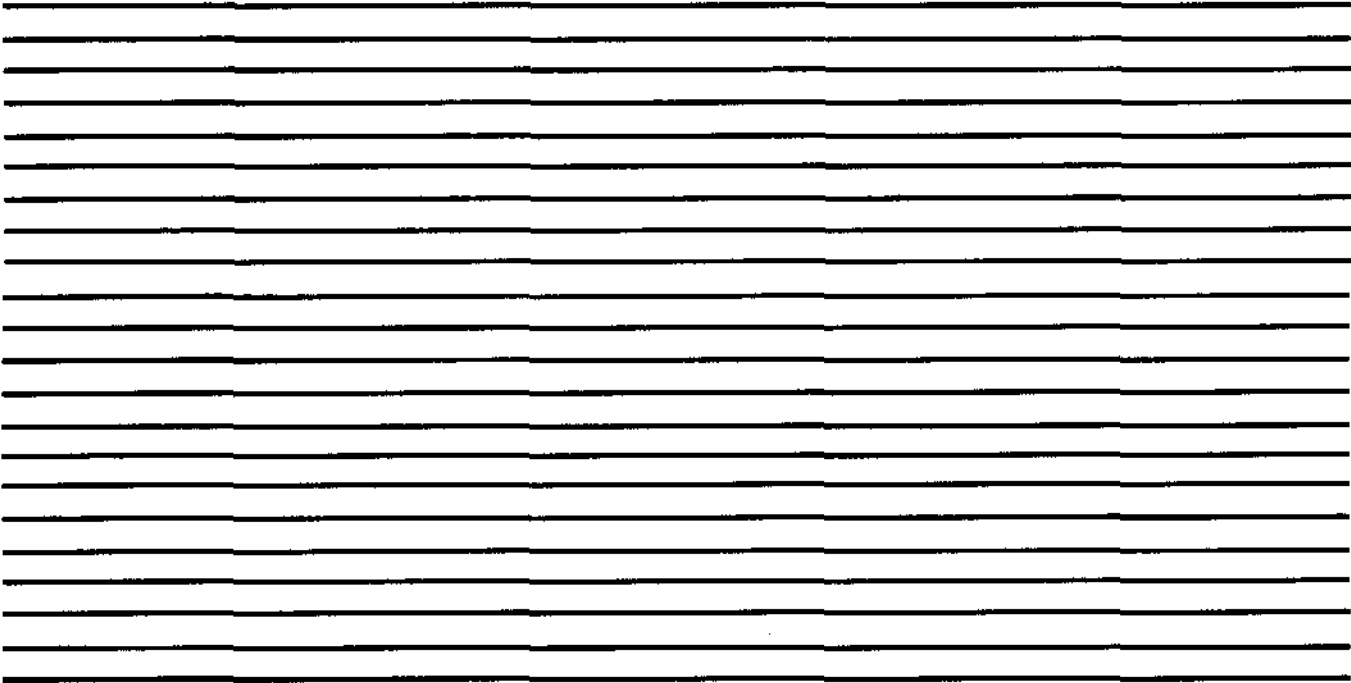# Programming Guide

MICRO-1 ™

Class 8003 MICRO-1 Controller
For use with Class 8003 Type PR3
Program Loader
Bulletin # 30598-791-01A2
May, 1991

D *Dedicated to Growth*
Committed to Quality

WARNING

The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise should be allowed to program, install, alter, and apply this product. Potential bodily injury, death, or equipment damage could result if the product is improperly applied to any equipment application.

NOTICE

The products and services described in this manual are useful in a wide variety of different applications. Therefore, the user and others responsible for applying the products and services described herein are responsible for determining their acceptability for each application. While efforts have been made to provide accurate information within this manual, the Square D Company assumes no responsibility for the application, completeness or usefulness of the information contained herein.

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No patent liability is assumed by the Square D Company with respect to the use of any of the information, products, circuits, programming or services referenced herein.
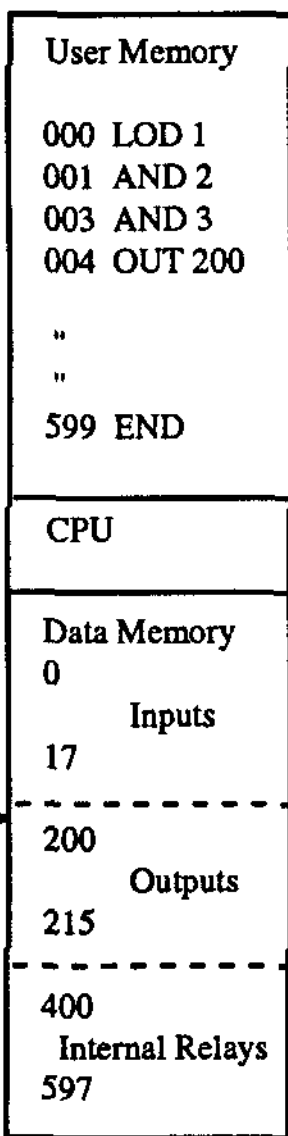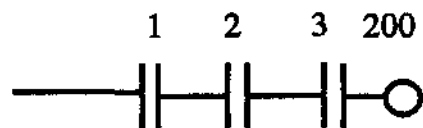
The information contained in this manual is subject to change without notice.

MICRO-1 CONTROLLER PROGRAMMING GUIDE
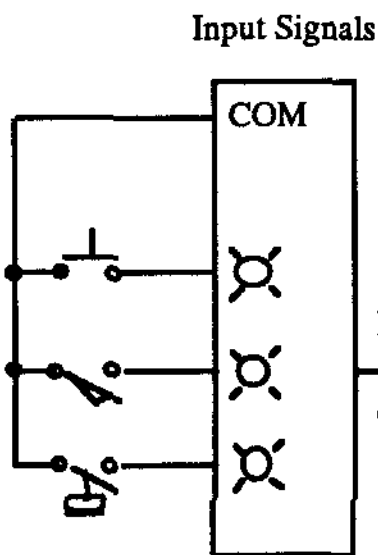## TABLE OF CONTENTS

This guide provides information when using the Class 8003 Type PR-3 Program Loader in conjunction with a MICRO-1 Controller System. For specific information on such topics as advanced instructions, error codes, and troubleshooting, refer to the MICRO-1 Instruction Bulletin 30598-779-XX. For specific information concerning the Class 8003 Type SFW-30 Programming Software, refer to the Instruction Bulletin 30598-788-XX.

```
  1     2     3    200
——||——||——||——O——
```

Input Signals

```
COM
```

The input modules convert the high voltage input signal to a logic signal and give a visual indication of the input on the led indicator.

User Memory

000 LOD 1
001 AND 2
003 AND 3
004 OUT 200

"

"

599 END

CPU

Data Memory
0
        Inputs
17
- - - - - - - - - -
200
        Outputs
215
- - - - - - - - - -
400
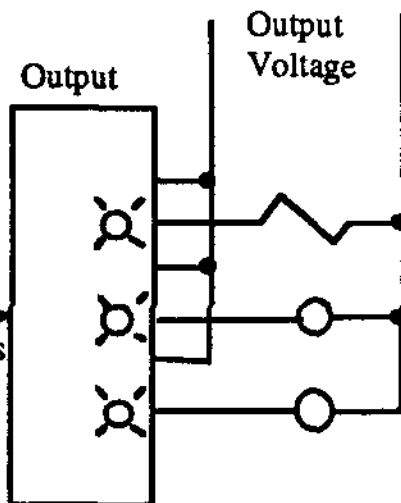   Internal Relays
597

Logic Signals

The sequence program is stored in user memory. The CPU reads the memory one step at a time, starting at 000, and checks the status of each input in the data memory, storing the results in the CPU. When 'OUT 200' is read, the CPU checks stored results of input checks.

If all inputs were present, then output 200 is switched ON. If any input was not present then output 200 is switched OFF.

At the end of the scan of the user program, the status of the inputs is transmitted from the input modules to the data memory. *Also the output status in the data memory is transmitted to the output modules.*

Output

Output Voltage

Logic Signals

```
Switch on
Switch off        Out-
                  put
```
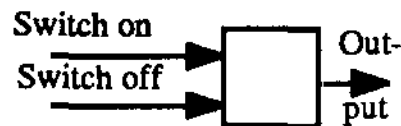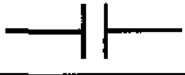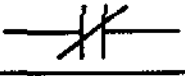
Each output is *controlled by a flip-flop* which is switched ON or OFF by CPU.

