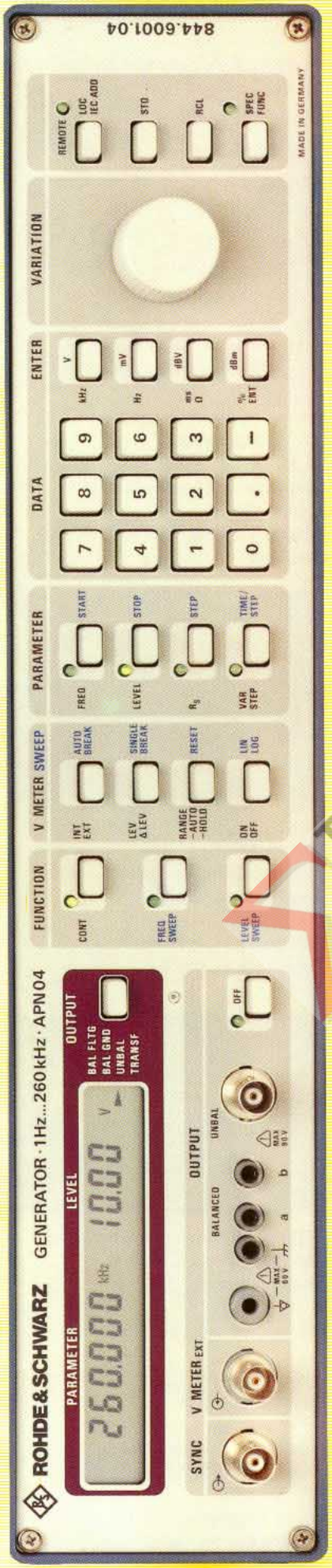



# AF Generator APN

1 Hz to 260 kHz

- Synthesizer
- 50 µV to 20 V – balanced and unbalanced
- Source impedance settable to values between 10 Ω and 640 Ω

# AF Test Set APN

with integral voltmeter
50 µV to 50 V

- Floating
- True rms at
  - generator output
  - test input

IEC625Bus IEEE 488

ROHDE&SCHWARZ

# CHARACTERISTICS

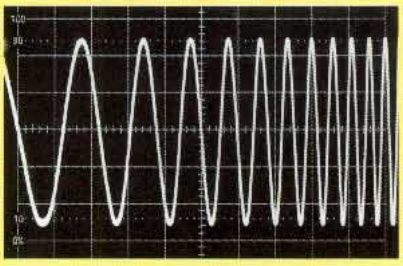
- Synthesizer generator 1 Hz to 260 kHz
- Frequency setting without transients
- Output voltage range 50 µV to 20 V
- Adjustable source impedance 10 to 640 Ω in 5-Ω steps entered via keypad
- Low distortion
- Frequency and level sweep
- APN 04: AF test set with signal generation and signal measurements by integral voltmeter
- Output configurations
  balanced, floating
  balanced, grounded
  unbalanced
- Reference-frequency input/output for external synchronization (option APN-B1)
- Voltage proportional to frequency or level (option APN-B1)

**Frequency resolution** 1 Hz over the whole range, 0.1 Hz at frequencies below 20 kHz

**Frequency accuracy** fully digital signal generation, error less than $4 \times 10^{-5}$, minimal drift, equal to that of the crystal reference

**Frequency setting** phase-continuous, no settling time, response time < 15 ms

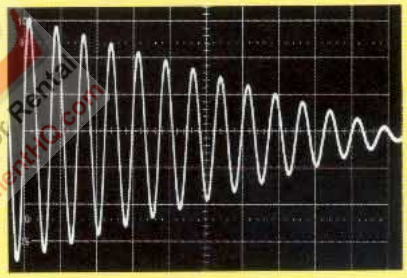
**Frequency sweep** fast, phase-continuous, synthesizer accuracy, START, STOP, STEP, TIME/STEP selectable



**Output voltage** 50 µV to 20 V (50 µV to 10 V when $Z_{load} = Z_{source}$), the units available are: V, dBV or dBm as EMF or as $V_{load}$

