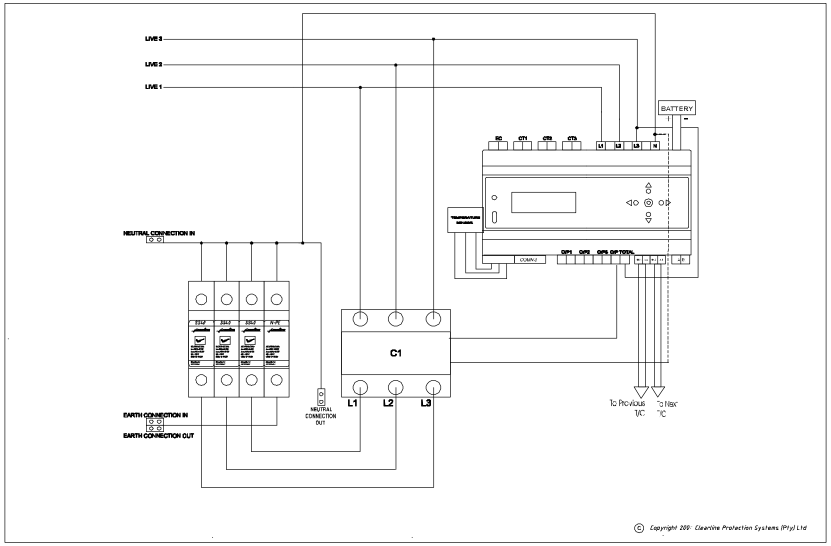
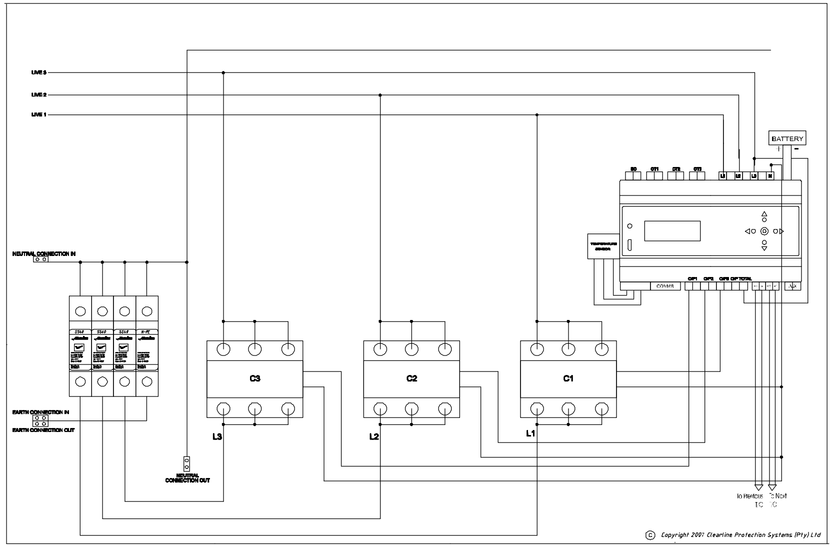
Wiring Diagram 5



Wiring diagram 6



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VERSION 1.0

Trip-Connect 3P User's Guide

Thank you for purchasing the Clearline Trip-Connect 3P. You have invested in state-of-the-art technology that is designed to offer the best possible protection to your valuable assets. Please read this User Manual for correct installation and operation details.

Product Highlights

The Trip-Connect 3P is an advanced, 3 phase, programmable, line protection system that offers an extensive range of customisation via a wide selection of programmable quantities.

