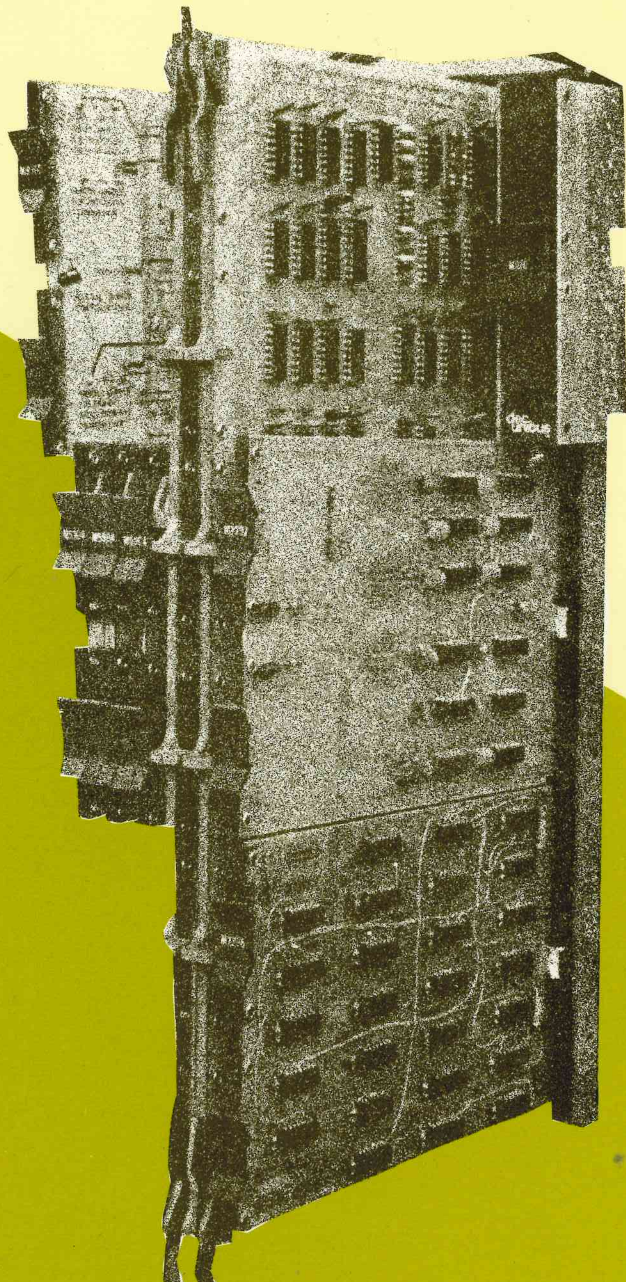
RH11/RH70 MASSBUS Controllers

A Self-Paced Course

Workbook 4



digital

RH11/RH70 MASSBUS CONTROLLERS
SELF-PACED COURSE

WORKBOOK IV

Document EY-D3024-WB-001
A Portion of Course EY-D3038-SP-001

Massbus Cabling Logic

RH11 Installation

RH70 Installation

educational services development and publishing
digital equipment corporation
colorado springs, colorado

Printed in U.S.A.

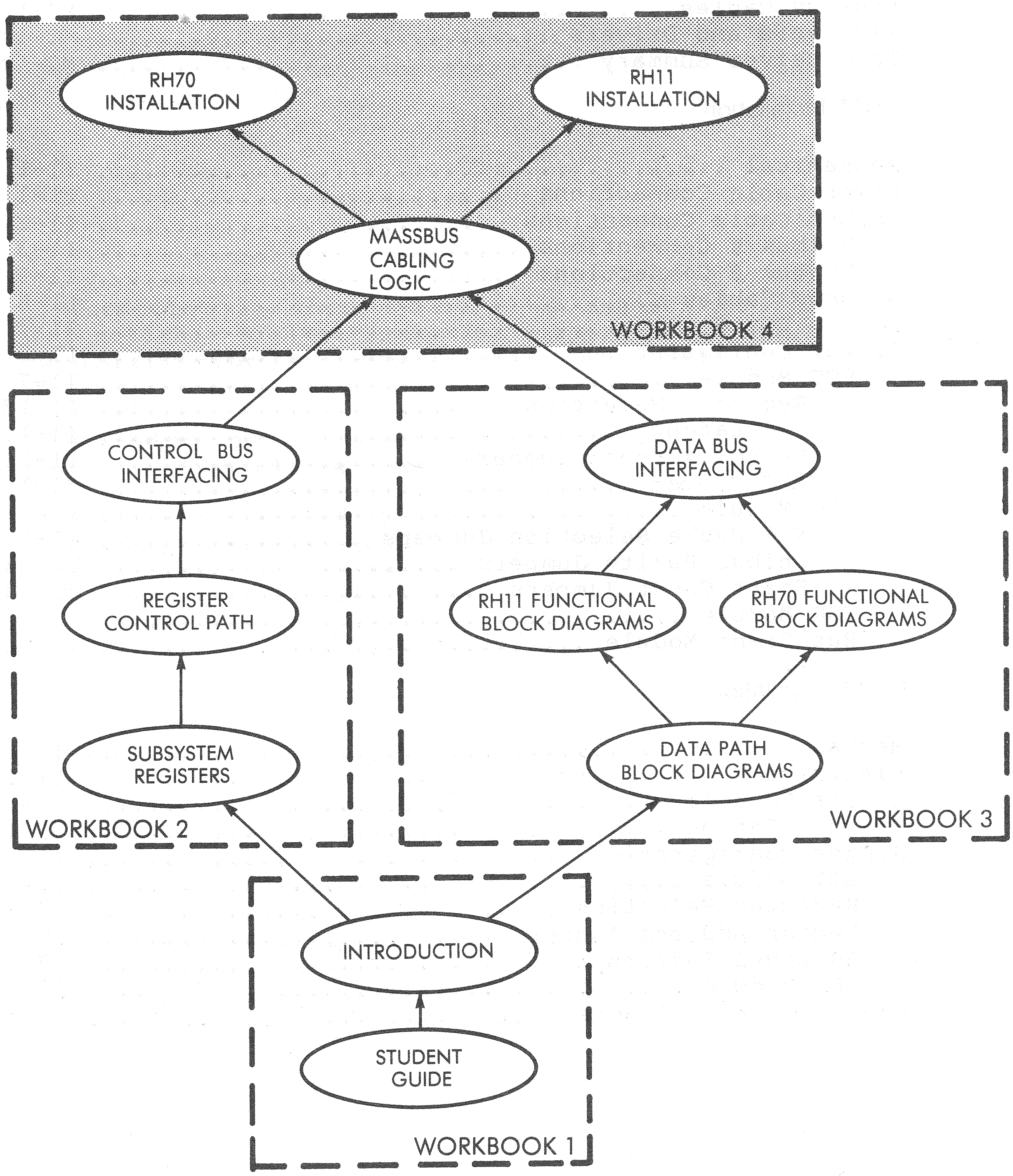
OUTLINE

Massbus Cabling Logic

RH11 Installation

RH70 Installation

COURSE MAP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Massbus Cabling Logic

MASSBUS CABLING LOGIC

INTRODUCTION

This module begins where the "Data Bus Interfacing" module ends. This module describes how the Massbus interfacing signals are handled via the Massbus drivers and receivers.

A description of the modules that do the converting of TTL logic levels to those necessary for Massbus communications, is alos covered in this module.

This module is divided into two sections:

- A physical description of the cabling system
- A sample of the Field Maintenance print set schematics.

The text uses the schematics to describe the operations of the Massbus.

The end result will be a working knowledge of Massbus communications. Many Massbus peripheral problems occur do to faulty interconnections or failures in the module logic to translate the signals properly.

You will find it much easier to isolate cable problems if you know the function of the various interfacing signals and how they are transmitted and received.

OBJECTIVES

Given the Massbus transceiver diagrams for an example Massbus device and RH controller, be able to trace signals through the logic on the diagrams. Label the supplied diagrams with all inputs, outputs, and voltage levels for each of the four types of Massbus signal.

ADDITIONAL RESOURCES

RJSØ4 Maintenance Manual, Pages 2-4, 5-21, 5-35

RJPØ4 Maintenance Manual, Pages 2-5, 6-31, 6-35

RWPØ4 Maintenance Manual, Pages 2-5, 6-45

TJU16 Maintenance Manual, Pages 2-4, 6-31, 6-35

MASSBUS CABLING LOGIC

MASSBUS CABLES

The Massbus is an interfacing system consisting of 56 signals. These include data, control, and parity. For a fixed-head disk or magtape unit, the Massbus cabling consists of three BC06R, 20-pair, flat-conductor cables. For moving-head disks, the BC06R cables are routed from the RH to a transition connector bracket at the back of the cabinet. There are four cutouts in the bracket to accommodate up to four transition connectors. A BC06S 60-pair round cable plugs into the transition bracket and is routed to the first drive. Each drive is daisy-chained to the next drive by another BC06R cable. These cables can be ordered in different lengths. Figure 1 and 2 show a single and dual-port installation of an RP.

> **NOTE**
>
> **Figure 1 shows the proper position of the transition bracket. This allows the flat cables to be plugged in the transition bracket easily.**

At the end of the cable that interfaces the moving-head disk, the BC06S connects to another transition connector, which is mounted at the rear of the Drive Control Logic (DCL). The internal end of this assembly accepts three flat BC06R Massbus cables that are routed to the logic in the drive. This method of cabling applies to RP04/05/06 disk drives. The RM family of disks utilize an RM adapter in place of a DCL. The BC06S cables plug directly into the logic backplane of the RM adapter eliminating one set of transition connectors.

RECEIVERS AND DRIVERS

There are two types of transceiver modules. The M5904 is designed for the RH Controllers. The M5903 is designed for the peripheral devices. Each transceiver module accepts one flat cable as shown in Figures 3 and 4.

The transceiver modules in the drive are of two varieties, M5903 and M5903 YA. The M5903 module has an "in" and "out" connector to daisy-chain the drives. A special terminator module, H870, should be placed in the out connector of the last drive. Figure 5 shows the H870 Terminator being inserted in the newest revision of the M5903 Module.

