



*High speed differential protection for buses and feeders for use with standard bushing-type current*

### Features and Benefits

- Replacement for earlier PVD models
- Thyrite stacks limit potential voltage across relay
- Drawout case construction

### Applications

- Bus differential high z voltage
- Shunt reactor differential protection
- Transformer high z ground differential

### Protection and Control

- High-speed, high z voltage sensing
- High seismic instantaneous O/C unit
- Breaker failure protection (with suitable timing relay)



## Introduction

The PVD21 relay is a single-phase, high-speed, high-impedance, voltage-operated relay designed to provide protection in bus differential schemes. The PVD21 utilizes the same operating principle (high impedance voltage) as the earlier PVD models, but provides faster operating speeds and higher seismic capabilities. Typical operating speed is 20 ms at 4X pickup (See Fig. 1). The PVD21 is mechanically interchangeable with the earlier PVD21 models, and provides additional output contacts as shown in Figs. 2 and 3.

## Description

The PVD21 relay is available in four models. All models include a high-speed voltage sensing unit (87L) that operates from the voltage provided by the differentially connected CT's during an internal fault. In addition, a high seismic instantaneous overcurrent unit (87H) is included in the PVD21B and 21D models. The overcurrent unit 87H, which has an electrically separate output contact, may be used to supplement the voltage

unit 87L, and/or to implement breaker failure protection when used with a suitable timing relay and other auxiliary devices.

The PVD21A and 21B models use a single Thyrite® stack to limit the magnitude of the voltage developed across the relay. For applications where high internal fault currents can be encountered, the PVD21C and 21D models are available. These relays include two Thyrite stacks, and offer the same basic protection, but with a slight decrease in sensitivity. See the PVD21 instruction book for proper selection and application for the PVD21C and 21D models.

same ratio. When adding to an existing bus, at least one CT set in the new breaker should be ordered with the same ratio as the bus differential CT's in the existing breakers. If the differential circuit unavoidably includes different ratio CT's, application of the PVD21 may still be possible, but special attention must be given to protection against over-voltage conditions during internal faults. Refer applications involving different ratio CT's to the local General Electric Company sales office.

## Current Transformer Requirements

The PVD21 relays can be applied for bus protection in most cases where CT's having negligible leakage reactance are used. This generally includes any kind of current transformer with a toroidal core if the windings (on the taps used) are completely distributed about the core. It is preferable that all the CT's in the bus differential circuit have the

## Connection Diagram

Fig. 2. Simplified internal connection diagram for PVD21A and PVD21C

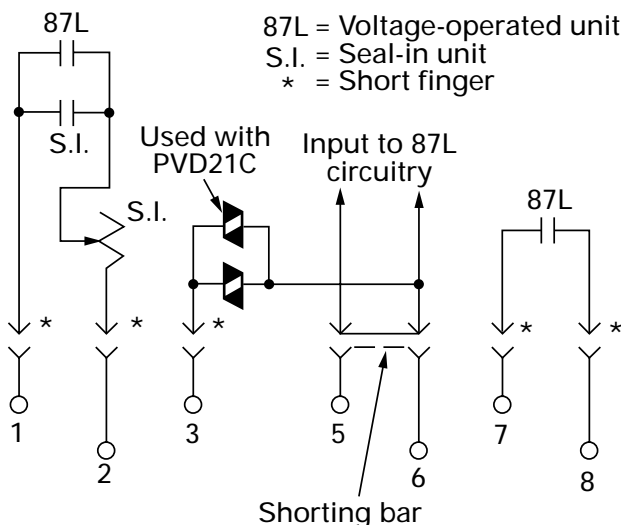
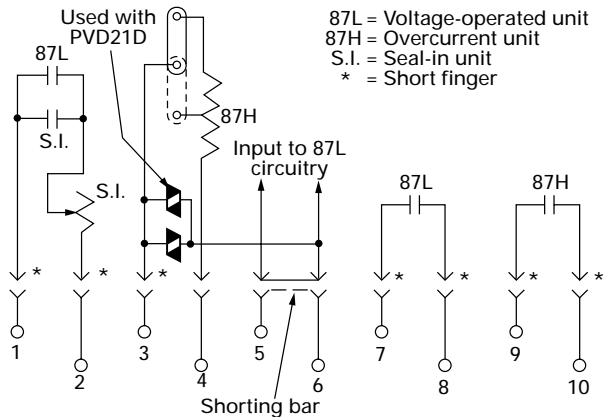


