INSTRUCTION MANUAL

Modulation Meter
Type AFM3b
From serial No.166886

RADIOMETER

ELECTRONIC MEASURING INSTRUMENTS
FOR SCIENTIFIC AND INDUSTRIAL USE

Instruction Manual
for

Modulation Meter
Type AFM3b

From serial No. 166886

1st edition

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Modulation Meter
Type AFM3

Section A. Introduction

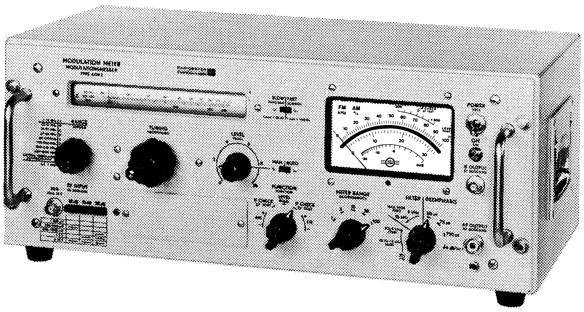


Fig.A1. The Modulation Meter, type AFM3.

The Modulation Meter, type AFM3, is a solid-state, line- or battery-operated precision measuring instrument for accurate measurement of the modulation depth of AM signals and the peak deviation of FM signals in the carrier frequency range from 6 to 1001 MHz. The Modulation Meter is designed for accepting signals with a modulation frequency from 30 Hz to 15 kHz.

The indicating meter has full-scale deflection for 1, 3, 10, 30, and 100% AM, and ±1, ±3, ±10, ±30 and ±100 kHz FM, peak value; furthermore a 0 to -20 dB meter range enables frequency response measurements. Due to the very small amount of residual modulation generated in the Modulation Meter proper, it is possible to measure residual FM and AM in oscillators, spurious AM on FM signals, and vice versa.

Accurate measurements on distorted signals are rendered easy by a switch that enables the positive and negative peak value to be measured separately. If increased resolution is desired, an external indicator, such as a voltmeter, can be employed to extend the measuring range downwards.

The input signal level necessary for full accuracy is 3 mV in the carrier frequency range 6 to 200 MHz, 30 mV in the range 200 to 1001 MHz. The maximum operating input voltage is 10 V. Besides a manual level control, the Modulation Meter features an automatic level control with a regulating range of 40 dB.

The IF bandwidth of the Modulation Meter is ±300 kHz, and four deemphasis networks of 50, 75, 750 μs, and 6 dB/octave (ref. 1 kHz), two low-pass filters with frequencies of 3 and 15 kHz, and two band-pass filters with 3 dB points at 50 Hz and 15 kHz, and 300 Hz and 3 kHz, respectively, ensure optimal measuring conditions for a wide range of applications.

A plug-in Crystal Oscillator Unit, code 900-252, is available for the reduction of residual FM - a convenience when measuring very low FM deviations.

Section B. Specifications

FREQUENCY RANGE OF INPUT SIGNAL	6 - 1001 MHz
FREQUENCY RANGE OF VARIABLE OSCILLATOR	7 - 1000 MHz
Fundamental ranges:	7-12, 12-21, 21-37, 37-65, 65-110, and 110-200 MHz
Harmonic ranges:	200-330, 330-600, and 600-1000 MHz
CALIBRATION ACCURACY	3%
CRYSTAL OPERATION	An optional Crystal Oscillator Unit, code 900-252, that accepts up to four switch-selected crystals, ensures low residual FM. Specification changes due to crystal operation: See SECTION C - ACCESSORIES.
INPUT LEVEL	One input socket in connection with a 3-step input attenuator (10 + 10 + 20 dB) adapts the AFM3 to input levels from 3 mV to 10 V.

Carrier frequency ranges:	6-200 MHz		200-1001 MHz
Attenuation 0 dB+:	3-100 mV		30-100 mV
Attenuation 10 dB:		100-300 mV	
Attenuation 20 dB:		300-1000 mV	
Attenuation 30 dB:		1-3 V	
Attenuation 40 dB:		3-10 V	

+ Basic sensitivity range, BSR

Max. safe input level:	10 V r.m.s.
Input level for residual FM and AM measurements:	Min. input level is 10 mV within the range 6-600 MHz, and 20 mV within the range 600-1001 MHz.
INPUT IMPEDANCE	50 Ω nominal
LEVEL SETTING	
Manual level setting:	Continuous within a range of min. 40 dB
Automatic level setting:	The AGC system keeps the level setting within 0.5% for input level variations within the specified input level ranges. Fine adjustment of the automatic level setting is possible.

FREQUENCY MODULATION

Deviation ranges: ±1, ±3, ±10, ±30 and ±100 kHz f.s.d. (peak deviation).

Positive and negative deviation peaks can be measured separately.

Accuracy:

±1 kHz deviation: 2% of reading +2% of full scale at modulation frequencies within 30 Hz - 15 kHz.

±3 kHz to ±100 kHz deviation: 2% of reading +1% of full scale at modulation frequencies within 30 Hz - 15 kHz.

Notes:

1. To obtain specified accuracy, the upper frequency limit of the built-in low-pass filter should be switched as follows:

Deviation range	
±1 kHz and ±3 kHz	3 kHz low-pass filter
±10 kHz to ±100 kHz	15 kHz low-pass filter

2. The specified accuracies are valid only with the METER switch set to SLOW. In position FAST, the lower frequency limit is 160 Hz.

Distortion:

up to ±15 kHz deviation: 0.2% distortion at modulation frequencies within 30 Hz - 5 kHz.

up to ±75 kHz deviation: 0.4% distortion at modulation frequencies within 30 Hz - 15 kHz.

AF output and meter response (FM): Within 50 Hz - 15 kHz, the frequency response is within +0.25% and -1.5%.

Notes:

1. The built-in 15 kHz low-pass filter is to be used.

2. The specified response for METER is valid only with the METER switch set to SLOW. In position FAST the lower frequency is 160 Hz.

Residual FM:

Filter: 50 Hz - 15 kHz (3 dB)
Deemphases: 50 μs and 75 μs

On condition of a quiet test room (noise level <60 dB rel. 2×10^{-4} μbar.):

Less than 25 Hz FM (r.m.s.) within the frequency range 6-200 MHz; typically 10 Hz (r.m.s.).

Less than 100 Hz FM (r.m.s.) up to 1001 MHz, typically 50 Hz FM (r.m.s.).

Filter: 300 Hz - 3 kHz
Deemphasis: 750 μs

8 Hz FM (r.m.s.) within the frequency range 6-200 MHz, typically 5 Hz FM (r.m.s.).

Less than 30 Hz FM (r.m.s.) up to 1001 MHz, typically 20 Hz FM (r.m.s.).

Notes:

1. 0.1% of full deviation range is to be added.
2. Minimum RF input level: See Input Level.

FM due to AM: Additional residual FM error due to AM is typically less than 50 Hz (r.m.s.) at 50% AM, when the band-pass filter (50 Hz - 15 kHz) is used.

Deemphases:

Standard deemphases: 50, 75, and 750 μs, switchable.

Deemphasis: 6 dB/oct. (ref. 1 kHz). For frequency response of filter, see Fig.B1.

The deemphases can be switched off.

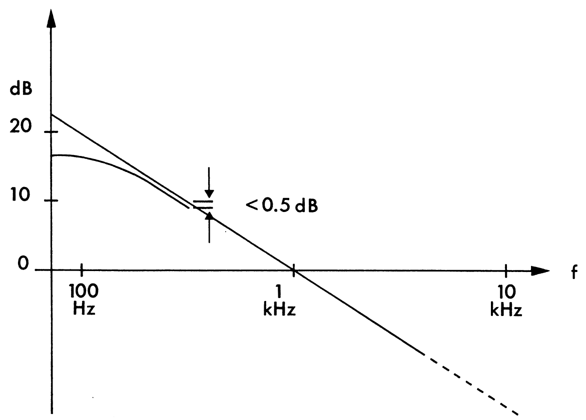


Fig.B1. Frequency response of the 6 dB/oct. filter.

AMPLITUDE MODULATION

Modulation depth range: 1, 3, 10, 30, and 100% AM f.s.d.

Positive and negative modulation peaks can be measured separately.

Accuracy:

Manual level setting:

±1% range: 2% of reading +2% of full scale at modulation frequencies within 30 Hz - 15 kHz.

±3 to ±100% ranges	2% of reading +1% of full scale at modulation frequencies within 30 Hz - 15 kHz.

Notes:

1. To obtain specified accuracy, the upper frequency limit of the built-in low-pass filter should be switched as follows:

modulation range	upper frequency range
1 and 3%	3 kHz low-pass filter
10 to 100%	15 kHz low-pass filter

2. The above accuracies are valid for modulation depths up to 90% AM within the carrier frequency range 6-200 MHz, and up to 30% AM within the carrier frequency range 200-1001 MHz.

Automatic level setting:

The following typical values are to be added to the above accuracies:

At a modulation frequency of 30 Hz: 5% of reading

At a modulation frequency of 50 Hz: 1% of reading

At modulation frequencies above 100 Hz, the additional error is negligible.

Note: The specified accuracies (manual and automatic level settings) are valid only with the METER switch set to SLOW. In position FAST, the lower frequency limit is 160 Hz.

AM distortion:

Carrier frequencies within the range 6 - 200 MHz:

0.2% distortion at 30% AM and at modulation frequencies within 30 Hz - 15 kHz.

1% distortion at 90% AM and at modulation frequencies within 30 Hz - 15 kHz.

Carrier frequencies within the range 200 - 1001 MHz:

1% distortion at 30% AM and at modulation frequencies within 30 Hz - 15 kHz.

Residual AM at CW:

Less than 0.03% AM (r.m.s.) at carrier frequencies up to 200 MHz, typically 0.01% AM (r.m.s.).

Less than 0.1% AM (r.m.s.) at carrier frequencies up to 500 MHz, typically 0.03% AM (r.m.s.).

Less than 0.3% AM (r.m.s.) at carrier frequencies up to 1001 MHz, typically 0.1% AM (r.m.s.).

Notes:

1. 0.1% of full AM range to be added.
2. Minimum RF input level: See Input Level.

3. The built-in band-pass filter (50 Hz - 15 kHz) is to be used.

4. By use of the filter 0.3-3 kHz the residuals will be halved.

AM due to FM: Additional error is less than 0.6% AM (r.m.s.) at ±50 kHz deviation.

AF output (AM)

Manual level settings: The frequency response is within ±0.5% in the range 30 Hz - 15 kHz.

Automatic level settings: The following typical error contributions are to be added to the above frequency response:

At a modulation frequency of 30 Hz: 5%

At a modulation frequency of 50 Hz: 1%

At modulation frequencies above 100 Hz, the error contribution is neglible.

INTERMEDIATE FREQUENCY CHANNEL

Frequency: 1 MHz

Bandwidth: Approx. ±300 kHz/3 dB.

IF check: The meter has a separate scale to facilitate correct tuning (IF = 1 MHz). Scale calibration 0, ±100, ±200, and ±300 kHz.

If output: 1 MHz IF signal of 0.2 V EMF from 50 Ω source at correct frequency tuning and full scale deflection on meter.

AUDIO FREQUENCY CHANNEL

Bandwidths: Two switchable low-pass filters, 3 kHz, 15 kHz, to be used when measuring FM deviation and AM modulation.

3 kHz filter: For mod. freq. up to 3 kHz.

15 kHz filter: For mod. freq. up to 15 kHz.

50 Hz - 15 kHz filter: Band-pass filter, 50 Hz (3 dB) - 15 kHz (3 dB), to be used when measuring residual FM and AM.

300 Hz - 3 kHz filter: Band-pass filter, 300 Hz (3 dB) - 3 kHz (3 dB), to be used when measuring residual FM and AM.

AF output: AF signal of 1 V EMF (peak value) at full scale deflection. Bandwidths as specified above.

dc OUTPUT

Mod. level:	dc-voltage of 1 V EMF from 600 Ω source at full scale deflection.

POWER SUPPLY

Voltages:	110 V and 220 V, ±10%.
Frequencies:	48 - 65 Hz.
Consumption:	about 20 VA.
	The power cord is fixed and provided with a mains plug of the Schuko type.
External dc supply:	
dc sources:	0 to +(18 to 25 V) and 0 to -(18 to 25 V).
Current drain:	approx. 350 mA from each source.

TERMINALS

RF input and IF output:	BNC
AF output:	UHF
dc output (AF):	Banana jacks
External dc supply:	Belling Lee L1436/S

OPERATING AMBIENT TEMPERATURE RANGE	0 - 50° C

DIMENSIONS AND WEIGHT

Height:	197 mm (7 3/4 in.)
Width:	485 mm (19 1/8 in.)
Depth:	245 mm (9 5/8 in.)
Weight:	13 kg (28.6 lbs)

MOUNTING AND FINISH	Steel cabinet finished in grey enamel lacquer.
ACCESSORIES SUPPLIED	1 coaxial cable (50 Ω), code 617-004, with type UG-88/U BNC plugs.
	1 battery plug, Belling & Lee, L1436/P, code 805-429.
	2 sets of spare fuses
OPTIONAL ACCESSORIES AVAILABLE	Crystal Oscillator, code 900-252.
	External-Oscillator Amplifier, code 900-253
	1 set of dust covers (top plate and bottom plate) for rack mounting, code 884-002.

Section C. Accessories

PLUG-IN CRYSTAL OSCILLATOR UNIT, CODE 900-252

General

The Plug-in Crystal Oscillator Unit, code 900-252, is preferably used within the frequency range 67 - 1001 MHz to achieve low residual FM. It is supplied without crystals.

The Crystal Oscillator Unit contains a crystal-controlled oscillator followed by a doubler stage, and it has room for up to four switch-selected crystals. The crystals are mounted inside the unit and can easily be exchanged. Initial adjustment is made by means of individual

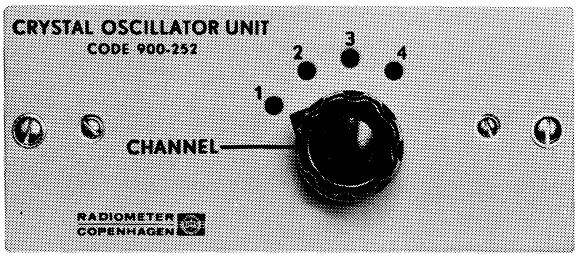


Fig.C1. The Crystal Oscillator Unit, code 900-252.

screwdriver adjustments on the front panel.

The trimmers directly cover a tuning range of 360 - 1000 MHz. In the ranges 67 - 120 MHz and 200 - 360 MHz, a fixed capacitor must be added in parallel with the trimmer.

Specifications

Number of crystals: Sockets for up to 4 crystals.

Frequency of crystals: In order to achieve the highest possible sensitivity of the Modulation Meter, the frequency of the crystals must be as high as possible. Overtone crystals having frequencies within the range 33 - 100 MHz are recommended. The crystal frequency f_{cr} is determined by

$$f_{cr} = \frac{f_s - 1}{2n} \text{ MHz}$$

where f_s indicates the carrier frequency and n the odd harmonic of the crystal overtone-frequency.

Initial conditions: The sensitivity specifications, item INPUT LEVEL (SECTION B), are based on the following combinations of carrier frequency, order of harmonic, and range of crystal frequencies.

Carrier frequency	Order of harmonic	Range of crystal frequencies
f_s	n	f_{cr}
200 - 600 MHz	3	33 - 100 MHz
600 - 1000 MHz	5	60 - 100 MHz

Characteristics of the crystals:

Type:	HC-25/U
Frequency:	See above.
Frequency tolerance:	10×10^{-6} at reference temperature 25°C
Frequency tolerance over operating temperature range:	10×10^{-6}, within 0-50°C
Condition of resonance:	Series
Mode of operation:	5. overtone
Max. drive level:	2 mW
Max. equivalent series resistance:	60 Ω

Input level for residual FM and AM measurements: See INPUT LEVEL in SECTION B.

EXTERNAL-OSCILLATOR AMPLIFIER, CODE 900-253

General

The Modulation Meter, type AFM3, is so designed that an optional plug-in External-Oscillator Amplifier, code 900-253, can be used if driving by means of an external oscillator, for example a synthesizer, is required. It will bring the output of the external oscillator up to the level required by the mixer.

Specifications

Input Level:	0.3 to 0.5 V depending on the frequency range.
Frequency Range:	90 to 200 MHz. Up to 1 GHz on harmonics.
Input Impedance:	50 Ω (BNC connector).

Section D. General Description

DESCRIPTION

As can be seen on the simplified block-diagram shown in Fig. D1, the RF input signals to the 50 Ω coaxial connector are fed to a diode mixer via an input attenuator providing for 10, 20, 30, and 40 dB attenuation and thus accommodating RF signals from 3 mV to 10 V r.m.s. The mixer, which is balanced and highly linear, so that distortion of amplitude-modulated signals is avoided, is coupled to the local tuning oscillator. For RF input signals in the range from 6 to 200 MHz, mixing is realized with the fundamental frequency of the local oscillator, whilst it takes place with the third and fifth harmonics in the range from 200 to 1001 MHz. This results in an IF signal of 1 MHz. The mixer can also be coupled to an optional Crystal Oscillator Unit, code 900-252, which can accommodate four crystals, thereby enabling measurements at four predetermined, fixed frequencies.

The signal from the mixer is passed through an IF filter, which is a Butterworth band-pass filter with a bandwidth of ±300 kHz/3 dB.

From the IF filter, the IF signal is fed to an IF preamplifier which acts as a buffer. At the same time, the IF preamplifier provides for amplification of the IF signal. This amplification, together with ideal coupling to the IF filter, keeps the noise level down to a minimum at all input levels.

The IF preamplifier is followed by a diode attenuator whose biasing current can be controlled by the potentiometer LEVEL, accessible on the front panel of the Modulation Meter. Level control can be performed within a range of 40 dB. Alternatively, the IF attenuator can be driven by a voltage proportional to the IF level amplified in an AGC amplifier. This provides for automatic level control within 40 dB. Fine adjustment is nevertheless also possible by means of the potentiometer LEVEL.

The IF signal from the IF attenuator is then fed to an IF amplifier which consists of two wideband amplifier stages. The IF amplifier brings the IF signal to the level required by the AM detector.

A buffer amplifier separates AM detector and IF output amplifier. It consists of a unity-gain amplifier with low output impedance and serves to suppress any influence from the IF output which is available for external monitoring from a coaxial connector on the front panel.

The IF signal from the buffer amplifier

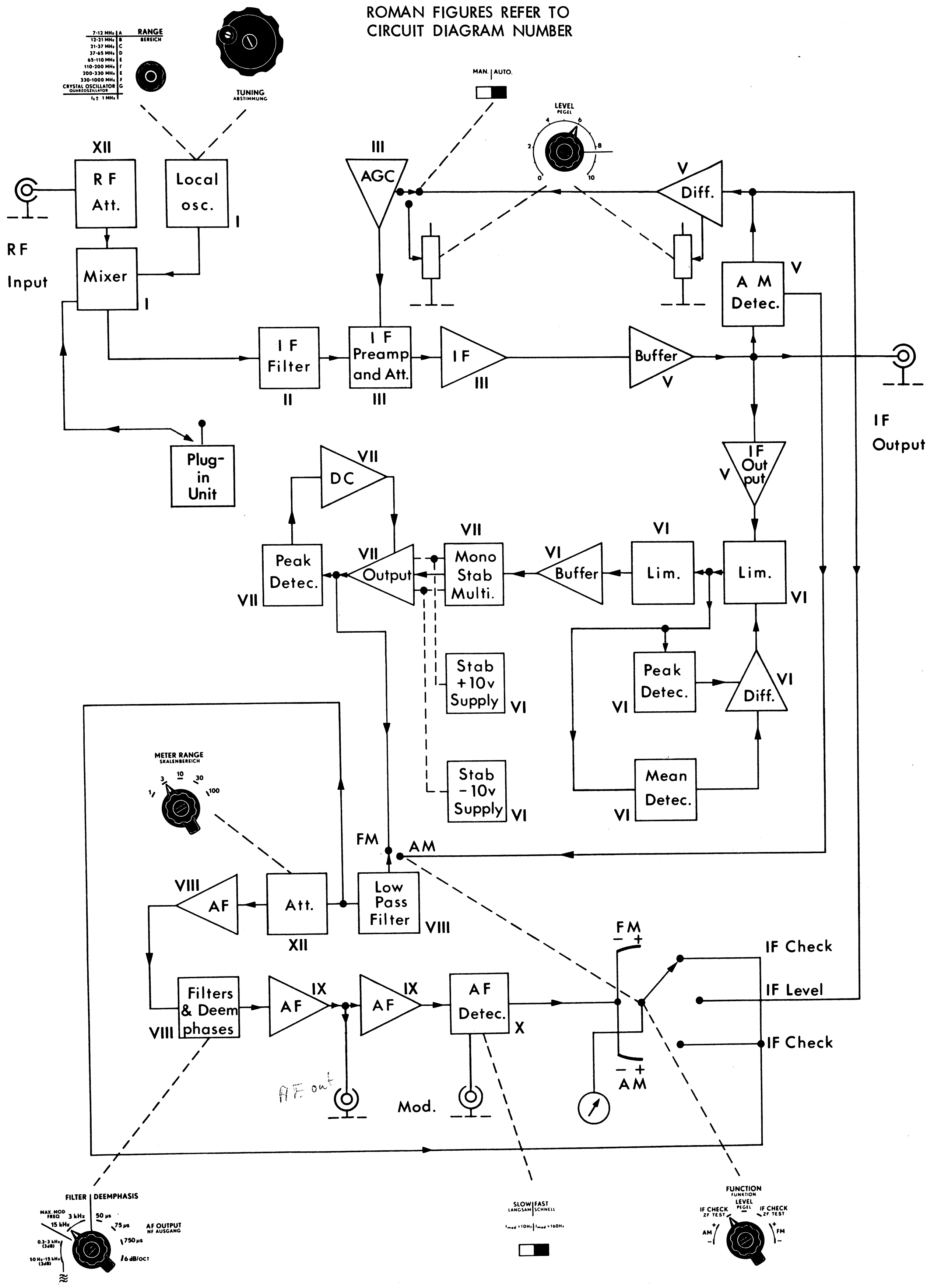


Fig. D1. Block-diagram of the Modulation Meter, type AFM3.

is fed to the AM detector and to the IF output amplifier. The AM detector is an amplifier with a mean-value detector in the feedback loop which also provides for the large amount of linearity required. The AM detector has a dc and an ac output. The first of these is coupled to the meter of the instrument via the FUNCTION selector.

In the corresponding position of the FUNCTION selector, the meter indicates the value of the AM detector's dc current - in other words: the IF level. The second output of the AM detector is coupled to the AF section (described below) via the selector FUNCTION.

As stated above, the IF signal from the buffer amplifier is also fed to the IF output amplifier which provides for amplification so that the level required for driving a following limiter is obtained.

The limiter transforms the IF signal into a square wave, the zero crossing of which is controlled by variations in the peak-to-peak value being compared with variations in the mean value. Subsequent limiting action takes place in the following limiter section. The resulting signal is fed via a buffer amplifier to the FM detector section which consists of a monostable multivibrator and an output amplifier.

The signal from the last limiter section is used to trigger a monostable multivibrator which provides for pulses of constant width. The pulses from the multivibrator are amplified in an output amplifier. The output amplifier is provided with a regulating loop consisting of a peak detector and an amplifier. This regulating loop keeps the value of the peak-to-peak voltage of the output amplifier constant. Hence, as the amplitude and the width of the pulses are constant, the mean value of the signal will vary according to the number of pulses per second. The mean value is utilized when the FUNCTION selector is in position IF CHECK for reading the value of the intermediate frequency. To ensure a high degree of accuracy and an extremely low hum level, both the multivibrator and the output amplifier are furnished with their own regulated power supply.

From the AM or FM detector, the signal is fed to a Butterworth low-pass filter via a relay controlled by the FUNCTION selector.

The low-pass filter is followed by a two-section, 4 x 10 dB precision attenuator which determines the metering ranges. It is followed by an amplifier providing for amplification of the AF signal to the level required by the next stages.

The AF amplifier is followed by deemphasis networks providing for the standard deemphases of 50, 75, and 750 µs, and the non-standard deemphasis of 6 dB/oct. The amplified AF signal can also be passed through one of the two low-pass filters for modulation frequencies up to 3 and 15 kHz, or through two band-pass filters with 3 dB points at 50 Hz and 15 kHz, and 0.3 kHz and 3 kHz, respectively, ensuring a wide range of applications.

These networks and filters are followed by an AF amplifier. The output signal from this amplifier is available on the front panel via the AF OUTPUT connector for distortion measurements or external monitoring. Loading of the AF OUTPUT does not interfere with the meter indication. The output voltage from the first AF amplifier is also fed to another AF amplifier providing for the voltage necessary for the AF detector.

