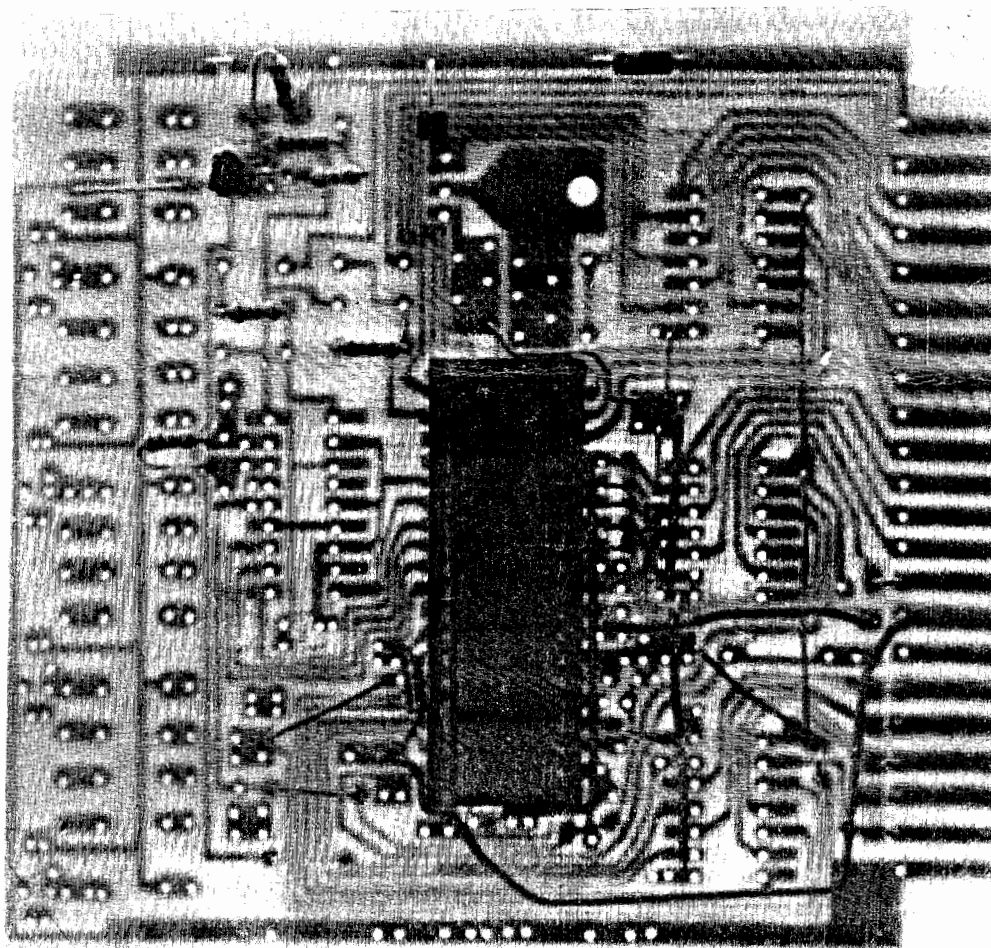

C . A . R . S . I N C .

C . A . R . S .
REPEATER CONTROLLER



Crawford Amateur Radio Society
P.O. Box 653
Meadville, PA 16335

November, 1987

Dear Fellow Ham,

The Crawford Amateur Radio Society is offering the CARS Repeater Controller for sale. We believe the enclosed information will show that the controller is very flexible and will add to the responsiveness and value of your repeater.

The CARS controller was designed and is being built by hams; lead design and construction is by Jim, KA3JFO; Joe, KB3EX; and Rick, WB3JDI. All income from the sale of controllers goes to the CARS treasury and is used to support club activities, notably the W3MIE repeater. This is truly a "by hams, for hams" operation.

We invite your attention to the enclosures. Your order or questions will be filled or answered promptly.

Happy hamming and 73s.

Rich

Rick Silverio, WB3JDI
President, CARS
P.O. Box 653
Meadville, PA 16335

C A R S I N C .

INTRODUCTION

The CARS 2-87 TONE DECODER AND MICROPROCESSOR CONTROLLER BOARD permits economical and reliable control of remotely located devices such as amateur repeaters. It is designed around the 8748 microprocessor and SSI202 tone decoder to keep components to a minimum.

The controller is offered as a completely assembled and tested operational unit; as a kit complete with the PC board, programmed microprocessor, decoder and all parts; or as a partial kit including PC board and programmed microprocessor (you supply decoder and common parts). This permits the lowest possible price.

The controller is programmed to your individual requirements after you order it. It may be reprogrammed for a \$15.00 fee if sent to us. The circuit board is single sided to make soldering easy for the builder and we supply a complete set of pictures, diagrams and instructions for building Kit. A 22 pin edge connector is supplied with the operational unit or the complete kit.

EXAMPLE CONTROL SEQUENCE

To turn relay number one ON, you would press: < * 123 * >.
To turn the same relay OFF you would press < * 123 # >.
The last character sent toggles ON/OFF.
The < 123 > is the function assignment for relay one (#1). It could be any three numbers or ABCD on the tone pad.
The < * > is the first digit and is used to start the decode timing sequence. If (and only if) the COR is active, you are allowed 10 seconds to enter codes.

----- PRICE LIST -----

PC board, Microprocessor & building instructions	\$35.00
Kit - all parts except relays	\$65.00
CARS controller - assembled and tested	\$80.00
On-board relay kit (relays, diodes, LEDs)	\$20.00.

F E A T U R E S

*12 LATCHED FUNCTIONS

The controlled board offers 12 independently controlled latched relay outputs

*4 SPECIAL FUNCTION RELAYS

1. Carrier Operated Relay output (COR).

2. Weather Relay Output - A special function that can be activated with an external pulse from a tone controlled weather radio.

3. Pulsed Relay Output - A special function used to give a 1/2 sec. pulse to start a special function like a tape recorder.

4. Mute Relay Output - This special function will be active when control tones are sent to the controller. This eliminates tones sent over the air for control and provides security.

*CODE ID

The controller provides your individual code ID that is programmed into the 8748 when you order. For example, W3MIE/R.

*COURTESY TONE CONTROL

An over-the-air signal can be sent to the controller to change the frequency of the courtesy tone. Four tones are available and can be used as a special signal to your group that is sent with each courtesy tone.

*CODED RESPONSE TO CONTROL TONES

The decoder will respond with CW "OK" for any correct control code it receives.

*5 DIGIT CONTROL CODES

Five digits are required for control which allows greater security. See example on last page.

*SPECIAL LOCK FUNCTION CODE

For security, control codes can lock the controller in its present state of operation.

*TONE PAD TEST

This function will give a response of "OK" if the correct sequence of tones are sent to the controller. If the tones are bad, the controller will not respond.

*SINGLE-TONE AUTOPATCH

The controller uses THREE SECONDS OF "*" for auto patch UP, and "#" for OFF. The weather relay output can be used for this.

*HANG TIME CONTROL

The hang time can be either short (1/2 sec.) or long (1 1/2 sec.). Used for open band conditions.

*TIME-OUT TIMER CONTROL

The controller will allow control of the time-out timer used with the COR relay. It can be either either three minutes or zero for special events.

*MULTIPLE COURTESY BEEPS

The controller has four different courtesy beeps. One, two, three or four beeps can be used for different weather conditions or whatever you want to dream up. CARS can provide a chart for suggested uses of this function.

*SPECIAL RESET CODE

A special reset code is provided to allow you to reset all controller codes to a power-up condition.

*AUTO RESET ON POWER UP

The controller will set the processor to a default condition on power-up but will not lock up on power failure.

*EMERGENCY TONE

If the touch tone "0" is sent to the controller for three seconds, the courtesy tone will change to FOUR BEEPS to alert any station monitoring of an emergency.

REPTONE FOR _____/R
COMMENT

CODE	on/off	FUNCTION	COMMENT
*601	*/#	RELAY #1	WHEN (ON) COURTESY BEEP IS THREE BEEPS
*602	*/#	" #2	
*603	*/#	" #3	
*604	*/#	" #4	
*605	*/#	" #5	
*606	*/#	" #6	
*607	*/#	" #7	
*608	*/#	" #8	
*609	*/#	" #9	MAYBE USED FOR AUDIO CUTOFF ON PATCH.
*610	*/#	" #10	
*611	*/#	" #11	
*612	*/#	" #12	MAY ALSO BE "PULSED" 1/2SEC. USING *616#
*613	*/#	BEEP	URNS ON /OFF COURTESY BEEP
*614	*/#	TIMED RLY	"ON" PULSES IT AFTER EACH ID AND CHANGES COURTESY BEEP TO TWO DITS, "OFF" PULSES IT EACH TIME CODED
*615	*/#	HANG TIME	CONTROLS THE LENGTH OF HANGTIME AFTER BEEP 'DEFAULT' IS SHORT HANG TIME. * LENGTHENS THE TIME.
616	RESET	*616# PULSE R12	* RESETS PROCESSOR, # PULSES RLY 12 FOR 1/2 SEC.
*617	*/#	"LOCK"	DISABLES ALL CODES EXCEPT UNLOCK CODE *617# IN THERE CURRENT STATE
*000	*/#	HELP/WX	CAUSES THE COURTESY BEEP TO GO TO "H" 4 DITS AND TURNS ON THE WX RLY OUTPUT. PIN 21 ON THE BOARD CAN BE USED FOR THE PATCH RELAY OUTPUT IF WX NOT USED.
*123#		PAD TEST	TONE DECODED OK IT WILL SEND A CW "OK" IF GOOD
*456#		"	"
*789#		"	"
*001	*/#	TONE CHANGE	CHANGES COURTESY BEEP # APPROX 750
			* " 1500
*002	*/#	"	" # " 2250
			* " 3000
*003	*/#	PHONE PATCH	* INTERNAL PATCH, # EXTERNAL
*004	*/#	TIME OUT	* TIME OUT TIMER ON 3 MIN
			# " " " WILL NOT TIME OUT

NOTES AND PROCEDURES

- 1) ALL CODES CONTAIN THREE DIGITS (0 THRU 9 AND A THRU 0)
- 2) ALL CODES ARE PRECEDED WITH A "*"
- 3) ALL CODES ARE TERMINATED WITH EITHER A "*" OR "#"
- 4) THE "*" TERMINATOR TURNS THE FUNCTION ON AND THE "#" TERMINATOR TURNS IT OFF (THERE ARE A FEW EXCEPTIONS)
- 5) CARRIER DROP DURING THE CODE WILL ABORT THE CODE
- 6) A "0" HELD FOR THREE SECONDS WILL ACTIVATE THE WEATHER/HELP RELAY JUST AS "*000*" WILL. A "H" WILL BE ON THE COURTESY TONE. A 5 VOLT VOLTAGE ON PIN 31 OF THE PROCESSOR WILL ALSO ACTIVATE THE RELAY BUT THE BEEP WILL NOW BE A "W" RESET THESE TWO FUNCTIONS BY USING THE *000#
- 7) A "*" HELD FOR THREE SECONDS WILL ACTIVATE THE PHONE PATCH .THE "#" WILL DROP THE PATCH

NOTE THE OUTPUT PIN 32 OF THE PROCESSOR IS THE PATCH LINE SEIZURE RELAY OUT PUT IT NEEDS A 7406 IF YOU ARE TO USE IT.

