Univac®

LARC

CONTROL CONSOLES

DESCRIPTION AND MAINTENANCE

Remington Rand Univac®
DIVISION OF SPERRY RAND CORPORATION
UNIVAC ENGINEERING CENTER • PHILADELPHIA

RESTRICTED DISTRIBUTION

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SEPTEMBER 1961

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CONTENTS

ILLUSTRATIONS

TABLES

SECTION 1
INTRODUCTION

1-1. SCOPE

The construction, arrangement, and function of the UNIVAC®-LARC* Control Consoles is described in this manual. It contains a brief description of the construction of the consoles, a guide to locating and identifying the components and assemblies, and a description of the controls, indicators, major assemblies, and circuits.

This manual is intended as a reference handbook for maintenance personnel; it should be used in conjunction with the UNIVAC-LARC Maintenance Manual. For descriptions of operating procedures, refer to UNIVAC-LARC System Operator's Manual and the LARC Maintenance Manual. Drawing references prefixed with the number 3 (D 3602 841) designate drawings originating in UEC, Philadelphia. In troubleshooting, ignore the 3 and use only the remaining six digits for locating drawings.

The UNISERVO* magnetic-tape units will be referred to in the remainder of this manual as servos.

The following register trademark of the Sperry Rand Corporation is used in this manual: UNIVAC

* Trademark of Sperry Rand Corporation.

SECTION 2
GENERAL DESCRIPTION

2-1. ENGINEER'S CONSOLE

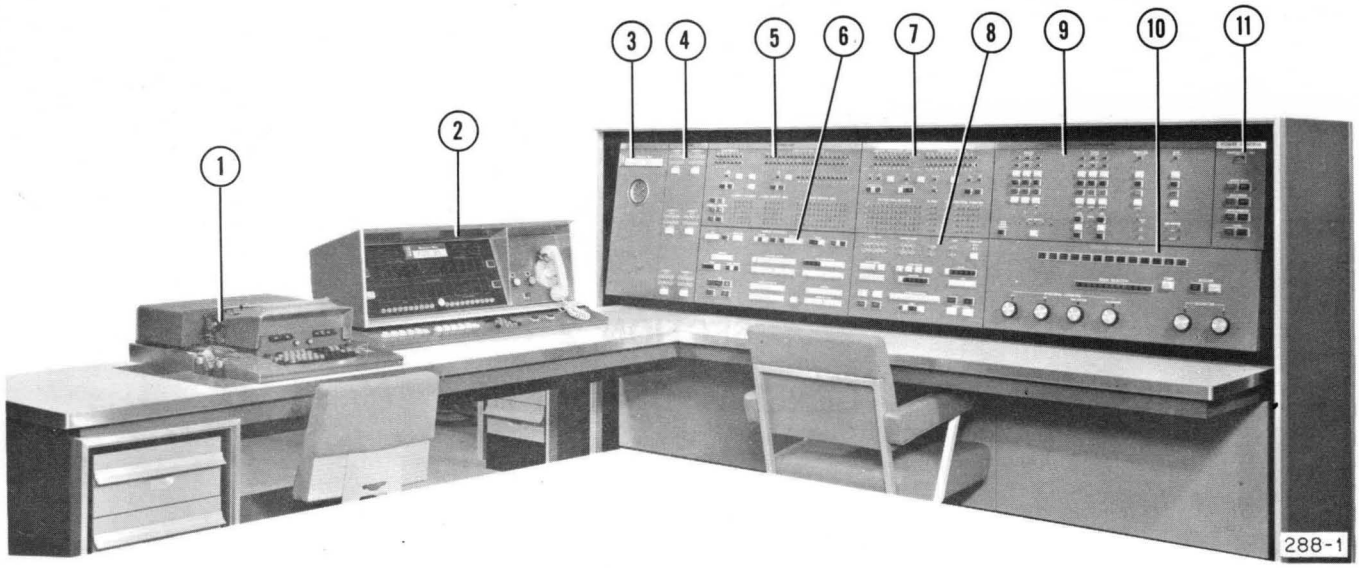
The engineer's console (figure 2-1), which consists of the engineer's panel and the local operator's console, contains the controls and indicators needed to operate and test the LARC system. The lower portion of the engineer's console contains relay chassis, connectors, and the cooling system. The upper portion contains the power supplies, timers, power-distribution barrier strips, circuit breakers, small components, and the control and indicator panel. The physical arrangement of the engineer's console is shown on drawings D 360 682, D 3814 472, D 3814 473, D 3814 474, and D 602 409.

2-2. OPERATOR'S CONSOLES

The operator's consoles contain the controls and indicators by which the engineer and operator monitor the operation of the computing unit (CU) and exercise limited control over the operation of the system. A basic LARC system has one remote operator's console; an expanded system has two.

2-3. PHYSICAL CHARACTERISTICS

Table 2-1 lists the weights and loading of the engineer's console (including local operator's console) and the remote operator's console.



1. Console Printer (Flexowriter)
2. Operator's Console (Figure 4-1)
3. Real-Time Clock
4. Memory Panel (Figure 3-1)
5. CU Diagnostic Panel (Figure 3-2)
6. CU Display Controls (Figure 3-3)
7. Processor Diagnostic Panel (Figure 3-4)
8. Processor Control Panel (Figure 3-5)
9. Synchronizers Panel (Figure 3-6)
10. System Power Monitor and Test Panel (Figure 3-9)
11. Power Control Panel (Figure 3-10)

Figure 2-1. Engineer's Panel

Table 2-1. Engineer's Console Weights and Loading

Characteristic	Engineer's Console			Operator's Console
	Engineer's Section	Operator's Section	Total	
Weight (lbs)	2100	600	2700	750
Average Floor Loading (lbs/sq ft)	70	30	—	35
Bearing Surface (sq in)	24	8	32	16
Average Point Loading (lbs/sq in)	87.5	75	—	46.8

SECTION 3
ENGINEER'S PANEL

3-1. GENERAL

The engineer's panel contains controls and diagnostic indicators for the memory units, each computing unit, processor (IOP), and the synchronizers. These controls and indicators manually control certain normally programmed operations, and also control and monitor power.

The engineer's panel assembly consists of six (or eight*) support panels on which space is provided for mounting all the switches and indicators required for an expanded system. The support panels are covered by nine (or 11*) overlay panels which contain the printed markings for the switches and indicators.

All casework panels are hinged; overlay panels snap off.

For operating procedures and descriptions of the controls and indicators on the engineer's console, refer to the LARC Maintenance Manual.

3-2. DESCRIPTION OF PANELS

The engineer's panel contains the nine control panels shown in figure 2-1.

3-3. REAL-TIME CLOCK

The real-time clock (figure 2-1, 3) is synchronous-motor driven and is connected to the 60-cycle power supply, from the main-breaker panel, at BS 14-3, (the ϕB line) and BS 14-2 (ACN). See D 3603 682.

3-4. MEMORY PANEL

The memory panel (figure 3-1) provides space for four MEMORY INTERLOCK indicators, four INHIBIT WRITE indicators, and a CLEAR pushbutton for each

* Expanded system with two computing-unit panels.

memory cabinet. (The LARC system has a maximum of ten cabinets.) Table 3-1 lists each switch and indicator on the memory panel.

3-5. COMPUTING-UNIT DIAGNOSTIC PANEL

The computing-unit diagnostic panel* (figure 3-2) contains the following groups of controls and indicators:

(1) Error flip-flop and contingency flip-flop neon indicators;

(2) The error-insert switch, error-option switches, and error flip-flop restore switches;

(3) Neon binary displays for the control counter and the 5- and 12-digit display registers.

The computing-unit diagnostic panel also contains the console selector (A and B), optional-insert (OP), and engineer's-option (ENG) switches. Table 3-2 lists each switch and indicator on the computing-unit diagnostic panel.

3-6. COMPUTING-UNIT DISPLAY-CONTROL PANEL

The computing-unit display-control panel* (figure 3-3) contains the computing-unit general-control switches and the switches which control the selection of information placed in the display registers. The display controls enable the selection of (1) the mode of display, (2) the source of the display information, and (3) the time interval during which the display information is taken from the selected source. Table 3-3 lists the computing-unit controls.

3-7. PROCESSOR DIAGNOSTIC PANEL

The processor-diagnostic panel (figure 3-4) contains the processor-error indicators and associated control and test switches, the neon binary display for instruction register 1 (IR1), the D-register, rP1, and the processor control counter. Table 3-4 lists each indicator on the processor panel.

3-8. PROCESSOR CONTROL PANEL

The processor-control panel (figure 3-5) contains the operating and test controls and indicators for the central processor. Table 3-5 lists the switches and indicators on the processor-control panel and gives the system function of each processor-control switch.

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* Two in the expanded system.

3-9. SYNCHRONIZERS PANEL

The synchronizers panel (figures 3-6 and 3-7) contains the control switches and error and status indicators for the input/output-equipment synchronizers (except the console printer). A fully expanded system requires 14 synchronizers; LARC serials 1 and 2 have fewer synchronizers, as shown in table 3-6. Table 3-7 lists each synchronizer switch and indicator in an expanded system.

3-10. SYSTEM POWER-MONITOR PANEL

The system power-monitor panel (figure 3-8 or 3-9) contains power-monitor indicators for the system. Table 3-8 lists the controls and indicators on the power-monitor panel. When system power is on, the red-and-green power-monitor indicators show the state of the monitored power-supply unit as follows:

(1) Green indicates normal operating conditions;

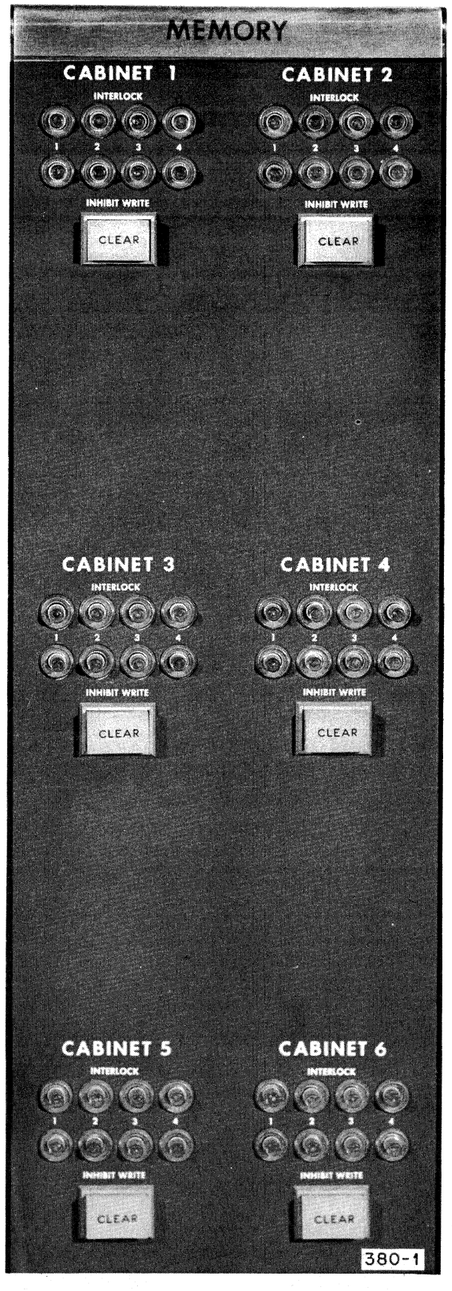
(2) Red and green together indicate an abnormal condition (all power remains on);

(3) Red indicates a serious fault. (D-c power is off in the indicated unit.)

The power controls and indicators are described in section 6.

3-11. POWER-CONTROL PANEL

The power-control panel (figure 3-10) has eight single-pole momentary-contact switches which, when actuated, cause the power-control relays to be energized or deenergized and consequently turn on or off power at remote locations. The power-control panel also has a 4-pole alternate-action switch which allows the simultaneous turnoff of all system power. Any push-button on the power-control panel is illuminated when the associated switch is operated. Table 3-9 lists the power-control switches.



Memory Panel

Table 3-1. Memory Panel, Component Listing

(a) CLEAR SWITCHES: Ten momentary-contact illuminated pushbuttons

For wiring diagram, see D 602 421.
Reference drawings apply for Serials 1, 2, and the expanded system.

Panel Marking — Cabinet	Switch (SW)	Schematic D 811...
1	201	410
2	200	
3	203	411
4	202*	
5	205*	412
6	204*	
7	207†	413
8	206†	
9	209†	414
10	208†	

* Not wired in Serials 1 and 2.
† Not installed in Serials 1 and 2.

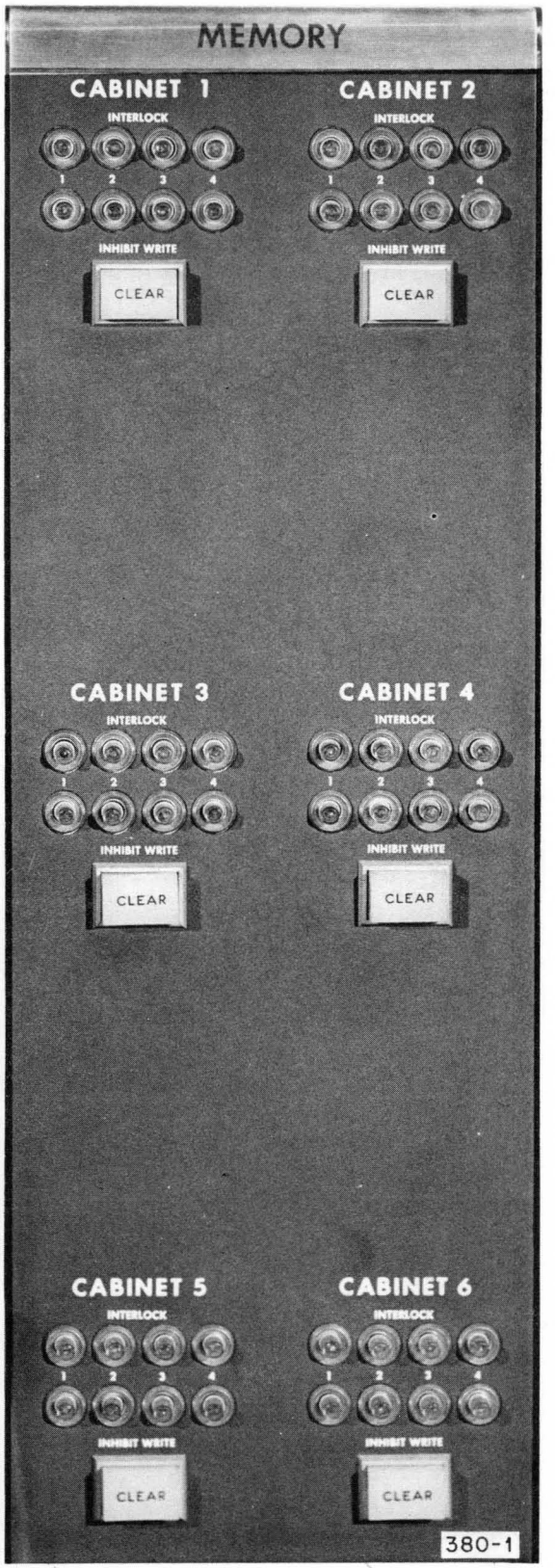
(b) INDICATORS: 80 neon lamps

For wiring diagram, see D 602 421.
Reference drawings apply for Serials 1, 2, and the expanded system.

Cabinet	Panel Marking	Neon Number (NE) Unit 1	Unit 2	Unit 3	Unit 4	Schematic D 811...
1	INTERLOCK	415	414	413	412	410
	INHIBIT WRITE	419	418	417	416	
2	INTERLOCK	407	406	405	404	410
	INHIBIT WRITE	411	410	409	408	
3	INTERLOCK	431	430	429	428	411
	INHIBIT WRITE	435	434	433	432	
	NOTE: Memory cabinets 4—10 were not installed in Larc Serials 1 and 2. Indicators for cabinets 4, 5, and 6 were installed, but not connected.					
4	INTERLOCK	423	422	421	420	411
	INHIBIT WRITE	427	426	425	424	
5	INTERLOCK	447	446	445	444	412
	INHIBIT WRITE	451	450	449	448	
6	INTERLOCK	439	438	437	436	412
	INHIBIT WRITE	443	442	441	440	
7	INTERLOCK	463	462	461	460	413
	INHIBIT WRITE	467	466	465	464	
8	INTERLOCK	455	454	453	452	413
	INHIBIT WRITE	459	458	457	456	
9	INTERLOCK	479	478	477	476	414
	INHIBIT WRITE	483	482	481	480	
10	INTERLOCK	471	470	469	468*	414
	INHIBIT WRITE	475	474	473	472*	

* Dummy Neon

Figure 3-1. Memory Panel and Associated Table



Memory Panel

Table 3-1. Memory Panel, Component Listing

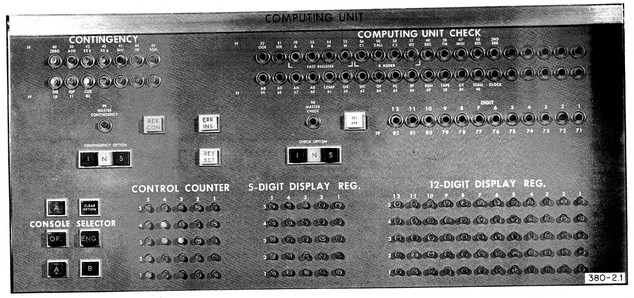
(a) CLEAR SWITCHES: Ten momentary-contact illuminated pushbuttons

For wiring diagram, see D 602 421. Reference drawings apply for Serials 1, 2, and the expanded system.

Panel Marking Cabinet	Switch (SW)	Schematic D 811...
1	201	410
2	200	
3	203	411
4	202*	
5	205*	412
6	204*	
7	207†	413
8	206†	
9	209†	414
10	208†	

* Not wired in Serials 1 and 2.

† Not installed in Serials 1 and 2.



Computing-Unit Diagnostic Panel

Table 3-2. Computing-Unit Diagnostic Panel, Component Listing

(a) CONTINGENCY Indicators: 15 red neon indicators

For neon schematic, see D 811 382.
For neon wiring diagram, see D 602 256.
Reference drawings apply for Serials 1, 2, and the expanded system.

Marking Panel	FF	Neon (NE)	Indicates
ZERO	40	274	Floating-point zero created.
ADD	39	273	Addition/subtraction-result error.
EX ↑	42	272	Exponent OF.
EX ↓	43	271	Exponent UF.
DIV	41	270	Nonnormalized divisor.
OF	44	269	Fixed-point OF.
SGN	45	268	Program error in sign.
DIS	10	281	Disclosure to IOP.
IOP	11	280	IOP intervention.
CU2	83	279	Disclosure from CU2. (Expanded system only.)
		275—278*	
MASTER CONTINGENCY	99	491†	Any contingency FF is set.

* Spare lamps.

† Below main group of contingency indicators. Neon schematic D 811 491.

(b) COMPUTING UNIT CHECK indicators: 53 red neon indicators

For neon wiring drawing, see D 602 256.
Drawing references apply to Serials 1, 2, and expanded system.

Marking Panel	FF	Neon Number (NE)	Schematic D 811 ...	Indicates
OOE	52	247	380	Output OE error.
IOE	51	246		Input OE error.
FAST REGISTER				
A	70	245		FR output error, t7, 0.
B	53	244		FR output error, t5, 6.
M	54	243		FR output error, t3, 4.
W	55	242		FR output error, t1, 2.
B ADDER				
C1	56	241		OE Error in B-adder output to C1, HSB, or AU.
CALL	50	240		OE Error in B-adder output to memory-address decoder.
C2	58	239		OE Error in B-adder output to C2.
IR2	57	238		OE or nonnumeric-character error in B-adder output to fast-register selector, selector storage, or to digits 1—5 of IR2.
DEC	49	237		Zero (0), space (Δ), minus (-), or plus (+) decoding error.
TM	20	236		Enter tracing mode.
MISC	47	235		Miscellaneous control error.
RES	48	234		Fast-register control error on result time.
2ND ERR	—	233		Two different errors occur.
—	—	232—228*	381	
AB	59	267	380	Adder-output error.
AD	68	266		Register-AD error.
AH	67	265		Register-AH error.
AS	60	264		Register-AS error.
COMP	61	263		Comparator error.
QIE	62	262		Quotient former, multiplier-decoder or extract-control error.
SFC	63	261		Shift-control error.
OF	64	260		Adder-overflow error.
PC	65	259		Program-counter error.
EP	66	258		Ending pulse.

* Spare Lamps

(b) COMPUTING UNIT CHECK indicators: 53 red neon indicators (cont)

Marking Panel	FF	Neon Number (NE)	Schematic D 811 ...	Indicates
SGN	69	257	380	Sign.
TAPE	38	256		Improper tape error.
CY	84	255		Cycling unit error.
STALL	46	254		Stall error.
CLOCK	—	253	381	
—	—	248—252*		
MASTER CHECK†	98	490	384	Any error FF is set.
12	82	293	383	Digit 12 error.
11	81	292		Digit 11 error.
.	.	.		.
.	.	.		.
.	.	.		.
2	72	283		Digit 2 error.
1	71	282		Digit 1 error.

* Spare Lamps

† Below other computing-unit check indicators.

(c) Control Switches

For wiring diagram, see D 602 256.

Marking Panel	Pushbutton	Switch	Schematic D 811 ...	Function
	RES CON	152	403	Resets contingency FFs
	ERR INS	151	384	Sets contingency and check FFs. Lights spare neons.
	RES ERR	150	403	Resets check FFs.
CONTINGENCY OPTION	I	154C	384	Ignores contingency.
	N	154B	—	Normal (program) operation on contingency. Release pushbutton not wired.
	S	154A	384	Stops on contingency.
	RES SGT	155	403	Resets sense and tracing-mode FFs.

