Tech20140312-0-4

Using a Thermal Runaway Controller Disconnect Relay

Released: 4/15/2014
Note: The Thermal Runaway Controller is compatible with Cellwatch 4.1 and above. Legacy software is not capable.

The Thermal Runaway Controller introduces a new disconnect relay which is designed to provide a volts-free contact that can send a signal to a shunt isolation breaker or a digital input to a UPS which can take a string offline.

The relay can be configured for a Normally-Open (NO) or Normally-Closed (NC) configuration. The dry, volt-free contact on the Thermal Runaway Controller is rated up to 30 VDC or 250 VAC and 5A. Recommended wire is 18-gauge two conductor with different colors to distinguish between the NO/NC and ground. However, UPS manufacturers may have their own guidelines for connections to their equipment and the installer should defer to those recommendations.

CONTROL EQUIPMENT

Many circuits and mechanisms can control the operation of a disconnect switch. Switches can be manually closed and opened and do not provide any automated operation of the switch. For example, a standard light switch is typically a manually thrown switch that either opens or closes a circuit. Cellwatch cannot control these manual switches.

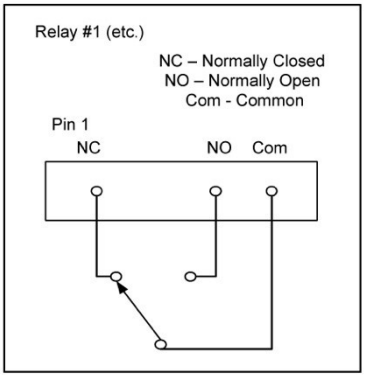


Figure 1. Volt Free Contact

Switches can also be fully automated where using electromechanical equipment to both open and close the breaker. The Cellwatch Thermal Runaway Controller is not compatible with these switches. While Cellwatch would be able to isolate the string, the string would automatically return to operation seconds after the signal is removed.

Many switches however will allow a breaker to open based on electronic control, but require manual operation to close. These are often driven by safety requirements. These switches use an electromechanical or electromagnetic force to maintain a closed state. Once a signal is applied or removed, depending on the operation of the switch, the charged device is released forcing the string to go offline while leaving the charger in operation. The Thermal Runaway Controller is designed to operate with these switches.

SHUNT TRIP DISCONNECT

A shunt trip allows for remote disconnection of the UPS string from the charging circuit often signaled by relays elsewhere in the installation. Voltage ratings for shunt trips can vary from 24V AC or DC to 48V DC, and in some cases 120 VAC. Requirements will vary depending on the switch installed.

For voltages beyond the relay rated 30V DC or 250V AC require a conversion circuit to modify the signal to the correct voltage to properly trip the disconnect switch.

Under Voltage (UV) Trip Device

An under-voltage trip device is an electromechanical control that manages the state of the switch. Usually this component consists of a motor charged spring. As long as the voltage applied to the UV trip is maintained to a certain percentage of the rated value, the switch will remain in the closed position (spring engaged and charged). Once the voltage drops to a certain level, the electromagnetic fields within the device are broken forcing the breaker to open (spring discharged and disengaged). Voltage must return to certain levels of the UV device to create a magnetic field strong enough to hold the breaker when it is manually closed.

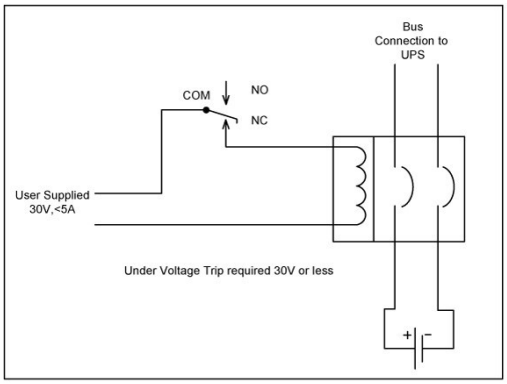


Figure 2. UV Trip using 30V or less

UV Trip devices are typically rated at 24VDC, 48 VDC, 125 VDC, 250 VDC, 120 VAC, and 240 VAC. For voltages beyond the relay rated 30V DC and 250V AC a conversion circuit will be required to modify the signal to the correct voltage to properly trip the disconnect switch. This means a 48 VDC, or 125 VDC device would require an additional circuit to operate with a Cellwatch TRC.

