PRODUCT GUIDE

TCC300M2270B Adapter Panel

Digital tapchanger control for power transformers and regulators

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TCC300M2270B
Adapter panel

1. Introduction
The ABB TCC300M2270B adapter panel, used in conjunction with the TCC300 tapchanger control, uses modern electronic digital design and digital processing circuitry to achieve an overall stability and resolution unattainable with electromechanical and analog design tapchanger controls. CMOS semiconductors are used throughout the design.

1.1 Description
The TCC300M2270B adapter panel, with the TCC300 tapchanger control, provides a solid-state voltage control relay designed to replace General Electric static LTC transformer controls and some balance beam models. The combination of the tapchanger control and adapter panel includes the following features:

- Voltage waveform sampling and digital processing circuitry ensure accurate rms voltage sensing in the presence of distortion on the input voltage and current.
- Control accuracy is ± 0.3 % when tested in accordance with the ANSI/IEEE C57.15.9-1999 standard over a temperature range of –30° C to +65° C. The control accuracy is ± 0.5 % when tested over the full operational temperature range of –40° C to +85° C.
- Input and output circuits are protected against system transients. Units pass all requirements of ANSI/IEEE C37.90.1-1989, which defines surge withstand capability. All input and output terminals will withstand 1500 V ac rms to chassis or instrument ground for one minute with a leakage current not to exceed 25 mA, for all terminals to ground. Input and output circuits are electrically isolated from each other, from other circuits and from ground.

The TCC300M2270B adapter panel factory configuration for **AUTO/OFF/MANUAL** switch status detection is enabled. The TCC300M2270B adapter panel **AUTO/OFF/MANUAL** switch status detection feature is available to TCC300 series units that have firmware version D-0067V07.08.15 or later installed. See section 2.0, application, disabling **AUTO/OFF/MANUAL** switch status detection, for the steps necessary to disable the **AUTO/OFF/MANUAL** switch detection function for TCC300 series units with an earlier firmware version.

Control switches
VOLTAGE SOURCE switch allows auto operation of the control or manual operation from the panel by using the **RAISE/LOWER** toggle switch. The **AUTO/OFF/MANUAL** switch status may be read by a TCC300 series control with firmware version D-0067V07.08.15 or later installed.

Caution
Do not reverse the ground and hot wires when connecting an external source. A 3 AG fuse (F2) is installed to protect the control from damage if these connections are accidentally reversed.

With the **VOLTAGE SOURCE** switch in the **EXT** position, the sensing and motor power circuits are connected to the External Power binding post on the front panel. The unit can be tested using an external 120 V RMS source of proper polarity applied to these terminals. Testing can be accomplished by adjusting the amplitude of the external source.

The **VOLTAGE SOURCE** switch will disconnect all power from the unit when selected to the **EXT** position with no source connected to the front panel voltage inputs.

DRAG HANDS RESET pushbutton switch resets the tapchanger position indicator drag hands on the regulator or LTC transformer.

AUTO/OFF/MANUAL toggle switch allows manual operation of the control. The **AUTO/OFF/MANUAL** switch status may be read by a TCC300 series control with firmware version D-0067V07.08.15 or later installed.

When the TCC300 **Input Selection 1** screen in the **Configuration** menu is set to **Toggle Switch Status Input**, the seal-in input will operate as a switch status input. All seal-in input functions will be disabled. In this mode, the switch status on the adapter panel can be read to determine if it is in Auto or Manual. The status can be read through the seal-in/switch status data point in the communications protocols.

Binding posts
VOLTAGE IN binding posts on the front panel allow application of a 120 V rms nominal voltage to the unit for test procedures.

MOTOR PWR IN binding posts on the front panel allow application of a 120 or 240 V rms nominal voltage to the unit for test procedures.

Note
If the Motor Power Input configuration has a different return from the 120 V regulated Voltage Input, then Jumper J12 on the printed circuit board must be removed and TB1-16 should be used for the separate motor power source and return connections (See figure 4 or 5 for J12 location).

METER OUT binding posts on the front panel allow reading of the input voltage when used in conjunction with the **BIAS TEST VOLTAGE** screen of the TCC300 tapchanger control.

Status indicators
NEUTRAL LIGHT illuminates when the regulator is in the neutral tap position.

The adapter panel includes three replaceable fuses: Test Terminal (3 A), Voltage Sense (1 A), and Motor Power (6 A).

Optional Control Switches
VOLTAGE REDUCTION (VR1/OFF/VR2) switch allows local voltage reduction 1 or 2 to be initiated.

SCADA CUTOUT (LOCAL/REMOTE) switch allows the local blocking of SCADA commands. The SCADA Cutout switch must be used with a TCC300 Series Control with firmware version D-0146V08.01.22 or later installed.

SCAMP™ (AUTO/MANUAL) pushbutton allows the Auto/Manual state on the adapter panel to be changed by a SCADA command. The SCAMP pushbutton switch must be used with a TCC300 Series Control with firmware version D-0146V08.05.XX or later installed.
Optional 19" rack mount adapter panel
19” rack mount adapter panel allows mounting the TCC300M2270B and TCC300 series control in a 19”, 8U rack application.

2. Application

External connections
Power and voltage sensing are obtained either from a common source or from independent sources having a nominal 120 V ac output. Normally, this is line-to-neutral voltage, although line-to-line voltage can also be used if recognition is made of any phase shift between the voltage and current signals when using line drop compensation.

Load current must be reduced by an appropriate auxiliary current transformer to 0.2 A “full scale” before connecting to the TCC300M2270B current inputs. The ABB M-0121 (5.0 A to 0.2 A) or M-0169A (5.0 A or 8.66 A to 0.2 A) auxiliary current transformer can be used for this purpose. The M-0121 can be used with ABB tapchanger controls when the only burden present is the Line Drop Compensator circuit of the voltage regulating relay. The M-0169A is used in higher burden circuits, such as are found in paralleling schemes. Outputs of the auxiliary CTs are protected against overvoltage. For further information, obtain ABB application note #17, “Basic Considerations for the Application of LTC Transformers and Associated Controls.”

The external connections for the TCC300M2270B are made to terminal blocks TB1 and TB2. Auxiliary external connections, if needed, are made to terminal blocks TB1 and TB2 on the printed circuit board at the base of the adapter panel. The wiring harness and external connections for the TCC300M2270B are shown in figures 3, 4 and 5.

Neutral light circuit
If the Neutral Light terminal TB1-11 needs to be grounded for the light to illuminate, set switch S1 (located in the right-hand corner of the adapter panel printed circuit board) to the toggle up position. If the Neutral Light terminal TB1-11 needs to be powered for the light to illuminate, set switch S1 (located in the right-hand corner of the adapter panel printed circuit board figures 4 and 5) to the toggle down position (Hot).S1 (located in the right-hand corner of the adapter panel printed circuit board figures 4 and 5) to the toggle down position (Hot).

Non-sequential operation (n/a for BASE-R or BASE-RS)
The operation of the TCC300M2270B can be interrupted during tapchanger operation by momentarily applying the “wetting” voltage of terminal TB2-28 to TB1-1 (timer reset for non-sequential operation input) through an external contact. This causes the output to de-energize and reinitialize the time delay circuit when the reset signal is removed. This function can be used to cause the LTC transformer, if so equipped, to wait for the unit to time out between tapchanges.

Caution
Voltage applied through dry contacts to actuate non-sequential input must be nominal +12 V dc obtained from pin TB2-28 of the TCC300M2270B adapter panel. If an M-0280 analog-version tapchanger control had previously been installed, the wiring harness must be reconfigured to remove the 120 V ac “wetting” voltage obtained from TB1-9 located on the top of the rear panel of the M-0280. Carefully examine the contacts of these functions to remove 120 V ac wetting voltages.

Automatic disable input

To disable automatic operation of the TCC300M2270B, remove Jumper #15 (See figures 4 and 5, for location) on the printed circuit board.

If SCADA is used to enable and disable this function, a contact rated at 6 A minimum can be connected between the terminals.

Auto disable may also be accomplished by closing a contact between TB1-1 and TB2-28.

Operations counter input

Caution
Do not apply any voltage to this terminal.

An operations count is registered by momentarily grounding TB1-13 through an external dry contact from the load tapchanger. The input is level-sensitive. Make sure that any “wetting” voltages are removed from the counter contacts before installing the TCC300M2270B adapter panel/ TCC300 tapchanger control.

