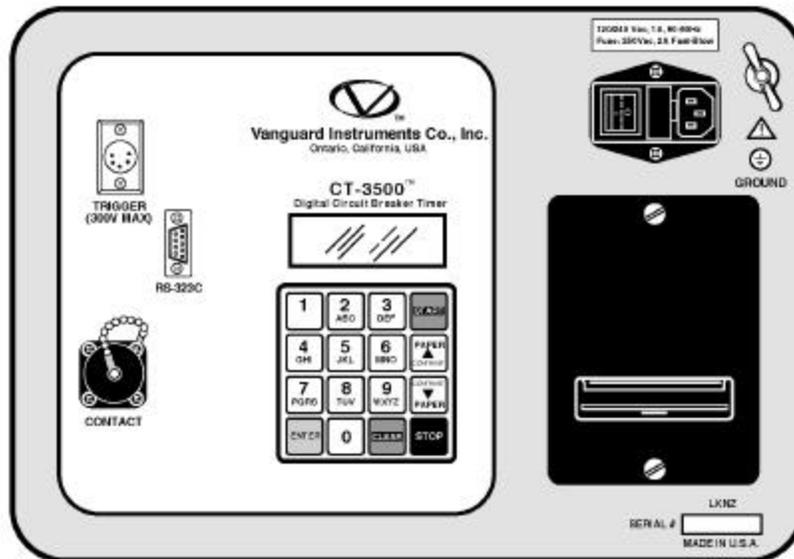


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**OPERATING INSTRUCTIONS**  
for the  
**Model CT-3500™**  
**Circuit-Breaker Timer**  
Part Number VIC-35000



**Vanguard Instruments Company**  
1710 Grevillea Court  
Ontario, California 91761

## SAFETY SUMMARY

The following safety precautions must be observed during all phases of test set-up, test hookups, testing, and test-lead disconnects.

### **Do Not Service or Test Alone**

Do not perform test procedures or service unless another person is also present who is capable of rendering aid and resuscitation.

### **Avoid Contact with High Voltage**

Because electrical utility station environments contain high voltages and currents, there is always the possibility of personal contact with an unexpected lethal voltage generated by magnetic induction and electrostatic leakage from nearby live circuitry. When test units are connected to deenergized ("dead") power lines, regardless of how short they are, always discharge the lines before attaching any test lead. Because of the possibly deadly consequences of physical contact with such high-voltage lines, engineers and technicians must always treat electrical equipment and hookups as though a lethal condition will eventually occur. Therefore, no matter how unlikely it may seem, never assume anything about the safety of any test setup.

*Ensure the safety of all personnel by checking first-hand to eliminate every possible hazard!*

### **Do Not Modify Test Equipment**

Because of the added risk of introducing additional or unknown hazards, do not install substitute parts or perform any unauthorized modification to the equipment. To ensure that designed safety features are maintained, it is recommended that all equipment repairs be performed at Vanguard Instruments Co. or by an authorized repair-service. Unauthorized equipment modifications can create unknown safety hazards and will void the warranty.

### **Follow Exact Operating Procedures**

Any deviation from operating procedures described in this manual may create one or more safety hazards, damage the unit, or cause test errors; Vanguard Instruments Co. assumes no liability for unsafe or improper use of this equipment or for any collateral damage to other equipment resulting from such misuse.

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## 1.0 INTRODUCTION

### 1.2 Applicability

This manual applies to Model CT-3500<sup>™</sup>, manufactured by Vanguard Instruments Co., part number CT-35000. This operator's manual is intended for personnel who operate and test utility circuit breakers (hereafter, breaker).

### 1.3 Supersedure Notice

This Operator's manual is the basic issue for the Model CT-3500<sup>™</sup> and does not supersede any previously published manual.

## 2.0 GENERAL DESCRIPTION

The CT-3500<sup>™</sup> Digital Breaker Timer (henceforth, for brevity, called CT-3500) is a microprocessor-controlled timer designed to test electrical-utility circuit breakers.

(The CT-3500 can also time contact operations of any switching device—e.g., switching relays, remotely controlled contactors, etc.) It contains 3 independent timers for the simultaneous timing of each set of contacts in three-phase breakers.

The CT-3500 fully analyzes the timing of breaker contact operation: OPEN, CLOSE, OPEN-CLOSE, and CLOSE-OPEN.

It's field-portable, very rugged, and is easily operated by first-time users with little training.

It features a 16-key pushbutton pad for entering breaker test ID and control function. A 4-line by 20-character back lighted LCD displays control menus, and measured test results.

Test results can be printed on a built-in 2.5 inch-wide thermal printer.

Operation requires little more than connecting the cables of the CT-3500 to utility breaker contacts, selecting the desired test options and enabling the test results to be stored in a non-volatile memory.

Operations do not require any conversion calculation, written note, or detailed list of steps to remember (thus, greatly reducing any chance of error by the operator).

The CT-3500 stores up to 128 timing (test shot) records in FLASH EEPROM memory. Stored timing-measurements and related data can be displayed and printed in the field or stored for later review, analysis, or printing.

A RS-232C serial interface port also provides for computer interface and diagnostic test.

### 2.1 Functional Description

CT-3500's operation (a timing shot) is started by an input trigger (e.g., a breaker's initiating control voltage), which starts all 3 timers at the same instant. Each timer independently stops after detecting each contact transition.

Besides measuring contact time each timer will also measure contact bounce time.

The timing results display in both milliseconds and cycles. The cycle display is selectable between 50Hz or 60Hz.

The CT-3500 can be interfaced (via an RS-232C interface port) with a IBM-compatible PC. A software package supplied with the CT-3500 allows the user to retrieve the test data stored in the CT-3500 Flash EEPROM.

