

Unit 3: Timer Instructions Counter Instructions Use of Handheld Terminal Program Structures II

Retentive Timer On-Delay

OUTPT
TIMER
901
---(RTO)---
PR 0300
AC 0037

This output instruction is energized when the rung conditions become true for the amount of time specified as the Preset Value (PR). The elapsed time is called the Accumulated Value (AC), which can be viewed in the program run mode. The preset value represents the number of tenths of a second and must be in the range 0-9999. Valid addresses for the timer instructions are 901-932. The timer status bit has the same address as the timer instruction. Examine On and Examine Off instructions are used to program status bit conditions. The accumulated value can be reset by using the reset instruction --- (RST)---

RTF = Retentive Timer Off-Delay: This instruction works similar to the RTO instruction, except that the accumulated value represents the amount of time the rung conditions are false.




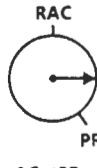




Up Counter

CYCLE
COUNT
901
---(CTU)---
PR 0300
AC 0037

This output instruction is energized when the Preset Value (PR) is equal to the Accumulated Value (AC). The accumulated value will increment each time the rung conditions make a false-to-true transition. The accumulated value can be viewed in the program run mode. The preset value represents the number of false-to-true transitions and must be in the range 0-9999. Valid addresses for the counter instructions are 901-932. The counter status bit has the same address as the counter instruction. Examine On and Examine Off instructions are used to program status bit conditions. The accumulated value can be reset by using the reset instruction --- (RST)---

CTD = Down Counter: This instruction works similar to the CTU instruction, except that the accumulated value is decremented with each false-to-true transition.

Addresses	Description
001-010	External Input
101-110	External Input (SLC-150 Only)
011-016	External Output
111-116	External Output (SLC-150 Only)
701-863	Internal Relay Type Addresses
901-932	Timer, Counter, Sequencer Addresses
951-982	Timer, Counter, Seq. Overflow Bits

<p>Status Bit</p> <p>901</p>  <p>Overflow Bit</p> <p>951</p>  <p>(Examine ON Instructions)</p>	<p>1. Timer Reset</p> <p>AC = RAC</p>  <p>AC < PR</p>	<p>2. RTO Rung TRUE or RTF Rung FALSE.</p> <p>AC Value Increments</p>  <p>AC < PR</p>  <p>AC ≥ PR</p>	<p>3. AC Value Overflows Beyond 999.9</p>  <p>AC < PR</p>  <p>AC ≥ PR</p>	<p>4. RST Rung TRUE.</p> <p>Timer Reset</p>  <p>AC < PR</p>		
RTO Status Bit	OFF	OFF	ON	ON	OFF	
RTF Status Bit	OFF	ON	OFF	OFF	OFF	
Overflow Bits	OFF	OFF	OFF	ON	ON	OFF

EXERCISES:

1. Using the PCIS software on the PC, read the TIMECNT program from the disk and save to the SLC unit. Transfer from the NVRAM to EEPROM. Enter the program run mode and monitor the program with the PC.
2. Examine rungs 1-3 of the program and verify the operation of the timer using input switches 1 and 2. Move the cursor to the RTO 901 instruction and push [F9]. Note that both the preset and accumulator values can be examined and changed.
3. Edit the program and change the RTO 901 instruction to RTF 901. Examine the operation of these rungs for this change.
4. Examine rungs 4-6 of the program and verify the operation of the counter using input switches 3 and 4. Move the cursor to the CTU 902 instruction and push [F9]. Note that both the preset and accumulator values can be examined and changed.
5. Make the accumulator value equal to 4. Turn the power off on the SLC and then turn back on. Has the accumulator value changed? Note that counters and timers are retentive. The accumulator values are retained even if power is turned off.
6. Rungs 7- 19 are the CYCLE part of the ladder logic program. These rungs function independently of rungs 1-6. When switch 5 is on, the cycle begins by swinging the frame right and left. On the fifth cycle the frame will stop after a swing to the right, the frame will be raised until the raised limit switch is engaged, the frame will drop for 8 seconds, and the frame will swing back to the left. The right swing and left swing cycles will repeat for another 5 times.

