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Diagnostics of the operating state of an S7-1500R/H system with a function block

S7-1500R/H / Diagnostics block

<https://support.industry.siemens.com/cs/ww/en/view/109763768>

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1 Introduction

1.1 Overview

1.1.1 Task

Introduction

Users are often interested in being able to evaluate the operating state of an S7-1500R/H system in the user program. The function block "R_H_Sys_Status" was created for this.

1.1.2 Solution

Schematic

The following schematic diagram shows the most important components of the solution:

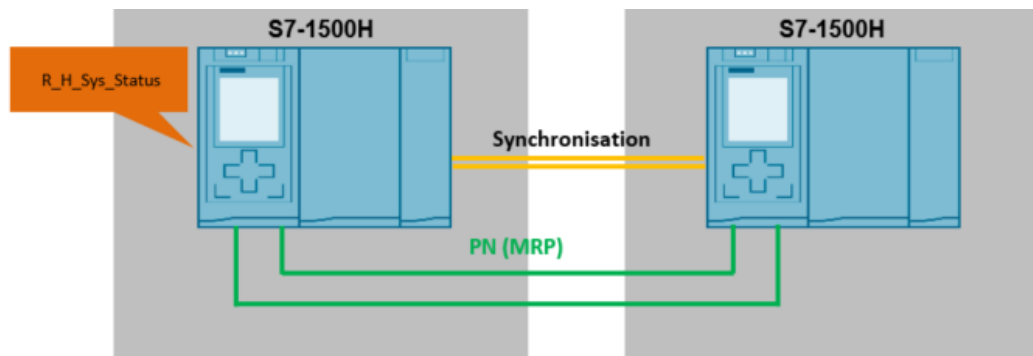


Figure 1: Structure with H-system

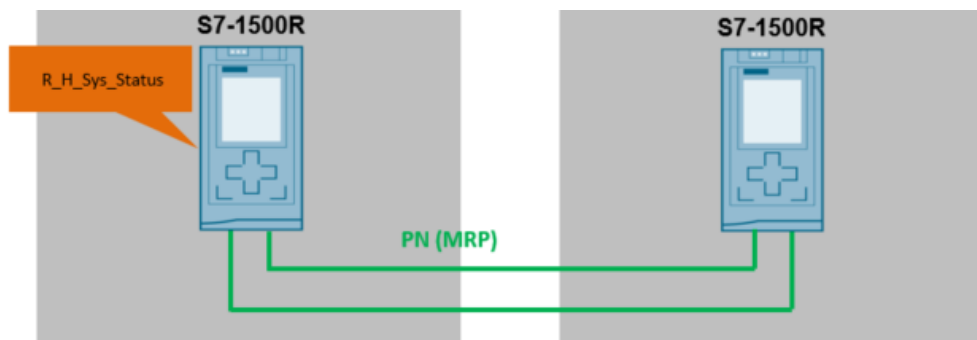


Figure 2: Structure with R-system

Setup

Each schematic structure shown above contains an S7-1500R/H system on which the "R_H_Sys_Status" function block is called cyclically in OB1.

Advantages

The solution presented here offers the following advantages:

- Ready-made diagnostics block for S7-1500R/H systems
- Easy interconnection of various hardware addresses for extensive diagnostics
- Integrated self-diagnostics function (in addition to the standard diagnostics functions) of the S7-1500R/H system for early detection and signaling of errors before they affect the process

Knowledge required

Knowledge of the following is required:

- Basics of using TIA Portal
- Basics of using high-availability systems, S7-1500R/H systems

1.2 Principle of operation

1.2.1 The function block R_H_Sys_Status

Overview

The core element of the automation task is the function block "R_H_Sys_Status".

This function block supplies a variety of diagnostics based on various hardware addresses of the R-system or H-system, such as operating states of the individual PLCs of the system and the state of the MRP ring.

1.3 Components used

This application example was created with the following hardware and software components.

Table 1: Components used

Component	Quantity	Article number	Note
S7-1515R-2 PN	2	6ES7 515-2RM00-0AB0	
Siemens TIA Portal V15.1	1		
PC	1		For engineering

Note

You can use other similar products not on the above list. Changes in the example code (e.g. different addresses) may then be necessary.

Note

Note that you can only use modules of the same product version and same firmware version as redundant pairs.

2 Program block of the system diagnostics

2.1 General overview

Overview of the standard functions

The following table shows the functions of the S7 standard library that are needed to implement the diagnostics function.

