

Diagnostic Block and HMI Template for AS Interface in the TIA-Portal

AS Interface

Library Description for S7-1200 • February 2012

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Diagnostic Block and HMI Template for AS Interface in the TIA-Portal

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1 Application

Overview

AS-Interface slaves are connected with a SIMATIC controller via gateways or communication modules. An individual evaluation of the diagnostic data of the AS-i master and slaves in the STEP 7 user program is very elaborate and therefore not a trivial matter.

The code package on hand shall simplify the diagnosis of AS-Interface masters and slaves in the user program and on HMI panels.

The package consists of three parts:

1. A TIA Portal Library **ASI_DIAG** with all relevant blocks you need for the diagnosis and HMI Templates.
This library is used for the creation of own AS-i diagnostic applications.
2. Two TIA Portal projects **ASI_DIAG_S71200_xx** in which the program blocks and HMI templates are used as an example.
 - TIA Portal project **ASI_DIAG_S71200_Basic** for selective Basic Panels
 - TIA Portal project **ASI_DIAG_S71200_Comfort** for selective Comfort Panels
3. This documentation for the description of using the library and the example projects.

The code package therefore offers you the opportunity to use an AS-i interface diagnostic and visualization without any own configuration (TIA portal project **ASI_DIAG_S71200_xx**) or only the relevant blocks for the diagnosis (**ASI_DIAG** library) and to integrate them into your own project.

Apart from the description of the code package, this document includes

- a detailed description of the most important blocks regarding the core functionality and of the internal functional sequences.
- explanations regarding content and structure of the diagnostic information read from the AS-i master.

This knowledge is vital for working without HMI templates.

In any case, the documents listed in Table 8-1 are recommended as accompanying literature.

Applicability

This application description is valid for the AS-i Master for SIMATIC S7-1200 - CM 1243-2.

STEP 7 V11 (TIA Portal) and WinCC V11 (TIA Portal) are used as the configuration software.

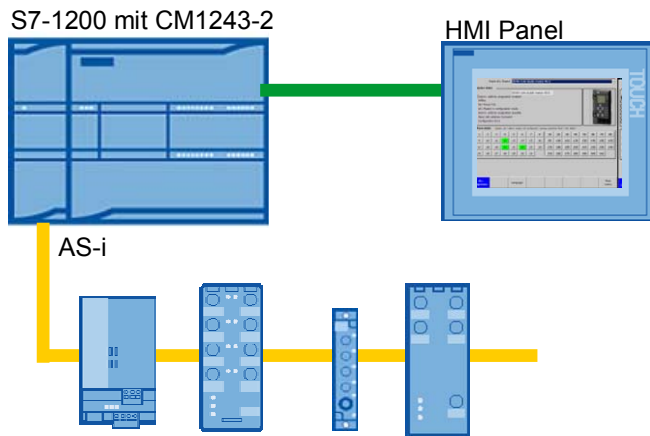
Note

For further information on the hardware and software requirements refer to chapter 2.3 (**Fehler! Verweisquelle konnte nicht gefunden werden.**).

Schematic layout

The figure below shows a possible hardware setup for the application of STEP 7 blocks:

Figure 1-1



HMI visualization

The figure below shows the HMI template for the visual diagnosis of AS-i masters and slaves:

Figure 1-2

The screenshot shows the HMI visualization interface for AS-i diagnosis. At the top, a dropdown menu is set to 'CM 1243-2 - Master 1'. Below this, the 'Master state' section contains several status indicators:

- autom. addressing activated
- Offline
- AS-i voltage error
- AS-i master in config mode
- autom. addressing enable
- Slave with address 0 exists
- Configuration error

To the right of these indicators is the ASi INTERFACE logo. Below the master state is the 'Slave state' section, which includes a legend: green: ok / yellow: exists, not configured / red: failed / orange: periphery fault. A grid of slave addresses is displayed:

1	2	3	4	5	6	7	8	1B	2B	3B	4B	5B	6B	7B	8B
9	10	11	12	13	14	15	16	9B	10B	11B	12B	13B	14B	15B	16B
17	18	19	20	21	22	23	24	17B	18B	19B	20B	21B	22B	23B	24B
25	26	27	28	29	30	31		25B	26B	27B	28B	29B	30B	31B	

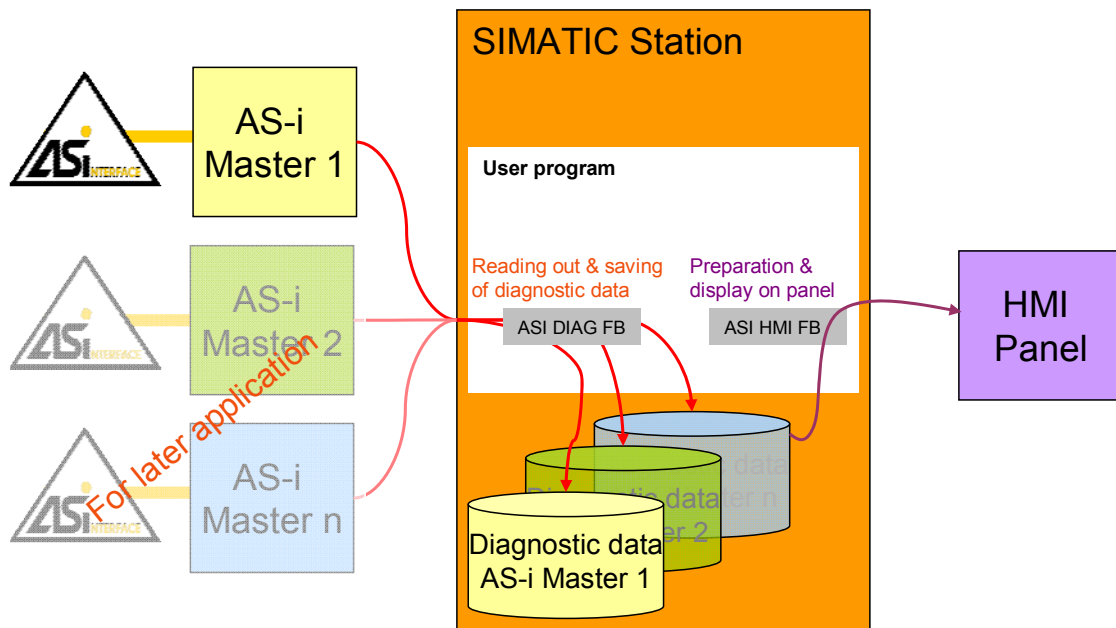
At the bottom, it shows 'Slave 0' with the status 'Not configured'. There are also language selection icons for UK and DE.

2 Overview blocks and HMI template

2.1 Function diagram

The figure below shows a schematic illustration of the project's functionality:

Figure 2-1



2.2 Program blocks

2.2.1 Overview

Two blocks are significantly involved in reading out and evaluating the status of AS-interface slaves and masters as well as the graphic display in the HMI:

- the AS-interface diagnostic block **ASI DIAG FB** (FB157)
- the AS-interface visualization block **ASI HMI FB** (FB158)

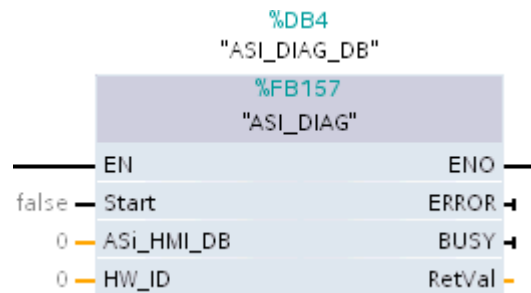
The ASI DIAG FB supplies the status bits for AS-interface line (master and slaves) respectively and stores the diagnostic data in the instance data block.

The ASI HMI FB can be optionally used for displaying the diagnostic data in a WinCC V11 (TIA Portal) environment.

ASI DIAG FB157

The graphic below shows the FB157 in LAD representation:

Figure 2-2



The parameters have the following meaning:

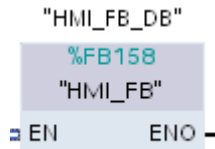
Table 2-1

Type	Tag	Data type	Default value	Significance
Input	HW_ID	DINT	L#0	Hardware identification of the master module as Long INT e.g. L#1.
	ASi_HMI_DB	DINT	L#0	Optional: number of the instance data block for the HMI visualization.
	Start	BOOL	0	Request Bit; when there is a positive edge at REQ, the block will be processed.
Output	BUSY	BOOL	0	True, when the block is processed.
	ERROR	BOOL	0	True, when an error has occurred.
	RetVal	DWORD	0	Contains an error code in the event of an error.

ASI HMI FB158

The graphic below shows the FB158 in LAD representation:

Figure 2-3



This block has no parameters.

2.2.2 Call environment

Overview

ASI DIAG FB157 must be called in the cyclic OB 1 and is activated by a parameter input in the OB 1, or in an error or cyclic interrupt OB.

Activation of the ASI DIAG FB157 via the error or cyclic interrupt OBs has the advantage that the block is only processed for certain situations (error or cyclic interrupt). This process saves unnecessary processing of the diagnostic block in the cyclic execution level.

Note

The error and cyclic interrupt OBs are only active for one cycle; the ASI DIAG FB, however, takes several runs for its execution. Therefore, the block is only triggered in this OB. Further processing is handled by the cyclic OB 1.

A call of all ASI DIAG FBs in OB 1 is therefore mandatory.

If the **ASI HMI FB158** is used for HMI visualization, it is sufficient to call it once in the cyclic OB 1 execution level.

The following table summarizes all of the call types:

Table 2-2

	OB 1	Error OB 8x	Cyclic interrupt OB 3x
ASI DIAG FB157	✓	(optional)	(optional)
ASI HMI FB158	✓	✗	✗

Error OBs

When an error occurs, the AS-i master generates a diagnostic interrupt and sends it to the CPU. To react to the error with a defined (programmed) behavior, this alarm calls a respective organization block in the user program.

- OB 82: diagnostic interrupt OB:
- OB 83: unplug/plug OB
- OB 84: CPU hardware error OB
- OB 85: program sequence error OB
- OB 86: module rack failure OB

Cyclic Interrupt OBs

By using the cyclic interrupt OBs of S7, certain program sequences can be started after up to nine equidistant time intervals. Numbers OB 30 – OB 38 serve as cyclic interrupt OBs.

The call in the cyclic interrupt OB has the function to poll the AS-i masters cyclically in a certain time grid. Errors can also be detected this way, even if the AS-i master reports no diagnostic interrupt and hence causes no error OB call.

Employing the cyclic interrupts avoids putting unnecessary load on the cyclic OB 1.

2.2.3 Resources and performance data

Project resources

The table below gives the size of the program blocks or instance data blocks in main memory:

Table 2-3

No.	Block	Size in main memory	Note
1.	ASI DIAG FB 157	2293 byte	
2.	ASI HMI FB 158	1999 byte	
3.	Instance data block for FB 157	140 byte	A separate instance data block per AS-i line is required.
4.	Instance data block for FB 158	140 byte	Only if HMI visualization is employed.

Maximum number of AS-i masters

With the CPU firmware version V2.2 a max. of one AS-i Master CM 1243-2 can be connected. A possible expansion of the number of AS-i masters will be announced via the Siemens Service&Support portal on the internet.

AS-i performance data

Up to 62 slaves can be connected per AS-i line, which are addressed at address 1A - 31A and 1B - 31B.

According to the specification, the update time is 5ms for 31 slaves and 10ms for maximum configuration.

2.3 Overview of the HMI Template

What will you learn here?

This chapter shows how the HMI template is represented and outlines how it works.

Note For all the functions described in this chapter, all blocks from the STEP 7 V11 (TIA Portal) project are required.

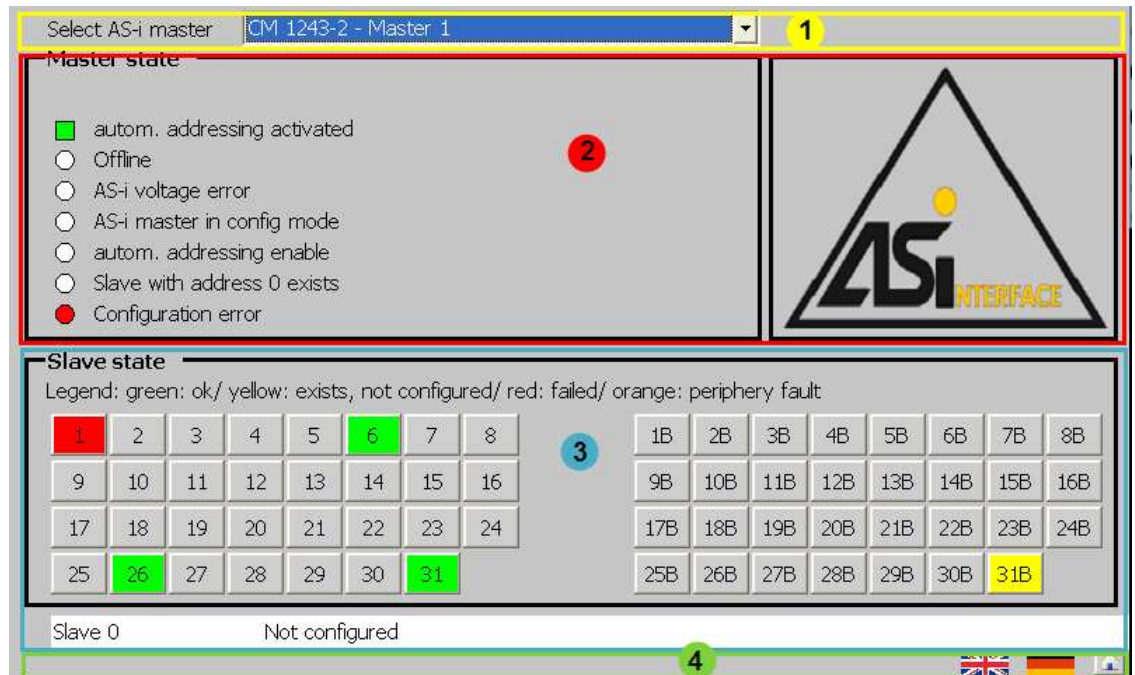
Overview of the layout of the AS-i master diagnosis

Using the WinCC V11 (TIA Portal) visualization provides an option for a clear graphic representation and diagnosis of the status of the configured AS-i master and its slaves.

