Saving Energy with SIMATIC S7

PROFIenergy with SENTRON PAC4200 (STEP 7 V5.5)

Application Description • December 2011

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Preface

This application is part of our series

"Saving Energy with SIMATIC S7".

Applications realized with STEP 7 V5.5 that have already been published:

- PROFIenergy with **ET 200S**
- PROFIenergy with the **I-Device**
- PROFIenergy with measuring devices **PAC3200 / PAC4200**

or with SCOUT:

- PROFIenergy with **SIMOTION**

The following applications have already been configured with **TIA Portal**:

- PROFIenergy with **ET 200SP**
- PROFIenergy with **Comfort panel**

The procedure and parameterization can also be used to migrate your PROFIenergy applications from STEP 7 V5.5 to TIA Portal.

Further information on the topic of energy efficiency is available on our website:

- Energy-efficient production

Validity

Valid for STEP 7 V5.5 and WinCC flexible 2008.

Table of Contents

1 Automation Task

1.1 Overview

Introduction

The importance of energy management will grow in the future. Sustainable reduction of energy costs initially requires an overview of power consumption and energy flows in the electrical installations.

Electrical measuring variables such as voltage, current, output, energy values, frequency, performance factor, symmetry and THD with minimal, maximal and average values must be acquired and read in at the automation system for evaluation and archiving.

Automation devices and motor controllers record the values for directly connected consumers.

Multifunctional power meters precisely and reliably record the energy values for electrical branches and individual consumers. Furthermore, they provide important measured values for evaluating the plant status and the network quality.

The decision for PROFINET already lays the foundations for a new and future-oriented energy management.

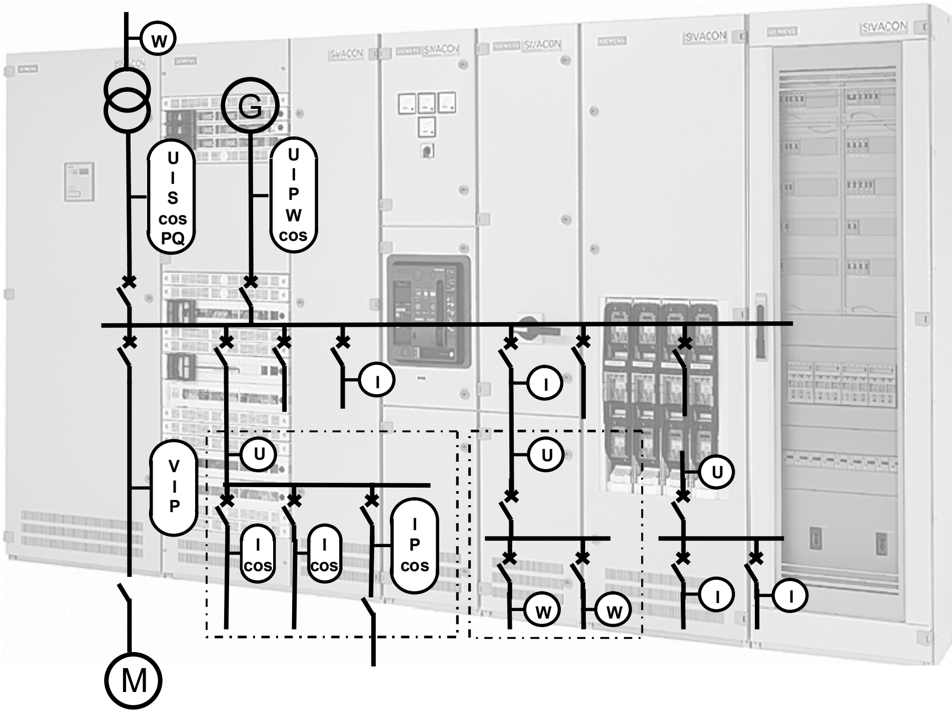
PROFIenergy is a profile defined by the PROFINET user organization. It provides the prerequisites for a vendor-independent system that can be generally used to switch off individual consumers or complete production units in a flexible and intelligent way on a short-term basis. Furthermore, measured values can be read from automation devices or multifunctional power meters.

SIEMENS already supports PROFIenergy /1/ with first implementations within the SIMATIC automation system.

Overview of the automation task

The illustration below provides an overview of the automation task.

Figure 1-1



An electrical distribution contains many points where values can be acquired:

- Automation devices measure the consumption of the directly connected sensors and actuators
- Motor starters record the current of the connected drive
- Frequency converters deliver all relevant motor data
- Multifunctional power meters, such as SENTRON PAC4200, or PAC3200 for simpler measurements, document the state of entire network branches

Description of the automation problem

The following application shows step by step how, how to use SENTRON PAC4200 and the PROFINET communication module – with integrated PROFIenergy functionality – to read out a list of measured values.

A variable table and an optional control panel are used for visualization and control.

1.2 Scenarios

The following PROFIenergy commands shall be introduced in this application example.

Table 1-1

Command	Explanation
Query measurement – get measurement list	Which values can be provided by SENTRON PAC4200 and what is the structure of this list.
Query measurement – get measurement list	How are selected values requested and how are the response data interpreted.

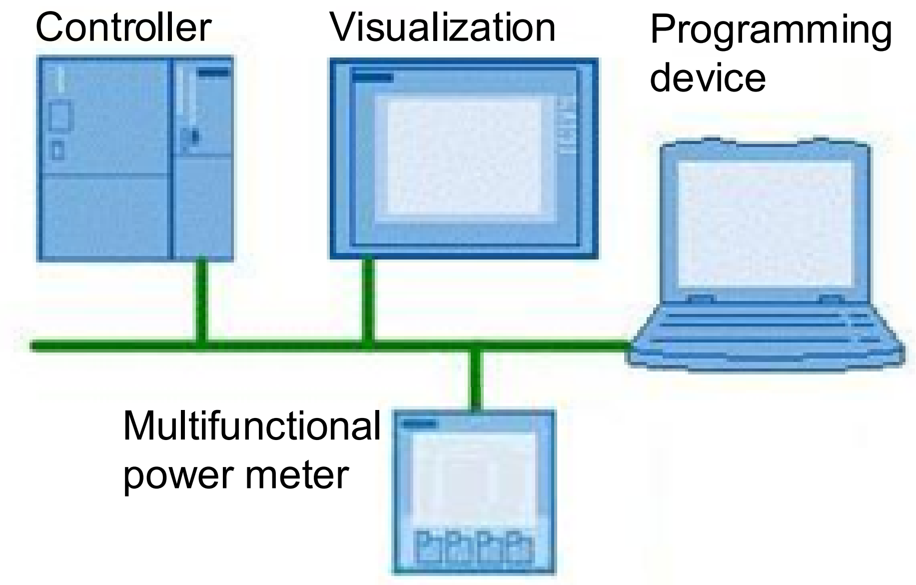
2 Automation Solution

2.1 Overview of the general solution

Schematic layout

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

Figure 2-1



Setup

The above displayed structure shows the configuration used here, hence, only the measuring device and the CPU for reading the data. The CPU reads the desired values via the PROFIenergy-capable communication module of the SENTRON PAC4200 and provides them for further processing.

The input / visualization via a real panel or via the simulation of the panel in WinCC flexible Runtime is optional. The same information and input fields are available in a variable table.

Restriction

This application contains no description of how the components can be switched off with PROFIenergy. For further information please refer to /1/.

In the following, only the commands

- Query measurement - Get measurement list
- Query measurement - Get measurement values

of the PROFIenergy profile are explained and not the complete command list.

Required knowledge

It is assumed that the user has basic knowledge in automation, SIMATIC, PROFINET, PROFIenergy and configuration with STEP 7.

2.2 Description of the core functionality

Overview and description of the program

In this application, the SENTRON PAC4200 is used with two different access methods:

Cyclic reading

The basic version of SENTRON PAC4200 has two interfaces:

PROFIBUS and ETHERNET with MODBUS TCP.

Additional usage of PROFINET IO is possible via a plug-in communication module.

For direct usage of the measuring variables in the process, the cyclic reading should be used.

For visualization and archiving of the energy values, the acyclic reading can be used.

Via this PROFINET interface, the SENTRON PAC4200 in the Step7 HW configuration is connected to the PROFINET interface of the CPU.

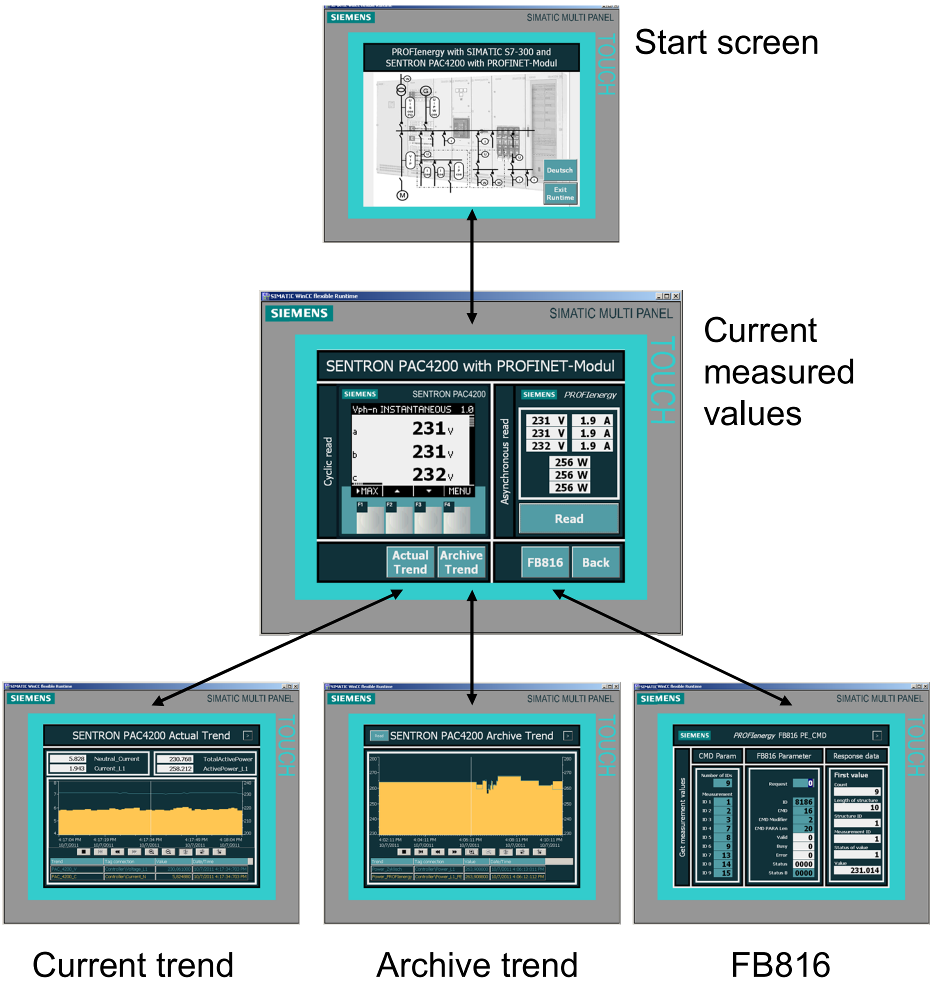
Some values, which are to be read cyclically, are also parameterized here. This illustrates the differences between cyclic reading and reading with PROFIenergy, is not necessary for the PROFIenergy function.

Acyclic reading with PROFIenergy

The SENTRON PAC4200 PROFINET communication module is also PROFIenergy-capable. After connecting PROFINET to the Step7 HW configuration the PROFIenergy commands can also be used. First, the list of the measuring variables supplied by SENTRON PAC4200 are read out. Then, a selection of these variables is read. Those measuring variables which are to be read cyclically are also prepared. The respective parameters can be changed to also read other variables or to provoke errors, such as reading a measuring variable which is not supported. The panel pictures and VAT tables are designed so this can be performed as easily as possible.

