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I. Interconnections

- A) With power off install L/D PROM on main board in PROM socket "1" (optional). Refer to Illustration #4 of MMD-1 manual for location and orientation.
- B) Prepare interconnect cable from M/I board to your tape recorder. Refer to "specifications" and "Cassette Modern Interface" schematic in M/I manual for pin out and voltage levels necessary for proper operation.

II. Operation

- A) Storing programs into recorder. (Dumping programs)
The write into cassette routine, WCAS, is used to store on cassette from 1 to 8 256 byte blocks of memory starting at 030 000. Once the routine has been started, a key on the MMD-1 keyboard is pressed to indicate how many 256 byte blocks are to be transferred. (key "0" indicates 8 blocks.) Then after a 5 second delay the data is written onto the cassette; after another 5 second delay control is returned to KEX.

To operate the Dump program place recorder in "record" mode, hit a reset, key 001 hi, 025 low then depress the "G" key, then the number of 256 blocks to be dumped.
- B) Loading programs from recorder.
The read from cassette routine, RCAS, Reads data from the cassette and stores it in successive memory locations on the M/I board, starting at 030 000. As the data is input it is displayed on the MMD-1's LEDs.

To operate the loader program hit a reset, key 001 hi 000 low. Place recorder in "PLAY" mode and listen for constant tone, then depress the "G" key. Pay attention to the LED displays on the MMD-1. When they stop flickering depress the reset key.

III. PROM LOAD/DUMP PROGRAM (Tychon Assembler V-1)

This is a listing of the Loader/Dump program when resident in the main board PROM (PROM "1").

/ 7-13-76 MMD-1 M-I Routines **VER 1**
/ THE FOLLOWING ROUTINES ARE USED WITH THE
/ MMD-1 MEMORY-INTERFACE BOARD

/ THE READ FROM CASSETTE ROUTINE, RCAS, READS
/ DATA FROM THE CASSETTE AND STORES IT IN
/ SUCCESSIVE MEMORY LOCATIONS ON THE M-I
/ BOARD, STARTING AT 030 000. AS THE DATA IS INPUT
/ IT IS DISPLAYED ON THE MMD-1'S LEDS.

001 000

001 000 041	RCAS,	LXIH	/ INITIALIZE THE MEMORY POINTER
001 001 000		000	
001 002 030		030	
001 003 333		IN	/ CLEAR FLAGS IF NECESSARY
001 004 022		022	
001 005 315	NEXTIN,	CALL	/ INPUT A BYTE OF DATA
001 006 103		CASIN	
001 007 001		0	
001 010 167		MOVMA	/ STORE THE DATA
001 011 323		OUT	/ OUTPUT DATA AND ADDRESS
001 012 002		002	
001 013 175		MOVAL	
001 014 323		OUT	
001 015 000		000	
001 016 174		MOVAH	
001 017 323		OUT	
001 020 001		001	
001 021 043		INXH	/ INCREMENT THE MEMORY POINTER
001 022 303		JMP	/ JUMP BACK FOR MORE DATA
001 023 005		NEXTIN	
001 024 001		0	

/ THE WRITE ONTO CASSETTE ROUTINE, WCAS, IS USED
/ TO STORE ON CASSETTE FROM 1 TO 8 256 BYTE BLOCKS
/ OF MEMORY STARTING AT 030 000. ONCE THE ROUTINE
/ HAS BEEN STARTED, A KEY ON THE MMD-1 KEYBOARD IS
/ PRESSED TO INDICATE HOW MANY 256 BYTE BLOCKS ARE
/ TO BE TRANSFERED. (KEY "0" INDICATES 8 BLOCKS.)
/ THEN AFTER A 5 SECOND DELAY THE DATA IS WRITTEN
/ ONTO THE CASSETTE; AFTER ANOTHER 5 SECOND DELAY
/ CONTROL IS RETURNED TO KEX.

001 025 041	WCAS,	LXIH	/ INITIALIZE THE MEMORY POINTER
001 026 000		000	
001 027 030		030	
001 030 315	KEY,	CALL	

001	031	315		315	/ KEX KEYBOARD INPUT ROUTINE
001	032	000		000	
001	033	376		CPI	/ CHECK FOR 0-7
001	034	010		010	
001	035	322		JNC	/ IF NOT, JUMP BACK
001	036	030		KEY	
001	037	001		0	
001	040	267		ORAA	/ S SET FLAGS
001	041	302		JNZ	
001	042	046		NOT0	
001	043	001		0	
001	044	306		ADI	/ ADD 8 IF ZERO KEY
001	045	010		010	
001	046	204	NOT0,	ADDH	/ COMPUTE STOPPING ADDRESS
001	047	127		MOVDA	/ SAVE IT IN REG D
001	050	315		CALL	/ DELAY FOR 5 SECONDS
001	051	130		FIVSEC	
001	052	001		0	
001	053	176	MORE,	MOVAM	/ GET DATA FROM MEMORY
001	054	315		CALL	/ OUTPUT TO CASSETTE
001	055	114		CASOUT	
001	056	001		0	
001	057	323		OUT	/ DISPLAY DATA AND ADDRESS
001	060	002		002	
001	061	175		MOVAL	
001	062	323		OUT	
001	063	000		000	
001	064	174		MOVAH	
001	065	323		OUT	
001	066	001		001	
001	067	043		INXH	/ INCREMENT THE MEMORY POINTER
001	070	174		MOVAH	
001	071	272		CMPD	/ CHECK FOR END OF LOOP
001	072	302		JNZ	/ JUMP BACK IF MORE DATA TO BE OUTPUT
001	073	053		MORE	
001	074	001		0	
001	075	315		CALL	/ DELAY 5 SECONDS
001	076	130		FIVSEC	
001	077	001		0	
001	100	303		JMP	/ RETURN TO KEX
001	101	070		070	
001	102	000		000	

/ THE CASSETTE INPUT SUBROUTINE, CASIN, WAITS
 / FOR DATA TO BE RECEIVED BY THE CASSETTE
 / UART, AND INPUTS THE DATA.

