

Introl:

Remote Control System

AC Remote

Features

- Control or sense up to 64 remote locations
- Communicates over AC power lines, no wires to string.
- Control programs may be easily written in BASIC
- Expandable system, remotes available for most applications



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ERRATA FOR INTROL SYSTEM COMPONENTS

The following modifications have been made to your Introl System. Please note the changes in your manual in both the Parts List and Schematic. The old components may be included (if you have a kit). Please ignore these.

The changes are:

| <u>unit part</u> | <u>was</u> | <u>change to</u> |
|-------------------------------|------------|---------------------------|
| S-100 AC Controller | | |
| C8 | .39 uF | .47 uF (+20%, >25v) |
| C9 | .05 uF | .01 uF (\pm 20%, >25v) |
| Apple Controller | | |
| C11 | .05 uF | .01 uF (+20%, >25v) |
| C12 | .39 uF | .47 uF (\pm 20%, >25v) |
| Dual Channel AC Remote | | |
| C11 | .39 uF | .47 uF (+20%, >25v) |
| C12 | .05 uF | .01 uF (\pm 20%, >25v) |

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I. INTRODUCTION and GENERAL INFORMATION

1.1 INTRODUCTION

This manual provides the necessary information to assemble, test, and use Mountain Hardware's AC Remote unit. It is advisable to review the entire manual before beginning construction of the unit. Then be sure all parts have been included, as listed in section 2.2. Follow the assembly instruction given in the order shown.

If you run into any problems during assembly, feel free to call on us if you feel help is necessary. If the completed unit does not function properly, recheck your assembly carefully. Check for backward or wrong component placement. The troubleshooting section 3.2 may be of help in locating problems. If you have double checked the unit for proper assembly, then feel free to contact us for help.

1.2 GENERAL INFORMATION

1.2.1 AC Remote Description

The AC Remote Unit is a device capable of controlling AC electrical devices under computer control. As part of the Introl* system, the Remote units receive their information from an AC Controller board. The information is passed over the standard 110 VAC power lines to avoid the necessity for external wiring.

The AC Remote unit can control two 500 watt (resistive, 300 w inductive) devices independently and also report the status of each channel under computer control.

1.2.2 Replacement Parts

To order replacement parts, use a complete description to identify the component. The parts list in section 2.2 gives an adequate description of the parts used.

1.2.3 Repair Service

Mountain Hardware provides a repair service for its products, both in and out of warranty. Before returning a module to Mountain Hardware, first obtain authorization to do so. When the return is authorized:

* Introl is a trademark of Mountain Hardware, Inc.

1. Include a letter describing the problem completely.
2. Pack the unit and letter in a suitable shipping container.
3. Ship prepaid to: Mountain Hardware, Inc.
P. O. Box 1133
Ben Lomond, CA 95005

Your module will be returned prepaid.

Upon receipt of the module at Mountain Hardware, it will be repaired promptly, usually within 4 days. No charge will be made for in warranty modules, if in our judgement the failure is not due to misuse or failure of purchaser to exercise care in assembly or operation. Out of warranty modules (or misused units) will be repaired for a minimal charge not to exceed 25 dollars. If the repairs exceed this amount, an estimate will be sent to the owner along with a request for instructions.

NOTE: We advise the owner to save all original packing materials in the event it is necessary to return the module.

1.2.4 Receiving Inspection

Upon receiving your AC Remote unit, check the shipping container for visible outside damage, that may have occurred in transit. If damage is noticed, please report this information to us.

Then check the contents of your kit for the proper number of components, as compared to the list in section 2.2. Let us know of any parts shortages so that we may supply the needed components to you.

1.2.5 Warranty Information

The parts supplied with your AC Remote unit are warranted against defects in materials and workmanship for a period of six months from the date of purchase. See Appendix A-1 for complete statement of warranty.

NOTE: If you purchased your units assembled, they must be calibrated to operate properly. See the Controller Manual.

II. ASSEMBLY INSTRUCTIONS

2.1 GENERAL INFORMATION

The following assembly instructions should be followed in the order given. All components are installed on the side of the pc board marked component side.

NOTE: The AC Remote unit contains MOS and CMOS integrated circuits. Avoid unnecessary handling, as these devices can be damaged by static electricity discharges. Wear cotton clothing, rather than synthetics, when handling them.

NOTE: The AC Remote unit is a complicated unit. Please use great care in assembly to insure proper operation.

WARNING: The AC Remote unit contains high voltages. Unplug the unit when performing any handling of the printed circuit board or back panel.

2.2 COMPONENT ORIENTATION

2.2.1 Parts and Shipping Check List - By Package

PACKAGE #1 - 30 COMPONENTS

| | | | |
|----|------|-----|---------------------|
| R1 | 10K | R25 | 200 |
| R2 | 3.9K | R26 | 100K |
| R3 | 1K | R27 | 270K |
| R4 | 6.2K | R28 | 100K |
| R5 | 10K | R29 | 270K |
| R6 | 10K | R30 | 100K 10K |

R7 3.3K

R8 3.3K

R9 3.3K

R10 330

R11 330

R12 27K

R13 1K

R14 ~~3.9K~~ 3.3KR15 ~~1K 10 turn pot~~ 2K pot

R16 51

R17 4.3K

R18 1K

R19 1K

R20 3.3K

R21 3.3K

R22 3.3K

R23 1K

R24 1K

RESISTOR COLOR CODE
(K = X1000)

| | Band 1 | 2 | 3 |
|--|----------|----------|--------------|
| | Black..0 | Black..0 | Black... |
| | Brown..1 | Brown..1 | Brown...0 |
| | Red....2 | Red....2 | Red.....00 |
| | Orange 3 | Orange 3 | Orange..000 |
| | Yellow 4 | Yellow 4 | Yellow..0000 |
| | Green..5 | Green..5 | |
| | Blue...6 | Blue...6 | 4 |
| | Violet 7 | Violet 7 | |
| | Gray...8 | Gray...8 | Gold |
| | White..9 | White..9 | |

