5. Repair Instructions

5.1 Measuring Instruments and Auxiliary Equipment Required

The following table lists all measuring instruments and auxiliary equipment required for checking and calibration.

Designation and specifications	Type	BN	Uses section
UHF-DC Millivoltmeter AC voltage 2 mV to 300 V Frequency range 1 kHz to 1.6 GHz Error of voltage indication ±8 % of f.s.d. DC voltage 1 mV to 1000 V Error of voltage indication ±8 % of f.s.d. with Insert Unit 100.0147 and probe (above 300 MHz to be used as indicator only - appreciable error)	URV	100.0130.02	5.3.11 5.3.12 5.3.13 5.4.6
Millivoltmeter Frequency range 10 Hz to 1 MHz Voltage range 0.1 mV to 300 V, - 80 to +52 dB Error of voltage indication ±2 % of f.s.d. Input resistance 1 MΩ, shunted by 30 pF.	UVN	100.0160.02	5.4.8
Digital Multimeter AC voltage 100 µV to 700 V_{rms} Frequency range 20 Hz to 20 kHz DC voltage 100 µV to 1000 V Resistance range 1 to 15 MΩ	UGWD	100.0218.02	5.4.9
RC Oscillator Frequency range 10 Hz to 1 MHz Output voltage 0 to 30 V continuously adjustable at $Z_{out} \approx$ 20 to 60 Ω	SRB	100.4094	5.3.15
Power and Standard Signal Generator Frequency range 30 kHz to 31 MHz Output voltage EMF 0 to 10 V into 60 Ω	SMAR	100.4513.02	5.4.9
Power Signal Generator Frequency range 30 to 300 MHz Output voltage EMF 0 to 3 V into 60 Ω	SMLM	100.4413.02	5.3.11
Power Signal Generator Frequency range 0.1 to 30 MHz Output voltage EMF 0 to 10 V into 60 Ω	SMLR	100.4171.02	5.3.11
VHF Signal Generator Frequency range 22.5 to 480 MHz Output voltage EMF 0 to 3.5 V into 60 Ω	SLSV	100.4188.02	5.4.3 5.4.9
UHF Power Signal Generator Frequency range 0.275 to 2.75 GHz Output voltage EMF - 50 to +45 dBm (P_{max} = 35 W)	SLRD	100.4194.02	5.3.13

Designation and specifications	Type	BN	Uses section
Field-Strength Meter Frequency range 0.1 to 30 MHz Voltage range 0 to 120 dB above 0.1 µV (0.1 µV to 0.1 V)	HFH	100.1014.02	5.3.11
VHF-UHF Monitoring Receiver with the 4 RF Plug-in Units 100.1189.02 at 25 to 230 MHz 100.1195.02 at 160 to 470 MHz 100.1208.02 at 460 to 900 MHz 100.1214.02 at 850 to 1300 MHz Input voltage for all RF Plug-in Units 0 to 120 dB above 1 µV (1 µV to 1 V)	ESU	100.1143.02	5.3.11 5.4.11
Limit Bridge Parameter R, L, C Measurement range: ±0.1 to 25 % Error of medsurement range ±5 % of f.s.d.	KZS	100.1950.02	5.5.2
YT Recorder	ZSG 2	110.2007.92	5.5.2
Oscilloscope Tektronix Type 545 with Type L and Type Z plug-in units Bandwidth 20 MHz			5.4.9
Microwave Power Meter Frequency range 0 to 4.8 GHz (0 to 13 GHz with Dezifix A connector) Power range 0.1 to 330 mW	NRS	100.2433.92	5.3.11 5.4.4
800-MHz-Counter with 800-MHz Plug-in 100.6080.02 Frequency range 10 to 800 MHz Error limits $\pm 10^{-10}$	FET 2	100.6039.02	5.4.6 5.4.8
UHF Attenuator Set Frequency range 0 to 2000 MHz Attenuation 0 to 140 dB Accuracy ±0.05 to 1 dB	DPU	100.8960.50	5.3.11 5.3.12
Power Supply Voltage range 0 to 32 V Current range 0 to 30 A Resolution 1 mA	NGR	100.5084..	5.3.13
SHF Termination	RMC	100.2940.50	5.3.11 5.3.13

Battery (2 ea) 24 V, I_{max} = 0.5 A

Adapter (Z = 50 Ω)

N connector system	⟷	Dezifix B [1])
Dezifix B [1])	⟷	Subminax socket
Dezifix B [1])	⟷	Subminax plug

Cable (Z = 50 Ω)

Dezifix B [1])	⟷	Subminax plug
Dezifix B [1])	⟷	Subminax socket
N connector system	⟷	Dezifix B [1])
Dezifix B [1])	⟷	Dezifix B [1])
BNC	⟷	4/13 [1])

[1]) These connectors apply to R&S instruments only

5.2 **Trouble-shooting** (see level plan Fig. 5-16)

5.2.1 Power Supply

Prior to trouble-shooting in the SMDA check that the rated power supply values are maintained, e. g. AC supply voltage 220 V_{rms} ±10 %. Press the POWER button: The pilot lamp must light. If it does not light, the power cable, power switch, fuse or the lamp itself may be defective. Measure the voltage at socket Bu70 (in circuit diagram 41314 S Bl.3).

Checking the operating voltage: Withdraw the set from its cabinet (see section 3.3.2) and measure the operating voltages ±18 V ±0.1 V at the outputs "+", "–" and "±" of the printed cable harness (Fig. 4-4).

NOTE: Adjust only if the frequency or deviation accuracy and the output power do not correspond to the specifications of section 1.3. If an adjustment is necessary, the +18-V voltage can be corrected with R662 and the –18-V voltage with R682 to within ±0.1 V. If no adjustment is possible or if no voltage is measurable, check the power supply according to section 5.3.1. After adjustment of the operating voltage, check frequency, deviation, output voltage and the overload protection.

5.2.2 RF Voltage

Trouble: RF voltage failure in one or all ranges.

Preliminary check: If the modulation unit functions properly, part of the RF generation can be checked by means of the AM indication. Set the INDICATION switch to AM, the range selector to 100, the AM switch to INT. and the AM control to mid-position. The positions of the other switches are of no importance.

Then press the frequency range buttons one after the other and adjust for a medium frequency in each range. The meter of the modulation unit should show mid-scale deflection in each case. If no deflection is obtained, check according to the following table:

No output voltage in range	Possible trouble source	Check according to section
All ranges	RF OUTPUT II	5.2.2
I	Oscillator IV	5.3.2
I	Crystal-stage + relay in the mixer	5.3.2 and 5.3.5
I+II+III	Output filter III	5.3.10
IV	Output filter IV and oscillator IV	5.3.2 and 5.3.10
VI	Output filter VI and oscillator VI	5.3.2 and 5.3.10
VII	Output filter VII and oscillator VII	5.3.2 and 5.3.10
II to VII	Relays in the mixer	5.3.5
indication in all ranges	RF attenuator and overload protector	5.3.11 and 5.3.13

Table 5 Fault location in case of RF voltage failure

RF OUTPUT II: After prechecking (no deflection with the AM indication) measure the second output voltage according to section 5.3.7.

a) No voltage present: Check the oscillator (see below), buffer, control circuit, mixer and second output amplifier. See sections 5.3.2, 5.3.4., 5.3.5, 5.3.7 and Fig. 5-16.

b) A voltage considerably higher than the nominal value (15 to 75 mV) is present: The control circuit is open, since no RF voltage is applied to test diode GI260; therefore check the modulator and the output amplifier (see sections 5.3.8, 5.3.10 and Fig. 5-16).

Oscillator: Disconnect cable K1 at the buffer and AGC circuit 41311-5.10 which is accessible from the bottom of the chassis. Measure the voltage at K1 with an RF voltmeter of 50 Ω input impedance. Press the frequency-range buttons one after the other and adjust for a medium frequency in each range. The oscillator voltage must be $> 40\ mV_{rms}$ in all ranges. If the voltage of one or all oscillators fails, check according to section 5.3.2. If voltage is present in all ranges, check as follows:

5.2.3 Modulation Unit (Trouble: No modulation obtainable)

Functioning of modulation generator: NOTE: The modulation generator is inoperative if the AM switch and the FM or φM switch are in position EXT. Set the INDICATION switch to MOD. GEN., the range selector to 100, the AM or FM switch to INT. or UNMOD. Full-scale deflection of the meter must be obtainable with the red AMPLITUDE potentiometer knob in all positions of the grey "kHz" switch. If an indication is obtained at all frequencies, the AF generator and the meter amplifier are intact. Then check the modulation characteristic according to section 3.2.3. If no output voltage is obtained at some frequencies, switch 8 is probably faulty. If no output voltage is obtained at any frequency, check as follows:

Output voltage of modulation generator: The voltage at the MOD. GEN. OUTPUT socket of the modulation unit must be adjustable up to $> 1\ V_{rms}$ into 200 Ω. Measure with AC voltmeter. The modulation generator operates only if the AM and the FM switches are at INT. or UNMOD. If no output voltage is present, check the modulation generator according to section 5.3.14. If output voltage is obtained, check the meter amplifier according to section 5.3.15.

Phase modulation, frequency modulation and amplitude modulation: See section 3.2.3.

5.3 Performance Check of Subassemblies

For all following measurements, withdraw the SMDA from its cabinet according to section 3.3.2. The measurements and data required for a performance check of the subassemblies and for repair are summarized in this chapter. The required measuring instruments are obvious from the type of measurement and are not described separately. Suitable instruments are listed in section 5.1. Before making an electrical check, a visual inspection of the subassembly concerned is recommended. Special attention should be given to the development of heat, contaminated or deformed elements, broken wires, defective soldered joints, etc. Such defects should be repaired before making the electrical check.

5.3.1 Power Supply (see circuit diagram 41314 S Bl.3)

Power consumption	17 VA ±20 %
Secondary voltages of power transformer at both windings	$25\ V_{rms}$ ±5 %
DC voltage at the charging capacitor C571	25 V ±10 %
C591	26 V ±10 %

Check voltages in the stabilizing circuits 41311-4.7 and 41314-4.9 according to circuit diagram 41314 S Bl.3. Tolerances of ±10 % are permissible.

Output voltages (operating voltages) at the outputs "+", "–" and "±" of the printed cable harness 41311-4.5 ±18 V ±0.1 V

NOTE: Prior to the adjustment, follow the instructions given in sections 5.2.1 and 5.4.1.

Check to operating voltages of ±18 V ±0.1 V of the subassemblies at the respective connections according to the circuit diagram.

Measure the hum and noise voltages at the operating-voltage leads with an oscilloscope at AC supply voltages of 198, 220 and 242 V_{rms}. Hum and noise must be $< 0.1\ mV_{pp}$.

The offset, i. e. the variation of the operating voltages, must be < 0.1 mV at AC supply voltage variations from 198 to 242 V_{rms}.

The power consumption of the subassemblies from the power supply must be < 450 mA for the +18-V lead and < 120 mA for the –18-V lead.

Battery operation: If two separate DC voltages (24 V $^{+5}_{-2}$ V each) are fed to the battery sockets at the rear of the signal generator, the same values must be obtained as in the measurement of the output voltages.

NOTE: The power supply does not withstand permanent short circuit. Short circuits of 1 to 2 minutes do not cause damage unless they occur at very short intervals.

5.3.2 Oscillator

For the mechanical procedure to be followed for opening the oscillator, see section 4.19.3. The correlation of the frequency ranges and the oscillator segments is also shown in this section.

Checking the operating voltage of the oscillator (– 18 V): The operating voltage is fed to the oscillator segments from below via lead-through chokes (deviation network); see Fig. 5-1. Press the button of the frequency range concerned. Turn the tuning knob until the dial drum has made a full revolution. The operating voltage must be present with the pointer (coloured arrow) up to 1 cm beyond the scale ends. Further off, no operating voltage must be present.

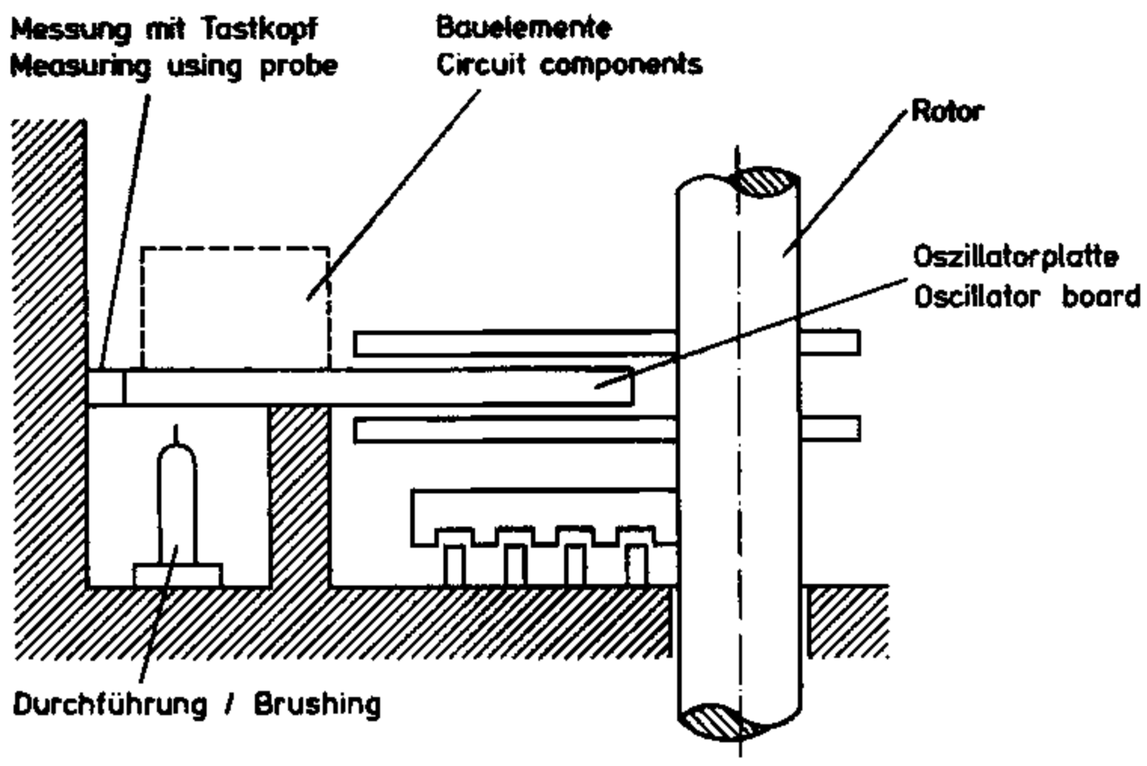


Fig. 5–1 Construction of oscillator

Checking the current consumption: No button must be pressed. Measure at the pushbutton assembly according to Fig. 5-2 using a milliammeter 0 to 10 mA, $Z_{in} < 10\ \Omega$. The current consumption should be 2 to 7 mA.

Checking the RF voltage: Measure the RF voltage at the star point of the isolating resistors R801 to R806 (output) with a UHF-DC Millivoltmeter Type URV ($Z_{in} > 20\ k\Omega$). Press the button of the frequency range being checked. Tune through the whole range. The RF voltage must be 30 to 70 mV.

At oscillator temperatures up to 60 °C (heat with a hot-air blower), the output voltage must not drop below 30 mV. The waveform of the oscillator output voltages should be sinusoidal in the whole frequency range. A rough check can be made with a sampling oscilloscope (at K1). For precision measurements, use a test receiver and tune to any harmonic present.

