



# MODEL CS-1688 PROGRAMMABLE TOUCH TONE® DECODER/CONTROLLER

## DESCRIPTION

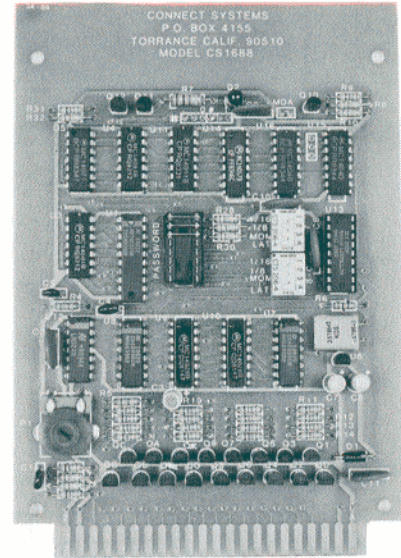
The Connect Systems Inc., Model CS-1688 Touch Tone Decoder/Controller Board will fulfill virtually any 16 function DTMF signalling requirement.

Dip switches allow the user to program all 16 output functions into the same mode, or the 16 output functions can be divided into two groups of 8 output functions. This permits each group of 8 to operate in a different mode.

The CS-1688 provides four choices of modes:

- **Latched**
- **Momentary**
- **1 of 8 selector**
- **1 of 16 selector**

To solve your particular signalling requirements, the CS-1688 can be effortlessly dip switch programmed into any of the ten mode/function configurations listed below:



## OUTPUT FUNCTIONS

	D	1	2	3	4	5	6	7	8	9	0	*	#	A	B	C	
	← D-7 GROUP →							← 8-C GROUP →									
1.	8 LATCHED							and	8 MOMENTARY								
2.	8 LATCHED							and	1 OF 8 SELECT								
3.	8 MOMENTARY							and	8 LATCHED								
4.	8 MOMENTARY							and	1 OF 8 SELECT								
5.	1 OF 8 SELECT							and	8 MOMENTARY								
6.	1 OF 8 SELECT							and	1 OF 8 SELECT								
7.	1 OF 8 SELECT							and	8 LATCHED								
8.	← 16 LATCHED →																
9.	← 16 MOMENTARY →																
10.	← 1 OF 16 SELECT →																

The CS-1688 password (access) code is also fully user programmable. And the length can be varied from 0 to 3 digits.

Reliability is important to us. The glass, silk screened and solder masked board with plated holes is reflow soldered and machine trimmed. The edge connector is gold plated to guarantee an intermittent free connection with the mating connector. (connector supplied)

## THE MODES DEFINED

- **Latched** — All outputs used in the latched mode are independently controllable and remain on or off as last commanded for an indefinite period.
- **Momentary** — All outputs used in the momentary mode are independently controllable and remain on for 2.5 seconds after commanding.
- **Selector (1 of 8 or 1 of 16)** — In selector mode only one function of the group can be on at a time. A previously selected function is automatically turned off when a new function has been commanded on.

Selector mode is ideal for remotely selecting 1 of N channels, 1 of N phone lines etc. etc.

