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VRF ADV MODBUS E6 ADAPTER

Série

ADV_MODBUS_E6

MODBUS GATEWAY (Mini)

Édition

06/23

To Users

Thank you for selecting this product. Please read this instruction manual carefully before installing and using the product, so as to master and correctly use the product. In order to guide you to correctly install and use our product and achieve expected operating effect, we hereby instruct as below:

(1) This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsibility for their safety. Children should be supervised to ensure that they do not play with the appliance.

(2) In order to ensure reliability of product, the product may consume some power under stand-by status for maintaining normal communication of system and preheating refrigerant and lubricant. If the product is not to be used for long, cut off the power supply; please energize and preheat the unit in advance before reusing it.

(3) Please properly select the model according to actual using environment, otherwise it may impact the using convenience.

(4) This product has gone through strict inspection and operational test before leaving the factory. In order to avoid damage due to improper disassembly and inspection, which may impact the normal operation of unit, please do not disassemble the unit by yourself. You can contact with the special maintenance center of our company if necessary.

(5) For personal injury or property loss and damage caused by improper operation such as improper installation and debugging, unnecessary maintenance, violation of related national laws and rules and industrial standard, and violation of this instruction manual, etc., we will bear no liability.

When the product is faulted and cannot be operated, please contact with our maintenance center as soon as possible by providing the following information.

Contents of nameplate of product (model, cooling/heating capacity, product No., ex-factory date).

Malfunction status (specify the situations before and after the error occurs).

All the illustrations and information in the instruction manual are only for reference. In order to make the product better, we will continuously conduct improvement and innovation. We have the right to make necessary revision to the product from time to time due to the reason of sales or production, and reserve the right to revise the contents without further notice.

Contents

1 Safety Notices (Please be sure to abide)

⚠	Warning: If not abide strictly, it may cause severe damage to the unit or the people.
⚠	Note: If not abide strictly, it may cause slight or medium damage to the unit or the people.
🚫	This sign indicates that the operation must be prohibited. Improper operation may cause severe damage or death to people.
⚠	This sign indicates that the items must be observed. Improper operation may cause damage to people or property.

⚠ WARNING!

This product can't be installed at corrosive, inflammable or explosive environment or the place with special requirements, such as kitchen. Otherwise, it will affect the normal operation or shorten the service life of the unit, or even cause fire hazard or serious injury. As for above special places, please adopt special product with anti-corrosive or anti-explosion function.

2 User Notice

Dear customer：

Please read this manual carefully prior to installation and operation and strictly observe all installation and operation instructions covered in the manual.

⚠ WARNING !
(1)Installation shall be performed by the qualified personnel; otherwise it would result in a fire hazard or electric shock.

(2)Do not place the plug of the power supply into the socket before it is dried and cleaned.

(3)Cut off the power supply before touching the electric element.

(4)Do not touch this device with wet hands; otherwise it would result in electric shock.

(5)Do use the power cable specified in this manual; otherwise it would result in a fire hazard.

(6)When the power cable is reversely connected or the power supply is beyond the rated range, it would result in a fire hazard or even damages to this device.

(7)Do install this device inside the electric control cabinet which is located indoor and then is locked.

(8)Do install this device where it will not be subject to the electromagnetic interference or heavy dust.

Notice！

(1)Be sure the specified adaptor is used; otherwise this device would work improperly or even be damaged.

(2)Be sure this device is setup in place; otherwise it would result in communication fault.

(3)Be sure the communication line is connected to the correct interface; otherwise it would result in communication fault.

(4)After connection, lines should be protected with insulating tape to avoid oxidation and short circuits.

(5)Normal working conditions for Modbus Gateway(Mini) :
①Temperature : -20 ～ +60℃;
②Humidity: less than 85%;
③Location: indoor (it is highly recommended to install this product in the electric control cabinet), not subject to direct sunlight, rain and snow etc.

(6)Graphics in the instruction manual are for reference only.

3 General Functions

　　Modbus Gateway(Mini) is intended to realize the data exchange between the air conditioner and BMS, and provides standard Modbus RTU protocol.
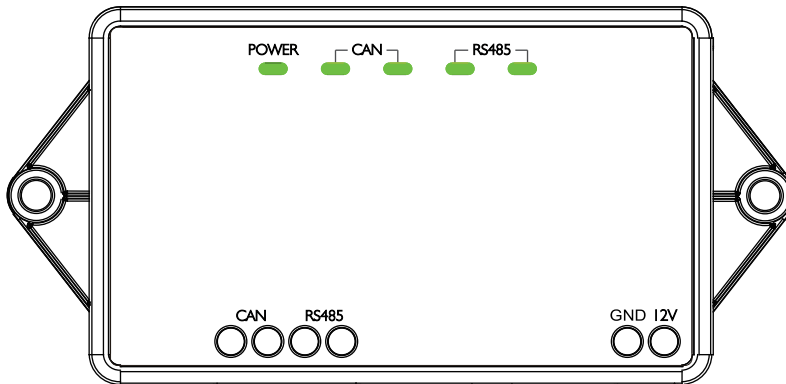
4 Composition

　　The product contains following items：

Modbus Gateway(Mini)	1 set
Owner's Manual	1 set

5 Detailed Introduction of Modbus Gateway(Mini)

5.1 Interface

5.1.1 Interface Function Drawing
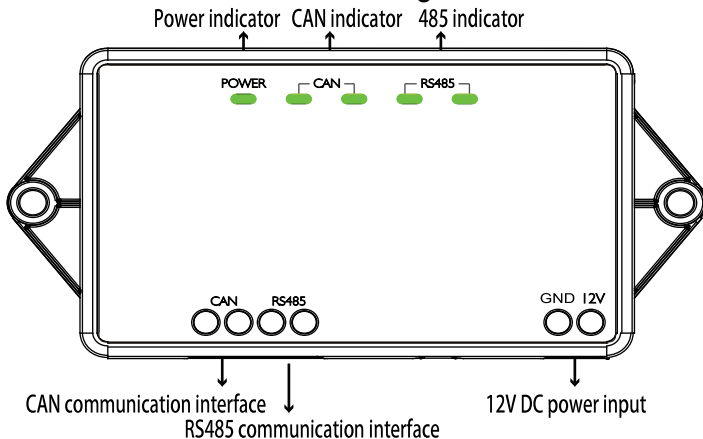
5.1.2 Power

The input power is 12V DC, external power supply can be prepared.
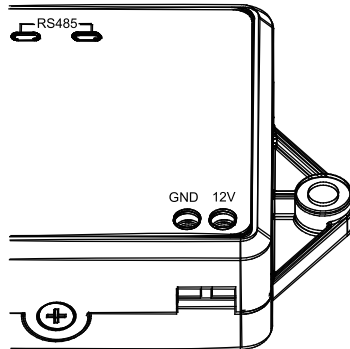
Note: pay attention to the polarity of power input and connect power according to the interface instruction.

