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Model 960 Computer Communications Register Unit 16 Input/16 Output Data Module
 User's Manual (966366-9701)

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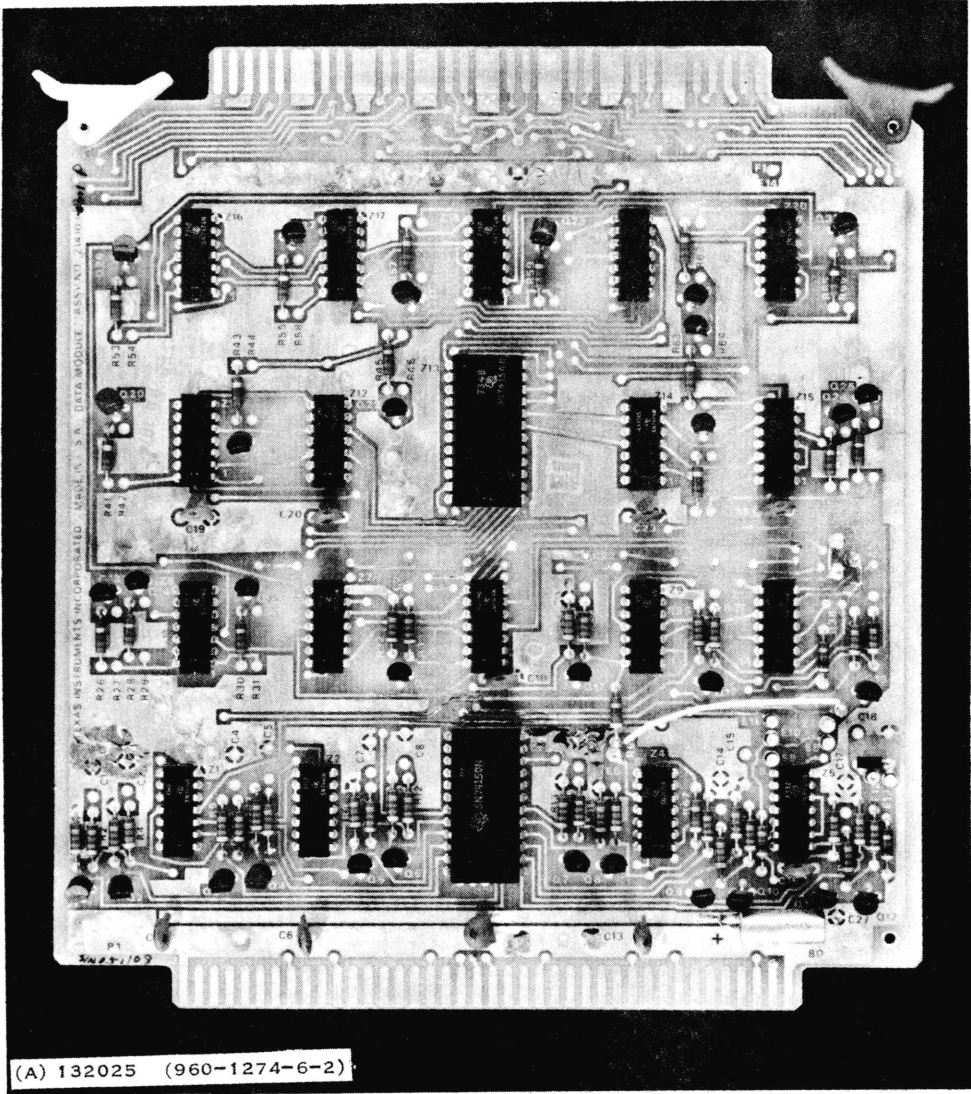


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**SECTION I****INTRODUCTION AND INSTALLATION****1.1 INTRODUCTION**

The 16 Input/16 Output Data Module shown in figure 1-1 provides two-way communications between the Texas Instruments Model 960 Computer Family and devices or transducers that are operated by or generate digital control signals.

The module provides 16 input lines and 16 output lines. Each line can be addressed as a single independent binary value or as a member of a group of 2 to 16 lines. Alternate versions of the Data Module provide 15 normal inputs, 14 normal outputs, an interrupt input line, and an interrupt mask output.

Variations of the 16 Input/16 Output Data Module are listed in table 1-1.

Table 1-1. 16 Input/16 Output Data Module Configurations

Part Number	Description
214103-0001	16 Inputs/16 outputs. Open collector outputs. No Interrupt. Nominal input current 15ma with low level input.
214103-0002	15 inputs/14 outputs, interrupt and interrupt mask. Interrupts generated by trailing edge of IN15- pulse. Nominal input current is 15ma with low level input. The output lines are internally pulled up to approximately 5Vdc logic power with 5.1 K ohm resistors.
214103-0003	15 inputs/14 outputs, interrupt, and interrupt mask. Interrupt is generated by leading edge of IN15- pulse. Nominal input current is 15ma with low level input. The output lines are internally pulled up to approximately 5Vdc logic power with 5.1 K ohm resistors.
214103-0004	16 inputs/16 outputs, no interrupt. Nominal input current is 1.5ma with low level input. Open collector outputs. +5Vdc available at top edge connector, P2-1 and A; through 30AWG wire fuse.
214103-0005	15 inputs/14 outputs, interrupt, and interrupt mask. OUT8-flip-flop is cleared by CRUMR-. Nominal input level is 15ma with low level input. The output lines are internally pulled up to approximately 5Vdc logic power with 5.1 K ohm resistors.
214103-0006	15 inputs/14 outputs, interrupt and interrupt mask. Interrupt is generated by leading edge of IN15- signal. Nominal input current is 15ma with low level input. The output lines are internally pulled up to approximately 5Vdc logic power with 5.1 K ohm resistors. OUT15- is connected to input 15 on input multiplexer Z3 making it independent of the interrupt mask.



1.2 INSTALLATION

The 16 Input/16 Output Data Module can be installed in any standard CRU port (port numbers EF0 through EF3), optional internal expansion ports (EF4 through EFF), or external expansion chassis ports (00 through F0). When inserted into an internal CRU port, the component side of the printed-circuit board faces the front of the computer. In an external expansion chassis, the component side of the module faces the Buffer Module as shown in figure 1-2.

External inputs and outputs are located on the top edge 72-pin connector. If other than the standard cables are used, connections to the module can be made by using connector and cover assembly, part number 217081-0001 (3/8-inch diameter cable maximum) or part number 217081-0002 (1/2-inch diameter maximum). Signal line length between the module and user's equipment should be kept as short as possible. The use of twisted pair or coaxial cable is recommended. Pin designators are listed in table 4-1.

1.2.1 DATA MODULE FILTERS AND PULLUP VOLTAGES. Capacitor mounting pads are provided across each input signal pair to allow the user to decouple noisy input signals. Typical capacitor values for purpose are 0.01 to 0.5 microfarad. The pad spacing is 0.25 inch (center-to-center) and the capacitor height is limited by a component height restriction of 0.31 inch. If necessary capacitor leads can be bent to meet height restrictions. The introduction of noise into the system power supply should be avoided. Excessively noisy signals should be buffered prior to input to the module.

When an application dictates the use of external voltage on the TTL Data Module output circuits, it must not exceed 30 volts or 50 milliamps.

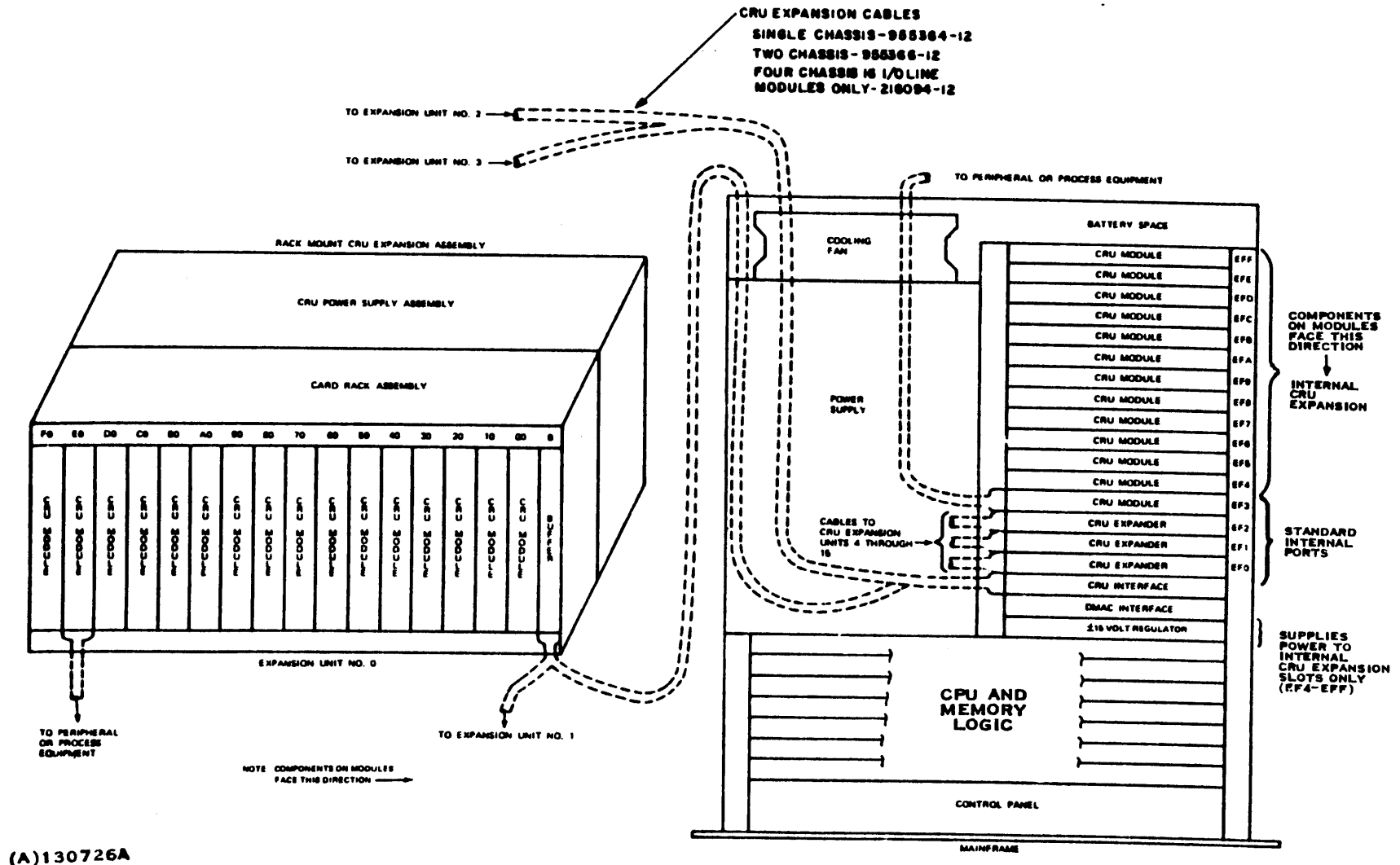
1.2.2 OPTION SELECTION. If the interrupt option is selected, jumper options provide for the interrupt to be set by either a logic zero or a logic one on either the positive or the negative transition.

Jumper selectable options (summarized in table 1-2):

- Input bit 15 = Input bit 15, output bit 15 or CRU INT. CRU INT = Logic AND of interrupt (OUT15LATCH) and mask (OUT14).
- OUT14 to top-edge connector (yes or no).
- OUT15 to top-edge connector (yes or no).
- Interrupts - select one
 - 1) no interrupts
 - 2) negative-edge triggered interrupt
 - 3) positive-edge triggered interrupt
- Supply 5 volts to top-edge connector (yes or no).
- State of OUT8 after power on reset (set or clear).



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Figure 1-2. CRU Mechanical Configurations



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Table 1-2. Data Module Configurations

Assembly No. 214103-000* ^①	Input 15 To MUX			Out 14 Enable E1-E3	Out 15 Enable E2-E4	Interrupts			Supply 5 Volt to Top Edge E14-E15	State of Bit 8 Out After Power on Reset	
	Out 15 E4-E5	In 15 E5-E6	CRUINT E5-E8			Transition		Enable E9-E10		Clear E16-E18 E17-E19	Set E16-E19 E17-E20
						Positive E7-E13 E11-E12	Negative E7-E13 E6-E12				
1		X		X	X					X	
2			X	X	X		X	X		X	
3			X	X	X	X		X		X	
4		X		X	X				X	X	
5			X	X	X		X	X			X
6	X			X	X	X		X		X	

NOTE:

- ① 8 = Last digit in assembly part number.
2. X = Jumpers are connected between these terminals on this listed assembly part number; e.g., on assembly 214103-0001, jumpers are connected between: E5 and E6, E1 and E3, E2 and E4, E16 and E18, E17 and E19.



SECTION II

OPERATING INSTRUCTIONS

Operation of a data module consists entirely of the programming required to perform some pre-established function. This module is commonly used to complete the interface to paper-tape readers, paper-tape punches, line printers, analog systems, plotters, CRT displays, digital voltmeters, and other devices that require parallel data transfer or control. The Texas Instruments Model 960 Computer User's Manuals that support the related peripheral hardware contain operating instructions for the individual peripheral devices. These manuals also include the programming details of the individual interfaces.

As an example, consider a very simple paper-tape reader with an interface specification as defined in table 2-1. The paper-tape reader uses a stepping motor that must be pulsed once for each character read. When the sprocket signal goes from ZERO to ONE, the character is available to be read.

A simple routine to read 80 characters from tape, storing these characters one per word in memory, might appear as listed in table 2-2. Note that the STCR instruction in table 2-2 is constructed to input 9 bits. The most significant bit of that field is the Ready bit which is normally a ZERO. Hence the high order eight bits placed in memory will be ZERO's when an eight bit field is inputted with the reader ready. This is normally desirable.

Table 2-1. Example of Paper Tape Reader Bit Assignments

Bit Addresses	Function*
CRU Input:	
0	} Character Read— Bit 0 is LSB 1/0 = hole/no hole
1	
2	
3	
4	
5	
6	
7	
8	Reader Ready— 0/1 = ready/not ready
.	
.	
.	
13	Sprocket— 1/0 = hole/no hole
14	Not used
15	Interrupt— 1 = interrupt — occurs when sprocket goes from 0 to 1 (5 Volts to 0 Volts)
CRU Output:	
0	Step— 1 = step — normally = 0 and set = 1 for 10 μ sec to step. tape moves one character for each step signal.
.	
.	
14	Interrupt Mask— 1/0 = enable/disable interrupts
15	Clear Interrupt 1/0 = set/clear

*ONE's and ZERO's are values as contained in memory.



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Table 2-2. Sample 80-Character Tape Read Routine

TI 960/980 ASSEMBLY CODING FORM

LABEL		OPER		OPERAND				COMMENTS											
1	6	8	11	13	17	21	25	26	30	35	40	45	50	55	60				
		LA	:	0	,	19				SET	UP	LOOP	COUNTER						
		LA	:	4	,	BUF				POINT	REGISTER	4	TO	BUFFER					
		SETB	:	0	,	0				INITIALIZE	STEP	LINE							
		SETB	:	14	,	0				MASK	INTERRUPTS								
*																			
*	NOTE:																		
*																			
*																			
*																			
	LOOP	BBNE	:	8	,	0	,	LOOP		WAIT	FOR	READER	READY						
		SETB	:	0	,	1				STEP	TAPE	ONE	FRAME						
		NOP	:							WITH	TO	MICROSECOND	PULSE						
		SETB	:	0	,	0													
		BBNE	:	13	,	0	,	\$		WAIT	FOR	CURRENT	SPROCKET	TO					
*										VANISH									
		BBNE	:	13	,	1	,	\$		WAIT	FOR	NEW	SPROCKET	TO					
*										APPEAR									
		STCR	:	(0	,	9)	,	0									
		AA	:	4	,	1				INCREMENT	CHARACTER	POINTER							
		ARB	:	-	1	,	LOOP	,	0	DECREMENT	LOOP	COUNTER	AND						
*										REPEAT									
		B	:	NEXT															
	BUF	RES	:	20															
	NEXT	.	:	.						BEGIN	NEXT	ROUTINE							
		.	:	.															
		.	:	.															
		.	:	.															
PROGRAM		PROGRAMMED BY							CHANGE			PAGE		OF					



In situations where idling the computer while waiting for characters is undesirable, the input routine must be run with interrupt control. This condition allows other work to be performed between appearances of the sprocket signal. The following is not a complete description of how such routines should be written, but is given as an illustration of an interrupt driven input routine.

Memory location 94_{16} must contain the instruction SSB CRUINT (or possibly SXBS CRUINT) where CRUINT is as defined in the program listed in table 2-3. This routine leaves many dangling ends including: the problems of register saving and restoring, the packing of characters 2 per word, and the contents of NOTME and FINISH. In most instances, the monitors or operating systems that are available from Texas Instruments are written to service all devices that generate CRU interrupt. Thus, this problem is eliminated for the user.