Local/Remote input
Removing Jumper #14 (See figures 4 and 5, for location) prohibits TCC300 operation by disabling the automatic raise and lower outputs and also by disabling the TCC300M2270B adapter panel’s manual **RAISE/OFF/LOWER** toggle switch.

Removing this jumper does not disable the SCADA-supplied motor voltage input to the manual raise/ manual lower contacts on the adapter panel.

Multi-step voltage reduction

Caution
Voltage applied through dry contacts to actuate Voltage Reduction Steps 1, 2, and 3 must be nominal +12 V dc obtained from pin TB2-28 of the TCC300M2270B adapter panel. If an M-0280 analog-version tapchanger control had previously been installed, the wiring harness must be reconfigured to remove the 120 V ac “wetting” voltage obtained from TB1-9 located on the top of the rear panel of the M-0280. Carefully examine the contacts of these functions to remove 120 V ac wetting voltages.

On the TCC300M2270B, TB1-2 and TB1-7 on the printed circuit board are used together to provide up to three levels of voltage reduction. The external connections to achieve these steps are shown in table 1 and figure 3. Voltage reduction amounts are set within the TCC300 tapchanger control software.

Paralleling (N/A for BASE-R and BASE-RS controls)

See TCC300 instruction book, section 4.9, parallel operation.

Disabling AUTO/OFF/MANUALtoggle switch status detection
The Auto/Off/Manual Toggle Switch status detection feature is available on TCC300 series digital tapchanger controls that have firmware version d-0067V07.08.15 or later installed. To disable the Auto/Off/Manual Toggle Switch status detection feature for earlier firmware versions, perform the following:

1. Ensure that all power is removed from the TCC300M2270B adapter panel and TCC300 control.
2. From the rear of the TCC300M2270B adapter panel locate (figure 4) and remove the wire connected to terminal S3-4 on the rear of the **AUTO/OFF/MANUAL** Toggle switch.
3. Connect the wire removed in Step 2 to terminal S2-4 on the rear of the **RAISE/OFF/LOWER** Toggle switch.
4. See TCC300 instruction book section 6.1, external connections, for information regarding TCC300 settings to disable this function.

Operations Counter Input

Caution
Do not apply either +12 V dc or 120 V ac to this terminal.

An operations count is registered by momentarily grounding TB1-13 through an external dry contact from the load tapchanger. The input is level-sensitive. Make sure that any “wetting” voltages are removed from the counter contacts before installing the TCC300M2270B adapter panel/ TCC300 tapchanger control.

Connections for LTC transformers and regulators
In general, the tapchanger motor must be operated from a different transformer than the VT used to measure regulated voltage. If this is not done, hunting at the upper band edge may result.

A typical connection for an TCC300M2270B is shown in figure 3. Connections are simplified and may not show all functions required in a typical load tapchanging transformer control scheme; for example, seal-in contacts, limit switches, etc.

Use of the M-0329 LTC backup control with the tapchanger control
The M-0329 is a single-phase, solid-state backup control that prevents a defective tapchanger control from running the voltage outside the upper and lower voltage limits. The Block Raise and Block Lower voltage levels are set by accurately calibrated dials.

The M-0329 LTC backup control is connected as a two terminal device to the voltage transformer. Figure 4 shows the typical interconnection of the two devices with motor auxiliary relays.

The M-0329 instruction book is available on request and gives added details. Please refer to the M-0329 instruction book for complete ordering information.

Table 1. Multi-step voltage reduction external connections

Voltage reduction setpoint: multiplier range	Apply "wetting voltage" from TB2-28 to terminal #
Voltage reduction setpoint #1: 0 to 10%	TB1-7
Voltage reduction setpoint #2: 0 to 10%	TB1-2
Voltage reduction setpoint #3: 0 to 10%	TB1-7 and TB1-2

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Figure 01. TCC300 and TCC300M2270B adapter panel with standard Auto/Off/Manual toggle switch and optional voltage reduction and SCADA cutout switches

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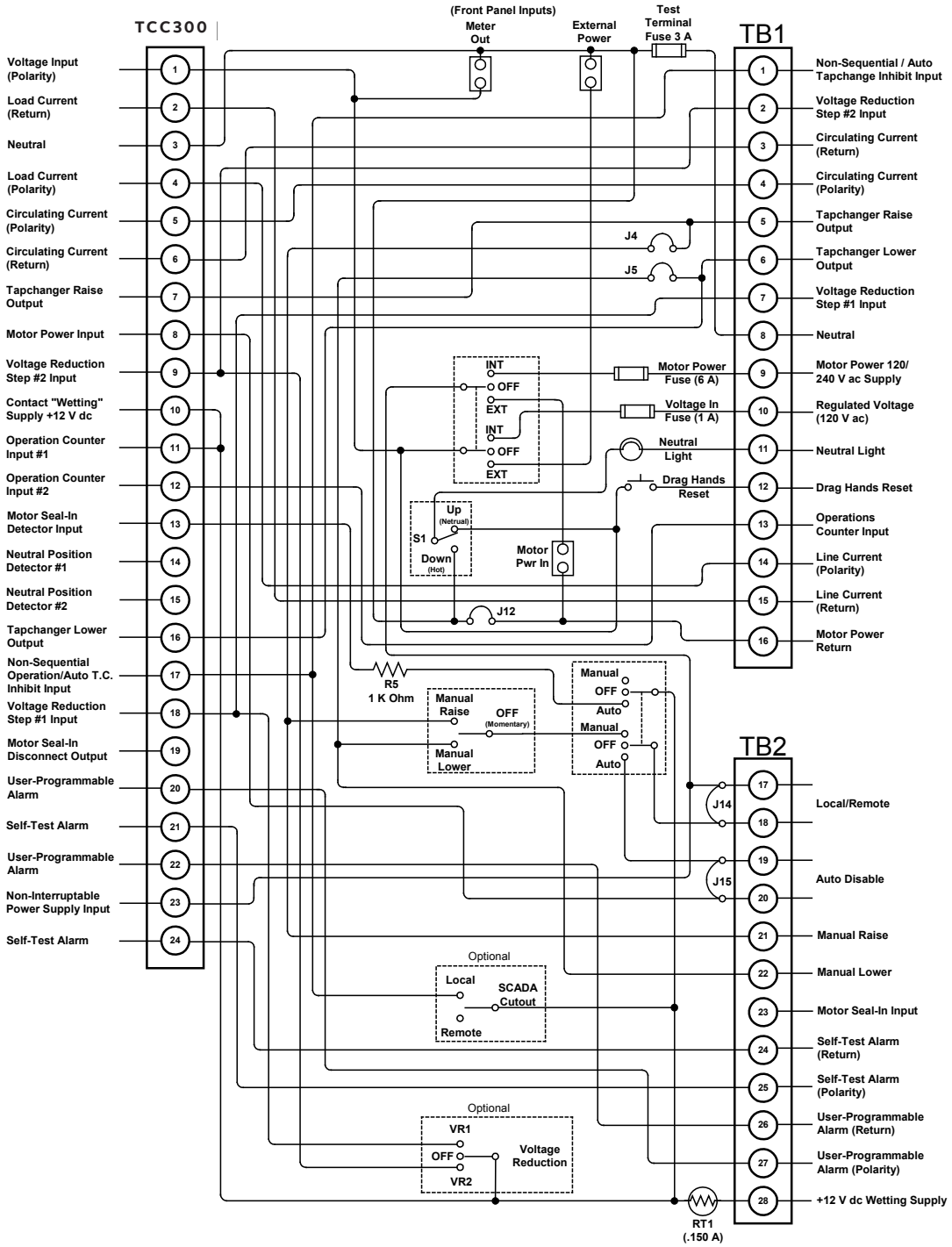
01



⚠Warning
In no case should the line current circuit be interrupted with the regulator or transformer energized. Do not remove auxiliary current transformers without shorting the current inputs. Death or severe electrical shock can occur.

Note
If the Motor Power Input configuration has a different return from the 120 V regulated Voltage Input, then jumper J12 on the printed circuit board must be removed and TB1-16 should be used for the separate motor power source and return connections (See figure 4 or 5 for J12 location).