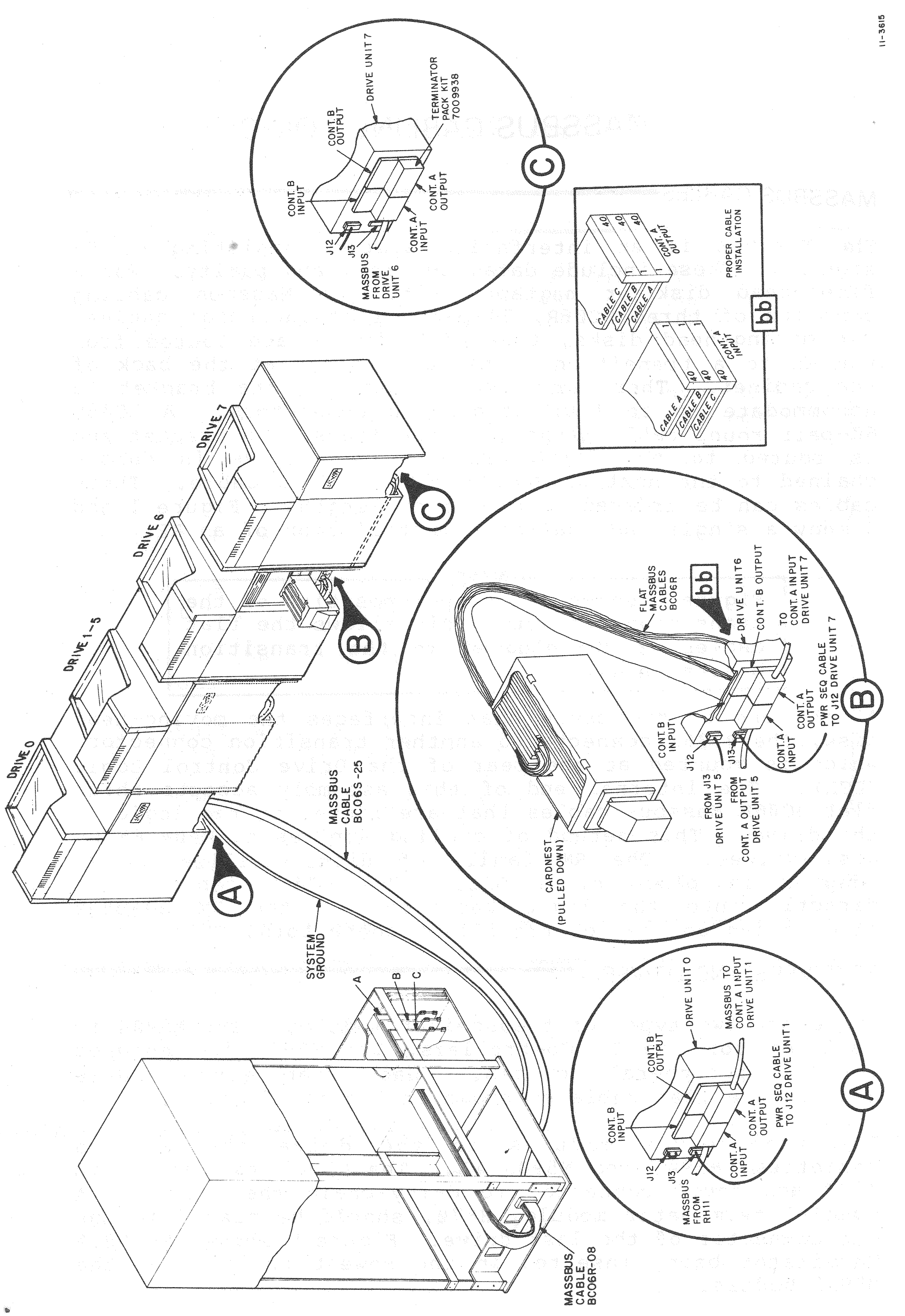

Figure 1 Single-Port Subsystem Cable Routing

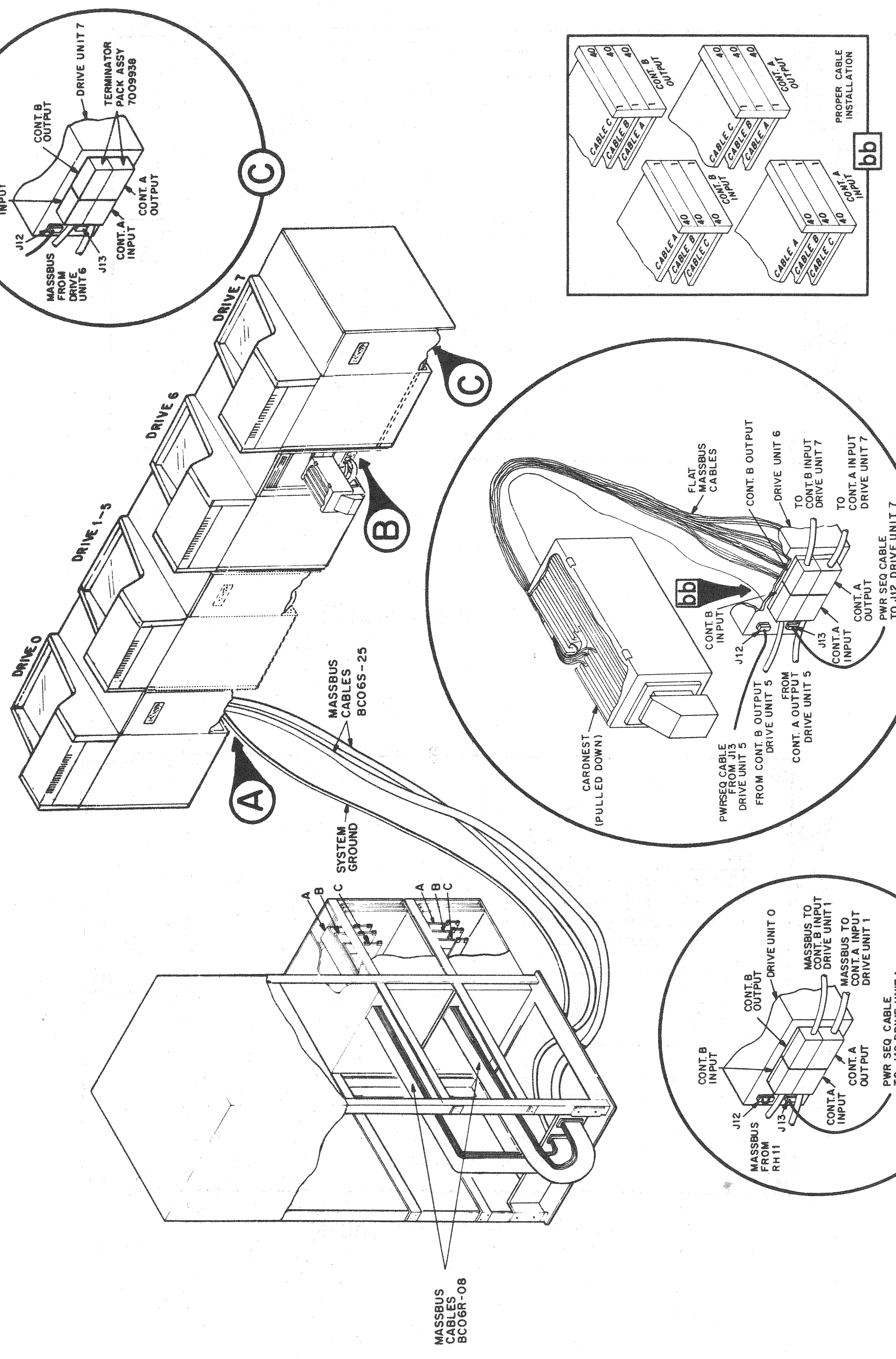

Figure 2 Dual-Port Subsystem Cable Routing

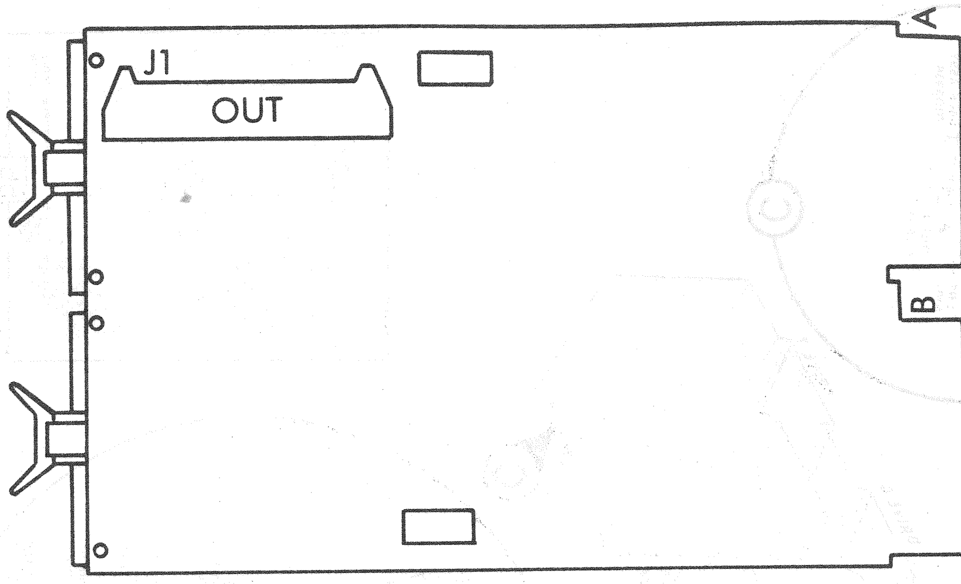

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Figure 3 M5904 Module

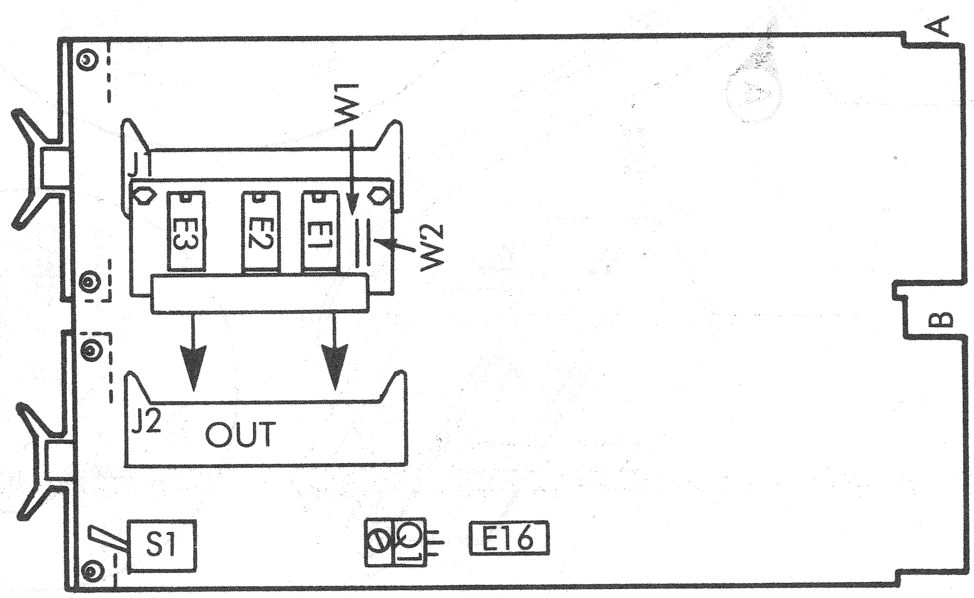

Figure 4 M5903 Module

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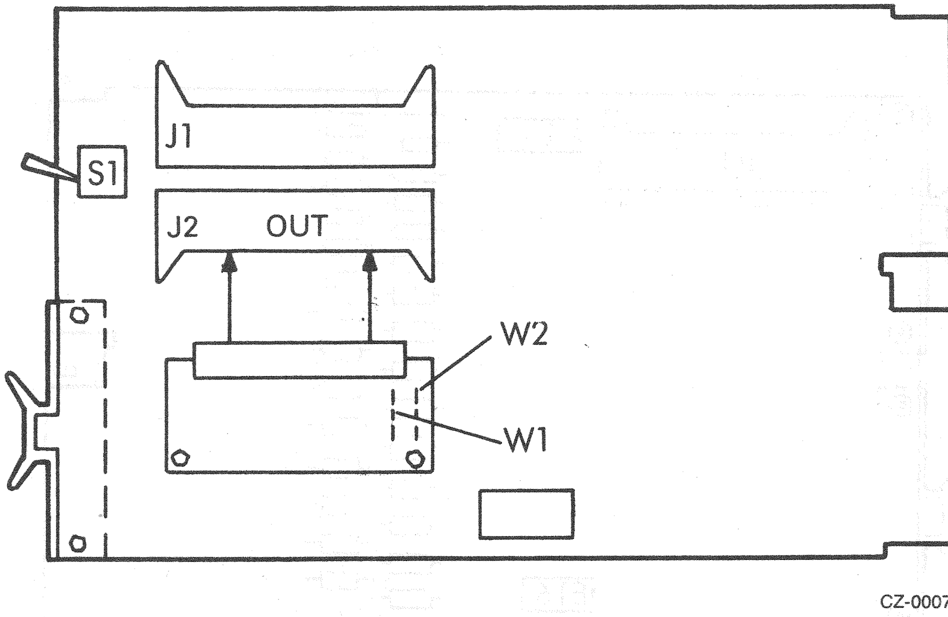


Figure 5 Newest Revision of M5903 Module with H870 Terminator

NOTE

An H870 is installed with components facing out away from the module in an older M5903 as shown in Figure 4. Jumper W1 should be cut in this configuration. Figure 5 represents the newest revision M5903. The H870 terminator is installed with the components facing in toward the module. Jumper W2 is cut in this configuration.

The M5903 YA (Figure 6) is designed to automatically terminate the Massbus. Note the lack of an "out" connector and the presence of terminating resistors. Three of these modules would be placed in the last drive to terminate the three Massbus cables.

The RMs and RPs normally use a 70-09938 Terminator Pack Assembly (Figure 7) to terminate the Massbus. Figure 1 and 2, insert "C", show where the terminator pack is used in the RP family. The same H870 terminator modules are used in the terminator pack.

NOTE

Only jumper W2 is removed from the three H870 modules when installed in a terminator pack.

