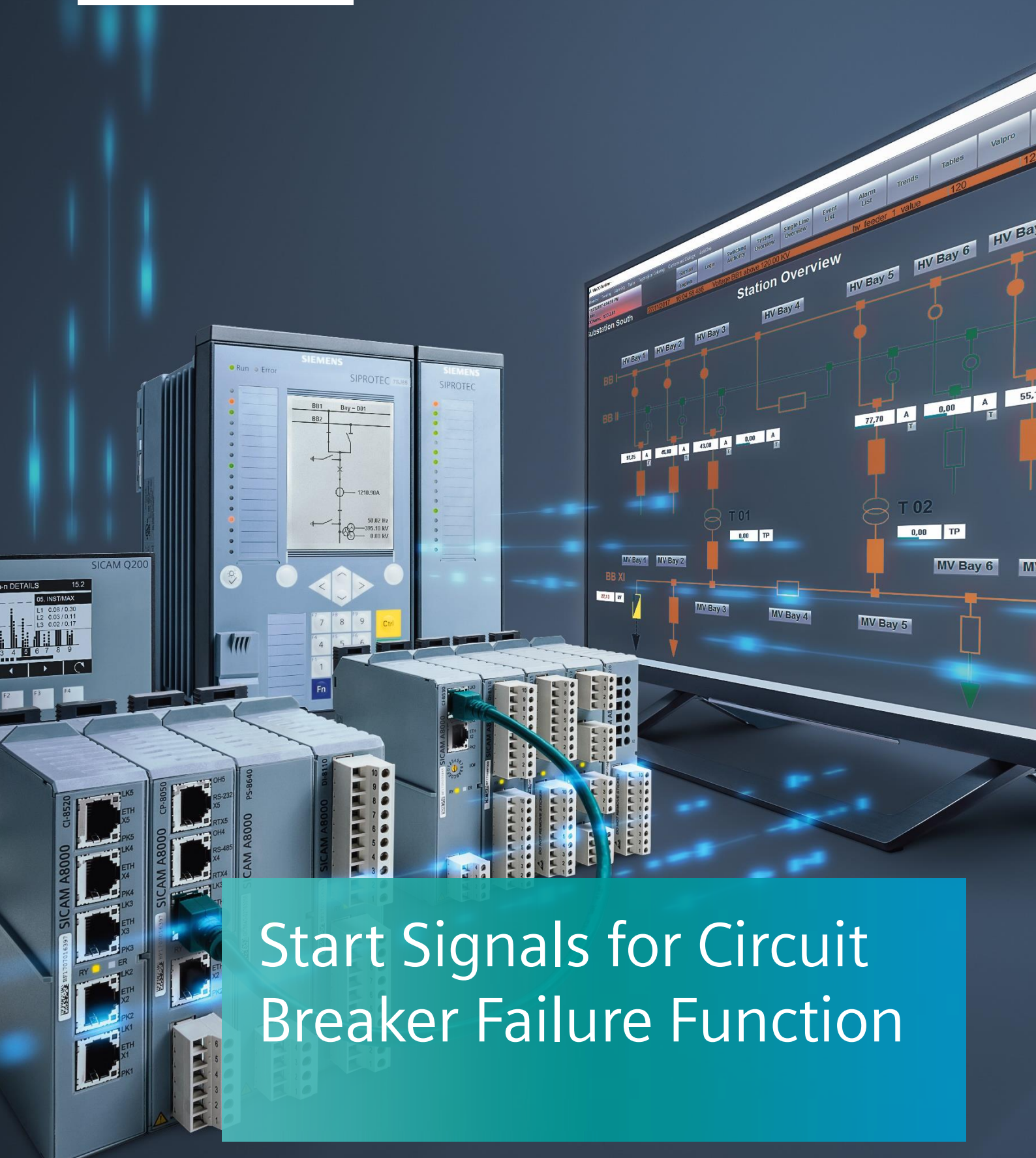


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## Start Signals for Circuit Breaker Failure Function

# SIPROTEC 5 Application

## Start Signals for Circuit Breaker Failure

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# SIPROTEC 5 Application

## Start Signals for Circuit Breaker Failure

APN-078, Edition 1

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# 1 Start Signals for Circuit Breaker Failure in SIPROTEC 5

## 1.1 Introduction

The breaker fail function is a local back-up protection. It can initiate tripping of the relevant circuit breakers when the initially tripped breaker does not open in all phases. In this manner the remote back-up protection (Zone 2 of remote feeder ends) does not have to operate and the fault clearance is possible with less system disruption.

