Technical Manual

MRC 2
MICROPROCESSOR
REMOTE CONTROL OPTIONS
VOLUME TWO

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WARRANTY

All equipment designed and manufactured by Moseley Associates, Inc. is warranted against defects in workmanship and material that develop under normal use within a period of (2) years from the date of original shipment, and is also warranted to meet any specifications represented in writing by Moseley Associates, Inc., so long as the purchaser is not in default under his contract of purchase and subject to the following additional conditions and limitations:

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A. to repair or replace such equipment or otherwise cause it to meet the represented specifications either at the purchaser's installation or upon the return thereof f.o.b. Santa Barbara, California, as directed by Moseley Associates, Inc.; or

B. to accept the return thereof f.o.b. Santa Barbara, California, credit the purchaser's account for the unpaid portion, if any, of the purchase price, and refund to the purchaser, without interest, any portion of the purchase price theretofore paid; or

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2. In case of any equipment thought to be defective, the purchaser shall promptly notify Moseley Associates, Inc., in writing, giving full particulars as to the defects. Upon receipt of such notice, Moseley Associates, Inc. will give instructions respecting the shipment of the equipment, or such other manner as it elects to service this Warranty as above provided.

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WARNING

This equipment complies with the requirements in Part 15 of FCC Rules for a Class A computing device. Operation of this equipment in a residential area may cause unacceptable interference to radio and TV reception requiring the operator to take whatever steps are necessary to correct the interference.

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Glossary

A/DFC	Analog to digital
ASCII	American Standard Code for Information Interchange
BCD	Binary-coded decimal
CMOS	Complementary metal-oxide semiconductor
CPU	Central processing unit
CRT	Cathode ray tube
CT	MRC-2 Control Terminal
D/A	Digital to analog
DACU	Data Acquisition and Command Unit
EAROM	Electrically alterable read-only memory
EPROM	Erasable programmable read-only memory
FSK	Frequency shift keying
GPIB	General purpose interface bus
IC	Integrated circuit

LED	Light-emitting diode
MAI	Moseley Associates Inc.
Modem	FSK MOdulator/DEModulator
NC	Normally closed
NO	Normally open
PROM	Programmable read only memory
PSTN	Public Switched Telephone Network
RAM	Random-only memory
ROM	Read-only memory
RT	MRC-2 Remote Terminal
RX	Receive or Receiver
SCA	Subsidiary communications authority
Telco	Telephone Company
Telemetry	Refers either to metering samples and functions or to signals from the Remote Terminal to the Control Terminal.
THD	Total harmonic distortion
TTL	Transistor-transistor logic
TX	Transmit or Transmitter

Manual Organization

The MRC-2 manufactured by Moseley Associates Inc., is a modular microprocessor-based system, which can monitor and control many types of equipment, including radio and TV transmitters.

The MRC-2 manual is divided into two volumes. Volume 2 is a comprehensive guide with information on each MRC-2 option available. It includes installation, operation, theory of operation, alignment procedures for customer troubleshooting and repairs, module descriptions, schematic and assembly drawings, and part lists.

If you are not familiar with the basic use of the instrument and want more detailed information, please read Sections 1 through 4 Volume 1 before installing the MRC-2 option.

Section 1, CRT Display Option, provides a multi-channel display for the Control Terminal or Remote Terminal of the MRC-2 system. This section covers operation of the CRT Terminal.

Section 2, Automatic Logging Option, provides automatic logging capability for the MRC-2 Microprocessor Remote Control System. This section describes the operation of the Automatic Logging Option.

Section 3, Multiple Status Display and Multiple Direct Command Option, covers installation, operation and maintenance.

Section One

CRT Display Option

1.1 Introduction

The MRC-2 CRT Display option presents data collected from the user's MRC-2 system on an Applied Digital Data Systems 2020, 2060, Viewpoint 60 or 60+, or Regent 40 Terminal. The CRT Display option consists of two additional modules (which plug into the Control Terminal or Remote Terminal of the user's existing system) along with a Terminal and connecting cable.

The CRT Display option when installed at a Control Terminal can collect data from any combination of the user's Remote Terminals and display it on the CRT Terminal. Data is displayed in three parts for each site (see Figure 1-1 on the following page):

1. The selected site, page, page title, and the current date and time are displayed on the top of each display. A message line displays numbers as they are being entered by the operator and messages generated by the CRT option. When in the SETUP mode, SET UP will appear on line four.

2. The current telemetry values, status conditions, and/or command channels are displayed along with user-defined text in the center of each display.

3. The bottom portion of the screen shows command mapping, data link performance, and other system information.

Complete control operation (with the exception of setting and changing passwords and limits) is possible from the keyboard of the CRT Terminal. Operation at the keyboard is very similar to operation from the front panel. Figures 1-2a, 1-2b and 1-2c are illustrations of the ADDS keyboards.

We recommend that a first-time user completely read and understand this section before attempting to install and use the CRT option. We assume in the following discussions that you are thoroughly familiar with Front Panel MRC-2 operations.

Figure 1-1
Typical CRT Option Display

```
Site 1  Page 1   THIS IS THE PAGE TITLE                4 Jul 1988 21:00:00
1234
Channel             Value             Channel              Value
SETUP
.
This is descriptive text.                  .
.                                          .
 1T003 Telemetry Title      1.234  Units   .
.                                          .
 S010 Status     Title      OFFTEXT        .
.                                          .
 C021 Command    Title      ONTEXT         .
.                                          .
.                                          .
.                                          .
.                                          .
.                                          .
.                                          .
.                                          .
.                                          .
On Raise: ?                 Raise     A=100% Site 1 ALARM MASTER MAINT LIMITS
On Lower: ?                 Lower     B=  0%        COMM   SLOW   ALT  MENU
                                              SYSTEM ALARM RESTRICTED
```

Figure 1-2a
ADDS Regent 40 Keyboard

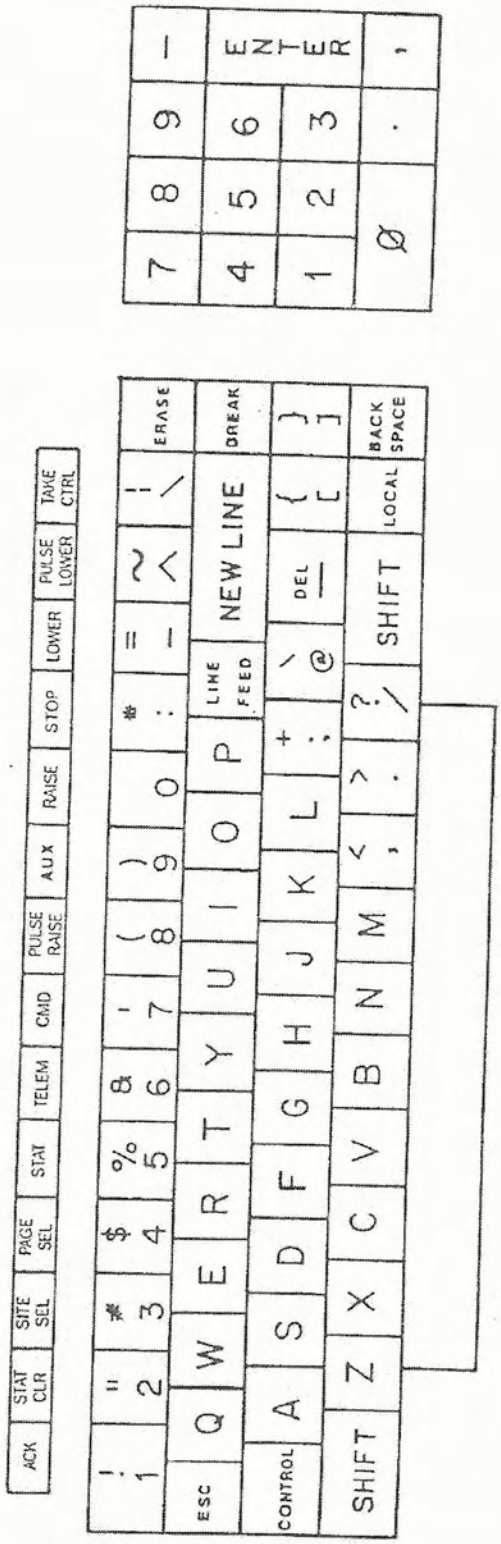


Figure 1-2b
ADDS Viewpoint 60 and 60+ Keyboard

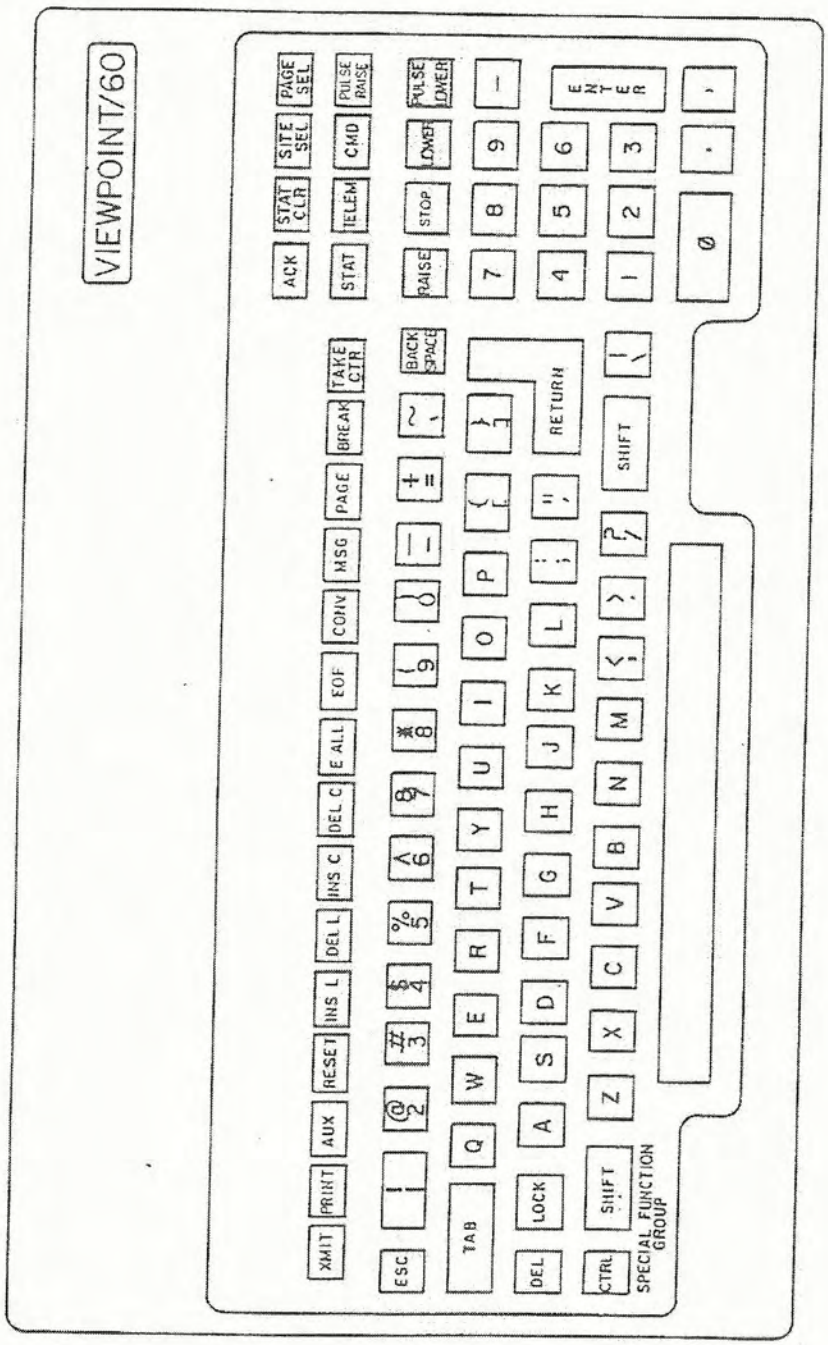
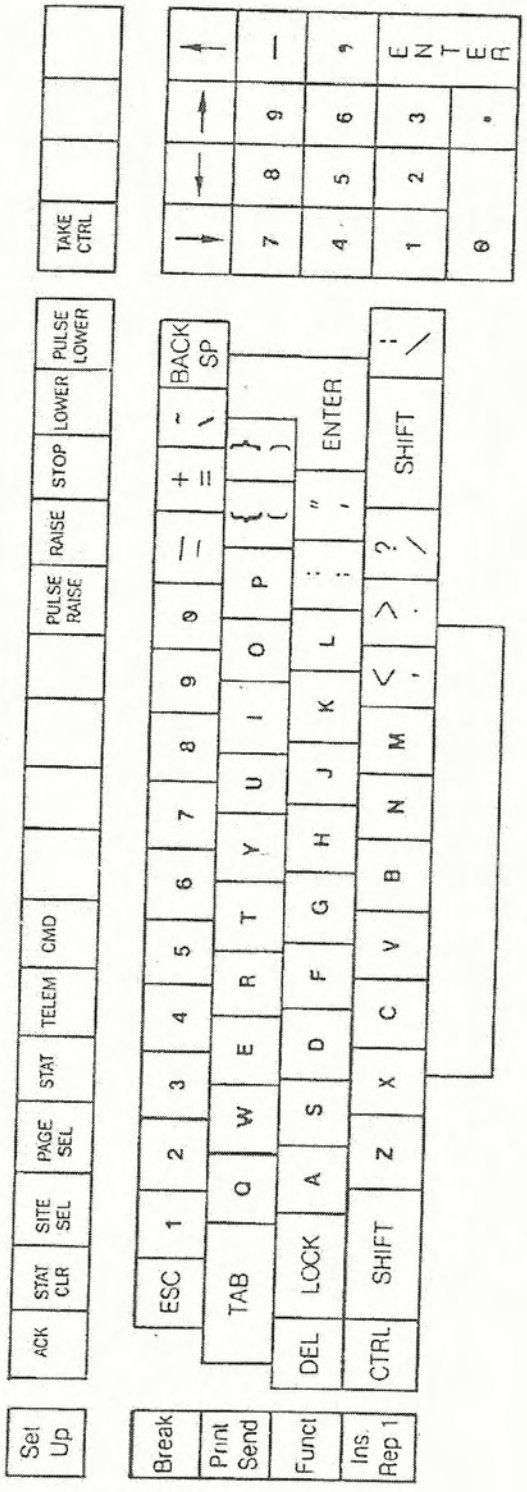


Figure 1-2c
ADDS 2020 Keyboard



1.2 The Page Concept

The MRC-2 CRT option displays are divided into various types of pages:

Regular pages can display any combination of up to 32 telemetry, status, and command channels. Each channel can be assigned text as described below. Regular pages can have both site-specific and generic channels. Regular pages also can be assigned a 32-character page title.

Page 0 Telemetry pages display 32 consecutive telemetry channels simultaneously. Each telemetry channel may be assigned 14 characters of user-supplied text, and 7 characters for user-defined units. The limits of the selected channel may also be displayed.

Page 0 Status pages display 32 consecutive status channels. Each status channel may be assigned 14 characters of user-supplied text, 7 characters for the "on" condition, and 7 characters for the "off" condition.

Page 0 Command pages display 32 consecutive command channels. Each command channel may be assigned 14 characters of user-supplied text, 7 characters for the "on", or energized, condition, and 7 characters for the "off", or deenergized, condition.

Each page also displays the site, page number, date, time, alarm indications, the states of "master", maintenance override, limit checking, and restricted functions. In addition, command mapping, data-link performance, and communications modes are shown.

1.3 The Selected Channel Concept

At the MRC-2 front panel, only one channel at a time may be observed. The telemetry, status or command channel selected for display is also the channel selected for command functions.

This command scheme has been preserved for the CRT option. At all times there is exactly one channel selected for command cor editing operations at any given CRT. This is indicated by the use of bright intensity for the selected channel. All other channels are shown with dim intensity.

Since up to four CRTs may be installed at any one Terminal, another constraint is required. Before issuing a command, you must "take control" (By pressing the TAKE CTL key). "In control" is indicated by reverse video on the selected channel. Further discussion of command functions is mentioned in Section 1.8 Issuing Commands.

1.4 Page Set-Up

There are 32 "slots" or fields on a Regular CRT page; Each one of these slots can be assigned to a telemetry, status, or command channel, or can contain descriptive text or can be left blank. Data can be obtained from the currently selected site or from a specific site.

1.4.1 Entering Set-Up Mode

After you have selected the page you want to set up (a CRT initially displays site 1, page 1 -- a good place to start), verify that restricted functions are enabled. Press **R** to toggle restricted functions. (If the CRT is installed at a Control Terminal, and if a password has been set up from the front panel, then the password must be entered before restricted functions can be enabled: XXXX R.) Now press S to enter SETUP mode. "SETUP" will be annunciated in reverse video near the top of the screen. To delete all set-up information from a page press - **PAGE**. Press S again to exit set-up mode.

1.4.2 Page Title

To enter the page title, press ^E (Ctrl and E, simultaneously; Ctrl is used just like the shift key). An area is underlined at the top of the screen. You can enter up to 32 characters for the page title. Use **Backspace** to correct mistakes and **ENTER** to terminate your entry. To delete a page title, press **space ENTER** after selecting the field. Page titles can only be entered on Regular pages, not Page 0 pages (e.g. Telemetry, Status, and Command).

1.4.3 Descriptive Text

Select one of the 32 fields on the screen by pressing **ENTER** or - **ENTER** repeatedly. Press ^W and the selected field will be underlined. You can enter up to 31 characters for the text. Use **Backspace** to correct mistakes and **ENTER** to terminate your entry. To delete Descriptive Text, press **space ENTER** after selecting the field. Descriptive Text can only be entered on Regular pages, not Page 0 pages (e.g. Telemetry, Status, and Command).

1.4.4 Channel

Select one of the 32 fields on the screen by pressing **ENTER** or - **ENTER** repeatedly. To enter a channel, press the channel number, XXX, followed by the **STATUS**, **TELEM**, or **CMD** key, depending on which type you desire. For example, 12 TELEM will select telemetry channel 12 to be displayed on the selected line. T012 will be shown on the display. To delete a channel press - followed by **STATUS**, **TELEM**, or **CMD**. Channel placement can only be done on Regular pages, not Page 0 pages (e.g. Telemetry, Status, and Command).

1.4.5 Site

Select one of fields which has been assigned a channel (see previous paragraph). To assign a specific site to a displayed channel, press the site number, XX, followed by the **SITE** key. The site number will appear as a prefix on the channel type and number. Continuing our example above, pressing 2 SITE will assign telemetry channel 12 to always obtain data from site 2. 2T012 will be shown on the screen. To delete site-specificity from a displayed channel, reenter the assigned channel.

There are some instances when you would not want to assign sites to all the channels. If you only have a single-site system that site will (most likely) always be selected. If you have a multiple-site system and the channels represent the same parameters, e.g. site 1 and site 2 telemetry channel 12 is building temperature, then simply selecting the site when in operations mode will update that channel with the correct site information.

1.4.6 Channel Text

Select one of fields which has been assigned a channel (see above). To enter text for the selected channel, press ^W. The Channel Title field will be underlined. You can enter up to 14 characters for the channel title. Use **Backspace** to correct mistakes and **ENTER** to terminate your entry. After the channel title is entered, the Units (for telemetry) or the "OFF" Text (for status or command) field is underlined. You can enter up to 7 characters for this field. The remaining field is unused (for telemetry) or is the "ON" Text (for status or command). You can enter up to 7 characters for this field, too. Press **space ENTER** on a selected field to delete the text for that field.

Channel Text can be either generic or site-specific, depending on which type of channel is selected (site-specific channels are prefixed by a site number). This allows flexibility for multi-site configurations and can reduce the amount of file memory used in those systems.

1.4.7 Full File Memory

When the limit of file memory is reached, i.e. full, the display will report **"FILE FULL"** after any operation which requires more file memory.

1.5 Selecting Pages and Channels

The function keys three through seven are used to select various CRT pages. Each key is discussed in detail below.

1.5.1 Site Select

Pressing **SITE SEL (F3)** selects the same page of the next site. After the highest site has been selected, the system cycles back to site 1. A specific site can be chosen by entering a 1- or 2-digit site number, XX, followed by **SITE SEL**. Pressing **0 SITE SEL** will select site 1 page 1.

When a site is selected for a page, all generic channels (those not prefixed with a site number) will obtain data from the selected site. Site-specific channels will continue to obtain data from the specific site.

On Page 0 pages (Status, Telemetry, and Command), pressing **U** toggles between generic and site-specific channels . (This is a restricted function.) When site-specific channels are selected for a whole page, the selected site can be changed to look at system indications (e.g. Alarms).

1.5.2 Page Select

Pressing **PAGE SEL (F4)** selects the next page of the current site and page type. After the highest numbered page has been selected, the system cycles back to the lowest numbered page and starts over again. A specific page on a given site may be selected by entering a 1- to 3-digit page number, XXX, followed by **PAGE SEL**. If the requested page is the same as the displayed page, then this key will be ignored.

1.5.3 Status Page Select

Pressing **STAT** (F5) selects the status page containing the currently selected channel or the next status page if no channel is highlighted (the lowest status page the first time). Pressing **STAT** again selects the next status page. After the highest numbered status channel is selected, the system cycles back to status channel 1. A specific status channel can be selected by entering a 1- to 3-digit channel number, **XXX**, followed by **STAT**. Pressing **0 STAT** selects the first status page of the displayed site. The STAT key cannot be used to select channels on Regular Pages.

Status values can take several forms:

1. If text has been entered for the "ON"- and "OFF"-conditions, that text will appear appropriately. Otherwise, "On" or "Off" will appear.

2. If the channel is not on a module that is installed (i.e., doesn't exist), a "?" appears.

3. If the data displayed is not current, a "?" appears before the value: ?OFFTEXT

4. If the channel experiences a rising or falling alarm, an asterisk, "*", precedes the value: *OFFTEXT

5. If the channel is muted, the value appears in brackets: [OFFTEXT]

1.5.4 Telemetry Page Select

Pressing **TELEM** (F6) selects telemetry pages in the same manner as Status Page Select, above.

