MODEL 110 PLOTTER CONTROLLER

OPERATOR'S MANUAL

PN-187133 N.E.C.

CALCOMP

California Computer Products, Inc.

August 1966

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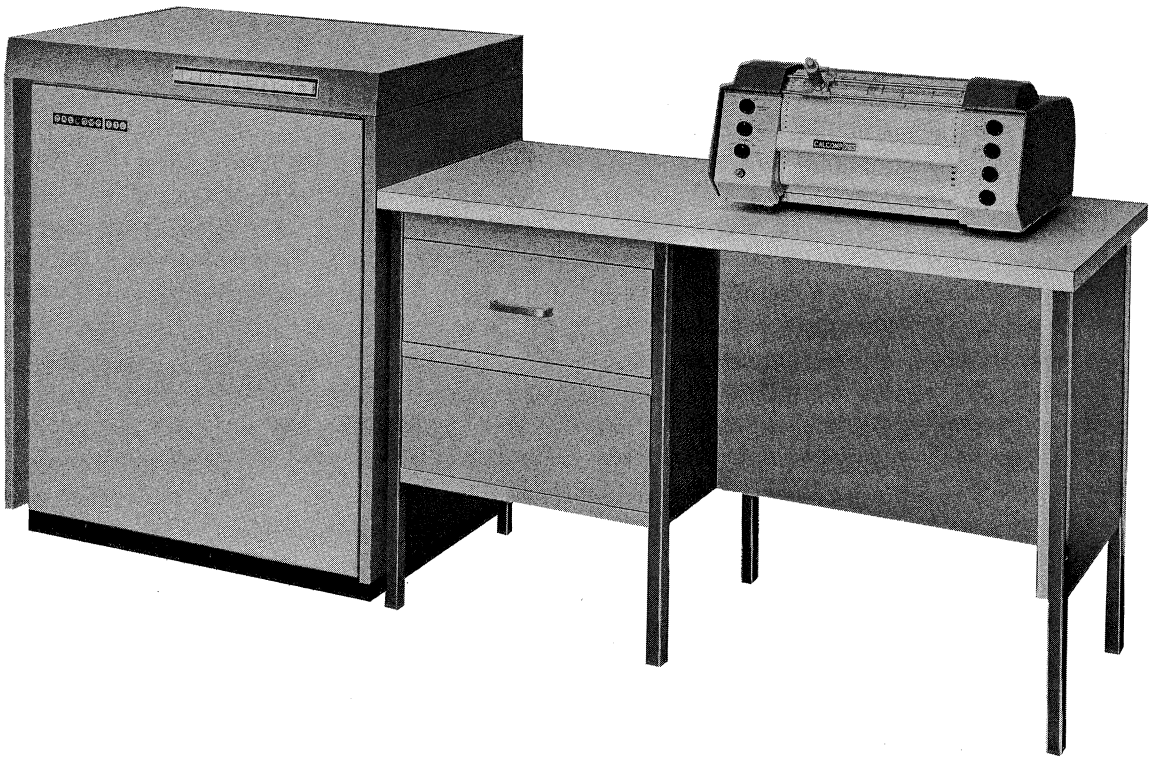
CALIFORNIA COMPUTER PRODUCTS, INC.
305 NORTH MULLER STREET, ANAHEIM, CALIFORNIA 92803



CALCOMP MODEL 110 PLOTTER CONTROLLER
WITH MODEL 765
DIGITAL ZIP MODE PLOTTER

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ILLUSTRATIONS

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SECTION 1
INTRODUCTION

1.1 GENERAL

The CalComp Model 110 Plotter Controller provides on-line operation of any CalComp 500 series, 700 series, or 835 digital plotter with the IBM System/360. The Model 110 performs the required decoding and controlling functions necessary for connecting a CalComp plotter to the System/360 multiplexer or selector I/O channel. As shown in Figure 1-1, the plotter controller may be connected to the channel either as the end device or at any point along the chain of devices connected to the channel. The required terminating voltages are provided to power the terminating network when the unit is connected as the end device.

Designed in modular form, the Model 110 permits the inclusion or addition of an optional 2048 or 4096 character core buffer. An optional dual channel feature is also available for driving two independent plotters simultaneously.

Power to the Model 110 is controlled by the System/360 Central Processing Unit (CPU) through a power control cable. The power control interface provides interlocked, sequential system powering.

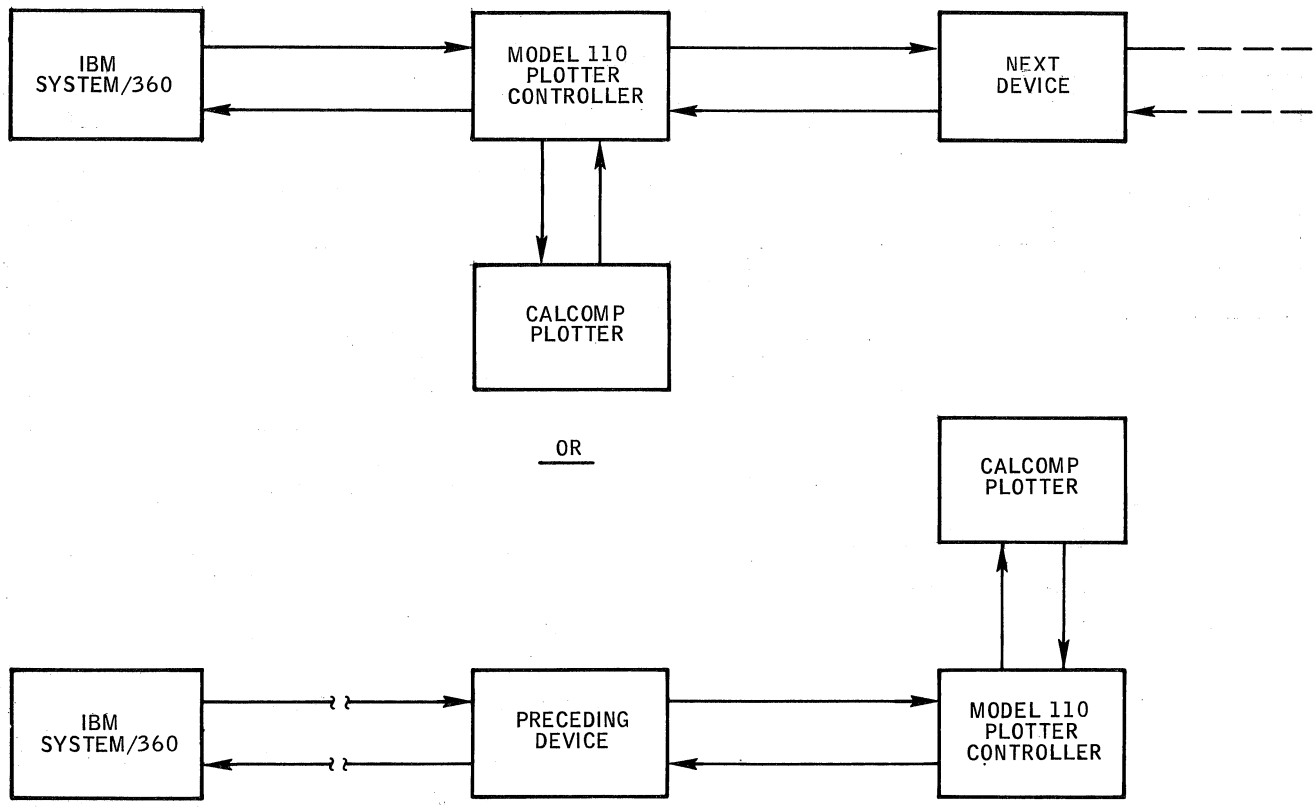


FIGURE 1-1
Model 110 System Configurations

1.2 FUNCTIONAL DESCRIPTION

The Model 110 is comprised of modular component parts which may be added or modified to meet the requirements of a particular application. As shown in the simplified block diagram of Figure 1-2, the basic Model 110 consists of a computer interface module, a plotter driver module, a power supply and control module, an operator control panel, and a connector panel which ties the component parts and external equipment together. For increased efficiency, the optional 2048 or 4096 character core buffer may be added. The optional plotter driver multiplexer module may also be substituted for the basic plotter driver module to permit simultaneous, independent operation of two CalComp plotters.

1.2.1 BASIC MODEL 110

The basic Model 110 with a single-character buffer connects to and operates with the System/360 multiplexer channel via the computer interface module. (Operation on the System/360 selector channel is not recommended except with one of the core buffer options.) The computer interface module consists of byte-buses for commands, addresses, data, or status and channel interlock signals. The interlock control functions also establish the Model 110 priority with respect to the other devices sharing the channel.

The basic Model 110 normally operates in the byte mode when connected to the System/360 multiplexer channel. (The burst mode of operation is usually used only with one of the core buffer options.) In the byte mode, the Model 110 releases the I/O channel after initial selection, after transferring each byte of data, and prior to presenting the terminating status.

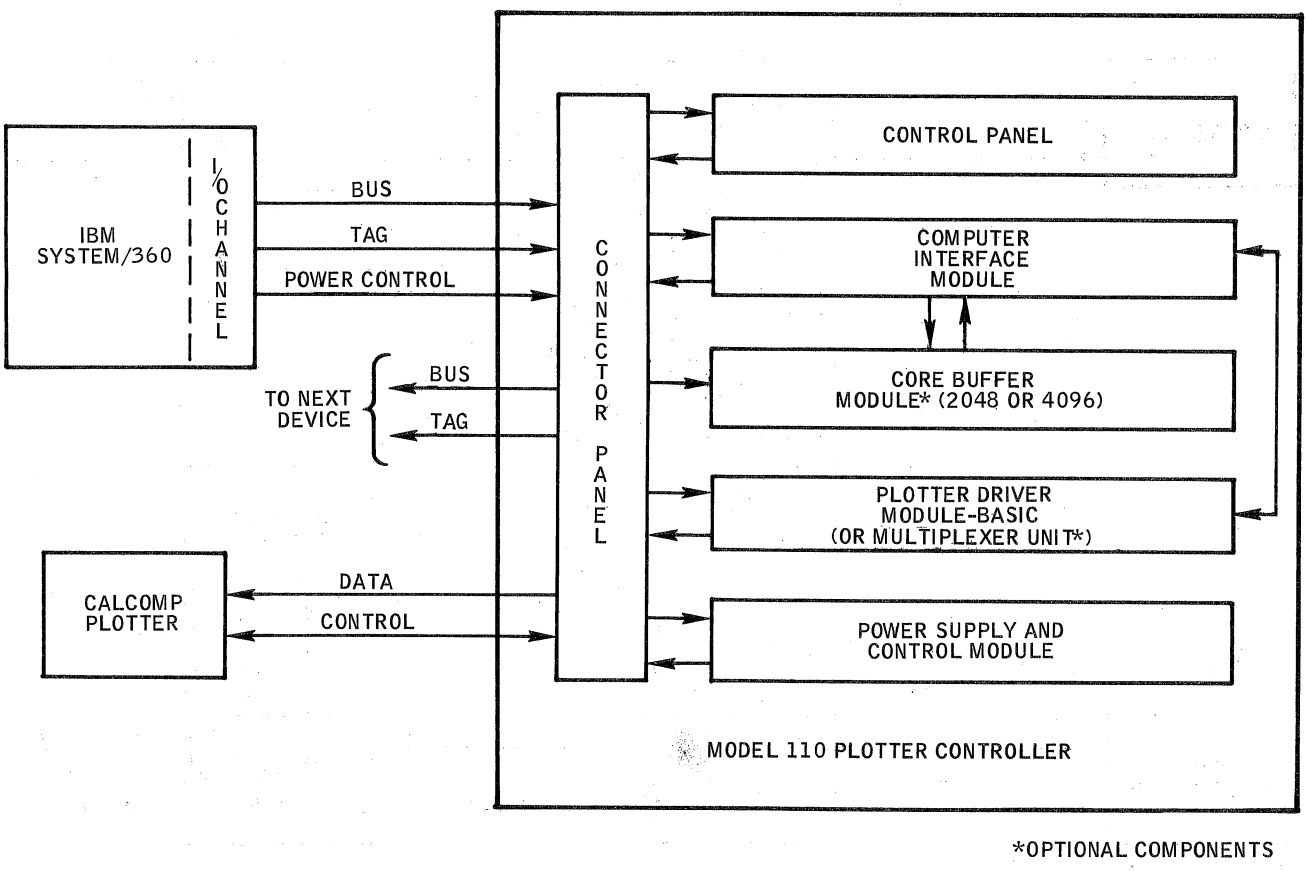


FIGURE 1-2
Model 110 Components

Operation is initiated by a program command from the channel and accepted by the Model 110. The plotter controller cannot be addressed again until it has presented the terminating status to the channel. Three I/O instructions are used to operate the plotter controller; start I/O, test I/O, and halt I/O. When a start I/O command to initiate a plotting operation occurs, the program routine prepares a list of channel command words in main storage. These commands may consist of the following plotter controller commands:

