

1.5 SYMBOLS, ABBREVIATIONS, AND DEFINITIONS.

Definitions for symbols used on the panel of the Type 1617 and for abbreviations used in this instruction manual are as follows:

C capacitance (see below for units)

C_s series capacitance $C_s = (1 + D^2) C_p$

C_p parallel capacitance $C_p = \frac{1}{1 + D^2} C_s$

L inductance (see below for units)

R resistance, the real part of an impedance – (see below for units)

R_s series resistance

R_p parallel resistance

X reactance, the imaginary part of an impedance

Z impedance

D dissipation factor $\frac{R}{X} = \frac{1}{Q}$

for capacitors $= \omega C_s R_s = \frac{1}{\omega C_p R_p}$

PF power factor $= \frac{R}{|Z|} = \frac{R}{\sqrt{R^2 + X^2}} = \frac{D}{\sqrt{1 + D^2}}$

ESR equivalent series resistance $= R_s = \frac{D}{\omega C_s}$

f frequency in hertz (Hz)

ω angular frequency (rad/sec) $= \omega = 2\pi f$

F farad, unit of capacitance

mF millifarad $= 10^{-3}F = 10^3\mu F$

μF microfarad $= 10^{-6}F = 10^3nF = 10^6pF$

nF nanofarad $= 10^{-9}F = 10^{-3}\mu F = 10^3pF$

pF picofarad $= 10^{-12}F = 10^{-6}\mu F = 10^{-3}nF$

Ω ohm, unit of resistance

m Ω milliohm $= 10^{-3}\Omega$

k Ω kilohm $= 10^3\Omega$

M Ω megohm $= 10^6\Omega = 10^3k\Omega$

H henry, unit of inductance

mH millihenry $= 10^{-3}H$

μH microhenry $= 10^{-6}H$

nH nanohenry $= 10^{-9}H$

1.6 OPERATOR SAFETY.

Measurements on charged capacitors are inherently dangerous. The Type 1617 Capacitance Bridge, being a self-contained instrument, is naturally safer than a temporary clip-lead set up and all possible safety features were included in its design. The operator must follow instructions at all times to ensure safe use of the instrument.

Connect or disconnect the capacitor to be tested only when both warning lights are off. This means that bias is not applied (CHARGE-DISCHARGE switch on the DISCHARGE position) and that there is less than 1 volt across the capacitor.

Do not rely solely on the warning lights (the lamps might burn out), especially if repeated measurements are to be made; use insulated test clips, rubber gloves, and a chair insulated from the ground.

Several capacitors in the instrument itself can carry charges of lethal energy; they are safe only when both warning lights are off.

When no bias is to be applied, set the VOLTAGE/RANGE switch to 2 V, the BIAS ADJ to EXT, and the CHARGE-DISCHARGE switch to DISCHARGE. Under these conditions, an accidental change in the setting of one of the controls will not endanger the operator.

If the bridge is never going to be used with internal dc bias, the bias supply can be disabled by disconnection of the leads to pins 10 through 15 on the power-transformer plate (see Figure 6-2). If only the lower bias voltages are to be used, the higher voltages can be eliminated by disconnection of pin 12 of the power transformer and by shorting the appropriate resistor (Table 1-3).

Table 1-3
Bias Range Variation

| Resistor Shorted | Value | Range Eliminated |
|------------------|--------|------------------|
| R115 | 402 K | 600 V |
| R154 | 140 K | 200 V |
| R153 | 40.2 K | 60 V |
| R152 | 14 K | 20 V |
| R151 | 4.02 K | 6 V |