Evaluation of the System and Station Diagnosis of the Diagnostic Package PNIODiag

FB126 “PNIODiag”

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Evaluation of the System and Station Diagnosis of the Diagnostic Package PNIODiag

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Preface

Purpose of the documentation

This documentation explains the structure of the data of the system and station diagnosis in the two data blocks in the diagnostic package PNIODiag.

It is possible to read out statuses of the system as in the “System Overview” screen and also statuses of the station as in the “Station Overview” screen and to process them in the application program.

With this documentation, the user can use the system and station statuses, the diagnosis package PNIODiag determines in his own program. Please note that the included HMI should be used nevertheless.

No further symbol information will be published.

Applicability

This documentation refers to version 1.82 of the diagnosis package PNIODiag. It remains applicable for the module version <16kB without any modification, too

Table of contents

1 Structure of the Diagnostic Package PNIO

The diagnostic package consists of the STEP 7 library “PNIODiag” and the visualization projects for WinCC and WinCC flexible. In addition to the organization blocks (OBs), the STEP 7 library contains function blocks (FBs) and the data blocks (DBs) that contain the diagnostic data during correct operation.

There are two data blocks relevant for the FB126 process. The instance data block of the FB126 called DB126 by default, contains mainly control data for the function block and status information about the configured systems. The data block DB200 contains status information about the configured stations from address 0 onwards.

The numbers of the two data blocks can be freely assigned. This is also described in the Online Help included in the diagnostic package PNIODiag. This document will not deal with in more detail. If you have changed the DB numbers, you must take over the information with the DB numbers that have been adapted respectively.

2 Function Block FB126

The function block FB126 is available in two variants:

- S7 block for CPUs with a storage capacity for S7 blocks of > 16 kbyte.
- S7 block for CPUs with a storage capacity for S7 blocks of <= 16 kbyte.

2.1 Field of application

The function block FB126 can be used for the following devices with integrated and external PROFIBUS DP and PROFINET IO interfaces:

SIMATIC S7-300 controller

Table 2-1 shows for which S7-300 CPUs with storage capacities for S7 blocks <= 6 kbyte the FB126 can be used.

Table 2-1 S7-300 CPUs with storage capacities for S7 blocks <= 16 kByte

CPU	Order number	From firmware version
CPU313C-2 DP	6ES7313-6CF03-0AB0	V2.6
CPU314C-2 DP	6ES7314-6CG03-0AB0	V2.6
CPU315-2 DP	6ES7315-2AG10-0AB0	V2.6
CPU315F-2 DP	6ES7315-6FF01-0AB0	V2.6.6
CPU315-2 PN/DP	6ES7315-2EH13-0AB0	V2.5
CPU315F-2 PN/DP	6ES7315-2FH13-0AB0	V2.5
CPU317-2 DP	6ES7317-2AJ10-0AB0	V2.6
CPU317F-2 DP	6ES7317-6FF03-0AB0	V2.6
IM151-7 CPU[1)]	6ES7151-7AA20-0AB0	V2.6
IM151-8 PN/DP CPU[1)]	6ES7151-8AB00-0AB0	V2.7
IM151-8F PN/DP CPU[1)]	6ES7151-8FB00-0AB0	V2.7
IM154-8 PN/DP CPU	6ES7154-8AB00-0AB0	V2.5

[1)] The FB126 also supports using the DP master module (6ES7138-4HA00-0AB0) on ET 200S CPU.

Table 2-2 shows for which S7-300 CPUs with storage capacities for S7 blocks > 16 kbyte the FB126 can be used.

Table 2-2 S7-300 CPUs with storage capacities for S7 blocks > 16 kByte

CPU	Order number	From firmware version
CPU313C-2 DP	6ES7313-6CG04-0AB0	V3.3
CPU314C-2 DP	6ES7314-6CH04-0AB0	V3.3
CPU314C-2 PN/DP	6ES7314-6EH04-0AB0	V3.3
CPU315-2 DP	6ES7315-2AH14-0AB0	V3.0
CPU315F-2 DP	6ES7315-6FF04-0AB0	V3.0
CPU315-2 DP/PN	6ES7315-2EH14-0AB0	V3.1
CPU315F-2 PN/DP	6ES7315-2FJ14-0AB0	V3.1