(1) reset and start write
(2) start write
(3) sense (basic)
(4) sense (switches)
(5) start plot
(6) no-op control

When the channel command words have been generated and stored, the program specifies the channel and address of the plotter. The execution of a start I/O command then causes the command, count, data address, and control information to be stored in a specified multiplexer subchannel. The channel then selects the plotter controller and presents the command to it. If the command is valid, the computer interface module of the 110 signals the channel that it has accepted the command. The channel, in turn, indicates to the program if the start I/O command was successful. Once the command has been accepted by the channel and the plotter controller, the CPU is released until the entire data area has been transmitted to the plotter controller.

As part of the initial selection sequence, the Model 110 presents a status byte to the channel to indicate one of the following conditions:

(1) manual interrupt
(2) outstanding status
(3) channel end status
(4) device end status (plotting completed)
(5) unit check

If a unit check is indicated, the Model 110 presents a sense byte to indicate one of the following:

(1) plotter not ready (700 series and 835 plotters only)
(2) bus out parity error
(3) core buffer parity error
(4) overrun (channel did not respond in time to service the Model 110, unbuffered basic model with 700 series plotter attached)
(5) low on paper (option)
(6) plotter limit switch actuated (option)

If the manual interrupt status is indicated, this normally signifies that a sense switch entry was made and the Model 110 presents a second sense byte to the channel indicating the status of the sense switches. These switches provide simplified and improved efficiency of operation for the on-line plotting system.

Upon the completion of transfer of the data character to the plotter controller and the status to the channel, the computer interface module disconnects from the channel. The data character is stored in the plotter driver module single-character buffer. At the appropriate time, the character is transmitted out to the plotter along with the required pen delay and plotter pulse control signals. For 500 series plotters, the plotter driver module also performs the decoding of the plot command. The decoding of plot commands for the 700 series and 835 plotters is performed in the plotter electronics.

Because the channel contains all necessary information relative to current operation, data transfer between the main storage and the Model 110 can be overlapped with the CPU processing. The extent of the overlapping depends upon the type of channel (multiplexer or selector) and the processor (Model 30, 40, 50, etc.) of the System/360.

The control panel includes a number of controls and indicators for operator convenience plus six special sense switches. The sense switches are used to inform the System/360 of the operational status or to identify plotting modes. The functions of the switches can be changed at the programmer's option. Typical program provisions for these switches include such functions as single plot, multiple plot, repeat last plot, change scale, etc.

In addition to the six sense switches, the control panel includes the following manual switches and indicators:

a) INTERRUPT — Manual switch; signals the computer to interrogate the sense switches; indicator remains on until computer has accepted the instruction

b) RESET — Manual switch; terminates plot function and establishes necessary conditions for accepting new data; used at start of on-line operation, or as an emergency reset to abort a plotting operation.

c) ON-LINE — Indicator; lights when conditions necessary for receiving data from computer are established by internal toggle switch

d) OFF-LINE — Indicator; lights when unit has been disconnected from the channel for test purposes; operates in conjunction with internal toggle switch; cannot be activated unless computer is in "halt" or "wait" status.

e) SELECT — Indicator; lights only during the time data is being transferred from the computer to the Plotter Controller; normally visible only when operating in Burst Mode

f) BUSY — Indicator; lights during plotting periods and/or when a status is outstanding; Outstanding Status includes one or more of the following:
   (1) Manual interrupt
   (2) Device end
   (3) Channel end
   (4) Unit check

g) UNIT CHECK — Indicator; lights when a malfunction has occurred, causing a sense byte to be sent to the computer; indicates one of the following:
   (1) Plotter not ready (700 series and 835 plotters only)
   (2) Bus out parity error during data transfer
   (3) Core buffer parity error (when provided)
   (4) Overrun (channel did not respond in time, 700 series plotter and unbuffered basic unit only)
   (5) Low paper (option)
   (6) Plotter limit switch actuated (option)

1.2.2 MODEL 110 WITH CORE BUFFER

The core buffer options provide storage of 2048 or 4096 plot characters, and offer a significant increase in efficiency and flexibility of operation. These options permit operation on the System/360 selector channel, or on the multiplexor channel in the burst mode. Burst mode operation provides maximum efficiency.

Burst loading of the core buffer may be accomplished in bursts of any size, in random fashion, through command chaining of write commands. When the buffer is full enough to warrant initiation of buffer-readout to the plotter,

the computer executes a start plot command. At this time, the buffer outputs its contents to the plotter at the appropriate plotter rate. The device end status response triggers new commands if desired.

1.2.3 MODEL 110 WITH DUAL-CHANNEL FEATURE

This option provides a modified output section in the Model 110 to permit simultaneous, independent operation of two CalComp plotters. The dual channel feature switches alternate input characters to the plotter driver channel A and channel B outputs. Two different plotter models, including one 500 series and one 700 series or 835, may be connected to the A and B outputs if desired. A manual selector switch establishes the output mode – channel A only, channel B only, channels A and B in parallel, or dual-channel operation. The selector switch also establishes the output data rate to the plotters, which is the maximum incremental speed of the slower plotter when parallel or dual-channel operation is used. For example, if a Model 565 and 763 are multiplexed, both will run at the Model 565 speed of 300 steps per second. Suitable pen delays are provided by the computer plot package. Pen delays in non-multiplexed mode may be provided either by the plot package or by the Model 110 as controlled by a toggle switch on the plotter driver module.

Two plotter output terminations are provided in each plotter channel, so that with the dual-channel feature, the Model 110 is capable of driving as many as four plotters simultaneously. The two plotters connected to a channel output must be of the same series (both 500 series or both 700 series) and both receive the same data.

1.3 SPECIFICATIONS

		Standard Unit	Expanded Unit*
a) DIMENSIONS:	Width	32 in.	62 in.
	Depth	22 in.	22 in.
	Height	37-1/2 in.	37-1/2 in.
b) WEIGHT:		250 lbs.	400 lbs.

c) OPTIONS:

I 2048 Character Core Buffer – Plug-in module containing necessary core planes, selection and inhibit drivers, address registers and sense amplifiers.

II 4096 Character Core Buffer – Same as Option I with double the storage capacity.

III Dual-Channel Feature – Modular option to provide two plotter channels which can be driven simultaneously. Data channels may be driven in parallel (identical data on each channel) or interlaced (alternate characters on each channel). Provides proper timing and control through a selector switch. Allows intermixing of 500 and 700 series plotters on separate channels. When operating in dual-channel mode, output data rate to each channel is the rate of the slowest attached plotter. Channel selection switch provides the following control positions:

Output to Plotter Channel A
Output to Plotter Channel B
Parallel Output to Channels A and B
Interlaced Output to Channels A and B

This feature available with basic unit or in combination with option I or II.

IV Expanded Unit – Includes provisions for electronics modules for 700 series plotters.

d) INPUT DATA RATE:

Basic Unit – Data transfer rate is under control of plotter controller and limited to maximum plotter rate.

Buffered Unit (Option I or II) – Data transfer rate is at maximum burst mode rate of 250 kc when connected to Multiplexor channel Data transfer rate is 330 kc maximum when connected to Selector channel.

Dual-Channel (Option III) Unbuffered Unit – Data transfer rate is twice the rate of the slowest plotter attached, controlled by the Model 110.

e) POWER:

60 Hz, 208 ±10% volts, single-phase, approximately 400 watts, plus plotter requirement.

SECTION 2
INSTALLATION

2.1 UNPACKING

The Model 110 Plotter Controller is shipped completely assembled. The cables and loose equipment shipped in a separate container are listed in Table 2-1. In addition to the cables listed in this table, the two 20-foot IBM signal cables (Part No. IBM 5353920) and one emergency power cable (Part No. IBM 5351178) are required to interconnect the plotter controller and the System/360. These cables may be purchased either from IBM or CalComp.

TABLE 2-1
Model 110 Plotter Controller Cables and Loose Equipment

Quantity	Cable Part No.	Description
1	10127-401	Power Cable (15 ft. std.)
1*	10112-401-11	Plotter Cable (3 ft. std.) 500 series plotter
1	11455-203	Terminating Connector
1	10328-502	Switch Card
1	10222-502	Extender Card
2	10966-203	Card Puller
2	Model 110	Operator's Manual

*Quantity may be 2 if Dual-Channel Plotter Driver
Substitute 10048-401 (10 ft. std.) if 700 series or CRT Plotter
Substitute 10115-401 (3 ft. std.) if IBM 1627 Plotter
Substitute 10116-401 (3 ft. std.) if CDC Plotter

2.2 INSPECTION

The Controller should be inspected for loose hardware, and corrective action should be taken before attempting to operate the equipment. Other special instructions are outlined in the following paragraphs.

2.2.1 FRONT GATE

The front gate contains the I/O and the plotter driver module. Remove the cover and check all printed circuit boards in the card cage and ensure that all boards are firmly seated in their connectors. Wiggle all switches on the test panels and tighten as required. Check the running time meter relay located on the bottom channel of the front gate for proper seating in the socket. Replace the card cage cover.

2.2.2 MEMORY GATE

The rear gate contains the optional memory module. Remove the card cage cover over this module and check all printed circuit boards to ensure that all boards are firmly seated in their connectors. Wiggle all switches on the test panel and tighten as required. Replace the card cage cover. Make sure capacitor on rear side of card cage is not loose.

2.2.3 CONNECTOR PANEL

Check mating of all connectors and tighten or adjust to ensure proper connection. Check the seating of the pins in the four IBM connectors.

2.2.4 POWER SUPPLY

Check for loose components and tighten as required. Check plug-in printed circuit boards and relays for correct seating. Remove masking tape used in shipping. Check cable connections to power supply and tighten as required.

2.2.5 COOLING

Proper operation of the equipment depends upon proper air circulation around the air intake vents in the right side of the cabinet. Make sure that no other equipment is placed against this side of the cabinet and that the air vents are free from any obstructions.

