



synchrotie equipment • temperature indicators • ground detectors and differential voltmeters

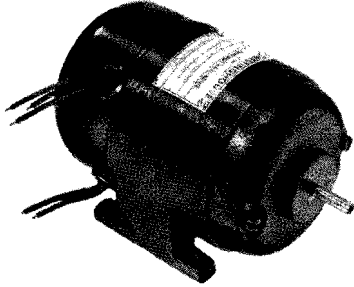
catalog section

43-270

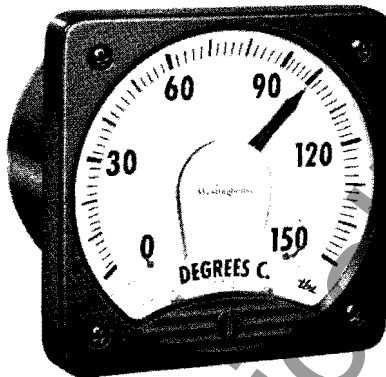
featuring *tbs*® electrical measuring instruments

page 1

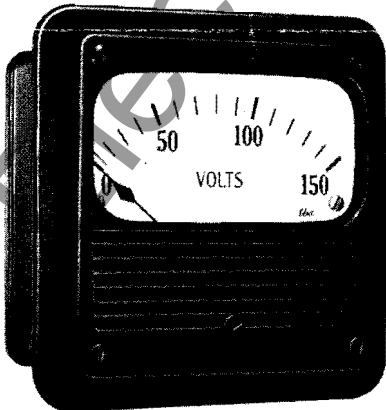
type ADS synchrotie motor



type KX-241 temperature indicator



type KX-251 ground detector



applications . . .

synchrotie equipment (pgs 1-3)

For remote position indication. A synchrotie system consists basically of two electrically interconnected motors (one the transmitter, the other the receiver). The stators and rotors of both are so wound that their shafts tend to occupy identical relative positions.

Typical devices whose position can be indicated by Westinghouse synchrotie include:

- turbines or water wheel governors
- draw or lift bridges
- elevators and conveyors
- liquid level floats
- transformer taps
- generator rheostats

These applications involve automatic positioning of the transmitter, which is connected to the mechanism whose position is being indicated.

By using manually operated transmitters, remote signalling (such as between a generator and switchboard or engine room and bridge) can be accomplished.

temperature indicators (pgs 4-5)

For remote indication of temperature. These instruments operate on the Wheatstone bridge principle, with 10-ohm copper "exploring" coils used as the detecting arms, and *tbs* electrical instruments used as the indicators. Typical electrical heavy apparatus in which the "exploring" coils can be deeply imbedded in the windings include:

- power transformers
- large circuit breakers
- a-c and d-c motors and generators
- rectifiers and resistors

ground detectors and differential voltmeters (pgs 6-8)

For indicating partial or complete electrical grounding, or to indicate voltage differential on two independent systems or on three-wire systems.

Ground detectors employ *tbs* electrical instruments as the display devices. External resistors are used to reduce the current loss on the circuit and provide a correct indication on these instruments.

April 16, 1962

supersedes catalog section 43-270 dated December 15, 1960
mailed to: E/1149/PL; D/823/CS; C/384/PL

for standard terms and conditions
of sale, see selling policy 43-000



Instrument style 10Y-652-8
 Type HX-25
 Serial 1312668

temperature indicators exploring coil type*

type KX-241

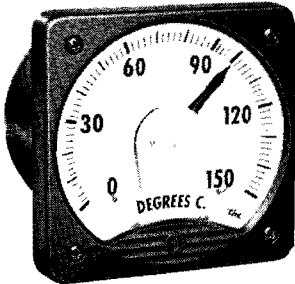


fig. 9

type KX-251

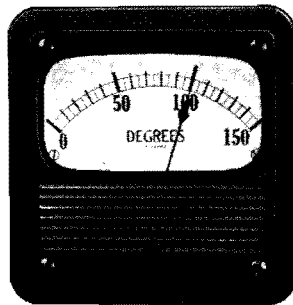


fig. 10

A change in resistance of the 10-ohm copper exploring coil embedded deep in the windings of the apparatus concerned causes a change in balance of the Wheatstone bridge circuit used by these indicators. This change results in an indication of the coil temperature on the dial of the **tb1** switchboard instrument used as the indicating device.