PIN 34 IS THE PATCH THE AUDIO CUTOFF RELAY THAT IS ACTIVATED BY THE COR IN PUT TO MUTE AUDIO FROM THE LINE IT ALSO NEEDS A 7406 THESE OUTPUTS ARE ACTIVE IN THE INTERNAL PATCH NODE IF THE EXTERNAL PATCH IS SELECTED THE PIN 32 SEIZURE RELAY WILL ACTIVATE A AND THEN WILL DEACTIVATE ON THE NEXT COR ACTIVATION. IT IS ASSUMED THE YOU ARE USING A SMART PATCH FROM THERE.

- 8) IF THE SYSTEM IS "LOCKED" NO CODES WILL BE RECOGNIZED EXCEPT THE "UNLOCK" CODE, THREE SECONDS OF "*" OR "#" FOR PHONE PATCH AND THE HELP /WEATHER RELAY "0" THREE SEC .
- 9) ALL INPUTS ARE 5VOLT ZENER PROTECTED (COR OR WX) HIGHER VOLTAGES CAN BE USED

***VOLTAGE PROTECTION OF BOARD**

The board will not be damaged if the power supply is reversed. All inputs, COR and weather are 5 volt Zener Diode protected.

***AREA FOR BOARD-MOUNTED RELAYS**

The PC board is designed to accomodate four board-mounted relays for simple control operations. When installed, these relays can be used with any controller output. No relays are supplied except in the relay installation kit (\$20.00).

***OPEN-COLLECTOR OUTPUTS**

All outputs are open collector, 40 ma. sink, rated 30 volts.

***VALID TONE INDICATOR**

This function uses a LED to indicate if a tone is valid and is used to set audio levels to the controller.

***INDEPENENT XTAL CONTROL STABILITY**

The controller has two 3.58 Mhz xtals to provide rock-solid stability. One is used to control the decoder chip and the other to control the microprocessor.

***SMALL SIZE**

The controller PC board is 4.5 x 4.5 inches and uses a standard 22 pin connector for all inputs and outputs.

***COURTEOUS ID**

The controller will wait for you to drop the carrier before it IDs and will ID if the COR is activated after that time.

***CONTROL TONE MUTING**

The controller can be set to mute all control tones; other tones will be normal. < * > starts the mute sequence.

M O R E I N F O R M A T I O N

Write to: Crawford Amateur Radio Society
P.O. Box 653
Meadville, PA 16335

Call: Rick Silverio, WB3JDI
814/724-4337

IF REQUIRED

10) THE VALID TONE LED WILL LIGHT IF A GOOD TONE IS PRESENT

11) ON RESET OR A POWER FAIL YOU WILL HAVE TO CHANGE THE CODES USED FOR HANG TIME, PHONE PATCH, ANY OTHER RELAY THAT WAS ON, THE TONE FREQ AND TIME OUT TIMER

- DEFAULTS
1. ALL RELAYS OFF
 2. SHORT HANG TIME
 3. THE LOWEST COURTESY TONE
 4. PATCH INTERNAL
 5. TIME OUT TIMER 3 MIN
 6. A SINGLE BEEP

12) ALL OUTPUTS ARE OPEN COLLECTOR 40 MA. MAX SINK, 30 VOLTS. RADIO SHACK 275-213

13) POWER SUPPLY VOLTAGE MUST BE HIGHER THAN 11 VOLTS TO GET A GOOD RESET ON A POWER FAIL. 15 VOLTS. MAX CURRENT IS ABOUT 120MA ON POWER UP NO OUTPUTS ON.

IF YOU HAVE ANY QUESTIONS WRITE TO

US AT

CRAWFORD AMATEUR RADIO SOCIETY

BOX 653

MEADVILLE, PA.

16335

THANKS FOR ORDERING OUR CONTROLLER. IN THE BOX YOU WILL FIND DRAWINGS FOR THE CONTROLLER, A PARTS LIST, RELAY BOARD INFO AND INTERCONNECT CABLE INFO. FOLLOW THE DRAWINGS AND YOU SHOULD HAVE NO PROBLEMS. START WITH THE JUMPERS PRINT.

BEFORE YOU PUT ANY OF THE CHIPS ON THE BOARD PLEASE DO THESE CHECKS FIRST. OBSERVE PIN ONE ON ALL CHIPS. (IF WRONG THEY SMOKE).

1. INSTALL THE 7405 REG. AFTER ALL OTHER PARTS ARE IN PLACE. DONT FORGET THE ALUMINUM HEAT SINK.

2. APPLY POWER TO PIN 1 +12 DC AND 22 GROUND OF THE EDGE CONNECTOR.

WITH A DC VOLT METER SET TO 12 VOLTS SCALE CHECK BETWEEN GROUND AND THESE PLACES ON THE BOARD

8748	PIN 40-26-5	TEST 5 VOLTS
7405*3	PIN 14	" 5 "
SSI202	PIN 2-3-5-8	" 5 "

3. REMOVE THE GND LEAD AND CLIP YOUR PLUS LEAD TO 12 VOLTS.

WITH THE GND LEAD CHECK THESE PINS.

8748	PINS 7-20	TEST 12 VOLTS.
7405*3	PINS 7	" 12 "
SSI202	PINS 4-7-10-15	" 12 "

4. REMOVE POWER, PLUG IN THE 7405 CHIPS OBSERVE PIN ONE AND CONNECT POWER AGAIN. PLUS LEAD OF YOUR METER TO PLUS 12 V, TEST ALL EDGE CONNECTOR OUTPUTS.

EDGE CONNECTOR PINS:

4-5-6-7-8-9-10-11-12-13-14- 17-18-19-20-21 ALL HAVE A 12 VOLT READING.

ALL OF THE CHIPS ARE TURNED ON.

5. REMOVE POWER AND PLUG IN THE 8748 AND THE SSI202. OBSERVE PIN ONE. CONNECT POWER.

ALL OF THE OUTPUT SHOULD NOW READ 0 OR VERY LOW VOLTAGE.

ALL OF THE CHIPS ARE NOW OFF

THE VALID TONE LED WILL BLINK WHEN THE POWER IS CONNECTED.

6. CONNECT PIN 16 OF THE EDGE CONNECTOR TO 12 VOLTS.

THIS TAKES THE COR HIGH TO ACTIVATE. CONNECT 8 OHM SPEAKER AUDIO FROM AN HT TO PIN 2 AND 22 GND. WITH ANOTHER HT SEND TOUCH TONES TO THE FIRST HT. YOU SHOULD SEE THE VALID TONE LED LIGHT WITH THE TONES.

7. CONNECT YOUR METER GND LEAD TO PIN 20 THIS IS RELAY NUMBER ONE.

SEND *601* AND YOU WILL SEE 12 VOLT ON YOUR METER.

SEND *601# AND 12 VOLTS WILL DROP.

8. RELOCATE YOUR LEAD TO PIN 6 AND REMOVE THE WIRE ON PIN 16 AFTER A FEW SECONDS THE 12 VOLTS WILL DROP. THE BOARD WAS ID'ING. CONNECT THE WIRE TO 16 AND THE 12 WILL COME BACK. THIS IS YOUR COR OUTPUT.

9. ALL THE OTHER OUTPUTS WILL ACT THE SAME ON THESE TEST IF THE CORRECT CODE FOR EACH IS SENT TO TURN ON THEN OFF THE OUTPUT.

10. A SMALL HI Z EARPHONE CONNECTED TO PIN 3 AND 22 WILL LET YOU HEAR THE ID AND COURTESY TONES, THREE DITS WHEN RLY#1 ON.

11. TAKING PIN 15 HIGH 12V WILL CAUSE A (W) ON THE COURTESY TONE.

THIS IS USED WITH AN EXTERNAL WEATHER RADIO TO INDICATE WX WARNINGS.

12. WE HAVE INDICATED, ON THE DRAWING, THE JUMPERS TO GIVE YOU PATCH OUTPUT AND AUDIO OUTPUT ON THE PATCH. THE AUDIO OUT OUT WILL ACTIVATE A RELAY ON PIN 10 TO CUT OUT ANY AUDIO FROM THE PHONE LINE SO YOU HAVE COMPLETE CONTROL. THE WX RELAY IS WIRED TO BE THE PATCH LINE RELAY YOU MAY CHANGE IT IF YOU WISH.

IF YOU HAVE ANY QUESTIONS CALL OR WRITE TO US AND WE WILL HELP AS MUCH AS WE CAN.

OUR ADDRESS IS: C.A.R.S.

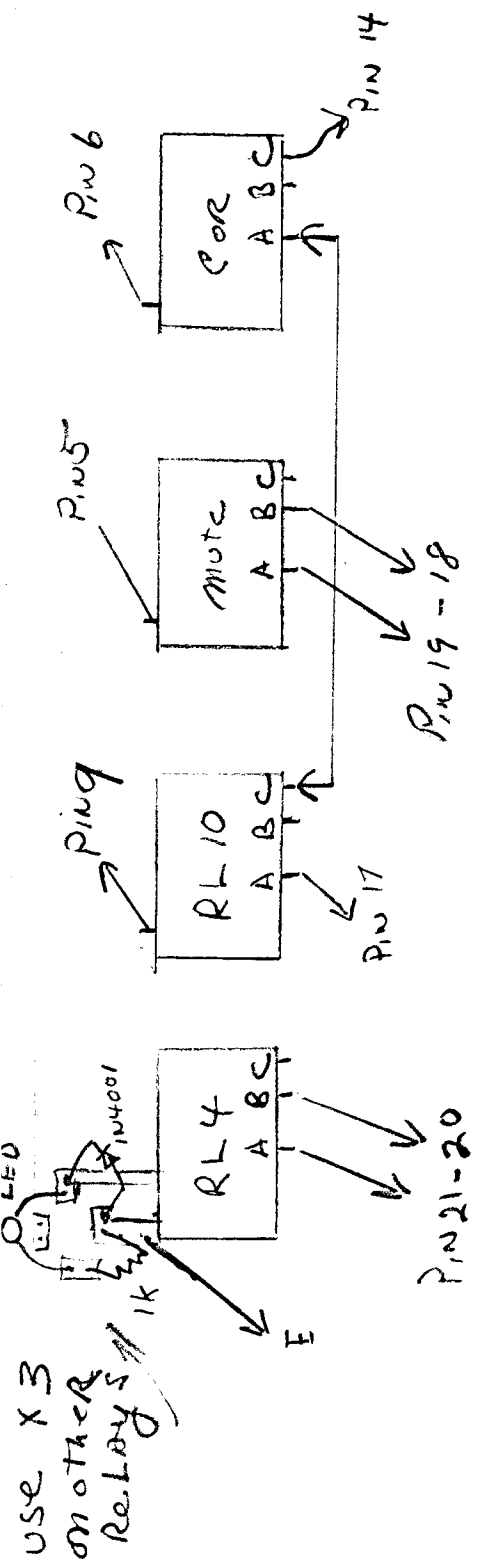
BOX 653

MEADVILLE PA. 16335

MY PHONE NUMBER IS 814 724 4337. CALL AFTER 6:00 PM. LEAVE A MESSAGE IF I'M NOT THERE.

