

EKS Light FSA on Siemens S7-300 – selection of operating mode using touchscreen – practical implementation



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Components/modules used

EUCHNER

Description	Order no./item designation
EKS Light FSA compact or EKS Light FSA modular EKS FHM	112207 / EKSA-IPLA-G01-ST05/04 113645 / EKSA-APRA-G08 106585 / EKSA-SFH-G30-2000
EKS Electronic-Key	077859 / EKSA-K1RDWT32-EU 084735 / EKSA-K1BKWT32-EU 091045 / EKSA-K1BLWT32-EU 094839 / EKSA-K1GNWT32-EU 094840 / EKSA-K1YEWT32-EU

Tip: More information and downloads about the mentioned EUCHNER products can be found at www.EUCHNER.com. Simply enter the order number in the search box.

Others

Description	Item
S7-300, CPU 315F-2 PN/DP	6ES7315-2FJ14-0AB0
SIMATIC S7, digital input module SM 326, F-DI	6ES7 326-1BK02-0ab0
Touchpanel Siemens TP9000 Comfort	6AV2 124-0JC01-0AX0

Abbreviations

Designation	Abbreviation
EKS light FSA EKS	The EKS light with FSA functionality used in this application (refer to the EUCHNER components used)
PLC	The conventional control system used and that offers PLC functionality. The PLC has connections for the bus systems used
F-PLC	The fail-safe PLC used in this application. The F-PLC shares a data range with the PLC via flag words or similar
HMI	The human-machine interface comprising a screen with touch-sensitive surface or softkeys
MW	Flag word, a 16-bit data word for data exchange between the F-PLC and the PLC
PL	Performance Level according to EN ISO 13849-1
PL _r	Performance Level required according to EN ISO 13849-1
SRASW	Safety-related application software according to EN ISO 13849-1

Functional description

General

Selection of operating mode is to be realized on a machine using the EKS light FSA as an access system. The operating mode is selected via a touchscreen or other control elements, e.g. softkeys in the HMI (human-machine-interface). Operation is therefore possible via the standard user interface; no key-operated switch is required. Evaluation and switchover of the operating mode are realized via a safe programmable logic controller (F-PLC). With the aid of the EKS light FSA, five access rights to selection of operating mode can be defined. Which operating modes the owner of the related Electronic-Key can select depends on the access rights.

This document is based on application AP000200-01_06-16... that has been checked by the "Institut für Arbeitssicherheit in St. Augustin". For details of the safety assessment, the Electronic-Key structure and other key data, please refer to the application stated.

This application addresses the program-related implementation in a safe control system based on the example of an S7-300. The operating modes MSO 1 to MSO 4 are possible. MSO 0 is not used in this example (in gray in the table below).

Definition of the data words for the operating mode level

In order to avoid errors due to overwriting of the memory in the PLC, the meaning of selection of operating mode in the various memory locations used **must** change the value. For this purpose, Table 2 defines the meaning of selection of operating mode in the respective variable or in the data word. This is undertaken by means of constants.

Variable or data word	Definition Operating mode	Hex	Comment
Value range for ReadAuthorization, Electronic-Key content (the Electronic-Key must be written according to these values) Permitted operating mode on the EKS Electronic-Key	RE_MS0_0	0F0FH	Output A set. Mode of Safe Operation 0: Manual mode
	RE_MS0_1	0FF0H	Output B set. Mode of Safe Operation 1: Automatic mode
	RE_MS0_2	3333H	Output C set. Mode of Safe Operation 2: Setup mode
	RE_MS0_3	33CCH	Output D set. Mode of Safe Operation 3: Automatic mode with manual intervention
	RE_MS0_4	3C3CH	Output STR set. Mode of Safe Operation Service: Operating mode for servicing and setup
SelectMSO – value range for the selection of the operating mode	SE_MS0_0	0FF0H	Mode of Safe Operation 0: Manual mode
	SE_MS0_1	3333H	Mode of Safe Operation 1: Automatic mode
	SE_MS0_2	33CCH	Mode of Safe Operation 2: Setup mode
	SE_MS0_3	3C3CH	Mode of Safe Operation 3: Automatic mode with manual intervention
	SE_MS0_4	0F0FH	Mode of Safe Operation Service: Operating mode for servicing and setup
CheckMSO – value range for the confirmation of the operating mode	CH_MS0_0	3333H	Mode of Safe Operation 0: Manual mode
	CH_MS0_1	33CCH	Mode of Safe Operation 1: Automatic mode
	CH_MS0_2	3C3CH	Mode of Safe Operation 2: Setup mode
	CH_MS0_3	0F0FH	Mode of Safe Operation 3: Automatic mode with manual intervention
	CH_MS0_4	0FF0H	Mode of Safe Operation Service: Operating mode for servicing and setup

SwitchMSO – value range for setting the operating mode	SW_MSO_0	33CCH	Mode of Safe Operation 0: Manual mode
	SW_MSO_1	3C3CH	Mode of Safe Operation 1: Automatic mode
	SW_MSO_2	0F0FH	Mode of Safe Operation 2: Setup mode
	SW_MSO_3	0FF0H	Mode of Safe Operation 3: Automatic mode with manual intervention
	SW_MSO_4	3333H	Mode of Safe Operation Service: Operating mode for servicing and setup

Table 2

The values represent a hierarchical order – MSO 1 and MSO 2 are contained in MSO 3, for example. For example, with the access right MSO3 the outputs LA and D are switched on. All others remain switched off.

Important These values must be used to safeguard the data transfer on the bus between the PLC and the HMI.

Block diagram and description

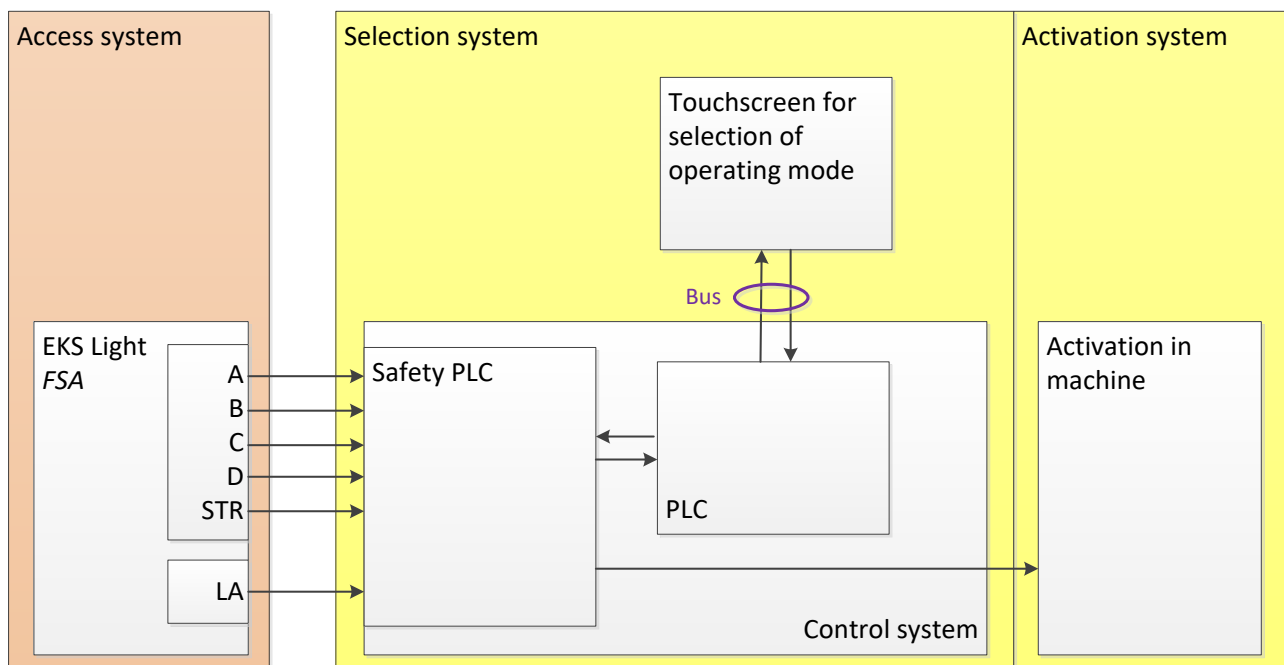


Figure 1

The switching outputs A to D as well as STR on the EKS Light FSA are connected to safe inputs on the F-PLC. In the example, the outputs B to D and STR are connected to the safe inputs FI0 to FI3. The F-PLC internally forwards the data to the PLC via flags. The PLC makes two flag words available to the F-PLC for verification. Any form of communication with the HMI is permissible, typically via a bus. Switching channel LA on the EKS FSA is connected to a further safe input on the F-PLC. FI4 is used in the example. The safe PLC is responsible for switching the operating mode. First the safety equipment for the selected operating mode is switched on via outputs. Maybe additional signals to the PLC are necessary. It must be observed that this part of selection of operating mode is also relevant to safety and therefore must fulfill the required Performance Level (PL) of selection of operating mode.

General notes about programming

The sequences in the four different devices are structured so that the F-PLC detects errors automatically based on the data generated and forwarded by the various devices.

The sequences given below must be programmed in the devices PLC, HMI and F-PLC. During this process the programming principles required in EN ISO 13849-1:2008 section 4.6 are to be followed. All sequences relevant for safety are programmed in the F-PLC. The PLC is only used to forward data between the HMI and F-PLC.