The entire Wheatstone bridge circuit, exclusive of the exploring coil and its associated leads, is self-contained in the indicating instrument. The bridge circuit must be energized from a 20-volt d-c source. (The necessary accessories required to obtain this voltage are listed below.)

The electrical zero, or bridge balance point, is indicated by a red line on the instrument dial. For all practical purposes, the temperature indication on the dial is independent of instrument ambient temperature or control voltage. An accurate initial calibration adjustment of the indicator can be made by setting the switch to "calibrate" (see wiring diagrams). The control voltage is then adjusted until the indicator reads zero.

In most instances, several exploring coils are used with each indicator, as shown in the wiring diagrams. For dimensional and other details on the **tb1** instruments used, refer to catalog sections 43-230, 43-240, 43-250, 43-260.

*Thermocouple type temperature indicators may also be supplied. Negotiate with nearest Westinghouse representative.

list prices

temperature indicators 20-volt d-c control

type	temperature range: °C	style number	list price
KX-231	0-100	290B903A09	\$260.00
	0-150	290B903A10	260.00
	0-200	290B903A11	260.00
KX-241	0-100	409C610A32	295.00
	0-150	409C610A33	295.00
	0-200	409C610A34	295.00
KX-251	0-100	291B393A10	280.00
	0-150	291B393A11	280.00
	0-200	291B393A12	280.00
UX-251	0-100	291B393A21	280.00
	0-150	291B393A22	280.00
	0-200	291B393A23	280.00
KX-26†	0-100	291B167A21	345.00
	0-150	291B167A22	345.00
	0-200	291B167A23	345.00

† pivot and jewel bearing

external accessory dimensions (inches):

approximate only; do not use for construction or installation purposes

rectifier for 105 to 132 volt control voltage

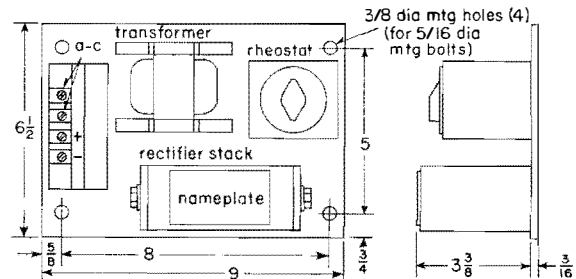


fig. 11

external accessories

to obtain basic 20-volt control voltage from:	accessory description	style number	number required	list price each
20 to 50 volts d-c	rheostat	1538 769	1	\$12.00
105 to 132 volts d-c	rheostat	1538 769	1	12.00
	resistor	1731 795	1	30.00
205 to 230 volts d-c	rheostat	1538 769	1	12.00
	resistor	1731 796	1	30.00
231 to 260 volts d-c	rheostat	1538 769	2	12.00
	resistor	1731 796	1	30.00
105 to 132 volts a-c	rheostat	1538 769	1	12.00
	rectifier	1360 952	1	12.00

⊙ Negotiate with nearest Westinghouse representative. Manufactured by Buffalo plant.
 ⊕ These styles carried in shipping stock ready for immediate shipment, subject to prior sale.

control voltage adjusting rheostat

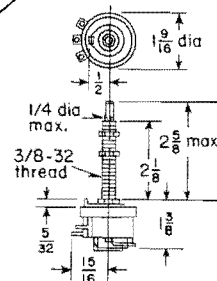


fig. 12

† External resistor used above 50 volts d-c has same dimensions as resistor figure 20, page 6. Dimensions of types 241, 251 and 26 instruments are in catalog sections 43-240, 43-250, and 43-260 respectively.

