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Direct Keys Configuration for Touch and Key Panels

WinCC V13 (TIA Portal)

<http://support.automation.siemens.com/WW/view/en/92186980>

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1 Task

Introduction

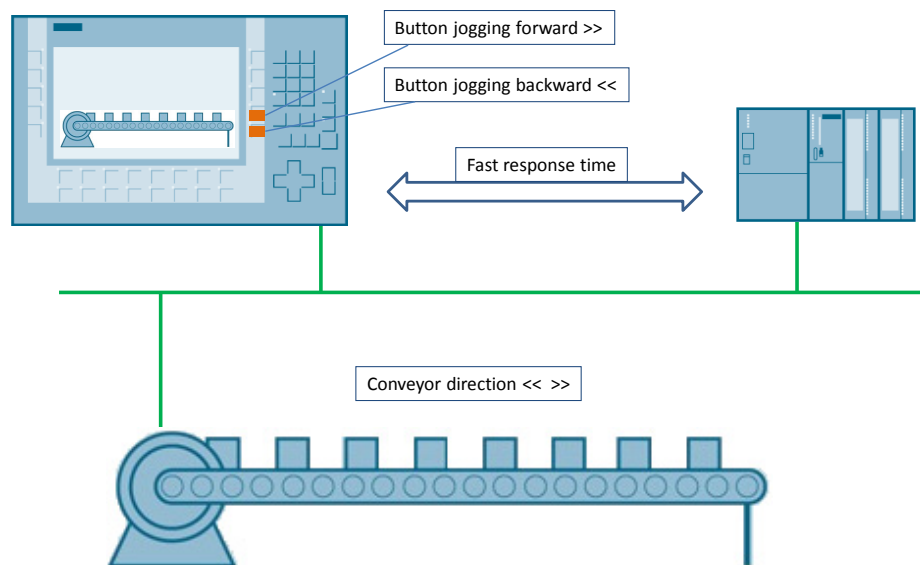
When operating a plant via HMI operator panels, there often is the need for a “jog mode”. The requirement for a jog mode is a short reaction time between “pressing the button” and the function to be executed.

A typical application case, for which fast reaction times are required, is the manual control of a belt, for example, to release a jammed workpiece/conveyed good or to position it.

Overview of the automation task

The figure below provides an overview of the automation task.

Figure 1-1



In “setup mode”, it shall be possible to move the belt forward or backward in jog mode. The “jog mode” requires a fast reaction time regarding the data exchange between the HMI operator panel and the PLC controller.

Furthermore, it shall be possible to expand the configuration by further conveyors without great expenditure.

The operator panels to be used are Touch panels as well as Key devices.

2 Solution

2.1 Overview

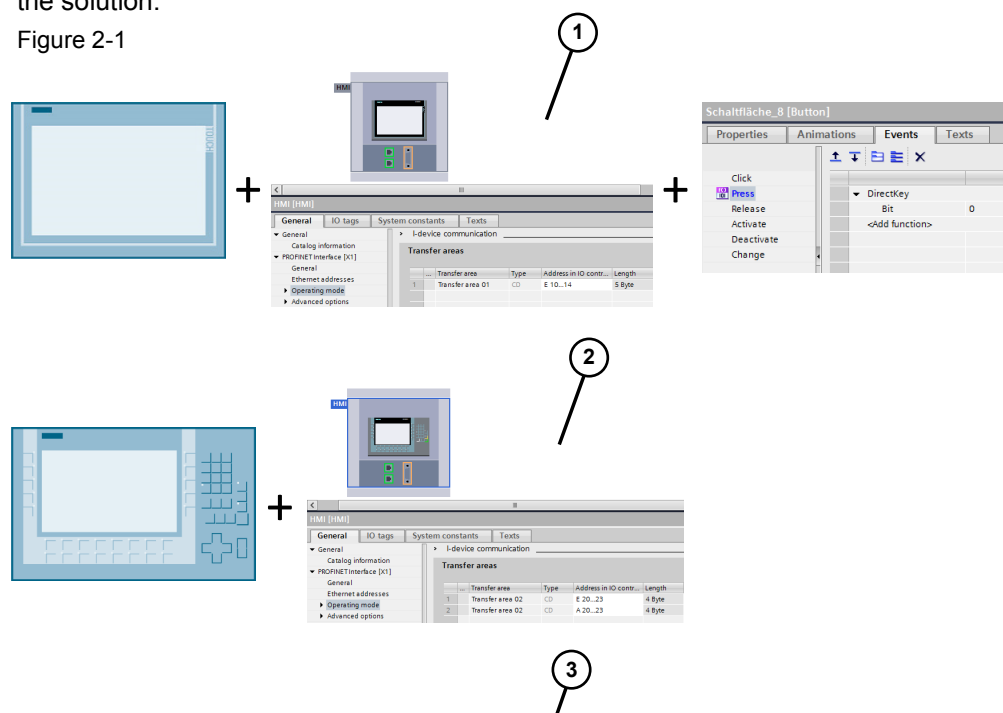
For realizing the task, the HMI system function “**DirectKey**” is used in this application.

Using an example, the application describes how the system function “DirectKey” is configured and used. Furthermore, the application shows how you can clearly reduce the configuration expenditure with this system function, especially when producing series machines.

Schematic layout

The figure below shows a schematic overview of the most important components of the solution:

Figure 2-1



- (1) Touch panel
 - Parameterization:
 - I-device communication (address assignment for the inputs).
 - “DirectKey” system function
- (2) Key panel
 - Parameterization:
 - I-device communication (address assignment for the inputs and outputs).
- (3) PROFINET IO communication

General: SIMATIC controller.

Structure

Depending on the operator panel used, the “DirectKey” system function can be used at the keys of a key panel or at the configured buttons of a touch panel respectively.

A list of which keys can be used as “direct key” in particular is available in the Direct keys assignment table (see example [Link](#)).

The following direct keys can be configured:

- PROFINET connection: PROFINET IO direct keys
- PROFIBUS connection: PROFIBUS DP direct keys

The application describes the usage of PROFINET **IO** direct keys. The realization with PROFIBUS **DP** direct keys is identical in principle.

The application comes with two sample projects.

- Project 01
The project contains the configuration of a TP1200 Comfort Panel.
- Project 02
The project contains the configuration of a KP900 Comfort Panel.

Both projects have the same respective scope of functions.

Advantages

The application of “PROFINET IO direct keys” has the following advantages.

- Fast reaction times (typical < 100ms).
- Clearly fewer tags are necessary in the HMI configuration.
- Clearly fewer HMI system functions are necessary, such as SetBit/ResetBit.
- Especially, when buttons execute the same function in several screens, time saving results during the configuration, since no tags need to be adjusted.
- HMI configuration and STEP 7 program easily extendible.

Operating principle of the PROFINET IO direct keys

The cycle time of the Ethernet bus is adjustable between 8 ms and 512 ms. This can also be used for determining the reaction time of the PROFINET IO direct keys. For a typical PLC program with a cycle time of 64 ms, the reaction time of the PROFINET IO direct keys is < 100 ms.

When using the PROFINET IO direct keys, a typical reaction time to the CPU of < 100 ms is ensured. This time can be clearly exceeded in the following cases:

- Complex functions running in the background, e.g. transfer of recipes, printing of protocols.
- Several connections to CPUs are retained simultaneously.

Restrictions for PROFINET IO direct keys

- Direct keys are also active if the operator panel is in “offline” mode.
- If an external application, such as pocket Internet Explorer or Control Panel is started, it becomes active in the foreground and places the runtime in the background. The bit for the “DirectKeyScreenNumber” function is no longer set and the keys or buttons with the configured “DirectKey” function do no longer trigger the respective bit in the controller.
- The simultaneous use of PROFINET IO direct keys and PROFIBUS DP direct keys is not possible.
- If the communication via PROFINET IO is enabled, the use of the serial interface is not permitted.
- You can only operate direct keys at the local operator panel. At the Sm@rtClient, the operation of the key/button for the direct key is possible. However, a bit is not set at the I/O area of the CPU.
- Direct keys assigned to a button are only triggered via touch operation. Triggering via mouse-click, e.g. with connected USB mouse, is not possible.
- During touch operation, direct keys are triggered irrespective of a configured password protection.
- Picture objects, placed over the button with system function “DirectKey” do cover the button optically. However, they do not prevent the system function “DirectKey” from triggering.
- For operator panels with Touch operation, you must not change buttons which you use as direct keys via scripts as follows:
 - move
 - change size
 - hide
 - lock against operation

Scope

This application does not contain a description of

- the used configuration software.
- the used operator panels.
- the used CPU.

Basic knowledge of these topics is assumed.

Assumed knowledge

The following basic knowledge is assumed...

- configuration of HMI operator panels with WinCC V13 (TIA Portal) (or higher).
- configuration in STEP 7 with STEP 7 V13 (or higher).

2.2 Hardware and software components

2.2.1 Validity

This application is valid from

- STEP 7 V13
- WinCC Comfort V13
- WinCC Advanced V13

2.2.2 Operator panels

You can configure the PROFINET IO direct keys with the following operator panels:

Table 2-1

Operator panel class	Operator panel
Panel	OP 177B PN/DP OP 277 6" TP 177B 4" PN/DP TP 177B 6" PN/DP TP 277 6"
Mobile Panel	Mobile Panel 177 PN Mobile Panel 277 8" Mobile Panel 277 10" Mobile Panel 277 IWLAN V2 Mobile Panel 277(F) IWLAN V2 Mobile Panel 277(F) IWLAN V2 (RFID tags)
Multi Panel	Multi Panel 177 6" Touch Multi Panel 277 Key Multi Panel 277 Touch Multi Panel 377 Key Multi Panel 377 Touch
Comfort Panel	KTP400 Comfort KP400 Comfort KP700 Comfort TP700 Comfort KP900 Comfort TP900 Comfort KP1200 Comfort TP1200 Comfort KP1500 Comfort TP1500 Comfort TP1900 Comfort TP2200 Comfort

2.2.3 Components used

The application was created with the following components:

Hardware components

Table 2-2

Component	No.	Article number	Note
TP1200 Comfort Panel	1	6AV2124-0MC01-0AX0	See 2.2.2
KP900 Comfort Panel	1	6AV2124-1JC01-0AX0	See 2.2.2
CPU315-2PN/DP	1	6ES7315-2EH114-0AB0	

Software components

Table 2-3

Component	No.	Article number	Note
WinCC Advanced V13	1	6AV2102-0AA03-0AA5	From WinCC Comfort V13
STEP 7 V13 Professional	1	6ES7822-1AA03-0YA7	From STEP 7 V13 Basic

Example files and projects

The following list includes all files and projects that are used in this example.

