

7 Operating Instructions

After installation, the microcomputer – controlled interlocking unit is commissioned in a defined series of steps. A distinction is made between the commissioning of new installations and the extension or conversion of an existing installation.

7.1 Safety precautions

The safety rules stipulated by VDE 0105, part 1/7.83, must be observed.

7.2 Commissioning of new installations

With a new installation, it is generally necessary to adjust the interaction between the motor drive, main contacts and auxiliary contacts on high – voltage switchgear. Once this work has been completed, it is possible to commission the switchgear interlocking units one after the other as long as the installation work described above has been completed. The central unit is always commissioned first, and then the feeder units.

7.2.1 Central unit

- On closing the PROTECTIVE CIRCUIT – BREAKERS FOR CONTROL AND CHECKBACK (see circuit diagram on page 5/11), the breaker position indications are fed to the interlocking unit via the auxiliary switches of the high – voltage unit. The power supply of the central unit remains off!

- First check:

The semaphore indicator must match the position of the high – voltage unit (e.g. OPEN), otherwise, the checkback signals are inverted!

This check must be performed on all switching devices that output a checkback signal to the central unit.

- After this, the power supply of the central unit is switched on. The operating lamps of the power supply light up and the microcomputer updates itself. During this time (approx. 5 seconds) all LEDs light up (F1 to F6 red, M1 to M3 yellow) on the manual control module (FGB). Readiness for operation is indicated when the LEDs on the FGB go out and all green (DLL) LEDs (data exchange lamp) light up on the microcomputer module and on the transmitter / receiver controlling module. The LED DLL1 on the BSF is assigned to DLL on the SAB1 (slot +AC135, see Fig. 3.6, page 3/7) and the LED DLL2 on the BSF is assigned to the DLL on the SAB2 (slot +AC141). (If only one SAB module is plugged in, the LED DLL2 on the BSF remains off). The transmitter lamp (SLL) on the SAB also lights up.
- When the steady light switch IND. ON/OFF is operated, the switch itself lights up, the CLOSE and OPEN buttons and all LEDs on the interface and control modules (intermediate position lamps). If an intermediate position lamp does not light up, the acknowledgement reset button QUIT must be pressed. However, if the LED remains off and the fault lamp F4 does not light up, the diode is defective and the module might have to be replaced. If the fault lamp F4 lights up and an LED on the ABB is blinking, the checkback from the associated high – voltage switching device must be checked. All other LEDs, F1 to F6, S1 remote, HR, LSF on the fault display panel of the manual control module (FGB), the indicators ELL1 to ELL6 on the transmitter / receiver controlling modules (SAB) of the central unit and the LEDs STO on the BSF and SAB remain off.

• Second check:

After the PROTECTION CIRCUIT–BREAKER FOR THE MOTOR DRIVE has been closed, a motor circuit control check can be made for all switching devices of the central unit using the master override keyswitch S1. In S1 operation, the switching unit can also be jogged, so that an incorrect direction of rotation can be detected immediately and corrected. It is important that the high–voltage switchgear be put in the intermediate position by hand, before the direction of rotation check is made in S1 operation.

If this is not done, the switching device can be locked and the break power of the motor circuit control relay is exceeded.

When the drive mechanism is rotating in the correct direction and the switching device has reached its final position, the command is terminated and the semaphore moves to the new position.

- After this, the switching devices of the central unit that are interlocked internally can be switched in normal operation – local control again. The interlocking conditions on the function diagram feeder interlocking (Fig. 7.1) can be compared with the intended switching operation as an additional check. If the device to be switched is only subject to internal interlocking conditions, and these have been fulfilled, the switching operation is performed. Because the feeder interlock units are not yet connected, operation of one of the externally interlocked switching devices will cause a “switching failure” and a fault message is output.
- When all the switching devices have been tested, they must all be put in the OPEN position before the feeder unit is commissioned and the three–position switch S5 must be in the LOCAL CONTROL position.

The central unit must remain switched on.

