

GE Power Management

Universal Relay Family

B30 Presentation

Q&As



Contents...

- ▶ Application
- ▶ Algorithm
- ▶ Biased Characteristic
- ▶ Dynamic Bus Replica
- ▶ CT Trouble



Application #1

- **Q:** How many circuits can be protected by a single B30?
- **A:** 6 or 5. If the voltage signal is not required the B30 can protect up to 6 circuits. With the voltage signal up to 5 circuits can be protected.



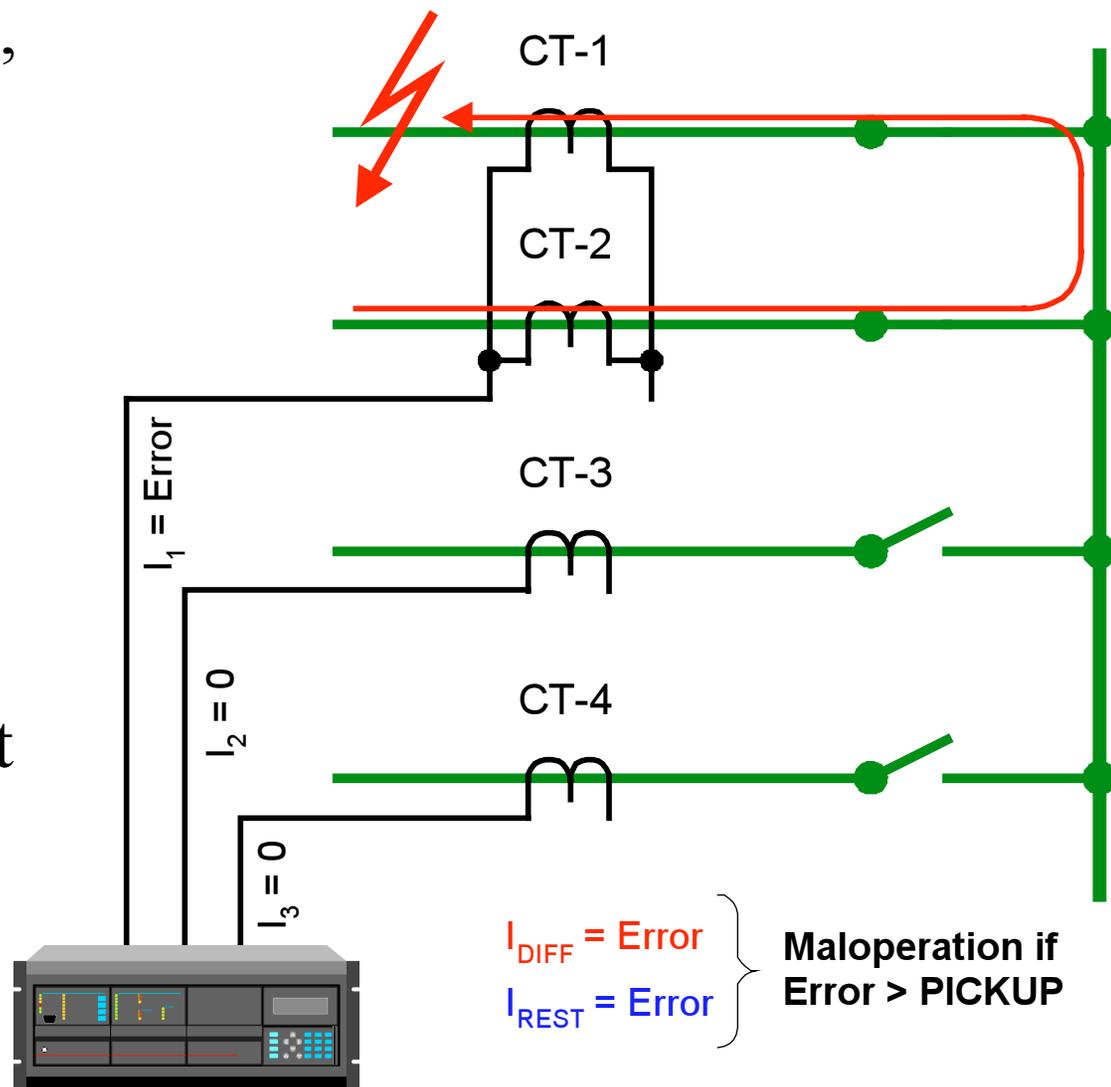
Application #2

- **Q:** Can I sum up several currents externally and extend the B30 application to more than 6 (5) circuits?
- **A:** **This is NOT recommended.** By doing so one may significantly degrade performance of the relay.