Table 2: Standard functions used

S7 function	Description	Used in
RH_GetPrimaryID	"RH_GetPrimaryID" is used to determine the primary PLC.	"R_H_Sys_Status"
GET_DIAG	"GET_DIAG" is used to read out various diagnostics of the S7-1500R/H system.	"R_H_Sys_Status"

2.2 Function block R_H_Sys_Status

2.2.1 Description

The function block "R_H_Sys_Status" is called cyclically in OB1.

By calling "RH_GetPrimaryID", "Get_DIAG", "LPNDR_ReadMrpState" and "LPNDR_ReadGlobalInfo", the state of the S7-1500R/H system, the individual PLCs of the redundant system and the MRP ring are indicated at the block outputs. The "LPNDR_ReadGlobalInfo" and "LPNDR_ReadMrpState" blocks are not system blocks. These blocks come from the application example with entry ID [109753067](#).

The states of the PLCs of the redundant system and the system correspond to the states of the "GET_DIAG" function.

2.2.2 Interface description

The following figure and the table show the call interface of the user function block "R_H_Sys_Status".

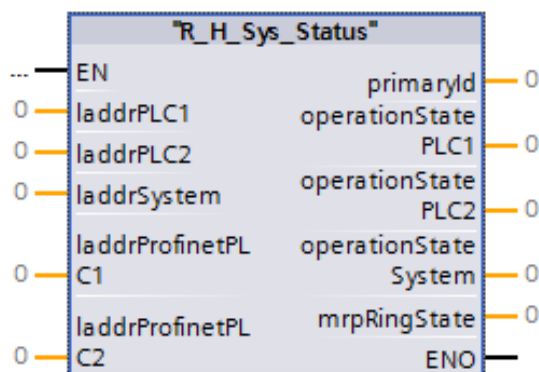


Figure 3: Function block "R_H_Sys_Status"

Input parameters

The input parameters have the following meanings:

Table 3: Input parameters

Parameter	Data type	Note
laddrPLC1	HW_ANY	Hardware address of the first PLC of the S7-1500R/H system
laddrPLC2	HW_ANY	Hardware address of the second PLC of the S7-1500R/H system
laddrSystem	HW_ANY	Hardware address of the S7-1500 R/H system
laddrProfinetPLC1	HW_ANY	Hardware ID of the PROFINET interface of the first PLC of the S7-1500R/H system
laddrProfinetPLC2	HW_ANY	Hardware ID of the PROFINET interface of the second PLC of the S7-1500R/H system

Output parameters

The output parameters have the following meanings:

Table 4: Output parameters

Parameter	Data type	Note
primaryID	INT	Returns the redundancy ID of the primary PLC
operationStatePLC1	UINT	Operating state of the first PLC of the S7-1500R/H system
operationStatePLC2	UINT	Operating state of the second PLC of the S7-1500R/H system
operationState-System	UINT	Operating state of the R/H system
mrpRingState	UINT	State of the MRP ring: Open: 0 Closed: 1 State undefined: 2

The "State undefined" state of the MRP ring can come about in the following circumstances:

- Neither of the two PLCs is the MRP ring manager.
- The PLC that is the MRP ring manager is in STOP operating state.

Operating states

The operating states of the PLCs and the S7-1500R/H system follow from the diagnostics of the "GET_DIAG" block and can supply the following outputs:

Table 5: Operating states

Operating state	Description
0	I/O module does not support this diagnostic
1	STOP/ Firmware Update
2	STOP/ Memory Reset
3	STOP/ Restart
4	STOP
5	Memory Reset
6	Power up
7	-
8	RUN
9	RUN-Redundant
10	Hold
11	-
12	-
13	Defect; note: can only be viewed in the diagnostics buffer
14	-
15	De-energized
16	CiR
17	STOP without ODIS
18	RUN ODIS
19	Pgm Test
20	Run Pgm Test (status of primary PLC when backup PLC runs the test)
21	Run-Syncup
22	SYNCUP (only backup PLC in SYNCUP)
31	State of partner PLC unknown (e.g. when it is not accessible)
32	-
33	STOP (system state)
34	Reserved
35	STARTUP (system state)
36	Reserved
37	RUN-Solo (system state)
38	SYNCUP (system state)
39	Reserved
40	RUN-Redundant (system state)

Interconnection example

The following figure shows an interconnection example of the function block "R_H_Sys_Status":

