PRODUCT GUIDE

# TCC300M2230 Adapter Panel

Digital tapchanger control for power transformers and regulators

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# TCC300M2230
## Adapter panel

**1. Introduction**
The ABB TCC300M2230 Adapter Panel, used in conjunction with the TCC300 Tapchanger Control, uses modern digital design and digital processing circuitry to achieve an overall stability and resolution unattainable with electromechanical and analog design tapchanger controls. CMOS semi conductors are used throughout the design.

This application guide should be used in conjunction with the applicable TCC300 Series Instruction Book for TCC300 applications.

**Description**

**Standard features**
The TCC300M2230 Adapter Panel, with the TCC300 Tapchanger Control, provides a solid-state voltage control relay intended for applications involving the control of tapchanging transformers and regulators. The combination of tapchanger control and adapter panel includes the following features:

- Voltage waveform sampling and digital processing circuitry to ensure accurate RMS voltage sensing.
- 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 Vac 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.
- **AUTO/OFF/MANUAL** switch allows manual operation of the tap changer by switches located on the customer's panel. 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** screen in the **Configuration** menu is set to **Switch Status Input**, this input will only 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 **ON/OFF**. The status can be read through the seal-in/switch status data point in the communication protocols.

**2. Aplication**

**Typical Connections**
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. As soon as the motor starts, and before it is sealed in, the motor current can drop the voltage within the band and reset the control. Some motor seal-in schemes are fast enough to prevent this, but others are not. The "step-by-step" method used by the Reinhausen tapchanger mechanism should avoid this problem.

With the step-by-step method, non-sequential operation, intertap time delay operation, or pulsed output should be used on the TCC300.

A typical connection for the TCC300M2230 is shown in Figure 1, TCC300 and TCC300M2230 Typical Connections. Connections are simplified and may not show all functions required in a typical load tapchanging transformer control scheme – for example, limit switches, etc.

**External connections**
Power and voltage sensing are obtained either from a common source or from independent sources having a nominal 120 Vac 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 is reduced by an auxiliary current transformer to 0.2 A "full scale" input for the TCC300. The auxiliary current transformer is supplied with the TCC300M2230 and is located within the TCC300M2230. This tapped auxiliary transformer accepts 5.0,1.0, or 0.2 A. A 3.0 to 0.2 A input is available as an option at time of order.

The external connections for the TCC300M2230 are made to terminal block TB1, located on the adapter panel. The external connections for the TCC300M2230 are shown in Figure 2, External Connections.

**Lightning protection**

**Caution**
For proper protection against system surges, chassis ground, terminal 21, must be connected to earth ground.

It has been determined that transient voltages in excess of 1500 Vac RMS can exist on the "ground" lead normally tied to TB1-2. In the tapchanger controls, these voltages are suppressed by varistors which still permit the unit to pass a 1500 Vac hi-pot test for one minute, with a leakage of approximately 25 mA, all terminals to 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.

**Automatic disable input**

**Caution**
Do not apply 120 Vac to these terminals.

To perform remote-initiated manual operation, connect TB1-29 to TB1-30, to block automatic operation of the TCC300M2230. The adapter panel is blocked from automatic operation so long as this connection is maintained, and will resume automatic operation when this connection is removed.

**Paralleling**

**Warning**
When paralleling regulators without sufficient series impedance, such as transformer leakage reactance or reactors, a dangerous amount of circulating current will appear if the regulators are on different tap positions. One series reactor per regulator is required in this application. Consult ABB Electric for more information.

**Warning**
Circulating current must be 0.2 A full load. Death or severe electrical shock can occur if 5 A is applied.

When the TCC300M2230 is paralleled using the Reinhausen SKB5 or SKB20 parallel units, additional connections must be made. Both SKB5 and the SKB20 parallel control units use the circulating current method to parallel multiple transformers. The separated circulating current is converted into a voltage signal inside the SKB5 and SKB20 before it is sent to the existing controls. The adapter panel is also designed for use with the circulating current method of paralleling, but has a 0.2 A input for direct input of the circulating current. This condition can be resolved by moving three wires in the SKB5 or SKB20. The terminal numbers are the same on both SKB5 and SKB20 units. Disconnect the wires connected to terminals 6, 11, and 12. Connect the wire labeled 12 to the 6 terminal block. Connect the two remaining wires (6 & 11) together. This routes the circulating current to the adapter panel via the number 12 wire, and then back via the number 11 wire, which connects to the original number 6 wire.

