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THE REMOTE LINK UNIT: A DEMONSTRATION OF OPERATIONAL  
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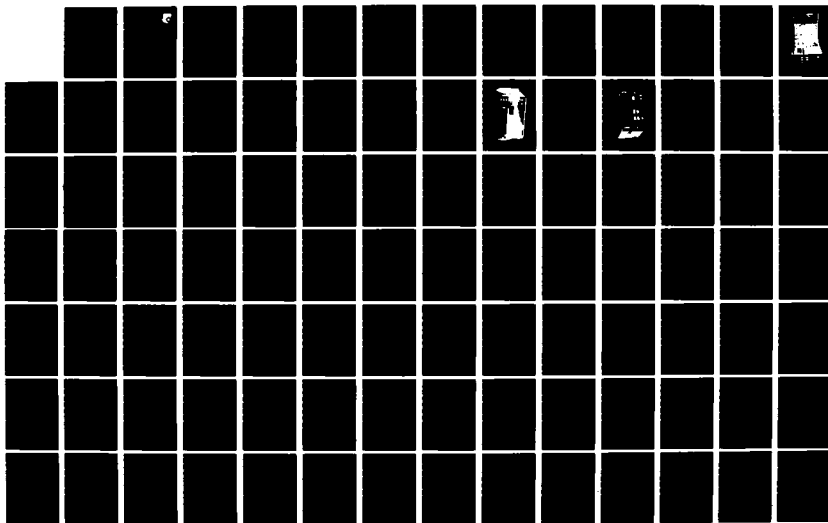
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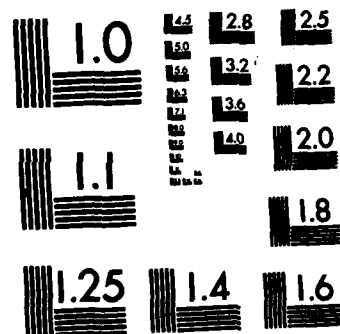
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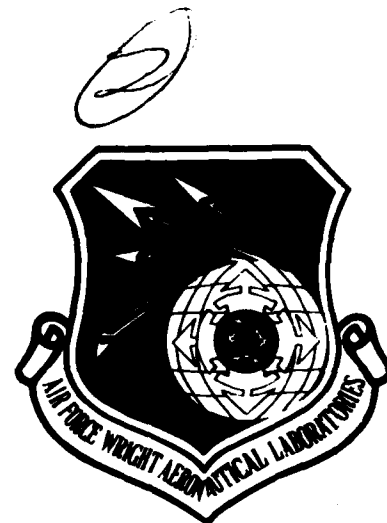
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PART II

THE REMOTE LINK UNIT: A DEMONSTRATION OF OPERATIONAL PERFORMANCE  
Part II - User's Manual

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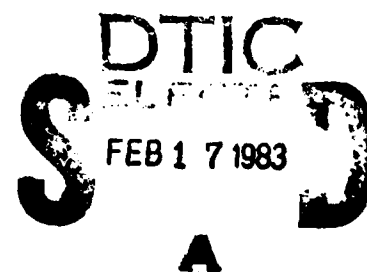
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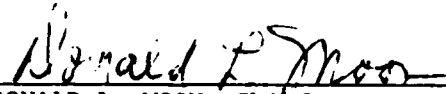
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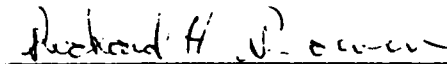


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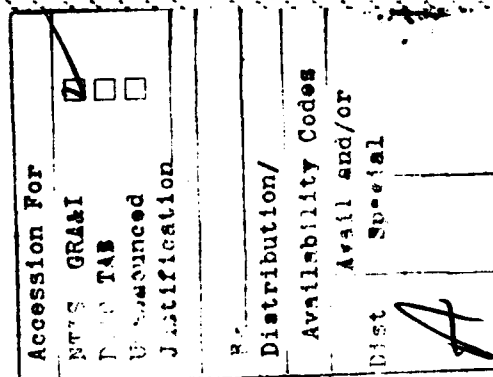
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| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number)<br>This report (Part II) is the User's Manual for the RLU Demonstration System and provides information on how to configure and operate the system. There are two accompanying reports: Part I summarizes the results of the program of implementation of the system, and Part III is the design manual describing the details of the hardware and software design. |                                      |                                                                                         |

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This document was prepared by the University of Houston, Houston, Texas, on Air Force Contract No. F33615-80-C-1095, entitled "The Remote Link Unit - A Demonstration of Operational Performance."

The work was administered under the direction of the Information Transfer Group, Information Processing Technology Branch, System Avionics Division of the Avionics Laboratory, under Project 2003, "Avionic System Design Technology," Task 08, "Multiplex and Information Transfer Technology," Work Unit 07, "Remote Link Unit Demonstration." The work was performed during the period 1 April 1980 to 31 December 1980 and this report was submitted in August 1981. The Air Force Project Engineer was Philip C. Goldman (AFWAL/AAAT-3).

The work is a continuation of a previous feasibility study entitled, "The Remote Link Unit: An Advanced Remote Terminal for MIL-STD-1553A." The results of this study are documented in a technical report entitled, "Remote Link Unit Functional Design: An Advanced Remote Terminal for MIL-STD-1553B," which was published as AFAL-TR-79-1176, AD-A080126. An add-on to this previous study resulted in a second technical report entitled, "The Remote Link Unit: Applications to the Design for Repair Methodology Program," published as AFWAL-TR-80-1033, AD-A086126.

This report summarizes the design, development, and testing accomplished under the contracted work. The Principal Investigator and Program Manager was Dr. Carlos J. Tavora. Drs. John Glover, Jr. and Miles A. Smither were Co-investigators. Dr. Tavora was responsible for the system architecture and modularization of the design. Dr. Glover supervised the design of the software for the Link Manager Simulator and the Link Module. He was assisted by Messrs. Hao-Cheng Hsia, William C. Law, and Parmanand Balsaver. Dr. Smither was assisted by Mr. Tzer-Tsan Lin in the design of the Interface Configuration Adapter. Mr. H. Mitchell Collins was in charge of the design of the Electronic Nameplate and the Nameplate Interface Controller.

This report is organized in three parts: Part I - Summary, Part II - User's Manual, and Part III - Design Manual. Part III is separated into two volumes: Volume 1 is the main body of the Design Manual, while Volume 2 contains the appendices.

This part is the User's Manual, which includes instructions for setup, connection, and operation of the Remote Link Unit Demonstration System (RLUDS). Also included are the test scripts used to exercise the system at the end-of-contract demonstration.

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## LIST OF ACRONYMS

|        |                                         |
|--------|-----------------------------------------|
| AC     | Alternating Current                     |
| A/D    | Analog to Digital                       |
| BCD    | Binary Coded Decimal                    |
| CMOS   | Complementary Metal Oxide Semiconductor |
| CPU    | Central Processing Unit                 |
| CRT    | Cathode Ray Tube                        |
| D/A    | Digital to Analog                       |
| DC     | Direct Current                          |
| DIP    | Dual In-line Package                    |
| DMA    | Direct Memory Access                    |
| EAROM  | Electrically Alterable ROM              |
| EEPROM | Electrically Erasable Programmable ROM  |
| EPROM  | Erasable Programmable ROM               |
| FP     | Front Panel                             |
| ICA    | Interface Configuration Adapter         |
| I/O    | Input/Output                            |
| ISR    | Interrupt Service Routine               |
| LA     | Link Address                            |
| LM     | Link Module                             |
| LMG    | Link Manager                            |
| LMP    | LM Processor                            |
| LSB    | Least Significant Bit                   |
| MP     | Maintenance Port                        |
| MSB    | Most Significant Bit                    |
| MUX    | Multiplexer                             |
| NIC    | Nameplate Interface Controller          |
| NP     | Nameplate                               |
| PCB    | Printed Circuit Board                   |
| PIA    | Peripheral Interface Adapter            |
| PROM   | Programmable Read Only Memory           |
| RAM    | Random Access Memory                    |
| RLU    | Remote Link Unit                        |
| RLUDS  | Remote Link Unit Demonstration System   |
| RMW    | Read-Modify-Write                       |
| ROM    | Read Only Memory                        |
| RT     | Remote Terminal                         |
| SIC    | Subsystem Information Channel           |
| SM     | Shared Memory                           |
| SRU    | Shop Replaceable Unit                   |
| TTL    | Transistor-Transistor Logic             |
| UFT    | User File Table                         |

## SECTION 1

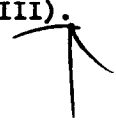
### INTRODUCTION



The purpose of this manual is to provide a guide for the use and operation of the Remote Link Unit Demonstration System (RLUDS) without the details of the design of the system. The sections of this manual provide information on:

- inspection of the equipment to verify a correct physical configuration
- external cable connections
- procedures for operation

This manual provides all the details necessary for operation of the RLUDS, assuming the user is generally knowledgeable of the concept, purpose, and configuration of the RLU and its major components. Both background information and design details may be found in the Design Manual (Part III).



#### 1.1 EQUIPMENT SUMMARY

There are several items of equipment which constitute the RLUDS. These items implement the many components of a Remote Link Unit (RLU) and the subsystems with which it communicates. The items delivered are:

LM Chassis - This is a demonstration version of the Link Module (LM) component of an RLU.

ICA Chassis - This is a demonstration version of two 4-channel groups of an Interface Configuration Adapter (ICA).

Subsystem Box - A set of subsystem and a synchro subsystem are implemented in a single test box.

Electronic Nameplates - Two nameplates (NP) are included in the subsystem box. One is configured for the serial subsystem and one is configured for the synchro subsystem.

ICA Test Box - This box allows testing all of I/O capabilities of the ICA, except for serial and synchro I/O, which are tested using the serial and synchro subsystems.

LMG Simulator Software - An 800 bpi 9-track mag tape provides all of the software necessary to run the Link Manager (LMG) Simulator on a PDP-11 computer.

Cables and Connectors - All cables and connectors necessary to assemble the RLUDS and connect it to the PDP-11 are provided.

## 1.2 UNPACKING AND INSTALLATION

The RLUDS is packed in foam in two large shipping boxes. Remove all items from the boxes and verify that none are missing. Before connecting any cables, it is necessary to install the ICA chassis on top of the LM chassis. To do so, first remove the top cover from the LM chassis and the bottom cover from the ICA chassis. Next, as shown in Figure 1, remove the two small pivot screws from the ICA chassis, align the ICA chassis with the LM chassis, and reinsert the two pivot screws. Connect the power cable at the rear of the LM chassis, and connect the double ribbon cable from the rear of the ICA chassis to the right edge connector on the ICA and Front Panel (FP) card in slot 1 of the LM. The ICA chassis should now swing down to rest just above the LM chassis.

Cabling instructions for interconnecting the components of the RLUDS are found in Section 2 (ICA), Section 3 (NP), Section 4 (LM), and Section 5 (subsystems). Instructions for installing the LMG simulator software on the PDP-11 and connecting the RLUDS to the PDP-11 are found in Section 6.

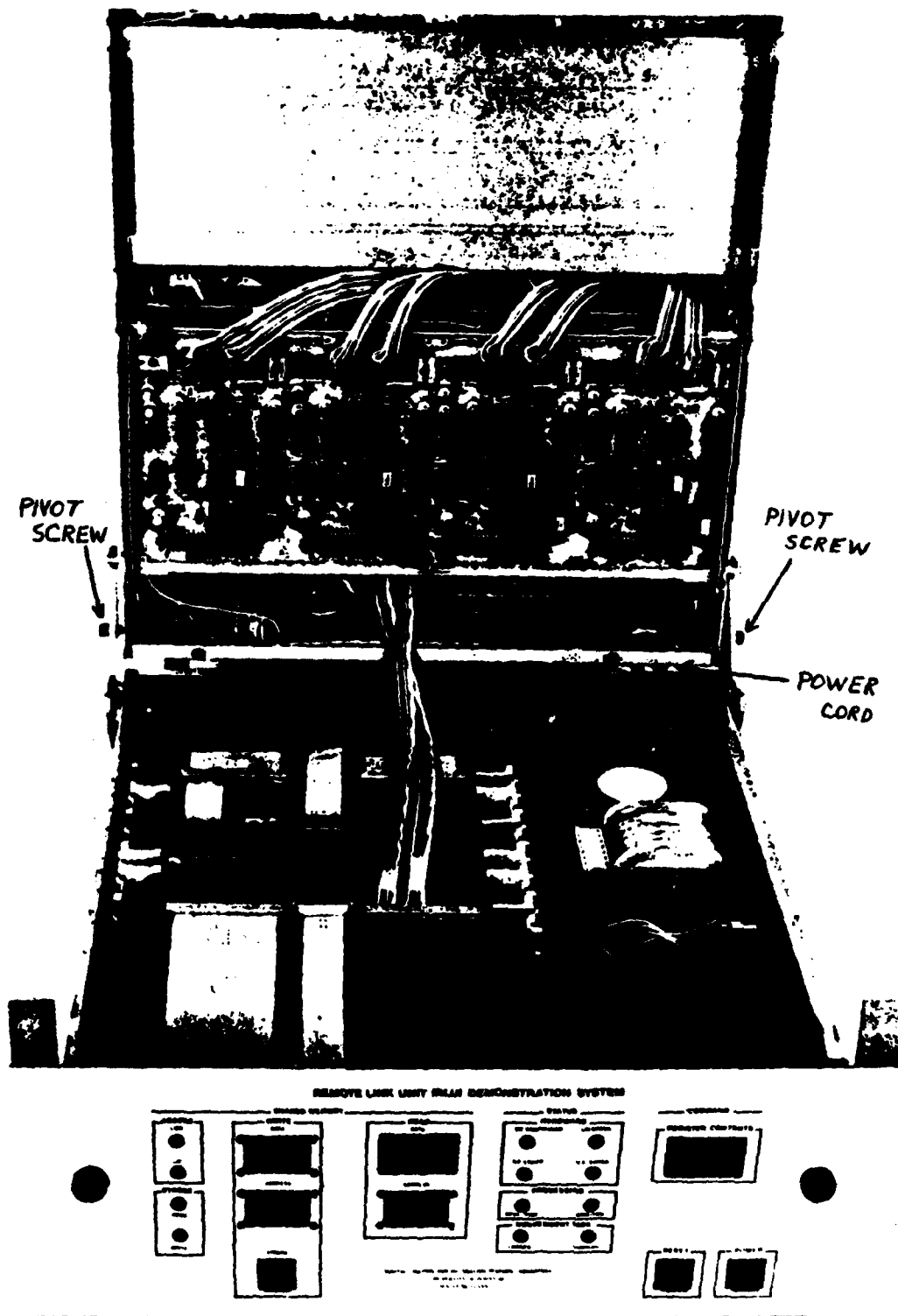


Figure 1 Connecting the ICA to the LM

## SECTION 2

### INTERFACE CONFIGURATION ADAPTOR

#### 2.1 INSPECTION OF EQUIPMENT

##### Subassemblies and their Locations

The Interface Configuration Adaptor (ICA) is housed in a chassis mounted to the top of the Link Module (LM). The ICA circuitry is contained on 3 major subassemblies as follows:

1. Wire wrap board.
2. Signal I/O group A PCB.
3. Signal I/O group B PCB.

The wire wrap board contains the circuitry used to generate the AC and DC references used by the Signal I/O boards. This circuitry is shared by the two groups. Additionally the wire wrap board contains the logic to perform address decoding and configuration control and serial I/O functions for each of the two groups.

The wire wrap board is located at the front top of the ICA chassis.

The Signal I/O PCBs contain the circuitry used to perform analog/digital/analog conversions, the input signal processing (both analog and digital), and the output signal buffering.

Signal I/O group A PCB is located at the top rear of the ICA chassis. Signal I/O group B PCB is located at the bottom rear of the ICA chassis.

##### Internal Cable Connections

The ICA is connected to the LM through INTCBL 212 and INTCBL 202. INTCBL 212 is used for digital control/data signals between the ICA and the LM. INTCBL 202 is used for power distribution within the ICA and to bring power from the LM.

Cables within the ICA chassis are listed in Table 1 .

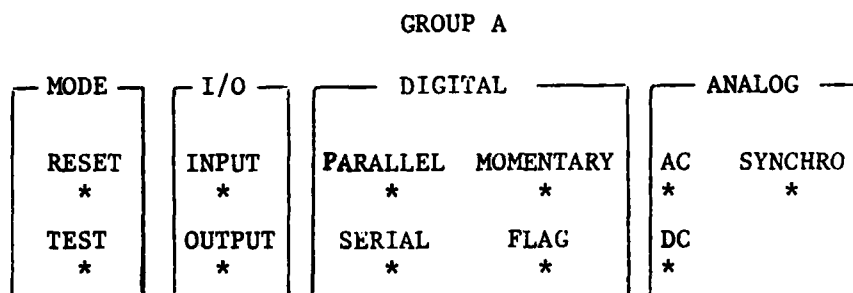
## 2.2 EXTERNAL CONNECTIONS

The ICA connects to the interfaced subsystem through CBL02. This cable connects at J4 on the rear panel of the ICA chassis. Cable CBL02 carries eight differential I/O lines (4 from/to group A and 4 from/to group B), signal return lines, the AC reference, and power (+/- 15 and +5 volt) to the subsystem.

## 2.3 OPERATION WITH THE LM

The ICA is completely controlled by the LM. There are no special hardware procedures to be followed in the use of the ICA. The LM provides initialization, configuration, and control signals to the ICA through INTCBL 212.