NOTE: Some Under Voltage trip circuits will have power provided by the breaker itself. In these cases, simply connecting to the proper normally-open or normally-closed circuit will be sufficient to provide the disconnect signal. Ensure that the supplied voltage is within the limits of the circuit. Using voltages in excess of 30V DC will shorten the life of the component and void the safety rating.

UPS DIGITAL INPUT

Some UPS systems contain the ability to isolate the string from the UPS remotely simply by pressing an on-screen button. Configurations such as this may incorporate devices mentioned above, but the control of these devices is managed by a UPS onboard computer. These can be used to isolate the string manually or automatically if certain conditions exist (ex. The string voltage drops dangerously low for the UPS).

NOTE: *If the UPS is configured to remove a single string or multiple strings from operation, Cellwatch may work with these configurations effectively. Some of these configurations may be designed to remove all strings from operation. While this will mitigate thermal runaway, it will also leave the customer exposed without a suitable backup solution.*

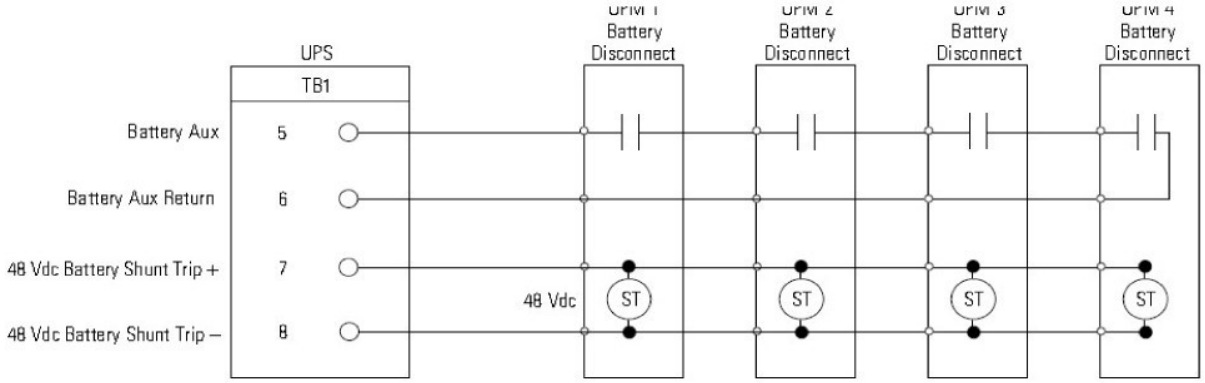


Figure 3. Example UPS Controlled Disconnect

STEP UP CIRCUIT FOR APPLICATIONS REQUIRING > 30 VDC, 5 A DC

Some circuits require a voltage greater than 30 volts to operate. This can be accomplished various ways, but one of the simplest is a conversion circuit utilizing another relay or dry contact. In the diagram below a user supplied 30V DC can be converted to 48V DC or 120V DC to actuate an Under Voltage Trip by using the closed signal from the TRC to force a closed connection on another dry contact.