Table 2-4

Component	Note
92186980_DOKU_v10_d.pdf	This zip file contains the demo project
92186980_CODE_v10.zip	The zip file contains the two sample projects. <ul style="list-style-type: none"> • TP1200 Comfort • KP900 Comfort Panel

3 Mode of Operation

3.1 General

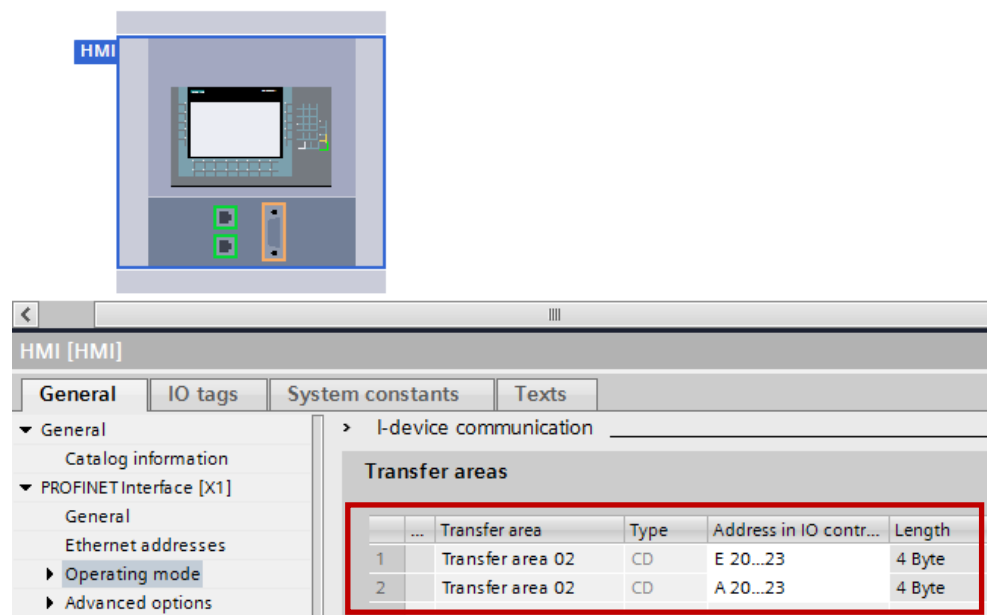
What are direct keys?

Direct keys set bits in the **IO area** of a SIMATIC S7 directly from the operator panel. A transfer area (input and output area) is defined in the device configuration of the HMI configuration.

The figure below shows the transfer areas (input and output area) of a KP900 Comfort Panel.

For Touch panels there is only one transfer area (input area)

Figure 3-1



Assignment of inputs/outputs

The keys for Key panels and the buttons for Touch panels assign bytes in the **input area**.

The LEDs for Key panels assign bytes in the **output area**.

Touch panels have no output area.

The number of used bytes depends on the operator panel. Detailed information is given in the further course of the application.

3 Mode of Operation

3.1 General

Key panel

For each Key panel there is a direct keys assignment table.

For Key panels, the function keys and LEDs have a **fixed** assignment regarding the input and output area.

[Figure 3-2](#) shows the **input area** of the direct keys assignment table of a KP1200 Comfort panel.

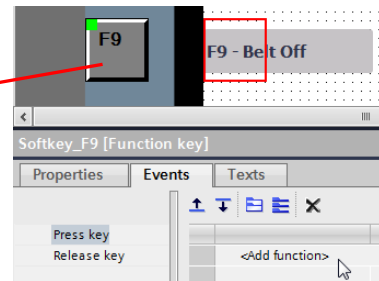
Using this assignment table, bit "0" of byte "1" is assigned to function key "F9".

Pressing button "F9" sets bit "0" in byte "1". When releasing the button, the bit is reset again. **No** system function, such as "SetBit" or "ResetBit", needs to be configured.

Figure 3-2

Direct keys KP1200 Comfort

Inputs	
5 bytes	
Direct keys assignment	
	7 6 5 4 3 2 1 0 Byte
Keys	F8 F7 F6 F5 F4 F3 F2 F1 n+0
	F16 F15 F14 F13 F12 F11 F10 F9 n+1
	F24 F23 F22 F21 F20 F19 F18 F17 n+2
	F32 F31 F30 F29 F28 F27 F26 F25 n+3
	F34 F33 n+4



[Figure 3-3](#) shows the **output area** of the LED assignment table of a KP1200 Comfort Panel.

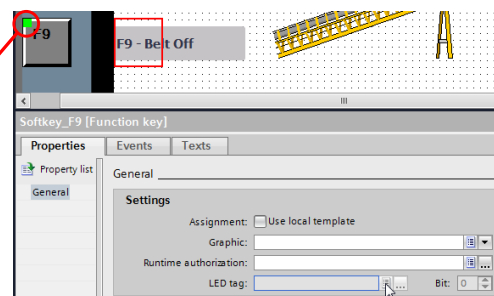
Using this assignment table, bit "0" of byte "1" is assigned to the LED of function key "F9".

No tag is required for controlling the LED.

Figure 3-3

KP1200 Comfort

Outputs	
5 bytes	
LED	
	7 6 5 4 3 2 1 0 Byte
F8 F7 F6 F5 F4 F3 F2 F1 n+0	
F16 F15 F14 F13 F12 F11 F10 F9 n+1	
F24 F23 F22 F21 F20 F19 F18 F17 n+2	
F32 F31 F30 F29 F28 F27 F26 F25 n+3	
F34 F33 n+4	



A detailed description for handling the tables is given in the further course of this document.

3 Mode of Operation

3.1 General

Touch panel

For each Touch panel there is a direct keys assignment table.

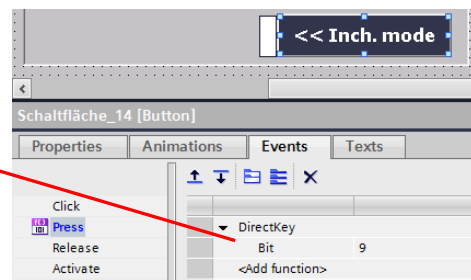
In contrast to the Key panels, the buttons on the Touch panels do **not** have a fixed “bit assignment”. The “DirectKey” system function must be configured to the buttons.

The figure below shows the input area of the direct keys assignment table of a TP1200 Comfort Panel.

Figure 3-4

Direct keys TP1200 Comfort

		Direct keys assignment:								
		7	6	5	4	3	2	1	0	Byte
Touch buttons	n+0	7	6	5	4	3	2	1	0	n+0
	n+1	15	14	13	12	11	10	9	8	n+1
	n+2	23	22	21	20	19	18	17	16	n+2
	n+3	31	30	29	28	27	26	25	24	n+3
	n+4	39	38	37	36	35	34	33	32	n+4



The “DirectKey” system function was configured at the displayed button and “Bit 9” was assigned.

Pressing the button sets “Bit 9” in the defined input area. Releasing the button resets “Bit 9” again.

No system function, such as “SetBit” or “ResetBit”, needs to be configured here.

A detailed description for handling the tables is given in the further course of this document.

3.2 Direct keys assignment

The tables with the “Direct keys assignments” for the individual operator panels are available in the online help or in the WinCC Advanced system manual. Search for the term “DirectKey” index ([Link](#)).

3.2.1 Key panel

Handling the tables for the “Direct keys assignment” and the “LED evaluation” is illustrated using the example of the KP900 Comfort Panel.

Specification:

- KP900 Comfort Panel
- Transfer area
 - I20...23 (4 bytes)
 - Q20...23 (4 bytes)

Direct keys assignment table for KP900 Comfort

Figure 3-5

		Direct keys assignment																
		7	6	5	4	3	2	1	0	Byte	7	6	5	4	3	2	1	0
Keys	F8	F7	F6	F5	F4	F3	F2	F1	n+0 => %EB20 =>	E20 .7	E20 .6	E20 .5	E20 .4	E20 .3	E20 .2	E20 .1	E20 .0	
	F16	F15	F14	F13	F12	F11	F10	F9	n+1 => %EB21 =>	E21 .7	E21 .6	E21 .5	E21 .4	E21 .3	E21 .2	E21 .1	E21 .0	
	F24	F23	F22	F21	F20	F19	F18	F17	n+2 => %EB22 =>	E22 .7	E22 .6	E22 .5	E22 .4	E22 .3	E22 .2	E22 .1	E22 .0	
							F26	F25	n+3 => %EB23 =>							E23 .1	E23 .0	

Function principle:

If, for example, function key “F13” is pressed, then the “4th bit” is set in the PLC controller in “%EB21”. This corresponds to input I21.4

If, for example, function key “F24” is pressed at the KP900 Comfort, then the “7th bit” is set in the PLC controller in “%EB22”. This corresponds to input I22.7

In the PLC program, these read values are evaluated accordingly and further processed by the user. Take a look at the attached STEP 7 program (see Chapter [5.1.4](#) and [5.1.5](#)).

3 Mode of Operation

3.2 Direct keys assignment

Direct keys assignment table for KP900 Comfort

Figure 3-6

		LED																
		7	6	5	4	3	2	1	0	Byte	7	6	5	4	3	2	1	0
Keys	F8	F7	F6	F5	F4	F3	F2	F1	n+0 => %QB20 =>	Q20 .7	Q20 .6	Q20 .5	Q20 .4	Q20 .3	Q20 .2	Q20 .1	Q20 .0	
	F16	F15	F14	F13	F12	F11	F10	F9	n+1 => %QB21 =>	Q21 .7	Q21 .6	Q21 .5	Q21 .4	Q21 .3	Q21 .2	Q21 .1	Q21 .0	
	F24	F23	F22	F21	F20	F19	F18	F17	n+2 => %QB22 =>	Q22 .7	Q22 .6	Q22 .5	Q22 .4	Q22 .3	Q22 .2	Q22 .1	Q22 .0	
							F26	F25	n+3 => %QB23 =>							Q23 .1	Q23 .0	

Mode of operation

If at the KP900 Comfort the LED, for example, shall be controlled at function key “F13”, the “4th bit” must be set in the PLC controller in “%AB21”. This corresponds to output Q21.4

If at the KP900 Comfort the LED, for example, shall be controlled at function key “F24”, the “7th bit” must be set in the PLC controller in “%AB22”. This corresponds to output Q22.7

Take a look at the attached STEP 7 program (see Chapter [5.1.4](#) and [5.1.5](#)).

