WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

TEKTRONIX®

P7001/CP Bus
Interface

021-0116-00 & up

SERVICE

INSTRUCTION MANUAL

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1654-01

P7001/CP Bus Interface (021-0116-00 & up).

DESCRIPTION

The TEKTRONIX P7001/CP Bus Interface is a circuit board assembly installed in the P7001 Processor to mate the P7001 with the CP bus.[1] This allows the Digital Processing Oscilloscope (DPO) to be interfaced to an external controller. Figure 1-1 relates the interface to a CP Bus System.

Through this interface, P7001 functions or memory can be addressed and data for the addresses transferred over the CP bus. This enables control of programmable functions of the DPO and waveform input/output for automated waveform acquisition, processing, and display in a CP Bus System.

Operation With TEK BASIC Software

TEK BASIC Software can be used in a compatible controller such as the Tektronix CP1100-series or CP4100-series controllers to operate the DPO over the CP bus. With this software, the interface is transparent to the operator; see the software manuals for operating instructions for the DPO using the software.

In TEK BASIC Software, the DPO using this interface is identified by its Hardware Unit Number (HUN) or a number assigned using the HUN. The HUN is determined by the position of jumpers on the controller interface and the device number jumper P7001/CP Bus Interface. Refer

DPO

P7001/CP
BUS INTERFACE

D7704
DISPLAY UNIT

P7001
PROCESSOR

A7704
ACQUISITION UNIT

CP BUS
INTERFACE
(e.g. CP4165)
CP BUS
INTERFACE

CONTROLLER
(e.g. CP4165)

CP BUS

UP TO 7
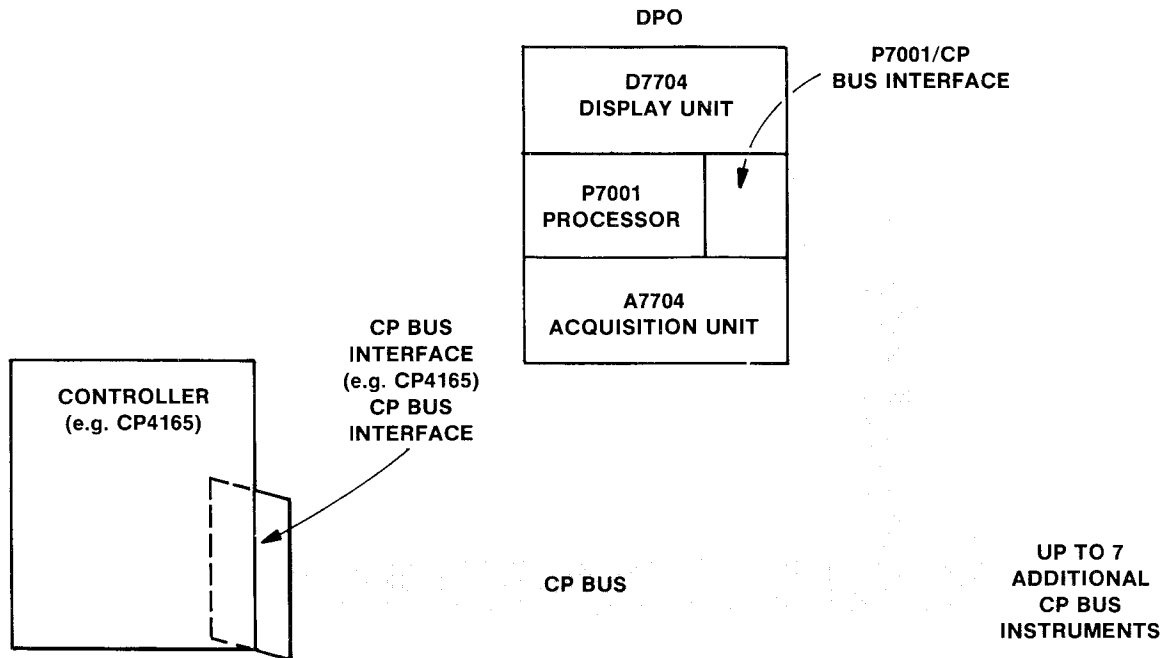ADDITIONAL
CP BUS
INSTRUMENTS

1654-02

Fig. 1-1. A P7001/CP Bus Interface connected to a CP Bus System.

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[1] This interface has also been called the APD Controller, DPO Controller, and the DPO/CP Bus Interface.

selection of the jumpers to qualified service personnel since this requires that the covers be removed from the instruments. Instructions for setting the jumper on this interface are found in the service section of this manual; see the controller interface manual for instructions for the other jumpers that determine the HUN.

System Cabling

CP bus cables available for connecting the DPO to a CP Bus System are shown in the Mechanical Replaceable Parts list. Limits on the combination of instruments connected to the CP bus are imposed by some versions of TEK BASIC Software. Refer to the software manuals for any restrictions that apply to your system. Subject to these limits and the electrical limit of 50 feet (15.2 meters) total length, up to eight CP bus instruments can be daisy-chained on the bus. In the case of the P7001/CP Bus Interface, in and out connectors are provided on the rear-panel of the DPO. In the case of the R7912 Transient Digitizer, a junction block at one end of R7912 CP Bus cables has a connector that accepts another cable to extend the CP bus to the next instrument in the chain. The HUN of each instrument is not affected by the position of the instrument in the chain. The HUN is determined solely by the jumpers as discussed above.

Bus termination resistors must be installed on the device interface of the instrument that is electrically farthest from the CP bus controller (last in the chain). Termination resistors on any interface connected between the controller and the last instrument in the chain must be removed. Since these resistors are inside the instrument, refer installation or removal to qualified service personnel. Instructions can be found in the service section of this manual.

Verification

P7001 Checkout Software can be run to determine if this interface is operating properly. Though intended to check the P7001, this interface must run correctly as well for the test to be completed successfully. The checkout software is available for both CP1100-series and CP4100-series controllers. To perform the tests, see the checkout software manual.

Programming

Input/output through the P7001/CP Bus Interface takes place over the CP bus in two steps: first, an address in P7001 memory or an address of a function's status word is sent to the DPO Address Register located on the P7001/CP Bus Interface. Then the data to be stored or read at that address is transferred in the second step. Although the data is transferred directly between the CP bus and the address loaded into the DPO Address Register, this is sometimes described as a read or write of the DPO Data Register. This occurs as a result of the bus structure of CP1100-series and CP4100-series controllers. In these controllers, an address is transferred through one address in controller memory and the data through an adjacent address in controller memory. The controller interface decoding logic then sets the CP bus control lines correctly for either an address or data transfer.

The CP bus signal lines are defined in Table 1-1.

Table 1-1
CP BUS SIGNALS

J02 Pin Number	Signal Name	Description
1	CB0	Bidirectional data lines used
2	CB1	to transfer both P7001 internal
3	CB2	addresses and data. If CBBZY
4	CB3	is not asserted at the same
5	CB4	time, CB0 through CB7 can be
6	CB5	asserted by a CP bus device
7	CB6	to request an interrupt.
8	CB7	
9	CB8	
10	CB9	
11	CB10	
12	CB11	
13	CB12	
14	CB13	
15	CB14	
16	CB15	
17	GND	Ground.
18	GND	
19	BCLR	Bus Clear. Sets the P7001/CP Bus Interface to an idle state. Asserted by the controller.
20	CLI	Clear Interrupt. Indicates the interrupt request is acknowledged. Asserted by the controller.

Table 1-1 (cont)

CP BUS SIGNALS

J02 Pin Number	Signal Name	Description
21	DRCV	Data Received. Indicates data has been received. Bidirectional, asserted by the device receiving the data in response to DSNT.
22 23	BQ1 BQ2	Control lines that indicate the action to be taken on the bus. Set by the controller.

BQ1	BQ2	
L	L	Starts a read of data from the P7001.
H	H	Quiescent state. Also, the transition of both BQ1 and BQ2 from low to high is part of the data read sequence.
H	L	Indicates a write of data to the P7001.
L	H	Indicates a write of an address to the P7001.

