CMR11/CMV11
Distributed
Multiprocess
Controller
Pocket
Service
Guide
CMR11/CMV11
Distributed
Multiprocess
Controller

Pocket
Service
Guide

Prepared by Educational Services
of
Digital Equipment Corporation
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PREFACE

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

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

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

1.1 GENERAL
The Compact Micro Remote (CMRII/CMVII) 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 CMRII/CMVII 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 CMRII/CMVII system is logically separated into two distinctive sections:

1. The CMRII/CMVII host controller, and
2. The CMROI remote unit.

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

1.2.1 CMRII Host Controller Component Summary
The CMRII/CMVII host controller, physically located at the site of the CPU, consists of the following three basic components:

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

- Communication panel assembly
  - CMRII-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
  - CMRII-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.
Figure 1-1 CMR11/CMV11 Basic Host Controller Diagram

ALLOWS COMMUNICATION UP TO 16 REMOTE CMR01 UNITS FOR EACH PORT USING LIMITED DISTANCE MODEMS (LDM)

OR

ALLOWS COMMUNICATION UP TO 63 REMOTE CMR01 UNITS FOR EACH PORT USING NORMAL EIA COMMUNICATION FACILITIES
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)
    CMV11 - 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.
INTRODUCTION

**CMR01 Option** | **Max. Current**
---|---
CMR01-AA 115 Vac | 2.5 A
CMR01-AB 230 Vac | 1.5 A
CMR01-AC 115 Vac | 2.5 A or 12 Vdc* at 30 A
CMR01-AD 230 Vac | 1.5 A or 12 Vdc* at 30 A

- 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 CMR11/CMV11 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
- CMR11-AA Engineering Drawings MP-01287
- CMV11-AA Engineering Drawings MP-01288
- CMR11-01/02 Engineering Drawings MP-01289
- CMR01 Engineering Drawings MP-01290

2.3 CMR11/CMV11 COMPONENTS LIST
Tables 2-1 and 2-2 identify the components required to configure the CMR11/CMV11 host and the CMR01 remote unit respectively.
<table>
<thead>
<tr>
<th>Option</th>
<th>Parts List</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMRII-AA</td>
<td>M8990, YC-C318C-00, MP-01287-00, AC-F912B-MC, AK-F913B-MC, 2C-HY50A-00</td>
<td>Basic PDP-11 Host Controller, Host Microprocessor Module, Option Description Manual, Engineering Print Set for CMRII-AA, CZCMJ** Diagnostic Paper, Tape, CZCMJ** Diagnostic Listing, Host Comm Port Test Connector</td>
</tr>
<tr>
<td>CMVII-AA</td>
<td>M7181, M7182, BC05L-1C, YC-C318C-00, MP-01288-00, AC-F912B-MC, AK-F913B-MC, 2C-HY50A-00</td>
<td>Basic LSI-11 Host Controller, Host Microprocessor Module #1, Host Microprocessor Module #2, Module Interconnect Cable, Option Description Manual, Engineering Print Set for CMVII-AA, CZCMJ** Diagnostic Paper, Tape, CZCMJ** Diagnostic Listing, Host Comm Port Loopback Test Connector</td>
</tr>
<tr>
<td>CMRII-01</td>
<td>2C-H434A-00, M8996, 2C-HY38A-06, MP-01289-00, 2C-HY51A-00, 2C-HY53A-00</td>
<td>Host Communication Panel Assembly, Communication Panel, Host LDM Modem Module, CMR LDM Communication Cable, Engineering Print Set for CMRII-01/02, EIA Berg Port Loopback Test Connector, LDM Loopback Cable Wire Assembly</td>
</tr>
<tr>
<td>CMRII-02</td>
<td>M8996, 2C-HY38A-06, 2C-HY51A-00, 2C-HY53A-00</td>
<td>Host LDM Communication Add-on Option for each additional communication port, Host LDM Modem Module, CMR LDM Communication Cable, EIA Berg Port Loopback Test Connector, 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>CMROI</td>
<td></td>
<td>CMROI Basic Components</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The basic CMROI without any I/O modules is the foundation for building custom configurations. It is not an orderable item.</td>
</tr>
<tr>
<td>2C-E265A-00</td>
<td></td>
<td>CMROI Remote Box Chassis Assembly with associated hardware</td>
</tr>
<tr>
<td>M8991</td>
<td></td>
<td>Microprocessor Controller #1 Module</td>
</tr>
<tr>
<td>M8992</td>
<td></td>
<td>Microprocessor Controller #2 Module</td>
</tr>
<tr>
<td>M8995</td>
<td></td>
<td>LDM Modem Module</td>
</tr>
<tr>
<td>M9052</td>
<td></td>
<td>Remote Connector Module</td>
</tr>
<tr>
<td>2C-E255A-00</td>
<td></td>
<td>Display Panel Assembly</td>
</tr>
<tr>
<td>MP-01290-00</td>
<td></td>
<td>Engineering Print Set for CMROI</td>
</tr>
<tr>
<td>YC-C328C-00</td>
<td></td>
<td>Option Description Manual</td>
</tr>
<tr>
<td>2C-HY51A-00</td>
<td></td>
<td>EIA Berg Port Loopback Test Connector</td>
</tr>
<tr>
<td>2C-HY53A-00</td>
<td></td>
<td>LDM Loopback Cable Wire Assembly</td>
</tr>
<tr>
<td>CMROI-AA</td>
<td>Basic CMROI 2C-E250A-01</td>
<td>See Description Above</td>
</tr>
<tr>
<td></td>
<td>17-00083-07</td>
<td>AC Power Supply (115/230 Vac)</td>
</tr>
<tr>
<td>CMROI-AB</td>
<td>Basic CMROI 2C-E250A-01</td>
<td>See Description Above</td>
</tr>
<tr>
<td></td>
<td>17-00083-08</td>
<td>AC Power Cord for 230 Vac Application</td>
</tr>
<tr>
<td>CMROI-AC</td>
<td>Basic CMROI 2C-E250A-02</td>
<td>See Description Above</td>
</tr>
<tr>
<td></td>
<td>17-00083-07</td>
<td>AC/DC Power Supply (115/230 Vac) without DC battery back-up capabilities</td>
</tr>
<tr>
<td>CMROI-AD</td>
<td>Basic CMROI 2C-E250A-02</td>
<td>See Description Above</td>
</tr>
<tr>
<td></td>
<td>17-00083-08</td>
<td>AC/DC Power Supply (115/230 Vac) without DC battery back-up capabilities</td>
</tr>
</tbody>
</table>
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 CMRII/CMVI I POWER/BUS LOADING

