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<table>
<thead>
<tr>
<th>REV</th>
<th>SHEET</th>
<th>DESCRIPTION</th>
<th>APPROVED</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>All</td>
<td>Release to Production</td>
<td>BC</td>
<td>1-28-85</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>ECN 3894</td>
<td>C. L.</td>
<td>2-21-85</td>
</tr>
<tr>
<td>C</td>
<td>7,3</td>
<td>ECN 3946</td>
<td>C. F.</td>
<td>4-12-85</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>ECN 3999</td>
<td>Q. R. Q.</td>
<td>26 Jun 85</td>
</tr>
<tr>
<td>E</td>
<td>6</td>
<td>ECN 4006</td>
<td>J. G.</td>
<td>7/16/85</td>
</tr>
<tr>
<td>F</td>
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<td>ECN 4057</td>
<td>J. H.</td>
<td>10/15/85</td>
</tr>
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<td>G</td>
<td>7,8</td>
<td>ECN 4136</td>
<td>J. H.</td>
<td>1/29/86</td>
</tr>
<tr>
<td>H</td>
<td>ADDENDUM</td>
<td>ECN 4454</td>
<td>J. H.</td>
<td>7/21/87</td>
</tr>
<tr>
<td>J</td>
<td>P. 8,9</td>
<td>ECN 4703</td>
<td>J. H.</td>
<td>6/2/88</td>
</tr>
<tr>
<td>K</td>
<td>PGS.9-11</td>
<td>ECN 4933</td>
<td>J. H.</td>
<td>7/12/89</td>
</tr>
</tbody>
</table>

**APPROVALS**

**DRAWN**

D. J. Harvey 1-28-85

**CHECKED**

Fred J. Smith 1/23/85

**ENGINEER**

BC 1-28-85

**ENGR. MGR.**

R. S. 28 Jan 85
ADDENDUM TO DR-216 INSTALLATION GUIDE

In certain system configurations, it is possible for the DR-216 memory module to short to the stiffener bar of the module below it causing system failure. Therefore, when installing the DR-216, verify that it does not contact the stiffener bar of the module below it. If contact does occur, move either the DR-216 or the other module to prevent possible system malfunction.
INSTALLATION

Switch Settings

When installing the DR-216, set the starting address according to Table 1. Set the CSR address according to Table 2.

Figure 1. DR-216 Jumper Locations
(Boards at REV E and later)

Jumper Options

Table 3 summarizes all jumper functions. Figures 1&2 detail the jumper locations for the different revision levels of artwork.
To determine which drawing to use, inspect switch 1. If switch 1 is an 8 position DIP, use Figure 1. If switch 1 is a 10 position DIP, use Figure 2. For boards with a 10 position switch, positions 9 and 10 are not used.

Figure 2. DR-216 Jumper Locations  
(Boards at REV D and earlier)
Table 1 - Switch SW1

<table>
<thead>
<tr>
<th>STARTING ADDRESS</th>
<th>POS 8</th>
<th>POS 7</th>
<th>POS 6</th>
<th>POS 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>0KW</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>8KW</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>16KW</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>24KW</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>32KW</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>40KW</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>48KW</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>56KW</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>64KW</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>72KW</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>80KW</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>88KW</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>96KW</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>104KW</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>112KW</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>120KW</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>

For all other settings use equal increments of 128KW plus the appropriate 8KW increment from the above table.

<table>
<thead>
<tr>
<th>POS 4</th>
<th>POS 3</th>
<th>POS 2</th>
<th>POS 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 128KW</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>128 - 256KW</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>256 - 384KW</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>384 - 512KW</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>512 - 640KW</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>640 - 768KW</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>768 - 896KW</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>896 - 1024KW</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>1024 - 1152KW</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>1152 - 1280KW</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>1280 - 1408KW</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>1408 - 1536KW</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>1536 - 1664KW</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>1664 - 1792KW</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>1792 - 1920KW</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>1920 - 2048KW</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>

