

INTERFACE

Modbus manual

September 2015

[Model Name]

PAC-IF013B-E

PAC-SIF013B-E

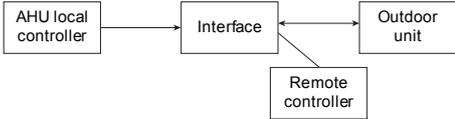
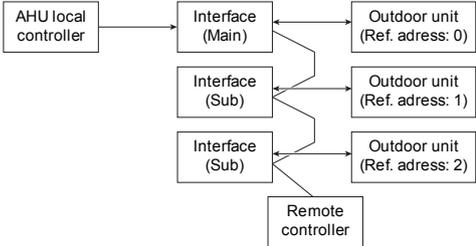
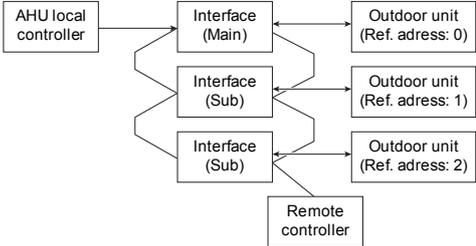
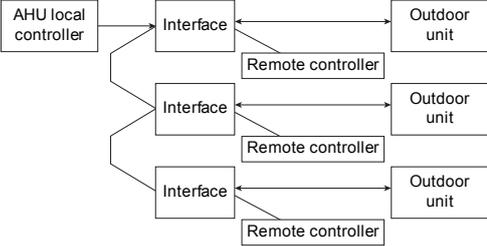
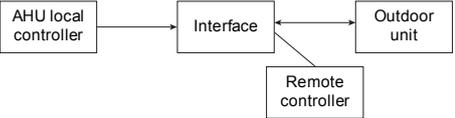
Related document:
Refer to the following manual
• PAC-IF013B-E/PAC-SIF013B-E
INSTALLATION MANUAL

This manual describes the Modbus communication only. For safety precautions, make sure to read installation manual of PAC-IF013B-E/PAC-SIF013B-E.

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1 System

No.	Using function by Modbus	Step mode	Input type	Number of outdoor unit	Intelligent multiple outdoor unit control	System *3
1	Writing and Reading (Input and monitoring)	Manual *1	Modbus	1	N/A	
2				2-6	Apply *4	<p>■When not monitoring sub interfaces</p> 
3				2-6	Apply *4	<p>■When monitoring sub interfaces (Wiring among interface units with Modbus cable)</p> 
4				Not apply *5	Input all interfaces separately.	
5		Auto *2	No input (Auto step mode)	1-5	N/A	
6	Only Reading (Only monitoring)	Manual	"Analog" or "Remote switch"	1-6		Refer to the installation manual.
7		Auto	No input (Auto step mode)	1-5		

*1. Manual step mode by Modbus:

- AHU local controller can send "capacity steps" and "operation mode" by Modbus communication to the interface unit.
- Do NOT send "temperature set point" or "Drive ON/ OFF".
- DIP SW 1-1 to 1-3, and SW6 are as follows. Regarding other settings, refer to the section 2 and the installation manual.

Input type	SW1-1	SW1-2	SW1-3	SW6-1	SW6-2
Modbus	ON	ON	ON	OFF	OFF

*2. Auto step mode by Modbus:

- AHU local controller can send "Drive ON/ OFF", "operation mode", and "temperature set point" by Modbus communication to the interface unit.
- Do NOT send "capacity request".
- DIP SW 1-1 to 1-3, and SW6 are as follows. Regarding other settings, refer to the section 2 and the installation manual.

Input type	SW1-1	SW1-2	SW1-3	SW6-1	SW6-2
No input (Auto step mode)	OFF	ON	ON	OFF	OFF

*3. Regarding thermistor positions, refer to the installation manual.

*4. Intelligent multiple outdoor unit control by Modbus:

- Input "capacity steps" signal and "operation mode" signal to the main interface unit (which connects to the ref. address 0 outdoor unit)
- Monitoring operation status of all interfaces is available. In this case, connecting to all interface units with Modbus cable is needed.
- Setting DIP SW3-6 to SW3-8, and SW4 of sub interfaces is necessary when monitoring sub interfaces.
- Regarding intelligent multiple outdoor unit control, refer to the installation manual.

*5. It is recommended to select Intelligent multiple outdoor unit control.

Design local AHU controller to make sure the following points.