Overview and description of the user interface

Figure 2-2



Start screen
For selecting the language and terminating Runtime via the function keys.
Further to the next screen via the entire remaining touch screen surface.

Current measured values
The cyclically read measuring values of SENTRON PAC4200 are displayed in the left part. Buttons F2 and F3 under the ▲ ▼ symbols enable you to change between the displays for current, voltage and output.
The values read with PROFIenergy are displayed in the right section, after request via the ***Read*** button.

The screen assumes the configuration of the FB816 for “Get measurement values”; had they been changed in the mean, please restore them using VAT “Get Values” or by rebooting the CPU (OB100)!

The ***Back*** button takes you back to the start screen, the other three buttons to the following screens:

FB816: parameterizing and operating the FB816 “PE_CMD” for the “Get measurement values” command.

Archive trend: the PROFIenergy values are filed in an archive and displayed as a trend. When working with Runtime, the archive data are available at *C:\Storage Card USB\PROFIenergy0.csv* . A real panel requires a memory card.

Current trend: the cyclically read values are represented as a trend

The trend screens shall only illustrate the performance spectrum of the panel, they are not necessary for the PROFIenergy function and are subsequently not discussed any further.

2.3 Used hardware and software components

The application document was generated using the following components:

Hardware components

Table 2-1

Component	Qty.	MLFB/order number	Note
SIMATIC S7-300, DIN rail	1	6S7 390-1AE80-0AA0	
SIMATIC S7-300 reg. power supply PS307, input : AC 120/230 V output DC 24 V/5 A	1	6ES7307-1EA01-0AA0	
SIMATIC S7-300 CPU 317-2 PN/DP, PROFINET	1	6ES7317-2EK14-0AB0	For all S7 CPUs available as an option
SIMATIC S7, MMC Micro Memory CardS7-300, 2 MBYTE		6ES7953-8LL20-0AA0	
SENTRON PAC4200 or SENTRON PAC3200	1	7KM4211-1BA00-3AA0 or 7KM2111-1BA00-3AA0	Or a different version of the PAC4200 as of FW V1.4 or PAC3200 FW as of V2.2
SENTRON PAC PROFINET communication module	1	7KM9300-0AE00-0AA0	
SIMATIC Field PG M2	1	Configurator	Compatible PC
SIMATIC PROFINET cable and connectors			As alternative Ethernet patch cable

Standard software components

Table 2-2

Component	Qty.	MLFB/order number	Note
STEP 7 V5.5	1	6ES7810-5CC10-…	
WinCC flexible 2008	1	6AV6613-0AA51-3CA5	optional

Example files and projects

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

Table 2-3

Component	Note
41986454_PROFIenergy_SENTRON_CODE_V10.zip	This zip file contains the STEP 7 project.
41986454_PROFIenergy_SENTRON_DOKU_V10_en.pdf	This document.

3 Basic Information

3.1 PROFIenergy profile

The PROFIenergy profile presents methods and techniques for implementing energy-saving functions into PROFINET IO devices. And not only manufacturer-independent into simple I/O devices, but also into intelligent and complex devices.

PROFIenergy consists of a group of methods that apart from parameterization and the actual start and stop commands are also used for recording the energy consumption.

PROFIenergy is based on existing PROFINET mechanisms - changes are not necessary. This way, users of PROFINET are able to integrate PROFIenergy into existing plants without fundamental modifications to the plant.

PROFIenergy controller: this refers to a PLC, in this case the SIMATIC S7 CPU 317-2PN/DP. The user can decide whether to integrate the PROFIenergy management into an existing controller or into an additional controller.

PROFIenergy device: a PROFINET IO device with integrated PROFIenergy functionality. In this case the SENTRON PAC4200 consisting of measuring device and plug-in PROFINET communication module.

3.2 Available hardware

PROFIenergy controller

There are blocks available that can be executed on all SIMATIC S7 CPUs.
The Step7 project which belongs to this application contains these blocks.

PROFIenergy device

SENTRON PAC4200 with PROFINET communication module:

The various designs of SENTRON-PAC4200 measuring devices only differ in the connection type and the supply voltage. The plug-in PROFIenergy-capable PROFINET communication module is decisive.

3.3 Required software

All required Step7 blocks are contained in the project file of this application and are available for downloading Reference to the document. The following chapters describe their function and application.

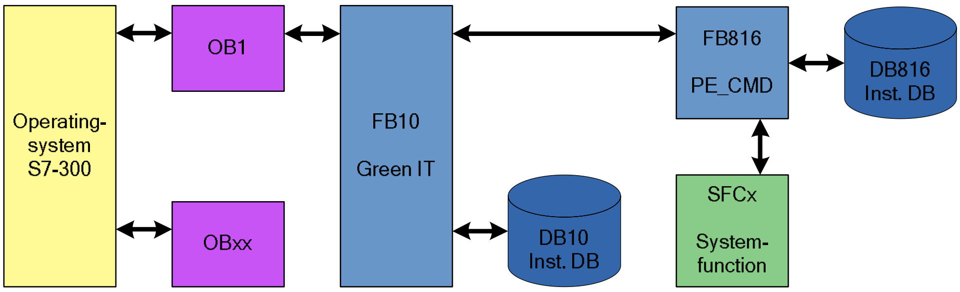
The STEP 7 V5.5 software is required for engineering.

4 Function Mechanisms of this Application

4.1 Program overview

The following figure shows the basic structure of the program of this application.

Figure 4-1



The function block FB 10 “GreenIT” bundles the actual PROFIenergy block calls and provides a comfortable interface for the HMI via its instance data block.

FB816 “PE_CMD”: executes all PROFIenergy commands. In this application the measured values are read as an example.

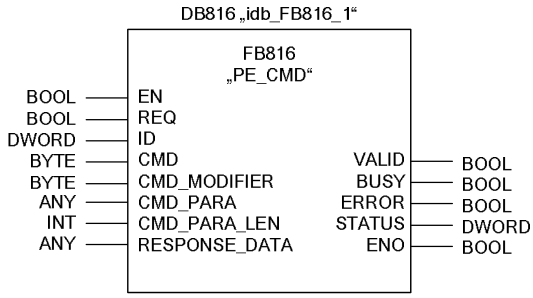
Parameters and function of the PROFIenergy blocks are described in detail in the following chapters.

4.2 FB816 “PE_CMD” functionality

FB816 “PE_CMD” is a transparent block to illustrate the complete PROFIenergy standard. Transparent means, the parameters are forwarded 1:1 to the PE device without checking the content. Due to its free parameter transfer the block is open to future extensions of the PROFIenergy profile. To use this block advanced knowledge of the PROFIenergy profile is required. In this application, especially the “Query measurement” command is discussed.

Program details on block FB816 “PE_CMD”

Figure 4-2



Use this FB816 to transfer PROFIenergy commands to a PROFIenergy-capable device.

The input data is stored in data range “CMD_PARA” addressed by the ANY-pointer. In this application the list of the requested measured values is filed in “CMD_PARA”.

The output data are stored in the data range RESPONSE_DATA which is addressed by the ANY-pointer. This application contains the list of possible measured values (Get List) or the measured values themselves (Get Values).

The commands are transferred to the modules without plausibility check – here SENTRON PAC4200 – where they are processed. The feedback from this module is provided at the output data without any changes.

This block can also be used after the PROFIenergy profile has been extended by further commands in the future.

The following commands are possible in the current PROFIenergy profile. In the following chapters the “Query Measurement” commands are described.

- Query Modes
  - List of energy saving modes
  - Get mode
- PEM_Status
- Identify
- **Query Measurement**
  - **Get measurement list**
  - **Get measurement values**

Input parameters

Table 4-1

Parameter	Data type	Description
EN	BOOL	Enable Input
REQ	BOOL	Start job: positive edge starts the command transfer
ID	DWORD	Address of the PROFINET IO device (SENTRON PAC PN module, to be taken from the hardware configuration)
CMD	BYTE	Service RQ-ID from the PROFIenergy profile Commands: 01 Start_Pause 02 End_Pause 03 Query_Modes 04 PEM_Status 05 PE_Identify **16 Query_Measurements** After the PROFIenergy profile expansions further command IDs are possible.
CMD_ MODIFIER	BYTE	Start_Pause Modifier: 00 End_Pause Modifier: 00 Query_Modes Modifier: - 01: List energy saving Modes - 02: Get Mode PEM_Status Modifier: 00 PE_Identify Modifier: 00 **Query_Measurement Modifier:** **- 01: Get_Measurement_List, get all supported Measurement_IDs** **- 02: Get_Measurement_Values** After an extension of the PROFIenergy profile further commands and modifiers are possible.
CMD_ PARA	ANY	Parameters for: Get mode: PE_mode_ID **Get measurement values:** **List of Measurement_Ids** Maximum length: = 234 Bytes The complete Service Data Request is registered
CMD_ PARA_LEN	INT	Actual length of the parameters to the command. <= length in CMD_PARAM (is checked by the FB) Maximum: = 234
RES-PONSE _DATA	ANY	PROFIenergy information; according to the command complete Response Telegram in good and error cases including block header. Note: if the buffer is to small, only the number of bytes is registered that are indicated in the ANY protocol.

Output parameters

Table 4-2

Parameter	Data type	Description
VALID	BOOL	Command send successfully
BUSY	BOOL	Command still in progress
ERROR	BOOL	An error occurred during the process
STATUS	DWORD	Block status/error number
ENO	BOOL	Enable Output

Error code

The output parameter STATUS contains error information. If it is interpreted as ARRAY[1...4] OF BYTE the error information is structured as follows:

Table 4-3

Array element	Name	Description
STATUS[1]	Function_Num	B#16#00: no error B#16#DE: read error in data set B#16#DF: write error in data set B#16#C0: PE-FB or SFB 52/53 discovered errors
STATUS[2]	Error_Decode	Place of error detection **80:** DPV1 - Error according to IEC 61158-6 or FB-specific FE:DP/PNIO Profile - PROFIenergy-specific error
STATUS[3]	Error_Code_1	(B#16#...) / (B#16#...): DPV1 Error_Decode 80: - 80: simultaneously a rising edge at input parameters “START” and “END” - 81: length conflict for the parameters CMD_PARAM and CMD_PARAM_LEN 82-8F: further error messages Error_Decode FE: - 01: invalid “Service Request ID” - 02: wrong “Request_Reference” - 03: invalid “Modifier” - 04: invalid “Data Structure Identifier RQ” - 05: invalid “Data Structure Identifier RS” - 06: “PE energy-saving modes” are not supported - 07: “Response” is too long. The current “Response” exceeds the max. transferable length - 08: invalid “Count” - 50: no suitable “energy mode” is available - 51: given time value is not supported - 52: illegal “PE_Mode_ID”
STATUS[4]	Error_Code_2	Manufacturer-specific extension of the error detection

4.3 Response data

Table 4-4

Block definitions	Attributes	Value	Data type	Description
BlockHeader	BlockType	0x0801	Unsigned16	
	BlockLength		Unsigned16	Counted without the BlockType and BlockLength fields
	BlockVersionHigh	0x01	Unsigned8	
	BlockVersionLow	0x00	Unsigned8	
Response Header	Service_Request_ ID	0x01.. 0xFF	Unsigned8	0x01 Start_Pause 0x02 End_Pause 0x03 Query_Modes 0x04 PEM_Status 0x05 PE_Identify 0x06..0x09 reserviert **0x10 Query_Measurement** 0x11..0xCF reserved 0xD0..0xFF manufacturer specific
	Request_Reference	0x01.. 0xFF	Unsigned8	Unique identification number (returned by the server in the answer)
Service Header Response	Status	0x01.. 0xFF	Unsigned8	0x00 - reserved 0x01 - finished 0x02 – finished with error 0x03 – data incomplete 0x04 .. 0xCF - reserved 0xD0.. 0xFF - dependent on Service_Request_ID
	Data_Structure_ Identifier_RS	0x01.. 0xFF	Unsigned8	0x00 - reserved 0x01..0xFF - dependent on Service_Request_ID 0xFF - error
Service Data Response				Dependent on Service_Request_ID

This table shows the principle structure of the fed back data according to the PROFIenergy profile /1/. The commands for “Query measurement” and the resulting composition of the response data are listed in the following chapters.