2.3 PREPARATION

The plotter controller internal cables are connected at the factory and are shown in Figure 2-1. Verify that all cable connections are properly mated.

2.3.1 PLOTTER CONNECTION

The plotter controller is capable of driving two plotters at the same rate. For the basic plotter driver model, connectors J100 and J101 are wired in parallel, thus producing identical plot data on two plotters. The plotters must be of the same series when utilizing this feature.

The relay driver circuit card (Part No. 10166-502-11) location in the Basic Plotter Driver Module is as follows:

Plotter Series	Board Location
500	J7
700 or CRT	J8

For the dual-channel model, the two channels may be driven in parallel (identical data on each channel) or interlaced (alternate characters on each channel). For the latter feature, channel A corresponds to the J100 connector and channel B the J101 connector. The relay driver card locations in the multiplex plotter driver module are as follows:

Channel A	Channel B	Board Location
500	500	J5 and J6
700	700	J7 and J8
700	500	J6 and J7

In the dual-channel mode, the maximum plot rate is restricted by the speed of the slower plotter. The faster plotter must be connected to channel A.

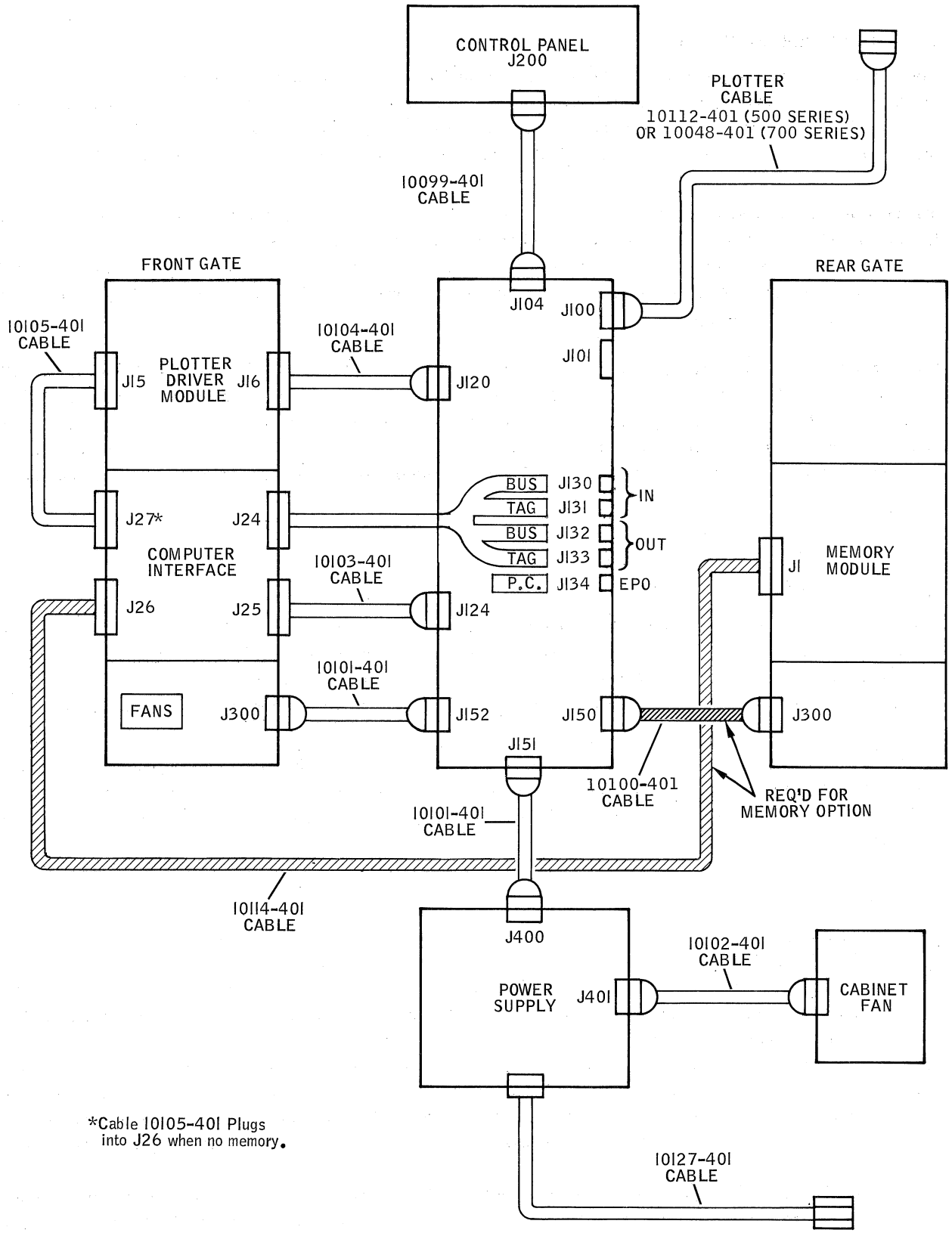


FIGURE 2-1
Controller Cable Connections

2.3.2 COMPUTER CONNECTION

Connect the computer signal cables, IBM Part No. 5353920, between the plotter controller and the computer bus and tag lines which may be made directly available at the central processing unit (CPU) or through intervening peripheral devices. Make sure the light colored end of the BUS signal cable mates with the dark BUS IN connector (J130), and the light colored end of the TAG-signal cable mates with the dark colored TAG IN connector (J131).

The next peripheral device is then connected to the plotter controller through the BUS OUT (J132) and TAG OUT (J133) connectors. Ensure that the dark colored end of the signal cables mate with the light colored connectors (J132 and J133). Clamp the four signal cables with the clamps provided. In the event that the plotter controller is the end device, two IBM supplied line terminators are required. The BUS terminator is plugged into J132 and the TAG terminator is plugged into J133.

Connect the Emergency Power Cable, IBM Part No. 5351178 (or CalComp Part No. 10132-401) from the CPU to connector J134 on the plotter controller. Make sure the shield lugs are mated to chassis ground on both the CPU and plotter controller. Whenever the Emergency Power Cable is disconnected, the CPU requires a terminating connector (shorting plug) to bypass the plotter controller power turn-on sequencing. The plotter controller also requires a terminating connector, Part No. 11455-203, if the power is to be turned on or off independent of computer control.

2.3.3 208-VAC SOURCE CONNECTION

Connect the female end of the power cable, Part No. 10127-401, to the power supply twist-lock receptacle J403. The power source end is terminated in a Russel and Stoll connector, Part No. 3720. The mate to this connector is a Russel and Stoll receptacle, Part No. 3743. In the event that the connector is not compatible with the customer's electrical power distribution requirements, it may be necessary to rewire, using a suitable connector.

The plotter controller requires approximately 400-volt amperes from the 208 vac, single-phase, 60 Hz source. It may be modified to operate on 230 vac, 50 Hz as shown in Drawing No. 10059-101. In the event that the system is desired to operate on 115 vac or 230 vac, 60 Hz, the difference in wiring of the power supply is tabulated by Drawing No. 10401-502.

2.4 ADDRESS MODIFICATION

The plotter controller address and echo address are hard-wired on the address selection card (Part No. 10344-502) in card slot J18 of the computer interface module. Normally, the plotter controller is shipped from the factory with the address selection card prewired with an address of all ones (address FF). The echo address, which must be the same as the plotter controller address, is also prewired for all ones. If desired, the plotter controller address may be changed to any 1 of 256 possible addresses by selectively soldering bus wires in appropriate locations on the address selection card for both the plotter controller address and the echo address. Figure 2-2 shows the portion of the card containing the address jumpering with the prewired address of FF.

Both the plotter controller address and the echo address wiring are contained on this circuit board. The wiring of both addresses must be the same. The left half of the board (pin A half) contains the wiring for decoding plotter controller address received from the computer while the right half of the board (pin Y half) contains the wiring for the echo address returned to the computer.

As shown in Figure 2-2, both the plotter controller address and the echo address each consist of a total of nine bits. Each address is made up of two 4-bit hexadecimal characters plus a parity bit. The 0 and 4 bits are the most significant bits of the first and second characters, respectively while the 3 and 7 bits are the least significant bits. Bit P of each address is the parity bit generated over the other 8 bits of the address. The 9-bit address utilizes odd parity; i.e., if bits 0 through 7 contain an odd number of one bits, the P bit will be a zero – if bits 0 through 7 contain an even number of one bits, the P bit will be a one. Table 2-2 shows the bit pattern of the standard hexadecimal characters used for addresses. The relations of the address bit positions are shown over each column.

TABLE 2-2
Hexadecimal Character Address Coding

Hexadecimal Character	Binary Address 0 1 2 3 - 1st character 4 5 6 7 - 2nd character
0	0 0 0 0
1	0 0 0 1
2	0 0 1 0
3	0 0 1 1
4	0 1 0 0
5	0 1 0 1
6	0 1 1 0
7	0 1 1 1
8	1 0 0 0
9	1 0 0 1
A	1 0 1 0
B	1 0 1 1
C	1 1 0 0
D	1 1 0 1
E	1 1 1 0
F	1 1 1 1

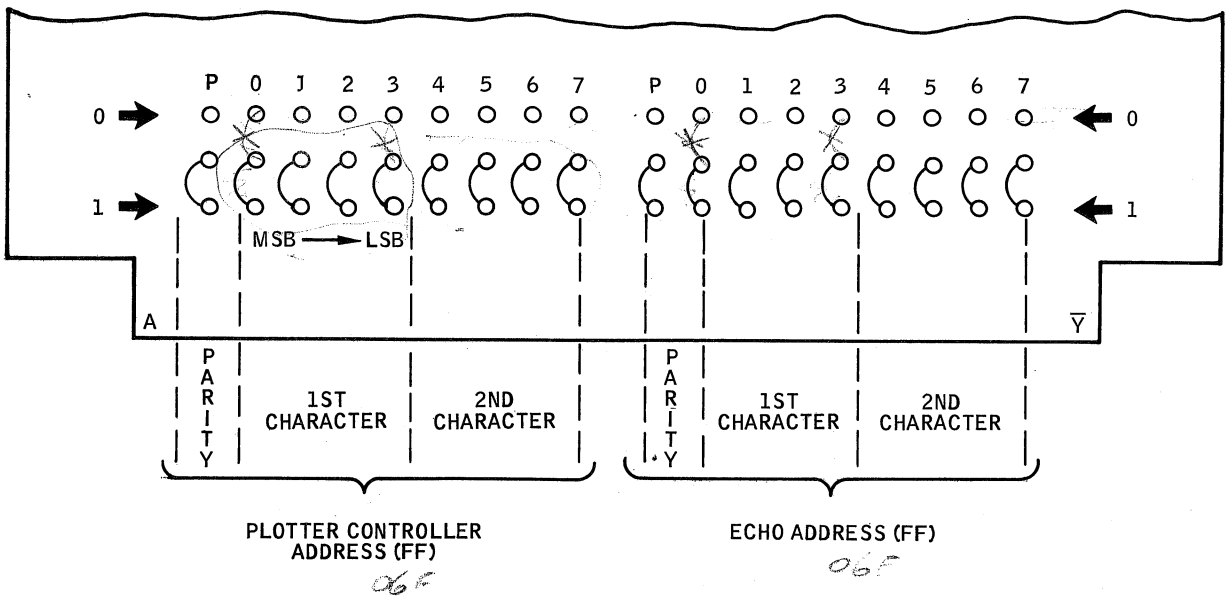


FIGURE 2-2
Address Selection Board Wiring

Each bit position on the address selection board must have a jumper either in the 1 or 0 position, but not both. The jumpers are made using 24-gauge tinned bus wire, soldered in place. Since both the plotter controller address and the echo address must be the same, both halves of the board are jumpered identically.

