SYSTEMS, INC.

DOUBLE PORT GPIB INTERFACE

- Programmed control of two 16-bit parallel I/O ports
- Use with any GPIB controller
- On-off control of up to 32 devices
- Special commands for process controllers and IC handlers
- Self-contained: no packaging required

MODEL 188A

The JC Systems Model 188A Double Port GPIB Interface makes it easy to remotely operate and interrogate digital devices of all types from an IEEE-488 controller. It is particularly well suited for operation with JC Systems Process Controllers and Setpoint Programmers, and special operating modes and commands are provided for these devices.

Any GPIB controller may be used, such as the HP 85/86 or 9800 series, Fluke 1720, or Tektronix 4050 series.

Two full 16-bit ports are supported, all from one address location on the IEEE bus. Instruments connected to the ports may be either "talkers" or "listeners."

Standard ASCII characters are used in the commands, which include status characters and specially created commands for use with temperature control applications. Invalid characters are ignored by the software.

Four different operating modes are software selectable for each port, providing a wide variety of interfacing possibilities:

BINARY (General Purpose) MODE

The interface provides full I/O control of two 16-bit ports, individually accessible on a bit-by-bit basis. A 17th line on each port is available for handshaking (see REMOTE and LOCAL modes, below). Data is presented as convenient BCD or hex ASCII characters.

HANDLER MODE

For equipment that can benefit from the service request (SRQ) capabilities of the IEEE-488 bus system, the Handler mode uses the GPIB's Serial Poll feature to gain control of the bus for transfer of data or status.

The commands and pinout assignments associated with the Handler mode are designed to easily integrate automatic IC handling machinery into your computer-controlled GPIB system.

PROCESS CONTROLLER MODE

Permits full bidirectional communications with a JC Systems Digital Process Controller, including setpoint and the reading of process temperature. The interface automatically interrogates the process controller twice each second (once each second if two process controllers are connected) to provide immediate, up to date temperature and status information whenever polled by the GPIB computer/controller.

PROGRAMMER MONITOR MODE

The JCS 188A interface allows the monitoring of setpoint and process variable values from digital process controllers operating under the command of a JC Systems Setpoint Programmer or Rate Programmer.

REMOTE AND LOCAL OPERATION

In addition to the 16 programmable I/O lines, another line $\overline{\text{RMT}}$ (pin 12 on both I/O connectors) may be software controlled. In Process Controller Mode the condition of this line determines whether the attached controller accepts its setpoint from the IEEE interface (Remote—$\overline{\text{RMT}}$ low) or from the controller's own front panel switches (Local—$\overline{\text{RMT}}$ high).

In Binary or Handler Modes, the $\overline{\text{RMT}}$ line may be used as a strobe or for other handshaking processes, or as an additional output line, separately controlled by RMT and LCL commands.

In Programmer Monitor Mode, the $\overline{\text{RMT}}$ line is normally left in the high (local) state.

REMOTE Switches

The condition of the $\overline{\text{RMT}}$ lines are affected by the position of four internal DIP switches.

Two DIP switches are provided for each port: a HARD REMOTE SWITCH, which holds the $\overline{\text{RMT}}$ line for its port low at all times if closed, and a SOFTWARE REMOTE switch, which has effect only if the HARD REMOTE switch is open.

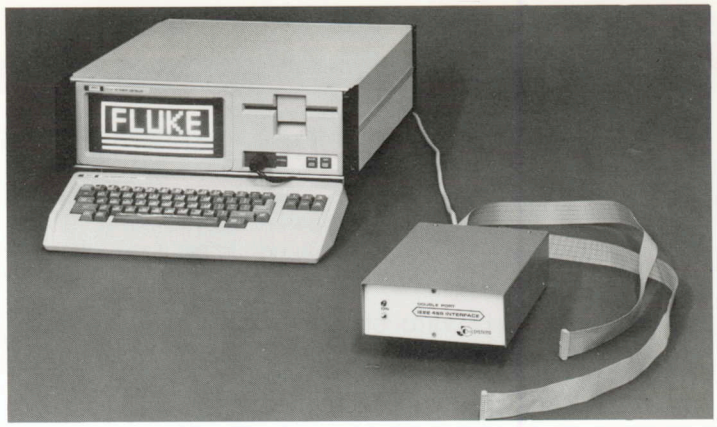
HARD REMOTE Switch	SOFTWARE REMOTE Switch	$\overline{\text{RMT}}$ Line
ON	(don't care)	low
OFF	OFF	high
OFF	ON	low or high by software command

Software Control

The software command LCL (see Command Set) will place $\overline{\text{RMT}}$ lines of both ports high if their HARD REMOTE switches are off.

The software command RMT will place $\overline{\text{RMT}}$ lines low if their SOFTWARE REMOTE switches are on. (The Process Controller Mode commands K or T will also perform the RMT function automatically.)

Note that software control of the $\overline{\text{RMT}}$ lines affects *both ports simultaneously*. If one port is to be operated in Local mode ($\overline{\text{RMT}}$ high) while another is in remote, one of the ports must have its $\overline{\text{RMT}}$ line condition firmly set by its DIP switches.



SOFTWARE EXAMPLES

In the following examples, 728 refers to the port number (7) and the bus address (28). This number may vary depending on the application. Examples shown are for the Fluke 1720A Instrument Controller, HP 9825 and HP 85 Microcomputers.

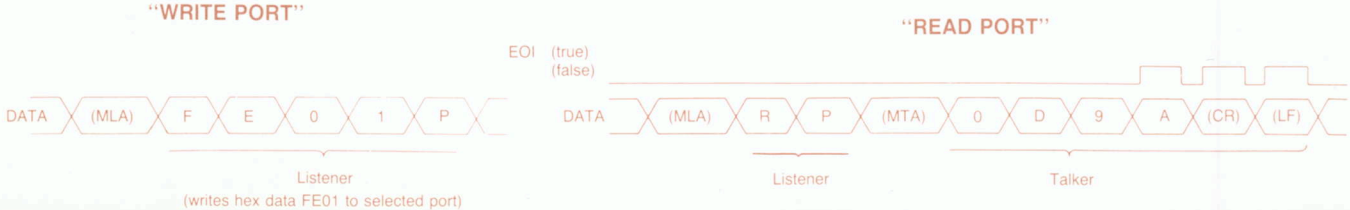
	BINARY COMMANDS		FUNCTION
FLUKE 1720A	**HP 9825**	**HP 85**	
PRINT @28, "IO2"	wrt 728, "IO2"	OUTPUT 728; "IO2"	Sets IO2. All subsequent operations occur at Port 2.
PRINT @28, "S0"	wrt 728, "S0"	OUTPUT 728; "S0"	Sets (raises to +5V) line 0 of selected I/O port.
PRINT @28, "RA"	wrt 728, "RA"	OUTPUT 728; "RA"	Reset (drop to 0V) line 10 of selected I/O port. A is a hexadecimal number for 10.
PRINT @28, USING "####", A$; "P"	fmt 4c, "P" wrt 728, A$	OUTPUT 728; A$&"P"	Write string variable A$ (4 hex characters max.) to previously selected port.
PRINT @28, "439EP"	wrt 728, "439EP"	OUTPUT 728; "439EP"	Write 439E to previously selected port.
PRINT @28, "RP" INPUT @28, A$	wrt 728, "RP" dim A$ (4) red 728, A$	OUTPUT 728; "RP" ENTER 728; A$	Read four digit hex data from previously selected port into A$.
PRINT @28, "RP" INPUT @28, A$ A=VAL (A$)	wrt 728, "RP" fmt f4 red 728, A	OUTPUT 728; "RP" ENTER 728; A$ A=VAL (A$)	Read four digit decimal data from previously selected port into A.

TEMPERATURE CONTROL COMMANDS

FLUKE 1720A	HP9825	HP 85	FUNCTION
PRINT @28, "−11.1T"	wrt 728, "−11.1T"	OUTPUT 728; "−11.1T"	Write setpoint of −11.1° to selected I/O port.
PRINT @28, "1T"	wrt 728, "1T"	OUTPUT 728; "1T"	Write 1° to controller setpoint.
PRINT @28, "001.0T"	wrt 728, "001.0T"	OUTPUT 728; "001.0T"	Write 1° to controller setpoint.
PRINT @28, "+319.7T"	wrt 728, "+319.7T"	OUTPUT 728; "+319.7T"	Write 319.7° to controller setpoint.
S$=NUM$ (S) + "T" PRINT @28, S$	fmt f6.1, "T" wrt 728, "S"	S$=VAL $(S) OUTPUT 728;S$[1,6]&"T"	Write content of variable S to controller setpoint. (S is a fixed point decimal quantity.)
PRINT @28, "RS" INPUT @28, S$	dim S$ (6) wrt 728, "RS" red 728, S$	OUTPUT 728; "RS" ENTER 728; S$	Read previously written controller setpoint from selected port and store six character ASCII string in variable S$. (First character is sign. 5th character is decimal point.)
PRINT @28, "RS" INPUT @28, S$ S=VAL (S$)	wrt 728, "RS" fmt f 6.1 red 728, S	OUTPUT 728; "RS" ENTER 728; S$ S=VAL (S$)	Same as above, except setpoint is stored as a fixed decimal quantity in variable S.
PRINT @28, "RT" INPUT @28, T$	dim T$ (7) wrt 728, "RT" red 728, T$	OUTPUT 728; "RT" ENTER 728; T$	Read controller temperature and status from selected port and store seven character ASCII string in variable T$. (First character is status, 2nd is sign, 6th is decimal point.)
PRINT @28, "RT" INPUT @28, T$ T=VAL (RIGHT (T$, 6)) T$=LEFT (T$, 1)	dim T$ (1) wrt 728, "RT" fmt c, f6.1 red 728, T$, T	OUTPUT 728; "RT" ENTER 728; T$ T=VAL (T$[2,7]) T$=T$[1,1]	Same as above, except status character is stored in string variable T$ and temperature is stored as a fixed point decimal quantity in variable T.

