

PATENT PENDING

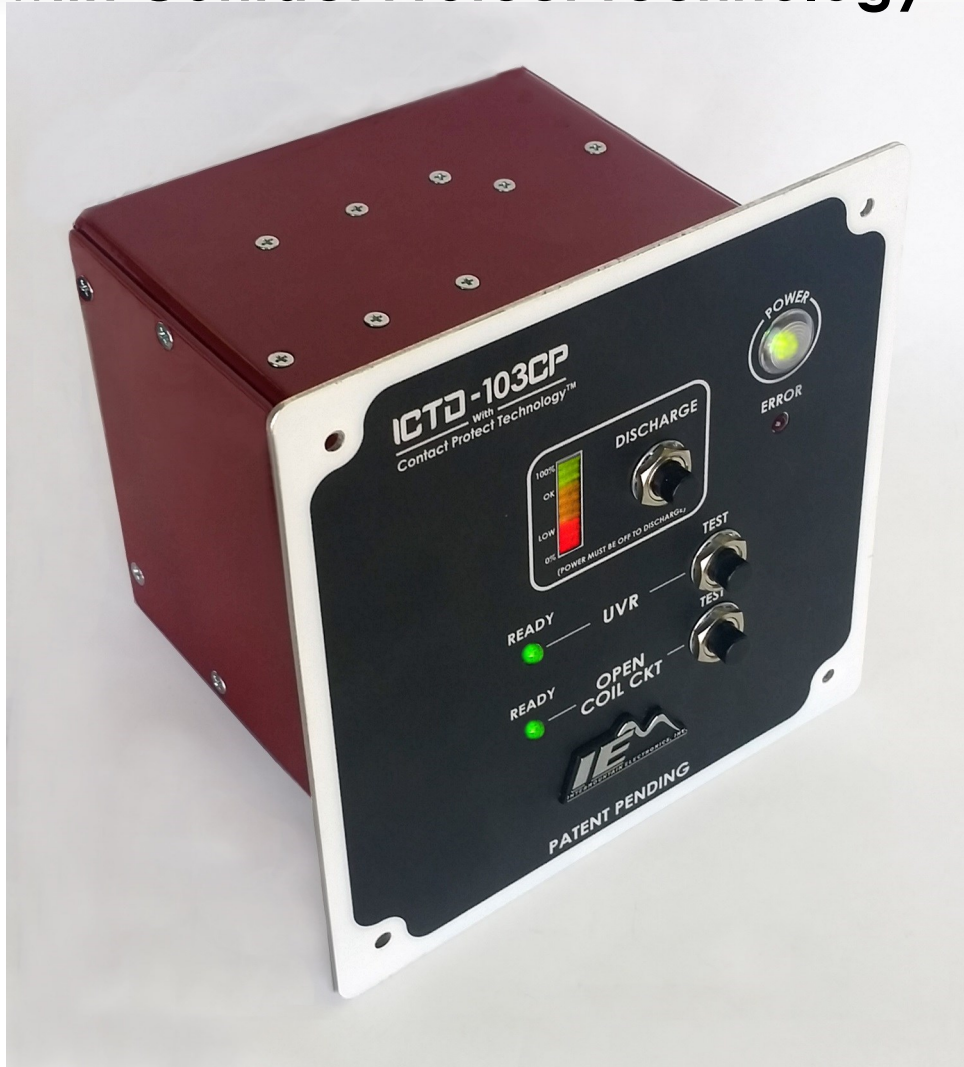


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**ICTD-100CP / ICTD-101CP
ICTD-102CP / ICTD-103CP**

**Capacitor Trip Devices
with Contact Protect Technology™**



Operation Manual and Data sheet



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Important Notice

This document contains information intended to aid in the proper installation and operation of the product described. Although this information will prove useful to the properly trained and qualified user, it is not practical to cover every possible situation, installation contingency, or other detail.