4.3.1 PE command Query Measurement – Get measurement list

Request

CMD = 16

CMD_ MODIFIER = 1

CMD_PARA_LEN = 0

CMD_PARA = irrelevant

Service-Data-Response

Parameter	Block	Data type
Count*	Header	Unsigned8
reserved	Header	Unsigned8
Measurement_ID**	1. Block	Unsigned16
Accuracy_Domain	1. Block	Unsigned8
Accuracy_Class	1. Block	Unsigned8
Range****	1. Block	Float32
…	…	
Measurement_ID***	x. Block	Unsigned16
Accuracy_Domain	x. Block	Unsigned8
Accuracy_Class	x. Block	Unsigned8
Range****	x. Block	Float32

* number of measurement_IDs

** first supported measurement_ID

*** last supported measurement_ID

**** for Accuracy Domain = 1: gives the maximum value for this ID, otherwise undefined

Accuracy Domain

Table 4-5

Accuracy Domain	Note
0	Reserved
1	The accuracy is given as a percentage of the entire measuring range. The percentage value is encoded as described in Table 4-6 and is output in the Accuracy_Class field.
2	The accuracy is given as a percentage of the current measured value. The percentage value is encoded as described in Table 4-6 and is output in the Accuracy_Class field.
3	The accuracy is given as described in IEC 61557-12. The value is encoded as described in Table 4-7 and is output in the Accuracy_Class field.
4	The accuracy is given as described in IEC 50470-3, chapter 8. The value is encoded as described in Table 4-8 and is output in the Accuracy_Class field.

Accuracy Class

Accuracy Domain 1&2

Table 4-6

Accuracy_Class	Meaning		Accuracy_Class	Meaning
0	Reserved		9	2%
1	0.01%		10	2.5%
2	0.02%		11	3%
3	0.05%		12	5%
4	0.1%		13	10%
5	0.2%		14	20%
6	0.5%		15	>20%
7	1%		>15	Undefined
8	1.5%			

Accuracy Domain 3

Table 4-7

Accuracy_Class	Meaning		Accuracy_Class	Meaning
0	Reserved		8	2.0%
1	0.02%		9	2.5%
2	0.05%		10	3.0%
3	0.1%		11	5.0%
4	0.2%		12	10%
5	0.5%		13	20%
6	1.0%		>13	Undefined
7	1.5%			

Accuracy Domain 4

Table 4-8

Accuracy_Class	Meaning		Accuracy_Class	Meaning
0	Reserved		4	2.0%
1	0.5%		5	2.5%
2	1.0%		6	3.0%
3	1.5%		>6	Undefined

4.3.2 PE command Query Measurement – Get measurement values

Request

CMD = 16

CMD_ MODIFIER = 2

CMD_PARA_LEN = length of the data structure in bytes

CMD_PARA = any-pointer on data structure which is structured as follows:

Parameter	Value	Data type
Count*		Unsigned8
reserved	0x00	Unsigned8
Measurement_ID**		Unsigned16
...		
Measurement_ID***		Unsigned16

* number of measurement_IDs

** first requested measurement value

*** last requested measurement value

Service-Data-Response

Parameter	Block	Value	Data type
Count*	Header		Unsigned8
reserved	Header		Unsigned8
Lenght_of_Structure	1. Block	0x0002...0xFFFF	Unsigned16
Measurement_Data_Structure_ID	1. Block	1=single value	Unsigned8
Measurement_ID**	1. Block	0...FFFF	Unsigned16
Status_of_Measurement_Value	1. Block	1=valid; 2=not available; 3=invalid	Unsigned8
Transmission_Data_Type	1. Block		Float32
End_of_demand (optional)	1. Block	Opt. time stamp data type TimeOfDay	Unsigned32 & Unsigned16
…	…		
Lenght_of_Structure	x. Block	0x0002...0xFFFF	Unsigned16
Measurement_Data_Structure_ID	x. Block	1=single value	Unsigned8
Measurement_ID***	x. Block	0...FFFF	Unsigned16
Status_of_Measurement_Value	x. Block	1=valid; 2=not available; 3=invalid	Unsigned8
Transmission_Data_Type	x. Block		Float32
End_of_demand (optional)	x. Block	Opt. time stamp data type TimeOfDay	Unsigned32 & Unsigned16

* number of measurement values

** first supported measurement value

*** last supported measurement value

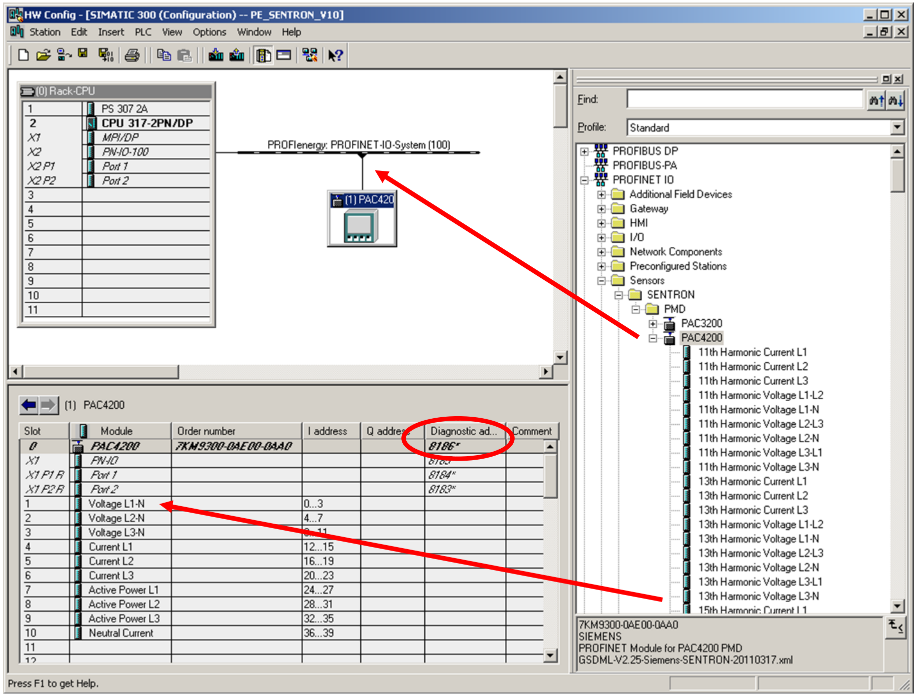
Note Appendix A: Measurement list contains a list with possible measured values from the PROFIenergy specification.

5 Configuration and Settings

You can adapt and change the delivered example program according to your needs and your hardware equipment. In the following chapters the crucial steps of the hardware configuration are described. If you want to integrate the PROFIenergy blocks into an existing software, you can rename them.

5.1 Configuration SENTRON PAC4200 with PN module

Figure 5-1



The project for this application already contains the GSDML for the SENTRON PAC4200 PROFINET communication module. If you are not using the project, install the latest hardware support package (HSP) or the GSDML for Sentron PAC PN module.

Select the PROFIenergy-capable SENTRON PAC4200 measuring device and add it to the PROFINET line.

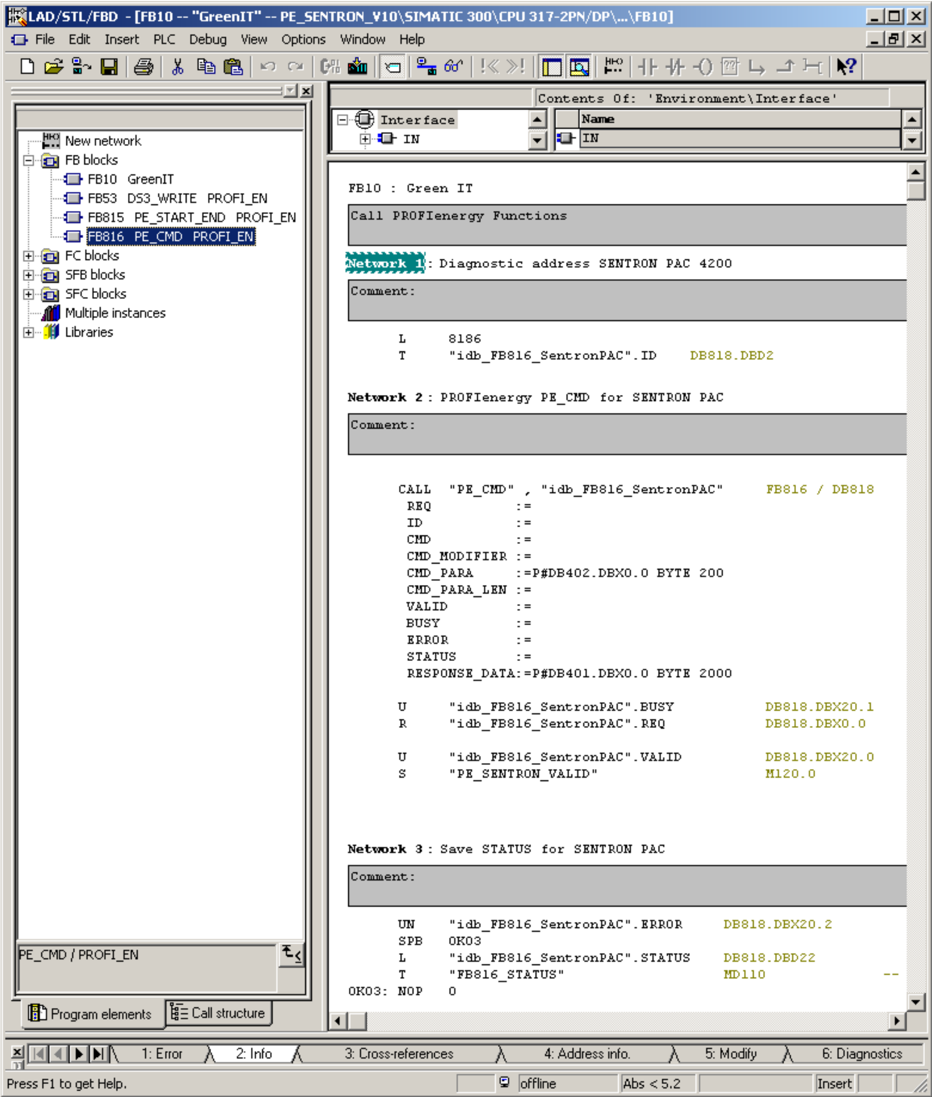
The diagnostic access of the PN module is later required for configuring the FB816, input parameter “ID”.

Add measured values which you want to read cyclically. In this application, these values shall demonstrate the difference between cyclic reading and acyclic reading via PROFIenergy. They are not required for the PROFIenergy function.

5.2 Configuration of the PROFIenergy program

The FB 10 “Green IT” contains a summary of all PROFIenergy functions.

Figure 5-2



Network 1

The static and the dynamic values are written to the iDB:

ID: diagnostic address of the PROFIenergy device from the hardware configuration. Here 8186 for SENTRON PAC4200.

Network 2

FB816 “PE_CMD” for SENTRON PAC is here called and parameterized.

Should you already be familiar with our other PROFIenergy application examples for ET200S and the I-Device Reference to the document: in this application the lengths of the data blocks for CMD_PARA and RESPONSE_DATA, have been extended to be able to receive the measured value lists.

Network 3

In this network the STATUS value is secured in case of an error (ERROR = 1). It must be manually overwritten with “0”.

FB816 “PE_CMD” PROFIenergy Command

In network 2 the FB816 is called up. The addresses for additional command parameters CMD_PARA and for the RESPONSE_DATA are default.