(c) Control Switches (cont)

Marking Panel	Pushbutton	Switch	Schematic D 811 ...	Function
CHECK OPTION	I	153C	384	Ignores CU machine error.
	N	153B	—	Normal (program) operation on CU machine error. Release pushbutton is not wired.
	S	153A	384	Stops on CU machine error.
(Optional Insert)				
	A	161	389	Wiring optional.
	B	160	389	
CONSOLE SELECTOR	OP.	163	421	Energizes local/remote relays. Transfers CU operating control to remote operator's console.
	ENG	162	421	Deenergizes local/remote relays. Transfers CU operating control to engineer's console.
(Engineer's Option)				
	A	165	389	Wiring optional.
	B	164	389	

(d) CONTROL COUNTER indicators: 25 neon indicators

For neon schematic diagram, see D 811 388; wiring, D 602 256.

Digit	Neon Number (NE) Bit 1	Bit 2	Bit 3	Bit 4	Bit 5
5	403	398	393	388	383
4	402	397	392	387	382
3	401	396	391	386	381
2	400	395	390	385	380
1	399	394	389	384	379

(e) 5-DIGIT DISPLAY REGISTER indicators: 25 neon indicators

For neon schematic diagram, see D 811 387; wiring, D 602 256.

Digit	Neon Number (NE) Bit 1	Bit 2	Bit 3	Bit 4	Bit 5
5	378	373	368	363	358
4	377	372	367	362	357
3	376	371	366	361	356
2	375	370	365	360	355
1	374	369	364	359	354

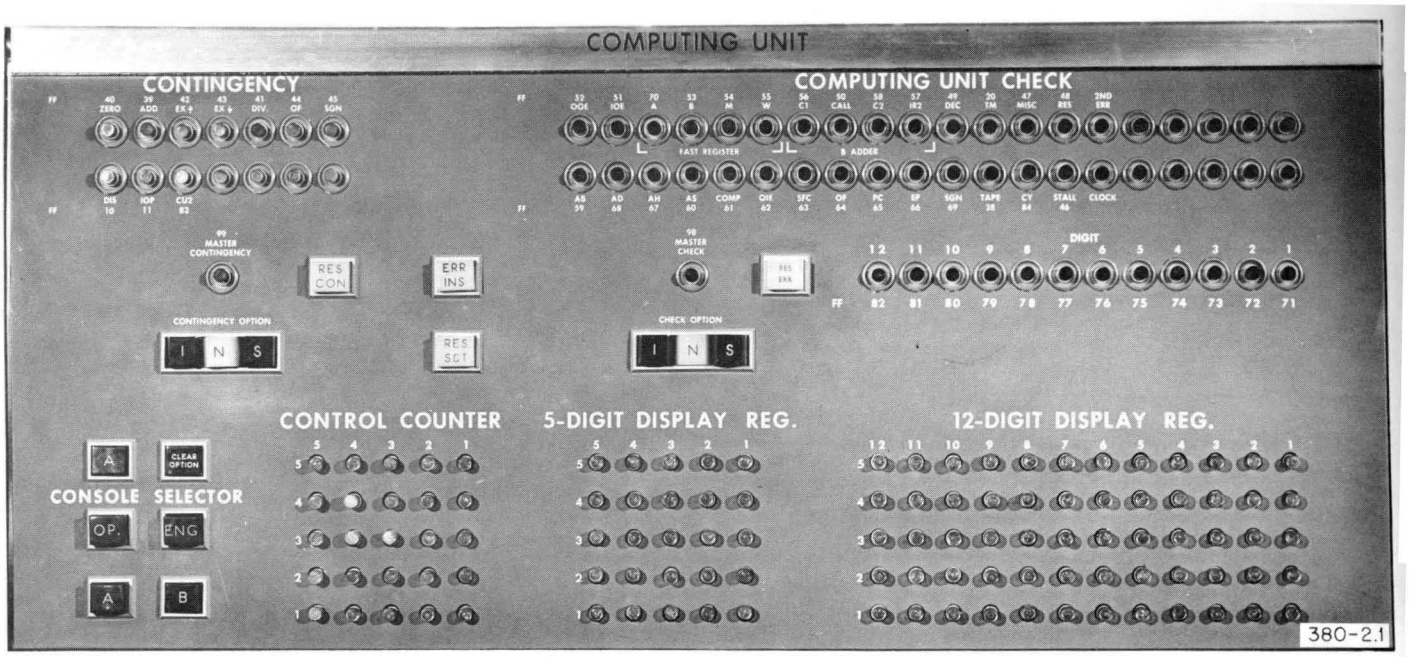
(f) 12-DIGIT DISPLAY REGISTER indicators: 60 neon indicators

For schematic of indicators in digits 1—6, see D 811 385; for neon indicators in digits 7—12, see D 811 386.
For wiring diagrams, see D 602 256.
Drawings apply for serials 1, 2, and the expanded system.

Digit	Neon Number (NE) Bit 1	Bit 2	Bit 3	Bit 4	Bit 5
12	353*	341	329	317	305
11	352*	340	328	316	304
10	351*	339	327	315	303
9	350*	338	326	314	302
8	349*	337	325	313	301
7	348*	336	324	312	300
6	347	335	323	311	299
5	346	334	322	310	298
4	345	333	321	309	297
3	344	332	320	308	296
2	343	331	319	307	295
1	342	330	318	306	294

* See D 811 385.

Figure 3-2. Computing-Unit Diagnostic Panel and Associated Table



Computing-Unit Diagnostic Panel

Table 3-2. Computing-Unit Diagnostic Panel, Component Listing

(a) CONTINGENCY Indicators: 15 red neon indicators

For neon schematic, see D 811 382.
For neon wiring diagram, see D 602 256.
Reference drawings apply for Serials 1, 2, and the expanded system.

Marking		Neon (NE)	Indicates
Panel	FF		
ZERO	40	274	Floating-point zero created.
ADD	39	273	Addition/subtraction-result error.
EX ↑	42	272	Exponent OF.
EX ↓	43	271	Exponent UF.
DIV	41	270	Nonnormalized divisor.
OF	44	269	Fixed-point OF.
SGN	45	268	Program error in sign.
DIS	10	281	Disclosure to IOP.
IOP	11	280	IOP intervention.
CU2	83	279	Disclosure from CU2. (Expanded system only.)
		275—278*	
MASTER CONTINGENCY	99	491†	Any contingency FF is set.

* Spare lamps.

† Below main group of contingency indicators. Neon schematic D 811 491.

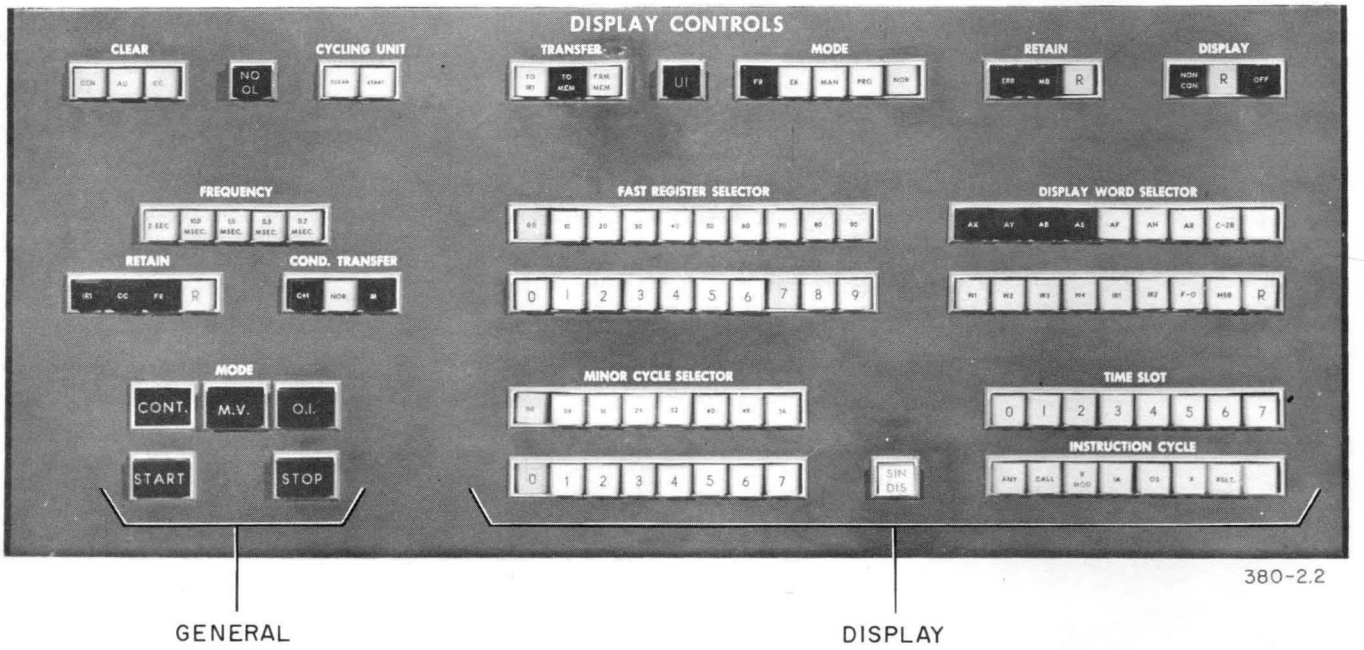


Figure 3-3. Computing-Unit Display-Control Panel

Table 3-3. Computing-Unit Controls

(a) GENERAL

For wiring diagram, see D 602 257.

Panel Marking	Pushbutton Marking and Type	Switch (SW) Number	Switch (SW) Schematic D 811 ...	Function
CLEAR	GEN, AU (M), CC	192C, 192B, 192A	403	CU general clear. Clears AU. Clears CC 1 to 02500.
	NO OL [AA(I)]	191	402	No overlap.
CYCLING UNIT	CLEAR, START (M)	190B, 190A	402	Clears cycling unit. Starts cycling unit.
FREQUENCY	2 SEC., 10.0 MSEC., 1.0 MSEC., 0.5 MSEC., 0.2 MSEC. (ILK(I)*)	194E, 194D, 194C, 194B, 194A	404	Performs instructions at 2-second intervals. Performs instructions at 10-msec intervals. Performs instructions at 1-msec intervals. Performs instructions at 0.5-msec intervals. Performs instructions at 0.2-msec intervals.
RETAIN	IR1, CC, FR, R (ILK(I))	196D, 196C, 196B, 196A	402	Retains instruction in IR1. Retains address in CC1. Retains contents of FRs. Release pushbutton.
COND. TRANSFER	C+1 [ILK(I)]† NOR (ILK) M [ILK(I)]†	195C 195B 195A	402	No transfer. Call C+1 instruction. Normal operation under program control. Release pushbutton not wired. Transfer. Calls instruction from address given by M digits of transfer-of-control instruction.
MODE	CONT., M.V., 0.I. (ILK(I))	197C, 197B, 197A	404	Normal, continuous operation under program control. Multivibrate mode. Executes instructions at a rate determined by the setting of frequency-control SW 194. Executes one instruction and stops each time start SW 199 is actuated.
	START, STOP (M(I))	199, 198	419, 420	Starts CU. Stops CU.

* Multivibrator period control. Use with SW 197B (M.V. Mode).

† Conditional transfer override.

(b) DISPLAY

For wiring diagram, see D 602 257.

Panel Marking	Pushbutton Marking and Type	Switch (SW) Number	Switch (SW) Schematic D 811 ...	Function
FAST REGISTER SELECTOR	00, 10, ..., 90 (ILK(I)*)	177K, 177J, ..., 177A	396	Selects MSD of two-digit FR number 00...99.
	0, 1, ..., 8, 9 (ILK(I)*)	179K, 179J, ..., 179B, 179A	397	Selects LSD of two-digit FR number 00...99.
	EXAMPLE: To select fast register 15, press pushbutton 10 on the MSD selector switch and pushbutton 5 on LSD selector switch.			
DISPLAY WORD SELECTOR	AX, AY, AB, AS, AF, AH, AR, C-2B (ILK(I)*)	175J, 175H, 175G, 175F, 175E, 175D, 175C, 175B	393, 394, 393, 394	Displays the output of adder-input PFRs AX via register AF. Displays the output of adder-input PFRs AY via register AH. Displays AB adder sum via result register AR. Displays the output of shifter AS via result register AR. Displays the contents of register AF. Displays the contents of register AH. Displays the contents of result register AR. Displays the output of the B-adder in digits 1—5; displays the contents of control-counter 2 in digits 6—10; displays the A-register selector digits in digits 11 and 12.
	None	175A	-	Release pushbutton for SW 175A—SW 175K. (Not wired.)
	W1, W2, W3, W4	175T, 175S, 175R, 175P	394, 395	Displays control words 1—4.
	IR1, IR2	175O, 175N	394	Displays the contents of IR1. Displays IR2 digits in positions 1—5 and 8—11; displays the selector-storage digits in positions 6 and 7.

* Selects source of information to be displayed.

(b) DISPLAY (cont)

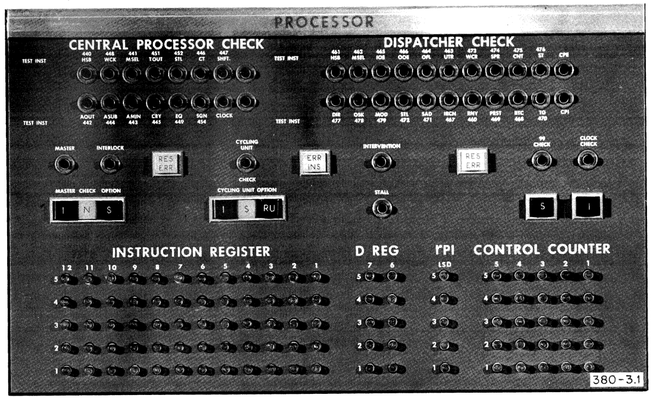
Panel Marking	Pushbutton Marking and Type	Switch (SW) Number	Switch (SW) Schematic D 811 ...	Function
DISPLAY WORD SELECTOR (cont)	F-0, HSB (ILK(I)*), R	175M, 175L, 175K	394, 395, -	Displays the FR regeneration output. Displays the information on the HSB. Release pushbutton.
	NOTE: TIME SLOT and INSTRUCTION CYCLE pushbuttons must be used in conjunction with the selected display word pushbutton.			
MINOR CYCLE SELECTOR	00, 08, 16, 24, 32, 40, 48, 56 (ILK(I)*)	181H, 181G, 181F, 181E, 181D, 181C, 181B, 181A	401	One pushbutton from each group (SW 181 and 184) is selected. The sum of the assigned values indicates the minor cycle selected. Used with the OS or IA pushbuttons.
	0, 1, ..., 6, 7 (ILK(I)*)	184H, 184G, ..., 184B, 184A	400	
	SIN DIS [ILK(I)*]	183	392	Used with pushbutton FR in FR mode, and pushbutton NON CON for non-continuous display.
TRANSFER	TO IR1, TO MEM (M), FRM MEM	174C, 174B, 174A	390	Transfers 12-digit display contents to IR1. Transfers 12-digit display contents to memory. Displays 5-digit address.
	UI [AA(I)]	173	390	Unity insert for FR.
MODE	FR, ER, MAN, PRO (ILK(I))	172E, 172D, 172C, 172B	391	Displays contents of selected FR. (Press SIN DIS pushbutton.) Displays an error. (Press SIN DIS pushbutton.) Displays selected source whenever selected time occurs. Displays selected source whenever program instruction has 1 in 12th digit position. (Use with time-selection pushbuttons.)
	NOR (ILK)	172A		Release pushbutton.

* Selects source of information to be displayed.

(b) DISPLAY (cont)

Panel Marking	Pushbutton Marking and Type	Switch (SW) Number	Switch (SW) Schematic D 811 ...	Function
RETAIN	ERR, MB (ILK(I))	171C, 171B	392	Retains display-register contents when error occurs. Retains display-register contents on memory-busy signal. (Use with O.I. pushbutton pressed.)
	R (ILK)	171A	-	Release pushbutton.
	NON CON [ILK(I)]	170C	392	Noncontinuous display. Press SIN DIS pushbutton to change display.
	R (ILK)	170B	-	Release pushbutton.
	OFF [ILK(I)]	170A	392	Extinguishes neon display.
TIME SLOT	0, 1, 2, ..., 6, 7 (ILK(I))	180H, 180G, 180F, ..., 180B, 180A	398	Selects pulse time from 0—7 for display sampling.
INSTRUCTION CYCLE	ANY, CALL, B MOD, IA, OS, X, RSLT. (ILK(I))	182H, 182G, 182F, 182E, 182D, 182C, 182B	399	Displays selected source once every 4 μsec at a pulse time selected by a TIME SLOT pushbutton. Displays selected source during call time when in One Instruction mode. Displays selected source during B-modification time when in One Instruction mode. Displays selected source during indirect-addressing time. Requires selection of minor cycle (MINOR CYCLE SELECTOR pushbutton). Displays selected source during operand-select time. Requires selection of minor cycle (MINOR CYCLE SELECTOR pushbutton). Displays selected source during execute time when in One Instruction mode. Displays selected source during result time when in One Instruction mode.
	None	182A	-	Release pushbutton. (Not wired.)

M momentary
AA alternate action
ILK interlocking
(I) illuminated



Processor Diagnostic Panel

Table 3-4. Processor-Diagnostic Panel Components

(a) CENTRAL PROCESSOR CHECK Indicators: 16 red neons

For neon schematic diagram, see D 811 368; for wiring, D 602 254.

Panel Marking		Lamp Number (NE)	Error When Lit
Name	TEST INST*		
HSB	440	79	High-speed bus.
WCK	448	78	Write.
MSEL	441	77	Memory select.
TOUT	451	76	Time out.
STL	452	75	Stall.
CT	446	74	Conditional transfer.
SHFT	447	73	Shift control.
—	—	72†	
AOUT	442	98	Adder output.
ASUB	444	97	Adder-subtrahend input.
AMIN	443	96	Adder-minuend input.
CRY	445	95	Carry.
EQ	449	94	Equality.
SGN	454	93	Sign.
CLOCK	—	92	Clock.
—	—	91†	

* Refer to UNIVAC-LARC Instruction and Function-Signal Analysis Manual: Test Instructions 44 and 45.

† Spare Lamp.

(b) DISPATCHER CHECK Indicators†: 22 red neons

For neon schematic diagram, see D 811 367; for wiring, D 602 254.

Panel Marking		Lamp Number (NE)	Error When Lit
Name	TEST INST*		
HSB	461	71	High-speed bus.
MSEL	462	70	Memory select.
IOE	465	69	Input odd even.
OOE	466	68	Output odd even.
OFL	464	67	Overflow.
UTR	463	66	Untranslatable character.
WCR	473	65	Word counter.
SPR	474	64	Sprocket.
CNT	475	63	Contingency.
ST	476	62	Start.
CPE	—	61	Console printer.
DIR	477	90	Direction.
OSK	478	89	Overskew.
MOD	479	88	Mode.
STL	472	87	Sentinel.
SAD	471	86	Sector address.
IRCN	467	85	Improper connection.
RNY	460	84	Runaway.
PRST	469	83	Preset.
RTC	468	82	Ring, trim, charge.
TG	470	81	Tape Sprocket generator.
CPI	—	80	Console printer interlock.

* Refer to UNIVAC-LARC Instruction and Function-Signal Analysis Manual: Instructions 46 and 47.

† Serial 2.

(c) Miscellaneous Indicators: 7 red neons

For neon schematic diagram, see D 811 368; for wiring, D 602 254.

Panel Marking	Lamp (NE)	Condition When Lit
MASTER	104	Lights when an error FF (tested by instructions 44—49 or 77) is set.
INTERLOCK	103	Error-intervention-interlock FF set.
CYCLING UNIT CHECK	102	No pulse or more than one pulse in any cycling-unit loop.
INTERVENTION	101	Intervention-Sync FF set.
STALL	105	No new instruction for 100 msec.
99 CHECK	100	Overdue 99 test.
CLOCK CHECK	99	8.33 msec clock not reset within 50 msec.

(d) Control Switches

Panel Marking	Pushbutton Marking and Type	Switch (SW) Number	Schematic D 811 ...	Wiring D 811 ...	Function
	RES ERR	102	368	420	Resets central-processor check FFs; extinguishes indicator neons.
	ERR INS (M)	101	367		Sets all central-processor and dispatcher-check FFs; lights all check neons. Tests error-indicating circuits and neons.
	RES ERR	100			Resets dispatcher-check FFs; extinguishes indicator neons.
MASTER CHECK OPTION	I [ILK(I)]	106C	368	254	Ignores error and continue operation.
	N (ILK)	106B			Normal operation; follow program.
	S [ILK(I)]	106A			Stops immediately on error.
CYCLING UNIT OPTION	I [ILK(I)]	105C	368	254	Ignores cycling-unit errors.
	S (ILK)	105B			Stops IOP on cycling-unit error.
	RU [ILK(I)]	105A			Transfers control to error routine.

M momentary
ILK interlocking
(I) illuminated

(e) INSTRUCTION REGISTER Display: 60 clear neons

For wiring diagram, see D 602 254.

Panel Marking		Lamp Number	Schematic D 811 ...	Panel Marking		Lamp Number	Schematic D 811 ...
Digit	Bit			Digit	Bit		
12	5	157	371	6	5	151	370
	4	169			4	163	371
	3	181			3	175	370
	2	193			2	187	370
	1	205			1	199	370
11	5	156	371	5	5	150	370
	4	168			4	162	371
	3	180			3	174	370
	2	192			2	186	370
	1	204			1	198	370
10	5	155	371	4	5	149	370
	4	167			4	161	371
	3	179			3	173	370
	2	191			2	185	370
	1	203			1	197	370
9	5	154	371	3	5	148	370
	4	166			4	160	
	3	178			3	172	
	2	190			2	184	
	1	202			1	196	
8	5	153	370	2	5	147	370
	4	165	371		4	159	
	3	177	370		3	171	
	2	189	370		2	183	
	1	201	370		1	195	
7	5	152	370	1	5	146	370
	4	164	371		4	158	371
	3	176	370		3	170	371
	2	188	370		2	182	370
	1	200	370		1	194	370

(f) D REGISTER Display: 10 clear neons

For neon schematic diagram, see D 811 361; wiring, D 602 254.