DOUBLE PORT INTERFACE

BUS DATA TRANSFER DIAGRAM



COMMAND SET—IEEE DUAL PORT INTERFACE

(Normal power on state: Binary Mode, Port 1 selected, Local operation)

General

IO1	Select port 1.
IO2	Select port 2.
H	Place selected port into HANDLER mode
K or xxxxT	Place selected port into PROCESS CONTROLLER mode. (see command function below)
M	Place selected port into PROGRAMMER MONITOR mode.
RP or xxxxP	Place selected port into BINARY mode (see command function below)

Binary Mode

Sx	Set bit **x** of selected port, where **x** is a hex character 0-F, representing bit 0-15, respectively.
Rx	Reset bit **x** of selected port, represented as above.
xxxxP	Write **xxxx** to selected port (and latch), where **xxxx** represents a one to four digit hex or BCD number. If fewer than four digits, leading zeros will be assumed.
RP	Read the selected port as a string of four hex or BCD digits, representing the status of 16 bits.
LCL	Open the $\overline{\text{RMT}}$ lines (whose HARD REMOTE switches are turned off), and latch. (May be used for handshaking)
RMT	Ground the $\overline{\text{RMT}}$ lines (whose SOFTWARE REMOTE switches are turned on), and latch. (May be used for handshaking)

Handler Mode

Hx	Write the 1's complement of the binary number represented by **x** to bits 12-15 of the selected port, latch, and then pull bit 11 to ground for 5 msec. **x** is a hex character 0-F. (Bits 12-15 typically connect to the handler's sort category input, and bit 11 to the $\overline{\text{EOT}}$ input.)
RQD	Disable SRQ. (The interface powers up with SRQ disabled.) SRQ conditions that occur after issuance of RQD will not generate an SRQ but will be remembered when SRQ is reenabled. With the RQN command SRQ is then generated.
RQN	Enable SRQ. SRQ is immediately generated if any SRQ conditions occurred while disabled. An SRQ condition is a "1" to "0" transition on bits 0, 1, 2, or 3 of a port previously placed in the Handler mode of operation (with an "H" command). If both ports are in Handler mode, their corresponding bits 0 through 3 are ANDed together.
ST?	Read the 8 bit serial poll register as a single ASCII character code, and clear the register. A NUL character (binary 0) indicates no activity on bits 0-3 of the handler port(s) since last read. Falling edges on input bits 0-3 of the handler port(s) set corresponding bits, as well as bit 6, in the serial poll register. SRQ is asserted anytime register bit 6 is set. The above data can be read and cleared with a normal serial poll sequence just as with "ST?". If both ports are in HANDLER mode, bits 0-3 of port 1 are ANDed with the corresponding bits of port 2.
N	Clear the serial poll register, and pull bit 11 of the selected port to ground for 5msec.
Sx	Set bit **x** of selected port, where **x** is a hex character 4-A, representing bit 4-10, respectively.
Rx	Reset bit **x** of selected port, represented as above.
LCL	Operates as described in BINARY mode.
RMT	Operates as described in BINARY mode.

Process Controller Mode

K	Kill (turn off) controller connected to selected port, and set REMOTE mode.
xxxxT	Write setpoint **xxxx** to selected port, where **xxxx** is a signed one to four digit number with or without decimal point. If fewer than four digits, leading zeros are assumed. If the sign is omitted, + is assumed. Execution of this command also sets REMOTE mode.
RS	If the interface is in REMOTE mode, read the previously written setpoint from the selected port in the format ±xxx.x, where ± is the sign, and xxx.x is a four digit number, resolved to a tenth of a unit. Leading zeros are returned if necessary. If the interface is in LOCAL mode, the setpoint cannot be read, and "----.-" is returned.
RT	Read the process variable (temperature) from the controller connected to the selected port in the format s±xxx.x, where ±xxx.x is as described above, and s is a status character. If the status character is an "F" the controller communication has failed (due to open probe, disconnected ribbon cable, or hardware failure). If it is an "L", the setpoint is outside of the controller's limits, or the controller has been "killed". If "N", the controller is not nulled (Port 1 only). Otherwise, (sp) is returned.
LCL	Place the ports whose hard REMOTE switches are off into LOCAL mode. The corresponding controllers will then take their setpoints from their front panel thumbwheel switches.
RMT	Place the ports whose hard REMOTE switches or whose SOFTWARE REMOTE switches are on into REMOTE mode. The corresponding controllers will then take their setpoints from their interface ports.

Programmer Monitor Mode

RS	Read the setpoint currently issued from the programmer connected to the selected port. The format is as described under CONTROLLER mode. In this case, the setpoint may be read in either LOCAL or REMOTE mode.
RT	Read the last process variable interrogated by the programmer connected to the selected port. The format is as described under CONTROLLER mode. In this case, an additional cause of the "F" status character is "programmer not running (executing stored program)". The process variable may be read in either LOCAL or REMOTE mode.

DOUBLE PORT INTERFACE PINOUTS

I/O Ports 1 and 2

PIN #	Binary Mode Function	Process Controller/ Programmer Monitor Function	Handler Mode Function
1	I/O Bit 0	Setpoint/Temp .1 Bit	Falling edges set SRQ
14	1	.2	
2	2	.4	(Start Test or other function)
15	3	.8	
3	4	1	
16	5	2	
4	6	4	Auxiliary I/O
17	7	8	
5	8	10	
18	9	20	
6	10(A)	40	
19	11(B)	80	$\overline{\text{Sort Category Strobe}}$ (5ms low-going pulse)
7	12(C)	100	$\overline{\text{Sort Category}}$ (Negative logic) (IEEE Output to handler)
20	13(D)	200	
8	14(E)	400	
21	15(F)	Negative	
9			
10			
22	Logic common	Logic common	Logic common
23			
11	PRINT 1 IN*	$\overline{\text{Controller Nulled}}$ **	†
24	HANDSHAKE OUTPUT#	$\overline{\text{Temperature Interrogate}}$	†
12	$\overline{\text{RMT}}$	$\overline{\text{RMT}}$	$\overline{\text{RMT}}$
25	†	Setpoint Valid	†
13	+5V	+5V	+5V

* HANDSHAKE INPUT — "RP" will not read data from Port 1 until PRINT 1 input is high or 0.6 sec. times out, whichever occurs first. GPIB handshake is delayed during this time. /HOLD remains low until read is completed (500 μsec minimum).

** I/O Port #2 pinout is identical except for Pin 11, which has no connection.

† Not used.

/HOLD 1 or /HOLD 2 OUTPUT (for "RP" command), DATA VALID 1 or DATA VALID 2 OUTPUT (for "P" command) DATA VALID remains low while output port is updating after a command (100 μsec typical)

I/O PORT D.C. CHARACTERISTICS (8243 device type)

Symbol	Parameter	Min.	Max.	Units	Test Conditions
V_{IL}	Input Low Voltage	−0.5	0.8	V	I_{IL} = −400 μA
V_{IH}	Input High Voltage	2.0	5.5	V	
V_{OL}	Output Low Voltage		0.45	V	I_{OL} = 5mA
V_{OH}	Output High Voltage	2.4		V	I_{OH} = −240 μA

SPECIFICATIONS

Modes: Binary Mode, Handler Mode, Process Controller Mode and Programmer Monitor Mode are available at both ports. For ease of operation, port I/O configuration is automatic: the correct mode is always assumed for the command issued.

Data Transmission: Data is transmitted only after the computer gives a "ready for data" signal. EOI (end or identify) signal, CR (carriage return) and LF (line feed) all end the transmission. EOI is always raised with the last character transmitted. However, these signals are not required by the interface for command termination.

Address: 5 bit address switch

Commands: all ASCII characters; 4 select/mode commands, 6 binary commands, 7 handler commands, 6 process controller commands, and 2 programmer monitor commands (see table).

Port connectors: two 25-pin connectors, Ansley PN 60925S. Mating connector is Cinch DB-25P or equivalent.

Bus connector: conforms to IEEE-488 standard.

LED power-on indicator

Package size: 7"W x 3"H x 15"D (17.8 x 7.6 x 38 cm)

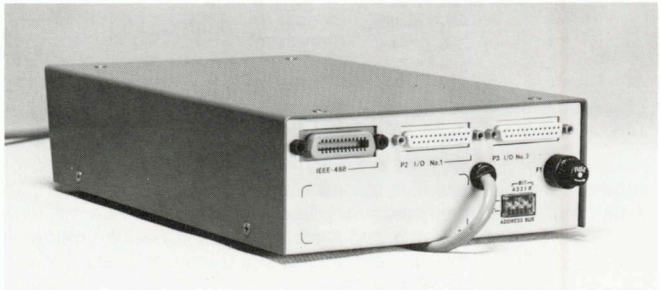
Weight: 3.5 lbs. (1.6 kg)

Power: 120V, 20W, 50/60 Hz.

ORDERING INFORMATION

MODEL 188A DOUBLE PORT INTERFACE

	Order No.
Double Port GPIB Interface, with bus connector conforming to IEEE-488 standard	C80188A
Options:	
16 line input isolator accessory	A1160
16 line output isolator accessory	A1164
Port transition board	A1604



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APPENDIXES

OPERATING INSTRUCTIONS FOR THE MODEL 188A DOUBLE PORT GPIB INTERFACE

1. FEATURES AND CAPABILITIES

JC Systems' Model 188A Interface makes it easy to operate and interrogate all types of digital devices using an IEEE-488 controller.

1.1. AVAILABLE CONFIGURATIONS

The Model 188A is available as a stand-alone unit, or packaged integrally with the Model 270 Single Loop Digital Process Controller in a rack-mount cabinet. Interface input and output isolators and a port transition board are also available as options (see the appendixes).

1.2. COMPATIBILITY

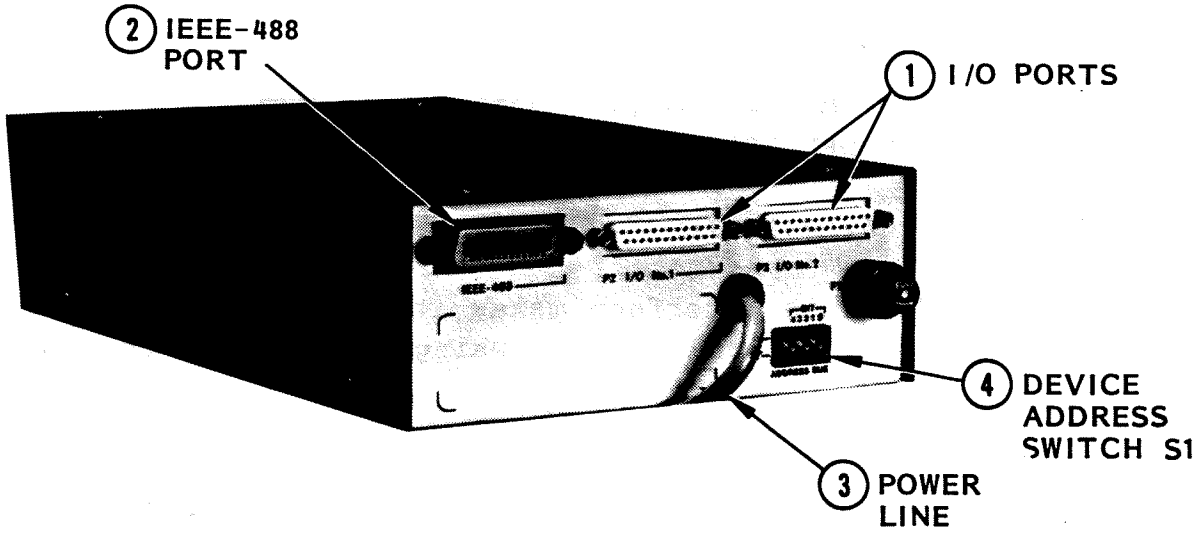
Any GPIB (IEEE-488) controller may be used with the JCS Model 188A. This includes any IBM PC or compatible equipped with the IEEE-488 controller option; Fluke 1720 Instrument Controller, Hewlett Packard HP 85/86 or 9800 series Microcomputers, and the Tektronix 4050 series controllers. Special operating modes and commands are provided to enhance the Model 188A's operation with JC Systems process controllers and setpoint programmers.