2.5 DEVICE PRIORITY SELECTION

The computer select out and select in lines provide the computer loop which enables the computer output channel to interrogate each control unit in a priority sequence. The select out line logically connects the CPU to the device with the highest priority and then serially to subsequent devices in descending order. The select in line logically connects the CPU to the device with the lowest priority and then serially to subsequent devices in an ascending order.

The plotter controller contains the option of connecting to either the select in or select out line. As shipped from the factory, the plotter controller is wired for low priority; however, it may be rewired for high priority if desired. This is accomplished by transferring three bus wires on the cable assembly connected to the circuit card in slot J24 of the computer interface module card cage. Figure 2-3 shows the wiring of these three bus wires for both the low and high priority connections.

FIGURE 2-3
Device Priority Selection

2.6 CIRCUIT CARD TYPES AND LOCATIONS

The types and locations of the circuit cards used in the plotter controller are tabulated in the following Tables 2-3 through 2-7.

TABLE 2-3
Computer Interface Module Circuit Card Complement

Part Number	Card Description	Location
10156-502	Flip-Flop/Logic	J1, J2, J3, J4, J5, J8, J9, J13, J15
10092-502	NAND/NOR Gate	J6, J17
10302-502	Complementary Driver	J7, J10, J14, J16
10130-502-11	Crystal Clock	J12
10344-502	Address Selection	J18
10342-502	360 Driver/Receiver	J18, J20, J21, J22
10328-502	Test Switches	J23

TABLE 2-4
Basic Plotter Driver Module Circuit Card Complement

Part Number	Card Description	Location
10160-502	Flip-Flop	J5*
10156-502	Flip-Flop/Logic	J6*, J9, J10, J14
10092-502	NAND/NOR Gate	J11
10329-502	Plot Rate Oscillator	J12
10166-502-11	Relay Driver	See Paragraph 2.3.1
10328-502	Test Switches	J13

*Required if no core buffer is used.

TABLE 2-5
Multiplex Plotter Driver Module Circuit Card Complement

Part Number	Card Description	Location
10156-502	Flip-Flop/Logic	J3, J4, J10*, J13
10160-502	Flip-Flop	J9*
10092-502	NAND/NOR Gate	J14
10329-502	Plot Rate Oscillator	J11
10166-502-11	Relay Driver	See Paragraph 2.3.1
10328-502	Test Switches	J12

*Required if no core buffer is used.

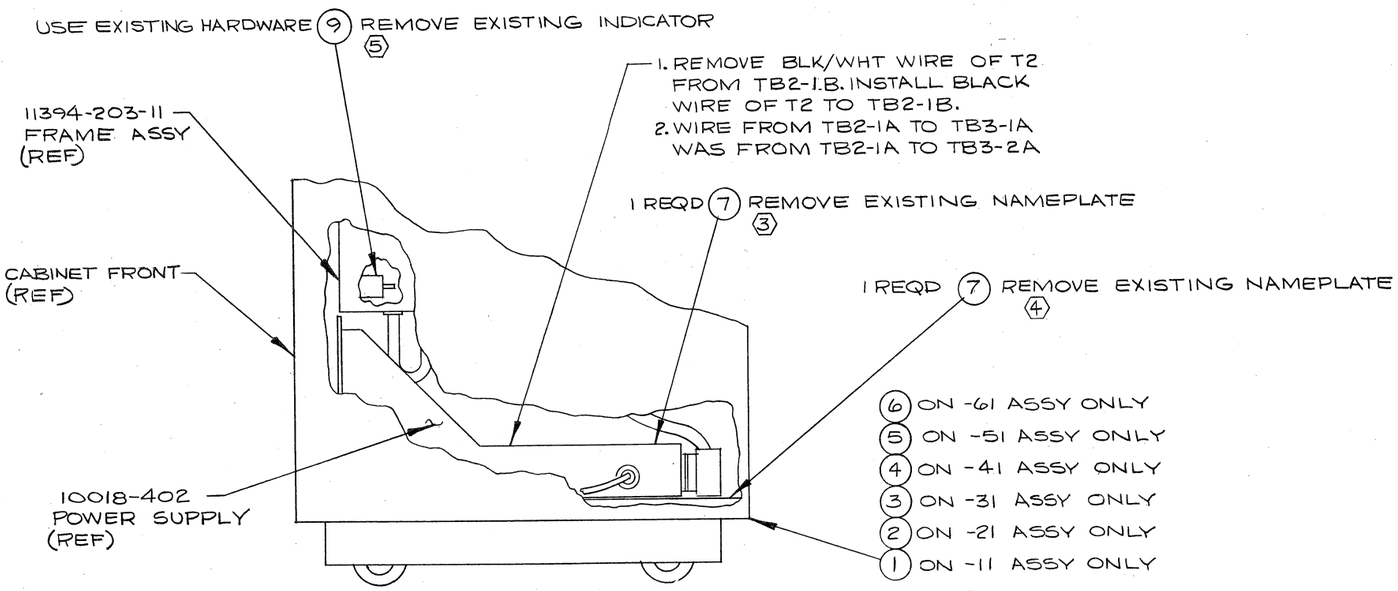
TABLE 2-6
Optional Core Memory Module Circuit Card Complement

Part Number	Card Description	Location
10302-502	Complementary Driver	J6, J7
10130-502-11	Crystal Clock (1 mHz)	J22
10160-502	Flip-Flop	J25
10156-502	Flip-Flop/Logic	J23, J24, J26, J27
	Memory Core Stack	J9 and J11
10306-502	Memory Driver Resistor	J13
10334-502	Memory Pulse Generator	J5
10092-502	NAND/NOR Gate	J4, J15
10264-502	N Core Driver	J14, J17, J20
10262-502	P Core Driver	J16, J18, J19, J21
10271-502	Sense Amplifier	J8
10328-502	Test Switches	J3

TABLE 2-7
Power Supply Circuit Card Complement

Part Number	Card Description	Location
10360-502-11	Regulator Assembly	J3
10176-502-11	Regulator +18, +8, -8	J4
10358-502-11	Transistor Assembly	J2, J5, J6

REVISIONS				
SYM	ZONE	DESCRIPTION		DATE & APPROVAL
		[1] MAY BE REWORKED [2] CANNOT BE REWORKED [3] NONE	DISPOS	CLASS



RIGHT-HAND VIEW

⟨1⟩	9	1	1	1	1	1	1	ED7212-001	ELAPSED TIME IND.		⟨2⟩	COML	
	7	2	2	2	2	2	2	10084-203	NAMEPLATE				
	6	1						-15	CONTROLLER	MAKE FROM 10047-101-61 (4K MEMORY)			
	5		1					-13	CONTROLLER	MAKE FROM 10047-101-51 (4K MEMORY)			
	4			1				-9	CONTROLLER	MAKE FROM 10047-101-41 (2K MEMORY)			
	3				1			-7	CONTROLLER	MAKE FROM 10047-101-31 (2K MEMORY)			
	2					1		-5	CONTROLLER	MAKE FROM 10047-101-21			
	1						1	-3	CONTROLLER	MAKE FROM 10047-101-11			
	ITEM NO.	-61 REQD ASSY	-51 REQD ASSY	-41 REQD ASSY	-31 REQD ASSY	-21 REQD ASSY	-11 REQD ASSY	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION			ZONE

LIST OF MATERIAL OR PARTS LIST

⟨5⟩ 5. TAG WIRES REMOVED FROM 60 CYCLE INDICATOR & INSTALL ON 50 CYCLE

⟨4⟩ 4. TYPEWRITER IMPRESSION STAMP PER CCP SPEC A0104-001, PART NO: 10059-101, MODEL: 110, SERIAL NO____, VOLTS: 230 VAC, AMPS: 2, CYCLES: 50, PHASE: 1

⟨3⟩ 3. TYPEWRITER IMPRESSION STAMP PER CCP SPEC A0104-001, PART NO: 10018-402, MODEL:___, SERIAL NO___, VOLTS: 230 VAC, AMPS: 2 CYCLES: 50, PHASE: 1

⟨2⟩ 2. 120 VOLTS, 50 CYCLE, HOURS & TENTHS

⟨1⟩ 1. HAYDON DIV., GEN. TIME CORP., TORRINGTON, CONN.

NOTE: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED			
DIMENSIONS ARE IN INCHES TOLERANCES ON			
DECIMALS	ANGLES		
.XX ± .03	± 0° 30'		
.XXX ± .010			
DRILLED HOLES			
.040	TO .1285: +.002, —.001		
.136	TO .228: +.003, —.001		
.234	TO .500: +.004, —.001		
.515	TO .750: +.005, —.001		
.765	TO 1.000: +.007, —.001		
1.015	TO 2.000: +.010, —.001		

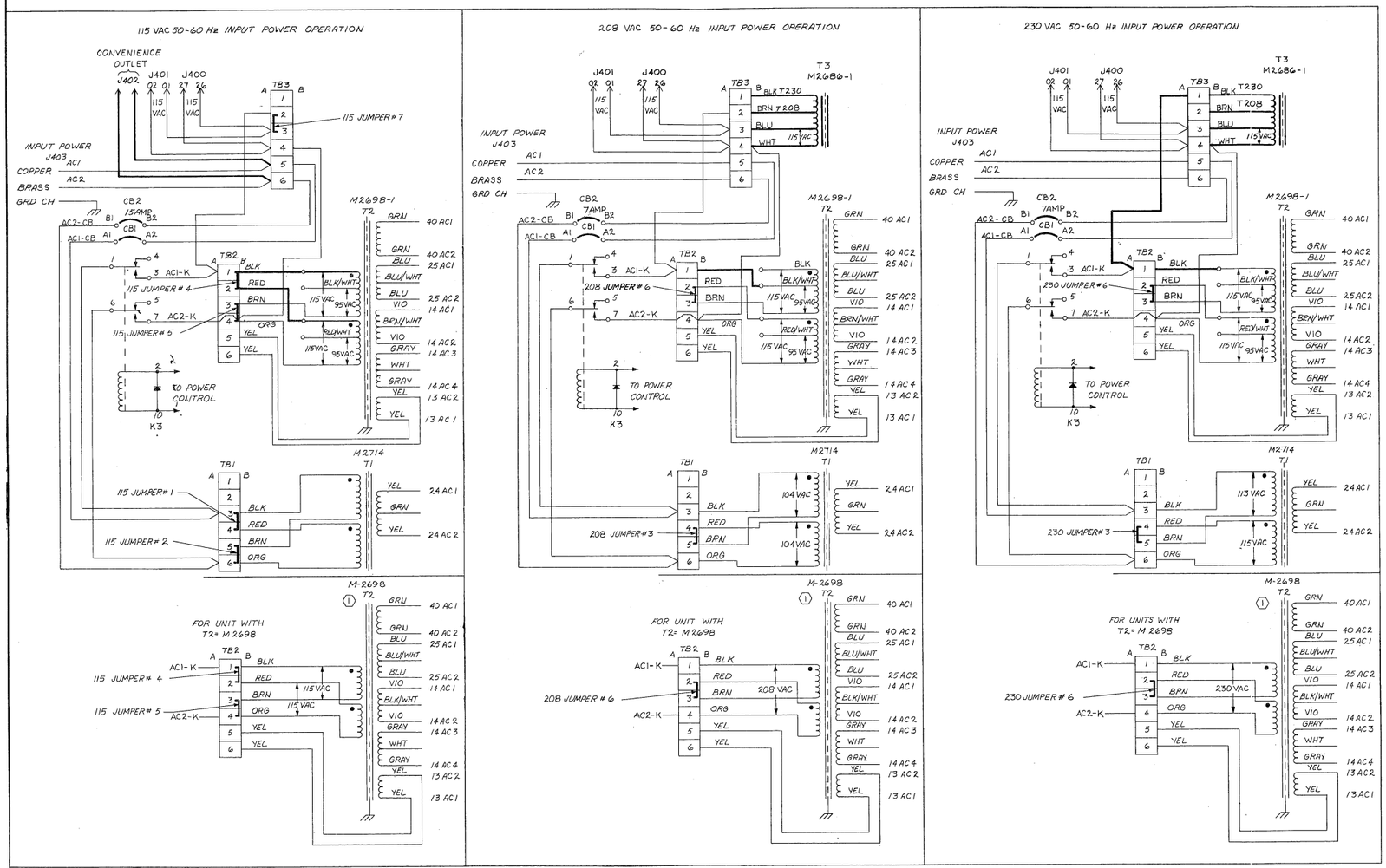
DRAWN	J. JOHNSON	4-20-66
CHECK	T.E. Woolley	5-12-66
APPD	[signature]	5-19-66
APPD	N.S. Nicholas	5-21-66
FINISH		
HEAT TREAT		
SURFACE ROUGHNESS PER MIL-STD-10	✓	