708947C = Rectifier (Rectifier)
 115V-600AC 12-24V.D.C.

featuring *the* instruments

wiring diagrams (rear view)

single lead compensation

single group of exploring coils (for use where exploring coils are closely spaced)

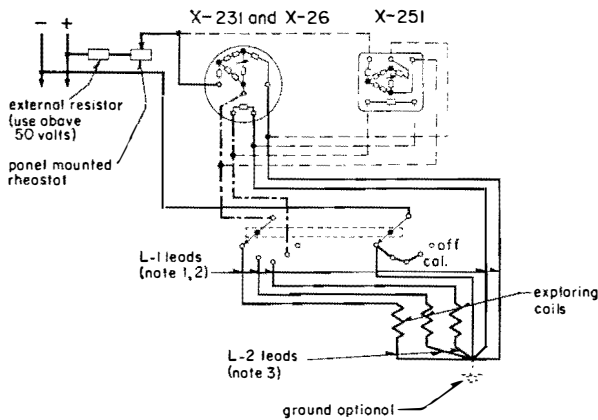


fig. 13

- note 1: Individual L-1 leads may have a maximum resistance of 3 ohms each.
- note 2: All L-1 leads must be within 0.02 ohm of the same resistance.
- note 3: L-2 leads should not exceed 0.02 ohm each.

paired lead compensation

single group of exploring coils (for use where exploring coils in the group are widely separated)

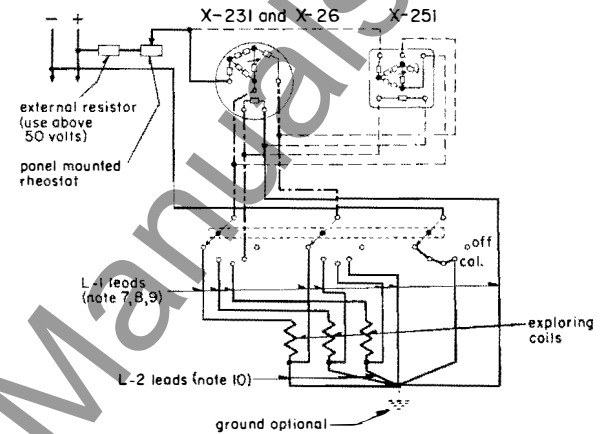


fig. 15

- note 7: Individual L-1 leads may have a maximum resistance of 3 ohms each.
- note 8: All pairs of L-1 leads must be within 0.4 ohm of the same resistance.
- note 9: The resistance of the separate leads in each pair of L-1 leads must be within 0.02 ohm of each other.
- note 10: L-2 leads must not exceed 1 ohm each.

multiple groups of exploring coils (for use where exploring coils of each group are closely spaced)

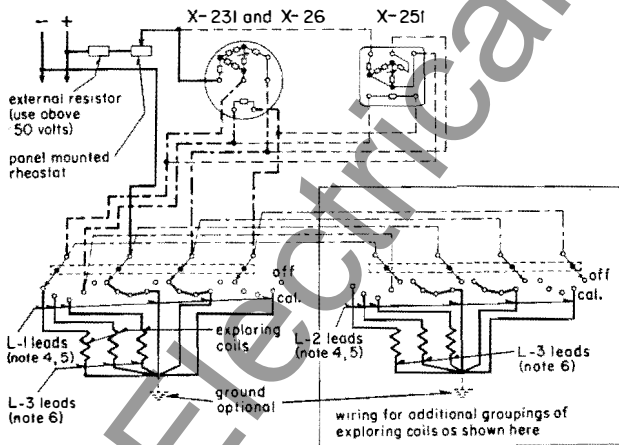


fig. 14

- note 4: Individual L-1 and L-2 leads may have a maximum resistance of 3 ohms each.
- note 5: All L-1 leads must be within 0.02 ohm of the same resistance. All L-2 leads must be within 0.02 ohm of the same resistance.
- note 6: L-3 leads must not exceed 0.02 ohm each.

multiple groups of exploring coils (for use where each group of exploring coils is widely separated)

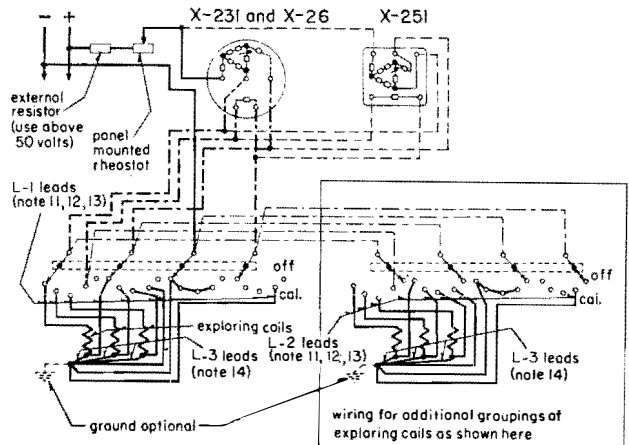


fig. 16

- note 11: Individual L-1 and L-2 leads may have a maximum resistance of 3 ohms each.
- note 12: All pairs of L-1 leads must be within 0.4 ohm of the same resistance. All pairs of L-2 leads must be within 0.4 ohm of the same resistance.
- note 13: The resistance of the separate leads in each pair of L-1 and L-2 leads must be within 0.02 ohm of each other.
- note 14: L-3 leads must not exceed 1 ohm each.

