ABB **Application Note**

Substation Automation and Protection Division

Torque Controlled Overcurrent Protection in the DPU2000R Relay Using the 21P Element

The DPU2000R relay with firmware version higher than 5.0 includes a distance element consisting of four zones. Two of these circular characteristic zones are in the forward direction, while two are in the reverse direction. If the relay is applied in sub-transmission line protection, it may be advantageous to torque control the overcurrent element of the relay. Another words, controlling the overcurrent functions by the distance element is possible in the DPU2000R relay. In addition, the relay does include a directional controlled overcurrent element, namely 67P & 67N. However, these will control the overcurrent units for directionality only. The 21 distance element will control the overcurrent protection function in not only direction, but only respond positive permitting the overcurrent element to operate if the fault is determined to within the circular characteristic zone or within the reach of the 21 impedance element. This feature will limit operation of the overcurrent function therefore to direction and distance of the fault from the terminal of the line.

All zones of the 21P element of the DPU2000R relay with firmware version 5.20 and higher have a voltage memory feature for six (6) cycles. This is important in that if the relay were to observe a close in fault, where there was no or insufficient voltage for the distance element to operate due to a voltage collapse, the memory of six cycles of voltage will permit the protective unit to correctly function. Depending on the settings of other protective elements in the DPU relay, they may also operate for this condition.

The distance feature of the DPU relay permits positive operation or torque to be applied to the selected overcurrent unit for the reach setting of the distance zone that is selected. The directional overcurrent feature of the relay, namely the 67P & N elements, will provide similar protection, but will operate for the given direction regardless of the distance to the fault. The overcurrent unit will operate on magnitude providing the direction is in the correct direction.

Configuration

The following overcurrent functions in the logical inputs may be programmed to be torque controlled:

- PH3 Used to torque control all phase overcurrent protection except 50P-3.
- 50-1 Used to torque control the 50P-1 & 50N-1 elements.
- 50-2 Used to torque control the 50P-2 & 50N-2 elements.
- 50-3 Used to torque control the 50P-3 & 50N-3 elements.

Select the distance zone to provide the torque controlling protection;
21P-1, -2, -3, -4. Note: Zones 1 & 2 are in the forward direction, zones; while zones 3 & 4 are in the reverse direction.

In the settings section of the Win ECP program, select the Programmable Outputs.

