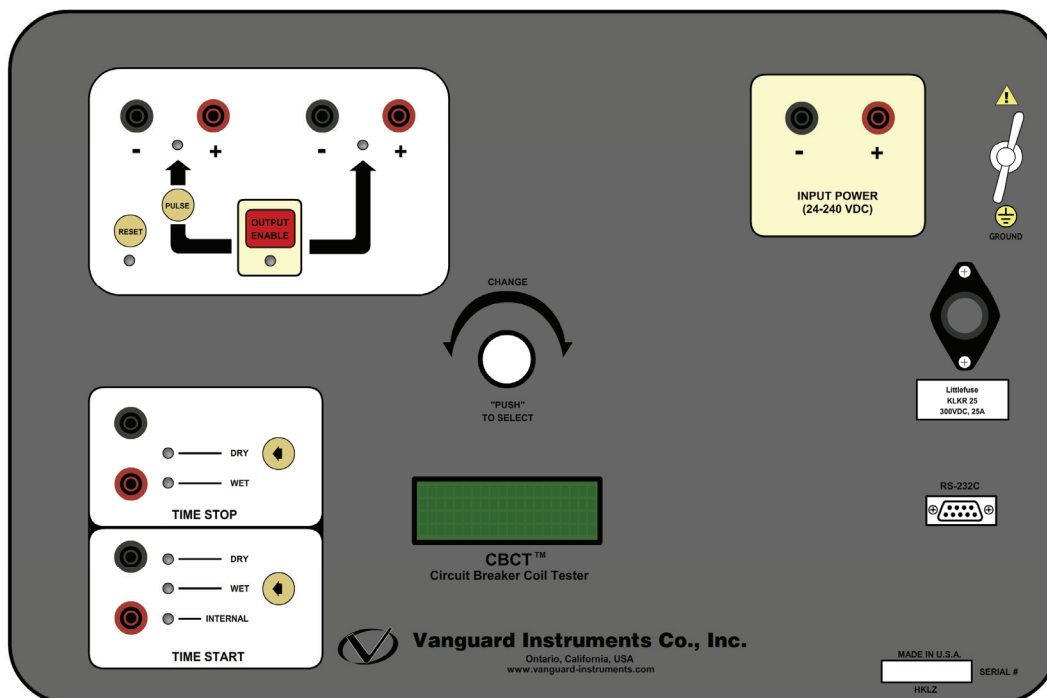


CBCT™

CIRCUIT BREAKER COIL TESTER

USER'S MANUAL



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SAFETY SUMMARY

FOLLOW EXACT OPERATING PROCEDURES

Any deviation from the procedures described in this User's Manual may create one or more safety hazards, may damage the CBCT, or cause errors in the test results. Vanguard Instruments Company, Inc. assumes no liability for unsafe or improper use of the CBCT.

All safety precautions provided in this manual must be observed during all phases of testing including test preparation, test lead connection, actual testing, and test lead disconnection.

SAFETY WARNING AND CAUTIONS

The CBCT shall be used only by **trained operators**. All devices under test shall be **off-line** and **fully isolated**.

DO NOT MODIFY TEST EQUIPMENT

To avoid the risk of introducing additional or unknown hazards, do not install substitute parts or perform any unauthorized modification to any CBCT test unit. To ensure that all designed safety features are maintained, it is highly recommended that repairs be performed only by Vanguard Instruments Company factory personnel or by an authorized repair service provider.

Unauthorized modifications can cause safety hazards and will void the manufacturer's warranty.

WARNING

Do not remove test leads during a test. Failure to heed this warning can result in lethal electrical shock to personnel and damage to the equipment.