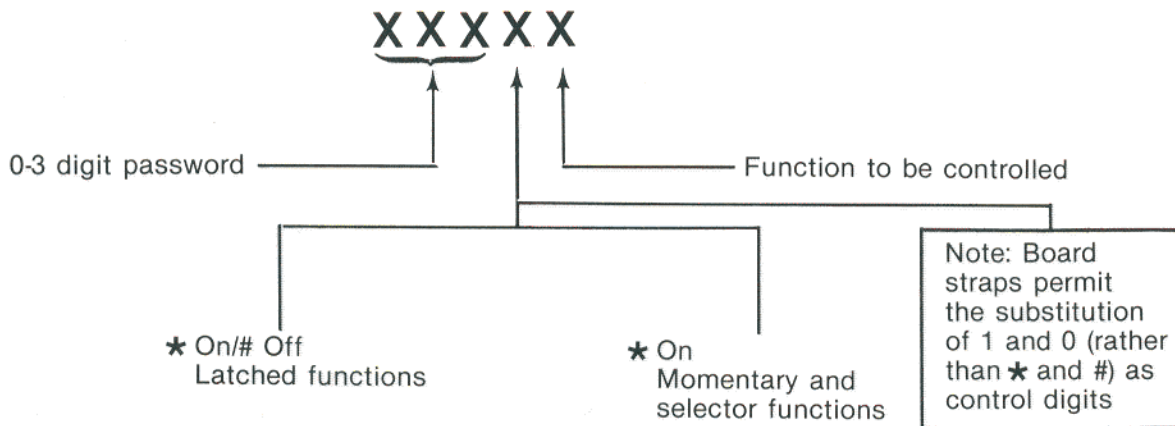
## FEATURES

- **16 User Configurable Functions**  
The CS-1688 provides more user programmable signalling power than any other touch tone control board ever offered.
- **Password Control**  
The password (access) code can be varied from 0-3 digits depending upon desired ease of operation vs. security requirements.
- **Password Programming**  
The password is programmed by arranging three jumper wires on a removeable 16 pin dip header plug. New codes can easily be made up at the shop in advance and simply plugged into the CS-1688.
- **XTAL Controlled Tone Decoder**  
The SSI-202 chip provides central office quality touch tone decoding. The CS-1688 will never false.
- **Open Collector and Logic Outputs**  
Each of the 16 outputs has both an open collector driver suitable for operating relays etc. and a 5 volt CMOS logic output to interface with external logic.
- **Data Strobe**  
This output is made available in both open collector and 5 volt CMOS logic formats. This signal can be used to gate repeater audio so that control commands are not re-transmitted.
- **Audio Preamp**  
An audio preamp with level control is provided which allows a generous 10 mv to 2 v input range.
- **Strobe LED**  
The strobe LED illuminates whenever a valid digit is decoded. This light is useful for setting the preamp level control and for test purposes.
- **Power up Reset**  
In the event of power interruption all outputs used in the latched mode come up in the off state after power is reapplied.
- **Limited One Year Warranty**  
The CS-1688 carries a full one year factory warranty. However, output devices used for energizing customer loads are excluded.

# SPECIFICATIONS

Tone decoder chip	SSI-202 (XTAL controlled)
Decode rate	Up to 15 digits/second
Maximum interdigit time	2.34 seconds
Input tone level	10 MV. to 2 volts
Input Impedance	100K ohms
Power supply voltage	10 VDC to 25 VDC.
	Reverse polarity protected
Power supply current	<20 MA.
Output collectors	30 V MAX 200 MA. MAX.
Output logic fanout	1 LS TTL or 50 CMOS
Size	4½"W × 6½"L
Connector	44 pin edge — gold plated
Board material	G12 Glass

# CONTROL PROTOCOL



## Control Examples

### MOMENTARY OR SELECTOR MODES

To turn function no. 9 on:

Without password	*9
With 1 digit password	X*9
With 2 digit password	XX*9
With 3 digit password	XXX*9

### LATCHED MODE

To turn function no. 3 on or off

	ON	OFF
Without password	*3	#3
With 1 digit password	X*3	X#3
With 2 digit password	XX*3	XX#3
With 3 digit password	XXX*3	XXX#3

**Note:** Password X's are user programmed digits

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 2064 EASTMAN AVE., UNIT 113  
 VENTURA, CA 93003

## PASSWORD PROGRAMMING

The CS-1688 three digit password is programmed by the arrangement of three jumper wires on a removable dip header plug.

The letters "XYZ" refer to the digit positions of the password code. Simply connect X to the number you wish for the first digit, Y to the number you wish for the second digit and Z to the number you wish for the third digit.

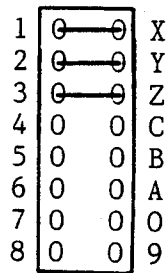
If a two digit password is desired, use Y as the first digit and Z as the second digit. Leave X open.

If a one digit password is desired use Z as the password digit. Leave X and Y open.

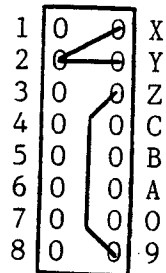
If password control is not required, remove the factory installed "MDA" (multi-digit access) strap on the board. (Located near transistor Q-10).

The four illustrated examples below should make the programming method clear.

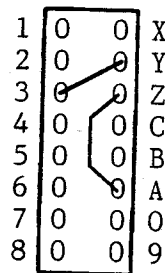
The CS-1688 is supplied with the password programmed "123". The CS-1688 will respond to this password code until it is user reprogrammed.