RICK SILVERIO W83J01

PRES. C.A.R.S.



RL10 USED

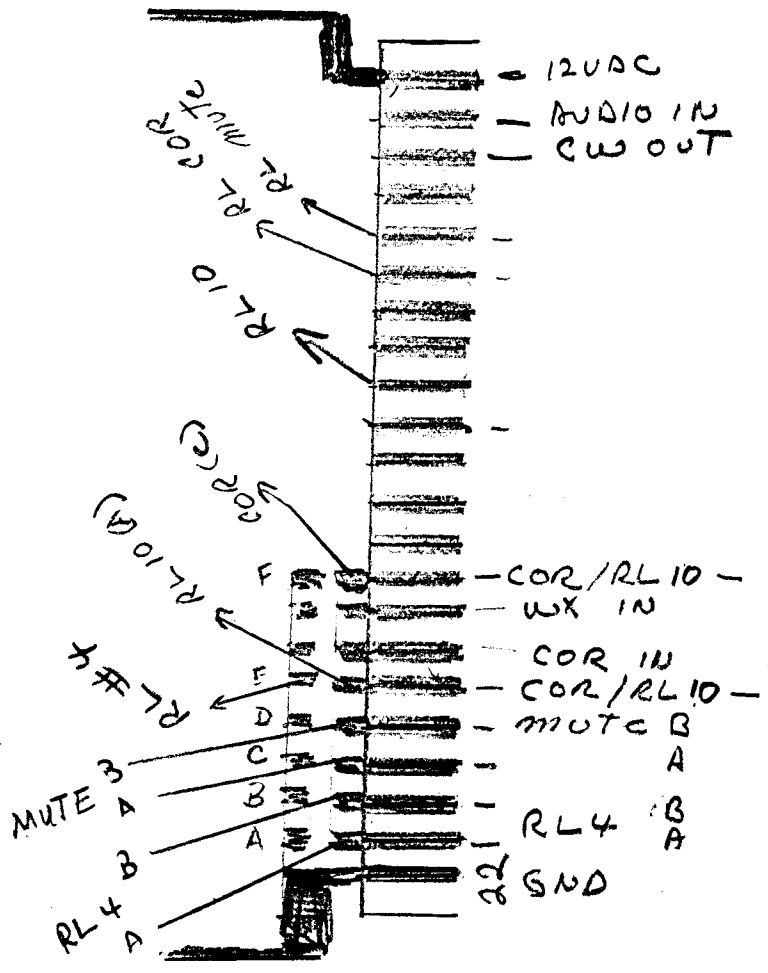
To open COR
Inhibit Xmit

RL4 - Other Operation

ON BOARD Relay
WIRING Chart.

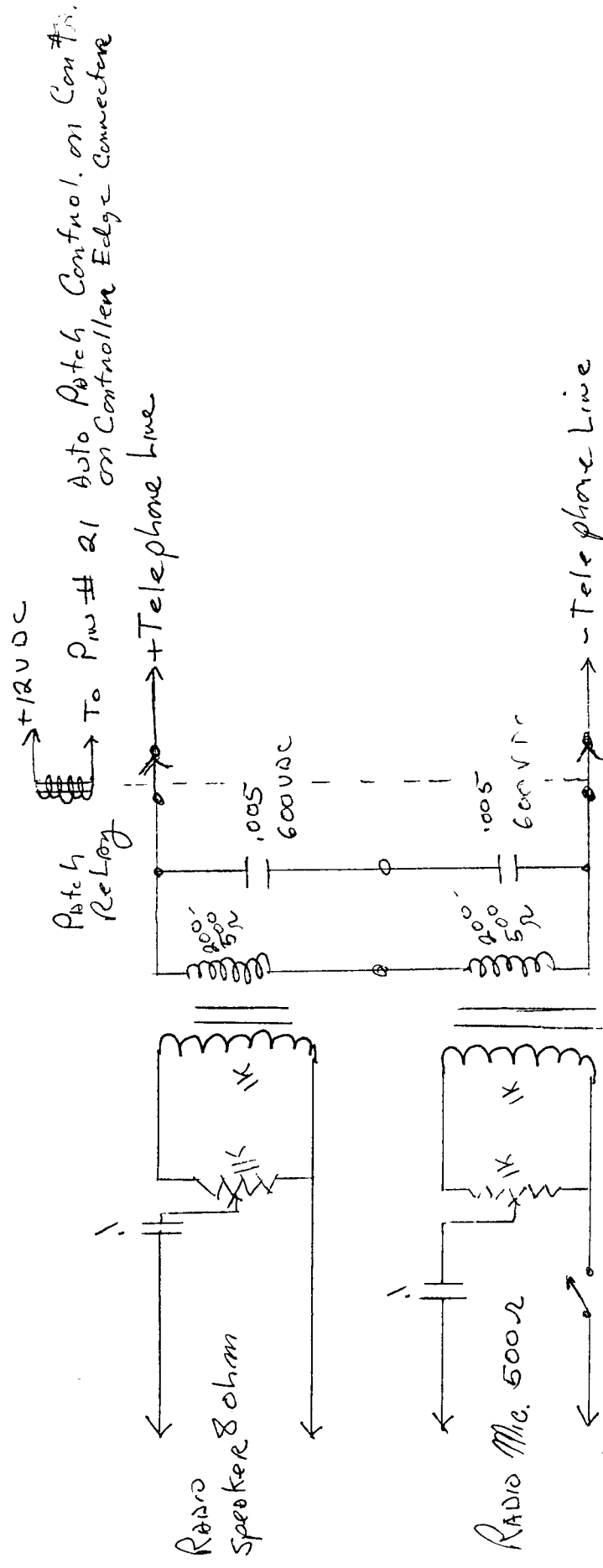
(C) 1987 CARS

R.S.



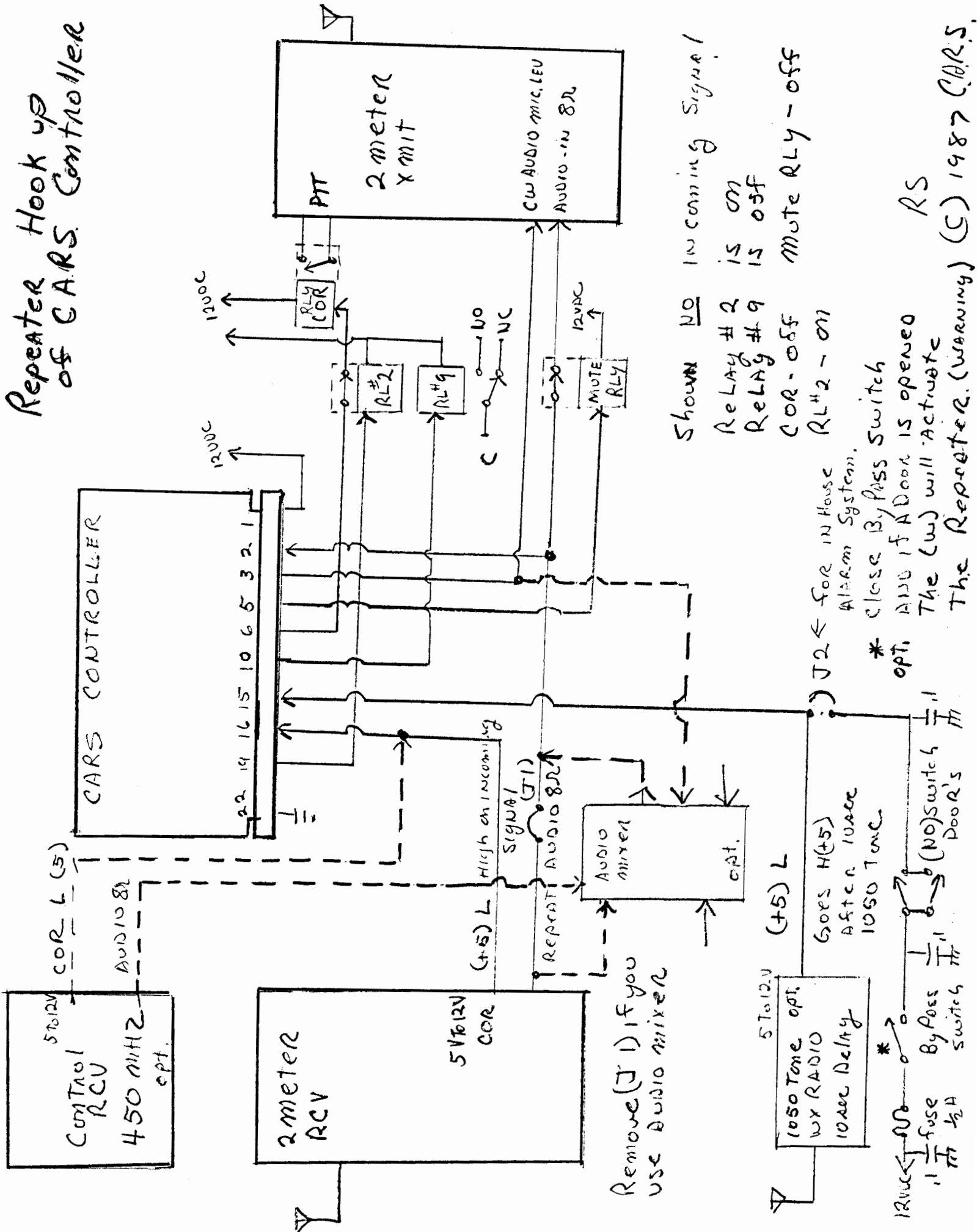
Simple Auto-Patch Hook up

Patch is shown Activated
 After 3 Seconds of (*)
 opens with (#)
 "COR" is Active



Audio Cutout Rly → To +12VDC
 → To Pin # 10 Controller Board Edge Connector
 Audio Cutout Relay
 This Relay will open when "COR" is Active
 to Cutout The Audio from The Phone Line to The Transmitter

Repeater Hook up of CARS Controller



Shown NO Incoming Signal
 RELAY # 2 IS ON
 RELAY # 9 IS OFF
 COR - OFF MUTE RLY - OFF
 RL#2 - ON

* J2 ← FOR IN HOUSE ALARM SYSTEM.
 * close Bypass Switch
 opt. ALSO if A Door is opened The (CW) will activate
 The Repeater. (Warning) (C) 1987 CARS.