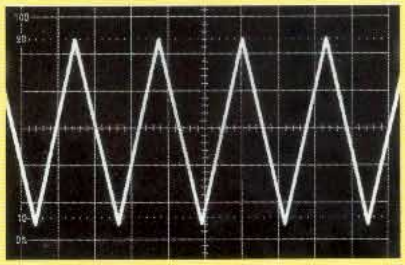
**Output** short-circuit-proof, a voltage of up to 50 V can be superimposed on the balanced, floating output

**Level sweep** continuous electronic sweep over 20 dB, START, STOP, STEP, TIME/STEP selectable



**Source impedance** the 10- to 640-Ω range is covered in 5-Ω steps. A single, user specific value can be added

**Other signal shapes** triangular, square and sawtooth from 1 Hz to 20 kHz



**Synchronization output** TTL/HCMOS logic signals having the same frequency as the output signal

**Operation** via keypad and spinwheel

**Memory** non-volatile storage of 20 complete front-panel setups

**Display** alphanumeric display for all parameters and operating modes

**Remote control** for all functions; talker mode for reading out frequency, output voltage, source impedance and voltmeter display

## Models and option

There are three versions of the Generator APN, and an option which can be fitted to each model.

**APN 02** Generator 1 Hz to 260 kHz, synthesizer, output configurations: balanced floating, balanced grounded, unbalanced

**APN 04** Like the APN 02, but with integral voltmeter for measuring the output voltage or external voltages. It has a remote-control interface to IEC 625 – 1 and IEEE 488

**APN 06** Like the APN 02, but with square signal in the frequency range 1 Hz to 260 kHz and variable level. It has a remote-control interface to IEC 625 – 1 and IEEE 488

**Option APN-B1** Reference-frequency input/output for external synchronization and to obtain an output voltage proportional to frequency or level

## Characteristics and uses

**Frequency range 1 Hz to 260 kHz**
Frequency generation is completely digital. The advantages of this are:
The output signal has crystal accuracy, high frequency resolution and fast phase-continuous frequency adjustments without transients. All these features make possible a sweep which is indistinguishable from a true analog sweep. Thanks to the high frequency resolution of 1 Hz over the whole range and 0.1 Hz in the range below 20 kHz, measurements on extra narrow bandwidth DUTs such as crystal filters are possible. The 0.1 Hz resolution allows the use of tone sequences to all known standards. Error-free measurements on filters with steep skirts or on narrowband DUTs are only possible if frequency adjustments are phase-continuous – this is the case with the APN.

**Output voltage 50 µV to 20 V**
The output signal is generated by means of D/A conversion so ensuring an extremely high level accuracy. Because of the low minimum level, all the levels likely to be required in practice can be obtained without the use of external attenuators. For checking the linearity of amplifiers and for dynamic tests on ALC circuits, the signal can be swept over 20 dB without interrupting the level. The start and stop level, the step size and the step time are selectable. The output level can be set in V, dBV, dBu or dBm. There are three possibilities:

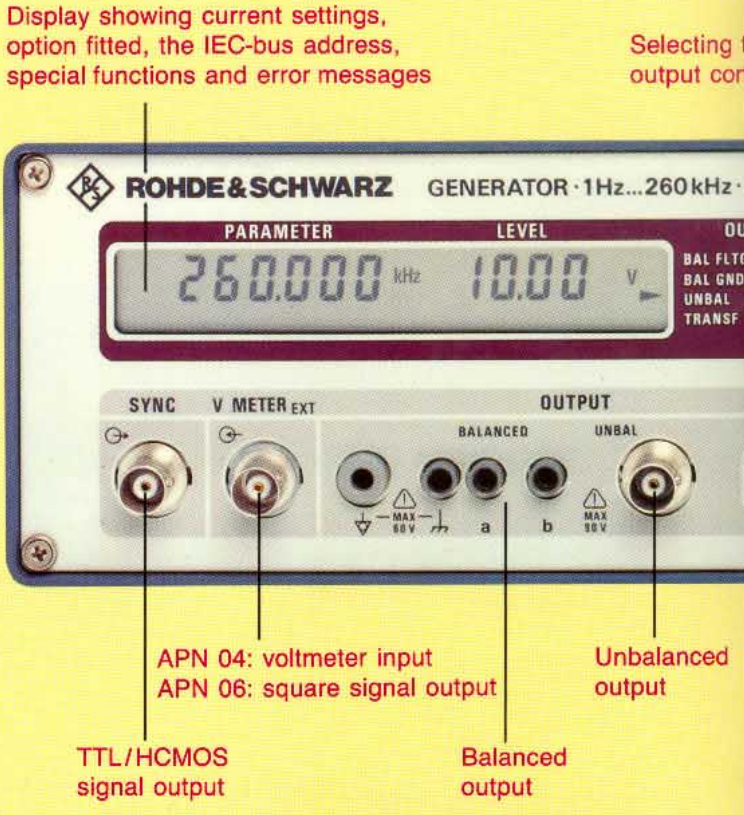
| | |
|---|---|
| Voltage (V, dBV, dBu) | the voltage across a resistance $R_{load} = R_{source}$ is set and displayed |
| EMF (V, dBV, dBu) | the EMF is set and displayed |
| Power (dBm) | the power dissipated by a resistance $R_{load} = R_{source}$ is set and displayed |

