8.3.11.5 Settings

Addr.	Parameter	C	Setting Options	Default Setting
Supv. ph.seq.I				
_:1	Supv. ph.seq.I:Mode		• off • on • test	off
_:6	Supv. ph.seq.I:Delay supervision alarm		0.00 s to 100.00 s	5.00 s

8.3.11.6 Information List

| No.	Information	Data Class (Type)	Type
Supv. ph.seq.I			
_:82	Supv. ph.seq.I:>Block function	SPS	I
_:54	Supv. ph.seq.I:Inactive	SPS	O
_:52	Supv. ph.seq.I:Behavior	ENS	O
_:53	Supv. ph.seq.I:Health	ENS	O
_:71	Supv. ph.seq.I:Failure	SPS	O

8.3.12 Trip-Circuit Supervision

8.3.12.1 Overview of Functions

The **Trip-circuit supervision** function recognizes disruptions in the trip circuit. When 2 binary inputs are used, the function recognizes all disruptions in the trip circuit. If only 1 binary input is available, it will not recognize disruptions at the circuit-breaker.

The control voltage for the circuit breaker must be greater than the sum of the minimum voltage drops at the binary inputs $V_{Ctrl} > 2\ V_{BImin}$. At least 19 V are required for each binary input. This makes the supervision usable only with a system-side control voltage of > 38 V.

8.3.12.2 Structure of the Function

The trip-circuit supervision is integrated into the **Circuit-breaker** function group. Depending on the number of available binary inputs, it works with 1 or 2 binary inputs.
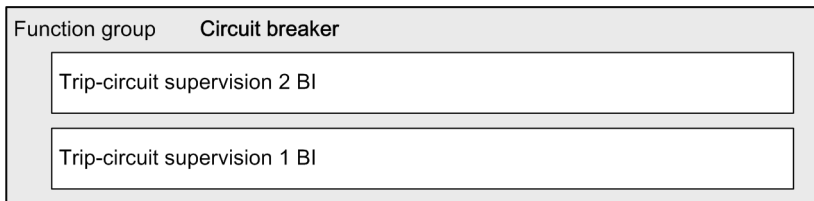

[dwtcsueb-010313-01.tif, 1, en_US]

Figure 8-29   Structure/Embedding of the Function

8.3.12.3 Trip-Circuit Supervision with 2 Binary Inputs

In order to recognize disruptions in the trip circuit for each switch position, you need 2 binary inputs. One input is connected parallel to the respective command relay of the protection, the other parallel to the circuit-breaker auxiliary contact.

The following figure shows the principle of the trip-circuit supervision with 2 binary inputs.
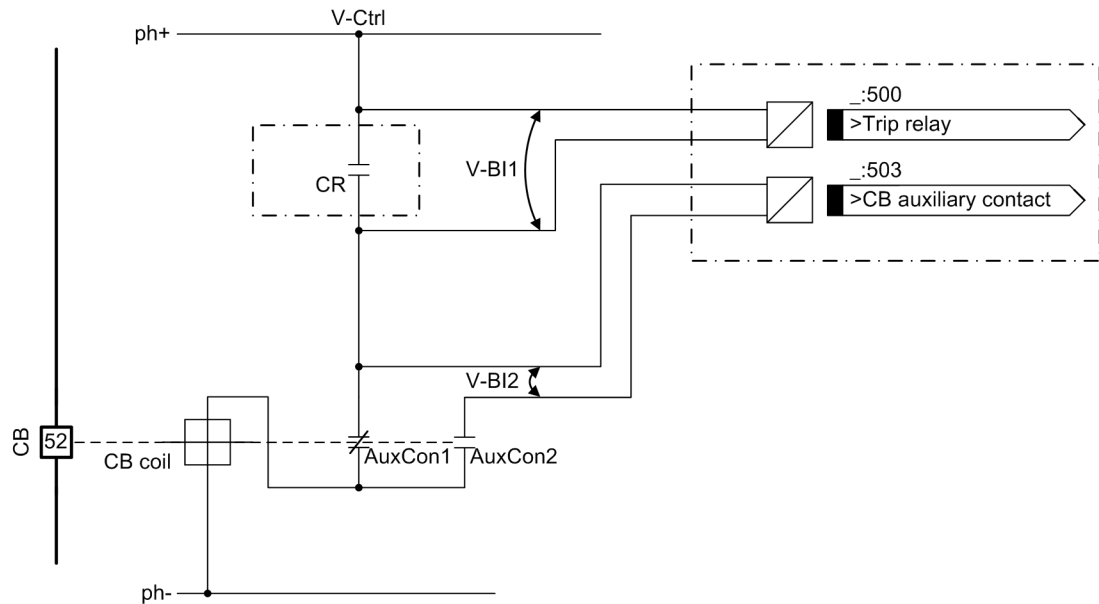
[dwtcs2be-110611-01.tif, 2, en_US]