Remove (J1) if you use audio mixer

12VDC ← 1050 TONE opt. W/ X RADIO 10sec Delay
 1 1/2 fuse By Pass switch #1
 1 1/2 A switch #2
 GOES H(+5) AFTER 1050 TONE
 (NO) SWITCH DOOR'S

HARDWARE		
25	1- 40 PIN SOCKET	276-1996
26	1- 18 PIN SOCKET	276-1992
27	3- 14 PIN SOCKETS	272-1999
28	1- SMALL ALUMINUM HEAT SINK	
29	1- FERRIT BEAD	
30	1- CARS 2/87 PC BOARD	CARS SUPPLIED
31	24 INCHS #30 WIRE WRAP WIRE	276-501
32	44 PIN EDGE CARD SOCKET	276-1551

OTHER PARTS:

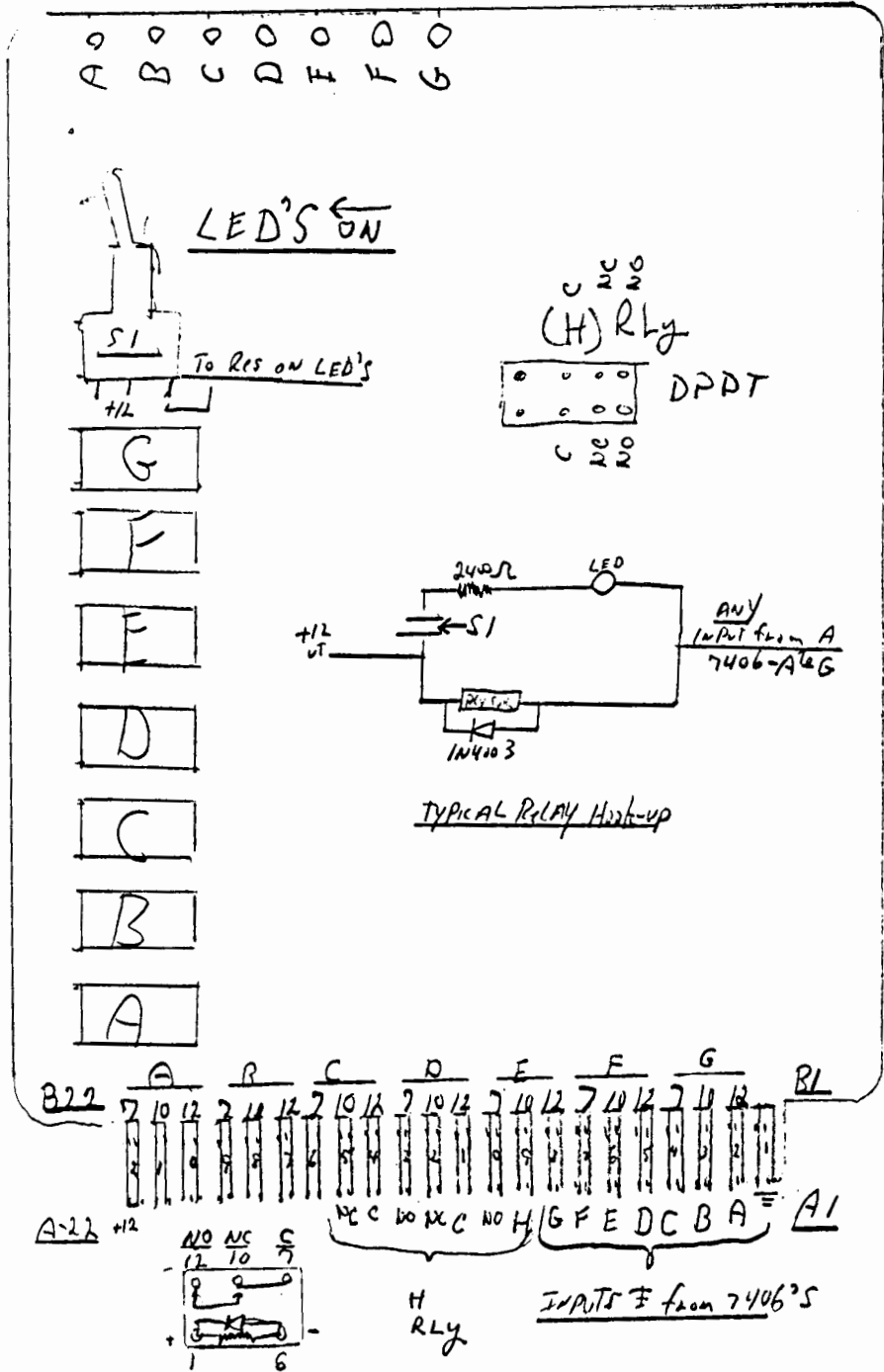
4-RELAY KIT			OPTIONAL FROM CARS
33	4	12V RELAY	275-213
34	4	1N4001	276-1101
35	4	LED	(OPTIONAL) 276-026
36	4	1K	" 271-1321
37	4	16 PIN SOCKETS	" 276-1998
38	1	30 WIRE WRAP WIRE	276-501

EXTERNAL RELAY BOARD 8 RELAYS (SPECIAL REQUEST ONLY).

39	8-	12V RELAYS	275-213
40	1-	PC BOARD	276-188
41	1-	44 PIN EDGE CARD SOCKET	276-1551
42	8-	16 PIN SOCKETS (OPTIONAL)	276-1998
43	1-	7805	" 276-1770
44	1-	7404	" 276-1802
45	1-	14 PIN SOCKET	" 276 1999
46	8-	LEDS	" 276-026
47	8-	1K	" 271-1321
48	8-	1N4001	276-1101
49	1-	SPST SWITCH	" 275-635
50	1-	30 WIRE WRAP WIRE	276-501

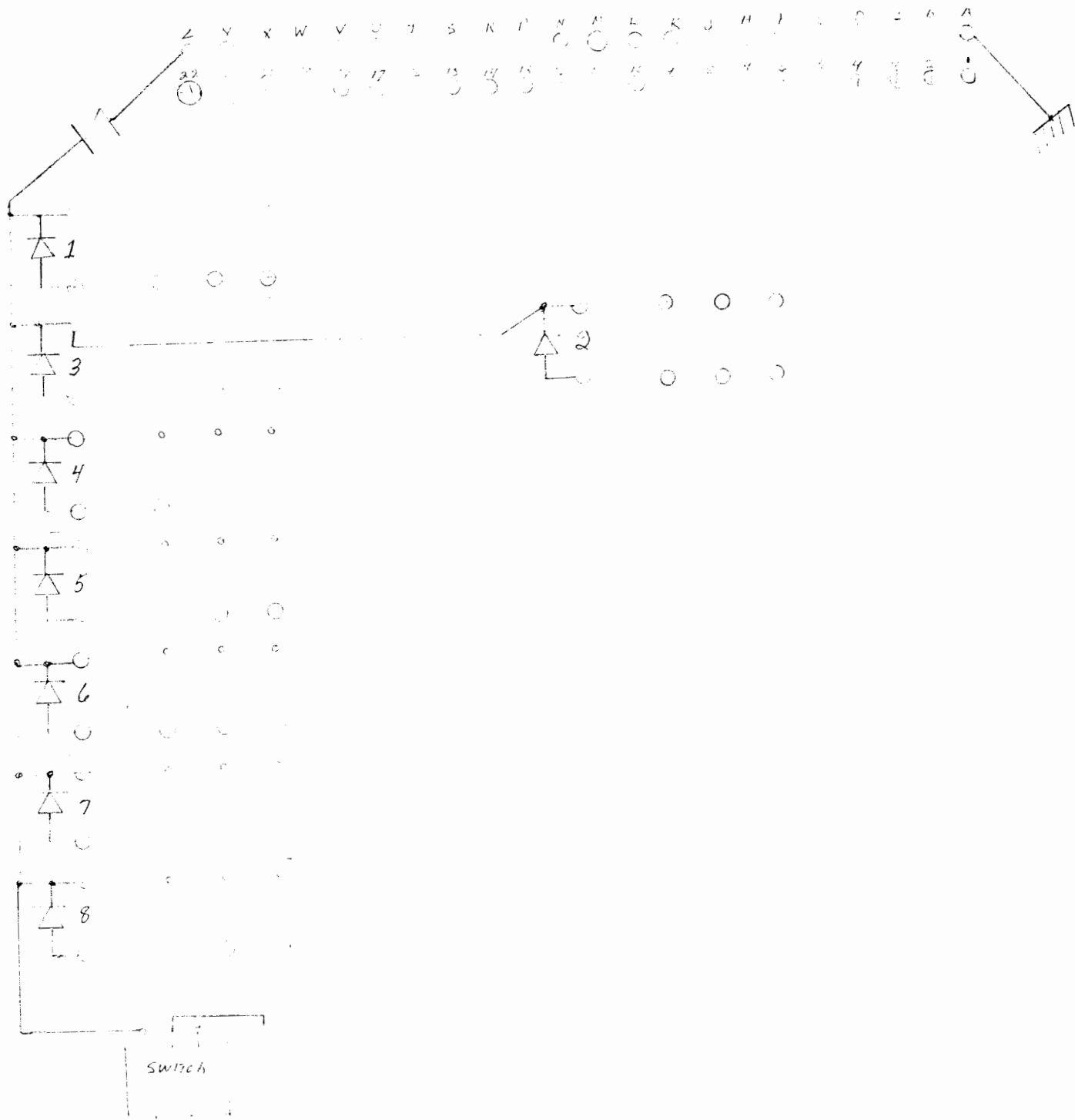
C.A.R.S WILL SUPPLY ANY INDIVIDUAL PARTS ON THIS LIST AT SUGGEST LIST PRICE PLUS SHIPPING. ORDER LINE NUMBER AND QUANTITY.