The breaker failure protection function (50BF) is started by the trip signal to the circuit breaker. In the SIPROTEC 5 relays this can be configured so that only internally selected functions start the 50BF. For example, the overvoltage protection or frequency protection may be considered to not require starting of the 50BF, while short circuit protection such as differential or distance protection will start the 50BF.

In some applications the 50BF function may not be located inside the same device as the other protection functions; in this case an external start signal is used to trigger the 50BF.

This document will describe the method recommended for starting the 50BF with both internal and external starting. The 50BF can be with 1 and/or 3 pole operation. The description here will mainly show the 1- and 3- pole starting; when only 3- pole starting is used it is essentially the same but without the signals for each pole.

## 1.2 Configuration

The switching state a CB includes the associated breaker isolators so that the open state is true when any of the series connections is open.

Each of the voltage measuring points may be a single or three phase measurement type. The single-phase measurements must all be of the same type, either Ph-G or Ph-Ph. A mix of Ph-G and Ph-Ph will cause a consistency alarm.

The 50BF function is in the Function Group Circuit Breaker. Both internal and external start signals can be configured as start condition.

Circuit breaker 1				
79 Auto. reclosing		Trip logic		50BF Ad.CBF 1
Protection group	Start auto.recl.	Blk. auto.recl.	Trip	Start CB failure
(All)	(All)	(All)	(All)	(All)
49 Th.overl.-A 1			X	X
21 RM Distance 1	X		X	X
Z 1	X		X	X
Z 1B	X		X	X
Z 3	X		X	X
Z 4	X		X	X
85-21Perm.overr.	X		X	X
85-67N Dir. comp.	X		X	X
Switch onto fault 1		X	X	X
Stage 1		X	X	X

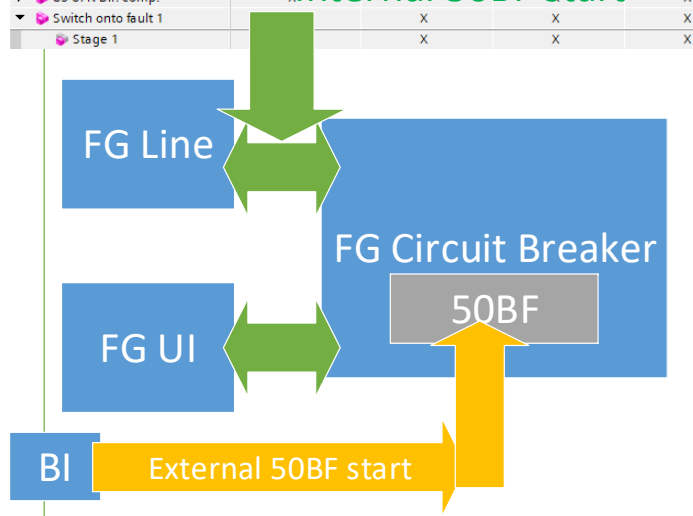


Figure 1: 50BF function with internal (Line and FG UI) as well as external start

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## Start Signals for Circuit Breaker Failure in SIPROTEC 5

### 1.2.1 Internal Start

The internal start signal to the 50BF is configured in the "Circuit-breaker interaction". Initially the circuit breaker is associated with the function group by "assignment", thereafter the circuit breaker interaction is used to configure the internal start signals to the 50BF.

