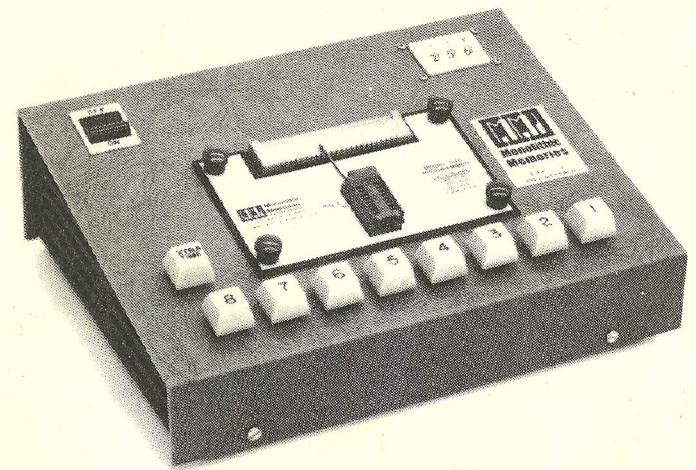


# MONOLITHIC MEMORIES INC

## MODEL 535 PROGRAMMER



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## I. INTRODUCTION

### A. General

The Model 535 programmer is designed to blow the fusible nichrome links of Monolithic Memories, Inc. (MMI) programmable read only memories (P.ROMS). No other device types can be programmed. The unit is manually operated by selecting the decimal word number to be programmed on the 3 digit thumbwheel switch on the front panel and depressing the front panel output switches numbered 1 to 8 where a TTL low level is required in the P.ROM.

MMI P.ROMS are initially shipped with highs in all locations. When a fusible link is opened by programming, the P.ROM output goes low and the light in the cap of the pushbutton switch will light indicating successful programming. The speed of manual programming is limited only by the operator. Fusing 1024 links will normally take about 20 minutes.

Optional copying boards are available for the Model 535 which permit automatic duplication of the contents of one P.ROM or read only memory into another P.ROM in several seconds. These boards are usually required for production requirements when several of one pattern is required and time or cost does not permit manual programming of each device. The copying boards also permit comparison of two devices to check that the stored patterns are the same and permit checking that an unprogrammed P.ROM is actually unprogrammed (blank checking). An interface for remote equipment is also provided.

### B. Program Boards

In order to handle the different P.ROM types with one mainframe, the 535 uses program boards. Boards are available for all MMI P.ROMS. The boards plug in and permit rapid change among part types.

### C. Copying Boards

Copying boards are available for all MMI P.ROMS. They derive the required voltages from the 535 mainframe and plug into the same connector as the manual program boards.

## II. FIRST TIME OPERATION — Manual Program Boards

- A. The cover of the 535 can be easily removed by sliding the cover, once it is in the full open position, to the right when facing the unit. The bottom plate that the cover is hinged to should also be removed. The bottom cover attachment plate is removed by unscrewing the four rubber feet, removing the bottom plate, and then replacing the rubber feet.
- B. Turn off the power switch located in the upper left corner of the chassis and insert a program board by unscrewing the four red caps and plugging the program board into the connector. The replace the four red caps.
- C. Turn on power and plug in the line cord. The light in the power on/off switch should light.

- D. Insert a device type with the same part number that is listed on the program board in the green socket. Note that pin 1 is in the upper left hand corner of the green socket. The socket is open when the lever is in the upright position and closed when the lever is pushed down.
- E. Dial in word 000 on the thumbwheel switch in the upper right hand corner.
- F. You are now ready to begin programming. Check the truth table of the device and depress the appropriate yellow output button and hold it down until the light in the yellow cap is lit wherever a TTL low level output is desired in the part. (If the light does not light see "G" below) MMI P.ROMS are shipped with all outputs high in all locations. Only one output at a time should be programmed to avoid inadvertently programming more than one word at a time.

When word 000 is complete advance the word limit switch to word 001 and repeat step F. Continue advancing the word limit switch until all desired locations have been programmed.

#### G. Hard to Program Units

If the light in the cap does not come on as the switch is depressed, depress the "XTRA TIME" switch on the left of the output switches while holding the output switch down. Both must be depressed at the same time. The extra time switch applies longer pulse widths and increments the programming voltage. Hold the extra time and the appropriate output depressed until the light in the output cap comes on or until the light in the cap of the "XTRA TIME" switch comes on. When the "XTRA TIME" lights up the programmer has "given up" on the P.ROM and the bit can be considered unprogrammable. Repeated programming attempts will not damage good P.ROMS.