The AF detector gives the true peak value of any AF signal. Depending on the position of the FUNCTION selector, the positive or the negative modulation

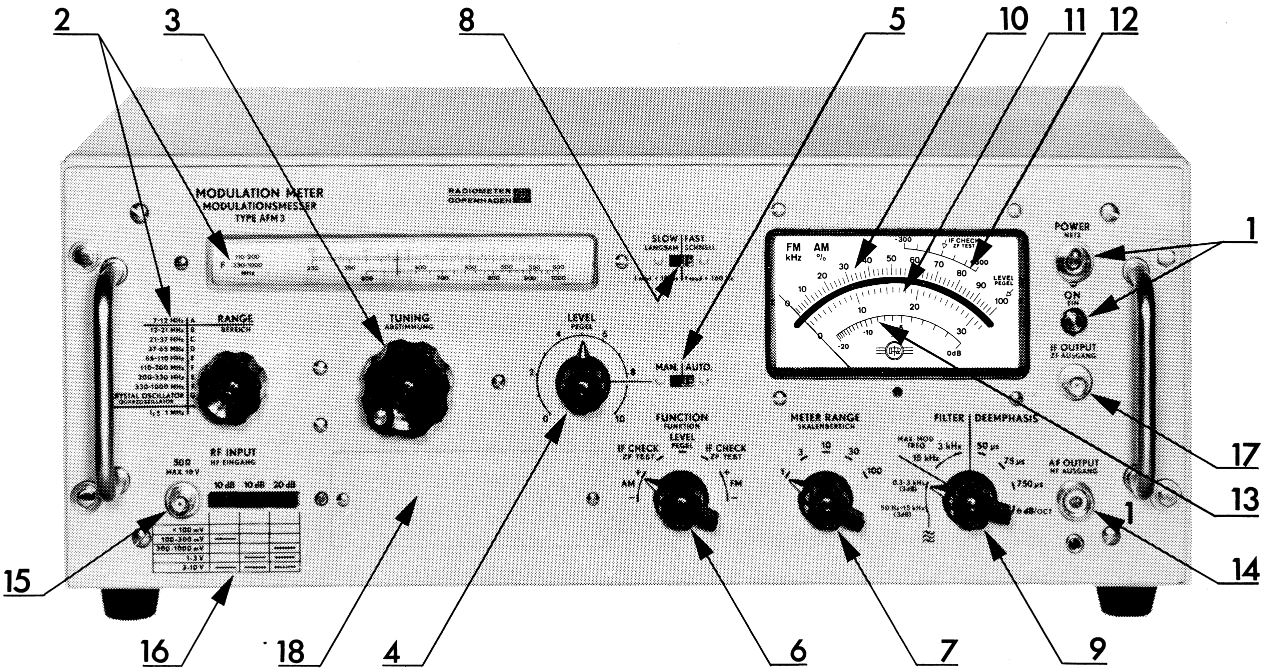


Fig.D2. Front plate of the Modulation Meter, type AFM3.

peak can be measured. The AF detector has two time constants, thereby furnishing two meter responses.

The AF detector is followed by an impedance-matching network providing for low output impedance to the meter.

CONTROLS, METER AND TERMINALS

General

As can be seen in Figs.D2 and D4, the Modulation Meter, type AFM3, is provided with the following controls, meter, and terminals:

Controls, Meter, and Front Plate Terminals (see Fig.D2)

Power Lamp and ON switch (1)

The power switch ON is a toggle switch monitored by the lamp POWER.

RANGE Selector and Drum Scale (2)

The selector RANGE is an eight-position rotary switch. In the first six positions, the RANGE selector provides for selection of the frequency ranges according to the table printed on the front plate of the instrument. (Note that the ranges E and F each cover two frequency bands.) The next position is a rest position. In the last position, the plug-in Crystal Oscillator Unit (if any) is connected. The selector RANGE is monitored by the drum scale immediately above.

TUNING Knob (3)

The knob TUNING provides for adjustment of the local escillator frequency at 1 MHz from the signal frequency. It is monitored by a cursor on the drum scale.

LEVEL Potentiometer (4) and MAN.-AUTO. Switch (5)

The potentiometer LEVEL has two functions according to the position of the switch MAN.-AUTO.

When the switch MAN.-AUTO. is in position MAN., the LEVEL potentiometer is used to vary the sensitivity of the instrument manually within a range of min. 40 dB.

When the switch MAN.-AUTO. is in position AUTO., the LEVEL potentiometer is used for fine-adjustment of the automatically adjusted sensitivity of the instrument.

FUNCTION Selector (6)

The selector FUNCTION is a seven-position rotary switch. The position LEVEL is used when searching the signal (i.e., tuning) and monitoring the IF level. When measuring, the positions IF CHECK are used to tune the instrument to the exact carrier frequency. (See under "Meter" below.) The percentage of amplitude modulation of AM signals can be measured by placing the selector in position AM+ or AM- according to the sign of the modulation peak to be measured. The frequency deviation of FM signals can be measured by placing the selector in position FM+ or FM- according to the sign of the modulation peak to be measured.

METER RANGE Selector (7)

The selector METER RANGE is a five-position rotary switch. Each position corresponds to the full-scale range of the meter, viz: AM 1 - 3 - 10 - 30 - 100%, FM 1 - 3 - 10 - 30 - 100 kHz.

SLOW/FAST Switch (8)

The switch SLOW/FAST is a sliding switch. In position SLOW $f_{mod} > 10$ Hz, the meter response is slow. This position should not be used when measuring on signals with modulation frequencies higher than 160 Hz. In position FAST $f_{mod} > 160$ Hz, the meter response is fast.

FILTER/DEEMPHASIS Selector (9)

The selector FILTER/DEEMPHASIS is an eight-position rotary switch. In the first position (50 Hz - 15 kHz (3 dB)) and in the second position (0.3 kHz - 3 kHz (3 dB)) a band-pass filter is switched in. They are used when measuring residual AM and FM. In the next two positions (15 kHz and 3 kHz) two low-pass filters are switched in. They are used when measuring FM deviation or AM modulation. The 3 kHz and 15 kHz filters are used for modulation frequencies up to 3 kHz and 15 kHz, respectively.

The last four positions of the AF FILTER/DEEMPHASIS selector introduce four deemphases of 50 µs, 75 µs (European and American standard), 750 µs (narrow-band equipment) and 6 dB/oct (non-standard).

Meter

The meter of the Modulation Meter, type AFM3, is of the taut-band suspension type. It is provided with three scales.

Scale (10) provides for reading in the AM ranges from 0 to 1% or 0 to 10% or 0 to 100%, and in the FM ranges from 0 to 1 kHz or 0 to 10 kHz or 0 to 100 kHz deviation, according to the position of the FUNCTION selector and the METER RANGE selector. It is also provided with a LEVEL mark to permit setting of the IF level.

Scale (11) provides for reading in the AM ranges from 0 to 3% or 0 to 30%, and in the FM ranges from 0 to 3 kHz or 0 to 30 kHz deviation, according to the position of the FUNCTION and METER RANGE selectors.

Scale (12) is utilized when checking the frequency of the converted signal. It is marked at ±100, ±200, and ±300 kHz around the 1 MHz intermediate frequency. An IF CHECK mark provides for exact tuning to the intermediate frequency.

Scale (13) enables frequency response measurements to be made in the range 0 to -20 dB.

AF OUTPUT Connector (14)

The AF signal of 1 V EMF (peak value) at full-scale deflection is delivered via the UHF connector AF OUTPUT.

RF INPUT Connector (15)

The BNC connector RF INPUT provides for connection of the RF signal to be measured on.

Input Attenuator (16)

The input attenuator is a three-step

	10 dB	10 dB	20 dB
<100 mV			
100 - 300 mV	———		
300 - 1000 mV			———
1 - 3 V		———	———
3 - 10 V	———	———	———

	FREQUENCY RANGE	
ATTENUATION	6 - 200 MHz	200 - 1001 MHz
0 dB	3 - 100 mV	30 - 100 mV
10 dB	100 - 300 mV	
20 dB	300 - 1000 mV	
30 dB	1 - 3 V	
40 dB	3 - 10 V	

Fig. D3. Attenuation and sensitivity ranges.

attenuator (10 + 10 + 20 dB). It is used to adapt the Modulation Meter, type AFM3, to input levels from 3 mV to 10 V. As can be seen in Fig. D3, the degree of attenuation to be selected depends on the input voltage range, and the sensitivity of the instrument depends on the frequency range.

IF OUTPUT (17)

The BNC connector IF OUTPUT provides for connection of the 1 MHz IF signal to, for example, external monitors. It delivers a 1 MHz IF signal of 0.2 V EMF from a 50 ohms source at correct frequency tuning and full deflection on the meter.

Plug-in Unit Receptacle (18)

The Modulation Meter, type AFM3, is so designed that two optional plug-in units can be used. (See SECTION C - ACCESSORIES.)

Rear Terminals (see Fig. D4)

MOD. (DC) (1)

The terminal MOD. LEVEL (DC) consists of two banana jacks (600 Ω) and delivers a dc voltage (meter current) of 1 V EMF at full-scale deflection.

Line Voltage Indicator (2)

The line voltage indicator shows the line voltage to which the instrument is switched: either 110 V or 220 V - 48 to 65 Hz. When the two screws (3) and (4) are loosened, the voltage indicator can be turned to the appropriate position. (For further details see SECTION E - OPERATING INSTRUCTIONS.)

Battery (5)

The terminals BATTERY are of the Belling & Lee L1436/S type and provide for connection of the instrument to an external dc supply by means of a Belling & Lee L1436/P Plug supplied with the instrument.

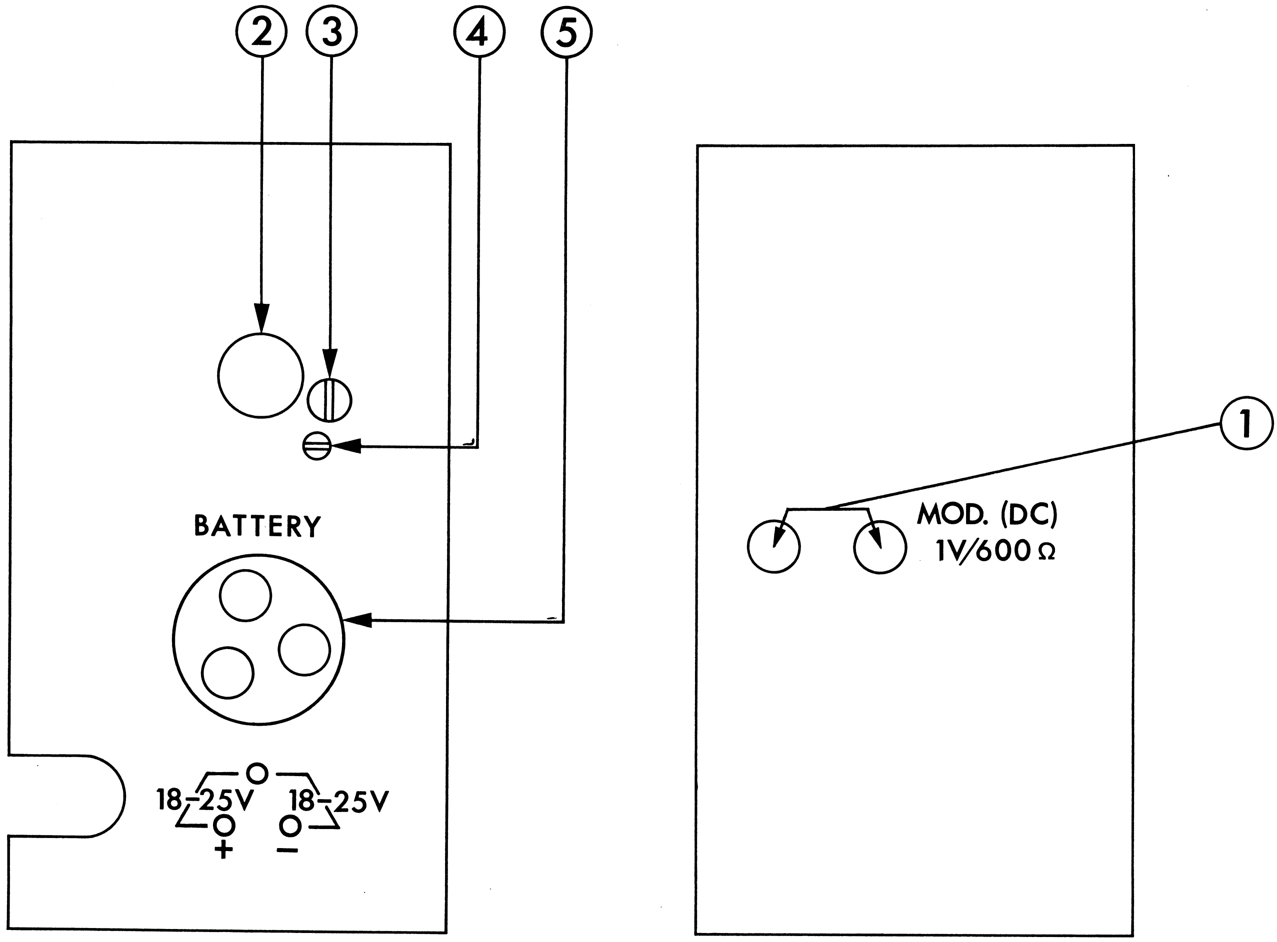


Fig. D4. Rear terminals of the Modulation Meter, type AFM3.

Section E. Operating Instructions

CONNECTING THE INSTRUMENT

Before connecting the instrument to the power line, make sure that the supply transformer and the line voltage indicator are set to the voltage of the power line.

To prepare the instrument for 110 V or 220 V line voltage operation, refer to diagram XI and proceed as follows:

1) If the instrument must be used at a line voltage of 110 V, interconnect lugs 3 and 5 and lugs 4 and 6 on the supply transformer.

2) If the instrument must be used at a line voltage of 220 V, interconnect lugs 4 and 5 on the supply transformer.

Then loosen the screws on the voltage indicator and set the indicator to the desired voltage.

MEASURING AMPLITUDE MODULATION PERCENTAGE

Modulation Percentage of AM Signals

1) Feed the signal to be measured to the RF INPUT connector. Bear in mind that the max. applicable signal is 10 V r.m.s., and that the input impedance is 50 Ω.

2) Use the RF input attenuator according to the instructions printed on the front panel, or refer to Fig. D3 in SECTION D - GENERAL DESCRIPTION.

3) Set the switch METER to SLOW if the modulation frequency of the signal is less than 160 Hz, otherwise set it to FAST.

4) Set the switch MAN.-AUTO to MAN.

5) Set the drum scale to the desired frequency range by using the RANGE selector.

6) Set the selector FUNCTION to LEVEL.

7) Set the tuning knob so that the cursor on the drum scale indicates the signal frequency ±1 MHz, and then tune so as to obtain maximum meter deflection.

8) Turn the selector FUNCTION to IF CHECK.

9) Make a fine adjustment with the TUNING knob so that the meter reads IF CHECK.

10) Set the selector FUNCTION to LEVEL. When using MAN.-AUTO. in

position MAN., readjust to the LEVEL mark, if necessary by means of the LEVEL potentiometer. When using MAN.-AUTO. in position AUTO., fine level-adjustment can be accomplished by means of LEVEL. It is recommended to use the MAN.-AUTO. switch in position AUTO. when performing AM measurements, as the inevitable level variations of the signal then are equalized.

11) In order to obtain the best accuracy, select the low-pass filter corresponding to the modulation frequency of the signal under test. See Fig. E1, and refer to SECTION B - SPECIFICATIONS under "AM MODULATION Accuracy".

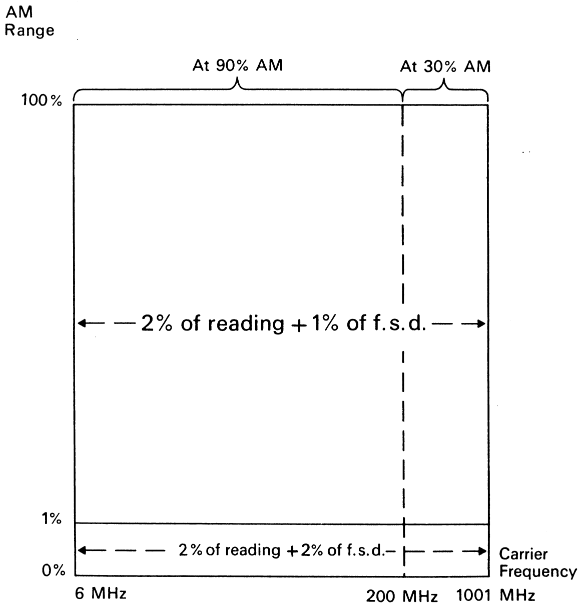


Fig. E1. Accuracy of modulation percentage measurements.

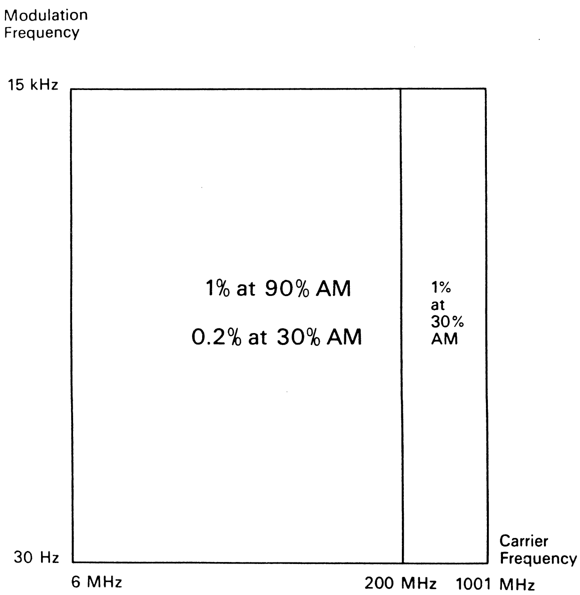


Fig. E2. Distortion for modulation percentage measurements.

12) Turn the selector FUNCTION to AM+ or AM-, depending on which peak of modulation is to be measured.

13) Rotate the selector METER RANGE until a proper deflection is obtained.

14) Read the modulation percentage. Check whether the reading is the same for both peaks of modulation; a difference indicates distortion of the modulation envelope. See Fig. E2, and refer to SECTION B - SPECIFICATIONS under "AM MODULATION Distortion".

Residual AM on FM Signals

Proceed as described above. If resolution somewhat higher than that corresponding to the 1% AM range is wanted, an external meter, e.g., an electronic voltmeter, may be connected to the AF OUTPUT connector. The external meter will read 1 volt for full deflection of the internal meter, i.e., with the METER RANGE selector set to 1, the modulation percentage read on the voltmeter is 0.001% per mV.

The minimum residual AM reading for a given deviation caused by the instrument itself can be estimated as follows:

1) Apply a CW signal and set the selector FUNCTION to LEVEL.

2) Rotate the TUNING knob back and forth so that the intermediate frequency is changed over the range 1 MHz $-\Delta F$ to 1 MHz $+\Delta f$, where Δf is the deviation of the frequency-modulated signal whose residual AM is to be measured. (Check the frequency change with the IF CHECK scale.)

3) Read the peak-to-peak value of the

change in the LEVEL reading. The minimum residual AM is approx. half of this percentage change.

MEASURING FREQUENCY DEVIATION (FM kHz)

Frequency Deviation of FM signals

1) Feed the signal to be measured to the RF INPUT connector. Bear in mind that the max. applicable signal is 10 V r.m.s. and that the input impedance is 50 Ω.

2) Use the RF input attenuator according to the instructions printed on the front panel, or refer to Fig.D3 in SECTION D - GENERAL DESCRIPTION.

3) Set the switch METER to SLOW if the modulation frequency of the signal is less than 160 Hz; otherwise set it to FAST.

4) Set the switch MAN.-AUTO. to MAN.

5) Set the drum scale to the desired frequency range by using the RANGE selector.

6) Set the selector FUNCTION to LEVEL.

7) Set the TUNING knob so that the cursor on the drum scale indicates the signal frequency ±1 MHz, and then tune so as to obtain maximum deflection.

8) Turn the selector FUNCTION to IF CHECK.

9) Make a fine adjustment with the TUNING knob so that the meter reads IF CHECK.

10) Set the selector FUNCTION to LEVEL. When using MAN.-AUTO. in position MAN., readjust to the LEVEL mark. When using MAN.-AUTO. in position AUTO., fine level-adjustment can be accomplished by means of LEVEL.

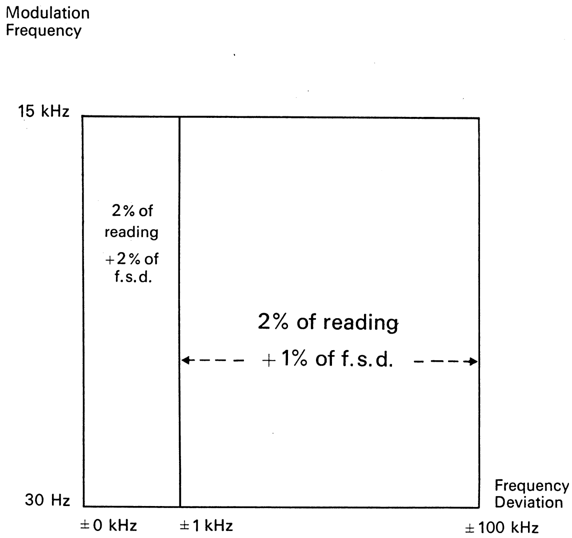


Fig. E3. Accuracy of frequency deviation measurements.

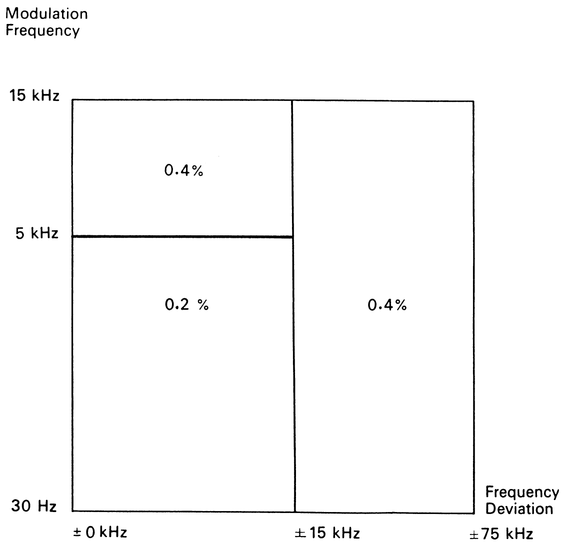


Fig. E4. Distortion for frequency deviation measurements.

11) In order to obtain the best accuracy, select the low-pass filter corresponding to the modulation frequency of the signal under test. See Fig. E3, and refer to SECTION B - SPECIFICATIONS under "FM MODULATION - Accuracy".

12) Turn the selector FUNCTION to FM+ or FM-, depending on which peak of modulation is to be measured.

13) Rotate the selector METER RANGE until a proper deflection is obtained.

14) Read the modulation deviation. Check whether the reading is the same for both peaks of modulation: a difference indicates distortion of the modulation envelope. See Fig. E4, and refer to SECTION B - SPECIFICATIONS under "FM MODULATION - Distortion".

Residual FM on CW and AM signals

Proceed as described immediately above. Because of the very effective limiter stages in the FM detector, the residual FM caused by amplitude modulation is quite low, viz. 25 Hz (r.m.s.) when the band-pass filter (50 Hz - 15 kHz) is used. The residual FM at a carrier frequency within 6 - 200 MHz is less than 25 Hz FM (r.m.s.), and less than 100 Hz FM (r.m.s.) up to 1001 MHz, when measurements are performed in a room with an acoustical noise level lower than 60 dB (rel. 2 10^{-4} μbar) and the band-pass filter (50 Hz - 15 kHz) or one of the deemphases (50 μs or 75 μs) is used. When the 0.3 - 3 kHz band-pass filter or the 750 μs deemphasis is used, the residual FM is 8 Hz FM (r.m.s.) within the frequency range 6 - 200 MHz, and less than 30 Hz FM (r.m.s.) up to 1001 MHz for the noise level specified above. (See SECTION B - SPECIFICATIONS.)

If a resolution somewhat higher than that corresponding to the 1 kHz deviation range is wanted, an electronic voltmeter can be connected to the AF OUTPUT terminals. The external meter will read 1 volt for full deflection of the internal meter, i.e., with the METER switch set to 1, the deviation read on

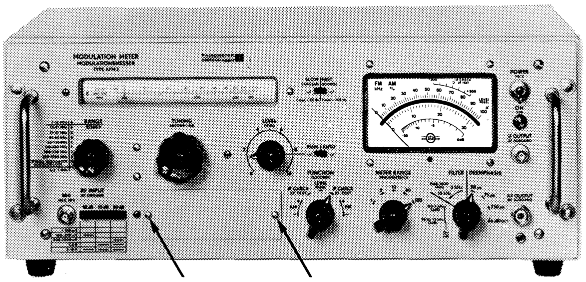


Fig. E5. The arrows show screws and plate to be removed when a plug-in unit is to be used.

the electronic voltmeter will be 1 Hz per mV.

USING A CRYSTAL OSCILLATOR PLUG-IN UNIT, CODE 900-252

1) Remove the two screws and the plate covering the receptacle in which the Crystal Oscillator Unit is to be placed (see Fig. E5).

2) Supply the Crystal Oscillator Unit with crystals. Bear in mind that the crystals must have the frequency f_{cr} defined below:

$$f_{cr} = \frac{f_s - 1}{2n} \text{ MHz}$$

where f_s indicates the carrier frequency and n the odd harmonic of the crystal overtone frequency. The sensitivity specifications (see item INPUT LEVEL in SECTION B - SPECIFICATIONS or Fig. E6) are based on the combinations shown below of carrier frequency, order of harmonic, and range of crystal frequencies.

Carrier frequency	Order of harmonic	Range of crystal frequencies
f_s	n	f_{cr}
200 - 600 MHz	3	33 - 100 MHz
600 - 1000 MHz	5	60 - 100 MHz

3) Position the Crystal Oscillator Unit in the Modulation Meter and fasten the two screws.

4) Switch the RANGE selector to position G - "CRYSTAL OSCILLATOR".

5) Tune the Modulation Meter to the desired carrier frequency.

6) Switch the function selector to IF CHECK.

7) Switch the Crystal Oscillator Unit to the desired channel by means of the four-position selector.

8) Insert a screwdriver in the hole corresponding to the selected channel, and adjust the corresponding trimmer until the meter indicates IF CHECK.

9) If necessary, repeat steps 6 to 8 until all four channels are trimmed.

10) The Crystal Oscillator Unit, code 900-252, is now ready for use.

Proceed as described above for AM or FM measurements.