Telemetry values can appear in several ways:

1. If the channel is not on a module that is installed (i.e., doesn't exist), a "?" appears.

2. If the channel is uncalibrated, a "?" appears.

3. If the data displayed is not current, a "?" precedes the value: ?1.2345

4. If the value exceeds a limit, an asterisk "*" precedes the value and a limit flag is appended to the value: * 12.345<<

5. If the channel is muted, the value appears in brackets: [1234.5]

1.5.5 Command Page Select

Pressing CMD (F7) selects command pages in the same manner as Status Page Select, above.

Command channel values can appear in these ways:

1. If text has been entered for the "ON"- and "OFF"-conditions, that text will appear appropriately. Otherwise, "On" or "Off" will appear.

2. If the channel is not on a module that is installed (i.e., doesn't exist), then a "?" appears.

3. If the data displayed is not current, a "?" precedes the value: ?CMNDOFF

1.5.6 Channel Select

The ENTER (or NEW LINE or RETURN) keys may be used to change which slot is selected. Once a page has been selected, pressing ENTER will advance the selected slot by one. Press - ENTER to retreat one slot.

To select a given slot number, enter a l- or 2-digit channel number, XX, followed by ENTER.

1.5.7 Erroneous Number Entry

If an erroneous number entry is made, it may be cleared by pushing the ACK key. This is the same as pushing ACK/CLR to clear a key entry at the front panel.

1.6 Acknowledging Alarms

In the event of an operator alarm, a continuous tone is sounded from the CRT Terminal, and the "ALARM" annunciator next to "System" at the bottom of the screen flashes in reverse video. If an alarm exists at the selected site, the "ALARM" next to the Site number at the bottom of the screen also flashes in reverse video. (The will not be heard if the "B" function has been invoked. See section 1.10)

Pressing ACK (F1) on the CRT keyboard has the same result as pressing ACK/CLR on the MRC-2 front panel, except when applicable, Page 0 (System) is selected on the CRT instead of Channel 0. Alarms can be acknowledged from either the CRT or Front Panel. Please re-read Volume 1, Sections 3.8.3 (RT alarms) and 3.10.7 (CT alarms) for a complete discussion of alarms and how to acknowledge alarms.

1.7 Status Clear

Press STAT CLEAR (F2) to clear any latched status channels on the selected site. If more than one Control Terminal exists, then you must be the "master" Control Terminal (see Section 3.6.1, Status Attributes).

1.8 Issuing Commands

The RAISE, LOWER, STOP, PULSE RAISE, PULSE LOWER, and the TAKE CTL (take control) keys are used to issue commands.

When a telemetry or status channel is selected (either on a regular or page 0 page), you can cause the command text from the mapped command channel(s) to appear in the lower left portion of the screen by pressing (Shift)-?. For example, suppose telemetry channel 3 has been mapped to momentary (or pulsed) command channels 20 and 21. After selecting telemetry channel 3 and pressing "?", the command channel 20 title will appear after the words "On Raise:", and the command channel 21 title will appear after the words "On Lower:". The titles are followed by the "ON" text of the corresponding channel.

As another example, suppose status channel 10 is mapped to latched command channel 2. In this case, when status channel 10 has been selected and "?" has been pressed, the command channel 2 title will appear after both "On Raise:" and "On Lower:". The "ON"-condition text will appear after the first title, and the "OFF"-condition text will appear after the second title.

1.8.1 Assuming Control

The stage is now set to raise or lower. To issue a command, assume control of the system by pressing TAKE CTL (HOME). If another device (either another CRT, the front panel, or an MDC) is already in control, this key will be ignored. If the CRT is installed at a Control Terminal, Maintenance Override must be DISABLED for the selected site. If more than one Control Terminal exists, then you also must be the "master" Control Terminal. If the CRT is installed at a Remote Terminal, Maintenance Override must be ENABLED. To relinquish control, press TAKE CTL again.

> Note: **Control is lost (times out) 20 seconds after the last key press if a Telemetry channel is selected. Control is lost 4 seconds after the last key press if a Status or Command channel is selected.**

1.8.2 Raise, Lower, and Stop

To issue a Raise or Lower, select the desired telemetry or status channel and press RAISE (cursor down, F13) or LOWER (cursor right, F15). When you have achieved the desired result, press STOP (cursor left, F14). Tally-back is indicated in reverse video on the appropriate command channel "ON"- or "OFF"-text (or "Raise" or "Lower" if "?" has not been pressed).

Using our example above, if a Raise is issued on telemetry channel 3 (and "?" has been pressed), the "ON"-text of command channel 20 appears in reverse video. If a Lower is issued, the "ON"-text of command channel 21 appears in reverse video.

> Caution: **Once issued, RAISE and LOWER are active until a STOP is pressed or control times out, even if you release the RAISE OR LOWER key!**

1.8.3 Pulse Raise and Pulse Lower

To issue a short (.1 second) pulse on any command channel, press **PULSE RAISE** (F8, F12) or **PULSE LOWER** (cursor up, F16). Continuing our example above, If a Pulse Raise is issued on telemetry channel 3, command channel 20 output will be activated for .1 seconds. If a Pulse Lower is issued, command channel 21 output will be activated for .1 seconds.

If a pulsed command is issued on a command channel that is set up in pulse mode, the result will always be .1 seconds, regardless of the pulse length that has been set up. To obtain the longer pulse length, use RAISE or LOWER and STOP.

A pulsed command issued on a latched command channel has the same effect as a normal raise or lower. We recommend using PULSE RAISE and PULSE LOWER for latched command channels. Continuing our second example above, if a Pulse Raise is issued on status channel 10 (and "?" has been pressed), the "ON"-text of command channel 2 appears in reverse video. If a Pulse Lower is issued, the "OFF"-text of command channel 2 appears in reverse video.

1.9 Other Non-Restricted Functions

1.9.1 Alarm Search (A)

Pressing A on the CRT keyboard has the same result as pressing ALARM SRCH on the MRC-2 front panel, except when applicable, Page 0 (System) is selected on the CRT instead of Channel 0. Please re-read Volume 1, Sections 3.8.4 (RT alarm search) and 3.10.7 (CT alarm search) for a complete discussion of alarm search.

1.9.2 Telemetry Failsafe Display (F)

To display Telemetry Failsafe Countdown Times from the selected site, press **F**. The six times will appear on the display line near the top of the screen following "Telem F.S.:" The times will remain displayed until another function needs the display line.

1.9.3 Limits Display (L)

To display tolerance limits for a selected telemetry channel, press **L**. The four limits and hystresis will appear on the display line near the top of the screen following the word "Limits:" in the following order: upper red limit, upper yellow limit, lower yellow limit, lower red limit and hystresis. The limits will remain displayed until another channel is selected, or another function needs the display line.

1.9.4 Page Re-Output (O)

To re-output the same CRT page that is displayed, press **0**. This is useful if the displayed page becomes garbled; e.g., if the CRT is turned off and then on again.

1.9.5 Mapped Command Display (?)

The mapped command assignments for a selected channel can be displayed by pressing "?". The command channel text for the Raise and Lower assignments will appear on the bottom left portion of the screen, and will remain until another channel is selected. (See also section 1.8, Issuing Commands.)

1.10 Restricted Functions

The five keys discussed in the following paragraphs are restricted functions, which must first be ENABLED by pressing the **R** key. If the CRT is installed at a Control Terminal, and if a password has been enabled from the front panel, then the password must be entered first: **XXXX R**. Pressing **R** a second time disables restricted functions.

1.10.1 Audible Alarms (B)

The ADDS viewpoint 60 is equipped with an audible alarm. This alarm sounds whenever the audible alarm on the MRC-2 front panel sounds. However, disabling the audible alarm (via the rear connector of the control Terminal's CPU Interface Module) does not disable the audible alarm at the CRT Terminal.

Therefore, a function has been provided at the CRT Terminal keyboard to completely disable audible alarming at the CRT (the flashing indications continue as normal). Pushing **B** (for Bell) will toggle audible alarming. This is a restricted function.

1.10.2 Setting Month and Date (D)

To set the month and date, press **mmdd D**, Where mm is the month (1-12) and dd is the date (1-31). For example, to set the date to February 16, enter **216 D**. The month and date are retained in the system for up to 1 year, provided the battery on the front panel is not removed. This is a restricted function.

1.10.3 Limit Checking (I)

To enable or disable limit checking, press **I**. This function is only performed at the selected site. This is a restrict-ed function.

1.10.4 Setting Time (T)

To set the time, press **hhmm, T**, Where hh:mm are the hours and minutes in 24-hour format. For example, to set the time to 10:05 pm, enter **2205 T**. Seconds are always set to 0 whenever the time is changed. The time is retained in the system for up to 1 year, provided the battery on the front panel is not removed. This is a restricted function.

1.10.5 Channel Type Selection (U)

Pressing U toggles between generic and site-specific channels on Page 0 pages. (See section 9.5.1, Site Select.) This is a restricted function.

1.10.6 Setting the Year (Y)

To set the year, press yyyy **Y**, where yyyy is the year. For example, to set the year to 1988, press **1988 Y**. The year is not retained upon power interruption. This is a restricted function.

1.10.7 Dial A Remote Terminal

Press **^D** to dial the selected site on the first available (main or alt) dial-up modem (See also section 3.10.7).

Press **^K** (Kill) to hang up a dial-up connection to the selected site. Press **0 ^K** to hang up the main modem and **1 ^K** to hang up the alt modem (See also section 3.10.7).

These are restricted functions

1.10.8 Multi-CT Actions

To make a polite request for control from another CT, press **^P**. An alarm will occur, and. if control is granted, "MASTER" will be annunciated in reverse video at the bottom of the screen. If control is denied, nothing will happen. To make a rude request (CT "A" only) press **^R**. "Master"-ship will be immediately granted. These are restricted functions.

To Grant an alarm request for control from another CT, press **^Y** (Yes). To deny the request from the other CT, press **^N** (No).

See Volume 1, Section 3.10.9 for a further discussion of Multi-CT Operations.

1.11 Auto-Repeat Feature

The keyboard of the CRT has an auto-repeat feature. When a key is pressed, a character is sent from the CRT terminal to the MRC-2. If the key is held down for more than half a second, a stream of additional characters is sent to the MRC-2. There is no way for the MRC-2 to distinguish the subsequent characters from the initial ones, so a light touch is recommended.

For example, holding "I" down will turn limit checking off, then on, then off, etc. Tapping the key (in the manner of typing rather than button pushing) will produce the desired effect. Since there is sometimes a delay between initiating an action and seeing the results on the screen, one must trust the system to be performing the specified operation, and not hold the key down until the results are seen.

Of course, for raising and lowering, the keys should be held down as required.

1.12 Remote Terminal Differences

Operation of a CRT installed at the RT is essentially the same as at the CT. The exceptions are outlined in the following paragraphs.

The RT CRT display does not have all the annunciators which pertain to the CT. Thus, the remaining ones displayed in the lower-right portion of the screen are ALARM, MAINT, LIMITS, and RESTRICTED.

Since RTs do not communicate with other RTs, the CRT can only obtain data from the RT in which it is installed. This means that the **SITE** key has no meaning at the RT.

Alarm acknowledge (**ACK**) and alarm search (**A**) operate the same way as the RT Front Panel. See Sections 3.8.3 and 3.8.4 for further discussion of alarms.

Maintenance Override must be enabled at the RT Front Panel before commands can be issued.

The Dial-Up and Multi-CT keys (**^D, ^K, ^P, ^R, ^Y, & ^N**) are not used on the RT CRT.

The remaining functions of the CRT apply at the RT.

1.13 Terminal Configuration

For the CRT Display Option to function properly, the ADDS terminal must be configured correctly. This is ordinarily done for you at our factory before your unit is shipped. However, it may be necessary at some point for you to restore the correct configuration of the terminal, for instance if there is a major software change (as this manual outlines), after ADDS factory service, or after "experimentation" by your personnel. There are several ADDS terminals in use with the MRC-2, and the configuration of each is outlined below.

You should read the User Manual of your terminal to familiarize yourself with the Set-Up procedures of the CRT.

1.13.1 Regent 40

Set the switches on the back of the CRT as follows:

Sw A: 11111111 Sw B: 00110101

This configures the terminal to the following conditions:

Cursor Display:	Underline
Line Mode:	Full Duplex
Parity:	Space
Cursor Blink:	Steady
Baud Rate:	9600
Termination Character:	CR
Auto Line Feed:	On
Auto Scroll:	On
EIA/CL:	RS232
Character Display:	White
Case Select:	Low/Up

1.13.2 Viewpoint 60

The set-up procedure is described in the Installation Section of the *Viewpoint/60 User Manual.* The set-up procedure will not work correctly unless the cable interconnecting the CRT with the MRC-2 is detached from the CRT. The correct SETUP mode status line is:

1=10001000 2=11011011 3=01110100 4=00000010

This configures the terminal to the following conditions:

EIA PORT	19.2 KBaud
AUX PORT	19.2 KBaud
Duplex	Full
Video presentation	Light-Dark
Video highlight	Half
Auto Scroll	Enable
Auto Line Feed	Enable
Display parity error	Disable
Parity	Space
Screen Refresh Rate	60 Hz
Cursor Suppress	Suppressed
Cursor Format	Steady Underline
Character Case	Lower/Upper
Line Terminator	CR
Keyclick	Disable
Regent 40 Compatible	Enable

You should now read the *Viewpoint/60 User Manual* to familiarize yourself with the CRT Terminal.

1.13.3 Viewpoint 60+

This procedure is used to set up the ADDS VP/60+ for Moseley use:

1. Attach the keyboard to the rear of the CRT using the "phone" cord. Plug in the unit (115 Vac).

2. Turn on power using the red switch located on the rear of the unit. Wait at least ten seconds.

3. Press **SHIFT & TAKE CTL** (HOME). The HOME key is located at the right end of the top row of the main part of the keyboard.

4. If the contrast need adjusting, press **C**. Adjust the contrast using **RAISE** (cursor down) or **PULSE LOWER** (cursor up). Press **TAKE CTL** to save the contrast.

5. Press **P**. You should see a screen similar to Figure 1-3. You must change the left column of parameters to match Figure 1-3. You can move the cursor using **RAISE** (cursor down) or **PULSE LOWER** (cursor up). Press **TAKE CTL** to save the changes.

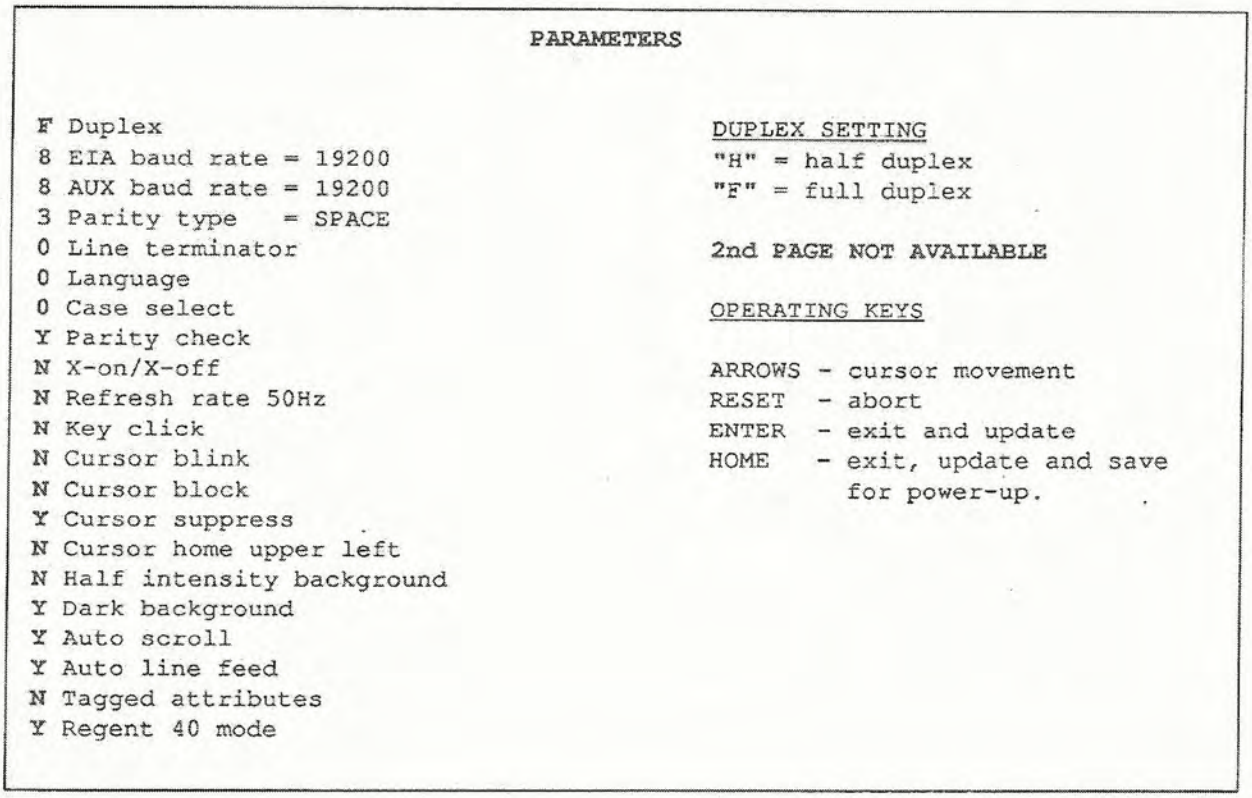


Figure 1-3
ADDS Viewpoint 60+ Configuration

1.13.4 ADDS 2020

This procedure is used to set up the ADDS 2020 parameters for Moseley use.

1. Attach the keyboard to the side of the CRT using the "phone" cord.

2. Check for operating voltage on equipment label. Plug in the CRT to an appropriate main outlet (115 Vac or 230 Vac).

3. Turn on power with the switch on the base of the CRT. The CRT keyboard should emit a beep to indicate that it passed a self-test.

4. Adjust the contrast and brightness controls on the top of the CRT so that you can see the characters on the screen. The screen should display a list of installed items, and under the column labeled "Status", there should appear either an asterisk (*) or "Pass". Perform the following to set the CRT parameters:

5. **Resetting the Terminal.** Press **SHIFT-SETUP**. A new screen should appear with "EXECUTE" highlighted in the upper left-hand corner. Press the "down" arrow (or **RAISE**) twice to select "Default Parameters". Press the **space bar**. "DONE" will appear on the left-middle part of the screen. Now, press the "down" arrow (or **RAISE**) three times to highlight "Default Programmable Keys". Press the **space bar**. "DONE" will appear on the left-middle part of the screen.

6. **Setting the E.I.A. Port.** Press **F2 (STAT CLR)**. "COMM" should be highlighted at the top of the screen. Select the following parameters on this page using the cursor keys (or **RAISE, PULSE RAISE, LOWER**, and **PULSE LOWER** if there are none):

Mode	FDX
Baud Rate	19200
Parity	None
Parity Check	No
Data Bits	8
Stop Bits	1
Xon/Xoff	None
Pace	00
Terminator	US/CR
Auto Line Feed	Yes

8. **Setting the Screen Parameters.** Press **F5 (STAT)**. "SCREEN" should be highlighted at the top of the screen.

Select the following parameters:

Screen Timeout	Yes
Autowrap	Yes
Auto Scroll	Yes
Scroll	Jump
Cursor Home	Auto Scroll Dependent Columns80
Cursor	None
Cursor Blink	No
Fore/Back	Wht/Blk
Protect	Normal
Alt Prot	Normal
Display Test	Yes

9. **Setting the CRT Mode.** Press **F6 (TELEM).** "MODE" should be highlighted at the top of the screen. Select the following parameters:

Terminal	Regent 40
Mode	Enhanced
Program Keys	User Dependent

10. **Saving Parameters.** Do not skip this step! Press **F1 (ACK).** "EXECUTE" should be highlighted at the top of the screen. Select "Save Parameters". Press the **space bar.** "DONE" will appear on the left-middle part of the screen. If you do not perform this step, the following will be for naught.

11. **Setting the Function Keys.** Press **F8.** "FUNCTION" should be highlighted at the top of the screen. You will be programming function keys F8 and F12 through F16.

    Press the **FUNCT** key followed by **F8.** Now press **SHIFT-DELCHAR** (next to **TAKE CTRL**) three times. This should delete any characters that were shown in the text area.

    Press **FUNCT,** then **F12 (PULSE RAISE).** Now press the **RIGHT ARROW** once. Press **8.**

    Press **FUNCT,** then **F13 (RAISE).** Press **SHIFT-DELCHAR** three times, and, then **CTRL-J.**

    Press **FUNCT,** then **F14 (STOP).** Press **SHIFT-DELCHAR** three times and then **CTRL-U.**

    Press **FUNCT,** then **F15 (LOWER); SHIFT-DELCHAR** three times, and then **CTRL-F.**

    Press **FUNCT,** then **F16 (PULSE LOWER).** Press **SHIFT-DELCHAR** three times, and then **CTRL-Z.**

    This concludes programming the function keys.

12. **Saving Function Keys.** Repeat Step 10.

1.13.5 ADDS 2060

Please turn to Section 1.13.2 and follow the procedure for the Viewpoint 60. Refer to the *ADDS 2060 User Manual* for informatino on how to change colors.

1.13.6 ADDS 4000

This procedure is used to set up the ADDS 4000 parameters for Moseley use.