The data is read and prepared from the AS-i master.

The AS-i diagnostic screen is subdivided into four areas:

Figure 2-4



The table below shows the meaning of the individual areas:

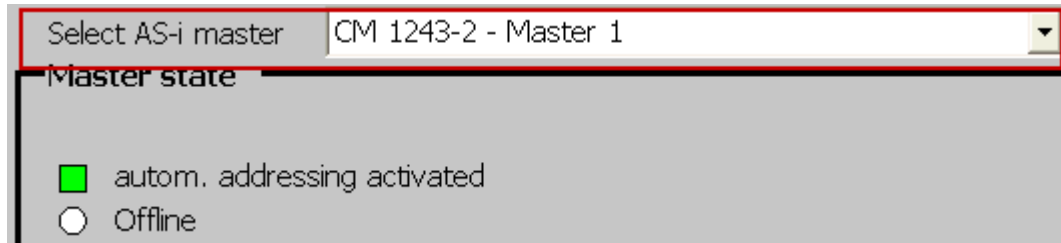
Table 2-4

No.	Function
1.	Selecting and unselecting the AS-i master; each AS-i master is represented with its bus.
2.	Status of the AS-i master according to the AS-i specification.
3.	Overview and status of the slaves connected at the bus.
4.	Menu fields

Selecting the AS-i masters for comfort panels

The AS-i master is selected via a drop-down list. The following screenshot shows the list:

Figure 2-5



Note For this version the number of AS-i masters is limited to **one**.

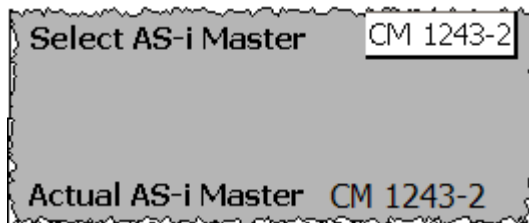
A graphic of the AS-i master and the slaves can also appear next to the display text.

Selecting the AS-i masters for basic panels

Basic panels have a smaller range of functions and do not support all tools from WinCC.

The AS-i master for the basic panel is selected via a button.

Figure 2-6



Note For this version the number of AS-i masters is limited to **one**.

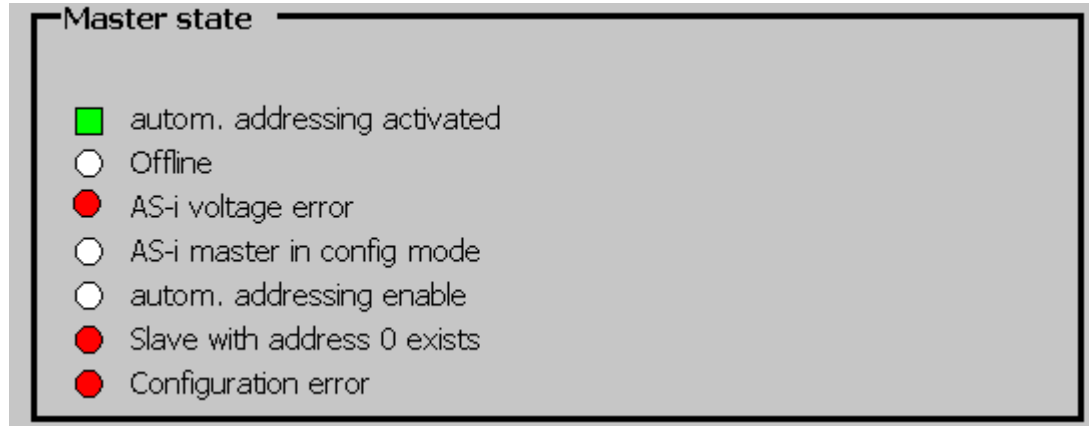
Status of the AS-i master

Via a data record, information can be read or written through the AS-i master connection.

Apart from information via the connected slaves, the AS-i master also provides own status flags according to the AS-i specification.

The flags of the selected AS-i master are read and highlighted in color in WinCC V11 (TIA Portal) according to their status.

Figure 2-7



The meaning of the individual status is illustrated in the following table:

Table 2-5

Flag	Display text	Significance
AUTO_ADDR_ENABLE	Automatic addressing activated	The flag indicates whether automatic addressing is blocked (bit = 0) or enabled (bit = 1) by the user.
OFFLINE_READY	Offline	The flag is set if the offline phase is active.
APF	AS-i voltage error	The flag is set if the voltage at the AS-i line is too low.
CONFIG_MODE	AS-i master in config mode	The flag is set in the configuration mode and reset in protected mode.
AUTO_ADDR_AVAIL	Autom. addressing enable	The flag is set if the automatic address programming can be performed (i.e. if precisely one AS-i slave has failed).
LDS_0	Slave with address 0 exists	The flag has been set if an AS-i slave with address 0 exists.
CONFIG_OK	Configuration error	The flag is set when the setpoint configuration and the actual configuration match.

If this description is transferred to the example in Figure 2-7 the following statements can be made of CM1243-2:

- automatic addressing is enabled
- The voltage at the connected AS-i line is too low, or no AS-i line is connected.
- An AS-i slave with the address 0 is located in the network.
- The setpoint configuration does not correspond to the actual configuration.

Slave state

The “Slave state” area displays an overview of the configured slaves. A maximum of 64 slaves (31 A slaves and 31 B slaves + 2 slaves for address 0A and 0B) can be diagnosed.

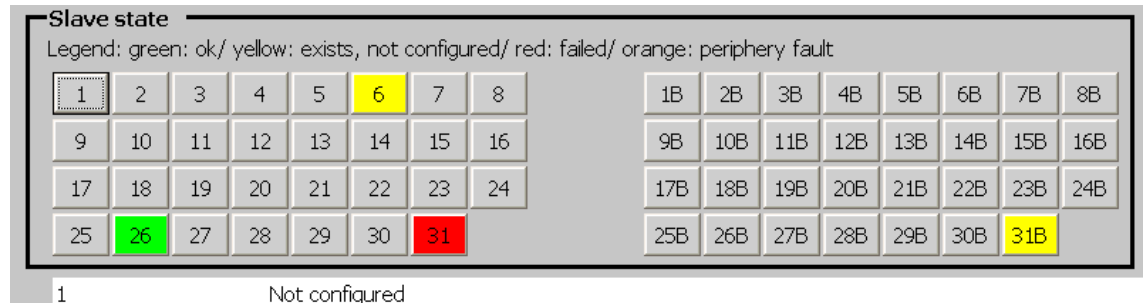
The status of the slaves is read via a data record from the AS-i master.

With the “Get_lists_and_flags” call the following entries are read from the AS-i master:

- List of active AS-i slaves (LAS)
- List of detected AS-i slaves (LDS)
- List of configured AS-i slaves (LPS)
- List of the present I/O error of the enabled AS-i slaves (LPF)
- Flags of the AS-i master according to AS-i specification.

Using WinCC V11 (TIA Portal) the slave states are symbolized via various background colors.

Figure 2-8



The following color assignments apply:

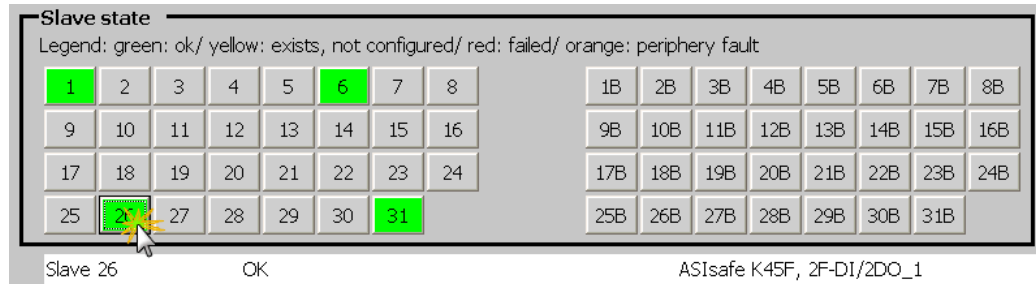
Table 2-6

Color	Significance
Green	The slave is detected, enabled and configured. No I/O error reported.
Yellow	The slave was detected but has not yet been configured.
Orange	The slave reports an I/O error.
Red	The slave is configured but has failed (disabled and/or not detected). However, it does not report an I/O error.
Gray	The slave has not been configured

For each slave a detailed description can be stored (e.g. MLFB number, location, function).

By simply clicking on a slave, the stored information and the current status is displayed as plain text in the output field underneath the “Slave state” area.

Figure 2-9



Note How to store additional information on the slaves is described in chapter 5.4 (Adjusting the AS-i slave information)

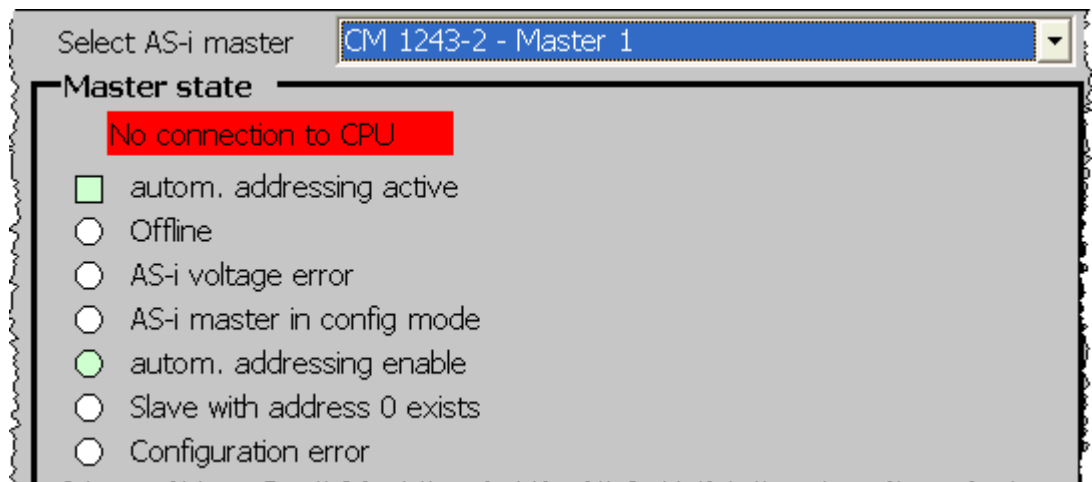
Further states

Apart from the states of the AS-i master and the AS-i slaves, failures from the visualization environment are also displayed. These include messages, such as:

- No connection between CPU and visualization (only for comfort panels);
- CPU in STOP
- Data missing from ASI HMI FB158;

The visualization displays the messages in plain text, as shown in the figure below:

Figure 2-10



Checking whether the connection between CPU and display device exists is implemented via system messages. System messages at the operator panel provide information of internal states of the operator panel and the controller.

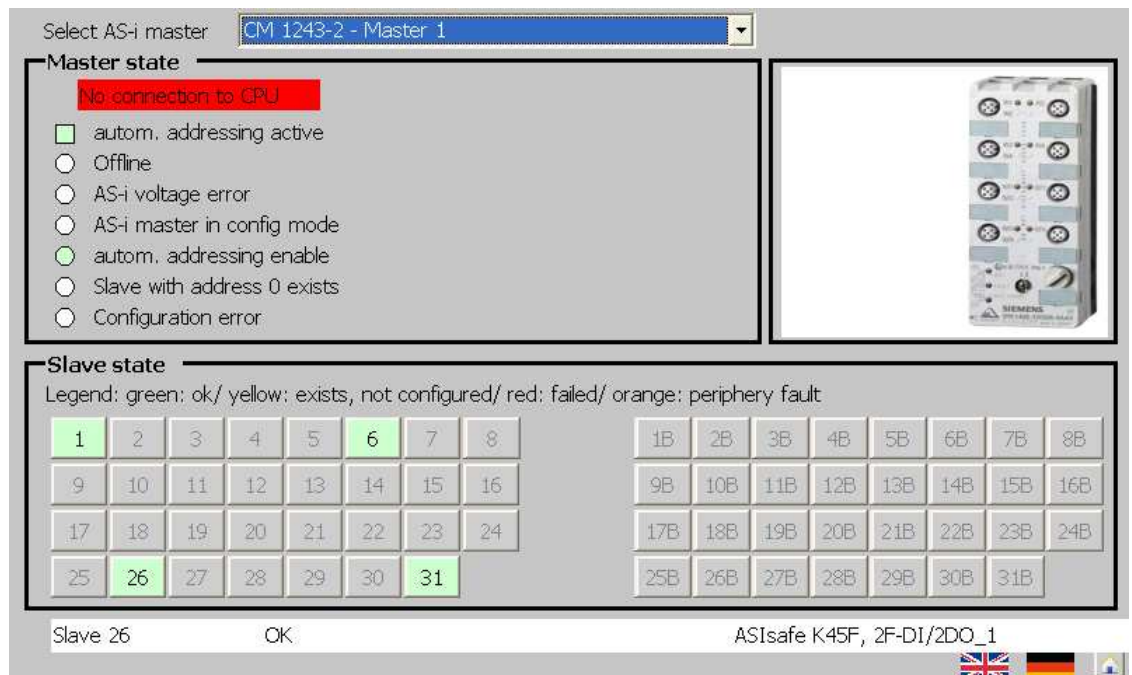
The table shows the possible states and the cause:

Table 2-7

Message text	Trigger
CPU in STOP	No further value change at the counter in ASI HMI FB.
Data missing from HMI block	The AS-i master has not yet logged on at ASI HMI FB or reports an internal error in ASI DIAG FB. ASI HMI FB receives no or faulty information.
No connection with CPU	Connection between CPU and visualization terminated.