USING AN EXTERNAL-OSCILLATOR AMPLIFIER, CODE 900-253

1) Remove the two screws and the plate covering the receptacle in which the External-Oscillator Amplifier is to be placed (see Fig. E5).

2) Position the External-Oscillator Amplifier in the Modulation Meter and fasten the two screws.

3) Connect the driving oscillator signal to the input of the External-Oscillator Amplifier, and proceed as described above for AM and FM measurements.

Section F. Technical Description

RF INPUT CIRCUIT (See diagram No. I)

The RF input signal is fed to the BNC connector on the front plate of the instrument, then passed through a resistive attenuator (providing for 10 dB, 20 dB, 30 dB or 40 dB attenuation) which is inserted to avoid overloading of the mixer and to adapt the Modulation Meter to RF signals in the range 3 mV to 10 V r.m.s.

All components of the RF attenuator are numbered between 1300 and 1399.

TUNER (See diagram No. I)

The local oscillator consists of Q103 in a common-base Hartley coupling. The same circuit configuration is used in all ranges. Only the tank circuit (C_C, C_B, and L_A) and the emitter capacitor C_A are exchanged to obtain the different fundamental ranges from 7 to 200 MHz. Up to 200 MHz the mixing takes place with the fundamental frequency of the local oscillator. Mixing with input signals which have a frequency higher than 200 MHz is accomplished with the 3rd or 5th harmonics of the local oscillator.

The intermediate frequency is chosen to be 1 MHz, and both sidebands can be used; however, only the lower sideband can be used at 6 MHz RF input signal because the lower frequency limit of the local oscillator is 7 MHz.

With the selector RANGE in position CRYSTAL OSCILLATOR, the local oscillator is disconnected, and an oscillator providing for operation at a fixed frequency, such as the Crystal Oscillator Unit, code 900-252, may be used.

The signal from the RF attenuator and that from the local oscillator or the Crystal Oscillator Unit are fed to the diodes CR101 to CR104 which form a balanced mixer and provide for good insulation between the input terminals and the local oscillator or the Crystal Oscillator Unit, and thereby reduce the influence of stray radiation. The resulting 1 MHz signal is fed to the IF filter via T102.

The tuner has its own current limiters, i.e., Q101 for +12 V, and Q102 for -12 V.

All components of the tuner are numbered between 100 and 199.

IF FILTER (See diagram No. II)

The output impedance of the mixer is matched capacitively to that of the IF filter. In this fashion, variations of the output impedance of the mixer become uncritical. From T102, the intermediate frequency signal of 1 MHz passes through a band-pass filter which rejects unwanted mixing products. It is of the Butterworth type, and it has a bandwidth of ±300 kHz around the intermediate frequency.

All components of the IF filter are numbered between 200 and 299.

IF PREAMPLIFIER AND IF ATTENUATOR (See diagram No.III)

The three-stage IF preamplifier consists of Q301, Q302, and Q303. It protects the IF filter against load impedance variations from the IF attenuator. At the same time, it provides for amplification before the signal is fed to the IF attenuator. Amplification alongside with an almost ideal connection to the IF filter results in a minimum amount of noise at all input levels. The ohmic part of the IF amplifier input is matched by means of R304, and the reactive part by means of C306. The amplified IF signal is then fed to the IF attenuator via C308.

The IF attenuator (see Fig.F1) consists of R311 and the four diodes CR301 to CR304. R311 and the four diodes form a voltage divider with one fixed resistance and the variable resistance resulting from the combination CR301 - CR302 // CR303 - CR304. Combining these four diodes ensures linear characteristic and thereby minimum distortion. The resistance value resulting from the above combination depends on the biasing current of the four diodes. This biasing current is drawn from the collector of the current generator Q310. In position MAN. of the MAN.-AUTO switch, the base of Q310 is at a potential determined by the reference voltage source Q311. The emitter current of Q310, and thereby its collector current, is controlled by means of the potentiometer R1A (LEVEL) accessible from the front of the instrument. This results in regulation of the biasing current of the diode complex CR301 to CR304, and, therefore, in regulation of the IF level. Finally, the sensitivity of the IF attenuator at a given RF input voltage can be adjusted by means of R345.

When the switch MAN.-AUTO is in position AUTO., the base of Q310 is at a voltage delivered by the AGC amplifier. The AGC amplifier consists of a differential amplifier Q512, followed by a unity-gain amplifier Q308 and Q309. The right base of Q512 is at a potential determined by the divider consisting of R1B (LEVEL), R552, R553, and R554. The left base of Q512 receives a signal proportional to the IF level from the AM detector. The difference signal (if any) is then fed to the input (base of Q308) of the unity-gain amplifier driving the amplifier Q310. The emitter of Q310 is at a voltage provided by the voltage reference source Q311. The emitter basis voltage of Q310, and thereby the biasing current of the diodes CR310 to CR304, is in this case controlled by the potentiometer R1B (LEVEL) and by the AGC amplifier.

All components of the IF preamplifier and IF attenuator are numbered between 300 and 399.

IF AMPLIFIER (See diagram No.III)

The signal from the IF attenuator is then fed to the IF amplifier which consists of the two wideband amplifier stages Q304, Q305 and Q306, Q307. The IF amplifier brings the IF signal to a voltage level higher than that required by the AM detector.

All components of the IF amplifier are numbered between 300 and 399.

BUFFER AMPLIFIER (See diagram No.V)

The signal from the IF amplifier is fed to a buffer amplifier which separates

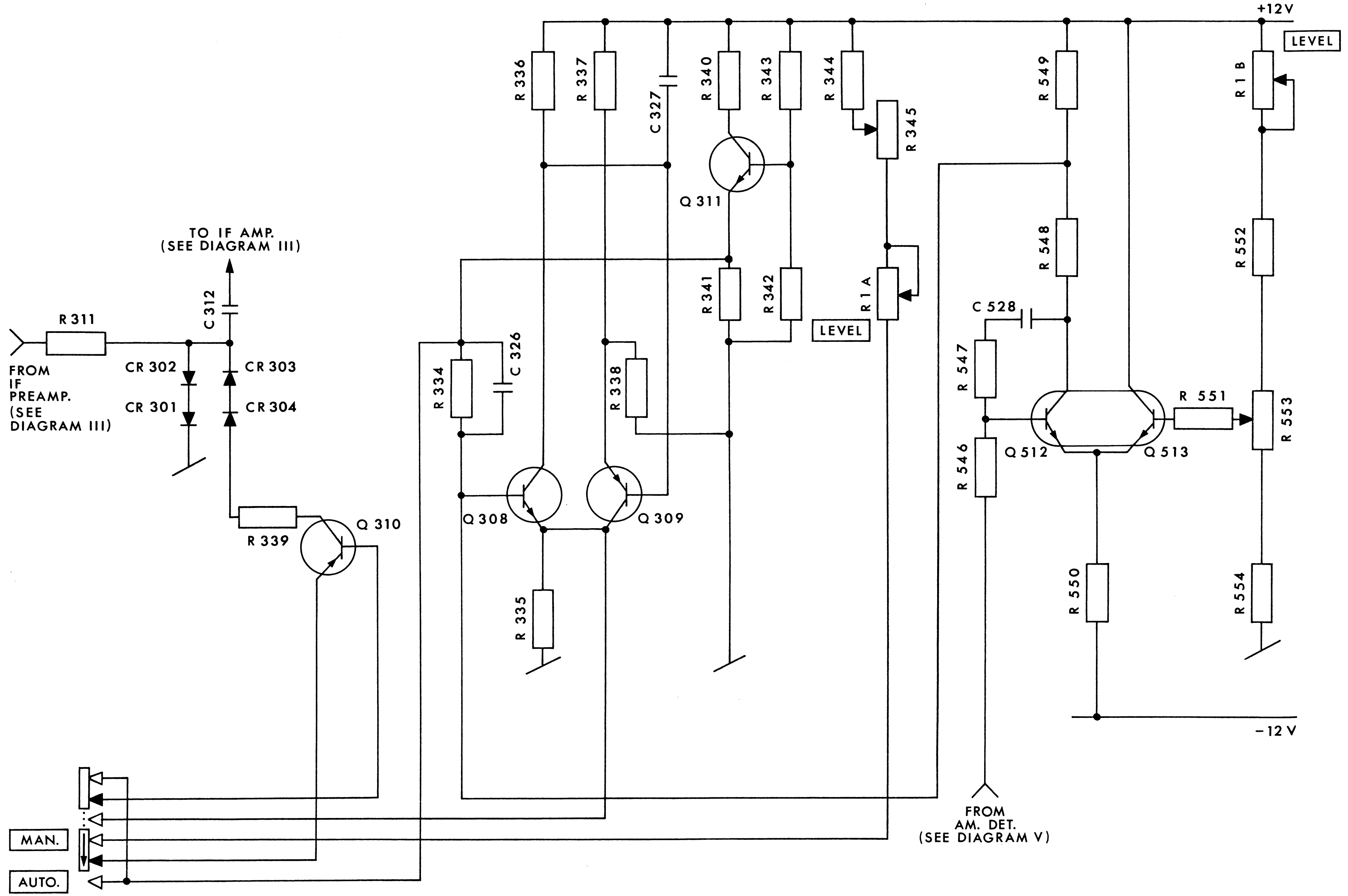


Fig. F1. IF attenuator and AGC amplifier.

AM detector and output amplifier. It consists of a two-stage unity-gain amplifier (Q501 and Q502) and serves to suppress any influence from the IF output. The signal from the buffer amplifier is fed both to the AM detector and to the IF output amplifier.

All components of the Buffer amplifier are numbered between 500 and 599.

AM DETECTOR (See diagram No.V)

The signal from the buffer amplifier is fed to the AM detector. It consists of a three-stage amplifier Q507, Q508, and Q509, with a mean-value detector CR505 and CR506 in the feedback loop. The feedback ensures a good linearity. A pair of output transistors, Q510 and Q511, provides for two outputs. The signal on the collector of Q511 is proportional to the IF level. This signal is fed via R546 to the differential amplifier which is part of the automatic level-setting circuitry (described above). The signal from the collector of Q511 is also fed via R544 to the indicating meter which provides for checking of the IF level.

The signal on the collector Q510 is the detected signal which is fed through a first low-pass filter section (L701, L702, C710 and C711 on diagram VII), via the network consisting of R537, R538, R539, and C530. R539 is used to calibrate the AM detector.

Note: The low-pass filter and the following AF section are described below.

All the components of the AM detector are numbered from 500 to 599.

IF OUTPUT AMPLIFIER (See diagram No.V)

The signal from the buffer amplifier is also fed to the IF output amplifier which consists of the four stages Q503, Q504, Q505, and Q506, and which provides for amplification of the IF signal to the level required by the following limiter stages. The two diodes CR502 and CR503 are used to protect the limiter input stage against too high a voltage.

All components of the IF output amplifier are numbered between 500 and 599.

LIMITER STAGES (See diagram No.VI)

General

The amplified IF signal is fed to a series of three limiters.

First limiter stage

The first limiter stage consists of two emitter-coupled transistors, Q601 and Q602. Their working point is determined by the current delivered by the constant dc current generator Q607. The amplified IF signal from the IF output amplifier is fed to the base of Q601, whilst the base of Q602 is connected to ground. When a sufficient IF level is reached, Q601 and Q602 are cut off, and the output voltage (at C605) of the first limiter is a square-wave. The peak-to-peak value of this square-wave is fixed by the constant current generator Q607. The first limiter is provided with a regulation circuit which holds the zero-crossing of the square-wave output voltage. The regulation circuit consists of a peak-difference detector, CR601 and CR602, and a differential amplifier, Q603 and Q604, where any signal from the peak-difference detector is compared with the dc component of the square-wave. The output signal (if any) of the differential amplifier is fed to the bases of Q601 and Q602 via the two emitter-followers Q605 and Q606.

Subsequent limiter stages

From C605, the square-wave signal is fed to two subsequent limiter stages Q608-Q609 and Q610-Q611 where it is again limited. The resulting signal is then fed to the FM detector via Q612.

All components of the limiter stages are numbered from 600 to 699.

FM DETECTOR (See diagram No.VII)

The FM detector consists of a monostable multivibrator and an output stage.

The multivibrator consists of Q701 and Q702. It is triggered by the train of positive pulses from the last limiter stage. This train of pulses is fed to the base of Q701 via C701. Transistor Q701 is cut off when no IF signal is applied to its base whilst transistor Q702 conducts, and conversely.

The multivibrator has a time-constant determined by R707, R708 and C703, and it delivers a square-wave signal across R702. The positive pulses drive the output stage which consists of Q703 and Q704. The working points of the two transistors of the output stage are determined by the constant dc current generator Q708. The peak value of the square-wave is detected by CR704 and amplified in Q705 and Q706, which in turn drive the constant-current generator Q708 via Q707, thereby regulating amplitude variations. As the width of the pulses and their amplitude are constant, the mean value of the output voltage of the output stage will vary according to the number of pulses per second of the square-wave. i.e., according to the modulating frequency. Frequency-modulation of the IF signal will cause a variation of the output voltage of the output stage. This signal is then passed, via a low-pass filter consisting of L701, L702, C711 and C712, to the AF section described below.

The monostable multivibrator and the output stage are provided with their own +10 V and -10 V regulated power supplies. They consist of Q613, Q614, Q615 and Q616 for +10 V, and of Q617, Q618, Q619 and Q620 for -10 V. (See diagram VI.)

All components of the FM detectors are numbered between 700 and 799.

AF AMPLIFIERS I AND II (See diagram VIII)

The filtered signal, either from the AM detector or from the FM detector, is then passed through the first section of a two-section resistive AF attenuator (see diagram XII) and fed to the first AF AMPLIFIER, which consists of Q801, Q802, and Q803.

The amplified signal at the collector of Q803 is passed via the second section of the AF attenuator (see diagram XII) and fed to the second AF AMPLIFIER which consists of Q804, Q805 and Q806. It provides for the necessary amplification and for the low output impedance required for coupling to the subsequent low-pass filter.

All components of the AF AMPLIFIERS I and II are numbered from 800 to 899.

AF AMPLIFIERS III - V (See diagram IX)

The amplified signal from amplifier II is fed to the third AF amplifier, which is a unity gain amplifier consisting of Q901 and Q902. It acts either as part of an active filter, in conjunction with the RC networks of the FILTER/DEEMPHASIS selector, or as a buffer.

The following AF amplifiers IV and V, consist respectively of Q903, Q904, Q905, Q906, Q907, and of Q908, Q910, Q911 and Q912. They bring the signal up to the level required by the AF detector.

The AF OUTPUT signal is drawn from the emitter of Q907 via R920.

All the components of the AF amplifiers III - V are numbered from 900 to 999.

AF DETECTOR (See diagram X)

The signal from the emitter of Q912 is fed to the AF detector which consists of diodes CR1001 and CR1002. Diode CR1002 is used for detection of the negative peaks of modulation, whilst diode CR1001 is used for detection of the positive modulation peaks. Selection of the peak of modulation (positive or negative) is done by means of the FUNCTION selector in the positions AM or FM.

The detected signal is fed to an impedance converter so that it can be passed on to the MOD. (DC) output and to the meter.

All the components of the AF detector are numbered from 1000 to 1099.

POWER SUPPLY (See diagram XI)

The power supply provides for the regulated dc voltages (-12 V, 0 V, +12 V) required by the different sections of the instrument. (For -10 V and +10 V supply, see FM DETECTOR.)

All the components of the power supply are numbered from 1100 to 1199.

Section H. Parts List

In the following parts list a group code prefix number is used. To facilitate the use of this code, the different types of parts and their corresponding group code prefixes are listed below:

Standard resistors	100- to 139-
Precision resistors	140- to 152-
Non-linear resistors	160-
UHF resistors	170- to 172-
Carbon potentiometers	180- to 185-
Wire-wound potentiometers	190- to 195-
Mica capacitors	200- to 208-
Ceramic capacitors	210- to 214-
Paper capacitors	220- to 222-
Metal-paper capacitors	224- to 229-
Plastic capacitors	240- to 245-
Electrolytic capacitors	260- to 267-
Variable capacitors	280- to 286-
Special tubes	310-
Rectifiers	340- to 341-
Diodes	350-
Transistors	360-
Integrated circuits	364-
Lamps, batteries, fuses	400- to 486-
Switches	500- to 580-
Coils, coil material and transformers	700- to 785-

As we are continually improving our instruments, it is important, when ordering spare parts, that you include the following information:

The code number and description of the part

The circuit reference from the wiring diagram

The complete type designation of your instrument

The serial number of your instrument

Please note that the position of any part can easily be found by referring to the last column of the parts list. This indicates on which figure the part can be located.

ˣIndicates special parts made by Radiometer.

MAIN PARTS LIST

CAPACITORS

Designation	Type	Value	Code No.
C1	polyester	2.2 µF 100 V	241-007
C10	polystyrene	50 nF 1% 63 V	243-019
C11	polystyrene	3 nF 2% 63 V	243-107
C12	polystyrene	3 nF 2% 63 V	243-107
C13	polystyrene	2 nF 1% 63 V	243-106
C14	tantalum	10 µF 15/18 V	267-003
C15	tantalum	10 µF 10% 10/12 V	267-017

LAMP

Designation	Type	Code No.
I1	neon lamp, 110 V, yellow	400-703

TERMINALS

Designation	Type	Code No.
J1	coaxial bushing BNC UG657/U	800-108
J3	coaxial bushing BNC UG657/U	800-108
J4	coaxial bushing UHF 83GB-73	800-009
J5	phone jack	803-241
J10	phone jack, red	803-206
J11	phone jack, black	803-205
J12	socket, 3-pole	805-430
J300	terminal strip, 20-pole	805-612
J500	terminal strip, 20-pole	805-612
J600	terminal strip, 10-pole	805-614
J700	terminal strip, 15-pole	805-613
J800	terminal strip, 20-pole	805-612
J900	terminal strip, 20-pole	805-612
J1000	terminal strip, 15-pole	805-613
J1100	terminal strip, 20-pole	805-612
J1200	terminal strip, 13-pole	805-639

INDUCTORS

Designation	Type	Code No.
L1	ferrite tube 15 mm	704-301
L2	ferrite tube 15 mm	704-301
L3	ferrite tube 15 mm	704-301
L4	ferrite tube 15 mm	704-301
L5	ferrite tube 15 mm	704-301
L6	ferrite tube 15 mm	704-301
L7	ferrite tube 15 mm	704-301
L8	ferrite tube 15 mm	704-301

METER

Designation	Type	Code No.
xM1	moving coil, 450 µA, with scale	482-140

RESISTORS

Designation	Type	Value	Code No.
R1	carbon pot.	500 Ω/250 kΩ pos. log.	180-203
xR2	wire-wound	110 Ω 2%	152-051
R3	metal film	4.95 kΩ 0.2% 0.25 W	140-393
R4	metal film	550 Ω 0.2% 0.25 W	140-390
R5	metal film	1 kΩ 0.2% 0.25 W	140-391
R6	metal film	3.16 kΩ 0.2% 0.25 W	140-392
R7	metal film	10 kΩ 0.2% 0.25 W	140-394
R8	carbon film	1.5 kΩ 5% 0.3 W	106-415
R9	carbon film	1.2 kΩ 5% 0.3 W	106-412
R14	metal film	1 kΩ 1% 0.1 W	140-477
R15	metal film	1.5 kΩ 1% 0.1 W	140-570
R16	metal film	15 kΩ 1% 0.1 W	140-575
R17	metal film	3.16 kΩ 1% 0.1 W	140-483
R24	metal film	56.2 kΩ 1% 0.1 W	140-443

RESISTORS

Designation	Type	Value	Code No.
R25	metal film	93.1 kΩ 1% 0.1 W	140-578
R31	metal film	22 kΩ 5% 0.2 W	106-522
R34	carbon film	51.1 Ω 1% 0.1 W	140-504
xR36	wire-wound	110 Ω 2%	152-051

SWITCHES

Designation	Type	Code No.
S1	switch "MAN./AUTO."	510-204
S3	switch "SLOW/FAST"	510-206
xS5	switch "RANGE"	550-985
xS6	switch "FUNCTION"	551-049
xS7	switch "DEEMPHASIS"	551-050
S8	power switch	500-102

TRANSFORMER

Designation	Type	Code No.
xT1	transformer	770-593

CABLES

Designation	Type	Code No.
W1	coaxial, 50 Ω, RG196/U, 0.20 m	600-014
W2	coaxial, 50 Ω, RG196/U, 0.17 m	600-014
W3	coaxial, 50 Ω, RG196/U, 0.13 m	600-014
W3	coaxial, 50 Ω, RG196/U, 0.085 m	600-014
W4	coaxial, 50 Ω, RG196/U, 0.165 m	600-014
W5	coaxial, 50 Ω, RG196/U, 0.045 m	600-014
W6	coaxial, 50 Ω, RG196/U, 0.045 m	600-014
W7	coaxial, 50 Ω, RG196/U, 0.39 m	600-014
W8	coaxial, 50 Ω, RG196/U, 0.195 m	600-014
W9	coaxial, 50 Ω, RG196/U, 0.18 m	600-014
W10	coaxial, 50 Ω, RG196/U, 0.155 m	600-014

W11	coaxial, 50 Ω, RG196/U, 0.205 m	600-014
W12	coaxial, 50 Ω, RG196/U, 0.275 m	600-014
W13	coaxial, 50 Ω, RG196/U, 0.16 m	600-014
W14	coaxial, 50 Ω, RG196/U, 0.145 m	600-014
W15	coaxial, 50 Ω, RG196/U, 0.23 m	600-014
W16	coaxial, 50 Ω, RG196/U	600-014
W17	coaxial, 50 Ω, RG196/U, 0.21 m	600-014
W18	coaxial, 50 Ω, RG196/U, 0.21 m	600-014
W19	coaxial, 50 Ω, RG196/U, 0.285 m	600-014
W20	coaxial, 50 Ω, RG196/U, 0.175 m	600-014
W21	coaxial, 50 Ω, RG196/U, 0.215 m	600-014
W22	coaxial, 50 Ω, RG196/U, 0.19 m	600-014
W23	coaxial, 50 Ω, RG196/U, 0.195 m	600-014
W24	coaxial, 50 Ω, RG196/U, 0.20 m	600-014
W25	coaxial, 50 Ω, RG196/U, 0.51 m	600-014
W26	coaxial, 50 Ω, RG196/U, 0.26 m	600-014
W27	coaxial, 50 Ω, RG196/U, 0.25 m	600-014
W29	coaxial, 110 Ω, T3283, 0.32 m	600-001
W30	coaxial, 50 Ω, RG196/U	600-014
W31	coaxial, 50 Ω, RG196/U, 0.155 m	600-014
W32	coaxial, 50 Ω, RG196/U	600-014
W2010	coaxial, 50 Ω, RG196/U	600-014

MISCELLANEOUS

Designation	Type	Code No.
x	knob N20	850-121
x	knob NPV18	850-122
x	knob N30	850-230
x	knob N40, with handle	850-241
x	rubber foot	855-002
x	scale A	861-220
x	scale B	861-214
x	scale C	861-215
x	scale D	861-216
x	scale E	861-217
x	scale F	861-218
x	scale G	861-221
x	scale, blank	861-219

TUNER Printed-circuit board

CAPACITORS

Designation	Type	Value	Code No.
C101	electrolytic	250 µF 10/12 V	267-017
C102	tantalum	10 µF 25 V	260-042
C103	ceramic	220 pF -20/+80% 25 V	213-018
C104	ceramic	22 µF -20/+80% 40 V	213-011
C105	ceramic	22 µF -20/+80% 40 V	213-011
C106	variable	ΔC 25 pF	285-513
C107	ceramic	2.2 nF -20/+80% 25 V	213-012
C108	trimmer	0.5-3 pF	286-206
C109	ceramic	1 nF -20/+80% 25 V	213-013
C110	trimmer	0.5-3 pF	286-206
C111	ceramic	1 nF -20/+80% 25 V	213-013
C112	trimmer	0.5-3 pF	286-206
C113	ceramic	470 pF -20/+80% 25 V	213-014
C114	trimmer	0.5-3 pF	286-206
C115	ceramic	220 pF -20/+80% 25 V	213-018
C116	trimmer	0.5-3 pF	286-206
C117	ceramic	47 pF 5%	210-247
C118	trimmer	0.5-3 pF	286-206
C119	ceramic	220 pF -20/+80% 25 V	213-018
C121	ceramic	2.2 pF ±0.25 pF	210-122

DIODES

Designation	Type	Code No.
CR101	diode HP5082-2812	350-802
CR102	diode HP5082-2812	350-802
CR103	diode HP5082-2812	350-802
CR104	diode HP5082-2812	350-802
L101	choke, 47 µH	703-008
L102	choke, 47 µH	703-008
xL103	oscillator coil	4993-A4
xL104	oscillator coil	4994-A4

xL105	oscillator coil	4995-A4
xL106	oscillator coil	4996-A4
xL107	oscillator coil	4997-A4
xL108	oscillator coil	4998-A4
L109	ferrite tube, 15 mm	704-301
L110	ferrite tube, 1.2/3.5 x 3.2	704-305
L113	ferrite tube, 1.2/3.5 x 3.2	704-305
L114	ferrite tube, 1.2/3.5 x 3.2	704-305
L115	choke, 47 µH	703-008
L116	ferrite tube, 7 mm	704-300
L117	ferrite tube, 1.2/3.5 x 3.2	704-305
L118	ferrite tube, 1.2/3.5 x 3.2	704-305

TRANSISTORS

Designation	Type	Code No.
Q101	transistor 2N3906	360-062
Q102	transistor BC149	360-072
Q103	transistor BFY90	360-071