Note that the cycle can be described in the timing diagram shown at the end of the program. Run the program and verify its operation. Note that switch 5 will start the cycle and switch 7 is the limit switch. If the program is stopped and restarted, does it start again at the beginning of the cycle? Examine the accumulator values and explain what you see. How would you change the program so that it always started with five right and left swing cycles?

7. Turn off the PC and disconnect the cable from the SLC. Connect the handheld terminal cable to the SLC. Press ENTER to go to the program and step through the instructions using the NEXT and LAST keys. Note how the instruction, address, and rung number are symbolized on the handheld terminal display. You can jump to any rung by using the RUNG key. The preset and accumulator values for any timer or counter can be changed in the run mode. Change the timers so that the cycle rate is 1.5 seconds in each direction and that the raise and drop frame occurs once every ten cycles.

Homework:

Modify the cylinder program from unit 2, so that after four cycles of retract and extend, a frame lift cylinder will lift the frame for 2 seconds and a frame drop cylinder will drop the frame for 5 seconds. The cycle counter on output 11 will measure the number of retract cycles. Manual controls of all outputs will be achieved using the input switches shown on the Input/Output Description Sheet attached.

Rung: 001 TIMER #1: Run

TIMR1
ON
001TIMER
#1
901

]	[(RTO)
		PR 0100

Rung: 002 TIMER #1: Controls Output 011

TIMER
#1
901TIMR1
OUTPT
011

]	[()
---	---	-----

Rung: 003 TIMER #1: Reset

TIMR1
RESET
002TIMER
#1
901

]	[(RST)
		RE 0000

Rung: 004 COUNTER #1: Increment

CNTR1
ON
003COUNT
#1
902

]	[(CTU)
		PR 0005

Rung: 005 COUNTER #1: Controls Output 012

COUNT
#1
902CNTR1
OUTPT
012

]	[()
---	---	-----

Rung: 006 COUNTER #1: Reset

CNTR1
RESET
004COUNT
#1
902

]	[(RST)
		RE 0000

Rung: 007 CYCLE: Swing Right Timer (Region A)

CYCLE
ON/OF
005SWGRT
TIMER
903

]	[(RTO)
		PR 0030

Rung: 008 CYCLE: Swing Right Actuator (Region A)

CYCLE SWGRT
ON/OF TIMER
005 903SWING
RIGHT
014

+---] [---] \ [-----] ()-----+

Rung: 009 CYCLE: Swing Right Timer Reset (Region H)

SWGLF
TIMER
904SWGRT
TIMER
903

+---] [-----] (RST)-----+

RE 0000

Rung: 010 CYCLE: Swing Left Timer (Region B)

SWGRT SWING
TIMER COUNT
903 905SWGLF
TIMER
904

+---] [---] \ [-----] (RTO)-----+

PR 0050

Rung: 011 CYCLE: Swing Left Actuator (Region B)

SWGRT SWGLF SWING
TIMER TIMER COUNT
903 904 905SWING
LEFT
015

+---] [---] \ [---] \ [-----] ()-----+

Rung: 012 CYCLE: Swing Left Timer Reset (Region J)

SWGRT SWGLF
TIMER TIMER
903 904SWGLF
TIMER
904

+---] \ [---] [-----] (RST)-----+

RE 0000

Rung: 013 CYCLE: Swing Count (Region B)

SWGRT
TIMER
903SWING
COUNT
905

+---] [-----] (CTU)-----+

PR 0005

Rung: 014 CYCLE: Raise Frame Actuator (Region C)

SWGRT SWING RASLM
TIMER COUNT BIT
903 905 701RAISE
FRAME
016

+---] [---] [---] \ [-----] ()-----+

Rung: 015 CYCLE: Raise Limit Switch Bit Latch (Region D)

RAISE
LMSWT
007RASLM
BIT
701

] [----- (L)-----

Rung: 016 CYCLE: Drop Frame Timer (Region D)