**Operations counter input**

**Caution**
Do not apply 120 Vac to this terminal.

An operations count is registered by momentarily grounding TB1-51 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 TCC300M2230 Adapter Panel/ TCC300 Series Tapchanger Control.

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Figure 01. TCC300 and TCC300M2230 typical connections

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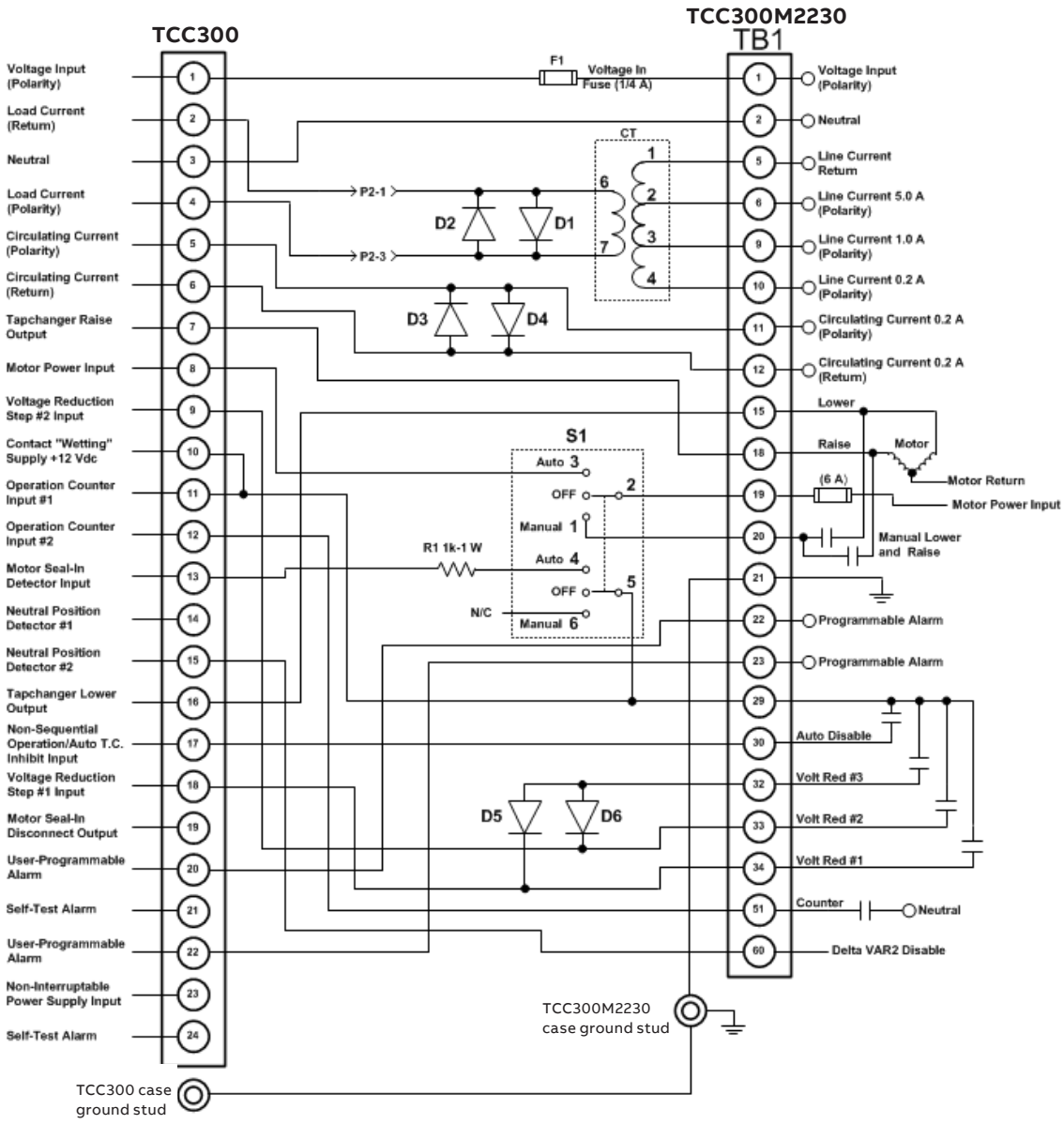
**01**