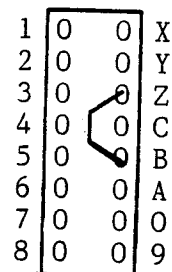
CODE=123



CODE=229



CODE=3A



CODE=B

### EXAMPLES OF PASSWORD PROGRAMMING

## MODE CHOICES

**LATCHED:** Functions operated in the latched mode are independently controllable. Each function retains the last on or off command until a new command is issued.

**MOMENTARY:** Functions operated in the momentary mode are also independently controllable. However a momentary function is only active (on) for 2.5 seconds after the command has been issued.

**SELECTOR:** In selector mode, one and only one function in a group can be on at a time. Commanding a new function on within a group will automatically turn off a previously commanded function.

**NOTE:** After applying power, functions used in the selector mode must be initialized with a valid on command for any function in the group. Until this is done, the selector function outputs will be in random states.

**Selector mode applications...** Select 1 of n phone lines, 1 of n base stations or repeaters, 1 of n links, 1 of n channels etc etc.

## MODE SELECTION

Each group of eight functions. D-7 (D1234567) and 8-C (890\*#ABC) are separately programmable. That is each group can operate in any mode. Or both groups can be set into the same mode to provide 16 similar functions.

The CS-1688 contains two separate sets of dip slide switches. One set is labelled "D-7" and the other set is labelled "8-C". Each set contains four switches. In each set the top switch is labelled "1/16" this means 1 of 16 selector, the next switch "1/8" means 1 of 8 selector, the next switch "MOM" means momentary and the bottom switch labelled "LAT" means latched.

With the exception of 1 of 16 selector mode, each group is fully independent. Turn on only one switch in each group that corresponds to the desired operating mode for that group. If 1 of 16 selector mode is chosen, the "1/16" switches in each group must be on. All others must be off.

**Remember, only one switch in each group (D-7) and (8-C) must be on at a time. Otherwise the CS-1688 will not function correctly.**

**LATCHED MODE MASTER RESET.** In some applications it may be desirable to reset (turn off) all latched functions with a single command.

You may sacrifice any function within a group to serve as the master reset for the remaining seven functions in the group. Of course this will not affect your individual on/off control of the remaining seven functions.

Assume you have selected function 7 as the master reset for the D-7 group. Simply send "password \*7" ("\*7" if you are not using password control). To reset the remaining seven functions.

## OPERATION

Commands consist of a two digit operational instruction preceded by the user defined password. The password can be 1,2 or 3 digits long. Or even eliminated altogether by removing the "MDA" strap as previously discussed. The factory installed password is "123". The CS-1688 will respond to this password until it is user reprogrammed.

**LATCHED MODE:** \* and # are used to indicate whether the function named afterward is to be turned on or off (\* on, # off). If you wish to turn function 5 on and 7 off send "password \* 5", "password #7 or simply "\*5" "#7" if password control has not been selected.

**MOMENTARY AND SELECTOR MODES:** In these two modes functions are never commanded off. Therefore only the \* is used in these modes. To turn on function 9 send "password \*9", or simply "\*9" if password control has not been selected.

**NOTE:** In certain applications it may be desirable to use digits other than \* and # for on/off control purposes.

1 and 0 have been made available as alternate control choices. Two separate strapping locations, one labelled with "\* and 1" the other labelled with "# and 0" are clearly visible on both the board and the schematic diagram.

To use 1 in lieu of \*: change the strap from the center pad and \*, to center pad and 1.

To use 0 in lieu of #: change the strap from center pad and #, to the center pad and 0.

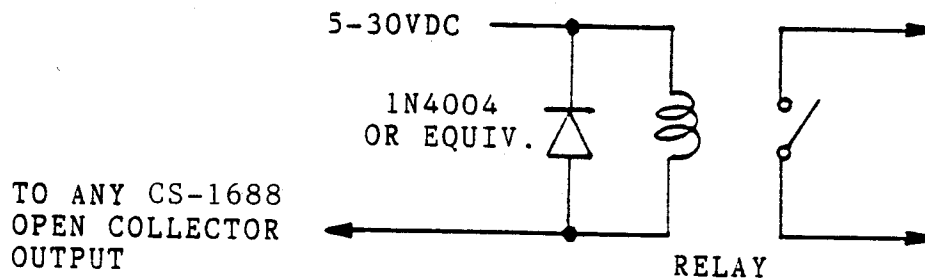
If these choices are not sufficient, a wire may be run from each center pad to any desired control digits available at the 4028 digit decoders. (U-9 and U-10)

Please feel free to call one of our applications engineers if in doubt.

