CMR11/CMV11
Distributed Multiprocess Controller

Pocket Service Guide

digital
CMR11/CMV11
Distributed
Multiprocess
Controller

Pocket
Service
Guide

Prepared by Educational Services
of
Digital Equipment Corporation
CONTENTS

PREFACE

1 INTRODUCTION
1.1 General ................................................................. 1
1.2 Physical/Functional Description ................................. 1
1.2.1 CMR11 Host Controller Component Summary ............. 1
1.2.2 CMR01 Remote Unit Component Summary .................. 4
1.2.3 Specifications ....................................................... 5

2 BOARD CONFIGURATIONS
2.1 General ......................................................................... 9
2.2 CMR11/CMV11 Reference Documentation ...................... 9
2.3 CMR11/CMV11 Components List ..................................... 9
2.4 I/O Control Modules/ Terminators ............................... 12
2.5 CMR11/CMV11 Power/Bus Loading .................................. 12
2.6 Configuration Variables ............................................... 15
2.6.1 CMR11/CMV11 Host Considerations ......................... 15
2.6.2 CMR01 Remote Unit Considerations .......................... 17
2.7 Installation Checkout ................................................... 25
2.8 Cabling and Test Connectors ......................................... 25

3 TEST AND CALIBRATION
3.1 Introduction ............................................................... 35
3.2 Diagnostic Summary .................................................... 35
3.3 Test Descriptions ........................................................ 37
3.3.1 Sub-Test 1 ........................................................... 37
3.3.2 Sub-Test 2 ........................................................... 37
3.3.3 Sub-Test 3 ........................................................... 38
3.4 CMR11/CMV11 Host Controller Checkout ..................... 40
3.5 CMR01 Remote Checkout Procedures ........................... 40
3.5.1 Maintenance Display Panel ....................................... 40
### CONTENTS

3.5.2 CMR01 Basic Test
   Procedure ........................................... 46
3.5.3 CMR01 Remote I/O
   Controller Test
   Procedure ........................................... 49
3.5.4 CMR01 Communications
   Line Adjustments .................................... 77

4 CORRECTIVE MAINTENANCE

4.1 General ............................................. 83
4.2 Maintenance Features ................................ 83
4.3 Register Bit Assignments ............................. 88
4.4 Tech-Tips/FCO Index ................................ 88

### FIGURES

1-1 CMR11/CMV11 Basic Host
   Controller Diagram .................................. 3
1-2 CMR01 Remote Basic Diagram ........................ 7
2-1 CMR11 (M8990) Device
   Address/Host Baud Rate
   Selection ............................................ 18
2-2 CMR11 (M8990) Vector
   Address Selection ................................... 19
2-3 CMV11 (M7181) Device
   Address/Host Baud Rate
   Selection (Ports 0-1) ................................ 20
2-4 CMV11 (M7181) Vector
   Address Selection ................................... 21
2-5 CMV11 Host Baud Rate
   Selection (Ports 2-3) ................................. 22
2-6 Host LDM (M8996) Modem
   Variables ............................................. 23
2-7 Remote (M9053)
   Configuration Variables ............................. 24
2-8 CMR11/CMV11 Installation
   Flowchart ............................................. 26
2-9 CMR01 Installation
   Flowchart ............................................. 29
2-10 CMR11/CMV11 Cabling
    Diagram/Test Connector
    Placement ............................................. 31
2-11 CMR11/CMV11 Cables ................................ 32
2-12 CMR11/CMV11 Test
    Connectors .......................................... 33
3-1 (C)ZCMJ Test 1 Sample Printout ........................................... 37
3-2 (C)ZCMJ Test 2 Sample Printout ........................................... 38
3-3 (C)ZCMJ Test 3 Sample Printout (No Status Changes) ....................... 39
3-4 (C)ZCMJ Test 3 Sample Printout (with Status Changes) ....................... 39
3-5 CMR11/CMV11 Checkout Procedures ........................................... 41
3-6 CMR01 Maintenance/Display Panel ........................................... 43
3-7 Basic CMR01 Test Procedure ........................................... 46
3-8 CMR01 Remote Unit LED Legend ........................................... 48
3-9 M8995 Switch Locations ........................................... 49
3-10 G5153 Digital I/O Pulse, Count Test Module ........................................... 50
3-11 CMRT1-11 Signal Conditioning Paddleboard (M9052) ............................... 51
3-12 BC08R Test Interconnect ........................................... 52
3-13 A908 Analog I/O Test Module ........................................... 52
3-14 A805 Test Configuration ........................................... 54
3-15 A805 Checkout Procedure ........................................... 55
3-16 A805 Calibration Procedure ........................................... 59
3-17 A805 Adjustments ........................................... 62
3-18 A6005 Test Configuration ........................................... 63
3-19 A6005 Checkout Procedure ........................................... 64
3-20 A6005 Calibration Procedures ........................................... 67
3-21 A6005 Adjustments ........................................... 68
3-22 A1004/A1005 Checkout Procedure ........................................... 69
3-23 M8986, M8987, or M8994 Checkout Procedures ........................................... 73
3-24 M8993 Checkout Procedure ........................................... 75
3-25 M8997 Checkout Procedure ........................................... 78
3-26 CMR01 Communications Line Adjustments ........................................... 80
4-1 CMR11/CMV11 Troubleshooting Flowchart ........................................... 86
4-2 CMR11/CMV11 Register Bit Assignments ........................................... 88
## TABLES

2-1 CMR11/CMV11 Components List .......................................................... 10
2-2 CMR01 Components List ................................................................. 11
2-3 Optional I/O Module List ............................................................... 13
2-4 CMR/CMV11 Module Input Voltage Chart ...................................... 14
2-5 CMR01 Remote Unit Voltage Chart .................................................. 15
2-6 CMR01 Optional Module Voltage Chart .......................................... 16
3-1 CMR11 Error Codes ......................................................................... 44
3-2 Valid Test Results ............................................................................ 72
3-3 M8993 Test Results ........................................................................ 77
PREFACE

The CMR11/CMV11 Distributed Multiprocess Controller Pocket Service Guide provides field service engineers with a quick-reference guide to help troubleshoot and maintain the CMR11/CMV11 controller to a field replaceable unit (FRU).

Additional information may be found in the reference documents listed below:

- CMR11 Systems Option Description (YC-C318C-00)
- CMR11 Product Description (YC-AB09-00)
- CMR11 Engineering Drawings (MP-01287-00)
- CMV11 Engineering Drawings (MP-01288-00)
1 INTRODUCTION

1.1 GENERAL

The Compact Micro Remote (CMR11/CMV11) system is a distributed multiprocess control device that controls and monitors a variety of I/O functions from one PDP-11 host computer system.

The CMR11/CMV11 uses a microprocessor-based controller at the host that is capable of distributed processing over multipoint communications facilities. Up to 252 EIA RS-232-C interface remote units or 64 limited distance modem (LDM) remote units can be controlled by the host controller. The remote units are standalone, firmware-based devices capable of controlling and monitoring 16 different I/O modules.

1.2 PHYSICAL/FUNCTIONAL DESCRIPTION

Hardware for the CMR11/CMV11 system is logically separated into two distinctive sections:

1. The CMR11/CMV11 host controller, and
2. The CMR01 remote unit.

A brief description of each is provided in the following sections.

1.2.1 CMR11 Host Controller Component Summary

The CMR11/CMV11 host controller, physically located at the site of the CPU, consists of the following three basic components:

- Host controller microprocessor
  - CMR11-AA - A single hex-height module (M8990) that mounts in any SPC UNIBUS slot.
  - CMV11-AA - Two dual-height modules (M7181 and M7182) that mount in any LSI-11 Q-BUS slot.
2 INTRODUCTION

- Communication panel assembly
  - CMR11-01 panel assembly – Includes one LDM module (M8996). Has three additional locations for add-on M8996 modules. Also includes 2C-HY38A-06 cable assembly.

- Add-on module
  - CMR11-02 – Includes one add-on LDM (M8996) module and 2C-HY38A-06 cable assembly.

The host controller module interfaces the UNIBUS or Q-BUS to the M8996 LDM. The LDM in turn provides the signal conversion necessary for interfacing to the network. Figure 1-1 is a basic diagram of the host controller configuration.

Three communication configurations are possible:

1. EIA RS-232-C using modems,
2. CMR on-board limited distance modem, or
3. A combination of both.

Typical network schemes are:

- Single or multiple CMR remotes with LDMs (located adjacent to the host or distributed throughout a building) operating over 2-wire or 4-wire private lines at rates up to 9600 baud.
- LDMs connected to dedicated leased telephone lines at speeds up to 2400 baud (depending on the number of remotes and the line distances involved).
- EIA RS-232-C modems operating long distance over leased telephone lines.
- EIA RS-232-C modems used to communicate with the first of a cluster of CMR01 remotes after which the remaining remotes of the cluster may use LDM communications.

