

Replacing a B-PRO 8701 with a B-PRO Multi-Bus Fixed Busbar System

1 Introduction

The B-PRO 4000 Multi-Busbar system provides protection for most of the typical bus bar configurations with 3 differential protection zones and a check zone. Its scalable architecture allows flexibility to use the most cost-effective hardware combinations, based on the actual number of zones and number of current inputs in the bus system. In addition to applications in complex bus configurations with dynamic bus replica, the B-PRO 4000 Multi-Busbar system can also be used to provide protection for typical fixed bus configurations up to 24 bays (i.e. 24 x 3-phase feeder inputs).

1.1 Hardware Options for Fixed Bus Topology

The B-PRO 4000 Multi-Busbar relay system has been designed with several flexible hardware options for fixed bus configurations.

1.2 Number of B-PRO Relay Units (Boxes)

One B-PRO unit can be used to protect up to 6 bays (lines). Depending on the number of bays protected, the required number of B-PRO units can be selected, as shown in Table-1.

Table-1: Number of B-PRO Relay Units

B-PRO Relay Unit (Boxes)	Maximum Number of Bays (Feeders)	External Inputs	Output Contacts
1	6	9	14
2	12	18	28
3	18	27	42
4	24	36	56

1.3 I/O Units (Optional for Fixed Configuration)

I/O units (up to 2) can be used to expand input and output capabilities, as shown in Table-2.

Table-2: Number of I/O Units

B-PRO Unit	External Inputs	Output Contacts
1	128	16 (15 configurable)
2	256	32 (30 configurable)

1.4 Time Synchronization

For correct operation of the differential protection, time synchronization of B-PRO units is required whenever more than one B-PRO unit is in use. Users will have following options for time synchronization.

Direct IRIG-B Inputs

All B-PRO units should be connected to the IRIG-B source. For correct operation, it is recommended to connect them to the same IRIG source. For enhanced operation of the primary differential protection, depending on the mode of operation of the IRIG clock during antenna failure, behavior of the B-PRO units will be adjusted automatically as described below.

IRIG-B source reports as IRIG-B Unsynchronized during antenna signal failures

In this mode of operation, differential protection is automatically blocked during IRIG loss conditions to ensure correct operation of the relays.

IRIG-B source reports as IRIG-B Synchronized (free-running mode active) during antenna signal failure

In this mode of operation, differential protection continues to operate normally as clock continues to run with its own timing with an acceptable accuracy and all B-PRO units remain synchronized to the same IRIG source.

Acceptable Accuracy for free-running devices: Selected clock should have less than ± 15 minutes drift per year over the full operating temperature range, and less than ± 90 seconds drift per year at a constant temperature of 25°C.

IRIG-B Inputs Via I/O Units

In this option, the IRIG-B source is provided to the I/O unit which distributes it to all B-PRO units. Use of this option provides more redundancy to the system, as the system continues to synchronize with I/O unit's internal clock during any antenna failures. Differential protection continues to run irrespective of the availability of the actual IRIG-B input. Therefore, when this option (I/O unit) is used, the IRIG-B source is not required for correct operation of the protection elements.