**Note**

1. For remote manual operation, connect TB1-29 to TB1-30 before initiating remote manual operation.
2. For counter operation, connect TB1-51 to neutral TB1-2 through an external dry contact.
3. For voltage reduction, connect TB1-29 through an external dry contact to desired step.
4. The user-programmable alarm contact is shown in the de-energized state (no voltage applied). This alarm contact closes when an alarm is recognized.

**⚠ Warning**

In no case should the line current circuit be interrupted with the regulator or transformer energized.

**⚠ Warning**

Do not remove auxiliary current transformer without shorting the current inputs. Death or severe electrical shock can occur.

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Figure 02. External connections

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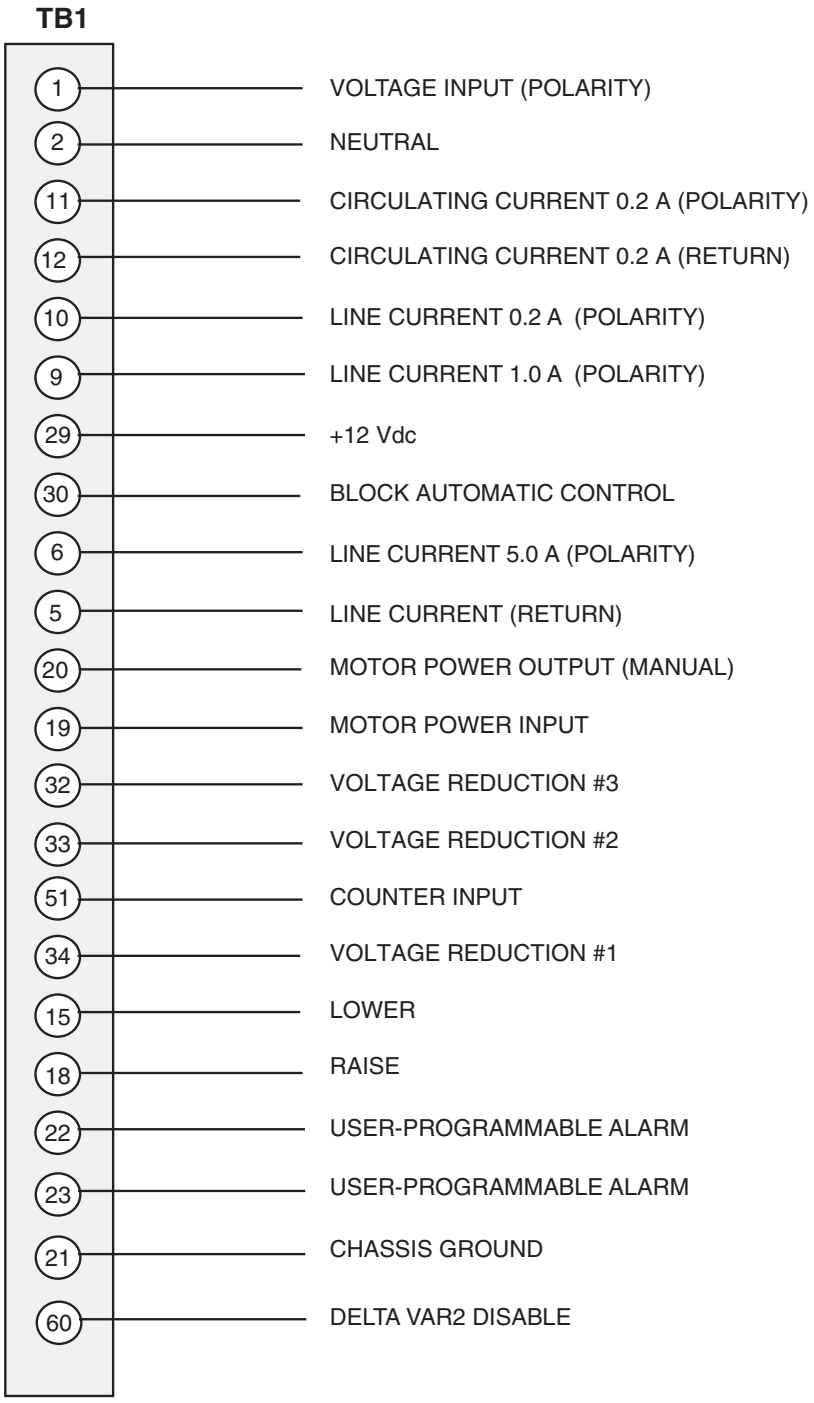
**02**