WRITE TO: C.A.R.S BOX 653 MERDVILLE, PA. 16335

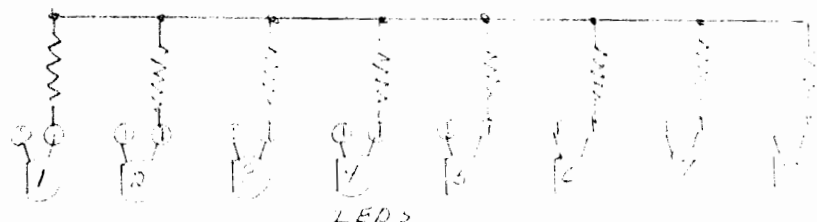


CARS Relay Board

SOLDER SIDE OF BOARD



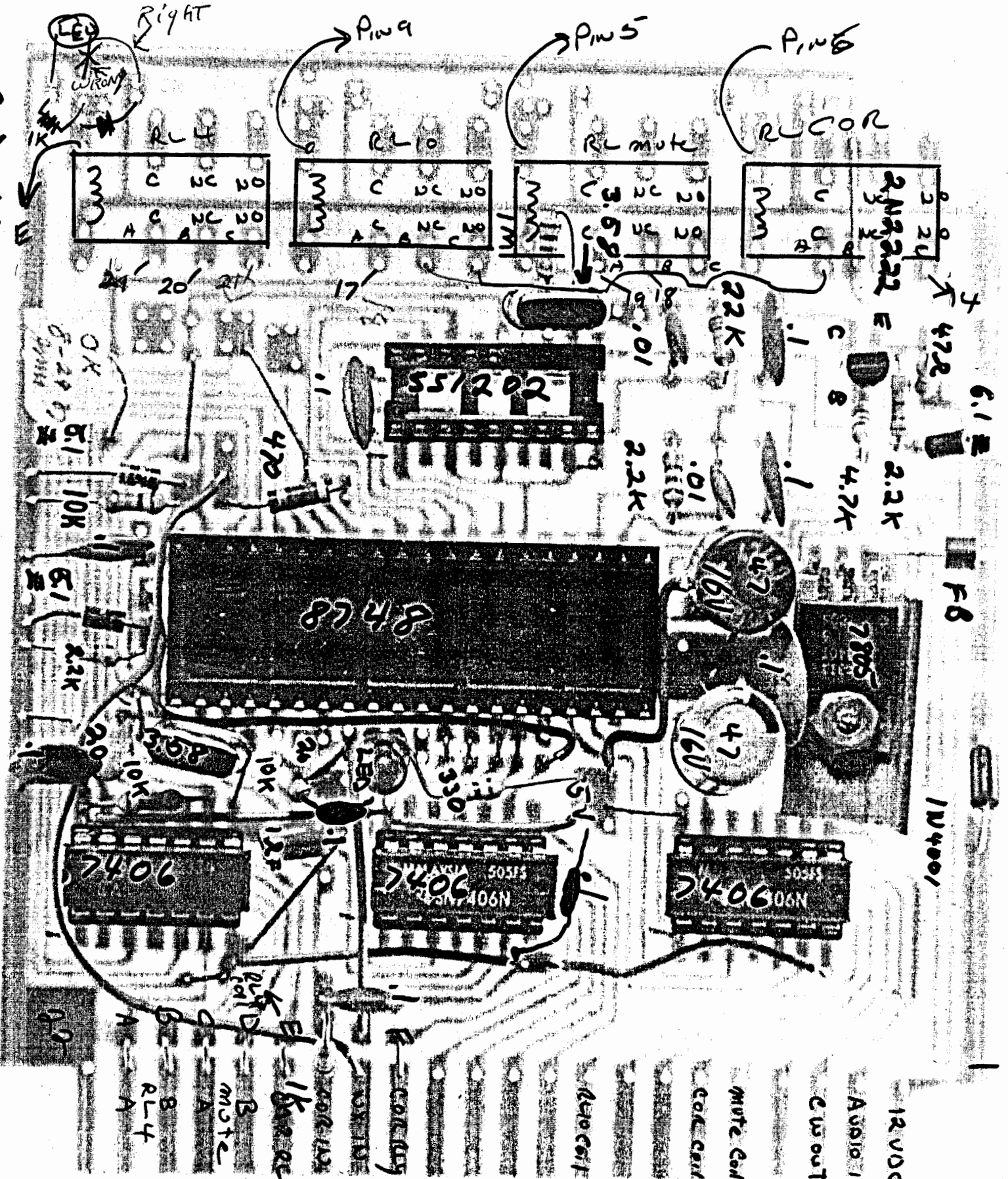
SWITCH



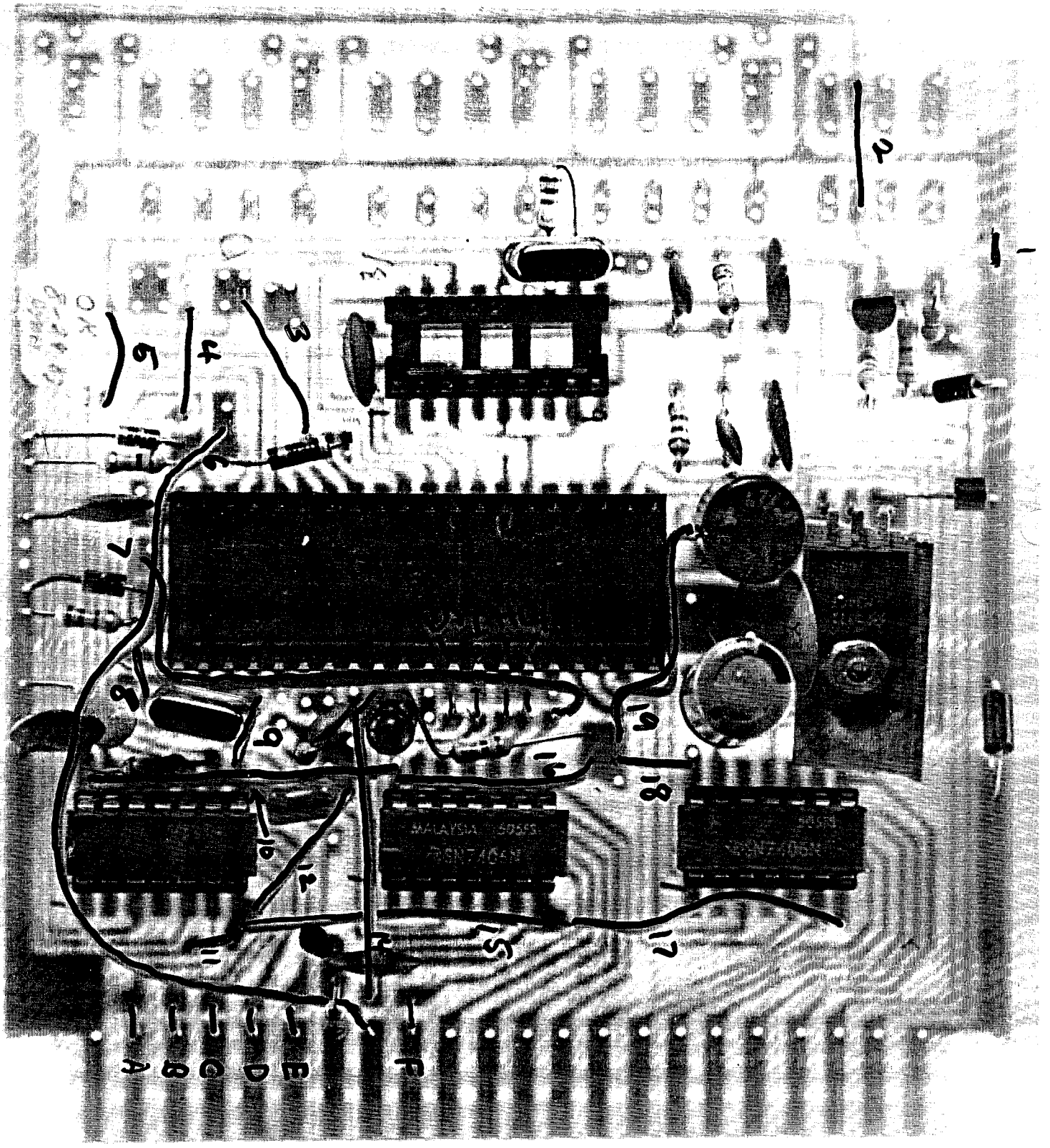
LEDs

CARD CONTROLLER
PCBA BOARD #1
6-11-87
EMP

(G) CAS 1983



Jumper C on A, B, C, D, E, F Note: No Patch this way



OK
8-11-40

A
B
C
D
E
F

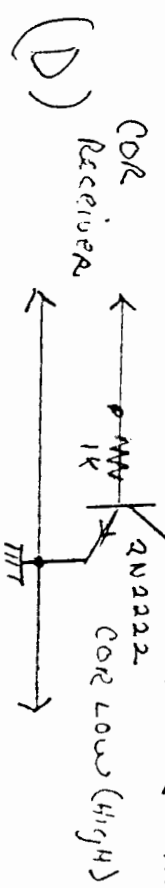
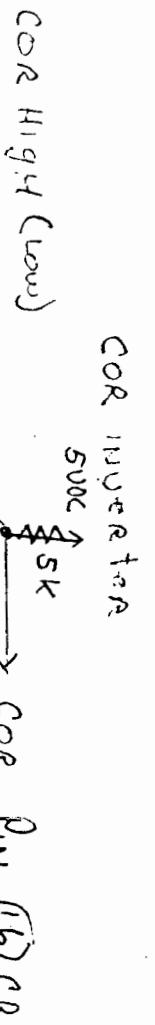
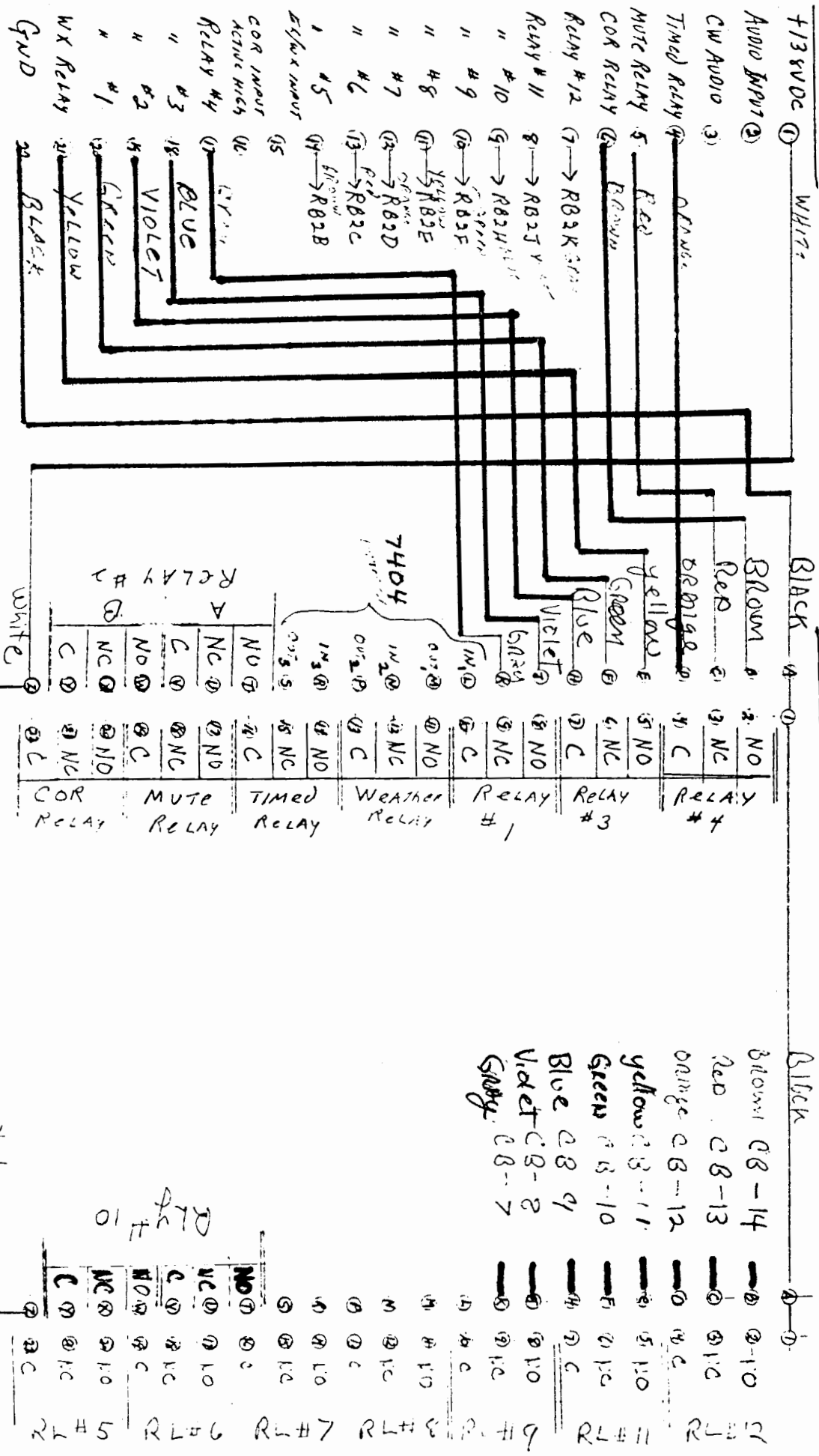
MALAYSIA 59543
76N746A1

