Saving Energy with SIMATIC S7

PROFIenergy with an I-Device (STEP 7 V5.5)

Application • November 2011

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SIMATIC
PROFIenergy I-Device

Application of the PROFINET “PROFIenergy” profile

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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

This documentation is based on the description of the “PROFIenergy with ET 200S” application. After a short introduction, the particularities of the communication with the i-device are described and the corresponding PROFIenergy blocks are explained.

Introduction

In future, energy management will gain increasing significance. Cost reduction through saving energy in the production is an approach that has been pursuit for quite some time. Shorter production-free times – from short breaks up to work-free shifts, have also become focal points.

Main switch off – the entire production comes to a halt and the light goes off in the production hall. This is common practice in non-productive periods such as on the weekends or during plant holidays in almost all the plants world-wide. However, what happens during shorter breaks? This is when the plant continues to run and still needs energy, despite there being no productive results.

Would it be possible to put smaller, currently not needed plant parts in an energy-saving mode, whilst the rest of the plant continues production?

All this would clearly increase the energy balance of a production unit.

Today’s technology, to separate production components through one or several main switches from the supply network, meaning to disable production units in an undifferentiated way, is not suitable for this purpose. Hard-wired switching paths for defined default production areas are too inflexible to fulfill the new requirements in view of energy efficiency.

By choosing PROFINET, the requirements for a new and future-oriented energy management are already provided.

Future-oriented energy management means: it is no longer switched off through the conventional method of the main switch technology but fine-granular, through the network.

The general supply network of the components remains activated and the components enter a defined energy saving state that was initiated by a command.

PROFIenergy, a profile defined by the PROFINET user organization, provides the condition for a generally usable, manufacturer-independent system, where individual loads or entire production units can be switched off flexibly, on short notice and intelligently.

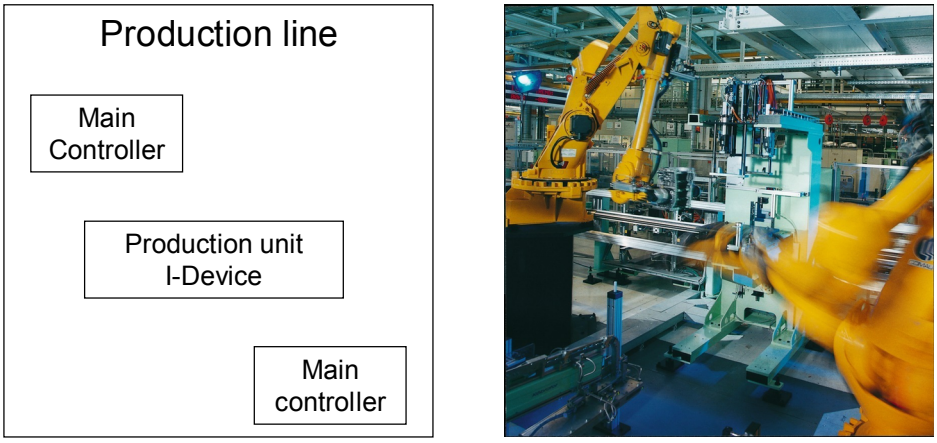
SIEMENS already supports PROFIenergy /1/ with the first implementations in the SIMATIC automation system.

The application that follows it explains step by step, how an application like this can be realized with the CPU 315-2PN/DP as i-device.

Overview of the automation task

The figure below provides an overview of the automation task.

Figure 1-1



By using an example from the production – here a production line with robot – the switching off of the independent production unit (robot as i-device) is described in this application.

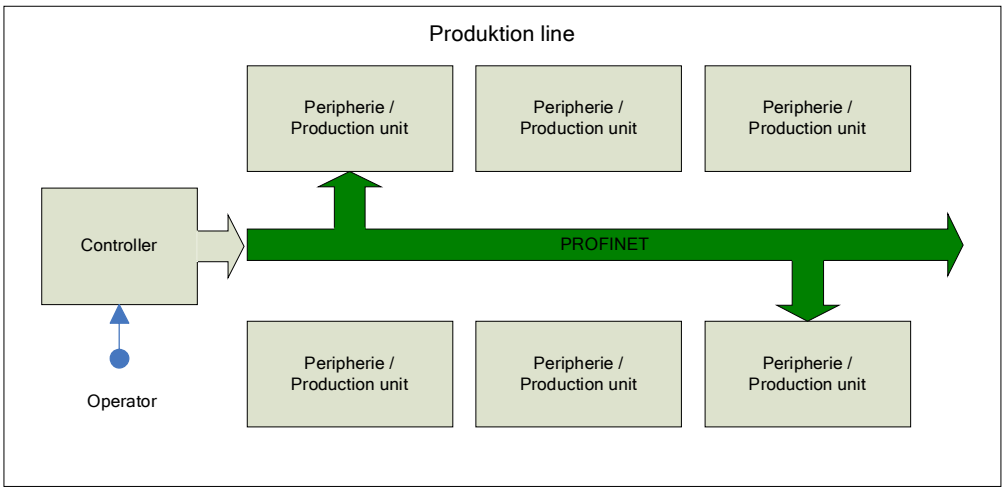
This production line consists of an inbound and outbound conveyor belt and a processing unit. The belts are not examined any further within this application. An independent controller serves as production or processing unit that is realized as i-device. In turn, the production unit is provided with a distributed I/O, for example, ET 200S with PROFIenergy.

The energy saving of PROFIenergy deals with the numerous sensors and other electronic components and not with the drive motors that are already turned off when there is a production stop.

Description of the automation task

Apart from the I/Os of the actual production line controller, the “i-device” production unit is to switch off parts of their automation components during a break. The break can be initiated by the user either spontaneously or regularly scheduled through the controller. Once production was halted, parts of the distributed I/O are switched off through the respective PROFIenergy commands. Before the production is started again, the necessary automation components are switched on again.

Figure 1-2



A variable table is used for the visualization and operation and optionally an operator panel.

1.2 Scenarios

Requirements of the automation task

In this application example, the PROFIenergy commands to the i-device and the response of the i-device to these commands are dealt with.

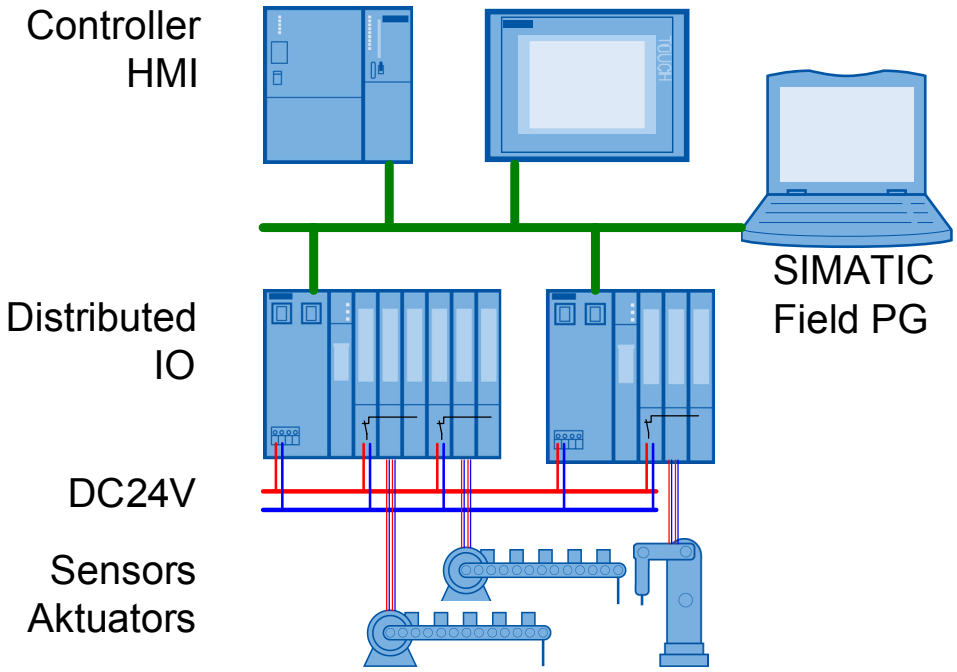
2 Automation Solution

2.1 Overview of the overall solution

Distributed I/Os

The following figure shows the structure of the “PROFIenergy with ET 200S” application. A robot (processing or production unit) is still controlled directly by the main controller of the production line (IO controller) through the distributed I/Os (ET 200S, IO device).

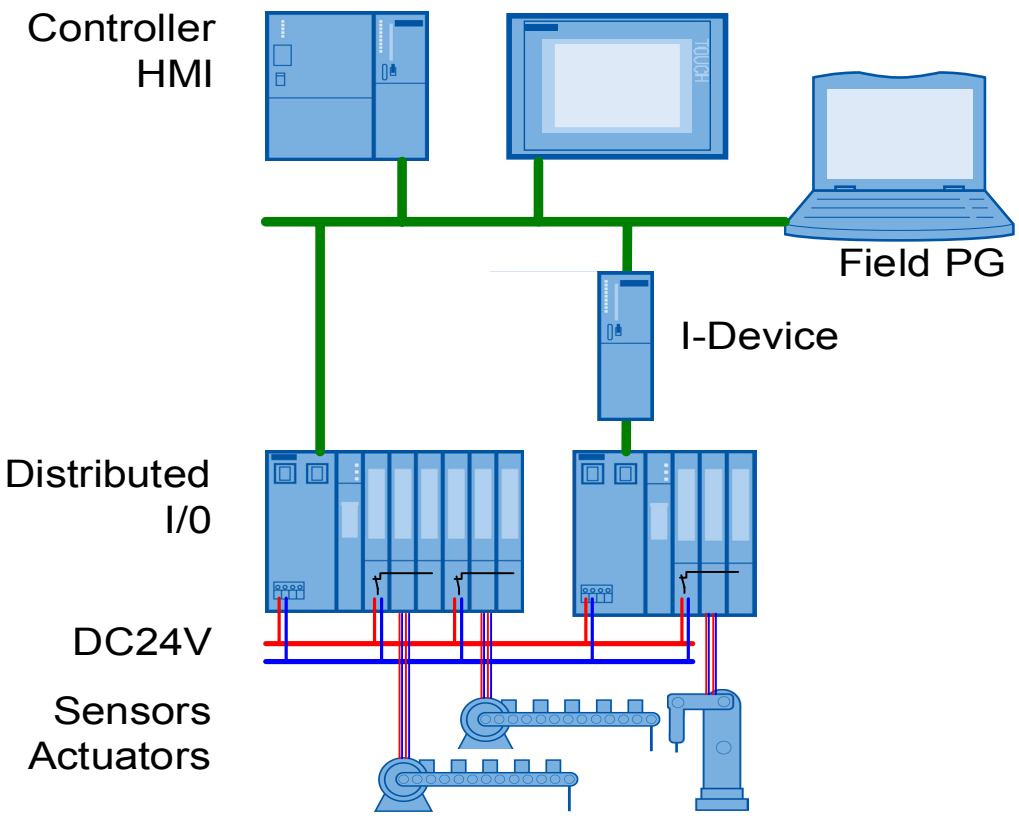
Figure 2-1



I-device

In the figure below, the robot is equipped with an independent controller. The independent distributed I/O is subordinate. This means the robot controller, is the IO controller here. Together with the main controller, the subordinate robot controller acts as an intelligent “i-device” IO device.

Figure 2-2



Definition of “I device”

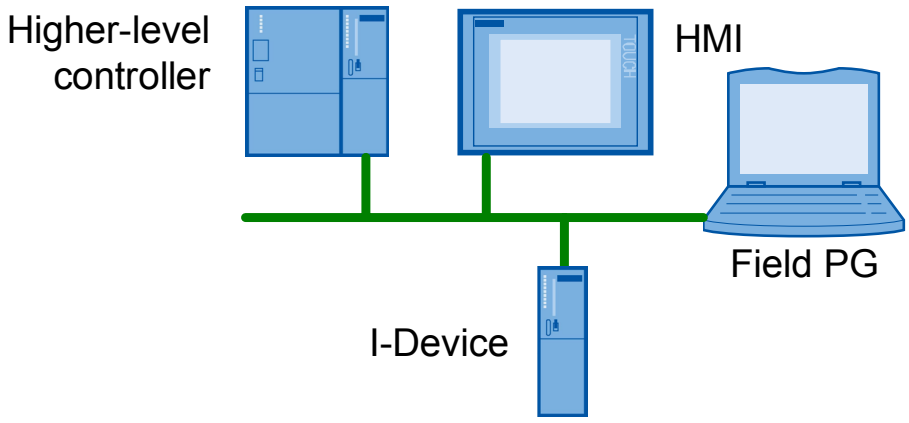
The "i device" (intelligent IO device) functionality of a CPU makes it possible to deterministically exchange data with an IO controller and to therefore use the CPU, for example, as intelligent pre-processing unit for partial processes. The i-device is integrated as an IO device in a "higher-level" IO controller.

The user program in the CPU ensures the pre-processing. The process values recorded in the central or distributed (PROFINET IO or PROFIBUS DP) I/Os are pre-processed through the user program. These values are provided to a higher-level station through a PROFINET IO device interface of the CPU or the CPs.

Structure of the application

The figure below shows the structure of this application: Compared to the previous figure, the distributed I/O is missing here.

Figure 2-3



Of course, function and programming of the distributed I/O in the i-device is analog to the function and programming of the main controller. Correspondingly, the "PROFIenergy with ET 200S" application can be used for both controllers.

In this application the higher-level controller sends the PROFIenergy commands to the i-device. The i-device evaluates the commands, controls its sensors and actuators with its user program and eventually reacts with a PROFIenergy response message. The i-device user program also contains the PROFIenergy commands to the own I/Os.

Input/visualization through HMI is optional. The same information and input fields can also be found in a variable table. The panel itself can be simulated through Runtime in WinCC flexible on the PG.

Topics not covered by this application

This application does not contain a description on how a production plant is switched off. This is already implemented in existing plants and varies greatly from plant to plant. For the same reason, a graded switch-off of the components is not applicable with PROFIenergy.

Hereafter, the basic functionality of the PROFIenergy profile for the i-device and the respective function blocks SIMATIC is explained.

Required knowledge

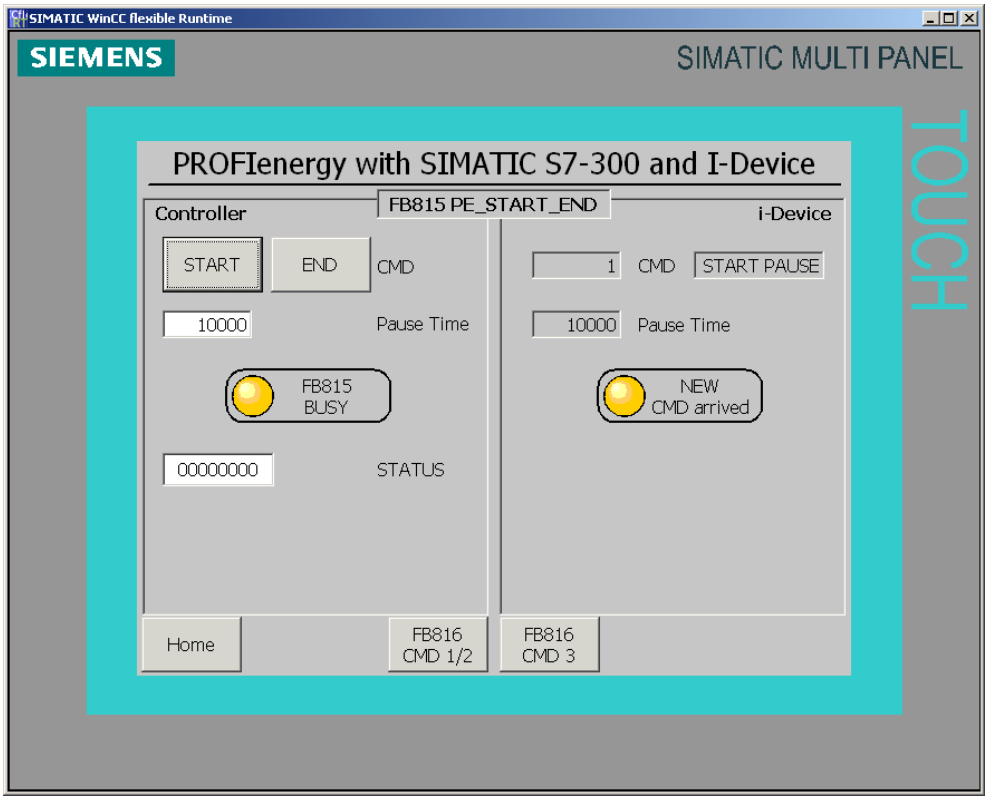
Basic knowledge of automation technology, SIMATIC, PROFINET, PROFIenergy and configuration with STEP 7 is assumed.

2.2 Description of the core functionality

Overview and description of the interface

This Application shows START and STOP of a PROFIenergy-Pause for the i-Device. The next picture shows the most commonly usage: specifiy the PAUSE_TIME and START or STOP the pause.

Figure 2-4



This picture and the other HMI screens are described in detail in the following chapters.

All command bits directly relate to the instance data blocks (FB815/DB815, FB816/DB816, FB817/DB817).

2.3 Hardware and software components used

The application was generated with 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 regulated 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	All S7-CPU alternatively possible
SIMATIC S7, MMC Micro Memory Card S7-300, 2 MBYTE		6ES7953-8LL20-0AA0	
SIMATIC S7-300 CPU 315-2 PN/DP, PROFINET	1	6ES7317-2EH14-0AB0	Alternatively all SIMATIC S7-CPUs from **firmware version V3.2**
SIMATIC Field PG M2	1	Configurator	Compatible PC
SIMATIC PROFINET cables and plugs			Alternatively Ethernet patch cable

Standard software components

Table 2-2

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

Sample files and projects

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

Table 2-3

Component	Note
41986454_PROFIenergy_I-Device_CODE_V12.zip	This zip file contains the STEP 7 project.
41986454_PROFIenergy_I-Device _DOKU_V12_EN.pdf	This document

3 Basics

This chapter explains the functions of PROFIenergy, especially the relationship between the function blocks and the hardware.

3.1 PROFIenergy profile

With the PROFIenergy profile, methods and techniques are introduced that allow implementing energy-saving functions in PROFINET IO devices. This can be done independent of the manufacturer, not only in simple I/O devices but also in intelligent and complex devices.

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

PROFIenergy is based on the existing PROFINET mechanisms – no changes are necessary here. PROFINET users can integrate PROFIenergy in existing plants, without general changes in the plant.

PROFIenergy - controller:
This means a PLC, here the SIMATIC S7 CPU 317-2PN/DP. Whether the PROFIenergy management is integrated in an existing controller or is left to an external controller, is up to the user.