A variety of communication line speeds are possible because each host unit has four individual communication ports. The total number of remote units may be evenly divided among the four ports. Each port can select either 300, 600, 1200, 2400, 4800, or 9600 baud.
4 INTRODUCTION

The individual baud-rate selection switches offer a convenient and easy means of providing high-speed communications to short distance remotes, while at the same time, establishing lower baud rates for ports connected to long distance remotes.

1.2.2 CMR01 Remote Unit Component Summary

The CMR01 remote unit is a self-contained, rack mounted unit, consisting of five major component areas. It is physically located at the site where process control is taking place. The five major component areas are:

1. Remote controller microprocessor modules (M8991 and M8992);
2. Limited distance modem (LDM) module (M8995);
3. Remote I/O process control modules (optional);
   a. 16-point (bit) optically coupled digital input modules,
   b. 16-point (bit) digital output modules,
   c. 4-channel optically coupled pulse counter modules,
   d. Analog to digital (A/D) converter modules,
   e. 8-channel analog input multiplexer modules, and
   f. 2-channel analog output modules.
4. Maintenance display panel – Includes the M9053 remote connector module; and
5. AC/DC power supply – DC feature is optional. If selected, unit switches to dc operation if a failure occurs at the ac.

The remote controller modules (M8991 and M8992) interface the remote LDM (M8995) to the I/O process control bus called the R-BUS.

In the normal RUN mode, messages from the host are received through the port, decoded and checked for errors by the remote controller, and then channeled to the correct I/O device.

When not receiving a message or executing a function, the remote controller can be enabled to scan specified channels for alarm conditions. Alarm conditions may be a change in the state of the digital input points or analog
changes beyond specified limits. When an alarm is detected it is stored. When the next interrogation message is received from the host, the CMR01 returns all alarm data.

The remote unit also contains built-in test programs which use the maintenance/display panel to check out the controller or any I/O modules. The panel contains a number of switches and LEDs to facilitate various maintenance functions. These switches and LEDs are discussed in Chapter 3. Figure 1-2 is a basic diagram of the CMR01 remote configuration.

Power for the CMR01 may be either 115 or 230 Vac or optional 12 Vdc (supplied by customer 20 AM battery). When ac power is lost, the unit automatically switches to the optional 12-volt system.

1.2.3 Specifications

- Mechanical

  - Host Controller
    CMR11 – One hex-height module (M8990 – UNIBUS)
    CVM11 – Two dual-height modules (M7181 and M7182*) – Q-BUS

  - Remote unit (CMR01)
    Height = 30.5 cm (12 in)
    Width = 48.3 cm (19 in)
    Depth = 27.9 cm (11 in)
    Weight = 22.7 kg (50 lbs)

- Electrical

  - Normal input power requirements

*The M7182 is a "piggyback" module requiring two adjacent slots. However, it attaches to only one slot for power.
6 INTRODUCTION

<table>
<thead>
<tr>
<th>CMR01 Option</th>
<th>Max. Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMR01-AA 115 Vac</td>
<td>2.5 A</td>
</tr>
<tr>
<td>CMR01-AB 230 Vac</td>
<td>1.5 A</td>
</tr>
<tr>
<td>CMR01-AC 115 Vac</td>
<td>2.5 A or</td>
</tr>
<tr>
<td></td>
<td>12 Vdc* at 30 A</td>
</tr>
<tr>
<td>CMR01-AD 230 Vac</td>
<td>1.5 A or</td>
</tr>
<tr>
<td></td>
<td>12 Vdc* at 30 A</td>
</tr>
</tbody>
</table>

- Environmental
  - Environmental conditions without analog circuits:
    - 5° – 50° Celsius
    - 41° – 122° Fahrenheit
    - Humidity 10 – 95% (Noncondensing)
  - Environmental conditions with analog circuits:
    - 15° – 32° Celsius
    - 59° – 90° Fahrenheit
    - Humidity 10 – 90% (Noncondensing)

- Communications
  - EIA RS-232-C or limited distance modem
  - Baud rates: 300, 600, 1200, 2400, 4800, or 9600 baud
  - Baud rate/line length
    - Voice-grade telephone lines: 2400 baud max. 422 km (300 miles)
    - 4-wire continuous line: 9600 baud max. 80 km (50 miles)
    - EIA limitations: 9600 baud max. No limit to distance

NOTE
Maximum baud rate and maximum distance cannot be achieved together.

*Battery 20 Ampere-hour (Ah)
Figure 1-2 CMR01 Remote Basic Diagram
2 BOARD CONFIGURATIONS

2.1 GENERAL
This section provides a summary of key factors concerning certain configuration variables that must be verified during troubleshooting. Board configurations, including jumper and switch selections, and system configurations, including cabling, are included to support the troubleshooting efforts.

2.2 CMRII/CMVII REFERENCE DOCUMENTATION
Refer to the following documents if the level of content in this section is insufficient.

- CMR Systems Option Description YC-C318-C-00
- CMRII-AA Engineering Drawings MP-01287
- CMVII-AA Engineering Drawings MP-01288
- CMRII-01/02 Engineering Drawings MP-01289
- CMR01 Engineering Drawings MP-01290

2.3 CMRII/CMVII COMPONENTS LIST
Tables 2-1 and 2-2 identify the components required to configure the CMRII/CMVII host and the CMR01 remote unit respectively.
### Table 2-1 CMR11/CMV11 Components List

<table>
<thead>
<tr>
<th>Option</th>
<th>Parts List</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CMR11-AA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M8990</td>
<td>Basic PDP-11 Host Controller</td>
</tr>
<tr>
<td></td>
<td>YC-C318C-00</td>
<td>Host Microprocessor Module</td>
</tr>
<tr>
<td></td>
<td>MP-01287-00</td>
<td>Option Description Manual</td>
</tr>
<tr>
<td></td>
<td>AC-F912B-MC</td>
<td>Engineering Print Set for CMR11-AA</td>
</tr>
<tr>
<td></td>
<td>AK-F913B-MC</td>
<td>CZCMJ** Diagnostic Paper Tape</td>
</tr>
<tr>
<td></td>
<td>2C-HY50A-00</td>
<td>CZCMJ** Diagnostic Listing Host Comm Port Test Connector</td>
</tr>
<tr>
<td><strong>CMV11-AA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M7181</td>
<td>Basic LSI-11 Host Controller</td>
</tr>
<tr>
<td></td>
<td>M7182</td>
<td>Host Microprocessor Module #1</td>
</tr>
<tr>
<td></td>
<td>BC05L-1C</td>
<td>Host Microprocessor Module #2</td>
</tr>
<tr>
<td></td>
<td>YC-C318C-00</td>
<td>Module Interconnect Cable</td>
</tr>
<tr>
<td></td>
<td>MP-01288-00</td>
<td>Option Description Manual</td>
</tr>
<tr>
<td></td>
<td>AC-F912B-MC</td>
<td>Engineering Print Set for CMV11-AA</td>
</tr>
<tr>
<td></td>
<td>AK-F913B-MC</td>
<td>CZCMJ** Diagnostic Paper Tape</td>
</tr>
<tr>
<td></td>
<td>2C-HY50A-00</td>
<td>CZCMJ** Diagnostic Listing Host Comm Port Loopback Test Connector</td>
</tr>
<tr>
<td><strong>CMR11-01</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2C-H434A-00</td>
<td>Host Communication Panel Assembly</td>
</tr>
<tr>
<td></td>
<td>M8996</td>
<td>Communication Panel Host LDM Modem Module</td>
</tr>
<tr>
<td></td>
<td>2C-HY38A-06</td>
<td>Host LDM Communication Cable</td>
</tr>
<tr>
<td></td>
<td>MP-01289-00</td>
<td>Engineering Print Set for CMR11-01/02</td>
</tr>
<tr>
<td></td>
<td>2C-HY51A-00</td>
<td>EIA Berg Port Loopback Test Connector</td>
</tr>
<tr>
<td></td>
<td>2C-HY53A-00</td>
<td>LDM Loopback Cable Wire Assembly</td>
</tr>
<tr>
<td><strong>CMR11-02</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M8996</td>
<td>Host LDM Communication Add-on Option for each additional communication port</td>
</tr>
<tr>
<td></td>
<td>2C-HY38A-06</td>
<td>Host LDM Modem Module</td>
</tr>
<tr>
<td></td>
<td>2C-HY51A-00</td>
<td>CMR LDM Communication Cable</td>
</tr>
<tr>
<td></td>
<td>2C-HY53A-00</td>
<td>EIA Berg Port Loopback Test Connector</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LDM Loopback Cable Wire Assembly</td>
</tr>
<tr>
<td>Option</td>
<td>Parts List</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>2C-E265A-00</td>
<td>CMR01 Basic Components. The basic CMR01 without any I/O modules is the foundation for building custom configurations. It is not an orderable item.</td>
</tr>
<tr>
<td>M8991</td>
<td></td>
<td>CMR01 Remote Box Chassis Assembly with associated hardware</td>
</tr>
<tr>
<td>M8992</td>
<td></td>
<td>Microprocessor Controller #1 Module</td>
</tr>
<tr>
<td>M8995</td>
<td></td>
<td>Microprocessor Controller #2 Module</td>
</tr>
<tr>
<td>M9053</td>
<td></td>
<td>LDM Modem Module</td>
</tr>
<tr>
<td>2C-E255A-00</td>
<td></td>
<td>Remote Connector Module</td>
</tr>
<tr>
<td>MP-01290-00</td>
<td></td>
<td>Display Panel Assembly</td>
</tr>
<tr>
<td>YC-C318C-00</td>
<td></td>
<td>Engineering Print Set for CMR01</td>
</tr>
<tr>
<td>2C-HY51A-00</td>
<td></td>
<td>Option Description Manual</td>
</tr>
<tr>
<td>2C-HY53A-00</td>
<td></td>
<td>EIA Berg Port Loopback Test Connector</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LDM Loopback Cable Wire Assembly</td>
</tr>
</tbody>
</table>