5.1.3 Communication Interfaces
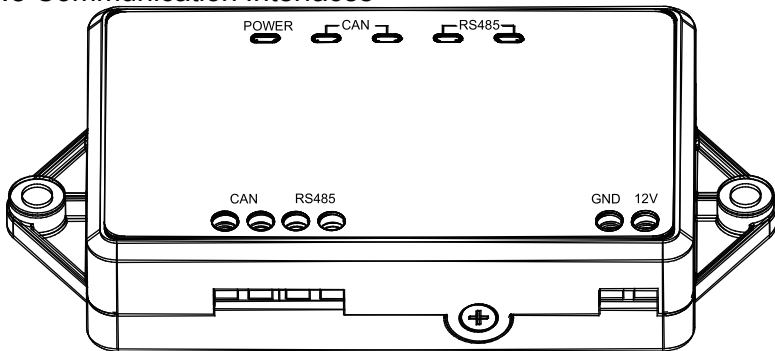
CAN communication interface: It is connected to air conditioner through two-core connection wire, to realize communication between Modbus Gateway(Mini) and air conditioner.

RS485 communication interface: It is connected to BMS through two-core communication cable, to realize communication between Modbus Gateway(Mini) and BMS or nearby Modbus Gateway(Mini).

5.2 LED Display
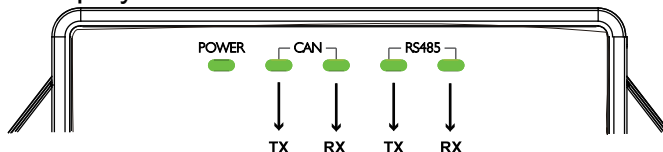
LED indicators shown in the above figure are divided into two parts: status indicators (power) and communication indicators(CAN, RS485). Operation status of each indicator is shown in the following table.

CAN	TX	When the data is transferred to the equipment (e.g. air conditioner) connected with Modbus Gateway(Mini), it will flash.
	RX	When the data from the equipment (e.g. air conditioner) connected with Modbus Gateway(Mini) is received, it will flash.
RS485	TX	When the data is transferred to the Modbus bus, it will flash.
	RX	When the data from the Modbus bus is received, it will flash.
Power		When power supply of Modbus Gateway(Mini) is normal, it will be always on.

5.3 DIP Switches

Notice! Please set DIP switches before using this gateway. Re-energize the device after setting DIP switches.

Otherwise this device cannot operate normally!

Setting area of Modbus gateway DIP switch is located inside the product, including address DIP switch and function DIP switch.
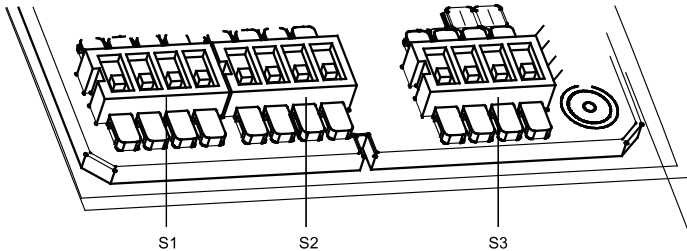
S1   S2   S3

5.3.1 Setting of Address DIP Switch

(1) Address DIP switch consists of S1 and S2. S3 is function DIP switch.

S1   **S2**   **S3**

ON-0
OFF-1

1 2 3 4   1 2 3 4   1 2 3 4

0
1
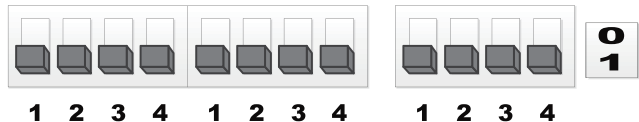
5.3.2 Address DIP Switch S1,S2—Address Setting of Modbus Gateway

⚠ Notice! Please set the address DIP switches before using this gateway. The network DIP switch address of the same bus cannot be repeated, otherwise communication error may happen.

Modbus Gateway(Mini) address setting range: 1~255. Detailed DIP value please refer to the Address DIP Form.

Address setting example:

Setting method of address 11 is shown as below:

Address								
S1				S2				Value
1	2	3	4	1	2	3	4	
1	1	0	1	0	0	0	0	11

Setting method of address 43 is shown as below:
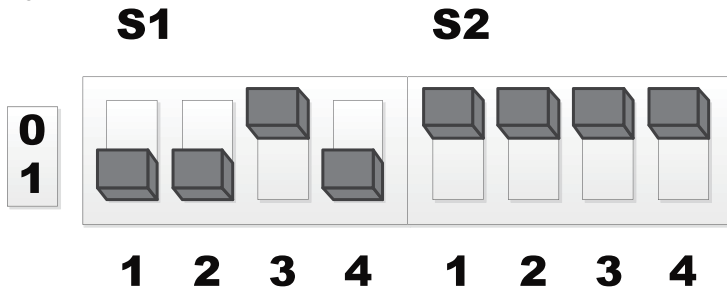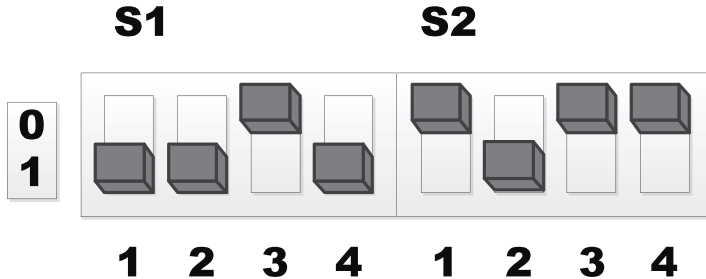
Address								Value
S1				S2				
1	2	3	4	1	2	3	4	
1	1	0	1	0	1	0	0	43

5.3.3 The Fourth Switch of Function DIP Switch S3 - Setting of CAN2 Bus Matched Resistance

 Notice!

Notice! Master outdoor unit or gateway of the system which is at the end of CAN2 bus must be set as with the matched resistance, otherwise communication will be abnormal!

The fourth switch of function DIP switch is used for setting the CAN2 bus matched resistance of this gateway.

If the Modbus gateway is at the end of CAN2 bus, the gateway shall be set as with the matched resistance, which means set the fourth DIP switch to 0;

If the Modbus gateway is not at the end of CAN2 bus, the gateway shall be set as without the matched resistance, which means set this DIP switch to 1.

DIP switch of matched resistance is shown as below:

without matched resistance   with matched resistance
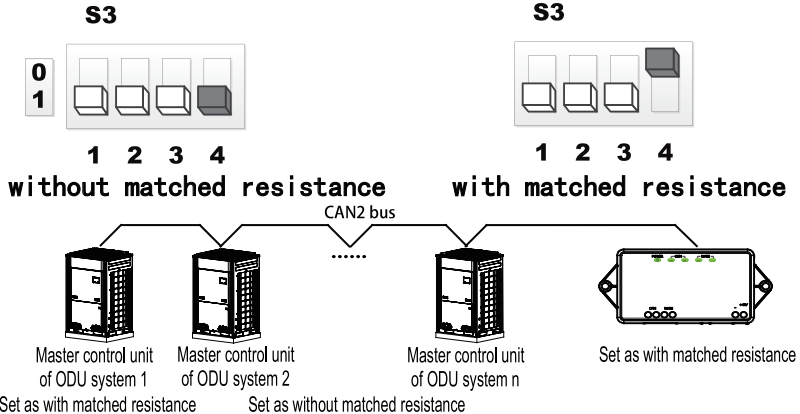
n is ODU system quantity, n≤16.

