INSTRUCTION BOOK

POWER SIGNAL GENERATOR

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1. Specifications

Frequency range	0.1 to 30 MHz
in 5 bands	0.1 – 0.3, 0.3 – 1, 1 – 3, 3 – 10, 10 – 30 MHz
Frequency calibration accuracy	±1%
Frequency stability for supply voltage variations of ±10%	approx. ±0.01%
Frequency calibration	for each band a separate slide-rule scale 350 mm in length; drum dial carrying the 5 scales coupled to the band switch; only the scale of the range selected is visible
Incremental frequency control	by 100-division dial; frequency increment per division 0 1%

Outputs

High-level output	coaxial adaptable 13-mm socket FK 018.2711 (see page 36, Screw-in Connectors)
Max. output voltage into 60 Ω	
from 100 kHz to 10 MHz	approx. 10 V } "10 V/30 V" position
from 10 MHz to 30 MHz	approx. 5 V } "10 V/30 V" position
Open-circuit output voltage (source impedance 60 Ω), continuously variable . .	1 to 10/30/100/300 mV/1/3 V or –60 to –40/–30/–20/–10/0+10 dB
Low-level output	coaxial adaptable 13-mm socket FK 018.2711 (see page 36, Screw-in Connectors)
Open-circuit output voltage across auxiliary 1000:1 attenuator (source impedance 60 Ω), continuously variable . .	1 to 10/30/100/300 μV/1/3 mV or –120 to –100/–90/–80/–70/–60/–50 dB
Output voltage indication	by meter calibrated in volts and in decibels relative to 0.775 V

Harmonic distortion of the unmodulated RF voltage	approx. 2%, valid a) for left-hand output socket in all other attenuator steps b) for right-hand output socket in all attenuators steps and in position 10 V/30 V if the output is terminated with 60 Ω
Accuracy	
of the voltage indication in the position "10 V/30 V" with a 60-Ω-load	±8% f.s.d.
of the attenuator	±1 dB ±0.5 μV
of the open-circuit voltage indication	±4% f.s.d.

Amplitude modulation

Internal modulation	1000 Hz, 30%
External modulation	
for a carrier frequency of 0.15 MHz	30 Hz to 5 kHz, 0 to 70%
for carrier frequencies above 0.5 MHz	30 Hz to 7 kHz, 0 to 90% 30 Hz to 10 kHz, 0 to 70%
Modulation input impedance	higher than 800 Ω
Input requirement for 1% modulation	approx. 70 mV impedance of the modulation voltage source preferably 600 Ω or less
Incidental frequency modulation at 90% AM	less than 1 part in 10,000
Power supply	115/125/220/235 V ±10% 47 to 63 Hz (60 VA)
Valves, etc.	1 valve EAA 91 1 valve ECC 81 2 valves EL 803 1 miniature glow lamp 220 V R&S Stock No. EG 019.2096 1 0.63-A fuse M 0,63 C DIN 41571 (for 220 V and 235 V) 1 1.25-A fuse M 1,25 C DIN 41571 (for 115 V and 125 V)
Dimensions	540 x 234 x 378 mm (R&S Standard Cabinet 56)
Weight	approx. 27 kg

2. Special Features and Uses

Conventional signal generators are available either as test, standard or power signal generators, mainly due to the design problem of providing accurately-known output signals in a very wide voltage range. Standard signal generators, used for development and testing of receivers, usually cover a range of 1 μV to 50 mV, whereas power signal generators, which are intended for the most diverse measurements in the laboratory and test department, deliver signals from a few tenths of one volt to approximately 10 volts.

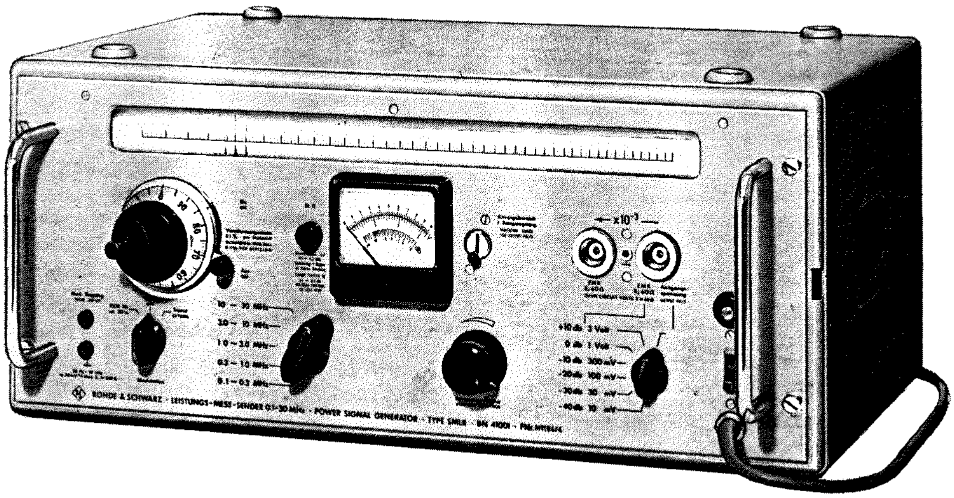


Fig. 1 Front view of the Power Signal Generator Type SMLR

The Power Signal Generator Type SMLR is capable of delivering voltages from approximately 1 μV up to 10 V into 60-Ω load, thus covering the voltage ranges of both types of signal generators mentioned above. It is as well suited for measurements on sensitive receivers as it is, for example, for driving experimental high-power transmitters or for feeding aerials whose radiation pattern is to be determined. The output voltage is continuously adjustable over the entire range and can be read from a panel meter which is calibrated in terms of volt and decibel.

Furthermore, the Power Signal Generator Type SMLR incorporates a number of special features which are the result of years of experience in this field of instrumentation and which considerably extend its range of application. Ease and reliability of frequency reading are provided by the five-scale drum dial which is coupled to the band switch. The front-panel window is so dimensioned that only one scale is displayed at a time. This ensures that the reading will always be taken from the correct scale. In addition, reading takes less time, and, particularly in the case of a series of measurements, is less fatiguing than with dials displaying all scales simultaneously.

Incremental frequency control, necessary for example in selectivity and bandwidth measurements, is facilitated by a 100-division dial around the tuning knob, which can be engaged with the shaft of the knob and permits accurate increments of 0.1% per scale division to be obtained at any frequency between 0.1 and 30 MHz. Any frequency setting can thus be varied by an accurately-known amount of ±5%.

Internal amplitude modulation is produced by a 1000-Hz oscillator at 30% modulation depth. In addition, provision is made for external modulation over the range 30 Hz to 10 kHz, modulation depths up to 90% being permissible. The circuits have been so designed that only small modulating voltages are required; approximately 70 mV produce one per cent modulation, i.e. for 30% modulation the external oscillator must supply approximately 2 V.

The features outlined above and the high output power – 1.5 watts over the major part of the frequency range – make the Power Signal Generator Type SMLR suitable for a wide variety of uses. Examples of application are:

(a) Measurement of the sensitivity and bandwidth of long, medium, and short-wave receivers; here the incremental-frequency dial and the high frequency stability of the set (±0.01% for AC supply voltage fluctuations of ±10%) are of particular advantage.

(b) Measurement of the constants of resonant circuits and filters, valve voltmeters of relatively low sensitivity being sufficient.

(c) Measurements on video amplifiers in the range 100 kHz to 10 MHz.

(d) Intermodulation and breakthrough measurements, e.g. on aircraft receivers where interfering signals of several volts may be present.

(e) Feeding of RF test bridges with modulated or CW voltages.

(f) Exciting of experimental transmitters or of an antenna whose radiation pattern is to be determined.

This great versatility of the Power Signal Generator Type SMLR ensures its continuous use in the laboratory and test department.

3. Preparation for Use

3.1 Setting the Mechanical Zero of the Meter

With the power supply switched off, the meter pointer should be on the mechanical zero, which is the zero of the two voltage scales. If necessary, reset the zero by turning the slotted screw-head recessed in the meter case.