2 Multi-Busbar Protection Units for a 12-Bay System

2.1 Description

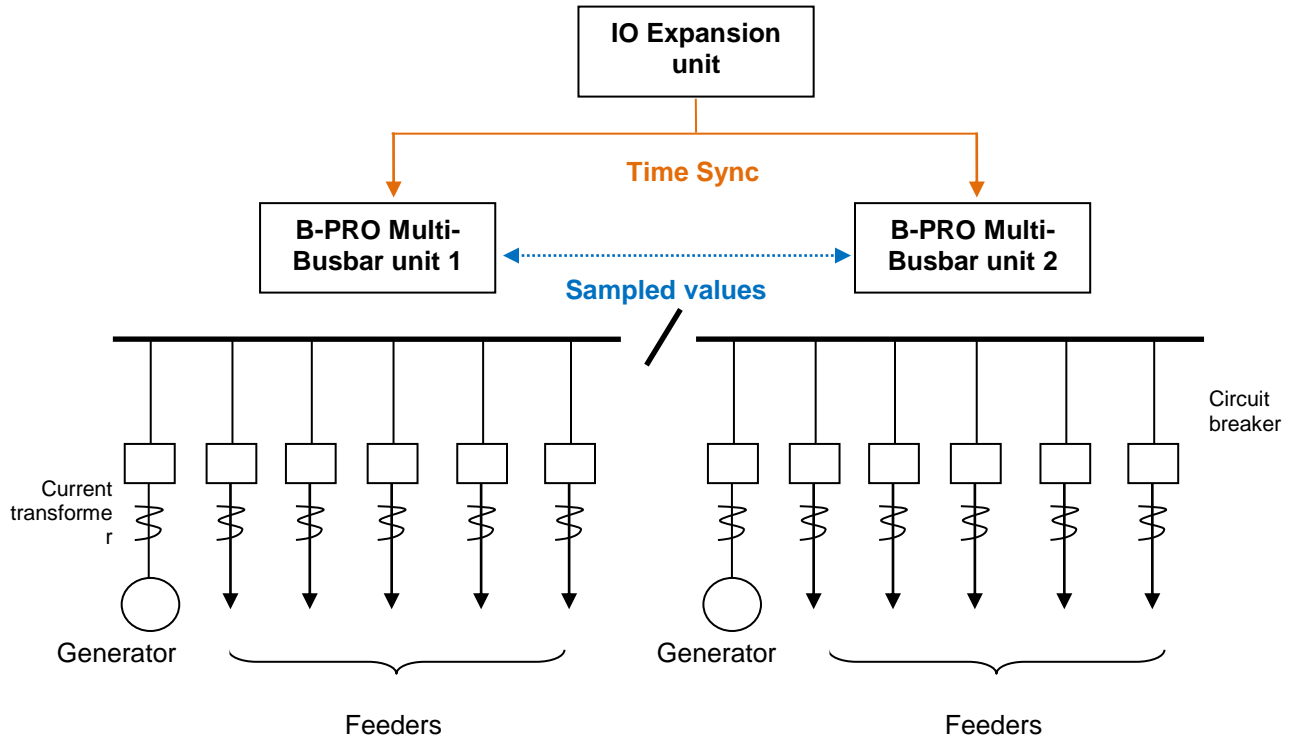


Figure 1: Single line diagram of the system with B-PRO Multi-Busbar Protection and I/O Expansion units

Figure 1 shows the test setup used to evaluate the performance of relays. In this testing, each relay is connected to 6 bays (total of 12 bays for 2 units) and tests are conducted by connecting two B-PRO Multi-Busbar Protection units.

2.2 Devices in the Setup

1. An I/O Expansion unit.
2. Two B-PRO Multi-Busbar units.

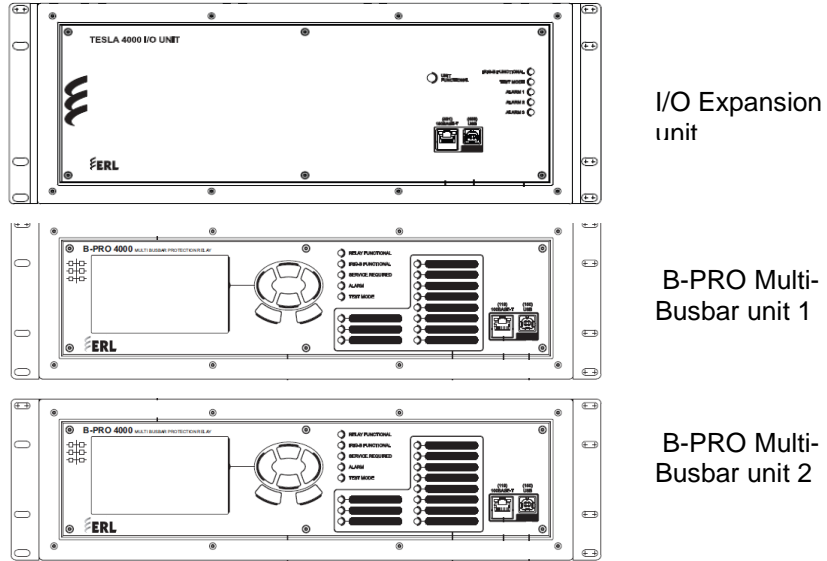


Figure 2: Test setup (front panel)