There are 22 LED lamps on the front panel of the ICA. These are used to indicate, in a condensed fashion, the state of the ICA. The following shows how the indicators for one of the two groups are arranged:



When the ICA is initialized by the LM the RESET lamp is on. The TEST lamp indicates that an ICA test mode has been selected by the LM. ANALOG DC, AC, or SYNCRO INPUT or OUTPUT is indicated by the appropriate lamp as are DIGITAL PARALLEL (either straight parallel or MOMENTARY) or SERIAL (either FLAG or refresh mode) INPUT or OUTPUT modes.

TABLE 1 ICA INTERNAL CABLES

| INTCBL# | WW Board<br>J# | SI/O#A<br>J# |
|---------|----------------|--------------|
| 210     | J1             | J1           |
| 220     | J3             | J2           |
| 230     | J5             | J3           |
| 240     | J7             | J4           |
| 250     | J2             | J5           |
| 260     | J4             | J6           |
| 270     | J6             | J7           |
| 280     | J8             | J8           |
| INTCBL# | WW Board<br>J# | SI/O#B<br>J# |
| 211     | J18            | J1           |
| 221     | J16            | J2           |
| 231     | J14            | J3           |
| 241     | J12            | J4           |
| 251     | J17            | J5           |
| 261     | J15            | J6           |
| 271     | J13            | J7           |
| 281     | J11            | J8           |

## SECTION 3

### SUBSYSTEM INFORMATION CHANNEL

#### 3.1 INSPECTION OF EQUIPMENT

The SIC consists of two main parts:

1) a Nameplate Interface Controller:

- Resides in the LM in slot number 6,
- Connected to the SIC bus connector J3 on the LM backpanel via cable INTCBL 300.

2) an Electronic Nameplate:

- Resides in the subsystem chassis,
- Connected to the SIC bus connectors, J3, P3, on the subsystem panel via cable: INTCBL 600.

#### 3.2 EXTERNAL CONNECTIONS

Connect the nameplate to the LM via the SIC bus cable CBL03. This cable is connected to the J3 connector on the LM back panel to the P3 connector on the panel of the subsystem to be used at this time. The SIC bus terminator T3 should be connected to the subsystem connector J3 directly below connector P3.

#### 3.3 OPERATION WITH THE LM

The diagnostic switch on the nameplate should be in the nameplate position (i.e. in the position nearest the NP's LEDS).

The nameplate's LEDS display the following functions (in order starting with the LED nearest the edge of the NP and ending with the LED nearest the NP diagnostic switch):

1) NP Busy

- 2) This NP selected
- 3) SIC RESP/CMD bus line level (LED on = CMD)
- 4) SIC SERIAL DATA bus line level
- 5) Write memory program strobe
- 6) Erase memory strobe
- 7) SIC PRIORITY IN bus line level
- 8) NP diagnostic in progress

The following LMG commands may be used to communicate with the nameplate:

- NPINIT<sup>1</sup>
- PRGMLD
- XFRTBL:
  - A) NPDIR
  - B) NPCNFG
  - C) NPREC:
    - 1) RDREC
    - 2) WRTREC
    - 3) EOD
    - 4) BOD
    - 5) BACREC
    - 6) FWDREL
    - 7) ERAWRT.

These commands may be issued to the NP through the LMG Simulator. More details on these commands and the LMG Simulator are given in Section 6.

The three DIP switches in the U18 socket on the nameplate provide the option of selecting 8 different read/write memory blocks. For a given DIP switch setting, the nameplate can access only one 256 byte block (i.e. 16 performance records of 16 bytes each). Once this area is full, an operator may change the DIP switch setting to obtain an unwritten 256 byte block. Thus eight such blocks may be written before the read/write memory chip

---

<sup>1</sup> Note: NPINIT must be run first before any other commands may be issued.

(U17) must be removed and erased. The DIP switches are numbered 1, 2 and 3 and comprise an octal digit. Switch 3 is the most significant bit and switch 1 the least. The "on" position of the switch corresponds to a binary zero.

## SECTION 4

### LINK MODULE

#### 4.1 INSPECTION OF EQUIPMENT

To gain access to inside the LM chassis, tilt back the ICA chassis which is mounted directly above the LM. Inside the LM are power supplies and a 10 slot card cage. Be sure all power supply connectors are firmly connected and all cards are firmly seated in their slots with their component side facing the front panel. There are 6 cards in the LM, and any card may be placed in any slot. However the recommended arrangement is as follows (slot 1 closest to front panel):

- slot 1: ICA & FP card
- slot 2: empty
- slot 3: PROM card
- slot 4: RAM card
- slot 5: empty
- slot 6: NIC card
- slot 7: empty
- slot 8: CPU card
- slot 9: SM card
- slot 10: empty

There are 7 internal cables which need to be connected to edge connectors on these 6 cards. Four of these cards have 3 edge connectors each for a total of 12. Thus there are 5 unused edge connectors.

1. The 2 cables from the front panel should be connected to the left 2 connectors on the ICA & FP card. The cable coming from the ICA connects to the right connector on the ICA & FP card.

2. The cable from the back panel NIC connector should be connected to the center connector on the NIC card. The other 2 connectors on the NIC card are unused.

3. The cable from the back panel CRT connector should be connected to the left connector on the CPU card. The other 2 connectors on the CPU card are unused.

4. The 2 cables from the back panel LMG connector should be connected to the left and right SM card connectors. The center SM card connector is unused.

Lastly, verify that the AUTO/MONITOR toggle switch on the back panel is in the AUTO position.

#### 4.2 EXTERNAL CONNECTIONS

The LM chassis has 3 external connectors on the back panel. See Figure 2.

| <u>CABLE NAME</u> | <u>FUNCTION</u> | <u>CONNECTORS</u> | <u>REMARKS</u>          |
|-------------------|-----------------|-------------------|-------------------------|
| CBL01             | LM/LMG          | P1                | to J1 on LM             |
|                   |                 | J1 J2             | to P1 & P2 on LMG-DR11C |
| CBL03             | SIC             | P3                | to J3 on LM             |
|                   |                 | J3                | to P3 on SS             |
| CBL04             | LM/CRT          | P2                | to J2 on LM             |
|                   |                 | P2                | to J2 on CRT            |

CBL01 is a dual 40 conductor flat cable connecting the LMG-DR11C to the LM-SM. It has 2-40 pin socket connectors on one end and one 50 pin 'D' male connector on the other. Always connect CBL01 before turning the LM power on in order to assure proper communication with the LMG.

CBL03 is a round cable connecting the NIC card to the NP's for the SS. It has a 15 pin 'D' male on one end and female on the other.

CBL04 is a round cable connecting the LM maintenance mode to a CRT via RS232C interface. It has a male 25 pin 'D' on each end.



Figure 2 LM Back Panel

#### 4.3 FRONT PANEL OPERATION

The front panel is for monitoring and accessing the SM link between the LM and LMG. It additionally has some special status indicators and SM access strobes. If necessary, the front panel can be used in place of the LMG to issue commands and data transfers to the LM. This would be done by writing into appropriate SM locations just as the LMG would do. Four LED's to the extreme left side of the front panel are strobes indicating when the LMG or LM makes a read or a write access to SM. LM strobes are generated when the front panel accesses SM. The write data thumbwheel switches, write address thumbwheel switches, and write pushbutton work together to enter data into SM. These thumbwheel switches may be set at will, since the data is only written to the corresponding address when the write pushbutton is activated. This is different from the read data display and read address thumbwheel switches which are continuously monitored and updated. Thus read data display should change immediately with new settings of the read address thumbwheel switches. In this way contiguous areas of SM may be stepped through and examined. The status LED's and LMG command display are continuously updated. The RESET pushbutton causes a hardware system reset and the LM is reinitialized and starts over. This function should not normally be needed. Figure 3 shows the layout of the front panel.

There are 12 function commands to the LM which may also be issued via the front panel. This is done by writing the commands associated code into address FF using the front panel write data thumbwheel switches, write address thumbwheel switches, and write pushbutton. This command location is continuously displayed on the front panel LMG command display. (Note: all function commands are 8 bits with the MSB semaphore set to 1. Each



command code thus has the form 8X. This semaphore is immediately cleared by LM to acknowledge receipt and thus will always be displayed as 0X.) Table 2 lists the LM commands and Table 3 gives the possible status returns from each. Some commands require additional parameters which must be loaded into LMBUF before issuing the command. LMBUF is a 64 byte buffer in SM starting at location 80. Table 4 gives the parameters.

The SM is 256 bytes organized as 4 groups of 64 bytes each. 00 to 3F is IOBUF0 for data output to subsystem. 40 to 7F is IOBUF1 for data input from subsystem. 80 to BF is LMBUF for passing function command parameters. C0 to FF is for all commands, handshakes, and statuses. The layout of SM is shown in Table 5. The SM is described in detail in Section 6.5.

#### 4.4 OPERATION WITH PDP-11

The LM operates with the PDP-11 (LMG) independently of any front panel switches or settings. With all cables properly connected, you need only to be sure the external switch on the back panel is in the AUTO position and press front panel RESET to insure proper initialization. Three front panel LED's indicate when the LMG makes an access to SM, and whether it was a read or a write access.

#### Shared Memory Connections

1. INTCBL 100-J4 connected to P4 of LM shared memory card.
2. INTCBL 100-J2 connected to P2 of LM shared memory card.

TABLE 2 LM COMMANDS

|        |    |                                           |
|--------|----|-------------------------------------------|
| PRGMLD | 81 | Load non-resident task.                   |
| RUN    | 82 | Run non-resident task.                    |
| STOP   | 83 | Stop non-resident task.                   |
| NPDIAG | 84 | Same as NPINIT                            |
|        | 85 | Reserved                                  |
| CANCEL | 86 | Cancel the previous cmd. that is pending. |
| XFRTBL | 87 | Transfer LM system tables to/from LMG.    |
| STATUS | 88 | Clear input buffer request bit.           |
| RESET  | 89 | Resets CMDITR and ICA.                    |
| RESTR  | 8A | Jump to power up restart location.        |
| NPINIT | 8B | Request NPHND to initialize NP's.         |
| CONFIG | 8C | Configure selected subsystem.             |
| NOOP   | 8D | No operation.                             |

TABLE 3 CMDITR STATUS RETURN CODES

| Command | Status | Indication                                 |
|---------|--------|--------------------------------------------|
| General | +2     | Command active.                            |
|         | +1     | Command received.                          |
|         | 0      | Success                                    |
|         | -1     | Invalid command.                           |
|         | -2     | Another command still in progress.         |
|         | -3     | Command not implemented yet.               |
|         | -4     | Command cancelled.                         |
| PRGMLD  | -10    | # of bytes not from -1 to +61.             |
|         | -11    | Existing non-resident task is not dormant. |
|         | -12    | TYPE not 0 or 1.                           |
|         | -13    | SOURCE not 0 or 1.                         |
|         | -15    | XFR or TRLR record with SOURCE=NP.         |
|         | -16    | Invalid start address.                     |
|         | -17    | Invalid end address.                       |
|         | -18    | XFR record with no HDR record.             |
|         | -19    | TRLR record with no XFR record.            |
|         | -20    | EXEC failure to REMOVE previous task       |
|         | -21    | NP failure to upload task.                 |
|         | -22    | EXEC failure to INSTAL NP task.            |
|         | -23    | Program checksum not zero.                 |
|         | -24    | EXEC failure to INSTAL LMG task.           |
| RUN     | -10    | A task is not installed.                   |
|         | -11    | The task is not dormant.                   |
|         | -12    | Task checksum not zero.                    |
| STOP    | -10    | A task is not installed.                   |
|         | -11    | The task is dormant.                       |
|         | -12    | Failure to STOP after 5 sec.               |
| NPDIAG  | -      | see NPINIT.                                |
| CANCEL  | -      | None                                       |
| XFRIBL  | -10    | Invalid table number.                      |
|         | -11    | To/from LM not 0 or 1.                     |

TABLE 3 (CONTINUED) CMDITR STATUS RETURN CODES

| Command | Status | Indication                          |
|---------|--------|-------------------------------------|
|         | -12    | # bytes not from 1 to 64.           |
|         | -13    | Offset < 0.                         |
|         | -14    | Attempt to write a read only table. |
|         | -15    | TIME: # bytes too large.            |
|         | -16    | TIME: Offset too large.             |
|         | -17    | NPREC: Function not 0 to 5.         |
|         | -18    | NPREC: Invalid # bytes.             |
|         | -19    | SICSTS: Table shows <1 # of NP's.   |
|         | -20    | SICSTS: Table shows >20 # of NP's.  |
|         | -21    | NPHND error.                        |
|         | -22    | ICCNFG: ICAHND error GRP A.         |
|         | -23    | ICCNFG: ICAHND error GRP B.         |
| STATUS  | -      | None                                |
| RESET   | -10    | ICAHND fail to reset ICA.           |
| RESTRT  | -      | None                                |
| NPINIT  | -10    | NPHND error.                        |
| CONFIG  | -10    | SOURCE not 0 or 1 (LMG or NP).      |
|         | -11    | GROUP not 1 or 2 (A or B).          |
|         | -12    | ICAHND error.                       |
|         | -13    | NPHND error.                        |
|         | -14    | Invalid NP table.                   |
| NOOP    | -      | None                                |

TABLE 4 LM COMMAND PARAMETERS

|                         |                                                                |
|-------------------------|----------------------------------------------------------------|
| PRGMLD header record:   | 80 - FF                                                        |
|                         | 81 - TYPE 00 - I/O program                                     |
|                         | 01 - DIAG program                                              |
|                         | 82 - SOURCE 00 - LMG                                           |
|                         | 01 - NP                                                        |
| PRGMLD transfer record: | 80 - # bytes, 01 to 3D                                         |
|                         | 81 - starting load address, high byte                          |
|                         | 82 - starting load address, low byte                           |
|                         | 83 to BF - program bytes                                       |
| PRGMLD trailer record:  | 80 - 00                                                        |
|                         | 81 - program checksum                                          |
| XFRTBL:                 | 80 - table #, 01 to 0B                                         |
|                         | 81 - # bytes                                                   |
|                         | 82 - offset into table                                         |
|                         | 83 - to/from 00 - LM to LMG                                    |
|                         | 01 - LMG to LM                                                 |
|                         | 84 to BF - table loaded by LM or LMG depending on to/from byte |
| CONFIG:                 | 80 - SOURCE 00 - LMG                                           |
|                         | 01 - NP                                                        |
|                         | 81 - GROUP 01 - GRPA                                           |
|                         | 02 - GRPB                                                      |
|                         | 82 to 89 - configuration data if from LMG                      |

TABLE 5 SHARED MEMORY

| Symbolic<br>Name | Address |     |
|------------------|---------|-----|
|                  | DEC     | HEX |
| LMFCMD           | 255     | FF  |
| DXCMD            | 254     | FE  |
| LMFSTS           | 253     | FD  |
| DXSTS-S1         | 252     | FC  |
| -S0              | 251     | FB  |
| STSALR           | 250     | FA  |
| LMSTS-H          | 249     | F9  |
| -L               | 248     | F8  |
| NPSTS-H          | 247     | F7  |
| -L               | 246     | F6  |
| ICASTS-H         | 245     | F5  |
| -L               | 244     | F4  |
| LASTS            | 243     | F3  |
|                  | 242     | F2  |
|                  |         |     |
| HWTST            | 192     | C0  |
|                  | 191     | BF  |
|                  |         |     |
| LMBUF            | 128     | 80  |
|                  | 127     | 7F  |
|                  |         |     |
| IOBUF 1          | 64      | 40  |
|                  | 63      | 3F  |
|                  |         |     |
| IOBUF 0          | 0       | 00  |

|                     |          |     |     |      |      |          |          |
|---------------------|----------|-----|-----|------|------|----------|----------|
| S1                  | cmd #    |     |     |      |      |          |          |
| X                   |          |     |     |      | IOB  | REF      |          |
| LMF cmd status      |          |     |     |      |      |          |          |
| RDY<br>1            | REQ<br>1 | FLG | X   |      |      | REQ<br>0 | RDY<br>0 |
| X                   |          | WSC |     |      |      |          |          |
| S                   | X        |     | LM  | NP   | ICA  | LA       |          |
| X                   |          |     | HND | IMSK | SMHW | INIT     | OPER     |
| LM diagnosis        |          |     |     |      |      |          |          |
| X                   |          |     |     |      |      |          |          |
| HWE                 | CFC      | NPP | INT | RCF  | 0    | 0        | RST      |
| ICA status          |          |     |     |      |      |          |          |
| X                   |          |     |     |      |      |          |          |
| LA status           |          |     |     |      |      |          |          |
| 50 bytes<br>spare   |          |     |     |      |      |          |          |
| SM HW Test Byte     |          |     |     |      |      |          |          |
| 64 bytes<br>LMBUF   |          |     |     |      |      |          |          |
| 64 bytes<br>IOBUF 1 |          |     |     |      |      |          |          |
| 64 bytes<br>IOBUF 0 |          |     |     |      |      |          |          |

## SECTION 5

### SUBSYSTEMS

#### 5.1 INSPECTION OF EQUIPMENT

The subsystems are contained in two test boxes: the RLU test box and the ICA test box. The former contains the serial and synchro subsystems along with their nameplates, and the latter contains four different test set-ups for various ICA tests.

In the RLU test box, the synchro subsystem consists of two synchros which are directly connected to connector J4 on the panel. Alongside are two dials which determine synchro angles.

The serial subsystem consists of a sending subsystem and a receiving subsystem, both of which are assembled on the wire wrap board on the base of the box. There are two cables, INTCBL 700 and INTCBL 701, on the wire wrap board which are used to connect a particular subsystem to a particular ICA group. The following table summarizes these connections.

| Connection                                    | Cable INTCBL 700 | Cable INTCBL 701 |
|-----------------------------------------------|------------------|------------------|
| Sending to Gr. B<br>and<br>Receiving to Gr. A | 28 to 12         | 29 to 13         |
| Sending to Gr. A                              | 28 to 13         | Unused           |
| Receiving to Gr. B                            | Unused           | 29 to 12         |

where 12,13,28 and 29 are 4 sockets on the wire wrap board.