Figure 5-3

```
Network 2 : PROFIenergy PE_CMD for SENTRON PAC

Comment:

      CALL  "PE_CMD" , "idb_FB816_SentronPAC"     FB816 / DB818
       REQ          :=
       ID           :=
       CMD          :=
       CMD_MODIFIER :=
       CMD_PARA     :=P#DB402.DBX0.0 BYTE 200
       CMD_PARA_LEN :=
       VALID        :=
       BUSY         :=
       ERROR        :=
       STATUS       :=
       RESPONSE_DATA:=P#DB401.DBX0.0 BYTE 2000

      U     "idb_FB816_SentronPAC".BUSY           DB818.DBX20.1
      R     "idb_FB816_SentronPAC".REQ            DB818.DBX0.0

      U     "idb_FB816_SentronPAC".VALID          DB818.DBX20.0
      S     "PE_SENTRON_VALID"                    M120.0
```

Parameterization and operation occurs via the respective instance data block DB818 “idb_FB816_SentronPAC”.

Resetting the REQ requirement with BUSY serves the more simple handling, memorizing the VALID serves the sequential control.

The query result is stored in DB401 "Response_Data_2”. The requested data is stored starting from data byte 10. Structure and interpretation of this data area depend on the job.

“Query measurement - Get measurement list” command

Request Data

CMD = 16 “Query measurement”

CMD_ MODIFIER = 1 “Get measurement list”

CMD_PARA_LEN = 0 one further parameter in CMD_PARA

CMD_PARA = not assigned

Service-Data-Response

Parameter	Block	Data type
Count*	Header	Unsigned8
reserved	Header	Unsigned8
Measurement_ID**	1. Block	Unsigned16
Accuracy_Domain	1. Block	Unsigned8
Accuracy_Class	1. Block	Unsigned8
Range****	1. Block	Float32
…	…	
Measurement_ID***	x. Block	Unsigned16
Accuracy_Domain	x. Block	Unsigned8
Accuracy_Class	x. Block	Unsigned8
Range****	x. Block	Float32

* number of measurement_IDs

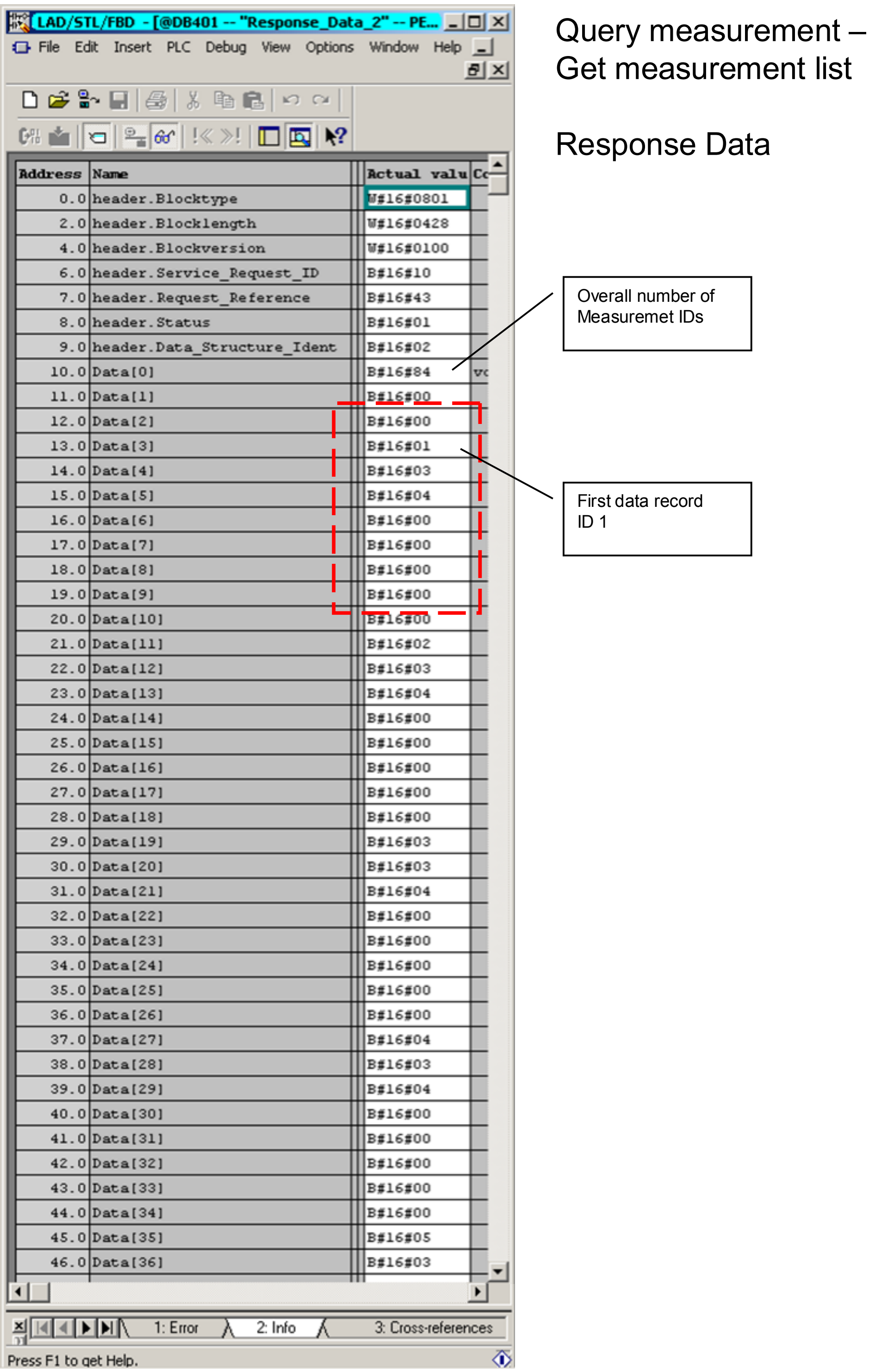
** first supported measurement_ID

*** last supported measurement_ID

**** for Accuracy Domain = 1: gives the maximum value for this ID, otherwise undefined

DB401 “Response_Data_2” to “Get measurement list”

Figure 5-4



Address	Name	Actual valu
0.0	header.Blocktype	W#16#0801
2.0	header.Blocklength	W#16#0428
4.0	header.Blockversion	W#16#0100
6.0	header.Service_Request_ID	B#16#10
7.0	header.Request_Reference	B#16#43
8.0	header.Status	B#16#01
9.0	header.Data_Structure_Ident	B#16#02
10.0	Data[0]	B#16#84
11.0	Data[1]	B#16#00
12.0	Data[2]	B#16#00
13.0	Data[3]	B#16#01
14.0	Data[4]	B#16#03
15.0	Data[5]	B#16#04
16.0	Data[6]	B#16#00
17.0	Data[7]	B#16#00
18.0	Data[8]	B#16#00
19.0	Data[9]	B#16#00
20.0	Data[10]	B#16#00
21.0	Data[11]	B#16#02
22.0	Data[12]	B#16#03
23.0	Data[13]	B#16#04
24.0	Data[14]	B#16#00
25.0	Data[15]	B#16#00
26.0	Data[16]	B#16#00
27.0	Data[17]	B#16#00
28.0	Data[18]	B#16#00
29.0	Data[19]	B#16#03
30.0	Data[20]	B#16#03
31.0	Data[21]	B#16#04
32.0	Data[22]	B#16#00
33.0	Data[23]	B#16#00
34.0	Data[24]	B#16#00
35.0	Data[25]	B#16#00
36.0	Data[26]	B#16#00
37.0	Data[27]	B#16#04
38.0	Data[28]	B#16#03
39.0	Data[29]	B#16#04
40.0	Data[30]	B#16#00
41.0	Data[31]	B#16#00
42.0	Data[32]	B#16#00
43.0	Data[33]	B#16#00
44.0	Data[34]	B#16#00
45.0	Data[35]	B#16#05
46.0	Data[36]	B#16#03

This figure shows the DB401 after the “Get measurement list” command. It contains the list supplied by SENTRON PAC with the IDs of the available measured values. If the DB is too short, a respective message is entered in *header.Status*.

“Query measurement - Get measurement values” command

Request Data

CMD = 16

CMD_ MODIFIER = 2

CMD_PARA_LEN = length of the data structure in bytes

CMD_PARA = any-pointer on data structure which is structured as follows:

Parameter	Value	Data type
Count*		Unsigned8
reserved	0x00	Unsigned8
Measurement_ID**		Unsigned16
...		
Measurement_ID***		Unsigned16

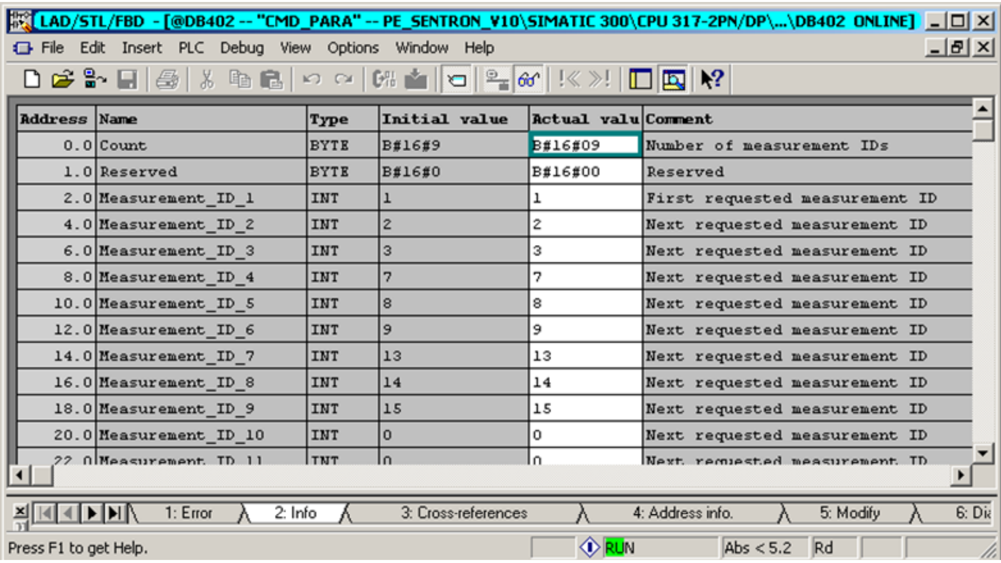
*   number of measurement_IDs

** first requested measurement value

*** last requested measurement value

DB402 “CMD_PARA”

Figure 5-5


LAD/STL/FBD - [@DB402 -- "CMD_PARA" -- PE_SENTRON_V10\SIMATIC 300\CPU 317-2PN/DP\...\DB402 ONLINE]

Address	Name	Type	Initial value	Actual valu	Comment
0.0	Count	BYTE	B#16#9	B#16#09	Number of measurement IDs
1.0	Reserved	BYTE	B#16#0	B#16#00	Reserved
2.0	Measurement_ID_1	INT	1	1	First requested measurement ID
4.0	Measurement_ID_2	INT	2	2	Next requested measurement ID
6.0	Measurement_ID_3	INT	3	3	Next requested measurement ID
8.0	Measurement_ID_4	INT	7	7	Next requested measurement ID
10.0	Measurement_ID_5	INT	8	8	Next requested measurement ID
12.0	Measurement_ID_6	INT	9	9	Next requested measurement ID
14.0	Measurement_ID_7	INT	13	13	Next requested measurement ID
16.0	Measurement_ID_8	INT	14	14	Next requested measurement ID
18.0	Measurement_ID_9	INT	15	15	Next requested measurement ID
20.0	Measurement_ID_10	INT	0	0	Next requested measurement ID
22.0	Measurement_ID_11	INT	0	0	Next requested measurement ID

DB402 was configured to request 9 values (ID:1,2,3,7,8,9,13,14,15) from SENTRON PAC4200. The IDs correspond to voltage, current and effective power for the 3 phases. The list of measurement values is available in Appendix A : Measurement list.