As soon as the connection to the CPU is separated or the data block of ASI HMI FB supplies no further data, the status of the slaves is grayed.

Figure 2-11



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Menu fields

The menu field is used to switch between languages and to terminate Runtime.

Figure 2-12



2.4 Hardware/software requirements for this project

The following list indicates the minimum hardware and software components.

Hardware

The WinCC V11 (TIA Portal) visualization screens were optimized for the following operator panels:

- TP900 Comfort 9"
- TP700 Comfort 7"
- KTP600 Basic PN 6"
- KTP1000 Basic PN 10"

Note

All following screenshots of the WinCC configuration have been recorded with the TP900 Comfort Panel.

In this version the AS-i master CM 1243-2 is supported.

Hardware of the TIA portal project ASI_DIAG_S71200_xx

In the TIA portal project enclosed, the following hardware components are used:

Table 2-8

No.	Order number	Qty.	Component
1	6ES7 212-1BD30-0XB0	1	CPU 1212C AC/DC/Rly V2.2
2	3RK7 243-2AA30-0XB0	1	CM 1243-2 V1.0
3	3RK1 405-0BQ20-0AA3	2	ASIsafe K45F, 2F-DI/2DO
4	3RK2 400-1CT30-0AA3	1	AS-i K20, 4DI/4DO, A/B
5	3RK1 400-1CQ00-0AA3	1	AS-i K60, 4DI/4DO
6	6AV2 124-0JC01-0AX0	1	TP900 Comfort Panel
7	6AV2 124-0GC01-0AX0	1	TP700 Comfort Panel
8	6AV6 647-0AD11-3AX0	1	KTP600 Basic PN
9	6AV6 647-0AF11-3AX0	1	KTP1000 Basic PN

Configuration software

Table 1-3

No.	Order number	Qty.	Component
1	6ES7822-1A.01-..	1	STEP 7 Professional V11
2	6AV2103-0DA01-0AH5	1	WinCC Professional V11

2.5 Guide to project documentation

This document gives you an overview of the AS-i diagnostic and the blocks required for this purpose.

For a convenient diagnosis of the AS-i slaves and AS-i master, the prepared WinCC V11 (TIA Portal) projects can be used in conjunction with the ASI HMI FB158. This block prepares the diagnostic raw data of the AS-i masters and supplies it to a panel.

This solution has been realized in the supplied TIA portal project.

It is furthermore possible to process the actual diagnostic raw data in the user program. The supplied HMI visualization is optional. In this case some chapters of this document become irrelevant for you.

The table below shows the respective chapters:

Table 2-10

Chapter	WinCC V11 (TIA portal) + FB158	Processing by user
Chapter 2.3. Overview of the HMI Template	✓	✗
Chapter 3.1 Function block ASI HMI FB158 in detail	✓	✗
Chapter 3.2 Function block ASI DIAG FB157 in detail	✓	✓
Chapter 3.3 Overview of the raw data	✗	✓
Chapter 4 Working with the example project	✓	✗
Chapter 5 The WinCC V11 (TIA Portal) Configuration	✓	✗
Chapter 6 The library ASI_DIAG	✗	✓
Chapter 7.1 Visualization in the configuration view	✓	✗
Chapter 7.2 Export and import of text lists	✓	✗
Chapter 8 Literature	✓	✓

3 The program blocks in detail

What will you learn here?

This chapter gives a description of the most important blocks regarding the core functionality and of the internal functional sequences.

Furthermore, content and structure of the diagnostic information read from the AS-i master is explained. This knowledge is vital for working without HMI templates.

Note

Maximum configuration

With the CPU firmware version V2.2 a max. of one AS-i Master CM 1243-2 can be connected.

3.1 Function block ASI HMI FB158 in detail

The most important task of the ASI HMI FB function block is the supply of the images for the AS-i master visualization in WinCC V11 (TIA Portal).

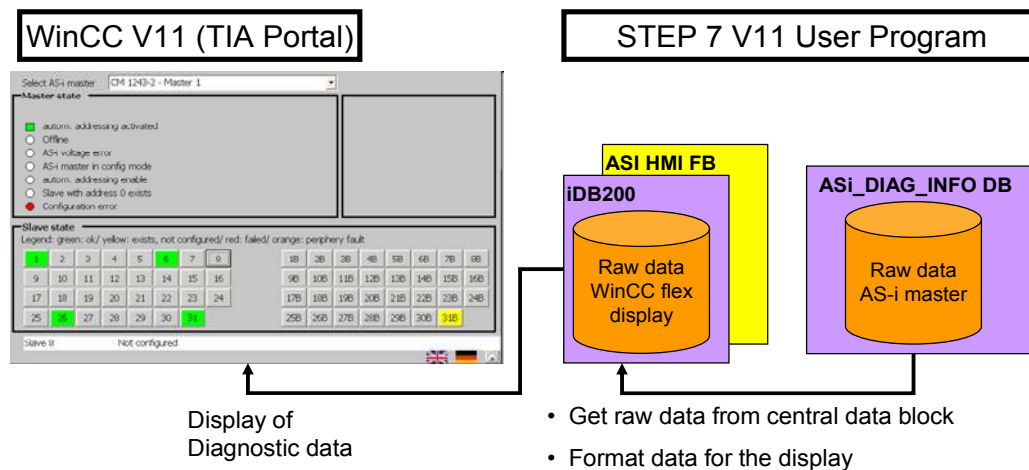
Supplying the WinCC V11 (TIA Portal) images

The task of the ASI HMI block is to supply the visualization screens with the desired data.

For this purpose, the ASI HMI block copies the raw information from the central data block into the separate instance data block and prepares it for display.

The chart below illustrates this procedure:

Figure 3-1



Reset after CPU restart

To avoid data loss in the event of a power failure, the tags in a data block are automatically marked as retentive in the TIA portal and the respective actual value is stored in a retentive storage area.

This property is not desirable for the instance data block of the ASI HMI FB158.

In order to reset the tags to loading values after switching the network on or off and after each STOP-RUN transition of the CPU, the retentive function has to be disabled. It is sufficient to disable the checkbox in the "Retain" column of a tag in the instance data block of FB158 in order to reset the retentive setting for all tags.

Figure 3-2

HMI_ASI_DB			
	Name	Data type	Retain
	▼ Input		
	▼ Output		
	▼ InOut		
	▼ Static		
	■ HMI_REQ	Bool	<input type="checkbox"/>
	■ Actual_ASi_Master	Word	<input type="checkbox"/>
	■ k	Int	<input type="checkbox"/>
	■ ▶ green	Array [0 .. 7] of Byte	<input type="checkbox"/>
	■ ▶ Yellow	Array [0 .. 7] of Byte	<input type="checkbox"/>
	■ ▶ Red	Array [0 .. 7] of Byte	<input type="checkbox"/>
	■ ▶ DiagnosticData	Array [0 .. 35] of Byte	<input type="checkbox"/>
	■ ▶ SlaveState	Array [0 .. 63] of Byte	<input type="checkbox"/>
	■ Panel_Area_Pointer	Word	<input type="checkbox"/>
	■ ERROR_ID	Byte	<input type="checkbox"/>
	■ Actual_HW_ID	Word	<input type="checkbox"/>

3.2 Function block ASI DIAG FB157 in detail

Core functionality

The core functionality of the ASI DIAG FB function block is the reading out of diagnostic information and flags from the AS-i master. The read out data is prepared, sorted and stored in the instance data block of the AS-i master and in the central ASI_DIAG Info DB data storage.

Processing requirements

The function block is equipped with two parameters that ensure processing.

- The “Start” input parameter for enabling the block.
- The “Busy” output tag for coordinating block processing.

In order to quickly receive an overview of the current status of the AS-i network, it is helpful to enable the FB157 in an error or cyclic interrupt OB by setting the “Start” input parameter.

Since one cycle is not sufficient for processing the ASI DIAG FB, the actual processing is performed in OB 1 where the integration of FB157 is also mandatory. Here, the start input can remain unconnected since a trigger has already occurred from another OB.

If the function block shall be processed even without trigger by an error or cyclic interrupt in OB 1, the “Start” input must be triggered by a positive edge.

Reading the diagnostic information

The AS-i master is addressed via the “HW_ID” input parameter which is the module identification address from the hardware configuration.

For PROFINET devices, reading occurs via a single “Read data record” command (data record number 84).

Figure 3-3

```
"RDREC_DB" (REQ:=#Start_Old XOR "RDREC_DB".BUSY,
           ID:=#HW_ID,
           INDEX:=84,
           MLEN:=36,
           RECORD:=#DataRecord_ASi);
```

Overall 36 bytes are read. The content of the data record is stored in the instance data block of the AS-i master.

Reset after CPU restart

Deleting old information from the instance data blocks of the AS-i master requires a reset function.

In order to reset the tags to loading values after switching the network on or off and after each STOP-RUN transition of the CPU, the retentive function has to be disabled. It is sufficient to disable the checkbox in the "Retain" column of a tag in the instance data block of FB157 in order to reset the retentive setting for all tags.

Figure 3-4

ASI_DIAG_DB			
Name	Data type	Retain	
▼ Input			
Start	Bool	<input type="checkbox"/>	
Asi_HMI_DB	DInt	<input type="checkbox"/>	
HW_ID	Word	<input type="checkbox"/>	
▼ Output			
ERROR	Bool	<input type="checkbox"/>	
BUSY	Bool	<input type="checkbox"/>	
RetVal	DWord	<input type="checkbox"/>	
▼ InOut			
▼ Static			
▶ DataRecordRead	RDREC	<input type="checkbox"/>	
▶ DataRecordWrite	WRREC	<input type="checkbox"/>	
▶ Flags	Struct	<input type="checkbox"/>	
Start_Old	Bool	<input type="checkbox"/>	
Step	Int	<input type="checkbox"/>	
k	Int	<input type="checkbox"/>	
▶ State	Struct	<input type="checkbox"/>	
▶ green	Array [0 .. 7] of Byte	<input type="checkbox"/>	
▶ Yellow	Array [0 .. 7] of Byte	<input type="checkbox"/>	
▶ Red	Array [0 .. 7] of Byte	<input type="checkbox"/>	
▶ DiagnosticData	Array [0 .. 35] of Byte	<input type="checkbox"/>	
Entry_HMI_DB	Byte	<input type="checkbox"/>	
Init	Bool	<input type="checkbox"/>	

3.3 Overview of the raw data

Processing your own diagnostic raw data in the user program requires knowing which information is provided by the system and where it is located in the instance data block of the ASI DIAG FB.

3.3.1 Overview of the diagnostic raw data

The status of the slaves and the AS-i master is read via a data record from the AS-i master.

Calling "Get_lists_and_flags" provides the following entries:

- List of active AS-i slaves (LAS)
- List of detected AS-i slaves (LDS)
- List of configured AS-i slaves (LPS)
- List of the present I/O error of the enabled AS-i slaves (LPF)
- Flags of the AS-i master according to AS-i specification.

Each slave assigns one bit per list, hence, a list has 8 bytes (64 slaves per 1 bit) of read data assigned to it. If the bit is FALSE, the AS-i slave is – depending on the list – not detected, disabled or not configured or does not indicate any I/O errors.

3.3.2 Data structure in the instance data block

Slave sequence in the lists

For PROFINET devices, the slaves are addressed in **ascending** bit address order.

The following assignments apply:

Table 3-1

Slave no	Address (byte x □ beginning of list)
0A	Byte x, bit 0
1A	Byte x, bit 1
2A	Byte x, bit 2
...	...
8A	Byte (x+1), bit 0
9A	Byte (x+1), bit 1
10A	Byte (x+1), bit 2
...	...
0B	Byte (x+4), bit 0
1B	Byte (x+4), bit 1
2B	Byte (x+4), bit 2
...	...
8B	Byte (x+5), bit 0
9B	Byte (x+5), bit 1
10B	Byte (x+5), bit 2
...	...

Structure of the information

The following table shows the structure of the 36 bytes for DiagnosticData:

Table 3-2

Byte	Address in iDB	Description
Byte [0] - Byte [1]	DBB 52 – DBB 53	Version ID
Byte [2] – Byte [9]	DBB 54 – DBB 61	List of activated slaves (LAS)
Byte [10] – Byte [17]	DBB 62 – DBB 69	List of detected slaves (LDS)
Byte [18] – Byte [25]	DBB 70 – DBB 77	List of configured slaves (LPS)
Byte [26] – Byte [33]	DBB 78 – DBB 85	List of present periphery faults (LPF)
Byte [34]	DBB 86	AS-i master flags 1
Byte [35]	DBB 87	AS-i master flags 2

Bit granular description of the AS-i master flags

Assignment and meaning of the bits for AS-i master flags 1 are given below:

Table 3-3

Byte	Significance
0	CONFIG_OK
1	LDS_0
2	AUTO_ADDR_ASSIGN
3	AUTO_ADDR_AVAIL
4	OPERATING MODE
5	NORMAL_OPERATION
6	APF
7	OFFLINE_READY

Assignment and meaning of the bits for AS-i Master Flags 2 are given below:

Table 3-4

Byte	Significance
0	PERIPHERY_OK
1	DATA_EXCHANGE_ACTIVE
2	OFFLINE
3	AUTO_ADDR_ENABLE
4	reserved
5	EPROM_OK
6	reserved
7	reserved

Note

An extensive description of the flags can be found in the manual for the AS-i Master (see [/2/](#)).

Example

In **DataRecord_ASi** data structure the following addresses are relevant for **Slave 1**:

Table 3-5

Address for slave 1A	Address for slave 1B	Significance
DBX 54.1	DBX 58.1	Slave active (LAS)
DBX 62.1	DBX 66.1	Slave detected (LDS)
DBX 70.1	DBX 74.1	Slave configured (LPS)
DBX 78.1	DBX 82.1	I/O fault (LPF)

4 Working with the example project

What will you learn here?

