Acuvim II Profibus Modules
User's Manual

* PROFIBUS-DP/V0 Protocol
* Work as PROFIBUS slave, baud rate adaptive, up to 12M
* Typical input bytes: 32, typical output bytes: 32
* PROFIBUS standard according to EN 50170 vol.2

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Please read this manual carefully before dong installation, operation and maintenance of Acuvim II meter.

Following symbols are used in this user's manual and on Acuvim II meter to alert the dangerous or to prompt in the operating or set process.

Dangerous symbol, Failure to observe the information may result in injury or death.

Alert symbol, Alert the potential dangerous. Observe the information after the symbol to avoid possible injury or death.

Focus symbol, avoid inadvertent operations which may lead to abnormal working of instrument ,even damage to the instrument or physical harm.

This mark is on product for UL Listed product

Installation and maintenance of the Acuvim II meter should only be performed by qualified, competent personnel that have appropriate training and experience with high voltage and current device.

This document is not fit for any untrained people. Accuenergy is not responsible for any problem happens under proper operation.

Content

Starting!

This manual is about PROFIBUS module of Acuvim II meter. With PROFIBUS module, Acuvim II meter can be linked to PROFIBUS network easily, and it can realize distribution automation based on field bus.

Please read this manual carefully before operating and setting the Acuvim II meter to avoid unnecessary trouble.

Chapter 1 helps you to understand the fundamental concept of PROFIBUS, and application points of PROFIBUS module.

Chapter 2 describes in detail hardware features of PROFIBUS module.

Chapter 3 describes in detail software application of PROFIBUS module.

Appendix lists technical data and specifications and ordering information of PROFIBUS module.

Chapter 1 Introduction

Introduction of PROFIBUS Technology
Application points of PROFIBUS module

PROFIBUS module is an extended communication module of Acuvim II meter. With PROFIBUS module, Acuvim II meter can be linked to PROFIBUS network easily.

1.1 Introduction of PROFIBUS Technology

PROFIBUS（Process Field bus）is an international field bus standard which is widely used in automation technology of manufactures and flow industry. It is a widely used, open digital communication system, which is suitable for high-speed, time-critical, and high reliability communications.

PROFIBUS is one kind of open style field bus standard which promotes by SIEMENS Corporation, in 1989 became German standard DIN19245, in 1996 became European standard EN50170, in 1999 is December accepted for an international standard IEC61158 part, in 2001 became China national standard JB/T 10308.3-2001 for field bus of machinery industry controlling system.

PROFIBUS has provided 3 kinds of agreements types: PROFIBUS-DP (Decentralized Periphery), PROFIBUS-PA (Process Automation) and PROFIBUS-FMS (Field bus Message Specification). ALL of types are follow the same protocol.

With optimized, high-speed, low-cost communications links, PROFIBUS-DP is specially used in automatic controlling systems and equipment level decentralized I / O communication, it can meet real-time response, stability and reliability of equipment level and distributed controlling system.

The PROFIBUS module uses PROFIBUS-DP（V0）protocol.

1.2 Application points of PROFIBUS module

Please read appendix of technical data and specifications of PROFIBUS module before using it. In addition, please read Acuvim II manual too, especially the communication addresses of MODBUS protocol, which are the communication addresses for PROFIBUS module too.

 * The PROFIBUS module can only be used as slave in PROFIBUS network. Its slave address is ranged from 0 to 126, which can only be set by the panel. If the address is changed, it will take effect immediately.

 * The PROFIBUS module's baud rate can be adaptive between 9.6Kbps to 12Mbps in PROFIBUS network.

 * The PROFIBUS module's hardware connection method should be accurately known, otherwise there will be troubles in debugging and using.

 * Please read GSD file of the PROFIBUS module carefully before using it, which contains much technology information such as device name, ID number and so on.

 * Please read and understand the communication data format, which is the key point of PROFIBUS module.

 * The simple example of PLC as a master will be useful to understand application characteristics of PROFIBUS module.

Chapter 2 Wiring and hardware configuration

Appearance and Dimensions
Installation Method
Definition of DP Interface
Cable
Bus Terminal

PROFIBUS module must be linked to Acuvim II meter when it is to be used. In addition, PROFIBUS module must be the first extended module linked to Acuvim II meter.

