digital

DRS11/DSS11/DSP11
INPUT-OUTPUT SYSTEM

OPTION DESCRIPTION

digital

Computer Special Systems

NOTEBOOK SECTION

4.3-15

OPTION NUMBER

-

DRAWING SET NUMBER

DRS11-0
DSS11-0
DSP11-0

PROGRAM NUMBER

DECSPEC-11-BBBAD
DECSPEC-11-BBBAX

DOCUMENT NUMBER **REVISION**

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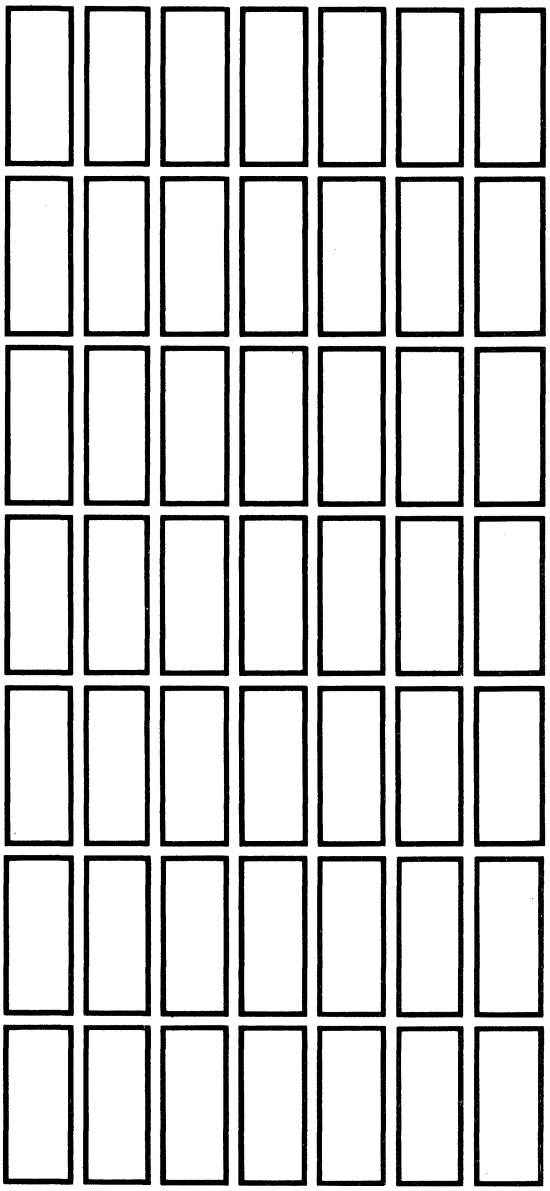
DATE

MAY 1981



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CHAPTER 1

INTRODUCTION

1.1 GENERAL DESCRIPTION

The DRS11/DSS11 input-output system, designed and manufactured by the Digital Equipment Corporation, allows PDP-11 users to control up to 48 digital inputs and 48 digital outputs.

Each output module can control up to 48 buffered outputs plus one RC filtered interrupt input with either TTL or open collector characteristics. Up to 16 DRS11 output modules can be implemented in each system.

The input modules are the DSS11 series. Each DSS11 module allows contact sense inputs or voltage sense inputs to be sent to the PDP-11. Up to 48 input signals can be attached to each DSS11 controller module, and up to 16 DSS11 controllers can be used on one system if desired. One interrupt input is also available on each DSS11 module. All DSS11 input signals are optically isolated for system protection.

A typical DRS11/DSS11 system is shown in Figure 1-1.

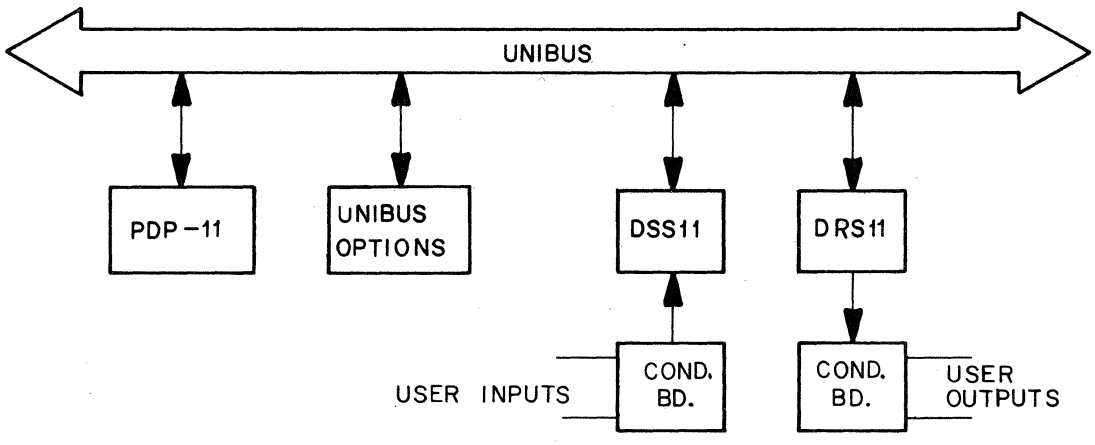

Figure 1-1 Typical DRS11/DSS11 Configuration

In addition to the I/O control modules, signal conditioning I/O modules can be ordered to satisify all system parameters. All I/O control and signal conditioning modules are designed to occupy small peripheral controller (SPC) slots in any PDP-11 or DD11 panel. The signal conditioning modules that are currently available are as follows:

1. DRS11-MP...48 Optlically Isolated dc Drivers
2. DSS11-MP...48 Voltage Free Contact Sense Inputs
3. DSS11-MR...48 Twenty-four Vdc Voltage Sense Inputs
4. DSS11-MS...48 Forty-eight Vdc Voltage Sense Inputs

Also available are two interconnect panels (DSP11-A AND DSP11-C) which allow easy user access to signals brought into the system's control modules.

1.2 SPECIFICATIONS*

DIGITAL INPUTS (DSS11)

Description	DSS11-A 48 inputs (TTL) plus one interrupt	DSS11-B 48 inputs (24Vdc) plus one interrupt
Input Voltage Range (ON state)	4-7V	24V±15%
Input Current	7-21mA	16mA (nominal)
Isolation Voltage	500V	500V
Prerequisite	PDP-11	PDP-11
Mounting	1 SPC	1 SPC
Unibus Loads	one	one
Amps @ +5V	1.6	1.6

INPUT SIGNAL CONDITIONING (DSS11-M)

Description	DSS11-MP RC filtered contact sense	DSS11-MR RC filtered voltage sense	DSS11-MS RC filtered voltage sense
RC Time Constant	2ms(nominal)	2ms(nominal)	2ms(nominal)
Input Volt Range (ON state)	24V±15%	24V±15%	48V±10%
Input Current	user supplied	13mA@24V	13mA@48V
Contact Current	15mA(nominal)	-	-

* Specifications are subject to change without notice.

Prerequisite	DSS11-A	DSS11-A	DSS11-B
Unibus Loads	none	none	none

DIGITAL OUTPUTS (DRS11)

DESCRIPTION	DRS11-A 48 outputs plus one interrupt	DRS11-B 48 outputs plus one interrupt
Type Output	TTL driver	open collector
Output Voltage Capability		
(OFF state)	TTL	30V max
(ON state)	compatible	.7V @ 40mA
Output Current Limitation	16mA @ .4V	40mA @ .7V
Prerequsite	PDP-11	PDP-11
Mounting	1 SPC	1 SPC
Unibus Loads	one	one
Amps @ +5V	2.5	2.5

OUTPUT SIGNAL CONDITIONING (DRS11-MP)

Description	48 optically isolated dc drivers-one interrupt input
Type Output	open-collector
Output Voltage Capability	
OFF state	50V max
ON state	1.0V max @ 75mA
Output Current Limitation	75mA @ 1.0V
Isolation Voltage	500V max
Prerequisite	DRS11-B
Mounting	1 SPC slot next to DRS11-B
Unibus Loads	none
Amps @ +5V	1.5

CHAPTER 2

INSTALLATION

2.1 SITE CONSIDERATIONS

The DRS11 and DSS11 modules are designed to occupy Small Peripheral Controller (SPC) slots in any DD11, and as such have the same environmental specifications as other PDP-11 module options. When the optional signal conditioning modules are used, space for them should be provided adjacent to the I/O control modules. The signal conditioning boards receive no signals from the backplane in which they are inserted. They do ,however pass on the Bus Grant signals in the same manner as the G727 Grant Continuity card.

2.2 CABLES

Two test cables (7012989-01) and one test card (5412426) are provided with the DSS11 option. In addition, each DRS11 and each DSS11 option is shipped with two 10-foot signal cables (7012989-10) to connect to user equipment.

A complete DRS11/DSS11 pin connector listing is given in Appendix C of this manual. Refer to this listing for pertinent hookup procedures. Also, refer to Paragraphs 2.4 through 2.7 for information concerning connections to customer equipment.

2.3 INITIAL OPERATION

2.3.1 Module Jumpers

The DRS11-A/B module has one hard-wired jumper (W1) that is used to connect the DRS11 power supply GND to the power supply GND of a DSS11-A when they are cabled for wraparound testing. This jumper should not be removed.

The DSS11-A module has two hard-wire jumpers, W1 and W2. These jumpers supply +5Vdc and GND to the cable connectors. Ensure that jumpers W1 and W2 are in place when no external power supply is to be used for testing the DSS11-A.

NOTE

Never install jumpers W1 and W2 on a DSS11-B option.

2.3.2 Checkout Procedure

Perform the set-up and checkout procedure in the following sequence. Ensure that the system power is turned OFF, and proceed as follows:

1. Set the DIP switches on the control modules for the address and vector desired (Paragraph 3.1).
2. Plug the desired priority jumper in the I/O control modules.
3. With an ohm meter, check for +5V to GND shorts. Proceed only when certain that none exist.
4. Insert the DRS11/DSS11 modules in the backplane.
5. Insert the signal conditioning modules, if used, in the backplane.
6. Insert the required cables (see the following paragraphs for the appropriate configuration).
7. Power-up the system and load the diagnostic program (DECSPEC-11-BBBAD) as described in the diagnostic write-up.
8. Run the diagnostic program for 15 error free passes with switch 07 set to a one (up).
9. Run tests 6 and/or 7, if applicable, for 5 passes.

