

1. General

1.1 Uses

The AM-FM Signal Generator Type SMDA 100.4559 is particularly suitable for measurements on receivers. All IF measurements can be performed thanks to the high output voltage and the low frequency limit at which the modulation characteristics are as good as in the upper frequency ranges. High frequency stability allows measurements to be taken on receivers with narrow channel spacing. The incremental tuning control calibrated in kHz is of advantage in measurements of adjacent-channel selectivity, intermodulation and cross-modulation, whereas the high scale resolution is sufficient for other selectivity measurements. Low RF leakage and an output attenuator adjustable down to $0.1 \mu\text{V}$ permit accurate S/N ratio and sensitivity measurements. Simultaneous AM and FM is ideal for measurements on limiters. The twelve fixed frequencies provided, which, in addition, may be finely adjusted over a range from -30 to $+400$ Hz, are very useful in modulation measurements, and the low distortion is important at high percentage modulation.

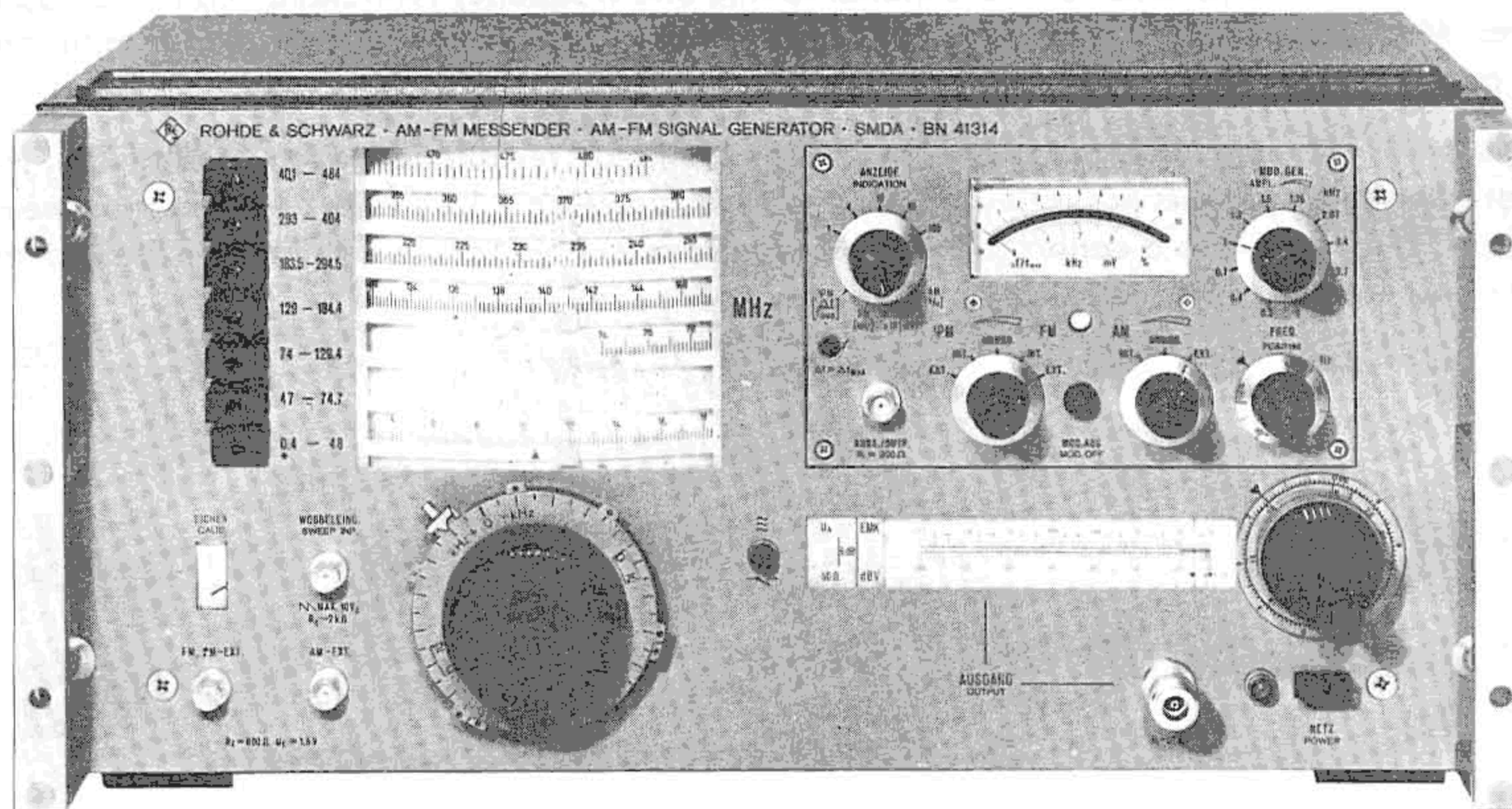


Fig. 1-1 AM-FM Signal Generator Type SMDA 100.4559

The modulation generator is provided with an output socket for measurements on the AF section of a receiver. The output voltage is continuously adjustable and can be read on the modulation meter in five switch-selected ranges.

The high output voltage, flat frequency response and low harmonic content of the SMDA are particularly useful in measurements on broad-band test items, such as amplifiers, filters mixers and transformers.

Mobile use is facilitated by small dimensions, light weight, the possibility of battery operation, small power consumption and negligible transient response.

When during the checking of a transmitter-receiver the push-to-talk button is pressed by mistake, the AM-FM Signal Generator Type SMDA is not destroyed – as other signal generators may be – since an RF overload protection is provided for the output attenuator and output stage.