Each subsystem in the RLU box has an accompanying nameplate along the sides of the box. For a description of their use please refer to Section 3.

The ICA test box consists of four test set-ups. All have separate external connections alongside them through connector J4. All internal connections are hardwired.

## 5.2 EXTERNAL CONNECTIONS

Each subsystem or test set-up has a female connector J4 alongside it. For connecting any set-up or subsystem to the ICA, connect the corresponding J4 on the subsystem box to J4 on the ICA box through cable CBL02.

## 5.3 OPERATION WITH LM

In the following, Reference switch (REFSW) selects between AC and DC inputs, mode switch (MODSW) selects between single ended and differential inputs, and control switch (CTLSW) selects between ON and OFF. Given below are the procedures for use of the subsystems in each of the I/O categories.

### d.c. analog input -

1. Connect setup #1 on test box to ICA
2. Set REFSW to dc
3. Set MODSW to S.E. for single ended or DF for differential input
4. Set CTLSW to ON

### a.c. analog input -

1. Same as d.c. input except set REFSW to ac

### Synchro input -

1. Connect synchro subsystem to ICA

2. Turn dials A & B to set desired angles for Groups A & B respectively

Discrete input (sampled) -

1. Connect setup #1 to ICA
2. Set REFSW to dc, MODSW to S.E. or DF and CTLSW to ON

Momentary discrete input -

1. Connect setup #3 to ICA
2. Flip any of momentary contact switches SW1-SW8 to produce a binary 1 on the corresponding input. SW1 to SW4 correspond to channels 1 to 4 respectively, of ICA group A and SW5 to SW8 correspond to channels 1 to 4 respectively of ICA Group B.

Serial input (refresh mode) -

1. Connect serial subsystem to ICA
2. Connect sending subsystem to desired ICA group
3. Set MODSW to REFR; TX PARITY to desired parity
4. Select desired BCD values to be input, on the three sets of thumbwheel switches.
5. LED TX DATA LATCHED indicates parity error during input

Serial input (flag mode) -

1. Connect serial subsystem to ICA
2. Connect sending subsystem to desired ICA group
3. Set MODSW to FLAG; TX PARITY to desired parity
4. The RESET switch resets the sending subsystem and the STBSW allows the current BCD values set on the thumbwheels to be input. Nothing is input in FLAG mode until STBSW is flipped.
5. LED TX DATA LATCHED indicates parity error during input

d.c. analog output -

1. Connect setup #4 to ICA
2. Pins 1-1' to 4-4' have outputs from channels 1 to 4 respectively, for Group A. Pins 5-5' to 8-8' have outputs from channels 1 to 4 respectively, for Group B.

a.c. analog output -

Same as d.c.

Synchro output -

1. Connect synchro subsystem to ICA
2. Output angles are seen through movement of dials

Discrete output -

1. Connect setup #2 to ICA
2. LED's 1 to 4 show outputs of channels 1 to 4 respectively, of Group A and LED's 5 to 8 show outputs of channels 1 to 4 respectively, of Group B.

Serial output -

1. Connect serial subsystem to ICA
2. Connect the receiving subsystem to desired ICA group
3. Set RX PARITY to desired parity and notice parity errors on LED RX PARITY ERROR.
4. Notice output in BCD on the display.

## SECTION 6

### LMG SIMULATOR

#### 6.1 INSTALLATION OF SOFTWARE

##### 6.1.1 System Configuration Requirements

A DEC PDP-11/45 or PDP-11/70 computer running version 3.2 or later of the RSX-11M operating system is required to operate the LMG simulator. At least 800 blocks of disk space are required to load the software from mag tape and install it. 84K bytes of memory must be available to run the two tasks which comprise the LMG simulator. The mag tape must be a 9-track 800 bpi unit. In addition, two refreshed display CRT's are required for the user interface, at least one of which (CRT #2) must have a 24-line display. Finally, a DR11-C general purpose interface card is used for communication with the LM (see Section 6.2).

##### 6.1.2 Installation from Mag Tape

The procedure described here should be performed by the System Manager of the computer installation, an individual well-versed in the operation of RSX-11M.

The software is delivered in DOS format on the mag tape. It will be copied to directory [77,10]. Then a series of indirect command files are executed to compile and install the two LMG simulator tasks and the DR11-C driver. A transcript of the installation sequence is given in Figure 4 .

The DR11-C driver, which communicates with the Link Module through the DR11-C interface, is written with the DR11-C interrupt vector address assumed to be 350 and the CSR address assumed to be 167760. If other addresses are to be used, edit VECADR and CSR in file SMTAB.MAC accordingly before giving the '@DRIVER' command in Figure 4 .

After completion of the installation sequence, subsequent opera-

```

>
>! RLUDS INSTALLATION PROCEDURE
>!
>
>TIM
08:28:18 15-DEC-80
>
>
>SET /UIC=[1,1]
>INS $F4P/TASK=...FOR
>PIP [77,10]*.*;*/DE
>SET /UIC=[77,10]
>FLX /RS=MMO:[*,*]*.*/*DO
>
>
>@ASN
>ASN SYO:=QSO:
>ASN NLO:=QLO:
>ASN SYO:=QOO:
>ASN SYO:=QTO:
>@ <EOF>
>
>
>@USER
>MAC @MACBLD
>FOR @FORBLD
>TKB @TKBBLD
>@ <EOF>
>
>
>@DRIVER
>SET /UIC=[1,1]
>MAC @[77,10]SMDRVMAC
>TKB @[77,10]SMDRVTKB
>SET /UIC=[77,10]
>@ <EOF>
>
>
>TIM
08:45:56 15-DEC-80
>
>
>

```

Figure 4 RLUDS Software Installation Procedure

tion of the LMG simulator does not require the expertise of the System Manager and is described in the sections which follow.

## 6.2 CONNECTION TO LM

The PDP-11 interfaces to the Link Module through a DR11-C interface card. The connection of the DR11-C to the LM is illustrated in Figure 5 .

- (1) Cable CBL01-J1 connects to P1 of the DR11-C.
- (2) Cable CBL01-J2 connects to P2 of the DR11-C.
- (3) The other end of CBL01-J1 and CBL01-J2 connect through P1 to J1 of the LM back panel.

## 6.3 OPERATION

### 6.3.1 Summary of Modules

The LMG simulator is comprised of two real-time tasks running under the RSX-11M operating system on the PDP-11 computer. The high level language FORTRAN IV is used whenever possible.

Figure 6 is a block diagram of the LMG simulation system. The Command Interpreter (CI) task runs on CRT #1 to interpret and execute commands. The Shared Memory Display task runs on CRT #2 to continually interpret and display the contents of the Shared Memory (SM) in an easy-to-read format.

There are three kinds of disk files. The Output Log File records all transactions during a simulation. The Output Command File records commands and parameters, when desired, for later use as an Input Command File. The commands and parameters can be input from CRT #1 or from a disk Input Command File.

LM Back Panel

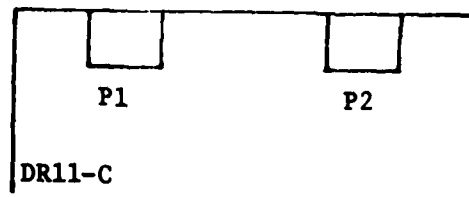
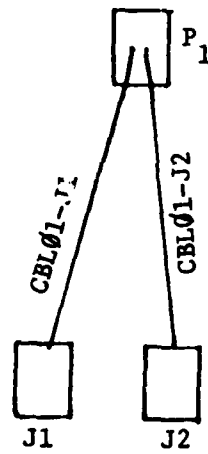
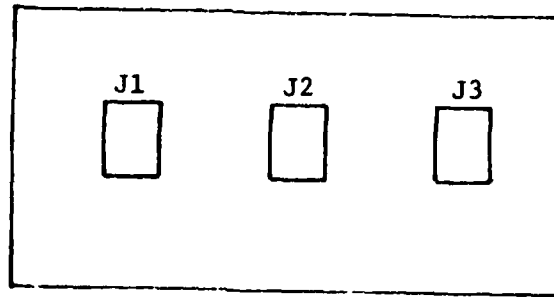


Figure 5 Connection of DR11-C and LM

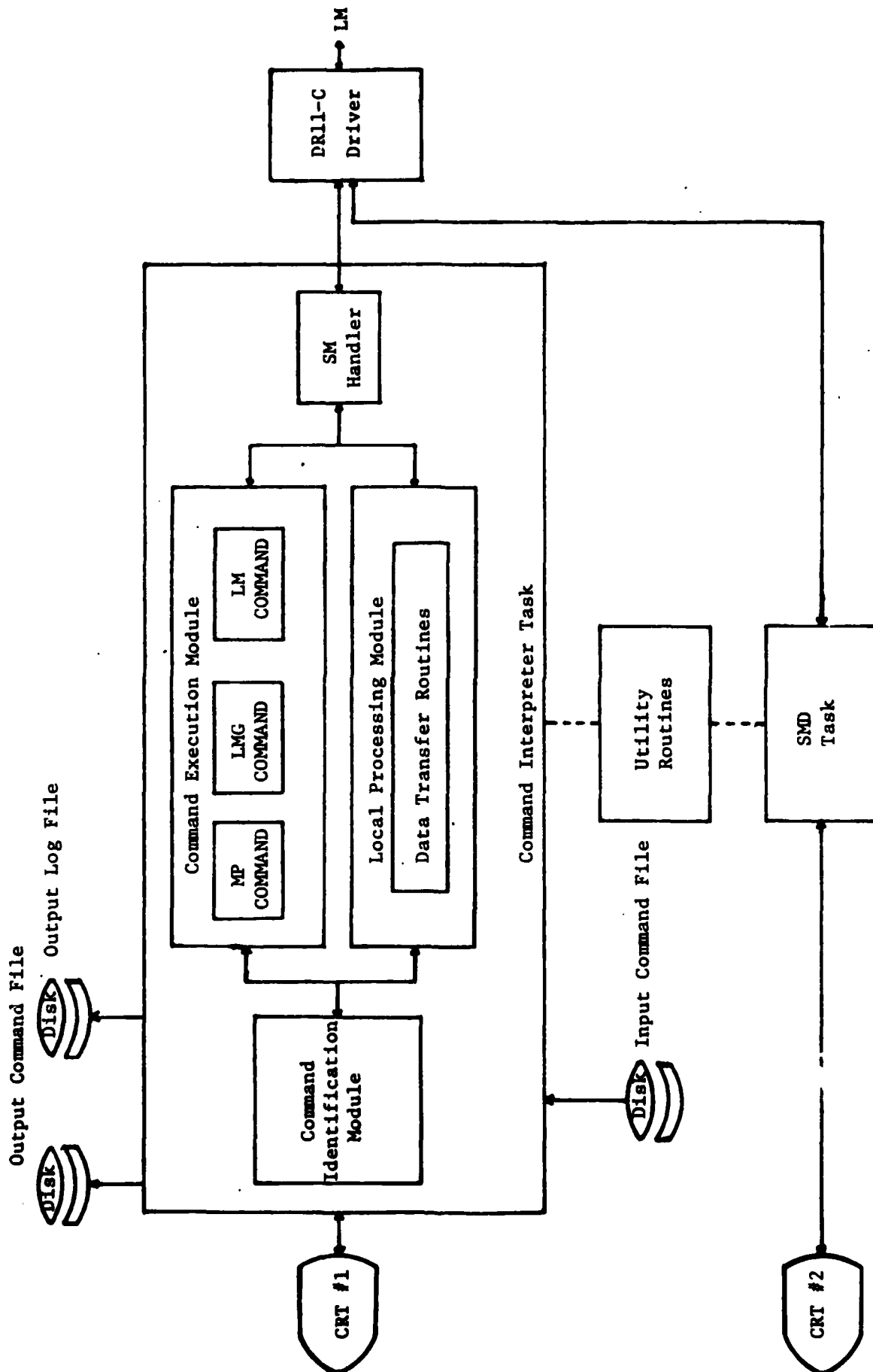


Figure 6 Block Diagram of LMG Simulator System

### 6.3.2 Initiating the Simulation

Before initiation of the simulation it is necessary to perform the setup procedures described in this manual for the ICA, nameplate, and link module. It is also assumed that the PDP-11 System Manager has installed the LMG simulation software as described in Section 6.1.

In order to set up for the simulation, enter the following commands at CRT #1 and at CRT #2:

```
>HELLO [uic]  
>PASSWORD?  
>@ [77,10]SETUP
```

where 'uic' is a privileged account assigned to you by the System Manager. The System Manager will also provide a password for the account. NOW enter 'RUN CMDINT' at CRT #1 to run the Command Interpreter task, and enter 'RUN SMD' at CRT #2 to run the Shared Memory Display task.

The remainder of this chapter describes the commands that can now be entered during the simulation. Appendix B gives a set of test scripts recommended for a user unfamiliar with the system.

At the completion of the simulation, to exit the program at each terminal, enter '@TERM' at either terminal, and log off the PDP-11 by entering 'BYE' at both terminals.

### 6.3.3 Tables of Commands and their Formats

There are three categories of commands: LMG command, LM function command, and maintenance port (MP) command. The LMG commands are listed in Table 6. The LM function commands are listed in Table 7. The MP commands are listed in Table 8. For detailed information of each command please see 6.3.3.1 (LMG commands), 6.3.3.2 (LM function commands) and

TABLE 6 LMG COMMANDS

| Command | Function                                                                                      |
|---------|-----------------------------------------------------------------------------------------------|
| SMDIAG  | Perform SM diagnostic function                                                                |
| LOCAL   | Request data transfer application program to transfer data between the LMG and the sub-system |

TABLE 7 LM FUNCTION COMMAND

| Command | Function Within LM                                                  |
|---------|---------------------------------------------------------------------|
| NOOP    | No operation                                                        |
| PRGMLD  | Load non-resident task                                              |
| RUN     | Run non-resident task                                               |
| STOP    | Stop non-resident task                                              |
| CONFIG  | Configure selected subsystem                                        |
| XFRTBL  | Transfer LM system tables to/from LMG                               |
| CANCEL  | Cancel the previous command that is pending                         |
| RESET   | Reset CMDITR and ICA                                                |
| RESTART | Jump to power up restart location                                   |
| STATUS  | Clear input buffer request bit and service request bit in flag mode |
| NPINIT  | Request NP handler to initialize NP's                               |
| NPDLAG  | Same as NPINIT                                                      |

TABLE 8 MP COMMANDS

| Command | Function                          |
|---------|-----------------------------------|
| CRT     | Input from CRT                    |
| DISK    | Input from disk                   |
| CLOLF   | Close log file                    |
| OPICF   | Open input command file           |
| CLICF   | Close input command file          |
| OPOCF   | Open output command file          |
| CLOCF   | Close output command file         |
| CREATE  | Creating Output Command File      |
| NOCRET  | Stop creating output command file |
| STPERR  | Stop on error                     |
| CNTERR  | Continue on error                 |
| MPSTAT  | Output Maintenance Port Status    |
| REWIND  | Rewind input command file         |
| EXIT    | Exit program                      |
| WRITE   | Write data to SM                  |
| READ    | Read data from SM                 |
| DUMP    | Dump all of SM to the CRT         |
| SETTIM  | Set PDP-11 system time to LM      |

#### 6.3.3.3 (MP commands).

##### 6.3.3.1 LMG Commands

In this section, the function and format of each LMG command are described. The parameters are also described, if any.

###### (1) SMDIAG

SMDIAG runs the shared memory diagnostic program to diagnose the hardware shared memory.

Format

CMD>SMDIAG

###### (2) LOCAL

LOCAL requests a data transfer application program to perform data transfer between the LMG and the subsystem.

Format

CMD>LOCAL

SELECT ONE OF THE DATA TRANSFER ROUTINES:

|        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|
| REFIN  | ALGIN  | SYNIN  | SINREF | SAMDIN | DINMOF |
| SEQIN  | SINFLG | DINMOL |        |        |        |
| SEQOUT | ALGOUT | SYNOUT | DISOUT | SOUTA  | SOUTB  |
| SYNIO  | SIO    | CRTSIM |        |        |        |

?

routinename

Parameter

taskfile

Specifies the name of local processing routine to be called. For available local processing routines please refer to Table 9 .

Example

CMD>LOCAL

SELECT ONE OF THE DATA TRANSFER ROUTINES:

|        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|
| REFIN  | ALGIN  | SYNIN  | SINREF | SAMDIN | DINMOF |
| SEQIN  | SINFLG | DINMOL |        |        |        |
| SEQOUT | ALGOUT | SYNOUT | DISOUT | SOUTA  | SOUTB  |
| SYNIO  | SIO    | CRTSIM |        |        |        |

?

SIO

In this example, the SIO subroutine is called to execute data transfer.

