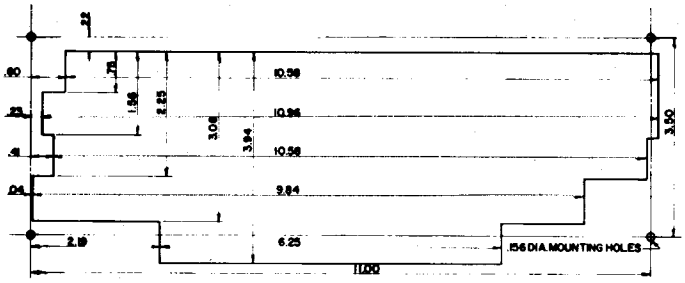
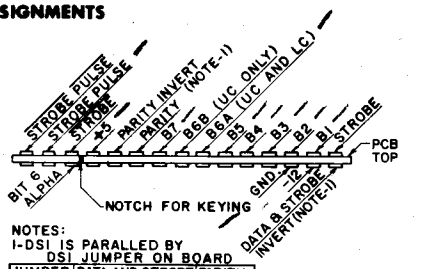
GEORGE RISK INDUSTRIES, INC.
TECHNICAL DATA

SUGGESTED PANEL CUTOUT



PIN ASSIGNMENTS



NOTES:
1-DSI IS PARALLED BY DSI JUMPER ON BOARD

JUMPER	DATA AND STROBE OUTPUTS	PARITY OUTPUT
5	NEG LOGIC	EVEN
GND.	POS LOGIC	ODD

2-B6A PROVIDES SELECTABLE UPPER AND LOWER CASE
B6B PROVIDES UPPER CASE ONLY
BIT 6 ALPHA IS THE BIT 6 OUTPUT WHEN ALPHA LOCK OPTION IS USED
3-STROBE PULSE WIDTH 1 MS WITH STD. VALUES
4-DRIVE CAPABILITY IS ONE TTL UNIT LOAD
5-TYP. CONNECTOR CINCH *251-15-30(NOT INCL.)

