Advanced Programmable Logic
Using ABB 2000R Series Intelligent Electronic Devices

Introduction

The programmable logic features in the ABB 2000R series relays are designed to provide complex and easy to build logic functions. Virtually any desired logic scheme can be accomplished through the advanced programmable I/O features in the 2000R relay. This application note explains how to build complex logic schemes in the 2000R relay. To describe the various functions, some terms need to be defined:

Definitions

Physical Inputs

These are hard wired inputs to the relay. Physical Inputs 1 - 6 are "single ended" inputs and require only a positive voltage on its terminals to denote a HIGH state. Physical Inputs 7 and 8 are "double ended" inputs requiring both positive and negative voltage on the terminals to denote a HIGH state.

Physical Outputs

These are hard wired "dry" output contacts from the relay. There are a total of 6 Physical Outputs on the 2000R relays.

Logical Inputs

In the programmable input table in ECP, the leftmost column lists the Logical Inputs to the relay. Logical Inputs are the protective functions in the relay that can be enabled or disabled via "input mapping". When a Logical Input is true, the function is enabled. When the logic to the Logical Input is false, the function is disabled. A simple example of how logical inputs work is shown below:

		IN1	**IN2**
50-1	AND	C	O
46	AND	C	
67P	AND		

In the above example, the first level of instantaneous (50-1) is enabled ONLY when IN1 is HIGH (has a + voltage wired to it) AND IN2 is LOW (no voltage wired to it).

The 46 function is enabled only when IN1 is HIGH.

The 67P function, since it is not "mapped", is enabled by default. Please note that this function can also be disabled through the primary settings table.

Logical Outputs

In the programmable output table in ECP, the leftmost column lists the Logical Outputs of the relay. Logical Outputs determine the state of a protective function in the relay. For example, the Logical Output 51P is considered HIGH when the 51P is in the TRIP state. the Logical Output 51P is considered LOW when 51P is dropped out.

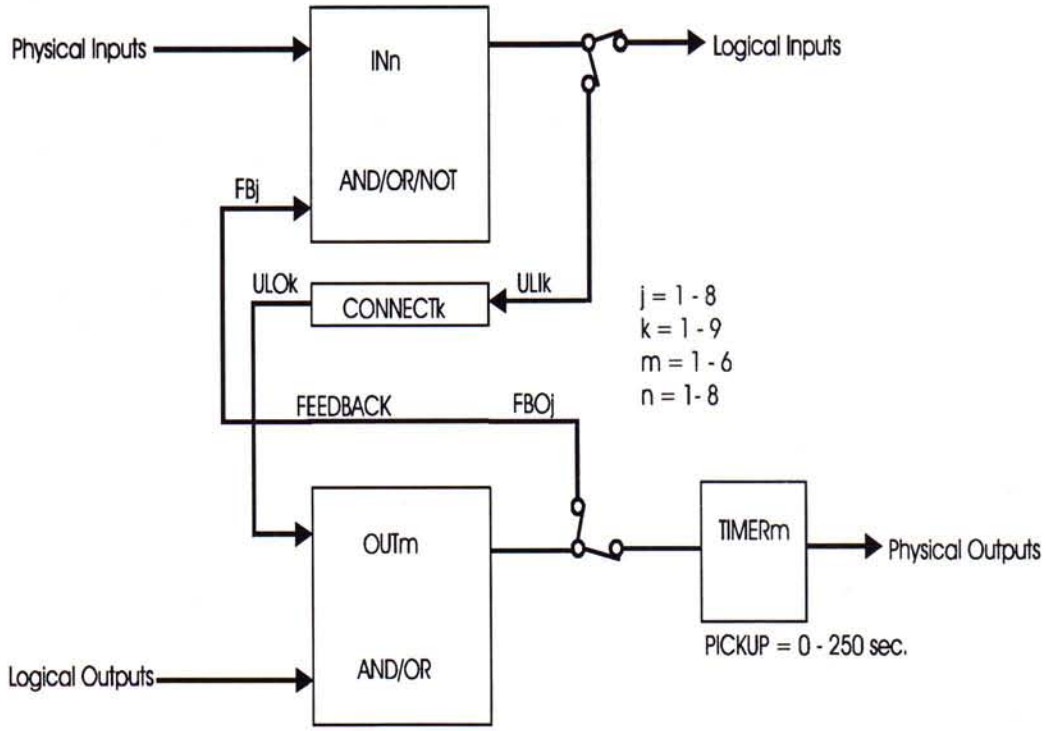
User Logical Inputs/User Logical Outputs

User Logical Inputs (ULI's) and User Logical Outputs (ULO's) are variables in the relay to be defined by the user. They can be considered "FEEDFORWARD" logic. When ULI1 goes HIGH, then ULO1 will automatically go HIGH. (User Logical Inputs can also be disconnected from its corresponding User Logical Output. In this case, if ULI1 is disconnected from ULO1, and ULI1 goes HIGH, then ULO1 will not be affected. This is used primarily for SCADA applications where the user can "force" a ULO HIGH for some control function.) For the purposes of this application note, all ULI's are connected to their corresponding ULO's.