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

CARS RESEARCH CONTROLLER BOARD — CB

RELAY BOARD #1 RB#1

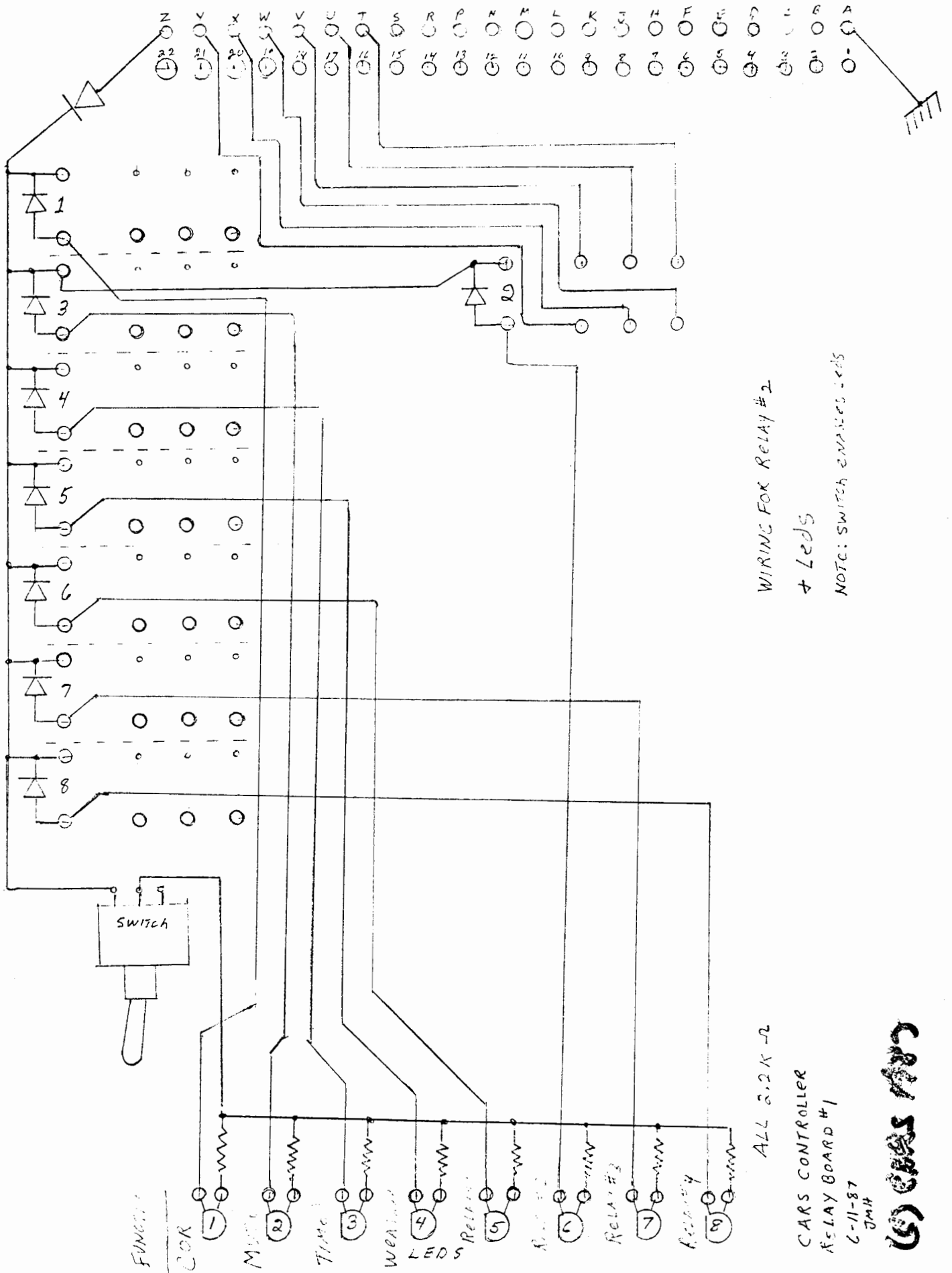
RELAY BOARD #2 RB#2



7404 (Inverter) #1
7405 (NAND) #1

RESEARCH CONTROLLER CONNECTION HARNESS WIRING. C-11-57 1987

SOLDER SIDE OF BOARD



WIRING FOR RELAY #2

+ LEDs

NOTE: SWITCH ENABLES LEDS

ALL 2.2K Ω

CARS CONTROLLER
RELAY BOARD #1

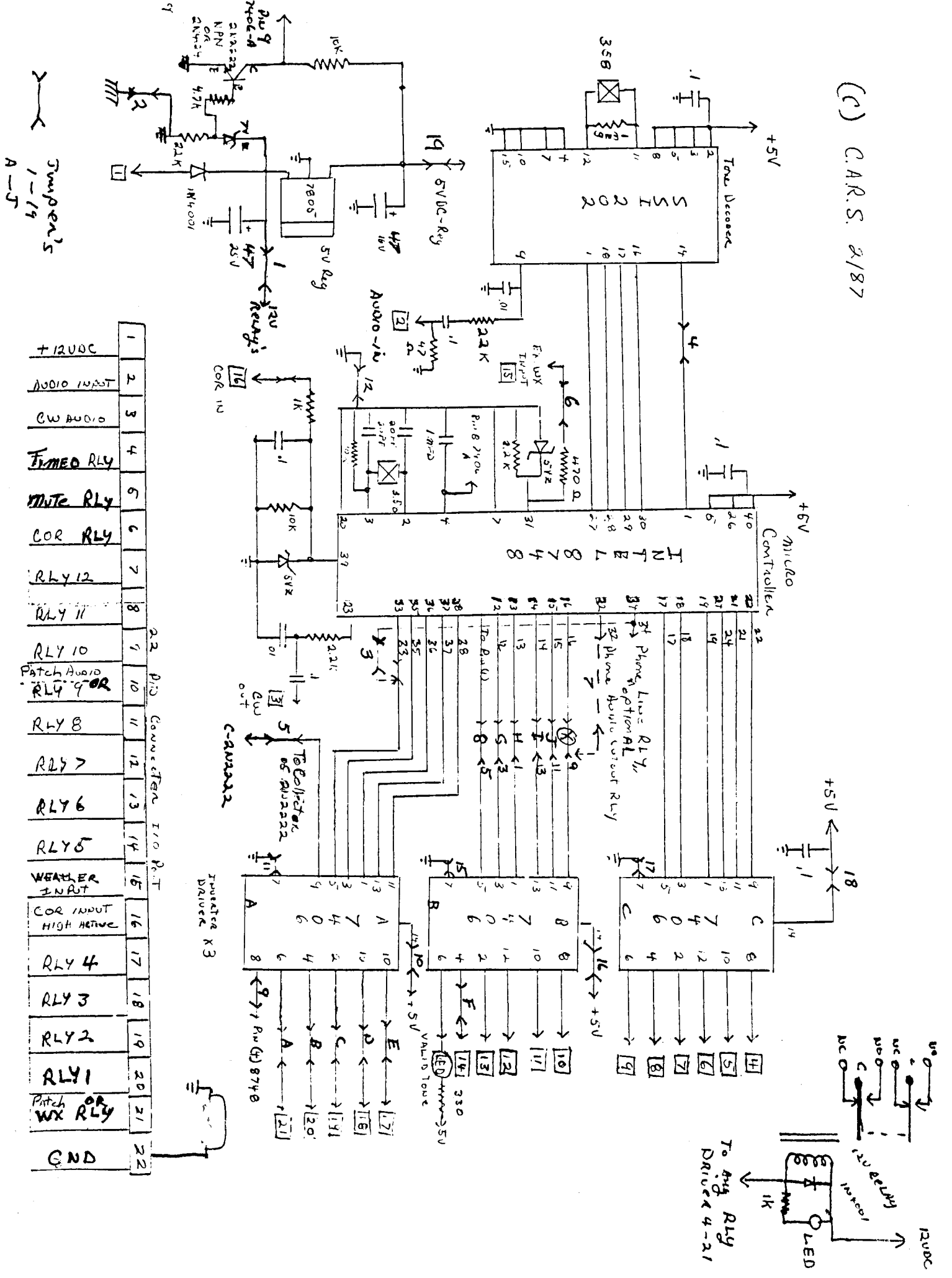
6-11-87
JMH



PARTS LIST C.A.R.S. REPTONE
 FOLLOWS IS A PARTS LIST FOR THE C.A.R.S. REPTONE CONTROLLER.

