

Precision Decade Capacitor

1413 Series p. 1 of 2

1413 Precision Decade Capacitor is a high-quality, high-accuracy, high-stability, wide-range standard. It is ideal for verification and calibration of LCR meters and multimeters.

- Capacitance Range: 1 pF to 1.111 11 μ F
- Base Accuracy: 0.05%
- Resolution: 6 digits
- Zero-Capacitance: <0.1 pF
- Stability: 100 ppm/year
- TC: <20 ppm/ $^{\circ}$ C
- Rack mounting available
- Front and rear outputs available



1413 Precision Decade Capacitor

For greater range and flexibility see the [HACS-Z Series](#)

SPECIFICATIONS

| Capacitance per step | Total decade capacitance | Max voltage | Accuracy* | Dissipation factor* | Stability | Capacitor type |
|----------------------|--------------------------|-----------------------------|---------------------------------|--|--|---|
| 1 pF | 10 pF | 500 V peak max up to 10 kHz | $\pm (0.05\% + 0.5 \text{ pF})$ | <0.002 | $\pm(100 \text{ ppm} + 0.1 \text{ pF})$ per year | Air capacitors |
| 10 pF | 100 pF | | | Position 1: <0.002 All others: <0.001 | | |
| 100 pF | 1 nF | | | Position 1: <0.001 Position 2: <0.0005 All others: <0.0003 | | Silvered mica Mechanically stabilized Hermetically sealed |
| 1,000 pF | 10 nF | | | <0.0003 | | |
| 0.01 μ F | 100 nF | | | <0.0003 | | |
| 0.1 μ F | 1 μ F | | | <0.0004 | | |

*1 kHz, 3-terminal measurement; series model; 1 Vrms, 23 $^{\circ}$ C; traceable to SI
No zero-subtraction required

Zero Capacitance:

≤ 0.1 pF maximum capacitance obtained with all dials set to zero;

Temperature Coefficient:

<20 ppm/ $^{\circ}$ C

Insulation Resistance:

>50,000 M Ω

Operating Temperature Range:

10 $^{\circ}$ C to 40 $^{\circ}$ C

Shielding:

Double-shielded construction; see below.

Connection to Capacitor:

Two bnc connectors labeled **HI** and **LO** are located on front panel.

Dimensions:

Bench: 43.2 cm W x 13.3 cm H x 27.7 cm D (17" x 5.2" x 10.9")

Rack: 48.3 cm W x 13.3 cm H x 27.7 cm D (19" x 5.2" x 10.9")

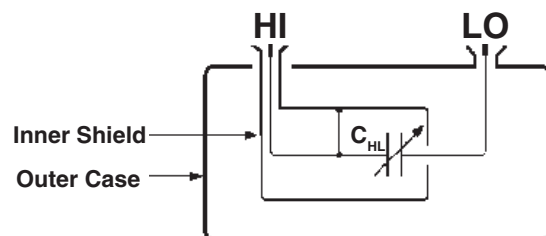
Weight:

8.6 kg (19 lb) for bench version

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.