ASCII CODE REFERENCE CHART

ASCII	BINARY	OCTAL	DECIMAL	HEX	ASCII	BINARY	OCTAL	DECIMAL	HEX	ASCII	BINARY	OCTAL	DECIMAL	HEX	ASCII	BINARY	OCTAL	DECIMAL	HEX
NUL	00000000	000	000	00	SP	00100000	040	032	20	@	01000000	100	064	40	`	01100000	140	096	6Ø
SOH	00000001	001	001	01	!	00100001	041	033	21	A	01000001	101	065	41	a	01100001	141	097	61
STX	00000010	002	002	02	"	00100010	042	034	22	B	01000010	102	066	42	b	01100010	142	098	62
ETX	00000011	003	003	03	#	00100011	043	035	23	C	01000011	103	067	43	c	01100011	143	099	63
EOT	00000100	004	004	04	$	00100100	044	036	24	D	01000100	104	068	44	d	01100100	144	100	64
ENQ	00000101	005	005	05	%	00100101	045	037	25	E	01000101	105	069	45	e	01100101	145	101	65
ACK	00000110	006	006	06	&	00100110	046	038	26	F	01000110	106	070	46	f	01100110	146	102	66
BEL	00000111	007	007	07	'	00100111	047	039	27	G	01000111	107	071	47	g	01100111	147	103	67
BS	00001000	010	008	08	(	00101000	050	040	28	H	01001000	110	072	48	h	01101000	150	104	68
HT	00001001	011	009	09	)	00101001	051	041	29	I	01001001	111	073	49	i	01101001	151	105	69
LF	00001010	012	010	0A	*	00101010	052	042	2A	J	01001010	112	074	4A	j	01101010	152	106	6A
VT	00001011	013	011	0B	+	00101011	053	043	2B	K	01001011	113	075	4B	k	01101011	153	107	6B
FF	00001100	014	012	0C	'	00101100	054	044	2C	L	01001100	114	076	4C	l	01101100	154	108	6C
CR	00001101	015	013	0D	-	00101101	055	045	2D	M	01001101	115	077	4D	m	01101101	155	109	6D
SO	00001110	016	014	0E	.	00101110	056	046	2E	N	01001110	116	078	4E	n	01101110	156	110	6E
SI	00001111	017	015	0F	/	00101111	057	047	2F	O	01001111	117	079	4F	o	01101111	157	111	6F
DLE	00010000	020	016	10	0	00110000	060	048	30	P	01010000	120	080	50	p	01110000	160	112	7Ø
DC1	00010001	021	017	11	1	00110010	061	049	31	Q	01010001	121	081	51	q	01110001	161	113	71
DC2	00010010	022	018	12	2	00110010	062	050	32	R	01010010	122	082	52	r	01110010	162	114	72
DC3	00010011	023	019	13	3	00110011	063	051	33	S	01010011	123	083	53	s	01110011	163	115	73
DC4	00010100	024	020	14	4	00110100	064	052	34	T	01010100	124	084	54	t	01110100	164	116	74
NAK	00010101	025	021	15	5	00110101	065	053	35	U	01010101	125	085	55	u	01110101	165	117	75
SYN	00010110	026	022	16	6	00110110	066	054	36	V	01010110	126	086	56	v	01110110	166	118	76
ETB	00010111	027	023	17	7	00110111	067	055	37	W	01010111	127	087	57	w	01110111	167	119	77
CAN	00011000	030	024	18	8	00111000	070	056	38	X	01011000	130	088	58	x	01111000	170	120	78
EM	00011001	031	025	19	9	00111001	071	057	39	Y	01011001	131	089	59	y	01111001	171	121	79
SUB	00011010	032	026	1A	:	00111010	072	058	3A	Z	01011010	132	090	5A	z	01111010	172	122	7A
ESC	00011011	033	027	1B	;	00111011	073	059	3B	[	01011011	133	091	5B	{	01111011	173	123	7B
FS	00011100	034	028	1C	<	00111100	074	060	3C	/	01011100	134	092	5C	:	01111100	174	124	7C
GS	00011101	035	029	1D	=	00111101	075	061	3D	]	01011101	135	093	5D	}	01111101	175	125	7D
RS	00011110	036	030	1E	>	00111110	076	062	3E	↑	01011110	136	094	5E	~	01111110	176	126	7E
US	00011111	037	031	1F	?	00111111	077	063	3F	-	01011111	137	095	5F	DEL	01111111	177	127	7F