Tables 2-4 through 2-6 list all of the module power requirements for the CMRII/CMVI host, the CMR01 standard components, and the CMR01 optional I/O control configuration.
Table 2-3 Optional I/O Module List

<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>101177</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 2-4 CMR/CMV11 Module Input Voltage Chart

<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>M8996 *</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</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pins AA1, AA2</td>
</tr>
<tr>
<td>Includes M9053,</td>
<td></td>
<td>Ground Pins AC1,</td>
</tr>
<tr>
<td>M8991, M8992,</td>
<td></td>
<td>AC2</td>
</tr>
<tr>
<td>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 CMRII/CMVII 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 CMRII/CMVII host requirements while Section 2.6.2 outlines the CMR01 remote unit requirements.

2.6.1 CMRII/CMVII Host Considerations

- **Mounting**
  - CMRII: one hex-height small peripheral controller (SPC) backplane slot.
  - CMVII: 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 CMVII, 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 CMRII or 2-3 for CMVII.

- **Vector Address**
  Assigned to user-address area beginning at 170. For switchpack location and address selection refer to Figure 2-2 for CMRII or 2-4 for CMVII.
<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>
BOARD CONFIGURATIONS  17

• 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  CMRO1 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.
### CMR11 (M8990) Device Address/Host

#### Baud Rate Selection

<table>
<thead>
<tr>
<th>Baud Rate</th>
<th>Setting</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>

#### Switch Configuration

- **S1 - PORT 0**
- **S2 - PORT 1**
- **S3 - PORT 2**
- **S4 - PORT 3**

#### Device Address Selection

<table>
<thead>
<tr>
<th>Address</th>
<th>Switch Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>ON ON ON ON ON</td>
</tr>
<tr>
<td>1</td>
<td>ON ON ON ON ON</td>
</tr>
<tr>
<td>2</td>
<td>ON ON ON ON ON</td>
</tr>
<tr>
<td>3</td>
<td>ON ON ON ON ON</td>
</tr>
<tr>
<td>4</td>
<td>ON ON ON ON ON</td>
</tr>
<tr>
<td>5</td>
<td>ON ON ON ON ON</td>
</tr>
<tr>
<td>6</td>
<td>ON ON ON ON ON</td>
</tr>
<tr>
<td>7</td>
<td>ON ON ON ON ON</td>
</tr>
<tr>
<td>8</td>
<td>ON ON ON ON ON</td>
</tr>
<tr>
<td>9</td>
<td>ON ON ON ON ON</td>
</tr>
<tr>
<td>10</td>
<td>ON ON ON ON ON</td>
</tr>
<tr>
<td>11</td>
<td>ON ON ON ON ON</td>
</tr>
<tr>
<td>12</td>
<td>ON ON ON ON ON</td>
</tr>
</tbody>
</table>

**NOTE:**

Switch on responds to a logical one on the UNIBUS.

---

**Figure 2-1** CMR11 (M8990) Device Address/Host Baud Rate Selection
Figure 2-2  CMR11 (M8990) Vector Address Selection
Figure 2-3  CMVII (M7181) Device Address/Host Baud Rate Selection (Ports 0-1)
Figure 2-4  CMVII (M7181) Vector Address Selection
### Figure 2-5 CMV11 Host Baud Rate Selection

(Ports 2-3)

<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>
BOARD CONFIGURATIONS

S3 - LINE LOOPBACK SWITCH
UP = LINE LOOPBACK
DOWN = NORMAL POSITION

S4 - LOCAL LOOPBACK SWITCH
UP = NORMAL POSITION
DOWN = LOCAL LOOPBACK

LIMITED DISTANCE MODEM CABLE CONNECTIONS

EIA RS232-C CABLE CONNECTION

EIA RS232-C

S5 - SPEED SELECT FILTER SWITCH
UP = MORE THAN 2400 BAUD
DOWN = EQUAL TO OR LESS THAN 2400 BAUD

NOTE
ALL SWITCHES ARE SHOWN IN THE DOWN POSITION

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 CABELING 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 (TSI) loopback
- **H325** – EIA cable loopback
BOARD CONFIGURATIONS

START

PRE-INSTALLATION CONSIDERATIONS

ALL VARIABLES OBTAINED

YES

PACK AND VERIFY ALL COMPONENTS RECEIVED

APPLY POWER VERIFY SELECTED BACKPLANE VOLTAGE, THEN TURN POWER OFF

CONFIGURE CMR/CMV11 HOST CONTROLLER MODULE(S)

INSTALL CMR/CMV11 MODULE(S)

PERFORM RESISTANCE CHECK ON +5 VOLTS, POWER ON, VERIFY +5 VOLTS, AND THEN TURN POWER OFF

DO NOT INSTALL OPTIONS

REFER TO TABLE 2-1

+5 VOLTS, BACKPLANE PIN AA2
- MINIMUM +5.00
- MAXIMUM +5.25

CONFIGURE M8990 MODULE FOR CMR11-AA, M7181 AND M7182 MODULES FOR CMV11-AA

FIGURE REFERENCE CMR11-AA CMV11-AA
- DEVICE ADDRESS
- DEVICE VECTOR ADDRESS
- COMMUNICATION BAUD RATE
- PRIORITY PLUG VERIFICATION

FOR CMV11 AA INSTALL B0051C
CABLE BETWEEN M1181 AND M1182

+5 VOLTS, BACKPLANE PIN AA2
- MINIMUM +5.00
- MAXIMUM +5.25

Figure 2-8 CMR11/CMV11 Installation Flowchart
(Sheet 1 of 3)
Board Configurations 27

1. Install any CMR11/CMV11 options.
2. Mount panel properly to cabinet.
3. Install 2C-HY3A-08 cable for each com port being used.
4. Configure each modem module for proper line configuration.
5. For EIA interface, attach the B道教 to J1 on modem (Figure 2-10).
6. For low interface, attach the I wire cable to T5 on modem (Figure 2-10).