Harmonic suppression
Ranges II, III, IV and V . . . . . > 30 dB
Ranges VI and VII . . . . . > 26 dB

Performance check of ranges II, III and VI being cut off by range VII: The diodes GI411, GI401 and GI371 short-circuit certain of the sections oscillator circuits and deviation networks of ranges II, III and VI when range VII is cut in. A voltage between +16 V and +18 V must be present at the cathodes of the diodes GI411, GI401 and GI371 if the ranges II to VI are selected. IF range VII is selected, a voltage between −1.0 V and −1.6 V must be present at the cathodes of the diodes GI411, GI401 and GI371.

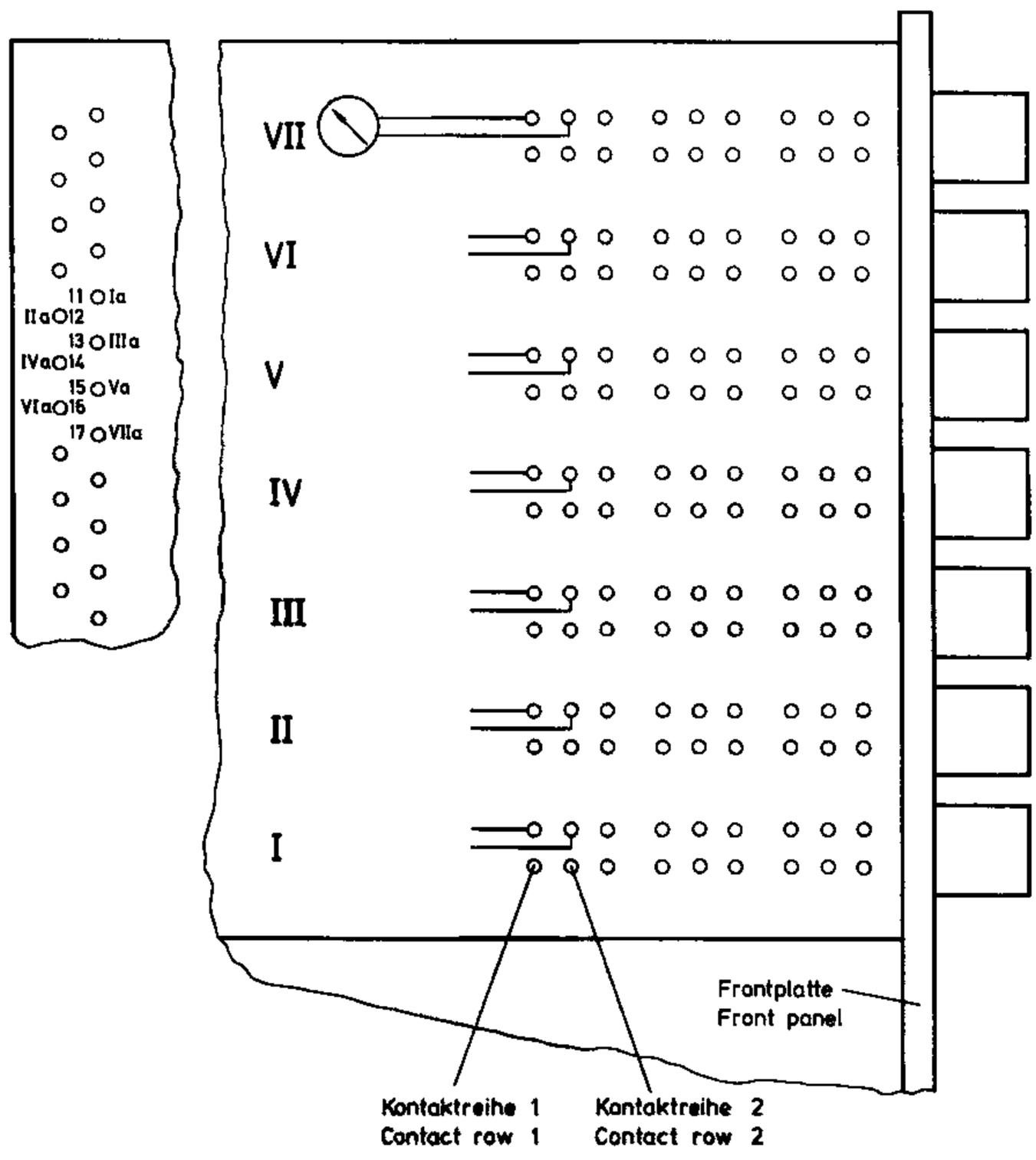


Fig. 5-2 Key set with test points

Checking the frequency deviation

Frequency deviation with DC: Unsolder link H2 in the deviation network 41314-2.100.25 and replace by a switch. Connect a frequency counter (FET 2 with 800-MHz plug-in) to the SMDA. Press the button of the frequency range being checked; no modulation must be present. A frequency deviation is produced by turning the switch replacing the soldered link 1-2 on and off. Measure the frequency deviation at the upper limit, at the centre and at the lower limit of the frequency range. The frequency deviation should be roughly equal at the three frequencies. The permissible departure of the value at the range ends from that measured at the centre is $< 4\,\%$. Remove the switch and resolder link 1-2.

Frequency modulation: Check according to section 3.2.3.5.

Checking the oscillator frequency: Proceed according to section 3.2.1.2.

5.3.3 FM Chokes and Operating-voltage Leads (see circuit diagram 41314 S Bl.1)

Since the FM chokes and the operating-voltage leads are not immediately accessible, it is recommended that the deviation network (section 5.3.16) and the operating voltages at the pushbutton contact rows 1 and 2 (Fig. 5-2) and soldering lugs Ia to VIIa (Fig. 4-7) be always checked first. For the mechanical procedure to be followed for withdrawing the FM chokes, see section 4.19.8.

DC voltage check: Unsolder cable K11 and transistor T42. Check the connection from C423 to C425 (resistance $< 1\,\Omega$). Measure the isolation of the line to chassis (resistance $> 1\,M\Omega$). Check cable K11: A DC voltage of about $+7.8\,V$ (without modulation) must be present at the inner conductor.

5.3.4 Buffer and AGC

For the mechanical procedure to be followed for withdrawing the subassembly, see section 4.19.11. Check the DC voltages according to the circuit diagram 41314 S Bl.2. Tolerances of $\pm 10\,\%$ are permissible. Separate the control circuit (unsolder the inner conductor K2 from lead-through choke D3). Feed in a DC voltage continuously adjustable from approx. $-9\,V$ to $-10\,V$.

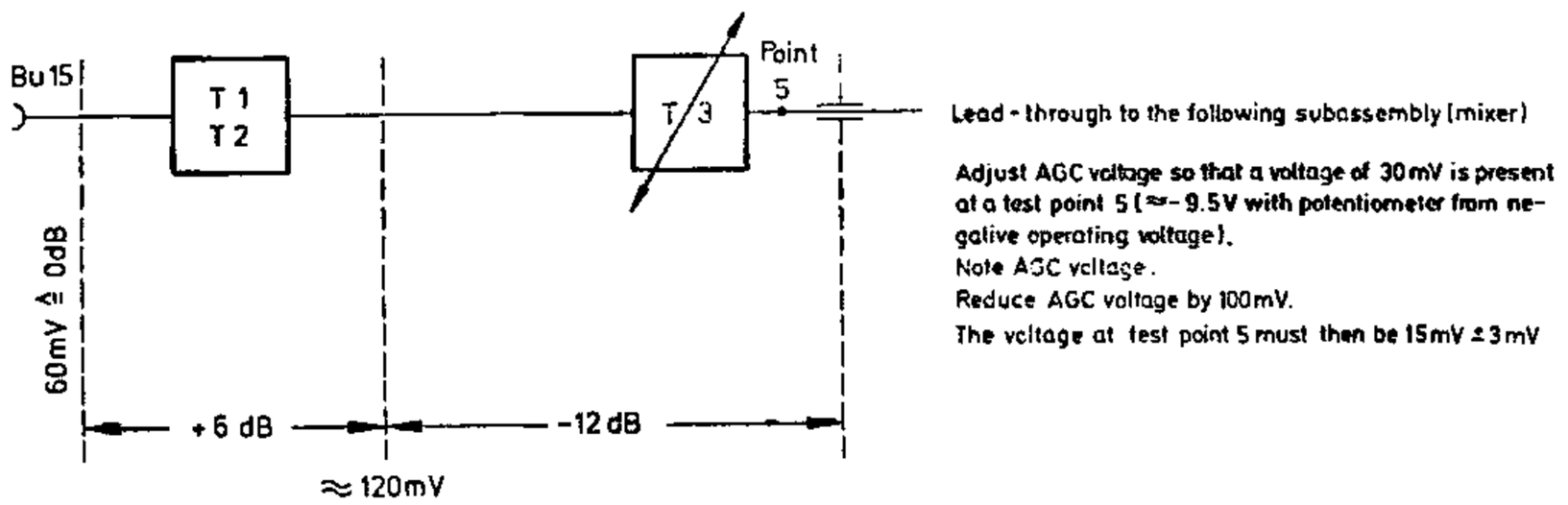


Fig. 5-3 Level schedule for the measurement of the RF levels at the buffer and AGC amplifier

RF level check: Test frequencies: 48 MHz (range II), 400 MHz (range VII). Measure with UHF-DC Millivoltmeter Type URV ($Z_{in} \geqq 50\,k\Omega$; $C_{in} \leqq 1\,pF$). See level diagram Fig. 5-3.

Checking the frequency response: The measurements are carried out with Polyskop SWOB II or SWOB III. Adjust the Polyskop as follows:

a) Put the EMF line in the upper third of the screen.

b) Set the output attenuator to – 20 dB and connect the RF output (A) with the RF input (B) via a 50-Ω cable.

c) Bring the cable line to coincidence with the EMF line by means of button "Vertical gain Y1". This line serves as reference line for the 0-dB amplification between (A) and (B).

Connect the RF output of the Polyskop with socket Bu15 and the RF input with soldering terminal 5. First apply a DC voltage of – 10 V to soldering terminal 3 so that the AGC circuit opens; then apply a DC voltage of – 9 V so that the AGC circuit closes and carry out the following measurements:

Frequency/MHz	50	100	200	300	400	500
Gain/dB with – 10 V at terminal 3	14±1	13±1	12±1	11.5±1	11±1	9±1
Gain/dB with – 9 V terminal 3	≧ 14	≧ 14	≧ 14	≧ 14	≧ 14	± 10

Table 6 Checking the frequency response of AGC

5.3.5 Mixer

The mixer consists of three printed circuit boards. Board 1: Low-pass filter preceding mixer 41314-5.11/2. Board 2: Mixer and null detector amplifier (calibration) 41314-5.12. Board 3: Low-pass filter following mixer 41314-5.14/2. For the mechanical procedure to be followed for withdrawing the subassembly, see section 4.9.11.

Checking the relays: Measure with a continuity tester at points a-(a), b-(b) and c-(c), d-(d) = no button pressed; a–c and e–b = range I button depressed; a–b = range II to VII buttons depressed. See Fig. 5-4. Press the frequency-range buttons one after the other.

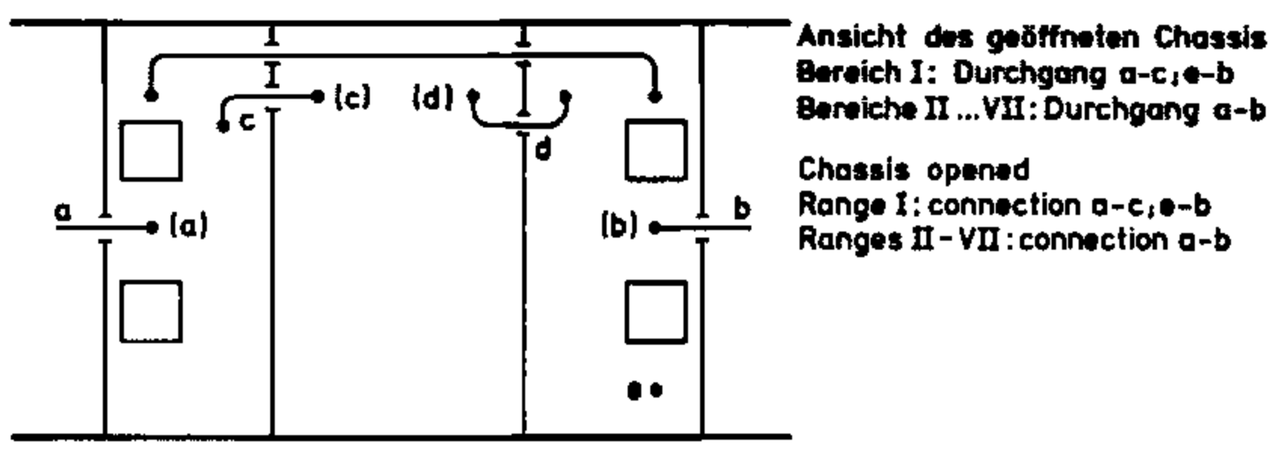


Fig. 5–4 Checking the relay of the mixer

Checking the mixer: Measure the signal voltage (≧ 1 V_{rms}) at C83 selectively (129 MHz) with the VHF-UHF Test Receiver Type ESU Measure the oscillator voltage at C74 selectively with the Test Receiver Type ESU. Measure the diode current at R84 with the DC-UHF Electronic Multimeter Type URV (DC input 1 : 1; Z_{in} = 1 MΩ) or with Type UGWD. The voltage drop resulting from the diode current must be approx. 600 mV.

Checking the null detector amplifier: Check the DC levels according to the circuit diagram 41314 S Bl.2. Observe the reading of meter J1 (zero beat indicator). Select range I and change the frequency tuning from the calibration mark to the left or right. For meter reading, see Fig. 5-5.

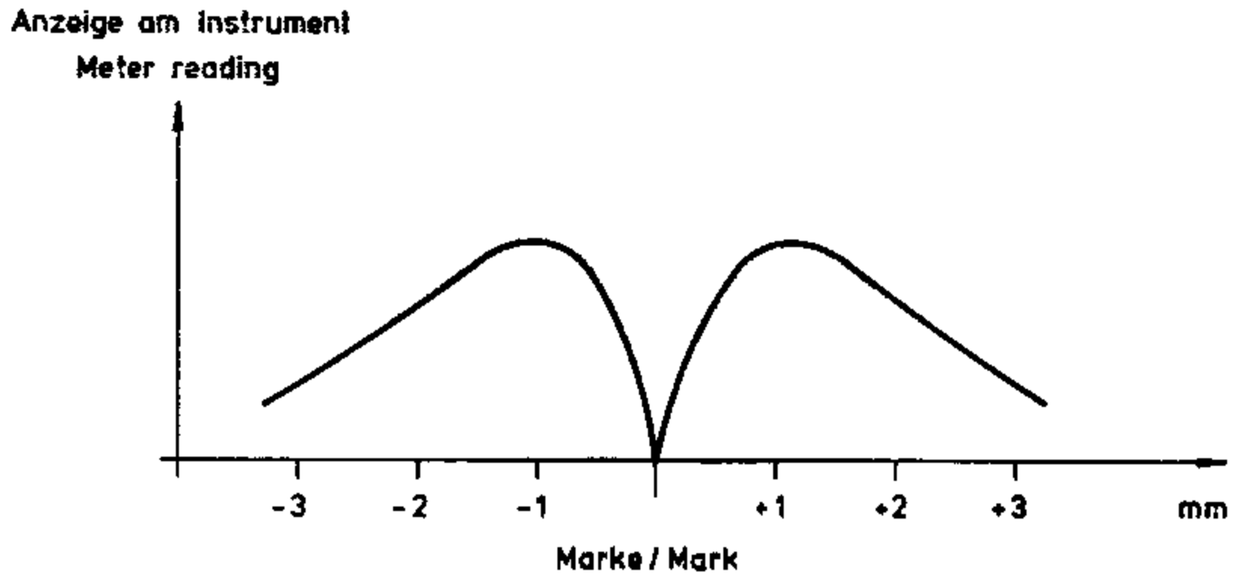


Fig. 5–5 Rated meter reading for checking of meter amplifier

Checking the frequency response: Measure as described in section 5.3.4.

a) Low-pass filter ahead of the mixer 41314-5.11/2: Connect the RF output of the Polyskop with soldering terminal 47 and the RF input with soldering terminal 8. At a frequency $\leqq$ 180 MHz (129 to 179 MHz) the attenuation must then be 15 $\pm$1 dB. At 220 MHz the attenuation must be greater than 25 dB.

b) Low-pass filter after the mixer 41314-5.14/2: Connect the RF output of the Polyskop with soldering terminal 10 and the RF input with terminal 22. In the frequency range 0.4 to 50 MHz the gain must be 24 $\pm$1 dB.

c) Mixer 41314-5.12 and low-pass filter after the mixer 41314-5.14/2: Connect the RF output of the Polyskop with soldering terminal 10 and the RF input with terminal 22. Apply an RF voltage of 20 mV to soldering terminal 10, which corresponds to an attenuator position of – 30 dB on the Polyskop. In the range 130 to 180 MHz the gain must then be 14 $\pm$2 dB.