1. Attach the keyboard to the left side of the CRT using the "phone" cord.
2. Check for operating voltage on equipment label. Plug in the CRT to an appropriate main outlet (115 Vac or 230 Vac).
3. Turn on power with the switch on the base of the CRT. The CRT keyboard should emit a beep to indicate that it passed a self-test.
4. Adjust the contrast and brightness controls on the right side of the CRT so that you can see the characters on the screen. Perform the following to set the CRT parameters:
5. **Resetting the Terminal.** Press **SHIFT-SETUP**. A new screen should appear with "EXEC1" highlighted in the upper left-hand corner. If "EXEC1" is not displayed, press **CTRL-SETUP** until it is. Pres the **"down"** arrow twice to select "Default Parameters". Press the **space bar**. "DONE" will appear on the left-middle part of the screen. Now, press the **"down"** arrow three times to highlight "Default Programmable Keys". Press the **space bar**. "DONE" will appear on the left-middle part of the screen.
6. **Setting the Global Parameters.** Press **F2 (STAT CLR)**. "GLOBAL" should be highlighted at the top of the screen. Select the following parameters on this page using the cursor keys:

Screen Timeout	Yes
Fore/Back	Wht/Blk
Scroll	Jump
Lines/Sessions	26/1
Printer Use	Ses1/Par
Font Style	Bold

7. **Setting the EIA Port.** Press **F3 (SITE SEL)**. "COMM1" should be highlighted at the top of the screen. Select the following parameters:

Mode	FDX
Baud Rate	19200
Parity	None
Parity Check	No
Data Bits	8
Stop Bits	1
Xon/Xoff	Both
Pace	00
Terminator	US/CR
XPC	Off

8. **Setting the Keyboard Parameters.** Press **F5 (STAT)**. "KEYBOARD1" should be highlighted at the top of the screen. Select the following parameters:

Case Select	Lower/Upper
Space Char	Destructive
Keyclick	No
Keyboard	U.S.
Print Scrn Key	Print Page

9. **Setting the Screen Parameters.** Press **F6 (TELEM)**. "SCREEN1" should be highlighted at the top of the screen. Select the following parameters:

Auto Wrap	Yes
Auto Scroll	Yes
Auto Line Feed	No
Margin Bell	No
Column Change	Save Screen
Columns	80
Cursor Home	Auto Scroll Dependent
Data Lines	24/42

10. **Setting the Visual Parameters.** Press **F7 (CMD)**. "VISUAL1" should be highlighted at the top of the screen. Select the following parameters:

Cursor	None
Cursor Blink	No
Prot Reverse	Off
Prot Half	Off
Prot Blink	Off
Prot Underline	Off
Prot Supress	Off
Status Line	On

11. **Setting the CRT Mode.** Press **F8 (next to CMD)**. "MODE1" should be highlighted at the top of the screen. Select the following parameters:

Terminal	Regent 40
Mode	Enhanced
Program Keys	User Dependent

12. **Saving Parameters.** Do not skip this step! Press **F1 (ACK)**. "EXEC1" should be highlighted at the top of the screen. Select "Save Parameters". Press the **space bar**. "DONE" will appear on the left-middle part of the screen. If you do not perform this step, the following will be for naught.

13. **Setting the Function Keys.** Press **F10**. "FUNCT1" should be highlighted at the top of the screen. You will be programming function keys F8 and F12 through F16.

    Press the **FUNCT** key followed by **F8**. Now press **SHIFT-INS/REPL** (next to left **SHIFT**) three times. This should delete any characters that were shown in the text area.

    Press **FUNCT**, then **F12 (PULSE RAISE)**. Press **SHIFT-INS/REPL** three times, and then **CTRL-U**.

    Press **FUNCT**, then **F13 (RAISE)**. Press **SHIFT-INS/REPL** three times, and then **CTRL-J**.

    Press **FUNCT**, then **F14 (STOP)**. Now press the **RIGHT ARROW** once. Press **8**.

    Press **FUNCT**, then **F15 (LOWER)**; **SHIFT-INS/REPL** three times, and then **CTRL-F**.

    Press **FUNCT**, then **F16 (PULSE LOWER)**. Press **SHIFT-INS/REPL** three times, and then **CTRL-Z**.

    This concludes programming the function keys.

14. **Saving Function Keys.** Repeat Step 12. **(THIS IS IMPORTANT!!)**

1.14 Installation of the CRT

If the CRT option was ordered separately from the MRC-2, this subsection provides the information necessary to install it. The option consists of the following:

1. A Serial I/O module (the larger board, to be installed at the front of the MRC chassis.
2. A Serial Interface module (the smaller board, to be installed at the rear of the MRC chassis.
3. A CRT cable.
4. An ADDS Terminal.
5. Blank cover plate.

Perform the following steps to install your CRT option:

1. Set switch settings for the Serial I/O module and Serial Interface module (refr to Tables 1-1 below and 5-2 in Volume 1.

Table 1-1. Switch S1 Settings for the Serial I/O Module

CRT Number	S1 Position	Validity
0	0	CT & RT
1	1	CT only
2	2	CT only
3	3	CT only

2. With the ac power off, install the Serial I/O module into a vacant slot in the chasszis.

3. With the ac power off, install the Serial Interface module into the corresponding position from the rear of the chassis (behind the Serial I/O module). Install two 4-40 screws to secure the module.

> **NOTE:**
>
> **The access plate(s) on the rear may need to be removed to install this module. If a dual-width access plate is removed, the resulting hole can be covered with the spare single-width access plate supplied.**

4. Install the CRT cable between the Serial module and the ADDS Terminal.

> **CAUTION:**
>
> **Removing the cable from the CRT while still connected to the Serial Interface module may cause the Terminal to reset. This could cause loss of some command, and turnoff of the transmitter may occur. Thus, disconnect the cable from the Terminal before disconnecting it from the CRT.**

5. Connect the CRT to the MRC-2 terminal by using the cable provided. Either end of the cable may be connected to either unit. Connect the cable to the connector marked "EIA" on the rear of the CRT, not the connector marked "AUX".

6. Apply power to the CRT, turning it on using the power switch on the rear of the terminal.

7. Power up the MRC-2 Terminal. You should see the screen clear and characters appear on the screen.

8. After setting up the CRT pages (see 1.4), select an enabled site which is sending data to the Control Terminal.

9. Adjust the contrast control on the CRT so that there is a clear distinction between the selected channel, in bright intensity, and the other channels in dim intensity.

1.15 Command Summary

> **NOTE:**
>
> **The letter X represents a numeric entry.**

Unrestricted Functions

ACK	Acknowledges alarms, and clears numeric entries. If a number has been partially entered, the first depression of **ACK** will simply clear the entry.
STAT CLEAR	Status clear for selected site.
SITE SEL	Selects the current page of the next site.
-SITE SEL	Selects the current page on the previous site.
XX SITE SEL	Selects the current page of the specified site. (Makes a channel site-specific in the SETUP mode.)

PAGE SEL	Advance to next page.
-PAGE SEL	Retreat to previous page.
XX PAGE SEL	Advance to specific page, same site.
STAT	Advance to next status page.
-STAT	Retreat to previous status page. (Deletes the selected channel in the SETUP mode.)
XXX STAT	Select specific status channel. Page changes if necessary. (Adds the specific channel in the SETUP mode.)
TELEM	Advance to next telemetry page.
-TELEM	Reatreats to previous telemetry page. (Deletes the specified channel in the SETUP mode.)
XXX TELEM	Select specific telemetry channel. Page changes if necessary. (Adds the specific channel in the SETUP mode.
CMD	Advance to next command page.
-CMD	Retreat to previous command page. (Deletes the selected channel in the SETUP mode.)
XXX CMD	Select specific command channel. Page changes if necessary. (Adds the specified channel in the SETUP mode.)
RAISE	
STOP	
LOWER	Execute designated command on selected channel. Pulse commands are 0.1 seconds. Control must have been taken (using TAKE CTL key below)
PULSE RAISE	
PULSE LOWER	
TAKE CTL	Assume control of the Control Terminal. Times out in 20 seconds for telemetry channel and 4 seconds for status or command channel. If at RT, Maintenance Override must be enabled.
ENTER	Select the next "slot" (position) on the page.
-ENTER	Select the previous "slot" on the page.
XX ENTER	Select a specific "slot" on the page.

NOTE:
NEW LINE or RETURN can be used instead of ENTER.

A	Alarm Search — advance to the next abnormal channel on the current site.
-A	Alarm Search — advance to the next abnormal channel system wide
F	Display Telemetry Failsafe Countdown Times
L	Display Limits for selected telemetry channel
O	Re-Output the page

XXXX R	Toggle Restricted functions. (Password is required if established at CT)
?	Request command mapping text for selected channel
^N	Deny control request (No)
^Y	Grant control request (Yes)

Restricted Functions

B	Toggle audible alarming (Bell). Visual alarms are always enabled.
Mmdd D	Set Date (month and date)
I	Toggle Limit Checking at selected site
S	Toggle Set-Up mode
hhmm T	Set Time (hours and minutes)
U	Toggle channel type (generic/site-specific)
yyyy Y	Set 4-digit Year
^D	Dial selected site
^E	Enter page title (Set-Up mode)
X ^K	Kill (disconnect) dial-up modem (0=main/1=alt)
^P	Polite control requres
^R	Rude control request
^W	Enter channel text (Set-Up mode)

NOTE:
^X indicates the CTRL key and X pressed simultaneously.

Section Two

Automatic Logging Option

2.1 Introduction

This section describes the operation of the Automatic Logging Option. The Logger is intended to provide automatic logging of MRC-2 parameters triggered by time or alarms. All operation of the Logger is done from the keyboard of the Genicom 2030 or Model 43 Printer. Once the user is familiar with the operation, the summary in Section 2.6 may be used for reference.

The Automatic Logging Option may be installed at either the Remote or Control Terminals. There can be up to four Logger options installed at one Control Terminal. Each Logger can be programmed with a different set of instructions extracting different sets of data, printing different headings, printing status-initiated messages, and/or printing alarms under different conditions. The operation and set-up of all Loggers is identical, regardless of where they are located. If multiple Loggers are at one location, each operates independently.

A Logger has two modes of operation. The EDIT mode is used to provide instructions to the Logger. The LOGGING mode applies the user's instructions to perform the type of logging desired at the selected intervals.

When an MRC-2 system is plugged in for the first time, there are no instructions for logging. This is known as a "Cold start." When a Logger is in this condition, the application of power will cause the Logger to automatically enter the EDIT mode. The user instructions to the Logger are retained in nonvolatile memory and will not be lost if power fails. Reapplication of power will cause the Logger to automatically return to the LOGGING mode.

2.2 Operational Overview

The MRC-2 Logger presents data collected from the user's MRC-2 system on a Genicom 2030 or Teletype (R) Model 43 Printer. There are four main parts to this presentation (refer to Figure 2-1):

1. One or more "page headers" (multi-line text messages at the top of the page) are printed manually or at preset intervals and (optionally) on each new page. The header texts and the intervals at which they are printed may be set and changed by the user at will. Before each new header or set of headers is printed, the Logger optionally advances to a new page, and prints the date.

Figure 2-1
MRC-2 Automatic Logging Option

```
6 Oct 1988

MOSELEY ASSOCIATES, INC.
111 Castilian Drive                                    MRC-2 Automatic Logging Option
Santa Barbara, CA   93117-3093                         Sample Log

The user can establish and change header text to appear anywhere on each page.
The user can also establish the intervals at which new pages are started.
The user can specify which channel are to be logged and the logging intervals.
The user can have messages printed whenever a status channel changes state.

          Your      column    titles    can       be        placed    here,     for       example.
          COLUMN 1  COLUMN 2  COLUMN 3  COLUMN 4  COLUMN 5  COLUMN 6  COLUMN 7  COLUMN 8  COLUMN 9  COLUMN 10
          ... or whatever else you like ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ...

15:43:50  6 Oct 1988 SITE 1 CHANNEL 1 STATUS Antenna switch FALLING EDGE EVENT  Status message; to MAIN!
15:45:06  6 Oct 1988 SITE 1 CHANNEL 4 TELEM Visual Power RED EVENT
15:45:06  6 Oct 1988 SITE 1 CHANNEL 4 TELEM Visual Power RESET EVENT
15:45:16  6 Oct 1988 SITE 1 CHANNEL 11 TELEM Aural  Power RED EVENT
15:45:16  6 Oct 1988 SITE 1 CHANNEL 11 TELEM Aural  Power RESET EVENT
1545 SITE  1     6.3      9.25      4.00     100.0      OFF      ON       ON       ON       101.0      .01

1600 SITE  1     6.3      9.25      4.00     100.0      OFF      ON       ON       ON       101.0      .01

1700 SITE  1     6.3      9.25      4.00     100.0      OFF      ON       ON       ON       101.0      .01

17:59:20  6 Oct 1988 SITE 1 COMM A ALARM
17:59:20  6 Oct 1988 SITE 1 COMM B ALARM
18:00:30  6 Oct 1988 SITE 1 CHANNEL 1 STATUS Antenna switch FALLING EDGE EVENT  Status message; to MAIN!
18:00:30  6 Oct 1988 SITE 1 CHANNEL 24 STATUS FALLING EDGE EVENT
18:00:30  6 Oct 1988 SITE 1 CHANNEL 1 STATUS Antenna switch RISING EDGE EVENT  Status message: to AUX!
18:00:30  6 Oct 1988 SITE 1 CHANNEL 24 STATUS FALLING EDGE EVENT

1800 SITE  1      .0       .00       .00  [     .0]    ON       OFF      OFF      OFF  [    .0]      .01
1800 SITE  1      .0       .00       .00  [     .0]    ON       OFF      OFF      OFF  [    .0]      .01
```

2. Beneath the header, data from the Remote Terminal(s) is printed at preset intervals or is requested manually. The intervals and channels logged may be specified by the user. Each log line gives the time and site followed by 1 to 16 status or telemetry values. If the user wishes to log more than one site or more than 16 values, multiple log lines may be specified.

3. As alarms occur, alarm messages are printed. These give the time, site, channel number where the alarm occurred, and CRT channel text if it exists. At the end of any minute in which an alarm message has been printed, one or more summary log lines can be printed, showing all logged measurements for each site at which an alarm has occurred.

4. An arbitrary message can be printed when a given status channel experiences a rising or falling alarm or event. The message is defined by the user in EDIT mode and may be a detailed description of what happened or instructions for an operator to perform.

While the system is in the LOGGING mode, it will respond to seven different entries from the keyboard:

1. Simultaneously pressing the **CTRL** (Control) and **I** keys (or **HT** on the Genicom) causes a "manually-initiated log" to take place - all data which the user has specified for logging will immediately be fetched and printed.

2. Simultaneously pressing the **CTRL** and **C** keys causes logging to stop and the system enters the EDIT mode. In this mode, the user may enter header text, assign the intervals at which new page headers will be printed, specify what will be logged and when, etc.

3. Simultaneously pressing the **CTRL** and **K** keys (or **VT** on the Genicom) causes the printer to advance to the next page and print all current headers. This allows the user to remove the current log page from the printer if desired.

4. Simultaneously pressing **CTRL** and **D** causes the printer to advance to the next page and print just the current date. THe logger then continues its normal operations. This can be used to go to a new page before editing or before logging when leaving EDIT mode.

5. Simultaneously pressing **CTRL** and **J** or just pressing LINE FEED (**LF** on the Genicom) causes a single blank line to be printed.

6. Simultaneously pressing **CTRL** and **H** followed by a three digit header number causes the logger to go to a new page, print the date and the chosen header.

7. Simultaneously pressing **CTRL** and **L** (or **FF** on the Genicom) followed by a three digit command line number causes the logger to print a specific log line.

2.3 Printer Set-Up

2.3.1 Model 43 KSR Operation

The switches on the Model 43 Printer must be set as follows:

a. Power ON (left rear of unit)
b. Parity ON
c. FULL Duplex
d. 30 CPS
e. Paper must be in unit.

The Printer must not be in the LOCAL mode. If it is, push the button marked **AUTO ANSW**. The light marked DATA must be on, and the lights marked INTRPT and ALARM must be off.

You should be aware that deliberately or accidentally pushing the **PRINTER TEST** button will cause the Printer to enter the LOCAL mode.

When the ALARM lamp is one, the cause usually is that the Printer is out of paper. Before removing the paper from the forms tractor, note the location of the paper crease of the page being printed. Insert the new paper with the crease in the same position. When the paper is properly inserted, the ALARM lamp will extinguish. Depress **AUTO ANSW** to continue printing. (The ALARM lamp will also come on if the printer cover is opened.)

For a more detailed description of the Model 43 Printer, refer to the separate Operator's Guide supplied.

2.3.2 Genicom 2030 KSR Set-Up

The printer is shipped already set-up to operate. If it does not operate correctly, perform the following:

1. Follow the checkout procedure as outlined in the User's Guide.

2. Press **FCT** and **I S U** to initialize electronics. (You may need to press **FCT** and **S U L** to unlock the keyboard.)

3. Press **FCT** and **CPI (2)** until 16 is displayed in the window.

4. Press **FCT** and **LPI (9)** repeatedly until 6 is displayed in the window.

5. Press **FCT** and **FULL DPLX (K)** until FUL is displayed in the window.

6. Press **FCT** and **CPS ({)** until 480 (4800 baud) is displayed in the window.

7. Press **FCT** and **STAT (del)**. The printer should display:

   KSR, 16 CPI, 6 LPI, STD FONT, AUTO-LF IS OFF, 480 CPS, LOCAL, FULL DUPLEX, TALK MODE, ORG MODE, 31312727*

   If it doesn't match (except for the last eight digits), repeat steps 2-7.

8. Press **FCT** and **O S U**. The printer will print two rows of numbers and letters. Press **I <SPACE> <SPACE> <SPACE> <SPACE> I <SPACE> <SPACE> <SPACE> I <RETURN>**. If P-O appears in the display, then you do not have the Paper-LOW switch properly installed. Press **FCT** and **O S U** and then **<RETURN>**. The printer should display:

```
12345678901234567890123456789012345678901234567890
IOOOOIOOOIOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
```

if not, repeat Step 8.

9. Pres **FCT** and **ON LINE (L)** until OnL is displayed in the window.

10. Press **FCT** and **S U L** to lock the set-up functions.

2.4 EDIT Mode

In the EDIT mode, the user gives instructions to the system that describe what to do while logging. In this mode, no logging takes place until the user types an **L** command. The system will then commence logging according to instructions. No more instructions may be given until **CTRL** and **C** are again pressed simultaneously, which causes the system to stop logging and re-enter the EDIT mode.

When the Logger is in the EDIT mode and is ready to accept the user data, it will perform a carriage return and line feed and will prompt the user by printing an "*" to indicate when a new command may be entered.

2.4.1 Correcting Entered Data

In the EDIT mode, instructions are entered via command lines. A command line consists of a sequence of characters followed by **RETURN**. (**RETURN** is the large key at the right of the keyboard.) Return will be denoted by **<CR>** in this manual (for Carriage Return).

The characters entered must be in the proper format (have correct "syntax") or the system will respond "WHAT?" Should the user notice a mistake while entering a command line, it may be removed with the **DELETE** key (at extreme lower right on the Model 43 and at upper right on the 2030). The system will backspace and, if necessary, advance the paper a line to prevent a strikeover. To remove several characters, press the **DELETE** key the appropriate number of times.

As an example, see Figure 2-2. (The significance of "H1:1:" in the command line will be explained later.) In Step A, the user has noticed a mistake in the second word. He hits **DELETE** 10 times.

When the print head is directly under the error, he then types in the correct character (Step B). All characters after the error must be retyped (Step C). In Step D, after typing a bit more, the user makes another mistake which he notices immediately. Pressing **DELETE** once, the print head backspaces and the paper advances a line. The correct character is entered followed by the remainder of the command line (Step E) -- followed by **RETURN**, which is the signal to the system that the command line is ready.

Alternatively, the entire line may be deleted by pressing the **CTRL** and **X** keys simultaneously. The system responds by going to a new line and repeating the "*". If **DELETE** is used several times, the printout may be confusing. At any time during entry of a line, the contents of the buffer may be examined by pressing the **CTRL** and **D** keys simultaneously. The system responds by typing the line anew, and then pauses for further input.

```
Step A:      1:1:THESE ARF THE TIMES

Step B:      H1:1:THESE ARF THE TIMES
                        E

Step C:      H1:1:THESE ARF THE TIMES
                        E THE TIMES

Step D:      H1:1:THESE ARF THE TIMES
                        E THE TIMES THAD

Step E:   H1:1:THESE ARF THE TIMES
                          E THE TIMES THAD
                                        T TRY MEN'S SOULS
```

Figure 2-2
Correcting Typing Errors

Correction with the **DELETE** or **CTRL-X** keys applies only to command lines which are in the process of being entered. (The crucial dividing line occurs when **RETURN** is pressed.) Mistakes in lines already entered must be corrected by re-entering the entire offending line. After a command line is entered (ie., after **RETURN** is pressed), the system will respond in one of three ways:

1. If the system cannot make sense of the command line, "WHAT?" is printed. The user must consult these instructions, find the mistake, and enter the line correctly.

2. If the command line calls for an explicit action by the system which results in printing, this is done immediately, For example, if the system is requested to print the time, this will be done immediately after **RETURN** is pressed. The system will then stand ready to be given another command line.

3. If the command line calls for the system to make some change in its internal state (for instance, a change in the intervals at which new headers are printed), the system will respond with a "*" to indicate the command line is in the proper format and the requested action has been taken. Note that this may take several seconds and in the meantime the keyboard will appear "dead."

2.4.2 Introduction to Editing Commands

The first character in every command line must be a letter specifying the type of command. Some command lines consist solely of this one letter; for instance, the previously mentioned **L** (followed by **RETURN**) causes the system to leave the EDIT mode and start logging. Most command types require additional characters following the initial character that specifies the type. The command types (see Table 2-1) are described in detail in the following pages.

Table 2-1. Summary of Commands

A	Alarm-Log mode command
C	Log line command
D	Date command
E	Eject command
F	Field model command
H	Header command
J	Line feed (Jump) command
L	Begin logging command
M	Set top of form command
N	New page command
P	Page length command
S	Status message command
T	Time command
V	View current ejects command
W	Log line window command
Y	Year command

In the following instructions, **RETURN** is denoted by <CR>. For ease of typing, semicolons (;) may be substituted for colons whenever the latter are specified, and spaces may be substituted for commas.

2.4.3 Setting Alarm-Log Mode (A)

It is assumed that the MRC-2 Remote Terminal will be set-up to issue alarms and events (see Section 3, Volume 1). Each Logger can be programmed to print alarms and/or events and/or summaries independently with varying degrees of discretion.

For alarms and events:

1. (Y) Unconditionally print all alarms (or events) from all sites and all channels.

2. (N) Never print an alarm (or event).

3. (S) Print only if the site of the alarm (or event) appears in at least one C command line.

4. <CR> Leave it the way it is.

The first programmed option produces a "dirty" log; the second programmed option produces a "clean" log. The third option logs alarms (or events) only if the site of the alarm or event appears in a summary printout.

For Alarm And Event Summaries:

1. (Y) Always print a summary if any alarm or event has been logged in the last minute.