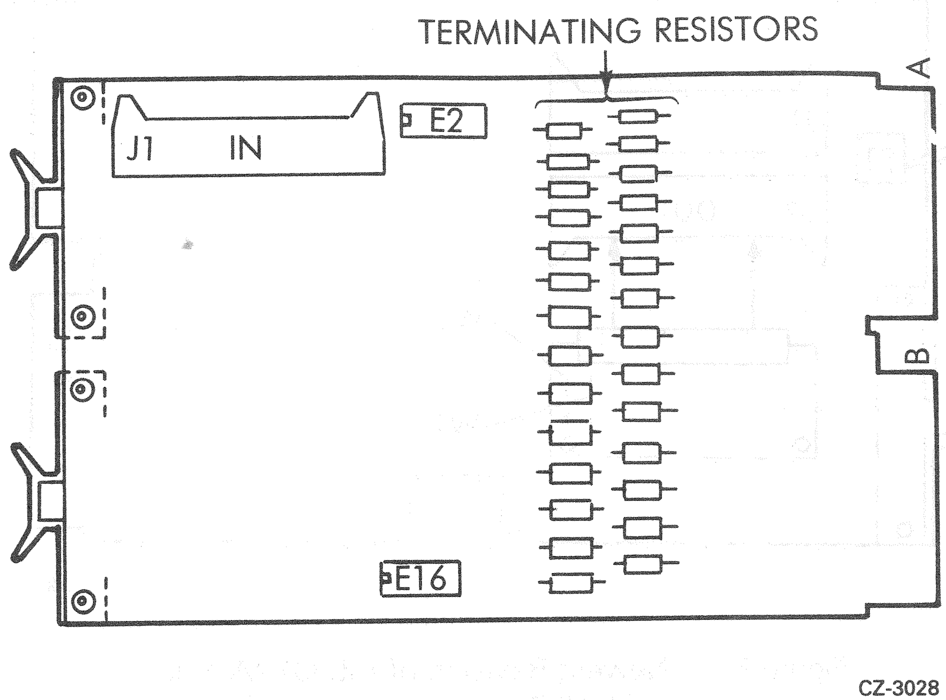


Figure 6 M5903 YA Module

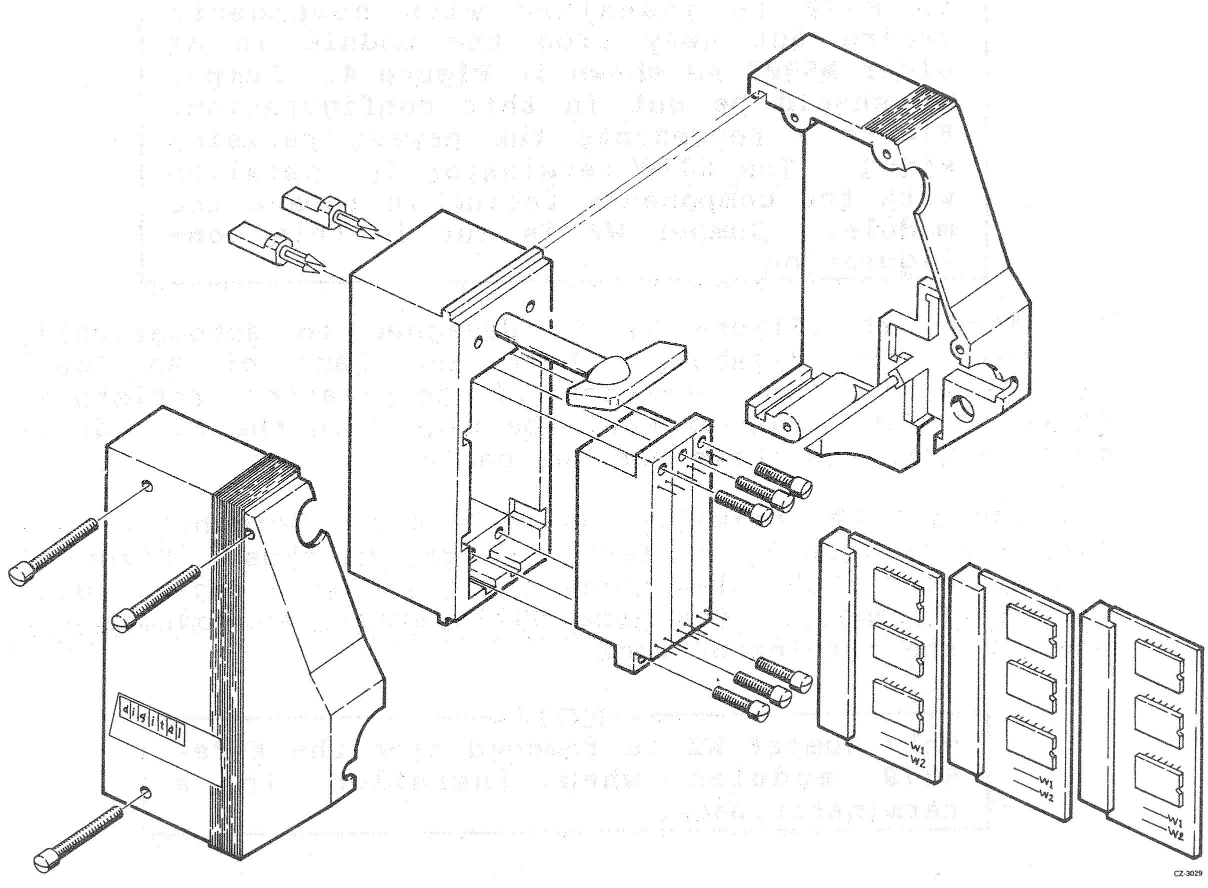


Figure 7 Terminator Pack Assembly (7009938)

Switch S1 on the M5903 (lower left corner of Figure 4) is used during troubleshooting of a hung device, preventing Massbus communications. The driver chips on the module are tristate logic. This means beside the normal highs and lows, the 75113 driver chip has a high-impedance "open" to comprise the third state. When switch S1 switch is placed in the Off position, the driver selects the "open" state and that drive appears nonexistent to the bus. This "open" state is also present when the drive is powered off. During normal operation, the drivers are in the "open" state except when gating signals onto the bus.

Figure 8 is a schematic of the M5904 transceiver module taken from the Field Maintenance print set. The module contains nine differential tristate drive chips (75113) and seven differential receiver chips (75107B). Each driver chip contains two drivers. Each receiver chip contains two receivers. On pin UU, a single-ended driver is used for the transmission of a Massbus power fail. The transmission line connected to the transceivers are bidirectional in that they can transmit information to and from the controller.

Figure 9 is a schematic of the M5903 transceiver module taken from the RS04 Field Maintenance print set.

Differential line driving/receiving is used on Massbus communications because any outside noise is generally picked up on both the inverted and noninverted signal lines. The differential receiver takes the difference between the signals regardless of the noise level, and the noise is effectively cancelled out.

Figure 10 illustrates a typical differential driver/receiver connection. The 75113 driver has a differential output. When the input pin 5 is high:

- Pin 2 is low (ground)
- Pin 4 is high (+2.5 volts)

When pin 5 is low:

- Pin 2 is high (+2.5 volts)
- Pin 4 is low (ground)

Pin 9 is the tristate control for the 75113. When pin 9 is low, pins 2 and 4 reflect a hi-impedance to the Massbus.

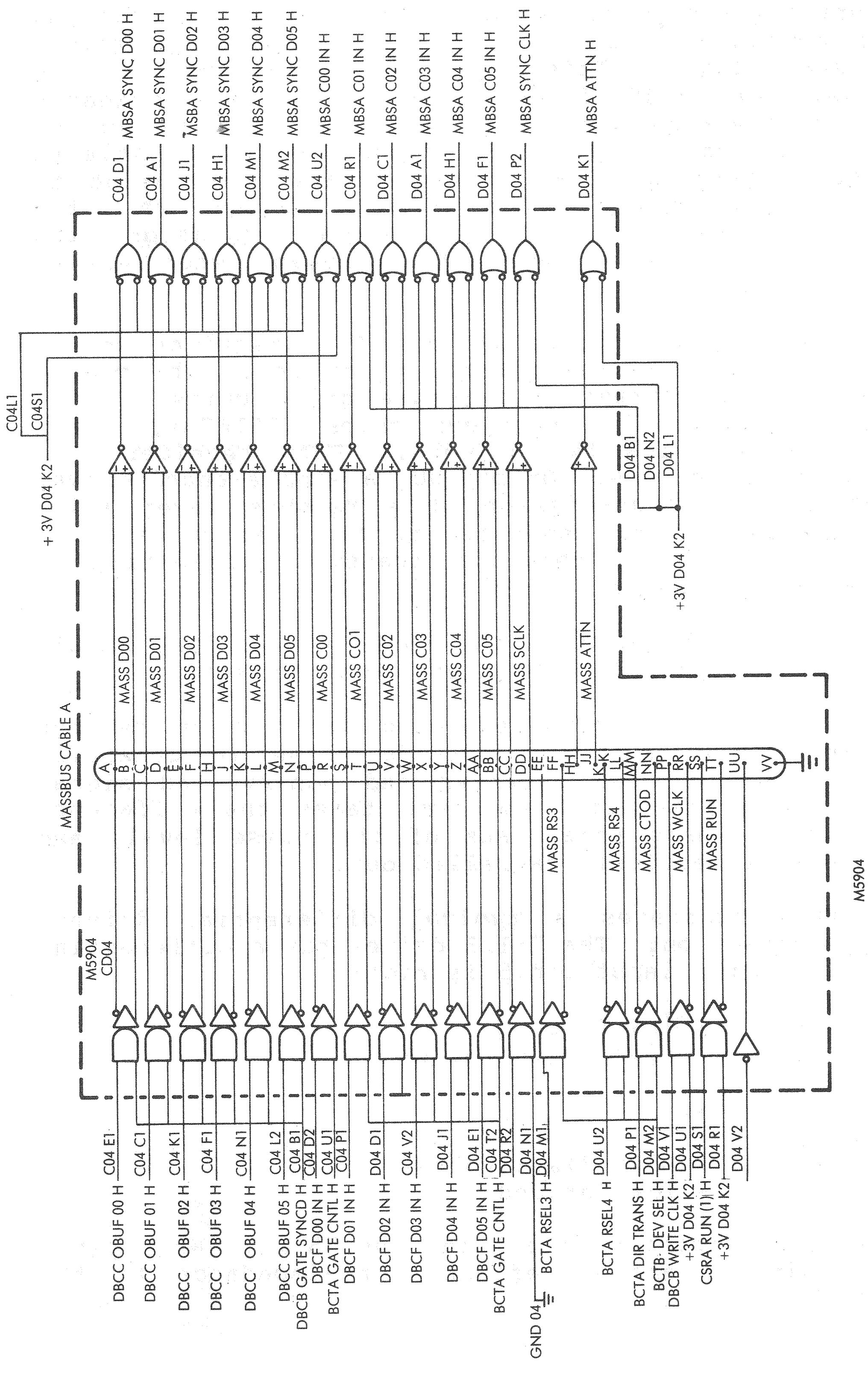


Figure 8 M5904 Transceiver Schematic

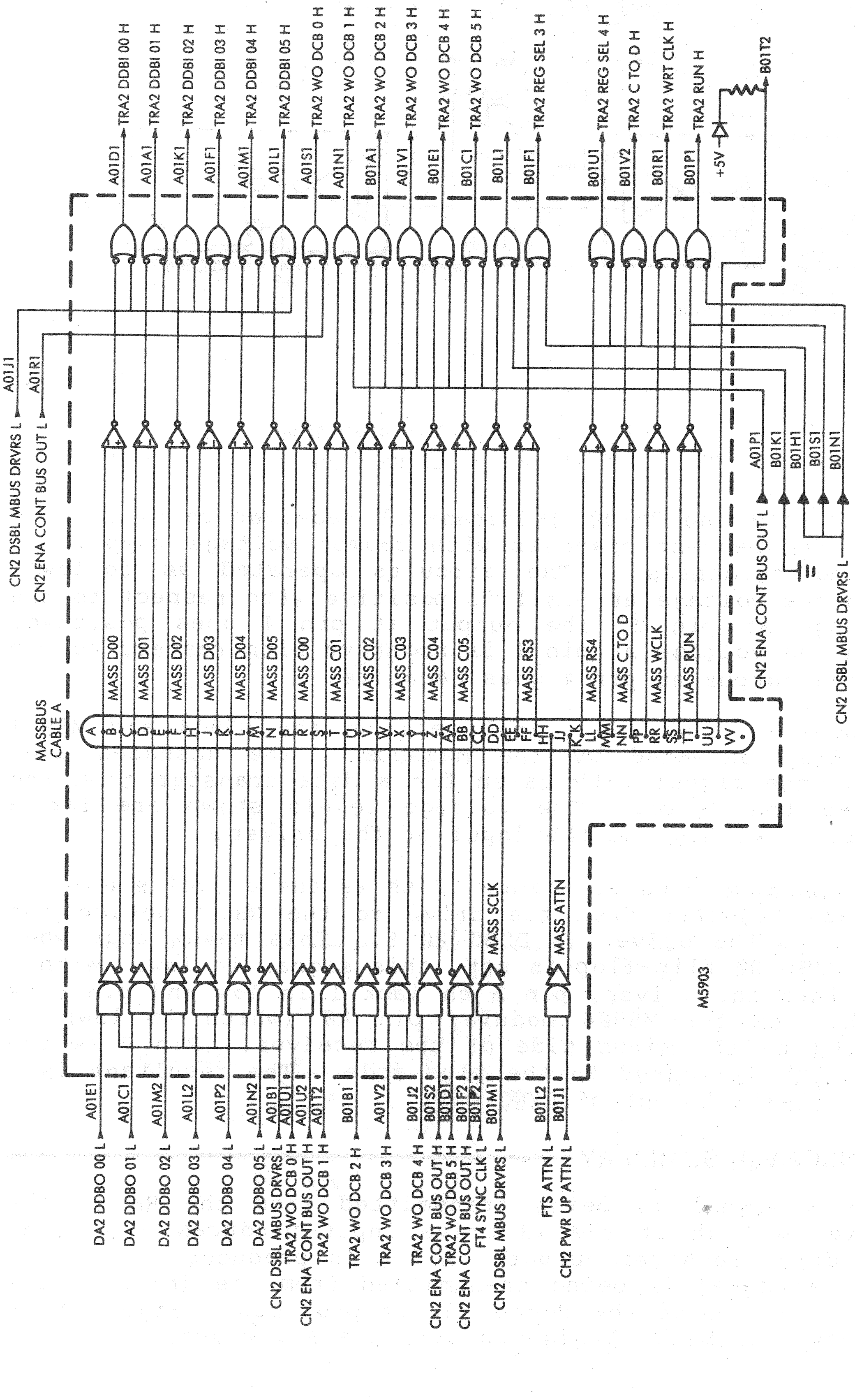


Figure 9 M5903 Transceiver Schematic

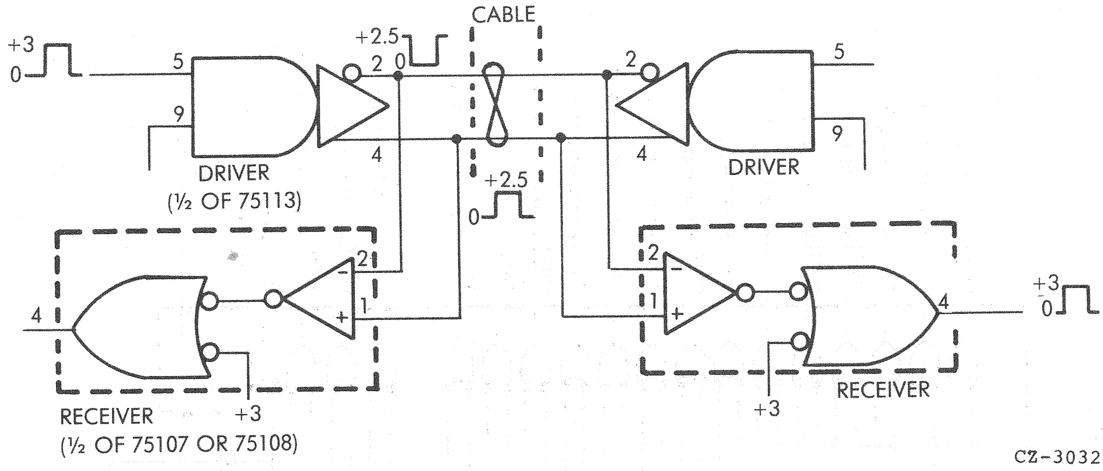


Figure 10 Typical Differential Driver/Receiver Connection

The 75107B and 75108 differential receiver chips feature dual independent channels with common voltage supply and ground terminals. The circuits operated as follows. When the voltage at pin 1 is positive with respect to the voltage at pin 2, the output at pin 4 goes positive. When the voltage at pin 1 is negative with respect to pin 2, the output at pin 4 goes negative.

Figure 11 shows one signal pair on the M5904 and M5903 modules connected by the Massbus. The unshaded area shows the signal path taken for a data transfer from the RH to the drive. The voltage levels shown are for a logic 1, or high at the input of the driver.