3.2.2 Touch Panel

Handling the table for “Direct keys assignment” is shown using the example of the TP1200 Comfort Panel.

Specification:

- TP1200 Comfort Panel
- Transfer area
 - I10...14 (5 bytes)

Direct keys assignment table for TP1200 Comfort

Figure 3-7

		Direct keys assignent																
		7	6	5	4	3	2	1	0	Byte	7	6	5	4	3	2	1	0
Keys		7	6	5	4	3	2	1	0	n+0 => %EB10 =>	E10 .7	E10 .6	E10 .5	E10 .4	E10 .3	E10 .2	E10 .1	E10 .0
		15	14	13	12	11	10	9	8	n+1 => %EB11 =>	E11 .7	E11 .6	E11 .5	E11 .4	E11 .3	E11 .2	E11 .1	E11 .0
		23	22	21	20	19	18	17	16	n+2 => %EB12 =>	E12 .7	E12 .6	E12 .5	E12 .4	E12 .3	E12 .2	E12 .1	E12 .0
		31	30	29	28	27	26	25	24	n+3 => %EB13 =>	E13 .7	E13 .6	E13 .5	E13 .4	E13 .3	E13 .2	E13 .1	E13 .0
		39	38	37	36	35	34	33	32	n+4 => %EB14 =>	E14 .7	E14 .6	E14 .5	E14 .4	E14 .3	E14 .2	E14 .1	E14 .0

Function principle:

For a KP900 Comfort Panel the system function “DirectKey” has been configured at a button. Bit “18” has been assigned to the system function. Pressing the button sets the “2nd bit” in the PLC in “%EB12”. This corresponds to input I12.2

At a further button, bit “37” has been assigned to system function “DirectKey”. Pressing the button sets the “5th bit” in the PLC in “%EB14”. This corresponds to input I14.5

In the PLC program, these read values are evaluated accordingly and further processed by the user. Take a look at the attached STEP 7 program (see Chapter [4.1.4](#) and [4.1.5](#)).

Note

System function “DirectKey” can only be configured once on a button.

3.3 Screen evaluation

General

One respective bit from the direct keys assignment table can be assigned to a direct key. If different functions shall be executed via one direct key in different screens, then an evaluation of the currently called HMI screen is necessary.

There are different options for evaluating the HMI screen.

- System function “DirectKeyScreenNumber” (only for Touch Panels)
- Area pointer “ScreenNumber”

3.3.1 “Touch Panel” example

Touch Panels have no function keys. A screen evaluation is not mandatory.

System function “DirectKey” is configured directly to a button and can only be operated on the called page.

If this direct key is used with the assigned bit in several screens **and** different functions are executed, then the current screen must be additionally evaluated. This is performed either with the **area pointer** “ScreenNumber” or via **system function** “DirectKeyScreenNumber”.

Evaluation via system function “DirectKeyScreenNumber”

In the properties of the respective screen (“Properties > Events > Loaded”), system function “DirectKeyScreenNumber” is configured.

When setting up the screen, the system function is executed and the assigned bit is set in the controller.

The assigned bit originates from the defined input area.

In the PLC program, the bit from system function “DirectKeyScreenNumber” as well as the bit from system function “DirectKey” is evaluated accordingly and further processed.

Take a look at the attached STEP 7 program ([FC200](#), network 1).

3.3.2 Example “Key panels”

When using direct keys with “Key panels”, these buttons are active in each screen. This means: if, for example, function key “F1” is pressed, the respective bit in the controller is set - irrespective of which screen was called. With respect to this application, input “I20.0” would be set in this case.

If different functions shall be executed via this “F1” direct key in several screens, the current screen number must additionally be evaluated. This is performed with **area pointer** “ScreenNumber”.

Evaluation via area pointer “ScreenNumber”

The figure below shows the structure of the “ScreenNumber” area pointer.

Figure 3-8

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1st word	Current screen type															
2nd word	Current screen number															
3rd word	Reserved															
4th word	Current field number															
5th word	Reserved															

The area pointer consists of 5 words. The system enters the current screen number into the 2nd word.

In the STEP 7 program, the 2nd word of the area pointer is read and compared with a given value.

Take a look at the attached STEP 7 program ([FC100](#), network 1).

4 Project 01, TP1200 Comfort Panel

4.1 PLC program overview

4.1.1 Device configuration

A CPU315-2 PN/DP is used as controller.

In the device configuration for the controller, the IP address and the subnet mask must be specified. No other settings are necessary.

4.1.2 Block overview

A conveyor belt is used for the example application. The program includes the evaluation of the buttons used in the HMI project and the respective status displays.

Figure 4-1

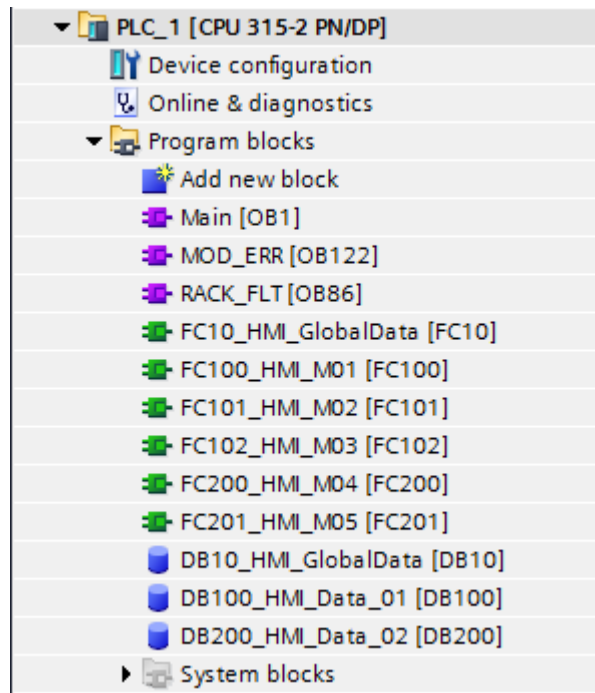


Table 4-1

No.	Block	Description
1.	Main (OB1)	OB1 receives the program calls of the blocks function.
2.	MOD_ERR (OB122)	The operating system of the CPU calls OB 122, if an error occurs when accessing the data of a module.
3.	RACK_FLT (OB86)	The operating system of the CPU calls OB 86 at the failure of a PROFINET IO system or a PROFINET IO station. In reference to the example: If the runtime of the HMI operator panel is not started, OB86 is called.
4.	FC10_HMI_GlobalData	The block contains general data which concerns all "conveyors".

4 Project 01, TP1200 Comfort Panel

4.1 PLC program overview

No.	Block	Description
5.	FC100_HMI_M01 (FC100)	The block contains the program for controlling the "Conveyor 01" conveyor belt. The evaluation of the "direct keys" is performed in connection with area pointer "ScreenNumber".
6.	FC101_HMI_M02 (FC101)	The block contains the program for controlling the "Conveyor 02" conveyor belt. The evaluation of the "direct keys" is performed in connection with area pointer "ScreenNumber".
7.	FC102_HMI_M03 (FC102)	The block contains the program for controlling the "Conveyor 03" conveyor belt. The evaluation of the "direct keys" is performed in connection with area pointer "ScreenNumber".
8.	FC200_HMI_M01 (FC200)	The block contains the program for controlling the "Conveyor 04" conveyor belt. The evaluation of the "direct keys" is performed in connection with the evaluation of system function "DirectKeyScreenNumber".
9.	FC201_HMI_M02 (FC201)	The block contains the program for controlling the "Conveyor 05" conveyor belt. The evaluation of the "direct keys" is performed in connection with the evaluation of system function "DirectKeyScreenNumber".
10.	DB10_HMI_GlobalData (DB10)	The data block contains data which concerns all "conveyors".
11.	DB100_HMI_Data_01	The data block includes the data for the conveyors 01 to 03.
12.	DB200_HMI_Data_02	The data block includes the data for the conveyors 04 to 05

4.1 PLC program overview

4.1.3 General

For simplifying the configuration and for the “application” of direct keys with regards to the application in “series machine building”, all HMI buttons are realized as “direct keys”.

All direct keys were used several times in different HMI screens, where the function controlled by the direct key is always the same (e.g. “Automatic mode” selection).

In order to distinguish the “direct keys”, two alternative evaluation options are described.

- via area pointer “ScreenNumber” (FC100, FC101, FC102)
- via system function “DirectKeyScreenNumber” (FC200, FC201)

The structure of block FC100 to FC201 is identical.

The following description only discusses the most important settings. For a better understanding it is helpful if the STEP 7 program is opened.

4.1.4 FC10

Network 1 and 2

In the device configuration of the operator panel, a transfer area from “I 10...14” (5 bytes) was defined. The evaluation of the direct keys assignment is performed via this transfer area.

The transfer area is copied byte by byte to the data block with number “10” using the “BLKMOV” block.

This measure enables making changes in the transfer at one central location in the program.

Note Only two bytes were necessary for realizing the application.

Network 3 to 9

The HMI projects contain several HMI screens which contain “buttons” for operating the “conveyors”.

Next to these HMI buttons there is a graphic which displays the status of the respective button - e.g. “Automatic mode activated”.

The respective evaluation is performed in the networks 3 to 9.

Note In all HMI screens, the same addresses are used for the respective “status display”. The evaluation is performed via blocks FC100 to FC201.

4.1 PLC program overview

4.1.5 FC100

The evaluation of the current HMI screen is performed in FC100, FC101 and FC102 via the area pointer "**ScreenNumber**".

Network 1

The evaluation of which HMI screen is currently called up is performed in network 1. This ensures that "Conveyor 01" can only be operated if the HMI screen with number "8" is called.

