

# Keysight Technologies N432A Thermistor Power Meter

Data Sheet



## Why Keysight's Power Meters and Sensors?

Keysight's only power meter that supports thermistor mount with useful enhancements for metrology and calibration lab environments.

### Key features

- Frequency range: 100 kHz to 18 GHz (sensor dependent)
- Power range: -30 dBm (1  $\mu$ W) to +10 dBm (10 mW)
- High accuracy  $\pm$  (0.1% of reading + 0.5  $\mu$ W), excellent for 1 mW transfer calibration (with 478A-H75)
- Built in 6.5 digit ADC eliminates the need of external DMM
- Selectable bridge resistance (100/200/300/400  $\Omega$ )
- Remote interface flexibility
- DC substitution measurement, traceable to the U.S. National Institute of Standards and Technology (NIST)

### Reliable, high-performing solutions

Every power meter and sensor from Keysight consistently delivers great results.

### A sure investment for many years to come

Code-compatibility between power meters reduces the need for re-coding. Not only that, all Keysight power meters are backward-compatible with most legacy power sensors.

### One specific application: One right solution

Keysight offers a wide selection of power meters and sensors for practically all application needs—wireless communications, radar pulse measurements, component test, and more.

### Global network support

No matter where you are, Keysight is committed to giving you the 24-hour support you need regarding our products, applications, or services.

Keysight's power meters have long been recognized as the industry standard for RF and microwave power measurements.

## We Listened to the Industry, Then Delivered a Better and Easier Replacement Solution for the Legacy 432A Analog Power Meter

As today's power measurements become more complex, it is increasingly difficult to make reliable, accurate power measurements. For more than 40 years, you've depended on Keysight's 432A analog power meter, used with temperature compensated thermistor sensors to provide high accuracy over a wide temperature range.

Today, the Keysight N432A digital thermistor power meter, loaded with enhancements, including a color digital display, and intuitive front panel interface will continue support your measurement needs with greater capability and expanded functionality. Best of all, you can get these extras at just a fraction of the price of the legacy 432A.



### LXI Class-C compliant N432A

The N432A is a single-channel, average RF power measurement meter that supports thermistor sensors. The N432A has the capability to measure and display average power, RF bridge voltages ( $V_{RF0}$  and  $V_{RF1}$ ), compensation bridge voltages ( $V_{COMP0}$  and  $V_{COMP1}$ ),  $V_0$ , and  $V_1$ . It is also provided with a set of features such as zeroing and a built-in self-test.

Developed using LXI technology, the N432A is an LXI Class-C compliant instrument.<sup>1</sup> The N432A basic configuration consists of two key sections: bridge and meter logic. When a compatible thermistor sensor is connected to the N432A, the RF and compensation bridge circuits are formed in the bridge section.  $V_{RF}$ , which is the voltage at the top of the RF bridge, is responsive to both input RF power and ambient temperature changes. On the other hand,  $V_{COMP}$ , which is the voltage at the top of the compensation bridge, is responsive only to ambient temperature changes. The  $V_{RF}$  and  $V_{COMP}$  values are used in calculating the RF power. Meanwhile, the meter logic section processes  $V_{RF}$  and  $V_{COMP}$  to produce a meter current proportional to RF power.



In general, the N432A is an easy-to-use instrument, especially with the availability of an integrated Web browser that provides a convenient way to view and modify the instrument network configuration. Besides the LAN interface, the N432A also supports industry standard GPIB and USB interfaces for measurement automation.

1. LXI, an acronym for LAN eXtension for Instrumentation, is an instrument standard for devices that use the Ethernet (LAN) as their primary communication interface.

## High accuracy— no thermoelectric error

The high accuracy  $\pm$  (0.1% of reading + 0.5  $\mu$ W) over a wide temperature range featured in the legacy 432A power meter is also included in the N432A, making it excellent for 1 mW transfer calibration (with 478A-H75/H76\*). Accuracy can be maintained on even the most sensitive range as the error due to thermoelectric effect is reduced to a negligible level.