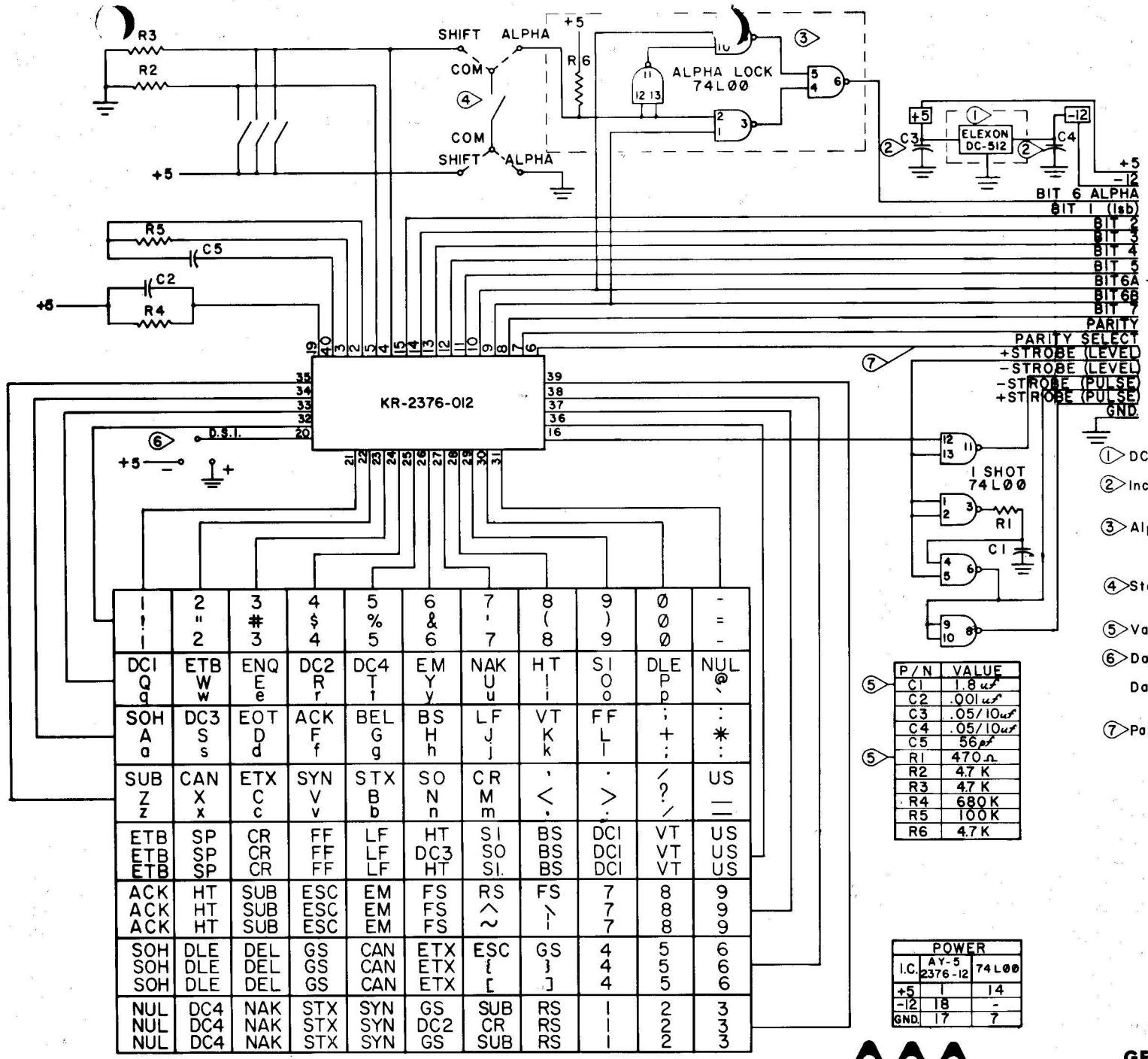
2376 KEYBOARD ENCODER PIN ASSIGNMENTS

1	Vcc (+5v)	21	Y 10
2	Freq. Control	22	Y 9
3	Freq. Control	23	Y 8
4	Shift Input	24	Y 7
5	Control Input	25	Y 6
6	Parity Invert	26	Y 5
7	Parity Output	27	Y 4
8	Data Output B7 (MSB)	28	Y 3
9	Data Output B6B (UC)	29	Y 2
10	Data Output B6A (UC/LC)	30	Y 1
11	Data Output B5	31	Y Ø
12	Data Output B4	32	X 7
13	Data Output B3	33	X 6
14	Data Output B2	34	X 5
15	Data Output B1 (LSB)	35	X 4
16	Strobe Output (level)	36	X 3
17	Vss (ground)	37	X 2
18	Vgg (-12v)	38	X 1
19	Strobe Control	39	X Ø
20	DSI (Data and Strobe Invert)	40	Freq. Control

NOTE: G.R.I. Keyboards use a custom-programmed ROM, designed especially for your keyboard. Order replacements ONLY direct from G.R.I. Specify p/n 2376-012 Encoder, $7.50 ea.

AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE (ASCII)

Bits b4 b3 b2 b1	Row	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
	Column	0	1	2	3	4	5	6	7
0 0 0 0	0	NUL	DLE	SP	0	@	P	`	p
0 0 0 1	1	SOH	DC1	!	1	A	Q	a	q
0 0 1 0	2	STX	DC2	"	2	B	R	b	r
0 0 1 1	3	ETX	DC3	#	3	C	S	c	s
0 1 0 0	4	EOT	DC4	$	4	D	T	d	t
0 1 0 1	5	ENQ	NAK	%	5	E	U	e	u
0 1 1 0	6	ACK	SYN	&	6	F	V	f	v
0 1 1 1	7	BEL	ETB	'	7	G	W	g	w
1 0 0 0	8	BS	CAN	(	8	H	X	h	x
1 0 0 1	9	HT	EM	)	9	I	Y	i	y
1 0 1 0	10	LF	SUB	*	:	J	Z	j	z
1 0 1 1	11	VT	ESC	+	;	K	[	k	{
1 1 0 0	12	FF	FS	,	<	L	/	l	|
1 1 0 1	13	CR	GS	—	=	M	]	m	}
1 1 1 0	14	SO	RS	.	>	N	^	n	~
1 1 1 1	15	SI	US	/	?	O	—	o	DEL



! 1	" 2	# 3	$ 4	% 5	& 6	' 7	(8	) 9	Ø	= -
DCI Q q	ETB W w	ENQ E e	DC2 R r	DC4 T t	EM Y y	NAK U u	HT I i	SI O o	DLE P p	NUL @ `
SOH A a	DC3 S s	EOT D d	ACK F f	BEL G g	BS H h	LF J j	VT K k	FF L l	; + ;	: * :
SUB Z z	CAN X x	ETX C c	SYN V v	STX B b	SO N n	CR M m	, < ,	. > .	/ ? /	US —
ETB ETB ETB	SP SP SP	CR CR CR	FF FF FF	LF LF LF	HT DC3 HT	SI SO SI	BS BS BS	DCI DCI DCI	VT VT VT	US US US
ACK ACK ACK	HT HT HT	SUB SUB SUB	ESC ESC ESC	EM EM EM	FS FS FS	RS ^ ~	FS \ |	7 7 7	8 8 8	9 9 9
SOH SOH SOH	DLE DLE DLE	DEL DEL DEL	GS GS GS	CAN CAN CAN	ETX ETX ETX	ESC { [	GS }]	4 4 4	5 5 5	6 6 6
NUL NUL NUL	DC4 DC4 DC4	NAK NAK NAK	STX STX STX	SYN SYN SYN	GS DC2 GS	SUB CR SUB	RS RS RS	1 1 1	2 2 2	3 3 3

P/N	VALUE
C1	1.8 uf
C2	.001 uf
C3	.05/10 uf
C4	.05/10 uf
C5	56 pf
R1	470 Ω
R2	4.7 K
R3	4.7 K
R4	680 K
R5	100 K
R6	4.7 K

POWER		
I.C.	AY-5 2376-12	74L00
+5	1	14
-12	18	-
GND	17	7

1. DC-512 convertor allows operation from +5 Reg. only (70ma.)
2. Increase C3-C4 to 10uf 20v. Tantalum or Electrolytic when DC-512 is installed
3. Alpha Lock circuitry provided on PC board, parts not included. Bit 6 alpha is bit connection when Alpha Lock is used.
4. Standard 756 jumpers shown. Jumper COM-ALPHA (2plcs) when Alpha Lock circuit is used.
5. Values shown produce 1 ms strobe pulse.
6. Data strobe invert tied to GND. = POS LOGIC
   Data strobe invert tied to +5 = NEG LOGIC (1-Shot active only on pos logic).
7. Parity invert tied to GND= odd, +5= even parity

GEORGE RISK INDUSTRIES, INC.

G.R.I. PLAZA • KIMBALL, NEBRASKA 69145
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INTERFACING AND USING THE G.R.I. MODEL 756 KEYBOARD

READ CAREFULLY BEFORE ASSEMBLING OR USING YOUR KEYBOARD!