ON = Closed
OFF = Open
### Table 2 - CSR Address Select

<table>
<thead>
<tr>
<th>16 Bit Address</th>
<th>18 Bit Address</th>
<th>22 Bit Address</th>
<th>Pin 1 to 2</th>
<th>Pin 2 to 3</th>
<th>Pin 4 to 5</th>
<th>Pin 5 to 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>172100</td>
<td>772100</td>
<td>17772100</td>
<td>OUT</td>
<td>OUT</td>
<td>OUT</td>
<td>OUT</td>
</tr>
<tr>
<td>172102</td>
<td>772102</td>
<td>17772102</td>
<td>IN</td>
<td>OUT</td>
<td>OUT</td>
<td>OUT</td>
</tr>
<tr>
<td>172104</td>
<td>772104</td>
<td>17772104</td>
<td>OUT</td>
<td>IN</td>
<td>OUT</td>
<td>OUT</td>
</tr>
<tr>
<td>172106</td>
<td>772106</td>
<td>17772106</td>
<td>IN</td>
<td>IN</td>
<td>OUT</td>
<td>OUT</td>
</tr>
<tr>
<td>172110</td>
<td>772110</td>
<td>17772110</td>
<td>OUT</td>
<td>OUT</td>
<td>IN</td>
<td>OUT</td>
</tr>
<tr>
<td>172112</td>
<td>772112</td>
<td>17772112</td>
<td>IN</td>
<td>OUT</td>
<td>IN</td>
<td>OUT</td>
</tr>
<tr>
<td>172114</td>
<td>772114</td>
<td>17772114</td>
<td>OUT</td>
<td>IN</td>
<td>IN</td>
<td>OUT</td>
</tr>
<tr>
<td>172116</td>
<td>772116</td>
<td>17772116</td>
<td>IN</td>
<td>IN</td>
<td>IN</td>
<td>OUT</td>
</tr>
<tr>
<td>172120</td>
<td>772120</td>
<td>17772120</td>
<td>OUT</td>
<td>OUT</td>
<td>OUT</td>
<td>IN</td>
</tr>
<tr>
<td>172122</td>
<td>772122</td>
<td>17772122</td>
<td>IN</td>
<td>OUT</td>
<td>OUT</td>
<td>IN</td>
</tr>
<tr>
<td>172124</td>
<td>772124</td>
<td>17772124</td>
<td>OUT</td>
<td>IN</td>
<td>OUT</td>
<td>IN</td>
</tr>
<tr>
<td>172126</td>
<td>772126</td>
<td>17772126</td>
<td>IN</td>
<td>IN</td>
<td>OUT</td>
<td>IN</td>
</tr>
<tr>
<td>172130</td>
<td>772130</td>
<td>17772130</td>
<td>OUT</td>
<td>OUT</td>
<td>IN</td>
<td>IN</td>
</tr>
<tr>
<td>172132</td>
<td>772132</td>
<td>17772132</td>
<td>IN</td>
<td>OUT</td>
<td>IN</td>
<td>IN</td>
</tr>
<tr>
<td>172134</td>
<td>772134</td>
<td>17772134</td>
<td>OUT</td>
<td>IN</td>
<td>IN</td>
<td>IN</td>
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<tr>
<td>172136</td>
<td>772136</td>
<td>17772136</td>
<td>IN</td>
<td>IN</td>
<td>IN</td>
<td>IN</td>
</tr>
</tbody>
</table>

**NOTE:**

E5 Pin 2 to 3 disables CSR selection.
E7 Pin 2 to 3 must be installed for 16 or 18 bit address operation.
### Table 3 - Jumper Function Summary