Load and execute IC1-CJM2* test program #1. See Figure 3-5.

Check cables, board/CRT, switches and/or replace modules.

Execute diagnostic test program number 2.

Figure 2-8 CMR11/CMV11 Installation Flowchart
(Sheet 2 of 3)
Figure 2-8  CMR11/CMV11 Installation Flowchart
(Sheet 3 of 3)
START

PREINSTALLATION CONSIDERATIONS

ALL VARIABLES OBTAINED

NO

DO NOT INSTALL OPTION

YES

UNPACK AND VERIFY ALL COMPONENTS RECEIVED

REFER TO TABLE 2-2

MOUNT CMR01 IN RACK WITH MINIMUM OF 3/4" TOP AND BOTTOM

VERIFY POWER SUPPLY FOR PROPER TYPE AND INSTALL POWER CABLES

REPLACE ALL I/O MODULES AND PADDLEBOARDS

PUT CMR01 INTO BASIC UNIT WITH NO I/O MODULES. LEAVE THE M8991, M8992, M8995 AND M9053 MODULES INSTALLED.

REMOVE THE DISPLAY PANEL AND M8953 MODULE. CONNECT THE MODM INTERFACE CABLES TO M8953 MODULE. REINSTALL MODULE AND DISPLAY PANEL.

FOR EIA INTERFACE: ATTACH THE BCDSC INTO J3 (FIGURE 2-10)
FOR LMO INTERAFCE: ATTACH THE 4 WIRE CABLE TO TS1 (FIGURE 2-10)

BOARD CONFIGURATIONS 29

Figure 2-9 CMR01 Installation Flowchart
(Sheet 1 of 2)
CONFIGURE THE CUSTOMER VARIABLES ON BASIC CMRO1 REMOTE UNIT

POWER ON CMRO1 AND PERFORM BASIC CHECKOUT PROCEDURE

POWER OFF CMRO1 AND INSTALL ALL I/O MODULES PER CUSTOMER CONFIGURATION SHEET.

POWER ON CMRO1 AND ALLOW DEVICE WARM UP. PERFORM ALL I/O MODULE CHECKOUT AND CALIBRATION PROCEDURES.

ALL I/O MODULES PASS TESTS

PERFORM COMMUNICATION LINE ADJUSTMENTS ON ALL CMRO1 REMOTE UNITS.

RETURN TO HOST INSTALLATION FLOW AND PERFORM NETWORK TEST PROGRAM #3.

EXIT

+ MULTIPONT ID ADDRESS. FIGURE 2-7
+ COMMUNICATION BAUD RATE: FIGURE 2-7
+ COMMUNICATION PORT NUMBER: FIGURE 2-7
+ REMOTE MODEM VARIABLES: FIGURE 2-6

VERIFY THE DISPLAY PANEL SEGMENTS AND THE MICROPROCESSOR LED INDICATORS. SEE FIGURE 2-7.

PERFORM I/O CHECKOUT ON ALL I/O MODULES INSTALLED ALLOWING PROPER TIME FOR ANALOG CIRCUITS TO WARM UP. SEE SECTION 3.5.

NO

RETEST AND/OR CHANGE MODULE; RECALIBRATE THOSE MODULES THAT HAVE THE ABILITY

YES

ALL CMRO1 UNITS ON A COMMUNICATION LINE MUST BE INSTALLED AND CHECKED OUT PRIOR TO DOING THIS PROCEDURE. SEE SECTION 3.5.

Figure 2-9 CMRO1 Installation Flowchart
(Sheet 2 of 2)
CABLE TURNAROUND TEST CONNECTOR 2C-HY93A

INSERT PLUG SO THAT WORDS "THIS SIDE UP" FACES OUT

CABLE 2C-HY93A (4 PLACES)

PORT 3

PORT 2

PORT 1

PORT 0

CABLE BOSC-XX

PORT 3

CABLE TURNAROUND TEST CONNECTOR H25

PORT 0

H25

PORT 2

PORT 1

PORT 0

NOTE 1

PORTS 1 AND 2 SAME AS PORT 0 OR PORT 3.

Figure 2-10 CMR11/CMV11 Cabling Diagram/Test Connector Placement
32  BOARD CONFIGURATIONS

Figure 2-11  CMR11/CMV11 Cables
Figure 2-12  CMR11/CMV11 Test Connectors (Sheet 1 of 2)
34 BOARD CONFIGURATIONS

2C-HY53A LDM TS1 LOOPBACK

USED ON TS1 ON THE M8955 LDM (HOST) OR ON THE M6955 LDM (REMOTE).

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 CMRII/CMVII system.

Because of the complexity of the CMRII/CMVII, 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 CMRII. As an alternative, checkout and calibration procedures are provided in flowchart format.