Select the distance element to be used for torque controlling the overcurrent element, List it and with the feedback screen selected, click onto feedback FBO #1 This will automatically connect to feedback FBI #1. A red square will show on the screen. Make certain that the same numerical FBO and FBI are used if number one is unavailable. Refer to figure 1.
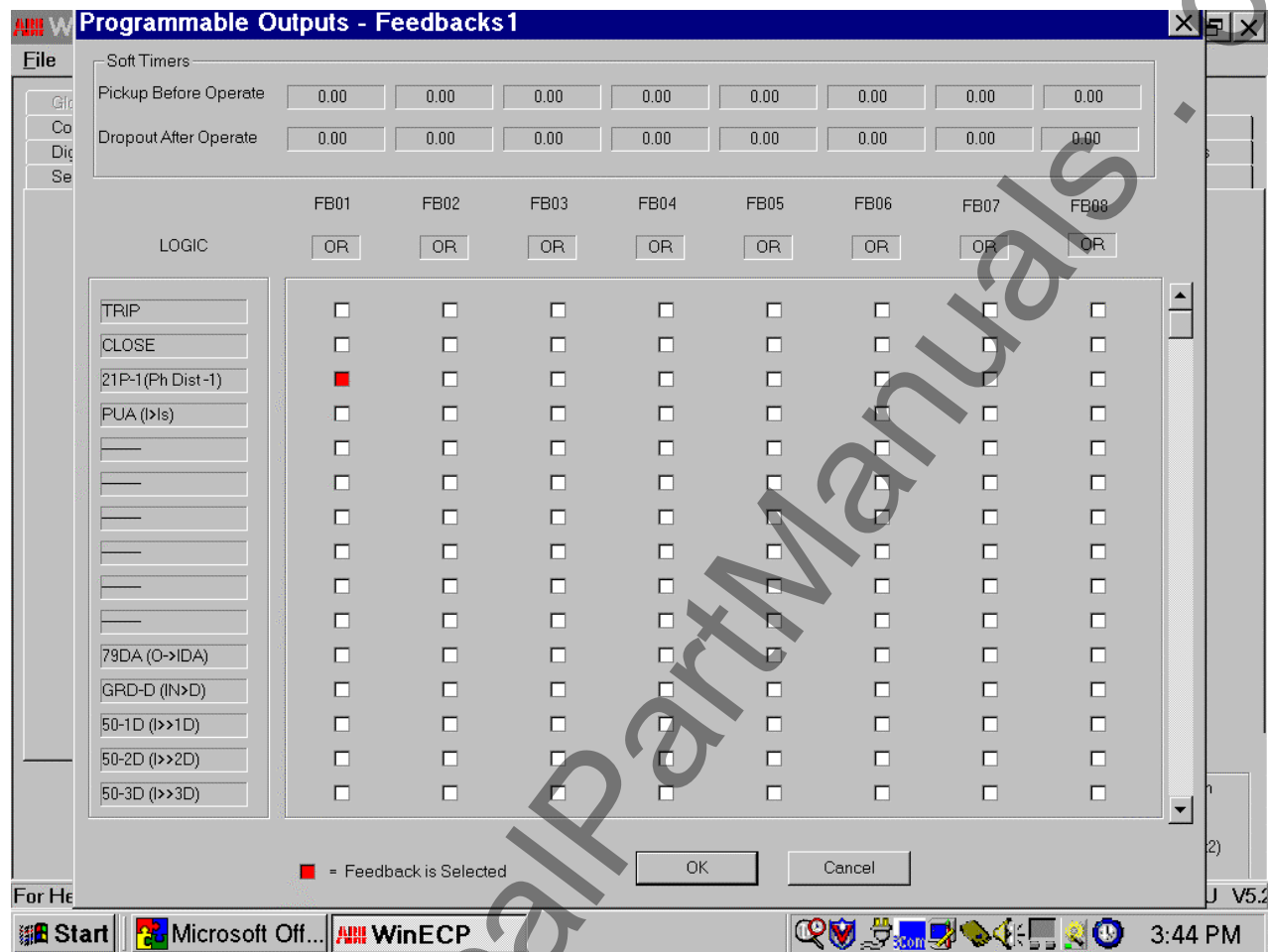
Figure 1 - Output Feedback Logic Configuration

In this example the 21P-1 element has been selected as the torque controlling element and applied to feedback output number 1.

