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Timer Counter Access Terminal (TCAT)

Demonstrator Exercises

Application

This demonstrator is intended for use with an SLC 100 Programmable Controller Demo Unit. The exercises in this product data sheet and the keystroke examples in the TCAT User's Manual will help prepare you to apply the TCAT to your specific needs.

Components

Demonstrator components include a TCAT mounted in a metal frame, an interconnect cable, two keys with keyring, a User's Manual, and this product data sheet.

We assume that you have access to an SLC 100 Demo Unit, demonstrator exercises (Pub. 1745-802), and User's Manual (Pub. 1745-800). Before you begin the exercises in this product data sheet, the program shown on Page 2 must be entered into the SLC 100 processor. In many demonstration situations, the program will already have been entered for you.

A typical setup appears below. It shows the TCAT interconnect cable plugged into the SLC 100 processor. The system is energized, and you are ready for the TCAT exercises.



Publication 1745-852 – April, 1986

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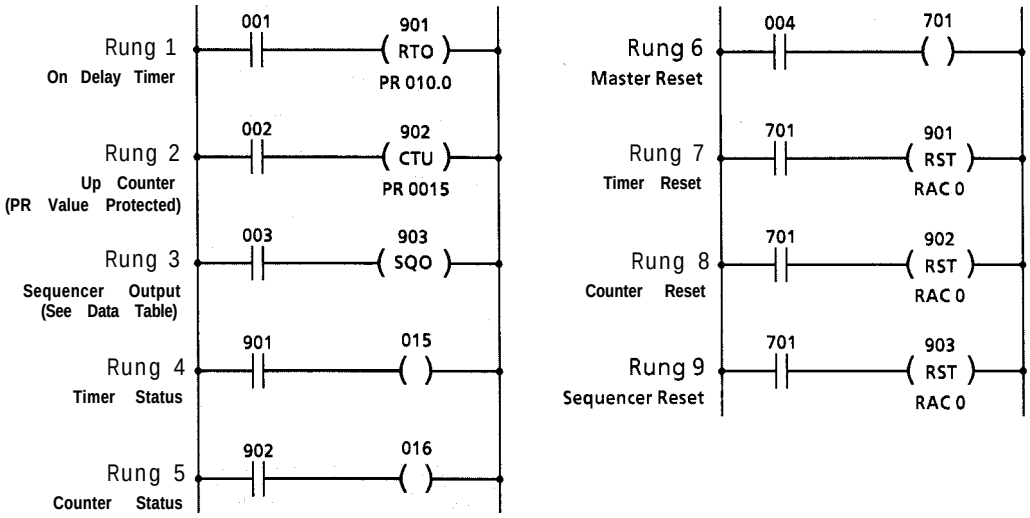
Entering the Program

If the program is already entered, go on to Page 3.

In preparation for performing the TCAT exercises, enter the following 9-rung ladder diagram into the processor memory. Follow the setup and programming procedures outlined in the SLC 100 demonstrator exercises (Pub. 17458021 and the User's Manual (1745-800).

Note that the counter PR value (rung 2) should be protected, and the PR values of sequencer steps 0 and 4 (data table) should be protected. (Protecting PR values is discussed on Page 14-7 of the SLC User's Manual.)

We recommend that you remove the EEPROM module. This avoids the possibility of losing modified data if you power down, then power up again during the TCAT exercises (see Auto-Load Procedure, SLC 100 manual).



CLASSIFICATION: ☐ –(SQI)– ☒ –(SQO)– ADDRESS: 903 ❑ TIME DRIVEN ☐ EVENT DRIVEN GROUP NUMBER: 0

BIT ADDRESS, DATA									PROGRAM CODE		PRESET VALUES
	B				A				Data B	Data A	Note: PR values of steps 0 and 4 are protected.
Bit Addresses +	018	017			016	013	012	011			
Mask Data+	0	0	0	0	1	1	1	1	0	F	
Step Data → 0	⊗	⊗	⊗	⊗	0	0	0	0	0	0	0. 3P
1	⊗	⊗	⊗	⊗	0	0	0	1	0	1	0. 3
2	⊗	⊗	⊗	⊗	0	0	1	0	0	2	0. 3
3	⊗	⊗	⊗	⊗	0	1	0	0	0	4	0. 3
4	⊗	⊗	⊗	⊗	1	0	0	0	0	8	0. 3P