Table 2-3. Sample Interrupt Driven Input Routine

TI 960/980 ASSEMBLY CODING FORM

LABEL		OPER	OPERAND		COMMENTS	
1	6	8	13	17	25	30
CRU INT	DATA	0,0	ENTRY			
ENTRY	L	5	CRU INT			PROGRAM BASE REGISTER
	L	7	RDRBAS			READER CRU BASE ADDRESS
	BBNE	15	1,NOTME			ANOTHER ROUTINE AT NOTME LOOKS
*						FOR OTHER CRU INTERRUPTS
	SETB	15	0			CLEAR INTERRUPT
	L	4	BUF			BUF CONTAINS ADDRESS OF NEXT
*						STORAGE LOCATION
	STCR	(0,9)	0			GET CHARACTER
	AA	4	1			INCREMENT STORAGE POINTER
	ST	4	BUF			AND RETURN TO MEMORY
	L	4	COUNT			GET COUNT OF CHARACTER READ
	ARB	-1	MORE,4			DECREMENT COUNT
	B		FINISH			GO TERMINATE INPUT OPERATION
MORE	ST	4	COUNT			PUT COUNT BACK
	SETB	0	1			STEP READER
	NOP					ONE CHARACTER
	SETB	0	0			FORWARD
	LDS		CRU INT			RETURN TO INTERRUPTED PROGRAM
BUF	DATA		PLACE			ADDRESS OF BUFFER
COUNT	DATA	20				WORD COUNT
PLACE	RES	20				BUFFER
RDRBAS	DATA	X	OF 40			READER CRU BASE ADDRESS
NOTME	.	.	.			ROUTINE TO DETERMINE SOURCE OF
	.	.	.			CRU INTERRUPT WHEN NOT READER.
FINISH	.	.	.			ROUTINE TO TERMINATE INPUT
	.	.	.			OPERATION
	.	.	.			
	.	.	.			
PROGRAM	PROGRAMMED BY			CHANGE	PAGE	OF

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SECTION III
PERIPHERAL SPECIFICATIONS

(Not Applicable)



SECTION IV

INTERFACE AND CONTROL SPECIFICATIONS

4.1 GENERAL

This section discusses the computer and 16 Input/16 Output Data Module interfaces, the signatures, and pin assignments for these signals, and the functioning of the signal generation circuitry. It also describes control of data transfer and presents the formats of software instructions used for CRU bit and field manipulation. The electrical and physical characteristics of the data module are specified. The jumper and resistor schedules for the various options are shown in the logic diagram (TI Drawing Number 214104) in Section VI.

4.2 CPU INTERFACE

The following paragraphs discuss the interface between the 16 Input/16 Output Data Module and the CPU. They include discussions of connector pin assignments, addressing of individual modules, control signals and data transfer, and CRU input and output instruction formats.

4.2.1 CONNECTOR PIN ASSIGNMENTS. The data module interfaces with the CPU through the Communications Register Unit (CRU). This interface is completed through the bottom-edge 80-pin connector of the module. Table 4-1 lists the interface signal signatures, pin numbers, and descriptions of signals. The logic voltage levels of these signals are TTL-compatible. Signals that

Table 4-1. CPU Interface Signals

Signature	Pin Number	Description
GROUND	1, 2, 79, 80	System Ground
CPUDATA OUT	16	Serial Data From CPU to Module
STORECLOCK-	22	CPU Output Data Strobe
CRUBIT15	34	CRU bit address select line
CRUBIT14	38	CRU bit address select line
CRUBIT13	40	CRU bit address select line
CRUBIT12	42	CRU bit address select line
CRUSELO-	48	Module select line from CRU rack and slot decode
CRUDATAIN	60	Serial data from module to CPU
CRUMR-	76	Power up reset
VCC	77, 78	Power, +5 Vdc
CRUINT-	66	Interrupt to CRU

Note pins 66 and 76 are inputs to CRU all others are outputs.



are true when the voltage level is low (zero) have signatures that end with a hyphen (-). An example of such a signal signature is CRUSEL0-. The pin assignment of the TTL Data Module connector are specified in table 4-2 and shown in figure 4-1. This table includes the 16 inputs, 16 outputs, and their ground returns. All grounds are common and are connected to the CPU digital ground bus. Connection to the module is normally made with a 72-pin connector (TI Part Number 217081-0001 or 217081-0002).

4.2.2 MODULE AND LINE ADDRESSING. Module selection is accomplished in the CRU interface or Expansion Module by decoding the CRU address rack and module fields (bits 4 through 11) of the CRU base address register. The CRU base address register contains the effective CRU base address. The effective CRU address is calculated by adding the register file CRU base address (supervisor mode location 87_{16} or worker mode location $8F_{16}$) and the CRU address field of the instruction being executed. The fields of this address are:

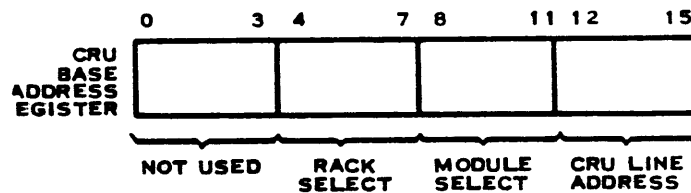


Table 4-2. TTL Data Module Top-Edge Connector Pin Assignments

Input	Signal/Ground	Output	Signal/Ground
0	M-/N-	0	L-/K-
1	H-/J-	1	F-/E-
2	C-/D-	2	B-/A-
3	Y/Z	3	X/W
4	U/V	4	T/S
5	P/R	5	N/M
6	K/L	6	J/H
7	E/F	7	D/C
8	33/34	8	32/31
9	29/30	9	28/27
10	25/26	10	24/23
11	21/22	11	20/19
12	17/18	12	16/15
13	13/14	13	12/11
14	9/10	14	8/7
15	5/6	15	4/3



36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
\bar{R}	\bar{P}	\bar{N}	\bar{M}	\bar{L}	\bar{K}	\bar{J}	\bar{H}	\bar{F}	\bar{E}	\bar{D}	\bar{C}	\bar{B}	\bar{A}	Z	Y	X	W	V	U	T	S	R	P	N	M	L	K	J	H	F	E	D	C	B	A

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Figure 4-1. Module Connector Pin Arrangement

Within the specified chassis the module select field is decoded to one of sixteen slots. The slot receiving the resulting signal, CRUSELO-, is enabled. The 16 Input/16 Output Data Modules input multiplexer, Z3, and output decoder, Z13, are selected by CRUSELO- (see figure 4-2). The CRU line address field (bits 12 through 15) determines the specific line or bit to be input or output (see figure 4-3).

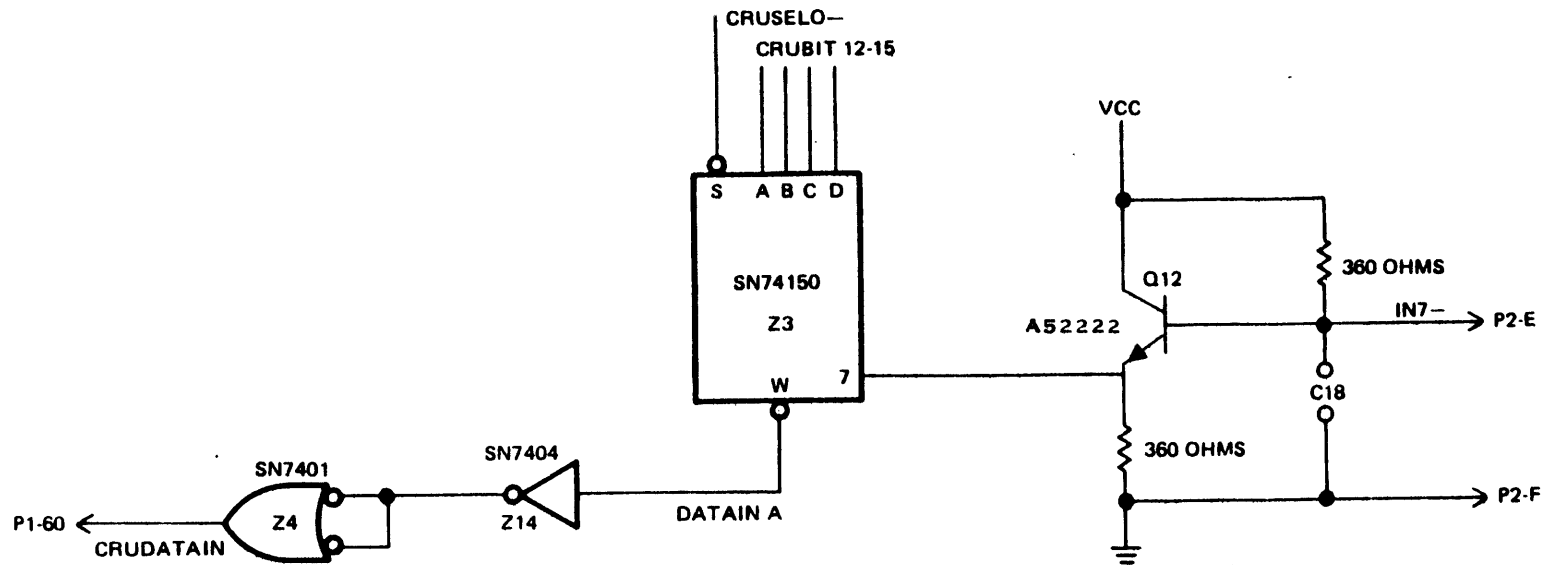
4.2.3 CONTROL AND TRANSFER OF DATA. Data is transferred serially between the 16 Input/16 Output Data Module and the CPU by direct program control. CRU instruction execution selects the module in the port addressed by the effective CRU base address register (contents of memory location 87_{16} or $8F_{16}$ plus the CRU base register modifier). The port of the 16 Input/16 Output Data Module is selected when the CRUSELO- signal goes true causing the input multiplexer and the output decoder to be enabled (see figure 4-4).

4.2.4 CRU INPUT TRANSFER OF DATA AND INSTRUCTIONS. When the input multiplexer is enabled it decodes the CRU line address and outputs the data (as the serial signal CPUDATAIN) to the CPU on the input lines of the requested module. The data is not latched except for the instantaneous value written into memory during an STCR instruction. The following four CRU input instructions are described and illustrated in the following paragraphs. Only one of these instructions transfers bits or fields from the 16 Input/16 Output Data Module. The other three instructions branch conditionally on the value of a sensed bit. The instructions are:

- STCR
- BBNE
- TSBX
- XBNE



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NOTE: C18 MAY BE ADDED FOR NOISE SUPPRESSION

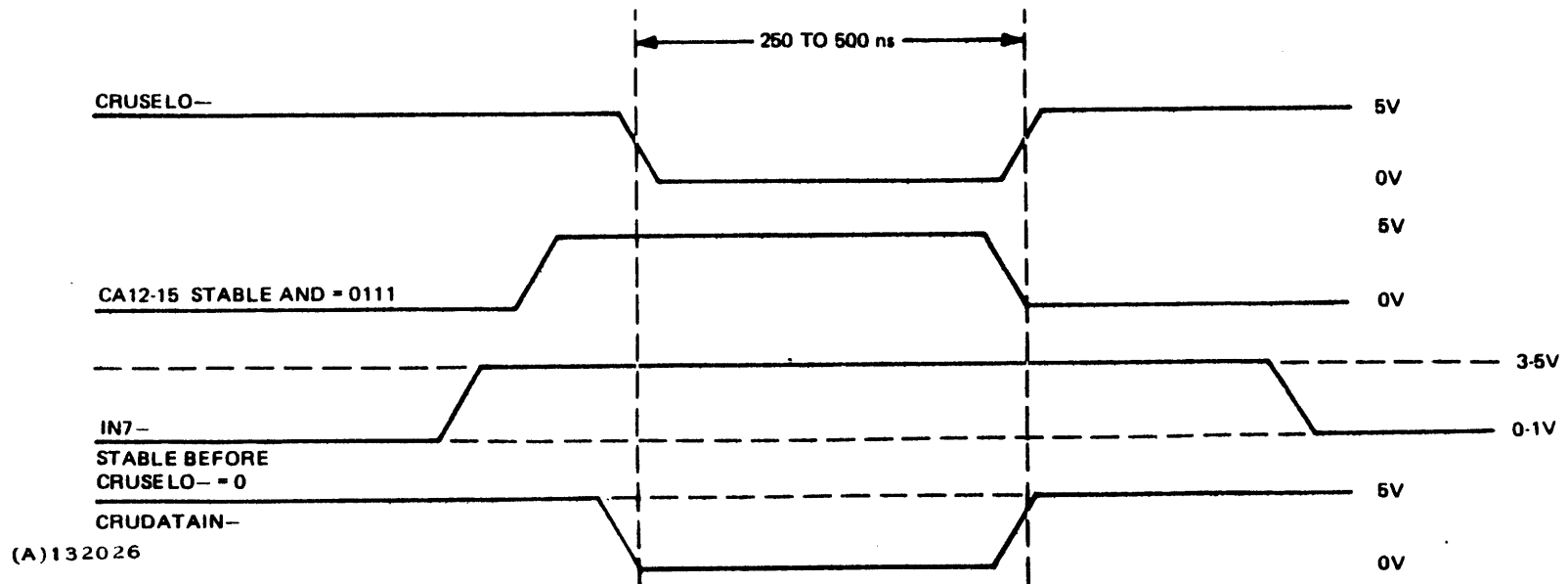
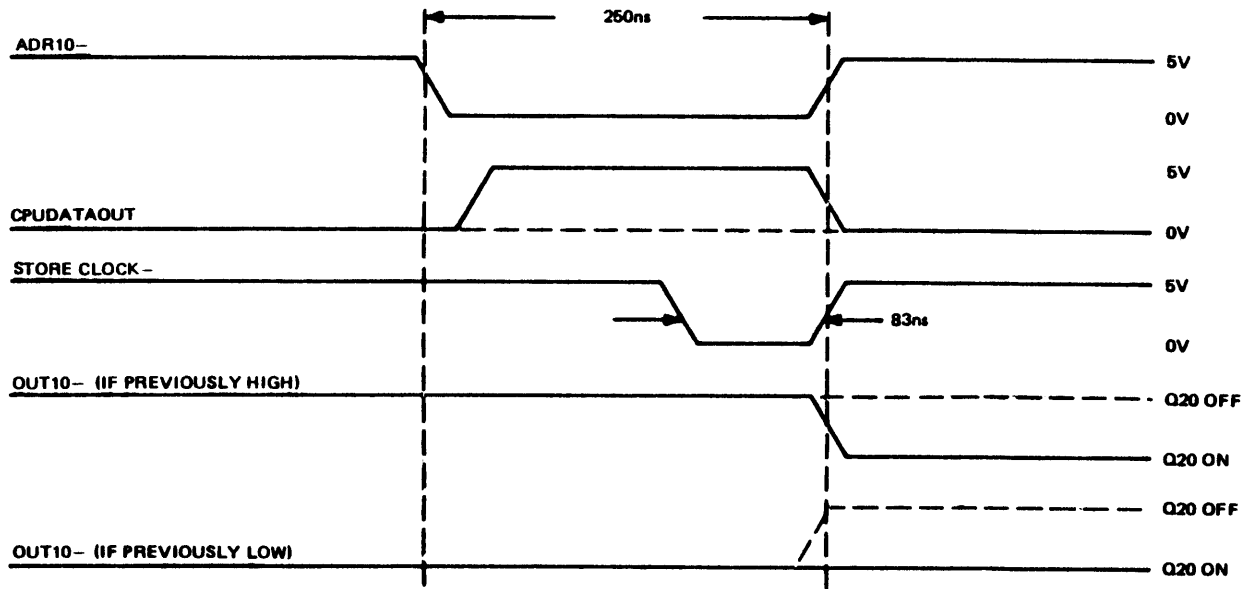
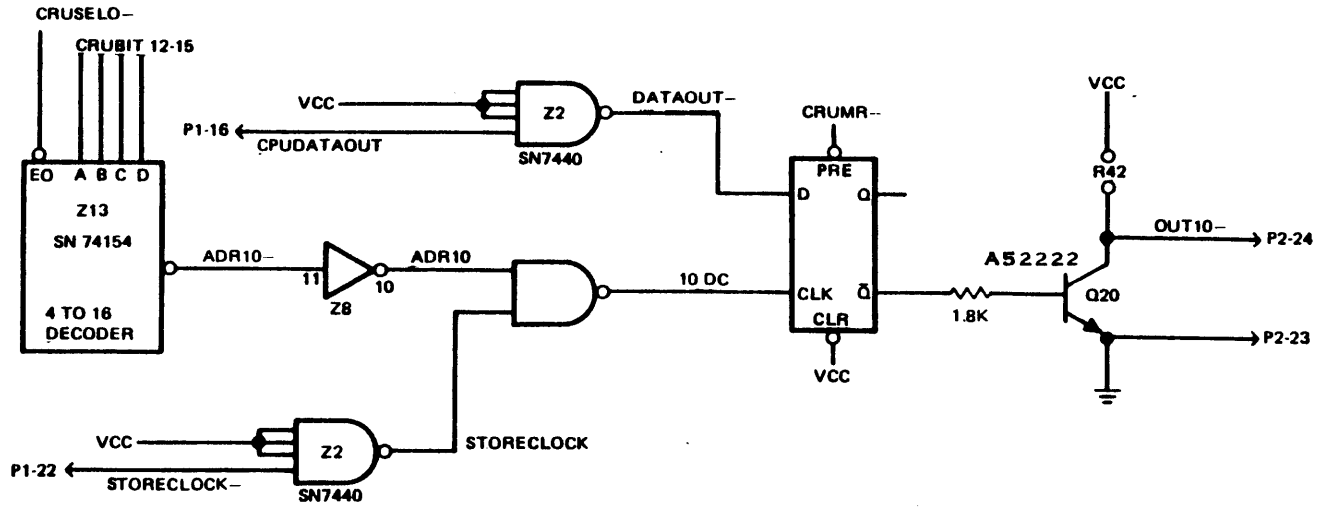