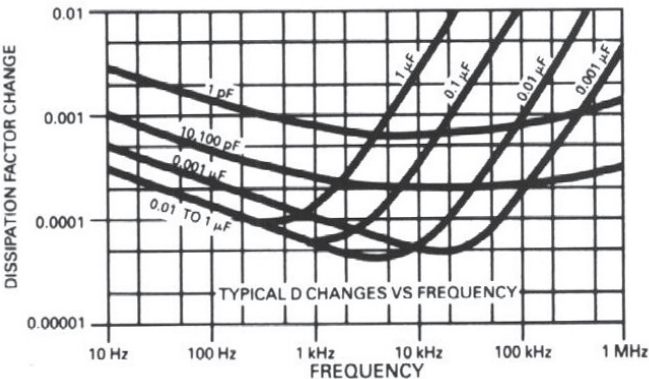
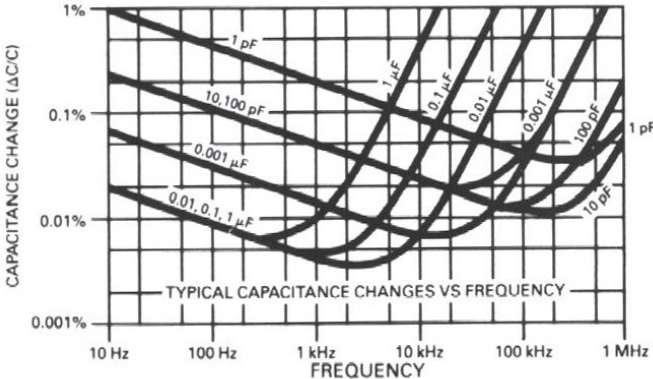
The outer shell of the **HI** connector is connected to the switch shaft. The outer shell of the **LO** connector is connected to the outer case. When these two shields are connected together, the 1413 becomes an excellent 3-terminal capacitance substituter with low zero capacitance.



Double Shielded Construction



FREQUENCY CHARACTERISTICS



MAX TERMINAL CAPACITANCE

| Capacitance values | 1 pF - 100 pF | 101 pF - 1000 pF | 1001 pF - 2000 pF | 2001 pF - 0.1 μF | >0.1 μF |
|--------------------------|--|--|---|--|--|
| Max Terminal Capacitance | HIGH to Case: 4 pF HIGH to GUARD: 85 pF LOW to GUARD: 45 p | HIGH to Case: 8 pF HIGH to GUARD: 110 pF LOW to GUARD: 70 pF | HIGH to Case: 10 pF HIGH to GUARD: 125 pF LOW to GUARD: 80 pF | HIGH to Case: 30 pF HIGH to GUARD: 165 pF LOW to GUARD: 110 pF | HIGH to Case: 60 pF HIGH to GUARD: 200 pF LOW to GUARD: 120 pF |

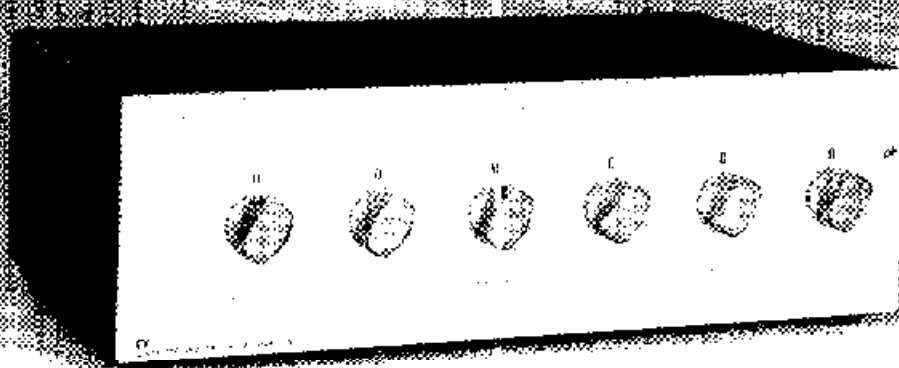
ORDERING INFORMATION

Precision Decade Capacitor - Benchtop Model: **1413-9700**
 Precision Decade Capacitor - Rack Mount Model: **1413-9701**

Optional

For rear output option, add **-RO** at the end of the part number.





1413 Precision Decade Capacitor

- 0 to $>1 \mu\text{F}$
- 0.05% basic accuracy
- 6-digit resolution
- 3-terminal connections
- provision for BCD output

The 1413 is not only a precision standard, it is a systems component as well. Connections are made at the rear and each decade provides contact closures for 1-2-4-8 BCD output. It is an excellent companion to the 1654 Impedance Comparator, with which it is combined in 1654-Z Sorting Systems.