J02 Pin Number	Signal Name	Description
24	CBBZY	CP Bus Busy. Indicates a device interface or controller is using the bus. Bidirectional. Set by the device using the bus.
25	BS1 BS2 BS3	Bus Select. Indicates the device number (0 through 7) in binary of the device addressed by the controller. Set by the controller.
28	DSNT	Data sent. Indicates the presence of valid data on the CB0 through CB15 lines. Bidirectional. Set by the device asserting the data.
29 30 31 32 33 34 35 36 37	GND GND GND GND GND GND GND GND GND	Ground.

Controller Write to DPO Address Register. To send a P7001 internal address, the controller writes to the DPO Address Register. The address can be that of a P7001 memory location or the status word of a DPO function. See the P7001 Processor Service Manual for a discussion of the memory and status word addresses. The sequence is as follows (shown in Fig. 1-2):

1. The controller puts the address on CB0 through CB15, the device number on BS1 through BS3, and sets CBBZY and BQ1.

2. The controller waits 0.3 microsecond for the address to settle and then asserts DSNT.

3. When the controller sees DRCV, it releases all lines.

Controller Write of Data to the DPO. To send data to the internal P7001 address sent to the DPO Address Register, the controller writes the data to the CP bus with BQ2 asserted. See the P7001 Processor Service Manual for more information about the data format. The data write sequence is as follows (shown in Fig. 1-3):

1. The controller puts the data on CB0 through CB15, the device number on BS1 through BS3, and asserts CBBZY and BQ2.

2. The controller waits 0.3 microsecond for the data to settle and then asserts DSNT.

3. When the controller sees DRCV, it releases all lines.

Controller Read of Data from the DPO. To read data from the internal P7001 address sent to the DPO Address Register, the controller reads the data put on the CP bus by the P7001/CP Bus Interface. The data read sequence is as follows (shown in Fig. 1-4):

1. The controller puts the device number on BS1 through BS3 and sets CBBZY, BQ1, and BQ2. This starts the read cycle.

2. The controller waits 0.3 microsecond for the signal lines to settle and then asserts DSNT.

3. When the controller sees the P7001/CP Bus Interface answer with DRCV, it releases BQ1 and BQ2, but continues to assert CBBZY and the device number on BS1 through BS3.

4. When the P7001/CP Bus Interface sees BQ1 and BQ2 high, it puts the data on CB0 through CB15 and sends DSNT to the controller.
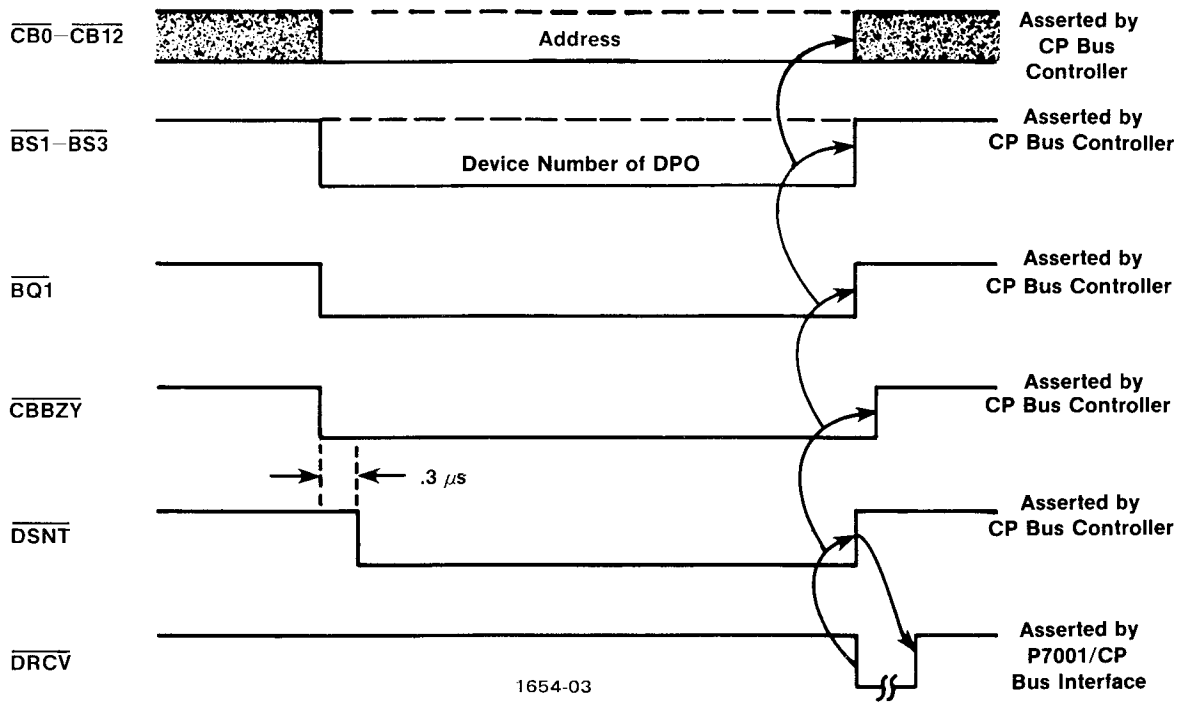
Fig. 1-2. Transfer of an address to the DPO Address Register.
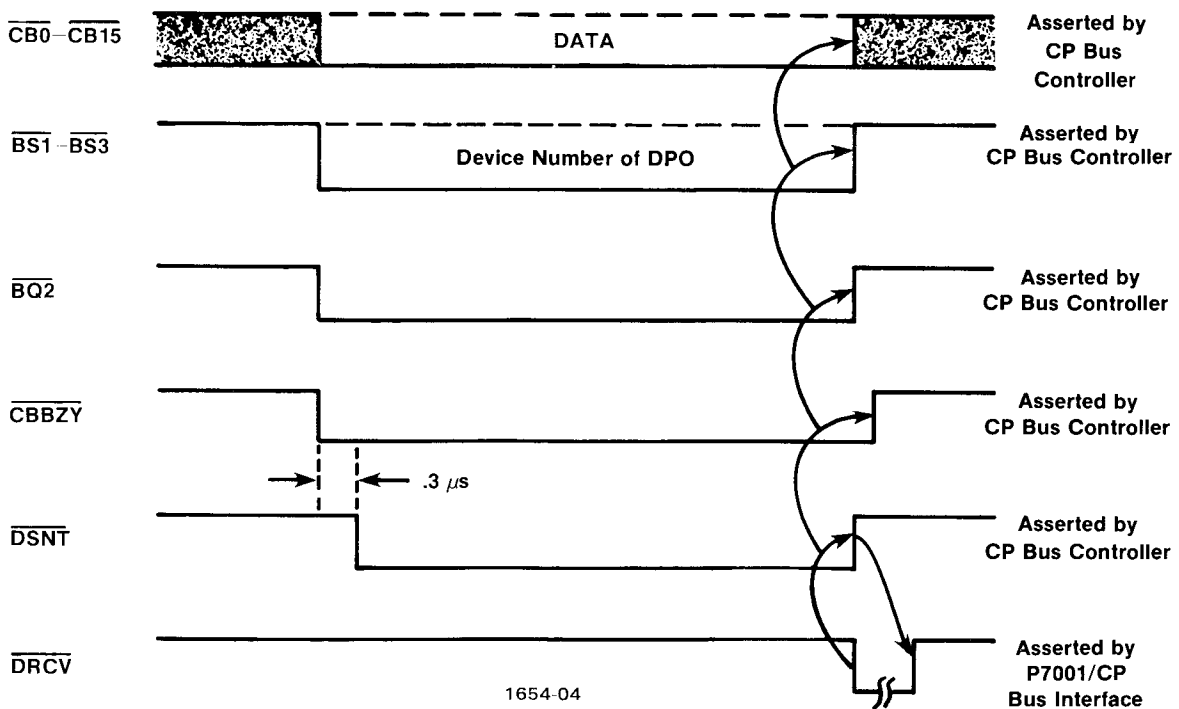
Fig. 1-3. Transfer data to the P7001.
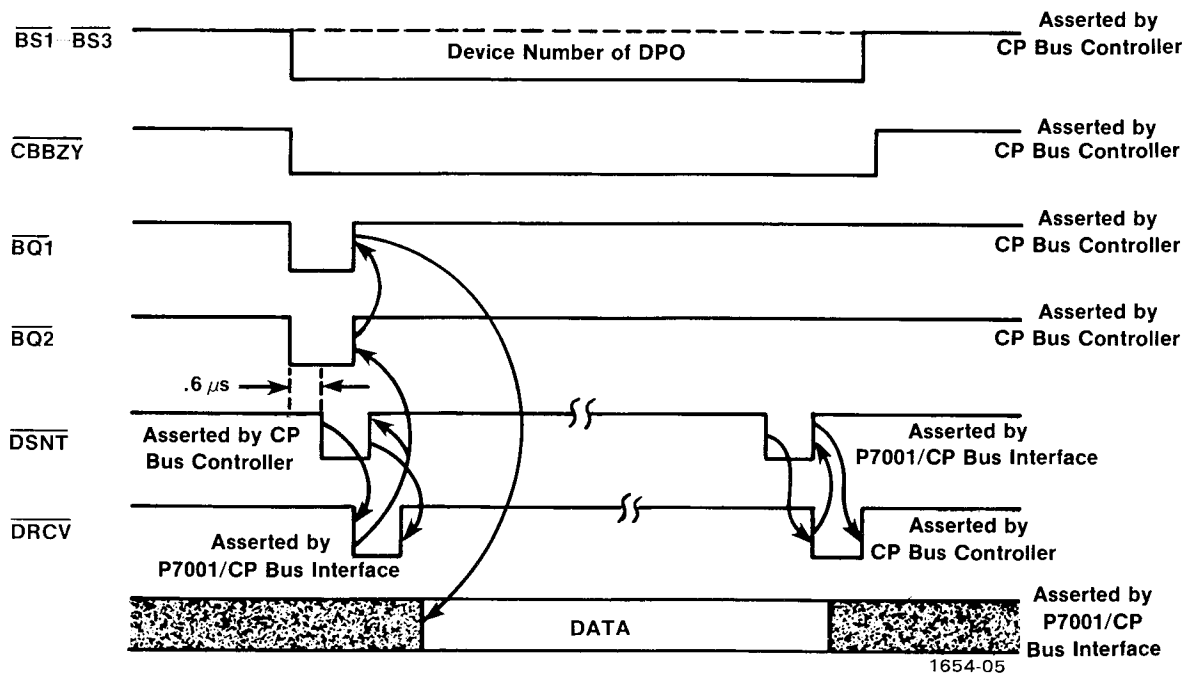
Fig. 1-4. Transfer of data from the controller to the P7001.