It is imperative that proper engineering and techniques are adhered to in the installation, operation, and maintenance of this product. It is the responsibility of the user to ensure that any system utilizing this product is safe, and that all personnel involved with the selection, installation, maintenance, and use of this product are properly qualified. This product must not be used in situations where its ratings are exceeded.

While every effort has been made to make sure the information in this document is accurate, IE cannot guarantee that there are no errors. Users of this product should verify any aspects of the product's design or performance that are critical to their application, and in particular, any aspects that may affect the safety of the overall system or installation.

Product design and specifications may change without notice.

Table of Contents

I: General Information 1

II: Controls & Connections 2

III: Operation & Specifications. 3

List of Figures & Tables

Figure 1: Front Panel. 2

Figure 2: Rear Panel. 2

Figure 3: ICTD-10xCP Block Diagram. 4

Figure 4: TRIP W/ ERROR Jumper. 5

Table 1: Connector Pin-Out. 2

Specifications. 6

Models and Part Numbers. 6

Mechanical Dimensions and Panel Cut-out 7



I: General Information

The patent-pending ICTD-10xCP family of Capacitor Trip Devices (CTDs) are the most advanced products of their kind. Every model is microprocessor based, and each features revolutionary innovations, including **Contact Protect Technology™**, which greatly improve performance, reliability, and safety.

Key features include:

- Contact Protect Technology™ eliminates the common problem of arcing damage to auxiliary (AUX) switch contacts.
- Easy-to-read level indicator allows instant verification of the capacitor reservoir charge level.
- Unique DISCHARGE button allows the reservoir to be quickly discharged for safety--no need to "arc" the trip circuit to do maintenance.
- Large 5000uF (69 joules) capacitor bank.
- Open Coil Circuit indicator verifies when a trip circuit is in place. Specially designed sensing circuitry detects both traditional trip coils and modern trip circuits.
- Open Circuit Test button (ICTD-101CP, -103CP) allows open coil circuit to be tested.
- UVR interlock function (ICTD-102CP, -103CP) with test button improves safety by preventing the circuit breaker from being closed until the capacitor reservoir is charged.
- Microprocessor and exclusive "watchdog" circuitry constantly monitor operation to ensure reliability and safety.
- Expansion module port allows the addition of IE expansion modules for extra connectivity options, such as external monitoring, control, and diagnostics.
- Fully enclosed chassis to improve reliability and product life-time.
- Standard pin-out allows direct replacement of many existing units, including the ICTD-1. Note: ICTD-10xCPs must not be wired with the same pin out as the ICTD-2.



Contact Protect Technology™ (Patent Pending)

In a typical circuit breaker installation, the breaker is tripped by energizing its trip circuit using energy stored in a CTD. As soon as the breaker is tripped, a breaker auxiliary contact is used to disconnect the CTD to prevent damage caused by continuously powering the breaker's trip circuit.

Unfortunately, auxiliary contacts in most breakers are only AC rated, and traditional CTDs only provide DC current. As a result, auxiliary contacts are commonly damaged, and this damage often extends to the breaker's trip circuit.

Contact Protect Technology™ eliminates this problem by converting the DC energy stored in the CTD to an alternating current before delivering it to the trip circuit.

II: Controls & Connections

Figure 1: Front Panel



Reservoir Level Indicator: Indicates the charge level of the energy storage capacitor reservoir:

	Fully charged
	Adequate charge to trip breaker
	Low charge - may not be able to trip breaker

Power Indicator: Lit when control power is on

Discharge button: Hold to quickly discharge the capacitor reservoir for safety when doing maintenance

Always remove control power and discharge the reservoir before performing system maintenance.