3.2 Adapting to the Local Supply Voltage and Switching on

The Type SMLR is factory-adjusted for operation from a 220-V AC supply. To adapt it for 115 V, 125 V or 235 V, loosen the cheese-head screws on the left and right edges of the front panel and withdraw the chassis from the cabinet. Insert a suitable fuse into the contact clips on the voltage selector panel (at the power transformer) which are marked with the local supply voltage. Use a 630-mA fuse (M 0,63 C DIN 41571) for 220 V and 235 V, and a 1.25-A fuse (M 1,25 C DIN 41571) for 115 V and 125 V.

Replace the chassis and connect the set to the AC supply. Put the toggle switch in the lower right-hand corner up for ON.

A deviation up to ±10% from the rating of the supply voltage (115/125/220/235 V) does not appreciably affect the characteristics of the instrument. It is, however, advisable to avoid long durations of over or undervoltage in order to save the valves. Especially in the case of undervoltage we recommend that the average voltage be determined and a suitable transformer connected ahead of the instrument.

3.3 Electrical Zero Setting

Allow a few minutes for warm-up, then check the electrical zero of the meter and correct it if necessary. To do so, set the band switch to "0.1–0.3 MHz", turn the VOLTAGE CONTROL knob completely counterclockwise and adjust the small knob El. 0 on the left of the meter until the meter pointer deflects to the zero mark of the two voltage scales. The signal generator is now ready for use.

3.4 Connecting Cable between Signal Generator and Load; Screw-in Assemblies

The cable connecting the signal generator to the load and the input impedance of the load by which the cable is terminated may introduce a considerable error, particularly at high frequencies. To avoid these errors due to standing waves it is important to use a coaxial cable of 60 Ω characteristic impedance and to terminate this cable in 60 Ω.

In the "10 V/30 V" position the meter will read the voltage across the load only if the cable is match-terminated.

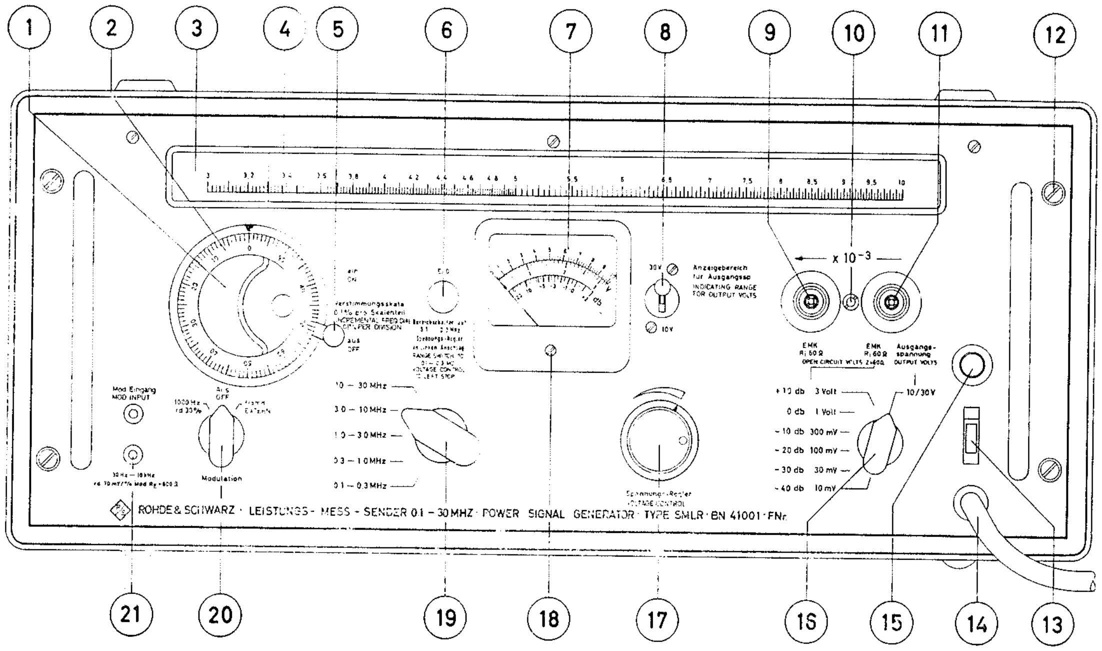
The two outputs (9 and 11; page 37) are adaptable 13-mm-sockets 4/13 DIN 47284 having the R&S Stock No. FK 018.2711. The plugs 4/13 DIN 47284, e.g. the R&S Types FK 018.1473 and FK 018.1467, mate with these sockets.

The above output sockets can be adapted to suit several other connector systems. At present the following screw-in connectors are available:

Designation for ordering	For adaptation to
FB 018.2263	R&S connector Dezifix B
FK 017.8900	Siemens connector 4/13 DIN 47283
FJ 017.5369	UHF series
FJ 017.5523	N series
FJ 017.5723	C series
FJ 017.5975	BNC series
FJ 017.9658	874 B

The adaptation is very simple: Screw the required screw-in connector into the socket and secure it against rotation by means of the two lateral headless screws.

The screw-in connector designed for the R&S connector Dezifix B has proved particularly useful because many of our instruments are equipped with this type of connector. This crew-in connector is also advantageous if great currents must be drawn from the Power Signal Generator while, on the other hand, very low voltages must be used and measured at the load, as is the case in measurement of mutual impedances. Equipped with this screw-in connector for R&S connector Dezifix B the Type SMLR has an output connector which presents an extraordinarily low mutual impedance.



1 Crank-type knob for the adjustment of the frequency-scale cursor and of the 100-division incremental dial 2.

2 Incremental dial, 100 divisions, 1 division corresponds to frequency variations of 0.1%.

3 Drum frequency dial, 5 scales; ganged with wave-band switch 19; only the scale corresponding to the chosen band is visible.

4 Frequency-scale cursor with double hair line for antiparallax reading.

5 Incremental operation lever; with the lever put up, dial 2 is coupled with knob 1; with the lever down (as shown), the dial is disengaged.

6 Electrical zero set.

7 Output voltmeter with the scales 0 to 10 V, 0 to 3 V, and –20 to +2 dB.

8 Meter range switch for the ranges 10 V and 30 V; effective only with switch 16 in position "10/30 V".

9 Low-level output, 60 Ω, E.M.F. = 1 µV to 3 mV in the steps –40 dB/10 mV to +10 dB/3 V of switch 16. The output voltage at this socket is 1000 times lower than that at socket 11. See 4.2.2 page 41.

10 Earth terminal for 4-mm plug.

11 High-level output, 60 Ω, E.M.F. = 3 mV to 3 V in the steps –40 dB/10 mV to +10 dB/3 V of switch 16; output voltage up to 10 V across 60 Ω in the step 10/30 V. See 4.2.1 and 4.2.2.

12 Chassis fixing screw (2 ea. at the left and right edges of the front panel).

13 On-off switch.

14 Power cable.

15 Voltage indicator lamp.

16 Step attenuator; steps: –40 dB/10 mV, -30 dB/30 mV, –20 dB/100 mV, –10 dB/300 mV, 0 dB/1 V, +10 dB/3 V, 10/30 V.

17 Variable attenuator.

18 Mechanical zero set.

19 Wave-band switch.

20 Modulation switch.

21 Sockets for modulation input.

4. Operating Instructions

4.1 Frequency Setting and Incremental Tuning

Select the appropriate frequency range by means of the switch to the left and below the meter and adjust the cursor of the frequency scale by the tuning knob. The two hair-lines on the cursor ensure anti-parallax reading.

For incremental frequency control, such as required for bandwidth measurements, the tuning knob is provided with a 100-division dial which can be engaged with the shaft of the control knob by means of a lever. In the lever position ON this dial is coupled to the knob. When the lever is put to OFF and the tuning knob turned, the incremental dial will rotate from any previous setting to zero and lock in position. It will therefore always be at zero when not in use.

