

## ABB CIRCUIT-SHIELD SOLID-STATE RELAY TO FPU-32 FEEDER PROTECTION UNIT UPGRADE

### ABB Circuit-Shield Type 51 Solid-State Overcurrent Relays

ABB Circuit-Shield Type 51 Solid-State relays provide overcurrent protection phase-to-phase and phase-to-ground. They are designed to be operated by standard five (5) ampere secondary current transformers. They come in eight (8) different time-current curve families:

- 51I (Inverse)
- 51Y (Very Inverse)
- 51E (Extremely Inverse)
- 51D (Definite Time)
- 51S (Short Time)
- 51L (Long Time)
- 51M (Long Time Inverse)
- 51YM (Long Time Very Inverse)

They also may include:

- 50 or 50I (Instantaneous or Inverse Instantaneous)

### 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 ABB Circuit-Shield Solid-State Relay to an FPU-32 Feeder Protection Unit

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

#### Age

Due to the age of most solid-state relays, replacement is mandated. The FPU-32 offers reliable performance, as it's a microprocessor based unit. The FPU-32 can also use the existing CT's, making replacement quick and easy.

#### Protective Functions

The FPU-32 features a wide variety of protective functions that solid-state relays do not offer, including but not limited to current unbalance, phase reverse, overload, and ground-fault. Communications options are also available, including Modbus TCP, DeviceNet, Profibus, EtherNet/IP.

#### 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, pre-configured for installation if desired.

#### 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 ABB Circuit-Shield Solid-State Overcurrent Relay to an FPU-32 Feeder Protection Unit

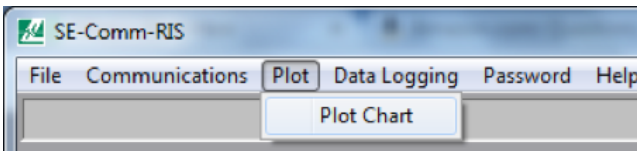
1. First, several pieces of information must be collected from the existing Circuit-Shield, by noting the face of the unit. For this example, we will use a 3-Phase Circuit-Shield.
  - a. **Current Pickup Taps:** For this example, we will use 5A.
  - b. **Time-Current Curve:** This information should be etched on to the face of the unit. For this example, we will use a Type 51E IEEE Extremely Inverse curve.
  - c. **Time-Dial Setting:** For this example, we will use Time-Dial Setting 1.

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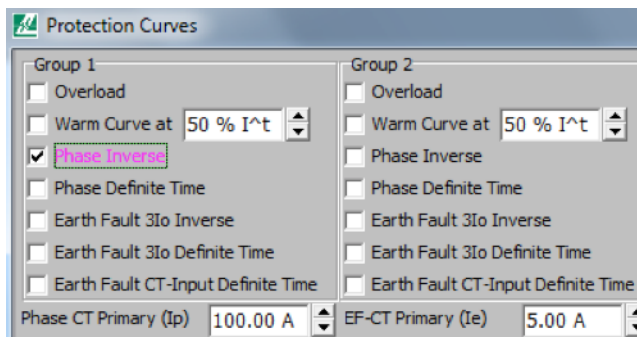
- After collecting the above information, values must be collected from the Circuit-Shield Time-Current Curve in the Circuit-Shield Manual. To adequately graph this curve, it is recommended to select 8-10 points.
- Once the points are noted, they must be entered in to the SE-Comm-RIS software. This software can be obtained under *Product Literature* section at the following link:

<http://www.littelfuse.com/products/protection-relays-and-controls/protection-relays/feeder-protection/fpu-32.aspx>

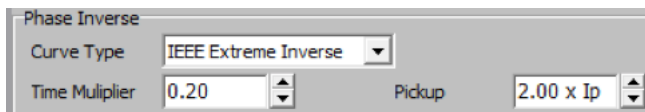
- After opening the software, select Plot on the menu bar and select Plot Chart.



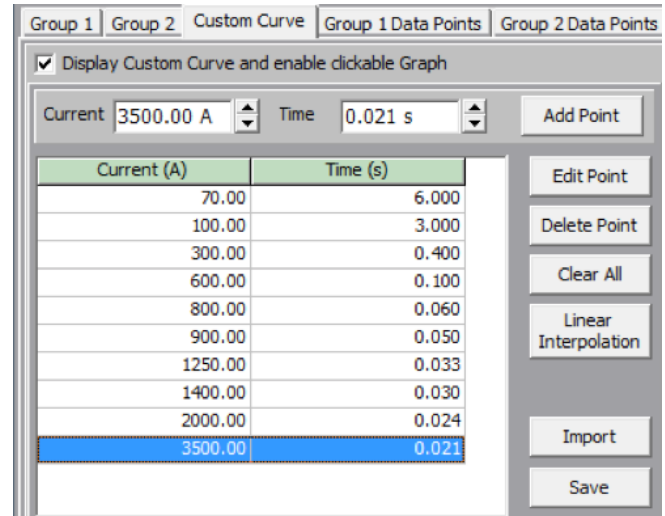
- Make sure that only the *Phase Inverse* box is checked, and enter the *Phase CT Primary (Ip)* and the *EF-CT Primary (Ie)*. For this example, these values will be 100A and 5A.



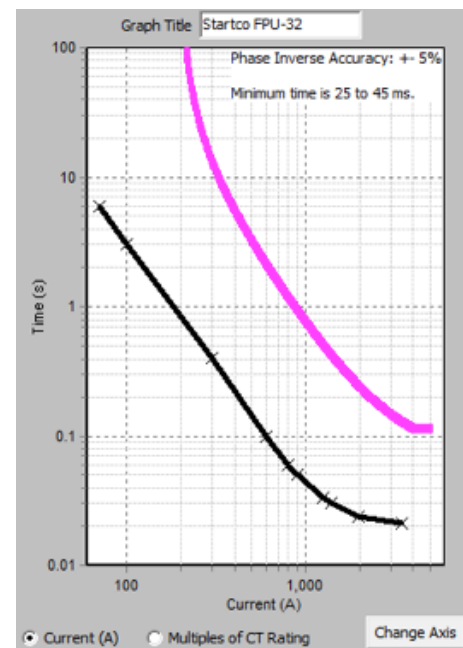
- A 51E relay has been selected for this example, so in the *Phase Inverse* section, select *IEEE Extremely Inverse* for the Curve Type. Leave the other boxes alone, for now.



- Now, select Custom Curve, make sure the *Display Custom Curve and enable clickable Graph* box is checked, and start entering the values obtained from the Circuit-Shield manual. For this example, 10 points have been selected from Curve 1 of the 51E Time-Current Characteristics in the Circuit-Shield manual.



- After completing this step, the graphs will look similar, but they will most likely not overlap.



- Next, go back to the Group 1 tab. Within the *Phase Inverse* section, adjust the *Time Multiplier* and *Pickup* until the curves overlap. For this example, a *Time Multiplier* of 0.05 and a *Pickup* of 0.80 x Ip overlaps the curves adequately. Select *Apply Changes*, and the transfer of settings is complete.