

Test Equipment Solutions Datasheet

Test Equipment Solutions Ltd specialise in the second user sale, rental and distribution of quality test & measurement (T&M) equipment. We stock all major equipment types such as spectrum analyzers, signal generators, oscilloscopes, power meters, logic analysers etc from all the major suppliers such as Agilent, Tektronix, Anritsu and Rohde & Schwarz.

We are focused at the professional end of the marketplace, primarily working with customers for whom high performance, quality and service are key, whilst realising the cost savings that second user equipment offers. As such, we fully test & refurbish equipment in our in-house, traceable Lab. Items are supplied with manuals, accessories and typically a full no-quibble 1 year warranty. Our staff have extensive backgrounds in T&M, totalling over 150 years of combined experience, which enables us to deliver industry-leading service and support. We endeavour to be customer focused in every way right down to the detail, such as offering free delivery on sales, presenting flexible technical + commercial solutions and supplying a loan unit during warranty repair, if available.

As well as the headline benefit of cost saving, second user offers shorter lead times, higher reliability and multivendor solutions. Rental, of course, is ideal for shorter term needs and offers fast delivery, flexibility, try-before-you-buy, zero capital expenditure, lower risk and off balance sheet accounting. Both second user and rental improve the key business measure of Return On Capital Employed.

We are based at Aldermaston in the UK from where we supply test equipment worldwide. Our facility incorporates Sales, Support, Admin, Logistics and our own in-house Lab.

All products supplied by Test Equipment Solutions include:

- No-quibble parts & labour warranty (we provide transport for UK mainland addresses).
- Free loan equipment during warranty repair, if available.
- Full electrical, mechanical and safety refurbishment in our 40GHz in-house Lab.
- Certificate of Conformance (calibration available on request).
- Manuals and accessories required for normal operation.
- Free insured delivery to your UK mainland address (sales).
- Support from our team of seasoned Test & Measurement engineers.
- ISO9001 quality assurance.

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SPM-15 Selective Level Meter

for the frequency range 50 Hz to 10 MHz, send section available

IEEE 488
IEC 625



- Selective and wideband measurements
- Synthesizer for high accuracy and stability of tuned frequency
- Frequency is set quasi-continuously
- Search-scan, AFC
- Analog or digital level display with autoranging; resolution 0.01 dB
- Absolute and relative measurements
- Automatic level calibration
- Fast signal detector, AFC
- Integral demodulator and loudspeaker
- A.C. line and battery operation
- Compact, handy, light

Version BN 955/02:

- Measures noise, reading in dBmC
- Connectors for WECO male connectors

The SPM-15 Selective Level Meter is used for level measurements on balanced and coaxial FDM systems, at the baseband of radio-link and satellite systems with up to 1872 channels and also in single voice-channels and sound programme channels. Because the SPM-15 is compact, robust and can be battery powered it is ideal for the servicing and maintenance work carried out on postal systems, on railways and on the networks of public utility companies supplying energy. The SPM-15 is particularly effective for detecting spurious signals, or for long-term monitoring applications.

As the SPM-15 is accurate, flexible and remote controllable, it can be used during the development, production and testing of system components. When the send section is fitted, a complete measuring setup for loss and gain measurements is

formed. The PS-15 Level Generator is available for measurements at different send and receive frequencies, and for end-to-end measurements.

Frequency conditioning in the SPM-15 is carried out in a synthesizer with an especially high spectral purity, accuracy and stability. The frequency can be tuned continuously, by increments or automatically (search-scan).

The frequency is shown on an LED display with a resolution of 1 Hz. The receive level can be displayed on a meter or digitally with greater resolution. The automatic level calibration and linearity check ensure a high accuracy of measurement. If required, the Level Meter can be delivered with a tracking generator, (inclusive batteries) or, alternatively, with the Interface Bus <IEC 625>/IEEE 488 for control by a computer.