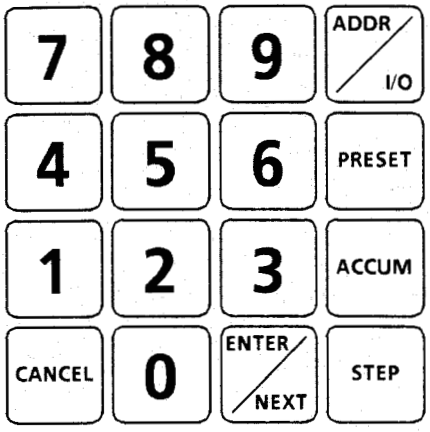
⊗ Masked address. Used as0 for coding purposes

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TCAT Keyboard and Displays

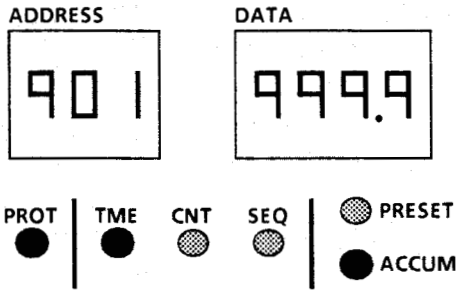
Explanations of the TCAT keyboard and displays are shown below. SLC demo unit inputs and outputs are also pointed out. You may want to review this information before you begin the exercises.

TCAT – Keyboard



Key	Explanation
ADDR	Address
I/O	Input/Output groups
PRESET	Preset (PR) value
ACCUM	Accumulator (AC) value
CANCEL	Cancel previous keystroke
ENTER	Enter an address or data
NEXT	Move to next instruction
STEP	Step number (sequencers)

TCAT – Displays



Abbreviations

PROT – Protected	SEQ – Sequencer
TME – Timer	PRESET – Preset (PR) Value
CNT – Counter	ACCUM – Accumulator (AC) Value

Explanation of displays and LED indicators

In this typical display, the TME indicator is lit, telling us that a timer is being monitored. The ADDRESS display indicates the timer address to be 901.

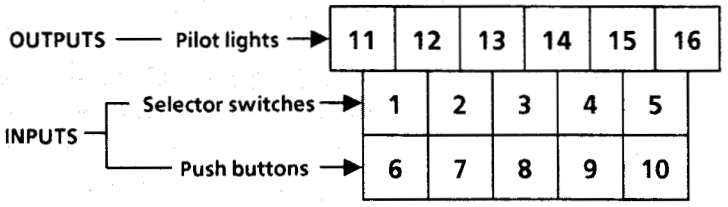
The ACCUM indicator is lit, telling us that the AC value is being monitored. The DATA display shows the AC value to be 999.9.

The PROT indicator is lit, telling us that the timer is protected (the AC or PR value cannot be modified).

Display Instruction Symbols: Various abbreviations and symbols appear in the DATA display to indicate timer, counter, and sequencer instructions. See Page 3-3 of the TCAT User's Manual.

SLC Demo – Inputs and Outputs

You will be using some of the selector switches in the exercises. Also, certain pilot lights will be energized to indicate timer, counter, or sequencer outputs.

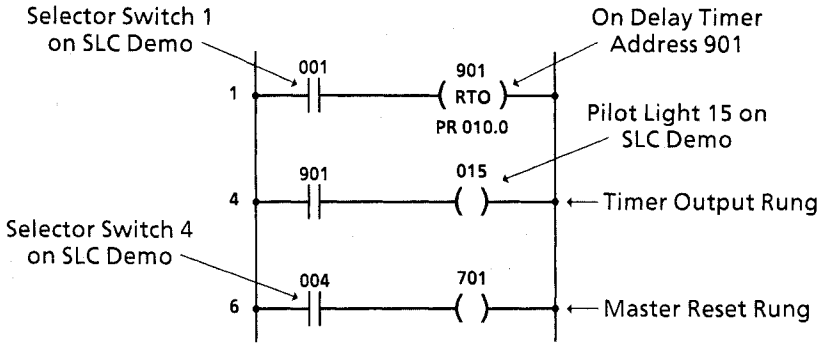


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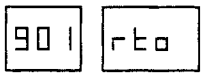
Exercise 1. Accessing a Timer

This exercise will show you how to access an On-Delay timer instruction at address 901. You will observe and change the PR and AC values.