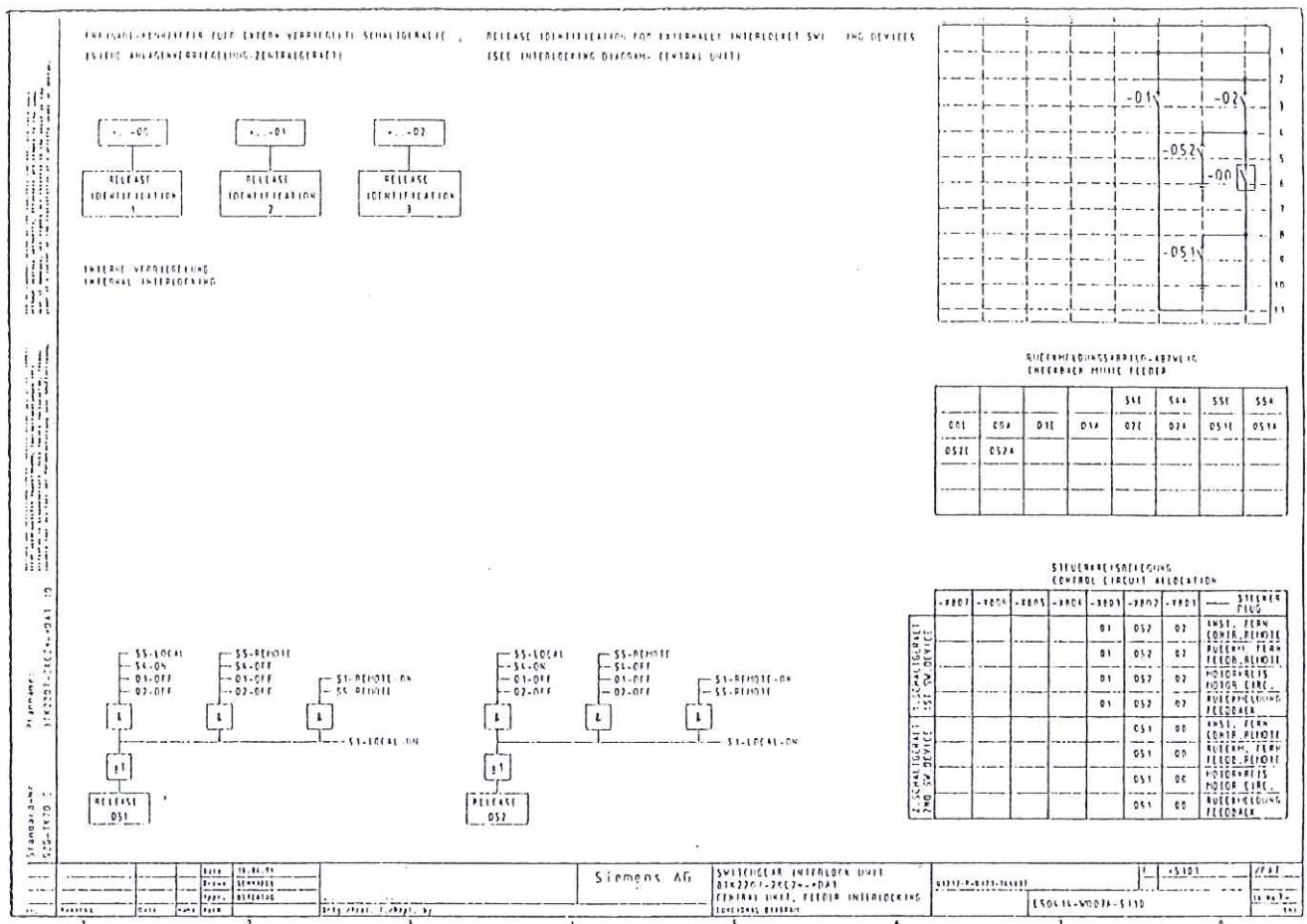


Fig. 7.1 Function diagram with internal feeder interlocking for a bus coupling, example of a central unit
(Method of representation 05.95)

7.2.2 Feeder unit

The feeder units are also commissioned in a defined series of steps. Feeder units ① are commissioned in the order of their allocation to the central unit plug board, beginning with plug position -X811 to -X814, -X821 to -X824 ②, -X831 to -X834, -X841 to -X845 ③, and the same thing goes for feeders 17 to 32, plug position -X851 to -X884.

This sequence of the feeder units is to be found in the tables on the single line diagram of the central unit (Fig. 7.2).