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The depiction in the diagrams below is a logical sequence that is not automatically observed in a PLC or in an F-PLC with cyclical processing. Therefore, programming must be performed so that each step is executed only once. This is ensured in each network by using a flag or also inputs from the EKS that unambiguously identify the steps.

In the flow diagram there is an overview of the complete sequence in the various devices such that both the cycle and the logical sequence are depicted. For each step, or also for several combined steps, you will find the related logical F-PLC or PLC network in ladder diagram format (LD).

Flowchart

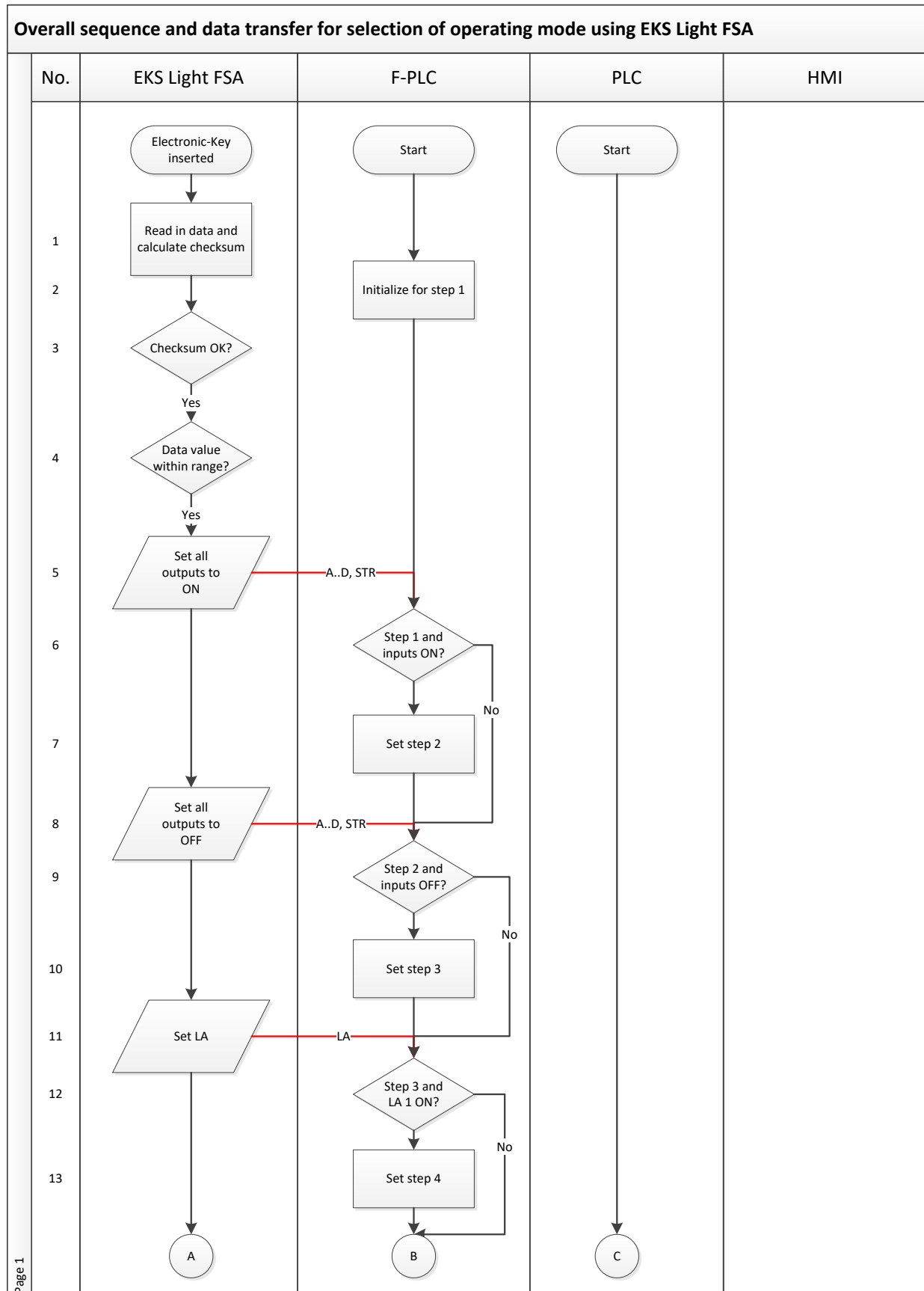


Figure 2.1

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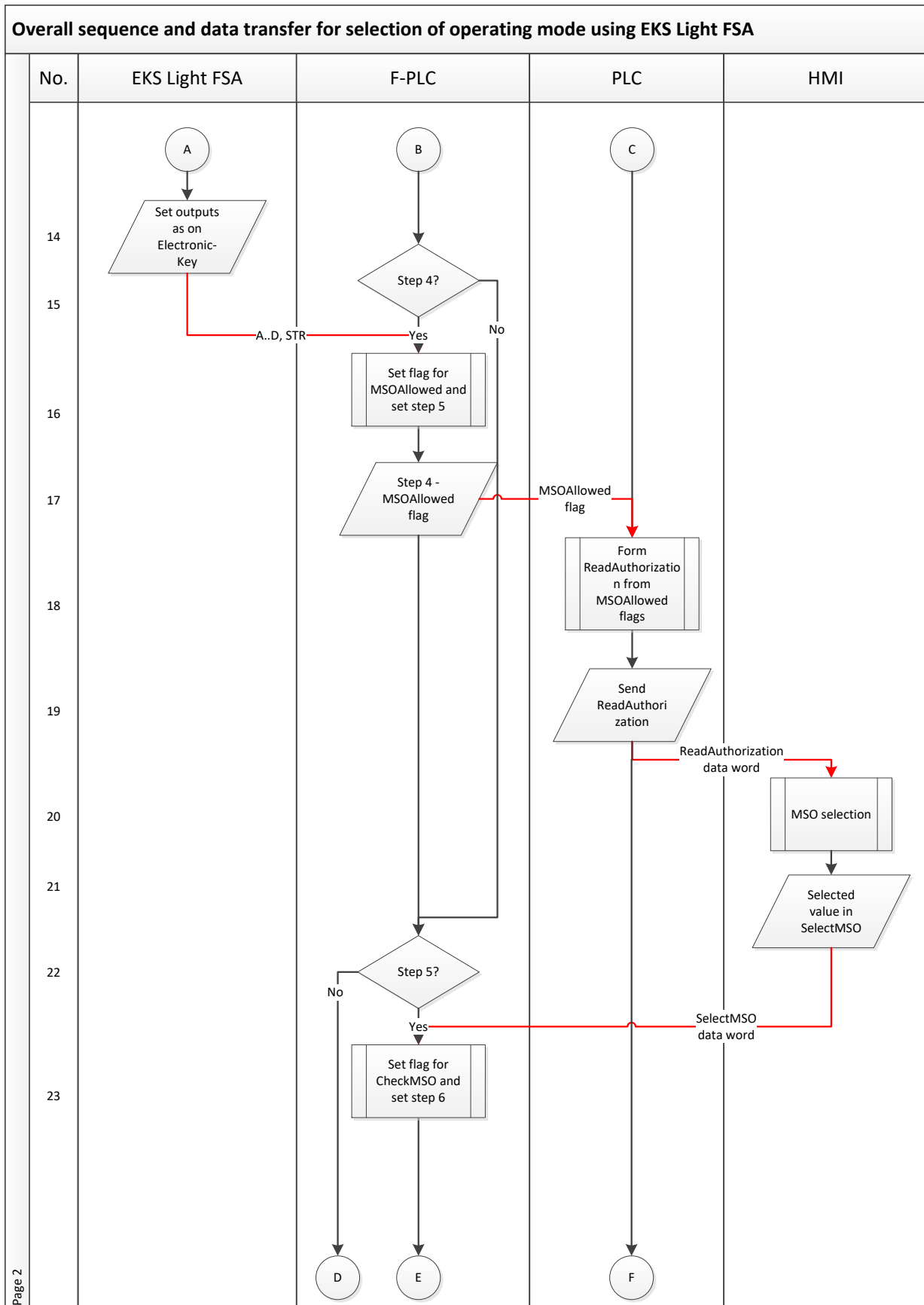