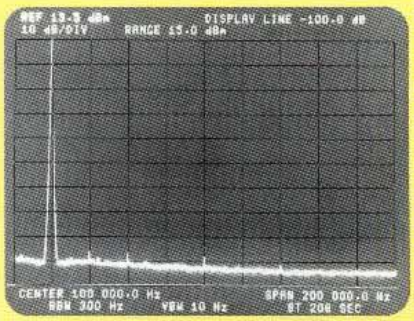
**Signal quality**
Over the whole of the audio range to 20 kHz, distortion is below 0.05 % ; up to 100 kHz it is below 0.1 %. When a DUT requires a balanced feed, the exact balance of the two signal components is of utmost importance. The fully balanced design of the two output signal branches ensures this. The unbalance caused by residual signals is more than 60 dB below the set signal level.

**Source impedance**
The APN's source impedance can be set to any value between 10 Ω and 640 Ω in 5-Ω steps and so covers practically the complete range of system impedances.

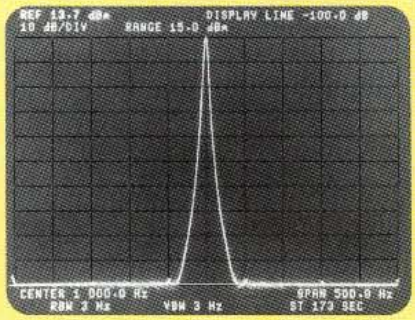
**Output configurations**
The APN's output signal can be balanced floating, balanced grounded or unbalanced grounded. Balanced signals are required for telephone systems and acoustic measurements.








Measured spacing for harmonics > 80 dB, signal 20 kHz, 10 V into 50 Ω, resolution 20 kHz/div.




Good suppression of sidebands produced by the AC line and microphonism; signal 1 kHz, resolution 50 Hz/div.

Voltmeter data:

| | |
|---|---|
| Measurement range | – 50 µV to 50 V |
| INT operating mode | – measures the voltage between balanced output terminals a and b;<br>– measures the voltage between the inner and outer conductors of the coaxial output |
| EXT operating mode | – measures the voltage between the inner and outer conductor of the (floating) V-METER$_{EXT}$ input |
| Display | – voltage or power at output terminals; when dBm is selected, the power dissipated in $R_{load} = R_{source}$ is shown |
| Trend display | – when there is a voltage change, the trend is shown by UP or DOWN symbols |
| Δ-display | – shows the difference between measured result and a reference in V or dB |