1

DATA MEMORY CONFIGURATION

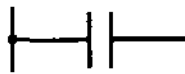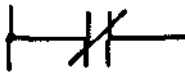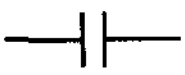| NAME	ALLOCATION NUMBERS		DESCRIPTION
Inputs	0 — 7, 10 — 17		16 Inputs
Outputs	200 — 205, 210 — 215		12 Outputs
Internal Relays	400 — 597		160 Internal Relays — A group of IR from 1 to 160 may be designated as retentive relays — See Function 6
Special Relays	600-677	Matrix Input Status	
	680-687	Matrix Scan Control	
	690	Short Pulse Input Status	
	691-697	Unused	
	700	Unused	
	701-702	Start/Stop control	
	703	All outputs off	
	704	Initialize pulse (turns on for one scan at start)	
	705-712	Unused	
	713	1 - second timer reset	
	714	1 - second clock	
	715	100 millisecond clock	
	716	Timer/counter preset value changed	
	717	In - operation output	
Timer	0 — 79		0.1 — 999.9 second timer
Counter	0 — 44		0 — 999 counter
Reversible Counter	45		Dual pulse (up and down counts)
Reversible Counter	46		Single pulse (up/down selection)
Shift Register	0 — 127		128 Bit (bi-directional)
Single Output	0 — 95		96 Outputs

INSTRUCTION	LADDER SYMBOL	NO. OF STEPS	FUNCTION
LOD	⊢⊣⊢	1	Store new rung (or branch) with N.O. contact
LOD NOT	⊢⫮⊢	1	Store new rung (or branch) with N.C. contact
AND	⊣⊢	1	N.O. contact in series
AND NOT	⫮	1	N.C. contact in series
OR	⊣⊢	1	N.O. contact in parallel
OR NOT	⫮	1	N.C. contact in parallel
AND LOD		1	Series connection with previously stored result
OR LOD		1	Parallel connection with previously stored result
OUT	─○─	1	Output
TIM	─ TIM	2	Timer
CNT	CNT	2	Counter
SFR, SFR NOT	SFR,SFRN	2	Shift Register - forward Shift Register - reverse
MCS	⊣MCS⊢	1	Start of Master Control
MCR	⊣MCR⊢	1	End of Master Control
SOT	⊣SOT⊢	1	Off to on transitional output
SET	⊣SET⊢	1	Sets an output, internal relay, or shift register
RST	⊣RST⊢	1	Resets an output, internal relay, or shift register
JMP	⊣JMP⊢	1	Jumps a designated program area
JEND	⊣JEND⊢	1	Ends a jump program
END	⊣END⊢	1	Ends a program

A MICRO-1 processor unit and a PR-3 program loader can be used with switches connected to simulate the inputs. Output status indicators on the unit can be used to indicate an output.

PROCEDURE with the PR-3 Program Loader

1. Connect the PR-3 programmer to the programming port located on the right hand side of the processor unit. Refer to notes listed below.

• The MICRO-1 controller maintains the same "RUN/STOP" status as before power was turned offf.
• If the "RUN/STOP status stored in the MICRO-1 controller differs from the RUN/STOP switch on the program loader, set the RUN/STOP switch to match the status of the processor unit. Controller status will then be synchronized with the switch.

2. Set processor to "STOP" via "RUN/STOP" switch on the PR-3 program loader.

3. Clear programmer memory and then processor memory by using following routines:-

[DELT] [END] [ENTR] then [TRS] [ENTR] [ENTR]

4. Program the relay circuit examples shown on pages 5 and 6.
5. Transfer program from programmer to RAM memory in processor:-

[TRS] [ENTR] [ENTR]

6. Set the processor to "RUN" via the "RUN/STOP" switch on the PR-3 programmer. If processor will not go into run, check error LED located on the processor unit.
7. Check operation of program by operating switches and observing status LEDS on the processor unit.
8. Use monitor routines to display input/output status on program loader. See pages 22 to 27.
9. Procedure 1 to 8 can then be repeated for the examples of timers, counters, shft registers etc, on pages 9 to 24.

Notes:
• RUN to STOP: The MICRO-1 controller stops operation immediately. After 2 seconds, "PC-STOP" is displayed on the program loader. After another 7 seconds, the program is displayed.
• STOP to RUN: The MICRO-1 controller sstarts operation in 1.5 seconds. After another 1.5 seconds, "PC-RUN" is displayed on the program loader. After another 7 seconds, the program is displayed.
• If FUN 4, STOP Input Terminal, the "RUN/STOP" operation is controller by a user defined input. Thus, the "RUN/STOP" switch on the program loader is disabled.
• When adding a new program to an existing program in memory, ALWAYS search for next empty address in memory, (ie, the end of the existing program) using the following key routine:-
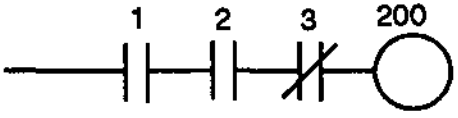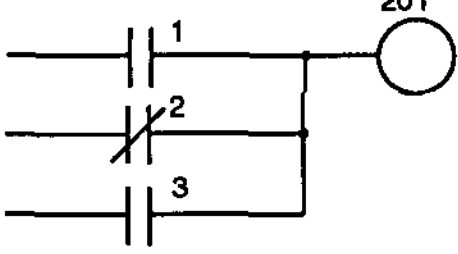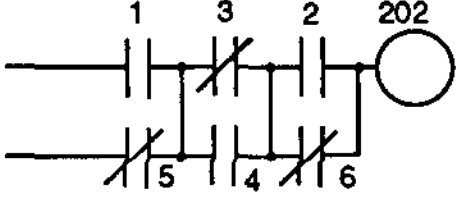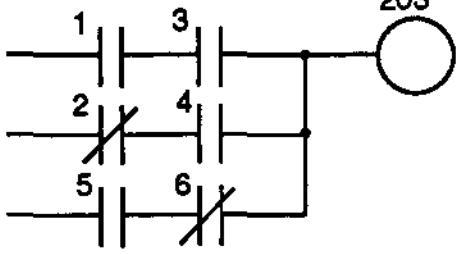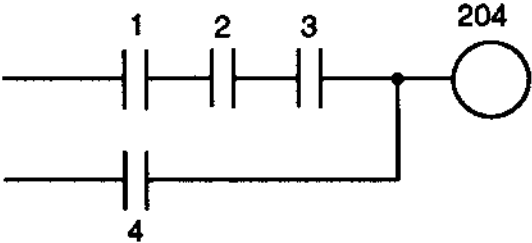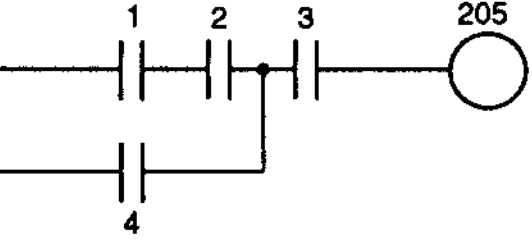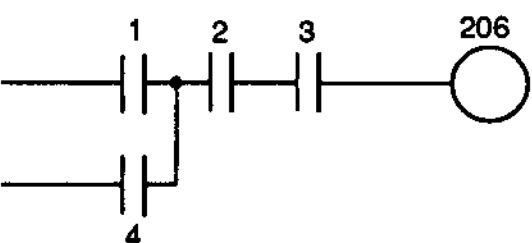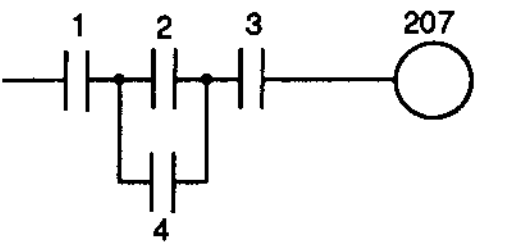
[END] [READ]