Digit	Neon Number (NE)				
	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5
7	145	143	141	139	137
6	144	142	140	138	136

(g) rPl LSD Display: 5 clear neons

For neon schematic diagram, see D 811 371; wiring D 602 254.

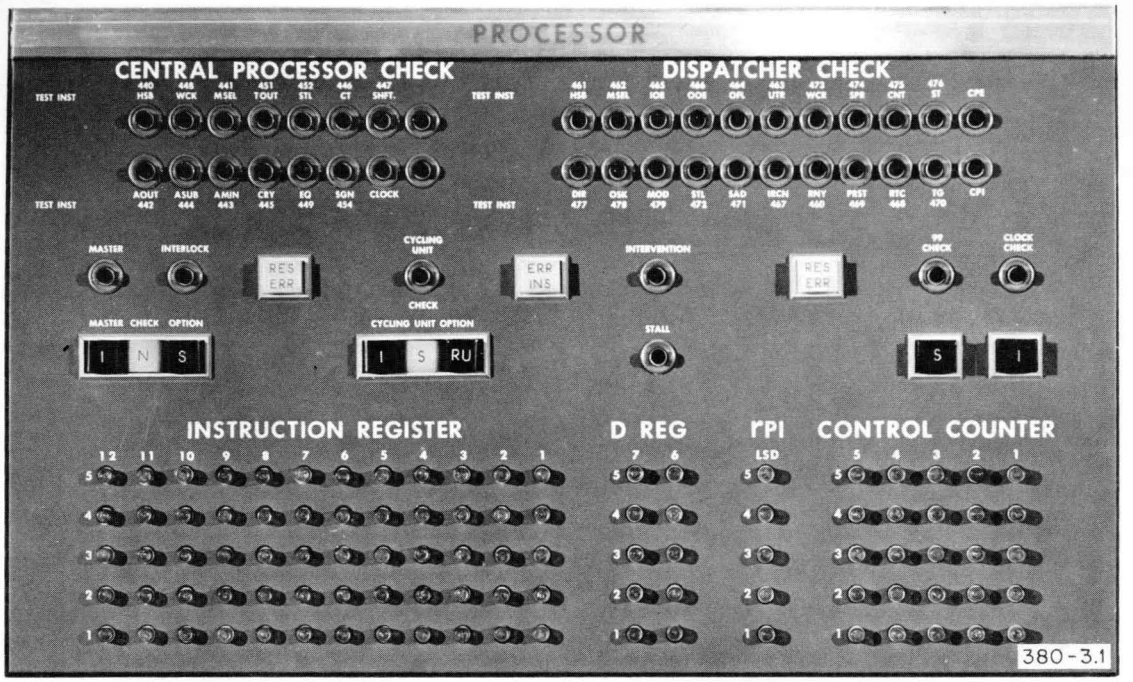
Digit	Neon Number (NE)				
	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5
LSD	135	134	133	132	131

(h) CONTROL COUNTER Display: 25 clear neons

For neon schematic diagram, see D 811 369; wiring D 602 254.

Digit	Neon Number (NE)				
	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5
5	130	125	120	115	110
4	129	124	119	114	109
3	128	123	118	113	108
2	127	122	117	112	107
1	126	121	116	111	106

Figure 3-4. Processor Diagnostic Panel and Associated Table



Processor Diagnostic Panel

Table 3-4. Processor-Diagnostic Panel Components

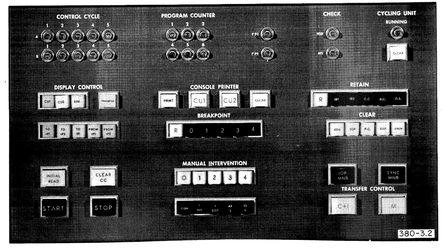
(a) CENTRAL PROCESSOR CHECK Indicators: 16 red neons

For neon schematic diagram, see D 811 368; for wiring, D 602 254.

Panel Marking		Lamp Number (NE)	Error When Lit
Name	TEST INST*		
HSB	440	79	High-speed bus.
WCK	448	78	Write.
MSEL	441	77	Memory select.
TOUT	451	76	Time out.
STL	452	75	Stall.
CT	446	74	Conditional transfer.
SHFT	447	73	Shift control.
—	—	72†	
AOUT	442	98	Adder output.
ASUB	444	97	Adder-subtrahend input.
AMIN	443	96	Adder-minuend input.
CRY	445	95	Carry.
EQ	449	94	Equality.
SGN	454	93	Sign.
CLOCK	—	92	Clock.
—	—	91†	

* Refer to UNIVAC-LARC Instruction and Function-Signal Analysis Manual: Test Instructions 44 and 45.

† Spare Lamp.



Processor Control Panel

Table 3-5. Processor Control Panel

(a) Indicators

For neon schematic, see D 811 369; wiring, D 602 255.

Panel Marking	Neon		Indicates
	Number	Color	
CONTROL CYCLE			
1A	221	Clear	Time-out FFs set; instruction decoder blocked.
1B	227		
2A	220		Ending-pulse FFs set.
2B	226		
3A	219		IR2-ready FFs set; new instruction writing in IR2.
3B	225		
4A	218		M ⟶ IR2 FFs set.
4B	224		
5A	217		Skip FFs set. (Operate only in non-continuous modes.)
5B	223		
PROGRAM COUNTER			
1	213	Clear	Indicates instruction step about to be executed. Stops on PC1 except on error.
2	212		
3	211		
4	216		
5	215		
6	214		
rP1	209	Red	Sign error.
rP2	210	Red	Sign error.
CHECK			
HSB	207	Red	High-speed bus checker not operating.
MS	208	Red	Memory-selection checker not operating.
CYCLING UNIT RUNNING	206*	Clear	Cycling unit operating properly.

* Neon schematic, D 811 371; wiring, D 602 254.

(b) Control Switches

For switch wiring diagram, see D 602 255.

Marking		Switch (SW)		Function
Panel	Pushbutton	Number	Schematic D 811 ...	
CYCLING UNIT	CLEAR (M)	110	371	Clears all cycling-unit loops. Cycling unit starts when switch is released.
DISPLAY CONTROL	CU1	116C	372	Selects 12-digit display register in CU1 as input/output register.
	CU2 ILK(I)*	116B		Selects 12-digit display register in CU2 as input/output register.
	SIM	118A		Selects external-memory simulator as input.
	TRANSFER (M)	117	372	Transfer between selected input/output register (SW 118) and selected processor register (SW 121).
	TO rP1	121E	372	Selects rP1 to receive information from source selected by a DISPLAY CONTROL pushbutton (SW 118).
	TO rP2	121D		Selects rP2 to receive information from source selected by a DISPLAY CONTROL pushbutton (SW 118).
	TO IR1 ILK(I)	121C		Selects IR1 to receive information from source selected by a DISPLAY CONTROL pushbutton (SW 118).
	FROM rP1	121B		Selects rP1 as source of information for selected CU register.
	FROM rP2	121A		Selects rP2 as source of information for selected CU register.
CONSOLE PRINTER	PRINT	116	372	When processor is stopped, starts or re-starts automatic typeout of contents of rP1 and rP2. Used with the CU1 or CU2 pushbuttons.
	CU1 M(I)	115		Selects CU1 printer for typeout. Console selector switch on CU panel selects local or remote printer.
	CU2	114		Selects CU2 printer for typeout. Console-selector switch on CU2 panel selects local or remote printer.
	CLEAR (M)	113		Clears console-printer control circuits.
BREAKPOINT	R	120F	373	Release pushbutton.
	0	120E		Stops on breakpoint instruction if sync-hronizer-selector digit matches the number of any operated switch. Any number of switches may be operated at one time.
	1	120D		
	2 ILK(I)	120C		
	3	120B		
	4	120A		

* Used with the TRANSFER pushbutton (SW117).

(b) Control Switches (cont)

Marking		Switch (SW)		Function
Panel	Pushbutton	Number	Schematic D 811 ...	
RETAIN	R	112F	372	Release pushbutton.
	IR1	112E		Retain contents of IR1.
	IR2 ILK(I)	112D		Retain contents of IR2.
	C.C.	112C		Retain contents of control counter.
	P.C.	112B		Do not step program counter, except with MNB.
	O.S.	112A		Operand-select (retain-operand).
CLEAR	GEN	119E	373	Stops IOP and all synchronizers. Resets all central-processor and dispatcher-error FFs. Disconnects input/output devices from synchronizers.
	IOP M	119D		Stops IOP. Sets time-out FFs. Resets all central-processor error FFs. Sets instruction-selection-interlock FF. Resets FF2 and FF4.
	P.C.	119C		Clears program counter.
	DISP.	119B		Clears dispatcher; resets dispatcher-diagnostic FFs.
	DRUM	119A		Clears drum synchronizers.
	INITIAL READ (M)	126	373	Read forward on Servo 10, synchronizer 1, and transfer contents of first block to memory starting with location 00000. At end of block, stop and transfer control to 00001. Used with START pushbutton and mode switches 129A—129D.
	CLEAR CC (M)	125	373	Transfer control to 00001. Used with START pushbutton.
	START [M(I)]	131	373	Starts IOP. Execute or complete instruction in IR1. Reset noncontinuous FF. Lights when noncontinuous FF is reset.
	STOP [M(I)]	130	373	Sets time-out FFs to stop IOP. Indicator lights when stall FF is set.
MANUAL INTERVENTION (Serials 1 and 2)	(Blank) AA	124K	373	Not used.
	(Blank) AA	124J		
	0	124H		Sets corresponding manual-intervention FF.
	1	124G		
	2 AA(I)	124F		
	3	124F		
	4	124D		
	(Blank)	124C		Not used.
	(Blank) AA	124B		
	(Blank)	124A		

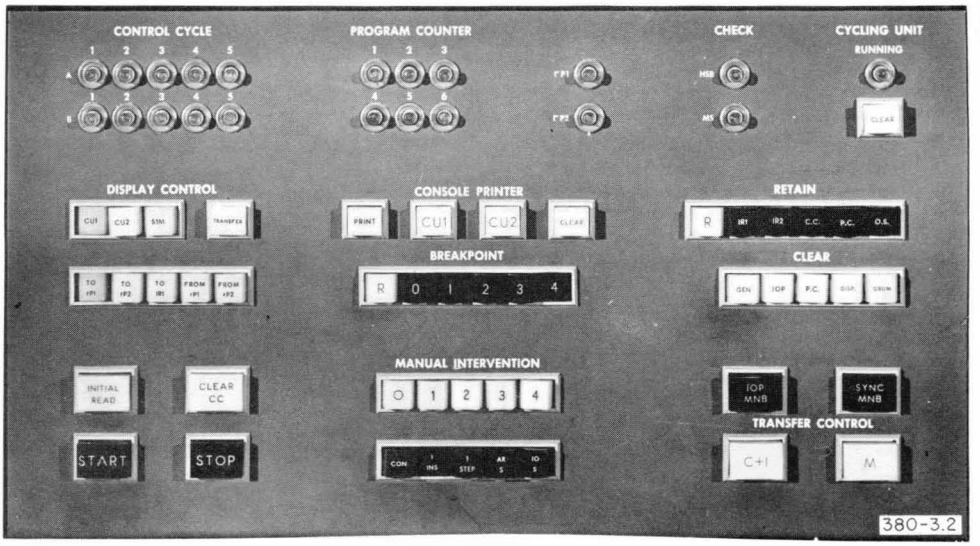
(b) Control Switches (cont)

Marking		Switch (SW)		Function
Panel	Pushbutton	Number	Schematic D 811 ...	
MODE*	CON	129E	373	Operate in normal, continuous mode. Release pushbutton for other mode switches.
	1 INS	129D		Operate in one-instruction mode.
	1 STEP ILK(I)	129C		Stop after each instruction step.
	AR	129B		Arithmetic stop: stop after executing test portion of arithmetic test instruction. Test instruction remains in IR1.
	S			
	IO	129A		Stop on I/O test instruction.
	S			
TRANSFER CONTROL	IOP MNB	123	373	Simulates MNB on IOP time slot.
	SYNC MNB AA(I)	122		Simulates MNB on dispatcher time slot.
	C+1 [M(I)]	128		Ignore instruction in IR1. Skip to instruction C+1 when START pushbutton is pushed.
	M [M(I)]	127		Ignore instruction in IR1, except for M address. When the START pushbutton is pressed, transfer control to M address of instruction in IR1.

* Serial 2 panel not marked.

AA alternate action
ILK interlocking
M momentary
(I) illuminated

Figure 3-5. Processor Control Panel and Associated Table



Processor Control Panel

Table 3-5. Processor Control Panel

(a) Indicators

For neon schematic, see D 811 369; wiring, D 602 255.

Panel Marking	Neon		Indicates
	Number	Color	
CONTROL CYCLE			
1A 1B	221 227	Clear	Time-out FFs set; instruction decoder blocked.
2A 2B	220 226		Ending-pulse FFs set.
3A 3B	219 225		IR2-ready FFs set; new instruction writing in IR2.
4A 4B	218 224		M → IR2 FFs set.
5A 5B	217 223		Skip FFs set. (Operate only in non-continuous modes.)
PROGRAM COUNTER			
1 2 3 4 5 6	213 212 211 216 215 214	Clear	Indicates instruction step about to be executed. Stops on PC1 except on error.
rP1	209	Red	Sign error.
rP2	210	Red	Sign error.
CHECK			
HSB	207	Red	High-speed bus checker not operating.
MS	208	Red	Memory-selection checker not operating.
CYCLING UNIT RUNNING	206*	Clear	Cycling unit operating properly.

* Neon schematic, D 811 371; wiring, D 602 254.

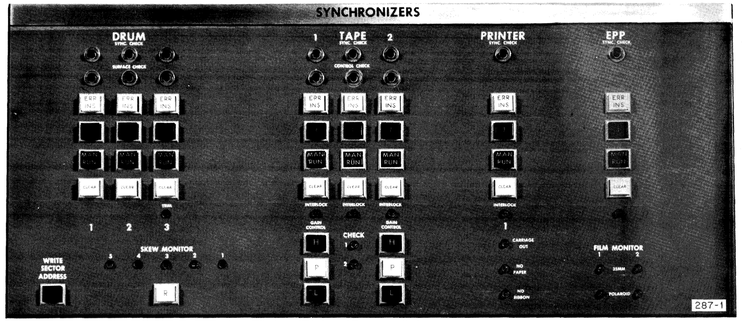
Table 3-6. Larc Systems Synchronizer Complement

Note: All synchronizers used in the expanded system.

Synchronizer		Serial	
Name	Number	1	2
Drum-read	0	†	†
Drum-read	1	*	*
Drum-read	2	*	*
Drum-write	3	*	*
Drum-write	4	†	†
Tape read-write	7	*	*
Tape read-write	8	*	*
Tape read-write	9	†	*
Tape read-write	10	†	*
Tape read-check	13	*	*
High-speed printer	5	*	*
High-speed printer	6	†	†
Electronic page recorder (EPP)	12	*	†
Card-reader	11	†	†

* used

† not used



Synchrcnizers Panel, Serial 1

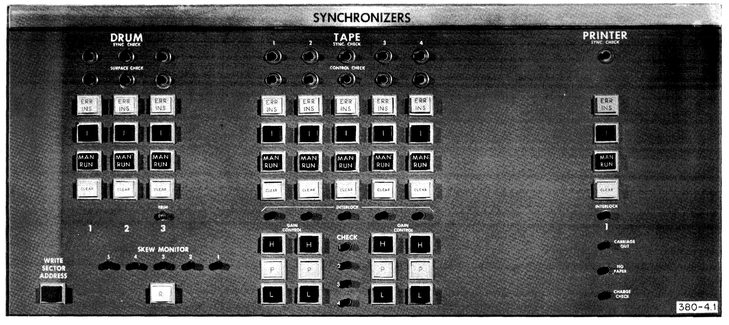
Table 3-7. Synchronizers Panel, Components Listing

(a) Drum Synchronizers

For schematic drawing of switches (SW) and neons (NE) see D 811 365.
Wiring drawing for switches 61—79, D 602 254. All other switches and neons, D 602 419.

Marking		Component					Indication or Test
Panel	Pushbutton	Sync 0	Sync 1	Sync 2	Sync 3	Sync 4	
SYNC CHECK		NE 45*	NE 44	NE 43	NE 42	NE 41*	Error.
SURFACE CHECK		50*	49	48	47	46*	Bad band; no sector address read with 10 msec of attempt.
	ERR INS	64*	63	62	61	60*	Tests sync error-detection circuits and indicators.
	I (Ignore)	SW 69*	SW 68	SW 67	SW 66	SW 65	Ignore errors.
	MAN RUN	74*	73	72	71	70	Manual run: insert instructions from console.
	CLEAR	79*	78	77	76	75	Reset error FFs.
TRIM		—	—	—	NE 52	NE 51*	
SKEW MONITOR							
5		—	—	—	—	NE 60	Indicates the channel or channels involved when an overskew error occurs.
4		—	—	—	NE 59	—	
3		—	—	NE 58	—	—	
2		—	NE 57	—	—	—	
1		NE 56	—	—	—	—	
	R (SW80)	—	—	—	—	—	Resets overskew FFs.
WRITE SECTOR ADDRESS	(SW81)	—	—	—	—	—	Use with WSA routine to write temporary sector address.

* Expanded system schematic diagram, D 811 366.



Synchronizers Panel, Serial 2

(b) Tape Synchronizers

For neon (NE) and switch (SW) schematic diagram, see D 811 363.
For neon and switch wiring diagrams, see D 602 419.

Marking		Component					Function or Indication
Panel	Pushbutton	Sync 7	Sync 8	Sync 9	Sync 10	Sync 13	
SYNC CHECK		26	25	23*	22*	24	Information error.
CONTROL CHECK		NE 31	NE 30	NE 28*	NE 27*	NE 29	Control error.
	ERR INS	32	31	29*	28*	30	Test error circuits and indicators.
	I (Ignore)	37	36	34*	33*	35	Ignore error.
	MAN RUN	SW 42	SW 41	SW 39*	SW 38*	SW 40	Manual run: instructions inserted from console.
	CLEAR	47	46	44*	43*	45	Clear sync.
INTER-LOCK		NE 36	NE 35	NE 33*	NE 32*	NE 34	Servo selected not available. Operator intervention required.
GAIN CONTROL	H (High)	51A	50A	49A*	48A*	—	Increases read-output voltage to 60 percent above normal.
	P (Program)	SW 51B	SW 50B	SW 49B*	SW 48B*	—	Release pushbutton.
	L (Low)	51C	50C	49C*	48C*	—	Decreases read-output voltage to 50 percent below normal.
CHECK							
1		—	—	—	NE 37	—	
2		—	—	NE 38	—	—	
3		—	NE 39†	—	—	—	Error in indicated sync.
4		NE 40†	—	—	—	—	

* Schematic for serial 2 and expanded system, D 811 364; wiring D 602 252.
† Larc Serial 2.

(c) High-Speed Printer Synchronizers

For neon (NE) and switch (SW) schematic, see D 811 362.
For wiring diagram, see D 602 419.

Marking		Component		Function or Indication
Panel	Pushbutton	Sync 5	Sync 6	
SYNC CHECK		NE 4	NE 3	Error.
	ERR INS	15	14*	Test error-detection circuits and indications.
	I (Ignore)	19	18*	Ignore synchronizer errors.
	MAN RUN	SW 23	SW 22*	Manual run: instructions inserted from console.
	CLEAR	27	26*	Clear synchronizer.
INTERLOCK		8	7	Printer off line or not available. Operator intervention required.
CARRIAGE OUT		NE 11	NE 10	Carriage not in printing position.
NO PAPER		16	15	Printer out of paper, or paper torn.
CHARGE CHECK		20	21	Malfunction in print-actuator charging circuits.

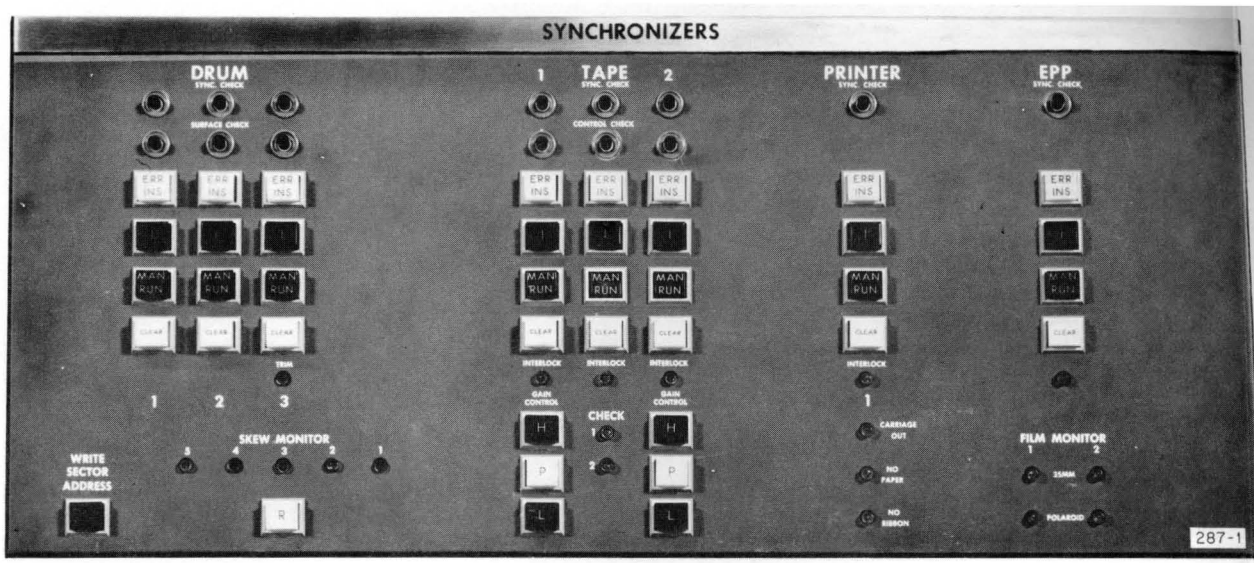
* Wiring for expanded system, D 602 252.