1. The Model 756 Full ASCII Keyboard is designed to be used with almost any available microcomputer-related product which requires alphanumeric data input. Because of the lack of standardization among manufacturers of input-output boards, video display boards, TVT boards, etc., it is impossible to furnish step-by-step instructions for using our keyboards with a particular unit. What we will attempt to do, however, is to outline the basic procedure for interfacing keyboards, so that you will have a minimum of difficulty. We believe the 756 will work directly with most interfaces available today, but like any rule, there will almost surely be exceptions!

2. To begin with, get out your manuals, and study up on the keyboard input structure of your interfacing equipment. Pay close attention to the logic requirements of the "Strobe," "Data Ready," or "Key-pressed" inputs, since several options are available on the 756, and this area seems to be the most troublesome of all. A sketch, with the input port on one side and the keyboard output connector on the other is the best way to keep things straight.

3. Most interfaces use a keyboard strobe signal to indicate that keyboard data is ready. The 756 provides the following strobe signals:
   - Positive Strobe Level (goes high with any key depression)
   - Negative Strobe Level (" low " " " ")
   - Positive Strobe Pulse (a 1 ms. pulse following key depression, going high)
   - Negative Strobe Pulse (" " " " " " " " low)

   Determine the correct strobe signal for interfacing with your equipment, and connect the keyboard connector pin associated with this signal to your interface.

4. Next select the appropriate data signals. The connector pins marked B1 through B7 correspond to the LSB through MSB of the ASCII code outputs. Attach your interface cable to the keyboard, making sure the LSB goes to B1, and so forth. You will notice there are two signals for bit 6, called B6A and B6B. This bit determines whether a character is upper case, or lower case, and B6A allows selection of the two by using the Shift key. B6B provides upper-case codes only. To further confuse the situation, you will notice another pin marked "Bit 6 Alpha" on the connector. You will connect the bit 6 signal from one of these three points to your bit 6 input. Here is how they differ.
   1. B6A provides upper-and-lower case, selectable by shift keys.
   2. B6B provides upper case only, with the shift keys selecting punctuation like (!) instead of numerals (1), etc.
   3. Bit 6 Alpha is an output from an optional Alpha Lock circuit provided on the keyboard PC board. Alpha lock or Caps lock differs from the standard Shift Lock in that it only shifts Alpha (A-Z) characters, without affecting punctuation, numerals, etc.

   The standard 756 keyboard PC board has jumpers (2) near the Shift Lock key, which connect the keyswitch as a Shift Lock key. As long as the keyboard is jumpered this way, the user may only select between B6A and B6B. A manual SPDT switch, like that supplied with our 702 enclosure, may be used to select between the two bit 6 outputs.
   Optionally, the shift lock key may be converted to an alpha lock key. This is done by adding two parts, changing two jumpers, and moving the bit 6 output connection. The added parts are a 7400 or 74LS00 IC, and a 4.7K ¼ watt resistor. Change the jumpers by moving the jumper from COM-SHIFT to COM-ALPHA (change both jumpers). Finally, move the bit 6 interface lead from wherever it is to the pin marked Bit 6 Alpha. Now, the selection of upper-lower case is made electrically, on the keyboard, by the status of the Shift Lock latching type keyswitch. This is an Alpha Lock switch now, and this feature is much preferred by many users of electronic keyboards. When depressed, the keyboard will output upper case only, but the shift keys will still be active for selecting between numerals and punctuation. When released, the keyboard outputs normally shifted upper and lower case. In any event, the control key may be used to generate control codes and funtions.

ASCII is a seven bit code, with the eighth bit used for error-checking, called Parity. The 756 provides parity, and for inversion of the parity bit, but most interfaces ignore it anyway. Sometimes the strobe is connected to the eighth bit, or it is just tied high or low, or allowed to float. A check of the interface board schematic or manual will be the best

guide to determining how to treat bit 8. (If you are confused, a hardware-oriented friend will no doubt be able to shed some light on the darkness!)