1.3. TWO I/O PORTS

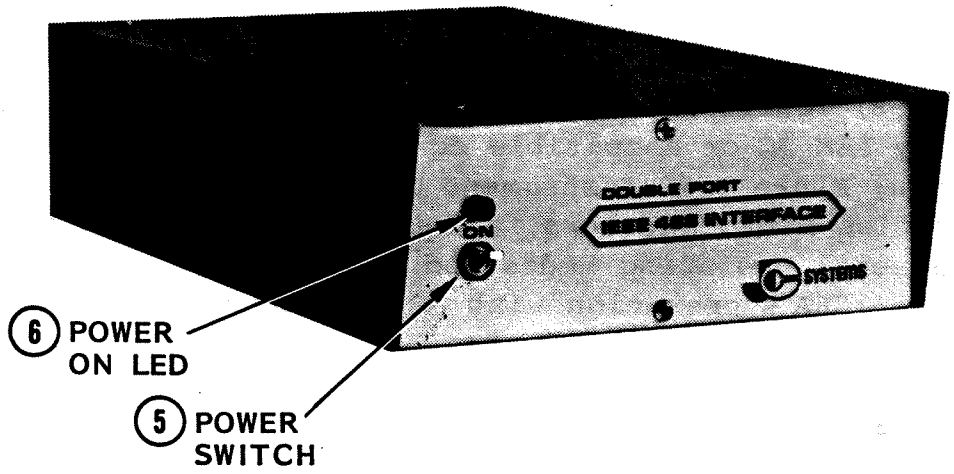
The 188A supports two full 16-bit input/output ports (Figure 1, Item 1) from a single, switch-selectable address location on the IEEE bus. I/O ports output via female connectors P2 and P3 mounted on the rear panel, and mate with standard DB-25 type 25-pin male connectors. The I/O ports support devices whether sending or receiving signals ("talkers" or "listeners" -- see Figure 2). Table I lists interface pinouts for the ports in various modes (described in Para. 1.5). Table II provides the port DC characteristics.

1.4. SOFTWARE CONTROL

General operating commands and a special command set for each operating mode reside in the 188A memory. The commands use standard ASCII characters; data and status responses are presented in either binary coded decimal (BCD) or ASCII form. Status queries, service request (serial poll), and other special commands are included, as shown in Tables III through VII.



A. Rear View.



B. Front View.

Figure 1. Model 188A Double Port GPIB Interface.

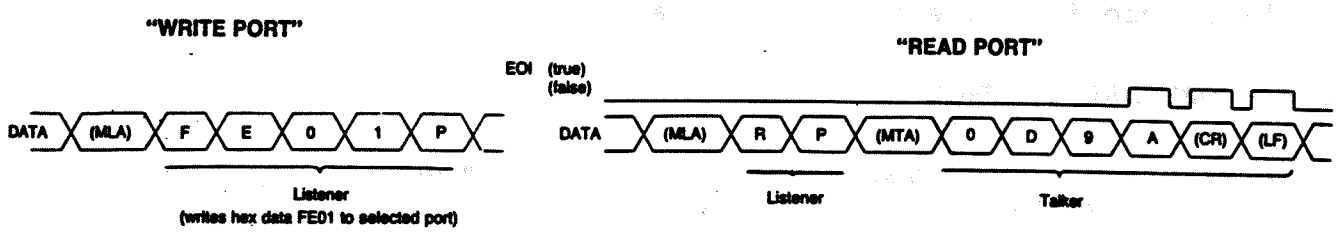


Figure 2. Bus Data Transfer Diagram.

Tables VIII and on show typical software instructions for various binary and temperature controller commands. Tables VIII and IX provide examples for the Fluke 1720A Instrument Controller, and for Hewlett-Packard HP-9825 and HP-85 Microcomputers. The numbers "728" refer to the port (7) and bus address (28), which may vary depending on the application (address assigned to the 188A).

1.5. FOUR OPERATING MODES

At power up, the 188A is set for binary mode, Port 1 selected, local operation. The general mode commands (Table III) may be used to select or return to one of the operating modes described below.

1.5.1. Binary (General Purpose) Mode

The binary mode permits bit manipulation, as well as read and write commands to the selected port. In this mode, the 188A provides full I/O control of the two 16-bit ports, individually accessible on a bit-by-bit basis. Local or remote operation can also be software selected using a handshaking line as explained in Para. 1.6. Data are presented as binary coded decimal (BCD) or hexadecimal (hex) characters.

1.5.2. Handler Mode

The handler mode uses the GPIB's service request feature to gain control of the bus for transfer of data or status, such as sort category and end of test (EOT). Handler mode commands and pinout assignments allow closed-loop operation with automatic integrated-circuit handling equipment under computerized control. Commands to enable and disable the serial poll (SRQ) function are included in the software.

1.5.3. Process Controller Mode

In this mode, the I/O port is used for full bidirectional communication with a JC Systems digital process controller. As shown in Table VI, entering a setpoint command followed by a "T" (for example, 125.5T) automatically places the 188A in process controller mode. (Certain timing considerations, detailed in the operating procedures of Para. 2.4.2, must be observed when using this command set to enter process controller mode immediately upon power up.) The 188A reads or writes the setpoint on command, and automatically generates a process temperature interrogation twice a second if one process controller is connected to the 188A, or once a second for each processor if two are connected.

1.5.4. Programmer Monitor Mode

This mode is used to monitor the operation of a JC Systems single setpoint programmer and temperature controller combination. Selecting this mode with a monitor command permits continuous monitoring of the setpoint generated by the programmer and the process temperature (or other variable) read by the controller.

1.6. LOCAL OR REMOTE OPERATION

In addition to the 16 programmable I/O lines, a 17th line, RMT (Pin 12 on both P2 and P3) may be set either HIGH or LOW for local or remote operation. As explained below, a combination of hardware and software switches are used to select the condition of this line.

1.6.1. Default Setting

When shipped, the 188A's are configured for **software** selection of local or remote mode. Local or remote operation is normally used in the process controller mode to select whether the attached controller accepts its setpoint from the 188A (remote operation), or from the controller's own front panel switches (local operation). In the binary or handler mode, the RMT line may be used as a strobe, or for handshaking. In the programmer monitor mode, the RMT line is normally left in the local condition.

1.6.2. Dip Switch Selection

Dip switch S2 on the 188A's printed circuit board assembly can be used to select a hard local/remote switch setting that will not be affected by software commands, or a soft setting that can be modified on command. Dip switches S2-1 and -2 control Port 1; S2-3 and -4 control Port 2. S2-1 and S2-3 are labeled "SFTWR REMOTE"; S2-2 and S2-4 are labeled "REMOTE".

When the hardware switches are positioned so that the 188A accepts software remote commands to both ports, software commands LCL (local) and RMT (remote) will set both ports to the corresponding operational mode.

If one of the ports must operate only in the remote mode, then that port must be set by hardware -- in other words, dip switch S2-2 or --4, as applicable, must be set to the ON position. This will maintain that port in remote mode regardless of the mode selected by the software switch commands LCL or RMT.

The settings for dip switch S-2 required to achieved local and remote operating modes are shown below. A "--" under switch setting means that it can be either on or off.

PORT	OPERATING MODE	RMT LINE CONDITION	DIP SWITCH SETTING S2-1	S2-2	S2-3	S2-4
1	Hardware Remote[1]	Low	--	ON	--	--
1	Hardware Local[1]	High	OFF	OFF	--	--
1	Software Select Local or Remote [2]	Low	ON	OFF	--	--
2	Hardware Remote[1]	Low	--	--	--	ON
2	Hardware Local[1]	High	--	--	OFF	OFF
2	Software Select Local or Remote [2]	Low	--	--	ON	OFF

[1]Operator **cannot** use software to change setting.
[2]Operator **can** use software to change setting.

2. OPERATING PROCEDURE

2.1. INSTALLATION

The 188A may be rack mounted (3-1/2 in. vertical space required) or bench mounted. In the latter case, be sure that rubber feet are installed to prevent bench surface damage.

The 188A is also available as an integral rack-mount unit combined with the Model 270 Single Loop Setpoint Controller.

2.2. SETUP FOR OPERATION

1. If necessary, set local/remote hardware dip switch (S2) to desired configuration (see Table X and Para. 1.5.1). This requires removing the cover to gain access to the 188A PCB.
2. Connect IEEE-488 system controller to P1 (Item 2) on the 188A.
3. Connect devices to I/O ports 1 and 2 (P2 and P3, Item 1).
4. Plug in power line (Figure 1, Item 3).

5. Select 188A address using device address switch S1 (Item 4). Note that this switch uses binary numbers as follows:

BIT	VALUE
0	1
1	2
2	4
3	8
4	16

Set the appropriate bits TRUE ("1") to achieve the sum corresponding to the desired address. For example, bits 0 and 4 set TRUE gives an address of 17; the highest possible address (all bits set true) is 31.

6. Turn on power switch (Item 5). LED (Item 6) will light.

2.3. MODE SELECTION

The 188A powers up in the binary mode with port 1 selected, SRQ disabled, and local operation software selected (unless S2 dip switch settings have been changed from factory settings). To select another mode, use the commands listed in Table III. Please see Para. 2.4 and 2.5 respectively for special instructions about selecting and using the Process Controller and Handler Modes.

2.4. PROCESS CONTROLLER MODE

Using the 188A with a JC Systems digital controller permits direct reading of the process variable (actual system-controlled temperature, for example) by the IEEE system controller. However, this capability cannot be used immediately after power-up; certain conditions must first be met:

1. The selected port must be configured for process controller mode by sending a setpoint command (xxx.xT).
2. At least one second must elapse between selecting process controller mode and attempting the first reading of the process variable.

If either of these conditions is not met, you will read garbage in response to your "RT" (read temperature) command. Note that these requirements apply only immediately after power-up. Once the process controller mode has been selected and the 188A has had enough time to access the current process variable from the digital controller, the 188A will automatically access the process variable twice a second when one controller is connected, or once a second for each controller when two are connected. This updated information is thereafter available for immediate transmission to the system controller upon receipt of an RT command.