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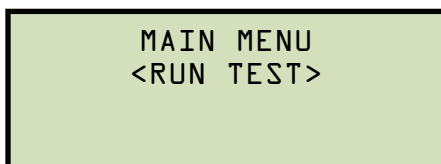
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CONVENTIONS USED IN THIS DOCUMENT

This document uses the following conventions:

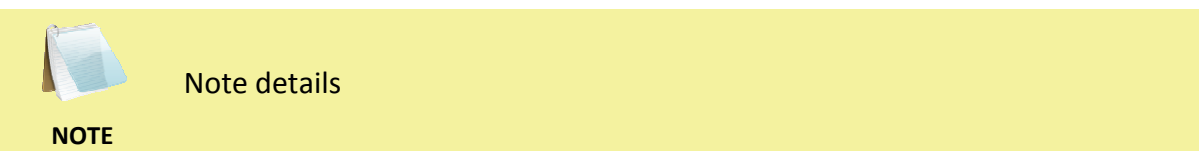
- A key, switch, or knob on the CBCT is indicated as **[KEY]**, **[SWITCH]**, and **[KNOB]**.
- Menu names are referenced as "MENU NAME"
- CBCT LCD screen output is shown as:



- Warning messages are indicated as:



- Important notes are indicated as:



1.0 INTRODUCTION

1.1 General Description and Features

The Vanguard Circuit Breaker Coil Tester (CBCT) is a variable voltage DC power supply designed specifically to test substation circuit-breaker Open and Close coils. The CBCT uses the substation's DC power supply to electronically generate a programmable output voltage from 5% to 95% of the source voltage. The CBCT can maintain up to an 80A test current while maintaining 2% or better voltage regulation during the circuit breaker coil operation. The CBCT provides a safe and convenient method for testing minimum operating voltages of Open and Close coils.

The CBCT provides one pulse and one continuous DC output. The unit's built-in short-circuit protection feature protects the coil under test if the current exceeds 80 amperes or if the current drawing duration is more than 500 milli-seconds. A general purpose single channel timer is also available for checking circuit breaker operating time or for any other timing application.

Input Voltage

The CBCT's input voltage range is from 20 to 300 Vdc. The input circuit is also protected from a reversed polarity connection.

Output Voltage

The output voltage is programmable from 5% to 95% of the input voltage and is set using the dial on the front panel. Output voltage regulation is better than 2% under load. Two DC outputs are available on the CBCT. The continuous DC output is capable of sourcing current up to 40 amperes. The pulse DC output is capable of sourcing up to 80 amperes for up to 500 milli-seconds. Both outputs are protected against short-circuit conditions if the test current exceeds 80 amperes or if the drawing duration is more than 500 milli-seconds.

CBCT Status Display

The CBCT features a back-lit LCD screen (20 characters by 4 lines) that is viewable in both bright sunlight and low-light levels. The input and output voltages are displayed on the screen during testing. If a power supply fault condition occurs, a red "FAULT" LED light is illuminated on the front panel and a corresponding message is displayed on the LCD screen.

CBCT Timer

The built-in, single channel timer can be used to verify circuit-breaker timing parameters or for any timing application. The timing range is from 0.000 to 999.000 seconds with an accuracy of 0.1 milli-seconds. The timing results are displayed in both milli-seconds and cycles. The timer can be started by circuit-breaker coil initiation or can be triggered by the dry or wet contact input. The timer can be stopped by either the dry or wet contact input.

