2": PM by internal 1 kHz signal
- "PM3": PM by a.c.-coupled external signal
- "PM4": PM by d.c.-coupled external signal

NOTE: Phase modulation may also be obtained by programming the mnemonic prefix "FM or fm" followed by 2 digits, the second of which is always 0.

Figure 3-8. Function Programming (Sheet 8 of 15)

FUNCTION PROGRAMMING

FM or PM

a) The FM deviation is set by programming the MNEMONIC PREFIX "D" followed by the deviation sensibility as a multiple of the step corresponding to 1/300 of the programmed range (± 3 k, ± 30 k or ± 300 k).

b) The PM deviation is set by programming the MNEMONIC PREFIX "D" followed by a number between 0 and 300 (resolution 1°).

c) In both cases, the modulating signal at input (17) must be at a level of 3 V rms at an impedance of 600 Ω.

NOTE: The FM or PM deviation can only be programmed if potentiometer control is disabled (refer to corresponding section on page 3-28). The FM or PM deviation is adjustable by potentiometer when this control is enabled.

d) The programmed FM or PM deviation is indicated on displays (7) and (8).

NOTE: In FM Mode with d.c. coupling, the carrier shift resulting from the connection of a d.c. component via input (17) is taken into account in the frequency meter display.

If the modulating frequency is greater than 30 Hz, the display corresponds to the average value or fluctuates around the instantaneous value with a period of 0.25 second.

e) FM and PM programming examples:

"FM33 D60"

- FM by a.c.-coupled external signal
- maximum deviation ± 300 kHz
- programmed deviation 60 kHz

"PM1 D45"

- PM by internal 400 Hz signal
- programmed deviation 45°

POTENTIOMETER CONTROL ((18) , (16) and (13))

a) Program the MNEMONIC PREFIX "P" followed by digit 0 or 1 to disable or enable the 3 potentiometers:

- "P0": the 3 potentiometers are disabled. For instrument with programming option 003, the FM, PM, AM and output levels are adjusted as follows:

FM: sensitivity as a multiple of the step corresponding to 1/300 of the range (± 3 k, ± 30 k or ± 300 k)

PM: resolution 1°

AM: resolution 1 %

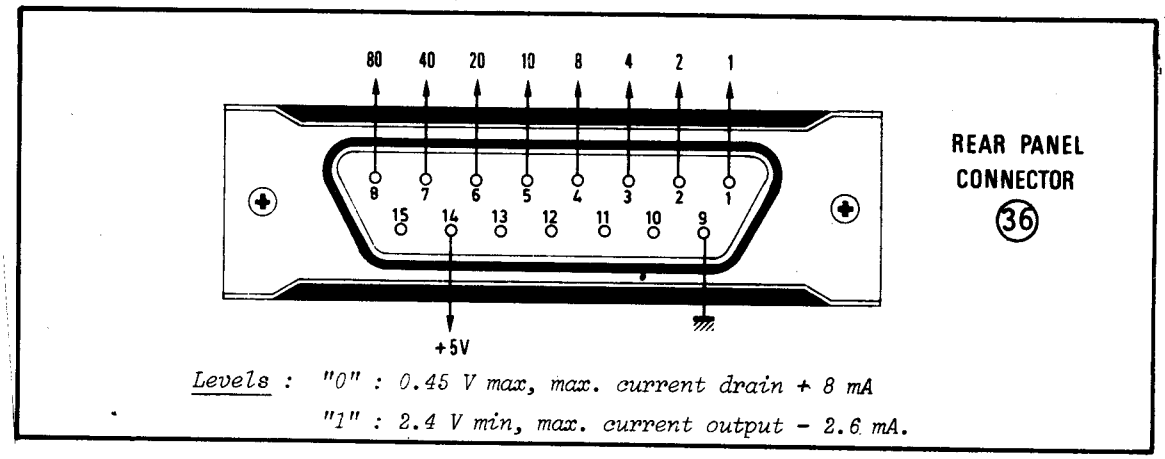
Output level: 0.1 dB steps.

Figure 3-8. Function Programming (Sheet 9 of 15)

- "P1": the 3 potentiometers are enabled. With the 003 programming option, the output level resolution is 1 dB and program control of the FM and PM deviation (D) and AM level (%) are disabled.

AUXILIARY OUTPUT

a) Program the MNEMONIC PREFIX "X or x" followed by a 2-digit number between 00 and 99. The corresponding BCD number is output to connector (36) on the rear panel. The diagram below shows the BCD weighting of the output signal at each connector pin.



TALKER FUNCTION

When programmed in LOCAL or in REMOTE mode, the instrument replies when addressed in TALKER mode, giving the value of the set frequency, allowing for variations due to the Vernier control, the analog control via the rear panel connector, the FM modulation with d.c. coupling and the rounding off of the frequency (where applicable).

The response sent to the controller consists of a message comprising 13 ASCII characters, with the following format:

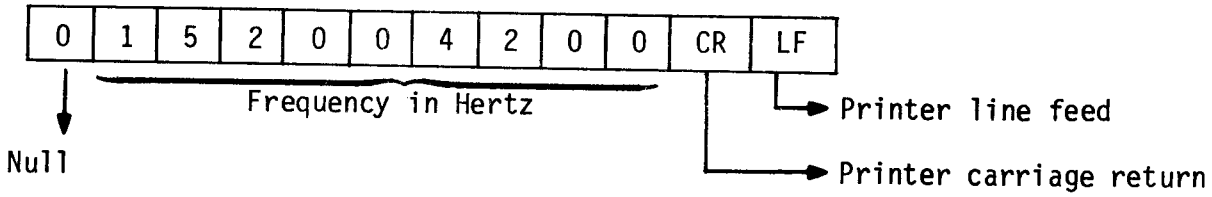
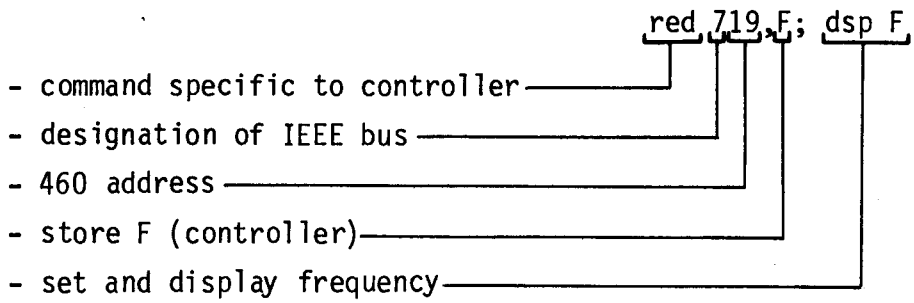


Figure 3-8. Function Programming (Sheet 10 of 15)

FUNCTION PROGRAMMING

Programming the TALKER function from the HP 9825 controller uses the following addressing for examples:



PROGRAMMING EXAMPLES

The following examples show how external command instructions are programmed, without providing an exhaustive listing as far as programming order and selection of free format are concerned. These examples are included for the guidance of first-time users programming the instrument in external mode.

With a view to facilitating comprehension, all the following examples are bases on the use of the HP 9825 controller as the programming source. It should be understood, however, that the instrument can be programmed from other types of controller.

Ⓐ-OUTPUT OF A CONTINUOUS PURE WAVE (CW)

The parameters to be defined are:

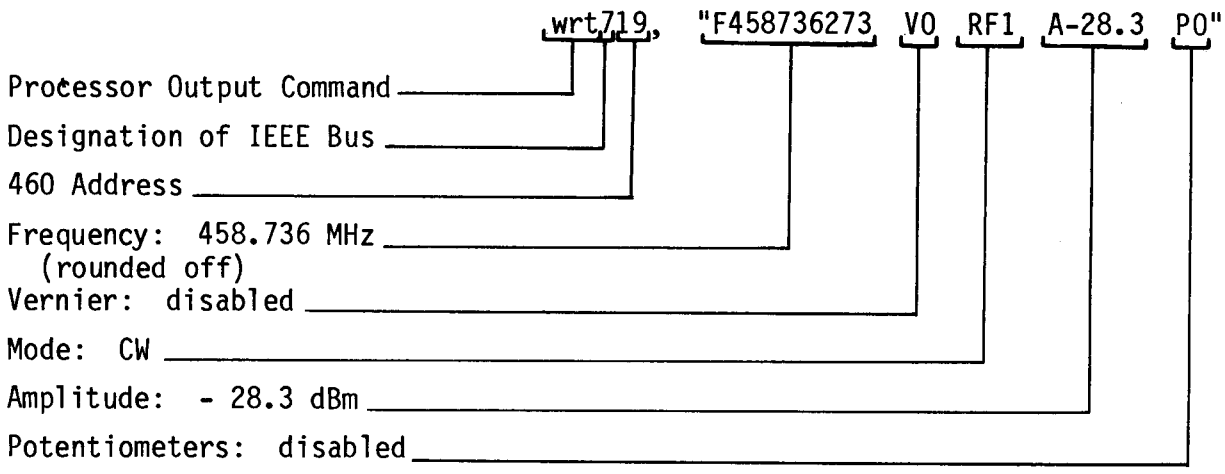
- "F" for the frequency
- "V" for the frequency Vernier
- "RF" for the functioning mode
- "A" for the output level
- "P" for potentiometer control.

In this examples, the output signal frequency is 458.736273 MHz and the output signal level is - 28.3 dBm.

Figure 3-8. Function Programming (Sheet 11 of 15)

OPTION 003

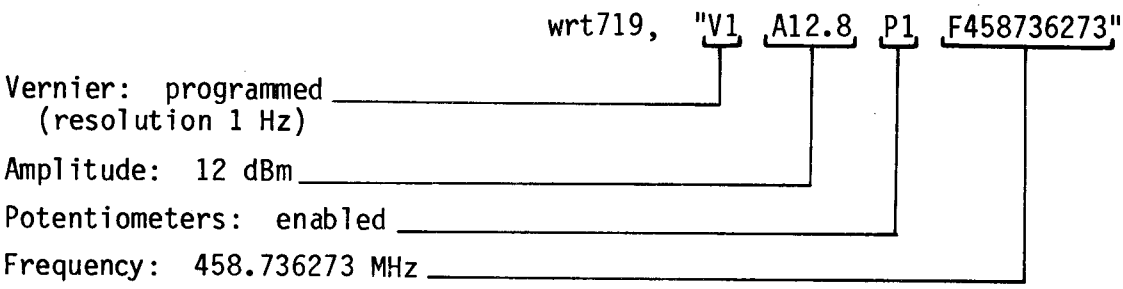
a) Program:



NOTE: The 460 ignores digits following a comma or a space. As the frequency is not a multiple of a resolution (see page 3-25), it is rounded off. As the potentiometer control mode is not programmed, it is taken as P0.

NOTE: By programming "V2", the output frequency may be defined by an external analog control signal input to connector (31) on the rear panel.

b) To modify the parameters V, P, A and F, programs:



NOTE: The output frequency corresponds to the programmed value, as the Vernier is used in programmed mode, providing 1 Hz resolution.

The output level is 12 dBm plus or minus the value corresponding to the setting of Vernier (13) .

The enabling of potentiometer (13) cancels the programming of the 0.1 dB steps.

Figure 3-8. Function Programming (Sheet 12 of 15)

(B)-OUTPUT OF MODULATED SIGNAL

The parameters to be determined are:

- "F" for the frequency
- "V" for the Vernier
- "FM" or "PM" for frequency or phase modulation
- "AM" for amplitude modulation
- "RF" for operating mode
- "P" for potentiometers
- "%" for the modulation depth
- "D" for the FM or PM deviation.

The example applies to the modulation of a signal at 350.245750 MHz at a level of 10.7 dBm.

Figure 3-8. Function Programming (Sheet 13 of 15)

OPTION 003 - AMPLITUDE MODULATION

Program:

wrt719, "F35024.5750e4, V1, AM3, RF2, A10.7, P0, %55"

- Frequency: 350.245750 MHz
- Vernier: programmed (resolution 1 Hz)
- Modulation: external a.c.-coupled signal
- Mode: modulated
- Level: +10.7 dBm
- Potentiometers: disabled
- AM level: 55%

NOTE: The output frequency corresponds to the programmed value, as the Vernier is used in programmed mode, providing 1 Hz resolution.

The AM level and the 0.1 dB output level resolution can be programmed as potentiometer control is disabled.

OPTION 003 - FREQUENCY MODULATION

Program:

wrt719, "V0, RF2, A10.7, FM33, P1, F3.50245750e8"

- Vernier: disabled
- Mode: modulated
- Level: + 10 dBm
- Modulation: external a.c.-coupled signal, deviation ± 300 kHz
- Potentiometers: enabled
- Frequency: 350.245500 MHz

NOTE: As the potentiometers are enabled, the output level resolution must be 1 dB.

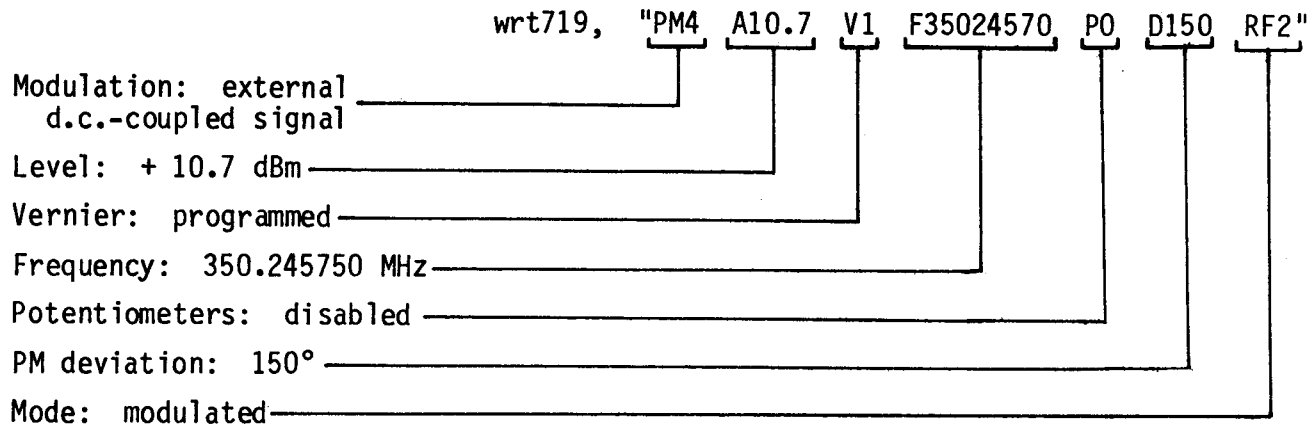
The output frequency is rounded off as it is not a multiple of the frequency resolution.

Simultaneous AM and FM modulation can be applied by programming both parameters.

Figure 3-8. Function Programming (Sheet 14 of 15)

OPTION 003 - PHASE MODULATION

Program:



Note: Simultaneous AM and PM modulation can be applied by programming both parameters.

Figure 3-8. Function Programming (Sheet 15 of 15)

SELF-TESTING

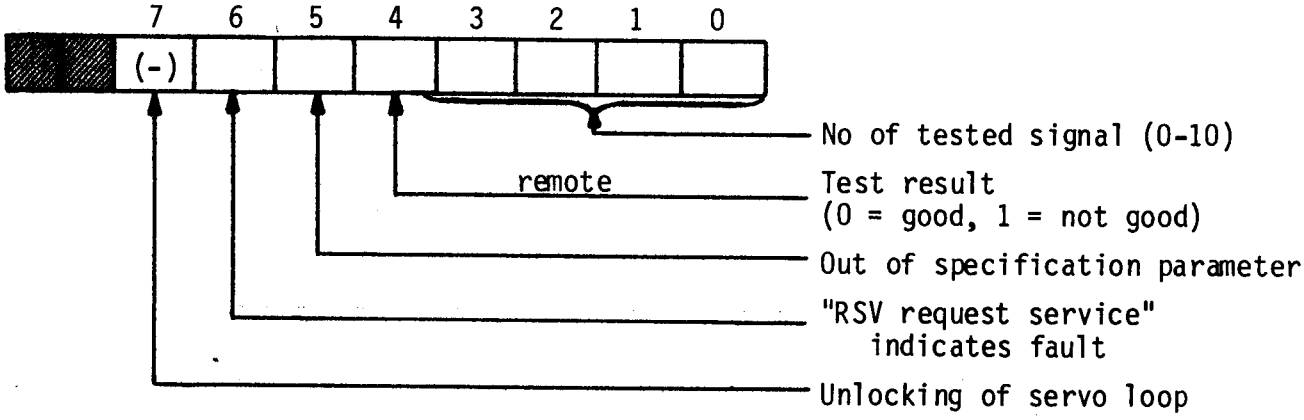
STATUS

The instrument provides function SR1 (IEEE standard 488).

It outputs the SRQ signal (service request) on the bus when either of the following 2 conditions occurs:

- out of specification parameter programmed (e.g. F1 e9 if the frequency-doubling option is not included);
- unlocking of synthesis loops, indicated by "-" flashing in display.

The controller can then request a status byte using the serial Polling proceeding. The status byte has the following format:



TEST

The 460 signal generator includes a self-testing facility for easing maintenance operations and for preventing misoperations on the part of the user. To this end the self-testing facility tests the 3 servo loops and the principal internal signal levels:

- a steady "-" at the most significant end of the display in local mode indicates that the user is attempting to operate the instrument outside its specification (frequency < 300 kHz);
- a flashing "-" indicates an internal fault (unlocking of one of the 3 loops). The local or programmed test procedure must then be run.

Using this test facility requires the preliminary setting of output frequency, output level and functional mode to 79 MHz, + 13 dBm and CW.

Figure 3-9. Self Testing (Sheet 1 of 4)

MANUAL (LOCAL) TEST

a) Remove the top panel of the instrument and set the TEST switch of the REGISTER board (See figure on page 3-38)

b) The number of the test point being checked and the results are displayed on the 10^0 - 10^2 Hz bits of display 1

c) Switch on the resolution indicator lamp "0" by operating pushbuttons (24) , and then operate pushbutton (22) to increment or decrement the number of the tested signal (0 - 10).

d) The units and tens digit of the frequency display indicate the number of the signal under test, the result of the test being indicated by the third digit:

- off: signal correct
- on: signal degraded.

The test points are listed below, and are indicated on Figure 4-5.

00: Input level of 2 MHz reference signal or 2 MHz $\pm$ F from vernier control.

01: Output level FP/40 (from 10 MHz step module).

02: Output level of 10 MHz step module.

03: Output level of AMPLIFIER module.

04: Output level of 20 - 25 MHz module.

05: Output level FS/40 (VHF module).

06: 400 MHz output level (10 MHz step module): this signal is only enabled when the output frequency exceeds 80 MHz.

07: Level of difference frequency (20/25 MHz) derived from 300/670 MHz and 320/650 MHz oscillators (VHF module).

08: 1 kHz control frequency of 20/25 MHz oscillator.

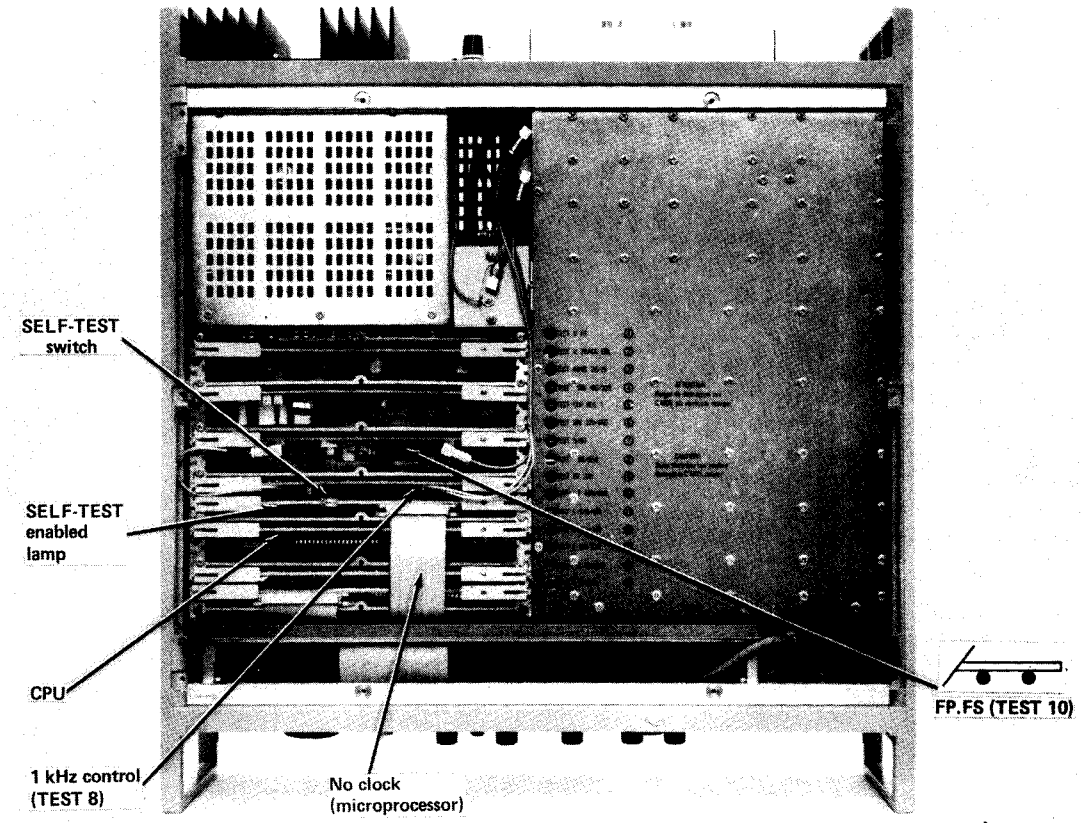
09: Level of 4 MHz difference frequency (phase-frequency comparator board).

10: FS and FP servo control (counter board).

For ease of maintenance and so as to offer improved efficiency, the instrument comprises internal indicator lamps which complement the self-testing facility by indicating the absence of the required level at certain test points, determining the faulty signal (FP or FS) for test 10 and indicating the operating state of the microprocessor.

Figure 3-9. Self-Testing (Sheet 2 of 4)

The diagram below shows the positions of these test lamps and the "TEST" switch:



The "CPU" indicator lamp flashes during each intervention by the microprocessor, the scanning phase being triggered by any operation of the front panel control.

The "no clock" indicator lamp comes on if the clock signal of the controlling element is incorrect.

The "1 kHz control" indicator lamp comes on when test 8 gives a negative result.

When the result of test 10 is negative, the lamps "FP-FS" indicate the signal providing the locking of the loop. The FS lamp comes on when the signal obtained from the 320/650 MHz oscillator is incorrect. Both lamps come on to indicate a fault in the signal from the 300/670 MHz oscillator.

When the fault has been located, return the TEST switch to its initial position, in which case the test lamp should go out.

Figure 3-9. Self Testing (Sheet 3 of 4)

PROGRAM (REMOTE) TEST

The instrument is interrogated via the controller, as follows:

a) Program the MNEMONIC PREFIX "T" followed by a number from 0 to 10.

b) The serial polling status is read off from bit 4 of the status byte, a "0" indicating no fault and a "1" indicating a fault at the level being tested.

Figure 3-9. Self Testing (Sheet 4 of 4)

SECTION 4

OPERATING PRINCIPLES

4.1 INTRODUCTION

This section sets out a simplified description of the principal frequency generator circuits of the 460 Signal Generator, indicating the points at which the AM, FM or PM modulation is applied and the output level regulation effected.

The section ends with a description of the structure and operation of the microprocessor.

The general block diagram of the 460 and the circuit diagrams for the various modules and circuit cards are contained in Figure 4-5 and Figures 5-1 through 5-23.

4.2 OPERATION PRINCIPLES

The 460 Signal Generator provides a very high level of spectral purity comparable with that of an LC resonant circuit or cavity resonator with a high overvoltage coefficient or with that obtained using indirect frequency synthesis.

An oscillator with a high overvoltage coefficient (a precondition for a high level of spectral purity) generates the small frequency steps whereas a digital control loop provides the frequency programming function and is responsible for the accuracy and stability of the output frequency.

The larger frequency steps are generated in a circuit using frequency synthesizer techniques, based on new technology made possible by the relatively small number of steps to be generated, and built around very low noise circuits. This means that only low multiplication ratios are needed, in conjunction with a very pure reference source.

The 460 signal generator therefore comprises a short-term free-running oscillator operating at 20 to 25 MHz, with long-term control from a quartz crystal oscillator, this section being followed by a frequency synthesizer offering high spectral purity which provides the larger frequency steps and extends the frequency range to 650 MHz without degrading the spectral quality of the 20 to 25 MHz oscillator. A simplified block diagram of the frequency generation system is given in figure 4-5.

The output frequency lies in one of 4 sub-ranges, the microprocessor providing an automatic range-switching function.

A wideband oscillator covers the frequency range from 320 to 650 MHz, which is divided down by 2 or 4 to generate the 160/320 MHz band and the 80/160 MHz band. The 0.3/80 MHz band is obtained by heterodyning the fixed frequency of the 400 MHz and the oscillator frequency which, in this instance, is variable between 480 and 400 MHz.

The output oscillator is included in the frequency increment control loop, and is controlled through two mixers by a signal obtained by addition or subtraction of the frequencies obtained at the outputs of two other oscillators, the "20 to 25" MHz" oscillator and the "300 to 670 MHz" oscillator.

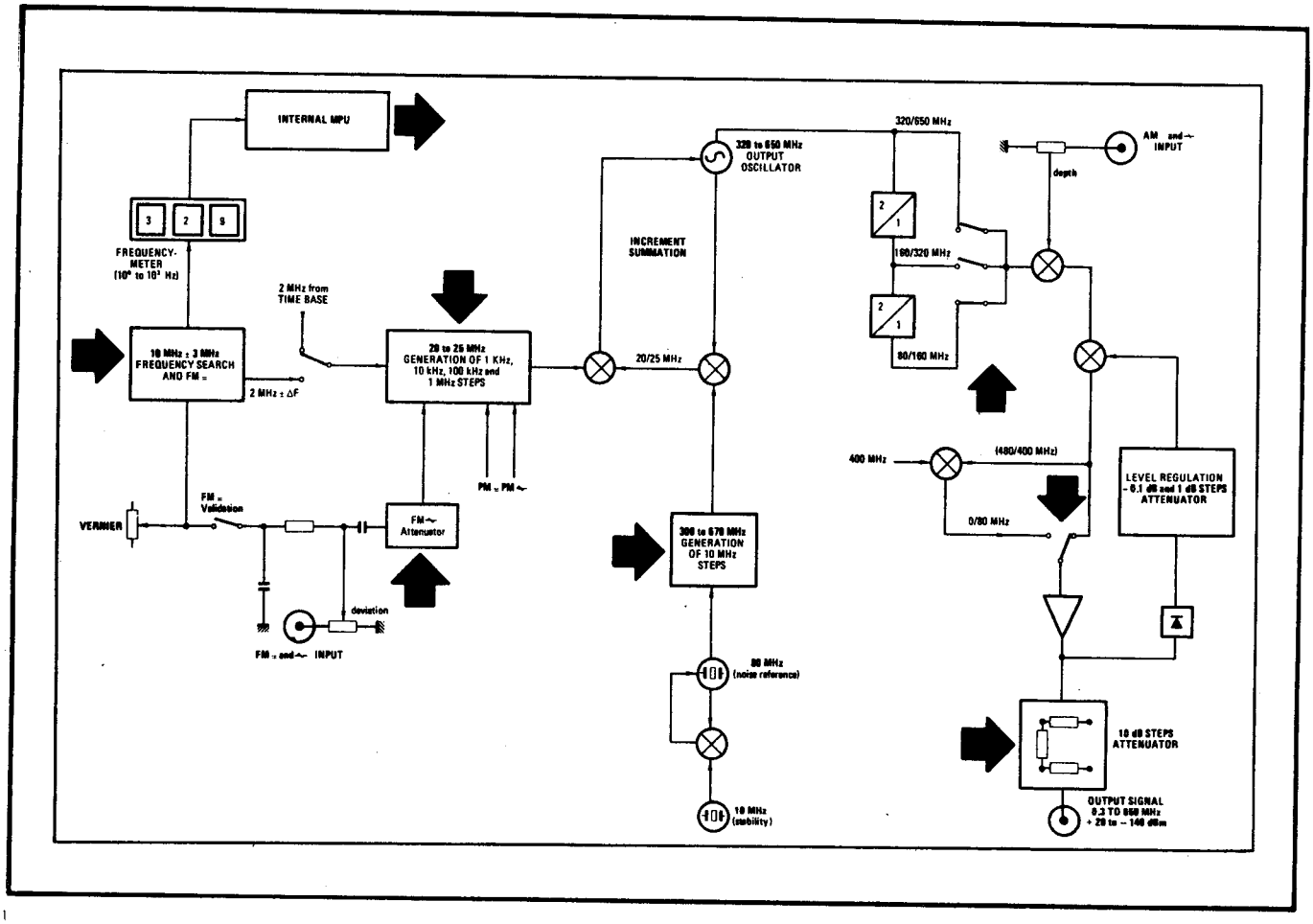


Figure 4-1. 460 Signal Generator Block Diagram

4.3 GENERATION OF SMALL FREQUENCY STEPS

The 20 to 25 MHz oscillator is in reality implemented as an 80/100 MHz oscillator operating in conjunction with a "divide by 4" circuit (refer to figure 4-5). This oscillator generates the small frequency steps (1 kHz, 10 kHz, 100 kHz and 1 MHz). The maximum resolution of the loop is in reality 500 Hz. In conjunction with the use of a microprocessor, this provides a frequency step of 12.5 kHz corresponding to the standard channel spacing and also means that the same output resolution is obtained in the direct output range (up to 650 MHz) and in the extended range when the frequency doubler option is included (up to 1300 MHz).

The 20 to 25 MHz circuit comprises two interleaved loops, the frequency steps being programmed by means of a counter with a high division ratio. The control loop for the 80/100 MHz oscillator (20 to 25 MHz) can therefore have a small pass-band (5 Hz), so that alternating FM modulation can be applied directly at the oscillator output. The deviation ranges $\pm$ 3 kHz, $\pm$ 30 kHz and $\pm$ 300 kHz obtained by analog division are maintained constant throughout the frequency band (0.3 to 650 MHz) by means of correction circuits which are enabled by the microprocessor.

Phase modulation is also provided by this "20 to 25 MHz" circuit, operating on the 80/100 MHz oscillator with AC input coupling or on a phase comparator with DC coupling. The phase deviation is also constant across the whole of the frequency band.

The same comparator can be switched to receive the frequency 2 MHz $\pm$ ΔF from the interpolation circuit and to introduce into the frequency generation loop small discrete frequency variations produced by operating the vernier control on the front panel.

The maximum excursion (5 MHz) of the 20 to 25 MHz oscillator is insufficient for generation of all steps equal to or less than 10 MHz (i.e. maximum excursion of 9.999 999 MHz). This involves setting the latter in the direct spectrum from 20 to 25 MHz and then in the inverted spectrum from 25 to 20 MHz. This feature, in conjunction with automatic switching of the 10 MHz steps (obtained from the 300 to 670 MHz oscillator) and with the cutting out of the 320 to 650 MHz oscillator prevents the appearance of transient signals at the generator output during frequency changing. The setting in the inverted spectrum requires switching over certain circuits so as to maintain various parameters in the same deviation sense as the 20/25 MHz frequency. All these operations, indicated symbolically in figure 4-5 by bold arrows, are automatically carried out by the microprocessor each time the operating mode is changed (32/58 MHz oscillators, comparators, FM correctors, etc.).

4.4 GENERATION OF 10 MHz STEPS

The wideband 300 to 670 MHz oscillator generates the 10 MHz steps across the whole frequency band using a sample and hold comparator. This loop actually provides only fine control of the oscillator, an approximation of the operating frequency being obtained by a first loop which is enabled by the microprocessor.

The sampling is obtained as shown in figure 4-5 on the difference frequency between the 300 to 670 MHz output frequency of the oscillator and the frequency obtained at the output of the filter whose tuned frequency is switched by the microprocessor. The 10 MHz sampling frequency is obtained from the 80 MHz output frequency of the quartz-controlled oscillator used as the noise reference, the 10 MHz oscillator providing the medium and long-term stability characteristics of the instrument.

The microprocessor monitors the operation of this oscillator and the 10 MHz step generator, forcing it to take account of the operating mode of the 20/25 MHz oscillator (direct or inverse), to provide continuous frequency variation of the

output oscillator frequency (320 to 650 MHz). This amounts to saying that the latter is sometimes controlled in accordance with an additive difference frequency and sometimes in accordance with a subtractive difference frequency.

The three oscillators therefore operate as follows, where:

- F_1 is the frequency: 20/25 MHz
- F_2 is the oscillator frequency: 300/670 MHz, and
- F_3 is the oscillator frequency: 320/650 MHz.

If the additional frequency F_2 is, for example, 320 MHz and F_1 varies from 20 to 25 MHz, the output oscillator frequency F_3 will increase from 340 to 345 MHz. In this instance, the control is based on the additive difference frequency between F_1 and F_2.

As soon as F_1 reaches 25 MHz, F_3 is locked at 345 MHz by the microprocessor, which simultaneously switches F_2 to 370 MHz. Control is thereafter based on the subtractive difference frequency between F_2 and F_1, so that F_3 varies from 345 to 350 MHz, continuously without generation of transience.

F_1 then operates in direct output again, from 20 to 25 MHz, F_3 being locked at 350 MHz and F_2 being switched to 330 MHz. The control of the output oscillator is based on the additive difference frequency between F_1 and F_2, F_3 varying from 350 to 355 MHz. This process is repeated across the whole frequency band of the signal generator.

Thus it will be seen that the output frequency of the 300/670 MHz oscillator switches to a value 50 MHz higher as soon as the small frequency step oscillator output reaches 25 MHz, subsequently switching to a value 40 MHz below the usual frequency when the output of this oscillator reaches 20 MHz. The frequency difference (10 MHz) between these 2 switching operations corresponds to the small frequency step increment (9.999 999 MHz).

4.5 FREQUENCY INTERPOLATION (VERNIER CONTROL)

Continuous variation of the frequency between the 1 kHz steps is obtained from a free-running oscillator operating at 10 MHz $\pm$ 3 MHz, the output frequency of which is divided down by a factor of 500, this division process reducing the instability of the oscillator by the same factor. The interpolation frequency is set on the basis of information sent to the microprocessor by a frequency meter, the microprocessor adding this to or subtracting it from the programmed small step value (20/25 MHz oscillator), knowing that the steps introduced by the interpolation circuit are between 0 and 1 kHz for the output range 320/650 MHz, 0 and 2 kHz for the range 160/320 MHz and 0 and 4 kHz for the range 80/160 MHz. For this reason, the maximum variation of the signal generator output frequency is, after all the various dividing down operations, approximately 2 kHz. When the instrument includes the frequency doubling option, the frequency variation introduced by the interpolation circuit is between 0 and 500 Hz for an output variation of 0 to 1 kHz.

This circuit also enables frequency modulation with transmission of the continuous component, the division ratio varying, as shown on figure 4-5, as a function of the deviation range ± 3 kHz, ± 30 kHz and ± 300 kHz. The vernier is operative at all times for compensating the output frequency due to any carrier offset caused by re-injection of the continuous component, the frequency meter indicating the exact mean output frequency. Continuous frequency modulation is obtained by transmitting the modulating signal to the interpolation circuit (signal integrator) and to the 20/25 MHz oscillator (signal differentiator), the connection being perfect at 5 Hz.

4.6 OUTPUT CIRCUITS

The output frequency is in one of the ranges 320/650 MHz, 160/320 MHz and 80/160 MHz, and is selected by the microprocessor. It is applied directly to the inputs of the AM modulating circuits and to the input of a first regulator responsible for the insertion of the 0.1 dB and 1 dB program steps. An internal switch is used to select the 80/650 MHz or the 0.3/80 MHz range, the output frequency being obtained through the output amplifier and the 10 dB step attenuator.

4.7 MICROPROCESSOR AND ASSOCIATED LOGIC CIRCUITRY

The instrument is controlled by a microprocessor, figure 4-5 being a schematic representation of the internal control functions.

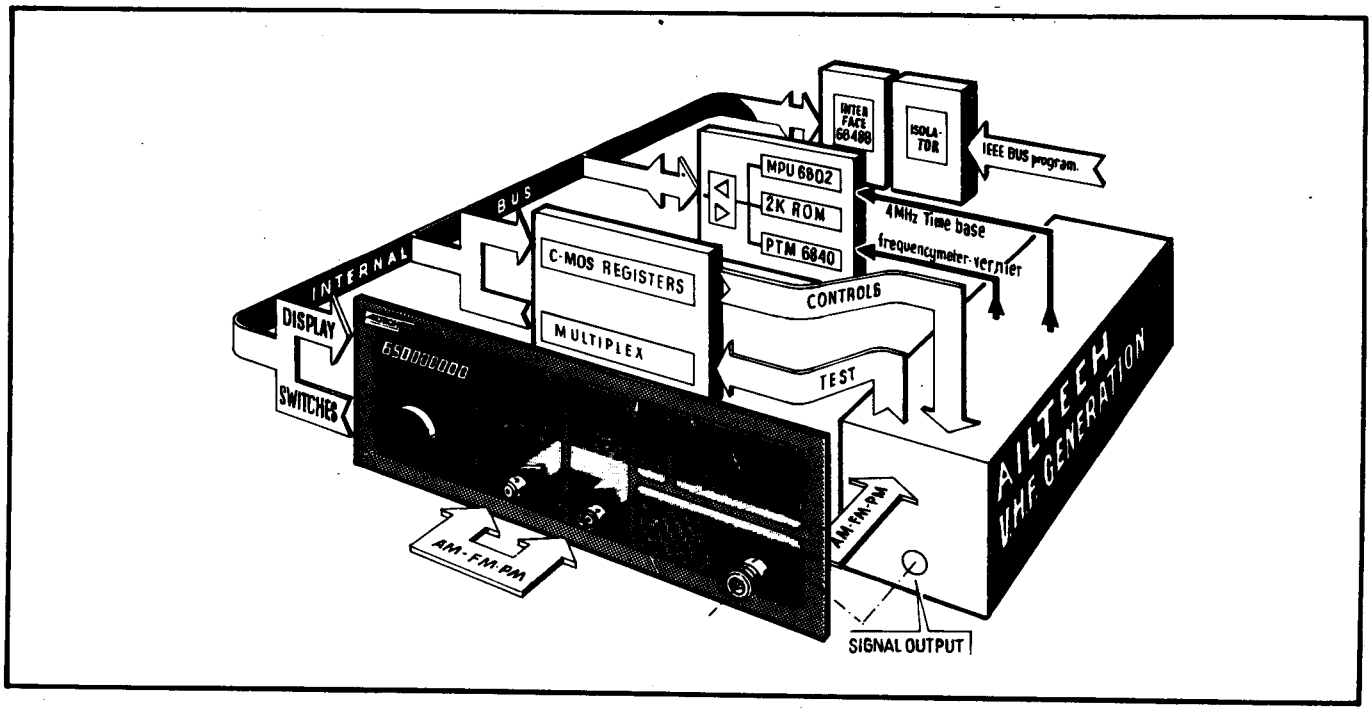


Figure 4-2. Microprocessor-Based Internal Control Functions

4.8 DESCRIPTION OF THE HARDWARE STRUCTURE

The internal control system comprises 7 separate functions, implemented on 7 circuit cards:

a) The "PROCESSOR" card comprises the 6802 microprocessor with 128 bytes of RAM storing data representing all operating modes of the instrument (frequency, level, switch settings, etc.). The microprocessor programs are written into a 2708 ROM, occupying between 2 and 3 kilobytes, depending on the options included in the instrument. The program describes all the computations and other functions to be executed when a new command is received. A 6840 programmable counter acts as a frequency meter for the interpolation frequency oscillator (10 MHz $\pm$ 3 MHz), the other associated circuits providing miscellaneous functions such as power down and power up detection. The logic circuitry external to this card is connected to the microprocessor via the internal bus of the instrument, through tristate gates.

b) The "FRONT PANEL SWITCHES AND DISPLAYS" card carries all the manually operated controls and associated displays (switches and optical coding wheel for frequency selection). An interrupt circuit informs the microprocessor of any change in the setting of any control.

c) The "REGISTER" card holds circuits storing the command bits for the HF and VHF subsystems and the tristate gates for entry of signals tested by the microprocessor.

d) The "COUNTER" card holds the two programmable counters for the frequency synthesizer function (32000 to 58000 and 30 to 67 counters). This card is connected to the CPF card for control of the various oscillators.

e) The "ANALOG FRONT PANEL" card carries the circuits for processing the AM and FM modulating signals, the level regulator and the vernier control circuit.

f) The "IEEE PROGRAMMING BUS" card enables the instrument to be programmed from a computer with an IEEE 488 or IEC TC66 interface, and also provides galvanic isolation between the signal generator and computer earth circuits.

g) The "COMPLEMENTARY PROGRAMMING" card is used in conjunction with the "IEEE programming bus" card for programming the AM modulation level and the FM frequency deviation, using 2 digital-analog converters, the 1 Hz step vernier being programmed through the programmable counter controlling the operation of the frequency interpolation circuit.

4-9 OPERATION

When the microprocessor has carried out all its tasks, it switches to a standby state which is interrupted only by a change in the setting of any of the external controls. It therefore has no function in terms of the generation of the output frequency.

However, as soon as a "stop" command is received, the microprocessor interrogates all interrupt sources to identify which one is active. It then processes the various operations to be carried out in accordance with received commands, and sends new states to the instrument and the display. A general block diagram of the various operations is set out in figures 5-1 and 5-2, the first showing the PRINCIPAL LEVEL at which the various computations and I/O operations are carried out, the second showing the INTERRUPT LEVEL used for identifying the cause of the interrupt which is simply listed by the setting of an indicator which is interrogated when the microprocessor has terminated the interrupted task.

GLOSSARY

BIT:	Smallest unit of binary data (contraction of BInary digiT)
BYTE:	A "word" comprising 8 "bits"
RAM:	Random Access Memory
ROM:	Read Only Memory
WORD:	A set of binary digits which operate as a unit and which represent a number.

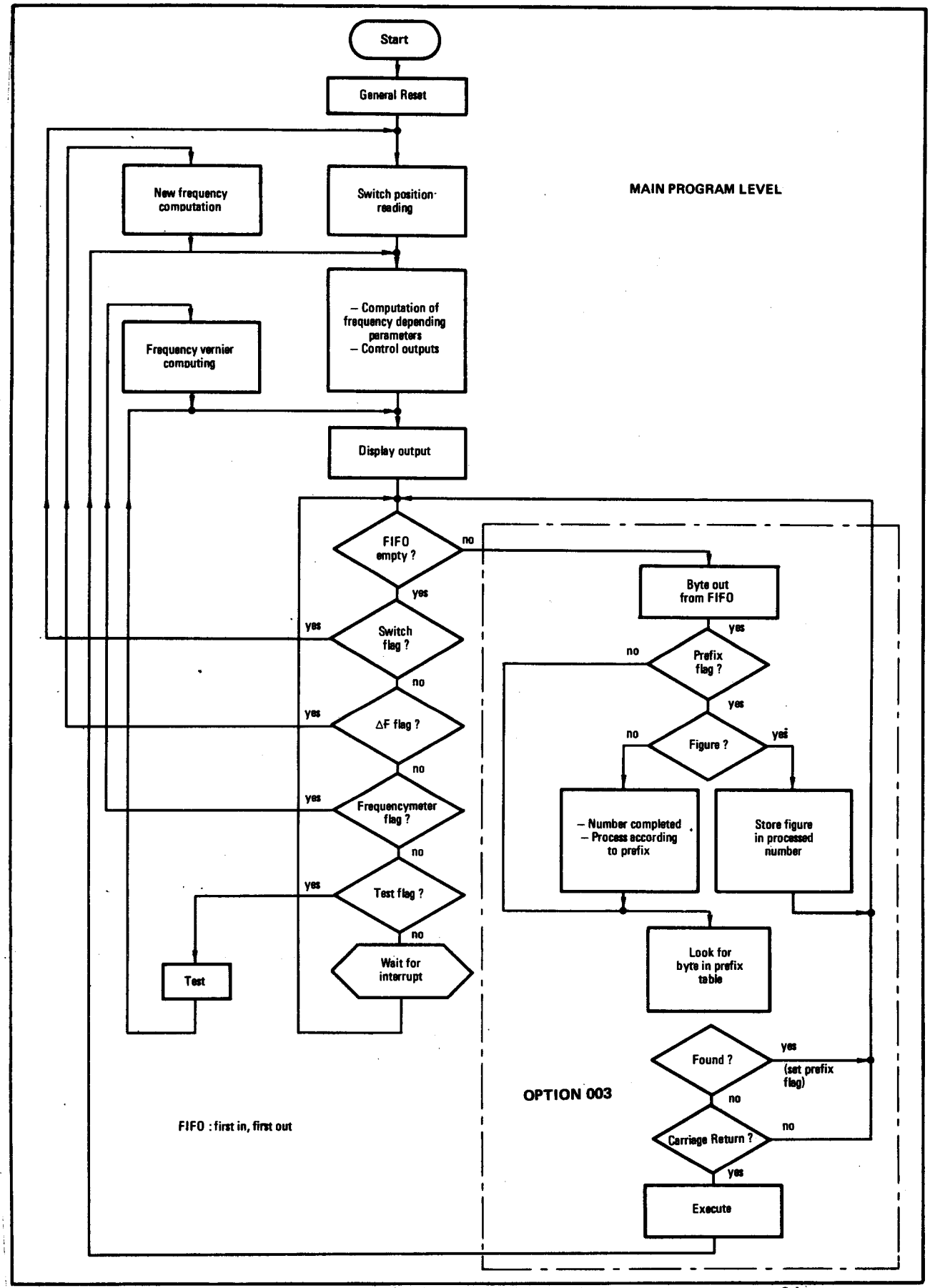


Figure 4-3. Microprocessor Flow Chart (Main Program Level)

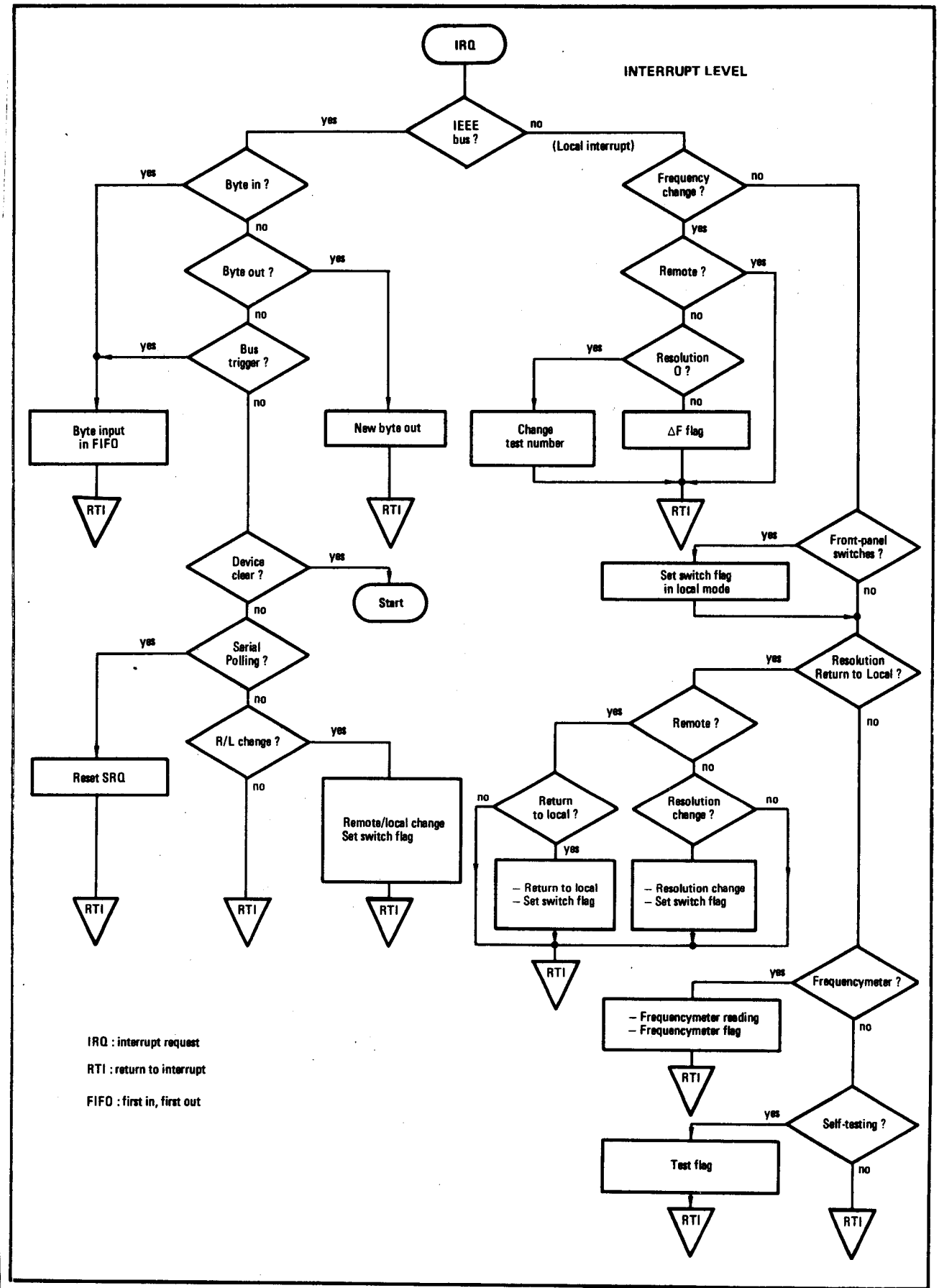


Figure 4-4. Microprocessor Flow Chart (Interrupt Level)

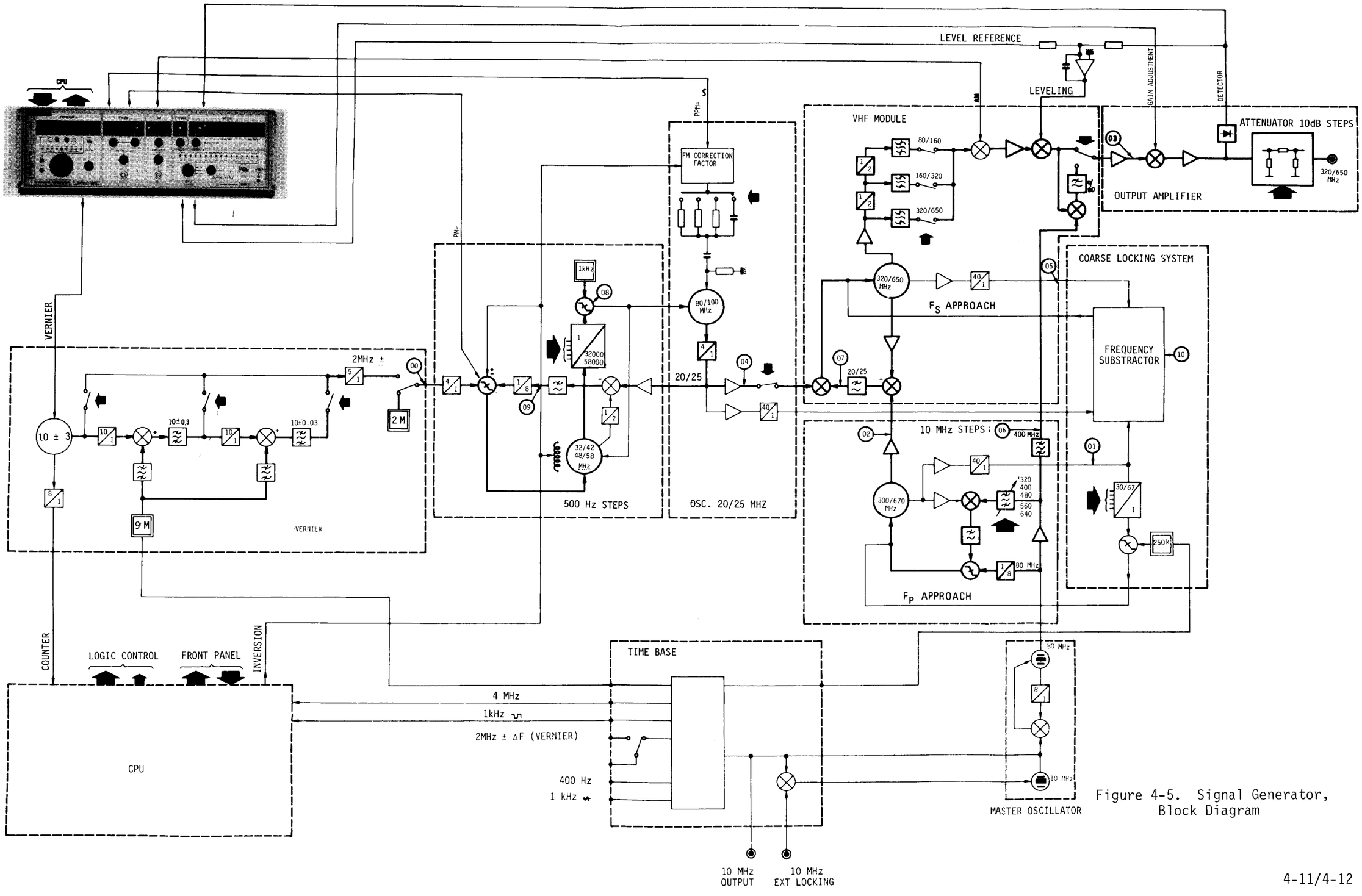


Figure 4-5. Signal Generator, Block Diagram

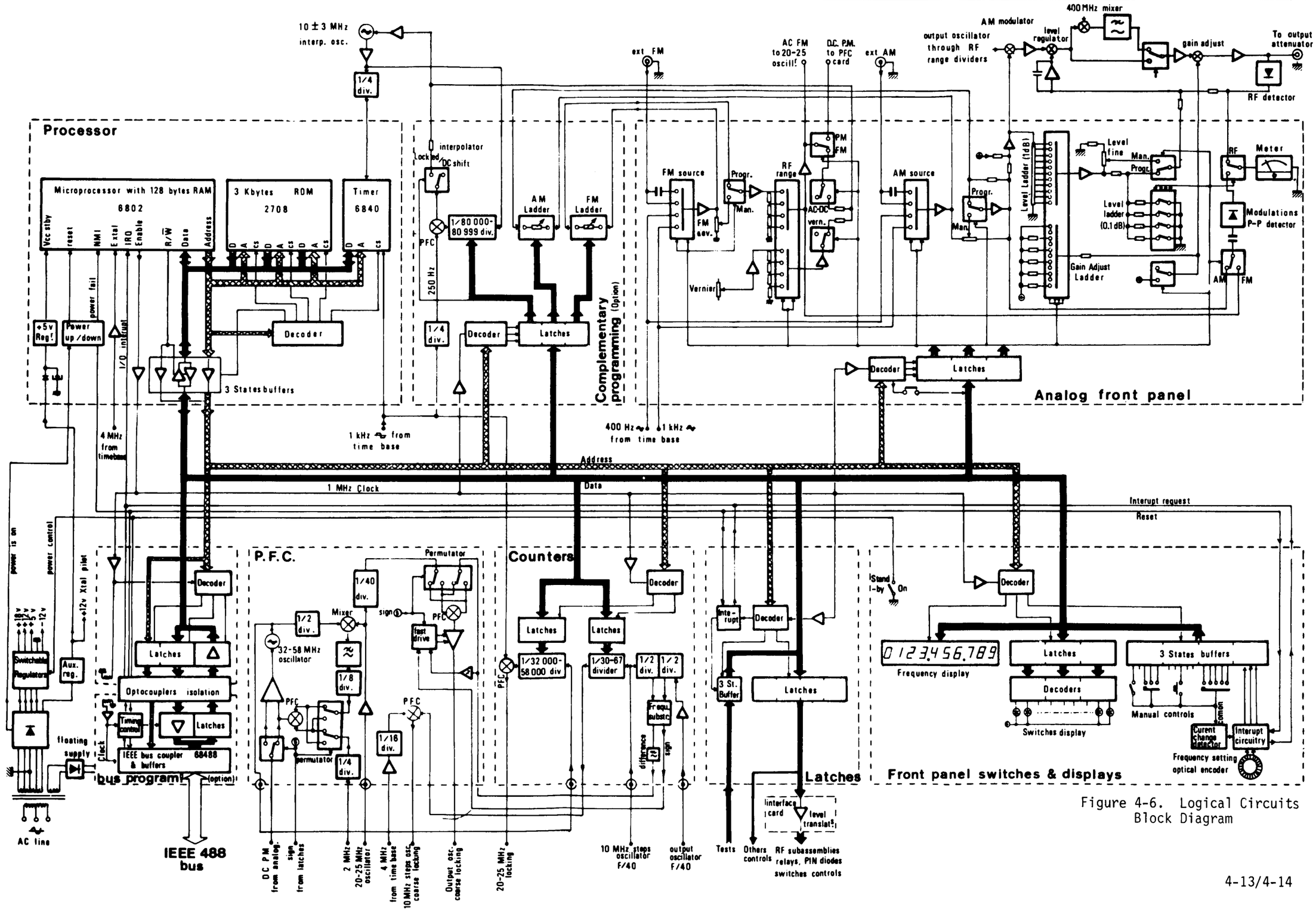


Figure 4-6. Logical Circuits Block Diagram

SECTION 5

SERVICE

5.1 CARD AND MODULE REPLACEMENT

This section describes the procedures to be followed for the removal and replacement of circuit cards and modules in order to avoid damage to them. Refer to Figures 5-1 through 5-23.