Rotation of the incremental dial by one division effects a frequency increment of 0.1%. The accuracy of an incremental frequency adjustment depends upon the magnitude of the increment and upon the frequency at which the adjustment is started. For a rotation of the 100-division dial of up to ±50 dial division, the accuracy is approximately ±10% in the first and last tenths of each frequency band approximately ±5% in the remaining portion of the band.

4.2 Adjusting the Output Voltage

In each of the 7 positions of the attenuator switch, continuous control of the output voltage is provided by the VOLTAGE CONTROL knob to the right and below the meter.

4.2.1 "10 V/30 V" Position

In this position of the attenuator switch, the Type SMLR operates as a power signal generator. The right-hand output socket delivers, to an external load of 60 Ω, a voltage up to 10 V at frequencies from 0.1 to 10 MHz and up to 5 V at frequencies from 10 to 30 MHz. With the output open-circuited or terminated in a high-impedance load, voltages up to 20 V are obtained. In this switch position, the panel meter reads the voltage across the output socket directly, the associated measurement ranges being 0 to 10 V and 0 to 30 V. The suitable range is selected by a toggle switch to the right of meter. The reading is taken on the 0–10 V or 0–3 V scale.

In this switch position, the output impedance is changed between 0 and 250 Ω depending upon the setting of the VOLTAGE CONTROL knob. To prevent standing waves from occurring at high frequencies and when a long connecting cable is used it is important for the cable to have a characteristic impedance of 60 Ω and to be terminated in a 60-Ω load. If this condition is fulfilled the voltage across the load is equal to the reading of the panel meter, provided the cable attenuation is negligible. At low frequencies, termination of the cable in its characteristic impedance is not absolutely necessary. The highest frequency admissible for a given accuracy depends on the resistive and reactive components of the load, the characteristic impedance and the length of the cable. For example, with a 60-Ω cable the error due to mismatch is less than 10% under the conditions specified in the following table.

Cable length	Load	Frequency
1 m	30 pF	< 3 MHz
1 m	1000 pF	< 1 MHz
5 m	30 pF	< 1.5 MHz
5 m	1000 pF	< 0.5 MHz

At frequencies higher than those specified above, the output voltage reading of the signal generator corresponds with the voltage across the load only if the 60-Ω cable is loaded with a 60 Ω resistance. A simple check of matching is to replace one 60-Ω connecting cable with another of different length; if matching is correct the voltage across the terminating resistance will not change. If mismatch cannot be avoided, while high accuracy is required, a valve voltmeter should be inserted between the cable and the load. Especially suitable for this purpose is the R&S HF-DC Millivoltmeter URV 216.3612.02 with a probe 243.8811.02 and insertion head 243.9418.64. This insertion head is a coaxial line section and can therefore be readily inserted between the coaxial lines if the line ends are fitted with R&S connectors Dezifix B.

4.2.2. "+10 dB/3 V" to "–40 dB/10 mV" Positions

In these six switch positions, the output signal can be taken either from the right-hand or the left-hand output socket. The right-hand output delivers voltages from 3 V to 3 mV or from +12 dB to –50 dB; the left-hand output, which receives the signal from the right-hand output through a 1000 : 1 attenuator, delivers voltages from 3 mV to 1 µV or from –50 to –120 dB. Thus the overall range of 3 V to 1 µV or +12 dB to –120 dB is covered in 12 subranges.

In these ranges the panel meter reads the open-circuit voltage, that is to say, the EMF of a 60-Ω voltage source. Thus the voltage across a 60-Ω load will be half the meter reading. The table shown below gives a survey of the open-circuit-voltage ranges that can be selected by means of the attenuator switch, all intermediate values being obtained by the VOLTAGE CONTROL knob.

Open-circuit-voltage range		Attenuator switch position	Output
1 to 10 μV	−120 to −98 dB	−40 dB/10 mV	left-hand socket
10 to 30 μV	−100 to −88 dB	−30 dB/30 mV	
30 to 100 μV	−90 to −78 dB	−20 dB/100 mV	
100 to 300 μV	−80 to −68 dB	−10 dB/300 mV	
0.3 to 1 mV	−70 to −58 dB	0 dB/1 V	
1 to 3 mV	−60 to −48 dB	+10 dB/3 V	
3 to 10 mV	−50 to −38 dB	−40 dB/10 mV	right-hand socket
10 to 30 mV	−40 to −28 dB	−30 dB/30 mV	
30 to 100 mV	−30 to −18 dB	−20 dB/100 mV	
100 to 300 mV	−20 to − 8 dB	−10 dB/300 mV	
0.3 to 1 V	−10 to + 2 dB	0 dB/1 V	
1 to 3 V	0 to +12 dB	+10 dB/3 V	

In the position "+10 dB/3 V" the impedance at the right-hand output socket, as viewed from the load, may increase to approximately 83 Ω, depending upon the setting of the VOLTAGE CONTROL knob. In the position "0 dB/1 V" the attenuation caused by the output attenuator is so high that the source impedance is approximately 60 Ω over the entire range. Although in the "+10 dB/3 V" position a wave reflected by a mismatched cable is not completely suppressed, the formula given below is still valid, since the response of the meter to the reflected wave is such that the meter reads the open-circuit voltage, or EMF, required for determining the voltage across the load with a generator source impedance of 60 Ω. With negligible attenuation of the connecting cable between generator and load, the voltage E across the load is

$$E = E_o \times \frac{Z_l}{Z_s + Z_l} = E_o \times e$$

where E_o = open-circuit voltage reading (EMF)

Z_l = terminating impedance of the generator (at right-hand or left-hand output)
Z_s = source impedance of the generator (60 Ω in all ranges)
e = E/E_o

The following table shows the value $E/E_o = e$ and the attenuation, in dB, against the voltage reading E_o for a number of resistive loads.

Load resistance	$E/E_0 = e$	Attenuation in dB = 20 x log e
50 Ω	0.45	-6.8 dB
60 Ω	0.50	-6.0 dB
75 Ω	0.56	-5.1 dB
150 Ω	0.71	-2.9 dB
600 Ω	0.91	-0.8 dB
open-circuit	1.C0	0 dB

When the connecting cable is not match-terminated, a small reactive component of the generator source impedance and impedance irregularities in the cable and connectors may cause an additional error. This error, however, remains below 10% in the "+10 dB/3 V" range and below 5% in all other ranges, even with extreme mismatch, e.g. when the cable is open-circuited and long in terms of a quarter of the wavelength adjusted for on the generator. For accurate measurements it is therefore recommended that the cable be terminated, at least with approximately 60 Ω. Frequently, even a load impedance very different from 60 Ω can be brought to approximately 60 Ω by series or parallel connection of a suitable resistor. In the case of series connection, the voltage division due to the series resistor must of course be taken into account.

Load voltages down to 1 μV, such as required e.g. for measurements on sensitive receivers, can of course be obtained only if the connecting cable has sufficiently low mutual impedance and the earth connection between the outer conductor of the coaxiable cable and the chassis of the load, e.g. the receiver, has very low inductance. This requirement is generally fulfilled in modern receivers with coaxial input sockets.

In each output socket a DC blocking capacitor has been provided which protects the output attenuators from DC voltages that may arrive from the load; DC voltages up to 250 V are permissible.

4.3 Internal and External Modulation

The Type SMLR provides for internal modulation, CW operation and external modulation. The corresponding positions of the modulation selector switch, below the crank type knob, are 1000 Hz, ABOUT 30%, OFF, and EXTERNAL.

In the position **1000 Hz, ABOUT 30%,** the output voltage is amplitude-modulated by the built-in AF oscillator, the modulation frequency being 1000 Hz and the modulation depth 30 ± 5%.

In the position **OFF,** the signal generator produces only the carrier wave. A modulation voltage source connected to the signal generator may remain connected since it is disconnected within the set. The hum modulation, 100 Hz, is below 0.3%.