Service-Data-Response

Parameter	**Value**	**Data type**
Count*		Unsigned8
reserved		Unsigned8
Lenght_of_Structure	0x0002...0xFFFF	Unsigned16
Measurement_Data_Structure_ID	1=single value	Unsigned8
Measurement_ID**	0...FFFF	Unsigned16
Status_of_Measurement_Value	1=valid; 2=not available; 3=invalid	Unsigned8
Transmission_Data_Type		Float32
End_of_demand (optional)	Opt. time stamp data type TimeOfDay	Unsigned32 + Unsigned16
…		

* number of measurement values

** first supported measurement value

End_Of_demand

This optional value is a time stamp which marks the end of the time range within which this value was determined.

Whether the value is delivered can be determined via ***Length_of_Structure***:

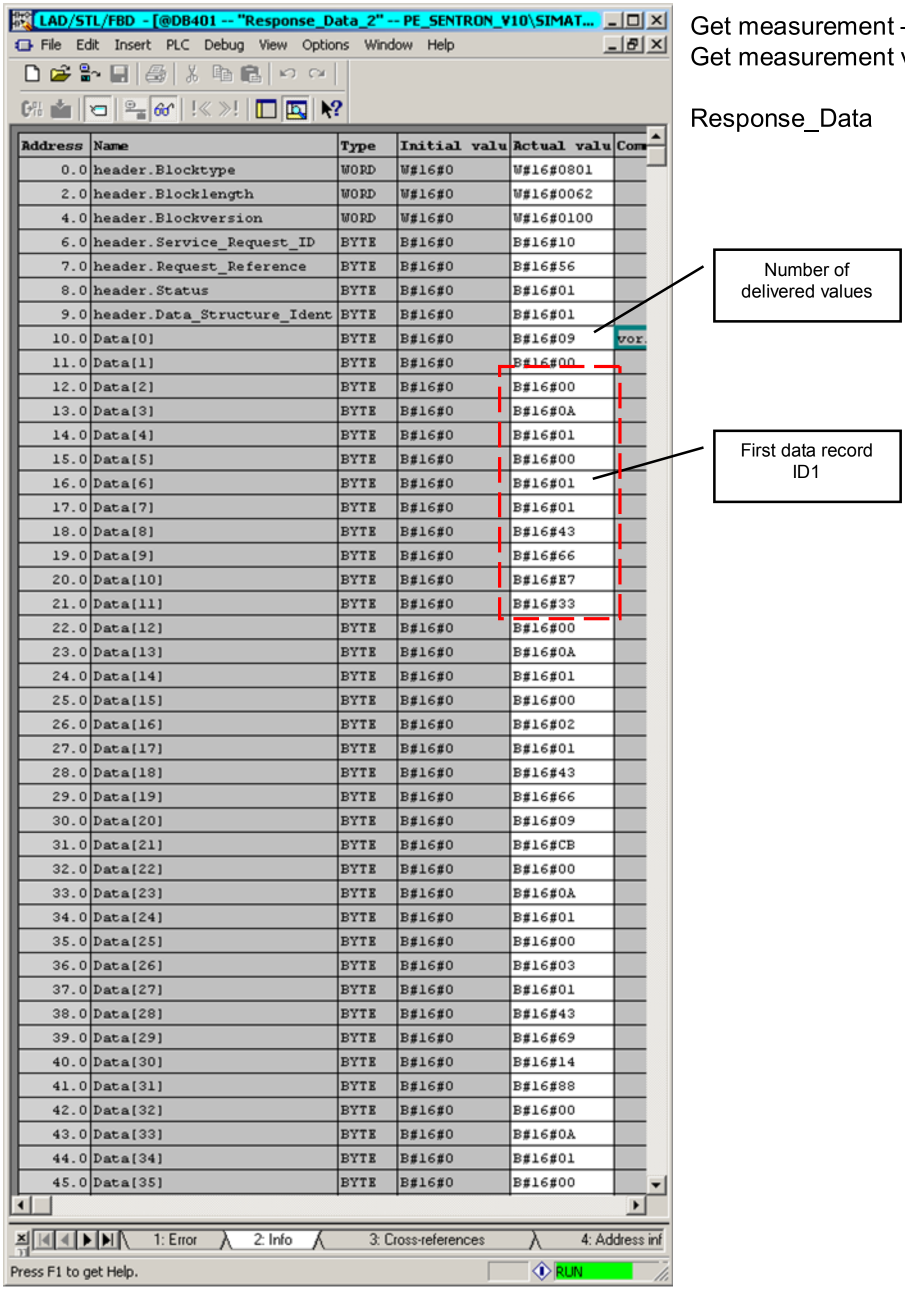
- without this value, the length is 10 bytes (A_{Hex})
- with this value it is 16 (10_{Hex}).

Values determined via a time range are IDs 190 to 198.

SENTRON PAC4200 will supply this time stamp with the next FW version.

DB401 “Response_Data_2” to “Get measurement values”

Figure 5-6



Address	Name	Type	Initial valu	Actual valu	Com
0.0	header.Blocktype	WORD	W#16#0	W#16#0801	
2.0	header.Blocklength	WORD	W#16#0	W#16#0062	
4.0	header.Blockversion	WORD	W#16#0	W#16#0100	
6.0	header.Service_Request_ID	BYTE	B#16#0	B#16#10	
7.0	header.Request_Reference	BYTE	B#16#0	B#16#56	
8.0	header.Status	BYTE	B#16#0	B#16#01	
9.0	header.Data_Structure_Ident	BYTE	B#16#0	B#16#01	
10.0	Data[0]	BYTE	B#16#0	B#16#09	vor.
11.0	Data[1]	BYTE	B#16#0	B#16#00	
12.0	Data[2]	BYTE	B#16#0	B#16#00	
13.0	Data[3]	BYTE	B#16#0	B#16#0A	
14.0	Data[4]	BYTE	B#16#0	B#16#01	
15.0	Data[5]	BYTE	B#16#0	B#16#00	
16.0	Data[6]	BYTE	B#16#0	B#16#01	
17.0	Data[7]	BYTE	B#16#0	B#16#01	
18.0	Data[8]	BYTE	B#16#0	B#16#43	
19.0	Data[9]	BYTE	B#16#0	B#16#66	
20.0	Data[10]	BYTE	B#16#0	B#16#E7	
21.0	Data[11]	BYTE	B#16#0	B#16#33	
22.0	Data[12]	BYTE	B#16#0	B#16#00	
23.0	Data[13]	BYTE	B#16#0	B#16#0A	
24.0	Data[14]	BYTE	B#16#0	B#16#01	
25.0	Data[15]	BYTE	B#16#0	B#16#00	
26.0	Data[16]	BYTE	B#16#0	B#16#02	
27.0	Data[17]	BYTE	B#16#0	B#16#01	
28.0	Data[18]	BYTE	B#16#0	B#16#43	
29.0	Data[19]	BYTE	B#16#0	B#16#66	
30.0	Data[20]	BYTE	B#16#0	B#16#09	
31.0	Data[21]	BYTE	B#16#0	B#16#CB	
32.0	Data[22]	BYTE	B#16#0	B#16#00	
33.0	Data[23]	BYTE	B#16#0	B#16#0A	
34.0	Data[24]	BYTE	B#16#0	B#16#01	
35.0	Data[25]	BYTE	B#16#0	B#16#00	
36.0	Data[26]	BYTE	B#16#0	B#16#03	
37.0	Data[27]	BYTE	B#16#0	B#16#01	
38.0	Data[28]	BYTE	B#16#0	B#16#43	
39.0	Data[29]	BYTE	B#16#0	B#16#69	
40.0	Data[30]	BYTE	B#16#0	B#16#14	
41.0	Data[31]	BYTE	B#16#0	B#16#88	
42.0	Data[32]	BYTE	B#16#0	B#16#00	
43.0	Data[33]	BYTE	B#16#0	B#16#0A	
44.0	Data[34]	BYTE	B#16#0	B#16#01	
45.0	Data[35]	BYTE	B#16#0	B#16#00	

Get measurement –
Get measurement values

Response_Data

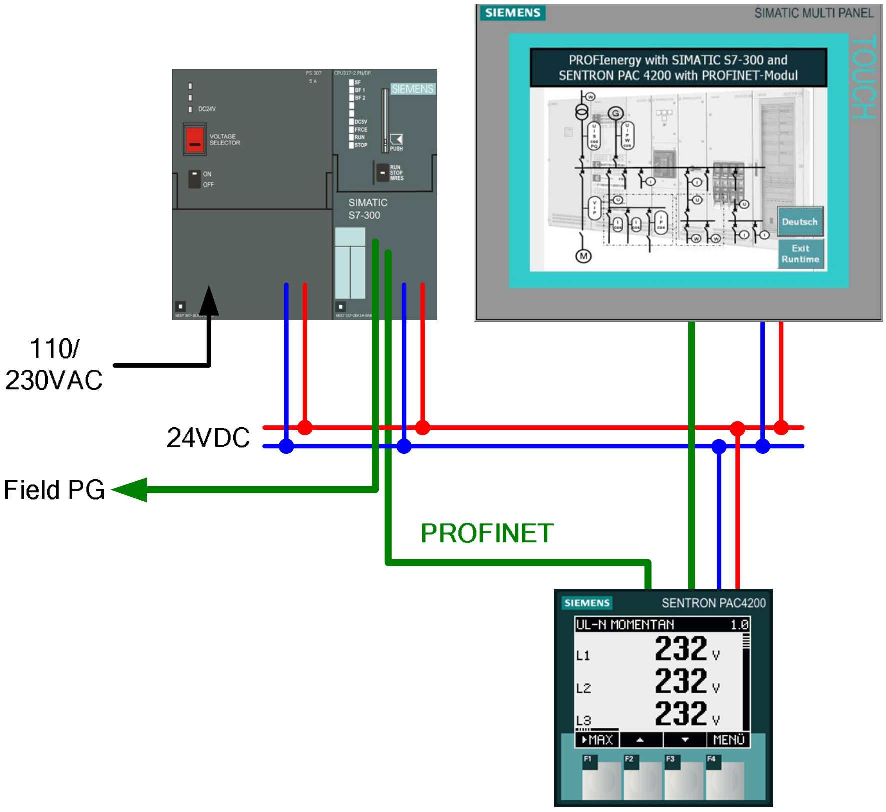
This figure shows the DB401 after the “Get measurement values” command. It contains the list supplied by SENTRON PAC with the requested measured values. If the DB is too short, a respective message is entered in *header.Status*.

6 Installation

6.1 Installation of the hardware

The figure below shows the hardware setup of the application.

Figure 6-1



The displayed Multi Panel is optional.

An MMC memory card is required for the S7 CPU.

DANGER

Please observe the relevant safety regulations for all connecting works!

CAUTION

For the SENTRON PAC4200 please select the voltage supply suitable for the type of your device (< 80 V DC / 95-240V AC)!

The type of measuring circuit selected by you depends on your test setup.

Please observe the notes in the manuals. /3/

CAUTION

For multi-range power supplies you must see to the correct setting of the selector switch for the input voltage.

Note

The setup guidelines for SIMATIC S7 must generally be followed.

6.2 Software installation

Configuration with PROFIenergy-capable modules requires STEP 7 version 5.5. Install them according to the delivered installation instructions. Additional software packages or special settings for PROFIenergy are not required.

If you wish to operate the system via a panel or the corresponding Runtime you should install the current WinCC flexible Version 2008. This is optional as PROFIenergy runs independently from WinCC flexible.

Operating SENTRON PAC with PROFIenergy requires the following block and the respective SFB's:

- FB816 "PE_CMD"

You find all blocks in the STEP 7 project of the application example. You can copy all delivered blocks into a user-specific project and, if required, rename them. You can use all PROFIenergy blocks without a license.

