New Information

Protective Relays
Digitrip 3000

Digitrip 3000

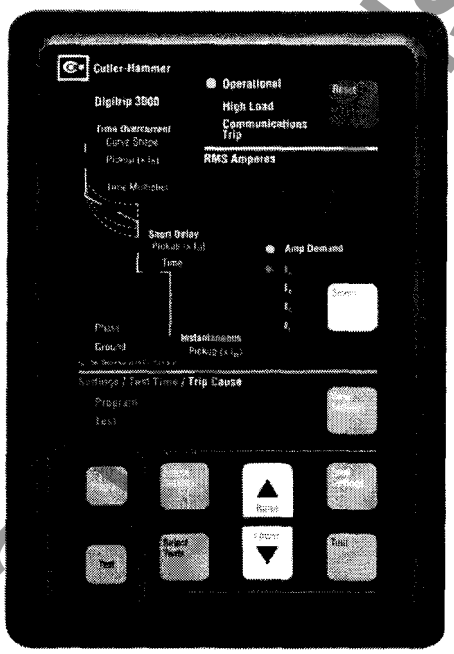
Applications
- Provides reliable 3-phase and ground overcurrent protection for all voltage levels.
- Primary feeder circuit protection
- Primary transformer protection
- Backup to differential protection
- May be used where instantaneous and/or time overcurrent protection is required
- Ground element capable of residual, zero sequence or external source connections

Protection Functions
- Phase overcurrent protection per time-current curve
- Independent ground fault protection per time-current curve
- Curve shapes: ANSI, IEC, or thermal curves
- True RMS sensing of each phase and ground current
- Phase instantaneous OC
- Ground instantaneous OC
- Zone selective interlocking (phase and ground) for bus protection

Monitored Values
- Phase currents
- Ground currents
- Magnitude and phase of current causing trip
- Peak demand current for each phase and ground since last reset

Communication
- Interface capability to computer network for data collection, storage and/or printout via the Cutler-Hammer PowerNet system

Physical Characteristics
- User-friendly front panel
- Program and test mode security access cover
- Internal circuitry self-testing
- Optional quick-release drawout case
- Optional dual source power supply



- Height: 10.25 inches
- Width: 6.722 inches
- Depth: 2.733 inches, 3.948 inches

Listings/Certification
- UL 1053
- ANSI C37-90
- IEC 255

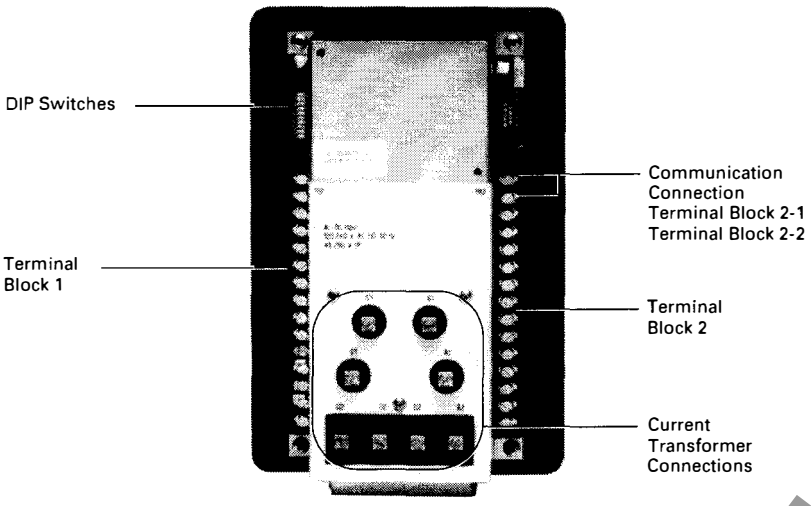
General Description

The Digitrip 3000 Protective Relay is a multifunction, microprocessor-based overcurrent relay designed for both ANSI and IEC applications. It is a panel-mounted, self-contained unit which operates from either ac or dc control power. The DT-3000 is available in an optional quick-release drawout case for panel-flush mounting. For ac control power applications, an optional Dual-Source Power Supply (DSPS) is recommended. The Digitrip 3000 design provides true RMS sensing of each phase and ground current. Only one unit is required for each three-phase circuit.

Current monitoring and operator selectable protective functions are integral to each relay.

The DT-3000 Relay operates from the 5 ampere secondary output of standard current transformers. Current transformer ratio information is quickly programmed into the unit via settings. This enables the relay to display metered current in primary amperes.