5.3.6 Crystal Stage

For the mechanical procedure to be followed for removing the crystal stage, see section 4.19.7. Measure the operating voltage (+18 V) at the lead-through choke (D33) of the crystal stage. The operating voltage must be present in frequency range I; in the other ranges, no operating voltage must be present. Check the DC voltages according to the circuit diagram 41314 S Bl.2 in the frequency range I. Measure the output voltage at socket Bu27 of the crystal stage, using the UHF-DC Millivoltmeter Type URV plus Insertion Unit terminated with 50 Ω. It must be $>$ 1.0 V_{rms}. Measure the output frequency at Bu27 with the Electronic Counter Type FET 2 (Z_{in} = 50 Ω) or Frequenzkontroller. It must be 129 MHz $\pm$10 kHz.

For **adjustment,** see section 5.4.5.

5.3.7 Second-output Amplifier

For the mechanical procedure to be followed for removing the subassembly, see section 4.19.10. Check the DC voltages according to circuit diagram 41314 S Bl.2. Tolerances

of ±10 % are permissible. No modulation should be cut in. Measure the RF levels at 0.4 MHz (range I) and 400 MHz (range VII) with the UHF-DC Millivoltmeter Type URV ($Z_{in} \geqq 50$ kΩ, $C_{in} \leqq 1$ pF). The attenuation between points 27 and 24 should be approximately 10 dB. The output voltage into 50 Ω must be between > 15 and < 45 mV_{rms} at attenuator settings < 0.5 V_{EMF} and < 75 mV_{rms} at attenuator settings > 0.5 V_{EMF}.

Adjustment: Adjust the attenuator pad R210 (in the output stage 41314-5.21/2) such that at an attenuator position of −20 dBV the voltage at the RF OUTPUT II is 20 mV at 115 MHz (see Fig. 5-16).

Checking the frequency response: Measure as described in section 5.3.4. Connect the RF output of the Polyskop with soldering terminal 27 and the RF input with socket Bu5 RF OUTPUT II. In the range 0.4 to 480 MHz the attenuation must be 10 ± 1 dB.

5.3.8 Buffer and Modulator

For the mechanical procedure to be followed for removing the subassembly, see section 4.19.10. Check the DC voltages according to the circuit diagram 41314 S Bl.2. Tolerances of ±10 % are permissible. No modulation should be cut in. Measure the RF levels as described in section 5.3.7 (level dicgram, Fig. 5-16). The input voltage at Bu15 should be about 50 mV and the output voltage at C161 (point 23 on 41314-5.15/2) 130 mV, min. Level variations of ±2 dB are permissible.

Checking the modulator: Select range I and adjust for a frequency of 1 MHz. Measure the levels according to the circuit diagram 41314 S Bl.2, using the UHF-DC Millivoltmeter Type URV ($Z_{in} = 50$ kΩ, $C_{in} \leqq 1$ pF). Then cut in modulation. Set the switch **8** for $f_{mod} = 1$ kHz, AM switch to INT. and adjust knob **11** for 85 % amplitude modulation. Measure the AF distortion at the output Bu14 for connection of the VOR-ILS Unit, using a distortion meter, such as Type FTZ. To do so, adjust potentiometer R130 (in the modulator 41314-5.15/2) starting from its midway position so that the AF distortion is at a minimum at 115 MHz and 335 MHz. At the attenuator setting 0 dBV the AF distortion must be less than 2.5 % in all frequency ranges. The gain between the points 27 and 23 should be 9 dB ±1.5 dB.

Checking the modulation feedback: Check the modulator and adjust for $f_{mod} = 1$ kHz and m = 50 %. Measure the AF level at the collector of T9. It should be about 0.3 V_{pp}. Disconnect cable K5 from socket Bu18. The AF level at the collector of T9 should then rise to about 2.4 V_{pp}. If no AF voltage is present, check the AGC amplifier according to section 5.3.12. If no meter reading is obtained, check the continuity from R148 to cable K7.

Modulation frequency response: Set the AM selector to EXT. and adjust the rotary knob "AM" for a modulation depth of 80 %. Modulation frequency $f_{mod} = 90$ Hz and 150 Hz and the carrier frequency = 115 MHz and 335 MHz. At a constant level at input AM-EXT., the fluctuations of the voltage at the output for connection of the VOR-ILS Unit, Bu14.1, Bu14.2, Bu14.3, to chassis must not be greater than 2×10^{-4}. At excessive fluctuations, the correcting network R165, C165 at the emitter of T9 must be adjusted by slightly changing R165.

Checking the frequency response: Measure as described in section 5.3.4. Connect the RF output of the Polyskop with soldering terminal 27 and the RF input with terminal 23. In the range 0.4 to 480 MHz the gain must be 7 ± 1.5 dB. The balancing potentiometer R130 affects the gain independent of the frequency.

5.3.9 Output stage

For the mechanical procedure to be followed for removing the subassembly, see section 4.19.10. Check the DC voltages according to the circuit diagram 41314 S Bl.2. The

emitter voltage of T25 is adjusted with R222, so that output voltage 500 mV and modulation depth 95 % also for frequencies > 400 MHz. Measure the RF levels at 0.4 MHz (range I) and 400 MHz (range VII) with the UHF-DC Millivoltmeter Type URV ($Z_{in} \geqq 50\ k\Omega$; $C_{in} \leqq 1$ pF). The input voltage must be between 120 and 200 mV and the output voltage about 700 mV. The RF level is adjusted with R210 (see section 5.3.7).

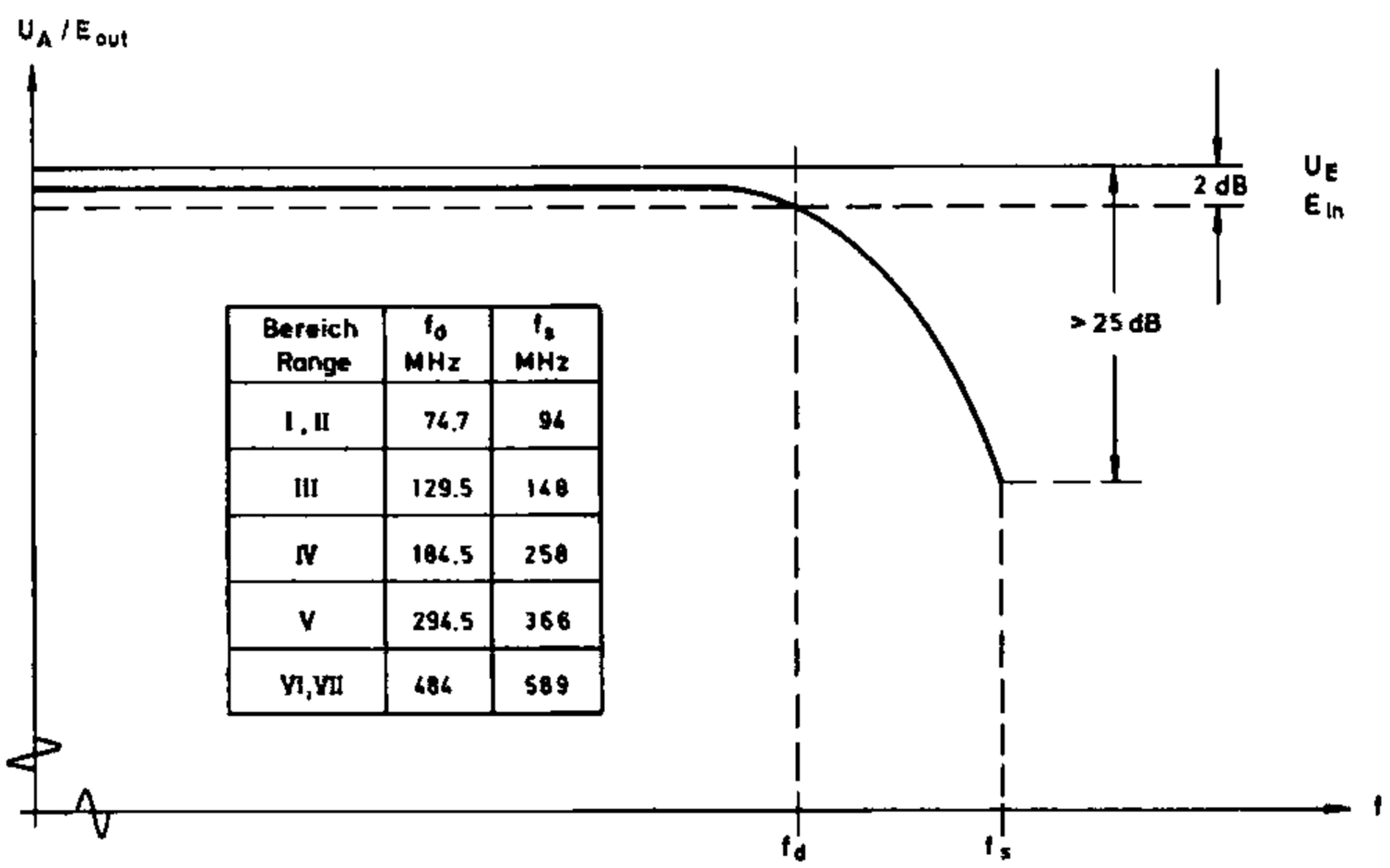
Checking the frequency response: Measure described in section 5.3.4. Connect the RF output of the Polyskop with the soldering terminal 44 and the RF input with terminal 46. In the range 0.4 to 480 MHz the gain must be 16 ± 1.5 dB, if minimum attenuation is adjusted with R210.

5.3.10 Filter

For the mechanical procedure to be followed for removing the subassembly, see section 4.19.10.

Checking the relays: Check the connection between the lead-through to the output stage, check point 46 and the inner conductor Bu19 with a continuity tester. If none of the frequency-range buttons I to VII is depressed, there must be no through-connection. Press the buttons I to VII one after the other; a through-connection should exist in each case.

Attenuation characteristic: Unsolder link 46 ⟷ 6 (41314 S Bl.2) at capacitor C252 and apply a voltage of about 0.5 V_{rms} (20 MHz to 600 MHz) from a signal generator (Z_{out} = 50 Ω). Measure the voltage at the filter output (inner conductor Bu19) terminated with 50 Ω. The output voltage should comply with the following curve if buttons III to VII are depressed one after the other:



Bereich Range	f_d MHz	f_s MHz
I , II	74.7	94
III	129.5	148
IV	184.5	258
V	294.5	366
VI, VII	484	589

Fig. 5-6 Voltage at the filter output

5.3.11 Attenuator

For the mechanical procedure to be followed for removing the attenuator, see section 4.19.4. The attenuator can be checked within the set. Feed a test voltage to Bu22 and measure it at the signal-generator output. The SMDA must be switched on (overload protector).

Test setup

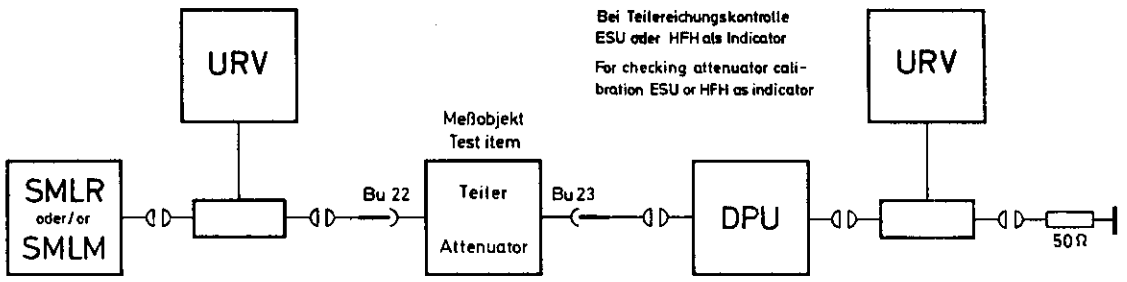


Fig. 5-7 Test setup for checking the attenuator function

Attenuator function: When the attenuator is turned through its range, the voltage at the voltmeter must decrease or increase uniformly (no jumps).

Scale calibration: Adjustments: Set the attenuator to 0 dBV using the cranc-type knob and adjust the attenuator set to 120 dB. Increase the voltage of the SMDA (max. 1 V_{rms}) until the indication of the receiver voltmeter is about 3/4 of full-scale value. Note this value. Set the SMDA to 0.4 MHz, 50 MHz and 400 MHz. Vary the attenuations of the attenuator set and of the SMDA attenuator inversely by equal amounts (e. g. 10 dB) and read the voltmeter indication. The input voltage of the attenuator must be kept constant. For this purpose, check the input voltage with the URV insertion head (rough check), or, still better, the rectified voltage (approx. 0.7 V DC voltage) at the output of the meter diode GI260 (C260) according to Fig. 27 and stabilize with the signal-generator voltage.

The voltmeter reading (test-receiver reading) may vary by < 1 dB.

Meter diode

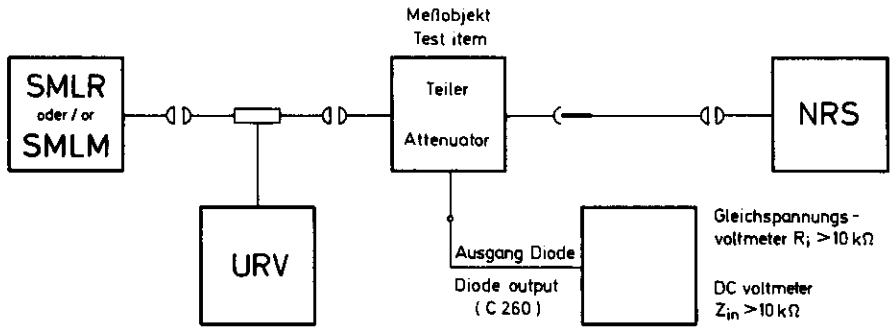


Fig. 5-8 Test setup for checking the diode of the attenuator

Vary the frequency in the range 0.4 to 480 MHz at a constant RF voltage across the test item (SMDA attenuator). The DC voltage at the output (C260) of the diode GI260 must be 0.7 V ±5 % if the supply voltage = 0.7 V (corresponding to 1.4 V EMF). The (rectified) DC voltage must not vary more than 1 % in the whole frequency range.

