

Volt, Phase and Flutter Meters, Measuring Amplifiers

type 2971

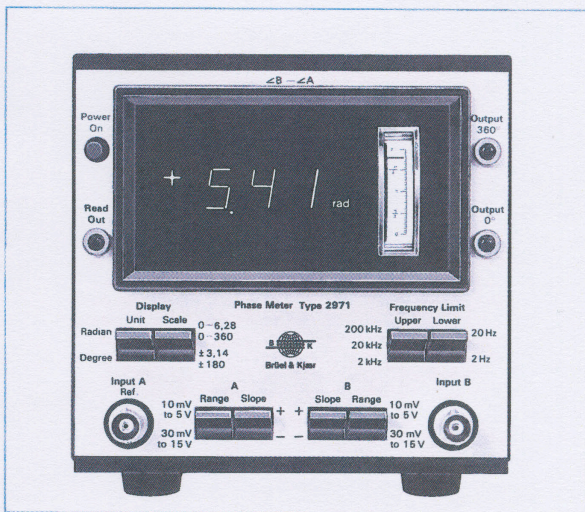
Phase Meter

FEATURES:

- Direct phase indication
- Digital display in degrees and radians
- Analog meter display in radians
- Triggering on positive or negative slope to permit measurement on any waveform
- Frequency range 2 Hz to 200 kHz without necessity of tuning
- Voltage range 10 mV to 15 V with "Out of Range" indication
- DC output \propto to phase angle
- Digital output for use with Tape Punch or Computer
- Provision for use with delay line
- High noise immunity

USES:

- Checking the phase characteristics of filters, amplifiers and transformers
- Mechanical Impedance Measurement
- Determination of loss factor and hence the complex modulus of material samples
- Measuring the phase distortion of loudspeakers (with Phase Delay Unit)
- Trim-balancing aircraft jet engines
- General phase measurement of electrical signals



The Phase Meter Type 2971 is a completely new instrument that fills a gap in the Brüel & Kjær range of precision measuring equipment. This versatile instrument measures the phase angle between two voltages alternating at the same frequency in the range between 2 Hz and 200 kHz. The measured angle is indicated in radians on an edgewise meter and is also shown on a digital display that can be switched to show degrees or radians. The digital display also indicates whether the unknown leads or lags behind the reference. The displays are supplemented by a DC output suitable for use with X-Y or level recorders, and a digital output that can either be recorded or fed to a computer for further processing and possible use in control systems.

Description

The Type 2971 normally accepts voltages in the range between

10 mV and 5V, but as some instruments have 10 V output, a 30 mV to 15 V range is also provided. It is not necessary for the input channels to have the same voltage. Both input channels can be switched to trigger the instrument on either the positive or negative slopes of signals so that any waveform, for example square wave, sine wave, pulse train etc., can be measured. This feature is also used to avoid the ambiguities encountered with some phase meters when the pointer on the analog meter changes from full deflection to zero or vice versa. The zero point (signals in phase) can be set in the centre of the scale by selecting the relevant triggering slopes. Most phase meters allow the zero point to be set at mid scale by changing one of the trigger slopes, but with the Type 2971, the operator decides which slope should be changed, and that is a big advantage where asymmetric signals are to be measured.

The digital information is presented on a Sperry gas discharge display having half inch (12,5 mm) high characters. This type of display has characters composed of seven elements all in the same plane to give easy reading at wide viewing angles.

In addition to the displays, various output possibilities are available. A DC output varying between 0 and 3,6V (with measurement of degrees) or 0 to 6,28V (with measurement of radians) can be fed to a B & K Level Recorder Type 2307 to obtain a permanent record of the measurements. The setting of trace ranges on the Level Recorder is facilitated by a pair of output buttons which allow the minimum and maximum levels to be perused. Digital information is also available from a multipin output on the rear panel. Internal logic controls the transfer of information which is initiated by the READ OUT button or by a request from the receiving unit.

If the voltage in either channel departs from the working range of the instrument, individual "Out of

Range" lamps flash as an indication, and an internal switching function operates the pen-lift of a recorder. Further, this switching can be selected to make, or break the circuit depending on the type of recorder being used.