5.3.4 The Third Switch of Function DIP Switch S3 - Setting of Modbus Bus Matched Resistance

Notice! The third switch of function DIP switch is used for setting the matched resistance of this gateway in Modbus bus.

Modbus bus: Detailed meaning please refer to topology introduction.

The seventh switch of function DIP switch is used for setting the matched resistance of this gateway in Modbus bus.

If the Modbus gateway is at the end of Modbus bus, the gateway shall be set as with the matched resistance, which means set the third DIP switch to 0;

If the Modbus gateway is not at the end of Modbus bus, the gateway shall be set as without the matched resistance, which means set this DIP switch to 1.

DIP switch of matched resistance is shown as below:
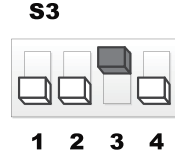
without matched resistance   **with matched resistance**

5.3.5 The Second Switch of Function DIP Switch S3 - Setting of gateway starting IDU project number

Gateway starting IDU project number means the IDU range that this gateway can be handled. The second switch of function DIP switch is used for setting the gateway starting IDU project number.

Gateway starting IDU project number is 1: this gateway can handle the IDU with project number from 1~128.

Gateway starting IDU project number is 129: this gateway can handle the IDU with project number from 129~255.

Setting diagram of gateway starting IDU project number DIP switch:

S3

Gateway starting IDU
project number is 1

S3
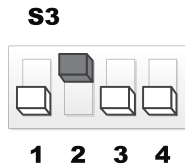
Gateway starting IDU
project number is 129

6 Application

Modbus Gateway(Mini) is usually applicable for Building Management System.

6.1 Building Management System (BMS)

This gateway adopts Modbus standard protocol, which can be used as the interface of BMS.

6.2 Topological Graph
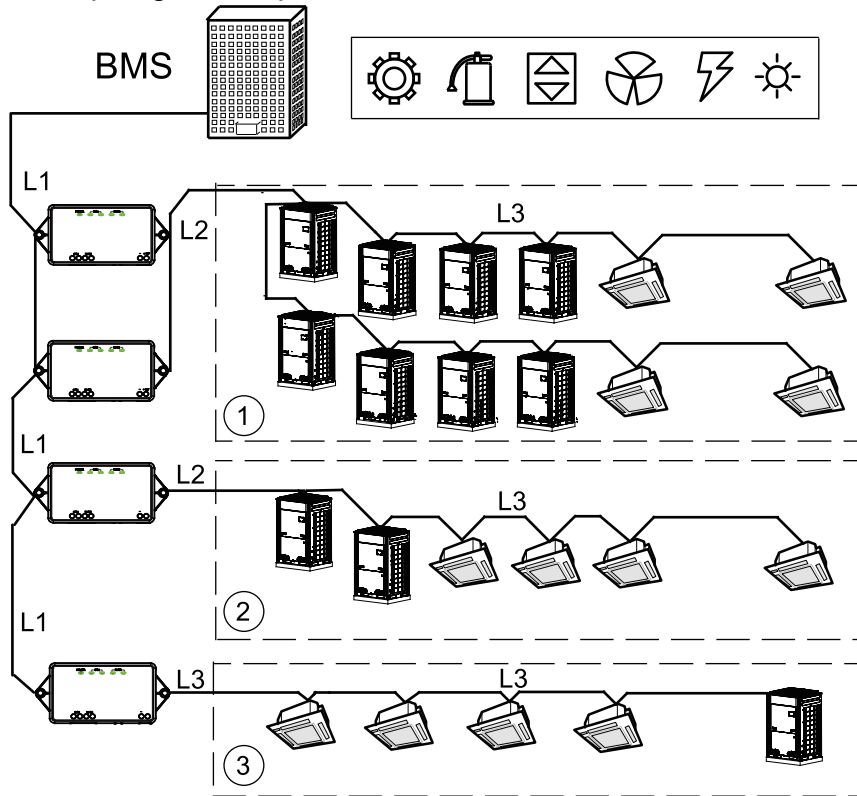
6.3 Topology Introduction

Modbus bus: L1 shown in the figure is the Modbus bus.

CAN1 network: network ③ shown in the figure is the CAN1 network, which is consist of Modbus Gateway(Mini) and all IDUs and ODUs of the system. One CAN1 network can be connected to maximum 80 IDUs. L3 shown in the network is CAN1 bus.

CAN2 network: network① and ② shown in the figure is the CAN2 network, which is consist of Modbus Gateway(Mini) and main control ODU of the system. One CAN2 network can be connected to maximum 16 systems and 255 IDUs. If the system quantity exceeds 16 sets or IDU quantity exceeds 255 sets, it shall be divided into two CAN2 network. L2 shown in the figure is CAN2 bus.

System: One system consists of one set of outdoor unit (one set of outdoor unit is a module group consisting of 1~4 modules, that is 1~4 outdoor units) and its connected indoor units.

Connectable unit quantity of Modbus Gateway(Mini): one Modbus Gateway(-Mini) can be connected to maximum 16 systems and 128 IDUs. If IDU quantity exceeds 128 sets, two Modbus gateways are needed.

7 Product installation

7.1 Product Dimension and Installation Space of Electric Control Cabinet

7.1.1 Product Dimension
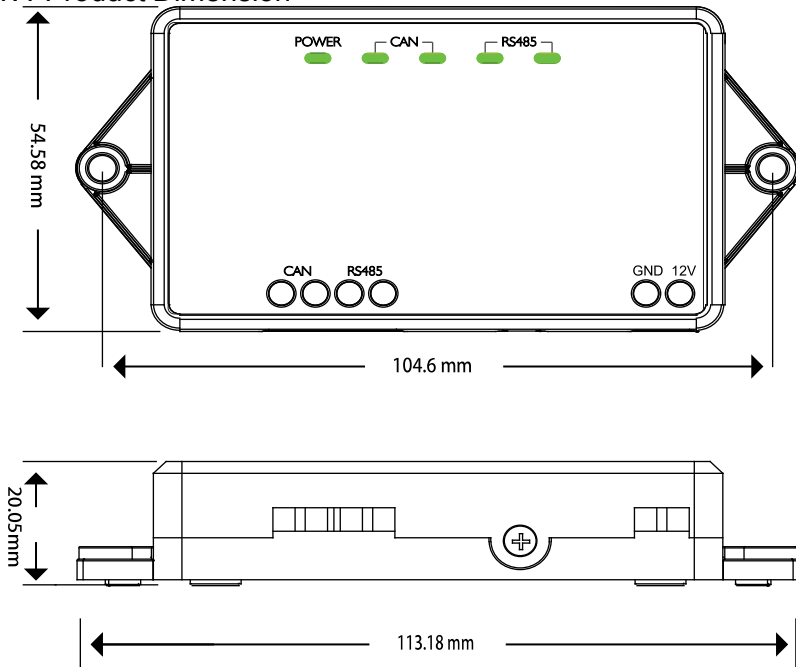
7.1.2 Installation Dimension of Electric Control Cabinet

Modbus Gateway(Mini) shall be installed in the electric control cabinet. The front side of gateway shall be hung upwards in horizontal level and secured by two screws. Required installation space is shown as below (only for reference).