RESISTORS

Designation	Type	Value	Code No.
R101	carbon film	100 Ω 5% 0.3 W	106-310
R102	carbon film	47 Ω 5% 0.3 W	106-247
R103	carbon film	1 kΩ 5% 0.3 W	106-410
R104	carbon film	5.6 kΩ 5% 0.3 W	106-456
R105	carbon film	100 Ω 5% 0.3 W	106-310
R106	carbon film	47 Ω 5% 0.3 W	106-247
R107	carbon film	1 kΩ 5% 0.3 W	106-410
R108	carbon film	6.8 kΩ 5% 0.3 W	106-468
R109	carbon film	3.3 kΩ 5% 0.3 W	106-433
R110	carbon film	6.8 kΩ 5% 0.3 W	106-468
R111	carbon film	1 kΩ 5% 0.3 W	106-410
R112	carbon film	50 Ω 5% 0.3 W	106-355
R113	carbon film	50 Ω 5% 0.3 W	106-355

TRANSFORMERS

Designation	Type	Code No.
xT101	transformer	5029-A4
xT102	transformer	6376-A4

FILTER - DEEMPHASIS Printed-circuit board

CAPACITORS

Designation	Type	Value	Code No.	Shown Fig.
C2	polystyrene	50 nF 1% 63 V	243-019	H1
C3	polystyrene	12 nF 2% 63 V	243-017	H1
C4	polystyrene	4 nF 1% 63 V	243-043	H1
C5	polystyrene	12 nF 2% 63 V	243-017	H1
C6	polystyrene	6 nF 2% 63 V	243-016	H1
C7	polystyrene	6 nF 2% 63 V	243-016	H1
C8	polystyrene	50 nF 1% 63 V	243-019	H1
C9	polystyrene	12 nF 2% 63 V	243-017	H1

RESISTORS

Designation	Type	Value	Code No.	Shown Fig.
R10	metal film	3.7 kΩ 1% 0.1 W	140-572	H1
R11	metal film	14 kΩ 1% 0.1 W	140-574	H1
R12	metal film	649 kΩ 1% 0.1 W	140-568	H1
R13	metal film	3.48 kΩ 1% 0.1 W	140-571	H1
R18	metal film	3.74 kΩ 1% 0.1 W	140-572	H1
R19	metal film	14 kΩ 1% 0.1 W	140-574	H1
R20	metal film	649 kΩ 1% 0.1 W	140-568	H1
R21	metal film	3.48 kΩ 1% 0.1 W	140-571	H1
R22	metal film	46.4 kΩ 1% 0.1 W	140-576	H1
R23	metal film	14 kΩ 1% 0.1 W	140-574	H1
R26	metal film	1.27 kΩ 1% 0.1 W	140-569	H1
R27	carbon pot.	1 kΩ lin. 0.1 W	182-030	H1
R28	carbon pot.	500 Ω lin. 0.1 W	182-038	H1
R29	carbon pot.	500 Ω lin. 0.1 W	182-038	H1
R30	metal film	1.78 kΩ 1% 0.125 W	140-580	H1

RF ATTENUATOR Printed-circuit board

CAPACITORS

Designation	Type	Value	Code No.	Shown Fig.
C1301	ceramic	1 pF ±0.25 pF	210-110	H2
C1302	ceramic	1 pF ±0.25 pF	210-110	H2

RESISTORS

Designation	Type	Value	Code No.	Shown Fig.
R1300	metal film	95.3 Ω 1% 0.5 W	140-428	H2
R1302	metal film	95.3 Ω 1% 0.5 W	140-428	H2
R1303	metal film	95.3 Ω 1% 0.5 W	140-428	H2
R1305	metal film	95.3 Ω 1% 0.5 W	140-428	H2
R1306	metal film	95.3 Ω 1% 0.5 W	140-428	H2
R1307	metal film	71.5 Ω 1% 0.5 W	140-429	H2
R1308	metal film	48.7 Ω 1% 0.5 W	140-430	H2
R1309	metal film	71.5 Ω 1% 0.5 W	140-429	H2
R1310	metal film	95.3 Ω 1% 0.5 W	140-428	H2
R1311	metal film	143 Ω 1% 0.1 W	140-527	H2
R1312	metal film	143 Ω 1% 0.1 W	140-527	H2
R1313	metal film	143 Ω 1% 0.1 W	140-527	H2
R1314	metal film	143 Ω 1% 0.1 W	140-527	H2

SWITCH

Designation	Type	Code No.	Shown Fig.
S1300	switch "ATTENUATOR"	550-992	H2

IF FILTER (WIDE) Printed-circuit board

CAPACITORS

Designation	Type	Value	Code No.	Shown Fig.
C201	polystyrene	4.476 nF 1% 63 V	243-161	H3
C202	polystyrene	1.875 nF 1% 63 V	243-161	H3
C203	polystyrene	2.863 nF 1% 63 V	243-161	H3
C204	polystyrene	2.433 nF 1% 63 V	243-161	H3
C205	polystyrene	1.098 nF 1% 63 V	243-161	H3
C206	polystyrene	4.198 nF 1% 63 V	243-161	H3
C207	polystyrene	1.768 nF 1% 63 V	243-161	H3

COILS

Designation	Type	Value	Code No.	Shown Fig.
xL201	filter coil	11 µH	6430-A4	H3
xL202	filter coil	11 µH	6430-A4	H3
xL203	filter coil	11 µH	6430-A4	H3

CABLE

Designation	Type	Code No.
W2010	coaxial, 50 Ω, RG196/U	600-014

IF AMPLIFIER and ATTENUATOR Printed-circuit board

CAPACITORS

Designation	Type	Value	Code No.	Shown Fig.
C301	polyester	0.1 μF 10% 250 V	241-017	H4
C302	ceramic	47 pF 5%	210-247	H4
C303	ceramic	1 pF ±0.25 pF	210-110	H4
C304	ceramic	47 nF -20/+80% 30 V	213-016	H4
C305	ceramic	47 nF -20/+80% 30 V	213-016	H4
C306	trimmer	10-60 pF	286-006	H4
C307	ceramic	22 nF -20/+80% 40 V	213-011	H4
C308	ceramic	10 nF -20/+50% 40 V	213-020	H4
C309	ceramic	47 nF -20/+80% 30 V	213-016	H4
C311	ceramic	0.1 μF -20/+80% 12 V	213-017	H4
C312	ceramic	10 nF -20/+50% 40 V	213-020	H4
C313	ceramic	47 nF -20/+80% 30 V	213-016	H4
C314	ceramic	3.3 pF ±0.5 pF	210-133	H4
C315	ceramic	47 nF -20/+80% 30 V	213-016	H4
C316	ceramic	0.1 μF -20/+80% 12 V	213-017	H4
C317	ceramic	10 pF 5%	210-210	H4
C318	ceramic	47 nF -20/+80% 30 V	213-016	H4
C319	ceramic	10 nF -20/+50% 40 V	213-020	H4
C320	ceramic	47 nF -20/+80% 30 V	213-016	H4
C321	ceramic	47 nF -20/+80% 30 V	213-016	H4
C322	ceramic	0.1 μF -20/+80% 12 V	213-017	H4
C323	ceramic	22 pF 5%	210-222	H4
C324	polyester	0.22 μF 10% 63 V	241-036	H4
C325	ceramic	0.1 μF -20/+80% 12 V	213-017	H4
C326	polyester	1.5 μF 10% 160 V	241-029	H4
C327	ceramic	4.7 nF -20/+80% 40 V	213-010	H4
C328	ceramic	82 pF 5%	211-282	H4

DIODES

Designation	Type	Code No.	Shown Fig.
CR301	diode BAY74	350-413	H4
CR302	diode BAY74	350-413	H4
CR303	diode BAY74	350-413	H4
CR304	diode BAY74	350-413	H4

TERMINALS

Designation	Type	Code No.	Shown Fig.
P300	terminal strip, 20-pole	805-612	H4

TRANSISTORS

Designation	Type	Code No.	Shown Fig.
Q301	transistor BFY90	360-071	H4
Q302	transistor 2N3904	360-064	H4
Q303	transistor 2N3906	360-062	H4
Q304	transistor BFY90	360-071	H4
Q305	transistor 2N3906	360-062	H4
Q306	transistor 2N3904	360-064	H4
Q307	transistor 2N3906	360-062	H4
Q308	transistor BC149	360-072	H4
Q309	transistor 2N3906	360-062	H4
Q310	transistor 2N3906	360-062	H4
Q311	transistor BC149	360-072	H4

RESISTORS

Designation	Type	Value	Code No.	Shown Fig.
R300	carbon film	1 kΩ 5% 0.3 W	106-410	H4
R301	metal film	48.7 Ω 1%	140-430	H4
R302	carbon film	47 Ω 5% 0.3 W	106-247	H4
R303	carbon film	390 Ω 5% 0.3 W	106-339	H4
R304	carbon pot.	1 kΩ lin. 0.3 W	182-030	H4
R305	carbon film	680 Ω 5% 0.3 W	106-368	H4
R306	carbon film	100 Ω 5% 0.3 W	106-310	H4
R307	carbon film	12 Ω 5% 0.3 W	106-212	H4
R308	carbon film	1.8 kΩ 5% 0.3 W	106-418	H4
R309	carbon film	4.7 kΩ 5% 0.3 W	106-447	H4
R310	carbon film	8.2 kΩ 5% 0.3 W	106-482	H4
R311	carbon film	1.2 kΩ 5% 0.3 W	106-412	H4
R312	carbon film	1.2 kΩ 5% 0.3 W	106-412	H4
R313	carbon film	39 Ω 5% 0.3 W	106-239	H4
R314	carbon film	8.2 kΩ 5% 0.3 W	106-482	H4
R315	carbon film	3.3 kΩ 5% 0.3 W	106-433	H4
R316	carbon film	1.5 kΩ 5% 0.3 W	106-415	H4
R317	carbon film	3.9 kΩ 5% 0.3 W	106-439	H4
R318	carbon film	22 Ω 5% 0.3 W	106-222	H4
R319	carbon film	270 Ω 5% 0.3 W	106-327	H4
R320	carbon film	150 Ω 5% 0.3 W	106-315	H4
R321	carbon film	82 Ω 5% 0.3 W	106-282	H4
R322	carbon film	2.2 kΩ 5% 0.3 W	106-422	H4
R323	carbon film	100 Ω 5% 0.3 W	106-310	H4
R324	carbon film	3.3 kΩ 5% 0.3 W	106-433	H4
R325	carbon film	8.2 kΩ 5% 0.3 W	106-482	H4
R326	carbon film	100 Ω 5% 0.3 W	106-310	H4
R327	carbon film	100 Ω 5% 0.3 W	106-310	H4
R328	carbon film	2.2 kΩ 5% 0.3 W	106-422	H4
R329	carbon film	33 Ω 5% 0.3 W	106-233	H4
R330	carbon film	470 Ω 5% 0.3 W	106-347	H4
R331	carbon film	180 Ω 5% 0.3 W	106-318	H4
R332	carbon film	82 Ω 5% 0.3 W	106-282	H4

R333	carbon film	330 Ω 5% 0.3 W	106-333	H4
R334	carbon film	27 kΩ 5% 0.3 W	106-527	H4
R335	carbon film	3.3 kΩ 5% 0.3 W	106-433	H4
R336	carbon film	15 kΩ 5% 0.3 W	106-515	H4
R337	carbon film	330 Ω 5% 0.3 W	106-333	H4
R338	carbon film	1.8 kΩ 5% 0.3 W	106-418	H4
R339	carbon film	68 Ω 5% 0.3 W	106-268	H4
R340	carbon film	100 Ω 5% 0.3 W	106-310	H4
R341	carbon film	1.5 kΩ 5% 0.3 W	106-415	H4
R342	carbon film	3.3 kΩ 5% 0.3 W	106-433	H4
R343	carbon film	1.5 kΩ 5% 0.3 W	106-415	H4
R344	carbon film	150 Ω 5% 0.3 W	106-315	H4
R345	carbon pot.	250 Ω lin. 0.1 W	182-039	H4

CABLE

Designation	Type	Code No.	Shown Fig.
W300	coaxial, 50 Ω, RG196/U, 0.14 m	600-014	H4

AM DETECTOR and IF OUTPUT AMPLIFIER

Printed-circuit board

CAPACITORS

Designation	Type	Value	Code No.	Shown Fig.
C501	polystyrene	200 pF 5% 160 V	243-001	H5
C502	ceramic	47 nF -20/+80% 30 V	213-016	H5
C503	polystyrene	100 pF 5% 125 V	243-037	H5
C504	ceramic	0.1 μF -20/+80% 12 V	213-017	H5
C505	ceramic	47 nF -20/+80% 30 V	213-016	H5
C506	polystyrene	150 pF 5% 125 V	243-030	H5
C507	ceramic	47 pF 5%	210-247	H5
C508	ceramic	47 nF -20/+80% 30 V	213-016	H5
C510	tantalum	10 μF 15 V	267-000	H5
C511	ceramic	3.3 pF ±0.5 pF	210-133	H5
C512	ceramic	47 nF -20/+80% 30 V	213-016	H5
C513	ceramic	47 nF -20/+80% 30 V	213-016	H5
C514	ceramic	47 nF -20/+80% 30 V	213-016	H5
C515	tantalum	10 μF 15 V	267-000	H5
C516	tantalum	10 μF 15 V	267-000	H5
C517	polystyrene	200 nF 2% 63 V	243-141	H5
C518	ceramic	10 nF -20/+80% 40 V	213-020	H5
C519	polystyrene	120 pF 5% 63 V	243-130	H5
C520	ceramic	47 nF -20/+80% 30 V	213-016	H5
C521	ceramic	22 nF -20/+80% 40 V	213-011	H5
C522	ceramic	0.1 μF -20/+80% 12 V	213-017	H5
C523	ceramic	2.2 nF -20/+80% 25 V	213-012	H5
C524	polystyrene	500 pF 2% 63 V	243-134	H5
C525	ceramic	0.1 μF -20/+80% 12 V	213-017	H5
C526	ceramic	0.1 μF -20/+80% 12 V	213-017	H5
C527	polystyrene	500 pF 2% 63 V	243-134	H5
C528	polyester	10 μF 10% 63 V	241-028	H5
C529	ceramic	220 pF 5%	211-322	H5
C530	tantalum	68 μF 15/18 V	267-015	H5
C531	polystyrene	300 pF 5% 63 V	243-133	H5

DIODES

Designation	Type	Code No.	Shown Fig.
CR501	zener diode BZY88C9V1	350-606	H5
CR502	diode 1N916	350-019	H5
CR503	diode 1N916	350-019	H5
CR504	zener diode BZY99C7V5	350-621	H5
CR505	diode ITT700	350-028	H5
CR506	diode ITT700	350-028	H5

COILS

Designation	Type	Value	Code No.	Shown Fig.
L501	choke	100 μH	703-009	H5
L502	choke	100 μH 2%	703-015	H5

TERMINALS

Designation	Type	Code No.	Shown Fig.
P500	terminal strip, 20-pole	805-612	H5

TRANSISTORS

Designation	Type	Code No.	Shown Fig.
Q501	transistor 2N3904	360-064	H5
Q502	transistor 2N3906	360-062	H5
Q503	transistor 2N3904	360-064	H5
Q504	transistor 2N3904	360-064	H5
Q505	transistor 2N3904	360-064	H5
Q506	transistor 2N3906	360-062	H5
Q507	transistor 2N3904	360-064	H5
Q508	transistor 2N3906	360-062	H5
Q509	transistor 2N3906	360-062	H5
Q510	transistor 2N3904	360-064	H5
Q511	transistor 2N3906	360-062	H5
Q512	transistor TD121	360-077	H5

RESISTORS

Designation	Type	Value	Code No.	Shown Fig.
R501	carbon film	10 kΩ 5% 0.3 W	106-510	H5
R502	carbon film	4.7 kΩ 5% 0.3 W	106-447	H5
R503	carbon film	27 Ω 5% 0.3 W	106-227	H5
R504	carbon film	560 Ω 5% 0.3 W	106-356	H5
R505	carbon film	120 Ω 5% 0.3 W	106-312	H5
R506	carbon film	47 Ω 5% 0.3 W	106-247	H5
R507	carbon film	330 Ω 5% 0.3 W	106-333	H5
R508	carbon film	22 Ω 5% 0.3 W	106-222	H5
R509	carbon film	47 Ω 5% 0.3 W	106-247	H5
R510	carbon film	2.7 kΩ 5% 0.3 W	106-427	H5
R511	carbon film	5.6 kΩ 5% 0.3 W	106-456	H5
R512	carbon film	220 Ω 5% 0.3 W	106-322	H5
R513	carbon film	5.6 kΩ 5% 0.3 W	106-456	H5
R514	carbon pot.	2.5 kΩ lin. 0.3 W	182-031	H5
R151	carbon film	560 Ω 5% 0.3 W	106-356	H5
R516	carbon film	2.7 kΩ 5% 0.3 W	106-427	H5
R517	carbon film	390 Ω 5% 0.3 W	106-339	H5
R518	carbon film	47 Ω 5% 0.3 W	106-247	H5
R519	carbon film	1 kΩ 5% 0.3 W	106-410	H5
R520	carbon film	2.2 kΩ 5% 0.3 W	106-422	H5
R521	carbon film	100 Ω 5% 0.3 W	106-310	H5
R522	carbon film	22 Ω 5% 0.3 W	106-222	H5
R523	carbon film	3.9 kΩ 5% 0.3 W	106-439	H5
R524	carbon film	27 kΩ 5% 0.3 W	106-527	H5
R525	carbon film	10 kΩ 5% 0.3 W	106-510	H5
R526	carbon film	270 Ω 5% 0.3 W	106-327	H5
R527	carbon film	3.3 kΩ 5% 0.3 W	106-433	H5
R528	carbon film	27 Ω 5% 0.3 W	106-227	H5
R529	carbon film	220 Ω 5% 0.3 W	106-322	H5
R530	carbon film	100 Ω 5% 0.3 W	106-310	H5
R531	carbon film	1.5 kΩ 5% 0.3 W	106-415	H5
R532	carbon film	4.7 kΩ 5% 0.3 W	106-447	H5
R533	carbon film	10 kΩ 5% 0.3 W	106-510	H5

R534	carbon film	680 Ω 5% 0.3 W	106-368	H5
R535	carbon film	22 Ω 5% 0.3 W	106-222	H5
R536	carbon film	1.5 kΩ 5% 0.3 W	106-415	H5
R537	carbon film	2.7 kΩ 5% 0.3 W	106-427	H5
R538	metal film	444 Ω 1% 0.25 W	140-396	H5
R539	carbon pot.	5 kΩ lin. 0.1 W	182-032	H5
R540	carbon film	5.6 kΩ 5% 0.3 W	106-456	H5
R541	carbon film	1.2 kΩ 5% 0.3 W	106-412	H5
R542	carbon film	5.6 kΩ 5% 0.3 W	106-456	H5
R543	carbon film	1.8 kΩ 5% 0.3 W	106-418	H5
R544	carbon film	2.07 kΩ 5% 0.1 W	143-038	H5
R545	carbon film	1.8 kΩ 5% 0.3 W	106-418	H5
R546	carbon film	56 kΩ 5% 0.3 W	106-556	H5
R547	carbon film	1.2 kΩ 5% 0.3 W	106-412	H5
R548	carbon film	82 kΩ 5% 0.3 W	106-582	H5
R549	carbon film	150 kΩ 5% 0.3 W	106-615	H5
R550	carbon film	100 kΩ 5% 0.3 W	106-610	H5
R551	carbon film	3.3 kΩ 5% 0.3 W	106-433	H5
R552	carbon film	12 kΩ 5% 0.3 W	106-512	H5
R553	carbon pot.	1 kΩ lin. 0.1 W	182-030	H5
R554	carbon film	1.8 kΩ 5% 0.3 W	106-418	H5
R561	metal film	500 kΩ 1% 0.1 W	140-586	H5
R562	metal film	121 kΩ 1% 0.125 W	140-522	H5
R563	carbon film	100 Ω 5% 0.3 W	106-310	H5
R564	carbon film	82 Ω 5% 0.3 W	106-282	H5
R565	carbon film	68 Ω 5% 0.3 W	106-268	H5
R566	carbon film	100 Ω 5% 0.3 W	106-310	H5

TERMINALS

Designation	Type	Code No.	Shown Fig.
TB501	terminal strip, 5-pole	821-105	H5

LIMITER Printed-circuit board

CAPACITORS

Designation	Type	Value	Code No.	Shown Fig.
C601	ceramic-	1 nF -20/+80% 25 V	213-013	H6
C602	polystyrene	100 pF 5% 125 V	243-037	H6
C603	tantalum	10 µF 15 V	267-000	H6
C604	tantalum	10 µF 15 V	267-000	H6
C605	ceramic	22 nF 40 V	213-011	H6
C606	ceramic	1 nF -20/+80% 25 V	213-013	H6
C607	ceramic	4.7 nF -20/+80% 40 V	213-010	H6
C608	tantalum	10 µF 15 V	267-000	H6
C609	polystyrene	100 pF 5% 125 V	243-037	H6
C610	polystyrene	100 pF 5% 125 V	243-037	H6
C611	ceramic	1 nF -20/+80% 25 V	213-013	H6
C612	ceramic	47 nF -20/+80% 30 V	213-016	H6
C613	ceramic	1 nF -20/+80% 25 V	213-013	H6
C614	ceramic	33 pF 5%	210-233	H6
C615	ceramic	22 nF -20/+80% 40 V	213-011	H6
C616	ceramic	22 nF -20/+80% 40 V	213-011	H6
C617	ceramic	33 pF 5%	210-233	H6
C618	ceramic	22 nF -20/+80% 40 V	213-011	H6
C619	ceramic	22 pF 5%	210-222	H6
C620	ceramic	22 nF -20/+80% 40 V	213-011	H6
C621	tantalum	10 µF 15 V	267-000	H6
C622	ceramic	470 pF -20/+80% 25 V	213-014	H6
C623	tantalum	10 µF 15 V	267-000	H6
C624	ceramic	47 nF -20/+80% 30 V	213-016	H6
C625	tantalum	10 µF 15 V	267-000	H6
C626	ceramic	22 nF -20/+80% 40 V	213-011	H6
C627	tantalum	10 µF 15 V	267-000	H6
C628	tantalum	10 µF 15 V	267-000	H6
C629	tantalum	10 µF 15 V	267-000	H6
C630	ceramic	2.2 nF -20/+80% 25 V	213-012	H6
C631	tantalum	10 µF 15 V	267-000	H6

DIODES

Designation	Type	Code No.	Shown Fig.
CR601	diode BAV10	350-022	H6
CR602	diode BAV10	350-022	H6
CR603	diode BAX16	350-023	H6
CR604	diode BAX16	350-023	H6
CR605	diode BAV10	350-022	H6
CR606	diode BAV10	350-022	H6
CR607	zener diode 1N3497	350-637	H6

TERMINALS

Designation	Type	Code No.	Shown Fig.
P600	terminal strip, 10-pole	805-614	H6

TRANSISTORS

Designation	Type	Code No.	Shown Fig.
Q601	transistor 2N3906	360-062	H6
Q602	transistor 2N3906	360-062	H6
Q603	transistor BC149	360-072	H6
Q604	transistor BC149	360-072	H6
Q605	transistor BC149	360-072	H6
Q606	transistor BC149	360-072	H6
Q607	transistor 2N3906	360-062	H6
Q608	transistor 2N3906	360-062	H6
Q609	transistor 2N3906	360-062	H6
Q610	transistor 2N3906	360-062	H6
Q611	transistor 2N3906	360-062	H6
Q612	transistor 2N3906	360-062	H6
Q613	transistor 2N3906	360-062	H6
Q614	transistor 2N3904	360-064	H6
Q615	transistor BC149	360-072	H6
Q616	transistor TD100	360-105	H6

Q617	transistor BC149		360-072	H6
Q618	transistor 2N3906		360-062	H6
Q619	transistor 2N3906		360-062	H6
Q620	transistor 2N3906		360-062	H6

RESISTORS

Designation	Type	Value	Code No.	Shown Fig.
R601	carbon film	330 Ω 5% 0.3 W	106-333	H6
R602	carbon film	470 Ω 5% 0.3 W	106-347	H6
R603	carbon film	330 Ω 5% 0.3 W	106-333	H6
R604	carbon film	150 Ω 5% 0.3 W	106-315	H6
R605	carbon film	3.9 kΩ 5% 0.3 W	106-439	H6
R606	carbon film	1.8 kΩ 5% 0.3 W	106-418	H6
R607	carbon film	180 Ω 5% 0.3 W	106-318	H6
R608	carbon film	18 Ω 5% 0.3 W	106-218	H6
R609	carbon film	33 kΩ 5% 0.3 W	106-533	H6
R610	carbon film	56 kΩ 5% 0.3 W	106-556	H6
R611	carbon film	56 kΩ 5% 0.3 W	106-556	H6
R612	carbon pot.	10 kΩ lin. 0.1 W	182-033	H6
R613	carbon film	8.2 kΩ 5% 0.3 W	106-482	H6
R614	carbon film	3.3 kΩ 5% 0.3 W	106-433	H6
R615	carbon film	27 kΩ 5% 0.3 W	106-527	H6
R616	carbon film	5.6 kΩ 5% 0.3 W	106-456	H6
R617	carbon film	68 kΩ 5% 0.3 W	106-568	H6
R618	carbon film	68 kΩ 5% 0.3 W	106-568	H6
R619	carbon film	10 kΩ 5% 0.3 W	106-510	H6
R620	carbon film	10 kΩ 5% 0.3 W	106-510	H6
R621	carbon film	1 kΩ 5% 0.3 W	106-410	H6
R622	carbon film	1 kΩ 5% 0.3 W	106-410	H6
R623	carbon film	6.8 kΩ 5% 0.3 W	106-468	H6
R624	carbon pot.	1 kΩ lin. 0.1 W	182-030	H6
R625	carbon film	560 Ω 5% 0.3 W	106-556	H6
R626	carbon film	2.2 kΩ 5% 0.3 W	106-422	H6
R627	carbon film	1.5 kΩ 5% 0.3 W	106-415	H6