Ladder Diagram	Program Entry	
Contacts in series	LOD 1 AND 2 AND NOT 3 OUT 200	ENTR " " "
Contacts in parallel	LOD 1 OR NOT 2 OR 3 OUT 201	ENTR " " "
Contracts in series/parallel	LOD 1 OR NOT 5 LOD NOT 3 OR 4 AND SHF LOD LOD 2 OR NOT 6 AND SHF LOD OUT 202	ENTR " " " " " " " "
Contacts in series/parallel	LOD 1 AND 3 LOD NOT2 AND 4 OR SHF LOD LOD 5 AND NOT 6 OR SHF LOD OUT 203	ENTR " " " " " " " "

RELAY CIRCUIT EXAMPLES

Ladder Diagram	Program Entry
1 2 3 (204) —| |—| |—| |——•——( ) —| |— 4	LOD 1 ENTR AND 2 " AND 3 " OR 4 " OUT 204 "
1 2 3 (205) —| |—| |•| |——( ) —| |— 4	LOD 1 ENTR AND 2 " OR 4 " AND 3 " OUT 205 "
1 2 3 (206) —| |•| |—| |——( ) —| |— 4	LOD 1 ENTR OR 4 " AND 2 " AND 3 " OUT 206 "
1 2 3 (207) —| |•| |•| |——( ) —| |— 4	LOD 1 ENTR LOD 2 " OR 4 " AND SHF LOD " AND 3 " OUT 207 "

Program Entry	Explanation of function
LOD 1	Store new rung with N.O. contact 1.
OR NOT 3	N.C. contact 3 in parallel.
LOD NOT 2	Store new branch with N.C. contact 2.
OR 5	N.O. contact 5 in parallel.
AND SHF LOD	Series connection with previously stored result.
LOD 4	Store new branch with N.O. contact 4.
OR NOT 6	N.C. contact 6 in parallel.
AND SHF LOD	Series connection with previously stored result.
OUT 201	Output 201.

EXAMPLE OF USE OF "OR LOD" INSTRUCTION
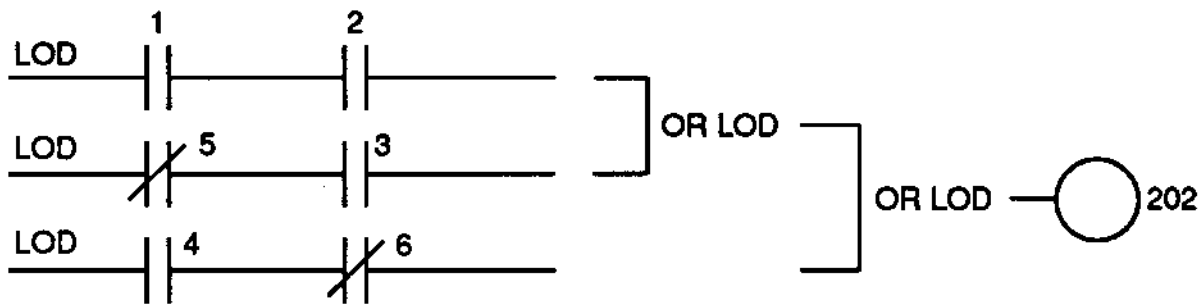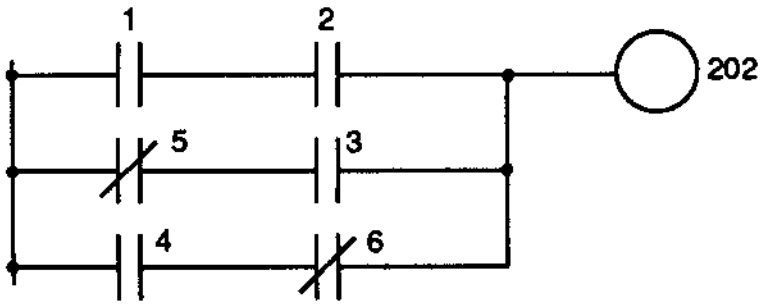
Program entry	Explanation of function
LOD 1	Store new rung with N.O. contact 1.
AND 2	N.O. contact 2 in series.
LOD NOT 5	Store new branch with N.C. contact 5.
AND 3	N.O. contact 3 in series.
OR SHF LOD	Parallel connection with previously stored result.
LOD 4	Store new branch with N.O. contact 4.
AND NOT 6	N.C. contact 6 in series.
OR SHF LOD	Parallel connection with previously stored result.
OUT 202	Output 202.

Time Delay 0.1 to 999.9 seconds	Note. This timer resets if supply power is interrupted.

Ladder Diagram	Program Entry
─┤├─² Enable ┌─────────┐ 　　　　　　　　　│ TIM 1 │ 　　　　　　　　　│ 150 │ 　　　　　　　　　└─────────┘ 　　　　　　　　　　Timer 1 Time delay in 0.1 seconds (e.g. Delay is 15 seconds)　Preset Value = 150 TIM 1 ─┤├─ Timed output ─○ 200 　┊ ┊ 200 ─ ─ ┤┊ ┊─ ─ ─ NOTC 　┊ ┊ 200 ─ ─ ┤┊ ┊─ ─ ─ NCTO	LOD 2　　　　ENTR TIM 1　　　　" 150　　　　　" LOD SHF TIM 1　ENTR OUT 200　　　"

When contact 2 opens the number 150 is preset into TIM 1.
When contact 2 closes, the timing starts, and the number in TIM 1 reduces by one every 0.1
second until TIM 1 contents are zero. Output 200 will then energize.

To display TIM 1 on programmer, operate following keys:-

[MON] [TIM] [1] [READ↓]

The programmer displays the remaining time of the delay during timing.

The above circuit may also be programmed as follows:-	
─┤├─² ┌─────────┐ ○ 200 　　　　│ TIM 1 │ 　　　　│ 150 │ 　　　　└─────────┘	LOD 2　　　　ENTR TIM 1　　　　" 150　　　　　" OUT 200　　　"

Time Delay
0.1 to 999.9 seconds

Ladder Diagram	Program Entry
3 400 Timer 2, Preset Value =150 400 TIM 2 150 (15 seconds) 400 TIM 2 203 203 203 ...... NOTC 203 ...... NCTO	LOD 3 ENTR OUT 400 " LOD NOT 400 ENTR TIM 2 " 150 " LOD 400 ENTR OR 203 " AND NOT SHF TIM 2 " OUT 203 "

When N.O. contact 3 closes, N.C. contact 400 opens and presets the number 150 into
TIM 2. Also N.O. contact 400 closes energizing output 203 via N.C. contact TIM 2. When
contact 3 opens, N.C. contact 400 closes starting the time delay. N.O. contact 400 opens but
output 203 is maintained via N.O. contact 203.
When the timer times out, N.C. TIM 2 contact opens, de-energizing output 203.

Note
The internal relay 400 must be designated as a "Retentive type "relay" -See Function 6
(FUN 6) - page 33.

Time Delays
0.1 to 999.9 seconds (715 pulse)
1 to 9999 seconds (714 pulse)

Ladder Diagram	Program Entry
Counter 1 Preset value = 100 1 — Reset 715 — 100mS pulse CNT 1 100 (10 Seconds) CNT 1 —( )201	LOD 1 ENTR LOD 715 " CNT 1 " 100 " LOD SHF CNT 1 ENTR OUT 201 "

When contact 1 is closed the counter is reset and output 201 is off.
When contact 1 is open, the counter counts the 100ms pulses. When the count value
equals the preset value, the output turns on.