PROFIenergy device:
a PROFINET IO device with integrated PROFIenergy functionality. In this case a SIMATIC S7 CPU 315-2PN/DP with the FB817 “PE_I_DEV” and its auxiliary blocks.

PROFIenergy generally includes several energy-saving modes for PROFIenergy devices. In the application introduced here, the OFF (“PAUSE”) and ON (“ready for operation“) mode is realized. It is possible to have the full PROFINET ability to community in the OFF mode. This is achieved by the i-device only reacting in its user program and that no parts of the CPU are switched off.

3.2 Available hardware

PROFIenergy - controller

There are blocks available that are executable on all SIMATIC S7 CPUs . These blocks are contained in the STEP 7 project that belongs to this application.

PROFIenergy device

There are blocks available that are executable on all SIMATIC S7 CPUs from firmware V3.2. These blocks are contained in the STEP 7 project that belongs to this application. Under chapter 10 Reference you will find the download for the firmware and the corresponding hardware support packages (HSP).

3.3 Necessary software

All necessary STEP 7 blocks are available for download. Their function and application is described in the following chapters.

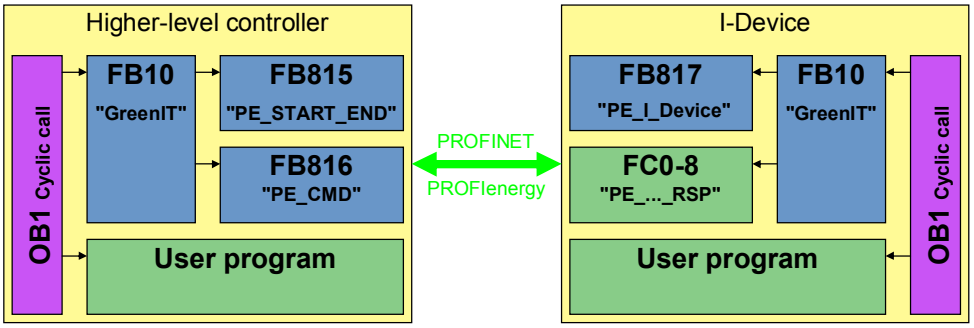
The STEP 7 V5.5 software is required for the engineering of an i-device.

4 Functional Mechanisms of this Application

4.1 Program overview

In the following figure you can see the general program structure of this application.

Figure 4-1



The FB10 “GreenIT” function block summarizes the actual PROFIenergy block calls and provides a comfortable interface through its instance data block for the HMI.

FB815 “PE_Start_End”:
starts and stops the pause of the i-device and simultaneously transmits the desired pause time.

FB816 “PE_CMD”:
executes all PROFIenergy commands. In this application the status values are read out exemplary.

FB817 “PE_I_DEV”:
Receives and sends all PROFIenergy commands.

FC0 - 8 “PE_..._RSP”:
Auxiliary blocks support the user in supplying the FB817 with the respective response data.

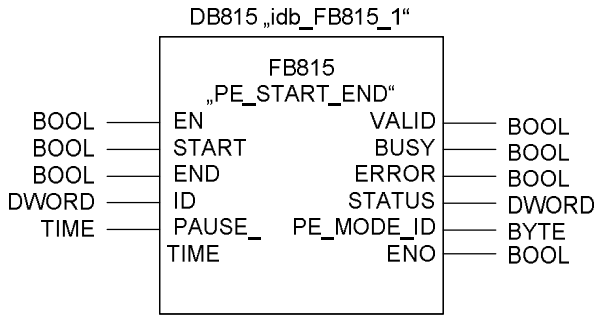
Call interface, parameter and function of individual PROFIenergy blocks are described in detail in the following chapters.

4.2 FB815 “PE_START_END” functionality

With the FB815 “PE_START_END”, the indicated PROFINET IO device, here an i-device, the pauses are started and stopped. Through the PAUSE_TIME parameter, the i-device is given the planned pause time for inspection.
The following applies: PAUSE_TIME >= Pause_Min
There will be no automatic restarting once the pause time has expired, the device remains in the OFF mode up to the “END” command. This prevents uncoordinated restarts that may eventually lead to unwanted load peaks.

4.2.1 Program details to block FB815 “PE_START_END”

Figure 4-2



Input parameters

Table 4-1

Parameters	Data type	Initial value	Description
EN	BOOL	0	Enable input
START	BOOL	0	Send “START PAUSE” to PROFINET IO device with “ID” address
END	BOOL	0	Send “END PAUSE” to PROFINET IO device with “ID” address
ID	DWORD	8100	Accept address of the PROFINET IO device (i-device) from the hardware configuration of the higher-level controller, in case of an output module bit15 has to be set: $256_{Dez} = 100_{Hex}$; Bit15 = 8000_{Hex}; ID = 8100_{Hex}
PAUSE_ TIME	TIME	T#10000MS Range: T#1MS to T#24D20H31M23S647MS	Planned pause time. IO device checks whether the planned pause time is larger or equal to the minimum pause time that is stored on the IO device. If a smaller pause is started, the IO device remains switched on, a negative acknowledge is set.

Output parameters

Table 4-2

Parameters	Data type	Initial value	Description
VALID	BOOL	0	Command successfully set
BUSY	BOOL	0	Command processing still running
ERROR	BOOL	0	An error occurred during processing
STATUS	DWORD	0	Block status/error number
PE_MODE _ID	BYTE	0	Energy-saving level that is adopted during the PAUSE
ENO	BOOL	0	Enable output

Error code

The STATUS output parameter contains error information. If it is interpreted as ARRAY[1...4] OF BYTE, the error information has the following structure:

Table 4-3

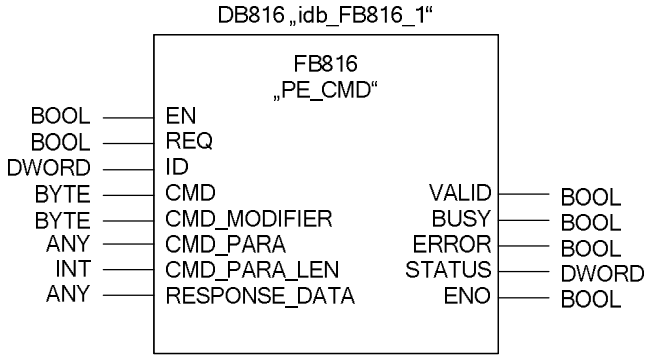
Field element	Name	Description
STATUS[1]	Function_Num	B#16#00 No error B#16#DE: error when reading the data record B#16#DF: error when writing the data record B#16#C0: PE-FB or SFB 52/53 have detected error
STATUS[2]	Error_Decode	Location of error detection **80**: DPV1 - Error according to IEC 61158-6 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 on the “START” and “END” input parameters - 81: Length conflict with the parameters CMD_PARAM and CMD_PARAM_LEN 82-8F: other error messages Error_Decode FE: - 01: invalid “Service Request ID” - 02: incorrect “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. transmittable length - 08: invalid “Count” - 50: No suitable “energy mode” is available - 51: indicated time value is not supported - 52: invalid “PE_Mode_ID”
STATUS[4]	Error_Code_2	Manufacturer-specific expansion of the error code

4.3 FB816 “PE_CMD” functionality

The FB816 ”PE_CMD” is a transparent block to display the entire PROFIenergy standards. By freely transmitting the parameters, the block is open for future expansions of the PROFIenergy profile. Advanced knowledge of the PROFIenergy profile is necessary for the application of this block. Hence, the reading of status information is shown exemplary in this application.

4.3.1 Program details to block FB816 “PE_CMD”

Figure 4-3



With this FB 816 you transmit PROFIenergy commands to a PROFIenergy capable device. The input data is stored in the “CMD_PARA” data area addressed by the ANY pointer . The output data is stored in the RESPONSE_DATA data area addressed by ANY pointer.

The commands are transferred to the module without plausibility test and are processed there. The feedbacks from this module are provided unchanged to the input data.

This FB can also be used when the PROFIenergy profile is expanded by further commands in future.

The following commands are possible in the current PROFIenergy profile and are explained in the following chapters: (“COMMAND”)

- Query Modes
  - List of energy saving modes
  - Get mode
- PEM_Status
- Identify
- Query Measurements – (if suitable modules are available)
  - Get measurement
  - Get measurement values

Input parameters

Table 4-4

Parameters	Data type	Initial value	Description
EN	BOOL	0	Enable Input
REQ	BOOL	0	Start job: Positive edge starts the command transfer
ID	DWORD	0	Address of PROFINET IO device
CMD	BYTE	0	Service RQ-ID from PROFIenergy profile Commands: 01 Start_Pause 02 End_Pause 03 Query_Modes 04 PEM_Status 05 PE_Identify 16 Query_Measurement After PROFIenergy profile expansions further command IDs are possible.
CMD_ MODIFIER	BYTE	0	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 PROFIenergy profile expansions, further command IDs and modifiers are possible.
CMD_ PARA	ANY	0	Parameter for: Get mode PE_mode_ID Get measurement values: List of Measurement_Ids Maximum length: = 234 byte The complete Service Data Request is entered.
CMD_ PARA_LEN	INT	0	Total length of parameter for command. <= length in CMD_PARAM (checked by FB) maximum: = 234
RES- PONSE _DATA	ANY	0	PROFIenergy information, depending on the command, the entire response message in normal case and in the event of a fault incl. block header. Note: if the buffer is too small, only the number of bytes that are indicated in the ANY pointer are

Parameters	Data type	Initial value	Description
			entered.

Output parameters

Table 4-5

Parameters	Data type	Initial value	Description
VALID	BOOL	0	Command successfully set
BUSY	BOOL	0	Command processing still running
ERROR	BOOL	0	An error occurred during processing
STATUS	DWORD	0	Block status/error number, see FB815
ENO	BOOL	0	Enable output

4.4 Response Data

Table 4-6

Block definitions	Attributes	Value	Data type	Description
BlockHeader	BlockType	0x0801	Unsigned16	
	BlockLength		Unsigned16	without counting the fields BlockType and BlockLength
	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 reserved 0x10 Query_Measurement 0x11..0xCF reserved 0xD0..0xFF manufacturer_specific
	Request_Referen ce	0x01.. 0xFF	Unsigned8	unique identification number (mirrored in the response by server)
Service Header Response	Status	0x01.. 0xFF	Unsigned8	0x00 - reserved 0x01 - ready 0x02 - ready_with_error 0x03 - data incomplete 0x04 .. 0xCF - reserved 0xD0.. 0xFF - depend on Service_Request_ID
	Data_Structure_ Identifier_RS	0x01.. 0xFF	Unsigned8	0x00 - reserved 0x01..0xFF - Data structures dependent on the Service_Request_IDs 0xFF - error
Service Data Response				dependent on the Service_Request_IDs

This table shows the general structure of the returned data according to the PROFIenergy profile /1/. In the following chapters, the individual commands and the thus resulting composition of the response data is listed.

4.4.1 PE command Start_Pause

Request

CMD = 1
CMD_ MODIFIER = 0
CMD_PARA_LEN = 4
CMD_PARA = any Pointer on value for Pause_Time (unsigned32)

Service Data Response

Parameters	Value	Data type
PE_Mode_ID*	0x01..0xFF	Unsigned8
Reserved	0x00	Unsigned8

* Identification number of the energy saving mode

4.4.2 PE command End_Pause

Request

CMD = 2
CMD_ MODIFIER = 0
CMD_PARA_LEN = 0
CMD_PARA = irrelevant

Service Data Response

Parameters	Value	Data type
Time_to_operate*		Unsigned32

* Expected time to switch the PROFIenergy device to “ready_to_operate”

4.4.3 PE command Query Modes - List of energy saving modes

Request

CMD = 3
CMD_ MODIFIER = 1
CMD_PARA_LEN = 0
CMD_PARA = irrelevant

Service Data Response

Parameters	Value	Data type
Number_of_PE_Mode_IDs*	0x01	Unsigned8
PE_Mode_IDs		Unsigned8-Array of Number_of_PE_Mode_IDs (Unique ID for mode)

* The number of energy saving modes

4.4.4 PE command Query Modes - Get mode

Request

CMD = 3
CMD_ MODIFIER = 2
CMD_PARA_LEN = 1
CMD_PARA = any pointer on value for Pause_Time (unsigned32)

Service Data Response

Parameter	Value	Data type
PE_Mode_ID	0x01.. 0xFF	Unsigned8
PE_Mode_Attributes	0x00..0x01	Unsigned8
Time_min_Pause		Unsigned32
Time_to_Pause		Unsigned32
Time_to_operate		Unsigned32
Time_min_length_of_stay		Unsigned32
Time_max_length_of_stay		Unsigned32
Mode_Power_Consumption		Float32
Energy_Consumption_to_pause		Float32
Energy_Consumption_to_operate		Float32

4.4.5 PE command PEM_Status

Request

CMD = 4
CMD_ MODIFIER = 0
CMD_PARA_LEN = 0
CMD_PARA = irrelevant

Service Data Response

Parameters	Value	Data type
PE_Mode_ID_Source		Unsigned8
PE_Mode_ID_Destination		Unsigned8
Time_to_operate		Unsigned32
Remaining_time_to_destination		Unsigned32
Mode_Power_Consumption		Float32
Energy_Consumption_to_Destination		Float32
Energy_Consumption_to_operate		Float32

4.4.6 PE command PE_Identify

Request

CMD = 5

CMD_ MODIFIER = 0

CMD_PARA_LEN = 0

CMD_PARA = irrelevant

Service Data Response

Parameters	Value	Data type
Count *	6	Unsigned8
Start_Pause**	0x01	Unsigned8
End_Pause	0x02	Unsigned8
Query_Modes	0x03	Unsigned8
PEM_Status	0x04	Unsigned8
PE_Identify	0x05	Unsigned8
Query_Measurement***	0x10	Unsigned8

* The number of supported PROFIenergy commands

** first supported Service_Request_ID

*** last supported Service_Request_ID

4.4.7 PE command Query Measurement – Get measurement list

Request

CMD = 16
CMD_ MODIFIER = 1
CMD_PARA_LEN = 0
CMD_PARA = irrelevant

Service Data Response

Parameters	Value	Data type
Count*		Unsigned8
reserved		Unsigned8
Measurement_ID**		Unsigned16
Accuracy_Domain		Unsigned8
Accuracy_Class		Unsigned8
Range		Float32
…		
Measurement_ID***		Unsigned16
Accuracy_Domain		Unsigned8
Accuracy_Class		Unsigned8
Range		Float32

* The number of measurement_IDs
** first supported Measurement_ID
*** last supported Measurement_ID

4.4.8 PE command Query Measurement – Get measurement values

Request

CMD = 16

CMD_ MODIFIER = 2

CMD_PARA_LEN = length of data structure in byte

CMD_PARA = any pointer on data structure that should have the following structure

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

* The number of measurement_IDs

** first requested measurement value

*** last requested measurement value

Service-Data-Response

Parameter	Value	Data type
Count*		Unsigned8
reserved		Unsigned8
Length_of_Structure	0x0002...0xFFFF	Unsigned16
Measurement_Data_Structure_ID	1=simple value	Unsigned8
Measurement_ID**	0...FFFF	Unsigned16
Status_of_Measurement_Value	1=valid; 2=not supported; 3=not valid	Unsigned8
Transmission_Data_Type		Float32
End_of_demand (optional)		Unsigned32 + Unsigned16
…		
Length_of_Structure	0x0002...0xFFFF	Unsigned16
Measurement_Data_Structure_ID	1=simple value	Unsigned8
Measurement_ID***	0...FFFF	Unsigned16
Status_of_Measurement_Value	1=valid; 2=not supported; 3=not valid	Unsigned8
Transmission_Data_Type		Float32
End_of_demand (optional)		Unsigned32 + Unsigned16

* The number of measurement value

** first requested measurement value

*** last requested measurement value

NOTE See Annex A: Measurement list for the Measurement ID list.

Energy Saving Data

Parameters	Data type	Value			Description
PE_MODE_ID PE_MODE_ID_ SOURCE PE_MODE_ID_ DESTINATON	Unsigned8	0x00	PE_POWER_OFF		Uniform ID of energy-saving mode Source and destination for PEM_STATUS
		0x01 – 0xFE	Manufacturer specific		
		0xFF	PE_READY_ TO_OPERATE		
PE_MODE_ ATTRIBUTES	Unsigned8	Bit 0	0	Only static time and consumption values available	Enum Byte
			1	Dynamic time and consumption values available	
		Bit 1 to Bit 7		reserved	
PAUSE_ TIME_1	Unsigned32	Duration			No absolute date
TIME_MIN_ PAUSE_1	Unsigned32	Duration			Min. pause time for this PE energy-saving mode. This is the sum of the three parameters: Time_to_Pause Time_to_operate Time_min_length_of_ stay
Time_to_ Pause [1]	Unsigned32	Duration			Duration from the START edge until the requested PE energy-saving mode is reached
Time_to_ operate [1]	Unsigned32	Duration			Max. ON duration till PE_ready_to_operate Time_to_operate can be directly used for respective calculations. This value can be either a static MAX value or can be calculated dynamically by the PE device.

Remaining_ time_to_ destination [1]	Unsigned32	Duration	Optional: remaining time till requested PE mode. Dynamic value or static MAX value
Time_min_ length_of_ stay [1]	Unsigned32	Duration	Minimum duration the PE device has to stay in this PE mode.
Time_min_ length_of_ stay [1]	Unsigned32	Duration	Maximum duration the PE device can stay in this PE mode.
Mode_Power_ Consumption [2]	Float32		Energy consumption in current PE mode [kW]
Energy_ Consumption_ to_pause [2]	Float32		Energy consumption from PE_ready_to_operate till current PE mode [kWh]
Energy_ Consumption_ to_operate [2]	Float32		Energy consumption from current PE mode to PE_ready_to_operate [kWh]
Energy_ Consumption_ to_Destination [2]	Float32		Energy consumption till requested PE mode [kWh]

[1] The PROFIenergy profile does not specify a valid time format.

If the duration is unlimited, the max. value can be specified as 0xFFFFFFFF. When the duration is “Zero”, 0x00 can be used.

[2] If an energy consumption value is not defined, 0.0 (Float32) can be indicated.