R628	carbon film	390 Ω 5% 0.3 W	106-339	H6
R629	carbon film	47 Ω 5% 0.3 W	106-247	H6
R630	carbon film	1 kΩ 5% 0.3 W	106-410	H6
R631	carbon film	1.8 kΩ 5% 0.3 W	106-418	H6
R632	carbon film	560 Ω 5% 0.3 W	106-356	H6
R633	carbon pot.	1 kΩ lin. 0.1 W	182-030	H6
R634	carbon film	6.8 kΩ 5% 0.3 W	106-468	H6
R635	carbon film	2.2 kΩ 5% 0.3 W	106-422	H6
R636	carbon film	1.5 kΩ 5% 0.3 W	106-415	H6
R637	carbon film	390 Ω 5% 0.3 W	106-339	H6
R638	carbon film	47 Ω 5% 0.3 W	106-247	H6
R639	carbon film	1 kΩ 5% 0.3 W	106-410	H6
R640	carbon film	1.8 kΩ 5% 0.3 W	106-418	H6
R641	carbon film	12 kΩ 5% 0.3 W	106-512	H6
R642	carbon film	1 kΩ 5% 0.3 W	106-410	H6
R643	carbon film	47 Ω 5% 0.3 W	106-247	H6
R644	carbon film	1 kΩ 5% 0.3 W	106-410	H6
R645	carbon film	68 Ω 5% 0.3 W	106-268	H6
R646	carbon film	10 kΩ 5% 0.3 W	106-510	H6
R647	carbon film	10 Ω 5% 0.3 W	106-210	H6
R648	carbon film	10 Ω 5% 0.3 W	106-210	H6
R649	carbon film	6.8 kΩ 5% 0.3 W	106-468	H6
R650	carbon film	6.8 kΩ 5% 0.3 W	106-468	H6
R651	carbon film	6.8 kΩ 5% 0.3 W	106-468	H6
R652	carbon film	100 kΩ 5% 0.3 W	106-610	H6
R653	carbon film	4.7 kΩ 5% 0.3 W	106-447	H6
R654	carbon film	1.5 kΩ 5% 0.3 W	106-415	H6
R655	carbon film	680 Ω 5% 0.3 W	106-368	H6
R656	carbon film	1.8 kΩ 5% 0.3 W	106-418	H6
R657	carbon film	27 kΩ 5% 0.3 W	106-527	H6
R658	carbon film	18 kΩ 5% 0.3 W	106-518	H6
xR659	wire-wound	4.18 kΩ 1%	152-031	H6
R660	trimmer	500 Ω 10%	193-000	H6
R661	wire-wound	2.46 kΩ 1%	152-029	H6
R662	carbon film	6.8 kΩ 5% 0.3 W	106-468	H6

R663	carbon film	100 kΩ 5% 0.3 W	106-610	H6
R664	carbon film	4.7 kΩ 5% 0.3 W	106-447	H6
R665	carbon film	47 kΩ 5% 0.3 W	106-547	H6
xR666	wire-wound	10 kΩ 0.1%	152-032	H6
xR667	wire-wound	10 kΩ 0.1%	152-032	H6

CABLE

Designation	Type	Code No.	Shown Fig.
W600	coaxial, 50 Ω, R196/U, 0.14 m	600-014	H6

FM DETECTOR Printed-circuit board

CAPACITORS

Designation	Type	Value	Code No.	Shown Fig.
C701	ceramic	39 pF 5%	211-239	H7
C702	ceramic	47 nF -20/+80% 30 V	213-016	H7
C703	ceramic	68 pF 5%	211-268	H7
C704	ceramic	47 nF -20/+80% 30 V	213-016	H7
C705	ceramic	47 nF -20/+80% 30 V	213-016	H7
C706	ceramic	10 µF 15 V	267-000	H7
C707	tantalum	10 µF 15 V	267-000	H7
C708	ceramic	1 nF -20/+80% 25 V	213-013	H7
C709	tantalum	10 µF 15 V	267-000	H7
C711	polystyrene	8.45 nF 1% 63 V	243-167	H7
C712	ceramic	47 nF -20/+80% 30 V	213-016	H7
C716	polystyrene	3.48 nF 1% 63 V	243-164	H7
C717	polystyrene	3.48 nF 1% 63 V	243-164	H7

DIODES

Designation	Type	Code No.	Shown Fig.
CR701	zener diode BZY88C3V3	350-625	H7
CR702	zener diode BZY88C3V6	350-626	H7
CR703	diode ITT700	350-028	H7
CR704	diode ITT700	350-028	H7
CR705	diode ITT700	350-028	H7

RELAY

Designation	Type	Code No.	Shown Fig.
K700	gas relay	570-033	H7

INDUCTORS

Designation	Type	Value	Code No.	Shown Fig.
xL701	inductor	2.12 mH	6374-A4	H7
xL702	inductor	0.822 mH	6375-A4	H7
xL703	choke	100 μH	703-009	H7

TERMINALS

Designation	Type	Code No.	Shown Fig.
P700	terminal strip, 15-pole	805-613	H7

TRANSISTORS

Designation	Type	Code No.	Shown Fig.
Q701	transistor 2N3904	360-064	H7
Q702	transistor 2N3904	360-064	H7
Q703	transistor 2N3904	360-064	H7
Q704	transistor 2N3904	360-064	H7
Q705	transistor 2N3251	360-052	H7
Q706	transistor 2N3251	360-052	H7
Q707	transistor 2N3906	360-062	H7
Q708	transistor BC149	360-072	H7

RESISTORS

Designation	Type	Value	Code No.	Shown Fig.
R701	carbon film	100 Ω 5% 0.3 W	106-310	H7
R702	carbon film	270 Ω 5% 0.3 W	106-327	H7
R703	metal film	390 Ω 1% 0.125 W	140-409	H7
R704	carbon film	10 Ω 5% 0.3 W	106-210	H7
R705	metal film	910 Ω 1% 0.125 W	140-410	H7
R706	carbon film	10 Ω 5% 0.3 W	106-210	H7
R707	metal film	8.2 kΩ 1% 0.25 W	140-333	H7

R708	trimmer	2 kΩ 10%	193-001	H7
R709	carbon film	470 Ω 5% 0.3 W	106-347	H7
R710	carbon film	10 Ω 5% 0.3 W	106-210	H7
R711	carbon film	820 Ω 5% 0.3 W	106-382	H7
R712	carbon film	3.3 kΩ 5% 0.3 W	106-433	H7
R713	metal film	100 Ω 0.2%	140-389	H7
R714	carbon film	240 Ω 5% 0.5 W	100-324	H7
R715	carbon film	220 Ω 5% 0.3 W	106-322	H7
R716	carbon film	68 Ω 5% 0.3 W	106-268	H7
R717	metal film	500 Ω 1% 0.25 W	140-397	H7
R718	metal film	500 Ω 1% 0.25 W	140-397	H7
R719	carbon film	15 kΩ 5% 0.3 W	106-515	H7
R720	carbon film	33 kΩ 5% 0.3 W	106-533	H7
R721	carbon film	10 MΩ 5% 0.5 W	100-810	H7
R722	carbon film	39 kΩ 5% 0.3 W	106-539	H7
R723	carbon film	39 kΩ 5% 0.3 W	106-539	H7
R724	carbon film	33 kΩ 5% 0.3 W	106-533	H7
R725	carbon film	3.3 MΩ 5% 0.5 W	100-733	H7
R736	metal film	5.11 kΩ 1% 0.1 W	140-442	H7
R737	carbon pot.	500 Ω lin. 0.1 W	182-038	H7

CABLE

Designation	Type	Code No.	Shown Fig.
W701	coaxial, 50 Ω, RG196/U, 0.075 m	600-014	H7

AF AMPLIFIER I - II Printed-circuit board

CAPACITORS

Designation	Type	Value	Code No.	Shown Fig.
C805	electrolytic	250 µF 15/18 V	260-037	H8
C806	polystyrene	130 pF 5% 125 V	243-039	H8
C807	ceramic	15 pF 5%	210-215	H8
C808	polystyrene	600 pF 5% 125 V	243-027	H8
C809	ceramic	1 nF -20/+80% 25 V	213-013	H8
C810	tantalum	10 µF -20/+50% 15 V	267-000	H8
C811	ceramic	47 nF -20/+80% 30 V	213-016	H8
C812	polystyrene	54.5 nF 1% 63 V	243-158	H8
C813	ceramic	82 pF 5%	210-282	H8

DIODES

Designation	Type	Code No.	Shown Fig.
CR801	diode BAY88	350-022	H8
CR802	zener diode BZY88C6V8	350-627	H8
CR803	zener diode BZY88C6V8	350-627	H8

TERMINALS

Designation	Type	Code No.	Shown Fig.
P800	terminal strip, 20-pole	805-612	H8

TRANSISTORS

Designation	Type	Code No.	Shown Fig.
Q801	transistor TD121	360-077	H8
Q802	transistor BC149	360-072	H8
Q803	transistor 2N3906	360-062	H8
Q804	transistor TD121	360-077	H8
Q805	transistor BC149	360-072	H8
Q806	transistor BC149	360-072	H8

RESISTORS

Designation	Type	Value	Code No.	Shown Fig.
R801	metal film	550 Ω 0.2% 0.125 W	140-390	H8
R802	carbon film	680 Ω 5% 0.3 W	106-368	H8
R803	carbon pot.	100 kΩ lin. 0.1 W	182-035	H8
R804	carbon film	3.9 MΩ 5% 0.5 W	100-739	H8
R805	metal film	3.16 kΩ 1% 0.25 W	140-408	H8
R806	carbon film	47 kΩ 5% 0.3 W	106-547	H8
R807	carbon film	22 kΩ 5% 0.3 W	106-522	H8
R808	carbon film	330 Ω 5% 0.3 W	106-333	H8
R809	carbon film	1 kΩ 5% 0.3 W	106-410	H8
R810	carbon film	1 kΩ 5% 0.3 W	106-410	H8
R811	carbon film	4.7 kΩ 5% 0.3 W	106-447	H8
R812	carbon film	180 Ω 5% 0.3 W	106-318	H8
R813	carbon film	82 Ω 5% 0.3 W	106-282	H8
R814	carbon film	2.2 kΩ 5% 0.3 W	106-422	H8
R815	carbon film	560 Ω 5% 0.3 W	106-356	H8
R816	carbon film	1 kΩ 5% 0.3 W	106-410	H8
R817	carbon film	39 kΩ 5% 0.3 W	106-539	H8
R818	carbon film	47 kΩ 5% 0.3 W	106-547	H8
R819	carbon film	6.8 kΩ 5% 0.3 W	106-468	H8
R820	carbon film	12 kΩ 5% 0.3 W	106-512	H8
R821	carbon film	470 Ω 5% 0.3 W	106-347	H8
R822	carbon film	6.8 kΩ 5% 0.3 W	106-468	H8
R824	carbon film	5.6 kΩ 5% 0.3 W	106-456	H8
R825	metal film	12.6 kΩ 0.5% 0.25 W	140-395	H8

AF AMPLIFIER III - V Printed-circuit board

CAPACITORS

Designation	Type	Value	Code No.	Shown Fig.
C903	polystyrene	100 pF 5% 160 V	243-037	H9
C906	electrolytic	22 μF 50/60 V	260-008	H9
C907	ceramic	47 pF 5%	210-247	H9
C908	polystyrene	700 pF 5% 125 V	243-033	H9
C909	tantalum	10 μF 15 V	267-000	H9
C910	tantalum	10 μF 15 V	267-000	H9
C912	polyester	2.2 μF 10% 100 V	241-007	H9
C913	ceramic	68 pF 5%	211-268	H9
C914	ceramic	2.2 pF ±0.5 pF	210-122	H9
C915	ceramic	0.1 μF -20/+80% 12 V	213-017	H9
C916	tantalum	10 μF 15 V	267-000	H9
C917	tantalum	10 μF 15 V	267-000	H9

DIODES

Designation	Type	Code No.	Shown Fig.
CR901	diode BAX16	350-023	H9
CR902	zener diode BZY88C6V2	350-604	H9
CR903	diode iN916	350-019	H9

TERMINALS

Designation	Type	Code No.	Shown Fig.
P900	terminal strip, 20-pole	805-612	H9

TRANSISTORS

Designation	Type	Code No.	Shown Fig.
Q901	transistor BC149	360-072	H9

Q902	transistor 2N3906		360-062	H9
Q903	transistor BC149		360-072	H9
Q904	transistor BC149		360-072	H9
Q905	transistor BC149		360-072	H9
Q906	transistor 2N3906		360-062	H9
Q907	transistor BC149		360-072	H9
Q908	transistor BC149		360-072	H9
Q909	transistor BC149		360-072	H9
Q910	transistor BC149		360-072	H9
Q911	transistor 2N3906		360-062	H9
Q912	transistor BC149		360-072	H9

RESISTORS

Designation	Type	Value	Code No.	Shown Fig.
R902	carbon film	150 Ω 5% 0.3 W	106-315	H9
R903	carbon film	2.7 kΩ 5% 0.3 W	106-427	H9
R904	carbon film	1.5 kΩ 5% 0.3 W	106-415	H9
R905	carbon film	56 Ω 5% 0.3 W	106-256	H9
R906	carbon film	150 Ω 5% 0.3 W	106-315	H9
R908	metal film	634 Ω 1% 0.1 W	140-567	H9
R910	carbon film	27 kΩ 5% 0.3 W	106-527	H9
R911	carbon film	12 kΩ 5% 0.3 W	106-512	H9
R912	carbon film	330 Ω 5% 0.3 W	106-333	H9
R913	carbon film	3.3 kΩ 5% 0.3 W	106-433	H9
R914	carbon film	560 Ω 5% 0.3 W	106-356	H9
R915	carbon film	100 Ω 5% 0.3 W	106-310	H9
R916	carbon film	10 kΩ 5% 0.3 W	106-510	H9
R917	carbon film	1 kΩ 5% 0.3 W	106-410	H9
R918	carbon film	100 Ω 5% 0.3 W	106-310	H9
R919	metal film	57.6 kΩ 1% 0.125 W	140-581	H9
R920	metal film	850 Ω 1% 0.25 W	140-399	H9
R921	metal film	2.04 kΩ 1% 0.25 W	140-400	H9
R923	carbon pot.	10 kΩ lin. 0.1 W	182-033	H9
R924	metal film	50 kΩ 1% 0.25 W	140-405	H9

R925	carbon film	5.6 kΩ matched 0.3 W	106-456	H9
R926	carbon film	470 kΩ 5% 0.3 W	106-647	H9
R927	carbon film	120 kΩ 5% 0.3 W	106-612	H9
R928	carbon film	5.6 MΩ 5% 0.5 W	100-756	H9
R929	carbon pot.	0.5 MΩ lin. 0.1 W	182-036	H9
R930	carbon film	680 Ω 5% 0.3 W	106-368	H9
R931	carbon film	330 Ω 5% 0.3 W	106-333	H9
R932	carbon film	39 kΩ 5% 0.3 W	106-539	H9
R933	carbon film	1 kΩ 5% 0.3 W	106-410	H9
R934	carbon film	12 kΩ 5% 0.3 W	106-512	H9
R935	carbon film	1.2 kΩ 5% 0.3 W	106-412	H9
R936	carbon film	100 Ω 5% 0.3 W	106-310	H9
R937	metal film	270 kΩ 1% 0.25 W	140-406	H9
R938	carbon film	100 Ω 5% 0.3 W	106-310	H9

AF DETECTOR Printed-circuit board

CAPACITORS

Designation	Type	Value	Code No.	Shown Fig.
C1001	polyester	68 nF 10% 400 V	240-568	H10
C1002	polyester	68 nF 10% 400 V	240-568	H10
C1003	polyester	0.47 µF 10% 125 V	240-001	H10
C1004	polyester	0.47 µF 10% 125 V	240-001	H10
C1005	ceramic	1 nF 20%	213-017	H10

DIODES

Designation	Type	Code No.	Shown Fig.
CR1001	diode 1N5220	350-028	H10
CR1002	diode 1N5220	350-028	H10
CR1003	diode ER1	350-414	H10
CR1004	diode ER1	350-414	H10
CR1005	zener diode BZY88C5V6	350-629	H10

TERMINALS

Designation	Type	Code No.	Shown Fig.
P1000	terminal strip, 15-pole	805-613	H10

TRANSISTORS

Designation	Type	Code No.	Shown Fig.
Q1001	transistor 2N930	360-038	H10
Q1002	transistor 2N3906	360-062	H10
Q1003	transistor BC149	360-072	H10

RESISTORS

Designation	Type	Value	Code No.	Shown Fig.
R1001	carbon film	18 MΩ 5% 0.5 W	100-818	H10
R1002	carbon pot.	0.5 MΩ lin. 0.1 W	182-036	H10
R1003	carbon film	5.6 MΩ 5% 0.5 W	100-756	H10
R1004	carbon film	470 kΩ 5% 0.3 W	100-647	H10
R1005	carbon film	180 kΩ 5% 0.3 W	106-618	H10
R1006	carbon film	12 kΩ selected 0.3 W	106-	H10
R1007	carbon film	560 Ω selected 0.3 W	106-	H10
R1008	carbon film	1.2 kΩ 5% 0.3 W	106-412	H10
R1009	carbon film	120 kΩ 5% 0.3 W	106-612	H10
R1010	carbon film	1.8 kΩ 5% 0.3 W	106-418	H10
R1011	carbon film	10 kΩ 5% 0.3 W	106-510	H10
R1012	carbon film	1.5 kΩ 5% 0.3 W	106-415	H10
R1013	metal film	700 Ω 1% 0.25 W	140-398	H10
R1014	metal film	4.2 kΩ 1% 0.25 W	140-402	H10
R1015	metal film	14.9 kΩ 1% 0.25 W	140-403	H10
R1016	carbon film	2.2 kΩ 5% 0.3 W	106-422	H10

POWER SUPPLY Printed-circuit board

CAPACITORS

Designation	Type	Value	Code No.	Shown Fig.
C1101	electrolytic	1000 µF 25 V	261-029	H11
C1102	ceramic	0.1 µF 30 V	213-009	H11
C1103	ceramic	15 pF 5%	210-215	H11
C1104	polyester	1 µF 10% 160 V	241-004	H11
C1105	polyester	33 nF 10% 400 V	240-533	H11
C1106	polyester	0.22 nF 10% 160 V	241-002	H11
C1107	electrolytic	1000 µF 25 V	261-029	H11
C1108	ceramic	33 pF 5%	210-233	H11
C1109	polyester	2.2 nF 10% 400 V	240-422	H11
C1110	polyester	0.22 µF 10% 160 V	241-002	H11

DIODES AND RECTIFIERS

Designation	Type	Code No.	Shown Fig.
CR1101	diode ER1	350-414	H11
CR1102	diode ER1	350-414	H11
CR1103	rectifier B80C2000	340-204	H11
CR1104	zener diode BZY88C5V6	350-629	H11
CR1105	zener diode BZY88C6V8	350-627	H11
CR1106	diode ER1	350-414	H11
CR1107	diode BAX16	350-023	H11

TERMINALS

Designation	Type	Code No.	Shown Fig.
P1100	terminal strip, 20-pole	805-612	H11

TRANSISTORS

Designation	Type	Code No.	Shown Fig.
Q1100	transistor 2N2905A	360-073	H11
Q1101	transistor BC149	360-072	H11
Q1102	transistor BC149	360-072	H11
Q1103	transistor 2N3906	360-062	H11
Q1104	transistor 2N2905A	360-073	H11
Q1105	transistor BD121	360-090	H11
Q1106	transistor BD121	360-090	H11

RESISTORS

Designation	Type	Value	Code No.	Shown Fig.
R1101	carbon pot.	1 MΩ lin. 0.1 W	182-037	H11
R1102	carbon film	1 MΩ 5% 0.3 W	106-710	H11
R1103	wire-wound	6.8 Ω 5% 2.5 W	133-036	H11
R1104	carbon film	12 Ω 5% 0.3 W	106-212	H11
R1105	carbon film	68 Ω 5% 0.3 W	106-268	H11
R1106	carbon film	2.7 kΩ 5% 0.3 W	106-427	H11
R1107	carbon film	82 Ω 5% 0.3 W	106-282	H11
R1108	carbon film	2.7 kΩ 5% 0.3 W	106-427	H11
R1109	wire-wound	2 Ω 2% 0.5 W	135-000	H11
R1110	carbon film	1.2 kΩ 5% 0.3 W	106-412	H11
R1111	carbon film	150 Ω 5% 0.3 W	106-315	H11
R1112	carbon film	2.7 kΩ 5% 0.3 W	106-427	H11
R1113	carbon film	5.6 kΩ 5% 0.3 W	106-456	H11
R1114	carbon film	2.2 kΩ 5% 0.3 W	106-422	H11
R1115	carbon pot.	1 kΩ lin. 0.1 W	182-030	H11
R1116	carbon film	2.7 kΩ 5% 0.3 W	106-427	H11
R1117	carbon film	1.2 kΩ 5% 0.5 W	100-412	H11
R1118	carbon film	1.2 kΩ 5% 0.3 W	106-412	H11
R1119	wire-wound	8.8 Ω 5% 2.5 W	133-037	H11
R1120	carbon film	330 Ω 5% 0.3 W	106-333	H11
R1121	carbon pot.	1 MΩ lin.	182-037	H11
R1122	carbon film	2.7 MΩ 5% 0.5 W	100-727	H11

Designation	Type	Value	Code No.	Shown Fig.
R1123	carbon film	100 Ω 5% 0.3 W	106-310	H11
R1124	carbon film	4.7 kΩ 5% 0.3 W	106-447	H11
R1125	metal film	4.4 kΩ 0.5% 0.25 W	140-407	H11
R1126	metal film	4.4 kΩ 0.5% 0.25 W	140-407	H11
R1127	carbon film	2.2 kΩ 5% 0.3 W	106-422	H11
R1128	carbon film	4.7 kΩ 5% 0.3 W	106-447	H11

CABLES

Designation	Type	Code No.	Shown Fig.
W1101	power cable with plug	615-005	H11
W1102	cable, 5-core	611-008	H11

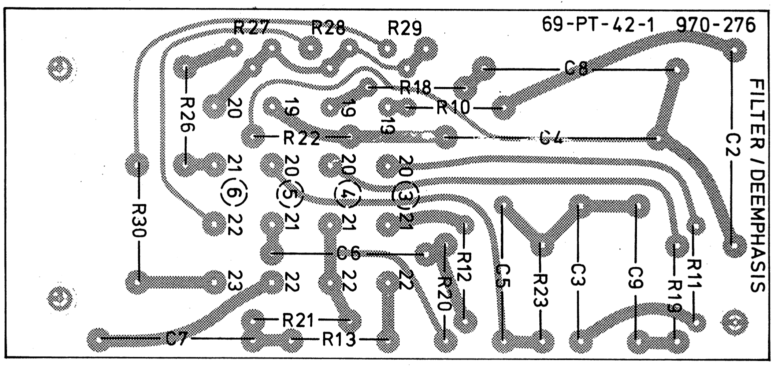


Fig. H1.

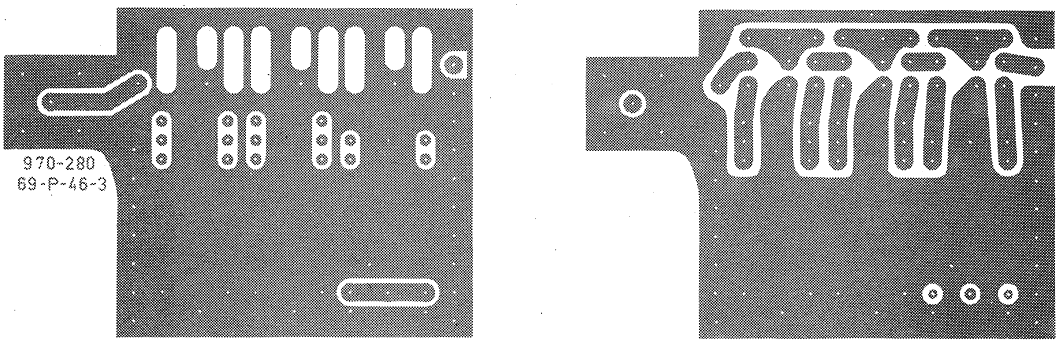


Fig. H2.

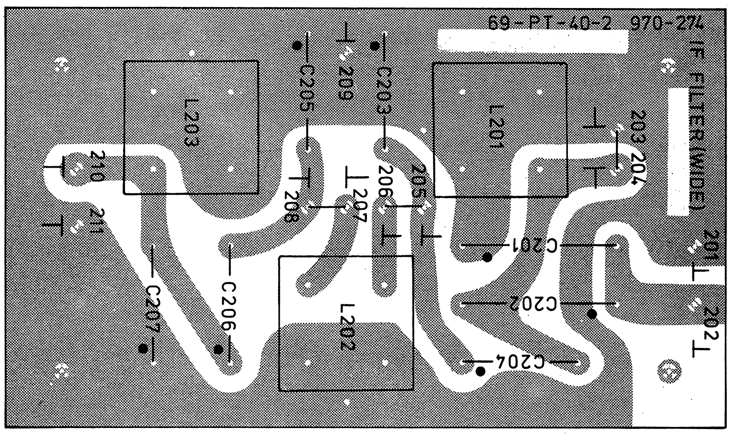


Fig. H3.