The description begins with the circuit cards and ends with the HF and output modules. Precaution must be taken to avoid damage to the bypass connections on the module mounting plate.

5.2 CARD REPLACEMENT

Open the top panel to gain access to the inside of the equipment. The circuit cards are numbered from 1 to 8. Card number 1 is nearest the power supply unit. To replace the Interface card it is necessary to remove the rear panel of the generator.

5.3 Interpolator Card (Continuous FM) Figure 5-1.

- Remove card 1 using PC board extractors.
- Insert replacement card.

5.4 Time Base Card Figure 5-2.

- Remove card 2 using PC board extractors.
- Insert replacement card.

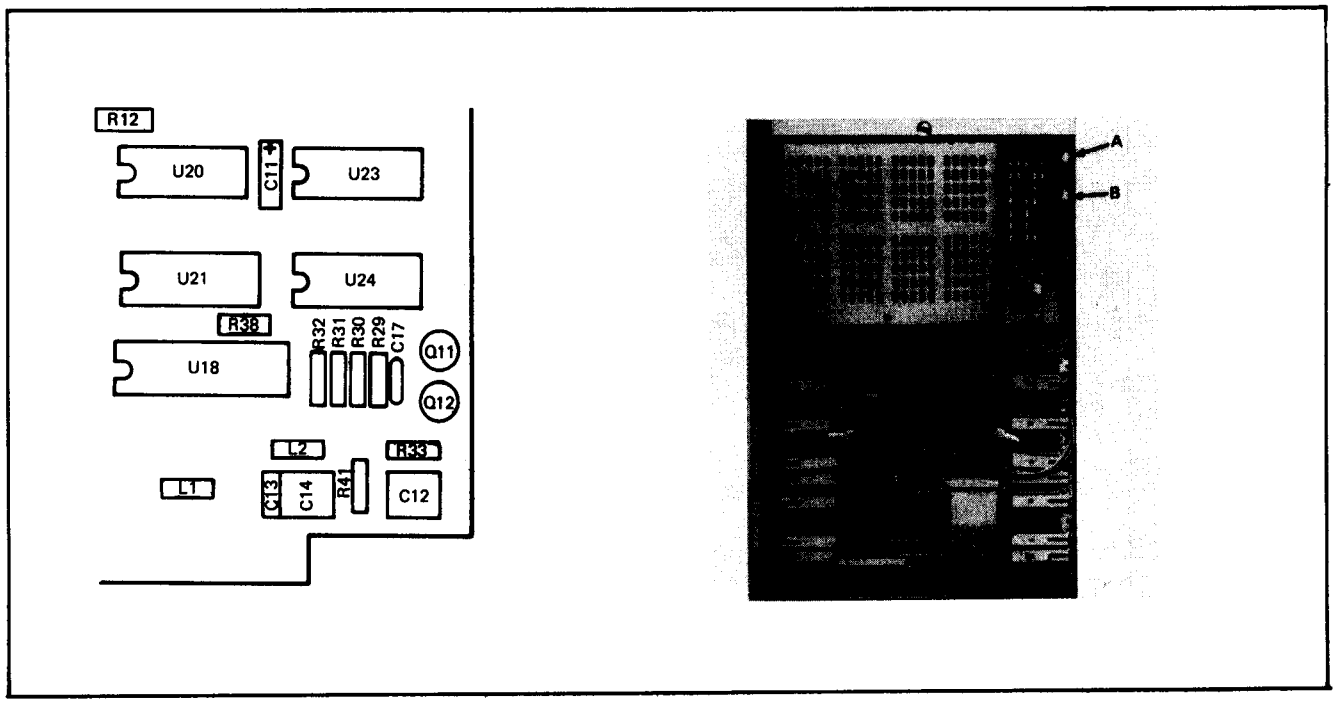
5.5 Comparator Card (CPF) Figure 5-3.

- Unplug the two coaxial connectors (the lefthand connector connects to the counter card, the righthand connector to the 20 to 25 MHz module).
- Remove card 3 using PC board extractors.
- Insert replacement card.
- Plug in the coaxial connectors.

5.6 Counter Card Figure 5-4.

- Unplug the lefthand coaxial connector from Comparator card 3 (CPF).
- Disconnect the relay panel located behind the pilot module, so as to release the coaxial connections to the Counter card.

- Disconnect the ribbon cable to the five registers.
- Pull card 5 halfway out. This will avoid damaging capacitor C17 when withdrawing the Counter card.
- Remove card 4 using PC board extractors.
- Insert the replacement card and then Register card 5.
- Replace the connectors:
  . lefthand coaxial connection to card 3
  . righthand coaxial connection to relay panel, as shown on diagram (A to A and B to B).



5.7 Register Card Figure 5-5.

- Remove the ribbon cable from the Interface card.
- Remove card 5 using PC board extractors.
- Insert the replacement card and remake the ribbon connection.

5.8 Microprocessor Card (CPU) Figure 5-6.

- Remove the ribbon cable to the Register card 5.
- Remove card 6 using PC board extractors.
- Insert the replacement card and remake the ribbon connection to the Register card 5.

NOTE: Check that the replacement card is fitted with memory modules ROM1 and ROM2 (and ROM3 if the unit includes programming option 003).

5.9 IEEE Option Card #1 Figure 5-7.

- Remove the ribbon cable to Register card 5.
- Remove card 7 using PC board extractors.
- Insert the replacement card and remake the ribbon connection.

5.10 IEEE Option Card #2 Figure 5-8.

- Remove the ribbon cable to Register card 5 and card 8.
- Remove card 8 using PC board extractors.
- Insert the replacement card and remake the ribbon connections:
  - ⟶ the first connects the Register card to the Interface card,
  - ⟶ the second connects the level and vernier options card to the programming connector board at the rear of the unit.

5.11 Regulator Card Figure 5-23.

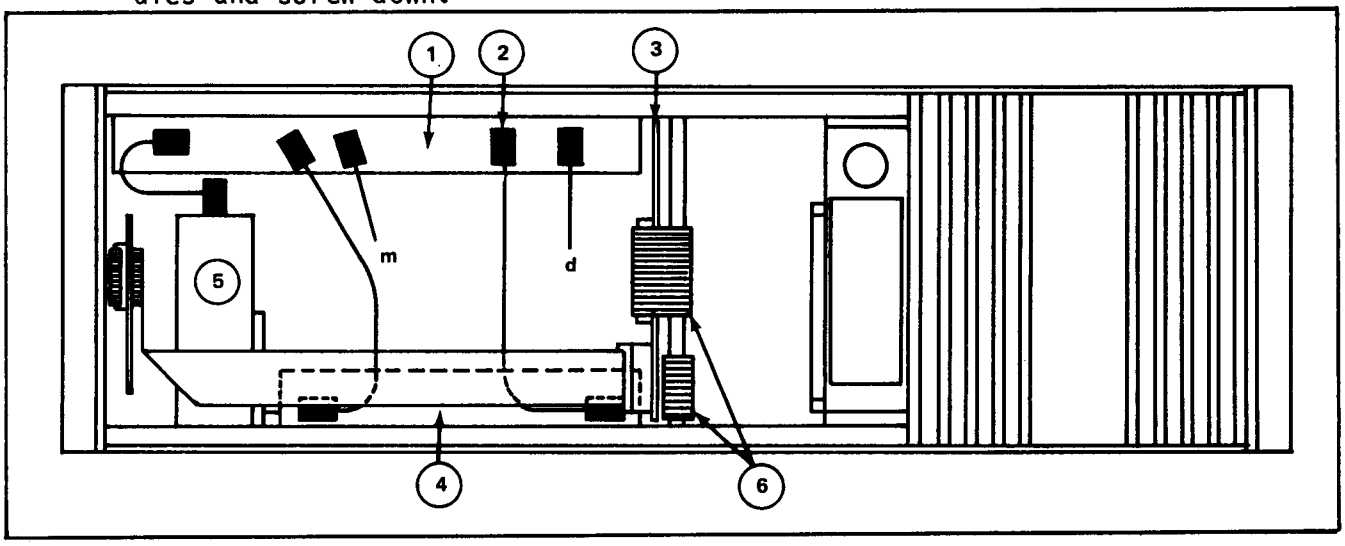
- Remove the retaining screws for the Regulator card/heat sink assembly from the rear panel of the unit, adjacent to the heat sinks.
- Pull out the card/heat sink assembly.
- Insert the replacement assembly and attach to frame using spring washers and 3 x 12 screws.

5.12 Interface Card Figure 5-14.

The Interface card is accessible from the rear of the unit.

- Remove the rear panel of the instrument by removing the eight 3 x 6 retaining screws. For instruments including the programming option, this operation can only be carried out after removing the External Connections unit which covers the rear panel retaining screws and is attached to the rear panel by means of four 3 x 6 screws.

- Remove the rigid coaxial connection between the VHF module and the 10 MHz step module in the vicinity of the Interface card (unscrew both ends).
- Remove the two ribbon connections, the center connection to the Register card and the lower connection to the Amplifier Control card.
- Remove the Interface card and insert the replacement card. As no guide is provided for this card, it must be inserted with great care to avoid damage to the connector.
- Replace the ribbon connections.
- Replace the rigid coaxial connection between the VHF and 10 MHz step modules and screw down.

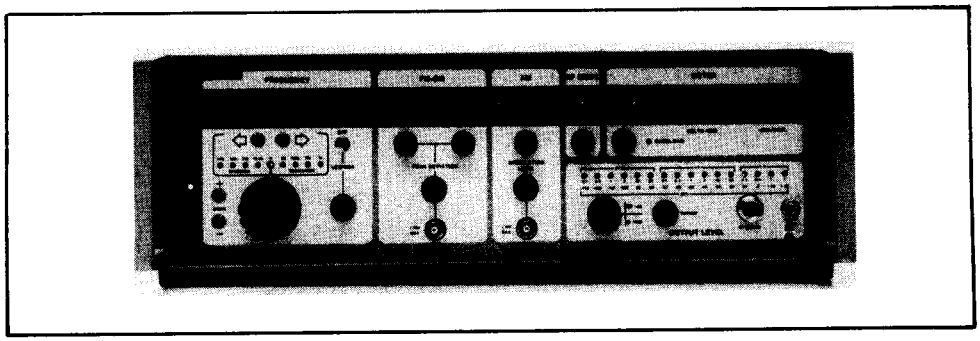


KEY TO DIAGRAM

1 VHF module	4 10 MHz step module
2 Rigid coaxial connection	5 Output Amplifier
3 Interface card	6 Flat cables

5.13 Analog Front Panel Card Figure 5-16.

- Remove the vernier knobs for the AM, FM - OM and level adjustment potentiometers by loosening the collet screws behind the knob caps.



- Disconnect the meter.
- Pull the card halfway out and remove the ribbon connection.
- Remove the coaxial connections and pull out the card.
- Insert the replacement card in the guides and replace the coaxial connectors, the longer connection terminating beneath the AM level adjustment potentiometer and the shorter connection terminating beneath the FM-OM deviation adjustment potentiometer.
- Replace the ribbon connection and push home the card, checking that there is a good ground connection between the metal-coated areas on the card and the card support slides.
- Reconnect the meter: red and black wires from analog front panel card to internal and external terminals, respectively.
- Replace the potentiometer knobs.

5.14 Switch Card Figure 5-17.

The replacement of this card is a relatively long procedure as it supports the front panel controls and signal lamps.

- Remove the analog front panel card (see above).
- Release the knurled head screw at the end of the amplifier/attenuator module.
- Remove the eight allen screws retaining the front panel assembly to the side flanges of the instrument.
- Remove the ribbon connection from the lower surface of the card.
- Remove the front panel assembly by pulling forward.
- Remove all control knobs except the frequency knob by loosening the respective collet screws.
- Remove the retaining net from each of the VERNIER and ON/STANDBY switches.
- Using the correct wrench, remove the retaining nut for the following switches:
  - FM-OM deviation
  - RF mode
  - Attenuator.

  This operation should be carried out carefully to avoid damage to the silkscreened front panel of the instrument.
- Remove the meter, support panel and TNC output connector.
- To fit the replacement card carry out the above operations in reverse order.

5.15 MODULE REPLACEMENT

To remove an HF module it is necessary to take off the top, bottom and rear panels of the instrument.

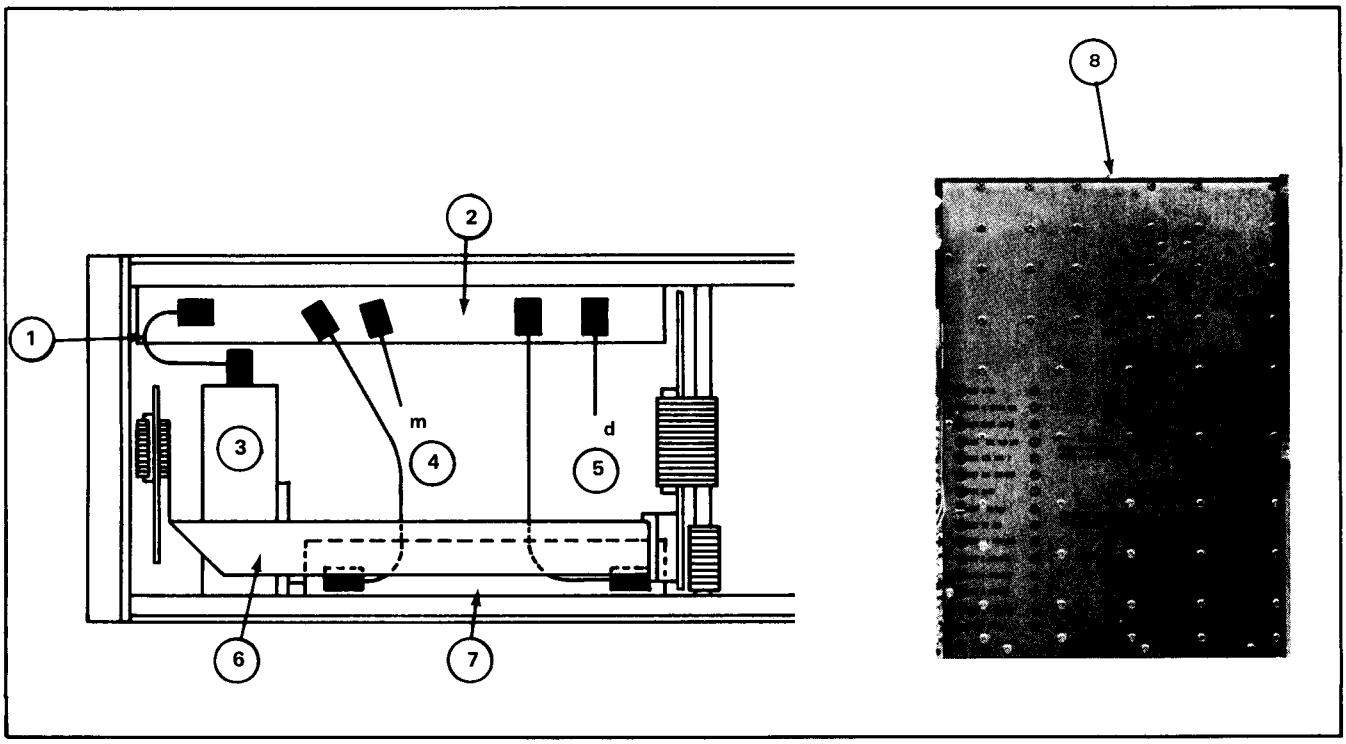
For instruments including the programming option, the rear panel can only be removed after the External Connection unit is removed, as this is located over the retaining screws.

5.16 80 MHz and 10 MHz Pilot Module Figure 5-15.

- Remove the flexible coaxial connection to the module, after releasing the locking ring.
- Remove the two screws holding the module onto the supporting circuit card.
- Remove the faulty module and replace with substitute module.
- Attach the module to the supporting circuit card using spring washers and two 4 x 8 screws.
- Replace the coaxial connector and screw down.

5.17 VHF Module Figure 5-10

- Remove the side panel on the right hand side of the instrument (adjacent to meter).
- Unscrew and remove the rear connections to the module, taking care to avoid damage to the rigid coaxial connections.
- Remove the retaining screw and washer at the side of the module.
- Remove the six retaining screws indicated on the diagram below from the top panel of the instrument.
- Lift out the module, taking care to avoid knocking it against any adjacent circuit cards and modules.
- Fit the replacement module and attach to top panel using six 3 x 6 screws.
- Replace lateral attachment: M4N washer and 4 x 12 screw.
- Replace and screw down rear connections (see diagram) and check that the flexible connections have not been reversed (refer to exploded view of 460).



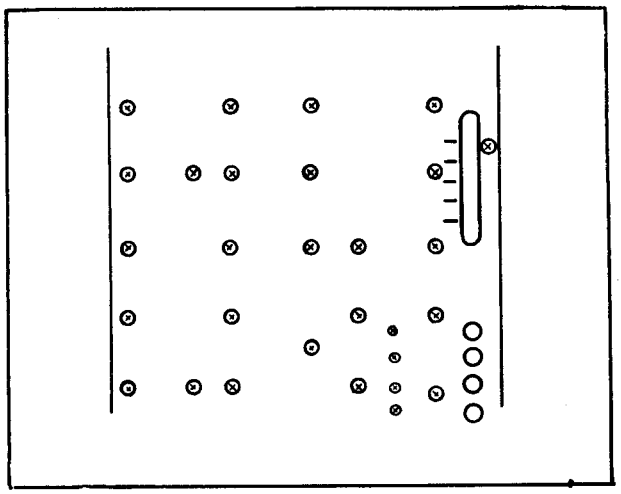
KEY TO DIAGRAMS

1	Lateral attachment	5	From front panel
2	VHF module	6	Flat cable
3	Output Amplifier	7	10 MHz step module
4	From VHF	8	Silkscreened cover

5.18 10 MHz Step Module Figure 5-11

The 10 MHz Step module is mounted in the lower part of the instrument adjacent to the 20 to 25 MHz module. Unscrew and remove from the rear panel the rigid coaxial connections between the VHF and 10 MHz Step modules.

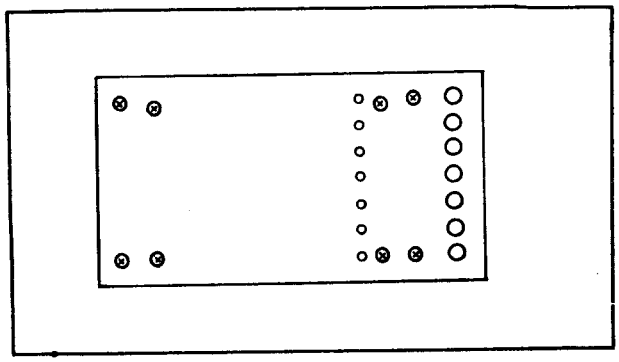
- Remove the four retaining screws indicated on the diagram below from the top of the module.



- Lift the module and release the two coaxial connectors from the unit mounting plate.
- Make the coaxial connections to the replacement module and insert module in instrument (refer to exploded view of 460 for internal connection markings).
- Attach the module to the frame using four 3 x 6 screws.
- Replace and screw down the rigid coaxial connections on the rear panel (refer to diagram of paragraph 5.12).

5.19 20 to 25 MHz Module Figure 5-12.

The 20 to 25 MHz module is mounted in the lower part of the instrument adjacent to the 10 MHz Step module.



- Remove the four retaining screws indicated on the diagram above from the top panel of the module.
- Lift the module and release the coaxial connector from the VHF module.
- Make and screw down the coaxial connection to the replacement module and insert in instrument.
- Attach the module to the frame using four 3 x 6 screws.

5.20 Amplifier Control and Output Amplifier/Attenuator Module Figures 5-20 and 5-22

This module is arranged vertically and extends parallel to the righthand side panel of the instrument, adjacent to the meter.

- Unscrew the knurled head screw at the end of the attenuator.
- Release and remove the rigid coaxial connection between the VHF and Amplifier modules (see diagram of paragraph 5.12).
- From the righthand side panel remove the retaining screws indicated on the diagram.
- Remove the Amplifier module from the rear, avoiding damage to the inside surface of the VHF module, which carries the bypass connections.
- Insert the replacement module.
- Attach at the side using spring washers and two 4 x 40 screws.
- Tighten the knurled head screw at the end of the module so as to make contact with the instrument output connection or the protective fuse.

5.21 Output Amplifier/Frequency Doubler Module (Option 002) Figure 5-21

The procedure for removal and replacement of this module is exactly as described for the amplifier control/output amplifier module, as the frequency doubler circuit card is housed inside the output module.

5.22 CALIBRATION

This section describes the adjustments to be made on each of the circuit cards and modules of the 460 generator to ensure that the instrument meets its specifications.

The following description covers only those cards or modules which require adjustments after replacement:

- Interpolation card (continuous FM):
  . FM range offset adjustment
- Timebase card:
  . internal modulating signal level adjustment
- Interface card:
  . 80 MHz harmonic level adjustment
- Analog Front Panel card:
  . adjustment to 1 kHz and 400 Hz signal levels, RF level calibration, FM calibration and AM calibration

- 20 to 25 MHz module:
  . adjustment of ripple at 1 kHz
- 10 MHz Step module:
  . adjustment of mixer input level and 80 MHz harmonic level (from Interface card)
- VHF module:
  . adjustment of regulator number 2,
  . check on wideband phase noise level,
  . intermodulation test.
- Amplifier Control/Output Amplifier module:
  . determination of regulator number 2 loop resistance,
  . centering of regulator number 2 (from VHF module),
  . linearity adjustment,
  . adjustment of detector number 1,
  . gain adjustment.
- Frequency Doubler option:
  . readjustment of VHF and amplifier control/output amplifier adjustments,
  . adjustment of 1/2 and 3/2 harmonics,
  . adjustment of envelope distortion and AM level.

5.23 INTERPOLATOR CARD (CONTINUOUS FM) Figure 5-1.

ADJUSTMENT: Center FM range offset

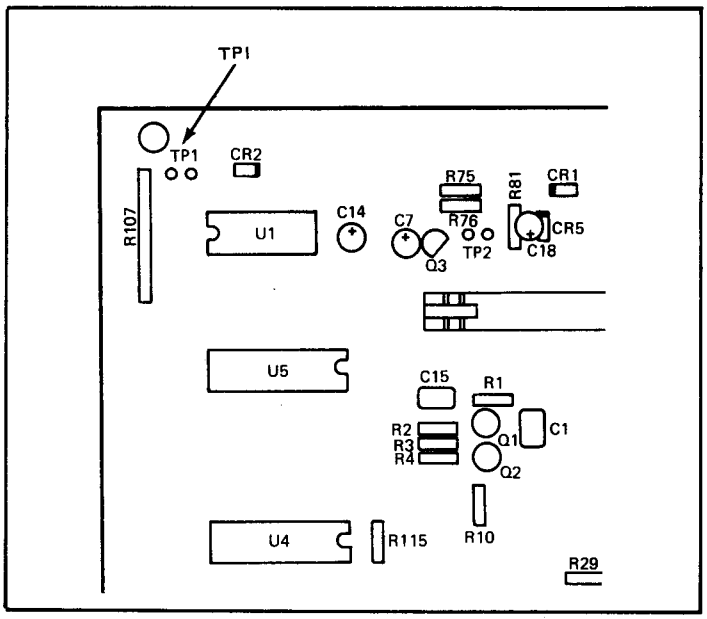
EQUIPMENT REQUIRED: None

Set up the generator as follows:

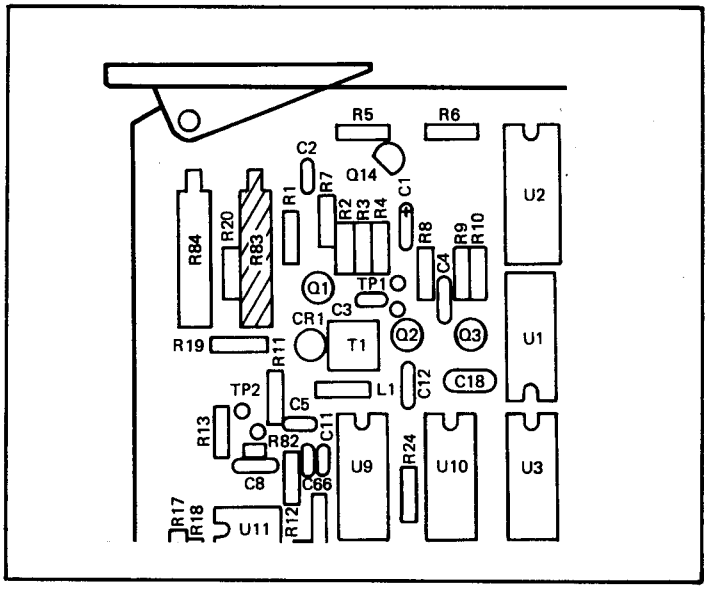
- frequency: 20 MHz
- FM modulation: external DC signal input $\pm$3 kHz deviation
- AM modulation: disabled
- operating mode: MOD (modulation).

Short circuit test point TP1 on the Analog Front Panel card and select FM/CW operating mode to disable the AM and FM/OM modulation potentiometers and the level vernier.

Adjust potentiometer R83 on the Interpolation card until the instrument displays 20,000 000 MHz.



Analog front panel card



Interpolator card

NOTE: Replacement of the Interpolator card does not call for adjustment of potentiometer R84.

5.24 TIMEBASE CARD Figure 5-2.

The output levels of the internal modulating signals at frequencies of 400 Hz and 1 kHz are adjusted from the analog Front Panel card.

5.25 INTERFACE CARD Figure 5-14.

The Interface card carries all the controls needed for adjustment of the calibration of the 10 MHz Step module.

ADJUSTMENTS: 320 MHz, 400 MHz, 480 MHz, 560 MHz and 640 MHz harmonic levels

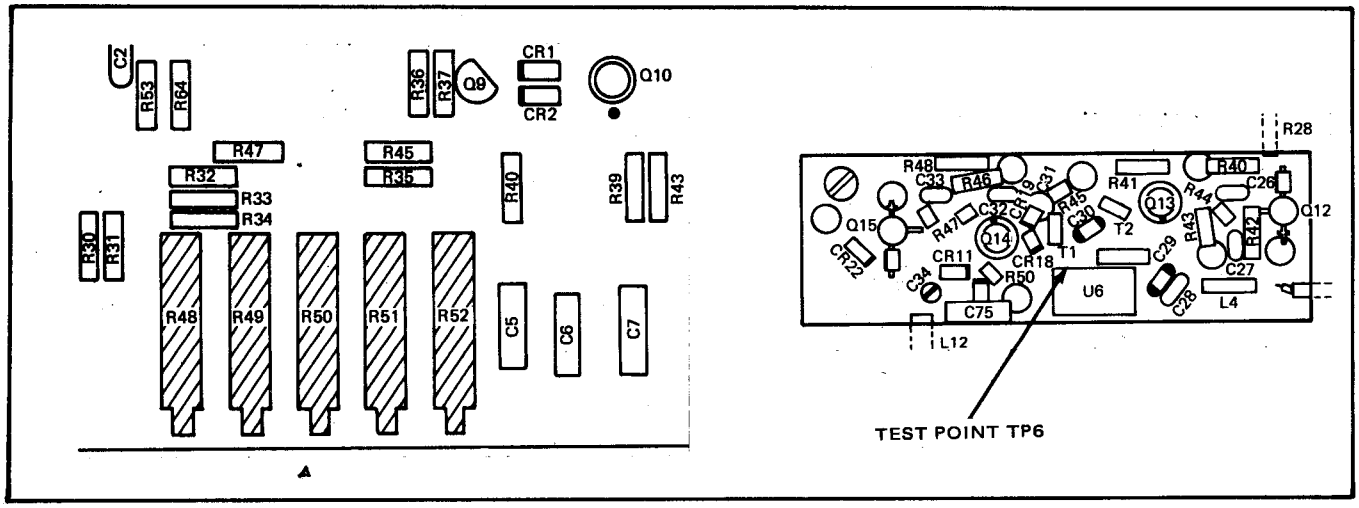
EQUIPMENT REQUIRED: Spectrum analyzer and 1 kΩ probe.

5.26 80 MHz HARMONIC LEVEL

Remove the cover of the 10 MHz Step module.

Connect the 1 kΩ probe to the input of the spectrum analyzer and apply to test point TP6 of the 10 MHz Step module.

Set the generator to a frequency of 328 MHz and adjust the level of the 320 MHz harmonic to its maximum value using potentiometer R52 on the Interface card (level > 0 dBm).



Interface card 10 MHz Step module

Set the generator to a frequency of 400 MHz and adjust potentiometer R51 to obtain the maximum level for the 400 MHz harmonic (level > 0 dBm).

Set up the frequencies 480 MHz, 560 MHz and 640 MHz and check that the corresponding harmonic levels are at their maximum values (> 0 dBm) by adjusting potentiometers R50, R49 and R48 respectively, on the interface card.

Replace the cover of the 10 MHz Step module.

5.27 ANALOG FRONT PANEL CARD Figure 5-16.

ADJUSTMENTS: Levels of internal signals at 400 Hz and 1 kHz (from Timebase card)
RF level calibration
FM calibration
AM calibration

EQUIPMENT REQUIRED: Multimeter
AF signal generator

5.28 400 Hz and 1 kHz SIGNAL LEVELS

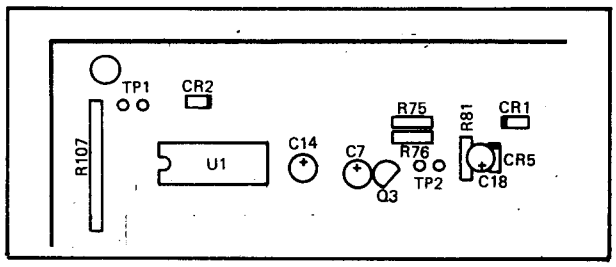
Short circuit test point TP1 on the Analog Front Panel card and select FM CW operating mode to disable the AM and FM/OM modulation potentiometers and the level vernier.

Set up the generator as follows:

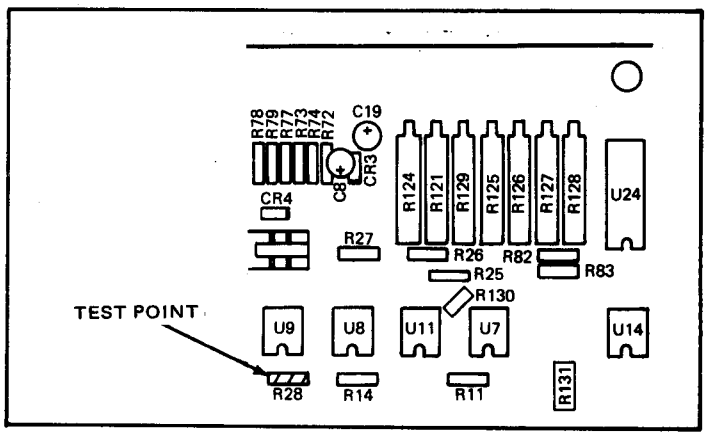
- frequency: 300 MHz
- FM modulation with deviation ±300 kHz with AC external source of modulation
- level: 0 dBm
- AM modulation: disabled.

Apply a modulating signal of 1 kHz at a level of 3 V_{rms}, (input impedance = 600Ω), to the FM input on front panel.

Connect multimeter to FM Modulating signal output point shown on diagram below, (connection to resistor R27 on Analog Front Panel card), and note the measured level (= 1.5 V_{rms}).



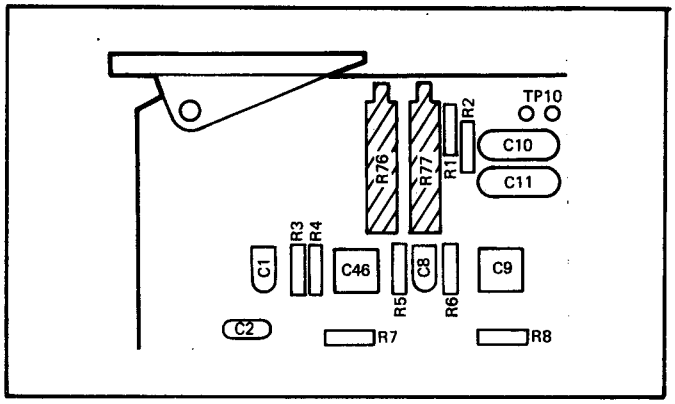
Analog front panel card



Analog front panel card

Test the internal modulating signal at 400 Hz and adjust potentiometer R76 on the Time Base card (Figure 5-2) to obtain a signal level at R27 of 1.5 V_{rms}.

Test the internal modulating signal at 1 kHz and adjust potentiometer R77 on the Timebase card to obtain a signal level at R27 of 1.5 V_{rms}.



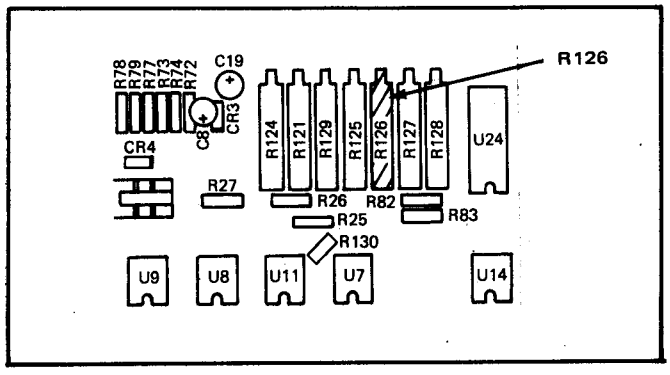
Timebase card

5.29 RF LEVEL ADJUSTMENT Figure 5-16

Set up the generator as follows:

- frequency: 50 MHz
- operating mode: CW
- output level: 0 dBm/50 Ω.

Adjust potentiometer R126 to obtain 0 dBm on the front panel meter (first check 0 setting of meter).



Analog Front Panel card

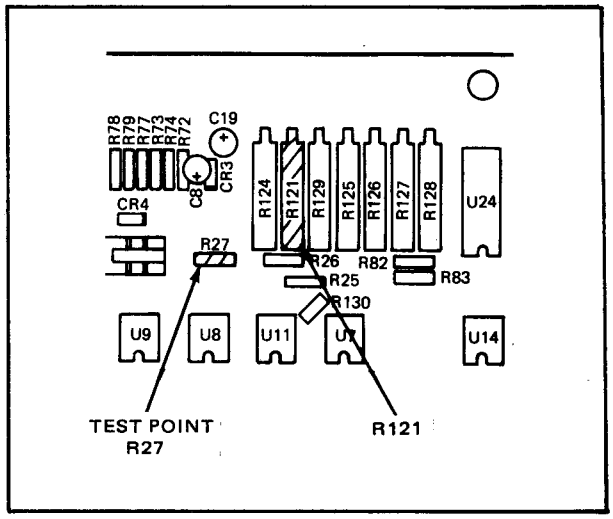
5.30 FM CALIBRATION Figure 5-16.

Set up the generator as follows:

- frequency: 100 MHz
- operating mode: MOD
- modulation: FM, deviation ±30 kHz, external AC modulating signal
- level: 0 dBm.

Apply a modulating signal of 1 kHz at a level of 3 V_{rms}, (input impedance = 600 Ω), to FM input on front panel.

Connect the multimeter to the FM modulating signal output point, (resistor R27 on Analog Front Panel card).



Analog Front Panel card

Set the level to 1.5 V_{rms} and adjust potentiometer R121 on the Analog Front Panel card (FM gain adjustment).

Set the multimeter to measure DC voltage and adjust potentiometer R124 (FM centering) so as to obtain a null voltage at the test point.

Select the FM deviation range ±300 kHz and adjust potentiometer R127 (FM x 3) so as to read a peak deviation of 300 kHz on the meter (center scale).

Apply a modulating signal of 1 kHz and 0.750 V_{rms} to the external input (input impedance 600 Ω). Short circuit test point TP2 on the Analog Front Panel card and adjust potentiometer R125 (FM x 1) to obtain a meter reading for the peak deviation of 75 kHz (upper scale).

5.31 AM CALIBRATION Figure 5-16.

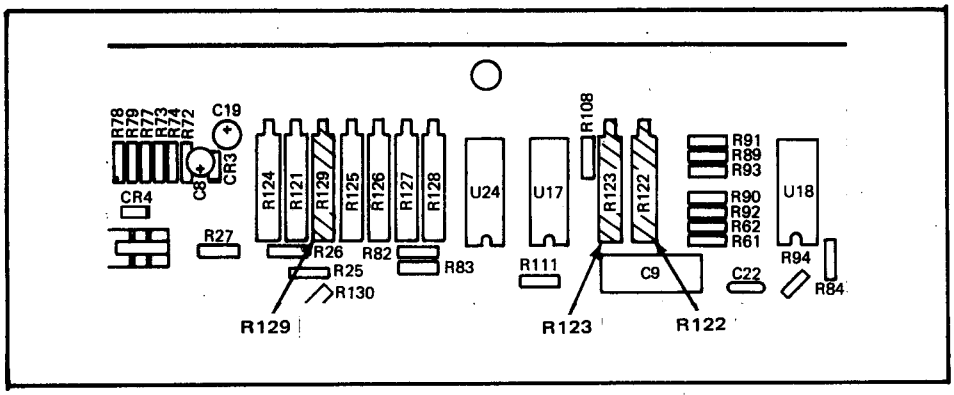
Remove the short circuit from test point TP2 and set up the generator as follows:

- frequency: 300 MHz
- operating mode: MOD
- FM modulation: disabled
- AM modulation: AC external signal.

Apply a modulating signal at a frequency of 1 kHz and a level of 200 mV_{rms}, (input impedance 600 Ω), to AM input on front panel.

Connect multimeter to test point TP9, (AF AM). This test point is situated, and marked, on the top of the VHF module. Adjust potentiometer R122, (AM gain), to obtain a reading of 1.77 V_{rms}. Then adjust potentiometer R123, (AM DC), to obtain a DC voltage of 2.5 V.

Adjust potentiometer R129, (AM x 1), to obtain a meter reading for the modulation depth of 100%.



Analog Front Panel card

Apply a modulating signal at a frequency of 1 kHz and a level of 60 mV_{rms} (input impedance 600 Ω), to the AM input. Short circuit test point TP2 on the Analog Front Panel card.

Adjust potentiometer R128, (AM x 3), to obtain a meter reading for the modulation depth of 30%.

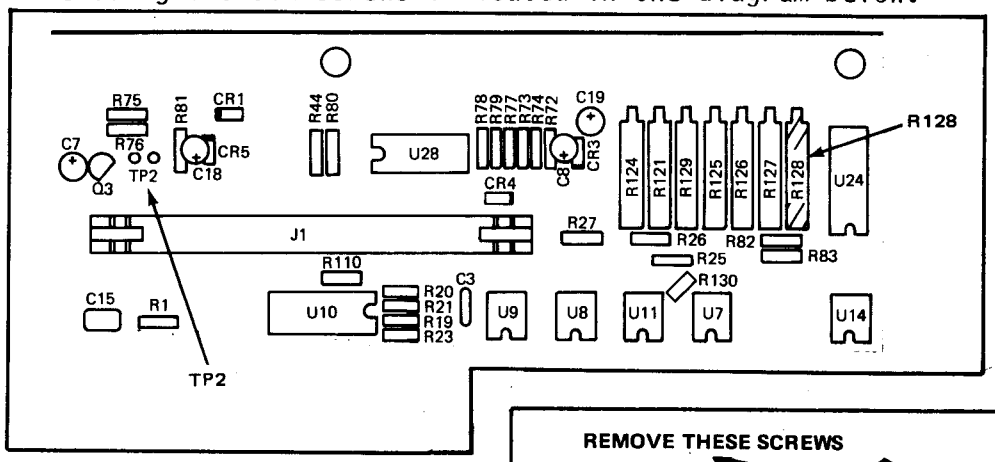
5.32 20 to 25 MHz MODULE Figure 5-12

This module does not require any significant adjustment, but it is always replaced with the Linearization card, the two cards being adjusted simultaneously.

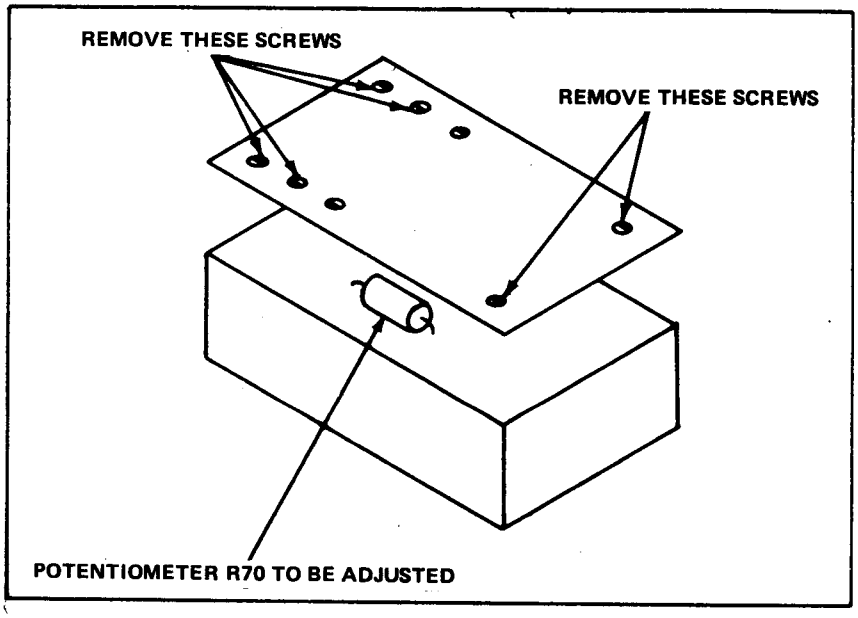
ADJUSTMENT: 20/25 MHz ripple at 1 kHz

EQUIPMENT REQUIRED: Oscilloscope.

Select a frequency of 12.5 MHz and open up the 20 to 25 MHz module by removing the six screws indicated in the diagram below.



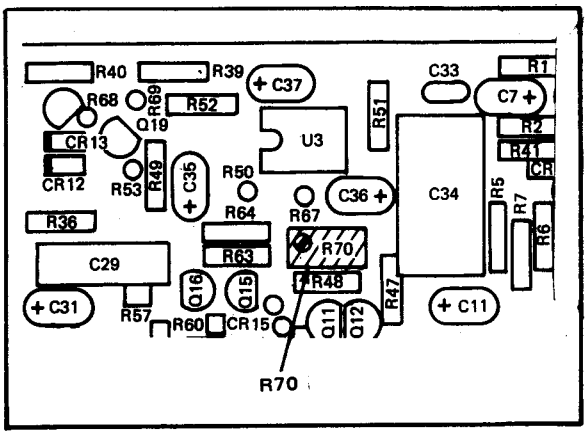
Analog front panel card

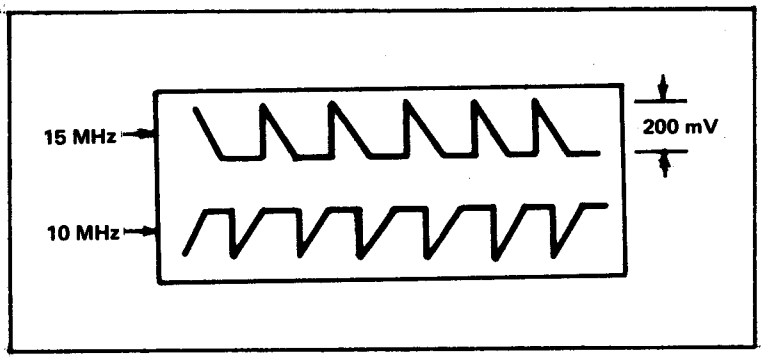


20/25 MHz Module

Connect the oscilloscope to the 20/25 terminal on the internal support card on the bottom panel of the instrument. Adjust potentiometer R70 in the 20/25 MHz module, (Figure 5-12), to obtain minimum ripple at 1 kHz.

Check that the signal levels at 10 to 15 MHz are approximately 200 mV (peak to peak).





5.33 10 MHz STEP MODULE

This module is basically adjusted on the Interface card, where all adjustments concerning the 80 MHz harmonic are carried out. However, before beginning the adjustments described in the "Interface card" section, it is necessary to adjust the mixer input level of the 10 MHz step module.

ADJUSTMENTS: Mixer input level (10 MHz step module)
80 MHz harmonic level (interface card)

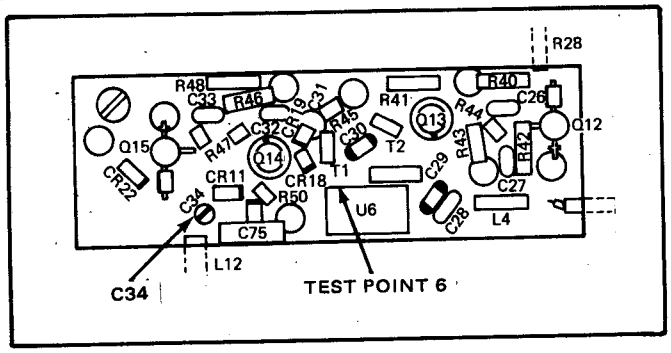
EQUIPMENT REQUIRED: Spectrum analyzer and 1 k Ω probe.

5.34 MIXER INPUT LEVEL ADJUSTMENT Figure 5-10.

Open up the module as described elsewhere.

Connect the 1 kΩ probe to the spectrum analyzer and apply to test point TP6 in the 10 MHz Step module.

Select a frequency of 640 MHz and CW mode. Adjust capacitor C34 of the 10 MHz Step module so as to obtain a maximum level at test point TP6.



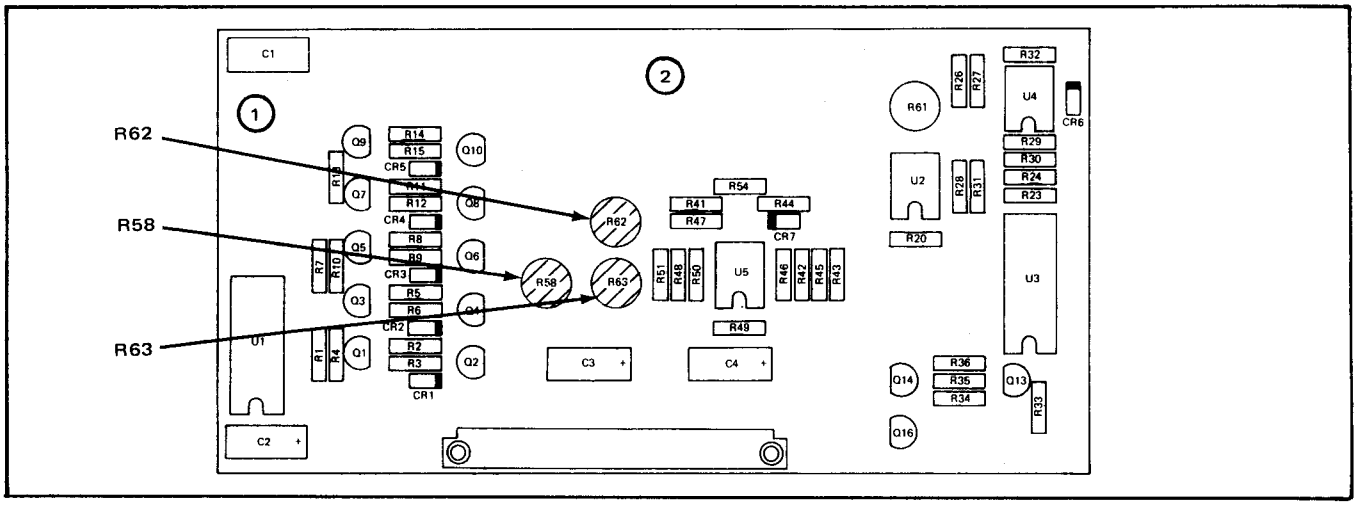
10 MHz Step module

5.35 80 MHz HARMONIC LEVEL

Repeat the adjustments to the Interface card described elsewhere.

5.36 VHF MODULE

The operation of the VHF module is closely associated with that of the Output Amplifier module, and calls for readjustment on the Amplifier Control card of regulator number 2.



Amplifier control card

KEY TO DIAGRAM

1 Connections to amplifier module
2 Amplifier Control card

ADJUSTMENTS: Regulator number 2
Wideband noise level
Intermodulation components

EQUIPMENT REQUIRED: DC voltmeter and spectrum analyzer.

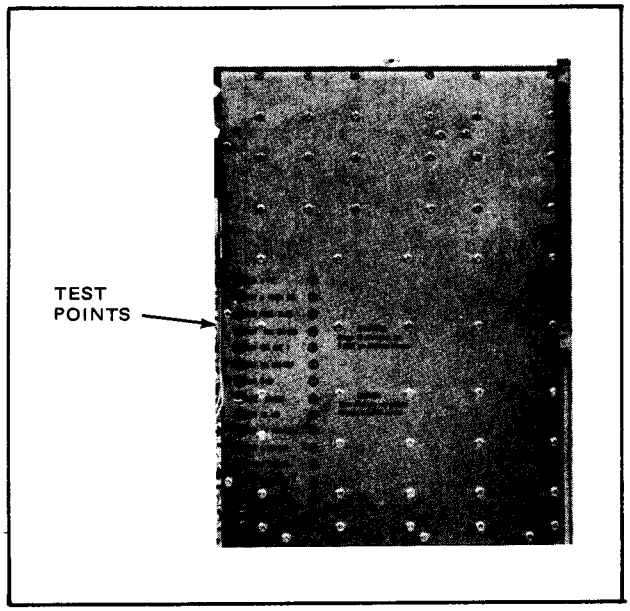
Set up the instruments as follows:

- frequency: 100 MHz
- level: 13 dBm/50
- operating mode: CW.