TABLE 9 LOCAL PROCESSING ROUTINES

| Routine | Function                                                                                                                             |
|---------|--------------------------------------------------------------------------------------------------------------------------------------|
| REFIN   | Just input refreshed data from subsystem once for the purpose of testing data transfer.                                              |
| ALGIN   | Inputs refreshed AC or DC voltages from subsystem and displays them.                                                                 |
| SYNIN   | Inputs refreshed synchro data, calculates and displays the angles set.                                                               |
| SINREF  | Inputs refreshed serial data and displays on the CRT.                                                                                |
| SAMDIN  | Inputs refreshed discrete data, displays the threshold voltage and the binary bit pattern of discrete data.                          |
| DINMOF  | Input refreshed discrete data and displays its binary bit pattern on the CRT.                                                        |
| SEQIN   | Just input sequential data from subsystem once for the purpose of testing data transfer.                                             |
| SINFLG  | Inputs sequential serial data and displays on the CRT.                                                                               |
| DINMOL  | Inputs sequential discrete data and displays its binary bit pattern on the CRT.                                                      |
| SEQOUT  | Just manually output sequential data from CRT to subsystem once for the purpose of testing data transfer.                            |
| ALGOUT  | Sequentially outputs triangle wave amplitude to the subsystem.                                                                       |
| SYNOUT  | Sequentially outputs synchro data to the subsystem.                                                                                  |
| DISOUT  | Sequentially outputs as discrete data a counter, which will increment at 1 sec intervals, to the subsystem.                          |
| SOUTA   | Sequentially outputs as serial data a counter, which will increment at 1 sec intervals, to the subsystem connected to Group A.       |
| SOUTB   | As above, except Group B instead of Group A.                                                                                         |
| SYNIO   | Inputs the refreshed input and output angles (already converted from synchro data) of the synchro subsystem and displays on the CRT. |
| SIO     | Inputs the refreshed operation results from the subsystem and displays on the CRT.                                                   |
| CRTSIM  | Simulate CRT to transfer ASCII character string to or from the LM.                                                                   |

### 6.3.3.2 LM Function Commands

In this section, the function and format of each LM function command are described. The parameters are also described, if any.

#### (1) NOOP

NOOP provides the LMG with a means of exercising the command handshake without causing anything to happen.

##### Format

```
CMD>NOOP
```

#### (2) PRGMLD

PRGMLD requests LM to down load a non-resident task from LMG or up load a non-resident task from NP.

##### Format

```
CMD>PRGMLD  
DATA I/O(DIO)OR SUBSYSTEM DIAGNOSTIC (SSD)? type  
FROM LMG OR NP? source  
[FILENAME? filespec]
```

##### Parameters

###### type

Specifies the type of non-resident task. Either data I/O conversion task or subsystem diagnostic task is allowed.

###### source

Specifies the source of the non-resident task: either from LMG down load or from NP up load.

###### filespec

Specifies the filename of the non-resident task. This parameter will be asked only when the source is LMG. The filetype .LX is automatically given and will override any filetype given by the user.

##### Examples

```
CMD>PRGMLD  
DATA I/O (DIO) OR SUBSYSTEM DIAGNOSTIC (SSD)? SSD  
FROM LMG OR NP? NP
```

In this example, subsystem diagnostic task will be up loaded from NP to LM.

```
CMD>PRGMLD  
DATA I/O (DIO) OR SUBSYSTEM DIAGNOSTIC (SSD)? DIO  
FROM LMG OR NP? LMG  
FILENAME? REFIN
```

In this example, data I/O task REFIN.LX will be down loaded from LMG to LM.

(3) RUN

RUN requests LM to run the non-resident task.

Format

```
CMD>RUN
```

(4) STOP

STOP requests LM to stop the non-resident task.

Format

```
CMD>STOP
```

(5) CONFIG

CONFIG requests LM to call the ICA handler to configure the selected subsystem from the LMG or NP.

Format

```
CMD>CONFIG  
FROM LMG OR NP? source  
GROUP A OR B? group  
CONFIGURATION TYPE:  
AINACS  AINACD  AINDCS  AINDCD  
AOTACS  AOTACD  AOTDCS  AOTDCD  
SINREF  SINFLG  SOUT    DOUT  
DINRFS  DINRFD  DINMOF  DINMOL  
SYNIN   SYNOUT  
? confitype  
[THRESHOLD VOLTAGE (-9 TO 9)? voltage]
```

Parameters

**source**  
Specifies the source from which to configure the subsystem.

**group**  
Specifies the group that will be configured.

### confitype

Specifies different configuration types. This parameter will be asked only when the source is LMG.

For configuration type, please refer to Table 10.

### voltage

Specifies the threshold voltage to be used to configure the sub-system. This parameter will be asked only when the configuration types are DINRFS and DINRFD.

### Example

```
CMD>CONFIG
FROM LMG OR NP? LMG
GROUP A OR B? A
CONFIGURATION TYPE:
AINACS  AINACD  AINDCS  AINDCD
AOTACS  AOTACD  AOTDCS  AOTDCD
SINREF  SINFLG  SOUT    DOUT
DINRFS  DINRFD  DINMOF  DINMOL
SYNIN   SYNOUT
? DINRFS
THRESHOLD VOLTAGE? -2.5
```

In this example, Group A is configured from LMG, with 'refreshed mode, single-ended discrete input' configuration type; the threshold voltage is -2.5v.

### (6) XFRTBL

XFRTBL requests LM to transfer LM system tables to/from LMG.

### Format

```
CMD>XFRTBL
TABLE NAME? tablename
READ OR WRITE (R/W)? tofrom
RECORD FUNCTION (0-5)
0:WRTREC  1:EOD
2:BOD     3:BACREC
4:FWDREC  5:ERAWRT
? recfunc
# OF BYTES? numbytes
# OF RECORDS? numrecs
ENTER HEXASC BYTES (10 BYTES/LINE)AS XX,XX,...
hexascii
LEAP YEAR (Y/N)? ansyear
MONTH: month
HOUR: hour
MINUTE: minute
SECOND: second
```

TABLE 10 ICA CONFIGURATION TYPES

| Type   | Indication                                                                  |
|--------|-----------------------------------------------------------------------------|
| AINACS | <u>A</u> nalog <u>I</u> N <u>A</u> C <u>S</u> ingle ended                   |
| AINACD | <u>A</u> nalog <u>I</u> N <u>A</u> C <u>D</u> ifferential                   |
| AINDCS | <u>A</u> nalog <u>I</u> N <u>D</u> C <u>S</u> ingle ended                   |
| AINDCD | <u>A</u> nalog <u>I</u> N <u>D</u> C <u>D</u> ifferential                   |
| AOTACS | <u>A</u> nalog <u>O</u> u <u>T</u> <u>A</u> C <u>S</u> ingle ended          |
| AOTACD | <u>A</u> nalog <u>O</u> u <u>T</u> <u>A</u> C <u>D</u> ifferential          |
| AOTDCS | <u>A</u> nalog <u>O</u> u <u>T</u> <u>D</u> C <u>S</u> ingle ended          |
| AOTDCD | <u>A</u> nalog <u>O</u> u <u>T</u> <u>D</u> C <u>D</u> ifferential          |
| SINREF | <u>S</u> erial <u>I</u> N- <u>R</u> E <u>F</u> resh mode                    |
| SINFLG | <u>S</u> erial <u>I</u> N- <u>F</u> L <u>A</u> G mode                       |
| SOUT   | <u>S</u> erial <u>O</u> U <u>T</u>                                          |
| DOUT   | <u>D</u> iscrete <u>O</u> U <u>T</u>                                        |
| DINRFS | <u>D</u> iscrete <u>I</u> N- <u>R</u> e <u>F</u> resh <u>S</u> ingle ended  |
| DINRFD | <u>D</u> iscrete <u>I</u> N- <u>R</u> e <u>F</u> resh <u>D</u> ifferential  |
| DINMOF | <u>D</u> iscrete <u>I</u> N- <u>M</u> o <u>M</u> entary <u>F</u> ollow mode |
| DINMOL | <u>D</u> iscrete <u>I</u> N- <u>M</u> o <u>M</u> entary <u>L</u> atch mode  |
| SYNIN  | <u>S</u> Y <u>N</u> chro <u>I</u> N                                         |
| SYNOUT | <u>S</u> Y <u>N</u> chro <u>O</u> U <u>T</u>                                |

## Parameters

### tablename

Specifies the name of table to be transferred. Available tables are shown in Table 11.

### tofrom

Specifies to write the table to LM or read the table from LM. This parameter will be asked only for two tables: TIME and NPREC.

### recfunc

Specifies the record function that will be performed. This parameter will be asked only when the table to be transferred is NPREC and is to be written to LM. Available record functions are shown in Table 12 .

### numbytes

Specifies the number of bytes that will be written to the nameplate record. This will be asked only for the NPREC table that will be written to the LM.

### numrecs

Specifies the number of records that will be read from the nameplate record or be moved by the nameplate record pointer.

### hexascii

The hexadecimal ASCII data to be written to the nameplate record. Each byte is formed by two hexadecimal ASCII characters and separated by a comma or blank.

### ansyear

Specifies that this year is a leap year (Y) or not (N). This parameter will be asked only when the TIME table is written to LM.

### month

Specifies the month of the date. Only the first 3 letters are received. This parameter will be asked only when the TIME table is written to LM.

### hour

Specifies the hour of the date. This parameter will be asked only when the TIME table is written to LM.

### minute

Specifies the minute of the date. This parameter will be asked only when the TIME table is written to LM.

### second

Specifies the second of the date. This parameter will be asked only when the TIME table is written to LM.

TABLE 11 TABLES TRANSFERRED TO/FROM LMG

| Table # | Name   | Bytes | R/W | Remark                               |
|---------|--------|-------|-----|--------------------------------------|
| 1       | TSKSTS | 12    | RO  | Task status                          |
| 2       | DLYTIM | 12    | RO  | Delay time                           |
| 3       | STAADR | 24    | RO  | Start address                        |
| 4       | RSTADR | 24    | RO  | Restart address                      |
| 5       | PRGMHD | 13    | RO  | Program header                       |
| 6       | TIME   | 5     | RW  | Time                                 |
| 7       | SICSTS | 5     | RO  | Subsystem information channel status |
| 8       | NPDIR  | 25    | RO  | Nameplate directory                  |
| 9       | NPCNFG | 23    | RO  | Nameplate configuration              |
| 10      | ICCNFG | 14    | RO  | ICA configuration                    |
| 11      | NPREC  | 16    | RW  | Nameplate record                     |

RO: can be read only by LMG.

RW: can be read or written by LMG.

For format of each table please refer to Appendix A.

TABLE 12 RECORD FUNCTIONS

| Name   | Function                 |
|--------|--------------------------|
| WRTREC | WRITE RECORD             |
| EOD    | END OF DATA RECORD       |
| BOD    | BEGINNING OF DATA RECORD |
| BACREC | BACK RECORD              |
| FWDREC | FORWARD RECORD           |
| ERAWRT | ERASE RECORD             |

### Examples

```
CMD>XFRTBL  
TABLE NAME? TIME  
READ OR WRITE (R/W)? W  
LEAP YEAR (Y/N)? N  
MONTH: JAN  
HOUR: 10  
MINUTE: 30  
SECOND: 00
```

In this example, the time of date will be set into the LM system.

```
CMD>XFRTBL  
TABLE NAME? PRGMHD  
READ OR WRITE (R/W)? R
```

In this example, the program header will be transferred from the LM.  
(For table format please refer to Appendix A).

```
CMD>XFRTBL  
TABLE NAME? NPREC  
READ OR WRITE (R/W)? W  
RECORD FUNCTION (0-5)  
0:WRTREC 1:EOD  
2:BOD 3:BACREC  
4:FWDREC 5:ERAWRT  
? 0  
# OF BYTES WRITTEN TO RECORD (AT MOST 14)? 5  
ENTER HEXASC BYTES (10 BYTES/LINE)AS XX,XX,...  
A1,A2,A3,B4,B5
```

In this example five HEXASCII bytes are written to the nameplate record that is pointed to by the nameplate pointer.

### (7) CANCEL

CANCEL requests LM to stop the execution of the previous command already in progress.

Format

```
CMD>CANCEL
```

### (8) RESET

RESET requests LM to reset the state of the CMDITR task and the ICA hardware.

Format

```
CMD>RESET
```

(9) **RESTRT**

**RESTRT** causes LM to jump to its power up restart location.

**Format**

**CMD>RESTRT**

(10) **STATUS**

**STATUS** clears the service request bit in status alert byte, and requests LM to clear the input buffer request bit in the data transfer handshake for sequential input.

**Format**

**CMD>STATUS**

(11) **NPINIT**

**NPINIT** requests NP handler to reset all the NP's, and causes each NP to run its internal diagnostic.

**Format**

**CMD>NPINIT**

**Note**

**NPINIT** command will return with two bytes. The format of the two bytes are the same as the last two bytes in SICSTS table.

(12) **NPDIAG**

**NPDIAG** does the same as **NPINIT**.

**Format**

**CMD>NPDIAG**

**Note**

**NPDIAG** command will return with two bytes. The format of the two bytes are the same as the last two bytes of SICSTS table.

### 6.3.3.3 **MP Commands**

In this section, the function and format of each MP command are described. The parameters are also described, if any.

(1) CRT

CRT directs that commands and parameters be input from the CRT.

Format

CMD>CRT

(2) DISK

DISK directs that commands and parameters be input from the disk.

Format

CMD>DISK

Note

The Input Command File should be opened before the DISK command is issued.

(3) CLOLF

CLOLF closes an old output log file and has an option to open a new one.

Format

CMD>CLOLF  
DO YOU WANT TO OPEN A NEW LOG FILE? (Y/N) answer  
OPEN OUTPUT LOG FILE  
ENTER FILE NAME  
filename  
\$\$\$\$ OUTPUT LOG FILE filename.LOG IS OPENED \$\$\$  
ENTER IDENTIFICATION  
identi

Parameters

answer

Replies to the question with Y or N.

filename

Specifies the file name of the output log file. The file type .LOG is automatically given and will override any filetype given by the user. This parameter will be asked only when the answer of first question is Y(yes).

identi

Specifies the identification of this demonstration. This parameter will be asked only when the answer of the first question is Y(yes).

#### Example

```
CMD>CLOLF  
DO YOU WANT TO OPEN A NEW LOG FILE? (Y/N) Y  
OPEN OUTPUT LOG FILE  
ENTER FILENAME  
SAM  
$$$$ OUTPUT LOG FILE SAM.LOG IS OPENED $$$$  
ENTER IDENTIFICATION  
TEST DATA TRANSFER COMMANDS
```

In this example, a new output log file SAM.LOG is opened to record the output of the testing of data transfer commands.

#### (4) OPICF

OPICF opens an input command file.

#### Format

```
CMD>OPICF  
ENTER FILENAME  
filename
```

#### Parameter

##### filename

Specifies the file name of input command file. The filetype .COM is automatically given and will override any filetype given by the user.

#### Example

```
CMD>OPICF  
ENTER FILENAME  
TRY
```

In this example, TRY.COM File is opened as an input command file.

#### Note

It is not permissible to open two input command files concurrently.

#### (5) CLICF

CLICF closes the input command file.

#### Format

```
CMD>CLICF
```

(6) OPOCF

OPOCF opens an output command file.

Format

```
CMD>OPOCF  
ENTER FILENAME  
filename
```

Parameter

filename  
Specifies the file name of the output command file. The filetype .COM is automatically given and will override any filetype given by the user.

Example

```
CMD>OPOCF  
ENTER FILENAME  
TRY.COM
```

In this example, TRY.COM is opened as an output command file. Note that the filetype given by the user is .CMD, but overridden by .COM.

Note

It is not permissible to open two output command files concurrently.

(7) CLOCF

CLOCF closes the output command file.

Format

```
CMD>CLOCF
```

(8) CREATE

CREATE puts the system into the creating mode. All the commands and parameters will be recorded into a disk file (output command file).

Format

```
CMD>CREATE
```

Note

An Output Command File should be opened before the CREATE command is issued.

(9) NOCRET

NOCRET puts the system into the non-creating mode.

Format

CMD><u>NOCRET

Note

In non-creating mode, commands and parameters will not be recorded into the disk file, even though the output command file is opened.

(10) STPERR

STPERR causes disk input mode execution to stop if an error occurs.

Format

CMD><u>STPERR

Note

This command is used only for disk input mode. CRT input mode always stops on error.

(11) CNTERR

CNTERR causes disk input mode execution to continue, even if an error occurs.

Format

CMD><u>CNTERR

Note

This command is used only for disk input mode. Stop-on-error condition will override the CNTERR command in CRT input mode.

(12) MPSTAT

MPSTAT shows the maintenance port status.

Format

CMD><u>MPSTAT

Note

The maintenance port status includes the files opened, stop-on-error or continue-on-error condition, creating (output command file) mode or non-creating mode, CRT input mode or DISK input mode.

(13) REWIND

REWIND rewinds the input command file to the top of the file.

Format

CMD>REWIND

Note

An input command file should be opened before the REWIND command is issued.

(14) EXIT

EXIT stops the program and closes all opened files.

Format

CMD>EXIT

(15) WRITE

WRITE writes data to certain locations of SM.

Format

CMD>WRITE  
STARTING ADDRESS (0-255)? startaddress  
# OF BYTES? numbytes  
ENTER HEXASC BYTES (10 BYTES/LINE)AS XX,XX,...  
hexascii

Parameters

startaddress

Specifies the starting address of the data to be modified.

numbytes

Specifies the number of data bytes to be modified.

hexascii

The hexadecimal ASCII data to be written to the SM. Each byte is formed by two hexadecimal ASCII characters and separated by a comma or blank.

Example

CMD>WRITE  
STARTING ADDRESS (0-255)? 64  
# OF BYTES? 2  
ENTER HEXASC BYTES (10 BYTES/LINE)AS XX,XX,...  
5E.4A

In this example, the data in SM addresses 64 and 65 will be 5E (hex) and 4A (hex), respectively.

#### Notes

It is not allowed to write data beyond the address range 0-255.

#### (16) READ

READ reads data from consecutive locations of SM and displays on CRT.

#### Format

```
CMD>READ  
STARTING ADDRESS (0-255)? startaddress  
# OF BYTES? numbytes
```

#### Parameters

startaddress  
Specifies the starting address of the data to be read.

numbytes  
Specifies the number of data to be read.