A respective comparison of the value from the second data word of the area pointer "ScreenNumber" with the given HMI screen number follows.

The result of this comparison is used as "enable signal" for all subsequent networks.

Note

The HMI screen number is given as "hexadecimal" number.

Network 2 to 7

The evaluation of the HMI direct keys and their respective function is performed in networks 2 to 7.

In FC10, the transfer area was copied to a data area in DB10. From the "direct keys assignment table", the respective bit can be read and assigned to the function to be executed.

Network 8 to 14

The evaluation for the "status display" is performed in networks 8 to 14. The "status displays" are graphics contained next to the HMI direct keys - e. g. "Automatic mode selected".

The result is transferred in FC10 of the respective status display.

4.1.6 FC101 and FC102

The structure of block FC101 and FC102 is identical with FC100. The difference lies mainly in network 1, where the current HMI screen number is evaluated.

4.1.7 FC200

The structure of block FC200 is identical with FC100. The difference is mainly in the evaluation of the HMI screen.

The evaluation of the current HMI screen is performed in FC200 via the system function "**DirectKeyScreenNumber**".

Network 1

The evaluation of which HMI screen is currently called up is performed in network 1. This ensures that "Conveyor 04" can only be operated if "Bit 32" was set.

4.1 PLC program overview

Bit “32” is set when calling the HMI screen via system function “DirectKeyScreenNumber”.

The result of this evaluation is used as “enable signal” for all subsequent networks.

Network 2 to 7

The evaluation of the HMI direct keys and their respective function is performed in networks 2 to 7.

In FC10, the transfer area was copied to a data area in DB10. From the “direct keys assignment table”, the respective bit can be read and assigned to the function to be executed.

Network 8 to 14

The evaluation for the “status display” is performed in networks 8 to 14. The “status displays” are graphics contained next to the HMI direct keys - e. g. “Automatic mode selected”.

The result is transferred in FC10 of the respective status display.

4.1.8 FC201

The structure of block FC201 is identical with FC200. The difference lies mainly in network 1, where the current HMI screen is evaluated.

4.1.9 DB10

ScreenNumber_TP1200

Data structure for the area pointer “ScreenNumber”.

TP1200_Button_

Prepared addresses for the “direct keys evaluation”

With a TP1200 Comfort Panel, one bit each can be assigned to 40 direct keys directly from the direct keys assignment table (see “Direct keys assignment table” for TP1200 Comfort [Figure 3-7](#)).

Animation_LED_

Prepared addresses for the animation of the status display located next to the HMI buttons.

4.1 PLC program overview

4.1.10 DB100

The setup/structure is not identical for all drives.

M01_

Includes data of conveyor belt 01 (M01)

M02_

Includes data of conveyor belt 02 (M02)

M03_

Includes data of conveyor belt 03 (M03)

4.1.11 DB200

The setup/structure is not identical for all drives.

M04_

Includes data of conveyor belt 04 (M04)

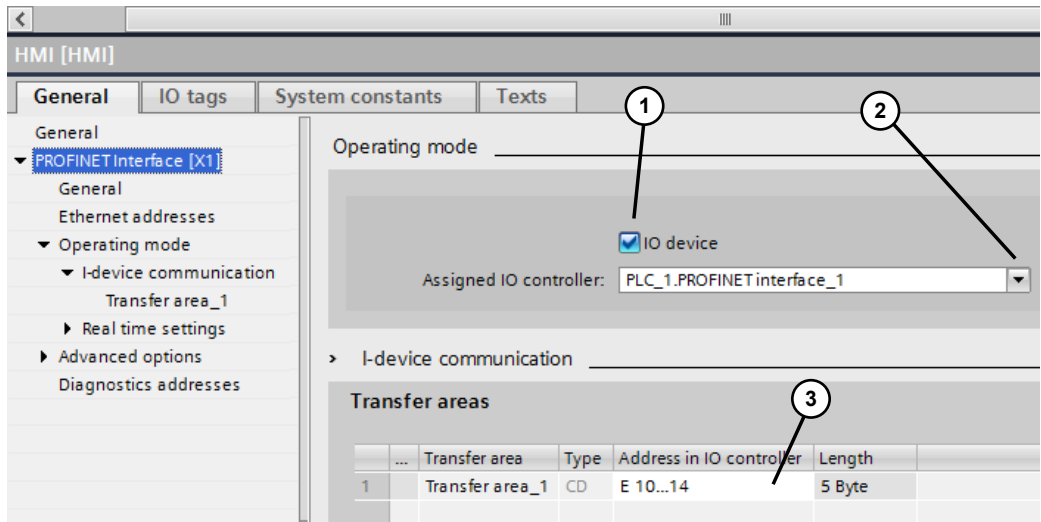
M05_

Includes data of conveyor belt 05 (M05)

4.2 HMI configuration

4.2.1 Device configuration

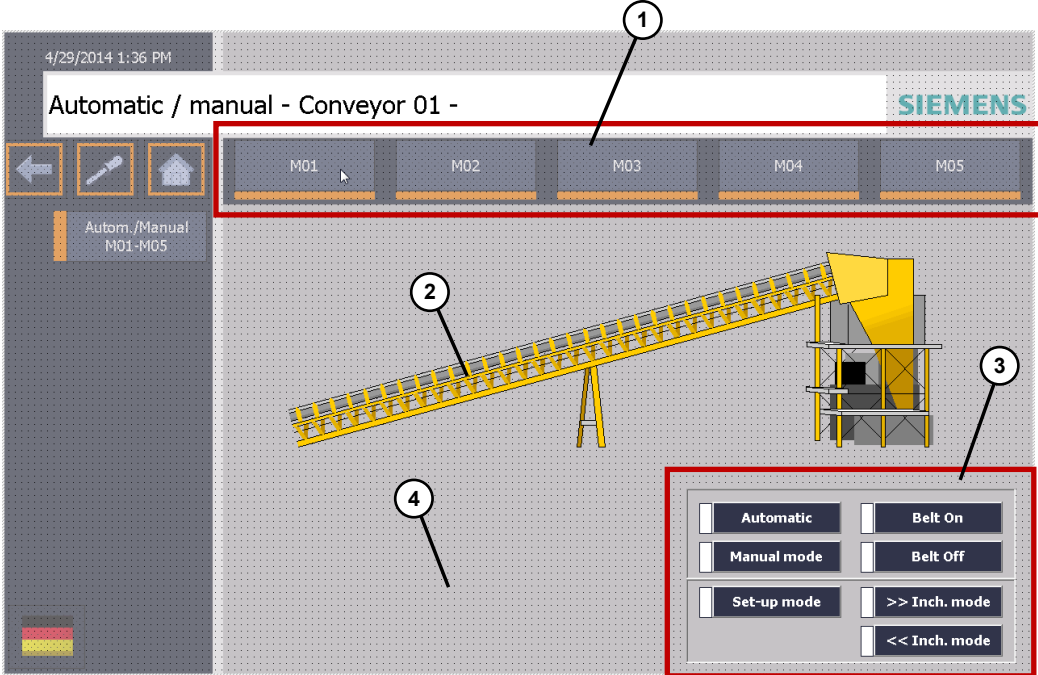
Table 4-2

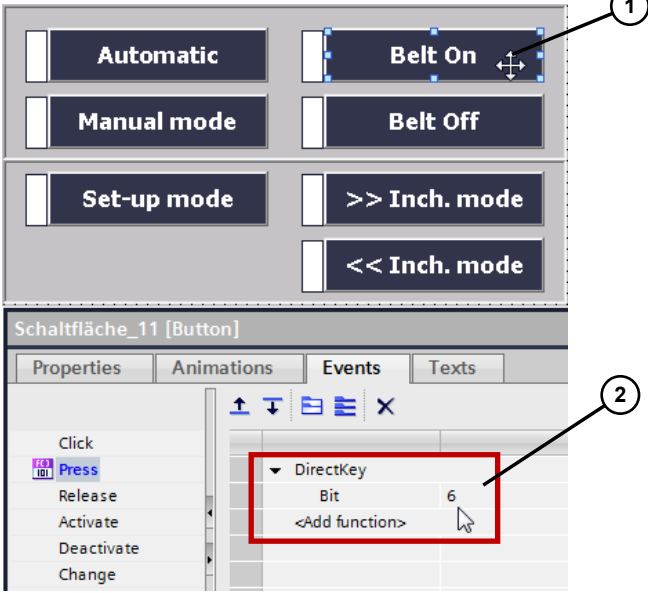
No.	Action
1.	<p>Create Ethernet connection</p> <ul style="list-style-type: none"> Open the network view of the operator panel “Project navigation > Device configuration > Network view”. Create an Ethernet connection between the HMI operator panel and the controller.
2.	<p>Settings at “PROFINET interface [X1]”</p> <p>Open the “HMI” view of TP1200 and select “General > PROFINET interface [X1]” from the area navigation.</p> <ul style="list-style-type: none"> PROFINET interface [X1] <ul style="list-style-type: none"> “IP Protocol” section Specify the IP address. “PROFINET” section Here, you specify the PROFINET device name. This name must match the PROFINET name entered at the panel in menu “PROFINET” Link. “Operating mode” section <ul style="list-style-type: none"> Activate the “IO device” checkbox. At “Assigned IO-Controller” you select the controller via the drop-down menu (2). “I-device communication” section In the “Address in IO controller” column you enter the address area which the “direct keys” use for communicating with the controller (3). 