2. (N) Never print a summary.

3. (S) Print summary only if site appeared in a log line during the last minute.

4. <CR> Leave it the way it is.

For System Alarms:

1. (Y) Always print the system alarms:

   System Configuration
   Data link errors
   Failsafe conditions
   Dialup errors

2. (N) Never print system alarms.

3. <CR> Leave it the way it is.

To examine the current alarm mode, type

A<CR>

The logger will respond by typing:

Log Alarms (Y,N,S): (x)
[where x is the current setting]

Press Y, N, or S to set how alarms will be handled, as described above. The Logger will permanently store your selection, print it just to the right of the old setting, and on the next line print:

Log Events (Y,N,S): (x)
[where x is the current setting]

Press Y, N, or S to set how events will be handled, as described above. The Logger will permanently store your selection, print it just to the right of the old setting, and on the next line print:

Print Summary Log After Alarms (Y,N,S): (x)
[where x is the current setting]

Press Y, N, or S to set how alarm summaries will be handled, as described above. The Logger will permanently store your selection, print it just to the right of the old setting, and on the next line print:

Print Summary Log After Events (Y,N,S): (x)
[where x is the current setting]

Press Y, N, or S to set how event summaries will be handled, as described above. The Logger will permanently store your selection, print it just to the right of the old setting, and on the next line print:

Log System Alarms (Y,N)? (x)
[where x is the current setting]

Press Y to always log system alarms or press N to never log system alarms. The Logger will permanently store your selection, print it to the right of the old selection, and once again display the "*" prompt.

2.4.4 Log-Line Commands (C)

Log-line commands are used to specify which data will be logged. It is possible to log different data at different times of day, to log different sites at different intervals, to log at different intervals at different times of day, etc., by entering multiple C command lines. W command lines control when log-lines print.

A log-line can contain telemetry or status values intermixed with blank columns as required to make a neat, logical presentation. The channels may be printed in any sequence.

The Logger can accommodate 16 columns of log information. Narrow paper can be used with a reduction of the number of available columns of data.

All log-line commands may be examined by entering,

```
C<CR>
```

A specific log-line may be examined by entering,

```
Cnnn<CR>
```

where

nnn is the log-line number (1-255).

The format of a log-line is as follows:

```
Cnnn:tccc,tccc,...,tccc
```

where

nnn is the one to three-digit log-line number (1-255), t is either A for analog telemetry or S for status, and ccc is a one to three-digit channel number (0-999).

There may be as many as 16 tccc fields in the command. Attempting to enter more than 16 tccc fields causes an error ("WHAT?") response on the printer. Entering fewer than 16 tccc fields results in blank fields on the log to the right of the last entry. There is a one-to-one correspondence between the columns and tccc fields, and the sequence in which the tccc fields are entered is the order in which data is printed.

To create a blank column, the tccc field should be A0 or S0: i.e. a telemetry or status channel of zero.

For example, suppose the user enters:

```
C1:A1,A2,A3,A4,A5,A6,A7,S7,S6,S5,S4,S3<CR>
```

This will result in log-lines that include telemetry channels 1 through 7 in ascending order and status channels 7 through 3 in descending order.

Suppose the user later adds:

```
C2:S17,S19,S21,S23,S25,A8,A7,A1,S3,S17,A19,S17
```

This will result in log-lines from various channels in the order given in the command. Note that there are duplicate channel numbers since S17 appears three times in line C2, and A1, A7 and S3 appear in both lines C1 and C2. The system is capable of handling this situation. Any data requested more than once is printed as many times as necessary to fulfill the request. Of course, the typical user probably will not log any particular channel more than once.

Any logged channel which goes out of tolerance will be marked with the symbol "<" if it is below its lower yellow limit and ">" if above its upper yellow limit. The red limit is treated similarly, except that two "<" or ">" symbols are printed. These marks will be printed until the channel goes back within tolerance.

Any logged channel which is uncalibrated or nonexistent will result in a blank column. Muted channels will be printed with brackets around the values.

If communications with a Remote Terminal have failed, blank spaces will be printed instead of values for logged channels at that site.

If the user wishes to skip a field, **A0** may be entered instead of a valid channel number and blank space will be printed instead of a value. For example,

```
C3:A0,A0,S1,A1<CR>
```

will result in two skipped fields at the left side of the page.

The C command line number is for reference only and has nothing to do with header numbers; however, in the event that two or more lines are due to be printed in the same minute, they will be printed in order of increasing line number.

Log-line commands may be deleted by entering **C**, followed by the line number, followed by a minus sign (-), then pressing **RETURN**. Thus,

```
C1-<CR>
```

deletes the log-line with reference number 1, if such has been entered.

The corresponding window command (W) may be found in Section 2.4.17.

Log-Line with Dial-Up Communications Note

If the Logger Option is installed in a Control Terminal that is also equipped with Dial-Up Modems, and the Logger has been instructed (using a **C** and a **W** command) to log data from a Remote Terminal connected only through a dial-up communication link, then the DIAL-UP SCHEDULE for that link must include the beginning, ending, and interval times of all **W** commands (see Section 3.10.5, Volume 1 for further details).

The dial-up time connected to the Remote Terminal should at least start at the same time as the logger requests data so that a link to the Remote Terminal exists when that data is required.

2.4.5 Date Commands (D)

Date commands are used to display and change the current date. To display the current date, enter:

```
D<CR>
```

and the current date, month and year will be printed.

To change the month and date, enter the letter D followed by the month and date as numbers. For example, entering,

```
D0817<CR>
```

sets the date to August 17. The year is set up with the Y command (Section 2.4.16).

2.4.6 Eject Commands (E)

Eject commands are used to force the Logger, at specified times, to optionally go to a new page and to print a header. Through the use of multiple eject commands, the interval between new pages may vary during the day: for example, every three hours between 8 a.m. and 5 p.m., but only every five hours at other times.

All eject lines on file may be listed by entering,

```
E<CR>
```

A specific eject line may be listed by entering,

```
Ennn<CR>
```

where

nnn is the line number (1-255)

The format of the eject line is as follows:

```
Ennn:bbbb,eeee,iiii,vvv,p,f
```

where

nnn	is the eject line number (1-255),
bbbb	is the begin time,
eeee	is the end time,
iiii	is the interval time,
vvv	is the number of the header which is to be printed,
p	is either Y or N, indicating whether to print the header at the top of each new page during the start and stop times,
f	is either Y or N, indicating whether to go to a new page at the beginning of each new interval.

In 24 hour format (midnight is 0000, noon is 1200, and the end of the day is 2359) 2400 is not a valid time. The interval, like the begin and end time, is expressed in hours and minutes. Thus, 0030 represents "every 30 minutes" and 0130 represents "every hour-and-a-half".

For example, suppose the user enters:

```
E1:0000,0759,0400,1,N,Y<CR>
```

followed by:

```
E2:0800,1759,0230,1,N,Y<CR>
```

Then between midnight and 7:59 a.m., new headers will be printed at four hour intervals (i.e., at midnight and 4:00 a.m.). Between 8:00 a.m. and 5:59 p.m., new headers will be printed at two-and-a-half hour intervals (i.e., at 8:00 a.m., 10:30 a.m., 1 p.m., and 3:30 p.m.). No headers will be printed between 6:00 p.m. and midnight.

It should be stressed that the "1" in E1:... and the "2" in E2:... are reference numbers only and have no bearing on page position and no relation to the header numbers above. In the example above had we entered:

```
E37:0000,0759,0400,1,N,Y<CR>
```

followed by:

```
E19:0800,1759,0230,1,N,Y<CR>
```

instead of using "1" and "2", the resulting behavior while logging would have been unchanged. These line numbers have meaning only in the EDIT mode and exist only for convenience in editing, allowing a specific command line to be pinpointed for replacement or removal, with the following exception: if two or more eject lines are active in a single minute, each specifying a header, the headers will be printed in the order of the eject line numbers. For example, if the following lines are present:

```
E6:0800,0800,0001,2,Y,Y

E3:0800,0800,0001,4,Y,Y
```

then at 8:00 a.m. both of these lines will be active. The Logger will go to a new page, then print header 4 and header 2. Header 4 comes out first since it is specified by the lower-numbered eject line. The second header is printed immediately after the first, not on a new page. This allows a general header to be followed by different subheaders at different times of the day.

Examples of New Page Control:

```
E1:0000,2359,0100,5,Y,Y
```

Once an hour, the current page will be ejected and header 5 will be printed on the new page. In addition, header 5 will be printed at the beginning of every page.

```
E1:0800,1700,0100,5,N,Y
```

Once an hour from 8:00 a.m. to 5:00 p.m., the current page will be ejected and the header 5 will be printed at the beginning of the new page. These are the only times this header will be printed.

```
E1:0800,1700,0100,5,Y,N
```

From 8:00 a.m. to 5:00 p.m. header 5 will be printed at the beginning of each page. Header 5 will also be printed at the beginning of each hour from 8:00 a.m. to 5:00 p.m. without going to a new page.

```
E1:0800,1700,0200,5,N,N
```

At the beginning of each hour between 8:00 a.m. and 5:00 p.m. header 5 will be printed without going to a new page. This is the only time it will be printed.

To create an eject line, enter it as shown above followed by a <CR>. For ease of typing, the colons and commas may be replaced with semicolons and spaces, respectively.

If a new page without a header is desired, specify an unused header number (e.g. 255).

To delete a specific eject line enter:

```
Ennn-<CR>
```

where

nnn is the eject line number (1-255)

See Section 2.4.8 for an explanation of the header (H) command.

2.4.7 Field Model Commands (F)

Referring back to Figure 2-1, it can be seen that the data is presented in 16 fixed-field columns. In most applications, the user will wish to make column titles part of his header. In order to facilitate this, the **F** command (field model command) is provided.

When the letter **F** is entered, followed by a **RETURN**, a row of asterisks and dashes are printed across the page, to indicate where the 16 data-field columns are positioned. By using the **F** command and then entering the header lines containing the column headings, accurate positioning of the titles can be achieved.

2.4.8 Header Commands (H)

Header commands are used to establish and change header text. Each Logger can support several headers at one time. Each header is identified with an arbitrary three-digit header number (1 to 255), and within each header each line has a two-digit line number (1 to 99).

Typing the "H" command alone,

```
H<CR>
```

causes the Logger to print out a list of all header numbers currently in file memory (but not the headers themselves).

For example, if headers 1, 2, and 5 are present, the print-out would appear as follows:

```
*H
1,2,5
*
```

Individual headers may be displayed by entering,

```
Hvvv<CR>
```

where

vvv is the desired header number.

Similarly, individual header lines may be displayed by entering,

```
Hvvv:nn<CR>
```

where

vvv is the header number, as before, and
nn is the desired line number.

Header lines are entered by specifying the header and line number, separated by colons (or semicolons) and followed by <CR> and then the text. For example,

```
H1:1:<CR>
THIS IS A HEADER LINE<CR>
```

sets the first line of header 1 to "THIS IS A HEADER LINE".
If this line was previously defined, the old version is erased.

Note: **Header lines may contain letters, numbers and punctuation marks, but not control characters (e.g., line-feed, backspace). Illegal characters will be ignored.**

Completely blank header lines need not be specified explicitly, unless at the end of the header. For example, if the header line,

```
H1:04:<CR>
KMAI-TV<CR>
```

was entered and the header printed, then "THIS IS A HEADER LINE" would be followed by two blank lines (lines 2 and 3); then "KMAI-TV" would be printed.

Individual header lines may be deleted by entering,

```
Hvvv:nn-<CR>
```

This is the same as the line-creation command except that it is followed by a minus (-) sign instead of a dash. The old line is erased, and the space in file memory is made available for other lines. If the deleted line is the last (highest) in the header, then the header will be shortened, losing not only the deleted line but any blank (unspecified) lines immediately preceding the deleted line. If the deleted line is not the last line, it is replaced by a blank line when the header is printed.

An entire header may be deleted by typing,

```
Hvvv-<CR>
```

2.4.9 Line Feed Command (J)

The number of line feeds following each log-line when the Logger is in log-mode can be set from 0 to 9.

J<CR> causes the Logger to print out the current setting.

Jn<CR> sets the number of line feeds to n, where n is a digit from 0 to 9. For example,

```
J2<CR>
```

would cause double-spaced log-lines, and

```
J1<CR>
```

would cause single-spaced log-lines.

2.4.10 Begin Logging Command (L)

After the Logger parameters are completely set up, the user can leave the EDIT mode and begin logging by typing,

```
L<CR>
```

The next header(s) will appear as scheduled by the last active eject line or lines. (See Section 2.4.15, View Current Header Command.)

When logging, none of the EDIT mode commands will work; the keyboard is "dead" except for the ^C, ^D, ^D, ^K, ^L, ^I and ^J keys.

When the LOG mode is entered or when logging overflows onto a new page, all headers specified in active E-lines are printed. For example, if there are only two eject lines in the system,

```
E1:0000,1159,0400,Y,N
E2:1200,2359,0400,Y,Y
```

then, if logging is started at 10:15 a.m., only header number 001 will be printed.

2.4.11 Top-of-Form Command (M)

The set top-of-form command is used to tell the system where the perforation is on the paper. Since the system determines page position by counting lines, it must count zero at the same time the print head is at the seam in the paper.

To use a type M command, align the paper so that the perforation is just at the top of the print head of the printer. Then simply enter:

```
M<CR>
```

The system will now be synchronized to the paper. Make sure the number of lines per page is correct (using command P below) before using command M.

2.4.12 New Page Command (N)

The new page command is used to advance the paper to the top of the next page. To use this feature, enter:

```
N<CR>
```

and the paper will move forward to the perforation, provided that the M command has been used previously to set the top of form.

2.4.13 Page Commands (P)

Page commands are used to reset the number of lines per page. In the case of the commonly available 14" W x 11" L or 8.5" W x 11" L fanfold paper, there are 61 lines per page. The system automatically initializes itself to this figure. The P command is available if other paper is used with a different number of lines per page.

Page commands consist of the letter P followed by a number indicating the desired number of lines per page.

For example, entering,

```
P51<CR>
```

will set the system to assume 51 lines per page. 8.5" L x 11" W computer paper is 51 lines long. The maximum number of lines per page is 255.

2.4.14 Status-Initiated Message Command (S)

This command allows descriptive messages to be automatically printed whenever a status alarm or event occurs. The format of the command is:

```
Snnn:ss,ccc,x,y<CR>
text<CR>
```

where

nnn	is the status message number 001-255 (used only for defining, displaying, and deleting the status command line)
ss	is the site of the status channel
ccc	is the status channel

x	y	Meaning
A	R	Print message when there is a rising edge alarm from channel ccc of site ss.
A	F	Print message when there is a falling edge alarm from channel ccc of site ss.
E	R	Print message when there is a rising edge event from channel ccc of site ss.
E	F	Print message when there is a falling edge event from channel ccc of site ss.

The text is the message that will be printed. It can be up to 190 characters in size. If more lines are needed, define more status message command lines with the same ss, ccc, x, y parameters. Make sure each subsequent line of a given message has a status message number (nnn) that is greater than the previous line. Typing the "S" command alone,

```
S<CR>
```

causes the logger to print out a list of all status message command line numbers currently in file memory (but not the status messages themselves), just like the H command.

Individual status message commands can be displayed by entering,

```
Snnn<CR>
```

where

nnn is the desired status message command number

Status message commands can be deleted by entering,

```
Snnn-<CR>
```

Status message commands are quite useful for describing system activity or for issuing instructions. For example, consider a door to a remote transmitter building that is equipped with a magnetic intrusion monitor switch that is shunted by a key switch mounted outside for authorized personnel. If this intrusion circuit is connected to the MRC-2 through status channel 200 at the Remote Terminal, then intrusions at the remote site could be reported at the studio Control Terminal's Logger by entering the following at the Logger:

```
S1:6,200,A,R<CR>
Intrusion at transmitter on  Mount Everest!  Call the
Himalayan Mounties at Shangri-La 65000!
```

This is status message command line number 1, site number 6, status channel 200. The message is printed when there is a rising alarm.

2.4.15 Time Commands (T)

Time commands are used to display and change the time-of-day. To display the current time, simply enter:

```
T<CR>
```

The current time will be displayed in the format HH:MM:SS: - where HH is the hours (following the 24-hour system), MM is the minutes, and SS the seconds.

To change the time, enter the character T, followed by the time in HHMM format. The seconds will always be set to zero. For example,

```
T1545<CR>
```

sets the time to 3:45 pm.

2.4.16 View Current Ejects Command (V)

To see which headers will be printed when going to the LOG mode (Section 2.4.10), enter the V command:

```
V<CR>
```

The Logger will print out the current header numbers. Referring to the example in Section 2.4.10, between noon and midnight the printout would appear as follows:

```
*V
3
*
```

This indicates that if the LOG mode was entered at this time header 3 alone would be in effect. You can temporarily change the time and then use this command to verify how your headers will appear at different times of day.

2.4.17 Log-Line Window Command (W)

One W command can control up to four command lines. Site codes are not needed for the command lines.

W command lines determine what part of the day and how often
C commands are used to initiate logs from what sites.

The format of the W command is as follows:

```
Wnnn:bbbb,eeee,iiii,mmm ,mmm ,mmm ,mmm ,ss ,ss ,ss ,ss
                     1    2    3    4   1   2   3   4
```

where

nnn is the W command line number (1-255), used for defining, displaying and deleting W command lines,

bbbb in hhmm format is the beginning of the logging period for C command lines mmm (1) thru mmm(4)

eeee in hhmm format is the end of the period for logging command lines mmm (1) thru mmm (4),

iiii in hhmm format determines how often command lines mmm (1) thru mmm (4) are logged, and

ss (1) thru ss (4) specify which sites data is to be gathered.

For example, if W command,

```
W103:0000,0759,0015,1,0,0,0,5,0,0,0
```

is entered, then from midnight (0000) to 7:59 a.m., C com-mand line 1 for site 5 will log every 15 minutes.

If we enter W command line,

```
W104:0000,2359,0030,2,0,0,0,6,7,8,9
```

then every fifteen minutes C command line 2 for sites 6, 7, 8, and 9 will log.

At this point we have one line printing at half-hour intervals (C2) and another at 15 minute intervals (C1). Since log lines printed in different minutes are separated by one or more blank lines and lines printed in the same minute are not separated from midnight to 7:59 a.m., we should see a repeating pattern of one line, one or more spaces, five lines, one or more spaces, etc. From 8:00 a.m. through the rest of the day, single lines separated by spaces will appear.

Entering,

```
W<CR>
```

in edit mode causes all W command lines to be printed out.

Entering,

```
Wnnn<CR>
```

causes just W command line nnn to be printed out.

Entering,

```
Wnnn-<CR>
```

causes W command line nnn to be deleted.

Using more than one W command line, any C command line can be logged at different periods and different intervals. For example, the following is entered:

```
C123:A1,S1,S3,S9,S100,A230
W1:0000,0759,0100,123,0,0,0,5,0,0,0
W2:0800,1659,0015,123,0,0,0,5,0,0,0
W3:1700,2359,0100,123,0,0,0,5,0,0,0
```

During the day, from 8:00 a.m. through 5:00 p.m., certain analog and status channels at site 5 will be logged every 15 minutes. From 5:00 p.m. until 8:00 a.m. the next morning, these channels will only be logged every hour (see Section 2.4.4).

2.4.18 Year Command (Y)

The year may be set by entering Y followed by four digits. For example, entering,

```
Y1988<CR>
```

sets the year to 1988.

2.4.19 Full File Memory

When the limit of file memory is reached, i.e. full, the display will report "FILE FULL" after any operation which requires more file memory.

2.5 LOGGING Mode

LOGGING mode operation is driven by the time-of-day clock according to the parameters stored in the file memory by the EDIT mode commands. Every minute, all E commands are checked to see if a new page is scheduled. If so, the program advances the printer to the next page (or, optionally, just two lines) and prints the Header(s). The W command is then searched to see if any log-lines are scheduled. If so, the required C-line data is fetched from the Remote Terminal and printed on the printer while not logging, the program checks for keyboard commands and alarms.

Keyboard commands are of seven types:

2.5.1 Enter Edit Mode (^C)

The first command, CRTL-C, causes the program to enter the EDIT mode.

2.5.2 New Page with Date (^D)

The second command, CTRL-D, when pressed, will advance the paper to a new page and then print the date without printing any active headers.

2.5.3 Print Single Header (^H)

The third command, CTRL-H, is similar to CTRL-K but will print any user-selected header. After pressing CTRL-H, the system advances the paper one line; the user enters any three digit header number. That header will then be printed, regardless of whether or not the header is active.

2.5.4 Manually-Initiated Log (^I)

The fourth command, CTRL-I, forces a "manually-initiated log," consisting of a log-line for each C command on file without regard to its schedule.

2.5.5 New Line (^J)

The fifth command, CTRL-J, causes the printer to advance (jump) one line.

2.5.6 New Page with Headers (^K)

The sixth command, CTRL-K, causes the printer to advance to the next page, print the date, print all active header(s), and continue logging.

2.5.7 Manually Initiated Single Log (^L)

The seventh command, CTRL-L, is similar to CTRL-I, but forces a log of a single C command. After pressing CTRL-L, the system advances the paper one line; the user enters a three-digit C command number. For instance, consider the C command:

```
C15:A1,A304,S0,S1,S256
```

If the Logger is in LOG mode and the user wants to print the single log line, all he has to do is enter:

```
CTRL-L 015
```

The log-line will be immediately printed.

2.5.8 Alarms

Alarms may by initiated by the Remote Terminal(s) when a telemetry value goes out of range or when a status value changes (see Section 3, Volume 1). Alarms are enabled on a channel-by-channel basis in the SETUP mode at the Remote Terminal front panel. Closely related to the alarm is the "event," the main difference being that alarms result in a front panel and CRT signal, but events do not.

Each Logger is notified of all alarms and events, but its response is determined by its configuration. It may print an alarm or event line, print alarm or event summaries, or print system alarms, depending upon the parameters specified with the "A" command (see Section 2.4.3).

If an alarm (or event) occurs and the Logger is configured to respond, it will print an alarm line on the printer. Alarm lines consist of the time, site, and channel of the alarm or event, the type of alarm (telemetry or status, alarm or event), and the mode that caused the alarm or event (red, yellow, end, rising, falling).