The figure below shows the programmed timer rungs and the master reset rung. Note that selector switches 1 and 4 and pilot light 15 of the SLC demo unit are involved in this exercise.



1. Place all selector switches of the SLC demo in the off position. Power up the demo and observe the TCAT displays. The TCAT will perform its diagnostic tests, then display the instruction at the lowest timer/counter/sequencer address in the program:

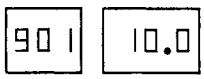
   (TME indicator lit)

   The display indicates an On-Delay timer at address 901. The TME indicator is lit. (Display instruction symbols are explained on Page 3-3 of the TCAT User's Manual.)

2. To observe the PR value, press this key:

   The TCAT will display:

   (TME, PRESET indicators lit)

3. Now change the PR value to 50.0 seconds. To do this, insert the TCAT key and turn it to the modify position. Then press these keys:

   The TCAT will display:

   (TME, PRESET indicators lit)

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Exercise 1. Accessing a Timer *(continued)*

4. Now observe the AC value. Press this key:



The TCAT will display:



(TME, ACCUM indicators lit)

5. Now turn selector switch 1 of the SLC demo to the on position. The timer is now operating, and the TCAT display will show the AC value incrementing.
6. Reset the AC value to the RAC value of 0. Do this by turning selector switch 4 of the SLC demo unit to the on position, then back to off. The AC value will increment from 0.
7. Change the AC value to 32.0 seconds by pressing these keys:

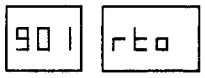


The AC value will increment from 32.0 seconds. When it reaches 50.0 (the PR value), the timer produces an output. Pilot light 15 on the SLC demo unit will be lit.

8. Return the display to the timer instruction symbol. Do this by pressing this key:



The TCAT returns to the display shown in step 1:



(TME indicator lit)

Note: When you are monitoring the PR or AC value, you can return the TCAT display to the instruction symbol at any time by pressing the CANCEL key.

9. Reset the timer by turning selector switch 4 of the SLC demo on, then off. Leave the TCAT display on the instruction symbol, in preparation for Exercise 2.

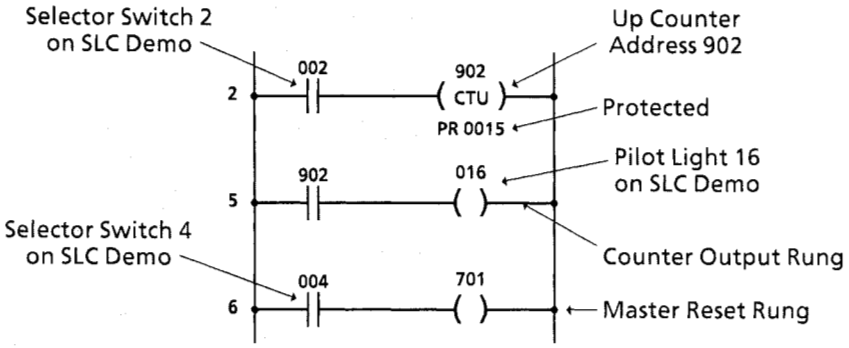
References: Pages 3-2, 3-3, 3-5, 3-11, 4-1, 4-2, 4-4, and 4-6 of the TCAT User's Manual.

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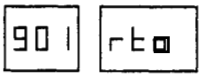
Exercise 2. Accessing a Counter

In this exercise you will access an up counter instruction at address 902. You will observe the PR and AC values, then discover that they are protected and cannot be changed.

The figure below shows the programmed counter rungs and the master reset rung. Note that selector switches 2 and 4 and pilot light 16 of the SLC demo unit are involved in this exercise.



1. We begin with the TCAT display on the RTO timer at address 901 (step 8 and 9 of exercise 1):

   (TME indicator lit)

   Press this key:

   The TCAT will display:

   (CNT, PROT indicators lit)

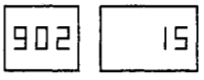
   The display indicates an up counter at address 902. The CNT (Counter) and PROT (Protect) indicators are lit.

