High Accuracy Capacitance Substituter

HACS-Z Series

The HACS-Z provides a wide range of capacitance in increments as low as 1 pF and a total capacitance of up to 10,000 µF. With its high quality, tight tolerance capacitors, it is an ideal part of a test or calibration system.

- High accuracy: 0.05% or 0.1%
- Low zero capacitance <0.1 pF
- Programmable version available
- Trimmable capacitors for lower decades
- 3-Terminal shielded construction
- Excellent stability - 100 ppm/yr
- Special high voltage units up to 10 kV
- Excellent TC - begins at 20 ppm/°C

Six Decade HACS-Z Capacitance Substituter

SPECIFICATIONS

Capacitor Type: Air capacitors for 1 and 10 pF steps;
stabilized sealed silvered-mica for 100 pF through 100 nF steps.
hermetically sealed polystyrene capacitors for 1 µF steps;
hermetically sealed metallized polycarbonate capacitors for 10 µF steps and over; polypropylene for 1000 µF steps.
1, 10, 100 and 1000 pF decades are trimmable from rear.

Accuracy:
A: ±(0.05% + 0.5 pF); ± 0.5% for 100 µF steps.
B: ±(0.1% + 1.0 pF); ± 0.5% for 100 µF steps.
[If 1,000 µF steps are present, accuracy for 6 to 10 µF at 1 kHz is: ±(0.1% + 0.5 pF)]

Test Conditions:
at 1 kHz for 1 pF to 10 µF; 100 Hz for 1 µF and over,
at 23°C, no zero subtraction, measured with a 3-terminal connection. (Calibration at other frequencies is available, and different frequencies may be selected for different decades.) SI traceable.

Range: 0 to 10,000 µF available, with minimum increments of 1 pF; see table on next page.

Dissipation Factor:
<0.002 for 1 pF and 10 pF steps;
<0.001 for 100 pF steps;
<0.0005 for 1 nF and 2 nF steps;
<0.0003 for 3 nF step through all 0.01 µF steps;
<0.0004 for 0.1 µF steps;
<0.0007 for 1 µF steps;
<0.007 for 10 µF steps;
<0.005 for 100 µF steps.

Zero Capacitance:
≤0.1 pF, measured with a 3-terminal connection, for units with highest decade steps ≤100 nF;
≤2 pF, measured with a 3-terminal connection, for units with highest decade steps 1 µF.

Insulation Resistance: >50,000 MΩ.

Operating Frequency Range: 10 Hz or less to at least 1 MHz.

Stability:
A: ±(100 ppm + 0.1 pF) per year for 0.1 µF steps and under;
±200 ppm per year for 1 µF and 10 µF steps;
±500 ppm per year for 100 µF and 1000 µF steps.
B: ±(200 ppm + 0.1 pF) per year for all steps.
±500 ppm per year for 1 µF and 10 µF steps;
±1000 ppm per year for 100 µF and 1000 µF steps.

MAXIMUM VOLTAGE:
1 pF through 100 nF steps: 500 V peak max up to 10 kHz;
1 µF steps: 50 V peak max
10 µF and 100 µF steps : (Vdc+Vac)< 30 V or (Vac)< 22 V, whichever applies first, where $Vac=1.8x10^4/f$, and f is freq. in Hz
Optional: up to 10 kV

Temperature Coefficient:
A: ≈20 ppm/°C for 0.1 µF steps and under;
-50 ppm/°C for 1 µF through 100 µF steps;
-150 ppm/°C for 1000 µF steps;

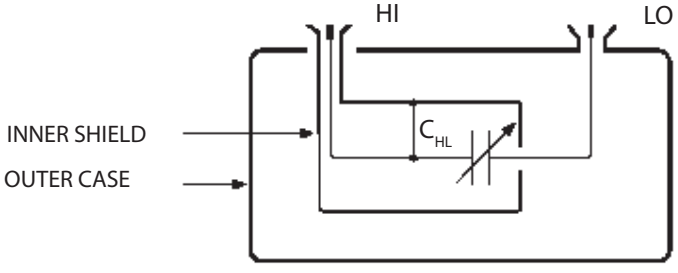
Operating Temperature Range: 10°C to 40°C.
Operating Frequency Range: 10 Hz or less to at least 1 MHz.

Shielding: Double shielded construction.

Dimensions: 43.2 cm W x 14.2 cm H x 30.4 cm D (17" x 5.6" x 12"), for 6 decade version.
Weight: 5.9 kg (13 lb), for 6 decade version.
Connection to Substituter: BNC (standard) or 874 type coaxial connectors (optional) labeled HI and LO on front panel. Also available is an optional 36 pin connector providing individual BCD weighted equivalent contacts for each decade.