2.4 DRS11/DSS11 CONNECTIONS

This section deals only with DRS11/DSS11 module testing. For information pertaining to signal conditioning module testing, refer to Paragraphs 2.6 through 2.7.

NOTE

In Paragraphs 2.4 through 2.7, all conections between I/O control modules and signal conditioning modules are done using the test cables (7012989-01). All connections to user equipment are shown using the 10-foot signal cable (7012989-10). In all cases, the Test card is the DSS11 Test Connector (5412426).

2.4.1 DRS11

The DRS11 module does not have any test plugs or test cable requirements when being run without a DSS11 module.

2.4.2 DSS11

The DSS11 module when tested alone requires the test card and two test cables to run Test 6 of the diagnostic.

The DSS11-A module must have the two hard-wire jumpers (W1 and W2) installed to run Test 6 of the diagnostic program. The cable and test sockets are shown in Figure 2-1 for this test.

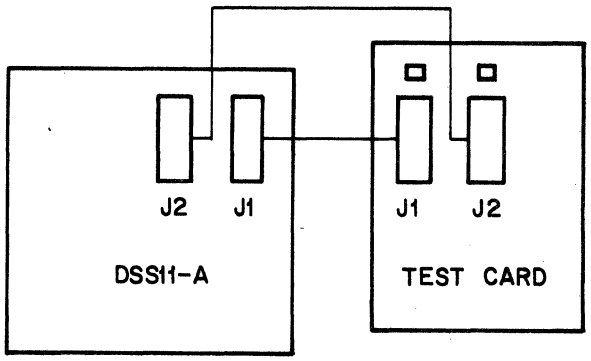

Figure 2-1 DSS11-A Stand Alone Test 6

When a DSS11-B is to be tested, an external 24Vdc power supply must be attached to the test card as shown Figure 2-2.

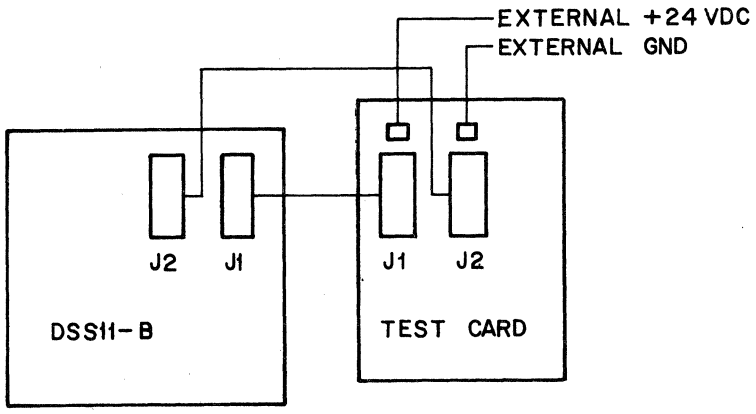

Figure 2-2 DSS11-B Stand Alone Test 6

2.5 WRAP ARROUND TESTING (TEST 7)

The wrap around test allows data from the DRS11 to be fed to the DSS11 and read to determine if any bits are not operating properly. The following diagrams (Figures 2-3 and 2-4) show the proper test cable connections to run this test.

2.5.1 DRS11-A Or DRS11-B Looped With DSS11-A

The W1 and W2 jumpers on the DSS11-A module must be in place to run this test and the W1 jumper on the DRS11-A/B module may be left in place.

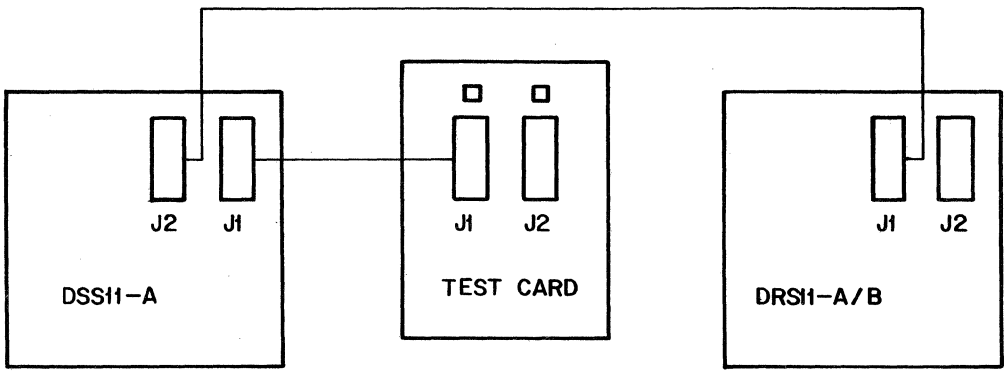

Figure 2-3 DRS11-A/B Looped With DSS11-A

2.5.2 DRS11-B Looped With DSS11-B

To run this test, the external 24Vdc power supply must be connected to the test sockets as shown in Figure 2-4. The W1 jumper must be removed from the DRS11-B.

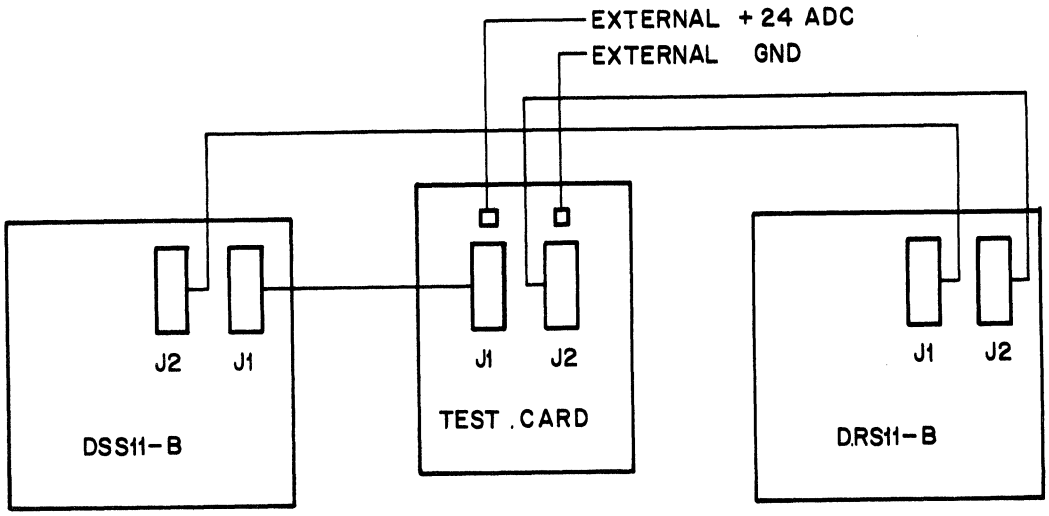

Figure 2-4 DRS11-B Looped With DSS11-B

2.6 DRS11-MP/DSS11-MP CABLING

2.6.1 DRS11-MP

The DRS11-MP, when used in conjunction with the DRS11-B, is hooked up in the following manner. Note that the outputs of the signal conditioning module are not tested unless either a DSS11-A or DSS11-B module is present. The outputs of the DRS11-MP can be checked with an oscilloscope using a toggle in program such as found in the Maintenance Chapter (Paragraph 5.4) of this manual, however, it will be necessary to use an external load and power supply connected to the outputs to see them change.

The connections for system use are shown in Figure 2-5. This method of hookup is also required for scope loop checking without the DSS11-A/B available for wraparound.

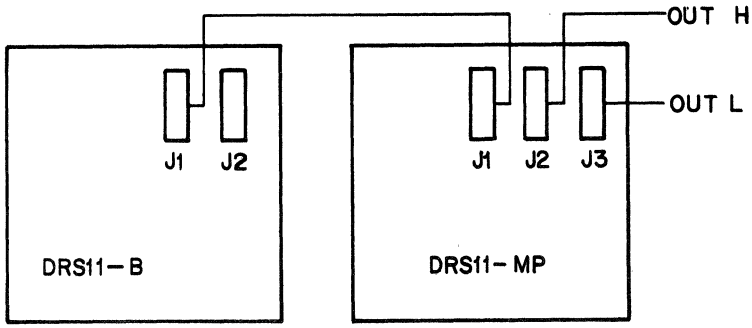

Figure 2-5 DRS11-MP Connected To User Equipment

2.6.2 DRS11-M/P Connected To DSS11-A/B (Test 7)

When a DRS11-MP module is to be tested in the wraparound mode as in Test 7 of the diagnostic, the cabling must be as shown in Figures 2-6 and 2-7.