#### H. Automatic DC Testing

While the unit is sitting in the closed socket with no output buttons depressed, it is having several DC tests performed. If the output lights blink they are informing you that the status of the outputs change when the voltage is varied from a  $V_{CC}$  of 4.20 V to 5.50 V and the part should be rejected since the blinking output will not work over the commercial voltage and temperature range.

### III. First Time Operation — Copying Boards

- A. The 535-A1, 535-A2, and 535-A3 copy boards permit the contents of a master device to be automatically copied into an unprogrammed device.
- B. Blank Checking

The copying boards can check that an unprogrammed device is unprogrammed by plugging in the 535A-X board putting it in an auto verify mode on the slide switch and select the word limit on those boards with a limit switch, 256 words for the 5300/6300, 5301/6301 and 5335/6335, and 512 words for the 5305/6305, 5306/6306, 5340/6340.

Then insert an unprogrammed device in the right socket and leave the master socket open. Press start, if the go light comes on the device is unprogrammed, if the no go comes on the device is programmed.

#### C. Copying

Place the master device in the left socket and an unprogrammed device in the right socket. Select the copy position on the slide switch, select a word limit on those boards with a word limit switch, and press start. The busy light indicator that the programmer is programming. When the device is complete the go light will light. If the unit cannot be programmed a no go will be indicated and start may be pushed again if desired.

The three digit thumbwheel switch is deactivated in the copying mode. The pulse width and voltage are automatically incremented in the copying mode similar to depressing the "XTRA TIME" switch in manual duplication.

#### D. Auto Verify

The auto verify mode permits checking that two devices have the same stored data. Select the auto verify position of the slide switch, a word limit if applicable and push start. Two devices which match will give a "go" indication.

### ELECTRICAL SPECIFICATIONS

#### Model 535 Mainframe

- |  |  |
|--|--|
| 1. Line Voltage  | 105 to 125 VAC, 50/60 Hz<br>or 200 to 250 VAC, 50/60 Hz<br>with specially modified units.<br>Maximum line current 0.125 amperes.                         |
| 2. P.ROM Verification Voltage  | 4.20 $\pm$ 0.10 VDC  |
| 3. P.ROM $V_{CC}$ Programming Voltage                                      | 5.50 $\pm$ 0.10 VDC  |
| 4. Maximum P.ROM $I_{CC}$ Current Available                                | 300 mA   |
| 5. $V_{CC}$ Rise Time  | 5 $\mu$ s max between 4.30 and 5.40 V  |
| 6. P.ROM Verification Sink Current   | 12 mA $\pm$ 2 mA at $V_{OL} = 0.40$ V  |
| 7. Maximum Permissible P.ROM Output Leakage at $V_{CC} = 5.5$ VDC and 25°C | 80 $\mu$ A   |
| 8. Maximum Permissible Verification $V_{OL}$ at 12 mA Sink                 | 1.0 VDC  |
| 9. I/O Levels at PROM Address Pins   | TTL HIGH (2.40 VDC min.<br>5.50 VDC max.)<br>TTL LOW (-0.50 VDC Min.<br>0.80 VDC max.)   |
| 10. Programming Voltage Pulse  | LOW LEVEL = 5.0 VDC (Typ)<br>HIGH LEVEL = 34.0 $\pm$ 1 VDC<br>RISE TIME = 40 $\pm$ 20 $\mu$ s<br>DUTY CYCLE = 23% TYP<br>MAX. AVAILABLE CURRENT = 250 mA |

### PROGRAM BOARDS SPECIFICATIONS

When the extra time is depressed the pulse amplitude is automatically incremented 2 VDC every 2 pulses until the maximum voltage allowed is reached.