5. When the controller sees DSNT asserted, it latches the data and sends DRCV to the P7001/CP Bus Interface.

6. The P7001/CP Bus Interface releases DSNT and the controller, in turn, releases DRCV, CBBZY, and the device number on BS1 through BS3.

Interrupt of CP Bus Controller. To interrupt the CP bus controller, the P7001/CP Bus Interface and controller perform the following sequence:

1. The P7001/CP Bus Interface waits until CBBZY is not asserted (a data or address transfer is not taking place) and asserts the CP bus data line that represents its device number. For instance, if the device number jumper on the

P7001/CP Bus Interface is set for device number 0, the interface asserts CB0; if the jumper is set for device number 1, it asserts CB1, etc.

2. When the CP bus controller recognizes the interrupt request, it latches the device number.

3. The controller then acknowledges the interrupt when it is ready by placing the device number on BS1 through BS3 and asserting the CLI line for approximately 1 microsecond. If the P7001/CP Bus Interface recognizes the device number as its own, it stops asserting the CP bus data line. If the device number belongs to another CP bus instrument, the interface continues to assert the CP bus data line to request an interrupt (except when CBBZY is asserted).

SERVICING

Selecting the Device Number

The device number of the DPO is set by the position of a connector at J01 on the P7001/CP Bus Interface. For a system with only one DPO, set the connector as shown in Fig. 2-1. This sets the DPO device number to 0. To choose another device number in a system with more than a single CP bus instrument, move the connector to the right so the arrowhead on the connector points to the desired device number.

The controller interface has other jumpers that are selected to determine the HUN of the DPO; see the controller interface manual for instructions.

Installation

Before installing the P7001/CP Bus Interface, be sure the termination resistors (Fig. 2-1) are installed in the DPO as part of a single-instrument CP bus system. If the system contains other DPOs or R7912s, remove the termination resistors in all interfaces in the chain except the last. Be sure the termination resistors are installed in the interface that is connected farthest from the controller (last in the chain).

Be sure power is off, then insert the interface into the opening in the P7001 rear panel. Secure the interface with the two mounting screws and attach the CP bus cable. Secure the cable if the cable and interface rear-panel are equipped with cable-mounting hardware.

Fig. 2-1. The device number (unit select) jumper and termination resistors. The jumper is shown as it should be set for device number 0.

CIRCUIT DESCRIPTION

The circuitry of the P7001/CP Bus Interface may be divided into the basic blocks as shown on diagrams 13A and 13B. The function of each block is indicated by its name.

The DPO Bus Controller block performs the same function and is the same general circuitry that is used on some of the other circuit cards within the P7001. The function of the Bus 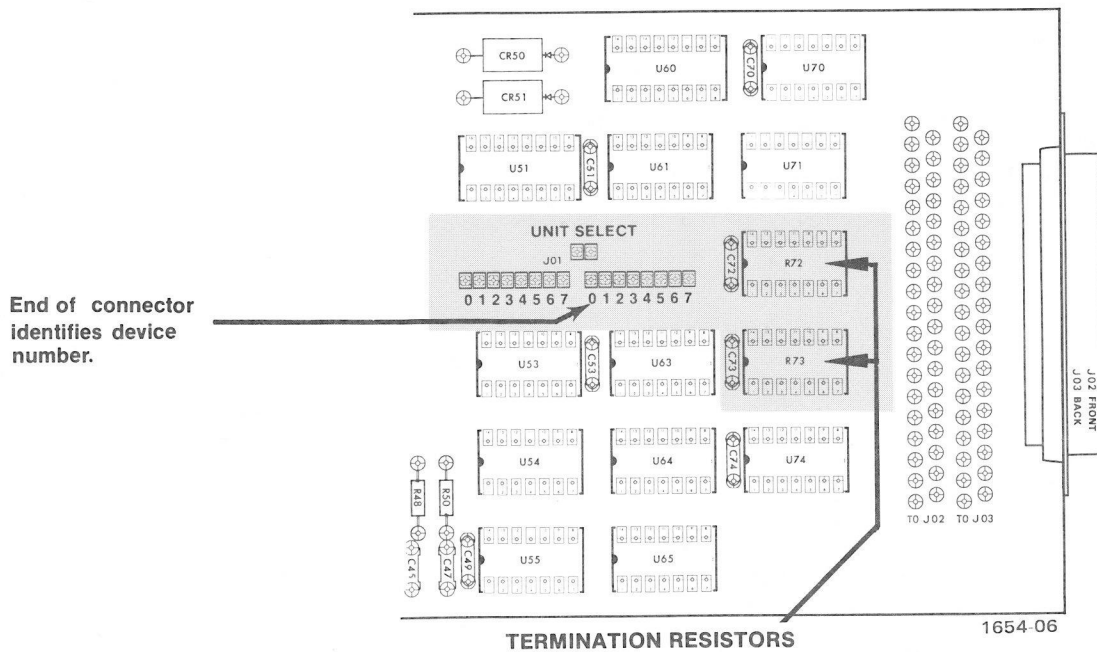Controller is to initiate a transfer of data either from or to a circuit card (device) within the P7001, by sequencing through the bus cycle of acquiring the bus, then putting data onto the bus; at the completion of the bus cycle, the Bus Controller is returned to the idle state. As indicated by the truth table for U41A and U41B, the Bus Controller sequences through four states.