#### Example

```
CMD>READ  
STARTING ADDRESS (0-255)? 0  
# OF BYTES? 10
```

In this example, the data in SM address from 0 to 10 will be displayed on CRT.

#### Note

It is not allowed to read data beyond the address range 0-255.

#### (17) DUMP

DUMP displays all data in SM on the CRT.

#### Format

```
CMD>DUMP
```

#### (18) SETTIM

SETTIM gets the PDP-11 system time and sends it to LM.

## Format

CMD>SETTIM

### 6.4 LM FUNCTION COMMAND STATUS RETURN CODES

The LM function command status return codes are shown in Table 13 .

### 6.5 SHARED MEMORY

A summary of shared memory is shown in Table 14 . Detailed descriptions of each area in SM are given in the sections that follow.

#### 6.5.1 Interpretation of Significant SM Locations

##### (1) LMFCMD - LM function command

S1: semaphore      1: given  
                    0: received

CMD#:      1 - PRGMLD  
            2 - RUN  
            3 - STOP  
            4 - NPDIAG  
            5 - reserved  
            6 - CANCEL  
            7 - XFRTBL  
            8 - STATUS  
            9 - RESET  
           10 - RESTRT  
           11 - NPINIT  
           12 - CONFIG  
           13 - NOOP

##### (2) DXCMD - Data transfer command

REF: refreshed buffer      0: sequential mode  
      indicator            1: refreshed mode

IOB: I/O buffer #        0: output buffer (IOBUF 0)  
                          1: input buffer (IOBUF 1)

##### (3) LMFSTS - LM function status

Refer to 6.4, table of LM function status return codes.

TABLE 13 LM FUNCTION COMMAND STATUS RETURN CODES

| Command | Status | Indication                                 |
|---------|--------|--------------------------------------------|
| General | +2     | Command active.                            |
|         | +1     | Command received.                          |
|         | 0      | Success                                    |
|         | -1     | Invalid command.                           |
|         | -2     | Another command still in progress.         |
|         | -3     | Command not implemented yet.               |
|         | -4     | Command cancelled.                         |
| PRGMLD  | -10    | # of bytes not from -1 to +61.             |
|         | -11    | Existing non-resident task is not dormant. |
|         | -12    | TYPE not 0 or 1.                           |
|         | -13    | SOURCE not 0 or 1.                         |
|         | -15    | XFR or TRLR record with SOURCE=NP.         |
|         | -16    | Invalid start address.                     |
|         | -17    | Invalid end address.                       |
|         | -18    | XFR record with no HDR record.             |
|         | -19    | TRLR record with no XFR record.            |
|         | -20    | EXEC failure to REMOVE previous task.      |
|         | -21    | NP failure to upload task.                 |
|         | -22    | EXEC failure to INSTAL NP task.            |
|         | -23    | Program checksum not zero.                 |
|         | -24    | EXEC failure to INSTAL LMG task.           |
| RUN     | -10    | A task is not installed.                   |
|         | -11    | The task is not dormant.                   |
|         | -12    | Task checksum not zero.                    |
| STOP    | -10    | A task is not installed.                   |
|         | -11    | The task is dormant.                       |
|         | -12    | Failure to STOP after 5 sec.               |
| NPDIAG  | -      | see NPINIT.                                |
| CANCEL  | -      | None                                       |
| XFRIBL  | -10    | Invalid table number.                      |
|         | -11    | To/from LM not 0 or 1.                     |

TABLE 13 (CONTINUED) LM FUNCTION COMMAND STATUS RETURN CODES

| Command | Status | Indication                          |
|---------|--------|-------------------------------------|
|         | -12    | # bytes not from 1 to 64.           |
|         | -13    | Offset < 0.                         |
|         | -14    | Attempt to write a read only table. |
|         | -15    | TIME: # bytes too large.            |
|         | -16    | TIME: Offset too large.             |
|         | -17    | NPREC: Function not 0 to 5.         |
|         | -18    | NPREC: Invalid # bytes.             |
|         | -19    | SICSTS: Table shows <1 # of NP's.   |
|         | -20    | SICSTS: Table shows >20 # of NP's.  |
|         | -21    | NPHND error.                        |
|         | -22    | ICCNFG: ICAHND error GRP A.         |
|         | -23    | ICCNFG: ICAHND error GRP B.         |
| STATUS  | -      | None                                |
| RESET   | -10    | ICAHND fail to reset ICA.           |
| RESTRT  | -      | None                                |
| NPINIT  | -10    | NPHND error.                        |
| CONFIG  | -10    | SOURCE not 0 or 1 (LMG or NP).      |
|         | -11    | GROUP not 1 or 2 (A or B).          |
|         | -12    | ICAHND error.                       |
|         | -13    | NPHND error.                        |
|         | -14    | Invalid NP table.                   |
| NOOP    | -      | None                                |

TABLE 14 SHARED MEMORY

| Symbolic<br>Name | Address |     |
|------------------|---------|-----|
|                  | DEC     | HEX |
| LMFCMD           | 255     | FF  |
| DXCMD            | 254     | FE  |
| LMFSTS           | 253     | FD  |
| DXSTS-S1         | 252     | FC  |
| -S0              | 251     | FB  |
| STSALR           | 250     | FA  |
| LMSTS-H          | 249     | F9  |
| -L               | 248     | F8  |
| NPSTS-H          | 247     | F7  |
| -L               | 246     | F6  |
| ICASTS-H         | 245     | F5  |
| -L               | 244     | F4  |
| LASTS            | 243     | F3  |
|                  | 242     | F2  |
|                  |         |     |
| HWTST            | 192     | C0  |
|                  | 191     | BF  |
|                  |         |     |
| LMBUF            | 128     | 80  |
|                  | 127     | 7F  |
|                  |         |     |
| IOBUF 1          | 64      | 40  |
|                  | 63      | 3F  |
|                  |         |     |
| IOBUF 0          | 0       | 00  |

|                     |          |     |      |      |      |          |          |
|---------------------|----------|-----|------|------|------|----------|----------|
| S1                  | cmd #    |     |      |      |      |          |          |
| X                   |          |     |      |      | IOB  | REF      |          |
| LMF cmd status      |          |     |      |      |      |          |          |
| RDY<br>1            | REQ<br>1 | FLG | X    |      |      | REQ<br>0 | RDY<br>0 |
| X                   |          | WSC |      |      |      |          |          |
| S                   | X        |     | LM   | NP   | ICA  | LA       |          |
| X                   |          | HND | IMSK | SMHW | INIT | OPER     |          |
| LM diagnosis        |          |     |      |      |      |          |          |
| X                   |          |     |      |      |      |          |          |
| HWE                 | CFC      | NPP | INT  | RCF  | 0    | 0        | RST      |
| ICA status          |          |     |      |      |      |          |          |
| X                   |          |     |      |      |      |          |          |
| LA status           |          |     |      |      |      |          |          |
| 50 bytes<br>spare   |          |     |      |      |      |          |          |
| SM HW Test Byte     |          |     |      |      |      |          |          |
| 64 bytes<br>LMBUF   |          |     |      |      |      |          |          |
| 64 bytes<br>IOBUF 1 |          |     |      |      |      |          |          |
| 64 bytes<br>IOBUF 0 |          |     |      |      |      |          |          |

(4) DXSTS - Data transfer status

a. DXSTS - S1

RDY0: IOBUF 0 ready bit  
REQ0: IOBUF 0 request bit  
FLG : subsystem down flag  
REQ1: IOBUF 1 request bit  
RDY1: IOBUF 1 ready bit

b. DXSTS - S0

WSC: word (byte) subcount

(5) STSALR - status alert

S: asynchronous service request bit (Flag mode)  
LM: LM status alert bit  
NP: NP status alert bit  
ICA: ICA status alert bit  
LA: LA status alert bit

(6) LMSTS - LM status

a. LMSTS-H

OPER: LM diagnostic error  
INIT: cleared by RESET command  
SMHW: shared memory hardware is not present  
IMSK: interrupt mask  
HND: cleared by shared memory handler

b. LMSTS-L

Written by resident or non-resident task relating to LM diagnostic.

1 is written by non-resident task SMDIAG.

(7) NPSTS - Nameplate status

a. NPSTS-H

Not used.

b. NPSTS-L

RST: SIC reset state

RCF: SIC maintenance record is full.

INT: SIC has been initialized.

NPP: at least one NP is present.

CFC: SIC configuration changed since initialization.

HWE: SIC hardware failure.

(8) ICASTS - ICA status

a. ICASTS-H

| <u>Status</u> | <u>Indication</u>                             |
|---------------|-----------------------------------------------|
| 00            | Success                                       |
| FF            | Invalid ICA function                          |
| FE            | Group not configured                          |
| FD            | Parity error during serial input              |
| FC            | Invalid configuration                         |
| FB            | No data received during serial input          |
| FA            | Parity error during serial output             |
| F9            | Data not transmitted during serial output     |
| F8            | Synchro-out configuration, but request input  |
| F7            | Synchro-in configuration, but request output  |
| F6            | Analog-out configuration, but request input   |
| F5            | Analog-in configuration, but request output   |
| F4            | Discrete-out configuration, but request input |
| F3            | Discrete-in configuration, but request output |
| F2            | Serial-out configuration, but request input   |
| F1            | Serial-in configuration, but request output   |

b. ICASTS-L

Not used.

(9) LA status - Data I/O Task Status

| <u>Status</u> | <u>Indication</u>                                      |
|---------------|--------------------------------------------------------|
| 02            | Running                                                |
| 03            | Stopped                                                |
| 0D            | Stopped - S1 byte error                                |
| 0B            | Stopped - ICA not configured                           |
| 0A            | Stopped - ICA error                                    |
| 05            | Stopped - invalid synchro voltages(don't sum to 0)     |
| 06            | Stopped - invalid synchro voltage (wrong value of 'A') |

| <u>Status</u> | <u>Indication</u>                               |
|---------------|-------------------------------------------------|
| A5            | Same as 05, but error not written into NP       |
| A6            | Same as 06, but error not written into NP       |
| 07            | Stopped - parity error on serial input          |
| A7            | Same as 07, but error not written into NP       |
| 08            | Stopped - parity error on serial output         |
| A8            | Same as 08, but error not written into NP       |
| 09            | Stopped - data not transmitted on serial output |
| A9            | Same as 09, but error not written into NP       |

(10) HWIST - Hardware test

This location is tested by SMHND for presence of hardware card. The tested byte is A5.

(11) LMBUF - LM function buffer

For transferring parameters and data for the LM function command.

(12) IOBUF 1 - Input/Output Buffer 1

Used as input buffer for single-buffered transfers in RLUDS.

(13) IOBUF 0 - Input/Output Buffer 0

Used as output buffer for single-buffered transfers in RLUDS.

## APPENDIX A - DETAILED DESCRIPTIONS OF LM TABLES

The detailed descriptions of the tables transferred to/from the LM with the XFRTEL command are given in this appendix. The name, size, function and format are described for each table.

(1) TSKSTS-12 bytes, 1 byte/task, indicating READY state

| Task Number | b7 | b0 | Task Name |
|-------------|----|----|-----------|
| Task #0     |    | X  | UPDATE    |
| #1          |    | X  | ICAHND    |
| #2          |    | X  | SICHND    |
| #3          |    | X  | SMHND     |
| #4          |    | X  | CMDITR    |
| #5          |    | X  | NRTSK     |
| #6          |    | X  |           |
| #7          |    | X  |           |
| #8          |    | X  |           |
| #9          |    | X  |           |
| #10         |    | X  |           |
| #11         |    | X  |           |

b7 = 0 - task not ready  
       1 - task ready  
 b6 - b0 not used

(2) DLYTIM-12 bytes, 1 byte/task, indicating delay time.

| Task Number | b7 | b0 |
|-------------|----|----|
| Task #0     |    |    |
| Task #1     |    |    |
| Task #2     |    |    |
| Task #3     |    |    |
| Task #4     |    |    |
| Task #5     |    |    |
| Task #6     |    |    |
| Task #7     |    |    |
| Task #8     |    |    |
| Task #9     |    |    |
| Task #10    |    |    |
| Task #11    |    |    |

b7 = 0 delay count in 10 ms  
1 delay count in 1 sec

b6-b0 delay count

(3) STAADR-24 bytes, 2 bytes/task, indicating start address.

| Task #0 | start address <sup>H</sup> <sub>L</sub> |
|---------|-----------------------------------------|
| #1      |                                         |
| #2      |                                         |
| #3      |                                         |
| #4      |                                         |
| #5      |                                         |
| #6      |                                         |
| #7      |                                         |
| #8      |                                         |
| #9      |                                         |
| #10     |                                         |
| #11     |                                         |

(4) RSTADR-24 bytes, 2 bytes/task, indicating restart address.

The format is the same as STAADR.

- (5) PRGMHD-13 bytes, indicating the program header of the loaded non-resident task.

|                       |        |
|-----------------------|--------|
| program               |        |
| name                  |        |
| start address         | H<br>L |
| last address +1       | H<br>L |
| initial stack pointer | H<br>L |
| checksum              |        |

- (6) TIME-5 bytes, indicating BCD date and time of day.

|                            |
|----------------------------|
| Day of the Year<br>(1-366) |
| hours                      |
| minutes                    |
| seconds                    |

(7) SICSTS-5 bytes, indicating subsystem information channel status

|                              |
|------------------------------|
| NIC status                   |
| # of NP's                    |
| 1st NP ID                    |
| 1st NP<br>diagnostic results |

NIC status

|   |   |   |   |   |     |     |     |
|---|---|---|---|---|-----|-----|-----|
| φ | φ | φ | φ | φ | PWR | CKE | RST |
|---|---|---|---|---|-----|-----|-----|

PWR: SIC is disconnected or SIC power not present

CKE: SIC system clock failure

RST: SIC in reset state

NP diagnostic result bytes

|    |     |      |   |      |   |      |      |   |
|----|-----|------|---|------|---|------|------|---|
| H: | DGC | ROME | φ | RECE | φ | RAME | TIME | φ |
|----|-----|------|---|------|---|------|------|---|

DGC: Diagnostic completed

ROME: ROM data errors

RECE: Write records in error

RAME: RAM errors

TIME: Timer errors

|    |      |      |      |      |             |
|----|------|------|------|------|-------------|
| L: | ROM4 | ROM3 | ROM2 | ROM1 | Free Record |
|----|------|------|------|------|-------------|

Free Record: Number of write memory records still available at time of diagnostic.

(8) NPDIR - 25 bytes, Directory of NP.

| Demonstration System<br>Values (Hex) |                                           |
|--------------------------------------|-------------------------------------------|
| NP ID                                | 81 = Serial NP, 82=SynchronP              |
| Directory Code                       | DC                                        |
| Size of<br>Directory (bytes)         | 00<br>19 = (25) <sub>10</sub>             |
| Entry #1 ID Code                     | CF = Subsystem Configuration<br>Table     |
| Entry #1 Starting<br>Address         |                                           |
| Entry #1 Size<br>in Bytes            |                                           |
| Entry #2 ID Code                     | C0 = Subsystem Data Conversion<br>Program |
| Entry #2 Starting<br>Address         |                                           |
| Entry #2<br>Size                     |                                           |
| Entry #3 ID                          | D1 = Subsystem Diagnostic                 |
| Entry #3 Starting<br>Address         |                                           |
| Entry #3 Size in<br>Bytes            |                                           |
| Entry #4 ID                          | DA = Write Memory Data Storage            |
| Entry #4 Starting<br>Address         |                                           |
| Entry #4 Size in<br>Bytes            |                                           |
| Directory checksum                   |                                           |

(9) NPCNFG-23 bytes, subsystem configuration table in nameplate.

|         |                                    | Demonstration System<br>Values (Hex) |
|---------|------------------------------------|--------------------------------------|
|         | Configuration Code                 | CF                                   |
|         | Size of<br>Table                   | 00<br>17=(23) <sub>10</sub>          |
|         | Number of ICA Group                | 02                                   |
| 8 bytes | Group 1<br><br>Configuration Bytes |                                      |
|         |                                    |                                      |
| 8 bytes | Group 2<br><br>Configuration Bytes |                                      |
|         |                                    |                                      |
|         | Number of NP's Present             | 01                                   |
|         | 1st NP                             | 81=serial, 82=synchro                |
|         | Checksum                           |                                      |

(10) ICCNFG-14 bytes, 7 bytes/Group, ICA configuration table in ICA.

|         |            |          |
|---------|------------|----------|
| Group A | Group A    | Topology |
|         | high level |          |
|         | low level  |          |
|         | threshold  |          |
|         | word count |          |
|         | clock rate |          |
| Group B | Group B    | Topology |
|         | high level |          |
|         | low level  |          |
|         | threshold  |          |
|         | word count |          |
|         | clock rate |          |

# Topology Bytes

|   | Bit 7 | 6     | 5    | 4    | 3    | 2    | 1    | 0    |
|---|-------|-------|------|------|------|------|------|------|
| H | A/D   | AC/DC | RI/V | DVRN | DVRP | INM2 | INM1 | INM0 |

A/D: 1 = Analog

0 = Digital

AC/DC: 1 = AC

0 = DC

RI/V    DVRN    DVRP

0        0        0        no source enabled

1        0        0        current source

0        0        1        voltage source, single-ended

0        1        1        voltage source, differential

INM2    INM1    INM0

0        1        1        single-ended

1        1        1        differential

|   | Bit 7      | 6         | 5         | 4        | 3      | 2       | 1          | 0   |
|---|------------|-----------|-----------|----------|--------|---------|------------|-----|
| L | Serial Out | Serial In | Synch Out | Synch In | Unused | FLG/REF | Out Enable | L/F |

Bit 7-4    at most one is set. If both bit 4 and 5 are set, it is in reset state.