RASLM
BIT
701DRFRM
TIMER
906

] [----- (RTO)-----

PR 0080

Rung: 017 CYCLE: Raise Limit Switch Bit Unlatch (Region E)

DRFRM
TIMER
906RASLM
BIT
701

] [----- (U)-----

Rung: 018 CYCLE: Drop Frame Timer Reset (Region F)

DRFRM RASLM SWING
TIMER BIT COUNT
906 701 905DRFRM
TIMER
906

] [---]\[---]\[----- (RST)-----

RE 0000

Rung: 019 CYCLE: Swing Counter Reset (Region E)

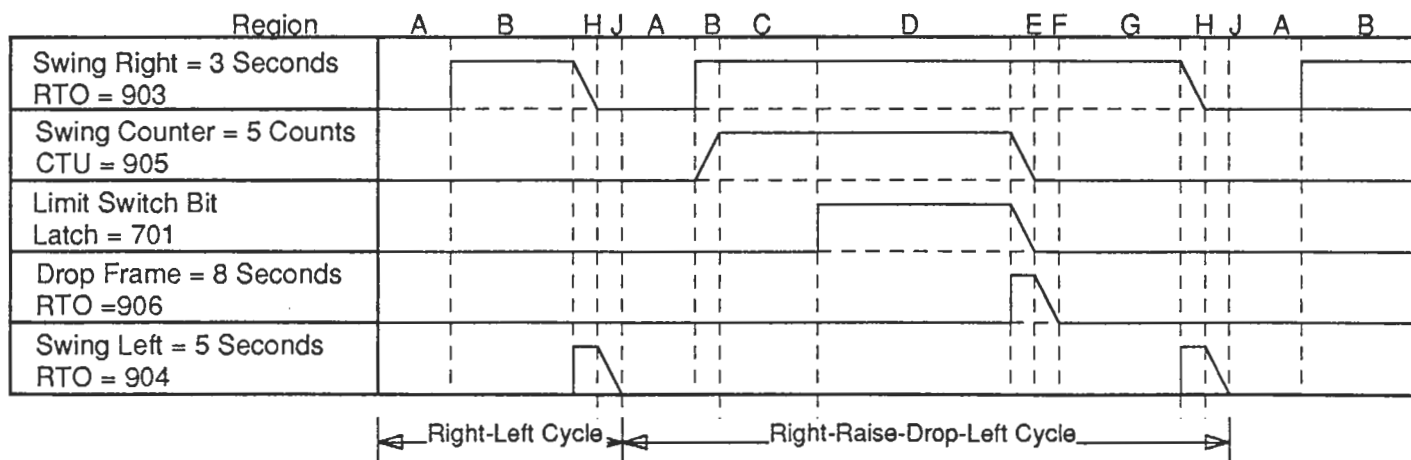
DRFRM
TIMER
906SWING
COUNT
905

] [----- (RST)-----

RE 0000

----- End of Ladder --- Words used = 00053 -----

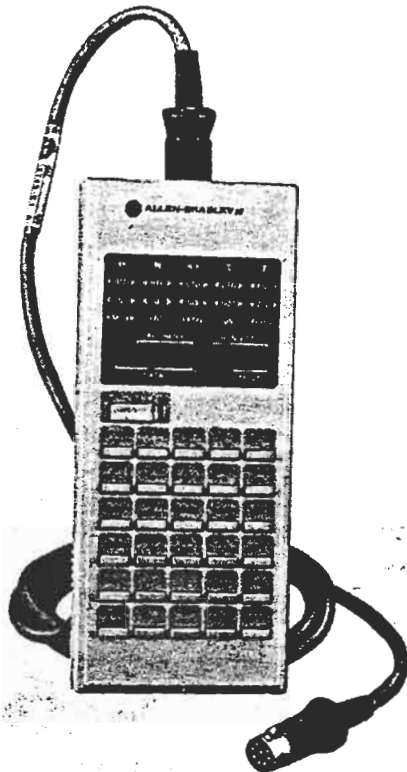
CYCLE PROGRAM TIMING DIAGRAM



SLC-150 Handheld Terminal

Figure 4.2

In this typical display, the cursor is located at an Examine OFF instruction, address 008. It is the first instruction in rung 3 of the program, and its current status is TRUE:



Pocket programmer.