The following is a description of the P7001/CP Bus Interface in its various operating modes, under the assumption that the DPO has had POWER FAIL asserted. When the DPO power is turned on, U41A/B are set, putting the DPO Bus Controller circuit in the idle state, U34A/B are cleared, and U20B is cleared.

Sequence for Sending the Address to the DPO from the CP Bus Controller

The CP bus controller puts the address of the circuit card, device, (Analog-to-Digital Converter, Readout Interface, Display Generator, or Front Panel) or P7001 memory location on CB0 through CB15. The address is put on the thirteen low order bits. The address now appears at the input of the address Register T0 through T12 of U10 and U11 (see Diagram 13B) via J02 CB0—CB12. The device (DPO) number (0 through 7) is put on BS1 through BS3; CBBZY and BQ1 are set. Setting CBBZY inhibits the Interrupt Circuit (U53C) of all the P7001/CP Bus Interfaces.

The device number (BS1—BS3) causes the selected output of U51 (BCD to decimal decoder) to go low putting a high on the C input of U60 (BCD to decimal decoder). BQ1 is set, therefore the 5 (pin 6) output of U60 is low.

After setting CBBZY and BQ1, the bus controller waits approximately 0.3 μs and sets DSNT. When DSNT is set, both inputs of U43C are low causing both inputs of U30A to be high generating CK1, CK1, and DRCV. CK1 and CK1 clock the address Register U10/U11; DRCV is sent to the bus controller to notify it that the action is completed. When the bus controller sees DRCV, it releases all lines. The contents of the Address Register are now gated onto the DPO address bus at this time as L BUS (load Bus) will be low until the DPO Bus Controller is sequenced through to the Master state.

Sequence for Sending Data to the DPO from the CP Bus Controller

The bus controller puts data on CB0 through CB15; the bit location on these lines depends upon the format of the status or data word of the addressed device (see General Status Word Information in the P7001 Processor Service Manual). The data now appears at the input of the Data Switching, J02 (see Diagram 13B). The DPO device number is put on BS1 through BS3; CBBZY and BQ2 are set. CBBZY inhibits the DPO interrupts, and since the B and C inputs of U60 are high, the 6 output (pin 7) is low, producing a high on pin 9 of U35C.

The bus controller waits approximately 0.3 μs, after setting CBBZY and BQ2, and then sets DSNT. Both inputs to U43C are now low causing Pin 10 of U35C to go high. Since both inputs of U35C are high, the output goes low firing the nomostable U45A. When U45A fires, both inputs to U30C are high and the DPO Bus Controller is set to the Bus Request state. A DATA CH REQ (Data Channel Request) signal is sent to the DPO Bus. The DPO will respond with a DATA CH GRANT IN (Data Channel Grant In), clocking U41A and sequencing the DPO Bus Controller to the Select Acknowledge state. A SELECT ACK (Select Acknowledge) signal is sent to the DPO bus and DATA CH GRANT OUT is inhibited by U31B. The SELECT ACK signal causes DATA CH GRANT IN to go low; if the bus is not busy, the DPO Bus Controller will sequence to the Master state developing CONT SYNC (Control Sync) and BUS BUSY.

With the Bus Controller in the Master state, pin 2 of U35A is high; since the 6 output of U60 is low, both inputs to U35A are high and a DTDPO signal gates the data through the Data Switching Logic to the P7001 data bus. Also a DATA MODE 0 bit is developed, which tells the addressed device that it is a write operation. After approximately 50 ns, the addressed device sends a SYNC ACK (Sync Acknowledge) signal to the DPO controller. SYNC ACK causes the output of U42B to go high, which clocks U20A and also returns the Bus Controller to the Idle state through U42D/U31D. When U20A is clocked, a DRCV pulse is sent to the bus controller and the bus controller releases all lines.

Sequence for the CP Bus Controller to Read Data from the DPO

The device number is put on BS1—BS3, causing the C input of U60 to be high. CBBZY is set, which inhibits the interrupts. BQ1 and BQ2 are set, causing the A and B inputs of U60 to be high. With the A, B, and C inputs of U60 high, the 7 output (pin 9) is low.

After setting BQ1 and BQ2 the bus controller waits approximately 0.3 μs and sends DSNT. DSNT is gated through U43C and clocks U34A; the Q output of U34A goes low, which starts the Bus Controller sequencing through the states previously described to the Master state. Also, when U34A was clocked, the output of U24C went low, sending DRCV to the bus controller. When the bus controller receives DRCV, it releases BQ1 and BQ2 but continues to assert CBBZY and BS1 through BS3. When BQ1 and BQ2 are released, the 4 output (pin 5) of U60 goes low. Since the DPO Bus Controller is in the Master state, both inputs to U25D are high and DTCB is

sent to the Data Switching Logic, gating the data onto the CP bus; DATA MODE 0 is high, which indicates a read cycle to the master device.

After the data is gated onto the CP bus, the master device sends SYNC ACK to the CP Bus Interface. SYNC ACK is gated through U42B, causing both inputs of U44B to go high, triggering the monostable U45B; U34B is clocked on the trailing edge of the pulse from the Q output of U45B and a DSNT is sent to the bus controller. When the bus controller receives DSNT, it latches the data and sends DRCV to the DPO. DRCV is gated through U43D, causing the DPO Bus Controller to return to the Idle state; also, U34B is cleared through U43B and DSNT goes high. As soon as the bus controller sees DSNT released by the DPO, it releases DRCV, BS1 through BS3 and CBBZY.

Interrupt Sequence

The interrupting DPO asserts I/O STROBE and clocks U20B. If CBBZY is not asserted by any device, then both inputs to U53C are high and the interrupt is gated onto one of the designated lines (CB0 through CB7); the interrupting DPO will interrupt on the CB line that corresponds to its device number, i.e., device number 5 will interrupt on CB5.

When the bus controller detects that one of the lines (CB0 through CB7) is asserted, it encodes the decimal representation of the interrupting device; the bus controller is interrupted and the encoded number is latched. The bus controller acknowledges the interrupt by placing the device number of the interrupting device on BS1 through BS3 and asserting CLI (Clear Interrupt) for approximately 1 μs. With the device number on BS1 through BS3 and CLI asserted, both inputs to U42C are high; this causes U20B to be cleared and the interrupt removed.

REPLACEABLE
ELECTRICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000   Part first added at this serial number

00X   Part removed after this serial number

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
04222	AVX CERAMICS, DIVISION OF AVX CORP.	P O BOX 867, 19TH AVE. SOUTH	MURTLE BEACH, SC 29577
18324	SIGNETICS CORP.	811 E. ARQUES	SUNNYVALE, CA 94086
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
90201	MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY AND CO., INC.	3029 E WASHINGTON STREET P O BOX 372	INDIANAPOLIS, IN 46206