Figure 2.2

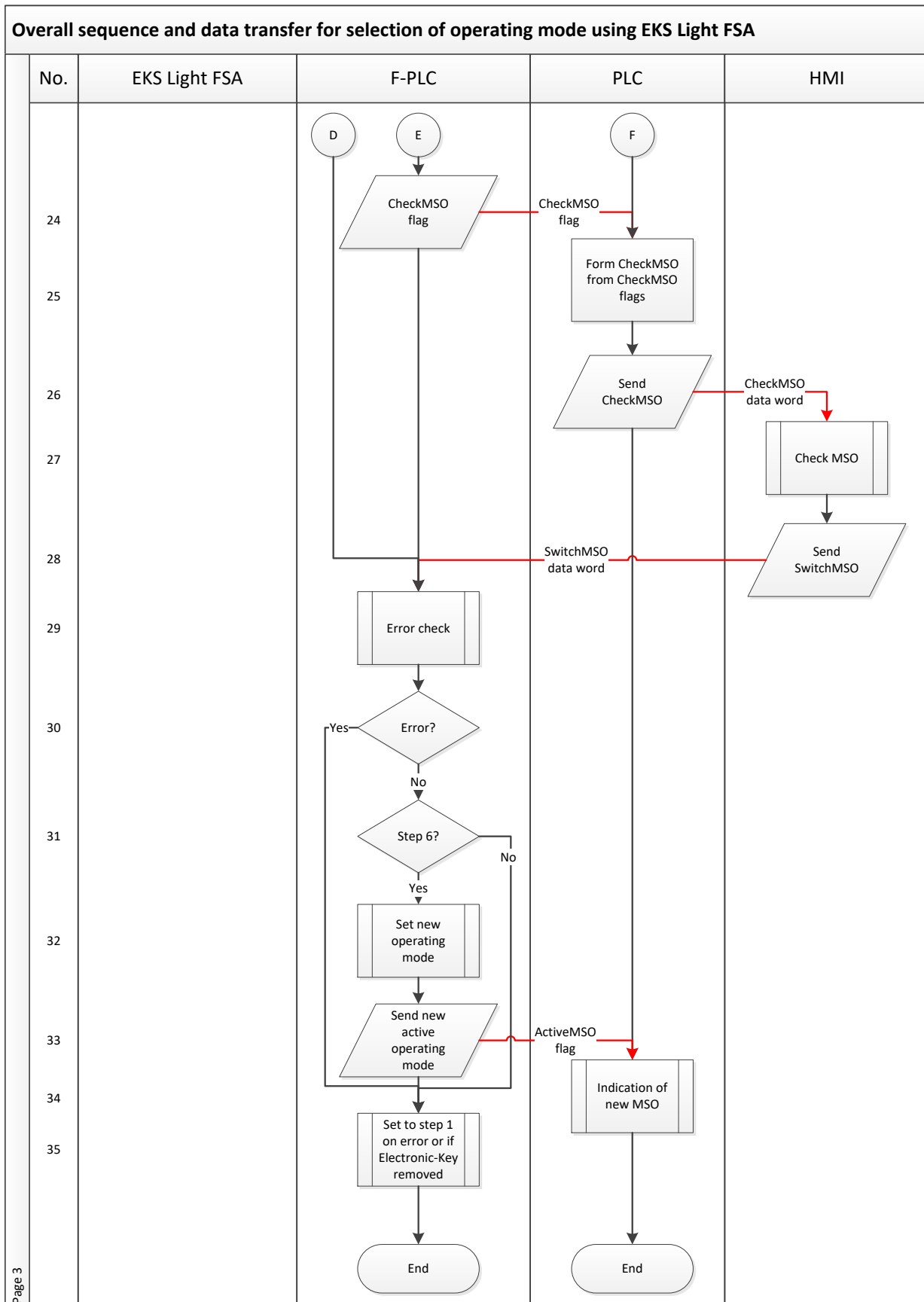


Figure 2.3

Memory usage

The following safe variables are saved in a data block in the global, non-volatile memory. These variables can be read by both the PLC and the F-PLC. They are written only by the F-PLC.

S5_M_MS01_Allowed	Bool		The flag is set in sequence step 5 if operating mode MSO 1 is allowed.
S5_M_MS02_Allowed	Bool		The flag is set in sequence step 5 if operating mode MSO 2 is allowed.
S5_M_MS03_Allowed	Bool		The flag is set in sequence step 5 if operating mode MSO 3 is allowed.
S5_M_MS04_Allowed	Bool		The flag is set in sequence step 5 if operating mode MSO 4 is allowed.
S6_M_MS01_Check	Bool		The flag is set in sequence step 6 if it has been detected that MSO 1 is to be se-
S6_M_MS02_Check	Bool		The flag is set in sequence step 6 if it has been detected that MSO 2 is to be se-
S6_M_MS03_Check	Bool		The flag is set in sequence step 6 if it has been detected that MSO 3 is to be se-
S6_M_MS04_Check	Bool		The flag is set in sequence step 6 if it has been detected that MSO 4 is to be se-
M_Global_Error	Bool		The flag is set if any error has occurred.

The following standard variables are saved or defined in the global, non-volatile memory. These variables can be written by the PLC. The F-PLC must be able to read the two variables Select_MS0_To_SafePLC and SwitchMS0_To_Safe_PLC.

I_EKS_B	Bool	%E0.0	Safe input B from the EKS Light
I_EKS_C	Bool	%E0.1	Safe input C from the EKS Light
I_EKS_D	Bool	%E0.2	Safe input D from the EKS Light
I_EKS_STR	Bool	%E0.3	Safe input STR from the EKS Light
I_EKS_LA	Bool	%E0.4	Safe input LA from the EKS Light
ReadAuthorization_to_Touch	Word	%MW0	This variable is set if an operating mode can be selected
SelectMS0_To_SafePLC	Word	%MW2	The variable indicates the selected operating mode
CheckMS0_To_Touch	Word	%MW4	This variable indicates what has been detected in the safe PLC
SwitchMS0_To_SafePLC	Word	%MW6	The variable contains the confirmation for the selected operating mode
M_Error_Off_Detected	Bool	%M8.0	Is used to filter error messages without an Electronic-Key inserted
M_Error_Off_Locked	Bool	%M8.1	An error found previously is locked with the aid of this variable
M_Ack_Err	Bool	%M8.2	This variable makes it possible to acknowledge a previously locked error

The following safe variables are saved in the local or global non-volatile memory in the safe PLC. These variables must be available only in the safe PLC. The transfer of the operating mode selected to the PLC is not taken into account in this example.

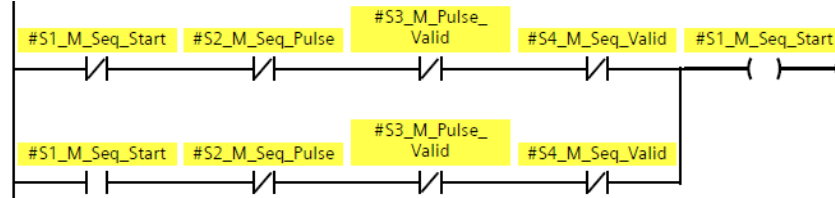
M_MS01_Active	Bool	0.0	Indicates that MSO 1 is to be activated
M_MS02_Active	Bool	0.1	Indicates that MSO 2 is to be activated
M_MS03_Active	Bool	0.2	Indicates that MSO 3 is to be activated
M_MS04_Active	Bool	0.3	Indicates that MSO 4 is to be activated
S1_M_Seq_Start	Bool	0.4	Indicates that sequence step 1 must be run through
S2_M_Seq_Pulse	Bool	0.5	Indicates that sequence step 2 must be run through
S3_M_Pulse_Valid	Bool	0.6	Indicates that sequence step 3 must be run through
S4_M_Seq_Valid	Bool	0.7	Indicates that a valid Electronic-Key is inserted
M_Error_Select	Bool	1.0	Indicates that there is a serious error in the data for the selection
M_Error_Switch	Bool	1.1	Indicates that there is a serious error in the data for the confirmation

Description of the steps

The step number relates to the flowchart in Figures 2.1 to 2.3

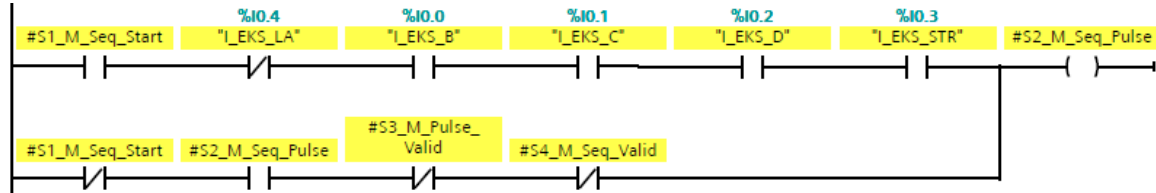
Step	System	Description
1	EKS light FSA	A user has inserted an Electronic-Key. The EKS reads the data and calculates a checksum for the Electronic-Key; in this way it can be excluded that the Electronic-Key is a copy.
2	F-PLC	The initialization of the chain of sequence steps in the safe PLC is started. The first flag in the chain is set if all others are reset and then latches.

F-PLC network 1:



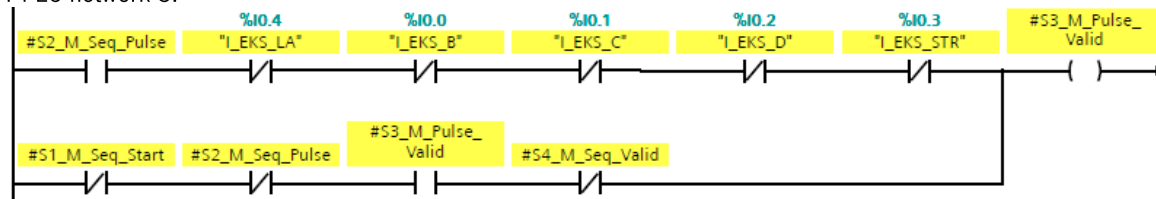
3	EKS light FSA	It is checked whether the checksum is correct. If not, a fault display is set. The rest of the sequence is inhibited (not shown here).
4	EKS light FSA	It is checked whether the data value for the selection of the operating mode is one of the data words allowed. If not, a fault display is set. The rest of the sequence is inhibited (not shown here).
5	EKS light FSA	For protection against tampering, all outputs A to D and STR are set to ON for approx. 200 ms. The outputs used in the application are checked in the network.
6	F-PLC	In the first sequence step, it is checked in the F-PLC whether all inputs from the EKS are set to ON. The check is made in F-PLC network 2. At the same time, the input LA must be set to OFF.
7	F-PLC	The second sequence step is started only if the result of the check is positive. The step latches after the detection of the input pulse.