| | |
|--|---|
| Frequency range | 50 Hz to 10 MHz |
| Frequency adjustments | quasi-continuous, by increments or search-scan |
| Error limits of the frequency | $\pm 3 \times 10^{-6}$ |
| Display range ($Z_0 = 75 \Omega$) | |
| selective | -140 to +20 dB / -130 to +20 dBm |
| wideband | -60 to +20 dB / -50 to +20 dBm |
| Bandwidth, switchable | 25 Hz*, 1.74 kHz, 3.1 kHz |
| Input impedance | * 100 Hz on request |
| coaxial | 75 Ω , high impedance |
| balanced | 124, 150 (135), 600 Ω , high impedance |
| Intrinsic harmonic ratio | ≥ 80 dB |
| Send level range (with PSE-15) | -60 to +11 dB/dBm |

Further characteristics and applications

SPM-15 Level Meter, BN 955/01

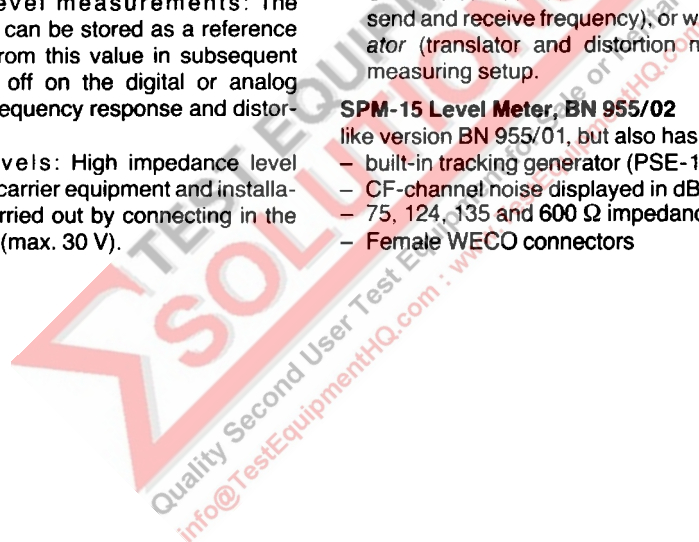
- **High frequency accuracy:** The small deviation of 3×10^{-6} from the set frequency means that the frequency selected is also accurate at high frequencies, e.g. when measuring pilot levels or carrier leaks. The error stated is valid in the rated range of temperature and includes ageing of the reference crystal.
- **Search-scan:** This facility is used to rapidly locate hot tones or discrete impairments whose level exceeds a set threshold. The scan speed is set automatically for the selected bandwidth.
- **Automatic frequency control (AFC):** Ensures exact tuning to frequency under test. Operates in selective mode and analog level display only.
- **Automatic level calibration:** Ensures high measuring accuracy in the selective mode, by using a tracking calibration signal which has the same frequency as the tuned frequency. This signal is switched into the signal path at regular intervals or when important setting parameters are altered.
- **Digital and analog level display:** The digital display has a resolution of 0.01 dB when autoranging is used. When the analog display is used (overview measurements, alignments) the 20 dB range or the *expander* with a range of ± 1 dB can be selected.
- **Absolute and relative level measurements:** The absolute level (in dB or dBm) can be stored as a reference level so that the deviations from this value in subsequent measurements can be read off on the digital or analog display. This simplifies both frequency response and distortion measurements.
- **Measuring very high levels:** High impedance level measurements on power-line carrier equipment and installations, for example, can be carried out by connecting in the SDG-40 Balanced Attenuator (max. 30 V).

- **Switch-selectable bandwidths:** Pilots, carrier leaks, or frequency spectra can be investigated using the narrow 25 Hz filter. On the other hand, weighted noise measurements can be carried out in single voice channels at the carrier frequency level using a 1.74 kHz effective noise bandwidth filter. A flat 3.1 kHz filter for measurements over the whole channel bandwidth (e.g. via the demodulator output) can also be switched in. The SPM-15 can be equipped with a 100 Hz bandwidth filter in place of 25 Hz to facilitate measurements on FM 120 VFT systems.
- **Remote control:** All important functions can be remote controlled using the remote control board option. The board complies with IEC 625/IEEE 488. The board is fitted in the back panel instead of the *BAZ-15 Battery Pack*. If you have to perform rapid level measurements or to handle large amounts of data (e.g. system monitoring), we recommend the use of the SPM-19 Selective Level Meter (50 Hz to 25 MHz).
- **BCI-1 Barcode Interface (accessory):** All the important device functions can be remote-controlled without using an external computer. The BCI-1 converts barcodes into the corresponding IEC bus commands. A generator program for DOS computers with matrix or laser printers is included.
- **Economical design:** Depending on the application, the SPM-15 can be used with the *PSE-15 Send Section* (same send and receive frequency), or with the *PS-15 Level Generator* (translator and distortion measurements) to form a measuring setup.