The CMRII 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 CMRII/CMVII 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:
CMRII/CMVII 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

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

<table>
<thead>
<tr>
<th>Bit</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>100000</td>
<td>Do not halt on errors</td>
</tr>
<tr>
<td>14</td>
<td>040000</td>
<td>Do not print errors</td>
</tr>
<tr>
<td>13</td>
<td>020000</td>
<td>Loop on erroneous routine</td>
</tr>
<tr>
<td>11</td>
<td>004000</td>
<td>Inhibit program iterations</td>
</tr>
<tr>
<td>10</td>
<td>002000</td>
<td>Do not print end of pass</td>
</tr>
</tbody>
</table>

TESTS

<table>
<thead>
<tr>
<th>Sub Test</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Logic test</td>
</tr>
<tr>
<td>2</td>
<td>Port loopback</td>
</tr>
<tr>
<td>3</td>
<td>CMR exercise</td>
</tr>
</tbody>
</table>

EXECUTION TIME

<table>
<thead>
<tr>
<th>Sub Test</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 minute</td>
</tr>
<tr>
<td>2</td>
<td>Depends on line speed</td>
</tr>
<tr>
<td>3</td>
<td>Depends on line speed</td>
</tr>
</tbody>
</table>

*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-91
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.
38 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 # ERR. CNT = 0 EL. TIM.=010111:58
END PASS # ERR. CNT = 0 EL. TIM.=010141:4
END PASS # ERR. CNT = 0 EL. TIM.=010161:4
END PASS # ERR. CNT = 0 EL. TIM.=010181:12
END PASS # ERR. CNT = 0 EL. TIM.=010110:21
END PASS # ERR. CNT = 0 EL. TIM.=010112:29
END PASS # ERR. CNT = 0 EL. TIM.=010114:37
END PASS # ERR. CNT = 0 EL. TIM.=010116:45
END PASS # ERR. CNT = 0 EL. TIM.=010118:54
END PASS # ERR. CNT = 0 EL. TIM.=010120:14
END PASS # ERR. CNT = 0 EL. TIM.=010123:12
END PASS # ERR. CNT = 0 EL. TIM.=010125:23
END PASS # ERR. CNT = 0 EL. TIM.=010127:33
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 ***

PORT 0  6(0)  37(0)  71(0)

END PASS $1$ ERR. CNT = 0 EL. TIM.=01:21:13:44
END PASS $2$ ERR. CNT = 0 EL. TIM.=01:21:20:155
END PASS $3$ ERR. CNT = 0 EL. TIM.=01:21:28:17
END PASS $4$ ERR. CNT = 0 EL. TIM.=01:21:35:35
END PASS $5$ ERR. CNT = 0 EL. TIM.=01:21:42:13
END PASS $6$ ERR. CNT = 0 EL. TIM.=01:21:50:28
END PASS $7$ ERR. CNT = 0 EL. TIM.=01:21:57:40
END PASS $8$ ERR. CNT = 0 EL. TIM.=01:31:51:6
END PASS $9$ ERR. CNT = 0 EL. TIM.=01:31:12:32
END PASS $10$ ERR. CNT = 0 EL. TIM.=01:31:19:46
END PASS $11$ ERR. CNT = 0 EL. TIM.=01:31:27:14
END PASS $12$ ERR. CNT = 0 EL. TIM.=01:31:34:46
END PASS $13$ ERR. CNT = 0 EL. TIM.=01:31:41:10
END PASS $14$ ERR. CNT = 0 EL. TIM.=01:31:49:29
END PASS $15$ ERR. CNT = 0 EL. TIM.=01:31:56:19

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 ***

PORT 0  37(0)  71(0)

*** REMOTE STATUS CHANGE ***
REMOTE $14$
REMOTE STATUS NOW REGULAR
END PASS $1$ ERR. CNT = 0 EL. TIM.=01:21:11:43
END PASS $2$ ERR. CNT = 0 EL. TIM.=01:21:19:10

*** PORT CONFIGURATION ***

PORT 0  14(0)  37(0)  71(0)

END PASS $3$ ERR. CNT = 0 EL. TIM.=01:21:29:56
END PASS $4$ ERR. CNT = 0 EL. TIM.=01:21:37:26
END PASS $5$ ERR. CNT = 0 EL. TIM.=01:21:44:21
END PASS $6$ ERR. CNT = 0 EL. TIM.=01:21:51:32

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

Checkout procedures for the CMRII/CMVII host controller require executing (C)ZCMJ diagnostics. The flowchart of Figure 3-5 illustrates the CMRII/CMVII 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 CMROI REMOTE CHECKOUT PROCEDURES

The CMROI remote unit checkout procedures are performed in three steps. The first step provides a simple checkout of the basic CMROI 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 CMROI 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?

YES

EXECUTE
DIAGNOSTIC TEST PROGRAM #2

TEST #2
PASSES?

NO

CHECK CABLES, BOARD SEATING, SWITCH CONFIGURATIONS, OR REPLACE MODULE(S):
M8990 FOR CMR
M7181 AND M7182 FOR CMV

YES

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

PERFORM I/O CONTROLLER TEST PROCEDURES, FOLLOWED BY PERFORMING THE COMMUNICATION LINE ADJUSTMENTS (SEE SECTION 3.5)

IS THIS A NEW INSTALLATION?

NO

PLACE S4 ON M8996 MODULES TO LOCAL LOOPBACK POSITION
LOAD AND EXECUTE (QZCMJ** - 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

NO

PLACE S4 ON M8996 MODULES TO THE NORMAL POSITION, UNLESS SELECTED AS LOOPBACK METHOD:
SELECT ONE OF THE LOOPBACK METHODS BELOW AND EXECUTE (QZCMJ, TEST # 2 ON ALL ACTIVE PORTS:
1. S4 ON M8996 TO LOCAL LOOP POSITION.
2. TEST CONNECTOR 2C-HYSD TO M8990 PORTS J 1, J 2, J 3, AND/OR J 4.
3. TEST CONNECTOR 2C-HYSA TO M8996 PORT J 1.
4. TEST CONNECTOR H325 TO BC0PC CABLE END.
5. TEST CONNECTOR TO M8996 TERMINAL STRIP (TB1).
6. S3 ON REMOTE M8995 TO LINE LOOP POSITION.
ALLOW TEST TO RUN FOR TWENTY ERROR FREE PASSES.
TO EXIT TEST, ENTER CONTROL C.