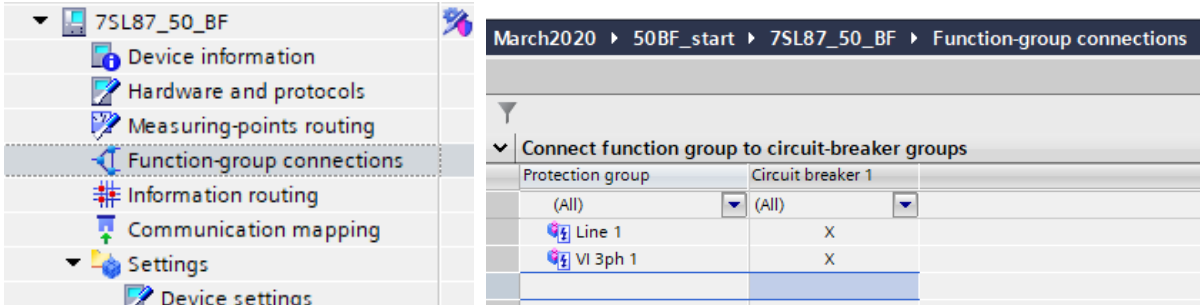


Figure 2: Assignment of function groups to circuit breakers.

As shown above, more than one FG can be assigned to the same circuit breaker.

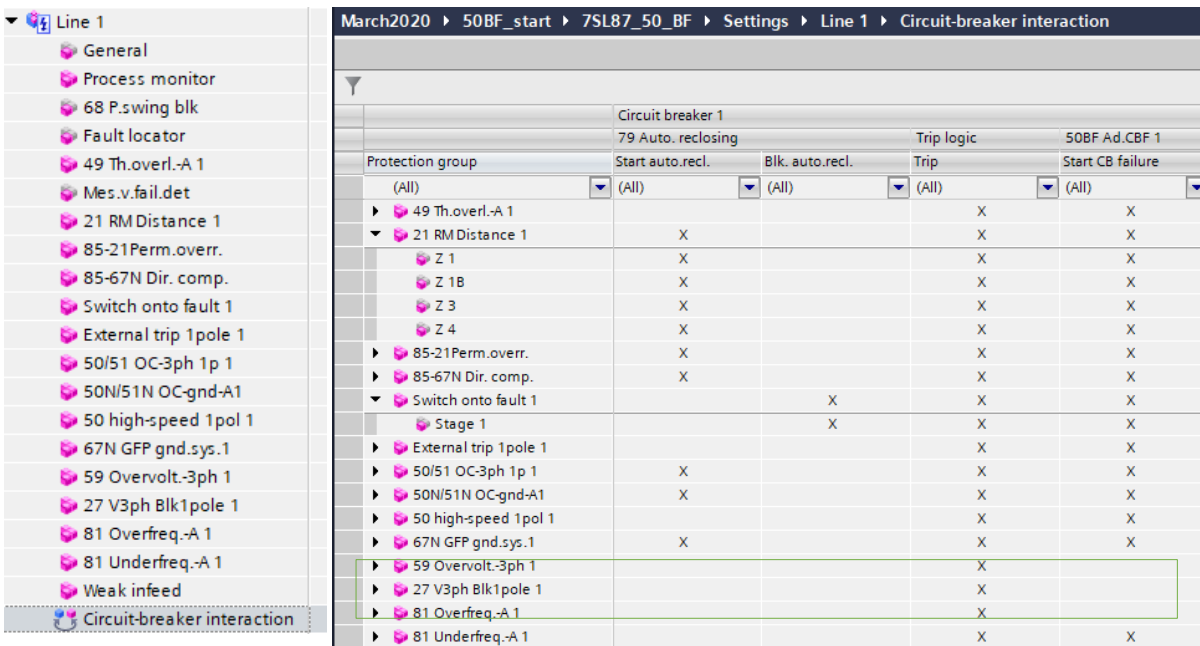


Figure 3: Assigning the protection operates to the internal start of 50BF

As shown in Figure 3, it is possible to select which protection functions start 50BF. In this example the voltage and frequency protection stages are configured to not start the 50BF.

Note: It must be avoided to assign an operate to the 50BF start without assigning it to the Trip!