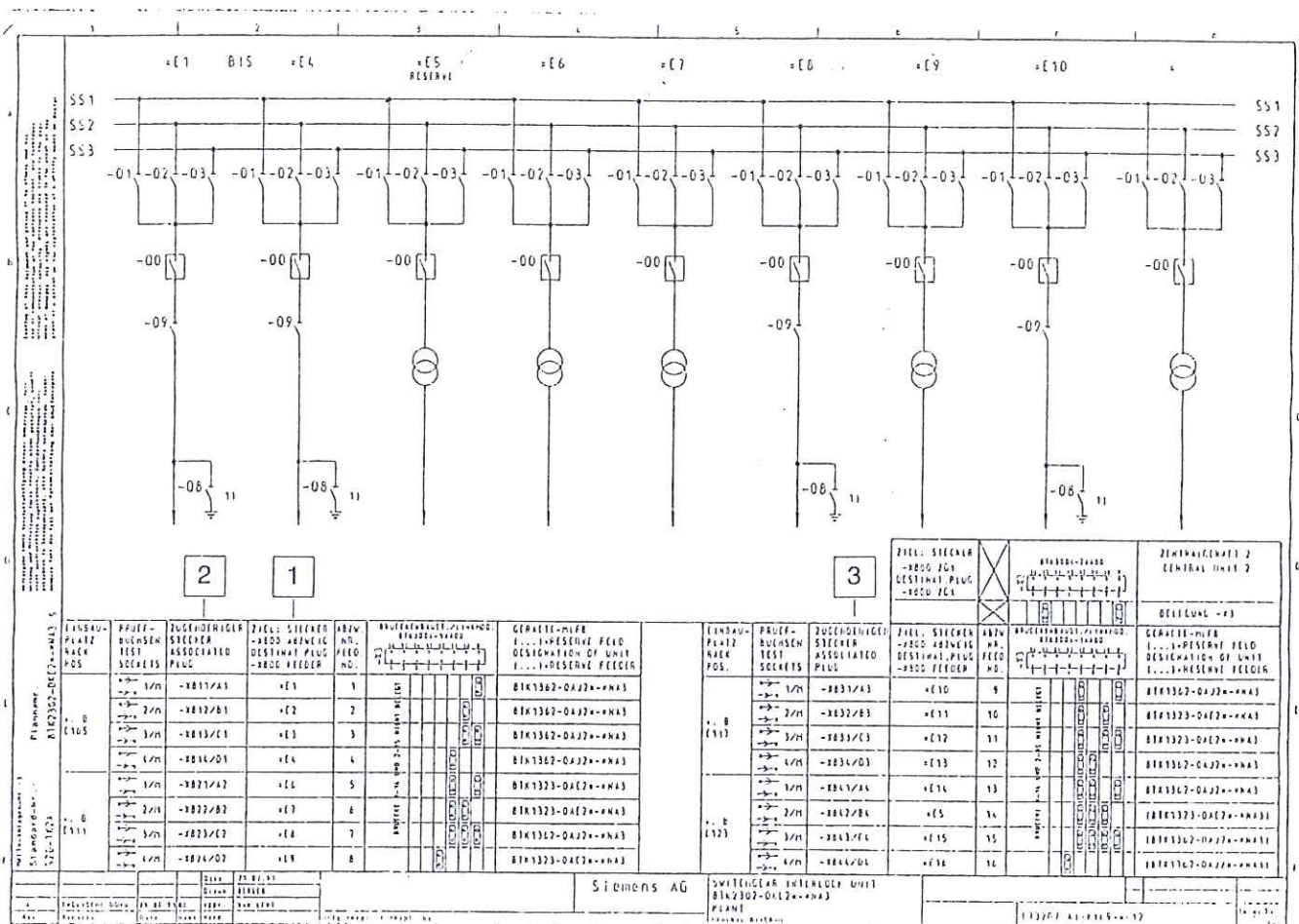


Fig. 7.2 Assignment of the feeder unit plugs ① to the positions on the plug board ② and ③
(Method of representation until 05.95)

- On closing the PROTECTIVE CIRCUIT–BREAKERS FOR CONTROL AND CHECKBACK (see circuit diagram on page 5/11), the breaker position indications are fed to the interlocking unit via the auxiliary switches of the high–voltage unit. The power supply of the central unit remains off!

- First check:

The semaphore indicator must match the position of the high–voltage unit (e.g. OPEN), otherwise, the checkback signals are reversed!

This check must be performed on all switching devices that output a checkback signal to the feeder unit.

- After this, the power supply of the central unit is switched on. The operating lamps of the power supply light up and the microcomputer updates itself. During this time (approx. 5 seconds) all LEDs light up (F1 to F6 red, M1 to M3 yellow) on the manual control module (FGB).

The green LEDs (ELL, SLL) on the microcomputer module indicate that data is being exchanged with the central unit. The red LED STO is off. When the LEDs ELL and SLL light up, the associated receiver lamp (ELL...) of the connected feeder on the transmitter / receiver controlling module of the central unit must also light up.