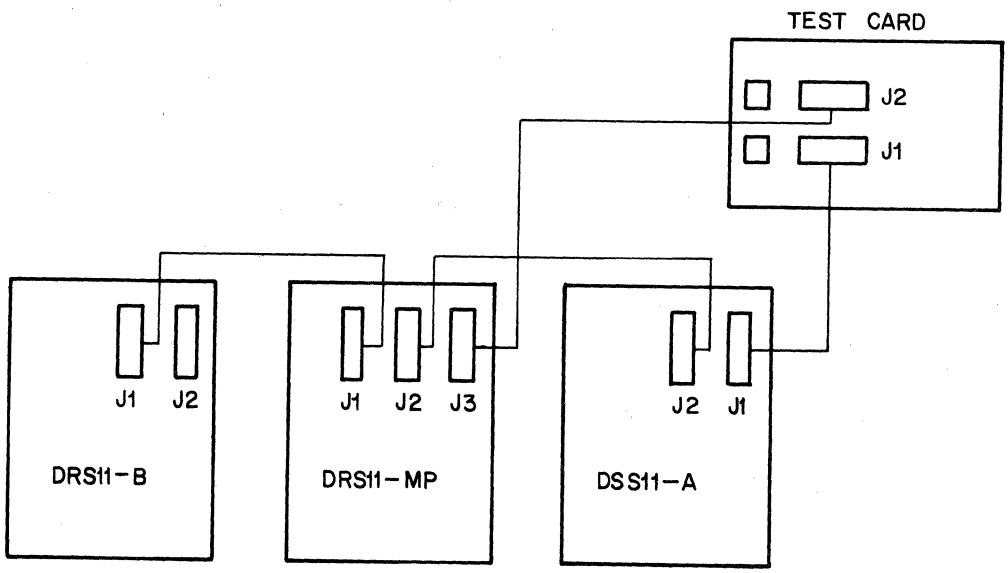

Figure 2-6 DRS11-MP To DSS11-A

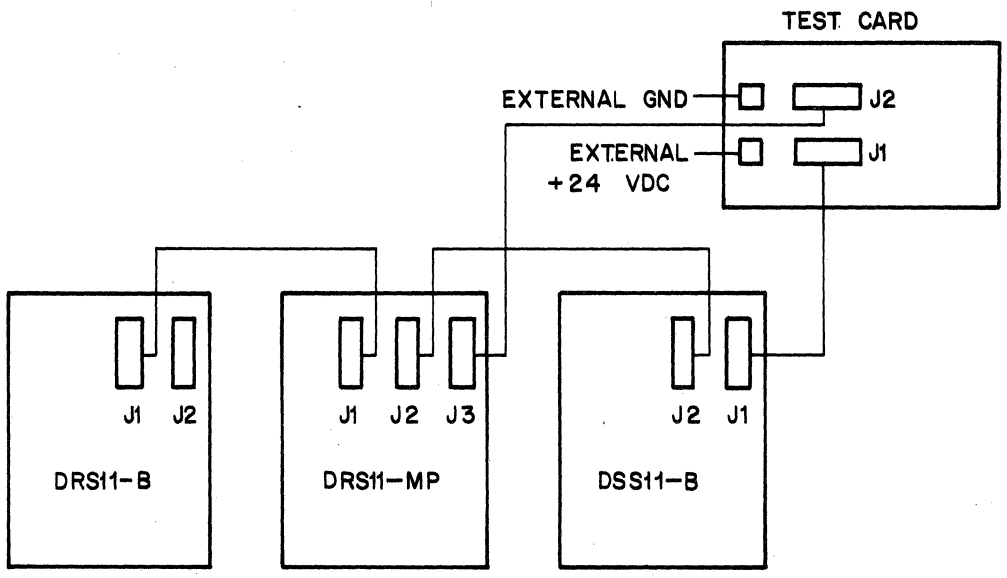

Figure 2-7 DRS11-MP To DSS11-B

2.6.3 DSS11-MP

The DSS11-MP input signal conditioning module mounts in a Small Peripheral Controller (SPC) slot next to the DSS11-B. The external power for the DSS11-MP must be supplied by the user and attaches to pin 50 of connector J1 or to the lug (P1) soldered to the module near the connectors.

Figure 2-8 shows the wiring used to run the static patterns test (Test 6) of the diagnostic.

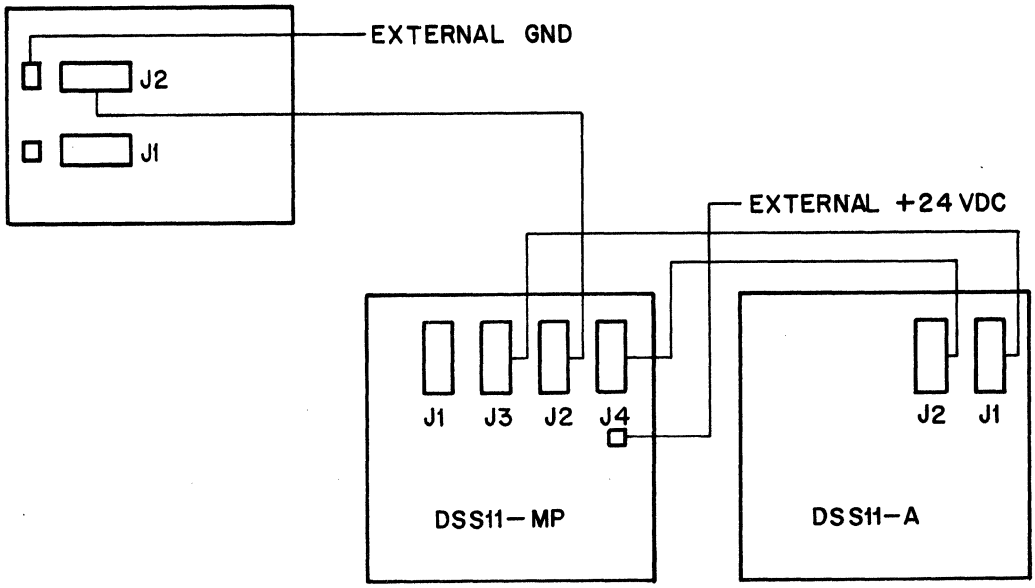

Figure 2-8 Cabling For Test 6 Static Patterns

NOTE

When using Test 6, the data is inverted on the Unibus with the DSS11-MP module in place. Therefore, it is necessary to remove the test socket from connector J2 only when asked to by the program, and when told to replace the test sockets, replace the test socket in connector J2.

The connections to the user equipment is as shown in Figure 2-9.

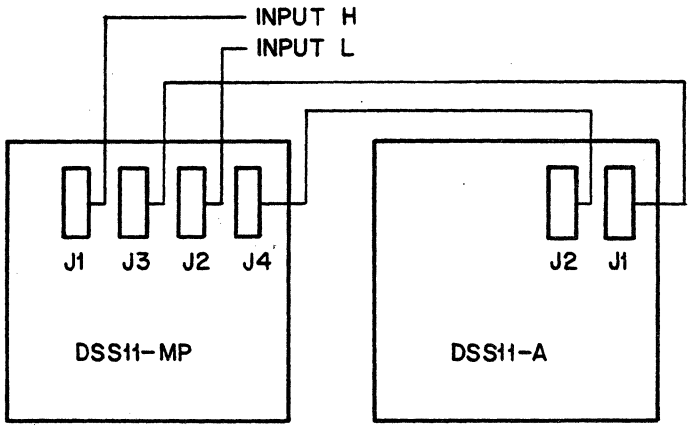

Figure 2-9 User Connections

2.7 DSS11-MR/MS CABLING

The DSS11-MR and DSS11-MS differ only in the voltages used for the inputs. The cabling is the same for both versions although the components differ.

User cabling for the DSS11-MR or DSS11-MS is shown in Figure 2-10. The cabling for the static pattern (Test 6 of the diagnostic) is shown in Figure 2-11.

NOTE

The DSS11-MR is used with a DSS11-A and the DS11-MS is used with a DSS11-B.

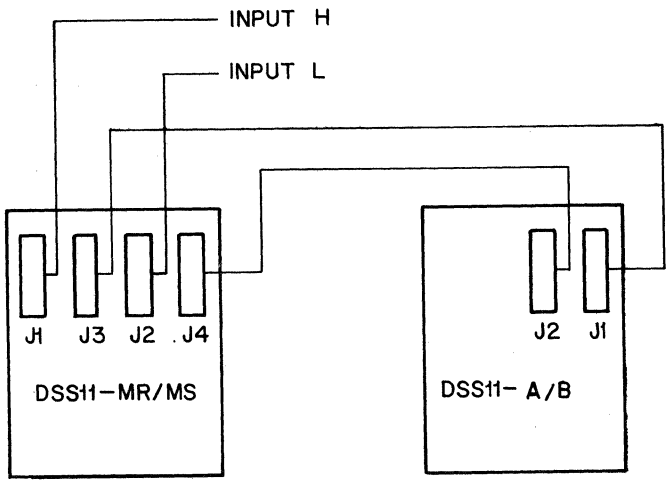

Figure 2-10 User Cabling Using DSS11-MR or DSS11-MS

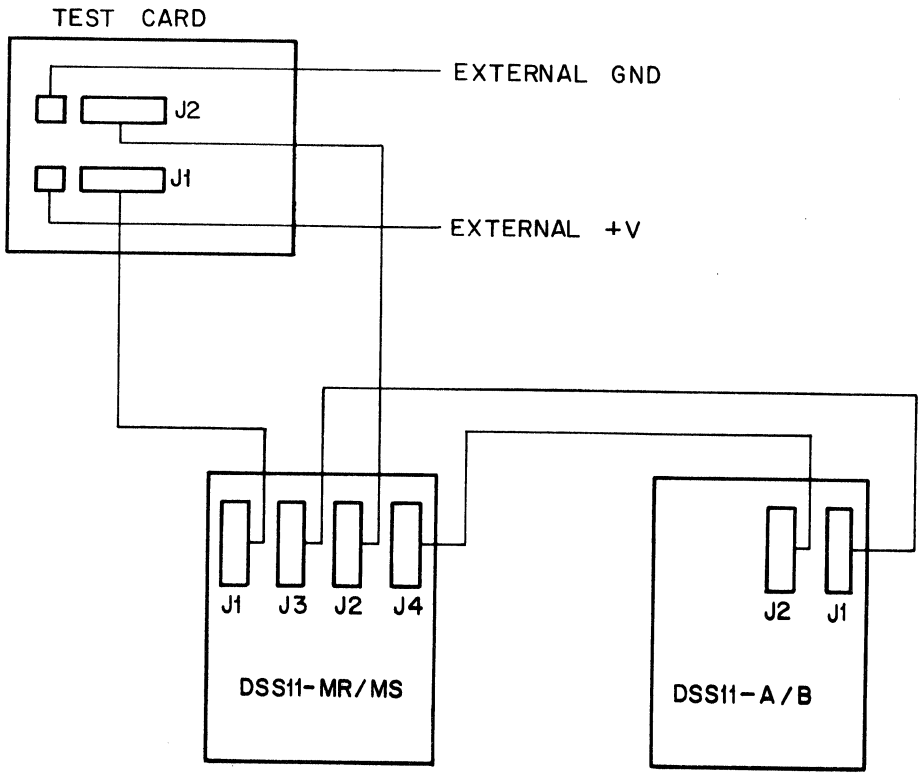

Figure 2-11 Static Pattern Test Cabling

2.8 ACCEPTANCE PROCEDURE

The acceptance procedure is similar to the Initial Operation (Paragraph 2-3) the difference being that the system should already be configured. Loading and running the diagnostic for 5 error free passes of the non-intervention tests (bit 07 set to a one) and 5 passes of the wraparound tests ensures that the DRS11 and DSS11 are operating properly. The program when loaded will do an automatic start and print operating instructions. See the diagnostic write-up for a description of the required TTY inputs. Lower all the switches of the switch register for normal operation, type the responses, and the diagnostic will execute tests 1 through 7. Running the diagnostic in this manner will require the operator to change the cabling and jumpers each time the wraparound test or Test 6 is run. It is, therefore, suggested that the tests be run in two groups as instructed above to facilitate easier checkout.

