

INSTALLATION AND OPERATING INSTRUCTIONS  
FIXED FREQUENCY CRYSTAL OSCILLATOR  
FIELD INSTALLATION KIT #9211-00-00002  
HQ-145-, HQ-170, AND HQ-180 SERIES RECEIVERS

Introduction

Hammarlund provides an eleven position crystal oscillator assembly for the HQ-145, HQ-170 and HQ-180 series receivers. This unit may be installed in the space provided for the 24 hour clock timer.

This oscillator employs a 6CW4 nuvistor (V201) and a relay K201. When the VFO/xtal switch (S201) is thrown to the desired crystal position (located on the crystal oscillator sub-chassis). The relay takes B plus from the plate of the 6C4 high frequency oscillator and applies it to the plate of the 6CW4 nuvistor and at the same time the relay switches the mixer input injection from the local oscillator 6C4 to the crystal oscillator 6CW4. The 6CW4 is now the high frequency oscillator.

The variable capacitor C201 located on the front panel of the crystal oscillator assembly provides exact frequency netting.

The VFO/xtal knob allows selection of normal variable frequency tuning or any one of eleven fixed frequencies crystal controlled. Six crystals are located on the front panel. The remaining five crystals are located behind the front panel on the oscillator box and may be changed by lifting the top cover of the cabinet. It is intended that the five crystals located inside the cabinet will be for commonly used channels not subject to change very often and the crystal positions on the front easily accessible for quick change.

The only operation required besides turning the VFO/xtal switch to the desired crystal position is to turn the band switch to the desired band and tune the main dial to the approximate frequency, rocking the knob for maximum "S" meter indication. The variable tuning knob is for more accurate netting if so desired.



Installation

## (a) Tools Required:

1. Hollow shaft hex nut drivers 1/4", 5/16" & 3/16" size.
2. Long nose pliers.
3. Small soldering iron.
4. Small Phillips head screwdriver.
5. Small slot head type screwdriver.

## (b) Items supplied with kit:

1. Crystal oscillator sub-chassis.
2. Miscellaneous parts listed below.

| <u>QUANTITY</u> | <u>ITEM DESCRIPTION</u>   | <u>HAMMARLUND PT. NO.</u> |
|-----------------|---------------------------|---------------------------|
| 1               | K201 Relay                | K4515-02-00001            |
| 1               | Knob with set screw       | K2430-01-00010            |
| 1               | Knob with set screw       | K2430-01-00003            |
| 1               | Bracket                   | K1450-01-00135            |
| 1               | Hex Nut 3-48              | K2893-71-03101            |
| 1               | Soldering Lug             | K2888-26-01002            |
| 1               | Wire #22 Red/White 6" Lg. | K6006-01-00029            |
| 1               | Wire #22 Green 4" Lg.     | K6006-01-00055            |
| 1               | Resistor 15K $\Omega$ 2W  | K4705-01-00946            |
| 1               | Dial Plate                | K2410-02-00038            |
| 2               | Sleeving 1-1/4" Lg.       | K3135-01-04100            |

Installation Procedure

Remove set from cabinet. (See Instruction Manual) With receiver bottom setting flat on table, face the front of the unit. Remove four 4-40 Phillips head screws from clock medallion. Remove medallion (or clock) and crystal applying pressure from front of receiver. Mount crystal oscillator sub-chassis from rear of panel and dial plate from front of panel, taking care to place the variable capacitor shaft in center of hole. (See Note) Mount knob with white marker on selector switch. Mount knob less white marker on variable capacitor shaft. Cable assembly will run from crystal oscillator through the hole in chassis behind the panel and directly behind the noise limiter control on HQ-170, HQ-180 and to the left of BFO sub-chassis on the HQ-145. Turn receiver so that left side rests on table. (Right side for HQ-145) In this position the transformer is nearest the table.

NOTE: On older models such as HQ-145, HQ-145X, HQ-170 and HQ-180, the hole beneath the clock medallion must be enlarged to accommodate the variable capacitor shaft of the crystal oscillator assembly.