> **🔔 Note**
>
> The environment temperature and humidity should fulfill the requirement of AcuvimII meter. Otherwise it may cause the meter damage.

2.1 Appearance and Dimensions

（Top View）

（Bottom View）

22mm
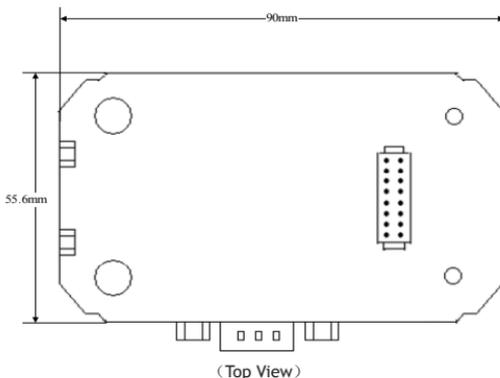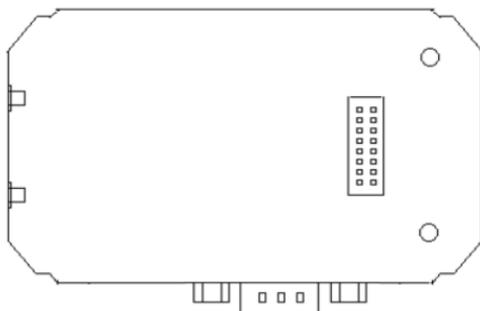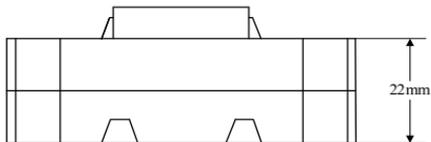
（Side View）

2.2 Installation Method
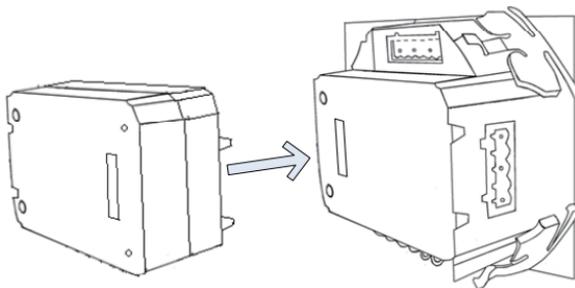
PROFIBUS is linked to Acuvim II meter by communication plug. It can also

be linked to other extended modules such as IO modules.

1. Insert the installation clips to the counterpart of Acuvim II meter, and then press the PROFIBUS module lightly, so linking is established.

2. Tighten the installation screw.

Note: 1. lightly in installation or it may cause damage to the PROFIBUS modules;

2. Installation with power is forbidden.

2.3 Definition of DP Interface

The PROFIBUS module uses standard 9-pin D-type connector to access PROFIBUS network. The mechanical and electrical characteristics of connector are consistent with the requirements of IEC 807-3. The connector of PROFIBUS is a socket, and the counterpart connector of cable is a plug. Connector pins are distributed as follows:

Pins	RS-485	ID	Content	Dose PROFIBUS use or not
1	——	SHIELD	Power GND	NO
2	——	N24V	-24V Output	NO
3	B	RXD/TXD-P	Data P（Receive /Send）	YES
4	——	CNTR-P	Controlling P	YES
5	C	DGND	Digital Ground	YES
6	——	Vp	Positive Voltage	YES
7	——	P24V	+24V output	NO
8	A	RXD/TXD-N	Data N（Receive /Send）	YES
9	——	CNTR-N	Controlling N	NO

Note: 4 pin is used for RTS controlling, TTL, it is not necessary.

2.4 Cable

Shielded twisted pair cable is usually recommended as reference to the EIA RS-485 standard. In addition, if the interference is not serious, non-shielded twisted pair cable can also be used.