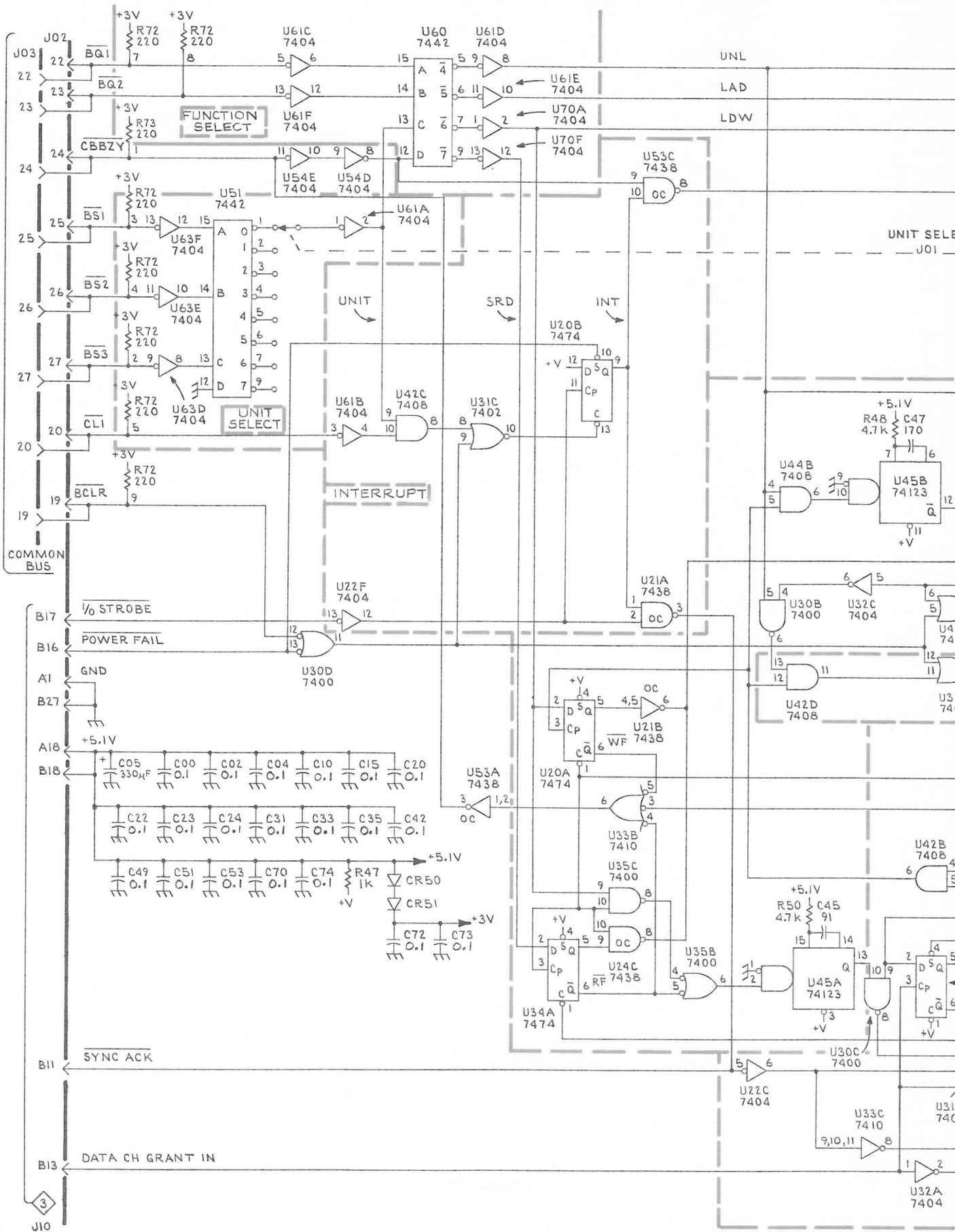| Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
	670-2390-00			CKT BOARD ASSY:DPO CONTROLLER	80009	670-2390-00
	670-2390-01			CKT BOARD ASSY:DPO CONTROLLER	80009	670-2390-01
C00	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C02	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C04	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C05	290-0533-00			CAP.,FXD,ELCTLT:330UF,20%,,6V	90201	TDC337M006WLD
C10	283-0111-00			CAP.,FXD,CFR DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C15	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C20	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C22	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C23	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C24	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C31	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C32	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C33	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C35	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C40	281-0623-00			CAP.,FXD,CER DI:650PF,5%,500V	04222	7001-1362
C42	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C45	281-0637-00			CAP.,FXD,CER DI:91PF,5%,500V	72982	301000Z5D910J
C47	281-0589-00			CAP.,FXD,CER DI:170PF,5%,500V	72982	301000Z5D171J
C49	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C51	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C53	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C70	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C72	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C73	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C74	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
CR50	152-0066-01			SEMICOND DEVICE:SILICON,400V,1A	80009	152-0066-01
CR51	152-0066-01			SEMICOND DEVICE:SILICON,400V,1A	80009	152-0066-01
Q41	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
R41	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R43	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R45	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R47	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R48	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R50	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R72 (13)	307-0347-00			RES.,FXD,FILM:13 RES NETWORK	73138	899-1-R220
R73 (13)	307-0347-00			RES.,FXD,FILM:13 RES NETWORK	73138	899-1-R220
U00	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U01	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U02	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U03	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U04	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U05	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U10	156-0221-00			MICROCIRCUIT,DI:QUAD LATCH	01295	SN74175N
U11	156-0250-00			MICROCIRCUIT,DI:10 BIT BUFFER REG	18324	N8202N
U13	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U14	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	01295	SN7404N
U15	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	01295	SN7404N

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U20	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U21	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U22	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	01295	SN7404N
U23	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U24	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U25	156-0150-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7437N
U30	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U31	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U32	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	01295	SN7404N
U33	156-0047-00			MICROCIRCUIT,DI:TPL 3-INPUT POS NAND GATE	80009	156-0047-00
U34	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U35	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U41	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U42	156-0129-00			MICROCIRCUIT,DI:QUAD 2-INPUT GATE	01295	SN7408N
U43	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U44	156-0129-00			MICROCIRCUIT,DI:QUAD 2-INPUT GATE	01295	SN7408N
U45	156-0172-00			MICROCIRCUIT,DI:DUAL RETRIG MONOSTABLE MV	80009	156-0172-00
U51	156-0061-00			MICROCIRCUIT,DI:SGL,BCD TO DEC DECODER	01295	SN7442N
U53	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U54	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	01295	SN7404N
U55	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U60	156-0061-00			MICROCIRCUIT,DI:SGL,BCD TO DEC DECODER	01295	SN7442N
U61	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	01295	SN7404N
U63	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	01295	SN7404N
U64	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U65	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U70	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	01295	SN7404N
U71	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U74	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	01295	SN7404N

J02 FRONT
J03 BACK

TO J03
TO J02

TERMINATION RESISTORS

U70 C70
U71 R72 R73 U74 C72 C73 C74
U60 U61 U63 U64 U65
C51 C53 C49
UNIT SELECT
01234567
01234567
01234567
J01
CR50 CR51 U51 U53 U54 U55
R50 C47
R48 C45
R47 C42 R45 C40 Q41 R43 R41
U41 U42 U43 U44 U45
C31 C32 C33 C35
U30 U31 U32 U33 U34 U35
C20 C22 C23 C24
U20 U21 U22 U23 U24 U25
C10 C15
U10 U11 U13 U14 U15
C00 C02 C04
U00 U01 U02 U03 U04 U05
C05