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

110 CONTROLLER— 50 CYCLE

SCALE:	SIZE	
1/4	C	10059-101
DO NOT SCALE THIS DRAWING	WEIGHT	SHEET

ISSUED	REVISIONS			
SYM	ZONE	DESCRIPTION		DATE & APPROVAL
		1 MAY BE REWORKED 2 CANNOT BE REWORKED 3 NONE	ECO-# / DWG REV	
A		1. ON T2, SECONDARY WINDING, WIRE BRN/WHT WAS BLK/WHT (TYP 3 PLACES)	3	6-6-66
		2. WIDENED LINE BETWEEN TB2-A1 & TB3-A1 IN 230 VAC CIRCUIT	3	
		3. ADDED G/N 12 EFFECT ON: NONE	3	



12. REF WIRE LIST NO. WL10018-402.
11. FOR T1, 208 VAC CONNECTION IS THE SAME AS 230 VAC
10. BOLD LINES ARE AFFECTED CHANGES
9. USE FIELD MODIFICATION TAG (11495-203) DENOTING INPUT POWER CHANGES IF ANY

8. FOR S/N 0026 AND SUBSEQUENT UNITS T2 IS 2698-1 (UNUSED PRIMARY TAP IS - SLEEVED AND SPOT TIED IN XMFR WIRE BUNDLE)
7. (1) FOR SERIAL NOS. P001, P002, 001 TO 0025, T2 TRANSFORMER IS M2698. (NO 95 VAC TAP IN PRIMARY WINDINGS.) 230 VAC TAP USED ON 208VAC/230VAC INPUT PWR.
6. FOR 50 Hz OPERATION, M1 OU CONTROLLER (FRONT GATE) SHALL BE CHANGED FROM 60 TO 50 Hz
5. POWER SUPPLIES ARE WIRED AS FOLLOWS
   BASIC 115 VAC INPUT POWER
   -11 208VAC " "
4. T3 (AUTO TRANSFORMER) IS INSTALLED AND WIRED IF INPUT POWER IS NOT 115 VAC
3. J402 (CONVENIENCE OUTLET) IS INSTALLED AND WIRED FOR 115 VAC ONLY
2. TRANSFORMERS USED ARE FOR 50-60 Hz OPERATION
1. INPUT POWER OPTIONS ARE APPLICABLE ON ALL 10048-502 POWER SUPPLIES

NOTE: UNLESS OTHERWISE SPECIFIED

REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION	ZONE
1	10401-502			
		LIST OF MATERIAL OR PARTS LIST		

UNLESS OTHERWISE SPECIFIED	DRAWN RT Blackburn	4-15-66
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS XX ± .03 XXX ± .010 ANGLES ± 0° 30'	CHECK	4-18-66
	APPD M Nishioka	4-25-66
	APPD	4-25-66
FINISH		
DRILLED HOLES .040 TO .128 +.002,-.001; .136 TO .228 +.003,-.001; .234 TO .500 +.004,-.001; .515 TO .750 +.005,-.001; .765 TO 1.000 +.007,-.001; 1.015 TO 2.000 +.010,-.001		
HEAT TREAT		
SURFACE ROUGHNESS PER MIL-STD-10 ✓		

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

TAB. OF INPUT PWR. CONN. FOR PLOTTER CONT. P.S. PART NO. 10018-402

SCALE:	SIZE	
NONE	F	10401-502
DO NOT SCALE THIS DRAWING	WEIGHT	SHEET

SECTION 3
OPERATION

3.1 GENERAL

The plotter controller indicators and controls are divided into three main areas: the normal operating controls, the power controls, and the test controls. Since the plotter controller normally operates automatically under computer control, the operating procedures consist essentially of selecting the desired address and priority and presetting the various controls.

This section describes the function of the normal operating controls and indicators, the test controls, the power controls, and the pre-operational setup procedure.

3.2 CONTROL PANEL SWITCHES AND INDICATORS

The normal operating controls and indicators located on the control panel permit interruption of the computer program, resetting of the plotter controller, and visual indications of the plotter controller operational status. Figure 3-1 shows these controls and indicators and their designations. The individual controls are described in detail in the following paragraphs.

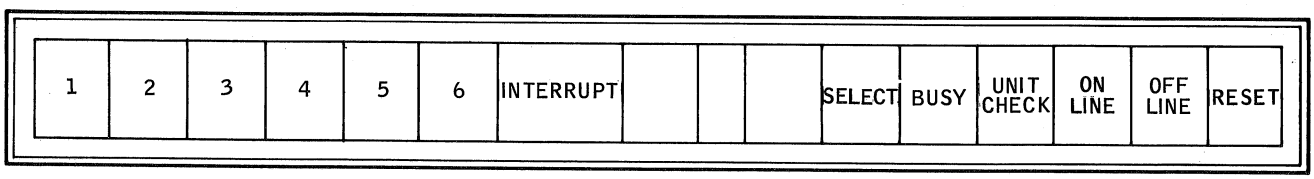


FIGURE 3-1
110 Control Panel

3.2.1 RESET INDICATOR-SWITCH

The RESET indicator-switch provides manual control of the plotter controller master reset function. Depressing this switch terminates a plotting operation and initializes the equipment for accepting new data from the computer. This switch is normally used prior to the start of a plotting operation to reset the circuits to the start condition. It can also be used during a plotting operation to perform the "stop" function which terminates the plot in progress.

3.2.2 OFF-LINE INDICATOR

The OFF-LINE indicator is controlled by a channel control signal and a flip-flop which, in turn, is 1-set and 0-set by the ON-LINE/OFF-LINE toggle switch located on the computer interface module test panel. When the switch is in the OFF-LINE position, the flip-flop is 0-set at the time the channel control signal (clock-out) goes true indicating the computer "halt" or "wait" status. This turns on the indicator to provide a visual indication that the plotter controller is electrically disconnected from the computer channel. The off-line condition is used primarily for maintenance and checkout of the equipment.

NOTE

The plotter controller is not actually disconnected from the computer channel until the computer is in the "halt" or "wait" status.

3.2.3 ON-LINE INDICATOR

The ON-LINE indicator operates in the same manner as the OFF-LINE indicator except it is only on when the ON-LINE/OFF-LINE switch is in the ON-LINE position and the computer is in the "halt" or "wait" status. This control provides a visual indication that the plotter controller is electrically connected to the computer channel.

3.2.4 SELECT INDICATOR

This indicator is on whenever a communication between the computer channel and the plotter controller is in progress. The indicator is automatically turned off when the interchange is terminated. Normally, the indicator will only be on during the burst mode of operation; data transfer in the byte mode occurs too fast for the indicator to respond. The indicator is automatically turned off when the interchange between the plotter controller and the computer channel is terminated.

3.2.5 BUSY INDICATOR

The BUSY indicator turns on during the actual plotting operation and/or when one of the four outstanding status indications waiting to be transmitted to the computer channel is present. The indicator is turned off after the computer channel has accepted the status byte. The outstanding status conditions include one or more of the following conditions:

a. manual interrupt
b. device end
c. channel end
d. unit check (malfunction or not ready)

3.2.6 UNIT CHECK INDICATOR

The UNIT CHECK indicator turns on when a malfunction occurs. When the computer channel requests status information from the plotter controller either during the initial selection sequence or at the end of a plotting operation prior to the transfer of new data, a sense byte is sent to the channel to indicate the plotter controller status. If this indicator is on at either of these times, the sense byte will indicate one of the following conditions:

a. plotter not ready (700 series or 835 plotters)
b. bus out parity error during the data transfer
c. core buffer parity error (when utilizing optional memory)
d. overrun (channel did not respond in time to service the plotter controller – 700 series plotters and unbuffered basic plotter controller only)
e. plotter low on paper (optional feature)
f. plotter limit switch actuated (optional feature)

3.2.7 INTERRUPT INDICATOR-SWITCH

The INTERRUPT indicator-switch is used to flag the program to interrogate the sense switches. Depressing this switch causes the indicator to turn on and establishes the manual interrupt status byte. At the end of the

data transfer, the program causes the computer channel to send out a sense byte 2 command. The plotter controller responds by sending back the status of the six sense switches. The indicator turns off when the status byte is accepted by the computer channel.

NOTE

Each time the sense switches are changed, the INTERRUPT switch must be depressed to enter the interrupt into the computer program.

3.2.8 SENSE SWITCHES

The six alternate-action sense switches, numbered "1" through "6", provide optional program interruptions that can be individually assigned to the switches by the programmer. Depressing the switch activates it and turns the indicator on; depressing it again turns the switch and indicator off.

NOTE

The status of the sense switches can not be changed after the INTERRUPT switch has been depressed. The switches can only be changed after the computer has accepted the sense bit (signified by INTERRUPT indicator turning off.)

These six switches are used in conjunction with the INTERRUPT switch to inform the computer of the operational status or to identify plotting modes. The function of the switches can be changed at the programmer's option. Typical program provisions for the sense switches include such functions as:

a. single plot – stop after finishing the plot in progress (used for changing pens, adding ink, replenishing plotter paper, etc.)

b. multiple plot – plot until end of data or until otherwise instructed

c. repeat last plot – replot the last data record

d. change scale – change the scale factor of the data to be plotted to a new value as designated by the program

3.3 POWER CONTROLS

The plotter controller power controls are located on the power supply front panel in the bottom module of the cabinet. These controls include a circuit breaker, POWER ON indicator, a POWER ON pushbutton switch, a POWER OFF pushbutton switch, and a POWER CONTROL switch. Normally, the Plotter Controller power on-off function is controlled by the computer power on-off control. Power turn-on in this case consists of placing the circuit breaker in the on (up) position, the POWER CONTROL switch in the REMOTE position, and turning the computer power on.