2.5. HANDLER MODE

Referring to Table I, note that bits 0 thru 3 may be used to generate a service request (SRQ). In normal handler operation, only one line would be software-selected by the user as an input, typically for the START TEST command. However, the other three bits may be programmed by the user to generate a serial request for other purposes -- for example, when the handler chamber exceeds limits. Bits are edge-sensitive; an SRQ is generated by a high-to-low transition on any of the bit 0 thru 3 lines of the HANDLER port.

2.6 PROGRAMMING

The user must develop suitable programs that cause the system controller to generate the correct 188A command sets for functions desired. The examples given in Tables VIII and on are provided to assist users in developing their programs.

TABLE I. PINOUTS FOR I/O PORTS.

PIN #	BINARY MODE FUNCTION	PROCESS CONTROLLER/ PROGRAMMER MONITOR FUNCTION	HANDLER MODE FUNCTION
1	I/O Bit 0	Setpoint/Temp .1 Bit	Falling edges set SRQ (Start Test or other function)
14	1	.2	
2	2	.4	
15	3	.8	
3	4	1	
16	5	2	
4	6	4	Auxiliary I/O
17	7	8	
5	8	10	
18	9	20	
6	10(A)	40	
19	11(B)	80	/Sort Category Strobe (5ms low-going pulse)
7	12(C)	100	Sort Category (Negative logic) (IEEE Output to handler)
20	13(D)	200	
8	14(E)	400	
21	15(F)	Negative	
9			
10			
22	Logic common	Logic common	Logic common
23			
11	PRINT 1 IN*	/Controller Nulled**	***
24	HANDSHAKE OUTPUT#	/Temperature Interrogate	***
12	/RMT	/RMT	/RMT
25	***	Setpoint Valid	***
13	+5V	+5V	+5V

See next page for footnotes (*, **, ***, #)

FOOTNOTES TO TABLE I

* HANDSHAKE INPUT -- "RP" will not read data from Port 1 until PRINT 1 input is high or 0.6 sec. times out, whichever occurs first. GPIB handshake is delayed during this time. /HOLD remains low until read is completed (500 μsec minimum).

** I/O Port #2 pinout is identical except for Pin 11, which has no connection.

*** Not used.

\# /HOLD 1 or /HOLD2 OUTPUT (for "RP" command)
DATA VALID 1 or DATA VALID 2 OUTPUT (for "P" command)
DATA VALID remains low while output port is updating after a "P" command (100 μsec typical)

TABLE II. I/O PORT DC CHARACTERISTICS (8243 DEVICE TYPE).

SYMBOL	PARAMETER	MIN.	MAX.	UNITS	TEST CONDITIONS
V_{IL}	Input Low Voltage	-0.5	0.8	V	I_{IL} = -400 μA
V_{IH}	Input High Voltage	2.0	5.5	V	
V_{OL}	Output Low Voltage		0.45	V	I_{OL} = 5mA
V_{OH}	Output High Voltage	2.4		V	I_{OH} = -240 μA

TABLE III. GENERAL COMMAND SET

COMMAND	FUNCTION
IO1	Select port 1.
IO2	Select port 2.
H	Place selected port into HANDLER mode.
xxxxT	Place selected port into PROCESS CONTROLLER mode.
M	Place selected port into PROGRAMMER MONITOR mode.
RP or xxxxP	Place selected port into BINARY mode.

TABLE IV. BINARY MODE COMMAND SET

COMMAND	FUNCTION
Sx	Set bit x of selected port, where x is a hex character 0-F, representing bit 0-15, respectively.
Rx	Reset bit x of selected port, represented as above.
xxxxP	Write xxxx to selected port (and latch), where xxxx represents a one- to four-digit hex or BCD number. If fewer than four digits, leading zeros will be assumed.
RP	Read the selected port as a string of four hex or BCD digits, representing the status of 16 bits.
LCL	Open the RMT lines (whose HARD REMOTE switches are turned off), and latch. (May be used for handshaking.)
RMT	Ground the RMT lines (whose SOFTWARE REMOTE switches are turned on), and latch. (May be used for handshaking.)

TABLE V. HANDLER MODE COMMAND SET

COMMAND	FUNCTION
Hx	Write the 1's complement of the hexadecimal number represented by **x** to bits 12-15 of the selected port, latch, and then pull bit 11 to ground for 5 msec. **x** is a hex character 0-F. (Bits 12-15 typically connect to the handler's sort category input, and bit 11 to the EOT input.)
RQD	Disable SRQ. (The 188A powers up with SRQ disabled.)
RQN	Enable SRQ. Any low levels present on bits 0 thru 3 of the handler port(s) while SRQ is disabled will generate a service request when SRQ is reenabled. Subsequent SRQ's will be generated by falling edges on the same bits.
ST?	Read the 8 bit serial poll register as a single ASCII character code, and clear the register. A NUL character (binary 0) indicates no activity on bits 0-3 of the handler port(s) since last read. (Falling edges on input bits 0-3 of the handler port(s) set corresponding bits, as well as bit 6, in the serial poll register.) SRQ is asserted anytime register bit 6 is set and SRQ is enabled. The above data can be read and cleared with a normal serial poll sequence just as with "ST?". If both ports are in HANDLER mode, bits 0-3 of port 1 are ANDed with the corresponding bits of port 2.
N	Clear the serial poll register and pull bit 11 of the selected port to ground for 5msec.
Sx	Set bit **x** of selected port, where **x** is a hex character 4-A representing bit 4-10, respectively.
Rx	Reset bit **x** of selected port, represented as above.
LCL	Operates as described in BINARY mode.
RMT	Operates as described in BINARY mode.

TABLE VI. PROCESS CONTROLLER MODE COMMAND SET

COMMAND	FUNCTION
K	Kill (turn off) controller connected to selected port and set REMOTE mode.
xxx.xT	Write setpoint xxx.x to selected port, where xxx.x is a signed one- to four-digit number with or without decimal point. If fewer than four digits, leading zeros are assumed. If the sign is omitted, + is assumed. Execution of this command also sets REMOTE mode.
RS	If the 188A is in REMOTE mode, read the previously written setpoint from the selected port in the format ±xxx.x, where ± is the sign and xxx.x is a four digit number resolved to a tenth of a unit. (Leading zeros are returned if necessary.) If the 188A is in LOCAL mode, the setpoint cannot be read and "----" is returned.
RT	Read the process variable (temperature) from the controller connected to the selected port in the format S±xxx.x, where ±xxx.x is as described above and S is a status character. If the status character is an "F", the controller communication has failed (due to open probe, disconnected ribbon cable, or hardware failure). If it is an "L", the setpoint is outside the controller's limit or the controller has been "killed". If "N", the controller is not nulled (Port 1 only); otherwise, (sp) is returned.
LCL	Places into LOCAL mode the ports whose hard REMOTE switches are off . The corresponding controllers will then take their setpoints from their front panel thumbwheel switches.
RMT	Places into REMOTE mode the ports whose hard REMOTE switches or whose SOFTWARE REMOTE switches are on. The corresponding controllers will then take their setpoints from their 188A ports. This command does not automatically place the unit in Process Controller Mode.

TABLE VII. PROGRAMMER MONITOR MODE COMMAND SET

COMMAND	FUNCTION
RS	Read the setpoint currently issued from the programmer connected to the selected port. The format is as described under PROCESS CONTROLLER mode. In this case, the setpoint may be read in either LOCAL or REMOTE mode.
RT	Read the last process variable interrogated by the programmer connected to the selected port. The format is as described under PROCESS CONTROLLER mode. In this case, an additional cause of the "F" status character is "programmer not running (executing stored program)". The process variable may be read in either LOCAL or REMOTE mode.

TABLE VIII. TYPICAL SOFTWARE COMMANDS FOR BINARY MODE OPERATION.

FLUKE 1720A	HP9825	HP 85	FUNCTION
PRINT @28, "IO2"	wrt 728, "IO2"	OUTPUT 728; "IO2"	Sets IO2. All subsequent operations occur at Port 2.
PRINT @28, "S0"	wrt 728, "S0"	OUTPUT 728; "S0"	Sets (raises to +5V) line 0 of selected I/O port.
PRINT @28, "RA"	wrt 728, "RA"	OUTPUT 728; "RA"	Reset (drop to 0V) line 10 of selected I/O port. A is the hexadecimal number for 10.
PRINT @28, USING "####",A$;"P"	fmt 4c, "P" wrt 728,A$	OUTPUT 728; A$&"P"	Write string variable A$ (4 hex characters maximum) to previously selected port.
PRINT @28, "439EP"	wrt 728, "439EP"	OUTPUT 728;"439EP"	Write 439E to previously selected port.
PRINT @28, "RP" INPUT @28, A$	wrt 728, "RP" dim A$ (4) red 728, A$	OUTPUT 728; "RP" ENTER 728; A$	Read four digit hex data from previously selected port into A$.
PRINT @28, "RP" INPUT @28, A$ A=VAL (A$)	wrt 728, "RP" fmt f4 red 728, A	OUTPUT 728; "RP" ENTER 728; A$ A=VAL (A$)	Read four-digit decimal data from previously selected port into A.

TABLE IX. TYPICAL SOFTWARE COMMANDS FOR PROCESS (TEMPERATURE) CONTROLLER MODE

FLUKE 1720A	HP9825	HP 85	FUNCTION
PRINT @28, "-11.1T"	wrt 728, "-11.1T"	OUTPUT 728; "-11.1T"	Write setpoint of -11.1 to selected I/O port.
PRINT @28, "1T"	wrt 728, "1T"	OUTPUT 728;"1T"	Write 1° to controller setpoint.
PRINT @28, "001.0T"	wrt 728, "001.0T"	OUTPUT 728; "001.0T"	Write 1° to controller setpoint.
PRINT @28, "+319.7T"	wrt 728, "+319.7T"	OUTPUT 728; "+319.7T"	Write 319.7° to contoller setpoint.
S$=NUM$(S)+ "T" PRINT @28, S$	fmt f6.1, "T" wrt 728, "S"	S$=VAL$(S) OUTPUT 728; S$[1,6]&"T"	Write content of variable S to controller setpoint. (S is a fixed point decimal quantity.)
PRINT @28, "RS" INPUT @28, S$	dim S$ (6) wrt 728, "RS" red 728, S$	OUTPUT 728; "RS" ENTER 728; S$	Read previously written controller setpoint from selected port and store six-character ASCII string in variable S$. (First character is sign. 5th character is decimal point.)
PRINT @28, "RS" INPUT @28, S$ S=VAL (S$)	wrt 728, "RS" fmt f6.1 red 728, S	OUTPUT 728; "RS" ENTER 728; S$ S=VAL (S$)	Same as above, except setpoint is stored as a fixed decimal quantity in variable S.
PRINT @28, "RT" INPUT @28, T$	dim T$ (7) wrt 728, "RT" red 728, T$	OUTPUT 728; "RT" ENTER 728; T$	Read controller temperature and status from selected port and store seven-character ASCII string in variable T$. (First character is status, 2nd is sign, 6th is decimal point.)
PRINT @28, "RT" INPUT @28, T$ T=VAL (RIGHT (T$,6)) T$=LEFT (T$,1)	dim T$ (1) wrt 728, "RT" fmt c, f6.1 red 728, T$, T	OUTPUT 728; "RT" ENTER 728; T$ T=VAL (T$[2,7]) T$=T$[1,1]	Same as above, except status character is stored in string variable T$ and temperature is stored as a fixed point decimal quantity in variable T.