Error Indicator: Lit in the event of that an error is detected

UVR Test Button (if equipped): Allows UVR function to be tested by deactivating the UVR output, causing the circuit breaker to trip

UVR Indicator (if equipped): Lit when the capacitor reservoir has sufficient charge to cause a trip if needed, and the Under-Voltage Relay (UVR) interlock output is active

Open Coil Circuit Test Button (if equipped): Allows the trip circuit to be tested by forcing the circuit breaker to trip

Open Coil Circuit Indicator: Lit when a trip circuit is detected

I/O Connector: Includes necessary connections for normal operation:

Figure 2: Rear Panel

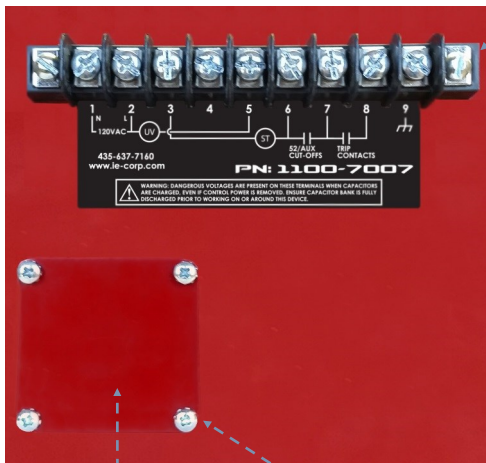
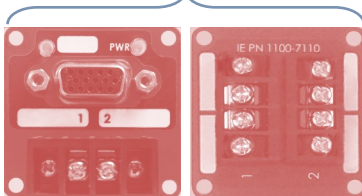


Table 1: I/O Connector Pin-out

Pin	Purpose
1	120V (Neutral)
2	120V (Line)
3	Trip Circuit Connection
4	Unused
5	Under-Voltage Relay (UVR) Interlock Output
6	To trip circuit and breaker AUX switch
7	To trip contacts and breaker AUX switch
8	To trip contacts
9	Chassis ground

NOTE: Pin 6 must connect between the trip circuit/shunt and any AUX switch(es). No AUX switch may exist between pins 6 and 3.



Optional IE Expansion Modules

Expansion Port: Installation location for optional IE expansion modules.



III: Operation & Specifications

General Description

The purpose of a Capacitor Trip Device (CTD) is to store energy in a capacitor bank, which acts as a reservoir, to be used in case there is a temporary loss of 120V AC control voltage. This energy may be used to trip a circuit breaker if the need arises, even when control voltage has failed.

Unique innovations

- Patent pending **Contact Protect Technology™** protects AUX switches or other contacts in circuit breaker trip circuits. These contacts are often AC rated, but most CTDs can only provide DC current to the trip circuit. This DC current can damage the AC contacts, which, in turn, may cause other damage. Contact Protect Technology™ eliminates this issue by converting reservoir current to an alternating signal compatible with AC rated contacts.
- A unique 3 color bar graph constantly indicates the level of the reservoir.
- A DISCHARGE button allows the reservoir to be quickly discharged for safe maintenance.
- On-board diagnostics and watch-dog circuitry constantly monitor all key functions, and redundant components in critical circuits provide unmatched circuit reliability.
- Unique open circuit sensing circuitry works equally well for traditional shunt coils or modern high-Z circuits, without having to set a jumper or make a circuit change.
- When equipped, UVR and Open Coil Circuit indicators with corresponding test buttons allow verification that UVR interlock and opening coil circuits are connected properly and functioning.

Like IE's other ICTD family capacitor trip devices, the ICTD-10xCP models include an IE expansion module port. Optional IE expansion modules, such as 1100-7100 or 1100-7110, may be installed in this port to provide additional features (refer to the manuals and spec sheets for each expansion module for details). For example installing an expansion module can provide additional functions such as:

- Remote status monitoring of key parameters (e.g. reservoir charge level, etc.)
- Remote control of key functions (e.g. open coil circuit or UVR test)
- External diagnostic monitoring to verify unit is working properly


Theory of operation

Figure 3 shows the block diagram for the ICTD-10xCP.

When there is control power, the capacitor bank charges quickly through the rectifier to about 170VDC. The capacitor bank then stores this energy for use if control power fails. The 170V supply circuit selects between the rectified control voltage (when the capacitor bank is not charged) and the capacitor bank (when there is no control voltage) to provide a reliable 170V supply.