## OUTPUT LOAD RULES

**Open Collector Outputs:** CS-1688 pins 4-20 may be used to energize positive current sinking loads such as 12 VDC relays. The off voltage must not exceed 30 VDC. The on current must not exceed 200 MADC.

**Note:** It is absolutely essential that a diode (1N4004 or equivalent) be installed across inductive loads. Otherwise the output transistors may be damaged. (The output transistors are **NOT** covered by warranty.)

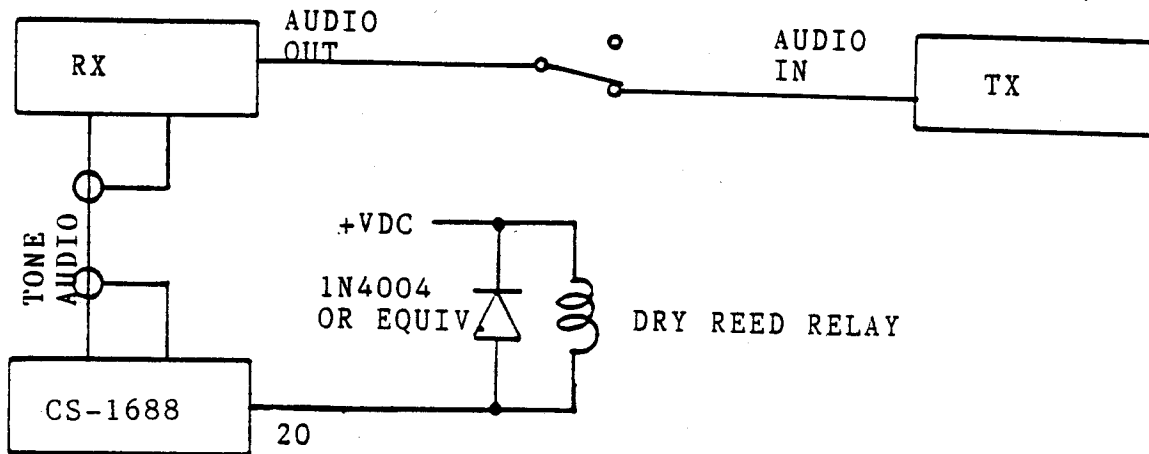


BE SURE TO ADD DIODE  
ACROSS INDUCTIVE LOAD!

**CMOS LOGIC OUTPUTS:** CS-1688 pins D - X are 5 volt CMOS logic levels. These outputs will drive over 50 external CMOS loads. Or one LS TTL load can be driven.

## CS-1688 INTERFACE DATA

**Control Code Muting:** The data strobe output can be used to eliminate the retransmission of control code sequences in a repeater. Decoding is so fast that only a very slight "chirp" will be heard on the output.



REPEATER CONTROL CODE MUTING

**CS-1688 Audio Take Off:** The 10MV to 2 volt input range of the CS-1688 will allow many choices of audio take off points in a receiver. Connection to the top of the volume control is the favored take off point in most receivers. Be certain that audio is taken after de-emphasis.

Be sure to use shielded wire when making the audio interface connection.

Refer to the CS-1688 pin assignment list and/or schematic diagram for pin outs.

**PRE-AMP AUDIO LEVEL ADJUSTMENT:** LED D2 will light when any valid touch tone digit is being decoded. Set the level control P1 to a setting that simultaneously permits both very low and very high level tones to be decoded.

**OUTPUT POLARITY:** When a given function is turned on, the corresponding open collector output is in the on (conducting) state. The corresponding CMOS output is in the high state. Opposite states occur when the function is turned off.

The data strobe open collector output is on (conducting) when any of the sixteen buttons on a pad are pressed. The corresponding CMOS output is in the high state. The open collector output goes off and the CMOS output goes low when decoding ceases.