| CMR01-AA      | Basic CMR01          | See Description Above AC Power Supply (115/230 Vac)                          |
| 2C-E250A-01   |                      | AC Power Cord for 115 Vac Application                                         |
| 17-00083-07   |                      |                                                                              |

| CMR01-AB      | Basic CMR01          | See Description Above AC Power Supply (115/230 Vac)                          |
| 2C-E250A-01   |                      | AC Power Cord for 230 Vac Application                                         |
| 17-00083-08   |                      |                                                                              |

| CMR01-AC      | Basic CMR01          | See Description Above AC/DC Power Supply (115/230 Vac) without DC battery back-up capabilities AC Power Cord for 115 Vac Application |
| 2C-E250A-02   |                      |                                                                              |
| 17-00083-07   |                      |                                                                              |

| CMR01-AD      | Basic CMR01          | See Description Above AC/DC Power Supply (115/230 Vac) without DC battery back-up capabilities AC Power Cord for 230 Vac Application |
| 2C-E250A-02   |                      |                                                                              |
| 17-00083-08   |                      |                                                                              |
2.4 I/O CONTROL MODULES/TERMINATORS
A wide variety of I/O control modules are optionally available with the CMR01 remote unit. These modules are selected by the customer to perform specific operations. Each I/O module must be equipped with a paddleboard cable terminator.

Module summary:
- I/O module
  - Mounts in R-BUS slots,
  - Contains built-in ID code,
  - Terminated by either M9050 or M9052 paddleboard (see Table 2-3),
  - Available in functional varieties.
- I/O paddleboard terminator
  - Predrilled for customized configuration,
  - Mounts in slot below the assigned I/O module.

Table 2-3 lists each of the optional I/O modules in addition to the ID code and associated paddleboard cable terminator.

2.5 CMR11/CMV11 POWER/BUS LOADING
Tables 2-4 through 2-6 list all of the module power requirements for the CMR11/CMV11 host, the CMR01 standard components, and the CMR01 optional I/O control configuration.
<table>
<thead>
<tr>
<th>Module</th>
<th>Module ID</th>
<th>Termination Paddleboard**</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1004*</td>
<td>120417</td>
<td>M9050</td>
<td>8-Channel Analog Multiplexer, Dry Reed Relay, 2 wire</td>
</tr>
<tr>
<td>A1005*</td>
<td>120417</td>
<td>M9050</td>
<td>8-Channel Analog Multiplexer, Dry Reed Relay, 3 wire</td>
</tr>
<tr>
<td>A6005</td>
<td>011063</td>
<td>M9050</td>
<td>2-Channel Analog Output Module</td>
</tr>
<tr>
<td>M8986</td>
<td>004421</td>
<td>M9050 or M9052</td>
<td>16-Bit Digital Output Module, Mercury Wetted Reed Relay, Form B</td>
</tr>
<tr>
<td>M8987</td>
<td>004421</td>
<td>M9050 or M9052</td>
<td>16-Bit Digital Output Module, Reed Relay, Form A</td>
</tr>
<tr>
<td>M8994</td>
<td>004421</td>
<td>M9050 or M9052</td>
<td>16-Bit Digital Output Module, Mercury Wetted Reed Relay, Form A</td>
</tr>
<tr>
<td>M8993</td>
<td>104401</td>
<td>M9050 or M9052</td>
<td>16-Bit Optically Coupled Input Module</td>
</tr>
<tr>
<td>M8997</td>
<td>101777</td>
<td>M9050 or M9052</td>
<td>4-Channel Optically Coupled Pulse Counter Module</td>
</tr>
</tbody>
</table>

*A805  Analog-to-Digital Converter (used with A1004 or A1005 and occupies a dedicated slot)

**M9050 Attaches 16, 2-wire channels with split lug solder connections

**M9052 Attaches a 40-pin standard Berg connector cable
<table>
<thead>
<tr>
<th>Module(s)</th>
<th>Voltage Rating (Approximate Values)</th>
<th>Maximum Voltage</th>
<th>Minimum Voltage</th>
<th>Test Point</th>
<th>Bus Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMR-11 M8990</td>
<td>+5 Volts @ 5.0 A</td>
<td>+5.25</td>
<td>+5.00</td>
<td>Backplane AA2 **</td>
<td>PDP-11, 1 DC Load, 4 AC Loads</td>
</tr>
<tr>
<td>CMV-11 M7181 &amp; M7182 M8996*</td>
<td>+5 Volts @ 5.0 A</td>
<td>+5.25</td>
<td>+5.00</td>
<td>Backplane AA2 **</td>
<td>LSI-11, 1 DC Load, 3 AC Loads</td>
</tr>
<tr>
<td></td>
<td>+5 Volts @ 1.0 A</td>
<td>+5.25</td>
<td>+5.00</td>
<td>J2-E, J2-F</td>
<td>N/A</td>
</tr>
</tbody>
</table>

* DC Power for the M8996 (up to four) is supplied by the host controller via cable 2C-HY38A. Add 1.0 A for each M8996.

** (Ground Pin is AC2)

**NOTE**

Do Not Exceed Normal Bus Loading:
- 20 DC Loads without bus repeater.
- 20 AC Loads (Q BUS) without terminated backplane.
- 35 AC Loads (Q BUS) with terminated backplane.
- Maximum UNIBUS cable without bus repeater — 15.25 m (50 feet).
### Table 2-5 CMR01 Remote Unit Voltage Chart

<table>
<thead>
<tr>
<th>Unit</th>
<th>Voltage</th>
<th>Test Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMR01 without I/O Modules.</td>
<td>12Vdc @ 1.7 A</td>
<td>CMR01 Backplane Pins AA1, AA2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ground Pins AC1, AC2</td>
</tr>
<tr>
<td>Includes M9053, M8991, M8992, M8995 and display panel.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 2.6 CONFIGURATION VARIABLES

This section provides the information needed to implement a wide variety of CMR11/CMV11 system configuration variables. These include device placement, device/vector addressing, port baud rate selection, remote ID addressing, and modem related variables. Section 2.6.1 provides CMR11/CMV11 host requirements while Section 2.6.2 outlines the CMR01 remote unit requirements.

#### 2.6.1 CMR11/CMV11 Host Considerations

- **Mounting**
  CMR11: one hex-height small peripheral controller (SPC) backplane slot.
  CMV11: three double-height SPC backplane slots – one for M7181 and two for piggybacked M7182.

- **Device Placement**
  Does not require any particular placement on the bus. For CMV11, Q-BUS interrupt priority rules apply. Because the M7182 does not pass on Q-BUS interrupt grant signals, the M7182 must be the last device on the Q-BUS.

- **Device Address**
  Assigned to user-address area beginning at 764070. For switchpack location and address selection refer to Figure 2-1 for CMR11 or 2-3 for CMV11.