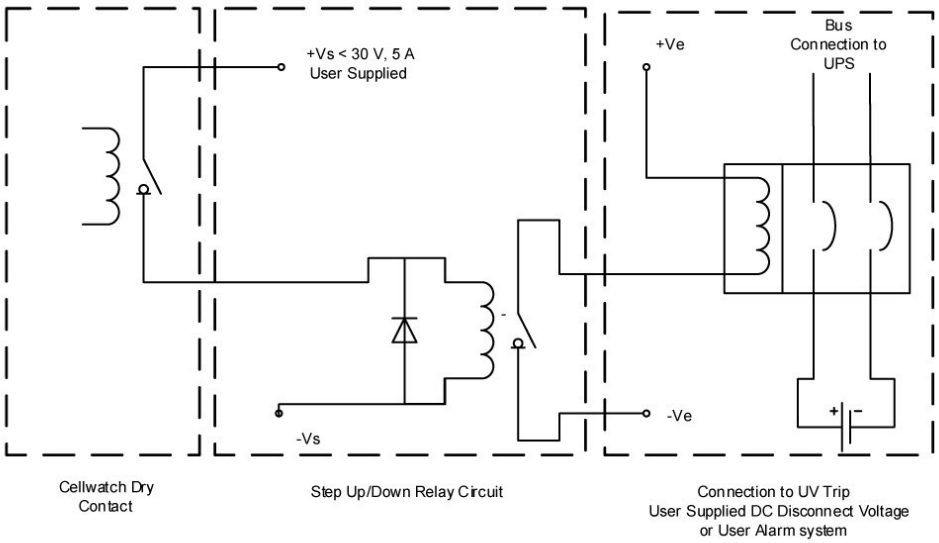


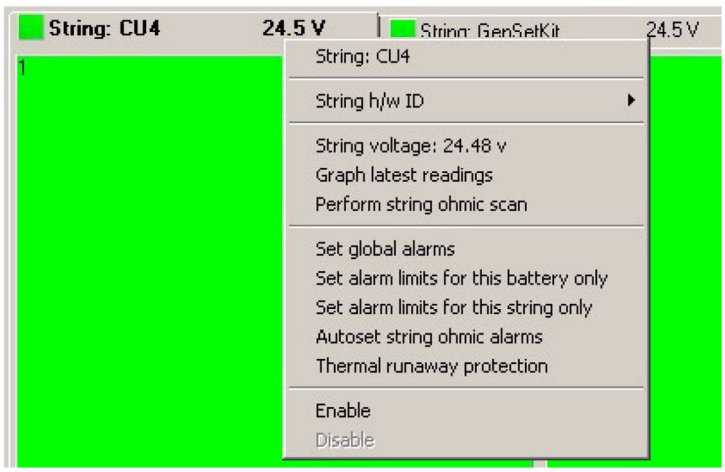
Figure 4. Step Up Circuit to Modify Signal Voltage

TEST PROCEDURE FOR THERMAL RUNAWAY RELAYS

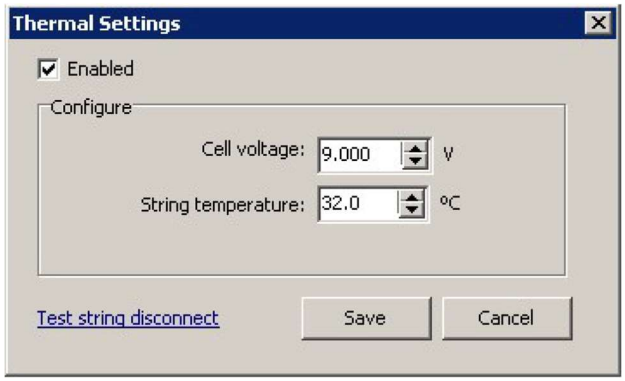
Note that a discharge event will delay all thermal warnings by one hour. It is advised to test thermal relays prior to discharge testing.

1. Verify Cellwatch is running, if stopped click on Start/Stop->System Active.

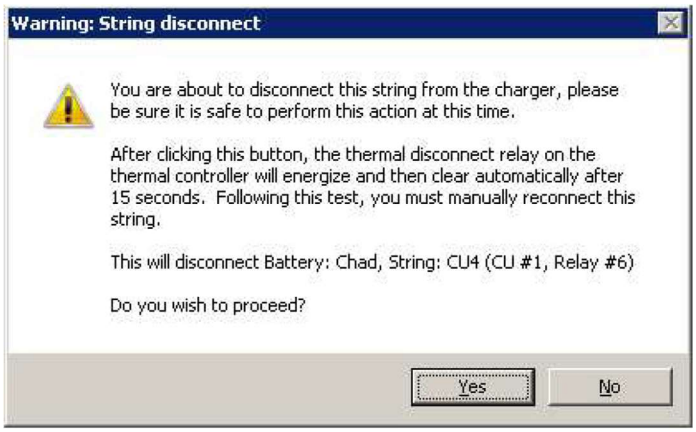
2. Verify the system is not scanning for Voltage or Ohmic Value (press escape to cancel an active scan). Right click on the string you wish to test, then choose 'Thermal Runaway Protection' from the drop-down menu.



