Since the thermostat's operation depends on CHANGES in temperature it is necessary to hold the compartment temperature well above that of the surrounding air. The upper ambient temperature limit at which these boxes are required to operate is 50° C. and the lower limit 0° C. Therefore, most compartments are designed to hold the temperature of the box at 60° C. However, many crystal ovens in use today operate at 50° C. Check your instruction for further information.

REMOTE CONTROL CIRCUITS

Most transmitters in use at present are equipped for operation with the standard four-wire remote control unit. This unit has a hand key, a start-stop switch of the toggle type, and a pilot light, all mounted on a small bakelite panel.

The circuits of the four-wire remote control unit and typical transmitter circuits used with it are shown in figure 127.

All circuits use the common negative connection. The key completes the keying relay circuit to the negative side of the line. The switch connects the master relay across the line while the pilot light is across the coil of the master relay and is energized when the start-stop switch is closed.

In general, transmitters built for shipboard use must meet the following requirements in their keying and start-stop circuits:

1. Provide a local-remote switch that, when in local position, will cause the remote control circuits to be inoperative and when in remote position will permit control from the remote control unit and from the front panel of the transmitter unit itself.

2. Provide an EMERGENCY shut-down feature which, when the equipment is stopped by use of the emergency switch, does not permit it to be started until the emergency switch has been placed in the ON position.

3. Provide terminals on the transmitter for connection to six- or four-wire remote-control units. Provide terminals on the terminal board for link connections required in changing from six- to four-wire control circuit operation.

4. Arrange transmitter circuits to facilitate the interchangeability of the start-stop switches so that the desired type of remote control circuit may be selected and the transmitter modified at the point of installation. The two-button momentary contact switch shall be installed and a suitable adapter plate furnished for installation of the maintaining toggle switch.

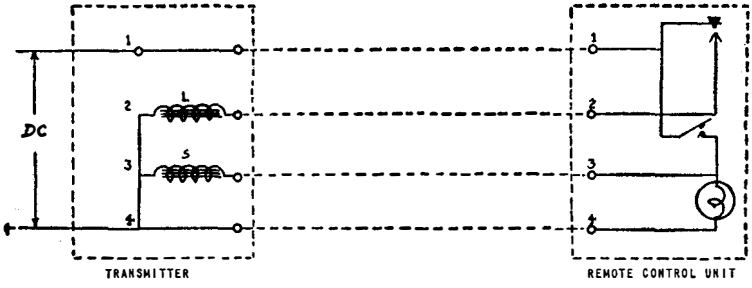

Figure 127.—Standard four-wire control circuit.

5. Use a standard potential of 110/115 volts direct current, for keying circuits. For a. c. supply equipments (four- and six-wire control circuits) and d. c. supply equipments (six-wire control circuits) obtain keying potential from the line; using suitable potentiometer to obtain standard potential from a 230-volt supply.

6. Use a standard potential of 110/115 volts alternating current for starting and indicator circuits in a. c. supply equipments. The line potential shall be used for starting and indicator circuits in d. c. equipment.

7. The keying potential shall not be available until the motor-generator has reached full speed.

SIX-WIRE CIRCUITS, A. C. AND D. C.

Supplementary requirements:

1. Equipment may be started and stopped locally by a two-button momentary contact, normally open switch. This feature to be operative when the local-remote switch is in the local or remote position.

2. Equipment may be started, stopped, and keyed from any connected remote control unit after the local-remote switch is placed in remote position.

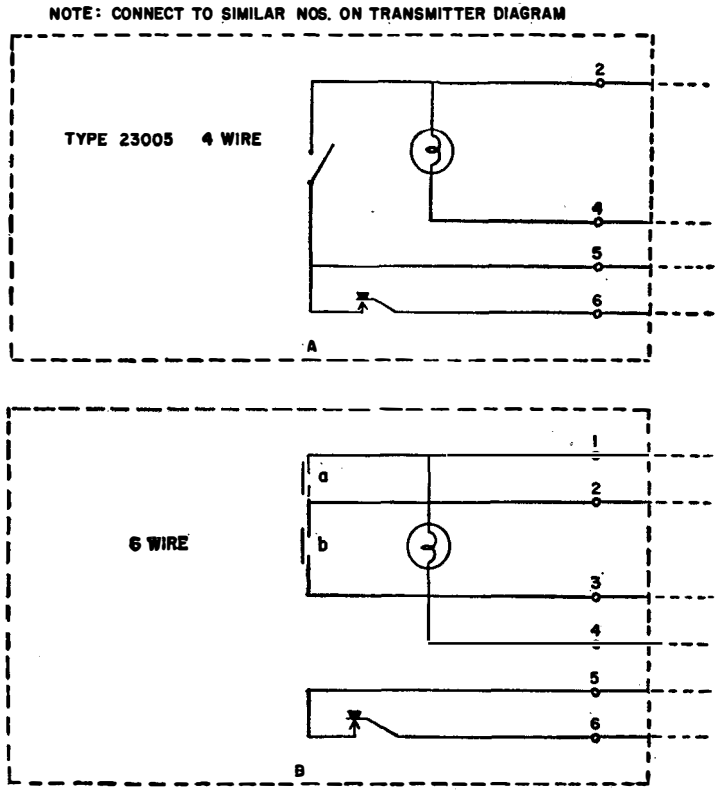

Figure 128.—Four- and six-wire remote control circuits.