5. The final step is to supply power to the keyboard. Two supply voltages are needed: +5 @ 20ma., and -12 @ 20ma. The current requirements are small enough the needed voltages can usually be "stolen" from an existing supply or board. Remember to connect the two supply leads, and ground to the keyboard connector. Above all, check the voltages at the IC socket, BEFORE inserting the chip. Encoder ROMs are an expensive way to discover a wiring error! Also, for those who don't have a source of -12 volts, GRI make available, a small DC-DC converter that plugs into the 756 PC board. No wiring changes are needed, however, to insure reliable operation, the .05uf bypass capacitors should be increased to 10uf, tantalum or electrolytic. Failure to do so can lead to erractic operation.

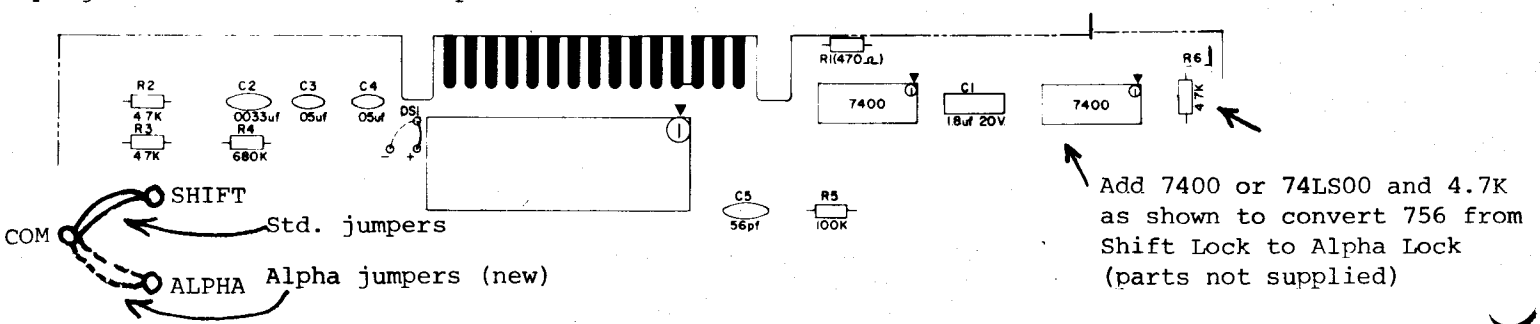
T R O U B L E S H O O T I N G

Because the keyboard is based upon a MOS LSI encoder, troubleshooting is largely a matter of checking the obvious (parts placement, wiring, voltages, connector insertion, etc), or replacing the chip. Most of the problems we have seen are attributable to the former, but the static-sensitive PMOS chip does get blown occasionally.

1. If you suspect the encoder, replacements are available from stock at GRI for $7.50. Also, we offer a same-day checkout and repair service for $15.00, for returned boards. If you are returning a board, please call or write for a Return Authorization first to assure prompt turnaround.
2. Chances are, the encoder is not to blame. We 100% test them just before shipping, and many problems can simulate a bad device. For instance, lack of a data-strobe invert jumper will cause sporadic outputs. Shorts between matrix scan lines will cause two or more outputs for a given key. Be sure to remove the encoder IC when measuring or you may damage it.
3. The designers of the 2376 encoder (G.I. or SMC) used PMOS technology, which is static sensitive. Use all normal precautions for handling and soldering. Also, please observe loading rules of one std. TTL load max. per output. Buffers like 7408s are suggested for driving heavy loads.
4. Normal cables of 5-6 feet pose no problem. Again, buffers or line drivers are suggested for longer cables.
5. The 2376 encoder is a scanning type device, which allows the data outputs to fluctuate between key depressions. Some systems see these fluctuations as rapidly changing data entries, and "glitch". The solution is to rewrite keyboard routines to first check for a valid strobe before reading any data from the keyboard. The strobe signals valid and debounced data. Alternatively, buffering each data line through a 7408 AND gate, with the strobe signal (buffered) gating each AND gate on will result in a stable output, resting low, and going true only with a valid strobe.
6. If everything seems right, but data just won't "take", perhaps the strobe pulse is too short. Increasing the value of the 1.8uf capacitor will stretch out the pulse, conversely, decreasing the value will shorten it.