001	103	333	CASIN,	IN	/ INPUT STATUS BITS
001	104	023		023	
001	105	037		RAR	
001	106	322		JNC	/ JUMP BACK IF NO DATA AVAILABLE YET
001	107	103		CASIN	

```
001 110 001
001 111 333
001 112 022
001 113 311
```

```
0
IN      / INPUT DATA
022
RET
```

```
/ THE CASSETTE OUTPUT SUBROUTINE, CASOUT, WAITS
/ IF THE TRANSMITTER HOLDING REGISTER IS FULL,
/ AND THEN OUTPUTS THE DATA
```

```
001 114 365 CASOUT,
001 115 333
001 116 023
001 117 346
001 120 004
001 121 312
001 122 115
001 123 001
001 124 361
001 125 323
001 126 022
001 127 311
```

```
PUSHPSW / SAVE DATA
IN      / INPUT STATUS BITS
023
ANI
004
JZ      / JUMP IF TRANSMISSION REG. NOT EMPTY
CASOUT+1
0
POPPSW  / RESTORE DATA
OUT     / OUTPUT DATA
022
RET
```

```
/ THE FIVE SECOND DELAY SUBROUTINE, FIVSEC, DELAYS
/ FOR FIVE SECONDS BY REPEATEDLY CALLING THE
/ 10 MSEC DELAY IN KEX.
```

```
001 130 365 FIVSEC,
001 131 305
001 132 001
001 133 364
001 134 001
001 135 315
001 136 277
001 137 000
001 140 013
001 141 170
001 142 261
001 143 302
001 144 135
001 145 001
001 146 301
001 147 361
001 150 311
```

```
PUSHPSW / SAVE REGISTERS
PUSHB
LXIB    / LOAD COUNT
364
001
CALL    / KEX TIMEOUT SUBROUTINE
277
000
DCXB    / DECREMENT COUNT
MOVAB
ORAC
JNZ     / JUMP IF COUNT IS NOT ZERO
FIVSEC+5
0
POPB    / RESTORE REGISTERS
POPPSW
RET
```

```
/ THE TELETYPE INPUT SUBROUTINE, TTYIN, WAITS FOR
/ A CHARACTER TO BE RECEIVED BY THE TTY UART,
/ INPUTS THE CHARACTER, MASKS OUT THE PARITY BIT,
/ AND THEN ECHOS IT.
```

```

001 151 333  TTYIN,      IN      / INPUT STATUS BITS
001 152 021      021
001 153 037      RAR
001 154 322      JNC      / JUMP BACK UNTIL A CHARACTER IS RECEIVED
001 155 151      TTYIN
001 156 001      0
001 157 333      IN      / INPUT THE CHARACTER
001 160 020      020
001 161 346      ANI      / MASK OUT THE PARITY BIT
001 162 177      177

```

/ THE TELETYPE OUTPUT SUBROUTINE, TTYOUT, WAITS
/ IF THE TRANSMISSION HOLDING REGISTER IS NOT
/ EMPTY, AND OUTPUTS THE CHARACTER.

```

001 163 365  TTYOUT,  PUSHPSW / SAVE THE CHARACTER
001 164 333      IN      / INPUT STATUS BITS
001 165 021      021
001 166 346      ANI
001 167 004      004
001 170 312      JZ      / JUMP IF TRANSMITTER REG. NOT EMPTY
001 171 164      TTYOUT+1
001 172 001      0
001 173 361      POPPSW / RESTORE THE CHARACTER
001 174 323      OUT      / OUTPUT THE CHARACTER
001 175 020      020
001 176 311      RET

```

/ THE PAPER TAPE READER INPUT SUBROUTINE, RDRIN,
/ TURNS ON THE READER RELAY CIRCUIT, WAITS FOR
/ DATA TO BE RECEIVED, AND INPUTS IT.

```

001 177 323  RDRIN,  OUT      / TURN READER RELAY ON
001 200 021      021
001 201 333      IN      / INPUT STATUS BITS
001 202 021      021
001 203 037      RAR
001 204 322      JNC      / JUMP BACK IF NO DATA AVAILABLE
001 205 201      RDRIN+2
001 206 001      0
001 207 333      IN      / INPUT DATA
001 210 020      020
001 211 311      RET

```

```

RCAS  = 001 000  NEXTIN = 001 005  WCAS  = 001 025  KEY   = 001 030
NOT0  = 001 046  MORE   = 001 053  CASIN = 001 103  CASOUT = 001 114
FIVSEC = 001 130  TTYIN  = 001 151  TTYOUT = 001 163  RDRIN  = 001 177

```

ERRORS DETECTED = 000