Whenever the output frequency of the SMDA must be known to within 100 Hz (or 10 Hz for 1 sec measuring time) or when a frequency stability of 2×10^{-7} is required, for example in unattended long-term measurements, the signal-generator frequency can be accurately measured and synchronized with the Frequenzkontroller 100.4542. This unit can be placed on the signal generator, connected to it at the rear via a cable, and switched on together with the signal generator. The frequency is then indicated in seven digits by indicator tubes. The SMDA can be frequency modulated even if synchronized.

1.2 Description (Fig. 1-2)

The SMDA is fully transistorized. In the range 47 to 484 MHz, its high-stability **oscillator** operates directly at the output frequency, thus ensuring complete freedom from non-harmonic spurious frequencies. Careful design of the oscillator makes for high spectral purity, i. e. prevents noise pickup in the adjacent channel. **Tuning** is continuous throughout the range, permitting rapid frequency selection. Each range on the frequency scale can be calibrated individually, the **Incremental tuning** being calibrated in kHz.

In the range 0.4 to 48 MHz, the output signal is obtained by the beat method, ensuring the same favourable conditions for incremental tuning and frequency modulation as in the upper ranges. **Modulation depth, frequency or phase deviation and AF output voltage** are indicated on a panel meter with mirror scale.

Buffers with ALC minimize amplitude response, oscillator reradiation and residual FM. An **output attenuator** permits the adjustment of voltages between 0.1 μ V and 1 V EMF or between -140 and 0 dB (V_{EMF}) on a calibrated scale. Outputs for connection of the Frequenzkontroller, Power Test Adapter and VOR-ILS Unit are provided on the rear.