### 2.2 Furnished Accessories

The CT-3500 is supplied with the following accessories:

1. One 15-ft. Trigger Cable.
2. One 15 ft Contact Cable.
3. One 30 ft Extension Cable.
4. One Grounding Cable.
5. One Power Cord.
6. One Cable Carrying Bag.

**3.0 CT-3500 SPECIFICATION**

(Refer to the specification list in Table 1.)

**Table 1. CT-3500 Specifications and Leading Particulars**

<b>MODEL</b>	CT-3500
<b>TYPE</b>	Special-purpose utility test equipment; Digital Circuit-Breaker Timer
<b>SIZE</b>	15-inches Wide by 7-inches High by 13-inches Deep
<b>WEIGHT</b>	Less than 15 pounds
<b>INPUT POWER</b>	90-120 or 220-240 volts ac (Selectable), 50/60Hz
<b>DRY CONTACT INPUTS</b>	3 channels (continuity detectors)
<b>TRIGGER INPUT</b>	Open/Close: 24 to 300 V, dc/peak ac
<b>OPERATIONS</b>	Open, Close, Open-Close, and Close-Open strokes
<b>RESOLUTION</b>	±1/10 millisecond
<b>ACCURACY</b>	0.1% of reading ±0.1ms
<b>DISPLAY</b>	LCD, back lighted, 4-line-by 20-character; alpha-numeric
<b>CONTROLS</b>	Keypad, 10 alpha-numeric and 6 function pushbuttons
<b>COMPUTER INTERFACE</b>	RS-232C
<b>PRINTER</b>	Built-in thermal printer (prints on 2.5-inch-wide strip)
<b>ENVIRONMENT</b>	Operating: 0°C to 55°C; Storage: -40°C to 65°C
<b>SHIPPING CASE</b>	Optional (Hard case with foam liner)
<b>WARRANTY</b>	One Year parts & labor; post-warranty service available

**NOTE:**

**THE ABOVE SPECIFICATIONS ARE VALID AT NOMINAL OPERATING VOLTAGE AND AT A TEMPERATURE OF 25°C (77°F)  
THE CT-3500<sup>Ⓞ</sup> SPECIFICATIONS MAY BE UPGRADED AND CHANGED WITHOUT PRIOR NOTICE.**

**3.1 CONTROLS and INDICATORS**

The control-panel is shown in figure 1. Leader lines point to each item in the figure with an index number cross-referenced to a functional description in Table 2.

Users should become familiar with these items before trying to use the CT-3500. Misuse of the CT-3500 can create serious hazards and cause loss of data, and equipment damage.