The unshaded area of Figure 12 shows the circuits used in a data transfer from the drive to the RH. Notice the input to the driver is DDBO 00 L. This means that when the DDBO 00 flip-flop is set, this signal is low. With a low into the driver, pin A on jack 1 is low and pin B is high. On the M5904 module, pin A0 (which is low) is routed to the minus side of the receiver. Pin B (which is high) is routed to the plus side. The resultant is a high (logic 1) out of SYNC D00.

TRANSCEIVER SUMMARY

When a signal is being transmitted from the RH to the drive, a high at the RH drive input produces a high at the drive receiver output. A low in produces a low out. When a signal is being transmitted from the drive to the RH, a low in at the device drive produces a high out at the RH receiver. A high in produces a low out.

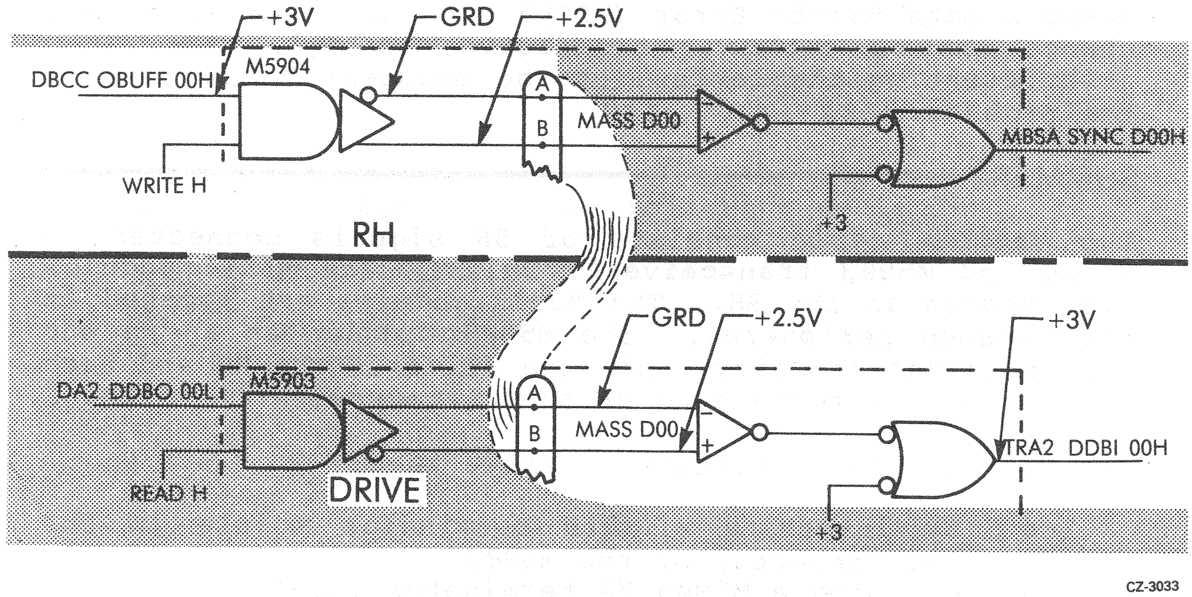


Figure 11 Data Transfer from RH to Drive

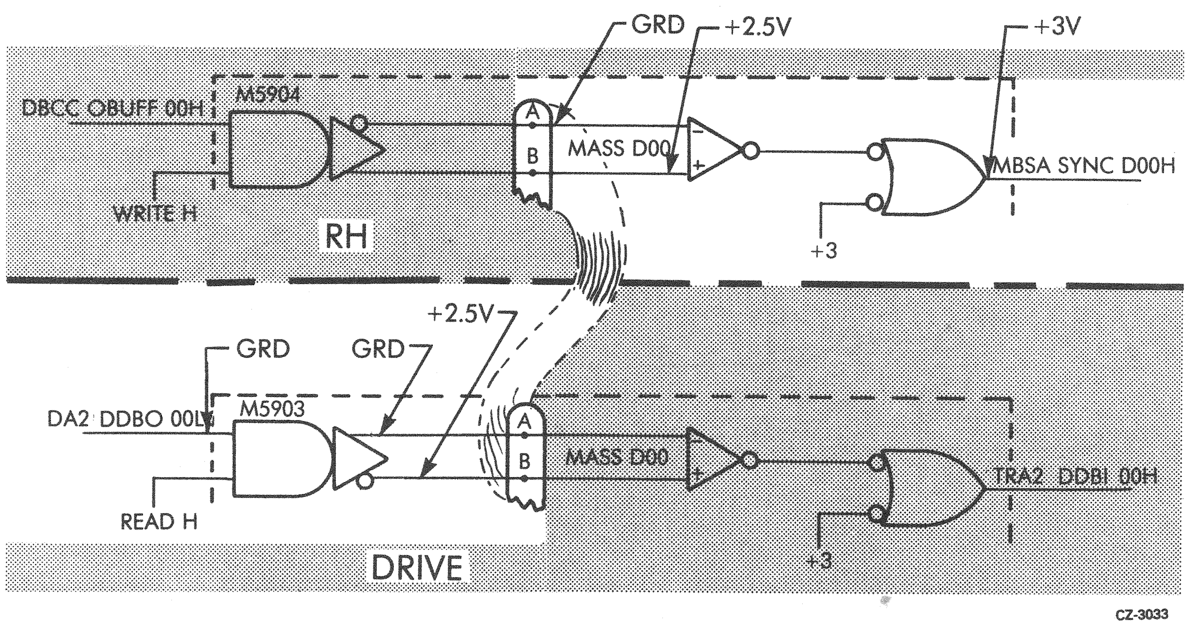


Figure 12 Data Transfer from Drive to RH

The transceiver cards and Massbus cables are high-failure items. If a Massbus Control Parity Error (MPCE) or Massbus Data Parity Error (MDPE) occurs, there is a good chance that a cable or transceiver is bad. Sometimes just reseating the cables (or the modules) takes care of the problem.

SUMMARY

The Massbus cable consists of 56 signals connected to M59Ø4 and M59Ø3 transceiver modules. The M59Ø4 modules are located in the RH. The M59Ø3 modules are located in the Massbus peripheral. The M59Ø3 module has an in and out connector to daisy-chain the drives. The RH and each drive contains three each of these transceiver modules.

The Massbus can be terminated three ways:

- By inserting a H87Ø terminator module in the out connector of the M59Ø3
- By using a M59Ø3 YA terminator module
- By using a 7Ø-Ø9938 Terminator Pack Assembly for the RP and RM Disk Drives.

A Massbus Data Parity Error or Massbus Control Parity Error is a good indication that a cable or transceiver is bad.

EXERCISES

Answer the following questions using any of your reference materials. Discuss any problems you have with another student or your course administrator. The solutions are on the next page.

1. Fill in the blanks in the following sentences.

   _______ transceiver modules are used in the RH.

   _______ transceiver modules are used in the drive.

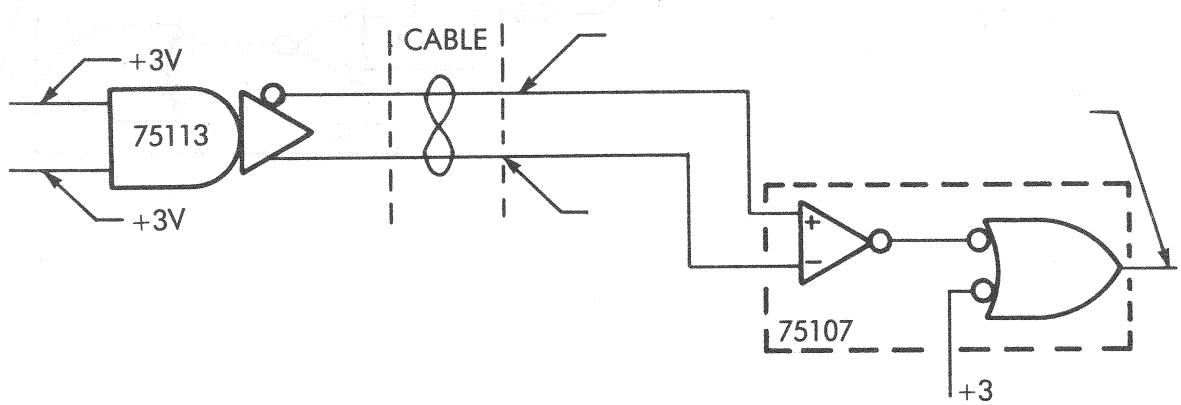
2. List three ways the Massbus is terminated.

   A.

   B.

   C.

3. Label the voltage levels on the following circuit.



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SOLUTIONS

1. M59Ø4

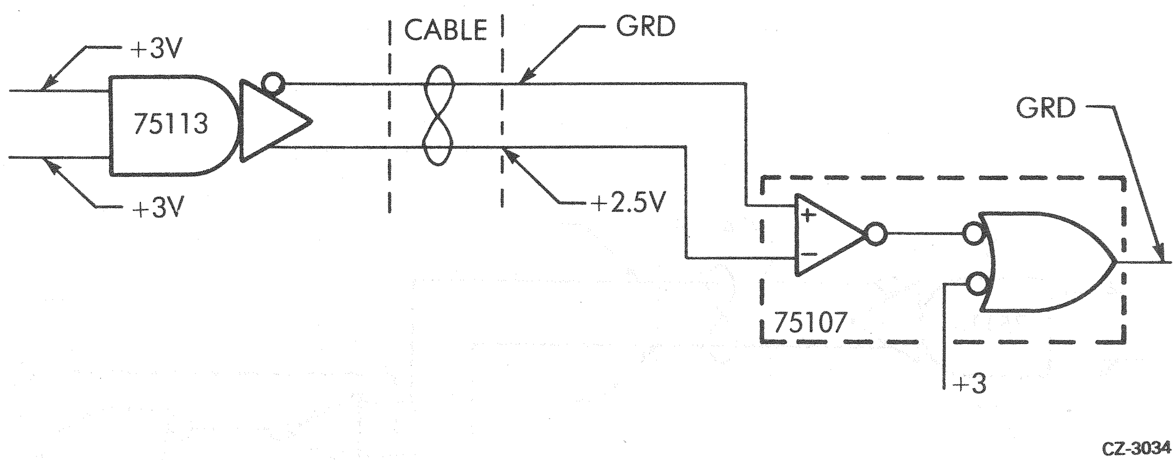
   M59Ø3

2. A. M59Ø3 YA modules.

   B. H87Ø terminator module installed in the out connector of the M59Ø3 modules.

   C. Terminator Pack (7Ø-Ø9938)

3. Voltage levels are shown:



RH11 Installation

RH11 INSTALLATION

INTRODUCTION

This module explains the installation procedures of the RH11 Controller. It will give you experience in identifying the jumpers, modules and the different cable configurations. After reading this module, you should find it easier to install an RH11.

This module is divided into three sections:

- Unibus A and Unibus B cabling and their respective terminators
- Power Fail configurations
- Jumper configurations.

Each peripheral has its own installation procedure described in the appropriate maintenance manual that should be used when performing installation.

OBJECTIVES

1. Given the installation procedures for the RH11 and component location drawings of

   - M93ØØ Unibus B terminator
   - M7295 Bus Control module
   - M7294 Data Buffer module,

   be able to draw in the appropriate jumpers as if installing these boards in a preconfigured system.

2. Given the installation procedure for the RH11, be able to answer essay questions relating to the installation. These questions deal with:

   - Power fail
   - Installation of modules
   - Massbus cabling

ADDITIONAL RESOURCES

RWSØ4 Maintenance Manual, Chapter 6

RWPØ4 Maintenance Manual, Chapter 7

RWPØ5/Ø6 Maintenance Manual, Chapter 7

TJU16 Maintenance Manual, Chapter 7

RH11 INSTALLATION

MECHANICAL

The RH11 Controller contains two hex-height modules, and therefore must be installed in a mounting box that accommodates hex-height modules. The modules are inserted in a double-system unit backplane which is installed in its mounting box with four thumbscrews. The double-system unit is oriented with the bus cable slots in line with the other options.

POWER CABLE CONNECTIONS

Power is distributed to the RH11 modules via two power cables that attach to the printed circuit backplane assembly by quick-disconnect tabs. (Refer to RH11 Wired Assembly Drawing D-AD-7009397-0-0.) The power cables have Mate-N-Lok connectors on one end, which connect to the power distribution panel. Quick-disconnect tabs on the other end of the power cables connect to the printed circuit backplane. The following list shows the color codes associated with the power harness connections.

Red	+5 Vdc
Black	Gnd
Blue	-15 Vdc
Gray	+15 Vdc
Violet	DC LO (+3 V to +5 V)
Yellow	AC LO (+3 V to +5 V)
Brown	LTC 8V peak-to-peak ac

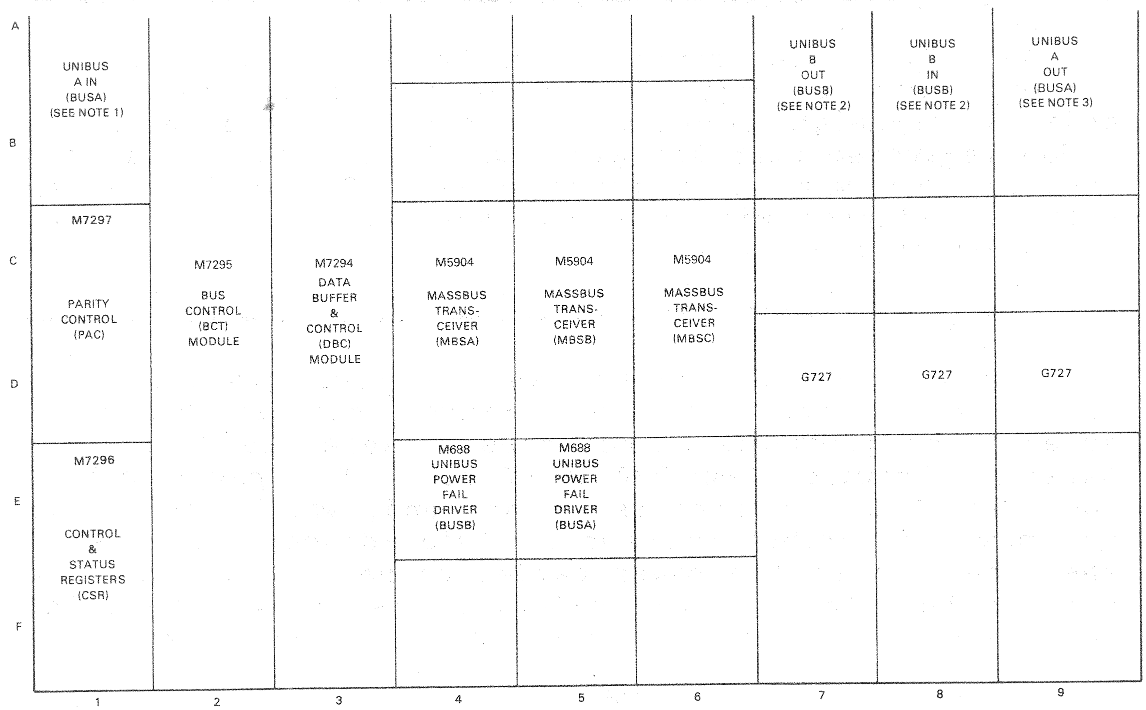
CAUTION!