SPECIFICATIONS

Range: 0 to 1.11111 μF , controlled by six in-line-readout dials.

Accuracy: $\pm(0.05\% + 0.5 \text{ pF})$ at 1 kHz.

Stability: $\pm(0.01\% + 0.1 \text{ pF})$ per year. TEMPERATURE COEFFICIENT: $\pm 20 \text{ ppm}/^\circ\text{C}$ from 10 to 50°C.

Zero Capacitance: $\leq 0.1 \text{ pF}$.

Voltage Rating: 500 V pk max up to 10 kHz.

Frequency: See curves.

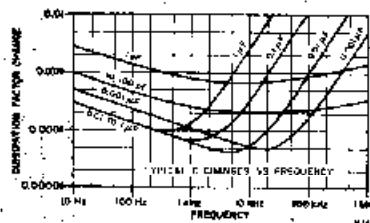
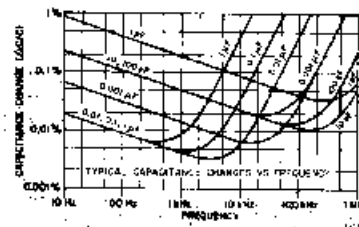
| | 1 pF to 100 pF | 101 pF to 1000 pF | 1001 pF to 2000 pF | 2001 pF to 0.1 μF | 0.1 μF to 1.11111 μF |
|--|-----------------------------|-------------------|--------------------|------------------------------|--|
| Dissipation Factor, max at 1 kHz | 0.002 | 0.001 | 0.0005 | 0.0003 | 0.0004 |
| Insulation Resistance, 3 term., after 2 min at 500 V dc | $\geq 5 \times 10^9 \Omega$ | | | | $\geq 5 \times 10^9 \Omega$ |
| Terminal Capacitance, max | | | | | |
| high to case | 4 pF | 8 pF | 10 pF | 30 pF | 60 pF |
| high to guard | 85 pF | 110 pF | 125 pF | 165 pF | 200 pF |
| low to guard | 45 pF | 70 pF | 80 pF | 110 pF | 120 pF |

Interface: CONNECTIONS: 2 rear-mounted GR874[®] locking connectors. DATA OUTPUT: 36-pin Amphenol Type 57 connector provides connections to 1-2-4-8 weighted BCD contacts rated at 28 V, 1 A, on each decade switch.

Available: 0480-9703 RACK-ADAPTOR SET to convert bench models to rack models. 874-Q2 ADAPTOR to convert GR874 connector to binding posts (2 req'd), 938-L SHORTING LINK to connect shields together when 874-Q2 Adaptors are used, 4220-3036 CONNECTOR to mate with Data Output Connector.

Six precision decades are employed to provide a range of 0 to 1.11111 μF in increments as small as 1 pF and with an accuracy of 0.05% + 0.5 pF. Air capacitors are used for the two lower decades and precision silvered-mica capacitors are used for the remainder. The lower four decades contain adjustments that are factory set but accessible for readjustment later if desired.

The shielding is divided into two parts, arranged to provide low terminal-to-guard capacitances and low detector input capacitance in order to reduce errors with the 16b4. When the two shields are connected together, the 1413 becomes a well-shielded three-terminal capacitor with an extremely low zero capacitance, suitable for a variety of applications.



Mechanical: Convertible-bench cabinet. DIMENSIONS (w x h x d): Bench, 17x5.59x11.96 in. (432x142x304 mm); rack, 19x5.22x10.9 in. (483x133x277 mm). WEIGHT: Bench, 23 lb (11 kg) net, 29 lb (14 kg) shipping; rack, 24 lb (11 kg) net, 30 lb (14 kg) shipping.

| Description | Catalog Number |
|---------------------------------|----------------|
| 1413 Precision Decade Capacitor | |
| Bench Model | 1413-9700 |
| Rack Model | 1413-9701 |
| Rack-Adaptor Set | 0480-9703 |