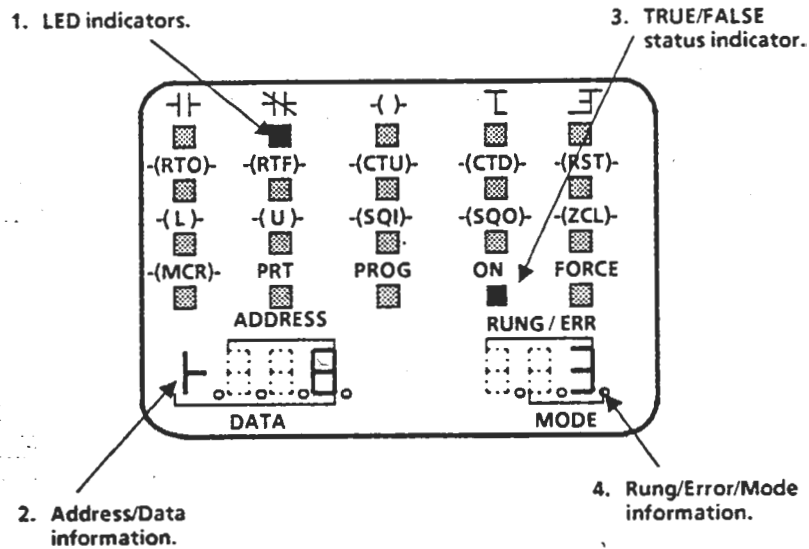
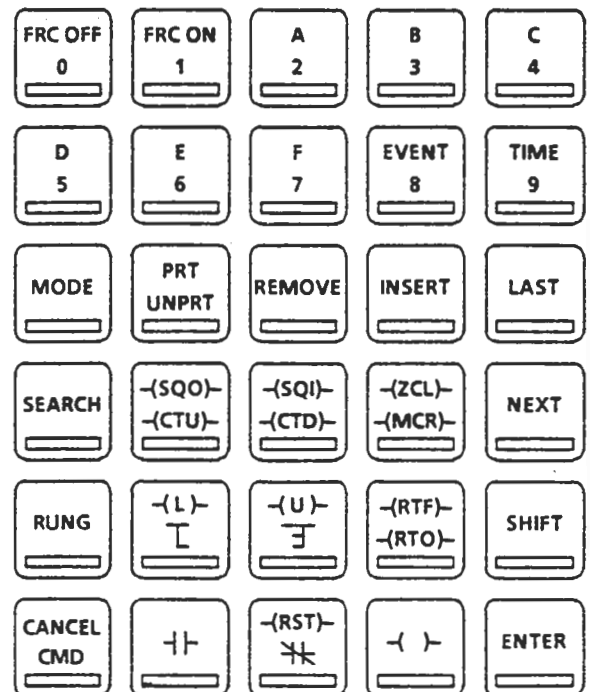


Figure 4.1



Pocket programmer keyboard.

SLC 150 Commands

Abbreviations and Symbols			
FRC OFF	Force OFF	-(RTF)-	Retentive Timer Off-Delay
FRC ON	Force ON	-(RTO)-	Retentive Timer On-Delay
PRT	Protect	CANCEL	Cancel Command
UNPRT	Not Protect	CMD	
-(SQO)-	Sequencer Output	-(RST)-	Reset
-(SQI)-	Sequencer Input	$\overline{\text{I}}$	Branch Open
-(CTU)-	Up Counter	$\overline{\text{E}}$	Branch Close
-(CTD)-	Down Counter	+	Examine ON
-(ZCL)-	Zone Control Last State	+	Examine OFF
-(MCR)-	Master Control Reset	+	
-(L)-	Latch	+	Output Energize
-(U)-	Unlatch	+	Shift Register (use shift key)

The pocket programmer is used to select the various *modes of operation*. A list of these modes appears on the back of the programmer. A detailed explanation is given below.

