



ROHDE & SCHWARZ

SERVICE INSTRUCTIONS

RF Millivoltmeter Option CM-B8

803.6813.02

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5.1 Function Description

The functional principle of this option is based on the comparison of the rectified voltages of two circuits.

In addition to the meter rectifier for the RF voltage to be measured, the probe and the insertion unit each contain a reference rectifier of similar design to which an AC reference voltage generated in the instrument is applied. The difference between the two rectified voltages is further amplified in the instrument. Since the voltages from the rectifiers may be less than 1 μ V, the input amplifier of the option is designed as a chopper-stabilized DC voltage amplifier. This consists of the chopper transistors V46 and V48, the amplifier V50 and N60, the synchronous rectifier D55, the transistor V65 and the amplifier N70. The generator D40 supplies the switching voltage for the chopping amplifier and the synchronous rectifier. The amplified voltage is applied to the feedback branch D25 via V80 and V81. Transistors V80 and V81 act like a rectifier which allows positive voltages to pass through but blocks negative voltages. This is necessary to stabilize the control loop.

The DC output voltage of transistors V80 and V81 is converted in D25 into an amplitude-proportional squarewave AC voltage with a frequency of 5 kHz. The switching voltage for D25 is provided by generator D30. The transformer T20 together with the capacitor C20 and the resistors R22 to R24 constitutes a dampened resonant circuit whose resonance frequency is 5 kHz and which converts the 5-kHz squarewave oscillation into a sinewave voltage. This voltage is amplified in the driver amplifier N10 and applied to the reference rectifier in the probe (or insertion unit) via transformer T1. The gain of this driver amplifier can be adjusted using R21 which sets the full-scale value of the display.

Because of the high gain of the control loop, the amplitude of the reference voltage is adjusted such that the difference between the rectified voltages becomes zero except for a small offset. Since the diodes in the meter and reference rectifiers are selected with the same characteristic, the rms values of the input voltage and the reference voltage become equal with the same waveform (sinewave).

The feedback circuit therefore produces a proportionality between the DC output voltage and the rms value of a sinewave input voltage. The display is therefore proportional to the rms value of a sinewave input voltage. The accuracy is largely dependent on the equality in the characteristics of the four diodes within a probe.

The input voltage taken from transistors V80 and V81 is applied to the A/D converter on the digital unit (802.4517.02) via the selectable amplifier N110 (0.20 dB) and the analog multiplexer on the analog unit (802.8412.02).

5.2 Testing and Adjustment

The ambient temperature must be between 20 and 25 °C and the instrument must have been switched on for at least 10 minutes.

The probe is used together with the BNC adapter (insertion adapter) as a URV probe. An insertion unit can also be used but a T-piece must be inserted so that the internal conductor is accessible for voltage measurements.

With a gain of 20 dB, first adjust the offset to 0 mV at N110. The gain of 20 dB at N110 is retained for the following adjustments.

Resonance adjustment

Apply a voltage with a frequency of 1 MHz and an amplitude $V_{rms} = 1\text{ V}$ to the probe. Using R30, adjust the output voltage at X1.B29 to a minimum as exactly as possible.

Chopper adjustment

Disconnect the test voltage and set R38 fully clockwise. Measure the voltage at X3.14 using an oscilloscope and adjust the AC voltage component (approx. 22 Hz) to a minimum using R45.

Offset adjustment

Adjust R38 such that the output voltage at X1.B29 varies between 0 and 3 mV (a voltage must not be applied to the probe).

Gain adjustment

Apply a voltage with a frequency of 1 MHz, an amplitude of $V_{rms} = 1\text{ V} \pm 1\text{ mV}$ and a distortion factor $<0.3\%$ to the probe. Adjust the output voltage at X1.B29 to $10.000\text{ V} \pm 10\text{ mV}$ using R21.

Fine adjustment for low RF voltages

Apply an AC voltage (1 MHz, $1.2\text{ mV} \pm 1\%$). Adjust the output voltage at X1.B29 to 12 mV using R38.

5.2.1 Testing the Reference Generator

The AC output voltage of the reference generator must be approx. 300 mV at X3.5 with a DC input voltage of 1 V at X3.13 (caution: internal impedance at test connector X3.5 = 10 k Ω .)

5.2.2 Replacing the Diodes in the Probe

If one or more of the diodes are destroyed because the permissible input voltage has been exceeded, all four diodes must be replaced. A set of four diodes can be ordered from Rohde & Schwarz under order number 243.9001. Replace as follows:

- Push back the cable bushing.
- Remove the fixing screw of the probe sleeve.
- Remove the probe sleeve in the cable direction.
- Replace the set of four diodes GL1.I to GL1.IV using tweezers.

!!! Do not solder, diodes are to be inserted !!!

If it is necessary to carry out soldering work on the probe, first remove the four diodes from their sockets to protect them from high temperatures.

5.2.3 Replacing the Diodes in the 10-V and 100-V Insertion Units

If one or more of the diodes are destroyed because the permissible input voltage has been exceeded, all four diodes must be replaced. A set of four diodes can be ordered from Rohde & Schwarz under order number 288.8304. Replace as follows:

- Unscrew the labelled cover. All four diodes are now accessible.
- Pull out the diodes GL1.III and GL1.IV. The connection wires are plugged into miniature sockets and are not to be soldered.
- The diodes GL1.I and GL1.II are also plugged in. First pull the wire facing the coaxial part upwards out of the miniature socket; then pull the diode to the front and thus the other wire from the miniature socket located in the chamber partition.