\* 478-H75/H76 has a maximum SWR of 1.05 at 50 MHz

## Sensor compatibility

The N432A is compatible with the Keysight 478A and 8478B thermistor sensors. The following table lists the frequency range and operating resistance for these two sensors:

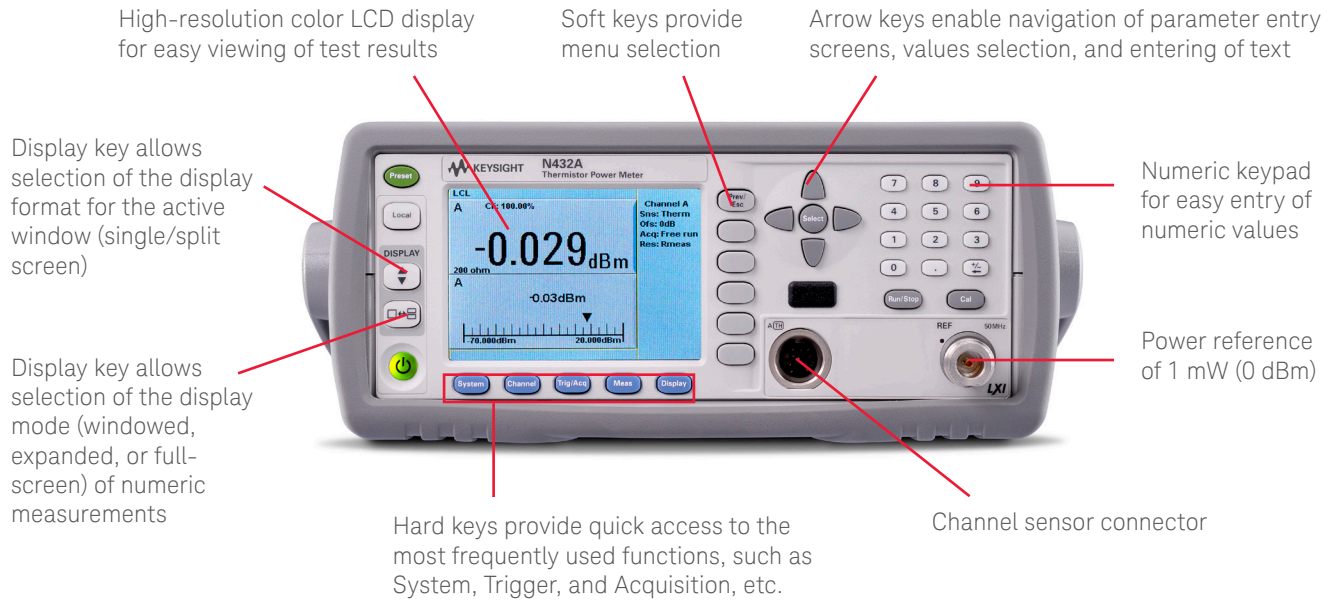
Thermistor sensor model	Frequency range (GHz)	Operating resistance ( $\Omega$ )
478A	0.01 to 10	200
478A Option H63	0.000001 to 1	200
478A Option H75	0.001 to 1	200
478A Option H76	0.001 to 1	200
8478B	0.01 to 18	200