If an alarm line is printed, the Logger will print a "summary log" at the end of the minute if it is configured to do this with the A command. A summary log is like a manually initiated log in that the line schedules of the C commands are ignored (see Section 2.4.3).

No printing of log or alarm lines occurs when the Logger is in the EDIT mode. For example, if a log is scheduled every hour on the hour but the Logger is in the EDIT mode between 1:50 and 2:05, the 2:00 log is not performed. Alarms are somewhat different since they are "stacked" by the Logger even in the EDIT mode and will be printed upon return to the LOGGING mode. However, the stack is finite and if a great many alarms (more than 100) occur while the Logger is in the EDIT mode, some (the oldest) will be lost.

2.6 Command Summary

All of the EDIT and LOGGING mode commands are summarized in Table 2-1, which has been designed to provide a quick reference guide to the user once he is familiar with the basic Logger operation.

Some examples of the various commands follow. Each Logger command should be ended with **RETURN**, denoted as <CR>.

```
A<CR>
Log Alarms (Y,N,S) :(N)Y<CR>
Log Events (Y,N,S) :(N)<CR>
(Log alarms but not events)

C1:A1,A2,A3,A4<CR>
W010:0000,2359,0001,0,0,0,1,0,0,0<CR>
(First log line; log from midnight to 11:59 p.m. at
one-minute intervals from site one; telemetry channels
1, 2, 3, and 4.)

C2:S4,S3,S2,S1<CR>
W011:1800,1900,0004,0,0,0,2,0,0,0<CR>
```
(second log line; log from 6:00 p.m. to 7:00 p.m. at four-minute intervals from site two; status channels 4, 3, 2, and 1 - printed in that order.)

```
S213:38,10,E,F<CR>
SOMEONE SHUT OFF THE TOWER LIGHTS.<CR>
```
(print message when status channel 10 at site 38 causes a falling edge event.)

```
H3:4:<CR>
111 Castilian Drive, Goleta, CA<CR>
```
(Establishes fourth line of header number 3.)

```
C1<CR>
```
(Entering line number not followed by colon causes specified line to be printed.)

```
C1-<CR>
```
(Line number followed by minus and nothing else deletes specified line.)

```
D0817<CR>
```
(Sets date to August 17.)

```
E<CR>
```
(Entering E causes all eject lines to be printed.)

```
E1:0000,2359,0200,3,N,Y<CR>
```

(Go to a new page and print header 3 at 2-hour intervals all day. Do not reprint header when a page fills up and a new one is started. The start-stop interval format is the same for the type W commands above. E stands for eject.)

F<CR>
(Print asterisks and dashes showing data fields. These data fields are always fixed. This command is for the purpose of assisting layout of column titles when entering headers.)

T1230<CR>
(Set time to 12:30 and 0 seconds.)

T<CR>
(Display time-of-day.)

P61<CR>
(61 lines per page. The Logger chooses this value as a default. This is appropriate for the paper most commonly used but can be set up to 255.)

M<CR>
(Set top of form.)

N<CR>
(Form feed.)

L<CR>
(Begin logging.)

Y1988<CR>
(Set year to 1988.)

J1<CR>
(Double space all log lines.)

CTRL-C (Pressed simultaneously in log mode.) (Stop logging and enter EDIT mode.)

CTRL-D (Pressed simultaneously in log mode.) (Eject page and print date.)

CTRL-H hhh (Pressed simultaneously in log mode.) (Print header line using header number "hhh".)

CTRL-I (Pressed simultaneously in log mode). (Manually initiated log of all command lines.)

CTRL-K (Pressed simultaneously in log mode.) (Advance to new page and print all active headers.)

CTRL-L ccc (Pressed simultaneously in log mode.) (Print data described by command number "ccc".)

2.7 System Capacity

All commands of type W, S, H, E, and C store their data in common file memory that is shared with the rest of the system. To estimate the amount of memory required for a logging application, the following data and algorithms are provided:

a. Each E, W, and C command uses 34 bytes of memory

b. Each H and S command will use 1 to 6, 34-byte blocks of memory determined as follows: count the number of characters including spaces in a heading line, except count each string of repeated characters as 2. If the total count is less than 31 for headings or 30 for status messages, 1, 34-byte block is required. Each additional 31 bytes for headings, or 32 bytes for status messages, requires an additional 34-byte block.

Once the number of File Memory pages has been determined, the number of File Memory Extension modules can be determined since each File Memory Extension module holds 240, 34 byte blocks of data.

2.8 Installation of Logging Option

If the Logging Option was ordered separately from the MRC this section provides the information necessary to install it. The option consists of the following:

1. A Serial I/O module (the larger board, to be installed at the front of the MRC-chassis).
2. A serial Interface module (the smaller board, to be installed at the rear of the MRC chassis).
3. A Logger cable.
4. A KSR printer.
5. Blank cover plate.

Perform the following steps to install your logging option.

1. Set switch settings for the Serial I/O module and Serial Interface module (refer to Table 2-2 (on the following page) and in Volume 1, Table 5-2.

Table 2-2. Switch S1 Settings for the Serial I/O Module

Logger Number	S1 Position	Validity
0	8	CT or RT
1	9	CT only
2	A	CT only
3	B	CT only

2. With the ac power off, install the Serial I/O module into a vacant slot in the chassis.

3. With the ac power off, install the Serial Interface module into the corresponding position from the rear of the chassis (behind the Serial I/O module). Install two 4-40 screws to secure the module.

   Note: The access plates on the rear may need to be removed to install this module. If a dual-width access plate is removed, the resulting hole can be covered with the spare single-width access plate supplied.

4. Install paper in the printer. Install the cable between the Serial Interface module and the printer.

5. Apply power to the printer. Set the printer switches as defined in Section 2.3.

6. Apply power to the Terminal. The Logging option will now come up in the "cold start" condition in the EDIT mode, ready for entry of logging commands.

2.9 Remote Terminal Differences

The logger option for the most part operatates identically at the Control and Remote Terminals. The following paragraphs outline the differences.

2.9.1 CRT and Logger

The CRT Option and the Logger Option cannot both operate at the same time in the Remote Terminal. There are two versions of firmware installed at the RT when both CRT and Logger are present. The CRT firmware normally resides in locations U7 thru U11 (bank 0) on the 96k ROM board. The Logger firmware then resides in locations U13 thru U16 (bank 1). To switch between CRT and Logger, perform the following:

a. Turn off power to the Remote Terminal.

b. Remove the 96k ROM board.

c. Set S1-2 OFF for bank 0 (CRT) or ON for bank 1 (Logger).

d. Re-install the 96k ROM board.

e. Restore power to the Remote Terminal.

2.9.2 Window command (W)

The window command is the same as the control terminal except it can specify up to 8 command lines but no sites:

```
Wnnn:bbbb,eeee,iiii,mmm,mmm,mmm,mmm,mmm,mmm,mmm,mmm
                    1   2   3   4   5   6   7   8
```

where

nnn is the W command line number (1-255), used for defining, displaying and deleting W command lines.

bbbb in hhmm format is the beginning of the logging period for C commands mmm (1) thru mmm(8).

eeee in hhmm format is the end of the period for logging command lines mmm (1) thru mmm (8).

iiii in hhmm format determines how often command lines mmm (1) thru mmm (8) are logged.

2.9.3 Status-Initiated Messages (S)

This command is the same as at the CT except the site number must always be set to 1, regardless of the actual site number of the RT:

```
Snnn:1,ccc,x,y<CR>
text<CR>
```

where

nnn is the status message number 001-255 (used only for defining, displaying, and deleting the status command line)
ccc is the status channel

x	y	Meaning
A	R	Print message when there is a rising edge alarm from channel ccc of site ss.
A	F	Print message when there is a falling edge alarm from channel ccc of site ss.
E	R	Print message when there is a rising edge event from channel ccc of site ss.
E	F	Print message when there is a falling edge event from channel ccc of site ss.

The text is the message that will be printed. It can be up to 190 characters in size. If more lines are needed, define more status message command lines with the same ss, ccc, x, y parameters. Make sure each subsequent line of a given message has a status message number (nnn) that s greater than the previous line.

Table 2-3. Command Summary

Boldface = Exact text as seen on printer

EDIT Mode

A<CR>	Log Alarms (Y,N,S): (Old) New Log Events (Y,N,S): (Old) New Print Summary Log After Alarms (Y,N,S):(Old) New Print Summary Log After Events (Y,N,S):(Old) New Log system Alarms (Y,N)?(Old) New For alarms and events: Y is log always, N is log never, S is log if the site appears in a log line. For summaries: Y is print summary always, N is print summary never, S is print summary if site appears in a log line.
C<CR>	Display all C command lines on file.
Cnnn<CR>	Display C command line number nnn.
Cnnn-<CR>	Delete C command line number nnn.
Cnnn:xccc...<CR>	Define C command line number nnn. where: nnn is the command line number (1-255), X is either A or S, and ccc is the channel number.
D<CR>	Display date and year.
Dmmdd<CR>	Set date where: mm is the month (01-12) and dd is the date (01-31).
E<CR>	Display all E lines on file.
Ennn<CR>	Display E command line number nnn.
Ennn-<CR>	Delete E command line number nnn.
Ennn:b,e,i,h,p,f	Define E command line number nnn. where: nnn is the E command line number (1-255), b is the beginning time (hhmm), e is the ending time (hhmm), i is the interval (hhmm), h is the header number (1-255), p is either Y or N (indicating whether to print the header at the top of a new page), f is either Y or N (indicating whether to eject the page before printing the header at the beginning of the interval).

Table 2-3. Command Summary

F<CR>	Print field model line
H<CR>	Print list of all headers on file.
Hvvv<CR>	Display header number vvv.
Hvvv-<CR>	Delete header number vvv.
Hvvv:nn-<CR>	Delete line number nn of header number vvv.
Hvvv:nn:<CR>	Define line number nn of header number vvv.
text<CR>	where: vvv is the header number (1-255), nn is the line number (1-99).
J<CR>	Display number of line feeds after a log.
Jn<CR>	Set number of line feeds after a log to n (0-9).
L<CR>	Begin logging.
M<CR>	Define current paper position as top of form.
N<CR>	Move to next page (manual form-feed).
P<CR>	Display lines per page.
Pn<CR>	Set lines per page to n (1-255).
S<CR>	Print list of all S command lines on file.
Snnn<CR>	Display S command line number nnn.
Snnn-<CR>	Delete S command line number nnn.
Snnn:ss,ccc,x,y<CR> text<CR>	Define S command line number nnn. where: nnn is a status-message number (1-255), ss is the site number (1-99), ccc is the status number, x is either A (alarm) or E (event), and y is either R (rising) or F (falling).
T<CR>	Display time of day.
Thhmm<CR>	Set time of day to hh:mm (24-hour format).
V<CR>	Display current eject number.
W<CR>	Display all W command lines on file.
Wnnn<CR>	Display W command line number nnn.
Wnnn-<CR>	Delete W command line number nnn.
Wnnn:b,e,i,ccc,ccc, ccc,ccc,ss,ss,ss,ss	Define W command line number nnn. where: nnn is the window line number (1-255), b is the beginning time (hhmm), e is the ending time (hhmm), i is the interval (hhmm), and ccc are four command line number (1-255). ss are four site numbers (1-64)

Table 2-3. Command Summary

Yyyyy<CR>	Set year.
CTRL-D	Retype input buffer.
CTRL-X	Abort command.
DELETE	Ignore last keystroke.

Logging Mode

CTRL-C	Stop logging, and enter EDIT mode.
CTRL-D	Go to new page and print date.
CTRL-Hn<CR> CTRL-Hnn<CR> CTRL-Hnnn	Print a specific header where n, nn, or nnn is the header number (wait for carriage return).
CTRL-I	Manually initiated log (print all C command lines regardless of start and stop times).
CTRL-J or LINE FEED	Prints a single blank line.
CTRL-K	Manually initiated heading (on new page).
CTRL-Lc<CR> CTRL-Lcc<CR> CTRL-Lccc	Print data described by command line number c,cc, or ccc (wait for carriage return).

Section Three

MSD-1/MDC-2 Option

3.1 System Characteristics

The MSD-1 Multiple Status Display and the MDC-2 Multiple Direct Command are two options available for the MRC-2 Microprocessor Remote Control System. Each MSD-1 chassis provides a visual status indication of 32 status channels (two user-selected status boards) through the medium of light-emitting diodes (see Figure 3-1). Each MDC-2 chassis provides 16 buttons which can be user programmed to activate (or deactivate) up to 16 command lines (see Figure 3-2). In addition, each switch also has its own "tallyback" LED which indicates when a specific command request has actually been completed (true tally-back).

The MDC-2 and MSD-1 options act, for the most part, independently. However, there are a number of character-istics they have in common, hence it is often convenient to reference the entire subsystem as the MSD/MDC option, where appropriate. For example, at a given MRC-2 chassis, all MSD-1s and all MDC-2s communicate through a single "daisy-chained" RS-232C compatible line.

The following document describes the installation, operation, and maintenance of the MSD/MDC option in some detail. It is assumed that the reader has read Sections 1-5, Volume 1 and is reasonably familiar with their contents.

3.2 System Specifications

Type:	Microprocessor-Based options for the MRC-2, Microprocessor Remote Control system.
Interconnect:	RS-232C compatible full-duplex "daisy chain"
Data Rate:	300 or 1200 bits/second user switchable
Data Format:	7-bit ASCII plus parity, fixed-frame format
Chassis per Terminal:	
MSD-1	See Section 1, Volume 1
MDC-2	See Section 1, Volume 1
Update Time:	
MSD-1	See Section 1, Volume 1
MSD-2 - Background:	See Section 1, Volume 1
MSD-2 - Controlling:	See Section 1, Volume 1
Command Activation:	
MDC-2	One button at a time, N-key roll-over
Command Activation Time:	See Section 1, Volume 1

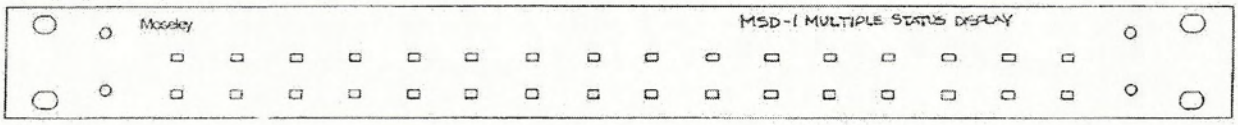


Figure 3-1
MSD-1 Front Panel

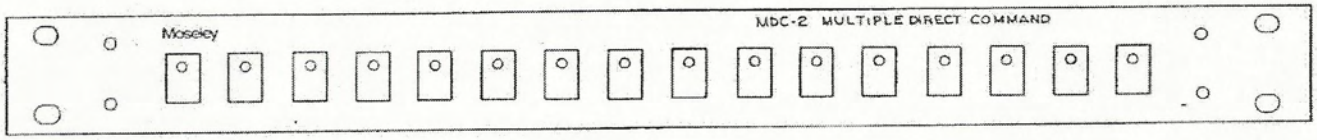


Figure 3-2
MDC-2 Front Panel

Display Format: MSD-1	Two rows of 16 rectangular LEDs, with the following output indications: off -> status off on -> status on 75% off, 25% on -> status off and alarmed 25% off, 75% on -> status on and alarmed
MDC-2	One LED per switch, (16 switches per chassis) indicating the state of the assigned command line, filtered by command type and user-set button action indicating the following: on -> command line action taken off -> command line action finished
External Connections: Downstream:	25 Pin D female connector supplying data to and receiving data from the MRC-2.
Upstream:	25 Pin D female connector supplying data to and receiving data from additional MDC-2 and MSD-1 chassis.
External I/O: MSD-1	37 Pin D female connector offering 32 open-collector pull-to-ground closures corresponding to individual status states. Max voltage (Voh max = 25 V; Iol max = 30 mA).
MDC-2	37 Pin D female connector offering 16 pull-to-ground contact closures for external commanding, and 16 open-collector pull-to-ground closures corresponding to individual tallyback states (Voh max = 25 V; Iol max = 30 mA).
Impact on Terminal:	Requires 1 Serial I/O board, 1 Serial Interface board.
Power Requirements:	120/240 Vac 50/60 Hz, 20 W max.
Operating Temp:	0-50 degrees C
Physical Dimensions:	1.75" H x 19" W x 12.25" D.

3.3 System Descriptive Information

The MSD-1 Multiple Status Display and MDC-2 Multiple Direct Command are two options available for the MRC-2 Microprocessor Remote Control system. The option consists of zero or more MSD-1 chassis, zero or more MDC-2 chassis and connecting cables. In addition, a Serial I/O and Serial Interface board are required to interface the MRC-2 to the other chassis over a line called the Stream.

The Stream is perhaps the most important portion of the MSD/MDC option since it is the path upon which all data is passed back and forth to the MRC-2 and the other chassis. Essentially, the Stream is a sequence of RS-232 compatible lines which run from chassis to chassis in a daisy-chain fashion. If a given unit is closer to the MRC-2 than another chassis, that unit is said to be Downstream from the chassis. Conversely, if the chassis is further from the MRC-2 than another unit, the unit is said to be Upstream to the chassis. Data which comes from the MRC-2 chassis is referred to as Upstream data; similarly, data sent to the MRC-2 is referred to as Downstream data. In normal operation, the MRC-2 sends data over the Upstream data line to the first chassis (either MDC-2 or MSD-1). That chassis passes the data on up to the next chassis in line, which in turn passes it on to the next chassis, and so forth. In this way, all chassis connected to the stream get all of the data the MRC-2 sends, and can use the data it "wants" while ignoring the rest.

The Downstream data path is a little more involved. The only device which uses the Downstream line is the MDC-2, which it uses to send command requests to the MRC-2. In the "ground" state, all devices handle Downstream data the same way they handle Upstream data, except in the opposite direction: Downstream data passes from device to device until it reaches the MRC-2. Unlike Upstream data, however, the devices which pass the data along do not "look" at the data; they can only detect when data is present. For the moment, let's assume that some MDC-2 chassis is generating data. Further assume that another MDC-2 closer to the MRC-2 wants to issue a command request. In this situation, since there is only one Downstream line, a conflict arises: Which device gets control of the Downstream line? Conflicts on Downstream line usage are resolved by adhering to two simple rules:

1. First come, first served. Essentially, this means that if the Downstream line is busy, don't interrupt it; wait for it to finish.

2. If the Downstream line is not busy, drive the Downstream line internally, and do not repeat messages from units Upstream.

This gets around the situation when one MDC-2 is issuing control, and an Upstream MDC-2 issues a command request. As far as the Upstream chassis is concerned, the Downstream line is free, so it transmits data. But since the original MDC-2 has cut-off the Downstream line, no contention results. When the controlling chassis finishes, it simply returns to the "ground" state and passes all Downstream data it receives towards the MRC-2.

Although the MSD-1 and MDC-2 chassis are microprocessor controlled, the majority of the setups, storage, interfacing and processing is done in the MRC-2 itself. This has several advantages:

1. Set-up retention during power failure (in File Memory installed in the MRC-2).

2. All MDC-2 and MSD-1 chassis are completely transportable; no major reinitialization setup is required.

3. MDC-2 and MSD-1 chassis can be powered down independently, and can indicate valid data within 10 seconds of power up.

4. All setups are easily accessed using the MRC-2 front panel, and can be password-protected (at the Control Terminal) through standard means.

3.3.1 MSD-1 Description

The MSD-1 chassis is a microprocessor controlled device which receives data from the Upstream data line, and displays user-selected status channels. Essentially, the MSD-1 consists of three modules: the power supply, the front panel, and the main electronics board, commonly referred to as the Parallel/Serial Processor board, or PSPB. The PSPB provides a "daisy-chained" RS-232 interface, a set of 32 parallel I/O lines, and various logic for the support of the 6809 uP. Since the MSD-1 doesn't use the Downstream line, all data generated Upstream to the MSD-1 is passed towards the MRC-2; the Data source select jumper to the daisy-chain interface is set to disable any interruptions by the MSD-1.

Operationally, the 6809 uP executes the program stored in EPROM which "listens" to the Upstream data as it is repeated to the Upstream chassis. If the message received addresses the current board number (as selected by the board select switch), the message is decoded, and the display is updated. Running in parallel with the data to the front panel is the data to the external connector, that is, anything which is displayed on the front panel is accessible through the EXTERNAL I/O connector located on the rear of the chassis. This makes for easy interfacing to external user equipment (such as "mimic panels").

3.3.2 MDC-2 Description

The MDC-2 is a microprocessor control device which transmits user-programmed command requests over the Downstream data line, and which displays pertinent tallyback information from data it receives on the Upstream data line. Structurally, the MDC-2 is very similar to the MSD-1. The MDC-2 consists of three modules: the power supply, the front panel, and the main electronics board, known as the Parallel/Serial Processor Board or PSPB. The PSPB used in the MDC-2 is identical to the PSPB in the MSD-1 except for the EPROM (which contains the program itself), and some integrated circuits in the front panel I/O drivers and external connector I/O drivers sections. Specific circuit details are discussed in the module description section of this manual.

Operationally, the 6809 uP executes the program stored in EPROM which monitors the sixteen buttons on the front panel of the MDC-2. When any one is pressed, and the Downstream data line is not already in use, the program first takes "control" of the Downstream data line, then transmits a command request to the MRC-2. Anytime the button is released, the program releases control of the Downstream line. The MDC-2 also receives messages from the MRC-2 on the Upstream line. When a message addresses the current board number (as selected by the board select switch), it is decoded, and the tallyback LEDs are updated. Like the MSD-1, all data going to, or coming from the front panel is accessible through the EXTERNAL I/O connector located on the rear of the chassis. This facilitates special user command interfacing from external equipment.