**Note**

1. To block operation of automatic control, connect TB1-29 to TB1-30.
2. Motor power fused external to the TCC300M2230.

**⚠ 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.

## 3. Installation

### Removal of the MK30

1. Verify that the voltage measured from terminals 2 to 1 is approximately 120 Vac.
2. Verify that the voltage measured from terminals 21 to 19 is approximately 120 Vac

**Note**
The 3 Amp current input is an option which must be specified when the TCC300M2230 is originally purchased.

3. Verify that the full scale current input is connected to the correct terminal. Terminal 5 is the common current return; terminal 6 is the 5 Amp input (existing terminal 7 not provided, use terminal 6), terminal 9 is the 1 Amp input, and terminal 10 is the 0.2 Amp input.
4. Short the current input externally before disconnecting terminals 5 through 10.
5. If transformer is paralleled with other transformers, then place the parallel control unit to independent and verify that there is no voltage or current present at terminals 11 and 12.
6. Open the voltage inputs to the existing control externally before disconnecting the 1 and 2 terminals and the 19 terminal.
7. Verify that all 120 Vac sources have been disconnected, and that the current input no longer has current.
8. Set the existing **AUTO/OFF/MANUAL** switch to "Off".

**⚠ Warning**
Open CT secondary will result in high voltage at CT terminals. Death, severe injury, or damage to equipment can occur.

**Note**
There are no provisions for automatic shorting of the current inputs of the MK30 control.

9. Loosen the four mounting screws holding the MK30 control, then pull the existing control out by the handles.

**⚠ Warning**
Open CT secondary will result in high voltage at CT terminals. Death, severe injury, or damage to equipment can occur.

10. Remove the four screws holding the existing terminal block in place.
11. Remove nut holding ground wire to enclosure and save (this will be needed for the ground wire of the new TCC300M2230).

**Note**
The TCC300M2230 uses the same terminal designations as the existing control. Sometimes wires are labeled to indicate where the other end of wire is terminated, instead of where to connect it. If wires are labeled in this manner, a table should be made to determine where to reconnect wires to the TCC300M2230 Terminal Block.

12. Label wires if they are not already labelled.
13. Disconnect the wires from the existing terminal block. The existing terminal block can now be removed.
14. Remove the enclosure.

**Mounting of the TCC300M2230**

The TCC300M2230 offers four methods of mounting the adapter panel:

- Surface Mount (using studs on back of panel)
- Surface Mount (using supplied surface mounting flanges)
- Panel Mount (using supplied reconfigured surface mount flanges)
- Panel Mount (using OEM clips)

**Surface mount (studs)**

1. Locate and drill holes for surface mount studs (see Item 1, Figure 5, Top and Side View Details).
2. Remove attached surface mount flanges (Item 2) from the TCC300M2230.
3. Mount the TCC300M2230 to the surface location.

**Surface mount (flanges/rear)**

1. Locate and drill holes for surface mount flange (see Item 2, Figures 3 and 4, Front and Rear View Details).
2. Mount the TCC300M2230 to the surface location.