The plotter controller POWER ON and OFF switches provide local power on-off control for maintenance and test purposes when either the computer power is turned off or the plotter controller is disconnected from the computer channel. To enable these two switches, the POWER CONTROL switch must be in the LOCAL position. When the computer power is off and the plotter controller is operating under local power control, the computer emergency power off (EPO) switch still has master power on-off control of the plotter controller. The computer EPO switch is connected between pins 1 and 2 of the plotter controller power connector.

When the plotter controller is physically disconnected from the computer channel, the POWER CONTROL switch must be in the LOCAL position to operate the plotter controller. In addition, the jumper connector (Part No. 11455-203) included with the loose equipment must be plugged into connector J134 on the connector panel.

NOTE

When the plotter controller is not being used during an operation (power disconnected or circuit breaker in OFF position), the POWER CONTROL switch must be placed in the LOCAL position to enable the computer power turn-on sequencing function.

3.4 PRE-OPERATIONAL SETUP

Since the plotter controller operates automatically under computer control, the operating procedures for the plotter controller consist essentially of performing the pre-operational setup and making sure the associated plotter is ready for operation (refer to the applicable plotter instruction manual for plotter setup procedures). The plotter controller pre-operational setup procedure is as follows:

a. Check the cable connections between the plotter controller and plotter and the plotter controller and computer (refer to intercabling diagram of Figure 2-1).

b. If a 700 series plotter is connected to the plotter controller, plug the plotter power cord into a 115 vac, single-phase, 60 Hz power source.

NOTE

The 500 series plotter obtains its power from the plotter controller through the interconnecting cable.

c. Place the POWER CONTROL switch on the power supply front panel in the REMOTE position and turn the circuit breaker on (up position).

d. Place the ON LINE/OFF LINE switch on the computer interface module test panel in the ON LINE position. Set the CLOCK switch on this same panel in the DYN position.

e. Set the SINGLE CYCLE/NORMAL switch on the plotter driver module test panel to the NORMAL position. Place the SPEED switch on this panel to the position corresponding to the plotter speed (see Table 3-1). When the optional multiplexer plotter driver module is substituted for basic plotter driver module, set the A SPEED switch to the speed of the plotter connected to channel A and the B SPEED switch to the speed of the plotter connected to channel B. The faster plotter must be connected to channel A. For plotter multiplex operation, the MULTIPLEX switch also located on this panel must be set for the desired type of plotter operation; i.e., channel A plotter only (A), channel B plotter only (B), both plotters in parallel (A+B), or multiplex plotter operation (MPX).

f. Place the PEN DELAY switch on the plotter driver module test panel in the required position. Usually, this is the NORM position. The REV position is used for certain liquid ink pens used with some plotter models (refer to applicable plotter instruction manual to determine correct setting of this switch). The OFF position is only used when the pen delays are incorporated in the program or when driving an 835 CRT plotter.

g. Place the three toggle switches on the optional memory module test panel in the down position.

TABLE 3-1
SPEED Switch Settings

Switch Position	Plotter Speed (steps/sec.)	CalComp Plotter Models
1	200	560, 563
2	300	502, 564, 565, 566
3	350	763
4	450	765
5	100,000	835

h. Make sure the relay driver circuit card (Part No. 10166-502-11) is inserted in the correct circuit card slot in the plotter driver module. Refer to Paragraph 2.3.1 of Section 2 for proper location of this card.

i. Depress the POWER ON/OFF switch on the control panel – indicator turns on.

j. Turn the associated plotter power on by placing the plotter POWER switch in the STANDBY position for 700 series plotters and in the ON position for 500 series plotters.

k. Position the pen carriage to the origin point of the plot using the plotter carriage and drum manual controls.

l. Place the plotter POWER switch in the RUN position (700 series plotters only).

m. Momentarily depress the RESET switch on the plotter controller (indicator momentarily turns on).

n. Depress the required sense switches on the control panel as specified by the program (indicator portion of depressed switches turn on).

o. Depress the INTERRUPT switch on the control panel to enter the activated sense switches into the computer program.

The plotter controller is now fully operational. Upon being selected by the computer channel, the plotting operation is automatically initiated.

3.5 TEST CONTROLS

The plotter controller includes built-in test controls to enable static testing of the equipment off-line. Each module of the plotter controller (computer interface, memory, and plotter driver) contains a test panel at one end of the module card cage. These panels contain the controls, indicators, and monitoring facilities for individually performing static tests of the various flip-flops, one-shot multivibrators, and major control functions associated with the module. The power supply module also contains test jacks for monitoring the various dc voltage levels. Each of the module test panels are described in detail in the following paragraphs.

3.5.1 COMPUTER INTERFACE MODULE TEST PANEL

The computer interface module test panel shown in Figure 3-2 contains the controls and indicators for individually 1-setting and 0-setting the flip-flops associated with the computer interface portion of the equipment. These functions are contained on the circuit cards located in the card cage to the left of the test controls associated with the computer interface module. This panel also contains the plotter controller test switch and the clock control switch. The function of each of these controls are described individually in the following paragraphs.

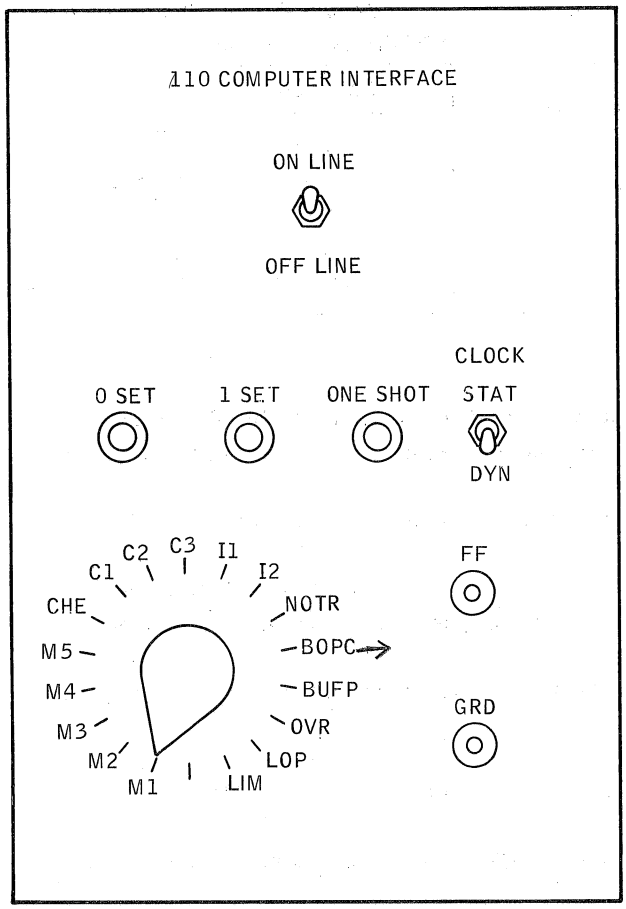
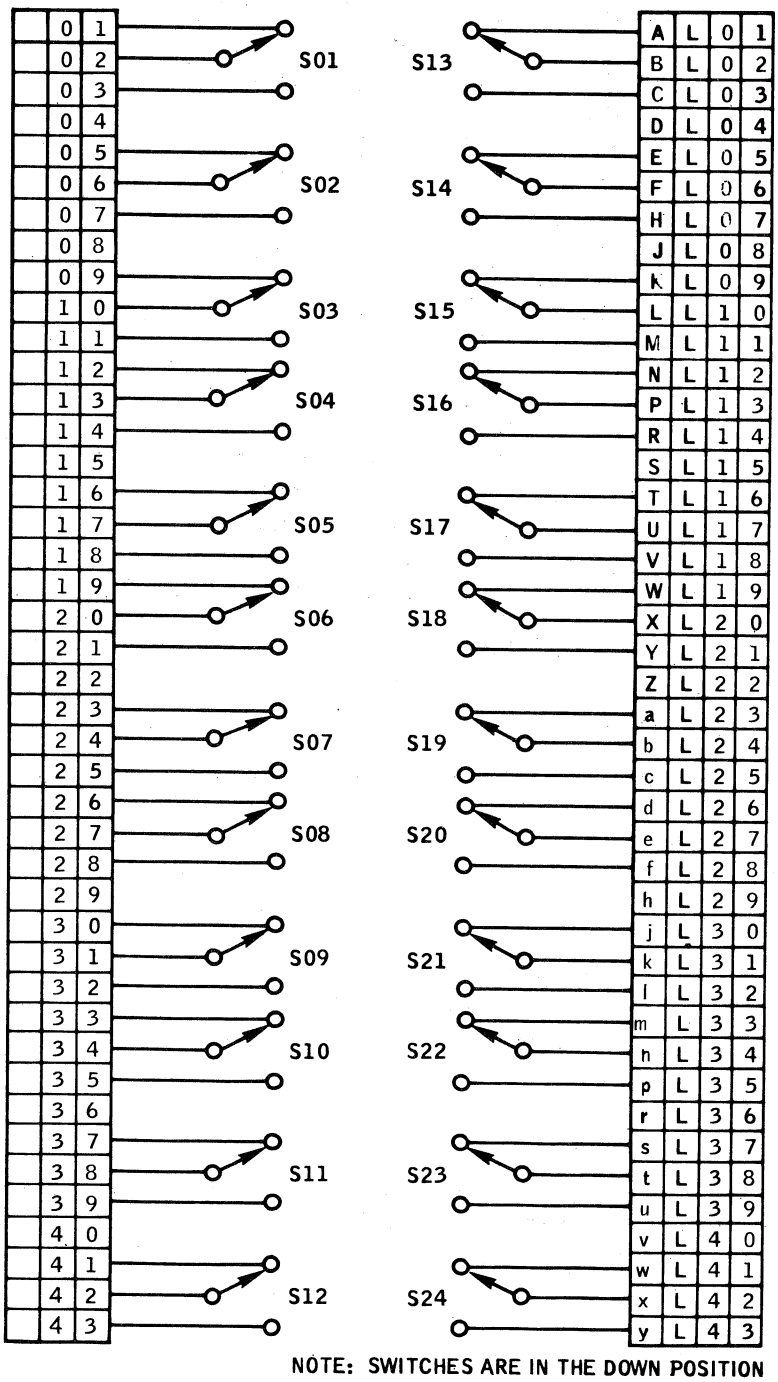


FIGURE 3-2
Computer Interface Module Test Panel

A test switch card containing 24 toggle switches is also provided for simulating inputs to the plotter controller bus-out line receivers and the various interface control line receivers. By plugging this card into card slot J23 of the interface card cage when the plotter controller is in the off-line status, the outputs of the switches are connected to the dc inputs of the receivers. A schematic diagram of this card is shown in Figure 3-3. Switches S01 through S09 control the test inputs to the nine bus-out line receivers while switches S13 through S19 control the test inputs to the tag out line receivers from the computer channel. The specific receiver controlled by each switch is tabulated in Table 3-2. The other switches on this card are not used for this test function.

With these switches, a specific plot command and the required raising and lowering of the channel interface control lines can be simulated at the receiver outputs. Then by means of the single-clock stepping test function, the plot command can be manually stepped through the plotter controller out to the plotter one clock pulse at a time. When a memory is included, the simulated data is loaded into the memory. A "start plot" command is required to output the data stored in memory to the plotter. These tests can also be performed with a dynamic clock.