Figure 3-3
MSD/MDC Block and Level
92D1268 Rev A

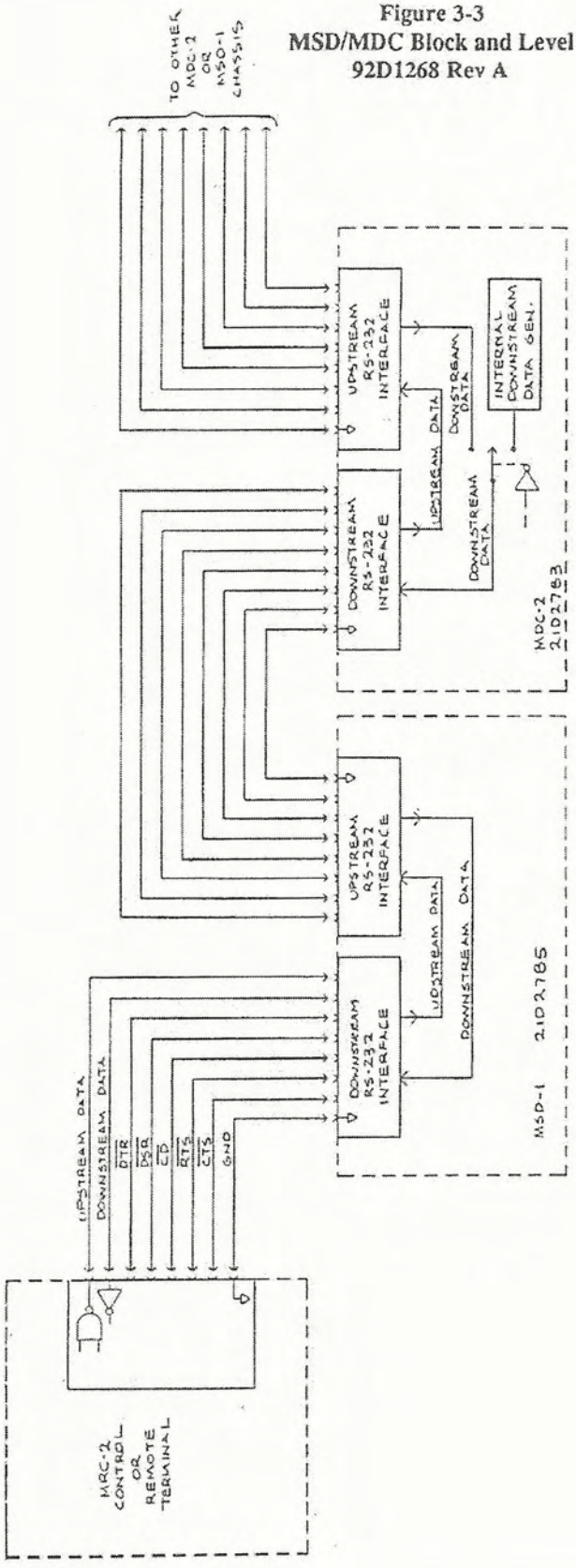


Figure 3-4
MSD-1 Block and Level
92D1266 Rev A

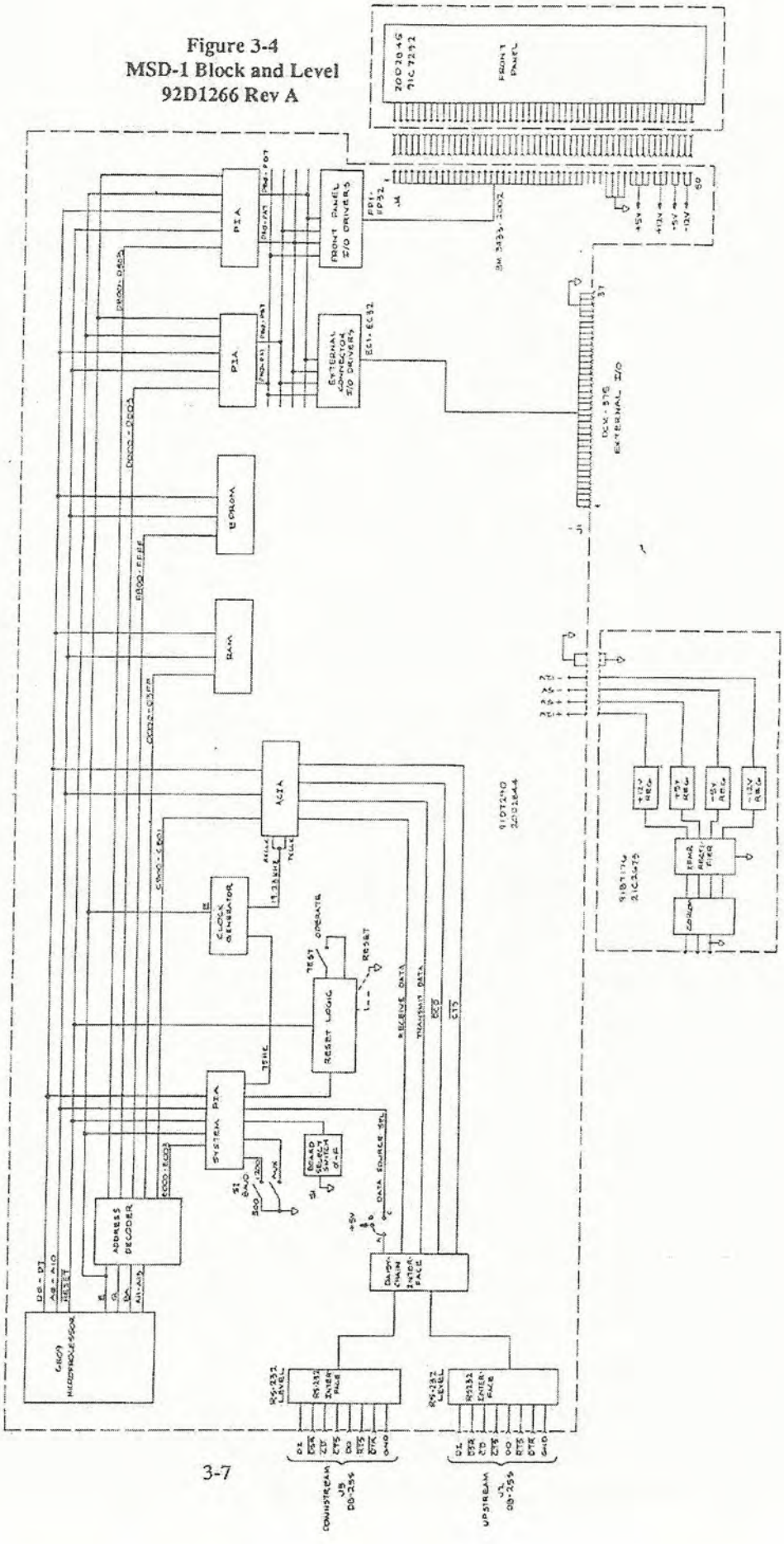
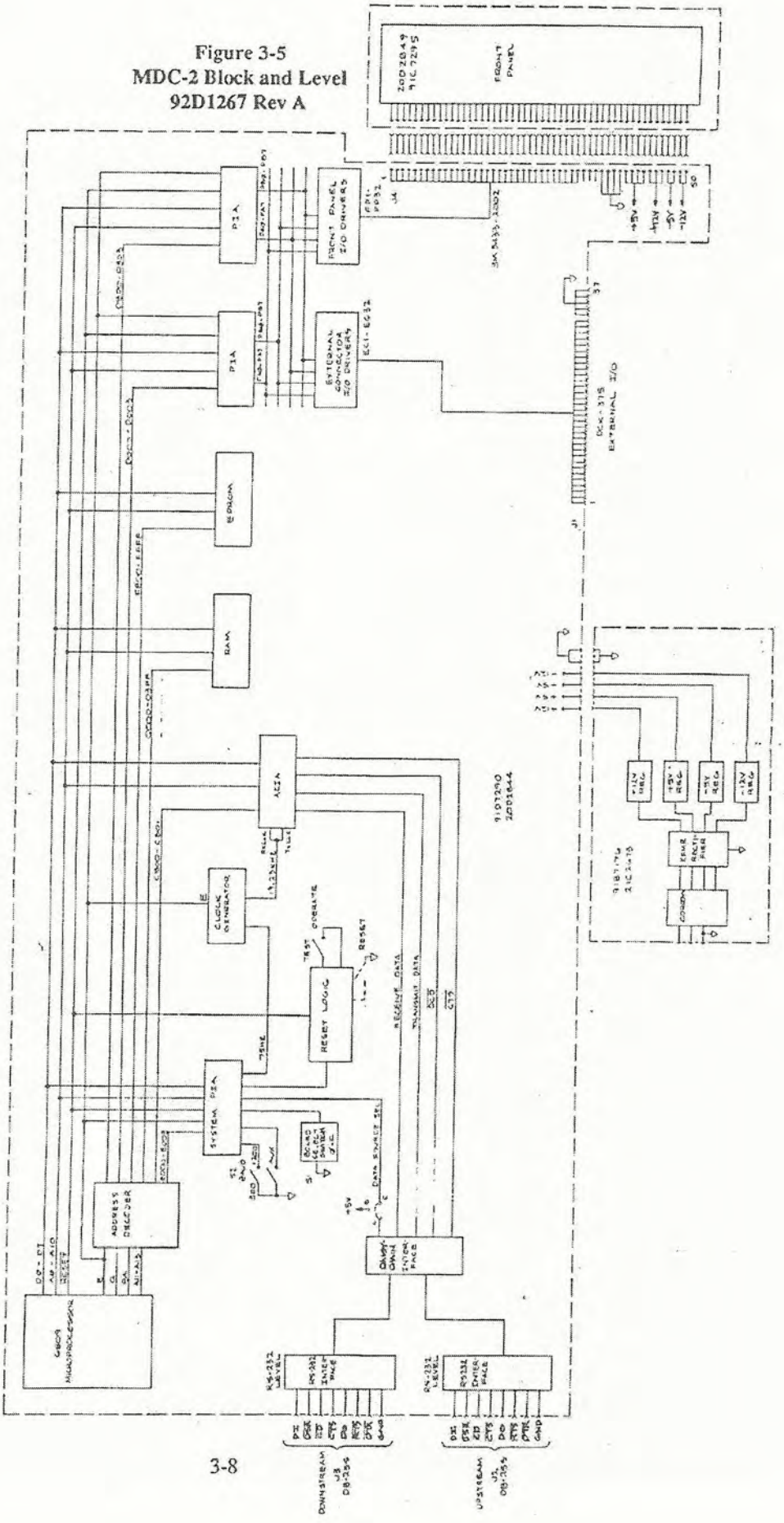


Figure 3-5
MDC-2 Block and Level
92D1267 Rev A



3.4 Installation

3.4.1 Unpacking

The MDC-2 and MSD-1 should be carefully unpacked and inspected for any shipping damage. Should inspection reveal any shipping damage, immediately file a claim with the carrier. Keep all packing materials until the performance of the system is confirmed.

Remove the top cover of all MDC-2 and MSD-1 chassis and verify that all cables are connected, and all integrated circuits are firmly seated in their sockets.

3.4.2 Preinstallation Instructions

The MDC-2 and MSD-1 each have the capability of operating at one of four nominal ac power source voltages: 100, 120, 220, or 240 Vac, 50-60 Hz. The units are shipped for 120 Vac operation, unless otherwise specified.

The ac power connector on each unit contains a voltage selector card (pc card) and a fuse. The pc card can be installed four different ways. Verify that the pc card is set for the line voltage to be applied to the unit. The voltage selected can be observed on the pc card through the window of the ac power connector.

If the voltage selector card needs to be changed to match the available power, do the following:

1. Unplug the power cord, and slide the access window to the left.
2. Pull out the FUSE PULL lever and remove the fuse. With a pair of small needle-nose pliers, firmly grasp the pc card and remove it with a straight pull.
3. Select the operating voltage by orienting the pc card to position the desire voltage number on the top left side. Replace the pc card with the needle-nose pliers.
4. If the voltage selector card is changed, change the fuse in accordance with the following:

Table 3-1. MSD/MDC Fuse Rating

Line Voltage	Fuse Rating
100	.5 A
120	.5 A
220	.25 A
240	.25 A

5. Return the FUSE PULL level to its normal position and insert the fuse into the holders. Slide the window to the right and install the ac power cord.

Locate a four switch dual inline package on the MSD-1 and MDC-2 front panel. On this package, three of the four switches serve to select various configurations within the chassis itself. Set the **TEST/OPER** switch to the OPER position, and the **AUX** switch to the OFF position.

Normally, the Stream should run at a rate of 1200 baud for maximum speed, hence the 300/1200 switch should be switched to the 1200 position. However, there are instances where 1200 baud is too fast for some user-supplied modems. In this case, an alternative of 300 baud is available and is selected by setting the 300/1200 switch to the 300 position.

While viewing the front panel, apply power to the chassis. All of the LEDs on the front panel should come on briefly, then go out. If this doesn't happen, see Section 3.7, Troubleshooting.

3.4.3 Installation

If the MSD/MDC option was ordered separately from the MRC-2, this subsection provides the information necessary to install it. The option consists of the following:

1. A Serial I/O module.
2. A Serial Interface module.
3. One or more interconnect cables.
4. Zero or more MSD-1 chassis.
5. Zero or more MDC-2 chassis.
6. Blank cover plate.

Procedures

1. Set switches S1 and S2 and the interrupt jumper on the Serial I/O module per Table 5-2 in Volume 1.
2. With the ac power off, install the Serial I/O module into a vacant slot in the chassis.
3. Set switch S1 on the Serial Interface module such that position 5 is ON and the remainder of the switches are off. This selects a 1200 baud data rate. If the Stream's baud rate should be 300 baud, set positions 5 and 8 to the ON position.
4. With the ac power off, install the Serial Interface module into the corresponding position from the rear of the chassis (behind the Serial I/O module).

5. Install the two 4-40 screws to secure the module. Note that access plate(s) on the rear may need to be removed to install this module. If a dual-width access plate is removed, the resulting hole can be covered with the spare single-width access plate supplied.

6. Install the interconnect cable between the Serial Interface module and the DOWNSTREAM connector on a MSD-1 or MDC-2 chassis. If the additional chassis are to be installed, connect the subsequent chassis DOWNSTREAM connector to the previous chassis UPSTREAM connector.

7. Apply power to all MSD-1 and MDC-2 chassis. Each chassis' LEDs should all be off. Apply power to the MRC-2 and verify the front panel functions normally.

8. Set-up at least one bank of an MSD or 1 button of an MDC (see Section 3, Volume 1).

9. Depress the **TEST** button on the MRC-2 front panel and verify that all LEDs on all MSD-1 and MDC-2 chassis illuminate for a period of approximately five seconds, then extinguish. If none of them illuminate, double check the installation of the Serial I/O board, the Serial Interface board, and the cable hookups.

The MSD/MDC option references each MDC-2 and MSD-1 by a specific board number. This board number is set within each MSD-1 and MDC-2 by S1. Before replacing the covers and installing them into their racks, set the board number switches. Board numbers which are attributed to MDC-2s should not be confused with board numbers attributed to MSD-1s, that is MDC-2 board 4, for example, has nothing whatsoever to do with MSD-1 board 4.

If a specific chassis programming is desired at more than one location, instead of programming another board the same way, two chassis may be set to the same board number. When this is done, any action done on one will be immediately evident on the other.

Once board numbers are assigned to all MDC-2s and MSD-1s, replace the covers of all chassis, and rack mount in a convenient place. Normally, the interconnect cables are supplied in three foot lengths. If desired, cable lengths of 15, 30, 50, and 100 feet are available upon request.

3.4.4 Post-Installation Set-Up

After setting the MSD-1 and MDC-2 switches to their proper positions, the remainder of the set-up is done through the front panel of the MRC-2 terminal.

The MSD-1 and MDC-2 set-up routines are two different procedures involving different parameters. Proper usage of each is described in Sections 3.7.6 and 3.7.7 located in Volume 1.

3.5 Additional MSD/MDC Operations

There are a number of conditions which could prevent or delay a MDC-2/MSD-1 command request from being fulfilled. They are as follows:

1. The current device "in control" (Front Panel or CRT) is issuing a command from. The MDC-2 command request will be suspended until the other device releases control.

2. Another MDC-2, associated with the same MRC-2 chassis is currently issuing a command. The MDC-2 command request will be suspended until the other MDC-2 finishes with its command sequence.

3. The MSD/MDC option is installed in a Remote Terminal, and the terminal is not in Maintenance Override. No command requests will be executed until the terminal is in Maintenance Override mode.

4. The MSD/MDC option is installed at a Control Terminal in a Multi-Control Terminal system, and the current Control terminal is not MASTER. The Control Terminal must be MASTER before any command requests will be granted.

5. The MSD/MDC is installed at a Control Terminal, and the site to be controlled is in Maintenance Override mode. Control requests of any kind will be ignored until the proper Remote Terminal is taken out of Maintenance Override.

6. The MSD/MDC is at a Control Terminal, and the selected site either doesn't exist, or does not have a link assignment. Verify that the Control Terminal can "talk" to the selected Remote Terminal.

7. The selected command line doesn't exist at the selected site. The command request will be ignored.

3.6 Module Characteristics

The modules are described in the following order:

3.6.1 Serial I/O Board

3.6.2 Serial Interface Board

3.6.3 Power Supply

3.6.4 Parallel/Serial Processor Board

3.6.5 Front Panel

3.6.1 Serial I/O Board

The Serial I/O board is a general purpose serial data input and output board used with several options within the MRC-2. For a complete circuit description refer to Section 5, Volume 1.

3.6.2 Serial Interface Board

The Serial Interface board is a general purpose RS-232 compatible interface which works in conjunction with the Serial I/O Board in the MRC-2. It provides a standard RS-232 interface, and a baud rate generator to produce a wide setting of I/O speeds. For a complete circuit description, consult Section 5, Volume 1.

3.6.3 Power Supply

Schematic: 91B7176 (Figure 3-6)
Assembly: 20C2764 (Figure 3-7)

Within each MSD-1 and MDC-2 chassis, there is a separate module responsible for generating the dc voltages required by the other modules. This power supply has the capability of operating at one of four nominal ac power source voltages: 100, 120, 220, or 240 Vac, 50-60 Hz. Input voltage selection is done through the voltage selector card (pc card) within the CORCOM 6J4.

The supply procedures a total of four different voltages: +12 Vdc at .5 A, +5 Vdc at 2 A, -5 Vdc at .1 A, and -12 Vdc at .15 A. Voltages are generated through a full-wave center-tap diode scheme, capacitively filtered, then regulated using series-pass integrated circuit regulators. Voltages are supplied to the rest of the modules through a six pin molex connector assembly.

Figure 3-6
AC Power Supply Schematic
91B7176 Rev E

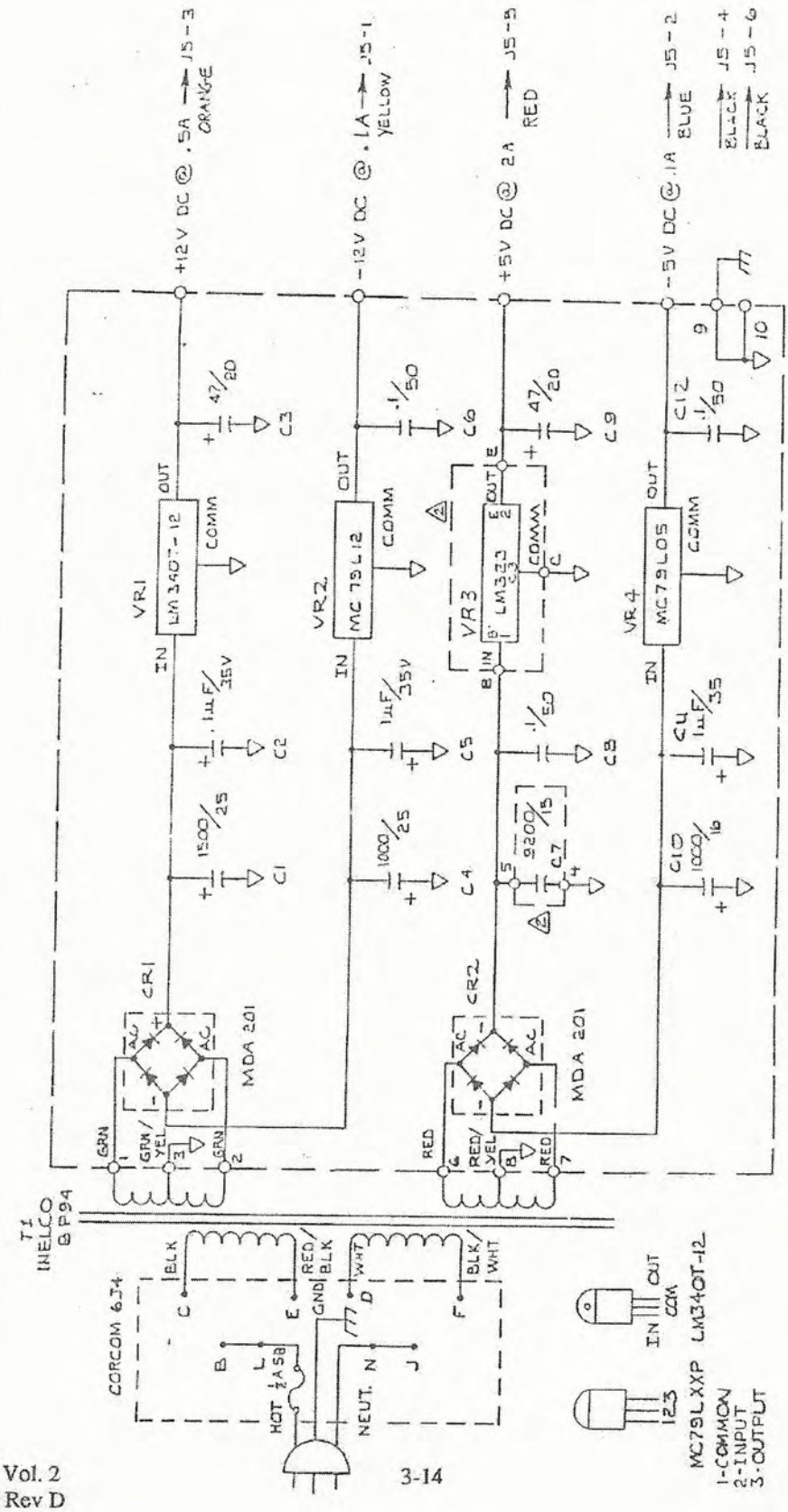
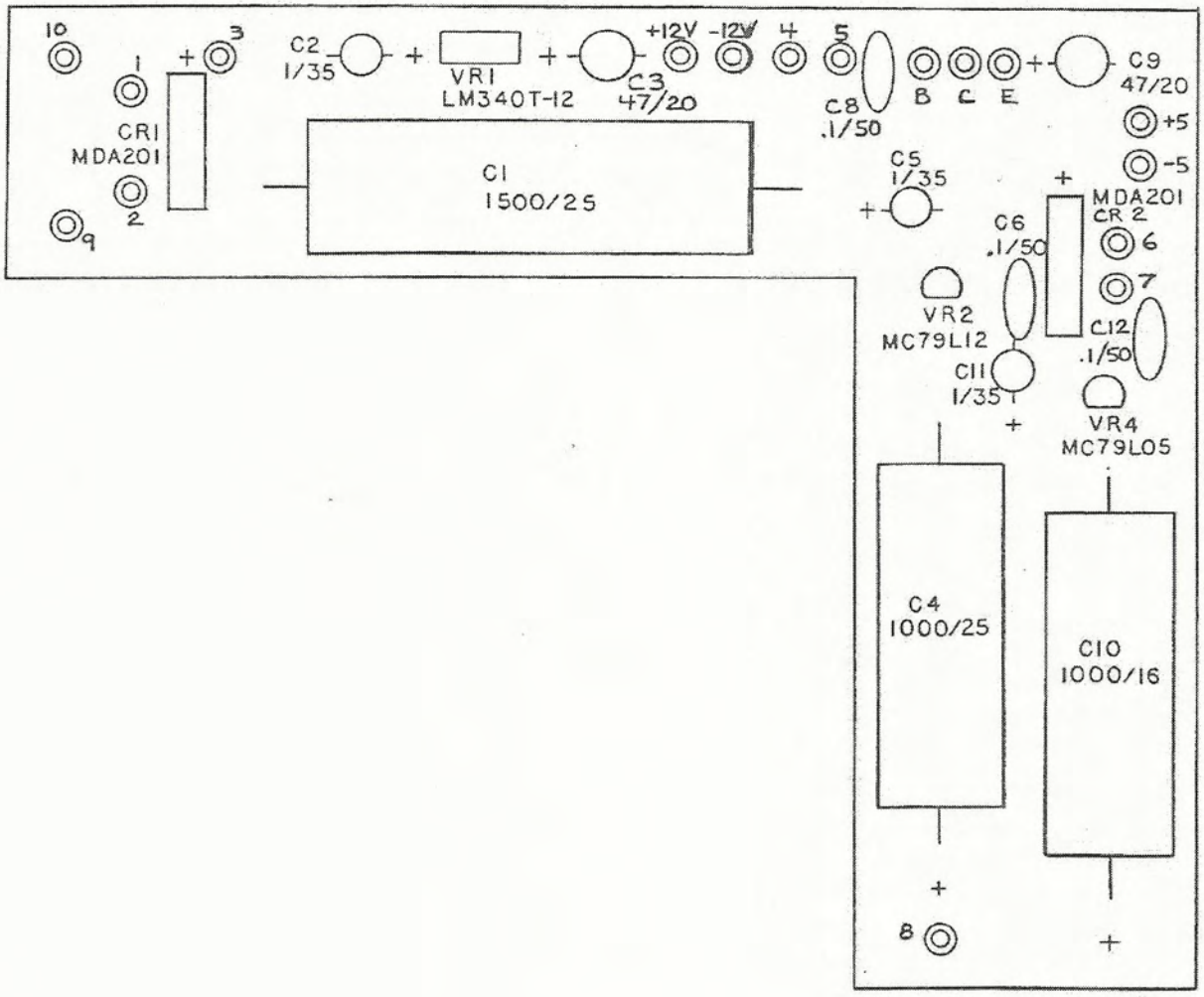