When connecting the power cables to the backplane, ensure that backplane wires are not damaged. Also, do not cut AC LO and DC LO wires out of the power harness as they are used for power fail conditions on the Massbus and on both Unibus A and Unibus B ports.

After making the power connections, check for power shorts to ground with an ohmmeter. Ensure that all modules are firmly seated in the proper slots (Figure 1).

NOTE

Some print sets show slots C, D, E and F of rows 7, 8 and 9 as Small Peripheral Controller (SPC) slots. These are no longer recommended for use as they put too much drain on the +5 volt regulators. Ensure that Grant Continuity Cards (G727) are installed correctly in slot D of rows 7, 8 and 9.



NOTES:

1. MAY BE EITHER M920 (CONNECTION FROM ADJACENT DEVICE) OR BC11A CABLE (CONNECTION FROM ANOTHER BOX OR NON ADJACENT DEVICE).
2. MAY BE M9300 (TERMINATION AT BEGINNING OR END OF UNIBUS B) OR BC11A CABLE (CONNECTION TO OTHER BUS B DEVICES).
3. MAY BE M920 (CONNECTION TO ADJACENT DEVICE). M930 (TERMINATION AT END OF UNIBUS A) OR BC11A CABLE (CONNECTION TO NEXT BOX OR NON ADJACENT DEVICE).
4. G727 GRANT CONTINUITY MODULE(S) MUST BE INSERTED IN SLOTS D

CZ-3098

Figure 1 RH11 Module Slot Utilization (Pin Side)

Power up the cabinet and measure voltages in accordance with values listed in the color code list for power connections.

NOTE

> All incoming voltages must be correct, especially the -15 volts for the Silo chips. If the voltages are not correct, adjust the appropriate regulator in the cabinet power supply.

After this is done, turn the power off.

UNIBUS CABLE CONNECTIONS

The RH11 is a two-port Unibus device that is capable of accepting two Unibus cable systems, designated Unibus A and Unibus B.

Unibus A Connections - The Unibus A cable connects the RH11 to the processor controlling it. The Unibus A cable enters the RH11 via slot A1, B1 and connects to the next device via slot A9, B9. (Refer to Figure 2). Connections to slot A1, B1 are made via the BC11A Unibus cable if the RH11 is the first Unibus A device in the mounting box. Otherwise, connection to A1, B1 from the preceding device is made by an M920 Unibus Jumper module; the BC11A Cables used if the devices are not adjacent.

NOTE

If the RH11 Controller is the last device on Unibus A, install an M930 Unibus Terminator module in slot A9, B9.

Unibus B Connections - Unibus B connections are generally made in systems with multiport memories. When the Unibus B port of the RH11 is not used, an M9300 Terminator module with jumper W1 cut (refer to Figure 2 for jumper location) should be installed in slot A8, B8 to terminate Unibus B signals into the RH11 (Figure 3). In order to conserve power, the second M9300 Terminator module should not be used. If the Unibus B port of the RH11 is used, connections are determined on the basis of whether a processor is connected to Unibus B. These connections are described below.

a. Processor on Unibus B - If a processor is connected to Unibus B, it is electrically connected at the beginning of the bus. In this case, the M930 Terminator modules supplied with the processor are used for bus termination, and the two M9300 Unibus B Terminator modules supplied with the RH11 are not used.

NOTE

The M9300 Terminator may be used as a substitute for the M930 Terminator if the W1 jumper is cut.

The Unibus B cable connection to the RH11 is made via slot A8, B8 with a BC11A Cable. Connection from the RH11 to the next device is made via a BC11A Cable connected to slot A7, B7. If the RH11 is the last device on the bus, the M930 or M9300 Terminator is installed in slot A7, B7 instead of the BC11A Cable (Figure 4).

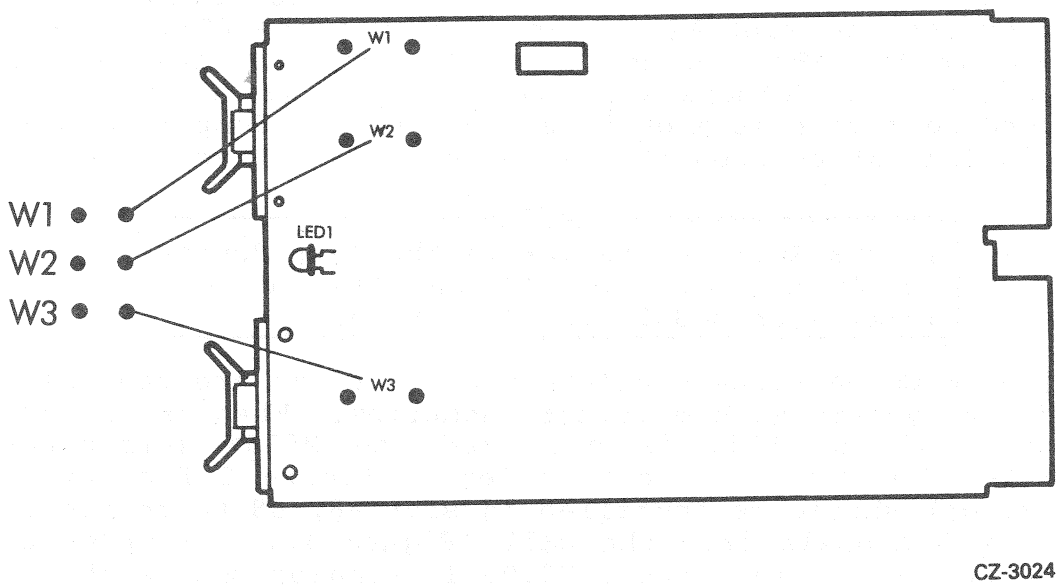


Figure 2 M9300 Unibus B Terminator Module

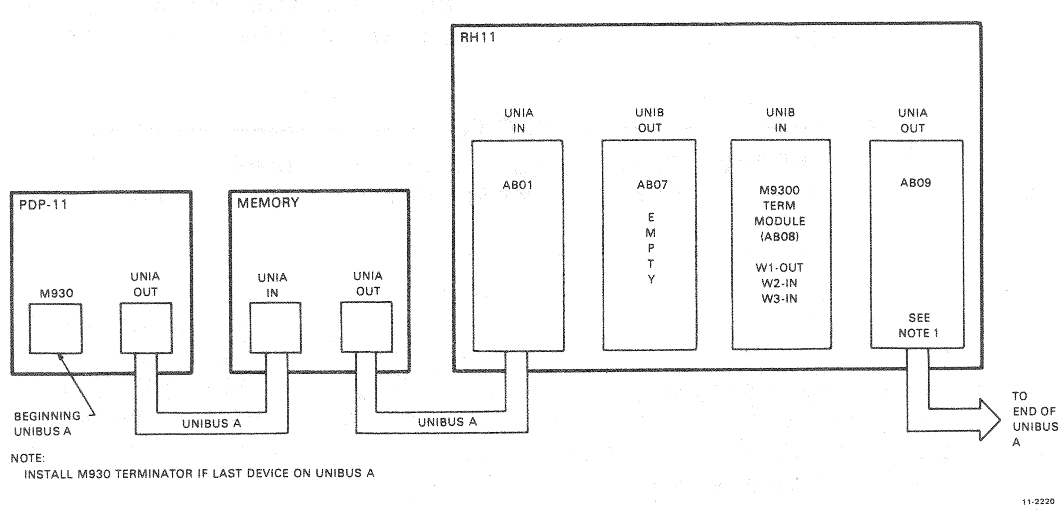


Figure 3 Single Port Unibus Configuration

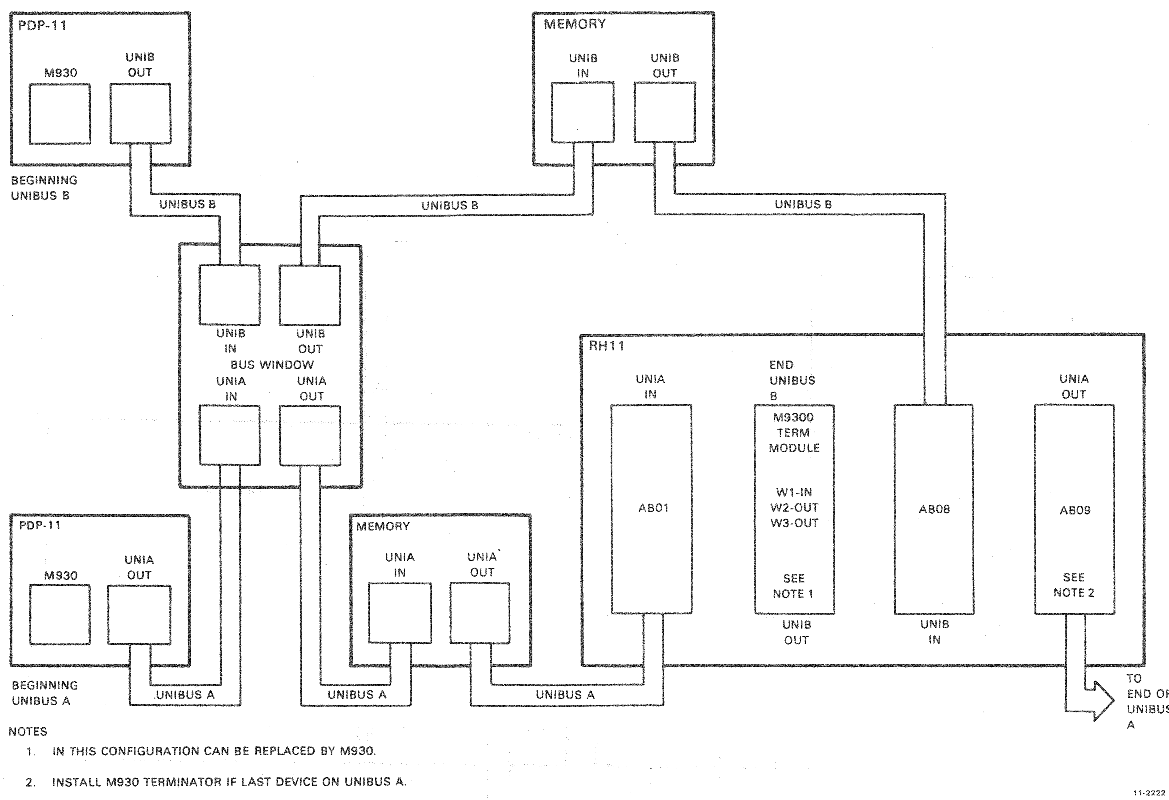


Figure 4 Dual Port Configuration with Memory and Processor on Unibus B

b. No processor on Unibus B - If no processor is connected to Unibus B such as in the case of an 11/45 with solid-state memory, an M9300 Unibus B Terminator must be selected as an NPR arbitrator. When using Unibus B, the RH11 is electrically connected at the beginning of the bus with the M9300 selected to act as an NPR arbitrator. One M9300 Unibus B Terminator module is placed in slot A8, B8 of the RH11. Jumper W1 on this module must be cut to enable the arbitration logic. Connection to other devices on Unibus B, such as memory, is made via a BC11A cable connected to slot A7, B7. The second M9300 Unibus B Terminator module is installed in the last device on Unibus B. Jumper W2 is removed for terminating the Unibus with no processor connected (Figure 5).