In the position **EXTERNAL,** the output voltage can be modulated up to 90% by an AF voltage applied to the MOD. INPUT sockets. The modulation voltage requirement is about 70 mV for each per cent of modulation. Audio-frequencies from 30 Hz to 10 kHz may be used for modulation in the medium and short-wave ranges. In the two long-wave ranges the maximum usable modulation frequency is somewhat reduced by the bandwidth of the amplifier tuning circuist. With a 3-dB decrease of the modulation depth at the highest modulation frequency, the following modulation frequencies may be used:

30 Hz to 2 kHz at 0.1 MHz carrier
30 Hz to 5 kHz at 0.15 MHz carrier
30 Hz to 10 kHz at 0.3 MHz carrier in the range 0.1 to 0.3 MHz
30 Hz to 5 kHz at 0.3 MHz carrier in the range 0.3 to 1 MHz
30 Hz to 10 kHz at frequencies above 0.5 MHz.

These values hold for the "10 V/30 V" range at a load impedance of 60 Ω and for the six switch positions from "+10 dB/3 V" to "–40 dB/10 mV" at any terminating impedance.

With the carrier modulated the meter reads the correct carrier voltage only at modulation frequencies up to about 1000 Hz. For high modulation frequencies and high percentage modulation, accurate determination of the carrier voltage is also possible; to this end, keep the modulation voltage constant and reduce its frequency below 1000 Hz. The magnitude of the carrier voltage thus measured is then valid also at higher modulation frequencies, independently of the indication, which may reach twice the true value at high modulation frequencies and high percentage modulation.

5. Description

The RF section of the Power Signal Generator Type SMLR consists of an oscillator stage and a buffer amplifier which has a tuned anode circuit and is capable of being modulated. Both stages employ Type EL 803 power pentodes. A special ventilating system ensures adequate cooling without loss of shielding. In the range of highest output power, i.e. 10 to 1 V into 60 Ω, the voltage is directly applied to the output through the potentiometer R29, which provided for continuous adjustment of the output voltage in all ranges. In the range from 3 V to 1 mV, the signal is attenuated in six 10-dB steps by a ladder type resistive attenuator R36 to R53. In the voltage range from 3 mV to 1 μV the signal passes to a separate output through the 1000 : 1 attenuator R56 to R59, which follows the ladder attenuator. The output voltage is indicated in volts and decibels by an internal valve voltmeter, Rö3–I1. Internal modulation at 30% modulation depth is provided by a stabilized 100-Hz oscillator, Rö4, of low harmonic distortion.

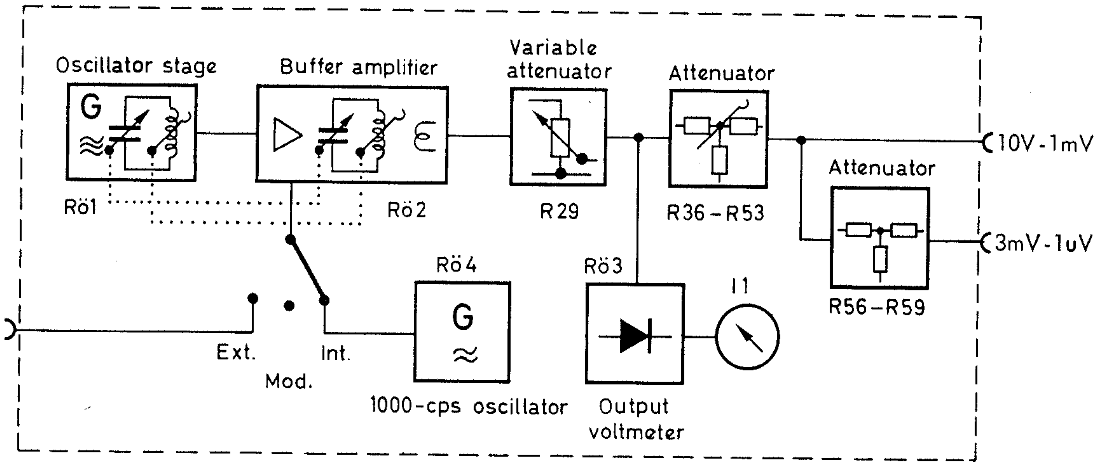


Fig. 3 Block Diagram of the Power Signal Generator Type SMLR

5.1 RF Oscillator Rö1

The oscillator stage of the power signal generator (see circuit diagram) uses a Type EL 803 power pentode and covers the frequency range 0.1 to 30 MHz in the five overlapping bands 0.1 to 0.3, 0.3 to 1, 1 to 3, 3 to 10, 10 to 30 MHz. Each band has an individual scale 350 mm in length, approximately 2.8 mm corresponding to a frequency change of 1%. The drum dial carrying the scales is coupled to the band switch. Only the scale of the frequency band selected is brought into view, reading errors because of scale confusion thus being avoided.

For incremental frequency control, e.g. for bandwidth measurements, the tuning knob is provided with a 100-division dial. Due to the logarithmic plate shape of the variable capacitor C5 and a suitable gear ratio between the variable-capacitor and tuning-knob shafts one division of the incremental frequency dial corresponds to a frequency variation of 0.1% at all frequencies. The accuracy of the frequency increments thus obtained is approximately ±5% over 80% of each band, falling to ±10% in the first and last tenths of the band, due to the fringe area of the variable capacitor characteristic not being fully logarithmic. This accuracy is the same in all five ranges and holds for a dial rotation of ±50 divisions or less, that is, for an incremental frequency adjustment of ±5% or less.

The oscillator stage has been carefully proportioned so that the frequency stability is inherently good. For example, a supply voltage change of ±10% from the nominal value results in a frequency shift of only ±0.01%. This stability is of great advantage when making fractional mistuning measurements with the aid of the 100-division incremental dial.

5.2 Buffer Amplifier Rö2

This stage operates as a linear Class B amplifier with a tunable anode circuit for each frequency band. These circuits are gang-tuned with those of the oscillator stage. The Q of the anode circuits is proportioned for minimum harmonic content without undue restriction of the modulation frequency range. The grid of the buffer valve is but loosely coupled to the oscillator stage so that incidental frequency modulation is negligible even at a high percentage of amplitude modulation.

The amplifier output is inductively coupled to the potentiometer R29 the output of which is taken to the output attenuator switch. In the switch position "10 V/30 V" the voltage is applied directly to the coaxial output socket in order to obtain maximum output power. The harmonic distortion of the RF voltage varies slightly with frequency as well as with the setting and loading of the potentiometer R29. With an external load of 60 Ω, the harmonic content is less than 3% in the frequency range 0.1 to 0.3 MHz, less than 2% from 0.3 to 3 MHz and less than 1% from 3 to 30 MHz. In the switch positions from "3 V/+10 dB" to "10 mV/–40 dB" the 60-Ω load is provided by the output attenuator. When the voltage is applied directly to the output, i.e. in the "10 V/30 V" position, and external 60-Ω termination is required. The performance of the amplifier is but little affected by load impedance variations between open circuit and short circuit, yet it is inadvisable to short-circuit the output at maximum output voltage.

5.3 Output Attenuator and Output Voltmeter

In the switch position "10 V/30 V" the voltage from R29 is taken to the output through cable K1, switch S2IIF–S2IR, cable K2–K5, and blocking capacitor C47. In this position, the voltage delivered to an external 60-Ω load is approximately 10 V at frequencies from 0.1 to 10 MHz and approximately 5 V from 10 to 30 MHz. The output impedance varies between 0 and 250 Ω, depending upon the setting of the potentiometer R29. This impedance variation does not affect the accuracy of the voltage adjusted across the load since in this switch position the voltage is measured directly at the input of the 60-Ω output cable K1. In this switch position the generator therefore constitutes a zero-impedance voltage source when the voltage indication of the built-in valve voltmeter is taken as a reference and the generator output is terminated in its characteristic impedance, i.e. 60 Ω. When the output is open-circuited or terminated in a high-impedance load the signal generator delivers an open-circuit voltage of up to 20 V.