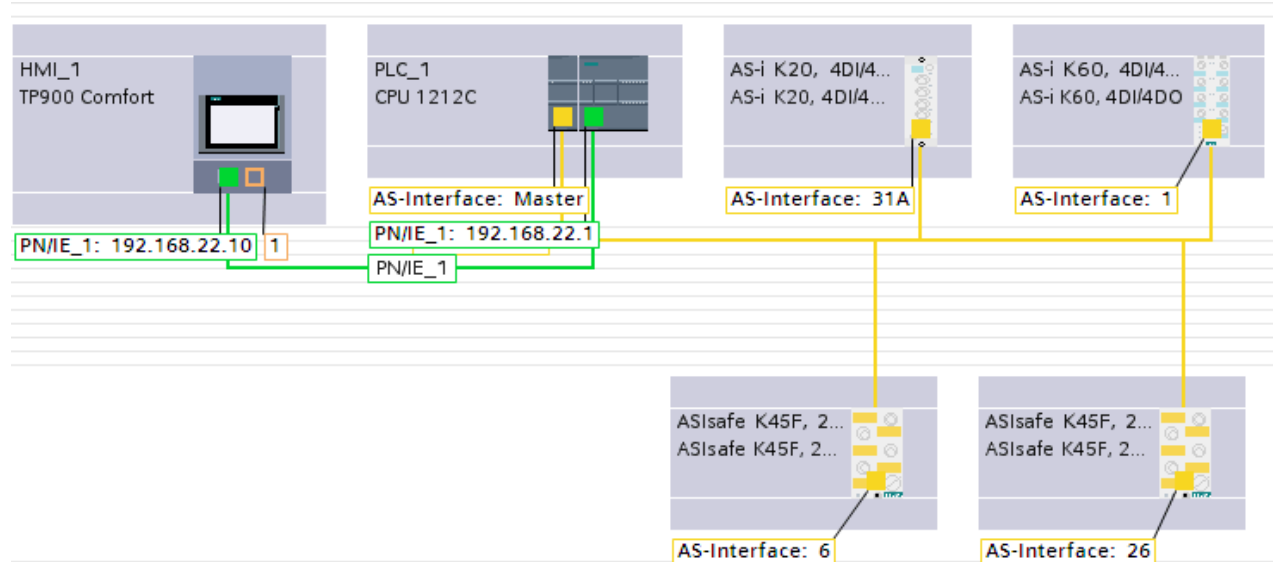
This chapter describes how you can use the provided TIA portal project unchanged – or if required – how to integrate the relevant diagnostic blocks into your own project.

4.1 Addresses of hardware components

Network addresses

The central modules, the panel and the AS-i components have been configured with the following addresses:

Figure 4-1



Module addresses

The AS-i master CM 1243-2 uses the hardware identification address 372 (W#16#174) in this project.

4.2 Parts of the TIA portal project

The TIA Portal Project `ASI_DIAG_S71200_xx` includes the following elements:

- Blocks, to conveniently provide diagnostic information of one or several AS-i master systems for further evaluations in the STEP 7 user program and for representation on an HMI panel.
- HMI Templates to visualize the diagnostic information on Siemens panels.
 - TIA Portal project `ASI_DIAG_S71200_Basic` for selected basic panels
 - TIA Portal project `ASI_DIAG_S71200_Comfort` for selected comfort panels

You find these projects in the download area of this document (see /6/).

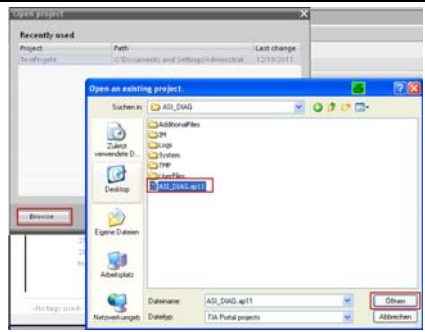

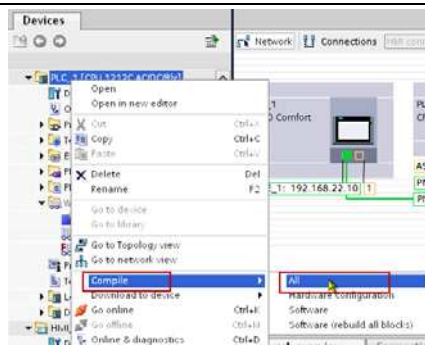
4.3 Installation of the TIA portal project ASI_DIAG_S71200_xx

Note

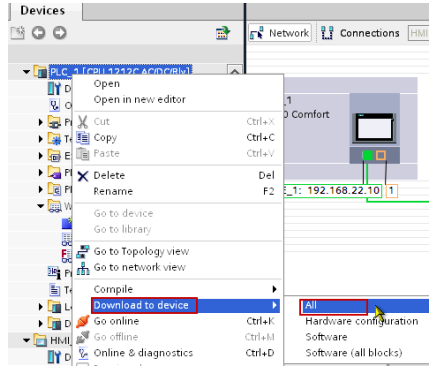
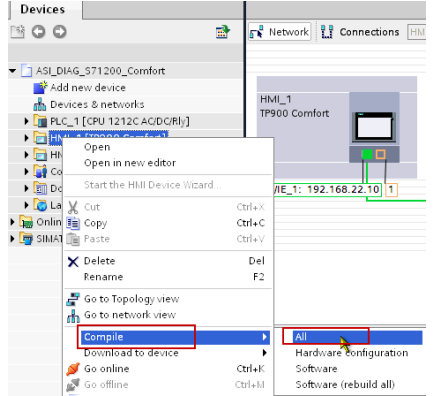
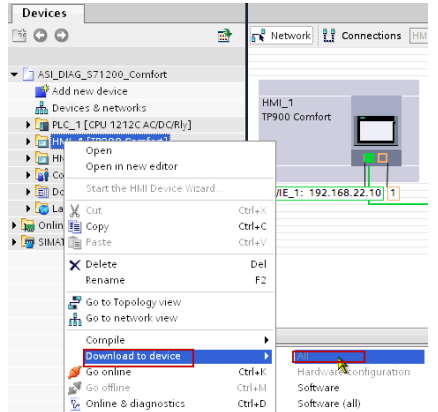
For the following installation instruction it is assumed that you are using the TIA Portal project without any changes. Changes in the hardware configuration and addresses require an adjustment of the WinCC projects (see chapter 5 (The WinCC V11 (TIA Portal) Configuration)).

To be able to use the TIA portal project ASI_DIAG_S71200_xx you have to observe the following steps:

Table 4-1

Steps	Function	Figure/Comment
1.	Set up your network in accordance with the specifications in chapter 4.1 (Addresses of hardware components).	
2.	Unzip the TIA portal project into a directory of your choice.	
3.	Open the TIA Portal and the project you just unzipped via Project > Open.	
4.	Check the hardware identification address of your AS-i master. If it differs from address 372, the HW_ID block parameter of FB157 has to be adjusted to all calls in the organization blocks.	
5.	Store the project.	
6.	Select the controller in the project tree and recompile the entire project.	

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Steps	Function	Figure/Comment
7.	After compilation without errors, load the project into your controller.	
8.	Visualization interfaces have been integrated into the TIA Portal project for several panels. Select an HMI station of your choice. Compile the entire project.	
9.	When the compilation was error free, load the project into the panel.	

Now you can check the functionality described earlier.

5 The WinCC V11 (TIA Portal) Configuration

What will you learn here?

This chapter describes the individual adjustment of the HMI template, as well as the configuration steps in WinCC V11 (TIA Portal).

5.1 The WinCC V11 (TIA Portal) projects

The WinCC V11 (TIA Portal) projects are integrated in the **ASI_DIAG_S71200_xx** TIA Portal project.

Appropriate operator panels

The visualization screens were created for and adjusted to the following operator panels:

- TP900 Comfort 9"
- TP700 Comfort 7"
- KTP600 Basic PN 6"
- KTP1000 Basic PN 10"

The TIA Portal project **ASI_DIAG_S71200_Basic** includes the visualization for the Basic Panels KTP600 and KTP1000.

The TIA Portal project **ASI_DIAG_S71200_Comfort** includes the visualization for the Comfort Panels TP700 and TP900.

5.2 Using visualization screen

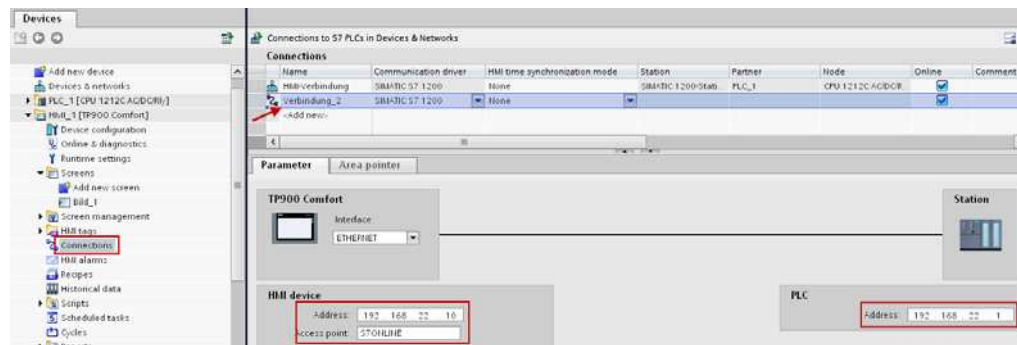
Adjustments in WinCC (TIA Portal) are required to make a diagnosis of your **own** AS-i environment possible.

Configuring a connection between CPU and panel

The Ethernet-based connection between CPU and panel must be configured correctly to allow data exchange.

Open the WinCC V11 (TIA Portal) project and navigate to **Connections**. Adapt the panel's and CPU's IP addresses to your requirements.

Figure 5-1



Adjusting the area pointer

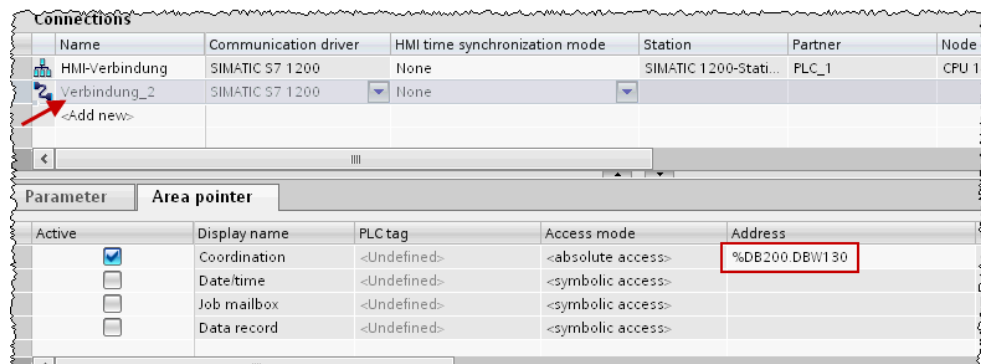
Using the area pointer of WinCC V11 (TIA Portal) enables detecting whether the connection to the CPU has been established or terminated.

The area pointers are configuration fields and contain the size of a data area from the controller. During communication, writing and reading occurs in turn between controller and operator panel this data area. By evaluating the data filed in the data areas, controller and operator panel mutually trigger exactly defined actions.

Open the **Area pointer** tab under **Connections**. Change the address of the tags in **Coordination** as follows:

DB <InstanceDataBlockNumber of Your ASI HMI FB158>.DBW130

Figure 5-2



Coordinating access to tags

The pictures for the display of the AS-i line state are controlled via the tags from the instance data block of the ASI HMI FB.

To make the project as flexible for the user as possible, the tags are not linked directly to an address (e.g. DB200.DBW2), but indirectly using tag multiplexing.

This means that the tag address at runtime is adjusted depending on the value of the **b51__DB_Number_HMI** index tags for the instance data block number of the FB158 and **b51__DB_Number_Info** for the number of the central data block.

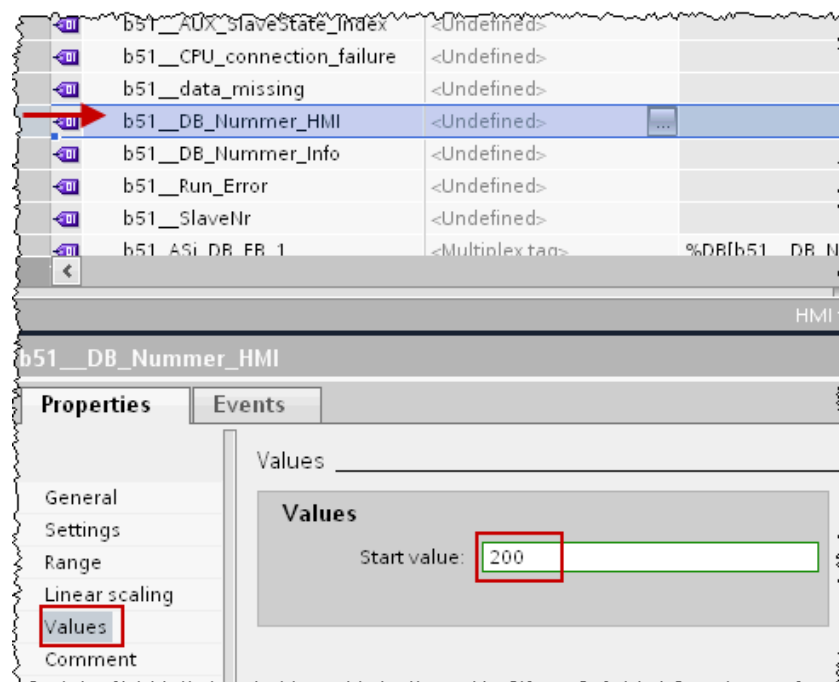
Figure 5-3

```
%DB[b51__DB_Nummer_Info].DBW0
%DB[b51__DB_Nummer_Info].DBW2
%DB[b51__DB_Nummer_Info].DBW4
%DB[b51__DB_Nummer_Info].DBW6
%DB[b51__DB_Nummer_HMI].DBB[b51__AUX_SlaveState_Index]
```

Tag multiplexing has the advantage, that the instance data block number of ASI HMI DIAG flexible can be defined by the user. Instead of adjusting all WinCC V11 (TIA Portal) tags it is sufficient to modify only the index tag.