The Digitrip 3000 features a user-friendly operations panel to monitor, program, and test the relay. Operating parameters and troubleshooting information are displayed in the two highly visible display windows. In addition, all data and information can be communicated to a host computer equipped with the appropriate software. A "Communication Trip" and "Communication Close" control command can also be initiated by a host computer with an authorized access code for remote breaker operation.



Digitrip 3000 Rear View

Applications

General

The Digitrip 3000 microprocessor-based relay provides reliable 3-phase and ground overcurrent protection for all voltage levels. It can be used for any application where instantaneous and/or time overcurrent protection is required. It is most commonly used as primary feeder circuit protection, as in Figure 1.

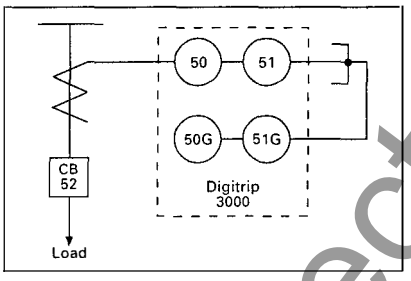


Figure 1. Primary Feeder Circuit Protection

The Digitrip 3000 may be applied as the transformer primary protection or as backup to the differential protection, as in Figure 2.

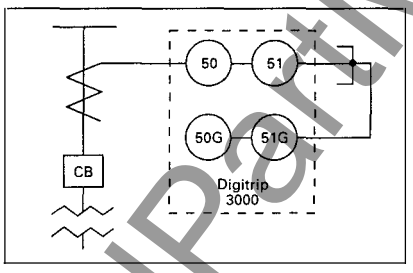


Figure 2. Transformer Overcurrent Protection

The Digitrip 3000 may be connected to the secondary side of a Delta-wye grounded transformer with the ground element connected to a separate CT in the neutral connection of the transformer. With this connection, a lower CT ratio and a pickup setting can be used to provide more sensitive ground fault protection especially for resistance grounded systems (see Figure 3).

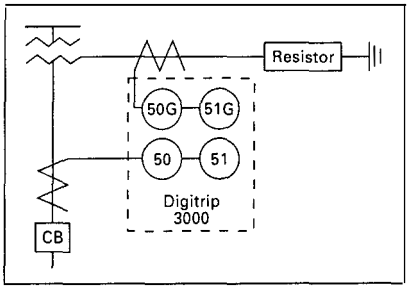


Figure 3. Transformer Secondary Protection with Neutral CT Connection

The Digitrip 3000 relay has special provisions for connection in a *Zone Interlocking Scheme* which can be used for bus protection or to improve protection coordination in a tight or close system. Zone interlocking is described in more detail on page 41.

Overcurrent Protection

The Digitrip 3000 provides complete 3-phase and ground protection with separate elements and settings. The relay can be used with CT ratios from 5/5 to 5000/5. The CT ratio can be set independently for phase and ground allowing the ground element to be connected in either the residual or the separate ground CT configuration, as in Figures 4 and 5.

