

HACS-Z Series

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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/ $^{\circ}\text{C}$

SPECIFICATIONS

Capacitor Type: Air capacitors for 1 and 10 pF steps; stabilized sealed silvered-mica for 100 pF through 100 nF steps; polystyrene capacitors for 1 μF steps; hermetically sealed metallized polycarbonate capacitors for 10 μF steps; metallized Polyphenylene Sulfide for 100 μF steps; polypropylene for 1000 μF steps.

1, 10, 100 and 1000 pF decades are trimmable from rear.

Accuracy:

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

Test Conditions:

1 kHz, for 1 μF steps and under;
100 Hz (equivalent to 120 Hz), for 10 μF steps and over;
at 23 $^{\circ}\text{C}$, no zero subtraction; S1 traceable.

(Calibration at other frequencies is available, and different frequencies may be selected for different decades.)

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:

$\leq 0.1 \text{ pF}$, measured with a 3-terminal connection, for units with highest decade steps $\leq 0.1 \mu\text{F}$;
 $\leq 2 \text{ pF}$, measured with a 5-terminal connection, for units with highest decade steps 1 through 100 μF ;
 $\leq 10 \text{ pF}$ (typically lower), measured with a 5-terminal connection, for units with highest decade steps of 1000 μF .



Six Decade HACS-Z Capacitance Substituter

Insulation Resistance: >50,000 $\text{M}\Omega$.

Operating Frequency Range: 10 Hz or less to at least 1 MHz, for units with highest decade steps $\leq 0.1 \mu\text{F}$; see chart on pg 2 for frequency performance.

Stability:

A: $\pm(100 \text{ ppm} + 0.1 \text{ pF})$ per year for 0.1 μF steps and under;
 $\pm 200 \text{ ppm}$ per year for 1 μF and 10 μF steps;
 $\pm 500 \text{ ppm}$ per year for 100 μF and 1000 μF steps.
B: $\pm(200 \text{ ppm} + 0.1 \text{ pF})$ per year for 0.1 μF steps and under;
 $\pm 500 \text{ ppm}$ per year for 1 μF and 10 μF steps;
 $\pm 1000 \text{ ppm}$ 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: $(V_{\text{dc}} + V_{\text{ac}}) < 50 \text{ V}$ or $(V_{\text{ac}}) < 22 \text{ V}$, whichever applies first, where $V_{\text{ac}} = 1.8 \times 10^{-4} / f$, and f is frequency in Hz;
1000 μF steps: $(V_{\text{dc}} + V_{\text{ac}}) < 50 \text{ V}$;
Optional: up to 10 kV

Temperature Coefficient:

$\approx 20 \text{ ppm}/^{\circ}\text{C}$ for 0.1 μF steps and under;
 $\pm 50 \text{ ppm}/^{\circ}\text{C}$ for 1 μF through 100 μF steps;
 $-150 \text{ ppm}/^{\circ}\text{C}$ for 1000 μF steps;

Operating Temperature Range: 10 $^{\circ}\text{C}$ to 40 $^{\circ}\text{C}$.

Shielding: Double shielded construction for units with highest decade steps $\leq 100 \mu\text{F}$.

Connection to Substituter: 2 bnc (standard) or 874 type coaxial connectors (optional) labeled HI and LO on rear panel for units with highest decade $\leq 1 \mu\text{F}$ steps.
4 binding posts for units with 1 μF steps and over.

Mechanical:

43.2 cm W x 14.2 cm H x 30.4 cm D (17" x 5.6" x 12"), for units with highest decade steps $\leq 100 \text{ nF}$; 9.5 kg (21 lb)
53.3 cm W x 33.0 cm H x 33.0 cm D (21" x 13" x 13"), for 7 decade units,
23.6 kg (52 lb)



HACS-Z Series

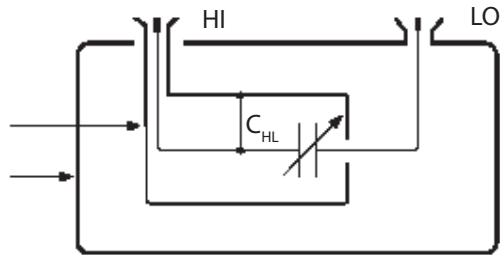
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DOUBLE SHIELDED CONSTRUCTION