- Performs Cycle-by-Cycle RMS measurement on all input channels, namely:
  - 3 phase voltage inputs.
  - 3 phase current input.
  - Earth leakage current input.
- In addition to the line monitor, the Trip-Connect 3P is provided with external temperature monitor.
- There is also a battery monitor that reports on the condition of the battery providing the DC operating voltage for the installation.
- A dedicated Interlock communication port allows for multiple Trip-Connect 3Ps to be cascaded to facilitate an orderly power-up after a long-duration power failure and consequential deep discharge of the supporting batteries.
- All measured quantities can be displayed on a 2X16 alphanumeric LCD with back illumination.
- Provides protection against:
  - Over voltage
  - Under voltage
  - Over current
  - Over temperature.
- Equipped with 4 potential free relay outputs, one per phase and a general fault relay.
- Bypass switch
- Easy to use, self-explanatory, menu system enables quick setup and calibration of all parameters.
- Event logger - logs up to 100 events.
- Based on AVR technology.
- Enclosed m standard din rail mount enclosure.

- All the connections are done via a pluggable terminal system

Specifications

Accuracy:

Voltage measurement	±3% at nominal voltage
Phase current measurement	±3% at nominal phase
Earth leakage current measurement	±3% at nominal earth leakage current
Temperature measurement	±3˚C at nominal temperature

Measurement range:

Phase voltage measurement range	0-500V
Phase current measurement range	CT Configurable
Earth leakage current measurement range	CT Configurable
Temperature measurement range	-20˚C to +120˚C

Power supply

Voltage	180V-260V
Frequency	49Hz-51Hz
Current consumption	<200mA

Environmental conditions:

Temperature range	0-70˚C
Maximum humidity	95% non-condensing
Maximum altitude	10000ft

Enclosure dimensions: 160 x 85 x 60 (L x W x H)

User interface

Display modes

While in default mode, the UP/DOWN buttons are used
to select the default display mode in the following sequence:

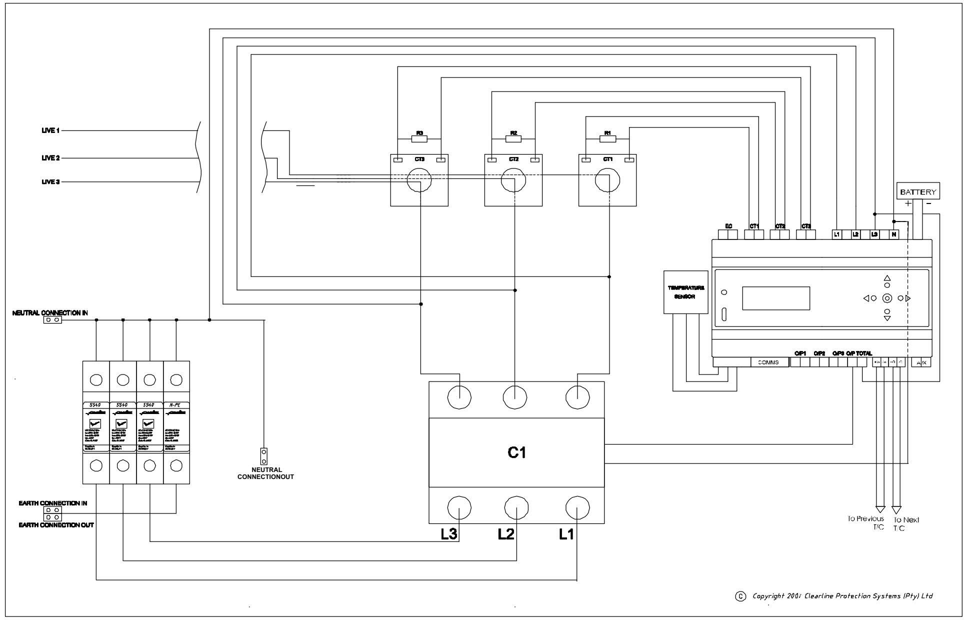
- V1, V2 and V3 (Factory default).
- I1, I2 and I3.
- V1and I1.
- V2 and I2.
- V3 and I3.
- Earth leakage current and external temperature.
- Date and time