In the switch position "+10 dB/3 V" the voltage is taken to the output through the attenuator R36–R37–R42–R43–R44, in the positions "0 dB/1 V" to "–40 dB/10 mV" the voltage is attenuated in the ladder network R45 to R53. In the positions from "+10 dB/3 V" to "–40 dB/10 mV" the signal generator forms a voltage source having an EMF equal to the indicated voltage and a source impedance of exactly 60 Ω. In the switch position "+10 dB/3 V" the open-circuit voltage indication varies somewhat with the load impedance, in the position "0 dB/1 V" this variation is very slight, depending upon the setting of the voltage control. All voltages that are obtained in these six positions, i.e. 3 V to 1 mV, can be reduced to 1/1000 of their value, or by 60 dB, using the attenuator R56–R57–R58–R59 which has a separate coaxial outlet. This outlet likewise has a source impedance of 60 Ω.

The output voltmeter, consisting of valve Rö3 and moving-coil meter I1, employs a double diode EAA 91 to give peak/peak rectification. The meter scale is calibrated in rms values. The contact potential appearing across the diode under no-signal condition is cancelled by a positive current flowing through the meter via the attenuator R69–R68 if the variable resistor R68 is adjusted so that the meter reads zero with the control R29 turned against its left stop. The variable resistor R68 can be operated by the front panel knob identified as El. 0.

In the position "10 V/30 V" of the attenuator switch S2IIF–S2IR, the toggle switch S3 provided on the front panel to the right of the meter permits the selecting of a full-scale reading of 10 V or 30 V. Thus voltages above 10 V – as present under no-load conditions – can be read directly. The switch S2III, which is ganged with the switches S2IIF–S2IR, is closed only in the "10 V/30 V" position; that is, S3 is inoperative in all other ranges.

5.4 Internal and External Modulation

The amplitude of the carrier is modulated by varying the effective grid bias of the buffer valve Rö2. The modulation selector S4 considerably increases the grid bias of Rö2 and reduces its screen voltage in internal and external modulation. This causes a reduction in output power, but there is still sufficient reserve to obtain output voltages up to 3 volts. The peak value of the carrier remains constant when the modulation depth is varied, only its mean value being reduced. This enables the maximum possible output voltage to be obtained at any modulation depth.

Due to the loose coupling between the oscillator and the amplifier stage, the frequency is only slightly affected even at a high percentage of modulation. At 90% AM the incidental FM is only about 0.01% of the frequency setting, which corresponds to a deviation of approximately 1 kHz at 10 MHz.

The 1000-Hz oscillator Rö4, which produces the internal modulating voltage, uses a twin-triode ECC 81. One triode operates as transformer-coupled oscillator with a tuned anode circuit, the other triode is used as diode rectifier to produce a negative DC voltage from the AF voltage delivered by the oscillator. This negative voltage is partly cancelled by a positive voltage applied through the attenuator R76–R77. As a result, the oscillator grid bias is such that the oscillator generates an AF signal producing 30% modulation.

When a modulating voltage is applied from an external source the anode supply voltage of the oscillator is disconnected by S41F and a path for the external voltage is provided by the switch S41R. The required modulating voltage is small, approximately 70 mV for each per cent of modulation. To provide, for example, 30% modulation, the external oscillator must supply about 2 volts. The input resistance is very high (approx. 16 MΩ), especially at low modulating frequencies, thus constituting a negligible load. The input capacitance, however, is approximately 20,000 pF. This relatively high value of capacitance is due to the RF filters. The influence of these filters on the frequency response of the modulation can be neglected if the source impedance of the external oscillator is not higher than about 600 Ω. It may be necessary to shunt the modulation input of the Type SMLR with a resistor to provide correct impedance match. The modulation frequency range is limited mainly by the bandwidth of the tuned circuits of the buffer. With 3 dB loss in modulation depth, the maximum modulation frequencies are: 2 kHz at 0.1 MHz carrier; 5 kHz at 0.15 MHz; 10 kHz at 0.3 MHz in the range 0.1 to 0.3 MHz; 5 kHz at 0.3 MHz in the range 0.3 to 1 MHz; and 10 kHz at all frequencies above 0.5 MHz; the minimum modulation frequency is 30 Hz. This holds in the "10 V/30 V" position with a 60-Ω load and at all the positions of the output attenuator. At the highest modulation frequencies given above, a modulation depth of up to 70% may be used.

Since the output voltmeter is operated by a rectifier, its reading can be affected by the modulation frequency. The departure of the reading from the true rms carrier value is negligible at 1000 Hz 30% modulation, but at higher modulation frequencies the meter will no longer indicate the true rms value of the carrier. It is, however, possible to determine the output voltage correctly. To do this first reduce the modulation frequency to, say, 800 Hz, adjust for the desired carrier and again raise the modulation frequency to the desired value, maintaining the modulating voltage and the carrier level constant. The voltage reading at the low modulation frequency will also apply to the high modulation frequency.

5.5 Power Supply

The power supply section is designed for AC supply voltages of 115 V, 125 V, 220 V and 235 V. The glow lamp Rl1, which is connected to the primary winding of the power transformer and located on the front panel above the on-off switch S5, indicates that the supply voltage is present. The anode voltage is supplied by the selenium rectifier Gl1 and smoothed by the filter C64–L30–C65–C63.

All leads to the RF section are provided with wide-band RF filters, so that practically no RF voltage can leak into the power supply and the internal oscillator section. To prevent possible RF leakage via the AC supply line or the modulation input, these are likewise protected by suitable filters. These filters and very careful arrangement of the internal earthing points ensure that this signal generator can be used in conjunction with very sensitive receivers.

6. Valve Replacement

All four valves can be replaced with others of the same type (see list of replaceable parts) without affecting the accuracy of the instrument. To do so, the chassis must be removed from the cabinet. The RF oscillator valve Rö1 and the amplifier valve Rö2 are mounted on the casting of the RF oscillator section under shielding cans, each fixed by three screws. The voltmeter valve Rö3 is accessible after removing the base plate of the RF oscillator section. The AF oscillator valve Rö4 is attached to a vertical mounting panel on the casting of the RF oscillator section.

7. Location of Defects

The location of defects is facilitated by the two components location plans Figs. 5 and 6. There are two possibilities of finding the location and rating of a circuit element:

a) Instrument ⟶ Figs. 5 or 6 ⟶ Table of Replaceable Parts ⟶ Circuit Diagram

b) Circuit Diagram ⟶ Table of Replaceable Parts ⟶ Figs. 5 or 6 ⟶ Instrument.

Example a):

If, for example, a defective (burnt) deposited-carbon resistor has been found, its reference number can immediately be seen from one of the figures. The Table of Replaceable Parts indicates the rating and the R&S stock number. The Circuit Diagram shows the function of the respective element (e.g. anode load resistor). Thus the reason for the defect can easily be guessed (e.g. burnt-out capacitor).

Example b):

If, however, the anode voltage is cut off from a valve, first find the elements located in the anode circuit (reference numbers). Based on the Table of Replaceable Parts and the respective figure indicated there the location of the element in question is easily determined.