CPU	Order number	From firmware version
CPU317-2 DP	6ES7317-2AK14-0AB0	V3.3
CPU317F-2 DP	6ES7317-6FF04-0AB0	V3.3
CPU317-2 PN/DP	6ES7317-2EK13-0AB0	V2.5
CPU317-2 PN/DP	6ES7317-2EK14-0AB0	V3.1
CPU317F-2 PN/DP	6ES7317-2FK13-0AB0	V3.5
CPU317F-2 PN/DP	6ES7317-2FK14-0AB0	V3.2
CPU319-3 PN/DP	6ES7318-3EL00-0AB0	V2.5
CPU319-3 PN/DP	6ES7318-3EL01-0AB0	V3.2
CPU319F-3 PN/DP	6ES7318-3FL00-0AB0	V2.5
CPU319F-3 PN/DP	6ES7318-3FL01-0AB0	V3.2
IM151-8 PN/DP CPU[1)]	6ES7151-8AB01-0AB0	V3.2
IM151-8F PN/DP CPU[1)]	6ES7151-8FB01-0AB0	V3.2
IM154-8 PN/DP CPU	6ES7154-8AB01-0AB0	V3.2
IM154-8F PN/DP CPU	6ES7154-8FB01-0AB0	V3.2
CPU315T-2 DP	6ES7315-6TH13-0AB0	V2.6
CPU317T-2 DP	6ES7317-6TK13-0AB0	V2.6
CPU317TF-2 DP	6ES7317-6TF14-0AB0	V2.7

[1)] The FB126 also supports using the DP master module (6ES7138-4HA00-0AB0) on ET 200S CPU.

Note In the technology CPUs only the MPI/DP interface X1 is supported.

SIMATIC S7-400 controllers

Table 2-3 shows for which S7-400 CPUs the FB126 can be used.

Table 2-3 S7-400 CPUs

CPU	Order number	From firmware version
CPU412-2 DP	6ES7412-2XJ05-0AB0	V5.1.1
CPU412-2 PN	6ES7412-2EK06-0AB0	V6.0
CPU414-2 DP	6ES7414-2XG04-0AB0	V4.1.1
CPU414-2 DP	6ES7414-2XK05-0AB0	V5.1.1
CPU414-3 PN/DP	6ES7414-3EM05-0AB0	V5.0
CPU414-3 PN/DP	6ES7414-3EM06-0AB0	V6.0
CPU414F-3 PN/DP	6ES7414-3FM06-0AB0	V6.0
CPU416-2 DP	6ES7416-2XK04-0AB0	V4.1.1
CPU416-2 DP	6ES7416-2XN05-0AB0	V5.1.1
CPU416F-2 DP	6ES7416-2FN05-0AB0	V5.2
CPU416-3 DP	6ES7416-3XL04-0AB0	V4.1.1
CPU416-3 DP	6ES7416-3XR05-0AB0	V5.1.1
CPU416-3 PN/DP	6ES7416-3ER05-0AB0	V5.0

CPU	Order number	From firmware version
CPU416-3 PN/DP	6ES7416-3ES06-0AB0	V6.0
CPU416F-3 PN/DP	6ES7416-3FR05-0AB0	V5.0
CPU416F-3 PN/DP	6ES7416-3FS06-0AB0	V6.0

SIMATIC S7-400 communication processors

Table 2-4 shows for which SIMATIC S7-400 CPUs the FB126 can be used.

Table 2-4 Communication processors SIMATIC S7-400

CP	Order number	From firmware version
CP443-1	6GK7443-1EX20-0XE0	V1.0.24
CP443-1 Advanced	6GK7443-1EX41-0XE0	V1.0.26
CP443-1 Advanced	6GK7443-1GX20-0XE0	V2.0.49
CP443-5 Extended	6GK7443-5DX04-0XE0	V6.0

SIMATIC PC-based Controller

Table 2-5 shows for which SIMATIC PC-based controller the FB126 can be used.

Table 2-5 SIMATIC PC-based controller

SIMATIC PC-based controller	Order number
WinAC RTX 2008	6ES7671-0RC06-0YA0
WinAC RTX 2009	6ES7671-0RC07-0YA0
WinAC RTX F 2009	6ES7671-1RC07-0YA0
WinAC RTX 2010	6ES7671-0RC08-0YA0
WinAC RTX F 2010	6ES7671-1RC08-0YA0

SIMATIC HMI control units

The visualization for WinCC flexible was made with the SIMATIC HMI control unit MP 377 Touch 15".
On the following SIMATIC HMI control unit, the visualization can also be used without any changes:

- MP 270 B
- MP 277
- MP 370
- MP 377
- PC Runtime

Note If you want to use the visualization on other SIMATIC HMI control units, you would have to check the possibilities on a case-by-case basis. For example, reworking the visualization may become necessary due to a different screen resolution.

3 System Status Information in the Instance DB of FB126

In the Instance Data Block (DB126) of the FB126, a space of 48 words (96 bytes) is reserved for the storage of the statuses of the individual systems. For every system one word has been reserved. The first 32 words contain the statuses of the PROFIBUS DP master systems. The remaining 16 words contain the statuses of the PROFIBUS IO systems.