(d) Electronic-Page-Recorder Synchronizer (Serial 1)

For switch (SW) and neon (NE) schematic, see D 811 361.
For wiring diagram, see D 602 419.

Marking		Component	Function or Indication
Panel	Pushbutton		
SYNC CHECK		NE 2	Synchronizer error.
	ERR INS	13	Test error-detection and indicator circuits.
	I (Ignore)	17	Ignore synchronizer error.
	MAN RUN	SW 21	Manual run. Insert instructions from console.
	CLEAR	25	Clear synchronizer.
INTERLOCK		NE 6	
FILM MONITOR	35 MM 1, 2	NE 14, 13	35-mm film magazine empty.
	POLAROID 1, 2	19, 18	Polaroid film exposed.

Figures 3-6 and 3-7. Synchronizers Panels and Associated Table



Synchronizers Panel, Serial 1

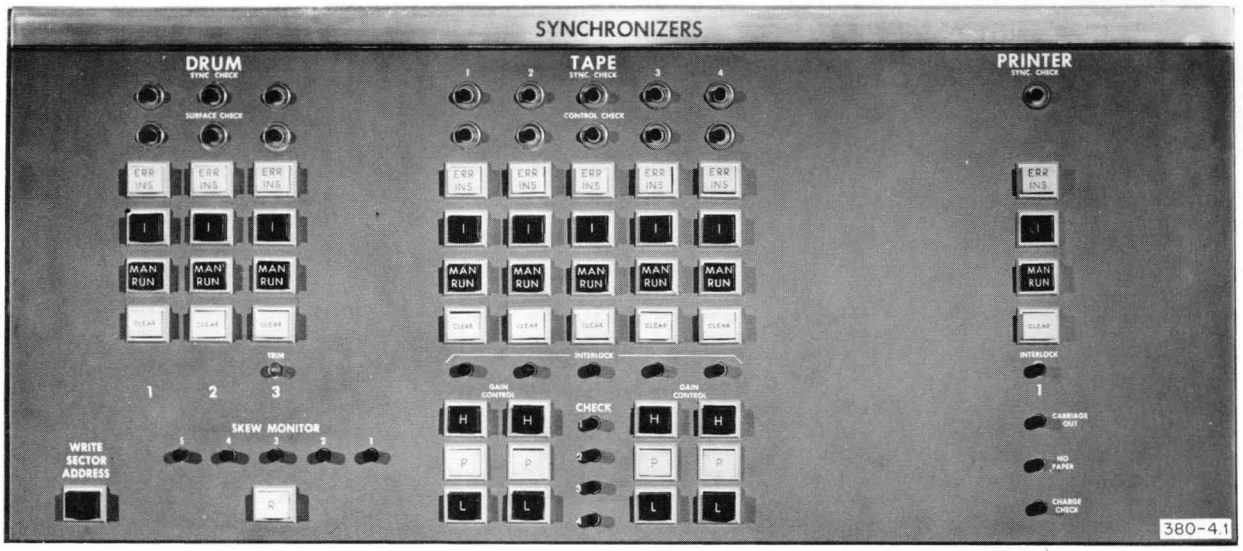
Table 3-7. Synchronizers Panel, Components Listing

(a) Drum Synchronizers

For schematic drawing of switches (SW) and neons (NE) see D 811 365.
Wiring drawing for switches 61—79, D 602 254. All other switches and neons, D 602 419.

Marking		Component					Indication or Test
Panel	Pushbutton	Sync 0	Sync 1	Sync 2	Sync 3	Sync 4	
SYNC CHECK		NE 45*	NE 44	NE 43	NE 42	NE 41*	Error.
SURFACE CHECK		50*	49	48	47	46*	Bad band: no sector address read with 10 msec of attempt.
	ERR INS	64*	63	62	61	60*	Tests sync error-detection circuits and indicators.
	I (Ignore)	SW 69*	SW 68	SW 67	SW 66	SW 65	Ignore errors.
	MAN RUN	74*	73	72	71	70	Manual run: insert instructions from console.
	CLEAR	79*	78	77	76	75	Reset error FFs.
TRIM		—	—	—	NE 52	NE 51*	
SKEW MONITOR							
5		—	—	—	—	NE 60	Indicates the channel or channels involved when an overskew error occurs.
4		—	—	—	NE 59	—	
3		—	—	NE 58	—	—	
2		—	NE 57	—	—	—	
1		NE 56	—	—	—	—	
	R (SW80)	—	—	—	—	—	Resets overskew FFs.
WRITE SECTOR ADDRESS	(SW81)	—	—	—	—	—	Use with WSA routine to write temporary sector address.

* Expanded system schematic diagram, D 811 366.



Synchronizers Panel, Serial 2

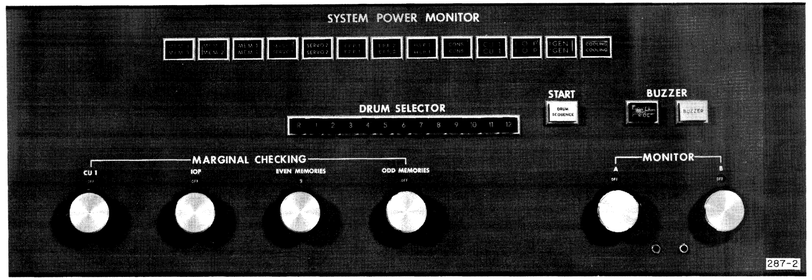
(b) Tape Synchronizers

For neon (NE) and switch (SW) schematic diagram, see D 811 363.
For neon and switch wiring diagrams, see D 602 419.

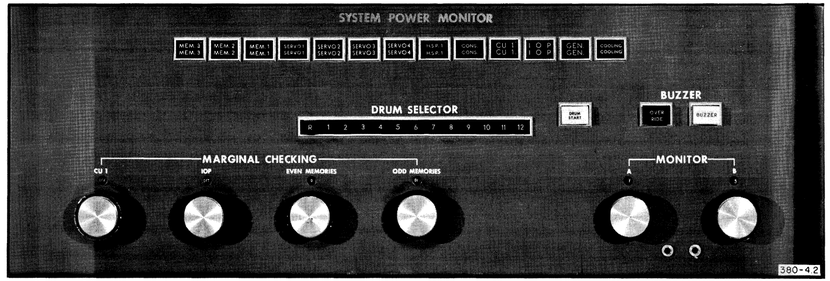
Marking		Component					Function or Indication
Panel	Pushbutton	Sync 7	Sync 8	Sync 9	Sync 10	Sync 13	
SYNC CHECK		NE 26	NE 25	NE 23*	NE 22*	NE 24	Information error.
CONTROL CHECK		NE 31	NE 30	NE 28*	NE 27*	NE 29	Control error.
	ERR INS	SW 32	SW 31	SW 29*	SW 28*	SW 30	Test error circuits and indicators.
	I (Ignore)	SW 37	SW 36	SW 34*	SW 33*	SW 35	Ignore error.
	MAN RUN	SW 42	SW 41	SW 39*	SW 38*	SW 40	Manual run: instructions inserted from console.
	CLEAR	SW 47	SW 46	SW 44*	SW 43*	SW 45	Clear sync.
INTER-LOCK		NE 36	NE 35	NE 33*	NE 32*	NE 34	Servo selected not available. Operator intervention required.
GAIN CONTROL	H (High)	SW 51A	SW 50A	SW 49A*	SW 48A*	—	Increases read-output voltage to 60 percent above normal.
	P (Program)	SW 51B	SW 50B	SW 49B*	SW 48B*	—	Release pushbutton.
	L (Low)	SW 51C	SW 50C	SW 49C*	SW 48C*	—	Decreases read-output voltage to 50 percent below normal.
CHECK							
1		—	—	—	NE 37	—	Error in indicated sync.
2		—	—	NE 38	—	—	
3		—	NE 39+	—	—	—	
4		NE 40+	—	—	—	—	

* Schematic for serial 2 and expanded system, D 811 364; wiring D 602 252.

+ Larc Serial 2.



System Power Monitor Panel, Serial 1



System Power Monitor Panel, Serial 2

Table 3-8. System Power-Monitor Panel: Component Listing

(a) Power-Fault Indicator Lamp Units

Neon schematic, D 811 351; wiring drawing, D 602 420.

Pushbutton	Component (LU)	Unit Indicated
CONS.	1	Engineer's Console
CARD READER*	2	Card reader
H.S.P.2*	3	High-speed printer No. 2 power supply.
H.S.P.1	4	High-speed printer No. 1 power supply.
E.P.P.2†	5	Electronic-page recorder No. 1 power supply.
E.P.P.1†	6	Electronic-page recorder No. 2 power supply.
SERVO 4**	7	Servo power supply 4.
SERVO 3**	8	Servo power supply 3.
SERVO 2	9	Servo power supply 2.
SERVO 1	10	Servo power supply 1.
MEM. 10*	11	Cabinet 10 (0) power supply.
MEM. 9*	12	Cabinet 9 power supply.
. . .	. . .	Cabinets 4—8 power supplies.
MEM. 3	18	Cabinet 3 power supply.
MEM. 2	19	Cabinet 2 power supply.
MEM. 1	20	Cabinet 1 power supply.
CU 2*	21	CU 2 power supply.
GEN.	22	Motor-generator control circuits.
IOP	23	IOP power supply.
CU 1	24	CU 1 power supply.
COOLING	25	Cooling system temperature and power.

* Expanded system.
† Serial 1.
** Serial 2 and expanded system.

(b) Drum-Selector and Start Pushbutton

For wiring diagram, see D 602 420.

Pushbutton Marking	Component (SW)	Schematic D 811 ...	Function
DRUM START	84	355	Starts automatic sequencing of selected drums.
DRUM SELECTOR Pushbuttons			
R	85N	353	Release pushbutton.
1	85M		Starts drum 1.
2	85L		Starts drum 2.
.	.		
.	.		Starts drums 3—10.
.	.		
11	85B		Starts drum 11.
12	85A		Starts drum 12.
DRUM SELECTOR Pushbuttons (Expanded system)			
R	86N	354	Release pushbutton.
13	86M		Starts drum 13.
14	86L		Starts drum 14.
.	.		
.	.		Starts drums 15—23.
.	.		
24	86A		Starts drum 24.

(c) MARGINAL CHECKING Switches

For wiring diagram, see D 602 420.

Panel Marking	Component (SW)	Schematic D 811 ...	Function
CU 1	97	356	Refer to Preventive Maintenance book, Larc Maintenance Manual.
IOP	96	357	
EVEN MEMORIES	95	358	
ODD MEMORIES	94	359	
(CU 2)*	93	360	

* Expanded system only.

(d) BUZZER Switches

For switch schematic, see D 811 352; wiring diagram D 602 420.

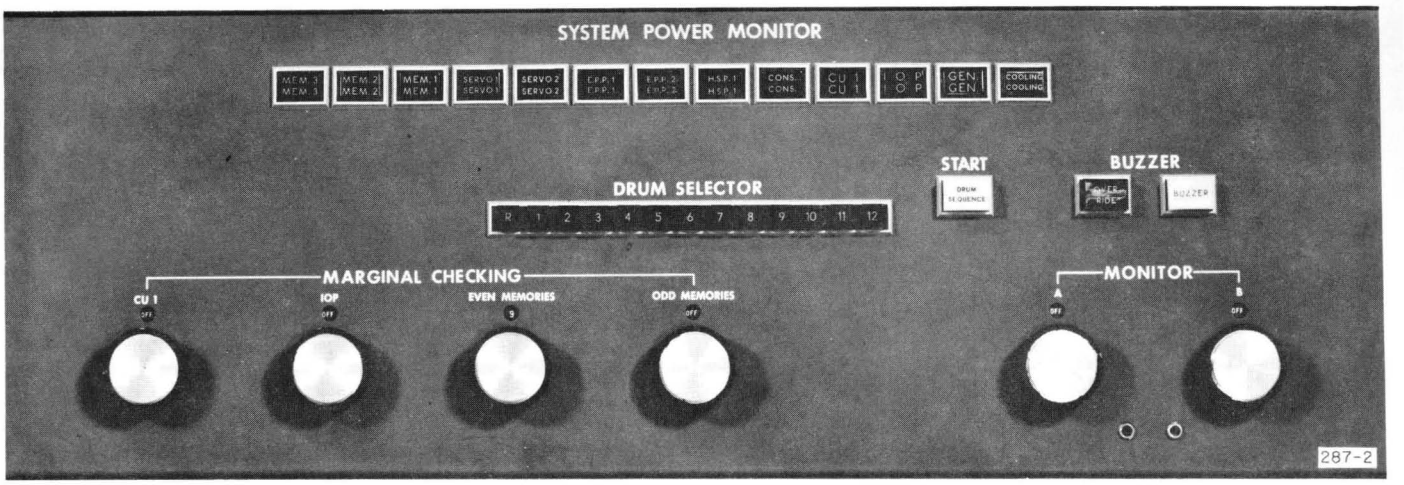
Pushbutton Marking	Component (SW)	Function
OVERRIDE	83	Silences warning buzzer.
BUZZER	82	Sounds warning buzzer.

(e) Utility MONITOR Switches and Jacks

For switch schematic, see D 811 374; wiring diagram D 602 420.

Pushbutton Marking	Component (SW)	Function
AA	92	Connections optional.
B	90	
-	J 2	
-	J 1	

Figures 3-8 and 3-9. System Power Monitor Panels and Associated Table



System Power Monitor Panel, Serial 1

Table 3-8. System Power-Monitor Panel: Component Listing

(a) Power-Fault Indicator Lamp Units

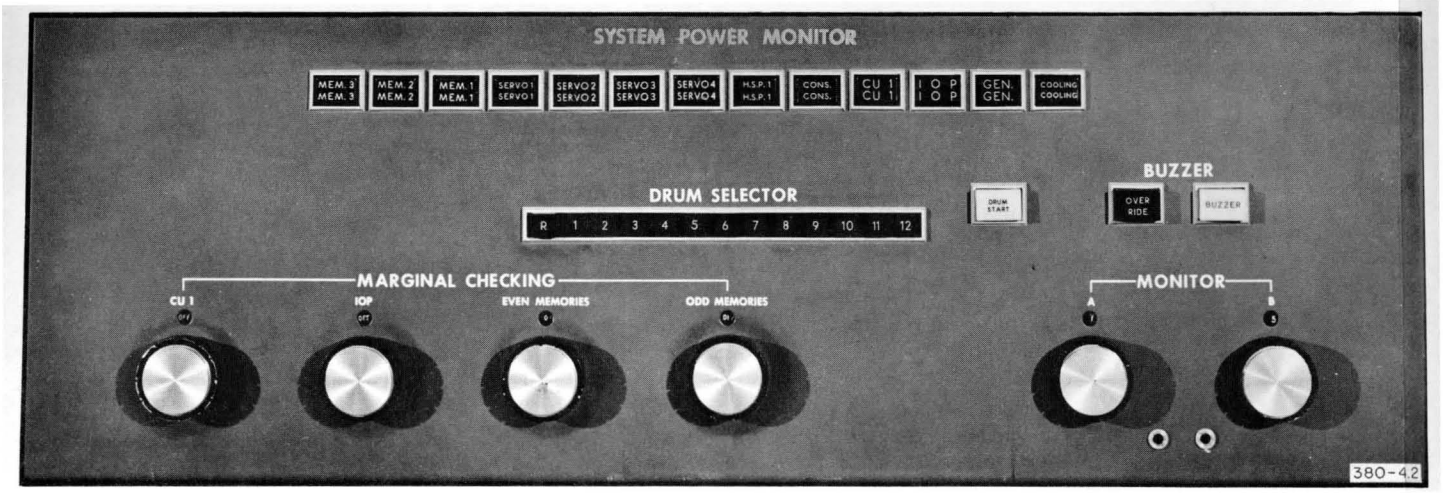
Neon schematic, D 811 351; wiring drawing, D 602 420.

Pushbutton	Component (LU)	Unit Indicated
CONS.	1	Engineer's Console
CARD READER*	2	Card reader
H.S.P.2*	3	High-speed printer No. 2 power supply.
H.S.P.1	4	High-speed printer No. 1 power supply.
E.P.P.2†	5	Electronic-page recorder No. 1 power supply.
E.P.P.1†	6	Electronic-page recorder No. 2 power supply.
SERVO 4**	7	Servo power supply 4.
SERVO 3**	8	Servo power supply 3.
SERVO 2	9	Servo power supply 2.
SERVO 1	10	Servo power supply 1.
MEM. 10*	11	Cabinet 10 (0) power supply.
MEM. 9*	12	Cabinet 9 power supply.
.	.	
.	.	Cabinets 4—8 power supplies.
.	.	
MEM. 3	18	Cabinet 3 power supply.
MEM. 2	19	Cabinet 2 power supply.
MEM. 1	20	Cabinet 1 power supply.
CU 2*	21	CU 2 power supply.
GEN.	22	Motor-generator control circuits.
IOP	23	IOP power supply.
CU 1	24	CU 1 power supply.
COOLING	25	Cooling system temperature and power.

* Expanded system.

† Serial 1.

** Serial 2 and expanded system.



System Power Monitor Panel, Serial 2

(b) Drum-Selector and Start Pushbutton

For wiring diagram, see D 602 420.

Pushbutton Marking	Component (SW)	Schematic D 811 ...	Function
DRUM START	84	355	Starts automatic sequencing of selected drums.
DRUM SELECTOR Pushbuttons			
R	85N	353	Release pushbutton.
1	85M		Starts drum 1.
2	85L		Starts drum 2.
.	.		
.	.		Starts drums 3—10.
.	.		
11	85B		Starts drum 11.
12	85A		Starts drum 12.
DRUM SELECTOR Pushbuttons (Expanded system)			
R	86N	354	Release pushbutton.
13	86M		Starts drum 13.
14	86L		Starts drum 14.
.	.		
.	.		Starts drums 15—23.
.	.		
24	86A		Starts drum 24.

(c) MARGINAL CHECKING

For wiring diagram, see D 602 420.

Panel Marking	Component (SW)	Schematic D 811 ...
CU 1	97	356
IOP	96	357
EVEN MEMORIES	95	358
ODD MEMORIES	94	359
(CU 2)*	93	360

* Expanded system only.

(d) BUZZER Switc

For switch schematic, see D 811 352; w
diagram D 602 420.

Pushbutton Marking	Component (SW)	
OVERRIDE	83	Silences
BUZZER	82	Sounds w

Table 3-9. Power-Control Switches

For schematic diagram, see D 811 349; wiring, D 602 419.

Marking		Switch Number (SW)	Function
Panel	Pushbutton		
EMERGENCY OFF	OFF	1	Turns off the entire system (motor-generator, drum-supply, and memory-oven power).
MEMORY OVENS	OFF	4	Turns off memory-oven power.
	ON	5	Turns on memory-oven power.
DRUM SUPPLIES	OFF	6	Turns off power to drum-file power supplies.
	ON	7	Turns on power to drum-file power supplies.
MOTOR GENERATOR	OFF	8	Stops 400-cycle motor generator.
	ON	9	Starts 400-cycle motor generator.
SYSTEM	OFF	10*	Turns off all power not turned off by SW 4, 6, and 8.
	ON	11*	Turns on all power not turned on by SW 5, 7, and 9.

* Schematic diagram, D 811 350.

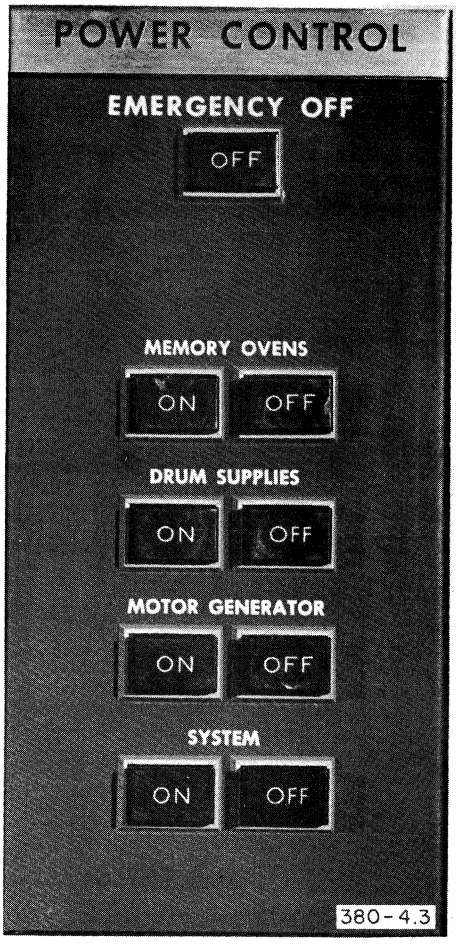


Figure 3-10. Power Control Panel

SECTION 4
OPERATOR'S CONSOLES

4-1. GENERAL

Each operator's console contains the controls and indicators needed to operate the system. Each console consists of an operator's display panel, an 18-key numeric keyboard, ten manual-intervention switches, START and STOP pushbutton switches for the computing unit, and a Flexowriter* printer with paper-tape punch and reader. Other switches control the aural monitor and intercommunication system loudspeakers.

The local operator's console (figures 2-1, 2 and 4-1), which is a part of the engineer's console, is used to control the operation of the computing unit from the engineer's console. The remote operator's console duplicates the facilities of the local operator's console.

4-2. CONSOLE PRINTER

The console printer consists of a Flexowriter, an eight-channel paper-tape punch and an eight-channel paper-tape reader. The paper-tape punch, when turned on, punches a code in the tape for each character typed (whether typing is under operator or system control), and operates with and is controlled by the printer. Refer to the UNIVAC-LARC System Operator's Manual, heading 6-16.