- **Vector Address**
  Assigned to user-address area beginning at 170. For switchpack location and address selection refer to Figure 2-2 for CMR11 or 2-4 for CMV11.
<table>
<thead>
<tr>
<th>Module(s)</th>
<th>Voltage Rating DC</th>
<th>Maximum Voltage</th>
<th>Minimum Voltage</th>
<th>Test Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1004</td>
<td>+12 Volts @ 0.3 A</td>
<td>+17.0 Vdc</td>
<td>+9.0 Vdc</td>
<td>CMR01 Backplane pins AA1, AA2</td>
</tr>
<tr>
<td>A1005</td>
<td>+12 Volts @ 0.3 A</td>
<td>+17.0 Vdc</td>
<td>+9.0 Vdc</td>
<td></td>
</tr>
<tr>
<td>A805</td>
<td>+12 Volts @ 0.9 A</td>
<td>+17.0 Vdc</td>
<td>+9.0 Vdc</td>
<td>Ground Pins are AC1, AC2</td>
</tr>
<tr>
<td>A6005</td>
<td>+12 Volts @ 0.9 A</td>
<td>+17.0 Vdc</td>
<td>+9.0 Vdc</td>
<td></td>
</tr>
<tr>
<td>M8986</td>
<td>+12 Volts @ 0.4 A</td>
<td>+17.0 Vdc</td>
<td>+9.0 Vdc</td>
<td></td>
</tr>
<tr>
<td>M8987</td>
<td>+12 Volts @ 0.4 A</td>
<td>+17.0 Vdc</td>
<td>+9.0 Vdc</td>
<td></td>
</tr>
<tr>
<td>M8993</td>
<td>+12 Volts @ 0.2 A</td>
<td>+17.0 Vdc</td>
<td>+9.0 Vdc</td>
<td></td>
</tr>
<tr>
<td>M8994</td>
<td>+12 Volts @ 0.4 A</td>
<td>+17.0 Vdc</td>
<td>+9.0 Vdc</td>
<td></td>
</tr>
<tr>
<td>M8997</td>
<td>+12 Volts @ 0.4 A</td>
<td>+17.0 Vdc</td>
<td>+9.0 Vdc</td>
<td></td>
</tr>
</tbody>
</table>
• Interrupt Priority
  Normally BR4. For location, refer to Figure 2-1 for CMR11 or Figure 2-3 for CMV11.

• Baud Rate Selection
  Switches are provided to select the host baud rate for each port. Refer to Figure 2-1 for CMR11 and Figures 2-4 and 2-5 for CMV11 selections.

• Host LDM (M8996) Modem Variables
  Five switches on the M8996 must be correctly positioned to select certain conditions. See Figure 2-6 for switch function and placement.

NOTE
The remote LDM (M8995) is very similar to the M8996. Switch locations on both modules are identical.

2.6.2 CMR01 Remote Unit Considerations

• Port Selection
  Switch S1 on the M9053 module must be placed in the correct position to select the host port number to which this remote is connected. See Figure 2-7 for details.

• Baud Rate Selection
  Switch S2 on the M9053 module must be placed in the correct position to select the baud rate at which the line will operate. See Figure 2-7 for details.

• Remote ID Address
  Each remote unit requires a unique three-digit address. The first digit is the port number selected above. The last two digits are set up by switches S3 and S4 on the M9053. Addresses are in octal. See Figure 2-7 for details.

• Remote LDM (M8995) Modem Variables
  Five switches on the M8995 module must be correctly positioned to select certain conditions. The M8995 is very similar to the host M8996. Switch locations and functions are identical. Refer to Figure 2-6.
Figure 2.1  CMRII (M8990) Device Address/Host Baud Rate Selection
Figure 2-2  CMR11 (M8990) Vector Address Selection
## BOARD CONFIGURATIONS

![Diagram of CMV11 (M7181) Device Address/Host Baud Rate Selection (Ports 0-1)]

### CMV11 (M7181) Device Address/Host Baud Rate Selection (Ports 0-1)

#### Switch Pack E16
- **Device Address Selection**
- **Switch ON = Logical 1**

#### Switch Setting

<table>
<thead>
<tr>
<th>Switch Setting</th>
<th>Baud Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>300</td>
</tr>
<tr>
<td>1</td>
<td>600</td>
</tr>
<tr>
<td>2</td>
<td>1200</td>
</tr>
<tr>
<td>3</td>
<td>2400</td>
</tr>
<tr>
<td>4</td>
<td>4800</td>
</tr>
<tr>
<td>5</td>
<td>9600</td>
</tr>
</tbody>
</table>

See Figure 2-5 for Ports 2 and 3

#### CMV11 (M7181) Device Addressing

<table>
<thead>
<tr>
<th>MSB</th>
<th>LSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table**: Switch On = Logical 1

**Device Address**

<table>
<thead>
<tr>
<th>Switch Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>764070</td>
</tr>
<tr>
<td></td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>764100</td>
</tr>
<tr>
<td></td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>764120</td>
</tr>
<tr>
<td></td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>764140</td>
</tr>
<tr>
<td></td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>764150</td>
</tr>
<tr>
<td></td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>764170</td>
</tr>
<tr>
<td></td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>764200</td>
</tr>
<tr>
<td></td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>764260</td>
</tr>
</tbody>
</table>

**Note**: Switch ON responds to a logical one on the O.Bus

Figure 2-3  CMV11 (M7181) Device Address/Host Baud Rate Selection (Ports 0-1)
Figure 2-4 CMV11 (M7181) Vector Address Selection
Figure 2.5 CMV11 Host Baud Rate Selection  
(Ports 2-3)
Figure 2-6  Host LDM (M8996) Modem Variables
Figure 2-7 Remote (M9053) Configuration Variables
2.7 INSTALLATION CHECKOUT

A number of steps are provided in the installation procedure to verify that the preinstallation considerations have been determined and correctly implemented.

The installation process involves two procedures:

1. Installing the CMR11/CMV11 host controller, and
2. The CRM01 remote unit.

Refer to the installation flowcharts of Figures 2-8 and 2-9 to verify that the CMR11/CMV11 is correctly installed.

2.8 CABLE AND TEST CONNECTORS

Two cabling configurations (shown in Figure 2-10) are possible: EIA and LDM. Outline drawings of each cable are provided in Figure 2-11.

Turnaround test connector placement is also shown in Figure 2-10, while Figure 2-12 provides a drawing and signal flow for each test connector.

Cable summary (See Figure 2-11):

- **BC05L-1C**
  A 38 cm (15 in), 40-conductor cable that connects M7181 to M7182 (CMV11 only).
- **2C-HY38A-06**
  A 1.8 m (6 feet), 10-conductor cable that connects host controller to host LDM (M8996).
- **BC05C-XX**
  Cable length variable up to 15.25 m (50 feet) maximum. Connects host LDMs (M8996) to EIA modems.
- **LDM Cable**
  Customer supplied 4-wire cable similar to standard telephone cable.

Test connector summary (See Figure 2-12):

- **2C-HY50A** – Host port loopback
- **2C-HY51A** – EIA berg loopback
- **2C-HY53A** – LDM (TS1) loopback
- **H325** – EIA cable loopback
Figure 2-8  CMRI11/CMV11 Installation Flowchart
(Sheet 1 of 3)
Figure 2-8 CMR11/CMV11 Installation Flowchart (Sheet 2 of 3)
Complete installing all remote units on each comm port and perform comm line adjustments.

Note: All CMR11 remote units must be installed and communication adjustments completed before (C) ZOM** test program #2 can be exercised.

Execute diagnostic test program number 3:

Test #3: Are all remote units installed?

Yes

Build and execute DECK11 and obtain three passes with out error.

DECK11 test passes:

Yes

Check system configuration.

Return system to normal cus tower configuration, initiate customer acceptance and exit.

No

Check faulty remote unit or comm line, verify multipoint add ress and comm port line speed.

Figure 2-8 CMR11/CMV11 Installation Flowchart
(Sheet 3 of 3)
Figure 2-9  CMR01 Installation Flowchart
(Sheet 1 of 2)
Figure 2-9  CMR01 Installation Flowchart
(Sheet 2 of 2)
Figure 2-10  CMRI/CMVII Cabling Diagram/Test Connector Placement
Figure 2-11  CMR11/CMV11 Cables
Figure 2-12  CMV11/CMV11 Test Connectors  
(Sheet 1 of 2)
Figure 2-12 CMR11/CMV11 Test Connectors
(Sheet 2 of 2)
3 TEST AND CALIBRATION

3.1 INTRODUCTION
This chapter provides all the information necessary to troubleshoot and maintain the CMR11/CMV11 system.

Because of the complexity of the CMR11/CMV11, and because the network configuration includes remote sites spread over a large geographic area, the system is difficult to adjust and maintain. The traditional symptom/probable cause approach to troubleshooting is next to impossible to generate for the CMR11. As an alternative, checkout and calibration procedures are provided in flowchart format.

The CMR11 is supported by many different testing capabilities from local device testing using internally stored microdiagnostics, to a complete network exerciser diagnostic program.

Maintenance procedures for the CMR11/CMV11 host controller utilize the (C)ZCMJ diagnostic program. The program provides three major subtests.

CMR01 procedures use internal microdiagnostics and a special maintenance panel to check out the basic remote unit and a special test kit (CMR01-TA) to perform I/O controller checkout.