A pair of switches can be used to limit the frequency range of the instrument. The upper frequency limit can be reduced to 20kHz or 2 kHz to remove high frequency noise, while the lower limit can be raised to 20Hz, thus reducing the instrument's integration time which gives a faster response to changes in phase.

Examples of Use

Phase measurement is becoming of increasing importance in the design and selection of electronic components. The Type 2971 is especially suitable for measuring the phase differences occurring between the input and output of filters, amplifiers and transformers. Phase/frequency curves can be plotted

when a suitable signal generator and level recorder are used. Measurement of the complete phase characteristics of loudspeakers is facilitated by the ability of the Type 2971 to incorporate a Phase Delay Unit Type 6202 into one of its channels. Connection is made via the multipin terminal.

Another important use of the Phase Meter is during measurement of ratios of force and motion. Here knowledge of the phase angle between the two signals may be very useful, for example in finding the complex value of Mechanical Impedance or in the determination of Elastic Modulus and Loss Factor for materials with high degrees of internal damping.

The instrument is built into a cabinet in the B & K Modular Cassette System to enable comprehensive instrumentation packages to be assembled for easy rack mounting. For example such a package might consist of a pair of Voltmeters together with the 2971 and possibly a Frequency Meter Type 5586.

Specifications 2971

Frequency range:

- 2 Hz to 200 kHz
- Low limit switchable to 20 Hz
- High limit switchable to 20 kHz or 2 kHz

Voltage Ranges:

- 10 mV to 5 V
- 30 mV to 15 V (maximum voltage 50V)
- "Out of Range" indication flashes on the digital display

Digital Display:

- Sperry gas discharge 4 figure display with 1/2" (12.5 mm) high characters
- Range: 0° to 360° and 0 to 6,28 radians
- Resolution: 1° or 0,01 radian
- Indication of measured signal lagging or leading the reference
- Information updated approx. three times per second

Frequency Dependence: < 0,03% per kHz above 20 kHz

Accuracy: ± 1 digit to be added to the values in the output error table

Analog Display:

- Edge-wise meter
- Range: 0 to 6,28 radians

Inputs:

- Channel A Reference and Channel B Unknown

Input impedance: 1 MΩ / 47 pF

Input waveform: selection of triggering on positive or negative slopes of the signals permits measurement on any waveform

Response Time:

- Lower Limit 20 Hz: 2400°/s
- Lower Limit 2 Hz: 240°/s

Noise Tolerance:

Less than 2% error for a 10 kHz 1 V sine wave on one channel and a 1 V sine wave plus gaussian noise limited to 500 kHz bandwidth and a signal to noise ratio as listed below:

Upper Limit	Phase Range	
	0° to 180°	180° to 360°
200 kHz	30 dB	16 dB
20 kHz	10 dB	3 dB

Proper phase range is achieved by choice of trigger slope

Outputs:

Analog: DC signal 0 to 3,6V with measurement of degrees, and 0 to 6,28V with measurement of radians

Digital: 14 data lines for 3 BCD characters, sign and unit. Levels according to SN74/TTL series (0V and +5V positive true)

Control signals out: Data Ready, Read Out Pulse, Slope A, Slope B
Control signals in: Data Request, Data Received, Slope A, Slope B

Analog Output Accuracy: over working temperature range 5°C to 40°C (41°F to 104°F)

Minimum Input (10 mV range, for 30 mV range multiply by 3)	Error per °C	Error at 25°C (77°F)
0,5 V RMS	± 0,05°	± 0,5°
0,1 V RMS	± 0,05°	± 1°
0,05 V RMS	± 0,1°	± 1°
0,01 V RMS	± 0,5°	± 3°

Power Supply:

- 100 to 240 V 50 to 400 Hz, 13 VA
- Complies with Safety Class I of IEC 348

Dimensions

- Height: 132,6 mm (5,2 in)
- width: 139,5 mm (5,5 in)
- Depth: 200,0 mm (7,9 in)
- (KK 0024 Cabinet, 4/12 of 19" rack module)

Weight:

- 2,8 kg (6,2 lb)

Accessories Supplied:

- 2 BNC plugs JP 0035
- 2 DIN plugs JP 0703
- 1 Power cable AN 0010