1.3 Specifications

Frequency

Range	Subranges	Scale resolution (mm)
	0.4 to 48 MHz	130 kHz
	47 to 74.7 MHz	65 kHz
	74 to 129.5 MHz	130 kHz
	129 to 184.5 MHz	130 kHz
	183.5 to 294.5 MHz	260 kHz
	293 to 404 MHz	200 kHz
	401 to 484 MHz	195 kHz
Error limits	± 0.5 ‰	
from 0.4 to 48 MHz	± (1.5 ‰ + 100 kHz)	
	with incorporated calibration facility	
Incremental tuning	calibrated in kHz	
Error limits	± (8 ‰ ± 2 kHz) ¹⁾	
Expansion with respect to main scale . . .	130 which corresponds to < 2 kHz/mm	
Frequency variation after 10 min warm-up time or after changing the frequency ²⁾		
in the range 0.4 to 185 MHz	< ± 1.5 kHz/5 min	
over the remainder of the range	< 10 ⁻⁵ /5 min, typ. ± 2.5 kHz/5 min	
Frequency variation after 3 hours operation, or 15 min after changing the frequency ²⁾		
in the range 0.4 to 185 MHz	< ± 600 Hz/10 min	
over the remainder of the range	< 6 x 10 ⁻⁶ /10 min, typ. 4 · 10 ⁻⁶	
Synchronization via 2nd RF output	crystal-controlled by Frequenzkontroller 100.4542	
Residual FM	< 10 Hz (weighted with CCIF filter 0.3 to 3 kHz)	

S/N ratio for 1-Hz test bandwidth

	at ≅ 20 kHz	at ≅ 100 kHz
0.4...48 MHz	> 125 dB (typ. 135 dB)	
47...48 MHz	> 130 dB (typ. 140 dB)	> 135 dB (typ. 145 dB)
184...404 MHz	> 125 dB (typ. 135 dB)	
404...484 MHz	> 120 dB (typ. 130 dB)	

¹⁾ Approx. 15 ‰ from 401-420 MHz and from 470-484 MHz.
²⁾ at a constant ambient temperature

RF harmonic suppression

50 to 484 MHz	> 30 dB	} at levels below 200 mV _{EMF}
0.4 to 50 MHz	> 26 dB, typical value 30 dB	

Suppression of non-harmonic spurious

responses	no spurious responses
from 0.4 to 35 MHz	> 70 dB
from 35 to 48 MHz	> 50 dB

RF output

Output impedance	50 Ω , VSWR < 1.3, typical value 1.2 at output levels < -20 dB V _{EMF} (with Dezifix A connector only)
Output EMF	1 V corresponding to 0 dBV _{EMF} , (continuously adjustable between 0.1 μ V and 1 V or -140 dBV _{EMF} and +0 dBV _{EMF})
Indication of output voltage	on linear scale in dBV and V _{EMF} E _{out} into 50 Ω
Minimum output voltage variation	0.25 dB
Scale resolution	0.7 mm/dB or 16 mm/dB (fine-adjustment scale)
Error limits of indication	< ± 1 dB at output levels < 10 dBV _{EMF}
RF output II (rear)	N socket (supplied with other connectors on request)
Output voltage	15 to 75 mV into 50 Ω
Output impedance	approx. 50 Ω

Modulation

Types	AM, FM, φ M or AM + FM or AM + φ M
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Frequency modulation

Types	internal and external
Frequency deviation	0 to 75 kHz, adjustable (if the maximum deviation is exceeded, a red lamp lights up)

Modulation frequency

internal	with modulation generator
external	30 Hz to 20 kHz

Modulation distortion

with frequency deviation ≤ 4 kHz	< 1 %
with frequency deviation ≤ 25 kHz	< 5 %
with frequency deviation ≤ 75 kHz	< 10 %

External modulation

Voltage requirement	
for maximum frequency deviation	approx. 2.5 V
Input impedance	600 Ω
Input	BNC socket