For this purpose, open the **Tag list** in WinCC V11 (TIA Portal) under **HMI Tags**. Select the **b51__DB_Number_HMI** index tag and enter the number of your instance data block for the ASI HMI FB as a start value in the tag properties.

Figure 5-4



5.3 Adjusting the AS-i master display

The next step is to adjust the master information in the WinCC V11 (TIA Portal) project.

Changing the display for comfort panels

The display texts of the AS-i master in the selection list are managed dynamically via the **Master** and **Master_Name** text lists.

While the order of the selection list is determined via the **Master** text list, the **Master_Name** text list manages the suitable display text for each existing hardware address.

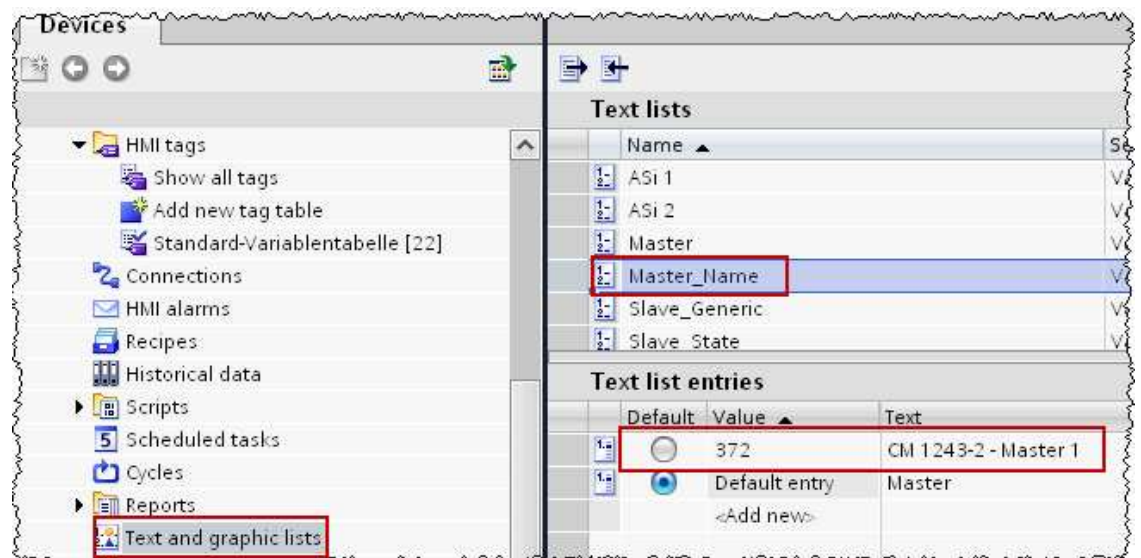
Note

Text lists are objects from the WinCC V11 (TIA Portal) environment and assign different texts to tag values. The texts can be changed at will and created in several languages too.

In WinCC V11 (TIA Portal) text lists can be exported and imported in .xlsx format. Please note chapter 7.2 (Export and import of text lists).

To change the display text, open the **Master_name** text list. Here, the hardware address is assigned with the text to be displayed.

Figure 5-5



Correct the hardware address in the **Value** column and enter the respective display text at **Text**.

Changing the display for basic panels

For basic panels, the AS-i master is selected via a button. To change the display text of the button, select the already configured button. Via doubleclick you can change the labelling.

5.4 Adjusting the AS-i slave information

Similar as for the AS-i master, user-defined information can also be stored for the AS-i slaves. They will then appear in an output field at runtime by the click of the mouse on the slave.

5.4.1 Logic operating diagram of the AS-i slave display

Implementation for comfort panels

The display of the accompanying texts is also controlled via dynamic text lists here, and referenced to the hardware address of the AS-i master.

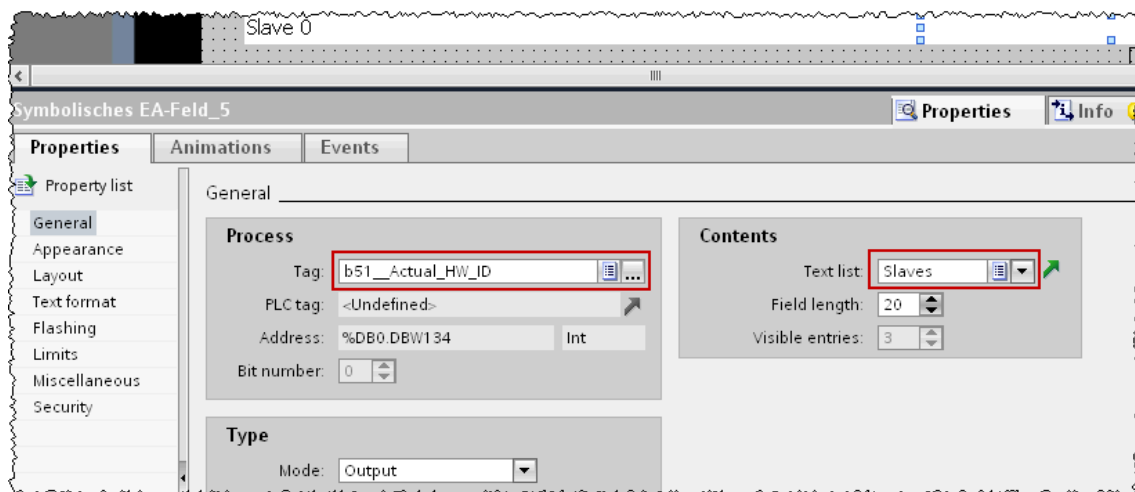
In WinCC V11 (TIA Portal) a **Slaves** main list and a slave **ASi x** sub-list is configured. The sub-list manages the information for the slaves of an AS-i master.

The AS-i master, whose slave information shall be displayed, is included in the main list with its hardware address and respective sub-list.

Behind each entry of the **Slaves** main list there is the WinCC V11 (TIA Portal) **b51__SlaveNr** tag, which contains the number of the slave you clicked on as information.

The entry of the main list is selected via the **b51_Actual_HW_ID** tag. This tag references the instance data block of ASI HMI FB158 and contains the hardware address of the AS-i line that is active during runtime.

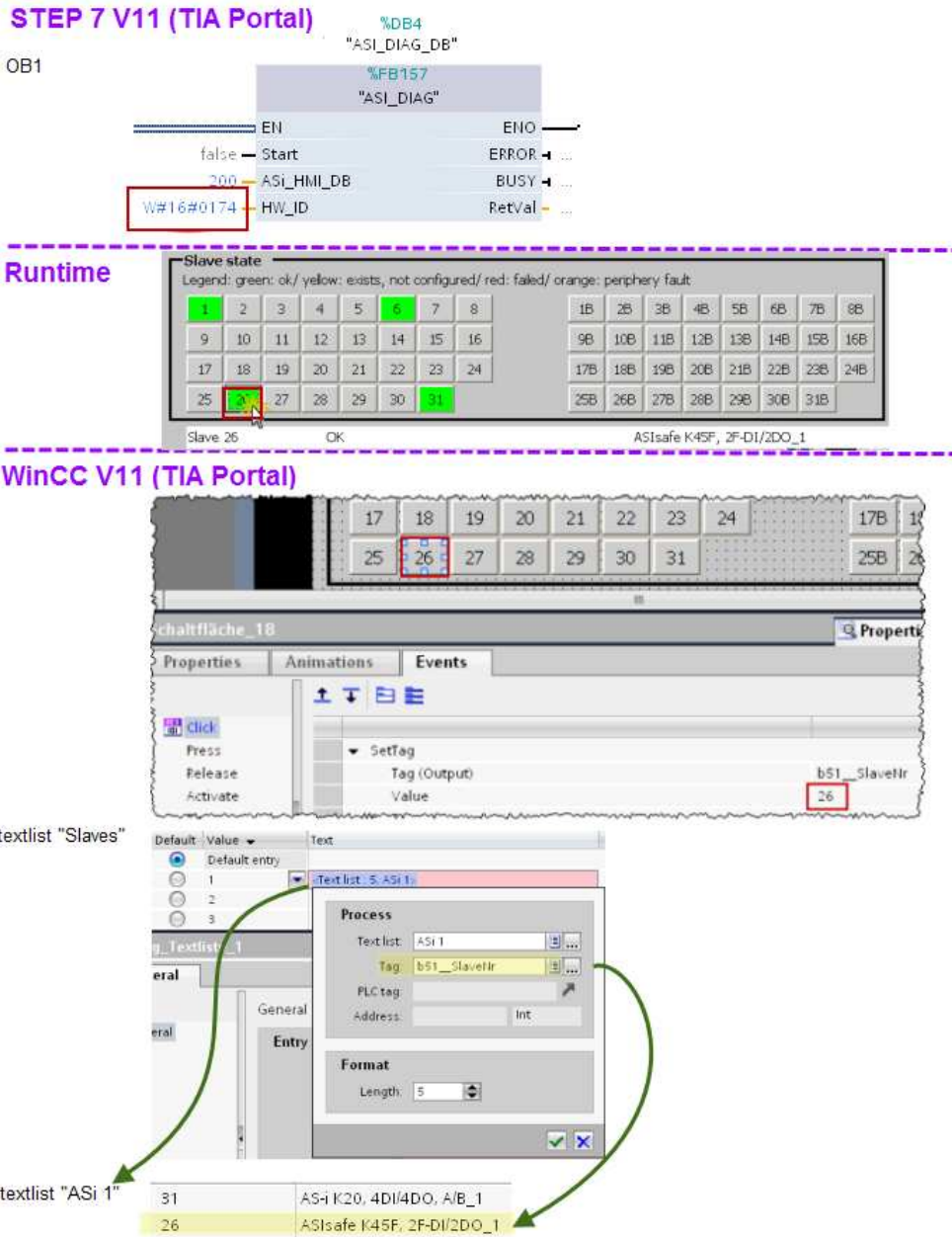
Figure 5-6



Both text lists are dynamically interconnected with each other and provide the AS-i slave information for display at runtime.

The following figure shows the logic operating diagram for the structure of the selection list based on a concrete example:

Figure 5-7



The sequence is represented as follows:

Table 5-1

Section	Area	Description
STEP 7 V11	OB 1	The AS-i master with hardware address 372 is assigned to ASI DIAG FB.
Runtime		The CM1243-2 was selected in the selection list of the runtime. The status of the respective slave is indicated in color. The active instance data block is DB 1.
WinCC V11 (TIA Portal)		The slaves are represented by buttons and provided with an event. When clicked, the slave number is saved in the b51__SlaveNr tag (here: Slave 26; therefore the tag receives the value 26).
	Slaves text list	The slaves text list manages the AS-i master for whose slaves, information has been stored. The entry contains the respective hardware address of the AS-i master, the sub-list and a reference to the b51__SlaveNr tag. In this example the active hardware address is the number 372 (CM1243-2). Using this number, the suitable entry is found in the main list and the respective ASi 1 sub-list is referenced.
	ASi 1 text list	The ASi 1 sub-list manages the information for its AS-i line. Slaves, which are to display an item of information, are included here with their number and a suitable text. The value of tag b51__SlaveNr determines the active line. In this concrete example the line with Value = 26 is referenced to, since b51__SlaveNr has the value 26.
Runtime		Clicking a slave during runtime displays the stored information in an output field.

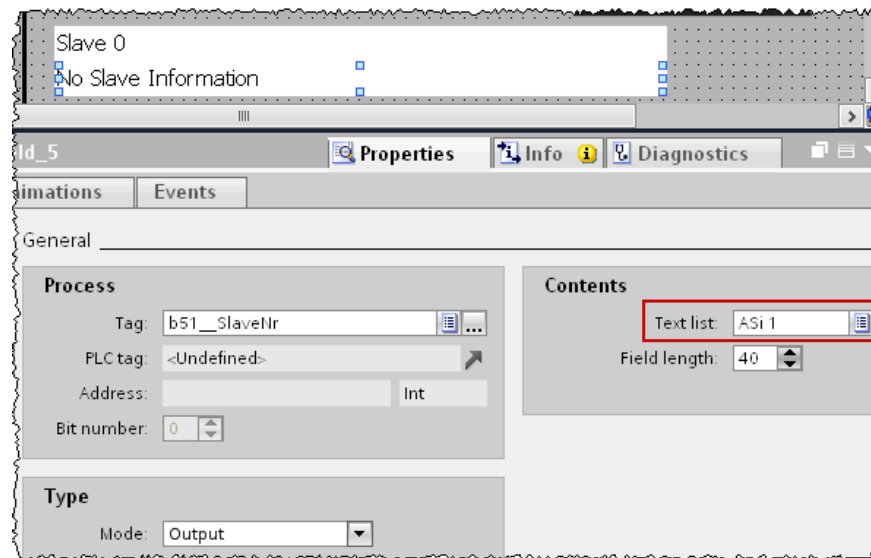
Implementation for basic panels

Basic panels do not support dynamic text lists. The display of accompanying texts is controlled directly via the **ASi x** slave sub-list.

The sub-lists manage the information for the slaves of an AS-i master.

The entry of the sub-list is selected via the **b51__SlaveNr** tag.

Figure 5-8



5.4.2 Changes in the main list (comfort panels)

The information texts of the AS-i slave are dynamically managed via the **Slaves** and **ASi x** text lists.

The **Slaves** text list coordinates the sub-list of the AS-i slaves which are part of an AS-i master.

Open the text lists in **Text and Graphics lists** and select the **Slaves** text list.

Correct the value column. Use the hardware address of the AS-i master from your STEP 7 project.