6.3 Installation of the application project

Download the application project from our Service & Support Portal. You find the link to the site at the beginning of this document Reference to the document. Copy the project (STEP 7 archive in zip-format) to the configuration computer (SIMATIC Field PG) and open it in the SIMATIC Manager via the "File->Retrieve..." menu.

7 Starting up the Application

7.1 Preparation

Table 7-1

No.	Action	Remarks
1	Make sure that the hardware structure and configuration correspond.	
2	Check the voltage supply settings. Switch on the plant.	Pay attention to all necessary provisions and safety regulations.
	If necessary, download the latest firmware for CPU and SENTRON PAC from our Service & Support portal and update the modules.	Follow the respective manuals and added instructions.
3	Connect the SIMATIC Field PG to the plant and select the correct interface via the “Select PG/PC interface...” function.	You find these settings, among others, under “Extras” in the main menu.

7.2 Commissioning

Table 7-2

No.	Action	Remarks
1	Assign device names and IP addresses for the nodes: S7-CPU 317 X2 PN-IO: Name: PN-IO-100, IP address: 192.168.1.100 SENTRON PAC4200 PN module: Device name: PAC4200 IP-address: 192.168.1.111	Use the functions in the hardware configuration under “PLC” -> “Ethernet”: - “Edit Ethernet nodes” and - “Assign Device Name”
2	Download the hardware configuration to the CPU.	
3	Download the application program to the CPU.	
4	No errors should be pending and the CPU should be in “RUN” mode.	
5	When using WinCC flexible, open the SIMATIC HMI station and the WinCC flexible project now.	
6	When not using a panel, you can start the Runtime directly.	via “Project” -> “Generator” -> “Start Runtime”
7	When using a panel, set “Ethernet” and the following IP address on it now: 192.168.1.103	via “Control Panel” -> “Transfer” -> “Advanced” -> “LAN”
8	Set the panel to “Transfer” and load the project from the PG to the panel.	

8 Operation of the Application

8.1 Overview

There are three options for operating the plant:

- HMI panel
- HMI Runtime (equivalent to the panel)
- Variable table in STEP 7

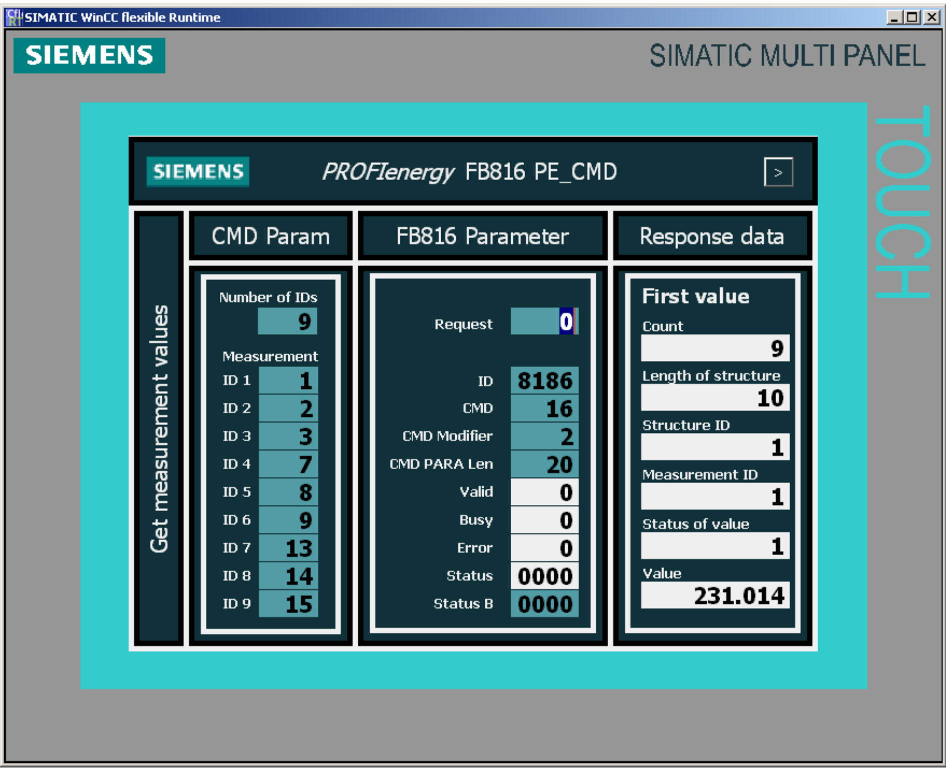
There are no functional differences, only the way how control bits are set differs. In a real application a time- or event-controlled program would set the corresponding control bits.

“Get measurement list” is only necessary once for a new and possibly unknown device. During runtime the once configured list with the Measurement IDs is simply read again and again.

8.2 Operation with HMI

Open the “FB816 PE_CMD” window. This window is intended primarily for “Get measurement values”. After downloading the CPU the parameters are set as illustrated below. If they were set in the course of the operation, you correct them, e.g. via the VAT “Get_Values” or a restart of the CPU (OB100).

Figure 8-1



Changing the “Request” parameter from “0” to “1” triggers the read process. 9 IDs are read as listed in the left block. The first value is displayed in the right block.

“Read value 195” scenario

Figure 8-2

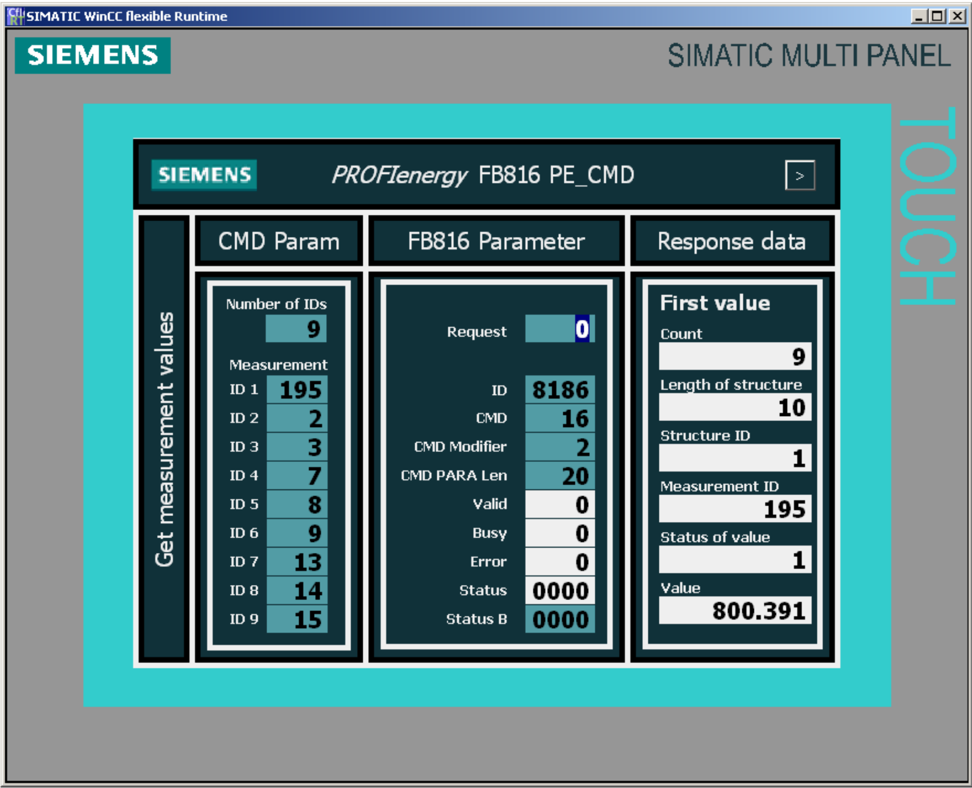


Table 8-1

No.	Action	Remarks
1	The appendix contains a table with possible PROFIenergy values. SENTRON supports all values. In this example we wish to read the value ID=195 “Maximum Active power within demand”.	The time range is 900 seconds here.
2	Change the ID 1 to “195”.	Don’t forget “Return”, otherwise the value is not accepted.
3	Start the read process with Request = 1	If an error occurs, the value is displayed permanently in STATUS-B.
4	In the output field “First value” the new value is displayed.	The length of the data block is 10 bytes, since currently no time stamp is delivered for the requested time range. From the next FW-version of the PAC onward, the “End of demand” parameter is also supplied which extends the data block accordingly.

“Read unknown value” scenario

Figure 8-3

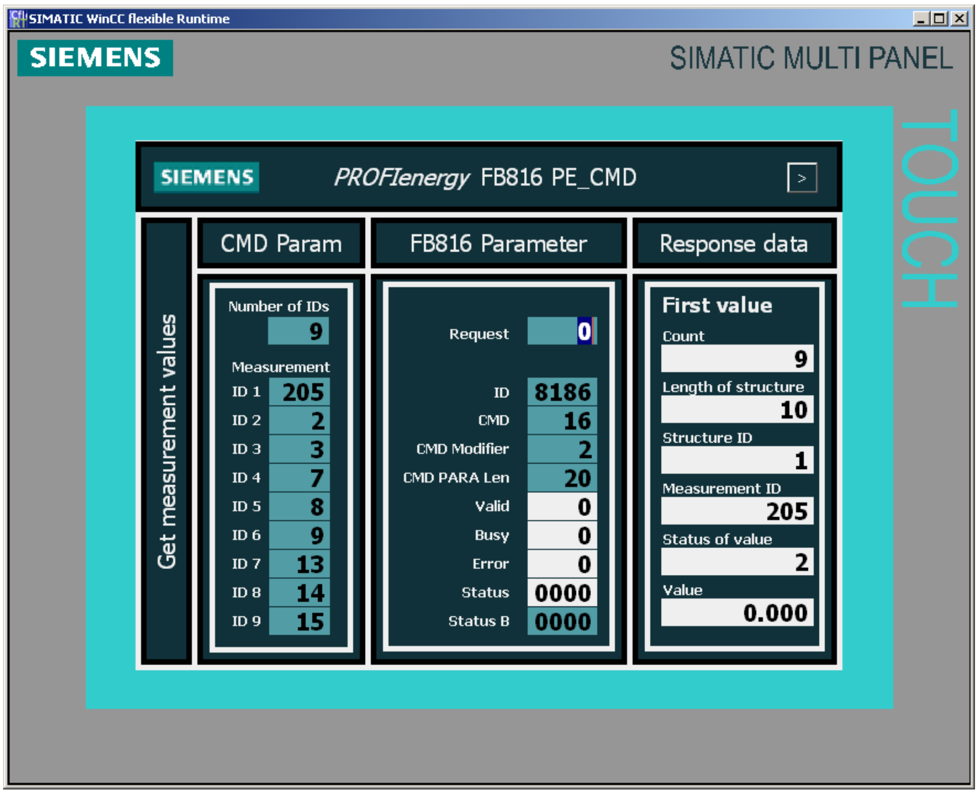


Table 8-2

No.	Action	Remarks
1	The appendix contains a table with possible PROFIenergy values. SENTRON supports all values. In this example we wish to read the value ID=205.	This value is currently unknown to PROFIenergy and does not exist.
2	Change the ID 1 to “205”.	Don’t forget “Return”, otherwise the value is not accepted.
3	Start the read process with Request = 1	If an error occurs, the value is displayed permanently in STATUS-B.
4	Start the read process with Request = 1	The PROFIenergy command is triggered.
5	In the output field “First value” the new value is displayed.	Value “2” has been entered in “Status of value”, i.e. “Value does not exist”. See also chapter 4.2.2 Service_Data_Response.
6	Don’t forget to set ID 1 back to “1”.	

8.3 Operation via variable table (VAT)

Below, the respective command bits are described in the variable tables. The panel is no longer required here.