2.5 Bus Terminal

Based on DP standard, the first station and the last station in PROFIBUS-DP network should connect bus terminal (resistor), and it is not necessary for other stations, as shown in below figure.
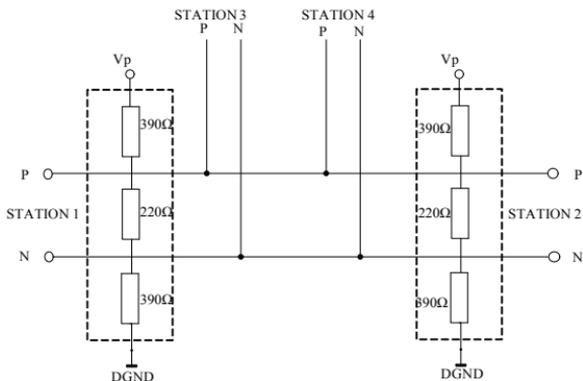
Connection of many DP stations

The bus terminal is composed of three resistors and connection wire, where Vp is the supply positive voltage and DGND is the Digital Ground. When the bus is idle, the bus terminal makes the data P level higher than data N, so the bus's idle signal is always 1.

Chapter 3 Application of PROFIBUS DP Protocol

Address Setting
Baud Rate
GSD Files
Information Exchange
Format of function code 01H
Format of function code 05H
Format of function code 02H
Format of function code 03H
Format of function code 10H

3.1 Address Setting

The PROFIBUS module can only be used as slave in PROFIBUS network. Its slave address is ranged from 0 to 126, which can only be set by the panel (in SYS sub menu of Acuvim II Setting menu). If the address is changed, it will take effect immediately.

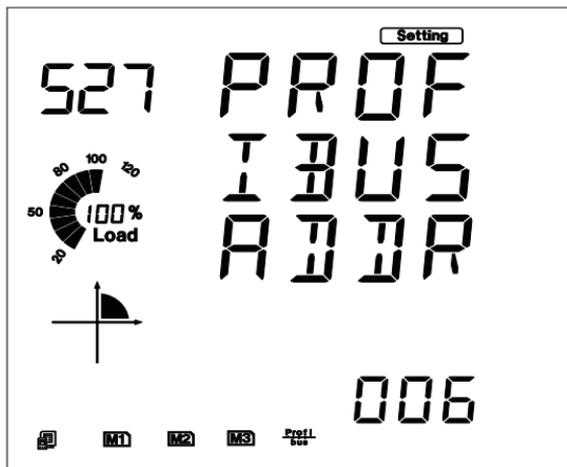Figure bellow shows the address setting of PROFIBUS module.

Address setting of PROFIBUS module

3.2 Baud Rate

The PROFIBUS module's baud rate can be adaptive between 9.6Kbps to 12Mbps in PROFIBUS network.

3.3 GSD Files

PROFIBUS-DP master can exchange data with various slave stations. In order to identify various slave stations safely and conveniently, it is necessary to obtain the technical data of slave stations. The file where the technical data are described is called Device Description Data File (GSD).

Because of the importance of GSD file, please read it carefully before using the PROFIBUS module. The GSD file is provided in pure text format with detailed comments.

 * As a DP slave station, the PROFIBUS module support protocol of V0 revision.

 * The PROFIBUS module's data interface is a 16 words input/output interface. It is a rule requirement higher than specific protocol.

 * The slave address of PROFIBUS module can be set by the panel. If the address is changed, it will take effect immediately, and there is no need to be powered on again.

3.4 Information Exchange

There are a lot of information of Acuvim II meter can be transmitted by the PROFIBUS module, such as electrical quantities and other parameters. There are various protocols to counterpart with various types of information. The basic communication method of Acuvim II meter is

RS-485, which uses protocol of MODBUS-RTU. In order to use the same address lists as MODBUS-RTU, the communication formats of PROFIBUS-DP is categorized in the same way as MODBUS-RTU.

It is recommended to read communication part of Acuvim II meter's manual at the same time of reading this part. If you have read communication address lists of MODBUS-RTU, you can find something as follows:

1. There are various function codes, such as 01H, 02H,03H, 05H,10H, for the various categorized parameters. Different function codes have different formats of query and response frames.

2. There is a specific relationship between numerical value in register of Acuvim II meter and the real physical value.

3. Different parameters may have different data length and data type.

These three points are also suitable for the PROFIBUS-DP protocol in PROFIBUS module.

Note: the following "communication formats" is suitable for the application data, but not for the PROFIBUS-DP's frame characteristic data.

Function codes, such as 01H, 02H and 03H, are inquiry commands. For users to quickly switch the inquiry contents, we define 8 channels named 1 to 8 , in order to update data more quickly.