Application #2

- In some situations, the relay becomes an unbiased differential relay because the restraint current may not be reflected properly as the fault current enters and leaves the zone without producing any bias.



Application #2

- **A:** Upon user preferences several currents may be summed up externally if:
 - they do not require the dynamic bus replica mechanism, or share exactly the same connection status
 - the “summed up circuits” are pure loads; they cannot produce any fault current, and their zero sequence back-feed is definitely insignificant
 - the settings reflect the peculiarity of this application



Application #3

- **Q:** Is there any chance to protect multi-section buses with a number of B30?
- **A: Yes.** If each section has up to 6 circuits connected (including ties), several B30s – ultimately one B30 per bus section – can be used to provide protection for the entire busbar.



Application #4

- **Q:** Can I protect buses with “switchable” circuits without mechanical switching of the CT secondaries?
- **A: Yes.** The B30 provides for the dynamic bus replica by associating a digital status signal with each current of the bus differential zone.



Application #5

- **Q:** How many differential zones can be configured in the B30?
- **A:** **One** zone can be configured.



Application #6

- **Q:** When supervising the bus differential element (such as using the undervoltage element or an external check zone) shall I use the BLOCK input or just AND the FlexLogic™ operands?
- **A:** One should AND the FlexLogic™ operands. The BLOCK input stops execution of the element and may cause malfunction of the Saturation Detector.



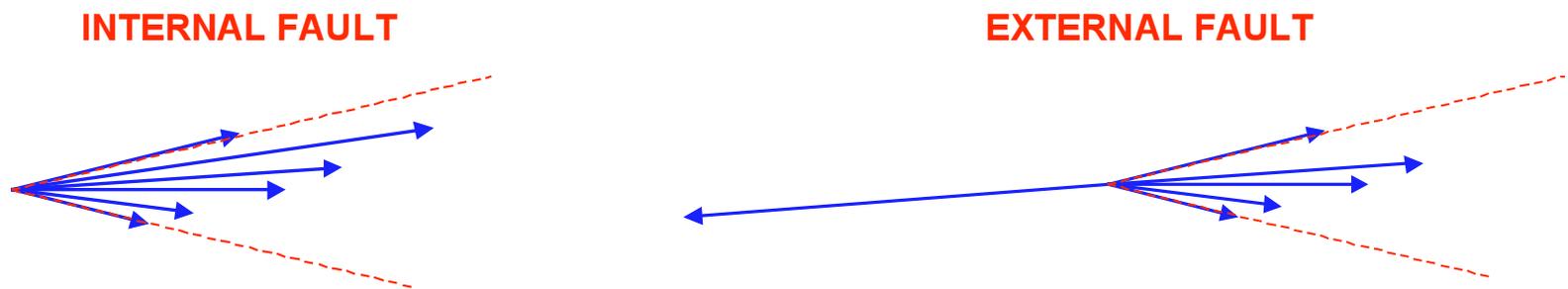
Algorithm #1

- **Q:** Why there is no threshold setting for the directional principle (no current supervision)?
- **A:** The threshold to decide whether or not a given current should be considered by the directional principle is generated automatically in proportion to the value of the restraint signal, the higher breakpoint of the biased characteristic and the number of circuits configured as the protected bus.



Algorithm #2

- **Q:** How is it possible to use the directional principle without the voltage signal?
- **A:** The directional principle checks the relative direction of the currents, i.e. compares the phase angles of the currents. The absolute direction (the one established with the help of voltage) is not required.