## Additional features of models APN 04 and APN 06

**APN 04**

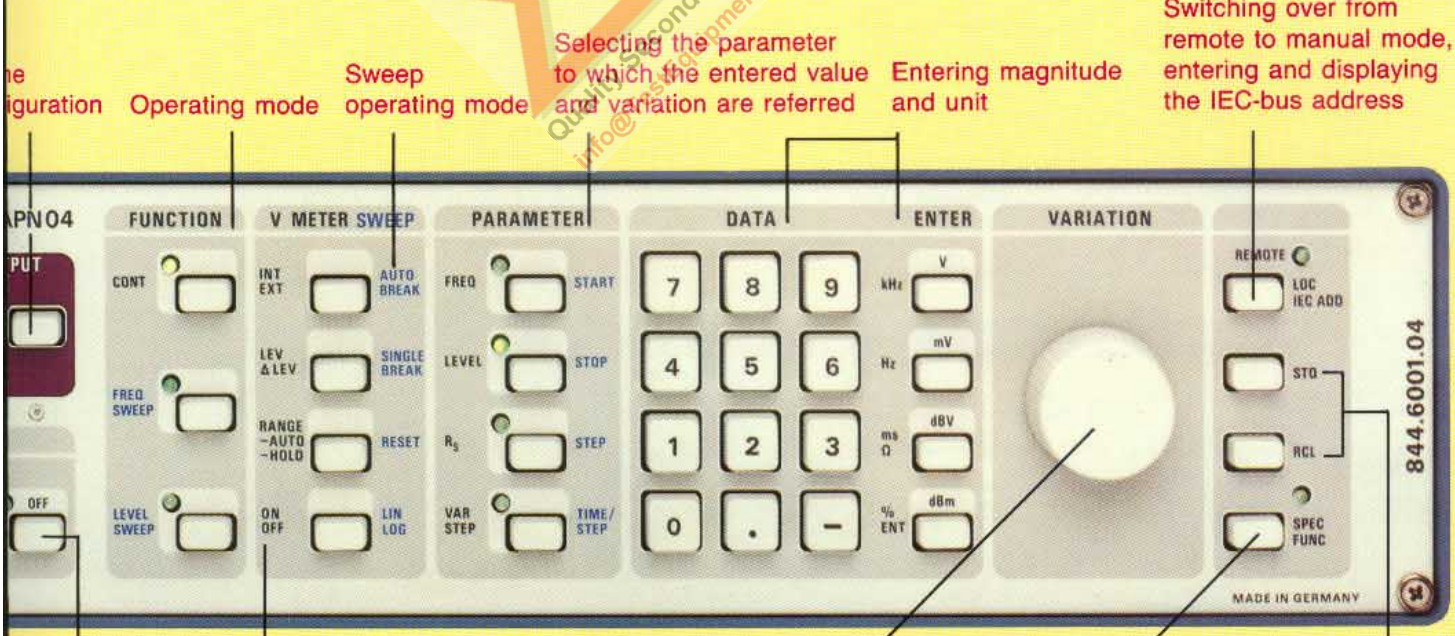
When a level is entered, the level shown by the display is only the same as the level across the load when the load impedance is equal to the source impedance. If the load impedance is not known, the voltage drop must be measured. Using the APN 04's integral voltmeter (true RMS, AUTO RANGE, RANGE HOLD), the display always shows the true load-dependent output voltage. The voltmeter has its own input for measuring external voltages.

To process the results using analog methods, a voltage which is proportional to the result is output. Numerical processing can be performed using the IEC bus in talker mode. Thanks to its integrated test functions, the APN 04 is an ideal, handy AF test set for determining the transmission characteristics of AF paths and control systems.

**APN 06**

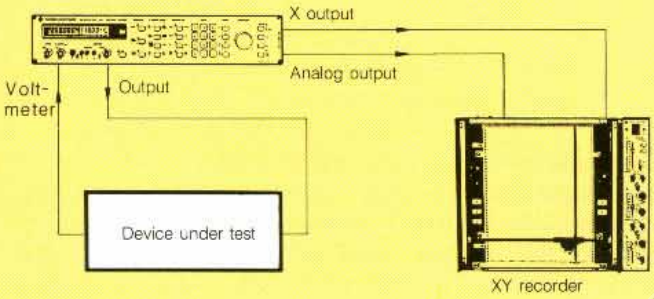
As well as sinusoids, the APN 06 can generate square signals whose level can be adjusted. These signals are output at a separate connector. The unit is also ideal as a stimulus for bipolar logic, for use in digital control systems and for overload measurements on analog devices.