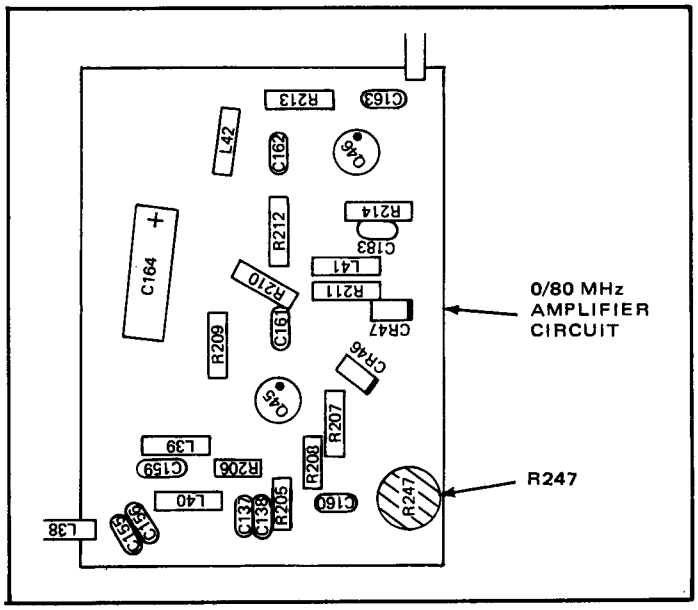
Connect a DC voltmeter to test point TP5 which is located and marked on top of the VHF module.

Adjust potentiometer R61 on the Amplifier Control card to obtain a meter reading of 2 V DC.

Select a frequency below 80 MHz (heterodyne range) and adjust potentiometer R247 of the VHF module to obtain a meter reading between 2 and 3 volts. Repeat the adjustment at various frequencies between 300 kHz and 80 MHz.



VHF MODULE (top view)



VHF MODULE

Using the spectrum analyzer, check that the wideband noise floor is -145 dB.

Select a generator output frequency of 79 MHz and check that the intermodulation components at ±5 MHz from the carrier frequency are below 100 dB.

Select frequency of 300 kHz, (or 100 kHz if the instrument includes option 05), and an output level of +13 dBm. Select CW mode.

Adjust potentiometer R58 on the Amplifier Control card so as to minimize the fourth harmonic of the signal.

5.37 AMPLIFIER CONTROL ADJUSTMENTS

The circuit card is fitted to the Output Amplifier module, and cannot be replaced independently.

Replacing this unit requires adjustment of the VHF module and Output module (Amplifier Control/Output Amplifier), followed by the adjustments listed below:

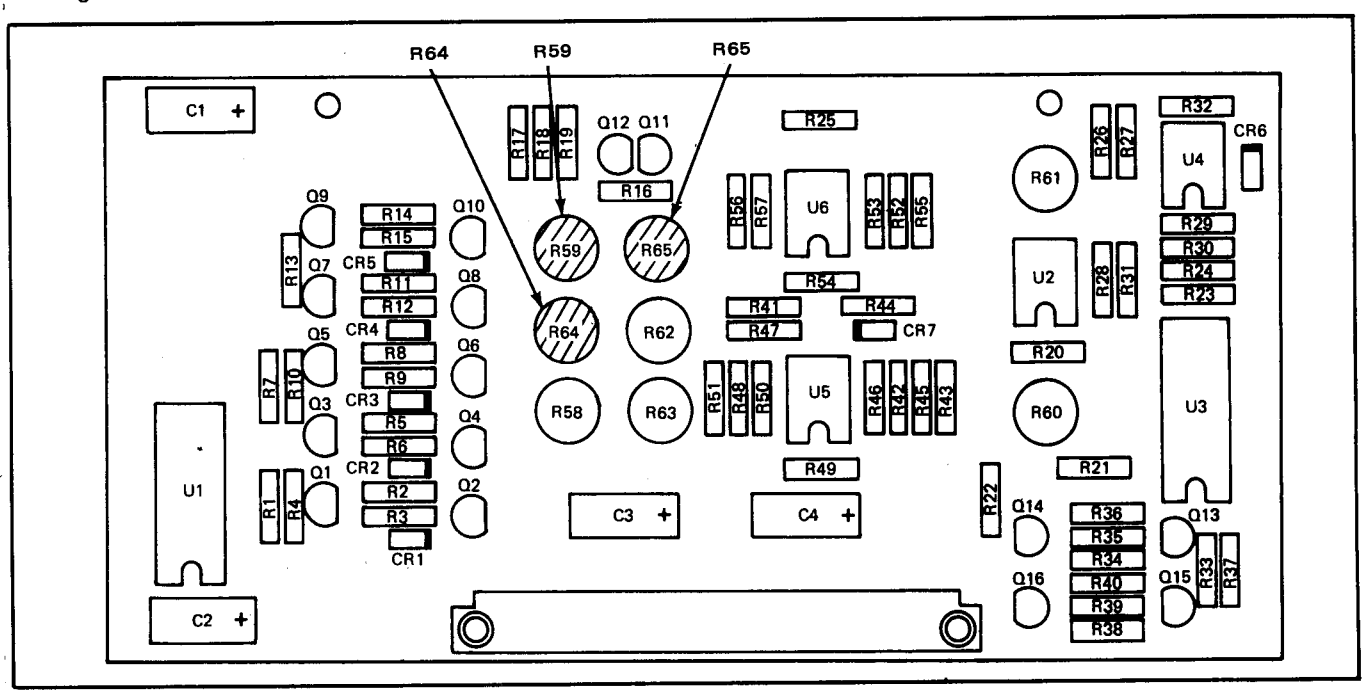
ADJUSTMENTS: 1/2 and 3/2 harmonics
Detector number 2
Envelope distortion and AM depth.

EQUIPMENT REQUIRED: Spectrum analyzer
1300 MHz modulation meter
Distortion meter
Power meter

Carry out the adjustments described in the VHF module section.

5.38 HARMONIC ADJUSTMENTS —

These adjustments are carried out on the Amplifier Control card shown in the diagram below:



Amplifier Control card

Leave the spectrum analyzer connected to the generator output.

Select a frequency of 650 MHz and an output level of +3 dBm.

Adjust potentiometer R59 to minimize the 1/2 harmonic (325 MHz).

Adjust potentiometer R60 to minimize the 3/2 harmonic (975 MHz).

5.39 DETECTOR NUMBER 2 ADJUSTMENTS

Connect the power meter to the output of the generator.

Using the double frequency range, select the frequency for which constancy of level is poorest.

Select an output level of +3 dBm and adjust potentiometer R65 to obtain +3 dBm ±0.5 dBm.

Select an output level of -6 dBm and adjust potentiometer R64 to obtain a reading of -6 dBm ±0.5 dBm.

5.40 AM ENVELOPE DISTORTION

Open up the Output Amplifier module, as described elsewhere.

Set a frequency of 650 MHz on the direct range and an output level of 0 dBm.

Select amplitude modulation (AM).

Select the internal modulating signal at 1 kHz and adjust the modulation depth to 80%, using the meter.

Check that the envelope distortion is below 3%.

Select a frequency of 1300 MHz, with option 002.

Check the modulation depth using the modulation meter, and adjust the potentiometer of the Output Amplifier module, R128, to obtain a value of 84%. This adjustment is necessary to compensate for envelope distortion.

Check that the envelope distortion is below 3%.

5.41 PROTECTIVE FUSE OPTION (OPTION 001)

ADJUSTMENT: Fuse replacement.

Remove the bottom panel from the instrument.

The fuse is located in a small module located between the attenuator and the output TNC connector.

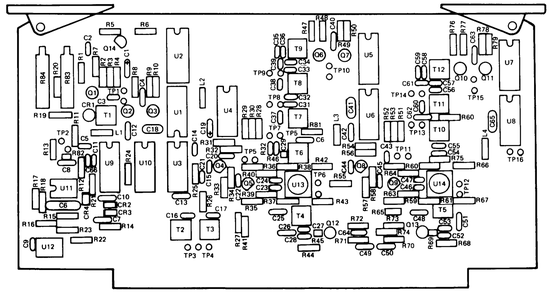
Remove the two retaining screws and the T-shaped metal component.

Replace the fuse, locating the replacement fuse correctly within the unit.

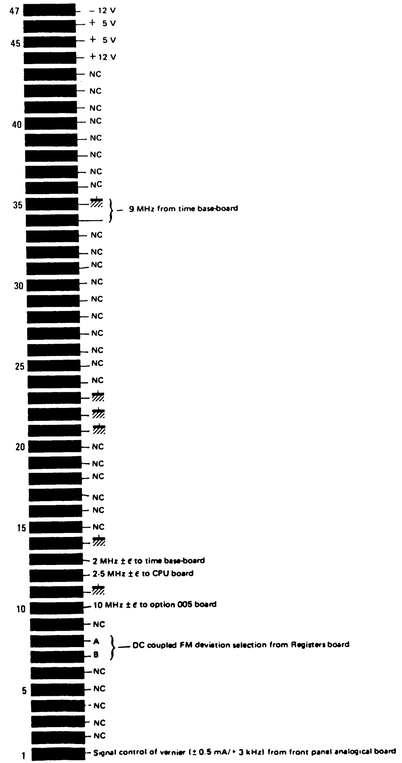
Fuse type reference: 1710004800 - 100 mA.

Manufacturer: AILTECH

Replace the T-shaped component and the instrument bottom panel.



SEARCH FREQUENCY / DC COUPLED FM. BOARD



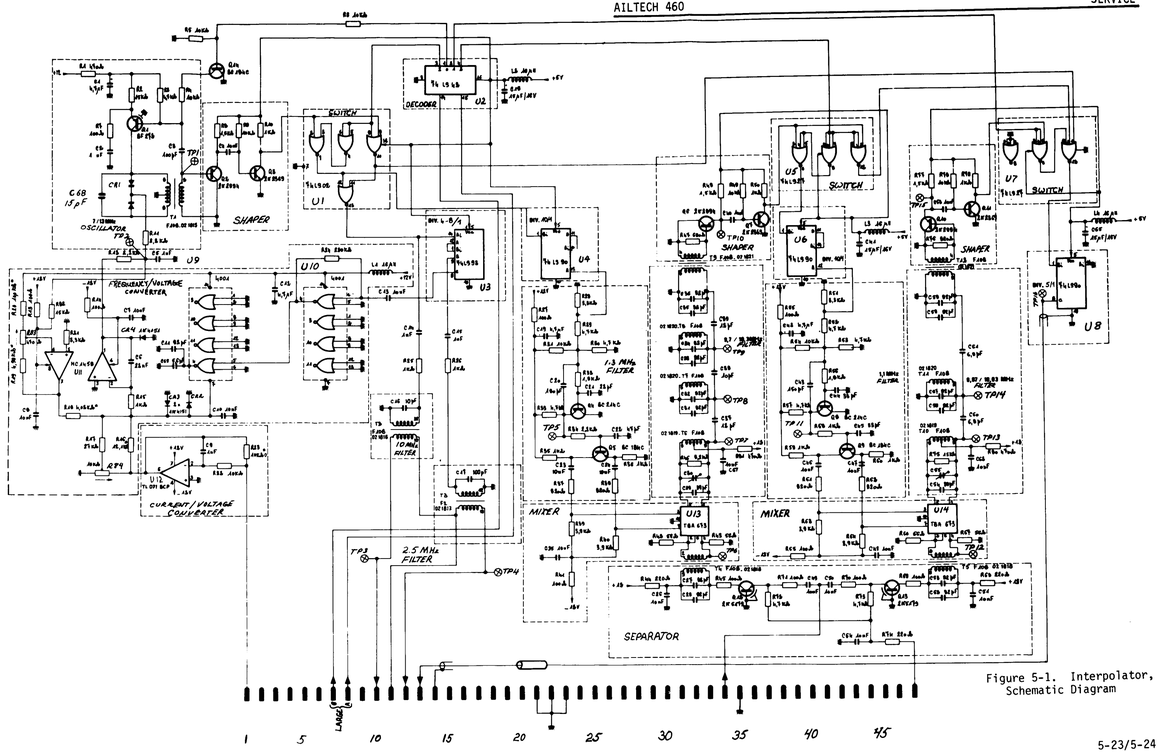
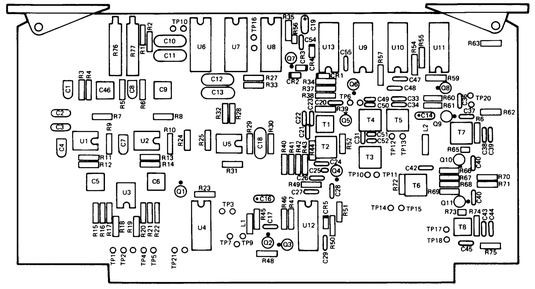


Figure 5-1. Interpolator, Schematic Diagram

TIME BASE BOARD



47	– 12 V
	+ 5 V
45	+ 5 V
	+12 V
	NC
	NC
	10 MHz master oscillator to rear panel
40	10 MHz from Master oscillator
	4 MHz to PFC and CPU boards
35	9 MHz to Interpolation board
	NC
	NC
	NC
30	NC
25	NC
20	External frequency reference from rear panel
	Phase locking control to LED indicator on rear panel
	Master oscillator phase locking
	2 MHz or 2 MHz ± ℓ to PFC board
15	2 MHz ± ℓ from Interpolation board
	Vernier control from registers board
	NC
	NC
10	
	1 kHz TTL to option 005 and counters boards
	NC
	1 kHz Internal modulating signal to front panel analogical board
5	1 kHz Internal modulating signal to rear panel
	400 Hz Internal modulating signal output to rear panel
1	400 Hz Internal modulating signal to front panel analogical board

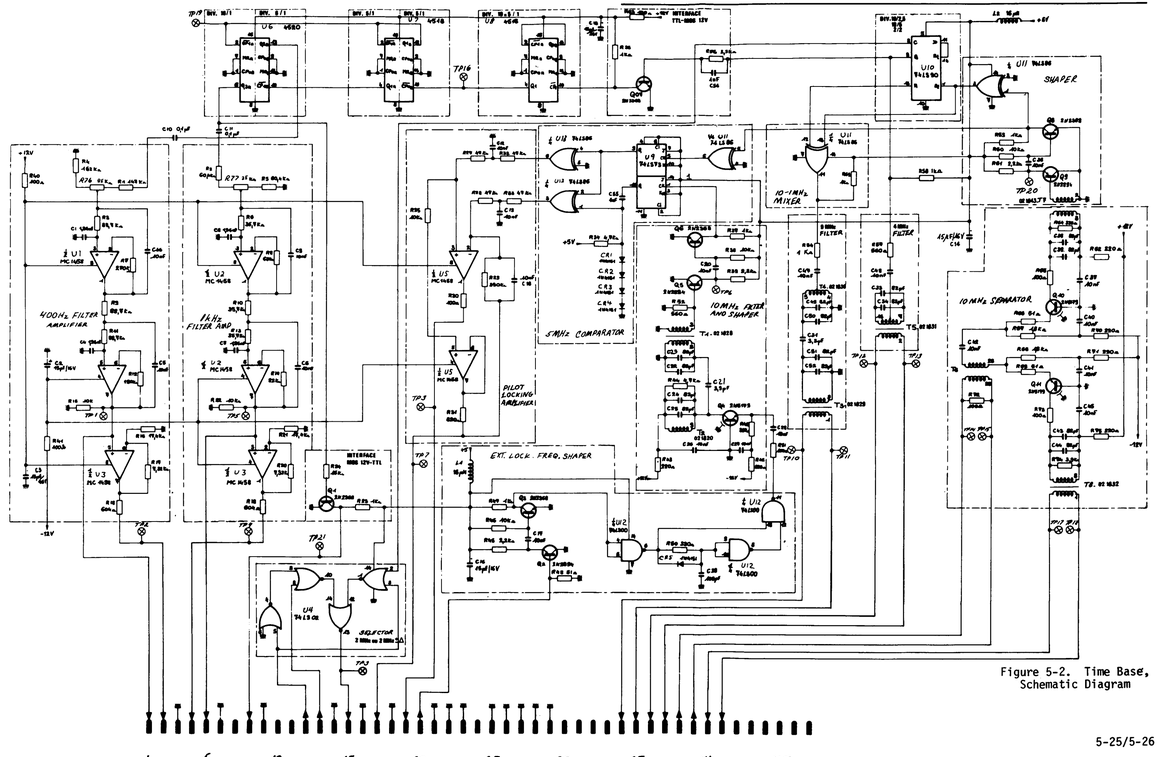
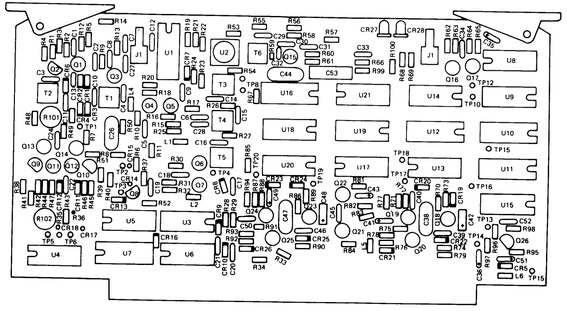


Figure 5-2. Time Base, Schematic Diagram



PHASE/FREQUENCY COMPARATOR (PFC)

47 – 12 V
+ 5 V
45 + 5 V
+ 12 V
NC
+ 18 V
Detected sense of Fs - Fp beat from counters board
40 Fs - Fp/80 frequencies beat from counters board
NC
250 kHz from 30/69 divider of counters board
4 MHz from time base board
35 Sense change bit of oscillators indicated on pin 34 from registers board
Sense bit of 20/25 and 32/58 oscillators and relative positions of Fp and Fs from registers board
Fine phase lock loop inhibition and validation of the approach voltage of 320-650 MHz oscillator to registers and interface boards
Approach validation of 300/670 MHz oscillator to 10 MHz steps module and inhibition of the fine phase lock loop
Approach voltage of 320/650 MHz oscillator to interface board (Fs)
30 NC
NC
NC
NC
NC
NC
25 NC
Approach voltage of 300/670 MHz oscillator to 10 MHz steps module (Fp)
20 NC
NC
NC
NC
15 2 MHz or 2 MHz ±ε from time base board
NC
NC
NC
NC
10 NC
NC
NC
NC
Phase locking voltage of 20/25 MHz oscillator from 20/25 MHz module
5 NC
NC
Test : level of 2 MHz or 2 MHz ±ε to registers board
Test : level of 4 MHz beat to registers board
1 DC component of FM modulation signal from front panel analogical board

Fs : 320/650 MHz oscillator (VHF module)
Fp : 300/670 MHz oscillator (10 MHz steps module)

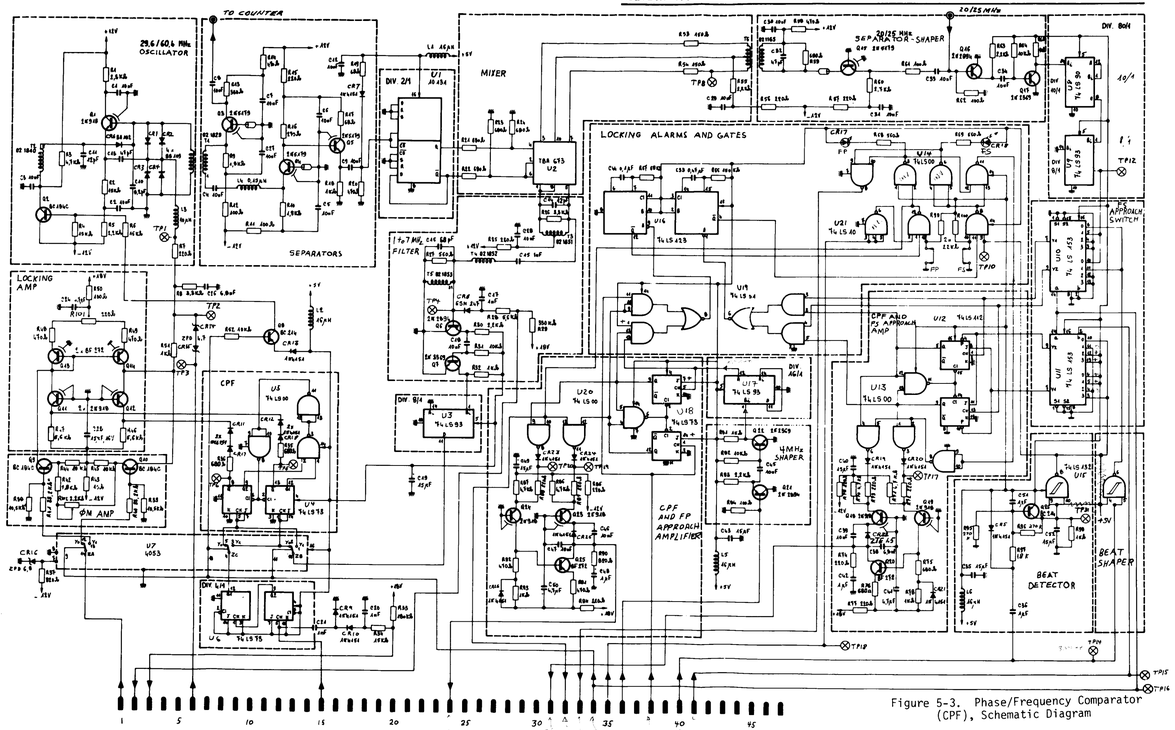
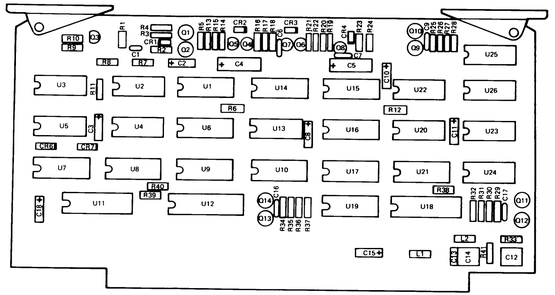
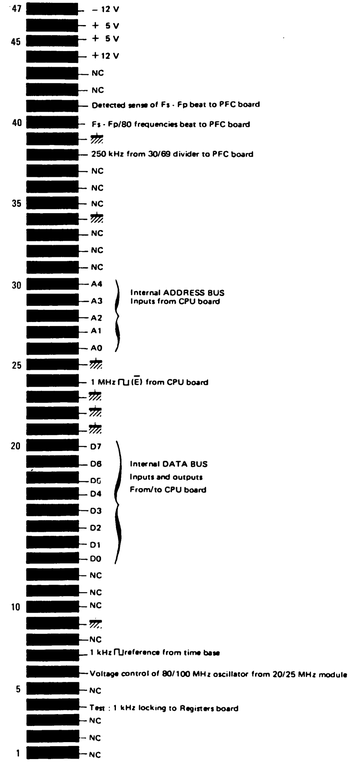


Figure 5-3. Phase/Frequency Comparator (CPF), Schematic Diagram

COUNTERS BOARD





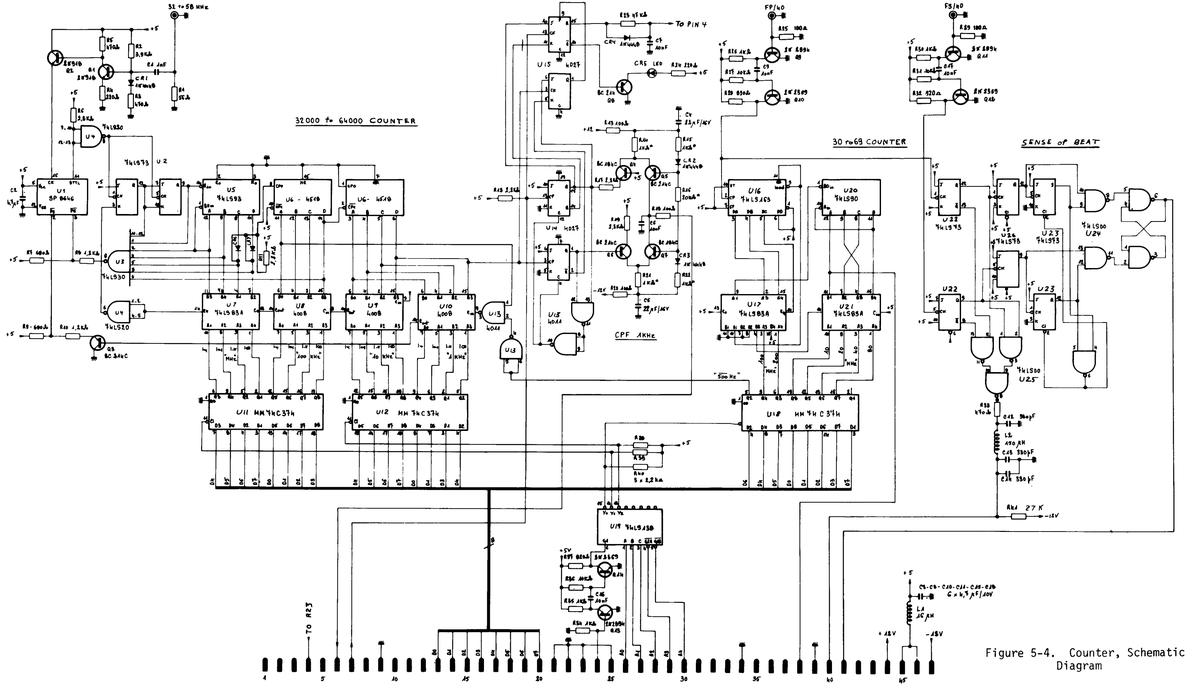
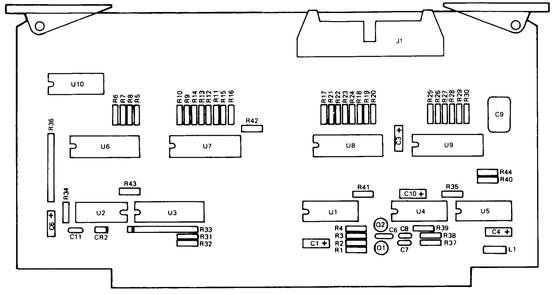


Figure 5-4. Counter, Schematic Diagram

REGISTERS BOARD



47	NC	
	+5 V	
45	+5 V	
	NC	
	NC	
	NC	
	NC	
40	NC	
	NC	
	NC	
	NC	
	Sense change bit of 20/25 MHz and 32/58 MHz oscillators and relative positions of Fp - Fs to PFC board	
35	Fine phase lock loop inhibition and validation of the approach voltage of 320/650 MHz oscillator to Registers and Interface boards	
	NC	
	NC	
	NC	
	NC	
30	A4	Internal ADDRESS BUS Inputs from CPU board
	A3	
	A2	
	A1	
	A0	
25	1 MHz (E) from CPU board	
20	D7	Internal DATA BUS Inputs and outputs From/to CPU board
	D6	
	D5	
	D4	
	D3	
15	D2	
	D1	
	D0	
	Vernier control to time base board	
	A	DC coupled FM deviation selection to Interface board
10	B	
	NC	
	NC	
	RESET from CPU board	
	IRQ - Interrupt request to CPU board	
5	NC	
	Test : 1 kHz locking from counters board	
	Test : level of 2 MHz or 2 MHz ± ε from PFC board	
	Test : level of 4 MHz beat from PFC board	
1	VHF test : output leveling loop from Interface board	

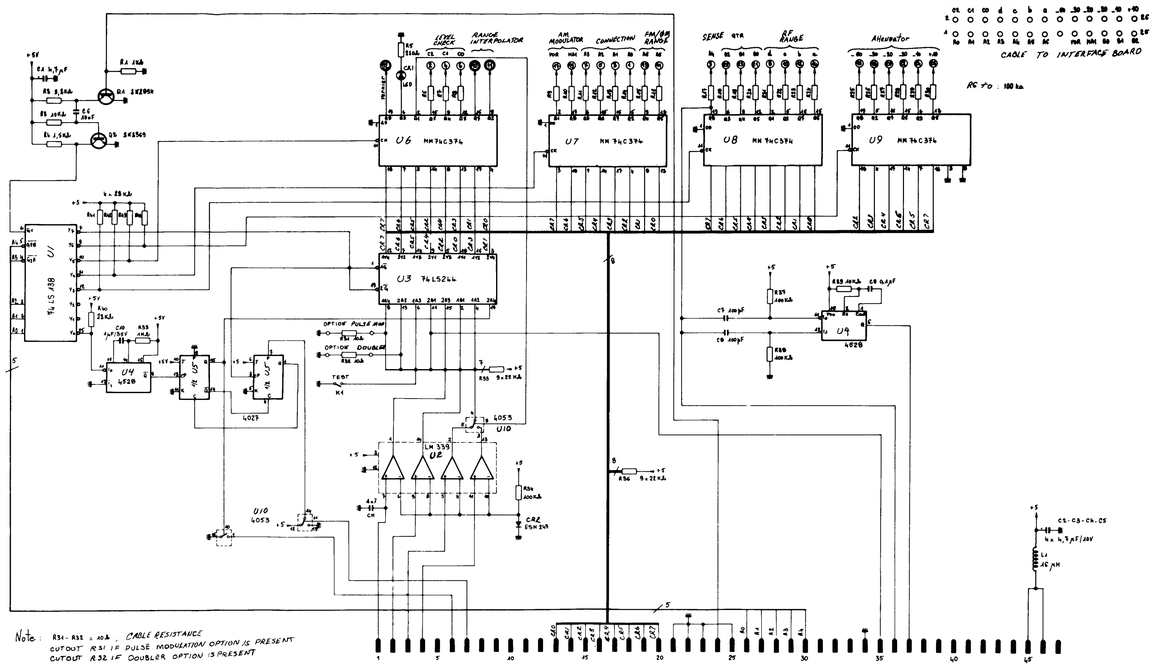
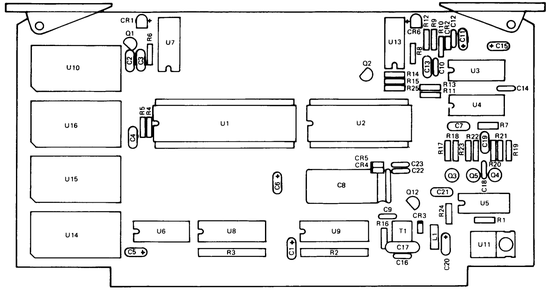
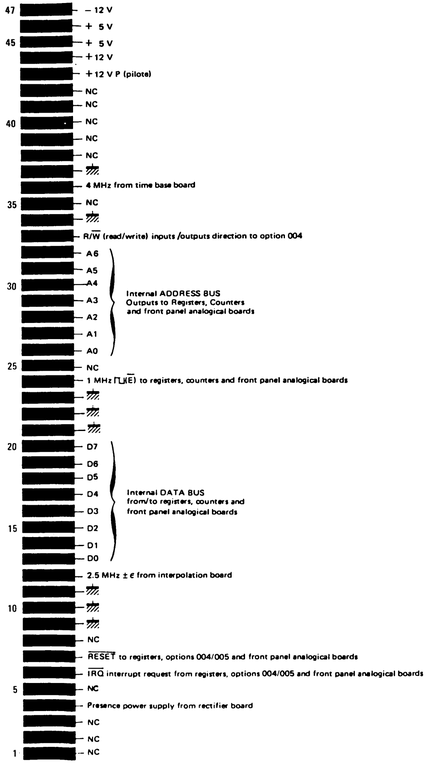


Figure 5-5. Registers, Schematic Diagram



MICROPROCESSOR (CPU)



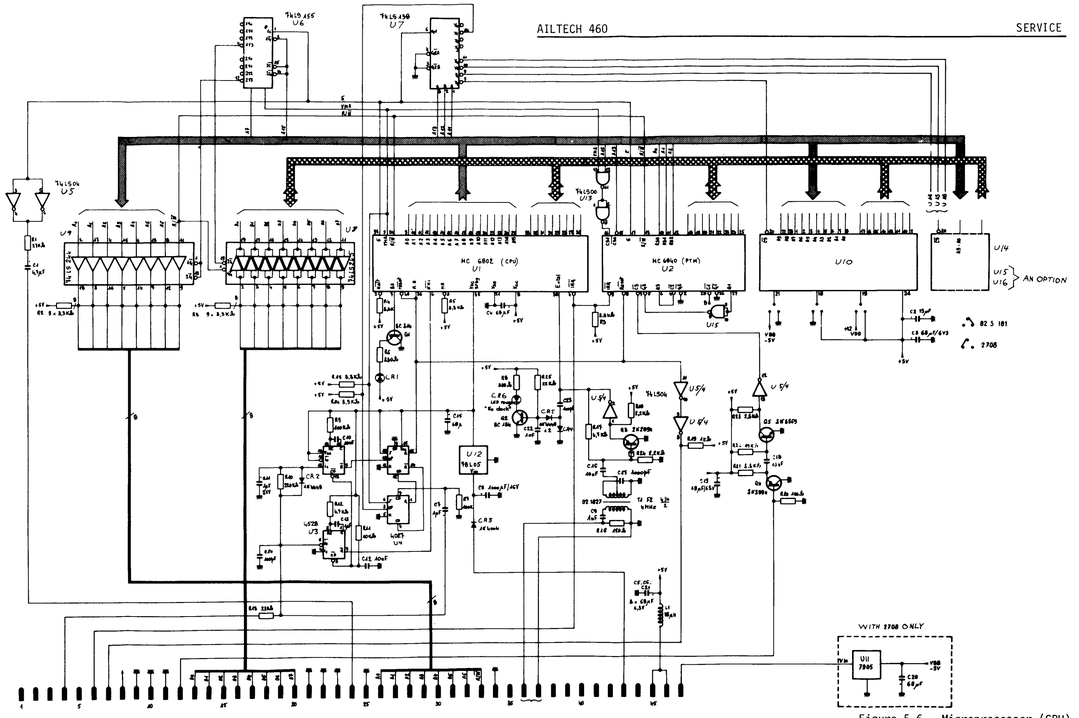
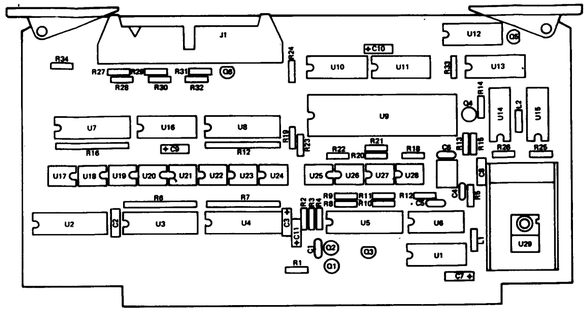
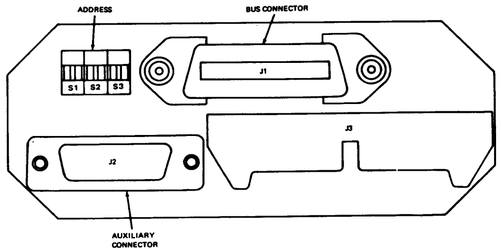


Figure 5-6. Microprocessor (CPU) Schematic Diagram





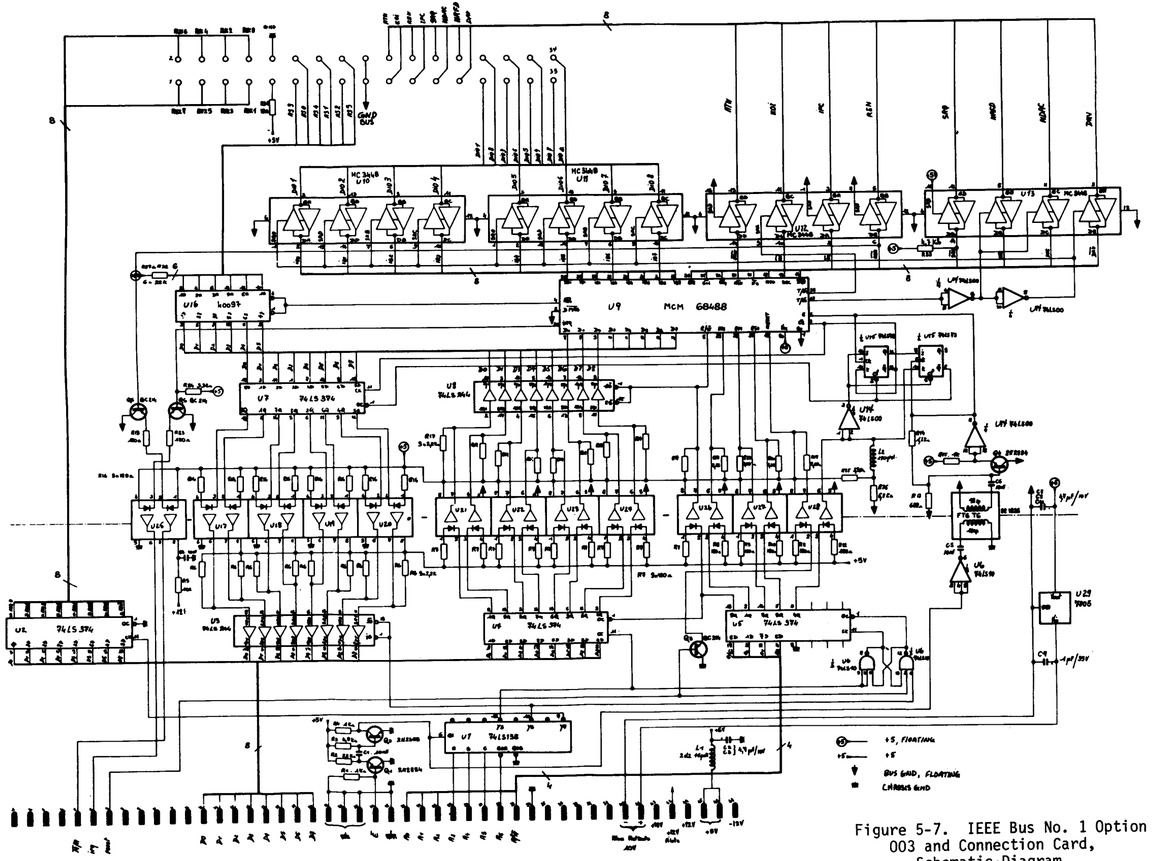
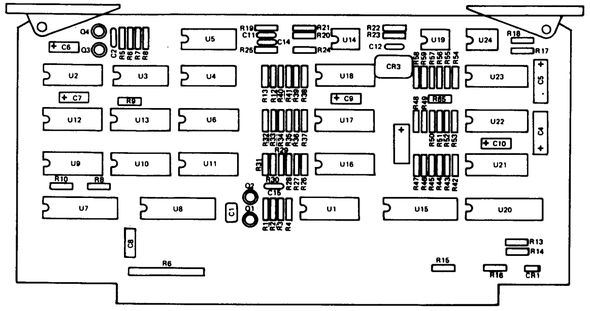


Figure 5-7. IEEE Bus No. 1 Option 003 and Connection Card, Schematic Diagram



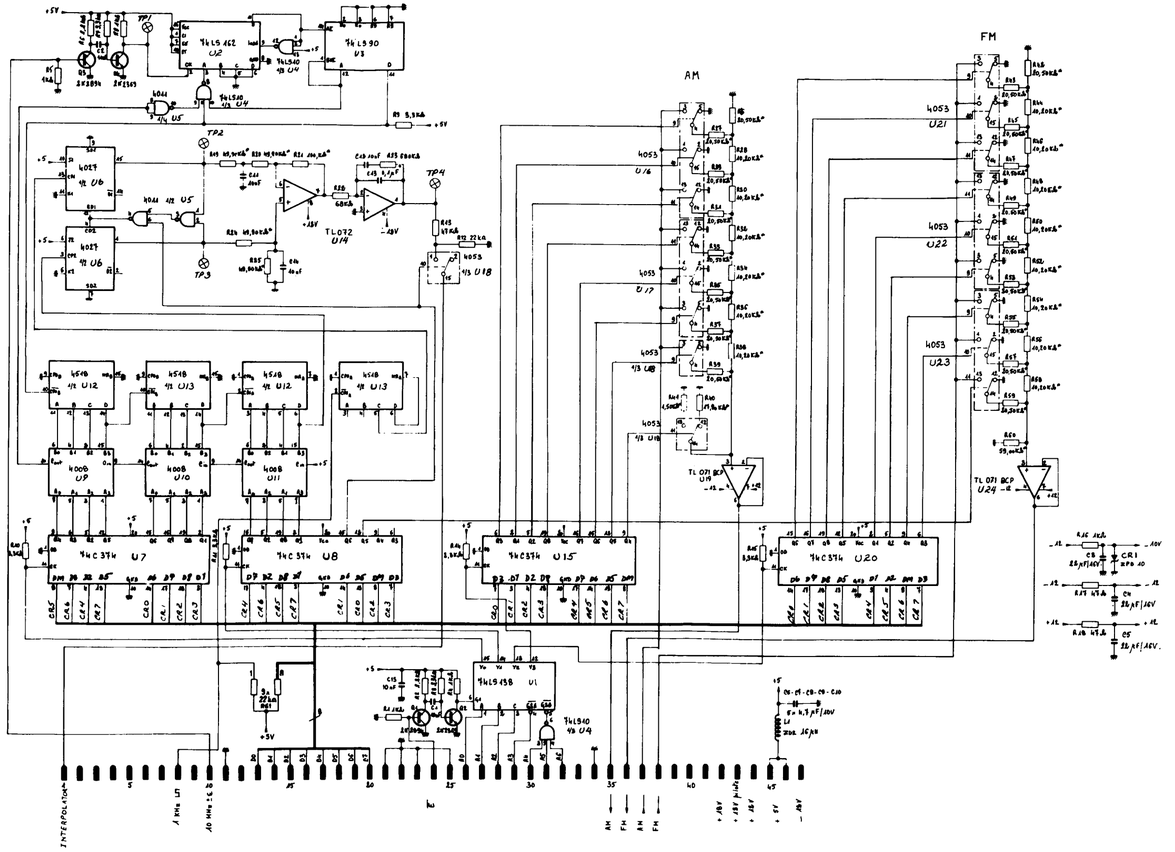


Figure 5-8. IEEE Bus No. 2, Option 003, Schematic Diagram

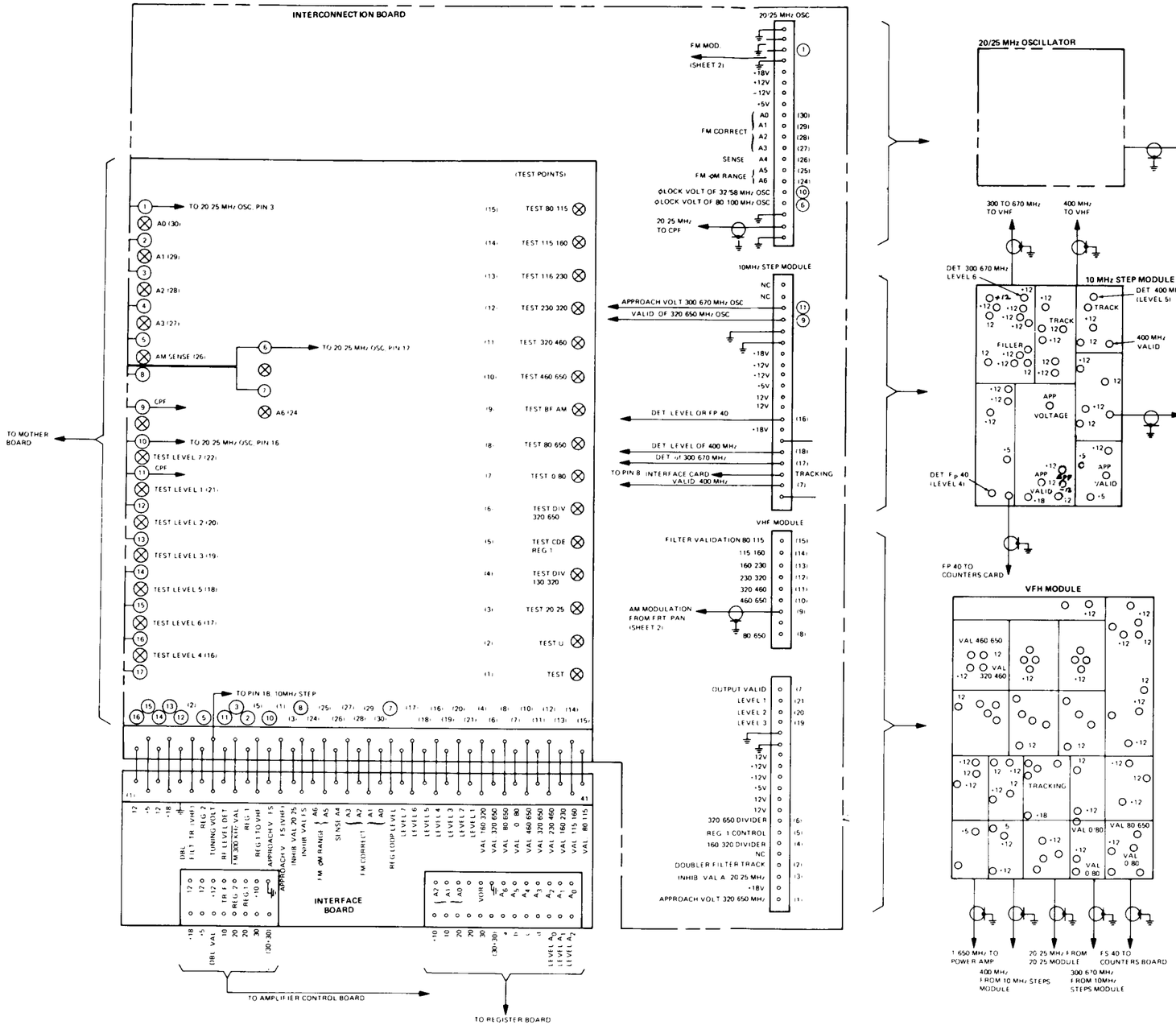
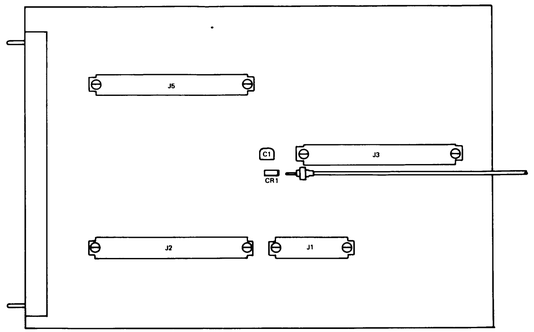
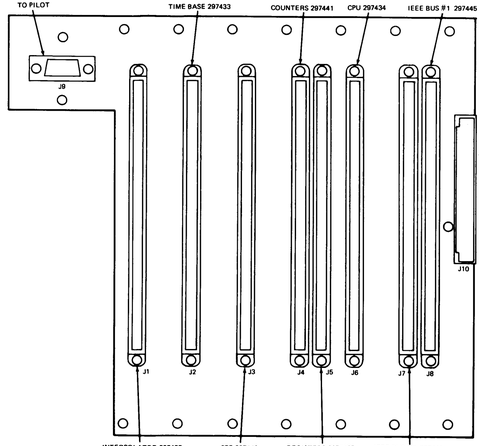
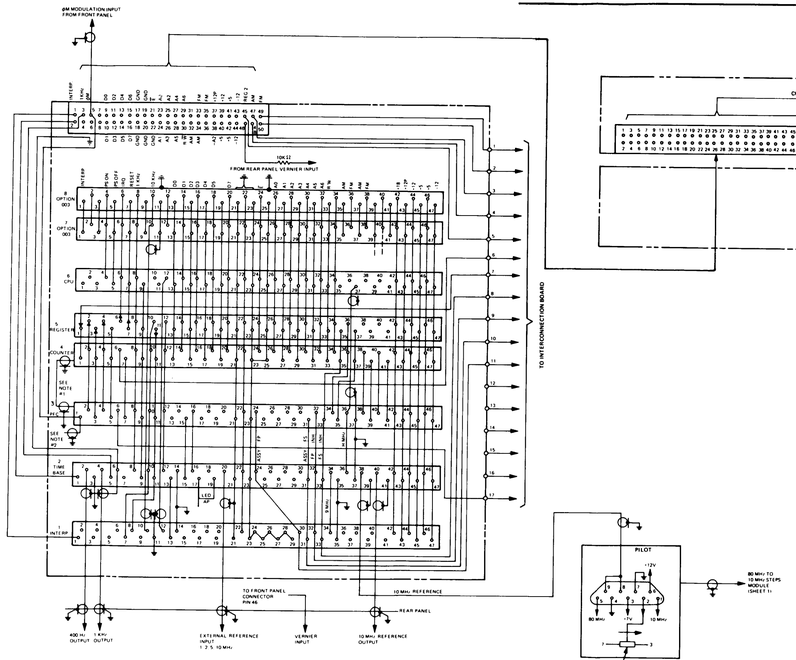
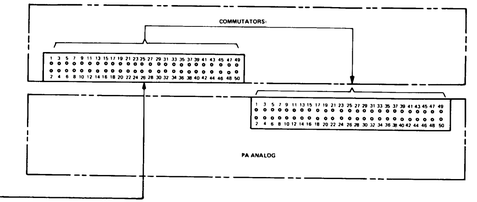


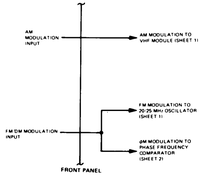
Figure 5-9. Motherboard and Interconnect Diagram (Sheet 1 of 2)







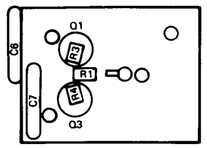


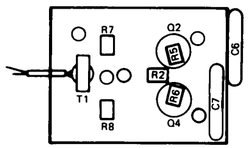


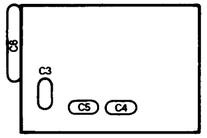
NOTES

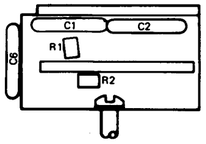
1. 32.58 MHz TO COUNTERS BOARD FROM PHASE FREQUENCY BOARD
2. 20.25 MHz FROM PIN 19 OF 20.25 MHz OSCILLATOR MODULE

Figure 5-9. Motherboard and Interconnect Diagram (Sheet 2 of 2)