If the DRS/DSS modules are included as a part of a system, it is necessary to include a DECX/11 module for each DRS11 and for each DSS11 following the procedures in the DECX/11 module write-up (DECSPEC-11-BBBAX).

2.9 RELATED LITERATURE

Title	Document Number
Logic Handbook	EB-07459-58
PDP-11 Peripherals Handbook	EB-17560-20

CHAPTER 3

OPERATION AND PROGAMMING

3.1 CONTROLS

Each DRS11 and DSS11 module is equipped with three switches, one toggle, a ten position DIP, and an eight position DIP. The function of these switches is to:

1. Enable the Maintenance Mode for testing purposes.
2. Set the device address of the registers on each option.
3. Set the Trap Vector address for each interrupt.

3.1.1 Toggle Switch

The toggle switch, mounted on each module, enables data bit 08 to set the INTERUPT REQUEST flip-flop when Bit 08 is loaded into the Control and Status register (CSR). This feature allows the diagnostic to generate interrupts without an external request.

3.1.2 Ten Position DIP Switch

The ten position DIP switch is used to set the device register address. Positions 1 through 10 correspond to address bits 03 through 12 of the PDP-11 word on the DSS11, and address bits 12-03 on the DRS11. To select the desired address, the switch is put in the OFF position to signify a ONE in that bit position. Therefore, if switches 10, 09, and 07 were in the OFF position, the device address would be 775000 on the DSS11.

3.1.3 Eight Position DIP Switch

The vector address of each module is selected with the eight position DIP switch. To obtain the desired vector address, the switch is put in the ON position to signify a ONE for that bit. Switch positions 2 through 8 correspond to data bits 02 through 08 respectively. Therefore, if switches 08 and 05 were ON , the corresponding interrupt vector is 440. Switch position 1 disables vector address bit 02 when it is in the ON position.

3.2 INTERFACE REGISTERS

The diagnostic program (DECSPEC-11-BBBAD) exercises control over the system and obtains information via four registers on each of the control modules:

DRS11

Control And Status Register..... CSR-DRS

1ST Data Register Out..... RG1-DRS

2ND Data Register Out..... RG2-DRS

3RD Data Register Out..... RG3-DRS

DSS11

Control And Status Register.....CSR-DSS

1ST Data Register In..... RG1-DSS

2ND Data Register In..... RG2-DSS

3RD Data Register In..... RG3-DSS

These registers can be assigned Bus Addresses as desired using the procedures outlined in Paragraph 3.1. The CSR for each module will represent the address chosen using the switches, with the data registers being the next three sequential addresses. For example, if the switches were set as previously described for an address of 775000, this would be the CSR and the data registers would be Unibus addresses 775002, 775004, 775006. These registers can be read or loaded using the PDP-11 instructions which access their addresses.

3.2.1 Control And Status Register (CSR)

The Control and Status registers for both the DRS11 and DSS11 are identical, and are organized as shown in Figure 3-1. The significance of each CSR bit is discussed in the following paragraphs.

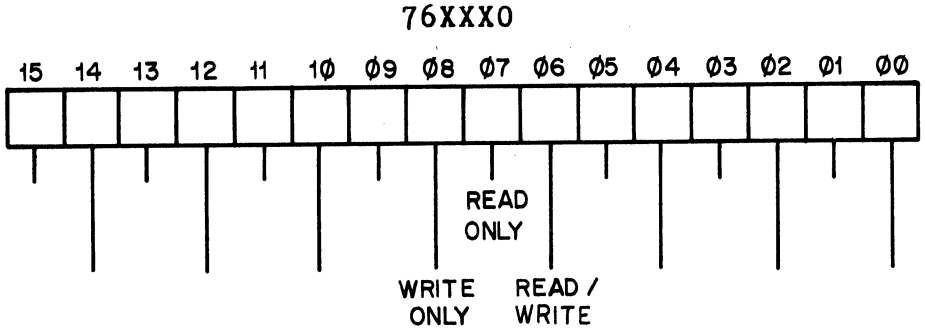

Figure 3-1 Control And Status Register

3.2.1.1 Bit 06, INT ENB (Interrupt Enable) - When set, this read/write bit allows an interrupt when CSR Bit 07 (REQUEST) is set. INIT clears this bit.

3.2.1.2 Bit 07, REQ (Request) - This read only bit is set when an external request occurs. An interrupt will occur if Bit 06 is set when REQ becomes true. INIT and any access to the CSR clears this bit.

3.2.1.3 Bit 08, Request In Maintenance Mode - This write only bit is used when checking modules in Maintenance Mode. Setting this bit simulates an external request whose function is identical to CSR Bit 07.

3.2.2 DRS11 Output Registers

Figures 3-2 through 3-4 show the DRS11 Output Registers format.

76XXX2

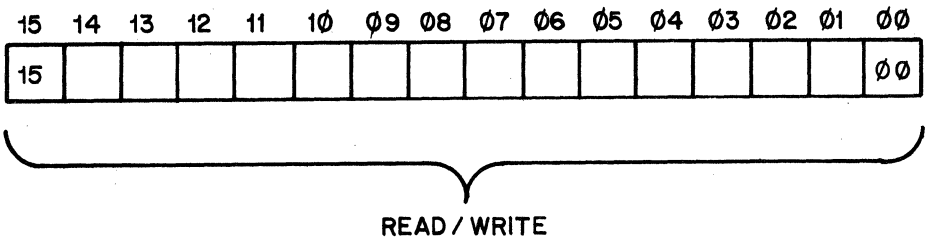

Figure 3-2 First Data Register Out (RG1-DRS)

76XXX4

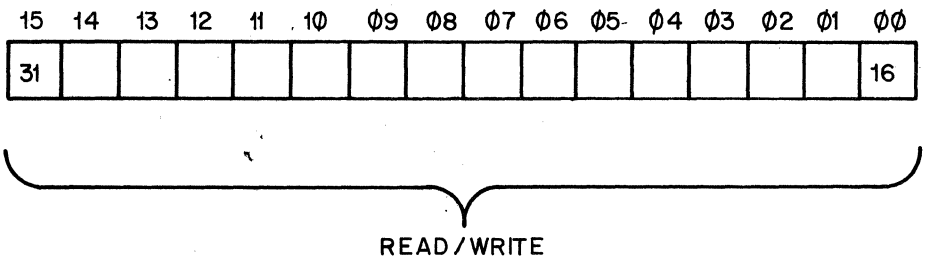

Figure 3-3 Second Data register Out (RG2-DRS)

76XXX6

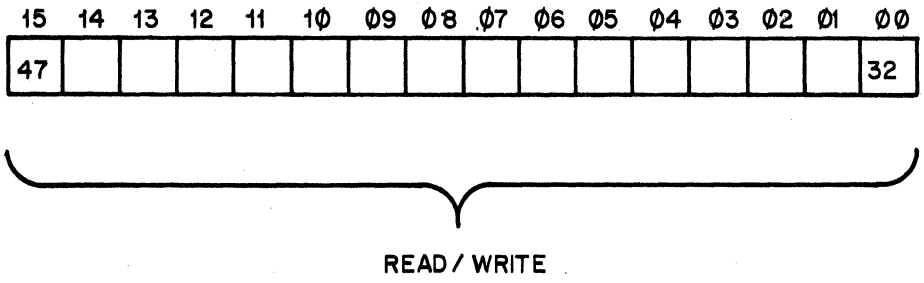

Figure 3-4 Third Data Register Out (RG3-DRS)

3.2.3 DSS11 Input Registers

Figures 3-5 through 3-7 show the DSS11 Input Register Format.