A1-36 FRONT
B1-36 BACK

36   1
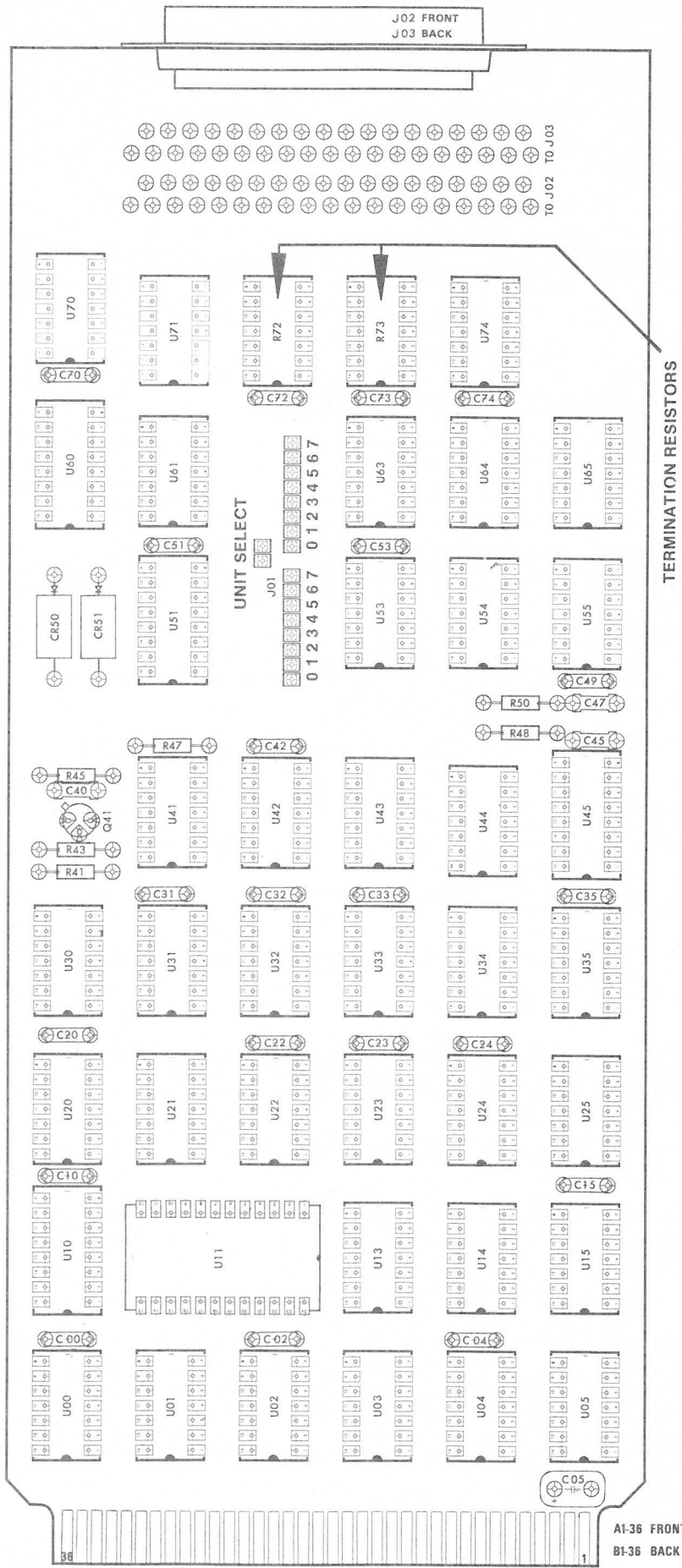
1654-07

P7001/CP Bus Interface component locations.

UNIT SELECT
JOI

STATE	U41A	U41B
IDLE	1	1
BUS REQ	1	0
SEL ACK	0	0
MASTER	0	1

CP BUS CONTROLLER

DPQ BUS CONTROLER

COMMON BUS
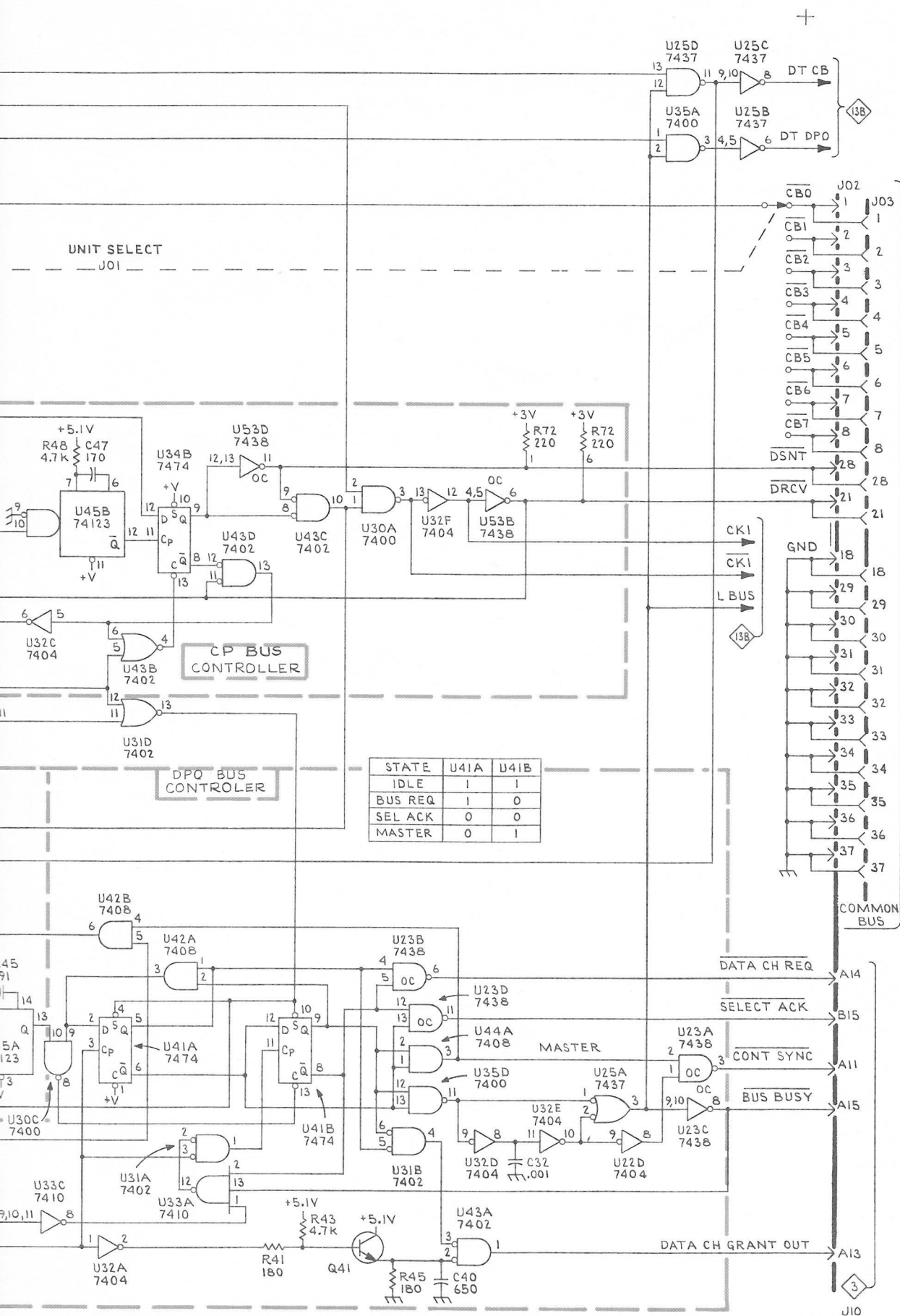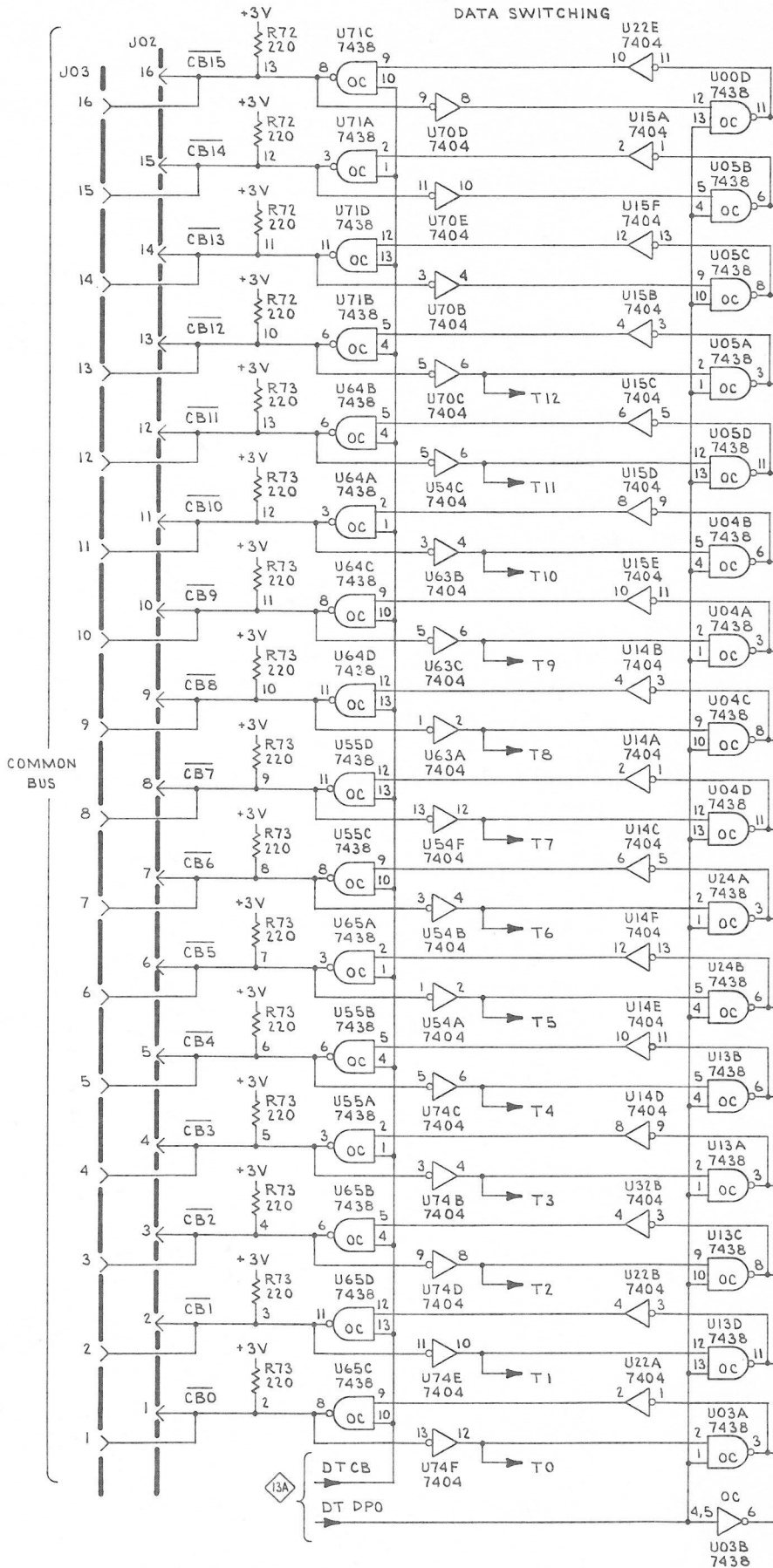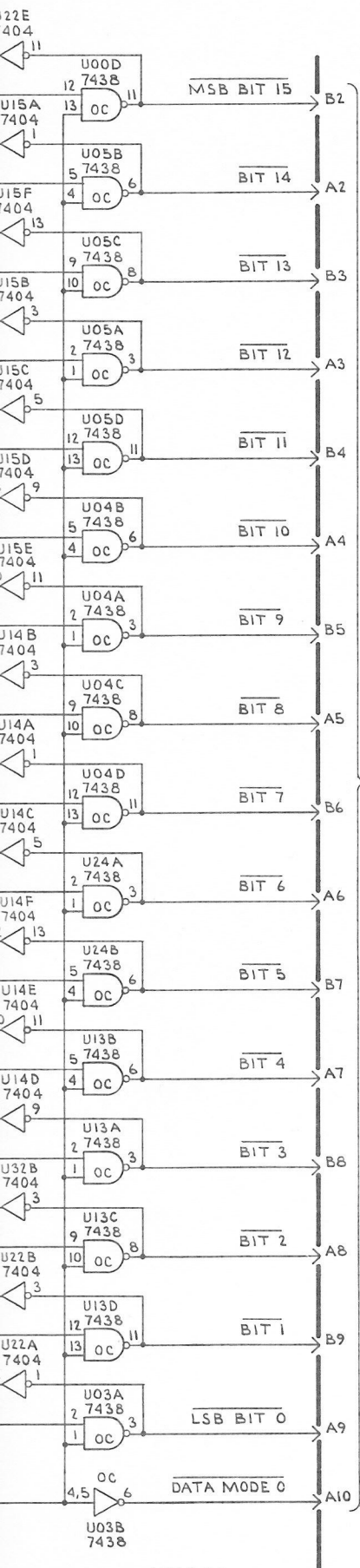
1654-08
B, JAN 1978