8. Table of Replaceable Parts

Ref. No.	Designation	Ratings	R & S Stock No.	Location in the set	
				Fig.	Coordinate square
C 1	Capacitor, ceramic	15 pF	CCG 68/15	6	H – 9
C 2	Capacitor, ceramic	47 pF	CCH 31/47	6	I – 8
C 3	Capacitor, ceramic	240 pF	2 x CCH 31/120 parallel	6	I – 7
C 4	Capacitor, ceramic	10 pF	CCH 31/10	6	G – 8
C 5	Capacitor, variable	$\Delta C = 2 \times 600$ pF	41001 – 1.40	5	D – I – 14
C 6	Trimmer, air	4 to 29 pF	CV 8025	6	I – 4
C 7	Trimmer, air	4 to 29 pF	CV 8025	6	G – 6
C 8	Trimmer, air	4 to 29 pF	CV 8025	6	G – 4
C 9	Trimmer, air	4 to 29 pF	CV 8025	6	G – 2
C 10	Trimmer, air	4 to 29 pF	CV 8025	6	I – 2
C 11	Capacitor, ceramic	1.5 pF	CCG 11/1,5	6	H – 3
C 12	Capacitor, ceramic	6 pF	2 x CCG 41/3 parallel	6	F – 6
C 13	Capacitor, ceramic	2 pF	CCG 41/2	6	F – 4
C 14	Capacitor, ceramic	4 pF	CCG 41/4	6	F – 2
C 15	Capacitor, ceramic	6 pF	CCG 41/6	6	H – 3
C 16	Capacitor, ceramic	8 pF	CCG 41/8	6	G – 8
C 17	Capacitor, ceramic	47 pF	CCH 31/47	6	G – 9
C 18	Capacitor, ceramic	0 to 20 pF	CCH 31/12	6	G – 9
C 21	Capacitor, feed-through, paper	50,000 pF/300 V	CPD 50 000/300	6	F – 9
C 22	Capacitor, feed-through, paper	50,000 pF/300 V	CPD 50 000/300	6	F – 9
C 23	Capacitor, feed-through, ceramic	5000 pF/500 V	CFR 1/5000/500	6	F – 8
C 24	Capacitor, feed-through, ceramic	5000 pF/500 V	CFR 1/5000/500	6	F – 8
C 25	Capacitor, feed-through, paper	10,000 pF/300 V	CPD 10 000/300	6	H – 11

Ref. No.	Designation	Ratings	R&S Stock Nr.	Location in the set	
				Fig.	Coordinate square
C 26	Capacitor, feed-through, paper	25,000 pF/300 V	CPD 25 000/300	6	F – 9
C 28	Capacitor, paper	50,000 pF/250 V	CPM 50 000/250	6	E – 8
C 29	Capacitor, paper	50,000 pF/250 V	CPM 50 000/250	6	C – 6
C 30	Trimmer, tubular, ceramic	1 to 12 pF	CVC 72692 p 12	6	D – 4
C 31	Trimmer, tubular, ceramic	1 to 12 pF	CVC 72692 p 12	6	D – 6
C 32	Trimmer, tubular, ceramic	1 to 12 pF	CVC 72692 p 12	6	D – 4
C 33	Trimmer, tubular, ceramic	1 to 12 pF	CVC 72692 p 12	6	D – 2
C 34	Trimmer, tubular, ceramic	1 to 12 pF	CVC 72692 p 12	6	E – 2
C 35	Capacitor, paper	4400 pF/1000 V	2 x CPK 70003 n 2,2 parallel	6	F – 13
C 36	Capacitor, synth. foil	250 pF/1000 V	CKS 250/1000	6	F – 12
C 38	Capacitor, MP	4 µF/250 V	2 x CMR 2/250 parallel	6	I – 16
C 39	Capacitor, feed-through, ceramic	5000 pF/500 V	CFR 1/5000/500	6	F – 13
C 40	Capacitor, feed-through, paper	50,000 pF/300 V	CPD 50 000/300	6	H – 16
C 41	Capacitor, feed-through, paper	50,000 pF/300 V	CPD 50 000/300	6	H – 17
C 42	Capacitor, feed-through, paper	50,000 pF/300 V	CPD 50 000/300	6	H – 17
C 43	Capacitor, feed-through, paper	10,000 pF/300 V	CPD 10 000/300	6	H – 15
C 44	Capacitor, feed-through, paper	50,000 pF/300 V	CPD 50 000/300	6	H – 14
C 45	Capacitor, feed-through, paper	50,000 pF/300 V	CPD 50 000/300	6	H – 14
C 47	Capacitor, synth. foil	100,000 pF/125 V	CKS 100 000/125	5	B – 2
C 49	Capacitor, synth. foil	100,000 pF/125 V	CKS 100 000/125	5	B – 5
C 52	Capacitor, paper	4700 pF/400 V	CPK 62003 n 4,7	6	A – 5
C 53	Capacitor, paper	220,000 pF/250 V	CPK 58004 n 220	6	A – 3
C 54	Capacitor, paper	100,000 pF/250 V	CPK 58004 n 100	5	G – 16

Ref. No.	Designation	Ratings	R&S Stock No.	Location in the set	
				Fig.	Coordinate square
C 55	Capacitor, MP	1 μF/250 V	CMR 1/250	5	D – 18
C 56	Capacitor, paper	10,000 pF/250 V	CPK 62003 n 10	5	E – 16
C 57	Capacitor, paper	100,000 pF/250 V	CPK 58004 n 100	5	D – 16
C 58	Capacitor, paper	10 nF/250 V (Factory adjusted 0 to 25,000 pF)	CPK 62003 n 10	5	D – 16
C 59	Capacitor, paper	1000 pF/1000 V	CPK 70003 n 1	5	G – 18
C 60	Capacitor, paper	22,000 pF/250 V	CPK 62003 n 22	5	E – 16
C 63	Capacitor, MP	16 μF/250 V	CMR 16/250	5	G – 5
C 64	Capacitor, MP	16 μF/250 V	CMR 16/250	5	E – 5
C 65	Capacitor, paper	220,000 pF/250 V	CPK 58004 n 220	5	H – 6
C 66	Capacitor, paper	2200 pF/1000 V	CPK 70003 n 2,2	6	A – 18
C 67	Capacitor, paper	2200 pF/1000 V	CPK 70003 n 2,2	6	A – 17
Gl 1	Rectifier, power	300 V/150 mA	GNB 19/300/150 M	5	E – 7
J 1	Meter, moving-coil	40 μA/3500 Ω	JNS 20202	5	A – 10
K 1	Cable, RF		LK 156/2		
K 2	Cable, RF		LK 126/2	6	C – 17
K 3	Power cord		LKA 08031	5	A – 1
K 4	Cable, RF		LKK 61900		
K 5	Cable, RF		LK 126/6	5	D – 2
L 1	Choke, anode		41001 – 1.1.6	6	H – 10
L 2	Coil, ceramic		MCC 0204/0,4	6	H – 5
L 3	Coil, oscillator		41001 – 1.8.8	6	G – 5
L 4	Coil, oscillator		41001 – 1.8.12	6	G – 3
L 5	Coil, oscillator		41001 – 1.8.10	6	G – 2
L 6	Coil, oscillator		41001 – 1.8.13	6	H – 2
L 9	Choke, anode		41001 – 1.1.5	6	E – 10

Ref. No.	Designation	Ratings	R&S Stock No.	Location in the set	
				Fig.	Coordinate square
L 10 I	Coil, ceramic		41001 – 1.7.10	6	E – 5
L 10 II, III	Coil		41001 – 1.7.16	6	E – 5
L 11	Coil		41001 – 1.7.14	6	C – 5
L 12	Coil		41001 – 1.7.21	6	C – 3
L 13	Coil		41001 – 1.7.18	6	C – 2
L 14	Coil		41001 – 1.7.22	6	E – 2
L 15 L 16 L 17	Coil Coil Coil		41001 – 1.7.17	6	E – 3
L 19	Choke, RF		41001 – 1.17	6	G – 14
L 20	Choke, RF		41001 – 1.19	6	G – 16
L 21	Choke, RF		41001 – 1.19	6	G – 18
L 22	Choke, RF		2 x 41001 – 1.18 in series	6	G – 17
L 23	Choke, RF		41001 – 1.17	6	G – 15
L 24	Choke, RF		41001 – 1.19	5	G – 3
L 25	Choke, RF		41001 – 1.19	5	G – 1
L 26	Choke, RF		41001 – 1.18	5	G – 2
L 27	Choke, RF		41001 – 1.17	5	G – 4
L 29	Choke		41001 – 4.3	6	A – 1
L 30	Choke		DB 75/2	5	H – 7
L 31	Choke		DUF 411/200	6	A – 17
L 32	Choke		DUF 411/200	6	A – 17
L 33	Choke		incl. in 1521 – 4.7	6	A – 17
R 1	Resistor, depos. carbon	1 kΩ 0.5 W	WFE 321 k 1	6	H – 9
R 2	Resistor, depos. carbon	20 kΩ/0.5 W	WFE 321 k 20	6	H – 9
R 3	Resistor, depos. carbon	20 kΩ/0.5 W	WFE 321 k 20	6	H – 9
R 4	Resistor, depos. carbon	20 kΩ/0.5 W	WFE 321 k 20	6	H – 9
R 5	Resistor, depos. carbon	2 x 10 kΩ/0.5 W	2 x WFE 321 E 10 parallel	6	H – 9
R 6	Resistor, depos. carbon	50 Ω/0.5 W	WFE 321 E 50	6	H – 8