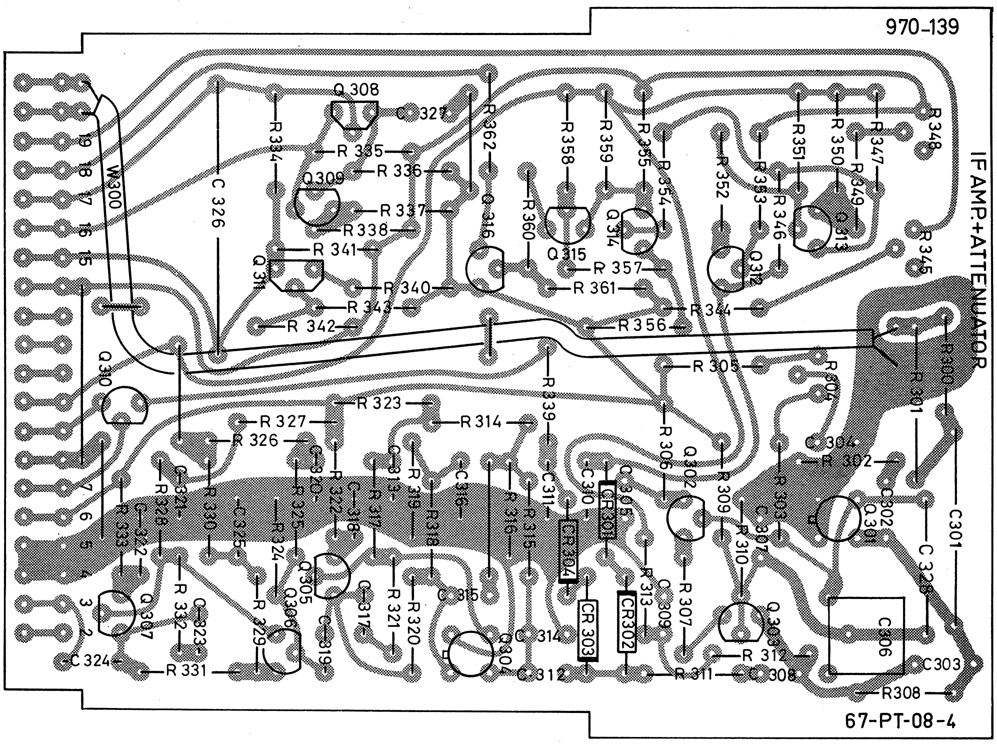

970-139
IF AMP.+ATTENUATOR
67-PT-08-4

Fig. H4.

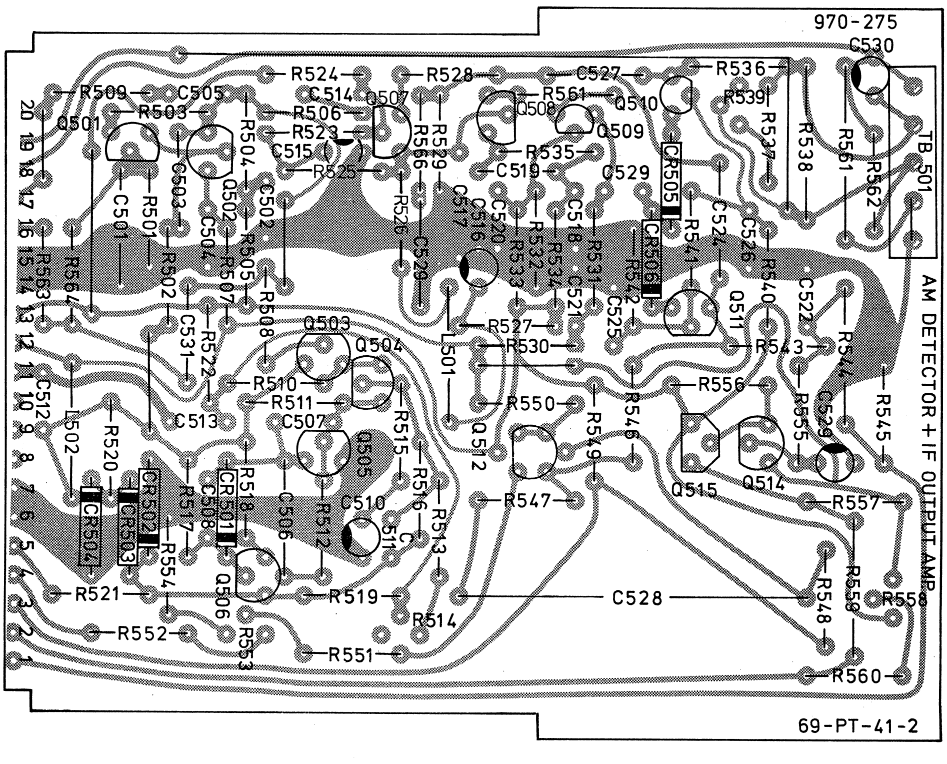

970-275
AM DETECTOR + IF OUTPUT AMP
69-PT-41-2

Fig. H5.

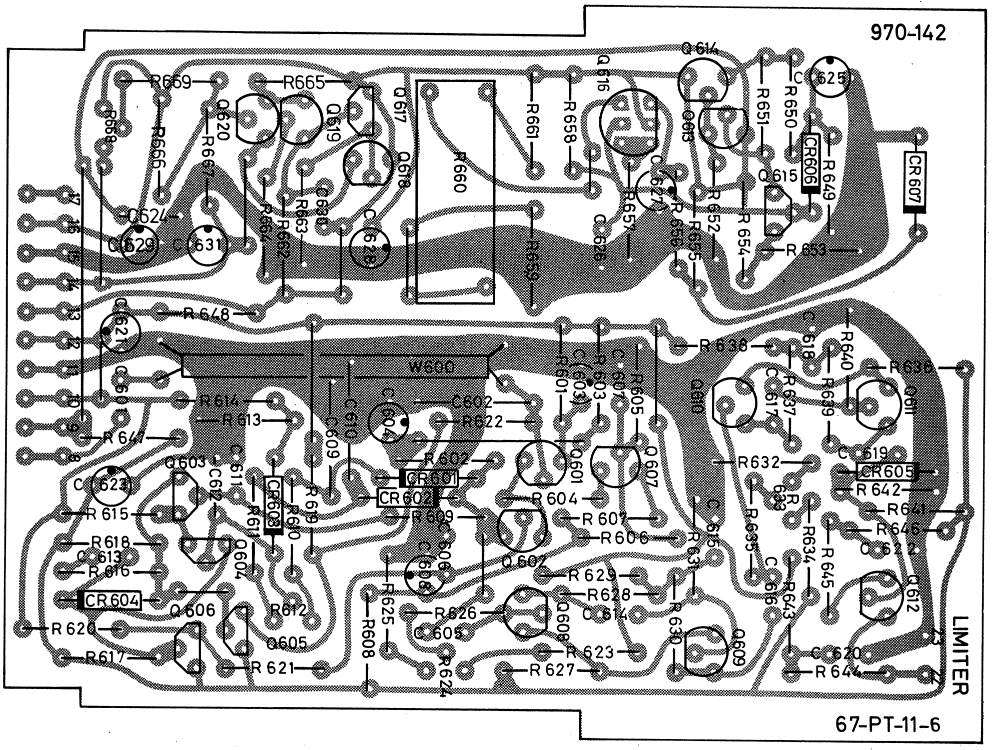


Fig. H6.

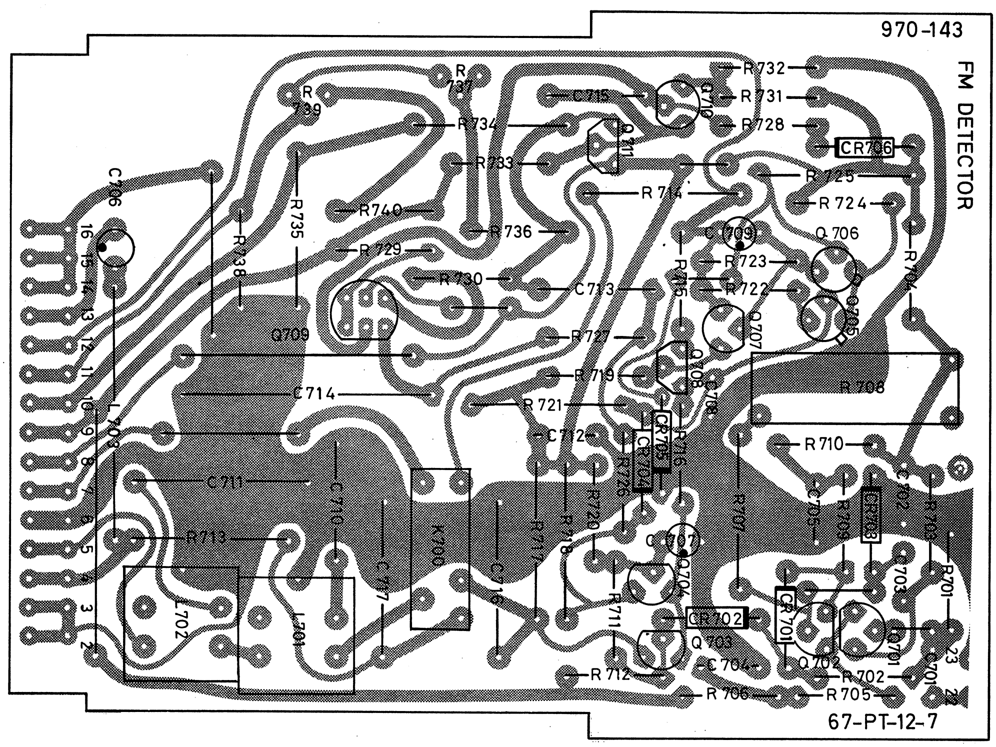


Fig. H7.

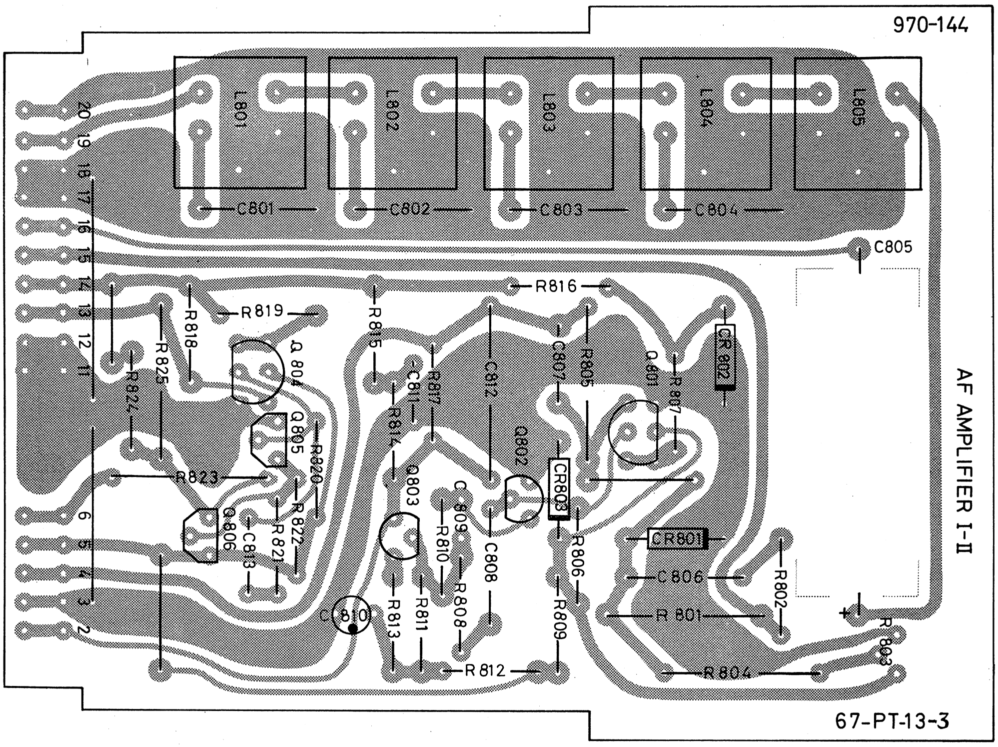

970-144
AF AMPLIFIER I-II
67-PT-13-3

Fig. H8.

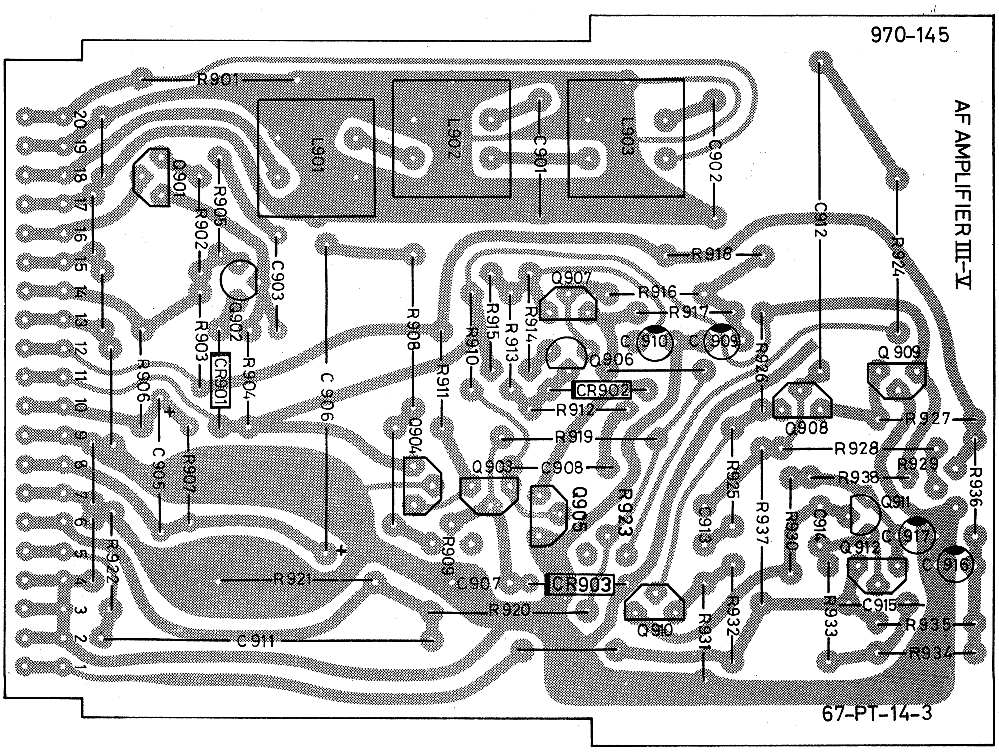

970-145
AF AMPLIFIER III-V
67-PT-14-3

Fig. H9.

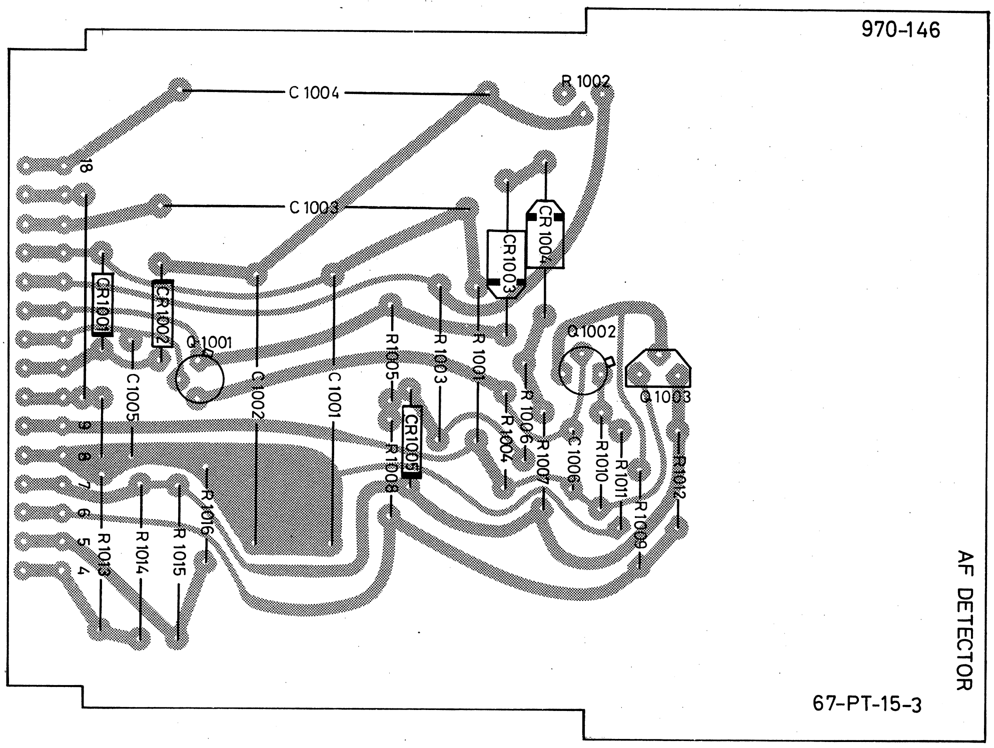


Fig. H10.

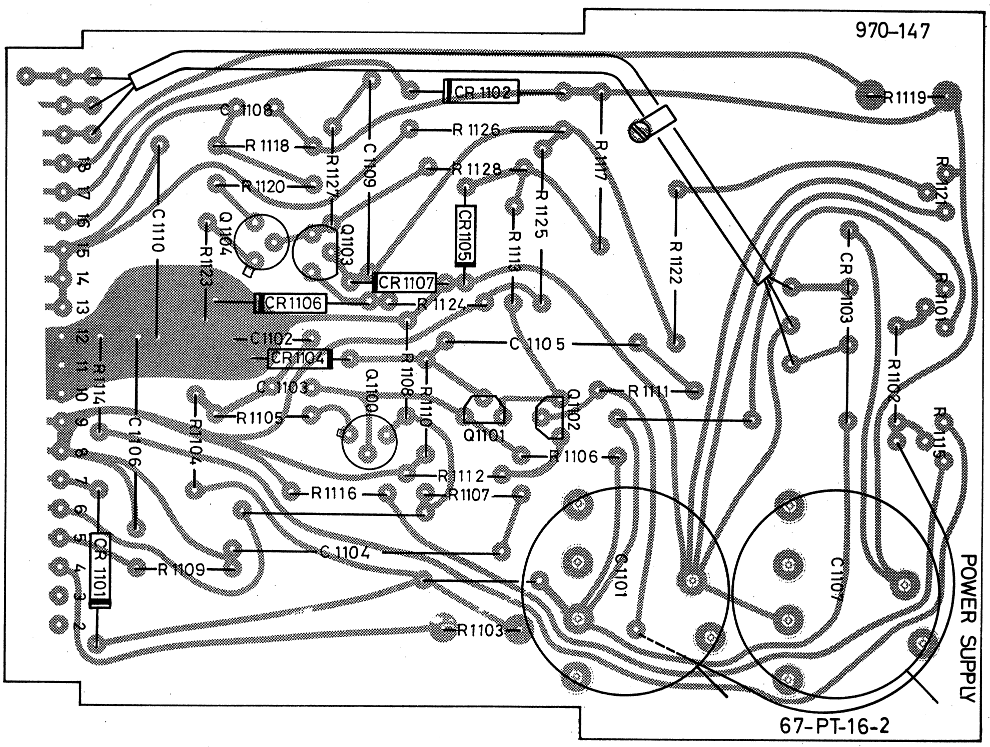
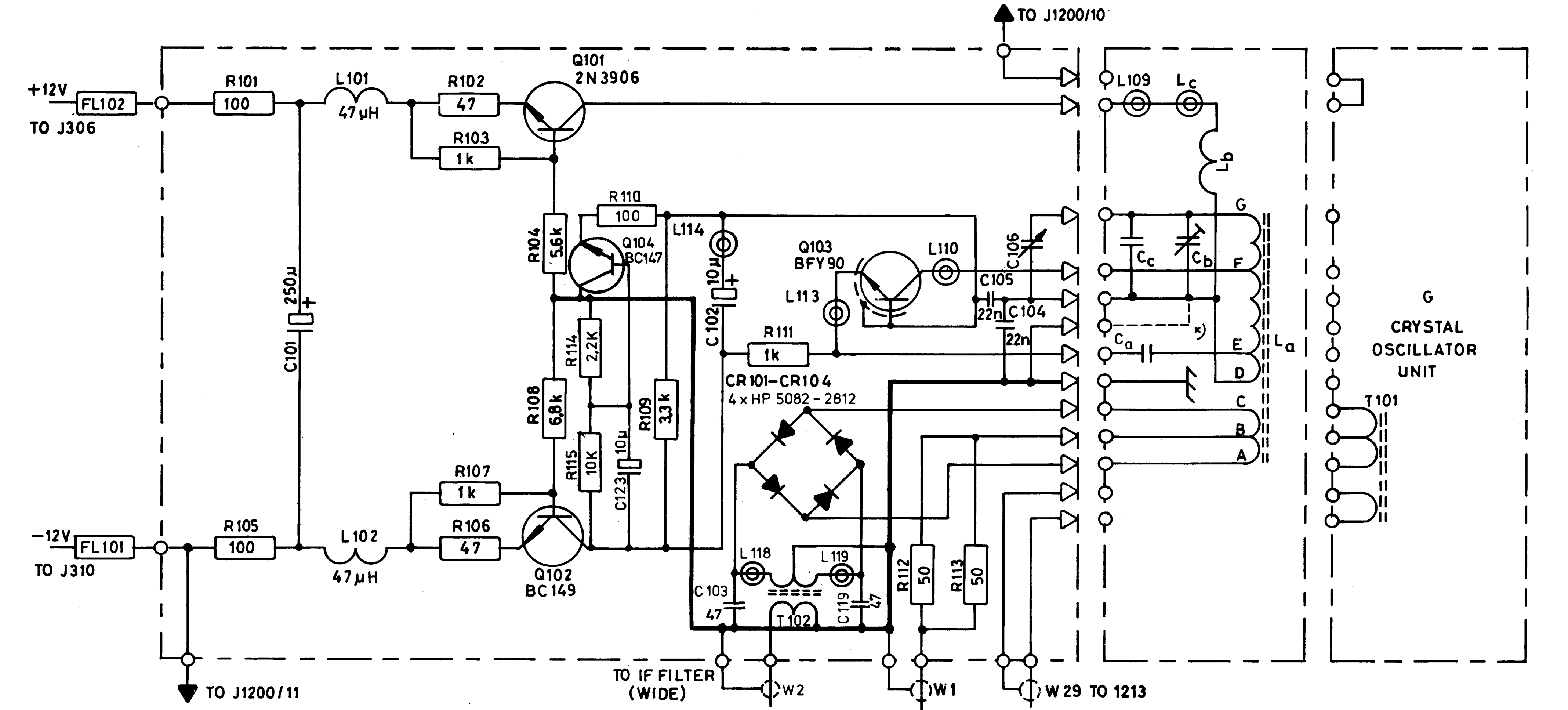
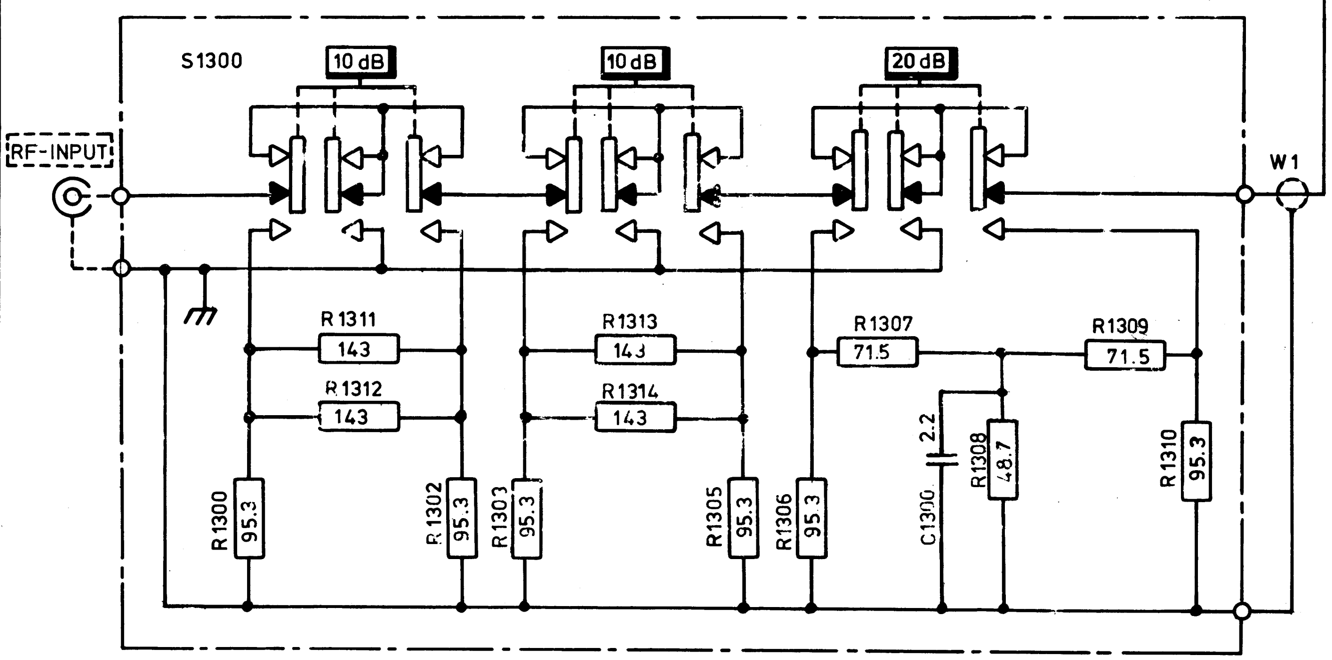


Fig. H11.