3.2 DIAGNOSTIC SUMMARY

DIAGNOSTIC NAME:
CMR11/CMV11 FUNCTIONAL DIAGNOSTIC

DESIGNATION:
(C)ZCMJ
ORDER NUMBER:
AK-F913*-M1;
BINARY TAPE

AH-F914*-MC;
LISTING (FICHE)

AH-F912*-M1;
LISTING (HARD COPY)

CONTROL CHARACTERS

CNTRL-C Exit test program
CNTRL-T Exit test program
CNTRL-G Show software switch register values
CNTRL-O Enter maintenance debug routine
CNTRL-F Show console fill count
CNTRL-A Print port configuration table
P Proceed

CAUTION
Before executing any diagnostics, be sure that the functions being controlled by this device (customer's process) are terminated and the I/O cable modules removed.

SWITCH REGISTER OPTIONS

Bit 15 (100000) Do not halt on errors
Bit 14 (040000) Do not print errors
Bit 13 (020000) Loop on erroneous routine
Bit 11 (004000) Inhibit program iterations
Bit 10 (002000) Do not print end of pass

TESTS

Sub Test 1 Logic test
Sub Test 2 Port loopback
Sub Test 3 CMR exercise

EXECUTION TIME

Sub Test 1 1 minute
Sub Test 2 Depends on line speed (up to 10 seconds at 300 baud)
Sub Test 3 Depends on line speed (up to 30 minutes at 300 baud)

*REV level
3.3 TEST DESCRIPTIONS

The (C)ZCMJ diagnostic program is started at address 200 and includes the following four hardware prompts that must be answered by operator interaction. Each entry must be followed by a <CR>. Entering only <CR> causes default values to be used.

<table>
<thead>
<tr>
<th>Prompt</th>
<th>Default Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device address</td>
<td>764070</td>
</tr>
<tr>
<td>Vector address</td>
<td>170</td>
</tr>
<tr>
<td>Device priority</td>
<td>4</td>
</tr>
<tr>
<td>Select test</td>
<td>1</td>
</tr>
</tbody>
</table>

3.3.1 Sub-Test 1

This test is a basic CMR11/CMV11 host controller logic test. It verifies all device registers, scratch pad memory, interrupt logic, and simple I/O functions. This test also reads baud rate switches and prints results. Figure 3-1 is a sample printout.

```
SELECT TEST (4=HELP) 1

LOGIC TEST

HOST FIRMWARE VERSION: V01.02 9-JUL-81

BAUD RATES:
PORT $0 = 9600
PORT $1 = 9600
PORT $2 = 9600
PORT $3 = 9600
END PASS #1 ERR, CNT = 0
END PASS #2 ERR, CNT = 0
END PASS #3 ERR, CNT = 0
END PASS #4 ERR, CNT = 0
END PASS #5 ERR, CNT = 0
SELECT TEST (4=HELP)
```

Figure 3-1 (C)ZCMJ Test 1 Sample Printout

3.3.2 Sub-Test 2

This test is a communication loopback test used to troubleshoot line problems and to provide the means to make LDM adjustments. Several methods are available to achieve loopback. This depends on the interface and loopback connector type.

Loopback variations:

- Local loopback switch – Place S4 on M8996 LDM to LOCAL LOOPBACK position.
TEST AND CALIBRATION

- Host port loopback – Attach 2C-HY50A-00 test connector to each M8990 port (J1-J4).
- EIA berg loopback – Attach 2C-HY51A-00 test connector to M8996 EIA berg port (J1).
- EIA cable loopback – Attach H325 test connector to the end of the BC05C-XX cable.
- LDM loopback – Place 2C-HY53A-00 test connector to M8996 terminal strip (TSI). Connect TT to RT (lug 1 to lug 3) and TR to RR (lug 2 to lug 4).
- Place S3 on remote M8995 to line loopback position.

Figure 3-2 is a sample printout of Test 2. Notice that one additional prompt is required.

SELECT TEST (4=HELP) 2

PORT LOOP-BACK TEST

TYPE PORT # (<CR>=ALL): 0

TYPE <CR> WHEN READY:

END PASS 01 ERR. CNT = 0 EL. TIM.=0101115B
END PASS 02 ERR. CNT = 0 EL. TIM.=01014114
END PASS 03 ERR. CNT = 0 EL. TIM.=0101611B
END PASS 04 ERR. CNT = 0 EL. TIM.=01018112
END PASS 05 ERR. CNT = 0 EL. TIM.=01010121
END PASS 06 ERR. CNT = 0 EL. TIM.=01012129
END PASS 07 ERR. CNT = 0 EL. TIM.=01014137
END PASS 08 ERR. CNT = 0 EL. TIM.=01016145
END PASS 09 ERR. CNT = 0 EL. TIM.=01018154
END PASS 10 ERR. CNT = 0 EL. TIM.=01012114
END PASS 11 ERR. CNT = 0 EL. TIM.=01023112
END PASS 12 ERR. CNT = 0 EL. TIM.=01025123
END PASS 13 ERR. CNT = 0 EL. TIM.=01027133

SELECT TEST (4=HELP)

Figure 3-2  (C)ZCMJ Test 2 Sample Printout

3.3.3 Sub-Test 3

This test is a network exerciser that scans the entire network and reports on all remote units. The report includes the ID numbers of all attached remotes and status changes or errors. Execution time could take as long as 30 minutes depending on the line speed. Loopback connector/switches are not required for this test. Figure 3-3
is a sample printout without any changes, while Figure 3-4 indicates a status change; remote unit ID 14 is activated.

SELECT TEST (4=HELP) 3
CMR EXERCISE ROUTINE

(GIVE ME A FEW MINUTES ALONE WITH THE REMOTES)
** PORT CONFIGURATION **

<table>
<thead>
<tr>
<th>PORT</th>
<th>6(0)</th>
<th>37(0)</th>
<th>71(0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>END PASS #1 ERR. CNT = 0 EL. TIM.=012113:144</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #2 ERR. CNT = 0 EL. TIM.=012120:155</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #3 ERR. CNT = 0 EL. TIM.=012128:17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #4 ERR. CNT = 0 EL. TIM.=012135:35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #5 ERR. CNT = 0 EL. TIM.=012142:13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #6 ERR. CNT = 0 EL. TIM.=012150:126</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #7 ERR. CNT = 0 EL. TIM.=012157:140</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #8 ERR. CNT = 0 EL. TIM.=012151:16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #9 ERR. CNT = 0 EL. TIM.=013121:32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #10 ERR. CNT = 0 EL. TIM.=013191:46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #11 ERR. CNT = 0 EL. TIM.=013271:14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #12 ERR. CNT = 0 EL. TIM.=013341:46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #13 ERR. CNT = 0 EL. TIM.=013411:10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #14 ERR. CNT = 0 EL. TIM.=013491:29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #15 ERR. CNT = 0 EL. TIM.=013561:59</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3-3 (C)ZCMJ Test 3 Sample Printout (No Status Changes)

SELECT TEST (4=HELP) 3
CMR EXERCISE ROUTINE

(GIVE ME A FEW MINUTES ALONE WITH THE REMOTES)
** PORT CONFIGURATION **

<table>
<thead>
<tr>
<th>PORT</th>
<th>37(0)</th>
<th>71(0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>END PASS #1 ERR. CNT = 0 EL. TIM.=012111:43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #2 ERR. CNT = 0 EL. TIM.=012119:110</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*** REMOTE STATUS CHANGE ***
REMOTE #14
REMOTE STATUS NOW REGULAR
END PASS #1 ERR. CNT = 0 EL. TIM.=012129:156
END PASS #2 ERR. CNT = 0 EL. TIM.=012137:26
END PASS #3 ERR. CNT = 0 EL. TIM.=012144:21
END PASS #4 ERR. CNT = 0 EL. TIM.=012151:32

** PORT CONFIGURATION **

<table>
<thead>
<tr>
<th>PORT</th>
<th>14(0)</th>
<th>37(0)</th>
<th>71(0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>END PASS #1 ERR. CNT = 0 EL. TIM.=012129:156</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #2 ERR. CNT = 0 EL. TIM.=012137:26</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #3 ERR. CNT = 0 EL. TIM.=012144:21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>END PASS #4 ERR. CNT = 0 EL. TIM.=012151:32</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3-4 (C)ZCMJ Test 3 Sample Printout (with Status Changes)
3.4 CMR11/CMV11 HOST CONTROLLER CHECKOUT

Checkout procedures for the CMR11/CMV11 host controller require executing (C)ZCMJ diagnostics. The flowchart of Figure 3-5 illustrates the CMR11/CMV11 checkout procedures. Test programs #1 and #2 can be executed on a partially installed system. Test program #3, however, requires that the complete system be installed and properly connected. Test program #3 further requires that the communications line adjustments be made before executing the test.