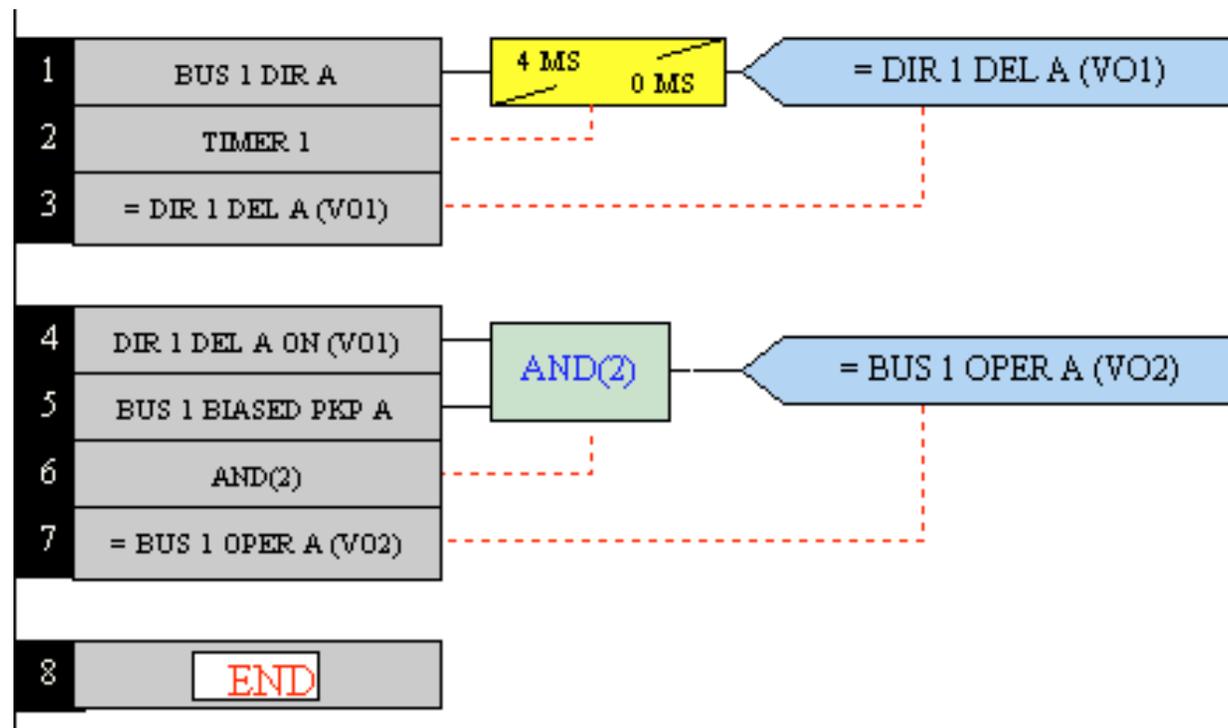
Algorithm #3

- **Q:** Can I program my own principle of operation (logic) reflecting my own preferences and practice?
- **A: Yes.** All the key logic signals (flags) are available as FlexLogic™ operands. Using the FlexLogic™ capabilities of the B30 one can build his/her own algorithm. The following slide shows an example.



Algorithm #3

- **Example:** 2-out-of-2 operating mode with extra security for the directional principle



Algorithm #4

- **Q:** Is there any off-line tool I can use to analyze the B30 performance?
- **A: Yes.** A stand-alone off-line tool is provided for this purpose. The program is a phasor (steady-state) model of the B30 algorithm. The user enters the B30 settings and phasor values. The basic B30 quantities and logic signals are analyzed and displayed. Visit the GEPM web page at <http://www.ge.com/indsys/pm> to get a free copy of the program.



Algorithm #4

UR B30 DIFFERENTIAL PROTECTION - PHASOR MODEL

File Edit Operate Windows Help

UR - B30 DIFFERENTIAL PROTECTION (PHASOR MODEL)