For simplification, the connections for all types of instruments are shown in the diagrams. One instrument only is to be used for each installation.

Use one rheostat, except for 231 to 260 volts use two in series. When two are used, one may be back of panel.

Switch contacts to the exploring coils must "make" before "break".

Leads shown in dot-dash must not exceed 0.02 ohm each.

To avoid adjustment of the rheostat between groups of exploring coils, L-1 and L-2 leads should be within 0.4 ohm of the same resistance, figures 15 and 16.

Each resistance tolerance or limit stated will prevent errors from this source of greater than one percent. Any increase will cause an approximately proportional error.



ground detectors and differential voltmeters

type KX-241

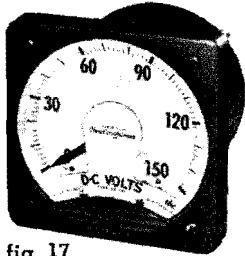


fig. 17

type KX-251

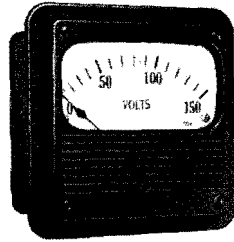


fig. 18

type KX-26

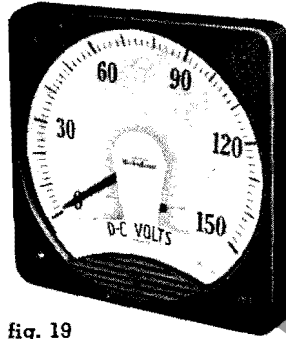


fig. 19

Fundamentally, these instruments are milliammeters with dials marked in volts. When used with external voltage dividing resistors, they indicate a difference in voltage between two or more points. The wiring diagrams (figures 22-32) indicate the types of instruments required for a given system, and instructions are included for calculating the values of the necessary external resistors.

Indicating instruments used are Westinghouse standard switch-board types 241 and 251 featuring taut suspension mechanisms, and type 26 with pivots and jewel bearings. For dimensions and other details on these instruments, refer to catalog sections 43-240, 43-250 and 43-260.

list prices (indicating instruments)

full scale deflection	type K-231		type K-241		type U-251		type K-251		type K-26+	
	style number	list price	style number	list price	style number	list price	style number	list price	style number	list price
0-1 ma d-c.....	290B904A09	\$102.00	409C610A44	\$113.00	291B392A21	\$109.00	291B392A10	\$109.00	291B167A09	\$163.00
.5-9.5 ma d-c.....	290B904A10	102.00	409C610A45	113.00	291B392A22	109.00	291B392A11	109.00	291B167A10	163.00
0-50 ma a-c.....	290B898A37	78.50	291B460A37	101.00	291B501A21	99.00	291B501A10	99.00	291B244A36	151.00

‡ Specify voltage rating on dial per wiring diagram instructions.

+ Pivot and jewel bearing mechanism.

external resistors

type VR-825 for a-c applications

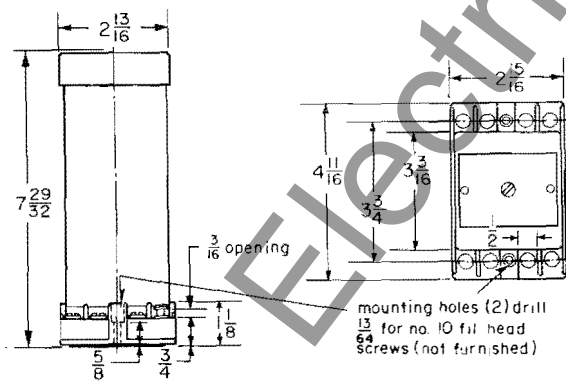


fig. 20

Dimensions are approximate only. Do not use for construction or installation purposes.