The input logic of the 50BF function will process the assigned operate signals from Figure 3 as follows:

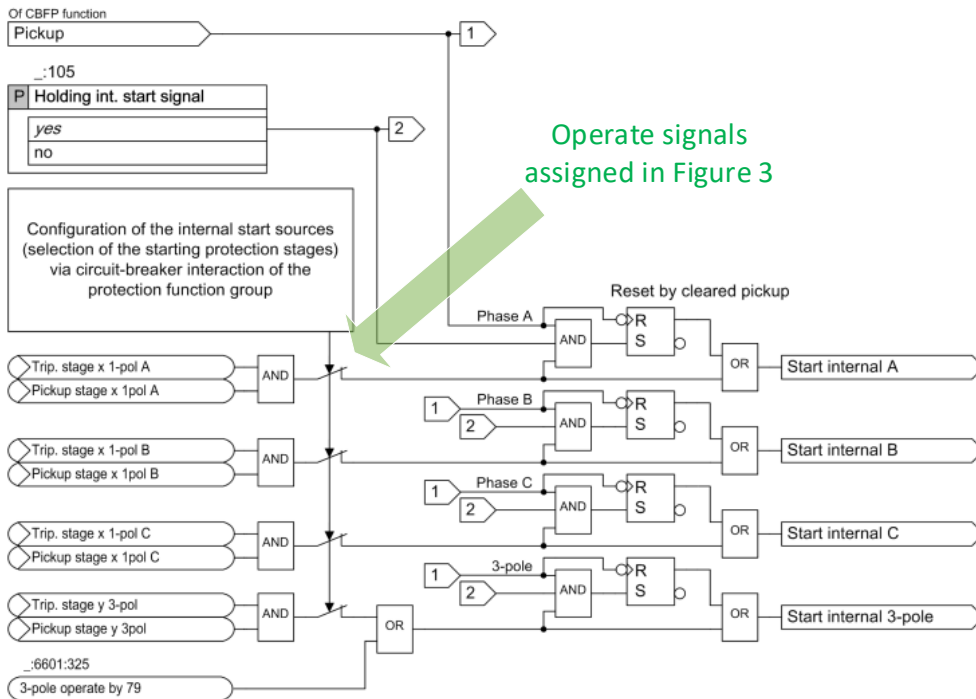


Figure 4: Internal start logic of 50BF

The parameter **:105 Holding int. start signal** must be set to **yes** as instructed in the manual. This is essential because the protection functions that initiated the trip and 50BF start may reset during the opening of the circuit breaker. In particular, if the circuit breaker only opens in 1 or 2 poles following a 3-pole trip.

### 1.2.2 External Start

The external start of the 50BF must be checked at the sending end (trip signal) and the receiving end (50BF start input). The 50BF start may be done with 2 channels or with 1 channel; the description here will be for 2-channel. The 1-channel method is essentially the same, but without the "release signal".

Information			Source				
			Binary input				
			Base module				
Signals	Number	Type	1.7	1.8	2.1	2.2	2.3
(All)	(All)	...	...	...	...	...	...
50BF Ad.CBF 1	301.18781			*	*	*	*
>Start 3-pole	301.18781....	SPS		H			
>Start pole A	301.18781....	SPS			H		
>Start pole B	301.18781....	SPS				H	
>Start pole C	301.18781....	SPS					H
>Release 3-pole	301.18781....	SPS					H
>Release 1-pole	301.18781....	SPS					H
>Block function	301.18781.82	SPS					

Figure 5: Binary inputs for external start of 50BF

The inputs ">Release 3-pole" and ">Release 1-pole" are required when the external start is set for 2 channel operation.

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## Start Signals for Circuit Breaker Failure in SIPROTEC 5

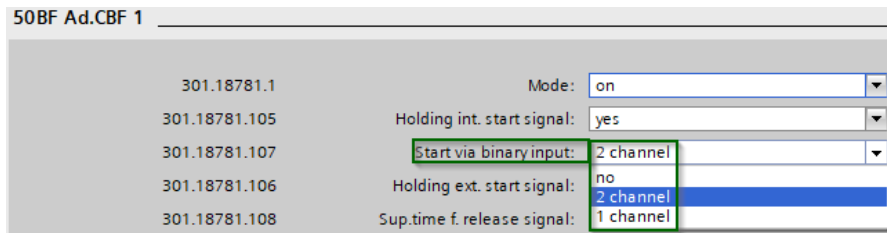


Figure 6: Setting for external start (no / 2 channel / 1 channel)

### 1.2.3 Configuring source of external start for 50BF (sending end)

The trip, and for 2-channel the pick-up signal as well, from any protection device may be rooted to the binary inputs of the device with the 50BF function as shown in Figure 1. If a SIPROTEC 5 device is the sending end, the following signals may be assigned to outputs for external connection to 50BF start:

Information			Destination				
			Binary output				
			Base Expansion module 3				
			2.2	3.1	3.2	3.3	3.4
Signals	Number	Type					
(All)	(All)						
▼ Circuit breaker 1	301		*	*	*	*	*
▼ Trip logic	301.5341		*	*	*	*	*
▼ Trip indication	301.5341.300	ACT	*	*	*	*	*
◆ general		SPS					
◆ phs A		SPS		U			
◆ phs B		SPS			U		
◆ phs C		SPS				U	
◆ 1-phase		SPS					U
◆ 3-phase		SPS					U

Figure 7: Trip Logic signals routed to binary output for external 50BF start

If the 50BF is used with 2 channel start from external, the trip indication "1-phase" and "3-phase", as routed to binary output 3.4 in Figure 7 above, may be used for the ">Release 3-pole" and ">Release 1-pole" in Figure 5.

### 1.2.4 Receive of external start for 50BF (breaker management relay)

In the relay with the 50BF function, the external start binary inputs must be routed as shown for example in Figure 5 above. This may be with 1- / or 2- channels as set (Figure 6 above). In the 50BF the external start is processed as follows:

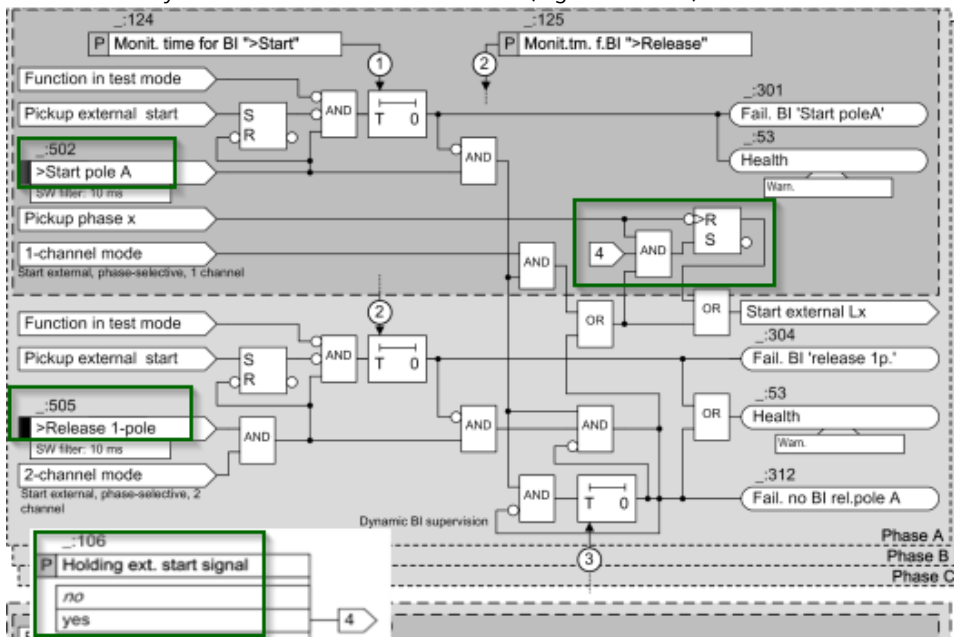


Figure 8: External start of 50BF

As shown in Figure 8 above, the "Holding ext. start signal" will, when set to "yes", only hold the start if both binary inputs ">Start ..." and ">Release..." have picked up together (may not be separated by more than the set "Monitoring time for BI >Start"). This provides security against external influence so that the parameter "Holding ext. start signal" may be set to "yes".

If the "sending" end will latch its trip signal used for the 50BF start securely, then the "Holding ext. start signal" may be set to "no" for even greater security against external influences.

### 1.3 Conclusion

The breaker fail function in SIPROTEC 5 can effectively be used with internal or external start. With internal start the circuit breaker interaction selection allows the individual selection of each protection stage as 50BF start condition.

With external start a 1- or 2- channel configuration is possible. The 2-channel method has increase security against external HW failures.

The 50BF function allows holding of the start signal (separate setting for internal and external start). For internal start the default setting of holding = "yes" should be applied. With external start the user can select as explained in this application note.



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