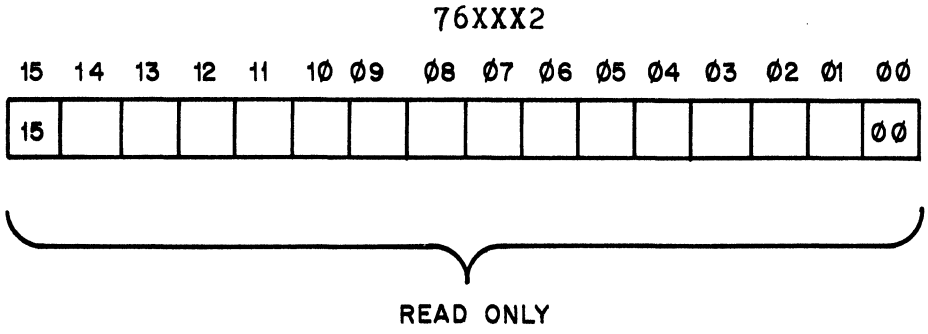

Figure 3-5 First Data Register In (RG1-DSS)

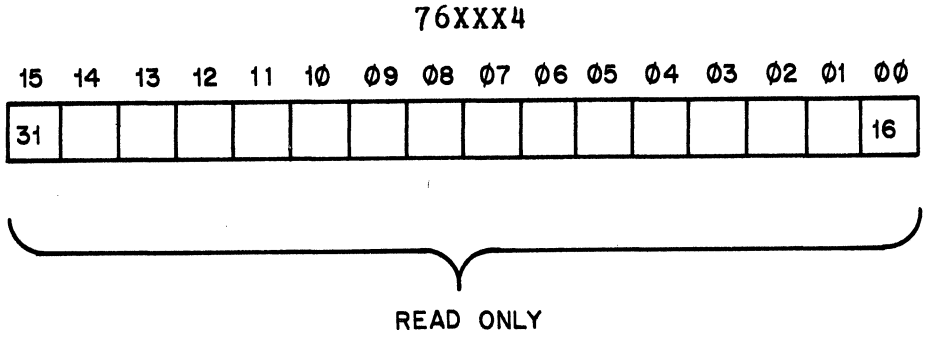

Figure 3-6 Second Data Register In (RG2-DSS)

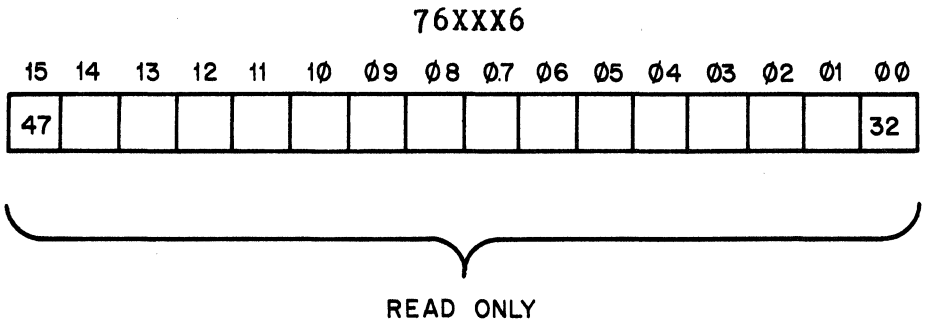

Figure 3-7 Third Data Register In (RG3-DSS)

3.3 INTERRUPT PROGRAMMING

Both DRS/DSS modules contain the facilities to perform program interrupts. Because the interrupt logic is identical, a discussion of one will suffice for both. There are two ways for DRS/DSS modules to generate interrupts.

1. Set the REQUEST flip-flop via one of the External Request Lines.

2. Set Bit 08 in the CSR when the Maintenance switch is in the Enable position.

In either case the interrupt will be generated if the INTERRUPT ENABLE flip-flop has been set by loading bit 06 of the CSR with a one.

When the interrupt is generated, the device will trap to the address specified by the VECTOR SELECTION switch as explained in Paragraph 3.1.3.

The only way to clear the REQ flip-flop is to read the CSR or to issue the bus INIT signal, therefore, this must be done each time the module does an interrupt.

NOTE

The REQ flip-flop is read as Bit 07. External Request or Maintenance Bit 08 will set the REQ flip-flop, and both are read as bit 07.

3.4 PROGRAMMING OPERATION

Programming for the DRS11 and DSS11 is very straight foward. The DRS11 output bits are enabled to the user connections immediately upon loading the data registers, and are enabled until cleared by the program or a system Reset.

The DSS11 inputs are available to be read by the program almost immediatly after being set by the user equipment, but due to the uncertain nature of switch contact bounce, and the long time constant of the optional input signal conditioning modules, it is suggested that these inputs be read only when the user external interrupt is generated. This external interrupt should be used by the user to signal when the data has settled.

CHAPTER 4

THEORY OF OPERATION

4.1 GENERAL DESCRIPTION

Since the bus control logic for the DRS11 and DSS11 is the same, they will be explained together. Reference to the appropriate module's prints and Figures 4-1 and 4-2 will help in understanding the following discussion. The print sets are designated DRS11-0 for the DRS11 modules and the DRS11-MP signal conditioning module. The prints for the DSS11 and the three signal conditioning modules (DSS11-MP/MR/MS) are designated DSS11-0.

4.1.1 Address Selection

The device selection address decoding is done using an Exclusive OR function. All of the address lines from the Unibus are received and checked against the address selected for that device. To accomplish this, Bus Address bits <17:13> are ANDed together as all of these bits must be present for a device address. Bus Address bits <12:03> are brought to one side of an Exclusive OR gate, and if the address lines match the respective switch setting for that line, then the output of the Exclusive OR gate will be high. When all the incoming signals and the switch settings match, all the outputs of the Exclusive OR gates will be high. The AND condition of these outputs with BUS MSYN generates the internal MSYN and BUS SSYN signals. The internal MSYN signal and Bus Address bits <02:01> generate the signals necessary to control the CSR and Data registers of the device.

4.1.2 Bus Interrupt Control

Both the DRS/DSS control modules utilize two methods to generate interrupts. Each module has the ability to generate interrupts under program control if the TOGGLE switch on the module is in the M-position. When the switch is in the M-position, loading Data bit 08 into the CSR will set the REQ flip-flop, generating an interrupt if INT EN is set.