list prices (external resistors)

type	rating: ohms	style number	list price
d-c	30,000- 30,000	1731 128	\$35.00
d-c	150,000- 150,000	1731 129	35.00
d-c	300,000- 300,000	1731 130	35.00
d-c	600,000- 600,000	1731 131	35.00
d-c	1,200,000-1,200,000	1731 132	35.00
a-c	2850	1957 300	30.00
a-c	5046	1957 301	30.00
a-c	5850	1957 302	30.00
a-c	10,240	1957 303	30.00
a-c	11,850	1957 304	30.00
a-c	20,630	1957 305	30.00

◆ Determine value from instructions on wiring diagrams, pages 7 and 8.

type VR-823 for d-c applications

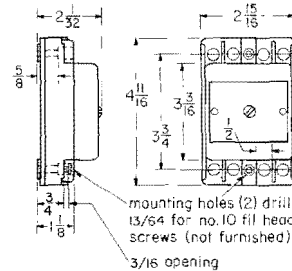
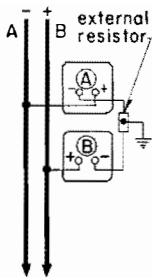


fig. 21

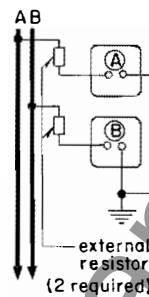
wiring diagrams

22: for d-c 2-wire ungrounded system



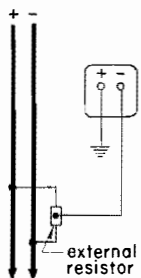
Under normal conditions both instruments will read approximately the same. If a ground occurs on either line, the corresponding instrument will read lower than the other. Instruments are 0-1 d-c milliammeters with dials marked in volts. For example: for 125 volts use a 0-150 volt dial. External resistor from center to either end has resistance of 1000 ohms per volt of dial rating.

26: for a-c single phase 2-wire ungrounded system



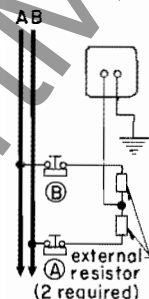
Under normal conditions both instruments will read approximately the same. If a ground occurs on either line, the corresponding instrument will read lower than the other instrument. Each external resistor has 20 ohms resistance per volt of instrument dial rating minus 150 ohms. Instruments are 0-50 a-c milliammeters with approximately 150 ohms terminal resistance and dial marking in volts. For example: for 120 volts use 0-150 volt dial.

23: for d-c 2-wire ungrounded system



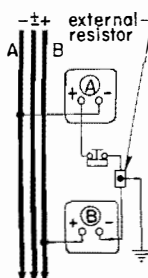
Under normal conditions instrument indicates zero. It will deflect to right (viewed from front) if ground occurs on positive line and to left if on negative line. Instrument is 0.5-0-0.5 d-c milliammeter with dial marked in volts. For example: for 125 volts use a 150-0-150 volt dial. External resistor from center to either end has resistance of 2000 ohms per volt of dial rating. For example: for 150-0-150 volt dial use 300,000-300,000 ohm external resistor.

27: for a-c single phase 2-wire ungrounded system



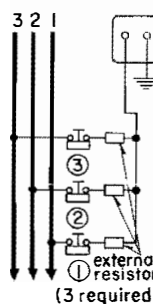
Under normal conditions the instrument indicates zero. If a ground occurs the instrument will indicate the approximate voltage between the ungrounded line and ground. Ground is in line to correspond to switch which, when opened, causes instrument to indicate the lower voltage. Instrument is 0-50 a-c milliammeter with approximately 150 ohms terminal resistance and dial marking in volts. For example: for 120 volts use 0-150 volt dial. Each external resistor has 20 ohms resistance per volt of instrument dial rating minus 150 ohms.

24: for d-c 3-wire system with ungrounded neutral



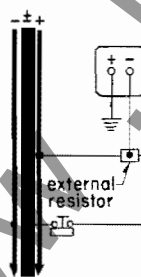
Under normal conditions both instruments will read approximately the same. With switch open they indicate zero. If a ground occurs on line A or B, the corresponding instrument will read lower than the other. If the neutral is grounded and the switch is opened, instrument A will read zero and B reads the voltage to ground. Instruments are 0-1 d-c milliammeters with dials marked in volts. For example: for 125-250 volts use a 0-300 volt dial. External resistor from center to either end has resistance of 1000 ohms per volt of dial rating.