PACKAGE #2 - 34 COMPONENTS

| | | |
|-----|------------|--|
| C1 | .1uF | 500v |
| C2 | .1uF | 500v |
| C3 | .015 | (153) |
| C4 | .001 | (102) |
| C5 | .001 | (102) |
| C6 | .1 | |
| C7 | .1 | |
| C8 | .1 | |
| C9 | .1 | |
| C10 | .1 | |
| C11 | .39 | 35v Tant. (Note polarity on Assembly Drawing) |
| C12 | .05 | |
| C13 | .005 | |
| C14 | .1 | 500v |
| C15 | .1 | 500v |
| C16 | .1 | |
| C17 | .1 | |
| C18 | .01 | 500 or 1000v |
| C19 | .01 | 500 or 1000v |
| C20 | 470 | 25v Elect. |
| C21 | 470 | 25v Elect. |
| C22 | .1 | |
| C23 | .1 | |
| C24 | 10 μ F | 25 or 35v Tant. |
| C25 | .1 | |
| C26 | .1 | |
| C27 | .1 | |
| C28 | .03 | (303) |
| C29 | .01 | (103) |
| C30 | .03 | (303) |
| C31 | .01 | (103) |
| C32 | .01 | (103) |
| C33 | .1 | |
| C34 | .1 | |

PACKAGE #3 - 14 COMPONENTS

| | |
|-----|---------------|
| U1 | UART (40 pin) |
| U2 | 4069 |
| U3 | 4069 |
| U4 | 4001 |
| U5 | 4011 |
| U6 | 74C107 |
| U7 | 74C30 |
| U8 | 4001 |
| U9 | 74LS93 |
| U10 | NE535 |
| U11 | NE535 |
| U12 | NE567 |
| VR1 | 7805 |
| VR2 | 79L12 |

PACKAGE #4 - 20 COMPONENTS

Q1 2N2907
 Q2 2N2907
 Q3, Q5, Q6, Q7 2N2222
 Q4 2N2907
 CR1-CR5 1N4148
 CR6-CR9 1N4001
 CR10-CR11 1N4148
 RV1, RV2 GE V33MAIA

PACKAGE #5 - 10 COMPONENTS

J1 - 4 pin Molex Conn
 Con 22-03-2041
 T1 - Pot Core Transformer
 MHI-000044
 1 - #6 Hardware Set
 1 - Mica Washer
 S0, S1 - Push Button Switches
 2 - 5A Fuses
 1 - 1/2A Fuse
 1 - #4 Nylon Hardware
 4 - Female Spade Terminals

PACKAGE #6 - 12 COMPONENTS

1 - 40 Pin Socket
 3 - 8 Pin Sockets
 8 - 14 Pin Sockets

MISCELLANEOUS COMPONENTS

1 - Walnut Box
 2 - 5A Relays
 1 - Back Panel
 1 - Power Line Cord
 3 - Fuse Holders
 2 - AC Sockets
 Misc. Hook-Up Wire (White)
 Misc. Hook-Up Wire (Black)
 1 - T2 Transformer PC-24-180
 1 - PC Board

2.3 GENERAL ASSEMBLY

The parts list in section 2.2.1 is listed according to the shipping packages. Keep the parts with their respective packages until inserting into pc board. Use the assembly drawing 4.2 to aid in assembly, along with the silk screen lettering on the pc board.

NOTE: Square solder pads on the pc board are used to mark the orientation of some components. Square pads are used for:

1. Pin 1 of all IC's
2. Cathode end of diodes (dark band on the case of the diode)
3. The positive (+) terminal of polarized capacitors

Be sure to follow this standard throughout construction of the unit.

() Place the board in front of you with the component side up and the large square heatsink pad at the top left. Install the 12 sockets with pin 1 facing up and to the right. Place all the sockets in their holes and then place a stiff piece of cardboard over the sockets so that the board may be flipped over. Carefully turn the board over and check to see that all the pins are through their holes. Then solder two diagonally opposite pins on each socket. Remove the cardboard and check to see that each socket is firmly seated. If not, reheat the soldered pins and press the socket into place. Then solder the remaining pins.

NOTE: See Appendix A-2 for proper soldering techniques.

NOTE: Refer to component placement (figure 4.2 and silk screen lettering on pc board for aid in assembly.

() From package 5 take the 5 volt regulator (340-5 or 7805) and bend the leads to match the holes in the triangular hole at the top left of the board. Insert the regulator into position. Secure the regulator with the 6-32 hardware inserted from the bottom. Install the -12 volt regulator (VR2) slightly below VR1. The regulator is a 79L12 and looks like a small plastic transistor. It mounts with the flat side facing left.

() From package 2 install the .1uF/25 volt decoupling capacitors. Note that there are 4 .1uF/500 volt capacitors. These (C1, C2, C14, C15) are installed at the top right. The following .1uF caps should be installed at this time; C6-C10, C16, C17, C22, C23, C25-C27, C34. Mount the two large filter capacitors (C20 & C21) to the left of the transformer. The + side of the capacitor should be connected to the square pad. Carefully install the little tantalum dipped capacitor. It is C24 and mounts with the positive lead into the square pad.

() Install the precision capacitors. These are the small green or black capacitors.

() Install the resistors from package 1. Use the parts list in the Appendix to determine the values and the assembly drawing to determine location. The leads may be bent at $\frac{1}{2}$ inch for easy insertion. The 10 turn pot R10 mounts in the lower right hand corner.

() Install the diodes, transistors and varistors from package 4. The diodes all mount with the dark band facing the square pad. The varistors RV1 and RV2 don't care which way they are inserted.

() The power transformer (T2) mounts in the six large holes at the top of the board. Polarity is important!! Mount the transformer so that P1 on the label agrees with P1, the square pad on the board. (Installing the transformer backwards is considered very bad form.)

NOTE: The dot on the label of the transformer goes nearest the square pad denoting pin one.

() Install the two relays. The relays mount at the top of the board to the right of the transformer.

() Install transformer T1. T1 is the gray potcore. It mounts near the top right hand side of the board to the right of the relays. The green dot faces the relays. Mount the round mica washer under the transformer. Use the plastic 4-40 hardware to mount the potcore. Tighten the screw by hand (the potcore is easily cracked by over-tightening). The insulation may be stripped from the wires by scraping them lightly with an exacto knife or razor blade. Put the wires into holes and solder.

2.4 FINAL ASSEMBLY

() Install the 2-AC connectors on the back panel provided. Install the 2-push button switches on the back panel.