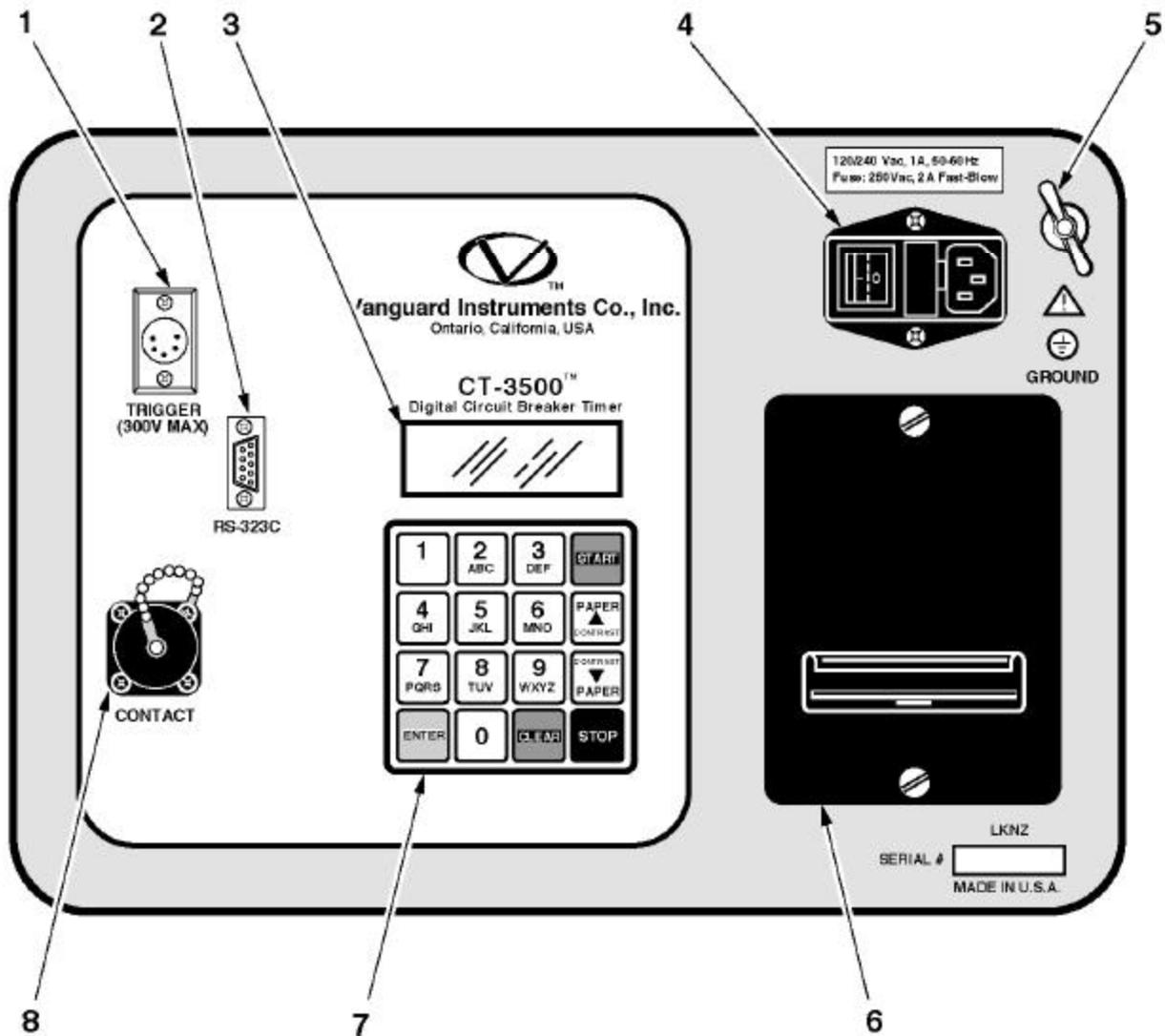


Figure 1.0 CT-3500 Controls and Indicators

Table 2. Functional Description of Controls and Indicators

Fig. 1 Index #	ADJACENT PANEL MARKING	FUNCTIONAL DESCRIPTION								
1	<b>TRIGGER (300V MAX)</b>	Connector, 5-pin, male; trigger input starts CT-3500 three timers; leads are connected to breaker-Trip and Close coils. Trigger voltage ranges from 24 to 300 volts dc or peak ac.								
2	<b>RS-232C</b>	Serial interface-port connector (9-pin, DB type) lets CT-3500 be controlled by an IBM type PC.  <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th><u>PIN</u></th> <th><u>SIGNAL</u></th> </tr> </thead> <tbody> <tr> <td>2</td> <td>Tx</td> </tr> <tr> <td>3</td> <td>Rx</td> </tr> <tr> <td>5</td> <td>Signal Ground</td> </tr> </tbody> </table>	<u>PIN</u>	<u>SIGNAL</u>	2	Tx	3	Rx	5	Signal Ground
<u>PIN</u>	<u>SIGNAL</u>									
2	Tx									
3	Rx									
5	Signal Ground									
3	none	Display, 4-line by 20-character LCD, backlit; displays menus, prompts, and test-result data.								
4	<b>120/240 Vac, 1A, 50-60 Hz</b>	Input power plug and ON/OFF rocker switch								
5	<b>GROUND</b>	Threaded grounding stud; 5/16-18 with wing nut; Safety Ground; Must be connected to station ground before hookup and testing.								
6	none	Built-in thermal printer; prints test result data on 2.5-inch-wide thermal paper.								
7	none	Keypad; ten alpha/numeric and 6 function keys (momentary-contact pushbuttons); functions are: ENTER, START, CLEAR, STOP, Up (^) and down (v)--paper control pushbuttons; used for test menu selections, and data entries.								
8	<b>CONTACT</b>	Contact cable connector, 16-pin male. Contact cable contains 3 contact leads (phase A, B, or C) and one common lead.								

**3.2 CT-3500 LCD Contrast Control**

To Darken the LCD display, press and hold the “Paper ^ Contrast” switch for two seconds; to lighten the LCD display, press and hold the “Paper v Contrast” switch for two seconds.

**3.3 CT-3500 Printer Control**

To advance printer paper, press “Paper ^ Contrast” switch once. Paper will advance from printer. Press “Paper v Contrast” switch once, paper will advance backward from printer.

**3.4 RS-232C Computer-Interface port**

An IBM PC software package is supplied with each CT-3500 allows the user to retrieve test records stored in the CT-3500 memory.

**4.0 PRETEST SETUP**

**4.1 Operating Voltage**

Primary input-power operating voltage is selectable between 90 to 120 Vac and 220 to 240 Vac.

Unless specified differently at the time of purchase, the CT-3500 is configured to operate from a 90 to 120 Vac (default) input. Changing jumper links on the primary power strip selects alternate (refer to Table 3) voltage levels

**Table 3. Input-Voltage-Selection Jumper Configurations**

<b>VOLTAGE SELECTION</b>	<b>J1 JUMPERS</b>
90 to 120 Volts, ac	Pin 1-2 and Pin 3-4
220 to 240 Volts, ac	Pin 2-3

**4.2 CT-3500 Printer Paper**

The CT-3500 printer uses 2.5-inch wide thermal paper for printing test results. We recommend that to maintain the highest quality printing and to avoid paper jamming, use paper supplied by our factory. Paper can be ordered from two sources, as follows:

BG Instrument Co.  
 13607 E. Trent Avenue  
 Spokane, WA 99216  
 Tel: 509-893-9881  
 Fax: 509-893-9803  
 Part Number: TP-3 paper

Vanguard Instruments Co, Inc.  
 1710 Grevillea Court  
 Ontario, CA 91761  
 Tel: 909-923-9390  
 Fax: 909-923-9391  
 Part Number: TP-3 Paper

OR

**4.3 Test Cable Connections**

Typical connection of a CT-3500 to a circuit breaker is shown in Figure 2.0.

**Note**

Always connect CT-3500 ground to the substation ground before connect any hook up cables to the circuit breaker.

**4.3.1 Contact Cable Connection**

CT-3500 contact cable contains 3 red clips and one black clip. The red clips are marked A, B, C for phase A, B, and C. The black clip is common of the sense cable.

**4.3.2 Trigger Cable Connection**

Trigger cable contains 3 leads. The leads are marked OPEN, CLOSE, COM. The CT-3500 timers are started by sensing the OPEN or CLOSE coil voltages. The trigger connection is shown in figure 3.0.

