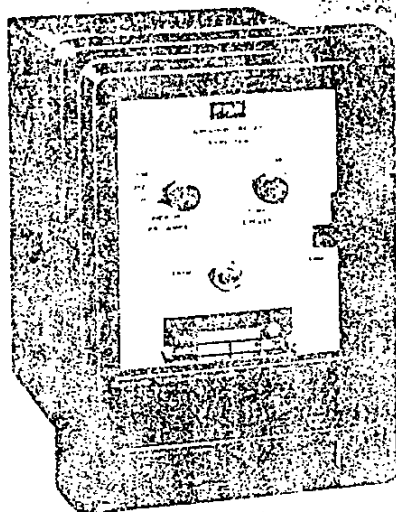
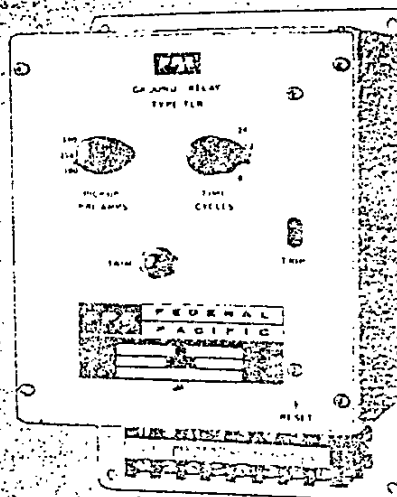


# Ground Protective Equipment Type TLR Relay

Descriptive Sheet  
Page 1



Drawout Case



Surface Mounted Unit

**TYPE**

TLR, ground fault relay with inverse time delay and instantaneous tripping.

**APPLICATION**

Grounded systems (solidly or resistance).

**CO-ORDINATION  
(for selectivity)**

- (a) Conventional time band separation
- (b) Extensive FPE ZSIP\* System

\* ZSIP is Federal Pacific Electric Company trademark for its exclusive (patent pending) Zone Selective Instantaneous Protection system and apparatus which provides instantaneous tripping in all zones while retaining selectivity.

**SENSITIVITY**

Five field adjustable relay ranges from 25 to 3000 amperes, each with three field adjustable pick-up settings.

Pick-up Settings Amperes	Time Coordinated System	ZSIP Coordinated System
25, 50, 100	TLR1-25	TLR2-25
100, 250, 500	TLR1-100	TLR2-100
500, 750, 1000	TLR1-500	TLR2-500
1000, 1500, 2000	TLR1-1000	TLR2-1000
2000, 2500, 3000	TLR1-2000	TLR2-2000
TLR1-25 to 3000	Not Applicable	TLR2-25 to 3000

Add suffix SM for surface mounted, and DO for drawout case.

**TIME DELAY**

Three field-adjustable inverse time delay bands and one instantaneous band. When used with ZSIP system these bands provide only "back up" protection by the "upstream" breakers. See Page 2 for Time - Current curves.

TIME DELAY CHARACTERISTICS				
Setting	TLR1	TLR2	At Pick up	At 7.5 x Pick up
0	ALL	NONE	INST.	INST.
0.1 sec. (6 cyc.)	-100, -500, -1000	-100, -500, -1000	1 sec.	0.1 sec.
0.2 sec. (12 cyc.)	-100, -500, -1000, -2000	-100, -500, -1000, -2000	2 sec.	0.2 sec.
0.4 sec. (24 cyc.)	-100, -500, -1000, -2000	-100, -500, -1000, -2000	4 sec.	0.4 sec.
0.6 sec. (36 cyc.)	-2000 Only	-2000 Only	6 sec.	0.6 sec.

# Ground Protective Equipment Type TLR Relay

Descriptive Sheet  
Page 2

## DESCRIPTION

Federal Pacific Type TLR-Relays are designed specifically for protection of electrical equipment from extensive damage caused by low magnitude arcing ground faults on low voltage systems. For detailed application data refer to Class 2502, Total Protection on Grounded Systems which includes information on the ZSIP System for Ground Fault Protection.