B30 Settings

PICKUP p

LOW SLOPE %

LOW BPNT p

HIGH SLOPE %

HIGH BPNT p

HIGH SET p

Number of circuits

I DIFF A

I REST A

Dir Ang deg

I BASE A

DIFF (L) ●

DIFF (H) ●

DIR ●

SAT ●

DIFF OP ●

HIGH SET ●

Circuit #1	Circuit #2	Circuit #3	Circuit #4	Circuit #5	Circuit #6
I mag <input type="text" value="4.25"/> A	I mag <input type="text" value="3.10"/> A	I mag <input type="text" value="4.50"/> A	I mag <input type="text" value="6.25"/> A	I mag <input type="text" value="1.62"/> A	I mag <input type="text" value="7.50"/> A
I dir <input type="text" value="5.00"/> de	I dir <input type="text" value="180.00"/> de	I dir <input type="text" value="10.00"/> de	I dir <input type="text" value="7.00"/> de	I dir <input type="text" value="0.00"/> de	I dir <input type="text" value="180.00"/> de
CT <input type="text" value="1000.00"/> A	CT Prim <input type="text" value="1000.00"/> A	CT Prim <input type="text" value="1000.00"/> A	CT Prim <input type="text" value="1000.00"/> A	CT Prim <input type="text" value="1000.00"/> A	CT Prim <input type="text" value="1000.00"/> A
CT Sec <input type="text" value="1A"/>					
Breaker <input checked="" type="checkbox"/> ON	Breaker <input checked="" type="checkbox"/> ON	Breaker <input checked="" type="checkbox"/> ON	Breaker <input type="checkbox"/> OFF	Breaker <input checked="" type="checkbox"/> ON	Breaker <input type="checkbox"/> OFF

Help

Breaker

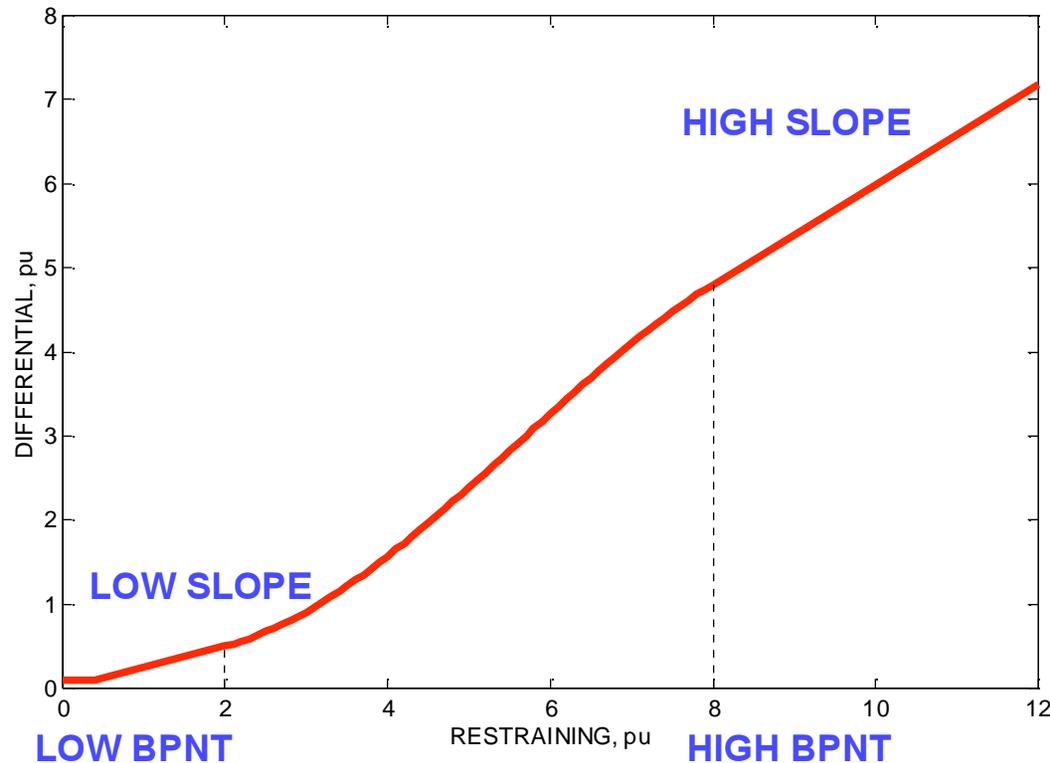
Breaker ON/OFF Status

Click on the switch to change the breaker status. If the breaker is opened the current (if any) will be ignored by the B30 as it is assumed that the dynamic bus replica is configured correctly.