DOUBLE SHIELDED CONSTRUCTION

The shielding is divided into two different parts: an inner shield that minimizes the low terminal-to-guard capacitance, and an outer shield (the case) that minimizes the detector input capacitance and noise.
When these two shields are connected together, the HACS-Z becomes an excellent 3-terminal capacitance substituter with low zero capacitance.



Double Shielded Construction

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ORDERING INFORMATION

STANDARD MODELS

Models*		Total Capacitance	No. of Decades	Resolution
Accuracy 0.05%	Accuracy 0.1%			
HACS-Z-A-3E-1pF	HACS-Z-B-3E-1pF	1,110 pF	3	1 pF
HACS-Z-A-3E-10pF	HACS-Z-B-3E-10pF	11,100 pF	3	10 pF
HACS-Z-A-3E-100pF	HACS-Z-B-3E-100pF	111,000 pF	3	100 pF
HACS-Z-A-3E-1nF	HACS-Z-B-3E-1nF	1.11 µF	3	1 nF
HACS-Z-A-3E-10nF	HACS-Z-B-3E-10nF	11.1 µF	3	10 nF
HACS-Z-A-3E-100nF	HACS-Z-B-3E-100nF	111 µF	3	100 nF
HACS-Z-A-3E-1µF	HACS-Z-B-3E-1µF	1,110 µF	3	1 µF
HACS-Z-A-3E-10µF	HACS-Z-B-3E-10µF	11,100 µF	3	10 µF
HACS-Z-A-4E-1pF	HACS-Z-B-4E-1pF	11,110 pF	4	1 pF
HACS-Z-A-4E-10pF	HACS-Z-B-4E-10pF	0.1111 µF	4	10 pF
HACS-Z-A-4E-100pF	HACS-Z-B-4E-100pF	1.111 µF	4	100 pF
HACS-Z-A-4E-1nF	HACS-Z-B-4E-1nF	11.11 µF	4	1 nF
HACS-Z-A-4E-10nF	HACS-Z-B-4E-10nF	111.1 µF	4	10 nF
HACS-Z-A-4E-100nF	HACS-Z-B-4E-100nF	1,111. µF	4	100 nF
HACS-Z-A-4E-1µF	HACS-Z-B-4E-1µF	11,110 µF	4	1 µF
HACS-Z-A-5E-1pF	HACS-Z-B-5E-1pF	0.111 11 µF	5	1 pF
HACS-Z-A-5E-10pF	HACS-Z-B-5E-10pF	1.111 1 µF	5	10 pF
HACS-Z-A-5E-100pF	HACS-Z-B-5E-100pF	11.111 µF	5	100 pF
HACS-Z-A-5E-1nF	HACS-Z-B-5E-1nF	111.11 µF	5	1 nF
HACS-Z-A-5E-10nF	HACS-Z-B-5E-10nF	1,111.1 µF	5	10 nF
HACS-Z-A-5E-100nF	HACS-Z-B-5E-100nF	11,111 µF	5	100 nF
HACS-Z-A-6E-1pF	HACS-Z-B-6E-1pF	1.111 11 µF	6	1 pF
HACS-Z-A-6E-10pF	HACS-Z-B-6E-10pF	11.111 1 µF	6	10 pF
HACS-Z-A-6E-100pF	HACS-Z-B-6E-100pF	111.111 µF	6	100 pF
HACS-Z-A-6E-1nF	HACS-Z-B-6E-1nF	1,111.11 µF	6	1 nF
HACS-Z-A-6E-10nF	HACS-Z-B-6E-10nF	11,111.1 µF	6	10 nF
HACS-Z-A-7E-1pF	HACS-Z-B-7E-1pF	11,111.11 µF	7	1 pF

*For 10 position switches, "0" - "9", in lieu of 11 position "0" - "10", delete E from model number.
Add suffix: BCD- for the BCD output option, RM- for rack mount option.

OPTIONAL MODELS

In order to satisfy any requirement for a HACS-Z Series capacitor, generate a part number from the chart below.

HACS-Z - A - 6E - 1pF - RM - __ ___

(Example: 0 to 1.11111 µF, 0.05% with 1 pF resolution, rack mount, with BNC connectors.)

Tolerance	No. of Decades	Capacitance/Step for Lowest Decade	Packaging	Connector Option
A: 0.05% B: 0.1%	1 to 7; add E for most significant decade extended by 10%	1 pF to 100 µF	NIL: Standard bench top case RM: Rack mounting option	NIL: BNC BP: Binding posts 874: 874 type