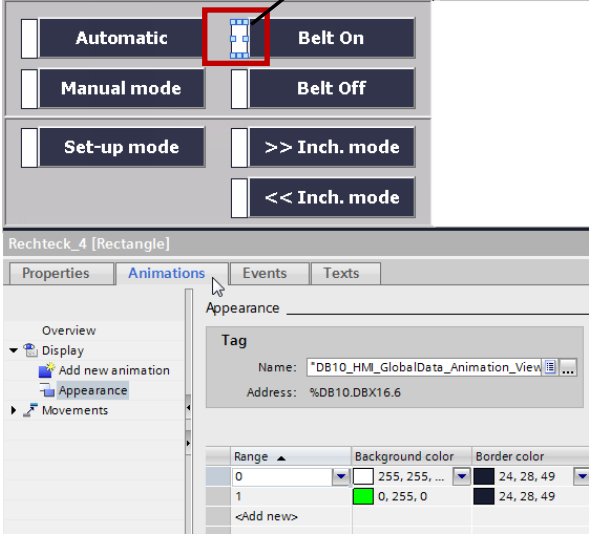
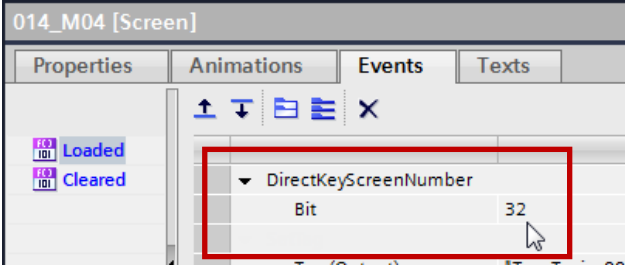
4.2.2 HMI screens

The pictures relevant for the application are located in folder “001_Application”.
 The screens “011_M01 to 015_M05” all have the same structure. Only the most important elements are described.

Table 4-3

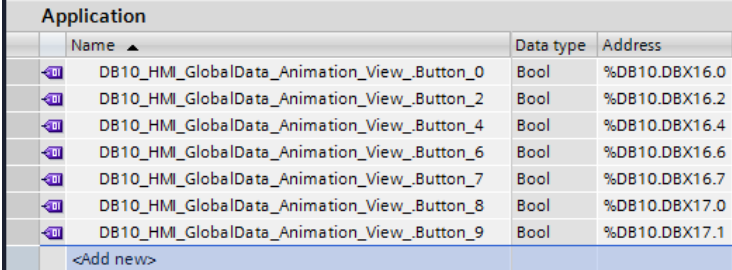
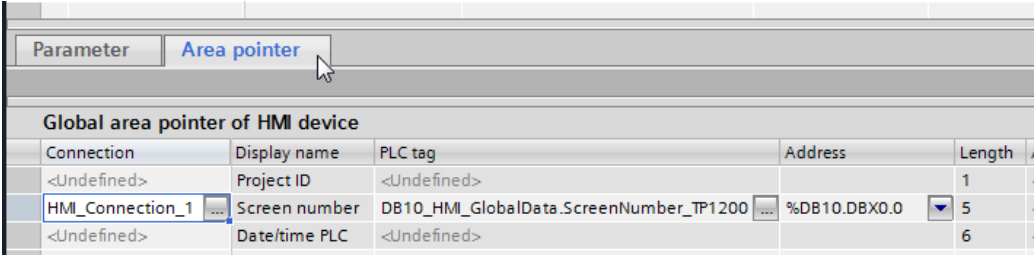
No.	Action
1.	<p>“010_Overview_Auto/Manual” screen</p> <p>The screen is used as “overview page”.</p>
2.	<p>Figure “011_M01”</p>  <ul style="list-style-type: none"> • (1) The respective pages for the individual conveyor belts are called via the buttons. • (2) The screen shows a conveyor belt. It does not have any functionality. • (3) The operator field is used for controlling the conveyor belt. The operator field has the same structure in each HMI screen. Respective details are given in the further course of this document. • (4) At the screens “014_M04 and 015_M05” the system function “DirectKeyScreenNumber” is configured at the properties of the screen. Respective details are given in the further course of this document.

No.	Action
3.	<p>Operator field</p>  <p>At each of the buttons displayed here, system function “DirectKey” is configured (1). With regards to the “Direct keys assignment table”, one “Bit” from this table was assigned to each button. In this example, the Bit “6” was assigned to the “Belt On” button (2).</p> <p>Note: The direct keys with the assigned “bits” are used in all screens. The evaluation, which conveyor is to be controlled, is performed in the controller by means of the current HMI screen number. Either the area pointer “ScreenNumber” or the system function “DirectKeyScreenNumber” is used.</p>

No.	Action
4.	<p>Status display</p>  <p>Rectangles (1) are placed next to the buttons. They serve as status display. If a button is pressed, the current function is displayed via the “status display”. The color change is executed via an animation of the rectangle.</p> <p>Note: The status displays have the same tag in all screens. For differentiation in the controller, the current HMI screen number is evaluated via the area pointer “ScreenNumber” or the system function “DirectKeyScreenNumber”.</p>
5.	<p>“DirectKeyScreenNumber” system function</p>  <p>For evaluating the current HMI screen, the system function “DirectKeyScreenNumber” is used for screens “014_M04 and 015_M05”.</p> <p>The system function is called at “Properties > Events > Loaded”. In this example, bit “32” is set when calling the screen and reset when clearing the screen.</p>

4.2.3 HMI tag and area pointer

Table 4-4

No.	Action																																								
1.	<p>HMI tags</p>  <table border="1"> <thead> <tr> <th colspan="4">Application</th> </tr> <tr> <th></th> <th>Name ▲</th> <th>Data type</th> <th>Address</th> </tr> </thead> <tbody> <tr> <td><DB></td> <td>DB10_HMI_GlobalData_Animation_View_Button_0</td> <td>Bool</td> <td>%DB10.DBX16.0</td> </tr> <tr> <td><DB></td> <td>DB10_HMI_GlobalData_Animation_View_Button_2</td> <td>Bool</td> <td>%DB10.DBX16.2</td> </tr> <tr> <td><DB></td> <td>DB10_HMI_GlobalData_Animation_View_Button_4</td> <td>Bool</td> <td>%DB10.DBX16.4</td> </tr> <tr> <td><DB></td> <td>DB10_HMI_GlobalData_Animation_View_Button_6</td> <td>Bool</td> <td>%DB10.DBX16.6</td> </tr> <tr> <td><DB></td> <td>DB10_HMI_GlobalData_Animation_View_Button_7</td> <td>Bool</td> <td>%DB10.DBX16.7</td> </tr> <tr> <td><DB></td> <td>DB10_HMI_GlobalData_Animation_View_Button_8</td> <td>Bool</td> <td>%DB10.DBX17.0</td> </tr> <tr> <td><DB></td> <td>DB10_HMI_GlobalData_Animation_View_Button_9</td> <td>Bool</td> <td>%DB10.DBX17.1</td> </tr> <tr> <td></td> <td><Add new></td> <td></td> <td></td> </tr> </tbody> </table> <p>The tags relevant for the application are located in folder “Tag_Application”. The tags are used for the animation of the status displays located next to the buttons in the operator field.</p>	Application					Name ▲	Data type	Address	<DB>	DB10_HMI_GlobalData_Animation_View_Button_0	Bool	%DB10.DBX16.0	<DB>	DB10_HMI_GlobalData_Animation_View_Button_2	Bool	%DB10.DBX16.2	<DB>	DB10_HMI_GlobalData_Animation_View_Button_4	Bool	%DB10.DBX16.4	<DB>	DB10_HMI_GlobalData_Animation_View_Button_6	Bool	%DB10.DBX16.6	<DB>	DB10_HMI_GlobalData_Animation_View_Button_7	Bool	%DB10.DBX16.7	<DB>	DB10_HMI_GlobalData_Animation_View_Button_8	Bool	%DB10.DBX17.0	<DB>	DB10_HMI_GlobalData_Animation_View_Button_9	Bool	%DB10.DBX17.1		<Add new>		
Application																																									
	Name ▲	Data type	Address																																						
<DB>	DB10_HMI_GlobalData_Animation_View_Button_0	Bool	%DB10.DBX16.0																																						
<DB>	DB10_HMI_GlobalData_Animation_View_Button_2	Bool	%DB10.DBX16.2																																						
<DB>	DB10_HMI_GlobalData_Animation_View_Button_4	Bool	%DB10.DBX16.4																																						
<DB>	DB10_HMI_GlobalData_Animation_View_Button_6	Bool	%DB10.DBX16.6																																						
<DB>	DB10_HMI_GlobalData_Animation_View_Button_7	Bool	%DB10.DBX16.7																																						
<DB>	DB10_HMI_GlobalData_Animation_View_Button_8	Bool	%DB10.DBX17.0																																						
<DB>	DB10_HMI_GlobalData_Animation_View_Button_9	Bool	%DB10.DBX17.1																																						
	<Add new>																																								
2.	<p>Area pointer “ScreenNumber”</p>  <table border="1"> <thead> <tr> <th colspan="5">Global area pointer of HMI device</th> </tr> <tr> <th>Connection</th> <th>Display name</th> <th>PLC tag</th> <th>Address</th> <th>Length</th> </tr> </thead> <tbody> <tr> <td><Undefined></td> <td>Project ID</td> <td><Undefined></td> <td></td> <td>1</td> </tr> <tr> <td>HMI_Connection_1</td> <td>Screen number</td> <td>DB10_HMI_GlobalData.ScreenNumber_TP1200</td> <td>%DB10.DBX0.0</td> <td>5</td> </tr> <tr> <td><Undefined></td> <td>Date/time PLC</td> <td><Undefined></td> <td></td> <td>6</td> </tr> </tbody> </table> <p>For evaluating the currently called HMI screen, the area pointer “ScreenNumber” is used. Open “Connections > Area pointer” via the project navigation.</p>	Global area pointer of HMI device					Connection	Display name	PLC tag	Address	Length	<Undefined>	Project ID	<Undefined>		1	HMI_Connection_1	Screen number	DB10_HMI_GlobalData.ScreenNumber_TP1200	%DB10.DBX0.0	5	<Undefined>	Date/time PLC	<Undefined>		6															
Global area pointer of HMI device																																									
Connection	Display name	PLC tag	Address	Length																																					
<Undefined>	Project ID	<Undefined>		1																																					
HMI_Connection_1	Screen number	DB10_HMI_GlobalData.ScreenNumber_TP1200	%DB10.DBX0.0	5																																					
<Undefined>	Date/time PLC	<Undefined>		6																																					

4.2.4 HMI device setting

For the communication between the controller and the HMI operator panel, the two following settings are required at the panel.

- “Network and dial-up connections”
- “PROFINET”
 - PROFINET IO enabled.
 - Device name
(must be identical with the PROFINET name in the Device configuration [Link](#)).

5 Project 02, KP900 Comfort Panel

5.1 PLC program overview, KP900 Comfort Panel

5.1.1 Device configuration

A CPU315-2 PN/DP is used as controller.