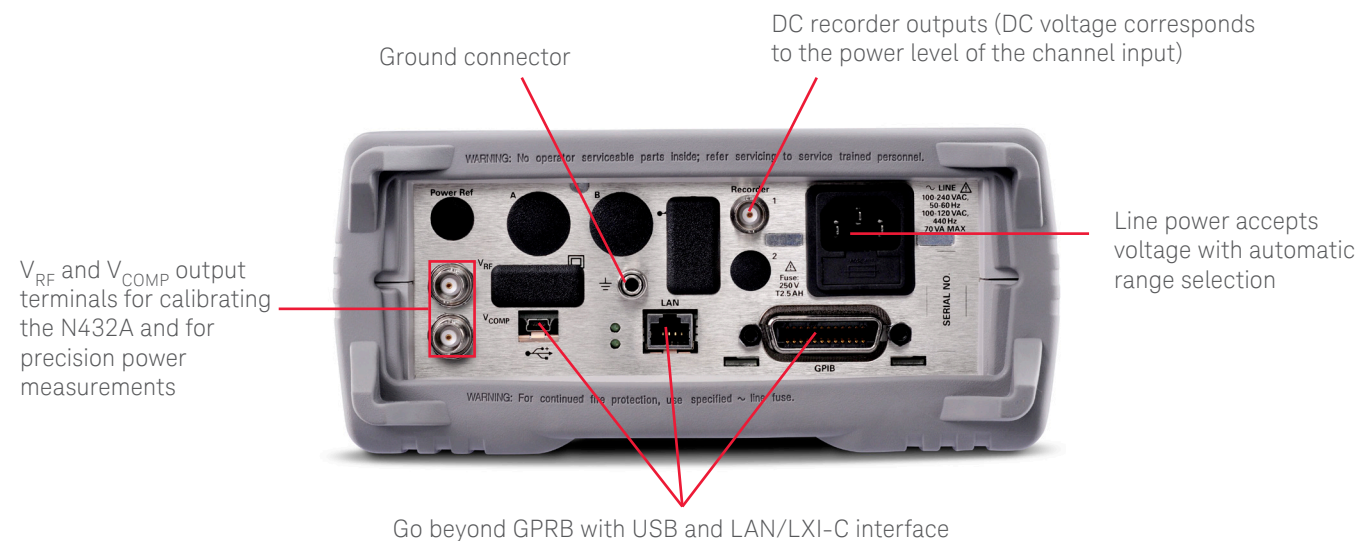
For further information on the thermistor sensors, refer to the respective manuals.

## Take a Closer Look

### N432A front panel



### N432A back panel



## Specifications and Characteristics

Specifications describe the instrument's warranted performance and apply after a 30 minute warm-up.

These specifications are valid over its operating/environmental range unless otherwise stated and after performing a zero and calibration procedure.

Supplemental characteristics (shown in italics) are intended to provide additional information, useful in applying the instrument by giving typical (expected), but not warranted performance parameters. These characteristics are shown in italics or labeled as “*typical*,” “*nominal*” or “*approximate*.”

General specifications	
Frequency range	100 kHz to 18 GHz, sensor dependent
Power range	-30 to +10 dBm (1 $\mu$ W to 10 mW), thermistor-sensor dependent
Compatible power sensors	<ul style="list-style-type: none"> <li>– Keysight 478A thermistor sensor (100 kHz to 10 GHz, with option H63)</li> <li>– Keysight 8478B thermistor sensor (10 MHz to 18 GHz)</li> </ul>
Meter power accuracy	
Power absolute accuracy	$\pm$ (0.1% of reading + 0.5 $\mu$ W)
Meter voltage accuracy (1-year reference specifications)	
$V_{RF}$ and $V_{COMP}$	$23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}: \pm (0.0035\% + 50\text{ }\mu\text{V})$ [ <i>reading + range</i> ]
$V_0$ and $V_1$	$23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}: \pm (0.0040\% + 25\text{ }\mu\text{V})$ [ <i>reading + range</i> ]
Bridge resistance	100, 200, 300, or 400 $\Omega$ (user selectable)
Display units	
Power	Watts (W) or dBm
Relative	Percent (%) or dB
$V_{RF}$ , $V_{COMP}$ , $V_0$ , and $V_1$	VDC and mVDC
Bridge resistance	Ohm
Display resolution	
Power	Selectable resolution of: 1.0, 0.1, 0.01 and 0.001 dB in logarithmic mode, or 1, 2, 3, and 4 significant digits in linear mode
Default resolution	0.01 dB in logarithmic mode or three digits in linear mode
Voltage	6.5-digit resolution
Bridge resistance	6.5-digit resolution