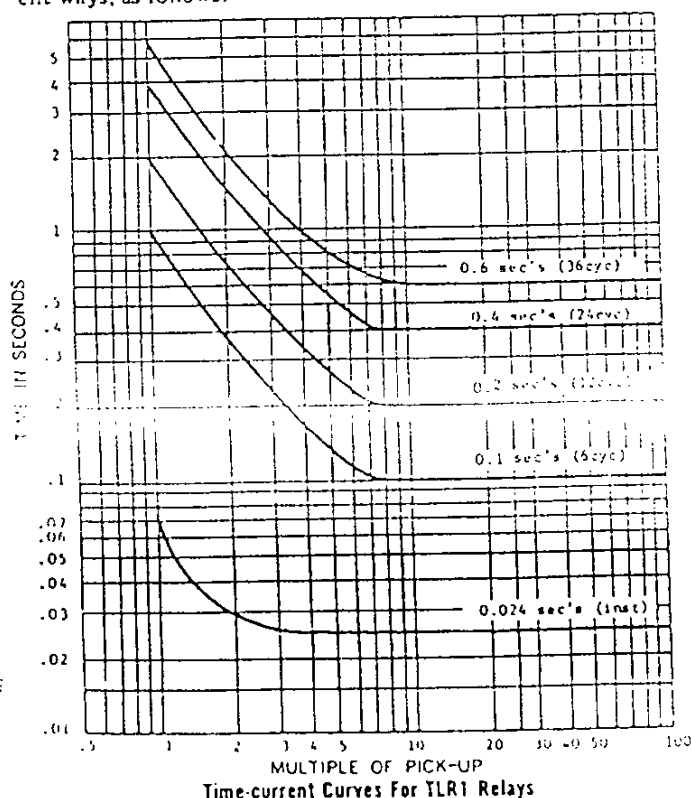
Type TLR Relays are self-powered latching relays with solid-state operators incorporating field-adjustable pick-up, time delay, manually resettable target, and test jack.

Two basic relays are available. TLR1 series for use on non-selective and time-coordinated selective ground fault protective systems. TLR2 series for use only on ZSIP\* (Zone Selective Instantaneous Protection) coordinated systems.

TLR Relays are designed to be operated by specially designed sensing transformers that can be applied to the ground strap between the neutral and the equipment ground bus or by zero sequence sensing transformers that surround all the conductors in the circuit being protected. Zero sequence sensing transformers are available in two designs. Toroidal zero sequence sensing transformers for cable conductors and rectangular zero sequence sensing transformers for bus duct, switchboard busses or for large groups of cable.

## OPERATION

When ground current is flowing under fault conditions, the sensing transformer senses this current; and, if the magnitude exceeds the pick-up setting of the relay, the relay will react to trip its associated circuit switching device. TLR1 and TLR2 Relays react in slightly different ways, as follows:



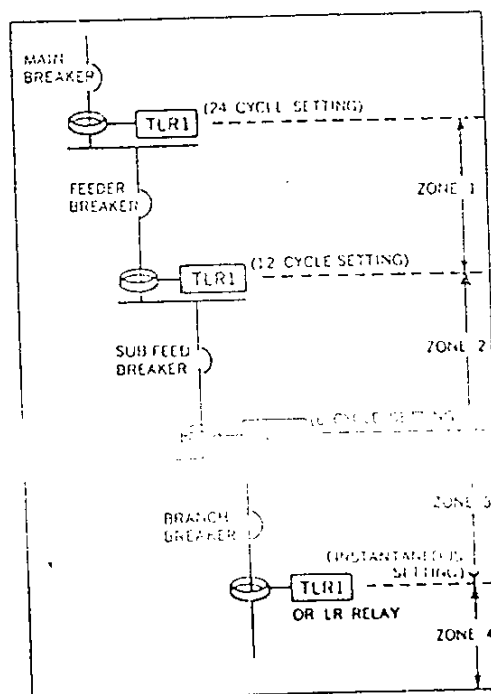
**TLR1 Relay:** The TLR1 Relay will trip after the time delay dictated by the time dial setting on the face of the relay and in accordance with the curves below. When used in a non-selective system the relay is normally used to trip the main circuit protective device. When used in a selective system, each zone of selectivity is separated by a time gradient. Main breaker relay is set for the longest time delay. Main feeder relays have shorter time delay and the branch relays have either the shortest time delay or are set to trip instantaneously. The TLR1 Relay can also be used as the last stage in a ZSIP\* system and is fitted with two extra terminals which will transmit a restraining signal, to relays upstream, under ground fault conditions.