5.3.12 AGC Amplifier

For the mechanical procedure to be followed for removing the attenuator with AGC amplifier, see section 4.19.4. The performance check can usually be made if the cover of the AGC amplifier is unscrewed (accessible from the bottom of the signal generator). Check the DC voltages according to circuit diagram 41314 S Bl.2. Tolerances of ±10 % are per-

missible. These values hold for an RF voltage of 0.7 V ± 10 % at Bu22 (attenuator input) if the AGC amplifier is in full operation.

AGC voltage

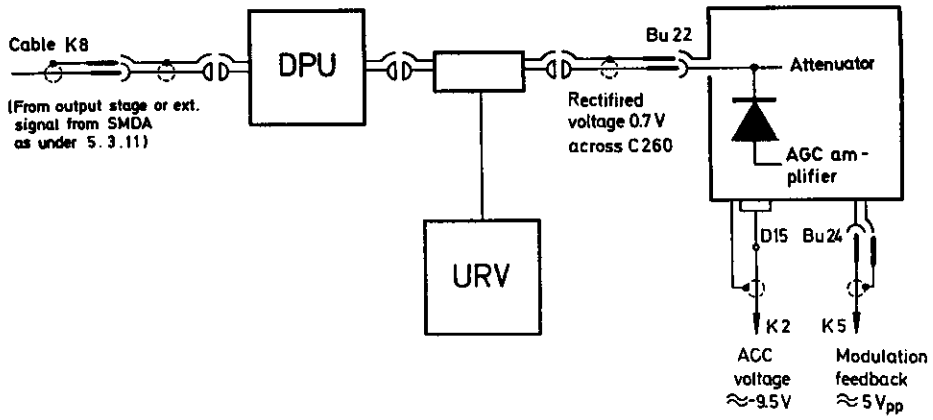


Fig. 5-9 Test setup for checking AGC voltage

Test frequencies are 0.4 and 480 MHz; no modulation is cut in. If the input voltage at Bu22 is decreased, the AGC voltage at D15 (K2 disconnected) must change by \E. Adjust the attenuator set to 0 dB corresponding to about 0.7 V at Bu22 and measure the AGC voltage. The rating is − 9.5 V ± 5 %. Note the accurate value measured for reference. Adjust the attenuator set to 6 dB; the AGC voltage must then rise by about 1.75 V.

Measuring the modulation feedback: Apply a modulated signal (50 % modulation; f_{mod} = 1 kHz). Connect cable K8 to Bu22 if the voltage is taken from the SMDA itself. Measure at Bu24 (inner conductor) with the Millivoltmeter Type UVN ($Z_{in} \geqq 100$ kΩ; $C_{in} < 50$ pF). The voltage level should be 3.75 V_{pp} ± 10 %.

Deviation measurement socket: Feed a test signal at a frequency the same as that of the SMDA to output **16**. Set the output attenuator to the points marked green (> 1 W, < 1 W) and feed the following voltages to output **16**:

Attenuator setting	Test voltage at **16**
>1 W = 0.2 V_{EMF}	0.7 V 3.2 V
< 1 W = 1 V_{EMF}	0.1 V 0.7 V

Table 7 Checking of the deviation measurement socket

With an IF of 111 kHz, a voltage of ≧ 20 mV to chassis must be present at Bu7R.

Checking the test output Bu14 for the VOR-ILS unit:
Select a modulated signal of 40 % modulation depth at 115 MHz. At the socket Bu14.1, the following voltages must be measured to chassis (Bu14.2,3): an AF voltage of 990 mV ±1 mV, a rectified voltage of -3.5 V ±5 mV, a maximum offset voltage of +30 mV. When the contacts .4 and .5 of the socket Bu14 are short-circuited, the carrier at the output Bu14.1 must be attenuated by at least 40 dB.

Adjustment of AGC amplifier and Rectified-voltage compensator see section 5.4.4.

5.3.13 Overload Protector

For the mechanical procedure to be followed for removing and checking the overload protector, see section 4.19.5.

Checking the relay function: Check connection (test voltage < 1 V) between the inner conductors of Bu25 and of Bu26 with a continuity tester. If no operating voltage is present, there must be no through-connection. If the operating voltage of $+18$ V or -18 V is present, a through-connection should exist.

Response threshold with DC voltage

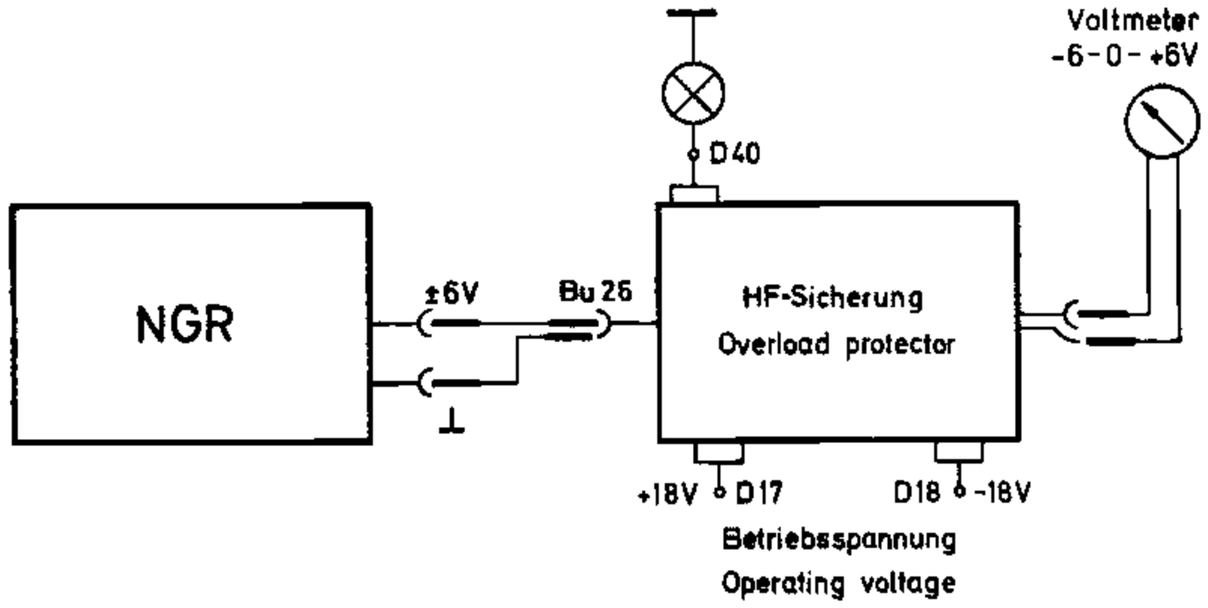


Fig. 5–10 Test setup for checking the threshold of the overload protector at DC

Measurement: Starting from 0 V, adjust the DC voltage to $+7$ V and -7 V. The voltmeter reading must rise according to the adjusted DC voltage and drop back to 0 when the relay operates. The maximum voltage readings give the response thresholds: The positive response threshold must be at $+2$ to $+7$ and the negative response threshold at -2 to -7 V.

Adjust according to section 5.4.7.

Response threshold with AC voltage

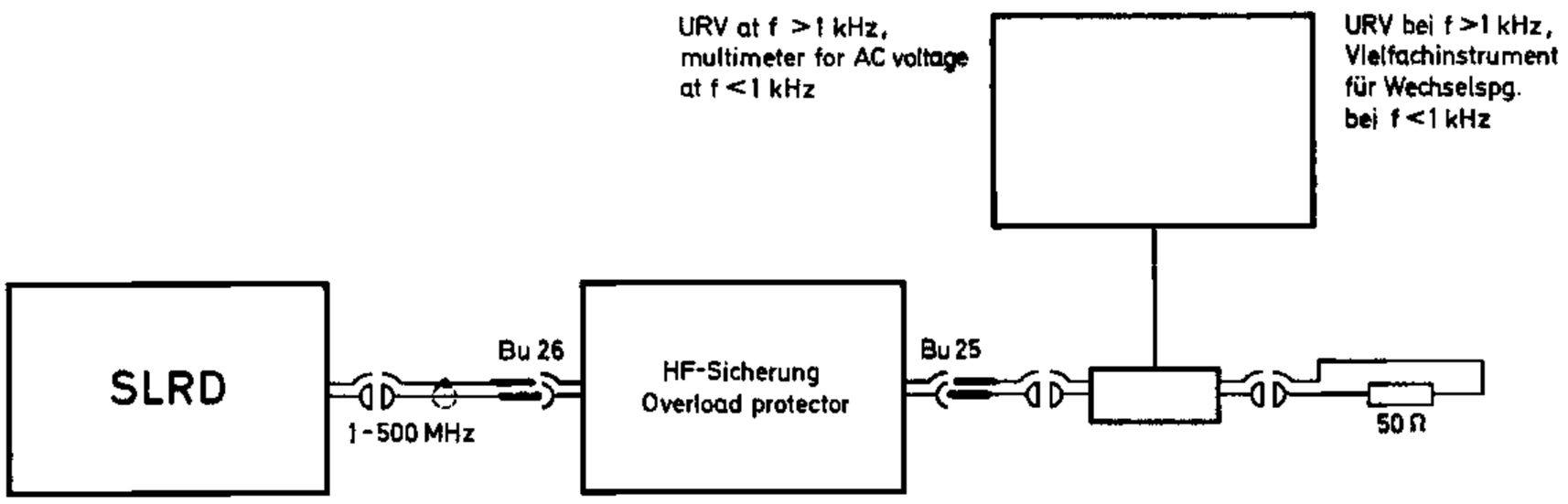


Fig. 5–11 Test setup for checking the threshold of the overload protector at AC

Measurement at test frequencies 10 MHz, 50 MHz and 490 MHz: Increase the signal-generator voltage starting from 0. The voltmeter reading increases according to the adjusted voltage and drops back to 0 when the relay responds. The maximum voltage readings give the response thresholds.

Frequency	RF voltage
10 MHz 50 MHz 490 MHz	4.0 to 6.5 V

Table 8 Threshold of the overload protector

When the response threshold is exceeded (overload protector responds), the red lamp on the front panel must blink. In the transition region, the lamp lights. NOTE: The response threshold is affected by the length of the connecting cable.

5.3.14 Modulation Generator (in the Modulation Unit)

For the mechanical procedure to be followed when removing and checking the modulation unit, see section 4.19.2. Check the DC voltages according to circuit diagram 413141-6 S. Check the output voltage, output frequency, switch functions and distortion factor according to section 3.2.3.

5.3.15 Meter Amplifier (in the Modulation Unit)

For the mechanical procedure to be followed for removing and checking the modulation unit, see section 4.19.2. Check the DC voltages according to circuit diagram 413141 S. At full-scale deflection on the meter **5** an AC voltage of about 7.5 mV must be present at the input of the amplifier B1. Measure the AF level with the Millivoltmeter Type UVN ($Z_{in} \geqq 100\ k\Omega$; $C_{in} < 50\ pF$). For checking the attenuator performance, set switch **3** to MOD. GEN. and vary knob **8** until an AF voltage of 1 V is present at R10 (contact 1 on S2). At the other attenuator resistors the following voltages must be measured: R11 → 400 mV, R12 → 100 mV, R13 → 40 mV, R14 → 10 mV.

Frequency response of indication: Feed 1 V_{rms} to input Bu3 AM EXT. from the RC Oscillator Type SRB covering the frequency range 10 Hz to 1 MHz. Adjust **11** so as to obtain a deflection of 80 % of the range of indication at f = 1 kHz. With a constant input voltage, the meter reading may vary within the following limits (referred to the indication at f = 1 kHz): 30 Hz to 20 kHz $< \pm 0.5$ scale division.

The **adjustment** is described in section 5.4.8.

5.3.16 Deviation Network

For the mechanical procedure to be followed for removing the deviation network, see section 4.19.9. The deviation network is checked within the signal generator. Check the DC voltage according to circuit diagram 41314 S Bl.1. A tolerance of ±5 % is permissible.

Checking with frequency modulation: For the **test setup** see Figs. 3-15 in section 3.2.3.5 and 3-16 in section 3.2.3.6 (measurement of frequency deviation). Adjust the frequency modulation for a deviation of 10 kHz at f_{mod} = 1 kHz (indication on the modulation unit). Check the FM deviation at a medium frequency of each range. The rated FM deviation is 10 kHz ±0.65 kHz. Correct, if necessary, according to section 5.4.3.

Narrow-band sweeping: Check according to 3.2.6.

5.3.17 Connectors for the Frequenzkontroller

AC supply: Check the AC supply voltage at the socket for the Frequenzkontroller (Bu70, Bu71) at the rear of the signal generator. Voltage must be present if the power switch is depressed. Check the RF OUTPUT II for driving the Frequenzkontroller according to sections 3.2.4 and 3.2.6. Check the synchronization input according to section 5.4.2. Deviation with DC measured via synchronization input. Check the control leads at the multipoint connector Bu7 (at the rear) by means of a continuity tester according to the following table:

Range button depressed	Range (MHz)	Connections at Bu7 between contacts
I	0.4 – 48	H ⟷ A and B ⟷ F
II	47 – 74.7	H ⟷ D and B ⟷ F
III	74 – 129.5	H ⟷ D and B ⟷ L
IV	129 – 184.5	H ⟷ E and B ⟷ K
V	183.5 – 294.5	H ⟷ E and B ⟷ J
VI	293 – 404	H ⟷ E and B ⟷ N
VII	401 – 484	H ⟷ E and B ⟷ N

Table 9 Check the control leads at the multipoint connector Bu7

Contacts M and P are not wired.

Deviation measurement output see section 5.3.12.

5.4 Trimming Instructions

Procedures for trimming and the relevant criteria are described in this chapter. The required test setups are referred to in the performance check instructions for the individual subassemblies.

5.4.1 Power Supply

Measure the output voltages of +18 V and – 18 V to chassis at the operating-voltage leads, using a voltmeter with an accuracy better than 0.5 %. Adjust with R662 (in 41314 S Bl.3) for +18 ±0.1 V, R682 (in 41314 S Bl.3) for – 18 ±0.1 V.

NOTE: Make the adjustment only if the frequency accuracy, deviation accuracy and output power do no longer conform to the specifications of section 1.3. When adjusting the operating voltages, check the frequency, deviation, output voltage and overload protection (see section 3.2.1).

5.4.2 Oscillator

The replacements for the oscillator are adjusted at the factory.

Current consumption: (Adjustment of operating points of transistors): Measure the current consumption of the oscillators according to section 5.3.2. Adjust for maximum RF amplitude at cable K1, using the associated potentiometers. The current consumption must be 2 to 7 mA. Turn the potentiometers counterclockwise until the current consumption referred to the maximum RF amplitude becomes less in ranges II to III by 20 %, in range IV by 10 %, in ranges V, VI and VII by 0.8 mA.

When the oscillator temperature rises to 60 °C, the RF amplitude must not be less than 30 mV (across coble K1, which is terminated with 50 Ω). If this value is not attained, the oscillator current must be increased. See "Output voltage" (penultimate paragraph in this section).

Adjustments

Range	Potentiometer
II	R 401
III	R 391
IV+I	R 381
V	R 371
VI	R 361
VII	R 411

Table 10 Adjustment of current consumption

Frequency range: Measure the frequency according to section 3.2.1.1. (It is possible to measure directly at the oscillator output with a sensitive frequency meter.) First make coarse frequency adjustments alternately at the highest and at the lowest frequency of the range.