ZONE	LTR	DESCRIPTION	DATE	APPD
	B	REDRAWN IN INC.; 3M CONN WAS ANSLEY	12-20-84	

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P1 AMPHENOL 57-40240 (METRIC)

P1- 3M #3593-6002

IEEE-488 INTERFACE

DIO1 DIO2 DIO3 DIO4 EOI DAV NRFD NDAC IFC SRQ ATN CHAS. GND DIO5 DIO6 DIO7 DIO8 REN GND (6) (7) (8) (9) (10) (11) LOGIC N.C. N.C.

P1 REAR PANEL

JC SYSTEMS INC
IEEE-488 4 DECADE
BCD INTERFACE
MODEL A1538/1038

P3- 3M #3593-6002

P3-3M #3482-1000

P5- 3M # 3429-6202

BIT NOTATION: 4 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 GND

HEX NOTATION: 0 1 2 3 4 5 6 7 8 9 A B C D E F

BINARY CODE: LSB 1 2 4 8 | 1 2 4 8 | MSB 1 2 4 8

I/O #2

N.C. N.C. N.C. N.C. N.C. N.C.

TEMP. INTERROGATE (3) INTERRUPT SET PT. VALID +5V N.C.

P2- 3M #3593-6002

P2-3M #3482-1000

P4 - 3M # 3429-6202

BIT NOTATION: 0 1 2 3 4 5 6 7 8 9 A B C D E F GND

HEX NOTATION: 1 2 4 8 | 1 2 4 8 | 1 2 4 8 | 1 2 4 8

BINARY CODE: LSB | | MSB

I/O #1

N.C. N.C. N.C. N.C.

NULL TEMP. INTERROGATE (5) INTERRUPT SET PT. VALID +5V N.C.

(OPTIONAL CONNECTOR)

REAR PANEL

OPTIONAL TERMINATION

3M # 3350-7000 3M # 3429-6202

TO P2 & P5 (REAR PANEL)

OPTIONAL: WIRE WRAP HEADER CABLE TERMINATION (P2 TO P4 & P5 TO P5)

CONNECTORS P2 & P5

3M # 3482-1000 MTG'D ON REAR PANEL

TB1

ON OFF

"POWER" "POWER ON" N.C. TIL220

TB1 +5VH +5VN SPARE +UNREG. GND GND

LINE FILTER CORCOM 6B1

P1 1A 18AWG

120VAC 50/60HZ, 300W

△ FINISH (IF APPLICABLE) △1 USED FOR TEMPERATURE CONTROLLER INTERFACE CONNECTIONS ONLY.

△ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON
APPLICATION			

SERIAL NO.	DATE EFF	DWG REV
EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON

DECIMALS .XX ± .03 .XXX ± .010

ANGLES 0°30'

HOLE TOLERANCES

.013 THRU .125 +.003 -.001

.251 THRU .500 +.005 -.001

.126 THRU .250 +.004 -.001

.501 THRU .750 +.006 -.001

MATERIAL △1

FINISH △2

ENGINEERING ACTIVITY

DESIGN	JC SYSTEMS INC
DRAFTED	" 20 DEC 1984
CHECKED	
APPROV	
RELEASE	

DO NOT SCALE DWG

JC SYSTEMS, INC.

TITLE: WIRING DIAGRAM - IEEE-488 INTERFACE UNIT MODEL

SIZE	CODE IDENT	
C		1044 B

SCALE N.A. SHEET 1 OF 1

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE	APPD

TB1

Z2 - 22K RES PAK BOURNS 4210R-101-223

Z3 - 22K RES PAK BOURNS 4310R-101-223

Z5,6,10&11 ARE ILR74'S

Z12 - RES. PAK BOURNS

Z16 - BOURNS RES PAK

MC14049 (16)

MC14050 (16)

Z1-Z4 ARE BOURNS 4116R-001- RES PAC OR EQUIV.

J1 - ANSLEY HDR 609-2603

+5V IEEE-488 INTERFACE +5V

GND - IEEE-488 INTERFACE INT. GND

BINARY	BIT NO	HEX NO		
1	0	0	1	
2	1	1	2	
4	2	2	3	LSB
8	3	3	4	
1	4	4	5	
2	5	5	6	
4	6	6	7	
8	7	7	8	
1	8	8	9	
2	9	9	10	
4	10	A	11	
8	11	B	12	
1	12	C	13	
2	13	D	14	
4	14	E	15	MSB
8	15	F	16	

INPUTS

EXT. EQUIP. PWR. SUPPLY: GND, +V

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON
	1	A1100	

SERIAL NO.	DATE EFF	DWG REV
1490	9/1/80	NC

APPLICATION | EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .05 .XXX ± .010 ANGLES 0°30'

MATERIAL ⚠ FINISH ⚠

DO NOT SCALE DWG

ENGINEERING ACTIVITY	
DESIGN	JC SYSTEMS INC.
DRAFTED	" 01SEPT1980
CHECKED	
APPROV	
RELEASE	

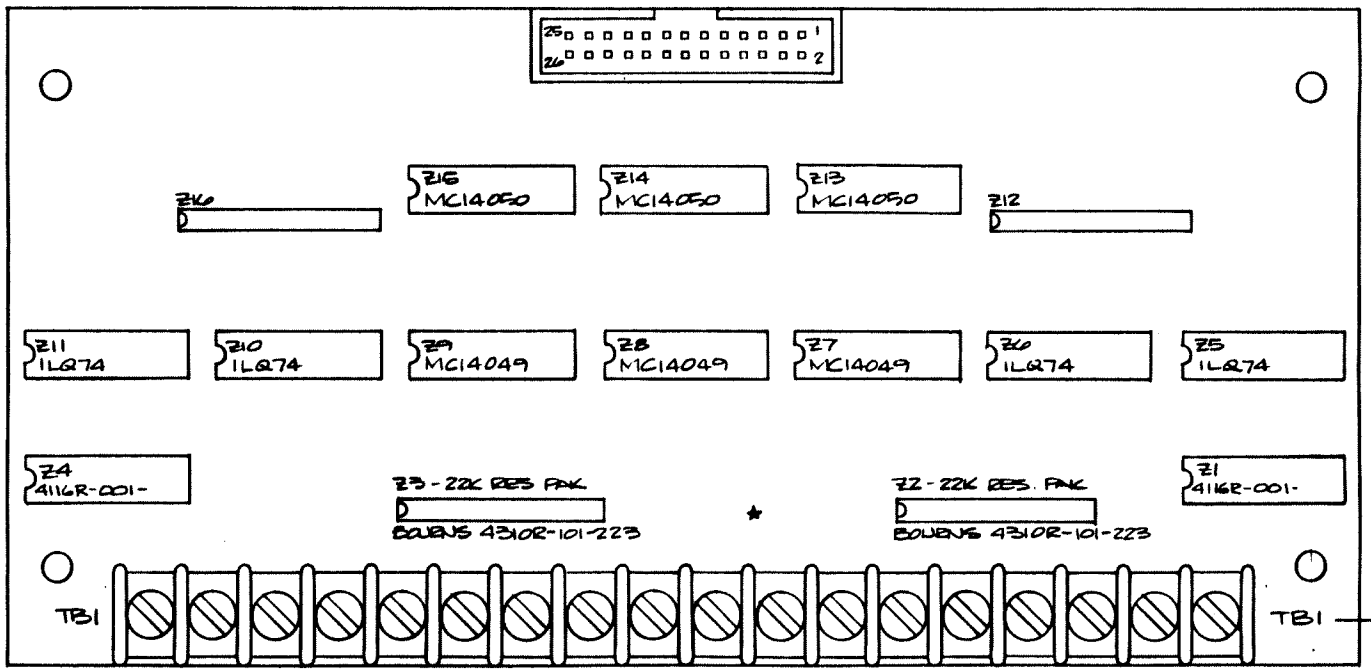
JC ENTERPRISES

TITLE: PRINTED CIRCUIT BD SCH- 16 LINE INPUT ISOLATOR MODEL A1100

SIZE D | CODE IDENT | 11159 | SCALE N.A. | SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD

J1 - ANSLEY 609-2627
"JCS INTERFACE" OUTPUTS



18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	TERMINAL PIN NO.
+V	GND	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	HEX NOTATION
		15	14	13	12	11	10	9	"	"	"	"	"	"	"	"	"	BIT NOTATION
		8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1	BINARY CODE
		MSB												LSB				

INPUTS

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV
	1	END ITEM		1400	9-1-80	M/C
APPLICATION				EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03 .XXX ± .010
ANGLES 0°30'

HOLE TOLERANCES
.010 THRU .120 +.004 −.001 .021 THRU .300 +.006 −.001
.126 THRU .520 +.006 −.001 .001 THRU .750 +.008 −.001