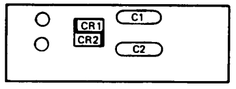


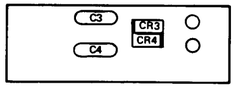




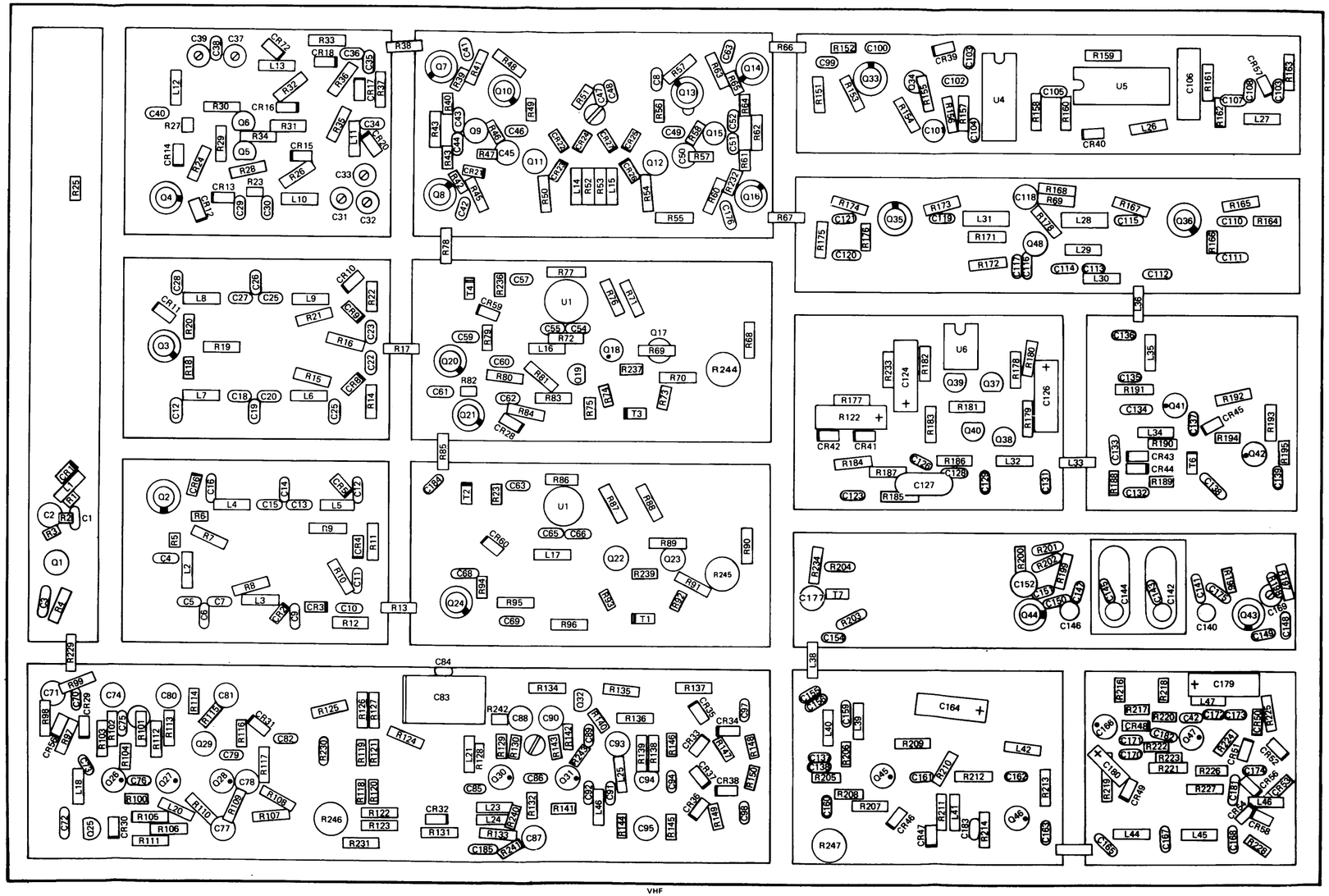


MIXER



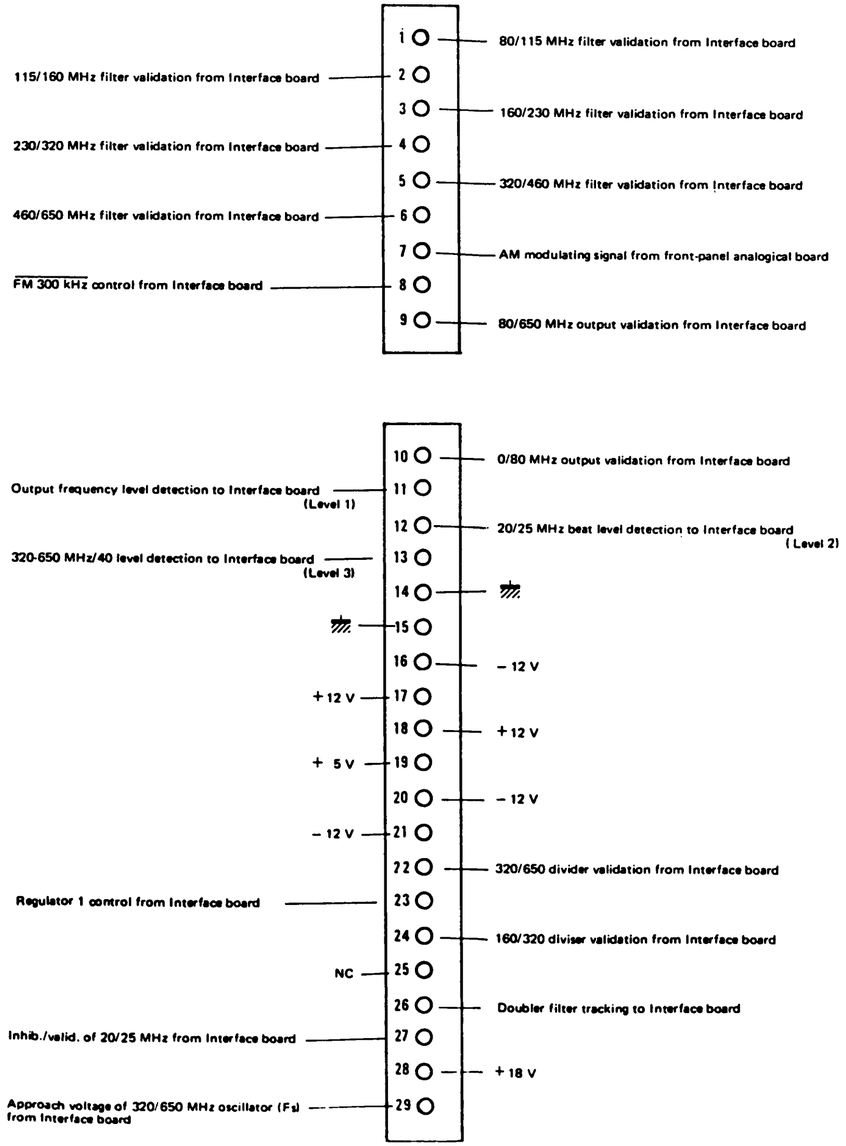


AM MODULATION



VHF

VHF MODULE



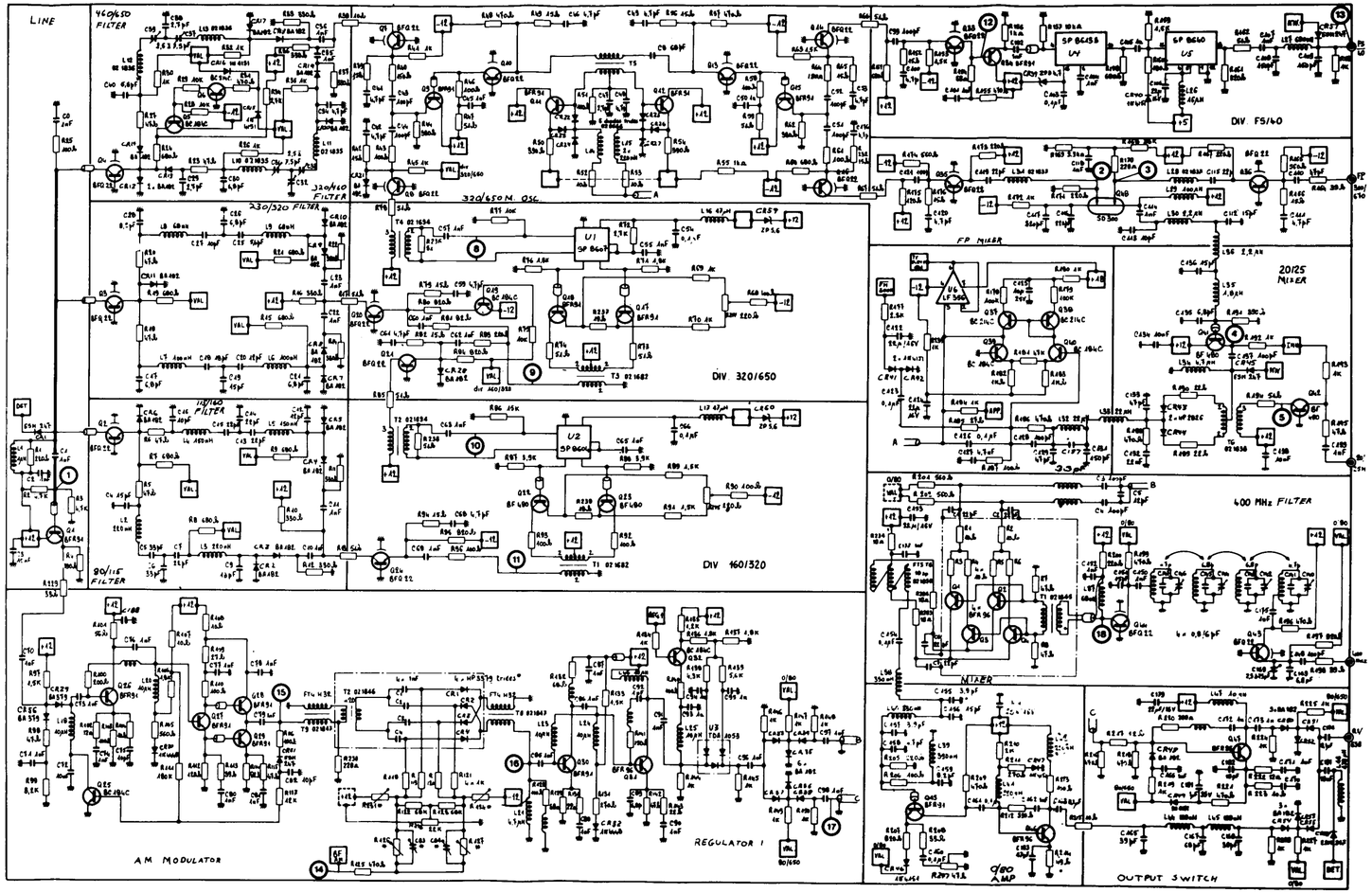
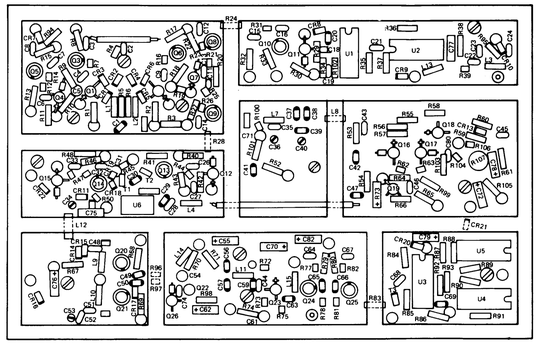
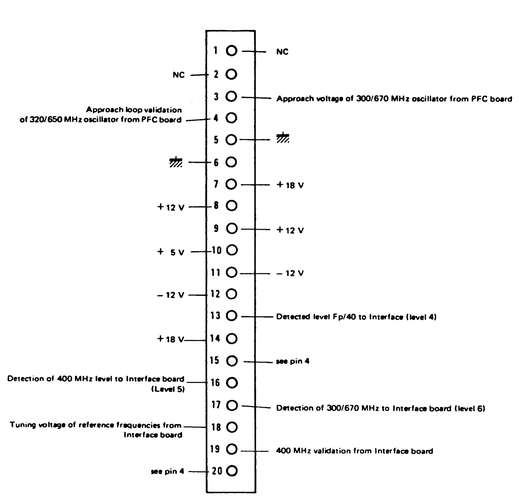


Figure 5-10. VHF, Mixer and AM Modulation, Schematic Diagram



10 MHz STEPS MODULE



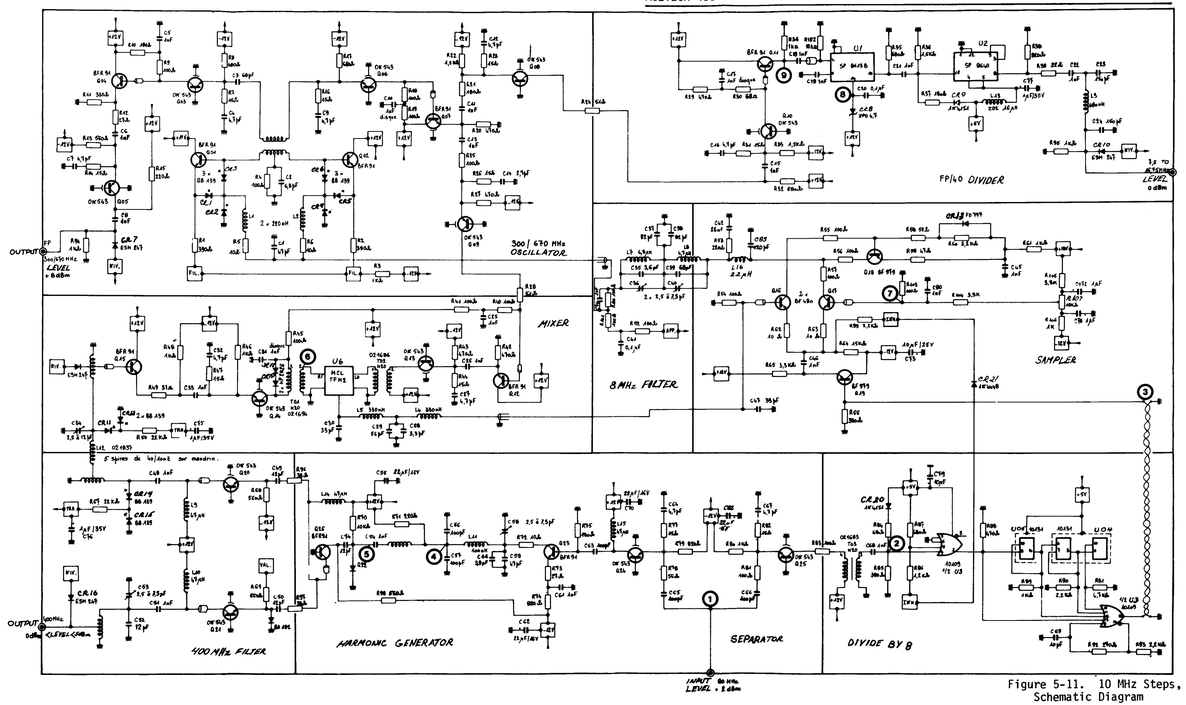
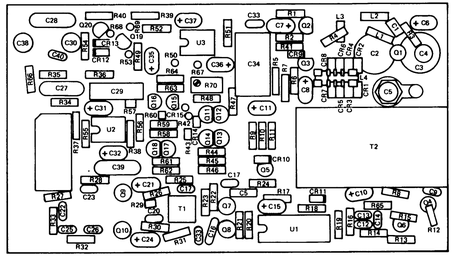


Figure 5-11. 10 MHz Steps, Schematic Diagram



20/25 MHz MODULE

1	
2	
3	FM modulating signal from front-panel analogical board
4	
5	+ 18 V
6	+ 12 V
7	- 12 V
8	+ 5 V
9	A0 — FM correction
10	A1 — FM correction
11	A2 — FM correction
12	A3 — FM correction
13	A4 — Sense bit
14	A5 — FM-PM range control
15	A6 — FM-PM range control
16	Phase locking voltage of 32/58 MHz oscillator to PFC board
17	Phase locking voltage of 80/100 MHz oscillator from counters board
18	
19	20/25 MHz to PFC board
20	

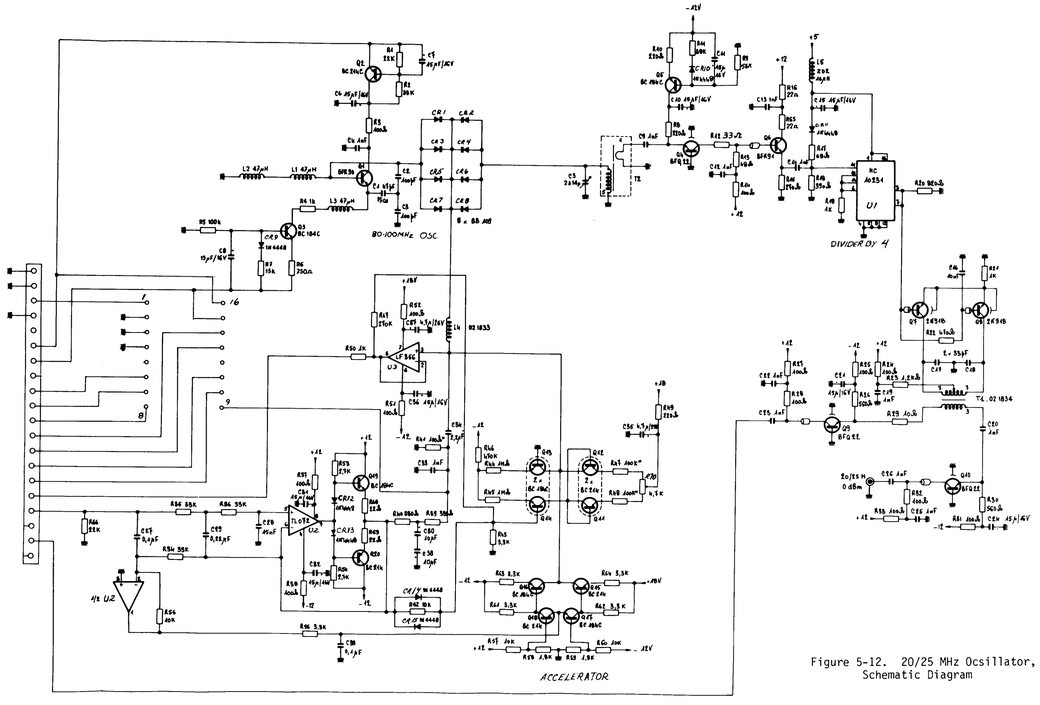
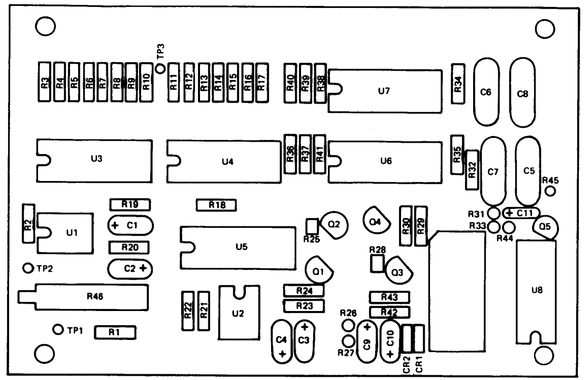
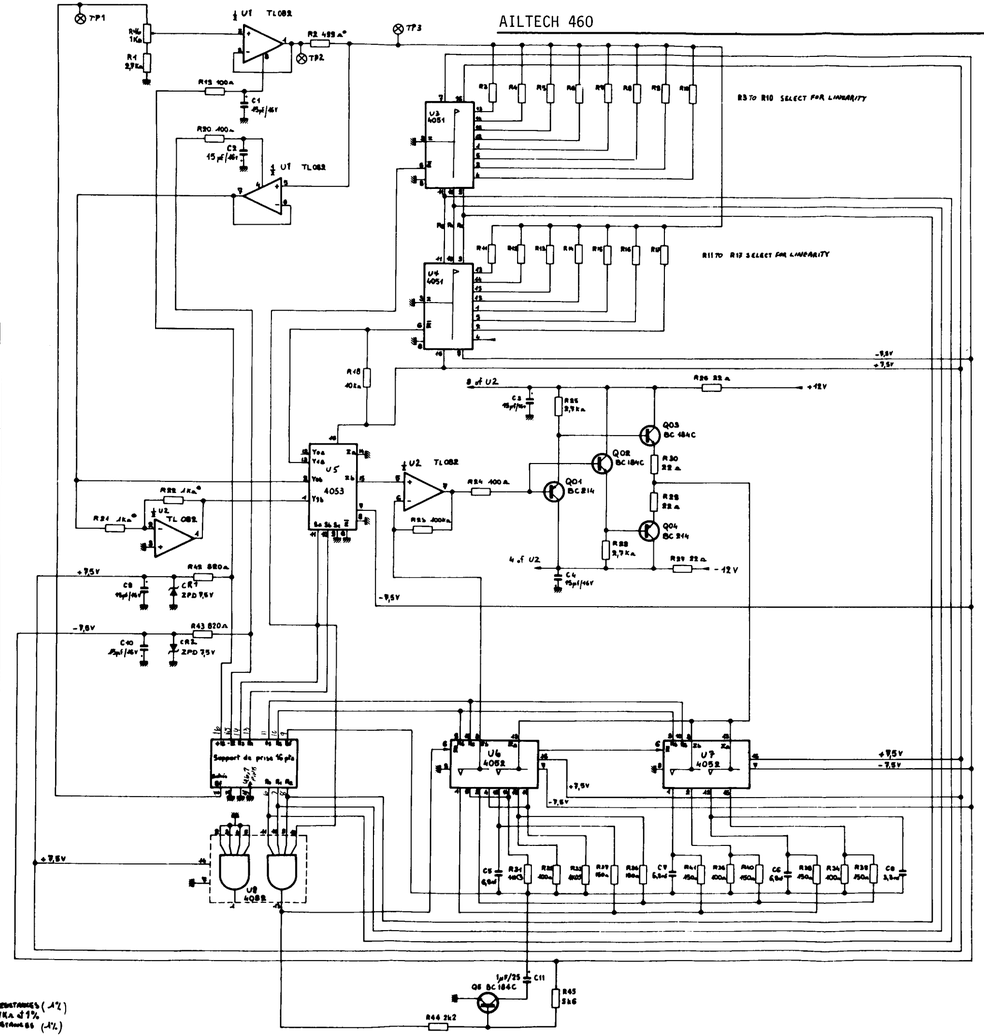


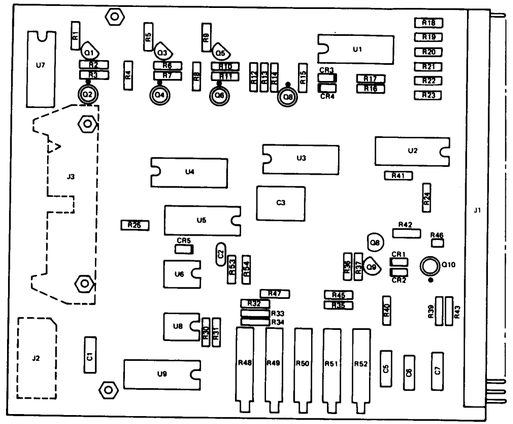
Figure 5-12. 20/25 MHz Ocsillator, Schematic Diagram



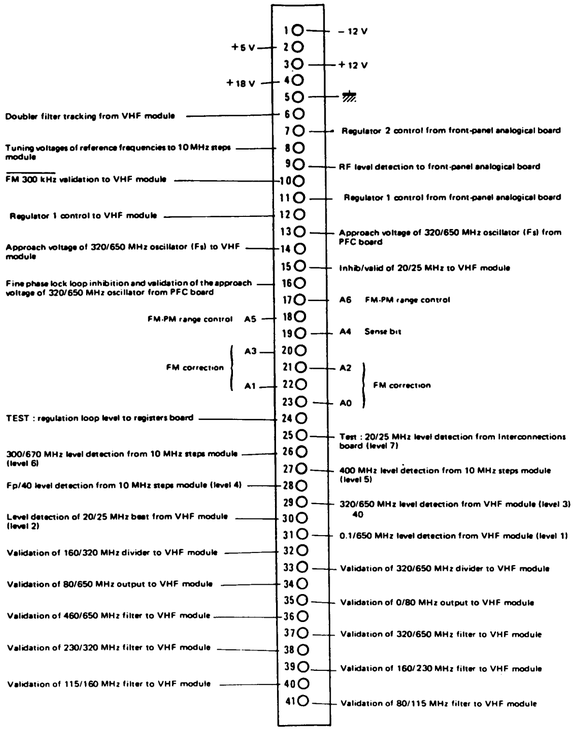


R3 to R10 SELECTED RESISTANCES (1%)
R24 & R23 SELECTED RESISTANCES (1%)
R28 & R27 SELECTED RESISTANCES (1%)

Figure 5-13. Linearizer, Schematic Diagram



INTERFACE BOARD



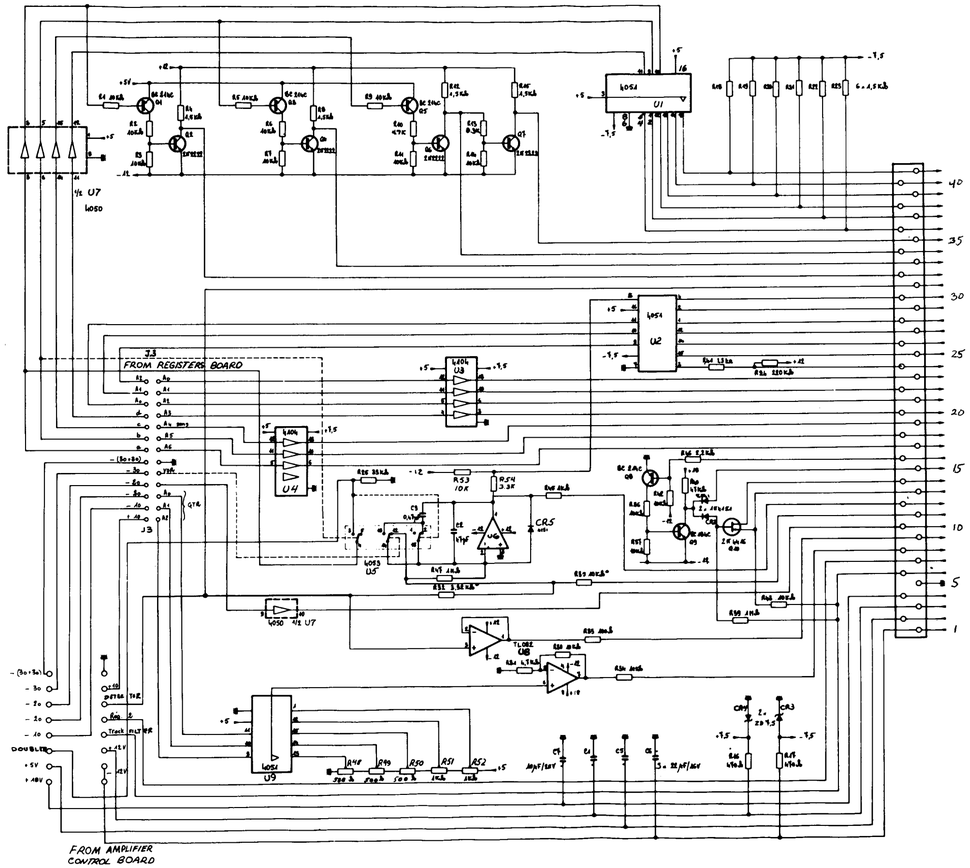
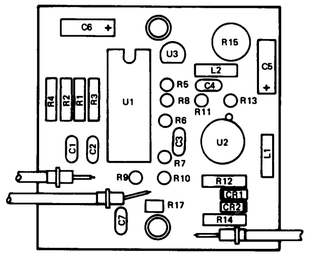
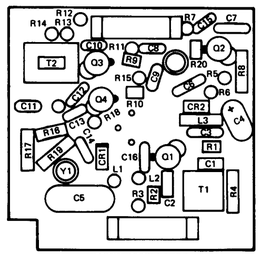


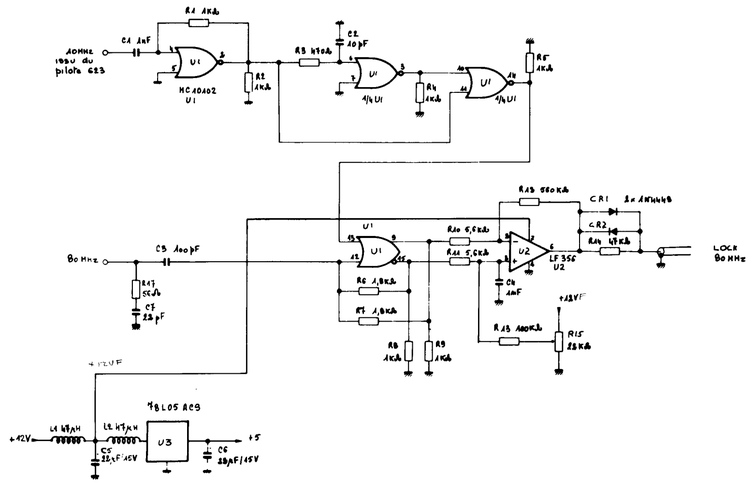
Figure 5-14. Interface, Schematic Diagram

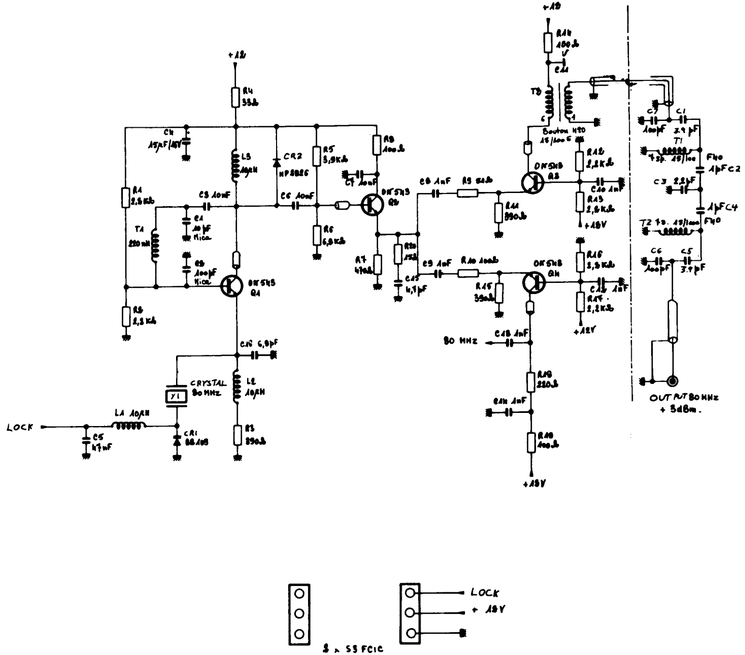


80 MHz LOCK



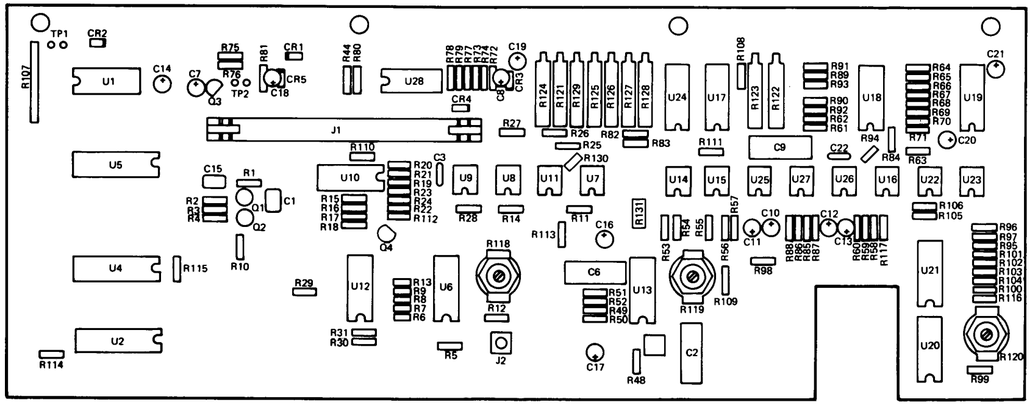
80 MHz OSCILLATOR



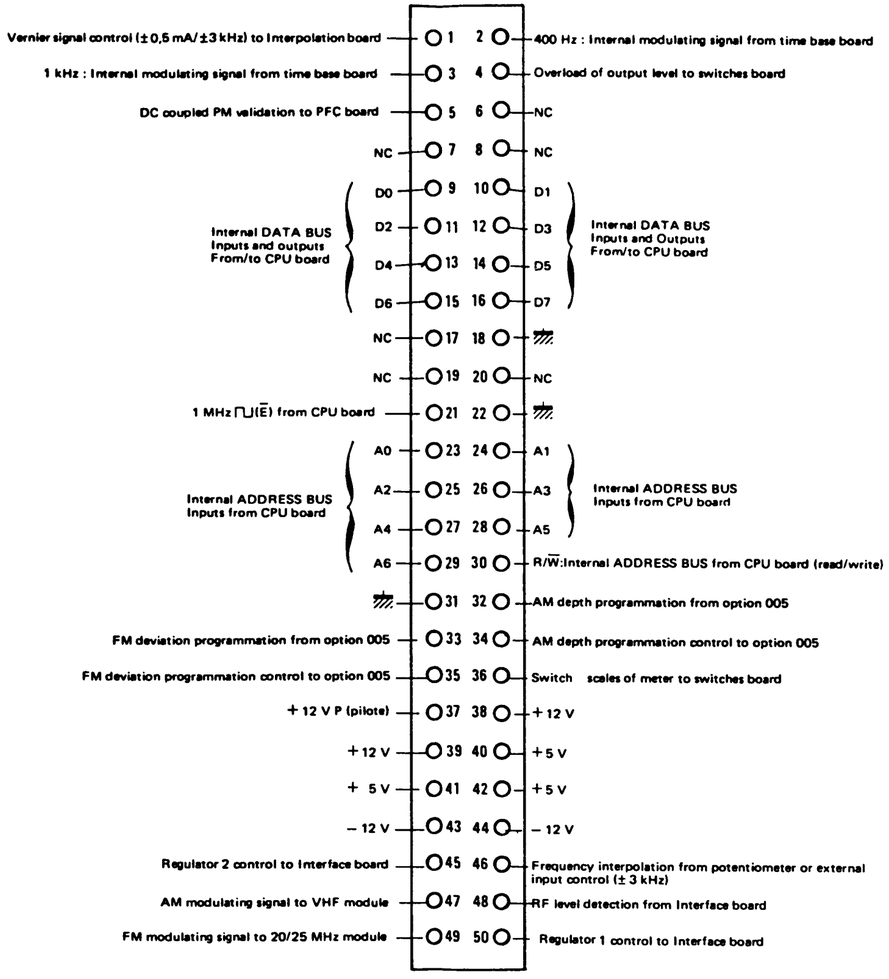


80 MHz OSCILLATOR

Figure 5-15. Pilot, Schematic Diagram



FRONT-PANEL ANALOGICAL BOARD



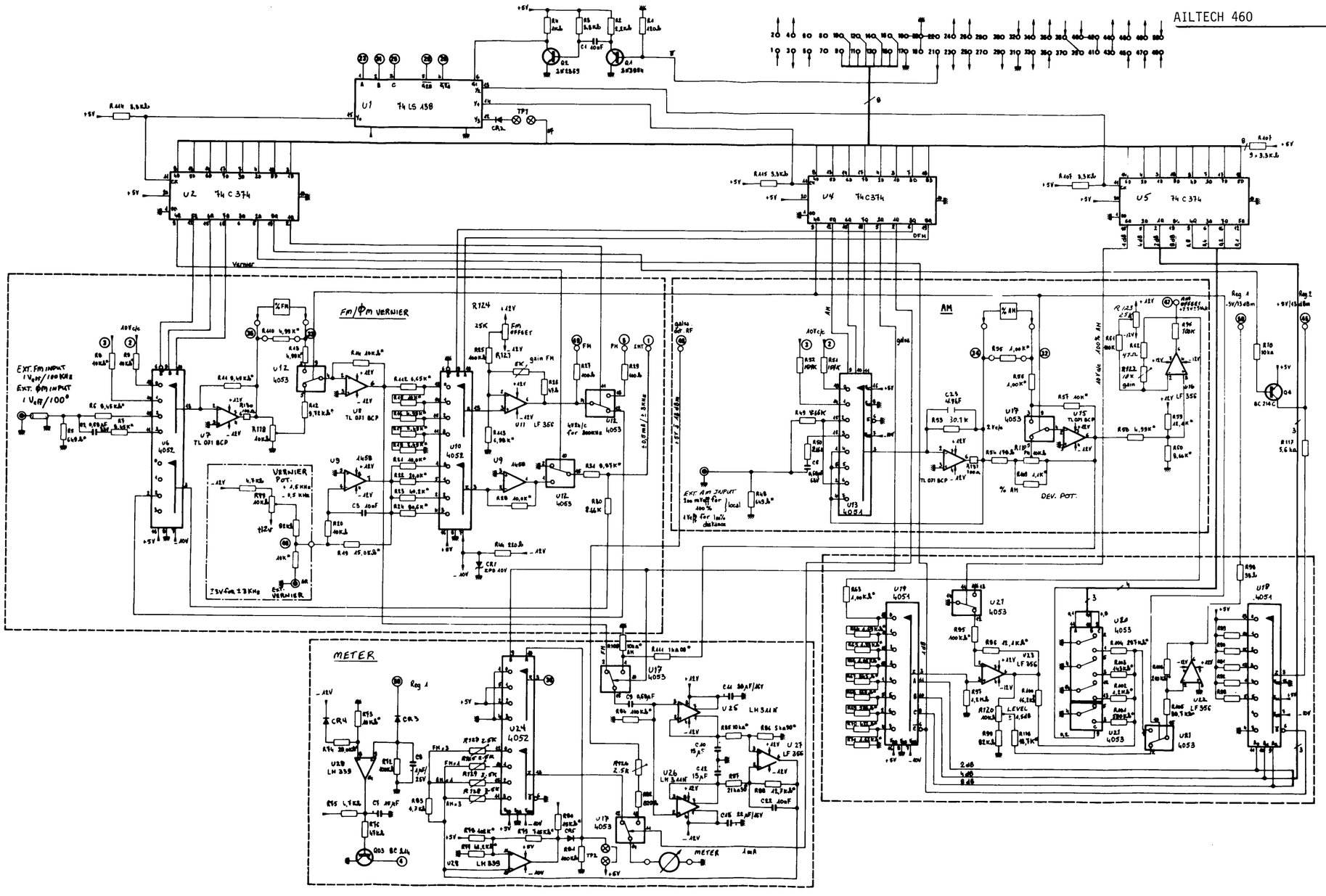
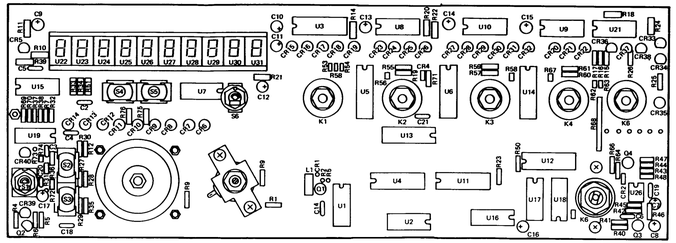
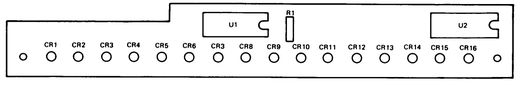
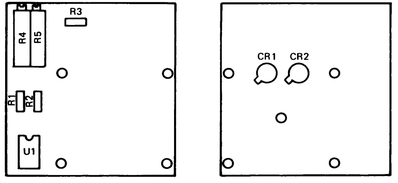


Figure 5-16. Front Panel Analog, Schematic Diagram



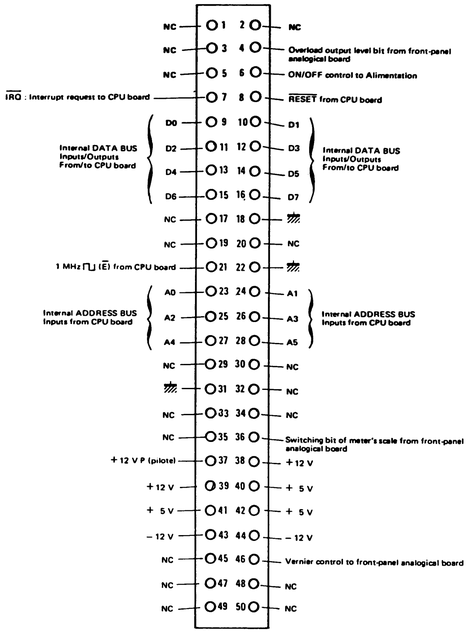


POWER LED INDICATIONS



ENCODER

FRONT PANEL
LOGICAL CIRCUITS



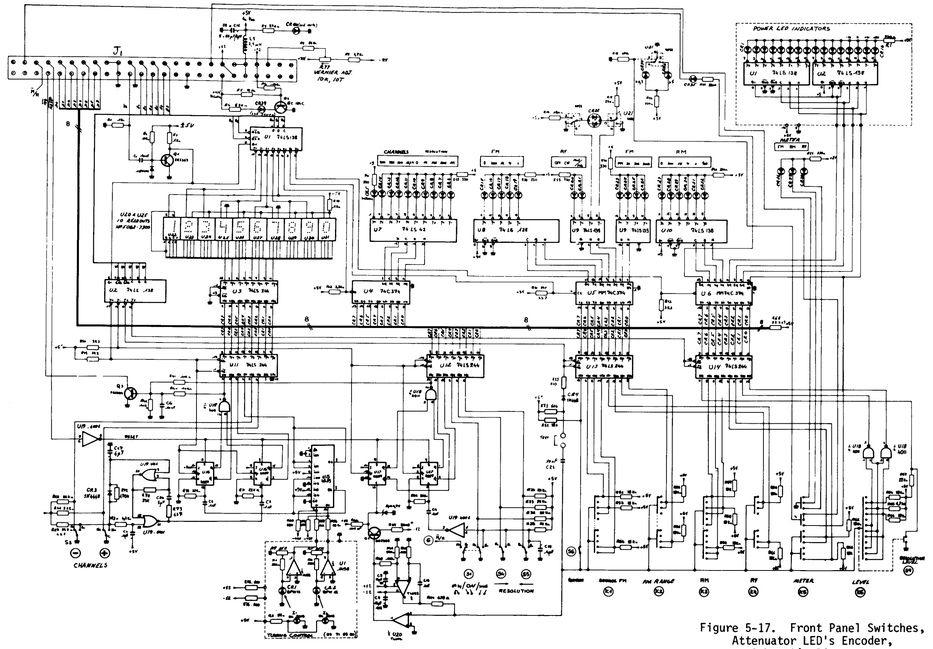
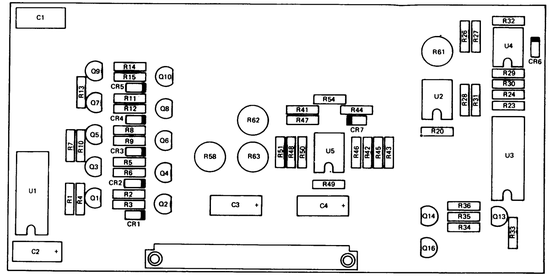
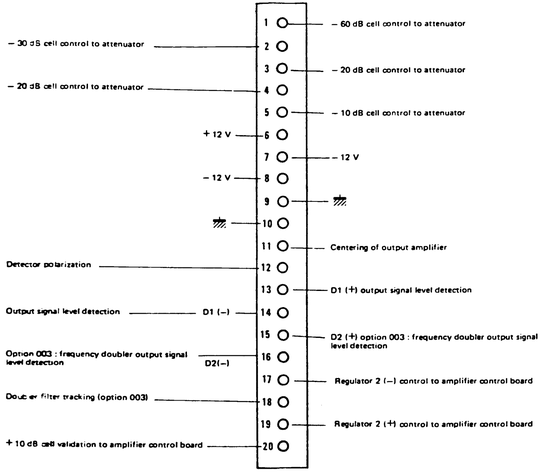


Figure 5-17. Front Panel Switches, Attenuator LED's Encoder, Schematic Diagram



OUTPUT AMPLIFIER MODULE CONNECT TO AMPLIFIER CONTROL BOARD



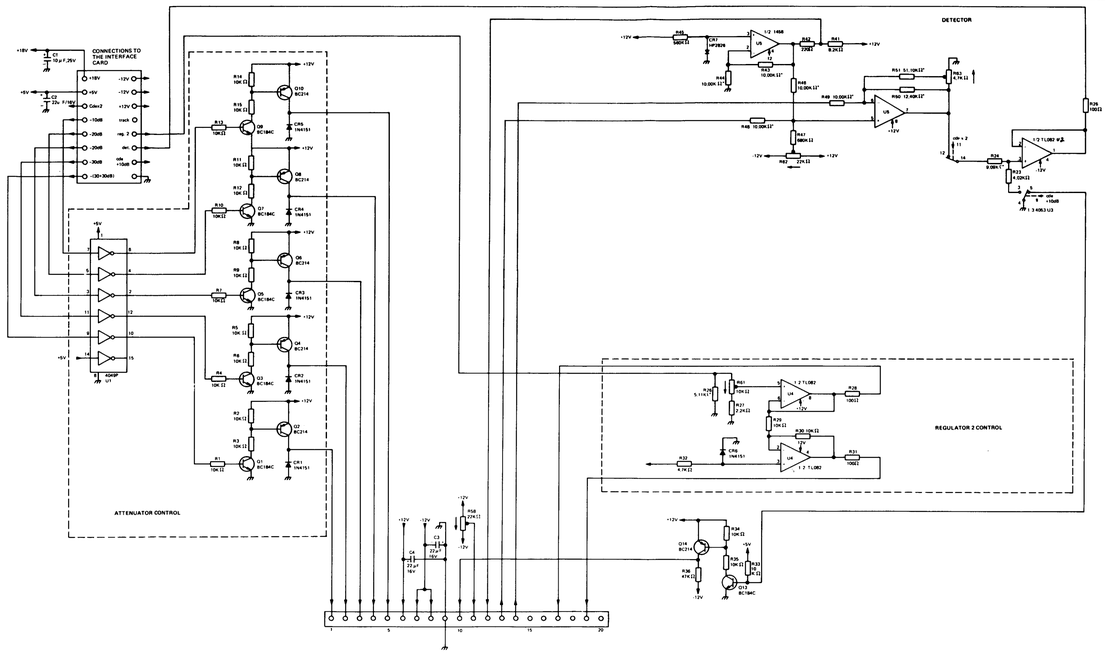
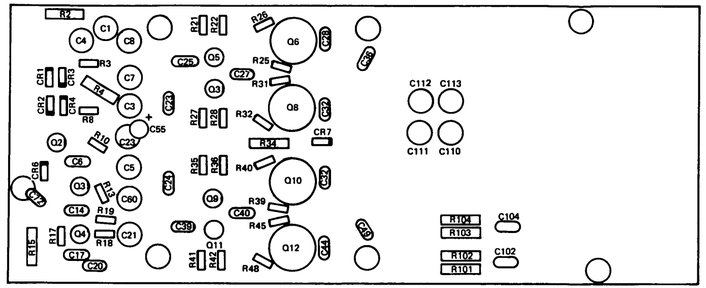
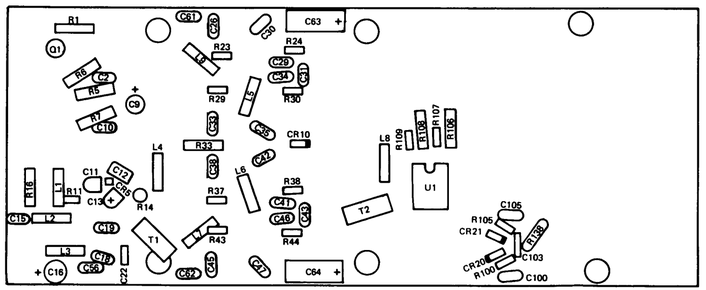


Figure 5-18. Amplifier Control Standard, Schematic Diagram





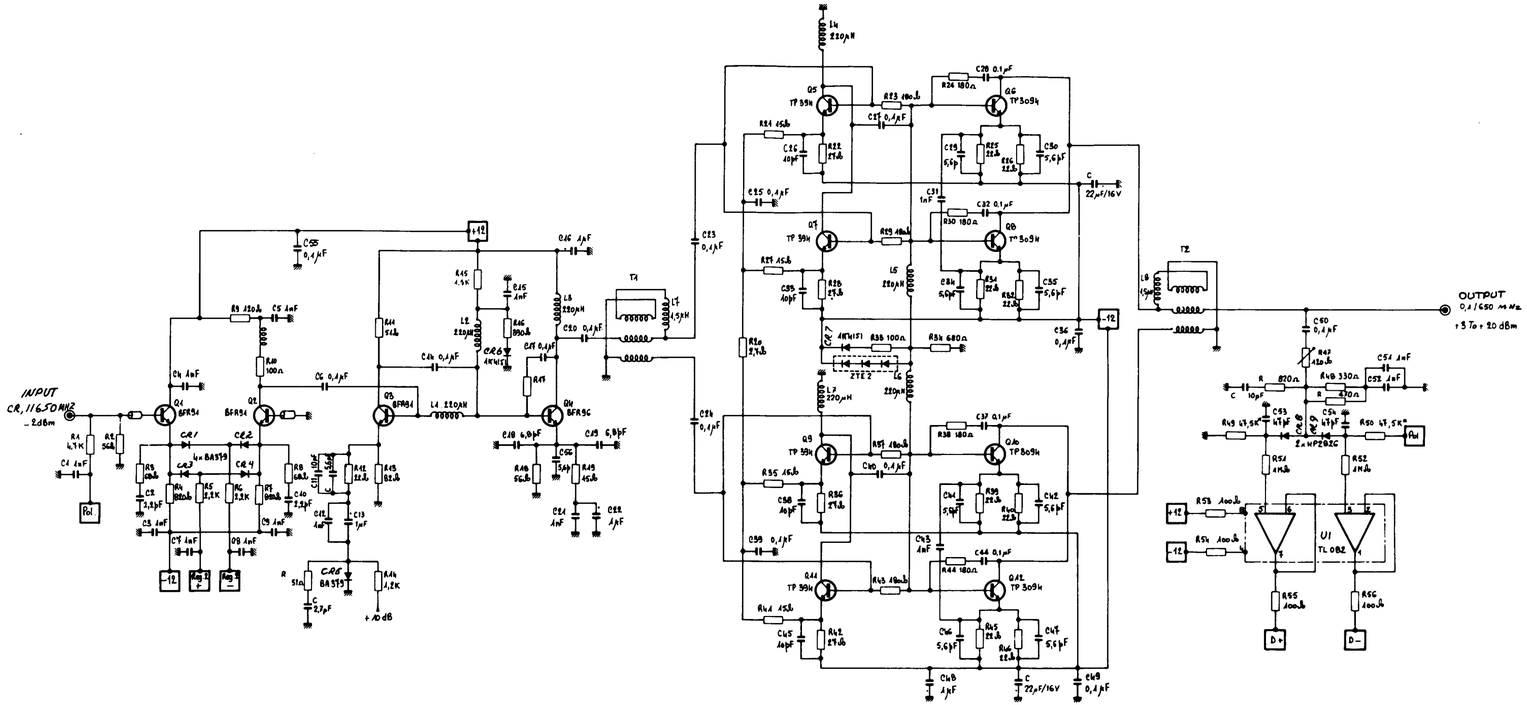
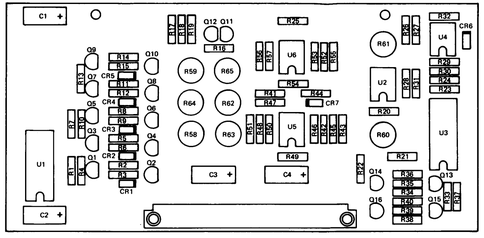
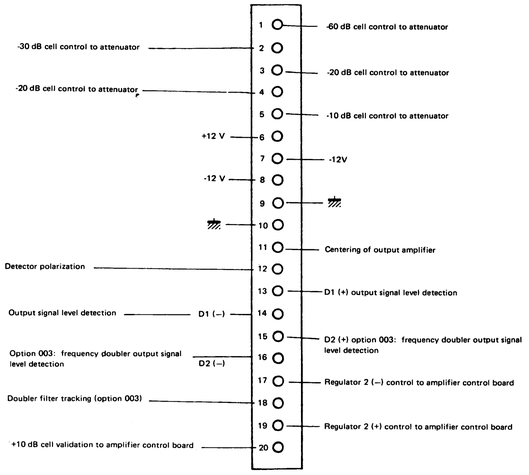


Figure 5-19. Output Amplifier, Standard, Schematic Diagram



COMMAND DOUBLER

OUTPUT AMPLIFIER MODULE CONNECT TO AMPLIFIER CONTROL BOARD



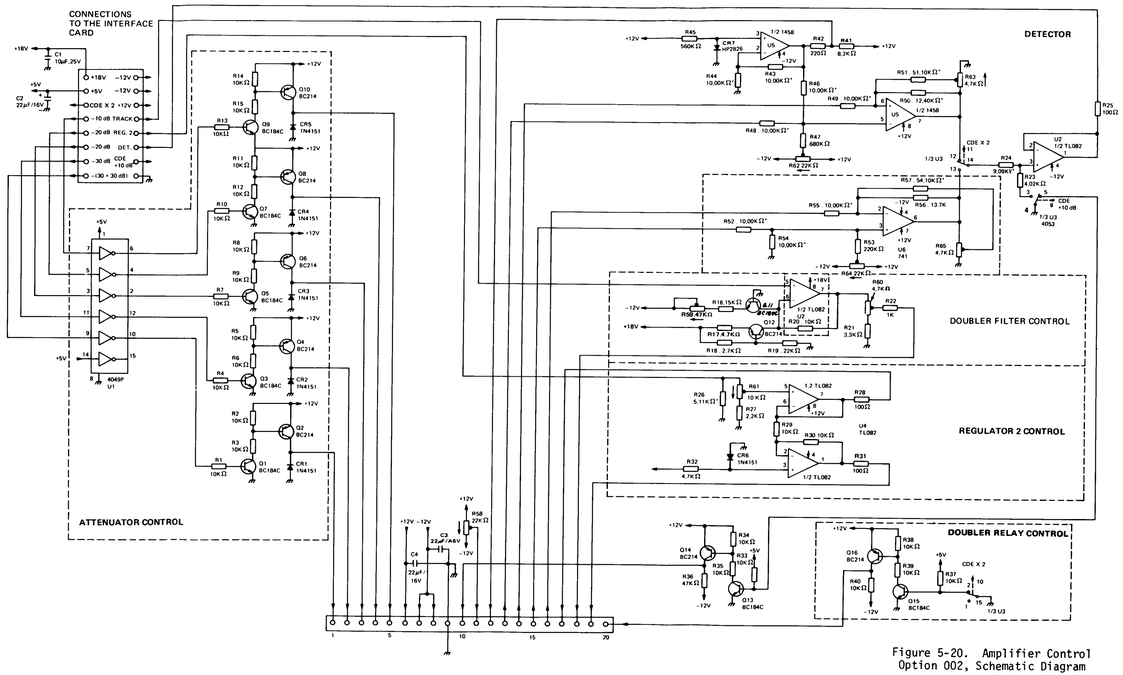
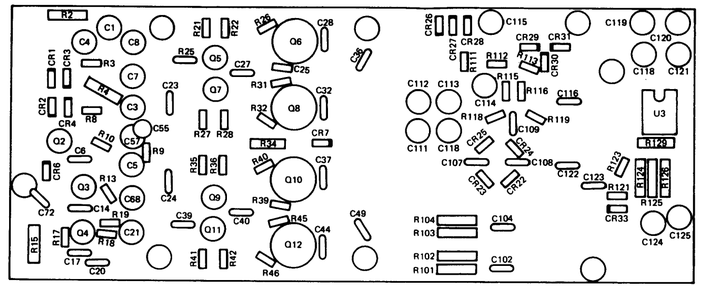
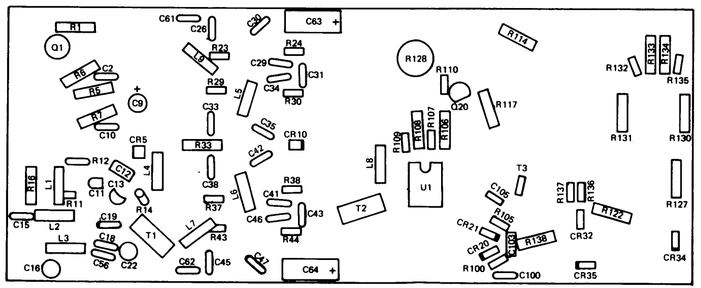