- When the steady light switch IND. ON/OFF is operated, the switch itself lights up, the CLOSE and OPEN buttons and all LEDs on the interface and control modules (intermediate position lamps). If an intermediate position lamp does not light up, the acknowledgement reset button QUIT must be pressed. However, if the LED remains off and the fault lamp F4 does not light up, the diode is defective and the module might have to be replaced. If the fault lamp F4 lights up and an LED on the ABB is blinking, the checkback from the associated high–voltage switching device must be checked. All other LEDs on the manual control unit of the feeder unit must be off.

- Second check:

After the PROTECTION CIRCUIT–BREAKER FOR THE MOTOR DRIVE has been closed, a motor circuit control check can be made for all switching devices of the feeder unit using the master override keyswitch S1. It is important that the high–voltage switchgear be put in the intermediate position by hand, before the direction of rotation check is made in S1 operation.

If this is not done, the switching device can be locked and the break power of the motor circuit control relay is exceeded.

In S1 operation the switching unit can also be jogged, so that an incorrect direction of rotation can be detected immediately and corrected. When the drive mechanism is rotating in the correct direction and the switching device has reached its final position, the command is terminated and the semaphore moves to the new position.

- After this, the switching devices of the feeder unit that are interlocked internally, can be switched in normal operation – local control. Now check whether the receiver lamp of the feeder on the transmitter / receiver controlling module has lit up on the central unit. The assignment of the LEDs to the feeders / plug in connections of the central plug board is as follows:

ELL1 of the transmitter / receiver controlling module 1 (8TK3005–1AA00) is assigned to position –X811, ELL2/–X812 etc. Up to ELL16/–X844 and on transmitter / receiver controlling module 2 (8TK3 005–2AA00) ELL1 to ELL16 are assigned to positions –X851 to –X884 in numeric sequence.

If the LEDs ELL and SLL of the feeder unit and the associated ELL... of the central unit light up, data exchange between the two units is being performed correctly. The switching units of the feeder can now be switched in order to check the interlock conditions. The interlocking conditions on the function diagram feeder interlocking (Fig. 7.1) can be compared with the intended switching operation as an additional check.

- If the device to be switched is only subject to internal interlocking conditions, and these have been fulfilled, the switching operation is performed; otherwise the fault alarm F3 is output (interlock conditions not fulfilled). The same thing applies to switching devices that are subject to external interlock conditions (switchyard interlocking).
- When all the switching devices have been tested, they must all be put in the OPEN position before the feeder unit is commissioned and the three position switch S5 must be in the LOCAL CONTROL position.

Only when all feeder units have been commissioned in the sequence described, is it possible to check the switchyard interlocks for all switching devices. If the interlocking conditions are fulfilled, the switching operation is executed, otherwise the fault alarm F3 is output. In the event of a fault, the function diagram switchyard interlocking (Fig. 7.3) can be checked to see which interlocks have to be fulfilled and then checked on the associated feeder units. (Comparison of the breaker position CLOSE / OPEN with the interlock condition).

CAUTION!

If a switching device cannot be operated although the interlock conditions have been fulfilled according to the function diagram, please call your local Siemens maintenance service stating the factory number of the unit and the diagram number.