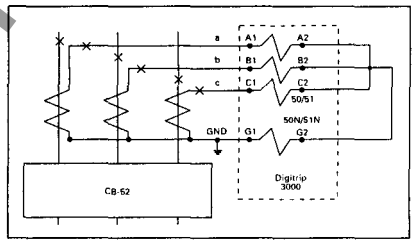


Figure 4. Residual Ground Connection

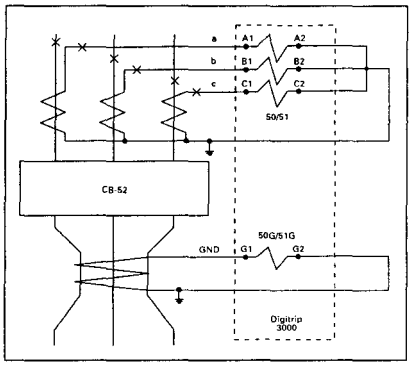


Figure 5. Separate Zero Sequence Ground CT Connection

Digitrip 3000 Selective Curve Types

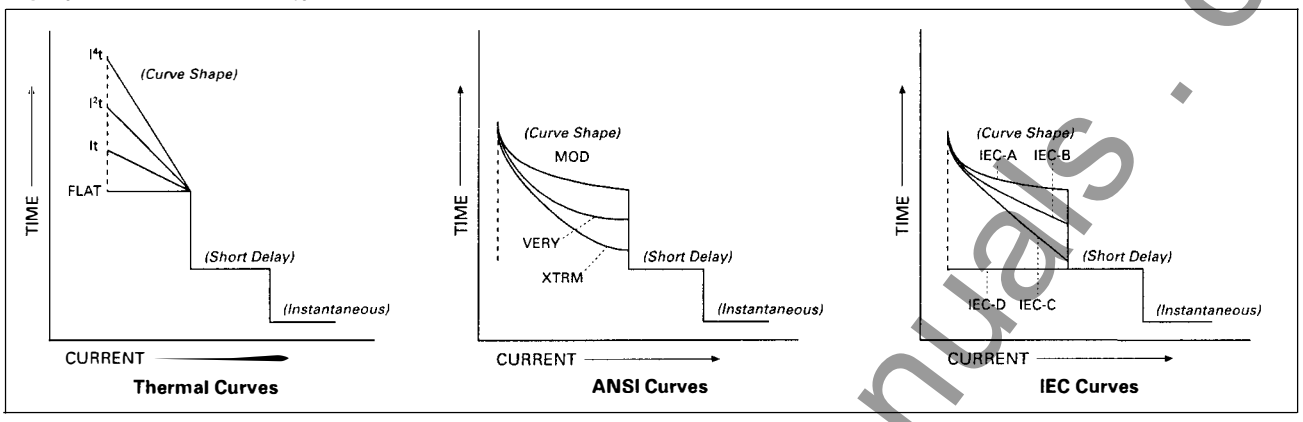


Figure 7. Time Overcurrent Curve Shapes

The phase and ground overcurrent characteristics are defined by six parameters as in figure 6.

1. Curve shape
2. Overcurrent pickup
3. Time multiplier or dial
4. Short delay pickup
5. Short delay time
6. Instantaneous pickup

Phase or Ground Overcurrent Characteristics

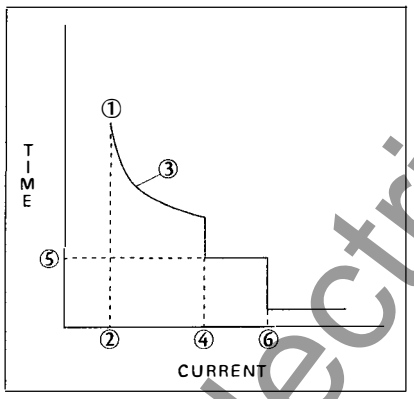


Figure 6

Phase Curve Shape

The Digitrip 3000 includes the thermal, ANSI and IEC family of curves as in Figure 7 which makes it easy to coordinate with any conventional protection scheme. The user can select Moderately Inverse, Very Inverse, Extremely Inverse or Definite Time characteristics. The Thermal curves It, I^2t, I^4t and Flat Slopes can also be selected.

Phase Time Overcurrent Protection

Time overcurrent (overload and fault) protection is defined by the current pickup setting and time multiplier.

Phase Short Time Protection

Short time (fault) protection responds to short circuit conditions. It is similar to the Phase Time Overcurrent Protection in that current and time settings are offered. It differs, however, in two ways: (1) "NONE" is a Short Delay Pickup setting which, if selected, will disable the Phase Short Time Protection, and (2) a slope selection is not available for the time line.

Instantaneous Protection

Instantaneous (short circuit) protection reacts to high level fault currents with no additional time delay. If "NONE" is selected for the instantaneous setting, the instantaneous trip function is disabled and a true making current release (discriminator) function is provided. If selected, the discriminator is functional for 10 cycles and will trip the breaker instantaneously, if the fault current is above 11 times (I_n).

Ground Fault Protection

The ground fault protection function is a composite of the Ground:

- Curve shape
- Time overcurrent and pickup time settings
- Short delay current and time settings
- Instantaneous setting

These are similar to the phase overcurrent functions. A "NONE" setting selection disables that characteristic of the ground fault protection.

Sensitive Ground Fault Protection

The DT-3000 overcurrent relay is available with an optional sensitive ground fault function. This feature provides a ground time overcurrent pickup range from 0.01 to 0.2 per unit and an instantaneous pickup range from 0.05 to 1.1 per unit. This can be used for ground fault protection where the total ground fault current is limited by a grounding resistor.

Zone Selective Interlocking (Phase and Ground)

Zone Selective interlocking is a protection function to minimize equipment damage resulting from a phase or a ground fault in an area where long time and/or short time delay is in use.