Wiring Instructions for HQ-145 Series

- Step 1. Position relay as shown in figure #1.
2. Place bracket along with soldering lug on relay, taking care not to short this lug to lugs on either side of it. Fasten with 3/16 inch hex nut driver.
  3. Connect center conductor of coax cable to lug #5 of K201.
  4. Connect shield of cable to soldering lug on K201.
  5. Unsolder capacitor C52 from pin 1 of the mixer V2.
  6. Resolder capacitor C52 to lug 1 of K201.
  7. Connect one end of 4" green wire to pin 1 of the mixer V2.
  8. Locate R37, a 1K 1/2 watt resistor, between pin 1 of V9 (6C4) and a terminal strip.
  9. Disconnect the end of this resistor at the terminal.
  10. Connect red/white 6 inch wire to the terminal strip at the same lug from which R37 was removed.
  11. Connect white/black wire from crystal oscillator to the lug directly above lug #9 of K201.
  12. Place the two 1-1/4 inch pieces of sleeving on both ends of the 15K 2 watt resistor (R205).
  13. Connect one end of the 15K 2 watt resistor to the lug directly above lug #12 of K201.
  14. Connect free end of 6 inch red/white wire to lug #12 of K201.
  15. Connect red wire from crystal oscillator to lug #8 of K201.
  16. Connect free end of 1K resistor (R37) to lug #4 of K201.
  17. Connect free end of 4" green wire to lug #9 of K201.
  18. The relay is mounted on the front lug (nearest panel) of the bandspread capacitor. Remove nut from front lug of bandspread capacitor and place slot in relay bracket toward oscillator rack and against lug. Fasten with 5/16 inch hex nut driver.
  19. Connect the free end of the 15K resistor to the terminal directly below the relay. This terminal now has 2 red wires and a 100K 1 watt resistor tied to it.
  20. Connect black wire from crystal oscillator to ground lug on tube socket X9, (6C4).
  21. Connect brown wire from crystal oscillator to pin #4 of V7 (12AX7).
  22. Check all wiring, soldering joints and associated components for bad connections, dress shorts, etc.

If in any doubt, check figures 1 and 4 or schematic diagram, figure #5.

Wiring Instructions for HQ-170 Series

- Step 1. Position relay as shown in figure #2.
2. Place bracket along with soldering lug on relay, taking care not to short this lug to lugs on either side of it. Fasten with 3/16 inch hex nut driver.
  3. Connect center conductor of coax cable to lug #5 of K201.
  4. Connect shield of cable to soldering lug on K201.
  5. Unsolder capacitor C78 from pin 1 of the mixer V2.
  6. Resolder capacitor C78 to lug 1 of K201.
  7. Connect one end of 4" green wire to pin 1 of the mixer V2.
  8. Locate R52, a 1K 1/2 watt resistor, between pin 1 of V12 (6C4) and pin 6 of V2 (6BE6).
  9. Disconnect the end of this resistor at pin 6 of V2 (6BE6).
  10. Cut red/white 6" wire to required length and connect to pin 6 of V2 (6BE6). The same pin from which R52 was removed.
  11. Connect white/black wire from crystal oscillator to the lug directly above lug #12 of K201.
  12. Place the two 1-1/4 inch pieces of sleeving on both ends of the 15K 2 watt resistor (R205).
  13. Connect one end of the 15K 2 watt resistor to the lug on the relay directly above lug #9 of K201.
  14. Connect free end of red/white wire to lug #12 of K201.
  15. Connect red wire from crystal oscillator to lug #8 of K201.
  16. Connect the free end of 4" green wire to lug 9 of K201.
  17. Connect free end of 1K resistor (R52) to lug #4 of K201. (See Note)
  18. The relay is mounted on the front lug (nearest panel) of the tuning capacitor. Remove nut from front lug of tuning capacitor and place slot in relay bracket toward oscillator tube and against lug taking care not to short the relay bracket against lug of the oscillator tuning capacitor.
  19. Connect the free end of the 15K (R205) resistor to the junction of C7. (.01 MFD) and L1 (2.5 MH). This terminal strip, located in front of RF bracket, now has one red wire, a .01 MFD capacitor (C7) and a 2.5 MH RF choke (L1) tied to it.
  20. Connect black wire from crystal oscillator to ground lug on tube socket X12 (6C4).
  21. Connect brown wire from crystal oscillator to pin #4 of V10 (6AL5).
  22. Check all wiring, soldering joints and associated components for bad connections, dress shorts, etc.
- If in any doubt check figures 2 and 4 or schematic diagram figure #5.

NOTE: In the event that the free end of R52 is not long enough, solder a piece of #22 hook-up wire to the free end.