MATERIAL ⚠
FINISH ⚠

ENGINEERING ACTIVITY

DESIGN	JC SYSTEMS INC.
DRAFTED	" 01 SEPT 1980
CHECKED	
APPROV	
RELEASE	

DO NOT SCALE DWG

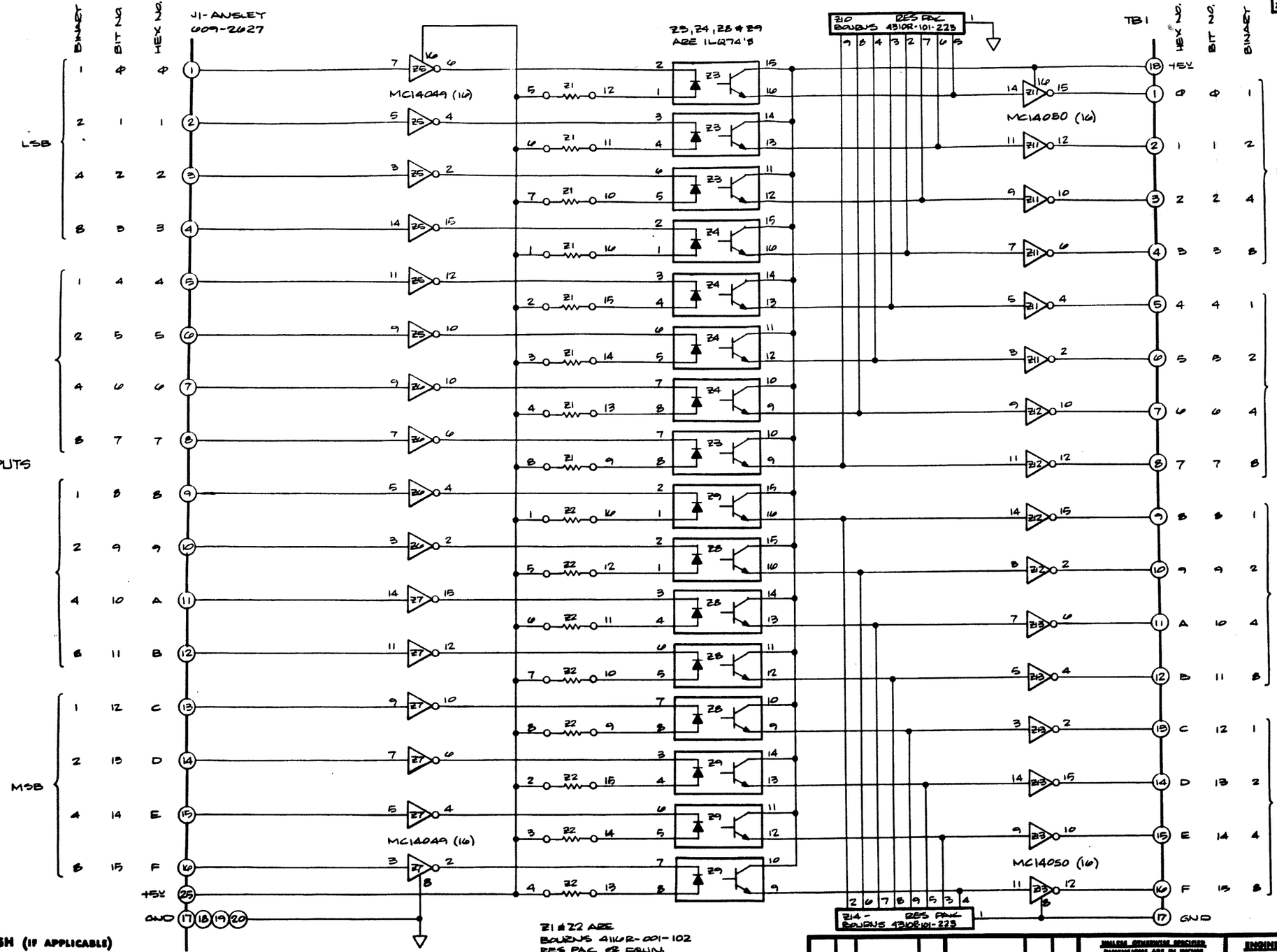
ENTERPRISES

TITLE: PRINTED CIRCUIT BD ASSY
16 LINE INPUT ISOLATOR
MODEL A1160

SIZE	CODE IDENT	
C		1160

SCALE 2:1

SHEET 1 OF 1



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

	1	A1164		1 of 1		4-5-90	N/C				
BASH	QTY	NEXT ASSY	USED ON	SERIAL NO.		DATE EFF	DWG REV	MATERIAL ⚠			
APPLICATION				EFFECTIVITY				FINISH ⚠			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMAL .XX ± .030 .XXX ± .010 ANGLES ± 0°30'

HOLE TOLERANCES

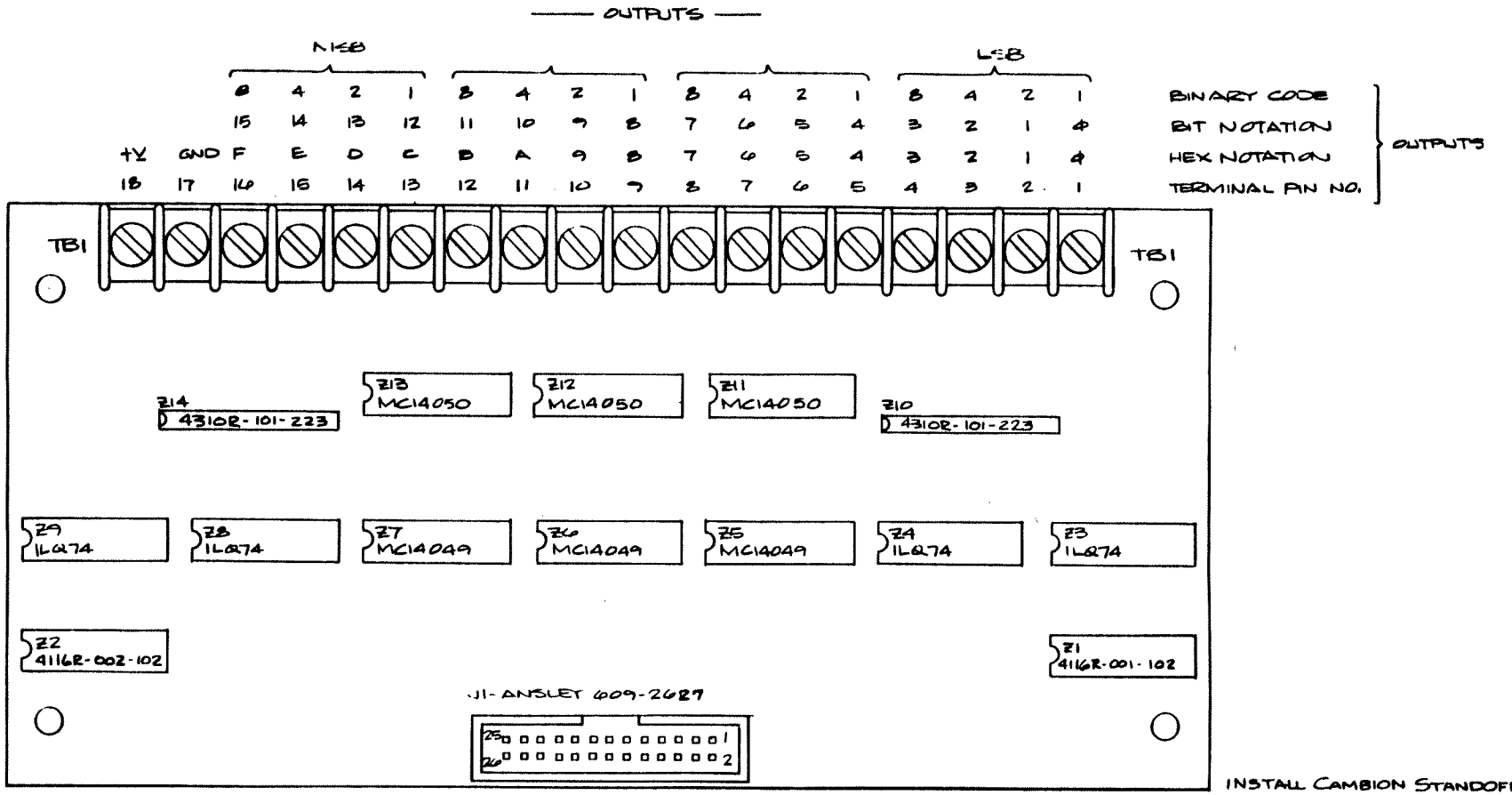
ENGINEERING ACTIVITY	
DESIGN	JC SYSTEMS INC.
DRAFTED	05 SEPT 1990
CHECKED	
APPROV	
RELEASE	
DO NOT SCALE DWG	

JC ENTERPRISES

TITLE: PRINTED CIRCUIT BD SCH- 16 LINE OUTPUT ISOLATOR MODEL A1164

SIZE	CODE IDENT		
D		11603	1
SCALE N.A.			SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD



INSTALL CAMBION STANDOFFS (4 ea)
350-7409-11-19-00

DASH	QTY	NEXT ASSY	USED ON
	1	BD ITEM	

APPLICATION

SERIAL NO.	DATE EFF	DWG REV
1 AND	9-6-80	N/C

EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: 0°30'
NON TOLERANCE: .013 THRU .156 +.004 −.001; .501 THRU .500 +.004 −.001; .206 THRU .500 +.005 −.001; .501 THRU .700 +.008 −.001

MATERIAL ⚠1

FINISH ⚠2

ENGINEERING ACTIVITY	
DESIGN	JC SYSTEMS INC.
DRAFTED	" 09 SEPT 1980
CHECKED	
APPROV	
RELEASE	

DO NOT SCALE DWG

ENTERPRISES

TITLE: PRINTED CIRCUIT BD ASSY - 16 LINE OUTPUT ISOLATOR MODEL A11604

SIZE	CODE IDENT	
C		11604

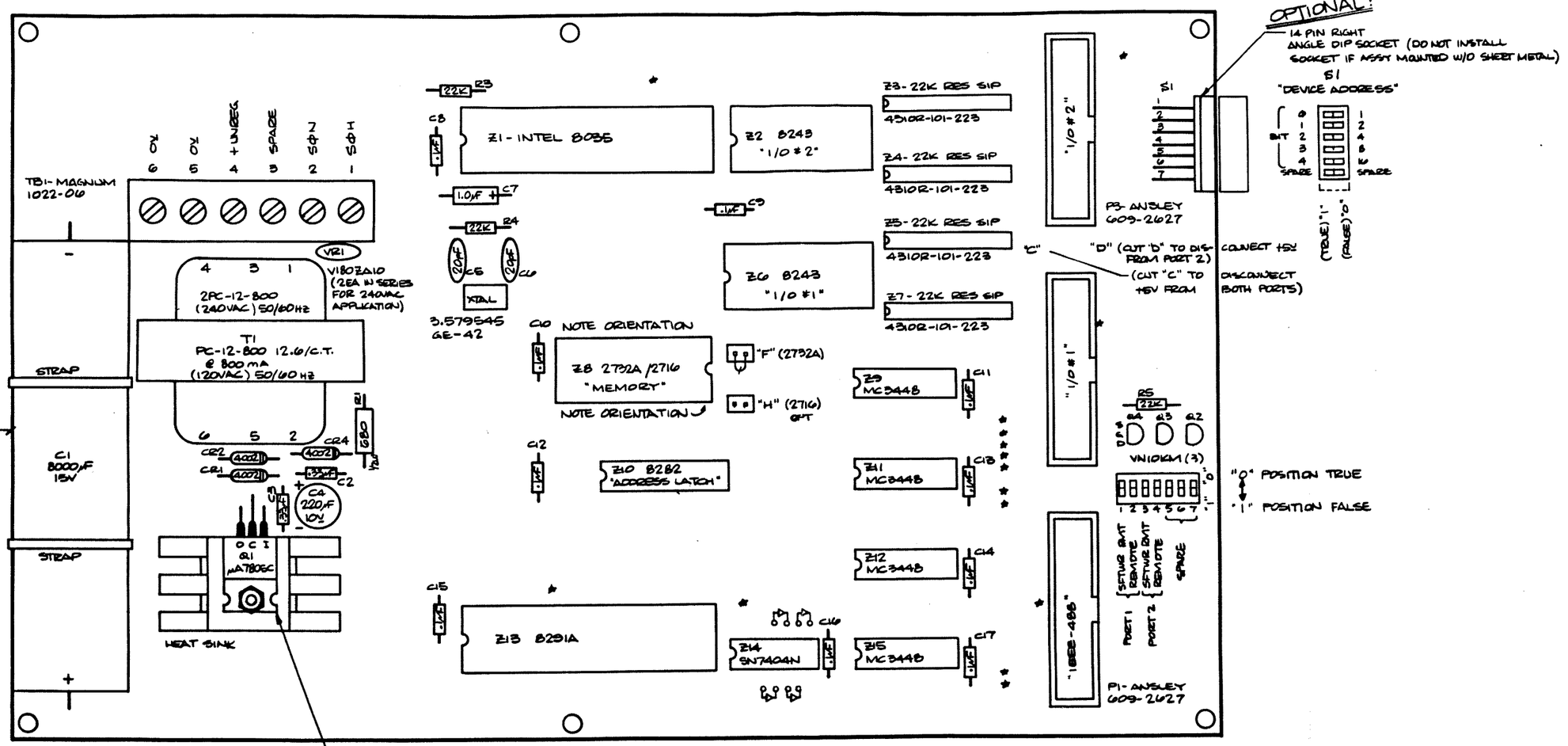
SCALE 2:1 SHEET 1 OF 1

⚠1 FINISH (IF APPLICABLE)