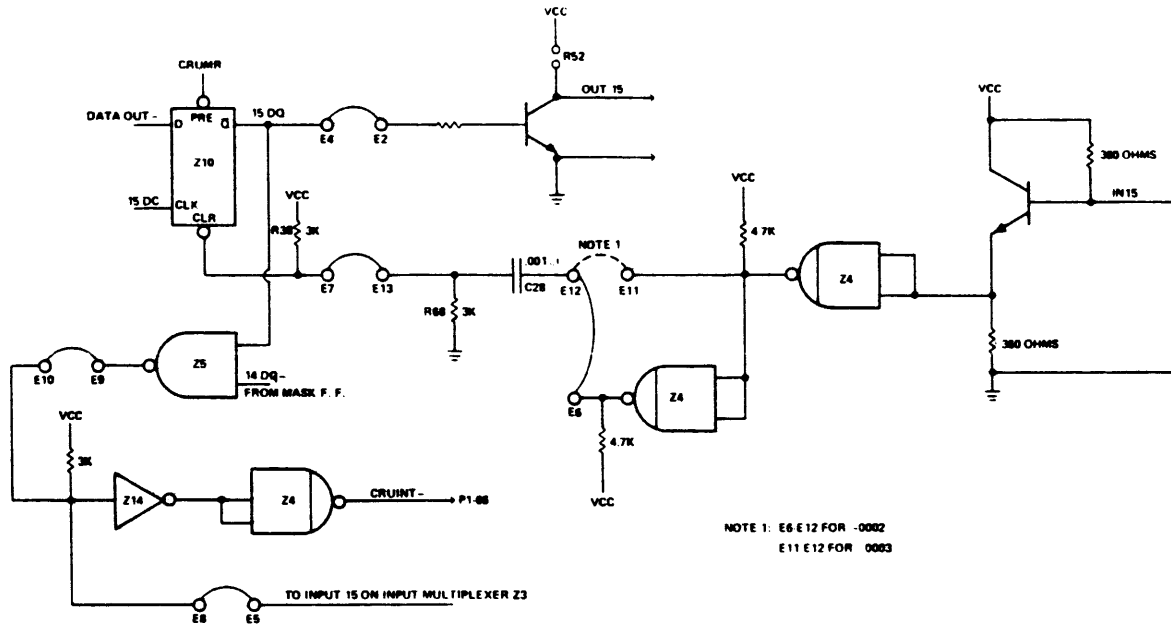
Figure 4-2. Data Module Input Circuit and Timing



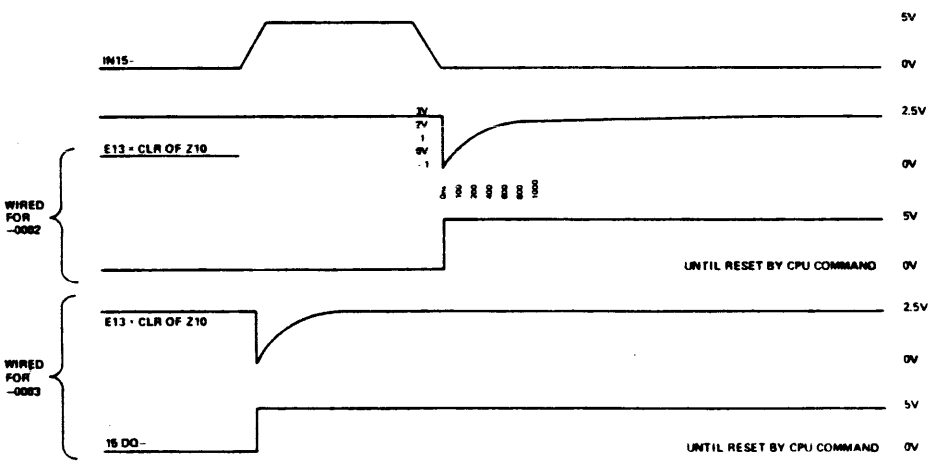
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Figure 4-3. Data Module Output Flip-Flop and Timing





NOTE 1: E6 E12 FOR -0002
E11 E12 FOR 0003



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Figure 4-4. Edge Triggered Interrupt Generation Logic and Signals



4.2.4.1 CRU Output Transfer of Data and Instructions. Data is transferred serially between the CPU and the 16 Input/16 Output Data Module on the CPUDATAOUT signal lines. The STORECLOCK- control signal indicates that the CPU output data, CPUDATAOUT, is active and stable. The data is latched by the module at the CRU bit location specified by the line address, CRUBIT 12-15, on the trailing edge (low-to-high transition) of STORECLOCK-. The formats for the following three CRU output instructions are described and illustrated in the following paragraphs. These instructions transfer bits or fields to the 16 Input/16 Output Data Module. The instructions are:

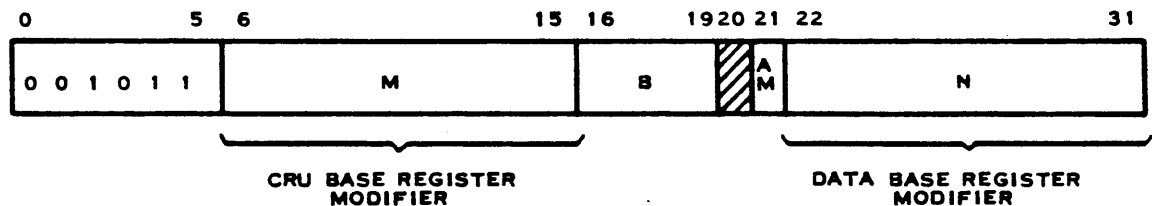
- LDCR
- SETB
- TSBX

4.2.5 CRU INPUT/OUTPUT INSTRUCTION FORMAT. Each instruction is identified by a unique operation code. In these instructions, the operation code is specified in bit position 0 through 5 in the instruction word. Other fields included in the formats of the instructions are:

- M and N address fields
- V1 field - immediate value bit, used to specify one of two possible actions or to perform a bit comparison.
- AM field - bit that specifies whether alternate mode registers are used; base registers for the inactive mode can be used when the other mode is the execution mode.

Base register relative addressing and alternate mode registers are explained in the *Model 960 Computer Assembly Language Programmer's Reference Manual*.

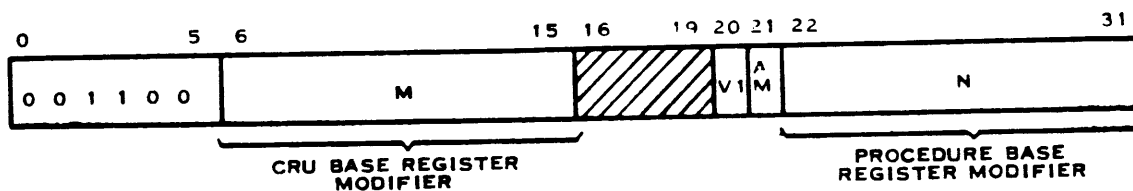
4.2.5.1 STCR Instruction. The format for the Store Communications Register (STCR) instruction is:



The address fields, M and N, contain the CRU base address modifier and the data base register address modifier. Sequential CRU input lines are read and stored as a right-justified bit field in the memory location specified by N plus the contents of the data base register. The CRU input line specified by the contents of the CRU base register plus M is stored as the least significant bit of the field. The B field contains the number of bits to be read and stored in memory. In this field, 0 indicates 16 bits. The bit in the AM field is 0 if execution mode base registers are used and 1 if alternate mode base registers are used.



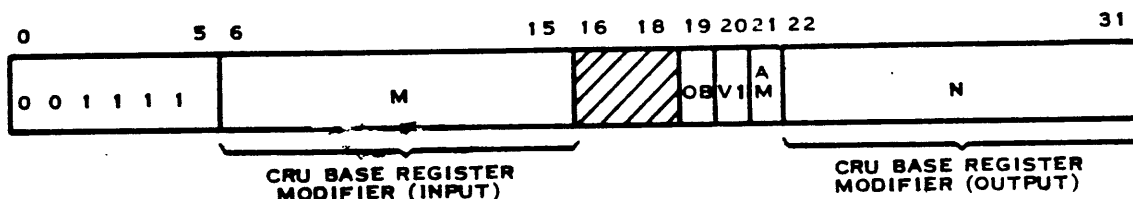
4.2.5.2 **BBNE Instruction.** The format for the Branch on Bit Not Equal (BBNE) instruction is:



The M field is the CRU base register address modifier, and the N field is the procedure base register address modifier. The addressed CRU input line, specified by the modifier in the M field plus the CRU base register, is compared to the bit in the V1 field. If the comparison fails, the Program Counter (PC) or Event Counter (EC) is loaded with the memory address specified by the modifier in the N field plus the contents of the procedure base register.

If the AM bit is 0, the execution mode base registers are used. If the AM bit is 1, the alternate mode CRU base register is used to calculate the CRU address. The branch address is calculated using the active mode procedure base register and the modifier in the N field.

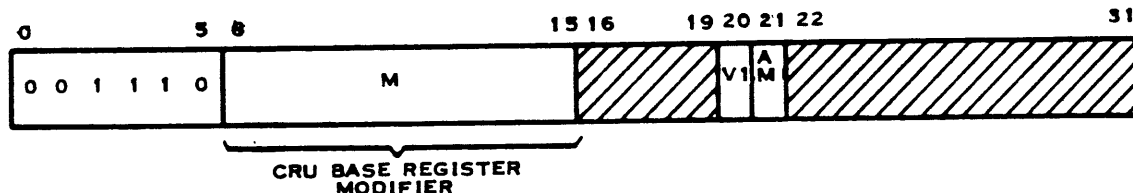
4.2.5.3 **TSBX Instruction.** The format for the Test Input Bit and Switch Mode or Set Output Bit (TSBX) instruction is:



The addressed CRU input line, specified by the address modifier in the M field plus the contents of the CRU base register, is compared to the bit in the V1 field. If the test fails, the mode is changed. If the test is successful, the value of the OB bit is output to the CRU output line specified by the address modifier in the N field plus the contents of the CRU base register.

If the AM bit is 0, the execution mode CRU base register is used. If the AM bit is 1, the alternate mode CRU base register is used and mode switching is inhibited.

4.2.5.4 **XBNE Instruction.** The format for the Switch Mode on Bit Not Equal (XBNE) instruction is:

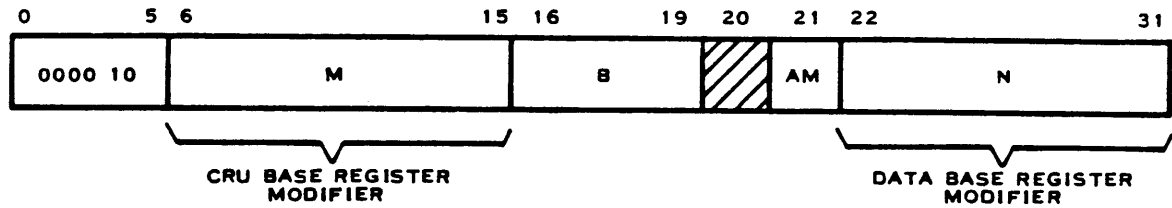


The addressed CRU input line, specified by the address modifier in the M field plus the contents of the CRU base register, is compared to the bit in the V1 field. If the test fails, the mode is changed.

If the AM bit is 0, the execution mode CRU base register is used. If the AM bit is 1, the alternate mode CRU base register is used.

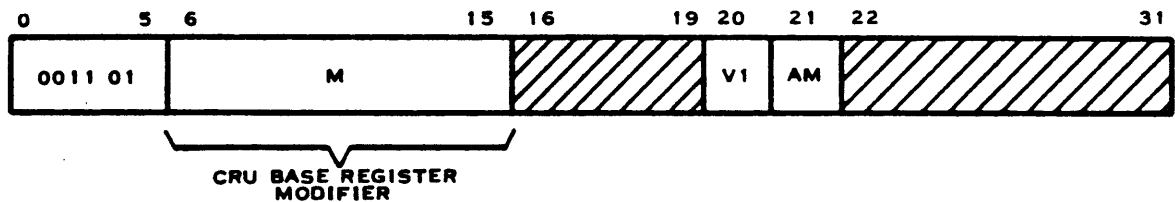


4.2.5.5 LDCR Instruction. The format for the Load Communications Register (LDCR) instruction is:



The address fields, M and N, contain the CRU base register address modifier and the data base register address modifier. The B field contains the number of bits to be read from memory and output to the interface. In this field, 0 indicates 16 bits. The bit in the AM field is 0 if execution mode base registers are being used and 1 if alternate mode base registers are being used. The values in the modifier fields are added to the contents of the corresponding base registers to determine the effective address.

4.2.5.6 SETB Instruction. The format for the Set CRU Output Bit (SETB) instruction is:



The M field is the CRU base register modifier or displacement. The bit in the V1 field is used to set the addressed CRU output bit. The V1 bit is 0 if the addressed bit is false and 1 if the addressed bit is true. The bit in the AM field is 0 if the execution mode base register is used and 1 if the alternate mode base register is used. The value in the modifier field is added to the contents of the corresponding base register to determine the effective address.

4.3 INTERRUPTS

There are six standard variations of the data module as described in the notes on the schematic diagram that is included in Section VI. The assemblies 214103-0001 and 0004 have 16 inputs and 16 outputs as previously described. Assemblies 214103-0002, -0003, -0005, and -0006 are wired to provide pull-up resistors on the output buffers and to provide the interrupt capability. The 214103-0002 assembly connects the interrupt line as illustrated in figure 4-3. The 214103-0005 assembly interrupt option is wired identically. A transition from high to low on IN15- is squared by two sections of Z4 and differentiated by C28, R38, and R68 to cause a short spike on the clear input of Z10. This latch is the out 15 flip-flop which is used as an interrupt latch. This sets Q- high to indicate the presence of an interrupt. If Q- of the mask flip-flop is also high (interrupt enabled), CRUINT- is forced low, causing a CRU interrupt. Input line 15 is wired in parallel to CRUINT- permitting the source of the interrupt to be program determined.

Figure 4-3 also shows the jumpers for the 214103-0003 assembly. The only difference is the sense of the transition that causes the interrupt. The -0006 assembly is identical to the -0003 assembly with the exception of the input 15 to multiplexer Z3. The interrupt latch output is used directly as the input 15 to multiplexer Z3 on the -0006 assembly, while in the -0003 assembly the multiplexer input is the logical AND of INTERRUPT (15DQ-) and INTERRUPT MASK (14DQ-).



4.4 INPUT CIRCUIT OPERATION

Figure 4-1 illustrates a typical input circuit and a basic timing diagram for the TTL Data Module. The CRU line address (CA12-15) is labeled CRUBIT(12-15) and is true at the logic one level. The CRU rack and module select fields (CA 04-11) are decoded by the CRU interface to provide a port select signal CRUSELO- to each chassis slot. Line address bits CRUBIT(12-15) are applied to the input multiplexer, Z3, along with CRUSELO- which is used as an enable. As long as CRUSELO- is false (high), the module ignores the line address. (Other modules are being selected.) When CRUSELO- is true (low), the input multiplexer, Z3, selects one of the 16 inputs to become signal DATAINA, based on the line address. The 16 input lines are buffered by an emitter-follower stage and terminate at the multiplexer inputs. The external inputs and multiplexer inputs are low-level signals when logically true. Selection of an input signal which is low results in a high output (true) from the multiplexer and becomes the DATAINA signal. DATAINA is inverted twice by Z14 and Z4 to become CRUDATAIN which is a true signal that is wire-ORed with the CRUDATAIN of every other CRU module in the chassis.