SPM-15 Level Meter, BN 955/02

like version BN 955/01, but also has

- built-in tracking generator (PSE-15)
- CF-channel noise displayed in dBmC
- 75, 124, 135 and 600 Ω impedances
- Female WECO connectors



If nothing to the contrary is stated, the data for the nominal ranges of ambient temperature, a.c. line voltage and a.c. line frequency are valid immediately after switch-on.

Inputs

Coaxial input* Versacon® 9 Universal Connector
 System suitable for all usual connector types
 BN 955/02: fem. connector for WECO 358 A male connector
 Input impedance, switchable 75 Ω and high impedance
 Frequency range 50 Hz to 10 MHz
 Return loss, f ≤ 4.5 MHz ≥34 dB

Balanced input 3 pole CF connector
 Input impedance, switchable 124, 150 Ω
 and high impedance
 BN 955/02: only 124 Ω
 fem. connector for WECO 372 A/379 A male connector
 Frequency range 6 kHz to 10 MHz
 Signal balance ratio as per CCITT O.121,
 f = 6 kHz to 1 MHz ≥40 dB
 Return loss at f = 100 kHz ≥40 dB

Input impedance, switchable 600 Ω and high impedance
 BN 955/02: also 135 Ω
 135 Ω fem. connector for WECO 241 A male connector
 600 Ω fem. connector for WECO 310 male connector
 Frequency range 50 Hz to 620 kHz
 Signal balance ratio as per CCITT O.121 ≥40 dB
 Return loss at f = 10 kHz ≥50 dB

Tolerable input voltage for all inputs
 Overload limit when terminated with Z₀, V_{r.m.s.} 10 V
 Tolerable d.c. voltage
 at high impedance input 60 V

Frequency

Frequency settings
 Manual quasi-continuous adjustment over the whole range
 without switchover, resolution 1 Hz
 also by increments with variable increment width and
 automatic search-scan. Stopped by signal detector.
 Automatic frequency control (AFC) operating in selective mode
 and analog level display.
 Synchronous tuning of the PS-15 Level Generator can also
 be carried out.

Frequency display 7 digits with LED
 Error limits for the tuning frequency including
 ageing over a year ±3 x 10⁻⁶

Level display

Display of power level (dBm) referred to 1 mW
 of voltage level (dB) referred to 0.775 V
 the level difference between an absolute
 and a stored reference level dB
 Noise level (dBrnC) ¹⁾ with Option BN 955/00.23
 instead of noise voltage level
 1) 0dBrnC ≅ 90 dBm

Display, switchable digital or analog
 Digital display, resolution 0.01 dB
 Analog display via meter, ranges ±1 dB and 20 dB

Fast signal detector with LED
 Activation threshold on the 20 dB scale approx. -15 dB
 (≅ -10 dB)

Display ranges

| Input ^{*)} | Selective | Wideband ¹⁾ |
|--|-----------------------------------|---------------------------------|
| Z ₀ = 75 Ω | -130 to +20 dBm 140 to +20 dB | -50 to +20 dBm -60 to +20 dB |
| Z ₀ = 124, 150 Ω (135 Ω) | -120 to +20 dBm -130 to +20 dB | 40 to +20 dBm -50 to +20 dB |
| Z ₀ = 600 Ω | -130 to +20 dB/dBm | -50 to +20 dB/dBm |

^{*)} "Inputs" describes the impedances for BN 955/02
¹⁾ In analog measurement mode, the lower limit is 10 dB less

Measurement range selection

Autoranging for digital display
 Manually in steps of 1 dB or 10 dB for analog display