Wiring Instructions for HQ-180 Series

- Step 1. Position relay as shown in figure #3.
2. Place bracket along with soldering lug on relay, taking care not to short this lug to lugs on either side of it. Fasten with 3/16 inch hex nut driver.
  3. Connect center conductor of coax cable to lug #5 of K201.
  4. Connect shield of cable to soldering lug on K201.
  5. Unsolder capacitor C78 from pin 1 of the mixer V2.
  6. Resolder capacitor C78 to lug #1 of K201.
  7. Connect one end of 4" green wire to pin 1 of the mixer V2.
  8. Locate the white wire connected between pin 1 of V12 (6C4) and L9 (2.5 MH RF choke).
  9. Disconnect the end of the white wire at pin 1 of V12.
  10. Connect free end of white wire to lug #12 of K201.
  11. Cut red/white 6" wire to required length and connect to lug #4 of K201.
  12. Connect white/black wire from crystal oscillator to lug directly above lug #12 of K201.
  13. Place the two 1-1/4 inch pieces of sleeving on both ends of the 15K 2 watt resistor (R205).
  14. Connect one end of the 15K 2 watt resistor to the lug on the relay directly above lug #9 of K201.
  15. Connect free end of red/white wire to pin 1 of V12 (6C4).
  16. Connect red wire from crystal oscillator to lug #8 of K201.
  17. The relay is mounted on the bottom lug of the oscillator transformer (T24). Remove nut from bottom lug of oscillator transformer and place slot in relay bracket toward oscillator tube and against lug. Fasten with 1/4 inch hex nut driver.
  18. Connect the free end of the 15K resistor to the lower lug on the terminal strip in front of RF bracket. This lug now has 1 red wire and a 1K 1/2 watt resistor tied to it.
  19. Connect the free end of 4" green wire to lug #9 of K201.
  20. Connect black wire from crystal oscillator to ground lug on tube socket X12 (6C4).
  21. Connect brown wire from crystal oscillator to pin #4 of V10 (6AL5).
  22. Remove R203 16K ohm 1/2 watt resistor (brown, blue and orange) from front of crystal position switch S201.
  23. Check all wiring, soldering joints and associated components for bad connections, dress shorts, etc.
- If in any doubt, check figures 3 and 4, or schematic diagram figure 5.

PARTS LIST

| <u>Circuit Symbol</u> | <u>Description</u>                          | <u>Part No.</u> |
|-----------------------|---------------------------------------------|-----------------|
| C201                  | Capacitor, Variable 3.2-50 Pf               | 9434-45-40021   |
| C202                  | Capacitor, Disc Ceramic .005 Mf<br>500 V    | 1509-01-01024   |
| C203                  | Capacitor, Dura-Mica DM-15<br>100 Pf 500V   | 1519-02-00057   |
| C204                  | Capacitor, 47 Pf, $\pm 10\%$ , 500V         | 1519-01-00004   |
| K201                  | Relay, Four Pole Double Throw               | 4515-02-00001   |
| L101                  | RF Choke, 2.5 Mh                            | 1802-01-00001   |
| R201                  | Resistor, 100K $\Omega$ , $\pm 10\%$ , 1/2W | 4703-01-00356   |
| R202                  | Resistor, 62K $\Omega$ , $\pm 5\%$ , 1/2W   | 4703-02-00490   |
| * R203                | Resistor, 16K $\Omega$ , $\pm 5\%$ , 1/2W   | 4703-02-00476   |
| R204                  | Resistor, 16K $\Omega$ , $\pm 5\%$ , 1/2W   | 4703-02-00476   |
| R205                  | Resistor, 15K $\Omega$ , $\pm 10\%$ , 2W    | 4705-01-00946   |
| S201                  | Switch, Crystal Selector                    | 5106-02-00015   |
| V201                  | Nuvistor 6CW4                               | 5704-02-00002   |

\* HQ-145A and HQ-170A only.

## CRYSTAL FREQUENCY

The oscillator or actual crystal frequency for a given signal frequency shall be determined from the following charts.