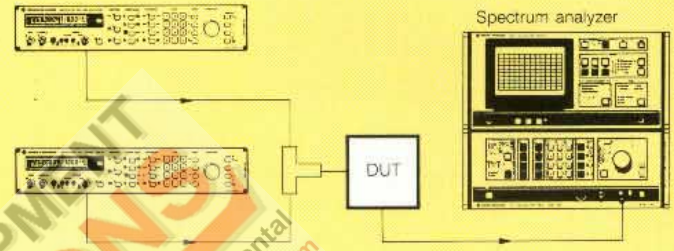


| Range of applications | Advantages of the APN |
|---|---|
| **Routine lab and service dept measurements** | high output voltage, flat frequency response, frequency and level sweep, synthesizer accuracy, integral voltmeter |
| **Radiotelephone measurements (test systems, multi-tone modulation, selective-call tone sequences, SSB)** | high frequency resolution, no phase hits when frequency changed, synthesizer accuracy, integral voltmeter |
| **Ultrasound measurements** | synthesizer accuracy, external synchronization possible, high output level |
| **Automation and control** | frequency and level sweep, floating output, high voltage, square signal with adjustable level |

**Transmission measurements**

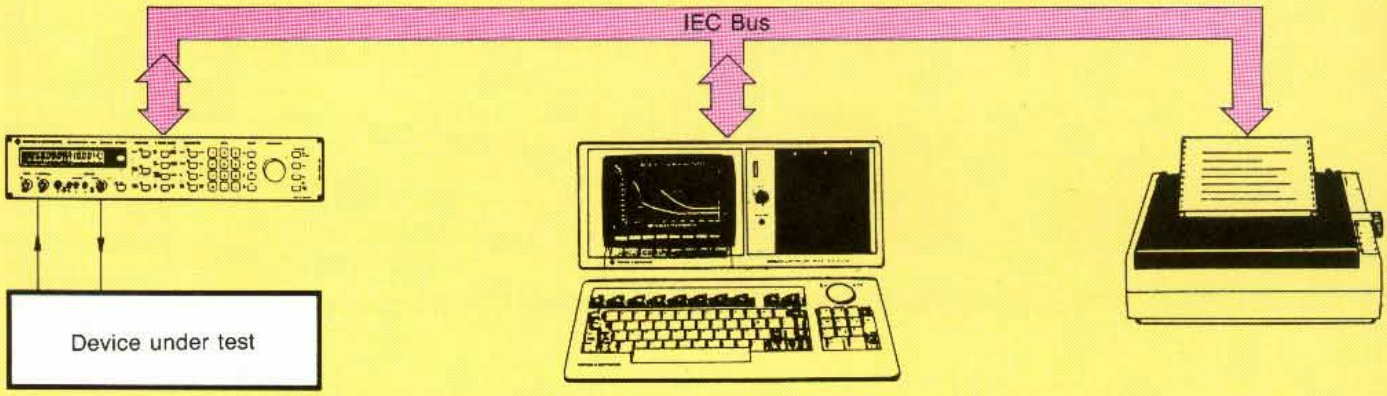



**Distortion measurements**




| | |
|---|---|
| **Telemetry** | fast frequency selection with no settling time |
| **Acoustics (loudspeakers, microphones)** | low distortion, selectable source resistance, floating and balanced output configurations, frequency sweep |
| **AF transmission systems (telephone)** | selectable source impedance floating and balanced output configurations |
| **Determining the load impedance** | selectable source impedance, simultaneous display of load voltage and EMF ($V_{load}$ = 1/2 EMF if $R_{source}$ = $R_{load}$) |

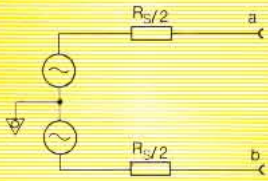




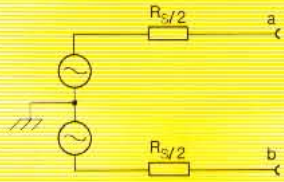

Computer-controlled test setup for transmission measurements

# SPECIFICATIONS

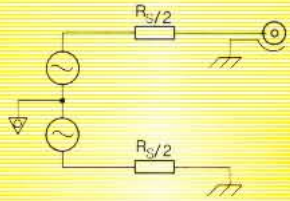
BAL FLTG



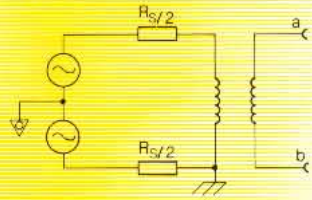

BAL GND




UNBAL




TRANSF




**Frequency**
- Range ..... 1Hz to 260 kHz
- Resolution ..... 1Hz, 0.1 Hz at f <20 kHz

Switching time (after reception of last character via IEC bus) ..... 15 ms
Frequency error (after 10 min warmup time) ..... $<4 \times 10^{-5}$ + aging error
Aging ..... $<10^{-5}$/year