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Figure 02. TCC300 and TCC300M2270B adapter panel with optional SCAMP™ Auto/Manual, SCADA cutout and voltage reduction switches

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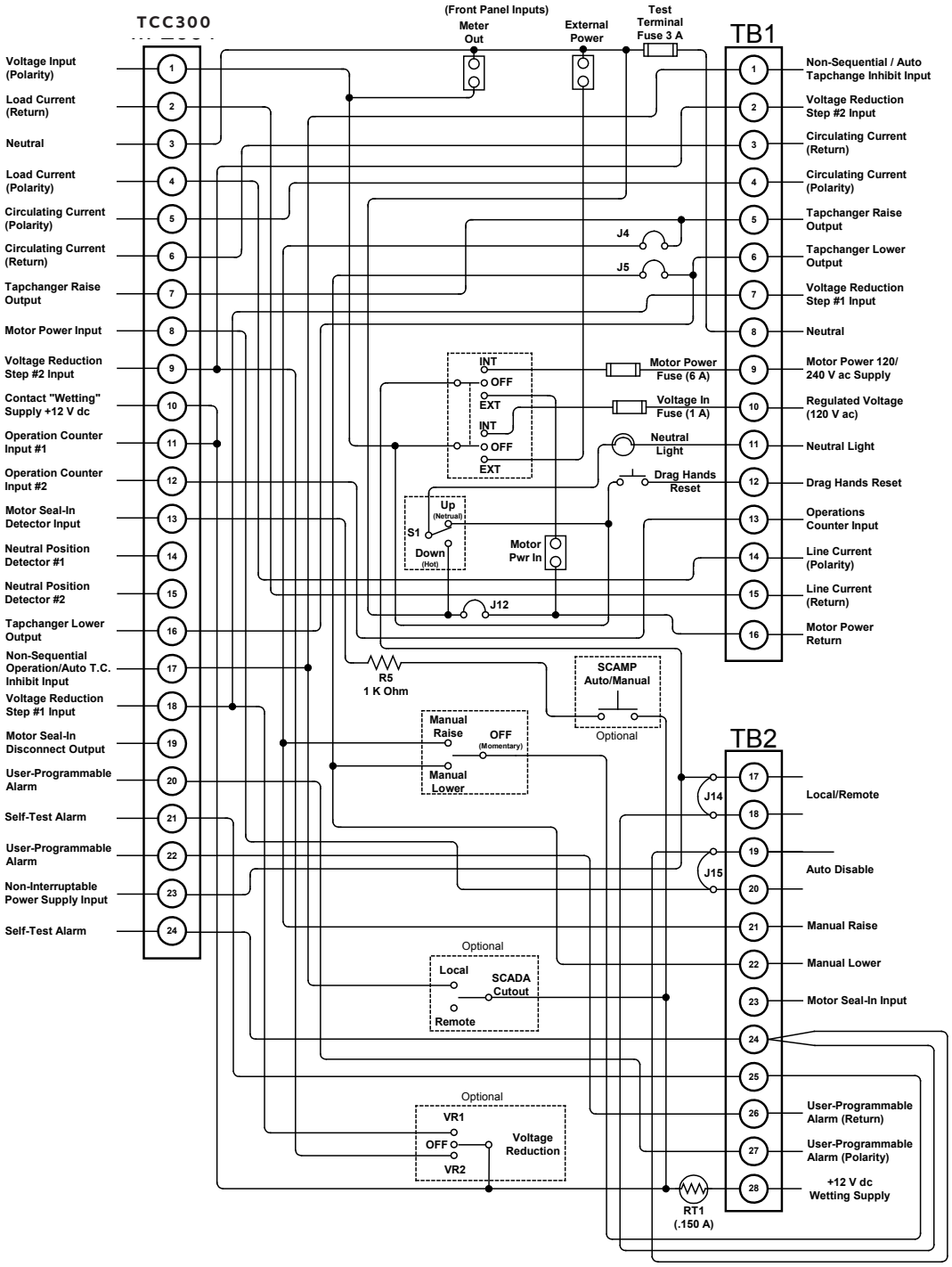
02



⚠Warning

In no case should the line current circuit be interrupted with the regulator or transformer energized. Do not remove auxiliary current transformers without shorting the current inputs. Death or severe electrical shock can occur.

Note

If the Motor Power Input configuration has a different return from the 120 V regulated Voltage Input, then jumper J12 on the printed circuit board must be removed and TB1-16 should be used for the separate motor power source and return connections (See figure 4 or 5 for J12 location).

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Figure 03. External connections

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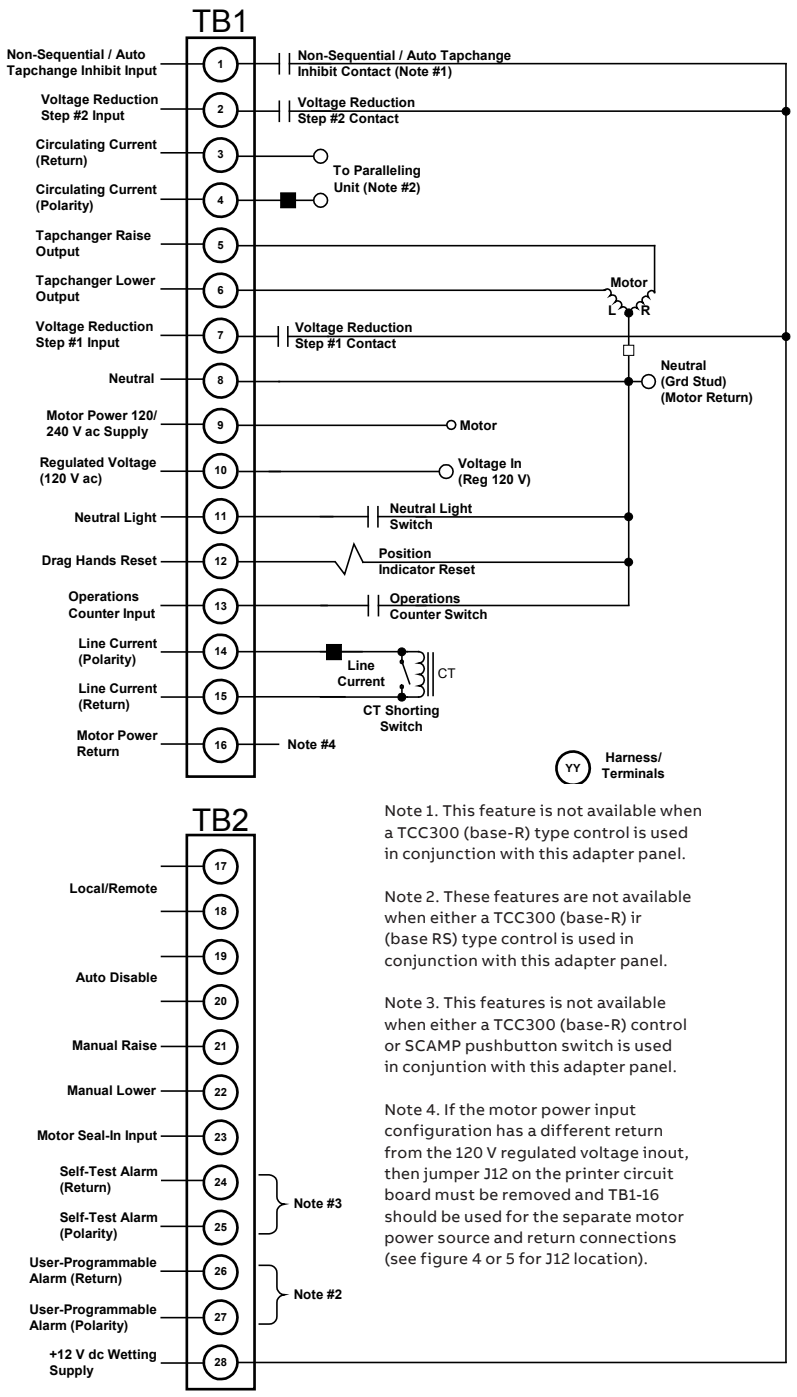
03



⚠Warning
Open CT secondary will result in high voltage at CT terminals. Death, severe injury or damage to equipment can occur. Do not operate with CT secondary open. Short circuit or apply burden at CT secondary during operation.