The above circuit may also be programmed as follows:- 1 — 715 — CNT 1 100 —( )201	LOD 1 ENTR LOD 715 " CNT 1 " 100 " OUT 201 "

Note
Counter 1 must be designated as a "Retentive type counter" - See Function 7 (FUN 7)
- page 34.
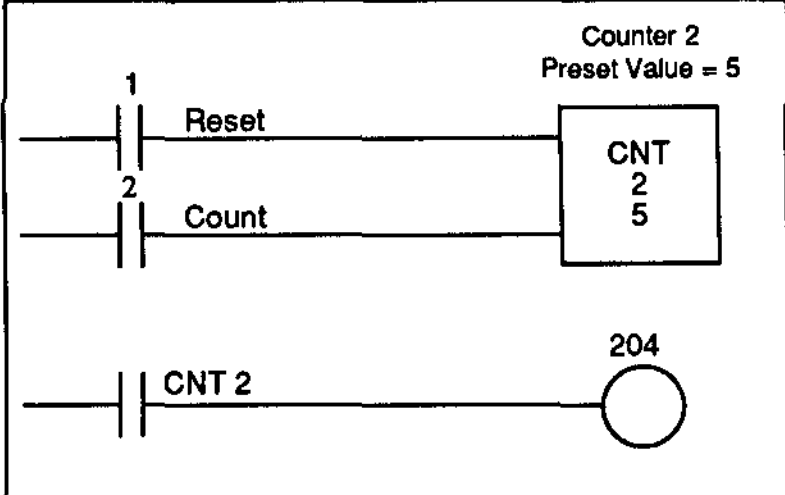
TIMING CIRCUITS - INTERRUPTIBLE TIMER (TIMER WITH HOLD)

<table>
<tr><td colspan="2" align="center">**Time Delays**
0.1 to 999.9 seconds (715 pulse)
1 to 9999 seconds (714 pulse)</td></tr>
<tr><th>Ladder Diagram</th><th>Program Entry</th></tr>
</table>

Ladder Diagram	Program Entry
Counter 2 Preset Value = 200 1 Reset/Enable ┤├ CNT 2 200 ┤│├ 100 mS pulse 2 715 20 (Seconds) CNT 2 ┤├ ◯ 202	LOD 1 ENTR LOD 2 " AND 715 " CNT 2 " 200 " LOD SHF CNT 2 ENTR OUT 202 "

When contact 1 closes, the counter is reset.
When contact 1 opens, the counter is enabled.
When contact 2 closes, the timing starts.
If contact 2 opens, the time is "held".
When counter 2 closes, the timing resumes from the "held" time.
When the timer times out, output 202 is energized.

Preset values
0 to 9999

Ladder Diagram	Program Entry

Counter 2
Preset Value = 5

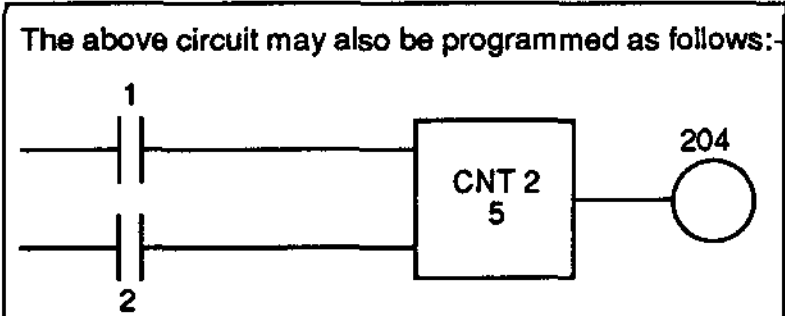|	
1 ┤├ Reset	CNT 2 5
2 ┤├ Count	

LOD 1   ENTR
LOD 2   "
CNT 2   "
5   "

204

┤├ CNT 2 ◯

LOD SHF CNT 2   ENTR
OUT 204   "

When contact 1 is closed, the counter is reset.
When contact 1 is open, the counter is enabled.
Each time contact 2 closes, the counter increments by one.
When the counted value equals the preset value, the output 204 is energized.
To display CNT 2 on programmer, operate the following keys:-

[MON] [CNT] [2] [↓READ]

The above circuit may also be programmed as follows:-

| 1
┤├ | CNT 2
5 | 204
◯ |
| 2
┤├ | | |

LOD 1   ENTR
LOD 2   "
CNT 2   "
5   "
OUT 204   "

13

REVERSIBLE COUNTER WITH UP AND DOWN PULSE INPUTS

Note. Only counter No. 45 may be used for this function	Preset values 0 to 9999

Ladder Diagram	Program Entry

```
                    Counter 45
  1| |  Preset
  ─┤ ├────────────┌─────────┐
                  │   CNT   │      205
  2| |  Up count  │    45   ├──────○
  ─┤ ├────────────┤         │
                  │    20   │
  3| |  Down count│    ↗    │
  ─┤ ├────────────└─────────┘
  Preset value ────────┘
```
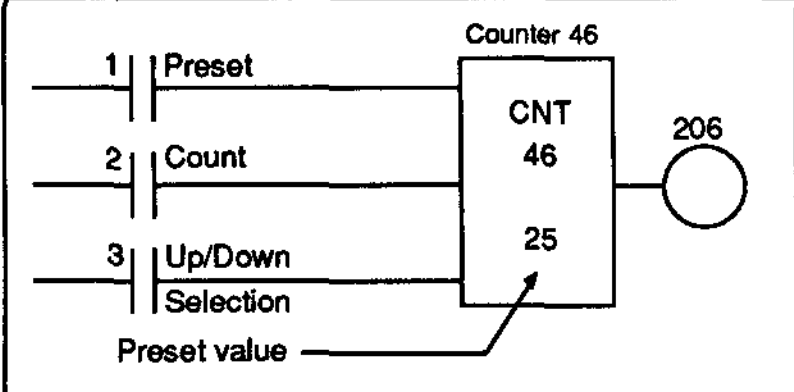
LOD 1	ENTR
LOD 2	"
LOD 3	"
CNT 45	"
20	"
OUT 205	"

When contact 1 closes, the counter is preset to 20.
When contact 1 opens, the counter is enabled.
Each time contact 2 closes, the counter counts up by one.
Each time contact 3 closes, the counter counts down by one.

Note. The count starts from the preset value.

When counting up, the count will go 9999 ──▶ 0 ──▶ 1.
When counting down, the count will go 1 ──▶ 0 ──▶ 9999.
If the up and down pulses are on simultaneously, the counter may miss a count pulse.

Note. Only counter No. 46 may be used for this function	Preset values 0 to 9999

Ladder Diagram	Program Entry
Counter 46 1├┤Preset CNT 46 206 2├┤Count 25 3├┤Up/Down Selection Preset value	LOD 1 ENTR LOD 2 " LOD 3 " CNT 46 " 25 " OUT 206 "

When contact 1 closes, the counter is preset to 25.
When contact 1 is open, the counter is enabled.
When contact 3 closes, the "UP" mode is selected.
When contact 3 is open, the "DOWN" mode is selected.
Each time contact 2 closes, the counter counts up or down by one.

Note The count starts from the preset value.

When the count value is zero, output 206 is energized.

When counting "UP" the count will go 9999 ⟶ 0 ⟶ 1
When counting "DOWN" the count will go 1 ⟶ 0 ⟶ 9999

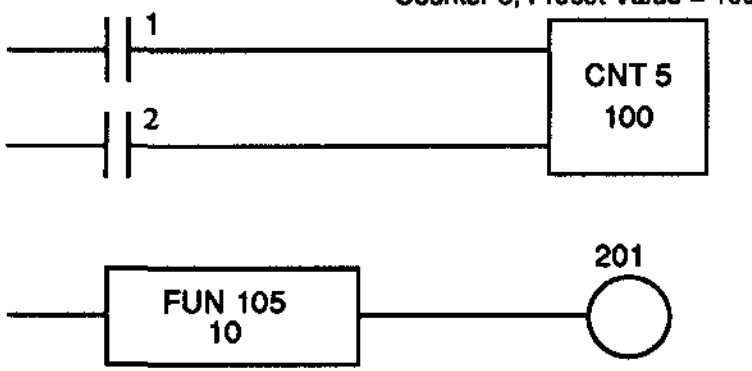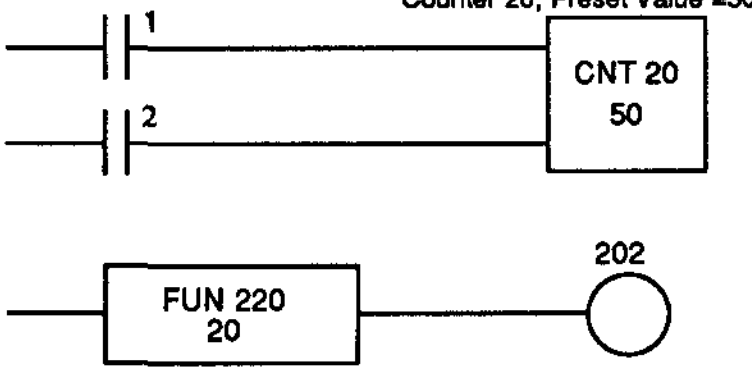## COUNTER EQUAL TO AND EQUAL TO OR GREATER THAN COMPARISON INSTRUCTIONS