**Signal output**
Impedance ..... entry via keypad (nominal values >640 Ω to customer specifications)
- Balanced, floating ..... 10 to 640 Ω in 5-Ω steps
- Balanced, grounded ..... 2 x (5 to 320 Ω) in 2,5-Ω steps
- Unbalanced ..... 10 to 640 Ω in 5-Ω steps

Impedance error ..... ≦ 2 Ω
Level
- Units ..... V, dBV, dBm
- Balanced, floating ..... 100 µV to 20 V EMF, $I_{max}$ = 200 mA (10 V into 50 Ω)
- Balanced, grounded ..... 2 x (50 µV to 10 V) EMF, $I_{max}$ = 200 mA (2 x 5 V into 25 Ω)
- Unbalanced ..... 100 µV to 20 V EMF, $I_{max}$ = 200 mA (10 V into 50 Ω)

Level resolution ..... at least 10 µV or 0.1 dB
Total level error[1] ..... < ± 0.5 dB
- Frequency response ..... <0.5 dB
- Attenuator error ..... <0.3 dB

Level setting time (after reception of last character via IEC bus) ..... 15 ms
Connectors
- Balanced ..... 3-contact female, DIN 41628
- Unbalanced ..... BNC

**Spectral purity**
THD[2]
10 Hz to 100 kHz ..... < – 60 dBc (<0.1 %, typ. – 70 dBc)
Sum 2nd to 9th harmonic 10 Hz to 20 kHz ..... – 80 dBc typ.
Harmonics and nonharmonics[2]
100 to 260 kHz ..... < – 46 dBc (< – 55 dBc typ.)

**SYNC output**
Frequency ..... same as signal output
Duty cycle ..... 2
Level ..... TTL / HCMOS
Impedance ..... 50 Ω

**Sweep, frequency**
Digital start-stop sweep
Operating modes ..... automatic after sawtooth or triangular signal, single shot, manual with knob, lin or log
Sweep range ..... any value from 1 Hz to 260 kHz
Stepwidth ..... any value ≧ 1 Hz (lin) or 1% (log)
Step time ..... any value between 1 ms and 65 s
Output voltage proportional to frequency ..... 0 to 5 V (option APN-B1)

**Sweep, level**
Digital start-stop sweep
Operating modes ..... as above
Sweep range ..... any value ≦ 20 dB
Stepwidth ..... any value above ≧ 10 µV (lin) or 0.1 dB (log)
Step time ..... any value between 2 ms and 65 s
Output voltage proportional to level ..... 0 to 5 V (option APN-B1)

**APN models**
**Model 02** ..... Generator 1 Hz to 260 kHz

**Model 04** ..... Generator 1 Hz to 260 kHz; with voltmeter and IEC connector

Voltmeter
Function (true RMS) ..... digital display, INT / EXT selectable, voltage difference measurements in V or dB, trend display
Measurement range ($V_{RMS}$) ..... 50 µV to 50 V
Display ..... $3^1/_2$ digits
Resolution ..... 10 µV
Measurement error[1]
(crest factor <3) ..... < ± 0.5 dB (5 Hz to 200 kHz)
< ± 1 dB (5 Hz to 260 kHz)
Input impedance ..... >100 kΩ
Analog output ..... 0 to 10 V, proportional to measured value

**Model 06** ..... Generator 1 Hz to 260 kHz; sine and square signal with adjustable level; IEC-bus connector
Square signal ..... 0 to 10 V into 100 Ω
Rise / fall time ..... <100 ns
Over / undershoot ..... <5 %
Tilt (f>500 Hz) ..... <5 %

**Remote control** ..... provided for models 04 and 06
System ..... IEC 625 – 1 (IEEE 488)
Connector ..... 24-contact, Amphenol
Remote-controllable functions ..... all front-panel functions that can be set manually, except power ON / OFF and variation
IEC-bus address ..... set via keypad, 00 to 30
Interface functions ..... listener and talker SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0