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Figure 04.
TCC300M2270B wiring harness with standard Auto/Off/Manual toggle switch, optional voltage reduction and scada cutout switches

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04

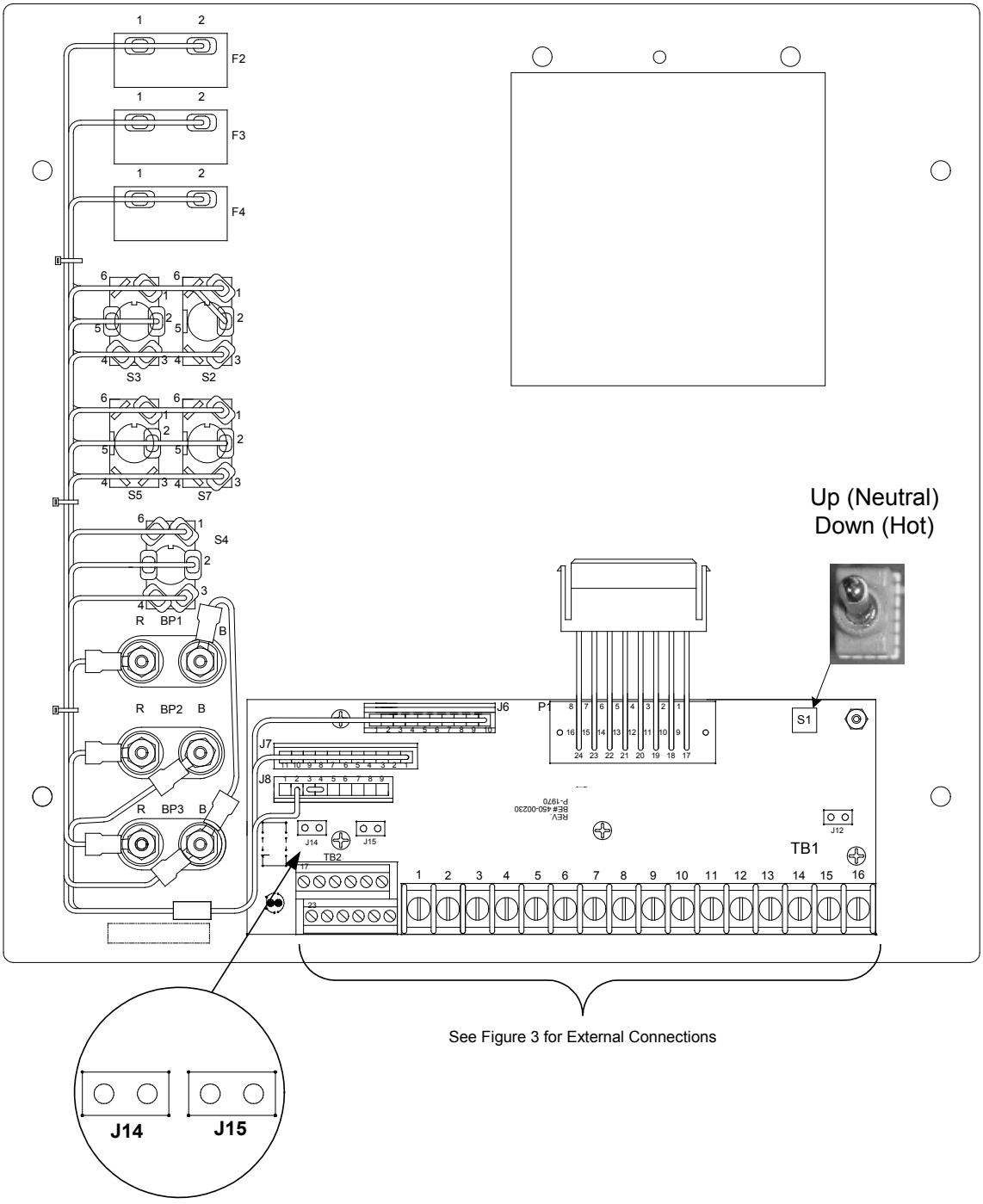

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Figure 05.TCC300M2270B wiring harness with optional SCAMP™ auto/ manual pushbutton switch, voltage reduction and scada cutout switches

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05

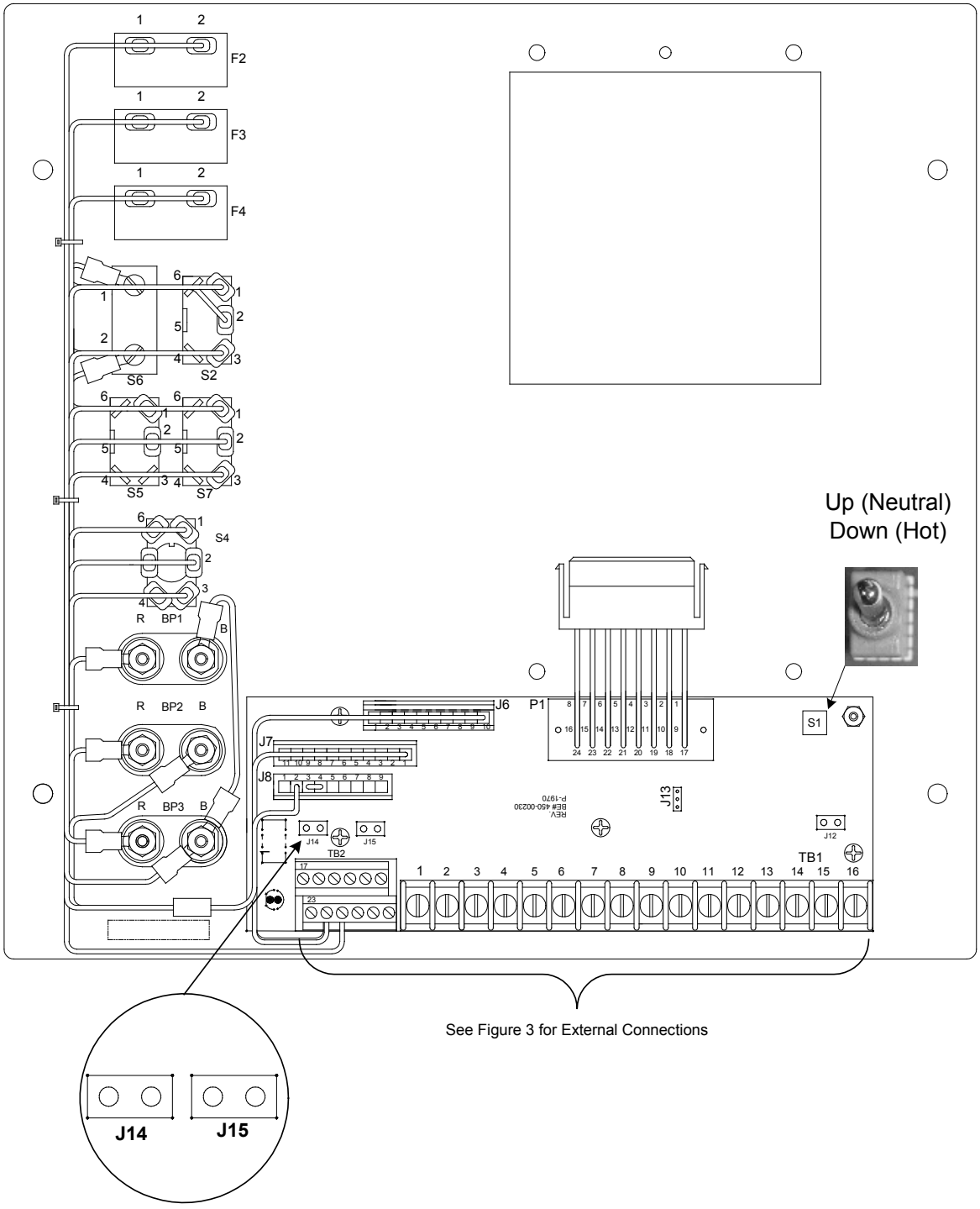

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Figure 06. Tapchanger control and LTC backup control interconnections

