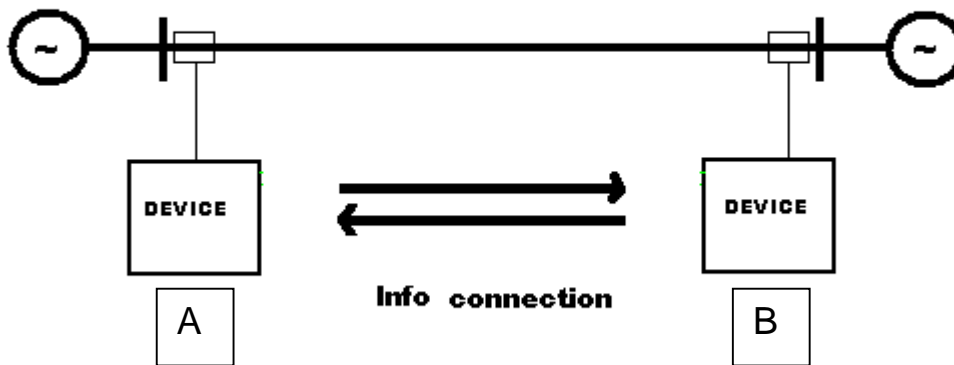


Echo function

Objective

The echo function is already included in the standard scope of functions in distance protection relays. It can also be implemented with CFC charts. In this example, a 7SJ63 device is programmed with an echo function.

Here we have a simple line with in-feed from both ends. At each end there is a protective relay. The relays are set to detect faults on 100% of the line. This implies that each relay will detect faults up to 100% of the line length and beyond. To ensure selectivity, a communication channel is required for sending blocking or permissive signals between the two line ends..



picture 1 : schematic diagram of the application

There is in-feed at both ends. If either device detects the fault in the forward direction, it initiates a permissive sent signal to the other device. In the event of a weak in-feed e.g. at end B (the source at B does not provide sufficient in-feed for the relay at B to pick up for a fault on the line), the relay at end B will not send a signal as it does not pick up for the internal fault.

If the fault were in the reverse direction at B, the in-feed to this fault would come from A (strong source), which would allow B to pick up as the fault current is large enough. In this event, the fault current level at end A and B is almost identical.

To achieve fast clearance of internal faults when one end has a weak in-feed situation, the echo function can be employed. This is achieved by echoing the receive signal at the weak in-feed end back to the sending stronger in-feed end. The echo signal is released when a receive signal is present while the relay is not picked up (no fault detection).

The strong in-feed end will then be able to trip with the received echo signal as if this signal were a normal permissive receive signal. The tripping at the strong in-feed end is therefor accelerated.