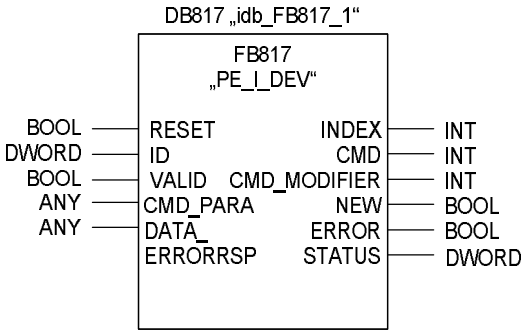
4.5 FB817 „PE_I_DEV“ functionality

The FB817 “PE_I_DEV” is a transparent block to process the PROFIenergy profile in the i-device. In the intelligent IO device, the i-device, the FB817 and the corresponding auxiliary blocks, take on what is done by the firmware in a normal PROFIenergy capable IO device, for example, the ET 200S. Explicit knowledge of the PROFIenergy standards is not required the comfortable generation of the PROFIenergy acknowledgement is performed by simple parameterization on the auxiliary block. The response in the pause is applicative and freely programmable by the user.

Note **Answer data has to be provided within 10s by the user, otherwise the IO controller will have the “Status” “Stateconflict 0x80B5”.**

4.5.1 Program details to block FB817 „PE_I_DEV“

Figure 4-4



Input parameters

Table 4-7

Parameters	Data type	Initial value	Description
RESET	BOOL	0	Resets FB817
ID	DWORD	100	Address of i-device, accept from hardware configuration: PN-IO -> Properties -> I-Device -> Transfer Area -> Input Address $256_{Dez} = 100_{Hex}$
VALID	BOOL	0	The answer data is available and can be sent

Output parameters

Table 4-8

Parameters	Data type	Initial value	Description
INDEX	INT	0	Data record number of PROFIenergy record
CMD	INT	0	Service RQ-ID according to PE standard: • 01 Start_Pause • 02 End_Pause • 03 Query_Modes • 04 PEM_Status • 05 PE_Identify • 16 Query_Measurement
CMD_ MODIFIER	INT	0	Modifier according to PROFIenergy profile: Query Mode • 01: List energy saving modes • 02: Get mode Query_Measurement • 01:Get_Measurement_List, get all supported Measurement_IDs • 02: Get_Measurement_Values For all other commands: 0
NEW	BOOL	0	New data available
ERROR	BOOL	0	Command terminated with error
STATUS	DWORD	0	Error information, see above
CMD_PARA (INOUT)	ANY	0	Parameter for: • Get mode: PE_mode_ID • Get measurement values: List of Measurement_IDs (one or more variables at once) Maximum length: = 234Byte
DATA_ ERRORRSP (INOUT)	ANY	0	Pointer to data area that contains acknowledgement data. Has to match with the pointer that is also used for auxiliary blocks.

4.6 Functionality of the auxiliary blocks

Purpose

- Together with FB817 they hide the PROFIenergy profile from the user.
- The auxiliary blocks support the user to comfortably generate the response message.
- The user enters the response data (in plain text) in the input parameters of the respective blocks.
- The user does not have to know the structure of the response, meaning the PROFIenergy standard.
- FB817 and the auxiliary blocks are compatible. The parameters are simply interconnected in parts.
- Per PROFIenergy command there is an independent auxiliary block for a positive response.
- In addition, there is a joint block for the negative response.

4.6.1 Brief description of the auxiliary blocks

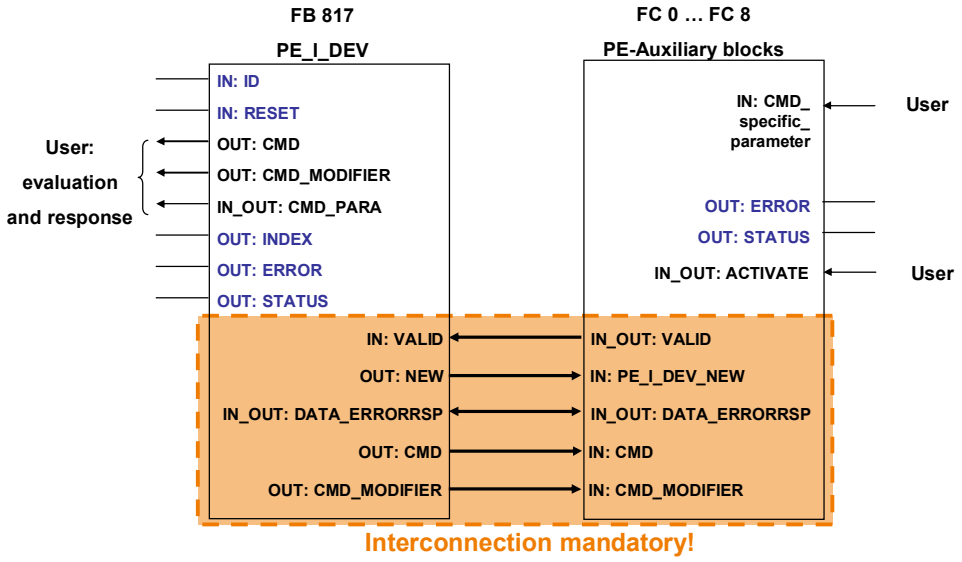
Table 4-9

Block	Name	Function
FC 0	**PE_Error_RSP** “Response with failure”	Generates a negative response, if the requested command is not generally or temporarily supported; irrespective of the requested command
FC 1	**PE_Start_RSP** “Start Pause”	Generates the response data to the "START_PAUSE" command. Returns the energy-saving mode the device has
FC 2	**PE_End_RSP** “End Pause”	Generates the response data to the "END_PAUSE" command.
FC 3	**PE_List_Modes_RSP** “Query Mode: List energy saving modes“	Generates the response data to the "LIST_OF_ENERGY_SAVING_MODES" command. The user transfers the IDs of the supported energy-saving modes.
FC 4	**PE_Get_Mode_RSP** “Query Mode: Get mode“	Generates the response data to the "GET_MODE" command. Supplies the times and performance or energy data of an individual energy-saving mode
FC 5	**PE_PEM_Status_RSP** “PEM status”	Generates the response data to the "PEM_STATUS" command
FC 6	**PE_Identify_RSP** “PE identify”	Generates the response data to the "PE_IDENTIFY" command. The user indicates what PROFIenergy commands are supported.
FC 7	**PE_Measurement_List_RSP** “Query measurement”	Generates the response data to the "GET_MEASUREMENT_LIST" command. The user indicates what variable Ids (measured values) are supported.
FC 8	**PE_ Measurement_Value_RSP** “Get measurement values”	Generates the response data to the "GET_MEASUREMENT_VALUES" command. The user returns the values of the requested measured value(s).

4.6.2 Interconnection of the auxiliary blocks

The following figure shows the general interconnection of the FB817 and its auxiliary blocks.

Figure 4-5



4.6.3 Joint parameters of the auxiliary blocks

Input parameters

Table 4-10

Parameters	Data type	Initial value	Description
ACTIVATE (INOUT)	BOOL	0	To be set by user. Positive edge on the input causes the block to copy the input parameters into the DATA_ERROR_RSP data area. Afterwards it is reset by the block. **Has to be set within 10s, once a positive edge was detected on NEW.**
PE_I_DEV_NEW	BOOL	0	Has to be linked with the NEW output parameter of FB817. The block is only processed if "1" is pending.
CMD	INT	0	Has to be switched to the CMD output parameter of the FB817.
CMD_MODIFIER	INT	0	Has to be switched to the CMD_MODIFIER output parameter of the FB817.

Output parameters

Table 4-11

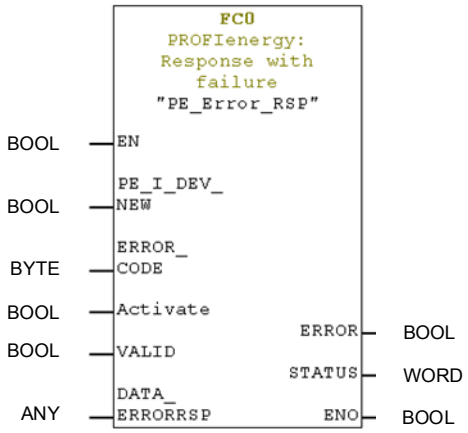
Parameters	Data type	Initial value	Description
DATA_ERRORRSP (INOUT)	ANY	0	Pointer on the data area where the response data is stored. Identical with the pointer for DATA_ERRORRSP on FB817. Contains the entire PROFIenergy message. Minimum length should be 244 byte.
VALID (INOUT)	BOOL	1	„1": No error Set by the block. Connected with the VALID input of FB817.
ERROR	BOOL	0	"1": An error has occurred.
STATUS	WORD	0	„0“: No error “0x80B1”: Error with ANY specification, for example, wrong area

Program details to block FC 0 “PE_Error_RSP”

“Response with failure”

Generates a negative response, if the requested command is not generally or temporarily supported; irrespective of the requested command.

Figure 4-6



Input parameters

Table 4-12

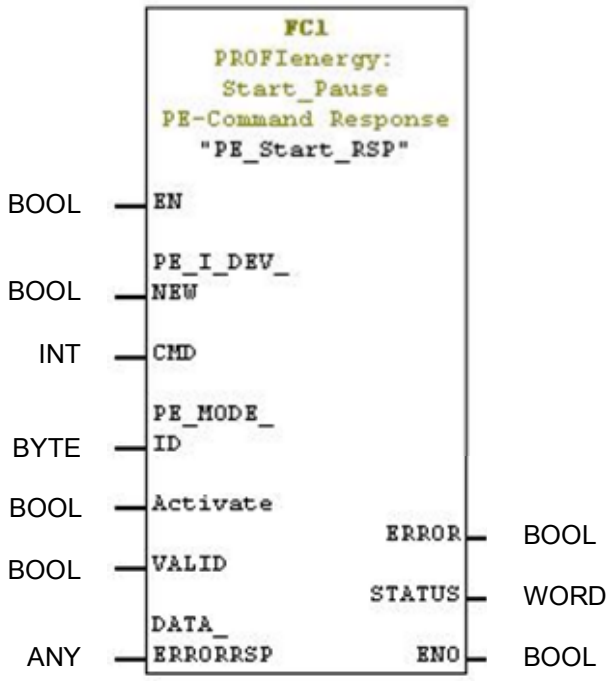
Parameters	Data type	Initial value	Description
ERROR_CODE	byte	0	Free error number

4.6.4 Program details to block FC 1 “PE_Start_RSP”

“Start Pause”

Generates the response to the "START_PAUSE" command. Returns the energy-saving mode that the device has.

Figure 4-7



Input parameters

Table 4-13

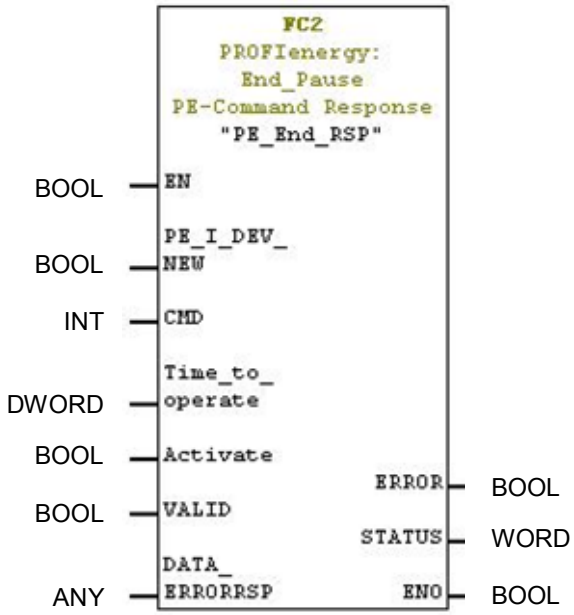
Parameters	Data type	Initial value	Description
PE_MODE_ID	byte	0	PE mode the process has, see Chapter 4.4

For different Pause_Times you can have different PE_Mode_IDs.

4.6.5 Program details to block FC 2 “PE_End_RSP”

“End Pause”
Generates the response to the "END_PAUSE" command.

Figure 4-8



Input parameters

Table 4-14

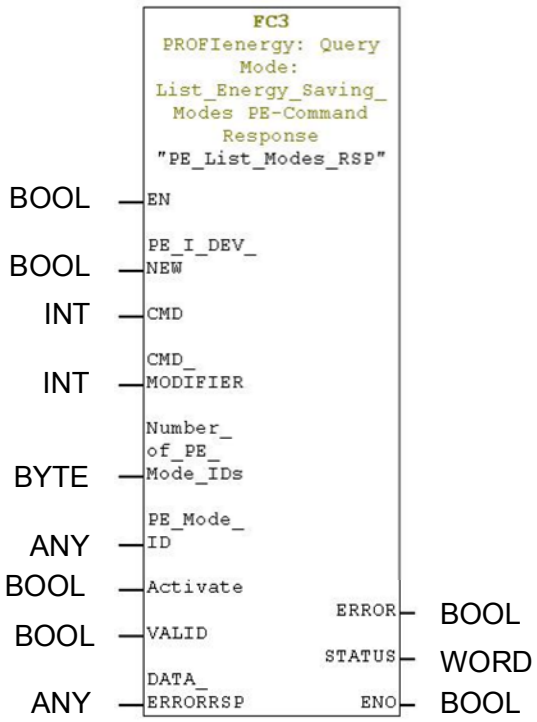
Parameters	Data type	Initial value	Description
Time_to_Operate	DWORD	0	Time that is necessary to change from the current mode to "Ready_To_Operate". See Chapter 4.4

4.6.6 Program details to block FC3 “PE_List_Modes_RSP”

“Query Mode: List energy saving modes“

Generates the answer to the "LIST_OF_ENERGY_SAVING_MODES" command. The user transfers the IDs of the supported energy-saving modes.

Figure 4-9



Input parameters

Table 4-15

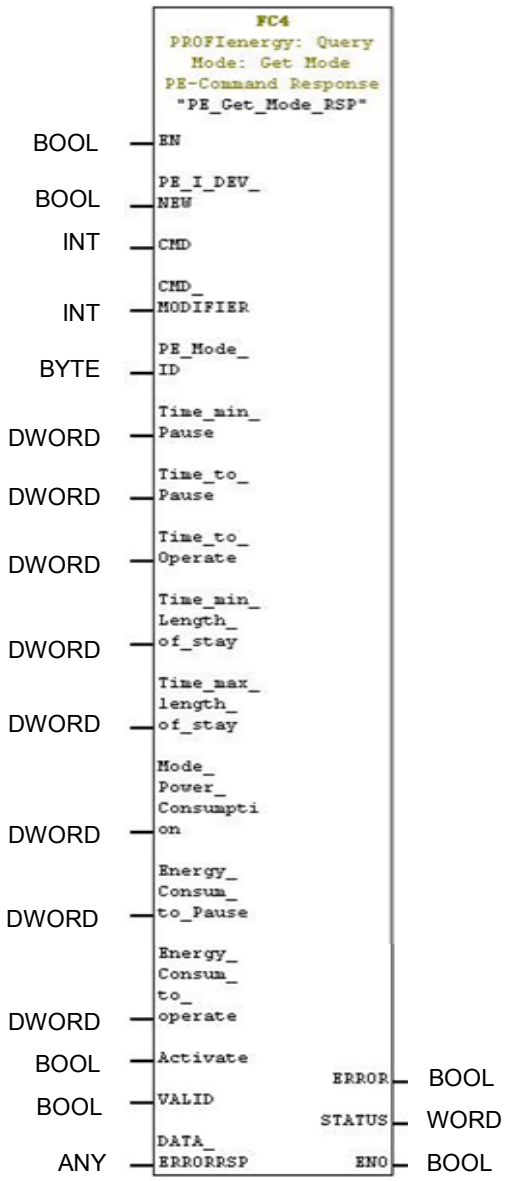
Parameters	Data type	Initial value	Description
Number_of_ PE_Mode_Ids	byte	0	Number of supported energy-saving modes. Permitted value: 1 to 254
PE_MODE_ID	Any	0	Shows the area in which the "Mode Ids" are stored. Depending on the mode, a so called "Mode ID" is assigned. Permitted area: 1 to 254 Chapter 4.4

4.6.7 Program details to block FC 4 “PE_Get_Mode_RSP”

“Query Mode: Get mode“

Generates the response to the "GET_MODE" command. Supplies the times and performance or energy data of an individual energy-saving mode.

Figure 4-10



Input parameters

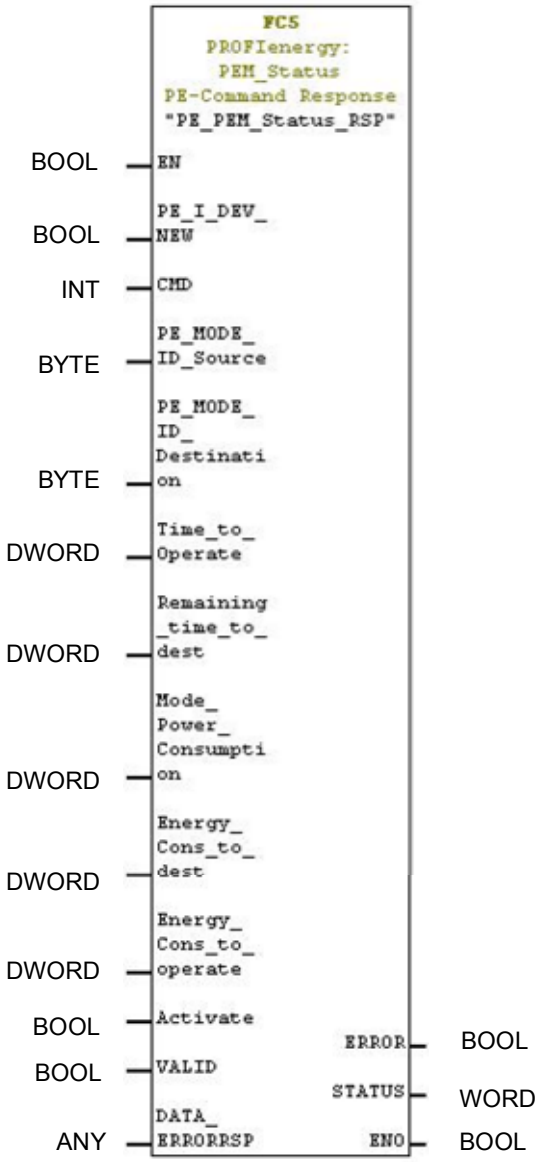
For a definition of the parameters see chapter 4.4

4.6.8 Program details to block FC 5 “PE_PEM_Status_RSP”

“PEM status”

Generates the response to the "PEM_STATUS" command.