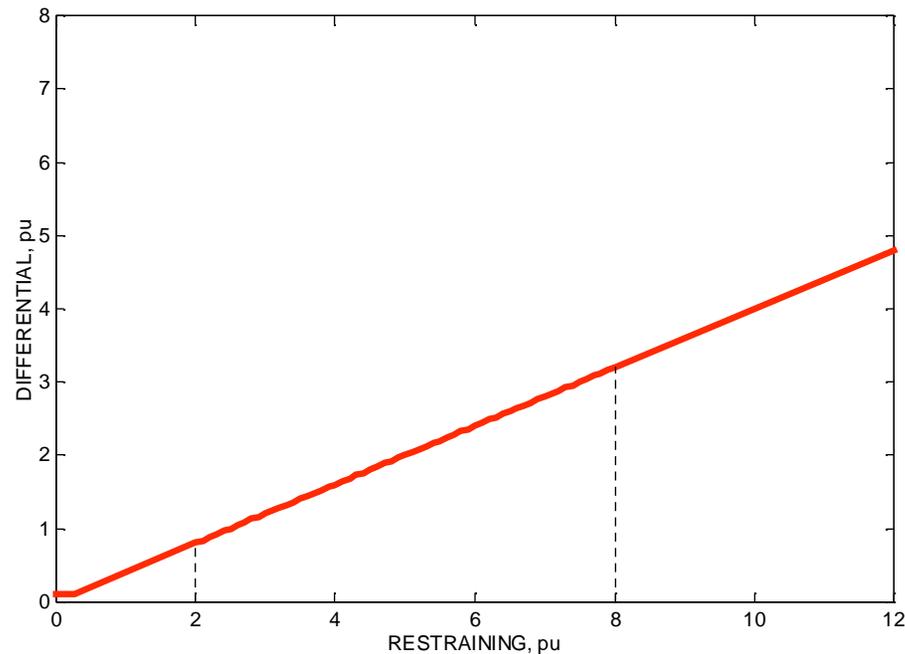
Biased Characteristic #1

- **Q:** I want to apply the characteristic of a shape different from the default. Is there a way to do that?
- **A:** Yes. The following slides present examples.



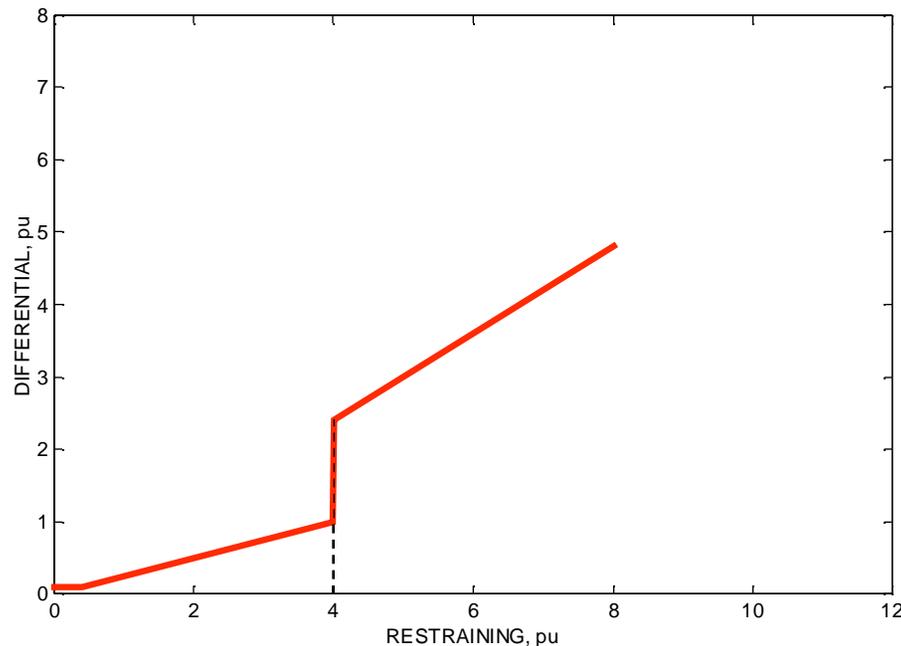
Biased Characteristic #1

- Single slope characteristic:
 - LOW SLOPE = HIGH SLOPE = required value
 - Breakpoints must be set according to the B30 guidelines (important for saturation detection - see the *Theory of Operation* chapter in the Manual)