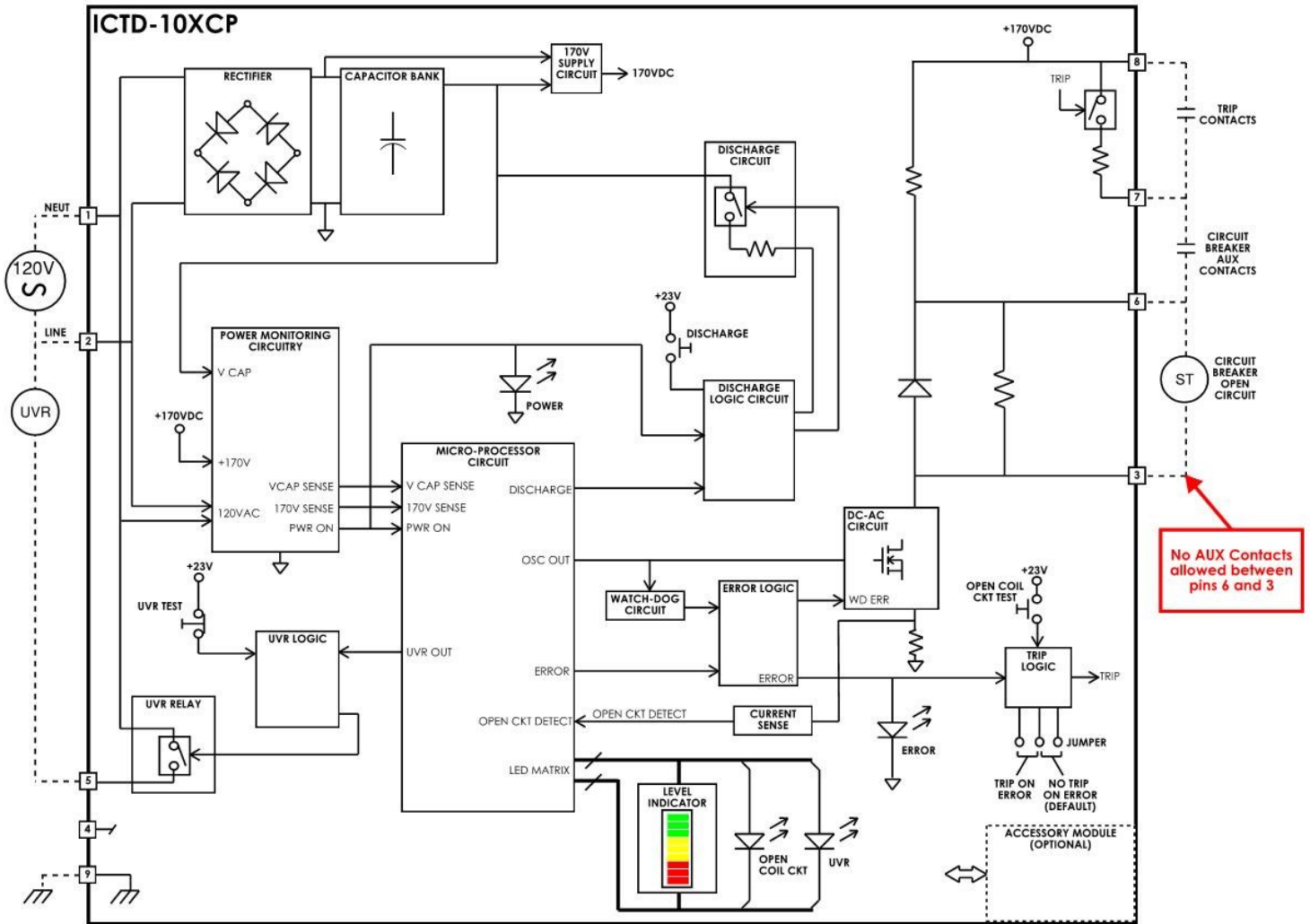
The 170V supply powers the external trip circuitry, which trips the breaker if trip contacts are closed.