## CS-1688 PIN ASSIGNMENTS

Function	Open Collector	Logic
D	PIN 4	PIN D
1	5	E
2	6	F
3	7	H
4	8	J
5	9	K
6	10	L
7	11	M
8	12	N
9	13	P
0	14	R
*	15	S
#	16	T
A	17	U
B	18	V
C	19	W
DATA STROBE	20	X

Power (+10 to +25 VDC): Pins 2 and B  
GND: Pins 1 and A

Audio in: Pin Y  
Audio return: Pins 22 and Z

### LIMITED WARRANTY

Connect Systems Inc. guarantees your CS-1688 to be free of defects in material and workmanship for a period of one year from invoice date.

Service to be performed at the CSI Torrance, Ca. facility. The owner is responsible for transportation costs.

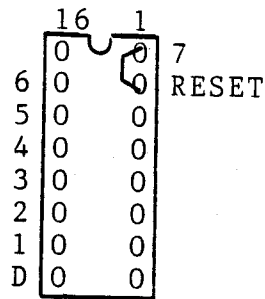
Warranty only valid to original purchaser.

Warranty void if serial number is defaced, altered or missing.

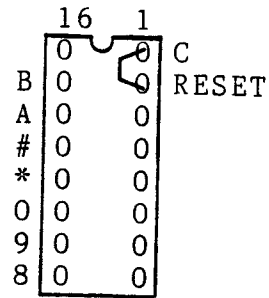
Warranty void if there are any signs of misuse, modification or tampering.

Warranty does not cover damage caused by input over voltage, plugging the board in backwards or any act of GOD such as lightning.