Figure 3-5 CMRII/CMVII Checkout Procedures
(Sheet 1 of 2)
TEST AND CALIBRATION

Figure 3-5  CMR11/CMV11 Checkout Procedures
(Sheet 2 of 2)
BAUD RATE SELECT SWITCH - S2 selects line speed; also selects gain code during certain I/O tests.
- 0 = 300
- 1 = 600
- 2 = 1200
- 3 = 2400
- 4 = 4800
- 5 = 9600

ID ADDRESS SELECT SWITCH - S3, S4 forms 8-bit address word combined with port select to form multipoint address.

SLOT SELECT SWITCH - S8 selects R-BUS slot containing I/O controller under test in some tests. Used to input hex data.

CHANNEL SELECT SWITCH - S9 selects one of 18 I/O controller channels. Also used to input hex data during maintenance testing.

I/O TEST BEGIN SWITCH - S7 starts the selected test.

MUST RECYCLE POWER TO CHANGE BAUD RATE, PORT NUMBER AND I.O. NUMBER.

PORT SELECT SWITCH - S1 selects one of four ports. Set to same port as host.

SIX DIGIT DISPLAY - displays data for user and maintenance verification. Also displays error codes.

ROTARY TEST SWITCH - selects various pre-programmed maintenance test routines. Functional only when mode select key is in test.

MODE SELECT KEY

Figure 3-6 CMR01 Maintenance/Display Panel
### Table 3-1 CMRII 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 Gains 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 3-1 CMR11 Error Codes (Cont)

<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

| 340  | CRC Error on message from remote                  |
| 341  | Timeout on transmission to remote                 |
| 342  | Received a byte count that is too long            |
| 343  | Received a byte count that is too short           |
| 344  | Received an erroneous function code               |
| 345  | Received an erroneous remote ID                    |
| 346  | Wrong function code received on return broadcast  |
| 347  | Time out on the Transmitter                       |

SUCCESS CODES

| 364  | Function was executed but some of the requests have errors |
| 360  | Function was executed but some of the requests have warnings |
| 372  | Data error on host loopback                        |
| 373  | Receiver timeout on host loopback                   |
| 374  | Transmitter time out on host loopback               |
| 375  | Illegal request count on maintenance function      |
| 376  | Illegal port number on host loopback               |
| 377  | Function failed, refer to USOR                      |
3.5.2 CMRO1 Basic Test Procedure

The basic CMRO1 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.

![Flowchart of Basic CMRO1 Test Procedure](image-url)
TEST AND CALIBRATION

PLACE ROTARY TEST SWITCH TO POSITION 6

PLACE SLOT SELECT SWITCH 68 TO ZERO POSITION

DOES PANEL LED DISPLAY MODULE ID FOR SELECTED SLOT?

NO

VERIFY SLOT # SELECTED.

CHANGE I/O MODULE IN SELECTED SLOT

YES

EMPTY R-BUS SLOTS WILL REGISTER AS "C200" ON THE PANEL LED DISPLAY. REFER TO TABLE 2.3 FOR CORRECT MODULE ID NUMBERS.

REPEAT MODULE ID TEST FOR EACH R-BUS SLOT

ALL SLOTS TESTED?

NO

PLACE MODE SELECT KEYLOCK SWITCH TO RUN POSITION

BASIC CMRO1 TEST PROCEDURE IS COMPLETE

YES

EXIT

Figure 3-7 Basic CMRO1 Test Procedure
(Sheet 2 of 2)
Figure 3-8  CMR01 Remote Unit LED Legend
3.5.3 CMR01 Remote 1/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).
- CMRTI-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 CMRTI-11 (see Figure 3-12).
- A908 analog I/O test module (see Figure 3-13).

Figure 3-9  M8995 Switch Locations
Figure 3-10  G5153 Digital I/O Pulse Count Test Module

- **S1** specifies module type under test.
- **S2** specifies input/output tests, not used in pulse counter mode.
- **Pulse Counter** monitors digital outputs.
- Power LED on - +5V is applied to module.
- E13 thru E16 - in digital mode, specifies bit pattern, corresponding LEDs (D33-D38) indicate state of switches.
- **E8** selects channel for sending pulses:
  - SW0=1 is channel 1
  - SW1=1 is channel 2
  - SW2=1 is channel 3
  - SW3=1 is channel 4
- **S3** starts series of pulses, used only in pulse counter mode.
Figure 3-11  CMRT-11 Signal Conditioning Paddleboard (M9052)
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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></th>
<th>Calibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>A805</td>
<td>3-15</td>
<td></td>
<td>3-16</td>
</tr>
<tr>
<td>A6005</td>
<td>3-19</td>
<td></td>
<td>3-20</td>
</tr>
<tr>
<td>A1004/1005</td>
<td>3-22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M8993</td>
<td>3-23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M8986-87</td>
<td>3-24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M8994</td>
<td>3-25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M8997</td>
<td></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

Figure 3-15  A805 Checkout Procedure (Sheet 1 of 4)

START

- Store paddleboard in the extra slot to right of slot 15.

CONFIGURE AND INSTALL THE A908 TEST MODULE IN ABOVE PADDLE BOARD SLOT.

- Turn on channel select switches 0-7.
- Turn signal short switch to short position.

ATTACH ANALOG TEST EQUIPMENT (SEE FIGURE 3-14)

- Attach lead of voltage standard to J3 on A908 module.
- Attach lead of voltage standard to J2 on A908 module.
- Attach digital voltmeter to monitor the voltage standard output.

POWER ON THE CMOD. Allow 20 minutes warm up for A908 module and voltage standard.

PERFORM ANALOG GAIN OF 1 TEST. VERIFY THE LEDS.

- 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.
- Press the I/O test begin switch.
- Verify the following LEDs:
  - A805 and A1004 or A1005 module power bottom LED is on.
  - A805 busy (2nd from top) LED is flashing.
  - A1004 or A1005 relay closed (top) LED is flashing.
- Verify that the display, which uses the following data format of PGXXXX, indicates:
  - Data value XXXX is not greater than 1.
  - Gain code value G is 0.
  - Polarity bit P is 1 or 0.
- Ensure go (2nd from top) and G1 (top) LEDs are off.

PERFORM GAIN OF 1 VERIFICATION.
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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.