Figure 4-11



Input parameters

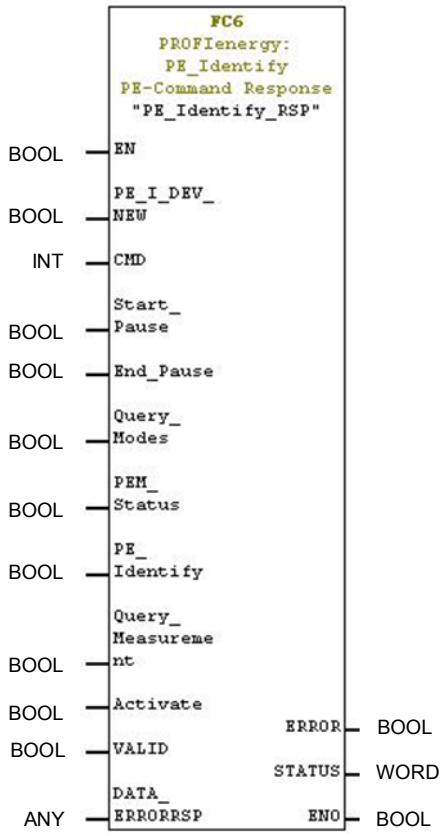
For a definition of the parameters see chapter 4.4

4.6.9 Program details to block FC 6 “PE_Identify_RSP”

“PE identify”

Generates the response to the "PE_IDENTIFY" command. The user indicates what PROFIenergy commands are supported.

Figure 4-12



Input parameters

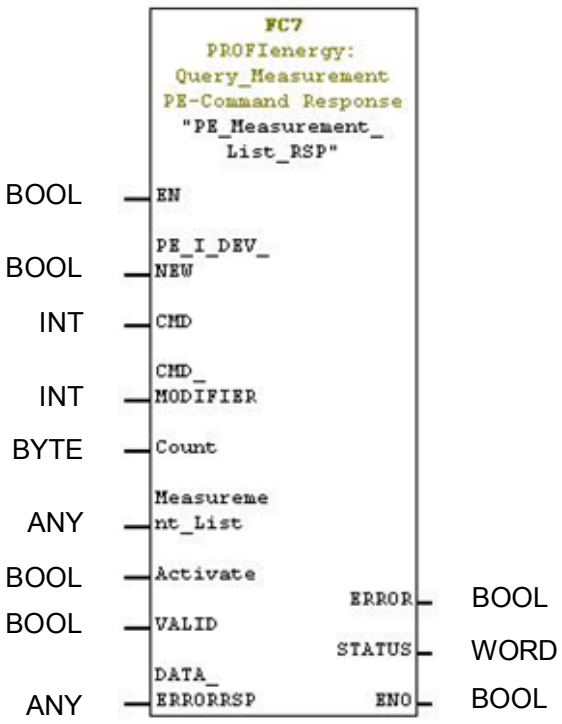
See chapter 4.4.6.

4.6.10 Program details to block FC 7 “PE_Measurement_List_RSP”

“Query measurement”

Generates the response to the "GET_MEASUREMENT_LIST" command. The user indicates what variable Ids (measured values) are supported.

Figure 4-13



Input parameters

Table 4-16

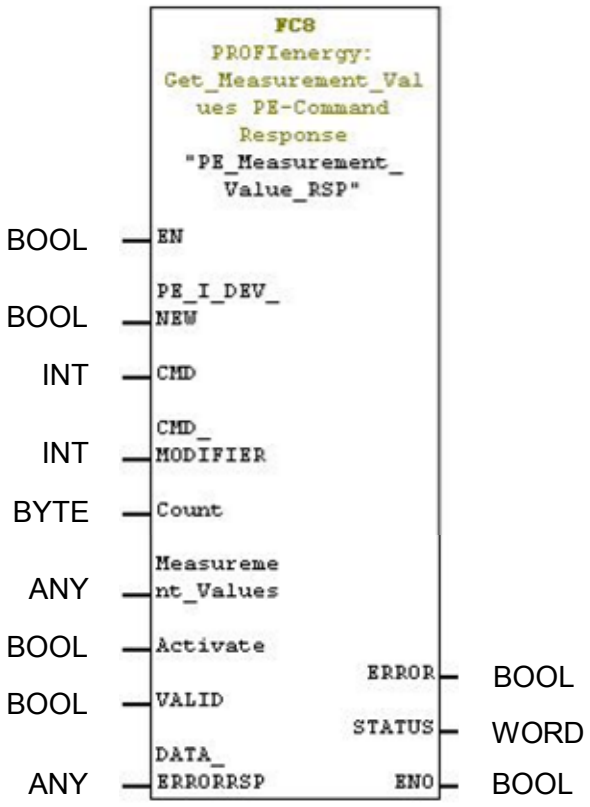
Parameters	Data type	Initial value	Description
Count	byte	0	Number of supported measurement IDs
Measurement_List	Any		Pointer on the array with the supported Measurement_IDs. Structure according to PROFIenergy Profile, see chapter 4.4.7

4.6.11 Program details to block FC 8 “PE_Measurement_Value_RSP”

“Get measurement values”

Generates the response to the "GET_MEASUREMENT_VALUES" command. The user returns the values of the requested measured value(s).

Figure 4-14



Input parameters

Table 4-17

Parameters	Data type	Initial value	Description
Count	byte	0	Number of measurement_values
Measurement_Values	Any		Pointer on the array with the Measurement_Values. Set-up according to PROFIenergy profile, see chapter 4.4.8

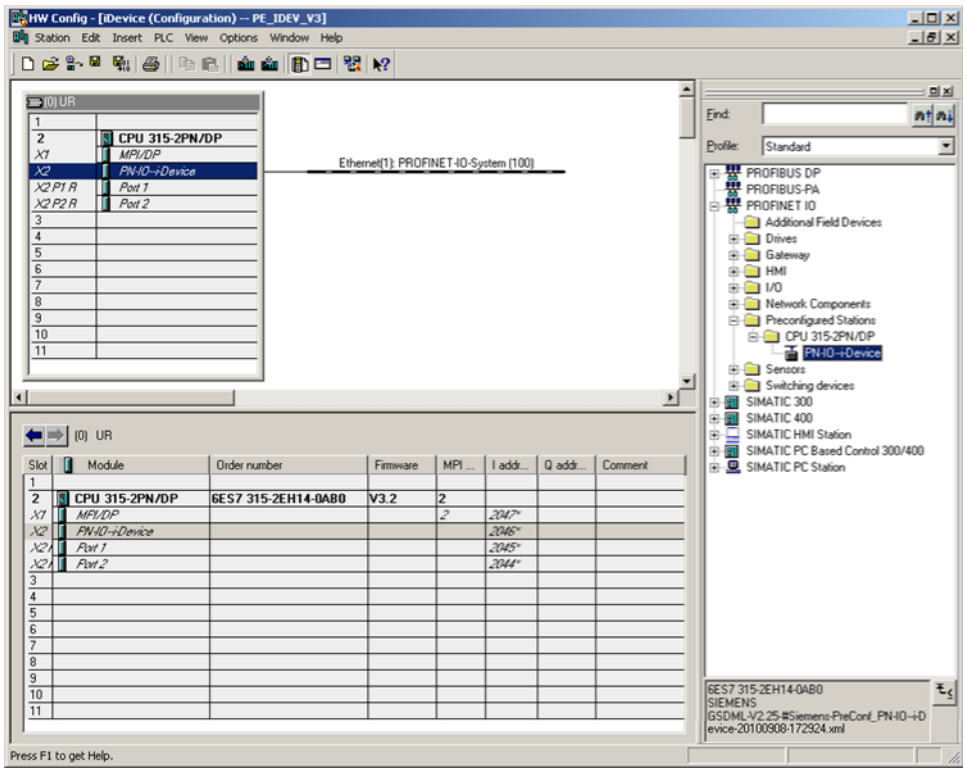
5 Configuration

At the moment, only the above listed controllers with i-device functionality can be delivered. You can adjust and change the delivered sample program according to your requirements and hardware configuration. The following chapters explain the decisive steps of the hardware configuration. If you want to integrate PROFIenergy blocks in existing software you can rename them.

5.1 Configuration of the CPU 315-2PN/DP “I-Device”

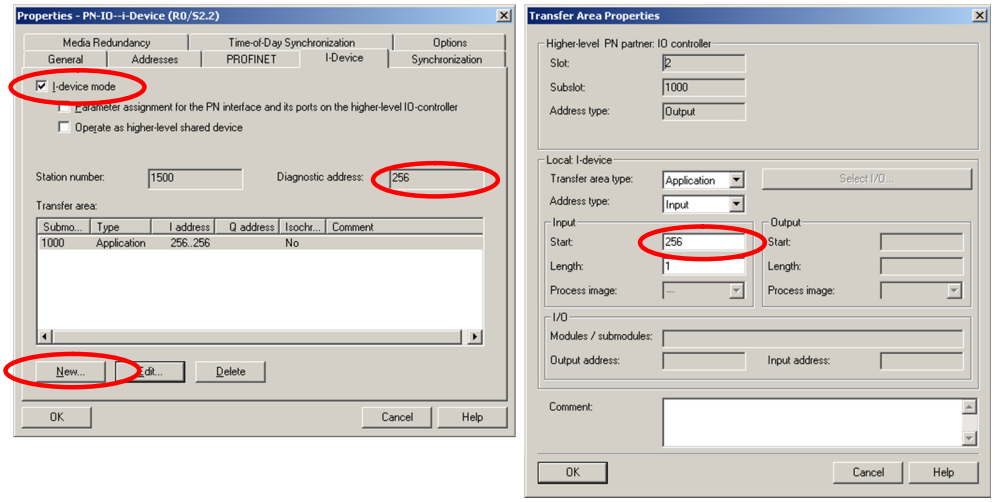
First of all, configure a normal station (controller) as required by you.

Figure 5-1



Afterwards, define this station as i-device. For this purpose, open the properties of the PN-IO interface. Enable the “I-device mode” in the i-Device tab. Click on the Button “New…” to open the Dialog “Transfer Area Properties”.

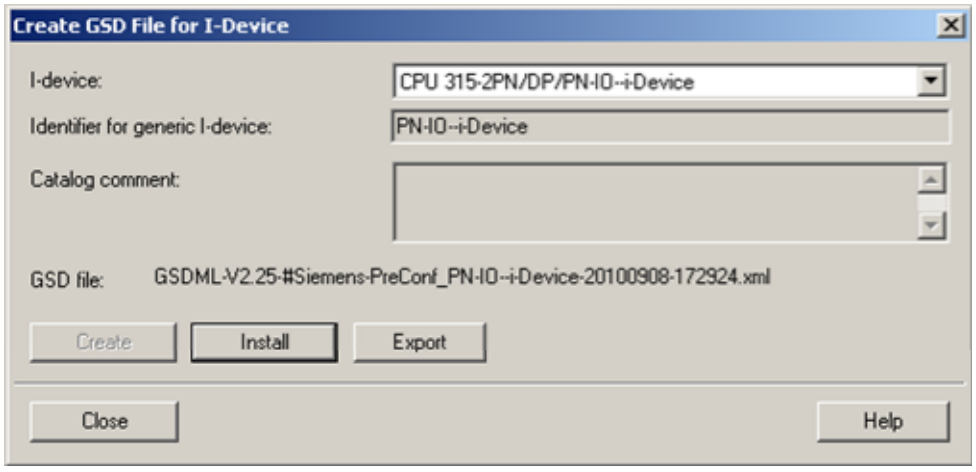
Figure 5-2



Parameterize the input and output areas for the data exchange between IO controller and i-device through “Transfer area” and “New…”. You need the Diagnosic Address “256” as “ID” for the FB parameterization. Close each of these dialogs with “OK” and save and compile the hardware configuration.

You need a GSD file, to be able to parameterize the i-device in the higher-lever controller. You can create it through the main menu
`Options -> Create GSD File for I-Device…`

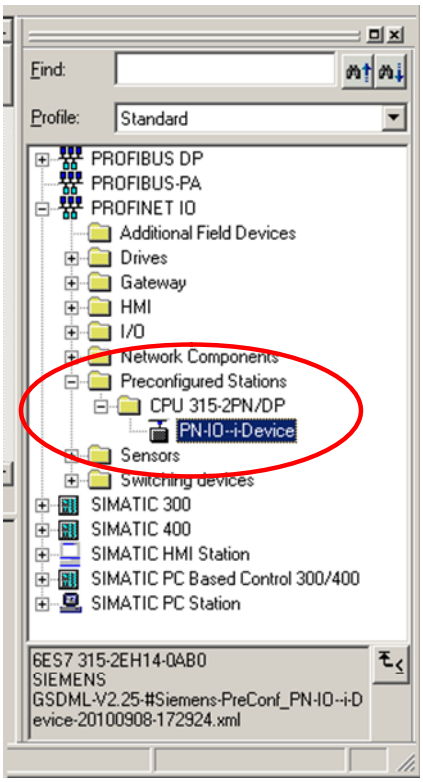
Figure 5-3



With “Install”, the created GSD file is entered in the hardware catalog under “PROFINET IO” – “Preconfigured Stations”.

Hinweis Assign an meaningful name to identify the preconfigured station fast and unambiguously!

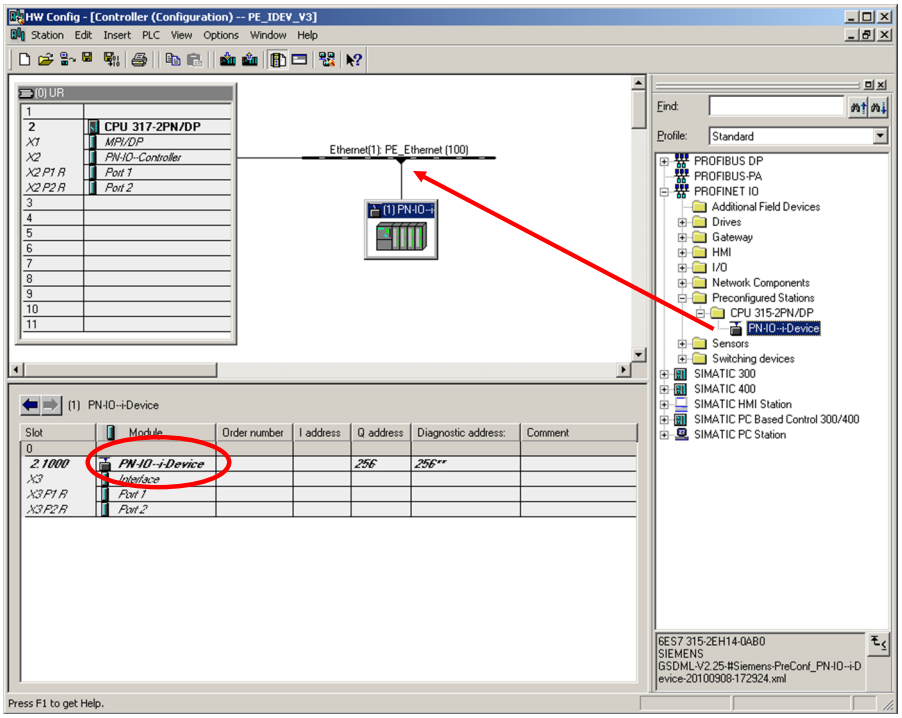
Figure 5-4



5.2 Configuration of the CPU 317-2PN/DP “IO controller”

The station with the CPU317-2PN/DP as IO controller can also be created as usual. Drag the i-device just like a normal IO device from the hardware catalog to your PROFINET line.

Figure 5-5



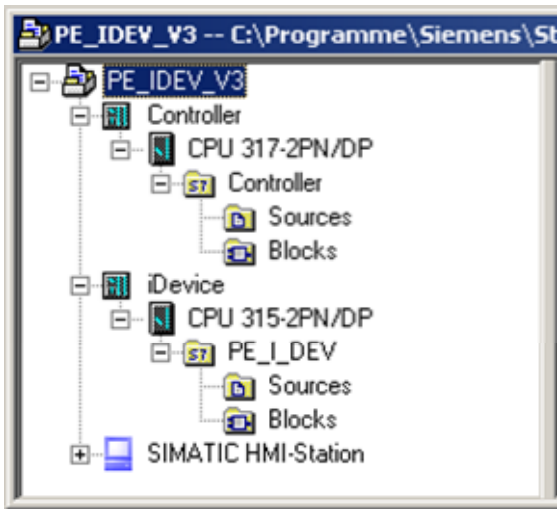
ATTENTION **Make sure never to change the name!**

After saving and compiling, the hardware configuration is completed.

Here, you can also see the diagnostic address “256” for the FB parameterization.

5.3 Configuration of the PROFIenergy programs

Figure 5-6



In both controllers, IO controller and i-device, all PROFIenergy functions are each combined in the FB 10 “Green IT”. Here, once again for reasons of clarity, the parameterization and interconnection of the most important blocks.

5.3.1 IO controller

You can either use FB815 “PE_START_END” or FB816 “PE_CMD” in the IO controller, depending on the complexity of your task.

FB815 “PE_START_END”

```
CALL  "PE_START_END" , "idb_PE_START_END"
 START          :=M100.0
 END            :=M100.1
 ID             :=DW#16#8100
 PAUSE_TIME     :=T#10S
 VALID          :=M100.2
 BUSY           :=M110.0
 ERROR          :=M110.1
 STATUS         :=MD128
 PE_MODE_ID     :=MB111
```

In the simplest case you set “START” to “1”.

FB816 “PE_CMD”:

```
CALL  "PE_CMD" , "idb_PE_CMD_1"
 REQ            :=M220.0
 ID             :=DW#16#8100
 CMD            :=MB222
 CMD_MODIFIER   :=MB224
 CMD_PARA       :=MD240
 CMD_PARA_LEN   :=MW226
 VALID          :=M220.2
 BUSY           :=M220.1
 ERROR          :=M220.3
 STATUS         :=MD228
 RESPONSE_DATA  :=P#DB400.DBX0.0 BYTE 244
```

Pause time “CMD_PARA” = “10000” ms, “CMD_PARA_LEN” = “4” and PAUSE_START “CMD” = “1”. With “REQ” = 1 the data record will be transferred.

5.3.2 I-device

The parameters marked in BLUE between the FB817 and the auxiliary blocks are directly interconnected, as already described earlier.

FB817 “PE_I_DEV”

```
CALL  "PE_I_DEV" , "PE_I_DEV__DI"
 RESET              :=M1.0
 ID                 :=DW#16#100
 VALID              :=M1.3
 INDEX              :="Commando_received_DB".INDEX
 CMD                :="Commando_received_DB".CMD
 CMD_MODIFIER       :="Commando_received_DB".CMD_MODIFIER
 NEW                :=M1.1
 ERROR              :=M1.2
 STATUS             :=MD2
 CMD_PARA           :=P#DB2.DBX6.0 BYTE 234
 DATA_ERRORRSP      :="DATA_ERRORRSP_DB".DATA_ERRORRSP
```

Evaluate the “CMD” = 1 “PAUSE_START” command and the pause time in “CMD_PARA”.