**TLR2 Relay:** The TLR2 Relay is designed specifically for use with the FPE Zone Selective Instantaneous Protection system. (See Class 2502, Total Protection on Grounded Systems which includes information on the ZSIP System for Ground Fault Protection). The TLR2 Relay incorporates circuitry that enables it to generate and transmit a restraining signal to other relays as well as to receive such a signal from a "downstream" relay under ground fault conditions. The relay also has the ability to react in two different ways when it receives a restraining signal from other relays, downstream from it, namely (a) to restrain, (b) to "block".

TLR2 has four terminals to provide access to this circuitry.

1. Restraint output
2. Time restraint
3. Block restraint
4. Common

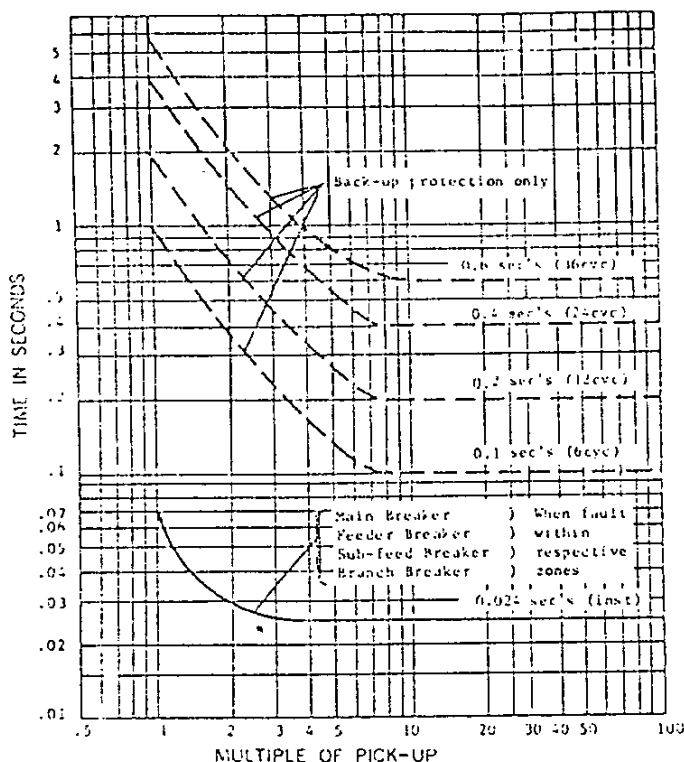
\*FPE Trademark



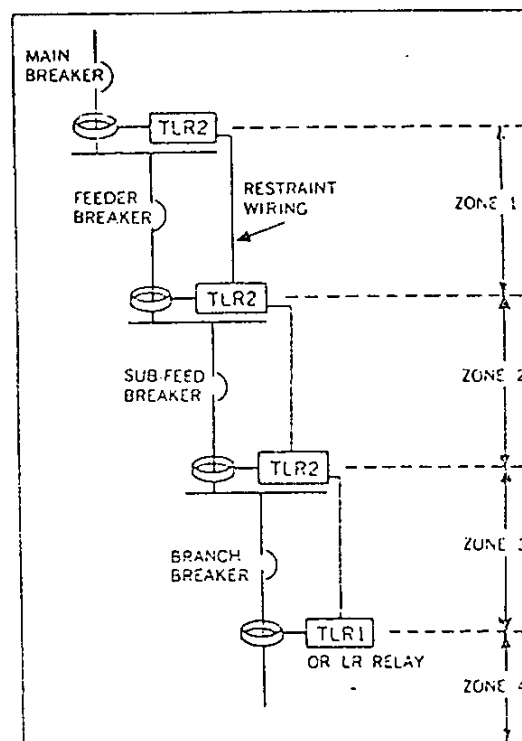
Time Coordinated Selective System

# Ground Protective Equipment Type TLR Relay

Descriptive Sheet  
Page 3



Time-current Curves For TLR2 Relays



ZSIP Coordination

The relays' response to a ground fault is determined by the signal it receives from downstream relays, or the absence of such a signal. Responses are as follows:

No signal at either Time or Block Restraint Terminal. No other relay senses a ground fault so the fault is within this relay's zone. Tripping is instantaneous regardless of the time-band setting.

Signal received at the Time Restraint Terminal. The ground fault is outside this relay's zone. If a downstream relay or protective device does not clear the fault, the relay will trip in accordance with time-band setting.