Figure 3-7
AC Power Supply Assembly
20C2764 Rev C



PARTS LIST

Assembly: 20C2764
Description: AC POWER SUPPLY/COMPONENT LAYOUT

REF DES	DESCRIPTION	MFG	MFG P/N (MAI DWG #)	MAI P/N
C1	CAP 1500/25	MALLOR	TC2515	4260238
C2,C5,C11	CAP 1/35	SPRAG	196D105X0035HAI	4280038
C3,C9	CAP 47/20	SPRAG	196D476X0020PE4	4280137
C4	CAP 1000/25	C/D	WBR-1000-25	4260212
C6,C8,C12	CAP 1/50	CRL	CY20C104M	4310207
C10	CAP 1000/16	SPRAG	TVA-1163	4260204
CR1, CR2	RECTIFIER BRIDGE	MOTOR	MDA-201	3610078
VR1	REGULATOR VARV 1.5A	NATL	LM-340T-12	3650074
VR2	REGULATOR 12V/0.1A	TI	MC79L12AACLP	3650140
VR4	REGULATOR 05V/0.1A T092	MOTOR	MC79L05ACP	3650132
	AC POWER SUPPLY	MAI	20C2764	9202896
	PC BOARD	MAI	51C891	3472164

3.6.4 Parallel/Serial Processor Board

Schematic: 91D7290 (Figure 3-8)
Assembly: 20D2844 (Figure 3-9)

The Parallel Serial Processor board (PSPB) contains the main electronics of the MDC-2 and MSD-1. Both products use the same board, with a few differences in details of assembly.

The PSPB is composed of six sections:

1. MPU
2. Address Decoding
3. System I/O
4. Reset Circuitry
5. Front Panel and External I/O
6. Stream I/O

MPU

U29 is the MPU (Microprocessing Unit) which generates the address from which data will be stored or retrieved. The address bus consists of 16 bits, allowing 65, 536 (2^{16}) address. These lines are used on the PSPB to select the PIAs (Peripheral Interface Adapter), the ACIA (Asynchronous Communications Interface Adapter), the RAM (Random Access Memory), or EPROM (Erasable, Programmable Read Only Memory).

The data bus (D0-D7 is used to carry the data between the MPU and other parts of the PSPB. This bus is bidirectional. When the MPU writes data, the MPU outputs and the peripherals input. Conversely, when the MPU reads data, the MPU inputs and the peripherals output. The direction of data flow is controlled by the R/W (Read or Write) line. Data is read into the MPU when this line is high.

E (Enable) is a 1 MHz square wave used for but timing. Data transfers occur on the falling edge of E. Q is a quadrature signal with E. *RESET disables operation and resets the MPU to a known state. BA indicates the MPU is accessing the bus. *IRA, *FIQ, and *NMI are interrupt inputs. *HALT and *DMA/BREQ are inputs used with direct memory access schemes and are not used on the PSPB. MRDY is a memory ready signal used to interface with slow memories and is also not used on the PSPB. XTAL and EXTAL connect with Y1 to form a 4.0 MHz oscillator. R7, C38 and C39 prevent oscillation at overtones.

Address Decoding

The majority of the address decoding is done by U30 which functions as a binary to octal converter. Depending upon the address generated by the MPU, U30 drives the proper select line to the logic zero level. Below is a chart showing the range of addresses for which a specific select line is driven low.

Table 3-2. Address Range

Select Line	Address
*RAMCE	0000-03FF
*ACIACE	C800-C801
*PIA1CE	D000-D003
*PIA2CE	D800-D803
*PIA3CE	E000-E003
*PROM2CE	F000-F7FF
*PROM1CE	F800-FFFF

System I/O

The bulk of the system I/O is done through the PIA installed in U27 which is selected by the *PIA3CE signal. On the A-side of the PIA, all 8 data I/O lines PA0-PA7 have internal pullups. Data lines PA0-PA3 accept the board number selected by the sixteen position switch S1. PA4 accepts the state of the 300/1200 baud switch (1200 baud is selected when the switch is closed and PA4 is pulled to ground). PA7 accepts the state of the AUX switch.

PA5 is programmed as an output and is used to select the Downstream data source (logic high selects the data generated from Upstream chassis; logic low selects an internal data source).

PA6 is programmed as an output and supplies a program generated clock to the Reset Circuitry. This signal is discussed in more detail in the next subsection.

The CB1 and CB2 lines are a little different than the PA0-PA7 lines. For one thing, they don't have internal pullups. More importantly, they can be programmed to detect and record rising or falling edges. Both CB1 and CB2 are used in this fashion: CB1 generates an interrupt each time a rising edge is detected. Since this input is connected to a steady 75 Hz square wave, it serves the function of a real-time clock. CB2 is also programmed to trap rising edges. Since its input is the serial Downstream data line, it serves as a kind of "data detect" line and notifies the MPU when the Downstream data line is "in use".

Reset Circuitry

The Reset Circuit is really the only analog section of the PSPB and is designed around a quad-comparator IC U34. The reset circuit's purpose is really twofold:

To provide a proper *RESET signal upon power-up and power-fail.

To provide a proper *RESET signal when the program is not running properly.

The central components in the reset circuit are the .247 uF capacitor C51, and the *RESET line driver comparator (U34 Pins 8, 9, and 14). Essentially, the output comparator pulls the *RESET line low (and hence, resets the MPU) whenever the voltage across C51 is below 1.2 volts. C50 connected in a positive feedback configuration forces clean, fast edges on the *RESET line.

The power monitor portion of the circuitry is formed by another comparator (U34 pins 6, 7 and 1). Upon power-up, R8 and C49 form an RC circuit with a large time constant. As long as the voltage across C49 is smaller than 3.2 volts, the power monitor comparator keeps C51 discharged through R16, which forces the *RESET line in a low state. When C49 does charge up, the comparator allows C51 to charge, ultimately to drive the *RESET line high. Upon power-fail, C49 discharges quickly as the +5 volt line drops in voltage, forcing the power monitor comparator to discharge C51, ultimately driving the *RESET line low.

The remaining two comparators form a "watchdog" timer of sorts. When the TEST/OPER switch is in the OPER position (switch closed), U34 pins 10, 11, and 13 along with C51, R22, R24, R23, and R19 form an oscillator, periodically charging and discharging C51 (which causes the *RESET line to be periodically driven low and high). When a clock is present on the PGMCHK line, U34-2 is driven high. This increases the oscillator's "high" threshold which insures that the voltage across C51 does not fall below the *RESET threshold, and hence, reset the MPU. The watchdog timer can be defeated by putting the TEST/OPER switch in the TEST position. As long as the program strobes the PGMCHK line a a rate faster than 30 Hz, the watchdog is dormant. As soon as the clock train disappears, however, the input is periodically reset until the PGMCHK clock is re-established.

Front Panel and External I/O

The front panel and external I/O data paths are the means which the MPU can pass data to the front panel, and to the outside world. The major components are the two PIAs (U25 and U26), and the 12 IC sockets (U1-U6 and U12-U17). The 12 sockets are configured in different ways depending upon whether the data lines are to be used as input or on outputs. Lines used as outputs have open collector drivers (7406s) installed; lines used as inputs have "shorting" headers installed. The MSD-1 chassis is an output-only device, hence all sockets have 7406s installed. The MDC-2, however, requires both inputs and outputs; U1-U6 have 7406s installed while U12-U17 have headers installed.

The data path to and from the front panel is supplied to the external I/O connector. Any data transmitted to the front panel can be used for external user-supplied equipment. Similarly, any data sourced from the front panel may also be sourced from the external I/O Connector. I/O specifications are as follows:

Input:	Internal 2.2K pullup. Pull to ground to activate.
Output:	Open collector pulled to ground when active. Voh (max): 25 V Iol (max): 30 ma

Stream I/O

The basic sections of the Stream I/O area are the RS-232 interfaces, the ACIA (U28), and the random logic which ties it all together. All RS-232 interfacing is done using 1488 (RS-232 transmitter), and 1489 (RS-232 receiver) integrated circuits. Since the Stream is a full-duplex data path, the RTS (Request to Send) and the DTR (Data Terminal Ready) signals are always in the "ready" condition.

Once the RS-232 signals are translated to TTL level signals, the random logic section takes care of most of the interfacing between the two ports, and the ACIA. Integrated circuits U8, U21, U22, U23, and U24 make up he bulk of the logic. In order for an input signal from one of the RS-232 ports, CD (Carrier Detect), and DSR (Data Set Ready) must indicate true. If they don't, the data input line is held in a steady mark condition, effectively eliminating noise from unconnected ports. Output signals are under the same constraint as input signals: Output will not be transmitted to a port unless CD, DR and the CTS (Clear to Send) signals on the transmitting port are in a true condition.

Downstream data can come from two different places: From the data input on the Upstream port, or generated internally by the ACIA. The data source is selected by the state of the DATA SOURCE SELECT line; a logic high selects the Upstream source, while a logic low selects the internal source.

The ACIA is responsible for decoding all Upstream data, and generating all internally sourced Downstream data. Baud rate selection is under software control. The ACIA transmit and receive clocks are derived from the MPU E signal: U20 is configured as a divide by 13, feeding U19 which divides again by 4 to produce the ACIA clock. The same signal, incidentally, is further divided to produce the 75 Hz real-time clock.

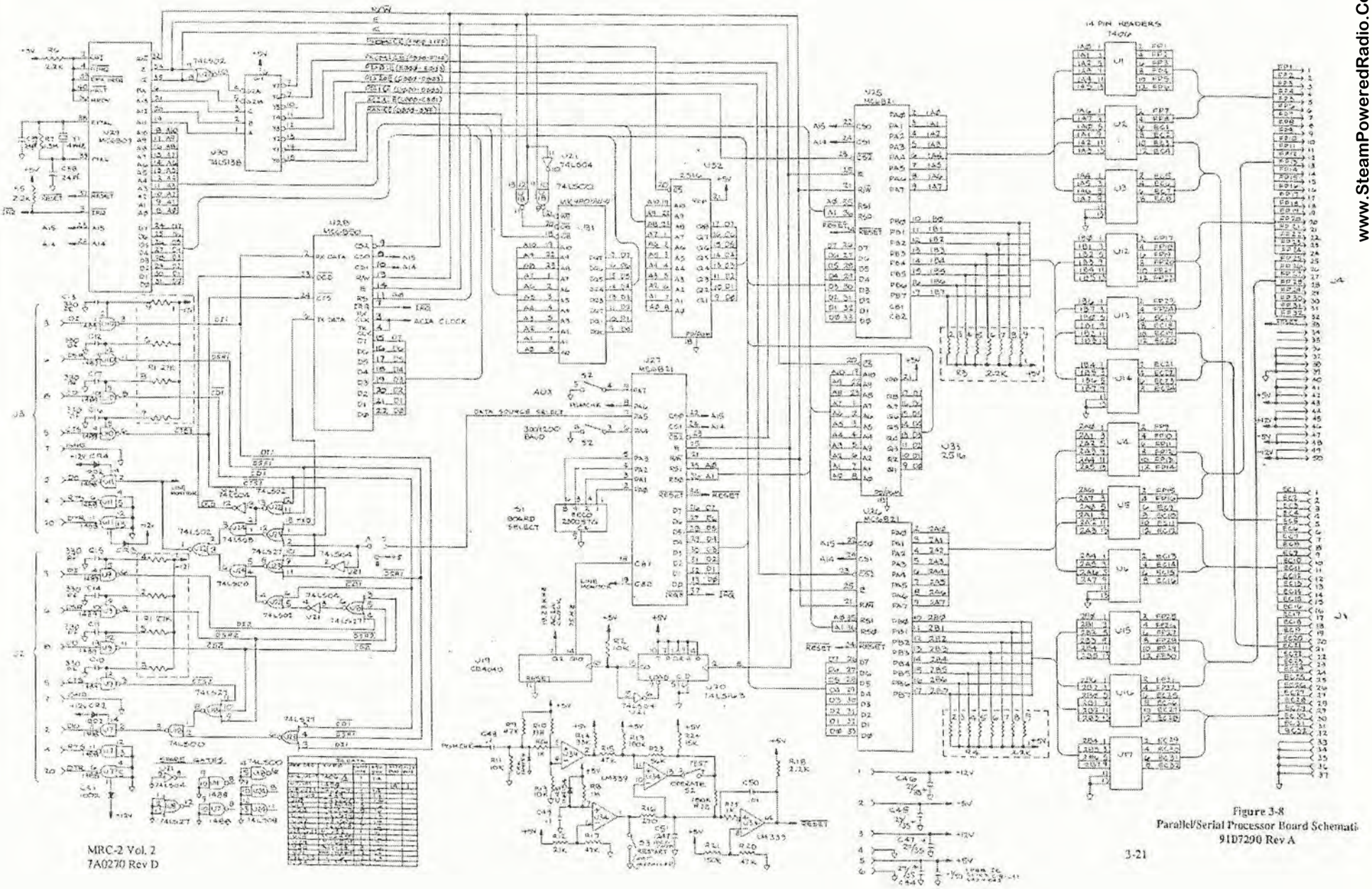
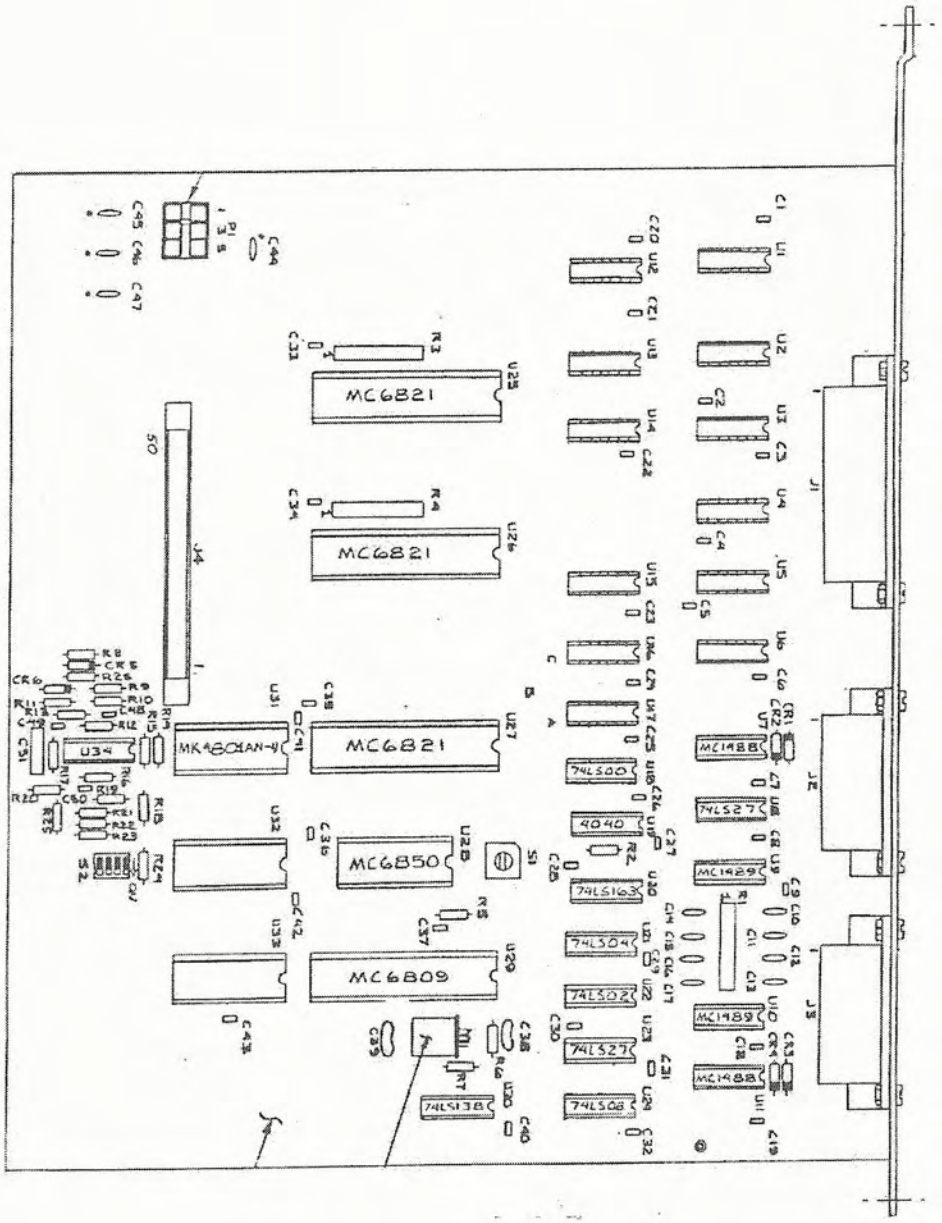


Figure 3-8
Parallel/Serial Processor Board Schematic
91D7290 Rev A

Figure 3-9
Parallel/Serial Processor Board Assembly
20D2844 Rev D



PARTS LIST

Assembly: 20D2844
Description: PARALLEL/SERIAL PROCESSOR BOARD

REF DES	DESCRIPTION	MFG	MFG P/N (MAI DWG #)	MAI P/N
1-18,21-24,34	IC SOCKET 14-PIN	AMP	6403571	3250024
19,20,30	IC SOCKET 16-PIN	AMP	6403581	3250032
28,31,32,33	IC SOCKET 24-PIN	AMP	6403611	3250073
25,26,27,29	IC SOCKET 40-PIN	AMP	6403791	3250099
C1-9,18-37, 40-43, 48,49	CAP .1 UF 50 20%	CRL	CY20C104M	4310207
C10-17	CAP DISC 330 pf 10%	CRL	DD331	4310082
C38,39	CAP SILVER MICA 24 pf 10%	ARCO	DM15240J	4210118
C44,45,46,47	CAP EPOXY-DIP 27 UF 35V	SPRAG	196D276X0035TE4	4280103
C50	CAP .01 UF 100V	CRL	CY15A103M	4310165
C51	CAP POLYCARB .247 UF 100V 3%	SEI	22UB2473H	4250585
CR1,2,3,4	DIODE 10D2 200V 1A S1 D039	IR	10D2	3610003
CR5,6	DIODE IN4154 25V 4NSS1 D035	GE	IN4154	3600145
J1	CONN 37-PIN D.P.C	AMP	206817-1	3050226
J2-3	CONN 25-PIN D.P.C	AMP	206584-1	3050192
J4	CONN 50-PIN P.C.	3M	3433-2002	3090404
P1	CONN MALE 6-PIN POWER	AMP	1-380999	3110111
R1	RES SIP 27 KOhm, 2% 10 PIN	BOURNS	4310R-101-273	4540191
R2,11,13	RES 10 K Ohm 1/4 W 5%	A/B	RC07GF103J	4460317
R3,4	RES SIP 2.2K Ohm 2% 10 PIN	BOURNS	4310R-101-222	4540209
R5,6,18	RES 2.2K Ohm 1/4W 5%	A/B	RC07GF222J	4460192
R7	RES 1.5M Ohm 1/4W 5%	A/B	RC07GF155J	4460564
R8	RES 1M Ohm 1/4W 5%	A/B	RC07GF105J	4460556
R9,15,17,20	RES 47K Ohm 1/4W 5%	A/B	RC07GF473J	4460432
R10,14	RES 33K Ohm 1/4W 5%	A/B	RC07GF333J	4460390
R12	RES 27K Ohm 1/4W 5%	A/B	RC07GF273J	4460382
R16	RES 270K Ohm 1/4W 5%	A/B	RC07GF271J	4460671
R19,22	RES 180K Ohm 1/4W 5%	A/B	RC07GF184J	4460515
R21	RES 150K Ohm 1/4W 5%	A/B	RC07GF154J	4460507
R23	RES 56K Ohm 1/4W 5%	A/B	RC07GF563J	4460457
R24	RES 15K Ohm 1/4W 5%	A/B	RC07GF153J	4460341
R25,26	RES 1K Ohm 1/4W 5%	A/B	RC07GF102J	4460143