When the "Ground Zone Interlocking" feature is utilized, an immediate trip is initiated when the fault is in the breaker's zone of protection, regardless of its preset time delay. When the "Phase Zone Interlocking" feature is utilized, the time overcurrent and short delay phase elements work as follows. The short delay phase element will initiate an immediate trip when the fault is in the breaker's zone of protection, regardless of its preset time delay. For the time overcurrent phase element, the current sensed by the DT-3000 must

Sample Zone Selective Interlocking System

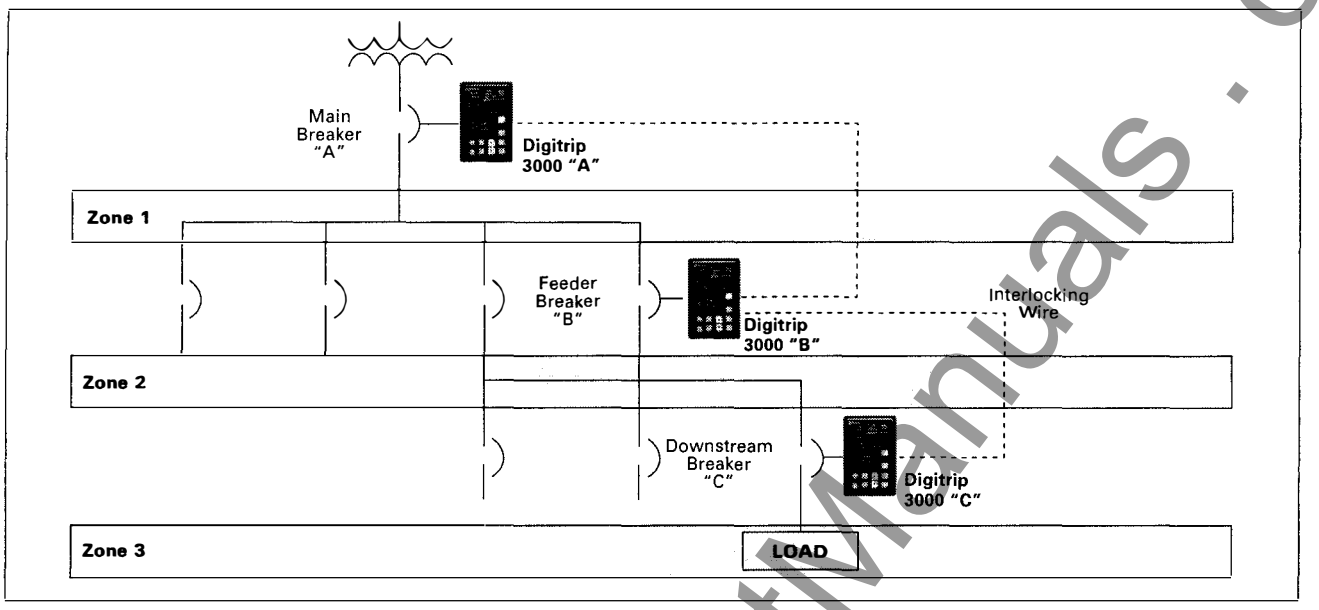


Figure 8

exceed 300 percent (3 x I_n) for the zone selective interlocking to initiate an immediate trip signal when the fault is in the breaker's zone of protection.

Upstream Digitrip 3000 protected breakers are restrained from tripping immediately by an interlocking signal from the downstream Digitrip 3000 relay. This interlocking signal requires only a pair of wires from the downstream breaker to the upstream breaker. It provides standard coordinated tripping when the fault is located outside the zone of protection.

In the sample zone interlocking system shown above, circuit breakers A, B and C are equipped with Digitrip 3000 overcurrent relays.

Fault Location Zone 3①

If a fault occurs at a point in Zone 3, the Digitrip 3000 of Downstream Breaker C senses the fault and sends a restraining signal to the upstream Digitrip 3000 of Feeder Breaker B.

Having received this signal, the Digitrip 3000 of Feeder Breaker B withholds its trip command. As a result, only Downstream Breaker C is tripped.

Fault Location Zone 2①

If a fault occurs at a point in Zone 2, the Digitrip 3000 of Feeder Breaker B senses the fault and sends a restraining signal to the upstream Digitrip 3000 of Main Breaker A.