1.2 Technical Specifications

Table 1. CBCT Technical Specifications

TYPE	Programmable DC Power Supply
PHYSICAL SPECIFICATIONS	19"W x 7"H x 15"D, (48 cm x 17 cm x 38 cm); Weight: 25 lbs (11.3 kg)
INPUT VOLTAGE	20 – 300 Vdc, 20A fuse
OUTPUT VOLTAGE	5% – 95% of input voltage with 2% regulation at max current (up to 80A)
OUTPUT VOLTAGE CHANNELS	One continuous and one pulse DC output
OUTPUT VOLTAGE PROTECTION	Shutdown if current exceeds 80A or if current drawing time exceeds 500 ms @ 80A
VOLT METER RANGE	Input/output meters, 0 – 300 Vdc; Accuracy: 1% of reading, $\pm 0.2V$
TIMER DISPLAY RANGE	0.0000 – 999.999 seconds; Accuracy: 0.1 ms, ± 1 digit
TIMER START INPUT	Internal (coil initiation), wet-contact input (10 c 240 Vac/dc), or dry-contact input (1 – 200 ohms)
TIMER STOP INPUT	Wet-contact (10 – 240 Vac/dc) or dry-contact (1 – 200 ohms)
DISPLAY	Back-lit LCD screen (20 characters by 4 lines); viewable in both bright sunlight and low-light levels
SAFETY	Designed to meet UL 6101A-1 and CAN/CSA C22.2 No 1010.1-92 standards
ENVIRONMENT	Operating: -10°C to 50°C (+15°F to +122°F); Storage: -30°C to 70°C (-22°F to +158°F)
CABLES	Three 6-foot (#10 AWG) DC cable sets, Two 10-foot timer cable sets, One ground cable, one cable bag
OPTIONS	Transportation case
WARRANTY	One year on parts and labor



NOTE

The above specifications are valid at nominal operating voltage and at a temperature of 25°C (77°F). Specifications may change without prior notice.

1.3 CBCT Controls and Indicators

The CBCT's controls and indicators are shown in Figure 1 below. A leader line with an index number points to each control and indicator, which is cross-referenced to a functional description in Table 2. The table describes the function of each item on the control panel. The purpose of the controls and indicators may seem obvious, but users should become familiar with them before using the CBCT. Accidental misuse of the controls will usually cause no serious harm. Users should also be familiar with the safety summary found on the front page of this User's Manual.