() The power cord has a strain relief built in. Push

the strain relief through the center hole of the back panel.

() Carefully follow the component drawing 4.2 to wire the back panel. Use the wires provided and the color code scheme called out on this drawing. The wires are long enough to allow the back panel to be easily inserted into the box. Use the 4 crimp (or solder) connectors to connect to the AC sockets. Solder the green spade ground wires to the Ground terminal on the AC sockets.

() The pc board slides in the slot of the walnut box with the transformer end first. The back panel slides in next with the AC sockets' end going last. The bottom corner can then be slid in place, locking the other two.

NOTE/WARNING: 110 VAC is present on the pc board and back panel when the unit is plugged in. Place pc board on non-conducting surface when testing the unit, and use extreme care when testing if power is applied.

2.5 PRELIMINARY CHECKOUT

() Smoke test - plug it in. There should be no noises or smoke, or any other noticeable phenomenon. Using a voltmeter, measure the following:

Unregulated +16 volts at the + side of C20.

Unregulated -16 volts at the - side of C21.

Regulated +5 volts at pin 1 of the 40 pin IC socket.

Regulated -12 volts at pin 2 of the 40 pin IC socket.

(Use the pad on the 7805 as ground reference).

If you get no voltages anywhere, unplug the unit and check the fuse. If it is blown you have a major problem (i.e. a short or wiring error!). If any voltages are wrong or missing locate the problem and fix it before continuing. (The unregulated voltages may vary from as little as 15 volts to as high as 20 volts, the regulated voltages should be within 10%).

WARNING: 110VAC is present on the printed circuit card and back panel. UNPLUG when handling.

If the proper voltages are present, unplug the unit and proceed.

Install the following IC's in their respective sockets (all the IC's on the board have pin 1 to the right):

U9 - 74LS93
U10-U11 - NE535
U12 - 567

() The remaining IC's are all MOS devices and should be handled with care. Avoid excessive handling. Install the remaining IC's as follows:

U1 - Uart (the 40 pin IC, different manufacturers use different numbers so ignore it.)
U2, U3 - 74C04 or 4069
U4, U8 - 4001
U5 - 4011
U6 - 74C107
U7 - 74C30

Test 2

Reconnect the AC power and measure the +5 volt and the -12 volt supplies at U1 pins 1 and 2 respectively.

() Select the address that you wish to use for the remote. The jumper area is in the lower left corner of the board. The center contacts are the active contacts. The contacts closest to the bottom of the board are "0" and the contacts nearest the top of the board are "1". Only bits 1 through 5 are programmed (bit 0 is used to select load 1 or 0 in the remote). Bit 1 is closest to the left side of the board. For example, to program the remote for address 4 (& 5), jumper as shown here:

```

@ @ @ @ @
  I
@ @ @ @ @
  I   I I I
@ @ @ @ @
Bit 1 2 3 4 5

```

This addressing scheme allows you to set the address of the remote to any of 32 possibilities. Since each remote has two consecutively numbered channels, this allows 64 channels to be operated on the Intral system.

We recommend that for simplicity you number the remotes starting from 0.

() Calibrate the remote.

Slide the back panel out and let it hang to the side of the remote. Connect the calibration cable (included with the AC Controller board) to J1 on the remote and the other end to the calibration input on the controller. Plug in the remote, taking care that nothing shorts with the 110 volts on the back panel or pc board. Adjust the pot R15 with a non-metallic screw driver until the green LED is maximized.

2.6 FINAL CHECKOUT

Set up the AC Controller per instructions in the manual. Plug the remote into a convenient AC socket. Plug a lamp (or other AC device) into each of the sockets on the remote. Use the push-button to turn them on and off. Each time the button is pushed the appliance should change state.

If it doesn't work, check out your wiring.

Here are a couple of programs you may use to check out your Remote.

The first program allows you to toggle either of the channels in a Dual Channel AC Remote. To use, run the program and type in a number corresponding to a channel number to toggle (typically 0 or 1). The remote should toggle. If it does not, check the addressing jumpers. Did you calibrate the remote?

The second program allows you to poll the remote, or get its on/off status. Type in the same numbers as in the previous program, and you will be informed of the status of the channels. If you get a 'NO ANSWER' message, check to see if the remote is plugged in. Is the AC Interface adapter connected?

The programs do no error checking, and do not wait for the TBE but in the status register. See the AC Controller Manual for examples of error-correcting programs.

Program 1 - Toggle a Remote

```

10 S = 4           : REM SET ADDRESS OF STATUS POINT
20 INPUT "DEVICE TO TOGGLE"; A
30 OUT S + 1, 128 + 64 + A
                   : REM SEND TOGGLE COMMAND
40 GO TO 20
50 END

```

Program 2 - Poll a Remote

```

10 S = 4           : REM SET STATUS ADDRESS
20 X = INP(S + 1)  : REM CLEAR FLAGS
30 INPUT "DEVICE TO POLL", A : T = 0
                   : REM GET #, RESET TIMER
40 OUT S + 1, 128 + A

```

```
50 IF INP (S) AND 8 THEN D = INP (S+1) - A : GO TO 30
      : REM WAIT FOR DATA
60 T = T + 1: IF T < 50 THEN GO TO 50
      : REM WE ONLY WAIT SO LONG
70 PRINT "NO ANSWER" : GO TO 30
      : REM . . BEFORE WE GIVE UP
80 IF D = 0 THEN PRINT "OFF"
90 IF D = 64 THEN PRINT "ON"
100 GO TO 30
101 END
```