PARAMETER	BOARD TYPE		
	535-1	535-2 5300/6300 5301/6301 5305/6305 5306/6306 5309/6309	535-3
P.ROM Types Handled	5330/6330 5331/6331		5335/6335 5340/6340
Program Pin Amplitude	NA	28 ± 1 VDC	NA
Program Pin Rise Time	NA	100 ± 30 μs	NA
Program Pin Duty Cycle (TYP)	20%	20%	20%
Extra Time Program Pin Amplitude	34 ± 1 VDC	34 ± 1 VDC	34 ± 1 VDC
Extra Time Program Pin Rise Time	100 ± 30 μs	100 ± 30 μs	100 ± 30 μs
Number of Pulses Extra Time Being Lighted	6-8	6-8	6-8
Output Programming Pulse Amplitude	20 ± 1 VDC	20 ± 1 VDC	20 ± 1 VDC
Output Programming Pulse Rise Time	30 ± 20 μs	30 ± 20 μs	30 ± 20 μs
Output Programming Pulse Width	2 ± .5 ms	2 ± .5 ms	2 ± .5 ms
Output Duty Cycle (TYP)	20%	20%	20%
Extra Time Output Programming Amplitude	27 VDC max.	27 VDC max.	25 VDC max.
Extra Time Output Programming Rise Time	30 ± 20 μs	30 ± 20 μs	30 ± 20 μs
Extra Time Output Programming Pulse Width	200 ± 50 ms	200 ± 50 ms	200 ± 50 ms
Extra Time Duty Cycle (TYP)	20%	20%	20%
Min. Current Available for Program Pin and Output Pin	150 mA	250 mA	150 mA

### COPYING BOARD SPECIFICATIONS

PARAMETER	COPYING BOARD TYPE		
	535-A1	535-A2	535-A3
P.ROM Types Handled	5330/6330 5331/6331	5300/6300 5301/6301 5305/6305 5306/6306	5335/6335 5340/6340
Program Pin Programming Amplitude	NA	Pulses #1, 2, 3 28 V ± 1 VDC Pulses #4, 5 30 ± 1 VDC Pulses # 6, 7 32 ± 1 VDC Pulses #8, 9 34 ± 1 VDC	NA
Program Pin Rise Time	NA	40 ± 20 μs	NA
Program Pin Duty Cycle	NA	20%	NA
Output Pin Programming Rise Time	30 ± 20 μs	30 ± 20 μs	30 ± 20 μs
Output Pin Programming Duty Cycle	20% TYP	20% TYP	20% TYP
Output Pin Programming Amplitude	20 ± 1 VDC	20 ± 1 VDC	20 ± 1 VDC
Pulses 1, 2, 3	22 ± 1 VDC	22 ± 1 VDC	22 ± 1 VDC
Pulses 4, 5	24 ± 1 VDC	24 ± 1 VDC	24 ± 1 VDC
Pulses 6, 7	26 ± 1 VDC	26 ± 1 VDC	25 ± 1 VDC
Pulses 8, 9			
Program Pin (or enable) and Output Pin Pulse Width During Programming			
Pulse 1	100 ± 25 μs	100 ± 25 μs	100 ± 25 μs
Pulses 2, 3	2.0 ± .5 ms	2.0 ± .5 ms	2.0 ± .5 ms
Pulses 4, 5	2.0 ± .5 ms	2.0 ± .5 ms	2.0 ± .5 ms
Pulses 6, 7	200 ± 50 ms	200 ± 50 ms	200 ± 50 ms
Pulses 8, 9	200 ± 50 ms	200 ± 50 ms	200 ± 50 ms
Total Programming Current for Program Pin and Output Pin	150 mA min.	250 mA min.	150 mA min.

## MAINTENANCE

### FUSES

A line voltage fuse is mounted on the logic board inside the unit. It can be replaced through the program board hole without taking apart the chassis. Unplug the unit before changing the fuse.

### SOCKET

The green sockets last about 7000 insertions. When the contacts do not close to less than 0.030" spacing, the socket must be replaced to avoid intermittent programming. The usual wear out mechanism is a small wear plate inside the socket. The socket can be disassembled by removing the screws on the underneath side of the socket. Replacements are available from MMI or Textool Inc.

### POWER SUPPLIES

The 535 has thermally limited power supplies. Should the interface to the P.ROM at the socket be a short, the power supplies will shut down and automatically restore the voltages a few seconds after the short is removed.

### BULBS

The bulbs in the caps of the yellow front panel switches can be changed by pulling off the yellow cap and removing the bulb. The bulbs are 28 VDC at 40 mA (IEE 7387 subminiature). After the bulb is replaced, the yellow cap must be keyed into place so that it will not rotate. This is accomplished by turning off power and inserting a small screw driver or pointed object into the slot in between the white movable shaft which accepts the bulb and the green case of the switch to stop the switch from depressing and then pushing on the cap. The bulb in the ON/OFF Switch is 28 VDC at 40 mA. The unit must be disassembled to replace this bulb.