5.4.3 Definition of the information for the AS-i slaves

One AS-i line can, depending on the specification, manage up to 64 slaves (31 A slaves and 31 B slaves). Since WinCC V11 (TIA Portal) expects only integers in the **Value** column, the slaves cannot be addressed with A or B. The following assignment has therefore been defined:






Table 5-2

Slave in STEP 7		Value of "b51__SlaveNr"
1A	Corresponds to WinCC V11 (TIA Portal)	1
2A		2
3A		3
...		...
1B		33
2B		34

Slave in STEP 7		Value of "b51__SlaveNr"
3B		35
...		...

Open a sub-list and enter the slave number under **Value** and the associated text in **Text**.

Figure 5-9

	ASI 1	Value/Range	
	ID	Value/Range	
	Master	Value/Range	
	Master Name	Value/Range	
Text list entries			
	Default	Value ▲	Text
	<input type="radio"/>	26	ASIsafe K45F, 2F-DI/2DO_1
	<input type="radio"/>	31	AS-I K20, 4DI/4DO, A/B_1

5.5 Implementing graphics

User-defined images of AS-i masters or AS-i slaves are realized via graphic input/output fields.

The coordination between graphic and AS-i master and/or slaves occurs in separate graphics lists in WinCC V11 (TIA Portal) via the hardware address or the slave address.

A separate output field per AS-i line is required. For the AS-i master image, one common output field is sufficient. All output fields are superimposed in the visualization screen and shown or hidden as required. Note that the AS-i master output field should lay above all others.

A graphic of the AS-i master and the slaves can also appear next to the display text.

Note

For maintaining a clear overview or selecting the correct output field during changes, it is recommended to give each output field a meaningful name and assign it to a separate layer. These can be shown or hidden, as required. The level assignment of this WinCC V11 (TIA Portal) projects can be found in chapter 7.1 (Visualization in the configuration view).

5.5.1 Coordination of the graphics

Using the assigned tags, the graphics lists coordinate which graphic appears in the output field.

Defined states of tags control the visibility of the graphics output fields.

The AS-i master graphic is hidden when the internal WinCC V11 (TIA Portal) is tag **b51__SlaveNr < 64**.

The output fields of the AS-i lines are invisible if the respective instance data block number of the AS-i line currently visible in Runtime does not correspond to the stored number.

Note

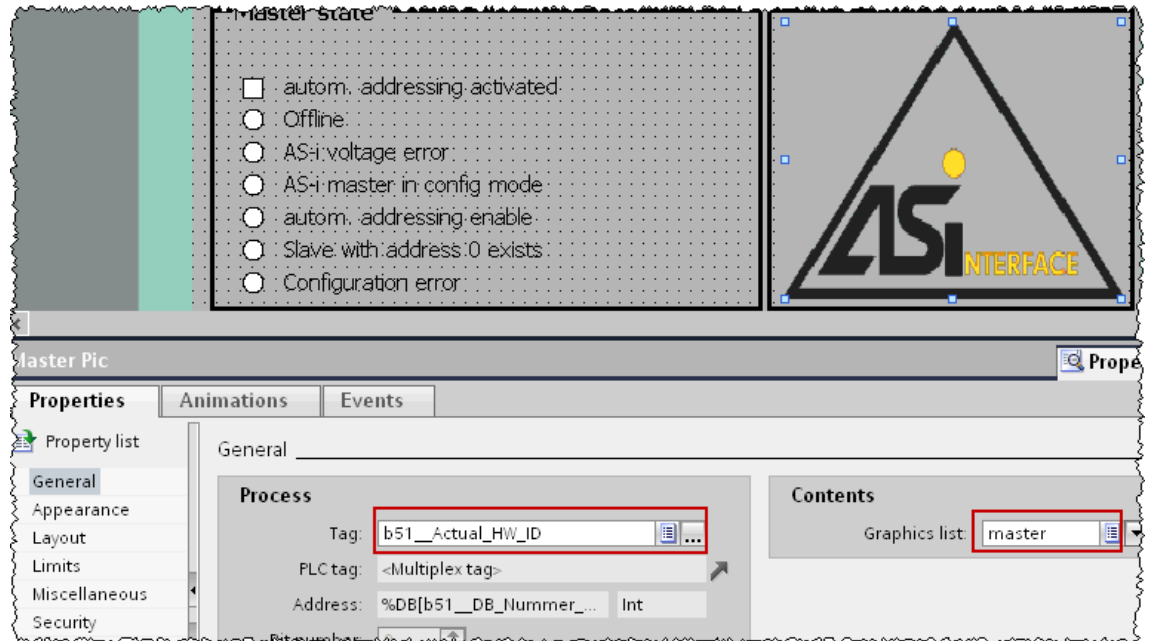
The output field measures 170x195 px. Please ensure that your graphics do not exceed this size, otherwise the default settings in the project will automatically scale the picture which might lead to blurring.

5.5.2 Graphics display of the AS-i masters

Properties of the graphics display

The **Master** graphics list is used in conjunction with the **b51_Actual_HW_ID** tag to display the AS-i master pictures.

Figure 5-10



The tag refers to the hardware address of the AS-i master.

Figure 5-11

Graphic list entries				
	Default	Value ▲	Graphic na...	Graphic
	<input type="radio"/>	372	CM1243-2	
	<input checked="" type="radio"/>	Default entry	ASi Logo	

Showing and hiding the AS-i master graphic is controlled by a specification in WinCC V11 (TIA Portal).

Figure 5-12

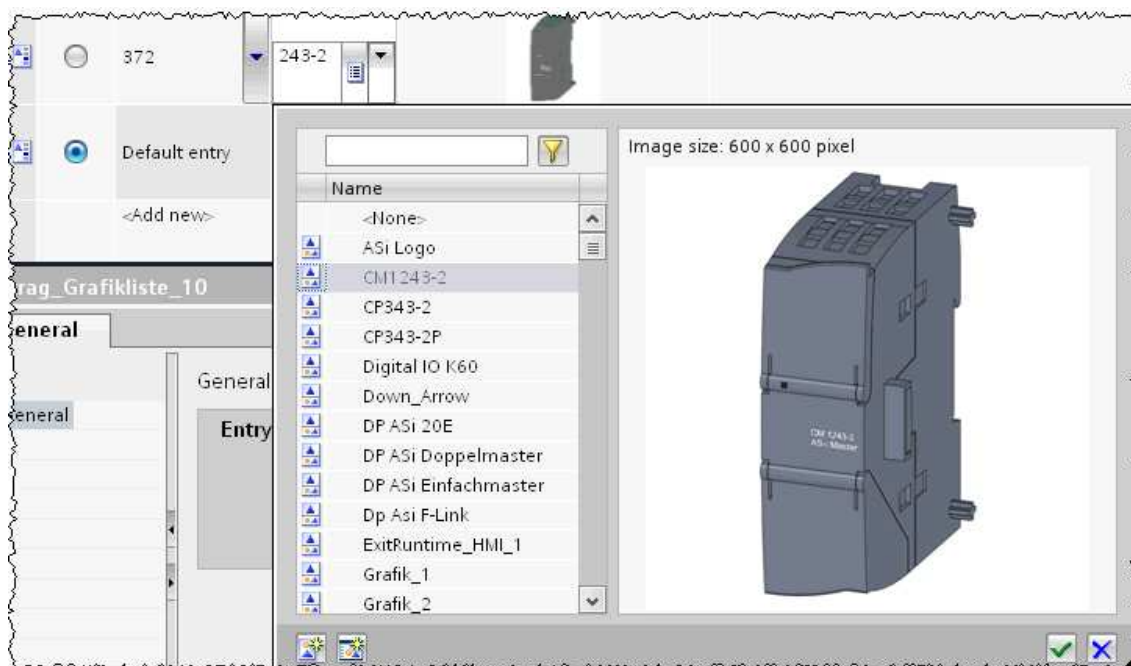


Modifying the graphics display

To modify the graphics display of the AS-i master, select the **master** graphics list in the **Text and graphics lists** menu.

To exchange the existing image, select the **Graphic name** column of the line to be changed and open the selection window. Import your graphic and accept it as new AS-i master picture.

Figure 5-13

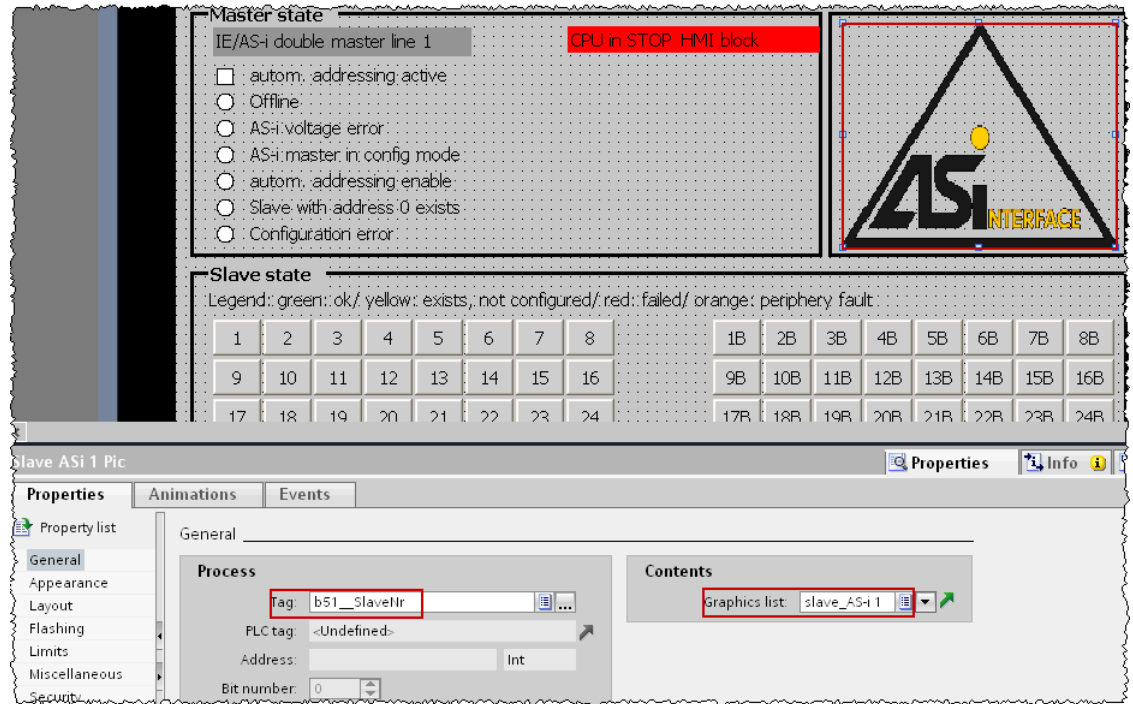


5.5.3 Graphics display of the AS-i slaves

Properties of the graphics display

The **slave_ASi x** graphics lists are used in conjunction with the **b51_SlaveNr** tag to display the AS-i pictures.

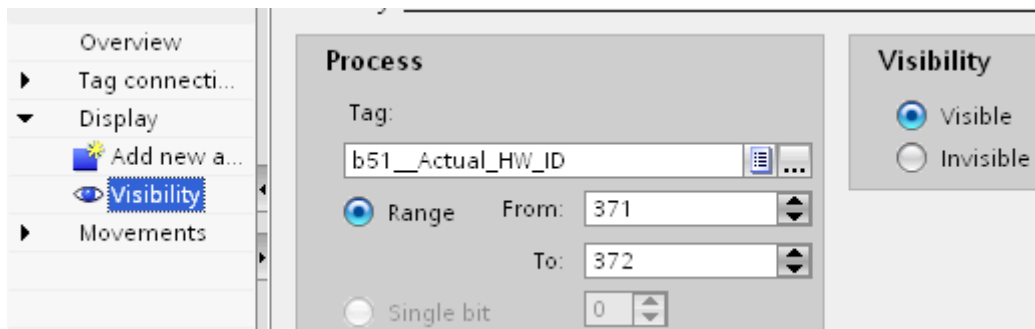
Figure 5-14



Clicking a slave during runtime writes the respective number to the tag (see chapter 5.4 (Adjusting the AS-i slave information)).

Showing and hiding is controlled via the **b51_Actual_HW_ID** tag. It contains the currently active hardware address of the AS-i master. If this value lies outside of the defined range, the graphic output field is hidden.

Figure 5-15

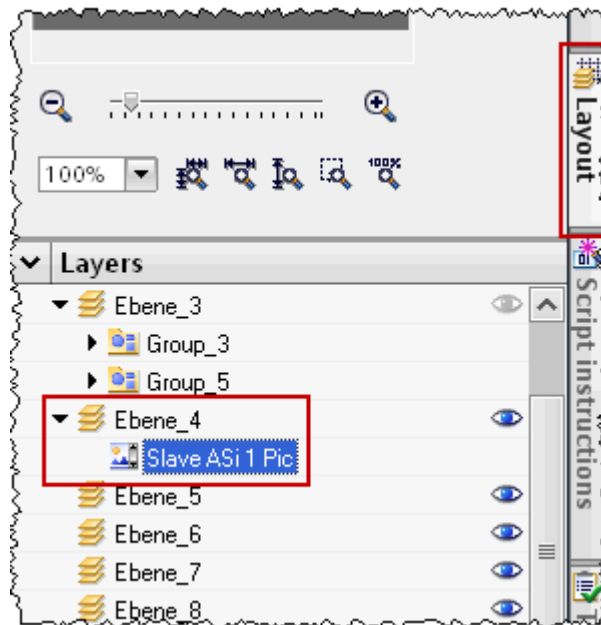


Modifying the existing output fields

In order to adjust such a graphics output field, proceed as follows:

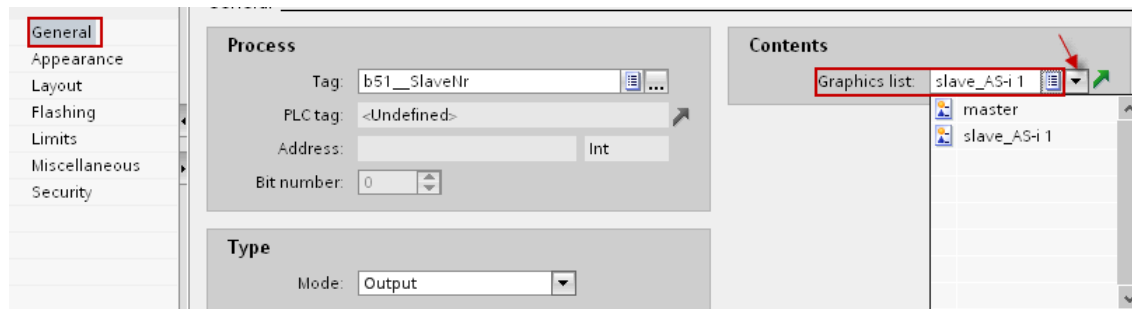
Select the symbolic **Slave ASi 1 pic.** graphics display in the **Layout** tab on layer 4 in WinCC V11 (TIA Portal).