The reader, when operating, is driven from the printer power train through a system-controlled clutch. Except for driving power, the reader operates independently of the printer. Drawings D 811 422 and 423 show the circuits to and from the reader.

The Flexowriter-Justowriter Adjustment Manual (Friden) contains detailed information on mechanical adjustments and maintenance. Drawing D 810 681 shows the intra-unit circuits.

* Registered trademark of Friden, Inc., San Leandro, California.

4-3. OPERATOR'S DISPLAY PANEL

The operator's display panel (figure 4-1) contains the visual register and CONTROL COUNTER decimal displays, CONNECT and INTERLOCK indicators, an INITIAL LOAD pushbutton, SENSE and TRACING MODE flip-flop indicators, general interlock, error, and power-fault indicators, and the CU1/CU2 indicator.

4-4. INDICATORS AND DECIMAL DISPLAYS

The decimal displays provide decoded numeric displays of the contents of the visual display registers and the control counter, and consist of either five or twelve decimal display units. Signals from the decoding relays (heading 7-5) light one or two of the 12 No. 44 lamps in each unit for each character to be displayed. [In the control counter display the plus (+) sign is not used and therefore not connected.] Table 4-1 lists the decimal-display units in the operator's consoles; table 4-2 lists the indicators on the operator's panel and the function of each.

4-5. CONSOLE KEYBOARD

The console keyboard (figure 4-2) is a coded 18-key keyboard. Two keys (C5 and C12) connect the keyboard to the two display registers; a third key (D) disconnects it. Ten keys are for the numerals 0 through 9; the remaining five keys are for the characters plus, minus, decimal point, space, and ignore. Drawing D 811 424 shows the keyboard circuits; for maintenance and adjustment procedures, refer to Appendix A.

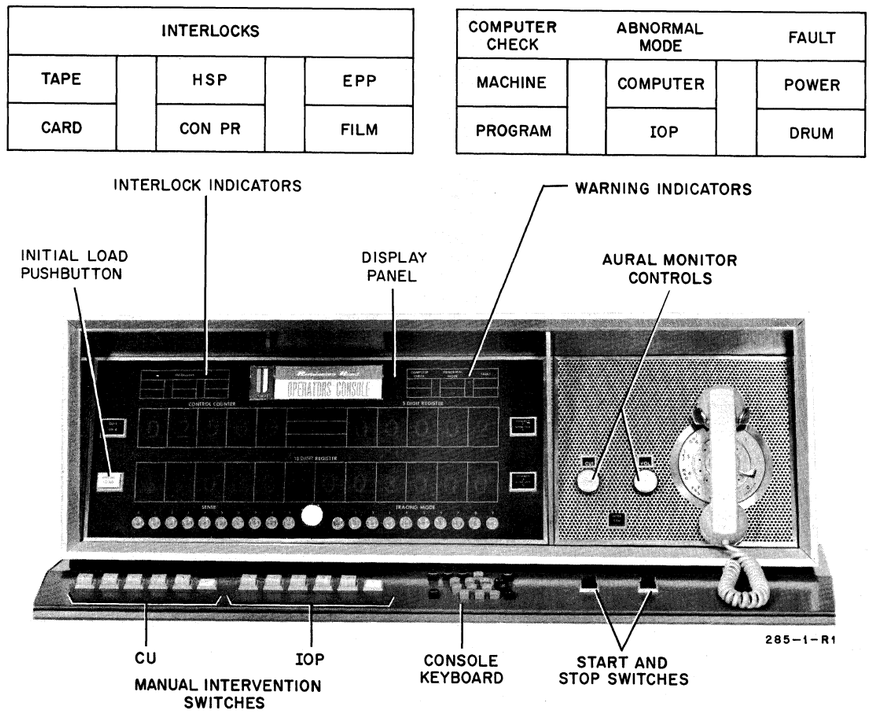
4-6. MANUAL-INTERVENTION SWITCHES

The five manual-intervention (MI) pushbuttons for the processor (IOP) and the five for the computing unit (CU) (figure 4-1) may be pressed singly or in combination to set the manual-intervention flip-flops in each unit. The release (R) pushbutton for each group releases any operated pushbutton. Pressing any numbered manual-intervention pushbutton releases the release pushbutton and actuates the release switch which interlocks the console-select circuits (section 8) to prevent changing consoles. Table 4-3 lists the manual-intervention pushbuttons on the local and remote operator's consoles.

4-7. COMPUTING-UNIT CONTROL SWITCHES

When the computing-unit START pushbutton located on the selected operator's console is pressed, a signal sets the start flip-flop. One pole of local/remote relay 46 (D 811 419) in the console-select circuits determines which switch will operate.

When the computing-unit STOP pushbutton located on the operator's consoles is pressed, a signal is generated which sets the stop flip-flop. One pole of local/remote relay 47 determines which switch will operate.



Operator's Panel

Table 4-1. Operator's Display Panel

(a) Decimal Displays

For schematic diagram, see D 811 431.
For wiring diagrams, see D 602 427, D 811 478, or D 3814 537.

Digit	Console Display Units	
	Local (LD)	Remote (RD)
Control Counter Display		
1 (LSD)	1	1
2	2	2
3	3	3
4	4	4
5 (MSD)	5	5
5-Digit Display		
1 (LSD)	6	6
2	7	7
3	8	8
4	9	9
5 (MSD)	10	10
12-Digit Display		
1 (LSD)	11	11
2	12	12
3	13	13
4	14	14
5	15	15
6	16	16
7	17	17
8	18	18
9	19	19
10	20	20
11	21	21
12 (MSD)	22	22

(b) Lamp Units

For schematic of Lamp Units (LU) 502—510, see D 811 429; for Lamp Units 602—610, see D 811 428.
For wiring drawing for LU 501—510, serial 1, see D 602 622; for serial 2, D 602 725. For LU 601—610, serial 1 and expanded system, D 602 427; for serial 2, D 602 724.

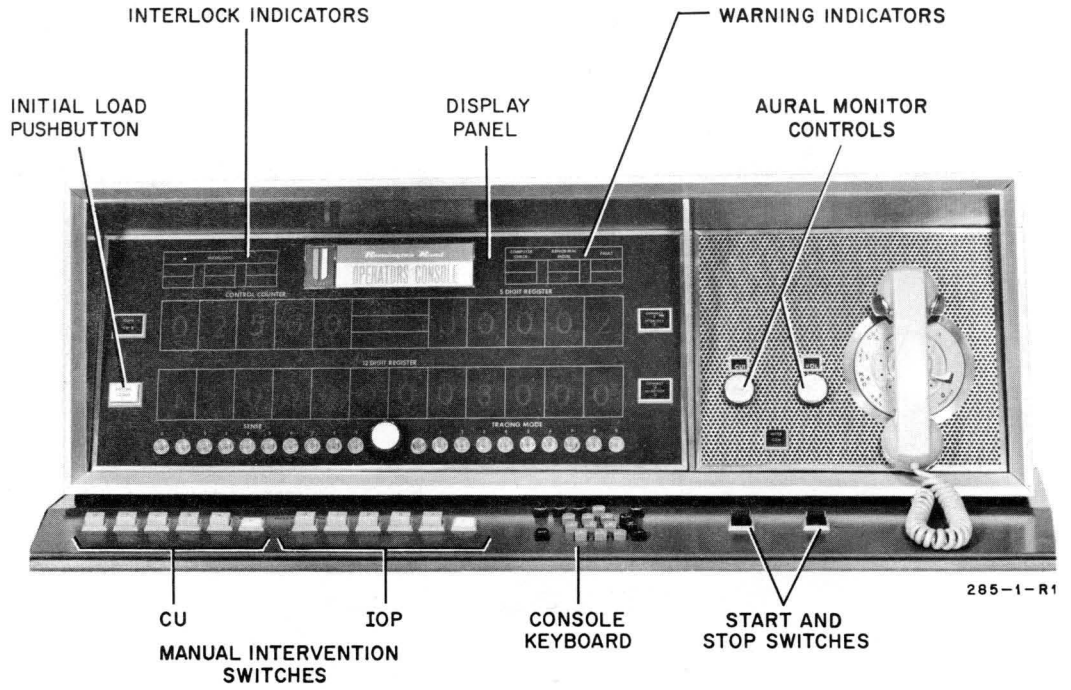
Panel Marking and/or Indication	Lamp Unit		Indicates
	Local	Remote	
CONNECT 5	609	509	5-digit register connected to console keyboard.
INTERLOCK 5			5-digit register being used by operator (unavailable to IOP or CU).
CONNECT 12	610	510	12-digit register connected to console keyboard.
INTERLOCK 12			12-digit register being used by operator (unavailable to IOP or CU).
ABNORMAL MODE			
COMPUTER	603	503	Any switch on indicated engineer's control panel not in normal position.
IOP			
COMPUTER CHECK			
MACHINE	604	504	Machine error detected (master-error FF set).
PROGRAM			Program error detected (master-contingency FF set).
FAULT			
POWER	602	502	Power fault.
DRUM			Drum-power fault.
INTERLOCK			
TAPE	607	507	SERVO interlocked against IOP.
CARD			Card reader interlocked against IOP.
HSP	606	506	HSP interlocked against IOP.
CON PR			Console printer interlocked against IOP.
EPP	605	505	EPR interlocked against IOP.
FILM			EPR out of film.
CU1	601*	501*	CU connected.
CU2			

* Schematic for LU601 and 501, D 811 421.

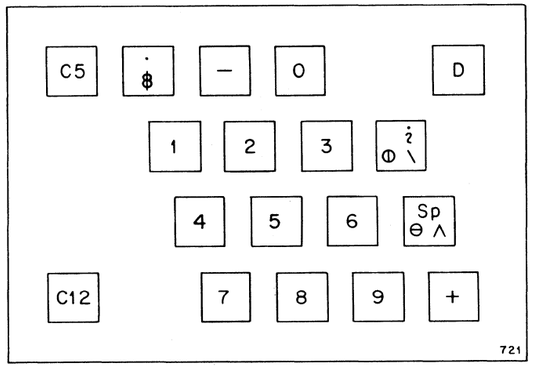
Figure 4-1. Operator's Panel and Associated Table

INTERLOCKS				
TAPE		HSP		EPP
CARD		CON PR		FILM

COMPUTER CHECK		ABNORMAL MODE		FAULT
MACHINE		COMPUTER		POWER
PROGRAM		IOP		DRUM



Operator's Panel



Console Keyboard Arrangement

Table 4-2. Operator's Panel: Neon Indicators

For neon schematic, see D 811 425. Wiring diagram for neons 501—520, serial 1, D 602 622; for serial 2, D 602 725. Wiring diagram for neons 601—620, serial 1, D 602 427; for serial 2 and expanded system, D 602 724.

Flip-Flop	Neon		Indicates
	Local	Remote	
SENSE			
4	601	501	Indicates which sense FF in the CU is set to cause conditional transfer from a general to a specific routine.
3	602	502	
2	603	503	
1	604	504	
0	605	505	
9	606	506	
8	607	507	
7	608	508	
6	609	509	
5	610	510	
TRACING MODE			
3	611	511	Indicates which tracing-mode FF in the CU is set.
2	612	512	
1	613	513	
6	614	514	
5	615	515	
4	616	516	
9	617	517	
8	618	518	
7	619	519	
INT			
—	620	520	Processor-intervention-inhibit FF set.

Figure 4-2. Console Keyboard Arrangement and Associated Table

Table 4-3. Operator's Console Manual-Intervention Switches

For schematic of switches 608A-609F, see D 811 428; for switches 508A-509F, see D 811 429.

Pushbutton Marking	Switch		Function
	Local	Remote	
Processor (IOP)			
R	608A	508A	Release pushbutton.
0	608F	508F	Sets associated manual-intervention FF.
1	608E	508E	
2	608D	508D	
3	608C	508C	
4	608B	508B	
Computing Unit (CU)			
R	609A	509A	Release pushbutton.
0	609F	509F	Sets associated manual-intervention FF.
1	609E	509E	
2	609D	509D	
3	609C	509C	
4	609B	509B	

SECTION 5
CONSOLE POWER SUPPLIES AND DISTRIBUTION

5-1. A-C POWER SUPPLIES

Sixty-cycle power supplies in the engineer's console consist of a 250-va constant-voltage transformer and two stepdown transformers. Drawing D 811 433 shows the a-c power supplies and distribution. The 24-volt a-c supply energizes relays in the consoles; the 6.3-volt a-c supply lights the decimal displays at the operator's consoles.

5-2. D-C POWER SUPPLIES

The console d-c power-distribution system is shown on drawings D 811 433 and 434. With the exception of the 2-volt regulated power supply distribution, all d-c voltages are brought into the console from external sources.

5-3. 2-VOLT D-C SUPPLY

The 2-volt d-c power supply (figure 5-1) (D 811 432) consists of three sections: power, regulating, and load. The nominal output voltage is +2.1 volts with ripple voltage of approximately ±10 millivolts at 120 cycles. When the power supply is turned on, the output voltage should rise smoothly to +2.1 volts. The output voltage changes less than 20 millivolts for each 5-percent change in line voltage; for an instantaneous load change of ±1 ampere, the output voltage changes less than ±0.2 volt.

5-4. POWER SECTION. The d-c power section, which provides a 7-volt output, consists of power-transformer T5, a bridge rectifier, and pi-section filter C1-T6-C2.

5-5. REGULATING SECTION. Regulation is accomplished by d-c feedback circuit RT30-TR9 which varies the impedance of series-resistance bank TR1 through TR8 with changes in load. The supply output voltage is applied between the emitter and base of RT30. Voltage changes caused by load variations cause transistor RT30 to conduct more or less heavily; the resulting change in collector voltage is applied to the base of transistor TR9; the emitter voltage of TR9 is applied to the bases of transistors TR1 through TR8.

5-6. LOAD SECTION. The load section, which consists of two 2-ohm resistors (RM6 and RM8) in parallel and diodes D1, D2, and D3, provides a fixed load that draws a current of 2.25 amperes (±15 percent); diodes D1, D2, and D3 conduct heavily when output voltages rise above +2.1 volts, thereby clamping the output.

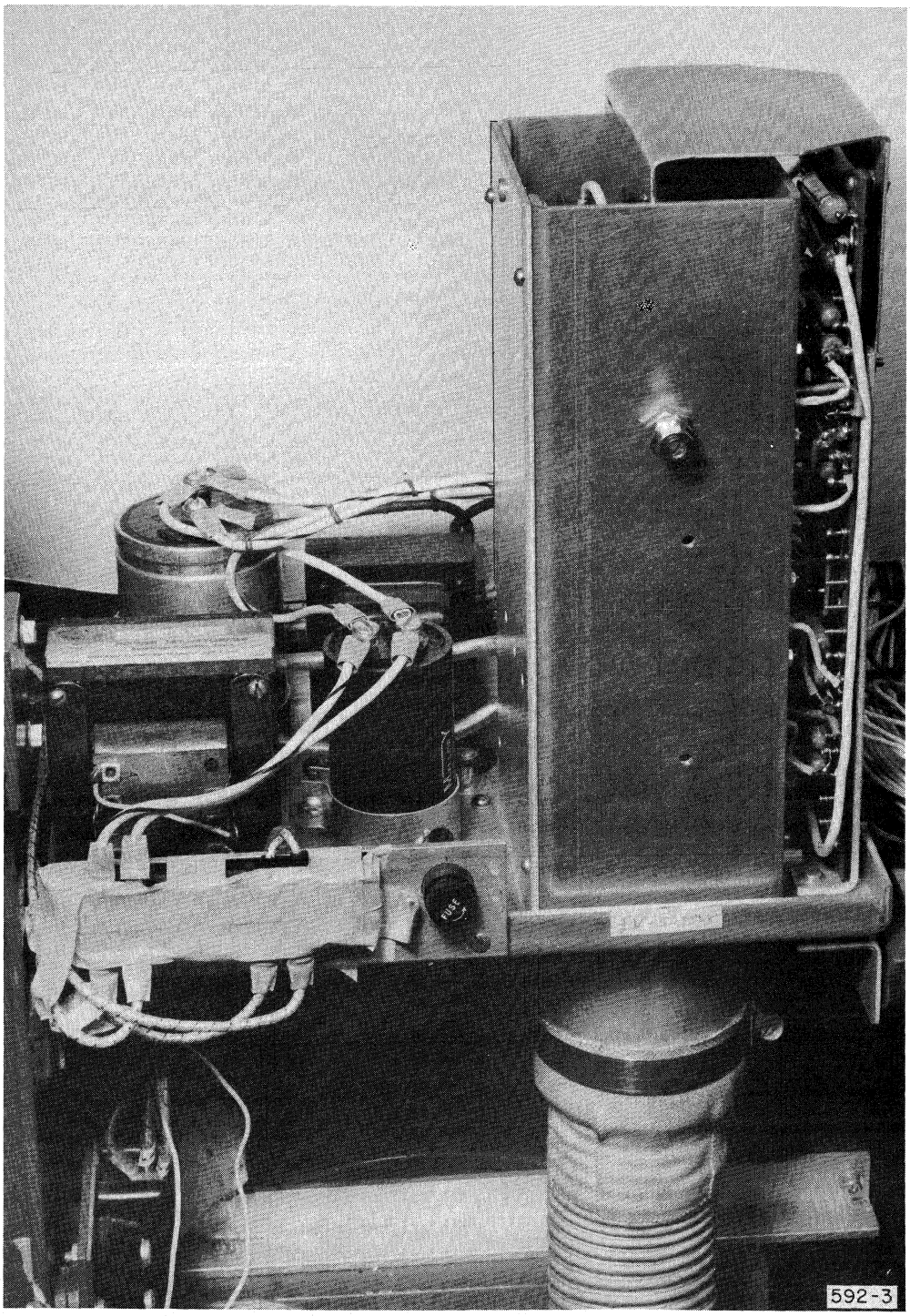


Figure 5-1. 2-Volt Power Supply

SECTION 6
POWER CONTROLS AND INDICATORS

6-1. GENERAL

The power controls and indicators (figure 3-10) consist of the control switches and indicators on the engineer's panel, and the eight power-control relays, the fault-alarm circuits, and the drum-selection and sequencing circuits in the engineer's console. Power-control switches 10 (pushbutton marking OFF) and 11 (pushbutton marking ON) control five relays that allow control signals to turn on or off power to remote units except the memory ovens, drum files, and the motor generator. The memory-oven switches control two relays that allow control signals to pass to the memory-oven power supplies; the drum-power switches control contactors in the drum-feeder cabinets; and the motor-generator ON and OFF pushbuttons on the power-control panel are the remote equivalents of the START and STOP pushbuttons on the motor-generator control panel.

For information pertaining to power controls and equipment not contained in this manual, refer to the UNIVAC-LARC Power System Manual.

6-2. SYSTEM CONTROLS

The system power-control switches (table 3-9) control relays 9, 23, 24, 25, and 26. Relay 9 is the motor-generator interlock relay; contacts 1, 2, and 3 are the interlock contacts; contacts 4, 5, and 6 are the holding and lamp contacts. The contacts of relays 23 through 26 control the energizing circuits of the power-control relays located in the power supplies of the individual units.

6-3. POWER-CONTROL RELAYS

Closing the contacts of the four power-control relays (table 6-1) completes part of an energizing circuit to the control circuits of each power supply in the LARC system except the memory ovens, drums, and motor generator which are independently controlled. Each power-control relay is a 6-pole, single-throw, 24-volt a-c relay. The coil of a fifth relay, relay 9 (motor-generator interlock), is in parallel with the coils of the power-control relays; contacts 5 and 6 of relay 9 act as holding contacts for all five relays. The initial energizing circuit for the relays begins at the

24-volt supply and consists of the coils, contacts 4 and 5 of switch 11, and contacts 3 and 4 of switch 10. When the contacts of relay 9 transfer, contacts 5 and 6 are in parallel with the closed contacts of switch 11 and hold them closed when switch 11 opens. Contacts 3 and 4 of switch 10 and contacts 1 and 2 of switch 1 must be closed to complete the a-c return path. Opening the return path at either switch 1 or 10 deenergizes the relays to turn off system power.

The motor-generator switches control the 400-cycle motor-generator system. Switch 8 (pushbutton marking OFF) is in series with the motor-generator stop switch; switch 9 (pushbutton marking ON) is in parallel with the start switch. Motor-generator interlock relay 9 prevents the motor-generator system from being stopped while system power is on.

The memory-oven switches operate relays 7 (chassis 23), 21, and 22 (chassis 24) to allow oven-power control signals. Relay 22 is used only in the expanded system; relay 7 is the holding relay for relays 21 and 22.

Drum-supplies switches 6 and 7 control the drum-feeder contactors in the feeder cabinets.

Emergency-off switch 1, a 4-pole locking switch, simultaneously performs the functions of switches 4, 6, 8, and 10.

6-4. FAULT-ALARM RELAYS

The console fault-alarm system consists of five relays, two thermostats, a warning buzzer, and two momentary-contact switches. Fault signals from the system power supplies are applied, through relays, to the common fault bus, either directly or indirectly, to complete a circuit through the console buzzer and to light the power-fault indicators on the operator's console. The buzzer switch (82) sounds the buzzer; the buzzer-override switch (83) silences the buzzer. The fault-alarm system components are listed in table 6-2.

6-5. COOLING-SYSTEM FAULT WARNING

Inadequate water flow or water temperature above 56°F causes warning indications. Inadequate water flow closes the ACNC return to relay 67 to energize the relay that allows warning signal E1WCR, thus lighting the red section of the COOLING warning indicator on the system power-monitor panel (figure 3-8). The green section of the indicator remains lit.

When the water temperature rises above 56°F, the aquastat closes the ACNC return to relay 67 and opens the ACNC return path to relay 39. Relay 67, when energized, allows warning signal E1WCR that lights the red section of the COOLING warning indicator. Relay 39 removes signal E1WCW to extinguish the green section of the indicator, sounds the alarm buzzer, and lights the POWER FAULT indicators on the operator's panels.