Signal received at Block Restraint Terminal. A downstream relay or protective device should clear this fault. This relay will not trip as long as the signal exists.

Signal received at both Time Restraint and Block Restraint Terminals. Action is same as above. Relay will not trip. Block restraint signal overrides Time Restraint Signal. Note: Relay on the main circuit breaker should not have any connections to the Block Restraint Input Terminal.

TLR1-1000, TLR1-2000 and TLR2-1000, TLR2-2000

TLR-1000 Relays are designed for use where high fault-currents are available and should be used only on the

main service. For this reason the TLR 1000 and TLR 2000 Relays are designed for use with the RT-6 ground strap sensing transformers. Application of relays with high pick-up settings is, at best, a compromise for coordination purposes and may let through more damage than is desirable. Their use should be avoided by the application of a selective ground fault protection system whenever possible.

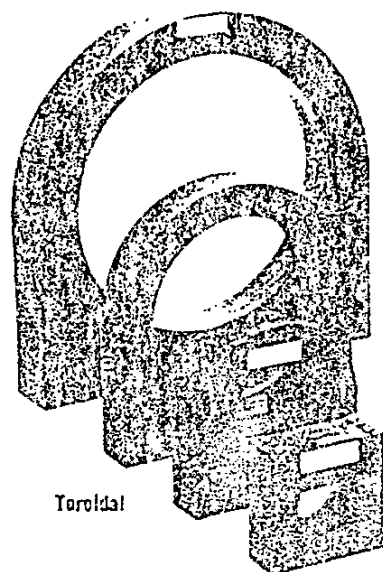
## TR-1 TRANSMITTING UNIT

The TR-1 Transmitting Unit is used in certain applications of Zone Selective Instantaneous Protection where tripping is not required or possible.

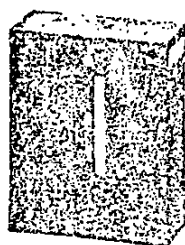
The TR-1 is a signal generator under ground fault conditions to indicate the location of ground fault to relays upstream. The TR-1 is applied to the circuit it is to monitor with any of the ground fault sensing transformers used by the TLR Relay. Output of the TR-1 is connected to the "Time" or "Block" restraint terminals of the next TLR2 Relay upstream. Application of TR-1 Transmitting Units is covered in detail in Class 2502, Total Protection on Grounded Systems which includes information on the ZSIP System for Ground Fault Protection.

Note: The upstream relay should have a pick up level equal to or greater than the normal current of the circuit being monitored by the TR-1 Transmitter Unit. (i.e. a TR-1 on a fused 100 amp circuit should not block a TLR2-25 relay, but may block a TLR2-100 relay or one of higher amperage).

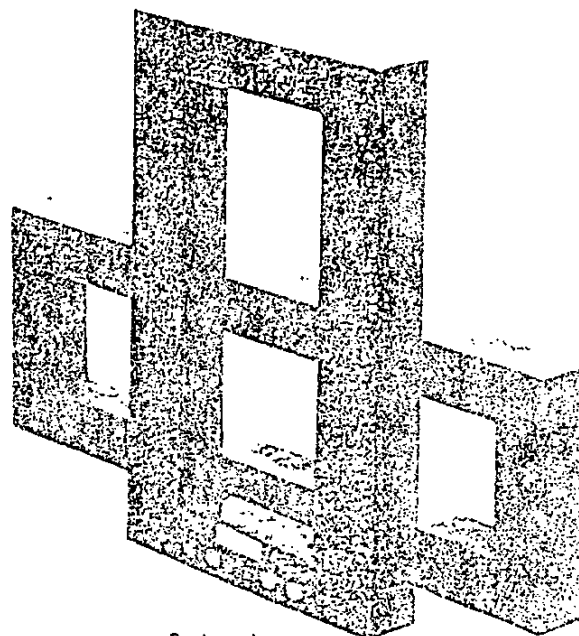
# Ground Protective Equipment Type TLR Relay



Toroidal



Groundstrap



Rectangular

## SENSING TRANSFORMERS

Type TLR Relays are designed to operate with a wide range of sensing transformers both for ground strap sensing and zero sequence sensing of ground fault currents. Toroidal zero sequence sensing transformers are for use with cable conductors only and the rectangular zero sequence sensing transformers are for use on bus bars and large groups of cable conductors. Sizes, types, and catalog numbers are listed below. For more information regarding the application of these sensing transformers, refer to factory.