Current from the 170V supply that is drawn through the external trip circuitry is converted to alternating current by a DC-AC circuit, which "chops" the signal, based on an oscillator in the microprocessor. This alternating current will not damage AC-rated circuit breaker AUX contacts (or any other similar contacts) in the trip circuitry.



The capacitor bank can be quickly discharged after control voltage is removed, by holding down the DISCHARGE button. This removes the 170V from external circuits to allow for safe maintenance.

Figure 3: ICTD-10xCP Block Diagram



An "open circuit detector" circuit senses the level of a small test current that is fed through the circuit breaker's opening (trip) coil or circuit. The microprocessor measures this current to determine if an open coil or circuit is present. The breaker's opening coil or circuit can be tested by pressing the OPEN COIL CKT TEST button, which will force the breaker to trip if it is wired properly.

An Under-Voltage Relay (UVR) function is operated by the microprocessor, which energizes the UVR relay when the capacitor bank is fully charged and when a open coil or circuit is detected. This relay may be connected to a breaker's UVR to prevent the breaker from being closed if there is insufficient energy in the reservoir to perform a trip. The UVR function can be tested by pressing the UVR TEST button, which will open the UVR relay, causing the breaker to trip.

The microprocessor directly operates most of the indicators (level indicator, OPEN COIL CKT, UVR) to make sure they are appropriately lit or unlit.

The ICTD-10xCP constantly monitors its own operation, using error detecting software and circuitry to make sure everything is working properly:

A power monitoring circuit monitors the key supply voltages, and provides supply status to the microprocessor, which constantly monitors for any malfunction. The microprocessor also monitors other key aspects of the operation to make sure no malfunctions occur.

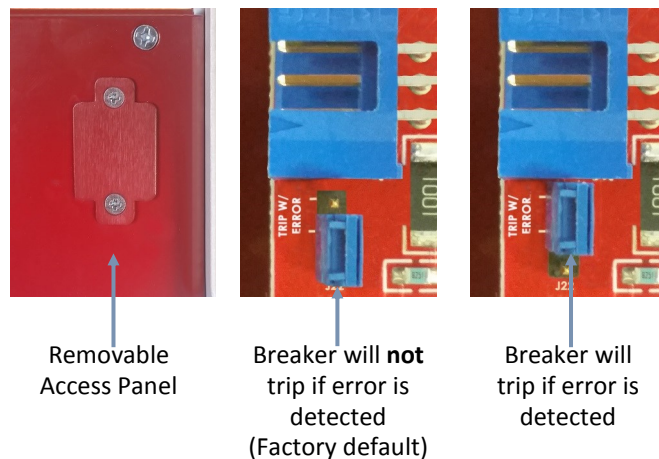
The microprocessor itself is also monitored by a “watchdog” system. This system consists of error detecting software and an independent watchdog circuit. If the microprocessor begins to operate incorrectly, the watchdog system will detect the problem.

If any problem is noted by the microprocessor or watchdog circuit, an error signal is activated, which causes the ERROR indicator to be lit. The error signal is also available on the expansion port for external diagnostic monitoring (an expansion port must be installed).

Additionally, depending on the position of the user-settable TRIP W/ERROR jumper on the main PCB, a detected error may or may not cause the circuit breaker to trip. (The factory default is to **not** force a trip when an error is detected.) The jumper is located on the edge of the front PCB (See Figure 4), and can be set either through the access panel on the right side of the ICTD-10xCP (using needle-nose pliers), or by simply opening the chassis.

Because of the ICTD-10xCP's fault-tolerant design, the unit may continue to work even if an error is detected. However, if the error indicator remains on after a power-down cycle, then something is not working properly, and the unit should be replaced or repaired. Because of the advanced nature of the design, we strongly recommend that repairs only be done at an IE repair facility.