In the device configuration for the controller, the IP address and the subnet mask must be specified. No other settings are necessary.

5.1.2 Block overview

A conveyor belt is used for the example application. The program includes the evaluation of the buttons used in the HMI project and the respective status displays.

Figure 5-1

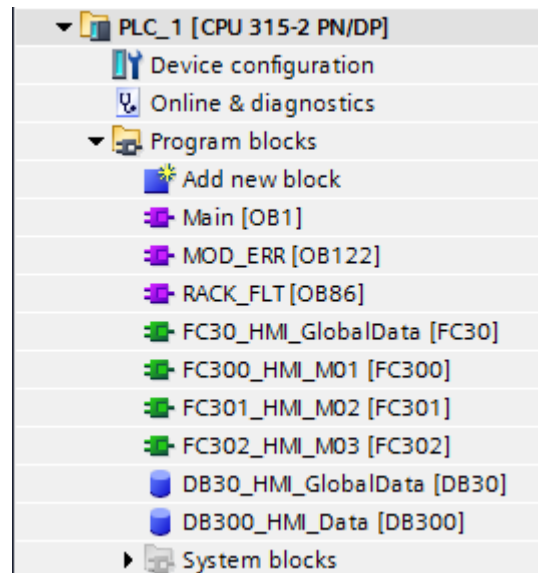


Table 5-1

No.	Block	Description
1.	Main (OB1)	The block contains the program calls of the blocks function.
2.	RACK_FLT (OB86)	The operating system of the CPU calls OB 86 at the failure of a PROFINET IO system or a PROFINET IO station. In reference to the example: If the runtime of the HMI operator panel is not started, OB86 is called.
3.	MOD_ERR (OB122)	The operating system of the CPU calls OB 122, if an error occurs when accessing the data of a module.
4.	FC30_HMI_GlobalData	The block contains general data which concerns all "conveyors".

No.	Block	Description
5.	FC300_HMI_M01 (FC300)	The block contains the program for controlling the "Conveyor 01" conveyor belt. The evaluation of the "direct keys" is performed in connection with area pointer "ScreenNumber".
6.	FC301_HMI_M02 (FC301)	The block contains the program for controlling the "Conveyor 02" conveyor belt. The evaluation of the "direct keys" is performed in connection with area pointer "ScreenNumber".
7.	FC302_HMI_M03 (FC302)	The block contains the program for controlling the "Conveyor 03" conveyor belt. The evaluation of the "direct keys" is performed in connection with area pointer "ScreenNumber".
8.	DB30_HMI_GlobalData (DB30)	The data block contains data which concerns all "conveyors".
9.	DB300_HMI_Data	The data block includes the data for the conveyors 01 to 03.

5.1.3 Functionality

General

All direct keys were used several times in different HMI screens, where the function controlled by the direct key is always the same (e.g. "Automatic mode" selection).

For differentiating the "direct keys", the area pointer "ScreenNumber" is used.

The following description only discusses the most important settings. For a better understanding it is helpful if the STEP 7 program is opened.

5.1.4 FC30

Network 1 and 2

In the device configuration of the operator panel, a transfer area from "I 20...23" (4 bytes) was defined. The evaluation of the direct keys assignment is performed via this transfer area.

The transfer area (input) was copied to data block number "30" byte by byte using the "BLKMOV" block.

This measure enables making changes in the transfer at one central location in the program.

Note Only two bytes were necessary for realizing the application.

Network 3 to 4

In the device configuration of the operator panel, a transfer area from “Q 20...23” (4 bytes) was defined. The evaluation for the LED control is performed via this transfer area.

The data content of DB30 is copied byte by byte to the transfer area (output) using “BLKMOV”.

This measure enables making changes in the transfer at one central location in the program.

Note

Only two bytes were necessary for realizing the application.

Network 5 to 11

One respective LED is located at the function keys of KP900 Comfort.

In this application, the LEDs are used for the output of the status of the respective function key - e.g. “Automatic mode activated”.

The respective evaluation is performed in the networks 5 to 11.

5.1.5 FC300

The evaluation of the current HMI screen is performed in FC300, FC301 and FC302 via the area pointer “ScreenNumber”.

Network 1

The evaluation of which HMI screen is currently called up is performed in network 1. This ensures that “Conveyor 01” can only be operated if the HMI screen with number “11” is called.

A respective comparison with the value from the second data word of the area pointer “ScreenNumber” with the given HMI screen number follows.

The result of this comparison is used as “enable signal” for all subsequent networks.

Note

The HMI screen number is given as “hexadecimal” number.

Network 2 to 7

The evaluation of the HMI direct keys and their respective function is performed in networks 2 to 7.

In FC30, the transfer area was copied to a data area in DB30. From the “direct keys assignment table”, the respective bit can be read and assigned to the function to be executed.

5.1 PLC program overview, KP900 Comfort Panel

Network 8 to 14

The evaluation for the LEDs (“status display”) is performed in the networks 8 to 14 - e. g. “Automatic mode selected”. The LEDs are located next to the function keys. The result is transferred to the transfer area in FC30.

5.1.6 FC301 and FC302

The structure of block FC301 and FC302 is identical with FC300. The difference lies mainly in network 1, where the current HMI screen number is evaluated.

5.1.7 DB30

ScreenNumber_TP1200

Data for the area pointer “ScreenNumber”.

KP900_KEY_

Prepared structure for the “direct keys evaluation”

Key panels have a fixed direct key assignment. The transfer area (inputs) is copied to this area (see FC30 NW1 and 2).

KP900_LED_

Prepared structure for the “LED evaluation”.

Key panels have a fixed LED assignment. The transfer area (outputs) is copied to this area (see FC30 NW3 and 4).

5.1.8 DB300

The setup/structure is not identical for all drives.

M01_

Includes data of conveyor belt 01 (M01)

M02_

Includes data of conveyor belt 02 (M02)

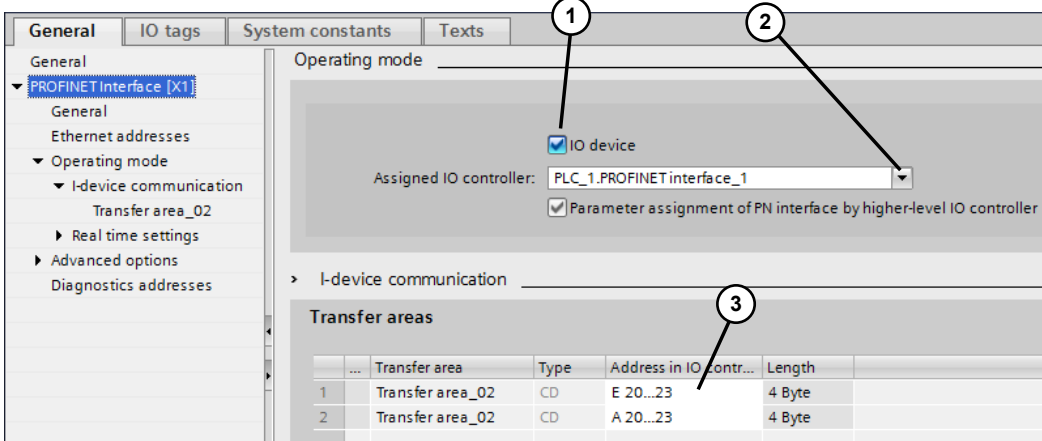
M03_

Includes data of conveyor belt 03 (M03)