Ref. No.	Designation	Ratings	R&S Stock Nr.	Location in the set	
				Fig.	Coordinate square
R 7	Resistor, depos. carbon	30 kΩ/0.5 W	WFE 321 k 30	6	I – 8
R 8	Resistor, depos. carbon	100 kΩ/0.5 W	WFE 321 k 100	6	F – 8
R 9	Resistor, depos. carbon	500 kΩ/0.5 W	WFE 321 k 500	6	F – 8
R 11	Resistor, depos. carbon	2 x 3 kΩ/1 W	2 x WFE 521 k 3 parallel	6	H – 4
R 12	Resistor, depos. carbon	4 kΩ/1 W	WFE 521 k 4	6	G – 4
R 13	Resistor, depos. carbon	40 kΩ/0.5 W	WFE 321 k 40	6	G – 4
R 14	Resistor, depos. carbon	160 kΩ/0.5 W	WFE 321 k 160	6	G – 2
R 15	Resistor, depos. carbon	250 kΩ/0.5 W	WFE 321 k 250	6	H – 2
R 16	Resistor, depos. carbon	25 kΩ/0.5 W	WFE 321 k 25	6	F – 9
R 17	Resistor, depos. carbon	25 kΩ/0.5 W	WFE 321 k 25	6	G – 10
R 20	Resistor, depos. carbon	400 Ω/0.5 W	WFE 321 E 400	6	F – 9
R 21	Resistor, depos. carbon	125 Ω/0.5 W	WFE 321 E 125	6	E – 9
R 22	Resistor, depos. carbon	3 kΩ/2 W	WF 3 k/2	6	C – 9
R 23	Resistor, depos. carbon	3 kΩ/2 W	WF 3 k/2	6	C – 9
R 24	Resistor, depos. carbon	4 kΩ/2 W	WF 4 k/2	6	C – 9
R 25	Resistor, depos. carbon	4 kΩ/2 W	WF 4 k/2	6	C – 9
R 26	Resistor, depos. carbon	3 kΩ/2 W	WF 3 k/2	6	C – 9
R 27	Resistor, depos. carbon	250 kΩ/0.5 W	WFE 321 k 250	6	F – 13
R 28	Resistor, depos. carbon	4 x 250 Ω/1 W	4 x WFE 521 E 250 parallel	6	D – 13
R 29	Resistor, depos. carbon variable	3 x 750 Ω/2 W	WSD 7	6	D – E – 12
R 31	Wire, resistive	0.87 Ω	WM 43/0,25 L	6	H – 15
R 32	Resistor, depos. carbon	800 Ω/0.5 W	WFE 321 E 800	6	H – 12
R 33	Resistor, depos. carbon variable	50 kΩ lin.	WS 9122 F/50 k	6	I – 14
R 34	Resistor, depos. carbon	20 kΩ/0.5 W	WFE 321 k 20	6	H – 14
R 36	Resistor, depos. carbon	220 Ω ±1%/1 W	WFE 541 E 220	6	E – 16*
R 37	Resistor, depos. carbon	220 Ω ±1%/1 W	WFE 541 E 220	6	E – 16*
R 38	Resistor, depos. carbon	220 Ω ±1%/1 W	WFE 541 E 220	6	E – 16*
R 39	Resistor, depos. carbon	220 Ω ±1%/1 W	WFE 541 E 220	6	E – 16*

***) in shielding can near switch**

Ref. No.	Designation	Ratings	R&S Stock Nr.	Location in the set	
				Fig.	Coordinate square
R 40	Resistor, depos. carbon	220 Ω ± 1%/1 W	WFE 541 E 220	6	E – 16 *
R 41	Resistor, depos. carbon	300 Ω ± 1%/1 W	WFE 541 E 300	6	E – 16 *
R 42	Resistor, depos. carbon	47.3 Ω ± 1%/1 W	WFE 541 E 47,3	6	E – 16 *
R 43	Resistor, depos. carbon	47.3 Ω ± 1%/1 W	WFE 541 E 47,3	6	E – 16 *
R 44	Resistor, depos. carbon	163 Ω ± 1%/1 W	WFE 541 E 163	6	E – 16 *
R 45	Resistor, depos. carbon	107.2 Ω ± 1%/0.5 W	WFE 341 E 107,2	6	E – 16 *
R 46	Resistor, depos. carbon	115.6 Ω ± 1%/0.5 W	WFE 321 E 115,6	6	E – 16 *
R 47	Resistor, depos. carbon	115.6 Ω ± 1%/0.5 W	WFE 321 E 115,6	6	E – 16 *
R 48	Resistor, depos. carbon	115.6 Ω ± 1%/0.5 W	WFE 321 E 115,6	6	E – 16 *
R 49	Resistor, depos. carbon	79 Ω ± 1%/0.5 W	WFE 341 E 79	6	E – 16 *
R 50	Resistor, depos. carbon	170.8 Ω ± 1%/0.5 W	WFE 341 E 170,8	6	E – 16 *
R 51	Resistor, depos. carbon	170.8 Ω ± 1%/0.5 W	WFE 341 E 170,8	6	E – 16 *
R 52	Resistor, depos. carbon	170.8 Ω ± 1%/0.5 W	WFE 341 E 170,8	6	E – 16 *
R 53	Resistor, depos. carbon	170.8 Ω ± 1%/0.5 W	WFE 341 E 170,8	6	E – 16 *
R 56	Resistor, depos. carbon	6 kΩ ± 1%/0.5 W	WFE 341 k 6	5	B – 3
R 57	Resistor, depos. carbon	231 Ω ± 1%/0.5 W	WFE 341 E 231	5	B – 3
R 58	Resistor, depos. carbon	2 kΩ ± 1%/0.5 W	WFE 341 k 2	5	B – 4
R 59	Resistor, depos. carbon	61.6 Ω ± 1%/0.5 W	WFE 341 E 61,6	5	B – 4
R 60	Resistor, depos. carbon	1 MΩ/0.5 W	WFE 321 M 1	5	B – 5
R 61	Resistor, depos. carbon	1 MΩ/0.5 W	WFE 321 M 1	5	B – 3
R 62	Resistor, depos. carbon variable	5 kΩ lin.	WS 9122 F/5 k	5	B – 11
R 63	Resistor, depos. carbon	8 kΩ/0.5 W	WFE 321 k 8	5	B – 9
R 64	Resistor, depos. carbon	2.3 kΩ ± 1%/0.5 W	WFE 341 k 2,3	5	B – 10
R 65	Resistor, depos. carbon variable	5 kΩ lin.	WS 9122 F/5 k	5	B – 8
R 66	Resistor, depos. carbon	8 kΩ/0.5 W	WFE 321 k 8	5	B – 9
R 67	Resistor, depos. carbon	1 MΩ/0.5 W	WFE 321 M 1	5	B – 10
R 68	Resistor, depos. carbon variable	10 kΩ lin.	WS 9126/10 k	5	A – 12