⚠2 MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	MOVED R1 (1/4") TOWARD PCB EDGE. ADDED R2, R3, R4, R5 & R6 & PCBRD CORRECTIONS	1-21-83	
	B	INSTALL JUMPER "F" FOR 2732A PART NO.	1-24-83	



⚠3 INSTALL JUMPER 'E' FOR 8748 AND EMITT 8282 (8HO) & 2716/2732A (2S).

⚠2 FINISH (IF APPLICABLE)

⚠1 MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON
APPLICATION			

SERIAL NO.	DATE EFF	DWG REV
EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON
DECIMALS .XX ± .05 .XXX ± .010
ANGLES 0°30'
HOLE TOLERANCES
.001 to .005 +.005 -.001
.006 to .010 +.005 -.001
.011 to .015 +.005 -.001
.016 to .020 +.005 -.001

MATERIAL ⚠1
FINISH ⚠2

ENGINEERING ACTIVITY	
DESIGN	JC SYSTEMS INC
DRAFTED	" 26 JAN 1983
CHECKED	
APPROV	
RELEASE	
DO NOT SCALE DWG	

JC SYSTEMS, INC.

TITLE: PRINTED CIRCUIT BD. ASSY- IEEE-488 4 DECADE BCD INTERFACE MODEL A1588/1088

SIZE	CODE IDENT		
D		1538/1088	B
SCALE 2:1			SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD

P1- ANSLEY 609-2627 P1

ANSLEY 609-24F (R.P.)

DIO1 DIO2 DIO3 NRFD DIO4 DIO5 DIO6 NDAC GND DIO7 DIO8 DAV EOI GND ATN IFC REN SRQ CHASSIS GND

"IEEE-488" REAR PANEL

R2 100Ω

Z14 SN7404N

MC3448 Z12

MC3448 Z11

MC3448 Z9

MC3448 Z16

Z13 INTEL 8291A

Z10-8282 "ADDR LATCH"

Z8 - 2732A/2716

2732A ("F") 2716

Z1 8035

Z2 INTEL 8243 "I/O#2"

Z6 INTEL 8243 "I/O#1"

Z4-4310R-101-223 22K RES SIP

Z5-4310R-101-223 22K RES SIP

Z7-4310R-101-223 22K RES SIP

Z3-4310R-101-223 22K RES SIP

Q2-VN10KM Q3-VN10KM Q4 VN10KM

XTAL 1 GEAR 3.579545 MHz

C5 20pF C6 20pF C7 1.0μF

R4 22K R5 22K R3 22K

S2-1

"S1 BUS ADD'S" DIP SWITCH

SET: 4 3 2 1 0 BIT (SHOWN IN "0" STATE)

S2-1 THRU 4 SHOWN IN "1" OR FALSE STATE

P3- ANSLEY 609-2627

.1 .2 .4 .8 1 2 4 8 SETPOINT I/O #2 TEMP

10 20 40 80 100 200 400 NEG.

GND

TEMP INTERROGATE

REMOTE

SETPOINT VALID

(+5V)

P2

P2- ANSLEY 609-2627

.1 .2 .4 .8 1 2 4 8 SETPOINT I/O #1 TEMP

10 20 40 80 100 200 400 NEG.

GND

NULL

TEMP INTERROGATE

REMOTE

SETPOINT VALID

+5V

P2

T1 PC 12-800 12.6V C.T. (800mA)

TB1 MAGNUM 1022-06

VR1 S1 470Ω 1/2W CR1 IN4001 CR2 IN4001 CR4 IN4002

HEAT SINK μA7805C Q1 C1 1000μF 16V C2 .33μF C3 .1μF C4 220μF 10V

+5V GND

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⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV	MATERIAL ⚠
APPLICATION				EFFECTIVITY			FINISH ⚠

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .05 .XXX ± .010 ANGLES 0°30' HOLE TOLERANCES .000 +.004 -.000 .001 +.005 -.000 .000 +.005 -.000 .001 +.005 -.000

ENGINEERING ACTIVITY

DESIGN	JC SYSTEMS INC.
DRAFTED	" 19 JAN 1983
CHECKED	
APPROV	
RELEASE	

DO NOT SCALE DWG

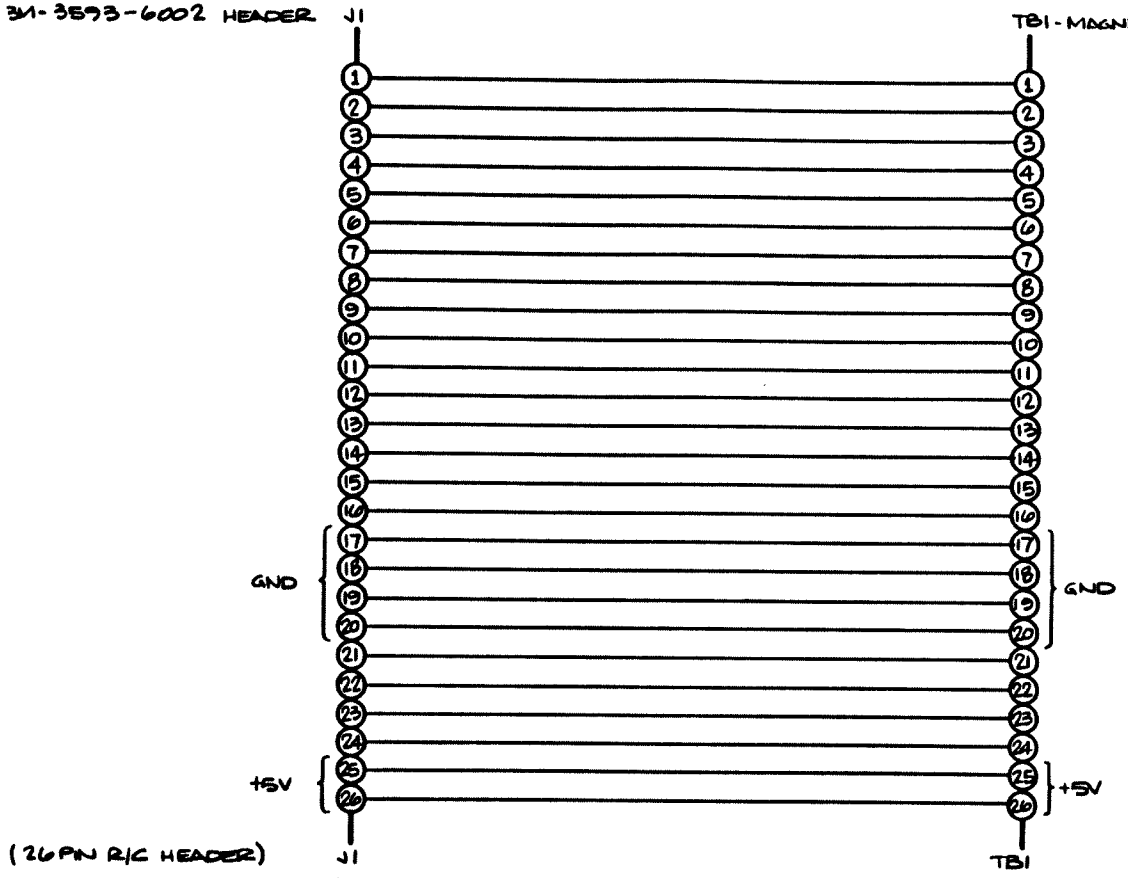
JC SYSTEMS, INC.

TITLE: PRINTED CIRCUIT BD SCH- IEEE-488 4 DECADE BCD INTERFACE MODEL A1538/1038

SIZE	CODE IDENT		
D		1537/1037	B

SCALE N.A. SHEET 1 OF 1

ZONE	LTR	DESCRIPTION	DATE	APPD



DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV
APPLICATION				EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: 0°30'
HOLE TOLERANCES

MATERIAL ⚠1
FINISH ⚠2

ENGINEERING ACTIVITY	
DESIGN	JC SYSTEMS INC
DRAFTED	" 15NOV1983
CHECKED	
APPROV	
RELEASE	

DO NOT SCALE DWG

JC SYSTEMS, INC.