**Panel mount (flanges/front)**

1. Locate and drill holes for surface-mount flanges (see Item 2, Figures 3 and 4, Front and Rear View Details).
2. Remove side support (see Item 3, Figure 5, Top and Side View Details) from TCC300M2230 to front side edges.
3. Move surface mount flange (Item 2) to front position for panel mount.
4. Mount the TCC300M2230 to the surface mount location.

**Panel Mount (OEM Clips)**

1. Locate and install OEM bracket.
2. Ensure that TCC300M2230 side supports (Item 3) are installed on TCC300M2230 front side edges (see Figure 5, Top and Side View Details).
3. Mount the TCC300M2230 to the OEM bracket.

**Connecting the TCC300M2230 and TCC300**

1. Connect the existing wires to the terminal block on the new TCC300M2230 bracket (see Figure 2, External Connections, and Figure 1, TCC300 and TCC300M2230 Typical Connections). Terminal screws should be firmly tightened (do not overtighten).
2. Check each wire, as it is installed, to make sure it is not loose. Also check the screws and wires on the other side of this terminal block for tightness, where the harness provided is connected. If existing wires are not used, tape or insulate accordingly.
3. If terminals 13, 14, and 16, 17 were used as interlocking connections, connect the Lower signal directly to terminal 15 and the Raise directly to terminal 18.
4. Mount the TCC300 to the TCC300M2230 Adapter panel by using the hardware provided in the cloth bag. Use the lock washers supplied between the screws and the top of the front panel.

**Note**

The blue connector is keyed by a "V" notch in the middle to prevent incorrect mating. Check location of the key before plugging connector into the TCC300.

5. While holding the top handle of the TCC300M2230, plug the blue connector of the harness into the bottom TCC300.
6. Place the TCC300M2230 panel into its enclosure. Check to keep anything from sliding under the TCC300, between it and the enclosure. Start the front panel captive screws. It may be necessary to adjust the position of the front panel to align the mounting screws to the mounting holes.
7. Set the toggle switch to the Manual position.
8. Set up the desired configuration and settings on the TCC300. See the applicable TCC300 Series Instruction Book.
9. Verify manual operation of the unit.
10. Set the toggle switch to the Auto position and verify automatic operation.

