

CONDENSED OPERATING INSTRUCTIONS

for

TYPE 1605-A,-AH IMPEDANCE COMPARATOR

(For complete details, refer to Instruction Book for Type 1605-A,-AR.)

U.S. Patent Nos. 2,548,457 and D187,740



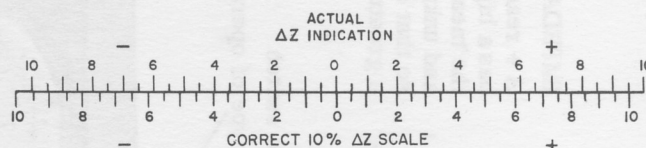
GENERAL PROCEDURE

- Turn the POWER switch on and allow about 15 minutes for warmup.
- To check the zeros of the meters, turn the function switch to either ZERO position and adjust the thumb-set ZERO controls for zero meter readings.
- Connect the standard and unknown components to the appropriate terminals using either direct connections or the Type 1605-P1.
- Select the operating frequency and check with the table below for impedance limits.
- To calibrate the ΔZ meter, set the IMPEDANCE DIFFERENCE PERCENTAGE switch to 1, set the function switch to CAL 1%, and adjust the CAL control to give a 1% (full-scale) indication.
- Select the desired range for the ΔZ and $\Delta \theta$ meters.
- Select guarded or unguarded operation. Guarded operation is preferred for shielded components or for remote measurements. Capacitance to the shield is reduced by a factor of 30 if the shield is guarded.
- Results are indicated by the ΔZ and $\Delta \theta$ meters.

ACCURACY

The accuracy of the Type 1605-A, except on the 10% impedance range, is 3% of full scale, i.e., for the $\pm 0.3\%$ impedance-difference scale, accuracy is 0.009% of the impedance magnitude measured. The ΔZ meter indicates the percent difference with respect to the average of the standard and unknown impedance. At a reading of 10%, there is a 0.5% difference between this and the percent with respect to the standard as shown

on the correction chart. This difference is negligible on the lower ranges.



The instrument may produce smaller errors above the specified 3% when the meters are used at opposite range extremes, that is, when one meter is near full scale on its least sensitive range and the other reading on its most sensitive range. The error occurs on the more sensitive meter. When very small differences are to be measured accurately, the other meter should be balanced to 1% (or 0.01 radian).

RANGES OF MEASUREMENT *

Frequency	Resistance	Capacitance	Inductance
100 cps	2 Ω to 2 M Ω	20 nf to 800 μ f	5 mh to 1000 h
1 kc	2 Ω to 200 k Ω	2 nf to 80 μ f	500 μ h to 100 h
10 kc	2 Ω to 20 k Ω	200 pf to 8 μ f	50 μ h to 1 h
100 kc	8 Ω to 2 k Ω	200 pf to 0.2 μ f	20 μ h to 10 mh

*without corrections

For measurements outside the ranges listed above, refer to the instruction book for correction formulas and tables.

Some difficulty may be encountered when the 100-cycle test frequency is used if the power-line frequency is near 50 cps, because of the harmonic relationship between the two frequencies. This difficulty is particularly objectionable if the external components are of high impedance and unshielded, because of pick-up on the amplifier input.

The Type 1605-AH Impedance Comparator is a modified version of the Type 1605-A. The principal difference is a 3-to-1 increase in sensitivity due to higher voltage applied to the bridge circuit. It is thus possible to detect impedance differences of .003 percent (30 ppm) and phase-angle differences of .00003 radian, so that very precise measurements can be made. Although many of the specifications have been changed, the general operating procedure is the same as that for the standard model.

PHASE ANGLE DIFFERENCE meter

A + reading indicates that the unknown has a larger phase angle than the standard, where θ is positive in the counterclockwise direction on the conventional complex impedance plane.

If D_s and D_x (or Q_s and Q_x) are both less than 0.1 and ΔZ is less than 10%, then $\Delta\theta$ can be interpreted directly as ΔD or ΔQ with negligible error.

OFF SCALE light

Lighted bulb indicates a meter off scale or excessive hum with high external impedances. The CRO jack on the rear of the instrument permits visual monitoring of this signal on an oscilloscope. In the measurement of high-Q inductors with function switch at OPERATE GUARDED, oscillation may actuate the off-scale relay. If such oscillations occur, use the OPERATE UNGUARDED position.

FREQUENCY switch

Selects operating frequency. (See reverse side of this page for impedance limits at each frequency.)

Common terminal

Remove for connection of Type 874 Connectors for guarded operation. In the OPERATE GUARDED position, the outer conductor of the common terminal is driven at nearly the same potential as the inner conductor. This results in a lower input capacitance for shielded operation ($\approx 4\text{pf}$).

IMPEDANCE DIFFERENCE meter

A + reading meter indicates that the unknown has a higher impedance than the standard. For the measurement of capacitors, the standard and unknown connections can be interchanged so that a + reading on the ΔZ meter indicates a greater capacitance in the unknown.

Function switch

Selects type of operation required.

POWER switch

After the instrument has been on for 15 minutes, the meter drift should be very small so that, except for the most precise measurements, the meter zero needs to be rechecked only occasionally.

CALibration control

Calibrates the instrument for 1% (full scale) with the function switch set at CAL 1% and the IMPEDANCE DIFFERENCE PERCENT control set at 1. When impedances below 20 ohms are measured, set the calibration level with the external components connected.

Ground post

For best results, particularly when the external impedances are high, the instrument, as well as nearby equipment, should be connected to ground. This instrument is automatically grounded when three-wire power cable is used.