Fix the gateway with two screws

Fix the upper cover with one screw
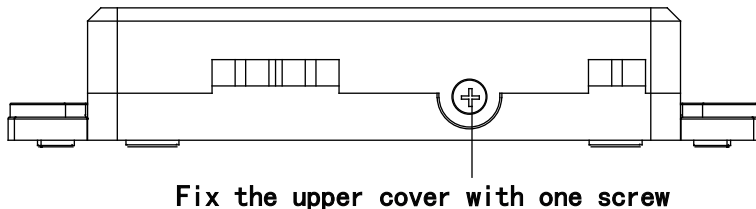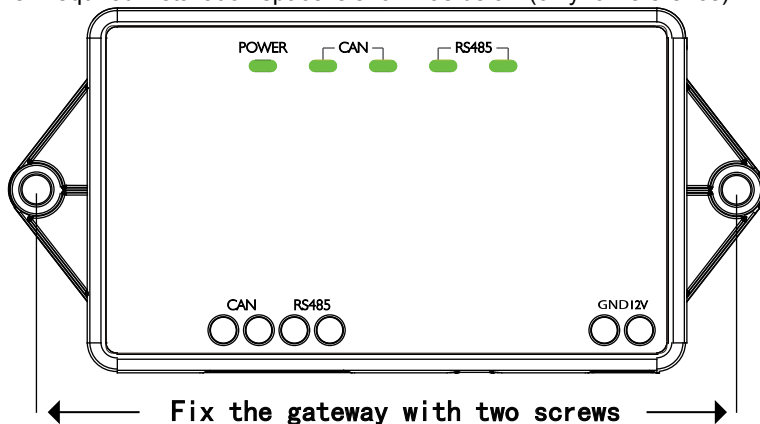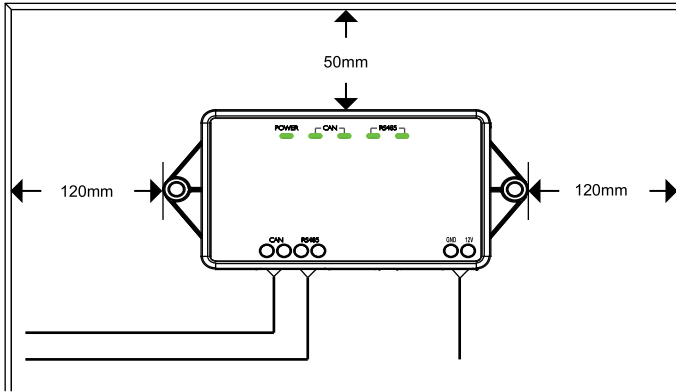
7.2 Communication Connection

Communication system of Modbus Gateway(Mini) includes:

（1）Communication between Modbus Gateway(Mini) and BMS;

（2）Communication between Modbus Gateway(Mini) and air conditioner.

7.2.1 Material Selection of Communication Cable

Communication system	Material of cable	Communication cable L(m)	Cable diameter (mm^2)	Material standard	Remark
Communication between Modbus Gateway(-Mini) and BMS	Light/ Ordinary PVC sheathed twisted pair copper wire (RVV)	L≤800	≥2×0.75	IE-C60227-5:2007	When communication distance exceeds 800m, photoelectric isolation repeater shall be added
Communication between Modbus Gateway(-Mini) and air conditioner	Light/ Ordinary PVC sheathed twisted pair copper wire (RVV)	L≤500	≥2×0.75	IE-C60227-5:2007	The length of communication cable shall not exceed 500m

7.2.2 Communication Connection Way

Notice! All communication cables of Modbus Gateway(Mini) must be connected in series instead of in star mode.

（1）Communicaiton connection between Modbus Gateway(Mini) and BMS;

BMS system

BMS system
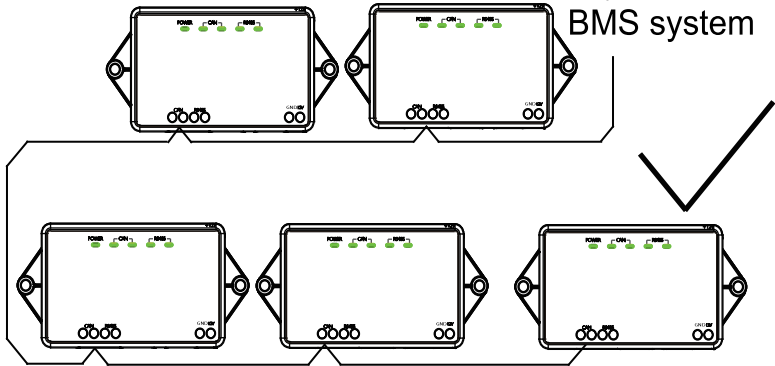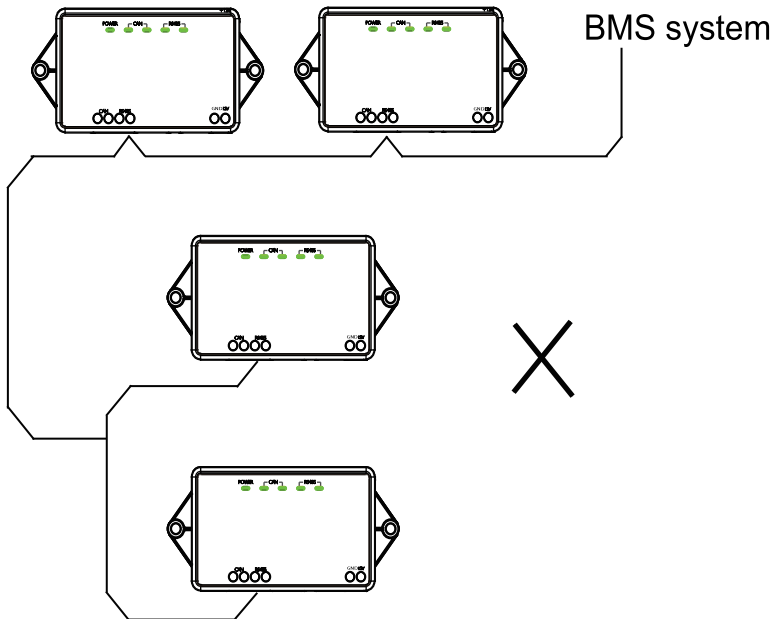
(2) Communication connection between Modbus Gateway(Mini) and air conditioner (n is air conditioner quantity, n≤16);

Master control unit of ODU system 1
Master control unit of ODU system 2
Master control unit of ODU system n

Master control unit of ODU system 3

Master control unit of ODU system 1
Master control unit of ODU system 2
Master control unit of ODU system n