Bit 3        Unused

Bit 2        Refreshed or flag mode for serial input

Bit 1        Output enable

Bit 0        Latch or refreshed mode for discrete input

(11) NPREC - 16 bytes/record. Nameplate maintenance record

|                       |                |
|-----------------------|----------------|
| Bit 7                 |                |
| RCV                   | Record ID Code |
| Number of Valid Bytes |                |
| Julian Day            |                |
| Time Hours            |                |
| Time Minutes          |                |
| Record Data           |                |
| 8 bytes Maximum       |                |
| Record Checksum       |                |
| Record Terminator     |                |

RCV = Record Valid Bit,

If cleared (=0), the NP wrote this record correctly. When requesting a record to be written, this bit should be cleared.

Record ID Codes:

- 30 = Subsystem repaired, or determined to be working correctly.
- 3A = Subsystem Failure Detected
- 31 = Subsystem Calibration Results
- 32 = Subsystem Diagnostic Results

Record Data:

Data Codes and formats left up to the user.

APPENDIX B  
TEST SCRIPTS FOR THE  
REMOTE LINK UNIT DEMONSTRATION SYSTEM

The tests are organized into 5 groups:

Group I: Initialization  
Group R: RLU Tests  
Group A: ICA Tests  
Group N: SIC Tests  
Group T: Termination

The Group I tests must be run first and Group T last. Groups R, A, and N may be conducted in any order.

The tests assume that all software has already been properly installed onto the computer, as described in Section 6 of this User's Manual.

When performing the tests at the CRT, all keyboard entries prescribed are terminated by the 'RETURN' key. The 'control-Z' entry prescribed is obtained by holding the 'CTRL' key down and then depressing the 'Z' key.

| I. SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | RESULTS/<br>REMARKS |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <p>The following steps must be performed to initialize the RLUDS and prepare for performing the RLU, ICA, and NP tests.</p> <p>I.1 CRT #1 (console) setup</p> <ul style="list-style-type: none"> <li>a) Verify that the LM is properly connected to the PDP-11 through the DR11C interface, as described in this User's Manual.</li> <li>b) Enter 'HELLO [uic]' at CRT #1, entering the proper password when it is requested. The uic and password must be obtained from the PDP-11 System Manager.</li> <li>c) Enter '@[77,10]SETUP' to set up for the demonstration.</li> <li>d) Enter 'RUN CMDINT' to begin execution of the LMG command interpreter task.</li> <li>e) The command interpreter will begin by asking a few questions: <ul style="list-style-type: none"> <li>1. First, it asks for information regarding the terminal type. Respond according to the type of CRT being used.</li> <li>2. Then it asks whether the user wants a FULL, BRIEF, or NO transcript on the CRT of the operations being performed by the LMG. For the purposes of these tests, respond '1' for BRIEF.</li> <li>3. Then it asks: DO YOU WANT A LOG FILE? A log file, if chosen, would be used to record all transactions performed on a disk file for later printing. For the purposes of these tests, respond 'NO'.</li> </ul> </li> <li>f) Verify that the CRT has prompted 'CMD&gt;' and is thus ready to receive commands.</li> </ul> <p>I.2 CRT #2 setup (optional)</p> <ul style="list-style-type: none"> <li>a) Enter 'HELLO [uic]' at CRT #2, entering the proper password when it is requested.</li> <li>b) Enter '@[77,10]SETUP' to set up for the demonstration.</li> <li>c) Enter 'RUN SMD' to begin execution of the shared memory task.</li> <li>d) SMD will begin by asking some questions:</li> </ul> |                     |

| I. SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ✓ RESULTS/<br>REMARKS |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| <ol style="list-style-type: none"> <li>1. First, it asks for information regarding the terminal type. Respond according to the type of CRT being used.</li> <li>2. Then it asks for the update rate in seconds for refreshing the display of the shared memory contents. The suggested rate is 1 second.</li> </ol> <p>e) SMD will then begin the refreshed display. Observe that characters typed at the keyboard have the following effects:</p> <ol style="list-style-type: none"> <li>1. 'R' restarts the display by asking for a new update rate.</li> <li>2. Any other character merely erases the screen and then continues the display anew.</li> </ol> <p>I.3 Initialization of RLU</p> <ol style="list-style-type: none"> <li>a) Return to CRT #1 and enter '@INIT' to initialize the RLU.</li> <li>b) When the prompt CMD&gt; is given, the RLU is ready for any of the remaining tests to be executed from CRT #1.</li> </ol> |                       |

| R.        SCRIPT - RLU TESTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | RESULTS/<br>REMARKS |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <p>Initialization tests I.1 to I.3 must be performed before beginning the tests that follow.</p> <p>R.1 Test of the Synchro Subsystem</p> <ul style="list-style-type: none"> <li>a) With no subsystem or nameplate connected to the LM, observe that the 'SIC configured' light on the LM front panel is off.</li> <li>b) Enter '@R1A' on the console to attempt operation with the subsystem.</li> <li>c) Observe that failure code -10 is reported on the CRT.</li> <li>d) As illustrated in FigureB-1, connect the LM to the Synchro Subsystem and its nameplate.</li> <li>e) Observe that the 'SIC configured' light on the LM front panel is now on.</li> <li>f) Enter '@R1A' on the console once again.</li> <li>g) Control the angle of input synchro B and observe the changes in output synchro A and the angles reported on the console by the LMG. Verify that the synchro program is operating properly.</li> <li>h) Disrupt the synchro input data and observe that the synchro program will stop execution. Observe that this condition is detected and reported by the LMG.</li> <li>i) Enter '@R1B' on the console to read the subsystem nameplate and identify the cause of the failure.</li> <li>j) Correct the failure introduced in the input synchro and enter @R1C on the console to restart the data I/O task in the LM and the local processing task in the LMG. Verify that the synchro program resumes normal operation.</li> <li>k) Enter 'control-Z' on the console to end the test.</li> </ul> <p>R.2 Test of the Serial Subsystem</p> <ul style="list-style-type: none"> <li>a) With no subsystem or nameplate connected to the LM, observe that the 'SIC configured' light on the LM front panel is off.</li> <li>b) Enter '@R2A' on the console to attempt operation with the subsystem.</li> </ul> |                     |

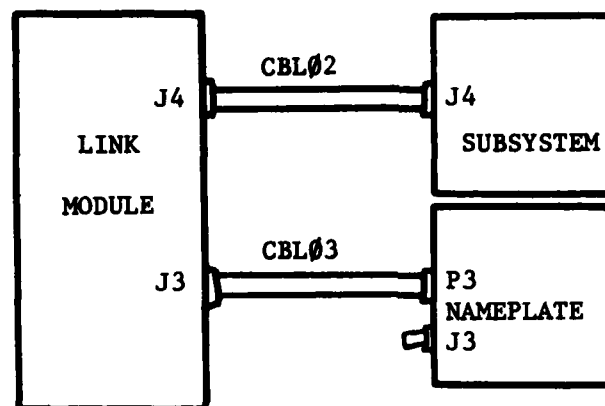


Figure B-1 Set-up for RLU Tests

| R. | SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ✓ RESULTS/<br>REMARKS |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
|    | <p>c) Observe that failure code -10 is reported on the CRT.</p> <p>d) As illustrated in Figure B-1, connect the LM to the Serial Subsystem and its nameplate.</p> <p>e) Observe that the 'SIC configured' light on the LM front panel comes on.</p> <p>f) Enter '@R2A' on the console once again.</p> <p>g) Set two numbers on the left and right thumbwheel switches and select an operation on the middle thumbwheel switch (=0 for addition, ≠0 for multiplication). Depress the STROBE switch on the serial subsystem and observe that the operation requested has been performed by the LM's data I/O task and has been displayed on the serial output display. Observe also that the entire operation has been reported to the local processing task in the LMG and displayed on the console. Repeat this test for several operations.</p> <p>h) Set TX PARITY switch on subsystem to ODD and push the flag switch again. Observe that the data I/O task stops running and that the condition is detected and reported by the LMG.</p> <p>i) Enter '@R2B' on the console to read the subsystem nameplate and identify the cause of the failure.</p> <p>j) Return TX PARITY to EVEN.</p> <p>k) Enter '@R2C' on the console to restart the data I/O task in the LM and the local processing task in the LMG. Verify that the serial program resumes normal operation.</p> <p>l) Set RX PARITY switch on subsystem to ODD and depress the STROBE switch. Observe that the data I/O task stops running and that the condition is detected and reported by the LMG.</p> <p>m) Enter '@R2B' on the console to read the subsystem nameplate and identify the cause of failure.</p> <p>n) Return RX PARITY switch to EVEN.</p> <p>o) Enter '@R2C' on the console to restart the data I/O task in the LM and the local processing task in the LMG. Verify that the serial subsystem resumes normal operation.</p> |                       |

| R. SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | ✓ RESULTS/<br>REMARKS |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| <p>p) Enter 'control-Z' at the console to end the test.</p> <p>R.3 Retrieval of Serial Subsystem Information</p> <p>This test will show the organization of subsystem information stored in a nameplate. This information includes parameters used to configure the signal interface and run the Data I/O task.</p> <p>a) Enter 'X' (transfer table command). The CRT will respond with a request for a table name.</p> <p>b) Enter 'NPDIR' (nameplate directory). Observe that a directory describing the information stored in the nameplate is displayed on the screen.</p> <p>c) Enter 'X'. The CRT will request a table name.</p> <p>d) Enter 'NPCNFG' (interface configuration). Observe that the configuration parameters for the serial subsystem are displayed on the screen.</p> <p>e) Enter 'X'. The CRT will request a table name.</p> <p>f) Enter 'PRGMHD' (program header). All parameters which are required to run the data conversion program for the serial subsystem demonstration will be displayed on the screen.</p> <p>g) Enter 'X'. The CRT will request a table name.</p> <p>h) Enter 'NPREC' (maintenance records). The console will request a read or write selection.</p> <p>i) Enter 'W' (write). The console will request selection of a write command.</p> <p>j) Enter '2' (beginning of data).</p> <p>k) Enter 'X'. The CRT will request a table name.</p> <p>l) Enter 'NPREC' (nameplate records). The console will prompt for selection of read or write operation.</p> <p>m) Enter 'R' (read). The console will prompt for the number of records to be read.</p> <p>n) Enter '3'. The first three records in the nameplate maintenance files will be displayed on the screen.</p> <p>o) Disconnect the subsystem cables at the end of this test.</p> |                       |

| A. SCRIPT - ICA TEST SCRIPTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | RESULTS/<br>REMARKS |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <p>Initialization tests I.1 to I.3 must be performed before beginning the tests that follow. Refer to Figure B-2 for <b>each</b> test set-up.</p> <p>A.1 d-c analog input</p> <p>These tests will verify the acquisition of analog d-c signals through the ICA.</p> <ul style="list-style-type: none"> <li>a) Test set-up: the LM to Test Panel #1.</li> <li>b) Set REFSW=dc, CTLSW=OFF and MODSW=se.</li> <li>c) Enter '@A1A' on the console for <u>single-ended source</u> test.</li> <li>d) Set CTLSW=ON.</li> <li>e) Observe the test results on the CRT screen and compare with expected values in Table B-1, column se.</li> <li>f) Enter 'control-Z' on the console to end the test.</li> <li>g) Set CTLSW=OFF and MODSW=df.</li> <li>h) Enter '@A1B' on the console for the <u>differential source</u> test.</li> <li>i) Set CTLSW=ON.</li> <li>j) Observe the test result on the CRT screen and compare with expected values in Table B-1, column df.</li> <li>k) Enter 'control-Z' on the console to end the test.</li> </ul> <p>A.2 a-c analog input</p> <p>This test will verify the acquisition of analog a-c signals (synchronous 400 Hz) through the ICA.</p> <ul style="list-style-type: none"> <li>a) Test set-up: connect the LM to Test Panel #1.</li> <li>b) Set REFSW=ac, CTLSW=OFF and MODSW=se.</li> <li>c) Enter '@A2A' on the console for the <u>single-ended source</u> test.</li> <li>d) Set CTLSW=ON</li> <li>e) Observe the test results on the CRT screen and compare with expected values (volts peak) in Table B-1.</li> <li>f) Enter 'control-Z' on the console to end the test.</li> </ul> |                     |

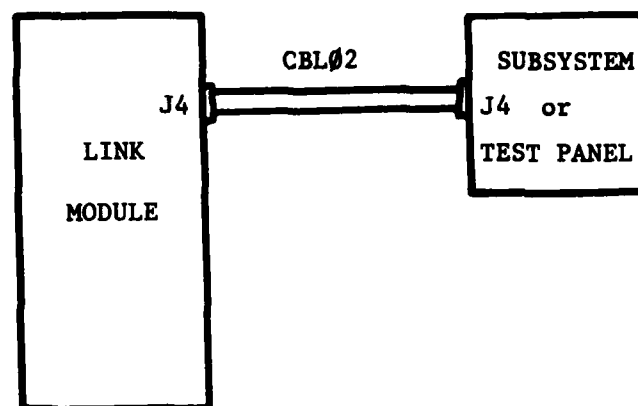


Figure B-2 Set-up for ICA Tests

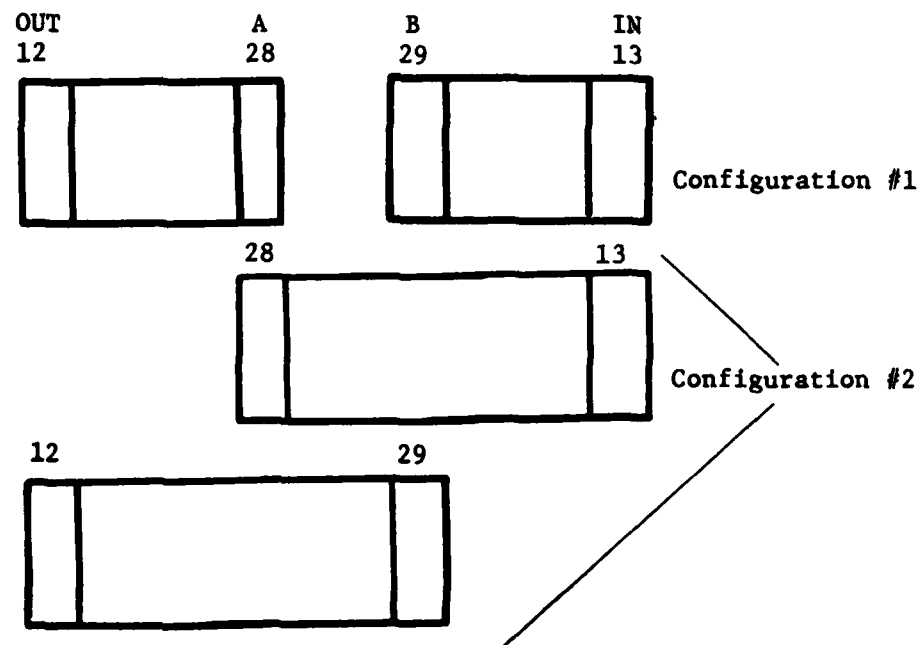


Figure B-3 Serial Subsystem Internal Cable Connections

TABLE B-1 ANALOG INPUT

| channel | dc (volts) <sup>se</sup> | dc (volts) <sup>or</sup> |
|---------|--------------------------|--------------------------|
|         | ac (volts peak)          | ac (volts peak)          |
| 1       | 8.0                      | 7.1                      |
| 2       | 6.8                      | 4.8                      |
| 3       | 5.9                      | 2.9                      |
| 4       | 4.8                      | 0.8                      |
| 5       | 3.9                      | -1.2                     |
| 6       | 2.9                      | -3.2                     |
| 7       | 1.9                      | -5.1                     |
| 8       | 0.9                      | -7.2                     |

Note:

1. Voltages measured are within  $\pm .1$  v.

| A. SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ✓ RESULTS/<br>REMARKS |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| <ul style="list-style-type: none"> <li>g) Set CTLSW=OFF and MODSW=df</li> <li>h) Enter '@A2B' on the console for the <u>differential source</u> test.</li> <li>i) Set CTLSW=ON.</li> <li>j) Observe the test results on the CRT screen and compare with the expected values (volts peak) in Table B-1.</li> <li>k) Enter 'control-Z' on the console to end the test.</li> </ul>                                                                                                                                                                                                                                                                                                             |                       |
| <p>A.3 Synchro input</p> <p>This test will verify the acquisition of synchro data through the ICA.</p> <ul style="list-style-type: none"> <li>a) Test set-up: connect the LM to the Synchro Subsystem.</li> <li>b) Enter '@A3' on the console.</li> <li>c) Set the angle of each synchro to a desired value.</li> <li>d) Observe the test result on the CRT screen and compare with the angles set in step c. Repeat c) and d) as desired.</li> <li>e) Enter 'control-Z' on the console to end the test.</li> </ul>                                                                                                                                                                         |                       |
| <p>A.4 Discrete input (sampled)</p> <p>This test will verify the acquisition of parallel digital data through the ICA.</p> <ul style="list-style-type: none"> <li>a) Test set-up: connect the LM to Test Panel #1.</li> <li>b) Set REFSW=dc, CTLSW=ON and MODSW=se.</li> <li>c) Enter '@A4A' on the console to download the data I/O task.</li> <li>d) Enter '@A4B' for the <u>single-ended source</u> test.</li> <li>e) <u>Twice</u> in response to the prompt, enter a threshold value from Table B-2, column se.</li> <li>f) Observe the results on the CRT and compare with the expected results in Table B-2.</li> <li>g) Enter 'control-Z' on the console to end the test.</li> </ul> |                       |

