



Substation Automation and Protection Division

## Using the Level Detector Functions LLDA and HLDA in the TPU2000R to Supervise Breaker Tripping Based upon the Fault Current Level

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### *Introduction*

A user of the TPU2000R transformer protection relay has a switch with limited short-circuit interrupting capability on the high side of the transformer. He desires that operation of the switch be blocked for fault currents above a certain level, and the trip signal be re-routed to a remote high voltage circuit breaker.

The TPU2000R provides a high-speed current-level detector for each winding. For winding #1, the detector is LDA-1, and its threshold setting is made as a multiple of the 51P-1 phase-time-overcurrent setting. The setting range is 0.5 to 20 multiples in increments of 0.1. The associated logical output functions are LLDA1 (asserted when the winding #1 current is below the set threshold) and HLDA1 (asserted when the current is above the set threshold).

The flexibility provided in the TPU2000R in the input and output programmable logic settings makes it easy to set up the logic to supervise the two fault interrupting devices. This application will make use of the Feedbacks and User Logical Functions to implement the required scheme.

### *Assumptions for this Example*

The following assumptions will be used in our example: Switch A1 on the high voltage side of the transformer is to operate for all differential and overcurrent faults below the set threshold of LDA-1. For faults above the set threshold, operation of Switch A1 is to be blocked, and a trip signal sent to the upstream high voltage circuit breaker B2. Back-up protection for through-faults on the medium voltage side of the transformer (winding 2) will send a trip signal to medium voltage Circuit Breaker C3.

### *Implementation*

Figure 1 shows the screen capture from the Programmable Outputs settings, Feedbacks. OR logic is selected for FBO1 at the top of its column. Feedback Output #1 is asserted when one or more of the following high-side protective elements operate: Differential (87T or 87H), Phase Instantaneous Overcurrent (50P-1), Phase Time-Overcurrent (51P-1), Ground Instantaneous Overcurrent (50N-1), Ground Time-Overcurrent (51N-1).

Figure 2 shows the Programmable Input screen, where the Feedback #1 is programmed to assert User Logical Input #1 when one or more of the high side protective elements operate.

Figure 3 shows the User Logical Input/User Logical Output configuration screen, showing that a direct connection has been set between ULI1 and ULO1. Therefore, when ULI1 is asserted, ULO1 becomes asserted.

Figure 4 shows the Programmable Output screen. Physical Output #1 has been assigned to trip Switch A1. Output #2 has been assigned to trip the high-voltage circuit breaker B1. Physical Output #3 has been assigned to trip the medium voltage breaker C3 on the winding 2 side of the transformer.



Using the Level Detector Functions LLDA and HLDA in the TPU2000R to Supervise Breaker Tripping based upon Fault Current Level AN-91D-02