![Diagram of A805 Calibration Procedure](Sheet 1 of 3)

Figure 3-16 A805 Calibration Procedure (Sheet 1 of 3)
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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.
TEST AND CALIBRATION

CHANNEL 1
LOWER LIMIT OFFSET - R15
UPPER LIMIT SCALE - R17

CHANNEL 0
LOWER LIMIT OFFSET - R8
UPPER LIMIT SCALE - R10

NOTE: MUST BE SMOOTH/EQUAL STEPS IN LINEAR INCREASE ON RAMP CHECK.

CIRCUIT
• ANALOG ON SCOPE CHANNEL A
• COMMON SCOPE CHANNEL B
• BOTH A & B VOLTS/DIV MUST BE EQUAL
• DIFFERENTIAL INPUT ADD A + B
• CHANNEL B - INVERTED
• AC COUPLED INPUTS

Figure 3-18 A6005 Test Configuration
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START

REMOVE PADDLE BOARD FROM THE A6005 MODULE BEING CALIBRATED.

CONFIGURE A90B TEST MODULE AND INSTALL IN ABOVE PADDLEBOARD SLOT.

TURN CARD ON; VERIFY LED ALLOWS WARM-UP OF 10 MINUTES THEN PROCEED.

PERFORM MODULE I/O TEST.

DOES DISPLAY = 11002?

NO

YES

ENSURE POWER ON (BOTTOM) LED IS ON.

ENSURE -15 VOLT (TOP) LED IS ON.

TURN MODE SWITCH TO TEST POSITION.

TURN TEST SELECT SWITCH TO POSITION 6.

PUT SLOT SELECT SWITCH TO SLOT # OF THE I/O MODULE BEING TESTED.

STORE PADDLE BOARD IN THE EXTRA SLOT TO RIGHT OF SLOT 19.

TURN OFF CHANNEL SELECT SWITCHES 0-7.

TURN SIGNAL SHORT SWITCH TO SHORT POSITION.

ENSURE PROPER SLOT IS SELECTED.

CHANGE I/O MODULE.

Figure 3-19 A6005 Checkout Procedure
(Sheet 1 of 2)
SET-UP TEST EQUIPMENT FOR ANALOG TESTING (SEE FIGURE 3-18).

- CONNECT SCOPE CHANNEL A TO CH1 + ON A008 MODULE.
- CONNECT SCOPE CHANNEL B TO COMM-15 ON A008 MODULE.

CHANGE VID MODULE AND/OR REGULATE

PERFORM RAMP DATA TEST CHANNEL B, OBSERVE PATTERN ON OSCILLOSCOPE

- TURN TEST SELECT SWITCH TO POSITION 4
- TURN CHANNEL SELECT SWITCH TO POSITION 0
- PRESS 1/O TEST BEGIN SWITCH

RAMP STARTS AT 2 VOLTS AND STOPS AT 10 VOLTS
- RAMP IS A LINEAR LINE AT APPROXIMATELY 45 DEGREE ANGLE

TEST COMPLETED RETURN CD56 TO NORMAL MODE, REMOVE TEST MODU顶 AND REINSTALL PADDLE BOARD.

EXIT

PERFORM RAMP DATA TEST CHANNEL 1, OBSERVE PATTERN ON OSCILLOSCOPE

- CONNECT SCOPE CHANNEL A TO CH1 + ON A008 MODULE.
- TURN CHANNEL SELECT SWITCH TO POSITION 1
- PRESS 1/O TEST BEGIN SWITCH

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.
TEST AND CALIBRATION

START

REMOVE PADDLE BOARD FROM BELOW THE A908 MODULE TO BE CALIBRATED

CONFIGURE A908 TEST MODULE AND INSTALL IN THE ABOVE PADDLEBOARD SLOT

TURN CMRO1 ON. VERIFY LED. ALLOW WARM-UP OF 10 MINUTES.

PERFORM MODULE 10 TEST

DOES DISPLAY = 1100?

YES

SET UP TEST EQUIPMENT FOR ANALOG TESTING.

NO

ENSURE POWER ON (BOTTOM LED IS ON.

ENSURE -15 VOLT (TOP LED IS ON.

TURN MODE SWITCH TO TEST POSITION. TURN TEST SELECT SWITCH TO POSITION 6.

PUT SLOT SELECT SWITCH TO SLOT # OF THE I/O MODULE BEING TESTED.

ENSURE PROPER SLOT IS SELECTED. CHANGE I/O MODULE.

CONNECT + LEAD OF DIGITAL VOLT METER TO CHO+ ON A908 MODULE.

CONNECT - LEAD OF DIGITAL VOLT METER TO COMM-15 ON A908 MODULE.

SET VOLT METER TO 1 Volt RANGE.

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

TURN OFF CHANNEL SELECT SWITCHES 0-7.

TURN SIGNAL SHORT SWITCH TO SHORT POSITION.

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Figure 3-20 A6005 Calibration Procedures

(Sheet 1 of 2)
TEST AND CALIBRATION

- TURN TEST SELECT SWITCH TO POSITION 2
- TURN CHANNEL SELECT SWITCH TO POSITION 4
- PRESS I/O TEST BEGIN SWITCH
- ADJUST CHANNEL 0 LOWER LIMIT - RB FOR 2 VOLTS + OR - 10 mV. (SEE FIGURE 3-21)
- MOVE + LEAD OF DIGITAL VOLTMETER TO CH1+ ON A908 MODULE
- ADJUST CHANNEL 1 LOWER LIMIT - R15 FOR 2 VOLTS + OR - 10 mV. (SEE FIGURE 3-21)
- CONNECT + LEAD OF DIGITAL VOLTMETER TO CH1+ ON A908 MODULE
- KEEP TEST SELECT SWITCH TO POSITION 2
- TURN CHANNEL SELECT SWITCH TO POSITION 8
- PRESS I/O TEST BEGIN SWITCH
- ADJUST CHANNEL 0 HIGH LIMIT - R10 FOR 10 VOLTS + OR - 10 mV. (SEE FIGURE 3-21)
- CONNECT + LEAD OF DIGITAL VOLTMETER TO CH1+ ON A908 MODULE
- TURN CHANNEL SELECT SWITCH TO POSITION 9
- PRESS I/O TEST BEGIN SWITCH
- ADJUST CHANNEL 1 HIGH LIMIT - R17 FOR 10 VOLTS + OR - 10 mV. (SEE FIGURE 3-21)