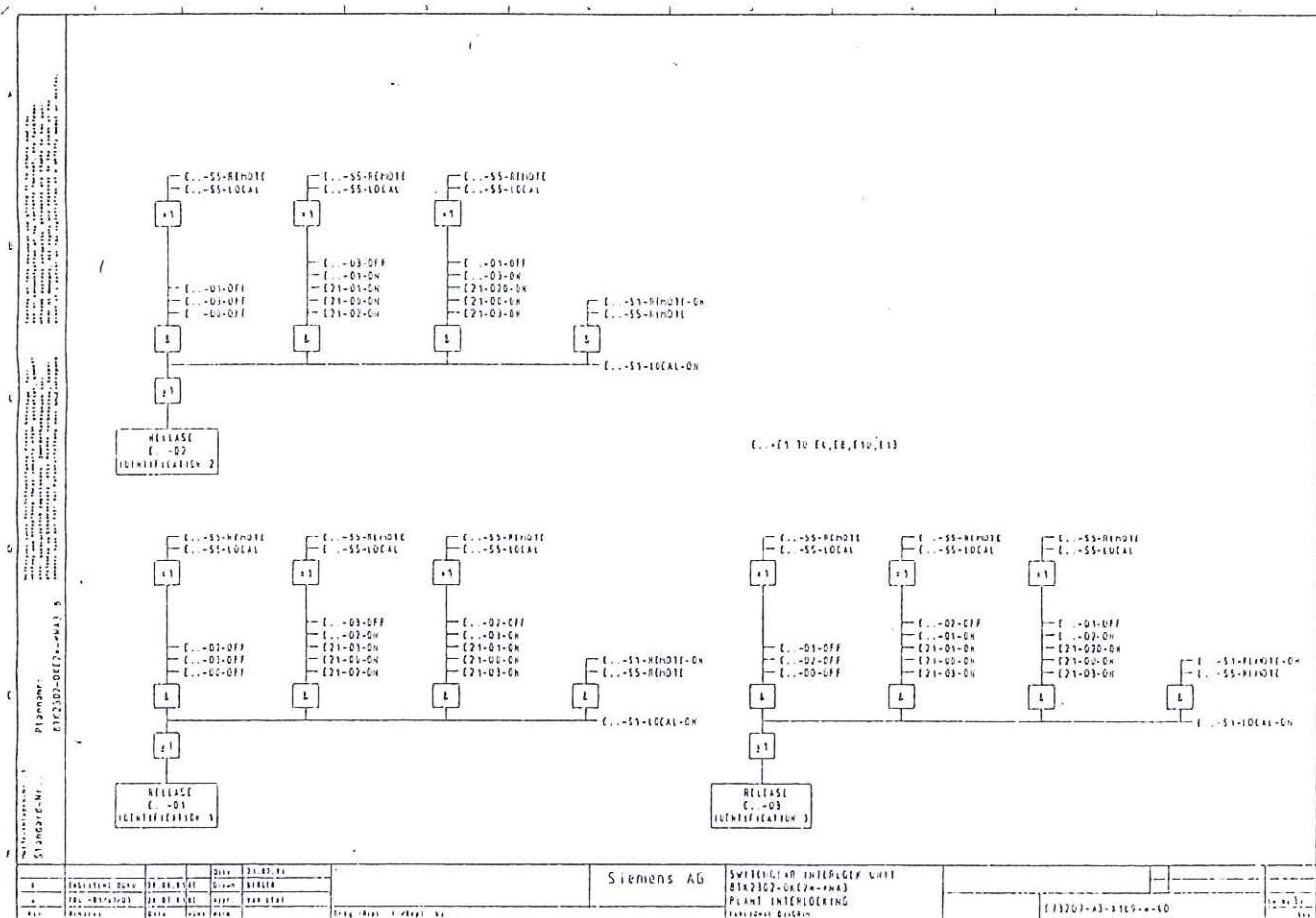





Fig. 7.3 Function diagram switchyard interlocking, example showing enabling of switching devices E...-Q1, E...-Q2 and E...-Q3 for bays E... = E1 to E4, E8, E10, E13 (see single line diagram page 7/4, Fig. 7.2)

7.3 Operation

The switchgear interlocking unit can be operated either by remote control and / or by local operation on the unit.

jumper B–C 8TK3002 – 1/3/5/7 **00	jumper A–C 8TK3002 – 2/4/6/8 **00	keyswitch position
remote control ON, local control OFF	remote control ON, local control ON	REMOTE 
remote control OFF, local control ON		LOCAL 
feeder disconnected: remote control OFF, local control OFF		OFF 

With remote operation, the interlocking units are operated with two poles. If the steady lamp switch IND. ON/OFF is not closed, an opening or closing movement will not be indicated. The completed switching operation is indicated by the movement of the semaphore indicator on the ABB. If the switching operation is not permissible, fault alarm F3 is set. If the switching device does not execute the command or remains in an "intermediate position", fault alarm F4 and / or F6 is set (see Section 9.2.2.2 "Interpretation of fault alarms"). If the steady lamp switch is closed, the sequence is the same as for local control.

With local control, a switching command must be given using two hands. If the steady light switch IND. ON/OFF is pressed, the pushbutton itself lights up, the CLOSE and OPEN button and all intermediate position lamps on the interface and control modules light up. The semaphore indicator shows the position of the main switching device and the associated intermediate position lamp, when lit up, indicates the final position of the main switching device. If the switching direction button CLOSE or OPEN is selected and at the same time the switching device pushbutton is pressed, it is possible to initiate a switching operation. If accepted, the switching operation is indicated by the fact that the lamp for the switching direction button (OPEN or CLOSE off) goes out and the associated intermediate position lamp of the switching device on the ABB blinks. Completion of the switching operation is indicated by the movement of the semaphore indicator to the new final position and the steady light of the intermediate position lamp and the fact that the lamp lights up in the switching direction button.