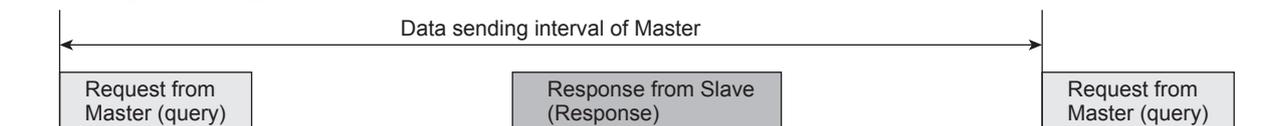
- Minimum capacity request should be 20% or more of total capacity.
- Operate all outdoor units when outdoor temperature is below -15 °C.

2 Communication specification

Item	Description																																																						
Interface	RS-485																																																						
Communication method	Half-duplex																																																						
Connectable units	Max.:31 Slave address can be set by DIP SW on the interface controller board. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>SW 4-1</th> <th>SW 4-2</th> <th>SW 4-3</th> <th>SW 4-4</th> <th>SW 4-5</th> <th>Slave address</th> </tr> </thead> <tbody> <tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>1</td></tr> <tr><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>1</td></tr> <tr><td>OFF</td><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>2</td></tr> <tr><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>3</td></tr> <tr><td>OFF</td><td>OFF</td><td>ON</td><td>OFF</td><td>OFF</td><td>4</td></tr> <tr><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>OFF</td><td>5</td></tr> <tr><td colspan="5" style="text-align: center;">...</td><td style="text-align: center;">...</td></tr> <tr><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>31</td></tr> </tbody> </table>	SW 4-1	SW 4-2	SW 4-3	SW 4-4	SW 4-5	Slave address	OFF	OFF	OFF	OFF	OFF	1	ON	OFF	OFF	OFF	OFF	1	OFF	ON	OFF	OFF	OFF	2	ON	ON	OFF	OFF	OFF	3	OFF	OFF	ON	OFF	OFF	4	ON	OFF	ON	OFF	OFF	5	ON	ON	ON	ON	ON	31
SW 4-1	SW 4-2	SW 4-3	SW 4-4	SW 4-5	Slave address																																																		
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ON	OFF	ON	OFF	OFF	5																																																		
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Baud rate	Selectable from: 1200/2400/4800/9600/19200/38400/57600 Baud rate can be set by DIP SW on the interface controller board. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>SW 3-6</th> <th>SW 3-7</th> <th>SW 3-8</th> <th>Details</th> </tr> </thead> <tbody> <tr><td>OFF</td><td>OFF</td><td>OFF</td><td>1200bps</td></tr> <tr><td>ON</td><td>OFF</td><td>OFF</td><td>2400bps</td></tr> <tr><td>OFF</td><td>ON</td><td>OFF</td><td>4800bps</td></tr> <tr><td>ON</td><td>ON</td><td>OFF</td><td>9600bps</td></tr> <tr><td>OFF</td><td>OFF</td><td>ON</td><td>19200bps</td></tr> <tr><td>ON</td><td>OFF</td><td>ON</td><td>38400bps</td></tr> <tr><td>OFF</td><td>ON</td><td>ON</td><td>57600bps</td></tr> <tr><td>ON</td><td>ON</td><td>ON</td><td>N/A</td></tr> </tbody> </table>	SW 3-6	SW 3-7	SW 3-8	Details	OFF	OFF	OFF	1200bps	ON	OFF	OFF	2400bps	OFF	ON	OFF	4800bps	ON	ON	OFF	9600bps	OFF	OFF	ON	19200bps	ON	OFF	ON	38400bps	OFF	ON	ON	57600bps	ON	ON	ON	N/A																		
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Transmission mode	RTU mode																																																						
Data length	8bit																																																						
Parity type	Selectable from: odd/even/none Set by DIP SW on the interface controller board. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>SW4-6</th> <th>SW4-7</th> <th>Details</th> </tr> </thead> <tbody> <tr><td>OFF</td><td>OFF</td><td>Odd</td></tr> <tr><td>ON</td><td>OFF</td><td>Even</td></tr> <tr><td>OFF</td><td>ON</td><td>None</td></tr> <tr><td>ON</td><td>ON</td><td>N/A</td></tr> </tbody> </table>	SW4-6	SW4-7	Details	OFF	OFF	Odd	ON	OFF	Even	OFF	ON	None	ON	ON	N/A																																							
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Stop bit	Selectable from: 1bit/2bit <table border="1" style="margin-left: 20px;"> <thead> <tr> <th></th> <th>OFF</th> <th>ON</th> </tr> </thead> <tbody> <tr> <td>SW 4-8</td> <td>1 bit</td> <td>2 bit</td> </tr> </tbody> </table>		OFF	ON	SW 4-8	1 bit	2 bit																																																
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3 Communication timing