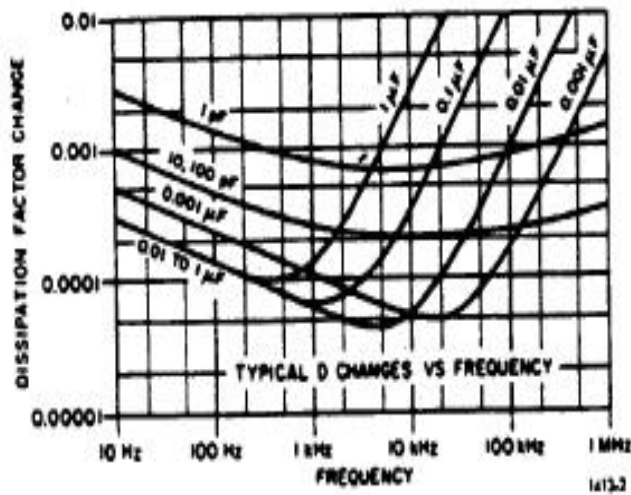
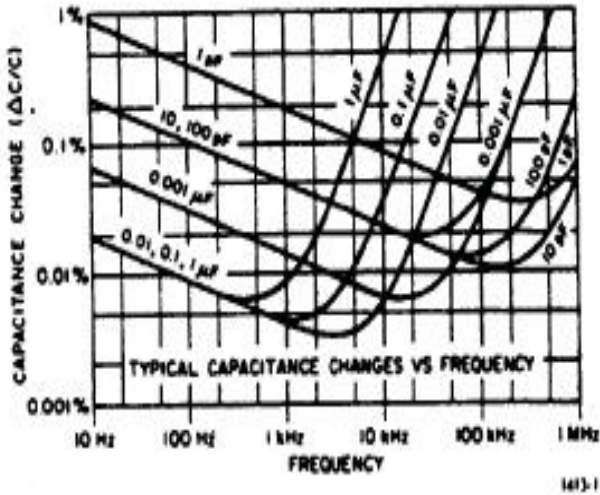
The shielding is divided into two different parts: an inner shield that minimizes the low terminal-to-guard capacitance, and an outer shield (the case) that minimizes the detector input capacitance and noise.

When these two shields are connected together, the HACS-Z becomes an excellent 3-terminal capacitance substituter with low zero capacitance. Applies to units with highest decade $\leq 1 \mu F$ steps.

INNER SHIELD
OUTER CASE



Double Shielded Construction



HACS-Z-10E-1pF
1 pF - 11,111.111 11 μF
1000 μF decade employs binding posts



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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
HACS-Z-A-7E-10pF	HACS-Z-B-7E-10pF	111.111.1 μF	7	10 pF
HACS-Z-A-7E-100pF	HACS-Z-B-7E-100pF	1,111.111 μF	7	100 pF
HACS-Z-A-7E-1nF	HACS-Z-B-7E-1nF	11,111.111 μF	7	1 nF
HACS-Z-A-8E-1pF	HACS-Z-B-8E-1pF	111.111.11 μF	8	1 pF
HACS-Z-A-8E-10pF	HACS-Z-B-8E-10pF	1,111.111.1 μF	8	10 pF
HACS-Z-A-8E-100pF	HACS-Z-B-8E-100pF	11,111.111 μF	8	100 pF
HACS-Z-A-9E-1pF	HACS-Z-B-9E-1pF	1,111.111.11 μF	9	1 pF
HACS-Z-A-9E-10pF	HACS-Z-B-9E-10pF	11,111.111.1 μF	9	10 pF
HACS-Z-A-10E-1pF	HACS-Z-B-10E-1pF	11,111.111.11 μF	10	1 pF

Add suffix:

BCD- for the BCD output option

RM- for rack mount option .