FC1 “Start Pause”

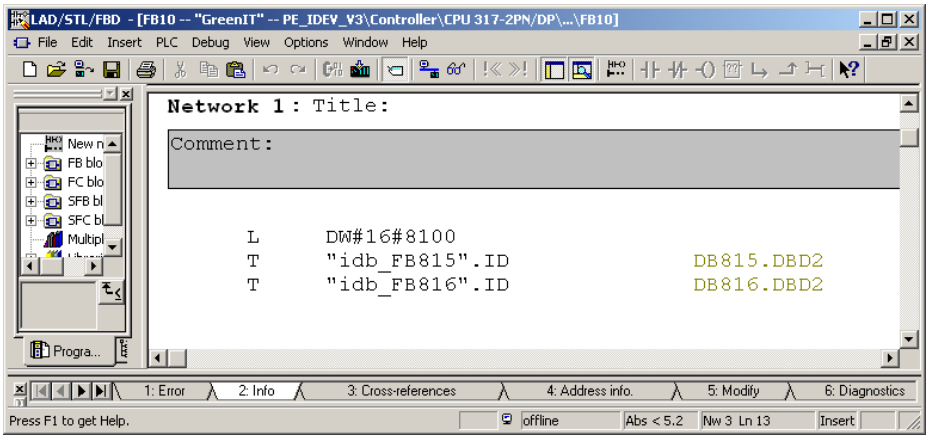
```
CALL  "PE_Start_RSP"
 PE_I_DEV_NEW       :=M1.1
 CMD                :="Commando_received_DB".CMD
 PE_Mode_ID         :=MB36
 ERROR              :=M6.3
 STATUS             :=MW10
 Activate           :=M6.2
 VALID              :=M1.3
 DATA_ERORRRSP      :="DATA_ERRORRSP_DB".DATA_ERRORRSP
```

As a response to CMD = 1 “START_PAUSE” now set PE_MODE_ID to “1” or “2” (for a short or long pause) and the M 6.2 “ACTIVATE” flag within 10 seconds.

FB10 “GreenIT” controller

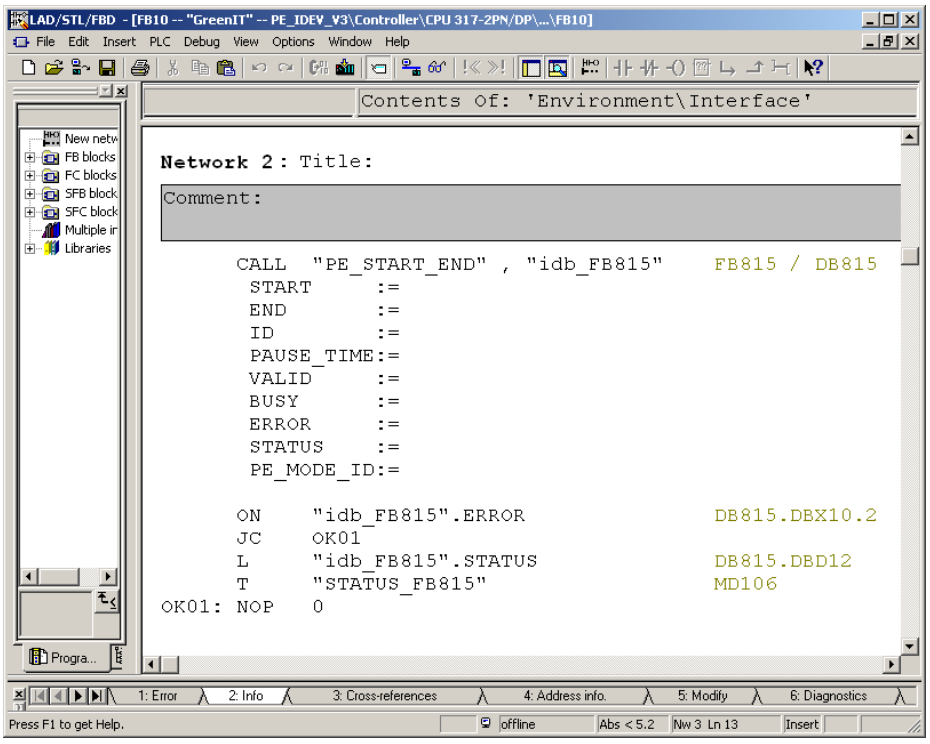
In network 1 the address (ID) is entered as default for the FB815 and the FB816. Parameterization and operation of the blocks is always performed through the corresponding instance data blocks. It is easiest to handle through the prepared variable tables.

Figure 5-7



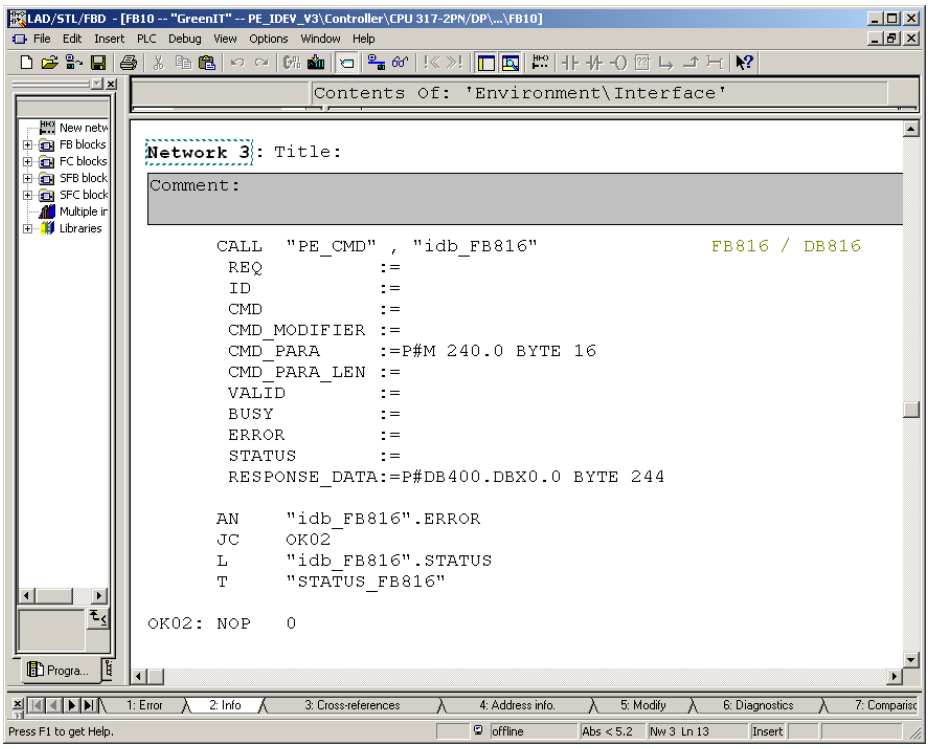
The FB815 is called in network 2 for the i-device.

Figure 5-8



The FB816 is called in network 3.

Figure 5-9



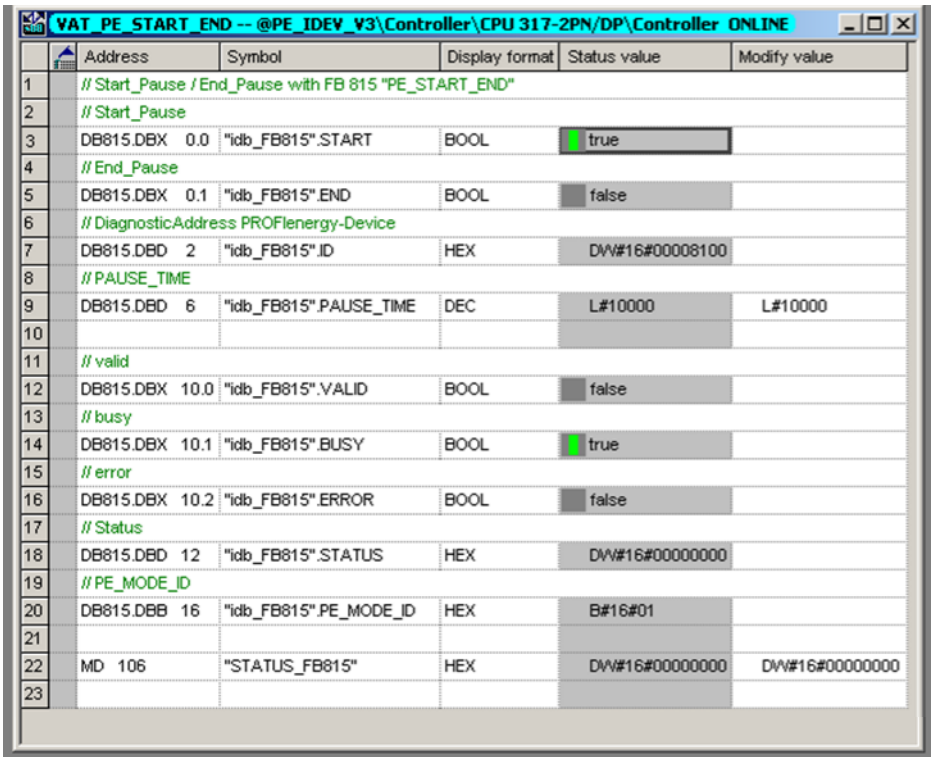
If there is an error "ERROR=1" after the block call, the STATUS is temporarily stored in a buffer.

The result of the request is stored in the DB400 “RESPONSE_DATA”. The requested data is entered from data byte 10. Structure and interpretation of this data area depends on the job.
See Chapter 4.3.

It is easier to read the structure through the corresponding variable table. For some sample jobs variable tables are prepared (VAT).

The FB815 can easily be operated through the “VAT_PE_START_END” variable table. Further down, in chapter 8.3, other variable tables and their operation is explained.

Figure 5-10



VAT_PE_START_END -- @PE_IDEV_V3\Controller\CPU 317-2PN/DP\Controller ONLINE

	Address	Symbol	Display format	Status value	Modify value
1	// Start_Pause / End_Pause with FB 815 "PE_START_END"				
2	// Start_Pause				
3	DB815.DBX 0.0	"idb_FB815".START	BOOL	true	
4	// End_Pause				
5	DB815.DBX 0.1	"idb_FB815".END	BOOL	false	
6	// DiagnosticAddress PROFIenergy-Device				
7	DB815.DBD 2	"idb_FB815".ID	HEX	DW#16#00008100	
8	// PAUSE_TIME				
9	DB815.DBD 6	"idb_FB815".PAUSE_TIME	DEC	L#10000	L#10000
10					
11	// valid				
12	DB815.DBX 10.0	"idb_FB815".VALID	BOOL	false	
13	// busy				
14	DB815.DBX 10.1	"idb_FB815".BUSY	BOOL	true	
15	// error				
16	DB815.DBX 10.2	"idb_FB815".ERROR	BOOL	false	
17	// Status				
18	DB815.DBD 12	"idb_FB815".STATUS	HEX	DW#16#00000000	
19	// PE_MODE_ID				
20	DB815.DBB 16	"idb_FB815".PE_MODE_ID	HEX	B#16#01	
21					
22	MD 106	"STATUS_FB815"	HEX	DW#16#00000000	DW#16#00000000
23					

Here, you see the default address (8100) and the variable command:

START: start command bit for pause. The rising edge is evaluated.

END: end command bit for pause. The rising edge is evaluated.

PAUSE_TIME: The value must be bigger or equal to the minimum pause time of the PROFIenergy device. Here, 10 seconds each (measured in milliseconds).

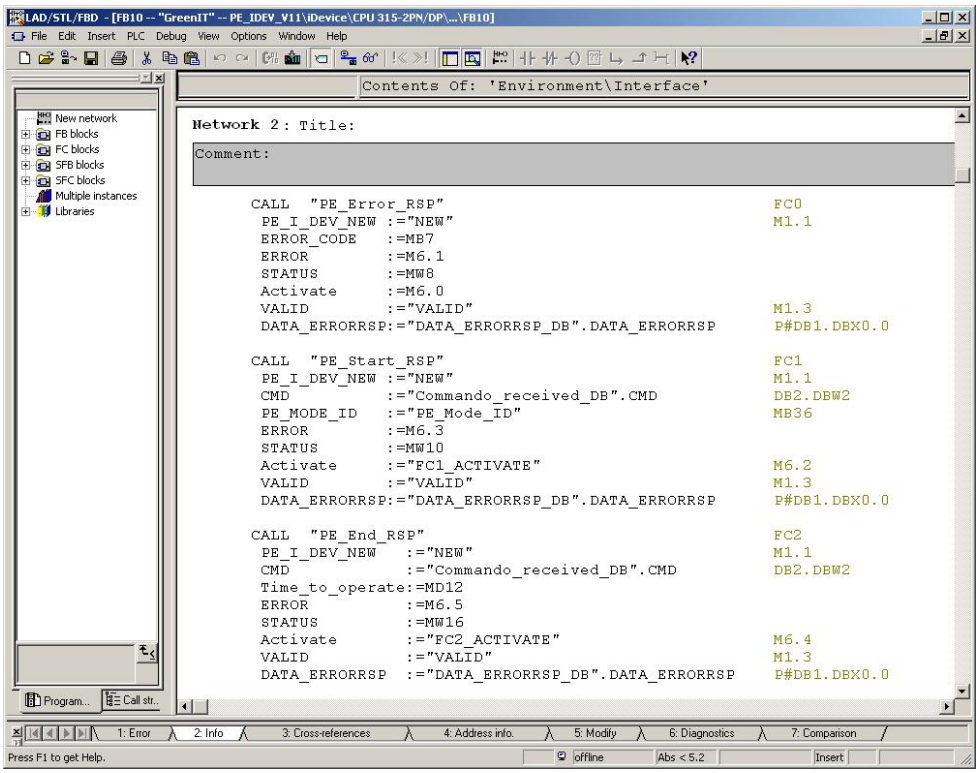
Tip

Tip: If the display format in the variable table is reset to TIME, then the value can be entered directly, for example, in minutes.
T#10S, value range:: T#1MS to T#24D20H31M23S647MS.

FB10 “GreenIT” i-device

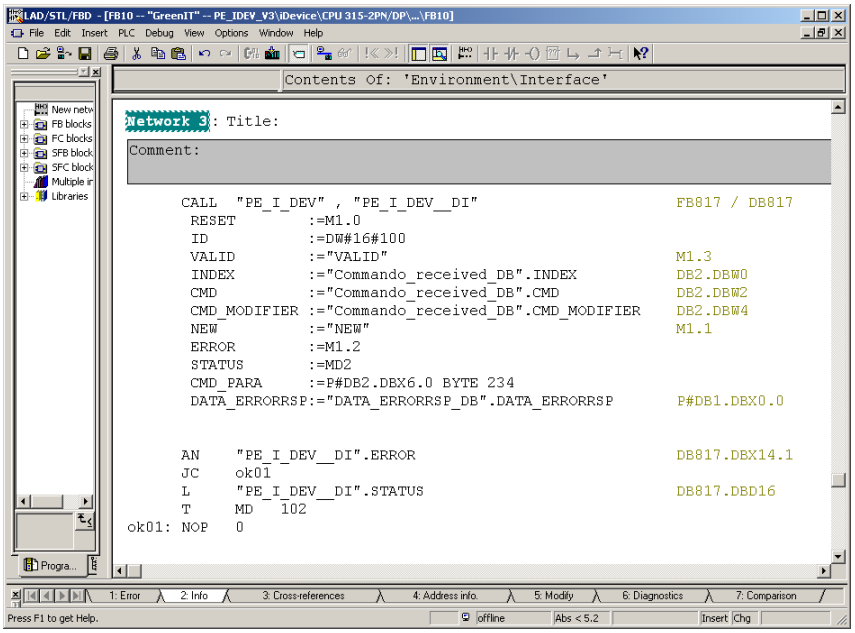
The auxiliary blocks FC0 to FC8 are called in network 2 for the FB817. Since FCs have no instance data block, the parameterization is performed through flags here.

Figure 5-11



The FB817 is called in network 3. In the event of an error, the STATUS is also saved in a buffer.

Figure 5-12

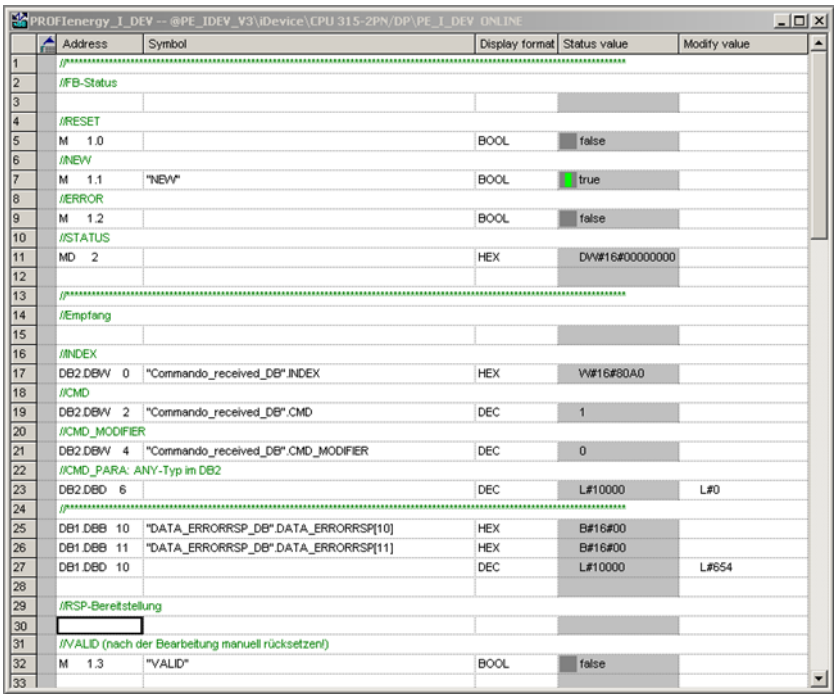


The block was directly parameterized, analog to the auxiliary blocks. The result of the request is stored in the DB1 “DATA_ERRORRSP_DB”. The requested data is entered from data byte 10. Structure and interpretation of this data area depends on the job.
See chapter 4.4

It is easier to read the structure through the corresponding variable table. For some sample jobs variable tables are prepared (VAT).

The “operation” is performed through the corresponding auxiliary blocks and the “PROFIenergy_I_Dev” variable table. Further explanations regarding the operation can be found in chapter XYZ further down.