Figure 8-30   Principle of Trip-Circuit Supervision with 2 Binary Inputs

CR   Command relay
CB   Circuit breaker
CB coil   Circuit-breaker coil
AuxCon1   Circuit-breaker auxiliary contact (NC)
AuxCon2   Circuit-breaker auxiliary contact (NO)
V-Ctrl   Control voltage (tripping voltage)
V-BI1   Input voltage for binary input 1
V-BI2   Input voltage for binary input 2

Supervision with 2 binary inputs identifies disruptions in the trip circuit and the outage of the control voltage. It also monitors the reaction of the circuit breaker by way of the position of the circuit-breaker auxiliary contacts.

Depending on the switch position of the command relay and circuit breaker, the binary inputs are either activated (**H**) or not (**L**). If both binary inputs are not activated, there is a fault. The fault may be a interruption or a short circuit in the trip circuit, an outage of the battery voltage or a fault in the mechanics of the circuit breaker. With intact trip circuits, this state will occur only briefly while the command relay is closed and the circuit breaker has not yet been opened.

No.	Command Relay (CR)	CB	AuxCon1	AuxCon2	BI 1	BI 2	Dynamic State	Static State
1	Open	ON	Closed	Open	H	L	Normal operation with closed circuit breaker	
2	Open	OFF	Open	Closed	H	H	Normal operation with open circuit breaker	
3	Closed	ON	Closed	Open	L	L	Transmission or fault	Fault
4	Closed	OFF	Open	Closed	L	H	CR successfully activated the circuit breaker	

With the **Alarm delay** parameter, you can set the time delay. After fixing the fault in the trip circuit, the failure indication will automatically expire after the same time.

If the binary input signals *>Trip relay* or *>CB auxiliary contact* are not routed on the binary inputs of the device, then the *Input sig. not routed* indication is generated and the **Trip-circuit supervision** function is not in effect.

The following figure shows the logic diagram of the trip-circuit supervision with 2 binary inputs.
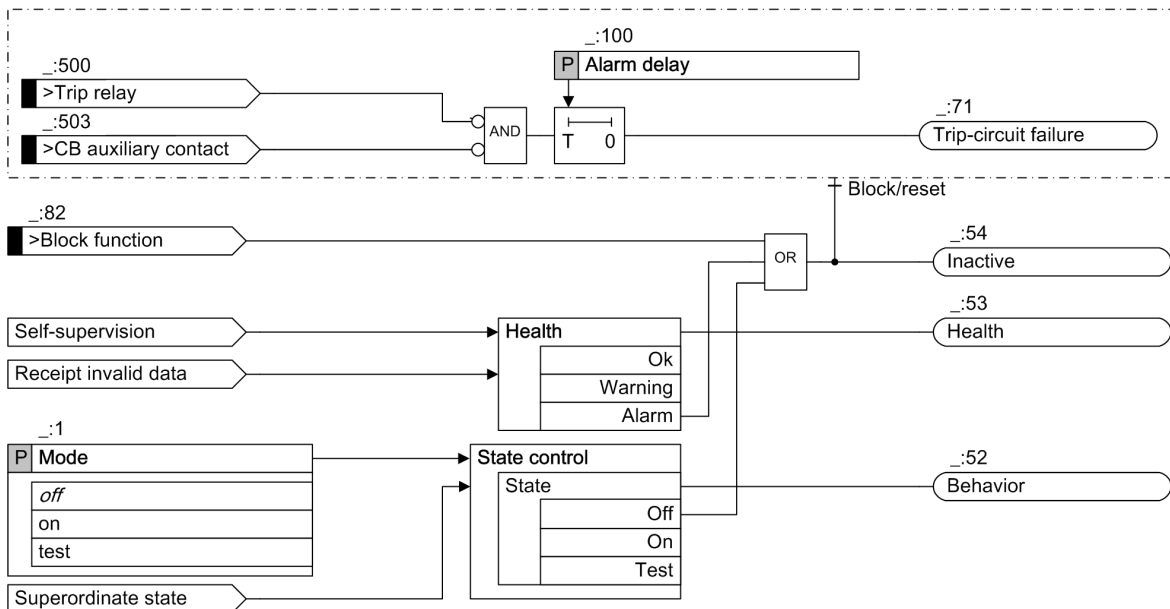
[lotcs2be-260912-01.tif, 1, en_US]

Figure 8-31   Logic Diagram of Trip-Circuit Supervision with 2 Binary Inputs

8.3.12.4   Trip-Circuit Supervision with 1 Binary Input

When using 1 binary input, you will not identify any disruptions on the circuit breaker. The binary input is connected in parallel with the respective command relay of the protection device. The circuit-breaker auxiliary contact is bridged with a high-resistance equivalent resistance R.