6-6. 2-VOLT CONSOLE SUPPLY WARNING

When +2-volt power is on, 2-volt sensing relay 65 energizes console-warning relay 19. When +2-volt power fails, contacts 4 and 5 of relay 19 connect the common fault bus to the a-c neutral circuit to sound the warning buzzer; contacts 1 and 2 close to allow warning signal ECOVH that lights the console (CONS.) fault-warning indicator.

6-7. CONSOLE OVERHEAT WARNING

Console thermostats 1 and 2 are in the a-c neutral return circuit of relay 19. If the temperature at either thermostat rises above 87°F, the thermostat opens, relay 19 deenergizes, and warning signals are generated which sound the warning buzzer. Contacts 1 and 2 close to allow warning signal ECOVH that lights the console (CONS.) fault-warning indicators.

6-8. DRUM-FAULT WARNING CIRCUITS

A drum-fault signal (EDPnF*) from any drum-file unit selected at drum-selector switch 85 or 86 allows the general drum-fault signal EDRUM that provides a return path for the 24-volt a-c supply to drum-fault relay 58. When drum-fault signal EDRUM energizes relay 58, the contacts close to (1) energize, through the common fault bus, the warning buzzer and (2) light the DRUM FAULT indicators on the operator's consoles.

6-9. BUZZER-OVERRIDE CIRCUIT

When actuated, buzzer-override switch 83 silences the warning buzzer without affecting other fault indications. When a fault signal sounds the buzzer, actuating switch 83 completes a-c circuits through buzzer-override relay 10 and the OVERRIDE indicator lamp. Contacts 1 and 2 open to silence the buzzer; contacts 5 and 6 close to hold the override relay closed and maintain a circuit through the indicator lamp. Once energized, the override relay remains energized and the indicator remains lighted as long as a fault signal is present. The removal of all fault signals deenergizes relay 10 and extinguishes the OVERRIDE indicator lamp.

6-10. DRUM SELECTION AND SEQUENCING CONTROLS

The drum-selector switches allow manual starting of individual drums or automatic starting of selected drums. The drum-sequencing controls limit the drum-feeder-current load to a safe value by restricting the number of drums starting at one time, and automatically start selected drums when the feeder current drops below the preset value.

6-11. MANUAL STARTING

6-12. DRUM-SELECTOR SWITCHES. Drum-selector switches 85 and 86 are identical assemblies. The drum-selector switches consist of 13 illuminated

* n is a number from 1 through 24.

locking pushbuttons (figure 3-8) that have two locking contacts, an overtravel contact, and an indicator lamp. Each switch is designated by a number on the pushbutton and an alphabetic character on the switch frame. The release pushbutton is designated by the letter R.

6-13. STARTING SEQUENCE. When a drum-selector pushbutton is pressed and the corresponding drum is available and operating properly on standby and interlock power (refer to the UNIVAC-LARC Drum Storage Description and Maintenance Manual), one of the following occurs:

(1) If drum-feeder current does not exceed 100 amperes (in a 12-drum system), closing the overtravel contacts allows drum-start signal EDPnS* that completes the energizing circuit through drum-sequence-completed relay 20 to the drum-motor-start relay in the drum-file unit, and initiates the starting sequence for that drum;

(2) If the total drum-feeder current exceeds 100 amperes but has not fallen below 80 amperes (because the maximum number of drums are starting), closing the overtravel contacts has no immediate effect. When the current falls below 80 amperes, the drum-start signal that corresponds to the lowest number drum selected, but not started, is generated.

If the selected drum is on local control or not available, actuating the selector switch allows drum-fault signal EDPnF which causes the general drum-fault signal EDRUM to be generated. Signal EDRUM sounds the warning buzzer and lights the DRUM FAULT indicators on the operator's consoles. A fault signal from a drum that has not been selected has no effect. (Refer to heading 6-8.)

6-14. CURRENT-SENSING CIRCUITS

Current-sensing relay 71 (figure 6-1) and drum-sequence-completed relay 20 disable the overtravel contacts of the drum-selector switches and the automatic sequencing circuits whenever the drum-feeder current exceeds the preselected value, and prevent the starting of additional drums until feeder current falls below the lower preselected value. In a 12 drum system the contacts of the current-sensing relay close when drum-feeder current exceeds 100 amperes, and release when feeder current drops below 80 amperes. Contacts 3 and 4 complete the energizing circuit to relay 20 when the contacts of relay 71 close.

Normally closed contacts 1 and 2 allow signal EDOVT that enables any overtravel switch to allow drum-start signal EDPnS*. Normally closed contacts 4 and 5 are in the circuit that energizes the repeat-cycle timer. Closing relay 71 energizes relay 20, and the normally closed contacts of relay 20 open: contacts 1 and 2 disable the overtravel contacts of the selector switches; contacts 3 and 4 disable the repeat-cycle timer, which in turn, disables the stepping-switch solenoid. The contacts of relay 20 cannot open until drum-feeder current falls below 80 amperes and opens the contacts of relay 71. The drum-sequencing circuits cannot operate until the contacts of relay 20 open.

* n is the number of the drum-file and selector switch.

6-15. AUTOMATIC-SEQUENCING CIRCUIT

The automatic-sequencing circuits consist of a repeat-cycle timer (figure 6-2), a solenoid-operated stepping switch, and sequence-starting switch 84.

6-16. START CYCLE

Closing the sequence-starting switch completes the energizing circuit through the repeat-cycle timer. Current from the -48-volt supply flows through the repeat-cycle timer motor, contacts 4 and 5 of relay 20, contacts of switch 84, and contact 1, deck B of the stepping switch to ground.

The repeat-cycle timer begins its cycle and closes switches A, B, and C. (See D 811 355.) Switch A provides an alternate energizing path for the repeat-cycle timer motor; switch B grounds the selector of stepping switch 1, deck A; switch C completes the energizing circuit for the solenoid coil. Contact 1, deck A of the stepping switch connects to drum-selector switch 1 and allows drum-start signal EDP1S if selector switch 1 is closed. The stepping switch is advanced to contact 2 by the solenoid action of the switch.

6-17. NORMAL STEPPING CYCLE

When sequence-starting switch 84 opens, the repeat-cycle timer completes its first cycle and switches A, B, and C open. The repeat-cycle timer motor, however, continues to operate because the shorted contacts of deck B now complete the circuit. The repeat-cycle timer begins a second cycle and closes switches A, B, and C. If selector switch 2 is closed, switch B grounds contact 2, deck A to generate starting signal EDP2S and the stepping sequence continues.

When the starting-current exceeds 100 amperes, the current-sensing circuits operate and contacts 4 and 5 of relay 20 open one energizing circuit to the repeat-cycle timer. When switch A opens, the repeat-cycle timer stops and will not operate until the contacts of relay 20 open. When contacts 4 and 5 close, the sequence continues.

6-18. STEP-TO-STARTING POSITION. The following description applies to a 12-drum system.

Stepping switch 1, deck B (D 811 355) has 24 contact points. Contacts 2 through 12 are wired together and have a common connection to contact 5 of relay 20. Contacts 13 through 24 are wired together and have a common connection to contact 1 of the solenoid-interrupter switch.

When contact 13 is selected, the following sequence occurs:

(1) The solenoid-energizing path is completed through contact 13;

(2) The cycle of the repeat-cycle timer is completed and switches A, B, and C open and the repeat-cycle timer no longer has an affect on the circuit;

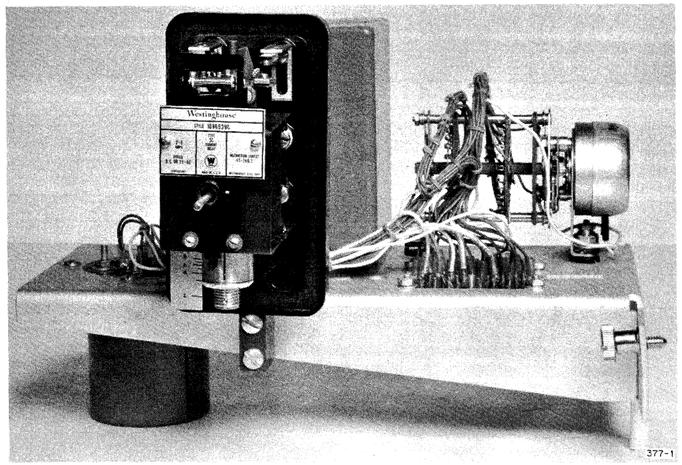
(3) The solenoid advances the selector to contact 14.

The cycle continues until the selector advances from contact 24 to contact 1. The next operation is a start cycle.

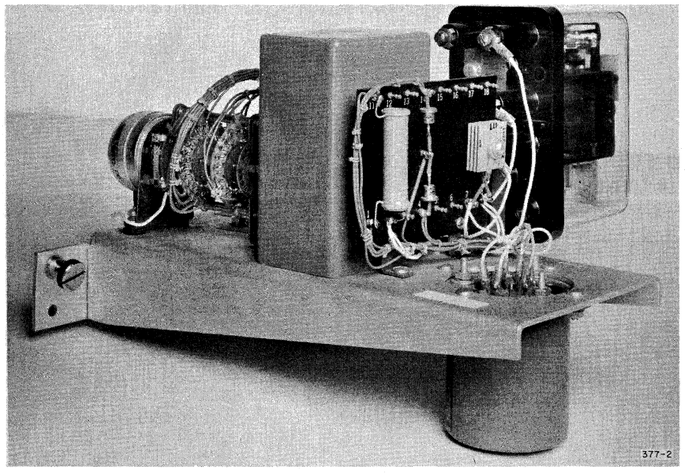
6-19. STARTING-SEQUENCE INDICATOR. The starting-sequence indicator lamp contained in the pushbutton of switch 84 lights when the stepping-switch selector of deck B advances past the last contact connected to contact 5 of relay 20. Resistor R1-11, MB36 limits lamp current to a maximum value of approximately 85 milliamperes.

6-20. MARGINAL-CHECKING CONTROLS

One marginal-checking switch is provided for each computing unit, all odd- and even-numbered memories, and the processor. The expanded system has five marginal-checking switches. Each is a 6-section, 2-pole, 12-position switch. Refer to the LARC Maintenance Manual and the LARC Power Systems Manual for information on marginal checking procedures. Drawings D 811 356 through 360 show the marginal checking circuits in the console.



Current Sensing Relay



Timer Chassis

Table 6-1. Power-Control Relays

Relay	Location (Chassis)	Drawing Reference		Function
		Schematic D811...	Wiring D602...	
7	23	349	379	Controls lamps in oven switches. Holds in oven-on relays 21 and 22.
9 (Motor-Generator Interlock)	23	350	379	Interlocks the motor generator against turn-off while system power is on.
21 (Oven Relay 1)	24	349	380	Produce oven-on signals to power-control circuits of memory cabinets 1—6.
22* (Oven Relay 2)	24	349	380	Produce oven-on signals to power-control circuits of memory cabinets 7—10.
23 (System On)	24	350	380	Produce system-on signals to power controls of IOP, CU1, M1, M2, T3, and T4.
24	24	350	380	Produce system-on signals to M3, T1, T2, EPP1, EPP2, and LP1.
25*	24	350	380	Produce system-on signals to M4, M5, M6, M7, and general bay.
26*	24	350	380	Produce system-on signals to M8, M9, M10 (MO), CU2, LP2, and card reader.

* Expanded system only

Table 6-2. Fault-Alarm System Components

Component		Location	Function
Name	No.		
Buzzer override relay. (Energized by SW83.)	10	Chassis 23. (D 811 352 and D 602 379)	When energized, disconnect console warning buzzer 1 from fault bus.
Console overheat and 2-volt supply-check relay.	19	Chassis 29. (D 811 352 and D 602 382)	When energized, allows a signal that lights CONS. warning indicator when relay 19 is deenergized.
Cooling system warning relays	39	Chassis 30. (D 811 352 and D 602 393)	When energized, allows a signal that connects ACNC to fault bus and lights COOLING warning indicator.
	67	Chassis 27. (D 811 352 and D 3603 296)	
Drum-fault relay	58	Chassis 31. (D 811 352)	When energized, allows a general fault signal that sounds warning buzzer.
Console warning buzzer	1	D 602 409	Sounds a fault warning.
Buzzer override switch	83	D 811 352 and D 602 420	Silences warning buzzer.
Warning buzzer switch	82	D 811 352 and D 602 420	Sounds warning buzzer.
Thermostat (TH1)	1	2-v power supply	Opens when console temperature rises above 87°F
Thermostat (TH2)	2	D 3603,682	

Figure 6-1. Current Sensing Relay
Figure 6-2. Timer Chassis and Associated Tables

SECTION 7
BASIC CIRCUITS

7-1. NEON INDICATOR LAMPS

7-2. DIAGNOSTIC FLIP-FLOP INDICATORS

Figure 7-1(a) shows the neon-indicator lamp circuit driven by the type-L neon-indicator-driver circuit. Operation of the type-L neon-indicator-driver circuit is described in the UNIVAC-LARC Circuitry Manual, heading 1-32.

7-3. BINARY DISPLAYS

Binary-display neons are driven by the relay-decoder circuits in the console. Figure 7-1(b) shows the binary-display-neon lamp circuit.

7-4. CONTROL SWITCHES

The basic control-switch circuit is shown in figure 7-2. When the switch is open, the 5-volt differential between the +2-volt source and the -3-volt bias on the signal line charges capacitor C1. (Refer to the LARC Circuitry Manual, heading 1-3.) When the switch (or relay contact) closes, capacitor C1 discharges through the switch and resistor R1. The value of R1 is chosen to provide the current level required for the number of driven circuits after C1 discharges and raises the signal voltage to approximately -0.6 volts.

7-5. DECODING RELAY MATRIX

The console contains 22 identical relay chassis, one chassis for each of the 22 digits displayed on the operator's console. Each chassis contains eight relays that decode one of the 22 digits from 5-bit memory code into (1) one or two signals that light one or two of the 12 lamps in the decimal-display unit corresponding to the digit position and (2) 5-bit LARC code for the binary displays on the engineer's computing-unit diagnostic panel.

The relay and chassis location for each control and lamp-driver relay is shown in table 7-1. Decoding relays are shown on table 7-2.

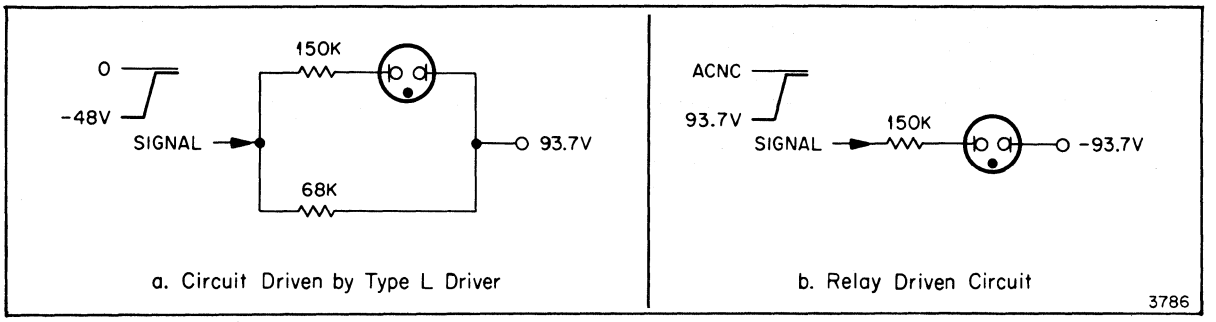


Figure 7-1. Neon Indicator Circuits

Table 7-1.
Control and Lamp-Driver Relays

Relay	Location (Chassis)
1—10	23
11—20	29
21—30	24
31—40	30
41—50	25
51—60	31
61—63	26

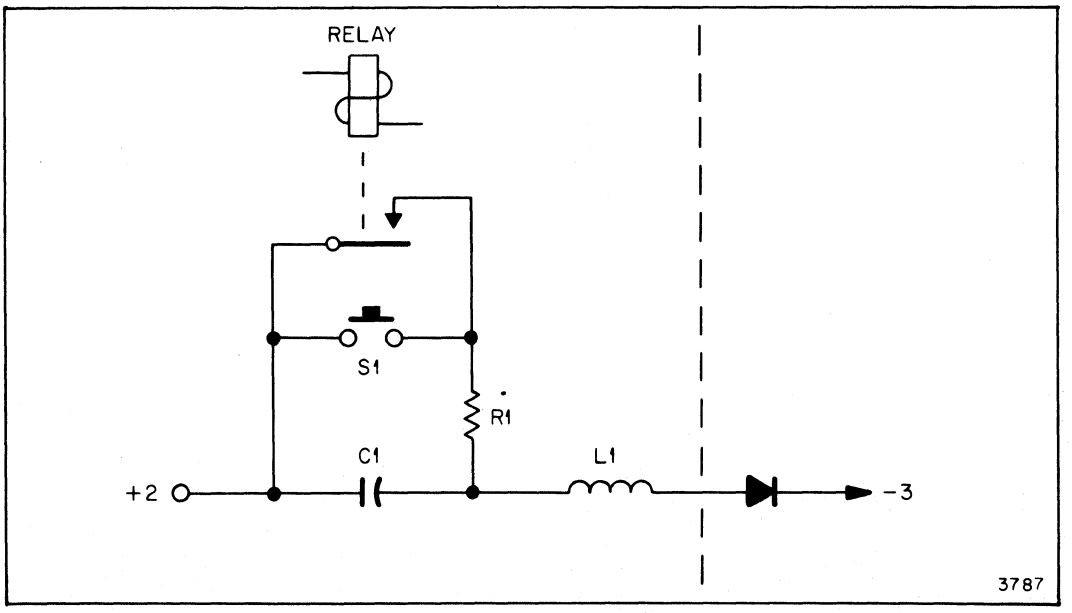


Figure 7-2. Control Switch Circuit

Table 7-2. Decoding Relays

For schematic drawing, see D 811 430.
For wiring and layout, see D 811 490.

Control Counter

Relay Chassis	Relay	Decodes	
		Bit	Digit
1	A-1	1	1
	B-1	1	1
	C-1	2	1
	D-1	2	1
	E-1	3	1
	F-1	3	1
	G-1	4	1
	H-1	5	1
2	A-2	1	2
	B-2	1	2
	C-2	2	2
	D-2	2	2
	E-2	3	2
	F-2	3	2
	G-2	4	2
	H-2	5	2
3	A-3	1	3
	B-3	1	3
	C-3	2	3
	D-3	2	3
	E-3	3	3
	F-3	3	3
	G-3	4	3
	H-3	5	3
4	A-4	1	4
	B-4	1	4
	C-4	2	4
	D-4	2	4
	E-4	3	4
	F-4	3	4
	G-4	4	4
	H-4	5	4
5	A-5	1	5
	B-5	1	5
	C-5	2	5
	D-5	2	5
	E-5	3	5
	F-5	3	5
	G-5	4	5
	H-5	5	5

5-Digit Display

Relay Chassis	Relay	Decodes	
		Bit	Digit
6	A-6	1	1
	B-6	1	1
	C-6	2	1
	D-6	2	1
	E-6	3	1
	F-6	3	1
	G-6	4	1
	H-6	5	1
7	A-7	1	1
	B-7	1	2
	C-7	2	2
	D-7	2	2
	E-7	3	2
	F-7	3	2
	G-7	4	2
	H-7	5	2
8	A-8	1	3
	B-8	1	3
	C-8	2	3
	D-8	2	3
	E-8	3	3
	F-8	3	3
	G-8	4	3
	H-8	5	3
9	A-9	1	4
	B-9	1	4
	C-9	2	4
	D-9	2	4
	E-9	3	4
	F-9	3	4
	G-9	4	4
	H-9	5	4
10	A-10	1	5
	B-10	1	5
	C-10	2	5
	D-10	2	5
	E-10	3	5
	F-10	3	5
	G-10	4	5
	H-10	5	5

12-Digit Display

Relay Chassis	Relay	Decodes	
		Bit	Digit
11	A-11	1	1
	B-11	1	1
	C-11	2	1
	D-11	2	1
	E-11	3	1
	F-11	3	1
	G-11	4	1
	H-11	5	1
12	A-12	1	2
	B-12	1	2
	C-12	2	2
	D-12	2	2
	E-12	3	2
	F-12	3	2
	G-12	4	2
	H-12	5	2
13	A-13	1	3
	B-13	1	3
	C-13	2	3
	D-13	2	3
	E-13	3	3
	F-13	3	3
	G-13	4	3
	H-13	5	3
14	A-14	1	4
	B-14	1	4
	C-14	2	4
	D-14	2	4
	E-14	3	4
	F-14	3	4
	G-14	4	4
	H-14	5	4
15	A-15	1	5
	B-15	1	5
	C-15	2	5
	D-15	2	5
	E-15	3	5
	F-15	3	5
	G-15	4	5
	H-15	5	5

12-Digit Display (cont)

Relay Chassis	Relay	Decodes	
		Bit	Digit
16	A-16	1	6
	B-16	1	6
	C-16	2	6
	D-16	2	6
	E-16	3	6
	F-16	3	6
	G-16	4	6
	H-16	5	6
17	A-17	1	7
	B-17	1	7
	C-17	2	7
	D-17	2	7
	E-17	3	7
	F-17	3	7
	G-17	4	7
	H-17	5	7
18	A-18	1	8
	B-18	1	8
	C-18	2	8
	D-18	2	8
	E-18	3	8
	F-18	3	8
	G-18	4	8
	H-18	5	8
19	A-19	1	9
	B-19	1	9
	C-19	2	9
	D-19	2	9
	E-19	3	9
	F-19	3	9
	G-19	4	9
	H-19	5	9
20	A-20	1	10
	B-20	1	10
	C-20	2	10
	D-20	2	10
	E-20	3	10
	F-20	3	10
	G-20	4	10
	H-20	5	10

12-Digit Display (cont)

Relay Chassis	Relay	Decodes	
		Bit	Digit
21	A-21	1	11
	B-21	1	11
	C-21	2	11
	D-21	2	11
	E-21	3	11
	F-21	3	11
	G-21	4	11
	H-21	5	11
22	A-22	1	12
	B-22	1	12
	C-22	2	12
	D-22	2	12
	E-22	3	12
	F-22	3	12
	G-22	4	12
	H-22	5	12

SECTION 8
CONSOLE SELECTION

8-1. INTERLOCK AND SELECTION CIRCUITS

An interlock circuit consisting of the computing unit and processor manual-intervention (MI) and release (R) switches in the local and remote operator's consoles (figure 4-1) prevents switching from one console to another while a manual-intervention switch is operated on either operator's console. When all manual-intervention release switches are operated, console-selector switches 162 (ENG) and 163 (IOP) control local/remote relays 18, 27, 46, 47, and 48.