Fig. 3. Simplified internal connection diagram for PVD21B and PVD21D



## Ratings

The voltage unit 87L has a continuous rating of 150 V.

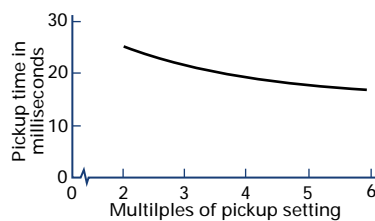
The current unit 87H is a Hi-G, high seismic instantaneous unit with the following ratings for the coil:

| 87H UNIT (2-50 A RANGE) |           |                       |                    |
|-------------------------|-----------|-----------------------|--------------------|
| Link Position           | Range (A) | Continuous Rating (A) | One Sec Rating (A) |
| Low                     | 2-10      | 3.7                   | 130                |
| High                    | 10-50     | 7.5                   |                    |

The contacts of the 87L unit have a current closing rating of 30 A for voltages not exceeding 250 V. The current carrying rating is limited by the seal-in unit rating (see below). The target and seal-in unit is a Hi-G, high seismic unit, dual rated with 0.2 and 2.0 A (dc) taps, with the following ratings:

| Description           | Tap Setting |       |
|-----------------------|-------------|-------|
|                       | 0.2 A       | 2.0 A |
| DC resistance (Ohms)  | 8.0         | 0.24  |
| Minimum operating (A) | 0.2         | 2.0   |
| Carry continuous (A)  | 0.3         | 3     |
| Carry 30 A for (sec)  | 0.03        | 4     |
| Carry 10 A for (sec)  | 0.25        | 30    |

Fig. 1. Typical operating times of the PVD relay—87L unit



## SELECTION GUIDE

Single-phase (3 Required)

| Continuous Rating (V) | Frequency (Hz) | Voltage Unit (87L) |      | Current Unit (87H) |          | Thyrite® Stacks | Model Number | Case Size | Approx. Wt. in lbs (kg) |          |
|-----------------------|----------------|--------------------|------|--------------------|----------|-----------------|--------------|-----------|-------------------------|----------|
|                       |                | Min                | Max  | Min                | Max      |                 |              |           | Net                     | Ship     |
| 150                   | 60             | 75V                | 500V | ---                | ---      | 1               | PVD21A1A     | M1        | 20(9)                   | 27(12.2) |
|                       | 50             |                    |      | ---                | ---      |                 | A2A          |           |                         |          |
|                       | 60             |                    |      | 2A                 | 50A      |                 | PVD21B1A     |           |                         |          |
|                       | 50             |                    |      | 2A                 | 50A      | B2A             |              |           |                         |          |
|                       | 60             |                    |      | ---                | ---      | 2               | PVD21C1A     |           |                         |          |
|                       | 50             |                    |      | ---                | ---      |                 | C2A          |           |                         |          |
|                       | 60             | 2A                 | 50A  | PVD21D1A           |          |                 |              |           |                         |          |
|                       | 50             | 2A                 | 50A  | D2A                |          |                 |              |           |                         |          |
|                       | 60             | 4A                 | 100A | 2                  | PVD21D3A |                 |              |           |                         |          |

NOTE: All PVD relays include a 0.2/2.0 A.T. & SI Unit used in conjunction with the 87L Unit.