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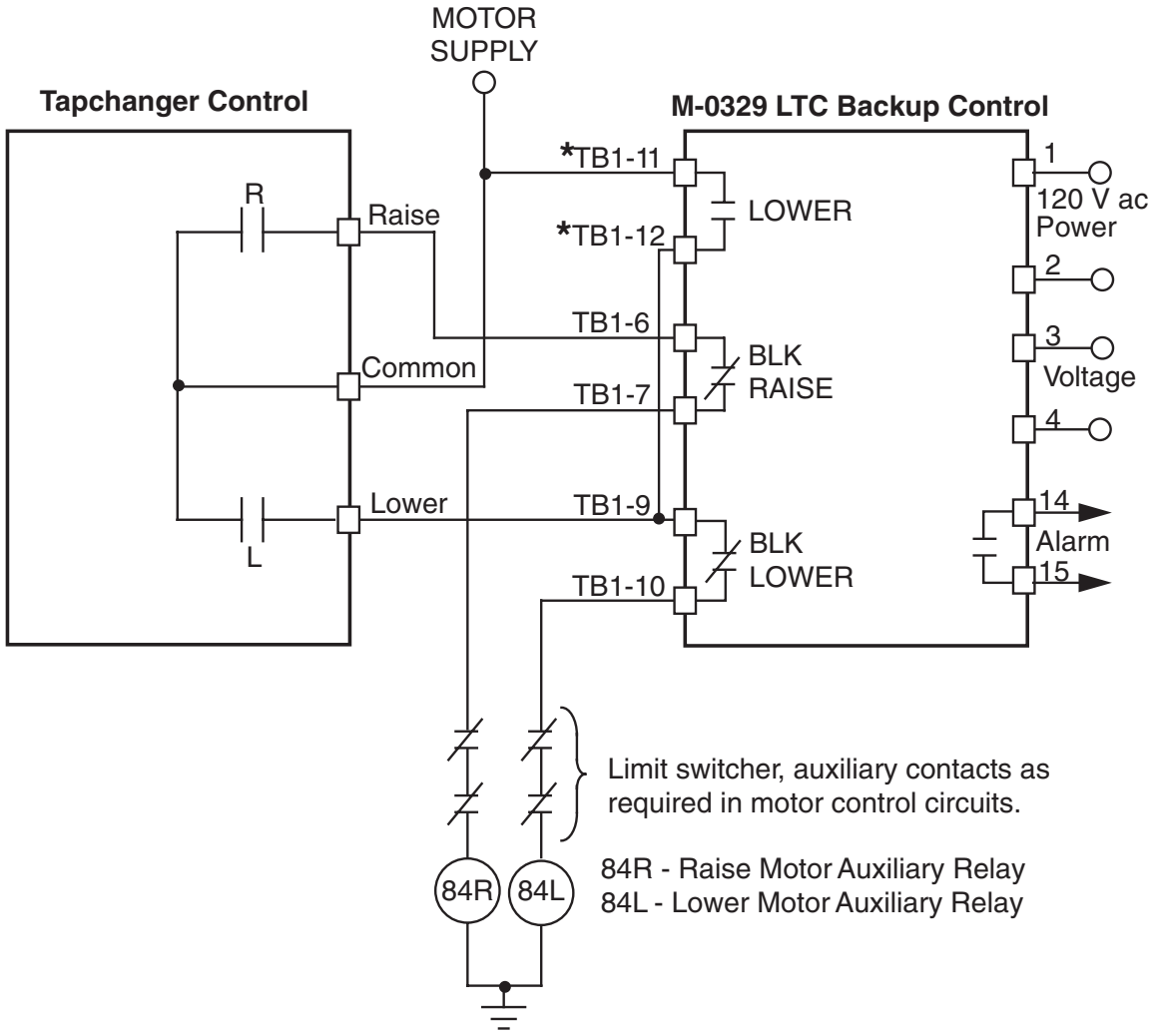
06



Note
If first customer protection is not required, delete these connections.

3. Installation

The TCC300M2270B is a flat-panel, general purpose adapter panel that is designed for surface mounting in a 10-1/2" x 12" panel cutout. Remove the old control from the cabinet. Refer to figure 7 for outline dimensions; refer to figure 8 for panel cutout dimensions of the TCC300M2270B.

Installation of the TCC300 tapchanger control
Mount the TCC300 tapchanger control to the back of the TCC300M2270B adapter panel and secure with the four screws provided. The four screws are shipped in a drawstring bag which is attached to the adapter panel. Insert the plug from the adapter panel into the connector at the base of the TCC300. Then install the TCC300M2270B adapter panel (with the TCC300 tapchanger control) into the control cabinet.

Installation of the TCC300M2270B adapter panel
Mount the TCC300M2270B adapter panel (with the TCC300 tapchanger control) in the control cabinet utilizing appropriate fasteners in the four mounting holes. External connections are made to the terminal block on the rear of the adapter panel (TB1). Figures 3, 4 and 5 show the TCC300M2270B external connections.

Alternate Installation of the TCC300M2270B adapter panel in the 19" rack mount adapter panel
Mount the TCC300M2270B adapter panel (with the TCC300 tapchanger control) into the 19" rack mounting adapter panel utilizing appropriate fasteners in the four mounting holes. Then mount the assembly into the 19" rack utilizing appropriate fasteners. External connections are made to the terminal block on the rear of the adapter panel (TB1). Figures 3, 4 and 5 show the TCC300M2270B external connections.

Lightning protection
It has been determined that transient voltages in excess of 1500 V ac rms can exist on the “ground” lead normally tied to TB1-8 on the printed circuit board. In the tapchanger controls, these voltages are suppressed by varistors which still permit the unit to pass a 1500 V ac Hi Pot test for one minute with a leakage current of approximately 15 mA, all terminals to ground.

Caution
For proper protection against system surges, chassis ground must be connected to earth ground.

Multiple VT grounds far apart must be avoided since a varying difference in ground voltage could add or subtract from the effective voltage and cause variation in the tapchanger control’s bandcenter voltage setpoint.

Figure 07. Outline dimensions

07

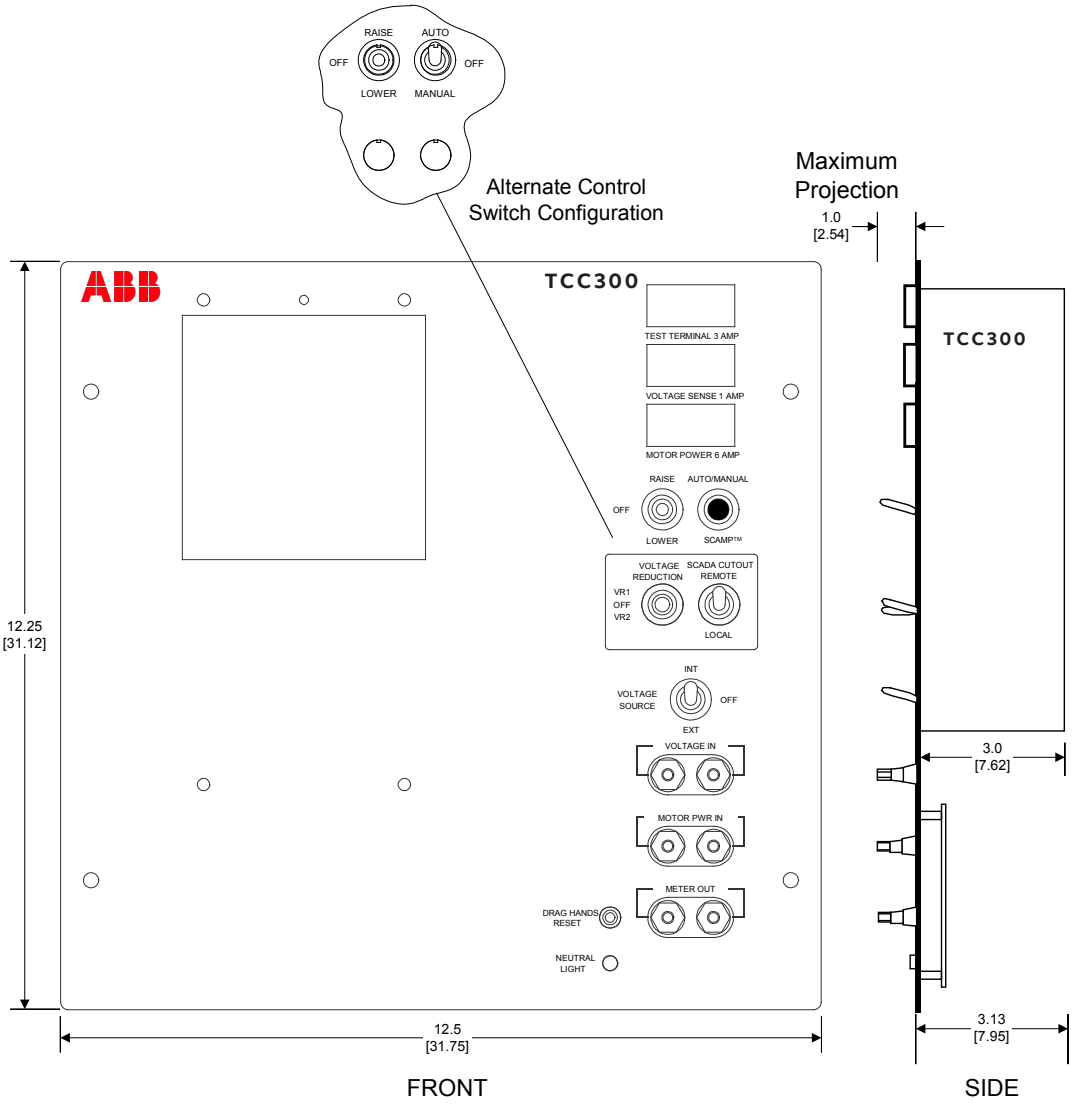


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Figure 08. TC-C300M2270B panel cutout dimensions