3.5 CMR01 REMOTE CHECKOUT PROCEDURES

The CMR01 remote unit checkout procedures are performed in three steps. The first step provides a simple checkout of the basic CMR01 without testing any of the I/O modules. The second step tests each of the I/O modules and provides for calibrating two modules; the A805 and the A6005. The final step is to perform communications line adjustments to ensure proper communication between host and remotes.

These three procedures must be performed in the order they were explained. All three procedures use the maintenance display panel located on the lower-left front of the remote chassis. The maintenance panel is summarized in the following section.

3.5.1 Maintenance Display Panel

The maintenance panel, shown in Figure 3-6, contains a variety of switches and a six-digit LED display to implement test functions associated with the three CMR01 checkout procedures. Some switches perform dual functions. Table 3-1 lists all of the possible error codes that may appear in the LED display.
TEST AND CALIBRATION

START

TURN POWER ON
EXECUTE DIAGNOSTIC PROGRAM 1

TEST #1 PASSES?

NO

CHECK CABLES, BOARD SEATING, SWITCH CONFIGURATIONS, OR REPLACE MODULE(S) MB990C FOR CMR, M7181 AND M7182 FOR CMV.

YES

EXECUTE DIAGNOSTIC TEST PROGRAM #2

TEST #2 PASSES?

NO

CHECK CABLES, MODEM +5 VOLT PULSE, MODEM SWITCHES, LOA ADJUSTMENTS OR REPLACE MODEM MODULE OR CABLE

YES

IS THIS A NEW INSTALLATION?

NO

1

YES

PLACE S4 ON MB996 MODULES TO LOCAL LOOPBACK POSITION.

LOAD AND EXECUTE [ وجزيل] START AT LOC 200 AND SELECT TEST #1

VERIFY PRINTOUTS OF BAUD RATES FOR EACH PORT

ALLOW TEST TO RUN FOR TEN ERROR FREE PASSES

TO EXIT TEST, ENTER CONTROL C

PLACE S4 ON MB996 MODULES TO THE NORMAL POSITION, UNLESS SELECTED AS LOOPBACK METHOD.

SELECT ONE OF THE LOOPBACK METHODS BELOW AND EXECUTE [ وجزيل] TEST #2 ON ALL ACTIVE PORTS:

1. S4 ON MB996 TO LOCAL LOOP POSITION.
2. TEST CONNECTOR 2C-HYSG TO MB990 PORTS J1, J2, J3 AND/OR J4.
3. TEST CONNECTOR 2C-HYSA TO MB996 PORT (J1).
4. TEST CONNECTOR H325 TO BOCSC CABLE END.
5. TEST CONNECTOR TO MB996 TERMINAL STRIP (TB1).
6. S3 ON REMOTE MB995 TO LINE LOOP POSITION.

ALLOW TEST TO RUN FOR TWENTY ERROR FREE PASSES.

TO EXIT TEST, ENTER CONTROL C.

PERFORM I/O CONTROLLER TEST PROCEDURES, FOLLOWED BY PERFORMING THE COMMUNICATION LINE ADJUSTMENTS (SEE SECTION 35).

Figure 3-5 CMRII/CMVI Checkout Procedures
(Sheet 1 of 2)
Figure 3-5  CMR11/CMV11 Checkout Procedures
(Sheet 2 of 2)
Figure 3-6  CMR01 Maintenance/Display Panel
Table 3-1  CMR11 Error Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Function or Request Successful</td>
</tr>
<tr>
<td>2</td>
<td>Broadcasted Message Was Sent Out Successfully</td>
</tr>
</tbody>
</table>

**GENERAL REMOTE ERRORS**
- 200  No module installed in slot specified
- 201  Channel requested is not contained in module
- 202  Module type is not correct for slot specified
- 203  Module does not respond, was there on power up
- 205  Too many read registers in Read All Function
- 206  No store data to return for a Return Broadcast

**REMOTE ERRORS ON ADD ALARM ENTRY FUNCTION**
- 220  Channel not added to alarm table, table full
- 221  Alarm table empty, no control possible
- 222  Guins not the same for both HI/LO parameters
- 223  Alarm type not available in the remote
- 224  Module type not suitable for alarm type spec’d

**ANALOG CONVERSION ERROR**
- 230  Multiplexer - Hard error
- 231  Time out on analog conversion

**FIRMWARE DIAGNOSTIC ERRORS ONLY AT REMOTE DISPLAY**
- 240  Input module error on Defined Output Test
- 241  Data Set Ready not set for Remote Loopback Test
- 242  Time out in Remote Loopback Test

**REMOTE WARNINGS**
- 250  Warning: Function not necessary in remote
- 251  Warning: Alarm Channel Overwritten
- 252  Warning: Output Channel Specified for Alarm Table

**REMOTE ERRORS WHICH INDICATE FUNCTION WAS ABORTED**
- 260  (Sub) Function not implemented in remote
- 261  Bad parameters detected at the remote
- 262  Function could not be executed in present remote state
- 300  Function could not be executed in host
- 301  Function not allowed (as spec’d) in host mode
- 302  Too many requests for this function
- 303  Bad parameters for this request
- 304  Invalid mode request
- 305  Invalid length
- 310  No Trace data stored
- 312  No regular remotes on this port
- 320  Broadcast on interrogate is invalid
- 321  Broadcast in poll queue is invalid
- 322  Broadcast on return broadcast store is invalid
<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>323</td>
<td>No poll queue in mode 1 is illegal</td>
</tr>
<tr>
<td>324</td>
<td>Poll queue specified is too large</td>
</tr>
<tr>
<td>330</td>
<td>Invalid slot number</td>
</tr>
<tr>
<td>332</td>
<td>Invalid Channel number</td>
</tr>
</tbody>
</table>

**COMMUNICATION ERRORS**

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>340</td>
<td>CRC Error on message from remote</td>
</tr>
<tr>
<td>341</td>
<td>Timeout on transmission to remote</td>
</tr>
<tr>
<td>342</td>
<td>Received a byte count that is too long</td>
</tr>
<tr>
<td>343</td>
<td>Received a byte count that is too short</td>
</tr>
<tr>
<td>344</td>
<td>Received an erroneous function code</td>
</tr>
<tr>
<td>345</td>
<td>Received an erroneous remote ID</td>
</tr>
<tr>
<td>346</td>
<td>Wrong function code received on return broadcast</td>
</tr>
<tr>
<td>347</td>
<td>Time out on the Transmitter</td>
</tr>
</tbody>
</table>

**SUCCESS CODES**

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>364</td>
<td>Function was executed but some of the requests have errors</td>
</tr>
<tr>
<td>360</td>
<td>Function was executed but some of the requests have warnings</td>
</tr>
<tr>
<td>372</td>
<td>Data error on host loopback</td>
</tr>
<tr>
<td>373</td>
<td>Receiver timeout on host loopback</td>
</tr>
<tr>
<td>374</td>
<td>Transmitter time out on host loopback</td>
</tr>
<tr>
<td>375</td>
<td>Illegal request count on maintenance function</td>
</tr>
<tr>
<td>376</td>
<td>Illegal port number on host loopback</td>
</tr>
<tr>
<td>377</td>
<td>Function failed, refer to USOR</td>
</tr>
</tbody>
</table>
3.5.2 CMR01 Basic Test Procedure

The basic CMR01 test procedure is illustrated in Figure 3-7. The procedure makes many references to various LEDs on each of the modules. Refer to Figure 3-8 for LED identification.

Figure 3-7  Basic CMR01 Test Procedure
(Sheet 1 of 2)
Figure 3-7  Basic CMR01 Test Procedure
(Sheet 2 of 2)
<table>
<thead>
<tr>
<th>LED INDICATOR LEGEND</th>
<th>Function</th>
<th>Mode</th>
<th>LED</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Figure 1.8: CMROI Remote Unit LED Legend*
3.5.3 CMR01 Remote I/O Controller Test Procedure

This procedure is the second part of the three step CMR01 checkout procedure. A special test kit (CMR01-TA), consisting of test modules and interconnecting cable, is required to perform this checkout and calibration procedure. These test modules and associated switches and LEDs are summarized below.

CMR01-TA test kit consists of one each:

- G5153 test module for digital I/O and pulse count testing (see Figure 3-10).
- CMRT1-11 signal conditioning paddleboard for the G5153 (see Figure 3-11).
- BC08R-03 40 conductor flat ribbon cable 0.9 m (3 feet) used to interconnect the G5153 and CMRT1-11 (see Figure 3-12).
- A908 analog I/O test module (see Figure 3-13).
Figure 3-10  G5153 Digital I/O Pulse Count Test Module
Figure 3-12  BC08R Test Interconnect

Figure 3-13  A908 Analog I/O Test Module
Figures 3-15, 3-19, and 3-22 through 3-25 outline checkout procedures for the various I/O modules listed below, while Figures 3-16 and 3-20 provide calibration procedures for the A805 and A6005 modules respectively.