Biased Characteristic #1

- Single breakpoint characteristic:
 - LOW BPNT = HIGH BPNT = required value
 - The value selected will have a bearing on the performance in a number of ways (see the *Theory of Operation* chapter in the Manual)



Dynamic Bus Replica #1

- **Q:** How often is the dynamic bus replica refreshed?
- **A:** The status of the input contacts is read 8 times per cycle. A new status is accepted by the relay if the change prevails for 2 consecutive protection passes. As a result any change in the state of the input contacts is recognized in **4.2 msec on 60Hz systems and 5 msec on 50Hz systems**. No extra delay is introduced by the algorithm.



Dynamic Bus Replica #2

- **Q:** Do I have to connect both normally open and normally closed contacts for the dynamic bus replica?
- **A:** The dynamic bus replica mechanism is formed from two parts: (1) The algorithm requires a digital (on/off) signal indicating the connection status of a given circuit, and (2) The user is expected to form such a signal in FlexLogic™ when required following his/her own practice. **It is up to the user what contacts to use.**



Dynamic Bus Replica #3

- **Q:** Do I always have to use the dynamic bus replica?
- **A: No.** The mechanism should be used only when a circuit may carry a non-zero current while being connected to a bus/bus section different than the protected one. The status signal of the bus differential element should not be used to replicate the breaker status of the circuit that can be connected only to the protected bus.



Dynamic Bus Replica #4

- **Q:** I do not have to use the dynamic bus replica mechanism. What do I use in place of the status signals?
- **A:** One should use the “On” FlexLogic™ constant. The digital value “on” (“high”) for the status means that the circuit cannot be connected to any other bus/bus section. Even if the breaker is opened, the circuit belongs to the protected bus and its current (being zero) is processed by the algorithm.



Dynamic Bus Replica #5

- **Q:** Does the dynamic bus replica mechanism include isolator (switch) alarms?
- **A: No.** The dynamic bus replica is partly formed by the user according to his/her practice. If required, the normally opened and normally closed contacts may be connected and an appropriate filtering/timing logic can be applied to produce the status signals of the bus replica as well as the isolator alarm signals.



Dynamic Bus Replica #6

- **Q:** Does the dynamic bus replica include any routing mechanism for the trip signal?
- **A: No.** The routing mechanism for the trip signal should be formed by the user in FlexLogic™ or externally. As a rule, the trip signal for a given bus (zone of protection) has to be supervised (logically AND-ed) by the connection status signal of this circuit.



CT Trouble #1

- **Q:** Does the CT Trouble invariably indicate a CT having a problem?
- **A: No.** The CT trouble feature monitors the level of the differential current. As such it senses the net bus current without attributing the existing differential signal to any circuit.



CT Trouble #2

- **Q:** Will the CT Trouble ever operate, given its time delay, if the bus differential element is not supervised by any extra condition?
- **A:** The CT trouble feature may not have a chance to operate as the bus differential element may maloperate first (if not supervised). The primary usage for the CT trouble function is when the differential element is supervised by an undervoltage check, for example, and will not maloperate due to CT problems.



CT Trouble #3

- **Q:** What is a typical application of the CT Trouble monitoring element?
- **A:** Application of the CT Trouble element may vary from not using it at all and allowing the bus differential element to trip during CT trouble conditions (to avoid bus faults caused by a damaged CT) to blocking the bus differential element by the CT trouble monitoring element and relying on / enabling / modifying the settings of the backup bus protection.



CT Trouble #4

- **Q:** Is the voltage supervision a perfect remedy to maloperation under CT trouble conditions?
- **A: No.** Voltage supervision will prevent immediate maloperation of the differential element and buy some time to solve the problem (switch off the troubled circuit, for example). A combination of CT trouble (spurious differential signal) and external fault (undervoltage situation) conditions is very likely to cause maloperation.



CT Trouble #5

- **Q:** Does the B30 provide for an external check zone?
- **A:** **Not directly.** An external check zone may be implemented by summing the currents from independent CTs externally and supplying the resulting current to a relay (it consumes one CT input). A simple IOC check on such independent differential current will cope with maloperation of the differential element due to CT trouble conditions.