Frequency deviation indication	on meter
Ranges	1/4/10/40/100 kHz
Error limits up to 25 kHz frequency deviation	$\pm(5\% + 1.5\% \text{ of FS})^1)$
Incidental AM with 10 kHz frequency deviation	$< 1\%$
Sweeping	via BNC socket on the front panel
Sweep width	depending on frequency range, max. $\pm(75 \text{ to } 300)$ kHz
Sweep frequency	0 to 1 kHz
Voltage requirement	frequency-dependent, ± 10 V into 1.5 k Ω , max. (max. ± 20 V into > 5 k Ω at 0.4–48 MHz)
Phase modulation	
Types	internal and external
Modulation index	adjustable from 0 to 100
Frequency deviation	75 kHz, max., depending on the modulation frequency (if exceeded, red lamp lights up)
Level adjustment frequency	1 kHz $\pm 3\%$ (same frequency deviation for φ M and FM)
Modulation frequency	
internal	from built-in modulation generator
external	30 Hz – 10 kHz
Modulation distortion	
with frequency deviation ≤ 4 kHz	$< 1\%$ ($< 5\%$ with deviation < 25 kHz, $< 10\%$ with deviation < 75 kHz)
External modulation	
Voltage requirement	approx. 2.5 V into 600 Ω for maximum frequency deviation; input: BNC socket
Indication of modulation index or frequency deviation	
	on panel meter
Indicating ranges	1/4/10/40/100 $\Delta f/f_{\text{mod}}$ or kHz, resp.
Error limits of modulation index $\Delta f/f_{\text{mod}}$ up to 25 kHz frequency deviation	$\pm(5\% + 1.5\% \text{ of FS})^1)$ typical value 2%
Incidental AM at 10 kHz frequency deviation	$< 1\%$
Max. permissible departure from the frequency-proportional deviation characteristic	
up to $f_{\text{mod}} = 3$ kHz	$< 3\%$
up to $f_{\text{mod}} = 5$ kHz	$< 6\%$
up to $f_{\text{mod}} = 10$ kHz	$< 30\%$

¹⁾ Approx. 10% from 401–420 MHz and from 470–484 MHz.

Amplitude modulation

Types	internal and external
Modulation depth	95 % max.
Frequency range	
internal	with modulation generator
external	30 Hz to 10 kHz
Modulation distortion	
at 80 % mod. 30 Hz to 4 kHz	< 2.5 % typical value 1 %
External modulation	
Voltage requirement for 95 % mod.	approx. 1.2 V
Input impedance	approx. 600 Ω
Input	BNC socket
Modulation depth indication	on meter
Ranges	(1/4)/10/40/100 % ¹⁾
Error limits up to 90 % mod.	$\pm(3 \% + 1.5 \% \text{ of FS})$ at output levels < 10 dBV _{EMF}
Residual AM	< 0.1 % (weighted with CCIF filter 0.3 to 3 kHz)
Incidental FM at 30 % AM and < 0.1 kHz modulation frequency	< 30 Hz

Built-in modulation generator

Fixed frequencies	0.3/0.4/0.7/1/1.3/1.5/1.75/2.07/ 2.4/2.7/3/6 kHz
Error limits	$\pm 1.5 \%$
Fine tuning of fixed frequencies	- 30 to + 400 Hz
Error limits	$\pm(5 \% + 5 \text{ Hz})$
Output voltage indication	< 0,5 mV to 1 V
Minimum load impedance	200 Ω
Input impedance	approx. 200 Ω
Distortion	< 0.5 %
Output voltage indication	on meter
Ranges	10/40/100/400/1000 mV
Error limits	$\pm(4 \% + 1.5 \% \text{ of FS})$
Output	BNC socket

RF overload protection responds automatically when RF power is applied to the output

Max. permissible RF power	20 W
Reset	automatic
Indication	by pilot lamp
Test output for VOR-ILS Unit	
Rectified voltage	approx. - 3.5 V
AF voltage at 40 % AM	0.99 V

¹⁾ The indicating ranges 1 and 4 % are for checking purposes only; indicated values not guaranteed.

General data

AC supply	115/125/220/235 V \pm 10 % 47 to 440 Hz; 18 VA
Battery operation	two batteries 22 to 26 V/500 mA or 120 mA can be connected at the rear
Ambient temperature	
Operating temperature	10 °C to 45 °C
Shelf temperature	- 45 °C to + 60 °C
Dimensions (W x H x D) (with cover)	484 x 238 x 338 mm
Weight	17 kg

Diodes, transistors, etc.