Measurement errors

Selective measurements

for Z_{in} = Z_{out} = Z₀ and automatic level calibration
 Error limits of level display for 0 dBm (dB) input level,
 display digital or analog (±1 dB scale),
 f = 10 kHz (100 kHz at Z₀ = 124, 150 Ω),
 bandwidth 1.74 and 3.1 kHz

| | Coaxial | Bal. |
|-----------------------------------|----------|---------|
| in the range (23 ± 3)°C | ±0.06 dB | ±0.1 dB |
| in the range 0 to +50°C | ±0.15 dB | ±0.2 dB |

Additional error for any input level

coaxial input

| | | | | | |
|----------|-------|---------|------|---------------------|------|
| +20 | 0 dBm | -70 | -90 | -100 | -110 |
| ±0.15 dB | | ±0.1 dB | | ±0.15 dB | |
| +0.3 dB | | +0.3 dB | | +1 dB ¹⁾ | |
| +20 | 0 dB | -80 | -100 | -110 | -120 |

balanced input

| | | | | | |
|----------|----------|---------|-----|---------------------|------|
| +20 | 0 dB/dBm | -65 | -85 | -95 | -105 |
| ±0.15 dB | | ±0.1 dB | | ±0.15 dB | |
| +0.3 dB | | +0.3 dB | | +1 dB ¹⁾ | |

¹⁾ Error limits only apply to the 25 Hz bandwidth

The variation of level display with frequency referred to 10 kHz
 (100 kHz at Z₀ = 124, 150 Ω), for input levels at least 40 dB
 greater than intrinsic noise (values in dB).

| Z ₀ | ±0.3 | ±0.08 | | | | |
|-----------------------------|------|-------|-------|---|-------|--------------------------|
| Z ₀ = 75 Ω | | | | | | |
| Z ₀ = 124, 150 Ω | — | ±0.4 | +0.15 | | | |
| Z ₀ = 600 Ω | ±0.8 | ±0.25 | +0.15 | | ±0.25 | — |
| | 50 | 200 | 2 | 6 | 60 | 100 620 10 Hz kHz MHz |

Additional error for analog display 20 dB scale,
 in the range -10 to +2 dB ±0.3 dB

Wideband measurements

Overall error in the range 0 to +50°C, Z_{in} = Z_{out} = Z₀
 and after calibration

| Input ^{*)} | Level range | Error limits |
|-----------------------------|------------------------------|--------------|
| Z ₀ = 75 Ω | -50 to +20 dB/-40 to +20 dBm | ±0.6 dB |
| Z ₀ = 124, 150 Ω | -40 to +20 dB/-30 to +20 dBm | ±0.7 dB |
| Z ₀ = 600 Ω | -40 to +20 dB/dBm | ±0.7 dB |

^{*)} See "inputs" for impedances for BN 955/02

Selectivity

The bandwidths are switchable between:

| Bandwidth | 25 Hz ¹⁾ | 1.74 kHz ²⁾ | 3.1 kHz |
|---|---|---|-----------------------------------|
| Eff. noise bandwidth ($\pm 10\%$) | — | 1.74 kHz ²⁾ | 3.1 kHz |
| Distance Δf from centre frequency for an attenuation of | ≤ 3 dB ≥ 50 dB ≥ 60 dB | ± 7 Hz ± 80 Hz ± 250 Hz | $+650$ Hz — ± 2 kHz |
| | | | ± 1.5 kHz — ± 2 kHz |

- 1) Values apply to a temperature range of $+5$ to $+40^\circ\text{C}$
2) 1.95 kHz for BN 955/02

100 Hz bandwidth

for BN 955/01 and /02 in place of 25 Hz
for BN 955/04 as additional external filter

Bandwidth, attenuation ≤ 3 dB 100 Hz ± 5 Hz
attenuation ≥ 18 dB ± 100 Hz
attenuation ≥ 60 dB ± 400 Hz

Image frequency rejection and IF suppression ≥ 70 dB

Harmonic ratio a_{k_2} , a_{k_3}

level of the fundamental ≤ 0 dB/dBm

with automatic calibration, frequency of the fundamental

$f \geq 3$ kHz ≥ 80 dB
 $f \geq 300$ Hz (bandwidth 25 Hz) ≥ 70 dB

Noise power ratio (NPR)

when loaded with noise having the bandwidth 12 kHz to 8160 kHz, wideband level -25 to $+10$ dBm, slot anywhere in the band with $B_{\text{eff}} \geq 20$ kHz, bandwidth 1.74 kHz (1.95 kHz) and with automatic calibration ≥ 54 dB