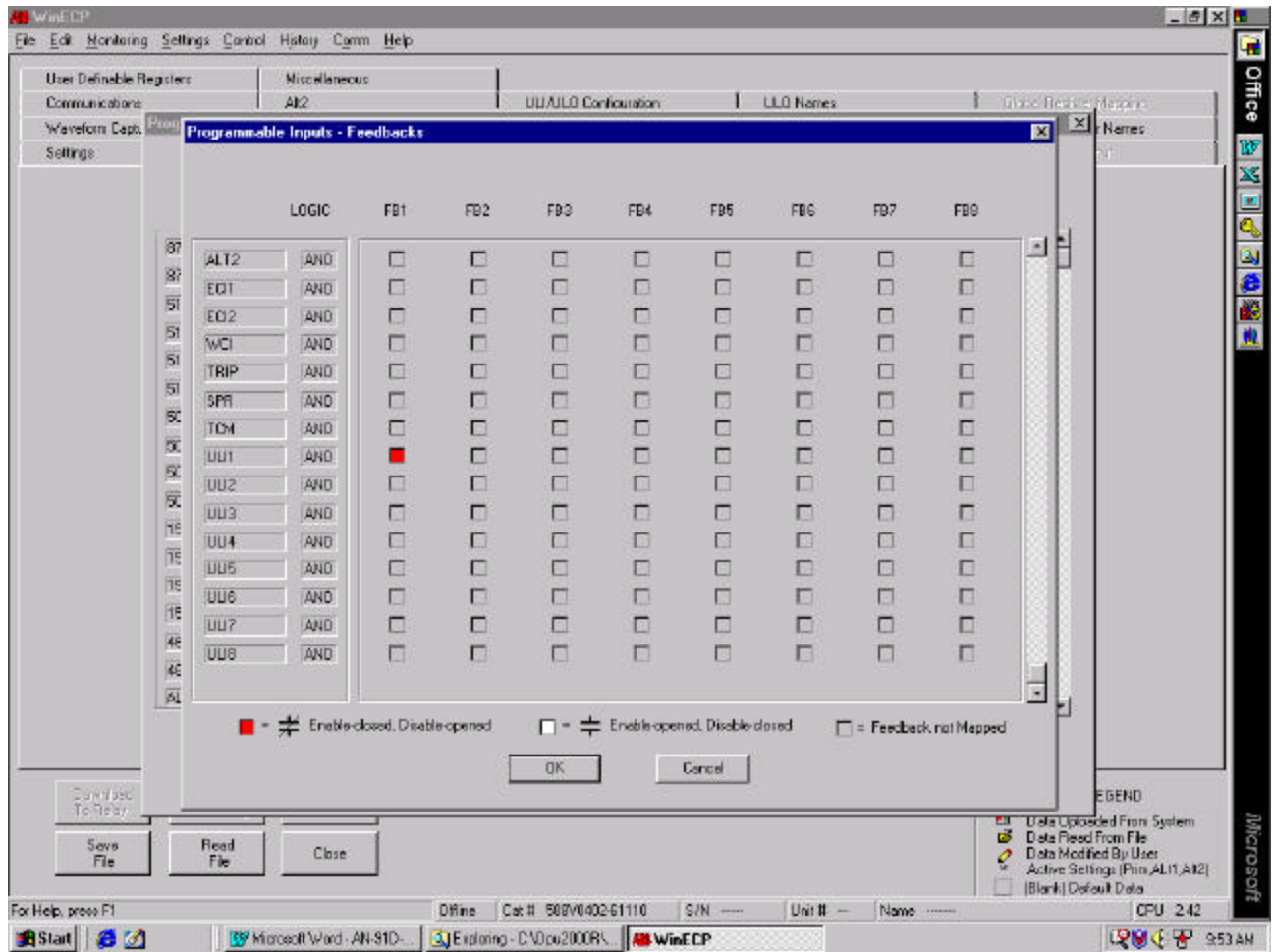


Figure 2 - Programmable Inputs Screen

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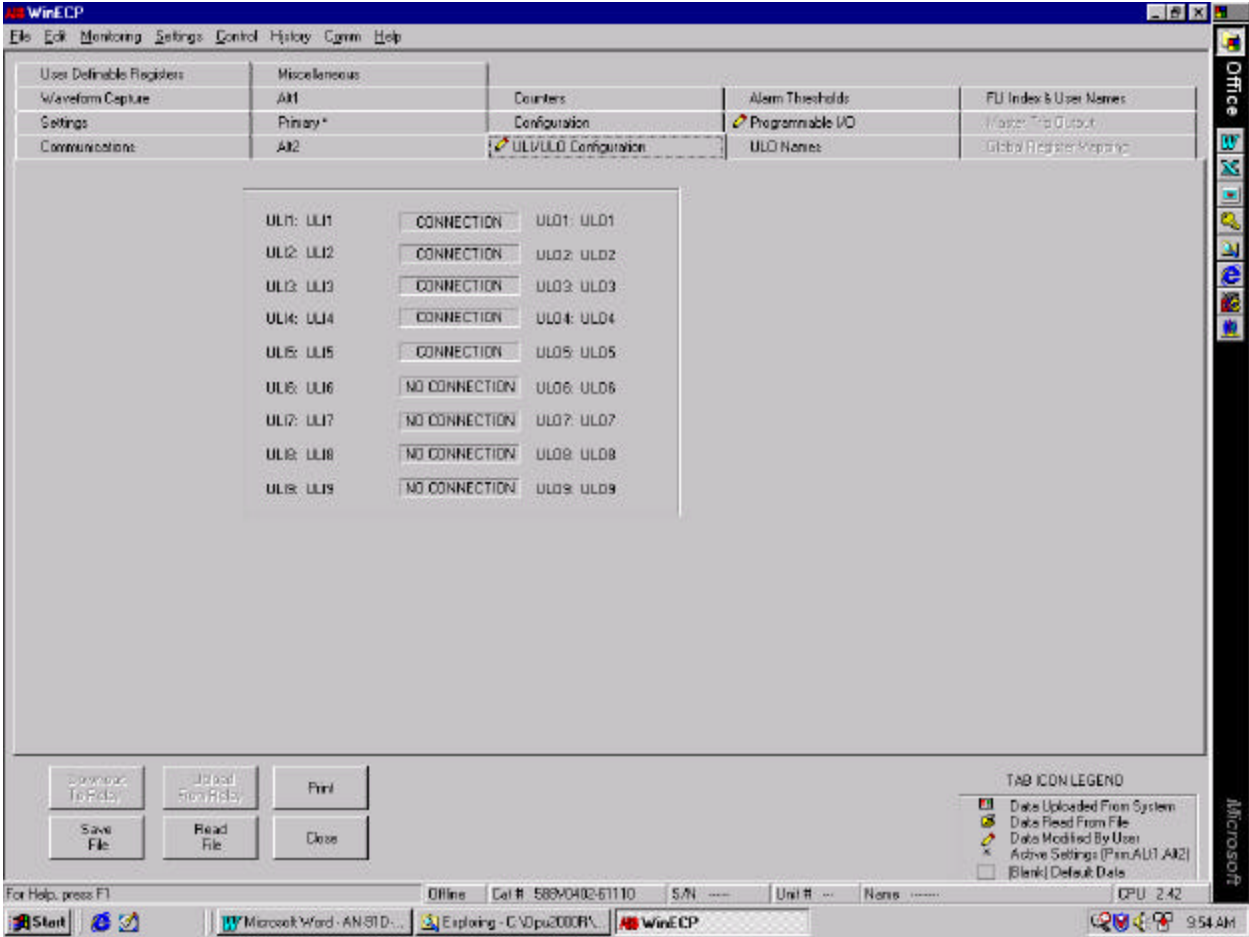