3.5 Format of function code 01H

Function code 01H is used to read relay status in MODBUS-RTU. In PROFIBUS-DP, the format of function code 01H is defined as follows:

Query:

Frame Bytes	Caption
Byte1	Channels can be chosen from 1 to 8
Byte2	01H
Byte3	starting address high byte
Byte4	starting address low byte
Byte5	quantity of coils high byte
Byte6	quantity of coils low byte
Byte7~32	0

Because 16 words are required for IO data in GSD file, all other bytes after Byte7 are set to 0.

Response

It is the information that slave stations response to master.

Frame Bytes	Caption
Byte1	The channel of inquiry frame
Byte2	01H
Byte3	byte count
Byte4	coil status
Byte5~32	0

The coils in the response message are packed as one coli per bit of the data field. Status is indicated as 1=ON and 0=OFF. The LSB of the first data byte contains the output addressed in the query. The other coils follow toward the high order end of this byte, and form low order to high order in subsequent bytes.

Example: reading Relay1 and Relay2 states (start register address is 0000H). Use 4 channels.

Query

Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7~32
04H	01H	00H	00H	00H	02H	00H

Response

Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7~32
04H	01H	01H	02H	00H	00H	00H

Coil Status

7	6	5	4	3	2	1	0
0	0	0	0	0	0	1	0

MSB   LSB

(Relay 1 = OFF，Relay 2=ON)

3.6 Format of function code 05H

The message with function code (05H) in MODBUS-RTU forces a single relay either on or off. The data value FF00H will set the relay on and the value 0000H will turn it off. All other values are illegal and will not affect that relay.

In PROFIBUS-DP, the format of function code 05H is defined as follows:

Query

Frame Bytes	Caption
Byte1	FAH
Byte2	05H
Byte3	outputs address high byte
Byte4	outputs address low byte
Byte5	outputs value high byte
Byte6	outputs value low byte
Byte7~32	0

Note: Because PROFIBUS-DP V0 exchanges information data periodically,

so controlling information such as function code 05H should be used carefully.

Response

The normal response to the command request is to retransmit the message as received after the relay states has been altered.

Frame Bytes	Caption
Byte1	FAH
Byte2	05H
Byte3	outputs address high byte
Byte4	outputs address low byte
Byte5	outputs value high byte
Byte6	outputs value low byte
Byte7~32	0

Example: setting Relay2 on.

Query

Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7~32
FAH	05H	00H	01H	FFH	00H	00H

Response

Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7~32
FAH	05H	00H	01H	FFH	00H	00H

3.7 Format of function code 02H

Function code 02H is used to read DI status in MODBUS-RTU. In PROFIBUS-DP, the format of function code 02H is defined as follows:

Query

Frame Bytes	Caption

Byte1	Channels can be chosen from 1 to 8
Byte2	02H
Byte3	starting address high byte
Byte4	starting address low byte
Byte5	quantity of digital inputs high byte
Byte6	quantity of digital inputs low byte
Byte7~32	0

Response

Frame Bytes	Caption
Byte1	The channel of inquiry frame
Byte2	02H
Byte3	byte count
Byte4	inputs status1
Byte5	inputs status2（or 0）
Byte6	inputs status3（or 0）
Byte7	inputs status4（or 0）
Byte8~32	0

The digital inputs in the response message are packed as one input per bit of the data field. Status is indicated as 1=ON; 0=OFF. The LSB of the first data byte contains the input addressed in the query. The other inputs follow toward the high order end of this byte, and from low order to high order in subsequent bytes.

Example: reading 4 DI statuses (starting address is 0000H). Use 6 channels.

Query

Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7~32
06H	02H	00H	00H	00H	04H	00H

Response

Byte1	Byte2	Byte3	Byte4	Byte5~32
06H	02H	01H	06H	00H

DI status

7	6	5	4	3	2	1	0
0	0	0	0	0	1	1	0

MSB   LSB

(DI1 = OFF，DI2=ON，DI3 = ON , DI4 = OFF)

3.8 Format of function code 03H

This function code is used in MODBUS-RTU to read the contents of a contiguous block of holding registers in Acuvim II meter. In PROFIBUS-DP, the format of function code 03H is defined as follows:

Query

Frame Bytes	Caption
Byte1	Channels can be chosen from 1 to 8
Byte2	03H
Byte3	starting address high byte
Byte4	starting address low byte
Byte5	quantity of registers high byte
Byte6	quantity of registers low byte
Byte7~32	0

"Quantity of registers" tells that how many words will be read.