LED

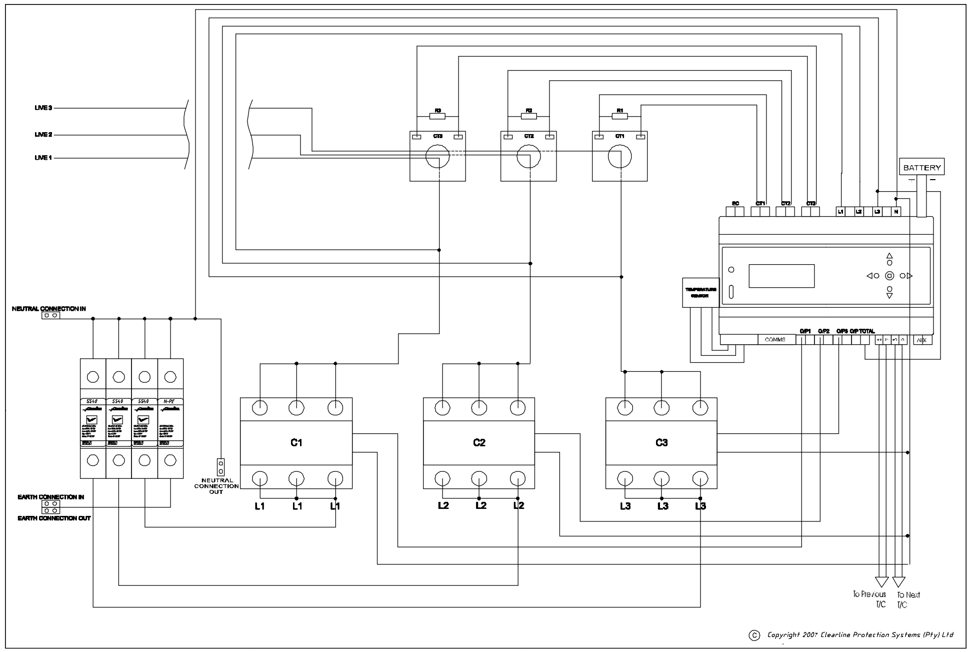
The LED is a Red/Green bi-colour LED. The Trip-Connect 3P uses it to indicate the system mode as follows:

- Green Blink - All inputs are within range and all relays are energized.
- Red blink - There is a problem with one of the inputs and at least one relay is not energized.
- Red/Green blink - There was a problem on one of the inputs. The problem has gone but the Trip-Connect is in its delay mode. At least one of the relays is not energized but will be energized once the delay is elapsed.
- Permanent Red - There have been a few problems and the Trip-Connect 3P has exhausted the number of allowed attempts to reconnect.