The Digitrip 3000 of the Downstream Breaker C does not see this fault since it is situated on the downstream side of the fault. As a result, the Digitrip 3000 of Downstream Breaker C does not send a restraining signal to the Digitrip 3000 of Feeder Breaker B.

Since it did not receive a restraining signal from the Digitrip 3000 of Downstream Breaker C, the Digitrip 3000 of Feeder Breaker B identifies that the fault is in Zone 2 and immediately trips Feeder Breaker B, regardless of its time setting.

Fault Location Zone 1①

If a fault occurs in Zone 1, no restraining signal is received by the Digitrip of Main Breaker A. As a result, Main Breaker A is immediately tripped by its Digitrip overcurrent relay, regardless of its time setting.

Drilling Pattern

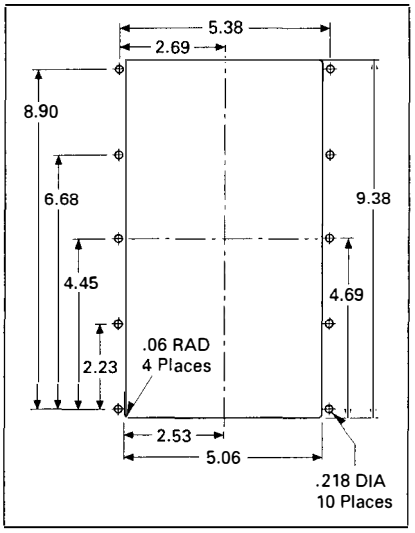


Figure 9

① For the phase time overcurrent element, the current sensed by the Digitrip 3000 must exceed 300 percent (3 x I_n) for the zone selective interlocking to initiate an immediate trip signal.

Layout Dimensions

Trip Unit Dimensions (Inches)

