

**TIME AND FREQUENCY MEASUREMENT INSTRUMENTS**  
**Frequency and Phase Comparators, Phase Comparators-Receivers**

# CH7-46, CH7-46A Frequency Comparators

◆ **Small frequency stability measurement error  $7 \cdot 10^{-14}/s$ ,  $5 \cdot 10^{-16}/hour$**



## DESCRIPTION

The CH7-46 and CH7-46A Frequency Comparators are designed to measure:

- phase and frequency difference of 5, 10, 100 MHz signals of frequency standards and high stability oscillators;
- frequency instability;
- phase and frequency instability introduced by amplifiers, frequency multipliers, frequency dividers and other assemblies with 5, 10 or 100 MHz output frequencies;
- spectral density of phase fluctuations (with an external spectrum analyzer).

## PRINCIPLE OF OPERATION

The CH7-46, CH7-46A principle of operation is based on 5, 10 or 100 MHz frequency conversion into 1 Hz frequency with multiplication of relative frequency instability by  $10^4$ ,  $10^6$  or  $10^8$  times.

To perform measurements the Frequency Comparator output frequency is applied to the Time Interval Meter and then is output to PC, which controls measurements, carries out statistical processing of results: computes RMS deviation, Allan deviation, linear frequency drift, robust estimates, builds frequency/time dependence graphs.

The Frequency Comparators have a phase detector to measure phase noise.

The CH7-46 Frequency Comparator comprises 5, 10, 100 MHz frequency converter.

The CH7-46A Frequency Comparator comprises:

- the CH7-46 Frequency Comparator;
- the Time Interval Meter built-in into PC;
- the IBM PC (to customer order);
- software.

## SPECIFICATIONS

Frequencies of input signals: 5, 10 or 100 MHz

Multiplication coefficients of measurement resolution:  $k=10^4$ ,  $10^6$ ,  $10^8$

Input signals voltage:  $1 \pm 0.2$  V into 50 Ohm load

Frequency deviation from nominal value not more than:

- for  $k=10^8$   $5 \cdot 10^{-11}$
- for  $k=10^6$   $5 \cdot 10^{-9}$
- for  $k=10^4$   $3.5 \cdot 10^{-7}$

The main measurement error (RMS)

Averaging time	Error		Multiplication coefficient k
	Input frequency 100 MHz	Input frequency 5, 10 MHz	
1 s	$5 \cdot 10^{-14}$	$7 \cdot 10^{-14}$	$10^8$
10 s	$7 \cdot 10^{-15}$	$1 \cdot 10^{-14}$	$10^8$
100 s	$2 \cdot 10^{-15}$	$2.5 \cdot 10^{-15}$	$10^8$
1 h	$3 \cdot 10^{-16}$	$5 \cdot 10^{-16}$	$10^6$

Note. Error  $\tau=100$  s and 1 h is specified only at  $\pm 1$  °C ambient temperature change in the operating temperature range.

The main error for input frequency 5 MHz, multiplication coefficient  $10^4$ :

- 1 s  $4 \cdot 10^{-13}$
- 10 s  $4 \cdot 10^{-14}$

Temperature coefficient of phase change: 15 ps/ °C

Phase noise introduced by the Frequency Comparator during frequency standard phase noise measurements at carrier frequency offset:

- 10 Hz -145 dB/Hz
- 100 Hz -150 dB/Hz
- 1 kHz -155 dB/Hz
- 10 kHz -155 dB/Hz

## GENERAL

Power:  $220 \pm 22$  V, 45-65 Hz

At ac line failure the CH7-46 automatically switches to 22-30 V external power supply without an interruption in operation.

Power consumption (CH7-46)

- ac: 50 VA
- dc: 40 W

Operating temperature range: 5...50 °C

Dimensions: 480x160x500 mm

Weight: 20 kg