> **NOTE**
>
> **In this case, an M930 Terminator module can be substituted for the M9300 Unibus Terminator in the last device slot. If more than one RH11 is installed, the user may have extra M9300 modules as a result of a particular configuration.**

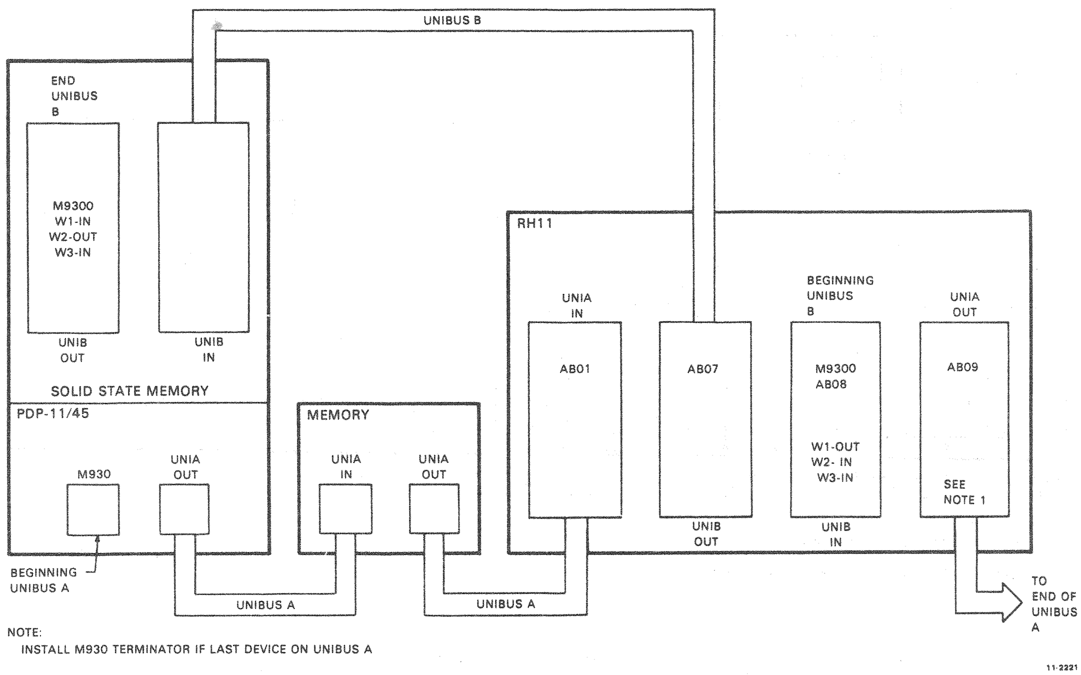


Figure 5 Dual Port Configuration with Memory on Unibus B

MASSBUS CABLES

Massbus connections to the RH11 are made via three 40-conductor ribbon cables. These cables plug into three M5904 Transceivers in the RH11 and are designated Massbus Cables A, B and C. the connections are made as shown below:

A to M5904 module in slot C4, D4.

B to M5904 module in slot C5, D5.

C to M5904 module in slot C6, D6.

The Massbus cables should be inserted per the individual cable markings. The colored edge of the Massbus cables should face the handle of the M5904.

AC LO, DC LO

AC LO and DC LO signals from the RH11 power supply must be connected to the RH11. The wires supplying these signals will not be cut from the power harness. There must be only one AC LO and one DC LO power fail connection to each Unibus for devices mounted in the same mounting box that share a power supply. Otherwise, power fail conditions would latch up due to positive feedback to the power fail logic. If a power fail connection for AC LO and DC LO is already made to a Unibus from a device in the same mounting box, the M688 Power Fail module in the RH11 for that Unibus is removed. The M688 module for Unibus A is in slot E5 and the M688 module for Unibus B is in slot E4. The following is a summary of power fail configuration rules.

1. For each mounting box, there is only one AC LO and one DC LO power fail connection to a Unibus from the power supply.

2. Power supply AC LO and DC LO must always be wired to each RH11 via the power harness.

3. Power fail signals may only be disconnected from a Unibus in an RH11 by removing the appropriate M688 Power Fail Driver module.

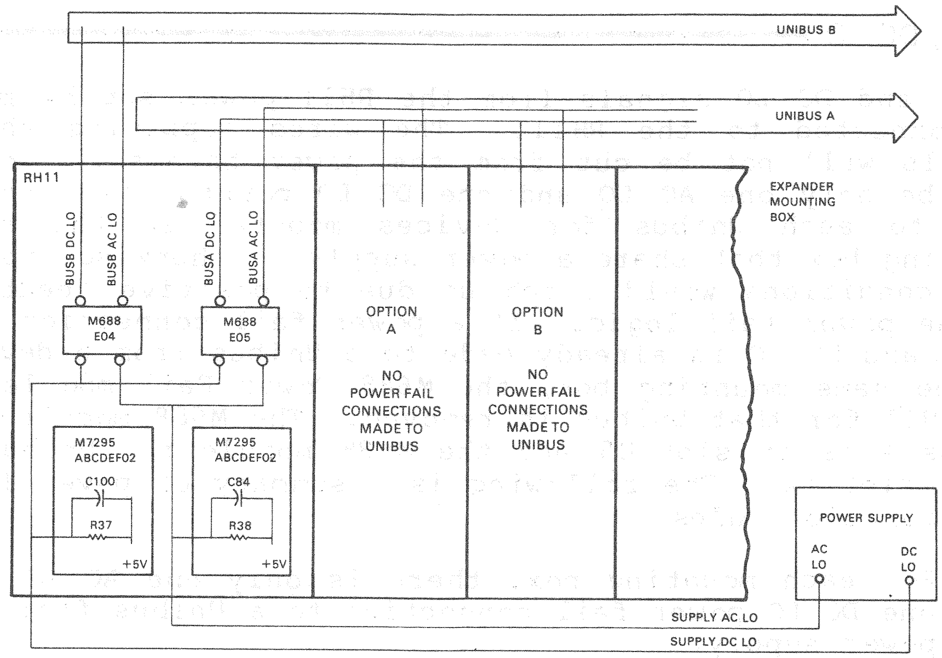
4. Power supply AC LO and DC LO should be disconnected from all other options mounted in the same box as the RH11 if they do not need those signals for internal operation.

Figure 6, 7 and 8 show three typical power fail configurations that follow these rules.

JUMPER CONFIGURATIONS

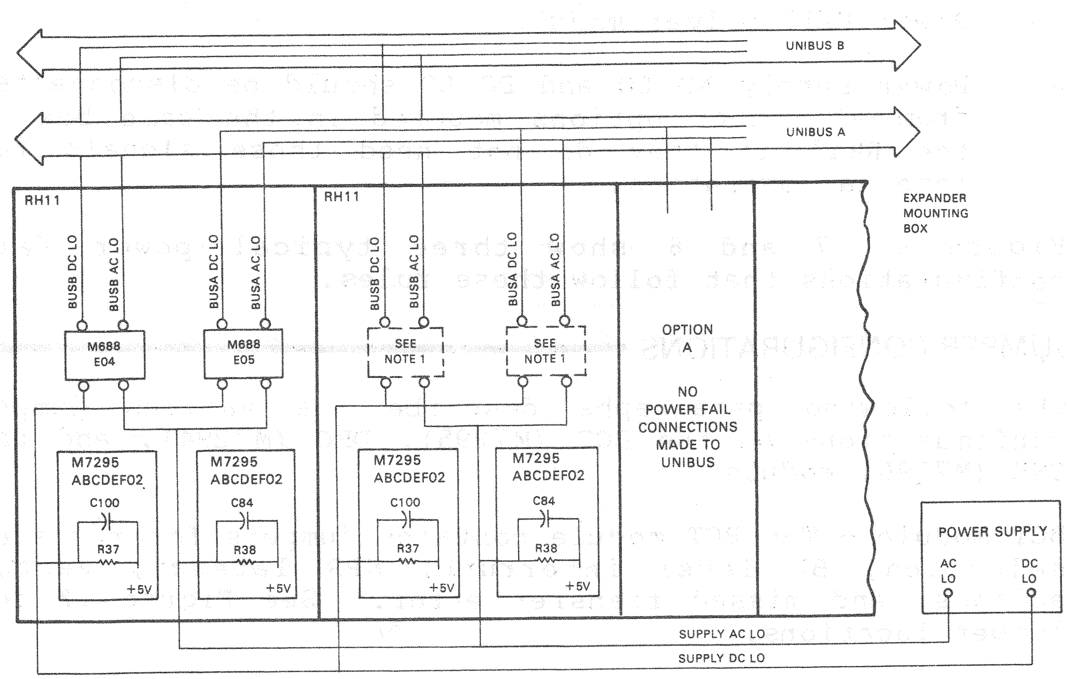
The following paragraphs describe the various jumper configurations on the BCT (M7295), DBC (M7294), and the CSR (M7296) modules.

BCT Module - The BCT module contains jumpers for register selection, BR level interrupt, NPR latency, vector address, and missed transfer error. See Figure 10 for jumper locations.



NOTE
ONE RH11 MOUNTED WITH OTHER OPTIONS IN AN EXPANDER MOUNTING BOX.

Figure 6 Typical Power Fail Configuration for RH11 and Options Mounted in Same Expander Box



NOTE 1:
DISCONNECT POWER FAIL SIGNALS FROM BUSA BY REMOVING M688 IN SLOT E05 B FROM BUSB BY REMOVING M688 IN SLOT E04

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Figure 7 Typical Power Fail Configuration for Two RH11s Mounted in Same Expander Box

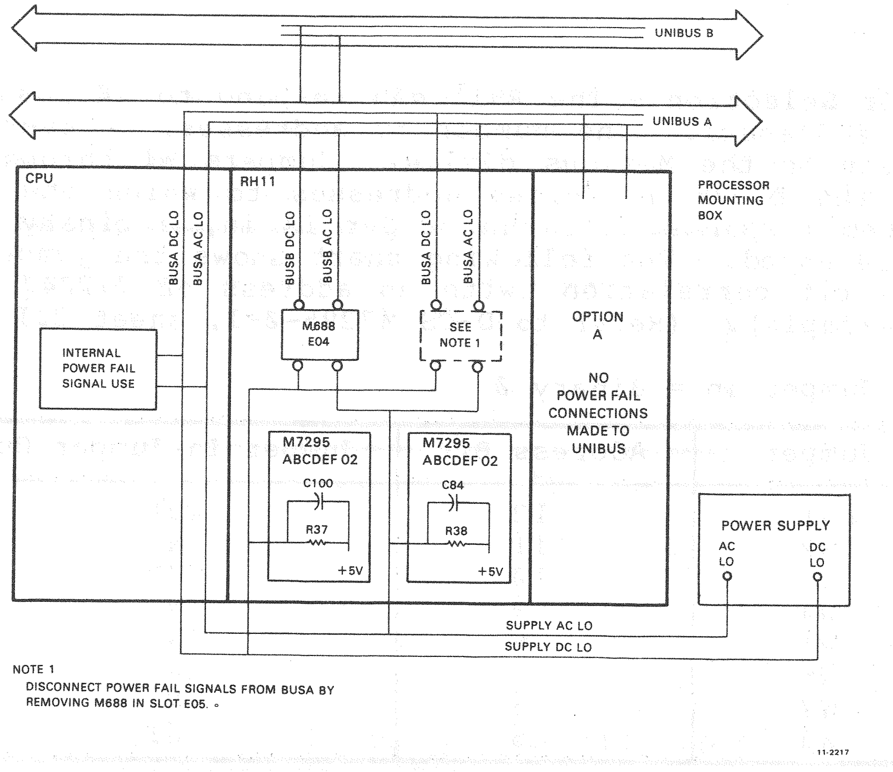

Figure 8 Typical Power Fail Configuration
For RH11 and CPU Mounted in Processor Box

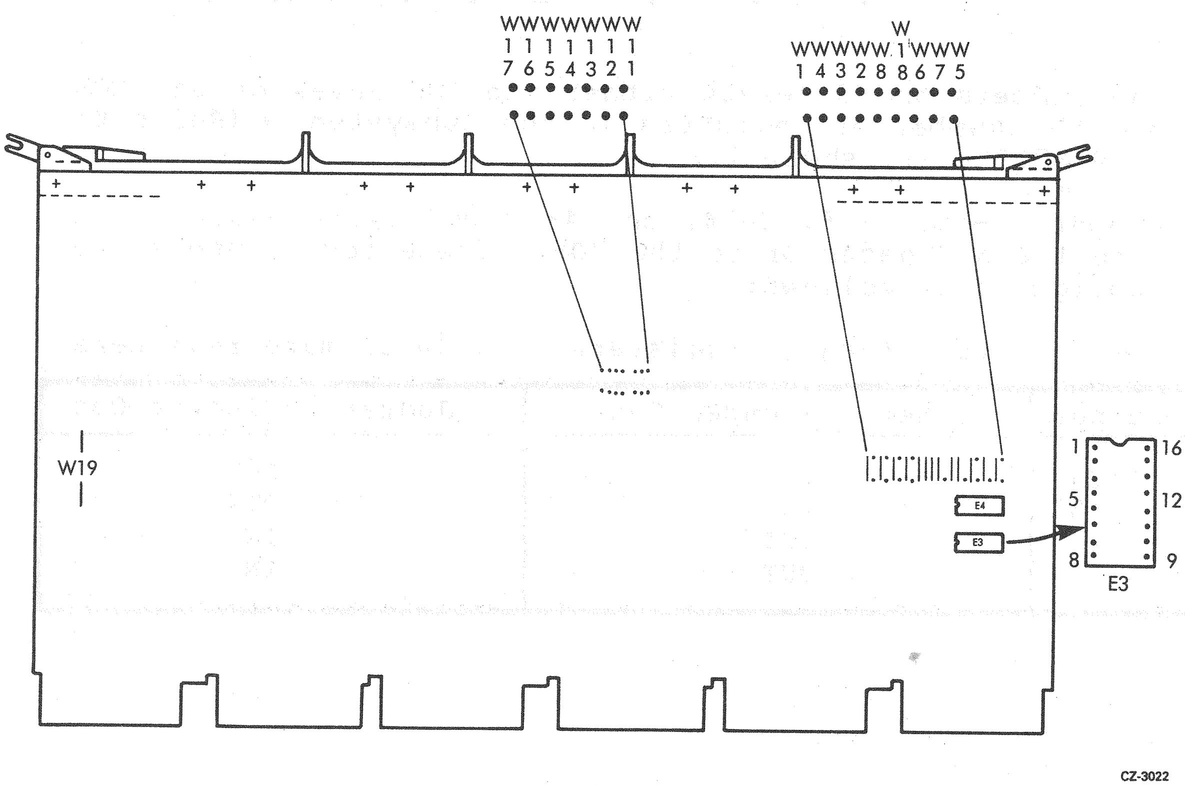

Figure 10 M7295 Bus Control Module

Register Selection - The RH11 can respond to 30 possible Unibus addresses. The number of addresses, however, is dependent on the Massbus device. Jumpers W1 through W8 select the block of Unibus addresses to which the RH11 subsystem responds. If the jumper is in, a binary zero is represented. The following chart shows the jumper to address bit correlation (with an address of 772040 used as an example). (Refer to D-CS-M7295-0-1, sheet 2.)