Figure 5-20. Amplifier Control Option 002, Schematic Diagram





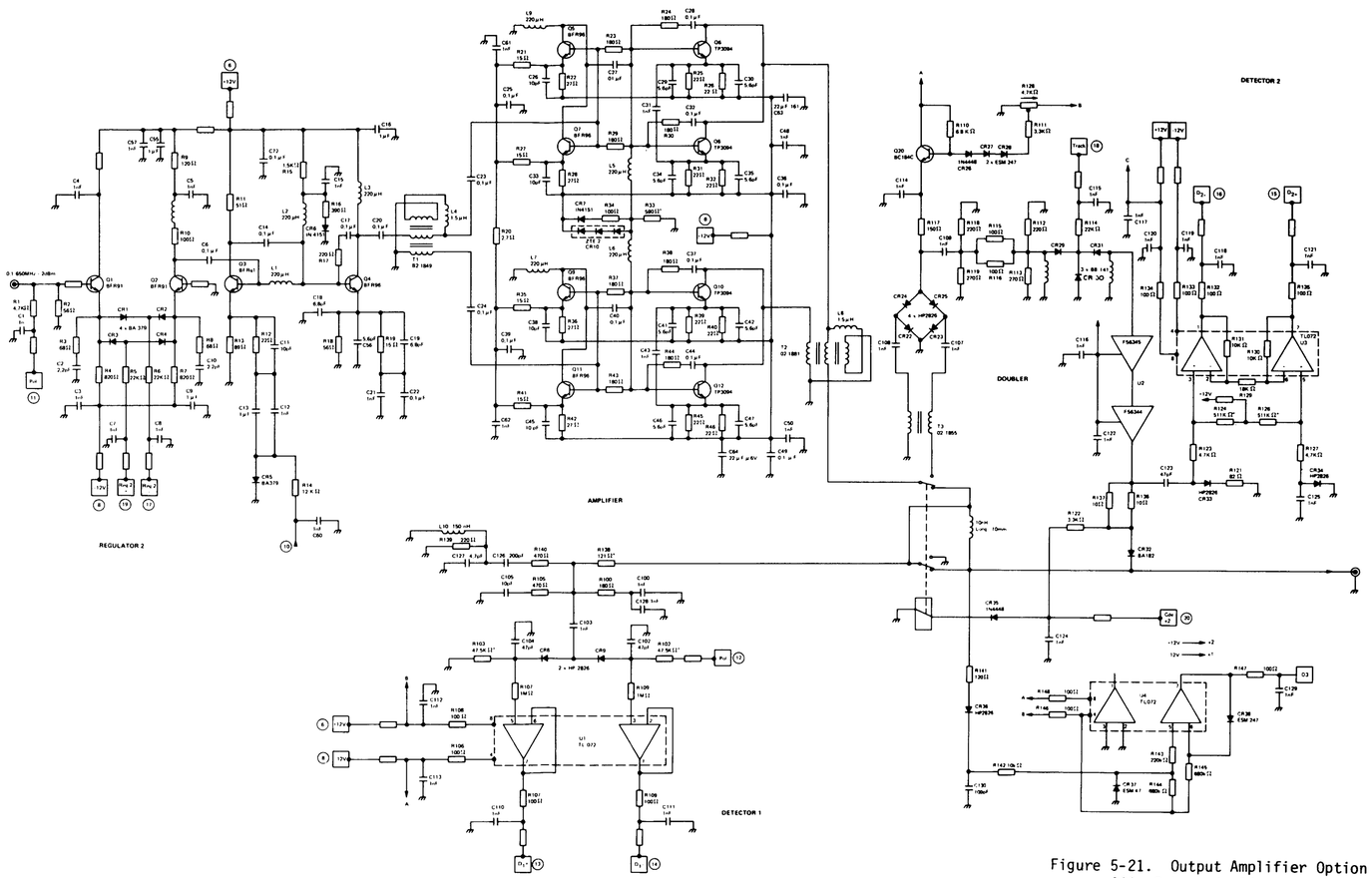


Figure 5-21. Output Amplifier Option 002, Schematic Diagram

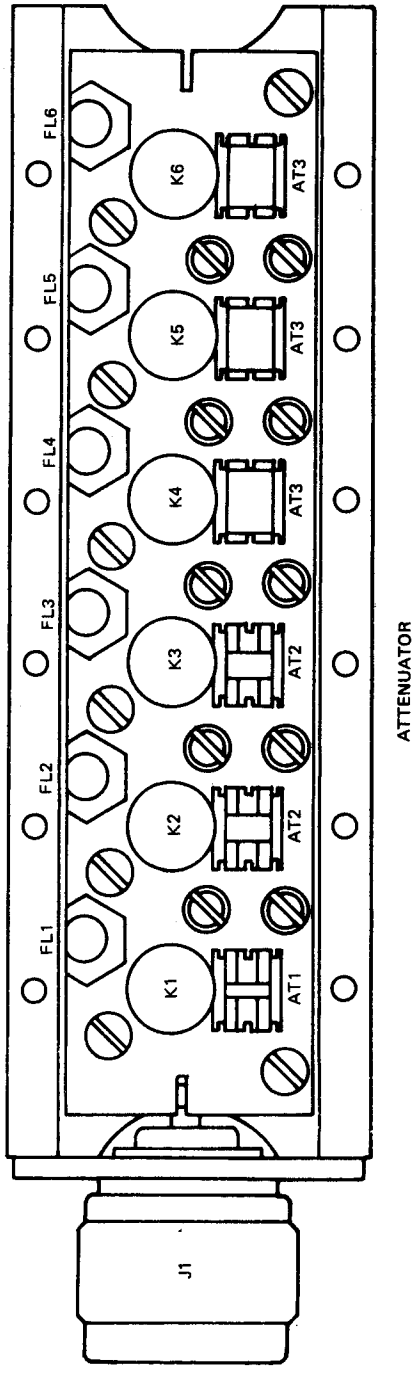
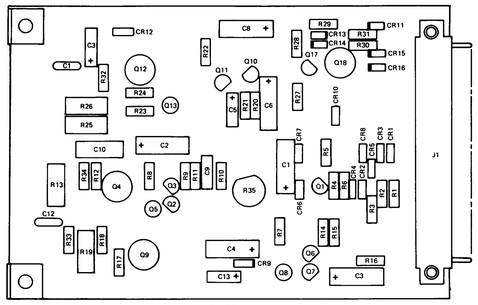
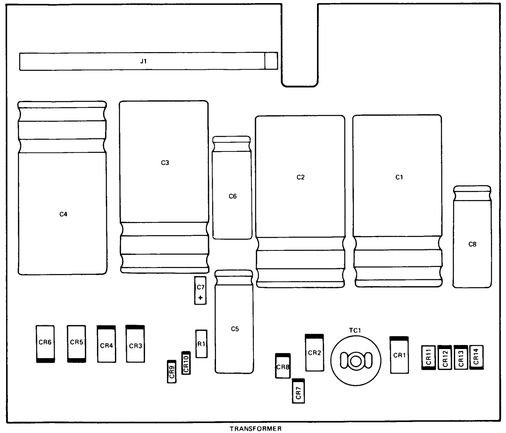


Figure 5-22. Attenuator

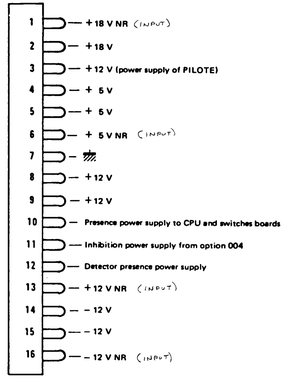


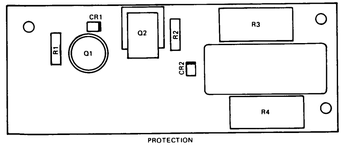
FILTER



TRANSFORMER

POWER SUPPLY/RECTIFIER





PROTECTION

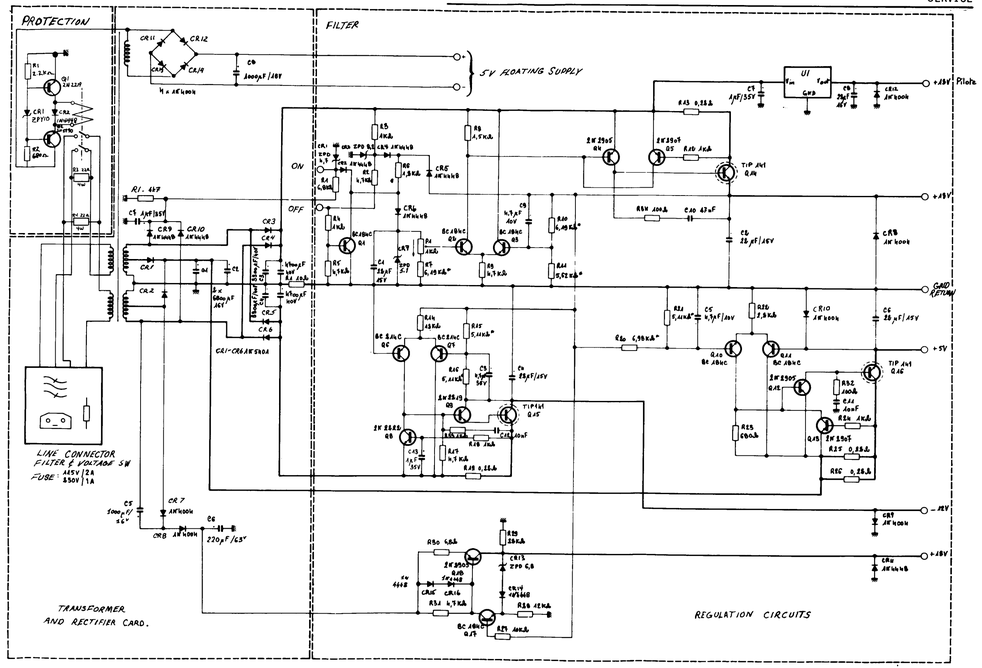


Figure 5-23. Filter, Regulation, and Protection, Schematic Diagram

SECTION 6

REPLACEABLE PARTS LIST

6.1. INTRODUCTION

6.2. This section contains the replaceable parts list for the 460 Signal Generator. The parts list contains the reference desgnation, AILTECH part number, quantity, description, manufacturer's part number, and figure number where part appears.

6.3 LIST OF MAJOR COMPONENTS

6.4 Table 6-1 provides a list of major components for the AILTECH 460 Signal Generator table 6-1 gives the name, and part number of each component.

6.5 REPLACEABLE PARTS LIST

6.6 Table 6-2 provides a list of replaceable parts for the AILTECH 460 Signal Generator.

Table 6-1. List of Major Components

Name	Part Number
Interpolator	297435
Time Base	297433
CPF	297440
Counters	297441
Registers	297437
CPU	297434
IEEE Bus No. 1	297445
Connector Card	297447
IEEE Bus No. 2	297446
Motherboard	297461

Table 6-1. List of Major Components (Cont.)

Name	Part Number
VHF	297462
Mixer	297471
AM Modulation	297463
10 MHz Steps	297464
Interconnect	297451
20/25 MHz Oscillator	297465
Linearizer	297466
Interface	297439
Pilot	297473
Front Panel Analog	297436
Front Panel Switches	297442
Attenuator LEDs	297443
Encoder	297444
Command Amplifier Standards	297467
Amplifier Standard	297468
Command Amplifier X2	297469
Amplifier Doubler	297470
Attenuator	297472
Filter	297448
Regulation Power Supply	297449
Protection, Power Supply	297450