28: for a-c three phase 3-wire ungrounded system



Under normal conditions instrument indicates zero. If ground occurs, instrument will indicate approximate voltage between ungrounded lines and ground. Ground is in line to correspond to switch which, when opened, causes instrument to indicate the highest voltage. Instrument is 0-50 a-c milliammeter with approximately 150 ohms terminal resistance and dial marking in volts. For example: for 120 volts use 0-150 volt dial. Each external resistor has 34.64 ohms resistance per volt of instrument dial rating minus 150 ohms.

25: for d-c 3-wire system with ungrounded neutral



Under normal conditions instrument indicates zero. It will deflect to the right (viewed from the front) if ground occurs on positive line and to left if on negative line. If ground is on neutral line, instrument will deflect to left when switch is open. Instrument is 0.5-0-0.5 d-c milliammeter with dial marked in volts. For example: for 125-250 volts use a 300-0-300 volt dial. External resistor from center to either end has resistance of 2000 ohms per volt of dial rating. For example: for 300-0-300 volt dial use 600,000-600,000 ohm external resistor.

continued

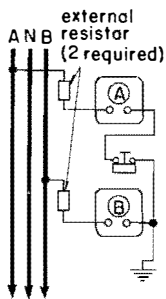


synchroie equipment • temperature
indicators • ground detectors and
differential voltmeters

ground detectors and differential voltmeters

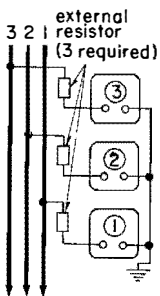
wiring diagrams • continued

29: for a-c single phase 3-wire system with ungrounded neutral



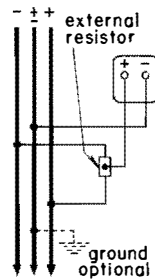
Under normal conditions the instruments indicate approximately the same and with switch open they indicate zero. If a ground occurs in A or B the corresponding instrument will read lower than the other. If the neutral is grounded and the switch is opened, instrument A will read zero and B will read the voltage to ground. Instruments are 0-50 a-c milliammeters with approximately 150 ohms terminal resistance and dial marking in volts. For example: for 120-240 volts use 0-300 volt dial. Each external resistor has 20 ohms resistance per volt of instrument dial rating minus 150 ohms.

30: for a-c three phase 3-wire ungrounded system



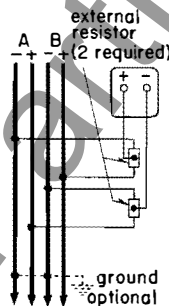
Under normal conditions and with balanced phases all instruments will read approximately the same. If a ground occurs the corresponding instrument will read lower than the others. Instruments are 0-50 a-c milliammeters with approximately 150 ohms terminal resistance and dial markings in volts. For example: for 120 volts use 0-150 volt dial. Each external resistor has 20 ohms resistance per volt of instrument dial rating minus 150 ohms.

31: differential voltmeter for d-c 3-wire system



Instrument indicates the voltage difference between the positive and negative sides of the system. Instrument will deflect to the left (viewed from front) with positive side low and to right with negative side low. Instrument is 0.5-0-0.5 d-c milliammeter with dial marked in volts. For example: for 125-250 volts use 15-0-15 volt dial. External resistor from center to either end has 2000 ohms resistance per volt of instrument dial rating. For example: for 15-0-15 volt dial use 30,000-30,000 ohm external resistor.

32: differential voltmeter for two independent d-c 2-wire systems



Instrument indicates the voltage difference between lines A and B. Instrument will deflect to the right (viewed from front) with line A low and to the left with line B low. Instrument is 0.5-0-0.5 d-c milliammeter with dial marked in volts. For example: for 125 volts use 150-0-150 volt dial. Each external resistor from center to either end has 1000 ohms resistance per volt of instrument dial rating. For example: for 150-0-150 volt dial use two 150,000-150,000 ohm external resistors.

further information

See selector guide 43-000.