TOROIDAL		RECTANGULAR		GROUND STRAP	
Size	Cat. No.	Opening Size	Cat. No.	Opening Size	Cat. No.
2 1/2"	TJA	3" x 13"	RB-11	1 1/2" x 4 1/8"	RT-6
		3 1/2" x 12 1/2"	RB-17		
		4" x 12 1/2"	RB-17		
5 1/4"	TJA	4 1/2" x 19"	RB-19		
9"	TJA	5 1/2" x 13"	RB-13		
		7 1/2" x 13"	RB-13		
		8" x 26 1/2"	RB-261		

\* For use with TLR 1000 and TLR 2000 relays only.

† RB-26 requires the use of mounting clamps. RB-268 has mounting holes in the sensor.

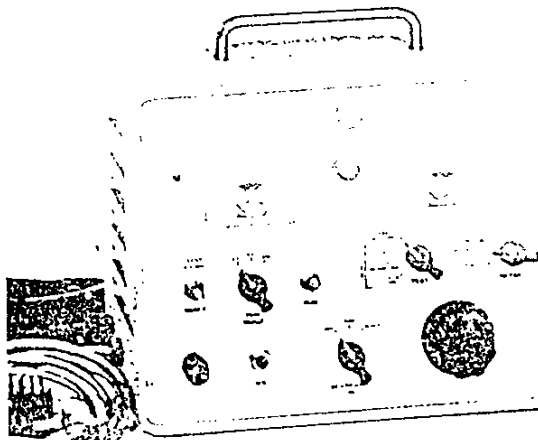
## TESTING

The DDT-TLR Test Unit is designed to perform all tests on TLR Relays. The test unit will check the calibration of the relay pick-up settings, conformance to the time-

current characteristic curves and the relay's circuitry for transmitting restraint signals on both the TLR1 and TLR2 relays. In addition the test unit can generate a restraint signal to check the TLR2 relay's response to signals at either the "Time" or "Block" terminals.

Testing is performed by removing the nameplate on the relay face and plugging the test unit plug into the socket behind the nameplate.

TLR Relays can be removed from the drawout case for testing or can be tested in place.



DDT-TLR Relay Test Unit

# Ground Protective Equipment Type TLR Relay

Descriptive Sheet  
Page 5

## ELECTRICAL CHARACTERISTICS

TLR Relays are equipped with a single pole, double throw contact that can be used for tripping a circuit breaker or service protector or opening the control circuit of a contactor. A reliable power source must be provided for tripping power. The contacts are rated:

- 10 amps @ 125/250 volts AC
- 1/2 amps @ 125 volts DC
- 1/4 amps @ 250 volts DC

Relays will reset at 98% of pick-up setting and 95% of time dial setting.

## WIRING

Wiring from the current transformer to the relays need only be 600V Class, AWG #14 wire. These conductors carry only very low magnitude currents.

Only two wires are required between relays for transmitting and receiving restraint signals. These wires may be AWG #14 or as required by code. Restraint signal wires should not be run in the same conduit as other signal or power wiring. These wires must not be grounded at any point. See pages 6 and 7 for connection diagrams.

When using the ZSIP\*System do not ground current transformer secondaries.

\*FPE Trademark

## RELAY CASES

### Drawout Mounting

The relay components are mounted on a withdrawable chassis to facilitate testing and unit interchangeability. The relay elements are internally wired to contact fingers on the bottom of the relay. These fingers come in contact with a matching set of spring loaded contacts in the relay case. Connections are brought out to external terminal studs for switchboard wiring. The sensing transformer is automatically shorted out when the relay is withdrawn.

The time and pick-up setting dials and manual reset target are located behind a removable glass front with a target reset lever projecting out the bottom.

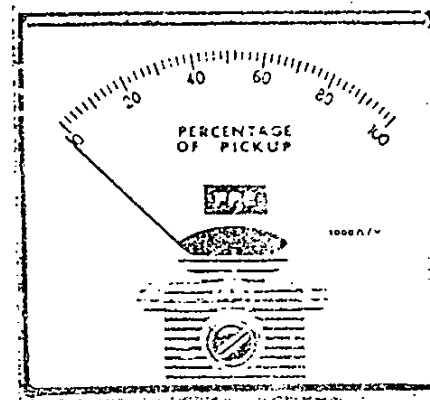
The drawout case is suitable for both flush and surface mounting with back connections.