Figure 5-16



You can determine the slave sub-list via the arrow next to "Graphics list".

Figure 5-17

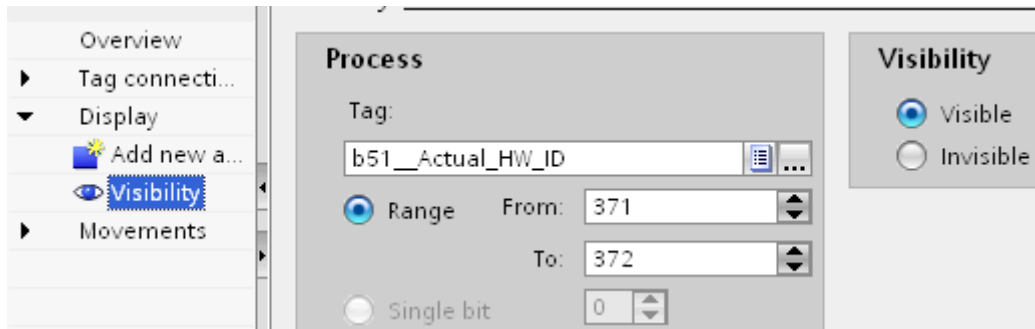


Note

Only the already existing graphics lists are displayed. If you wish to assign a new slave sub-list to this output field, it must be previously created.

In **Animation -> Visibility** you can adjust the range in which this field shall be visible. Here you enter the instance data block number of your AS-i line.

Figure 5-18

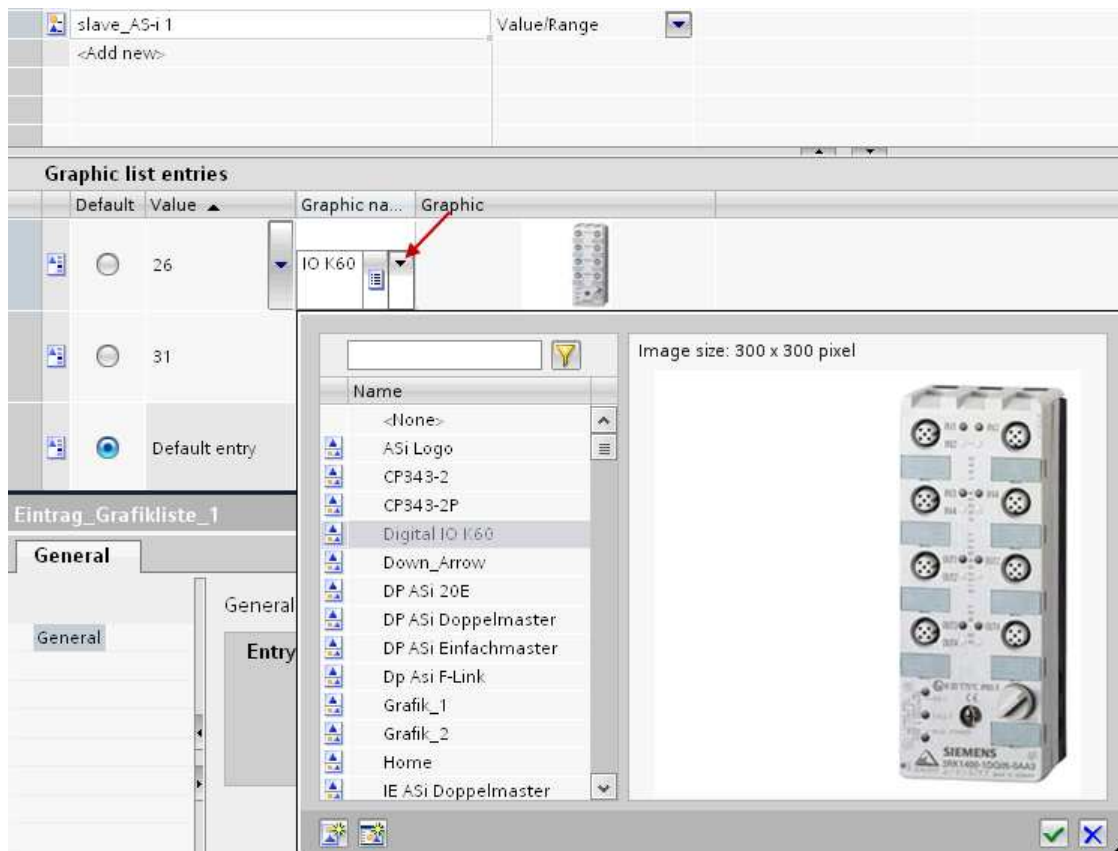


Changes in the slave sub-list

To modify the graphics display of the AS-i slave, select the **slave_AS-I x** graphics list to be changed in the **Text and Graphics Lists** menu. The number in the **Value** column represents one each of the 62 possible slaves.





To exchange the existing pictures, select the **Graphics** column of the line to be changed and open the selection window. Import your graphic and accept it as new AS-i slave picture.

Figure 5-19



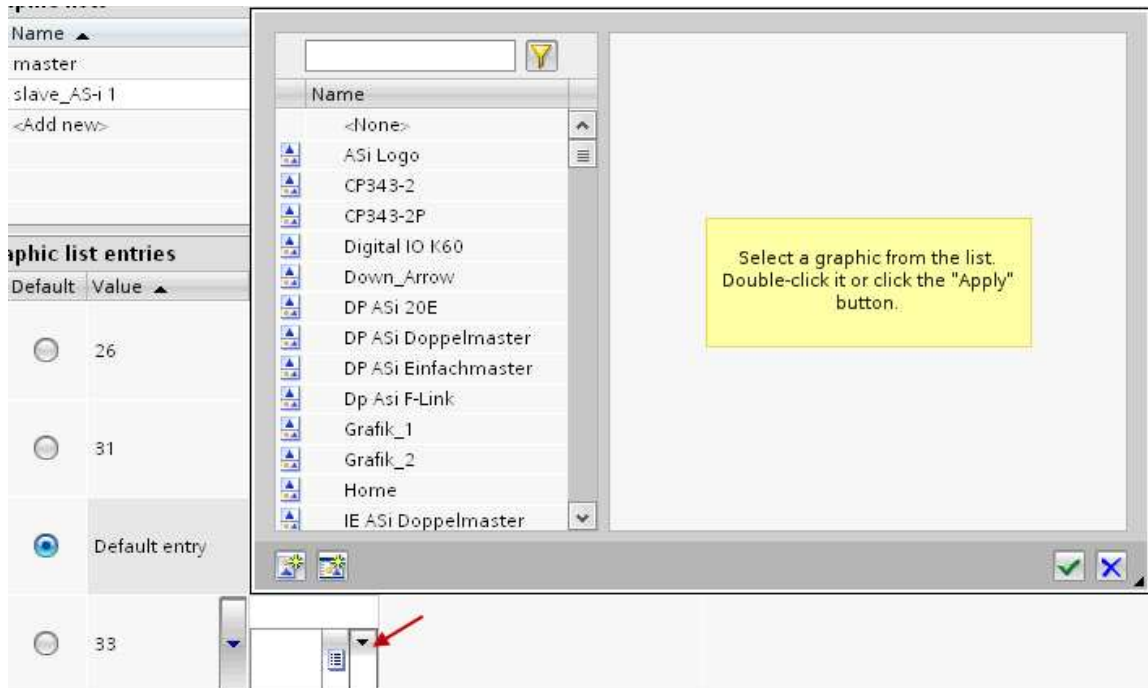
To insert a new slave graphics select <Add new> from the value column and thus add a new entry.

Figure 5-20

26	Digital IO K...	
31	ASi Logo	
Default entry	ASi Logo	
 <Add new>  		

In **Value** you enter the number of the respective slave and link a picture in the **Graphics** column.

Figure 5-21



The screenshot shows the WinCC configuration interface. On the left, there is a table with columns 'Name' and 'Value'. The 'Name' column contains 'master', 'slave_ASi 1', and '<Add new>'. Below this is a section titled 'Graphic list entries' with a table with columns 'Default' and 'Value'. The 'Value' column contains '26', '31', 'Default entry', and '33'. A red arrow points to a dropdown menu in the 'Value' column for the entry '33'. In the center, a dialog box is open, displaying a list of graphics including '<None>', 'ASi Logo', 'CP343-2', 'CP343-2P', 'Digital IO K60', 'Down_Arrow', 'DP ASi 20E', 'DP ASi Doppelmaster', 'DP ASi Einfachmaster', 'Dp Asii F-Link', 'Grafik_1', 'Grafik_2', 'Home', and 'IE ASi Doppelmaster'. A yellow text box in the dialog box reads: 'Select a graphic from the list. Double-click it or click the "Apply" button.' At the bottom of the dialog box, there are 'Apply' and 'Cancel' buttons.

6 The library ASI_DIAG

In order to integrate the diagnostic function described in this document into your own TIA Portal project, the following blocks are required:


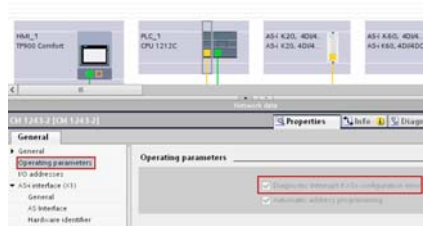

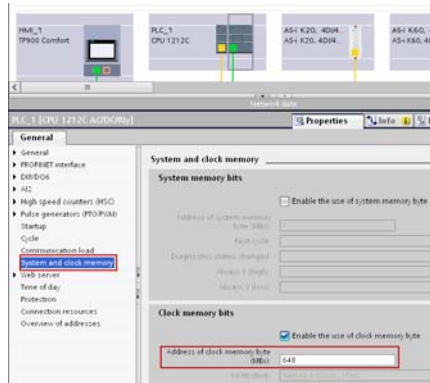
- ASI DIAG FB157
- ASI HMI FB158
- ASi_DIAG INFO DB3

These blocks are included in the TIA Portal library **ASI_DIAG**. You find this library in the download area of this document (see /6/)

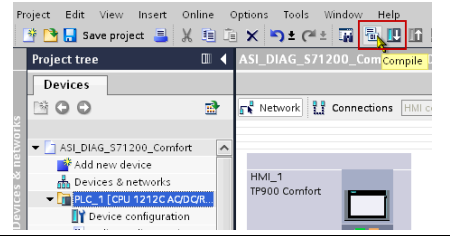
6.1 Requirements for the use of the blocks

For the use of the diagnostic blocks, some points have to be observed.

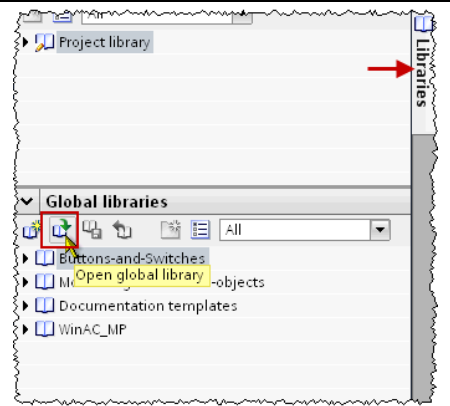

Table 6-1

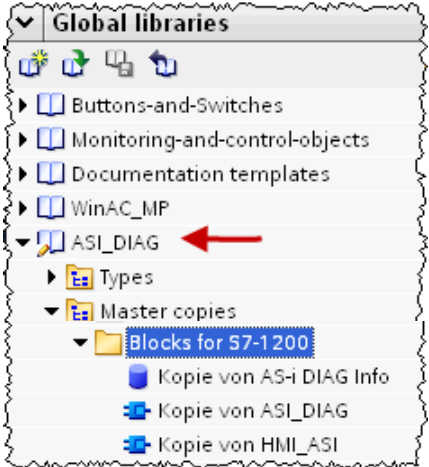
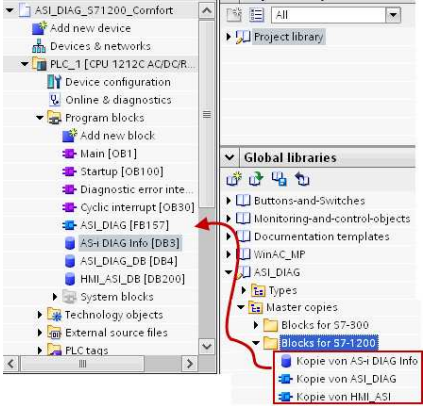
Steps	Function	Figure/Comment
1.	Open the TIA portal and create a new project.	
2.	Insert all used devices and AS-I masters after their setup under Devices & networks.	
3.	Check whether the diagnostic alarms have been enabled for the AS-i master.	
4.	If you want to use the cyclic interrupt OBs, insert a new organization block. Specify the cyclic interrupt time. Recommended time: 10000ms (10s). Close the dialog box with OK.	
5.	Enable the clock memory of the CPU and set it to byte 648.	