NOTE: Prior to the adjustment, set the pointer to the centre of the scale window by means of the grub screw in the button (corresponds to the centre of the adjustment range; 60 mm ±0.5 mm from left or right border of scale window). The oscillator frequencies are given in the following table:

Range	Segment No.	Frequency Signal generator MHz		Frequency Oscillator MHz			Adjust with			Tolerance at		Permissible scale error over the range
		low	high	low	medium	high	low	medium	high	coarse adj. MHz	fine adj. %	
I [1])	41313-2.8	0.4	48	129	152.8	176.6	—	—	—	—	—	80 kHz ±1.2 %
II	41314-2.6	47	74.7	47		74.7	L 400		C 404	±0.8	±0.1	±0.3 %
III	41313-2.7	74	129.5	74		129.5	L 390		C 394	±1.0	±0.1	±0.3 %
IV	41313-2.8	129	184.5	129	152.8	184.5	C 388 [2])	L 380	C 384	±1.0	±20 kHz	to 177 MHz see range I; from 177 MHz ±0.3 %
V	41314-2.9	183.5	294.5	183		294	L 370		C 374	±2.0	±1 %	±0.3 %
VI	41314-2.10	293	404	293		404	L 360		C 364	±3.0	±0.1	±0.3 %
VII	41314-2.11	401	484	401		484	C 418		C 414	±3.0	±0.1	±0.3 %

Table 11 Adjustment of oscillator frequency

[1]) Range I is obtained by conversion of range IV (129 to 184.5 MHz) with a fixed crystal frequency.

[2]) Turn C388 to stop and then continue adjustment with L380 at f = 129 MHz.

If the required scale accuracy is not attained in range I, the capacitance of C3813 must be increased in the case of negative errors and decreased for positive errors with due consideration of the temperature coefficient.

After the coarse frequency adjustment, adjust the frequency deviation as described below. Adjust the output voltage as described below under "Output voltage". Make the fine frequency adjustment; then check the frequency deviation again. Adjust alternately until all tolerances are kept to. Also observe the amplitude adjustment. Check the current consumption during the adjustment (see above). Check the sinewave form of the output voltage with a sampling oscilloscope. No distortion must be visible on the screen. If there is a distortion, reduce the current, taking into consideration the paragraphs "Current consumption" and "Output voltage" in this section.

Deviation (Constant deviation throughout the frequency range): Check for constant frequency deviation with a low-impedance voltage of ±0.84 V ±1 % applied alternately to test point 1 (in circuit diagram 41314 S Bl.1). Adjust alternately at the highest, a medium and the lowest frequency of the range converned.

Range		Adjust at frequencies (MHz)			Adjust with			Deviation (with DC)	Checking interval MHz
		low	medium	high	low	medium	high		
II	– 2.6	47	50	74.7	C 409	R 459	C 401		1
III	– 2.7	74	102	129.5	C 399	R 460	C 391		2
IV + I	– 2.8	129	157	184.5	C 389	R 461	C 381	40 kHz	2
V	– 2.9	183.5	238	294.5	C 379	R 462	C 371	±1 %	4
VI	– 2.10	293	348	404	C 361	R 463	C 369		4
VII	– 2.11	401	442	484	C 411	R 464			3

Table 12 Adjustment of deviation

If the required frequency deviation cannot be obtained by means of the capacitors C409, C399, C389, C379, C401, C391, C381, C371, the capacitance of the parallel capacitors marked "Trimmwert" (factory-adjusted) can be increased or decreased (do not alter the temperature coefficient).

After having adjusted for constant deviation throughout the frequency range, check the frequency range and adjust, if necessary. If the frequency is readjusted, check again for constant deviation. Repeat the two adjustments alternately until a deviation of 40 kHz ±1 % is obtained at all points of adjustment. Also observe the amplitude adjustment of the output voltage as described below. Check the deviation with DC in intervals of 0.5, 1, 2 and 4 MHz, respectively in the whole frequency range (see table 8). A departure of ±4 % from the rated deviation of 40 kHz is permissible.

Deviation with DC measured via synchronization input (Deviation of the DC input): Alternately feed +1.1 V and −1.1 V with low impedance to socket Bu6. SYNCHRONISATION. The resulting frequency variation is the deviation which can be adjusted according to the following table:

Range		Frequency MHz	Adjust with	Deviation (with DC) kHz
I	41313 – 2.8	24	R 491	7.5
II	41314 – 2.6	60	R 492	60
III	41313 – 2.7	100	R 493	60
IV	41313 – 2.8	160	R 494	120
V	41314 – 2.9	240	R 495	120
VI	41314 – 2.10	350	R 496	125
VII	41314 – 2.11	440	R 497	125

Table 13 Adjust the frequency deviation

Output voltage: Measure the oscillator output voltage according to section 5.3.2. Adjust the output voltage according to the following table. Note that this adjustment influences the oscillator frequency and the deviation. Correct, if necessary. Check the oscillator for temperature stability, as described above under "Current consumption".

Range	Adjust with	Voltage mV_{rms}
I	—	—
II	C 407	50 to 80
III	C 397	50 to 80
IV	C 387	50 to 80
V	C 377	50 to 80
VI	C 367	50 to 70
VII	C 417	40 to 70

Table 14 Adjust the output voltage

If the voltage is higher than required, reduce the oscillator current. The RF voltage must be checked in the ranges II, III and IV at the reactance diodes. Measure with a probe voltmeter ($Z_{in} \geqq 1\ M\Omega$; $C_{in} \leqq 0.5$ pF) directly at the reactance diodes. The maximum permissible voltage is 3.5 V_{rms}; if necessary, reduce the oscillator current. Observe the output voltage.

Range	II	III	IV+I	V	VI	VII
Reactance diode	GI 400	GI 390	GI 380	GI 370	GI 360	GI 410

Table 15 RF voltage at the reactance diodes

At oscillator temperatures $\leqq 60\ ^{\circ}C$, the output voltage must not be less than 30 mV.

5.4.3 Frequency Modulation

For the **test setup** see Fig. 3-15.

Modulation setting: Set FM switch to INT. Set **8** switch for $f_{mod} = 1$ kHz. Adjust potentiometer **18** so as to obtain a deviation of 10 kHz or 25 kHz or 50 kHz on the Frequency Deviation Meter Type FMV with the signal generator tuned to 200 MHz (reference frequency). Check the frequency deviation at the lower and the upper limit of all frequency ranges. Indication of deviation meter 10 kHz ±3 % or 25 kHz ±6 %.

5.4.4 AGC Amplifier and Rectified-voltage compensator

For the **test setup** see Fig. 3-2 in section 3.2.1.2.

Prior to the adjustment, allow a warm-up period of 30 minutes. Ambient temperature should be 23 °C. The instrument must be opened for the adjustment.

a) Measure the RF output power at RF OUTPUT 16. Set the output attenuator 13 to -10 dB. Adjust the test frequency to 115 MHz. Using R273 (AGC amplifier 413114-3.10.7) adjust the output power to 0.5 mW.

b) Using R276 adjust the voltage contact 6 of the AGC amplifier to 0 V ±20 mV.

c) Steps a) and b) being interdependent, repeat several times.

d) Adjustment of rectified-voltage compensator 41314. 17. 3:
Set potentiometers R322, R325 and R327 mid-position. Connect VOR-ILS Unit. Adjust Signal Generator for a modulation depth of 40 % at 115 MHz.

e) Using R327 adjust the AF voltage the at Bu14. 1 to 990 mV ±1 mV.

f) Using R325 adjust the rectified voltage at Bu14. 1 to -3. 500 V ±5 mV.

g) Repeat adjustments e) and f) several times.

h) Using R322 adjust the offset voltage at Bu14. 1 to 0 V +30 mV at frequencies between 115 and 330 MHz.

i) Check the voltages according to e), f) and h) and correct, if necessary.

5.4.5 Modulator

The measurement is made as described in section 5.3.8.

5.4.6 Crystal Stage

Test setup

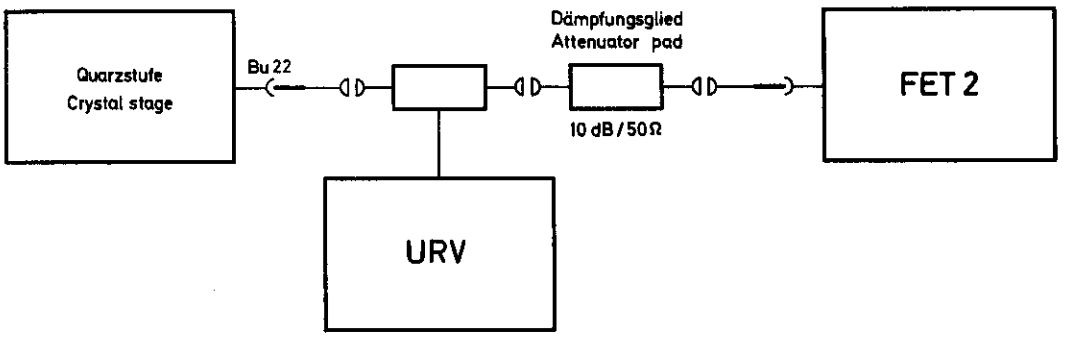


Fig. 5-12 Test setup for checking the crystal stage

Start of oscillations: Adjust C434 so that the oscillations are just initiated. Then advance C434 another 5° in the same direction (safety margin).

Spurious resonances: Turn the capacitor C431 through its range and observe the output frequency. No frequency jumps are allowed to occur. The output frequency must be 129 MHz ±7 kHz.

Output voltage: Adjust C431 for maximum output voltage, i. e. > 1.0 V into 50 Ω.

5.4.7 Overload Protector

Test setup: Feed a voltage of 5.5 V_{rms} (f = 60 MHz) to Bu26 of the overload protector or to the RF output Bu1 of the SMDA. Terminate Bu25 with 50 Ω via a voltmeter with insertion unit (see also section 5.3.13). Vary potentiometer R322 until relay Rs1 responds. Check according to section 5.3.13 at other frequencies and with DC.

5.4.8 Modulation Generator

For the **test setup** see Fig. 3-7 in section 3.2.2.1 and Fig. 3-8 in section 3.2.2.2.

Output voltage: The output voltage must be > 1.0 V into 200 Ω (at Bu4) in all frequency ranges. For this purpose, the amplitude control **8** must be turned fully clockwise.

Frequency: Select the fixed frequency 300 Hz with R141. For this purpose, set switch **7** to position 0.3 kHz and knob **10** to position CAL. Adjust C3 so that the departure from the rated frequency is $\leqq \pm 0.5$ % at all adjustable frequencies. Find a good compromise. Adjust the fine frequency tuning with R144 at 270 Hz (switch **7** at 0.3 kHz and knob 10 at – 30 Hz).

5.4.9 Meter Amplifier

Output voltage indication of modulation generator

Test setup: Measure the output voltage of the modulation generator at output **20**. Setting of control knobs: Type-of-indication switch S12 to MOD. GEN. INDICATION switch to 100, switch **7** to 1 kHz.

Adjustment: Adjust the voltage at output **20** by means of R36 to obtain a reading of 100 scale divisions (full-scale deflection) on meter J2 with an output voltage of 1 V ± 2 % at output **20**.

Check: Check the other ranges of indication according to the following table:

Voltage at **20** [1]	Reading (J 2))
1 V_{rms} ± 2 %	100 divisions
0.4 V_{rms} ± 2 %	40 divisions
0.1 V_{rms} ± 2 %	100 divisions [2]
0.04 V_{rms} ± 2 %	40 divisions
0.01 V_{rms} ± 2 %	100 divisions

Table 16 Check the ranges of indication

[1] adjusted with the AMPLITUDE control **8**.
[2] corresponds to full-scale deflection.

Frequency-deviation indication: Check the indication of frequency deviation after the adjustment according to sections 5.4.2 and 5.4.3 have been made.

For the **test setup** see Fig. 3-15 in section 3.2.3.5. Feed a voltage of 1.6 V_{rms} (f = 1 kHz) to the FM EXT. input Bu2 from an AF generator.

Setting of control knobs: Type-of-indication switch S12 to FM, INDICATION switch S13 to 10, FM switch S9 to EXT., deviation control **18** for 10 kHz (referring to frequency deviation meter).

Adjustment: Adjust potentiometer R35 for full-scale deflection on meter J2. Check the reading at 40 Hz, 300 Hz and 20 kHz. The maximum permissible departure is ± 0.5 scale division.

Indication of amplitude modulation

For the **test setup** see Fig. 3-10 in section 3.2.3.1.

Setting of control knobs: Select 60 MHz (range III) on the SMDA, and set type-of-indication switch S12 to AM, INDICATION switch S13 to 100, AM switch S8 to INT. Adjust AM control **11** for 70 % modulation (measured at the RF output).

Adjustment: Adjust potentiometer R37 for a meter reading of 70 % (corresponding to 70 % modulation).

Check: Check the indication at the signal-generator frequencies of 0.4 MHz and 400 MHz. The maximum permissible departure is 6.5 %.

5.4.10 Automatic IF Generation

For **test setup** see Fig. 3-1 in section 3.2.1.1.

Measurement: Feed a voltage of +14 V to the socket 7R on the rear wall of the signal generator via an 82-kΩ resistance. Vary the frequency of the SMDA at the beginning, in the middle and at the end of each frequency range switching the applied DC voltage on and off.

Adjustment: Adjust the frequency variation with R150 (413141-5 S) such that a mean value of 110 kHz ±12 kHz is obtained.

5.4.11 Mixer

Measure at RF output II (Bu5) with a selective voltmeter (e. g. Type ESU) tuned to the frequency of the crystal oscillator (129 MHz). Select frequency range I on the SMDA. (If the crystal oscillator is operating, the covers of the subassemblies must be closed.)

Adjustment: Adjust trimmer C89 for minimum crystal-oscillator voltage at the RF output.

5.5 Calibration of the Subassemblies

5.5.1 Oscillator: Zero Beat in Frequency Range I

Prior to calibration, adjust the oscillator according to section 5.4.2.

Calibration procedure: Turn the scale drum by 90° and affix to its left side a pointer for calibration marking. Adjust the pointer so as to keep the indicating error as small as possible over the entire range I (0.4 to 48 MHz). Then turn the scale clockwise ($f < 0.4$ MHz) until zero beat is indicated on meter **29** (see Fig. 5-5). Mark this point.

5.5.2 Attenuator

For checking the performance of the attenuator, it must be withdrawn from the signal generator (see section 4.19.4). Feed the test voltage into Bu22 and measure at Bu23. The circuit board 41314-3.10.7 must be inserted and connected up.

Checking the DC resistance

Test setup

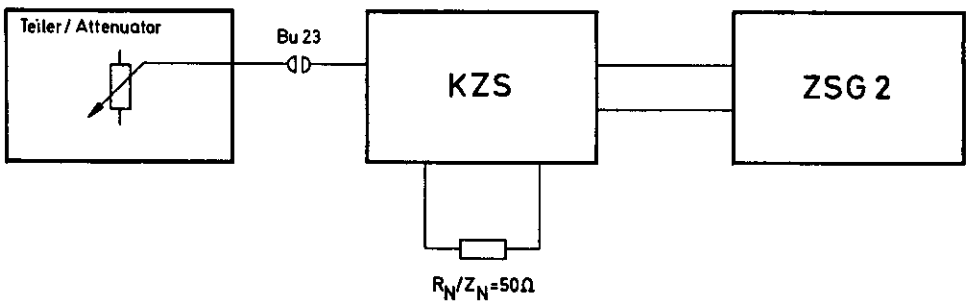


Fig. 5-13 Checking the DC resistance

Measurement: Turn the attenuator through its range. The resistance must be 50 Ω ± 10 %.