Figure 4: Access Port and TRIP W/ ERROR Jumper



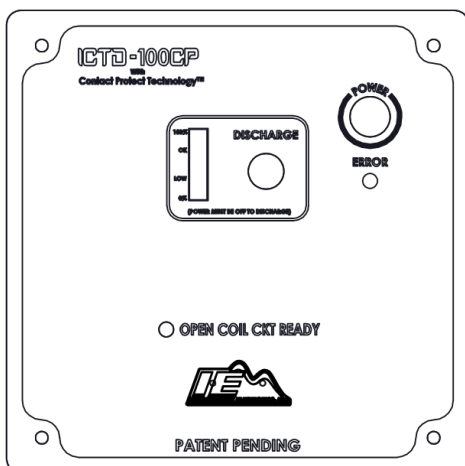
Note: Make sure power is off, and the capacitor reservoir is fully discharged before opening chassis or opening the access panel to access the jumper.

Specifications

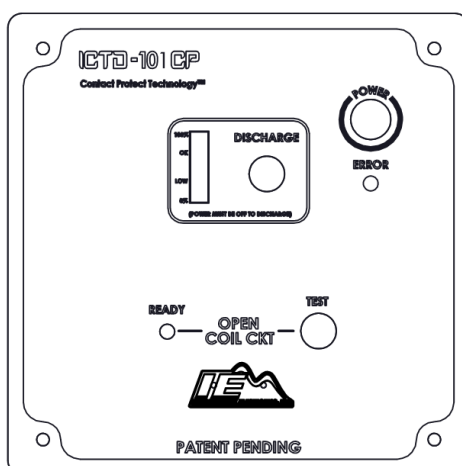
- Input voltage (Control Voltage): 120 VAC
- Power Draw, continuous: 100mA at 120VAC (caps fully charged, normal operation)
- Momentary (turn on, caps uncharged): 7A peak at 120VAC (during capacitor charge time)
- Capacitor Charge Time: Less than 1 Second
- Storage Capacity: 5000uF/66 Joules
- Typical capacitor storage time: 40 Seconds (varies for different shunt coils/circuits)
- Output voltage (fully charged): 160-170V (Chopped DC)
- Required Trip Contact rating: 10A/240VAC (Resistive)
- UVR Relay Contact rating: 8A/250VAC (Resistive)
- Error Jumper settings:
 - Position 1 (Labeled "TRIP W/ ERROR") Breaker will trip if an error is detected
 - Position 2 (Factory Default) Breaker will not trip if an error is detected
- Weight: 3 lbs / 1.3 kg

Models and Part Numbers

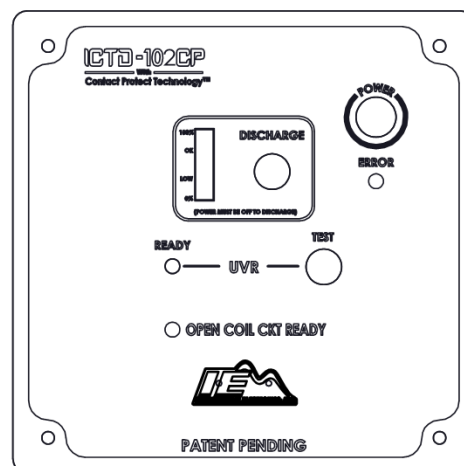
Model:	Part number	Description
ICTD-100CP	1100-7004	Capacitor Trip Device featuring Contact Protect Technology™, cap bank level indicator, OPEN COIL CKT READY indicator
ICTD-101CP	1100-7005	Same as ICTD-100CP, plus OPEN COIL CKT TEST button
ICTD-102CP	1100-7006	Same as ICTD-100CP, plus UVR Indicator and UVR TEST button
ICTD-103CP	1100-7007	Same as ICTD-100CP, plus UVR Indicator, UVR TEST button, and OPEN COIL CKT TEST button.