F-PLC network 2:



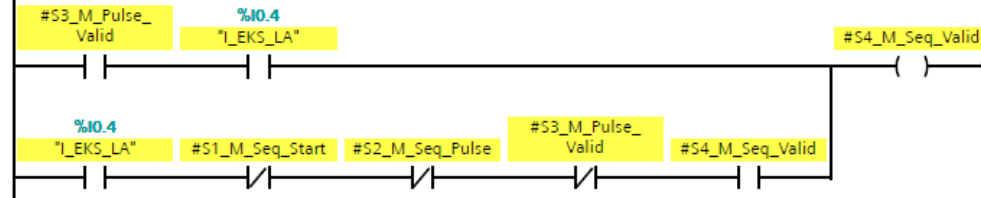
8	EKS light FSA	For protection against tampering, all outputs A to D and STR are set to OFF for approx. 200 ms.
9	F-PLC	In the second sequence step, it is checked in the F-PLC whether all inputs from the EKS are set to OFF.
10	F-PLC	The third sequence step is started only if the result of the check is positive. The step latches after the detection of the input pulse.

F-PLC network 3:



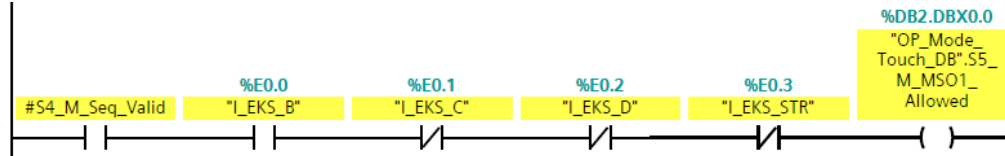
11	EKS light FSA	The EKS then sets the output LA to identify that the data on the outputs A to D and STR are valid.
12	F-PLC	In the third sequence step, it is checked in the F-PLC whether the input LA is set to ON.
13	F-PLC	Sequence step 4 is started only if the result of the check is positive. The input LA must always remain switched on from now. Otherwise the sequence will be invalid again.

F-PLC network 4:

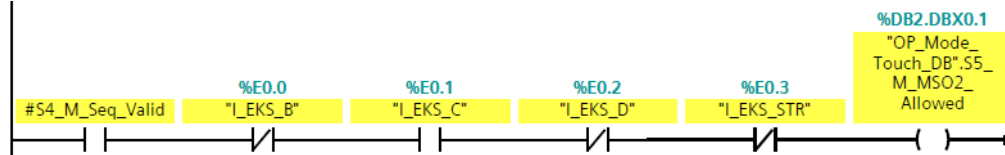


14	EKS light FSA	The EKS sets just one of the outputs A to D or STR with the highest permissible level of selection of operating mode for the owner of the Electronic-Key to suit the data word read from the Electronic-Key.
15	F-PLC	Only if step 4 is active is a flag for the permissible operating mode set.
16	F-PLC	It is written to a flag which operating mode is allowed to be selected as a maximum corresponding to the input. The flags also stand for sequence step 5. F-PLC networks 5 to 8: It is checked that only one input is set. The input LA must also continue to be set to ON. It is checked in F-PLC network 13 that LA remains switched on. Otherwise an error is detected.
17	F-PLC	The flags formed from step 15 must be available in the PLC. For this reason, these flags are saved in a global area.

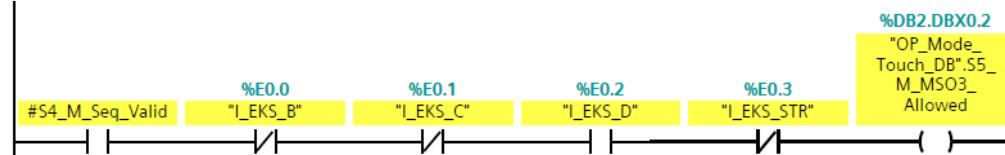
F-PLC network 5:



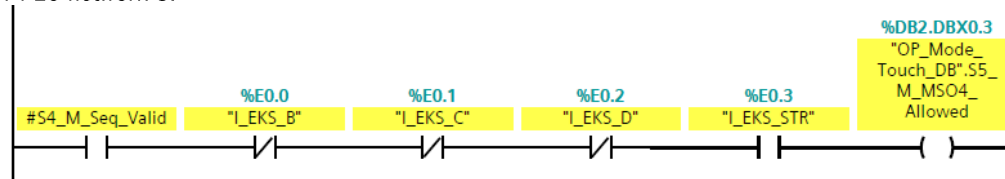
F-PLC network 6:



F-PLC network 7:

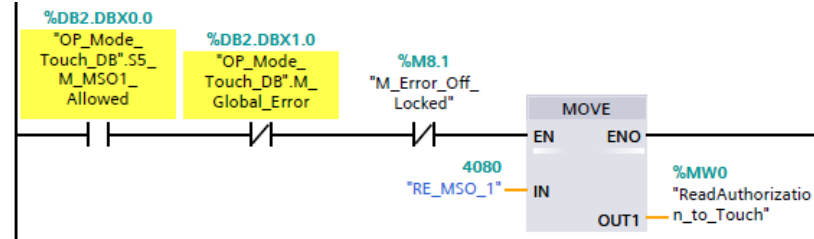


F-PLC network 8:

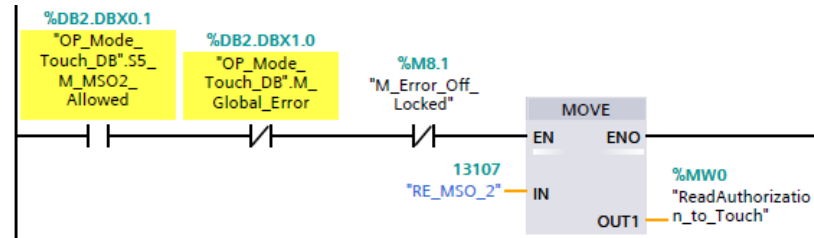


18	PLC	The PLC forms a data word for the HMI from the flags for the permitted operating mode. PLC networks 1 to 4: A fixed data word from the pool is assigned to each flag. If an error has been detected, the assignment to ReadAuthorization is not made so that there can be no indication on the HMI if there is an error. PLC network 5: If there is no longer a flag set or an error has been detected, ReadAuthorization for the HMI is set to 0.
19	PLC	The data word formed in step 17 must be available to the HMI.

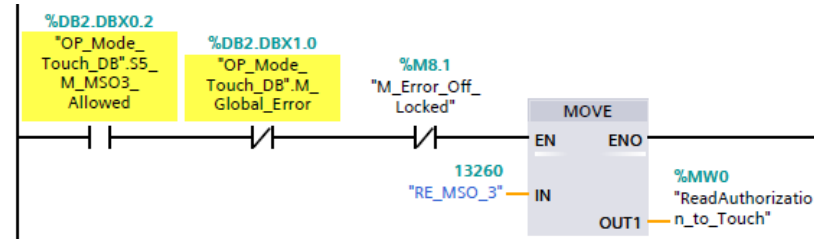
PLC network 1:



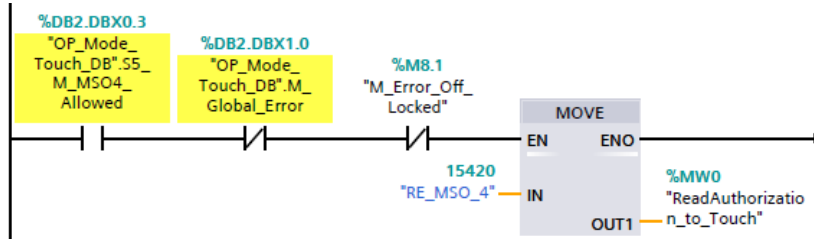
PLC network 2:



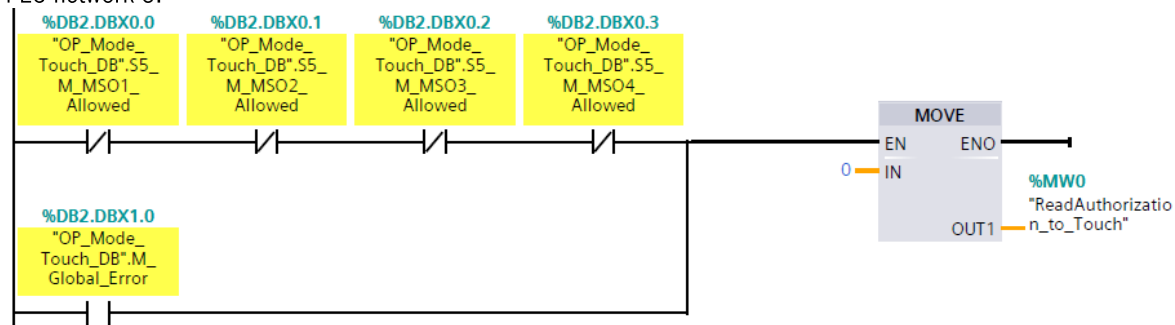
PLC network 3:



PLC network 4:



PLC network 5:



20	HMI	A screen with the permitted operating mode(s) is displayed or made available in the HMI. The user can now select an operating mode.
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Script for opening mask operating mode selection on touch:

```
1 Sub Check_ReadAuthorization()  
2 'Der Aufruf dieses Script startet bei der Wertänderung der Variable ReadAuthorization_to_Touch  
3  
4 'Variablendeklaration  
5 Dim ReadAuthorization_to_Touch  
6  
7 'Zuweisung SmartTag an Variable  
8 Set ReadAuthorization_to_Touch = SmartTags("ReadAuthorization_to_Touch")  
9  
10 'Wenn kein Schlüssel steckt, zurück ins Hauptbild ansonsten Bild MSO_Anwahl  
11 If ReadAuthorization_to_Touch = 0 Then  
12     ActivateScreen "Main_Screen",0  
13     SmartTags("SelectMSO_To_SafePLC") = 0  
14     SmartTags("SwitchMSO_To_SafePLC") = 0  
15 Else  
16     ActivateScreen "MSO_Selection",0  
17 End If  
18  
19  
20 End Sub
```

Script to activate fields in operating mode selection:

```
1 Sub Enable_Buttons ()
2 |Der Aufruf dieses Script startet beim Aufbau des Bildes MSO_Anwahl
3
4 'Variablendeklaration
5 Dim MSO1, MSO2, MSO3, MSO4 'Werte in INT für die MSO
6 Dim Button_MS01,Button_MS02,Button_MS03, Button_MS04 'Softkeys
7 Dim ReadAuthorization_to_Touch
8
9 'Zuweisung Konstanten
10 MSO1 = 4080
11 MSO2 = 13107
12 MSO3 = 13260
13 MSO4 = 15420
14
15
16 'Zuweisung Softkey an Variable
17 Set Button_MS01 = HmiRuntime.Screens("MSO_Selection").ScreenItems("Schaltfläche_MS01")
18 Set Button_MS02 = HmiRuntime.Screens("MSO_Selection").ScreenItems("Schaltfläche_MS02")
19 Set Button_MS03 = HmiRuntime.Screens("MSO_Selection").ScreenItems("Schaltfläche_MS03")
20 Set Button_MS04 = HmiRuntime.Screens("MSO_Selection").ScreenItems("Schaltfläche_MS04")
21
22 'Zuweisung SmartTag an Variable
23 Set ReadAuthorization_to_Touch = SmartTags("ReadAuthorization_to_Touch")
24
25 'Freigabe Buttons mit Read Authorization
26 If ReadAuthorization_to_Touch = MSO1 Then
27     Button_MS01.Enabled = True
28     Button_MS01.Visible = True
29     Button_MS02.Enabled = False
30     Button_MS02.Visible = False
31     Button_MS03.Enabled = False
32     Button_MS03.Visible = False
33     Button_MS04.Enabled = False
34     Button_MS04.Visible = False
35
36 ElseIf ReadAuthorization_to_Touch = MSO2 Then
37     Button_MS01.Enabled = True
38     Button_MS01.Visible = True
39     Button_MS02.Enabled = True
40     Button_MS02.Visible = True
41     Button_MS03.Enabled = False
42     Button_MS03.Visible = False
43     Button_MS04.Enabled = False
44     Button_MS04.Visible = False
45 ElseIf ReadAuthorization_to_Touch = MSO3 Then
46     Button_MS01.Enabled = True
47     Button_MS01.Visible = True
48     Button_MS02.Enabled = True
49     Button_MS02.Visible = True
50     Button_MS03.Enabled = True
51     Button_MS03.Visible = True
52     Button_MS04.Enabled = False
53     Button_MS04.Visible = False
```

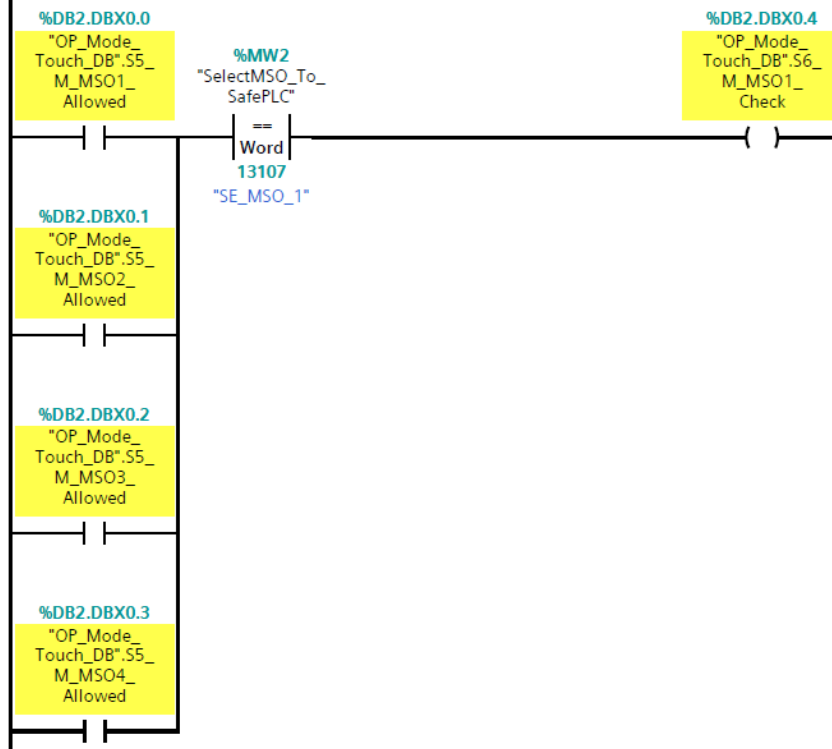
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54
55 ElseIf ReadAuthorization_to_Touch = MS04 Then
56     Button_MS01.Enabled = True
57     Button_MS01.Visible = True
58     Button_MS02.Enabled = True
59     Button_MS02.Visible = True
60     Button_MS03.Enabled = True
61     Button_MS03.Visible = True
62     Button_MS04.Enabled = True
63     Button_MS04.Visible = True
64
65 Else
66     ActivateScreen ("Main_Screen"),0
67     Button_MS01.Enabled = False
68     Button_MS01.Visible = False
69     Button_MS02.Enabled = False
70     Button_MS02.Visible = False
71     Button_MS03.Enabled = False
72     Button_MS03.Visible = False
73     Button_MS04.Enabled = False
74     Button_MS04.Visible = False
75 End If
76
77
78
79 End Sub

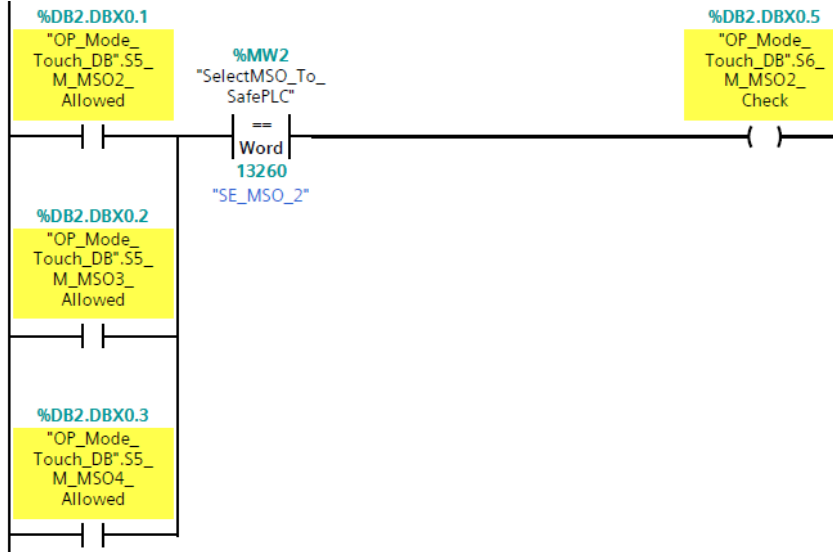
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21	HMI	The HMI writes the value for the selected operating mode from step 19 to a data word that is available to the F-PLC. Notice: If this action is not possible directly, an intermediate step can also be inserted during which the PLC forms a data word for the F-PLC from the data word from the HMI. The value from the HMI must be forwarded unchanged to the F-PLC by the PLC.
22	F-PLC	Only if step 5 is active is a flag for the selected operating mode set.
23	F-PLC	In sequence step 5 it is checked which operating mode is to be selected. For this purpose the data word must be a word from the pool for the selected operating mode and the selected operating mode must be within the range allowed. F-PLC networks 9 to 12: A flag is formed that corresponds to the operating mode selected. An error in SelectMSO is detected in F-PLC network 14.
24	F-PLC	The flag formed in step 21 is made available to the PLC for checking by the user.