Noise floor

Intrinsic noise and discrete spurious signals, selective, bandwidth 25 Hz, input terminated with Z_0 , $f \geq 3$ kHz
Input 75 Ω ≤ -135 dB (-125 dBm)
Input 124, 150 Ω ($f \geq 6$ kHz) ≤ -125 dB (-120 dBm)
Input 135, 600 Ω ≤ -120 dB/dBm
When the bandwidths 1.74 kHz (1.95 kHz) and 3.1 kHz are used, the level values increase by $+10$ dB.

Additional outputs

Demodulator output

3 pole CF connector $Z_{\text{out}} = 600 \Omega$
BN 955/02: fem. connector for WECO 310 male connector
SSB demodulation erect/inverted position
Frequency of the translated channel when tuned to channel carrier 0 to 4 kHz

A. C. voltage output (BNC), short circuit proof (not fitted to BN 955/04)

Output level for $Z_{\text{out}} = Z_L = 75 \Omega$ and 0 dB range display 0 dBm
Output frequency, operating mode, selective 10 kHz wideband as input signal

D. C. output

3 pole CF connector $Z_{\text{out}} = 5 \text{ k}\Omega$
Open-circuit voltage for f.s.d. $+5 \text{ V}$
Output for internal standard frequency (BNC) 10 MHz

Control output for external tuning (BNC) of the PS-15 Level Generator, frequency range 40 to 50 MHz

Options

PSE-15 Tracking Generator, BN 955/00.02

(Standard in BN 955/02 and BN 955/04)

Frequency range, adjustment and display same as Level Meter

Generator outputs

Coaxial output, fem same as Level Meter
Output impedance 75 Ω
Return loss at 10 kHz ≥ 50 dB
Balanced output, fem same as Level Meter
Output impedance, switchable 600, 150, 124 Ω , approx. 15 Ω
BN 955/02: 600, 135, 124, approx. 15 Ω
Return loss at $f = 100$ kHz or 10 kHz (600 Ω) ≥ 36 dB
Signal balance ratio as per CCITT O.121 ≥ 40 dB

Send level

Send level is displayed digitally by pressing a button, resolution 0.1 dB

Send level range

| | | | |
|----------|----------------------------------|---------------------|-------------------|
| Coaxial | $Z_0 = 75 \Omega$ | -55 to $+12$ dBm | -65 to $+3$ dB |
| Balanced | $Z_0 = 124 \Omega$ | -58 to $+9.9$ dBm | -65 to $+3$ dB |
| | $Z_0 = 150 \Omega$ | -59 to $+9$ dBm | |
| Balanced | $Z_0 = 135 \Omega$ ¹⁾ | -58 to $+9.5$ dBm | -65 to $+3$ dB |
| | $Z_0 = 600 \Omega$ | -65 to $+3$ dBm | -65 to $+3$ dB |
| | $Z_{\text{out}} \approx 0$ | -59 to $+11$ dBm | -59 to $+11$ dB |

1) BN 955/02: instead of 150 Ω

Level adjustment in steps of 5 dB or 0.1 dB

Error limits of the send level

for $Z_{\text{out}} = Z_L = Z_0$ or $Z_{\text{out}} = 0$, $Z_L = Z_0$

| Z_{in} | $Z_{\text{out}} = Z_L = Z_0$ | $Z_{\text{out}} = 0$, $Z_L = Z_0$ | | |
|-------------------|------------------------------|------------------------------------|--------------|---|
| 75 Ω | ± 0.6 dB | ± 0.25 dB | | |
| 124, 150 Ω | — | ± 0.3 dB | | |
| 600 Ω | ± 0.6 dB | ± 0.3 dB | ± 0.4 dB | — |
| 600 Ω | ± 0.6 dB | ± 0.3 dB | ± 0.6 dB | — |

50 200 Hz 6 100 620 kHz 10 MHz

Intrinsic harmonic ratio a_{k_2} and a_{k_3}

$f = 50$ Hz to 10 MHz ≥ 40 dB

Attenuation of discrete nonharmonic spurious signals, at least 50 dB below wanted signal.