If the switching operation is not permissible, fault alarm F3 is set; if the switching operation is not executed or the switching device remains in the "intermediate position", fault alarm F4 and / or F6 is set (see Section 9.2.2.2 "Interpretation of fault displays").

To minimize the constant power consumption of the interlocking unit, the steady light switch IND. ON/OFF must be switched off if no switching operations are being performed on the switchgear interlocking unit (remote or local operation).

Fig. 7.4 Single line diagram (new)

[illegible]

Fig. 7.5 Switchyard overview, derived from 8TKTOOLS

7.4.2 Central unit

The parameter sheet of the central unit contains general parameters, designations and enables for switching devices. The general parameters contain the device MLFB and specific information derived from it, e.g. operating times, counter control command. Moreover, information about any keyswitches (exception: keyswitches S1 and S5 are not documented because they are always used independently of the software) with additional information and bus coupling contacts are given.

The switching devices themselves are shown in tables with their name, plug position, switching device type and the function name for CLOSING or OPENING (Fig. 7.6).

central unit:		E06		
general parameter:				
MLFB:	8TK2257-0JB2E-6PA3	keyswitch:	no.2: S2	
operating time of device disconnecter:	25 s	no.3:	S3	
operating time of device circuit-breaker:	1 s	no.4:	S4	
scan counter control command:	no	supplementary information:	no.1:	
			no.2:	
			no.3:	
			no.4:	
		condition:	Relais K11: OK OFF OK1	
			Relais K12:	
switching devices and releases:				
slot	switching device name	release ON	release OFF	switching device type
1	Q52	E06-Q52	E06-Q52	switching switch
3	Q2	E06-Q1	E06-Q1	isolator
4	Q0	E06-Q0 CLOSE	E06-Q0 OPEN	circuit breaker
7	Q1	E06-Q1	E06-Q1	isolator
9	Q22	E06-Q22	E06-Q22	isolator
10	Q51	E06-Q51	E06-Q51	switching switch
11	Q12	E06-Q12	E06-Q12	isolator
12	Q27	E06-Q27	E06-Q27	switching switch
13	Q17	E06-Q17	E06-Q17	switching switch

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switchgear interlock unit 8TK

General parameter and switch enables

Fig. 7.6 General parameters and device enables derived from 8TKTOOLS

The interlocks themselves are represented in function path form using 8TKTOOLS. This type of representation has already been introduced into installations with integrated substation control and protection where modern parameterization tools are used.