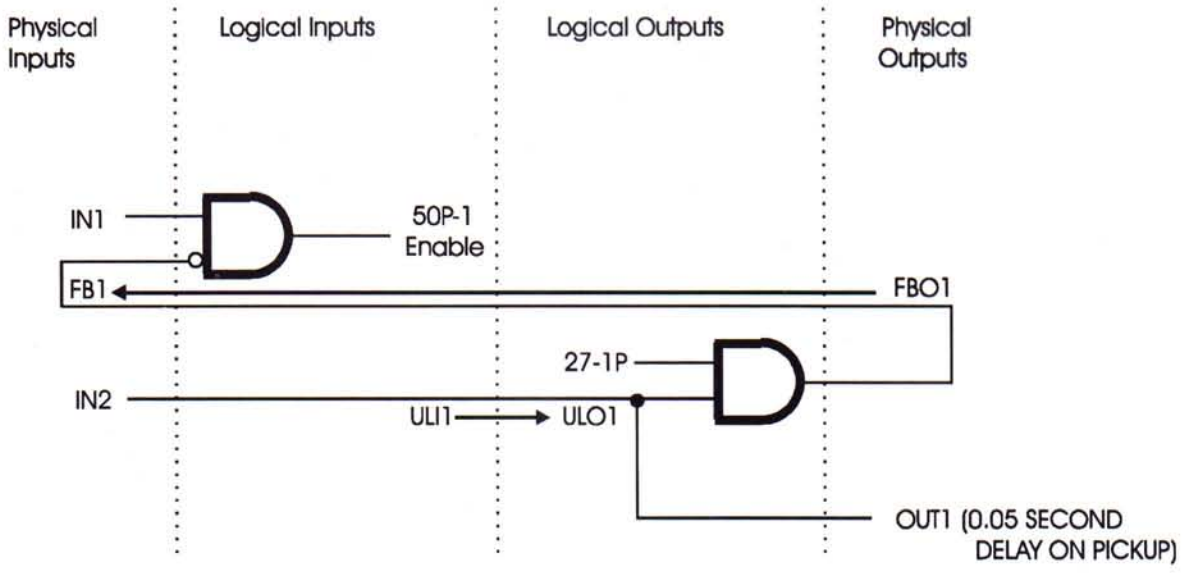
Feedbacks

Feedbacks are similar to ULI/ULO's but are used for Feedback Purposes. When Feedback Output 1 (FBO1) goes HIGH, then Feedback Input 1 (FB1) will automatically go HIGH.

The above definitions provide building blocks necessary to describe the logic features of the 2000R relays.



The advanced features of the 2000R relays can be best described by example. A user would like to implement the following logic in a 2000R relay:



In the above example, the 50-1 function is enabled when IN1 is HIGH (denoted by a C in the Programmable Input map) **AND** FB1 is LOW (denoted by an O in the Programmable Input map).

When IN2 is HIGH, then ULI1 goes HIGH. When ULI1 is HIGH, then ULO1 *automatically* goes high. When ULO1 goes HIGH, OUT1 closes after a 0.05 second delay. FBO1 will go HIGH immediately as long as ULO1 is HIGH **AND** the 27-1P function is Tripped. When FBO1 goes HIGH, then FB1 *automatically* goes HIGH. When FB1 goes HIGH, then 50-1 is disabled. If the 27-1P is NOT tripped, then FBO1 will remain low and 50-1 is enabled.

Conversely, when IN2 is LOW, then ULI1 is LOW, forcing ULO1 to go LOW. When ULO1 goes LOW, OUT1 opens immediately (The timer is a Time Delay on Pickup) and FBO1 becomes LOW immediately. In this case, with the condition that IN1 is still HIGH, then 50-1 is enabled. The required mapping is shown below:

Programmable Inputs

Logical Inputs	IN1	IN2	IN3	FB1	FB2
.					
.					
50-1	AND - -	C- - - - - - - - - - - - - - -		O	
ULI1	AND- - - - - - -	C			
.					

Programmable Outputs

Logical Outputs	OUT1 OR	OUT2 OR	FBO1 AND	FBO3 OR
.				
.				
ULO1	X		X	
27-1P			X	
.				

The logic shown above is a very simple example of the programming capabilities of the ABB 2000R series relays. We hope that this note will encourage the user to further explore the logic capabilities of the 2000R series relays. If there are any questions regarding this paper or any specific application, please contact technical support at 1-800-634-6005.

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