P7001/CP BUS INTERFACE 13A N_L

DATA SWITCHING

P7001   021-0116-00+UP   REV.

U22E
7404

U00D
7438

12
7438
13 OC 11 $\overline{MSB\ BIT\ 15}$ B2

U15A
7404
1

U05B
5 7438
4 OC 6 $\overline{BIT\ 14}$ A2

U15F
7404
13

U05C
9 7438
10 OC 8 $\overline{BIT\ 13}$ B3

U15B
7404
3

U05A
2 7438
1 OC 3 $\overline{BIT\ 12}$ A3

U15C
7404
5

U05D
12 7438
13 OC 11 $\overline{BIT\ 11}$ B4

U15D
7404
9

U04B
5 7438
4 OC 6 $\overline{BIT\ 10}$ A4

U15E
7404
11

U04A
2 7438
1 OC 3 $\overline{BIT\ 9}$ B5

U14B
7404
3

U04C
9 7438
10 OC 8 $\overline{BIT\ 8}$ A5

U14A
7404
1

U04D
12 7438
13 OC 11 $\overline{BIT\ 7}$ B6

U14C
7404
5

U24A
2 7438
1 OC 3 $\overline{BIT\ 6}$ A6

U14F
7404
13

U24B
5 7438
4 OC 6 $\overline{BIT\ 5}$ B7

U14E
7404
11

U13B
5 7438
4 OC 6 $\overline{BIT\ 4}$ A7

U14D
7404
9

U13A
2 7438
1 OC 3 $\overline{BIT\ 3}$ B8

U32B
7404
3

U13C
9 7438
10 OC 8 $\overline{BIT\ 2}$ A8

U22B
7404
3

U13D
12 7438
13 OC 11 $\overline{BIT\ 1}$ B9

U22A
7404
1

U03A
2 7438
1 OC 3 $\overline{LSB\ BIT\ 0}$ A9

OC
4,5   6 $\overline{DATA\ MODE\ 0}$ A10
U03B
7438

3
J10

1654-09
REV. B JAN, 1978

ADDRESS REGISTER

13A CK1

FROM
DATA
SWITCHING

T12 4 D_A Q_A 2
T11 5 D_B Q_B 7
T10 12 D_C Q_C 10
U10
74175
+V 1

U00C
9 7438
10 OC 8 $\overline{MSB\ ADD\ 12}$ A25

U00B
5 7438
4 OC 6 $\overline{ADD\ 11}$ B24

U00A
2 7438
1 OC 3 $\overline{ADD\ 10}$ A24

13A $\overline{CK1}$

T9 2 1 22
T8 3   21
T7 4   20
T6 5   19
T5 6   18
T4 7   17
T3 8   16
T2 9   15
T1 10   14
T0 11   13
U11
8202
+V 23

FROM
DATA
SWITCHING

U21C
9 7438
10 OC 8 $\overline{ADD\ 9}$ B23

U21D
12 7438
13 OC 11 $\overline{ADD\ 8}$ A23

U01C
9 7438
10 OC 8 $\overline{ADD\ 7}$ B22

U01D
12 7438
13 OC 11 $\overline{ADD\ 6}$ A22

U01B
5 7438
4 OC 6 $\overline{ADD\ 5}$ B21

U01A
2 7438
1 OC 3 $\overline{ADD\ 4}$ A21

U02C
9 7438
10 OC 8 $\overline{ADD\ 3}$ B20

U02D
12 7438
13 OC 11 $\overline{ADD\ 2}$ A20

U02B
5 7438
4 OC 6 $\overline{ADD\ 1}$ B19

U02A
2 7438
1 OC 3 $\overline{LSB\ ADD\ 0}$ A19

3
J10

13A L BUS

P7001/CP BUS INTERFACE   13B N_{LL}

REPLACEABLE
MECHANICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000   Part first added at this serial number

00X   Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5   *Name & Description*

Assembly and/or Component
Attaching parts for Assembly and/or Component
- - - * - - -
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
- - - * - - -
Parts of Detail Part
Attaching parts for Parts of Detail Part
- - - * - - -