Figure 4.3

Mode	Description	Display
1	CLEAR MEMORY: Selecting this mode erases the contents of the on-board RAM memory. Upon completion, the programmer automatically switches to mode 2, Program.	CLER
2	PROGRAM: Used to enter a new program or up-date an existing one in the RAM memory.	prog
3	RUN: In this mode, the processor scans and executes the user program. Input devices are monitored and output devices are energized accordingly. In this mode, the programmer can be used to monitor the user program, force I/O, and change timer/counter preset and accumulated values. Sequencer preset values can also be changed.	run
4	TEST-SINGLE SCAN: This mode causes the processor to complete a single scan of the user program each time the ENTER key is pressed. No outputs will be energized. Timer and time-driven sequencer accumulated values will be incremented by 0.1 on each scan if rung conditions are correct. The programmer can be used to monitor the user program, force I/O, and change counter/timer/sequencer values.	SScn
5	TEST-CONTINUOUS SCAN: Causes the processor to operate from the user program without energizing any outputs. The programmer can be used to monitor the user program, force I/O, and change counter/timer/sequencer values.	CScn
6	STORE USER PROGRAM IN EEPROM MODULE: Allows you to save a program, that is, store a program contained in the on-board RAM memory in an EEPROM memory module.	SAUE
7	LOAD USER PROGRAM FROM EEPROM MODULE: This mode allows you to read a program into memory, that is, load a program contained in an EEPROM module into the on-board RAM memory. You can then remove the EEPROM module or leave it in place. The processor operates from the RAM only.	rEAd
8	ENTER/CHANGE ACCESS CODE: This mode allows you to enter or change an access code or password.	PASS
9	DIAGNOSTIC TEST-PROGRAMMER: A sequence of self-checking diagnostic tests. Refer to Page 22-15 (Maintenance and Troubleshooting) for details.	dIAG

SLC 150 HHT Modes

Use if PLC Locks Up →

One of these
2 Modes are
Generally Used

EEPROM Program
Transfer

SLC 150 EXTERNAL INPUT/OUTPUT DESCRIPTION

Date: 3 June '92

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Project: 2CYLNDR

SLC 150 Serial Number:

Test Engineer:

PLC Programmer: Robert Laurie

Account Number:

Program Name:

Input Address	Input Symbol		Input Description	Remarks
	Upper	Lower		
001	CYLDR	ON/OFF	Panel Switch: Cylinder Program On/Off	
002	MANUL	EXCYL	Panel Switch: Manual Extend Cylinder	
003	MANUL	RTCYL	Panel Switch: Manual Retract Cylinder	
004	MANUL	LIFT	Panel Switch: Manual Lift Frame	
005	MANUL	DROP	Panel Switch: Manual Drop Frame	
006	LMSWT	EXTND	Limit Switch: Extend Cylinder	Normally Open
007	LMSWT	RETRC	Limit Switch: Retract Cylinder	Normally Open
008	LMSWT	EMSTP	Limit Switch: Emergency Stop	Normally Open
009	PUMP	START	Panel Switch: Pump Start	
010	PUMP	STOP	Panel Switch: Pump Stop	
101				
102				
103				
104				
105				
106				
107				
108				
109				
110				

Output Address	Output Symbol		Output Description	Remarks
	Upper	Lower		
011	CYLDR	CYCNT	Cylinder Actuation Cycle Counter	
012	HYDRL	PUMP	Hydraulic Pump On	
013	LIFT	FRAME	Lift Frame Solenoid Valve	
014	DROP	FRAME	Drop Frame Solenoid Valve	
015	EXTND	CYLDR	Extend Cylinder Solenoid Valve	
016	RETRC	CYLDR	Retract Cylinder Solenoid Valve	
111				
112				
113				
114				
115				
116				