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08

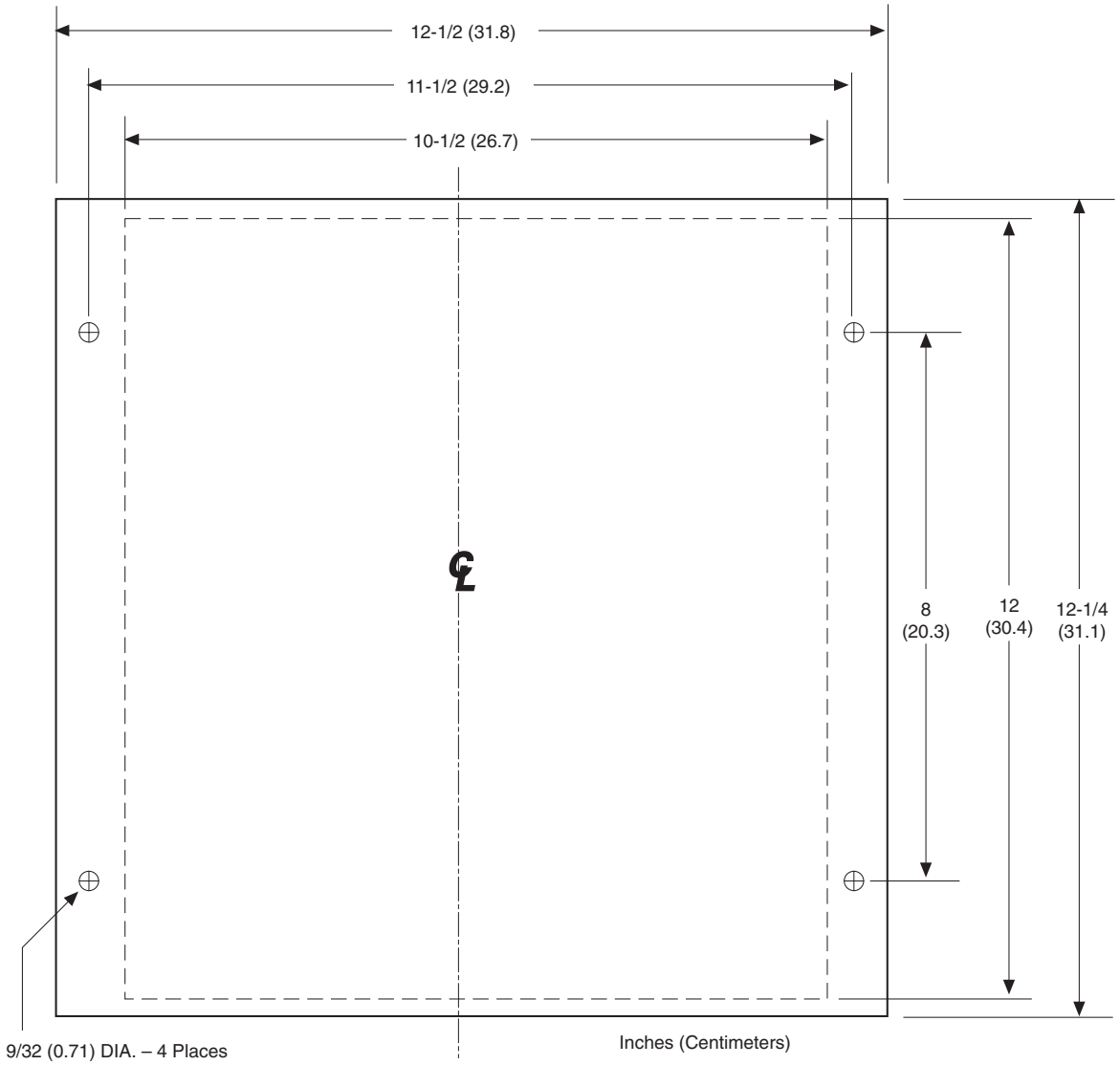

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Figure 09. 19" rack mount adapter panel dimensions

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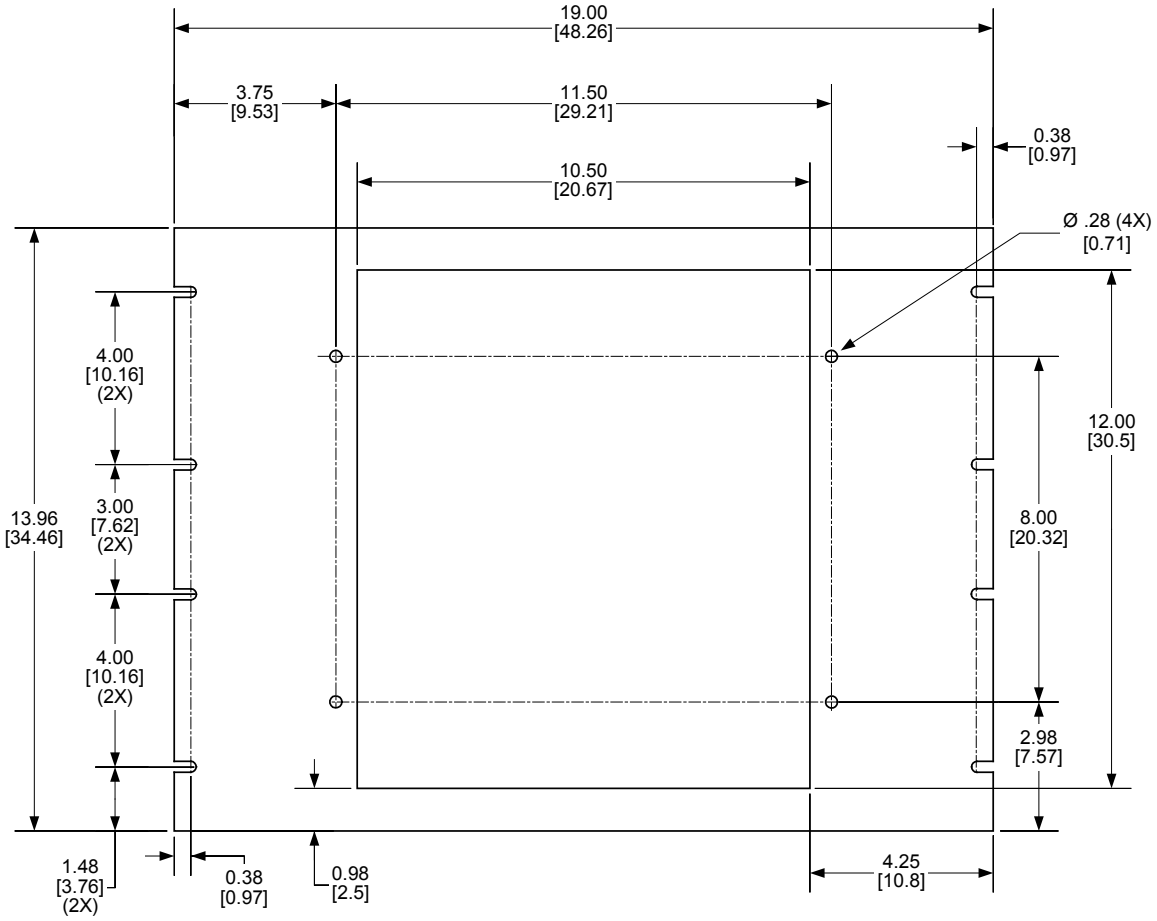
09



4.0 TCC300 tapchanger control software settings
Adjust the BANDCENTER setting to the nominal voltage desired. Adjust the BANDWIDTH setting to the desired voltage band, centered on the Bandcenter setpoint, that the voltage must exceed before timer and subsequent tapchanger operation occurs. Adjust the TIME DELAY setpoint to a sufficient amount to eliminate excessive tapchanger operations. The LINE DROP COMPENSATOR should be set for the line impedance from the transformer to the load center. For further information, obtain ABB application note #17, "Basic Considerations for the Application of LTC Transformers and Associated Controls."