Jumper in = Binary 0

Jumper	Address Bit	Jumper In/Jumper Out
W1	12	OUT
W2	11	IN
W3	10	OUT
W4	9	IN
W5	8	IN
W6	7	IN
W7	6	IN
W8	5	OUT

Addr. Bit	17 16 15	14 13 12	11 10 9	8 7 6	5 4 3	2 1 0
	1 1 1	1 1 1	0 1 0	0 0 0	1 X X	X X X
	7	7	2	0	4 to 7	0 to 7

The jumpers on E3 select either the XOR gates or the ROM and the number of registers in the subsystem. (Refer to D-CS-M7295-0-1, sheet 2.)

Jumpers 1-16, 2-15, 3-14, and 4-13 configure address bit 5 to the XOR gates or to the ROM. These four jumpers are configured as follows:

	Less than 20 registers	20 or more registers
Jumper	Jumper In/Jumper Out	Jumper In/Jumper Out
1-16	IN	OUT
2-15	IN	OUT
3-14	OUT	IN
4-13	OUT	IN

Jumpers 5-12, 6-11, 7-10 and 8-9 select the number of registers in the subsystem. In the following example the jumpers are selected for 20 registers. The number in parentheses is the weighted decimal value of the jumper.

Jumper	Jumper In/Jumper Out
5-12 (2)	IN
6-11 (4)	OUT
7-10 (8)	IN
8-9 (16)	OUT
	20

BR Level Interrupt - The priority jumper plug for the RH11 is normally set for the BR5 level. This plug is located in E57. (Refer to D-CS-M7295-0-1, sheet 7)

NPR Latency - The BCT module contains special circuitry to improve NPR latency time for devices connected to the Unibus. This circuitry is enabled via jumper W18. When the jumper is left in, the NPR latency feature is enabled. The PDP-11/20 cannot use this special feature. (Refer to D-CS-M7295-0-1, sheet 7)

Vector Address Jumpers - The interrupt vector transferred to the processor is jumper-selectable via jumpers W11 through W17, representing vector bits 2 through 8, respectively. When a jumper is left in, a binary 1 is encoded. The following shows the jumper configuration for a vector address of 000204. (Refer to D-CS-M7295-0-1, sheet 7.)

Jumper	Vector Bits	Jumper In/Jumper Out
W11	V2	IN
W12	V3	OUT
W13	V4	OUT
W14	V5	OUT
W15	V6	OUT
W16	V7	IN
W17	V8	OUT

V8 V7 V6	V5 V4 V3	V2 V1 V0
0 1 0	0 0 0	1 0 0
2	0	4

MXF Jumper - Jumper W19 is removed to disable detection of MXF errors during special maintenance procedures. This jumper must be left in for normal operation. (Refer to D-CS-M7295-0-1, sheet 9.)

DBC MODULE

The DBC module contains jumpers for NPR cycle selection, Unibus parity, and start counter capacities. Refer to Figure 10 for jumper location.

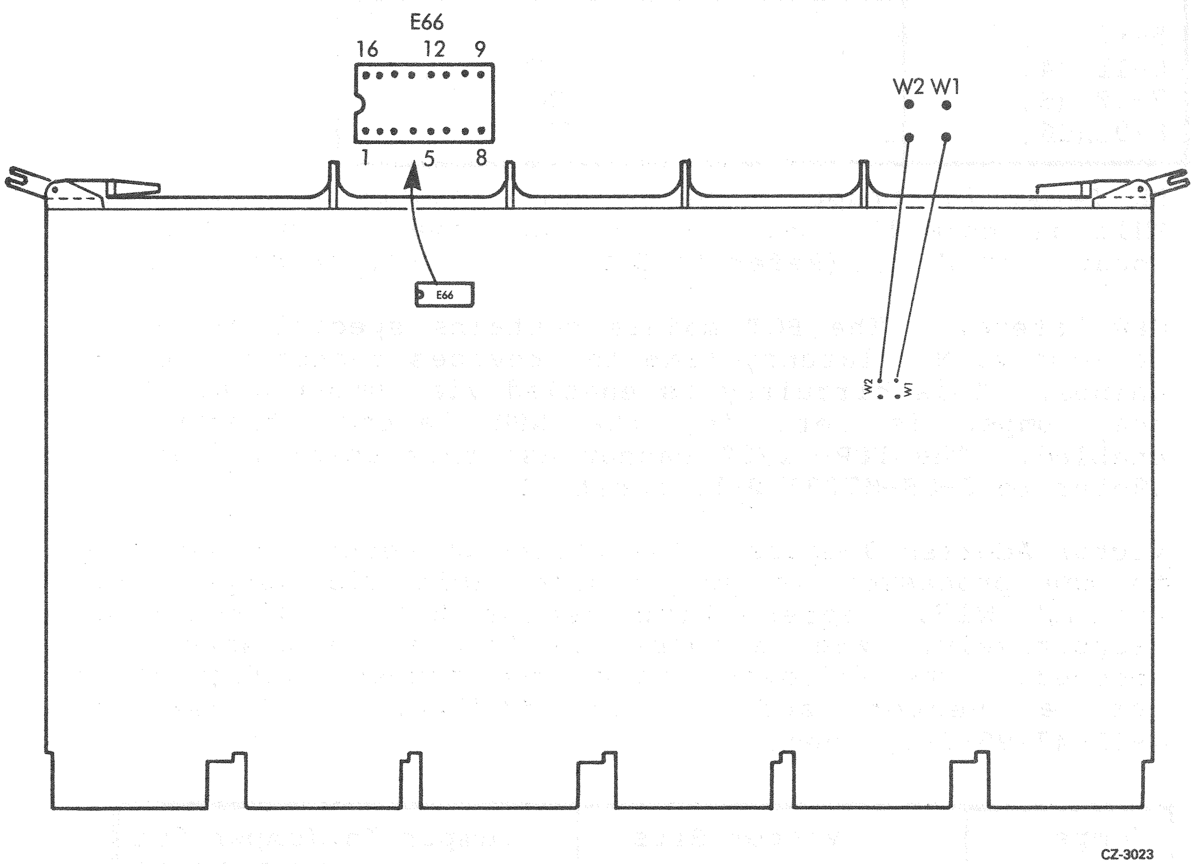

Figure 11 M7296 CSR Module

NPR Cycle Selection Jumpers - There are two jumpers used to select the type of cycle implemented during NPRs. Jumper E66 (3-14) selects the RH11 to perform one memory reference for each NPR request. This jumper is removed to allow back-to-back memory cycles to occur. (Refer to D-CS-M7294-0-1, sheet 2.)

Jumper E66 (2-15) takes advantage of dedicated Unibus B systems by allowing the RH11 to transfer complete consecutive blocks of data without giving up the Unibus. In a dedicated Unibus B system, the RH11 is used exclusively as a Unibus B master. To implement this feature (called "Bus Hog" mode), the one-cycle jumper [E66 (3-14)] and the Bus Hog Disable [E66 (2-15)] must be cut. (Refer to D-CS-M7294-0-1, sheet 2.)

Unibus Parity Jumpers - The RH11 can be selected for 16 data bit with 2 parity bits transfers or 18 data bit transfers. Unibus A and Unibus B can each be selected individually via jumpers W1 and W2. Jumper W1, if left in, allows parity error code detection on Unibus A when the RH11 is doing DATI operations. If jumper W1 is removed, the Unibus A PA and PB parity lines are used as data bits 16 and 17, respectively. Jumper W2 serves the same function for Unibus B as jumper W1 does for Unibus A. The jumpers are normally left in. (Refer to D-CS-M7294-Ø-1, sheet 8.)

Start Counter Jumpers - The capacity of the Silo is jumper-selectable. The available capacities are listed below. (Refer to D-CS-M7294-Ø-1, sheet 9.)

Jumper E66, Pins 1-16	Selects full capacity of 64 words
Jumper E66, Pins 5-12	Selects 32 words
Jumper E66, Pins 7-1Ø	Selects 16 words
No Jumper	Selects 1 word

NOTE

Only the jumper representing the desired Silo capacity should be connected. The other jumpers should be removed. Most subsystems use the 64-word jumper (E66, pins 1-16).

CSR MODULE

The CSR module has a jumper that allows for Unibus A selection only. The jumper is designated W1. (Figure 11 shows the location of W1.) The purpose of this jumper is to override the ability of the program to select Unibus B data transfers. With jumper W1 connected, only Unibus A operations are allowed. (Refer to D-CS-M7296-Ø-1, sheet 2.)

BUS GRANT MODULES

Bus Grant Continuity modules (G27) must be installed in slots D7, D8, and D9. These modules continue the Bus Grant signals to the next device on the Unibus.

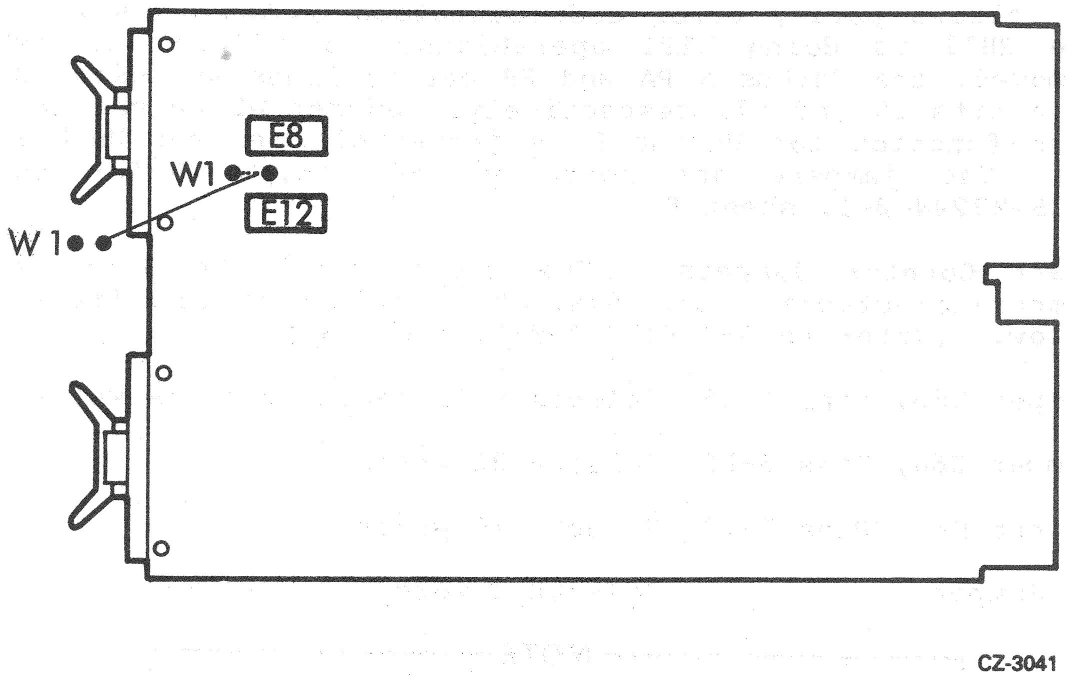

Figure 12 M7296 CSR Module

EXERCISES

Answer the following questions using any of your reference materials. Discuss any problems you have with another student or your course administrator. The solutions are on the next page.

1. All voltages should be correct, but which voltage is the most critical?

2. Name the slots in which the Unibus A cables are inserted.

3. Answer the following in regard to RH bus termination. Unibus B is not used in this example installation.

   A. Which jumper(s) is (are) cut on the M9300 Unibus B Terminator module?

   B. Into which slot is the Unibus B Terminator module installed?

4. Into which slot(s) is (are) the power fail module(s) (M688) installed in a RH11 that is mounted in the processor box?

5. Which jumpers are cut on the DBC module to set up the RH11 in Bus Hog mode?

SOLUTIONS

1. -15 volt DC

2. A1, B1

3. A. W1

   B. ABØ8

4. One M688 power fail module in slot EØ4

5. One-cycle jumper E66 pin 3-14
   Bus Hog Disable jumper E66 pin 2-15

RH70 Installation

RH70 INSTALLATION

INTRODUCTION

This module describes the installation procedures for the RH7Ø Controller. It is designed to give you experience in identifying the jumpers, modules, and cable configurations.

This module consists of two sections:

- Cabling for the RH7Ø
- Jumper configuration

Each peripheral has its own installation procedure (described in the appropriate maintenance manual) that should be used for installation. All installation procedures for RH7Øs are similar, except for jumper configurations.

OBJECTIVES

Given the installation procedures for the RH7Ø and the component location drawing for the M8153, be able to draw in the appropriate jumpers as if installing this module in a preconfigured system.

ADDITIONAL RESOURCES

RWPØ4 Maintenance Manual, Chapter 7

RWPØ5/Ø6 Maintenance Manual, Chapter 7

RMØ2/Ø3 User's Guide, Chapter 2

RMØ2/Ø3 Service Manual, Chapter 2

RH70 INSTALLATION

MECHANICAL

The RH7Ø consists of one hex-height module, three quad-height modules and three double-height modules (Massbus transceivers). These modules are installed in the appropriate slots in the 11/7Ø CPU backplane, as shown in the Module Utilization chart in Figure 1. The three Massbus cables are plugged into the double-height transceiver modules and jumpers are configured for the proper address and interrupt vector.

ELECTRICAL

The 11/7Ø CPU mounting box contains a wired backplane that runs the full depth of the box. The Unibus signals are prewired on the backplane. Power to the RH7Ø is provided by the cabinet power supply as follows:

- +5 V @ 18.5 A max
- -15 V @ Ø.5 A max

MODULE LOCATIONS

The 11/7Ø mounting box houses the:

- Floating Point Unit
- Central Processor
- Memory Management
- Unibus map
- Cache
- Five Small Peripheral Controller (SPC) slots
- KW11-L clock
- Up to four RH7Ø Controllers.

The location of the respective modules is shown in Figure 1.