HQ-145 SERIES RECEIVERS

| <u>Signal Frequency<br/>Range mc</u> | <u>Add IF-----<br/>Frequency mc</u> | <u>Subtract IF-----<br/>Frequency mc</u> | <u>Mode of<br/>Operation</u> |
|--------------------------------------|-------------------------------------|------------------------------------------|------------------------------|
| 1.8 to 4.0                           | .455000                             |                                          | Fundamental                  |
| 4.0 to 10.0                          | .455000                             |                                          | Fundamental                  |
| 10.0 to 20.0                         | 3.035                               |                                          | Fundamental'                 |
| 20.0 to 30.0                         |                                     | 3.035                                    | 2nd Harmonic                 |

HQ-170 SERIES RECEIVERS

| <u>Signal Frequency<br/>Range mc</u> | <u>Add IF-----<br/>Frequency mc</u> | <u>Subtract IF-----<br/>Frequency mc</u> | <u>Mode of<br/>Operation</u> |
|--------------------------------------|-------------------------------------|------------------------------------------|------------------------------|
| 1.8 to 2.0                           | .455000                             |                                          | Fundamental                  |
| 3.5 to 4.0                           | .455000                             |                                          | Fundamental                  |
| 7.0 to 7.3                           | 3.035                               |                                          | Fundamental                  |
| 14.0 to 14.4                         | 3.035                               |                                          | Fundamental                  |
| 21.0 to 21.6                         |                                     | 3.035                                    | 2nd Harmonic                 |
| 28.0 to 30.0                         |                                     | 3.035                                    | 2nd Harmonic                 |
| 50.0 to 54.0                         |                                     | 3.035                                    | 3rd Harmonic                 |
| 144.0 to 148.0                       | See Note                            |                                          |                              |

An external converter is required for reception on the 144.0 mc range. To determine the frequency of the proper crystal to be used for the 144.0 to 148.0 mc range the following formula can be used:

$$\text{Freq. of Xtal} = \frac{\text{Oper. Freq.} - 97.035 \text{ mc}}{3}$$

HQ-180 SERIES RECEIVERS

| <u>Signal Frequency<br/>Range mc</u> | <u>Add IF-----<br/>Frequency mc</u> | <u>Subtract IF-----<br/>Frequency mc</u> | <u>Mode of<br/>Operation</u> |
|--------------------------------------|-------------------------------------|------------------------------------------|------------------------------|
| 1.80 to 2.05                         | .455000                             |                                          | Fundamental                  |
| 2.05 to 4.0                          | .455000                             |                                          | Fundamental                  |
| 4.0 to 7.85                          | .455000                             |                                          | Fundamental                  |
| 7.85 to 15.35                        | 3.035                               |                                          | Fundamental                  |
| 15.35 to 20.662                      | 3.035                               |                                          | Fundamental                  |
| 20.662 to 30.0                       |                                     | 3.035                                    | 2nd Harmonic                 |