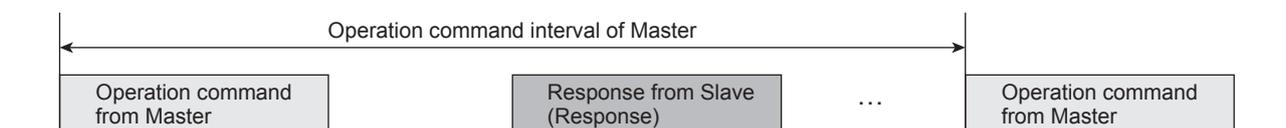
3.1 Message sending interval



Note:

- Please send a query (or a operation command) every certain period. [10 seconds is recommended, but it's acceptable that interval is 10 seconds or more and less than 10 minutes.]
- "Drive ON/OFF" becomes available by remote controller when no query is received for more than 10 minutes, in order to be able to turn on and off in the case of Modbus communication failure.

3.2 Operation command interval

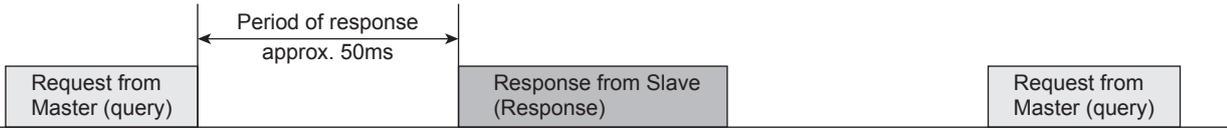


Note:

- Please send next operation command **Min. 1 minute after** previous command regardless of the baud rate.

3 Communication timing

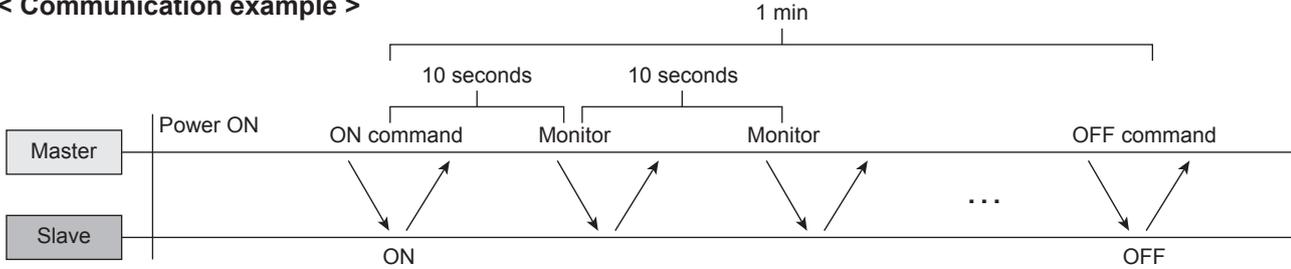
3.3 Response interval of Slave



Note:

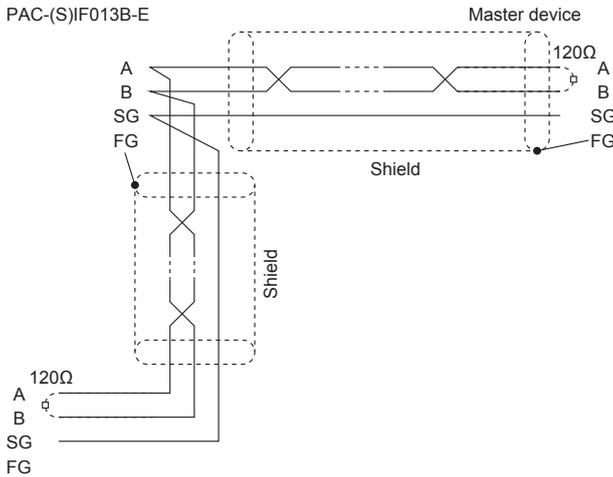
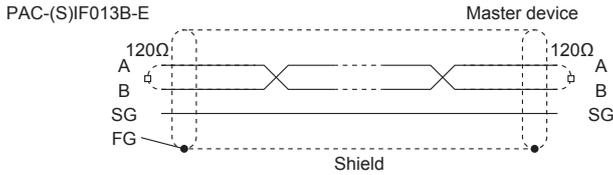
- Slave will reply approx. 50ms after receiving data from Master regardless of the baud rate.