Figure 3 - ULI / ULO Configuration Screen

Using the Level Detector Functions LLDA and HLDA in the TPU2000R to Supervise Breaker Tripping based upon Fault Current Level AN-91D-02

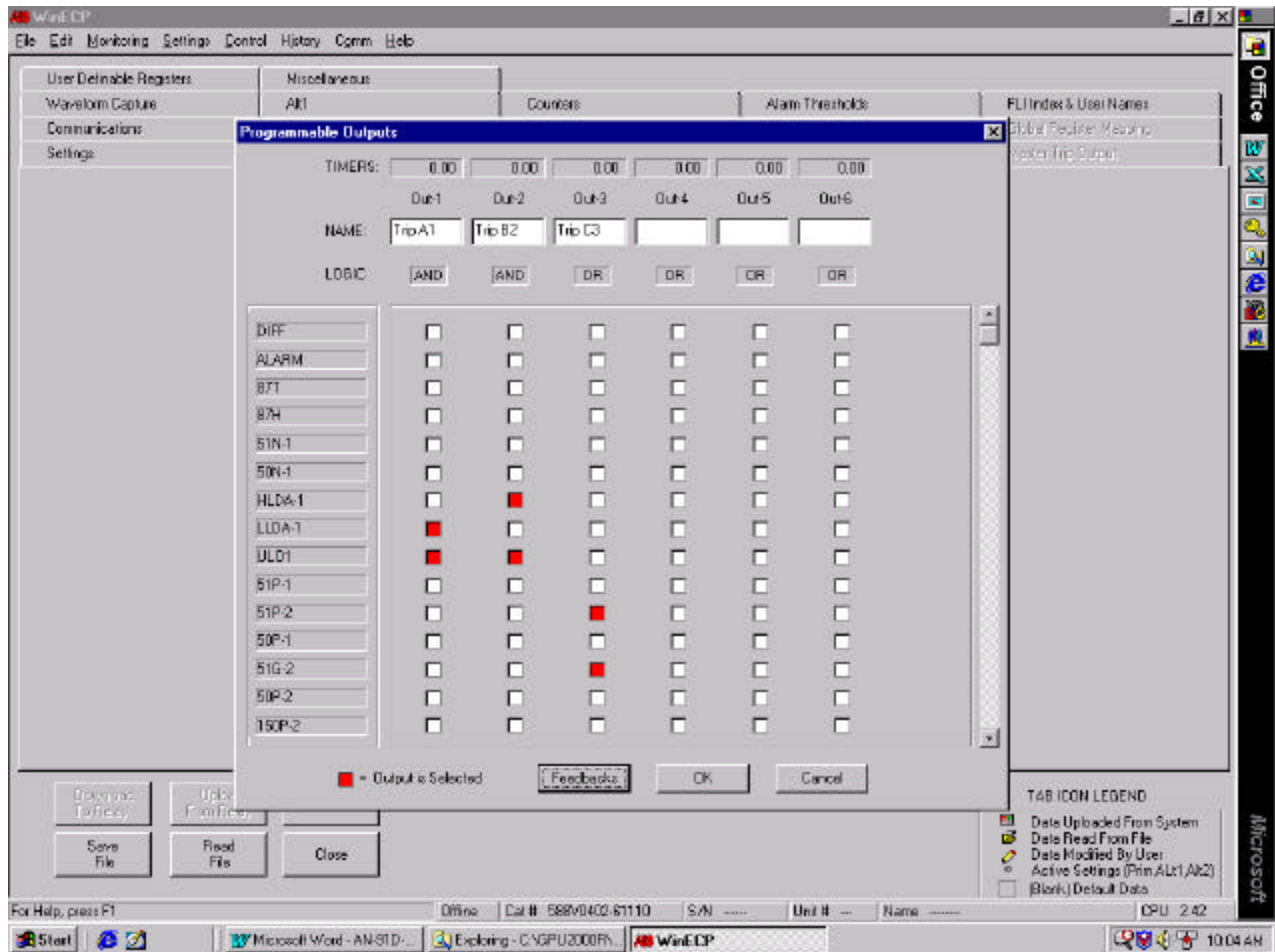


Figure 4 - Programmable Outputs Screen

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