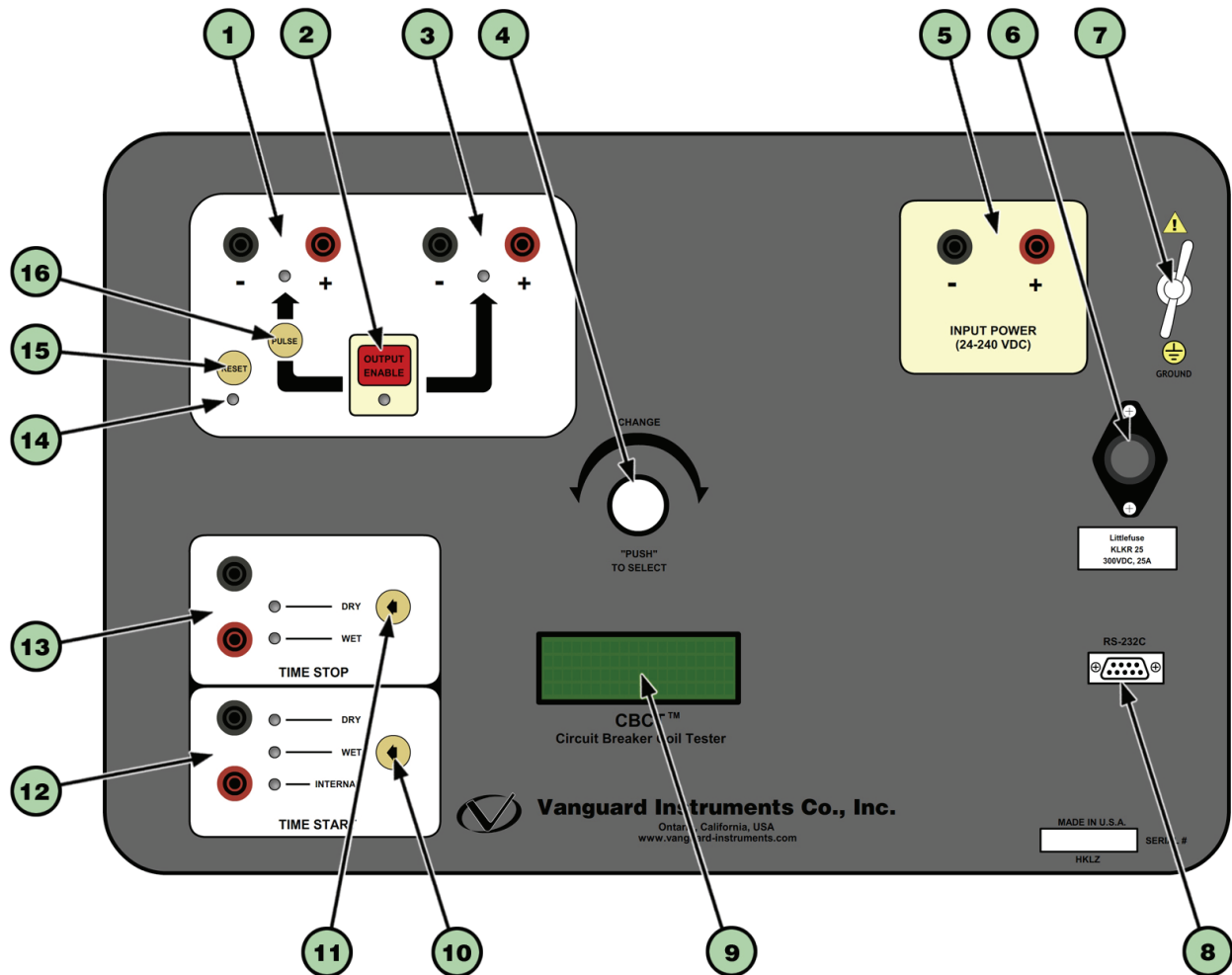


Figure 1. CBCT Controls and Indicators

Table 2. Functional Descriptions of CBCT Controls and Indicators

Item Number	Panel Markings	Functional Description
1		Pulse output voltage. Constant output has to be on first. Press PULSE switch to output voltage. Output voltage is turned on for 1 second. LED indicator is lit when output is on.
2	OUTPUT ENABLE	Use this key to turn on the constant output voltage.
3		Constant output voltage. Use [OUTPUT ENABLE] key to turn on or off. Output is enabled when LED is lit.
4	CHANGE "PUSH" TO SELECT	Control knob. Turn to change, press to select.
5	INPUT POWER (24-240 VDC)	DC voltage input (20-240 VDC).
6		Fuse holder. Use 200 Vdc/25A Littlefuse® P/N KLKR25.
7	GROUND	Ground stud. Ground this terminal to sub-station ground.
8	RS-232C	RS-232C PC interface for firmware upgrade and diagnostics.
9		Back-lit LCD screen (20 characters by 4 lines), viewable in bright light and low-light conditions.
10		Timer Start mode selection switch.
11		Timer Stop mode selection switch.
12		Timer Start inputs.
13		Timer Stop inputs.
14		Fault indicator LED is lit when one of the following conditions occurs: • Coil current exceeds 80A • Output voltage regulation exceeds 2% at full load • Coil energization duration is longer than 500ms
15	RESET	Reset fault mode.
16	PULSE	Enable Pulse output voltage. Press this switch to output DC voltage at the Pulse voltage terminals for 1 second.

2.0 OPERATING PROCEDURES

2.1 CBCT Cable Connections

Typical CBCT DC control connection diagrams are shown below. Figure 2 illustrates the CBCT “Constant Output” connection to the circuit breaker control circuit. Figure 3 and Figure 4 illustrate the CBCT “Pulse Output” connection to the circuit breaker Trip and Close coil.



WARNING

Always connect the CBCT ground stud to the sub-station ground.