## Specifications and Characteristics (continued)

Power meter functions	
Accessed by key entry	Either hard keys, or soft key menu, and programmable
Zero	Zeros the meter. (Power reference calibrator is switched off during zeroing)
Frequency	Entered frequency range is used to interpolate the calibration factors table. Frequency range from 1 kHz to 999.9 GHz
Bridge resistance type	Setting the bridge resistance, user-selectable R <sub>measure</sub> (factory set) or R <sub>user</sub> (measured by user)
Cal factor	Sets the cal factor versus frequency for the calibration factor for power sensor. Range: 1.00% to 150.00%, in 0.01% increments. Cal factor can be set from either CF table or single entry CF
Relative	Displays all successive measurements relative to the last displayed value
Offset	Allows power measurements to be offset by -100 to +100 dB, settable in 0.001 dB increments, to compensate for external loss or gain. Offset table can be set from either CF table or single entry CF
Save/recall	Store up to 10 instrument states via the save/recall menu
Measurement averaging	Selectable from 4 to 128
Duty cycle	Duty cycle values between 0.001 to 99.999%, in 0.001% increments, can be entered to display a peak power representation of measured power. The following equation is used to calculate the displayed peak power value: peak power = measured power/duty cycle
Limits	High and low limits can be set in the range -150.000 to +230.000 dBm, in 0.001 dBm increments
Preset default values	dBm mode, relative off, power reference off, duty cycle off, offset off, frequency 50 MHz, measurement averaging 16, free run
Display	Color display with selectable single and split screen formats are available. User selectable on digital measurement type or analog scale presentation
1 mW (0 dBm) power reference	1.0 mW (0.0 dBm), 50 MHz from type N (f) connector on the front panel, for power meter/sensor function check.
Accuracy (for two years)	± 0.4% (25 ± 10 °C) ± 1.2% (0 to 45 °C)
SWR	1.05 (typical), 1.08 (0 °C to 45 °C)

## Specifications and Characteristics (continued)

### Power meter general specifications

Dimensions	The following dimensions exclude front and rear protrusions: 212.6 mm W x 88.5 mm H x 348.3 mm D (8.5 in x 3.5 in x 13.7 in)
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Weight	Model	Net	Shipping
	N432A	3.6 kg (8.0 lb)	8.2 kg (18.1 lb)

### Rear panel connectors

$V_{RF}$ output	$V_{RF}$ BNC terminal outputs the RF bridge voltage, used to connect to external DMM for more precise power measurement
$V_{COMP}$ output	$V_{COMP}$ BNC terminal outputs the compensation bridge voltage, used to connect to external DMM for more precise power measurement
Recorder output	Analog 0 to 1 V, 1 k $\Omega$ output impedance, BNC connector
GPIO, USB 2.0 and 10/100BaseT LAN	Interfaces to allow communication with an external controller
Ground	Binding post, accepts 4 mm plug or bare wire connection
Line power	
Input voltage range	100 – 240 VAC, automatic selection 220 – 240 V $\pm$ 10%
Input frequency range	50 – 60 Hz, 400 Hz 400 Hz (100 – 120 Vac)
Power requirement	70 VA