<table>
<thead>
<tr>
<th>Module</th>
<th>Checkout</th>
<th>Calibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>A805</td>
<td>3-15</td>
<td>3-16</td>
</tr>
<tr>
<td>A6005</td>
<td>3-19</td>
<td>3-20</td>
</tr>
<tr>
<td>A1004/1005</td>
<td>3-22</td>
<td></td>
</tr>
<tr>
<td>M8993</td>
<td>3-23</td>
<td></td>
</tr>
<tr>
<td>M8986-87</td>
<td>3-24</td>
<td></td>
</tr>
<tr>
<td>M8994</td>
<td>3-25</td>
<td></td>
</tr>
<tr>
<td>M8997</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**IMPORTANT**

- Be sure to allow ample time for modules to warm up and stabilize before testing.
- Test all I/O controllers of the same type before proceeding to the next type.

### 3.5.3.1 Module A805 Checkout Procedure

- **Test summary**
  - Verifies the four gain codes.
  - Verifies automatic gain code conversion.
  - Verifies analog to digital (A/D) conversion for each gain code.

- **Equipment required**
  - An A1004 or A1005 analog multiplexer input module.
  - An A908 analog test module.
  - A voltage standard.
  - A precision digital voltmeter.

- **Test configuration**
  See Figure 3-14.

The A805 analog-to-digital converter checkout procedure is presented in Figure 3-15.
Figure 3-14  A805 Test Configuration
TEST AND CALIBRATION 55

START

- STORE PADDLE BOARD IN THE EXTRA SLOT TO RIGHT OF SLOT 15.

- TURN ON CHANNEL SELECT SWITCHES 0-7.
- TURN SIGNAL SHORT SWITCH TO SHORT POSITION.

CONFIGURE AND INSTALL THE ARBI TEST MODULE IN ABOVE PADDLE BOARD SLOT.

- ATTACH LEAD OF VOLTAGE STANDARD TO J1 ON ARBI MODULE.
- ATTACH LEAD OF VOLTAGE STANDARD TO J2 ON ARBI MODULE.
- ATTACH DIGITAL VOLTMETER TO MONITOR THE VOLTAGE STANDARD OUTPUT.

ATTACH ANALOG TEST EQUIPMENT (SEE FIGURE 3-14)

POWER ON THE CMRO. ALLOW 20 MINUTES WARM UP FOR ARBI MODULE AND VOLTAGE STANDARD.

PERFORM ANALOG GAIN OF 1 TEST. VERIFY THE LED.

- TURN MODE SELECT SWITCH TO TEST POSITION.
- PUT THE SLOT SELECT SWITCH TO SLOT # OF THE I/O MODULE BEING TESTED.
- PUT THE BAUD RATE SWITCH TO POSITION 0.
- TURN CHANNEL SELECT SWITCH TO POSITION 0.
- PUT TEST SELECT SWITCH TO POSITION 3.
- PRESET THE I/O TEST BEGIN SWITCH.
- VERIFY THE FOLLOWING LEDS:
  - ARBI AND ARBI04 OR ARBI06 MODULE POWER BOTTOM LED IS ON.
  - ARBI BUSY (2ND FROM TOP) LED IS FLASHING.
  - ARBI 04 OR ARBI 06 RELAY CLOSED (TOP) LED IS FLASHING.
- VERIFY THAT THE DISPLAY WHICH USES THE FOLLOWING DATA FORMAT OF DXX DXX, INDICATES:
  - DATA VALUE XXXX IS NOT GREATER THAN 1.
  - GAIN CODE VALUE G IS 0.
  - POLARITY BIT P IS 1 OR 0.
- ENSURE GC (2ND FROM TOP) AND G1 (TOP) LEDS ARE OFF.

PERFORM GAIN OF 1 VERIFICATION.

Figure 3-15 A805 Checkout Procedure (Sheet 1 of 4)
Figure 3-15  A805 Checkout Procedure (Sheet 2 of 4)
Figure 3-15  A805 Checkout Procedure (Sheet 3 of 4)
Figure 3-15 A805 Checkout Procedure
(Sheet 4 of 4)
3.5.3.2 Module A805 Calibration Procedure

- Calibration summary – Calibrations ensure that correct analog conversions are obtained for each of the four gain settings.
- Equipment required
  - An A1004 or A1005 analog multiplexer input module.
  - An A908 analog test module.
  - A voltage standard.
  - A precision digital voltmeter.
- Calibration configuration
  Same as test configuration (see Figure 3-14).

The A805 calibration procedure is presented in Figure 3-16. Refer also to Figure 3-17 for adjustment and LED locations.

Figure 3-16  A805 Calibration Procedure
(Sheet 1 of 3)
Figure 3-16  A805 Calibration Procedure (Sheet 2 of 3)
Figure 3-16  A805 Calibration Procedure
(Sheet 3 of 3)
3.5.3.3 Module A6005 Checkout Procedure -

- Test summary
  Verifies that the output voltage increments of both channels are equal and linear beginning at 2 V up to a maximum of 10 V with no spikes.
- Equipment required
  - An A908 analog test module.
  - An oscilloscope.
- Test configuration
  See Figure 3-18.

The A6005 two-channel analog output module checkout procedures are presented in Figure 3-19.
Figure 3-18  A6005 Test Configuration
Figure 3-19  A6005 Checkout Procedure
(Sheet 1 of 2)
Figure 3-19  A6005 Checkout Procedure (Sheet 2 of 2)
3.5.3.4 Module A6005 Calibration Procedure –

- Calibration summary
  To adjust the A6005 output: lower limit to 2 V ±10 MV and upper limit to 10 V ±10 MV for both channels.

- Equipment required
  - An A908 analog test module.
  - A precision digital voltmeter.

- Calibration configuration
  Basically the same as the test configuration of Figure 3-18 except that scope is replaced by voltmeter.

The A6005 calibration procedure is presented in Figure 3-20. Also refer to Figure 3-21 for adjustment locations.

3.5.3.5 Modules A1004/A1005 Checkout Procedure –

- Test summary
  - Verifies that each channel is independent from all other channels.
  - Verifies that input analog signal leads are connected to the analog bus.
  - Verifies that relays cannot close on an error condition.

- Required equipment
  - An A805 A/D converter module.
  - An A908 test module.
  - A voltage standard.

- Test configuration
  See Figure 3-14.

The A1004/A1005 checkout procedure is presented in Figure 3-22. Table 3-2 lists the correct maintenance panel LED display readings for selected test voltage inputs. Test results must comply with these values.
Figure 3-20  A6005 Calibration Procedures
(Sheet 1 of 2)
Figure 3-20  A6005 Calibration Procedures
(Sheet 2 of 2)

Figure 3-21  A6005 Adjustments
Figure 3-22 A1004/A1005 Checkout Procedure
(Sheet 1 of 3)
Figure 3-22  A1004/A1005 Checkout Procedure (Sheet 2 of 3)
Figure 3-22  A1004/A1005 Checkout Procedure
(Sheet 3 of 3)
Table 3-2 Valid Test Results

<table>
<thead>
<tr>
<th>Input Voltage</th>
<th>Maintenance Panel Display Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short or 0 Volts</td>
<td>130001 to 130006 or 30001 to 30006</td>
</tr>
<tr>
<td>2 Volts</td>
<td>1454 to 1470</td>
</tr>
<tr>
<td>4 Volts</td>
<td>3140 to 3154</td>
</tr>
<tr>
<td>6 Volts</td>
<td>4630 to 4644</td>
</tr>
<tr>
<td>8 Volts</td>
<td>6314 to 6313</td>
</tr>
</tbody>
</table>

3.5.3.6 Modules M8986, M8987, or M8994 Checkout Procedures –

- Test summary
  - Verifies that all relays energize and that contacts close or open correctly.
  - Verifies that each relay LED indicator operates correctly.
- Required equipment
  - A G5153 digital I/O test module.
  - A BC08R-03 interconnect cable.
  - A CMRTI-11 test paddleboard.
- Module configuration
  - M8986 uses mercury type B relays with normally closed contacts.
  - M8987 uses dry reed relays with normally open contacts.
  - M8994 uses mercury type A relays with normally open contacts.

The checkout procedure for the M8986, M8987, or M8994 digital output modules is presented in Figure 3-23. Also refer to Figure 3-8 for LED locations.

3.5.3.7 Module M8993 Checkout Procedure –

- Test summary
  - Verifies each of 16 process points to ensure that register bits are set correctly and that the LEDs function correctly.
• Required equipment
  - A G5153 digital I/O test module.
  - A BC08R-03 interconnect cable.
  - A CMRTI-11 test paddleboard.