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

"	INCH	ELCTRN	ELECTRON	IN	INCH	SE	SINGLE END
#	NUMBER SIZE	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ACTR	ACTUATOR	ELCTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICOND	SEMICONDUCTOR
ADPTR	ADAPTER	ELEM	ELEMENT	INTL	INTERNAL	SHLD	SHIELD
ALIGN	ALIGNMENT	EPL	ELECTRICAL PARTS LIST	LPHLDR	LAMPHOLDER	SHLDR	SHOULDERED
AL	ALUMINUM	EQPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSEM	ASSEMBLED	EXT	EXTERNAL	MECH	MECHANICAL	SL	SLIDE
ASSY	ASSEMBLY	FIL	FILLISTER HEAD	MTG	MOUNTING	SLFLKG	SELF-LOCKING
ATTEN	ATTENUATOR	FLEX	FLEXIBLE	NIP	NIPPLE	SLVG	SLEEVING
AWG	AMERICAN WIRE GAGE	FLH	FLAT HEAD	NON WIRE	NOT WIRE WOUND	SPR	SPRING
BD	BOARD	FLTR	FILTER	OBD	ORDER BY DESCRIPTION	SQ	SQUARE
BRKT	BRACKET	FR	FRAME or FRONT	OD	OUTSIDE DIAMETER	SST	STAINLESS STEEL
BRS	BRASS	FSTNR	FASTENER	OVH	OVAL HEAD	STL	STEEL
BRZ	BRONZE	FT	FOOT	PH BRZ	PHOSPHOR BRONZE	SW	SWITCH
BSHG	BUSHING	FXD	FIXED	PL	PLAIN or PLATE	T	TUBE
CAB	CABINET	GSKT	GASKET	PLSTC	PLASTIC	TERM	TERMINAL
CAP	CAPACITOR	HDL	HANDLE	PN	PART NUMBER	THD	THREAD
CER	CERAMIC	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CHAS	CHASSIS	HEX HD	HEXAGONAL HEAD	PWR	POWER	TNSN	TENSION
CKT	CIRCUIT	HEX SOC	HEXAGONAL SOCKET	RCPT	RECEPTACLE	TPG	TAPPING
COMP	COMPOSITION	HLCPS	HELICAL COMPRESSION	RES	RESISTOR	TRH	TRUSS HEAD
CONN	CONNECTOR	HLEXT	HELICAL EXTENSION	RGD	RIGID	V	VOLTAGE
COV	COVER	HV	HIGH VOLTAGE	RLF	RELIEF	VAR	VARIABLE
CPLG	COUPLING	IC	INTEGRATED CIRCUIT	RTNR	RETAINER	W	WITH
CRT	CATHODE RAY TUBE	ID	INSIDE DIAMETER	SCH	SOCKET HEAD	WSHR	WASHER
DEG	DEGREE	IDENT	IDENTIFICATION	SCOPE	OSCILLOSCOPE	XFMR	TRANSFORMER
DWR	DRAWER	IMPLR	IMPELLER	SCR	SCREW	XSTR	TRANSISTOR

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
06540	AMATOM ELECTRONIC HARDWARE, DIV. OF MITE CORP.	446 BLAKE ST.	NEW HAVEN, CT 06515
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
71468	ITT CANNON ELECTRIC	666 E. DYER RD.	SANTA ANA, CA 92702
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-	021-0116-00			1		INTERFACE:P7001 TO APD CONTROLLER	80009	021-0116-00
	021-0116-02			1		INTERFACE:P7001 TO APD CONTROLLER	80009	021-0116-02
-1	670-2390-00			1	.	CKT BOARD ASSY:APD CONTROLLER	80009	670-2390-00
	670-2390-01[1]			1	.	CKT BOARD ASSY:APD CONTROLLER	80009	670-2390-01
-2	131-0608-00			18	. .	CONTACT,ELEC:0.365 L X 0.25 PH BRZ GOLD PL	22526	47357
-3	136-0252-04			27	. .	SOCKET,PIN TERM:0.188 INCH LONG	22526	75060
-4	136-0269-02			2	. .	SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C951401
-5	200-1408-00			1	. .	COVER,CONN HOLE:	80009	200-1408-00
						(ATTACHING PARTS)		
-6	211-0008-00			2	. .	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
						- - - * - - -		
-7	380-0295-00			1	. .	HOUSING HALF:CONNECTOR BOX	80009	380-0295-00
						(ATTACHING PARTS)		
-8	211-0008-00			6	. .	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
-9	210-0586-00			2	. .	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
						- - - * - - -		
-10	131-1413-00			1	. .	CONNECTOR BODY,:37 CONTACT,FEMALE	00779	205210-1
						(ATTACHING PARTS)		
-11	131-0976-00			2	. .	CONNECTOR,RCPT,:SLIDING LOCK POST	71468	D53018
	131-0890-00[2]			2	. .	LOCK,CONNECTOR:4-40 X 0.312 L	71468	D 20418-2
						- - - * - - -		
-12	131-1279-01[3]			37	. .	CONTACT,ELEC:FEMALE	00779	205311-4
-13	131-1412-00			1	. .	CONNECTOR BODY,:37 CONTACT,MALE	00779	205209-1
						(ATTACHING PARTS)		
-14	131-0976-00			2	. .	CONNECTOR,RCPT,:SLIDING LOCK POST	71468	D53018
	131-0890-00[2]			1	. .	LOCK,CONNECTOR:4-40 X 0.312 L	71468	D 20418-2
	210-0004-00			4	. .	WASHER,LOCK:INTL,0.12 ID X 0.26"OD,STL	78189	1204-00-00-0541C
						- - - * - - -		
-15	131-1279-00[3]			37	. .	CONTACT,ELEC:MALE,28-24 AWG WIRE,0.040 DIA	00779	205310-4
-16	380-0334-00			1	. .	HOUSING HALF:CONNECTOR	80009	380-0334-00
-17	407-1125-00			1	. .	BRACKET,CKT BD:	80009	407-1125-00
						(ATTACHING PARTS)		
-18	211-0008-00			2	. .	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
-19	210-0586-00			2	. .	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
						- - - * - - -		
-20	214-1573-00			2	. .	THUMBSCREW:6-32 X 0.656 INCH LONG,SST	06540	6130-SS-0632
-21	131-0707-00			4	. .	CONNECTOR,TERM.:0.48" L,22-26AWG WIRE	22526	75691-005
-22	352-0169-00			1	. .	CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0169-00
-23	352-0168-00			1	. .	CONN BODY,PL,EL:10 WIRE BLACK	80009	352-0168-00
						STANDARD ACCESSORIES		
-24	012-0432-00			1		CABLE,INTERCONN:4 FEET LONG	80009	012-0432-00
	070-1654-01			1		MANUAL,TECH:SERVICE	80009	070-1654-01
	012-0432-02			1		CABLE,INTERCONN:6.5 FEET LONG	80009	012-0432-02
						OPTIONAL ACCESSORIES		
	012-0432-01			1		CABLE,INTERCONN:10 FEET LONG	80009	012-0432-01
	012-0432-02			1		CABLE,INTERCONN:6.5 FEET LONG	80009	012-0432-02
	012-0432-03[1]			1		CABLE,INTERCONN:15 FEET LONG	80009	012-0432-03
	012-0432-04[1]			1		CABLE,INTERCONN:40 FEET LONG	80009	012-0432-04
	012-0432-05[1]			1		CABLE,INTERCONN:50 FEET LONG	80009	012-0432-05
-25	016-0571-00			1		OVERLAY PACKAGE:UD FOR COMPUTER(PDP11)	80009	016-0571-00
	012-0509-01			1		CABLE,INTERCONN:4 FEET LONG	80009	012-0509-01
	012-0509-02			1		CABLE,INTERCONN:8 FEET LONG	80009	012-0509-02
	012-0509-03			1		CABLE,INTERCONN:12 FEET LONG	80009	012-0509-03
	012-0509-04			1		CABLE,INTERCONN:20 FEET LONG	80009	012-0509-04
	012-0509-05			1		CABLE,INTERCONN:30 FEET LONG	80009	012-0509-05
	012-0509-06			1		CABLE,INTERCONN:40 FEET LONG	80009	012-0509-06
	012-0509-07			1		CABLE,INTERCONN:50 FEET LONG	80009	012-0509-07

[1]Used in the 021-0116-02 only.
[2]Used in the 670-2390-01 only.
[3]To remove and replace male and female contacts, a special tool is needed. Order Tektronix PN 003-0725-00 or order from Amp, Inc. (Mfr. Code 00779) PN 91067-2.