III CIRCUIT DESCRIPTION AND TROUBLESHOOTING

3.1 THEORY OF OPERATION

The AC Remote receives and decodes information from the controller and acts on the decoded command by controlling the device plugged into it. The actions the remote can take are: "Toggle A," "Toggle B," "Poll A" or "Poll B." As can be seen from the drawings, many sections of the remote closely resemble their counterparts found in the controller. This is a logical result, since both devices must be able to send and receive data through the same medium--the AC line. The remote contains the following blocks of circuitry: an AC interface and power supply, a filter and amplifier, a data recovery and clock generator, a UART receiver/transmitter, address and command decode logic, a power driver and the relay drivers. The AC interface and power supply (VR1, VR2, T1 and T2) supplies power to the remote and provides the interface between the digitally modulated audio signal and the AC line. Power transformer T2 supplies stepped-down AC to the rectifier composed of CR6-CR9. Voltage regulators VR1 and VR2 provide regulated +5 V and -12 V respectively. In addition, this circuit also supplies unregulated +15 V to the power driver circuit. T1, a tuned transformer resonant at 45 kHz, provides the audio interface to the AC line. The filter and amplifier (IC10 and IC11) has the same function and operation here as the one on the controller board. The data recovery unit and clock generator (IC9, IC12 and R15) basically operates identically to the one on the controller, except the phase-locked loop (IC12) has a 1 K 10-turn pot for calibration. Adjustment of this potentiometer synchronizes the frequencies of the controller and the remote. The UART receiver/transmitter (IC1, IC3, IC4 and IC5) decodes and "unformats" the data received from the controller and also formats the data to be sent to the controller. The receiver section of the UART takes the serial information from the PLL lock output (IC12) and converts it to parallel data and status information. The status information is then used by the next circuit--the address and command decode logic. This information indicates when data is available and if any errors were received. Data at the receiver output is looped back to provide the first six bits of the transmit data word. The seventh and eighth bits of the transmit data word are originated by the address and command decode logic. The transmit side of the UART responds with data to the controller whenever the address and command decode logic detects a poll command. The data word sent from the computer through the controller has a specific meaning to the remote. The first five bits contain the address of the remote to be controlled. The sixth and seventh bits contain command information. If the seventh bit is a '0',

all remotes ignore the word (this means the word is "poll" information--discussed shortly). However if the seventh bit is a '1', the word is defined as being a command to the remote whose address is contained in the first five bits. The sixth bit contains the actual command. A sixth bit of '1' toggles the remote channel addressed. If the sixth bit is a '0', the remote responds with poll information that informs the computer of its status (on or off). Bit 6 of the transmitted word contains the on or off information about the remote being polled (1 = on; 0 = off). Bit 7 is always a '0' during a poll. The address and command decode logic (IC3, IC4, IC5, IC6, IC7 and IC8) compares the incoming data word with that formed by the user-selected jumpers (located on the remote) to determine that it, and no other remote, is being addressed. It then decodes one of the four possible commands and executes the decoded information. ICs 3 and 7 decode the address and check for errors; ICs 4 and 5 decode the specific command. Flip-flop IC6 controls the state of the outputs A and B. IC 8 provides the transmit side of the UART with correct poll information on the status of each side of the remote (A or B). The power driver (Q1, Q2 and Q3) performs the same function as the one on the controller, except that it is capacitively coupled to the AC line directly--it does not go through a transformer. The relay drivers (Q6, Q7 and relays K1 and K2) converts the outputs from the CMOS circuits to a power level sufficient to operate the relay coils. Emitter-follower Q6 is tied to the coil of K1 and sinks current. The other side of the coil is tied to the unregulated +15 V supply. Q7 is tied to K2 in the same fashion.

3.2 TROUBLESHOOTING GUIDE

WARNING: Use extreme care when troubleshooting the AC Remote unit. When the unit is plugged into 110V, there is a potential shock hazard on the pc card and the back panel.

Troubleshooting any equipment requires a minimum of a voltmeter and an oscilloscope may be necessary for complex problems.

Most problems that occur are due to assembly errors. Backward diodes and capacitors are the major villain. Interchanged components are also known to upset the works. Be sure to check everything carefully, including the wiring to the back panel. Also check for bent up IC pins.

In order for any of the circuits to function properly, the supply voltages must be working. Check them as outlined in Preliminary Checkout.

Power supply voltages are
not present

Check output of T2 voltage
across C21, C20

Check VR1, VR2

With power off, check for
short from supply to
ground with ohm meter

Remote doesn't cali-
brate

Check that pin 5 of V12
has approx. 45 KHz out-
put

Check pin 12 of U9 for 45 KHz
divided by 16

.25 Amp Fuse blows if
appliance is on

Check wiring of back panel

A good way to check out problems is to write a short program that continually outputs to the remote, and then check the circuit performance using an oscilloscope. Familiarity with digital circuits and understanding the theory of operation section is required for in depth troubleshooting. Feel free to consult with us in the event of problems with your unit.

3.3 COMMUNICATING WITH THE AC REMOTE

Data presented to the AC Remote is formatted using a UART (Universal Asynchronous Receiver Transmitter). The UART transmits an 8-bit word in serial to the remote. It also handles all protocol, parity and error checking. The remote decodes this word as follows:

| MSB | LSB |
|-------------------------------|-------|
| ! 7 ! | ! 0 ! |
| ! 6 ! | ! 1 ! |
| ! 5 ! | ! 2 ! |
| ! 4 ! | ! 3 ! |
| ! 3 ! | ! 4 ! |
| ! 2 ! | ! 5 ! |
| ! 1 ! | ! 6 ! |
| ! C ! | ! P ! |
| ! T ! O ! ADDRESS ! | |
| ! R ! L ! 0 THRU 63 | |
| ! L ! L ! | |

Bits 0-5 are address bits that are set up with jumpers on the AC remote pc board.

Bit 6 is the POLL/TOGGLE bit. If it is a 1 the remote channel is toggled. If 0, it is polled (the remote sends back its status for the channel addressed).

Bit 7 is the control bit. It is a 1 if the controller is commanding a remote. It is a 0 if the remote is answering or if the controller is sending data to a different remote.

| | | | | | | | |
|--------------------|-----|---|-----|---|-----|---|--|
| BIT | --- | ! | 7 | ! | 6 | ! | |
| REACTION | | ! | --- | ! | --- | ! | |
| TOGGLE THIS REMOTE | ! | 1 | ! | 1 | ! | | |
| | | ! | --- | ! | --- | ! | |
| POLL THIS REMOTE | ! | 1 | ! | 0 | ! | | |
| | | ! | --- | ! | --- | ! | |
| IGNORE THIS DATA | ! | 0 | ! | X | ! | | |
| | | ! | --- | ! | --- | ! | |

X = DON'T CARE

A toggle command will cause the remote to turn on (or off) depending on its previous state. For example, to toggle remote number 41 (decimal) you would output 233 (decimal) to the controller's output port.