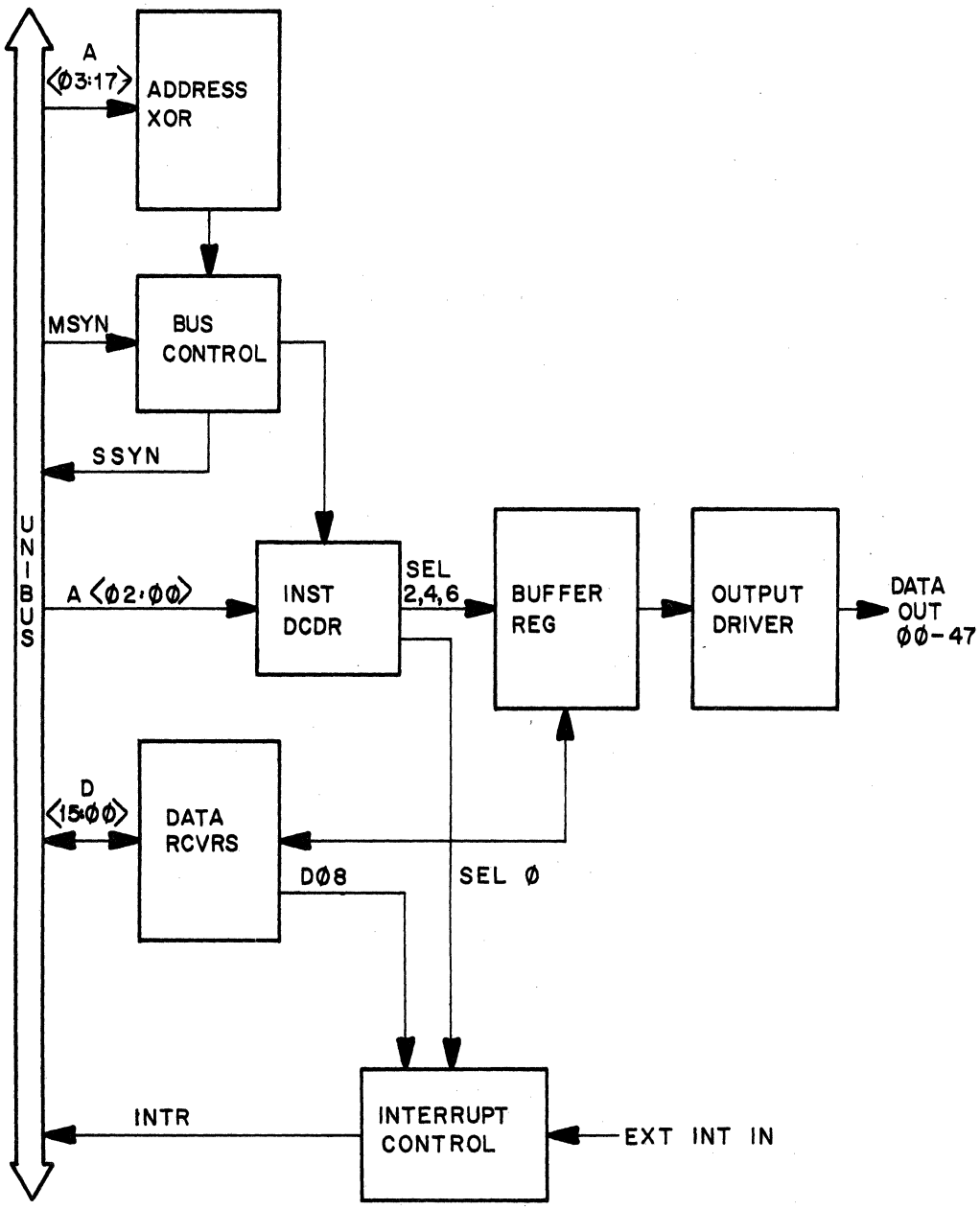

Figure 4-1 DRS11-A/B Block Diagram

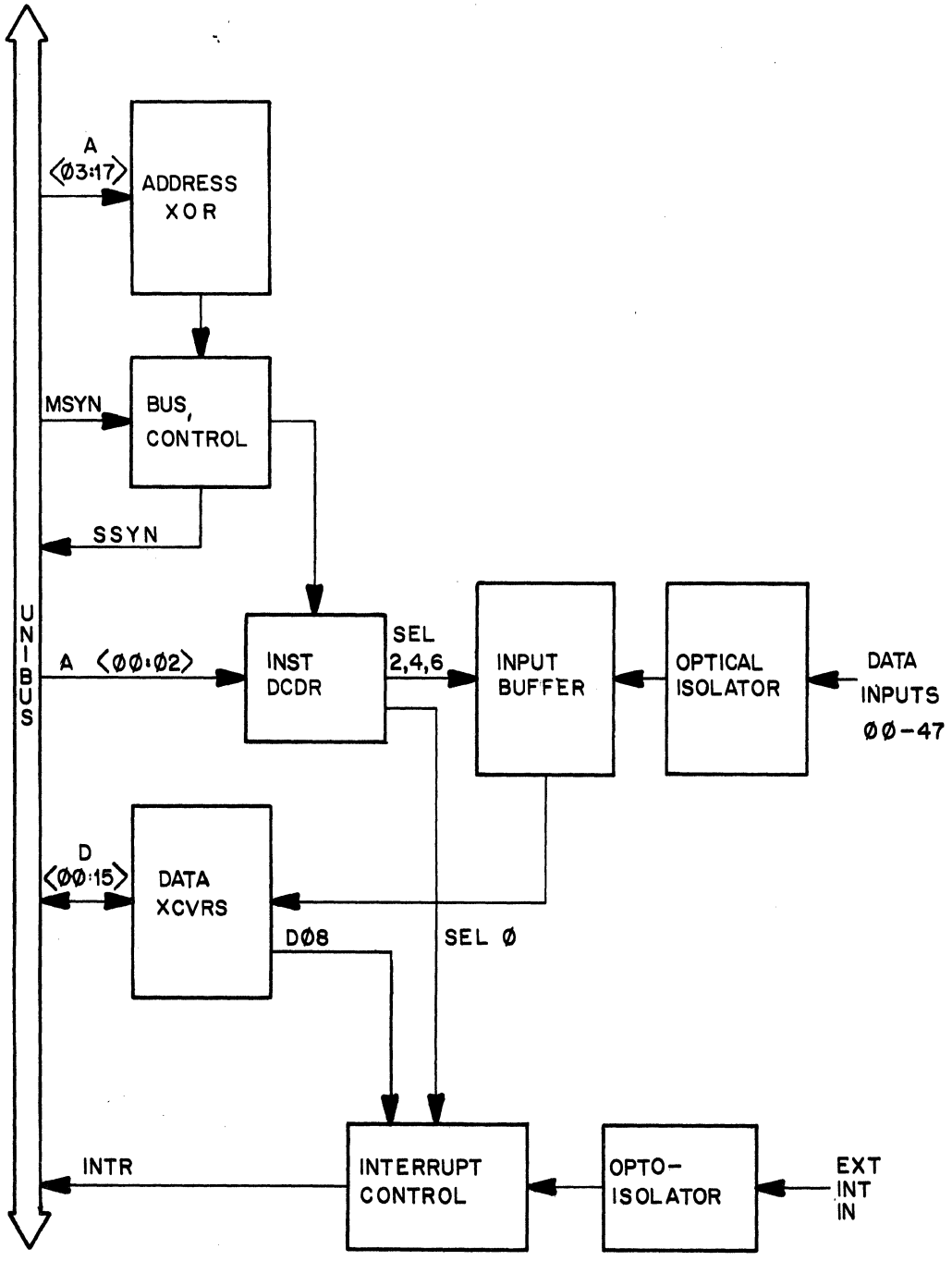

Figure 4-2 DSS11-A/B Block Diagram

If the TOGGLE switch is in the N-position, then the REQ flip-flop will be set by an external interrupt request. On the DRS11 when the EX INT IN signal is grounded, the REQ flip-flop is set. On the DSS11 module, the interrupt inputs are INT IN H and INT IN L. In this case, the INT IN H signal is brought to a level of +5Vdc or +24Vdc depending on the version of the DSS11 used, and the INT IN L signal is brought to ground. This turns on the opto-isolator and in turn sets the REQ flip-flop.

When the REQ and INT EN flip-flops are both set, the bus interrupt cycle is started and is executed in the same manner as all other Unibus interrupt requests.

The address which is used as the trap vector is selected by the eight-position DIP switch. When the BUS INTR L signal is generated, those lines for which the switch is closed will be asserted on the bus.

4.2 DRS11 OUTPUTS

The DRS11 outputs are controlled by three registers. These registers are loaded from the Data bus by SEL 2 H, SEL 4 H, or SEL 6 H. When the data is loaded into the registers, it is presented to the output lines to be used in whatever manner desired. On the DRS11-A , the output drivers are SN7404 gates which are capable of TTL outputs with +5Vdc as the maximum level. The DRS11-B is supplied with SN7406 Open Collector Drivers which have greater drive and higher voltage threshold output levels. These SN7406's are capable of levels to +30Vdc and currents up to 40mA.

The status of the output bits can be read back to the Unibus by doing a read of the respective address.

4.3 DSS11 INPUTS

The DSS11 inputs are all optically isolated to provide system protection from the external connection points. When the IN XX H line is tied to an exterl source of +5Vdc or +24Vdc (depending on the version of the DSS11) and the IN XX L line is tied to a ground level, the LED in the optoisolator turns ON. This causes the B XX L line to go to ground enabling the respective line in the SN74153 chip. Now the data can be read onto the Unibus by reading the appropriate register.

4.4 DRS11-MP OUTPUT SIGNAL CONDITIONING MODULE

The DRS11-MP Output Siginal Conditioning module provides the DRS11-B with a higher output drive capacity. The output current can be a maximum 75mA and the output voltage can be up to 50Vdc.

This module is mounted next to the DRS11-B in a small peripheral slot. It does not use any of the backplane signals except for +5Vdc and GND.

When the output driver of the DRS11-B is turned ON, the output goes to ground. This turns ON the LED in the optoisolator of the DRS11-MP signal conditioning card. When the LED is ON the output transistor is also turned ON, thus causing the output of the signal conditioning module to conduct from the OUT H output to the OUT L line. Therefore, if the OUT L line was connected to power supply ground, and the OUT H line was connected to a load of which the other side was connected to the high side of the power supply, when the transistor was turned ON, the external power supply would be applied to the load.

There are 48 such circuits on the output signal conditioning module, and all have separate two lead outputs, thus allowing more than one voltage level to be switched by one DRS11-MP.

There is also one interrupt request line on the DRS11-MP. This line is opticaly isolated, and requires a TTL level input. If desired, the user may change the value of the current limiting resistor to allow other input levels of this signal.

When this module is used to switch inductive loads or relays, the user is responsible for any overvoltage protection of the output driver.

Refer to Appendix C for DRS11-MP connector pinning.

4.5 DSS11-MP INPUT CONTACT SENSE CONDITIONING MODULE

The DSS11-MP input signal conditioning module allows the DSS11-A module to sense switch contact closures. The DSS11-MP provides 48 filtered RC inputs plus one RC filtered interrupt input.

The time constant of the input filters is about 2 milliseconds. For this reason, the interrupt request input must be used to signal when the data inputs are to be read by the computer, as false readings may be encountered due to contact bounce.

The 24Vdc power for the switches is supplied by the user, and may be wired to pin 50 of connector J1, or it may be applied to the solder lug located on the edge of the DSS11-MP module. Use of the solder lug is recommended for external supplies except for light loading of the module.

NOTE

When using this module, the open state of a switch is read on the Unibus as a ONE and the closed contacts are read as a ZERO.

Refer to Appendix C for DSS11-MP connector pinning.

4.6 DSS11-MR/MS VOLTAGE SENSE CONDITIONING MODULES

The DSS11-MR provides 48 RC filtered data inputs for 24Vdc signals and one interrupt request input. The DSS11-MS provides the same RC filtered inputs except for the input levels which are 48Vdc.

When a contact is open, the input opto-isolator of the DSS11-A/B is turned OFF, and the data on the Unibus will be read as a ZERO. When the contact is closed, the data on the Unibus will be read as a ONE.

The time constant of the RC filters is about 2 milliseconds. For this reason the interrupt request line should be used to signal when valid data is avalilable to be read.

The 24 or 48Vdc power must be supplied by the user with the negative side of the supply connected to the INPUT L line of the signal conditioning module line, and the high side of the input signal connected to the INPUT H line.

The DSS11-A is used with the DSS11-MR, and a DSS11-B must be used with the DSS11-MS.

Refer to Appendix C for DSS11-MR/MS connector pinning.

CHAPTER 5

MAINTENANCE

5.1 GENERAL DESCRIPTION

Maintenance of the DRS/DSS11 option conforms to the accepted maintenance procedures for electronic equipment presently in use; i.e., ample preventive procedures performed on a routine schedule can forecast failures before they occur. If a specific item does fail, the design of the equipment allows for quick replacement of modular elements of the complete package. One of the design objectives was to provide a dependable and relatively maintenance free assembly.

5.2 PREVENTIVE MAINTENANCE

Preventive maintenance consists of tasks performed at periodic intervals to ensure proper equipment operation and minimum unscheduled downtime. These tasks include visual inspection and replacement of marginal components.

The preventive maintenance schedule depends on the operating environment and conditions at the installation site. Under normal conditions, the recommended preventive maintenance schedule consists of inspection and cleaning every 600 hours of operation or every four months, whichever occurs first.

5.3 DIAGNOSTIC TESTING

If a system failure is suspected, the diagnostic can be run following the procedures in the diagnostic writeup. It is necessary to remove the user equipment to run these tests. This is simply facilitated by disconnecting the "BERG" type connectors on the modules.

It is also very easy to do a static check of the DRS11 modules by depositing data into the output registers from the PDP-11 console, and then reading the data to see if it agrees. Checking the DSS11 inputs is also possible using this method provided the

DRS11 module is hooked up as described in Paragraph 2.5 of this manual for Wraparound Testing.

5.4 QUICK TEST PROGRAM

The following toggle in program can be used to do a quick check of the DRS11 or DSS11 if a problem is encountered while running the diagnostic. This program allows the operator to send bits contained in the Switch register to the Data register selected so that the suspected bit that is failing may be checked in a tight scope loop.

The address of the module under test must be put in the program where the XXXX is shown in the following listing. If desired, the DSS11 may also be checked using this program (if a DRS11 is present) by using the wrap around cabling as described in Paragraph 2.5 for the particular setup that is under test.

TEST PROGRAM

```
1$: MOV  177570,@REG
 BR  1$
REG: 76XXXX
 END
```

This may be deposited anywhere in memory. At 1000 it would look like this:

```
1000: 013777
1002: 177570
1004: 000002
1006: 000774
1010: 76XXXX
```

Where the address of the DRS11 register is put in where the 76XXXX is shown.

CHAPTER 6

CSS BUILT PARTS

6.1 CSS PARTS

The following equipment is available from the Computer Special Systems group , and must be supplied through them.