1 germanium diode AAY 10/120	1 relay in BN 41311-7.1.1
6 silicon varactors BB 105 B	1 fuse M 0,1 C DIN 41571 for 220 V or M 0,2 C DIN 41571 for 115 V
2 bridge-connected rectifiers B 60 C 600 Si	1 silicon transistor BC 214
2 silicon diodes HPA 3080	13 silicon transistors BC 171 B
4 silicon diodes HPA 5082-2800	2 silicon transistors BC 251 B
1 meter diode HFA 5082-4440	12 silicon transistors BCY 59 IX
1 silicon diode 1 N 4002	7 silicon transistors BCY 79 IX
2 silicon diodes 2 N 936	2 silicon transistors BF 223
26 silicon diodes 1 N 914	2 silicon transistors BF 244 A
2 silicon Zener diodes ZD 4,7	5 silicon transistors BFR 15
2 silicon Zener diodes ZF 3,9	2 silicon transistors BFR 35
3 silicon Zener diodes ZF 5,6	1 silicon transistor BFW 16
2 silicon Zener diodes ZF 18	1 silicon transistor BFW 30
2 Zener diodes ZP 3.5	3 silicon transistors BFY 90
1 Zener diode ZP 5.6	2 silicon transistors BSV 81
1 Zener diode ZP 6.8	2 silicon transistors BSY 55
1 Zener diode ZP 8.2	1 silicon transistor MD 007
1 Zener diode ZP 10	1 silicon transistor 2 N 2914
1 Zener diode ZP 12	6 silicon transistors 2 N 4416
1 Zener diode ZP 15	2 silicon transistors 2 N 5296
3 silicon diodes 12 P 2	1 silicon transistor TIP 32
1 crystal RN 3 K 1 A DIN 45111 (129 MHz)	2 operational amplifier μ A 709 C
1 glow lamp EG 019.2750	1 operational amplifier μ A 715
1 incandescent lamp EF 019.2650	1 buffer amplifier SG 310
4 relay coils BN 41311-5.11.5	4 operational amplifier μ A 714
10 relay coils BN 41311-5.22.5	

1.4 Accessories Supplied

- 1 Power Cable 025.2365.00
- 1 Coupling Connector FO 018.5356

1.5 Recommended Extras

- 1 RF Patch Cord 100.6945.10 (for modulation input, BNC connector)
- 1 RF Patch Cord 100.7670.10 (50 Ω , N connector)

- 1 Frequenzkontroller 100.4542
(crystal control unit with 7-digit frequency counter; section 1.5.1)
- 1 Counter Adapter 100.8131.02
- 1 Power Test Adapter 100.4620 (RF switch, attenuator pad and power meter; connector for radiotelephone systems; section 1.5.2)
- 1 Vor-ILS Unit 214.3115.02
- 1 Fixing Kit (section 1.5.4)
- 1 Coupling Head 124.7558.50 (section 1.5.3)
- 1 Polyskop Type SWOB III consisting of:
 - Basic Unit with Display Unit (100.5249 + 100.5349)
 - Deflection Amplifier Lin-Log 100.5390
 - Voltage Reference Lines Plug-in 100.5403
 - Time-Base Plug-in 100.8054

1.5.1 Specifications of Signal Generator with Frequenzkontroller 100.4542

Frequency range	0.4 to 484 MHz	
Frequency indication		
Accuracy	10 Hz and 100 Hz, respectively	
Temperature coefficient	$< 2 \times 10^{-8}/^{\circ}\text{C}$	
Aging	$< 5 \times 10^{-8}/\text{month}$	
Frequency instability	$< 2 \times 10^{-7}/\text{h}^1)$	} in the lower range
	$< 2 \times 10^{-7}/^{\circ}\text{C}$	
	$< 2 \times 10^{-6}/\text{h}^1)$	
	$< 2 \times 10^{-6}/^{\circ}\text{C}$	
Electronic fine tuning	1 % in the lower range 0.1 % in all other ranges	
Spacing of locked frequencies in the tuning range	5/20/40/80 kHz, depending on frequency range	
Frequency modulation		
Permissible modulation index	< 20	
Permissible modulation frequency	> 100 Hz	