Counters 0 to 46 can perform the above comparisons by using following instructions:-

Equal to comparison:
FUN 100 to FUN 146 - Equivalent to counters 0 to 46.
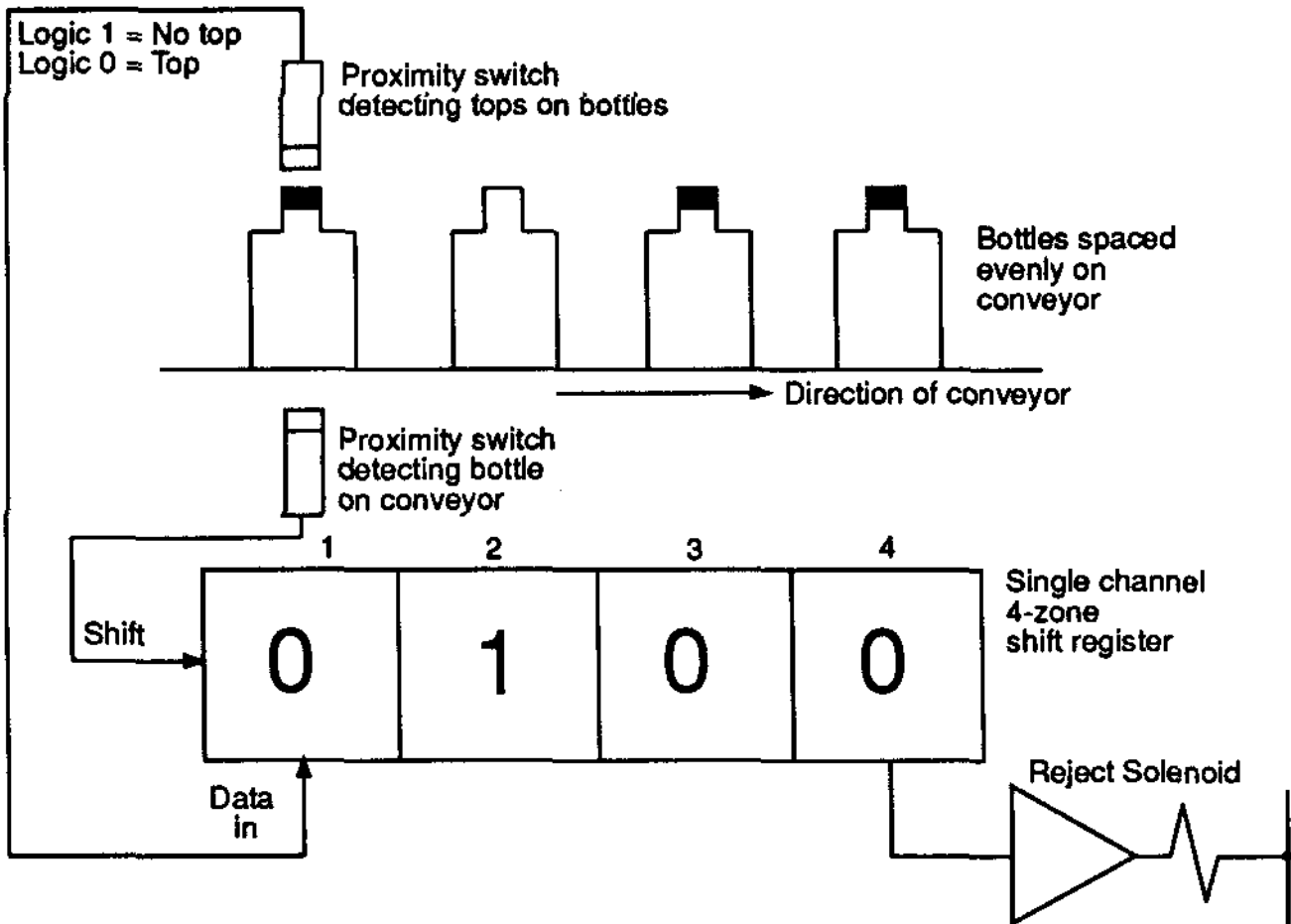Equal to or greater than comparison:
FUN 200 to FUN 246 - Equivalent to counters 0 to 46.

Ladder Diagram	Program Entry
Equal to comparison Counter 5, Preset Value = 100 ─┤├─ 1 ──────── CNT 5 / 100 ─┤├─ 2 ──────── ── FUN 105 / 10 ──(201)	LOD 1 ENTR LOD 2 " CNT 5 " 100 " FUN 105 " 10 " OUT 201 "
Equal to or greater than comparison Counter 20, Preset Value =50 ─┤├─ 1 ──────── CNT 20 / 50 ─┤├─ 2 ──────── ── FUN 220 / 20 ──(202)	LOD 1 ENTR LOD 2 " CNT 20 " 50 " FUN 220 " 20 " OUT 202 "

The same "FUN" number can be used repeatedly for different preset values.

Example: Bottling Line

Logic 1 = No top
Logic 0 = Top

Proximity switch
detecting tops on bottles

Bottles spaced
evenly on
conveyor

Direction of conveyor

Proximity switch
detecting bottle
on conveyor

Single channel
4-zone
shift register

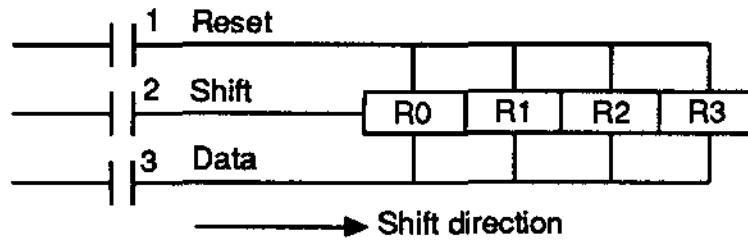| 1	2	3	4
0	1	0	0

Shift

Data
in

Reject Solenoid

The shift register is an electronic model of what is happening on the conveyor. As each bottle moves over proximity switch, previous data is all shifted one zone to the right and either a logic 1 or a logic 0 is shifted into the first zone.

When the bottle with no top has moved to the fourth position on the conveyor, the logic 1 has moved to the fourth zone in the shift register where it operates the reject solenoid and removes the bottle from the conveyor.

Block Diagram

```
     1  Reset
──┤├──────────
     2  Shift         ┌────┬────┬────┬────┐
──┤├────────── ───────┤ R0 │ R1 │ R2 │ R3 │
     3  Data          └────┴────┴────┴────┘
──┤├──────────

        ──────────────► Shift direction
```

Ladder Diagram	Program Entry
1 ┤├ Reset ┌──────────┐ Initial bit number SSR 0 ◄── 2 ┤├ Shift │ │ Number of bits 3 ┤├ Data └──────────┘ 8 ◄── ┤├ R0 ◯ 200 ┤├ R6 ◯ 201	LOD 1 ENTR LOD 2 " LOD 3 " SFR 0 " 8 " LOD SHF SFR 0 " OUT 200 " LOD SHF SFR 6 " OUT 201 "

When contact 1 is closed the shift register is reset. When contact 1 is open the shift register is enabled.

Each time contact 2 closes, the data in the shift register moves one bit position to the right and new data moves into bit 0.
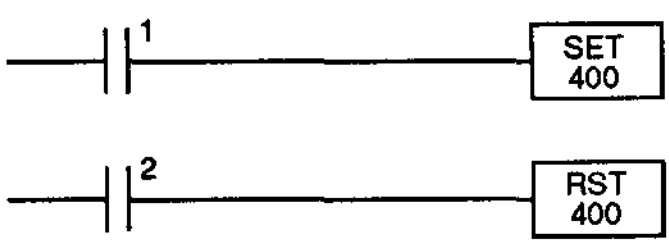
If contact 3 is closed, when shift contact 2 closes, then a logic 1 is entered. If contact 3 is open, then a logic 0.

The above shift register bits may be monitored by operating following keys:-

[MON] [SFR] [0] [READ]

Note. Only internal relays can be used to give equivalent of mechanically latched relay in following circuit. Also internal relays must be designated as "retentive type relays" - See Function 6 (FUN 6) page 33.