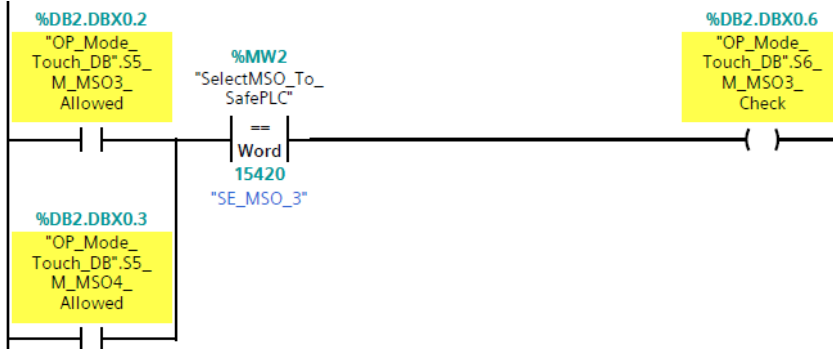
F-PLC network 9:



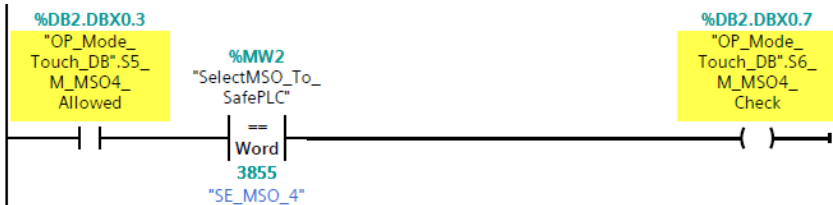
F-PLC network 10:



F-PLC network 11:

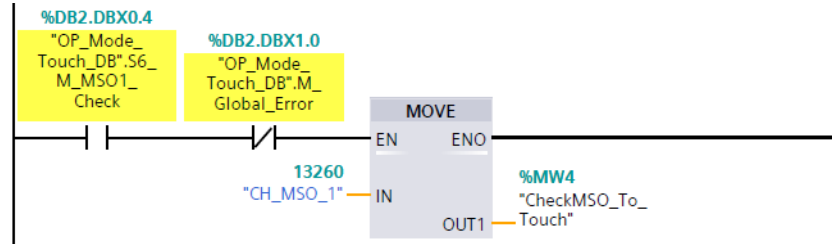


F-PLC network 12:

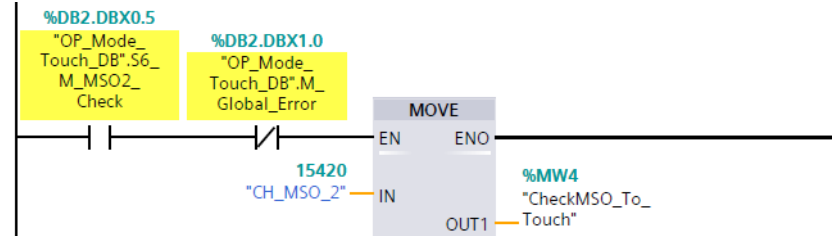


25	PLC	The PLC forms a data word for the HMI from the flags M_MSO_Check for the operating mode to be checked. PLC networks 6 to 9: A fixed data word from the pool is assigned to each flag. If an error has been detected, the assignment to CheckMSO is not made so that there is no indication on the HMI if there is an error. PLC network 10: If there is no longer a flag set or an error has been detected, CheckMSO for the HMI is set to 0.
26	PLC	The data word formed in step 23 must be available to the HMI.

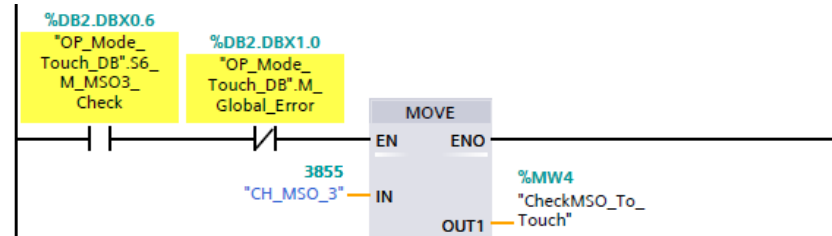
PLC network 6:



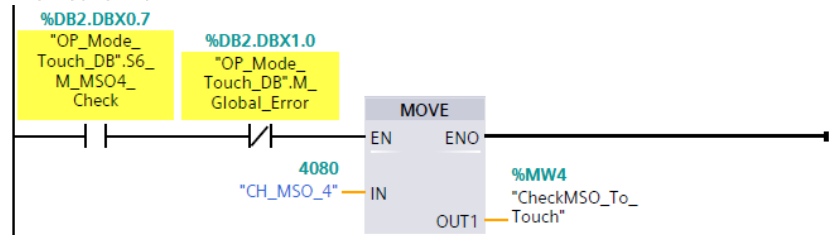
PLC network 7:



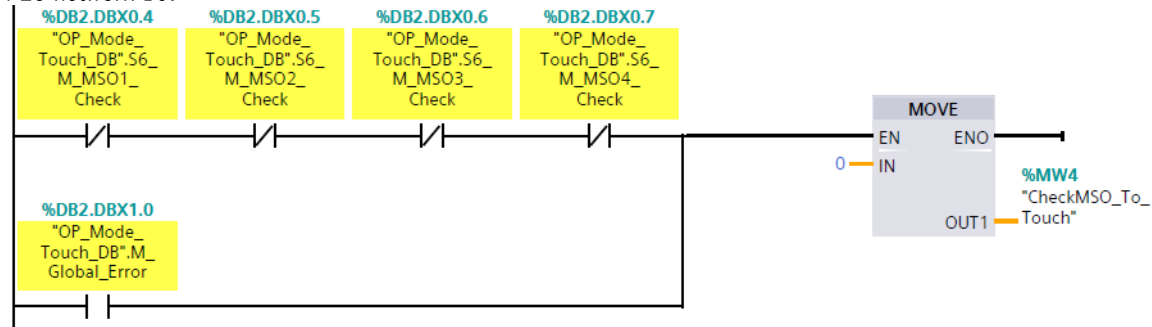
PLC network 8:



PLC network 9:



PLC network 10:



27	HMI	In the HMI, a screen is displayed where the operating mode to be confirmed and a selection for "OK" and "Not OK" are displayed. This confirmation must be in a separate prompt to the previous selection of the operating mode to prevent errors in the HMI (e.g. in a new dialog box).
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Script for opening acknowledge mask for operating mode selection:

```

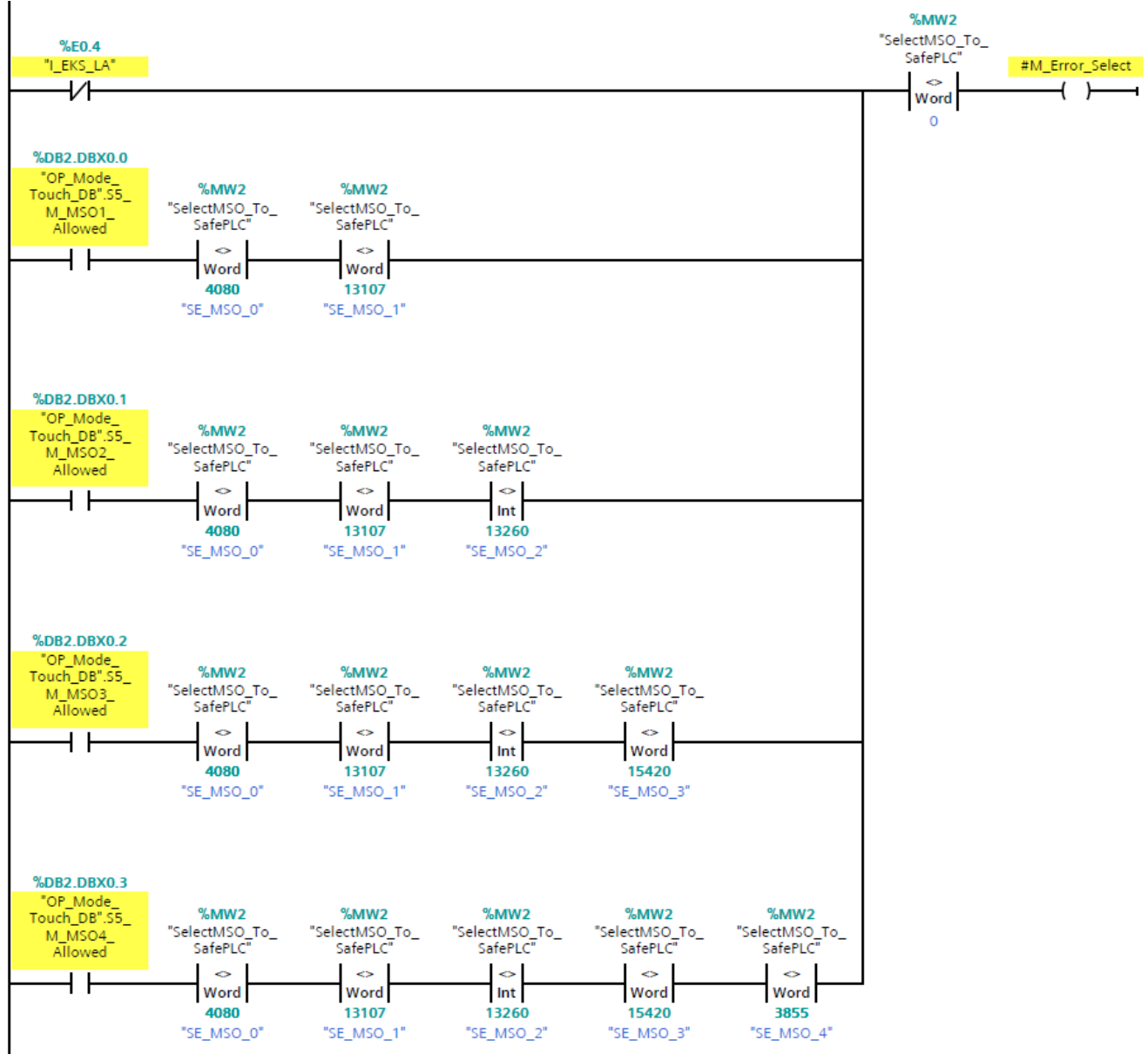
1 Sub Start_Check_Screen()
2 |Der Aufruf dieses Script startet bei der Wertänderung der Variable CheckMSO_To_Touch
3
4 'Variablendeklaration
5 Dim CheckMSO_To_Touch
6
7 Dim Button_MS01_OK, Button_MS01_NOK
8 Dim Button_MS02_OK, Button_MS02_NOK
9 Dim Button_MS03_OK, Button_MS03_NOK
10 Dim Button_MS04_OK, Button_MS04_NOK
11
12 Dim CH_MS01, CH_MS02, CH_MS03, CH_MS04
13
14 'Zuweisung Softkey an Variable
15 Set CheckMSO_To_Touch = SmartTags("CheckMSO_To_Touch")
16
17 'Zuweisung Konstanten
18 CH_MS01 = 13260
19 CH_MS02 = 15420
20 CH_MS03 = 3855
21 CH_MS04 = 4080
22
23 'Aufruf Bild CheckMSO
24 If CheckMSO_To_Touch = CH_MS01 Then
25     ActivateScreen "01_Check_MS01",0
26
27 ElseIf CheckMSO_To_Touch = CH_MS02 Then
28     ActivateScreen "02_Check_MS02",0
29
30 ElseIf CheckMSO_To_Touch = CH_MS03 Then
31     ActivateScreen "03_Check_MS03",0
32
33 ElseIf CheckMSO_To_Touch = CH_MS04 Then
34     ActivateScreen "04_Check_MS04",0
35
36 End If
37
38
39
40 End Sub