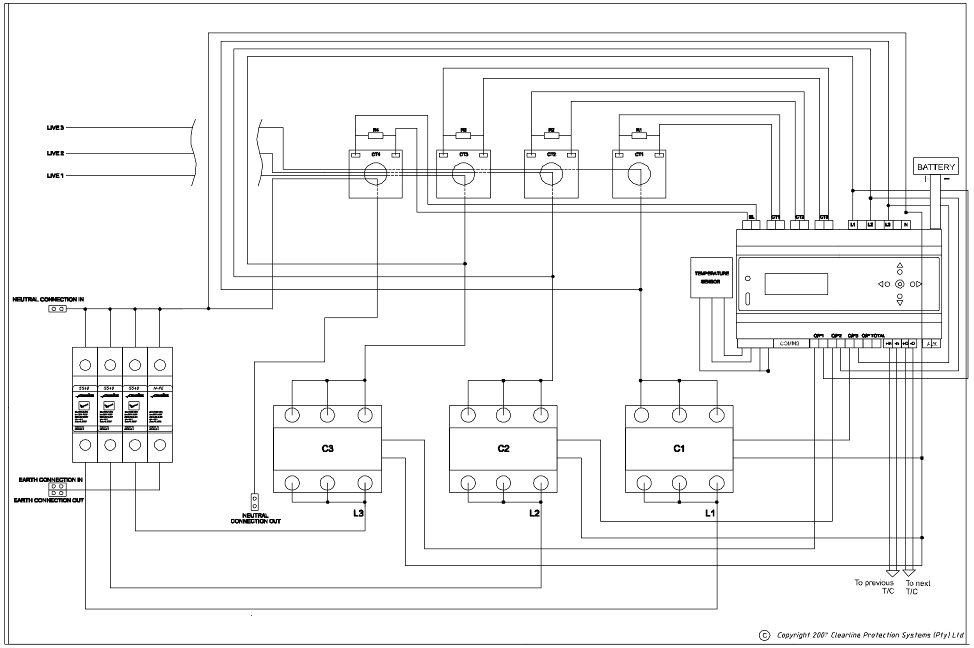
Wiring diagram 3



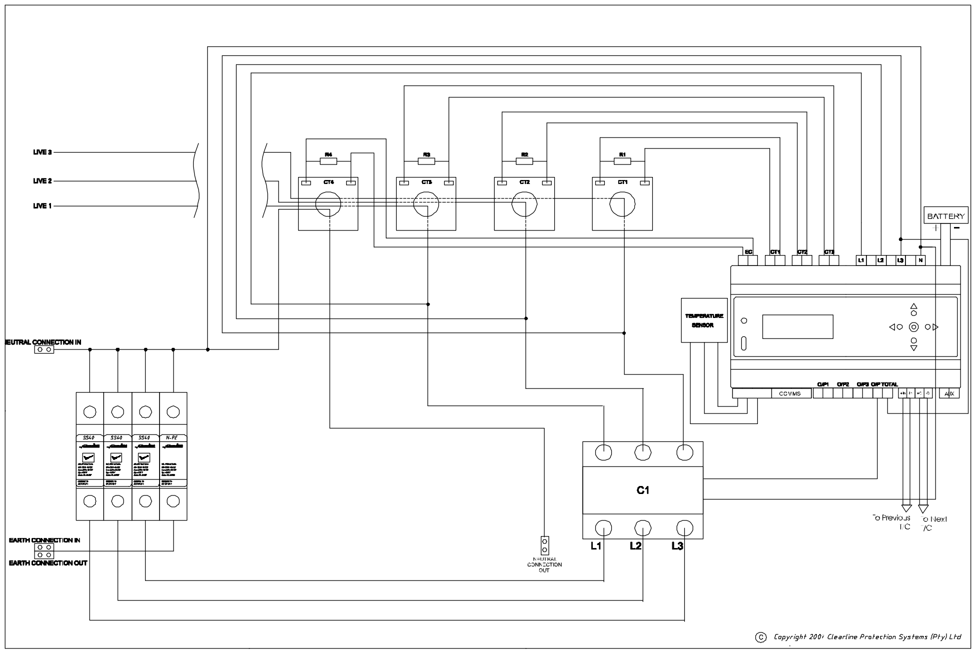
Wiring diagram 4



Wiring Diagram 1



Wiring diagram 2



Interlock Operation

The Interlock system is designed to allow inter-related systems to be powered up sequentially in a manner that ensures that the start-up current of the systems will not exceed the maximum current available on the site.

Each Trip-Connect 3P has an interlock connection, which provides two input and two output terminals. To use this system, simply connect the interlock output of the 3P on the most significant load to the interlock input of the 3P on the load of next highest significance. Repeat this pattern until the 3P on the least significant load is connected.

Note that the input on the most significant side, and the output on the least significant side, will remain unconnected.

Menu system - summary

When in default mode, the first press of LEFT/RIGHT buttons enters the Trip-Connect 3P into calibration and setup mode. Subsequent presses of the LEFT/RIGHT buttons browses through the various parameters as follows:

- Event logger.	- PH1 V CalF
- Disconnect voltage high - VdisHi	- PH2 V CalF
- Connect voltage high - VconHi	- PH3 V CalF
- Disconnect voltage low - VdisLow	- PH1 I CalF
- Connect voltage low - VconLow	- PH2 I CalF
- Disconnect phase current - Idis	- PH3 I CalF
- Disconnect earth leakage current - Eldis	- E/L CalF
- Disconnect temperature - Tdis	- Hour
- Connect temperature - Tcon	- Minute
- Battery Voltage high alarm - Vbahigh	- Volts
- Battery Voltage low alarm - Vbslow	- Volts
- Steady state current average - Istd	- Amps
- Steady state delay - Stdydelay	- Second
- Maximum attempt number - AttemptNo	- Second
- Connect delay - ConDly	- Date
- Attempt counter reduction delay - ECRDly	- Month
- Current transformer ratio	- Year
- Current transformer Burden resistor	- Week day
- Ph1 V – CalF	- Percentage
- Ph2 V – CalF	- Percentage
- Ph3 V – CalF	- Percentage
- Ph1 I – CalF	- Percentage
- Ph2 I – CalF	- Percentage
- Ph3 I – CalF	- Percentage
- ErtLkg I – CalF	- Percentage
- Vbat – CalF	- Percentage
- Time set	- Hour, minute, second
- Date set	- Day, month, year

While any one of the menu items is selected, the UP/DOWN buttons can be used to set the menu item to the desired value. The last value is automatically saved into a non-volatile memory and used in subsequent operations.

Menu system - detailed
The following section discusses each menu item in details

To set the quantity, use the UP/DOWN buttons to increment or decrement the quantity until the desired value is displayed.

To advance to the next quantity, use the LEFT/RIGHT buttons as before.

The Trip-Connect 3P exits the Programming mode automatically after a delay of five seconds of inactivity on the buttons.

Event logger.
The event logger is a unique feature of the Trip-Connect 3P, as it enables an analysis of the performance of a system, in cases of repeated faults. The 100 most recent events are logged with the event cause, event value, and a time and date stamp. Each event is logged with its respective value and with the time and the date of the event.

The following conditions are logged in the event logger:
- Disconnect due to over voltage
- Disconnect due to under voltage.
- Disconnect due to over current.
- Disconnect due to over temperature
- Disconnect due to Earth Leakage
- Connecting

Press UP and DOWN simultaneously to clear the Event Logger, but retains the Attempt Counter.

Press UP and DOWN simultaneously during power-up to clear the Event Logger AND the Attempt Counter.

Disconnect voltage high - VdisHi
The VdisHi is a voltage above which the Trip-Connect 3P disconnects the respective phase.

Allowed range	240V - 260V
Increment value	1V
Factory default	260V

Connect voltage high - VconHi
If the Trip-Connect 3P detects voltage exceeding VdisHi, it will only connect the respective phase if the voltage remains below VconHi for the duration of ConDly (see below)

Allowed range	230V - 250V
Increment value	1V
Factory default	250V

Disconnect voltage low - VdisLow
The VdisLow is a voltage below which the Trip-Connect 3P disconnects the respective phase

Allowed	180V - 210V
crement value	1V
Factory default	180V

Date and Time setup

The time and date set-up is at the end of the calibration menu. The time and date are displayed while the item being set, Hour, Minute, Second, Date, Month or Year, is displayed in reverse font. The setting is performed by using the UP/DOWN buttons.

The last menu item before rolling back to the first menu item is the week day.
This is similarly set.

Installation

The Trip-Connect 3P has many connections which must be correctly wired to ensure correct and reliable operation of the product. Please ensure that the connections are according to the diagram. The Trip-Connect 3P mounts on a standard DIN rail, and all connections are via simple screw terminals. 0.5mm 2 should be used for all connections to the Trip-Connect 3P.

Programming

Programming the Trip-Connect 3P is achieved by means of the buttons and the display.

To enter the Programming mode, simply press the LEFT/RIGHT buttons. The Trip-Connect will switch from the default mode to the programming mode. The Trip-Connect 3P remembers the location that was last programmed, and the display will switch to this quantity.

To locate the quantity that requires programming, simply scroll through the menu using the LEFT/RIGHT buttons until the desired quantity appears in the display. The menu sequence is described in User Interface section of this User Guide, under the heading MenuSystem Summary.