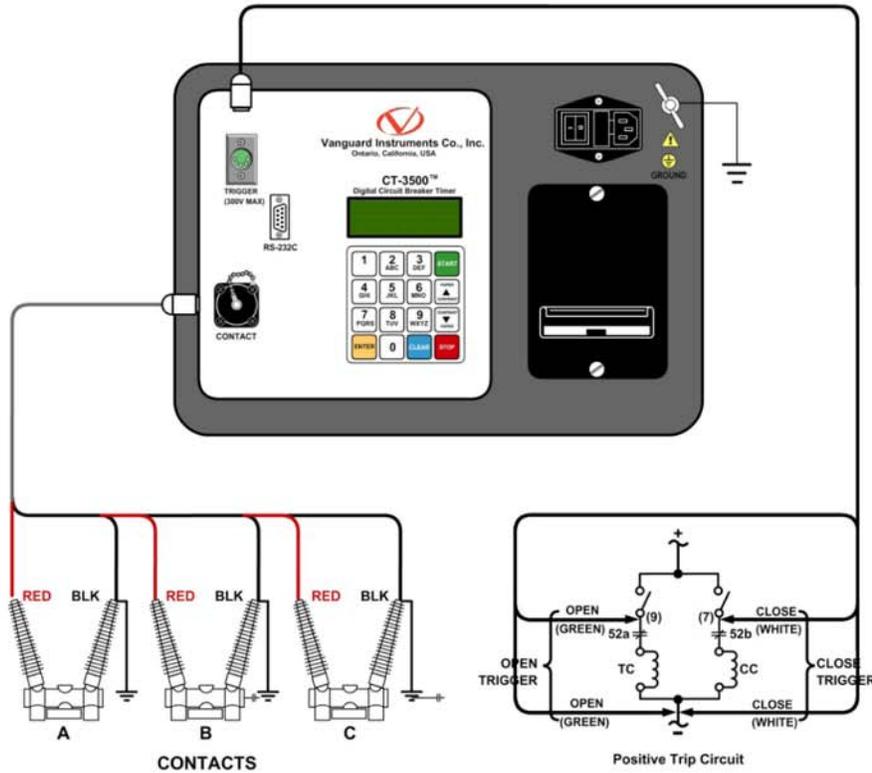
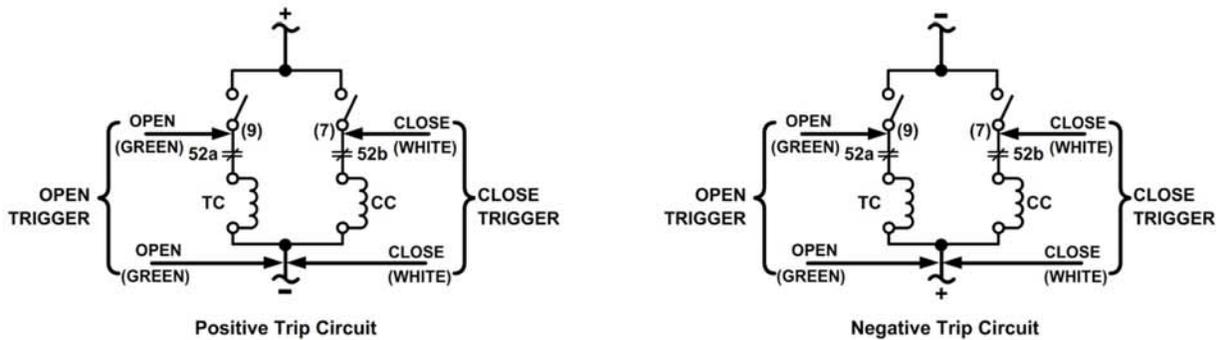
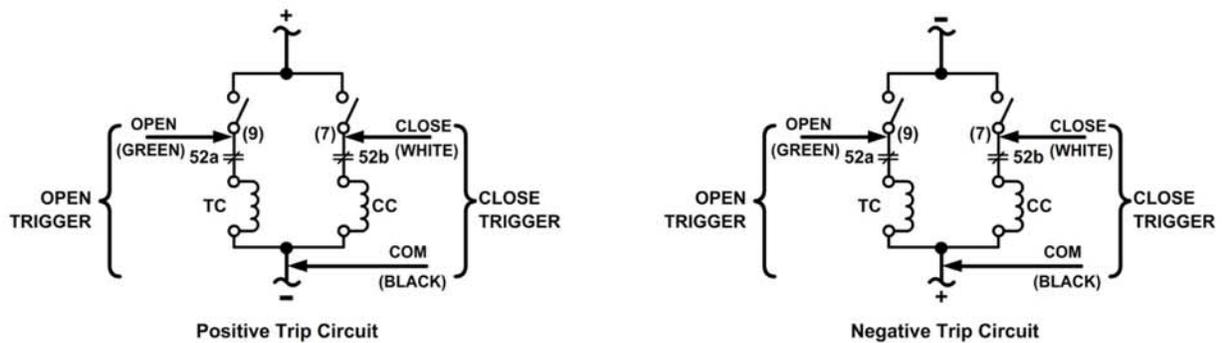


Figure 2.0 CT-3500 Timing Hook-Up Diagram



Trigger Circuit Hook-Up Diagram (4 Leads)



Trigger Circuit Hook-Up Diagram (3 Leads)

Figure 3.0 Trigger Circuit Hook-Up Diagrams



**5.0 Operating Procedures**

(See Figure 3.0. Step-by-Step Procedures for Operating the CT-3500.)

with STARTUP MENU(see next display menu).

**5.1 Introduction**

Before first-time operation of the CT-3500, *Step-by-Step Operating Procedures Flow Diagram* (Figure 3) should be reviewed. This figure shows the logic-flow branching of multiple test options. CT-3500 operation is simple, requiring little more than selecting choices from display menus and responding to the displayed prompts. (Experienced operators may use Figure 3.0 as a handy operating reference.)