	CAPS.	RADIO SHACK PART
1	9- .1 MFD	272-135
2	2- .01 MFD	272-131
3	2- 20 PF	
4	1- 1 MFD TANT 16VDC	272-1434
5	2- 47 MFD 16VDC	272-1027
	RESISTORS	
6	3- 2.2K	271-1325
7	2- 1K	271-1321
8	1- 22K	271-1339
9	1- 1M	271-1356
10	1- 47 OHM	271-009
11	2- 10K	271-1335
12	1- 4.7K	271-1330
13	1- 330 OHM	271-1315
14	1- 470 OHM	271-1317
	IC	
15	1- 8748	CARS SUPPLIED
16	3- 7406	JTM PACK OR OTHER
17	1- 7805	276-1770
18	1- 1N4001	276-1101
19	1- 981202	276-1303
20	1- 2N2222	276-2009
21	2- 1N4733 5.1 VOLT ZENER	276-565
22	1- 1N4735 6.2 VOLT ZENER	276-561
23	2- 3.58 MHZ XTALS	272-1310
24	1- LED (RED)	276-026

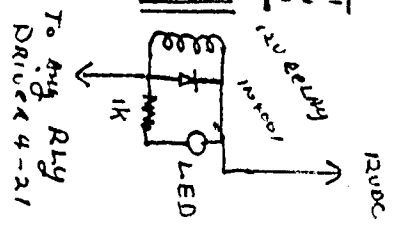
(C) C.A.R.S. 2/87



22 Pin Connector I/O P.I.T

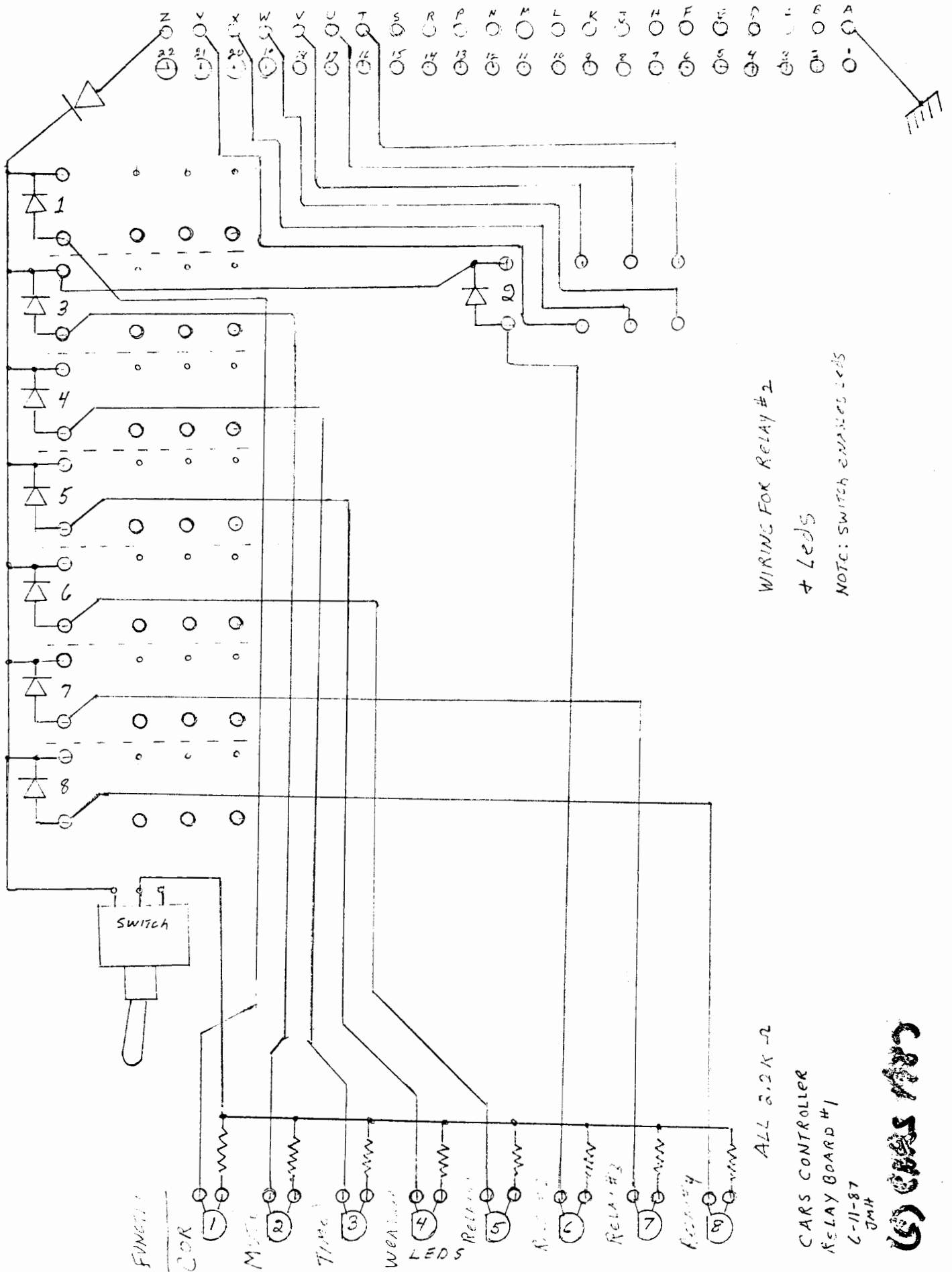
1	+12VDC
2	AUDIO INPUT
3	CW AUDIO
4	TIMED RLY
5	MUTE RLY
6	COR RLY
7	RLY 12
8	RLY 11
9	RLY 10
10	Patch Board RLY 9 OR
11	RLY 8
12	RLY 7
13	RLY 6
14	RLY 5
15	WEATHER INPUT
16	COR INPUT HIGH ACTIVE
17	RLY 4
18	RLY 3
19	RLY 2
20	RLY 1
21	Patch Board OR WX RLY
22	GND