4.5 OUTPUT CIRCUITRY OPERATION

Figure 4-2 illustrates a flip-flop output circuit and also includes a basic timing diagram of an output. CRUBIT(12-15) and CRUSELO- are applied to the output decoder Z13, in parallel to the input multiplexer. CRUBIT(12-15) selects the line and CRUSELO- is used as an enable line. The line selected by Z13 (ADR0- to ADR15-) will be true (low). This signal is inverted and applied to a NAND gate along with the STORECLOCK signal from the CRU. The resultant signal (ODC-15DC) is applied to the CLK input of an output storage flip-flop. The value of CPUDATAOUT is clocked into the storage flip-flop and in turn determines the on/off status of the output transistor.

4.6 16 INPUT/16 OUTPUT DATA MODULE CHARACTERISTICS

The electrical and mechanical characteristics of the 16 Input/16 Output Data Module are summarized in table 4-3.



Table 4-3. 16 Input/16 Output Data Module Characteristics

Characteristic	Description
Electrical	
Input lines	16 lines; 0.0 to 1.0 volts for logic 1; 3.0 to 5.0 volts for logic 0.
Input power	5 Vdc; 0.5 amp nominal; current will vary according to resistor schedule.
Maximum input signal voltage	+5.5 volts absolute
Nominal load on external driver	
Standard input	15 milliamps
4 TJ input circuit	1.5 milliamps
Output lines	16 lines; (depending upon configuration) open or 3.0 to 5.0 volts logic 0; 0.0 to 0.4 volts for logic 1.
Output options	a. Collector resistors to +5 Vdc on module b. External voltage source not to exceed +30 Vdc and current limit not to exceed 50 milliamps.
Physical	
Length	7.91 inches
Width	7.0 inches
Bottom connector	80 pins: 40 connector tabs on each side: 0.125- inch spacing between tabs.
Top connector	72 pin: 36 connector tabs on each side: 0.125- inch spacing between tabs.



SECTION V

UNIT MAINTENANCE

5.1 GENERAL

The 16 Input/16 Output Data Module does not require preventive maintenance or adjustments. The diagnostic program (SIODMT), contained in Section VIII, can be used to test individual units suspected of being faulty.

5.2 EQUIPMENT REQUIRED

The following equipment, in addition to the items listed in paragraph 8.2, allow the isolation of any problems in the unit.

- Oscilloscope Tektronix Model 453, or equivalent
- DC Voltmeter

5.3 TROUBLESHOOTING

The following procedure should be used to troubleshoot the unit.

- Ensure that power is being applied to the board.
- Execute SIODMT program. This PDT cannot be used to test Part Number 214103-0006. This module should be temporarily jumpered to function as a -0003 configuration by changing the jumper selecting INPUT 15 to the multiplexer.
- If a data module failure is detected during program execution, the problem can be isolated by checking the individual signals with an oscilloscope.

5.4 TROUBLESHOOTING AIDS

The following aids can be of great help in the troubleshooting of the individual data modules.

- Logic diagram 214104 (see Section VI).
- Top-edge connector pin assignments (table 4-2).
- Top-edge connector symbology (table 4-3).
- Bottom-edge connector pin assignments (table 4-1).
- Input circuit and timing diagram (figure 4-1).
- Output circuit and timing diagram (figure 4-2).
- Interrupt generation logic and signals (figure 4-3).
- Assembly listing for SIODMT program (Section VIII).
- CRU Extender board (TI Part Number 226851-0001).



SECTION VI

ELECTRICAL DRAWINGS, ASSEMBLY DRAWINGS, AND PARTS LIST

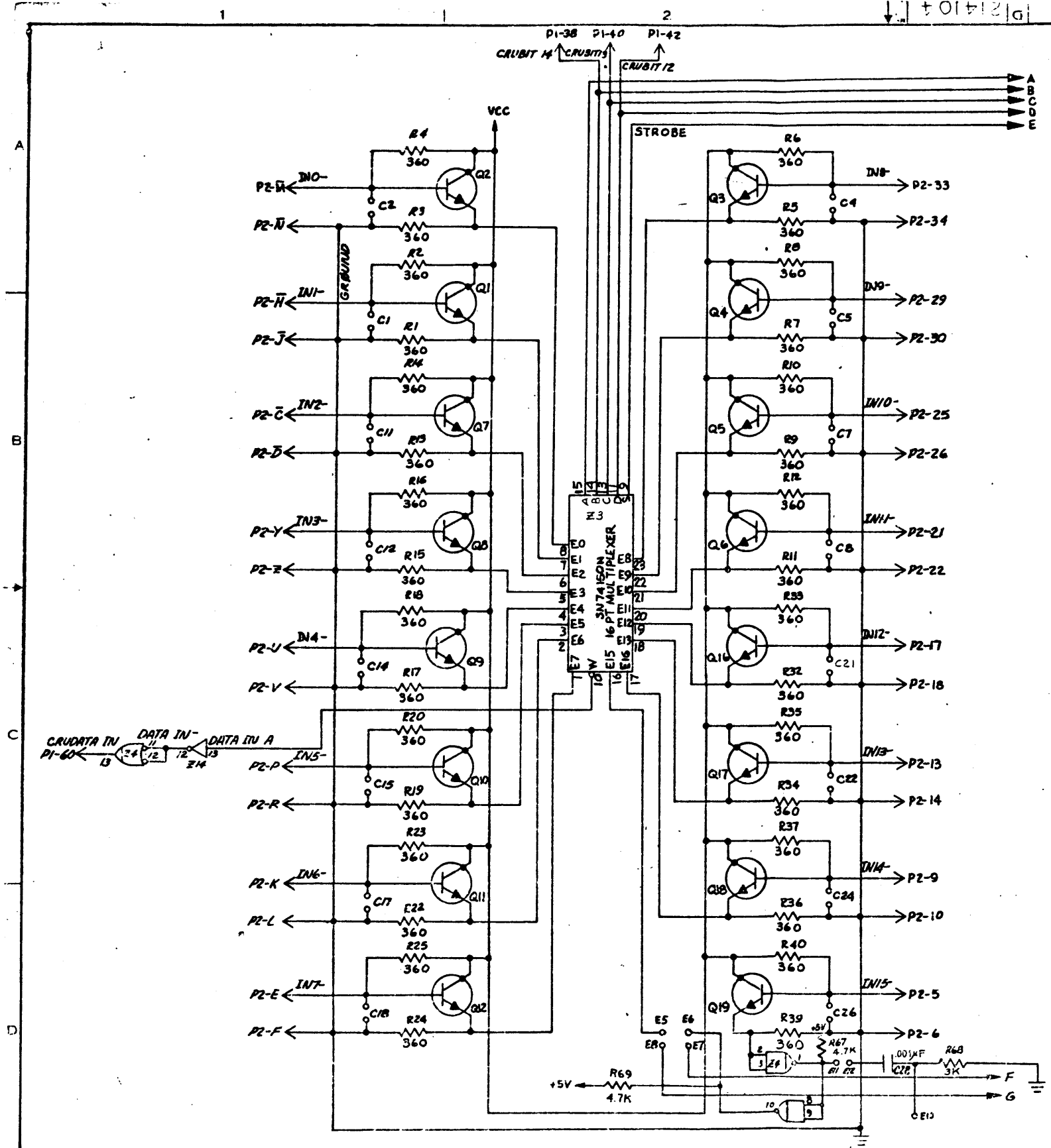
6.1 GENERAL

The electrical drawings, assembly drawings, and parts lists that are required by maintenance personnel to properly service and maintain the 16 Input/16 Output Data Module are included in this section. Parts lists, assembly drawings, and electrical drawings for the computers are contained in the following manuals:

Title	TI Part Number
<i>Model 960A Maintenance Manual Parts List and Assembly Drawings</i>	226750-9707
<i>Model 960A Maintenance Manual Electrical Drawings</i>	226750-9708
<i>Model 960B Maintenance Manual Parts List and Assembly Drawings</i>	942773-9704
<i>Model 960B Maintenance Manual Electrical Drawings</i>	942773-9705

As a convenience to the user a drawing and parts list index appears below. This index lists the electrical drawings, assembly drawing, and parts list (LM).

Description	Drawing	Page
Schematic	214104	6-3
Assembly and Parts List	214103	6-7
Test Kit	966300	6-28
Test Connector	966307	6-33

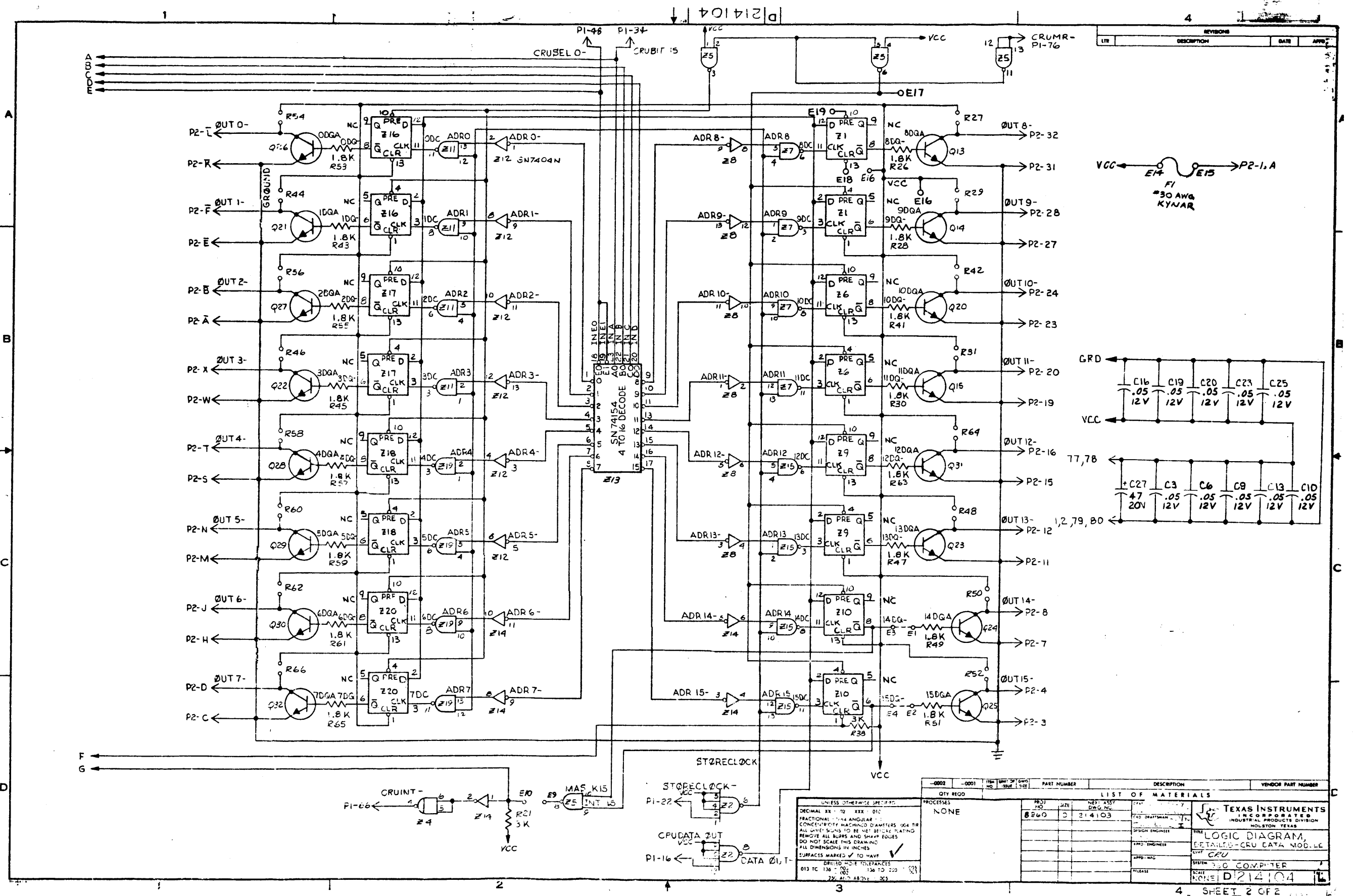


NOTES:
 UNLESS OTHERWISE SPECIFIED
 1. RESISTANCE VALUES ARE IN OHMS.
 2. RESISTORS ARE .25W ± 5%.
 3. CAPACITANCE VALUES ARE IN MICROFARADS.
 4. TRANSISTORS ARE AST2222
 5. NETWORKS Z1, Z6, Z9, Z10, Z16, Z17, Z18 AND Z20 ARE SN7474N.
 6. NETWORKS Z5, Z7, Z11, Z15 AND Z19 ARE SN7400N.
 7. NETWORK Z4 IS SN7401N.
 8. NETWORKS Z8, Z12 AND Z14 ARE SN7404N.
 9. NETWORK Z2 IS SN7400N.
 10. NETWORK Z3 IS SN74150N.
 11. NETWORK Z13 IS SN74154N.
 12. FILTER CAPACITORS TO GROUND MAY BE ADDED ON THE PDS PROVIDED, AT INSTALLATION.
 13. FF'S ARE RESET TO OUTPUT DATA.
 14. OUTPUTS ARE NORMALLY ON-OFF TRANSISTOR SWITCHES SINKING UP TO 50MA AND HOLDING OFF UP TO 30 VOLTS. HOWEVER, PROVISION IS MADE ON THE BOARD TO ADD A 3K-OHM RESISTOR FROM EACH COLLECTOR TO VCC.
 15. ASSEMBLY 214103-0001
 JUMPER CONNECTIONS
 E1-E3 E17-E19
 E2-E4
 E5-E6
 E6-E10
 Z10 IS USED AS A DATA OUTPUT STORAGE DEVICE
 16. ASSEMBLY 214103-0002
 JUMPER CONNECTIONS
 E1-E3 E16-E18
 E2-E4 E17-E19
 E5-E8
 E9-E10
 E6-E12
 E7-E13
 R40 NOT INSTALLED
 R27, R19, R31, R42, R44, R46, R48, R54, R56, R58, R60, R62, R64 AND R66 ARE 5.6K
 Z10 USED AS AN INTERRUPT AND MASK
 IN15-15 DIFFERENTIATED
 17. ASSEMBLY 214103-0003
 JUMPER CONNECTIONS
 E1-E3 E9-E10 E16-E18
 E2-E4 E11-E12 E17-E19
 E5-E8 E7-E13
 R40 NOT INSTALLED
 R44, R46, R56, R58, R60, R62 AND R66 ARE 5.6K
 IN15-15 INVERTED AND DIFFERENTIATED
 18. ASSEMBLY 214103-0004
 JUMPER CONNECTIONS
 E1-E3 E16-E18
 E2-E4 E7-E13
 E5-E8 E6-E10
 E9-E10 E17-E19
 E5-E6
 E14-E15 0.5 INCH OF 30GA KYNAR WIRE (FUSE)
 R2, R4, R6, R8, R10, R12, R14, R16, R18, R20, R23, R25, R33, R35, R37 AND R40 ARE 3K
 VCC IS CONNECTED TO EDGE CONNECTOR BY FUSE WIRE BETWEEN E14 AND E15
 19. ASSEMBLY 214103-0005
 JUMPER CONNECTIONS
 E1-E3 E17-E19
 E2-E4
 E5-E8
 E9-E10
 E6-E12
 E7-E13
 E16-E19
 SAME RESISTOR SCHEDULE AS FOR -0002
 INPUTS TO Z1, PRESET, PIN 10 AND CLEAR, PIN 13 ARE REVERSED

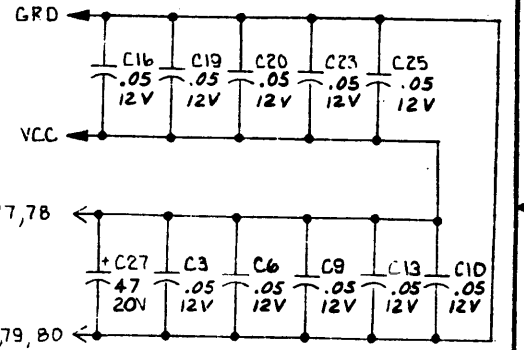
REV	DESCRIPTION	DATE	BY
A	INITIAL DESIGN	10/1/64	
B	REVISED NOTES	10/1/64	
C	371844(B) 2P 18-19-71	11/1/64	
D	317836 (C) 11-20-71 R. P. ...	11/1/64	
E	296647(C) 1-4-72 J. ...	1-17-72	
F	372416 (C) J. ...	10-25-72	
G	38107(E) J. ...	2-16-73	
H	389072 (C) D. ...	2-16-73	
I	390435 (E) K. ...	10/1/64	
J	390435 (E) K. ...	10/1/64	
K	390435 (E) K. ...	10/1/64	
L	407830		