TITLE: PRINTED CIRCUIT BD SCH — PORT TRANSITION MODEL A1604

SIZE	CODE IDENT	
C		1603

SCALE N.A. SHEET 1 OF 1

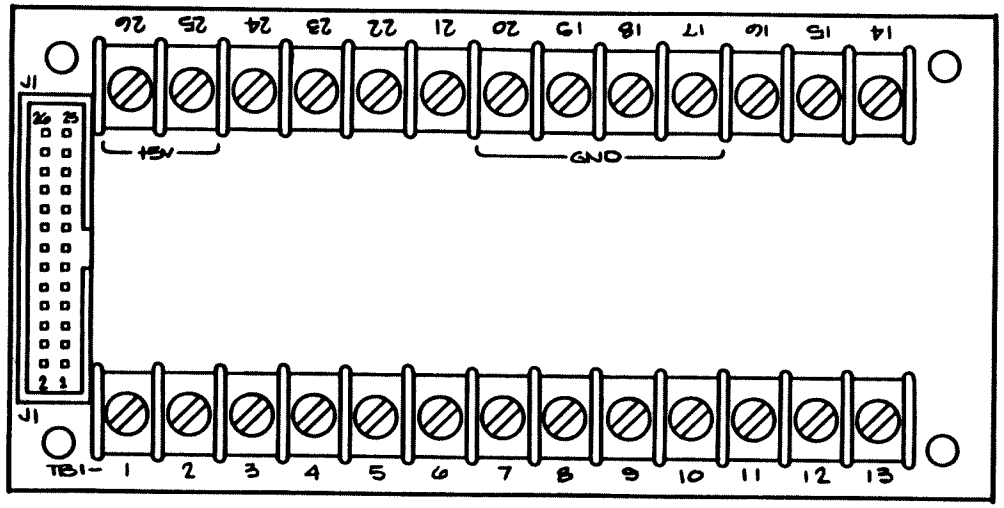
⚠1 FINISH (IF APPLICABLE)

⚠2 MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD

J1- 3M- 3593-6002



MAGNUM 1022-13

MAGNUM 1022-13

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON
APPLICATION			

SERIAL NO.	DATE EFF	DWG REV
EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03; .XXX ± .010
ANGLES: 0° 30'

HOLE TOLERANCES

MATERIAL ⚠1

FINISH ⚠2

DO NOT SCALE DWG

ENGINEERING ACTIVITY	
DESIGN	JC SYSTEMS INC
DRAFTED	" 15 NOV 1993
CHECKED	
APPROV	
RELEASE	

JC SYSTEMS, INC.

TITLE: PRINTED CIRCUIT BD ASSY- PORT TRANSITION MODEL A1604

SIZE	CODE IDENT	
C		1604

SCALE 2:1

SHEET 1 OF 1

APPENDIX A. MODEL A1160 INTERFACE INPUT ISOLATOR

The A1160 Input Isolator printed circuit board performs two functions: 1) provides photocoupling for the 16 input lines of the 188A Dual Port Interface and 2) corrects for differences of potential between the 188A and external devices.

A ribbon cable connects the A1160 Input Isolator and the 188A Interface. The cable runs from J1, a 26-pin RC header on the isolator board, to P2 (I/O 1) or P3 (I/O 2), DB-25 type male connectors on the 188A.

An 18-pin terminal strip provides for hookup of external inputs. Pins 1 through 16 are used for the 16 input lines. The external ground and source voltage necessary for the input drivers connect at Pins 17 and 18.

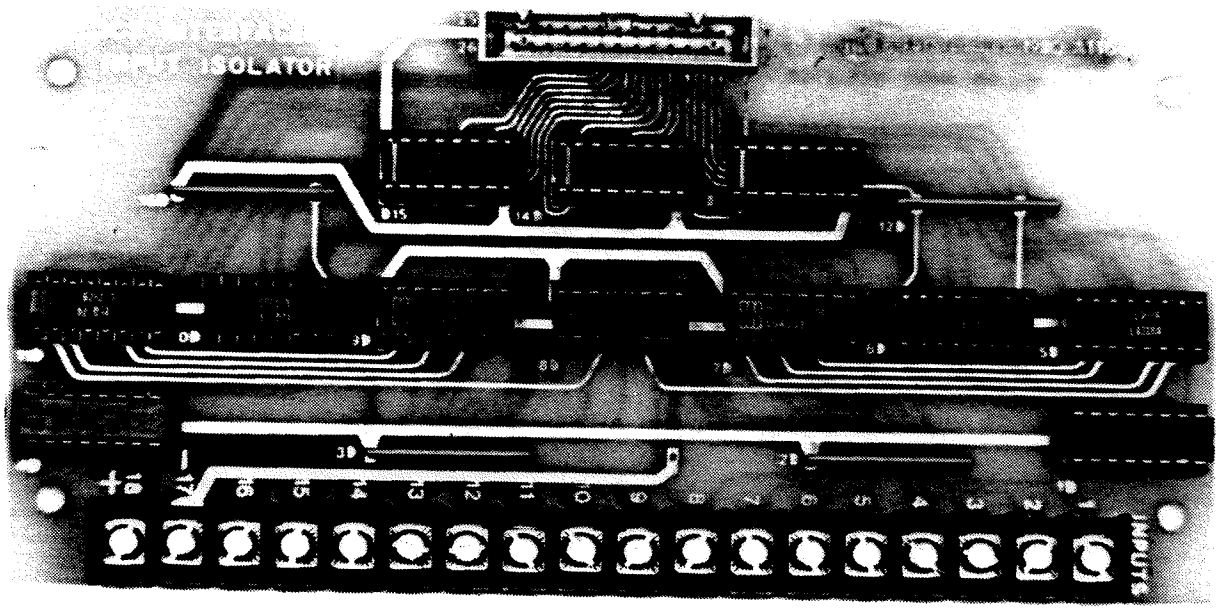


Figure A-1. Model A1160 Input Isolator Printed Circuit Board.

APPENDIX B. MODEL A1164 INTERFACE OUTPUT ISOLATOR

The A1164 Output Isolator printed circuit board provides photocoupling for the 16 output lines of the 188A Dual Port Interface. The board is also used to correct for differences in potential between the 188A and external devices.

A ribbon cable connects the A1160 Input Isolator and the 188A Interface. The cable runs from J1, a 26-pin RC header on the isolator board, to P2 (I/O 1) or P3 (I/O 2), DB-25 type male connectors on the 188A.

An 18-pin terminal strip provides for hookup of external outputs. Pins 1 through 16 are used for the 16 output lines. The external ground and source voltage necessary for the output drivers connect at Pins 17 and 18.

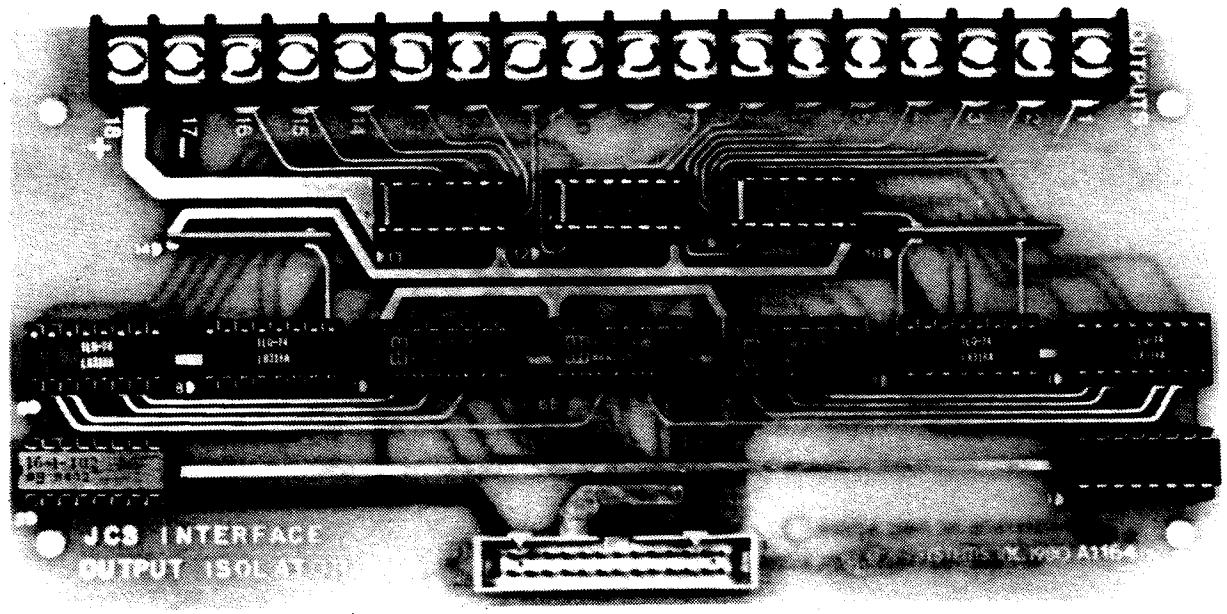


Figure B-1. Model A1164 Output Isolator Printed Circuit Board.

APPENDIX C. MODEL A1604 PORT TRANSITION BOARD

Input or output devices such as photocoupled solid-state relays may be conveniently connected to the 188A Interface using the A1604 Port Transition Board.

A ribbon cable connects the 188A Interface and the A1604 Port Transition. The cable runs from J1, a 26-pin RC header on the transition board, to P2 (I/O 1) or P3 (I/O 2), DB-25 type male connectors on the 188A.

A terminal strip provides for hookup to external connections from the 188A Interface port outputs. Pins are available for the 16 I/O lines, as well as ground and 5-volt source voltage.

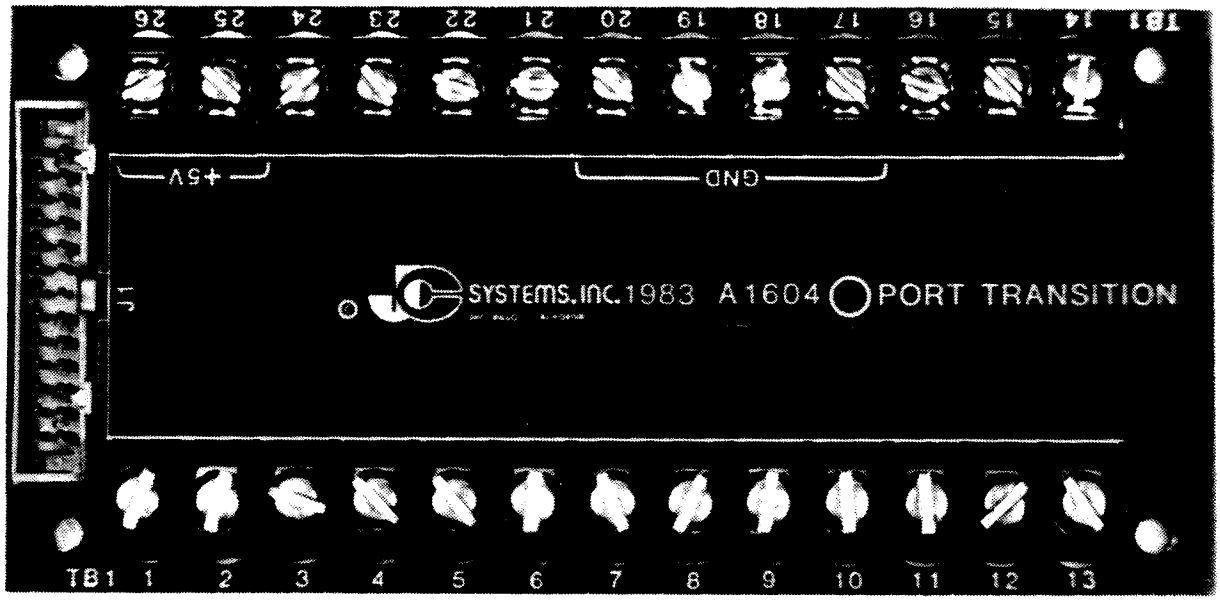


Figure C-1. Model A1604 Port Transition Board.