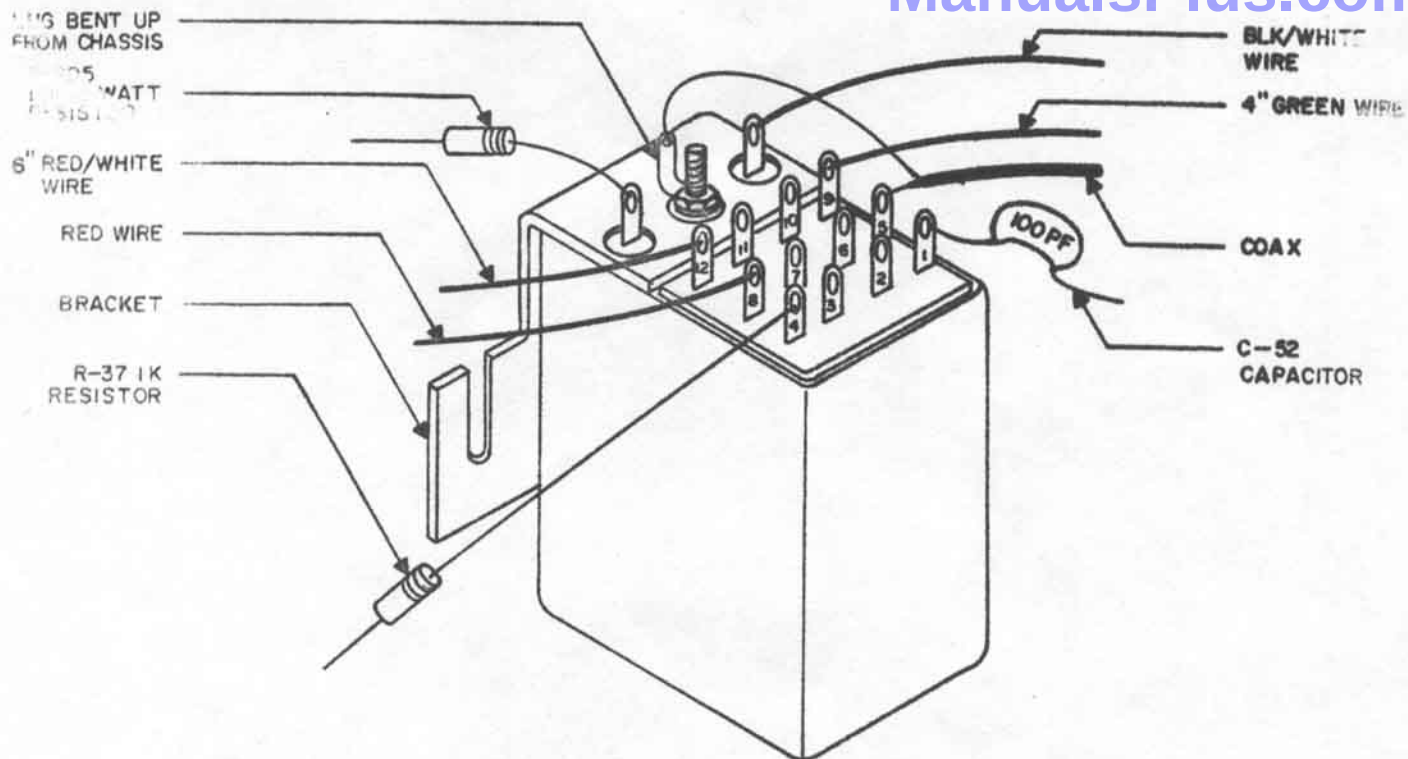


FIGURE 1. PICTORIAL WIRING DIAGRAM, K201 RELAY, HQ-145 SERIES

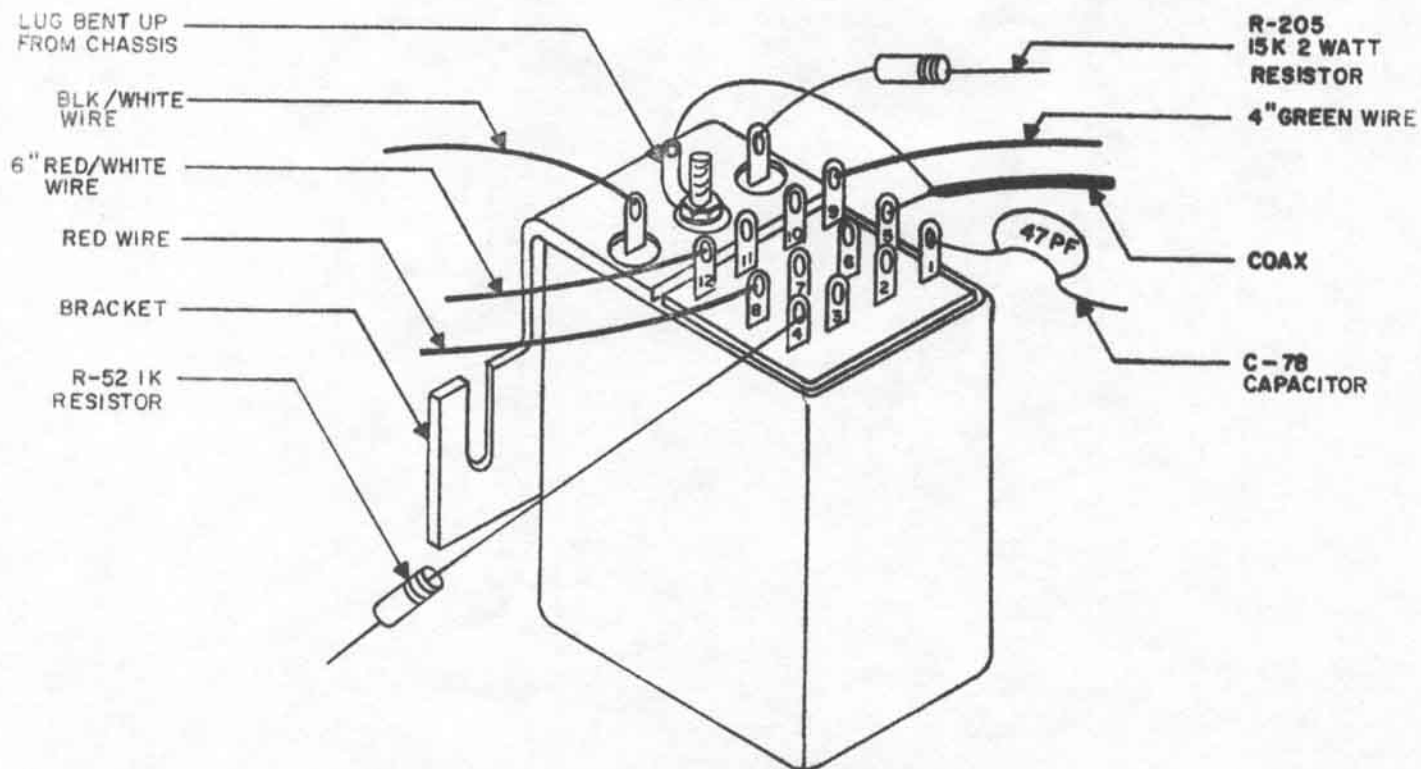