MASSBUS CABLES

Massbus connections to the RH7Ø are made via three 4Ø-conductor ribbon cables. These cables plug into three M59Ø4 transceivers in the RH7Ø and are designated:

- Massbus Cable A
- Massbus Cable B
- Massbus Cable C.

The Massbus cables are marked and should be inserted with the edge-marking facing the module handles. Figure 1 shows the slot that the M59Ø4 modules are in for each of the four controllers.

Group	Slot	A	B	C	D	E	F	Controller
	01	FPMAINT	CPMAINT		KW11-L	M930		
FPU	02	M8114		FRN				
FPU	03	M8115		FRL				
FPU	04	M8112		FRM				
FPU	05	M8113		FXP				
CPU	06	M8130		DAP				
CPU	07	M8131		GRA				
CPU	08	M8132		IRC				
CPU	09	M8133		RAC				
CPU	10	M8134		PDR				
CPU	11	M8135		TMC				
CPU	12	M8136		UBC				
CPU	13			M8139		TIG		
MEM. MAN.	14	M8137		SAP				
MEM. MAN.	15	M8138		SSR				
MEM. MAN.	16	M8140		SCC				
CACHE	17	M8142		CCB				
CACHE	18	M8143		ADM				
CACHE	19							
CACHE	20	M8144		DTM				
MAP	21	M8145		CDP				
MAP	22	M8141		MAP				
	23							
MASSBUS	24	M8150		MDP				CNTLR A
MASSBUS	25	M5904	MBSA	M8151		CST		CNTLR A
MASSBUS	26	M5904	MBSB	M8152		AWR		CNTLR A
MASSBUS	27	M5904	MBSC	M8153		BCT		CNTLR A
MASSBUS	28	M8150		MDP				CNTLR B
MASSBUS	29	M5904	MBSA	M8151		CST		CNTLR B
MASSBUS	30	M5904	MBSB	M8152		AWR		CNTLR B
MASSBUS	31	M5904	MBSC	M8153		BCT		CNTLR B
MASSBUS	32	M8150		MDP				CNTLR C
MASSBUS	33	M5904	MBSA	M8151		CST		CNTLR C
MASSBUS	34	M5904	MBSB	M8152		AWR		CNTLR C
MASSBUS	35	M5904	MBSC	M8153		BCT		CNTLR C
MASSBUS	36	M8150		MDP				CNTLR D
MASSBUS	37	M5904	MBSA	M8151		CST		CNTLR D
MASSBUS	38	M5904	MBSB	M8152		AWR		CNTLR D
MASSBUS	39	M5904	MBSC	M8153		BCT		CNTLR D
SPC'S	40				SPC			
SPC'S	41				SPC			
SPC'S	42				SPC			
SPC'S	43				SPC			
SPC'S	44	UBUSOUT			SPC			

11-2942

Figure 1 Module Utilization Chart

JUMPER CONFIGURATIONS

The following paragraphs describe the various jumper configurations on the BCT (M8153) module and on the MDP (M815Ø) modules. Refer to Figure 2 for jumper location.

BCT Module (M8153) - The BCT module contains jumpers for register selection, BR level interrupts and vector addressing.

Register Selection - The RH7Ø is capable of responding to 32 possible Unibus addresses. The number of addresses, however, is dependent on the Massbus device. Jumpers W8 to W15 select the block of Unibus addresses that the subsystem responds to. If the jumper is in, a binary zero is represented. The following chart illustrates the jumper-to-address-bit relationship using an example address of 772Ø4Ø. (Refer to D-CS-M8153-Ø-1, sheet 2)

Jumper In = Binary Ø

Address Bit	Jumper	Jumper In/Jumper Out
12	W14	OUT
11	W1Ø	IN
1Ø	W9	OUT
9	W8	IN
8	W11	IN
7	W13	IN
6	W15	IN
5	W12	OUT

ADDRESS BIT	17	16	15	14	13	12	11	1Ø	9	8	7	6	5	4	3	2	1	Ø
	1	1	1	1	1	1	Ø	1	Ø	Ø	Ø	Ø	1	X	X	X	X	X
		7			7			2			Ø			4 to 7			Ø to 7	

The jumpers in location E41 (D-CS-M8153-Ø-1, sheet 2) select either the XOR gates or the ROM and the number of registers in the subsystem minus two. For example, there are 14 registers in the RWSØ4 subsystem, so the jumpers are selected for a weighted value of 14 - 2 or 12.

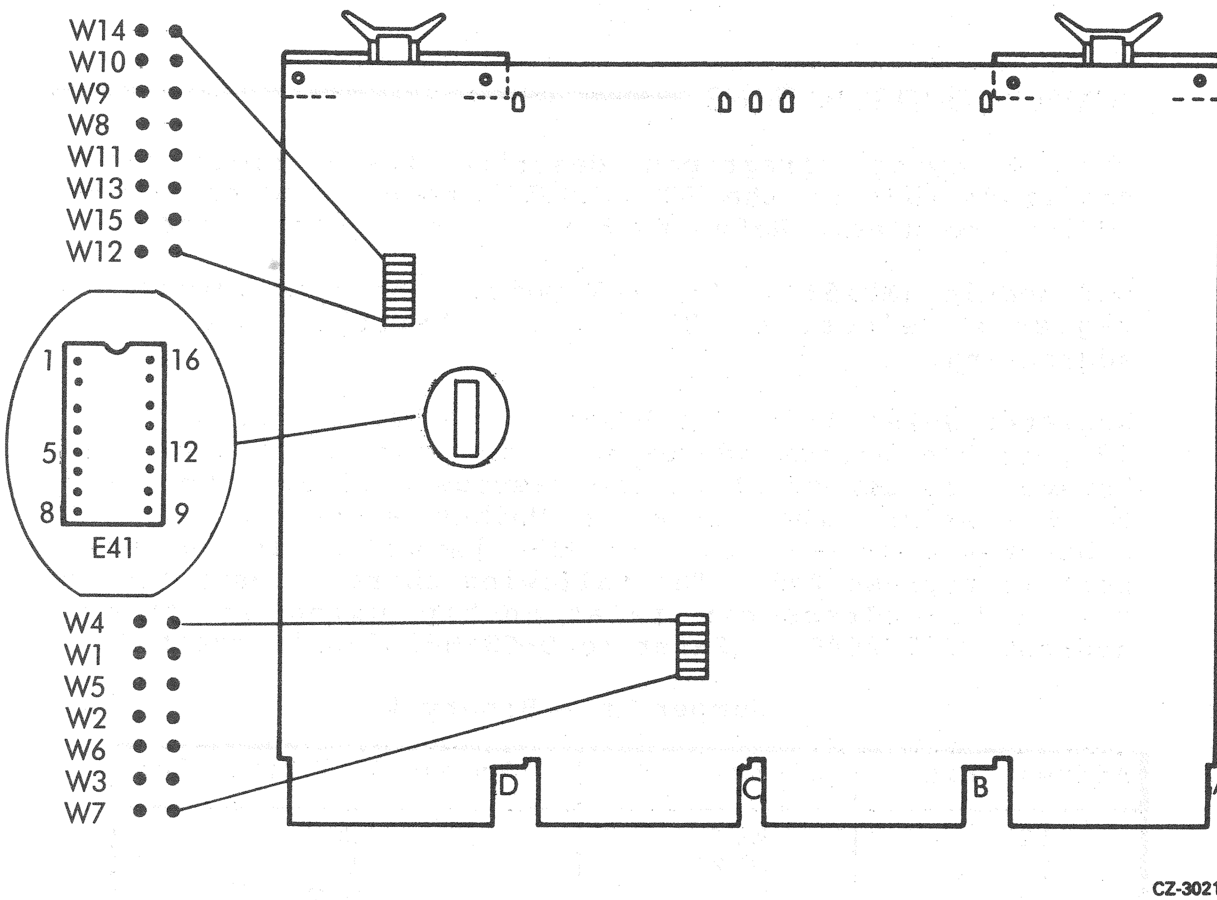

Figure 2 M8153 Unibus Control Module

Jumpers 1-16, 2-15, 3-14, and 4-13 configure address bit 5 to the XOR gates or to the ROM. These four jumpers are configured as follows:

Jumper	Less than 20 registers Jumper In/Jumper Out	20 or more registers Jumper In/Jumper Out
1-16	IN	OUT
2-15	IN	OUT
3-14	OUT	IN
4-13	OUT	IN

Jumper 5-12, 6-11, 7-10, and 8-9 select the number of registers in the subsystem minus two. In the following example the jumpers are selected for 12 registers. The number in parentheses is the weighted value of the jumper.

Jumper	Jumper In/Jumper Out
5-12(2)	IN
6-11(4)	OUT
7-10(8)	OUT
8-9(16)	IN

12

Vector Address Jumpers - The interrupt vector transferred to the processor is jumper selectable via jumpers W1 - W7, representing vector bits 2-8, respectively. When a jumper is left in, a binary 1 is encoded. The following shows the jumper configuration for a vector address of ØØØ2Ø4. (Refer to D-CS-M8153-Ø-1, sheet 4)

Jumper	Vector Bits	Jumper In/Jumper Out
W7	V2	IN
W3	V3	OUT
W6	V4	OUT
W2	V5	OUT
W5	V6	OUT
W1	V7	IN
W4	V8	OUT

V8 V7 V6	V5 V4 V3	V2 V1 VØ
Ø 1 Ø	Ø Ø Ø	1 Ø Ø
2	Ø	4

BR Level Interrupt - The priority jumper plug for the RH7Ø is normally set for the BR5 level. This plug is located in E22 (refer to D-CS-M8153-Ø-1, sheet 4 Øf 6).

MDP Module (M815Ø) - The MDP module contains jumpers which allow maintenance personnel to disconnect wired-OR connections from the Exclusive-OR network used to detect Write Check errors. These jumpers are designated W1 - W4 and are shown on D-CS-M815Ø-Ø-1, sheet 6 of 9. The jumpers provide maintenance personnel with a method of isolating a faulty output (stuck low) of the wired-OR bus to one of four Integrated Circuit (IC) chips, which perform the Exclusive-OR function during Write Check operations.

LIGHT-EMITTING DIODES

The following light-emitting diodes (LEDs) are incorporated in the RH7Ø Massbus Controller logic BCT module (see Figure 3) on the M8153.

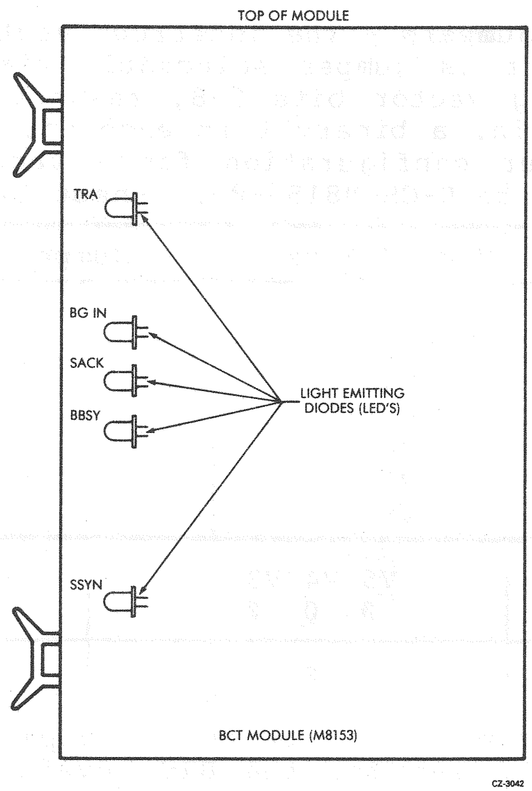

Figure 3 LED Physical Locations

Transfer (TRA) D-CS-M8153-Ø-1, sheet 3 of 6

Bus Grant In (BG IN) D-CS-M8153-Ø-1, sheet 4 of 6

Selection Acknowledge (SACK) D-CS-M8153-Ø-1, sheet 4 of 6

Bus Busy (BBSY) D-CS-M8153-Ø-1, sheet 4 of 6

Slave Sync (SSYN) D-CS-M8153-Ø-1, sheet 3 of 6

These LEDs are provide to aid maintenance personnel in isolating system faults as described below:

1. Unibus on PDP-11/7Ø is in "hung" condition (no operations can be performed on Unibus).

   This condition may be caused by:

   a. Stuck SACK
   b. Stuck BBSY
   c. Stuck SSYN

2. Unibus device interrupt sequence not functioning properly (processor continuously loops in service routine and fails to execute instructions).

   This condition is caused by discontinuity of the Bus Grant signal on the Unibus from the processor to the device interrupting. This may be caused by missing Grant continuity cards or defective circuitry, which normally passes Grant signals from device to device. This will cause the BG IN LED to illuminate. If this LED is brightly illuminated, this indicates that the Unibus BG IN signal coming to that device is stuck high.

3. Processor attempts to read or write a remote register in the RWP04 subsystem and receives an address error indication on the console (CPU traps to location 4).

   This condition may be caused by a stuck TRA signal on the Massbus which prevents the SSYN response from the RH70. Determination of this condition may be made if local registers in the RH70 can be successfully accessed. If no register responds, the address jumpers may be improperly selected.

EXERCISES

Answer the following questions using any of your reference materials. Discuss any problems you have with another student or your course administrator. The solutions are on the next page.

1. The PDP-11/7Ø backplane is prewired to accept up to ______ RH7Øs.

2. The Massbus cables should be inserted with the edge-marking facing/facing away from the module handles.

3. ______________________ is used to terminate the RWPØ4 Massbus Cable.

4. Which group of jumpers determines register selection on the BCT module?

5. Which group of jumpers determines the vector address on the BCT module?

SOLUTIONS

1. The PDP-11/7Ø backplane is prewired to accept up to ___4___ RH7Øs.

2. The Massbus cables are marked and should be inserted with the edge-marking ___facing___ the module handles.

3. Terminator Pack Assembly 7ØØ9938 is used to terminate the RWPØ4 Massbus Cable.

4. W8 - W15

5. W1 - W7

EDUCATIONAL SERVICES