BAZ-15 Battery Pack³⁾, BN 955/00.01

Operating time approx. 5 h
Charging time approx. 14 h

Interface Bus <IEC 625>/IEEE 488³⁾, BN 955/00.04

Interface functions SH1, AH1, T6, L4, SR1, RL1, PP2, DC1, DT1, C0

Measurement times if level changed (x = measurement range) within $x \pm 1$ dB typically 2 (2.3) s
 $x \pm 10$ dB typically 3.3 (3.6) s
additionally (due to calibration clock) typically 1.9 (2.3) s (values in parentheses refer to 25 Hz bandwidth)

Default high impedance¹⁾, BN 955/00.25

Input switches to high impedance after power interruption or change of impedance.

General Specifications

Power supply
A.C. line
Nominal ranges of use for a.c. line voltage,
switchable 110/117/127/220/227/237 V, -12 to +10 %
Nominal range of use for a.c. line frequency 47.5 to 63 Hz
Power consumption, measuring or charging approx. 38 VA
Safety class as per IEC 348 and VDE 0411 Class I
Battery powered from BAZ-15 Battery Pack, BN 955/00.01.
Ambient temperature
Nominal range of use 0 to +55°C
Limits operating range -10 to +55°C

Storage and transportation -40 to +70°C*)
*) with BAZ-15 Battery Pack, BN 955/00.01, -40 to +60°C
Dimensions (w x h x d) in mm 317 x 175 x 342
Weight
SPM-15 with PSE-15 approx. 13 kg
BAZ-15 approx. 2.8 kg
< IEC 625 > Interface Bus Card approx. 1 kg
German Post Office Certificate of Approval No.
for SPM-15, BN 955/01 272 181 826-5
for PSE-15, BN 955/00.02 272 918 104-5
for BAK-15, BN 955/00.01 191 090 156-0

Ordering Information

| | | |
|---|---------------------|--|
| Level Meter SPM-15* | BN 955/01 | BN 955/00.21 |
| Level Meter SPM-15 with Tracking Generator PSE-15, noise measurements in dBmC ²⁾ , and WECO connectors | BN 955/02 | |
| Level Meter SPM-15 same as BN 955/02, 75/124 Ω connectors: WECO 558 A | BN 955/04 | |
| Option (included in price) Default high impedance ¹⁾ | BN 955/00.25 | Noise measurements in dBmC ²⁾ (for BN 955/01) BN 955/00.23 |
| Options (at extra cost) Tracking Generator PSE-15* (for BN 955/01) | BN 955/00.02 | Accessories (at extra cost) ⁴⁾ |
| Battery Pack BAZ-15, rechargeable ³⁾ | BN 955/00.01 | BCI-1 Barcode Interface for SPM-15 with IEC bus board |
| Interface < IEC 625 > board ³⁾ with IEEE 488 connector and K 420 cable | BN 955/00.04 | Return Loss Measuring Attachment RFZ-12 200 Hz to 4.5 MHz |
| 100 Hz bandwidth for BN 955/01 and /02 in place of 25 Hz | BN 955/00.09 | Signal Balance Ratio Measuring Attachment SDZ-12 200 Hz to 4.5 MHz |
| 100 Hz bandwidth for BN 955/04 as additional external filter | BN 955/00.06 | Impedance Magnitude Measuring Attachment SFZ-1 300 Hz to 612 kHz |
| | | SDG-40 Balanced Attenuator IEEE 488/IEC 625 (plug) adaptor |
| | | Protective Transportation Cover SD-940 (1 set) 19" conversion kit |

1) Factory installed. Order with instrument.

2) has bandwidth of 1.95 kHz instead of 1.74 kHz

3) The BAZ-15 and the Interface Bus cannot be used at the same time

4) For specifications and more ordering information see the Specification Sheet "Measuring Accessories". Accessories suitable for BN 955/01.

* Equipped with the 75 Ω basic connector Versacon® 9 and BNC adaptor. For other adaptor types, see "Specification Sheet Versacon® 9", and order chosen type when ordering instrument.