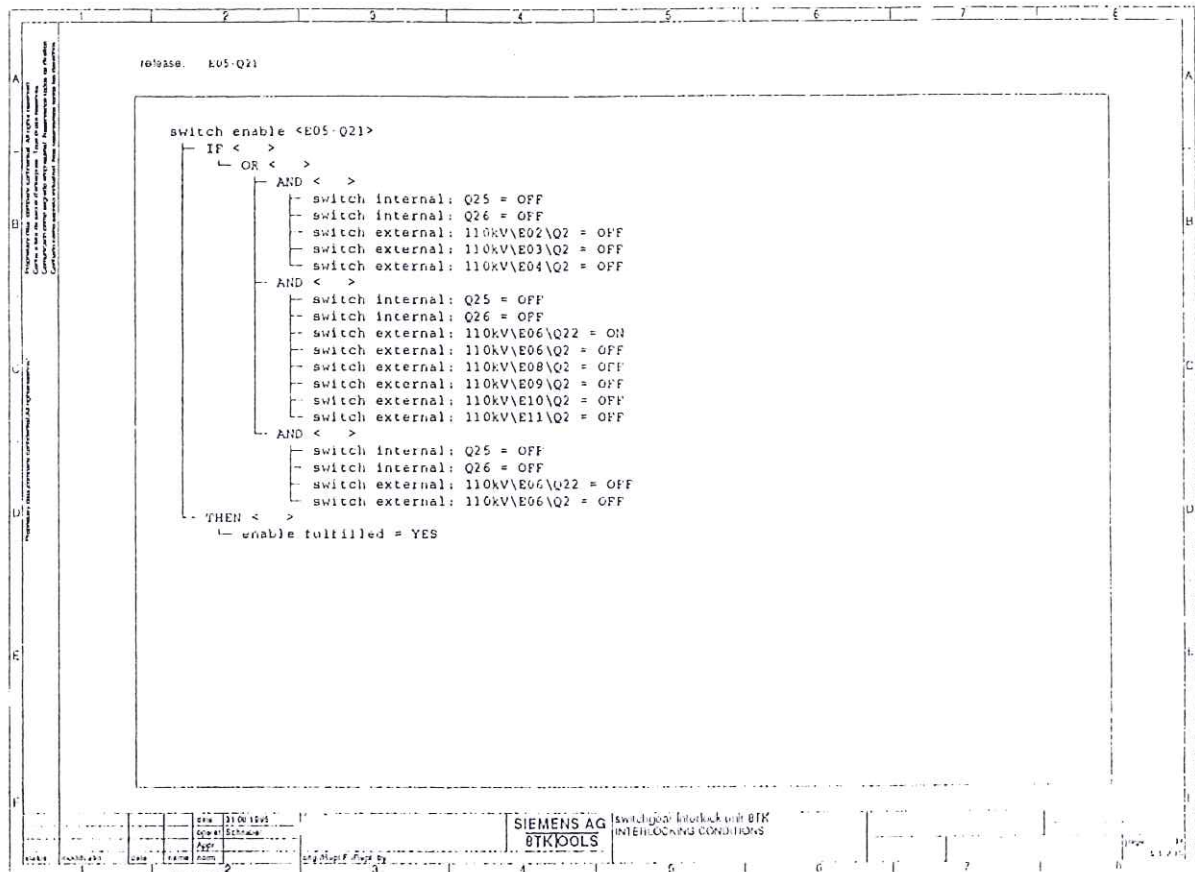


Fig. 7.7 Interlock conditions generated in function path form using 8TKTOOLS

Explanation of the function path representation:

The function path of the selected object is shown in the logic sequence in the interlock conditions work sheet. The path elements are made up of single information items. There are structure and data elements. The function path consists of a condition and an action branch. In the condition branch, those conditions are defined that must be fulfilled to execute the action branch. Condition branches are represented by the logical structure element "IF". The conditions are formed by data elements. Each of the condition blocks is assigned an action branch ("THEN").

In the action branch, the actions are defined that are executed if the conditions of the higher level condition branch are fulfilled. The actions of the "THEN" branch are executed if – and only if – the conditions of the higher–level condition branch are fulfilled. The structure elements form the logical structure of the function path. The following structure elements are available:

- | | |
|-----------------------|---|
| Switchgear enable < > | This structure element designates switchgear interlocking and is the highest level of the function path. |
| IF < > | <p>Logical element to designate the condition branch.</p> <p>Only one "IF" element can exist in a function path. It always directly follows the structure element "switchgear enable < >". The conditions listed under "IF" must be fulfilled if the following action branch is to be executed. This structure element is located on the second level of the function path.</p> |
| THEN < > | <p>Logical element to designate the action branch.</p> <p>An "IF" element always has its "THEN" element. This is on the second level of the function path.</p> |
| AND < > | <p>Logical element that only occurs in the condition branch and logically combines conditions.</p> <p>All conditions listed under "AND" must be fulfilled before the "AND" condition as a whole is fulfilled. This structure element is optional and is located on the third or lower level of the function path.</p> |
| OR < > | <p>Logical element only used in the condition branch which logically combines conditions.</p> <p>One of the conditions listed under "OR" must be fulfilled before the "OR" condition as a whole is fulfilled.</p> |

In this method of representation, the interlock conditions for each switchgear enable are shown on a separate sheet.

7.4.3 Feeder unit

The feeder device types of a switchyard are contained in the switchyard overview.

The documentation with 8TKTOOLS comprises: Parameter sheets of the central unit of all feeder unit types
interlock conditions.

The documentation of the feeder unit types has a similar structure to that of the central unit. Sheet 1 also states in which bays this feeder unit type is used (Fig. 7.8).

feeder unit type:		E02										
general parameter:		feeder unit type used in the following bays:										
MLFB:	8TK1227-1AY26-6FA3											
operating time of device disconnector:	25 s	<table border="1"> <tr><td>bay:</td></tr> <tr><td>E02</td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> </table>	bay:	E02								
bay:												
E02												
operating time of device circuit-breaker:	1 s											
scan counter control command:	no											
single controlling device:	no											
standby device:	no											
keyswitch:	no.2: S2											
	no.3: S3											
	no.4: S4											
supplementary information:	no.1: 21R1 01	Q1/Q2										
	no.2:											
	no.3:											
	no.4:											
condition:	Relais K11:											
	Relais K12:											