VAT_SENTRON_Get_List

Figure 8-4

Var - [VAT_SENTRON_Get_List -- @PE_SENTRON_V10\SIMATIC 300\CPU 317-2PN/DP\S7 Program...

Table Edit Insert PLC Variable View Options Window Help

	Address	Symbol	Display format	Status value	Modify value
1	MD 110	"FB816_STATUS"	HEX	DW#16#00000000	
2					
3	// FB816 PE_CMD open interface				
4	// REQ enable				
5	DB818.DBX 0.0	"idb_FB816_SentronPAC".REQ	BOOL	false	
6	// ID Diagnosticaddress PE-Device 1: "8184" or 2:"8178"				
7	DB818.DBD 2	"idb_FB816_SentronPAC".ID	DEC	L#8186	L#8186
8	// CMD				
9	// 1 = Start Pause 2 = End Pause				
10	// 3 = Query Modes 4 = PEM Status				
11	// 5 = PE Identify 16 = Query Measurment				
12	DB818.DBB 6	"idb_FB816_SentronPAC".CMD	DEC	16	16
13	// CMD_MODIFIER Command Modifier				
14	DB818.DBB 7	"idb_FB816_SentronPAC".CMD_MODIFIER	DEC	1	1
15	// CMD_PARA Command Parameter Pointer to Array DB402				
16	//				
17	DB402.DBB 0	"CMD_PARA".Count	HEX	B#16#00	B#16#00
18	// CMD_PARA_LEN Command length				
19	DB818.DBW 18	"idb_FB816_SentronPAC".CMD_PARA_LEN	DEC	0	0
20	// VALID				
21	DB818.DBX 20.0	"idb_FB816_SentronPAC".VALID	BOOL	false	
22	// BUSY Bearbeitung läuft				
23	DB818.DBX 20.1	"idb_FB816_SentronPAC".BUSY	BOOL	false	
24	// ERROR				
25	DB818.DBX 20.2	"idb_FB816_SentronPAC".ERROR	BOOL	false	
26	// STATUS				
27	DB818.DBD 22	"idb_FB816_SentronPAC".STATUS	HEX	DW#16#00000000	
28					
29	// RESPONSE_DATA				
30	// depends on Command ...				
31	// Count				
32	DB401.DBB 10	"Response_Data_2".Data[0]	HEX	B#16#84	
33	// First measuremet ID				
34	DB401.DBW 12		DEC	1	
35	// Accuracy_Domain				
36	DB401.DBB 14	"Response_Data_2".Data[4]	DEC	3	
37	// Accuracy_Class				
38	DB401.DBB 15	"Response_Data_2".Data[5]	DEC	4	
39	// Range				
40	DB401.DBD 16		FLOATING_POINT	0.0	
41					
42	// 2. measuremet ID				
43	DB401.DBW 20		DEC	2	
44	// Accuracy_Domain				
45	DB401.DBB 22	"Response_Data_2".Data[12]	DEC	3	
46	// Accuracy_Class				
47	DB401.DBB 23	"Response_Data_2".Data[13]	DEC	4	
48	// Range				
49	DB401.DBD 24		FLOATING_POINT	0.0	
50					

PE_SENTRON_V10\SIMATIC 300\...\S7 Program(2) RUN Abs < 5.2

First phase: Adjust parameters

Activate the control values with “Modify variable”:

- CMD = 16 for the “Query measurement” command
- CMD_MODIFIER = 1 for sub-command “Get measurement list”
- CMD_PARA_LEN = 0 since no “CMD_PARAmeters” are required.

Now you have adjusted the parameterization for “Get measurement list”.

Second phase: Trigger a command

Start the query with an edge on line 5 “REQ = 1”.

Third step: Result:

After processing the command without errors, you see the complete list sent by SENTRON PAC4200 in DB401 “Respond_Data_2”.

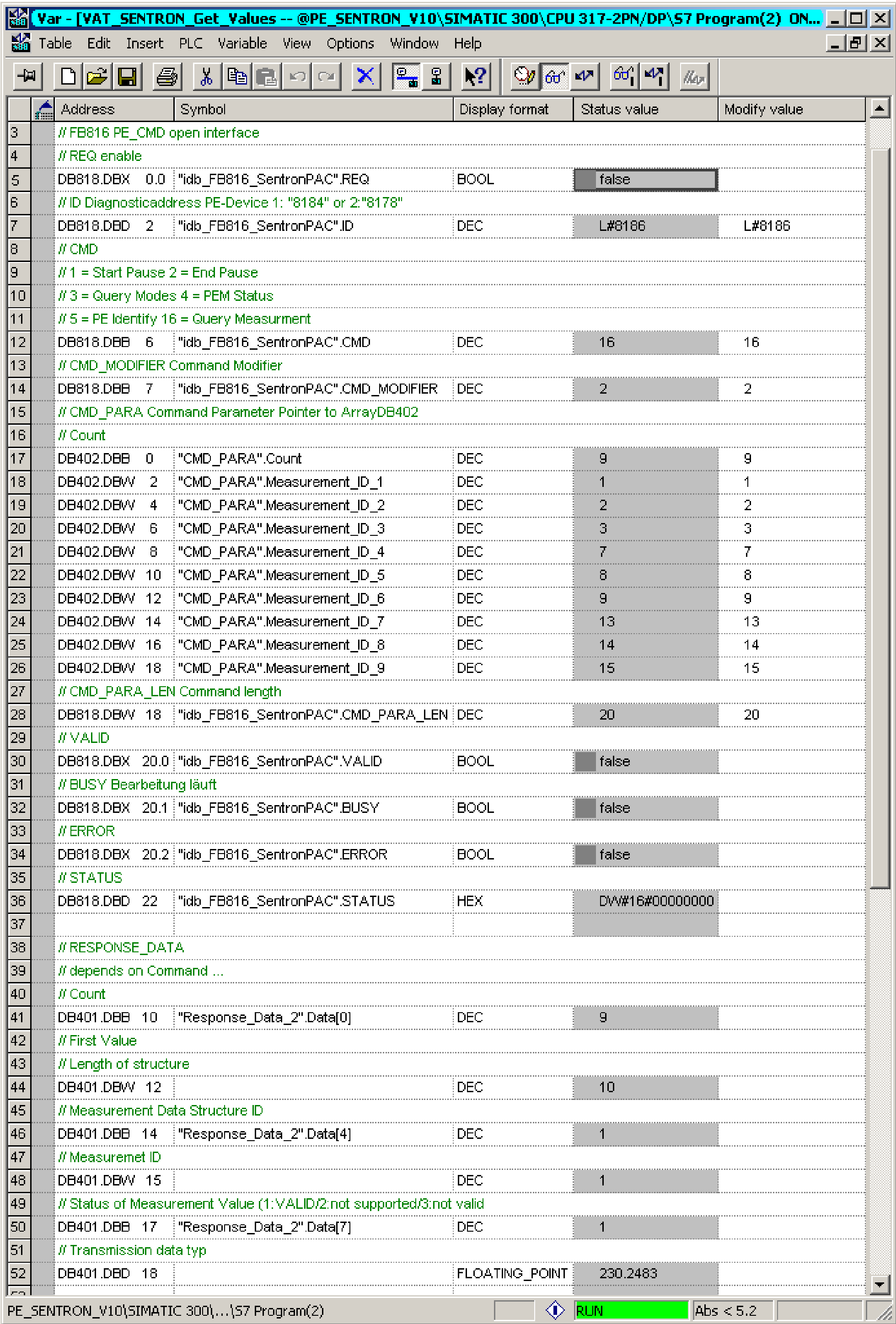
If DB401 is too short, only part of the list is delivered and a respective error message is entered in the header.

The meaning of the individual IDs is available in Appendix A : Measurement list.

See also PE command Query Measurement – Get measurement list.

VAT_SENTRON_Get_Values

Figure 8-5



	Address	Symbol	Display format	Status value	Modify value
3	// FB816 PE_CMD open interface				
4	// REQ enable				
5	DB818.DBX 0.0	"idb_FB816_SentronPAC".REQ	BOOL	false	
6	// ID Diagnosticaddress PE-Device 1: "8184" or 2:"8178"				
7	DB818.DBD 2	"idb_FB816_SentronPAC".ID	DEC	L#8186	L#8186
8	// CMD				
9	// 1 = Start Pause 2 = End Pause				
10	// 3 = Query Modes 4 = PEM Status				
11	// 5 = PE Identify 16 = Query Measurment				
12	DB818.DBB 6	"idb_FB816_SentronPAC".CMD	DEC	16	16
13	// CMD_MODIFIER Command Modifier				
14	DB818.DBB 7	"idb_FB816_SentronPAC".CMD_MODIFIER	DEC	2	2
15	// CMD_PARA Command Parameter Pointer to ArrayDB402				
16	// Count				
17	DB402.DBB 0	"CMD_PARA".Count	DEC	9	9
18	DB402.DBW 2	"CMD_PARA".Measurement_ID_1	DEC	1	1
19	DB402.DBW 4	"CMD_PARA".Measurement_ID_2	DEC	2	2
20	DB402.DBW 6	"CMD_PARA".Measurement_ID_3	DEC	3	3
21	DB402.DBW 8	"CMD_PARA".Measurement_ID_4	DEC	7	7
22	DB402.DBW 10	"CMD_PARA".Measurement_ID_5	DEC	8	8
23	DB402.DBW 12	"CMD_PARA".Measurement_ID_6	DEC	9	9
24	DB402.DBW 14	"CMD_PARA".Measurement_ID_7	DEC	13	13
25	DB402.DBW 16	"CMD_PARA".Measurement_ID_8	DEC	14	14
26	DB402.DBW 18	"CMD_PARA".Measurement_ID_9	DEC	15	15
27	// CMD_PARA_LEN Command length				
28	DB818.DBW 18	"idb_FB816_SentronPAC".CMD_PARA_LEN	DEC	20	20
29	// VALID				
30	DB818.DBX 20.0	"idb_FB816_SentronPAC".VALID	BOOL	false	
31	// BUSY Bearbeitung läuft				
32	DB818.DBX 20.1	"idb_FB816_SentronPAC".BUSY	BOOL	false	
33	// ERROR				
34	DB818.DBX 20.2	"idb_FB816_SentronPAC".ERROR	BOOL	false	
35	// STATUS				
36	DB818.DBD 22	"idb_FB816_SentronPAC".STATUS	HEX	DW#16#00000000	
37					
38	// RESPONSE_DATA				
39	// depends on Command ...				
40	// Count				
41	DB401.DBB 10	"Response_Data_2".Data[0]	DEC	9	
42	// First Value				
43	// Length of structure				
44	DB401.DBW 12		DEC	10	
45	// Measurement Data Structure ID				
46	DB401.DBB 14	"Response_Data_2".Data[4]	DEC	1	
47	// Measuremet ID				
48	DB401.DBW 15		DEC	1	
49	// Status of Measurement Value (1:VALID/2:not supported/3:not valid				
50	DB401.DBB 17	"Response_Data_2".Data[7]	DEC	1	
51	// Transmission data typ				
52	DB401.DBD 18		FLOATING_POINT	230.2483	

First phase: Adjust parameters

Activate the control values with "Modify variable":

- CMD = 16 for the "Query measurement" command
- CMD_MODIFIER = 2 for sub-command "Get measurement values"
- CMD_PARA is preassigned with the list of the IDs:
  - Count = 9 for the number of the IDs
  - Measuremet_ID_1 = 1 for "Voltage a-n"
  - Measuremet_ID_2 = 2 for "Voltage b-n"
  - Measuremet_ID_3 = 3 for "Voltage c-n"
  - Measuremet_ID_4 = 7 for "Current a"
  - Measuremet_ID_5 = 8 for "Current b"
  - Measuremet_ID_6 = 9 for "Current c"
  - Measuremet_ID_7 = 13 for "Active Power a"
  - Measuremet_ID_8 = 14 for "Active Power b"
  - Measuremet_ID_9 = 15 for "Active Power c"
- CMD_PARA_LEN = 20 for the length of the CMD_Parameter (10 x INT16)

Now you have adjusted the parameterization for "Get measurement values".