NOTE: SWITCHES ARE IN THE DOWN POSITION

FIGURE 3-3
Test Switch Card Schematic Diagram

TABLE 3-2

Test Switch Assignments (Interface Module)

Switch No.	Line Receiver
S01	BOP (parity bit)
S02	B00 (data bit 1)
S03	B01 (data bit 2)
S04	B02 (data bit 3)
S05	B03 (data bit 4)
S06	B04 (data bit 5)
S07	B05 (data bit 6)
S08	B06 (data bit 7)
S09	B07 (data bit 8)
S10-S12	Not Used
S13	ADD (address out control line)
S14	COM (command out control line)
S15	SERV (service out control line)
S16	OPR (operational out control line)
S17	HLD (hold out control line)
S18	SUP (suppress out control line)
S19	SEL (select control line)

3.5.1.1 ON LINE/OFF LINE Switch

This switch permits the plotter controller to be electrically disconnected from the computer channel for maintenance and checkout purposes. The ON LINE position is used for normal operation. Placing the switch in the OFF LINE position 0-sets a flip-flop which causes the plotter controller to be electrically disconnected from the computer channel.

NOTE

The plotter controller is not actually disconnected from the channel until the computer is in the "halt" or "wait" mode.

3.5.1.2 CLOCK Switch

The CLOCK switch permits single clock stepping of the plotter controller clock by means of the associated ONE-SHOT switch. The normal operating position of this switch is the DYNAMIC position. Placing the switch in the STATIC position disables the normal free running input to the clock circuit and connects the output of the associated ONE-SHOT switch to the clock circuit input.

3.5.1.3 ONE-SHOT Switch

This switch is used in conjunction with the CLOCK switch to permit single clock stepping of the plotter controller clock. Each time this switch is depressed when the associated CLOCK switch is in the STATIC position, a single plotter controller clock pulse is generated. In this manner, the plotter controller can be stepped through an operation, one clock pulse at a time.

3.5.1.4 Flip-Flop Select Switch

This 18 position rotary switch enables selection of a specific flip-flop for either static testing or monitoring. The 1-set output of the selected flip-flop is connected to the indicator of the associated 1-SET pushbutton switch and the FF test jack. The outputs from the associated 1-SET and 0-SET pushbutton switches are connected to the dc inputs of the selected flip-flop. This permits the selected flip-flop to be manually 1-set and 0-set for static testing. When the 1-set output of the selected flip-flop is true, the indicator portion of the 1-SET pushbutton switch will be on.

Switch positions are provided for the mode control flip-flops (M1-M4), the channel end flip-flop (CHE), the command code register flip-flops (C1-C3), the manual interrupt register flip-flops (I1-I2), and the basic sense register flip-flops (NOTR, BOPC, BUFP, OVR, LOP, and LIM).

3.5.1.5 1-SET Indicator-Switch

This pushbutton indicator-switch is connected to the 1-set dc input of the flip-flop selected by the associated flip-flop select switch described in the preceding paragraph. Depressing this switch 1-sets the selected flip-flop causing the indicator portion of the switch to turn on.

3.5.1.6 0-SET Switch

The 0-SET pushbutton switch operates in a similar manner to the 1-SET pushbutton switch except the output of this switch is connected to the 0-set dc input of the selected flip-flop. Depressing this switch 0-sets the selected flip-flop.

3.5.1.7 Test Jacks

Two test jacks are also provided on the test panel. The FF test jack is connected to the 1-set output of the flip-flop select rotary switch. This provides a convenient point for monitoring the 1-set output of the selected flip-flop. The GRD test jack provides a convenient equipment ground point.

3.5.2 MEMORY MODULE TEST PANEL

The memory module test panel shown in Figure 3-4 contains the controls and indicators for static testing of the memory module of the plotter controller. The functions associated with these controls are located on the circuit cards in the card cage to the right of the test panel. The controls and associated test functions are individually described in the following paragraphs.

In addition to the various test controls, the test switch card provided with the equipment can be plugged into card slot J03 to enable simultation of data inputs into the memory and the output data register drivers. A schematic diagram of this card is shown in Figure 3-3.

NOTE

When using this test switch card, the interface connector card (J01) should be disconnected.

The top six switches of each column (S01-S06 and S13-S18) control the manual 1-set and 0-set inputs to the output data register drivers. Switches S01-S06 generate the 1-set signal while switches S13-S18 generate the 0-set signal. These switches are used as momentary action switches; i.e., moving the switch to the up position

and returning to the down position. In the up position, the switch is closed, connecting the signal to the flip-flop input; the down position is the open condition. The top two switches (S01 and S13) correspond to the output data register driver most significant bit (DR7) while the bottom two switches (S06 and S18) correspond to the least significant bit (DR1). The clock bit driver (DR4) is not included.

The bottom 12 switches control the simulation of inputs to the memory locations. In order to simulate data inputs, the left column of switches (S07-S12) must be in the down position. The right column of switches (S19-S24) are used to generate the one and zero bits. The up position corresponds to a one bit while the down position corresponds to a zero bit.

In addition to simulating data inputs to the memory, these 12 switches are also used to perform the read/load test operation. For this test function, both lower columns of switches (S07-S12 and S19-S24) must be in the up position. This enables the output of the memory to be switched out to both the output data register drivers and also back into the memory. As a result, the data stored in memory can be read out into the output data register and at the same time restored back into memory.

3.5.2.1 TEST CONTROL Switch

Selection of either the normal mode or test mode of memory operation is controlled by this switch. In the OFF position, the memory operates in the normal mode and the test panel controls are disabled. In the ON position, the test panel controls are enabled.

NOTE

When performing a memory test operation, the interface connector in card slot J01 must be disconnected.

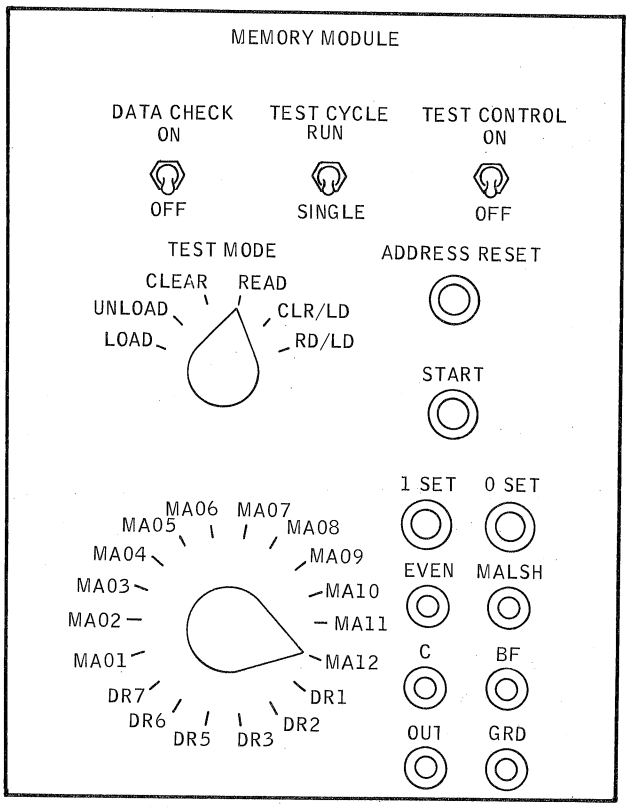


FIGURE 3-4
Memory Module Test Panel

3.5.2.2 TEST CYCLE Switch

The TEST CYCLE switch controls the memory test multivibrator circuit. In the RUN position, the multivibrator operates in a free running mode when the START switch is depressed, enabling the address counter to cycle through a complete count. In the SINGLE position, the switch causes the multivibrator circuit to lockup after generating a single clock pulse when the START switch is depressed.

3.5.2.3 DATA CHECK Switch

The DATA CHECK switch controls the memory test parity check on-off function. In the ON position, the odd output of the parity circuit is connected to the test multivibrator circuit which disables the multivibrator circuit if the character contains an odd number of one bits (parity error). Disabling of the multivibrator causes the address counter to stop at the following memory address. Since the parity is generated over the output of the output data register drivers, this function is only operative when a read or unload operation is performed. For an unload operation, the address counter stops on the following address when a parity error occurs. In the read/load test mode of operation, a parity error inhibits the load portion of the cycle.

3.5.2.4 ADDRESS RESET Switch

This pushbutton switch controls the memory address counter reset function. Depressing this switch resets the address counter to the first memory address. The buffer full signal (BF test jack) is also reset by this switch.

3.5.2.5 TEST MODE Switch

The selection of a specific test mode of operation is controlled by this rotary switch. By placing the switch in the desired test position and depressing the START pushbutton switch, the memory module will cycle through the selected test function. The specific test mode selectable with this switch and the corresponding operations are as follows:

a. LOAD – In this position, the simulated data set up on the test switch card in card slot J03 is loaded into memory when the START switch is depressed. If the TEST CYCLE switch is in the RUN position, all memory addresses are filled with the simulated data. With the TEST CYCLE switch in the SINGLE position, only the selected memory location is loaded. However, the address counter is incremented one count at the completion of the operation due to the characteristic of the load operation.

b. UNLOAD – Placing the switch in the UNLOAD position and depressing the START switch causes the data stored in memory to be unloaded into the output register. Depending upon the position of the TEST CYCLE switch, this operation will be performed for either a single memory address or for all memory addresses. The address is incremented at completion of the unload cycle.

c. CLEAR – Depressing the START switch with the TEST MODE switch in the CLEAR position clears out the data stored in the selected memory location. In this mode of operation, the data is lost and not transferred to the output data register. This test function is operative when the TEST CYCLE switch is in the SINGLE position only. Since the address counter is not automatically incremented after the clear operation, each memory address to be cleared must be manually selected.

d. READ – This switch position is used to perform a read operation of a single memory address location. Depressing the START switch with the TEST MODE switch in this position causes the data stored in the selected memory location to be read out into the output data register. Since the address counter is not automatically incremented, this test function is only operative in the SINGLE mode.

e. CLEAR/LOAD – When the START switch is depressed with the TEST MODE switch in this position, the data stored at a particular location in memory is first cleared out and the simulated data set up on the test switch card is loaded into memory in its place. The address counter is then incremented to the next sequential address upon completion of the load cycle. This test function is operative in both the SINGLE and RUN modes of operation.

f. READ/LOAD – Depressing the START switch with the TEST MODE switch in this position causes the data stored at a selected location in memory to be read out into the output data register. Then the simulated test data set up on the test switch card is loaded into memory in place of the data read out. At the end of the load operation, the address counter is incremented to the next sequential address. This test function can be performed for either a single memory address location or all locations as controlled by the TEST CYCLE switch.

3.5.2.6 Flip-Flop Select Switch

The 18 position, rotary flip-flop select switch enables individual selection of the address counter flip-flops (MA01-MA12) and the output data register drivers for monitoring and test purposes. The 1-set outputs of both the address counter flip-flops and the output register drivers are connected through this switch to the indicator of the associated 1-SET indicator-switch and the OUT test jack for monitoring purposes. When the 1-set output of the selected flip-flop or driver is true, the indicator portion of the switch will be on and a +8.7 volt signal will be present at the OUT test jack.

The associated 1-SET and 0-SET pushbutton switches enable manual 1-setting and 0-setting of the address counter flip-flops. (The output data register drivers are manually controlled with the test switch card.) In addition to static testing of the flip-flops, this function also enables manual selection of desired memory addresses.