03

Figure 03. Front view details

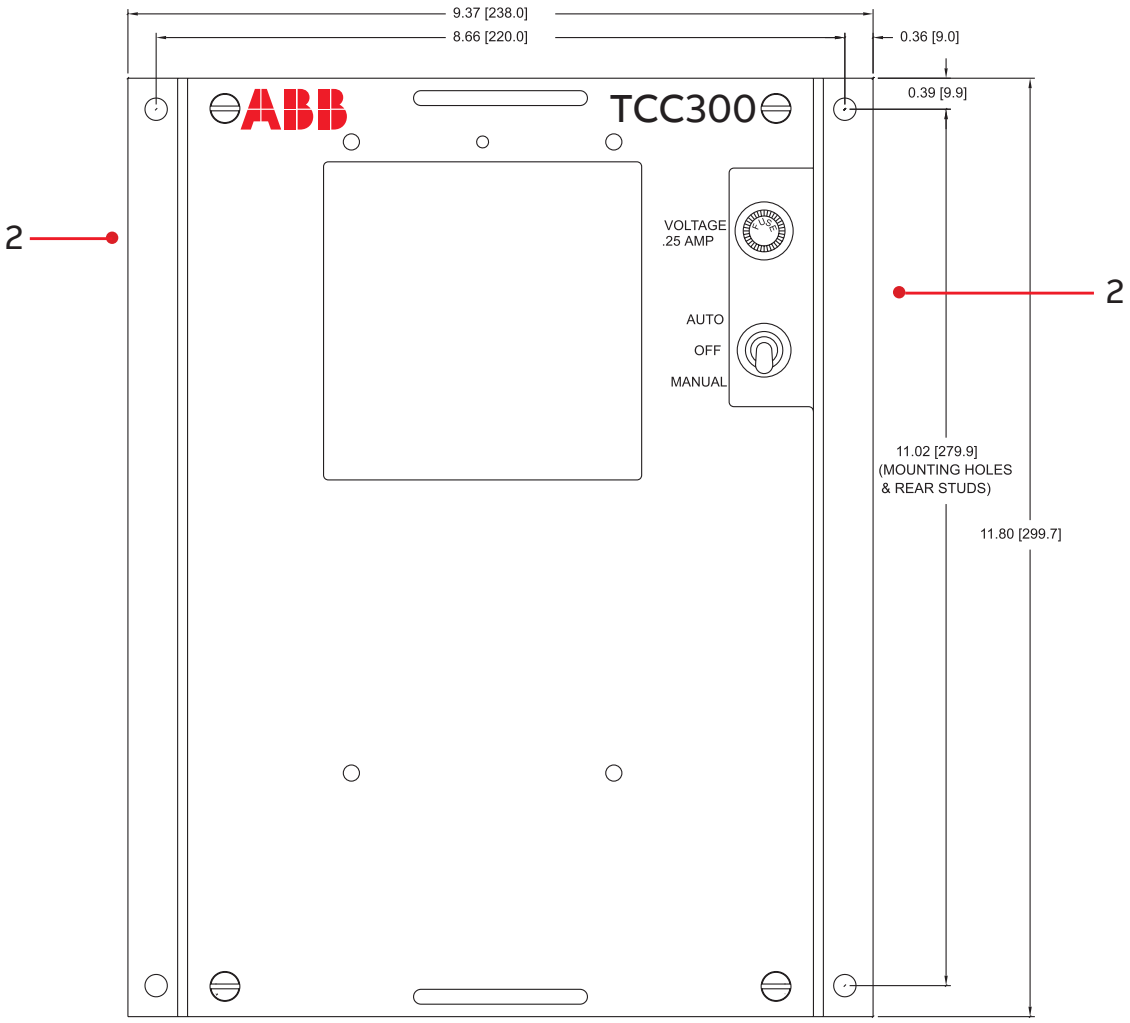


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Figure 04. Rear view details