TABLE B-2 DISCRETE INPUT

| Threshold Voltage<br>se | Bit Pattern     | Threshold Voltage<br>df |
|-------------------------|-----------------|-------------------------|
| 8.5                     | 0 0 0 0 0 0 0 0 | 8.0                     |
| 7.5                     | 0 0 0 0 0 0 0 1 | 6.0                     |
| 6.5                     | 0 0 0 0 0 0 1 1 | 4.0                     |
| 5.5                     | 0 0 0 0 0 1 1 1 | 2.0                     |
| 4.5                     | 0 0 0 0 1 1 1 1 | 0.0                     |
| 3.5                     | 0 0 0 1 1 1 1 1 | -2.0                    |
| 2.5                     | 0 0 1 1 1 1 1 1 | -4.0                    |
| 1.5                     | 0 1 1 1 1 1 1 1 | -6.0                    |
| 0.5                     | 1 1 1 1 1 1 1 1 | -8.0                    |

| A. SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ✓ RESULTS/<br>REMARKS |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| <ul style="list-style-type: none"> <li>h) Repeat d)-g) for each threshold in Table B-2, column se.</li> <li>i) Set MODSW=df.</li> <li>j) Enter '@A4C' on the console for the <u>differential source</u> test.</li> <li>k) <u>Twice</u> in response to the prompt, enter a threshold value from Table B-2, column df.</li> <li>l) Observe the results on the CRT and compare with the expected results in Table B-2.</li> <li>m) Enter 'control-Z' on the console to end the test.</li> <li>n) Repeat j)-m) for each threshold in Table B-2, column df.</li> </ul>                                                                                                                                                                                                                                                                                                    |                       |
| <p>A.5 Momentary discrete input</p> <p>This test will verify the acquisition of parallel digital data associated with the momentary closure of contacts.</p> <ul style="list-style-type: none"> <li>a) Test set-up: connect the LM to Test Panel #4.</li> <li>b) Enter '@A5A' on the console for the <u>latched mode</u> test.</li> <li>c) Depress a switch (or switches) on the test panel.</li> <li>d) Observe detection of the switch closure on the CRT. Repeat c) and d) as desired.</li> <li>e) Enter 'control-Z' on the console to end the test.</li> <li>f) Enter '@A5B' on the console for the <u>follow mode</u> test.</li> <li>g) Depress a switch (or switches) on the test panel.</li> <li>h) Observe detection of the switch closure on the CRT. Repeat g) and h) as desired.</li> <li>i) Enter 'control-Z' on the console to end the test.</li> </ul> |                       |
| <p>A.6 Serial input (Group B)</p> <p>This test will verify the acquisition of serial digital data through ICA, Group B.</p> <ul style="list-style-type: none"> <li>a) Test set-up: connect the LM to the Serial Subsystem.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                       |

| A. SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | RESULTS/<br>REMARKS |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <ul style="list-style-type: none"> <li>b) Verify that the two small ribbon cables inside the ICA chassis are as indicated in FigureB-3 ,configuration #1.</li> <li>c) Set MODSW=REFR and TX PARITY=EVEN.</li> <li>d) Enter '@A6A' on the console for the <u>refresh mode</u> test.</li> <li>e) Set a number on each of the three thumbwheel switches on the test panel.</li> <li>f) Observe the test results on the CRT screen and compare with the value set on the switches. Repeat e) and f) as desired.</li> <li>g) Enter 'control-Z' on the console to end the test.</li> <li>h) Set MODSW=FLAG.</li> <li>i) Enter '@A6B' on the console for the <u>flag mode</u> test.</li> <li>j) Set a number on each of the three thumbwheel switches and depress the STROBE switch.</li> <li>k) Observe the results on the CRT screen and compare with the value set on the switches. Repeat j) and k) as desired.</li> <li>l) Enter 'control-Z' on the console to end the test.</li> </ul> |                     |
| <p>A.7 Serial input (Group A)</p> <p>This test will verify the acquisition of serial digital data through ICA, Group A.</p> <ul style="list-style-type: none"> <li>a) Test set-up: connect the LM to the Serial Subsystem.</li> <li>b) Rearrange the two small ribbon cables inside the ICA chassis to be as shown in FigureB-3,configuration #2.</li> <li>c) Set MODSW=REFR and TX PARITY=EVEN.</li> <li>d) Enter '@A7A' on the console for the <u>refresh mode</u> test.</li> <li>e) Set a number on each of the three thumbwheel switches on the test panel.</li> <li>f) Observe the test results on the CRT screen and compare with the value set on the switches. Repeat e) and f) as desired.</li> <li>g) Enter 'control-Z' on the console to end the test.</li> </ul>                                                                                                                                                                                                          |                     |

| A. SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ✓ RESULTS/<br>REMARKS |
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| <ul style="list-style-type: none"> <li>h) Set MODSW=FLAG.</li> <li>i) Enter '@A7B' on the console for the <u>flag mode</u> test.</li> <li>j) Set a number on each of the three thumbwheel switches and depress the STROBE switch.</li> <li>k) Observe the results on the CRT screen and compare with the value set on the switches. Repeat j) and k).</li> <li>l) Enter 'control-Z' on the console to end the test.</li> <li>m) Return the two small ribbon cables to the configuration shown in Figure B-3, configuration #1.</li> </ul>                                                                                                                                                                                                       |                       |
| <p>A.8 d-c analog output</p> <p>This test will verify the generation of analog d-c signals by the ICA.</p> <ul style="list-style-type: none"> <li>a) Test set-up: connect the LM to Test Panel #2.</li> <li>b) Enter '@A8A' on the console for the <u>single-ended</u> test.</li> <li>c) Monitor the output of each ICA channel and compare the output values with the expected results in Table B-3.</li> <li>d) Enter 'control-Z' on the console to end the test.</li> <li>e) Enter '@A8B' on the console for the <u>differential</u> test.</li> <li>f) Monitor the output of each ICA channel and compare the output values with the expected results in Table B-3.</li> <li>g) Enter 'control-Z' on the console to end the test.</li> </ul> |                       |
| <p>A.9 a-c analog output</p> <p>This test will verify the generation of analog a-c signals by the ICA.</p> <ul style="list-style-type: none"> <li>a) Test set-up: connect the LM to Test Panel #2.</li> <li>b) Enter '@A9A' on the console for the <u>single-ended</u> test.</li> <li>c) Monitor the output of each ICA channel and verify that a sine wave is being generated between channel 1 of the scope and ground. Compare the peak amplitudes with the</li> </ul>                                                                                                                                                                                                                                                                       |                       |

TABLE B-3 ANALOG OUTPUT

| channel | dc (volts)<br>ac (volts peak) |
|---------|-------------------------------|
| 1       | 1                             |
| 2       | 2                             |
| 3       | 3                             |
| 4       | 4                             |
| 5       | 5                             |
| 6       | 6                             |
| 7       | 7                             |
| 8       | 8                             |

Notes:

1. Results are within  $\pm 1$  v.
2. Single-ended voltages are measured between (+) and ground terminals.
3. Differential voltages are measured between (+) and (-) terminals.

DO NOT GROUND THE (-) TERMINAL.

| A. SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | RESULTS/<br>REMARKS |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <p>expected results in Table B-3.</p> <ul style="list-style-type: none"> <li>d) Enter 'control-Z' on the console to end the test.</li> <li>e) Enter '@A9B' on the console for the <u>differential</u> test.</li> <li>f) Monitor the output of each ICA channel and verify that a sine wave is being generated between channel 1 and channel 2 of the scope. Compare the peak amplitudes with the expected results in Table B-3.</li> <li>g) Enter 'control-Z' on the console to end the test.</li> </ul>                                                |                     |
| <p>A.10 Synchro output</p> <p>This test will verify the generation of synchro signals by the ICA.</p> <ul style="list-style-type: none"> <li>a) Test set-up: connect the LM to the Synchro Subsystem.</li> <li>b) Enter '@A10' on the console.</li> <li>c) When requested, enter on the console the desired output angles.</li> <li>d) Observe the angles displayed on the CRT and verify that the synchros are positioned at the correct angles. Repeat c) and d) as desired.</li> <li>e) Enter 'control-Z' on the console to end the test.</li> </ul> |                     |
| <p>A.11 Discrete output</p> <p>This test will verify the output of parallel digital data by the ICA.</p> <ul style="list-style-type: none"> <li>a) Test set-up: connect the LM to Test Panel #3.</li> <li>b) Enter '@A11' on the console.</li> <li>c) Observe the output LED's corresponding to each bit. The system will output the contents of a counter which is incremented at 1 second intervals.</li> <li>d) Enter 'R' on the console, as desired, to zero the counter.</li> <li>e) Enter 'control-Z' on the console to end the test.</li> </ul>  |                     |

| A. SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ✓ RESULTS/<br>REMARKS |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| <p>A.12 Serial output</p> <p>This test will verify the transmission of serial data by the ICA.</p> <ul style="list-style-type: none"> <li>a) Test set-up: connect the LM to the Serial Subsystem.</li> <li>b) Verify that the two small ribbon cables inside the ICA chassis are as shown in Figure B-3, configuration #1.</li> <li>c) Set RX PARITY switch on subsystem to EVEN.</li> <li>d) Enter '@A12A' on the console for the Group A test.</li> <li>e) Observe the LED display. The system will output to the display a counter which is incremented at 1 second intervals.</li> <li>f) Enter 'control-Z' on the console to end the test.</li> <li>g) Rearrange the two small ribbon cables to be as shown in Figure B-3, configuration #2.</li> <li>h) Enter 'A12B' on the console for the Group B test.</li> <li>i) Observe the LED display. The system will output to the display a counter which is incremented at 1 second intervals.</li> <li>j) Set RX PARITY switch on subsystem to ODD. Observe that the LM reports 'subsystem down' to the LMG.</li> <li>k) Return RX PARITY to EVEN.</li> <li>l) Enter '@A12B' on the console once again.</li> <li>m) Observe that the system is again operating correctly.</li> <li>n) Enter 'control-Z' on the console to end the test.</li> <li>o) Return the two small ribbon cables to the configuration shown in Figure B-3, configuration #1.</li> </ul> |                       |

| N. <b>SCRIPT - SIC TESTS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>✓ RESULTS/<br/>REMARKS</b> |
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| <p>The SIC tests will establish the operational performance of all components of the Subsystem Information Channel (SIC). The components to be tested include the nameplate interface controller, the subsystem information channel bus and two electronic nameplates. Test scripts I.1, I.2, and I.3 should have been run and the LMG CRT should have the prompt:</p> <p style="padding-left: 40px;">CMD&gt;</p> <p>displayed before preceding with these test scripts.</p> <p>N.1 SIC Test Setup<br/>(Refer to Figure B-4 )</p> <ul style="list-style-type: none"> <li>a) Disconnect the SIC cable Ø3 from the back of the LM if it is connected. Observe that the SIC CONFIGURED LED on the LM front panel is not lighted.</li> <li>b) Connect the SIC bus terminator, 3, to the J3 connector of the synchro subsystem's nameplate.</li> <li>c) Connect one of the SIC cables numbered Ø3 to P3 of the synchro nameplate and to J3 of the serial nameplate.</li> <li>d) Connect the other SIC cable Ø3 between P3 of the serial nameplate and J3 on the back of the LM.</li> </ul> <p>Observe:</p> <p style="padding-left: 40px;">As soon as the nameplates are connected to the LM the SIC CONFIGURED LED lights.</p> <ul style="list-style-type: none"> <li>e) To the CRT prompt:</li> </ul> <p style="padding-left: 40px;">CMD&gt;</p> <p style="padding-left: 40px;">enter:</p> <p style="padding-left: 40px;">@SIC (CR)</p> <p style="padding-left: 40px;">when the CRT displays:</p> <p style="padding-left: 40px;">SUBSYSTEM INFORMATION CHANNEL TEST</p> <p style="padding-left: 40px;">ENTER COMMAND AND DATA AS XX,XX,XXXX,XX...</p> <p style="padding-left: 40px;">proceed to the following tests.</p> <p>On the following tests an interpreter program will accept instructions in a format similar to the SIC commands and will</p> |                               |

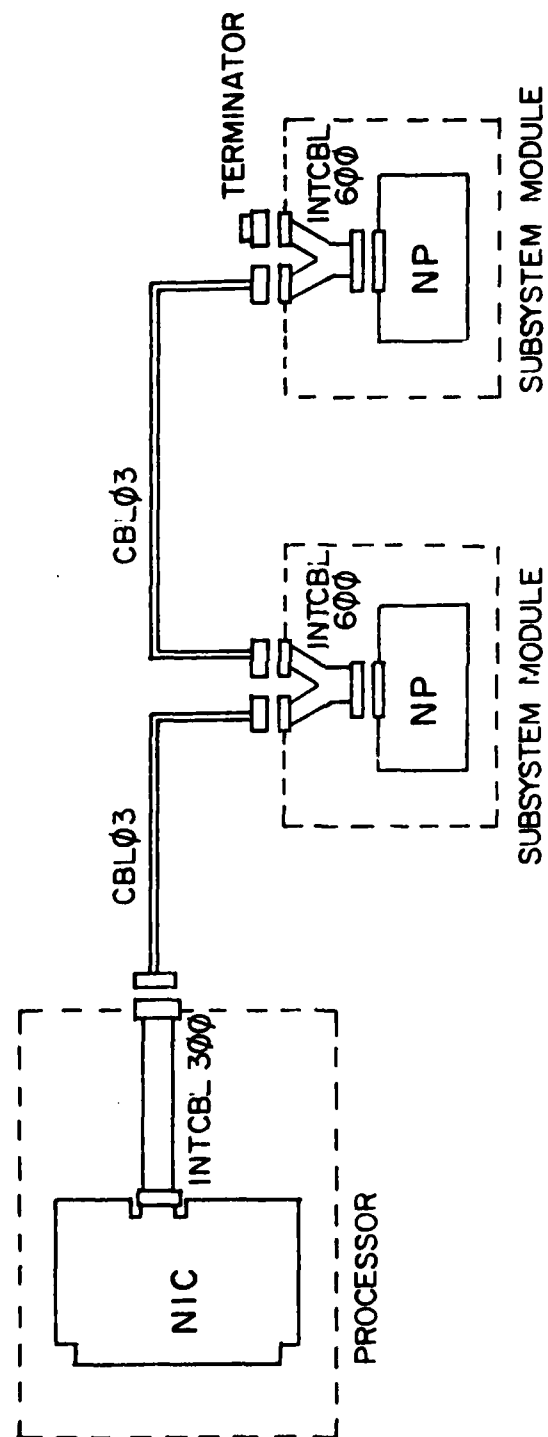


Figure B-4 SIC Bus Connections

AD-A124 620

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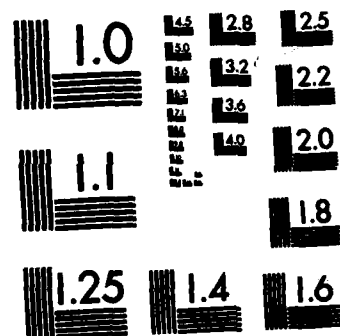
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DTIC



MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

| N. SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | RESULTS/<br>REMARKS |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <p>display the response from the nameplate as a sequence of bytes in hexadecimal notation that conforms with the formats described in Table B-4. Note that the first byte of the response is always the nameplate status byte (Figure B-5). Upon the occurrence of an error the second byte of the response will be the error diagnostic byte (Figure B-6). The definition of the nameplate's display LEDs is shown in Table B-5.</p> <p>In these scripts the symbol: (CR) at the end of each command is used to designate the carriage return key.</p> <p><b>N.2 Sequential Addressing/Address Assignment Test</b></p> <p>This test will demonstrate the capability of the SIC to address existing electronic nameplate sequentially. This test will also demonstrate the capability of the SIC to assign an arbitrary 8-bit address to each nameplate.</p> <p>a) Select the Serial NP</p> <p>Enter:</p> <p>01 (CR) (Select Level Zero NP Command)</p> <p>Observe:</p> <p>- response is:</p> <p>00 FF (FF = NP default address)</p> <p>- LED #2 of the serial NP (see Table B-5) is on indicating that NP is selected.</p> <p>b) Assign Serial NP the Address: 01</p> <p>Enter:</p> <p>05,01 (CR) (Assign NP Address Command)</p> <p>Observe response:</p> <p>00 01 (01 = newly assigned NP address)</p> <p>c) Select the Synchro NP</p> <p>Enter:</p> <p>02 (CR) (Select next NP command)</p> <p>Observe:</p> <p>- response:</p> <p>20 FF ("Last NP" status bit set)</p> <p>- LED #2 of Synchro NP is on indicating the Synchro NP is selected.</p> |                     |

TABLE B-4 NAMEPLATE COMMANDS

| COMMAND                                        |                                                                               | RESPONSE  |                                                                       |
|------------------------------------------------|-------------------------------------------------------------------------------|-----------|-----------------------------------------------------------------------|
| Instruction                                    | Data                                                                          | Status    | Data                                                                  |
| 1. Select level<br>0 NP                        | N/A                                                                           | NP status | NP address                                                            |
| 2. Select next NP                              | N/A                                                                           | NP status | Newly selected<br>NP address                                          |
| 3. Select NP by<br>address                     | NP address                                                                    | NP status | NP address                                                            |
| 4. Deselect NP                                 | N/A                                                                           | NP status | NP address                                                            |
| 5. Assign NP<br>address                        | Address to be<br>assigned                                                     | NP status | NP address                                                            |
| 6. Read selected<br>NP's address               | N/A                                                                           | NP status | NP address                                                            |
| 7. Read selected<br>NP's memory                | Number of<br>memory bytes<br>wanted (0=256)<br>starting memory<br>address     | NP status | Number of memory<br>bytes, starting<br>memory address,<br>memory data |
| 8. Write enable/<br>disable                    | Enable/disable<br>flag (Enable=1)                                             | NP status | NP address                                                            |
| 9. Write memory<br>data                        | Number of data<br>bytes, starting<br>memory address,<br>Data to be<br>written | NP status | Starting memory<br>address                                            |
| 10. Next available<br>address to be<br>written | N/A                                                                           | NP status | Address of next<br>available write<br>memory record                   |
| 11. Erase read/<br>write memory                | N/A                                                                           | NP status | NP address                                                            |
| 12. Run NP<br>diagnostic                       | N/A                                                                           | NP status | NP address                                                            |
| 13. Read NP<br>diagnostic<br>results           | N/A                                                                           | NP status | Diagnostic<br>results                                                 |
| 14. Abort selected<br>NP                       | N/A                                                                           | NP status | NP address                                                            |

|     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|
| b7  | b6  | b5  | b4  | b3  | b2  | b1  | b0  |
| CER | NPB | LNP | WRE | DLA | WED | DT1 | DT0 |

CER: Command error

NPB: NP is busy

LNP: This NP is the last NP on the SIC bus

WRE: Error occurred on last write

DLA: Deselect acknowledge

WED: Write enabled/disabled flag (enabled=1)

DT1, DT0: Indicated type of data in response as follows:

| <u>CER</u> | <u>DT1</u> | <u>DT0</u> | <u>Response Data</u>           |
|------------|------------|------------|--------------------------------|
| 0          | 0          | 0          | Nameplate Address              |
| 0          | 0          | 1          | Diagnostic Results             |
| 0          | 1          | 0          | Memory Address Only            |
| 0          | 1          | 1          | Memory Address and Memory Data |
| 1          | X          | X          | Error Diagnostic Byte          |

NOTE: A one in the associated bit position indicates condition is true.