DGITIAL P/N	Description
M7893-YA/YB	DRS11 Module
M7894	DRS11-MR Module
M7895-YA/YB	DSS11 Module
M7896-YA/YC/YD	DSS11 Signal Conditioning Module
7012989	Cables
7012990	DSS11 Test Plug

APPENDIX A

SHIPPING/ACCESSORIES LIST

A.1 EQUIPMENT FURNISHED

DIGITAL EQUIPMENT CORPORATION
MAYNARD, MASSACHUSETTS
SHIPPING LIST

ITEM NO.	DWG NO./PART NO.	DESCRIPTION	QUANTITY/VARIATION											
			DRS11-A	DRS11-B	DRS11-MP	DSS11-A	DSS11-B	DSS11-MP	DSS11-MR	DSS11-MS	DSP11-A	DSP11-C		
1		The following hardware will ship per												
		option:												
1	M7893-YA	DRS11-A Module	1	-	-	-	-	-	-	-	-	-		
2	M7893-YB	DRS11-B Module	-	1	-	-	-	-	-	-	-	-		
3	M7894	DRS11-MP Module	-	-	1	-	-	-	-	-	-	-		
4	M7895-YA	DSS11-A Module	-	-	-	1	-	-	-	-	-	-		
5	M7895-YB	DSS11-B Module	-	-	-	-	1	-	-	-	-	-		
6	M7896-YA	DSS11-MP Module	-	-	-	-	-	1	-	-	-	-		
7	M7896-YC	DSS11-MR Module	-	-	-	-	-	-	1	-	-	-		
8	M7896-YD	DSS11-MS Module	-	-	-	-	-	-	-	1	-	-		
9	70-12989-01	50 Pin Interconnect Cable	-	-	2	2	2	2	2	2	-	-		
10	70-12989-10	50 Pin Interconnect Cable	2	2	-	2	2	-	-	-	-	-		
11	54-12426-0	DSS11 Test Connector	-	-	-	1	1	-	-	-	-	-		
12	DSP11-A	DSP11-A Panel	-	-	-	-	-	-	-	-	1	-		
13	54-12502-0-0	Connector Module	-	-	-	-	-	-	-	-	2	-		
14	DSP11-C	DSP11-C Panel	-	-	-	-	-	-	-	-	-	1		

TITLE	DOCUMENT NUMBER	REV.
DRS11/DSS11/DSP11 INPUT-OUTPUT SYSTEM	CSS-MO-F-4.3-15	C

A.2 EQUIPMENT FURNISHED (CONT.)

DIGITAL EQUIPMENT CORPORATION
MAYNARD, MASSACHUSETTS

SHIPPING LIST

ITEM NO.	DWG NO./PART NO.	DESCRIPTION	QUANTITY/VARIATION											
			Std. Doc. Pkg.	DSP11	DRS11-MP	DSS11-MP/MR/MS								
		One standard Document Package will be												
		provided with each shipment; an addition-												
		al standard Document Package will ship												
		with each additional five basic modules												
		(DRS/DSS11-A,B)												
1	DECSPEC-11-BBBAD	Diagnostic Listing	1	-	-	-								
2	DECSPEC-11-BBBAD	Diagnostic Tape	1	-	-	-								
3	DECSPEC-11-BBBAX	DEC/X-11-Module Listing	1	-	-	-								
4	DECSPEC-11-BBBAX	DEC/X-11-Module Tape	1	-	-	-								
5	B-DD-DRS11-0-0	DRS11 Print Set	1	-	1	-								
6	B-DD-DSS11-0-0	DSS11 Print Set	1	-	-	1								
7	B-DD-DSP11-A	DSP11-A Print Set	1	1	-	-								
8	B-DD-DSP11-C	DSP11-C Print Set	1	1	-	-								
9	CSS-MO-F-4.3-15	DRS11/DSS11/DSP11 Option Description	1	1	1	1								

TITLE	DOCUMENT NUMBER	REV.
DRS11/DSS11/DSP11 INPUT-OUTPUT SYSTEM	CSS-MO-F-4.3-15	C

APPENDIX B

DSP11 INTERCONNECT PANELS

B.1 DSP11-A GENERAL DESCRIPTION

The DSP11-A panel provides the user with a convenient means for connecting the DRS11 or DSS11 family of modules to his equipment. The panel consists of 200 screw terminals to allow 100 double ended signals to be connected to the control modules.

The 10-foot signal cable (7012989-10) is plugged from the module to the DSP11-A panel, and all user connections are made to the screw terminals.

The DSP11-A is a rack mountable panel that measures 5.25 inches in height and approximately 3.5 inches in depth. The panel consists of two identical rows of connector blocks to which the user makes all of his connections. The following paragraph lists only the connections for one half of the panel (one row). The other half of the panel is identical.

B.1.1 DSP11-A CONNECTIONS

The cable from the module (M7893-M7896) is attached to one of the "BERG" connectors on the DSP11-A so that the pinning of the module connector is carried to the screw terminals on the front of the DSP11-A. In other words pin 1 on the module is now connected to screw terminal 1 etc. The top row of screws are connected to connector J1 on the DSP11 module and the lower row of screw terminals on the blocks is connected to J2. For the sake of consistency, the active signal lines from the modules should be brought to J1. The return lines should be connected to J2 on the DSP11-A.

B.2 DSP11-C GENERAL DESCRIPTION

The DSP11-C panel provides the user with a convenient means of connecting the DRS11 or DSS11 family of modules to his equipment. The panel consists of four fifty pin female micro-ribbon "telephone" type connectors with attached ten foot cables.

The 5.25 inch high panel can be rack mounted in the cabinet such that the tenfoot signal cables will attach to the appropriate DRS/DSS modules with enough slack to permit the mounting box to be fully extended from the cabinet.

B.2.1 DSP11-C Connections

Each of the four connectors (J1-J4) on the DSP11-C panel are identical. In a typical application, J1 would be the signal cable and J2 the return cable for one DRS11 or DSS11 module. J3 and J4 would be used for a second DRS11 or DSS11.

The pinout of the connectors does not follow the numbered outputs of the DRS/DSS11 modules. Pins 1-25 do correspond to outputs 1-25, but pins 26-50 correspond to signals 50-26 respectively. Refer to Appendix C for full definition of all DRS/DSS11 module outputs.

APPENDIX C

CONNECTOR PINNING

C.1 GENERAL DESCRIPTION

The following pages list the signal pins for the entire DRS/DSS family of modules. Refer to these to determine the user cabling to the external equipment.

NOTE

The pinning of all 50-pin connectors are as shown in Figure C-1, and NOT as indicated on the connector itself.

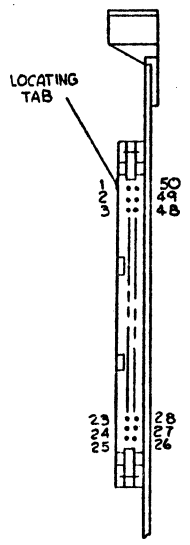

Figure C-1 Connector Edge View

C.2 DRS11-A/B

CONNECTOR J1		CONNECTOR J2	
SIGNAL NAME	PIN NUMBER	SIGNAL NAME	PIN NUMBER
OUT 00	01	GND	01
OUT 01	02	GND	02
OUT 02	03	GND	03
OUT 03	04	GND	04
OUT 04	05	GND	05
OUT 05	06	GND	06
OUT 06	07	GND	07
OUT 07	08	GND	08
OUT 08	09	GND	09
OUT 09	10	GND	10
OUT 10	11	GND	11
OUT 11	12	GND	12
OUT 12	13	GND	13
OUT 13	14	GND	14
OUT 14	15	GND	15
OUT 15	16	GND	16
OUT 16	17	GND	17
OUT 17	18	GND	18
OUT 18	19	GND	19
OUT 19	20	GND	20
OUT 20	21	GND	21
OUT 21	22	GND	22
OUT 22	23	GND	23
OUT 23	24	GND	24
OUT 24	25	GND	25
OUT 25	26	GND	26
OUT 26	27	GND	27
OUT 27	28	GND	28
OUT 28	29	GND	29
OUT 29	30	GND	30
OUT 30	31	GND	31
OUT 31	32	GND	32
OUT 32	33	GND	33
OUT 33	34	GND	34
OUT 34	35	GND	35
OUT 35	36	GND	36
OUT 36	37	GND	37
OUT 37	38	GND	38
OUT 38	39	GND	39
OUT 39	40	GND	40
OUT 40	41	GND	41
OUT 41	42	GND	42
OUT 42	43	GND	43
OUT 43	44	GND	44
OUT 44	45	GND	45
OUT 45	46	GND	46
OUT 46	47	GND	46
OUT 47	48	GND	48
EX INT IN	49	GND	49
GND	50	GND	50

C.3 DSS11-A/B

CONNECTOR J1		CONNECTOR J2	
SIGNAL NAME	PIN NUMBER	SIGNAL NAME	PIN NUMBER
IN 00 H	01	IN 00 L	01
IN 01 H	02	IN 01 L	02
IN 02 H	03	IN 02 L	03
IN 03 H	04	IN 03 L	04
IN 04 H	05	IN 04 L	05
IN 05 H	06	IN 05 L	06
IN 06 H	07	IN 06 L	07
IN 07 H	08	IN 07 L	08
IN 08 H	09	IN 08 L	09
IN 09 H	10	IN 09 L	10
IN 10 H	11	IN 10 L	11
IN 11 H	12	IN 11 L	12
IN 12 H	13	IN 12 L	13
IN 13 H	14	IN 13 L	14
IN 14 H	15	IN 14 L	15
IN 15 H	16	IN 15 L	16
IN 16 H	17	IN 16 L	17
IN 17 H	18	IN 17 L	18
IN 18 H	19	IN 18 L	19
IN 19 H	20	IN 19 L	20
IN 20 H	21	IN 20 L	21
IN 21 H	22	IN 21 L	22
IN 22 H	23	IN 22 L	23
IN 23 H	24	IN 23 L	24
IN 24 H	25	IN 24 L	25
IN 25 H	26	IN 25 L	26
IN 26 H	27	IN 26 L	27
IN 27 H	28	IN 27 L	28
IN 28 H	29	IN 28 L	29
IN 29 H	30	IN 29 L	30
IN 30 H	31	IN 30 L	31
IN 31 H	32	IN 31 L	32
IN 32 H	33	IN 32 L	33
IN 33 H	34	IN 33 L	34
IN 34 H	35	IN 34 L	35
IN 35 H	36	IN 35 L	36
IN 36 H	37	IN 36 L	37
IN 37 H	38	IN 37 L	38
IN 38 H	39	IN 38 L	39
IN 39 H	40	IN 39 L	40
IN 40 H	41	IN 40 L	41
IN 41 H	42	IN 41 L	42
IN 42 H	43	IN 42 L	43
IN 43 H	44	IN 43 L	44
IN 44 H	45	IN 44 L	45
IN 45 H	46	IN 45 L	46
IN 46 H	47	IN 46 L	47
IN 47 H	48	IN 47 L	48
INT IN H	49	INT IN L	49
PWR TST	50	PWR TST	50