External Connections

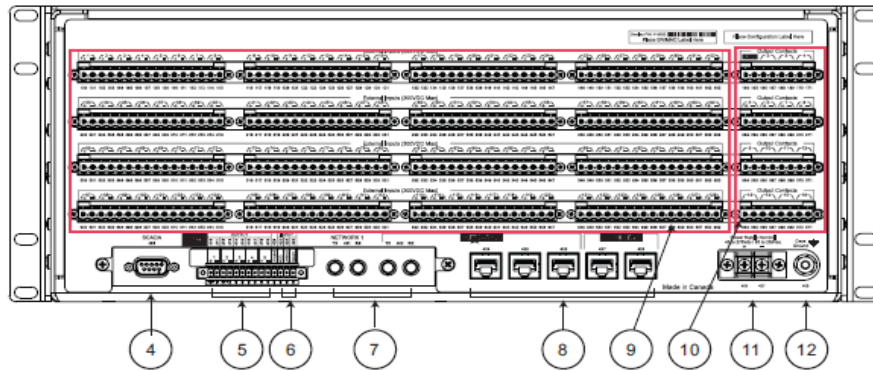


Figure 3: Rear panel of an I/O Expansion unit

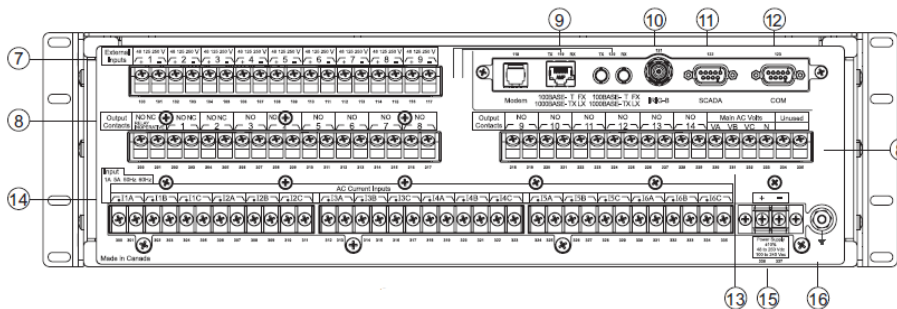


Figure 4: Rear panel of a B-PRO Multi-Busbar unit

2.2.1 Time Input (Via I/O Box)

Both the ERL I/O Expansion unit and B-PRO Multi-Busbar units are equipped to handle modulated or un-modulated GPS satellite time IRIG-B signals (please refer to B-PRO 4000 Multi-Busbar Protection [1] and I/O Expansion [2] user manuals). Modulated or un-modulated IRIG-B time signal input is connected to port 6 shown in Figure 3. Both B-PRO Multi-Busbar units can be synchronized with the IRIG output from the I/O Expansion unit by connecting port 10 (as shown in Figure 4) of both B-PRO Multi-Busbar units to port 5 (as shown in Figure 3) of the I/O Expansion unit. This connection will synchronize all the B-PROs to a common reference time (to a system sync generated by the I/O Expansion unit), in stations where a GPS clock is not available.

2.2.2 Network Architecture

As shown in Figure 5, the two B-PRO Multi-Busbar units and I/O Expansion unit are connected to exchange digitized current signals using IEC 61850 Sampled Values (SV).

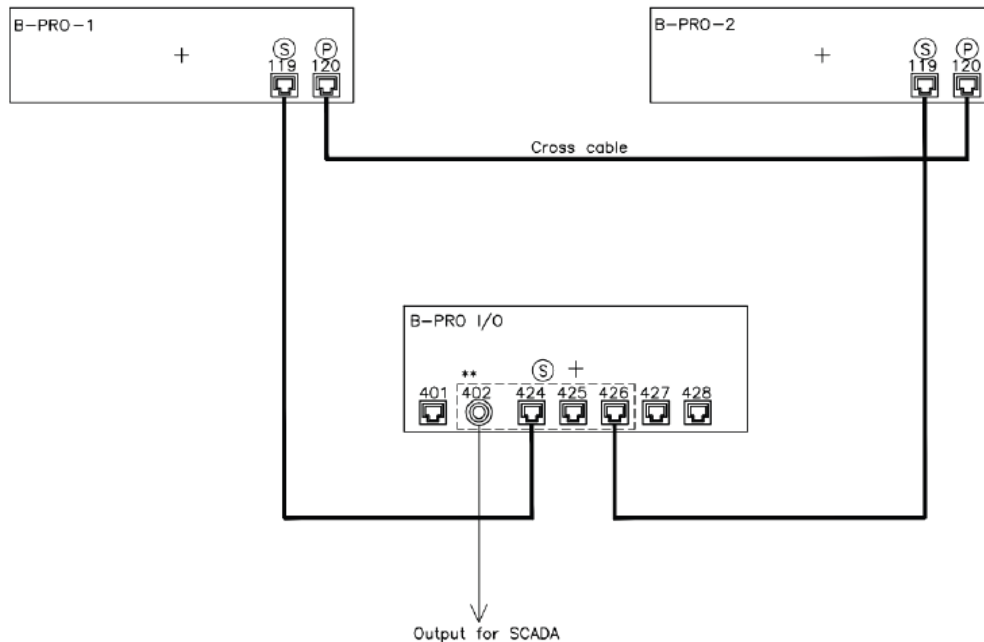


Figure 5: Network architecture for two B-PRO units and one I/O unit

8 References

- [1]. B-PRO 4000 Multi-Busbar Protection User Manual, ERLPhase Power Technologies, Winnipeg, MB, Canada.
- [2]. ERL Digital I/O Expansion User Manual, ERLPhase Power Technologies, Winnipeg, MB, Canada.