Table 3-1 gives an overview of the memory area.

Table 3-1 Memory area of the system statues in the Instance Data Block (DB126)

Instance Data Block (DB126)	
Address	**Description**
Word 1578	DP master system 1
Word 1580	DP master system 2
Word 1582	DP master system 3
…	…
Word 1640	DP master system 32
Word 1642	PROFINET IO system 100
Word 1644	PROFINET IO system 101
Word 1646	PROFINET IO system 102
…	…
Word 1672	PROFINET IO system 115

Table 3-2 describes the meaning of the individual bits.

Table 3-2 Bit assignment for coding of the system statuses

Bit number	Meaning
Bit 0	OK
Bit 1	Maintenance
Bit 2	Faulty
Bit 3	Failed
Bit 4	Reserved
Bit 5	Reserved
Bit 6	was under maintenance
Bit 7	was faulty
Bit 8	had failed
Bit 9 to 15	reserved

Table 3-3 shows the coding of the system statuses, i.e. which bits are assigned to the various system statuses.

Table 3-3 Coding of the system statuses

System status	Value		Button colors		Description
	Hex	Dec	Front	Back	
Not configured	0000	0	Not visible		Bit 0 to 15 = 0
OK	0001	1	Green	Green	Bit 0 = 1
Was Maintenance	0041	65	Green	Orange	Bit 0 = 1 Bit 6 = 1
Maintenance	0042	66	Orange	Orange	Bit 1 = 1 Bit 6 = 1
Was Faulty	0081	129	Green	Yellow	Bit 0 = 1 Bit 7 = 1
Faulty	0084	132	Yellow	Yellow	Bit 2 = 1 Bit 7 = 1
Was Failed	0101	257	Green	Red	Bit 0 = 1 Bit 8 = 1
Failed	0108	264	Red (flashing)	Red (flashing)	Bit 3 = 1 Bit 8 = 1

For a query of the status of the PROFINET IO system 104 for example, the data word from address 1650 in the Instance Data block (DB126) must be read and evaluated in accordance with Table 3-3.

4 Station Status Information in the Data Block DB200 (Global DB)

The data block DB200 contains status information about the stations of the configured systems from address 0 onwards. The configured systems are filed in the DB in ascending order from address 0 onwards. If there are both, PROFIBUS DP master systems, and PROFINET IO systems, the PROFIBUS DP master systems are filed first.

For each DP slave or for each IO device, there is a storage are with the Word format. In this word, the status of the DP slave ort he IO device is coded. The possible statuses of a device will be described in chapter 4.2.

The maximum number of nodes is 256, therefore 256 words (512 bytes) are reserved for every configured system. This is a fixed setting, which is also applicable for PROFIBUS.

The following calculation rule is for the determination of the address of the status word for a DP slave or for an IO device.

Address [Byte] = (system number-1) * 256 * 2Byte + (station number-1) * 2Byte

The system number refers to the number of configured systems. An example is available in chapter 4.1.

4.1 Example of the structure of the DB200

5 systems have been configured, which makes a total of 2560 bytes or 1280 words (5*256 words). The first system begins with the first node at the address 0. The last node in the first system with the number 256 begins at the address 510. The second system begins at the address 512, the third system at the address 1024, etc. Table 4-1 shows the structure of the DB200.

Table 4-1 Structure of the data block DB200

DB200	
Address	**Description**
Word 0	System 1: Station 1
Word 2	System 1: Station 2
Word 3	System 1: Station 3
…	…
Word 510	System 1: Station 256
Word 512	System 2: Station 1
….	…
Word 1022	System 2: Station 256
Word 1024	System 3: Station 1
…	…
Word 1534	System 3: Station 256
Word 1536	System 4: Station 1
…	…
Word 2046	System 4: Station 256
Word 2048	System 5: Station 1
…	…
Word 2558	System 5: Station 256

4.2 Coding of the statuses of a node

Every station of a system is represented by a word in the data block DB200. The word contains a hexadecimal number describing the status of the station. By means of this value, a clear overview is created in the visualization (HMI). In the application program, you can react if an error occurs.

In the visualization in the "Station Overview" screen, the stations are represented as buttons. The background color of the buttons is distributed into "Button Center" and "Button Edge". Therefore, the user can see at a glance at the station overview, whether there have been changes in the status of a station.