Tempers
1-19
A-5



To Aug RLY DRIVER 4-21

SOLDER SIDE OF BOARD



WIRING FOR RELAY #2

+ LEADS

NOTE: SWITCH EMERGES LEADS

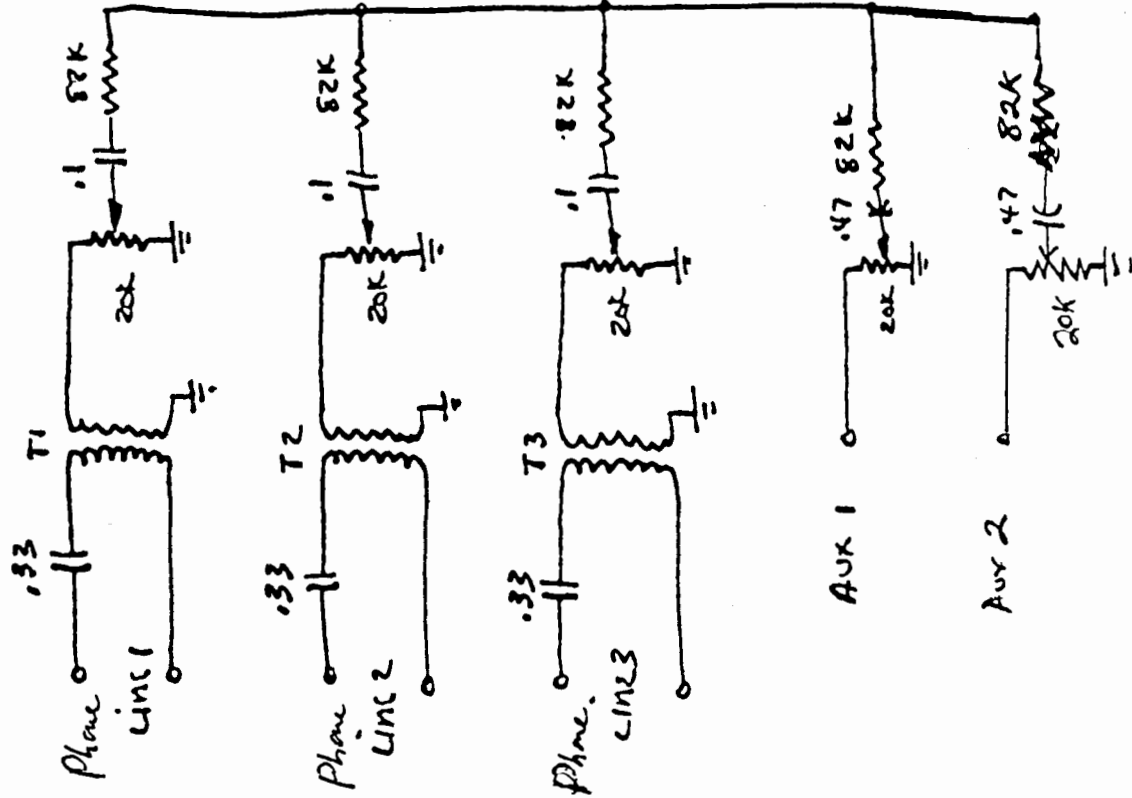
ALL 2.2K-Ω

CARS CONTROLLER
RELAY BOARD #1

6-11-87
JMH

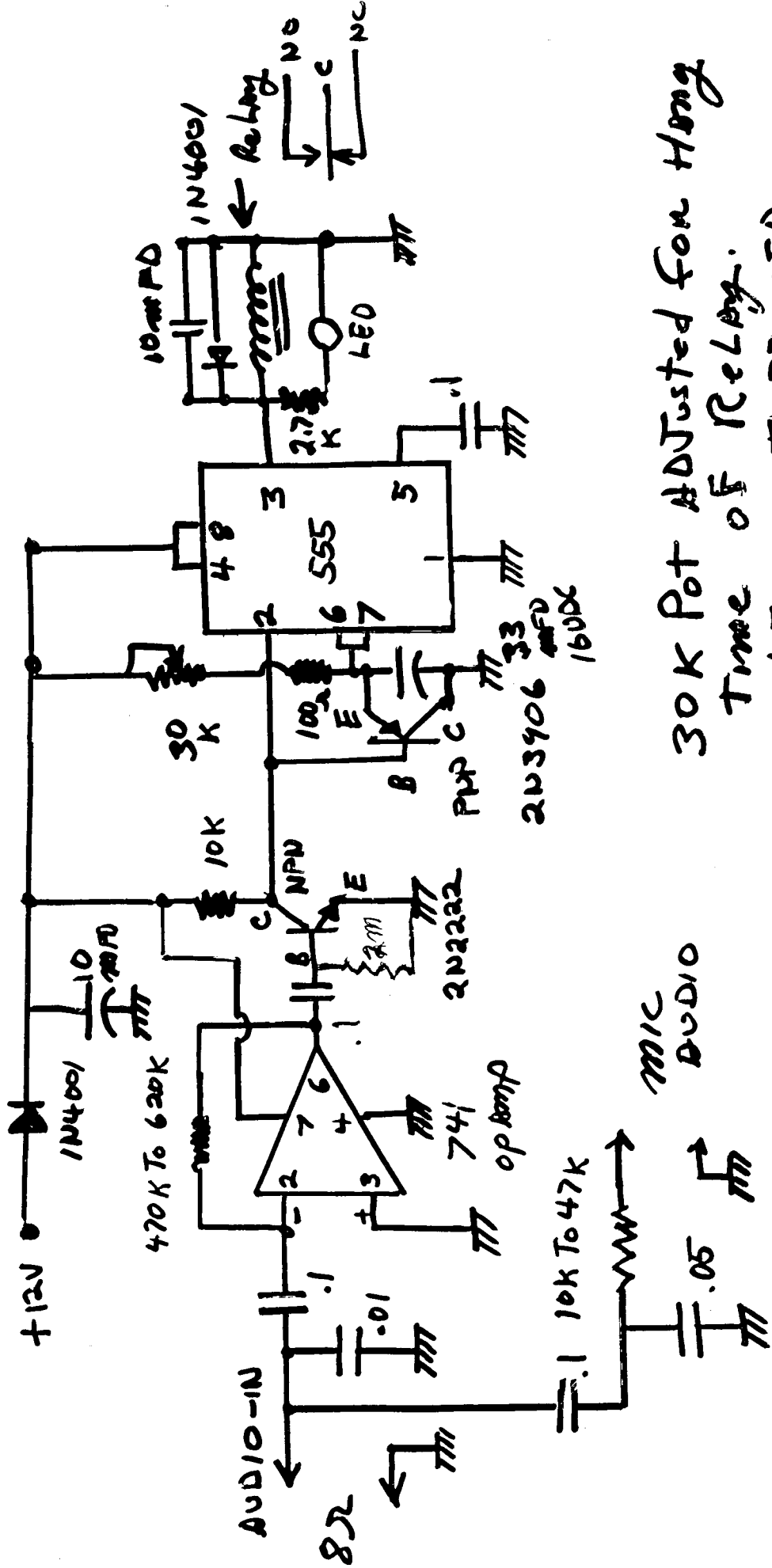


UNSELECT AUDIO AMP - LINE DRIVER AUDIO MIXER



741 - OR - LM 386 AUDIO AMP

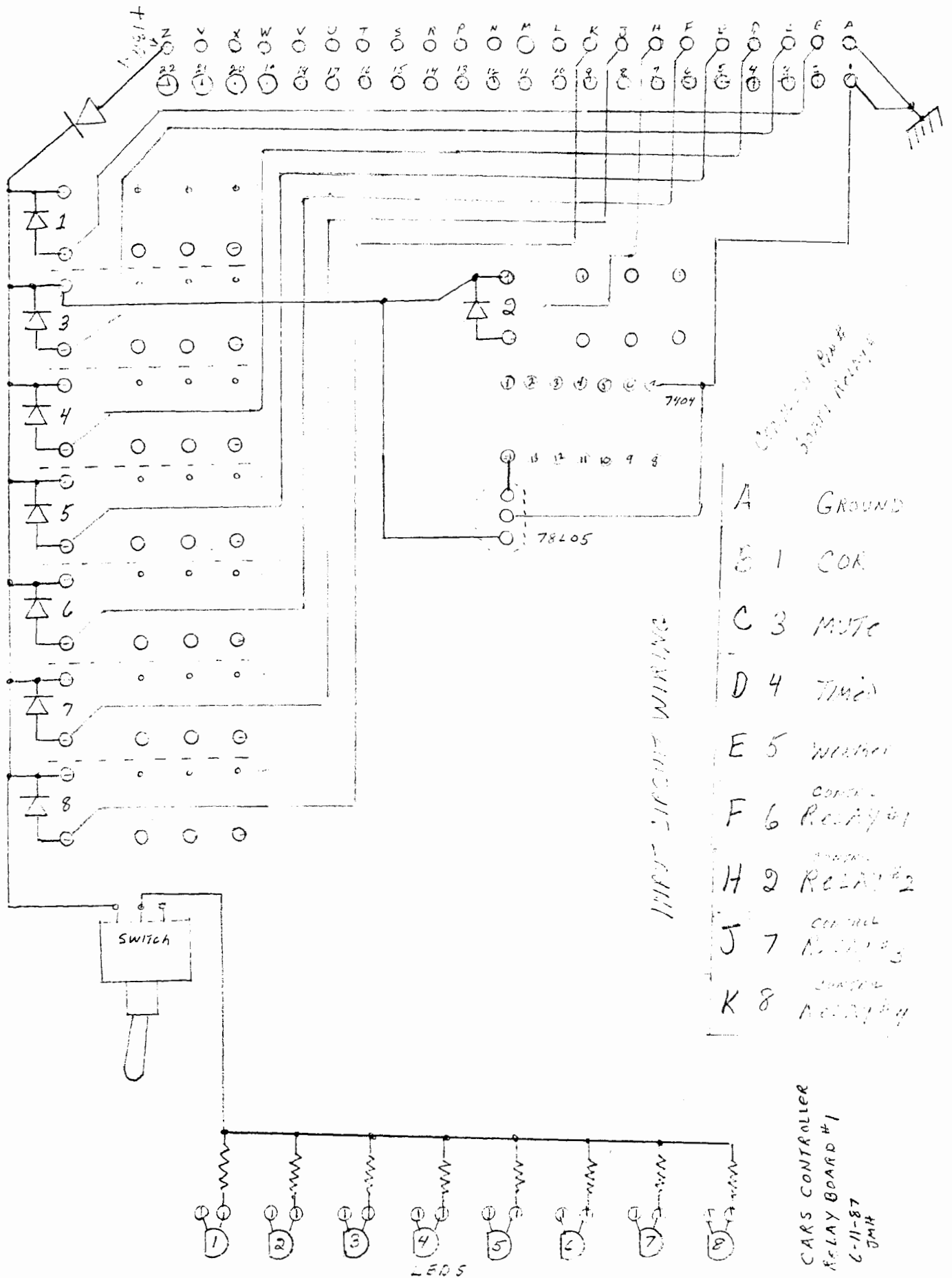
T1 - T3 Not used when there is NO
Phone Line



30K Pot Adjusted for Hong
Time of Relay.
1.5 sec with 33mFD.

A.O.R. Audio operated Relay

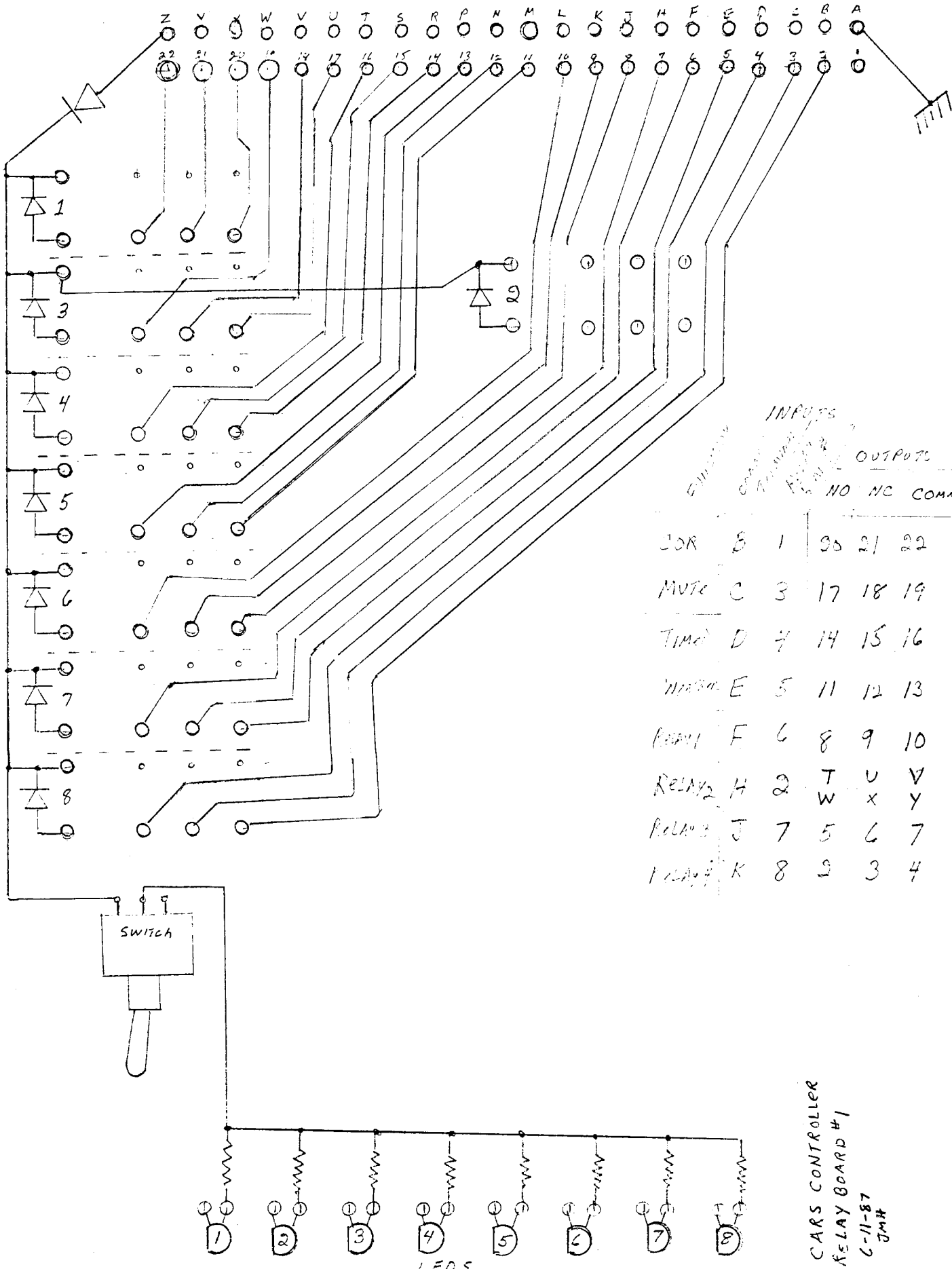
SOLDER SIDE OF BOARD



- A GROUND
- B 1 COR
- C 3 MUTE
- D 4 TIME
- E 5 WATER
- F 6 RELAY #1
- H 2 RELAY #2
- J 7 RELAY #3
- K 8 RELAY #4

LED 5

SOLDER SIDE OF BOARD



FUNCTION	COMMON	RELAY NO.	INPUTS			OUTPUTS		
			NO	NC	COMMON	NO	NC	COMMON
DOOR	B	1	20	21	22			
MUTE	C	3	17	18	19			
TIME	D	4	14	15	16			
MOTOR	E	5	11	12	13			
RELAY 1	F	6	8	9	10			
RELAY 2	H	2	T	U	V			
RELAY 3	J	7	5	6	7			
RELAY 4	K	8	2	3	4			

CARS CONTROLLER
 RELAY BOARD #1
 JMT
 6-11-87

LEDS