Frequency counter

Frequency range switching	ganged with signal-generator range		
Readout	7 digits		
Resolution	100 Hz at 0.1 sec gate time	} in position FREQ. INT. + EXT. B	
	10 Hz at 1 sec gate time		
	10 Hz at 0.1 sec gate time		} in position FREQ. EXT. A
	1 Hz at 1 sec gate time		
Error limits	± 100 Hz, ± 10 Hz and ± 1 Hz, respectively		
Time base	10 MHz, crystal-controlled; external calibration possible		
Error limits of time base			
Temperature effect	$< 2 \times 10^{-8}/^{\circ}\text{C}$		
Aging	$< 5 \times 10^{-8}/\text{month}$		
Warm-up time	< 15 min		

¹⁾ After a warm-up period of 40 min.
During the warm-up period of 15 to 40 min the values $< 2 \times 10^{-7}/15$ min and $< 2 \times 10^{-6}/15$ min, respectively apply.

Deviation measurement (positive and negative deviations can be measured separately)

Frequency deviation

Ranges of indication	5 kHz and 20 kHz
Modulation frequency	50 Hz to 9 kHz
Error limits	$\pm 1.5\%$ of measured value $\pm 1.5\%$ of FS

Phase deviation

Ranges of indication	$\Delta f/f_{\text{mod}} = 2$ and $\Delta f/f_{\text{mod}} = 5$
Error limits	$\pm 2\%$
Modulation frequency	300 Hz to 9 kHz

Relative error between

positive and negative measurement	$\pm 1.5\%$ of FS
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Voltage requirement	100 mV into 50 Ω
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Check	green pilot lamp lights if level is sufficient and frequency correct
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Test output

Output level	14 V _{pp} at f.s.d., or 1 mV _{rms} /Hz
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Output impedance	2 k Ω
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Residual FM or φM	< 15 Hz weighted according to CCIF
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Automatic indication of modulation

frequency for deviation measurement	10 Hz at 0.1 sec gate time
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Resolution	1 Hz at 1 sec gate time
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General data

AF output and front-panel input	BNC sockets
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RF input (50 Ω)	N plug, can be adapted to other connector systems
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AC supply	115/125/220/235 V $\pm 10\%$, 47 to 440 Hz, 47 VA
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Ambient temperature

Operating temperature	+10 °C to +45 °C
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Shelf temperature	-40 °C to +60 °C
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Dimensions (W x H x D)	484 x 91 x 338 mm
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Weight	10 kg
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Order designation	Frequenzkontroller 100.4542 for SMDF/SM DA
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1.5.2 Specifications of Signal Generator with Power Test Adapter 100.4620

Frequency range	10 to 500 MHz
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Power ranges	0.01 to 0.2/0.1 to 2/1 to 20 W
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Error limits	+6% of measured value $\pm 1.5\%$ of FS
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VSWR	approx. 1.05
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Accuracy of the 20-dB/20-W attenuator

(10 to 500 MHz)	± 0.2 dB
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Types of operation selectable on the Power Test Adapter

Receiver	receiver-section measurement on radio-telephone systems
Power	power measurement on transmitter section
Deviation	frequency-deviation measurement on transmitter section
Frequency	frequency measurement on transmitter section
RF inputs or outputs, respectively (50 Ω)	N sockets, can be adapted to other connector systems
AF output	BNC socket
AC supply	115/125/220/235 V ± 10 %; 47 to 440 Hz, 6 VA
Ambient temperature	
Operating temperature	+10 °C to +45 °C
Shelf temperature	-45 °C to +70 °C
Dimensions (W x H x D)	484 x 91 x 338 mm
Weight	7 kg
Order designation	Power Test Adapter 100.4620 for SMDF/SMDA

1.5.3 Coupling Head 124.7558.50

The coupling head consists of a cylindrical casing provided with a grub screw at its front end. A flexible coaxial cable with N connector is used to connect the coupling head to the output of the signal generator. The cable is match-terminated in the probe casing; the RF voltage across the termination is coupled out via an isolating capacitor and taken to the probe tip.