If all else fails, remember our repair policy and/or replacement policy. Even with careful handling, static sensitive parts can get "blown".
Murphy's Law as applied to keyboards says "It can happen to anyone!"

NOTE: Use only 2376 encoders obtained from GRI in the 756, since this part contains a custom-programmed ROM. "Standard" parts WON'T work!

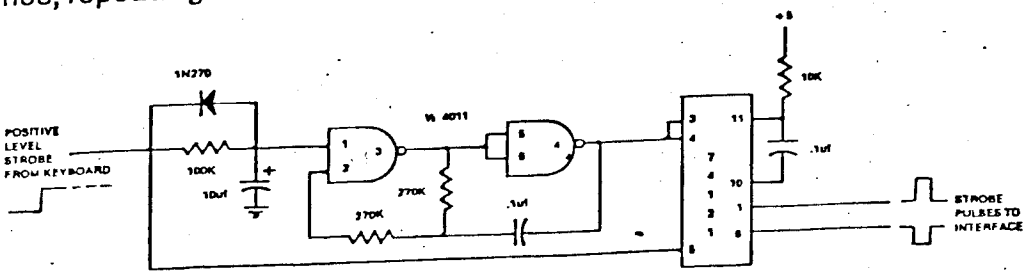


With Shift Lock option (STD) connector pin B6A provides both upper and lower case, B6B provides upper case only. Shift Lock key locks 756 into upper case shift mode. With Alpha Lock modification, connector pin Bit 6 Alpha becomes the new bit 6 output from the keyboard. Alpha Lock key locks 756 alpha keys (A-Z) only.

KEYBOARD TRICKS YOU CAN USE . . . (FREE!!!)

As an OEM keyboard vendor, GRI has accumulated a few little "tricks of the trade," which come in darned handy now and then. Here are a few:

AUTO-REPEAT (usually found on only the maxi-buck equipment)
Repeat is neat, but ever try to generate a slew of control Q's? Using a separate repeat key can try one's patience, if not tie one's fingers in knots! This circuit uses two I.C.'s and provides control over the delay before auto-repeat begins, the repetition rate, and the strobe pulse width. It works by merely generating one pulse for each normal key depression, and outputting numerous pulses if the key is held down for a certain length of time. Each pulse signals valid data, hence, repeating characters appear!



NUMERIC PAD (decimal numerics, for people with $1x10^1$ computers!)
Another premium feature in some equipment, is the numeric pad. Useful for entering numeric data (like for accounting or games uses) the pad usually shares the keyboard's encoder and data lines. Contrary to some stories, they do not output hexadecimal, etc., but just plain old ASCII. The key is, they are unaffected by the shift or control keys. For those who need or want one, GRI offers a numeric pad accessory for the 756 keyboard. Wires connect the Model 710 Numeric pad to the mother board, allowing use of the same input port. At $9.95 from most stores, you won't mind coming up with a box or longer enclosure for it. (won't fit GRI 701 or 702 enclosures.)

SINGLE SUPPLY OPERATION
What? No minus 12v supply? Never fear, because the clever guys at Elexon Power Systems have an under $10 so, on to your problem which will not put more lead (iron?) in your pants. The DC-512 dc-dc converter manufactures its own minus twelve volts, with just a little 5 volt input! And the best part is, it plugs right into the holes provided on the upper left hand corner of the pc board. Order model DC-512 (be sure to include the "dash") from GRI or:

Elexon Power Systems
3131 S. Standard Ave.
Santa Ana, CA 92705 (714) 979-4440

SERIAL OUTPUT
Sure you can use a UART, but here is a little circuit which requires only 5 volts, is easily built with regular TTL parts, and is easily adjusted to any desired baud rate without crystals. The 555 oscillator is steady enough (1%) for most uses, and the output can drive either a 20 ma current loop, RS-232, or what have you.