Attenuator calibration

Test setup

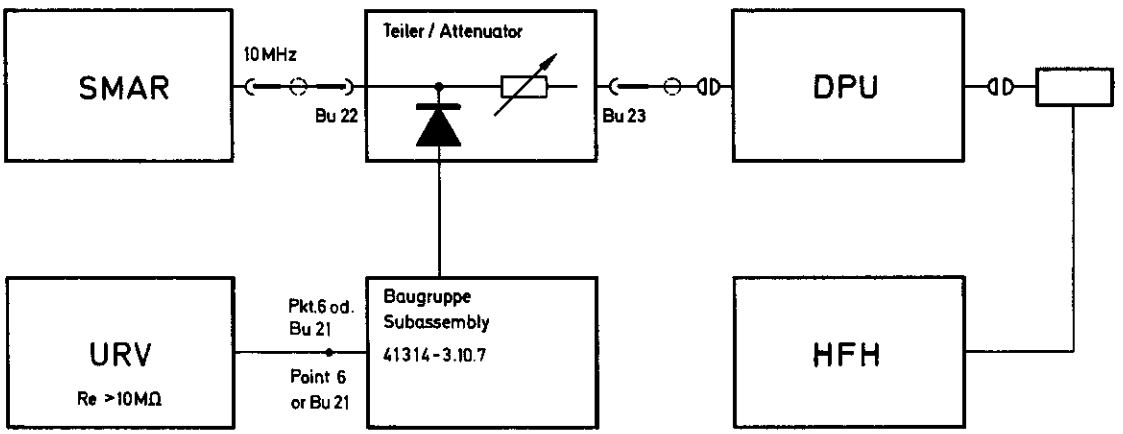


Fig. 5–14 Test setup for attenuator calibration

Attenuator performance: When turning the attenuator through its range the voltage indicated on the voltmeter must increase or decrease uniformly (no jumping).

Scale calibration: Efficient RF shielding must be ensured in order to measure also high attenuations. Solid-jacket cables are to be used for all connecting cables. Connect the calibrated attenuator Type DPU with cable K9 and an adapter to the attenuator. Keep the line between the generator Type SMAR and the attenuator as short as possible. Tighten down the plug-and-socket connections. The input voltage can be observed on the DC voltmeter type URV on the VOR-ILS unit. It is advisable to use a stabilizer for the generator, receiver and voltmeter. Release the attenuator lock.

Calibration procedure: The calibration frequency is 10 MHz. Do not apply any voltage to socket Bu22. Vary the potentiometer R273 on 41314-3.10.7 until – 3.5 V are measured at the VOR-ILS output. Move the attenuator carriage to the right stop (minimum attenuation), set the calibrated attenuator for maximum attenuation, i. e. 120 dB and increase the voltage on the SMDA (1.5 V_{rms}, max.) until the meter on the receiver gives full-scale deflection. The rectified voltage of – 3.5 V at the VOR-ILS unit must be kept constant during all further steps of the calibration procedure be means of the generator voltage.

Residual attenuation and 1-V_{EMF} marker: Reduce the attenuation of the calibrated attenuator by 3 ± 0.1 dB and increase the generator voltage and the attenuation of the attenuator until the rectified voltage at the DC voltmeter and the receiver voltage have reached again the old value (– 3.5 V). Mark down "1 V". Reduce the attenuation of the calibrated attenuator by another 7 dB, adjust the generator voltage to a constant rectified value and the attenuator such that full-scale deflection is obtained on the receiver. The dBV scale is calibrated every 2 dB down to – 80 dBV. The attenuations of the attenuator and the calibrated attenuator must be varied in opposite directions. Keep the rectified voltage constant with the aid of the generator.

From – 20 dBV onwards the spacings between the division lines must be absolutely equal. From – 80 dBV onwards the spacings should be checked. If they are wider or smaller extrapolate the scale linearly starting at least from – 100 dBV. Draw the scale accordingly and check it after insertion.

Attenuator locking position: After the scale has been inserted and checked set the attenuator approximately 0.2 mm beyond 1 V_{EMF}. In this position, the attenuator is locked. Insert the completed scale in the attenuator and check the attenuator.

The voltmeter indication (test receiver indication) may fluctuate by $< \pm 0.6$ dB over the entire frequency and attenuation range.

Meter diode

Test setup

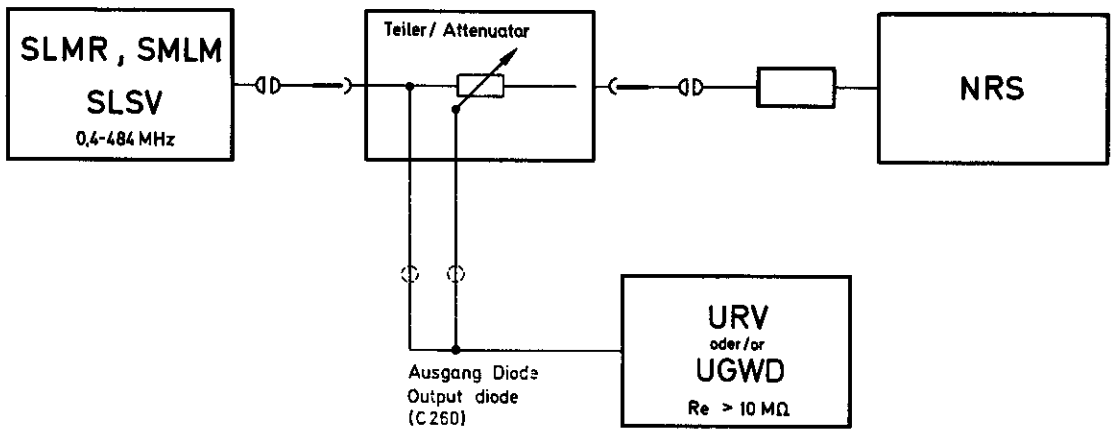


Fig. 5-15 Test setup for checking the meter diode

With a constant RF voltage at the attenuator vary the frequency in the range from 0.4 to 490 MHz. Measure the DC voltage at the diode output to chassis with a supply voltage of 0.7 V (= EMF 1.4 V). It must be 0.7 V $\pm$ 5 %. The DC voltage (rectified voltage) must not change by more than 2 % over the entire frequency range.

5.5.3 Calibrating the Fine Tuning of the Modulation Frequency

For the **test setup** see Fig. 3-7 in section 3.2.2.1.

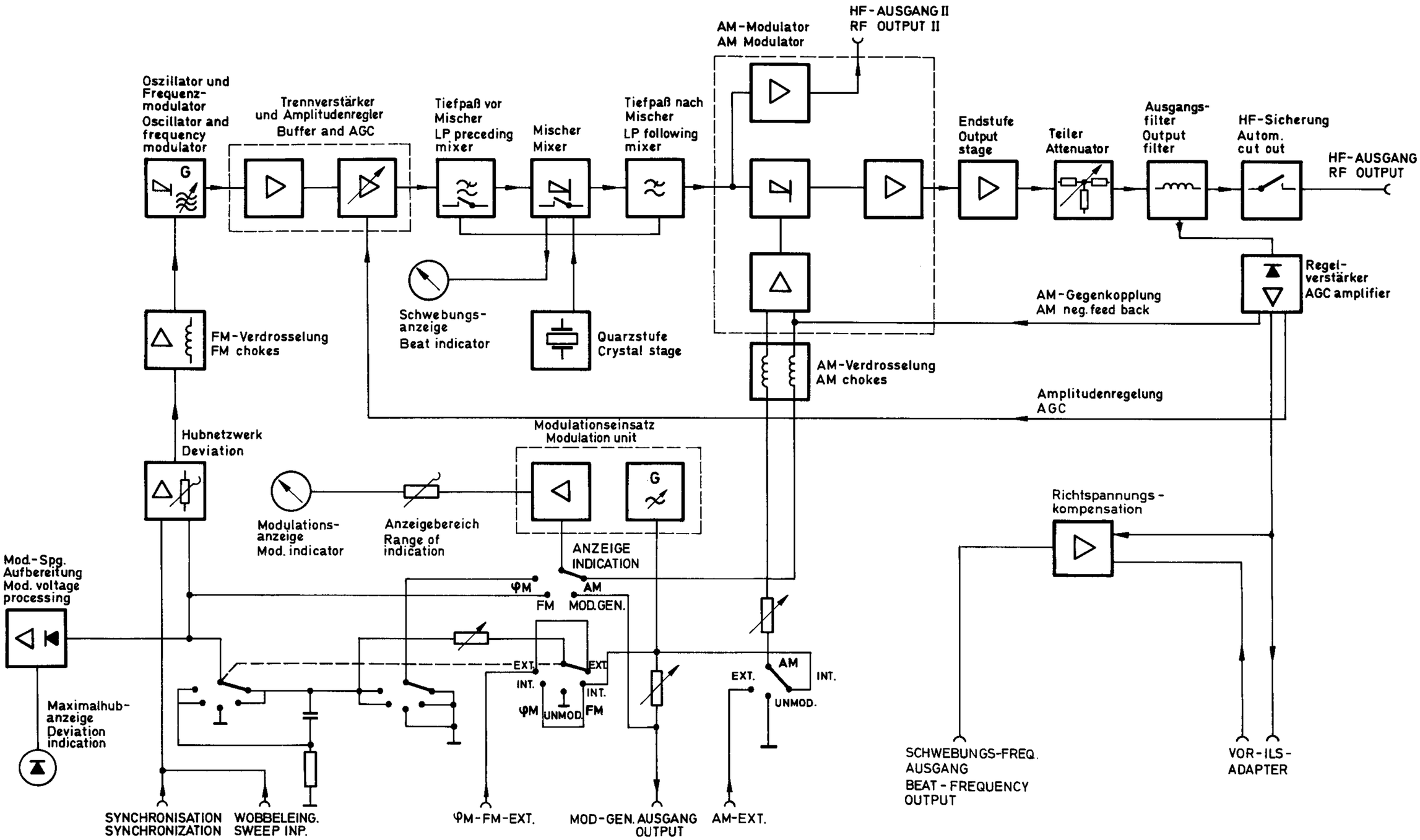
Prior to calibrating the fine tuning, the modulation generator must be adjusted according to section 5.4.8.

Calibration procedure: Set switch **8** to position 0.3 kHz. Turn knob **10** fully counterclockwise and adjust the marking CAL. to the reading marker on the front panel. (Frequency indication on the counter: 300 Hz). Turn knob **10** clockwise away from the locked position. The generator frequency must now be 267 to 270 Hz (adjust with R144). Turn the knob clockwise until the frequency just begins to change. Mark this point – 30 Hz. Then adjust the following frequencies with knob **10** in the listed order and mark accordingly.

Modulation frequency Hz	Fine tuning Hz
300	0
350	+ 50
400	+100
450	+150
500	+200
550	+250
600	+300
650	+350
700	+400

Table 17 Calibration the fine tuning of the modulation frequency

The marking is made with pencil directly on the edge of the knob. The markers and the marking arrow on the front panel should form on line.