5.2 HMI configuration

5.2.1 Device configuration

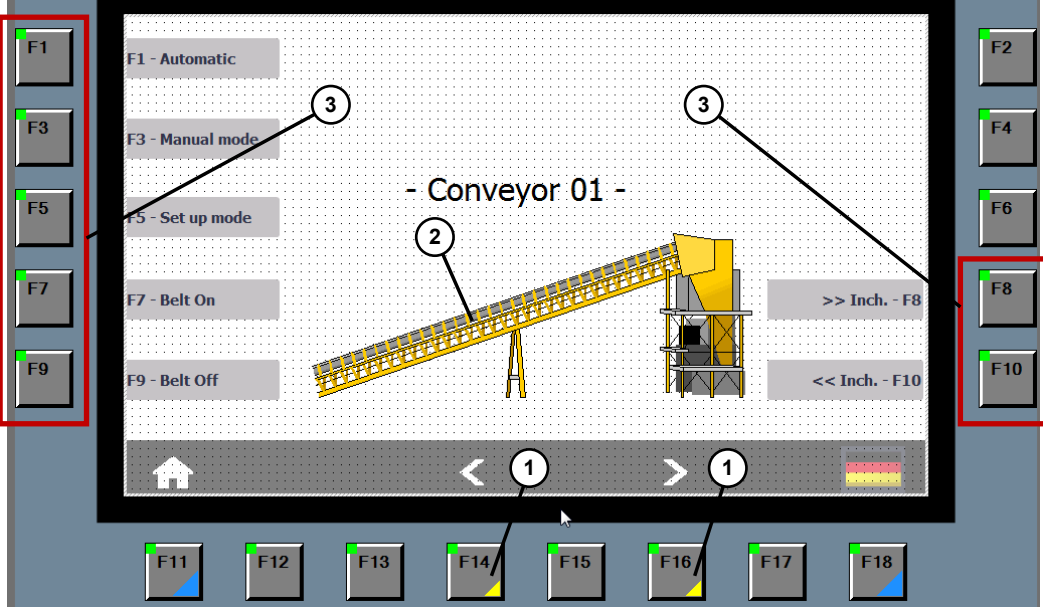
Table 5-2

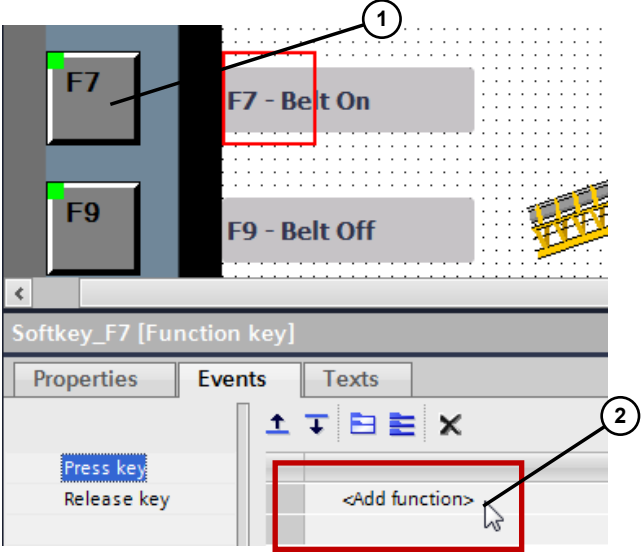
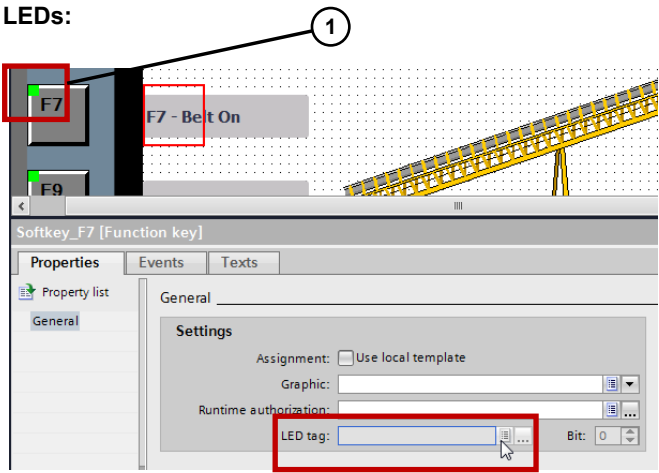
No.	Action
1.	<p>Create Ethernet connection</p> <ul style="list-style-type: none"> Open the network view of the operator panel "Project navigation > Device configuration > Network view". Create an Ethernet connection between the HMI operator panel and the controller.
2.	<p>Settings at "PROFINET interface [X1]"</p> <p>Open the "HMI" view of TP1200 and select "General > PROFINET interface [X1]" from the area navigation.</p> <ul style="list-style-type: none"> PROFINET interface [X1] <ul style="list-style-type: none"> "IP Protocol" section Specify the IP address. "PROFINET" section Here, you specify the PROFINET device name. This name must match the PROFINET name entered at the panel in the "PROFINET" menu. "Operating mode" section <ul style="list-style-type: none"> Activate the "IO device" checkbox. At "Assigned IO-Controller" you select the controller via the drop-down menu (2). "I-device communication" section In the "Address in IO controller" column you enter the address area which the "direct keys" use for communicating with the controller (3). 

5.2.2 HMI screens

The pictures relevant for the application are located in folder “001_Application”.
 The screens “011_M01 to 013_M03” all have the same structure. Only the most important elements are described.

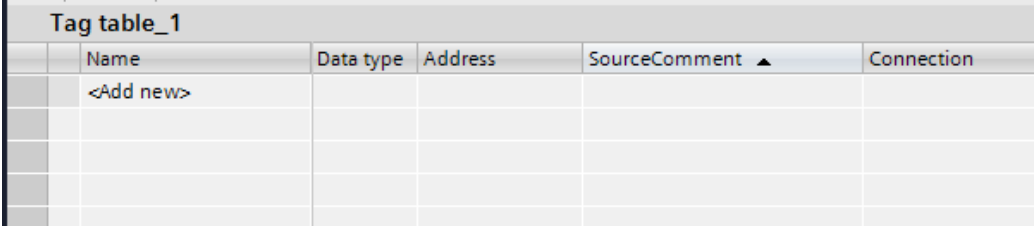
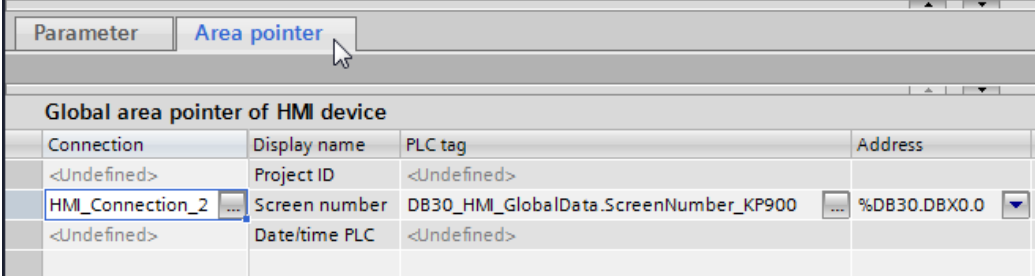
Table 5-3

No.	Action
1.	<p>“010_Overview_Auto/Manual” screen</p> <p>The screen is used as “overview page”.</p>
2.	<p>Figure “011_M01”</p>  <ul style="list-style-type: none"> (1) The respective pages for the individual conveyor belts are called via the buttons “F14” or “F16”. (2) The screen shows a conveyor belt. It does not have any functionality. (3) The control of the conveyor belt is performed via the function keys. The functionality has the same structure in each HMI screen. Respective details are given in the further course of this document.

No.	Action
<p>3.</p>	<p>Function keys</p>  <p>Due to the fixed direct keys assignment, no system function (2) needs to be configured at the function keys (1). With to the fixed transfer area, the respective bit is set when pressing the key and reset when releasing the key.</p> <p>Note: The direct keys are active in all screens. In order to differentiate which “conveyor” is to be controlled, an evaluation of the HMI screen number is performed via the area pointer “ScreenNumber”</p>
<p>4.</p>	<p>LEDs:</p>  <p>Due to the given transfer area (output), the LEDs (1) have a fixed bit assignment. For this reason, no tag is necessary for controlling the LEDs.</p> <p>Note: The LEDs are active in all screens. For differentiation, the current HMI screen number is evaluated via the area pointer “ScreenNumber”.</p>

5.2.3 HMI tags and area pointers

Table 5-4

No.	Action
1.	<p>HMI tags</p>  <p>No tags are required for the implementation of the task described in the application.</p>
2.	<p>Area pointer "ScreenNumber"</p>  <p>For evaluating the currently called HMI screen, the area pointer "ScreenNumber" is used. Open "Connections > Area pointer" via the project navigation.</p>

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5.2.4 HMI device setting

For the communication between the controller and the HMI operator panel, the two following settings at the panel are particularly important.

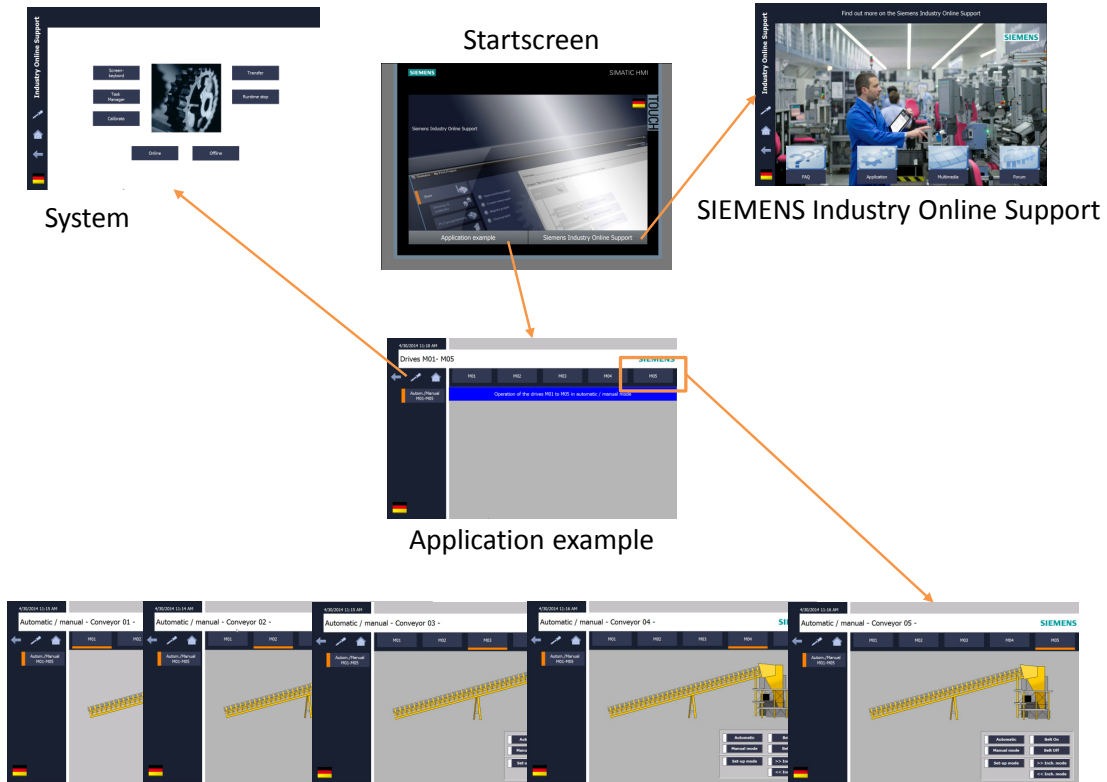
- "Network and dial-up connections"
- "PROFINET"
 - PROFINET IO enabled.
 - Device name
(must be identical with the PROFINET name in the device configuration).

6 Operation of the Application

6.1 TP1200 Comfort Panel overview

Overview of the user interface

Figure 6-1

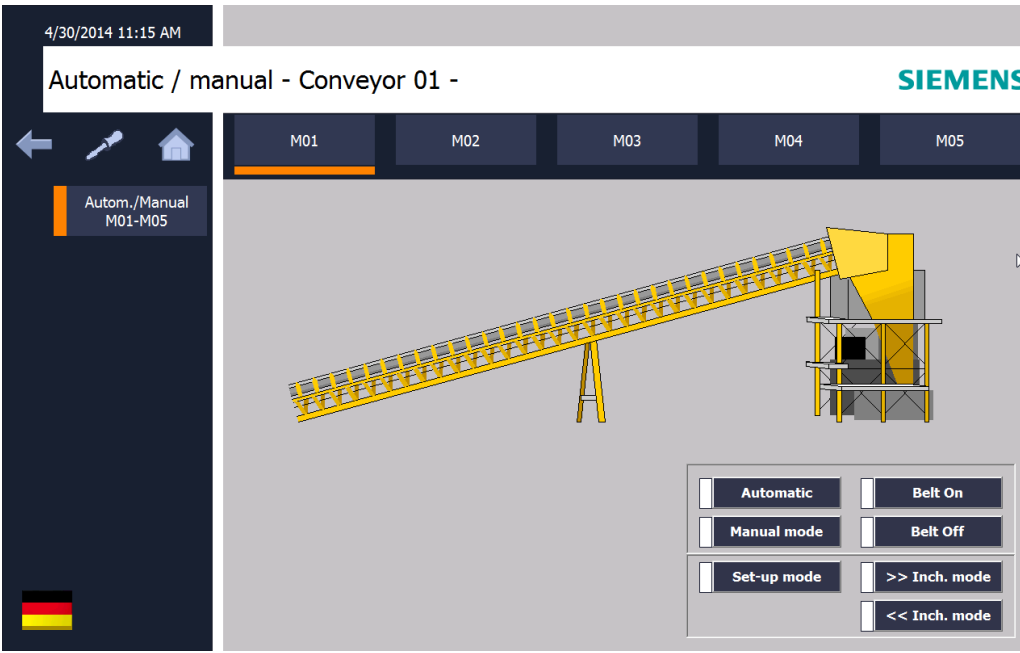


6.2 “Conveyor 01” screen

The operation of conveyors 01 to 05 is the same on all sides.