*) in shielding can near switch

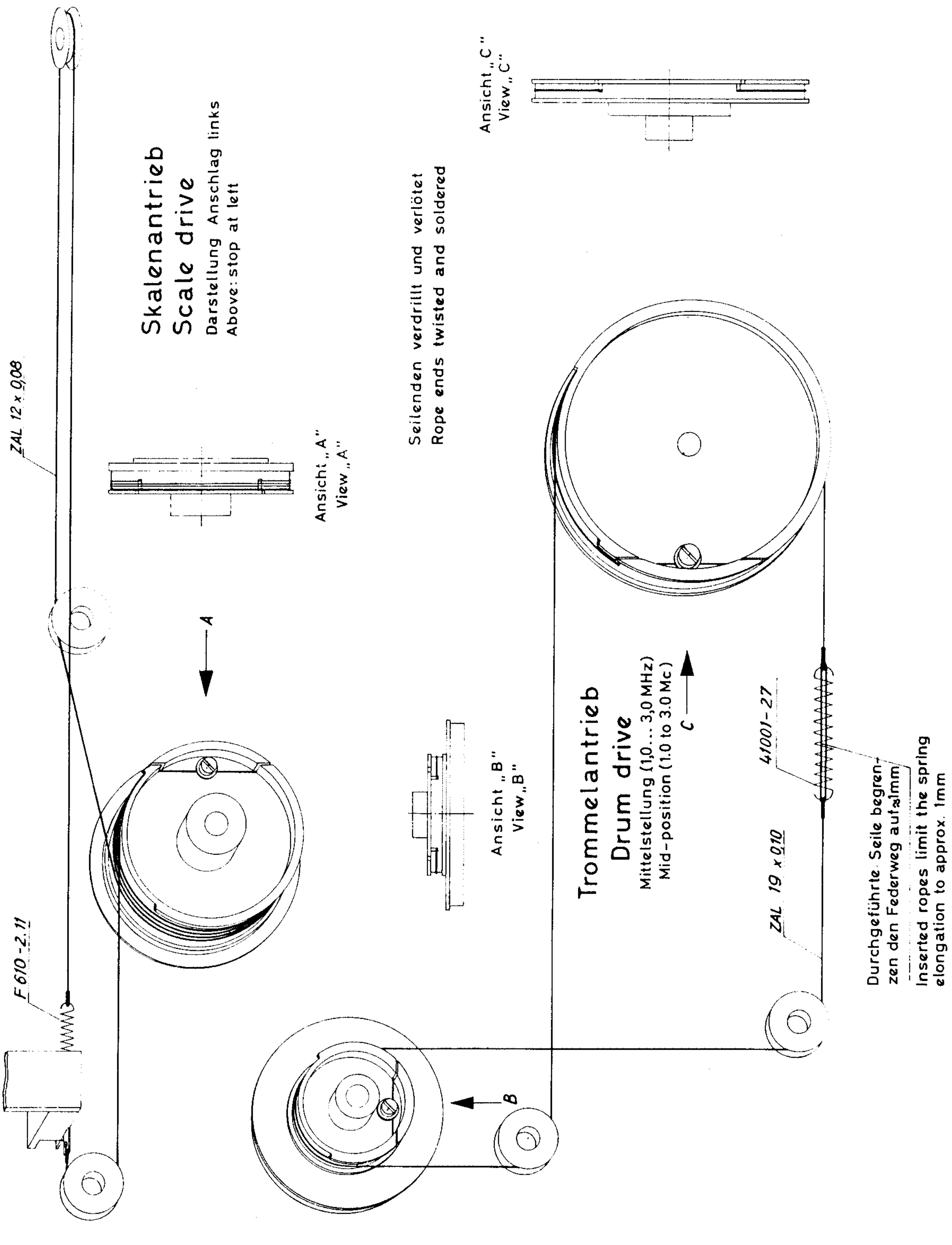
Ref. No.	Designation	Ratings	R&S Stock Nr.	Location in the set Fig.	Coordinate square
R 69	Resistor, depos. carbon	400 kΩ/0.5 W	WFE 321 k 400	5	B – 10
R 70	Resistor, depos. carbon	5 kΩ/1 W	WFE 521 k 5	5	I – 5
R 71	Resistor, depos. carbon	16 kΩ/0.5 W	WFE 321 k 16	6	A – 2
R 72	Resistor, depos. carbon	300 to 800 Ω/0.5 W	WFE 321 E 600	6	I – 6
R 73	Resistor, depos. carbon	16 MΩ/1 W	WFE 521 M 16	5	A – 3
R 74	Resistor, depos. carbon	100 kΩ/0.5 W	WFE 321 k 100	6	A – 4
R 75	Resistor, depos. carbon	16 kΩ/0.5 W	WFE 321 k 16	5	G – 17
R 76	Resistor, depos. carbon	4 MΩ/0.5 W	WFE 321 M 4	5	G – 17
R 77	Resistor, depos. carbon	500 kΩ/0.5 W	WFE 321 k 500	5	E – 16
R 78	Resistor, depos. carbon	16 MΩ/1 W	WFE 521 M 16	5	F – 16
R 79	Resistor, depos. carbon	1.6 MΩ/0.5 W	WFE 321 M 1,6	5	F – 16
R 80	Resistor, depos. carbon	1 MΩ/0.5 W Factory adjusted	WFE 321 M 1	5	F – 16
Rl 1	Lamp, glow, miniature	220 V	EG 019.2096	5	A – 1
Rö 1	Pentode, output		EL 803	6	G – 9
Rö 2	Pentode, output		EL 803	6	E – 9
Rö 3	Diode, duo		EAA 91	6	G – 12
Rö 4	Triode, duo		ECC 81	5	I – 18
S 1	Switch- wafer		41001 – 1.5	6	D – G – 7
S 2 I, II	Switch- wafer		SRN 323/2/32	6	D – 16
S 2 III	Spring contact assembly		SFR 3	6	A – 16
S 3	Switch, toggle, RF		SR 301/2	5	A – 7
S 4	Switch, wafer		SRN 314/32	6	A – 3
S 5	Power switch assembly		SR 122/3	5	A – 1
S 6	Tapping panel		FD 60513	5	I – 3
Si 1	Fuse	0.63 A (220/235 V) 1.25 A (115/125 V)	M 0.63 C DIN 41571 M 1.25 C DIN 41571	5	I – 3
Tr 1	Transformer		41001 – 2.2	5	F – 18
Tr 2	Transformer, power		41001 – 3.3/2	5	G – 3

Table of Voltages & Currents

(Numbers refer to circuit diagram)

Unless otherwise spectified, current and voltage values are measured at 1.5 MHz, output-voltage indication 3 V, range switch S2 below +10 dB/3 V and mod. off. All voltages are measured against chassis.

No.	Ratings	Remarks
1	7 V AC, approx.	
2	130 V DC, approx.; 2.5 mA DC	
3	260 V DC, approx.; 15 mA DC	
4	260 V DC, approx.; 45 mA DC	
5	75 V AC, approx.	
6	220 V DC, approx.; 8 mA DC	
	215 V DC, aprox.; 3.5 mA DC	with mod. ext.
	200 V DC, approx.; 3 mA DC	with mod. int.
7	255 V DC, approx.; 135 V AC	
8	25 mA DC, approx.	
	18 mA DC, approx.	with mod. ext.
	14 mA DC, approx.	with mod. int.
9	14 V AC, approx.	
10	4.5 V AC, approx.	
11	–13 V DC, approx.	
12	0.8 mA DC, approx.	
13	65 V DC, approx.	
14	–6 V DC, approx.	
15	–15 V DC, approx.	
16	255 V DC, approx.	
17	3 V DC, approx.	
18	260 V DC, approx.; 72 mA DC	
	260 V DC, approx.; 60 mA DC	with mod. ext.
	260 V DC, approx.; 56 mA DC	with mod int.
19	275 V DC, approx.	



Skalen- und Trommelantrieb

Scale and Drum Drive

Bild 4

Fig. 4