The following figure shows the principle of the trip-circuit supervision with 1 binary input.
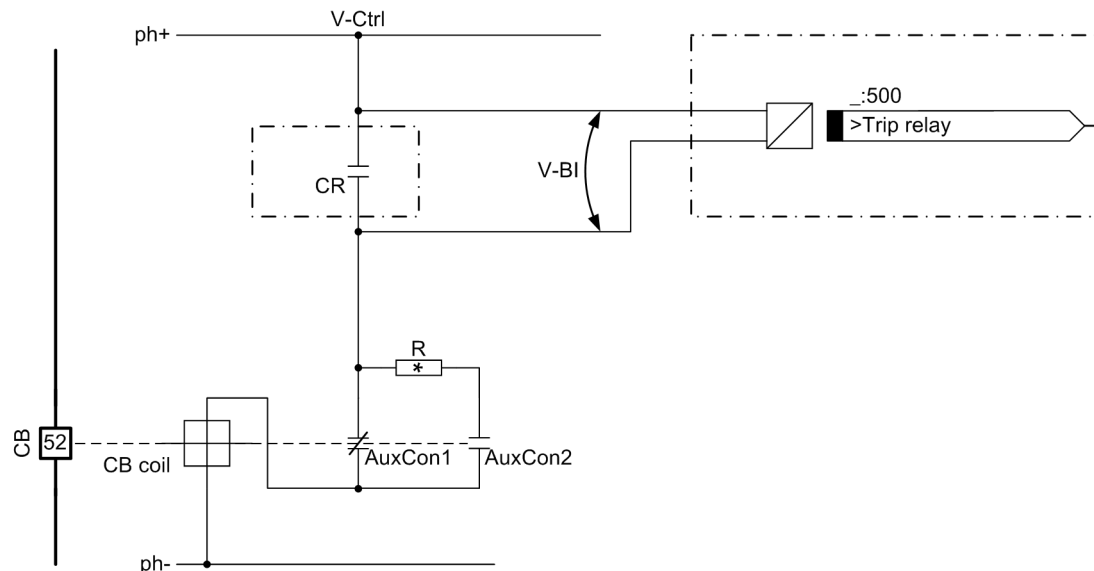
[dwtcs1be-110611-01.tif, 2, en_US]

Figure 8-32   Principle of Trip-Circuit Supervision with 1 Binary Input

CR   Command relay

CB   Circuit breaker

CB coil   Circuit-breaker coil

AuxCon1   Circuit-breaker auxiliary contact (NC)

AuxCon2   Circuit-breaker auxiliary contact (NO)

V-Ctrl   Control voltage (tripping voltage)

V-BI   Input voltage for binary input

R   Equivalent resistance

The supervision with 1 binary input identifies disruptions in the trip circuit and the failure of the control voltage.

In normal operation, the binary input is activated with the command relay open and the trip circuit intact (**H**). The supervision circuit is closed with the equivalent resistance R or with the auxiliary contact AuxCon1 of the closed circuit breaker. The binary input is not activated while the command relay is closed (**L**). If the binary input is not activated for a prolonged time, there is a disruption in the trip circuit or the control voltage has failed.

No.	Command Relay	CB	AuxCon1	AuxCon2	BI	Dynamic State	Static State
1	Open	ON	Closed	Open	H	Normal operation with closed circuit breaker	
2	Open	OFF	Open	Closed	H	Normal operation with open circuit breaker	
3	Closed	ON	Closed	Open	L	Transmission or fault	Fault
4	Closed	OFF	Open	Closed	L	CR successfully activated the circuit breaker	

Use the parameter `Blk.by trip/open cmd from` to set the conditions under which the trip-circuit supervision is blocked. The following conditions can cause a blocking of the trip-circuit supervision function:

- The *Trip/open cmd.* of the circuit breaker is activated.

- One of the trip commands of the circuit-breaker failure protection is activated.

As long as the trip-circuit supervision function is blocked, the closed contact of the command relay does not cause a failure indication.