Note The functions cannot be tested in the runtime simulation.

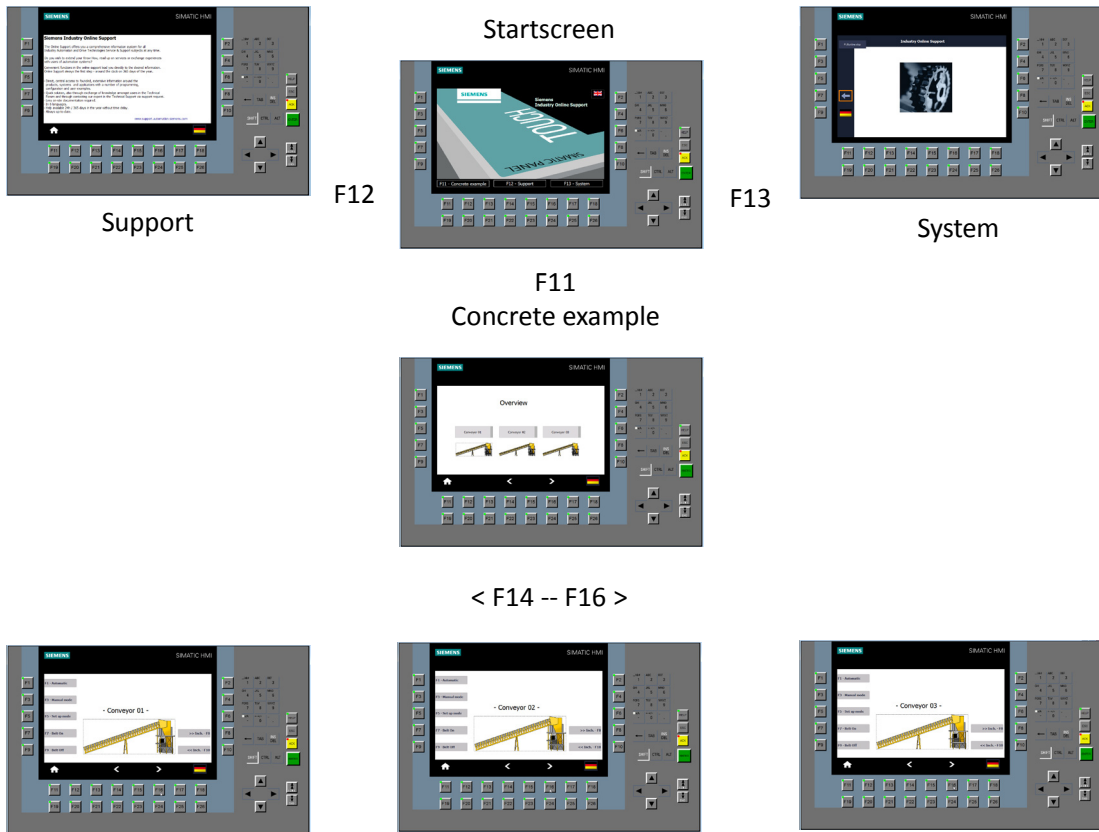
Table 6-1

No.	Action
1.	<p>Figure “011_M01”</p>  <p>Conveyor belt operation:</p> <ul style="list-style-type: none"> • Automatic : Automatic mode selection • Manual mode: Manual mode selection • Set-up mode: Set-up mode selection • Belt On: Belt On • Belt Off: Belt Off • >> Inch mode. Jog mode belt forward (only possible if set-up mode active) • << Inch mode. Jog mode belt backward (only possible if set-up mode active)

6.3 KP900 Comfort Panel overview

Overview of the user interface

Figure 6-2

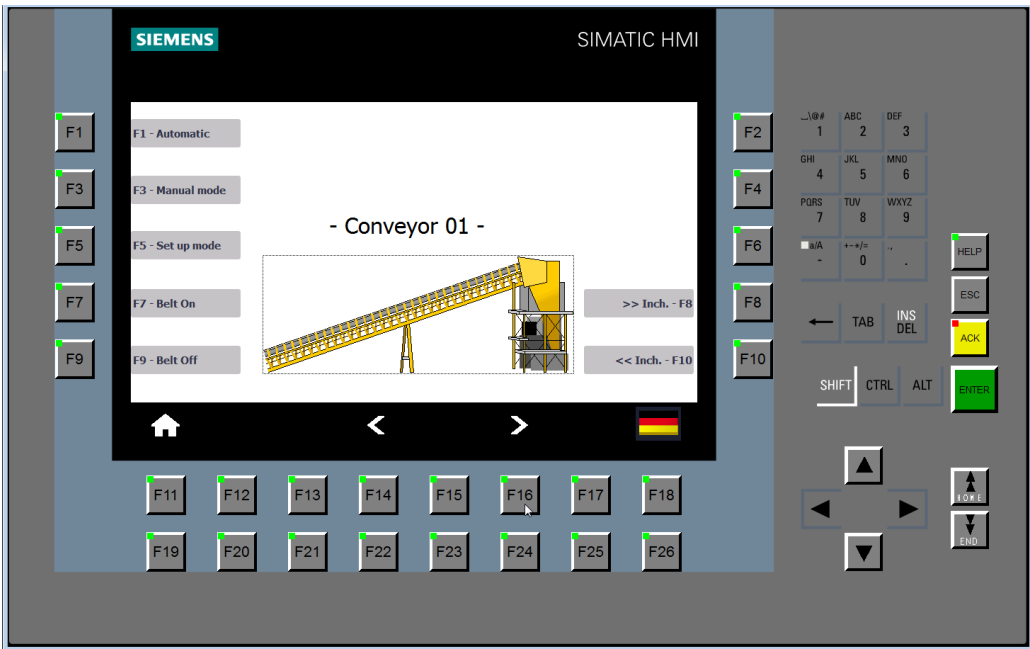


6.4 "Conveyor 01" screen

The operation of conveyors 01 to 03 is the same on all sides.

Note The functions cannot be tested in the runtime simulation.

Table 6-2

No.	Action
1.	<p data-bbox="336 629 544 656">Figure "011_M01"</p>  <p data-bbox="336 1373 624 1400">Conveyor belt operation:</p> <ul data-bbox="336 1406 1078 1671" style="list-style-type: none"> • F1 - Automatic mode • F3 - Manual mode • F5 - Set-up mode selection • F7 - Belt on • F9 - Belt off • F8 - Jog mode belt forward (only possible if set-up mode active) • F10 - Jog mode belt forward (only possible if set-up mode active) <p data-bbox="336 1709 552 1736">General functions:</p> <ul data-bbox="336 1742 831 1839" style="list-style-type: none"> • F11 - Start page • F14 / F16 call of individual conveyor belts • F18 change language

7 Tips for Configuration

7.1 Expansion of project 02 (KP900)

Using “direct keys” enables expanding an existing configuration easily.

As an example, a further conveyor belt shall be added in project 02 (KP900).

For the expansion of the configuration, only the following points must be adjusted

HMI configuration

- Copy the existing screen "013_M03" and rename it
→ e.g. "014_M04". Note down the screen number.
- Call up the newly created screen accordingly.

STEP 7 program

DB300

- In DB300 you copy the data structure of the existing "M03_" and then rename it
→ e.g. "M04_".

FC302

- Copy "FC302" and then rename the block
→ e.g. "FC303".

FC303 (new)

- Open "FC303" and adjust the existing screen number in network 1.
- Execute "Search and replace" with (Ctrl + F).
Replace the texts "M03_" with "M04_". With symbolic addressing, the addresses of the tags are automatically adapted. Finished.

OB1

Call the newly created "FC303" in OB1.

This completes the configuration of the new conveyor belt.

In few steps, you have added a new conveyor belt.

7.2 Migrating an existing project

This chapter uses an example to describe the procedure of how to migrate an existing “direct key configuration” created with STEP 7 V5.x and WinCC flexible 2008 SP3 to WinCC V13 (TIA Portal).

STEP 7 V5.x project

- Open the STEP 7 hardware configuration
- From the PROFNET GSD file of the operator panel you note down the IO address as well as the used device name.

WinCC (TIA Portal)

- Migrate the STEP 7 project to WinCC (TIA Portal).
 - After completion, you receive a query stating that the direct key module was not migrated. This must be configured manually in the device configuration.
- Adjusting the device configuration
 - In WinCC (TIA Portal) the GSD file required in STEP 7 V5.x is no longer necessary. In Chapter [4.2.1](#) you perform the described settings. For this, you use the previously noted GSD data.

This completes the migration.

7.3 No PROFINET connection with the panel

If a connection with PROFINET cannot be established, check the PROFINET name in the device configuration of the HMI configuration with the PROFINET name in the Control Panel of the operator panel.

8 Related Literature

Table 8-1

	Topic	Title
\1\	Siemens Industry Online Support	http://support.automation.siemens.com
\2\	Download page of the entry	http://support.automation.siemens.com/WW/view/en/92186980
\3\	System Manual	WinCC Advanced V13 http://support.automation.siemens.com/WW/view/en/91479053

9 History

Table 9-1

Version	Date	Modifications
V1.0	10/2014	First version