3.5.2.7 1-SET Indicator-Switch

The 1-SET pushbutton indicator-switch is connected to the 1-set dc input of the address counter flip-flop selected by the flip-flop select switch. Depressing this switch 1-sets the selected flip-flop. The indicator portion of this switch is connected to the selected address counter flip-flop or output data register driver 1-set output through the flip-flop select switch. When the selected flip-flop or driver 1-set output is true, the indicator will be on.

3.5.2.8 0-SET Switch

The 0-SET pushbutton switch operates in a similar manner to the 1-SET pushbutton switch except the output of the switch is connected to the 0-set dc input of the selected flip-flop. Depressing this switch 0-sets the selected flip-flop.

3.5.2.9 Test Jacks

Several test jacks are provided on the test panel for monitoring various control functions. The output level of these test jacks (with the exception of the GRD jack) is a nominal +8.7 (±1) volts when the associated function is enabled. The specific function of each jack is as follows:

a. C – memory module clock signal

b. BF – buffer full signal

c. EVEN – even output line of the parity flip-flop

d. MALSH* – ANDed 1-set outputs of six least significant address counter flip-flops (MA01-MA06)

e. GRD – ground

The one we have!

3.5.3 PLOTTER DRIVER MODULE TEST PANEL (BASIC UNIT)

The plotter driver test panel shown in Figure 3-5 contains the controls and indicators for static testing of the plotter driver module. Also included on the test panel are the plotter speed selector switch and the pen delay switch. Each of the controls and indicators are described in detail in the following paragraph.

In addition to these test controls, a test switch card is provided with the equipment to enable manual simulation of data input and control lines to the plotter drive module. The test switch card plugs into card slot J13. The individual test switches and corresponding functions are tabulated in Table 3-3.

NOTE

The interface card connector in card slot J15 must be disconnected when static testing of the plotter driver module alone.

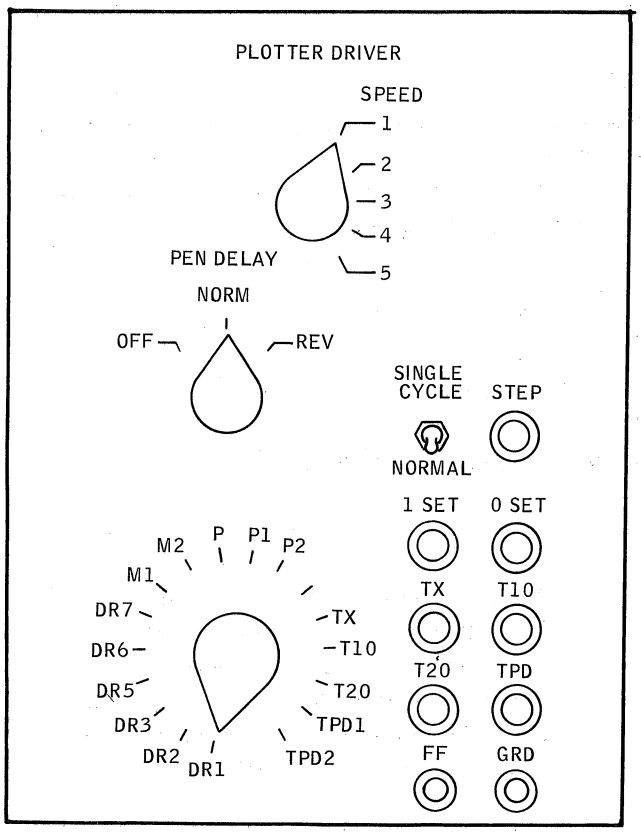


FIGURE 3-5
Plotter Driver Module (Basic) Test Panel

TABLE 3-3
Plotter Driver Test Switch Card Functions

Switch	Function
S01	Data bit 1 interface line
S02	Data bit 2 interface line
S03	Data bit 3 interface line
S04	Not used
S05	Data bit 5 interface line
S06	Data bit 6 interface line
S07	Data bit 7 interface line
S08-S12	Not used
S13	Start interface line
S14	Complete interface line
S15	Clear interface line
S16	Load interface line
S17	Low-on-paper interface line (optional)
S18	Limit switch interface line
S19	Plotter ready interface line
S20	Film advance interface line (CRT plotter only)
S21-S24	Not used

3.5.3.1 SPEED Selector Switch

The plotter SPEED rotary select switch is located on the plotter driver module test panel for convenience and has no test function. This switch controls the data output rate to the associated plotter. Prior to the start of a plotting operation, this switch must be set to the position corresponding to the speed of the associated plotter. The switch positions and corresponding plotter speeds are as follows:

a. 1 – 200 steps/second
b. 2 – 300 steps/second
} 500 series plotters

c. 3 – 350 steps/second
d. 4 – 450 steps/second
} 700 series plotters

e. 5 – 100,000 plot increments/second – 835 plotter

NOTE

When connecting a 500 series plotter to the plotter controller, the relay driver circuit in the plotter driver card cage must be located in card slot J07. For operation with a 700 series or 835 plotter, this card must be located in card slot J08.

3.5.3.2 PEN DELAY Switch

The PEN DELAY switch controls the length of the pen up and pen down delays. In the NORM position, a pen up command generates approximately a 10 ms delay and a pen down command generates approximately a 35 ms delay. (The longer pen down delay compensates for any pen bounce as it comes down against the paper.)

The REV (reverse) switch position reverses these two delays; i.e., a pen up command turns on the 35 ms delay and a pen down command turns on the 10 ms delay. The reversal of these two delays is required when certain liquid ink pens are used on some plotter models. Refer to applicable plotter instruction manual for the correct setting of this switch.

The OFF position disables both delays. This position is only used when the plotter program incorporates the required pen delays, or when driving a CRT plotter.

3.5.3.3 SINGLE CYCLE Switch

This switch selects either the continuous mode or the single-step mode of plotter driver test operation. In the NORM position, the plotter driver timing (P flip-flops) cycle continuously, outputting a plot character each time one is received. The SINGLE position causes the plotter driver to output only one plot character to the plotter each time the associated STEP pushbutton switch is depressed.

3.5.3.4 Flip-Flop/Multivibrator Select Switch

This 18 position rotary switch permits individual selection for static testing and/or monitoring of the single character buffer register flip-flops, the mode control and phase control flip-flops, and the various one-shot multivibrators. The switch positions and corresponding plotter driver functions are as follows:

a. DR1-DR7 – single character data register flip-flops (six bits)
b. M1-M2 – mode control flip-flops
c. P – pen control; 1-set = pen down; 0-set = pen up
d. P1-P2 – phase control flip-flops (timing)
e. TX – plot rate oscillator one-shot multivibrator (plotter pulse rate)
f. T10 – 10 μs one-shot multivibrator (plotter pulse timing control)
g. T20 – 20 μs one-shot multivibrator (plotter pulse timing control)
h. TPD1 – pen delay one-shot multivibrator (approximately 10 ms)
i. TPD2 – pen delay one-shot multivibrator (approximately 35 ms)

The 1-set outputs of the flip-flops and one-shot multivibrators are connected through this rotary select switch to the indicator of the associated 1-SET indicator switch and the F/F test jack for monitoring. When the 1-set output of the selected flip-flop or multivibrator is true, the indicator will be on and a +8.7v signal will be present at the test jack.

The associated 1-SET and 0-SET pushbutton switches enable static testing of the flip-flops. Depressing these two switches cause the selected flip-flop (DR1-DR7, M1 & M2, and P, P1 & P2) to be 1-set or 0-set respectively.

Static testing of the one-shot multivibrators are controlled by the associated pushbutton switches TX, T10, T20, TPD1, and TPD2. These five positions of the rotary select switch are used for monitoring the 1-set output of these one-shot multivibrators only.

3.5.3.5 One-Shot Multivibrator Test Switches

The TX, T10, T20, and TPD pushbutton switches operate in conjunction with the flip-flop/one-shot multivibrator rotary select switch to provide static testing of the various one-shot multivibrators. Depressing one of these pushbutton switches 1-sets the associated one-shot multivibrator. The TPD pushbutton switch 1-sets both the TPD1 and TPD2 one-shot multivibrator. The functions associated with these switches are described in the preceding paragraph.

3.5.3.6 Test Jacks

Two test jacks are provided on the test panel. The FF jack is connected to the 1-set output of the flip-flop/one-shot multivibrator rotary select switch. This provides a convenience for monitoring the 1-set output of the selected flip-flop or multivibrator. The GRD jack provides a convenient ground point.

3.5.4 DUAL CHANNEL PLOTTER DRIVER MODULE (MULTIPLEXER)

The multiplexer plotter driver module test controls are identical to the basic plotter driver unit test controls described in subsection 3.5.3 except for two additional controls and a third phase flip-flops position (P3) on the rotary select switch. These two additional switches are the MULTIPLEX select switch and a second plotter SPEED switch. The multiplexer plotter driver test panel is shown in Figure 3-6.

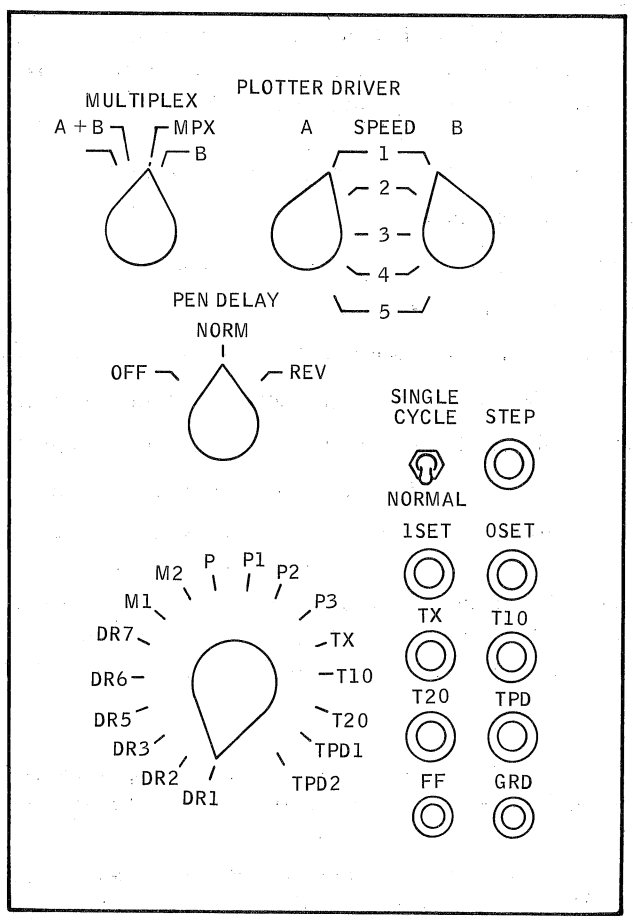


FIGURE 3-6
Plotter Driver Module (Multiplexer) Test Panel

The MULTIPLEX switch controls selection of either or both plotters. The A and B switch positions enable individual selection of the plotters (A corresponds to the plotter connected to channel A and B corresponds to the plotter connected to channel B). The A + B switch permits parallel operation with both plotters receiving the same data. The MPX position permits multiplex plotter operation with the plotters alternately receiving plot commands for the two different plots.

NOTE

When the two plotters are operated in the multiplex mode, the PEN DELAY switch must be in the OFF position.

A second SPEED switch is provided to permit individual selection of speeds for the two channels (A and B). The plotter speeds corresponding to the numbers are the same as described for the basic unit. When the channels are operated in parallel or multiplex modes, the speed of both plotters is determined by the maximum speed of the slower plotter even though the channel A SPEED switch is set to a faster speed. The faster plotter must always be connected to channel A.