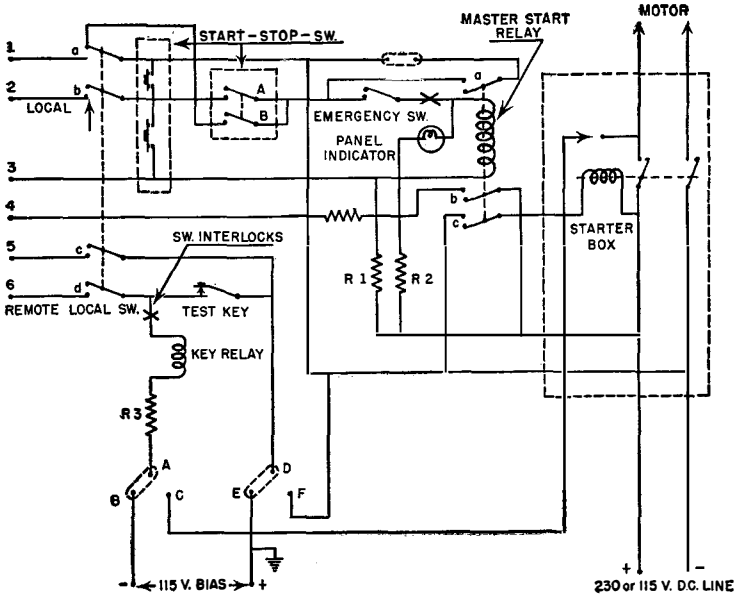

Figure 129.—Control circuits for four- or six-wire remote control units d. c. supply.

FOUR-WIRE CIRCUITS, A. C. AND D. C.

Supplementary requirements:

1. Equipment may be started or stopped locally by a contact toggle switch, this feature to be operative when the local-remote switch is in the local position. The equipment may be stopped locally when the local-remote switch is in the remote position or started locally if the remote starting switch is in the ON position, and the local-remote switch is placed in the remote position.

2. Equipment may be started, stopped, and keyed from a remote unit after the local-remote switch is placed in the remote position, and the local-start switch is placed in the start position.

3. Local indicator lamp connected in parallel with the master start relay.

4. Remote indicator lamp connected in parallel with the local indicator after local-remote switch is placed in remote position.

The circuits and terminal markings of the four- and six-wire remote control units are shown in figure 128a and figure 128b respectively. A schematic diagram of the internal transmitter circuits for d. c. operation from either of these units is shown in figure 129. The diagram of these circuits for a. c. operation is shown in figure 129.

These circuits meet all the requirements and are therefore more or less standard. However, you can expect some variations in different model transmitters and in transmitters built by different manufacturers.

TRANSMITTER CONTROL CIRCUITS

When four-wire control is used, starting and stopping must be done by the DPDT toggle switch with the transmitter LOCAL-REMOTE position on LOCAL. When control is on REMOTE starting and stopping is performed by means of a SPST switch connected between terminals 2 and 5. Figure 129 shows the REMOTE-LOCAL switch in position for LOCAL control operations.

Operation of the circuit is as follows: (a) REMOTE-LOCAL switch on REMOTE. (b) Transmitter START-STOP switch closed. (c) EMERGENCY switch and door interlocks closed. The circuit is from the 230-volt line through the voltage dropping and protective resistor and the coil of the master relay, through the door interlocks, the emergency switch, contact (a) of the DPST switch to terminal No. 2 on transmitter to terminal No. 2 in the remote control unit; from terminal No. 2 in the remote control unit through the SPST starting switch to terminal No. 5 in the remote control unit, to terminal No. 5 in the transmitter; from terminal No. 5 through the REMOTE-LOCAL switch through the link *D–F* to the negative side of the 230-volt line.

The master starting relay in the transmitter closes its

contacts, completing a circuit from the 230-volt side of the line through the starting relay in the starting box, through contact (c) of the master relay back to the negative side of the line.