FREQUENCY		L_a	L_b	L_c	C_a	C_b	C_c
A	7–12 MHz	L103 14,8 µH			C107 2,2 n	C108 3	
B	12–21 MHz	L104 5 µH			C109 1 n	C110 3	
C	21–37 MHz	L105 1,6 µH			C111 1 n	C112 3	
D	37–65 MHz	L106 530 nH			C113 470	C114 3	C124 1,5
E	65–110 MHz	L107 172 nH			C115 220	C116 3	C121 2,2
F	110 220 MHz	L108 60 nH	L115 47 µH	L 116	C117 47	C118 3	
G	CRYSTAL OSCILATOR UNIT						

x) ONLY IN RANGE F_1

VALUES IN Ω OR pF IF NOT OTHERWISE SPECIFIED.

1—O PRINT TERMINAL.

RADIOMETER A/S COPENHAGEN

Rt.Nr.	Fra Fab. Nr.	Dato	Rt. af	Konf.	Norm.
3	175936	10.11.70	OH.	AJH	PK
2	166886	4.11.70	OH	AJH	PK
1	171216	12.8.70	SHH	sfa	

RADIOMETER COPENHAGEN
72 EMDRUPVEJ NV

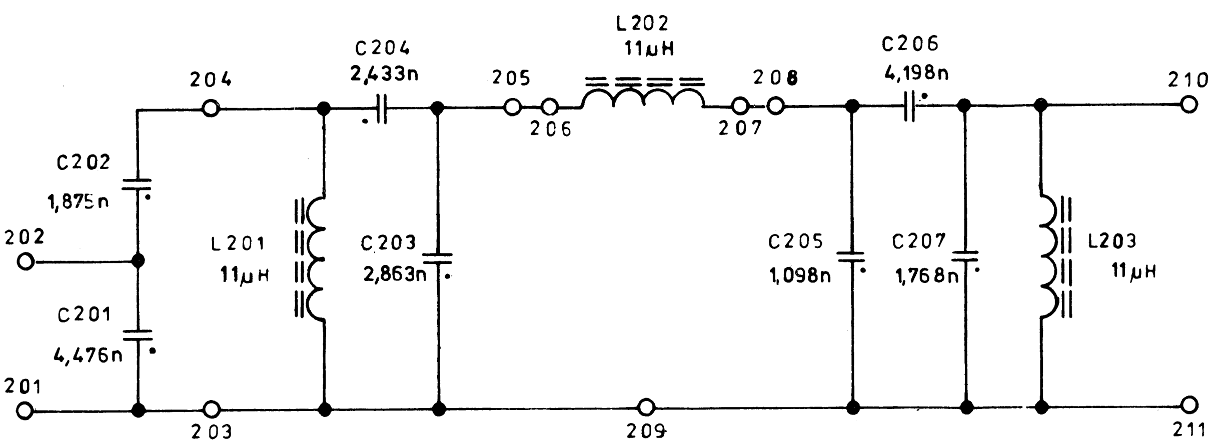
Målestok: /
Tegn. SHM 31.3.70
Konf. sfa 1.4.70.
Norm.

MODULATION METER
TYPE: AFM 3a+b
I: TUNER DIAGRAM
From no. 160166 to no.

Erstatter

1979 - A2

Erstattes af



REVISIONS

ISSUE	FROM NO.	DATE	DRAWN BY	CHECKED BY	APPR. BY
2	175936	11.11.70	OH		
1	160661	26.2.70	OH		ϑla.

RADIOMETER A/S
EMDRUPVEJ 72
DK 2400 COPENHAGEN NV
DENMARK

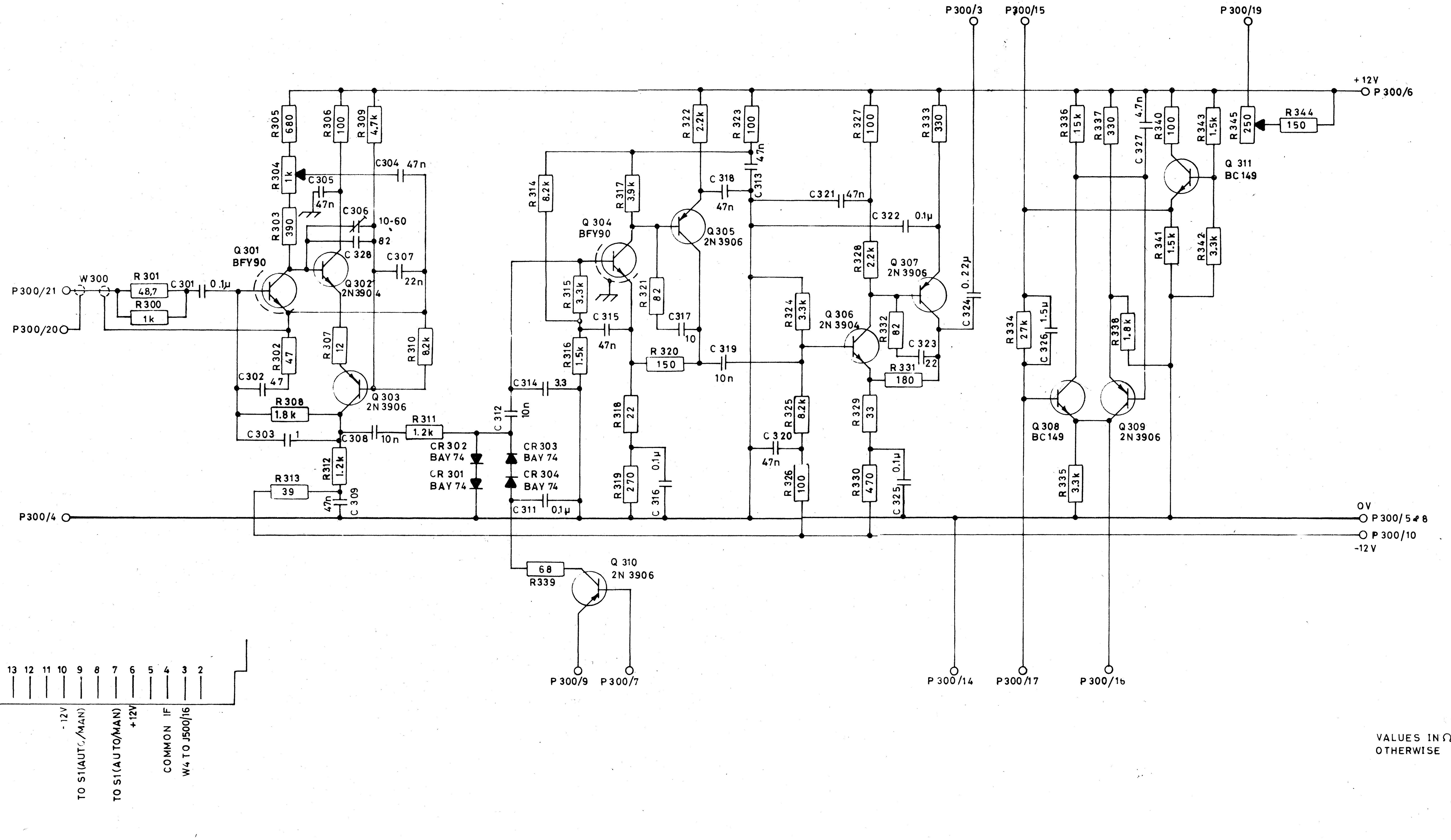
DRAWN BY	NH	28.11.69
CHECKED BY	ϑk	7.1.70
APPR BY	ϑa	7.1.70

II

IF FILTER (WIDE)
900-357

FROM NO. 160661 TO NO.

2712-A3



VALUES IN Ω OR pF IF NOT OTHERWISE SPECIFIED

RADIOMETER A/S COPENHAGEN

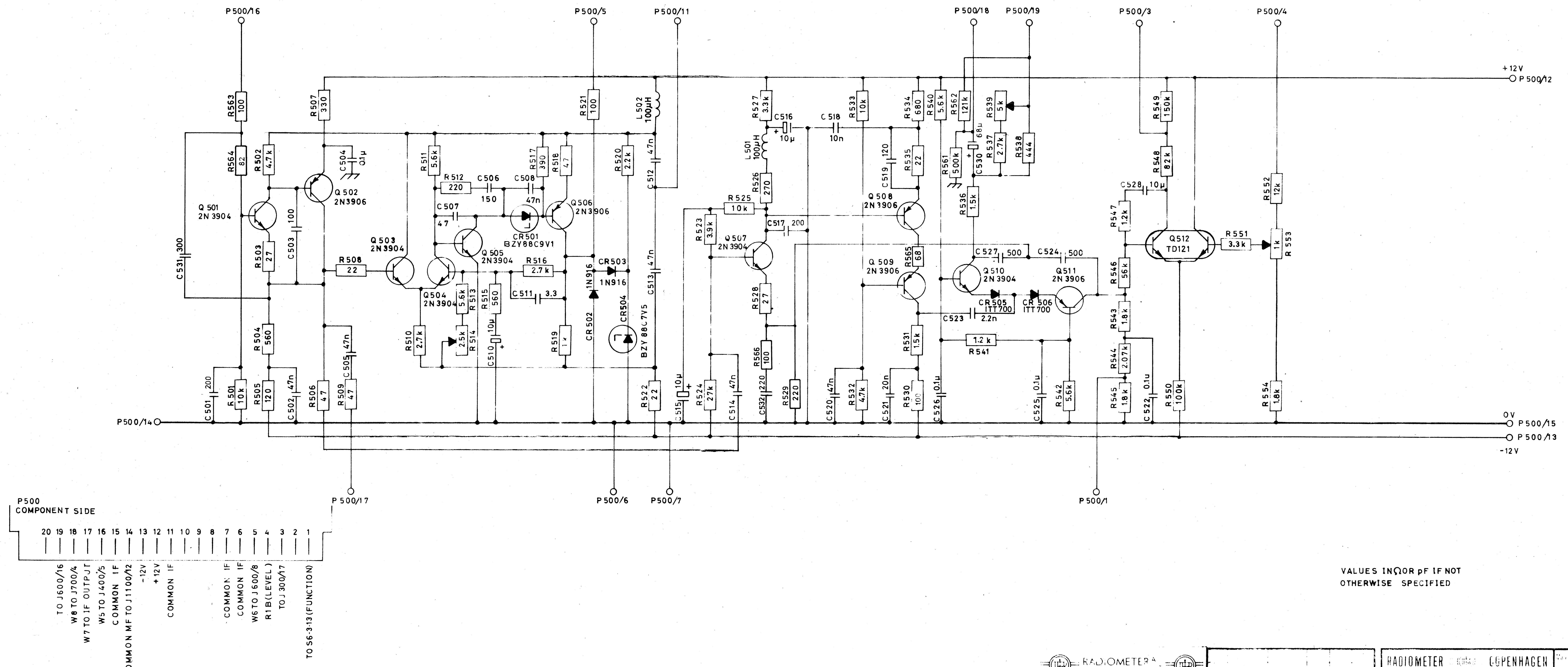
2	175936	11.11.70	OH	
1	160661	23·2·70	OH	da

RADIOMETER COPENHAGEN
72 EMDRUPVEJ NV

III
IF AMP+ATTENUATOR
900-356

Tegn	EA	2.12.69
Kontr	PK	7.1.70
Norm	da	7.1.70

1284-A1



VALUES IN Ω OR pF IF NOT OTHERWISE SPECIFIED

RADIOMETER

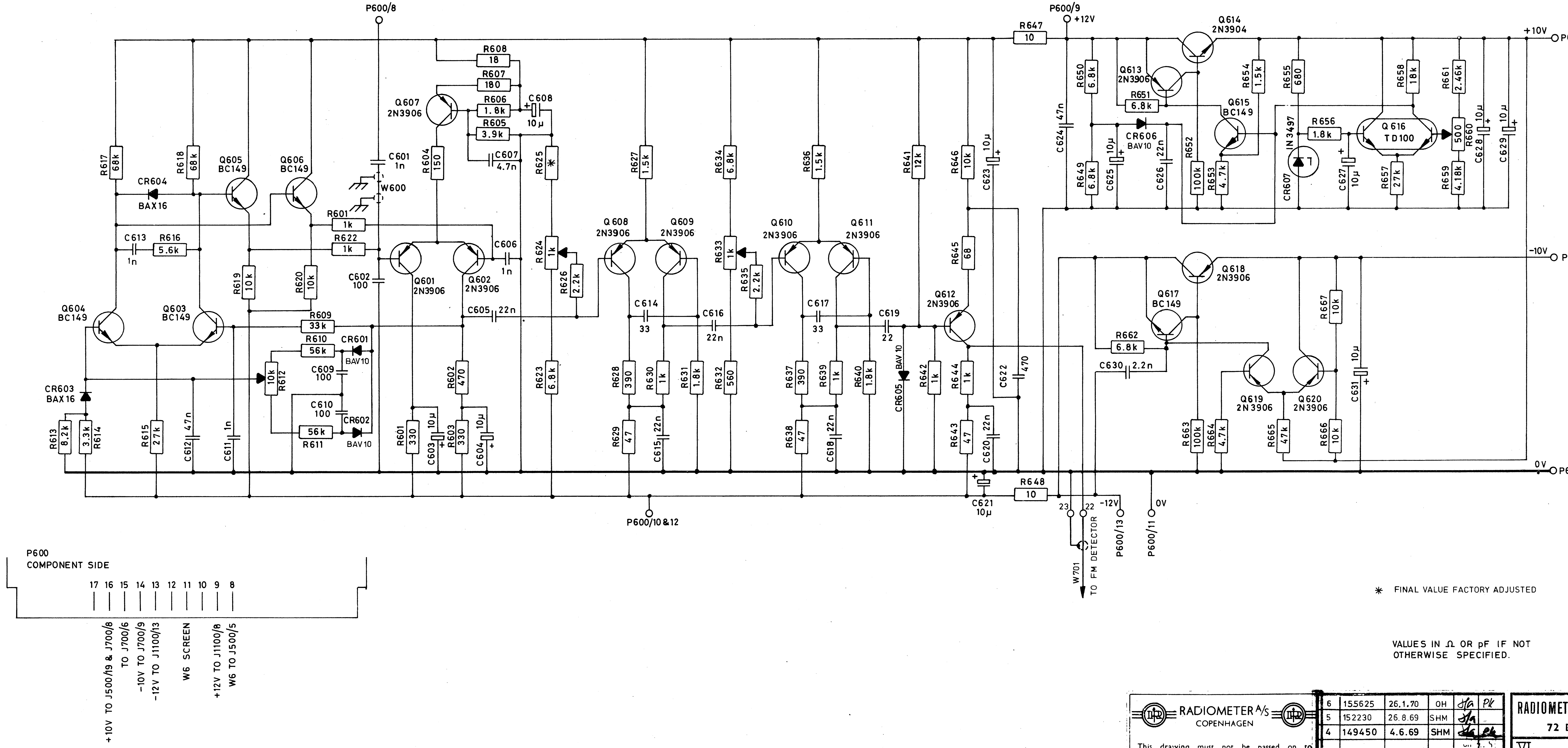
3	175936	12.11.70	OH	
2	160661	24.3.70	OH	

RADIOMETER COPENHAGEN
72 EMDRUPVEJ NV

EA 8.12.69
PK 7.1.70

V
AM DET.+IF OUTPUT AMP
900-355
From no. 160661

1279-A1



* FINAL VALUE FACTORY ADJUSTED

VALUES IN Ω OR pF IF NOT OTHERWISE SPECIFIED.

RADIOMETER A/S COPENHAGEN

This drawing must not be passed on to any person not authorized by us to receive it, nor be copied or otherwise made use of by such person without our authority

Ht.Nr.	Fra Fab. Nr.	Dato	Rt. af	Kont.	Norm.
6	155625	26.1.70	OH		
5	152230	26.8.69	SHM		
4	149450	4.6.69	SHM		
8	175936	10.11.70	B.G.	OH	
7	171265	13.8.70	SHM		

RADIOMETER COPENHAGEN
72 EMDRUPVEJ NV

VI

LIMITER
900-245

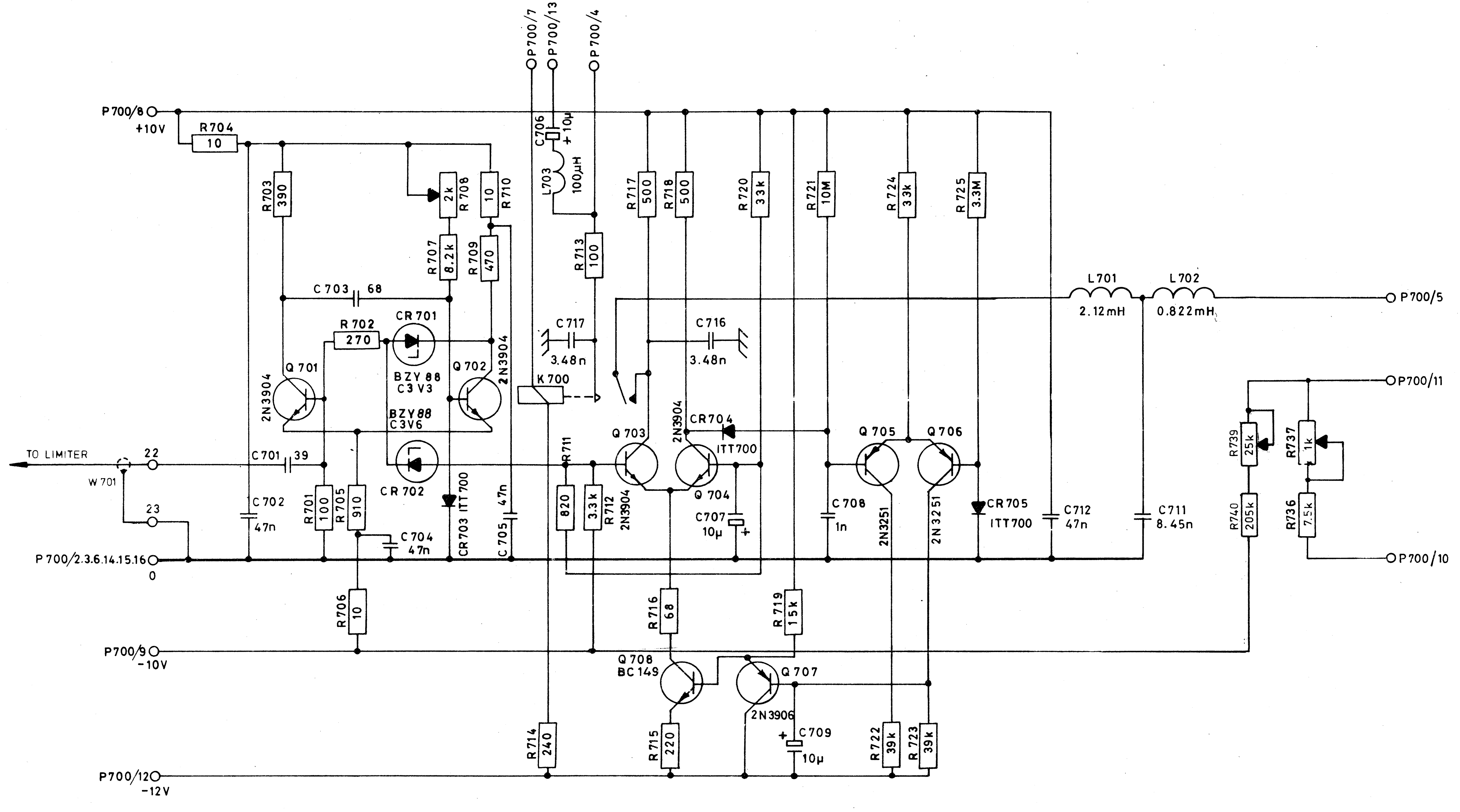
From no. to no.

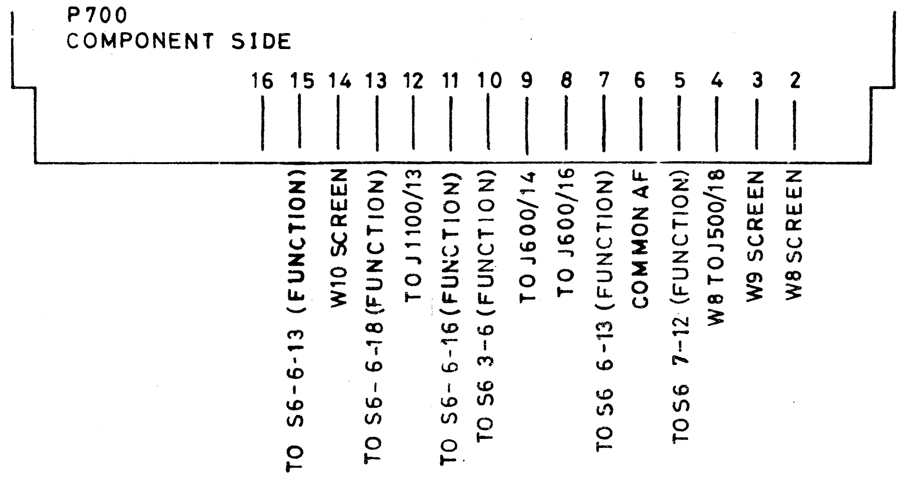
Målestok / | Tegn. 3.9.68 | Konf. | Norm.

Erstatter

1197-A1

Erstattes af





VALUES IN Ω OR pF IF
NOT OTHERWISE SPECIFIED

RADIOMETER A/S
COPENHAGEN

Rt. Nr.	Ers.tab Nr.	Dato	Rt. af	Kont.	Norm.
2	175935	12.11.70	OH		
1	173161	12.8.70	SHM		

RADIOMETER COPENHAGEN
72 EMDRUPVEJ NV

VII

FM DETECTOR
900-360

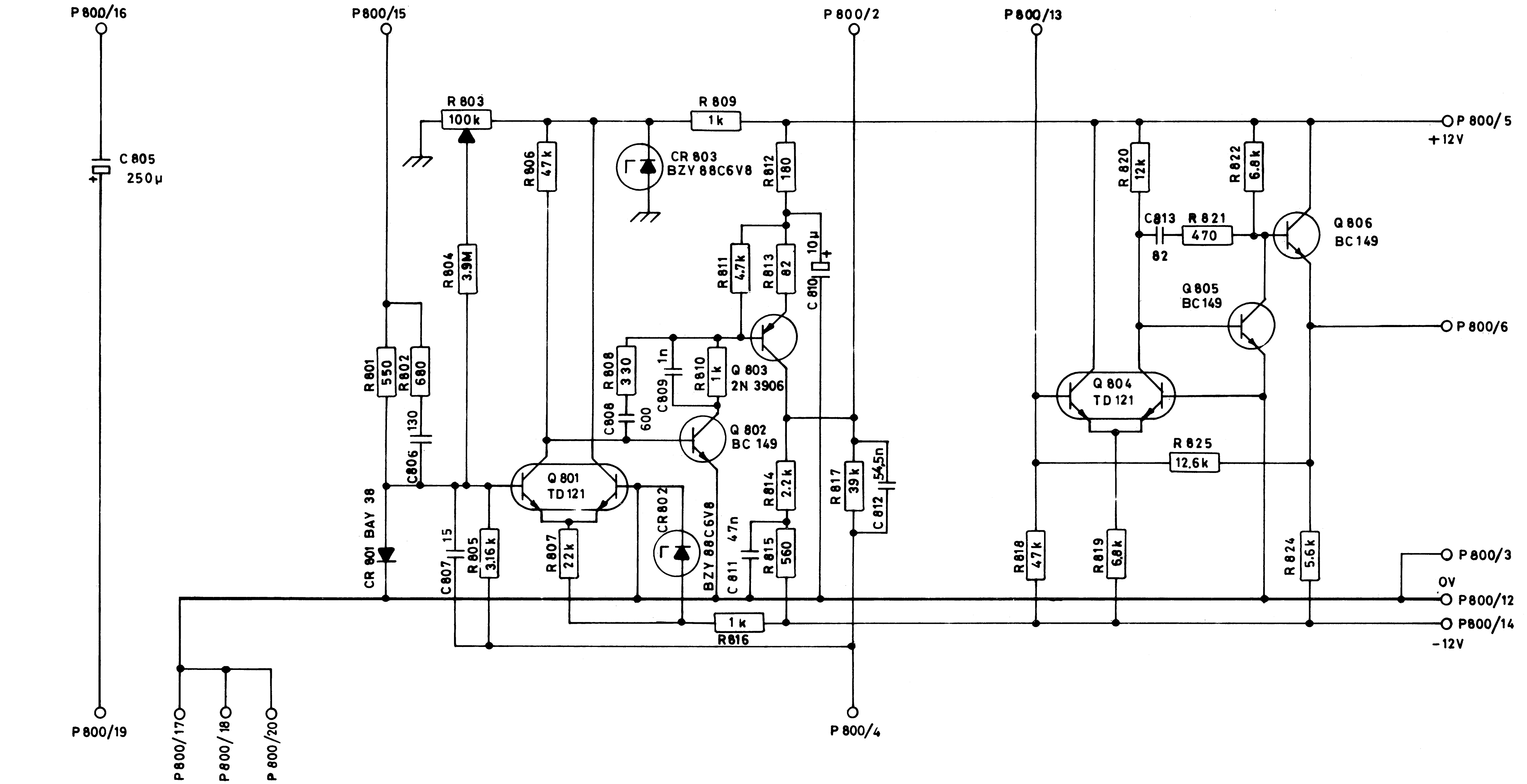
From no. 160661 to no.