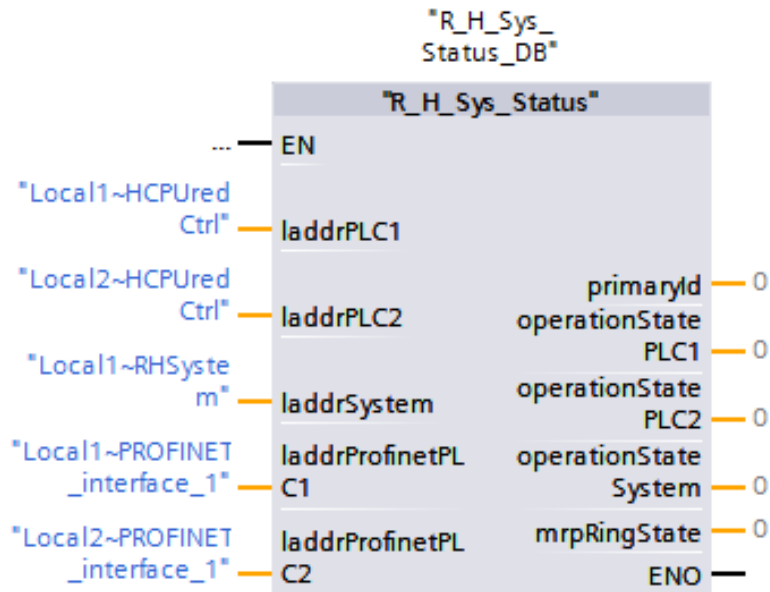


Figure 4: Interconnection example of the function block "R_H_Sys_Status"

In the TIA Portal you must insert all three blocks as well as all five PLC data types from the library into the "Program blocks" and "PLC data types" folders. However, only the function block "R_H_Sys_Status" has to be actively called in the user program. Figures 5 and 6 below show the inserted blocks and data types in the TIA Portal:

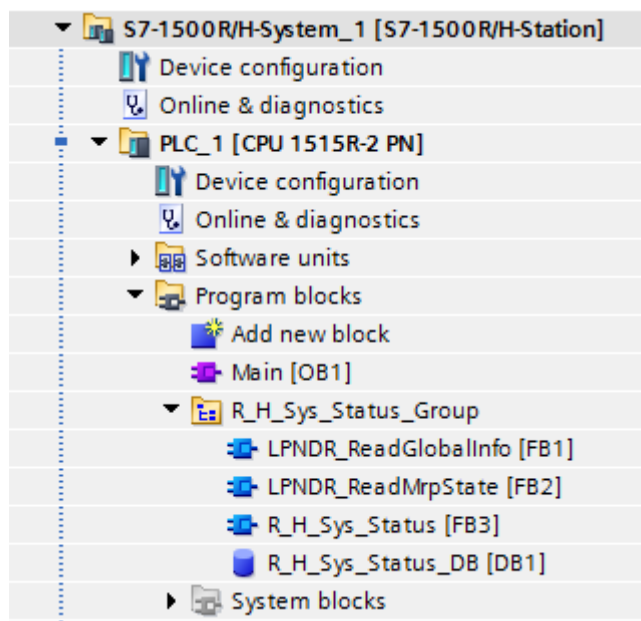


Figure 5: Example of inserted function blocks

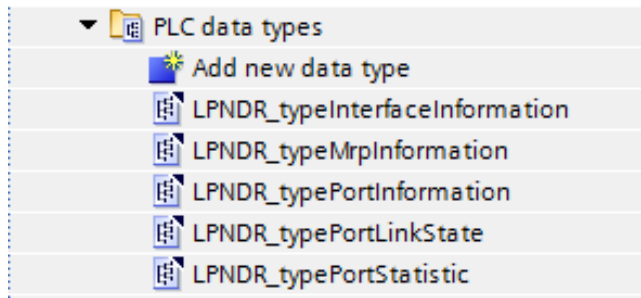


Figure 6: Example of inserted data types

3 Appendix

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3.2 Application support

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3.3 Links and references

Table 3-1

No.	Subject
1	Siemens Industry Online Support https://support.industry.siemens.com
2	Link to the entry page of the application example https://support.industry.siemens.com/cs/ww/en/view/109763768
3	Link to the library for PROFINET data sets https://support.industry.siemens.com/cs/de/en/view/109753067

3.4 Change documentation

Table 3-2

Version	Date	Change
V1.0	02/2019	First edition