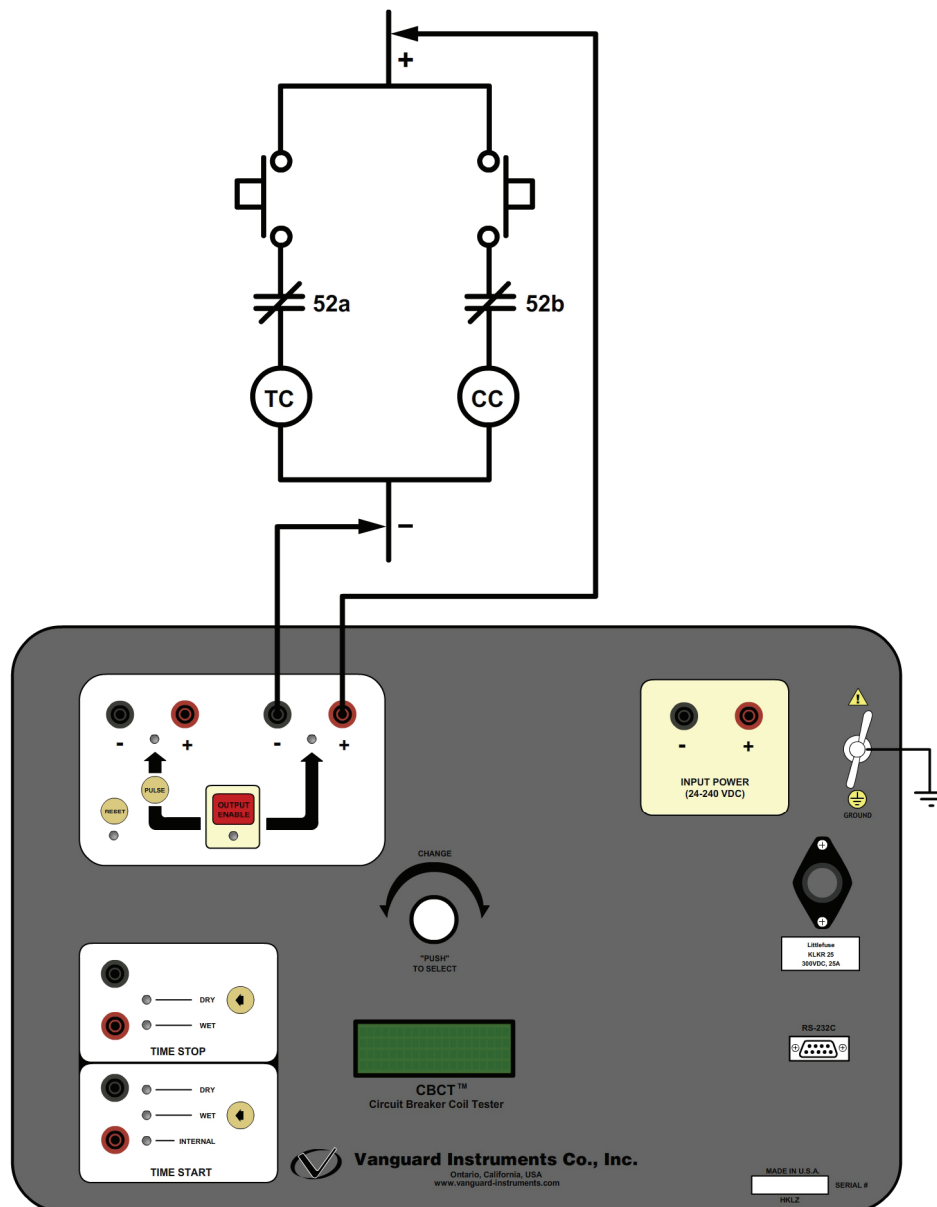


Figure 2. CBCT Constant Output to CB Control Circuits

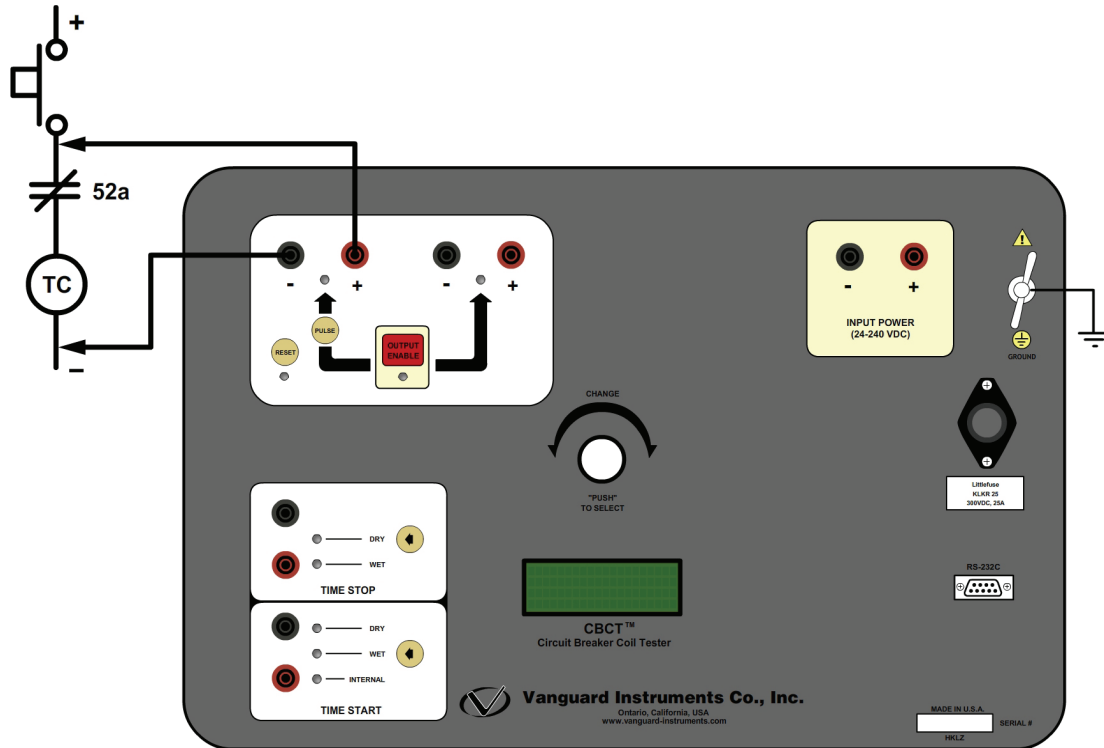


Figure 3. Direct Connection from CBCT Pulse Output to CB Trip Coil

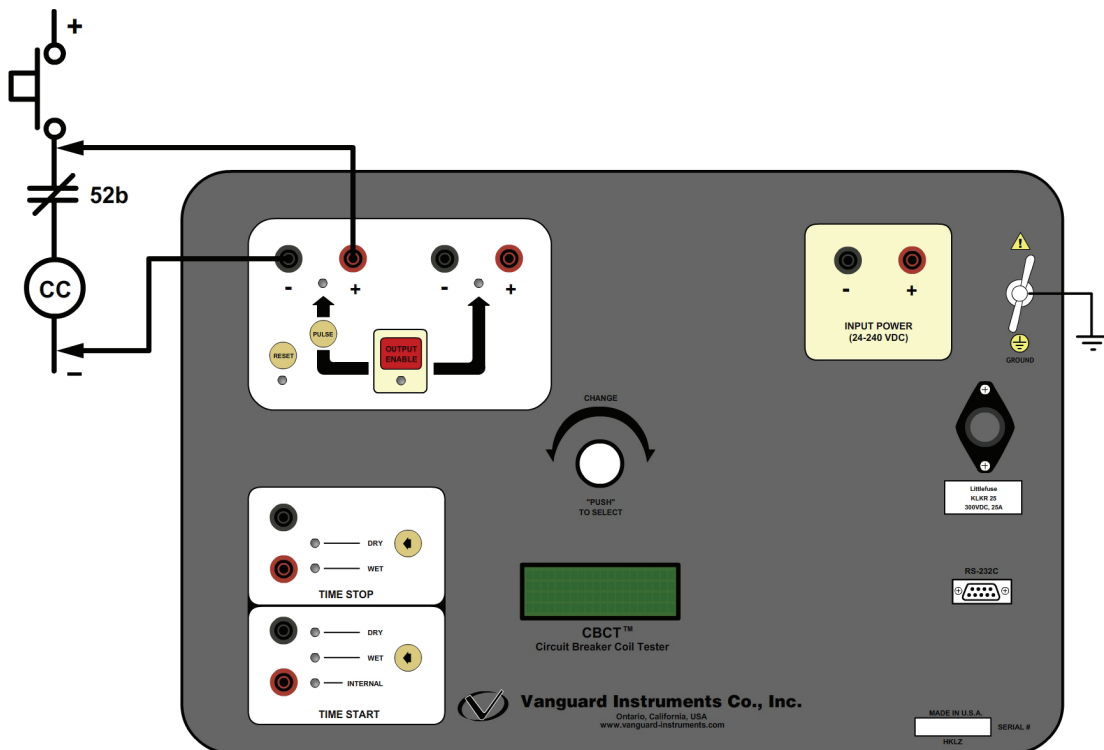


Figure 4. Direct Connection from CBCT Pulse Output to CB Close Coil

2.2 Setting the Output Voltage

Follow the steps below to set the output voltage:

- a. Turn on the unit and start from the "MAIN MENU":

```

MAIN MENU
<RUN TEST>

```

Press the **[CONTROL KNOB]** to start the test.

- b. The following screen will be displayed:

```

INPUT VTG: 124.0
OUTPUT VTG: 0.0
TIME:      0.0mS
Status:    *READY*

```

The input DC voltage is displayed as 'INPUT VTG: xxx.0'. In the above example, the input voltage is 124.0. The output voltage is 0.0 since it is not enabled.

Press the **[OUTPUT ENABLE]** switch.