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>IN</th>
<th>OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CSR Selection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disable CSR</td>
<td>E5-2 to E5-3</td>
<td>E5-1 to E5-2</td>
</tr>
<tr>
<td>Enable CSR</td>
<td>E5-1 to E5-2</td>
<td>E5-2 to E5-3</td>
</tr>
<tr>
<td></td>
<td>E9-1 to E9-2</td>
<td>E9-2 to E9-3</td>
</tr>
<tr>
<td><strong>Parity Error Reporting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-CSR</td>
<td>E1-2 to E1-3</td>
<td>E1-1 to E1-2</td>
</tr>
<tr>
<td>With CSR</td>
<td>E1-1 to E1-2</td>
<td>E1-2 to E1-3</td>
</tr>
<tr>
<td><strong>Write Wrong Parity Enable</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enable</td>
<td>E6-1 to E6-2</td>
<td>E6-2 to E6-3</td>
</tr>
<tr>
<td>Disable</td>
<td>- E6-2 to E6-3</td>
<td>E6-1 to E6-2</td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disable</td>
<td>- E4-2 to E4-3</td>
<td>E4-1 to E4-2</td>
</tr>
<tr>
<td>Enable</td>
<td>E4-1 to E4-2</td>
<td>E4-2 to E4-3</td>
</tr>
<tr>
<td><strong>Memory Size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fully Populated</td>
<td>E14-1 to E14-2</td>
<td>E14-2 to E14-3</td>
</tr>
<tr>
<td>Half Populated</td>
<td>E14-2 to E14-3</td>
<td>E14-1 to E14-2</td>
</tr>
<tr>
<td><strong>Addressing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16/18 Bit Address</td>
<td>- E7-2 to E7-3</td>
<td>E7-1 to E7-2</td>
</tr>
<tr>
<td>22 Bit Address</td>
<td>E7-1 to E7-2</td>
<td>E7-2 to E7-3</td>
</tr>
<tr>
<td><strong>Battery Backup</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery Backup</td>
<td>E3-2 to E3-3</td>
<td>E3-1 to E3-2</td>
</tr>
<tr>
<td>No Battery Backup</td>
<td>- E3-1 to E3-2</td>
<td>E3-2 to E3-3</td>
</tr>
<tr>
<td><strong>Block Mode</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enable</td>
<td>E2-1 to E2-2</td>
<td>E2-2 to E2-3</td>
</tr>
<tr>
<td>Disable</td>
<td>E2-2 to E2-3</td>
<td>E2-1 to E2-2</td>
</tr>
<tr>
<td><strong>I/O Space Size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4KW</td>
<td>E8-1 to E8-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E8-2 to E8-3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E9-1 to E9-2</td>
<td>E9-2 to E9-3</td>
</tr>
<tr>
<td>2KW</td>
<td>E8-2 to E8-3</td>
<td>E8-1 to E8-2</td>
</tr>
<tr>
<td></td>
<td>E9-1 to E9-2</td>
<td>E9-2 to E9-3</td>
</tr>
<tr>
<td>1KW</td>
<td>E8-1 to E8-2</td>
<td>E8-2 to E8-3</td>
</tr>
<tr>
<td></td>
<td>E9-1 to E9-2</td>
<td>E9-2 to E9-3</td>
</tr>
<tr>
<td>.5KW</td>
<td>-----</td>
<td>E8-1 to E8-2</td>
</tr>
<tr>
<td></td>
<td>-----</td>
<td>E8-2 to E8-3</td>
</tr>
<tr>
<td></td>
<td>E9-1 to E9-2</td>
<td>E9-2 to E9-3</td>
</tr>
</tbody>
</table>
Table 5-3. (Cont'd)

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>IN</th>
<th>OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>64K/256K DRAMs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>64K</td>
<td>E15-1 to E15-2</td>
<td>E15-2 to E15-3</td>
</tr>
<tr>
<td></td>
<td>E10-1 to E10-2</td>
<td>---</td>
</tr>
<tr>
<td>256K</td>
<td>E15-2 to E15-3</td>
<td>E15-1 to E15-2</td>
</tr>
<tr>
<td></td>
<td>---</td>
<td>E10-1 to E10-2</td>
</tr>
</tbody>
</table>

COMPUTER INSTALLATION

The DR-216 plugs into a dual-width Q-Bus (LSI-11) slot. Install the DR-216 into a LSI-11 computer as follows:

1. Set starting address. Take care not to overlap memory module addresses. If they do, the computer will not boot.

2. Set the CSR address if CSR is enabled. Each CSR must have a unique address. If more than one CSR is used, the CSR addresses must be in increasing order relative to the memory which it is monitoring. For example, if memory locations 0000 to 512K words have a CSR located at address 17772104, the next CSR must be at an address above 17772104 (i.e., 17772106, 17772110). In this configuration, CSR addresses 17772100 and 17772102 cannot be used.

3. Plug the DR-216 into the computer.

NOTE:

Due to a design change, jumper point E4 has been eliminated and should no longer be inserted on assembly numbers 61545, 61546, 61548 and 61549 revision levels C7 or D4. The assembly number and revision level are stamped on the solder side of the board along one edge.

All other revision levels still require jumper E4-1 to E4-2 to be inserted for parity to be enabled.

Status Indicators

The DR-216 contains three LED indicators, shown in figure 2 which define the following conditions:

LED1 (RED) - When LED1 is lit, a memory cycle, is in progress.
LED2 (RED) - When LED2 is lit, a parity error has occurred on the memory board. LED2 is reset (extinguished) by initializing the system with BINITL, or by writing a zero into bit 15 of the status register.