If the command contacts of other devices work in parallel on the trip circuit, the failure indication must be delayed. With the `Alarm delay` parameter, you can set the time delay. After fixing the fault in the trip circuit, the failure indication will automatically expire after the same time.

If the binary input signal *>Trip relay* is not routed to a binary input of the device (**information routing** in DIGSI 5), then the *Input sig. not routed* indication is generated and **Trip-circuit supervision** is no longer in effect.

The following figure shows the logic diagram of the trip-circuit supervision with 1 binary input.
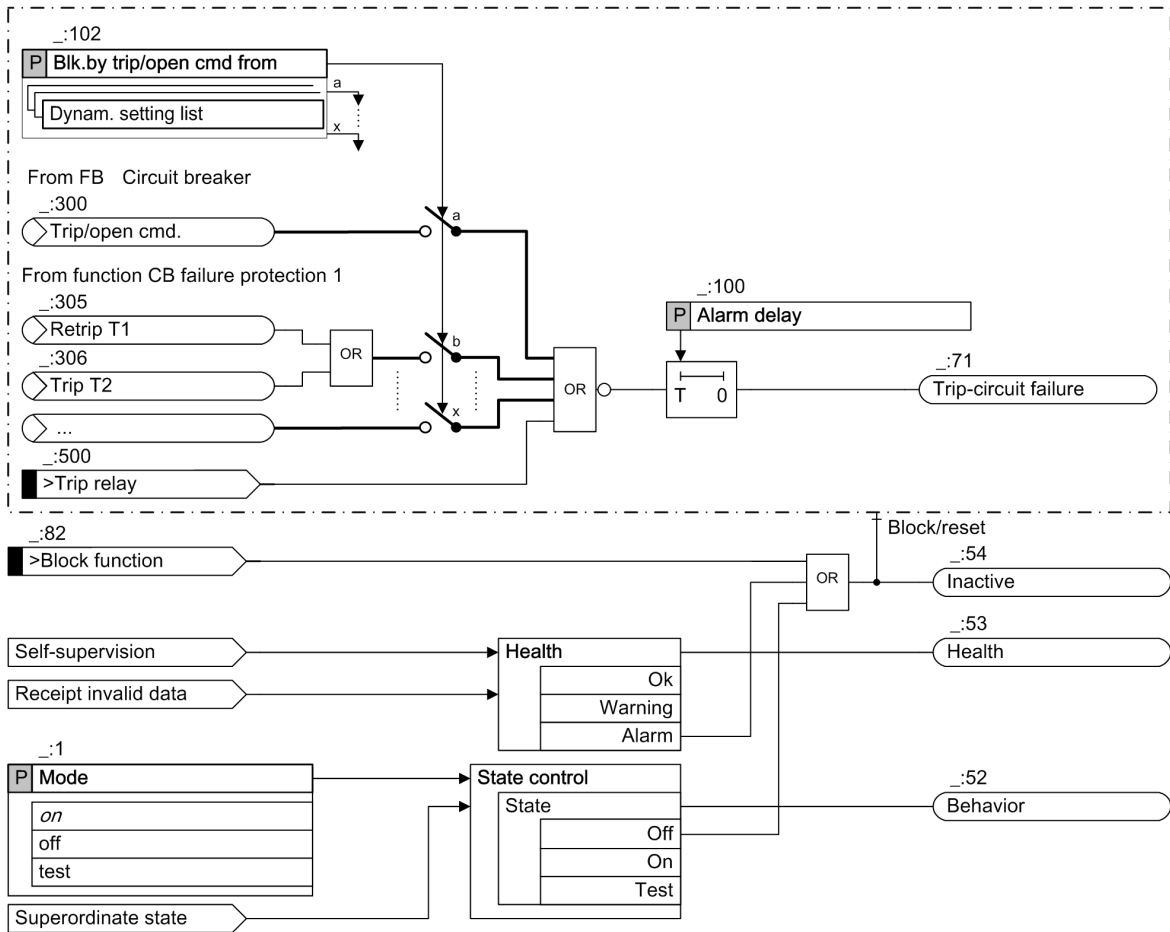
[lotcs1be-260912-01.tif, 1, en_US]

Figure 8-33   Logic Diagram of Trip-Circuit Supervision with 1 Binary Input

Equivalent Resistance R

The equivalent resistance R must be dimensioned such that the circuit-breaker coil is no longer activated when the circuit breaker is open. Simultaneously, the binary input must still be activated when the command relay is open.

