

FP-05 : UPGRADING FROM A CO-SERIES OVERCURRENT RELAY TO AN FPU-32

CO-Series Overcurrent Relays

The CO-Series relay is an electromechanical device designed to energize in the event of a phase or ground fault. It does so by employing the magnetic field generated by fault current to force the closure of a contact. For selective-coordination purposes, eight individual relays were designed to function according to specific time-current characteristics:

- CO-2 (Short)
- CO-4 (Long [Step])
- CO-5 (Long)
- CO-6 (Definite)
- CO-7 (Moderately Inverse)
- CO-8 (Inverse)
- CO-9 (Very Inverse)
- CO-11 (Extremely Inverse)

FPU-32 Feeder Protection Unit

The FPU-32 is a microprocessor-based feeder protection device that supports both IEC and IEEE inverse-time overcurrent curves. Overload, current-unbalance, phase-reverse, phase-loss, and earth-fault protection are also provided. The FPU-32 is compact in size requiring minimum accommodations; it is ideal for retrofit applications. The operator interface, comprised of a four-line illuminated display, four LEDs, and seven push-buttons, is used to observe metered data, retrieve stored information, reset trips and alarms, and program system parameters and set points. A TIA-232 interface allows access with a personal computer. Optional network communications provide an interface for a distributed control system.

Upgrading from a CO-Series Overcurrent Relay to an FPU-32 Feeder Protection Unit

The FPU-32 is capable of replacing most CO-Series Overcurrent Relays. There are several benefits in such an upgrade:

Accuracy

An electromechanical relay's set point will drift from its calibrated value over time. A microprocessor-based relay will never require calibration. When several electromechanical relays are used within a system, a cumulative set-point-drift error could cause coordination issues.

Cost

Foremost, annual calibration costs are eliminated. In addition, a single FPU-32 can replace multiple electromechanical relays, depending upon their configuration, and use their current transformers.

Size

The FPU-32's small size facilitates a clean retrofit installation. Our custom-products department has manufactured various kits used to upgrade many kinds of electromechanical devices – we can provide all the parts needed, preconfigured for installation if desired.

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Features

Unlike IEC and IEEE inverse-time overcurrent protection, the FPU-32 tracks thermal capacity for currents below the pickup setting. It provides indication of thermal trend and used thermal capacity; for currents greater than or equal to the pickup current, the time-to-trip is displayed.

The unit employs password protection. Once the results of an arc-flash study have been implemented, for example, changing a relay's trip setting could adversely affect the desired results. When password access is active, all set points are locked from changes until the four-character password is entered.

SE-Comm-RIS Relay Interface Software is freely available on the web. While it can be used to program set points or access metered data on the relay, it can also be used to represent the operational curve of the existing electromechanical relay and assign the exact tripping characteristic to the FPU-32. This can be extremely useful if, as another example, a coordination study has been completed – the new relay can be programmed to trip in an identical fashion as the relay it replaced. There would be no need to revisit the coordination assessment.

Several other additional features will also be available: extra protective functions, multiple programmable contacts, two set-point groups, communications, a universal power supply, a single temperature-sensor input, and an eighty-character display through which you can program the relay or review metered and logged data.

Reliability

The FPU-32 contains circuitry that is concealed within a conformal coating to preserve its electronics in humid, corrosive environments. Each and every relay is thoroughly tested after its manufacture; before shipping, the FPU-32 will have spent 72 hours in a heat room – a burn-in facility maintained at 60°C – while in an operational mode. They are designed for rugged, industrial use, and tested as such. In addition, the FPU-32 carries a 10-year warranty.

Transferring settings from a CO-Series Overcurrent Relay to an FPU-32 Feeder Protection Unit

1. The CO-Series tap setting is the overcurrent pickup in CT-secondary amps. The FPU-32 inverse-time overcurrent-pickup setting (IP) is in per unit (pu) of the CT-primary rating. Dividing the tap setting by 5 (presuming 5-A secondary current transformers are being used) will result in the equivalent FPU-32 setting.
2. The IEEE standard equations were derived by taking the average response of a number of IAC and CO relays set to a time-dial setting of 5. The FPU-32 time-multiplier setting (TM) of 1.0 corresponds to the IAC/CO time-dial setting of 15. Dividing the CO time-dial setting by 15 will result in the equivalent FPU-32 setting.
3. Match the FPU-32 inverse-time-overcurrent curve type to the CO curve type. If this information is not known, it can be obtained either by comparing charts (see the FPU-32 manual) or by using SE-Comm-RIS. The settings below, however, are quite common:

CO-Series Relay	FPU-32 Feeder Protection Unit
CO-7	IEEE Moderate Inverse
CO-9	IEEE Very Inverse
CO-11	IEEE Extreme Inverse

The FPU-32 is capable of matching operational curves with electromechanical relays from numerous other manufacturers as well; Littelfuse Startco application engineers can assist with this step and ensure that the identical tripping characteristics are maintained.

4. Enter the value of the CT-primary rating into the FPU-32.

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The following settings-transfer example will follow the four steps listed above. For demonstration purposes, the FPU-32 will be configured to replace a CO-9 relay having a tap setting of 5, and a time-dial setting of 7. In addition, we will assume that the CO-9 was utilizing a current transformer having an 800:5 current ratio.

$$1. \quad I_p = \frac{\text{Tap Setting}}{5 \text{ (Presuming 5 A Secondary Current Transformers)}} = \frac{5}{5} = 1.0$$

A CO relay having a tap setting of 5 translates to an FPU-32 inverse-time-overcurrent pickup setting of 1.0.

$$2. \quad T_M = \frac{\text{Time Dial Setting}}{15} = \frac{7}{15} = 0.47$$

A CO relay having a time-dial setting of 7 translates to an FPU-32 time-multiplier setting of 0.47.

3. A CO-9 relay follows an IEEE Very Inverse time-current curve. This curve should be selected in the FPU-32's protection menu.

4. A value of 800 A should be entered as the CT-primary rating in the FPU-32's system-ratings menu.

Given a three-phase system, it is typical that three CO-9 relays provide overcurrent protection for each phase while a CO-11 relay encompasses all three phases to detect zero-sequence ground-fault current. A single FPU-32 is capable of replacing all four CO-Series units and can be configured to trip in an identical fashion.