Master control unit of ODU system 1
Master control unit of ODU system 2
Master control unit of ODU system 3
Master control unit of ODU system n
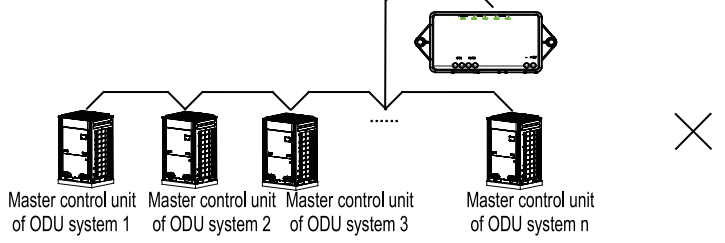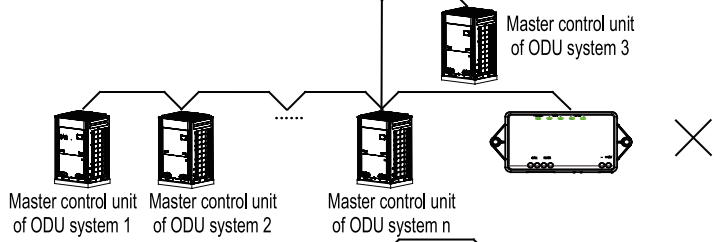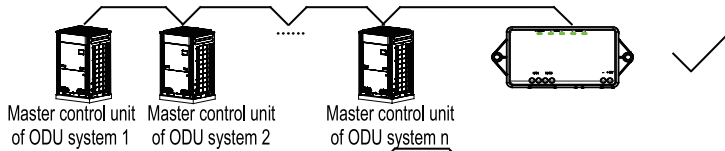
7.2.3 Setting of Communication Connection
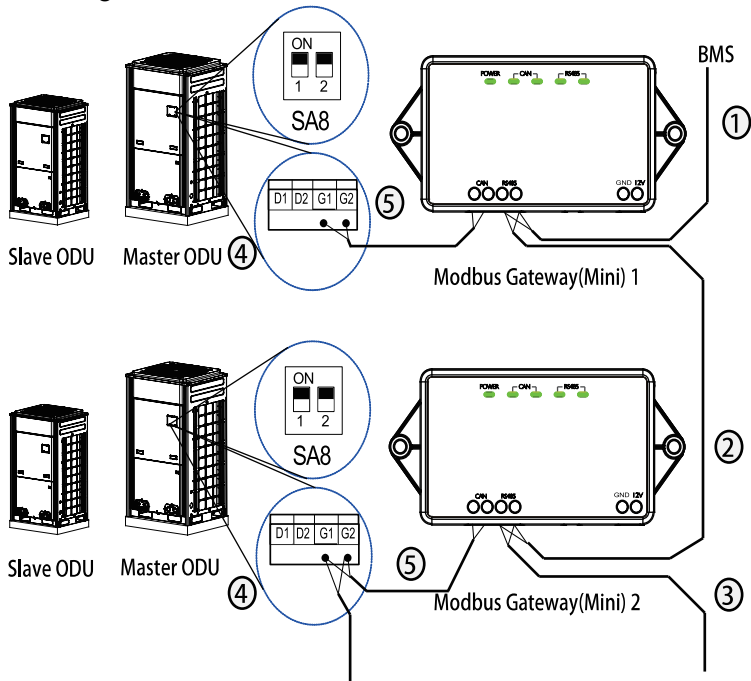
(1) Communication wire connection between Modbus Gateway(Mini) and BMS:

Step 1: Confirm the first Modbus Gateway(Mini) (Modbus Gateway(Mini)1 as shown in the figure) that needs to be connected to BMS. Connect the port of RS485 of this gateway and the BMS with communication cable, as shown in step ① in the figure.

Step 2: Connect the RS485 communication port of Modbus Gateway(Mini) (-Modbus Gateway(Mini)1) with the RS485 communication port of the second Modbus Gateway(Mini) (Modbus Gateway(Mini)2 as shown in the figure) with communication cable; as shown in step ② in the figure.

Step 3: The other Modbus Gateway(Mini)shall be connected in series; as shown in step ③ in the figure.

（2）Communication wire connection between Modbus Gateway(Mini) and air conditioner:

Step 1: Confirm the master ODU that each Modbus Gateway(Mini) shall be connected (set master ODU with SA8 DIP). Please refer to "7.2.2(2) Communicaiton connection between Modbus Gateway(Mini) and air conditioner" and adopt series connection, as shown in step ④ in the figure.

Step 2: Connect the G1 and G2 port of CAN communication interface of Modbus Gateway(Mini) and the G1 and G2 port of wiring board of corresponding master ODU with communication cable, as shown in step ⑤ in the figure.

※ CAN2 network: Detailed meaning please refer to topology introduction.

（3）Modbus Gateway(Mini) DIP setting:

Step one: Set address DIP of Modbus Gateway(Mini);

Step two: Refer to Chapter 5.3.4 to set matching resistance of Modbus Gateway(Mini);

Note:

1. In Modbus bus, if the connected Modbus Gateway(Mini) exceeds 30 or communication distance exceeds 800m, one photoelectric isolation repeater shall be added. Connect the R+ and R- port of photoelectric isolation repeater with the R+ and R- port of RS485 communication port of nearby Modbus Gateway(Mini).

30 Modbus gateways in maximun between two repeaters

Total accumulative length of communication cable
between two repeaters shall not exceed 800m
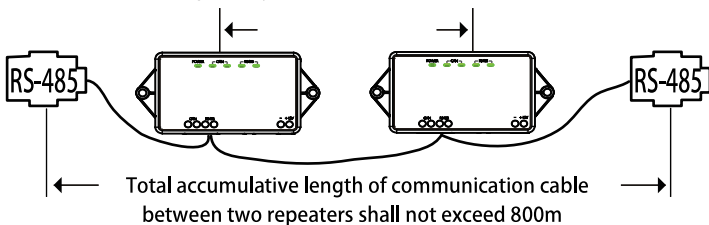
2. In "5.3.3 The fourth switch of DIP switch S3——setting of CAN2 bus matched resistance", the setting method of matched resistance of Modbus Gateway(Mini) is introduced. Meanwhile, the master ODU in the first and end systems of CAN2 bus shall be set as with matched resistance. In the following, the detailed setting position and method of matched resistance of VRF and Multihybrid
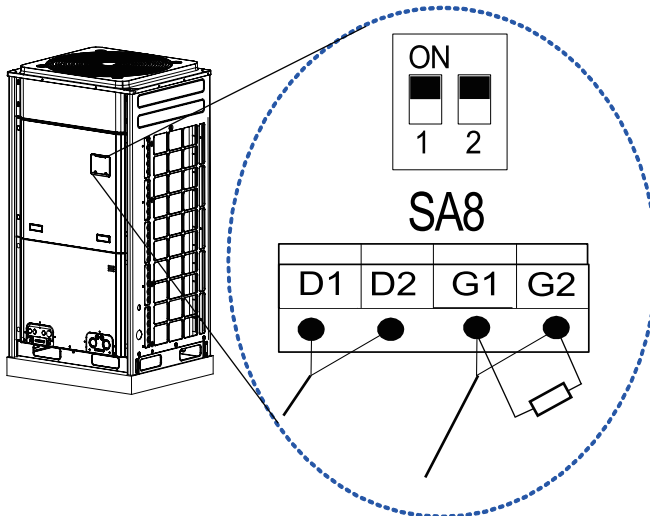
※ CAN2 bus: Detailed meaning please refer to topology introduction.