Interlock Operation
The Interlock system is designed to allow inter-related systems to be powered up sequentially in a manner that ensures that the start-up current of the systems will not exceed the maximum current available on the site.

Each Trip-Connect 3P has an interlock connection, which provides two input and two output terminals. To use this system, simply connect the interlock output of the 3P on the most significant load to the interlock input of the 3P on the load of next highest significance. Repeat this pattern until the 3P on the least significant load is connected.

Note that the input on the most significant side, and the output on the least significant side, will remain unconnected.

While in any of these menu items, two values are displayed. The calibration factor and the respective measured value. In order to calibrate the Trip-Connect 3P, first connect an external, calibrated and certified meter to measure the quantity being calibrated. Use the UP/DOWN pushbuttons to set the calibration parameter until the measured value equals the externally and accurately measured value.

Press LEFT and RIGHT simultaneously during power-up to reset all variables to the factory defaults.

Phase 1 Voltage Calibration
This is the calibration factor expressed as a percentage that is used to set the measurement of the Phase 1 Voltage

Allowed Range	79.9 - 120%
Increment Value	0.1%
Factory Default	100%

Phase 2 Voltage Calibration
This is the calibration factor expressed as a percentage that is used to set the measurement of the Phase 2 Voltage

Allowed Range	79.9 - 120%
Increment Value	0.1%
Factory Default	100%

Phase 3 Voltage Calibration
This is the calibration factor expressed as a percentage that is used to set the measurement of the Phase 3 Voltage

Allowed Range	79.9 - 120%
Increment Value	0.1%
Factory Default	100%

Phase 1 Current Calibration
This is the calibration factor expressed as a percentage that is used to set the measurement of the Phase 1 Current

Allowed Range	79.9 - 120%
Increment Value	0.1%
Factory Default	100%

Phase 2 Current Calibration
This is the calibration factor expressed as a percentage that is used to set the measurement of the Phase 2 Current

Allowed Range	79.9 - 120%
Increment Value	0.1%
Factory Default	100%

Phase 3 Current Calibration
This is the calibration factor expressed as a percentage that is used to set the measurement of the Phase 3 Current

Allowed Range	79.9 - 120%
Increment Value	0.1%
Factory Default	100%

Connect voltage low - ConLow
If the Trip-Connect 3P detects voltage below VdisLow, it will only connect the respective phase if the voltage remains above VconLow for the duration of ConDly (see below)

Allowed range	190V - 220V
Increment value	1V
Factory default	190V

Disconnect phase current - Idis
The Idis is the current above which the Trip-Connect 3P disconnects the respective phase.

Allowed range	1A - 300A
Increment value	1A
Factory default	20A

Disconnect earth leakage current - ELdis
The ELdis is the earth fault current above which the Trip-Connect 3P disconnects all phases.

Allowed range	500mA
Increment value	1mA
Factory default	25mA

Disconnect temperature - Tdis
The Trip-Connect 3P is equipped with temperature sensor which facilitates detection of, and response to, an over- temperature condition. If the temperature exceeds Tdis, the Trip-Connect 3P will disconnect the power from the equipment.

Allowed range	50˚C - 80˚C
Increment value	1˚C
Factory default	60˚C

Connect temperature - Tcon
The Trip-Connect 3P is equipped with temperature sensor which facilitates detection of, and response to, an over- temperature condition. If the Trip-Connect 3P detects an over- temperature condition, the Trip-Connect 3P will wait for the temperature to reduce to Tcon before connecting the power to the equipment.

Allowed range	20˚C - 70˚C
Increment value	1˚C
Factory default	50˚C

Battery Voltage High alarm
The Vbahigh is the battery voltage above which the Trip-Connect 3P records a battery voltage fault in the Event Logger

Allowed Range	58 - 70V
Increment Value	1V
Factory Default	60V

Battery Voltage Low alarm
The Vbalow is the battery voltage below which the Trip-Connect 3P records a battery voltage fault in the Event Logger

Allowed Range	35 - 50V
Increment Value	1V
Factory Default	48

Steady State Current
The Istd is the current level below which the average across the phases must be to enable the interlock output to trigger the subsequent Trip-Connect in the sequence.