TABLE 6-2. REPLACEABLE PARTS LIST

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
	297435	1	Interpolator	297435	5-1
C1	3700100000	4	Capacitor, 4.7 MMF, 25V		
C2	3120021000	5	Capacitor, 1000 pF		
C3	3120011000	2	Capacitor, 100 pF		
C4	3150031000	19	Capacitor, 10 nF		
C5	3120021000		Capacitor, 1000 nF		
C6	3233220000	1	Capacitor, 22 nF, 10%		
C7	3150031000		Capacitor, 10 nF		
C8	3150031000		Capacitor, 10 nF		
C9	3120021000		Capacitor, 1000 pF		
C10	3150031000		Capacitor, 10 nF		
C11	3120003200	15	Capacitor, 82 pF		
C12	3700100000		Capacitor, 4.7 MMF, 25V		
C13	3150031000		Capacitor, 10 nF		
C14	3120021000		Capacitor, 1000 pF		
C15	3120021000		Capacitor, 1000 pF		
C16	3120001000	2	Capacitor, 10 pF		
C17	3120011000		Capacitor, 100 pF		
C18	3700180000	3	Capacitor, 15 MMF, 16V		
C19	3700100000		Capacitor, 4.7 MMF, 25V		
C20	3120011800	1	Capacitor, 180 pF		
C21	3120002200	1	Capacitor, 22 pF		
C22	3120004700	1	Capacitor, 47 pF		
C23	3150031000		Capacitor, 10 nF		
C24	3150031000		Capacitor, 10 nF		
C25	3150031000		Capacitor, 10 nF		
C26	3150031000		Capacitor, 10 nF		
C27	3120008200		Capacitor, 82 pF		
C28	3120008200		Capacitor, 82 pF		
C21	3120003900	2	Capacitor, 39 pF		
C30	3100000000		Capacitor, SELECTED		
C31	3120008200		Capacitor, 82 pF		
C32	3120008200		Capacitor, 82 pF		
C33	3120008200		Capacitor, 82 pF		
C34	3120008200		Capacitor, 82 pF		
C35	3120008200		Capacitor, 82 pF		
C36	3120008200		Capacitor, 82 pF		
C37	3120001200	2	Capacitor, 12 pF		
C38	3120001000		Capacitor, 10 pF		
C39	3120001200		Capacitor, 12 pF		
C40	3150031000		Capacitor, 10 nF		
C41	3700180000		Capacitor, 15 MMF, 16V		
C42	3700100000		Capacitor, 4.7 MMF, 25V		
C43	3120011500	1	Capacitor, 150 pF		
C44	3120003300	2	Capacitor, 33 pF		
C45	3120003300		Capacitor, 33 pF		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-1
C46	3150031000		10 nF, Capacitor		
C47	3150031000		10 nF, Capacitor		
C48	3150031000		10 nF, Capacitor		
C49	3150031000		10 nF, Capacitor		
C50	3150031000		10 nF, Capacitor		
C51	3150031000		10 nF, Capacitor		
C52	3120008200		82 pF, Capacitor		
C53	3120008200		82 pF, Capacitor		
C54	3120003900		39 pF, Capacitor		
C55	3100000000		Selected Capacitor		
C56	2120008200	2	82 pF, Capacitor		
C57	3120008200		82 pF, Capacitor		
C58	3120008200		82 pF, Capacitor		
C59	3140008200		82 pF, Capacitor		
C60	3120096800	2	6.8 pF, Capacitor		
C61	3120096800	2	6.8 pF, Capacitor		
C62	3150031000		10 nF, Capacitor		
C63	3150031000		10 nF, Capacitor		
C64	3150031000		10 nF, Capacitor		
C65	3700180000		15 MMF/16V, Capacitor		
C66	3120095600	1	5.6 pF, Capacitor		
C67	3150031000		10 nF, Capacitor		
C68	3120001500	1	15 pF		
CR1	4500440000	1	Diode	BB212	
CR2	4500020000	3	Diode	IN4151	
CR3	4500020000		Diode	IN4151	
CR4	4500020000		Diode	IN4151	
L1	5303360000	4	Inductor, 16 MMH		
L2	5303360000		Inductor, 16 MMH		
L3	5303360000		Inductor, 15 MMH		
L4	5303360000		Inductor, 16 MMF		
MP1	1900200000	1	Extractor		
MP2	1900210000	1	Extractor		
Q1	4300220000	1	Transistor	BF 272	
Q2	4300070000	3	Transistor	2N2894	
Q3	4300050000	3	Transistor	2N2369A	
Q4	4300110000	2	Transistor	BC214C	
Q5	4300190000	3	Transistor	BC184C	
Q6	4300070000		Transistor	2N2894	
Q7	4300050000		Transistor	2N2369A	
Q8	4300110000		Transistor	BC214C	
Q9	4300190000		Transistor	BC184C	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-1
Q10	300070000		Transistor	2N2894	
Q11	4300050000		Transistor	2N2369A	
Q12	4300140000	2	Transistor	2N5179	
Q13	4300140000		Transistor	2N5179	
Q14	43000190000		Transistor	BC184C	
R1	2200014700	3	Resistor, 470 Ω , 1/4W, 2%		
R2	2200031500	2	Resistor, 15K, 1/4W, 2%		
R3	2200024700	9	Resistor, 4.7K, 1/4W, 2%		
R4	2200031000	9	Resistor, 10K, 1/4W, 2%		
R5	2200031000		Resistor, 10K, 1/4W, 2%		
R6	2200031000		Resistor, 10K, 1/4W, 2%		
R7	2200011000	9	Resistor, 100 Ω , 1/4W, 2%		
R8	2200021500	3	Resistor, 1.5K, 1/4W, 2%		
R9	2200031000		Resistor, 10K, 1/4W, 2%		
R10	2200021000	11	Resistor, 1K, 1/4W, 2%		
R11	2200022200	3	Resistor, 2.2K, 1/4W, 2%		
R12	2200022200		Resistor, 2.2K, 1/4W, 2%		
R13	2200011000		Resistor, 100 Ω , 1/4W, 2%		
R14	2200011000		Resistor, 100 Ω , 1/4W, 2%		
R15	2200021000		Resistor, 1K, 1/4W, 2%		
R16	2500212100	1	Resistor, 12.1K, 1/2W, 1%		
R17	2200032700	1	Resistor, 27K, 1/4W, 2%		
R18	2500140200	1	Resistor, 4.02K, 1/2W, 1%		
R19	2500149900	1	Resistor, 4.99K, 1/2W, 1%		
R20	2500210000	2	Resistor, 10K, 1/2W, 1%		
R21	2200023300	3	Resistor, 3.3K, 1/4W, 2%		
R22	2200031000		Resistor, 10K, 1/4W, 2%		
R23	2500210000		Resistor, 10K, 1/2W, 1%		
R24	2200042200	1	Resistor, 220K, 1/4W, 2%		
R25	2200021000		Resistor, 1K, 1/4W, 2%		
R26	2200021000		Resistor, 1K, 1/4W, 2%		
R27	2200011000		Resistor, 100 Ω , 1/4W, 2%		
R28	2200023300		Resistor, 3.3K, 1/4W, 2%		
R29	2200024700		Resistor, 4.7K, 1/4W, 2%		
R30	2200024700		Resistor, 4.7K, 1/4W, 2%		
R31	2200031000		Resistor, 10K, 1/4W, 2%		
R32	2200021800	2	Resistor, 1.8K, 1/4W, 2%		
R33	2200024700		Resistor, 4.7K, 1/4W, 2%		
R34	2200022200		Resistor, 2.2K, 1/4W, 2%		
R35	2200021000		Resistor, 1K, 1/4W, 2%		
R36	2200021000		Resistor, 1K, 1/4W, 2%		
R37	2200018200	5	Resistor, 820 Ω , 1/4W, 2%		
R38	2200018200		Resistor, 820 Ω , 1/4W, 2%		
R39	2200023900	4	Resistor, 3.9K, 1/4W, 2%		
R40	2200023900		Resistor, 3.9K, 1/4W, 2%		
R41	2200011000		Resistor, 100 Ω , 1/4W, 2%		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-1
R42	2200005600	4	Resistor, 56 Ω , 1/4W, 2%		
R43	2200005600	4	Resistor, 56 Ω , 1/4W, 2%		
R44	2200012200	3	Resistor, 220 Ω , 1/4W, 2%		
R45	2900011000	2	Resistor, 100 Ω , 1/8W, 2%		
R46	2900028200	1	Resistor, 8.2K, 1/8W, 2%		
R47	2200016800	1	Resistor, 680 Ω , 1/4W, 2%		
R48	2200021500		Resistor, 1.5K, 1/4W, 2%		
R49	2200031000		Resistor, 10K, 1/4W, 2%		
R50	2200021000		Resistor, 1K, 1/4W, 2%		
R51	2200023300		Resistor, 3.3K, 1/4W, 2%		
R52	2200024700		Resistor, 4.7K, 1/4W, 2%		
R53	2200024700		Resistor, 4.7K, 1/4W, 2%		
R54	2200031000		Resistor, 10K, 1/4W, 2%		
R55	2200011000		Resistor 100 Ω , 1/4W, 2%		
R56	2200021800		Resistor, 1.8K, 1/4W, 2%		
R57	2200024700		Resistor, 4.7K, 1/4W, 2%		
R58	2200021000		Resistor, 1K, 1/4W, 2%		
R59	2200021000		Resistor, 1K, 1/4W, 2%		
R60	2200021000		Resistor, 1K, 1/4W, 2%		
R61	2200018200		Resistor, 820 Ω , 1/4W, 2%		
R62	2200018200		Resistor, 820 Ω , 1/4W, 2%		
R63	2200023900		Resistor, 3.9K, 1/4W, 2%		
R64	2200023900		Resistor, 2.9K, 1/4W, 2%		
R65	2200011000		Resistor, 100 Ω , 1/4W, 2%		
R66	2200005600		Resistor, 56 Ω , 1/4W, 2%		
R67	2200005600		Resistor, 56 Ω , 1/4W, 2%		
R68	2200012200		Resistor, 220 Ω , 1/4W, 2%		
R69	2900011000		Resistor, 100 Ω , 1/8W, 2%		
R70	2200011000		Resistor, 100 Ω , 1/4W, 2%		
R71	2200011000		Resistor, 100 Ω, 1/4W, 2%		
R72	2200024700		Resistor, 4.7K, 1/4W, 2%		
R73	2200024700		Resistor, 4.7K, 1/4W, 2%		
R74	2200012200		Resistor, 220 Ω , 1/4W, 2%		
R75	2200031500		Resistor, 15K, 1/4W, 2%		
R76	2200018200		Resistor, 820 Ω , 1/4W, 2%		
R77	2200021500		Resistor, 1.5K, 1/4W, 2%		
R78	2200021000		Resistor, 10K, 1/4W, 2%		
R79	2200021000		Resistor, 10K, 1/4W, 2%		
R80	2200014700		Resistor, 470 Ω , 1/4W, 2%		
R81	2200014700		Resistor, 470 Ω , 1/4W, 2%		
R82	2900031500		Resistor, 15K, 1/8W, 2%		
R83	2131470000	1	Potentiometer, 470 Ω , 10K		
R84	2133100000	1	Potentiometer, 470 Ω , 10K		
T1	0218150000	1	Transformer	F10B	
T2	0218160000	1	Transformer	F10B	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-1
T3	0218170000	1	Transformer	F2	
T4	0218180000	2	Transformer	F10B	
T5	0218180000		Transformer	F10B	
T6	0218190000	2	Transformer	F10B	
T7	0218200000	3	Transformer	F10B	
T8	0218200000		Transformer	F10B	
T9	0218210000	2	Transformer	F10B	
T10	0218190000		Transformer	F10B	
T11	0218200000		Transformer	F10B	
T12	0218210000		Transformer	F10B	
TP1 thru TP31	1400109900	31	Test Point		
U1	4150740200	1	Integrated Circuit	SN74LS02N	
U2	4150744200	1	Integrated Circuit	SN74LS42N	
U3	4150749300	1	Integrated Circuit	SN74LS93N	
U4	4150749001	3	Integrated Circuit	SN74LS90N	
U5	4150742700	2	Integrated Circuit	SN72LS27N	
U6	4150749001		Integrated Circuit	SN72LS90N	
U7	4150742700		Integrated Circuit	SN74LS27N	
U8	4150749001		Integrated Circuit	SN74LS90N	
U9	4160400100	2	Integrated Circuit	C-MOS 4001	
U10	4160400100		Integrated Circuit	C-MOS 4001	
U11	4200180000	1	Integrated Circuit	NC 1458	
U12	4200400000	1	Integrated Circuit	TL 071 BCP	
U13	4200110000	2	Integrated Circuit	TBA 673	
U14	4200110000	2	Integrated Circuit	TBA 673	
W1	1100430000	1	Cable, Coaxial		
	297433	1	Time Base	297433	5-2
C1	3211196000	4	Capacitor, 1.96, nF, 63V, 25%		
C2	3700180000	5	Capacitor, 15 uF, 16V		
C3	2700180000	5	Capacitor, 15 uF, 16V		
C4	3211196000		Capacitor, 1.96 nF, 63V, 25%		
C5	3212100000	4	Capacitor, 10 nF, 63V, 25%		
C6	3212100000		Capacitor, 10 nF, 63V, 25%		
C7	3211196000		Capacitor, 1.96 nF, 63V, 25%		
C8	3211196000		Capacitor, 1.96 nF, 63V, 25%		
C9	3212100000		Capacitor, 10 nF, 63V, 25%		
C10	3234100000	2	Capacitor, 0.1 F, 10.2V, 10%		
C11	3232100000		Capacitor, 0.1 F, 10.2V, 10%		
C12	3233100000	3	Capacitor, 10 nF, 10.2V, 10%		
C13	3233100000		Capacitor, 10 nF, 10.2V, 10%		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-2
C14	3700180000		Capacitor, 15 MF, 15V		
C15			NOT USED		
C16	3700180000		Capacitor, 15 μF, 16V		
C17	3150031000	13	Capacitor, 10 nF		
C18	3233100000		Capacitor, 10 nF, 10.2V, 10%		
C19	3700180000		Capacitor, 15 μF, 16V		
C20	3150031000		Capacitor, 10 nF		
C21	3120093300	2	Capacitor, 3.3 pF		
C22	3120008200	14	Capacitor, 82 pF		
C23	3120008200		Capacitor, 82 pF		
C24	3120008200		Capacitor, 82 pF		
C25	3120008200		Capacitor, 82 pF		
C26	3150031000		Capacitor, 10 nF		
C27	3150031000		Capacitor, 10 nF		
C28	3150031000		Capacitor, 10 nF		
C29	3120011000	1	Capacitor, 100 nF		
C30			NOT USED		
C31	3120093300		Capacitor, 3.3 pF		
C32			NOT USED		
C33	3120008200		Capacitor, 82 pF		
C34	3120008200		Capacitor, 82 pF		
C35			NOT USED		
C36	3150031000		Capacitor, 10 nF		
C37	3150031000		Capacitor, 10 nF		
C38	3120008200		Capacitor, 82 pF		
C39	3120008200		Capacitor, 82 pF		
C40	3150031000		Capacitor, 10 nF		
C41	3140031000		Capacitor, 10 nF		
C42	3150031000		Capacitor, 10 nF		
C43	3120008200		Capacitor, 82 pF		
C44	3120008200		Capacitor, 82 pF		
C45	3150031000		Capcaitor, 10 nF		
C46	3212100000		Capacitor, 10 nF, 63V, 25%		
C47	3150031000		Capacitor, 10 nF		
C48	3150031000		Capacitor, 10 nF		
C49	3120008200		Capacitor, 82 pF		
C50	3120008200		Capacitor, 82 pF		
C51	3120008200		Capacitor, 82 pF		
C52	3120008200		Capacitor, 82 pF		
C53			NOT USED		
C54	3120021000	2	Capacitor, 1 nF		
C55	3120021000		Capacitor, 1 nF		
CR1	4500020000	5	Diode	1N4151	
CR2	4500020000		Diode	1N4151	
CR3	4500020000		Diode	1N4151	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-2
CR4	4500020000		Diode	1N4151	
CR5	4500020000		Diode	1N4151	
L1	5303360000	2	Inductor, 16 μH		
L2	5303360000	2	Inductor, 16 μH		
MP1	1900220000	1	Extractor		
MP2	1900200000	1	Extractor		
Q1	4300050000	5	Transistor	2N2369	
Q2	4300070000	3	Transistor	2N2894	
Q3	4300050000		Transistor	2N2369	
Q4	4300140000	3	Transistor	2N5179	
Q5	4300070000		Transistor	2N2894	
Q6	4300050000		Transistor	2N2369	
Q7	4300050000		Transistor	2N2369	
Q8	4300050000		Transistor	2N2369	
Q9	4300070000		Transistor	2N2894	
Q10	4300140000		Transistor	2N5179	
Q11	4300140000		Transistor	2N5179	
R1	2500314700	1	Resistor, 147K, 1/2W, 1%		
R2	2500260400	2	Resistor, 60.4K, 1/2W, 1%		
R3	2500288700	3	Resistor, 88.7K, 1/2W, 1%		
R4	2500316200	1	Resistor, 162K, 1/2W, 1%		
R5	2500260400		Resistor, 60.4K, 1/2W, 1%		
R6	2500235700	3	Resistor, 35.7, 1/2W, 1%		
R7	2200042700	1	Resistor, 270K, 1/4W, 2%		
R8	2200036800	1	Resistor, 68K, 1/4W, 2%		
R9	2500288700		Resistor, 88.7K, 1/2W, 1%		
R10	2500235700		Resistor, 35.7K, 1/2W, 1%		
R11	2500288700		Resistor, 88.7K, 1/2W, 1%		
R12	2200041800	1	Resistor, 180K, 1/4W, 2%		
R13	2500235700		Resistor, 35.7K, 1/2W, 1%		
R14	2200038200	1	Resistor, 82K, 1/4W, 2%		
R15	2200031000	6	Resistor, 10K, 1/4W, 2%		
R16	2500217400	2	Resistor, 17.4K, 1/2W, 1%		
R17	2500173200	2	Resistor, 7.32K, 1/2W, 1%		
R18	2500060400	2	Resistor, 604 Ω , 1/2W, 1%		
R19	2500060400		Resistor, 604 Ω , 1/2W, 1%		
R20	2500173200		Resistor, 7.32K, 1/2W, 1%		
R21	2500217400		Resistor, 17.4K, 1/2W, 1%		
R22	2200031000		Resistor, 10K, 1/4W, 2%		
R23	2200021000	7	Resistor, 1K, 1/4W, 2%		
R24	2200031500	1	Resistor, 15K, 1/4W, 2%		
R25	2200031000		Resistor, 10K, 1/4W, 2%		
R26			NOT USED		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-2
R27	2200034700	4	Resistor, 47K, 1/4W, 2%		
R28	2200034700		Resistor, 27K, 1/4W, 2%		
R29	2200043900	1	Resistor, 390K, 1/4W, 2%		
R30	2200011000	6	Resistor, 100 Ω , 1/4W, 2%		
R31	2200018200	1	Resistor, 820 Ω , 1/4W, 2%		
R32	2200034700		Resistor, 47K, 1/4W, 2%		
R33	2200034700		Resistor, 47K, 1/4W, 2%		
R34	2200024700	2	Resistor, 4.7K, 1/4W, 2%		
R35	2200021000		Resistor, 1K, 1/4W, 2%		
R36			NOT USED		
R37	2200021000		Resistor, 1K, 1/4W, 2%		
R38	2200031000		Resistor, 10K, 1/4W, 2%		
R39	2200022200	3	Resistor, 2.2K, 1/4W, 2%		
R40	2200011000		Resistor, 100 Ω , 1/4W, 2%		
R41	2200011000		Resistor, 100 Ω , 1/4W, 2%		
R42	2200012200	6	Resistor, 220 Ω , 1/4W, 2%		
R43	2200012200		Resistor, 220 Ω , 1/4W, 2%		
R44	2200024700		Resistor, 4.7K, 1/4W, 2%		
R45	2200022200		Resistor, 2.2K, 1/4W, 2%		
R46	2200031000		Resistor, 10K, 1/4W, 2%		
R47	220021000		Resistor, 1K, 1/4W, 2%		
E48	2200051000	3	Resistor, 51 Ω , 1/4W, 2%		
R49	2200033300	1	Resistor, 33K, 1/4W, 2%		
R50	2200013300	2	Resistor, 330 Ω , 1/4W, 2%		
R51	2200011000		Resistor, 100 Ω , 1/4W, 2%		
R52	2200015600	2	Resistor, 560 Ω , 1/4W, 2%		
R53			NOT USED		
R54	2200021000		Resistor, 1K, 1/4W, 2%		
R55	2200021000		Resistor, 1K, 1/4W, 2%		
R56	2900023300	1	Resistor, 3.3K		
R57	2200015600		Resistor, 560 Ω , 1/4W, 2%		
R58	2200021000		NOT USED		
R59	2200021000		NOT USED		
R60	2200021000		Resistor, 10K, 1/4W, 2%		
R61	2200022200		Resistor, 2.2K, 1/4W, 2%		
R62	2200012200		Resistor, 220 Ω , 1/4W, 2%		
R63	2900011000	2	Resistor, 100 Ω		
R64	2200013300		Resistor, 220 Ω , 1/4W, 2%		
R65	2200011000		Resistor, 100 Ω , 1/4W, 2%		
R66	2200005100		Resistor, 51 Ω , 1/4W, 2%		
R67	2200021800	2	Resistor, 1.8K, 1/4W, 2%		
R68	2200021800		Resistor, 1.8K, 1/4W, 2%		
R69	2200005100		Resistor, 51 Ω , 1/4W, 2%		
R70	2200012200		Resistor, 220 Ω , 1/4W, 2%		
R71	2200012200		Resistor, 220 Ω , 1/4W, 2%		
R72	2900011000		Resistor, 100 Ω		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-2
R73	2200011000		Resistor, 100 Ω , 1/4W, 2%		
R74	2200023900	1	Resistor, 3.9K, 1/4W, 2%		
R75	2200012200		Resistor, 220 Ω , 1/4W, 2%		
R76	2133220000	2	Potentiometer, 22K		
R77	2133220000		Potentiometer, 22K		
T1	0218280000	1	Transformer		
T2	0218200000	1	Transformer		
T3	0218290000	1	Transformer		
T4	0218300000	1	Transformer		
T5	0218310000	1	Transformer		
T6	0213760000	1	Transformer		
T7	0214830000	1	Transformer		
T8	0218320000	1	Transformer		
TP1 thru TP28	1400109900	28	Test Point		
U1	4200180000	4	Integrated Circuit	NC1458	
U2	4200180000		Integrated Circuit	NC1458	
U3	4200180000		Integrated Circuit	NC1458	
U4	4150740200	1	Integrated Circuit	SN72LS02	
U5	4200180000		Integrated Circuit	NC1458	
U6	4160452000	1	Integrated Circuit	4520	
U7	4160451800	2	Integrated Circuit	4518	
U8	4160451800	2	Integrated Circuit	4518	
U9	4150747300	1	Integrated Circuit	SN72LS73N	
U10	4150749001	1	Integrated Circuit	SN72LS90N	
U11	4150748600	2	Integrated Circuit	SN72LS86N	
U12	4150740000	1	Integrated Circuit	SN74LS00N	
U13	4150748600		Integrated Circuit	SN74LS86N	
	297440		Phase/Frequency Comparator	297440	5-3
C1	3150031000	22	Capacitor, 10 nF		
C2	3150031000		Capacitor, 10 nF		
C3	3150031000		Capacitor, 10 nF		
C4	3150031000		Capacitor, 10 nF		
C5	3150031000		Capacitor, 10 nF		
C6	3150031000		Capacitor, 10 nF		
C7	3150031000		Capacitor, 10 nF		
C8	3150031000		Capacitor, 10 nF		
C9	3150031000		Capacitor, 10 nF		
C10	3120098200	1	Capacitor, 8.2 pF		
C11	3120001200	2	Capacitor, 12 pF		
C12	3150031000		Capcaitor, 10 nF		
C13	3120004700	2	Capacitor, 47 pF		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-3
C14	3120001200		Capacitor, 12 pF		
C15	3120021000	3	Capacitor, 1000 pF		
C16	3120006800	1	Capcaitor, 68 pF		
C17	3150031000		Capacitor, 10 nF		
C18	3150031000		Capacitor, 10 nF		
C19	3700018000	7	Capacitor, 15MMF, 16V		
C20	3120021000		Capacitor, 1000 pF		
C21	3120021000		Capacitor, 100 pF		
C22	3700180000		Capacitor, 15MMF, 16V		
C23	NOT USED				
C24	3700100000	3	Capacitor, 4.7MMF, 25V		
C25	NOT USED				
C26	3232680000	2	Capacitor, 6800 pF, 10%		
C27	3150031000		Capacitor, 10 nF		
C28	3150031000		Capacitor, 10 nF		
C29	3150031000		Capacitor, 10 nF		
C30	3150031000		Capacitor, 10 nF		
C31	3150031000		Capacitor, 10 nF		
C32	3120004700		Capacitor, 47 pF		
C33	3150031000		Capacitor, 10 nF		
C34	3150031000		Capacitor, 10 nF		
C35	3700180000		Capcitor, 15MMF, 16V		
C36	3700020000	2	Capacitor, 1MMF, 25V		
C37	NOT USED				
C38	3232680000		Capacitor, 680 pF, 10%		
C39	3150031000		Capacitor, 10 nF		
C40	3700180000		Capacitor, 15MMF, 16V		
C41	3700100000		Capacitor, 4.7MMF, 25V		
C42	3700020000	2	Capacitor, 1MF, 35V		
C43	3700180000		Capacitor, 15MMF, 16V		
C44	3234100000	1	Capacitor, 0.1MMF, 10%		
C45	3150031000		Capacitor, 10 nF		
C46	3150031000		Capacitor, 10 nF		
C47	3233100000	1	Capcitor, 10 nF, 10%		
C48	3700020000		Capacitor, 1MF, 35V		
C49	3700180000		Capacitor, 15MMF, 16V		
C50	3700100000		Capacitor, 4.7MMMF, 25V		
C51	3700020000		Capacitor, 1MMF, 25V		
C52	3700180000		Capacitor, 15MMF, 16V		
C53	3224470000	1	Capacitor, 0.47MMF, 10%		
CR1	4500260000	4	Diode	BB109G	
CR2	4500260000		Diode	BB109G	
CR3	4500260000		Diode	BB109G	
CR4	4500260000		Diode	BB109G	
CR5	4500020000	17	Diode	IN4151	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-3
CR6	4500200100	1	Diode	BA182	
CR7	4500020000		Diode	IN4151	
CR8	4500300000	1	Diode	ESM 247	
CR9	4500020000		Diode	IN4151	
CR10	4500020000		Diode	IN4151	
CR11	4500020000		Diode	IN4151	
CR12	4500020000		Diode	IN4151	
CR13	4500020000		Diode	IN4151	
CR14	4600020000	1	Diode	ZPD 4.7	
CR15	4600010000		Diode	ZPD 4.7	
CR16	4600080000	1	Diode	ZPD 6.8	
CR17	4500020000		Diode	IN4151	
CR18	4500020000		Diode	IN4151	
CR19	4500020000		Diode	IN4151	
CR20	4500020000		Diode	IN4151	
CR21	4500020000		Diode	IN4151	
CR22	4500020000		Diode	IN4151	
CR23	4500020000		Diode	IN4151	
CR24	4500020000		Diode	IN4151	
CR25	4500020000		Diode	IN4151	
CR26	4500020000		Diode	IN4151	
CR27	4000160000	2	Diode	LD30 11 3.7	
CR28	400160000		Diode	LD30 11 3.7	
J1	1400202600	1	Receptacle		
J2	1400202600		Receptacle		
L1	5303360000	4	Inductor, 16MMH		
L2	5303360000		Inductor, 16MMH		
L3	5303400000	1	Inductor, 10MMH		
L4	5300120000	1	Inductor, .15MMH		
L5	5303360000		Inductor, 16MMH		
L6	5303360000		Inductor, 16MMH		
MP1	1900230000	1	Extractor		
MP2	1900200000	1	Extractor		
Q1	4300040000	7	Transistor	2N918	
Q2	4300190000	3	Transistor	BC184C	
Q3	4300140000	4	Transistor	2N5179	
Q4	4300140000		Transistor	2N5179	
Q5	4300140000		Transistor	2N5179	
Q6	4300070000	3	Transistor	2N2894	
Q7	4300005000	3	Transistor	2N2369A	
Q8	4300110000	2	Transistor	BC214C	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-3
Q9	4300190000		Transistor	BC184C	
Q10	4300190000		Transistor	BC184C	
Q11	4300040000		Transistor	2N918	
Q12	4300040000		Transistor	2N918	
Q13	4300220000	4	Transistor	BF272	
Q14	4300220000		Transistor	BF272	
Q15	4300140000		Transistor	2N5179	
Q16	4300070000		Transistor	2N2894	
Q17	4300050000		Transistor	2N2369A	
Q18	4300040000		Transistor	2N918	
Q19	4300040000		Transistor	2N918	
Q20	4300220000		Transistor	BF272	
Q21	4300070000		Transistor	2N2894	
Q22	4300050000		Transistor	2N2369A	
Q23	4300040000		Transistor	2N918	
Q24	4300040000		Transistor	2N918	
Q25	4300220000		Transistor	BF272	
Q26	4300110000		Transistor	BC214C	
R1	2900022200	2	Resistor, 2.2K, 1/8W		
R2	2200031500	4	Resistor, 15K, 1/4W		
R3	2200024700	5	Resistor, 4.7K, 1/4W		
R4	2200031500		Resistor, 15K, 1/4W		
R5	2200022200	5	Resistor, 2.2K, 1/4W		
R6	2200031500		Resistor, 15K, 1/4W		
R7	2900012200	9	Resistor, 220 Ω , 1/8W		
R8	2900023300	1	Resistor, 3.3K, 1/8W		
R9	2200021800	3	Resistor, 1.8K, 1/4W		
R10	2200021800		Resistor, 1.8K, 1/4W		
R11	2200011000	5	Resistor, 100 Ω , 1/4W		
R12	2900011000	1	Resistor, 100 Ω , 1/8W		
R13	2200013300	1	Resistor, 330 Ω , 1/4W		
R14	2200014700	5	Resistor, 470 Ω , 1/4W		
R15	2200012200	7	Resistor, 200 Ω , 1/4W		
R16	2200012700	1	Resistor, 270 Ω , 1/4W		
R17	2900006800	1	Resistor, 68 Ω , 1/8W		
R18	2200021000	5	Resistor, 1K, 1/4W		
R19	2200006800	1	Resistor, 68 Ω , 1/4W		
R20	2200014700		Resistor, 470 Ω , 1/4W		
R21	2200016800	4	Resistor, 680 Ω , 1/4W		
R22	2200016800		Resistor, 680 Ω , 1/4W		
R23	2200016800		Resistor, 680 Ω , 1/4W		
R24	2200016800		Resistor, 680 Ω , 1/4W		
R25	2200012200		Resistor, 220 Ω , 1/4W		
R26	2900022200		Resistor, 2.2K, 1/8W		
R27	2200015600	3	Resistor, 560 Ω , 1/4W		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-3
R28	2200025600	3	Resistor, 5.6K, 1/4W		
R29	2200043300	1	Resistor, 3230K, 1.4W		
R30	2200022200		Resistor, 2.2K, 1/4W		
R31	2200031000	6	Resistor, 10K, 1/4W		
R32	2200021000		Resistor, 1K, 1/4W		
R33	2200041800	1	Resistor, 180K, 1/4W		
R34	2200031500		Resistor, 15K, 1/4W		
R35	2900016800	5	Resistor, 680 Ω , 1/8W		
R36	2900016800		Resistor, 680 Ω , 1/8W		
R37	2200018200	2	Resistor, 820 Ω , 1/4W		
R38	250021500	2	Resistor, 10.5K, .3W, 1%		
R39	2500210500		Resistor, 10.5K, .3W, 1%		
R40	2500233200	2	Resistor, 33.2K, .3W, 1%		
R41	2500233200		Resistor, 33.2K, .3W, 1%		
R42	2200021800		Resistor, 1.8K, 1/4W		
R43	2200001000	1	Resistor, 10 Ω , 1/4W		
R44	2200031000		Resistor, 10K, 1/4W		
R45	2200031000		Resistor, 10K, 1/4W		
R46	2200025600		Resistor, 5.6K, 1/4W		
R47	2200025600		Resistor, 5.6K, 1/4W		
R48	2200014700		Resistor, 470 Ω , 1/4W		
R49	2200014700		Resistor, 470 Ω , 1/4W		
R50	2200011000		Resistor, 100 Ω , 1/4W		
R51	2900021000	3	Resistor, 1K, 1/8W		
R52	2200031000		Resistor, 10K, 1/4W		
R53	2200011500	2	Resistor, 150 Ω , 1/4W		
R54	2200011500		Resistor, 150 Ω , 1/4W		
R55	2200022200		Resistor, 2.2K, 1/4W		
R56	2200012200		Resistor, 220 Ω , 1/4W		
R57	2200012200		Resistor, 220 Ω , 1/4W		
R58	2200014700		Resistor, 470 Ω , 1/4W		
R59	2900016800		Resistor, 680 Ω , 1/8W		
R60	2200022700	1	Resistor, 2.7K, 1/4W		
R61	2200011000		Resistor, 100 Ω , 1/4W		
R62	2200011000		Resistor, 100 Ω , 1/4W		
R63	2200022200		Resistor, 2.2K, 1/4W		
R64	2200031000		Resistor, 10K, 1/4W		
R65	2200021000		Resistor, 1K, 1/4W		
R66	2200041500	1	Resistor, 150K, 1/4W		
R67	2900036800	1	Resistor, 68K, 1/8W		
R68	2200015600		Resistor, 560 Ω , 1/4W		
R69	2200015600		Resistor, 560 Ω , 1/4W		
R70	2200024700		Resistor, 4.7K, 1/4W		
R71	2200024700		Resistor, 4.7K, 1/4W		
R72	2900012200		Resistor, 220 Ω , 1/8W		
R73	2900012200		Resistor, 220 Ω , 1/8W		
R74	2200012200		Resistor, 220 Ω , 1/4W		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-3
R75	2900016800		Resistor, 680 Ω , 1/8W		
R76	2900168000		Resistor, 680 Ω , 1/8W		
R77	2900012200		Resistor, 220 Ω , 1/8W		
R78	2900021000		Resistor, 1K, 1/8W		
R79	2200012200		Resistor, 220 Ω , 1/4W		
R80	NOT USED				
R81	2200021000		Resistor, 1K, 1/4W		
R82	2200031000		Resistor, 10K, 1/4W		
R83	2200022200		Resistor, 2.2K, 1/4W		
R84	2200011000		Resistor, 100 Ω , 1/4W		
R85	2200012200		Resistor, 220 Ω , 1/4W		
R86	2200024700		Resistor, 4.7K, 1/4W		
R87	2200024700		Resistor, 4.7K, 1/4W		
R88	2900012200		Resistor, 220 Ω , 1/8W		
R9	2900012200		Resistor, 220 Ω , 1/8W		
R90	2200018200		Resistor, 820 Ω , 1/4W		
R91	2900014700	2	Resistor, 470 Ω , 1/8W		
R92	2900014700		Resistor, 470 Ω , 1/8W		
R93	2900021000		Resistor, 1K, 1/8W		
R94	2900012200		Resistor, 220 Ω , 1/8W		
R95	2200027000	2	Resistor, 270K, 1/4W		
R96	2200027000		Resistor, 270K, 1/4W		
R97	2200018000	1	Resistor, 18K, 1/4W		
R98	2200021000		Resistor, 1K, 1/4W		
R99	2200032200	2	Resistor, 22K, 1/4W		
R100	2200032200		Resistor, 22K, 1/4W		
R101	2151220000	1	Potentiometer, 220		
R102	2152220000	1	Potentiometer, 2.2KΩ		
T1	0218390000	1	Transformer	NEOSID F40	
T2	0218400000	1	Transformer	NEOSID F40	
T3	0218510000	1	Transformer	F2 45+45 CPF	
T4	0218520000	1	Transformer	F10B 24 CPF	
T5	0218530000	1	Transformer	F2 45 CPD	
T6	0211650000	1	Transformer	NEOSID F40	
TP1 thru TP20	1400109900	20	Test Points		
U1	4101013100	1	Integrated Circuit	MC10131 CP	
U2	4200110000	1	Integrated Circuit	TBA673	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-3
U3	4150749300	3	Integrated Circuit	SN74LS93N	
U4	4150747300	3	Integrated Circuit	SN74LS73N	
U5	4150740000	4	Integrated Circuit	SN74LS00N	
U6	4150747300		Integrated Circuit	SN74LS73N	
U7	4160405400	1	Integrated Circuit	C-MOS 4053	
U8	4150749000	1	Integrated Circuit	SN74LS90N	
U9	4150749300		Integrated Circuit	SN74LS93N	
U10	4157415300	2	Integrated Circuit	SN74LS-153N	
U11	4157415300		Integrated Circuit	SN74LS-153N	
U12	4157411200	1	Integrated Circuit	SN74LS-112N	
U13	4150740000		Integrated Circuit	SN74LS00N	
U14	4150740000		Integrated Circuit	SN74LS00N	
U15	4157413200	1	Integrated Circuit	SN74LS-132N	
U16	4157412300	1	Integrated Circuit	SN74LS-123N	
U17	4150749300		Integrated Circuit	SN74LS93N	
U18	4150747300		Integrated Circuit	SN74LS73N	
U19	4150745100	1	Integrated Circuit	SN74LS51N	
U20	4150740000		Integrated Circuit	SN74LS00N	
U21	4150741000	1	Integrated Circuit	SN74LS10N	
	297441	1	Counters	297441	5-4
C1	3120021000	1	Capacitor, 1000 µF		
C2	3700080000	7	Capacitor, 4.7 µF, 10V		
C3	3700080000		Capacitor, 4.7 µF, 10V		
C4	3700170000	2	Capacitor, 22 µF, 16V		
C5	3700170000		Capacitor, 22 µF, 16V		
C6	3150031000	5	Capacitor, 10 nF		
C7	3150031000		Capacitor, 10 nF		
C8	3700080000		Capacitor, 4.7 µF, 10V		
C9	3150031000		Capacitor, 10 nF		
C10	3700080000		Capacitor, 4.7 µF, 10V		
C11	3700080000		Capacitor, 4.7 µF, 10V		
C12	3120013300	3	Capacitor, 330 µF		
C13	3120013300		Capacitor, 330 µF		
C14	3120013300		Capacitor, 330 µF		
C15	3700080000		Capacitor, 4.7 µF, 10V		
C16	3150031000		Capacitor, 10 nF		
C17	3150031000		Capacitor, 10 nF		
C18	3700080000		Capacitor, 4.7 µF, 10V		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-4
CR1	450031000	4	Diode	IN4440	
CR2	450031000		Diode	IN4440	
CR3	450031000		Diode	IN4440	
CR4	450031000		Diode	IN4440	
CR5	4000160000	1	Diode	IN4440	
CR6	4500310000		Diode	IN4448	
CR7	4500310000		Diode	IN4448	
L1	5303360000	1	Inductor, 16 μH		
L2	5300480100	1	Inductor, 150 μH		
MP1	1900240000	1	Extractor		
MP2	1900200000	1	Extractor		
Q1	4300040000	2	Transistor	2N918	
Q2	4300040000		Transistor	2N918	
Q3	4300110000	4	Transistor	BC214C	
Q4	4300190000	2	Transistor	BC184C	
Q5	4300110000		Transistor	BC214C	
Q6	4300110000		Transistor	BC214C	
Q7	4300190000		Transistor	BC184C	
Q8	4300110000		Transistor	BC214C	
Q9	430000700000	3	Transistor	2N2894	
Q10	430000500000	3	Transistor	2N2369A	
Q11	430000700000		Transistor	2N2894	
Q12	430000500000		Transistor	2N2369A	
Q13	430000700000		Transistor	2N2894	
Q14	430000500000		Transistor	2N2369A	
R1	2200005600	1	Resitor, 56 Ω, 1/4W, 2%		
R2	2200005600	1	Resistor, 3.9K, 1/4W, 2%		
R3	2200014700	3	Resjstor, 470 Ω , 1/4W, 2%		
R4	2200012200	2	Resistor, 220 Ω , 1/4W, 2%		
R5	2200014700		Resistor, 470 Ω , 1/4W, 2%		
R6	2200022200	8	Resistor, 2.2K, 1/54W, 2%		
R7	2200016800	2	Resistor, 680 Ω , 1/4W, 2%		
R8	2200021200	2	Resistor, 1.2K, 1/4W, 2%		
R9	2200016800		Resistor, 680 Ω , 1/4W, 2%		
R10	2200021200		Resistor, 1.2K, 1/4W, 2%		
R11	2200021200		Resistor, 1.2K, 1/4W, 2%		
R12	2200021200		Resistor, 1.2K, 1/4W, 2%		
R13	2200011000	5	Resistor, 100 Ω , 1/4W, 2%		
R14	2500110000	4	Resistor, 1K, 1/2W, 1%		
R15	2500110000		Resistor, 1K, 1/2W, 1%		
R16	2500220000	1	Resistor, 20K, 1/2W, 1%		
R17	2200022200		Resistor, 2.2K, 1/4W, 2%		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-4
R18	2200011000		Resistor, 100 Ω , 1/4W, 2%		
R19	2200022200		Resistor, 2.2K, 1/4W, 2%		
R20	2200011000		Resistor, 100 Ω , 1/4W, 2%		
R21	2500110000		Resistor, 1K, 1/2W, 1%		
R22	2500110000		Resistor, 1K, 1/2W, 1%		
R23	2200034700	1	Resistor, 47K, 1/4W, 2%		
R24	2200012200		Resistor, 220 Ω , 1/4W, 2%		
R25	2200011000		Resistor, 100 Ω , 1/4W, 2%		
R26	2200021000	4	Resistor, 1K, 1/4W, 2%		
R27	2200031000	3	Resistor, 10K, 1/4W, 2%		
R28	2200018200	4	Resistor, 820 Ω , 1/4W, 2%		
R29	2200011000		Resistor, 100 Ω , 1/4W, 2%		
R30	2200021000		Resistor, 1K, 1/4W, 2%		
R31	2200031000		Resistor, 10K, 1/4W, 2%		
R32	2200018200		Resistor, 820 Ω , 1/4W, 2%		
R33	2200014700		Resistor, 470 Ω , 1/4W, 2%		
R34	2200021000		Resistor, 1K, 1/4W, 2%		
R35	2200021000		Resistor, 1K, 1/4W, 2%		
R36	2200031000		Resistor, 10K, 1/4W, 2%		
R37	2200018200		Resistor, 820 Ω , 1/4W, 2%		
R38	2200022200		Resistor, 2.2K, 1/4W, 2%		
R39	2200022200		Resistor, 2.2K, 1/4W, 2%		
R40	2200022200		Resistor, 2.2K, 1/4W, 2%		
R41	2200027000	1	Resistor, 27K, 1/4W, 2%		
U1	4100864700	1	Integrated Circiut	SP8647B	
U2	4150747300	4	Integrated Circuit	SN74LS73N	
U3	4150743000	1	Integrated Circuit	SN72LS30N	
U4	4150742000	1	Integrated Circuit	SN74LS20N	
U5	415074300	1	Integrated Circuit	SN74LS93N	
U6	4160451800	1	Integrated Circuit	4518	
U7	4150748300	3	Integrated Circuit	SN74LS83N	
U8	4160400800	3	Integrated Circuit	4008	
U9	4160400800		Integrated Circuit	4008	
U10	4160400800		Integrated Circuit	4008	
U11	4167437400	3	Integrated Circuit	74C374	
U12	4167437400		Integrated Circuit	74C374	
U13	4160401100	1	Integrated Circuit	4011	
U14	4160402700	2	Integrated Circuit	4027	
U15	4160402700		Integrated Circuit	4027	
U16	4157416300	1	Integrated Circuit	SN74LS163N	
U17	4150748300		Integrated Circuit	SN74LS83N	
U18	4167437400		Integrated Circuit	74C374	
U19	4157413800	1	Integrated Circuit	SN74LS138N	
U20	4150749000	1	Integrated Circuit	SN74LS90N	
U21	4150748300		Integrated Circuit	SN74LS83N	
U22	4150747300		Integrated Circuit	SN74LS73N	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-4
U23	4150747300		Integrated Circuit	SN74LS73N	
U24	4150740000	2	Integrated Circuit	SN74LS00	
U25	4150740000		Integrated Circuit	SN74LS00	
U26	4150747300		Integrated Ciruit	SN74LS73N	
W1	1100430000	1	Cable, Coax		
W2	0205740000	1	Cable, Coax		
W3	0205830000	1	Cable, Coax		
W4	0205840000	1	Cable, Coax		
	297437		Registers	297437	5-5
C1	3700080000	5	Capacitor, 4.7MF, 10V		
C2	3700080000		Capacitor, 4.7MF, 10V		
C3	3700080000		Capacitor, 4.7MF, 10V		
C4	3700080000		Capacitor, 4.7MF, 10V		
C5	3700080000		Capacitor, 4.7MF, 10V		
C6	3150031000	1	Capacitor, 10nF		
C7	3120011000	2	Capacitor, 100pF, "N10"		
C8	3120011000		Capacitor, 100pF, "N10"		
C9	3234100000	1	Capacitor, 0.1MMF, 10%		
C10	3700040000	1	Capacitor, 1MF, 35V		
C11	3120024700	1	Capacitor, 4700pF		
CR1	4000160000	1	Diode	LD30	
CR2	4500300000	1	Diode	ESM 247	
J1	1426020000	1	Connector		
L1	5303360000	1	Inductor 16mmH		
MP1	1900250000	1	Extractor		
MP2	1900200000	1	Extractor		
Q1	4300070000	1	Transistor	2N2894	
Q2	4300050000	1	Transistor	2N2369A	
R1	2200021000	1	Resistor, 1K, 1/4W		
R2	2200022200	1	Resistor, 2.2K, 1/4W		
R3	2200031000	2	Resistor, 10K, 1/4W		
R4	2200021500	1	Resistor, 1.5K, 1/4W		
R5	2200012200	1	Resistor, 220Ω, 1/4W		
R6	2200041000	28	Resistor, 100K, 1/4W		
R7	2200041000		Resistor, 100K, 1/4W		
R8	2200041000		Resistor, 100K, 1/4W		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-5
R9	2200041000		Resistor, 100K, 1/4W		
R10	2200041000		Resistor, 100K, 1/4W		
R11	2200041000		Resistor, 100K, 1/4W		
R12	2200041000		Resistor, 100K, 1/4W		
R13	2200041000		Resistor, 100K, 1/4W		
R14	2200041000		Resistor, 100K, 1/4W		
R15	2200041000		Resistor, 100K, 1/4W		
R16	2200041000		Resistor, 100K, 1/4W		
R17	2200041000		Resistor, 100K, 1/4W		
R18	2200041000		Resistor, 100K, 1/4W		
R19	2200041000		Resistor, 100K, 1/4W		
R20	2200041000		Resistor, 100K, 1/4W		
R21	2200041000		Resistor, 100K, 1/4W		
R22	2200041000		Resistor, 100K, 1/4W		
R23	2200041000		Resistor, 100K, 1/4W		
R24	2200041000		Resistor, 100K, 1/4W		
R25	2200041000		Resistor, 100K, 1/4W		
R26	2200041000		Resistor, 100K, 1/4W		
R27	2200041000		Resistor, 100K, 1/4W		
R28	2200041000		Resistor, 100K, 1/4W		
R29	2200041000		Resistor, 100K, 1/4W		
R30	2200041000		Resistor, 100K, 1/4W		
R31	2200001000	2	Resistor, 10 Ω , 1/4W		
R32	2200001000		Resistor, 10 Ω , 1/4W		
R33	2610932200	2	Resistor, 22K	4310R-101-223	
R34	2200041000		Resistor, 100K, 1/4W		
R35	2200051000	1	Resistor, 1MEG, 1/4W		
R36	2610932200		Resistor, 22K	4130R-101-223	
R37	2200041000		Resistor, 100K, 1/4W		
R38	2200041000		Resistor, 100K, 1/4W		
R39	2200031000		Resistor, 10K, 1/4W		
R40	2200032200	5	Resistor, 22K, 1/4W		
R41	2200032200		Resistor, 22K, 1/4W		
R42	2200032200		Resistor, 22K, 1/4W		
R43	2200032200		Resistor, 22K, 1/4W		
R44	2200032200		Resistor, 22K, 1/4W		
S1	1530214500	1	Switch		
U1	4157413800	1	Integrated Circuit	SN74LS-318N	
U2	4200340000	1	Integrated Circuit	LM339	
U3	4157424400	1	Integrated Circuit	SN74LS-244N	
U4	4160452800	1	Integrated Circuit	C-MOS 4528	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-5
U5	4160402700	1	Integrated Circuit	C-MOS 4027	
U6	4167437400	4	Integrated Circuit	C-MOS 74C374	
U7	4167437400		Integrated Circuit	C-MOS 74C374	
U8	4167437400		Integrated Circuit	C-MOS 74C374	
U9	4167437400		Integrated Circuit	C-MOS 74C374	
U10	4160405300	1	Integrated Circuit	C-MOS 4053	
	297434	1	(CPU) Microprocessor	297434	5-6
C1	3700100000	1	Capacitor, 4.7MMF/25V		
C2	3700180000	1	Capacitor, 15MMF/16V		
C3	3700250000	8	Capacitor, 68MMF, 6/3V		
C4	3700250000		Capacitor, 68MMF, 6.3V		
C5	3700250000		Capacitor, 68MMF, 6.3V		
C6	3700250000		Capacitor, 68MMF, 6.3V		
C7	3700200000	3	Capacitor, 1MMF/25V		
C8	2500490000	1	Capacitor, 1000MMF/16V		
C9	3120021000	2	Capacitor, 1000pF		
C10	3150031000	4	Capacitor, 10N, 5,08		
C11	3700020000		Capacitor, 1MMF/25V		
C12	3150031000		Capacitor, 10N, 5,08		
C13	3700020000		Capacitor, 1MMF/25V		
C14	3120011000	2	Capacitor, 100P, "N10"		
C15	3700250000		Capacitor, 68MMF, 6.3V		
C16	3150031000		Capacitor, 0N, 5,08		
C17	3300110000	1	Capacitor, 1000pF, 7,6 2% 250V MICA		
C18	3150031000		Capacitor, 10nF, 5,08		
C19	3700250000		Capacitor, 68MMF, 6.3V		
C20	3700250000		Capacitor, 68MMF, 6.3V		
C21	3700250000		Capacitor, 68MMF, 6.3V		
C22	3120021000		Capacitor, 1000pF		
C23	3120011000		Capacitor, 100P, "N10"		
CR1	4000160000	2	Diode	LD, 30II '3,17'	
CR2	4500310000	3	Diode	IN4448	
CR3	4500040000	1	Diode	IN4004	
CR4	4500310000		Diode	IN4448	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-6
CR5	4500310000		Diode	IN4448	
CR6	4000160000		Diode	LD, 30II '3,17'	
L1	5003360000	1	Inductor 16MMH		
MP1	1900260000	1	Extractor #6		
MP2	1900200000	1	Extractor		
Q1	4300110000	1	Transistor	BC214C	
Q2	4300110000	1	Transistor	BC214C	
Q3	4300070000	2	Transistor	2N2894	
Q4	4300070000	2	Transistor	2N2894	
Q5	4300050000	1	Transistor	2N2389	
R1	2210012700	1	Resistor, 270Ω, 1/4W, 2%		
R2	2010923300	2	Resistor, 3K, 4310R-101-332		
R3	2010923300		Resistor, 9x3.3K, 4310R-101-332		
R4	2200023300	4	Resistor, 3.3K, 1/4W, 2%		
R5	2200023300		Resistor, 3.3K, 1/4W, 2%		
R6	2200012200	2	Resistor, 220Ω, 1/4W, 2%		
R7	2200041000	2	Resistor, 100K, 1/4W, 2%		
R8	2200013300	1	Resistor, 330Ω, 1/4W, 2%		
R9	2200041000		Resistor, 100K, 1/4W, 2%		
R10	2200032200	1	Resistor, 220K, 1/4W, 2%		
R11	2200051000	2	Resistor, 10K, 1/4W, 2%		
R12	2200024700	2	Resistor, 4.7K, 1/4W, 2%		
R13	2200012200		Resistor, 220Ω, 1/4W, 2%		
R14	2200023300		Resistor, 3.3K, 1/4W, 2%		
R15	2200023300		Resistor, 3.3K, 1/4W, 2%		
R16	2200011200	1	Resistor, 120Ω, 1/4W, 2%		
R17	2200024700		Resistor, 4.7K, 1/4W, 2%		
R18	2200022200	4	Resistor, 2.2K, 1/4W, 2%		
R19	2200021000	1	Resistor, 1K, 1/4W, 2%		
R20	2200011000	1	Resistor, 100Ω, 1/4W, 2%		
R21	2200022200		Resistor, 2.2K, 1/4W, 2%		
R22	2200031000		Resistor, 10K, 1/4W, 2%		
R23	2200022200		Resistor, 2.2K, 1/4W, 2%		
R24	2200022200		Resistor, 2.2K, 1/4W, 2%		
R25	2200042200	1	Resistor, 22K, 1/4W, 2%		
R26	2200023300		Resistor, 3.3K, 1/4W, 2%		
T1	0218270000	1	Coil F2		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-6
U1	4170680200	1	Integrated Circuit	N-MOS MC 6802P	
U2	4170684000	1	Integrated Circuit	N-MOS MC 6840P	
U3	4160453800	1	Integrated Circuit	C-MOS 4528	
U4	4160402700	1	Integrated Circuit	C-MOS 4027	
U5	4150740400	1	Integrated Circuit	SN74LS04N	
U6	4157415500	1	Integrated Circuit	SN74LS-155N	
U7	4157413800	1	Integrated Circuit	SN74LS-138N	
U8	4157424500	1	Integrated Circuit	SN74LS-245N	
U9	4157424400	1	Integrated Circuit	SN74LS-244N	
U11	4200200000	1	Integrated Circuit	REGUL-5, 5A 7905 CU RTC	
U12	4200310000	1	Integrated Circuit	78 L05AC REGUL. 5U, 5Y, FU RTC	
U13	4150740000	1	Integrated Circuit	SN74LS00N	
U14	02721101	1	ROM #1		
U15	02721001	1	ROM #2		
Z1	1424017600	4	IC Socket		
Z2	1424017600		IC Socket		
Z3	1424017600		IC Socket		
Z4	1424017600		IC Socket		
Z5	490020000	1	IC Socket		
Z6	4900210000	1	IC Socket		
	297445	1	IEEE Bus No. 1	297445	5-7
C1	3150031000	4	Capacitor, 10 nF		
C2	3700080000	5	Capacitor, 4.7MF, 10V		
C3	3700080000		Capacitor, 4.7MF, 10V		
C4	3150031000		Capacitor, 10nF		
C5	3150031000		Capacitor, 10nF		
C6	3150031000		Capacitor, 10nF		
C7	3700040000	2	Capacitor, 1MF, 35V		
C8	3700080000		Capacitor, 4.7MF, 10V		
C9	3700080000		Capacitor, 4.7MF, 10V		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-7
C10	3700080000		Capacitor, 4.7MF, 10V		
C11	3700040000		Capacitor, 1MF, 35V		
J1	1434019200		Connector		
L1	5303360000	1	Inductor, 16MMH		
L2	5300480100	1	Inductor, 150MMF		
MP1	1900280000	1	Extractor		
MP2	1900200000	1	Extractor		
MP3	8107110200	1	Heat Sink	942625A	
Q1	4300070000	2	Transistor	2N2894	
Q2	4300050000	1	Transistor	2N2369A	
Q3	4300110000	3	Transistor	BC214C	
Q4	4300070000		Transistor	2N2894	
Q5	4300110000		Transistor	BC214C	
Q6	4300110000		Transistor	BC214C	
R1	2200021000	3	Resistor, 1K, 1/4W		
R2	2200022200	5	Resistor, 2.2K, 1/4W		
R3	2200024700	2	Resistor, 4.7K, 1/4W		
R4	2200021000		Resistor, 1K, 1/4W		
R5	2200031000	1	Resistor, 10K, 1/4W		
R6	2610922200	2	Resistor, 2.2K	4310R-101-222	
R7	2610911800	2	Resistor, 180Ω	4310R-101-181	
R8	2200011800	7	Resistor, 180Ω, 1/4W		
R9	2200011800		Resistor, 180Ω, 1/4W		
R10	2200011800		Resistor, 180Ω, 1/4W		
R11	2200011800		Resistor, 180Ω, 1/4W		
R12	2200011800		Resistor, 180Ω, 1/4W		
R13	2200016800	1	Resistor, 680Ω, 1/4W		
R14	2200021200	1	Resistor, 1.2K, 1/4W		
R15	2200021000		Resistor, 1K, 1/4W		
R16	2610911800		Resistor, 180Ω		
R17	2610922200		Resistor, 2.2K		
R18	2200022200		Resistor, 2.2K, 1/4W		
R19	2200011800		Resistor, 180Ω, 1/4W		
R20	2200022200		Resistor, 2.2K, 1/4W		
R21	2200022200		Resistor, 2.2K, 1/4W		
R22	2200022200		Resistor, 2.2K, 1/4W		
R23	2200011800		Resistor, 180K, 1/4W		
R24	2200023300	2	Resistor, 3.3K, 1/4W		
R25	2200023300		Resistor, 3.3K, 1/4W		
R26	2200026800	1	Resistor, 6.8K, 1/4W		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-7
R27	2200032200	6	Resistor, 22K, 1/4W		
R28	2200032200		Resistor, 22K, 1/4W		
R29	2200032200		Resistor, 22K, 1/4W		
R30	2200032200		Resistor, 22K, 1/4W		
R31	2200032200		Resistor, 22K, 1/4W		
R32	2200032200		Resistor, 22K, 1/4W		
R33	2200024700		Resistor, 4.7K, 1/4W		
R34	2200001000	1	Resistor, 10, 1/4W		
T1	0218260000	1	Transformer	FT6.3 T6	
U1	4157413800	1	Integrated Circuit	SN74LS-138N	
U2	4157437400	4	Integrated Circuit	SN74LS-374N	
U3	4157424400	2	Integrated Circuit	SN74LS-244N	
U4	4157437400		Integrated Circuit	SN72LS-374N	
U5	4157437400		Integrated Circuit	SN74LS-374N	
U6	4150741000	1	Integrated Circuit	SN74LS10N	
U7	4157437400		Integrated Circuit	SN74LS-374N	
U8	4157424400		Integrated Circuit	SN74LS-244N	
U9	4176848800		Integrated Circuit	N-MOS MC68488P	
U10	4100344800	4	Integrated Circuit	MC3448P	
U11	4100344800		Integrated Circuit	MC3448P	
U12	4100344800		Integrated Circuit	MC3448P	
U13	4100344800		Integrated Circuit	MC344P	
U14	4150740000	1	Integrated Circuit	SN74LS00N	
U15	4150747300	1	Integrated Circuit	SN74LS73N	
U16	4164009700	1	Integrated Circuit	C-MOS 40097	
U17	4000150000	12	Integrated Circuit	HPCL 2531	
U18	4000150000		Integrated Circuit	HPCL 2531	
U19	4000150000		Integrated Circuit	HPCL 2531	
U20	4000150000		Integrated Circuit	HPCL 2531	
U21	4000150000		Integrated Circuit	HPCL 2531	
U22	4000150000		Integrated Circuit	HPCL 2531	
U23	4000150000		Integrated Circuit	HPCL 2531	
U24	4000150000		Integrated Circuit	HPCL 2531	
U25	4000150000		Integrated Circuit	HPCL 2531	
U26	4000150000		Integrated Circuit	HPCL 2531	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-7
U27	4000150000		Integrated Circuit	HPCL 2531	
U28	4000150000		Integrated Circuit	HPCL 2531	
U29	4000150000		Integrated Circuit	HPCL 2531	
	297447	1	IEEE Connector Card	297447	5-7
J1	1424018400	1	Connector, Female, 24 Pins		
J2	1415020100	1	Connector, Female, 15 Pins		
J3	1434019200	1	Connector, Male, 34 Pins		
S1	1530214500	3	Switch, Miniature		
S2	1530214500		Switch, Miniature		
S3	1530214500		Switch, Miniature		
	297446	1	IEEE Bus #2	297446	5-8
C1	3150031000	6	Capacitor, 10N		
C2	3150031000		Capacitor, 10N		
C3	3700170000	3	Capacitor, 22MF, 16V		
C4	3700170000		Capacitor, 22MF, 16V		
C5	3700170000		Capacitor, 22MF, 16V		
C6	3700080000	5	Capacitor, 4.7MF, 10V		
C7	3700080000		Capacitor, 4.7MF, 10V		
C8	3700080000		Capacitor, 4.7MF, 10V		
C9	3700080000		Capacitor, 4.7MF, 10V		
C10	3700080000		Capacitor, 4.7MF, 10V		
C11	3150031000		Capacitor, 10N		
C12	3150031000		Capacitor, 10N		
C13	3234100000	1	Capacitor, .1MMF, 10%		
C14	3150031000		Capacitor, 10N		
C15	3150031000		Capacitor, 10N		
CR1	4600170000	1	Diode	ZP 10	
Q1	4300070000	2	Transistor	2N2894	
Q2	4300050000	2	Transistor	2N2369	
Q3	4300070000		Transistor	2N2894	
Q4	4300050000		Transistor	2N2369	
R1	2200021000	5	Resistor, 1K, 1/4W		
R2	2200022200	2	Resistor, 2.2K, 1/4W		
R3	2200023300	7	Resistor, 3.3K, 1/4W		
R4	2200021000		Resistor, 1K, 1/4W		
R5	2200021000		Resistor, 1K, 1/4W		
R6	2200022200		Resistor, 2.2K, 1/4W		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-8
R7	2200023300		Resistor, 3.3K, 1/4W		
R8	2200021000		Resistor, 1K, 1/4W		
R9	2200023300		Resistor, 3.3K, 1/4W		
R10	2200023300		Resistor, 3.3K, 1/4W		
R11	2200023300		Resistor, 3.3K, 1/4W		
R12	2200032200	1	Resistor, 22K, 1/4W		
R13	2200034700	1	Resistor, 47K, 1/4W		
R14	2200023300		Resistor, 3.3K, 1/4W		
R15	2200023300		Resistor, 3.3K, 1/4W		
R16	2200021000		Resistor, 1K, 1/4W		
R17	2200004700	2	Resistor, 47Ω, 1/4W		
R18	2200004700		Resistor, 47Ω, 1/4W		
R19	2500249900	4	Resistor, 49.9K, .3W, 1%		
R20	2500249900		Resistor, 49.9K, .3W, 1%		
R21	2500310000	1	Resistor, 100K, .3W, 1%		
R22	2200036800	1	Resistor, 68K, 1/4W		
R23	2200046800	1	Resistor, 680K, 1/4W		
R24	2500249900		Resistor, 49.9K, .3W, 1%		
R25	2500249900		Resistor, 49.9K, .3W, 1%		
R26	2500220500	18	Resistor, 20.5K, .3W, 1%		
R27	2500220500		Resistor, 20.5K, .3W, 1%		
R28	2500210200	14	Resistor, 10.2K, .3W, 1%		
R29	2500220500		Resistor, 20.5K, .3W, 1%		
R30	2500210200		Resistor, 10.2K, .3W, 1%		
R31	2500220500		Resistor, 20.5K, .3W, 1%		
R32	2500210200		Resistor, 10.2K, .3W, 1%		
R33	2500220500		Resistor, 20.5K, .3W, 1%		
R34	2500210200		Resistor, 10.2K, .3W, 1%		
R35	2500220500		Resistor, 20.5K, .3W, 1%		
R36	2500210200		Resistor, 10.2K, .3W, 1%		
R37	2500220500		Resistor, 20.5K, .3W, 1%		
R38	2500210200		Resistor, 10.2K, .3W, 1%		
R39	2500220500		Resistor, 20.5K, .3W, 1%		
R40	2500217800	1	Resistor, 17.8K, .3W, 1%		
R41	2500114300	1	Resistor, 1.5K, .3W, 1%		
R42	2500220500		Resistor, 20.5K, .3W, 1%		
R43	2500220500		Resistor, 20.5K, .3W, 1%		
R44	2500210200		Resistor, 10.2K, .3w, 1%		
R45	2500220500		Resistor, 20.5K, .3W, 1%		
R46	2500210200		Resistor, 10.2K, .3W, 1%		
R47	2500220500		Resistor, 20.5K, .3W, 1%		
R48	2500210200		Resistor, 10.2K, .3W, 1%		
R49	2500220500		Resistor, 20.5K, .3W, 1%		
R50	2500210200		Resistor, 10.2K, .3W, 1%		
R51	2500220500		Resistor, 20.5K, .3W, 1%		
R52	2500210200		Resistor, 10.2K, .3W, 1%		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-8
R53	2500220500		Resistor, 20.5K, .3W, 1%		
R54	2500210200		Resistor, 10.2K, .3W, 1%		
R55	2500220500		Resistor, 20.5K, .3W, 1%		
R56	2500210200		Resistor, 10.2K, .3W, 1%		
R57	2500220500		Resistor, 20.5K, .3W, 1%		
R58	2500210200		Resistor, 10.2K, .3W, 1%		
R29	2500220500		Resistor, 20.5K, .3W, 1%		
R60	2500259000	1	Resistor, 59K, .3W, 1%		
R61	2610932200	1	Resistor, 9 X 22K		
TP1 to TP4	1400109900	4	TEST POINT		
U1	4157413800	1	Integrated Circuit	SN74LS 138N	
U2	4157416200	1	Integrated Circuit	SN74LS 162N	
U3	4150749000	1	Integrated Circuit	SN74LS 90N	
U4	4150741000	1	Integrated Circuit	SN74LS 10N	
U5	4160401100	1	Integrated Circuit	C-MOS 4011	
U6	4160402700	1	Integrated Circuit	C-MOS 4027	
U7	4167437400	4	Integrated Circuit	C-MOS 74C374	
U8	4167437400		Integrated Circuit	C-MOS 74C374	
U9	4160400800	3	Integrated Circuit	C-MOS 4008	
U10	4160400800		Integrated Circuit	C-MOS 4008	
U11	4160400800		Integrated Circuit	C-MOS 4008	
U12	4160451800	2	Integrated Circuit	C-MOS 4518	
U13	4160451800		Integrated Circuit	C-MOS 4518	
U14	4200360000	1	Integrated Circuit	TLO 72 CP	
U15	4167437400		Integrated Circuit	C-MOS74C 374	
U16	4160405300	6	Integrated Circuit	C-MOS 4053	
U17	4160405300		Integrated Circuit	C-MOS 4053	
U18	4160405300		Integrated Circuit	C-MOS 4053	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-8
U19	4200400000	2	Integrated Circuit	TLO 71 BCP	
U20	4167437400		Integrated Circuit	C-MOS74C 374	
U21	4160405300		Integrated Circuit	C-MOS 4053	
U22	4160405300		Integrated Circuit	C-MOS 4053	
U23	4160405300		Integrated Circuit	C-MOS 4-53	
U24	4200400000		Integrated Circuit	TL071 BCP	
	297461	1	Motherboard	297461	5-9
FL1	271910000	13	Filter		
FL2	271910000		Filter		
FL3	271910000		Filter		
FL4	271910000		Filter		
FL5	271910000		Filter		
FL6	272590000	3	Filter		
FL7	271910000		Filter		
FL8	271910000		Filter		
FL10	271910000		Filter		
FL11	272590000		Filter		
FL12	272590000		Filter		
FL13	271910000		Filter		
FL14	271910000		Filter		
FL15	271910000		Filter		
FL16	271910000		Filter		
J1	14470196	8	Connector, 47 Pin		
J2	14470196		Connector, 47 Pin		
J3	14470196		Connector, 47 Pin		
J4	14470196		Connector, 47 Pin		
J5	14470196		Connector, 47 Pin		
J6	14470196		Connector, 47 Pin		
J7	14470196		Connector, 47 Pin		
J8	14470196		Connector, 47 Pin		
J9	1409003200	1	Connector, 9 Pin		
J10	1450019800	1	Connector, 50 Pin		
	297462		VHF	297462	5-10
C0	3800130000	21	Capacitor, 1nF		
C1	3800031000	4	Capacitor, 11nF		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-10
C2	3800130000		Capacitor, 1nF		
C3	3150031000	5	Capacitor, 10N		
C4	3800001500	1	Capacitor, 15pF		
C5	3120003300	1	Capacitor, 33pF		
C6	3800003300	1	Capacitor, 33pF		
C7	3120002200	3	Capacitor, 22pF		
C8	3800006800	2	Capacitor, 68pF		
C9	3800001800	1	Capacitor, 18pF		
C10	3120021000		Capacitor, 1nF		
C11	3120021000		Capacitor, 1nF		
C12	3800001200	1	Capacitor, 12pF CHIP		
C13	3120002200		Capacitor, 22pf		
C14	3800002200	3	Capacitor, 22pF CHIP		
C15	3120002200		Capacitor, 22pF		
C16	2800001000	4	Capacitor, 10pF CHIP		
C17	3120096800	8	Capacitor, 6.8pF		
C18	3120001800	1	Capacitor, 18pF		
C19	3800001500		Capacitor, 15pF CHIP		
C20	3120001200	3	Capacitor, 12pF		
C21	3120096800		Capacitor, 6.8pF		
C22	3120021000		Capacitor, 1nF		
C23	3120021000		Capacitor, 1nF		
C24					
C25	3120095600	2	Capacitor, 5.6pF		
C26	3120096800		Capacitor, 6.8pF		
C27	3120001000	3	Capacitor, 10pF		
C28	3120098200	2	Capacitor, 8.2pF		
C29	3120092700	3	Capacitor, 2.7pF		
C30	3120096800		Capacitor, 6.8pF		
C31	3600170000	6	Capacitor 2.5 to 7.5pF, VARIABLE		
C32	3600170000		Capacitor 2.5 to 7.5pF, VARIABLE		
C33	3600170000		Capacitor 2.5 to 7.5pF, VARIABLE		
C34	3120094700	17	Capacitor, 4.7pF		
C35	3120021000		Capacitor 1nF		
C36	3120021000		Capacitor 1nF		
C37	3600170000		Capacitor 2.5 to 7.5pF, VARIABLE		
C38	3120092700		Capacitor 2.7pF		
C39	3600170000		Capacitor 2.5 to 7.5pF, VARIABLE		
C40	3120095600		Capacitor, 5.6pF		
C41	3120094700		Capacitor, 4.7pF		
C42	3120094700		Capacitor, 4.7pF		
C43	3800011000	9	Capacitor, 100pF CHIP		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-10
C44	3800011000		Capacitor, 100pF CHIP		
C45	3800130000		Capacitor, 1nF		
C46	3120094700		Capacitor, 4.7pF		
C47	3120092700		Capacitor, 2.7pF		
C48	3120094700		Capacitor, 4.7pF		
C49	3120094700		Capacitor, 4.7pF		
C50	3800130000		Capacitor, 1nF		
C51	3800011000		Capacitor, 100pF CHIP		
C52	3800011000		Capacitor, 100pF CHIP		
C53	3120094700		Capacitor, 4.7pF		
C54	3800370000	10	Capacitor, .1MMF CHIP		
C55	3800021000		Capacitor, 1nF CHIP		
C56					
C57	3120021000		Capacitor, 1nF		
C58					
C59	3120094700		Capacitor, 4.7pF		
C60	3120021000		Capacitor, 1nF		
C61	3120094700		Capacitor, 4.7pF		
C62	3120021000		Capacitor, 1nF		
C63	3120021000		Capacitor, 1nF		
C64					
C65	3120021000		Capacitor, 1nF		
C66	3800370000		Capacitor, .1MMF CHIP		
C67					
C68	3120094700		Capacitor, 4.7pF		
C69	3120021000		Capacitor, 1nF		
C70	3120021000		Capacitor, 1nF		
C71	3800130000		Capacitor, 1nF		
C72	3150031000		Capacitor, 10N		
C73	3120021000		Capacitor, 1nF		
C74	3800130000		Capacitor, 1nF		
C75	3120001000		Capacitor, 10pF		
C76	3120021000		Capacitor, 1nF		
C77	3800130000		Capacitor, 1nF		
C78	3800130000		Capacitor, 1nF		
C79	3120021000		Capacitor, 1nF		
C80	3800130000		Capacitor, 1nF		
C81	3800130000		Capacitor, 1nF		
C82	3800001000		Capacitor, 10pF CHIP		
C83			Capacitor, SELECTED		
C84			Capacitor, SELECTED		
C85	3120021000		Capacitor, 1nF		
C86	3120021000		Capacitor, 1nF		
C87	3800130000		Capacitor, 1nF		
C88	3800130000		Capacitor, 1nF		
C89	3120096800		Capacitor, 6.8pF		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-10
C90	3800130000		Capacitor, 1nF		
C91	3120021000		Capacitor, 1nF		
C92	3120021000		Capacitor, 1nF		
C93	3800130000		Capacitor, 1nF		
C94	3800130000		Capacitor, 1nF		
C95	3800130000		Capacitor, 1nF		
C96	3120021000		Capacitor, 1nF		
C97	3120021000		Capacitor, 1nF		
C98	3120021000		Capacitor, 1nF		
C99	3800011000		Capacitor, 100pF, CHIP		
C100	3120094700		Capacitor, 4.7pF		
C101	3800130000		Capacitor, IN		
C102	3120021000		Capacitor, IN		
C103	3800370000		Capacitor, .1MMF, CHIP		
C104	3800021000		Capacitor, IN, CHIP		
C105	3120021000		Capacitor, IN		
C106	3700170000	6	Capacitor, 22MF, 16V		
C107	3120021000		Capacitor, IN		
C108	3120011500		Capacitor, 150pF		
C109	3120011500		Capacitor, 150pF		
C110	3800004700	3	Capacitor, 4.7pF, CHIP		
C111	3120094700		Capacitor, 4.7pF		
C112	3800001500		Capacitor, 15pF, CHIP		
C113	3800001000		Capacitor, 10pF, CHIP		
C114	3800021000		Capacitor, IN, CHIP		
C115	3800002200		Capacitor, 22pF, CHIP		
C116	3800012200	2	Capacitor, 220pF, CHIP		
C117	3800012200		Capacitor, 220pF, CHIP		
C118	3800130000		Capacitor, IN		
C119	3800002200		Capacitor, 22pF, CHIP		
C120	3120094700		Capacitor, 4.7pF		
C121	3800011000		Capacitor, 100pF, CHIP		
C122	2700170000		Capacitor, 22MF, 16V		
C123	3800370000		Capacitor, .1MMF, CHIP		
C124	2700170000		Capacitor, 22MF, 16V		
C125	3700140000	1	Capacitor, 10MF, 25V		
C126	3800370000		Capacitor, .1MMF, CHIP		
C127	3120024700	1	Capacitor, 4700pF		
C128	3800011000		Capacitor, 100pF, CHIP		
C129	3800004700		Capacitor, 47pF, CHIP		
C130			NOT USED		
C131	3800011500	1	Capacitor, 150pF, CHIP		
C132	3800032200	1	Capacitor, 22nF, CHIP		
C133	3800004700		Capacitor, 10N		
C135	3120096800		Capacitor, 6.8pF		
C136	3800001500		Capacitor, 15pF, CHIP		
C137	3800011000		Capacitor, 10nF		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-10
C138	3150031000		Capacitor, 10N		
C139	3120021000		Capacitor, IN		
C140			Capacitor, SELECTED		
C141	3120094700		Capacitor, 4.7pF		
C142			SELECTED		
C143	3120096800		Capacitor, 6.8pF		
C144			Capacitor, SELECTED		
C145	3120096800		Capacitor, 6.8pF		
C146			Capacitor, SELECTED		
C147	3120094700		Capacitor, 4.7P		
C148	3800011000		Capacitor, 100pF, CHIP		
C149	3120001200		Capacitor, 12pF		
C150	3120021000		Capacitor, IN		
C151	3120001500	1	Capacitor, 15pF		
C152	3800130000		Capacitor, IN		
C153	3700170000		Capacitor, 22MF, 16V		
C154	3800370000		Capacitor, .1MMF, CHIP		
C155	3120093900	2	Capacitor, 3.9pF		
C156	3800001500		Capacitor, 15pF CHIP		
C157	3120093900		Capacitor, 3.9pF		
C158	3120094700		Capacitor, 4.7pF		
C159	3120098200		Capacitor, 8.2pF		
C160	3800370000		Capacitor, .1MMF, CHIP		
C161	3800370000		Capacitor, .1MMF, CHIP		
C162	3120021000		Capacitor, IN		
C163	3800370000		Capacitor, .1MMF, CHIP		
C164	3700170000		Capacitor, 22MF, 16V		
C165	3800003900	2	Capacitor, 39pF, CHIP		
C166	3800130000		Capacitor, IN		
C167	3800006800		Capacitor, 68pF, CHIP		
C168	3800003900		Capacitor, 39pF, CHIP		
C169	3600170000		Capacitor, 2.5 to 7.5 pF VARIABLE		
C170	3800001000		Capacitor, 10pF, CHIP		
C171	3120021000		Capacitor, IN		
C172	3120021000		Capacitor, IN		
C173	3120021000		Capacitor, IN		
C174	3800370000		Capacitor, .1MMF, CHIP		
C175	3120021000		Capacitor, IN		
C176	3120094700		Capacitor, 4.7pF		
C177	3800130000		Capacitor, IN		
C178					
C179	3700170000		Capacitor, 22MF, 16V		
C180	3700040000	1	Capacitor, 1MF, 35V		
C181	3150031000		Capacitor, 10N		
C182	3120001000		Capacitor, 10pF		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-10
C183	3120004700	1	Capacitor, 47pF		
C184	3120001200		Capacitor, 12pF		
C185	3120021000		Capacitor, IN		
C186	NOT USED				
C187	3120093300		Capacitor, 3.3 pF		
CR1	4500300000	5	Diode	ESM247	
CR2	4500200100	32	Diode	BA182	
CR3	4500200100		Diode	BA182	
CR4	4500200100		Diode	BA182	
CR5	4500200100		Diode	BA182	
CR6	4500200100		Diode	BA182	
CR7	4500200100		Diode	BA182	
CR8	4500200100		Diode	BA182	
CR9	4500200100		Diode	BA182	
CR10	4500200100		Diode	BA182	
CR11	4500200100		Diode	BA182	
CR12	4500200100		Diode	BA182	
CR13	4500200100		Diode	BA182	
CR14	4500200100		Diode	BA182	
CR15	4500020000	8	Diode	IN4151	
CR16	4500020000		Diode	IN4151	
CR17	4500200100		Diode	BA182	
CR18	4500200100		Diode	BA182	
CR19	4500200100		Diode	BA182	
CR20	4500200100		Diode	BA182	
CR21	4500200100		Diode	BA182	
CR22	0205660000	6	Diode	BB139	
CR23	0205660000		Diode	BB139	
CR24	0205660000		Diode	BB139	
CR25	0205660000		Diode	BB139	
CR26	0205660000		Diode	BB139	
CR27	0205660000		Diode	BB139	
CR28	4500200100		Diode	BB139	
CR29	4500340000	2	Diode	BA379	
CR30	4500310000	2	Diode	IN4448	
CR31	4500300000		Diode	ESM247	
CR32	4500310000		Diode	IN4448	
CR33	4500200100		Diode	BA182	
CR34	4500200100		Diode	BA182	
CR35	4500200100		Diode	BA182	
CR36	4500200100		Diode	BA182	
CR37	4500200100		Diode	BA182	
CR38	4500200100		Diode	BA182	
CR39	4600010000	1	Diode	ZPD 4V7	
CR40	4500020000		Diode	IN4151	
CR41	4500020000		Diode	IN4151	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-10
CR42	4500020000		Diode	IN4151	
CR43	4500180000	2	Diode	HP2826	
CR44	2500180000		Diode	HP2826	
CR45	4500300000		Diode	ESM247	
CR46	4500020000		Diode	IN4151	
CR47	4500020000		Diode	IN4151	
CR48	4500200100		Diode	BA182	
CR49	4500020000		Diode	IN 4151	
CR50	4500200100		Diode	BA182	
CR51	4500200100		Diode	BA182	
CR52	4500200100		Diode	BA182	
CR53	4500200100		Diode	BA182	
CR54	4500200100		Diode	BA182	
CR55	4500200100		Diode	BA182	
CR56	4500340000		Diode	BA379	
CR57	4500300000		Diode	ESM247	
CR58	4500300000		Diode	ESM247	
CR59	4500300000		Diode	ZPD5.6	
CR60	4500300000		Diode	ZPD566	
L1	5300220000	1	Inductor, 1MMH		
L2	5300140100		Inductor, .22MMH		
L3	5300140100		Inductor, .22MMH		
L4	5300120000	2	Inductor, .15MMH		
L5	5300120000		Inductor, .15MMH		
L6	5300110000	5	Inductor, .1MMH		
L7	5300110000		Inductor, .1MMH		
L8	5300090000	3	Inductor, .068MMH		
L9	5300090000		Inductor, .068MMH		
L10	0218350000	2	Inductor, .IMR 7 SPIRES		
L11	0218350000		Inductor, .IMR 7 SPIRES		
L12	0218360000	2	Inductor, .IMR 5 SPIRES		
L13	0218360000		Inductor, .IMR 5 SPIRES		
L14	5300140100		Inductor, .22MMH		
L15	5300140100		Inductor, .22MMH		
L16	5300420100	2	Inductor, 47MMH		
L17	5300420100		Inductor, 47MMH		
L18	5300340000	7	Inductor, 10MMH		
L19	5300340000		Inductor, 10 MMH		
L20	5300340000		Inductor, 10 MMH		
L21	5300300100	2	Inductor, 4.7MMH		
L22	5300340000		Inductor, 10MMH		
L23	5300340000		Inductor, 10MMH		
L24	5300340000		Inductor, 10MMH		
L25	5300340000		Inductor, 10MMH		
L26	5303360000	1	Inductor, 16 MMH		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-10
L27	5300200000	1	Inductor, .68MMH		
L28	0218370000	2	Inductor, SELF		
L29	5300460000	1	Inductor, 100MMH		
L30	5300260100	2	Inductor, 2.2MMH		
L31	0218370000		Inductor, SELF		
L32	5300380000	2	Inductor, 22MMH		
L33	5300380000		Inductor, 22MMH		
L34	5300300100		Inductor, 4.7MMH		
L35	5300250000	1	Inductor, 1.8 MMH		
L36	5300260100		Inductor, 2.2MMH		
L37	5300090000		Inductor, .068MMF		
L38	5300160000	1	Inductor, .33MMH		
L39	5300170000	2	Inductor, .39MMH		
L40	5300170000		Inductor, .39MMH		
L41	5301100000	2	Inductor, 220MMH		
L42	5301100000		Inductor, 220MMH		
L43	5300110000		Inductor, .1MMH		
L44	5300110000		Inductor, .1MMH		
L45	5300110000		Inductor, .1MMH		
L46	5300540000	1	Inductor, 470MMH		
L47	5300340000		Inductor, 10MMH		
Q1	4300280000	14	Transistor	BFR91	
Q2	0271920000	17	Transistor	BFQ22	
Q3	0271920000		Transistor	BFQ-22	
Q4	0271920000		Transistor	BFQ22	
Q5	3000190000	6	Transistor	BC184C	
Q6	4300110000	3	Transistor	BC214C	
Q7	0271920000		Transistor	BFQ22	
Q8	0217920000		Transistor	BFQ22	
Q9	4300280000		Transistor	BFR91	
Q10	0271920000		Transistor	BFQ22	
Q11	4300280000		Transistor	BFR91	
Q12	4300280000		Transistor	BFR91	
Q13	0271920000		Transistor	BFQ22	
Q14	0271920000		Transistor	BFQ22	
Q15	4300280000		Transistor	BFR91	
Q16	0172920000		Transistor	BFQ22	
Q17	4300280000		Transistor	BFR91	
Q18	4300280000		Transistor	BFR91	
Q19	4300190000		Transistor	BC184C	
Q20	0271920000		Transistor	BFQ22	
Q21	0271920000		Transistor	BFQ22	
Q22	4300380000	4	Transistor	BF480	
Q23	4300380000		Transistor	BF480	
Q24	0271920000		Transistor	BFQ22	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-10
Q25	4300190000		Transistor	BC184C	
Q26	4300280000		Transistor	BFR91	
Q27	4300280000		Transistor	BFR91	
Q28	4300280000		Transistor	BFR91	
Q29	4300280000		Transistor	BFR91	
Q30	4300280000		Transistor	BFR91	
Q31	4300270000	3	Transistor	BFR96	
Q32	4300190000		Transistor	BC184C	
Q33	0271920000		Transistor	BFQ22	
Q34	4300280000		Transistor	BFR91	
Q35	0271920000		Transistor	BFQ22	
Q36	0271920000		Transistor	BFQ22	
Q37	4300110000		Transistor	BC214C	
Q38	4300110000		Transistor	BC214C	
Q39	4300190000		Transistor	BC184C	
Q40	4300190000		Transistor	BC184C	
Q41	4300380000		Transistor	BF480	
Q42	4300380000		Transistor	BF480	
Q43	0271920000		Transistor	BFQ22	
Q44	0271920000		Transistor	BFQ22	
Q45	4300280000		Transistor	BFR91	
Q46	4300270000		Transistor	BFR96	
Q47	4300270000		Transistor	BFR96	
Q48	4400130000	1	Transistor	SD300	
R1	2900012200	5	Resistor, 220 Ω , 1/8W		
R2	2900024700	2	Resistor, 4.7K, 1/8W		
R3	2900024700		Resistor, 4.7K, 1/8W		
R4	2200013900	4	Resistor, 390 Ω , 1/4W		
R5	2900004700	9	Resistor, 47 Ω , 1/8W		
R6	2900004700		Resistor, 47 Ω , 1/8W		
R7	2200016800	10	Resistor, 680 Ω , 1/4W		
R8	2200016800		Resistor, 680 Ω , 1/4W		
R9	2200016800		Resistor, 680 Ω , 1/4W		
R10	2200013300	12	Resistor, 330 Ω , 1/4W		
R11	2200013300		Resistor, 330 Ω , 1/4W		
R12	2200013300		Resistor, 330 Ω , 1/4W		
R13	2200005100	6	Resistor, 51 Ω , 1/4W		
R14	2200013300		Resistor, 330 Ω , 1/4W		
R15	2200016800		Resistor, 680 Ω , 1/4W		
R16	2200013300		Resistor, 330 Ω , 1/4W		
R17	2200005100		Resistor, 51 Ω , 1/4W		
R18	2900004700		Resistor, 47 Ω , 1/8W		
R19	2200016800		Resistor, 680 Ω , 1/4W		
R20	2900004700		Resistor, 47 Ω , 1/8W		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-10
R21	2200016800		Resistor, 680 Ω , 1/4W		
R22	2200013300		Resistor, 330 Ω , 1/4W		
R23	2900004700		Resistor, 47 Ω , 1/8W		
R24	2200016800		Resistor, 680 Ω , 1/4W		
R25	2900011000	12	Resistor, 100 Ω , 1/8W		
R26	2200021000	25	Resistor, 1K , 1/4W		
R27	2900004700		Resistor, 47 Ω , 1/8W		
R28	2200031000	4	Resistor, 10K, 1/4W		
R29	2200031000		Resistor, 10K, 1/4W		
R30	2200021000		Resistor, 1K, 1/4W		
R31	2200014700	9	Resistor, 470 Ω , 1/4W		
R32	2200021000		Resistor, 1K, 1/4W		
R33	2200013300		Resistor, 330 Ω , 1/4W		
R34	2200022700	2	Resistor, 2.7K, 1/4W		
R35	2200021000		Resistor, 1K, 1/4W		
R36	2200013300		Resistor, 330 Ω , 1/4W		
R37	2200013300		Resistor, 330 Ω , 1/4W		
R38	2200001000	9	Resistor, 10 Ω , 1/4W		
R39	2900001500	12	Resistor, 15 Ω , 1/8W		
R40	2900011500	3	Resistor, 150 Ω , 1/8W		
R41	2200021000		Resistor, 1K, 1/4W		
R42	2900001500		Resistor, 15 Ω , 1/8W		
R43	2900011000		Resistor, 100 Ω , 1/8W		
R44	2200013300		Resistor, 330 Ω , 1/4W		
R45	2200021000		Resistor, 1K, 1/4W		
R46	2900011000		Resistor, 100 Ω , 1/8W		
R47	2900005100	8	Resistor, 51 Ω , 1/8W		
R48	2200014700		Resistor, 470 Ω , 1/4W		
R49	2900001500		Resistor, 15 Ω , 1/8W		
R50	2200013900		Resistor, 390 Ω , 1/4W		
R51	2900011000		Resistor, 100 Ω , 1/8W		
R52	2200001000		Resistor, 10 Ω , 1/4W		
R53	2200001000		Resistor, 10 Ω , 1/4W		
R54	2200013900		Resistor, 390 Ω , 1/4W		
R55	2200021000		Resistor, 1K, 1/4W		
R56	2900001500		Resistor, 15 Ω , 1/8W		
R57	2200014700		Resistor, 470 Ω , 1/4W		
R58	2900011000		Resistor, 100 Ω , 1/8W		
R59	2900005100		Resistor, 51 Ω , 1/8W		
R60	2200016800		Resistor, 680 Ω , 1/4W		
R61	2900011000		Resistor, 100 Ω , 1/8W		
R62	2200013300		Resistor, 330 Ω , 1/4W		
R63	2200021500	7	Resistor, 1.5K, 1/4W		
R64	2900012200		Resistor, 220 Ω , 1/8W		
R65	2900001500		Resistor, 15 Ω , 1/8W		
R66	2200005100		Resistor, 51 Ω , 1/4W		
R67	2200005100		Resistor, 51 Ω , 1/4W		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-10
R68	2200011000	7	Resistor, 100 Ω , 1/4W		
R69	2200021000		Resistor, 1K, 1/4W		
R70	2200021000		Resistor, 1K, 1/4W		
R71	2200021800	5	Resistor, 1.8K, 1/4W		
R72	2200022700		Resistor, 2.7K, 1/4W		
R73	2900005100		Resistor, 51 Ω , 1/8W		
R74	2900005100		Resistor, 51 Ω , 1/8W		
R75	2900031000	1	Resistor, 10K, 1/8W		
R76	2200021800		Resistor, 1.8K, 1/4W		
R77	2200031000		Resistor, 10K, 1/4W		
R78	2200005100		Resistor, 51 Ω , 1/4W		
R79	2900001500		Resistor, 15 Ω , 1/8W		
R80	2200018200	6	Resistor, 820 Ω , 1/4W		
R81	2200008200	1	Resistor, 82 Ω , 1/4W		
R82	2900001500		Resistor, 15 Ω , 1/8W		
R83	2200012200	5	Resistor, 220 Ω , 1/4W		
R84	2200018200		Resistor, 820 Ω , 1/4W		
R85	2200005100		Resistor, 51 Ω , 1/4W		
R86	2200031500	1	Resistor, 15K, 1/4W		
R87	2200023900	2	Resistor, 3.9K, 1/4W		
R88	2200023900		Resistor, 3.9K, 1/4W		
R89	2200021500		Resistor, 1.5K, 1/4W		
R90	2200011000		Resistor, 100 Ω , 1/4W		
R91	2200021500		Resistor, 1.5K, 1/4W		
R92	2900011000		Resistor, 100 Ω , 1/8W		
R93	2900011000		Resistor, 100 Ω , 1/8W		
R94	2900001500		Resistor, 15 Ω , 1/8W		
R95	2200018200		Resistor, 820 Ω , 1/4W		
R96	2200011000		Resistor, 100 Ω , 1/4W		
R97	2200021500		Resistor, 1.5 Ω , 1/4W		
R98	2200004700		Resistor, 47 Ω , 1/4W		
R99	2200028200	1	Resistor, 8.2K, 1/8W		
R100	2900012000	2	Resistor, 200 Ω , 1/8W		
R101	2200005600	1	Resistor, 56 Ω , 1/4W		
R102	2200001200	1	Resistor, 12 Ω , 1/4W		
R103	2200011000		Resistor, 100 Ω , 1/4W		
R104	2900001000	3	Resistor, 10 Ω , 1/8W		
R105	2200015600	5	Resistor, 560 Ω , 1/4W		
R106	2200021800		Resistor, 1.8K, 1/4W		
R107	2200001000		Resistor, 10 Ω , 1/4W		
R108	2200001000		Resistor, 10 Ω , 1/4W		
R109	2200002700	2	Resistor, 27 Ω , 1/4W		
R110	2200011000		Resistor, 100 Ω , 1/4W		
R111	2200041800	1	Resistor, 180K, 1/4W		
R112	2200012000	2	Resistor, 120 Ω , 1/4W		
R113	2200003900	1	Resistor, 39 Ω , 1/4W		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-10
R114	2900008200	1	Resistor, 82 Ω , 1/8W		
R115	2900004700		Resistor, 47 Ω , 1/8W		
R116	2900011000		Resistor, 100 Ω , 1/8W		
R117	2200031200	1	Resistor, 12K, 1/4W		
R118	2200021000		Resistor, 1K, 1/4W		
R119	2200021000		Resistor, 1K, 1/4W		
R120	2200021000		Resistor, 1K, 1/4W		
R121	2200021000		Resistor, 1K, 1/4W		
R122	2200036800	2	Resistor, 68K, 1/4W		
R123	2200036800		Resistor, 68K, 1/4W		
R124	2200000000	4	SELECTED, 1/4W		
R125	2200014700		Resistor, 470 Ω , 1/4W		
R126	2200000000		SELECTED, 1/4W		
R127	2200000000		SELECTED, 1/4W		
R128	2900011000		Resistor, 100 Ω , 1/8W		
R129	2900006800	3	Resistor, 68 Ω , 1/8W		
R130	2900002200	5	Resistor, 22 Ω , 1/8W		
R131	2200012700	2	Resistor, 270 Ω , 1/4W		
R132	2900006800		Resistor, 68 Ω , 1/8W		
R133	2200021500		Resistor, 1.5K, 1/4W		
R134	2200021000		Resistor, 1K, 1/4W		
R135	2200021200	1	Resistor, 1.2K, 1/4W		
R136	2200021800		Resistor, 1.8K, 1/4W		
R137	2200021800		Resistor, 1.8K, 1/4W		
R138	2200024300	1	Resistor, 4.3K, 1/4W		
R139	2200025600	1	Resistor, 5.6K, 1/4W		
R140	2900011000		Resistor, 100 Ω , 1/8W		
R141	2900011500		Resistor, 150 Ω , 1/8W		
R142	2900004700		Resistor, 47 Ω , 1/8W		
R143	2900002200		Resistor, 22 Ω , 1/8W		
R144	2900021000	10	Resistor, 1K, 1/8W		
R145	2900021000		Resistor, 1K, 1/8W		
R146	2900021000		Resistor, 1K, 1/8W		
R147	2900021000		Resistor, 1K, 1/8W		
R148	2900021000		Resistor, 1K, 1/8W		
R148	2900021000		Resistor, 1K, 1/8W		
R149	2900021000		Resistor, 1K, 1/8W		
R150	2900021000		Resistor, 1K, 1/8W		
R151	2200016800		Resistor, 680 Ω , 1/4W		
R152	2900001500		Resistor, 15 Ω , 1/8W		
R153	2200021500		Resistor, 1.5K, 1/4W		
R154	2200006800	1	Resistor, 68 Ω , 1/4W		
R155	2200014700		Resistor, 470 Ω , 1/4W		
R156	2200021000		Resistor, 1K, 1/4W		
R157	2200031000		Resistor, 10K, 1/4W		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-10
R158	2200016800		Resistor, 680 Ω , 1/4W		
R159	2200021500		Resistor, 1.5K, 1/4W		
R160	220001800	1	Resistor, 180 Ω , 1/4W		
R161	2200018200		Resistor, 820 Ω , 1/4W		
R162	2900005100		Resistor, 51 Ω , 1/8W		
R163	2200021000		Resistor, 1K, 1/4W		
R164	2900003900	2	Resistor, 39 Ω , 1/8W		
R165	2200015600		Resistor, 560 Ω , 1/4W		
R166	2900001500		Resistor, 15 Ω , 1/8W		
R167	2200012200		Resistor, 220 Ω , 1/4W		
R168	2200033300	1	Resistor, 33K, 1/4W		
R169	2200023300	1	Resistor, 3.3K, 1/4W		
R170	2200012200		Resistor, 220 Ω , 1/4W		
R171	2200012200		Resistor, 220 Ω , 1/4W		
R172	2200021000		Resistor, 1K, 1/4W		
R173	2200012200		Resistor, 220 Ω , 1/4W		
R174	2200015600		Resistor, 560 Ω , 1/4W		
R175	2200012000		Resistor, 120 Ω , 1/4W		
R176	2900001500		Resistor, 15 Ω , 1/8W		
R177	2200022200	1	Resistor, 2.2K, 1/4W		
R178	2200041000	2	Resistor, 100K, 1/4W		
R179	2200041000		Resistor, 100K, 1/4W		
R180	2200021000		Resistor, 1K, 1/4W		
R181	2200034700	1	Resistor, 47K, 1/4W		
R182	2200051000	2	Resistor, 1 MEG, 1/4W		
R183	2200051000		Resistor, 1 MEG, 1/4W		
R184	2200021000		Resistor, 1K, 1/4W		
R185	2200002700		Resistor, 27 Ω , 1/4W		
R186	2200014700		Resistor, 470 Ω , 1/4W		
R187	2200011000		Resistor, 100 Ω , 1/4W		
R188	2900014700	4	Resistor, 470 Ω , 1/8W		
R189	290002200		Resistor, 22 Ω , 1/8W		
R190	2900002200		Resistor, 22 Ω , 1/8W		
R191	2200013900		Resistor, 390 Ω , 1/4W		
R192	2200021000		Resistor, 1K, 1/4W		
R193	2200021000		Resistor, 1K, 1/4W		
R194	2900005100		Resistor, 51 Ω , 1/8W		
R195	2900004700		Resistor, 47 Ω , 1/8W		
R196	2900014700		Resistor, 470 Ω , 1/8W		
R197	2200018200		Resistor, 820 Ω , 1/4W		
R198	2900003900		Resistor, 39 Ω , 1/8W		
R199	2200014700		Resistor, 470 Ω , 1/4W		
R200	2900012200		Resistor, 220 Ω , 1/8W		
R201	2200015600		Resistor, 560 Ω , 1/4W		
R202	2200015600		Resistor, 560 Ω , 1/4W		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-10
R203	2200001000		Resistor, 10 Ω , 1/4W		
R204	2200001000		Resistor, 10 Ω , 1/4W		
R205	2900012200		Resistor, 220 Ω , 1/8W		
R206	2900011000		Resistor, 100 Ω , 1/8E		
R207	2200018200		Resistor, 820 Ω , 1/4W		
R208	2900003300	1	Resistor, 33 Ω , 1/8W		
R209	2200014700		Resistor, 470 Ω , 1/4W		
R210	2200022000	1	Resistor, 2K, 1/4W		
R211	2200012700		Resistor, 270 Ω , 1/4W		
R212	2200013300		Resistor, 330 Ω , 1/4W		
R213	2200011000		Resistor, 100 Ω , 1/4W		
R214	2200004300	1	Resistor, 43 Ω , 1/4W		
R215	2200001000		Resistor, 10 Ω , 1/4W		
R216	2900014700		Resistor, 470 Ω , 1/8W		
R217	2900001200	2	Resistor, 12 Ω , 1/8W		
R218	2900014700		Resistor, 470 Ω , 1/8W		
R219	2200021000		Resistor, 1K, 1/4W		
R220	2900012000		Resistor, 200 Ω , 1/8W		
R221	2200014700		Resistor, 470 Ω , 1/4W		
R222	2900001200		Resistor, 12 Ω , 1/8W		
R223	2900001000		Resistor, 10 Ω , 1/8W		
R224	2900021000		Resistor, 1K, 1/8W		
R225	2200021000		Resistor, 1K, 1/4W		
R226	2900021000		Resistor, 1K, 1/8W		
R227	2200021000		Resistor, 1K, 1/4W		
R228	2900021000		Resistor, 1K, 1/8W		
R229	2200003300	1	Resistor, 33 Ω , 1/4W		
R230	2900012200		Resistor, 220 Ω , 1/8W		
R231	2200000000		SELECTED, 1/4W		
R232	2900001500		Resistor, 15 Ω , 1/8W		
R233	2200021000		Resistor, 1K , 1/4W		
R234	2200001000		Resistor, 10 Ω , 1/4W		
R236	2900005100		Resistor, 51 Ω , 1/8W		
R237	2900001800	2	Resistor, 18 Ω , 1/8W		
R238	2900005100		Resistor, 51 Ω , 1/8W		