Ladder Diagram	Program Entry	
	LOD 1	ENTRY
	SET 400	"
	LOD 2	"
	RST 400	"

If contact 1 closes momentarily, internal relay 400 will switch on.

If contact 2 closes momentarily, internal relay 400 will switch off.

If the power is interrupted, internal relay 400 will "remember" whether it was switched on or switched off at the time of power interruption and will resume that condition when power is restored.

Ladder Diagram	
Without MCS and MCR	

Without MCS and MCR

```
  ─┤ ├─┤ ├─────────────( ) 200
    1   7

  ─┤ ├─┤ ├─┤ ├─────────( ) 201
    1   2   3

  ─┤ ├─┤ ├─┤/├─┤/├──────( ) 202
    1   2   4    5

  ─┤ ├─┤ ├─┤ ├─┤ ├──────( ) 203
    1   2   5   6

  ─┤ ├─┤ ├──────────────( ) 204
    1   4
```

	Program Entry

With MCS and MCR

```
  ─┤ ├──────────────[ MCS ]─┐
    1                       │
  ┌─────────────────────────┘
  ├─┤ ├──────────────( ) 200
  │   7
  ├─┤ ├──────────────( ) 204
  │   4
  ├─┤ ├──────────────[ MCS ]─┐
    2                        │
  ┌──────────────────────────┘
  ├─┤ ├──────────────( ) 201
  │   3
  ├─┤/├─┤/├──────────( ) 202
  │   4    5
  ├─┤ ├─┤ ├──────────( ) 203
      5   6

  ──────────────────[ MCR ]
```

LOD 1	ENTR
MCS	"
LOD 7	"
OUT 200	"
LOD 4	"
OUT 204	"
LOD 2	"
MCS	"
LOD 3	"
OUT 201	"
LOD NOT 4	"
AND NOT 5	"
OUT 202	"
LOD 5	"
AND 6	"
OUT 203	"
MCS MCS	"

Note

If the input to the MCS is off, all inputs following the MCS are forced off until the MCR instruction is executed. MCS MCS toggles the function to MCR.

Ladder Diagram	Program Entry
	LOD 1 ENTR JMP " LOD 2 " OUT 200 " LOD 3 " TIM 10 " 150 " OUT 201 " JMP JMP "

When contact 1 is open, the circuit within the dotted lines operates normally.

After contact 1 is closed, all outputs will remain in the state they were in at the time contact 1 closed and any input contact changes will be ignored.
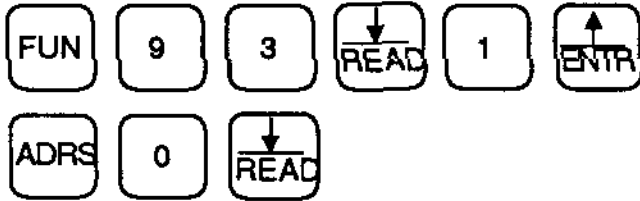
The timed value in the timer will also be held at the value it was when contact 1 closed.
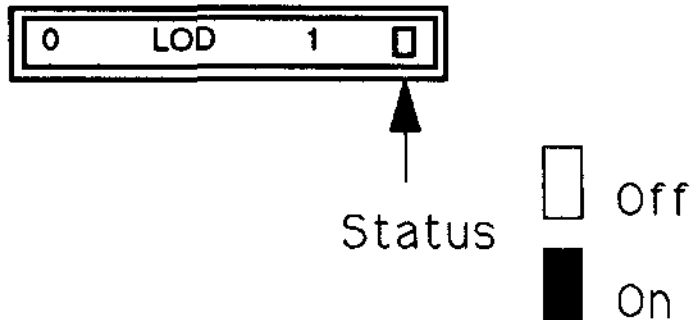
JMP JMP toggles the function to JEND.

The ON/OFF status of inputs/outputs/internal relays/timers/counters and shift register bits can be monitored by using the following routine.

Key Sequence:-

FUN 9 3 READ↓ 1 ENTR↑

ADRS 0 READ↓

Display will show the address '0' instruction and status

```
┌─────────────────────────────┐
│  ┌───────────────────────┐   │
│  │ 0      LOD      1   ☐ │   │
│  └───────────────────────┘   │
└─────────────────────────────┘
                    ↑
         Status    ☐  Off

                   ■  On
```

Where a 'NOT' instruction is displayed, the status is reversed.

Note
Once this mode has been selected it can only be cancelled by interrupting the supply power to the processor or by using the following key sequence:-
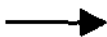
FUN 9 3 READ↓ 0 ENTR↑ CLR

Search for an address in user memory

e.g. search for address 4. Operate keys:-

| ADRS | 4 | ↓ READ |

This search routine will find the
user memory address and
display the instruction
at that address.

User Memory
Address	Program
0	LOD 1
1	AND 4
2	AND 6
3	OUT 200
4	LOD 7
5	AND 5
6	OUT 202
7	LOD 2
599	END

The ↓ READ and ↑ VERI keys

may then be used to move from specified memory
address to higher or lower addresses.

Note

If the sequential monitoring function, (FUN 93) - see page 22, has already been selected,
then the I/O, internal relay, timer, counter and shift register bit status will also be displayed.

Search for Input/output/TIM/CNT/SFR/special relay in program

e.g. search for "LOD 201"
operate keys:-

[CLR] [CLR] [CLR]

User Memory

Address	Program
0	LOD 1
1	AND 2
2	OUT 200
3	LOD 201
4	AND 4
5	AND 5
6	OUT 203
7	LOD 201
8	OR 6
9	OR 7
10	OUT 210
11	LOD 201
599	END

(This sets user memory at address 0)
Then operate keys:-

[LOD] [201] [↓ READ]

This search routine will find the first
"LOD 201" in the program.

Each of the remaining
"LOD 201" entries in
the program may
be found by repeating the
routine:-

[LOD] [201] [↓ READ]

When no more entries can be located, programmer will emit double 'beep'.

Note
If the sequential monitoring function, (FUN 93) - see page 22, has already been selected, then the I/O, internal relay, timer, counter and shift register bit status will be displayed.

Search for next empty address in memory.

Note
This key sequence is required whenever additional program is to be added to an existing *program:-*

Address	Program
0	LOD 1
1	AND 4
2	AND 6
3	OUT 200
4	LOD 7
5	AND 5
6	OUT 202
7	END
8	END
	"
	"
	"
	"
	"
599	

Existing program

In this example the first instruction of the additional piece of program will be entered at memory address 7.

Note   IF THIS ROUTINE IS NOT FOLLOWED,
THE ADDITIONAL PROGRAM MAY
OVERWRITE THE EXISTING PROGRAM

Monitored status is displayed in units of 8 points starting with the designated number. Monitor display is as follows:-

■ 'ON' display   ☐ 'OFF' display

e.g. To monitor output 200 operate keys:-

[MON] [2] [0] [0] [↓READ]

Display will show:-

M 200	☐	■	☐	☐	☐	■	☐	☐

```
         ↑   ↑   ↑   ↑   ↑   ↑
         2   2   2   2   2   2
         0   0   0   0   0   0
         0   1   2   3   4   5
         On              On
```
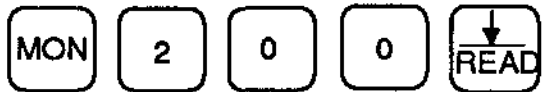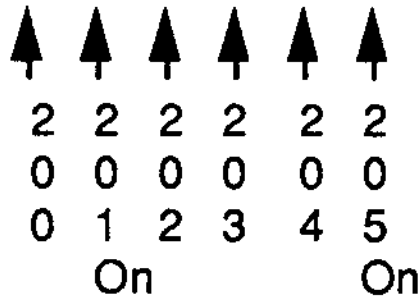
To display next 8 outputs press [↓READ]

Notes

Monitored data is updated and displayed every 100 msec.

To cancel monitoring, press "CLR" key.

The above notes apply to all monitoring routines on the MICRO-1.