The bulbs in the output switches can be tested without removal by shorting the output to ground at the green socket.

For example to test output 1 with a 535-2 board put a jumper between pins 12 and 8 of the socket (O<sub>1</sub> to ground). The XTRA time light should light up within 10 seconds after it and an output are depressed at the same time under programming conditions.

## FUNCTIONAL DESCRIPTION OF PROGRAMMER LOGIC

### A. GENERAL

The programmer circuitry is partitioned into two parts which consist of the main logic board and the program card.

### B. MAIN LOGIC BOARD

The main logic board contains three power rectifiers, one each for 5 V, 24 V, and 36 V power supplies; 8 output threshold level detectors and indicators, 8 output data switches for data entry, an extra time switch and end of voltage increment indicator light; two digitally programmable selectable oscillators; three digitally programmable power supplies to generate the power pulse waveform required for program and verify; and a Binary coded decimal to binary converter to generate the address for the P.ROM. A line fuse is also provided.

### C. 5 V LOGIC SUPPLY

The five volt logic power supply is generated by rectifying the 8 voltage AC output winding off the transformer and regulated by the LM309K.

### D. 24 V POWER SUPPLY

The 24 volt power is generated by rectifying the 23 VAC winding of the transformer and regulated by the F7824 which is located on the chassis.

E. The 36 V power supply generated by rectifying the 29 VAC winding of the transformer and regulated by the stack which consists of F7812 and the 24 V regulators.

### F. LOAD CURRENT POWER SUPPLY

The load current power supply is generated by (3J)  $\mu$ A 723 and it is controlled by the verify oscillator, the supply is adjusted for 12 mA load current. During leakage current detection 1/2 cycle of the oscillator, the supply is turned off.

### G. DUP V<sub>CC</sub> POWER SUPPLY

Dup V<sub>CC</sub> power supply generates (3H)  $\mu$ A 723 and it is controlled by both the verify and program oscillators. During V<sub>OL</sub> test in either programming or verify, the voltage level is set at 4.2 V  $\pm$  0.10 V. During programming the supply voltage level is pulsed to 5.5 V  $\pm$  0.1 V. During I<sub>OL</sub> test, the supply level is also pulsed to 5.5 V  $\pm$  0.1 V. The voltage levels during program and leakage test can be remote programmed independent of the program card. The 4.2 V level is fixed and can be adjusted internally.

### H. PROGRAM PULSE GENERATOR

IC (3L) the  $\mu$ A 723 and its associated circuitry forms a remote programmable pulse generator. The amplitude is set by a resistor in the program card, furthermore the amplitude can be digitally incremented with the volt per step programming resistors located on the program card also.

### I. BINARY CODED DECIMAL TO BINARY CONVERTER

The address is generated by a three digit thumbwheel switch in binary coded decimal form and is converted into binary form. The binary coded decimal to binary conversion is accomplished by adding the weighted code with 7483 adders.

### J. PROGRAM CARD

The program card routes the appropriate addressing and programming pulses to the proper I/O pins of the P.ROM and also hard wire program the digital and analog circuits to deliver the required programming pulse required for the P.ROM.

### WIRE LIST

#### MODEL 535 PROGRAMMER 115 VAC WIRING

FROM	TO
J1	T1 Red Wire 1 1
J1 1	T1 Blue Wire 1
J1 2	T1 Blue Wire 2
J1 4	T1 Orange Wire 1
J1 5	Lamp Wire 1 and 7824 Reg. Pin 3
J1 6	T1 Black and Green-black wire
J1 6	Power On/Off switch Side B
J1 A	Chassis
J1 B	T1 Red Wire 2
J1 C	7824 Reg. Pin 1
J1 D	T1 Orange Wire 2
J1 E	T1 Black-yellow and Red-black wire
J1 F	Switch Side B
Chassis	Line Cord Green Wire
Switch	Line Cord Black Wire
Switch	Line Cord Red Wire