POLLING THE DIGITAL REMOTE

A poll is a request for information. In this case it is a question... "Are you on or off?". It is accomplished by transmitting the address of the remote with only the control bit set..the remote will then reply by sending back its address with the control bit off (i.e. = 0). The poll bit (bit 6) will contain the on/off information (0 = off, 1 = on).

For example, suppose we want to determine if remote #41 is on or off. We would transmit 169 (41+128). The response would be either 41 (off) or 105 (on, 41+64). If you haven't quite followed this, the following may help...

| | MSB | | | | | | | LSB |
|---------------|-----|-----|---|-----|---|----|---|-----|
| | ! | 7 | ! | 6 | ! | 5 | ! | 4 |
| | ! | | ! | | ! | | ! | |
| | ! | | ! | | ! | | ! | |
| | ! | | ! | | ! | | ! | |
| | ! | | ! | | ! | | ! | |
| | ! | | ! | | ! | | ! | |
| DECIMAL VALUE | ! | 128 | ! | 64 | ! | 32 | ! | 16 |
| | ! | | ! | | ! | | ! | |
| | ! | | ! | | ! | | ! | |
| | ! | | ! | | ! | | ! | |
| OCTAL VALUE | ! | 200 | ! | 100 | ! | 40 | ! | 20 |
| | ! | | ! | | ! | | ! | |
| | ! | | ! | | ! | | ! | |
| | ! | | ! | | ! | | ! | |
| HEX VALUE | ! | 80 | ! | 40 | ! | 20 | ! | 10 |
| | ! | | ! | | ! | | ! | |
| | ! | | ! | | ! | | ! | |
| | ! | | ! | | ! | | ! | |

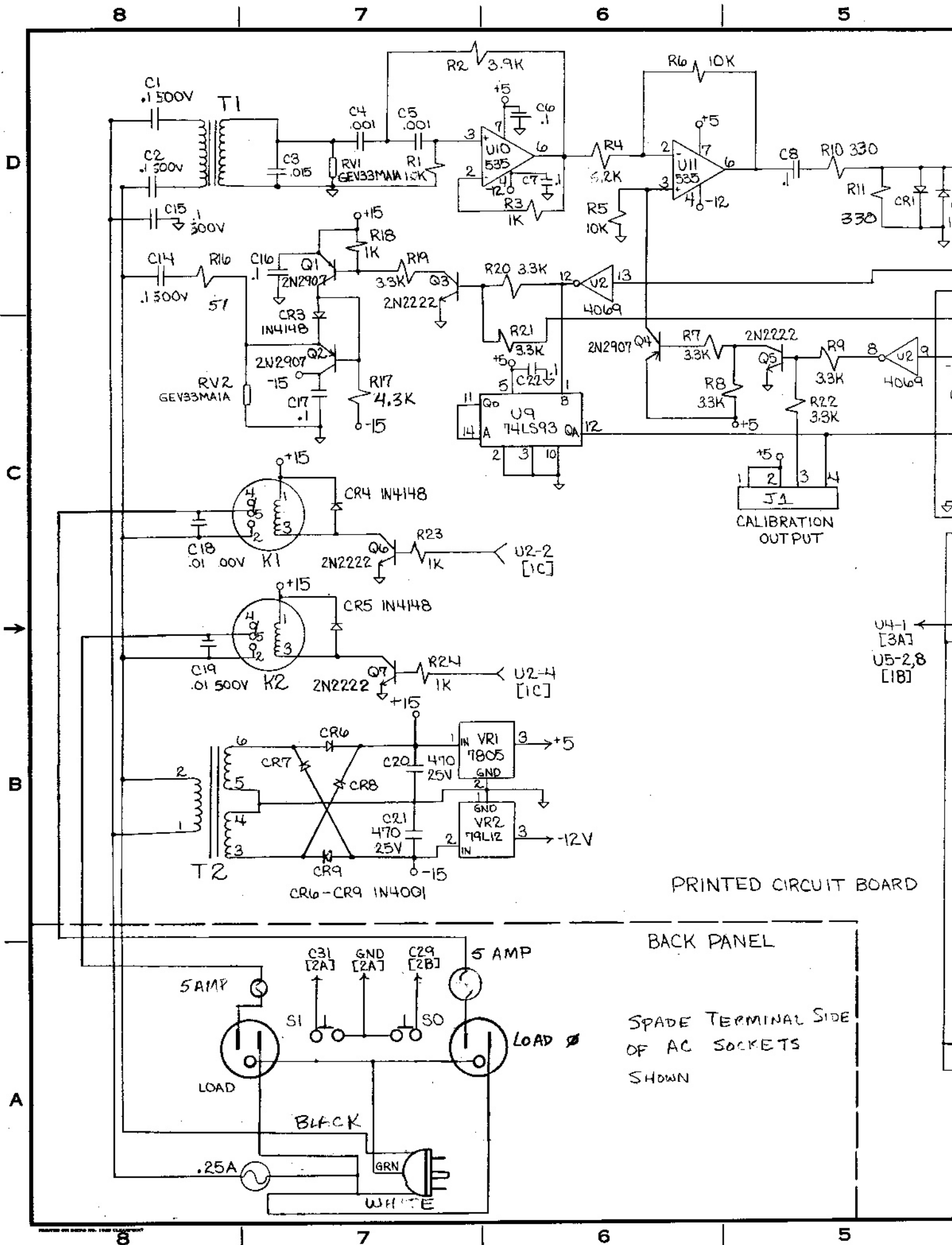
The table contains the binary value for each bit. If you add up the bits that are to be set to a '1' you will find the correct value of the word you need to transmit. However, you must do your addition in the correct base!

Yet another approach. If you want to toggle the remote send $128 + 64 + \text{remote address}$. To poll the remote send $128 + \text{remote address}$. The answer received back from a poll will be $0 + 64 + \text{remote address}$ if it is on, and $0 + 0 + \text{remote address}$ if it is off.