R 28073 Bl. 171

Blockschaltbild Bild 1-2
Block diagram Fig. 1-2

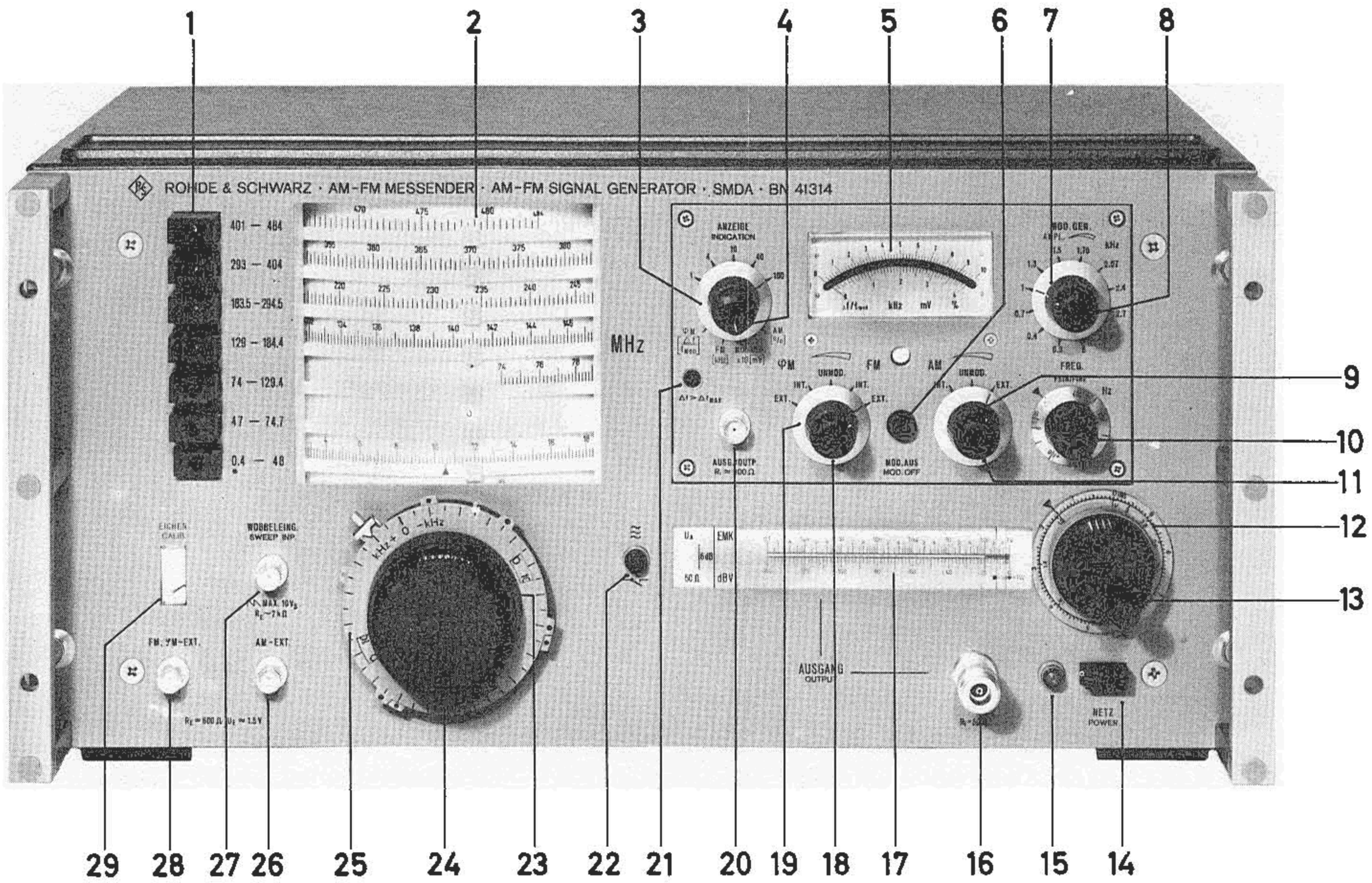


Bild 2-1 Bedienungsbild 1
Fig. 2-1 Front panel

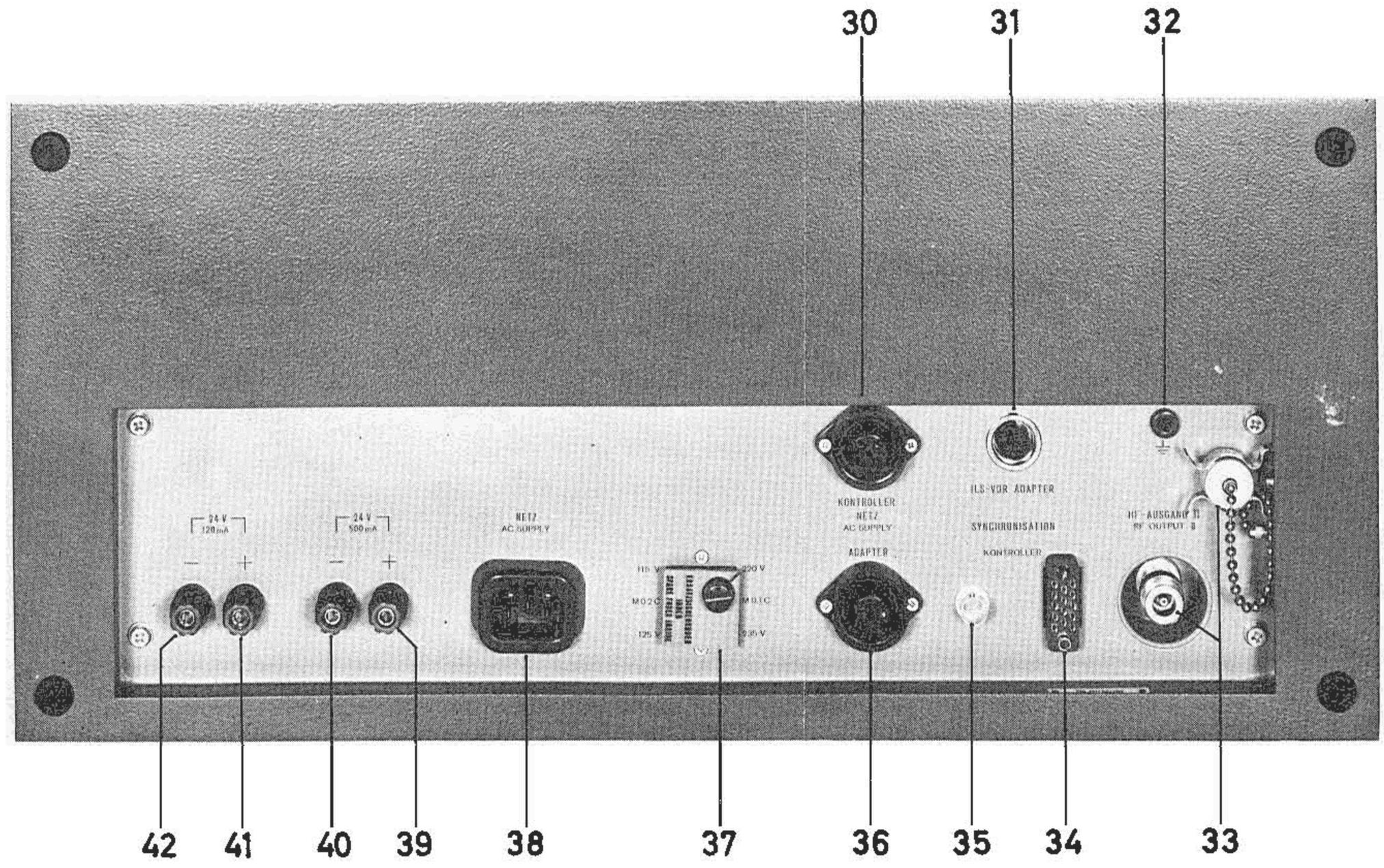
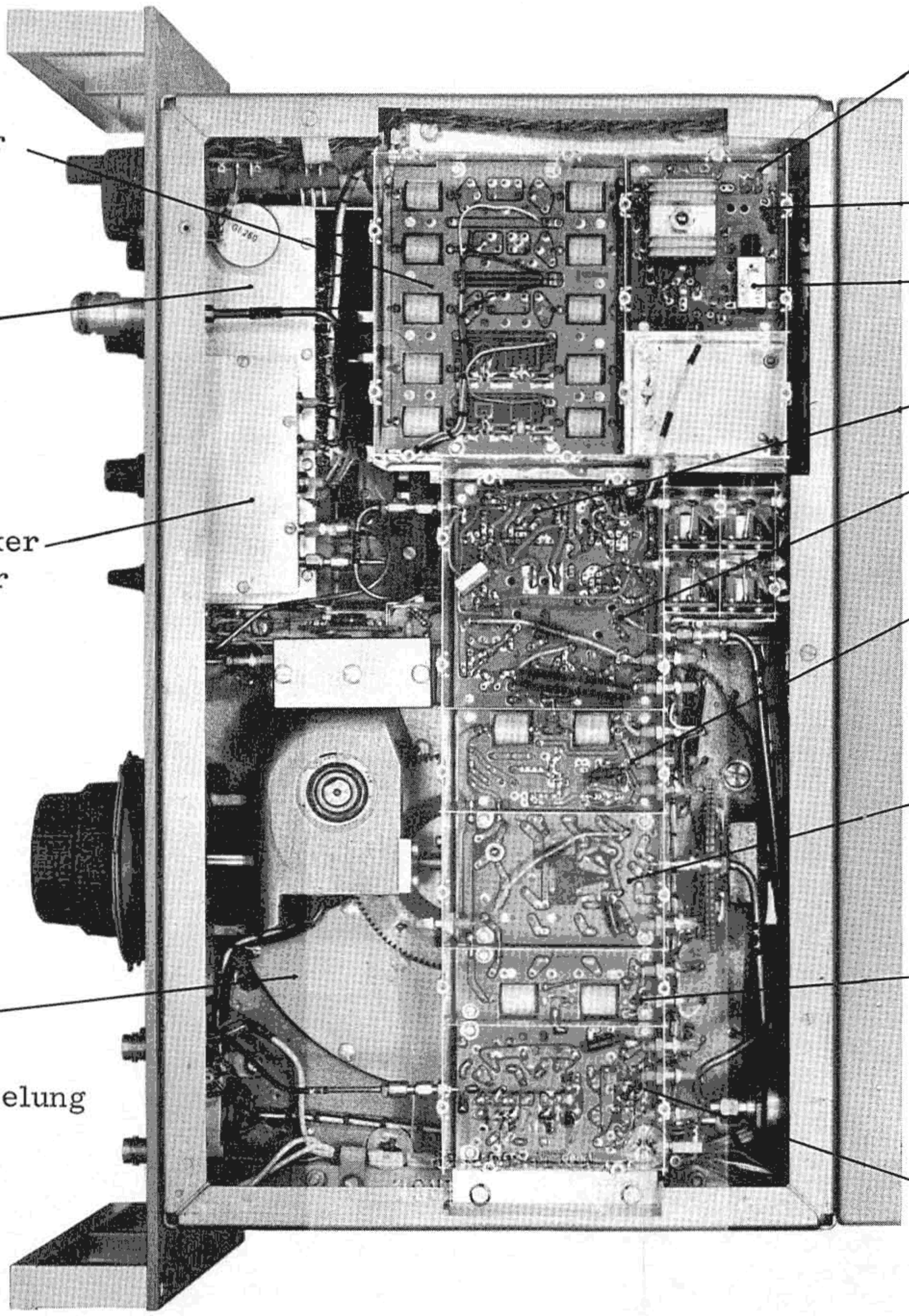


Bild 2-2 Bedienungsbild 2
Fig. 2-2 Rear panel

Bild 2-1 Bild 2-2
Fig. 2-1 Fig. 2-2



Ausgangsfilter
Output filter
41314-5.22

Teiler
Attenuator
41314-3

Regelverstärker
AGC amplifier
41314-3.10.7

Deckel
Cover
FM-Verdrosselung
FM chokes
41311-2.95
41311-2.96
41311-2.97

Endstufe
Output stage
41314-5.21/2

R222

R210

R130

Modulator
41314-5.15/2

Tiefpaß nach
dem Mischer
LP following mixer
41314-5.14/2

Mischer
Mixer
41314-5.12

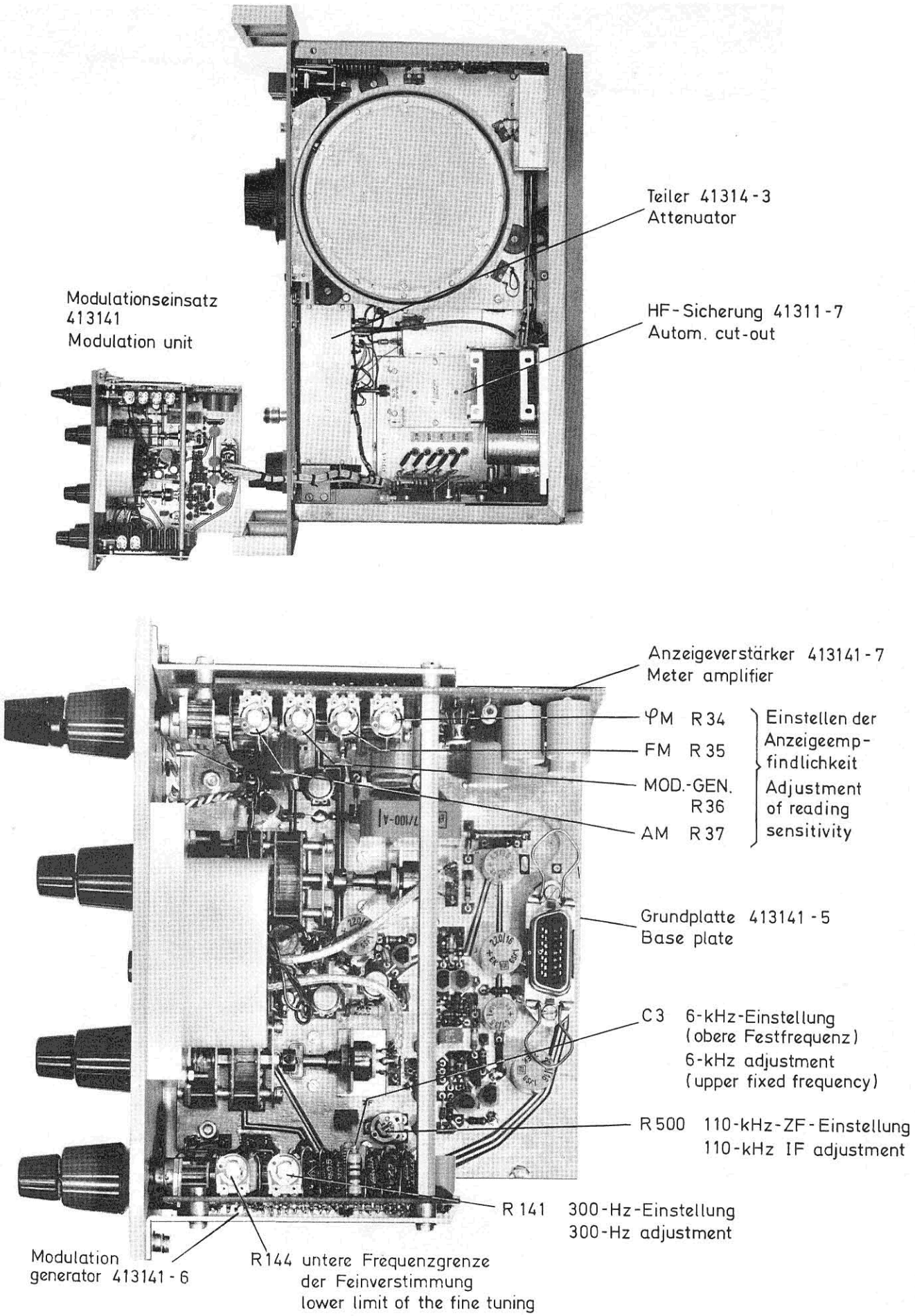
Tiefpaß vor
dem Mischer
LP preciding mixer
41314-5.11/2

Trennverstärker und
Amplitudenregler
Buffer and AGC
41314-5.10

Ansicht von unten ohne Deckel
Bottom view, cabinet removed

R 28073 Bl.175

Bild 4-1
Fig. 4-1



Ansicht von oben mit herausgezogenem Modulationseinsatz
Top view, modulation generator with drawn