8 Annex: DIP Address

0~31 DIP address table										32~63 DIP address table								
S1				S2				a-d-dr		S1				S2				ad-dr
1	2	3	4	1	2	3	4			1	2	3	4	1	2	3	4	
0	0	0	0	0	0	0	0	/		0	0	0	0	0	1	0	0	32
1	0	0	0	0	0	0	0	1		1	0	0	0	0	1	0	0	33
0	1	0	0	0	0	0	0	2		0	1	0	0	0	1	0	0	34

1	1	0	0	0	0	0	0	3	1	1	0	0	0	1	0	0	35
0	0	1	0	0	0	0	0	4	0	0	1	0	0	1	0	0	36
1	0	1	0	0	0	0	0	5	1	0	1	0	0	1	0	0	37
0	1	1	0	0	0	0	0	6	0	1	1	0	0	1	0	0	38
1	1	1	0	0	0	0	0	7	1	1	1	0	0	1	0	0	39
0	0	0	1	0	0	0	0	8	0	0	0	1	0	1	0	0	40
1	0	0	1	0	0	0	0	9	1	0	0	1	0	1	0	0	41
0	1	0	1	0	0	0	0	10	0	1	0	1	0	1	0	0	42
1	1	0	1	0	0	0	0	11	1	1	0	1	0	1	0	0	43
0	0	1	1	0	0	0	0	12	0	0	1	1	0	1	0	0	44
1	0	1	1	0	0	0	0	13	1	0	1	1	0	1	0	0	45
0	1	1	1	0	0	0	0	14	0	1	1	1	0	1	0	0	46
1	1	1	1	0	0	0	0	15	1	1	1	1	0	1	0	0	47
0	0	0	0	1	0	0	0	16	0	0	0	0	1	1	0	0	48
1	0	0	0	1	0	0	0	17	1	0	0	0	1	1	0	0	49
0	1	0	0	1	0	0	0	18	0	1	0	0	1	1	0	0	50
1	1	0	0	1	0	0	0	19	1	1	0	0	1	1	0	0	51
0	0	1	0	1	0	0	0	20	0	0	1	0	1	1	0	0	52
1	0	1	0	1	0	0	0	21	1	0	1	0	1	1	0	0	53
0	1	1	0	1	0	0	0	22	0	1	1	0	1	1	0	0	54

1	1	1	0	1	0	0	0	23
0	0	0	1	1	0	0	0	24
1	0	0	1	1	0	0	0	25
0	1	0	1	1	0	0	0	26
1	1	0	1	1	0	0	0	27
0	0	1	1	1	0	0	0	28
1	0	1	1	1	0	0	0	29
0	1	1	1	1	0	0	0	30
1	1	1	1	1	0	0	0	31

1	1	1	0	1	1	0	0	55
0	0	0	1	1	1	0	0	56
1	0	0	1	1	1	0	0	57
0	1	0	1	1	1	0	0	58
1	1	0	1	1	1	0	0	59
0	0	1	1	1	1	0	0	60
1	0	1	1	1	1	0	0	61
0	1	1	1	1	1	0	0	62
1	1	1	1	1	1	0	0	63

64~95 DIP address table								
S1				S2				addr
1	2	3	4	5	6	7	8	
0	0	0	0	0	0	1	0	64
1	0	0	0	0	0	1	0	65
0	1	0	0	0	0	1	0	66
1	1	0	0	0	0	1	0	67
0	0	1	0	0	0	1	0	68
1	0	1	0	0	0	1	0	69
0	1	1	0	0	0	1	0	70

96~127 DIP address table								
S1				S2				addr
1	2	3	4	5	6	7	8	
0	0	0	0	0	1	1	0	96
1	0	0	0	0	1	1	0	97
0	1	0	0	0	1	1	0	98
1	1	0	0	0	1	1	0	99
0	0	1	0	0	1	1	0	100
1	0	1	0	0	1	1	0	101
0	1	1	0	0	1	1	0	102

1	1	1	0	0	0	1	0	71	1	1	1	0	0	1	1	0	103
0	0	0	1	0	0	1	0	72	0	0	0	1	0	1	1	0	104
1	0	0	1	0	0	1	0	73	1	0	0	1	0	1	1	0	105
0	1	0	1	0	0	1	0	74	0	1	0	1	0	1	1	0	106
1	1	0	1	0	0	1	0	75	1	1	0	1	0	1	1	0	107
0	0	1	1	0	0	1	0	76	0	0	1	1	0	1	1	0	108
1	0	1	1	0	0	1	0	77	1	0	1	1	0	1	1	0	109
0	1	1	1	0	0	1	0	78	0	1	1	1	0	1	1	0	110
1	1	1	1	0	0	1	0	79	1	1	1	1	0	1	1	0	111
0	0	0	0	1	0	1	0	80	0	0	0	0	1	1	1	0	112
1	0	0	0	1	0	1	0	81	1	0	0	0	1	1	1	0	113
0	1	0	0	1	0	1	0	82	0	1	0	0	1	1	1	0	114
1	1	0	0	1	0	1	0	83	1	1	0	0	1	1	1	0	115
0	0	1	0	1	0	1	0	84	0	0	1	0	1	1	1	0	116
1	0	1	0	1	0	1	0	85	1	0	1	0	1	1	1	0	117
0	1	1	0	1	0	1	0	86	0	1	1	0	1	1	1	0	118
1	1	1	0	1	0	1	0	87	1	1	1	0	1	1	1	0	119
0	0	0	1	1	0	1	0	88	0	0	0	1	1	1	1	0	120
1	0	0	1	1	0	1	0	89	1	0	0	1	1	1	1	0	121
0	1	0	1	1	0	1	0	90	0	1	0	1	1	1	1	0	122

1	1	0	1	1	0	1	0	91
0	0	1	1	1	0	1	0	92
1	0	1	1	1	0	1	0	93
0	1	1	1	1	0	1	0	94
1	1	1	1	1	0	1	0	95

1	1	0	1	1	1	1	0	123
0	0	1	1	1	1	1	0	124
1	0	1	1	1	1	1	0	125
0	1	1	1	1	1	1	0	126
1	1	1	1	1	1	1	0	127

128~159 DIP address table								
S1				S2				addr
1	2	3	4	1	2	3	4	
0	0	0	0	0	0	0	1	128
1	0	0	0	0	0	0	1	129
0	1	0	0	0	0	0	1	130
1	1	0	0	0	0	0	1	131
0	0	1	0	0	0	0	1	132
1	0	1	0	0	0	0	1	133
0	1	1	0	0	0	0	1	134
1	1	1	0	0	0	0	1	135
0	0	0	1	0	0	0	1	136
1	0	0	1	0	0	0	1	137
0	1	0	1	0	0	0	1	138
1	1	0	1	0	0	0	1	139