**EXCLUSION:** All output devices used for energizing customer loads are specifically excluded from warranty.



I.C. U7  
D-7 Group



I.C. U8  
8-C Group

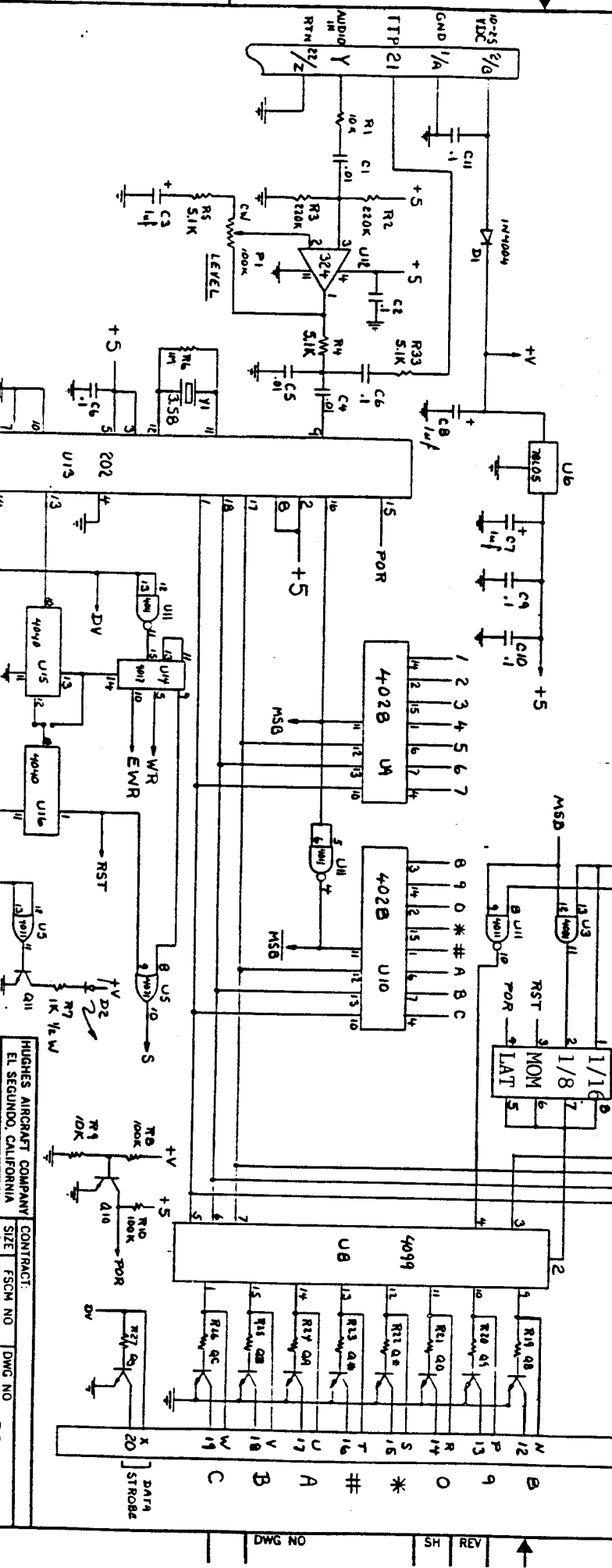
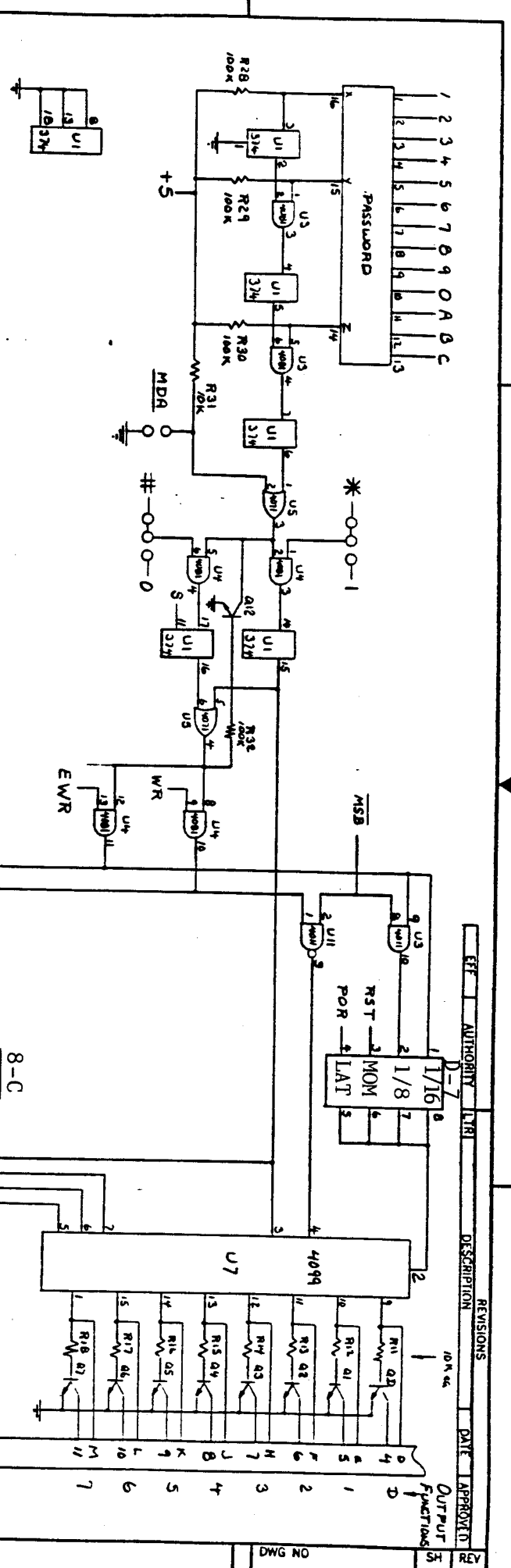
(Solder Side View)

### MASTER RESET STRAPING

The D-7 group master reset function number is selected by soldering a buss wire from U7 pin 2 (reset input) to the pin corresponding to the desired master reset function. Function 7 has been selected in the above example.

The 8-C group is strapped in a similar fashion at U8. Function C has been selected as the master reset in the above example.

Important: If a group is strapped for master reset control, all four of that groups' mode select switches must be in the off position.



REV	DESCRIPTION	DATE	APPROVED
1			

REV	DESCRIPTION	DATE	APPROVED
1			

REV	DESCRIPTION	DATE	APPROVED
1			

REV	DESCRIPTION	DATE	APPROVED
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FORM NO. 11064-3-CS 10-60  
DIETRICH-POST CLEARPRINT 1000H-10

HUGHES AIRCRAFT COMPANY CONTRACT:  
EL SEGUNDO, CALIFORNIA  
SIZE FSCM NO. DWG NO. CS-1688  
DR C 82577 SCALE SHEET