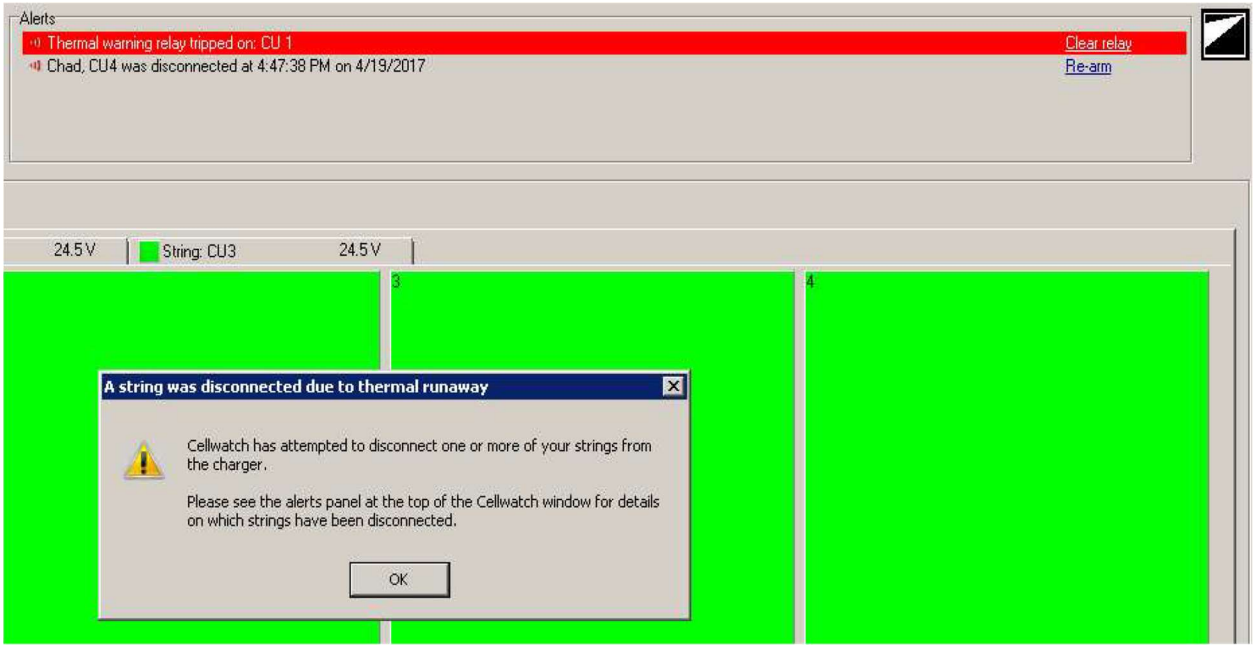
3. On the next window, click on 'Test String Disconnect'.



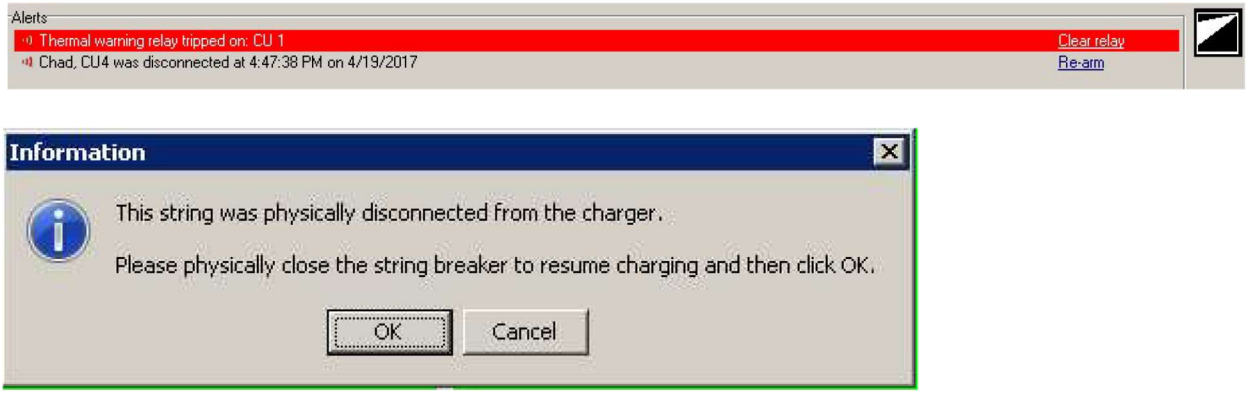
4. You will be prompted for the diagnostic password, enter in the following: deafcat
5. The next message you see will be the String Disconnect Warning. It will also show which string will be disconnected along with the relay #. If this matches the relay you wish to test, click on 'yes'.



6. At this point the relay trip, the red LED on the TRC will begin flashing (solid indicates warning conditions, blinking if string disconnected), and the LED below the respective relay on the TRC will light up as the relay activates for 15 seconds. If the under voltage or shunt trip circuit has been connected properly, the breaker should disconnect.



7. Once testing of the relay has been confirmed proceed with clearing the relay and re-arming the Cellwatch system. Clearing the relay will reset it, re-arming it will prompt you to physically close the string breaker.



8. After clicking OK, the red LED on the control unit will stop blinking and the system will return to normal operation.