4.1 M-0329 LTC backup control settings
The BANDCENTER and BANDWIDTH dials on the M-0329 LTC backup control should be set so that the Block Lower limit is a small amount (approximately 2 V) below the lower band limit of the tapchanger control, and the Block Raise limit is a similar amount above the upper limit if line drop compensation is not used.

If line drop compensation is used, the M-0329 Block Raise limit should be set at the maximum voltage desired at the transformer secondary under full load.

The M-0329 LTC backup control also includes a deadband or runback function that regulates the maximum voltage from the transformer. This "Lower" function operates slightly above the Block Raise limit and is connected to force the tapchanger to lower the voltage if the upper limit is exceeded.

5.0 Bench Test (TCC300 Connected to TCC300M2270B)

Note
This test assumes that the TCC300 tapchanger control is connected to the TCC300M2270B adapter panel.

Test Equipment
- 0–200 mA current supply with phase angle settings of 0° to +90°
- 90–145 V ac voltage source at 60 Hz
- High impedance true RMS voltmeter with accuracy on ac of at least ±0.2% of reading
- Accurate Stop watch

Setup
1. Make the electrical connections as shown in figure 10.

Note
Refer to the TCC300 instruction book appendix, figures A-1 through A-13 for the locations of screens within the software.

Note
There is a one second delay between the out-of-band condition and panel LED indication.

2. Enter initial TCC300 settings:

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Table 2. Initial settings

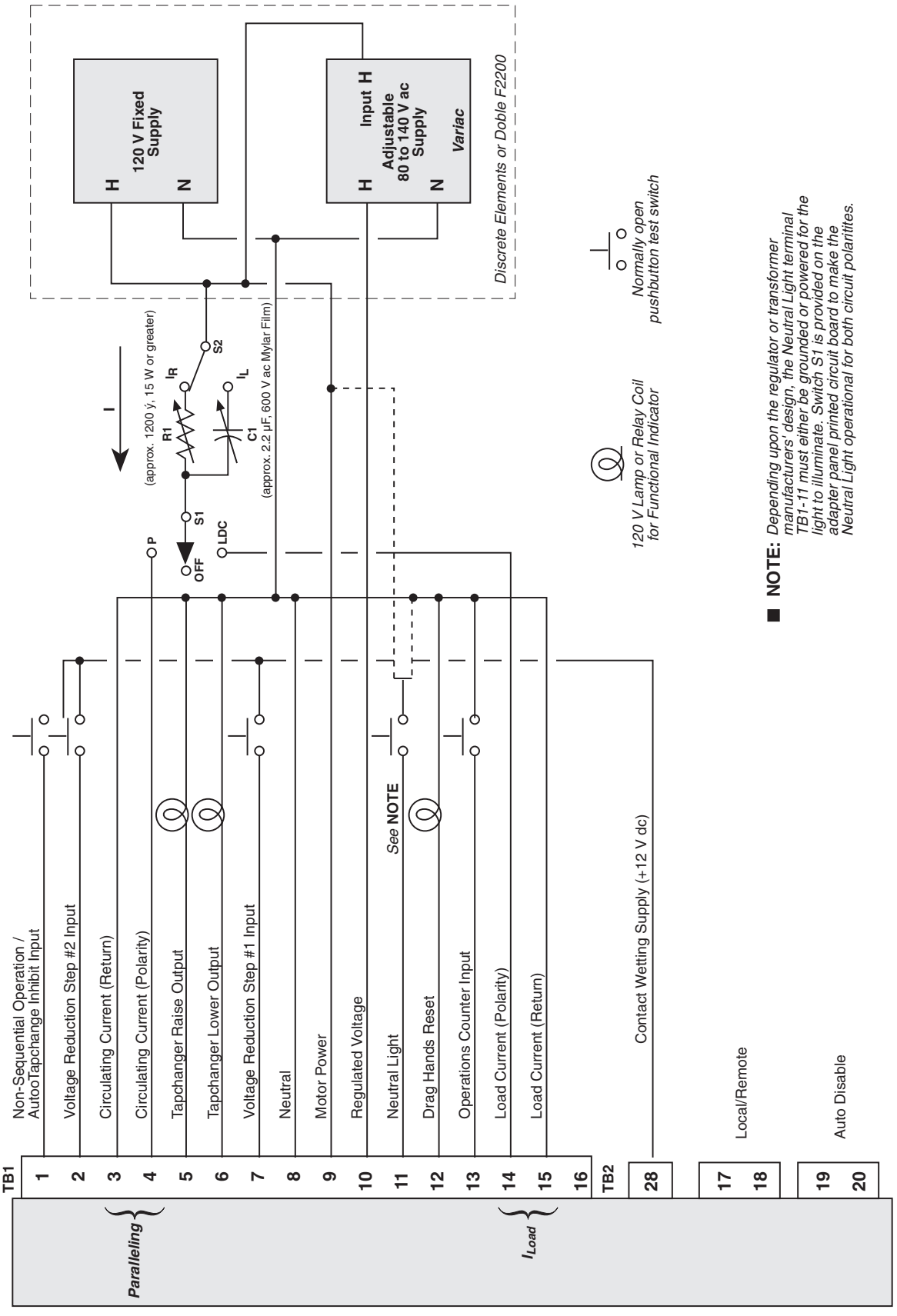
Initial settings	
Bandcenter	120.0 V
Bandwith	2.0 V
LDC resistance	0.0 V
LDC reactance	0.0 V
Paralleling	Circulating current method
Block raise	135.0 V
Block lower	105.0 V
Deadband	2.0 V
Timer	5.0 seconds

Procedure
1. Apply 120.0 V ac from power source.
2. The display of the TCC300 will automatically advance to the **Local Voltage** screen.
3. Increase voltage to 121.2. The **LOWER** LED should illuminate.
4. Decrease voltage to 118.8. The **RAISE** LED should illuminate.
5. Set input voltage to 120.0 V ac. Wait for **RAISE** and **LOWER** LEDs to extinguish.
6. Increase voltage to 122.0 V ac, then start timing when voltage passes 121.0 V.
7. Stop timing when the lamp connected to the LOWER output illuminates (should be approximately 5 seconds).

Resistance
1. Apply 100.0 mA in-phase current to TB1-14 (load current-polarity) and TB1-15 (load current-return) of the adapter panel. (Set S1 to LDC and S2 to IR.)
2. Set LDC Resistance to 24.0 V. The **RAISE** LED should illuminate.
3. Increase input voltage to 132.0 V ac. The **RAISE** and **LOWER** LEDs should be extinguished.
4. Set LDC Resistance to –24.0 V. The **LOWER** LED should illuminate.
5. Decrease input voltage to 108.0 V ac. Both **RAISE** and **LOWER** LEDs should extinguish.
6. Set LDC Resistance to 0.0 V.

Figure 10. Setup for current checkout procedure

10



Reactance

1. Apply 100.0 mA 90° leading current to TB1-14 (load current-polarity) and TB1-15 (load current-return) of the adapter panel.
2. Set S1 to LDC and S2 to IL.
3. Set LDC Reactance to 24.0 V. The **LOWER** LED should illuminate.
4. Decrease input voltage to 108.0 V ac. The **RAISE** and **LOWER** LEDs should be extinguished.
5. Set LDC Reactance to –24.0 V. The **RAISE** LED should illuminate.
6. Increase input voltage to 132.0 V ac. Both **RAISE** and **LOWER** LEDs should be extinguished.
7. Set LDC Reactance to 0.0 V.

Paralleling

1. Apply 100.0 mA 90° leading current to TB1-4 (circulating current-polarity) and TB1-3 (circulating current-return) of the adapter panel.
2. The **LOWER** LED should illuminate.
3. Decrease voltage to 108.0 V ac. Both **RAISE** and **LOWER** LEDs should be extinguished.
4. Turn off current.