CAPACITOR & RESISTOR USE SCHEDULE	
USED	OPTIONAL
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47, R48, R49, R50, R51, R52, R53, R54, R55, R56, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R72, R73, R74, R75, R76, R77, R78, R79, R80, R81, R82, R83, R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R95, R96, R97, R98, R99, R100	C1, C2, C3, C4, C5, C7, C8, C11, C12, C14, C15, C17, C18, C21, C22, C24, C26, R27, R29, R31, R42, R44, R46, R48, R50, R52, R54, R56, R58, R61, R62, R64, R66, C10, C13, C16, C19, C20, C23, C25, C27, F6, R60, R62

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REV	DESCRIPTION	DATE	APP'D



QTY	REQD	ITEM NO	UNIT	SYMBOL	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER

UNLESS OTHERWISE SPECIFIED:	
DECIMAL XX . XX	XXX . 01C
FRACTIONAL 1/16 ANGULAR .	
CONNECTIONS TO BE MADE BY THE FABRICATOR	
REMOVE ALL BURRS AND SHARP EDGES	
DO NOT SCALE THIS DRAWING	
FILL DIMENSIONS IN INCHES	
SURFACES MARKED ✓ TO HAVE	
DRILLED HOLE TOLERANCES	
013 TC	136 - .001
002	136 TO 220 - .002
22	ALL OTHERS - .003

PROJ	NO	SIZE	NEXT ASSY	DWG NO
860	3	2 1/4 103		

DESIGN ENGINEER	TITLE

DATE	SCALE



TEXAS INSTRUMENTS
INCORPORATED

DATE 06/30/75

LIST OF MATERIAL

PAGE 1 of

PART NUMBER
LM 214103-0001 ABREV
AB

PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG. SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER	
0001	00001.000	EA		214102-0001	PRINTED WIRING BRD, DATA MODULE		
0002	00016.000	EA		972946-0071	RES FIX 1.8K OHM 5 % .25 W CARBON FILM	ROH- R-25	
0002A					R26, R28, R30, R41, R43, R45, R47,		
0002B					R49, R51, R53, R57, R59, R61, R63,		
0002C					& R65, R55		
0003	00032.000	EA		972946-0054	RES FIX 360 OHM 5 % .25 W CARBON FILM	ROH- R-25	
0003A					R1 THRU R20 R22 THRU R25, R32		
0003B					THRU R37, R39 & R40		
0005	00003.000	EA		972946-0076	RES FIX 3.0K OHM 5 % .25 W CARBON FILM	ROH- R-25	
0005A					R21 R38 R68		
0006	00032.000	EA		972057-0001	TRANSISTOR-A52222 NPN SILICON	TI--A5T2222	
0006A					Q1 THRU Q32		
0007	00005.000	EA		222222-7400	NETWORK SN7400N	-SN7400N	
0007A					Z5, Z7, Z11, Z15, & Z19		
0008	00001.000	EA		222222-7401	NETWORK SN7401N		
0008A					Z4		
0009	00003.000	EA		222222-7404	NETWORK SN7404N		
0009A					Z8, Z12, & Z14		
0010	00001.000	EA		222222-7440	NETWORK SN7440N	-SN7440N	
0010A					Z2		
DRAFTSMAN		DATE	CRD. DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
			<i>P. Halgren</i>	7/14/75			CARD ASSY, DATA MODULE
APPD. MFG		DATE	APPD. PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO.
							6100/75.02
						PART NUMBER	REV
						LM 214103-0001	AB

69



TEXAS INSTRUMENTS
INCORPORATED

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PART NUMBER	REV
LM 214103-0001	AB

PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER	
0011	00008.000	EA		22222-7474	NETWORK SN7474N	-SN7474N	
0011A					Z1, Z6, Z9, Z10, Z16, Z17, Z18, &		
0011B					Z20		
0012	00001.000	EA		22222-7150	NETWORK SN74150N		
0012A					Z3		
0013	00001.000	EA		22222-7154	NETWORK SN74154N	-SN74154N	
0013A					Z13		
0014	00010.000	EA		230590-9000	CAP .05 MF 12 V 20. % CER TRANSCAP	ERI-5635-000-Y5F0503	
0014A					C3 C6 C9 C10 C13 C16 C19		
0014B					C20 C23 C25		
0015	00001.000	EA		972924-0015	CAP FIX TANT SOLID 47 MFD 10 % 20 VOLT	QPL-439003/L-2295	
0015A					C27		
0016	AR	FT		457313-0006	WIRE 24 AWG SOLID, TEFLON, WHITE	QPL- MIL-W-16878/4E	
0016A					E1 THRU E10		
0018	REF	EA		214104-9901	DIAGRAM, LOGIC DETAIL-DATA MODULE		
0020	00002.000	EA		972946-0081	RES FIX 4.7K OHM 5 % .25 W CARBON FILM	ROH- R-25	
0020A					R67 R69		
0023	REF	EA		217761-9901	WIRE LIST, PT-TO-PT-DATA MOD DATE STORAGE		
0024	00001.000	EA		972929-0397	CAP FIX CERAMIC .001 UF 10% 200V	QPL-439014/01-1397	
0024A					C28		
DRAFTSMAN		DATE	CED DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
							CARD ASSY, DATA MODULE
APPD MFG		DATE	APPD PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO
						PART NUMBER	REV
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PART NUMBER **LM 214103-0001** REV **AB**

PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER	REV
0026	00001.000	EA		231302-0100	EJFCTOR,PC BD WHITE	SCA-S-202 533-887-0001	1867
0027	00001.000	EA		231802-0105	EJECTOR,PC BD GREEN	SCA-S-202 533-887-0009	1867
0029	00032.000	EA		972507-0001	INSULATOR DISC-TO-18	THR--7717-220	
0030	REF	EA		217163-9901	TEST PROCEDURE-DATA MODULE		

DRAFTSMAN	DATE	CRD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
						CARD ASSY, DATA MODULE
APPD MFG	DATE	APPD PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO

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PART NUMBER	REV
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PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG. SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER	
0001	00001.000	EA		214102-0001	PRINTED WIRING BRD, DATA MODULE		
0002	00016.000	EA		972946-0071	RES FIX 1.8K OHM 5 % .25 W CARBON FILM	ROH- R-25	
0002A					R26, R28, R30, R41, R43, R45, R47		
0002B					R49, R51, R53, R57, R59, R61, R63		
0002C					R65, R55		
0003	00031.000	EA		972946-0054	RES FIX 360 OHM 5 % .25 W CARBON FILM	ROH- R-25	
0003A					R1 THRU R20, R22 THRU R25, R32		
0003B					THRU R37, R39		
0005	00003.000	EA		972946-0076	RES FIX 3.0K OHM 5 % .25 W CARBON FILM	ROH- R-25	
0005A					R21 R38 R68		
0006	00032.000	EA		972057-0001	TRANSISTOR-A52222 NPN SILICON	TI--A5T2222	
0006A					Q1 THRU Q32		
0007	00005.000	EA		222222-7400	NETWORK SN7400N	-SN7400N	
0007A					Z5, Z7, Z11, Z15, Z19		
0008	00001.000	EA		222222-7401	NETWORK SN7401N		
0008A					Z4		
0009	00003.000	EA		222222-7404	NETWORK SN7404N		
0009A					Z8, Z12, Z14		
0010	00001.000	EA		222222-7440	NETWORK SN7440N	-SN7440N	
0010A					Z2		
DRAFTSMAN		DATE	CKD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
							CARD ASSY, DATA MODULE-INPUT
APPD. MFG		DATE	APPD. PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO
						PART NUMBER	REV
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PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER
0011	00008.000	EA		222222-7474	NETWORK SN7474N	-SN7474N
0011A					Z1, Z6, Z9, Z10, Z16, Z17, Z18, Z20	
0012	00001.000	EA		222222-7150	NETWORK SN74150N	
0012A					Z3	
0013	00001.000	EA		222222-7154	NETWORK SN74154N	-SN74154N
0013A					Z13	
0014	00010.000	EA		230590-9000	CAP .05 MF 12 V 20. % CER TRANSCAP	ERI-5635-000-Y5F05034
0014A					C3 C6 C9 C10 C13 C16 C19	
0014B					C20 C23 C25	
0015	00001.000	EA		972924-0015	CAP FIX TANT SOLID 47 MFD 10 % 20 VOL	QPL-439003/1-2295
0015A					C27	
0016	AR	FT		457313-0006	WIRE 24 AWG SOLID, TEFLON, WHITE	QPL- MIL-W-16878/4E
0016A					E1 THRU E13	
0018	REF	EA		214104-9901	DIAGRAM, LOGIC DETAIL-DATA MODULE	
0020	00002.000	EA		972946-0081	RES FIX 4.7K OHM 5 % .25 W CARBON FILM	ROH- R-25
0020A					R67 R69	
0021	REF	EA		217762-9901	WIRE LIST, PT-TO-PT- DATA MOD, INPUT	
0022	00014.000	EA		972946-0083	RES FIX 5.6K OHM 5 % .25 W CARBON FILM	ROH- R-25
0022A					R27, R29, R31, R42, R44, R46, R48	
0022B					R54, R56, R58, R60, R62, R64, R66	

DRAFTSMAN	DATE	CKD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE	CARD ASSY, DATA MODULE-INPUT	
APPD-MEG	DATE	APPD PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO		
							PART NUMBER	REV
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PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER	
0024	00001.000	EA		972929-0397	CAP FIX CERAMIC .001 UF 10% 200V	QPL-439014/01-1397	
0024A					C28		
0026	00001.000	EA		231802-0100	EJECTOR, PC BD WHITE	SCA-S-202 533-887-0001 18671	
0027	00001.000	EA		231802-0105	EJECTOR, PC BD GREEN	SCA-S-202 533-887-0009 18671	
0029	00032.000	EA		972507-0001	INSULATOR DISC-TD-18	THR--7717-220	
0030	REF	EA		973589-9901	UNIT TEST PROC, 16 I/O DATA MOD, SPECIAL		
DRAFTSMAN		DATE	CRD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
APPD -MFG		DATE	APPD PROJEC ENGINEER	DATE	RELEASED	DATE	PROJECT NO
						CARD ASSY, DATA MODULE-INPUT	
						PART NUMBER REV LM 214103-0002 AB	

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PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER	
0001	00001.000	EA		214102-0001	PRINTED WIRING BRD, DATA MODULE		
0002	00016.000	EA		972946-0071	RES FIX 1.8K OHM 5 % .25 W CARBON FILM	ROH- R-25	
0002A					R26, R28, R30, R41, R43, R45, R47,		
0002B					R49, R51, R53, R57, R59, R61, R63,		
0002C					R65, R55		
0003	00031.000	EA		972946-0054	RES FIX 360 OHM 5 % .25 W CARBON FILM	ROH- R-25	
0003A					R1 THRU R20, R22 THRU R25, R32		
0003B					THRU R37, R39		
0005	00003.000	EA		972946-0076	RES FIX 3.0K OHM 5 % .25 W CARBON FILM	ROH- R-25	
0005A					R21 R38 R68		
0006	00032.000	EA		972057-0001	TRANSISTOR-A52222 NPN SILICON	TI--A5T222	
0006A					Q1 THRU Q32		
0007	00005.000	EA		222222-7400	NETWORK SN7400N	-SN7400N	
0007A					Z5, Z7, Z11, Z15, Z19		
0008	00001.000	EA		222222-7401	NETWORK SN7401N		
0008A					Z4		
0009	00003.000	EA		222222-7404	NETWORK SN7404N		
0009A					Z8, Z12, Z14		
0010	00001.000	EA		222222-7440	NETWORK SN7440N	-SN7440N	
0010A					Z2		
DRAFTSMAN		DATE	CRD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
							CARD ASSY, DATA MODULE-INV INPUT
APPD MFG		DATE	APPD PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO
						PART NUMBER	REV
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PART NUMBER	REV
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PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER
0011	00008.000	EA		222222-7474	NETWORK SN7474N	-SN7474N
0011A					Z1, Z6, Z9, Z10, Z16, Z17, Z18, Z20	
0012	00001.000	EA		222222-7150	NETWORK SN74150N	
0012A					Z3	
0013	00001.000	EA		222222-7154	NETWORK SN74154N	-SN74154N
0013A					Z13	
0014	00010.000	EA		230590-9000	CAP .05 MF 12 V 20. % CER TRANSCAP	ERI-5635-000-Y5F0503M
0014A					C3 C6 C9 C10 C13 C16 C19	
0014B					C20 C23 C25	
0015	00001.000	EA		972924-0015	CAP FIX TANT SOLID 47 MFD 10 % 20 VOLT	QPL-439003/1-2295
0015A					C27	
0016	AR	FT		457313-0006	WIRE 24 AWG SOLID, TEFLON, WHITE	QPL- MIL-W-16878/4E
0016A					E1 THRU E13	
0018	REF	EA		214104-9901	DIAGRAM, LOGIC DETAIL-DATA MODULE	
0020	00002.000	EA		972946-0081	RES FIX 4.7K OHM 5 % .25 W CARBON FILM	ROH- R-25
0020A					R67 R69	
0021	REF	EA		217763-9901	WIRE LIST, PT-TO-PT- DATA MOD, INV INPUT	
0022	00008.000	EA		972946-0083	RES FIX 5.6K OHM 5 % .25 W CARBON FILM	ROH- R-25
0022A					R44, R46, R54, R56, R58,	
0022B					R60, R62, R66	
DRAFTSMAN	DATE	CKD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
						CARD ASSY, DATA MODULE-INV INPUT
APPD -MFG	DATE	APPD PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO
						PART NUMBER
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PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER
0024	00001.000	EA		972929-0397	CAP FIX CERAMIC .001 UF 10% 200V	QPL-439014/01-1397
0024A					C28	
0026	00001.000	EA		231802-0100	EJECTOR,PC BD WHITE	SCA-S-202 533-887-0001 18677
0027	00001.000	EA		231802-0105	EJECTOR,PC BD GREEN	SCA-S-202 533-887-0009 18677
0029	00032.000	EA		972507-0001	INSULATOR DISC-TU-18	THR--7717-220
0030	REF	EA		973589-9901	UNIT TEST PROC, 16 I/O DATA MOD, SPECIAL	

DRAFTSMAN	DATE	CRD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
						CARD ASSY, DATA MODULE-INV INPUT
APPD -MPG	DATE	APPD PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO

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PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER	
0001	00001.000	EA		214102-0001	PRINTED WIRING BRD, DATA MODULE		
0002	00016.000	EA		972946-0071	RES FIX 1.8K OHM 5 % .25 W CARBON FILM	ROH- R-25	
0002A					R26 R28 R30 R41 R43 R45 R47		
0002B					R49 R51 R53 R57 R59 R61 R63		
0002C					R65 R55		
0003	00016.000	EA		972946-0054	RES FIX 360 OHM 5 % .25 W CARBON FILM	ROH- R-25	
0003A					R1 R3 R5 R7 R9 R11 R13 R15		
0003B					R17 R19 R22 R24 R32 R34 R36		
0003C					R39		
0004	00019.000	EA		972946-0076	RES FIX 3.0K OHM 5 % .25 W CARBON FILM	ROH- R-25	
0004A					R2 R4 R6 R8 R10 R12 R14 R16		
0004B					R18 R20 R21 R23 R25 R33 R35		
0004C					R37 R38 R40 R68		
0006	00032.000	EA		972057-0001	TRANSISTOR-A52222 NPN SILICON	TI--A5T2222	
0006A					Q1 THRU Q32		
0007	00005.000	EA		222222-7400	NETWORK SN7400N	-SN7400N	
0007A					Z5 Z7 Z11 Z15 Z19		
0008	00001.000	EA		222222-7401	NETWORK SN7401N		
0008A					Z4		
0009	00003.000	EA		222222-7404	NETWORK SN7404N		
DRAFTSMAN		DATE	CKD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
							CARD ASSY, DATA MODULE-4TI
APPD MFG		DATE	APPD PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO.
						PART NUMBER	REV
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PART NUMBER **LM 214103-0004** REV **AB**

PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER	
0009A					Z8 Z12 Z14		
0010	00001.000	EA		222222-7440	NETWORK SN7440N	-SN7440N	
0010A					Z2		
0011	00008.000	EA		222222-7474	NETWORK SN7474N	-SN7474N	
0011A					Z1 Z6 Z9 Z10 Z16 Z17 Z18 Z20		
0012	00001.000	EA		222222-7150	NETWORK SN74150N		
0012A					Z3		
0013	00001.000	EA		222222-7154	NETWORK SN74154N	-SN74154N	
0013A					Z13		
0014	00010.000	EA		230590-9000	CAP .05 MF 12 V 20. % CER TRANSCAP	ERI-5635-000-Y5F0503N	
0014A					C3 C6 C9 C10 C13 C16 C19		
0014B					C20 C23 C25		
0015	00001.000	EA		972924-0015	CAP FIX TANT SOLID 47 MFD 10 % 20 VOLT	OPL-M39003/1-2295	
0015A					C27		
0016	AR	FT		457313-0006	WIRE 24 AWG SOLID,TEFLON,WHITE	OPL- MIL-W-16878/4E	
0016A					E1 THRU E10		
0018	REF	EA		214104-9901	DIAGRAM,LOGIC DETAIL-DATA MODULE		
0020	00002.000	EA		972946-0081	RES FIX 4.7K OHM 5 % .25 W CARBON FILM	ROH- R-25	
0020A					R67 R69		
0023	REF	EA		966571-9901	WIRE LIST,PT-PT,DATA MOD-4TI		
DRAFTSMAN		DATE	CED DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
							CARD ASSY,DATA MODULE-4TI
APPD MFG		DATE	APPD PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO
						PART NUMBER	REV
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PART NUMBER	REV
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PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER
0024	00001.000	EA		972929-0397	CAP FIX CERAMIC .001 UF 10% 200V	OPL-M39014/01-1397
0024A					C28	
0026	00001.000	EA		231802-0100	EJECTOR,PC BD WHITE	SCA-S-202 533-887-0001 18677
0027	00001.000	EA		231802-0105	EJECTOR,PC BD GREEN	SCA-S-202 533-887-0009 18677
0028	A"	FT		535978-0044	WIRE,HOOKUP 30 AWG SOLID,YELLO WIREWRAP	QEN- SPCX130K6
0028A					F1	
0029	00032.000	EA		972507-0001	INSULATOR DISC-T0-18	THR--7717-220
0030	REF	EA		217163-9901	TEST PROCEDURE-DATA MODULE	

DRAFTSMAN	DATE	CKD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
						CARD ASSY,DATA MODULE-4TI
APPD-MFG	DATE	APPD. PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO

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QTY PER ASSEMBLY	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG. SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER	
0001	00001.000	EA		214102-0001	PRINTED WIRING BRD, DATA MODULE		
0002	00016.000	EA		972946-0071	RES FIX 1.8K OHM 5 % .25 W CARBON FILM	RQH- R-25	
0002A					R26, R28, R30, R41, R43, R45, R47		
0002B					R49, R51, R53, R57, R59, R61, R63		
0002C					R65, R55		
0003	00031.000	EA		972946-0054	RES FIX 360 OHM 5 % .25 W CARBON FILM	RQH- R-25	
0003A					R1 THRU R20, R22 THRU R25, R32		
0003B					THRU R37, R39		
0005	00003.000	EA		972946-0076	PES FIX 3.0K OHM 5 % .25 W CARBON FILM	RQH- R-25	
0005A					R21, R38, R68		
0006	00032.000	EA		972057-0001	TRANSISTOR-A52222 NPN SILICON	TI--A5T2222	
0006A					Q1 THRU Q32		
0007	00005.000	EA		222222-7400	NETWORK SN7400N	-SN7400N	
0007A					Z5, Z7, Z11, Z15, Z19		
0008	00001.000	EA		222222-7401	NETWORK SN7401N		
0008A					Z4		
0009	00003.000	EA		222222-7404	NETWORK SN7404N		
0009A					Z8, Z12, Z14		
0010	00001.000	EA		222222-7440	NETWORK SN7440N	-SN7440N	
0010A					Z2		
DRAFTSMAN		DATE	CRD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
							CARD ASSY, DATA MODULE
APPD -MFG		DATE	APPD. PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO
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PART NUMBER **LM 214103-0005** REV **AB**

PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER			
0011	00008.000	EA		222222-7474	NETWORK SN7474N Z1,Z6,Z9,Z10,Z16,Z17,Z18,Z20	-SN7474N			
0011A									
0012	00001.000	EA		222222-7150	NETWORK SN74150N Z3				
0012A									
0013	00001.000	EA		222222-7154	NETWORK SN74154N Z13	-SN74154N			
0013A									
0014	00010.000	EA		230590-9000	CAP .05 MF 12 V 20. % CER TRANSCAP C3,C6,C9,C10,C13,C16,C19 C20,C23,C25	ERI-5635-000-Y5F0503N			
0014A									
0014B									
0015	00001.000	EA		972924-0015	CAP FIX TANT SOLID 47 MFD 10 % 20 VOLT C27	QPL-M39033/1-2295			
0015A									
0016	AR	FT		457313-0006	WIRE 24 AWG SOLID,TEFLON,WHITE E1 THRU E13	QPL- MIL-W-16878/4E			
-0016A									
0018	REF	EA		214104-9901	DIAGRAM,LOGIC DETAIL-DATA MODULE				
0020	00002.000	EA		972946-0081	RES FIX 4.7K OHM 5 % .25 W CARBON FILM R67,R69	ROH- R-25			
0020A									
0021	REF	EA		973550-9901	WIRE LIST,DATA MODULE				
0022	00014.000	EA		972946-0083	RES FIX 5.6K OHM 5 % .25 W CARBON FILM R27,R29,R31,R42,R44,R46,R48 R54,R56,R58,R60,R62,R64,R66	ROH- R-25			
0022A									
0022B									
DRAFTSMAN		DATE	CRD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE	CARD ASSY, DATA MODULE	
APPD MFG		DATE	APPD PROJECT ENGINEER	DATE	RELEASD	DATE	PROJECT NO	PART NUMBER LM 214103-0005 REV AB	

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ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER
0024	00001.000	EA		972929-0397	CAP FIX CERAMIC .001 UF 10% 200V	OPL-439014/01-1397
0024A					C28	
0026	00001.000	EA		231802-0100	EJECTOR, PC 8D WHITE	SCA-S-202 533-887-0001 18677
0027	00001.000	EA		231802-0105	EJECTOR, PC 8D GREEN	SCA-S-202 533-887-0009 18677
0029	00032.000	EA		972507-0001	INSULATOR DISC-T0-18	THR--7717-220
0030	REF	EA		973594-9901	UNIT TEST PROC, 161/O DATA MODULE, -5ASSY	

DRAFTSMAN	DATE	CHK DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
						CARD ASSY, DATA MODULE
APPD MFG	DATE	APPD PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO.

PART NUMBER	REV
LM 214103-0005	AB



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PART NUMBER	REV
LM 214103-0006	AB

PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER	
0001	00001.000	EA		214102-0001	PRINTED WIRING BRD, DATA MODULE		
0002	00016.000	EA		972946-0071	RES FIX 1.8K OHM 5 % .25 W CARBON FILM	ROH- R-25	
0002A					R26 R28 R30 R41 R43 R45 R47		
0002B					R49 R51 R53 R55 R57 R59 R61		
0002C					R63 R65		
0003	00031.000	EA		972946-0054	RES FIX 360 OHM 5 % .25 W CARBON FILM	ROH- R-25	
0003A					R1 THRU R20 R22 THRU R25		
0003B					R32 THRU R37 R39		
0005	00003.000	EA		972946-0076	RES FIX 3.0K OHM 5 % .25 W CARBON FILM	ROH- R-25	
0005A					R21 R38 R68		
0006	00032.000	EA		972057-0001	TRANSISTOR-A52222 NPN SILICON	TI--A5T2222	
0006A					Q1 THRU Q32		
0007	00005.000	EA		222222-7400	NETWORK SN7400N	-SN7400N	
0007A					Z5 Z7 Z11 Z15 Z19		
0008	00001.000	EA		222222-7401	NETWORK SN7401N		
0008A					Z4		
0009	00003.000	EA		222222-7404	NETWORK SN7404N		
0009A					Z8 Z12 Z14		
0010	00001.000	EA		222222-7440	NETWORK SN7440N	-SN7440N	
0010A					Z2		
DRAFTSMAN		DATE	CRD CRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
							CARD ASSY, DATA MODULE
APPD -MFG		DATE	APPD PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO
						PART NUMBER	REV
						LM 214103-0006	AB

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PART NUMBER
LM 214103-0006 REV
AB

PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER	
0011	00008.000	EA		222222-7474	NETWORK SN7474N	-SN7474N	
0011A					Z1 Z6 Z9 Z10 Z16 Z17 Z18 Z20		
0012	00001.000	EA		222222-7150	NETWORK SN74150N		
0012A					Z3		
0013	00001.000	EA		222222-7154	NETWORK SN74154N	-SN74154N	
0013A					Z13		
0014	00010.000	EA		230590-9000	CAP .05 MF 12 V 20. % CER TRANSCAP	ERI-5635-000-Y5F0503N	
0014A					C3 C6 C9 C10 C13 C16 C19 C20		
0014B					C23 C25		
0015	00001.000	EA		972924-0015	CAP FIX TANT SOLID 47 MFD 10 % 20 VOLT	OPL-439003/1-2295	
0015A					C27		
0016	AR	FT		457313-0006	WIRE 24 AWG SOLID,TEFLON,WHITE	OPL- MIL-W-16878/4E	
0018	REF	EA		214104-9901	DIAGRAM,LOGIC DETAIL-DATA MODULE		
0020	00002.000	EA		972946-0081	RES FIX 4.7K OHM 5 % .25 W CARBON FILM	ROH- R-25	
0020A					R67 R69		
0021	REF	EA		840995-9901	INCOMING TEST PROC, 2230/2260 LINE PTR		
0022	00008.000	EA		972946-0083	RES FIX 5.6K OHM 5 % .25 W CARBON FILM	ROH- R-25	
0022A					R44 R46 R54 R56 R58 R60 R62		
0022B					R66		
0024	00001.000	EA		972929-0397	CAP FIX CERAMIC .001 UF 10% 200V	OPL-M39014/01-1397	
DRAFTSMAN		DATE	CRD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
					CARD ASSY, DATA MODULE		
APPD-MFG		DATE	APPD PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO
						PART NUMBER	REV
						LM 214103-0006	AB

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PART NUMBER **LM 214103-0006** REV **AB**

PRY. ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG. SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER
0024A					C28	
0026	00001.000	EA		231802-0100	EJECTOR, PC BD WHITE	SCA-S-202 533-887-0001 18677
0027	00001.000	EA		231802-0105	EJECTOR, PC BD GREEN	SCA-S-202 533-887-0009 18677
0029	00032.000	EA		972507-0001	INSULATOR DISC-TO-18	THR--7717-220
0030	REF	EA		973589-9901	UNIT TEST PROC, 16 I/O DATA MOD, SPECIAL	

DRAFTSMAN	DATE	CRD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
						CARD ASSY, DATA MODULE
APPD MFG	DATE	APPD PROJ. CT ENGINEER	DATE	RELEASED	DATE	PROJECT NO.

PART NUMBER **LM 214103-0006** REV **AB**

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PART NUMBER **LM 214103-0960** REV **AB**

ITEM LABEL	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER
0001	00001.000	EA		966366-9701	MANUAL, CRU 16IN/16OUT DATA MODULE-960A	
0002	00001.000	EA		970592-1101	PTO, SIO DMT, 16 I/O DATA MODULE-PDT960	

DRAFTSMAN	DATE	CHKD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE CARD ASSY, DATA MODULE-DOCUMENTATION	
APPD MFG	DATE	APPD PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO.	PART NUMBER LM 214103-0960 REV AB

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TABLE 1	
<u>TEST KIT</u>	<u>USED ON</u>
-0001	214103-0001
-0002	NOT USED
-0003	214103-0002 214103-0003

SIZE	CODE IDENT NO.	DRAWING NO.
A	96214	966300
SCALE	REV	SHEET
	D	2



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PART NUMBER	REV
LM 966300-0001	D F

QTY PER ASSEMBLY	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER
CCC1	00001.000	EA		566307-0001	CONNECTOR, TEST-DATA MODULE #1	
CCC2	REF	EA		566366-9701	MANUAL, CPL 16IN/16CUT DATA MODULE 960A	
CCC3	REF	EA		970592-1201	CDC, SICCMY, 16 I/C DATA MODULE-PDT960	
CCC4	REF	EA		970592-1101	PTC, SICCMY, 16 I/C DATA MODULE-PDT960	
CCC5	REF	EA		970592-9901	PD, SICCMY, 16 I/C DATA MODULE-PDT960	
CCC6	REF	EA		970592-9902	AL, SICCMY, 16 I/C DATA MODULE-PDT960	

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DRAWN BY	DATE	CRD. DRAWN BY	DATE	DESIGN ENGINEER	DATE	TITLE
		<i>R. C. ...</i>	<i>5/29/75</i>			TEST KIT, STANDARD DATA MODULE
APPD. MFG	DATE	APPD. PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO
						8100 7502
					PART NUMBER	REV
					LM 966300-0001	D F



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PART NUMBER	REV
LM 966300-0002	D-E

PART NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER
CCC1	0001.CC0	EA		966307-CCC2	CONNECTOR, TEST-DATA MODULE #2	
CCC2	REF	EA		966366-9701	MANUAL, CRL 16IN/16OUT DATA MODULE 960A	
CCC3	REF	EA		970592-1201	CDC, SICCMT, 16 I/C DATA MODULE-PDT960	
CCC4	REF	EA		970592-1101	PTC, SICCMT, 16 I/C DATA MODULE-PDT960	
CCC5	REF	EA		970592-9901	PD, SICCMT, 16 I/C DATA MODULE-PDT960	
CCC6	REF	EA		970592-9902	AL, SICCMT, 16 I/O DATA MODULE-PDT960	

DRAFTSMAN	DATE	CKD DRAFTER	DATE	DESIGN ENGINEER	DATE	TITLE
						TEST KIT, STANDARD DATA MODULE
APPROV MFG	DATE	APPROV PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO

PART NUMBER	REV
LM 966300-0002	D-E

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PART NUMBER	REV
LM 966300-0003	DF

PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER
C001	CCC1.CCC	FA		966307-0003	CONNECTOR, TEST-DATA MODULE #3	
C002	REF	FA		966366-9701	MANUAL, CPL 16IN/16OUT DATA MODULE 960A	
C003	REF	EA		970592-1201	CDC, SICCM1, 16 I/O DATA MODULE-PDT960	
C004	REF	EA		970592-1101	FTC, SICCM1, 16 I/C DATA MODULE-PDT960	
C005	REF	EA		970592-9501	PD, SICCM1, 16 I/C DATA MODULE-PDT960	
C006	REF	EA		970592-9902	AL, SICCM1, 16 I/C DATA MODULE-PDT960	

DRAFTSMAN	DATE	CRD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
						TEST KIT, STANDARD DATA MODULE
APPD MFG	DATE	APPD PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO

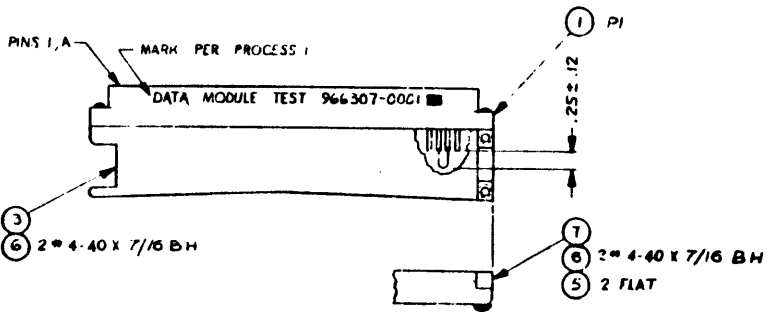
PART NUMBER	REV
LM 966300-0003	DF

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WIRE NO	DESCRIPTION	SIGNATURE	-0001 (-0003		-0002		ITEM NO	
			START	FINISH	START	FINISH		
1	#22 SOLID BUS	AR	IN 0 / OUT 0	PI-M	PI-L	PI-4	PI-2	2
2			IN 1 / OUT 1	PI-R	PI-F	PI-D	PI-A	
3			IN 2 / OUT 2	PI-C	PI-B	PI-5	PI-E	
4			IN 3 / OUT 3	PI-Y	PI-X	PI-E	PI-E	
5			IN 4 / OUT 4	PI-U	PI-T	PI-J	PI-2	
6			IN 5 / OUT 5	PI-P	PI-N	PI-B	PI-K	
7			IN 6 / OUT 6	PI-K	PI-J	PI-3	PI-R	
8			IN 7 / OUT 7	PI-E	PI-D	PI-B	PI-C	
9			IN 8 / OUT 8	PI-33	PI-32	PI-F	PI-Y	
10			IN 9 / OUT 9	PI-29	PI-28	PI-7	PI-X	
11			IN 10 / OUT 10	PI-25	PI-24	PI-H	PI-M	
12			IN 11 / OUT 11	PI-21	PI-20	PI-8	PI-L	
13			IN 12 / OUT 12	PI-17	PI-16	PI-N	PI-M	
14			IN 13 / OUT 13	PI-13	PI-12	PI-13	PI-F	
15			IN 14 / OUT 14	PI-9	PI-8	PI-P	PI-C	
16	#22 SOLID BUS	AR	IN 15 / OUT 15	PI-5	PI-4	PI-14	PI-B	2
17	#26 AWG WRT	AR		PI-M	PI-5			8

- NOTES:
- 1 -0001 ONLY
 - 2 -0003 ONLY

ZONE/LTR	REVISIONS	
	DESCRIPTION	DATE
A	374267 (E) R11... 8 2 73	8-2-73
B	385584 (C) 2 AN... ADD'D 1 ON W... FINISH STATION... START... SH... ITEM 6... ITEM 4 WAS	1/30/73
C	392873 (D) P... WIRE 17 TO WIRE... 172 IS ADDED... 18 IN WIRE... -0001 IS ADDED... 16 IS ADDED -0003	5/1/74



CONNECTOR, TEST-DATA MODULE #3	966307-0003
CONNECTOR TEST-DATA MODULE #2	966307-0002
CONNECTOR TEST-DATA MODULE #1	966307-0001
DESCRIPTION	PART NO.