   How the NEXT key works: Pressing the NEXT key moves the display to the next highest timer/counter/sequencer address used in the program. As the display moves from one address to the next, it shows the same *type* of data – instruction symbol, or PR value, or AC value.

2. Observe the PR value of the counter by pressing this key:

   The TCAT will display:

   (CNT, PRESET, PROT indicators lit)

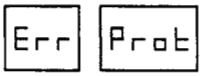
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Exercise 2. Accessing a Counter *(continued)*

3. The PR value is protected. Verify this by trying to change it. With the TCAT mode key in the modify position, press this key:



The TCAT will display:



(CNT, PRESET, PROT indicators lit)

This is an error code, indicating that the PR value is protected and cannot be changed.

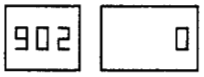
4. Clear the error by pressing this key:



5. Observe the AC value by pressing this key:



The TCAT will display:



(CNT, ACCUM, PROT indicators lit)

The AC value is also protected. We won't try to change it.

6. Turn selector switch 2 of the SLC demo to the on position, then off. The TCAT display will show the AC value increment to 1. Repeat turning the selector switch on and off. At an AC value of 15, pilot light 16 of the SLC demo will be lit.

7. Reset the AC value to 0 by placing selector switch 4 in the on position, then off. Leave the TCAT display on the AC value of address 902 in preparation for exercise 3.

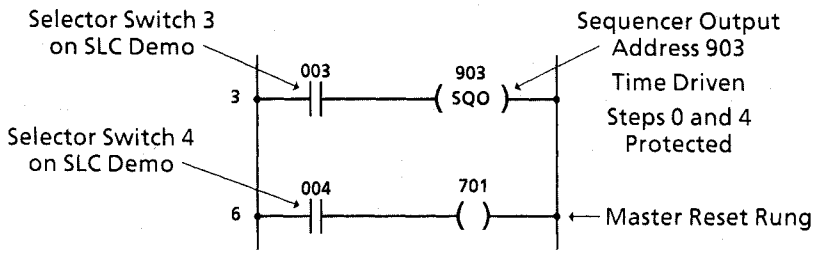
References: Pages 3-2, 3-3, 3-4, 3-9, 3-10, 3-11, 4-1, 4-3, 4-5, and 4-7 of the TCAT User's Manual.

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Exercise 3. Accessing a Sequencer

In this exercise, you will access a sequencer output instruction at address 903. It is a 5-step sequencer, with steps 0 and 4 protected. You will observe the PR and AC values, and change the PR value of step 1.

The figure below shows the programmed sequencer output rung and the master reset rung. Selector switches 3 and 4 as well as pilot lights 11, 12, 13, and 14 of the SLC demo unit are involved in this exercise.



In the last exercise, we left the TCAT display showing the AC value of counter 902. To access the sequencer at address 903, we could simply press the NEXT key. But don't. We'll use an alternate method.

1. Select address 903. You don't have to enter the "9" or the "0" in 903. Press these keys:

   The TCAT will display:

   (SEQ, ACCUM, PROT indicators lit)

   Whenever you use this method of selecting an address, the TCAT automatically displays the AC value of the particular instruction. In this case, the AC value of the current sequencer step is displayed. The PROT indicator is lit, indicating that the step is protected.

2. Observe the instruction symbol by pressing this key:

   The TCAT will display:

   (SEQ indicator lit)

   The instruction symbol is interpreted as follows:

   - □ Sequencer output
   - C Time driven
   - 00 Group number 0

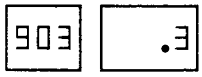
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Exercise 3. Accessing a Sequencer *(continued)*

3. If we choose, we can go back to the AC value display (by pressing the ACCUM key), but we'll go to the PR value display instead. Press this key:



The TCAT will display:

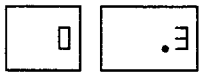


(SEQ, PRESET, PROT indicators lit)

This tells us that the PR value of the current step is 0.3 seconds, and it is protected. To find out what the current step number is, press this key:



The TCAT will display:



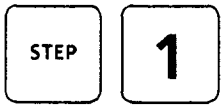
(SEQ, PRESET, PROT indicators lit)

The step number is 0. You can call up a step number *only when the display is showing the AC value or the PR value.*

4. Change the PR value of step 1 from 0.3 second to 0.5 second. Place the TCAT mode key in the modify position, then press these keys:



The change is entered and the display automatically resumes monitoring step 0. To verify the change, press these keys:



The TCAT will display:



(SEQ, PRESET indicators lit)

Return to monitoring step 0 by pressing this key:



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Exercise 3. Accessing a Sequencer (continued)

5. Now we'll observe the sequencer operating. Place selector switch 3 of the demo in the on position. The TCAT address display will show you the step numbers in sequence; the data display will show you the PR values of the steps; the PROT indicator will show you which steps are protected.