R239	2900001800		Resistor, 18 Ω , 1/8W		
R240	2900006800		Resistor, 68 Ω , 1/8W		
R241	2900011500		Resistor, 150 Ω , 1/8W		
R242	2900002200		Resistor, 22 Ω , 1/8W		
R243	2900001000		Resistor, 10 Ω , 1/8W		
R244	2151220000	2	Resistor, TRIM POT 220K, 1 TURN		
R245	215122000		Resistor, TRIM POT 220K, 1 TURN		
R246	2153220000	1	Resistor, TRIM POT 22K 1 TURN		
R247	2150470000	1	Resistor, TRIM POT 47K, 1 TURN		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-10
T1	0216820000	2	Transformer	H20 2/2+2	
T2	0216940000	4	Transformer	H20 3/2	
T3	0216820000		Transformer	H20 2/2+2	
T4	0216940000		Transformer	H20 3/2	
T5					
T6	0218380000	1	Transformer	H20 3/2+2	
T7	0218500000	1	Transformer	FT5 T6	
T8	0218470000	2	Transformer	FT4 H32	
T9	0218470000		Transformer	FT4 H32	
U1	4100860700	1	Integrated Circuit	SP8607B	
U2	4100230000	1	Integrated Circuit	SP8604	
U3	4500430000	1	Integrated Circuit	TDA 1053	
U4	4100861300	1	Integrated Circuit	SP8613B	
U5	4100540000	1	Integrated Circuit	SP8640B	
U6	4200320000	1	Integrated Circuit	LF356N	
	297471	1	Mixer	297471	5-10
C1	3310022000	4	Capacitor, 22pF		
C2	3310022000		Capacitor, 22pF		
C3	3800011000	2	Capacitor, 100pF, CHIP		
C4			Capacitor, 100pF, CHIP		
C5	380001200	1	Capacitor, 12pF, CHIP		
C6	3310022000		Capacitor, 22pF		
C7	3310022000		Capacitor, 22pF		
Q1	4300270000	4	Transistor	BFR96	
Q2			Transistor	BFR96	
Q3			Transistor	BFR96	
Q4			Transistor	BFR96	
R1	2900001000	6	Resistor, 10 Ω , 1/8W		
R2	2900001000		Resistor, 10 Ω , 1/8W		
R3	2900001000		Resistor, 10 Ω , 1/8W		
R4	2900001000		Resistor, 10 Ω , 1/8W		
R5	2900001000		Resistor, 10 Ω , 1/8W		
R6	2900001000		Resistor, 10 Ω , 1/8W		
R7	2900004700	2	Resistor, 10 Ω , 1/8W		
R8	2900004700				
T1	021845	1	Transformer		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
	297463	1	AM Modulation	297463	5-10
C1	3120021000	4	Capacitor, 1000PF		
C2	3120021000		Capacitor, 1000PF		
C3	3120021000		Capacitor, 1000PF		
C4	3120021000		Capacitor, 1000PF		
CR1	0205700000	4	Diode Array	HP 3379	
CR2	0205700000		Diode Array		
CR3	0205700000		Diode Array		
CR4	0205700000		Diode Array		
T1			NOT USED		
T2	021846	1	Transformer		
	297464	1	10MHz Steps Module	297464	5-11
C1	3800004700	2	Capacitor, Chip, 47 pF		
C2	3120096800	1	Capacitor, 6.8 pF		
C3	3800006800	2	Capacitor, 68 pF		
C4	3120094700	9	Capacitor, 4.7 pF		
C5	3800130000	8	Capacitor, 1000 pF		
C6	3800130000		Capacitor, 1000 pF		
C7	3120094700		Capacitor, 4.7 pF		
C8	3800130000		Capacitor, 1000 pF		
C9	3120094700		Capacitor, 4.7 pF		
C10	3800130000		Capacitor, 1000 pF		
C11	3800130000		Capacitor, 1000 pF		
C12	3120094700		Capacitor, 4.7 pF		
C13	3800130000		Capacitor, 1000 pF		
C14	31200092700	1	Capacitor, 2.7 pF		
C15	3800130000		Capacitor, 1000 pF		
C16	3120094700		Capacitor, 4.7 pF		
C17	3800130000		Capacitor, 1000 pF		
C18	3800130000		Capacitor, 1000 pF		
C19	3800130000		Capacitor, 1000 pF		
C20	3800370000	2	Capacitor, 0.1 μF		
C21	3800130000		Capacitor, 1000 pF		
C22	3800130000		Capacitor, 1000 pF		
C23	3120011500	2	Capacitor, 150 pF		
C24	3120011500		Capacitor, 150 pF		
C25	3800130000		Capacitor, 1000 pF		
C26	3800130000		Capacitor, 1000 pF		
C27	3120094700		Capacitor, 4.7 pF		
C28	3120093300	1	Capacitor, 3.3 pF		
C29	3800005600	1	Capacitor, CHIP, 56 pF		
C30	3800003300	2	Capacitor, CHIP, 33 pF		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-11
C31	3800370000		Capacitor, 1000 pF		
C32	3120094700		Capacitor, 4.7 pF		
C33	3800130000		Capacitor, 1000 pF		
C34	3800001200	2	Capacitor, CHIP, 12 pF		
C35	3120095600	1	Capacitor, 5.6 pF		
C36	3600170000	5	Capacitor, 7.5 pF		
C37	3800008200	2	Capacitor, 82 pF		
C38	3800008200		Capacitor, 82 pF		
C39	3800006800		Capacitor, 68 pF		
C40	3600170000		Capacitor, 7.5 pF		
C41	3000370000		Capacitor		
C42	3800032200	1	Capacitor, CHIP 22nF		
C43	3120011200	2	Capacitor, 120 pF		
C44	3120093900	1	Capacitor, 3.9 pF		
C45	3800130000		Capacitor, 1000 pF		
C46	3800130000		Capacitor, 1000 pF		
C47	3800003300		Capacitor, 33 pF		
C48	3800130000		Capacitor, 1000 pF		
C49	3800001200	2	Capacitor, CHIP, 12 pF		
C50	3120001200	2	Capacitor, 12 pF		
C51	3800130000		Capacitor, 1000 pF		
C52	3120001200		Capacitor, 12 pF		
C53	36001700000		Capacitor, 7.5 pF		
C54	3800130000		Capacitor, 1000 pF		
C55	3700170000	4	Capacitor, 22 μF, 15V		
C56	38000110000	3	Capacitor, CHIPS, 100 pF		
C57	38000110000		Capacitor, CHIPS, 100 pF		
C58	3600170000		Capacitor, 7.5pF		
C59	3800004700		Capacitor, CHIPS, 47 pF		
C60			NOT USED		
C61	3120021000	17	Capacitor, 1000 pF		
C62	3700170000		Capacitor, 22 μF, 15V		
C63	2800011000		Capacitor, CHIP, 100 pF		
C64	3120094700		Capacitor, 4.7 pF		
C65	3120011000	2	Capacitor, 100 pF		
C66	3120011000		Capacitor, 100 pF		
C67	3120094700		Capacitor, 4.7 pF		
C68	3120021000		Capacitor, 10000 pF		
C69	3800001000	1	Capacitor, CHIP, 10 pF		
C70	3700170000		Capacitor, 22 μF, 15V		
C71	3120021000		Capacitor, 1000 pF		
C72	3700040000		Capacitor, 1 μF, 35V		
C73	3700140000		Capacitor, 10 μF, 25V		
C74	3800001200		Capacitor, CHIP, 12 pF		
C75	3700040000	5	Capacitor, 1 μF, 35V		
C76	3700040000		Capacitor, 1 μF, 35V		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-11
C77	3700040000		Capacitor, 1 μF, 35V		
C78	3700040000		Capacitor, 1 μF, 35V		
C79	3700140000	2	Capacitor, 10 μF, 25V		
C80	31200210000		Capacitor, 1000 pF		
C81					
C82	3700170000		Capacitor, 22 μF, 15V		
C83	3120011200		Capacitor, 120 pF		
CR1	4500230000		Diode	BB39	
CR2	4500230000		Diode	BB139	
CR3	4500230000		Diode	BB139	
CR4	4500230000		Diode	BB139	
CR5	4500230000		Diode	BB139	
CR6	4500230000		Diode	BB139	
CR7	4500300000	4	Diode	ESM247	
CR8	4600080000	1	Diode	ZPD 6.8	
CR9	4500020000	2	Diode	IN4151	
CR10	4500300000		Diode	ESM247	
CR11	4500230000		Diode	BB139	
CR12	4500230000		Diode	BB139	
CR13	4500130000		Diode	FD777	
CR14	4500230000		Diode	BB139	
CR15	4500230000		Diode	BB139	
CR16	4500300000		Diode	ESM247	
CR17	4500200100	1	Diode	BA182	
CR18	4500180000	2	Diode	HP2826	
CR19	4500180000		Diode	HP2826	
CR20	4500020000		Diode	IN4151	
CR21	4500310000	1	Diode	IN4448	
CR22	4500300000		Diode	ESM247	
L1	5300140100	2	Inductor, 220 nH		
L2	5300140100		Inductor, 220 nH		
L3	5300020000		Inductor, 680 nH		
L4	5300160000	2	Inductor, 330 nH		
L5	5300160000		Inductor, 330 nH		
L6			NOT USED		
L7	5300320100	1	Inductor, 6.8 μH		
L8	5300300100	1	Inductor, 4.7 μH		
L9	5300420000	4	Inductor, 47 μH		
L10	5300430000		Inductor, 47 μH		
L11	5300110000	1	Inductor, 1000 nH		
L12	218370000	1	Inductor		
L13	5303360000	1	Inductor, 16 μH		
L14	5300420000		Inductor, 47 μH		
L15	5300420000		Inductor, 47 μH		
L16	5300421000	1	Inductor, 212 μH		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-11
Q1	4300280000	9	Transistor	BFR91	
Q2	4300280000		Transistor	BFR91	
Q3	4300310000		Transistor	BFQ22	
Q4	4300280000		Transistor	BFR91	
Q5	4300310000		Transistor	BFQ22	
Q6	4300310000		Transistor	BFQ22	
Q7	4300280000		Transistor	BFR91	
Q8	4300310000		Transistor	BFQ22	
Q9	4300310000		Transistor	BFQ22	
Q10	4300310000		Transistor	BFQ22	
Q11	4300280000		Transistor	BFR91	
Q12	4300280000		Transistor	BFR91	
Q13	4300310000		Transistor	BFQ22	
Q14	4300310000		Transistor	BFQ22	
Q15	4300280000		Transistor	BFR91	
Q16	4300380000	2	Transistor	BF480	
Q17	4300380000		Transistor	BF480	
Q18	4300390000	2	Transistor	BF979	
Q19	4300390000		Transistor	BF979	
Q20	4300310000		Transistor	BFQ22	
Q21	4300310000		Transistor	BFQ22	
Q22	3200370000		Transistor	BFT95	
Q23	4300280000		Transistor	BFR91	
Q24	4300310000		Transistor	BFQ22	
Q25	4300310000		Transistor	BFQ22	
Q26	4300280000		Transistor	BFR91	
R1	2200013900	2	Resistor, 390Ω		
R2	2200013900		Resistor, 390Ω		
R3	2200021000	5	Resistor, 1K		
R4	2200011000	7	Resistor, 100Ω		
R5	2900001000	3	Resistor, 10Ω		
R6	2900001000		Resistor, 10Ω		
R7	2900001500	10	Resistor, 15Ω		
R8	2210016800	2	Resistor, 680Ω		
R9	2200011000		Resistor, 100Ω		
R10	2200011800	1	Resistor, 180Ω		
R11	2210013300	2	Resistor, 330Ω		
R12	2900002700	2	Resistor, 27Ω		
R13	2200015600	4	Resistor, 560Ω		
R14	2900001500		Resistor, 15Ω		
R15	2200012200	2	Resistor, 220Ω		
R16	2900001500		Resistor, 15Ω		
R17	2210016800		Resistor, 680Ω		
R18	2200011000		Resistor, 100Ω		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-11
R19	2200011000		Resistor, 100Ω		
R20	2200014700	4	Resistor, 470Ω		
R21	2200011800	1	Resistor, 180Ω		
R22	2200021500	2	Resistor, 1.5K		
R23	2900001500		Resistor, 15Ω		
R24	2900005100	1	Resistor, 51Ω		
R25	2200011000		Resistor, 100Ω		
R26	2900001500		Resistor, 15Ω		
R27	2200014700	2	Resistor, 470Ω		
R28	2200005100		Resistor, 51Ω		
R29	2200014700		Resistor, 470Ω		
R30	2200006800	1	Resistor, 68Ω		
R31	2900001500		Resistor, 15Ω		
R32	2200016800		Resistor, 680Ω		
R33	2200021500		Resistor, 1.5K		
R34	2200021000		Resistor, 1K		
R35	2200016800		Resistor, 680Ω		
R36	2210021500		Resistor, 1.5K		
R37	2900011800		Resistor, 180Ω		
R38	2210018200	1	Resistor, 820Ω		
R39	2900002200	1	Resistor 22Ω		
R40	2200011000		Resistor, 100Ω		
R41	2200011000		Resistor, 100Ω		
R42	2210014700	2	Resistor, 470Ω		
R43	2210014700		Resistor, 470Ω		
R44	2900001500		Resistor, 15Ω		
R45	2900011000	6	Resistor, 100Ω		
R46	2900021000	1	Resistor, 1K		
R47	2900001500		Resistor, 15Ω		
R48	2210021000		Resistor, 1K		
R49	2200005100		Resistor, 51Ω		
R50	2200032200		Resistor, 22K		
R51			NOT USED		
R52	2210011000		Resistor, 100Ω		
R53	2210012200		Resistor, 220Ω		
R54	2210011000		Resistor, 100Ω		
R55	2210011000		Resistor, 100Ω		
R56	2210011000		Resistor, 100Ω		
R57	2210011000		Resistor, 100Ω		
R58	2210005600		Resistor, 56Ω		
R59	3300004700		Resistor, 47Ω		
R60	2200022200	1	Resistor, 2.2K		
R61	2200021000		Resistor, 1K		
R62	2900001000		Resistor, 10Ω		
R63	2900001000		Resistor, 10Ω		
R64	2200031500	1	Resistor, 15K		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-11
R65	2200023300	2	Resistor, 3.3K		
R66	2210013300		Resistor, 330Ω		
R67	2200032200		Resistor, 22K		
R68	2200015600		Resistor, 560Ω		
R69	2200015600		Resistor, 560Ω		
R70	2200031000		Resistor, 220Ω		
R71	2200012200		Resistor, 220Ω		
R72	2210001000		Resistor, 10Ω		
R73	2900002700		Resistor, 27Ω		
R74	2200018200		Resistor, 820Ω		
R75	2200011800		Resistor, 180Ω		
R76			NOT USED		
R77	2900001500		Resistor, 15Ω		
R78	2900005600		Resistor, 56Ω		
R79	2210018200		Resistor, 820Ω		
R80	2210021000		Resistor, 1K		
R81	2900011000		Resistor, 100Ω		
R82	2900001500		Resistor, 15Ω		
R83	2900011000		Resistor, 100Ω		
R84	2210006800		Resistor, 68Ω		
R85	2210013900		Resistor, 390Ω		
R86	2200021200		Resistor, 1.2K		
R87	2200016800		Resistor, 680Ω		
R88	2200014700		Resistor, 470Ω		
R89	2200021000		Resistor, 1K		
R90	2210022200		Resistor, 2.2K		
R91	2210024700		Resistor, 4.7K		
R92	2210012700		Resistor, 270Ω		
R93	2210022200		Resistor, 2.2K		
R94	2200021000		Resistor, 1K		
R95	2210021000		Resistor, 1K		
R96	2900003300		Resistor, 33Ω		
R97	2900003300		Resistor, 33Ω		
R98	2200015600		Resistor, 560Ω		
R99	2210022200		Resistor, 2.2K		
R100	2900011000		Resistor, 100Ω		
R101	2900011000		Resistor, 100Ω		
R102	2200031000		Resistor, 10K		
R103	2900011000		Resistor, 100Ω		
R104	2900023300		Resistor, 3.3K		
R105	2900023300		Resistor, 3.3K		
R106	2210021000		Resistor, 1K		
R107	2153100000		Resistor, Variable, 10K		
T1	216940000	1	Transformer	H20 3/2	
T2	216860000	1	Transformer	H20	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-11
U1	4100086100	1	Integrated Circuit	SP8610B	
U2	4100864700	1	Integrated Circuit	SP8647B	
U3	4101010900	1	Integrated Circuit	MC10109	
U4	4101013100	2	Integrated Circuit	MC10131P	
U5	4101013100		Integrated Circuit	MC10131P	
U6	4200370000	1	Integrated Circuit	MCLTFM 2	
	297451	1	Interconnect	297451	5-9
C1	3120021000	1	Capacitor 1000pF		
CR1	4500300000	1	Diode	ESM 247	
J1	1409020400	1	Connector	TRF254 FC1C9	
J2	1420020300	3	Connector	TRF254 FC120	
J3	1420020300		Connector	TRF254 FC120	
J4	1420020300		Connector	TRF254 FC120	
J5	1441020500	1	Connector	TM41 FC1G	
TP1 thru TP30	1400109900	30	Test Points		
W1	0205730000	1	Cable Coax		
	297465	1	20/25 MHz Oscillator	297465	5-12
C1	3309470000	1	Capacitor, 47pF		
C2	3310100000	2	Capacitor, 100pF		
C3	3310100000		Capacitor, 100pF		
C4	3800130000	1	Capacitor, 1nF		
C5	3600140000	1	Capacitor, 2a14pF		
C6	3700180000	11	Capacitor, 15MMF, 16V		
C7	3700180000		Capacitor, 15MMF, 16V		
C8	3700180000		Capacitor, 15MMF, 16V		
C9	3120021000	11	Capacitor, 1nF		
C10	3700180000		Capacitor, 15MMF, 16V		
C11	3700180000		Capacitor, 15MMF, 16V		
C12	3120021000		Capacitor, 1nF		
C13	3120021000		Capacitor, 1nF		
C14	3120021000		Capacitor, 1nF		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
C15	3700180000		Capacitor, 15MMF, 16V		
C16	3120031000	1	Capacitor, 10nF		
C17	3120003300	2	Capacitor, 33pF		
C18	3120003300		Capacitor, 33pF		
C19	3120021000		Capacitor, IN		
C20	3120021000		Capacitor, IN		
C21	3600180000		Capacitor, 15MMF, 16V		
C22	3120021000		Capacitor, IN		
C23	3120021000		Capacitor, IN		
C24	3700180000		Capacitor, 15MMF, 16V		
C25	3120021000		Capacitor, IN		
C26	3120021000		Capacitor, IN		
C27	3234100000	2	Capacitor, .1MMF		
C28	3233150000	1	Capacitor, 15N		
C29	3224220200	1	Capacitor, .22MMF		
C30	3700140000	2	Capacitor, 10MF		
C31	3700180000		Capacitor, 15MMF, 16V		
C32	3700180000		Capacitor, 15MMF, 16V		
C33	3120021000		Capacitor, IN		
C34	3225220000	1	Capacitor, 2.2MMF		
C35	3700100000	2	Capacitor, 4.7MMF, 25V		
C36	3700180000		Capacitor, 15MMF, 16V		
C37	3700100000		Capacitor, 4.7MMF, 25V		
C38	3700140000		Capacitor, 10MF		
C39	3234100000		Capacitor, .1MMF		
CR1	4500260000	8	Diode	BB109G	
CR2	4500260000		Diode	BB109G	
CR3	4500260000		Diode	BB109G	
CR4	4500260000		Diode	BB109G	
CR5	4500260000		Diode	BB109G	
CR6	4500260000		Diode	BB109G	
CR7	4500260000		Diode	BB109G	
CR8	4500260000		Diode	BB109G	
CR9	4500310000	7	Diode	IN4448	
CR10	4500310000		Diode	IN4448	
CR11	4500310000		Diode	IN4448	
CR12	4500310000		Diode	IN4448	
CR13	4500310000		Diode	IN4448	
CR14	4500310000		Diode	IN4448	
CR15	4500310000		Diode	IN4448	
J1			Connector	14200206	
J2	4900150000	1	Connector, 16 Pin	490015	
L1	5300420100	3	Inductor, 47MMH		
L2	5300420100		Inductor, 47MMH		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-12
L3	5300420100		Inductor, 47MMH		
L4	0218330000	1	Inductor	021833 BAQ	
L5	5303360000	1	Inductor 16MMH		
Q1	4300250000	1	Transistor	BFR90	
Q2	4300110000	6	Transistor	BC214C	
Q3	4300190000	7	Transistor	BC184C	
Q4	4300310000	3	Transistor	BFQ22	
Q5	4300190000		Transistor	BV184C	
Q6	4300280000	1	Transistor	BFR91	
Q7	4300040000	2	Transistor	2N918	
Q8	4300040000		Transistor	2N918	
Q9	4300310000		Transistor	BFQ22	
Q10	4300310000		Transistor	BFQ22	
Q11	4300110000		Transistor	BC214C	
Q12	4300110000		Transistor	BC214C	
Q13	4300190000		Transistor	BC184C	
Q14	4300190000		Transistor	BC184C	
Q15	4300110000		Transistor	BC214C	
Q16	4300190000		Transistor	BC184C	
Q17	4300190000		Transistor	BC184C	
Q18	4300110000		Transistor	BC214C	
Q19	4300190000		Transistor	BC184C	
Q20	4300110000		Transistor	BC214C	
R1	2200032200	2	Resistor, 22K, 1/4W		
R2	2200033300	4	Resistor, 33K, 1/4W		
R3	2200011000	13	Resistor, 100Ω, 1/4W		
R4	2200021000	4	Resistor, 1K, 1/4W		
R5	2200041000	1	Resistor, 100K, 1/4W		
R6	2500075000	1	Resistor, 750 Ω , .3W 1%		
R7	2200031500	1	Resistor, 15K, 1/4W		
R8	2200012200	3	Resistor, 220 Ω , 1/4W		
R9	2200036800	1	Resistor, 68K, 1/4W		
R10	2200012200		Resistor, 220 Ω , 1/4W		
R11	2200033900	1	Resistor, 39K, 1/4W		
R12	2900003300	2	Resistor, 33 Ω , 1/8W		
R13	2200006800	2	Resistor, 68 Ω , 1/4W		
R14	2200011000		Resistor, 100 Ω , 1/4W		
R15	2200012700	1	Resistor, 270 Ω , 1/4W		
R16	2200002200	4	Resistor, 22 Ω , 1/4W		
R17	2200001100		Resistor, 68 Ω , 1/4W		
R18	2200013900	1	Resistor, 390 Ω , 1/4W		
R19	2200021000		Resistor, 1K, 1/4W		
R20	2200018200	1	Resistor, 820 Ω , 1/4W		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-12
R20	2200018200	1	Resistor, 820 Ω , 1/4W		
R21	2200021000		Resistor, 1K, 1/4W		
R22	2200014700	1	Resistor, 470 Ω , 1/4W		
R23	2200021200	1	Resistor, 1.2K, 1/4W		
R24	2200011000		Resistor, 100 Ω , 1/4W		
R25	2200011000		Resistor, 100 Ω , 1/4W		
R26	2200015600	2	Resistor, 560 Ω , 1/4W		
R27	2200011000		Resistor, 100 Ω , 1/4W		
R28	2200011000		Resistor, 100 Ω , 1/4W		
R29	2900001000		Resistor, 10 Ω , 1/8W		
R30	2200015600		Resistor, 560 Ω , 1/4W		
R31	2200011000		Resistor, 100 Ω , 1/4W		
R32	2200011000		Resistor, 100 Ω , 1/4W		
R33	2200011000		Resistor, 100 Ω , 1/4W		
R34	2200033300		Resistor, 33K, 1/4W		
R35	2200033300		Resistor, 33K, 1/4W		
R36	2200033300		Resistor, 33K, 1/4W		
R37	2200011000		Resistor, 100 Ω , 1/4W		
R38	2200011000		Resistor, 100 Ω , 1/4W		
R39	2200013300	2	Resistor, 330 Ω , 1/4W		
R40	2200013300		Resistor, 330 Ω , 1/4W		
R41	2500010000	1	Resistor, 100 Ω , .3 1%		
R42	2900031000	3	Resistor, 10K, 1/8W		
R43	2900023300	1	Resistor, 3.3K, 1/8W		
R44	2200051000	2	Resistor, 1 MEG, 1/4W		
R45	2200051000		Resistor, 1 MEG, 1/4W		
R46	2200044700	1	Resistor, 470K, 1/4W		
R47	2500310000		Resistor, 100K, .3W, 1%		
R48	2500310000		Resistor, 100K, .3W, 1%		
R49	2200012200		Resistor, 220 Ω , 1/4W		
R50	2200021000		Resistor, 1K, 1/4W		
R51	2200011000		Resistor, 100 Ω , 1/4W		
R52	2200011000		Resistor, 100 Ω , 1/4W		
R53	220002700	2	Resistor, 2.7K, 1/4W		
R54	220002700		Resistor, 2.7K, 1/4W		
R55	2200031000	1	Resistor, 10K, 1/4W		
R56	2200023300	5	Resistor, 3.3K, 1/4W		
R57	290031000		Resistor, 10K, 1/8W		
R58	2200021800	2	Resistor, 1.8K, 1/4W		
R59	2200021800		Resistor, 1.8K, 1/4W		
R60	2900031000		Resistor, 10K, 1/8W		
R61	2200023300		Resistor, 3.3K, 1/4W		
R62	2200023300		Resistor, 3.3K, 1/4W		
R63	2200023300		Resistor, 3.3K, 1/4W		
R64	2200002200		Resistor, 22 Ω , 1/4W		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
T1	0218340000	1	Transformer	021834 F40	
T2			Transformer	021856	
U1	4101023100	1	Integrated Circuit	MC 10231 P	
U2	4200360000	1	Integrated Circuit	TL0 72	
U3	4200320000	1	Integrated Circuit	LF 356	
	297466	1	Linearizer	297466	5-13
C1	3700180000		Capacitor, 15pF, 16VDC		
C2	3700180000		Capacitor, 15pF, 16VDC		
C3	3700180000		Capacitor, 15pF, 16VDC		
C4	3700180000		Capacitor, 15pF, 16VDC		
C5	3232680000		Capacitor, 6800pF		
C6	3232680000		Capacitor, 6800pF		
C7	3232680000		Capacitor, 6800pF		
C8	3232330000		Capacitor, 3300pF		
C9	3700180000		Capacitor, 15pF, 16VDC		
C10	3700180000		Capacitor, 15pF, 16VDC		
C11	3700020000		Capacitor, 1 μfd, 25VDC		
CR1	4600100000		Diode, 7.5V	ZPD	
CR2	4600100000		Diode, 7.5V	ZPD	
Q1	4300110000		Transistor	BC 214	
Q2	4300190000		Transistor	BC 184C	
Q3	4300190000		Transistor	BC 184C	
Q4	4300110000		Transistor	BC 214	
Q5	4300190000		Transistor	BC 184C	
R1	2210022700		Resistor, 2.7K		
R2	2500049900		Resistor, 499 Ω, 1% 0.3W		
R3	2500000000		Resistor, select for linearity		
R4			Resistor, select for linearity		
R5			Resistor, select for linearity		
R6			Resistor, select for linearity		
R7			Resistor, select for linearity		
R8			Resistor, select for linearity		
R9			Resistor, select for linearity		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-13
R10			Resistor, select for linearity		
R11			Resistor, select for linearity		
R12			Resistor, select for linearity		
R13			Resistor, select for linearity		
R14			Resistor, select for linearity		
R15			Resistor, select for linearity		
R16			Resistor, select for linearity		
R17			Resistor, select for linearity		
R18	2210031000	1	Resistor, 10K, 1/4W		
R19	2210011000	6	Resistor, 100Ω, 1/4W		
R20	2210011000		Resistor, 100Ω, 1/4W		
R21	2500110000	2	Resistor 1K, 1%, 0.3W		
R22	2500110000		Resistor 1K, 1%, 0.3W		
R23	2210041000	1	Resistor, 100K, 1/4W		
R24	2210011000		Resistor, 100 Ω , 1/4W		
R25	2900022700	2	Resistor, 2.7K, 1/8W		
R26	2200002200	2	Resistor, 22Ω, 1/4W		
R27	2200002200		Resistor, 22Ω, 1/4W		
R28	2900022700		Resistor, 2.7K, 1/8W		
R29	2210002200		Resistor, 22Ω, 1/4W		
R30	2210002200		Resistor, 22Ω, 1/4W		
R31	2500211300	1	Resistor, 11.3K, 1%, 0.3W		
R32	2210011000		Resistor, 100 , 1/4W		
R33	2500110500	1	Resistor, 1.05K, 1%, 0.3W		
R34	2210011000		Resistor, 100Ω, 1/4W		
R35	2210011000		Resistor, 100Ω, 1/4W		
R36	2210011500	6	Resistor, 150Ω, 1/4W		
R37	2210011500		Resistor, 150Ω, 1/4W		
R38	2210011500		Resistor, 150Ω, 1/4W		
R39	2210011500		Resistor, 150Ω, 1/4W		
R40	2210011500		Resistor, 150Ω, 1/4W		
R41	2210011500		Resistor, 150Ω, 1/4W		
R42	2210018200	2	Resistor, 820Ω, 1/4W		
R43	2210018200		Resistor, 820Ω, 1/4W		
R44	2200022200	1	Resistor, 2.2K, 1/4W		
R45	2200025600	1	Resistor, 5.6K, 1/4W		
R46	2132100000	1	Resistor, Variable, 1K,		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-13
U1	4200360000		Integrated Circuit	TL 072 CP	
U2	4200360000		Integrated Circuit	TL 072 CP	
U3	4160405100		Integrated Circuit	C-MOS 4051	
U4	4160405100		Integrated Circuit	C-MOS 4051	
U5	4160405300		Integrated Circuit	C-MOS 4053	
U6	4160405200		Integrated Circuit	C-MOS 4053	
U7	4160405200		Integrated Circuit	C-MOS 4053	
U8	4160408200		Integrated Circuit	C-MOS 4082	
	297439	1	Interface	297439	5-14
C1	3700170000	3	Capacitor, 22MF, 15V		
C2	3120004700	1	Capacitor, 47pF		
C3	3224470000	1	Capacitor, .47MMF		
C4	- -		NOT USED		
C5	3700170000		Capacitor, 22MF, 15V		
C6	3700170000		Capacitor, 22MF, 15V		
C7	3700140000	1	Capacitor, 10MF, 25V		
CR1	4500020000	3	Diode	IN4151	
CR2	4500020000		Diode	IN4151	
CR3	4600010000	2	Diode	ZPD 7V5	
CR4	4600010000		Diode	ZPD 7V5	
CR5	4500020000		Diode	IN4151	
J1	1441020200	1	Connector, 41 Pin		
J2	4900150000	1	Connector, 16 Pin		
J3	1426020000	1	Connector, 26 Pin		
Q1	4300110000	4	Transistor	BC214C	
Q2	4300010000	4	Transistor	2N2222	
Q3	4300110000		Transistor	BC214C	
Q4	4300010000		Transistor	2N2222	
Q5	4300110000		Transistor	BC214C	
Q6	4300010000		Transistor	2N2222	
Q7	4300010000		Transistor	2N2222	
Q8	4300110000		Transistor	BC214C	
Q9	4300110000	1	Transistor	BC184C	
Q10		1	Transistor	2N4416	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-14
R1	2200031000	18	Resistor, 10K, 1/4W		
R2	2200031000		Resistor, 10K, 1/4W		
R3	2200031000		Resistor, 10K, 1/4W		
R4	2200021500	11	Resistor, 1.5K, 1/4W		
R5	2200031000		Resistor, 10K, 1/4W		
R6	2200031000		Resistor, 10K, 1/4W		
R7	2200031000		Resistor, 10K, 1/4W		
R8	2200021500		Resistor, 1.5K, 1/4W		
R9	2200031000		Resistor, 10K, 1/4W		
R10	2200031000		Resistor, 10K, 1/4W		
R11	2200031000		Resistor, 10K, 1/4W		
R12	2200021500		Resistor, 1.5K, 1/4W		
R13	2200031000		Resistor, 10K, 1/4W		
R14	2200031000		Resistor, 10K, 1/4W		
R15	2200021500		Resistor, 1.5K, 1/4W		
R16	2200014700	2	Resistor, 470 Ω , 1/4W		
R17	2200014700		Resistor, 470 Ω , 1/4W		
R18	2200021500		Resistor, 1.5K, 1/4W		
R19	2200021500		Resistor, 1.5K, 1/4W		
R20	2200021500		Resistor, 1.5K, 1/4W		
R21	2200021500		Resistor, 1.5K, 1/4W		
R22	2200021500		Resistor, 1.5K, 1/4W		
R23	2200021500		Resistor, 1.5K, 1/4W		
R24	2200042200	1	Resistor, 220K, 1/4W		
R25	2200033300	1	Resistor, 33K, 1/4W		
R26	2200000000	3	Resistor, SELECTED, 1/4W		
R27	- -		NOT USED		
R28	- -		NOT USED		
R29	2200000000		Resistor, SELECTED, 1/4W		
R30	2200031000		Resistor, 10K, 1/4W		
R31	2200024700	1	Resistor, 4.7K, 1/4W		
R32	2500133200	1	Resistor, 3.32K .3W 1%		
R33	2200011000	1	Resistor, 100 Ω , 1/4W		
R34	2200031000		Resistor, 10K, 1/4W		
R35	2500210000	1	Resistor, 10K, .3W 1%		
R36	2200031000		Resistor, 10K, 1/4W		
R37	2200031000		Resistor, 10K, 1/4W		
R38	2200031000		NOT USED		
R39	2200051000	2	Resistor, 1MEG.1/4W		
R40	2200034700	1	Resistor, 47K, 1/4W		
R41	2200021500		Resistor, 1.5K		
R42	2200031000		Resistor, 10K, 1/4W		
R43	2200031000		Resistor, 10K, 1/4W		
R44	2200000000		Resistor, SELECTED 1/4W		
R45	2200021000	1	Resistor, 1K, 1/4W		
R46	2900022200	1	Resistor, 2.2K, 1/8W		
R47	2200051000		Resistor, 1MEG., 1/4W		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-14
R48	2131470000	3	Potentiometer, 470K		
R49	2131470000		Potentiometer, 470K		
R50	2131470000		Potentiometer, 470K		
R51	2132100000	2	Potentiometer, 1K		
R52	2132100000		Potentiometer, 1K		
R53	2200031000		Resistor, 10K, 1/4W		
R54	2200033000		Resistor, 3.3K, 1/4W		
U1	4160405100	3	Integrated Circuit	C-MOS 4051	
U2	4160405100		Integrated Circuit	C-MOS 4051	
U3	4160410400	2	Integrated Circuit	C-MOS 4104	
U4	4160410400		Integrated Circuit	C-MOS 4104	
U5	4160405300	1	Integrated Circuit	C-MOS 4053	
U6			Integrated Circuit	TL 082	
U7	4160405000	1	Integrated Circuit	C-MOS 4050	
U8		2	Integrated Circuit	C-MOS 4051	
U9	4160405100		Integrated Circuit	C-MOS 4051	
	297473	1	Pilot, 80MHz Lock	297473	5-15
C1	3120021000	2	Capacitor, 1000 pF		
C2	3120001000	1	Capacitor, 10 pF		
C3	3120011000	1	Capacitor, 100 pF		
C4	3120021000		Capacitor, 1000 pF		
C5	3700170000	2	Capacitor, 22μF, 15V		
C6	3700170000		Capacitor, 22μF, 15V		
C7	3120002200	1	Capacitor, 22 pF		
CR1	4500310000	2	Diode	IN4448	
CR2	4500310000		Diode	IN4448	
L1	5300420100	2	Inductor, 47 μH		
L2	5300420100		Inductor, 47 μH		
R1	2210021000	3	Resistor, 1K		
R2	2210021000		Resistor, 1K		
R3	2210014700	1	Resistor, 470Ω		
R4	2210021000		Resistor, 1K		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-15
R5	2200021000	3	Resistor, 1K		
R6	2200021800	2	Resistor, 1.8K		
R7	2200021800		Resistor, 1.8K		
R8	2200021000		Resistor, 1K		
R9	2200021000		Resistor, 1K		
R10	2200025600	2	Resistor, 5.6K		
R11	2200025600		Resistor, 5.6K		
R12	2210045600	1	Resistor, 560K		
R13	2200041000	1	Resistor, 100K		
R14	2200034700	2	Resistor, 47K		
R15	2153220000	1	Resistor, Variable, 22K		
R16			NOT USED		
R17	2900005600	1	Resistor, 56 Ω		
U1	4101010200	1	Integrated Circuit	MC10102	
U2	4200320000	1	Integrated Circuit	LF356N	
U3	4200310000	1	Integrated Circuit	78L05AC	
	297473	1	Pilot, 80 MHz Oscillator	297473	5-15
C1	3309100000	1	Capacitor, MICA, 10pF		
C2	3301100200	1	Capacitor, MICA, 100pF		
C3	3150031000	3	Capacitor, 10 nF		
C4	3700180000	1	Capacitor, 15 μF, 16V		
C5	3233470000	1	Capacitor, 47 nF, 10%		
C6	3150031000		Capacitor, 10 nF		
C7	3150031000		Capacitor, 10 nF		
C8	3120021000	7	Capacitor, 1000 pF		
C9	3120021000		Capacitor, 1000 pF		
C10	3120021000		Capacitor, 1000 pF		
C11	3120021000		Capacitor, 1000 pF		
C12	3120021000		Capacitor, 1000 pF		
C13	3120021000		Capacitor, 1000 pF		
C14	3120021000		Capacitor, 1000 pF		
C15	3120094700	1	Capacitor, 4.7 pF		
C16	3170096800	1	Capacitor, 6.8 pF		
CR1	4500260000	1	Diode	BB109	
CR2	4500180000	1	Diode	HP2826	
L1	5300340000	3	Inductor, 10 μH		
L2	5300340000		Inductor, 10 μH		
L3	5300340000		Inductor, 10 μH		
Q1	4300310000	4	Transistor	ON543	
Q2	4300310000		Transistor	ON543	
Q3	4300310000		Transistor	ON543	
Q4	4300310000		Transistor	ON543	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-15
R1	2200022200	3	Resistor, 2.2K		
R2	2200022200		Resistor, 2.2K		
R3	2200013900	3	Resistor, 390Ω		
R4	2210003300	1	Resistor, 33Ω		
R5	2200023900	1	Resistor, 3.9K		
R6	2200026800	1	Resistor, 6.8K		
R7	2200014700	1	Resistor, 470Ω		
R8	2200011000	1	Resistor, 100Ω		
R9	2900005100	1	Resistor, 51Ω		
R10	2900011000	1	Resistor, 100Ω		
R11	2200013900		Resistor, 390Ω		
R12	2200022200		Resistor, 2.2K		
R13	2210022200	1	Resistor, 2.2K		
R14	2210011000	2	Resistor, 100Ω		
R15	2200013900		Resistor, 390Ω		
R16	2900022200	2	Resistor, 2.2K		
R17	2900022200		Resistor, 2.2K		
R18	2200012200	1	Resistor, 220Ω		
R19	2210011000		Resistor, 100Ω		
R20	2900001500	1	Resistor, 15Ω		
T1	214970000	1	Transformer		
T2	218430000	1	Transformer	H20	
Y1	5100470000	1	Crystal, Quartz, 80MHz		
	297473	1	Pilot, 80MHz Output	297473	5-15
C1	31200093900	2	Capacitor, 3.9pf		
C2	3120091000	2	Capacitor, 1pF		
C3	3120092200	1	Capacitor, 2.2pF		
C4	3120091000		Capacitor, 1pF		
C5	31200093900		Capacitor, 3.9pF		
C6	3800010000	2	Capacitor, 100pF		
C7	3800010000		Capacitor, 100pF		
T1	216560000	2	Transformer, F40		
T2	216560000		Transformer, F40		
	297436		Front Panel Analog	294736	5-16
C1	3150031000	4	Capacitor, 10nF		
C2	3224680000	3	Capacitor, .68MMF, 63V, 10%		
C3	3150031000		Capacitor, 10N		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-16
C4			NOT USED		
C5			NOT USED		
C6	3224680000		Capacitor, .68MMF, 63V, 10%		
C7	3700180000	8	Capacitor, 15MMF, 16V		
C8	3700020000	1	Capacitor, 1MMF, 25V		
C9	3224680000		Capacitor, .68MMF, 63V, 10%		
C10	3700180000		Capacitor, 15MMF, 16V		
C11	3700180000		Capacitor, 15MMF, 16V, 22MMF		
C12	3700180000		Capacitor, 15MMF, 16V		
C13	3700180000		Capacitor, 15MMF, 16V, 22MMF		
C14	3700250000	4	Capacitor, 68MMF, 6.3V		
C15	3150031000		Capacitor, 10nF		
C16	3700180000		Capacitor, 15MMF, 16V		
C17	3700250000		Capacitor, 68MMF, 6.3V		
C18	3700250000		Capacitor, 68MMF, 6.3V		
C19	3700180000		Capacitor, 15MMF, 16V		
C20	3700250000		Capacitor, 68MMF, 6.3V		
C21	3700180000		Capacitor, 15MMF, 16V		
C22	3150031000		Capacitor, 10nF		
C23	3800000470		Capacitor, 4.7pF		
CR1	4600170000	1	Diode	ZPD 10V	
CR2	4500310000	4	Diode	IN4448	
CR3	4500310000		Diode	IN4448	
CR4	4500310000		Diode	IN4448	
CR5	4500310000		Diode	IN4448	
J1	1450019800	1	Connector		
J2	1400219300	2	Connector		
J3	1400219300		Connector		
'MP1	800711200		Bracket	942604A	
Q1	4300070000	1	Transistor	2N2894	
Q2	4300050000	1	Transistor	2N2369	
Q3	4300110000	2	Transistor	BC214C	
Q4	4300110000		Transistor	BC214C	
R1	2200011200	1	Resistor, 120, 1/4W		
R2	2200022200	1	Resistor, 2.2K, 1/4W		
R3	2200023300	3	Resistor, 3.3K, 1/4W		
R4	2200021000	1	Resistor, 1K, 1/4W		
R5	2500064900	2	Resistor, 649Ω .3W 1%		
R6	2500184500	6	Resistor, 8.45K .3W 1%		
R7	2500184500		Resistor, 8.45K .3W 1%		
R8	2500210000	10	Resistor, 10K .3W 1%		
R9	2500210000		Resistor, 10K .3W 1%		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-16
R10			NOT USED		
R11	2500184500		Resistor, 8.45K, .3W, 1%		
R12	2500197600	1	Resistor, 9.76K, .3W, 1%		
R13	2500149900	4	Resistor, 4.99K, .3W, 1%		
R14	2500210000		Resistor, 10K, .3W, 1%		
R15	2500210000		Resistor, 10K, .3W, 1%		
R16	2500149900		Resistor, 4.99K, .3W, 1%		
R17	2500124900	2	Resistor, 2.49K, .3W, 1%		
R18	2500124900		Resistor, 2.49K, .3W, 1%		
R19	2500215000	1	Resistor, 15K, .3W, 1%		
R20	2200031000	1	Resistor, 10K, 1/4W		
R21	2500210000		Resistor, 10K, .3W, 1%		
R22	2500220000	1	Resistor, 20K, .3W, 1%		
R23	2500240200	1	Resistor, 40.2K, .3W, 1%		
R24	2500280600	1	Resistor, 6K, .3W, 1%		
R25	2200041600	4	Resistor, 100K, 1/4W		
R26	2200004700	2	Resistor, 47 Ω , 1/4W		
R27	2200011000	3	Resistor, 100 Ω , 1/4W		
R28	2500210000		Resistor, 10K, .3W 1%		
R29	2200011000		Resistor, 100 Ω , 1/4W		
R30	2500186600		Resistor, 8.66K, .3W, 1%		
R31	2500188700	1	Resistor, 8.87K, .3W, 1%		
R32 thru R43			NOT USED		
R44	2200012200	1	Resistor, 220 Ω 1/4W		
R48	2500064900		Resistor, 649, .3W, 1%		
R49	2500186600		Resistor, 8.66K, .3W, 1%		
R50	2500186600		Resistor, 8.66K, .3W, 1%		
R51	2500315400	2	Resistor, 154K, .3W, 1%		
R52	2500315400		Resistor, 154K, .3W, 1%		
R53	250030100	1	Resistor, 30.1K, .3W, 1%		
R54	2500017800	1	Resistor, 178, .3W, 1%		
R55	2500110000	3	Resistor, 1K, .3W, 1%		
R56	2500110000		Resistor, 1K, .3W, 1%		
R57	2500210000		Resistor, 10K, .3W, 1%		
R58	2500149900		Resistor, 4.99K, .3W, 1%		
R59	2500212100	2	Resistor, 12.1K, .3W, 1%		
R60	2500186600	1	Resistor, 8.66K, .3W, 1%		
R61	2200041000		Resistor, 100K, 1/4W		
R62	2200004700		Resistor, 47, 1/4W		
R63	2500110000		Resistor, 1K, .3W 1%		
R64	2500116900	1	Resistor, 1.69K, .3W, 1%		
R65	2500113300	1	Resistor, 1.33K, .3W, 1%		
R66	2500110500	1	Resistor, 1.05K, .3W, 1%		
R67	2500084500	1	Resistor, 845 Ω , .3W, 1%		
R68	2500066500	1	Resistor, 665 Ω , .3W, 1%		
R69	2500053600	1	Resistor, 536 Ω , .3W, 1%		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-16
R70	2500042200	1	Resistor, 422 Ω , .3W, 1%		
R71	2500116200	1	Resistor, 1.62K, .3W, 1%		
R72	2200041000		Resistor, 100K, 1/4W		
R73	2500021000		Resistor, 10K, .3W, 1%		
R74	2500228000	1	Resistor, 28K, .3W, 1%		
R75	2200024700	2	Resistor, 4.7K, 1/4W		
R76	2200034700	1	Resistor, 47K, 1/4W		
R77	2500242200	1	Resistor, 42.2K, .3W, 1%		
R78	2500210200	1	Resistor, 102K, .3W, 1%		
R79	2500371500	1	Resistor, 715K, .3W, 1%		
R80	2200031500	1	Resistor, 15K, 1/4W		
R81	2200041000		Resistor, 100K, 1/4W		
R82	2200018200	1	Resistor, 820 Ω , 1/4W		
R83	2200024700		Resistor, 4.7K, 1/4W		
R84	2500310000	2	Resistor, 100K, .3W, 1%		
R85	2500210000		Resistor, 10K, .3W, 1%		
R86	2500159000	1	Resistor, 5.9K, .3W, 1%		
R87	2500221500	1	Resistor, 21.5K, .3W, %		
R88	2500212700	1	Resistor, 12.7K, .3W, 1%		
R89	2200000000	5	Selected, 1/4W		
R90	2200000000		Selected, 1/4W		
R91	2200000000		Selected, 1/4W		
R92	2200000000		Selected, 1/4W		
R93	2200000000		Selected, 1/4W		
R94	2200011000		Resistor, 100 Ω , 1/4W		
R95	2500310000		Resistor, 100K, .3W, 1%		
R96	2500212100		Resistor, 12.1K, .3W, 1%		
R97	2200051200	2	Resistor, 1.2M, 1/4W, 5%		
R98	2200003300	1	Resistor, 33 Ω , 1/4W		
R99	2200038200	1	Resistor, 82K, 1/4W		
R100	2500216200	1	Resistor, 16.2K, .3W, 1%		
R101	2500359000	1	Resistor, 590K, .3W, 1%		
R102	2200051200		Resistor, 1.2M, 1/4W, 5%		
R103	2500314300	1	Resistor, 143K, .3W, 1%		
R104	2500328700	1	Resistor, 287K, .3W, 1%		
R105	2500288700	1	Resistor, 88.7K, .3W, 1%		
R106	2500321000	1	Resistor, 210K, .3W, 1%		
R107	2610923300	1	Resistor, 3.3K	4310R-101-332	
R108	2500210000		Resistor, 10K, .3W, 1%		
R109	2500111000	1	Resistor, 1.1K, .3W, 1%		
R110	2500149900		Resistor, 4.99K, .3W, 1%		
R111	2500110700	1	Resistor, 1.07K, .3W, 1%		
R112	2500166500	1	Resistor, 6.65K, .3W, 1%		
R113	2500169800	1	Resistor, 6.98K, .3W, 1%		
R114	2200023300		Resistor, 3.3K, 1/4W		
R115	2200023300		Resistor, 3.3K, 1/4W		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-16
R116	2500213700	1	Resistor, 13.7K, .3W, 1%		
R117	2200025600	1	Resistor, 5.6K, 1/5W		
R118	2163100300	3	Resistor, Variable, 10K, 20%		
R119	2163100300		Resistor, Variable, 10K, 20%		
R120	2163100300		Resistor, Variable, 10K, 20%		
R121	2132500000	2	Resistor, Variable, 5K		
R122	2132500000		Resistor, Variable, 5K		
R123	2133250000	2	Potentiometer, 25K		
R124	2133250000		Potentiometer, 25K		
R125	2132250000	5	Potentiometer, 2.5K		
R126	2132250000		Potentiometer, 2.5K		
R127	2132250000		Potentiometer, 2.5K		
R128	2132250000		Potentiometer, 2.5K		
R129	2132250000		Potentiometer, 2.5K		
R130	2200011000		Resistor, 100 Ω , 1/4W		
R131	2200011000		Resistor, 100 Ω , 1/4W		
	297442	1	Front Panel Switches	297442	5-17
C1	3150031000	3	Capacitor, 10nF		
C2	3700020000	3	Capacitor, 1MMF, 25V		
C3	3120021000	4	Capacitor, 1000pF		
C4	3120021000		Capacitor, 1000pF		
C5	3120021000		Capacitor, 1000pF		
C6	3150031000		Capacitor, 10nF		
C7	3700180000	2	Capacitor, 15MMF, 16V		
C8	3700180000		Capacitor, 15MMF, 16V		
C9	3700250000	8	Capacitor, 68MMF, 6.3V		
C10	3700250000		Capacitor, 68MMF, 6.3V		
C11	3700250000		Capacitor, 68MMF, 6.3V		
C12	3700250000		Capacitor, 68MMF, 6.3V		
C13	3700250000		Capacitor, 68MMF, 6.3V		
C14	3700250000		Capacitor, 68MMF, 6.3V		
C15	3700250000		Capacitor, 68MMF, 6.3V		
C16	3700250000		Capacitor, 68MMF, 6.3V		
C17	3700100000	1	Capacitor, 4.7MMF		
C18	3700020000		Capacitor, 1MMF, 25V		
C19	3120021000		Capacitor, 1000pF		
C20	3700020000		Capacitor, 1MMF, 25V		
C21	3150031000		Capacitor, 10nF		
CR1	4500310000	3	Diode	IN4448	
CR2	4600010000	1	Diode	ZPD 417	
CR3	4500310000		Diode	IN4448	
CR4	4500310000		Diode	IN4448	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-17
CR5	4000010000	24	Diode	LD41	
CR6	4000160000	10	Diode	LD30	
CR7	4000160000		Diode	LD30	
CR8	4000160000		Diode	LD30	
CR9	4000160000		Diode	LD30	
CR10	4000160000		Diode	LD30	
CR11	4000160000		Diode	LD30	
CR12	4000160000		Diode	LD30	
CR13	4000160000		Diode	LD30	
CR14	4000160000		Diode	LD30	
CR15	4000010000		Diode	LD41	
CR16	4000010000		Diode	LD41	
CR17	4000010000		Diode	LD41	
CR18	4000010000		Diode	LD41	
CR19	4000010000		Diode	LD41	
CR20	4000010000		Diode	LD41	
CR21	4000010000		Diode	LD41	
CR22	4000010000		Diode	LD41	
CR23	4000010000		Diode	LD41	
CR24	4000010000		Diode	LD41	
CR25	4000010000		Diode	LD41	
CR26	4000010000		Diode	LD41	
CR27	4000010000		Diode	LD41	
CR28	4000010000		Diode	LD41	
CR29	4000010000		Diode	LD41	
CR30	4000010000		Diode	LD41	
CR31	4000010000		Diode	LD30	
CR32	4000010000		Diode	LD41	
CR33	4000010000		Diode	LD41	
CR34	4000010000		Diode	LD41	
CR35	4000160000		Diode	LD30	
CR36	4000010000		Diode	LD41	
CR37	4000010000		Diode	LD41	
CR38	4000010000		Diode	LD41	
CR39	4000070000	1	Diode	LD56	
CR40	4000060000	1	Diode	LD57	
J1	1450019800	1	Connector		
L1	5303250000		Inductor 2.5MMH		
MP1	0271690000	1	Encoder Montee		
Q1	4300050000	3	Transistor	2N2369	
Q2	4300190000	1	Transistor	BC184C	
Q3	4300050000		Transistor	2N2369	
Q4	4300050000		Transistor	2N2369	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-17
R1	2200021000	3	Resistor, 1K, 1/4W		
R2	2200031000	18	Resistor, 10K, 1/4W		
R3	2200021000		Resistor, 1K, 1/4w		
R4	2200016800	1	Resistor, 680 Ω, 1/4W		
R5	2200031200	1	Resistor, 12K, 1/4W		
R6	2200031000		Resistor, 10K, 1/4W		
R7	2200012700	3	Resistor, 270 Ω , 1/4W		
R8	2200024700	5	Resistor, 4.7K, 1/4W		
R9	2200038200	1	Resistor, 82K, 1/4W		
R10	2200021000		Resistor, 1K, 1/4W		
R11	2200013300	8	Resistor, 330 Ω , 1/4W		
R12	2200013300		Resistor, 330 Ω , 1/4W		
R13	2900023300	2	Resistor, 3.3K, 1/8W		
R14	2900013300	1	Resistor, 330 Ω , 1/8W		
R15	2200013300		Resistor, 330 Ω , 1/4W		
R16	2200011800	1	Resistor, 180 Ω , 1/4W		
R17	2200012700		Resistor, 270 Ω , 1/4W		
R18	2200034700	1	Resistor, 47K, 1/4W		
R19	2200012200	1	Resistor, 220 Ω , 1/4W		
R20	2200013300		Resistor, 330 Ω , 1/4W		
R21	2200024700		Resistor, 4.7K, 1/4W		
R22	2200013300		Resistor, 330 Ω , 1/4W		
R23	2200023300	2	Resistor, 3.3K, 1/4W		
R24	2200013300		Resistor, 330 Ω , 1/4W		
R25	2200013300		Resistor, 330 Ω , 1/4W		
R26	2200013300		Resistor, 330 Ω , 1/4W		
R27	2200032200	9	Resistor, 22K, 1/4W		
R28	2200032200		Resistor, 22K, 1/4W		
R29	2200024700		Resistor, 4.7K, 1/4W		
R30	2200024700		Resistor, 4.7K, 1/4W		
R31	2200032200		Resistor, 22K, 1/4W		
R32	2200032200		Resistor, 22K, 1/4W		
R33	2200032200		Resistor, 22K, 1/4W		
R34	2200032200		Resistor, 22K, 1/4W		
R35	2200032200		Resistor, 22K, 1/4W		
R36	2200032200		Resistor, 22K, 1/4W		
R37	2200031000		Resistor, 10K, 1/4W		
R38	2200031000		Resistor, 10K, 1/4W		
R39	2200032200		Resistor, 22K, 1/4W		
R40	2200031000		Resistor, 10K, 1/4W		
R41	2200031000		Resistor, 10K, 1/4W		
R42	2200031000		Resistor, 10K, 1/4W		
R43	2200014700	1	Resistor, 470 Ω , 1/4W		
R44	2500210000	1	Resistor, 10K, .3W 1%		
R45	2200012700		Resistor, 270 Ω , 1/4W		
R46	2200031000		Resistor, 10K, 1/4W		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-17
R47	2500190900	1	Resistor, 9.09K, .3W 1%		
R48	2200031000		Resistor, 10K, 1/4W		
R49	2900023300		Resistor, 3.3K, 1/8W		
R50	2200023300		Resistor, 3.3K, 1/4W		
R51	2200031000		Resistor, 10K, 1/4W		
R52	2900031000	7	Resistor, 10K, 1/8W		
R53	2900031000		Resistor, 10K, 1/8W		
R54	2900031000		Resistor, 10K, 1/8W		
R55	2200031000		Resistor, 10K, 1/4W		
R56	2900031000		Resistor, 10K, 1/8W		
R57	2200031000		Resistor, 10K, 1/4W		
R58	2900031000		Resistor, 10K, 1/4W		
R59	2200031000		Resistor, 10K, 1/4W		
R60	2200031000		Resistor, 10K, 1/4W		
R61	2200031000		Resistor, 10K, 1/4W		
R62	2900031000		Resistor, 10K, 1/8W		
R63	2900031000		Resistor, 10K, 1/8W		
R64	2200031000		Resistor, 10K, 1/4W		
R65	2900024700	1	Resistor, 4.7K, 1/8W		
R66	2200031000	1	Resistor, 10K, 1/8W		
R67	2900032200	1	Resistor, 22K, 1/8W		
R68	2610932200	1	Resistor, 22K	4310R-101-223	
R69	2200036800	2	Resistor, 68K, 1/4W		
R70	2200036800		Resistor, 68K, 1/4W		
R71	2200031000		Resistor, 10K, 1/4W		
R72	2200044700		Resistor, 4.7K, 1/4W		
R73	2200024700		Resistor, 4.7K, 1/4W		
R74	2900033300	1	Resistor, 33K, 1/8W		
R75	2200011000	2	Resistor, 100 Ω , 1/4W		
R76	2200011000		Resistor, 100 Ω , 1/4W		
R77	2123100700		Potentiometer, 25%		
S1	1530315200	1	Switch 2 POLE 2 POSITION		
S2	1530215300	4	Switch 2 POLE 1 POSITION		
S3	1530215300		Switch 2 POLE 1 POSITION		
S4	1530215300		Switch 2 POLE 1 POSITION		
S5	1530215300		Switch 2 POLE 1 POSITION		
S6	1530215500	1	Switch 1 POLE 2 POSITION		
S7	0205670000	4	Switch 12 POSITION		
S8	0205670000		Switch 12 POSITION		
S9	0205670000		Switch 12 POSITION		
S10	0205670000		Switch 12 POSITION		
S11	0205670000	1	Switch 12 POSITION		
S12	1511215600	1	Switch 12 POSITION		
S13	1530215400	1	Switch 1 POLE 1 POSITION		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-17
U1	4157413800	4	Integrated Circuit	SN74LS-138N	
U2	4157413800		Integrated Circuit	SN74LS-138N	
U3	4157424400		Integrated Circuit	SN74LS-244N	
U4	4167437400	3	Integrated Circuit	C-MOS-74C374	
U5	4167437400		Integrated Circuit	C-MOS-74C374	
U6	4167437400		Integrated Circuit	C-MOS-74C374	
U7	4150744200	1	Integrated Circuit	SN74LS42N	
U8	4157413800		Integrated Circuit	SN74LS-138N	
U9	4157413900	1	Integrated Circuit	SN74LS-139N	
U10	4157413800		Integrated Circuit	SN74LS-138N	
U11	4157424400		Integrated Circuit	SN74LS-244N	
U12	4157424400		Integrated Circuit	SN72LS-244N	
U13	4157424400		Integrated Circuit	SN74LS-244N	
U14	4157424400		Integrated Circuit	SN74LS-244N	
U15	4160453900	1	Integrated Circuit	C-MOS 4539	
U16	4160402700	2	Integrated Circuit	C-MOS 4027	
U17	4106402700		Integrated Circuit	C-MOS 4027	
U18	4160401100	1	Integrated Circuit	C-MOS 4011	
U19	4160400100	1	Integrated Circuit	C-MOS 4001	
U20	4200360000	1	Integrated Circuit	TL 072	
U21	4160405300	1	Integrated Circuit	C-MOS 4053	
U22	4000180000	10	Integrated Circuit	HP5082-7300	
U23	4000180000		Integrated Circuit	HP5082-7300	
U24	4000180000		Integrated Circuit	HP5082-7300	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-17
U26	4000180000		Integrated Circuit	HP5082-7300	
U27	4000180000		Integrated Circuit	HP5082-7300	
U28	4000180000		Integrated Circuit	HP5082-7300	
U29	4000180000		Integrated Circuit	HP5082-7300	
U30	4000180000		Integrated Circuit	HP5082-7300	
U31	4000180000		Integrated Circuit	HP5082-7300	
	297443	1	Attenuator LEDs	297443	5-17
CR1	4000160000	16	Diode	LD 30 II '317'(RS)	
CR2	4000160000		Diode	LD 30 II '317'(RS)	
CR3	4000160000		Diode	LD 30 II '317'(RS)	
CR4	4000160000		Diode	LD 30 II '317'(RS)	
CR5	4000160000		Diode	LD 30 II '317'(RS)	
CR6	4000160000		Diode	LD 30 II '317'(RS)	
CR7	4000160000		Diode	LD 30 II '317'(RS)	
CR8	4000160000		Diode	LD 30 II '317'(RS)	
CR9	4000160000		Diode	LD 30 II '317'(RS)	
CR10	4000160000		Diode	LD 30 II '317'(RS)	
CR11	4000160000		Diode	LD 30 II '317'(RS)	
CR12	4000160000		Diode	LD 30 II '317'(RS)	
CR13	4000160000		Diode	LD 30 II '317'(RS)	
CR14	4000160000		Diode	LD 30 II '317'(RS)	
CR15	4000160000		Diode	LD 30 II '317'(RS)	
CR16	4000160000		Diode	LD 30 II '317'(RS)	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-17
I1	1740004400	2	Lamps	OL 3019 not on assy	
I2	1740004400		Lamps	OL 3019 not on assy	
R1	2210012700	1	Resistor, 330 Ω		
U1	4157913800	2	Integrated Circuit	SN 74LS-138N	
U2	4157913800		Integrated Circuit	SN 74LS-138N	
	297444	1	Encoder	297444	5-17
CR1	4000190000	2	Diode	BPW 12	
CR2	4000190000		Diode	BPW 12	
I1	1740004400	2	Lamp	OL 3019	
I2	1740004400		Lamp	OL 3019	
R1	2200033300	2	Resistor, 33K		
R2	2200033300		Resistor, 33K		
R3	2200002700	1	Resistor, 27 Ω		
R4	2133250000	2	Potentiometer, 25K		
R5	2133250000		Potentiometer, 25K		
U1	4200180000	1	Integrate Circuit	NC1458	
	297467	1	Command Amplifier Standard	297467	5-18
C1	3700140000	1	Capacitor, 10 μfd, 25WVDC		
C2	3700170000	3	Capacitor, 22 μfd, 14WVDC		
C3	3700170000		Capacitor, 22 μfd, 14WVDC		
C11	3700170000		Capacitor, 22 μfd, 14WVDC		
CR1	4500020000	6	Diode	IN4151	
CR2	4500020000		Diode	IN4151	
CR3	4500020000		Diode	IN4151	
CR4	4500020000		Diode	IN4151	
CR5	4500020000		Diode	IN4151	
CR6	4500020000		Diode	IN4151	
CR7	4500180000	1	Diode	HP2826	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-18
Q1	4300190000	8	Transistor	BC184C	
Q2	4300110000	8	Transistor	BC214C	
Q3	4300190000		Transistor	BC184C	
Q4	4300110000		Transistor	BC214C	
Q5	4300190000		Transistor	BC184C	
Q6	4300110000		Transistor	BC214C	
Q7	4300190000		Transistor	BC184C	
Q8	4300110000		Transistor	BC214C	
Q9	4300190000		Transistor	BC184C	
Q10	4300110000		Transistor	BC214C	
Q11			NOT USED		
Q12			NOT USED		
Q13	4300190000		Transistor	BC184C	
Q14	4300110000		Transistor	BC214C	
R1	2200031000	22	Resistor, 10K		
R2	2200031000		Resistor, 10K		
R3	2200031000		Resistor, 10K		
R4	2200031000		Resistor, 10K		
R5	2200031000		Resistor, 10K		
R6	2200031000		Resistor, 10K		
R7	2200031000		Resistor, 10K		
R8	2200031000		Resistor, 10K		
R9	2200031000		Resistor, 10K		
R10	2200031000		Resistor, 10K		
R11	2200031000		Resistor, 10K		
R12	2200031000		Resistor, 10K		
R13	2200031000		Resistor, 10K		
R14	2200031000		Resistor, 10K		
R15	2200031000		Resistor, 10K		
R16			NOT USED		
R17			NOT USED		
R18			NOT USED		
R19			NOT USED		
R20	2200031000		Resistor, 10K		
R21			NOT USED		
R22			NOT USED		
R23	2500140200	1	Resistor, 4.02K, 1%, 2.3W		
R24	2500190900	1	Resistor, 2.09K, 1%, 0.3W		
R25	2200011000		Resistor, 100Ω		
R26	2500151100	1	Resistor, 5.11K, 1%, 0.3W		
R27	2200022200	1	Resistor, 2.2K		
R28	2200011000		Resistor, 100Ω		
R29	2200031000		Resistor, 10K		
R30	2200031000		Resistor, 10K		
R31	2200011000		Resistor, 100Ω		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-18
R32	2200024700		Resistor, 4.7K		
R33	2200031000		Resistor, 10K		
R34	2200031000		Resistor, 10K		
R35	2200031000		Resistor, 10K		
R36	2200034700	2	Resistor, 47K		
R37			NOT USED		
R38			NOT USED		
R39			NOT USED		
R40			NOT USED		
R41	2200028200	1	Resistor, 8.2K		
R42	2200012200	1	Resistor, 220		
R43	2500210000	8	Resistor, 10.0K, 1%, 0.3W		
R44	2500210000	8	Resistor, 10.0K, 1%, 0.3W		
R45	2200045600	1	Resistor, 560K		
R46	2500210000		Resistor, 10.0K, 1%, 0.3W		
R47	2200046800	1	Resistor, 680K		
R48	2500210000		Resistor, 10.0K, 1%, 0.3W		
R49	2500210000		Resistor, 10.0K, 1%, 0.3W		
R50	2500212400	2	Resistor, 12.4K, 1%, 0.3W		
R51	2500210000		Resistor, 10.0K, 1%, 0.3W		
R52			NOT USED		
R53			NOT USED		
R54			NOT USED		
R55			NOT USED		
R56			NOT USED		
R57			NOT USED		
R58	2153220000	3	Resistor, Variable, 22K, 1%		
R59			NOT USED		
R60			NOT USED		
R61	215310000	1	Resistor, Variable, 10K, 1%		
R62	2153220000		Resistor, Variable, 22K, 1%		
R63	2152470000		Resistor, Variable, 4.7K, 1%		
U1	4160404900	1	Integrated Circuit	C-MOS 4049	
U2	4200360000	2	Integrated Circuit	TL082 CP	
U3	4160405300	1	Integrated Circuit	C-MOS 4053	
U4	4200360000		Integrated Circuit	TL082 CP	
U5	4200180000	2	Integrated Circuit	NC 1458	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
	297468	1	Standard Amplifier Card	297468	5-19
C1	3800130000	23	Capacitor, 1000pF		
C2	3120092200	2	Capacitor, 2.2pF		
C3	3800130000		Capacitor, 1000pF		
C4	3800130000		Capcaitor, 1000pF		
C5	3800130000		Capacitor, 1000pF		
C6	3800370000	17	Capacitor, Chip, 0.1 μfd		
C7	3800130000		Capacitor, 1000pF		
C8	3800130000		Capacitor, 1000pF		
C9	3700030000	5	Capacitor, 1 μfd, 35WVDC		
C10	3120092200		Capacitor, 2.21F		
C11	3120001000	6	Capacitor, 10pF		
C12	3120021000	7	Capacitor, 1000pF		
C13	3700030000		Capacitor, 1 μfd, 35WVDC		
C14	3800370000		Capacitor, Chip, 0.1 μfd		
C15	3120021000		Capacitor, 1000pF		
C16	3700030000		Capacitor, 1 μfd, 35WVDC		
C17	3800370000		Capacitor, Chip, 0.1 μfd		
C18	3120096800	2	Capacitor, 6.8pF		
C19	3120096800		Capacitor, 6.8pF		
C20	3800370000		Capacitor, Chip, 0.1 μfd		
C21	3800130000		Capacitor, 1000pF		
C22	3700030000		Capacitor, 1 μfd, 35WVDC		
C23	3800370000		Capacitor, Chip, 0.1 μfd		
C24	3800370000		Capacitor, Chip, 0.1 μfd		
C25	3800370000		Capacitor, Chip, 0.1 μfd		
C26	3120001000		Capacitor, 10pF		
C27	3800370000		Capacitor, Chip, 0.1 μfd		
C28	3800370000		Capacitor, Chip, 0.1 μfd		
C29	3120095600	9	Capacitor, 5.6pF		
C30	3120095600		Capacitor, 5.6pF		
C31	3120021000		Capacitor, 1000pF		
C32	3800370000		Capacitor, Chip, 0.1 μfd		
C33	3120001000		Capacitor, 10pF		
C34	3120095600		Capacitor, 5.6pF		
C35	3120095600		Capacitor, 5.6pF		
C36	3800370000		Capacitor, Chip, 0.1 μfd		
C37	3800370000		Capacitor, Chip, 0.1 μfd		
C38	3120001000		Capacitor, 10pF		
C39	3800370000		Capacitor, Chip, 0.1 μfd		
C40	3800370000		Capacitor, Chip, 0.1 μfd		
C41	3120095600		Capacitor, 5.6pF		
C42	3120095600		Capacitor, 5.6pF		
C43	3120021000		Capacitor, 1000pF		
C44	3800370000		Capacitor, Chip, 0.1 μfd		
C45	3120001000		Capacitor, 10pF		
C46	3120095600		Capacitor, 5.6pF		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-19
C47	3120095600		Capacitor, 5.6pF		
C48	3120021000		Capacitor, 1000 pF		
C49	3800370000		Capacitor, CHIP, 0.1μfd		
C50	3120021000		Capacitor, 0.1 μF		
C51	3800370000		Capacitor, 1000pF		
C52	3800370000		Capacitor, 1000pF		
C53	3800004700		Capacitor, CHIP, 47pF		
C54	3800004700		Capacitor, CHIP, 47pF		
C55	3700030000		Capacitor, 1 μfd, 35WVDC		
C56	3120095600		Capacitor, 5.6pF		
C57	3800130000		Capacitor, 1000pF		
C58	3120095600		Capacitor, 5.6pF		
C59			Capacitor, Variable		
C60	3800130000		Capacitor, 1000pF		
C61	3800130000		Capacitor, 1000pF		
C62	3800130000		Capacitor, 1000pF		
C63	3700170000		Capacitor, 22 μF, 15V		
C64	3700170000		Capacitor, 22 μF, 15V		
C65		1	Capacitor, 1.5pF		
C66	3120001000	1	Capacitor, 10pF		
C67	3800130000	4	Capacitor, 1000pF		
C68	3800130000		Capcaitor, 1000pF		
C69	3800130000		Capacitor, 1000pF		
C70	3800130000		Capacitor, 1000pF		
C71	3700030000	1	Capacitor, 1 μF		
CR1	4500340000	5	Diode	BA379	
CR2	4500340000		Diode	BA379	
CR3	4500340000		Diode	BA379	
CR4	4500340000		Diode	BA379	
CR5	4500340000		Diode	BA379	
CR6	4500020000	2	Diode	IN4151	
CR7	4500020000		Diode	IN4151	
CR8	4500180000		Diode	HP2826	
CR9	4500180000		Diode	HP2826	
CR10	4600360000	1	Diode	ZTE 2	
L1	5301100000	7	Inductor, 220 μH		
L2	5301100000		Inductor, 220 μH		
L3	5301100000		Inductor, 220 μH		
L4	5300240100	2	Inductor, 1.5 μH		
L5	5301100000		Inductor, 220 μH		
L6	5301100000		Inductor, 220 μH		
L7	5301100000		Inductor, 220 μH		
L8	5300240100		Inductor, 1.5 μH		
L9	5301100000		Inductor, 220 μH		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-19
Q1	4300280000	3	Transistor	BFR91	
Q2	4300280000		Transistor	BFR91	
Q3	4300280000		Transistor	BFR91	
Q4	4300270000	5	Transistor	BFR96	
Q5	4300270000		Transistor	BFR96	
Q6	4300400000	4	Transistor	TP3094	
Q7	4300270000		Transistor	BFR96	
Q8	4300400000		Transistor	TP3094	
Q9	4300270000		Transistor	BFR96	
Q10	4300400000		Transistor	TP3094	
Q11	4300270000		Transistor	BFR96	
Q12	4300400000		Transistor	TP3094	
R1	2200024700	2	Resistor, 4.7K		
R2	220005600	1	Resistor, 56Ω		
R3	2900006800	2	Resistor, 68Ω		
R4	2200018200	2	Resistor, 820Ω		
R5	2200022200	2	Resistor, 2.2K		
R6	2200022200		Resistor, 2.2K		
R7	2200018200		Resistor, 820Ω		
R8	2900006800		Resistor, 68Ω		
R9	2900011200	1	Resistor, 120Ω		
R10	2900011000	12	Resistor, 100Ω		
R11	290005100	1	Resistor, 51Ω		
R12	290002200	9	Resistor, 22Ω		
R13	2900008200	1	Resistor, 82Ω		
R14	2900021200	1	Resistor, 1.2K		
R15	2210021500	1	Resistor, 1.5K		
R16	2200013900	1	Resistor, 390Ω		
R17	2900012200	3	Resistor, 220Ω		
R18	2900005600	1	Resistor, 56Ω		
R19	2900001500	5	Resistor, 15Ω		
R20	2300092700	1	Resistor, 27Ω		
R21	2900001500		Resistor, 15Ω		
R22	2900002700	4	Resistor, 27Ω		
R23	2900011800	9	Resistor, 180Ω		
R24	2900011800		Resistor, 180Ω		
R25	2900002200		Resistor, 22Ω		
R26	2900002200		Resistor, 22Ω		
R27	2900001500		Resistor, 15Ω		
R28	2900002700		Resistor, 27Ω		
R29	2900011800		Resistor, 180Ω		
R30	2900011800		Resistor, 180Ω		
R31	2900002200		Resistor, 22Ω		
R32	2900002200		Resistor, 22Ω		
R33	2200016800	1	Resistor, 680Ω		
R34	2900011000		Resistor, 100Ω		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
	297469	1	Command Amplifier Option 002	297469	5-20
C1	3700140000	1	Capacitor, 10 μfd, 25WVDC		
C2	3700170000		Capacitor, 22 μfd, 15WVDC		
C3	3700170000		Capacitor, 22 μfd, 15WVDC		
C4	3700170000		Capacitor, 22 μfd, 15WVDC		
CR1	4500020000	6	Diode	IN4151	
CR2	4500020000		Diode	IN4151	
CR3	4500020000		Diode	IN4151	
CR4	4500020000		Diode	IN4151	
CR5	4500020000		Diode	IN4151	
CR6	4500020000		Diode	IN4151	
CR7	4500180000	1	Diode	HP2826	
Q1	4300190000	8	Transistor	BC184C	
Q2	4300110000	8	Transistor	BC214C	
Q3	4300190000		Transistor	BC184C	
Q4	4300110000		Transistor	BC214C	
Q5	4300190000		Transistor	BC184C	
Q6	4300110000		Transistor	BC214C	
Q7	4300190000		Transistor	BC184C	
Q8	4300110000		Transistor	BC214C	
Q9	4300190000		Transistor	BC184C	
Q10	4300110000		Transistor	BC214C	
Q11	4300190000		Transistor	BC184C	
Q12	4300110000		Transistor	BC214C	
Q13	4300190000		Transistor	BC184C	
Q14	4300110000		Transistor	BC214C	
Q15	4300190000		Transistor	BC184C	
Q16	4300110000		Transistor	BC214C	
R1	2200031000	22	Resistor, 10K		
R2	2200031000		Resistor, 10K		
R3	2200031000		Resistor, 10K		
R4	2200031000		Resistor, 10K		
R5	2200031000		Resistor, 10K		
R6	2200031000		Resistor, 10K		
R7	2200031000		Resistor, 10K		
R8	2200031000		Resistor, 10K		
R9	2200031000		Resistor, 10K		
R10	2200031000		Resistor, 10K		
R11	2200031000		Resistor, 10K		
R12	2200031000		Resistor, 10K		
R13	2200031000		Resistor, 10K		
R14	2200031000		Resistor, 10K		
R15	2200031000		Resistor, 10K		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-20
R16	2200031500	1	Resistor, 15K		
R17	2200024700	2	Resistor, 4.7K		
R18	2200022700	1	Resistor, 2.7K		
R19	2200032200	1	Resistor, 22K		
R20	2200031000		Resistor, 10K		
R21	2200023300	1	Resistor, 3.3K		
R22	2200010000	4	Resistor, 1K		
R23	2500140200	1	Resistor, 4.02K, 1%, 2.3W		
R24	2500190900	1	Resistor, 2.09K, 1%, 0.3W		
R25	2200011000		Resistor, 100Ω		
R26	2500151100	1	Resistor, 5.11K, 1%, 0.3W		
R27	2200022200	1	Resistor, 2.2K		
R28	2200011000		Resistor, 100Ω		
R29	2200031000		Resistor, 10K		
R30	2200031000		Resistor, 10K		
R31	2200011000		Resistor, 100Ω		
R32	2200024700		Resistor, 4.7K		
R33	2200031000		Resistor, 10K		
R34	2200031000		Resistor, 10K		
R35	2200031000		Resistor, 10K		
R36	2200034700	2	Resistor, 47K		
R37	2200031000		Resistor, 10K		
R38	2200031000		Resistor, 10K		
R39	2200031000		Resistor, 10K		
R40	2200034700		Resistor, 47K		
R41	2200028200	1	Resistor, 8.2K		
R42	2200012200	1	Resistor, 220Ω		
R43	2500210000	8	Resistor, 10.0K, 1%, 0.3W		
R44	2500210000		Resistor, 10.0K, 1%, 0.3W		
R45	2200045600	1	Resistor, 560K		
R46	2500210000		Resistor, 10.0K, 1%, 0.3W		
R47	2200046800	1	Resistor, 680K		
R48	2500210000		Resistor, 10.0K, 1%, 0.3W		
R49	2500210000		Resistor, 10.0K, 1%, 0.3W		
R50	2500212400	2	Resistor, 12.4K, 1%, 0.3W		
R51	2500210000		Resistor, 10.0K, 1%, 0.3W		
R52	2500210000		Resistor, 10.0K, 1%, 0.3W		
R53	2200042200	2	Resistor, 220K		
R54	2500210000		Resistor, 10.0K, 1%, 0.3W		
R55	2500210000		Resistor, 10.0K, 1%, 0.3W		
R56	2500213700		Resistor, 13.7K, 1%, 0.3W		
R57	2500251100		Resistor, 51.1K, 1%, 0.3W		
R58	2153220000	3	Resistor, Variable, Cemet, 22K, 1T		
R59	2153470000	1	Resistor, Variable, Cemet, 47K, 1T		
R60	2152470000		Resistor, Variable, Cemet, 4.7K, 1T		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-20
R61	2153100000	1	Resistor, Variable, Cemet, 10K, 1T		
R62	2153220000		Resistor, Variable, Cemet, 22K, 1T		
R63	2152470000		Resistor, Variable, Cemet, 4.7K, 1T		
R64	2153220000		Resistor, Variable, Cemet, 22K, 1T		
R65	2152470000		Resistor, Variable, Cemet, 4.7K, 1T		
U1	4160404900	1	Integrated Circuit	C-MOS 4049	
U2	4200360000	2	Integrated Circuit	TL082CP	
U3	4160405300	1	Integrated Circuit	C-MOS 4053	
U4	4200360000		Integrated Circuit	TL082CP	
U5	4200180000	2	Integrated Circuit	NC 1458	
U6	4200090000	1	Integrated Circuit	MA 741	
	297470	1	Amplifier Doubler	297470	5-21
C1	3800130000	23	Capacitor, 1000pF		
C2	3120092200	2	Capacitor, 2.2pF		
C3	3800130000		Capacitor, 1000pF		
C4	3800130000		Capcaitor, 1000pF		
C5	3800130000		Capacitor, 1000pF		
C6	3800370000	17	Capacitor, Chip, 0.1 μfd		
C7	3800130000		Capacitor, 1000pF		
C8	3800130000		Capacitor, 1000pF		
C9	3700030000	5	Capacitor, 1 μfd, 35WVDC		
C10	3120092200		Capacitor, 2.2F		
C11	3120001000	6	Capacitor, 10pF		
C12	3120021000	7	Capacitor, 1000pF		
C13	3700030000		Capacitor, 1 μfd, 35WVDC		
C14	3800370000		Capacitor, Chip, 0.1 μfd		
C15	3120021000		Capacitor, 1000pF		
C16	3700030000		Capacitor, 1 μfd, 35WVDC		
C17	3800370000		Capacitor, Chip, 0.1 μfd		
C18	3120096800	2	Capacitor, 6.8pF		
C19	3120096800		Capacitor, 6.8pF		
C20	3800370000		Capacitor, Chip, 0.1 μfd		
C21	3800130000		Capacitor, 1000pF		
C22	3700030000		Capacitor, 1 μfd, 35WVDC		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-21
C23	3800370000		Capacitor, Chip, 0.1 μfd		
C24	3800370000		Capacitor, Chip, 0.1 μfd		
C25	3800037000		Capacitor, Chip, 0.1 μfd		
C26	3120001000		Capacitor, 10pF		
C27	3800370000		Capacitor, Chip, 0.1 μfd		
C28	3800370000		Capacitor, Chip, 0.1 μfd		
C29	3120095600	9	Capacitor, 5.6pF		
C30	3120095600		Capacitor, 5.6pF		
C31	3120021000		Capacitor, 1000pF		
C32	3800370000		Capacitor, Chip, 0.1 μfd		
C33	3120001000		Capacitor, 10pF		
C34	3120095600		Capacitor, 5.6pF		
C35	3120095600		Capacitor, 5.6pF		
C36	3800370000		Capacitor, Chip, 0.1 μfd		
C37	3800370000		Capacitor, Chip, 0.1 μfd		
C38	3120001000		Capacitor, 10pF		
C39	3800370000		Capacitor, Chip, 0.1 μfd		
C40	3800370000		Capacitor, Chip, 0.1 μfd		
C41	3120095600		Capacitor, 5.6pF		
C42	3120095600		Capacitor, 5.6pF		
C43	3120021000		Capacitor, 1000pF		
C44	3800370000		Capacitor, Chip, 0.1 μfd		
C45	3120001000		Capacitor, 10pF		
C46	3120095600		Capacitor, 5.6pF		
C47	3120095600		Capacitor, 5.6pF		
C48	3120021000		Capacitor, 1000 pF		
C49	3800370000		Capacitor, Chip, 0.1 μfd		
C50	3120021000		Capacitor, 1000 pF		
C51 thru C54			NOT USED		
C55	3700030000		Capacitor, 1 μfd, 35WVDC		
C56	3120095600		Capacitor, 5.6pF		
C57	3800130000		Capacitor, 1000pF		
C58	3120095600		Capacitor, 5.6pF		
C59			NOT USED		
C60	3800130000		Capacitor, 1000pF		
C61	3800130000		Capacitor, 1000pF		
C62	3800130000		Capacitor, 1000pF		
C63	3700170000		Capacitor, 22 μF, 15V		
C64	3700170000		Capacitor, 22 μF, 15V		
C65			NOT USED		
C66			NOT USED		
C67			NOT USED		
C68			NOT USED		
C69			NOT USED		
C70			NOT USED		
C71			NOT USED		
C72	3800370000		Capacitor, Chip, 0.1mmF		
C73			NOT USED		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-21
C74			NOT USED		
C75			NOT USED		
C76			NOT USED		
C77			NOT USED		
C78			NOT USED		
C79			NOT USED		
C80			NOT USED		
C81			NOT USED		
C82			NOT USED		
C83			NOT USED		
C84			NOT USED		
C85			NOT USED		
C86			NOT USED		
C87			NOT USED		
C88			NOT USED		
C89			NOT USED		
C90			NOT USED		
C91			NOT USED		
C92			NOT USED		
C93			NOT USED		
C94			NOT USED		
C95			NOT USED		
C96			NOT USED		
C97			NOT USED		
C98			NOT USED		
C99			NOT USED		
C100	3800130000		Capacitor, 1000pF		
C101			NOT USED		
C102	3800004700		Capacitor, CHIP, 47pF		
C103	3800130000		Capacitor, 1000pF		
C104	3800004700		Capacitor, CHIP, 47pF		
C105	3120001000		Capcitor, 10pF		
C106			NOT USED		
C107	3800130000		Capacitor, 1000pF		
C108	3800130000		Capacitor, 1000pF		
C109	3800130000		Capacitor, 1000pF		
C110	3800130000		Capacitor, 1000pF		
C111	3800130000		Capacitor, 1000pF		
C112	3800130000		Capcaitor, 1000pF		
C113	3800130000		Capacitor, 1000pF		
C114	3800130000		Capacitor, 1000pF		
C115	3800130000		Capacitor, 1000pF		
C116	3800130000		Capacitor, 1000pF		
C117	3800130000		Capacitor, 1000pF		
C118	3800130000		Capacitor, 1000pF		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-21
C119	3800130000		Capacitor, 1000pF		
C120	3800130000		Capacitor, 1000pF		
C121	3800130000		Capacitor, 1000pF		
C122	3800130000		Capacitor, 1000pF		
C123	3800004700		Capacitor, Chip, 47pF		
C124	3800130000		Capacitor, 1000pF		
C125	3800130000		Capacitor, 1000pF		
CR1	4500340000	5	Diode	BA379	
CR2	4500340000		Diode	BA379	
CR3	4500340000		Diode	BA379	
CR4	4500340000		Diode	BA379	
CR5	4500340000		Diode	BA379	
CR6	4500020000	2	Diode	IN4151	
CR7	4500020000		Diode	IN4151	
CR8	4500180000		Diode	HP2826	
CR9	4500180000		Diode	HP2826	
CR10	4600360000	1	Diode	ZTE 2	
CR11			NOT USED		
CR12			NOT USED		
CR13			NOT USED		
CR14			NOT USED		
CR15			NOT USED		
CR16			NOT USED		
CR17			NOT USED		
CR18			NOT USED		
CR19			NOT USED		
CR20			NOT USED		
CR21			NOT USED		
CR22	4500180000	8	Diode	HP2826	
CR23	4500180000		Diode	HP2826	
CR24	4500180000		Diode	HP2826	
CR25	4500180000		Diode	HP2826	
CR26	4500310000	2	Diode	IN4448	
CR27	4500300000	2	Diode	ESM247	
CR28	4500300000		Diode	ESM247	
CR29	4500090000	3	Diode	BB141	
CR30	4500090000		Diode	BB141	
CR31	4500090000		Diode	BB141	
CR32	4500200100		Diode	BA182	
CR33	4500180000		Diode	HP2826	
CR34	4500180000		Diode	HP2826	
CR35	4500310000		Diode	IN4448	
L1	5301100000	7	Inductor, 220 μH		
L2	5301100000		Inductor, 220 μH		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-21
L3	5300110000		Inductor, 220 μH		
L4	5300240100	2	Inductor, 1.5 μH		
L5	5301100000		Inductor, 220 μH		
L6	5301100000		Inductor, 220 μH		
L7	5301100000		Inductor, 220 μH		
L8	5300240100		Inductor, 1.5 μH		
L9	5301100000		Inductor, 220 μH		
Q1	4300280000	3	Transistor	BFR91	
Q2	4300280000		Transistor	BFR91	
Q3	4300280000		Transistor	BFR91	
Q4	4300270000	5	Transistor	BFR96	
Q5	4300270000		Transistor	BFR96	
Q6	4300400000	4	Transistor	TP3094	
Q7	4300270000		Transistor	BFR96	
Q8	4300400000		Transistor	TP3094	
Q9	4300270000		Transistor	BFR96	
Q10	4300400000		Transistor	TP3094	
Q11	4300270000		Transistor	BFR96	
Q12	4300400000		Transistor	TP3094	
Q20	4300190000		Transistor	BC184C	
R1	2200024700	2	Resistor, 4.7K		
R2	220005600	1	Resistor, 56Ω		
R3	2900006800	2	Resistor, 68Ω		
R4	2200018200	2	Resistor, 820Ω		
R5	2200022200	2	Resistor, 2.2K		
R6	2200022200		Resistor, 2.2K		
R7	2200018200		Resistor, 820Ω		
R8	2900006800		Resistor, 68Ω		
R9	2900011200	1	Resistor, 120Ω		
R10	2900011000	12	Resistor, 100Ω		
R11	290005100	1	Resistor, 51Ω		
R12	290002200	9	Resistor, 22Ω		
R13	2900008200	1	Resistor, 82Ω		
R14	2900021200	1	Resistor, 1.2K		
R15	2210021500	1	Resistor, 1.5K		
R16	2200013900	1	Resistor, 390Ω		
R17	2900012200	3	Resistor, 220Ω		
R18	2900005600	1	Resistor, 56Ω		
R19	2900001500	5	Resistor, 15Ω		
R20	2300092700	1	Resistor, 27Ω		
R21	2900001500		Resistor, 15Ω		
R22	2900002700	4	Resistor, 27Ω		
R23	2900011800	9	Resistor, 180Ω		
R24	2900011800		Resistor, 180Ω		
R25	2900002200		Resistor, 22Ω		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-21
R26	2900002200		Resistor, 22Ω		
R27	2900001500		Resistor, 15Ω		
R28	2900002700		Resistor, 27Ω		
R29	2900011800		Resistor, 180Ω		
R30	2900011800		Resistor, 180Ω		
R31	2900002200		Resistor, 22Ω		
R32	2900002200		Resistor, 22Ω		
R33	2500059000	1	Resistor, 590Ω		
R34	2900011000		Resistor, 100Ω		
R35	2900001500		Resistor, 15Ω		
R36	2900002700		Resistor, 27Ω		
R37	2900011800		Resistor, 180Ω		
R38	2900011800		Resistor, 180Ω		
R39	2900002200		Resistor, 22Ω		
R40	2900002200		Resistor, 22Ω		
R41	2900001500		Resistor, 15Ω		
R42	2900002700		Resistor, 27Ω		
R43	2900011800		Resistor, 180Ω		
R44	2900011800		Resistor, 180Ω		
R45	2900002200		Resistor, 22Ω		
R46	2900002200		Resistor, 22Ω		
R47			NOT USED		
R48			NOT USED		
R49			NOT USED		
R50			NOT USED		
R51			NOT USED		
R52			NOT USED		
R53			NOT USED		
R54			NOT USED		
R55			NOT USED		
R56			NOT USED		
R57			NOT USED		
R58			NOT USED		
R59			NOT USED		
R60			NOT USED		
R61			NOT USED		
R62			NOT USED		
R63			NOT USED		
R64			NOT USED		
R65			NOT USED		
R66			NOT USED		
R67			NOT USED		
R68			NOT USED		
R69			NOT USED		
R70			NOT USED		
R71			NOT USED		
R72			NOT USED		
R73			NOT USED		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-21
R74			NOT USED		
R75			NOT USED		
R76			NOT USED		
R77			NOT USED		
R78			NOT USED		
R79			NOT USED		
R80			NOT USED		
R81			NOT USED		
R82			NOT USED		
R83			NOT USED		
R84			NOT USED		
R85			NOT USED		
R86			NOT USED		
R87			NOT USED		
R88			NOT USED		
R89			NOT USED		
R90			NOT USED		
R91			NOT USED		
R92			NOT USED		
R93			NOT USED		
R94			NOT USED		
R95			NOT USED		
R96			NOT USED		
R97			NOT USED		
R98			NOT USED		
R99			NOT USED		
R100	2900011800		Resistor, 180Ω		
R101			NOT USED		
R102	2500247500	2	Resistor, 47.5		
R103	2500247500		Resistor, 47.5		
R104			NOT USED		
R105	2900018200	1	Resistor, 820Ω		
R106	2900011000		Resistor, 100Ω		
R107	2210051000	2	Resistor, 1M		
R108	2210051000		Resistor, 1M		
R109	2210051000		Resistor, 1M		
R110	2900026800	1	Resistor, 6.8K		
R111	2900023300	1	Resistor, 3.3K		
R112	2900012200		Resistor, 220Ω		
R113	2900012700	2	Resistor, 270Ω		
R114	2200032200	1	Resistor, 22K		
R115	2900011000		Resistor, 100Ω		
R116	2900011000		Resistor, 100Ω		
R117	2200011500	1	Resistor, 150Ω		
R118	2900012200		Resistor, 220Ω		
R119	2900012700		Resistor, 270Ω		
R120			NOT USED		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-21
R121	2900008200		Resistor, 82Ω		
R122	2200023300	1	Resistor, 3.3K		
R123	2200024700		Resistor, 4.7K		
R124	2500351100	2	Resistor, 511K		
R125	2210042200	1	Resistor, 220K		
R126	2500351100		Resistor, 511K		
R127	2152470000	1	Resistor, 4.7K		
R128	2152470000	1	Potentiometer, 4.7K		
R129	2210031800	1	Resistor, 18K		
R130	2210031000	2	Resistor, 10K		
R131	2210031000		Resistor, 10K		
R132	2200011000		Resistor, 100Ω		
R133	2200011000		Resistor, 100Ω		
R134	2200011000		Resistor, 100Ω		
R135	2200011000		Resistor, 100Ω		
R136			Resistor, 10Ω		
R137			Resistor, 10Ω		
R138					
T1	0218490000	1	Transformer	FT10T6	
T2	0218810000	1	Transformer	FT10T6	
T3	0218550000	1	Transformer	FT4H32	
U1	4200360000	2	Integrated Circuit	TL072CP	
U2	4200410000	1	Integrated CIrcuit	F56344 F56345	
U3	4200360000		Integrated Circuit	TL072CP	
	297472	1	Attenuator	297472	5-22
AT1	2600001000	1	Attenuator, Pad, 10 dB		
AT2	2600002000	2	Attenuator, Pad, 20 dB		
AT3	2600003000	3	Attenuator, Pad, 30 dB		
FL1	3100610000	6	Filter		
FL2	3100610000		Filter		
FL3	3100610000		Filter		
FL4	3100610000		Filter		
FL5	3100610000		Filter		
FL6	3100610000		Filter		
J1	1400221200	1	Connector, Male		
K1	1600070000	6	Relay		
K2	1600070000		Relay		
K3	1600070000		Relay		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-22
K4	1600070000		Relay		
K5	1600070000		Relay		
K6	1600070000		Relay		
	297448	1	Filter	297448	5-23
C1	3500430000	2	Capacitor, 6800MF, 16V		
C2	3500430000		Capacitor, 6800MF, 16V		
C3	3500440000	2	Capacitor, 3300MF, 40V		
C4	3500440000		Capacitor, 3300MF, 40V		
C5	3500490000	2	Capacitor, 1000MMF 16V		
C6	3500500000	1	Capacitor, 220MMF, 63V		
C7	3700040000	1	Capacitor, 1MF 35V		
C8	350049000		Capacitor, 1000MMF, 16V		
CR1	4500050000	6	Diode	IN5401	
CR2	4500050000	6	Diode	IN5401	
CR3	4500050000		Diode	IN5401	
CR4	4500050000		Diode	IN5401	
CR5	4500050000		Diode	IN5401	
CR6	4500050000		Diode	IN5401	
CR7	4500040000	6	Diode	IN4004	
CR8	4500040000		Diode	IN4004	
CR9	4500310000	2	Diode	IN4448	
CR10	4500310000		Diode	IN4448	
CR11	4500040000		Diode	IN4004	
CR12	4500040000		Diode	IN4004	
CR13	4500040000		Diode	IN4004	
CR14	4500040000		Diode	IN4004	
J1	1416007200	1	Connector Female 16 Pins		
R1	2200024700	1	Resistor, 4.7K, 1/4W, 2%		
TC1	2000080000	1	Thermo Connect 50/40 Dgres		
	297449	1	Regulation, Power Supply	297449	5-23
C1	3700170000	5	Capacitor, 22 μF, 15V	TAS2	
C2	3700170000		Capacitor, 22 μF, 15V	TAS2	
C3	3700090000	1	Capacitor, 4.7 μF, 35V	TAS2	
C4	3700170000		Capacitor, 22 μF, 15V	TAS2	
C5	3700080000	2	Capacitor, 4.7 μF, 10V	TAS1	
C6	3700170000		Capacitor, 22 μF, 15V	TAS2	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-23
C7	3700040000	2	Capacitor, 1 μF, 35V	TAS1	
C8	3700170000		Capacitor, 22 μF, 15V	TAS2	
C9	3700080000		Capacitor, 4.7 μF, 10V	TAS1	
C10	3233470000	1	Capacitor, .047 μF, 10.2V, 10%		
C11	3150031000	2	Capacitor, 0.01 μF, 5.08V		
C12	3150031000		Capacitor, 0.01,μF, 5.08V		
CR1	4600016000	1	Diode, Zener	ZPD 4.7	
CR2	4500310000	7	Diode	IN4448	
CR3	4600120000	1	Diode	ZPD 8.2	
CR4	4500310000		Diode	IN4448	
CR5	4500310000		Diode	IN4448	
CR6	4500310000		Diode	IN4448	
CR7	4600030000	1	Diode	ZPD 5.1	
CR8	4500040000	5	Diode	IN4004	
CR9	4500040000		Diode	IN4004	
CR10	4500040000		Diode	IN4004	
CR11	4500040000		Diode	IN4004	
CR12	4500040000		Diode	IN4004	
CR13	4600080000	1	Diode	ZPD 6.8	
CR14	4500310000		Diode	IN4448	
CR15	4500310000		Diode	IN4448	
CR16	4500310000		Diode	IN4448	
J1	1416007100	1	Connector, Male, 16 Pin		
Q1	4300190000	6	Transistor	BC184C	
Q2	4300190000		Transistor	BC184C	
Q3	4300190000		Transistor	BC184C	
Q4	4800080000	3	Transistor	2N2905	
Q5	4300100000	2	Transistor	2N2907	
Q6	4300110000	2	Transistor	BC214C	
Q7	4300110000		Transistor	BC214C	
Q8	4300010000	1	Transistor	2N2222	
Q9	4800060000	1	Transistor	2N2219	
Q10	4300190000		Transistor	BC184C	
Q11	4300190000		Transistor	BC184C	
Q12	4800080000		Transistor	2N2905	
Q13	4300100000		Transistor	2N2907	
Q14	4300360000	3	Transistor	TIP41	
Q15	4300360000		Transistor	TIP41	
Q16	4300360000		Transistor	TIP41	
Q17	4300190000		Transistor	BC184C	
Q18	4800080000		Transistor	2N2905	
R1	2200026800	1	Resistor, 6.8K, 1/4W, 2%		
R2	2200024700	5	Resistor, 4.7K, 1/4W, 2%		