IV DRAWINGS

4.1 SCHEMATIC

4.2 COMPONENT PLACEMENT



8

7

6

5

D

C

B

A

8

7

6

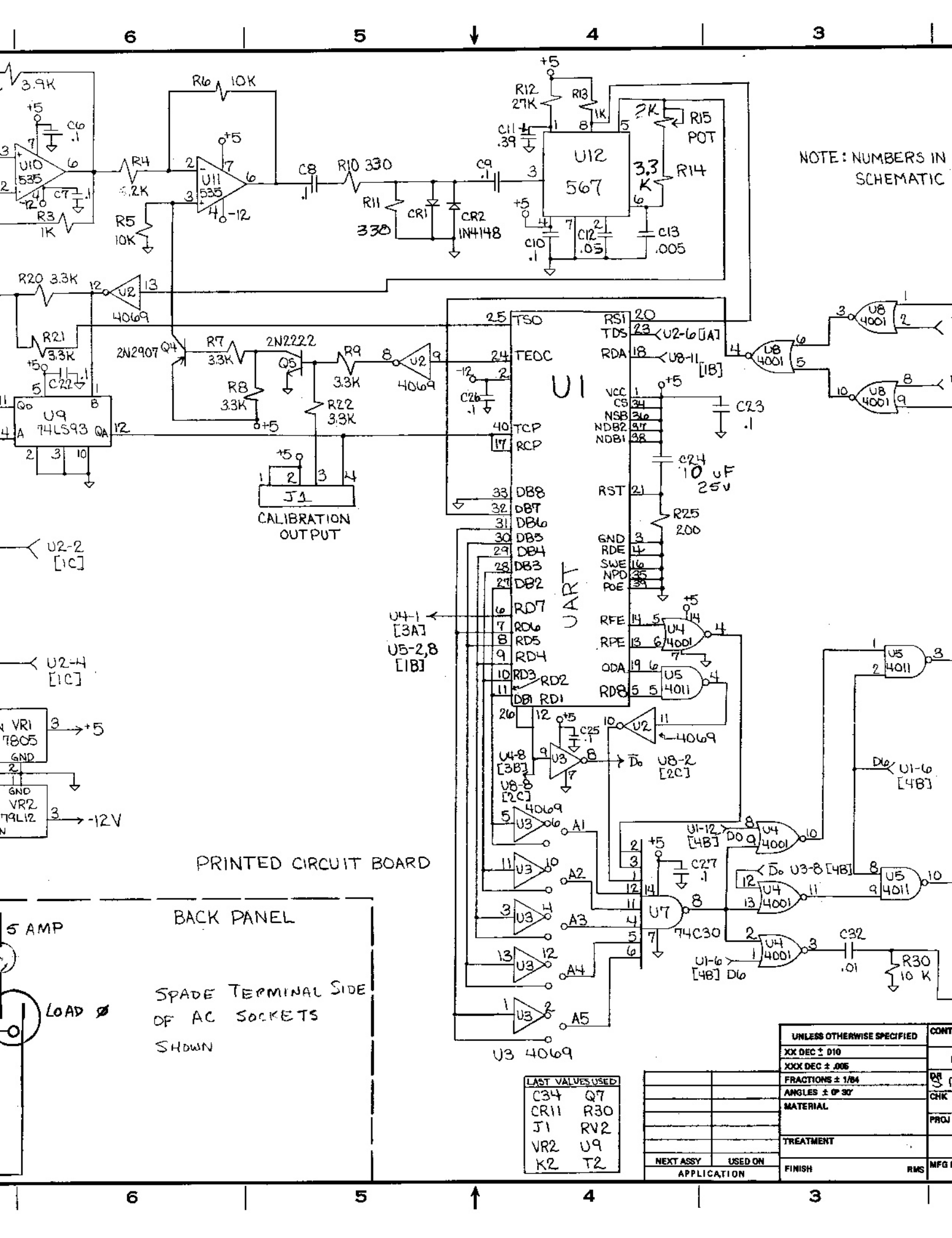
5

PRINTED CIRCUIT BOARD

BACK PANEL

SPADE TERMINAL SIDE OF AC SOCKETS SHOWN

U4-1 [3A]
U5-2,8 [1B]



NOTE: NUMBERS IN SCHEMATIC

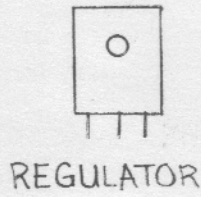
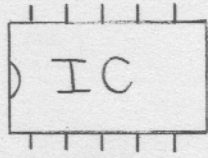
PRINTED CIRCUIT BOARD