PROCESSES:
1) RUBBER STAMP, F-100, HEIGHT .12,
COLOR: BLACK.

UNLESS OTHERWISE SPECIFIED	UNLESS OTHERWISE SPECIFIED
* REMOVE ALL BURRS AND SHARP EDGES	* DIMENSIONS ARE IN INCHES
* CONCENTRICITY MACHINED	* TOLERANCES
* DIAMETERS .010 MIN	* ANGLES 1:1
* DIMENSIONAL LIMITS APPLY BEFORE FINISH PROCESSING	* PLACE DECIMALS & 0'S
* IDENTIFYING NUMBERS SHOWN IN PARENTHESES FOR REFERENCE ONLY	* PLACE DECIMALS & 0'S
* INTERPRET DRAWING IN ACCORDANCE WITH MIL-STD-100	

QTY REQD	ITEM NO	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	PROCUREMENT SPECIFICATION
2	1	1			
PARTS LIST					
			DATE	TEXAS INSTRUMENTS	
			9-20-72	EQUIPMENT GROUP DATA FORM	
			6-14-72	CONNECTOR, TEST-DATA MODULE	
			DATE	SIZE CODE (ENTR #)	
			4-72	DRAWING NO	
				C 96214 966307	
			DATE	DATE	
			2/27/74	10/20/74	

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966307



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LM	PART NUMBER 966307-0001	REV C
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PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER
0001	00001.000	EA		231447-0800	CONNECTOR PC 36 PIN	VIK-2VH-36/10A-5
0001A					P1	
0002	AR	EA		411400-0022	WIRE 22AWG ELETRO-TIN-PLATED,COPPER	
0003	00001.000	EA		214080-0001	CONNECTOR-COVER	
0005	00002.000	EA		411027-0804	WASHER .125 X .312 X .032 FLAT CRES	QPL- MS15795-804
0006	00004.000	EA		418293-0016	SCREW 4-40 UNC-2A X .438 PAN HEAD CRES	QPL- MS1957-16
0007	00001.000	EA		214081-0001	CLAMP	

DRAFTSMAN	DATE	CRD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
						CONNECTOR,TEST-DATA MODILF #1
APPD MFG	DATE	APPD PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO
						8101/8101
						PART NUMBER
						LM 966307-0001
						REV
						C

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LM	PART NUMBER	REV
	966307-0002	C

PRP. ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG. SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER
0001	00001.000	EA		231447-0800	CONNECTOR PC 36 PIN	VIK-2VH-36/1CN-5
0001A					P1	
0002	AK	EA		411400-0022	WIPE 22AWG ELETRO-TIN-PLATED,COPPER	
0003	00001.000	EA		214080-0001	CONNECTOR-COVER	
0005	00002.000	EA		411027-0804	WASHER .125 X .312 X .032 FLAT CRES	QPL- MS15795-804
0006	00004.000	EA		418293-0016	SCREW 4-40 UNC-2A X .438 PAN HEAD CRES	QPL- MS1957-16
0007	00001.000	EA		214081-0001	CLAMP	

DRAFTSMAN	DATE	CKD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
						CONNECTOR,TFST-DATA MODIJE #2
APPD MFG	DATE	APPD PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO.

LM	PART NUMBER	REV
	966307-0002	C

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LM	PART NUMBER	REV
	966307-0003	C

PRINT ITEM NUMBER	QUANTITY PER ASSEMBLY	UNIT OF ISSUE	DWG SIZE	PART NUMBER	DESCRIPTION	VENDOR PART NUMBER
0001	00001.000	EA		231447-0800	CONNECTOR PC 36 PIN	VIK-2VM-36/1CN-5
0001A					P1	
0002	AR	EA		4114J0-0022	WIRE 22AWG ELETRO-TIN-PLATED,COPPER	
0003	00001.000	EA		214080-0001	CONNECTOR-COVER	
0005	00002.000	EA		411027-0804	WASHER .125 X .312 X .032 FLAT CRES	QPL- MS15795-804
0006	00004.000	EA		418293-0016	SCREW 4-40 UNC-2A X .438 PAN HEAD CRES	QPL- MS1957-16
0007	00001.000	EA		214081-0001	CLAMP	
0008	AR	FT		411402-0269	WIRE,TYPE E-26 AWG 7STR WHT PTFE	

DRAFTSMAN	DATE	CRD DRAFTSMAN	DATE	DESIGN ENGINEER	DATE	TITLE
						CONNECTOR,TEST-DATA MODULE #3
PPD MFG	DATE	APPD PROJECT ENGINEER	DATE	RELEASED	DATE	PROJECT NO

LM	PART NUMBER	REV
	966307-0003	C

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SECTION VII
LOGIC IMPLEMENTATION LIST

(Not Applicable)



SECTION VIII

PERFORMANCE DEMONSTRATION TEST

8.1 GENERAL

The diagnostic program included in this section for the 16 Input/16 Output Data Modules (TI Part Numbers 214103-0001, -0002, and -0003) is entitled SIODMT (Sixteen Input/Output Data Module Test). Before this test can be executed the reliability of the instruction set and the CPU must be confirmed. The other assemblies of the 214103 data modules can be tested as follows:

- 214103-0004 can be tested as a -0001
- 214103-0005 can be tested as a -0002
- 214103-0006 can be tested as a -0003 (by temporarily jumpering as a -0003)

8.2 RELATED MATERIAL

The following part numbers apply to the equipment and documentation for the test:

966300-0001	Test kit for data module 214103-0001
966300-0003	Test kit for data modules 214103-0002 and 0003
970592-2201	Source input deck (cards) for SIODMT
970592-1201	Object input deck (cards) for SIODMT
970592-1101	Object input tape (paper tape) for SIODMT
970592-9901	Program description for SIODMT
970592-9902	Assembly listing for SIODMT

8.3 EQUIPMENT CONFIGURATION

The minimum equipment required to execute SIODMT is a Texas Instruments Model 960A or Model 960B computer with 4096 words of memory, an input device suitable for the program input source (cards or paper tape) together with its appropriate bootstrap loader, a data module, and a test connector (included in one of the above test kits). The test connector feeds the module output signals back to the corresponding input signals for checkout of both input and output circuits.

8.4 PROGRAM OPERATION

Program Operation consists of the following steps:

1. Initialize the CPU memory, load the primitive and bootstrap loaders. (See Section I of the CPU Performance Assurance Test Manual, TI Part Number 958953-9701).
2. Insert the data module in CRU port F30. If the module must be located elsewhere, modify relative location 4 after the program is loaded.



3. Using the loader, load and execute SIODMT. If a /* record terminates the load operation, the program will immediately begin execution.
4. SIODMT then waits for test selection via the front panel switches. Set DATA switches 4 through 15 on the front panel to the down (zero) position.
5. Set one of the following switch patterns to select one of the tests:

Module	Switch		
	1	2	3
214103-0001	Up	Down	Down
214103-0002	Down	Up	Down
214103-0003	Down	Down	Up

6. Change the position of switch 0 (from down to up, or from up to down) to start the test.
7. Successful execution requires approximately 30 seconds (60 seconds for the -0001 unit) and terminates with a return to the loader.
8. Errors are indicated by a program halt with the instruction $72D2_{16}$ in IA and the relative address of the halt in IB.

If errors occur, refer to the following program listing for an explanation of the failing operation.

0001 * TITLE =SIODMT, 16 INPUT/16 OUTPUT DATA MODULE TESTS
0002 * REVISION =04/12/75 PROGRAMS LDCRUA AND DMX2X3 WERE
0003 * COMBINED TO MAKE SIODMT.
0004 * COMPUTER =960
0005 * ABSTRACT =THIS IS A DIAGNOSTIC FOR 16I/O DATA MODULES
0006 * 214103-0001, 214103-0002, AND 214103-0003.
0007 * TEST SELECTION IS MADE VIA THE FRONT PANEL
0008 * SWITCHES AFTER SIODMT HAS BEEN LOADED. THE
0009 * OPERATOR SHOULD RAISE EITHER PANEL SWITCH
0010 * 1 TO TEST 214103-0001, OR PANEL SWITCH 2 TO
0011 * TEST 214103-0002, OR PANEL SWITCH 3 TO TEST
0012 * 214103-0003. ONCE THE TEST IS SELECTED PANEL
0013 * SWITCH ZERO SHOULD BE TOGGLED TO INDICATE TO
0014 * SIODMT TO READ THE PANEL SWITCHES. IN OTHER
0015 * WORDS PANEL SWITCH ZERO SHOULD BE RAISED OR
0016 * LOWERED DEPENDING UPON ITS ORIGINAL POSITION.
0017 * CALL =SIODMT IS AN INDEPENDENT, STAND ALONE, RELOCAT-
0018 * ABLE, SAL960 PROGRAM.
0019 * STATISTICS=CRU ADDRESS OF THE DATA MODULE IS X'0F30'.
0020 * ERROR DETECTION RESULTS IN A PROGRAMMED HALT
0021 * WITH THE SAL960 OUTPUT LISTING ADDRESS OF THE
0022 * FAILURE IN THE IB REGISTER.
0023 *
0024 * TEST 1: REQUIRES TOP EDGE CONNECTOR 966307-1
0025 *
0026 * THIS TEST PERFORMS 232200 LOAD/STORE
0027 * CRU TESTS. INCLUDED ARE TESTS OF ALL
0028 * POSSIBLE FIELD WIDTHS WITH ALL POS-
0029 * SIBLE BIT PATTERNS FOR EACH WIDTH.
0030 *
0031 * TEST 2: REQUIRES TOP EDGE CONNECTOR 966307-3
0032 *
0033 * ONE RUN OF THIS TEST INCLUDES THE
0034 * LOADING AND STORING OF ALL POSSIBLE
0035 * BIT PATTERNS TO ADDRESSES 0 THRU 14
0036 * AND GENERATING 32768 INTERRUPTS USING
0037 * OUTPUT LINE ZERO. THE MASK BIT IS ALSO
0038 * TESTED.
0039 *
0040 * TEST 3: SAME AS TEST 2.
0041 *
PAGE

SAL960 V4L2 SIODMT, 16I/O DATA MODULE TESTS
09159:24 APR.28, 1975

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0042                                TITL SIODMT, 16I/O DATA MODULE TESTS
0043 0000 SIODMT PSEG
0044 0000 MODE
0045 0000 LOADER EQU 0
0046 0000 7C000002 LDS TCRUST
0047 0002 0005 TCRUST DATA S+3.X'1C0i
      0003 01C0

0048 *
0049 0004 0F30 BIAS DATA X'0F30i CRU SLOT FOR 16I/O DATA MODULE
0050 *
0051 0005 E400015F STPS PANEL GET INITIAL POSITION OF SW 0
0052 0007 E00C000F BC 12,S+8 JUMP IF UP
0053 0009 E400015F STPS PANEL ELSE WAIT UNTIL IT GOES UP
0054 000B E00C0013 BC 12,SELECT
0055 000D 70020009 B 8-4
0056 000F E400015F STPS PANEL WAIT UNTIL SW 0 IS LOWERED
0057 0011 E00C000F BC 12,S-2
0058 0013 44050000 SELECT LA 5,SIODMT
0059 0015 4400015F L 0,PANEL
0060 0017 50007FFF NA 0,X'7FFFi
0061 0019 C0004000 CRA 0,X'4000i
0062 001B E0000027 BC 11,DMX1 JUMP IF SWITCH 1 IS UP
0063 001D C0002000 CRA 0,X'2000i
0064 001F E0000167 BC 11,DMX2X3 JUMP IF SWITCH 2 IS UP
0065 0021 C0001000 CRA 0,X'1000i
0066 0023 E0000167 BC 11,DMX2X3 JUMP IF SWITCH 3 IS UP
0067 0025 72D20025 B 03.5 PANEL SWITCHES NOT SET RIGHT
0068 *
0069 * TEST ONE
0070 *
0071 0027 44000000 DMX1 LA #5,SIODMT INITIALIZE DATA BASE REG
0072 0029 4404015A LA 4,FIELD
0073 002B 440C015A LA #4,FIELD
0074 002D 44000000 LA 0,X'0000i SET REG 0 TO 0
0075 002F 440F0004 L #7,BIAS INITIALIZE CRU BASE REG
0076 0031 44031000 LA 3,X'1000i PUT FIELD SIZE IN REG 3
0077 0033 48030044 ST 3,INST1+1 BUILD LOAD CRU INSTRUCTION
0078 0035 4803005E ST 3,INST2+1
0079 0037 44090001 LA #1,X'0001i INITIALIZE MASK TO 1
0080 0039 48090156 ST #1,MASK
0081 003B 44010000 BEGD LA 1,X'0000i SET FIELD TO ZERO
0082 003D 4801015A ST 1,FIELD
0083 003F 44070004 LOOPD L 7,BIAS SET CRU BASE REG TO X'0C00i
0084 0041 00000002 LDCR (0,0),2 ZERO CRU (ALL 16 BITS)
0085 0043 00000000 INST1 LDCR (0,0),0 LOAD CRU WITH FIELD
0086 0045 2C000001 STCR (0,0),1 STORES CRU IN FIELD+1
0087 0047 115A055B CM FIELD,FIELD+1 ARE THE VALUES EQUAL?
0088 0049 72D20049 B 03.5 LOAD/STORE ERROR
0089 004B 72D2004B B 03.5 LOAD/STORE ERROR
0090 *

```

```

0091          *LOAD/STORE HAS BEEN TESTED. NOW SEE IF ALL POSSIBLE BIT
0092          *COMBINATIONS HAVE BEEN TESTED FOR GIVEN FIELD SIZE
0093          *
0094 004D 11560559          CM  MASK,HEXF          IS FIELD A FULL 16 BITS?
0095 004F 70820055          B   $+6          NO, CONTINUE....
0096 0051 70820055          B   $+4          WITH NEW CRU ADDRESS
0097 0053 708200AF          B   CMPR          YES, RESET FOR NEW PATTERN
0098
0099          *
0100          *NOW SET UP FOR VARIED CRU ADDRESS
0101          *
0101 0055 4409015A          L   #1,FIELD          GET FIELD AND
0102 0057 40890157          ST  #1,PATRN          STORE IN PATRN
0103          *
0104 0059 46F70001          INCR LA  7,1,7          INCRUMENTS EFFECTIVE CRU ADDRES
0105          *
0106 005B 08000402          LDCR #(0,0),2          ZERO CRU
0107          *
0108 005D 08000000          INST2 LDCR (0,0),0          LOAD CRU WITH SPECIFIED PATTERN
0109 005F 2C000401          STCR #(0,0),1          STORE ALL 16 BITS OF CRU
0110 0061 44020157          L   2,PATRN          GET THE PATTERN IN REG 2
0111 0063 48820066          ST  2,$+3
0112 0065 46A20000          LA  2,0,2          ROTATE 1 PLACE LEFT
0113 0067 48820157          ST  2,PATRN          STORE NEW NUMBER
0114 0069 1157055B          CM  PATRN,FIELD+1          COMPARE
0115 006B 7202006B          B   $S,5          LOAD/STORE ERROR
0116 006D 7202006D          B   $S,5          LOAD/STORE ERROR
0117          *
0118          *SEE IF CRU ADDRESS SHOULD BE TESTED
0119          *
0120 006F 48870158          ST  7,TEMPD          GET CRU ADDRESS FOR COMPARE
0121 0071 44020158          L   2,TEMPD          PUT IN REG 2
0122 0073 40020159          XOR  2,HEXF          COMPLIMENT IT
0123 0075 46A20001          LA  2,1,2          INCREMENT IT (NOW IN TWOS COMP)
0124 0077 4882007A          ST  2,$+3          SHIFT 12 LEFT
0125 0079 46A20000          LA  2,0,2          1
0126 007B 4882007E          ST  2,$+3          2
0127 007D 46A20000          LA  2,0,2          3
0128 007F 48820082          ST  2,$+3          4
0129 0081 46A20000          LA  2,0,2          5
0130 0083 48820086          ST  2,$+3          6
0131 0085 46A20000          LA  2,0,2          7
0132 0087 4882008A          ST  2,$+3          8
0133 0089 46A20000          LA  2,0,2
0134 008B 4882008E          ST  2,$+3
0135 008D 46A20000          LA  2,0,2
0136 008F 48820092          ST  2,$+3
0137 0091 46A20000          LA  2,0,2
0138 0093 48820096          ST  2,$+3
0139 0095 46A20000          LA  2,0,2
0140 0097 4882009A          ST  2,$+3