8-2. MANUAL-INTERVENTION SWITCHES

Relays 46 and 47, in the deenergized (local) position, complete the circuits to the signal contacts of the manual-intervention switches in the local operator's console. Relays 17 and 18 form an interlock circuit that disables the processor manual-intervention switches on the engineer's processor panel if any processor manual-intervention switch on either operator's console is operated. If no processor manual-intervention switch is operated, the processor manual-intervention switches on the engineer's processor panel can be used without regard to which console has been selected.

8-3. PROCESSOR MANUAL-INTERVENTION SWITCHES. One pole of local/remote relay 47 selects the processor manual-intervention switches. The operator's console manual-intervention switches are 2-pole, locking-type pushbutton switches. One pole allows a signal, and the other pole interlocks the manual-intervention switches on the engineer's processor panel.

8-4. COMPUTING-UNIT MANUAL-INTERVENTION SWITCHES. Local/remote relay 46 selects the computing unit manual-intervention switches.

8-5. CONSOLE PRINTER

8-6. MOTOR CONTROL

The processor or computing unit can start either Flexowriter regardless of which console has been selected. Relay 1 controls the local

console Flexowriter on a processor signal; relay 2 controls the remote Flexowriter on a processor signal. Relay 59 controls either Flexowriter: the state of relay 27 (D 811 421) determines which motor will start.

8-7. TAPE READER

Relay 27 (1) completes the ground return path for one read lamp when read-lamp relay 60 operates and (2) switches the reader-clutch control signal to select the reader. Relay 48 switches the tape-reader timing-control signal lines and allows one of two signals that indicate, by illuminating an indicator on the processor panel, which reader will operate.

8-8. CONSOLE KEYBOARD

Relay 27 allows -48 volts to either keyboard solenoid (D 811 424). Relay 47 switches the +2-volt supply to the selected keyboard.

8-9. INITIAL-LOAD SWITCH

Relay 47 (D 811 424) switches the initial-load signal line between the initial-load switches [501 (remote) and 601 (local)]. Initial-load-lamp relay 3, when operated, allows signals that light both INITIAL LOAD indicator lamps on the operator's consoles.

SECTION 9
PREVENTIVE MAINTENANCE

9-1. EXTERNAL CLEANING

9-2. PANELS

Clean panels with a soft cloth dampened with paint thinner (mineral spirits). Rub lightly.

9-3. FORMICA* AND STAINLESS STEEL TRIM

Clean Formica and stainless steel with SBS-30† hand cleaner. Use no abrasive cleaners.

9-4. PAINTED CASEWORK

Clean painted casework with a damp (not wet) cloth and a mild detergent.

9-5. CONSOLE PRINTER

Refer to the Flexowriter-Justowriter Adjustment Manual.

9-6. CONSOLE KEYBOARD

Refer to appendix A.

9-7. TEST LAMPS

9-8. NEONS

9-9. DIAGNOSTIC FLIP-FLOP INDICATORS. Neon error-indicator lamps may be tested by pressing the ERROR INSERT pushbutton associated with lamps. A

* Registered trademark of American Cyanamid Co., Fort Washington, Pa.

† Registered trademark of Sugar Beet Products Co., Saginaw, Mich.

lamp that does not light should be replaced with a new lamp; if the new lamp does not light, refer to the LARC Maintenance Manual.

9-10. BINARY DISPLAY NEONS. Test binary display neons by typing decimal 9, plus (+) and minus (-) into each digit position of the register display to be tested. Digit 9 lights the three most significant bits; the plus sign lights the three least significant bits; and the minus checks that bit 3 can be turned off. For operating procedures refer to the LARC Maintenance Manual.

9-11. INCANDESCENT LAMPS

9-12. DECIMAL DISPLAY. Type into the decimal display to be tested each number in rotation until each digit has appeared in every position. Repeat with signs and special characters.

APPENDIX A

FK-104 MAINTENANCE INSTRUCTIONS

INTRODUCTION

The Series FK-104 Coded Keyboards are precision mechanical devices which were subjected to careful factory adjustment, lubrication, and unit test prior to shipment. Although periodic lubrication will be required, under normal operating conditions further adjustment of mechanical parts should not be required during the life of the instruments.

The Model FK-104 Coded Keyboards are ready for operation as shipped from the factory. Upon receipt, careful examination of the receiving packing case and the enclosed keyboards should be made to detect damage during shipment. Prior to operation, a visual and physical check of the keyboard should be made to assure proper key button alignment and free key button operation. In addition to unrestricted key motion, all keys should exhibit full return to neutral when pressure is removed from all buttons. If inspection reveals damage during shipment, no adjustments should be attempted until the factory has been notified.

A-1. OPERATION

The sequence of operations which produces a coded output from the FK-104 Keyboard may be described as follows (figure A-1):

(1) As an operator depresses a key button, an affixed actuator enters coded slots on the spring loaded coding bars locking all bars except those pertaining to the selected code. During this same operation, the actuator displaces the hinged switch bail causing it to operate an associated microswitch.

(2) The microswitch energizes the Ledex rotary solenoid which operates a mechanism locking the entire keyboard from further operation. The locking mechanism also forces the selected key button to sustain full depression while the solenoid action retracts the code bar restoring bail permitting unblocked coding bars to move forward under spring tension.

(3) The free moving coding bars thereby engage corresponding coding contacts, closing electrical circuits to produce the selected electrical pulse code.

(4) All preceding conditions are maintained until a feedback signal from the driven mechanism operates the anti-repeat relay. The anti-repeat relay then releases the rotary solenoid and allows all units to return to their normal or original condition.

It should be noted that during the complete code production sequence, the anti-repeat relay is interlocked with the action of the microswitch to prevent transmittal of more than one coded output signal from any single key depression.

A-2. ADJUSTMENT AND MAINTENANCE

Removal of the four No. 10 screws on the sides of the keyboard case permits removal of the bottom cover thereby providing access to the keyboard mechanism. In general this provides adequate access for scheduled lubrication, replacement of microswitches, and such other adjustments as might occasionally be required.

To remove the main keyboard panel, unsolder the dial light leads, remove the light assembly, and then remove the keyboard name plate. The screws which visibly pass through the keyboard housing are all that now retain the panel in place. Further disassembly of the keyboard mechanism should be performed only by qualified personnel, preferably at the Soroban factory.

If the keyboard panel is to be installed in an auxiliary piece of equipment, care should be taken to insure its rigid support in a plane frame. Warping of the keyboard panel will jeopardize its adjustment and reliable operation.

A-3. MICROSWITCHES

The sequence of keyboard operations which follows a key depression involves the use of one of the two microswitches with each key depression. Although an attempt has been made to limit microswitch over travel thereby extending switch life, it is anticipated that with continuous use microswitches may fail due to fatigue. The following definite (not intermittent) symptoms are observed following a microswitch failure: (1) nothing happens with the depression of a given key, (2) approximately half of the keys are affected while the other half operate normally, and (3) the characteristic click, which should be observed when a key is depressed with power off, is absent. Microswitch failures provide a measure of the keyboard's service, hence when one switch fails, it is likely that the companion switch is approaching its useful life. For this reason failure of one switch should be followed by replacement of both.* Replacement microswitches can be obtained from Soroban or directly from Minneapolis-Honeywell, Microswitch Division (Microswitch Type 1SM1).

To replace a defective microswitch, first remove the keyboard's bottom cover. The two soldered leads, followed by the two screws which hold the switch are then removed. Care must be exercised to catch the two spacers and the single nut during this operation. Further, care should be

* Keyboards should be lubricated whenever microswitches are replaced.

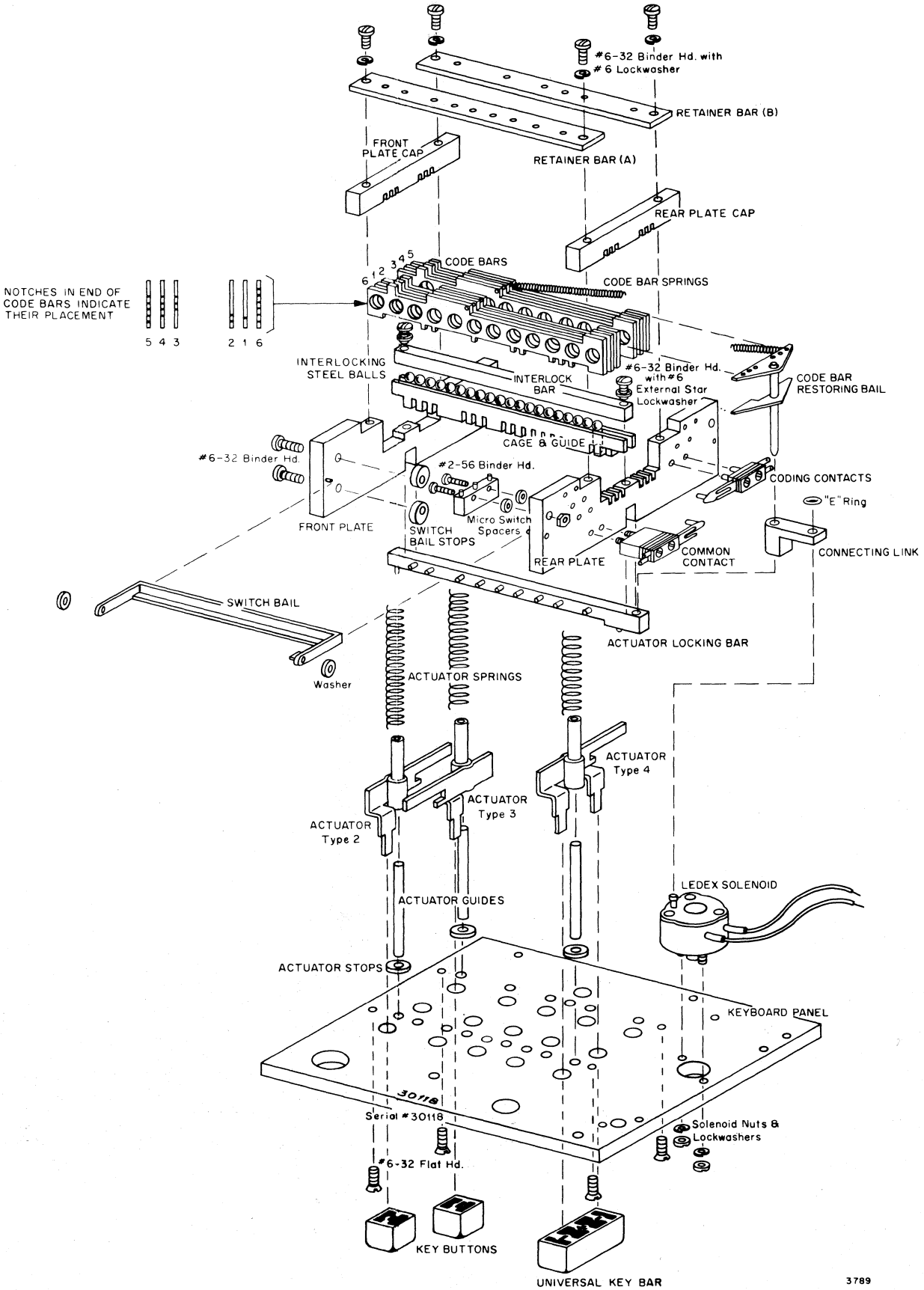
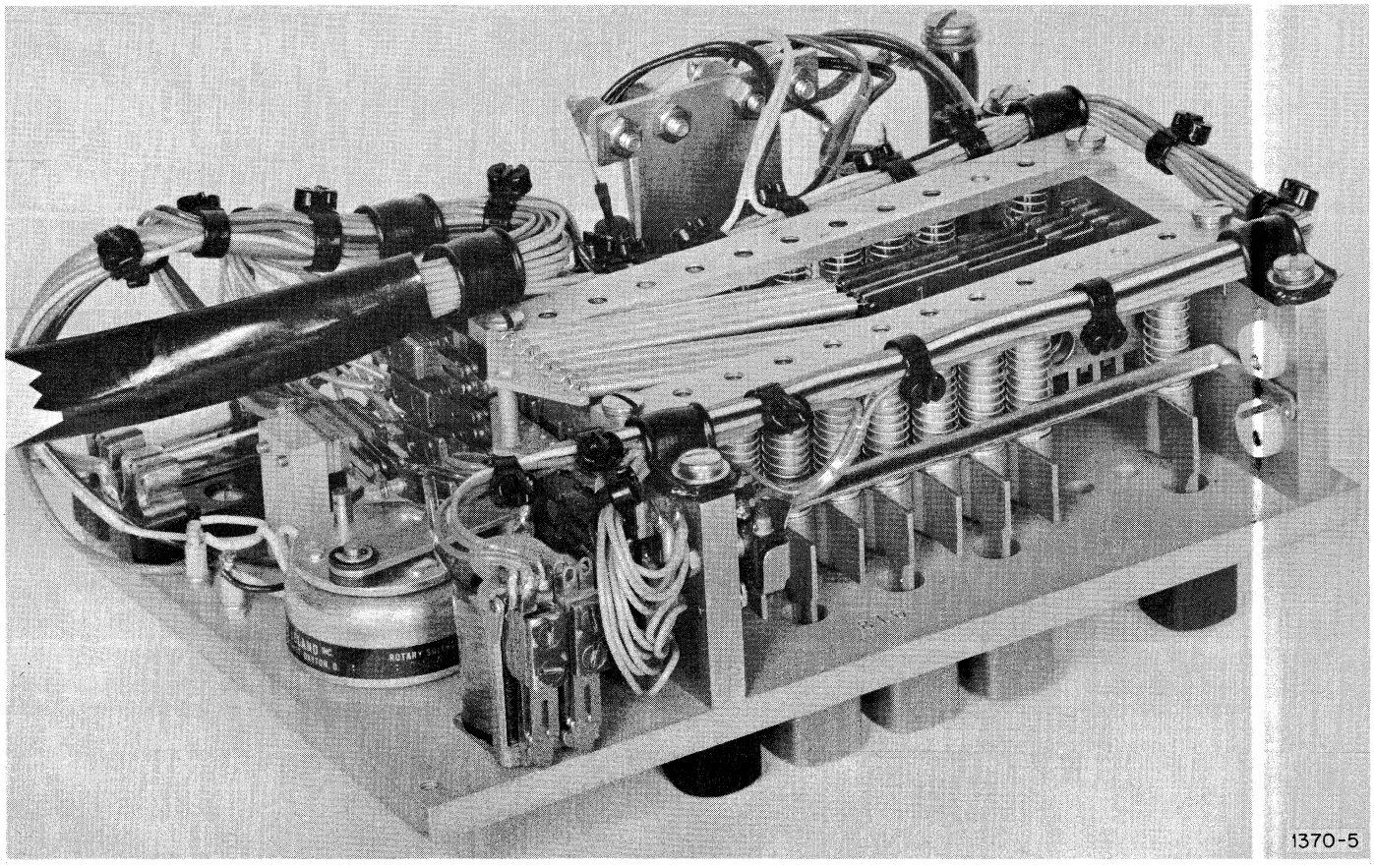


Figure A-1. Keyboard Assembly


1370-5

exercised in replacing the microswitch to avoid distortion of the microswitch bail. It should be noted that careful removal of the microswitch generally will not affect adjustment of the bail.

Proper operation of the microswitch is dependent upon satisfactory operation of the microswitch bail as well as proper positioning of the microswitch and its associated bail stops. The microswitch bail should hit all actuators evenly and must ride free on its pivots with a slight amount of end play (.005 inch) to permit the microswitch spring to return the bail to its neutral position. To position the microswitch, depress a key button and manually engage the rotary solenoid so that the keyboard locking mechanism retains the key in the depressed position. With the key restrained solely by the locking mechanism, adjust the microswitch for a minimum of switch over-travel consistent with reliable operation of the microswitch from any button. It is extremely important that the preceding adjustment be made only when keys are locked in the depressed position by the keyboard's locking mechanism—not by full manual depression.

With the microswitch properly located, adjustment of the black nylon eccentric bail stops which limit the travel of the switch bail may be undertaken. The upper stop (that is, the stop nearest the keyboard panel) should be adjusted to permit the switch bail to move approximately 1/64 inch beyond the point of microswitch release. The lower bail stop prevents switch-bail rattle, and so forth, and should be adjusted to prevent bail travels in excess of that encountered during full manual depression of any key.

Improper adjustment of the microswitch system will produce unreliable operation. If mounted too far from the switch bail, some keys will fail to operate or only intermittently operate the switch. Improper positioning of the lower nylon bail stop which limits bail travel will produce similar operation. When the microswitch is mounted too close to the bail, the solenoid may be energized before a depressed actuator has fully engaged the slots in the coding bars or passed the pins of the actuator locking bar. In addition to unreliable keyboard operation, such improper positioning of a microswitch results in excessive over-travel with accompanying decreased microswitch life.

A-4. CONTACT ADJUSTMENT

With the FK-104 Keyboard, seven normally open contacts are generally mounted on the rear plate (that is, plate nearest the solenoid); six provide the coded output, one provides the common contact synchronization signal. On special order, keyboards have been provided with six transfer contacts on the rear plate and five normally closed contacts on the front plate in addition to the common contact.

Adjustment of electrical contacts should be performed with power removed. Each code bar in sequence is blocked by depression of an appropriate key, and the rotary solenoid manually operated. Blocked code bars should clear the pusher of an associated rear plate contact by at least .005 inch and the contact should remain open .010 to .015 inch. Every key should be checked to insure that blocked code bars clear associated contact pushers by .005 inch.

When contacts are mounted on both front and rear plates, blocked code bars should again clear the rear plate contact pushers by .015 inch with transfer contacts remaining .010 to .015 inch open. For blocked code bars, normally closed contacts on the front plate should remain blocked .010 to .015 inch open when the rotary solenoid is operated. However, selected code bars should clear their respective front plate contact pusher by .005 when the rotary solenoid is operated, and complete transfer should be observed on the rear plate transfer contacts.

The common contact on the rear plate is adjusted to close <u>after</u> all other contacts have operated.

A-5. SOLENOID ADJUSTMENT

Installation of a keyboard rotary solenoid first involves winding of the solenoid spring to provide the required restoring torque, followed by careful positioning of the unit on the keyboard panel. When properly wound, a force of 8 to 12 ounces applied tangentially to the solenoid's drive pin is required to overcome the spring tension.

Positioning of the Ledex Rotary Solenoid, which determines the positioning of the keyboard's locking bar, should be performed with power removed from the keyboard.* The solenoid should be positioned to provide clearance between various actuators and the associated locking bar pins. To verify proper solenoid adjustment, depress each key in sequence and verify that proper clearance (approximately .005 inch) exists between each half depressed key's actuator and its associated locking bar pin. Finally, a check should also be made to insure that "E" ring on the solenoid drive pin is secure.

A-6. LUBRICATION

All keyboards are lubricated during their final factory test and adjustment. However due to normal wear and evaporation of lubricating oils, keyboards should periodically be re-lubricated (that is, with each microswitch replacement, or once each year, whichever occurs more often).

The use of light machine oil such as SAE 20 (Soroban Keyboard Oil), a mixture of Molylube and Plastilube, (or Soroban Keyboard Grease**), plus a mixture of the three (or Soroban Keyboard Lubricant) are suggested for lubrication of Series FK-104 Keyboards. Quantities of these lubricants plus an appropriate hypodermic lubricator are included in Soroban Lubrication and Repair Kits. Note that only mineral oil lubricants should be used, fish or vegetable oils will not permit satisfactory service.

Lubrication should be performed as follows:

(1) Actuator guides — keyboard oil, one drop only per guide

(2) Interlocking balls — keyboard oil

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* Solenoid Type BD 3ER25-38-X5-X9, manufactured by G. H. Leland, Inc., 123 Webster Street, Dayton 2, Ohio.

** Graphite grease is suggested as an alternate to the Molylube and Plastilube lubricant.

(3) Actuator locking bar guiding surfaces in front and back plates — keyboard grease

(4) Switch bail and pivots — keyboard grease

(5) Code bar restoring bail — keyboard grease

(6) Code bar guide surfaces in front and rear plates and caps — keyboard lubricant

(7) Ledex rotary solenoid — keyboard grease, one dab on the plates and balls.

A-7. TESTS DURING ASSEMBLY

If the keyboard is disassembled beyond removal of the panel from its cast aluminum case, the following tests must be made during re-assembly:

(1) All actuators should freely enter the slots in the interlock cage. If binding action is noted, the actuators should be bent and twisted until, as an actuator is depressed, play exists between the actuator and its guiding slot.

(2) The code bars should travel freely in their respective slots after the caps and retaining bars have been tightened. The ends of the code bars are notched for identification.

(3) The interlocking balls in the cage should shift back and forth freely with the interlock bar secured.

(4) With the code bar springs in place, a weight of 50 ($\pm$ 5) grams should be sufficient to pull the code bar away from the restoring bail.

(5) Following assembly, the retaining bars should be moved in (towards the code bars) until all keys have vertical play when the solenoid is energized.

The above checks are performed in addition to tests previously mentioned in the sections describing adjustment of microswitches, contacts, and solenoids.

A-8. FINAL TESTS

Final tests should be performed with a keyboard test set or equal. This unit contains a power supply, appropriate indicators for checking the generated code, indicators to insure proper adjustment of the make-before-make keyboard coding contact - common contact circuit, switches to provide or inhibit feedback signals, etc.