Figure 4-1

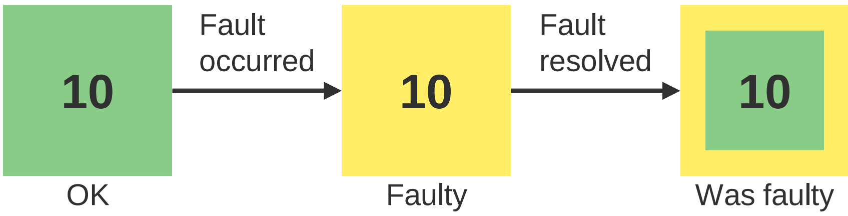

Table 4-2 describes the meaning of the individual bits.

Table 4-2 Bit assignment for coding of the station statuses

Bit number	Meaning
Bit 0	OK
Bit 1	Maintenance
Bit 2	Faulty
Bit 3	Failed
Bit 4	Was deactivated
Bit 5	DPV1
Bit 6	was under maintenance
Bit 7	was faulty
Bit 8	had failed
Bit 9	deactivated
Bit 10 to 15	reserved

Table 4-3 shows the coding of the different statuses and contains the corresponding assignments of the display and the hexadecimal values.

Table 4-3 Coding of the system statuses

State	Value	Button colors		Description
	Hex	Center	Edge	
Not configured	0000			Bit 0 to 15 = 0
OK (DP/PN)	0001	Green	Green	Bit 0 = 1
OK (DPV1)	0021	Green	Green	Bit 1 = 1 Bit 5 = 1
Was under maintenance	0041	Green	Orange	Bit 0 = 1 Bit 6 = 1
Was under maintenance (DPV1)	0061	Green	Orange	Bit 0 = 1 Bit 5 and 6 = 1
Maintenance	0042	Orange	Orange	Bit 1 = 1 Bit 6 = 1
Maintenance (DPV1)	0062	Orange	Orange	Bit 1 = 1 Bit 5 and 6 = 1
Was faulty	0081	Green	Yellow	Bit 0 = 1 Bit 7 = 1
Was faulty (DPV1)	00A1	Green	Yellow	Bit 0 = 1 Bit 5 = 1 Bit 7 = 1
Faulty	0084	Yellow	Yellow	Bit 2 = 1 Bit 7 = 1
Faulty (DPV1)	00A4	Yellow	Yellow	Bit 2 = 1 Bit 5 = 1 Bit 7 = 1

State	Value	Button colors		Description
	Hex	Center	Edge	
Had failed	0101	Green	Red	Bit 0 = 1 Bit 8 = 1
Had failed (DPV1)	0121	Green	Red	Bit 0 = 1 Bit 5 = 1 Bit 8 = 1
Failed	0108	Red (flashing)	Red (flashing)	Bit 3 = 1 Bit 8 = 1
Failed (DPV1)	0128	Red (flashing)	Red (flashing)	Bit 3 = 1 Bit 5 = 1 Bit 8 = 1
Was deactivated	0011	Green	Blue	Bit 0 = 1 Bit 4 = 1
Was deactivated (DPV1)	0031	Green	Blue	Bit 0 = 1 Bit 4 and 5 = 1
Deactivated	0210	Blue	Blue	Bit 4 = 1 Bit 9 = 1
Deactivated (DPV1)	0231	Blue	Blue	Bit 4 and 5 = 1 Bit 9 = 1

4.3 Example for calculating the address

Setting

There are three PROFIBUS DP master systems and two PROFINET IO systems. The PROFIBUS DP master systems have the numbers 2, 5 and 12. The PROFINET IO systems have the numbers 102 and 107. So there are 5 systems altogether.

In the DB, the PROFIBUS DP master systems are filed from address 0 onwards, beginning with the lowest number. Then follow the PROFINET IO systems, beginning with the lowest number.

Example of an address calculation for PROFINET IO

We are looking for the status of the device with the number 12 in the PROFINET IO system 107. According to the given order, the system number in this case is 5. The station number is the same as the device number in the hardware configuration. Using the calculation rule explained above, the address DB200.DBB2070 results as follows.

Address [Byte] = (5-1) * 256 * 2Byte + (12-1) * 2Byte = 2070 Byte

Example of an address calculation for PROFIBUS

We are looking for the status of the DP slave with the PROFIBUS address 88 in the DP master system 12. According to the given order, the system number in this case is 3. The station number is the same as the PROFIBUS address in the hardware configuration. Using the calculation rule explained above, the address DB200.DBB1198 results as follows:

Address [Byte] = (3-1) * 256 * 2Byte + (88-1) * 2Byte = 1198 Byte

5 History

Table 5-1

Version	Date	Change
V1.0	02.02.2012	First issue
V1.1	13.03.2012	Extension in chapter 2.1 “Field of application”, that the DP master module of ET 200S is supported