Figure 3-20  A6005 Calibration Procedures

(Sheet 2 of 2)

Figure 3-21  A6005 Adjustments
TEST AND CALIBRATION

Figure 3-22  A1004/A1005 Checkout Procedure
(Sheet 1 of 3)
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**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 BC08-R-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 1 of 2)
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Figure 3-23  M8986, M8987, or M8994 Checkout Procedures (Sheet 2 of 2)

**Figure 3-23**
TEST AND CALIBRATION

START

REMOVE PADDLE BOARD FROM SLOT BELOW THE I/O CONTROLLER MODULE BEING TESTED

STORE PADDLE BOARD IN THE EXTRA SLOT TO RIGHT OF SLOT 19.

INSTALL CMR11-TI MODULE IN ABOVE PADDLE BOARD SLOT
INSTALL G5153 TEST MODULE INTO ANY AVAILABLE I/O CONTROLLER MODULE SLOT (ROW A8).

CONNECT CMR11-TI MODULE AND G5153 MODULE TOGETHER USING A B03R-03 CABLE.

SET DIGITAL I/O PULSE COUNTER SWITCH TO DIGITAL I/O POSITION.
PUT TEST I/O SWITCH TO INPUT POSITION.
PUT ANALOG SELECT SWITCHES TO D POSITION.
PUT DIGITAL INPUT DATA SWITCHES TO D POSITION.

ENSURE POWER ON (BOTTOM) LED IS ON.

CONFIGURE G5153 TEST MODULE

PERFORM I/O CONTROLLER MODULE ID TEST.

TURN MODE SELECT SWITCH TO TEST POSITION.
TURN TEST SELECT SWITCH TO POSITION 6.
PUT SLOT SELECT SWITCH TO SLOT # OF I/O MODULE BEING TESTED.

VERIFY PROPER SLOT # SELECTED, CHANGE I/O CONTROLLER MODULE.

DOES DISPLAY = 10401?

YES

Figure 3-24 M8993 Checkout Procedure (Sheet 1 of 2)
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Figure 3-24 M8993 Checkout Procedure (Sheet 2 of 2)

1. Perform Digital Input Test - Zero Value
   - Turn Test Select Switch to Position 2.
   - Turn Channel Select Switch to Channel 0.
   - Press I/O Test Begin Switch.
   - Verify that display = 0 and that only the M8930 power LED is on.

   YES
   - Change I/O Controller Module.
   - Perform Digital Input Test - One Value
     - On G5153 Test Module, raise each bit one at a time, starting with bit 0. This will input a one value for each associated bit.
     - Verify that display indicates proper value as indicated in Table 4-6.
     - Verify that only the corresponding LED for appropriate bit comes on.

   NO
   - Change I/O Controller Module.
   - All Channels Tested
     - Yes: Test completed. Return CMBI to normal. Remove test modules and re-install the paddleboard.
     - No: Select Next Digital Input Channel (0-7).

Exit

- Turn Channel Select Switch to next channel.
- Reset Digital Input Data Switch previously set.
### Table 3-3 M8993 Test Results

<table>
<thead>
<tr>
<th>Bit Set (= 1)</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 CMRTI-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.
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Figure 3-25  M8997 Checkout Procedure (Sheet 2 of 2)
START

IS COMM PORT EIA?

YES

NO

NO ADJUSTMENT NECESSARY FOR EIA COMM PORTS.

ALL FOUR COMM PORTS ADJUSTED.

YES

EXIT

PLACE COMMUNICATION TEST SWITCHES IN APPROPRIATE POSITIONS ON ALL LOW MODULES.

POWER ON HOST CM/CMY11 SYSTEM AND LOAD DIAGNOSTIC COMM*.
SELECT TEST PROGRAM #3

PERFORM HOST TRANSMIT LEVEL ADJUSTMENT ON MB996 COMM MODULE.

SELECT THE CMR01 REMOTE UNIT THAT IS ELECTRICALLY THE FARTHEST ON THAT COMM PORT.

PERFORM THE TRANSMIT LEVEL ADJUSTMENT ON THAT REMOTE UNIT.

* MODEM MODE SWITCH SHOULD BE IN LOW POSITION.
* REQUEST TO SEND SWITCH AS CUSTOMER SPECIFIED.
* SPEED SELECT SWITCH AS CUSTOMER SPECIFIED.
* LOCAL MODEM LOOPBACK - NORMAL POSITION.
* COMM LINE LOOPBACK - NORMAL POSITION.

SET SWITCH REGISTER TO 160000

TURN TRANSMIT LEVEL ADJUSTMENT R42 COUNTER-CLOCKWISE TO FULL EXTENT OF ITS TRAVEL (SETS TRANSMIT LEVEL TO MAX.)

TURN TRANSMIT LEVEL ADJUSTMENT R42 COUNTER-CLOCKWISE ON THE MB995 LOW MODULE TO ITS FULL TEST EXTENT OF ITS TRAVEL (SETS TRANSMIT LEVEL TO MAX.)