The Soroban Keyboard Test set should be used in the performance of the following keyboard final tests:

(1) Depress each key button in sequence to verify that the desired codes are being generated.

(2) Check the action of the anti-repeat relay and actuator locking bar by depressing a key and verifying that the keyboard locks-up properly. The keyboard may be unlocked by supplying an appropriate feedback pulse.

(3) Depress each button and then push every other to verify complete locking action. Look for keyboard lock-up.

(4) Press each button slowly, checking to insure that (a) the locking bar pulls it down, (b) the code appears, and (c) that the key is not jammed by the locking bar.

(5) Check for speed with feedback switch closed. Keyboards should operate reliably at a speed of at least 10 operations per second.

(6) Check all buttons for alignment, ease of action and smoothness.

APPENDIX B

FLEXOWRITER TEST PROCEDURE

B-1. FLEXOWRITER TEST PROCEDURE

B-2. PRELIMINARY TESTS

B-3. PRINTING TEST.

> NOTE
>
> These tests should be made with the Friden representative present, because he will be able to render technical assistance.

(1) Test and inspect character printing as follows:

(a) Test for smooth printing operation and observe print density. Does any type bar stick in type-bar guide?

(b) Do the printed characters align properly?

(c) Test upper and lower case printing. Does type basket shift smoothly and lock firmly into position?

(d) Test ribbon advance and reversal.

(e) Check ribbon-cover operation. Does the ribbon cover all characters in both color positions?

B-4. CARRIAGE-RETURN TEST.

(1) Does carriage always return to the carriage-return (CR) stop setting on both long and short returns?

(2) Is the carriage-return operation smooth?

(3) Does the clutch slip?

(4) Does the paper space properly on successive carriage-return operations?

B-5. TABULATION CHECK. Does tab detent operate reliably on long and short operation?

B-6. PRINTER MOTOR V-BELT TENSION TEST. The V-belt should have minimum tension, but should allow positive carriage-return operation.

B-7. PRINTER AND PAPER-TAPE READER CHECK

B-8. EQUIPMENT REQUIRED. The following equipment is required to perform the printer and paper-tape check:

(1) An oscilloscope with dual switched-input preamplifier,

(2) A 48-volt, 2-ampere d-c power supply,

(3) Flexowriter interconnecting cables,

(4) Flexowriter test box,

(5) Flexowriter schematic D 801 681,

(6) Special test tapes (table B-1) broken into the following three catagories:

Test Tape	Use
A	Tests all printable characters, both upper and lower case.
B	Causes successive tabulation and carriage-return operations.
C	Tests the positive return of the permutation bars.

B-9. PROCEDURE. Prepare for the printer and paper-tape reader checks as follows:

(1) Remove the relay cover and the jumper between terminals 21 and 25 on terminal block A.

(2) Connect the test box, by way of the interconnecting cables, to the Flexowriter.

(3) Connect the 48-volt power supply to the test box (+ to ground, - to -48 volts).

(4) Load the paper and mount test-tape A.

B-10. PRINTING TEST. The printing test is accomplished as follows:

(1) With test-tape A mounted, set the Flexowriter power-control switch to OPERATOR. The motor should be running and the Flexowriter keyboard should operate and type as on an ordinary electric typewriter.

(2) Set the margin and tabulation stops:

Left margin 20	tab stop 24
Right margin 86	tab stop 40

(3) Press START READING switch. The reader reads the test tape and the printer prints the read material. Pressing the STOP READING switch causes the tape and printing to stop. (The STOP READING switch is a locking type switch and must be restored to its normal (up) position in order to operate the reader.) A definite pattern should be apparent after the loop has been traversed twice. To ensure that all characters on test-tape A have been printed, check the printed copy with the characters shown in table B-1(a). Print the pattern eight or ten times and check for reliable printer operation by comparing each pattern.

B-11. READER TEST. The reader test consist of (1) the reader-contact test and (2) the system-reader test.

(1) The reader-contact test is performed as follows: At the test points on the test box observe, with the oscilloscope, the output waveforms of the reader contacts. The waveform should be a squarewave without excessive spikes caused when the reader contacts bounce.

(2) The system-reader test is performed as follows:

(a) Set the Flexowriter power-control switch to COMPUTER.

(b) Move the MOTOR switch on test box to the ON position.

(c) Move the READ switch on the test box to the ON position. The reader is now under control of the test box. Be sure the STOP READING switch on the Flexowriter keyboard is in the nonoperated (up) position.

(d) Use an oscilloscope to check the voltage levels at the following test points:

Test Point	Voltage Level
2-11	Ground, with tape guard open; low, with tape guard closed.
2-17	Ground, with START READ switch closed; low, with START READ switch open.
2-18	Ground, with STOP READ switch closed; low, with STOP READ switch open.

B-12. PUNCH TEST. Establish the following preliminary requirements:

(1) Insert a roll of paper tape on the paper-tape supply spool.

(2) Turn on the Flexowriter.

(3) Press the PUNCH ON switch and the NUM key on the Flexowriter keyboard. The punch lamp (P) should light. If the lamp does not light check the tension arm, the run-out arm, and the hold-down arm. The tension arm should be in its most rearward position, the run-out arm should be resting on the top surface of the tape, and the hold-down arm should be holding the tape firmly against the tape-feed sprocket.

With the preceding conditions established, perform the following tests:

(1) Press the TAPE FEED switch. Channels 1 through 5 are punched and the tape is advanced as long as the TAPE FEED switch is closed. If the tape does not advance properly, press down the hold-down arm and operate the TAPE FEED switch. This will help the tape-feed sprocket pull the tape through until the punched sprocket holes can engage the sprocket pins.

(2) Press the TRANS. TO PROG. switch. Channels 7 and 8 are punched and the tape is advanced each time the switch is pressed.

(3) Press each keyboard key several times. Write on the tape which key produced each combination. Compare the punched combinations with the characters in table B-2. The punch is inhibited in the alphanumeric mode, although a control code combination will be punched going from alphanumeric to numeric mode, or from numeric to alphanumeric modes.

(4) Remove tape from the punch and type several characters. The punch should not operate because when the run-out arm drops, the PTC switch opens the circuit to the punch-clutch magnet.

B-13. TRANSLATOR RELIABILITY TEST

The translator reliability test determines whether the permutation bars and the magnet armatures return reliably.

(1) Mount test-tape C.

(2) Set line spacing to two lines.

(3) Start the reader, print several pages and examine each line for any missing characters.

(4) Using table B-1(c) check missing characters as follows: If a G fails to print in the G E combination, either the magnet armature did not operate, or the permutation bars did not restore. The latter failure is the one most often encountered in the translator and may be corrected by readjusting the bar-restoring bail. Refer to the Flexowriter-Justowriter Adjustment Manual, figure 7-10.

B-14. PRINTER-CONTACT TESTS

B-15. TRANSLATOR AND VALIDITY-CONTACTS TEST.

(1) Set the mode-selector switch on the oscilloscope to the chopped position and observe, with the printer printing, the signal at test-points JL2-12 (20°) and JL2-13 (300°). While the printer is printing, check for excessive bounce. Photograph the signal.

(2) Observe and photograph the signal at test-points JL2-13 (300°) and JL2-21 (validity check). The validity-check contacts should not bounce after the 20° signal of the next cycle appears.

B-16. TABULATOR AND CARRIAGE-RETURN CONTACTS TEST.

(1) Insert test-tape B. Since tape B is a tabulation carriage-return tape, the paper may be removed.

(2) Start the reader and observe the signal at test-points JL2-12 (20°) and JL2-14 (delay contact). The oscilloscope-triggering pulse is taken from test-point JL1-10. The signal at JL2-12 (20°) should go negative when, or slightly before, the signal at JL2-14 (delay contact) goes positive. The signal should remain negative until the end of tabulation or carriage return. Be sure no spike appears on JL2-12 (20°) at the trailing edge of JL2-14 (delays). If a spike appears, readjust the SCRT-1 contacts so that contacts 4 and 5 open before contacts 1 and 2. Photograph the signal.

All signals photographed must be pasted in the Flexowriter log book.

B-17. RIGHT- AND LEFT-MARGIN SWITCHES CHECK.

(1) Set the right- and left-margin switch stops to any setting.

(2) Insert test-tape B and turn on the machine.

(3) Observe the signal at test-points JL2-23 and JL2-24 (left and right margins). The switch stops should operate the switches. Be sure the switch arms do not ride on the switch-stop rail. Excessive bounce when these two switches operate is inconsequential.

B-18. PUNCHING INSTRUCTIONS FOR TEST-TAPE A

Since the translator and punch-selector codes differ for some characters, double and triple punching is necessary to obtain the desired combinations. For instance the translator code for a 2 is bits 3, 4, and 6. No single selector character has this combination, but by punching a 4 (bit 3), period (bit 4), and connect-five (bit 6) on the same position on the tape, the desired combination is obtained. Tape back-spacing is accomplished by turning the tape-punch sprocket back one step with the knurled knob. Refer to table B-1 for the sequence of characters.

B-19. PUNCHING INSTRUCTIONS FOR TEST-TAPE C

(1) Punch six tape-feed codes.

(2) Punch ALPHA; turn off the punch. Press the NUM key and turn on the punch. (This allows ALPHA code on the tape without a NUM code.)

(3) Punch 5 and ▽ to give a carriage-return code on the tape. (Refer to the punching instructions for test-tape A.)

(4) Punch about six tape-feed codes.

(5) Alternately punch G and E for 40 characters.

(6) Repeat steps 3 and 4.

(7) Punch alternate ▽ and D; C and G; G and =; 7 and G; B and <; T and ~; D and C. Make each pair 40 characters long and separate each line with carriage-return code and tape feeds as described in operations 3 and 4.

(8) Splice tape into a continuous loop at tape-feed characters.

Table B-1. Flexowriter Test Tapes

(a) Test-Tape A

Key or Switch Used	Number of Repetitions	Result When Tape Read Back: Prints	Result When Tape Read Back: Operation Performed
TAPE FEED	10	—	Feeds Tape
5 ▽	1	—	Carriage return
NUM	1	—	Shift
TAPE FEED	3	—	Feeds Tape
· 2 CON 12	3	a	—
2 4 CON 12	3	/	—
B 7	3	·	—
7	3	-	—
‡ C CON 12	3	□	—
Q	3	Q	—
W	3	W	—
Σ	3	Σ	—
R	3	R	—
T	3	T	—
Y	3	Y	—
(DISC	3	|	—
· 4 CON 5	3	2	—
· 1 CON 12	3	3	—
P	3	P	—
€	3	€	—
5 ▽	1	—	Carriage return
TAPE FEED	6	—	Feeds Tape
A	3	A	—
S	3	S	—
→	3	→	—
η	3	η	—
:	3	:	—
H	3	H	—
< 1	3	4	—
- 2 CON 12	3	5	—
3 <	3	6	—
4 [CON 12	3	∧	—
▽	3	▽	—
Z	3	Z	—
X	3	X	—
*	3	*	—
v	3	v	—
N	3	N	—
- 4 CON 12	3	7	—
5 G	3	8	—

(a) Test-Tape A (cont)

Key or Switch Used	Number of Repetitions	Result When Tape Read Back: Prints	Result When Tape Read Back: Operation Performed
1 □	3	9	—
NUM □	3	+	—
5 ▽	1	—	Carriage return
TAPE FEED	7	—	Feeds Tape
Alpha	1	—	Unshift
· 0 CON 12	1	—	Tabulation
TAPE FEED	3	—	Feeds Tape
· 2 CON 12	3	[	—
]	3	]	—
<	3	<	—
=	3	=	—
Δ	3	Δ	—
2 4 CON 12	3	P	—
B 7	3	·	—
7	3	-	—
< C	3	λ	—
(	3	(	—
- 0 CON 12	3	)	—
5 ▽	1	—	Carriage Return
TAPE FEED	9	—	Feeds Tape
· 0 CON 12	1	—	Tabulation
TAPE FEED	5	—	Feeds Tape
Q	3	Q	—
W	3	W	—
R	3	R	—
E	3	E	—
T	3	T	—
Y	3	Y	—
(DISC	3	U	—
CON 5 · 4	3	I	—
P	3	P	—
~	3	~	—
5 ▽	1	—	Carriage Return
TAPE FEED	6	—	Feeds Tape
· 0 CON 12	1	—	Tabulation
TAPE FEED	3		Feeds Tape
A	3	A	—
S	3	S	—
D	3	D	—
F	3	F	—

(a) Test-Tape A (cont)

Key or Switch Used	Number of Repetitions	Result When Tape Read Back: Prints	Result When Tape Read Back: Operation Performed
G	3	G	—
H	3	H	—
< 1	3	J	—
- 2 CON 12	3	K	—
< 3	3	L	—
[4 CON 12	3	π	—
▽	3	▽	—
5 ▽	1	—	Carriage Return
TAPE FEED	5	—	Feeds Tape
· 0 CON 12	1	—	Tabulation
TAPE FEED	3	—	Feeds Tape
Z	3	Z	—
X	3	X	—
C	3	C	—
V	3	V	—
B	3	B	—
N	3	N	—
- 4 CON 12	3	M	—
5 G	3	,	—
1 □	3	/	—
NUM □	3	+	—
NUM	1	—	Shift
5 ▽	1	—	Carriage Return
TAPE FEED	5	—	Feeds Tape
5 ▽	1	—	Carriage Return
TAPE FEED	2	—	Feeds Tape
· 0 CON 12	1	—	Tabulation
TAPE FEED	3	—	Feeds Tape
Alpha	1	—	Unshift
F	1	F	—
3 <	1	L	—
E	1	E	—
X	1	X	—
· 1 CON 12	1	O	—
W	1	W	—
R	1	R	—
· 4 CON 5	1	I	—
T	1	T	—
E	1	E	—
R	1	R	—
(Space Bar)	3	—	Spaces

(a) Test-Tape A (cont)

Key or Switch Used	Number of Repetitions	Result When Tape Read Back: Prints	Result When Tape Read Back: Operation Performed
T	1	T	—
E	1	E	—
S	1	S	—
T	1	T	—
(Space Bar)	3	—	Spaces
T	1	T	—
A	1	A	—
P	1	P	—
E	1	E	—
5 ▽	1	—	Carriage Return
TAPE FEED	8	—	Feeds Tape
· 0 CON 12	1	—	Tabulation
TAPE FEED	3	—	Feeds Tape
F	1	F	—
· 1 CON 12	1	O	—
R	1	R	—
(Space Bar)	2	—	Spaces
3 <	1	L	—
B 7	1	·	—
(Space Bar)	1	—	Space
A	1	A	—
B 7	1	·	—
(Space Bar)	1	—	Space
R	1	R	—
B 7	1	·	—
(Space Bar)	1	—	Space
C	1	C	—
B 7	1	·	—
(Space Bar)	3	—	Spaces
F	1	F	—
3 <	1	L	—
E	1	E	—
X	1	X	—
· 1 CON 12	1	O	—
W	1	W	—
R	1	R	—
CON 5 · 4	1	I	—
T	1	T	—
E	1	E	—
R	1	R	—

(a) Test-Tape A (cont)

Key or Switch Used	Number of Repetitions	Result When Tape Read Back: Prints	Result When Tape Read Back: Operation Performed
S	1	S	—
(Space Bar)	2	—	Spaces
· 1 CON 12	1	O	—
N	1	N	—
3 <	1	L	—
Y	1	Y	—
5 ▽	1	—	Carriage Return
TAPE FEED	6	—	Feeds Tape

NOTE

Splice tape at tape feed punching to form loop.

(b) Test-Tape B

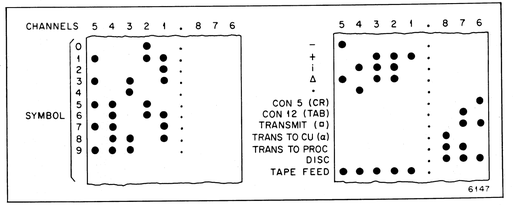
Key or Switch Used	Number of Repetitions	Operation Performed When Tape Read
TAPE FEED	6	Feeds Tape
5 ▽	1	Carriage Return
TAPE FEED	6	Feeds Tape
· 0 CON 12	1	Tabulation
TAPE FEED	3	Feeds Tape
5 ▽	1	Carriage Return
TAPE FEED	3	Feeds Tape
· 0 CON 12	1	Tabulation
TAPE FEED	3	Feeds Tape
· 0 CON 12	1	Tabulation

NOTE

Repeat until punched tape is long enough to make a loop to clear the reader case; then splice ends.

(c) Test-Tape C

Character Pair	Tape Code Punched (Bits Present)	Bit Checked
G	146	1
E	246	2
▽	268	2
D	368	3
C	136	3
G	146	4
G	146	4
E	156	5
-	145	5
G	146	6
B	168	6
<	178	7
T	13567	7
~	13568	8
D	368	8
C	136	1



Tape Symbol

Table B-2. Console Printer Character Codes

Key or Switch		Code	
Upper Case	Lower Case	Translator	Punch
TAPE FEED *			12345
NUM *		258	
ALPHA *		125	
CR/CON 5 *		24568	6
TAB/CON 12 *		247	7
SPACE BAR *		12458	
DISC *		678	
TRANS. TO PROG. *		78	
+	+	25678	123
-	-	145	5
.	.	14568	4
∧	π	378	235
\	P	137	
0 (Zero)	λ	13678	2
1	U	35678	125
2	I	346	1
3	O	12457	135
4	J	12578	3
5	K	157	245
6	L	13578	124
7	M	357	145
8	,	12456	134
9	/	12567	345
α (Trans to CU	[	147	
□ (Transmit)	)	257	
Σ	E	246	
∈	~	13568	
→	D	368	
η	F	12468	
:	G	146	
	∇	268	
*	C	136	
>	B	168	
	]	12478	
	<	178	
	=	156	
	Δ	167	

Key or Switch		Code	
Upper Case	Lower Case	Translator	Punch
	(	356	
	Q	13457	
	W	1245678	
	R	34578	
	T	13567	
	Y	1345678	
	P	14578	
	A	126	
	S	15678	
	H	13468	
	Z	34567	
	X	14567	
	V	24567	
	N	24578	

* Nonprinting. Control code is punched in the tape, or cause printer operation.

APPENDIX C
CONTROL RELAYS

Relay No.	Schematic (D811...)			Wiring (D602...)		
	Serial 1	Serial 2	Expanded System	Serial 1	Serial 2	Expanded System
1	421	421	421	379	691	691
2	421	421	421	379	691	691
3	424	424	424	379	691	691
4	426	426	426	379	691	691
5	426	426	426	379	691	691
6	426	426	426	379	691	691
7	349	342*	991**	379	691	691
8	403	403	403	379	691	691
9	350	350	350	379	691	691
10	352	334*	352	379	691 †	691 †
11	426	426	426	382	687	687
12	426	426	426	382	687	687
13	426	426	426	382	687	687
14	426	426	426	382	687	687
15	426	426	426	382	687	687
16	426	426	426	382	687	687
17	420	420	420	382	687	687
18	420	420	420	382	687	687
19	352	334*	352	382	687	687

* D 3816... (refer to Section 1).

** D 3814... (refer to Section 1).

† D 3603... (refer to Section 1).

Relay No.	Schematic (D811...)			Wiring (D602...)		
	Serial 1	Serial 2	Expanded System	Serial 1	Serial 2	Expanded System
20	355	335*	355	382	687	687
21	349	342*	991**	382	687	687
22	—	—	—	—	—	—
23	350	350	350	380	689 †	689 †
24	350	350	350	380	689	689
25	350	350	350	380	689	689
26	—	—	—	—	—	—
27	421	421	421	380	689	689
28	—	—	—	—	—	—
29	—	—	—	—	—	—
30	—	—	—	—	—	—
31	426	426	426	383	726	383
32	426	426	426	383	726	383
33	427	427	427	383	726	383
34	427	427	427	383	726	383
35	427	427	427	383	726	383
36	427	427	427	383	726	383
37	426	426	426	383	726	383
38	427	427	427	383	726	383
39	352	—	352	383	726	383
40	404	404	404	383	726	383
41	375	375	375	381	692	692
42	375	375	375	381	692	692
43	375	375	375	381	692	692
44	—	—	—	—	—	—
45	403	403	403	381	692 †	692 †
46	419	419	419	381	692	692
47	420 424	420 424	420 424	381	692	692
48	422	422	422	381	692	692

* D 3816... (refer to Section 1).

** D 3814... (refer to Section 1).

† D 3603... (refer to Section 1).

Relay No.	Schematic (D811...)			Wiring (D602...)		
	Serial 1	Serial 2	Expanded System	Serial 1	Serial 2	Expanded System
49	—	—	—	—	—	—
50	—	—	—	—	—	—
51	427	427	427	384	688	384
52	427	427	427	384	688	384
53	427	427	427	384	688	384
54	—	—	—	—	—	—
55	427	427	427	384	688	384
56	376	376	376	384	688	384
57	427	427	427	384	688	384
58	—	—	—	—	—	—
59	421	421	421	384	688	384 †
60	421	421	421	384	688	384
61	376	376	376	508	693 †	693
62	—	—	—	—	—	—
63	376	376	376	508	693	693
64	427	427	427	508	693	693
65	352	352	352	296	690	690
66	352	352	352	296 †	690	690
67	352	352	352	296	690	690
68	—	352 991**	352 991**	—	690	690
69	—	—	—	—	—	—
70	—	—	—	—	—	—
71	335*	335	—	524	697	—

* D 3816... (refer to Section 1).

** D 814...

† D 3603... (refer to Section 1).

GLOSSARY

AU	Arithmetic Unit
CC	Control Counter
CU	Computing Unit
EPR	Electronic page recorder
FF	Flip-flop
FR	Fast Register
HSP	High-speed printer
IOP	Processor
IR	Instruction register
NE	Neon
OE	Odd-even
OF	Overflow
Sync	Synchronizer
SW	Switch
UF	Underflow