160~191 DIP address table								
S1				S2				addr
1	2	3	4	1	2	3	4	
0	0	0	0	0	1	0	1	160
1	0	0	0	0	1	0	1	161
0	1	0	0	0	1	0	1	162
1	1	0	0	0	1	0	1	163
0	0	1	0	0	1	0	1	164
1	0	1	0	0	1	0	1	165
0	1	1	0	0	1	0	1	166
1	1	1	0	0	1	0	1	167
0	0	0	1	0	1	0	1	168
1	0	0	1	0	1	0	1	169
0	1	0	1	0	1	0	1	170
1	1	0	1	0	1	0	1	171

Modbus Gateway(Mini)

0	0	1	1	0	0	0	1	140	0	0	1	1	0	1	0	1	172
1	0	1	1	0	0	0	1	141	1	0	1	1	0	1	0	1	173
0	1	1	1	0	0	0	1	142	0	1	1	1	0	1	0	1	174
1	1	1	1	0	0	0	1	143	1	1	1	1	0	1	0	1	175
0	0	0	0	1	0	0	1	144	0	0	0	0	1	1	0	1	176
1	0	0	0	1	0	0	1	145	1	0	0	0	1	1	0	1	177
0	1	0	0	1	0	0	1	146	0	1	0	0	1	1	0	1	178
1	1	0	0	1	0	0	1	147	1	1	0	0	1	1	0	1	179
0	0	1	0	1	0	0	1	148	0	0	1	0	1	1	0	1	180
1	0	1	0	1	0	0	1	149	1	0	1	0	1	1	0	1	181
0	1	1	0	1	0	0	1	150	0	1	1	0	1	1	0	1	182
1	1	1	0	1	0	0	1	151	1	1	1	0	1	1	0	1	183
0	0	0	1	1	0	0	1	152	0	0	0	1	1	1	0	1	184
1	0	0	1	1	0	0	1	153	1	0	0	1	1	1	0	1	185
0	1	0	1	1	0	0	1	154	0	1	0	1	1	1	0	1	186
1	1	0	1	1	0	0	1	155	1	1	0	1	1	1	0	1	187
0	0	1	1	1	0	0	1	156	0	0	1	1	1	1	0	1	188
1	0	1	1	1	0	0	1	157	1	0	1	1	1	1	0	1	189
0	1	1	1	1	0	0	1	158	0	1	1	1	1	1	0	1	190
1	1	1	1	1	0	0	1	159	1	1	1	1	1	1	0	1	191

192~223 DIP address table									224~255 DIP address table								
S1				S2				addr	S1				S2				addr
1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8	
0	0	0	0	0	0	1	1	192	0	0	0	0	0	1	1	1	224
1	0	0	0	0	0	1	1	193	1	0	0	0	0	1	1	1	225
0	1	0	0	0	0	1	1	194	0	1	0	0	0	1	1	1	226
1	1	0	0	0	0	1	1	195	1	1	0	0	0	1	1	1	227
0	0	1	0	0	0	1	1	196	0	0	1	0	0	1	1	1	228
1	0	1	0	0	0	1	1	197	1	0	1	0	0	1	1	1	229
0	1	1	0	0	0	1	1	198	0	1	1	0	0	1	1	1	230
1	1	1	0	0	0	1	1	199	1	1	1	0	0	1	1	1	231
0	0	0	1	0	0	1	1	200	0	0	0	1	0	1	1	1	232
1	0	0	1	0	0	1	1	201	1	0	0	1	0	1	1	1	233
0	1	0	1	0	0	1	1	202	0	1	0	1	0	1	1	1	234
1	1	0	1	0	0	1	1	203	1	1	0	1	0	1	1	1	235
0	0	1	1	0	0	1	1	204	0	0	1	1	0	1	1	1	236
1	0	1	1	0	0	1	1	205	1	0	1	1	0	1	1	1	237
0	1	1	1	0	0	1	1	206	0	1	1	1	0	1	1	1	238
1	1	1	1	0	0	1	1	207	1	1	1	1	0	1	1	1	239
0	0	0	0	1	0	1	1	208	0	0	0	0	1	1	1	1	240

1	0	0	0	1	0	1	1	209	1	0	0	0	1	1	1	1	241
0	1	0	0	1	0	1	1	210	0	1	0	0	1	1	1	1	242
1	1	0	0	1	0	1	1	211	1	1	0	0	1	1	1	1	243
0	0	1	0	1	0	1	1	212	0	0	1	0	1	1	1	1	244
1	0	1	0	1	0	1	1	213	1	0	1	0	1	1	1	1	245
0	1	1	0	1	0	1	1	214	0	1	1	0	1	1	1	1	246
1	1	1	0	1	0	1	1	215	1	1	1	0	1	1	1	1	247
0	0	0	1	1	0	1	1	216	0	0	0	1	1	1	1	1	248
1	0	0	1	1	0	1	1	217	1	0	0	1	1	1	1	1	249
0	1	0	1	1	0	1	1	218	0	1	0	1	1	1	1	1	250
1	1	0	1	1	0	1	1	219	1	1	0	1	1	1	1	1	251
0	0	1	1	1	0	1	1	220	0	0	1	1	1	1	1	1	252
1	0	1	1	1	0	1	1	221	1	0	1	1	1	1	1	1	253
0	1	1	1	1	0	1	1	222	0	1	1	1	1	1	1	1	254
1	1	1	1	1	0	1	1	223	1	1	1	1	1	1	1	1	255

9 Modbus Protocol Format

4. Modbus Protocol Format

4.1 Brief Introduction

Modbus actually has become the industrial communication standard because it is not only fully opened and used widely but also simple and can be debugged flexibly. Besides, as for the communication of multiple units, it can be developed fast and also can be conveniently connected with the devices which support this protocol. There are two communication modes, RTU and ASCII. The former one is adopted for this BMS interface.

4.2 Protocol Interface

The protocol interface is the Modbus RTU protocol.

4.3 Hardware Interface

1) RS485 Communication Interface：RS485
2) Communication Mode: Baud Rate: 9600 bit/s
   Start Bit: 1
   Data Bit: 8
   Check Bit: None
   Stop Bit: 1

4.4 Universal Communication Frame Format of Modbus under RTU Mode

Start Time Interval	Address Code	Function Code	Data Area	CRC	Stop Time Interval
T1-T2-T3-T4	1 Byte	1 Byte	n Bytes	2 Bytes	T1-T2-T3-T4

Under the RTU mode, there is at least 3.5ms dead time before the data transmission, which can be figured out through the adopted baud rate (like T1-T2-T3-T4 listed in the table above) and there is another 3.5ms dead time after the transmission of the last character. After that, another set of data can be transmitted.

The whole set of data should be transmitted continuously. If there is a pause more than 1.5ms, the receiver will jump to the transmission of next set of data.

If the dead time is less than 3.5ms, the transmission would fail as the CRC for the information combination is ineffective.