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Steps	Function	Figure/Comment
6.	Select your controller in the project tree and save and compile the hardware configuration. Load it in your controller.	

6.2 Integration of the library

Steps	Function	Figure/Comment
1.	Unzip the enclosed 50897766_ASI_DIAG_TIA_CODE_S71200.zip into a directory of your choice.	
2.	Select the “Libraries” tab on the right side in the TIA Portal and open a new global library via the respective icon.	
3.	Navigate to the file you just retrieved, open the ASI_DIAG_Library > ASI_DIAG folder, select the library file and open it.	

Steps	Function	Figure/Comment
4.	The ASI_DIAG new global library will appear in the output window. All blocks relevant for diagnosis exist as copies under Master copies > Blocks for S7-1200 .	
5.	Successively select all blocks of the ASI_DIAG global library. Drag the blocks via Drag & Drop into the program folder of your project.	
6.	All blocks used can now be found in the project tree under program blocks.	
7.	If necessary, create error interrupts and cyclic interrupts.	
8.	Save your project.	

6.3 Initializing the blocks

The configuration

ASI HMI FB158 has no parameters and is called in the organization blocks without further modifications.

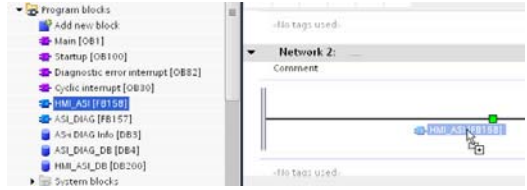
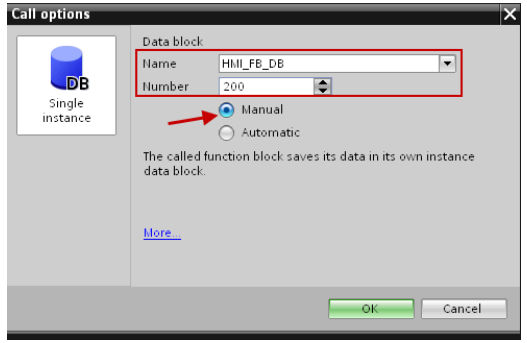
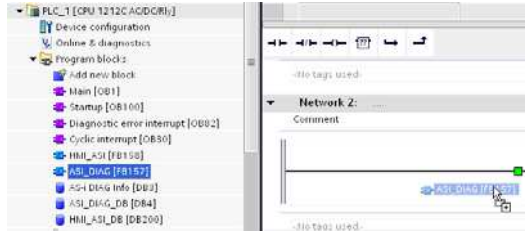
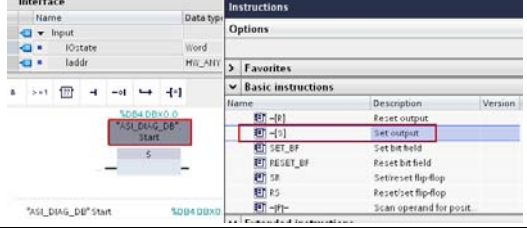

ASI DIAG FB157 has input and output parameters. The following table shows, which parameters need to be interconnected – depending on the call environment:

Table 6-2

Type	Tag	Data type	Default value	Interconnection necessary?
Input	EN	BOOL	1	<u>no</u>
	HW_ID	DINT	L#0	<u>Yes</u> ; The logic address for PN IO modules is the diagnostic address.
	ASi_HMI_DB	DINT	L#0	<ul style="list-style-type: none"> <u>Yes</u>, if an HMI visualization is desired. The number of the instance data block of the ASI HMI FB is entered here. <u>No</u>, if no HMI visualization shall occur.
	Start	BOOL	0	<ul style="list-style-type: none"> <u>No</u>, if the block shall only be processed in the case of an error or cyclic interrupt. <u>Yes</u>, if the block is also to be processed in a normal case.
Output	BUSY	BOOL	0	
	ERROR	BOOL	0	<u>Yes</u> , to cause a response in the other user program in the case of an error.
	RetVal	DWORD	0	<u>Yes</u> , to determine the type of error.

The block call

Table 6-3

Steps	Function	Screen/Comment
1.	Only required for HMI visualization: Open OB 1. Select FB158 and drag the block via Drag & Drop into a free network.	
2.	You are prompted to enter an instance data block name and number. Select Manual for the type of numbering. After confirming the dialog box, the TIA Portal automatically generates the data block. ASI HMI FB has no parameters. Note: Note down the number of the instance data block. This number must be entered at the ASI_HMI_DB input of the ASI DIAG FB as well as in the WinCC V11 (TIA Portal) project.	
3.	Repeat the step 1 and 2 with FB157. Here you must also enter an instance data block number. After confirming the dialog box, the TIA Portal automatically generates the data block.	
4.	Configure the input and output parameters of FB157.	
5.	Save OB 1.	
6.	Open an error or cyclic interrupt OB.	
7.	Open the bit operations under Instructions . Select the Set output command and drag it via Drag & Drop into a free network. Interconnect the command with the Start input parameter of FB157.	
8.	Repeat step 7. Drag another Set output command via Drag & Drop into a free network. Interconnect the command with the HMI_REQ input parameter of FB158.	
9.	Save the OBs.	

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6.4 Disabling the retain properties of the tags

From chapter 3.1 (Function block ASI HMI FB158 in detail) it is known that the tags of the ASI HMI FB158 are reset to initialization values by disabling the “Retain” properties.

Open the instance data block of the ASI HMI FB158. It is sufficient to disable the checkbox in the "Retain" column of a tag in order to reset the retentive setting for all tags.

Figure 6-1

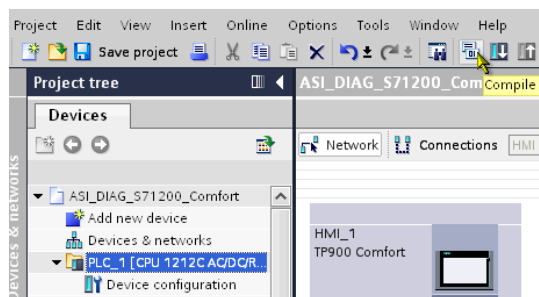
Name	Data type	Retain
▼ Input		
▼ Output		
▼ InOut		
▼ Static		
■ HMI_REQ	Bool	<input type="checkbox"/>
■ Actual_ASi_Master	Word	<input type="checkbox"/>
■ k	Int	<input type="checkbox"/>
■ ▶ green	Array [0 .. 7] of Byte	<input type="checkbox"/>
■ ▶ Yellow	Array [0 .. 7] of Byte	<input type="checkbox"/>
■ ▶ Red	Array [0 .. 7] of Byte	<input type="checkbox"/>
■ ▶ DiagnosticData	Array [0 .. 35] of Byte	<input type="checkbox"/>
■ ▶ SlaveState	Array [0 .. 63] of Byte	<input type="checkbox"/>
■ Panel_Area_Pointer	Word	<input type="checkbox"/>
■ ERROR_ID	Byte	<input type="checkbox"/>
■ Actual_HW_ID	Word	<input type="checkbox"/>

Also proceed in the same way with the instance data block of the ASI_DIAG FB157.

6.5 Loading the blocks into the CPU

To make sure that all required blocks are loaded into the CPU, save your TIA Portal project, recompile it and load it all into your CPU.

Figure 6-2



7 Tips and Tricks

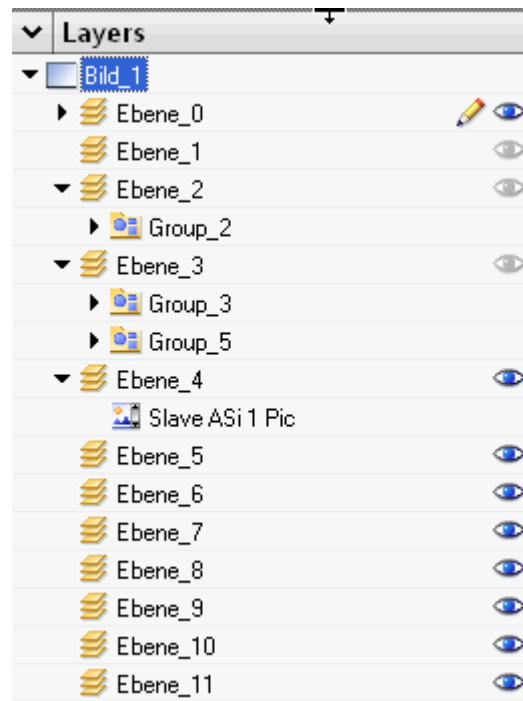
Note In this section no concrete code solutions are given. Instead, tips & tricks are illustrated for modifying and setting up the program.

7.1 Visualization in the configuration view

The AS-i diagnostic overview screen in WinCC V11 (TIA Portal) consists of many individual elements, which partly also overlap.

For a better overview, the objects were assigned to different display layers, which can be hidden or shown on demand.

Figure 7-1



The table below shows, which objects belong to which layer:

Table 7-1

Layer	Objects
Layer 0	<ul style="list-style-type: none"> All texts and frames All current elements such as buttons for displaying the slave status, the selection list of the AS-i masters, the output field and the display of the AS-i master status.
Layer 1	The master graphics picture
Layer 2/3	Grayed elements which only become visible in the case of an error.
Layer 4	Slave pictures

7.2 Export and import of text lists

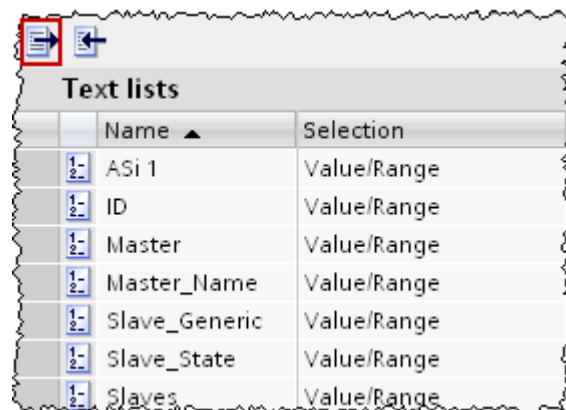
WinCC V11 (TIA Portal) offers the option to export and import text lists in .xlsx format. This has the huge advantage that all information can be clearly managed and edited in a file and that they can furthermore be imported into other projects or display devices.

Exporting text lists

During the export, all information from the text lists is stored in an .xlsx file.

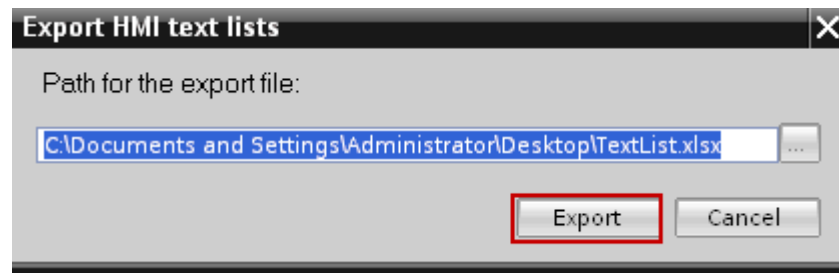
Click the respective button in the **Text lists** tab.

Figure 7-2



Specify the storage path and start the export via the respective button.

Figure 7-3

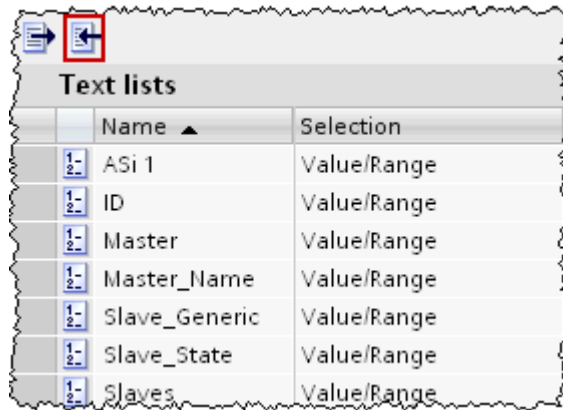


The information of the text lists is now located as .xlsx file in the specified path.

Importing text lists

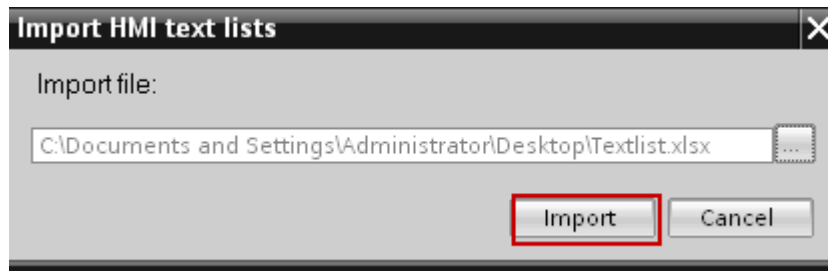
To make the information from the text lists also available to other display devices, or after modifying the text lists outside of WinCC V11 (TIA Portal), the .xlsx file can be imported.

Figure 7-4



Navigate to the .xlsx file. Start the Export process via the **Import** button.

Figure 7-5



8 Literature

Table 8-1

No.	Document / Link
/1/	SIMATIC S7 S7-1200 Programmable controller http://support.automation.siemens.com/WW/view/en/36932465/0
/2/	Manual for AS-i master CM 1243-2 and AS-i data decoupling unit DCM 1271 for SIMATIC S7-1200 http://support.automation.siemens.com/WW/view/en/57358958
/3/	System manual AS-Interface (Edition 11/2008) http://support.automation.siemens.com/WW/view/en/26250840
/4/	Supplements to System Manual AS-Interface http://support.automation.siemens.com/WW/view/en/44365425
/5/	Manuals of the AS-Interface Slaves http://support.automation.siemens.com/WW/view/en/10805898/133300
/6/	Link to the application http://support.automation.siemens.com/WW/view/en/50897766

9 History

Table 9-1

Version	Date	Modification
V1.0	01/2012	First issue for the TIA Portal V11