Figure 3-26 CMR01 Communications Line Adjustments (Sheet 1 of 3)
TEST AND CALIBRATION

PERFORM THE RECEIVE LEVEL ADJUSTMENT (START WITH FARTHEST REMOTE UNIT FIRST)

ALL CMROI'S RECEIVE LEVEL ADJUSTED ON THE COMM PORT

GO TO HOST CMR-CMV11 SYSTEM AND PERFORM RECEIVE LEVEL ADJUSTMENT ON MB996 LDM MODULE

PERFORM HOST LDM MODEM ADJUSTMENT VERIFICATION

GO TO EACH CMROI1 NOT ALREADY ADJUSTED ON THAT COMM PORT AND PERFORM RECEIVE LEVEL ADJUSTMENT

TURN RECEIVE LEVEL ADJUSTMENT R49 COUNTER CLOCKWISE TO FULL EXTENT OF ITS TRAVEL (SETS RECEIVE LEVEL TO ITS MINIMUM VALUE)

NOW ADJUST R49 CLOCKWISE UNTIL THE RECEIVE LEVEL OK LED COMES ON. THEN TURN R49 ANOTHER 1/2 TURN CLOCKWISE

ON FARTHEST REMOTE UNIT ONLY - AFTER RECEIVE LEVEL ADJUSTMENT PUT COMM LINE LOOPBACK SWITCH ON MB995 MODULE TO LINE LOOPBACK POSITION FOR FUTURE TESTING.

TURN RECEIVE LEVEL ADJUSTMENT R49 COUNTER CLOCKWISE TO FULL EXTENT OF ITS TRAVEL.

NOW ADJUST R49 CLOCKWISE UNTIL THE RECEIVE LEVEL OK LED COMES ON. THEN TURN R49 ANOTHER 1/2 TURN CLOCKWISE

CHANGE DIAGNOSTIC CZDM*** SWITCH REGISTER TO ZERO.

PUT LOOPBACK CONNECTOR PIN 2C-HYSA-00 ON TERMINAL STRIP.

SELECT TEST PROGRAM # 2.

RUN DIAGNOSTIC FOR MINIMUM OF 20 PASSES WITHOUT ERRORS, THEN HALT PROCESSOR TO STOP TEST.

TEST NOW COMPLETE AT HOST. PUT LINE LOOPBACK SWITCH TO LINE POSITION AND REMOVE LOOPBACK CONNECTOR.

Figure 3-26 CMR01 Communications Line Adjustments (Sheet 2 of 3)
PROCEED TO SECOND FROM LAST REMOTE UNIT.

PERFORM REMOTE UNIT TRANSMIT LEVEL ADJUSTMENT.

- ENSURE ALL MB/95 MODULE LOOPBACK SWITCHES ARE IN THE NORMAL POSITION.
- TURN MODE SELECT SWITCH TO TEST POSITION.
- TURN TEST SELECT SWITCH TO POSITION 5.
- TURN SLOT SELECT SWITCH TO POSITION 7.
- TURN CHANNEL SELECT SWITCH TO POSITION 7.
- PRESS I/O TEST BEGIN SWITCH.
- TURN ONLY THE TRANSMIT LEVEL ADJUSTMENT R42 COUNTER-CLOCKWISE UNTIL THE DISPLAY READS 0 AND DOES NOT FLASH THEN TURN R42 ANOTHER 5 TURN COUNTER-CLOCKWISE.
- THIS COMPLETES TEST FOR THIS CMROI. TURN THE MODE SELECT SWITCH TO RUN POSITION FOR FUTURE TESTING.

- ALL CMROI TRANSMIT LEVELS ADJUSTED ON THIS COMM PORT?
  - NO
    - GO TO EACH CMROI NOT ALREADY ADJUSTED ON THAT COMM PORT AND PERFORM TRANSMIT LEVEL ADJUSTMENT.
  - YES
    - THIS Completes CMROI COMM ADJUSTMENTS FOR THIS COMM PORT. GO BACK TO HOST AND PUT LINE LOOPBACK SWITCH TO NORMAL POSITION.

- ALL COMM PORTS ADJUSTED?
  - NO
    - GO TO START
  - YES
    - PERFORM DIAGNOSTIC CMROI** TEST PROGRAM #3 TO VERIFY CMROI NETWORK OPERATION.
      - RESTART CMROI** DIAGNOSTIC PROGRAM WITH SWITCH REGISTER SET TO ZERO.
      - ENSURE ALL REMOTE UNITS ON EACH COMM PORT COMMUNICATE WITH THE HOST CMRCMV11 SYSTEM AND EACH ONE HAS THE PROPER MULTIPORT ADDRESS.

Figure 3-26 CMROI 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
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) CMRII-TA test kit; includes test modules G5153 and A908, a test paddleboard CMRII-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)
CORRECTIVE MAINTENANCE

EXECUTE DIAGNOSTIC
PROGRAM #1

TEST #1
PASSES ?

CHECK CABLES,
BOARD SEATING,
SWITCH CONFIG-
URATION, OR
REPLACE MB990 OR
M7181-M7182

PLACE 54 ON MB996 TO THE NORMAL POSITION, UNLESS SELECTED AS LOOPBACK METHOD
SELECT ONE OF THE LOOPBACK METHODS BELOW AND EXECUTE CEMJ TEST #2 ON ALL ACTIVE REMOTES
1. 54 ON MB996 TO LOCAL POSITION
2. TEST CONNECTOR 2C-HY50A TO MB996 PORTS J1, J2, J3, J4
3. TEST CONNECTOR 2C-HY51A TO MB996 PORT J1
4. TEST CONNECTOR Y234 TO BOC SC CABLE END
5. TEST CONNECTOR 2C-HY52A TO MB995 TERMINAL STRIP TS1
6. $3 ON REMOTE MB995 TO LINE LOOP POSITION
ALLOW TEST TO RUN FOR TWENTY ERROR FREE PASSES
TO EXIT TEST, ENTER CONTROL C

CHECK CABLES,
MODEM 10 VOLT
FUSE, MODEM
SWITCHES OR
REPLACE MODEM
MODULE OR CABLE

TEST #2
PASSES ?

EXIT

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 CMRII/CMVII.

4.4 TECH-TIPS/FCO INDEX

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

Figure 4-2 CMRII/CMVII Register Bit Assignments
READER'S COMMENTS
CMR11/CMV11 Distributed Multigroess 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.

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<th>Very Good</th>
<th>Good</th>
<th>Fair</th>
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Accuracy □ □ □ □
Completeness □ □ □ □
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