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**04**

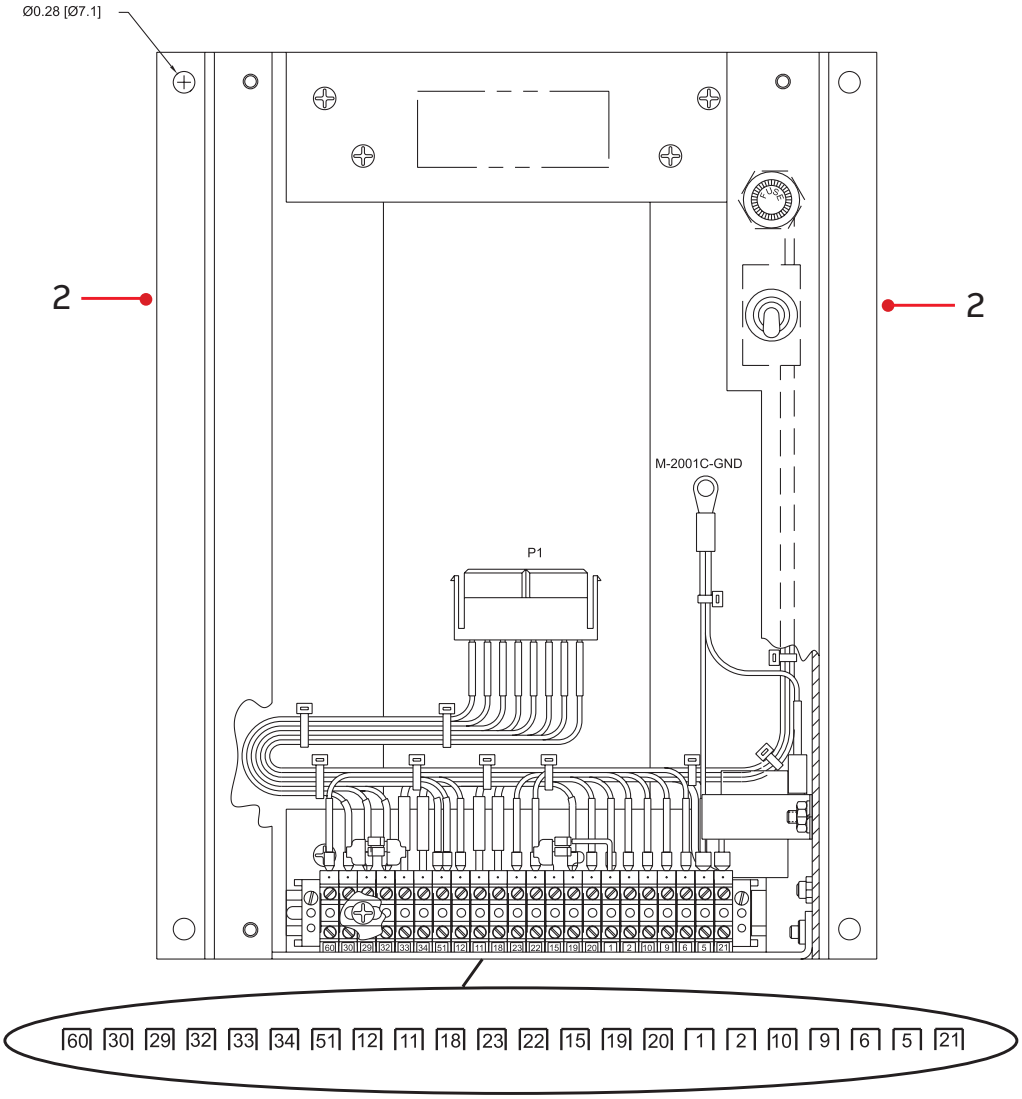

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Figure 05. Top and side view details

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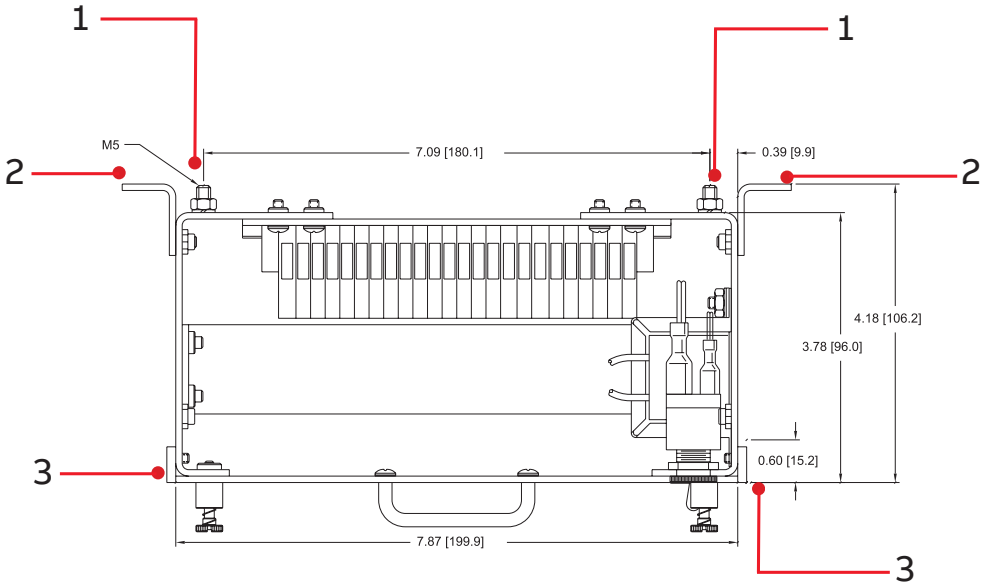
**05**