Bild 4-2
Fig. 4-2

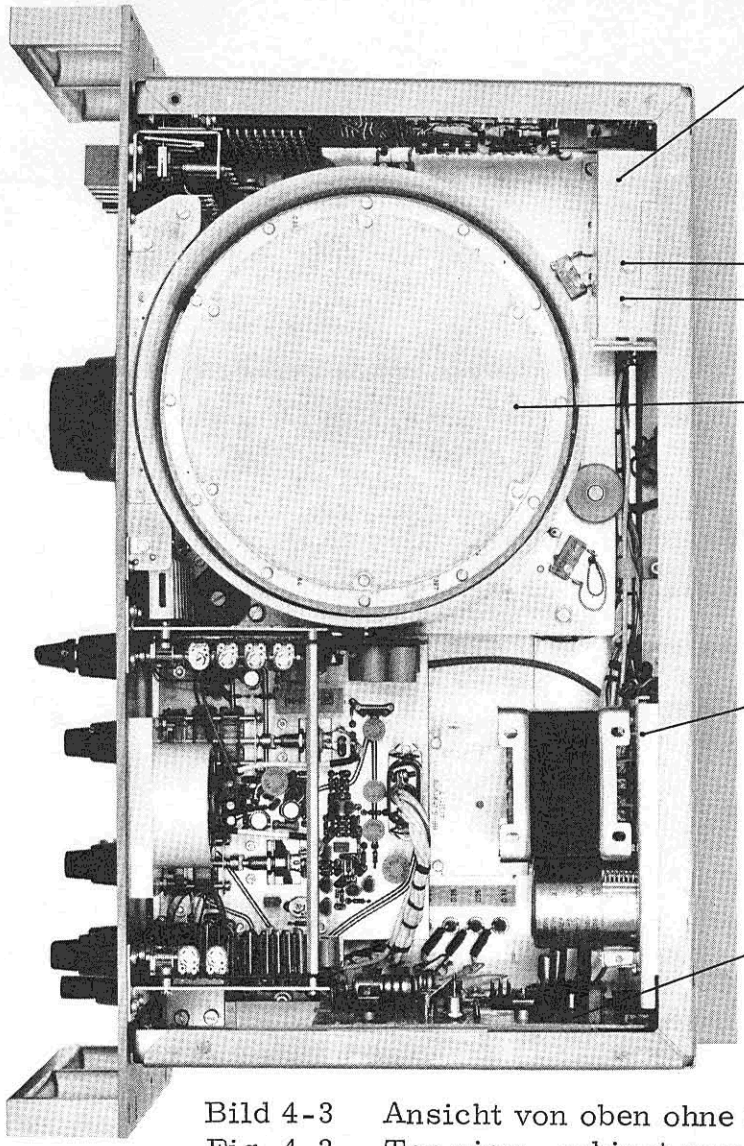


Bild 4-3 Ansicht von oben ohne Kasten
Fig. 4-3 Top view, cabinet removed

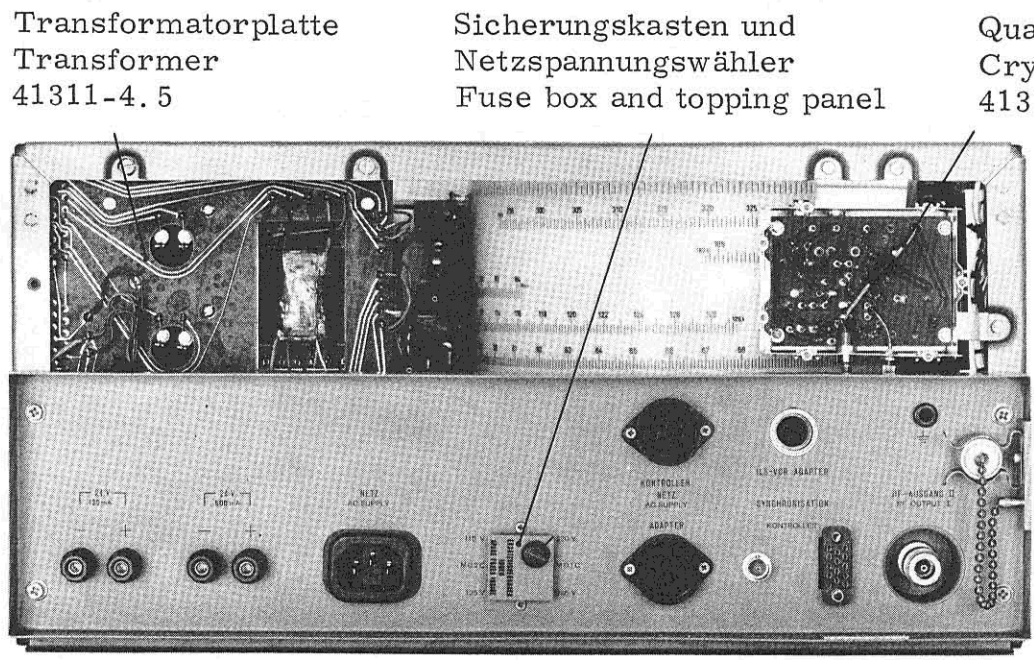


Bild 4-4 Ansicht von hinten ohne Kasten
Fig. 4-4 Rear view, cabinet removed

Bild 4-3 Bild 4-4
Fig. 4-3 Fig. 4-4

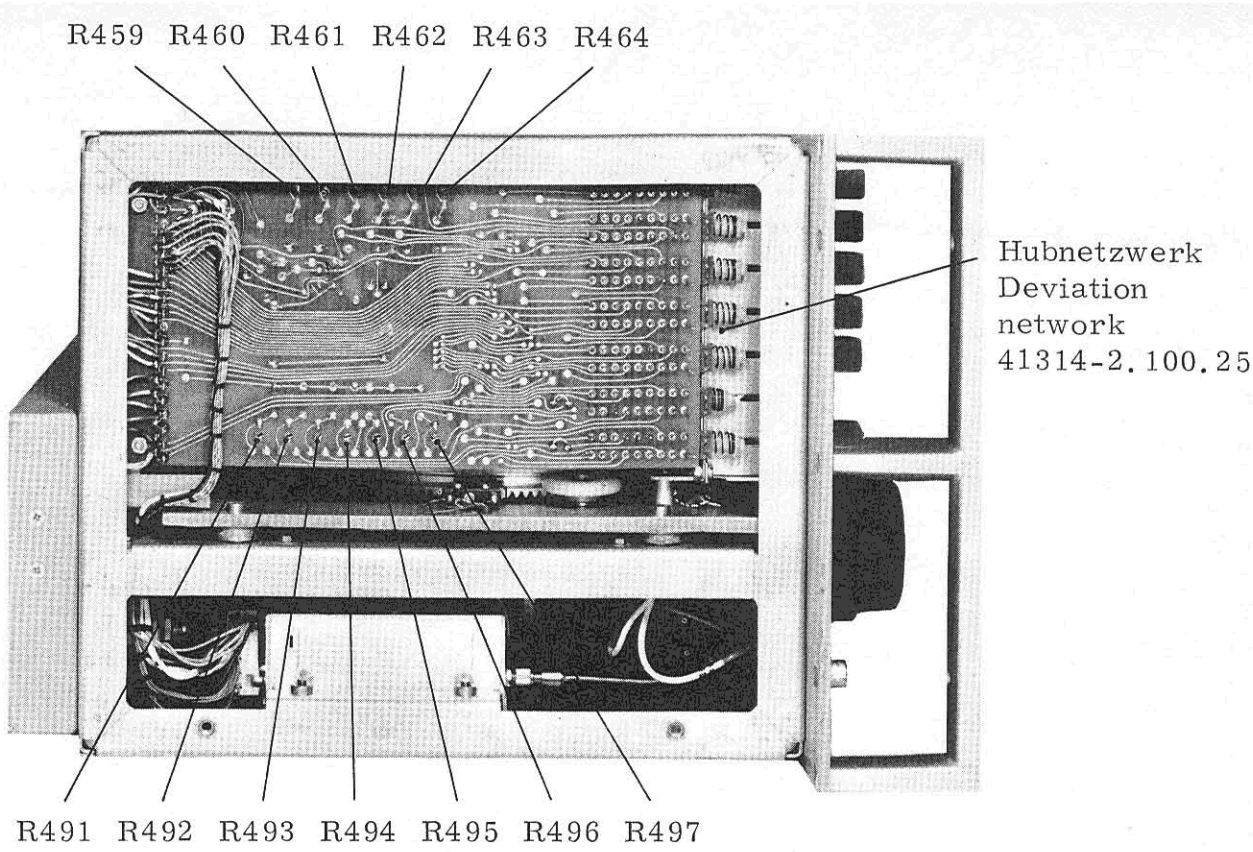


Bild 4-5 Ansicht von der linken Seite ohne Kasten
Fig. 4-5 Left-hand side view, cabinet removed

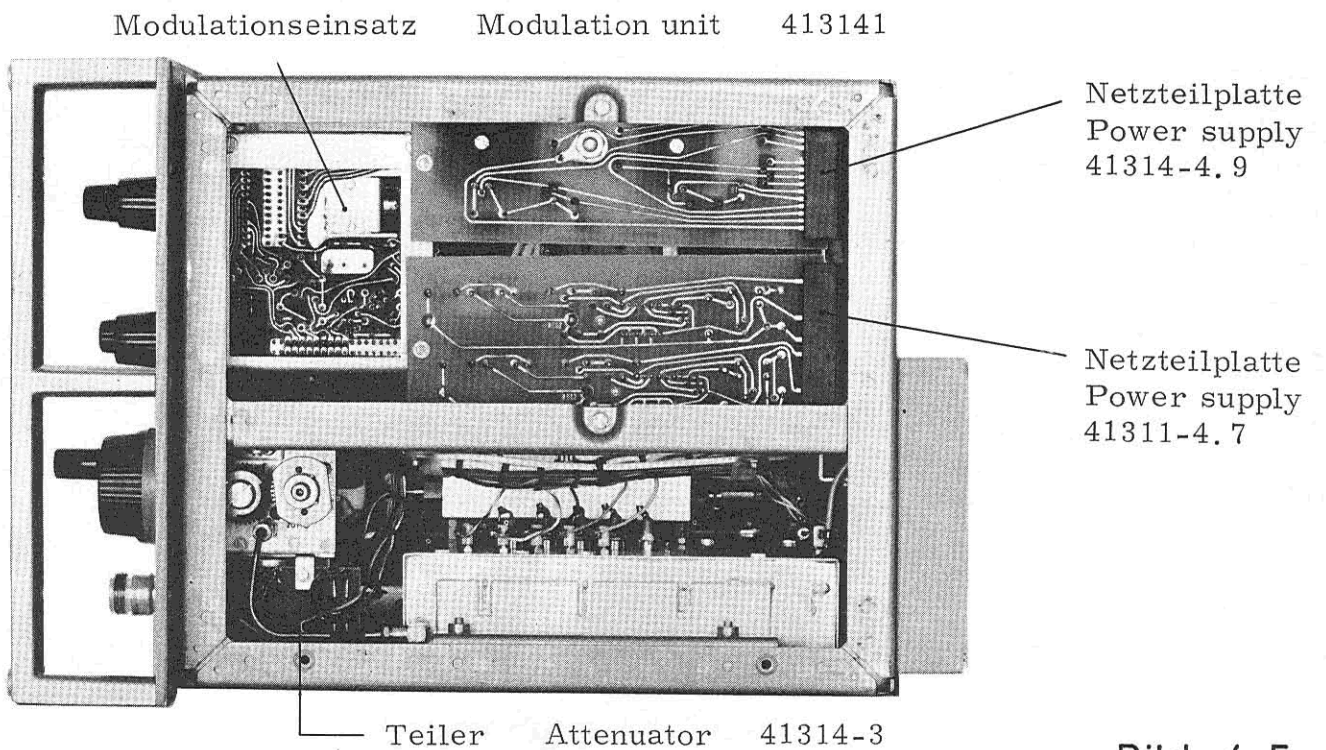
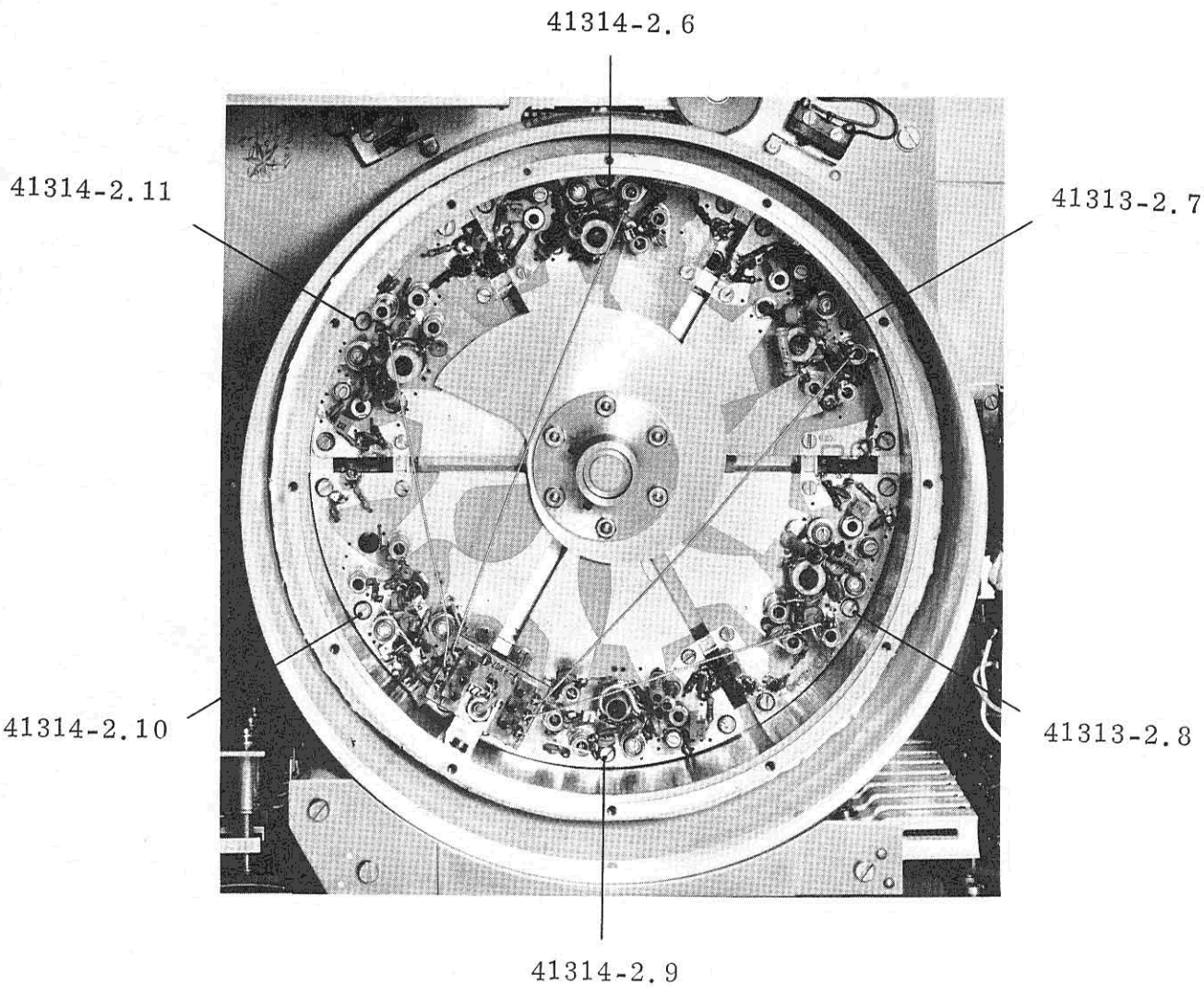


Bild 4-6 Ansicht von der rechten Seite ohne Kasten
Fig. 4-6 Right-hand side view, cabinet removed

Bild 4-5
Fig. 4-5

Bild 4-6
Fig. 4-6



Oszillator
Oscillator

Bild 4-7
Fig. 4-7

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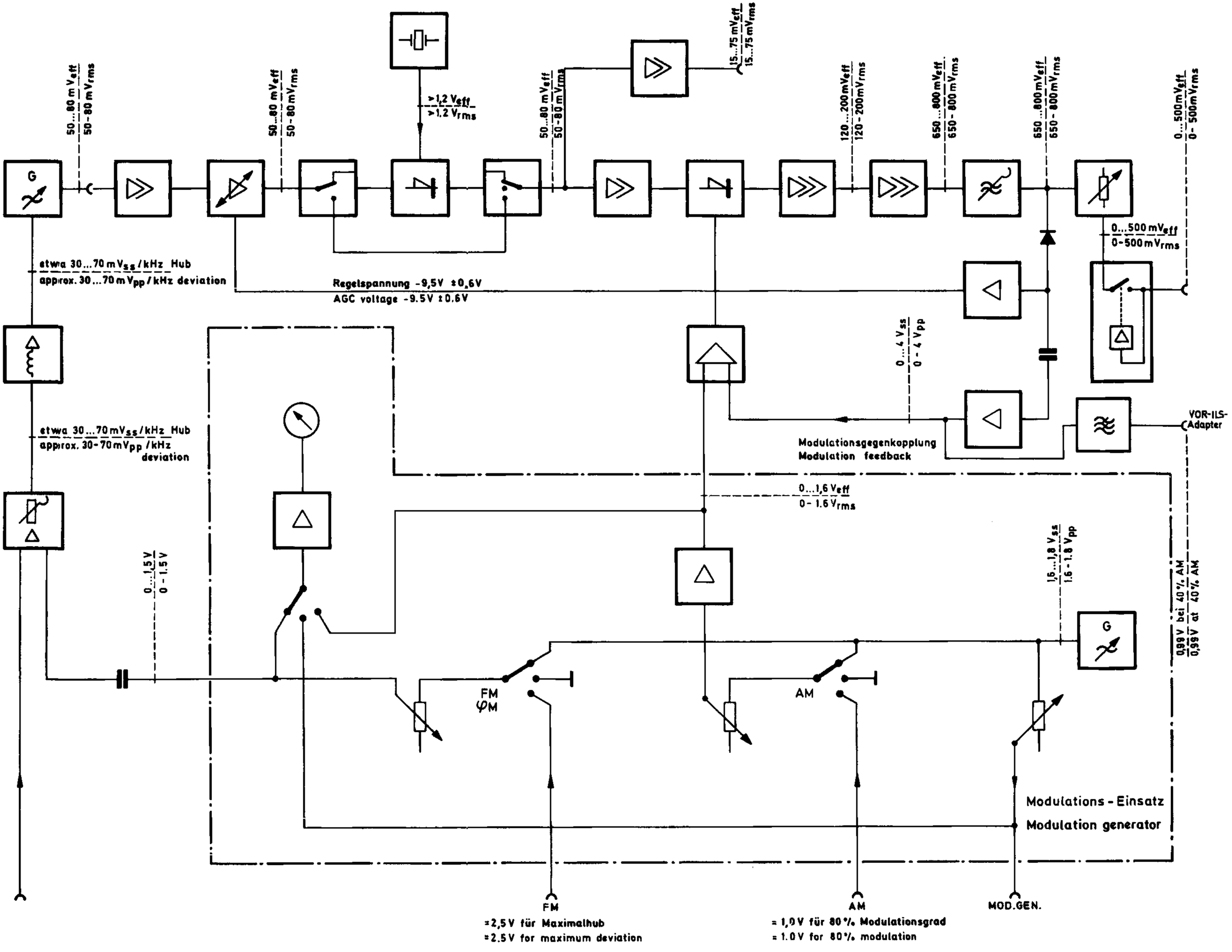

Pegelplan Bild 5-16
Level diagram Fig. 5-16

R 28488 Bl.185