```

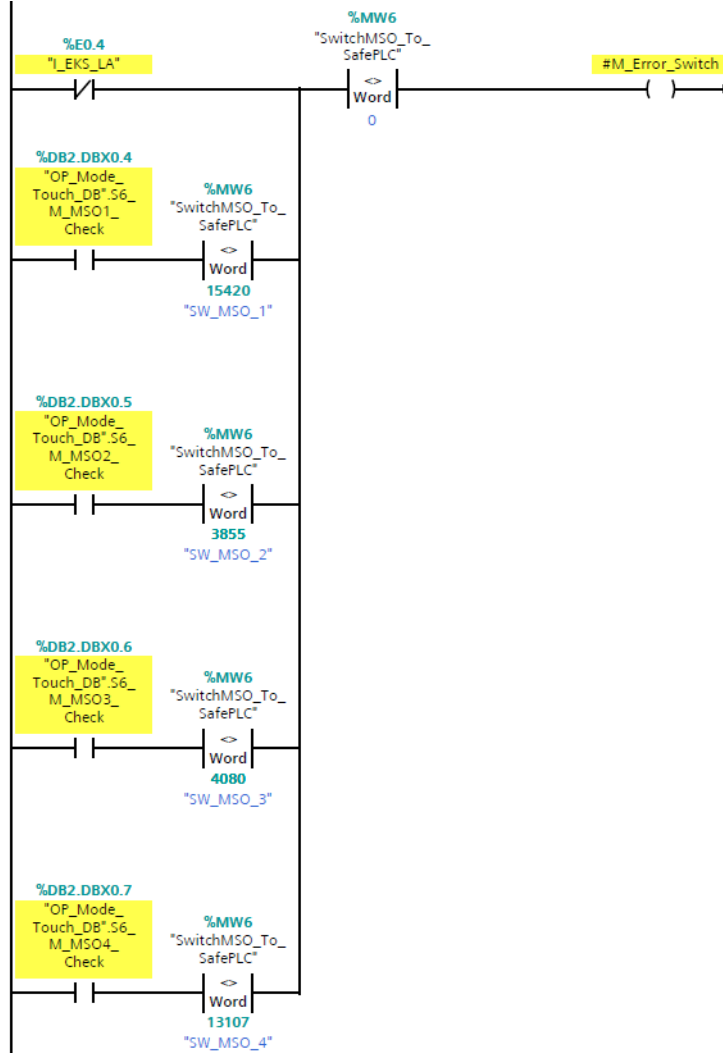
28	HMI	<p>The HMI writes the value for the confirmed operating mode from step 25 to a data word that is available to the F-PLC.</p> <p>Notice: If this action is not possible directly, an intermediate step can also be inserted during which the PLC forms a data word for the F-PLC from the data word from the HMI. The value from the HMI must then be forwarded unchanged to the F-PLC by the PLC.</p> <p>If "OK" has been selected, the value from the data pool for the operating mode confirmed must be sent. If the operating mode is not confirmed, an invalid data word, e.g. the value OFFFFH, can be sent.</p>
29	F-PLC	<p>It is checked in the F-PLC whether an error has occurred.</p> <p>F-PLC network 13: It is checked whether a discrepancy has occurred on the inputs. If LA is OFF and one of the inputs A to D or STR is ON or if LA is ON and none of the inputs A to D or STR is ON, an error has occurred.</p> <p>The logic of the input LA if not set is an XOR such that an error is not indicated if all four inputs from the EKS are set to ON (anti-tampering pulse). Notice: nevertheless, an error may</p>

	<p>be indicated briefly on inserting an Electronic-Key because the outputs A to D and STR in the EKS are not synchronized with LA.</p> <p>If input LA is set, the M_MSO_Allowed flags are checked because only one of these flags can be set. The logic is a 1 of N check.</p> <p>F-PLC network 14: There is a selection error if an Electronic-Key is not inserted but there is a value in the data word for the selection. There is also a selection error if a value has been selected that is not allowed according to the EKS Electronic-Key.</p> <p>F-PLC network 15: There is an error in the confirmation if the previously selected operating mode is different to the operating mode confirmed. There is also a rejection, e.g. using the data word 0FFFFH, included here.</p> <p>F-PLC network 16: If one of the errors from the F-PLC networks 13 to 15 is found, a global error flag is set.</p> <p>PLC networks 11 and 12: The global error from F-PLC network 16 can occur briefly each time on inserting removing an Electronic-Key because the outputs on the EKS are not synchronized. A switch-on delay of 500 ms is therefore used in PLC network 11 to filter out brief errors before the error is saved as a real error. This error is latched in network 12 because otherwise it would be deleted by inserting an Electronic-Key. The error can be reset with a confirmation.</p> <p>The time for the filtering can be set to suit the cycle time in the PLC and the HMI such that hardware errors latch but software errors, e.g. data corruption on the communication cable, are detected but do not result in a latching error. The input can then be repeated. An indication for the user on the detection of such an error can be useful.</p>
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F-PLC network 14:



F-PLC network 15:



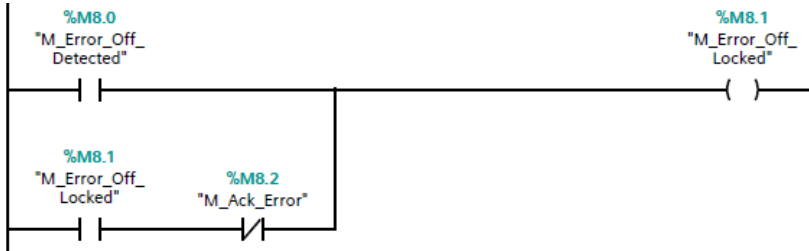
F-PLC network 16:



PLC network 11:

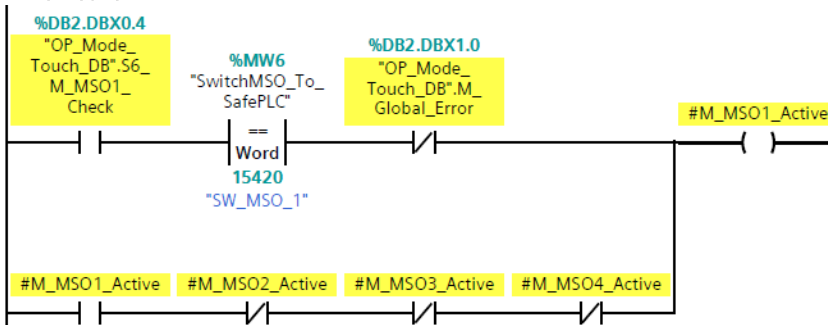


PLC network 12:

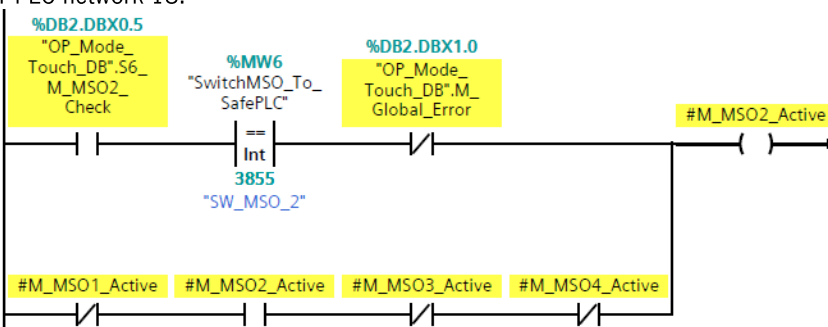


30	F-PLC	The error check is linked to F-PLC networks 17 to 20.
31	F-PLC	Only if step 6 is active is a flag for the new operating mode set.
32	F-PLC	The switch to the new operating mode is made, provided an error does not occur. For this purpose, the previously selected operating mode saved in the flag for which confirmation has been requested from the HMI must match the operating mode confirmed. F-PLC network 17: A check for operating mode 1 has been saved, and operating mode 1 is now confirmed. F-PLC network 18: A check for operating mode 2 has been saved, and operating mode 2 is now confirmed. F-PLC network 19: A check for operating mode 3 has been saved, and operating mode 3 is now confirmed. F-PLC network 20: A check for operating mode SE has been saved, and operating mode SE is now confirmed.
33	F-PLC	The flags formed in step 29 are also available in the PLC or HMI if an indication or reaction is required.