### PROGRAM BOARD TO MAIN LOGIC INTERFACE I/O

SIGNAL	PIN	FUNCTION
1	S8	26 BCD to Binary Converter V <sub>CC</sub>
2	S7	27 Manual Program Power
3	S6	28 Program Pulse Generator Current Limit
4	S5	29 Power to Program Pin Driver Switch
5	S4	30 Manual Start Program
6	S3	31 Program/Verify
7	S2	32 A <sub>1</sub>
8	S1	33 A <sub>3</sub>
9	DUP 8	34 Increase Time
10	DUP 7	35 Program Osc. Out
11	DUP 6	36 Power Into Output Pin Driver Switch
12	DUP 5	37 Program Pin
13	DUP 4	38 Manual or Auto Mode Output Pin Driver Switch Out
14	DUP 3	39 Program Dup V <sub>CC</sub> Set
15	DUP 2	40 A <sub>4</sub>
16	DUP 1	41 A <sub>5</sub>
17	DUP V <sub>CC</sub> Set	42 A <sub>6</sub>
18	DUP V <sub>CC</sub>	43 Won't Program
19	Ground	44 A <sub>7</sub>
20	+5 V	45 A <sub>0</sub>
21	+24 V	46 A <sub>8</sub>
22	Load Current Set	47 Program Voltage Increment Level 2
23	A <sub>2</sub>	48 Verify Osc. Out
24	Program Voltage lower limit set	49 I <sub>OH</sub> V <sub>CC</sub> Set
25	Pulse Power Generator Current Sense	50 Program Voltage Increment Level 1

FROM DIP SOCKET RIBBON CABLE	TO, B THUMBWHEEL SWITCH	COLOR
1	H8	1st Brown
2	H4	1st Red
3	H2	1st Green
4		
5	H1	White
6	T4	2nd Brown
7	T2	2nd Orange
8	T8	2nd Yellow
9	T1	2nd Red
10	Common	Black
11	U8	Gray
12	U2	1st Blue
13	U4	1st Yellow
14	U1	1st Red

## REMOTE OPERATION

### General Description

The Model 535 has been designed to be easily interfaced with remote equipment. Only three signal types are required. First a reset pulse (for initialization only), second data to be programmed or verified, and finally a start pulse. The programmer automatically keeps track of the word number and advances only on a success. All programmer switches and status information are available in the remote mode.

When the 535A-X copier is connected with the remote equipment, pin 29 must be grounded to active the copier to operate. In the remote mode, the operator picks either the auto verify or copy master mode. The programmer upon receipt of a remote reset lights the busy light and then makes a success or no-go decision and awaits a remote start signal for each new word. The remote reset is wired across the programmer start button so the remote equipment start can be reset by depressing the start button if the busy signal is not required. The word number is available in binary to the remote equipment.

Success, binary address, no-go, busy, acknowledge and word limit signals are available to the remote equipment to use as required.

### TIMING FOR REMOTE OPERATION

#### 1. Inputs Required from Remote Equipment

##### A. Loading

The start pulse drives one 7400L series TTL gate and a 10K resistor to 5 VDC. The reset and data in lines (Ext./M) drive one 7400 series TTL gate and a 10K resistor to 5 VDC.

##### B. Timing (See Figure 1)

The data in lines can come up to 50  $\mu$ s after the remote start or reset. They must remain stable until a success or no-go is received. A second remote start should not be sent unless a success or no-go has been received. A busy signal is available for status information. The reset (initialization pulse) should be sent at the same time with the first remote start pulse or not sent the first remote start at all because the reset pulse will also start the programmer.

##### C. Levels Required from Remote Inputs

Data In Lines (Ext./M) and Reset Start Pulse

$$2\text{ V} < V_{IN} \text{ High} < 5.5\text{ V} \quad I_{IN} \text{ Max. at } 2.4\text{ V} = 100\ \mu\text{A}$$

$$0\text{ V} < V_{IN} \text{ Low} < 0.80\text{ V} \quad I_{IN} \text{ Max. at } 0.4\text{ V} = -2.2\text{ mA}$$

#### 2. Outputs Available from Programmer

##### A. Drive Capability

**Addresses** — The word number of the programmer is present in binary on the remote connector. These lines are capable of driving one 7400 Series TTL load maximum. The drive voltages and currents are shown below:

$$2.4\text{ V} < V_{OUT} \text{ High} < 5.0\text{ V} \quad I_{OUT} \text{ max. at } 2.4\text{ V} = 200\ \mu\text{A}$$

$$0\text{ V} < V_{OUT} \text{ Low} < 0.5\text{ V} \quad I_{SINK} \text{ max. at } 0.5\text{ V} = 1.5\text{ mA}$$