## Specifications and Characteristics (continued)

### Environmental characteristics

Electromagnetic compatibility	<p>Complies with the essential requirements of EMC Directive (2004/108/EC) as follows:</p> <ul style="list-style-type: none"> <li>– IEC61326-1:2005 / EN61326-1:2006</li> <li>– CISPR11:2003 / EN55011:2007 (Group 1, Class A)</li> </ul> <p>The product also meets the following EMC standards:</p> <ul style="list-style-type: none"> <li>– Canada: ICES/NMB-001:2004</li> <li>– Australia/New Zealand: AS/NZS CISPR 11:2004</li> </ul>
Product safety	<p>This product conforms to the requirements of the following safety standards:</p> <ul style="list-style-type: none"> <li>– IEC 61010-1:2001 / EN 61010-1:2001</li> <li>– CAN/CSA-C22.2 No.61010-1-04</li> <li>– ANSI/UL61010-1:2004</li> </ul>
Low voltage directive	This product conforms to the requirements of European Council Directive “2006/95/EC”
Operating environment	
Temperature	0 °C to 45 °C
Maximum humidity	95% at 40 °C (non-condensing)
Minimum humidity	15% at 40 °C (non-condensing)
Maximum altitude	4,600 m (15,000 ft)
Storage conditions	
Non-operating storage temperature	–40 °C to +70 °C
Non-operating maximum humidity	90% at 65 °C (non-condensing)
Non-operating maximum altitude	4,600 m (15,000 ft)
Remote programming	
Interface	GPIB, USB, and LAN interfaces operates to IEEE 488.2 standard
Command language	SCPI standard interface commands
GPIB compatibility	SH1, AH1, T6, TE0, L4, LEO, SR1, RL1, PP1, DC1, DT1, CO

## Ordering Information

Standard product	
N432A	Thermistor power meter
Standard shipped accessories	Thermistor sensor adaptor cable 1.5 m* (5 ft) Power cord (country dependant) USB adaptor cable Keysight N432A thermistor power meter product reference CD-ROM Envelope–calibration certificate IO libraries media suite
Warranty	Standard 3-year, return-to-Keysight warranty and service plan 3 months for standard shipped accessories
Power sensors, accessories, calibration, and documentation options	
478A-H13	Frequency range 100 kHz to 1 GHz, with maximum SWR 1.8 to 300 KHz, 1.3 to 1 GHz. Include 13 frequency points Standard Lab calibration
478A-H55	Frequency range 1 MHz to 1 GHz, with maximum SWR 1.3
478A-H63	Frequency range 100 kHz to 1 GHz, max SWR 1.8 to 300 kHz, 1.3 to 1 GHz
478A-H72	Frequency range 1 MHz to 1 GHz, with maximum SWR 1.2
478A-H73	Frequency range 1 MHz to 100 MHz, with maximum SWR 1.1, except 1.05 at 50 MHz
478A-H75	Frequency range 1 MHz to 1 GHz, max SWR 1.3 except 1.05 at 50 MHz
478A-H76	Frequency range 1 MHz to 1 GHz, max SWR 1.3 except 1.05 at 50 MHz. Standard lab calibration at 50 MHz
478A-H83	Frequency range 1 MHz to 1 GHz, with maximum SWR 1.3, except 1.05 at 50 MHz Include 8 frequency points Standard Lab calibration
478A-H93	Frequency range 1 MHz to 1 GHz, with maximum SWR 1.3, except 1.05 at 50 MHz Include 2 frequency points Standard Lab calibration
8478B-H01	Frequency range 10 MHz to 18 GHz, with maximum SWR 1.05 at 50 MHz
8478B-H27	Frequency range 10 MHz to 18 GHz. Include Standard Lab calibration at 9 MHz
N4998A	Thermistor sensor adaptor cable 1.5 m (5 ft)
N4998B	Thermistor sensor adaptor cable 3 m (10 ft)
N4998C	Thermistor sensor adaptor cable 6.1 m (20 ft)
N432A-908	Rackmount kit with 1 unit with blank filler included
N432A-909	Rackmount kit with 2 units side-by-side
N432A-OBK	English language user guide and English programming guide
N432A-ABJ	Japanese user guide and English programming guide
N432A-OB1	English language user guide and installation guide
N432A-OBF	English language programming guide
N432A-A6J	Certificate of compliance calibration - ANSI/NCSL Z540
N432A-1A7	Compliant calibration test data - ISO17025

\* The 1.5 m (5 ft) standard cable can be replaced with a 3 or 6.1 m (10 or 20 ft) cable, charges apply



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