- c. The output voltage will be displayed on the LCD as shown below:

```

INPUT VTG: 124.0
OUTPUT VTG: 86.8
TIME:      0.0mS
Status:    *READY*

```

Output voltage is automatically set for 70% of the input voltage. The constant output voltage indicator will be lit.

Turn the **[CONTROL KNOB]** to adjust the output voltage.

If the 'Constant' output connection is being used, the circuit breaker control circuit voltage is powered with the voltage displayed on the CBCT screen. The circuit breaker is now ready to be operated by the control switches.

If the 'Pulse' output connection is being used, press the **[PULSE]** switch to output voltage to the coil.

2.3 CBCT Timer Start Input

Timer Start Input mode can be selected only when the “Main Menu” is being displayed. Select the Timer Start input mode by pressing the **[Arrow]** key. The LED will be lit next to the label for the currently selected mode. The CBCT timer can be started in three selectable modes: internal, wet input, and dry input. Each mode is described below:

- Internal Mode**
 In this mode, the timer will start when the **[PULSE]** switch is pressed. The CBCT will output the preset voltage to the Pulse output terminals and start the timer.
- Dry Contact Mode**
 In this mode, the timer will look for a change in the Start input terminals after the **[PULSE]** switch is pressed. The CBCT will output a DC voltage to the Start input terminals to detect the dry contact status.
- Wet Contact Mode**
 In this mode, the timer will look for a change in the Start input terminals after the **[PULSE]** switch is pressed. In this mode, the input will look for a change in voltage or no-voltage condition to start the timer. A voltage from 24 Vdc to 300 Vdc is considered as ‘Voltage Present’.