Figure 5-13



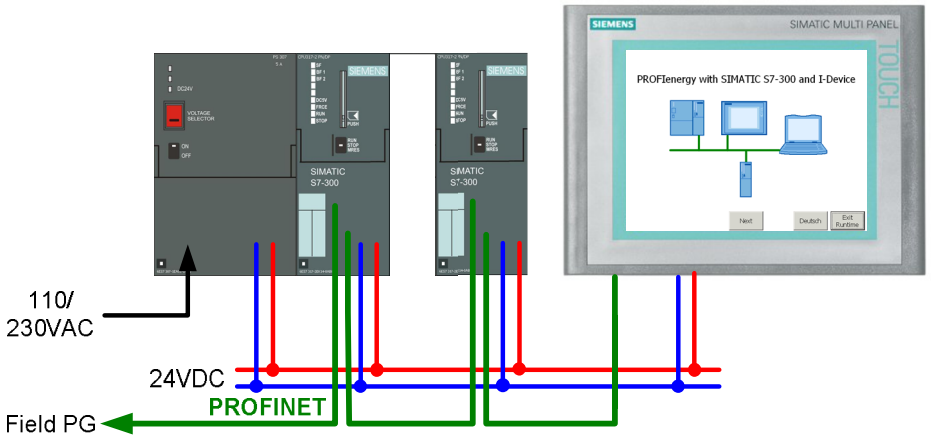
	Address	Symbol	Display format	Status value	Modify value
1	//**********				
2	//FB-Status				
3					
4	//RESET				
5	M 1.0		BOOL	false	
6	//NEW				
7	M 1.1	"NEW"	BOOL	true	
8	//ERROR				
9	M 1.2		BOOL	false	
10	//STATUS				
11	MD 2		HEX	DW#16#00000000	
12					
13	//**********				
14	//Empfang				
15					
16	//INDEX				
17	DB2.DBW 0	"Commando_received_DB".INDEX	HEX	W#16#80A0	
18	//CMD				
19	DB2.DBW 2	"Commando_received_DB".CMD	DEC	1	
20	//CMD_MODIFIER				
21	DB2.DBW 4	"Commando_received_DB".CMD_MODIFIER	DEC	0	
22	//CMD_PARA: ANY-Typ im DB2				
23	DB2.DBD 6		DEC	L#10000	L#0
24	//**********				
25	DB1.DBB 10	"DATA_ERRORRSP_DB".DATA_ERRORRSP[10]	HEX	B#16#00	
26	DB1.DBB 11	"DATA_ERRORRSP_DB".DATA_ERRORRSP[11]	HEX	B#16#00	
27	DB1.DBD 10		DEC	L#10000	L#654
28					
29	//RSP-Bereitstellung				
30					
31	//VALID (nach der Bearbeitung manuell rücksetzen!)				
32	M 1.3	"VALID"	BOOL	false	
33					

6 Installation

6.1 Installation of the hardware

The figure below shows the hardware setup of the application:

Figure 6-1



Note The setup guidelines /3/ for SIMATIC S7 always have to be observed.

For the SIMATIC S7 CPU, you need a MMC memory card each.

CAUTION **Please make sure to have the right setting of the selector switch for the for multi-range power supply.**

6.2 Installing the software

For the configuration of the i-device STEP 7 Version 5.5 is required together with the hardware support package, HSP, for the CPU with firmware 3.2. Please install it according to the installation instruction included in delivery. Additional software packages or settings especially for PROFIenergy are not necessary.

Install the current WinCC flexible Version 2008, if the operation is to be performed through a panel or the respective runtime. This is optional. PROFIenergy is irrespective of WinCC flexible.

The following blocks and the corresponding SFBs are necessary for the integration of PROFIenergy:

- FB 815 “PE_START_END”
- FB 816 “PE_CMD”
- FB817 “PE_I_DEV”

All blocks can be found in the STEP 7 project of the application example. All blocks included in delivery can be copied in a user-specific project and if desired they can be renamed. All PROFIenergy blocks can be used license free.

6.3 Installing the application software

Download the application project from the Service & Support portal. The link on the respective page can be found at the beginning of this document. Copy the project, (STEP 7 archive in ZIP format) onto the configuration computer (SIMATIC Field PG) and open it in the SIMATIC Manager through the `File -> Retrieving…` menu

7 Startup of the Application

7.1 Preparation

Table 7-1

No.	Instruction	Comment
1	Please make sure that the hardware structure and hardware configuration are compatible.	
2	Check the power supply settings. Switch on the system.	Observe all necessary regulations and safety specifications.
	Download the current firmware for the CPU from our Service & Support portal and to update the modules, if necessary.	Note the corresponding manuals and attached instructions.
3	Connect the SIMATIC Field PG with the system and set the correct interface with the “Set PG/PC interface…” function.	They can be found, among others, in the main menu under “Options”.

7.2 Commissioning

Table 7-2

No.	Instruction	Comment
1	Assign the device name and IP addresses for the stations: S7-CPU 317: X2: PN-IO: Name: PN-IO--Controller, IP addr.: 192.168.1.100 S7-CPU 315: X2: PN-IO: Name: PN-IO--i-Device, IP addr.: 192.168.1.101	Use the functions in the hardware configuration under `Target system -> Ethernet:` - `edit Ethernet station` and - `assign device name`
2	Download the hardware configuration into the CPU	
3	Download the user program into the CPU	
4	Make sure that the i-device name in the hardware configuration of the controller was not changed.	
5	If you have WinCC flexible, now open the SIMATIC HMI station and the WinCC flexible project.	
6	If you do not have a panel, you can start runtime directly.	Through `Project -> Generator -> Start runtime`
7	If you have a panel, set “Ethernet” and IP address: 192.168.1.103	Through `Control Panel -> Transfer”-> Advanced -> LAN`
8	Set the panel to “Transfer” and load the project from PG to the panel	

8 Operating the Application

8.1 Overview

There are 3 options to operate the plant:

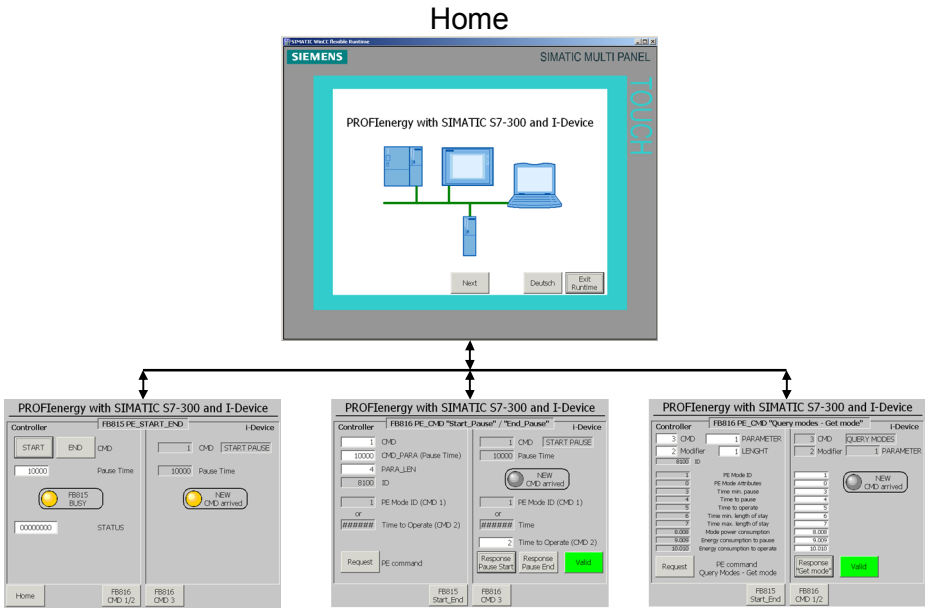
- HMI panel
- HMI runtime (identical with the panel)
- Variable table in STEP 7

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

8.2 Operation with HMI

HMI runtime and a real panel do not differ in the operation. After start-up you can change between German and English in the start screen or exit the HMI interface with “Exit Runtime”. Click to the Button “Next” to go to the first PROFIenergy screen.

Figure 8-1



From the first “FB815” screen you can go to the start screen again, or you can go directly to one of the operating screens with the corresponding buttons. The used parameters on the different sides address the same parameter of the blocks. However, they are sometimes interpreted differently (depending on command). By changing the screen, some CMD parameters are assigned accordingly.

Detailed information to the individual screens can be found in the next chapters.

First of all, make sure that the “Valid” parameter is reset. On a FB816 screen click the green “Valid” button to reset the parameter.

Scenarios

The following applications are explained in detail in the next chapters:

FB815 PE_START_END:
Pause_Start and Pause_End with FB815

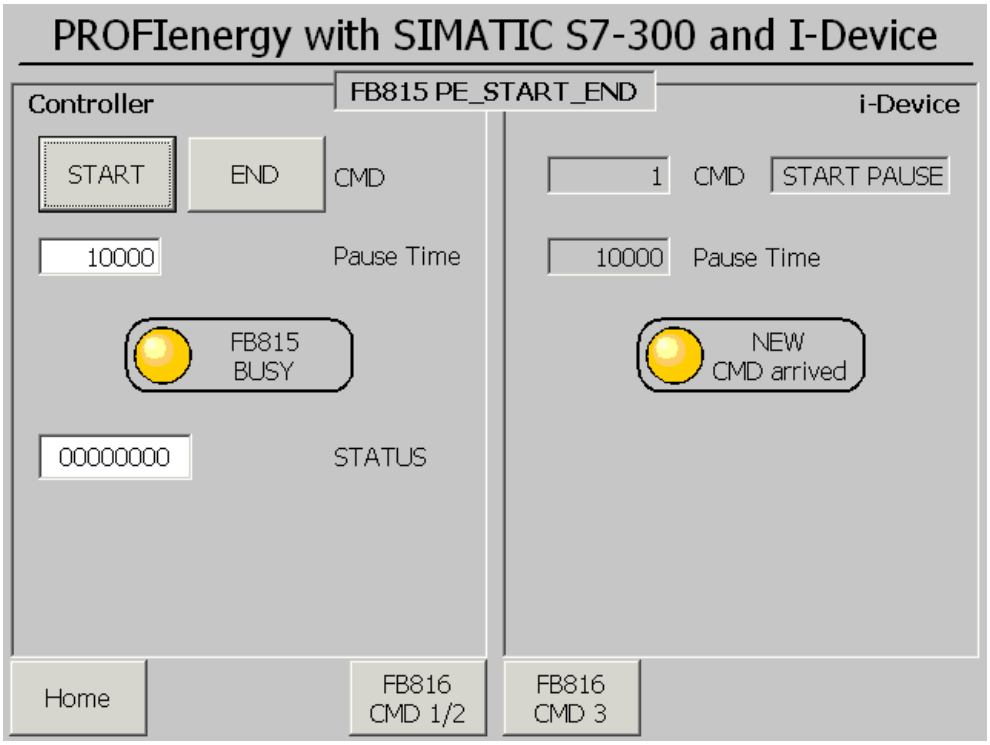
FB816 PE_CMD “START / END”:
Pause_Start and Pause_End with FB816

FB816 PE_CMD “Query modes – Get mode”:
Reading of PROFIenergy parameter with FB816

8.2.1 Scenario FB815 “PE_START_END”

This scenario shows how a pause can easily be started or ended with the FB815.

Figure 8-2



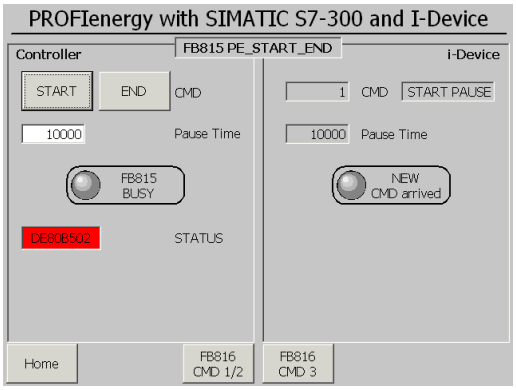
Assignment of the signals:

Table 8-1

HMI	Parameters
Controller	
CMD START	FB815 START
CMD END	FB815 END
Pause Time	FB815 PAUSE_TIME
FB815 BUSY	FB815 BUSY, new command sent and not yet answered
STATUS	FB815 STATUS, if ERROR = 1, copied to MD106
I-device	
CMD	FB817 CMD, with text list for plain text display
Pause Time	FB817 CMD_PARA, DB2 “Commando_received_DB“ DBD6, CMD specific DB structure
New CMD arrived	FB817 NEW, new command arrived and not yet answered

Operating steps:

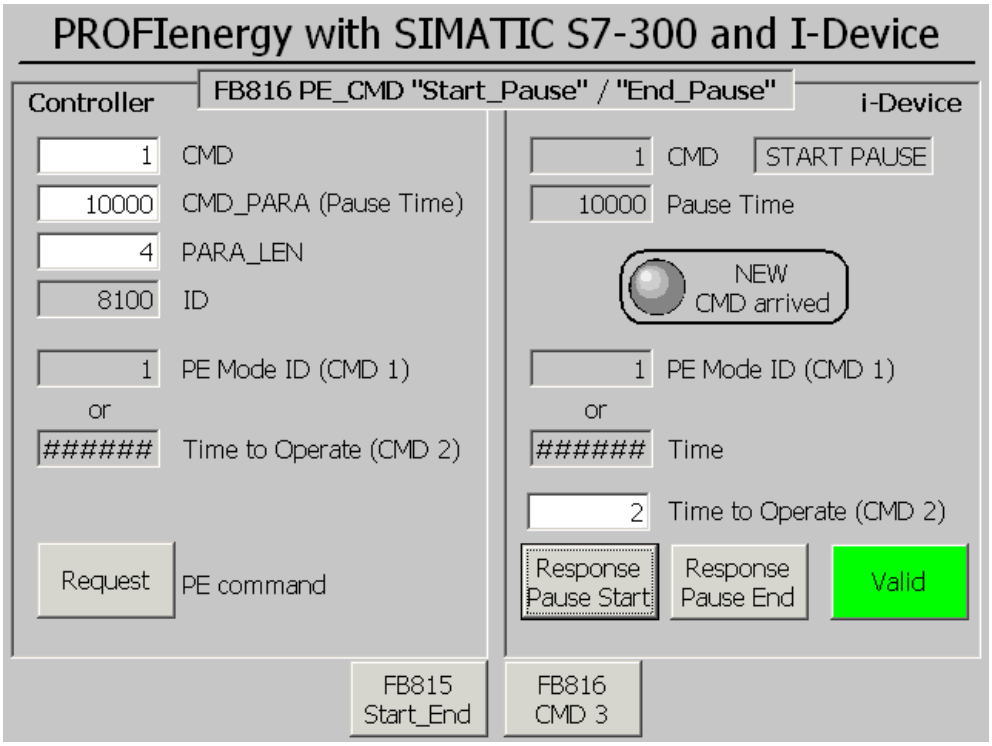
Table 8-2

No.	Instruction	Comment
1	Controller: Enter a pause time of, e.g. 10000 ms.	If the minimum pause time is not reached, the i-device will not participate in the pause. For the i-device the “Time min pause” parameter can be freely defined and is requested in scenario 3.
2	Controller: Click the "START" button.	The “PAUSE_START” command is sent to the i-device.
3	I device: The “PAUSE_START” (CMD=1) command, the “Pause Time” (10000) and “NEW CMD arrived” is displayed.	The command can be answered within 10 seconds. For this scenario just wait 10 seconds, please. These 10 seconds are not identical with the parameterizable “Pause_Time”!
4	Controller: “FB815 BUSY” is displayed	The commands waits 10 seconds for an answer
5	I device: After 10 seconds without an answer, “NEW” is reset.	
6	Controller: After 10 seconds without an answer “BUSY” is reset and “STATUS” displays the error code. 	After 10 seconds without an answer the FB generates an error. If the ERROR parameter is set, the STATUS is saved in a memory double word (MD106).
7	Controller: Reset the error code.	Overwrite the value with “0”. Do not forget to complete value entries with “Return”
8	Controller: Click the "END" button.	The “PAUSE_END” command is sent to the i-device.
9	I device: The “PAUSE_END” (CMD=2) command, and “NEW CMD arrived” is displayed.	If no answer is sent, the responses of the system are identical to CMD=1.
10	Controller: The FB815 provides a simpler form for PAUSE_START and PAUSE_END. The answer is identical with the response to the commands CMD=1 or CMD=2 of FB816 and is explained in more detail there.	You can send the answers for the FB815 from the “FB816 CMD ½” side.

8.2.2 Scenario FB816 PE_CMD “START / END”:

Of course, you can also send the "PAUSE_START” and “PAUSE_END” commands with the open command interface of the FB816.

Figure 8-3



Assignment of the signals:

Table 8-3

HMI	Parameters
Controller	
CMD	FB816 CMD
CMD_PARA	FB816 CMD_PARA, MD240 interpreted as PAUSE_TIME here
PARA_LEN	FB816 CMD_PARA_LEN
ID	FB816 ID, here preassigned with the address of the i-device.
PE Mode ID	FB816 RESPONSE_DATA, DB400.DBB10 here interpreted as PE Mode ID for CMD=1
Time to Operate	FB816 RESPONSE_DATA, DB400.DBD10 here interpreted as Time_to_Operate for CMD=2 The RESPONSE_DATA data area is used differently, depending on the command. If the content of the DBD can no longer be interpreted, ### will be displayed.
Request – PE command	FB816 REQ, starts the block processing.

HMI	Parameters
I-Device	
CMD	FB817 CMD, with text list for plain text display
Pause Time	FB817 CMD_PARA, DB2 “Command_received_DB“ DBD6, CMD specific DB structure
New CMD arrived	FB817 NEW, new command arrived and not yet answered
PE Mode ID	FB817 DATA_ERRORRSP, DB1.DBB10 here interpreted as “PE mode ID”, as answer for CMD=1
Time	FB817 DATA_ERRORRSP, DB1.DBB10 here interpreted as “Time to operate”, as answer for CMD=2. The value is assigned through the next parameter.
PE_Mode_ID	FC1 PE_MODE_ID, this input parameter is copied from FC1 into the DATA_ERRORRSP area of FB817 (Parameter PE_Mode_ID, see above). The value indicates the PE Mode of the PE-Device. Select the PE_Mode_ID scaled to the pause duration for example. Later on you can set specific Measurement Values for every Mode (see „Query modes – Get Mode“ below).
Time to Operate	FC2 “Time_to_operate”, this input parameter is copied from FC2 into the DATA_ERRORRSP area of FB817 (Parameter Time, see above). The value indicates the period until the i-device is fully ready to operate.
Response Pause Start	FC1 Activate, sends the “Pause started” response. The FC1 provides the parameters of the FB817 and starts the block. Pressing the button sets the bit, releasing it resets it again.
Response Pause End	FC2 Activate, sends the “Pause ended” response. The FC2 provides the parameter of the FB817 (see above) and starts the block. Pressing the button sets the bit, releasing it resets it again.
Valid	FC1, FC2 VALID, data successfully transferred to FB817 FB817 VALID, data sent to controller. Button turns green with VALID=1 and as a result has to be reset by the user (pressing the button).