**Option APN-B1:** reference-frequency input / output and output voltage proportional to level or frequency
Input / output frequency ..... 5 or 10 MHz, selectable
Output level ..... >0.2 V into 50 Ω
Input level ..... 0.2 to 2 V into 50 Ω or TTL / HCMOS

X-output
- 1 Hz ..... 0 V
- 260 kHz ..... 5 V
- For sweep (frequency and level)
  - Start ..... 0 V
  - Stop ..... 5 V

**Extra specifications**
SINAD (signal to noise and distortion), typical measured values at f = 1 kHz and $R_{source} = R_{load}$ = 600 Ω, signal level 1 V and 100 µV, balanced and unbalanced

| | 1 V | 100 µV |
|---|---|---|
| Bandwidth 22 Hz to 22 kHz | 80 dB | 40 dB |
| Weighted to CCITT | 84 dB | 50 dB |
| Weighted to CCIR | 70 dB | 32 dB |

**General data**
Rated temperature range ..... 0 to +55 °C
Storage temperature range ..... – 40 to + 70 °C
Power supply ..... 100 / 120 / 220 / 240 V ± 10 % 47 to 440 Hz, safety class I to VDE 0411 (IEC 348)
Mechanical resistance ..... shock-tested to DIN 40046, part 7 (30 g, 11 ms) and vibration tested to DIN 40046, part 8 ( 5 to 55 Hz, 2g); corresponds to IEEE 68 – 2 – 27 and 86 – 2 – 6
Dimensions (B x H x D), weight ..... 435 mm x 103 mm x 350 mm, 7.5 kg

## Ordering information

| | | |
|---|---|---|
| **Order designation** | ▶ Generator APN | |
| APN 02 | 844.6001.02 | |
| APN 04 | 844.6001.04 | |
| APN 06 | 844.6001.06 | |
| Supplied accessories | power cable, manual | |

**Options**

| | | |
|---|---|---|
| Reference-frequency input / output and output voltage proportional to frequency or level | | |
| APN-B1 | | 844.8340.02 |
| Transformer 1 : 3, APN-B2 | | 844.9700.02 |
| Transformer 1 : 1, APN-B2 | | 844.9700.04 |

**Recommended extras**

| | | |
|---|---|---|
| 19" Adapter | ZZA-92 | 396.4886.00 |
| Set of Front-panel Handles | ZZG – 92 | 396.5147.00 |
| Feed-through Termination 50 Ω | RAD 50 | 844.9352.02 |
| Feed-through Termination 100 Ω | RAD 100 | 844.9400.02 |
| Feed-through Termination 600 Ω | RAD 600 | 844.9452.02 |
| Two-core cable, shielded, balanced, with 3-contact connector and 3 banana plugs | APN-Z1 | 884.9652.00 |
| Service Kit with test connector for unbalance measurements and a floppy disk for checking the instrument | APN-Z5 | 844.9898.00 |

[1] Level > 10 mV (EMF), frequency > 5 Hz
[2] Level > 100 mV (EMF)



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# GENERATOR APN 62

**Model 62** ..... model APN 62 is a modified version of the APN 06. It contains an output transformer and has different AC supply voltage ranges

Transformer

| | |
|---|---|
| Frequency range | 20 Hz to 25 kHz |
| Impedance | 2 kΩ |
| Level range | 100 µV to 30 V into 2 kΩ |
| Level resolution | min. 10 µV or 0.1 dB |
| Total level error[1] | < ±1.0 dB |
| Frequency response | <1.2 dB |
| Attenuator error | <0.6 dB |
| Connector | 3-contact female, balanced, DIN 41628 |

General specifications

| | |
|---|---|
| Power supply | 94 to 127 V, 188 to 265 V<br>45 to 440 Hz |

All other specifications are the same as those of the APN 06[2]

**Order designation** ..... ▶ Generator APN 62
844.6001.62

Recommended extra:
Accessory Case ZZT-97 ..... 396.9936.00

[1] Level > 10 mV (EMF), frequency > 20 Hz

[2] with the exception of SINAD extra specifications at the condition:
level 100 µV/unbalanced



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