S1	SW 16P BCD ROT OUTPUT YEL	EECO	230057G	3150117
S2	SW DIP CTS 4	CTS	206-4	3190071
U7,11	IC MC1488P QU LINE DRIVER	MOTOR	MC1488P	3730355
U8,23	IC TR 3IN NOR	TI	SN74LS27N	3660727
U9,10	IC QU LINE RECEIVER	MOTOR	MC1489P	3730363
U18	IC QU 2IN NAND	TI	SN74LS00N	3660669
U19	IC 12 STAGE BIN CT	RCA	CD4040BE	3680063
U20	IC BINCOUNT PRESET	TI	SN74LS163AN	3660826
U21	IC HX INV	TI	SN74LS04N	3660685
U22	IC QU 2IN NOR	TI	SN74LS02N	3660677
U24	IC QU 2IN AND	TI	SN74LS08N	3660693
U25,26,27	IC PIA INTERFACE	MOTOR	MC6821P	3710027
U28	IC ACIA INTERFACE	MOTOR	MC6850P	3710043
U29	IC MPU	MOTOR	MC6809P	3661048
U30	IC 3-8LINE DECDE MUX	TI	SN74LS138N	3660792
U31	IC RAM STATIC 1K X 8	MOSTEK	MK4801AN-4	3710621
U34	IC COMPARITOR QUAD	NATL	LM339N	3730207
Y1	CRYSTAL 4.00 MHz	I/C	30A0066	3340163
	REAR PANEL	MAI	5C2878	2062818
	PARALLEL/SERIAL BOARD	MAI	20D2844	9204439
	PC BOARD MAIN ELECTRIC	MAI	51C5959	3473287

3.6.5 Front Panel

The front panel is the module with which the user will be the most familiar, since most interaction is done through it. The front panel in both MSD-1 and the MDC-2 are connected to the PSPB via a 50-pin flat cable. The MDC-2 and MSD-1 panels are discussed separately below:

MSD-1 Front Panel

Schematic: 91C7292 (Figure 3-10)
Assembly: 20D2845 (Figure 3-11)

The MSD-1 front panel is really quite bare compared to some of the previous modules. The bulk of the "circuitry" consists of LEDs pulled up to +5 via a current limiting resistor. When a LED is to be activated, the PSPB pulls the cathode to ground.

MDC-2 Front Panel

Schematic: 91C7295 (Figure 3-12)
Assembly: 20D2849 (Figure 3-13)

The MDC-2 front panel consists of 16 switches, each with an LED. Activation of a particular switch pulls an appropriate line to ground through the switch. LED activation is similar to the MSD-2 front panel: The anode of the LED is pulled up to +5 through a current-limiting resistor, and illuminates when its cathode is pulled to ground.

Figure 3-10
MSD-1 Front Panel Schematic
91C7292 Rev A

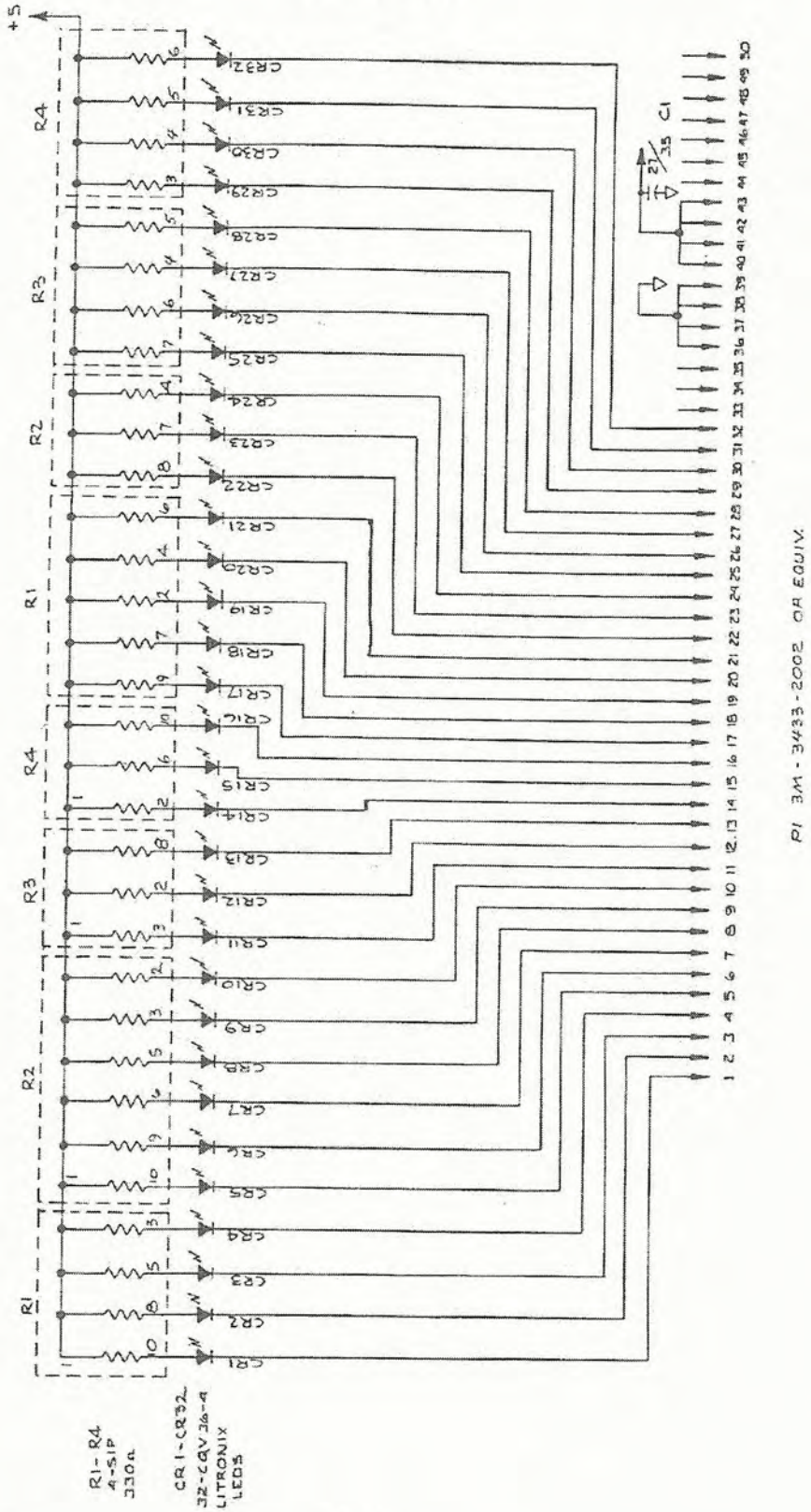
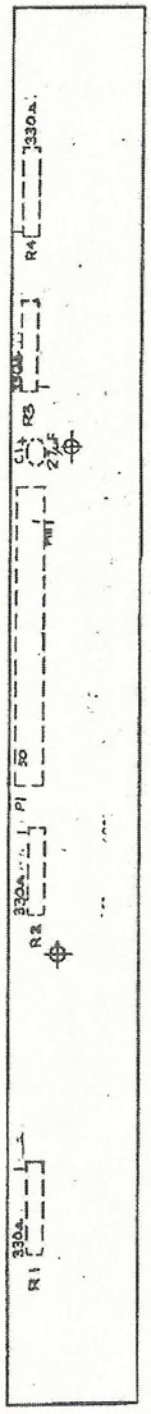


Figure 3-11
MSD-1 Front Panel Assembly
20D2845 Rev A



PARTS LIST

Assembly: 20D2845
Description: MSD-1/FRONT PANEL PC BOARD ASSEMBLY

REF DES	DESCRIPTION	MFG	MFG P/N (MAI DWG #)	MAI P/N
C1	CAP TANT EPOXY DIP 27/35V	SPRAG	196D276X0035TE4	4280103
P1	CONN 50 PIN P.C.	3M	3433-2002	3090404
R1-4	RES SIP 330 Ohm 1/4W 10%	BOURNS	4310R-101-331	4540092
	MSD-1 FRONT PANEL PC	MAI	20D2845	9204454
	PC BOARD MSD-1 FRONT PANEL	MAI	51C5961	3473303

Assembly: 21D2786
Description: MSD-1/FRONT PANEL ASSEMBLY

REF DES	DESCRIPTION	MFG	MFG P/N (MAI DWG #)	MAI P/N
CR1-32	LED RED 1.6 @ 20 WIDE RECT	SIEMNS	LDH3601	3390507
	MSD-1 FRONT PANEL ASSY	MAI	21D2786	9103201
	MSD-1 FRONT PANEL	MAI	5C2880	2010932
	PC BOARD ASSY	MAI	20D2845	9204454
	STANDOFF NYL 1/4 RND 6-32X X 5/16	AMATOM	8153-N-0632	1230952
	NUT NYLON HEX LOCKING	MCROPL	0700632LN	1090810

Figure 3-12
MDC-2 Front Panel Schematic
91C7295 Rev A

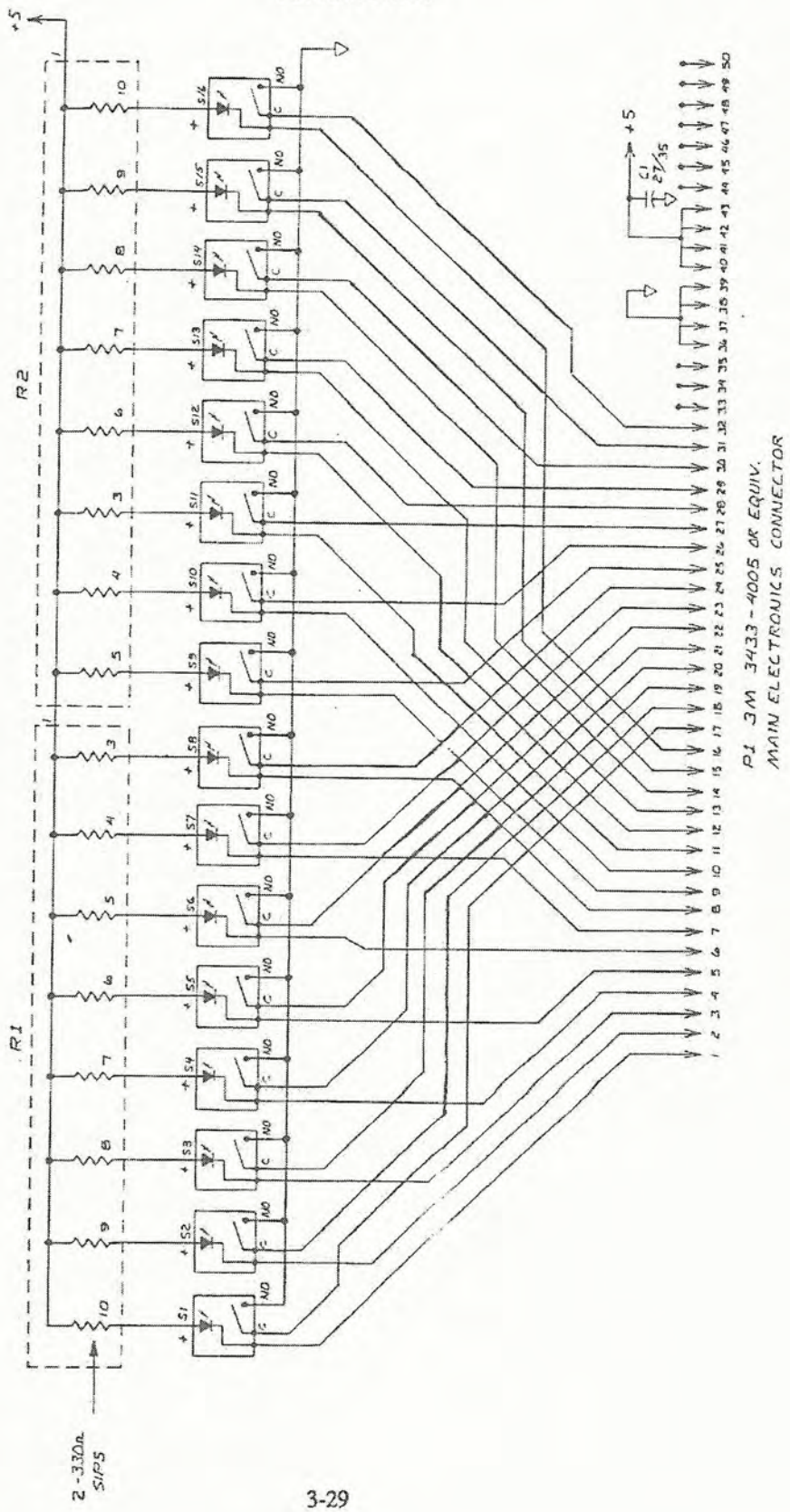
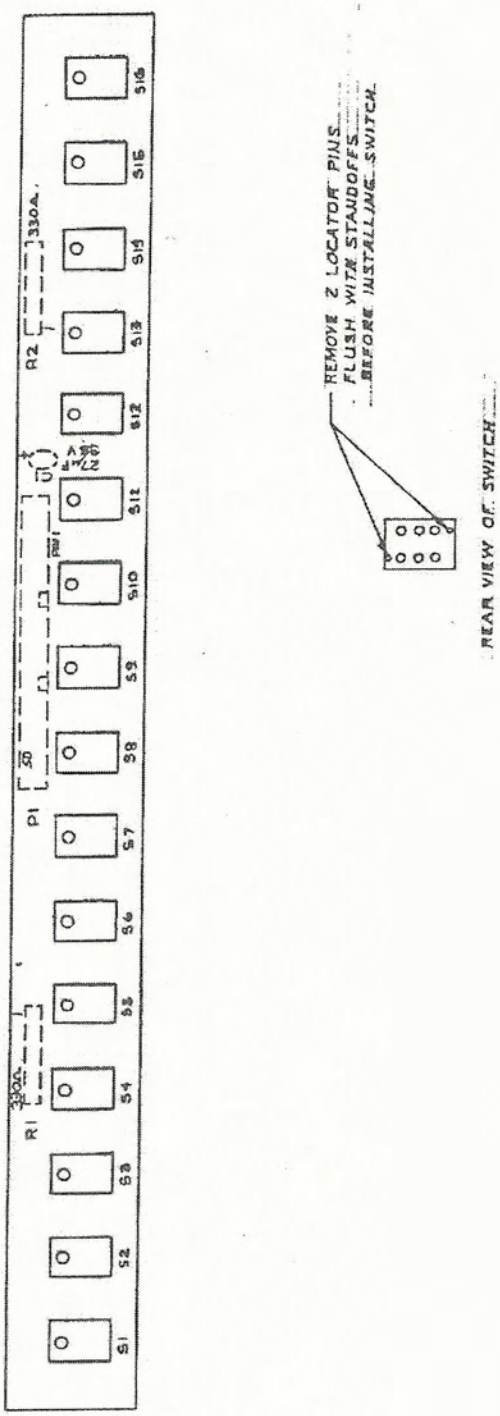


Figure 3-13
MDC-2 Front Panel Assembly
20D2849 Rev A



PARTS LIST

Assembly: 20D2849
Description: MDC-2/PC BOARD ASSEMBLY

REF DES	DESCRIPTION	MFG	MFG P/N (MAI DWG #)	MAI P/N
C1	CAP TANT EPOXY DIP 27/35 V	SPRAG	196D276X0035TE4	4280103
P1	CONN 50 PIN P.C.	3M	3433-2002	3090404
R1,2	RES S1P 330 Ohm 1/4W 10%	BOURNS	4310R-101-331	4540092
S1-16	SWITCH MOM PC BOARD	SHDOW	SE AVO.A.0702R	3170818
	FRONT PANEL PC BD ASSY MDC-2	MAI	20D2849	9204447
	FRONT PANEL PC BOARD MDC-2	MAI	51C5960	3473295

Assembly: 21D2784
Description: MDC-2/FRONT PANEL ASSEMBLY

REF DES	DESCRIPTION	MFG	MFG P/N (MAI DWG #)	MAI P/N
	FRONT PANEL ASSY MDC-2	MAI	21D2784	9103193
	FRONT PANEl MDC-2	MAI	5C2879	2010924
	PC BD ASSY MDC-2 FRONT PANEL	MAI	20D2849	9204447
	STANDOFF NYLON 1/4RND 6 X 32 X 5/16	AMATOM	8153-N-0632	1230952
	HEX NUT NYLON LOCKING	MCROPL	0700632LN	1090810

3.7 Alignment and Adjustment Procedures

The MDC-2 and MSD-1 have no adjustments except for the for the settings described in Section 3.4. If you have trouble with your system, double check the switch settings on the Serial Interface card, and in the MSD-1 and MDC-2 chassis. If problems persist, consult the troubleshooting procedures below.

3.7.1 General Troubleshooting

The first thing to do is to determine where the problem is (in the MRC-2, or in one or more external chassis). Follow the procedure below to decide:

1. Verify the MRC-2 terminal works normally. Verify that set-up parameters are correct (see Sections 3.7.6 and 3.7.7 in Volume 1).

2. Hit the **TEST** button on the MRC-2 front panel and note which of the external chassis (MSD-1 or MDC-2) enters lamp test mode. If one or more does, the problem is not in the MRC-2; refer to Step 5. If none of the chassis go into lamp test, proceed with Step 3.

3. Attempt to go into the MSD-1 set-up routine. If the option is installed in the Control Terminal and a password is required, enter it and hit the **ENTER** key. If you can't enter the set-up routine, the problem is definitely within the MRC-2; proceed to Step 4. If the set-up routine was accessed, do the following: Remove power from the MRC-2 and verify that the Serial Interface switches indicate the same baud rate that the external chassis does. If it does, verify that the Serial I/O and the Serial Interface cards work by exchanging with another device's boards. If problems persist, check the interconnecting cable.

4. Verify that the Serial I/O board's setting are correct and try again. Verify that the Serial I/O and Serial Interface boards work satisfactorily by exchanging with another device's boards. Move both the Serial I/O and Serial Interface board to another empty slot; the slot originally picked might be defective. If problems persist, refer to Section 5.4.

   If there is a reasonable certainty that the problem is in one or more of the external chassis, proceed with the following steps:

   a. Hit the **TEST** button on the MRC-2 and note which of the chassis are not illuminating their LEDs, and check the interconnect cables, starting with the most Downstream chassis. This can be done easily and quickly by exchanging cables of dubious reliability with cables that are known to work.

   b. Check for a pattern of failures: Since the Stream is a daisy-chain, if one chassis fails, it may disrupt operation of chassis Upstream. Isolate bad chassis by limiting the chain length to two chassis, swapping chassis, and hitting the **TEST** button. Once the bad chassis are located, use the chassis troubleshooting procedure below.

When all chassis respond to the TEST key, the MSD-1s should work fine. The MDC-2s, however, may still cause some grief. Assuming that there are no operational snags, there may be a break in the Downstream data line. Use the method described above to locate the faulty chassis.

3.7.2 Chassis Troubleshooting

Once the problem has been narrowed down to a particular chassis, debugging is relatively simple. Proceed with the following steps to isolate and correct the problem.

1. Verify that the OPER/TEST switch is in the OPER position, and the 1200/300 switch is in the proper position.

2. With an oscilloscope, verify that a "clock" (not necessarily steady) appears at U27-8. If it does, proceed to Step 4 - the chassis is running.

3. Absence of a clock indicates that the program is not running. Verify that a 1 MHz square wave is present at U29-34 and U29-35. If there isn't, replace U29 and check for a clock at U27-8 again.

4. Once the PGMCHK clock has been established, the major components of the board are working. If you find that the chassis doesn't enter lamp test mode when the TEST button is depressed on the MRC-2, verify that data is present at U28-2. If data exists, verify that U28-23 is at a logic low. If both conditions exist but the chassis still doesn't enter lamp test, replace U28 and try again. If U28-23 was not a logic low, check the interconnect cable, U10, U22, and U21 for problems.

5. If the chassis receives lamp test signals but doesn't seem to pass them on, do the following: Verify that U8-8 is a logic high; if it isn't, check the Upstream interconnect cable, U9 and U8. Verify that data appears at U23-6; if it doesn't, replace U23. Finally, verify that data appears at U18-3. If it doesn't, replace U18. If it does, but data still isn't passed to the Upstream chassis, replace U7.

6. If the chassis receives lamp test data and passes it on to Upstream chassis, but does not seem to pass downstream data, do the following: When an Upstream MDC-2 button is pressed, verify that data appears at U9-6. If it doesn't, check the interconnect line, and U9. If it does, trace the data path through U8, U21, U22, U24, through U22 to the data output IC, U11-2. If the chassis is an MSD-1, verify that the DATA SOURCE SELECT jumper runs from A to B. If the chassis is an MDC-2, verify the DATA SOURCE SELECT line (U27-7) is a logic high. If it isn't, check U28-6 for data; if data exists, check for a front panel (or external I/O) short. If no data exists, replace U27.