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
					5-23
R3	2200021000	6	Resistor, 1K, 1/4W, 2%		
R4	2200021000		Resistor, 1K, 1/4W, 2%		
R5	2200024700		Resistor, 4.7K, 1/4W, 2%		
R6	2200021200	1	Resistor, 1.2K, 1/4W, 2%		
R7	2500161900	2	Resistor, 6.19K, .03W, 1%		
R8	2200021500	1	Resistor, 1.5K, 1/4W, 2%		
R9	2200024700		Resistor, 4.7K, 1/4W, 2%		
R10	2500161900		Resistor, 6.19K, .03W, 1%		
R11	2500140200	1	Resistor, 4.02K, .03W, 1%		
R12	2200021000		Resistor, 1K, 1/4W, 2%		
R13	2800082200	4	Resistor, 22Ω, 4W		
R14	2200031200	2	Resistor, 12K, 1/4W, 2%		
R15	2500151100	3	Resistor, 5.11K, .3W, 1%		
R16	2500151100		Resistor, 5.11K, .3W, 1%		
R17	2200024700		Resistor, 4.7K, 1/4W, 2%		
R18	2200021000		Resistor, 1K, 1/4W, 2%		
R19	2800082200		Resistor, 22Ω, 4W		
R20	2500169800	1	Resistor, 6.98K, .3W, 1%		
R21	2500151100		Resistor, 5.11K, .3W, 1%		
R22	2200022200	1	Resistor, 2.2K, 1/4W, 2%		
R23	2200016800	1	Resistor, 680Ω, 1/4W, 2%		
R24	2200021000		Resistor, 1K, 1/4W, 2%		
R25	2800082200		Resistor, 22Ω, 4W		
R26	2800082200		Resistor, 22Ω, 4W		
R27	2200031000	1	Resistor, 10K, 1/4W, 2%		
R28	2200031200		Resistor, 12K, 1/4W, 2%		
R29	2200032200	1	Resistor, 22K, 1/4W, 2%		
R30	2300096800	1	Resistor, 6.8Ω, 1/4W, 2%		
R31	2200024700		Resistor, 4.7K, 1/4W, 2%		
R32	2200011000	2	Resistor, 100Ω, 1/4W, 2%		
R33	2200021000		Resistor, 1K, 1/4W, 2%		
R34	2200011000		Resistor, 100Ω, 1/4W, 2%		
R35	2162100100	1	Resistor, Variable, 1K, 20%		
U1	4200280000	1	Integrated Circuit	7812VC	
	297426		Heat Sink	800722-0100	
	297450	1	Protection, Power Supply	297450	5-23
CR1	4600390000	1	Diode	ZPY10	
CR2	4500310000	1	Diode	IN4448	
Q1	4800060000	1	Transistor	2N2219	
Q2	4800010000	1	Transistor	2N5190	

TABLE 6-2. REPLACEABLE PARTS LIST (Continued)

Reference Designation	AILTECH Part Number	Qty	Description	MFR Part Number	Fig. No.
			5-23		
R1	2200022200	1	Resistor, 2.2K		
R2	2200016800	1	Resistor, 680Ω		
R3	2800002200	2	Resistor, 22Ω, 4W, 10%		
R4	2800002200		Resistor, 22Ω, 4W, 10%		