BACK PANEL

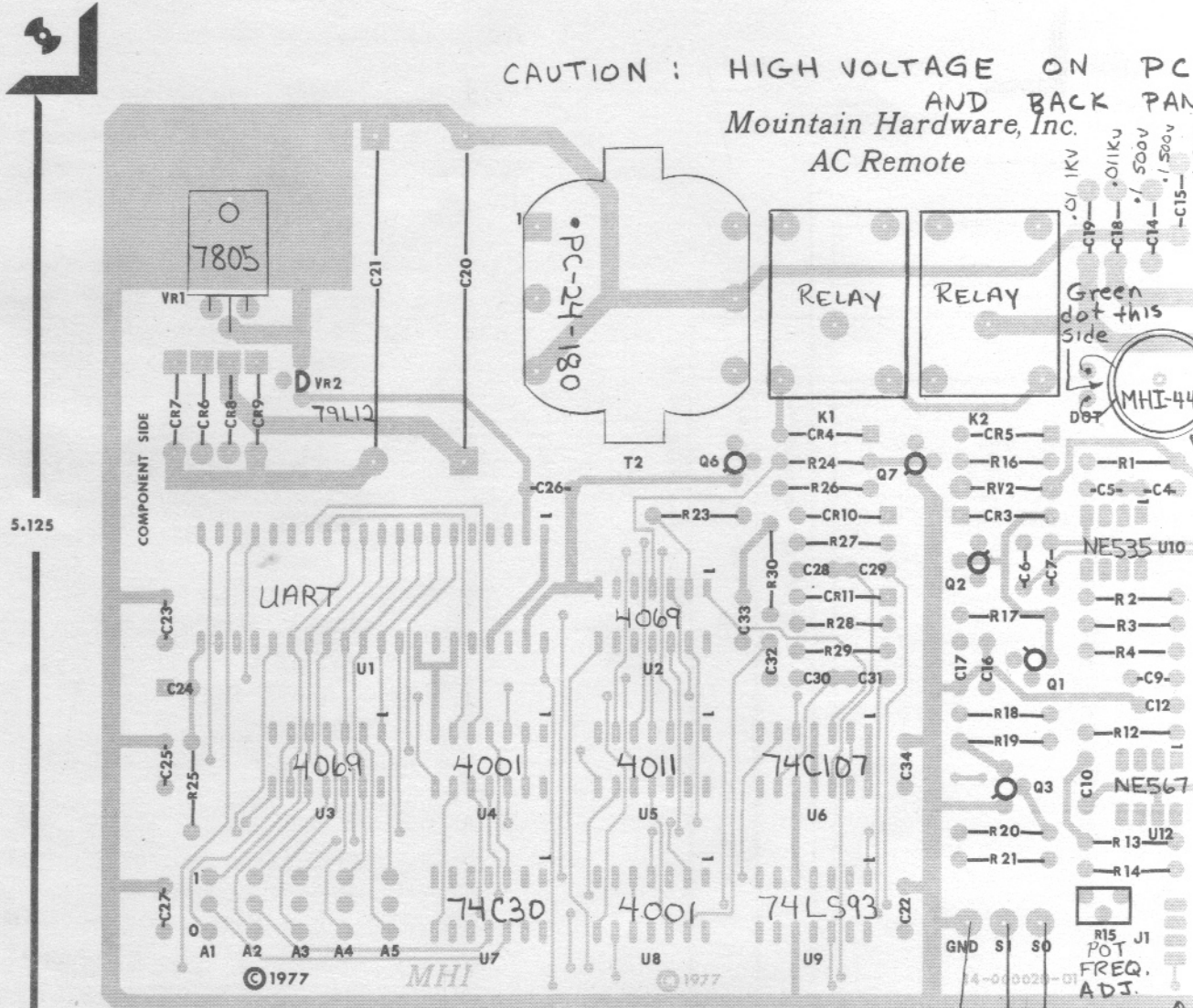
5 AMP
LOAD
SPADE TERMINAL SIDE OF AC SOCKETS SHOWN

| LAST VALUES USED | |
|------------------|-----|
| C34 | Q7 |
| CR11 | R30 |
| J1 | RV2 |
| VR2 | U9 |
| K2 | T2 |

| UNLESS OTHERWISE SPECIFIED | | CONT |
|----------------------------|---------|--------|
| XX DEC | ± D10 | |
| XXX DEC | ± .005 | |
| FRACTIONS ± 1/64 | | DR |
| ANGLES ± 0° 30' | | CHK |
| MATERIAL | | PROJ |
| TREATMENT | | |
| NEXT ASSY | USED ON | FINISH |
| APPLICATION | | RMS |
| | | MFG |



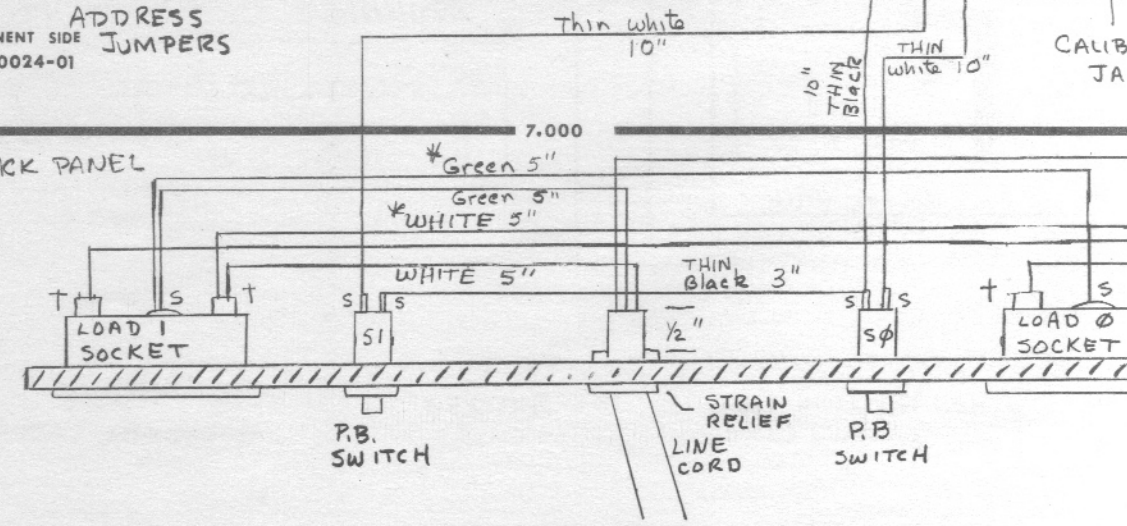
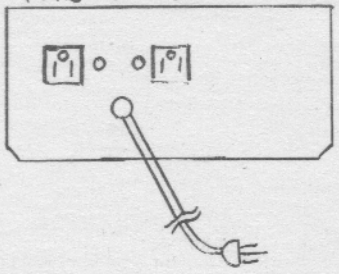
CAUTION: HIGH VOLTAGE ON PC AND BACK PANEL
 Mountain Hardware, Inc.
 AC Remote

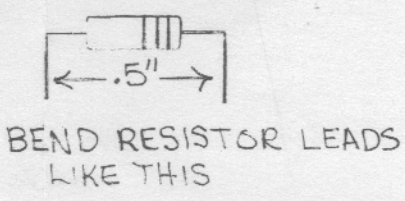
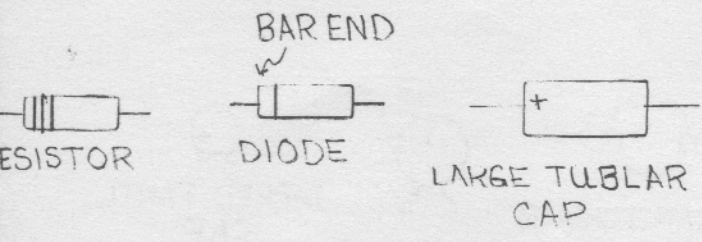