In order to ensure the minimum voltage for activating the binary input, R_{max} results in:

$$R_{max} = \left(\frac{V_{Ctrl} - V_{BImin}}{I_{BI(High)}} \right) - R_{CBC}$$

[fofr1b02-090330-01.tif, 1, en_US]

So that the circuit-breaker coil does not remain activated, R_{min} results in:

$$R_{min} = R_{CBC} \cdot \left(\frac{V_{Ctrl} - V_{CBC(Lowmax)}}{V_{CBC(Low)}} \right)$$

[fofr1b03-090330-01.tif, 1, en_US]

You can calculate the optimal value for the equivalent resistance R from the 2 values R_{min} and R_{max}:

$$R = \frac{R_{max} + R_{min}}{2}$$

[fofr1b01-090330-01.tif, 1, en_US]

The following applies for the power consumption of the equivalent resistance R:

$$P_R = I^2 \cdot R = \left(\frac{V_{Ctrl}}{R + R_{CBC}} \right)^2 \cdot R$$

[fofr1b04-090330-01.tif, 1, en_US]

8.3.12.5 Application and Setting Notes

Parameter: Alarm delay

- Recommended setting value **(_:100) Alarm delay** = *2 s* (Trip-circuit supervision with 2 binary inputs)

- Recommended setting value **(_:100) Alarm delay** = *300 s* (Trip-circuit supervision with 1 binary input)

With the parameter **Alarm delay**, you can set the time for the delayed output of the indication *Trip-circuit failure*.

For **Trip-circuit supervision with 2 binary inputs**, you set the **Alarm delay** parameter so that the short-term transient states do not cause the function to activate.

For the **Trip-circuit supervision with 1 binary input,** you set the **Alarm delay** so that the longest duration of a trip command is bridged without fail. This ensures that the indication is emitted only if the trip circuit is actually interrupted.

Parameter: Blk.by trip/open cmd from

- Possible settings, application-dependent

The parameter works only with the trip-circuit supervision with 1 binary input.

Use the parameter **Blk.by trip/open cmd from** to set the conditions under which the trip-circuit supervision is blocked. The following conditions can cause a blocking of the trip-circuit supervision function:

- The *Trip/open cmd.* of the circuit breaker is activated.

- One of the trip commands of the circuit-breaker failure protection is activated.

- One of the trip commands of the circuit-breaker reignition protection is activated.

The circuit-breaker failure protection is set to protect a different trip circuit than the local circuit breaker. Using the configuration options of the **Blk.by trip/open cmd from** parameter, multiple trip-circuit supervision functions can be operated in parallel. For instance, a trip-circuit supervision function dedicated to a local circuit breaker can also be operated parallel to a higher-level circuit breaker upon which the circuit-breaker failure protection acts.

8.3.12.6 Settings

Addr.	Parameter	C	Setting Options	Default Setting
74TC sup.1BI #				
_:1	74TC sup.1BI #:Mode		• off • on • test	on
_:100	74TC sup.1BI #:Alarm delay		1.00 s to 600.00 s	300.00 s
_:102	74TC sup.1BI #:Blk.by trip/open cmd from		Setting options depend on configuration	
74TC sup.2BI #				
_:1	74TC sup.2BI #:Mode		• off • on • test	on
_:100	74TC sup.2BI #:Alarm delay		1.00 s to 30.00 s	2.00 s

8.3.12.7 Information List

No.	Information	Data Class (Type)	Type
74TC sup.1BI #			
_:82	74TC sup.1BI #:>Block function	SPS	I
_:500	74TC sup.1BI #:>Trip relay	SPS	I
_:54	74TC sup.1BI #:Inactive	SPS	O
_:52	74TC sup.1BI #:Behavior	ENS	O
_:53	74TC sup.1BI #:Health	ENS	O
_:71	74TC sup.1BI #:Trip-circuit failure	SPS	O
_:301	74TC sup.1BI #:Input sig. not routed	SPS	O
74TC sup.2BI #			
_:82	74TC sup.2BI #:>Block function	SPS	I
_:500	74TC sup.2BI #:>Trip relay	SPS	I
_:503	74TC sup.2BI #:>CB auxiliary contact	SPS	I
_:54	74TC sup.2BI #:Inactive	SPS	O
_:52	74TC sup.2BI #:Behavior	ENS	O
_:53	74TC sup.2BI #:Health	ENS	O
_:71	74TC sup.2BI #:Trip-circuit failure	SPS	O
_:301	74TC sup.2BI #:Input sig. not routed	SPS	O