   Observe pilot lights 11, 12, 13, and 14 of the demo. Note that they light in sequence as the sequencer moves from step to step.

   Observe the AC value by pressing this key:

   The TCAT data display will show the AC value incrementing thru each step.

6. Turn off the sequencer by turning selector switch 3 off. Reset the sequencer to step 0 by turning selector switch 4 on, then off.

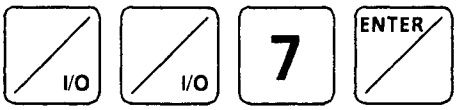
References: Pages 3-2, 3-3, 3-4, 3-9, 3-11, 5-1, 5-2, 5-3, 5-4, and 5-5 of the TCAT User's Manual.

Exercise 4. Monitoring Group Number Addresses

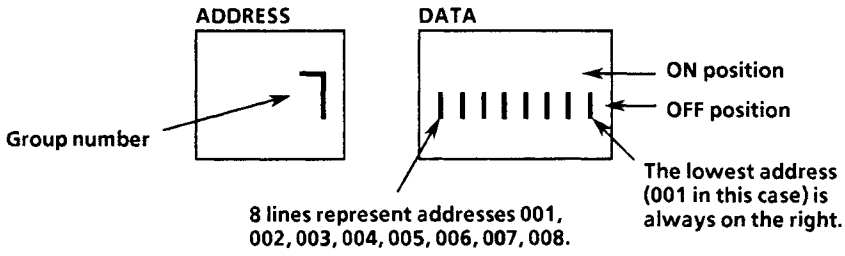
An address group number represents 8 user program addresses. This exercise will show you how to access addresses and monitor the status of instructions at these addresses.

Before you begin, refer to Figure 6.1 on Page 6-2 of the TCAT User's Manual. This figure lists the addresses assigned to the various group numbers.

1. We left exercise 3 with all selector switches off and the sequencer reset. Beginning at this point, select group number 7 by pressing these keys:

   The TCAT will display the following. We've added an explanation of the symbols:

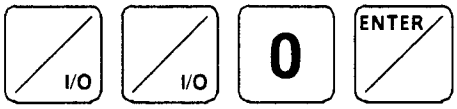
   Selector switches 1 thru 5 and push buttons 6, 7, and 8 of the demo unit correspond respectively to addresses 001 thru 008 of group number 7. The display is telling you that all of these inputs are off.

2. Turn the selector switches on. observe how the display indicates the on condition. Press push buttons 6, 7, and 8. Observe the display.

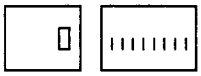
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Exercise 4. Monitoring Group Number Addresses *(continued)*

3. Now select group number 0, corresponding to addresses 011 thru 018, by pressing these keys:



The TCAT will display:



Pilot lights 11 thru 16 of the demo unit correspond respectively to addresses 011 thru 016 of group number 0. (Addresses 017 and 018 of group number 0 are internal.) The display is telling you that all of these outputs are off.

4. In the demonstrator program, pilot lights 11 thru 14 are used as outputs of sequencer 903. We can observe the on/off status of these outputs under operating conditions by turning on the sequencer. Do this by placing selector switch 3 in the on position. Observe the TCAT display. Then turn selector switch 3 off.

5. One final step. You can move from one group number to the next by pressing the NEXT key. Try it.

References: Chapter 6 of the TCAT User's Manual.

Preparation for the next demonstration

During these exercises, the PR value of the timer and the PR value of sequencer step 3 have been changed. Other changes may have been made.

The user program should be examined and restored to the one appearing on Page 2. Make certain all selector switches are off and the instructions are reset.

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