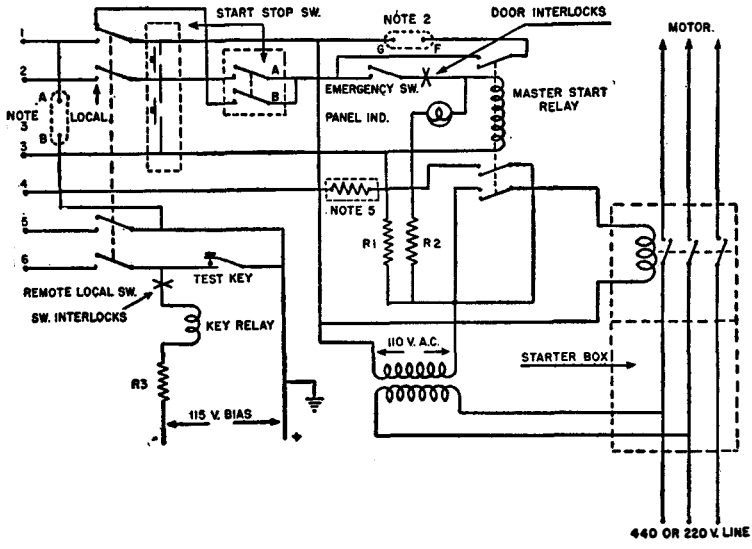

Figure 130.—Control circuits for four- or six-wire control units a. c. supply.

Another contact, (b), on the master relay, completes a circuit placing the indicator lamp in the remote control unit across the line through terminals No. 4 and No. 5, the remote-starting switch, contact (c) of REMOTE-LOCAL switch and link *D–F*.

When the motor-starter starting relay operates, it closes auxiliary contacts which form a circuit from the +230-volt side of the line. The keying circuit is not energized until the motor starter operates. The auxiliary starter contact should not close until the motor is up to speed.

Test-key operation of the keying relay is obtained

through the circuit from the positive side of the line, through the auxiliary starter contact, through link *A–C*, the keying relay voltage-dropping resistor and coil, the switch interlocks, through the test key to the negative side of the line through link *D–F*.

SIX-WIRE CONTROL

To follow the explanation of six-wire control, refer to figures 128b and 129. When six-wire control is to be used, link *G* and *F*, *A* and *B*, *D* and *E*, replace DPST toggle switch with two-button momentary contact switch, and replace contact (a) of the toggle switch with a jumper. The keying relay circuit is thus shifted to the bias generator and is independent of the starting circuit.

Operation of the circuit is as follows: (a) Emergency and door interlock switches closed; (b) REMOTE-LOCAL switch on REMOTE; (c) depress starting button connected across terminals No. 1 and No. 2 in remote control unit.

The master relay is energized through the circuit from the positive side of the line through the voltage-dropping and protective resistor, master relay coil, door interlocks and emergency switches; then to the jumper across (a) of toggle switch connection, REMOTE-LOCAL contact (b) to terminal No. 2 in transmitter and in the remote control unit, through momentary starting button to terminal No. 1 in remote control unit to terminal No. 1 in the transmitter; thence through contact (a) of REMOTE-LOCAL switch directly to the negative side of the line.

The master relay is sealed to the line through the circuit from the positive side of the line, the relay coil and its protective resistor, the emergency and door interlocks, master relay contact (a) link *G–F* to the negative side of the line.

The remote control unit pilot light is energized through the circuit from the positive side of the line, through master relay contact (b), terminals No. 4 in the transmitter and remote control unit, through the pilot light

back to terminals No. 1 in both the units; thence through REMOTE-LOCAL contact (a) to the negative side of the line.

The keying relay circuit will be energized when the bias generator is up to normal speed. Its circuit starts at the positive terminal of the bias generator, through link *D–E*, remote-local switch contacts (c) and (d) and the remote hand key via terminals No. 5 and No. 6 in both units, through the switch interlocks, keying relay coil, the voltage-dropping resistor, link *A–B* to the negative terminal of the bias generator.

To stop the motor generator, momentary contact button (b) is closed. This short-circuits terminals No. 2 and No. 3 and the master relay coil. The resistor R_1 prevents the short-circuit current from rising too high. Shorting the relay coil deenergizes it, its contacts open, the motor-starting relay is deenergized and the motor stops.

Alternating current operation of these circuits is almost the same as the operation of direct current. A standard voltage of 110 volts is used for the starting circuits and is provided by a separate transformer whose primary is across one phase of the three-phase line. The motor-starter relay has three sets of contacts which connect the a. c. motor to the three phases of the line. Keying relay voltage is provided by the bias generator for both four- and six-wire control. Changes necessary for switching from four- to six-wire control are shown in the diagram, figure 130.

The operation of these circuits for both four- and six-wire control should be worked out by the radioman for his own information and for practice.

POWER-CONTROL CIRCUITS

Transmitter power-control circuits provide for the proper application of the various voltages necessary to operate a transmitter. They also provide for protection