**5.2 Precautions**

**WARNING**

Make sure that the CT-3500 is fully grounded before connecting it to any presumed-to-be *deenergized* breaker. Also, disconnect main lines to the breaker and ground main links to breaker contacts before making test hookups. Failure to heed this warning can result in death, personal injury, and/or damage to equipment.

**5.3 Preliminary Procedure**

- a. Turn on CT-3500 power; press “1” on the rocker switch (item 4 in Figure 1).
- b. Observe that after configuration data displays briefly, the START-UP MENU displays (selections for “1. RUN TEST,” “2. SETUP,” and “3. CABLE TEST”).

**5.4 Identification Setup Procedure**

If documented test records are to be kept and full test reports are to be printed, then the IDENTIFICATION SETUP must be entered before any other timing-related procedure.

- a. **START-UP MENU:** Observe that the Start-Up menu is the initial display at power-up and boot; all procedures start

**START-UP MENU**

<b>1. RUN TEST</b>	<b>05/15/01</b>
<b>2. SETUP</b>	<b>10:28:03</b>
<b>3. CABLE TEST</b>	

- b. Press number 2 (SETUP) to enter identification data. (See Figures 3.0 for reference to the desired test path.) Go to the next step (c.). If identification data are already entered, then press number 1 key (RUN TEST) and go to section 5.5.
- c. When SETUP is chosen, the SET-UP MENU (below) displays. Go to next step.

**SET-UP MENU**

<b>1. ENTER ID</b>
<b>2. REVIEW SHOT</b>
<b>3. RESTORE SHOT</b>
<b>4. NEXT PAGE</b>

**NOTICE**

The next steps require entering of identification data, which involves pressing keys to enter character for the prompted input. The keypad (Figure 1, item 7) is marked like a telephone keypad, but is used differently, as explained here; As an example, consider alpha/number key 2/ABC:



Press the key once to select number “2,” press a second time to select letter “A,” press a third time to select letter “B,” and press a fourth time to select letter “C.” Pressing the key a fifth time returns to display number 2, after which, additional key presses

repeat the A, B, C cycle. Selections from the rest of the alpha/numeric keys are done the same. The 1 and 0 (zero) keys have no alpha functions.

When a character is entered and appears in the display at the cursor position, the cursor is advanced to the next position by pressing the ^ key or backed-spaced by pressing the v key. To delete a character, press CLEAR. When all character entries are selected, press ENTER key to load the identity data in storage registers, and go to the next prompt display.

- d. On the Set-Up Menu, press number 1 (ENTER ID); the prompt COMPANY displays (see below).

**COMPANY:**

- e. Key select characters of the utility COMPANY name, then press ENTER. The STATION prompt appears:

**STATION:**

- f. Key select characters of the STATION name, then press ENTER. The CIRCUIT prompt appears:

**CIRCUIT:**

- g. Key select characters of the CIRCUIT name, then press ENTER. The MANUFACTURER prompt appears:

**MANUFACTURER:**

- h. Key select characters of the MANUFACTURER name, then press ENTER key. The MODEL prompt appears:

**MODEL:**

- i. Key select characters of the MODEL name, then press ENTER key. The SERIAL prompt appears:

**SERIAL NUMBER:**

- j. Key select characters of the SERIAL NUMBER, then press ENTER. The KVA RATING prompt appears:

**KVA RATING:**

- k. Key select characters of the KVA RATING, then press ENTER. The OPERATOR prompt appears:

**OPERATOR:**

- l. Key select characters of OPERATOR name, then press ENTER key. The display returns to the START-UP MENU.

**NOTE**

Identification data should be entered for each breaker that is tested

**5.5 Run Test Procedure**

Time a breaker by performing the step-by-step sequence that follows. The Run-Test Procedure assumes that setups have been loaded (typically, a one-time test can be run without such documentation).

The CT-3500 will stamp the date and time of each test on the record. The user needs to verify the time and date (displayed at the top left corner of the CT-3500 LCD) before test

**START-UP MENU**

<b>1. RUN TEST</b>	<b>05/15/01</b>
<b>2. SETUP</b>	<b>10:28:03</b>
<b>3. CABLE TEST</b>	

a. Begin the RUN-TEST procedure by pressing key #1 on the START-UP MENU (see last illustration). The SELECT TEST TYPE menu then displays (see below):

<b>SELECT TEST TYPE</b>	
<b>1. OPEN</b>	<b>2. CLOSE</b>
<b>3. OPEN-CLOSE</b>	
<b>4. CLOSE-OPEN</b>	

b. Press the key for the breaker test to be timed (listed on the Menu above). An OPERATE BREAKER prompt will display. In the example below, the OPEN test was selected. The test procedure is shown in steps below.

<b>TEST: OPEN</b>
<b>OPEN BREAKER NOW...</b>

c. The above display prompts the operator to activate the breaker for the selected test (OPEN, CLOSE, OPEN-

CLOSE, or CLOSE-OPEN), in this case, an OPEN.

When the breaker has operated, the selected test (also called a “shot”), a date and time “stamp” displays (see below), which will link this timing record (if it is saved) for all future recall references.

<b>OPEN SHOT</b>
<b>07/12/01 15:25:48</b>

d. When date and time of test is noted, press ENTER to advance to the next display (timing results of each phase). Timing results display in both milliseconds (mS) and decimal parts of a cycle (CY).

