Peripheral Board Emulator Graphical User Interface
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Abstract
In order to make SEL's Peripheral Board Emulator (PBE) user friendly, Team Bell replaced the hard-to-use console interface with a graphical user interface (GUI) that aids the setup and use of emulated 400-Series Relay peripherals. This required additional changes to the PBE firmware in order to meet objectives.

Objectives
• Consider the end user – the GUI improves nothing if it requires any documentation just to use.
• Extend existing functionality – the needs of a GUI are different from the needs of a console interface and changes to the system should reflect this.

Impact Analysis

GUI-Firmware Communications
• Created custom serial communication language.
• Extended existing PBE firmware to improve communications with the GUI.
• Maintained backwards compatibility with previous firmware.
• Reduced bandwidth requirements – For most supported commands, the GUI transmits approximately 70-75% the number of bytes as the user would for the same command. The GUI receives around 20% of the normal number of bytes for a read.

GUI Feature List
• Provides PBE register memory read/write access through easy-to-use interface.
• Streamlines PBE configuration and EEPROM programming process.
• Shows how to safely setup PBE-relay system.
• Manages PBE profiles, including settings stored on the on-board EEPROMs.
• Controls multiple PBEs at a time.
• Prints log file for test validation.

Testing Setup
As the relay mainboard differentiates PBEs by reading their EEPROM contents, the following tests were performed to verify system functionality:
• EEPROM data written to PBE using the GUI. Result validated using the serial port on the relay’s mainboard.
• EEPROM data written to PBE using the relay’s mainboard serial port. Result validated using the GUI.

Glossary
Relay: SEL product that monitors, controls and protects power systems.
Peripheral: Components of the relay system.
Profile: A description of an emulated peripheral that identifies the PBE to the relay.
Port: A UART connection between the GUI and PBE.

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Team Bell