Allowed Range	1 - 40A
Increment Value	1A
Factory Default	30A

Steady State Delay
This is the delay that is initiated when the Trip-Connect receives an interlock enable before switching on the outputs.

Allowed Range	2 - 300s
Increment Value	1s
Factory Default	5s

Maximum attempt number Attempt No, Connect delay ConDly and DecrDly

These three parameters govern the connect policy of the Trip-Connect 3P as follows:

When a fault condition is detected, the power is removed from the equipment. If the fault condition has been removed, the Trip-Connect 3P will reconnect the power to the equipment after the pre-set Connect Delay. However it will register the attempt and increment its Attempts Counter.

This process will repeat every time a fault condition is detected. If the Trip-Connect Attempt Counter exceeds the pre-set maximum Attempt Number, it will assume that there is a problem with the power or with the equipment, and it will not attempt again.

In the case of a random fault which does not repeat within the pre-set Decr delay, the Trip-Connect 3P will decrease the Attempt Counter.

Press UP and DOWN simultaneously during power-up to clear the Event Logger AND the Attempt Counter.

Maximum attempt number

Allowed range	1 - 100 Attempts
Increment value	1
Factory default	10 Attempts

Connect delay

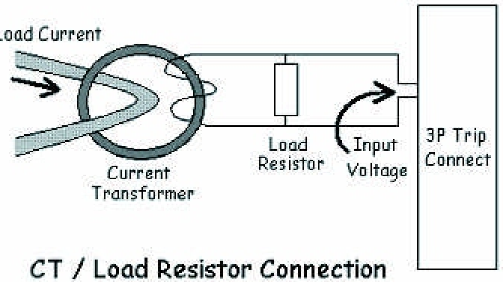
Allowed range	2 - 120 Seconds
Increment value	1 Second
Factory default	5 Seconds

Attempt Counter Reduction Dealy

Allowed range	60 - 3600 Seconds (1 minute to 1 hour)
Increment value	10 Seconds
Factory default	60 Seconds

CT Ratio and CT Load Resistance

The Trip-Connect 3P uses these two parameters to calculate the actual current.



CT / Load Resistor Connection

With:
- CT Ratio = 1
- Load resistor = 1 Ohm
- Load current = 1V RMS

then the Input voltage = 1V RMS, which corresponds to a current of 1A.

However, the maximum allowable voltage on the current inputs is $0.5V_{RMS}$. The Load Resistance and the CT turns ratio must be scaled according to the current requirements of the equipment being protected to ensure that the voltage of the current signal remains within $0.5V_{RMS}$.

CT Ratio

The CT ratio is the ratio between the actual load current and the current signal from the CT detector that is presented to the Trip-Connect 3P. This is determined by the turns ratio of the CT, and the installer should program the Trip-Connect 3P with this value.

Allowed range	1 - 5000
Increment value	1
Factory default	50

CT Load Resistance

The CT Load Resistance is used to convert the current signal from the CT into a voltage signal that can be used by the Trip-Connect 3P to calculate the actual load current. This must also be programmed into the Trip-Connect 3P.

Allowed range	1 - 50Ω
Increment value	0.1Ω
Factory default	1Ω

Variables Calibration factors

The Trip-Connect 3P can be calibrated using calibration factors. The calibration factors are expressed in percentage, and are nominally 100%. Each of the following variables can be calibrated using the respective calibration factor:

- Phase 1 voltage reading - PH1 V CalF
- Phase 2 voltage reading - PH2 V CalF
- Phase 3 voltage reading - PH3 V CalF
- Phase 1 current reading - PH1 I CalF
- Phase 2 current reading - PH2 I CalF
- Phase 3 current reading - PH3 I CalF
- Earth leakage current reading E/L CalF
- Battery Voltage calibration