The monitor display shows timer or counter number, counted/timed value and on/off status. For both counter and timer, the On/Off status display is as follows:-

■ On (Timed out or count up)

☐ Off (Timing or counting)

e.g. To monitor Timer 1 operate keys:-

MON SHF TIM 1 READ

Display will show

M T I M 1 ☐☐☐☐2 0 0
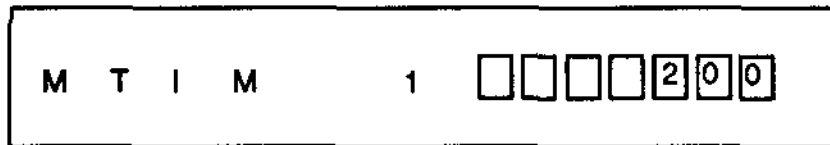
On/Off Status — Remaining time value

To monitor next timer (No. 2) operate READ

To change an Input/output/Internal relay timer/counter/special relay in the program.

Example

1   2   3   200
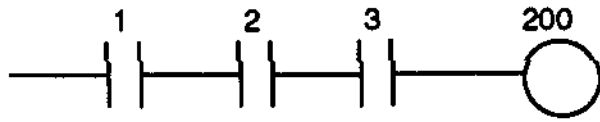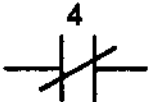
Program
LOD 1
AND 2
AND 3
OUT 200

To change ──┤ ├── (AND 2) to ──┤/├── (AND NOT 4)

1. Set program loader to start of program (address 0)

[CLR] [CLR] [CLR]

2. Search for "AND 2" by first searching for "OUT 200"

[OUT] [200] [READ]   then use   [VERI]

To step program back until "AND 2" is displayed.

3. Operate following keys:-

[AND] [NOT] [4] [ENTR]

1   4   3   200
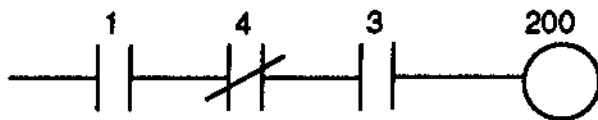
Program
LOD 1
AND NOT 4
AND 3
OUT 200

4. Transfer program to the processor unit when completing the changes. Refer to page 32.

[TRS] [ENTR] [ENTR]

To insert an input/output/timer/counter/special relay in the program.

Example
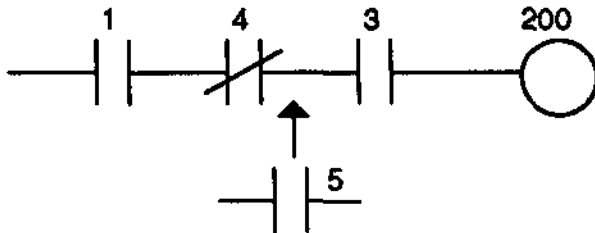
'AND 5' in rung

Program
LOD 1
AND NOT 4
AND 3
OUT 200

1. Set programmer to start of program (address 0)

2. Search for "AND 3" by first searching for "OUT 200"
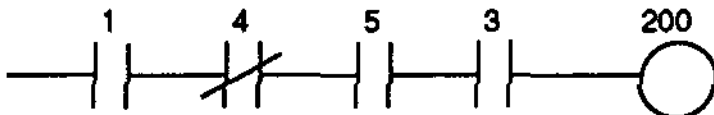
 then use

To step program back until "AND 3" is displayed.

3. Operate following keys:-

This will insert "AND 5" between "AND NOT 4" and "AND 3".
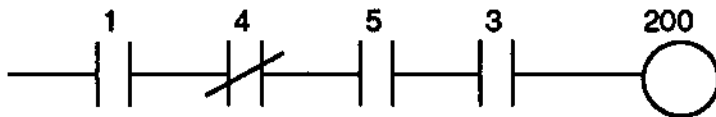
4. Final result.

Program
LOD 1
AND NOT 4
AND 5
AND 3
OUT 200

5. Transfer changes to the processor when completing changes. Refer to page 32.

To delete an input/output/internal relay timer/counter/special relay in the program.

Example

Delete "AND NOT 4"
and "AND 5"

Program
LOD 1
AND NOT 4
AND 5
AND 3
OUT 200

1. Set program loader to start of program (address 0).

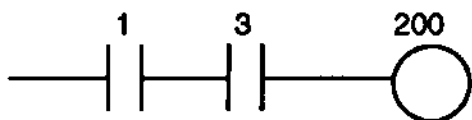2. Search for "AND NOT 4" by first searching for "OUT 200"

 then use

to step back until "AND NOT 4" is displayed.

3. Operate following keys:-

This will delete two instructions in the program. The one displayed and the instruction following it. When deleting two address instructions (TIM, CNT, SFR etc) the two addresses will be deleted at one time as one instruction.

4. Final result

Program
LOD 1
AND 3
OUT 200

5. Transfer program to the processor when completing changes. Refer to page 32.

1. This routine clears the memory in the program loader.
   This routine must be carried out before entering a new program.
2. When the memory is cleared "END" instructions are automatically written at every step in the memory.

Key sequence to clear memory:-

DELT   END   ENTR

Display will show:-

0   END
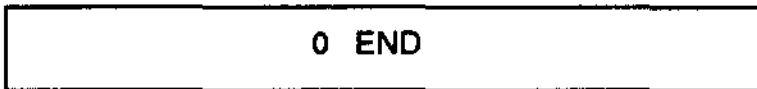
Notes
1. The clear program loader memory routine can be performed when the program loader mode switch is in either "RUN" or "STOP" position.
2. All function (FUN) settings are cleared by a clear memory routine.
3. The processor memory is not cleared by this routine.
4. After a memory clear, the program capacity of the program loader is set to 1K steps. The program capacity of the MICRO-1 controller is 600 steps.

Transfer of program from program loader to processor unit's EEPROM memory

Check that the processor is not in 'STOP'.
Key sequence is as follows:-

| TRS | ENTR | ENTR |

When writing is complete, the following message is displayed:-

| TRS   L T P   END |

Transfer of program from processor unit's EEPROM memory to program loader

Key sequence is as follows:-

| TRS | READ | ENTR |

When writing is complete, the following message is displayed:-

| TRS   P T L   END |

NOTE: The PR3 Program Loader only retains the program for 3 minutes when power is removed. The program should be transferred to the processor before power is removed to ensure that the program is not lost.

It is possible to optionally assign the numbers of internal relays whose conditions are cleared (clear type relays) or maintained (retentive relays) when the processor goes to halt or the supply power is interrupted.

The internal relays are numbered from 400 to 597 (160 total).

Any number in this range can be specified as the number at which the clear type relays start.

<u>**Example**</u>

400 — — — — — — 497   500 — — — — — — 597

Retentive internal
relays

Clear type internal
relays
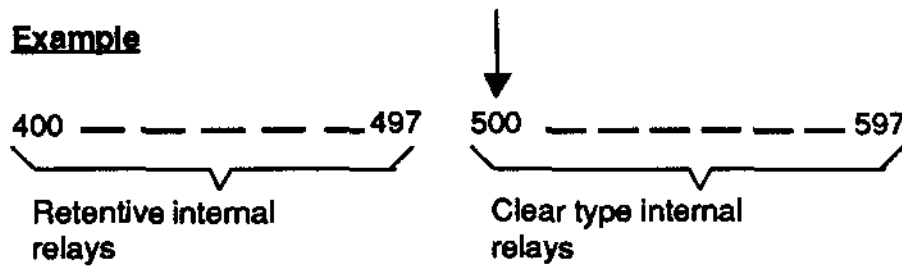
To set number 500, operate the following keys:-

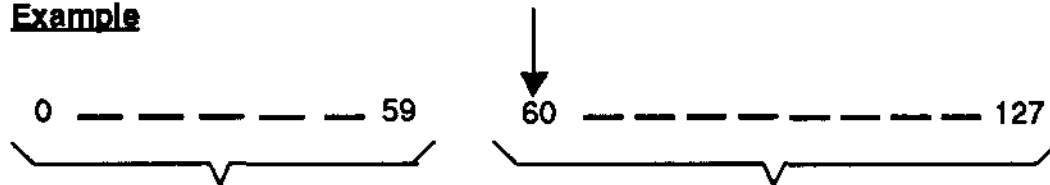[FUN] [6] [↓ READ] [500] [ENTR]

<u>**Notes**</u>

1. When all memories are cleared (program loader and processor), number "400" is set automatically; therefore, all internal relays are assigned as clear type relays.
2. The assignment of the number must be completed before the program is transferred to the processor's memory.