<b>OPEN (mS / CYCLES)</b>		
<b>A</b>	<b>34.90mS</b>	<b>2.09CY</b>
<b>B</b>	<b>30.39mS</b>	<b>1.81CY</b>
<b>C</b>	<b>33.70mS</b>	<b>2.02CY</b>

e. After the initial test time is displayed and observed, press ENTER key to advance to the next display contact bounce time

<b>OPEN BOUNCE TIME</b>		
<b>A:</b>	<b>0.00mS</b>	<b>0.00CY</b>
<b>B</b>	<b>0.00mS</b>	<b>0.00CY</b>
<b>C</b>	<b>0.00mS</b>	<b>0.00CY</b>

f. When the three-phase bounce time results display, press ENTER key to advance to next display. If the timing was a single stroke, the next display will prompt: PRINT TEST RESULTS?

<b>PRINT RESULTS?</b>
<b>1. YES</b>
<b>2. NO</b>

- g. Press key 1 (YES, print test results) if a timer results paper record is to be printed, in which case the printing advisory (below) displays. If YES, go to the next step.
- h. Press key #2 (NO, don't print the test results) to bypass the printing phase, in which case the SAVE THIS SHOT? prompt displays. If NO, go to step n.

**PLEASE WAIT  
PRINTING...**

- j. Press key #1 (YES) to save the timing shot in memory for future reference, in which case the save is confirmed by the next display (see below). If Key #2 (NO) is pressed, the run-test timing is completed and the display returns to the START-UP menu.

**SHOT NUMBER 01  
HAS BEEN SAVED!**

- i. While the printer is printing no other action is required of the operator until printing is complete, after which the SAVE THIS SHOT? prompt displays (see below):

**SAVE THIS SHOT?**  
**1. YES**  
**2. NO**

- k. When the shot number displays (the shot is automatically numbered by the CT-3500), press ENTER: the display returns to the START-UP MENU. This step completes the RUN TEST procedure.

TEST RESULTS			
DATE: 08/28/01		TIME: 08:11:59	
COMPANY:	VANGUARD		
STATION:	ONTARIO		
CIRCUIT:	A		
MFR:	ITE		
MODEL:	TREND LINE		
S/N:	M 3210 102		
KVA RATING:	14		
OPERATOR:	JOE		
NOTES: _____			
TEST: OPEN			
CONTACT OPEN TIME			
CH	TIME	CYCLE	BOUNCE
	(ms)	60 Hz	(ms)
A	34.90	2.09	0.00
B	30.30	1.81	0.00
C	33.70	2.02	0.10
DELTA TIME (ms) =			4.60

VANGUARD INSTRUMENT CO., INC. (C) 2001  
 3710 CHEVILLER CT  
 DUNFORD, CA 94751, USA  
 TEL: (925) 923-9990 FAX: (925) 923-9991  
 WWW.VANGUARD-INSTRUMENTS.COM  
 CT-3500 REV 1.02 SERIAL NUMBER: 24288

**Figure 5.0 A typical CT-3500 OPEN Test print out**

TEST RESULTS			
DATE: 08/28/01		TIME: 09:12:47	
COMPANY:	VANGUARD		
STATION:	ONTARIO		
CIRCUIT:	A		
MFR:	ITE		
MODEL:	TREND LINE		
S/N:	M 3210 102		
KVA RATING:	14		
OPERATOR:	JOE		
NOTES: _____			
TEST: CLOSE-OPEN			
CONTACT CLOSE TIME			
CH	TIME (ms)	CYCLE 60 Hz	BOUNCE (ms)
A	171.80	10.30	32.10
B	174.20	10.45	0.90
C	172.00	10.32	14.80
DELTA TIME (ms) =		2.40	
CONTACT OPEN TIME			
CH	TIME (ms)	CYCLE 60 Hz	BOUNCE (ms)
A	1632.70	97.96	0.00
B	1628.50	97.71	4.20
C	1631.70	97.90	0.40
DELTA TIME (ms) =		4.20	
CONTACT LIVE TIME			
CH	TIME (ms)	CYCLE 60 Hz	
A	1460.90	87.65	
B	1454.30	87.25	
C	1459.70	87.58	

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 1713 SHELLEN CT  
 ONTARIO, CA 91761 USA  
 TEL: (951) 922-4280 FAX: (951) 922-4190  
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 CT-3500 REV 1.02 SERIAL NUMBER: 24288

Figure 6.0 A typical CT-3500 CLOSE-OPEN Test print out

**Note:**

If the timing shot was a dual operation (e.g., CLOSE-OPEN), the display will display the test results first operation (in this case CLOSE) then the second operation (OPEN) and finally time between the two operation (contact LIVE time).

A typical CLOSE-OPEN operation the first test results (CLOSE) is shown as follows:

CLOSE (mS / CYCLES)	
A	171.80mS 10.30CY
B	174.20mS 10.45CY
C	172.00mS 10.32CY

- a. Press ENTER key to advance to the next display (i.e., second-stroke bounce time).

CLOSE BOUNCE TIME	
A	32.10mS 1.92CY
B	00.90mS 0.05CY
C	14.80mS 0.88CY

- b. Press ENTER key to advance to the next display (i.e., second-stroke bounce time).

OPEN (mS / CYCLES)	
A	1632.80mS 97.96CY
B	1628.50mS 87.71CY
C	1631.70mS 97.90CY

c. Press ENTER key to advance to the next display (i.e., second-stroke bounce time).

OPEN BOUNCE TIME		
A	00.00mS	0.00CY
B	04.20mS	0.25CY
C	00.40mS	0.02CY

d. Press ENTER key to advance to the next three-phase timing result display (i.e., CONTACT LIVE TIME—see below).

CONTACT LIVE TIME		
A	1460.90mS	87.65CY
B	1454.30mS	87.25CY
C	1459.70mS	87.58CY

### 5.6 Review Shot Procedure

This procedure describes steps to review a test record residing in CT-3500 working memory. The user can view the record on the LCD display or from a thermal printout.