< Communication example >

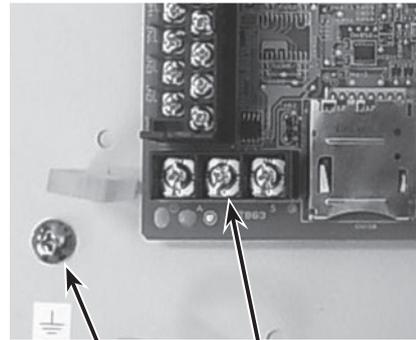


4 Connecting Modbus input

Connect Modbus input to TB63. (See <Fig. 4.1> and <Photo 4.1>)
Besides, See <Table 4.1> regarding RS-485 cable specifications.
Connect only one side of the shield wire to the FG terminal.



PAC-(S)IF013B-E < Fig. 4.1 >



< Photo 4.1 >

Note :

- Termination resistor is NOT mounted in the circuit on PAC-IF013B-E/PAC-SIF013B-E. Therefore, if you install PAC-IF013B-E/PAC-SIF013B-E at line end, connect a termination resistor.

< Table 4.1 : Cable specifications >

Item	Description
Cable type	Shielded cable
Number of pairs	2P
Conductor resistance (20°C)	88.0 Ω/km or less
Insulation resistance	10000MΩ · km or more
Dielectric withstand voltage	500VDC, 1 minute
Electrostatic capacitance (1 kHz)	60nF/km or less by an average
Characteristic impedance (100 kHz)	110±10Ω
Recommended conductor size	0.5 to 1.25 mm ²
Length	Max. 1200m

5 LED Display detail for Modbus connection

LED	LED display	
LED4	No communication	: Not lighted
	During Communication	: 1 blinking
	Communication error	: Lighted

6 Function code and Data address

6.1 Coils

Read using function code 01 and write using function code 05/15.

Function code 05 is single coil register, and function code 15 is multiple coil register. Broad cast request is available.

Function Code	Address	Modicon Address	Register Name	Details	System No.*1	
					1-4,6	5,7
Read:01 Write:05/15	0	00001	Drive ON/OFF	0=OFF / 1=ON • If the interface unit receives other data, received data will be cancelled.	N/A	✓

*1. Refer to the section 1 "System". "✓" means available, and "N/A" means NOT available.

6.2 Input Register

Read using function code 04. (Response is data in terms of 2 bytes.)

Function Code	Address	Modicon Address	Register Name	Details
Read:04	0	30001	TH11:HEX inlet air temp.	-39°C-88.5°C (by 0.5°C) Actual thermistor temp. × 10 = Communication data 0xFC19=-99.9°C ~~~~~
	1	30002	TH1: Target air temp.	-39°C-88.5°C (by 0.5°C) 0xFFFF=-0.1°C 0x0000=0.0°C ~~~~~
	2	30003	TH5: 2-Phase temp.	-39°C-88.5°C (by 0.5°C) 0x0001=0.1°C ~~~~~
	3	30004	TH2: Ref. liquid temp.	-39°C-88.5°C (by 0.5°C) 0x012C=30.0°C • When thermistor is open or short, Open:0xFC19/ Short:0x03E7
	4	30005	TH7: Outdoor temp.	-15°C-46°C (by 1°C) Actual thermistor temp. × 10 = Communication data 0xFC19=-99.9°C ~~~~~ 0xFFFF=-0.1°C 0x0000=0.0°C ~~~~~ 0x0001=0.1°C ~~~~~ 0x012C=30.0°C
	6	30007	Error Code (hex)	0x8000=No error 0x8000≠Error Code *1
	7	30008	Error Code (decimal)	8000=No error 8000≠Error Code *1
	8	30009	External Output OUT1: ON/OFF OUT2: Error OUT3: Compressor OUT4: Defrost OUT5: Cooling mode OUT6: Heating mode OUT7: Self protection OUT8: Predefrost	bit0:OUT1 0=OFF / 1=ON ~~~~~ bit7:OUT8 e.g.) When only OUT3 is "ON", outputs are as follows. bit 7654 3210 Out 0000 0100 → 0x0004"
	9	30010	Ref.address	0x0000=address0 0x0001=address1 ~~~~~ 0x000F=address15
	10	30011	Modbus Comms Counter	Value or a counter which increments upon every valid Modbus command received. 0=0count 1=1count ~~~~~ 65535=65535count • When the counter becomes more than 65535, it's cleared.