LED3 (GREEN) - When LED3 is on, correct power is being supplied to memory. LED3 is powered by the +5VB line. Thus, if the +5VL supply fails, the LED remains lit if proper backup power exists.

DIAGNOSTICS

The DR-216 is compatible with all DEC memory diagnostics. However some diagnostics will not exercise the entire memory board. The following is a list of recommended diagnostics for the DR-216:

11/23, 11,23+, 11/73 Processors and the MicroPDP.

Use either diagnostic ZMSD?? or VMSA??

NOTE

The 11/73 processor has an on-board cache that must be disabled prior to running any diagnostics. The steps are as follows:

1. Boot the operating system. XXDP or XXDP+.

2. After the prompt, a period (.), press the break key if enabled or the halt switch on the front panel.

3. Deposit 14 in location 17777746, the cache control register. This will disable the cache on the 11/73.

4. Type P to return to XXDP or XXDP+. Do not use the GO command because a bus INIT will be issued which will clear the cache control register.

MICROVAX I

Use diagnostic EHXMS.

NOTE

The 2 megabyte DR-216 will fail with this diagnostic. The error message will be:

Error during test 2, subtest 5
Memory configuration Test, Memory/CSR Correlation Test
Part 1
Too few memory CSRs present; expected at least 2, found 1

This error will occur on all board larger than 1 megabyte, including DEC's. Later versions of the diagnostic should have this problem corrected. Presently, the only way around this problem is to disable the halt feature of the diagnostic.
Determining Bad RAM Locations

If a diagnostic uncovers a bad RAM location it should be replaced to insure data integrity.

All DRAMs are socketed so replacement can be done with little trouble. To find the location of a defective DRAM on the DR-216 follow the procedure outlined below. All addresses are given in both octal and decimal to facilitate replacement.

1. Subtract the starting address of the DR-216 memory board from the address of the bad DRAM.

2. Determine which row the bad DRAM is in by using the appropriate table below. Table 5-4 is for DR-216 memory boards populated with 64K DRAMs and Table 5-5 is for boards with 256K DRAMs. Use only the first two entries in a table for half populated boards.

Table 5-4. 64K DRAMs

<table>
<thead>
<tr>
<th>Address</th>
<th>Octal</th>
<th>Decimal</th>
<th>Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-377777</td>
<td>0-128KB</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>400000-77777</td>
<td>128KB-256KB</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>1000000-137777</td>
<td>256KB-384KB</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>1400000-177777</td>
<td>384KB-512KB</td>
<td>D</td>
<td></td>
</tr>
</tbody>
</table>

Table 5-5. 256K DRAMs

<table>
<thead>
<tr>
<th>Address</th>
<th>Octal</th>
<th>Decimal</th>
<th>Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-177777</td>
<td>0-512KB</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>2000000-377777</td>
<td>512KB-1024KB</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>1000000-577777</td>
<td>1024KB-1536KB</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>6000000-777777</td>
<td>1536KB-2048KB</td>
<td>D</td>
<td></td>
</tr>
</tbody>
</table>

3. The row letter is silkscreened on the edge of the board opposite from the connector fingers. The bit numbers are silkscreened down the side of the DRAM array near the long edge of the board. The parity bits are designated by PO and PI.

TROUBLESHOOTING GUIDE

The DR-216 is completely tested prior to shipping. However sometimes problems do occur and the board fails to function correctly. If a problem does arise, the following sequence of steps should be followed to isolate the fault.

1. With power off, remove the DR-16 from the backplane and visually inspect it for damaged components and other obvious problems.
2. Check the strapping of the board against Table 5-3, and use Table 5-1 to insure that switch 1 (SW1) is set to the proper starting address.

3. Turn power on and check the backplane for proper voltages at the following pins:

   +5V           AA2, BA2, BV1
   +5V BBU       AV1

4. Remove power from the backplane and replace the DR-216 in the computer. Turn the computer back on and verify that the DR-216 can be read from and written to under ODT.

5. If the fault has been isolated to the DR-216, run one of the diagnostics recommended in the Diagnostic Section. If the system will not boot with the DR-216, put a working memory board at location 000000 and set the address of the DR-216 in question to start above that of the lower board. Now boot and run the diagnostic.

6. If the problem persists, further assistance on the DR-216 installation can be obtained through DATARAM's toll free number - (800)822-0071.