Implementation

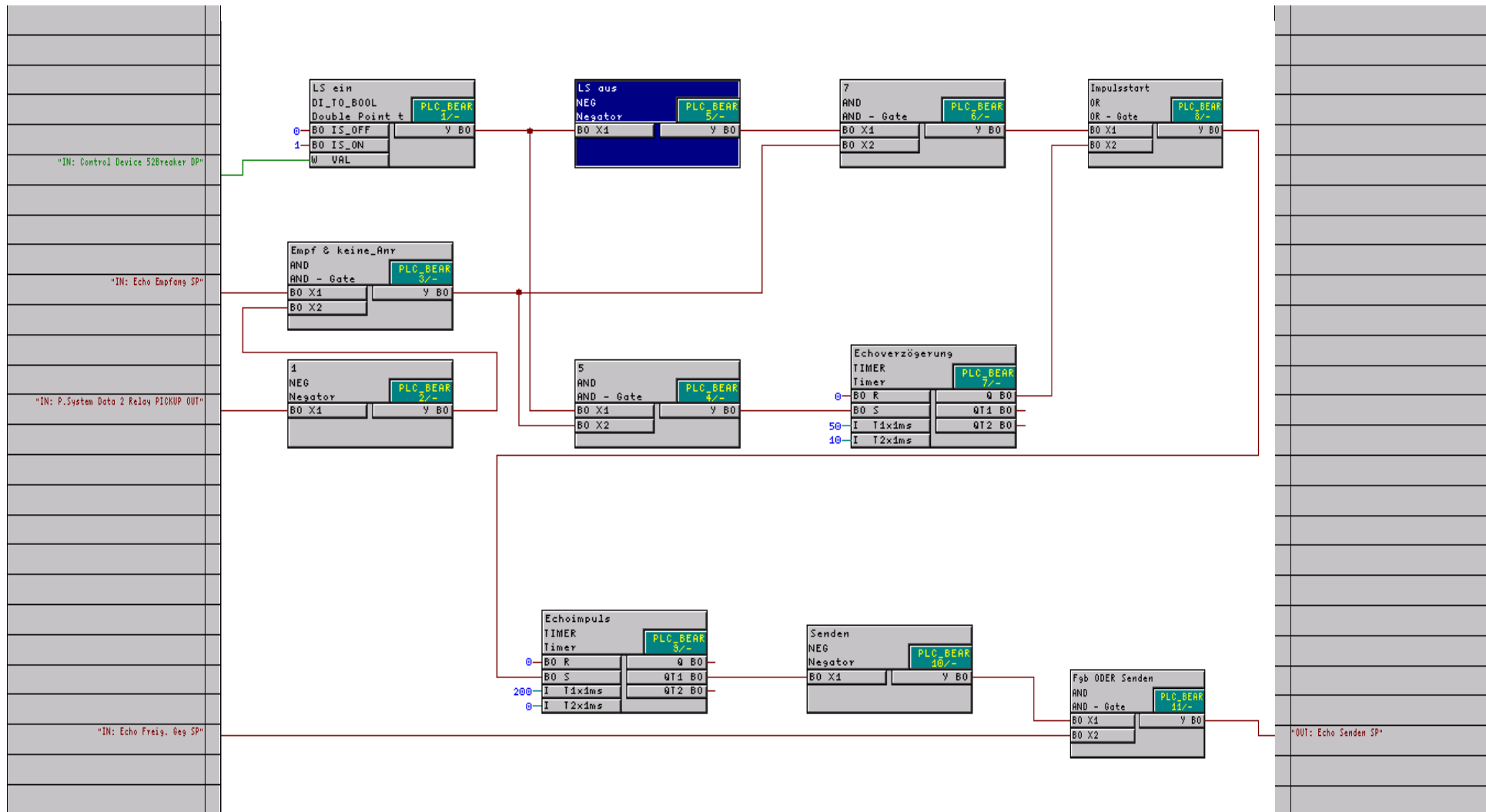
Initially the input/output matrix has to be configured. A new information group called *Echo* is applied. The single point annunciations as shown are entered in the usual manner.

	Information				Source							Destination																	
	No.	Display text:	Long text:	Type	BI											F	C	BO							LE	Buffer			C
					1	2	3	4	5	6	7	8	9	10	11			1	2	3	4	5	7	O		S	T		
Device, General															*										*			*	
P.System Data 1																									*			*	
Osc. Fault Rec.															*										*			*	
Echo	Anr Tr/Eig	Anregung Trafo / eigene Station	SP	H																						OO		X	
	Freig. Geg	Freigabe Gegenstation	SP												X											OO		X	
	>Spawa-Aut	Spawa-Automat	SP								H															OO		X	
	Empfang	Empfang	SP		L																					OO		X	
	Senden	Senden	SP												X			U								OO		X	
P.System Data 2						*	*																	*	*	*	*		
50/51 Overcur.															*	*								*	*	*	*		
67 Direct. O/C															*	*		*						*	*	*	*		
Measurem.Superv																								*		*	*		
50BF BkrFailure																								*	*	*	*		

picture 2 : input/output matrix with user-defined annunciations

A CFC-chart called *Echo* is created. 11 elements running in the fast PLC run time group are applied. Inputs to the chart are the permissive receive signal from the opposite line end (Echo Empfang), the circuit breaker status, relay pick-up condition and echo release. The circuit breaker status is decoded with a DI_TO_BOOL gate. The output indicates breaker closed. By means of a negator, the breaker open condition is derived from this signal (breaker not closed implies breaker open).

The receive signal (Echo Empfang) is connected to an input of AND gate 3. The other input to AND gate 3 is the negated relay pick-up (fault detection) status derived from the output of NEG 1. In other words, AND gate 3 will only produce a logic 1 when there is a receive signal and no pick-up. This is connected to the AND gates 5 and 7. The other input to AND gate 5 is the breaker closed condition. When the breaker is closed, a security time margin is required before an echo may be sent. The output of AND gate 5 is therefor routed to a timer (Echoverzögerung), which provides this time delay of 50 ms. AND gate 7 on the other hand bypasses this timer when the circuit breaker is open. The output of AND gate 7 and the timer (Echoverzögerung) are connected to the inputs of the OR gate (Impulsstart). When this OR gate is triggered and echo impulse shall be generated. For this purpose the output is connected to the timer (Echoimpuls), which provides a 200 ms pulse to the echo send output signal on the right hand margin.



picture 3: CFC chart for echofunction