C.4 DRS11-MP

CONNECTOR J1

SIGNAL NAME	PIN NUMBER
IN 00 L	01
IN 01 L	02
IN 02 L	03
IN 03 L	04
IN 04 L	05
IN 05 L	06
IN 06 L	07
IN 07 L	08
IN 08 L	09
IN 09 L	10
IN 10 L	11
IN 11 L	12
IN 12 L	13
IN 13 L	14
IN 14 L	15
IN 15 L	16
IN 16 L	17
IN 17 L	18
IN 18 L	19
IN 19 L	20
IN 20 L	21
IN 21 L	22
IN 22 L	23
IN 23 L	24
IN 24 L	25
IN 25 L	26
IN 26 L	27
IN 27 L	28
IN 28 L	29
IN 29 L	30
IN 30 L	31
IN 31 L	32
IN 32 L	33
IN 33 L	34
IN 34 L	35
IN 35 L	36
IN 36 L	37
IN 37 L	38
IN 38 L	39
IN 39 L	40
IN 40 L	41
IN 41 L	42
IN 42 L	43
IN 43 L	44
IN 44 L	45
IN 45 L	46
IN 46 L	47
IN 47 L	48
REQ LINE	49
---	50

DRS11-MP (cont.)

CONNECTOR J2		CONNECTOR J3	
SIGNAL NAME	PIN NUMBER	SIGNAL NAME	PIN NUMBER
OUT 00 H	01	OUT 00 L	01
OUT 01 H	02	OUT 01 L	02
OUT 02 H	03	OUT 02 L	03
OUT 03 H	04	OUT 03 L	04
OUT 04 H	05	OUT 04 L	05
OUT 05 H	06	OUT 05 L	06
OUT 06 H	07	OUT 06 L	07
OUT 07 H	08	OUT 07 L	08
OUT 08 H	09	OUT 08 L	09
OUT 09 H	10	OUT 09 L	10
OUT 10 H	11	OUT 10 L	11
OUT 11 H	12	OUT 11 L	12
OUT 12 H	13	OUT 12 L	13
OUT 13 H	14	OUT 13 L	14
OUT 14 H	15	OUT 14 L	15
OUT 15 H	16	OUT 15 L	16
OUT 16 H	17	OUT 16 L	17
OUT 17 H	18	OUT 17 L	18
OUT 18 H	19	OUT 18 L	19
OUT 19 H	20	OUT 19 L	20
OUT 20 H	21	OUT 20 L	21
OUT 21 H	22	OUT 21 L	22
OUT 22 H	23	OUT 22 L	23
OUT 23 H	24	OUT 23 L	24
OUT 24 H	25	OUT 24 L	25
OUT 25 H	26	OUT 25 L	26
OUT 26 H	27	OUT 26 L	27
OUT 27 H	28	OUT 27 L	28
OUT 28 H	29	OUT 28 L	29
OUT 29 H	30	OUT 29 L	30
OUT 30 H	31	OUT 30 L	31
OUT 31 H	32	OUT 31 L	32
OUT 32 H	33	OUT 32 L	33
OUT 33 H	34	OUT 33 L	34
OUT 34 H	35	OUT 34 L	35
OUT 35 H	36	OUT 35 L	36
OUT 36 H	37	OUT 36 L	37
OUT 37 H	38	OUT 37 L	38
OUT 38 H	39	OUT 38 L	39
OUT 39 H	40	OUT 39 L	40
OUT 40 H	41	OUT 40 L	41
OUT 41 H	42	OUT 41 L	42
OUT 42 H	43	OUT 42 L	43
OUT 43 H	44	OUT 43 L	44
OUT 44 H	45	OUT 44 L	45
OUT 45 H	46	OUT 45 L	46
OUT 46 H	47	OUT 46 L	47
OUT 47 H	48	OUT 47 L	48
INT IN H	49	INT IN L	49
---	50	GND	50

C.5 DSS11-MP/MR/MS

CONNECTOR J1		CONNECTOR J2	
SIGNAL NAME	PIN NUMBER	SIGNAL NAME	PIN NUMBER
IN 00 H	01	IN 00 L	01
IN 01 H	02	IN 01 L	02
IN 02 H	03	IN 02 L	03
IN 03 H	04	IN 03 L	04
IN 04 H	05	IN 04 L	05
IN 05 H	06	IN 05 L	06
IN 06 H	07	IN 06 L	07
IN 07 H	08	IN 07 L	08
IN 08 H	09	IN 08 L	09
IN 09 H	10	IN 09 L	10
IN 10 H	11	IN 10 L	11
IN 11 H	12	IN 11 L	12
IN 12 H	13	IN 12 L	13
IN 13 H	14	IN 13 L	14
IN 14 H	15	IN 14 L	15
IN 15 H	16	IN 15 L	16
IN 16 H	17	IN 16 L	17
IN 17 H	18	IN 17 L	18
IN 18 H	19	IN 18 L	19
IN 19 H	20	IN 19 L	20
IN 20 H	21	IN 20 L	21
IN 21 H	22	IN 21 L	22
IN 22 H	23	IN 22 L	23
IN 23 H	24	IN 23 L	24
IN 24 H	25	IN 24 L	25
IN 25 H	26	IN 25 L	26
IN 26 H	27	IN 26 L	27
IN 27 H	28	IN 27 L	28
IN 28 H	29	IN 28 L	29
IN 29 H	30	IN 29 L	30
IN 30 H	31	IN 30 L	31
IN 31 H	32	IN 31 L	32
IN 32 H	33	IN 32 L	33
IN 33 H	34	IN 33 L	34
IN 34 H	35	IN 34 L	35
IN 35 H	36	IN 35 L	36
IN 36 H	37	IN 36 L	37
IN 37 H	38	IN 37 L	38
IN 38 H	39	IN 38 L	39
IN 39 H	40	IN 39 L	40
IN 40 H	41	IN 40 L	41
IN 41 H	42	IN 41 L	42
IN 42 H	43	IN 42 L	43
IN 43 H	44	IN 43 L	44
IN 44 H	45	IN 44 L	45
IN 45 H	46	IN 45 L	46
IN 46 H	47	IN 46 L	47
IN 47 H	48	IN 47 L	48
REQ IN H	49	REQ IN L	49
PWR TST	50	PWR TST	50

DSS11-MP/MR/MS (cont)

CONNECTOR J3		CONNECTOR J4	
SIGNAL NAME	PIN NUMBER	SIGNAL NAME	PIN NUMBER
OUT 00 H	01	OUT 00 L	01
OUT 01 H	02	OUT 01 L	02
OUT 02 H	03	OUT 02 L	03
OUT 03 H	04	OUT 03 L	04
OUT 04 H	05	OUT 04 L	05
OUT 05 H	06	OUT 05 L	06
OUT 06 H	07	OUT 06 L	07
OUT 07 H	08	OUT 07 L	08
OUT 08 H	09	OUT 08 L	09
OUT 09 H	10	OUT 09 L	10
OUT 10 H	11	OUT 10 L	11
OUT 11 H	12	OUT 11 L	12
OUT 12 H	13	OUT 12 L	13
OUT 13 H	14	OUT 13 L	14
OUT 14 H	15	OUT 14 L	15
OUT 15 H	16	OUT 15 L	16
OUT 16 H	17	OUT 16 L	17
OUT 17 H	18	OUT 17 L	18
OUT 18 H	19	OUT 18 L	19
OUT 19 H	20	OUT 19 L	20
OUT 20 H	21	OUT 20 L	21
OUT 21 H	22	OUT 21 L	22
OUT 22 H	23	OUT 22 L	23
OUT 23 H	24	OUT 23 L	24
OUT 24 H	25	OUT 24 L	25
OUT 25 H	26	OUT 25 L	26
OUT 26 H	27	OUT 26 L	27
OUT 27 H	28	OUT 27 L	28
OUT 28 H	29	OUT 28 L	29
OUT 29 H	30	OUT 29 L	30
OUT 30 H	31	OUT 30 L	31
OUT 31 H	32	OUT 31 L	32
OUT 32 H	33	OUT 32 L	33
OUT 33 H	34	OUT 33 L	34
OUT 34 H	35	OUT 34 L	35
OUT 35 H	36	OUT 35 L	36
OUT 36 H	37	OUT 36 L	37
OUT 37 H	38	OUT 37 L	38
OUT 38 H	39	OUT 38 L	39
OUT 39 H	40	OUT 39 L	40
OUT 40 H	41	OUT 40 L	41
OUT 41 H	42	OUT 41 L	42
OUT 42 H	43	OUT 42 L	43
OUT 43 H	44	OUT 43 L	44
OUT 44 H	45	OUT 44 L	45
OUT 45 H	46	OUT 45 L	46
OUT 46 H	47	OUT 46 L	47
OUT 47 H	48	OUT 47 L	48
INT IN H	49	INT IN L	49
---	50	---	50

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