#### NOTE

To review a test record stored in Flash EEPROM, the user must first restore test record from Flash EEPROM to working memory (see paragraph 5.7)

The Restore Recording Procedure steps begin at the Set-Up Menu, shown below:

#### SET-UP MENU

1. ENTER ID
2. REVIEW SHOT
3. RESTORE SHOT
4. NEXT PAGE

a. Press key #2 (REVIEW SHOT) to begin the Review-Shot procedure. The following menu displays:

<b>REVIEW TEST</b>
1. DISPLAY TEST DATA
2. PRINT TEST DATA

b. Press key 1 to display shot identification and key-in number of shot to be reviewed (default is last timing shot). The display will show the shot record number (just selected), the type of shot (OPEN, CLOSE, OPEN-CLOSE, or CLOSE-OPEN), and the date and time of the selected shot (shown in the second display below)—go to the next step.

<b>SHOT 01</b>
<b>OPEN SHOT</b>
<b>05/15/01 10:28:03</b>

Press key # 2 (PRINT DATA) to print out all the timing data on the selected shot record, during which the advisory DISPLAY IS shown below.

<b>PRINTING REPORT</b>
<b>PLEASE WAIT...</b>

After printing, the display returns to the START-UP MENU, thus ending the Review Shot procedure).

c. When the shot record of interest displays (see b.), press ENTER to begin the timing review sequence (virtually the same display sequence that displayed during the original timing shot—refer to section 5.5), after which the display returns to the START-UP Menu. This ends the Review Data procedure.

### 5.7 Restore Shot Procedure

This procedure allows the user to restore a test record from the CT-3500 Flash EEPROM to working memory. The user then can review the test record using the REVIEW RECORD command (5.6).

The Restore Recording Procedure steps begin at the Set-Up Menu, shown below:

#### SET-UP MENU

1. ENTER ID
2. REVIEW SHOT
3. RESTORE SHOT
4. NEXT PAGE

a. Press key #3 (RESTORE SHOT) to begin the Restore-Shot procedure. The following menu displays:

1. RESTORE SHOT
2. DIRECTORY
3. ERASE SHOT
4. (RE)SAVE SHOT

b. Press key # 1 to select the Restore Shot function: this displays the RESTORE SHOT menu (shown below).

- RESTORE SHOT
1. ENTER SHOT NUMBER
2. SCROLL TO SELECT

c. If the number of the shot to be restored is known, press key number 1(ENTER SHOT NUMBER) and go to next step; if the number of the shot to be restored is *not* known, press key number 2 (SCROLL TO SELECT) and skip forward to step e.

**RESTORE SHOT  
NUMBER: 1**

d. Key in the number of the shot to be restored and press ENTER: “Shot Restored” displays (see below) after which the REVIEW DATA sequence begins (go back to step b of section 5.6 to continue the RESTORE SHOT procedure to conclusion).

**SHOT RESTORED!**

e. The SCROLL TO SELECT (option 2 back in step c) an instructional prompt displays (see below):

**SHOT DIRECTORY  
“UP” TO SCROLL FWD  
“DWN” TO SCROLL RVS**

Use the UP (↑) and DOWN (↓) keys to scroll through the saved shot records until the shot record of interest displays, and then press ENTER. Then the REVIEW DATA sequence begins (go back to step b of section 5.6 and continue the RESTORE SHOT procedure to conclusion, after which the START-UP MENU displays).

**#01 08/15/01 10:28:03  
OPEN SHOT**

This ends the RESTORE SHOT procedure.

**5.8 Print Test-Record Directory**

Printing the test record directory begins with the Set-Up Menu shown below (the same display from which the Review Records steps began):

**SET-UP MENU**

- 1. ENTER ID
- 2. REVIEW SHOT
- 3. RESTORE SHOT
- 4. NEXT PAGE

a. Press key #3 (RESTORE SHOT) to begin the Restore-Shot procedure. The following menu displays:

- 1. RESTORE SHOT
- 2. DIRECTORY
- 3. ERASE SHOT
- 4. (RE)SAVE SHOT

b. Press key # 2 to select the Directory function: this displays the DIRECTORY menu (shown below).

- PRINT DIRECTORY**
- 1. FULL DIRECTORY**
- 2. SHORT DIRECTORY**

c. Press key #1 to print a directory of all shots stored in the CT-3500 memory. Press key #2 to print the directory of the last 10 timing shots stored in the CT-3500 memory. A typical CT-3500 directory print out is shown in figure 7.0.

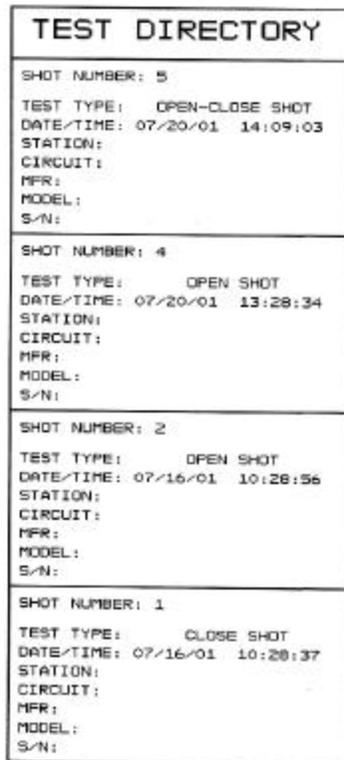


Figure 7.0 Typical CT-3500 Shot Directory

**5.9 Computer Interface Procedure**

The CT-3500 can store up to 128 timing records in the FLASH EEPROM. These test reports can be transferred through the RS-232C port. A window software package provided with the CT-3500 allows the user to transfer test report to the IBM PC.