Voltage Source Switch

1. Set **AUTO/OFF/MANUAL** switch to **OFF**.
2. Set **VOLTAGE SOURCE** switch to **EXT**.
3. Verify that there is no manual **Raise** or **Lower** output.
4. Attach a voltmeter to **Meter Out** terminals.
5. Verify that no voltage is present.
6. Apply 120 V ac to both the **Voltage In** and **Motor Pwr In** binding posts (Black-Neutral, Red-Hot).
7. Set the **AUTO/OFF/MANUAL** switch to **AUTO**.
8. Verify normal raise and lower operation.
9. Return the **VOLTAGE SOURCE** switch to INT.

Drag Hands Reset

1. Verify that the **DRAG HAND RESET** switch works by connecting a lamp or ac relay from TB1-12 (drag hands reset) to TB1-8 (neutral) of the adapter panel. When the switch is pressed, the connected indicator should function.

Counter/Neutral Light/Tap position

1. Set the TCC300 tapchanger control to display the **Operations Count** screen.
2. Verify the counter operation by connecting a switch between TB1-13 (operations counter input) and TB1-8 (neutral) of the adapter panel.
3. Lower the input voltage until the **RAISE** LED lights. Allow the delay timer to time out and then activate the switch between TB1-13 (operations counter input) and TB1-8 (neutral).
4. The tap position should change.
5. Jumper TB1-11 (neutral light) to TB1-8 (neutral).
6. Set the neutral light switch S1, located on the adapter panel printed-circuit board figures 4 and 5, to the toggle down position (Hot).
7. The neutral light on the adapter panel should light and the tap position should return to “0 Neutral.”
8. Remove the jumper.

Block raise/block lower/dead band

1. Set Block Raise to 126.0 V.
2. Set Block Lower to 114.0 V.
3. Set the TCC300 tapchanger control to display the **Bias Voltage** screen.
4. Press **Enter**.
5. Increase voltage to 126.5 V. **BR** should be displayed on the screen.
6. Increase voltage to 128.5 V. **BR** extinguishes and FL is displayed on the screen.
7. Decrease voltage to 113.5 V. **BL** is displayed on the screen.

—Bench Test Complete—

5.1 TCC300 checkout procedure

Note
This test of the TCC300 assumes that the unit remains connected to the TCC300M2270B adapter panel.

Basic operational test

1. Apply 120.0 V ac to TB1-9 (motor power) and TB1-10 (regulated voltage) of the adapter panel.
2. Connect neutral to TB3-5 (neutral).
3. Verify local voltage ≈ input voltage ±0.3 V.
4. Apply 100.0 mA in-phase current to TB1-14 (load current-polarity) and TB1-15 (load current-return) of the adapter panel. Verify **Control Load** I ≈ 100 mA and **Power Factor** ≈ 1.0 ±0.02.
5. Apply 100.0 mA 90° leading current to TB1-4 (circulating current-polarity) and TB1-3 (circulating current-return) of the adapter panel.
6. Verify **Control Circ** I ≈ 100.0 mA ±2 mA.
7. Verify **Up, Down** and **Enter** buttons work.

—Checkout Procedure Complete—

5.2 In-service test

1. Set the TCC300 tapchanger control to display the **Bias Voltage** screen.
2. Press **Enter**.
3. Use **Up** and **Down** buttons to cause **RAISE** and **LOWER** outputs.

—In-Service Test Complete—

RETURN UNIT TO DESIRED SETTINGS

5.3 TCC300M2270B checkout procedure

Note
All ABB units are fully calibrated at the factory. There is no need to re-calibrate the units before initial installation.

Set the **AUTO/OFF/MANUAL SWITCH** to **OFF**. Inspect the **MOTOR POWER** and **VOLTAGE** fuses to ensure they are correctly sized and have not blown.

POWER

1. Remove any external connection between TB1-9 and TB1-10 which are located on the adapter panel printed circuit board. Also remove any voltage applied to TB1-9 externally. Using a voltmeter, make sure that the voltage applied to TB1-10 is nominal 120 V ac with respect to TB1-8 (neutral). Apply power to TB1-10 (hot) and TB1-8 (neutral).
2. Connect a voltmeter to the **METER OUT** test terminal on the front of the adapter panel. 120 V ac should be indicated.

⚠ Warning
Voltage applied at the METER OUT test terminal may energize the regulator or transformer to a high voltage through the voltage transformer. Death or severe electrical shock can occur. Do not connect any voltage source at the METER OUT test terminal.

Caution
Do not reverse the ground and hot wires when connecting an external source. A 3 AG fuse (F2) is installed to protect the relay from damage if these connections are accidentally reversed. Spare fuses are supplied inside the fuse holders.

3. Apply motor power to TB1-9 (hot) and TB1-8 (neutral). Set the **AUTO/OFF/MANUAL** switch to **MANUAL** and using the **RAISE/OFF/LOWER** switch, verify that the motor runs in the proper direction when this switch is in the **RAISE** and **LOWER** positions.
4. Set the **AUTO/OFF/MANUALSWITCH** to the **AUTO** position. Refer to the Field Checkout Procedure as found in the TCC300 Status & Setpoint Review Guide of the TCC300 tapchanger control Instruction Book for test/operation procedures.
5. As shown in figure 11 temporarily place a shorting device across the LDC-CT secondary to short the line drop compensator circuit, and place another shorting device across TB1-3 and TB1-4 to short the circulating current paralleling input, for the load current check. Insert an ammeter between the polarity input and TB1-14. Open the load current shorting device and with a known load on the transformer or regulator, measure the current in the load current circuit to ensure that this current is correct for 0.2 A full load.
6. Replace the shorting device across the load current input and remove the ammeter. Reconnect polarity to the unit and remove both jumpers. The **LINE DROP COMPENSATOR** will be activated. Correct CT polarity can be checked by simply incorporating sufficient +R compensation. The regulator should time out and run so as to raise the output voltage.

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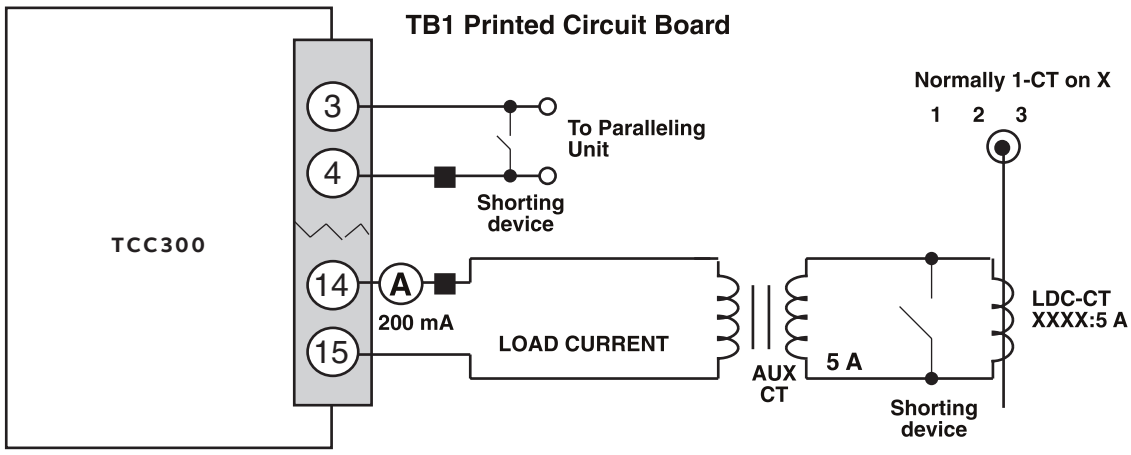
Figure 11. Setup for current checkout procedure

⚠ Warning
In no case should the load current circuit be interrupted with the regulator or transformer energized. Do not remove auxiliary current transformers without shorting the current inputs. Death or severe electrical shock can occur.

Voltage source switch
The **VOLTAGE SOURCE** switch will disconnect all power from the unit when in the **EXT** position with no source connected to the front panel voltage and motor power inputs.

! Caution
Do not reverse the ground and hot wires when connecting an external source. A 3 AG (F2) is installed to protect the relay from damage if these connections are accidentally reversed.

With the **VOLTAGE SOURCE** switch in the **EXT** position, the sensing and motor power circuits are connected to the **VOLTAGE IN** and **MOTOR PWR IN** binding posts on the front panel. The unit can be tested using an external 120 V rms source of proper polarity applied to these terminals. Testing can be accomplished by adjusting the amplitude of the external source.



Notes

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