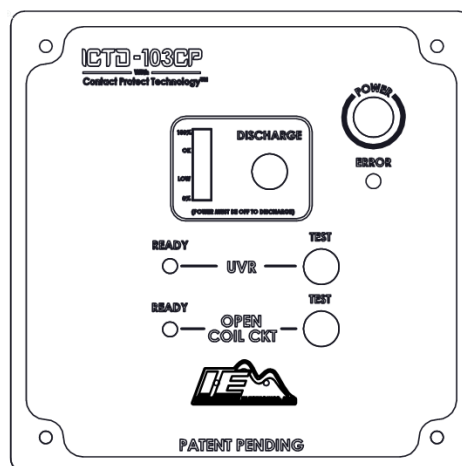
ICTD-100CP



ICTD-101CP



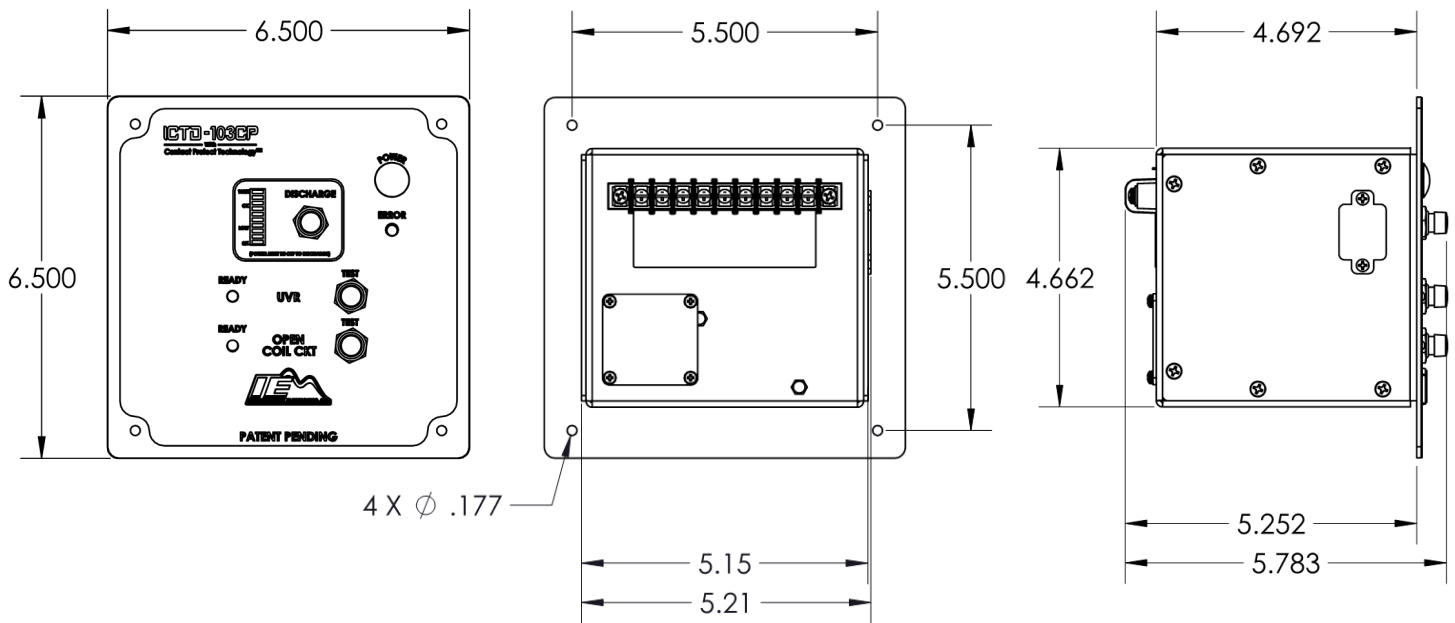
ICTD-102CP



ICTD-103CP



Mechanical Dimensions



Panel Cutout