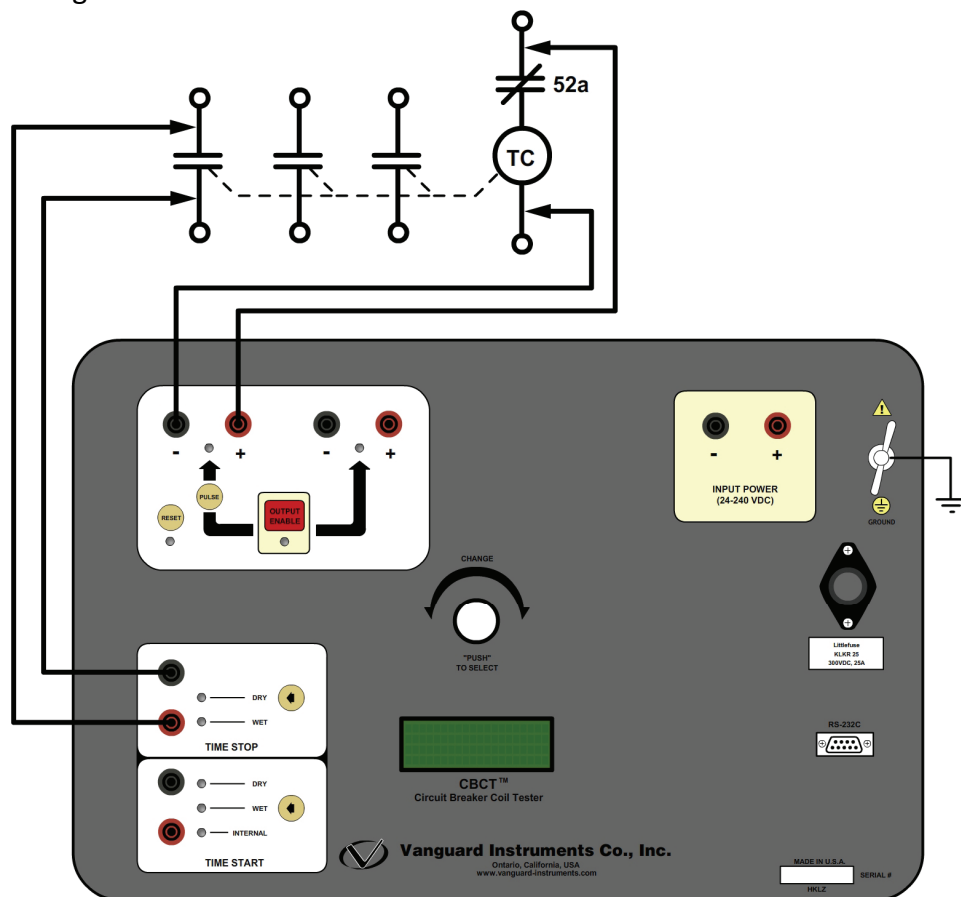


Figure 5. Typical CBCT Timer Connection
(Internal Start, Dry Contact Stop)

2.4 CBCT Timer Stop Input

Timer Start Input mode can be selected only when the “Main Menu” is being displayed. Select the Timer Stop Input mode by pressing the **[ARROW]** key. The LED will be lit next to the label for the currently selected mode. The CBCT timer can be stopped in two selectable modes described below:

- Dry Contact Mode

In this mode, the timer will look for a change in the Stop Input terminals to stop the timer. The CBCT will output a DC voltage to the Stop Input terminals to detect the dry contact status.

- Wet Contact Mode

In this mode, the timer will look for a change in the Stop Input terminals to stop the timer. Under the wet contact mode, the input is looking for a change in voltage or no-voltage condition to stop the timer. A voltage from 24 Vdc to 300 Vdc is considered as ‘Voltage Present’.

2.5 CBCT Timer Display

The CBCT displays the timer result in milliseconds and seconds on the LCD. Typical timer test results are shown below:

```
INPUT VTG: 48.5
OUTPUT VTG: 33.7
TIME: 197.3mS
Status: *READY*
```



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