Figure B-5 Nameplate Status Byte

| b7  | b6  | b5  | b4  | b3  | b2 | b1 | b0 |
|-----|-----|-----|-----|-----|----|----|----|
| INC | INA | INW | CER | INS | 0  | 0  | 0  |

INC: Invalid command

INA: Invalid memory address (either starting or ending address)

INW: Invalid write (erase) request, write not enabled

CER: Communication error

INS: Another NP requested while this NP is still selected

NOTE: A one in the associated bit position indicates the condition is true

Figure B-6 Error Diagnostic Byte

**TABLE B-5 NP STATUS DISPLAY**

| LED NUMBER* | STATUS DISPLAYED                         |
|-------------|------------------------------------------|
| 1           | NP is busy                               |
| 2           | This NP is selected                      |
| 3           | SIC RESP/CMD bus line level (CMD=on)     |
| 4           | SIC SERIAL DATA bus line level           |
| 5           | EPROM write strobe                       |
| 6           | EPROM simulated erase strobe             |
| 7           | SIC PRIORITY IN bus line level (High=on) |
| 8           | NP Diagnostic is executing               |

\*LED #1 is the LED closest to the edge of the nameplate board.

| N. SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ✓ RESULTS/<br>REMARKS |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| <p>d) Assign Synchro NP the Address: 02</p> <p>Enter:</p> <p>05,02 (CR) (Assign NP Address Command)</p> <p>Observe the response:</p> <p>20 02</p> <p>e) Deselect the NPs</p> <p>Enter:</p> <p>04(CR) (Deselect command)</p> <p>Observe:</p> <ul style="list-style-type: none"> <li>- response:</li> <li>28 02 ("Deselect Acknowledge"<br/>status bit set)</li> <li>- LED #2 on both NPs are off</li> </ul>                                                                                                                                                                                                                                      |                       |
| <p>N.3 Random Addressing Test</p> <p>This test will demonstrate the capability of the SIC to randomly select nameplates using the address previously assigned.</p> <p>a) Select the Synchro NP (Address: 02)</p> <p>Enter:</p> <p>03,02 (CR) (Select NP by Address Command)</p> <p>Observe:</p> <ul style="list-style-type: none"> <li>- response:</li> <li>20 02</li> <li>- Led #2 of the Synchro NP is on</li> </ul> <p>b) Deselect the Synchro NP</p> <p>Enter:</p> <p>04 (CR) (Deselect NP command)</p> <p>Observe:</p> <ul style="list-style-type: none"> <li>- response:</li> <li>28 02</li> <li>- LED #2 of Synchro NP is off</li> </ul> |                       |

| N. | SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | RESULTS/<br>REMARKS |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
|    | <p>c) Select the Serial NP (Address: 01)</p> <p>Enter:</p> <p>03,01 (CR) (Select NP by Address Command)</p> <p>Observe:</p> <p>- response:</p> <p>00 01</p> <p>- LED #2 of the Serial NP is on</p> <p>N.4 Retrieval of the Nameplate Directory Test</p> <p>This test will demonstrate the capability of the SIC to retrieve the directory of each nameplate.</p> <p>a) Read Directory of Serial NP</p> <p>Enter:</p> <p>07,19,5020 (CR) (Read memory command)</p> <p>Observe the response:</p> <p>03 19 5020</p> <p>81 DC 00 19 CF 50 40 00 17 C0 50 60 06 00 D1 56<br/>70 02 00 DA 70 00 01 00 BA</p> <p>The format of this directory is given in Figure B-7. Note that this NP ID = 81 which indicates this NP is the serial NP.</p> <p>b) Read Directory of Synchro NP</p> <p>1) Deselect NPs</p> <p>Enter:</p> <p>04 (CR) (Deselect Command)</p> <p>Observe the response:</p> <p>08 01</p> <p>2) Select the Synchro NP</p> <p>Enter:</p> <p>03,02 (CR) (Select NP by Address Command)</p> <p>Observe:</p> <p>- response:</p> <p>20 02</p> <p>- LED #2 of the Synchro NP is on</p> |                     |

|                                         |                           |
|-----------------------------------------|---------------------------|
| Hex Values in Directory:                |                           |
| NP ID                                   | 81 - Serial, 82 - Synchro |
| Directory Code                          | DC                        |
| Size of<br>Directory (bytes)            | 00<br>19                  |
| Subsystem Configuration Table Code      | CF                        |
| Configuration Table<br>Starting Address | 50<br>40                  |
| Configuration Table<br>Size (bytes)     | 00<br>17                  |
| Data Conversion Program Code            | C0                        |
| Data Program Starting<br>Address        | 50<br>60                  |
| Data Program Size<br>(bytes)            | 06<br>00                  |
| Diagnostic Program Code                 | D1                        |
| Diagnostic Program<br>Starting Address  | 56<br>70                  |
| Diagnostic Program<br>Size (bytes)      | 02<br>00                  |
| Read/Write Memory Data Code             | DA                        |
| Read/Write<br>Starting Address          | 70<br>00                  |
| Read/Write<br>Size (bytes)              | 01<br>00                  |
| Directory Checksum                      |                           |

Figure B-7 Nameplate Directory

| N.      SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | RESULTS/<br>REMARKS |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <p>3)    Read Directory of Synchro NP</p> <p>Enter:</p> <p>      07,19,5020(CR) (Read memory command)</p> <p>Observe response:</p> <p>          23 19 5020</p> <p>82 DC 00 19 CF 50 40 00 17 C0 50 60 06 00 D1 56</p> <p>70 02 00 DA 70 00 01 00 B9</p> <p>Note that this NP ID = 82, the ID of the Synchro NP.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                     |
| <p>N.5   NP Read/Write Tests</p> <p>This test will demonstrate the ability of reading and writing into the read/write memory area of an electronic nameplate. This test will also demonstrate the protection against errors resulting from trying to write on protected memory or read from non-existing memory. The memory map of an electronic nameplate is given in Figure B-8 .</p> <p>a)    Attempt Read from Non-Existing Memory</p> <p>Enter:</p> <p>      07,00,6000(CR) (Read memory address:<br/>                          6000-60FF)</p> <p>Observe response:</p> <p>      A0 40 (Error status with "invalid address"<br/>                  bit set in the error diagnostic byte)</p> <p>b)    Write into Read/Write Memory</p> <p>1)    Read All of Read/Write Memory Area First</p> <p>Enter:</p> <p>      07,00,7000(CR) (Read memory command)</p> <p>Observe response:</p> <p>          23 00 7000</p> <p>XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX</p> <p>.</p> <p>.</p> <p>.</p> <p>where each XX is a hexadecimal byte and each line on the CRT represents one 16 byte record area. The records containing all FF are unwritten as of now. The first 16 byte line</p> |                     |

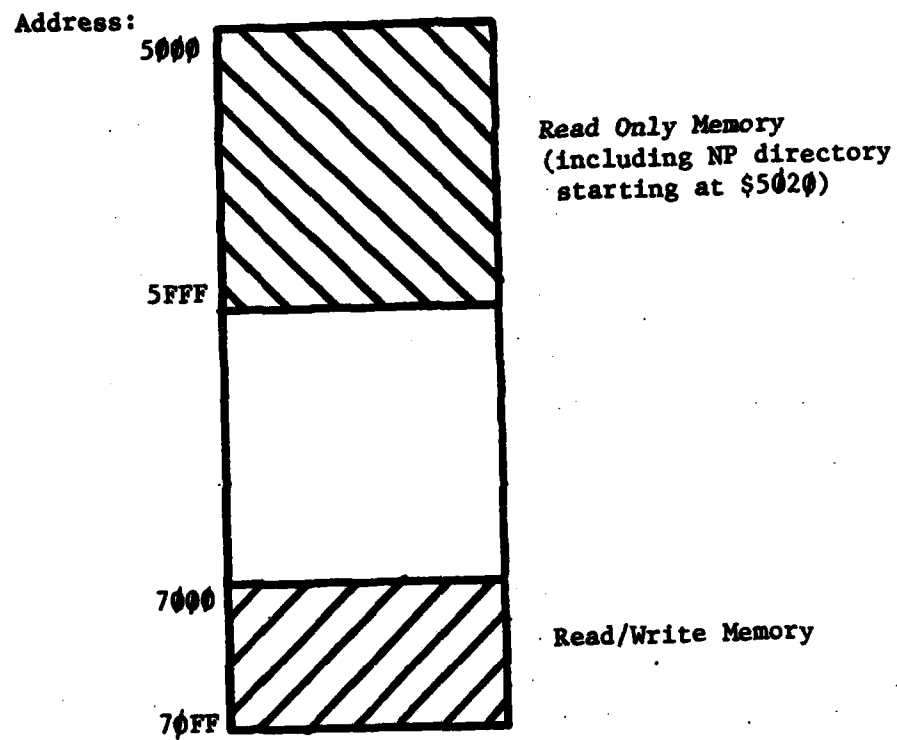


Figure B-8 Nameplate Memory Map

| N. | SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | RESULTS/<br>REMARKS |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
|    | <p>corresponds to the record with starting address: 7000; the next line is record with starting address: 7010; etc.</p> <p>Observe the address of the 1st unwritten record.</p> <p>2) Enable Write to this NP</p> <p>Enter:</p> <p>08,01 (CR) (Write enable/disable command)</p> <p>Observe response:</p> <p>24 02 ("Write enabled" status bit set)</p> <p>3) Obtain the Address of the Next Available Record</p> <p>Enter:</p> <p>0A(CR) (Next record address command)</p> <p>Observe response:</p> <p>26 XXXX</p> <p>where XXXX = record address in range: 7000-70FF. If XXXX=0000, read/write area is full, replace EPROM with an erased one. The address XXXX should be the address observed above.</p> <p>4) Write Data into NP</p> <p>Note: Upon entering this command's (CR) the synchro NP's LED #1 and #5 will pulse indicating the NP is writing data. However this pulse is fairly fast so one should be watching as the (CR) key is depressed.</p> <p>Enter:</p> <p>09,0E,XXXX,01,02,03,04,05,06,07,08,09,0A,0B,0C,0D,0E (CR)</p> <p>where XXXX = address from above next address response.</p> <p>Observe LED #1 and #5 pulse on then off.</p> <p>Observe response:</p> <p>26 XXXX</p> <p>5) Read All of the Read/Write Memory to Verify Data was Written.</p> <p>Enter:</p> <p>07,00,7000(CR) (Read memory command)</p> |                     |

| N. SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | ✓ RESULTS/<br>REMARKS |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| <p>Observe response:</p> <p>27 00 7000</p> <p>XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX</p> <p>...</p> <p>Note that the data was written in the record specified by XXXX as described above.</p> <p>c) Attempt to Write into Read Only Memory (Address: 5020)</p> <p>Enter:</p> <p>09,01,5020,22(CR) (Write data command)</p> <p>Observe response:</p> <p>A4 40</p> <p>indicating an invalid address for writing data but not for reading since this area is the NP directory read in a preceding test.</p> <p>d) Attempt to Write into Read/Write Memory when Writing is Disabled</p> <p>1) Disable Write</p> <p>Enter:</p> <p>08,00(CR) (Write enable/disable command)</p> <p>Observe response:</p> <p>20 02 ("Write enabled" status bit is cleared)</p> <p>2) Obtain the Next Available Record Address</p> <p>Enter:</p> <p>0A(CR) (Next record address command)</p> <p>Observe response:</p> <p>22 XXXX</p> <p>where XXXX is the record address.</p> <p>3) Attempt to Write Data</p> <p>Enter:</p> <p>09,02,XXXX,11,22(CR) (Write data command)</p> <p>Observe response:</p> <p>A0 20 ("invalid write" bit set in error diagnostic byte)</p> |                       |

| N. SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | RESULTS/<br>REMARKS |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <p>N.6 Nameplate Diagnostic Test</p> <p>This test will verify the execution of the nameplate diagnostic and the retrieval of the results of this test. Each nameplate is equipped with a diagnostic program that exercises the nameplate internal architecture to establish its operational status.</p> <p>a) Run NP's Diagnostic</p> <p>Note: Upon entering this command's (CR), the synchro NP's LED #1 and #8 will pulse. One should be watching them as the carriage return key is depressed.</p> <p>Enter:</p> <p>    ØC (CR) (run NP diagnostic command)</p> <p>Observe:</p> <p>    - response:</p> <p>        2Ø Ø2</p> <p>    - LED #1 and #8 pulse on then off indicating the diagnostic program is running.</p> <p>b) Read Diagnostic Results</p> <p>Enter:</p> <p>    ØD (CR) (Read diagnostic results command)</p> <p>Observe response:</p> <p>        21 8ØØX (see figure B-9)</p> <p>        where X = number of records not yet written (Ø-F)</p> <p>c) Run Diagnostic on Bad Read/Write Area</p> <p>If the read/write EPROM in the synchro NP is the one delivered from U of H, set the dip switches on the nameplate to OFF, OFF, OFF (top to bottom). This enables a read/write area which contains at least one record with an invalid checksum.</p> <p>1) Run NP Diagnostics</p> <p>Enter:</p> <p>    ØC (CR) (Run NP diagnostic command)</p> <p>Observe:</p> <p>    - response:</p> <p>        2Ø Ø2</p> <p>    - LED #1 and #8 pulse on then off.</p> |                     |

### First Result Byte

| b7  | b6   | b5 | b4   | b3 | b2   | b1   | b0 |
|-----|------|----|------|----|------|------|----|
| DCG | ROME | Ø  | RECE | Ø  | RAME | TIME | Ø  |

DGC: Diagnostic completed  
 ROME: ROM data errors  
 RECE: Read/Write records in error  
 RAME: RAM errors  
 TIME: Timer errors

### Second Result Byte

| b7   | b6   | b5   | b4   | b3 | b2 | b1  | b0 |
|------|------|------|------|----|----|-----|----|
| ROM4 | ROM3 | ROM2 | ROM1 | FR | EE | REC |    |

ROM4: ROM number 4, address (5800-5FFF)<sub>16</sub>, data errors  
 ROM3: ROM number 3, address (5000-57FF)<sub>16</sub>, data errors  
 ROM2: ROM number 2, address (4800-4FFF)<sub>16</sub>, data errors  
 ROM1: ROM number 1, address (4000-47FF)<sub>16</sub>, data errors  
 FREE REC: Number of read/write records still available

NOTE: A one in the associated bit position indicates the condition is true.

Figure B-9 NP Diagnostic Result Data Bytes

| N. | SCRIPT                                                                                                                                                                                                                                                                                                                                                                                                                              | RESULTS/<br>REMARKS |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
|    | <p>2) Read Diagnostic Results</p> <p>Enter:</p> <p>    0D (CR) (Read diagnostic result command)</p> <p>Observe response:</p> <p>    21 900X</p> <p>        where bit 4 of the first result byte indicates<br/>        some record data is in error.</p> <p>N.7 SIC Test Termination</p> <p>a) Enter:</p> <p>    X (CR)</p> <p>Observe response:</p> <p>    SIC TEST STOPPED</p> <p>    CMD&gt;</p> <p>b) Disconnect NPs from LM</p> |                     |

| T. <b>SCRIPT - TERMINATION</b>                                                                                                                                                                                                                                                                                                                                                                                             | <b>RESULTS/<br/>REMARKS</b> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| <p>T.1 Terminating at CRT #1</p> <ul style="list-style-type: none"> <li>a) Enter 'EXIT' at CRT #1 to exit the command interpreter.</li> <li>b) Enter ' BYE ' to log off the computer.</li> </ul><br><p>T.2 Terminating at CRT #2</p> <ul style="list-style-type: none"> <li>a) Enter 'control-Z' to exit the shared memory display.</li> <li>b) Enter '@TERM'.</li> <li>c) Enter 'BYE' to log off the computer.</li> </ul> |                             |

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