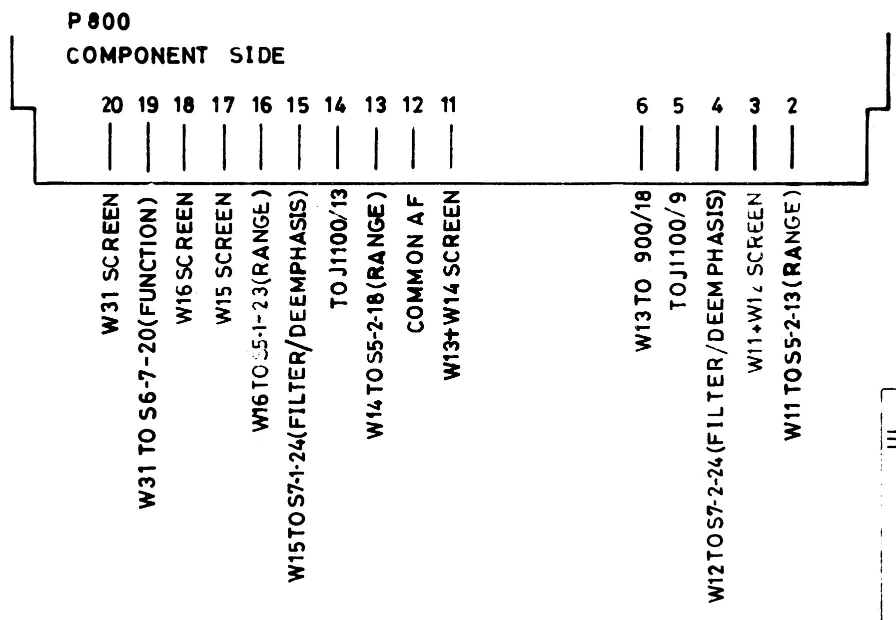
Målestok: /
Tegn. EA 22.12.69
Kont.
Norm.

Erstatter

1281- A1

Erstattes af





VALUES IN Ω OR pF IF NOT OTHERWISE SPECIFIED

Rt. Nr.		Dato	Rt. af	Konf.	Norm
1	175936	12.11.70	OH		

RADIOMETER COPENHAGEN
72 EMDRUPVEJ NV

Malestok	Tegn.	EA	2.12.69
/	Konf.	PK	7.1.70
	Norm.		1.7.70

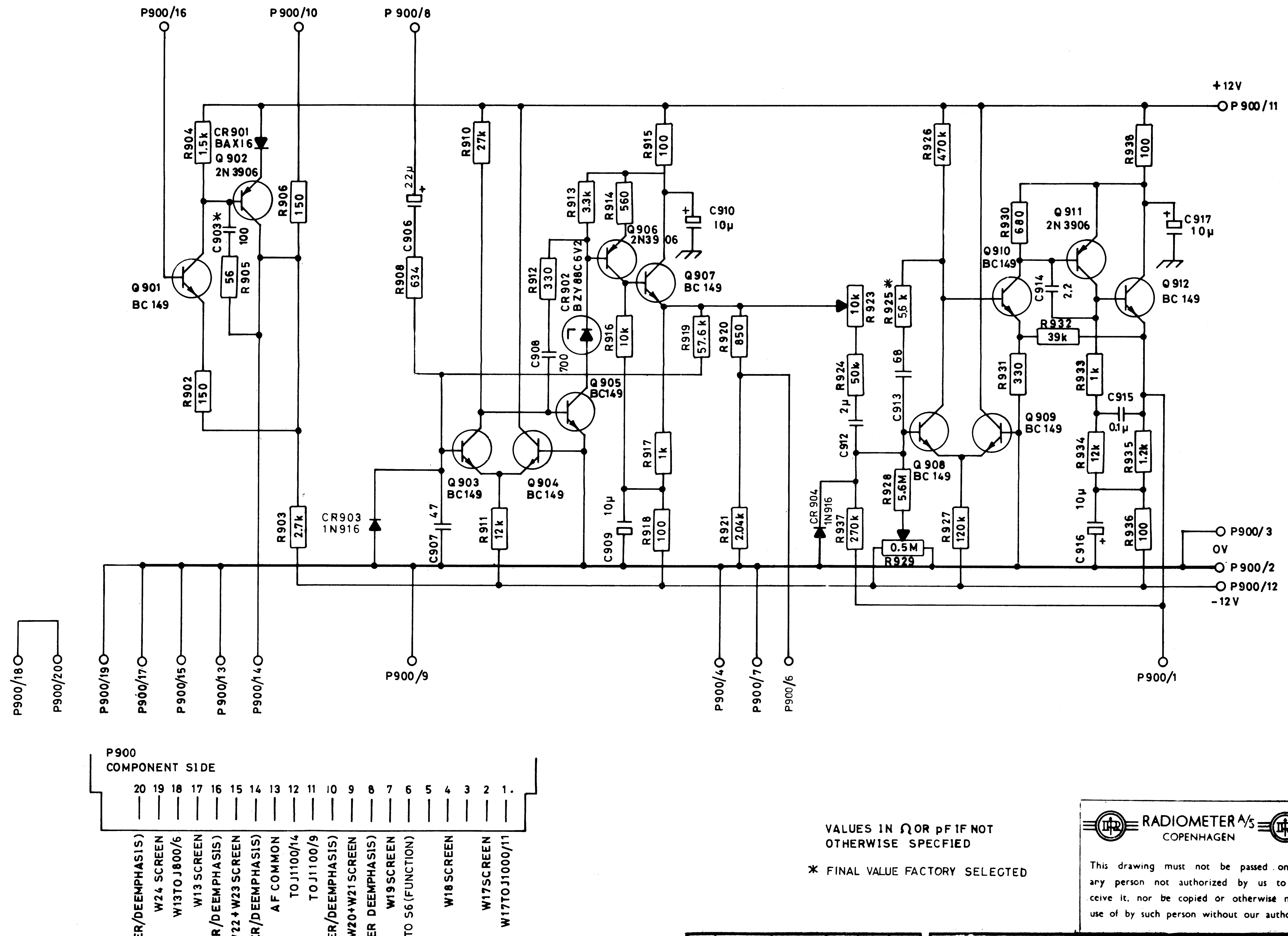
VIII
AF AMPLIFIER I-II
900-358

From no.160661 to no.

Erstatter

1952 - A2

Erstattes af



VALUES IN Ω OR pF IF NOT OTHERWISE SPECFIED

* FINAL VALUE FACTORY SELECTED

RADIOMETER A/S COPENHAGEN

Rt.Nr	Fra Fab. Nr.	Dato	Rt af	Konf.	Norm.
3	175936	12.11.70	OH		
2	166886	22.9.70	SHM	OJL	
1	166886	20.5.70	OH		

RADIOMETER COPENHAGEN

72 EMDRUPVEJ NV

IX

AF AMPLIFIER III-V

900-359

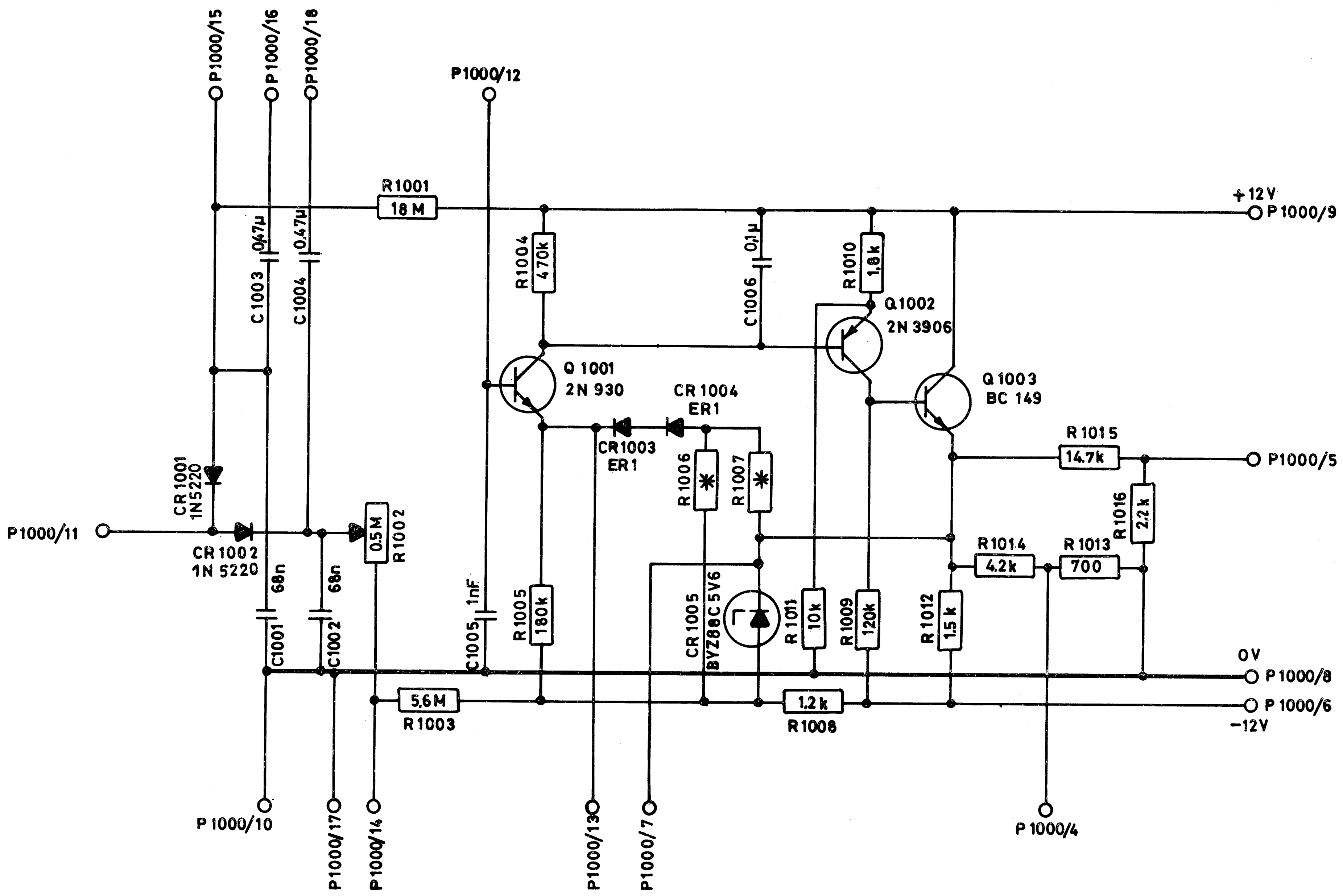
From no. 166886 to no.

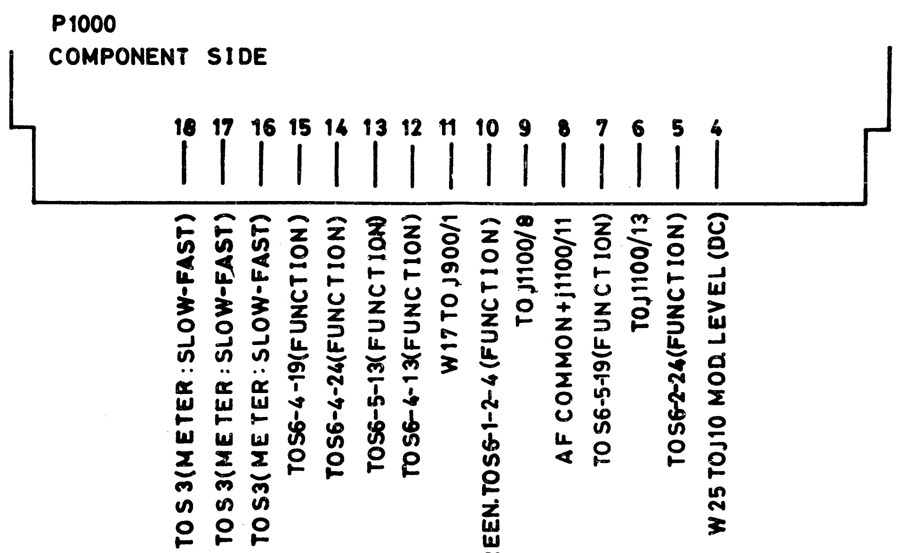
Målestok	Tegn.	SHM 7.4.70
/	Konf.	7.4.70
	Norm.	

Erstatter

1980-A2

Erstattes af





✱FINAL VALUE FACTORY ADJUSTED

VALUES IN Ω OR pF IF NOT OTHERWISE SPECIFIED

RADIOMETER A/S COPENHAGEN

3	175936	10.11.70	B.G.	OH	
2	171216	3.8.70	SHM	Ha	
1	129836	31.10.68.	Je.	AIH	PK
Rt.Nr.	Fra Fab. Nr.	Dato	Rt. af	Konf.	Norm.

RADIOMETER COPENHAGEN
72 EMDRUPVEJ NV

X

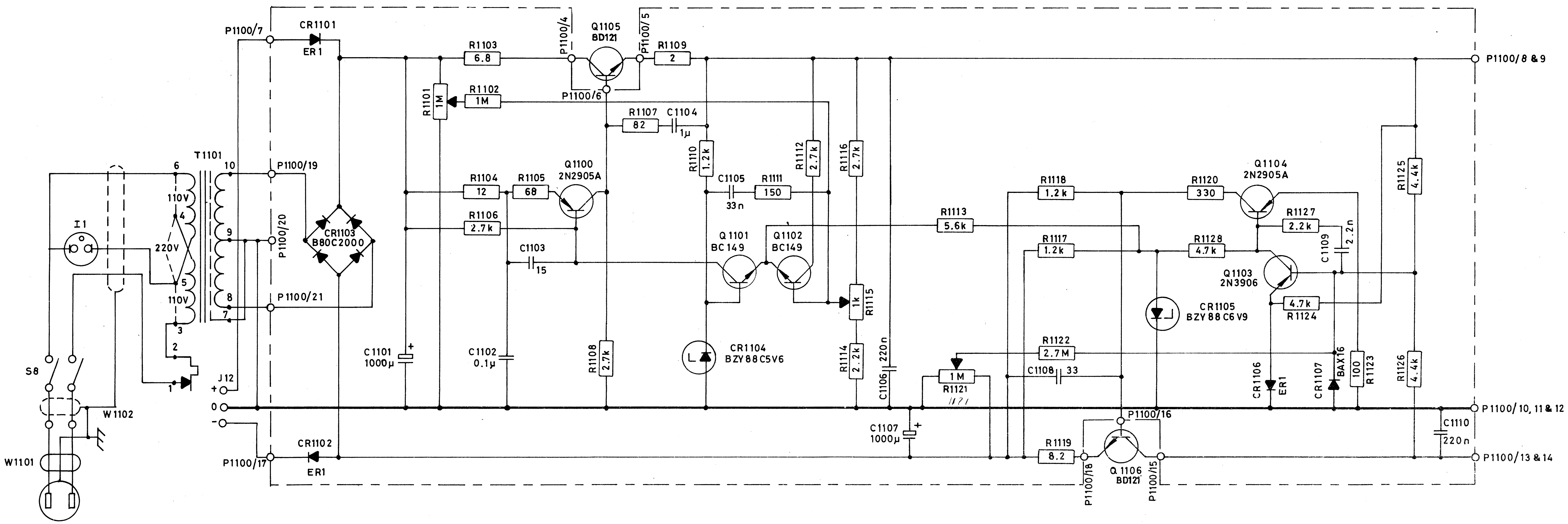
AF DETECTOR
900-249

From no. to no.

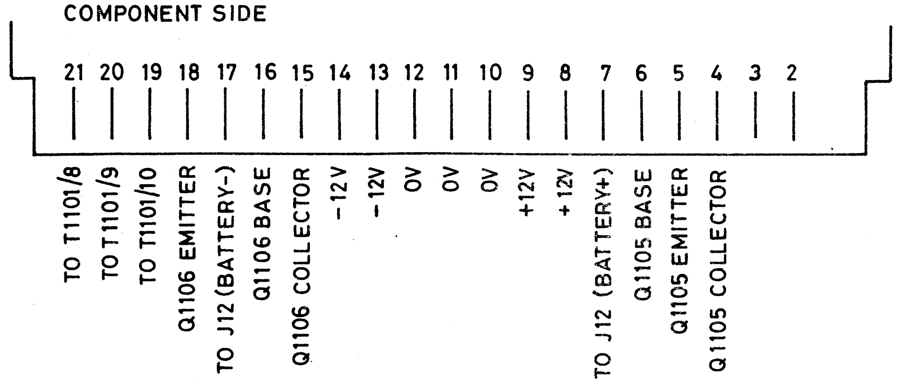
Erstatter

1816-A2

Erstattes af



P1100
COMPONENT SIDE



VALUES IN Ω OR pF IF NOT OTHERWISE SPECIFIED.

RADIOMETER A/S COPENHAGEN

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4	175936	10.11.70	BG.	OH	
3	144435	6.6.69	NH	AIH	PK
2	133865	25.9.68	NH		PK
1		5.7.68	SHM	AIH	PK

RADIOMETER COPENHAGEN
72 EMDRUPVEJ NV

XI

POWER SUPPLY 900-250

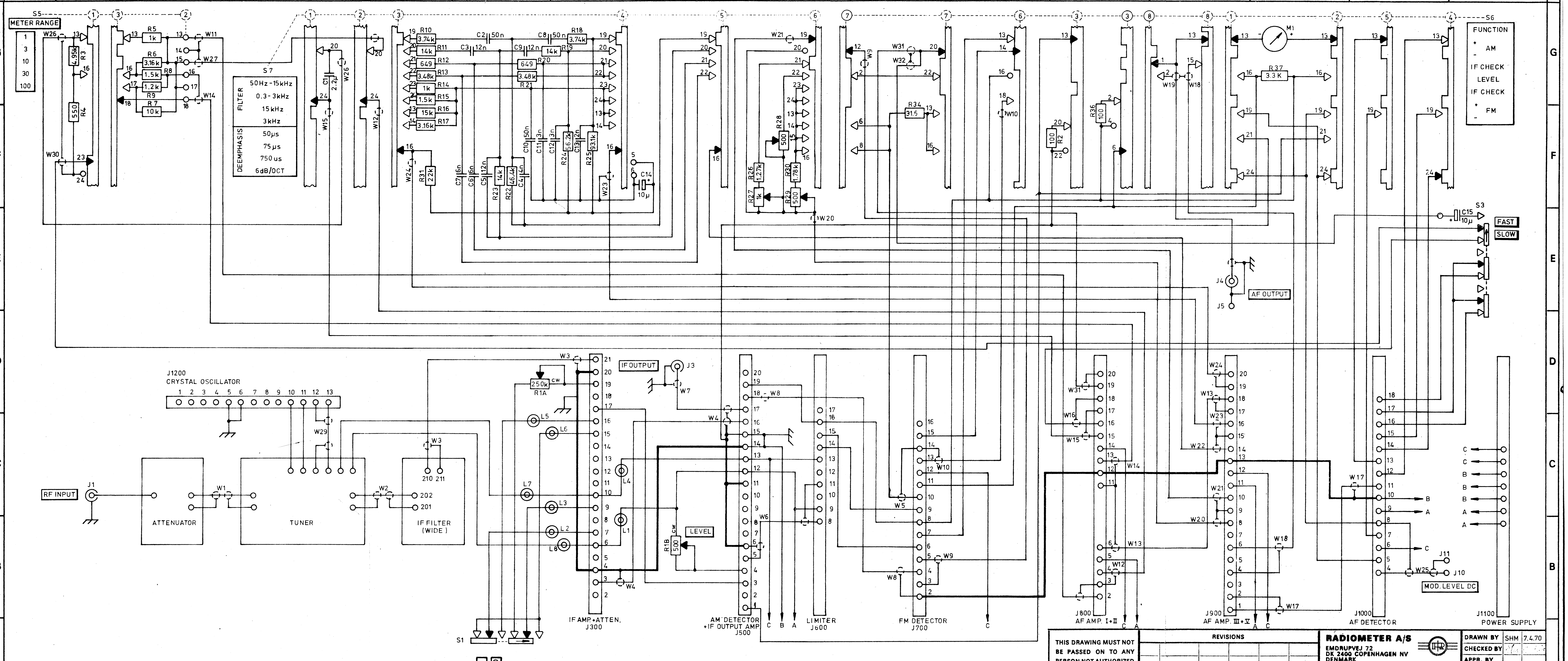
From no. to no.

Målestok: /
Tegn. EA 5.9.68
Konf.
Norm. PK 3.10.68

Erstatter

1196-A1

Erstattes af



VALUES IN Ω OR pF IF NOT OTHERWISE SPECIFIED.
cw: CLOCKWISE POSITION.

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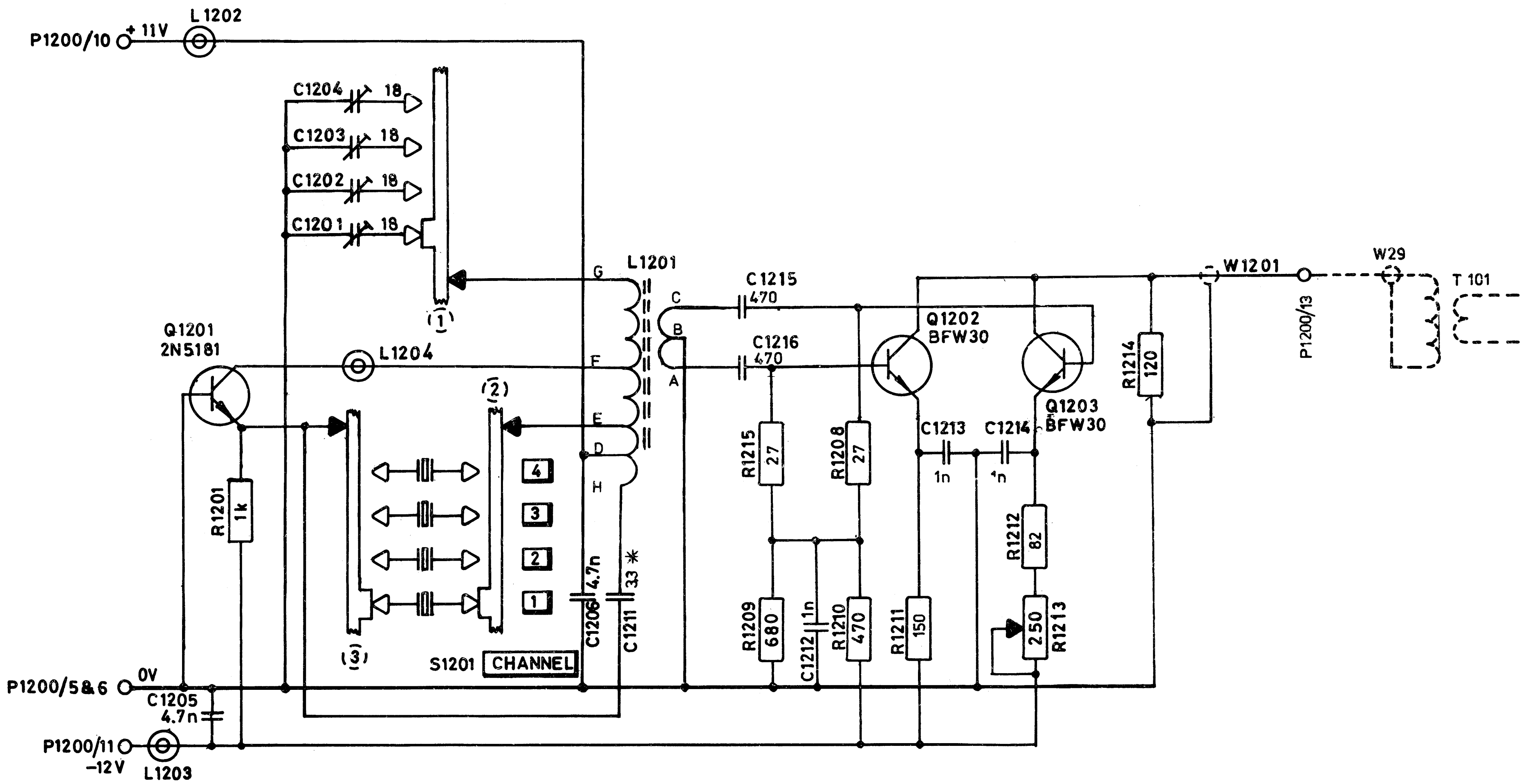
REVISIONS					
ISSUE	FROM NO.	DATE	DRAWN BY	CHECKED BY	APPR. BY
2	175936	10.11.70	OH		PK
1	173161	12.8.70	SHM		

RADIOMETER A/S
EMDRUPVEJ 72
DK 2400 COPENHAGEN NV
DENMARK

DRAWN BY SHM 7.4.70
CHECKED BY
APPR. BY

MODULATION METER
TYPE AFM3b
XII: WIRING DIAGRAM
FROM NO. 166886 TO NO.

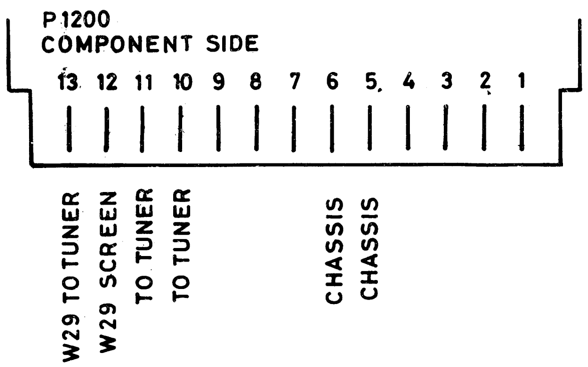
1303-A1



VALUES IN Ω OR pF IF NOT OTHERWISE SPECIFIED.

cw: CLOCKWISE POSITION.

*: FINAL VALUE FACTORY ADJUSTED.



RADIOMETER A/S
COPENHAGEN

Rt.Nr.	Fra Fab. Nr.	Date	Rt. af	Konf.	Norm.
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2		8.8.69	OH	[illegible]	
1		26.3.69	SHM	[illegible]	

RADIOMETER COPENHAGEN
72 EMDRUPVEJ NV

CRYSTAL OSCILLATOR UNIT
TYPE 900-252

From no. to no.

Tegn.	EA	20.6.68
Konf.	[illegible]	24.[illegible]
Norm.	[illegible]	21.[illegible]

Erstatter

1831-A2

Erstattes af