*1. Meanings of error codes, please see Table 6.

< Continued to next page. >

6 Function code and Data address

< Continued from the previous page. >

< Table 6 : Error codes >

Error code (Modbus)	Error code (Remote controller)	Discription	Error code (Modbus)	Error code (Remote controller)	Discription
5101	P1	Refer to the installation manual.	6832	"E3" or "E5"	Refer to the installation manual.
5102	P2		6833		
1503	P6 (Freezing)		6840	E6	
1504	P6 (Overheating)		6843	E7	
5103	P9		6842	Fb	
6831	"E0" or "E4"		0404	PL	
6834			1514	PU	
6201	E1		5111	EE	
6202	E2		7130		

6.3 Holding Register

Read using function code 03 and write using function code 06/ 16.

Function code 06 is single holding register, and function code 16 is multiple holding register.

Broadcast request is available ONLY when function code is 06/16.

Function Code	Address	Modicon Address	Register Name	Details	System No.*1	
					1-4,6	5,7
Read:03 Write: 06/ 16	0	40001	Capacity request (from Local controller)	OFF, Step1-Step11, Auto step mode • Auto step mode is Read only 0(0x0000)=OFF 1(0x0001)=Step1 (Min.) 2(0x0002)=Step2 ~~~~ 11(0x000B)=Step11 (Max.) 12(0x000C)=Auto step mode (Auto) • If the interface unit receives other data, received data will be cancelled. • OFF=DriveOFF / Others=DriveON • When reading and the intelligent multiple outdoor unit control is used, response of the sub interface unit becomes "12 (0x000C)", because capacity request is only for the main interface unit.	✓	N/A
	1	40002	Drive Mode	1 (0x0001) = Heating mode, 3 (0x0003) = Cooling mode, 7(0x0007) = Fan mode, 8 (0x0008) = Auto change over • If the interface unit receives other data, received data will be cancelled.	✓	✓
	2	40003	Temperature Setpoint	Cooling: 12~30°C Heating: 17~28°C Auto change over: 17~28°C (by 1°C) 0(0x0000)=0°C 10(0x000A)=1.0°C 20(0x0014)=2.0°C Actual set point × 10 = Communication data ~~~~ 300(0x012C)=30.0°C • If the interface unit receives other data, received data will be cancelled. • When the interface unit receives decimal value, value will be round down.	N/A	✓
	3	40004	Drive ON/OFF	0=OFF / 1=ON • If the interface unit receives other data, received data will be cancelled.	N/A	✓
	4	40005	Error Code (hex) [READ ONLY]	0x8000=No error 0x8000≠Error Code *2	✓	✓
	5	40006	Error Code (decimal) [READ ONLY]	8000=No error 8000≠Error Code *2	✓	✓
	6	40007	Step status [READ ONLY]	OFF, Step1-Step11, Auto step mode 0(0x0000)=OFF 1(0x0001)=Step1 (Min.) 2(0x0002)=Step2 ~~~~ 11(0x000B)=Step11 (Max.) 12(0x000C)=Auto step mode (Auto) • When the intelligent multiple outdoor unit control is used, step status shows divided capacity step of each interface unit.	✓	✓
	7	40008	Ref.address [READ ONLY]	0x0000=address0 0x0001=address1 ~~~~ 0x000F=address15	✓	✓
8	40009	Modbus Comms Counter [READ ONLY]	Value or a counter which increments upon every valid Modbus command received. 0=0count 1=1count ~~~~ 65535=65535count • When the counter becomes more than 65535, it's cleared.	✓	✓	

*1. Refer to the section 1 "System". "✓" means available, and "N/A" means NOT available.

*2. Meanings of error codes, please see Table 6.

6 Function code and Data address

6.4 Exception code

When the message from the master device is not valid, the interface unit will discard the message and respond exception code. The structure of exception response is shown below.

- ① Slave address
- ② Function code + 80h
- ③ Exception code
- ④ CRC-16

The description of exception codes in exception response is shown in the table below.

Code	Name	Description
01h	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the slave (the interface unit).
02h	ILLEGAL DATA ADDRESS	The data address received in the query is not allowable address for the slave (the interface unit).
03h	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for the slave (the interface unit).

7 System Design Responsibility

- Mitsubishi Electric does not take any responsibility on the local system design of Modbus communication.

8 Laws and Regulations

- Please make sure to comply with laws and regulations in terms of Modbus communication designed locally.

This product is designed and intended for use in the residential,
commercial and light-industrial environment.



mitsubishi electric corporation

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