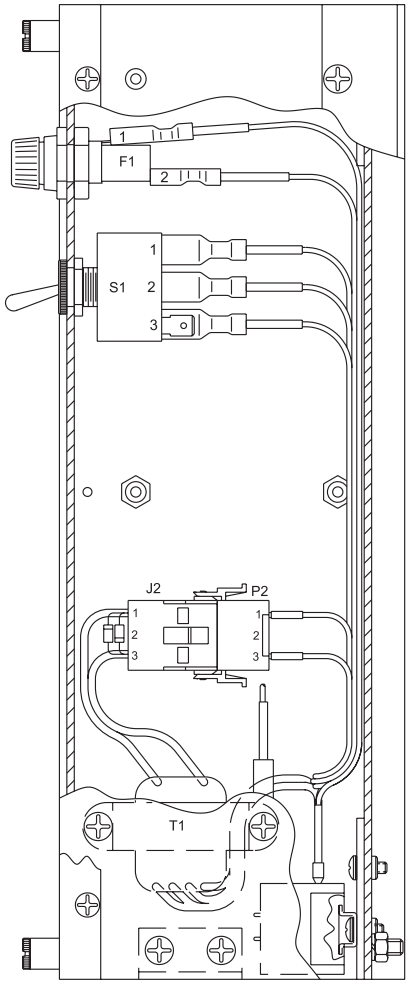



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Figure 06. Setup for current checkout procedure

**4. Checkout Procedure**

**Note**
All ABB Electric units are fully calibrated at the factory. There is no need to recalibrate the units before initial installation.

**Power**

1. Remove any external connections to TB1-1 (voltage input) and TB1-19 (motor auxiliary voltage), which are located on the adapter panel.
2. Apply test voltage source between TB1-1 and TB1-2.
3. Using a voltmeter, make sure that the voltage applied to TB1-1 is nominal 120.0 Vac with respect to TB1-2 (neutral).

**⚠ Warning**
Voltage applied at TB1-1 may energize the regulator or transformer to a high voltage through the voltage transformer. Death or electrical shock can occur.

**Caution**
Do not reverse the ground and hot wires when connecting an external source.

4. Apply motor auxiliary voltage to TB1-19 (motor power input), then verify that the motor runs in the proper direction when conditions of sensed voltage result in activation of Raise and Lower outputs.
5. Temporarily place a shorting device across the LDC-CT secondary to short the line drop compensator circuit (see Figure 6, Setup for Current Checkout Procedure).
6. Place a shorting device across TB1-11 and TB1-12 to short the circulating current paralleling input, for the load current check.
7. Insert an ammeter between the polarity input and TB1-6, 9, or 10.
8. Open the load current shorting device, then, with a known load on the transformer or regulator, measure the current in the load current circuit to ensure that this current is correct.

**⚠ Warning**
In no case should the load 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.

9. Replace the shorting device across the load current input installed in Step 4.
10. Remove the ammeter.
11. Reconnect polarity to the unit and remove both jumpers. The Line Drop Compensator will be activated. Correct CT polarity can be checked by incorporating sufficient +R compensation. The regulator should time out and run so as to raise the output voltage.

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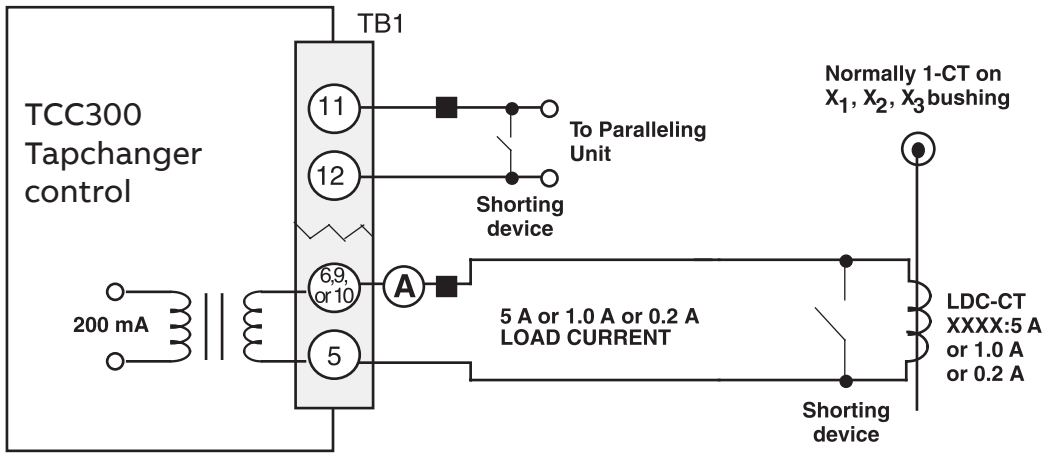
06



## Notes

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## Notes

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