Second phase: Trigger a command

Start the query with an edge on line 5 "REQ = 1".

Third step: Result:

After processing the command without errors, you see the complete list sent by SENTRON PAC4200 in DB401 "Respond_Data_2".

If DB401 is too short, only part of the list is delivered and a respective error message is entered in the header.

The meaning of the individual IDs is available in Appendix A : Measurement list.

See also PE command Query Measurement – Get measurement list.

9 Appendix

9.1 Appendix A: Measurement list

The supported measured values are module-specific. The following list was taken from the Technical Specification PROFIenergy (Table 10-1).

9.1.1 Instantaneous measurements

Table 9-1

Measurement ID	Measurements	Unit	Phase	Aggregation	Duration
1	Voltage	V	a-n	rms	
2	Voltage	V	b-n	rms	
3	Voltage	V	c-n	rms	
4	Voltage	V	a-b	rms	
5	Voltage	V	b-c	rms	
6	Voltage	V	c-a	rms	
7	Current	A	a	rms	
8	Current	A	b	rms	
9	Current	A	c	rms	
10	Apparent Power	VA	a	Sliding Demand	200 ms
11	Apparent Power	VA	b	Sliding Demand	200 ms
12	Apparent Power	VA	c	Sliding Demand	200 ms
13	Active Power	W	a	Sliding Demand	200 ms
14	Active Power	W	b	Sliding Demand	200 ms
15	Active Power	W	c	Sliding Demand	200 ms
16	Reactive Power Qn	var	a	Sliding Demand	200 ms
17	Reactive Power Qn	var	b	Sliding Demand	200 ms
18	Reactive Power Qn	var	c	Sliding Demand	200 ms
19	Power factor	non	a	Sliding Demand	200 ms
20	Power factor	non	b	Sliding Demand	200 ms
21	Power factor	non	c	Sliding Demand	200 ms
22					
…					
29					
30	Frequency	Hz	total	Sliding Demand	10 s
31	Voltage	V	average-ph-n	rms	
32	Voltage	V	average-ph-ph	rms	
33	Current	A	average-abc	rms	
34	Reactive Power Qn	W	total	Sliding Demand	200 ms
35	Active Power	var	total	Sliding Demand	200 ms
36	Apparent Power	VA	total	Sliding Demand	200 ms

37	Power factor	non	total	Sliding Demand	200 ms
38					
39					
Maximum					
40	Maximum Voltage	V	a-n	rms	
41	Maximum Voltage	V	b-n	rms	
42	Maximum Voltage	V	c-n	rms	
43	Maximum Voltage	V	a-b	rms	
44	Maximum Voltage	V	b-c	rms	
45	Maximum Voltage	V	c-a	rms	
46	Maximum Current	A	a	rms	
47	Maximum Current	A	b	rms	
48	Maximum Current	A	c	rms	
49	Maximum Apparent Power	VA	a	Sliding Demand	200 ms
50	Maximum Apparent Power	VA	b	Sliding Demand	200 ms
51	Maximum Apparent Power	VA	c	Sliding Demand	200 ms
52	Maximum Active Power	W	a	Sliding Demand	200 ms
53	Maximum Active Power	W	b	Sliding Demand	200 ms
54	Maximum Active Power	W	c	Sliding Demand	200 ms
55	Maximum Reactive Power Qn	var	a	Sliding Demand	200 ms
56	Maximum Reactive Power Qn	var	b	Sliding Demand	200 ms
57	Maximum Reactive Power Qn	var	c	Sliding Demand	200 ms
58	Maximum Power factor	non	a	Sliding Demand	200 ms
59	Maximum Power factor	non	b	Sliding Demand	200 ms
60	Maximum Power factor	non	c	Sliding Demand	200 ms
61	Maximum Frequency	Hz	total	Sliding Interval	10 s
62	Maximum Voltage	V	average-ph-n	rms	

63	Maximum Voltage	V	average-ph-ph	rms	
64	Maximum Current	A	average-abc	rms	
65	Maximum Active Power	W	total	Sliding Demand	200 ms
66	Maximum Reactive Power Qn	var	total	Sliding Demand	200 ms
67	Maximum Apparent Power	VA	total	Sliding Demand	200 ms
68	Maximum Power factor	non	total	Sliding Demand	200 ms
Minimum					
70	Minimum Voltage	V	a-n	rms	
71	Minimum Voltage	V	b-n	rms	
72	Minimum Voltage	V	c-n	rms	
73	Minimum Voltage	V	a-b	rms	
74	Minimum Voltage	V	b-c	rms	
75	Minimum Voltage	V	c-a	rms	
76	Minimum Current	A	a	rms	
77	Minimum Current	A	b	rms	
78	Minimum Current	A	c	rms	
79	Minimum Apparent Power	VA	a	Sliding Demand	200 ms
80	Minimum Apparent Power	VA	b	Sliding Demand	200 ms
81	Minimum Apparent Power	VA	c	Sliding Demand	200 ms
82	Minimum Active Power	W	a	Sliding Demand	200 ms
83	Minimum Active Power	W	b	Sliding Demand	200 ms
84	Minimum Active Power	W	c	Sliding Demand	200 ms
85	Minimum Reactive Power Qn	var	a	Sliding Demand	200 ms
86	Minimum Reactive Power Qn	var	b	Sliding Demand	200 ms
87	Minimum Reactive Power Qn	var	c	Sliding Demand	200 ms
88	Minimum Power factor	1	a	Sliding Demand	200 ms
89	Minimum Power factor	1	b	Sliding Demand	200 ms
90	Minimum Power factor	1	c	Sliding Demand	200 ms

91	Minimum Frequency	Hz	total	Sliding Demand	10 s
92	Minimum Voltage	V	average-ph-n	rms	
93	Minimum Voltage	V	average-ph-ph	rms	
94	Minimum Current	A	average-abc	rms	
95	Minimum Active Power	W	total	Sliding Demand	200 ms
96	Minimum Reactive Power Qn	var	total	Sliding Demand	200 ms
97	Minimum Apparent Power	VA	total	Sliding Demand	200 ms
98	Minimum Power factor	non	total	Sliding Demand	200 ms

9.1.2 Demand measurements

Demand measurements are averages over a certain time.

Table 9-2

Measurement ID	Measurements	Unit	Phase	Aggregation	Duration 1)	Sub_block 1)	End_time 1)
150	Voltage	V	a-n	Sliding Demand	3 s	not defined	not defined
151	Voltage	V	b-n	Sliding Demand	3 s	not defined	not defined
152	Voltage	V	c-n	Sliding Demand	3 s	not defined	not defined
153	Voltage	V	a-b	Sliding Demand	3 s	not defined	not defined
154	Voltage	V	b-c	Sliding Demand	3 s	not defined	not defined
155	Voltage	V	c-a	Sliding Demand	3 s	not defined	not defined
156	Current	A	a	Sliding Demand	600 s	not defined	not defined
157	Current	A	b	Sliding Demand	600 s	not defined	not defined
158	Current	A	c	Sliding Demand	600 s	not defined	not defined
160	Voltage	V	average -ph-n	Sliding Demand	3 s	not defined	not defined
161	Voltage	V	average -ph-ph	Sliding Demand	3 s	not defined	not defined
162	Current	A	average -abc	Sliding Demand	600 s	not defined	not defined
163	Active Power	W	total	Sliding Demand	900 s	not defined	not defined
164	Reactive Power Qn	var	total	Sliding Demand	900 s	not defined	not defined
165	Apparent Power	VA	total	Sliding Demand	900 s	not defined	not defined
166	Power factor	1	total	Sliding Demand	not defined	not defined	not defined
167							

Maximum							
170	Maximum Voltage	V	a-n	Sliding Demand	3 s	not defined	not defined
171	Maximum Voltage	V	b-n	Sliding Demand	3 s	not defined	not defined
172	Maximum Voltage	V	c-n	Sliding Demand	3 s	not defined	not defined
173	Maximum Voltage	V	a-b	Sliding Demand	3 s	not defined	not defined
174	Maximum Voltage	V	b-c	Sliding Demand	3 s	not defined	not defined
175	Maximum Voltage	V	c-a	Sliding Demand	3 s	not defined	not defined
176	Maximum Current	A	a	Sliding Demand	600 s	not defined	not defined
177	Maximum Current	A	b	Sliding Demand	600 s	not defined	not defined
178	Maximum Current	A	c	Sliding Demand	600 s	not defined	not defined
Minimum							
180	Minimum Voltage	V	a-n	Sliding Demand	3 s	not defined	not defined
181	Minimum Voltage	V	b-n	Sliding Demand	3 s	not defined	not defined
182	Minimum Voltage	V	c-n	Sliding Demand	3 s	not defined	not defined
183	Minimum Voltage	V	a-b	Sliding Demand	3 s	not defined	not defined
184	Minimum Voltage	V	b-c	Sliding Demand	3 s	not defined	not defined
185	Minimum Voltage	V	c-a	Sliding Demand	3 s	not defined	not defined
186	Minimum Current	A	a	Sliding Demand	600 s	not defined	not defined
187	Minimum Current	A	b	Sliding Demand	600 s	not defined	not defined
188	Minimum Current	A	c	Sliding Demand	600 s	not defined	not defined

190	Apparent power	VA	total	Fixed Block	900 s	1	jj.mm.dd.hh. min.sec
191	Active power import	W	total	Fixed Block	900 s	1	jj.mm.dd.hh. min.sec
192	Reactive power import	var	total	Fixed Block	900 s	1	jj.mm.dd.hh. min.sec
193	Active power export	W	total	Fixed Block	900 s	1	jj.mm.dd.hh. min.sec
194	Reactive power export	var	total	Fixed Block	900 s	1	jj.mm.dd.hh. min.sec
195	Maximum Active power with in demand	W	total	Fixed Block	900 s	1	jj.mm.dd.hh. min.sec
196	Minimum Active power with in demand	W	total	Fixed Block	900 s	1	jj.mm.dd.hh. min.sec
197	Maximum Reactive power with in demand	var	total	Fixed Block	900 s	1	jj.mm.dd.hh. min.sec
198	Minimum Reactive power with in demand	var	total	Fixed Block	900 s	1	jj.mm.dd.hh. min.sec

1) These are typical attributes for demand measurements. They may be defined vendor specific.
The Transmission Data Type for all demand measurements will be Float32 in first step

9.1.3 Energy measurements

Table 9-3

Measurement ID	Measurements	Unit	Phase	Tariff
200	Active Energy Import	V	total	User defined
201	Active Energy Export	V	total	User defined
202	Reactive Energy Import	V	total	User defined
203	Reactive Energy Export	V	total	User defined
204	Apparent Energy	V	total	User defined

10 Links & Literature

Further Literature

This list is by no means complete and only presents a selection of relevant literature.

Table 10-1

	Topic	Title
\1\	PROFIenergy profile	Common Application Profile PROFIenergy; Technical Specification for PROFINET; Version 1.0; January 2010; Order No: 3.802

Internet links

The following list is by no means complete and only provides a selection of appropriate sources.

Table 10-2

	Topic	Title
\1\	Reference to the document	http://support.automation.siemens.com/WW/view/en/41986454
\2\	Siemens Industry Online Support	http://support.automation.siemens.com
\3\	SENTRON PAC4200 Manuals	http://support.automation.siemens.com/WW/view/en/34261595 http://support.automation.siemens.com/WW/view/en/34261817 http://support.automation.siemens.com/WW/view/en/49742527
\4\	FW Download SENTRON PAC	http://support.automation.siemens.com/WW/view/en/35029840
\5\	GSDML file PN module	http://support.automation.siemens.com/WW/view/en/50186868

11 History

Table 11-1

Version	Date	Revisions
V1.0	01.12.2011	First issue