FIGURE 2. PICTORIAL WIRING DIAGRAM, K201 RELAY, HQ-170 SERIES

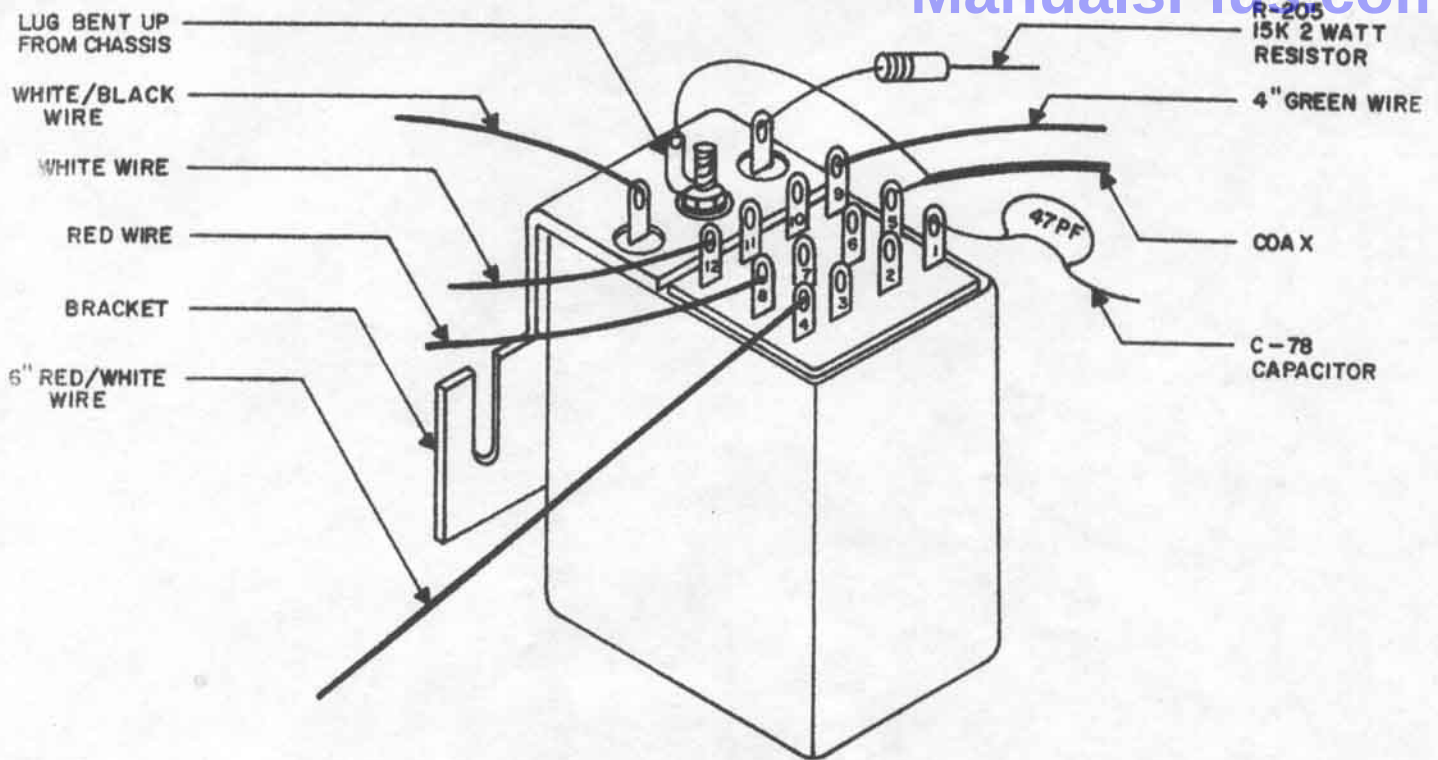


FIGURE 3. PICTORIAL WIRING DIAGRAM, K201 RELAY HQ-180 SERIES