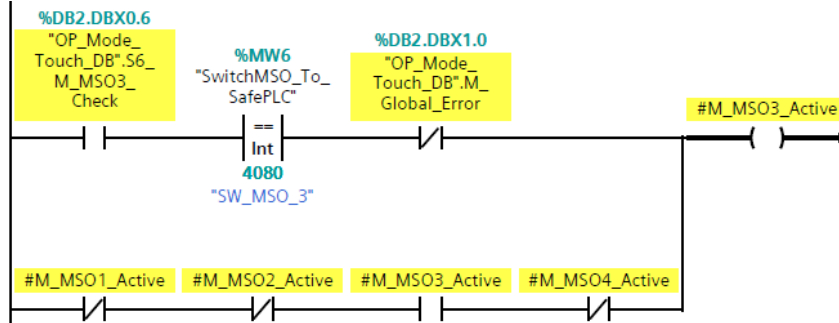
F-PLC network 17:



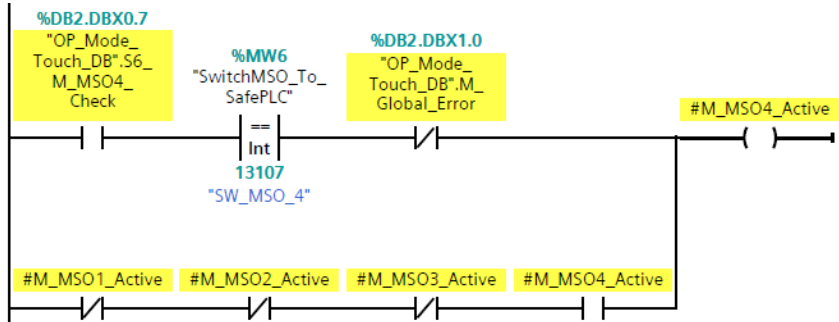
F-PLC network 18:



F-PLC network 19:

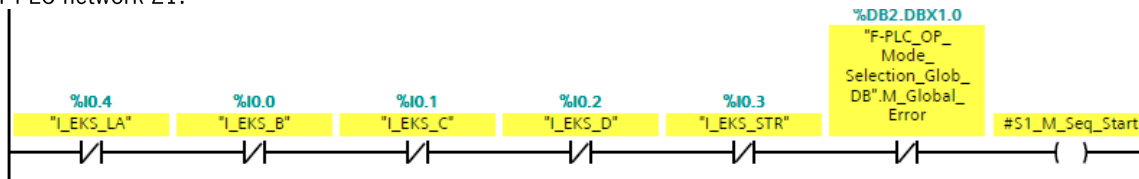


F-PLC network 20:



34	PLC	The PLC ensures the reaction to the change in the operating mode is suitable.
35	F-PLC	If all inputs from the EKS go to OFF and an error has not been detected, in F-PLC network 21 there is a switch to the first step in the sequence.

F-PLC network 21:



Overview table of the data words

Permitted operating mode on the EKS Electronic-Key (ReadAuthorization)	MS00	MS01	MS02	MS03	MS0 SE
Output on the EKS light FSA	A	B	C	D	STR

Selected operating mode (SelectMSO)	MS00	MS01	MS02	MS03	MS0 SE
	0FF0H	3333H	33CCH	3C3CH	0F0FH

Operating mode to be confirmed (CheckMSO)	MS00	MS01	MS02	MS03	MS0 SE
	3333H	33CCH	3C3CH	0F0FH	0F0FH

Application of the selected operating mode (SwitchMSO)	MS00	MS01	MS02	MS03	MS0 SE
	33CCH	3C3CH	0F0FH	0F0FH	3333H

Basic circuit diagram

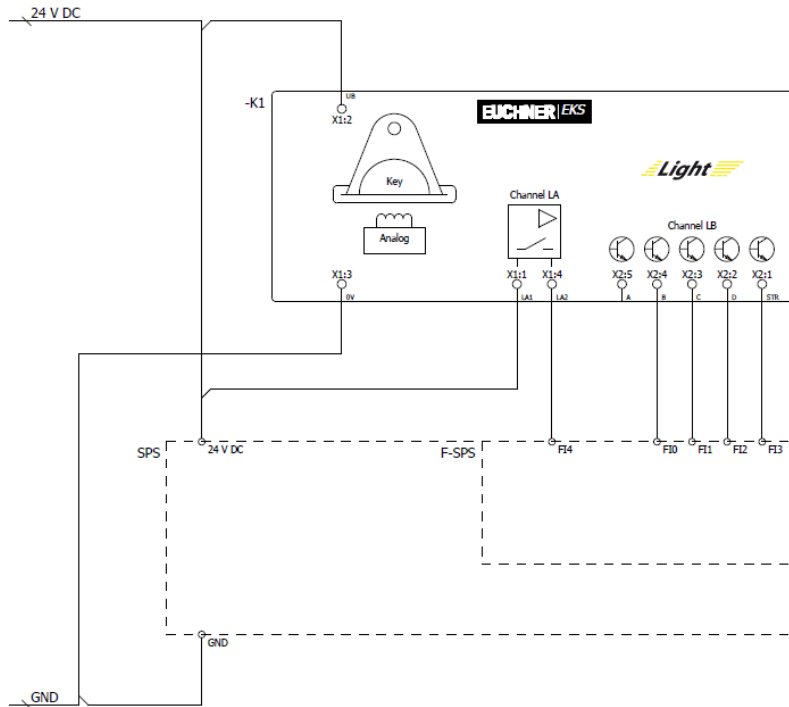


Figure 10

Safety description

For the safety description, please refer to the application AP000200-01_06-2016..., which you will find on the Internet at www.euchner.com.

Important note – please observe carefully!

This document is intended for a design engineer who possesses the requisite knowledge in safety engineering and knows the applicable standards, e.g. through training for qualification as a safety engineer. Only with the appropriate qualification is it possible to integrate the example provided into a complete safety chain.

The example represents only part of a complete safety chain and does not fulfill any safety function on its own. In order to fulfill a safety function, the energy switch-off function for the danger zone and the software within the safety evaluation must also be considered, for example.

The applications provided are only examples for solving certain safety tasks for protecting safety doors. The examples cannot be comprehensive due to the application-dependent and individual protection goals within a machine/installation.

If questions concerning this example remain open, please contact us directly.

According to the Machinery Directive 2006/42/EC, the design engineer of a machine or installation has the obligation to perform a risk assessment and take measures to reduce the risk. While doing this, the engineer must comply with the applicable national and international safety standards. Standards generally represent the current state-of-the-art. Therefore, the design engineer should continuously inform himself about changes in the standards and adapt his considerations to them. Relevant standards include EN ISO 13849 and EN 62061. This application must be regarded only as assistance for the considerations about safety measures.

The design engineer of a machine/installation has the obligation to assess the safety technology him/herself. The examples must not be used for an assessment, because only a small excerpt of a complete safety function was considered in terms of safety engineering here.

In order to be able to use the safety switch applications correctly on safety doors, it is indispensable to observe the standards EN ISO 13849-1, EN ISO 14119 and all relevant C-standards for the respective machine type. Under no circumstances does this document replace the engineer's own risk assessment, and it cannot serve as the basis for a fault assessment.

In particular in relation to a fault exclusion, it must be noted that a fault can only be excluded by the machine's or installation's design engineer and this action requires justification. A general fault exclusion is not possible. More information about fault exclusion can be found in EN ISO 13849-2.

Changes to products or within assemblies from third-party suppliers used in this example can lead to the function no longer being ensured or the safety assessment having to be adapted. In any event, the information in the operating instructions on the part of EUCHNER, as well as on the part of third-party suppliers, must be used as the basis before this application is integrated into an overall safety function. If contradictions should arise between the operating instructions and this document, please contact us directly.

Use of brand names and company names

All brand names and company names stated are the property of the related manufacturer. They are used only for the clear identification of compatible peripheral devices and operating environments in relation to our products.