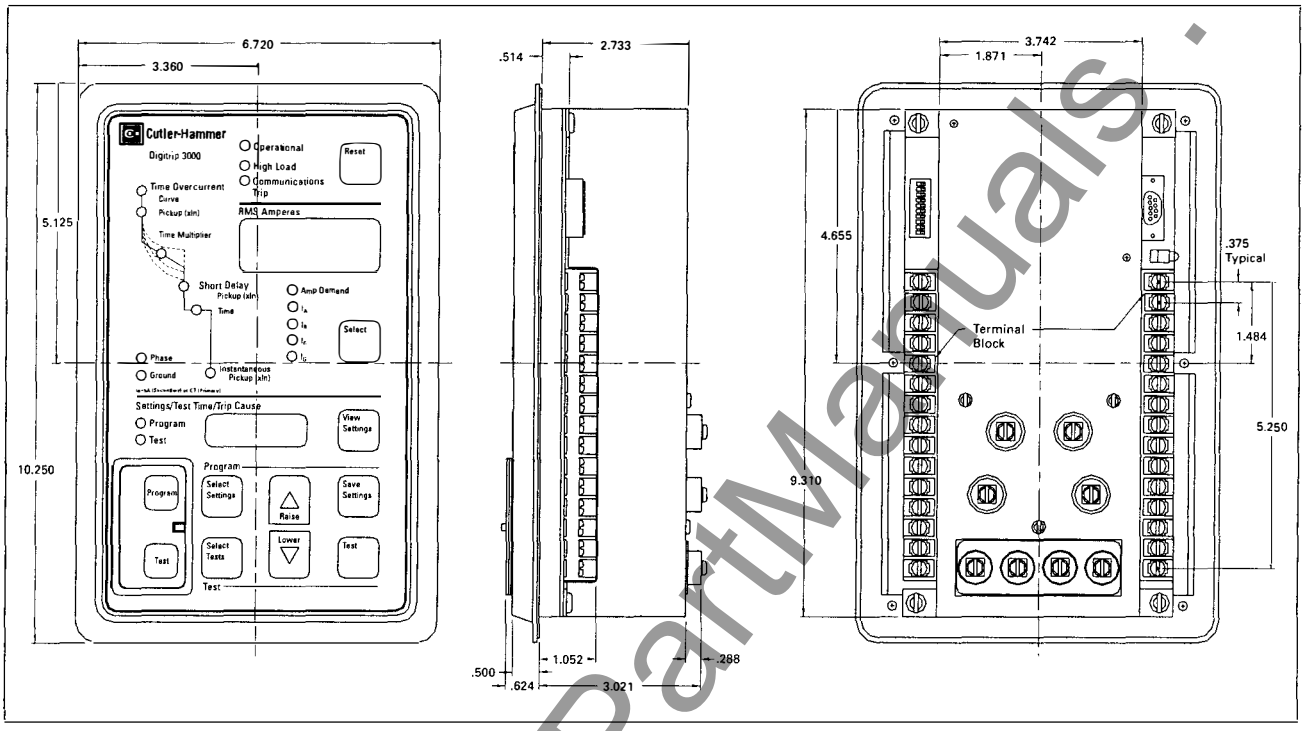


Figure 10

Digitrip 3000 Typical Wiring Diagram

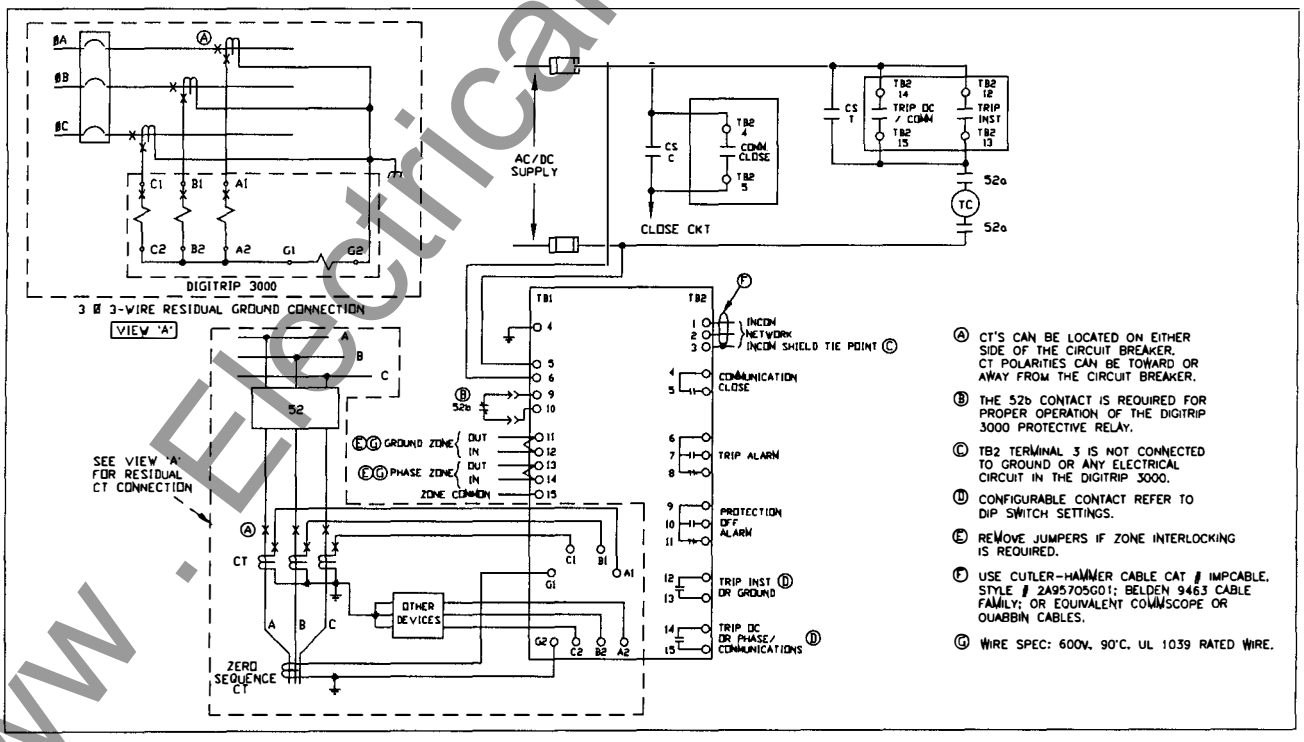


Figure 11

Specifications

Current Inputs

CTs: 5A Secondary

CT Burden:
- <0.004 ohm @ Rated Current (5A)
- <0.1VA @ Rated Current (5A)

I_n: 5A (Secondary) or CT (Primary)

Saturation: 30 x I_n

CT Thermal Rating: 10A Continuous
500A for 1 Second

CT (Primary) Settings Available

Phase and Ground:
5/10/25/50/75/100/150/200/250/300/400/500/600/630/800/1000 1200/1250/1500/1600/2000/2400 2500/3000/3200/4000/5000