### Surface Mounting

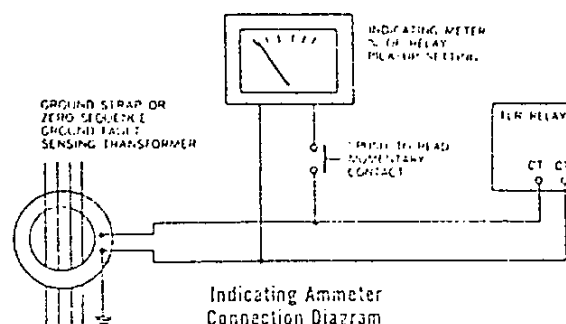
A surface mounting, front connected case is available for use where the relay is to be mounted on a panel. This front connected case is designed so that the reset lever will not be visible without opening the compartment. Add the suffix "SM" to the catalog number, otherwise the drawout case will be supplied.

## INDICATING AMMETER

An accessory, indicating ammeter, is available for use with TLR Relays. The meter is scaled in "percentage of pick-up" and will indicate any ground fault currents flowing as a percentage of the pick-up setting of the relay to which it is connected. The meter is connected across the sensing transformer terminals through a momentary contact (either push button or spring return switch).



TLR Indicating Ammeter



Indicating Ammeter  
Connection Diagram

## TYPICAL SPECIFICATIONS

### TLR1 Relays

All ground fault relays and sensing transformers, as specified herein and shown on the plans, shall be Federal Pacific Electric Company's Type TLR1 or approved equal, with pick-up and time-delay settings as shown.

Each ground fault relay shall have three field-adjustable pick-up points of (25, 50, 100 amperes) (100, 250, 500 amperes) (500, 750, 1000 amperes) (1000, 1500, 2000 amperes) (2000, 2500, 3000 amperes) and a field-adjustable inverse time delay characteristic providing minimum time delay settings of "Instantaneous" (0.2, 0.4, 0.6 seconds for TLR1-2000). The relay shall employ solid state components and shall be self-protected from high magnitude ground faults. The components shall be mounted on a withdrawable chassis in a case for semi-flush mounting. Each relay shall be provided with its own sensing transformer to surround the conductors of the circuit that it is monitoring. In addition, each relay shall have a single-pole, double-throw contact with manual reset target that indicates relay operation due to a ground fault.

During construction all relays shall be set on "instantaneous" to limit damage caused by accidental ground faults.

# Ground Protective Equipment Type TLR Relay

Descriptive Sheet  
Page 6

## TLR2 Relays

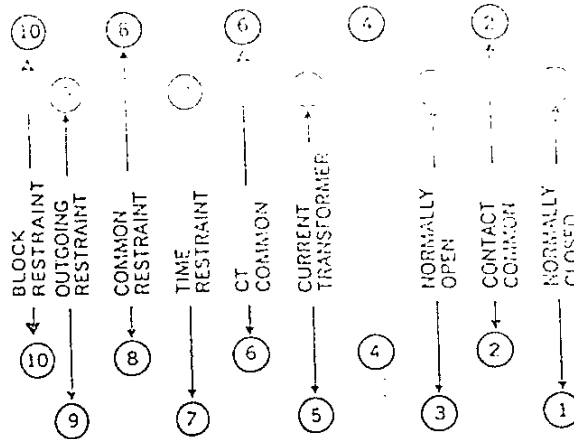
All ground fault relays and sensing transformers as specified herein and shown on the plans shall be Federal Pacific Electric Company's ZSIP ground fault relays Type TLR2 (or approved equal).

Relays shall be of the following ratings: (1000, 1500, 2000, 2500, 3000 amperes) (1000, 1500, 2000 amperes) (1000, 1500, 2000 amperes) (1000, 1500, 2000 amperes) (1000, 1500, 2000 amperes).

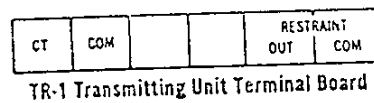
Relays shall have circuitry that enables them to be compatible with Federal Pacific ZSIP System (Zone Selective Instantaneous Protection). The relay shall be capable of discriminating between ground faults that are within its protection zone and if the fault is in its zone to initiate tripping instantaneously. If the fault is in the zone protected by another relay, the relay shall not trip instantaneously, but shall provide back-up protection in accordance with its time-dial setting.