Response

Frame Bytes	Caption
Byte1	The channel of inquiry frame
Byte2	03H
Byte3	byte count
Byte4	Register value1 high byte
Byte5	Register value1 low byte

Byte6	∘ ∘ ∘
Byte32	∘ ∘ ∘

"Byte count" tells that how many bytes will be read.

The register data in the response message are packed as two bytes per register, with the binary contents right justified with each byte. For each register, the first byte contains the high order bits and the second contains the low order bits.

There is one important thing should be noted. The response frame has 16-word, so the maximum "quantity of registers" should less than 15. Otherwise, it will return error result.

Example: reading 3 measured data (F,V1,V2) from Acuvim II meter. The data address of F includes 4000H and 4001H. The data address of V1 includes 4002H and 4003H. The data address of V2 includes 4004H and 4005H. (Use 7 channels)

Query

Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7~32
07H	03H	40H	00H	00H	06H	00H

Response

Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
07H	03H	0CH	42H	48H	00H	00H	42H

Byte9	Byte10	Byte11	Byte12	Byte13	Byte14	Byte15	Byten16~32
C7H	CCH	CDH	42H	C8H	33H	33H	00H

(F=42480000H(50.00Hz), V1=42C7CCCDH(99.9v),
V2=42C83333H(100.1v)).

Note: the relationship between numerical value in register of Acuvim II meter and the real physical value is described in detail in communication part of Acuvim II manual, so it will not be described here.

3.9 Format of function code 10H

This function code is used in MODBUS-RTU to write a block of contiguous registers in Acuvim II meter, such as system parameters setting and so on. In PROFIBUS-DP, the format of function code 10H is defined as follows:

Query

Frame Bytes	Caption
Byte1	FAH
Byte2	10H
Byte3	starting address high byte
Byte4	starting address low byte
Byte5	quantity of registers high byte
Byte6	quantity of registers low byte
Byte7	byte count
Byte8	register value 1 high byte
Byte9	register value 1 low byte
Byte10	register value 2 high byte
Byte11	register value 2 low byte
° ° °	° ° °
Byte32	0

"Quantity of registers" tells that how many words will be written.

"Byte count" tells that how many bytes will be written. If "quantity of register" is N, then "byte count" is (N x 2).

There is one important thing should be noted. The response frame has 16-word, so the maximum "quantity of registers" should less than 13. Otherwise, it will return error result.

Response

The normal response returns the function code, starting address, and quantity of registers written.

Frame Bytes	Caption
Byte1	FAH
Byte2	10H
Byte3	starting address high byte
Byte4	starting address low byte
Byte5	quantity of registers high byte
Byte6	quantity of registers low byte
Byte7~32	0

Example: presetting import active enengy (EP_imp) to 17807783.3Kwh. Based on the relationship between the register value and the physical value, we can get that the register value in hex is 0A9D4089H. The data address of EP_imp includes 4048H and 4049H.

Query

Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
FAH	10H	40H	48H	00H	02H	04H	0AH

Byte9	Byte10	Byte11	yte12~32
9DH	40H	89H	00H

Response

Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7~32
FAH	10H	40H	48H	00H	02H	00H

Example Projects

To facilitate your understanding of the use of PROFIBUS module, we purposely develop a PLC-based DEMO engineering application program. Please read DEMO procedure documentation for the specific information.

Appendix

Appendix A Technical Data and Specifications

Appendix B Ordering Information

Appendix C Revision History

Appendix A Technical data and specification

Standards	
Protocol Standard	JB/T 10308.3-2001
	EN50170
Environmental	IEC 60068-2-30
Safety	IEC 61010-1

Communication Port	
Physical Layer	standard DB9 socket with optical isolation
Protocol	PROFIBUS-DP V0
Baud Rate	9.6k～12M bps

Suitable Condition	
Dimensions	90X55.6X22 (mm)
Weight	65g
Operating Temperature	-25℃～70℃
Storage Temperature	-40℃～85℃
Humidity	5%～95% non-condensing
Power Supply	DC 5V（supplied by Acuvim II meter）
Power Consumption	1W

Appendix B Ordering Information

Type: AXM-PROFI

Appendix C Revision History

Revision	Date	Description
1.0	20070915	First version
1.10	20080915	We enhance the channel management of the inquiry commands, so it will cause the incompatiblility of the formal version.

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