Input Voltage①

Nominal: 48 to 250 Vdc
120 to 240 Vac 50/60 Hz

Operating Range:
28 to 280 Vdc
90 to 254 Vac 50/60Hz

Power Consumption:

48 Vdc	125 Vdc	250 Vdc	120 Vac	240 Vac
10W	17W	18W	18VA	25VA

Output Trip Contacts: (Trip OC/Comm., Trip Inst., and Comm. Close)

Momentary:
- Make 30A ac/dc for 0.25 Sec.
- Break 0.25A @ 250 Vdc
- Break 5A @ 120/240 Vac

Continuous:
- 5A @ 120/240 Vac
- 5A @ 30 Vdc

Meets ANSI C37.90, Paragraph 6.7

Environment

Operating Temperature:
-30 to +55°C

Operating Humidity:
0 to 95% Relative Humidity (Non-condensing)

Storage Temperature: -40 to +70°C

Auxiliary Alarm Contacts

5A Continuous @ 120/240 Vac, 30 Vdc
5A Break @ 120/240 Vac, 30 Vdc

① Consult factory for 24/48 Vdc input voltage specification
② Consult factory for sensitive ground fault specification

Tests

Dielectric Strength:
Current Inputs:
3000 Vac for 1 Minute
Phase to Phase

Seismic Test:
Meets requirements for UBC and California Building Code Zone 4. ZPA = 3.5

Standards:
- ANSI C37.90, 1989
- IEC 255
- UL 1053

Phase and Ground Time-Current Curves

Thermal:
- It (Moderately Inverse)
- I^2t (Very Inverse)
- I^4t (Extremely Inverse)
- FLAT (Definite TIme)

ANSI: (Per ANSI C37.112, 1996)
- Moderately Inverse
- Very Inverse
- Extremely Inverse

IEC: (Per IEC 255-3, 1989)
- IEC-A (Moderately Inverse)
- IEC-B (Very Inverse)
- IEC-C (Extremely Inverse)
- IEC-D (Definite Time)

Overcurrent Functions and Pickup Ranges②

Long Delay or Inverse Time Overcurrent:
- Phase: (0.2 to 2.2) x I_n (28 Settings)
- Ground: (0.1 to 2.0) x I_n, None (26 Settings)

Short Delay:
- Phase: (1 to 11) x I_n, None (25 Settings)
- Ground: (0.1 to 11) x I_n, None (45 Settings)

Instantaneous:
- Phase: (1 to 25) x I_n, None (30 Settings)
- Ground: (0.5 to 11) x I_n, None (33 Settings)

Time Delay Settings

Inverse Time Overcurrent Time Multiplier:
It, 1^2t, 1^4t Curve:
0.2 to 40 (47 Settings)
FLAT: 0.2 to 2 (21 Settings)
ANSI (all): 0.1 to 5.0 (50 Settings)
IEC (all): 0.05 to 1.00 (20 Settings)

Short Delay Time:
0.05 to 1.5 sec (22 Settings)

Current Monitoring②

True RMS Sensing:
3-Phase and Ground

Display Accuracy:
- ±1% of Full Scale [In] from 0.04 x I_n to 1 x I_n
- ±2% of Full Scale [I_n] from 1 x I_n to 2 x I_n

Ampere Demand:
Average Demand over 5 Minute Sampling Window

High Load:
85% of Inverse Time Overcurrent Setting

Timing Accuracy

Inverse Time Overcurrent Time:
±10% @ >1.5 x Pickup

Short Delay Time: ±50 ms

Standards:
- ANSI C37.90
- IEC 255
- UL 1053

Communications

Cutler-Hammer PowerNet Compatible: Built-in INCOM

Data Rate is 1200 or 9600 Baud

Ordering Information

Digitrip 3000

Description	Catalog Number
Digitrip 3000	**DT3000**
Digitrip 3000 Drawout Relay	**DT3001**
Digitrip 3000 Drawout Inner Chassis	**DT3001-IC**
Digitrip 3000 Drawout Outer Chassis	**DT3001-DC**
Digitrip 3000 with 120 Vac Dual Source Power Supply	**DT3010**
Digitrip 3000 with 240 Vac Dual Source Power Supply	**DT3020**
Digitrip 3000 with 24/48 Vdc Power Supply	**DT3030**
Digitrip 3000 with 24/48 Vdc Power Supply in Drawout Case	**DT3031**
Digitrip 3000 with Sensitive Ground Fault Protection	**DT3200**

Notes