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INSTRUMENTS FOR POWER INDUSTRY

Making energy visible

LOW-INDUCTANCE CURRENT SHUNTS

Current Shunts of CS series

Rated current: 1.0 mA to 100 A

History

The first prototype was manufactured at the D.I. Mendeleev All-Russian Institute for Metrology (VNIIM) in the late 1970s. Nowadays similar shunts are serially produced by Fluke Corporation (USA) under the brand "A40B Current Shunts" (No. 51518-12).

Mars-Energy manufactures sets of reference-class low-inductance AC current shunts of the CS series in various configurations depending on the rated current and resistance.



**0.02 A,
0.1 A**

2.5–10 A

**50 A,
100 A**

Target users

State institutes for metrology and calibration/metrology laboratories

Purpose

The reference-class low-inductance shunts are intended to measure DC current and AC current in the frequency range from 10 Hz to 100 kHz.

Equivalent

The Fluke A40B current shunts (produced by Fluke Corporation, USA) are known as the most precision ones operating in the range from 10 Hz to 100 kHz which are in most common use among state metrology institutes all over the world. The shunts measure current from 1 mA to 100 A providing an output voltage of 0.8 V at a rated load. The “squirrel cage” principle underlying the design of the Fluke shunts has been originally developed in the “Electrical Power Measurements” laboratory of the All-Russian Institute for Metrology named after D.I. Mendeleev. Later such a design became a common practice around the world.

The shunts Fluke A40B and our shunts of CS series feature the same design and characteristics, but the latter ones are entirely manufactured in Russia. Our shunts have been used as part of state standards in Russia and other countries over many years. Each shunt is calibrated in the D.I. Mendeleev Institute for Metrology.

In the sphere of mass-scale calibration, the CS shunts serve as a modern alternative to high-precision measures of electrical resistance and shunts Fluke A40B. They can be used for calibration of the following precision measuring instruments:

Tested device	Registry #
Multimeters Fluke 8508A	25984-14
Calibrators Fluke 5500A	20211-00
Calibrators Fluke 5500A	20211-06
Calibrators Fluke 5502A(E)	55804-13
Calibrators Fluke 5520A	23346-02
Calibrators Fluke 5520A	29282-05
Calibrators Fluke 5522A, 5520A	51160-12
Calibrators 3010, 3041, 3050, Transmille Ltd., UK	34284-07
Calibrator/Multimeter 5051Plus, Time Electronics, UK	25200-03
Calibrators Fluke 5700A, Fluke 5720A with amplifier, and Fluke 5725A	52495-13
Calibrator Fluke 5080A	52496-13
General-purpose calibrators N4-7, N4-7/1, RITM, city of Krasnodar, Russia	22125-01

Highlights

- The design of the shunts ensures minimal:
 - Stray inductance and capacitance
 - Mutual inductance between current and voltage circuits
 - Leakage currents
 - Heating-dependent change in resistance caused by operating current flow thanks to natural cooling and application of low TCR resistors
 - Impact of frequency-dependent behaviour of the resistors in use.
- Time of continuous operation of the shunts at a time below 120% of the rated current is unlimited.
- Average lifetime of the shunts is no less than 15 years.

Scope of supply

1. Set of reference-class low-inductance current shunts (as selected at the time of order)
2. Current cable compatible with the rated current of the shunt (10 A, 50 A, or 100 A)
3. Voltage cable for connection to measuring instruments
4. Equipment certificate
5. Plastic cases for transportation and storage of the shunts





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Basic accuracy specifications

Parameter	Value
Limits of permissible phase shift between the input current and output voltage of the shunt caused by current-to-voltage conversion at a frequency from 10 to 70 Hz	3–10 μ rad

Accuracy specifications for AC current measurements

Rated current I_N , A	Frequency, kHz					
	0.02...0.70	1	10	20	50	100
0.001	± 0.0055	± 0.0055	± 0.0075	± 0.01	± 0.014	± 0.02
0.02	± 0.005	± 0.005	± 0.0075	± 0.01	± 0.014	± 0.02
0.1	± 0.005	± 0.005	± 0.0075	± 0.01	± 0.014	± 0.02
0.5	± 0.005	± 0.005	± 0.0075	± 0.015	± 0.02	± 0.025
1	± 0.005	± 0.005	± 0.0075	± 0.015	± 0.02	± 0.025
2.5	± 0.005	± 0.005	± 0.0075	± 0.015	± 0.02	± 0.025
5	± 0.005	± 0.005	± 0.0075	± 0.02	± 0.025	± 0.03
10	± 0.007	± 0.007	± 0.008	± 0.02	± 0.025	± 0.03
50	± 0.015	± 0.015	± 0.015	± 0.03	± 0.035	± 0.04
100	± 0.015	± 0.015	± 0.015	± 0.035	± 0.04	± 0.06

Basic specifications

Parameter	Value
AC frequency operating range	From 10 Hz to 100 kHz
Operating range for AC/DC current measurements	From $0.1 \cdot I_{NOM}$ to $1.2 \cdot I_{NOM}$
Change in resistance caused by self-heating (relative)	$\pm 0.003\%$, or less
Temperature Coefficient of Resistance (TCR)	$1.0 \cdot 10^{-6} K^{-1}$, or less