The M8993 checkout procedure is presented in Figure 3-24, while test results are provided in Table 3-3.
Figure 3-23  M8986, M8987, or M8994 Checkout
Procedures (Sheet 2 of 2)
Figure 3-24  M8993 Checkout Procedure (Sheet 1 of 2)
Figure 3-24  M8993 Checkout Procedure (Sheet 2 of 2)
Table 3-3  M8993 Test Results

<table>
<thead>
<tr>
<th>Bit Set</th>
<th>Display Panel LEDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Bits Set</td>
<td>0</td>
</tr>
<tr>
<td>Bit 0 Set</td>
<td>1</td>
</tr>
<tr>
<td>1 Set</td>
<td>2</td>
</tr>
<tr>
<td>2 Set</td>
<td>4</td>
</tr>
<tr>
<td>3 Set</td>
<td>10</td>
</tr>
<tr>
<td>4 Set</td>
<td>20</td>
</tr>
<tr>
<td>5 Set</td>
<td>40</td>
</tr>
<tr>
<td>6 Set</td>
<td>100</td>
</tr>
<tr>
<td>7 Set</td>
<td>200</td>
</tr>
<tr>
<td>8 Set</td>
<td>400</td>
</tr>
<tr>
<td>9 Set</td>
<td>1000</td>
</tr>
<tr>
<td>10 Set</td>
<td>2000</td>
</tr>
<tr>
<td>11 Set</td>
<td>4000</td>
</tr>
<tr>
<td>12 Set</td>
<td>10000</td>
</tr>
<tr>
<td>13 Set</td>
<td>20000</td>
</tr>
<tr>
<td>14 Set</td>
<td>40000</td>
</tr>
<tr>
<td>15 Set</td>
<td>100000</td>
</tr>
</tbody>
</table>

3.5.3.8  Module M8997 Checkout Procedure –

- Test Summary
  - Verifies that all channels correctly accumulate pulses.
  - Verifies that only the channel selected accumulates pulses.
  - Verifies that counter can be reset and begin counting again.
  - Checks the operation of each channel LED.

- Required equipment
  - A G5153 digital I/O test module.
  - A BC08R-03 interconnect cable.
  - A CMRT1-11 test paddleboard.

The checkout procedure for the M8997 is presented in Figure 3-25.

3.5.4  CMR01 Communications Line Adjustments

This procedure is the last procedure to be performed prior to testing a complete CMR11/CMV11 system using the network exerciser [(C)ZCMJ, program #3]. These adjustments are critical to ensure proper communications between the host and remotes.
These procedures must be performed during the installation process and when troubleshooting efforts determine that they are required. However, these procedures must also be performed whenever the system configuration is changed by either adding or deleting remote units.

Figure 3-26 outlines the procedure for making these critical adjustments.
Figure 3-25  M8997 Checkout Procedure (Sheet 2 of 2)
Figure 3-26 CMR01 Communications Line Adjustments (Sheet 1 of 3)
TEST AND CALIBRATION

Figure 3-26  CMR01 Communications Line
Adjustments (Sheet 2 of 3)
Figure 3-26  CMR01 Communications Line Adjustments (Sheet 3 of 3)
4 CORRECTIVE MAINTENANCE

4.1 GENERAL

This chapter simply reviews the maintenance features available with the CMR11/CMV11 to aid the troubleshooting processes. Also included are some troubleshooting precautions, service limitations, and maintenance aids such as register bit assignments and TECH TIPS/FCO index.

Test and calibration procedures have already been presented in detail in Chapter 3. Although these procedures are slanted towards installation checkout, they are also used in corrective maintenance; the only difference being the sequence in executing these procedures. For example, as shown in Figure 4.1, the first step for corrective maintenance is to load and execute the system network exerciser [(C)ZCMJ, program #3] to determine if the fault is with the host or one of the remote units.

4.2 MAINTENANCE FEATURES

1. (C)ZCMJ** diagnostic — Used to test host controller and system network level.
   
   a. Diagnostic media
   
   1) Functional diagnostic — (C)ZCMJ**, paper tape, AK-F913**-M1.
   2) DEC/X11 diagnostic — (C)XCMJ**, paper tape, AK-S331**-MC.
   
   b. Precautions
   
   1) When running program #2, make sure that the proper loopback switches or test connector are installed correctly.

---

*Revision level
CORRECTIVE MAINTENANCE

2) When executing program #3, if the line speed is slow (300 baud) – the run time is considerable (up to 30 minutes).

3) Be sure that the customer’s process is terminated and the I/O cable modules removed.

2. Remote firmware – Used to test the three major sections of the remote unit; controller, LDM, and R-BUS options.

a. Test equipment

1) Standard field service tool kit.

2) An oscilloscope.

3) A precision digital voltmeter.

4) EDC MV-105GJ voltage standard.

5) CMR11-TA test kit; includes test modules G5153 and A908, a test paddleboard CMR11-TI, and a BC08R-03 cable.

b. Precautions

1) For safety reasons, terminate customer’s operation and remove ALL I/O paddleboards from slots below R-BUS.

2) Any remote that is added to or removed from the system configuration changes the loading characteristics. This makes it necessary to readjust the communications line adjustments (refer to Section 3.5.4).

c. Display panel – Provides the means to implement the firmware and to observe test results.

1) Keylock switch (three position)

   RUN mode – normal position

   RUN/DISPLAY mode

   TEST mode – selects one of six test conditions
<table>
<thead>
<tr>
<th>Position</th>
<th>Selects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Display RAM (locations 2000 through 27FF)</td>
</tr>
<tr>
<td>2</td>
<td>I/O module test (slow speed)</td>
</tr>
<tr>
<td>3</td>
<td>Defined output</td>
</tr>
<tr>
<td>4</td>
<td>I/O module test (fast speed)</td>
</tr>
<tr>
<td>5</td>
<td>Loopback</td>
</tr>
<tr>
<td>6</td>
<td>I/O module ID</td>
</tr>
<tr>
<td>7 &amp; 8</td>
<td>Not used</td>
</tr>
</tbody>
</table>

d. Error readout – Normal error codes are displayed in the three right-hand LEDs of the display. This three-digit error code is prefixed by the letter c (refer to Table 3-1). Data errors in loopback testing are indicated by the prefix of a backwards letter c. The erroneous character is displayed (in octal) in the right-hand LEDs. Errors prefixed by the letter u indicate that the loopback test is currently passing, but that an error did occur earlier.
Figure 4-1  CMR11/CMV11 Troubleshooting
Flowchart (Sheet 1 of 2)
Figure 4-1  CMR11/CMV11 Troubleshooting
Flowchart (Sheet 2 of 2)
4.3 REGISTER BIT ASSIGNMENTS

Figure 4-2 shows the bit assignments for each of the three registers in the CMR11/CMV11.

4.4 TECH-TIPS/FCO INDEX

As of this printing, there have been no TECH-TIPS or FCOs issued on the CMR11/CMV11.

---

**CONTROL STATUS REGISTER (CSR) 764070**

```
07 06 05 04 03 02 01 00
MAIN | IE | REP | THRU | CLR | TPB | ENA | CST | ENA | BKS | INIT | ST | FLIN
INT  | FUN | COM | CHG | STA | ALM | DET | THRU | PWR | UP | NOT USED
15 14 13 12 11 10 09 08

**SCRATCHPAD ADDRESS REGISTER (SPAR) 764072**

```
07 06 05 04 03 02 01 00
SCRPAD ADDRESS

15 14 13 12 11 10 09 08
0 = REQUEST SCRATCHPAD
1 = RESULTS SCRATCHPAD

**SCRATCHPAD DATA REGISTER (SPDR) 764074**

```
07 06 05 04 03 02 01 00
SCRATCHPAD DATA

15 14 13 12 11 10 09 08
NOT USED
```

Figure 4-2 CMR11/CMV11 Register Bit Assignments
READER'S COMMENTS
CMR11/CMV11 Distributed Multisensor Controller
Pocket Service Guide
EK-CMR11-PS-001

This Pocket Service Guide is intended for Field Service Technicians. Your comments and suggestions will help us in our continuous effort to improve its quality and usefulness.

What is your general reaction to this Pocket Service Guide?

<table>
<thead>
<tr>
<th>Excellent</th>
<th>Very Good</th>
<th>Good</th>
<th>Fair</th>
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<tbody>
<tr>
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Accurancy

<p>| | | | |</p>
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<thead>
<tr>
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Completeness

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Organization

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Format

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What features are most useful?
(Notes, Tables, Illustrations, etc.)

1.__________________ 3.__________________

2.__________________ 4.__________________

Does the publication satisfy your needs? □ Yes □ No

What errors have you found?
(Ref. page no., table no., and figure no.)

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

Comments.

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_________________________________________________________________

_________________________________________________________________

Name ____________________________
Title ____________________________ Dept. ____________________________
Company __________________________
Address __________________________
City ____________________________ State ______ Zip ________

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