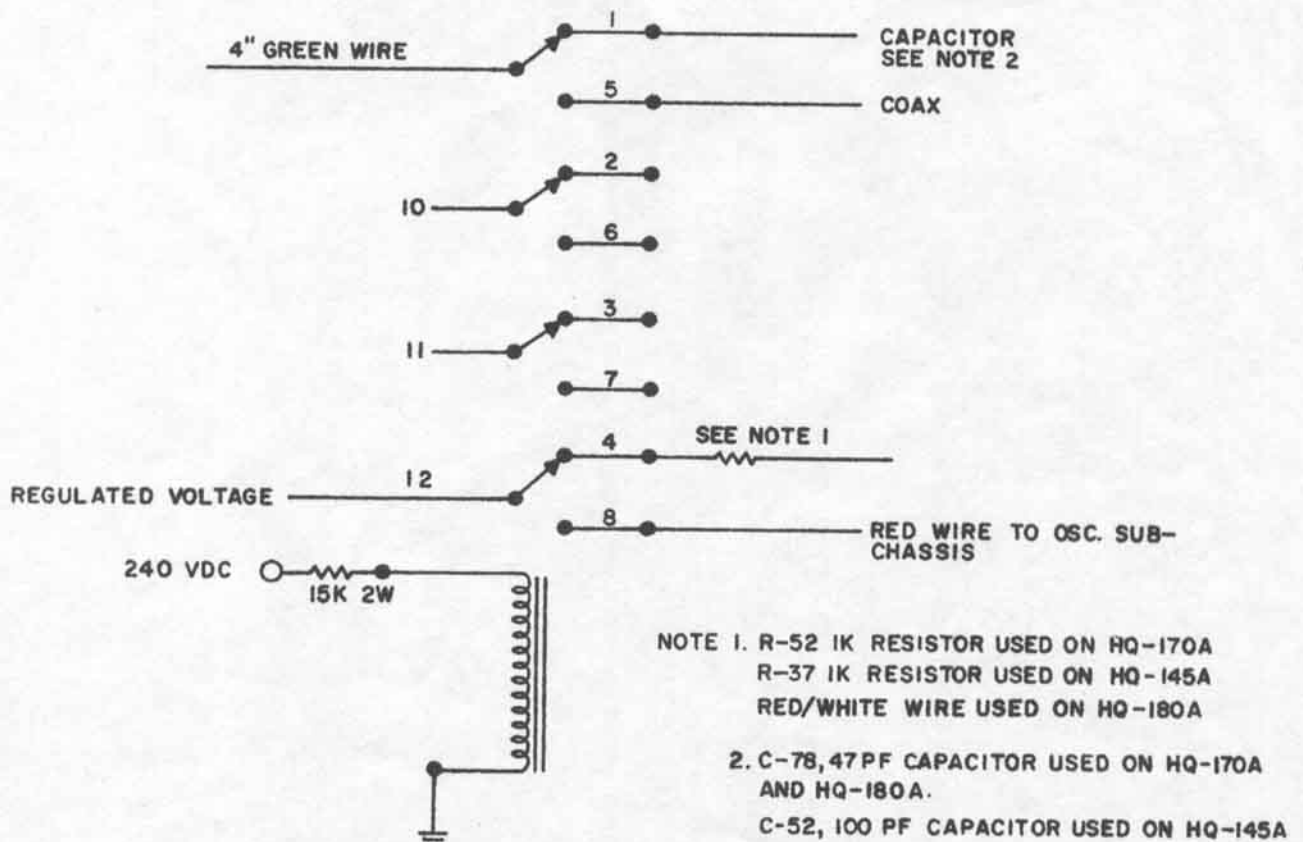


FIGURE 4. SCHEMATIC DIAGRAM OF K201 RELAY

FIGURE 5. SCHEMATIC DIAGRAM, FIXED FREQUENCY CRYSTAL OSCILLATOR