Use the following steps to put the CT-3500 under computer interface mode:

- a. Accordingly, Press key #2 (SETUP) on the Start-Up Menu, which will produce the SET-UP MENU (shown below):

**SET-UP MENU**

1. ENTER ID
2. REVIEW SHOT
3. RESTORE SHOT
4. NEXT PAGE

- b. Press key # 4 (NEXT PAGE) to display the following options menu:

1. COMPUTER CONTROL
2. SET TIME
3. SET 50/60 Hz

- c. Press Key # 1 (COMPUTER CONTROL) to control the CT-3500 from a remote IBM-compatible PC. The computer interface (ITF) mode advisory displays (shown below): go to the next step

**COMPUTER ITF MODE**

- d. From this point on (for as long as this screen displays, the CT-3500 is controlled by the PC. To end the Computer Interface mode, press the STOP key, at which time the display will return to the START-UP MENU (section 5.4).

**5.10 Set Date and Time**

The date and time setting begins at the Set-Up Menu, shown below:

- a. Begin at the START-UP MENU: Press key #2 (SETUP) to display the SET-UP MENU shown below:

**SET-UP MENU**

1. ENTER ID
2. REVIEW SHOT
3. RESTORE SHOT
4. NEXT PAGE

- b. Press key #4 (NEXT PAGE) to display the menu shown below:

1. COMPUTER CONTROL
2. SET TIME
3. SET 50/60 Hz

- c. Press key # 2 (SET TIME) to display the prompt to enter the present date and time (shown below):

**ENTER**  
**MM-DD-YY HH:MM:SS**

**NOTE**

In the above prompt: MM = month, DD = day, YY = year, and HH = hour, MM = minute, SS=seconds.

- d. Set the date (month, day, year) with six key presses for the above prompt; Set the time (hour, minute, second) with six key presses. When date and time are set, the screen will return to the START-UP MENU. This completes set date/time procedure.

**5.11 Set 50/60 Hz Procedure**

The test result of the CT-3500 display in millisecond and cycles. The user can select either 50Hz or 60Hz cycle mode on the test results.

Use the following steps to set 50/60Hz mode:

- a. Beginning at the START-UP MENU, press key #2 (SETUP) to display the SET-UP MENU shown below:

**SET-UP MENU**

- 1. ENTER ID
- 2. REVIEW SHOT
- 3. RESTORE SHOT
- 4. NEXT PAGE

- b. Press key #4 (NEXT PAGE) to display the menu shown below:

- 1. COMPUTER CONTROL
- 2. SET TIME
- 3. SET 50/60 Hz

- c. Press key #3 (SET 50/60 Hz) to select the Menu for power-line frequency that the breaker controls. This displays the Set Line Frequency menu shown below:

- SET LINE FREQUENCY**
- 1. 60 Hz
  - 2. 50 Hz

- d. Press the key for the frequency of power that the breaker controls when it's in service (i.e., on line). When either the #1 or #2 key is pressed, the display returns to the Start-Up Menu.

This ends the Set Line Frequency procedure.

**5.12 Cable Test Procedure**

The purpose of the Cable Test is to quickly check the test leads and breaker contacts for continuity at each of the 3 phase contacts. (For example, a close test should begin with all contacts open; conversely an open test should begin with all three contacts closed—the closed condition also checks continuity of the test leads for opens or erroneous

hookups.) When the test hookup is made to the breaker, run a Cable Test to make sure all 3 test lead clips are properly connected (contact clips are across mating contacts). Begin with the Start-Up Menu (below):

**START-UP MENU**

- 1. RUN TEST           05/15/01
- 2. SETUP             10:28:03
- 3. CABLE TEST

- a. After test hookup to the breaker, open the breaker and press key #3 (Cable Test). The display below shows the line status of each of three sets of contacts (all three should show open).

- CABLE TEST**
- |                   |      |      |
|-------------------|------|------|
| CH A              | CH B | CH C |
| OPEN              | OPEN | OPEN |
| (ANY KEY TO EXIT) |      |      |

- b. Press ENTER key to return to Start-Up Menu.

- c. Set the breaker contacts to the closed condition and again press key #3 (cable test) on the Start-Up Menu. The display below shows the line status of each of three sets of contacts (all three should show close).

- CABLE TEST**
- |                   |       |       |
|-------------------|-------|-------|
| CH A              | CH B  | CH C  |
| CLOSE             | CLOSE | CLOSE |
| (ANY KEY TO EXIT) |       |       |

- d. Press ENTER to return to Start-Up Menu.

This completes the Cable test procedure.

This completes all operating procedures



**APPENDIX A****CT-3500<sup>®</sup> Troubleshooting Guide**

<b>Item</b>	<b>Symptom</b>	<b>Possible Problem</b>	<b>Solution</b>
1	CT-3500 will not start timing.	1. No trigger voltage detected. 2. Broken trigger lead.	1. Check trigger cable connection to Trip and Close coil. 2. Inspect trigger cable cables.
2	CT-3500 displays “Detect Standing Voltage”.	1. There is standing voltage across trigger input lead. The CT-3500 expects a voltage only when the circuit breaker coil is energized.	1. Check trigger-cable connection to trip and close coil. 2. If there is standing voltage across coil, check for lamp (indicator) circuit.
3	Timing channels is not working correctly.	1. Bad contact cable connection to breaker. 2. Missing common connection on the breaker bushing.	1. Check contact cable connection to breaker. 2. Inspect contact leads. 3. Make sure the common side (black lead) of contact bushing is tied to ground.



**Vanguard Instruments  
Company, Inc.**

1710 Grevillea Court, Ontario, CA 91761, USA  
Phone: 909-923-9390      Fax: 909-923-9391  
Website: <http://www.vanguard-instruments.com>