Select the programmable inputs of the settings section, and select from the available torque controlled overcurrent functions listed above the function to be controlled. Click onto the FBI (same corresponding number in the feedback screen). This will insure that the overcurrent function selected is now torque controlled by the 21P element selected, a red square will so note this selection. Refer to figure 2.
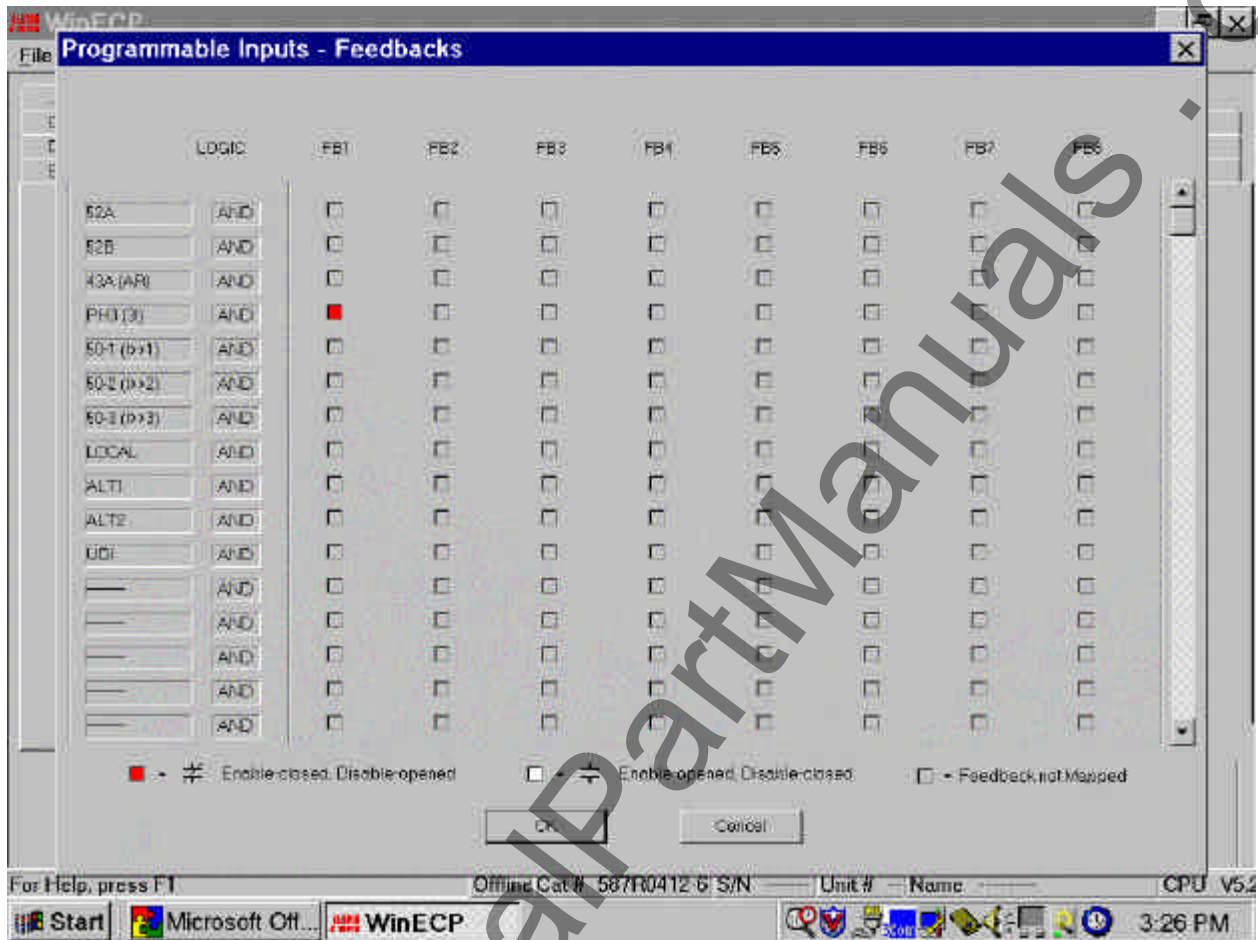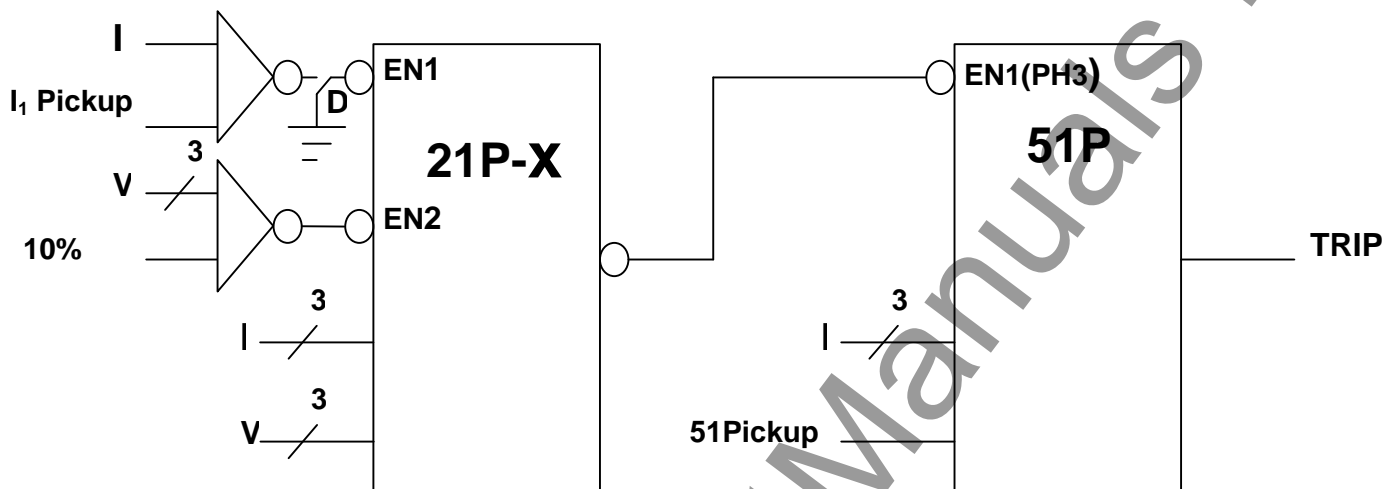
Figure 2 - Input Feedback Logic Configuration

In this example, Feedback number 1 is applied to the PH3 phase torque control input.

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Shown below is the logic diagram of the 21P element supervising the overcurrent unit, either a 50P or 51P unit.

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