## Connection Diagrams

## TLR1 Terminal Board



## TLR2 Terminal Board

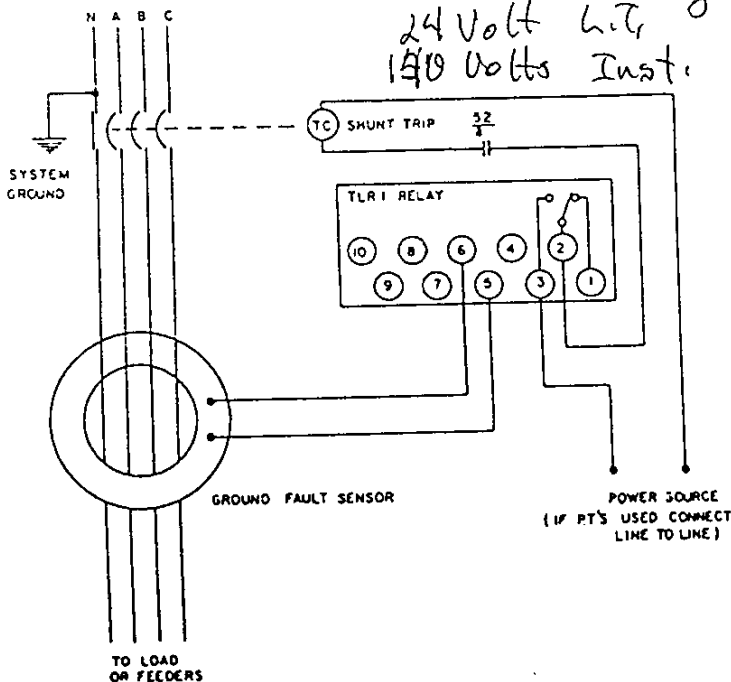


TR-1 Transmitting Unit Terminal Board

*Mike R. Bridge*  
*Ernie Hermesmeier*  
*L.A. - 213/254-7366*

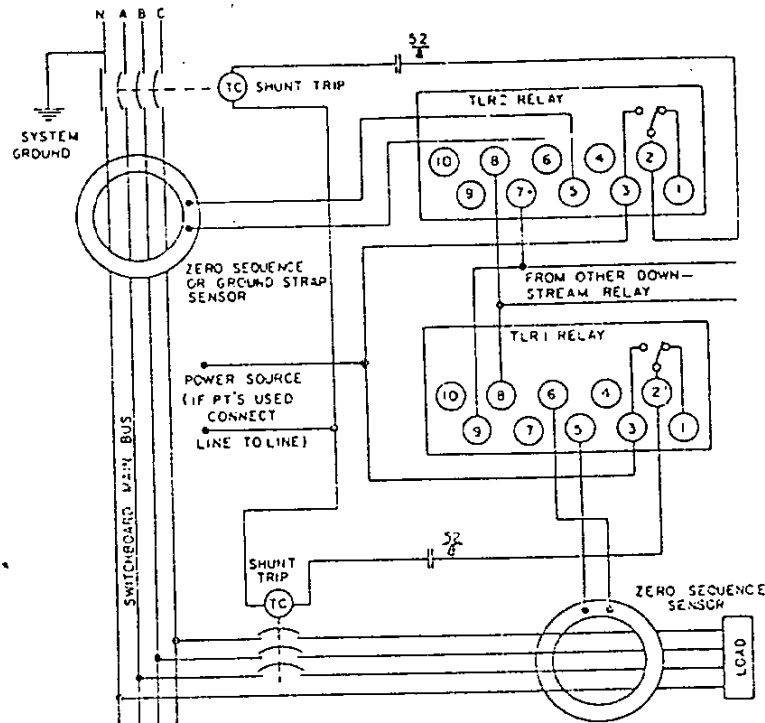
*Lowest setting*  
*24 Volt L.T.*  
*150 Volts Inst.*

*combination of*  
*both current*  
*voltage*



# Ground Protective Equipment Type TLR Relay

Descriptive Sheet  
Page 7



DIMENSIONS—Inches