Operating steps:

Table 8-4

No.	Instruction	Comment
1	Controller: Once the screen has been selected, the input fields are assigned as follows: CMD = 1: PAUSE_START command CMD_PARA=10000 ms: PAUSE_TIME: PARA_LEN=4: Double word for PAUSE_TIME	The ID is preassigned. The values of the other parameters depend on the previous commands.
2	Controller: For PAUSE_START click the “Request” button.	Displaying BUSY and the error code was avoided for reasons of space, the response is identical with that of FB815 (see Table 4-3).
3	I device: CMD and PAUSE_TIME is updated “NEW CMD arrived” shows Green for 10 seconds	The monitoring time of 10 seconds also applies here (not identical with PAUSE_TIME).
4	I device: Answer the request by clicking “Response Pause Start”	Through the FC1 the FB817 is supplied and started.
5	I-device: The “01” PROFIenergy-Mode is entered in “PE Mode ID” as feedback.	“Valid” turns green and shows that the answer was sent.
6	Controller: On the controller, the PROFIenergy mode of the i-device is displayed in “PE Mode ID”.	
7	I-device: Before you continue, click the “Valid” button to reset it.	
8	Controller: Change the CMD to “2”, meaning the “PAUSE_END” command. Send the command with “Request”.	Complete the entry with “Return”. The other parameters are not relevant.
9	I-device: The new command is displayed with CMD=2 and “NEW CMD arrived”.	
10	I-device: Enter the time the i-device requires to be fully ready to operate, in the “Time to Operate” parameter. Answer the command with “Response Pause End”. The “Time to Operate” is now also displayed in “Time”.	“Time to Operate” is a parameter of the FC2 that is copied in the response data area of the FB817 (here “Time”) with the start of the command.
11	Controller: The “Time to Operate” is now displayed as feedback in the response data area, instead of “PE Mode ID” for command “1”.	The response data area is updated with BUSY=0 and ERROR=0.
12	I-device: Reset “Valid” again.	

8.2.3 Scenario FB816 PE_CMD “Query modes – Get mode”:

The PROFIenergy parameters of the i-device are requested as an example for the other PROFIenergy commands.

Figure 8-4

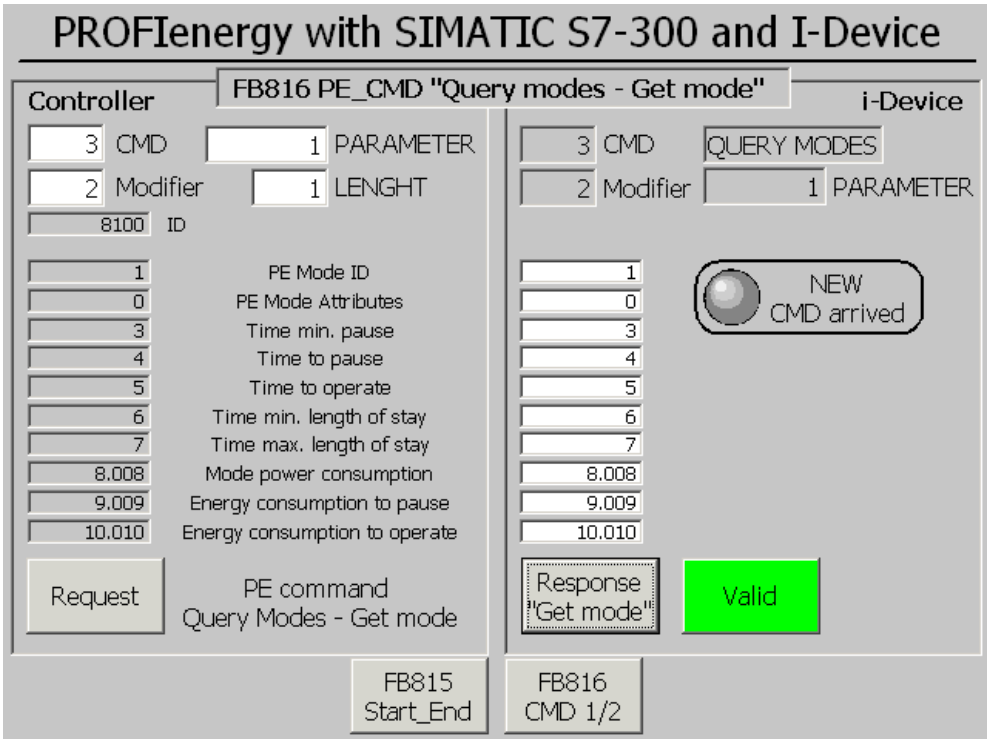


Table 8-5

HMI	Parameters
Controller	
CMD	FB816 CMD
PARAMETER	FB816 CMD_PARA, here MB240 interpreted as PE_mode_ID. Different values for each PE_Mode are possible.
LENGTH	FB816 CMD_PARA_LEN, here “1” stands for “one byte”
ID	FB816 ID, here preassigned with the address of the i-device.
Output fields PE mode ID …	FB816 RESPONSE_DATA, DB400.DBB10 here interpreted as PE Mode ID For further set-up information, see chapter 4.4.4.
Request	FB816 REQ, starts the block processing.

HMI	Parameters
I-Device	
CMD	FB817 CMD, with text list for plain text display
Modifier	FB817 CMD_MODIFIER
PARAMETER	FB817 CMD_PARA
New CMD arrived	FB817 NEW, new command arrived and not yet answered
Input fields PE Mode ID …	FC4 PE_mode_ID …, FB817 DATA_ERRORRSP, DB1.DBB10 here interpreted as “PE mode ID” … For further set-up information, see chapter 4.4.4.
Response “Get mode”	FC4 Activate, sends the “Get Mode Response” answer. The FC4 provides the parameters of the FB817 and starts the block. Pressing the button sets the bit, releasing it resets it again.
Valid	FC4 VALID, data successfully transferred to FB817 FB817 VALID, data send to controller. Button turns green with VALID=1 and as a result has to be reset by the user (pressing the button).

Operating steps:

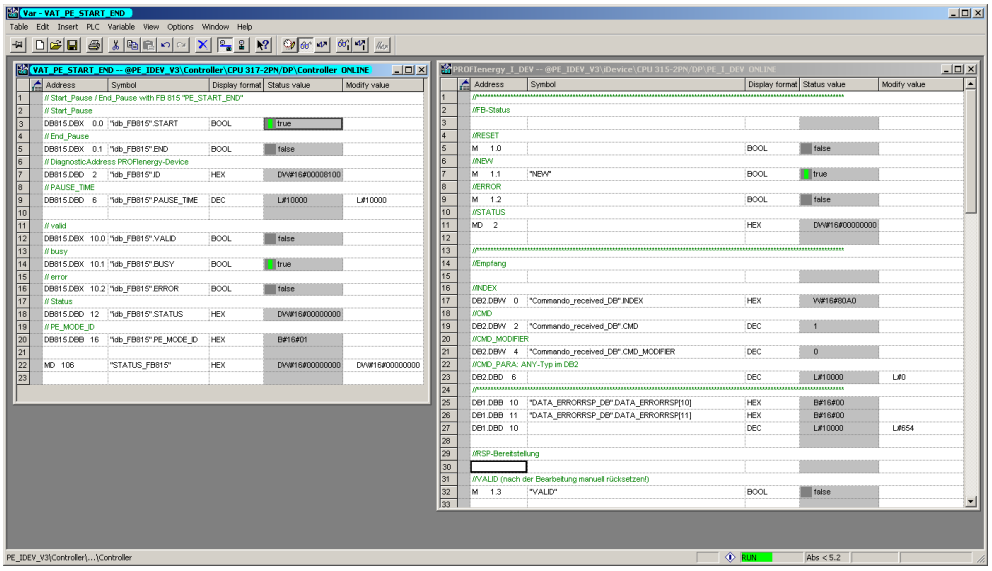
Table 8-6

No.	Instruction	Comment
1	Controller: Once the screen has been selected, the input fields are assigned as follows: CMD = 3: Query Modes command MODIFIER = 2: Get mode CMD_PARA = 1: PE Mode ID PARA_LEN = 1: byte for PE mode ID	The ID is preassigned. The values of the other parameters depend on the previous commands. No other parameter combination is possible for the structure of the screen (interpretation of the response data area). Only the "PE mode ID" can be changed if the i-device manages other PE modes apart from PE Mode "1".
2	Controller: Click the "Request" button for the PROFIenergy "Query Modes – Get mode" command.	Displaying BUSY and the error code was avoided for reasons of space, the response is identical with that of FB815 (see there).
3	I-Device: CMD, MODIFIER and PARAMETER are updated "NEW CMD arrived" shows Green for 10 seconds	The monitoring time of 10 seconds also applies here (not identical with PAUSE_TIME).
5	I-Device: Enter some values, for "PE mode ID" here a "1" (as requested in PARAMETER). Answer the request by clicking "Response Get mode"	The FB817 is supplied and started through the FC4. PE mode attributes is currently not supported.
6	I-Device: "Valid" turns green and shows that the answer was sent.	
7	Controller: From "PE Mode ID", the requested PROFIenergy parameters of the i-device are also displayed on the controller.	
8	I-Device: Before you continue, click the "Valid" button to reset it.	

8.3 Operation with a variable table (VAT)

Below, the corresponding command bits are described in the variable tables. This corresponds to the HMI commands described in the previous chapter.

Figure 8-5



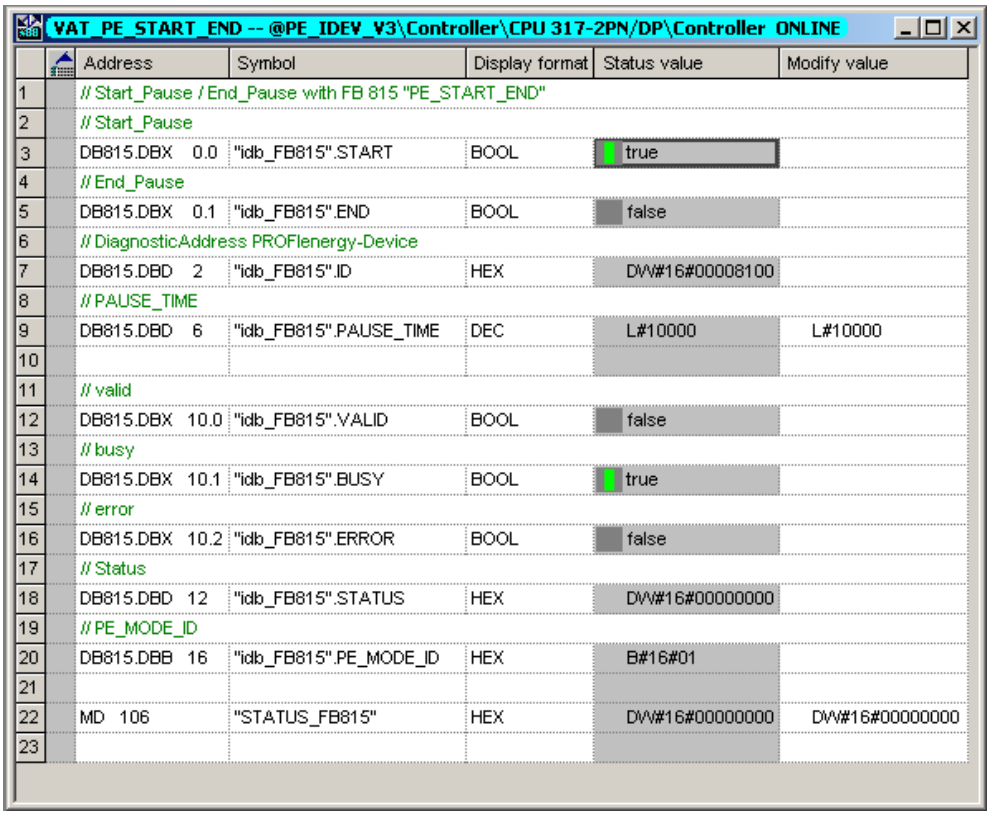
Just as in the screens of the HMI panel, you can arrange the variable tables for the controller and the i-device next to each other. Scenarios and operating steps are identical with the operation through the HMI.

In the following sections, the tables are explained in detail.

8.3.1 VAT_PE_START_END controller

To use the FB815, open the VAT_PE_START_END variable table in the controller block container.

Figure 8-6



	Address	Symbol	Display format	Status value	Modify value
1	// Start_Pause / End_Pause with FB 815 "PE_START_END"				
2	// Start_Pause				
3	DB815.DBX 0.0	"idb_FB815".START	BOOL	true	
4	// End_Pause				
5	DB815.DBX 0.1	"idb_FB815".END	BOOL	false	
6	// DiagnosticAddress PROFIenergy-Device				
7	DB815.DBD 2	"idb_FB815".ID	HEX	DW#16#00008100	
8	// PAUSE_TIME				
9	DB815.DBD 6	"idb_FB815".PAUSE_TIME	DEC	L#10000	L#10000
10					
11	// valid				
12	DB815.DBX 10.0	"idb_FB815".VALID	BOOL	false	
13	// busy				
14	DB815.DBX 10.1	"idb_FB815".BUSY	BOOL	true	
15	// error				
16	DB815.DBX 10.2	"idb_FB815".ERROR	BOOL	false	
17	// Status				
18	DB815.DBD 12	"idb_FB815".STATUS	HEX	DW#16#00000000	
19	// PE_MODE_ID				
20	DB815.DBB 16	"idb_FB815".PE_MODE_ID	HEX	B#16#01	
21					
22	MD 106	"STATUS_FB815"	HEX	DW#16#00000000	DW#16#00000000
23					

Table 8-7

Line	Parameters	Description
7	ID	I-device address, ID predefined in FB10 program
9	PAUSE_TIME	For example 10000ms
3	START	After having entered the PAUSE_TIME, start the pause here with an edge (setting/resetting)
14	BUSY	The parameter is “1” as long as no answer arrived from the i-device and the monitoring time has not yet run out.
16	ERROR	Has status “1” for one cycle if a job was completed with error, for example, when the monitoring time has run out.
18	STATUS	Output of the error code in the event of ERROR=1
22	MD106	STATUS buffered, delete after evaluation.
20	PE_MODE_ID	Feedback activates energy-saving mode of i-device
5	END	End the pause with an edge here (setting/resetting)

8.3.2 VAT_PE_CMD_OpenInterface CMD 1/2 controller

The FB816 processes all PROFIenergy commands. Here, first of all the commands PAUSE_START and PAUSE_END.

Figure 8-7

VAT_PE_CMD_OpenInterface -- @PE_IDEV_V11\Controller\CPU 317-2PN/DP\Controller ONLINE

	Address	Symbol	Display format	Status value	Modify value
1	// FB816 PE_CMD open interface				
2	// REQ enable				
3	DB816.DBX 0.0	"idb_FB816".REQ	BOOL	false	false
4	// ID Diagnosticaddress PE-Device 1: "8184" or 2:"8178"				
5	DB816.DBD 2	"idb_FB816".ID	HEX	DW#16#00008100	DW#16#00008100
6	// CMD				
7	// 1 = Start Pause 2 = End Pause				
8	// 3 = Query Modes 4 = PEM Status				
9	// 5 = PE Identify 16 = Query Measurment				
10	DB816.DBB 6	"idb_FB816".CMD	DEC	1	1
11	// CMD_MODIFIER Command Modifier				
12	DB816.DBB 7	"idb_FB816".CMD_MODIFIER	DEC	0	0
13	// CMD_PARA Command Parameter Pointer to Array MB240 - 255				
14	//				
15	MB 240		DEC	1	
16	// CMD_PARA_LEN Command length				
17	DB816.DBW 18	"idb_FB816".CMD_PARA_LEN	DEC	4	4
18	// VALID				
19	DB816.DBX 20.0	"idb_FB816".VALID	BOOL	false	
20	// BUSY Bearbeitung läuft				
21	DB816.DBX 20.1	"idb_FB816".BUSY	BOOL	true	
22	// ERROR				
23	DB816.DBX 20.2	"idb_FB816".ERROR	BOOL	false	
24	// STATUS				
25	DB816.DBD 22	"idb_FB816".STATUS	HEX	DW#16#00000000	
26					
27	MD 102	"STATUS_FB816"	HEX	DW#16#00000000	DW#16#00000000
28					
29	// RESPONSE_DATA				
30	// depends on Command ...				

Table 8-8

Line	Parameters	Description
5	ID	I-device addressee, ID predefined in FB10 program
15	CMD_PARA	For CMD=1 as double word for PAUSE_TIME, here 10000ms.
17	CMD_PARA_LEN	Length of CMD_PARA, here 4 byte for CMD=1
10	CMD	Preassign the desired PROFIenergy command: “1” for PAUSE_START “2” for PAUSE_END
3	REQUEST	This sends the CMD command to the i-device (edge!).
21	BUSY	The parameter is “1” as long as no answer arrived from the i-device and the monitoring time has not yet run out.
23	ERROR	Has status “1” for one cycle if a job was completed with error, for example, when the monitoring time has run out.
25	STATUS	Output of the error code in the event of ERROR=1
27	MD102	STATUS buffered, delete after evaluation.
29	RESPONSE_DATA	The interpretation of DB400 depends on the command. You can find the set-up information in chapter 4.4

8.3.3 I-Device VAT_PROFIenergy_I_DEV CMD 1/2

This variable table is to be used for all commands. In the upper part, the parameters of the FB817 are displayed. The actual operation is performed further down, through the parameters of the auxiliary blocks.