It is possible to optionally assign the numbers of up counters (counters 0 to 44) whose counts are cleared (clear type counters) or maintained (maintain type counters) when the processor halts or the supply power is interrupted.

Any number in the range 0 to 44 can be specified as the number at which the clear type counters start.

Example

Counter No.

```
0 ── ── ── ── ──19    ▼20 ── ── ── ── ── ──44
 _____/      _____/
         ▽                         ▽
  Counted values          Counted values are
  are held                cleared
```
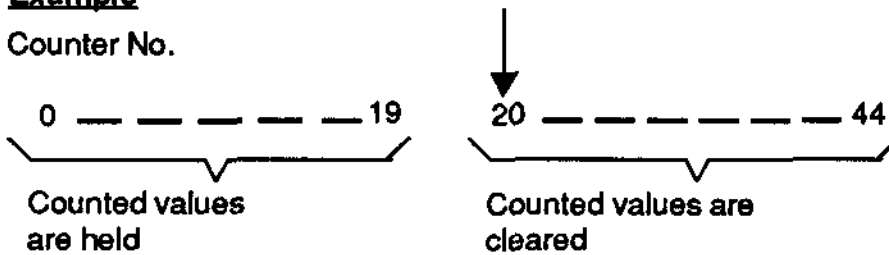
To set number 20, operate following keys:-

| FUN | 7 | READ↓ | 20 | ENTR |

To assign all counters as maintain type, set number to '45'.

Notes

1. When all memories are cleared (program loader and processor), number "0" is set automatically; therefore, all counters are assigned as clear type counters.
2. Reversible counters 45 and 46 are both maintain type: however, the counted value can be cleared automatically on power up by programming a 704 contact in the preset line.
3. The assignment of the number must be completed before the program is transferred to the processor unit's memory.

It is possible to optionally assign the number of shift register bits whose status is cleared, (clear type bits) or retained (retentive type bits) when the processor halts or the supply. power is interrupted.

Any number in the range 0 to 127 can be specified as the number at which the clear type bits start.

Example

```
          ↓
0 ─ ─ ─ ─ ─ ─ 59    60 ─ ─ ─ ─ ─ ─ ─ ─ 127
_____∨_____/   _____∨_____/
```

To set bit number 60, operate keys:-

[FUN] [8] [READ↓] [60] [ENTR]

To assign all shift register bits as retentive, set number 127.

Notes

1. When all memories are cleared (program loader and processor), number "0" is set automatically; therefore, all shift register bits are assigned as clear type.
2. The assignment of the number must be completed before the program is transferred to the processor unit's memory.

For systems requiring an external reset input, FUN5 allows an input to be defined as a reset indication. In the example below, Input 3 is wired to a switch as shown below.

RESET

COM	3
MICRO-1 Processor	
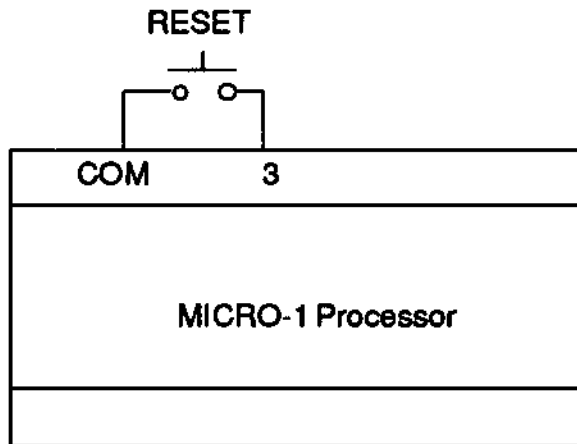
Any input terminal can be assigned as a reset input terminal. When the designiated input goes ON, the MICRO-1 controller is reset. While the reset input is ON, the controller is in halt. This setting must be completed before transferring the user program to the processor unit.

For systems requiring stop/start inputs, FUN4 allows an input to be defined as a stop start indication. In the example below, Input 0 is wired to a switch as shown below.

```
        Halt        Run
                 \
            ┌─o  o─┐
     ┌──────┘      └──────┐
     │  COM        0      │
     ├────────────────────┤
     │                    │
     │  MICRO-1 Processor  │
     │                    │
     │                    │
     └────────────────────┘
```
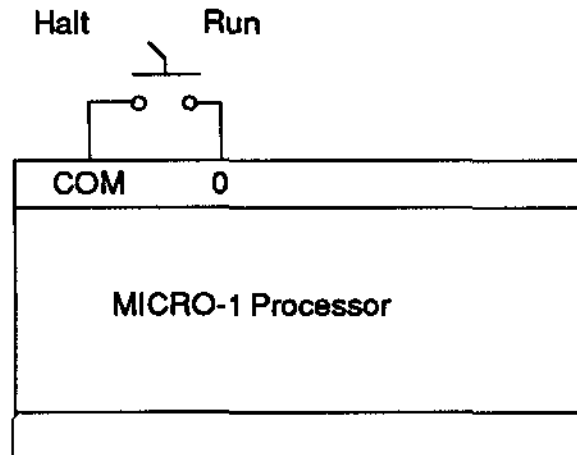
When the HALT/RUN switch is put to RUN, input 0 is turned ON, and the processor switches to run (RUN LED is ON).
When the HALT/RUN switch is put to HALT, input 0 is turned OFF, and the processor switches to HALT.
When the switch is in RUN, the processor will automatically go into RUN if the supply power is switched off and then restored.

Note
The above circuit will only operate as described, if Function 4 is set to 0.

When the HALT/RUN switch is put to RUN, there will be a delay before the processor goes into run. The delay is: 1.5 sec.

The MICRO-1 controller can be started or stopped through the use of the "RUN/STOP" switch located on the front of the PR3 program loader or the use of contacts 701 and 702.

Special IR Status	701	702
Run	OFF	OFF
Stop	ON	OFF

With special internal relays 701 and 702 switched off, will automatically start the processor (RUN LED ON) as soon as power is switched on to the processor.

To stop the processor (RUN LED OFF), operate following keys:

[TRS] [SET] [7] [0] [1] [ENTR]

[TRS] [RST] [7] [0] [2] [ENTR]
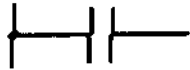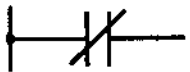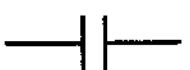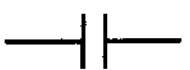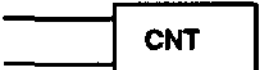
To restart the processor operate the following keys:-

[TRS] [RST] [7] [0] [1] [ENTR]

If the processor is in "RUN", at the time the supply power to the processor is interrupted, it will switch back to "RUN" when supply power is restored to the processor.

APPENDIX:

INSTRUCTION	LADDER SYMBOL	PROGRAM ENTRY
LOD	┤ ├	LOD, (DATA NUMBER), ENTR
LOD NOT	┤ /├	LOD, NOT, (DATA NUMBER), ENTR
AND	─┤ ├─	AND, (DATA NUMBER), ENTR
AND NOT	─┤/├─	AND, NOT, (DATA NUMBER), ENTR
OR	─┤ ├─	OR, NOT, (DATA NUMBER), ENTR
OR NOT	─┤/├─	OR, NOT, (DATA NUMBER), ENTR
OUT	─( )─	OUT, (DATA NUMBER), ENTR
TIM	[TIM]	TIM, (TIMER NUMBER), ENTR
CNT	[CNT]	COUNTER, (COUNTER NUMBER), ENTR
SFR, SFR NOT	[SFR,SFRN]	SFR, (INITIAL BIT NUMBER), ENTR, (# OF BITS)
MCS	┤MCS├	MCS, ENTR
MCR	┤MCR├	MCR, MCR, ENTR
SOT	┤SOT├	SOT, (SINGLE OUTPUT NUMBER), ENTR
SET	┤SET├	SET, (DATA NUMBER), ENTR
RST	┤RST├	RST, (DATA NUMBER), ENTR
JMP	┤JMP├	JMP, ENTR
JEND	┤JEND├	JMP, JMP, ENTR
END	┤END├	END, ENTR