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0141 0099 46A20000 LA 2,0,2 9
0142 0098 4882009E ST 2,3+3
0143 009D 46A20000 LA 2,0,2 10
0144 009F 488200A2 ST 2,3+3
0145 00A1 46A20000 LA 2,0,2 11
0146 00A3 488200A6 ST 2,3+3
0147 00A5 46A20000 LA 2,0,2 IS NOW SHIFTED 12 LEFT
0148 00A7 48820158 ST 2,TEMPD STORE NUMBER FOR COMPARE
0149 *
0150 * *NOW TEST TO SEE IF CRU ADDRESS IS MAXIMUM
0151 *
0152 00A9 1150045E CM TEMPD,INST2+1 COMPARE WITH SIZE FIELD
0153 00AB 70820059 B INCR TEST BIT PATTERN...
0154 00AD 70820059 B INCR WITH NEW CRU ADDRESS
0155 *
0156 *IF THE NUMBERS COMPARED WERE EQUAL,
0157 *TEST IF ALL BIT PATTERNS HAVE BEEN TESTED
0158 *
0159 00AF 1156055A CMPR CM MASK,FIELD ARE THE VALUFS EQUAL?
0160 00B1 708200B7 B 3+6 NO,
0161 00B3 708200B7 B 3+4 NO,
0162 00B5 708200BF B ENDD YES, GO CHECK FOR END
0163 00B7 4402015A L 2,FIELD GET THE TEST FIELD IN REG 2
0164 00B9 46A20001 LA 2,1,2 INCREMENT IT
0165 00BB 4882015A ST 2,FIELD STORE IT BACK
0166 00BD 7082003F B LOOPD BRANCH BACK TO BEGINNING
0167 *
0168 *NOW TEST FOR END OF JOB
0169 *
0170 00BF 11560559 ENDD CM MASK,HEXF EOJ?
0171 00C1 708200C7 B 3+6 NO,
0172 00C3 708200C7 B 3+4 NO,
0173 00C5 708200D9 B TSTR YES, TEST CRU STORAGE
0174 *
0175 *NOW INCREMENT THE MASK (SET NEXT LEFT BIT ON)
0176 *
0177 00C7 44020156 L 2,MASK
0178 00C9 488200CC ST 2,3+3
0179 00CB 46A20000 LA 2,0,2 SHIFT MASK 1 LEFT
0180 00CD 46A20001 LA 2,1,2 INCREMENT MASK
0181 00CF 48820156 ST 2,MASK STORE BACK
0182 *
0183 *NOW INCREMENT SIZE FIELD FOR MODIFICATION OF CRU LOAD INST.
0184 *
0185 00D1 46031000 LA 3,X'1000',3
0186 00D3 48030044 ST 3,INST1+1
0187 00D5 4803005E ST 3,INST2+1
0188 00D7 70820038 B BEGD RESTART
0189 *
0190 *

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```

0191 *TEST THE STCR INSTRUCTION TO SEE IF IT LEFT EXTENDS
0192 *THE MOST SIGNIFICANT BIT STORED IN MEMORY.
0193 *
0194 00D9 4484015A TSTR LA 4,FIELD SET UP DATA BASE REG
0195 00DB 44070004 L 7,BIAS SET UP CRU BASE REGISTER
0196 00DD 4880015A ST 0,FIELD ZERO FIELD
0197 00DF 00001000 LDCR (0,1),0 LOAD BIT 0 OF CR WITH 0
0198 00E1 2C001001 STCR (0,1),1 STORE BIT 0
0199 00E3 115A855B CM FIELD,FIELD+1 SEE IF ZEROS ARE EXTENDED
0200 00E5 720200E5 B #3.5 LEFT EXTENDED ZEROS ERROR
0201 00E7 720200E7 B #3.5 LEFT EXTENDED ZEROS ERROR
0202 00E9 44810001 LA 1,X'0001' SET FIELD TO 1
0203 00EB 4881015A ST 1,FIELD
0204 00ED 00001000 LDCR (0,1),0 LOAD 1 INTO CRU
0205 00EF 2C001001 STCR (0,1),1 STORE 1 FROM CRU
0206 00F1 115B8559 CM FIELD+1,HEXF ARE ONES LEFT EXTENDED?
0207 00F3 720200F3 B #3.5 LEFT EXTENDED ONES ERROR
0208 00F5 720200F5 B #3.5 LEFT EXTENDED ONES ERROR
0209 00F7 70070000 NOP YES, GOOD TEST
0210 00F9 4401015D L 1,BRWD
0211 00FB 46910001 LA 1,1,1
0212 00FD 4801015D ST 1,BRWD
0213 00FF 1D5DA001 CMT BRWD,1 * FIRST LOOP?
0214 0101 70070000 NOP
0215 0103 70000107 XSB 3+4 * NO: EXIT
0216 0105 70010027 XWB DMX1 * YES: TRANSFER MODES & RETEST
0217 0107 70020109 B 3+2 * NOP
0218 0109 44810000 LA 1,0
0219 010B 4801015D ST 1,BRWD
0220 *
0221 * FOLLOWING TESTS SUBMITTED BY ENGINEERING GROUP
0222 *
0223 010D 44840153 LA 4,ENGDAT
0224 010F 44070004 L 7,BIAS
0225 0111 00000000 LDCR ENGF1,0
0226 0113 2C000002 STCR ENGF1,2
0227 0115 11538555 CM ENGDAT,ENGDT2
0228 0117 72020117 B #3.5
0229 0119 72020119 B #3.5
0230 011B 7002011D B ENCK2
0231 011D 44800001 ENCK2 LA 0,1
0232 011F 44070004 L 7,BIAS
0233 0121 4484014F LA 4,E60A
0234 0123 08000000 LDCR ENGF2,0
0235 0125 2C000001 STCR ENGF2,1
0236 0127 11508551 CM E70C,E60A1
0237 0129 72020129 B #3.5
0238 012B 7202012B B #3.5
0239 012D 44030152 L 3,E70C1
0240 012F 4883014F ST 3,E60A

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0241 0131 40030151      ST   3,E60A1
0242 0133 0C0F0123      ARB  -1,ENCK2+6,0
0243 0135 70070000      NOP
0244
0245      *
0246      * CHECK FOR STATUS BLOCK ERRORS
0247 0137 70060140      SS   STAT-1
0248 0139 4400014E      LA   6,STAT
0249 013B 8400293F      BFNE (0,2),1,3+4
0250 013D 7202013D      B    #3,5      * PARITY ERROR
0251 013F 84003943      BFNE (0,3),1,3+4
0252 0141 72020141      B    #3,5      * POWER FAILURE
0253 0143 84004947      BFNE (0,4),1,3+4
0254 0145 72020145      B    #3,5      * UNDEFINED CODE
0255 0147 8400594B      BFNE (0,5),1,3+4
0256 0149 72020149      B    #3,5      * MEMORY VIOLATION
0257 014B 70020160      B    RLDCRU
0258
0259      *
0260      * DATA STORAGE AREA
0261 014D 0000      DATA 0
0262 014E 0000      STAT  DATA 0
0263
0264 014F 0707      E60A  DATA X'0707'
0265 0150 0000      E70C  DATA 0
0266 0151 FF07      E60A1 DATA X'FF07'
0267 0152 0307      E70C1 DATA X'0307'
0268 0153 F00F      ENGOAT DATA X'F00F',0
0269 0154 0000
0269 0155 0000      ENGDT2 DATA 0
0270 0156 0000      MASK  DATA 0
0271 0157 0000      PATRN DATA 0
0272 0158 0000      TEMPD DATA 0
0273 0159 FFFF      HEXF  DATA X'FFFF'
0274 015A 0000      FIELD DATA 0,0,X'0000'
0275 015B 0000
0275 015C 0000
0275 015D 0000      BRWD  DATA 0,0
0276 015E 0000
0276 015F 0000      PANEL DATA 0
0277
0278 0160 70020000      RLDCRU B  LOADER      RETURN POINT
0279      PAGE
  
```

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0280 *****
0281 *
0282 * TESTS TWO AND THREE
0283 *
0284 0000 OUT EQU X'80' FOR LDCR/STCR DATA LOCATIONS
0285 0001 IN EQU X'81'
0286 0162 FFFF INTEN DATA -1 ENABLE FLAG FOR INT ROUTINE
0287 0163 788201E1 SSB SSB CRUINI DUMMY SSB FOR TRAP LOCATIONS
0288 7FFF MSK EQU X'7FFF'
0289 0165 7FFF ONES DATA X'7FFF' BAS10 DATA PATTERNS
0290 0166 0000 ZERO DATA 0
0291 *
0292 0167 44840000 DMX2X3 LA 4.0 LOAD BASE REGISTERS
0293 0169 4486015F LA 6,PANEL
0294 0168 44070004 L 7,BIAS
0295 016C 15630094 MOV SSB,(X'94',4) SET TRAP LOCATIONS
0296 016F 15640095 MOV SSB+1,(X'95',4)
0297 0171 15650562 MOV ONES,INTEN
0298 *
0299 0173 44830004 LA 3.4
0300 0175 44807FFF LA 0,MSK LOOP COUNTER AND DATA PATTERN
0301 0177 00000000 LUP1 LDCR (0.0),OUT PATTERN TO DATA MODULE
0302 0179 2C000001 STCR (0.0),IN RETRIEVE PATTERN
0303 017B 58817FFF NA 1,MSK MASK OFF BIT 0
0304 017D C4000001 CRL 0,IN
0305 017F E2DA017F BC 10,03.5 BIT PATTERNS NOT EQUAL
0306 0181 E2DC0181 BC 12,03.5 BIT PATTERNS NOT EQUAL
0307 0183 0C0F0177 ARB -1,LUP1,0 DECREMENT PATTERN
0308 0185 0C3F0175 ARB -1,LUP1-2.3
0309 *
0310 * END PATTERN TEST
0311 *
0312 0187 44800156 LA 0,MASK SET LOOP COUNTER
0313 0189 340E0000 SETB 14.0 MASK INTERRUPTS
0314 018B 340F0000 LUP2 SETB 15.1 TRY TO SET INTERRUPT F/F
0315 018D 300F0991 BBNE 15.1,3.4 JUMP IF NOT SET
0316 018F 72D2010F B 03.5 ELSE ERROR
0317 0191 340F0000 SETB 15.0 SET TO TRY AGAIN
0318 0193 0C0F018B ARB -1,LUP2,0 DECREMENT AND LOOP
0319 *
0320 * END MASKED INTERRUPT TEST
0321 *
0322 0195 34000000 SETB 0.0 PREPARE FOR UNMASKED INT TEST
0323 0197 340E0000 SETB 14.1 UNMASK INTERRUPTS ON BOARD
0324 0199 44807FFF LA 0,MSK SET LOOP COUNTER
0325 019B 340F0000 LUP3 SETB 15.1 TRY TO SET INT F/F DIRECTLY
0326 019D 300F01A1 BBNE 15.0,3.4 JUMP IF SET
0327 019F 72D2019F B 03.5 ELSE ERROR
0328 01A1 340F0000 SETB 15.0 TRY TO CLEAR INT F/F
0329 01A3 300F09A7 BBNE 15.1,3.4 JUMP IF CLEARED

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0330 01A5 72D201A5          B    03.5          ELSEF ERROR
0331
0332          * NOW CHECK THAT PROPER LEVEL CHANGE CAUSFS INTERRUPT
0333          *
0334 01A7 34000000          SETB 0.1          TRY TO SET INT F/F WITH 0 TO 1
0335 01A9 840031B5          BFNE (0.3),0,TSTA JUMP IF TESTING 214103-0003
0336 01AB 300F01AF          BBNE 15.0,3+4    JUMP IF 0 TO 1 SET INT F/F
0337 01AD 72D201AD          B    03.5          ELSEF ERROR
0338 01AF 340F0000          SETB 15.0        TRY TO CLEAR INTERRUPT F/F
0339 01B1 300F09B9          BBNE 15.1,TSTB   JUMP IF CLEARED
0340 01B3 72D201B3          B    03.5          ELSEF ERROR
0341 01B5 300F09B9 TSTA BBNE 15.1,3+4  0-1 CHANGE SHOULD NOT SET F/F
0342 01B7 72D201B7          B    03.5          ERROR IF IT DID
0343 01B9 34000000 TSTB SETB 0.0        TRY TO SET INT F/F WITH 1 TO 0
0344 01BB 840031C1          BFNE (0.3),0,TSTC JUMP IF TESTING 214103-0003
0345 01BD 300F09CB          BBNE 15.1,BOTTOM 1-0 CHANGE SHOULD NOT SET F/F
0346 01BF 72D201BF          B    03.5          ERROR IF IT DID
0347 01C1 300F01C5 TSTC BBNE 15.0,3+4  JUMP IF 1 TO 0 SET INT F/F
0348 01C3 72D201C3          B    03.5          ELSEF ERROR
0349 01C5 340F0000          SETB 15.0        TRY TO CLEAR INT F/F
0350 01C7 300F09CB          BBNE 15.1,3+4    JUMP IF IT CLEARED
0351 01C9 72D201C9          B    03.5          ELSEF ERROR
0352 01CB 0C0F019B BOTTOM ARR -1,LUP3,0
0353          *
0354          * END UNMASKED TEST
0355          *
0356 01CD 7C0001CF          LDS 3+2
0357 01CF 01D1          DATA 3+2,X'0100'          ENABLE CRU INTERRUPTS
0358 01D1 44007FFF          LA 0,MSK
0359 01D3 15660562 LUP4 MOV ZERO,INTEN
0360 01D5 34000000          SETB 0.1          GENERATE EXTERNAL
0361 01D7 34000000          SETB 0.0          INTERRUPT
0362 01D9 72D201D9          B    03.5          INTERRUPT DID NOT OCCUR
0363 01DB 0C0F01D3 INTOK ARR -1,LUP4,0
0364          *
0365          * END FINAL INTERRUPT TEST
0366          *
0367 01DD 7C0001DF          LDS 3+2          EXIT STAGE LEFT
0368 01DF 0000          DATA LOADER,X'01C0'
0369 01E0 01C0
0369          *
0370 01E1 0000          CRUINT DATA 0.0,3+1          CRU INTERRUPT HANDLER
0370 01E2 0000
0370 01E3 01E4
0371 01E4 44030162          L 3,INTEN
0372 01E6 E20A01E6          BC 10,03.5        INTERRUPT NOT EXPECTED
0373 01E8 300F01EC          BBNE 15.0,3+4    CHECK INT FOR LOC OF INSTR
0374 01EA 72D201EA          B    03.5
0375 01EC 340F0000          SETB 15.0        CLEAR INTERRUPT

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0376	01EE	300F09F2	BBNE	15.1,3+4	
0377	01F0	720201F0	B	03.5	NOT CLEARED
0378	01F2	44830108	LA	3,INTOK	SET UP RETURN
0379	01F4	488301E1	ST	3,CRUINT	
0380	01F6	7C0001E1	LDS	CRUINT	RETURN
0381	01F8		END		

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0382	0000	BITS	BSEG	LDCRU CRU BIT SEGMENT
0383	0000	ENGF1	CON 0.16	
0384	0000	ENGF2	CON 0.11	
0385	01F8		END TCRUST	

0000 ERRORS ; LENGTH = 01F8



966366-9701

ALPHABETICAL INDEX



ALPHABETICAL INDEX

INTRODUCTION

The following index lists key words and concepts from the subject material of the manual together with the area(s) in the manual that supply major coverage of the listed concept. The numbers along the right side of the listing reference the following manual areas:

- Sections - References to Sections of the manual appear as "Section x" with the symbol x representing any numeric quantity.
- Appendixes - References to Appendixes of the manual appear as "Appendix y" with the symbol y representing any capital letter.
- Paragraphs - References to paragraphs of the manual appear as a series of alphanumeric or numeric characters punctuated with decimal points. Only the first character of the string may be a letter; all subsequent characters are numbers. The first character refers to the section or appendix of the manual in which the paragraph is found.
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- Other entries in the Index - References to other entries in the index are preceded by the word "See" followed by the referenced entry.



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16 Input/16 Output Data Module User's Manual (966366-9701)

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