**Success, No-Go, Busy, No-Go Latches, and Acknowledge** — These lines are driven from a 7400L series TTL gate and can drive one 7400 series load or 10 7400L series gates. The drive voltages and currents are as follows:

$$2.4\text{ V} < V_{OUT} \text{ High} < 5.5\text{ V} \quad I_{OUT} \text{ Max. at } 2.4\text{ V} = 100\ \mu\text{A}$$

$$0\text{ V} < V_{OUT} \text{ Low} < 0.3\text{ V} \quad I_{SINK} \text{ Max. at } 0.3\text{ V} = -2\text{ mA}$$

##### B. Timing (See Figure 1)

Upon receipt of a low active reset or start pulse (100 ns to 200 ns wide) on pin 10 or pin 7 of the remote connector, the programmer will send a low active acknowledge pulse, about 40 ns later, on pin 2. The busy signal on Pin 1 will go high on the first clock pulse and stay high until a success or no-go decision is made by the programmer.

A low active success pulse (Pin 40) which is about 450 ns wide is available to the remote equipment.

A latched high active no-go signal is available at Pin 4. The word number is advanced automatically in the case of a success pulse. The present word number is retained in the case of a no-go. The word number in the case of a success is advanced at the same time as the pulse and about the same time as the busy latch is cleared. The address is stable 2  $\mu$ s after the trailing edge of the — advance word pulse.

The remote equipment can send another start (Pin 7) in the case of a no-go (the start button on the copier should not be activated, since the start button function is also a reset).

**Precautions** — The master must be removed from the master socket during remote operation to avoid OR-tying of the master and remote outputs and overloading the address lines.

# 535A COPIER INTERFACE I/O

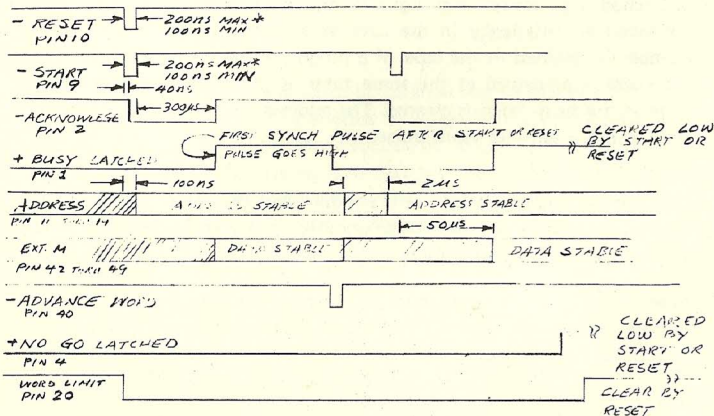
## INPUT OUTPUT

1. + Busy	X
2. - Acknowledge	X
3.	c28. Ground
4. + No-Go	X
5.	29. - Remote
6.	30.
7. - Remote Start	X
8. - Auto Verify	X X
9. + Remote	X X
10. - Reset	X X
11. A <sub>8</sub>	X
12. A <sub>7</sub>	X
13. A <sub>6</sub>	X
14. A <sub>5</sub>	X
15. A <sub>4</sub>	X
16. A <sub>3</sub>	X
17. A <sub>2</sub>	X
18. A <sub>1</sub>	X
19. A <sub>0</sub>	X
20. Word Limit	X
21. A <sub>9</sub>	X
22. A <sub>10</sub>	X
23. B <sub>2</sub>	X
24. B <sub>1</sub>	X
25. B <sub>0</sub>	X

## INPUT OUTPUT

26.	X
27.	X
28. Ground	X
29. - Remote	X
30.	X
31. EXT S1	X
32. EXT S2	X
33. EXT S3	X
34. EXT S4	X
35. EXT S5	X
36. EXT S6	X
37. EXT S7	X
38. EXT S8	X
39.	X
40. - Advance Word	X
41.	X X
42. EXT M1	X X
43. EXT M2	X X
44. EXT M3	X X
45. EXT M4	X X
46. EXT M5	X X
47. EXT M6	X X
48. EXT M7	X X
49. EXT M8	X X
50.	X X

## REMOTE TIMING



\* Maximum Pulse Width Applies to External Equipment that Requires A Busy Status Signal.

MONOLITHIC MEMORIES INC  
MODEL 535 PROGRAMMER LOGIC ASSEMBLY  
MMI 10017C