The isolating capacitor has a rating of 47,000 pF ± 20 %, its highest permissible DC loading is 400 V. The termination of the coupling head is single-ended. The characteristic impedance is 50 Ω

The source impedance of the signal generator together with the coupling head, as seen from the test item, is 50 Ω. The coupling head is used to feed the signal-generator voltage to high-impedance points that present a DC potential to chassis.

Test connections:

Three types of probe tips can be screwed to the grub screw at the front end of the probe.

Straight tip	in insulating bushing (approx. 30 mm long), 19129-5
Retractable hook tip	for hooking to connecting leads (spring-loaded in insulating bushing about 80 mm long), 19129-3
Clamping tip	for clamping wires of 0.8 to 1 mm dia., approx. 20 mm long, 19129-6

Chassis connections:

Cable	with alligator clip (approx. 220 mm long), to be attached to the rear end of the probe, 19129-8
Cable	with alligator clip (approx. 120 mm long), to be inserted into clamp 41300-36.7, 19129-7
Clamp	for sliding onto the probe casing with 4-mm hole for insertion of banana plug and wire clamping device (max. wire diameter 1 mm), 41300-36.7

1.5.4 Fixing Kit 082.5476.02

When a test assembly, comprising the AM-FM Signal Generator SMDA, Frequenzkontroller and Power Test Adapter, is set up, the individual instruments can be screwed together with the Fixing Kit 082.5476.02.

If the **sidewalls** of the instrument are **perforated**, hook the blocks 41311-35.1/2 into the four outer perforations in the corners, and join them together with screws provided.

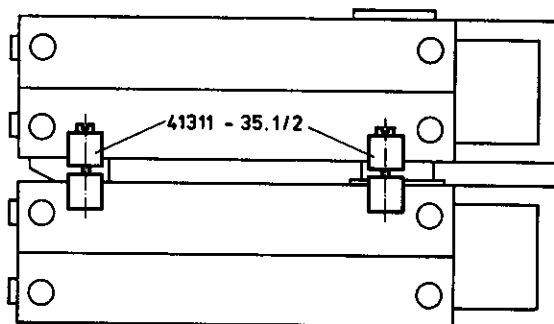


Fig. 1-3 Connection of two instruments

If the **sidewalls** are **not perforated**, withdraw the instrument from the cabinet and mark and drill the required holes according to the two templates provided. Use template 41311-35.3/2 ("vorn") for the front corners and 41311-35.2/2 ("hinten") for the rear corners.

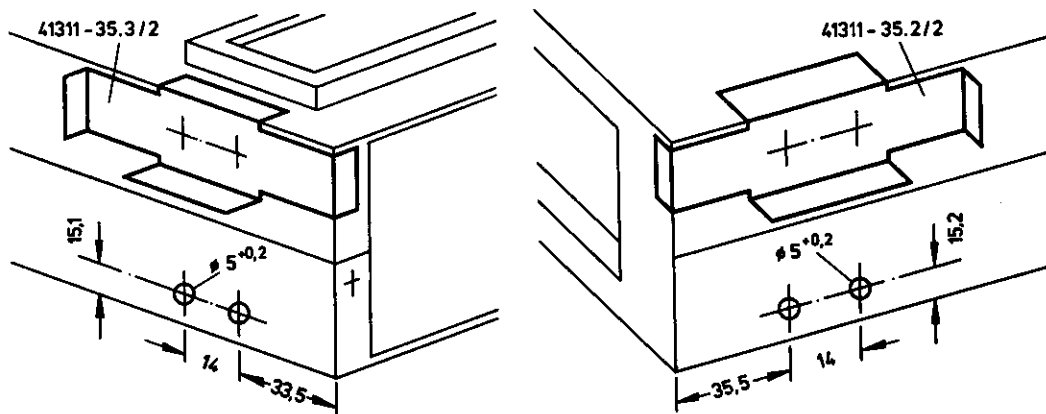


Fig. 1-4 Templates

Four blocks 082.5476.02 are required for screwing together two instruments. Four more such blocks must be used for each additional unit.