Fig. 7.8 General parameters feeder unit

[illegible]

Fig. 7.9 switchgear and enables feeder unit

Here too, the interlock conditions are represented in the form of function paths:

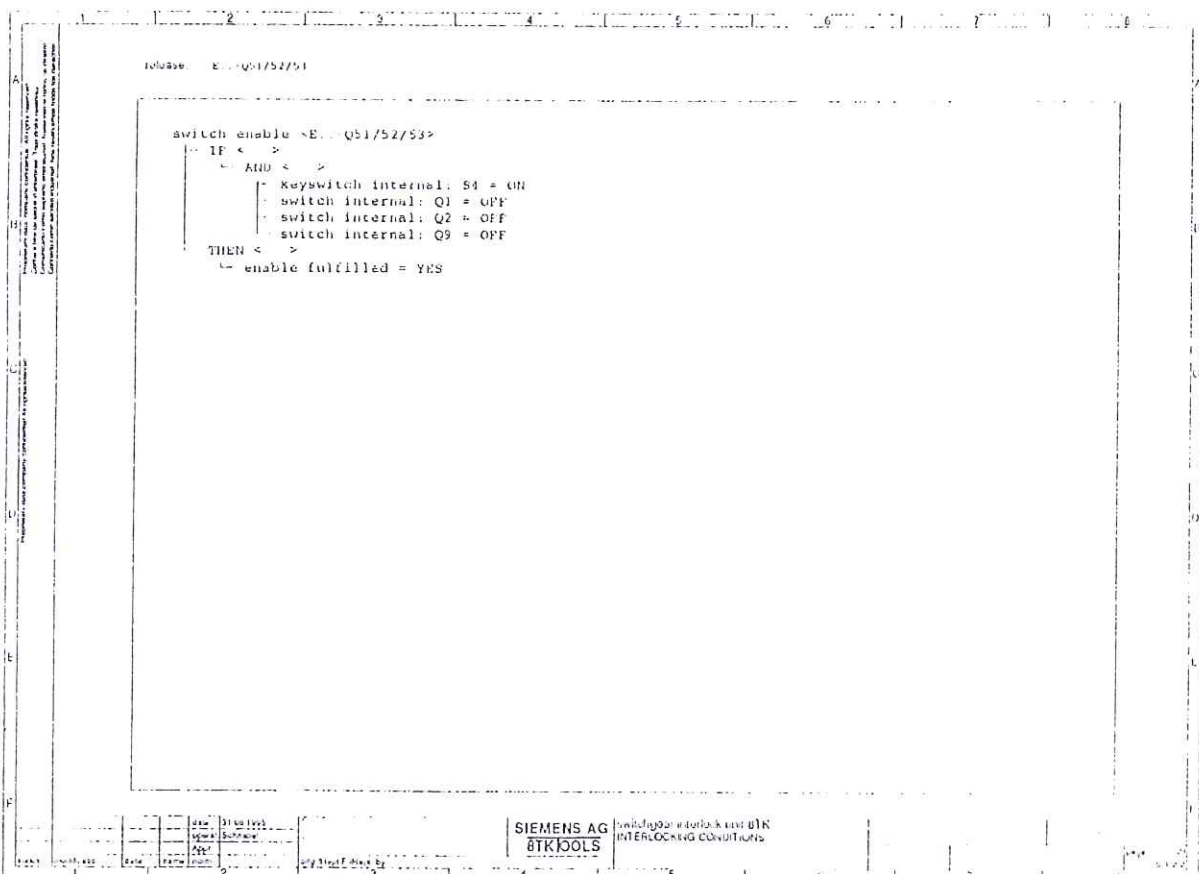


Fig. 7.10 Interlock conditions internal, generated using 8TKTOOLS

8 Mechanical Design

The mechanical design is not important for the operation and maintenance of this device.

The mounting location of each module and the order number can be seen from the location diagram (Figs. 3.3, 3.4, 3.6, 3.8, 3.9).

The order number of the module is printed on the front lower securing bar of the module rack and is visible when the module is removed. On the module itself, it is printed on the front panel, either on the front or on the side. If the order number is printed on the side, e.g. on the ABB, it can only be read if the module is removed.

See Catalog LSA3.1 "8TK Switchgear Interlocking System" for explanations of the order numbers of the interlocking units and modules. For the modules, an extract of the Catalog is listed under spare parts.