Figure 8-8

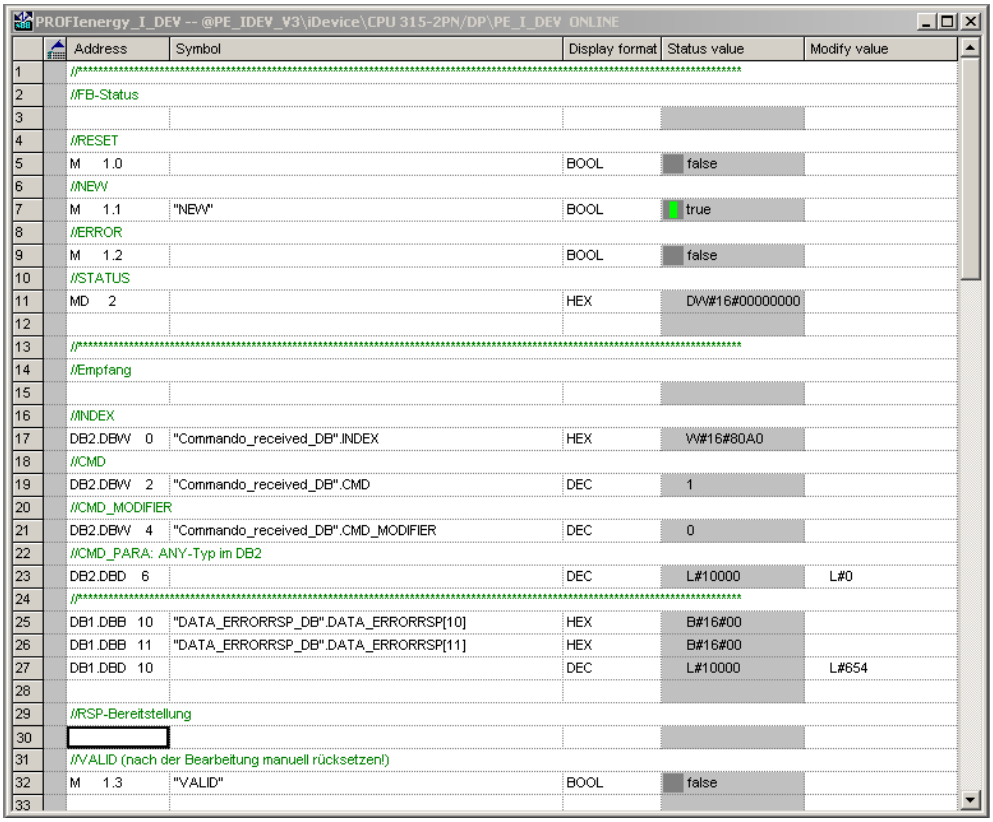
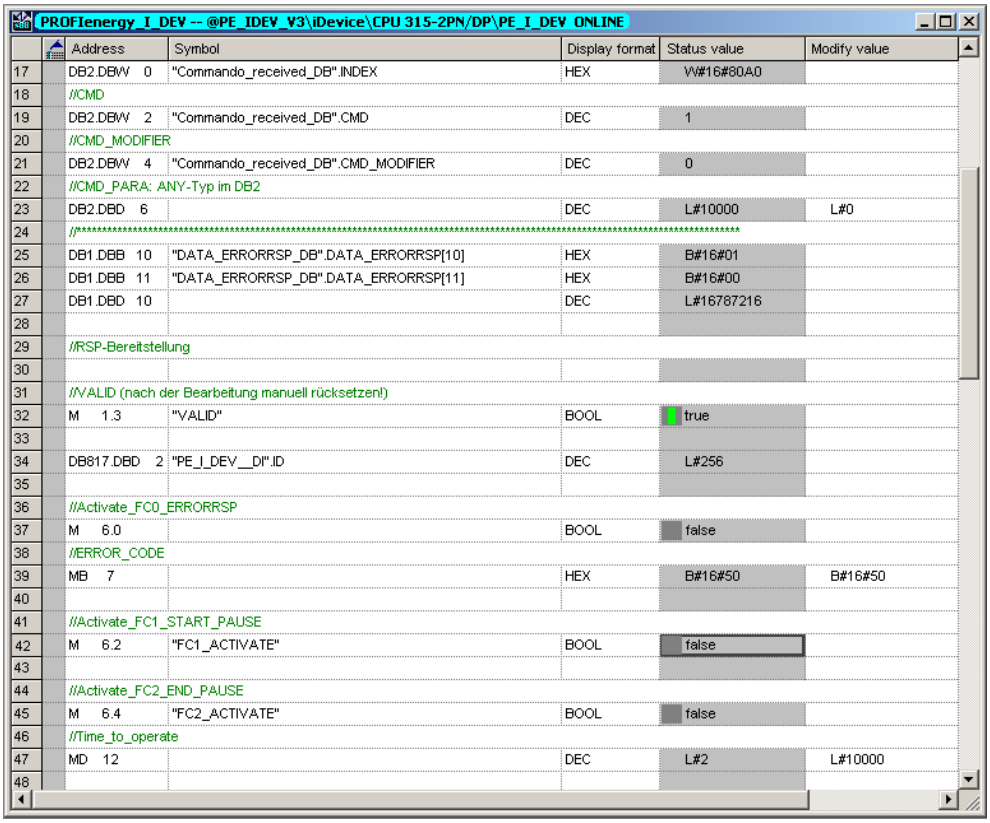


Table 8-9

Line	Parameters	Description
5	RESET	Resets block processing.
7	NEW	Displays the command that has just arrived. Reset with the response message or in the event of timeout (ERROR/STATUS)
19	CMD	The current PROFIenergy command
21	CMD_MODIFIER	Interpretation depending on command
23	CMD_PARA	Interpretation depending on command here double word for PAUSE_TIME for CMD=1
25	Response data area	Interpretation depending on command, here DBB10 as PE_MODE_ID as answer to PAUSE_START
27	Response data area	Interpretation depending on command, here DBD10 as TIME_TO_OPERATE as answer to PAUSE_END
32	Valid	Auxiliary block FC0-FC8 provided the data for FB817, FB817 starts processing. Has to be reset manually

For the response message (parameter of auxiliary blocks), scroll down a little:

Figure 8-9



	Address	Symbol	Display format	Status value	Modify value
17	DB2.DBW 0	"Commando_received_DB".INDEX	HEX	W#16#80A0	
18	//CMD				
19	DB2.DBW 2	"Commando_received_DB".CMD	DEC	1	
20	//CMD_MODIFIER				
21	DB2.DBW 4	"Commando_received_DB".CMD_MODIFIER	DEC	0	
22	//CMD_PARA: ANY-Typ im DB2				
23	DB2.DBD 6		DEC	L#10000	L#0
24	//**********				
25	DB1.DBB 10	"DATA_ERRORRSP_DB".DATA_ERRORRSP[10]	HEX	B#16#01	
26	DB1.DBB 11	"DATA_ERRORRSP_DB".DATA_ERRORRSP[11]	HEX	B#16#00	
27	DB1.DBD 10		DEC	L#16787216	
28					
29	//RSP-Bereitstellung				
30					
31	//VALID (nach der Bearbeitung manuell rücksetzen!)				
32	M 1.3	"VALID"	BOOL	true	
33					
34	DB817.DBD 2	"PE_I_DEV__DI".ID	DEC	L#256	
35					
36	//Activate_FC0_ERRORRSP				
37	M 6.0		BOOL	false	
38	//ERROR_CODE				
39	MB 7		HEX	B#16#50	B#16#50
40					
41	//Activate_FC1_START_PAUSE				
42	M 6.2	"FC1_ACTIVATE"	BOOL	false	
43					
44	//Activate_FC2_END_PAUSE				
45	M 6.4	"FC2_ACTIVATE"	BOOL	false	
46	//Time_to_operate				
47	MD 12		DEC	L#2	L#10000
48					

Table 8-10

Line	Parameters	Description
43	PE_Mode_ID	FC1: Enter the PE_Mode_ID of the i-device here
42	FC1_ACTIVATE	FC1: Sends the response message “PAUSE_START” (Edge!)
47	TIME_TO_OPERATE	FC2: Enter the time here that the i-device needs to be fully ready to operate again.
45	FC2_ACTIVATE	FC2: Sends the response message “PAUSE_END” (Edge!)

8.3.4 VAT_PE_CMD_OpenInterface CMD 3 controller

The RESPONSE_DATA area is only displayed through the variable tables here and is not opened as data block. This is due to the interpretation of the read data that depends on the PROFIenergy command. All commands that are presently possible are listed in chapter 4.4. This is where the PROFIenergy “Query Modes - Get mode” command is explained. See also chapter 4.4.4.

Figure 8-10

VAT_PE_CMD_OpenInterface -- @PE_IDEV_V11\Controller\CPU 317-2PN/DP\Controller ONLINE

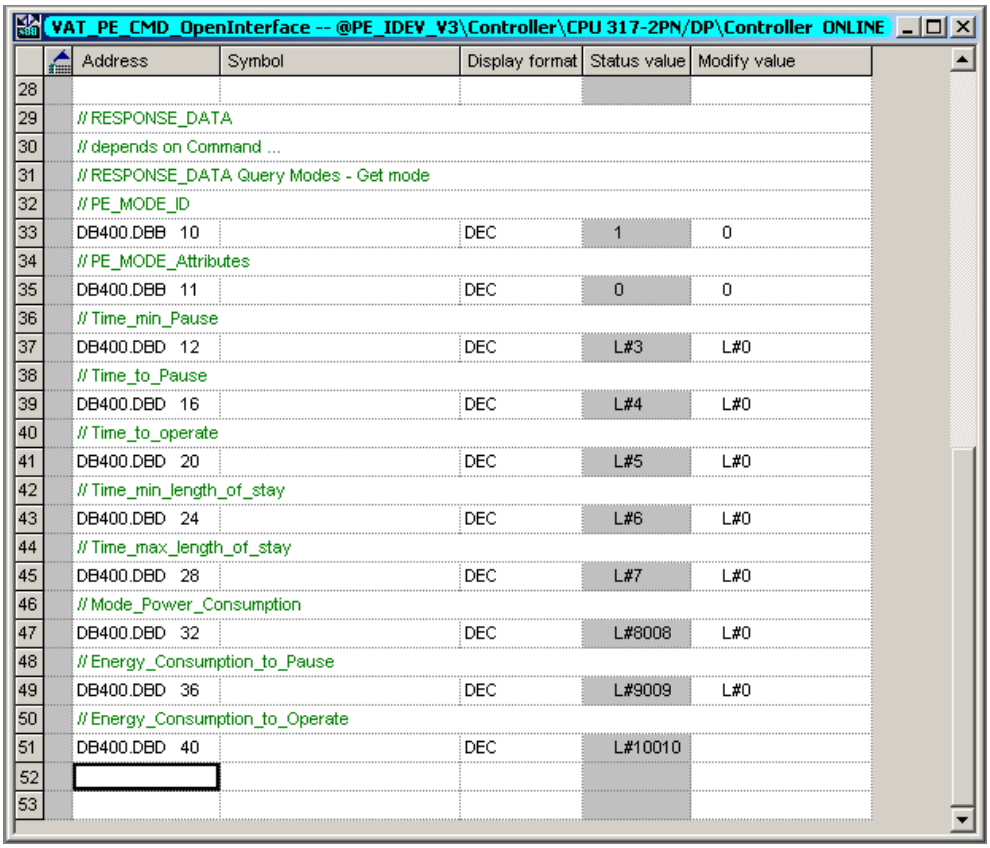
	Address	Symbol	Display format	Status value	Modify value
1	// FB816 PE_CMD open interface				
2	// REQ enable				
3	DB816.DBX 0.0	"idb_FB816".REQ	BOOL	false	false
4	// ID Diagnosticaddress PE-Device 1: "8184" or 2:"8178"				
5	DB816.DBD 2	"idb_FB816".ID	HEX	DW#16#00008100	DW#16#00008100
6	// CMD				
7	// 1 = Start Pause 2 = End Pause				
8	// 3 = Query Modes 4 = PEM Status				
9	// 5 = PE Identify 16 = Query Measurment				
10	DB816.DBB 6	"idb_FB816".CMD	DEC	3	1
11	// CMD_MODIFIER Command Modifier				
12	DB816.DBB 7	"idb_FB816".CMD_MODIFIER	DEC	2	0
13	// CMD_PARA Command Parameter Pointer to Array MB240 - 255				
14	//				
15	MB 240		DEC	1	
16	// CMD_PARA_LEN Command length				
17	DB816.DBW 18	"idb_FB816".CMD_PARA_LEN	DEC	1	4
18	// VALID				
19	DB816.DBX 20.0	"idb_FB816".VALID	BOOL	false	
20	// BUSY Bearbeitung läuft				
21	DB816.DBX 20.1	"idb_FB816".BUSY	BOOL	true	
22	// ERROR				
23	DB816.DBX 20.2	"idb_FB816".ERROR	BOOL	false	
24	// STATUS				
25	DB816.DBD 22	"idb_FB816".STATUS	HEX	DW#16#00000000	
26					
27	MD 102	"STATUS_FB816"	HEX	DW#16#00000000	DW#16#00000000
28					
29	// RESPONSE_DATA				
30	// depends on Command ...				

Table 8-11

Line	Parameters	Description
10	CMD	3 : “Query_Modes” command
12	CMD_MODIFIER	2 : “Get_Mode” subcommand
15	CMD_PARA	1 : for PE_Mode_ID 1
17	CMD_PARA_LEN	1 : 1 byte “PE_Mode_ID”
3	REQ	Send command (edge!)

After the response (see next chapter) you will find the parameters in the bottom part of the VAT:

Figure 8-11



	Address	Symbol	Display format	Status value	Modify value
28					
29	// RESPONSE_DATA				
30	// depends on Command ...				
31	// RESPONSE_DATA Query Modes - Get mode				
32	// PE_MODE_ID				
33	DB400.DBB 10		DEC	1	0
34	// PE_MODE_Attributes				
35	DB400.DBB 11		DEC	0	0
36	// Time_min_Pause				
37	DB400.DBD 12		DEC	L#3	L#0
38	// Time_to_Pause				
39	DB400.DBD 16		DEC	L#4	L#0
40	// Time_to_operate				
41	DB400.DBD 20		DEC	L#5	L#0
42	// Time_min_length_of_stay				
43	DB400.DBD 24		DEC	L#6	L#0
44	// Time_max_length_of_stay				
45	DB400.DBD 28		DEC	L#7	L#0
46	// Mode_Power_Consumption				
47	DB400.DBD 32		DEC	L#8008	L#0
48	// Energy_Consumption_to_Pause				
49	DB400.DBD 36		DEC	L#9009	L#0
50	// Energy_Consumption_to_Operate				
51	DB400.DBD 40		DEC	L#10010	
52					
53					

Here an extract from chapter 4.4.4:

Request Data:

CMD = 3 “Query Mode”

CMD_ MODIFIER = 2 “Get Mode”

CMD_PARA_LEN = 1 another parameter in CMD_PARA

CMD_PARA = 1 (PE_MODE)

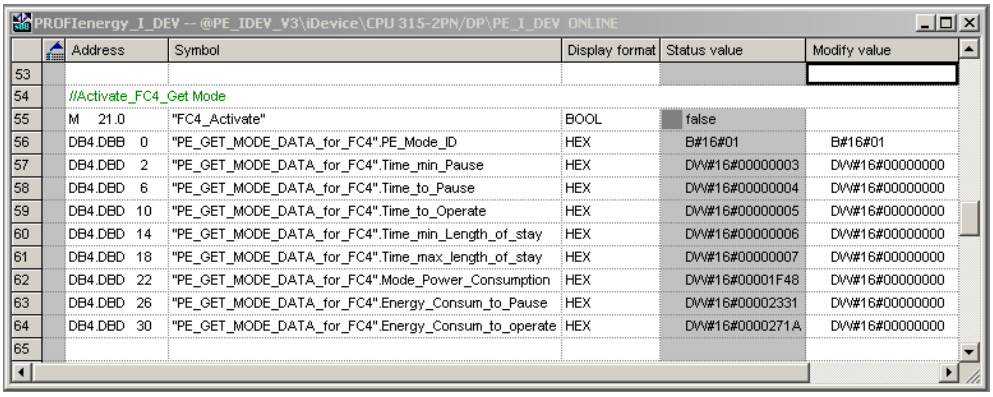
Response_Data in DB400 from DW10:

Parameters	**Value**	**Data type**
PE_Mode_ID	0x01	Unsigned8
PE_Mode_Attributes	0x00	Unsigned8
Time_min_Pause	10000	Unsigned32
Time_to_Pause	0	Unsigned32
Time_to_operate	10000	Unsigned32
Time_min_length_of_stay	0	Unsigned32
Time_max_length_of_stay	FFFFFFFF	Unsigned32
Mode_Power_Consumption	0.0	Float32
Energy_Consumption_to_pause	0.0	Float32
Energy_Consumption_to_operate	0.0	Float32

8.3.5 I-Device VAT_PROFIenergy_I_DEV CMD 3

In section FC4 Get mode, you can change the parameter values and send them to the controller with FC4_Activate.

Figure 8-12



	Address	Symbol	Display format	Status value	Modify value
53					
54	//Activate_FC4_Get Mode				
55	M 21.0	"FC4_Activate"	BOOL	false	
56	DB4.DBB 0	"PE_GET_MODE_DATA_for_FC4".PE_Mode_ID	HEX	B#16#01	B#16#01
57	DB4.DBD 2	"PE_GET_MODE_DATA_for_FC4".Time_min_Pause	HEX	DW#16#00000003	DW#16#00000000
58	DB4.DBD 6	"PE_GET_MODE_DATA_for_FC4".Time_to_Pause	HEX	DW#16#00000004	DW#16#00000000
59	DB4.DBD 10	"PE_GET_MODE_DATA_for_FC4".Time_to_Operate	HEX	DW#16#00000005	DW#16#00000000
60	DB4.DBD 14	"PE_GET_MODE_DATA_for_FC4".Time_min_Length_of_stay	HEX	DW#16#00000006	DW#16#00000000
61	DB4.DBD 18	"PE_GET_MODE_DATA_for_FC4".Time_max_length_of_stay	HEX	DW#16#00000007	DW#16#00000000
62	DB4.DBD 22	"PE_GET_MODE_DATA_for_FC4".Mode_Power_Consumption	HEX	DW#16#00001F48	DW#16#00000000
63	DB4.DBD 26	"PE_GET_MODE_DATA_for_FC4".Energy_Consum_to_Pause	HEX	DW#16#00002331	DW#16#00000000
64	DB4.DBD 30	"PE_GET_MODE_DATA_for_FC4".Energy_Consum_to_operate	HEX	DW#16#0000271A	DW#16#00000000
65					

Table 8-12

Line	Parameters	Description
56-64	Parameters	PROFIenergy parameter for the requested PE mode.
55	FC4_Activate	Sends the data record (edge!)

Note Manually reset the VALID parameter after each operation!

9 Annex

9.1 Annex A: Measurement list

The supported measurement values are hardware specific. This list is taken from 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)]	Subblock [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 Reference

Bibliographic references

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

Table 10-1

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

Internet link specifications

This list is by no means complete and only presents a selection of suitable information.

Table 10-2

	Subject	Title
\1\	Reference to the entry	http://support.automation.siemens.com/WW/view/en/41986454
\2\	Siemens Industry Online Support	http://support.automation.siemens.com
\3\	SIMATIC S7-300	http://support.automation.siemens.com/WW/view/en/10805161/133300
\4\	FW Download	http://support.automation.siemens.com/WW/view/en/33516848/133100
\5\	HSP	http://support.automation.siemens.com/WW/view/en/23183356

11 History

Table 11-1

Version	Date	Modification
V1.0	10.12.2010	First issue
V1.1	29.06.2011	New PE-Block version, Annex A added
V1.2	01.09.2011	FB817 V1.1, Security note added