5.125

INSTALL LINE CORD AND AC SOCKETS IN THIS DIRECTION ON BACK PANEL

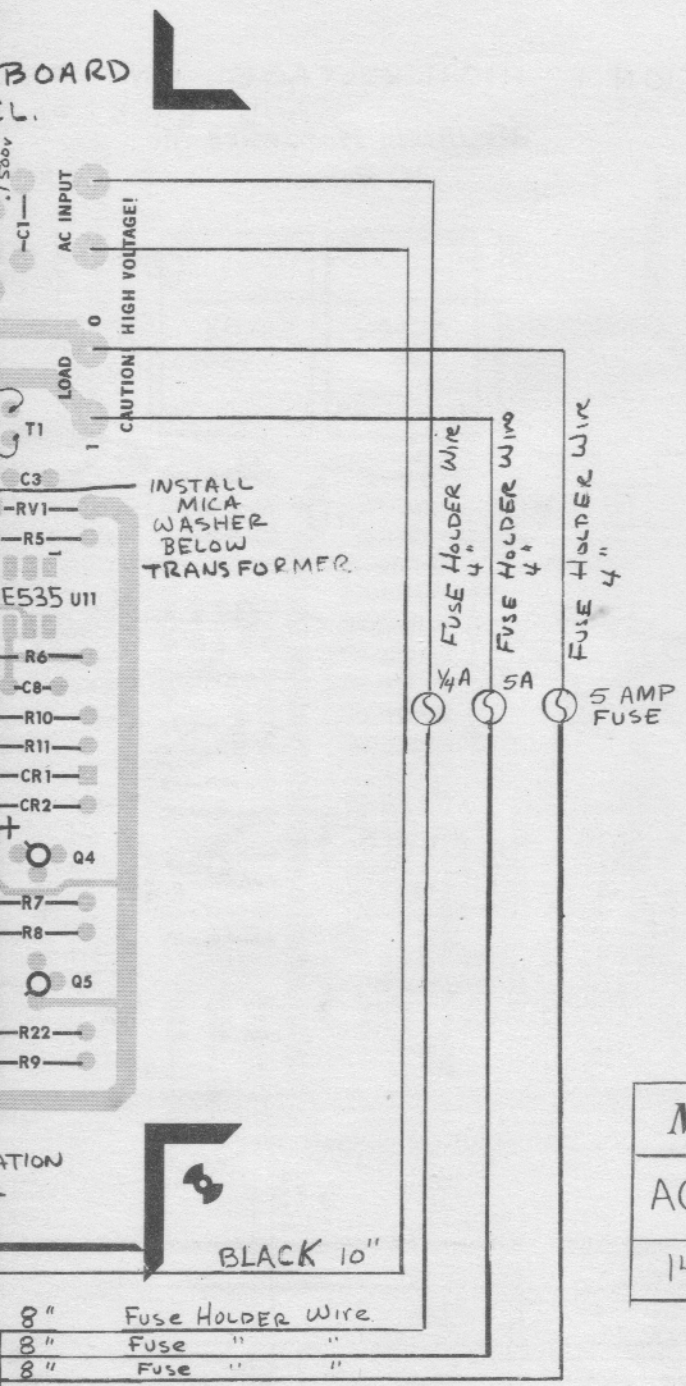
ADDRESS JUMPERS
 COMPONENT SIDE
 40-000024-01





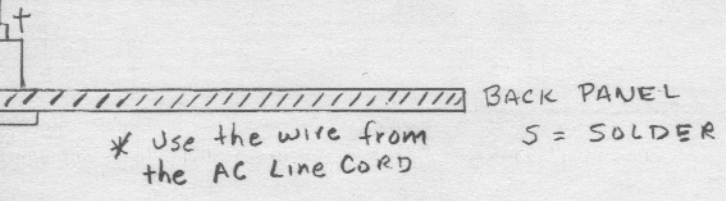
AC REMOTE WIRING

1. When wiring the back panel use great care. Use a colored pencil to mark over the lines as you install them.
2. Cut the wires to the length as marked. Follow the the color code shown.
3. Install T₁ as shown, with washer.
4. Use the thin gauge wire for the switch wiring, and the heavy for the AC power
5. SQUARE PADS DENOTE
 - a) CATHODE END (BAR END) OF DIODES
 - b) POSITIVE LEAD (+) OF CAPACITORS
 - c) PIN 1 OF ALL IC'S
6. NOTE THAT THE HIGH VOLTAGE CAPACITORS GO IN THE TO RIGHT HAND CORNER
7. Install the line cord and AC sockets in back panel as shown.



Mountain Hardware, Inc.
 AC Remote Assembly
 14-000026 10-11-77

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A. APPENDICIS**A.1 Statement of Warranty**

Mountain Hardware warrants its products in the following manner:

Any part that fails because of defects in workmanship or materials will be replaced at no charge, if the part is returned postpaid to Mountain Hardware within six months of the date of purchase.

Any malfunctioning module returned postpaid to Mountain Hardware within the six month warranty period will be repaired and returned, if in the judgement of Mountain Hardware the module was assembled with care (in the case of kits) and not electrically or mechanically abused.

This warranty is made in lieu of all other warranties expressed or implied, and is limited in any case to the replacement or repair of the unit involved.

A.2 Soldering Techniques

The most needed skills to soldering are patience and care. Use plenty of both when assembling any kit.

- a. Use a small, good soldering iron. The wattage should be 30 watts or less. Larger irons can burn the pc boards, and cause traces to lift. Soldering guns are too hot and large for this application. The tip on the iron should be small and clean. Wipe the tip on a damp sponge before each use.
- b. Use 60-40 rosen core solder ONLY. The diameter of the solder should be small, around 20 to 30 thousandths of an inch. DO NOT use externally applied flux, or acid core solder.
- c. When soldering, wipe the tip first. Lightly set the iron on both the lead and the pad to be soldered. After a second, apply solder to the lead and the pad, near the iron. The solder should melt freely. Apply enough solder to surround the entire lead, allowing a little extra to flow with the hole. Remove the solder and let the iron bubble out some of the resin on the solder. Then remove the iron. The entire process should take less than 3 seconds. The soldered joint should be neat and shiny. When soldering on large metalized areas, a longer time may be required to solder the joint.

- d. The solder mask varnish is intended to prevent solder bridges and splashes. Excessive heat in soldering may cause this varnish to blister. If this happens try to reduce the length of time the iron is on the pad when soldering.