4.5 Modbus Standard Protocol Format

4.5.1 Coil (Bit)

Table 2: Coils Data

Address	Corresponding Byte	Values (example)
Bit 0	Byte0.0	1
Bit 1	Byte0.1	0
Bit 2	Byte0.2	1
Bit 3	Byte0.3	0
Bit 4	Byte0.4	1
Bit 5	Byte0.5	0
Bit 6	Byte0.6	1
Bit 7	Byte0.7	0
Bit 8	Byte1.0	1
Bit 9	Byte1.1	0
Bit 10	Byte1.2	1
Bit 11	Byte1.3	0
Bit 12	Byte1.4	1
Bit 13	Byte1.5	0
Bit 14	Byte1.6	1
Bit 15	Byte1.7	0
……	……	……

1. "Coil" indicates the data of some flag bit or failure bit etc.
2. The unit of data is bit and each bit has a corresponding address.
3. The data bit exists in the byte of the communication frame and each byte is composed of eight bits. The high-order byte is corresponding to the high-order bit, so is the low-order byte and bit. See Table 2 for more details.
4. The master unit can operate one bit among the Modbus gateway data or multiple continuous bits at the same time.
5. The bit count which the master unit can read or transmit is less than Byte×8. The ineffective data bit of the last byte should be cleared when transmit or read the effective data of the communication frame. For instance, when nine "1" bits are read or transmitted, then two bytes are needed, namely "1111 1111" and "0000 0001". The front part of valid data "1" is invalid data, which should be cleared.

4.5.2 Register (Word, 16 Bit)

Table 3: Register Data

Address	Corresponding Byte Address	Value (Example)
Word 0	Byte 0	AA 55
	Byte 1	
Word 1	Byte 2	AA 55
	Byte 3	
Word 2	Byte 4	55 AA
	Byte 5	
……	……	……
	……	

1. The unit of the register is "word " which has a corresponding address starting from 0.

2. When the master unit reads a word, it needs to read two bytes from the high-order eight bits to the low-order eight bits.

3. When the master unit transmits or read the request frame, it can transmit or read one or multiple continuous words in the data list.

4.5.3 Read Coils (Read Bit)

Note：It can read the coil data but not support the broadcast.

Function code: 0x01

Table 4: Request Frame

Device Address	Function Code	Starting Address	Data Size	CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes

Table 5: Response Frame

Device Address	Function Code	Byte Count	Effective Data	CRC
1 Byte	1 Byte	1 Byte	n Bytes	2 Bytes

Starting Address: it is the starting place where to read a series of bits.

Data size：It indicates the bit count.

Case：Read ten bits from the coil 5 of the device 10(see Table 2 for the coil data), as follows:

Request Frame: 0A(device address) 01(function code) 00 05(starting address) 00 0A(data size) AD 77(CRC）

Response Frame: 0A(device address) 01(function code) 02(byte count) AA 02(effective data) E3 5C(CRC).

The last byte is "0000 0010", among which the part in front of valid data "10" is invalid data and should be cleared.

4.5.4 Write Coils (Write Bit)

Note: The master writes coil data to the Modbus gateway and also supports the broadcast.

Function code: 0x0F

Table 6: Request Frame

Device Address	Function Code	Starting Address	Data Size	Byte Count	Effective Data	CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	1 Byte	n Bytes	2 Bytes

Table 7: Response Frame

Device Address	Function Code	Starting Address	Data Size	CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes
Note: The response frame has the same device address, function code, starting address and data size as the request frame.				

Case: set eleven consecutive bits to "1" from the device 10 and starting at the address 6, as follows:

Request Frame: 0A(device address) 0F(function code) 00 06(starting address) 00 0B(data size) 02(byte count) FF 07(effective data) 97 A0(CRC);

Response Frame: 0A(device address) 0F(function code) 00 06(starting address) 00 0B(data size) F5 76(CRC);

The last byte is "0000 0111", among which the part in front of valid data "111" is invalid data and should be cleared.

4.5.5 Read Registers (Read Word)

Note: Read the register data of Modbus gateway but do not support the broadcast.

Function code: 0x03

Table 8: Request Frame

Device Address	Function Code	Starting Address	Data Size	CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes

Table 9: Response Frame

Device Address	Function Code	Byte Count	Effective Data	CRC
1 Byte	1 Byte	1 Byte	n Bytes	2 Bytes

Starting Address: It indicates the starting address to read the Word block data.

Data Size：It indicates the word count with the maximum of 127 each time.

Case: read two continuous words (see Table 3) from the device 10 starting at the address 1, as follows:

Request Frame：0A (device address) 03 (function code) 00 01(starting address) 00 02(data size) 94 B0 (CRC);

Response Frame: 0A (device address) 03 (function code) 04(byte count) AA 55 55 AA (effective data) CE 14(CRC).

4.5.6 Write Registers (Write Word)

Note：Write control data from the master unit to the register and support the broadcast

Function code: 0x10

Table 10: Request Frame

Device Address	Function Code	Starting Address	Data Size	Byte Count	Effective Date	CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	1 Byte	n Bytes	2 Bytes

Table 11: Response Frame

Device Address	Function Code	Starting Address	Data Size	CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes
Note: The response frame has the same device address, function code, starting address and data size as the request frame.				

Case: Write three words (0x12, 0x23, 0x34) from the device 10 starting at the address 2, as follows:

Request Frame: 0A (device address) 10 (function code) 00 02(starting address) 00 03(data size) 06 (byte count) 00 12 00 23 00 34(effective data) 15 DF (CRC)

Response Frame: 0A (device address) 10 (function code) 00 02 (starting address) 00 03 (data size) 20 B3 (CRC)

4.5.7 Alarm Response

Note: The master unit sends out a request frame, but the Modbus gateway detects that there is some default, so an alarm response alarm is replied.

Function Code: Set the highest-order bit to "1", which is value figured out through the OR operation of the request frame's function code and 0x80.

Communication Format of the Response Frame:

Table12: Alarm Response Frame

Device Address	Function Code	Alarm Code	CRC
1 Byte	1 Byte	1 Bytes	2 Bytes

Description to the Alarm Codes:

Table13: Alarm Codes

Alarm Code	Name	Description
0x03	Illegal data	The transmitted data is incorrect or beyond the data area.
0x04	Slave device failure	There is communicating failure between the communication module and the unit.

Case: Master unit reads 128 words from the device 10 starting at the address 0, but exceeds valid length of Modbus readable range, so the replay of the alarm response frame is as follows:

Request Frame: 0A(device address) 03(function code) 00 00(starting address) 00 80(data size) 45 11(CRC);

Reponses Frame: 0A(device address) 83(function code) 03(alarm code) 70 F3 (CRC).

5. Communication Protocol for Duct Type Unit (CAN)

5.1 Brief Introduction to Communication Protocol for Duct Type Unit (CAN)

Inverter Big Duct Type Unit (CAN) provides Modbus protocol interface through Modbus Gateway external BMS interface. The unit is connected to user's BMS system through Modbus RTU. Through the long-distance monitoring PC or the BMS system, the user can take a centralized management and control to the unit. It without doubt is the high-efficiency tool for the management of the intelligent air conditioning system in the modern buildings.

Through this interface, it can not only realize the long-distance monitoring to the unit, including the running temperature of the unit, the status of the compressor, and the failure status but also set the unit long remotely, like temperature, running mode, on/off, shield setting, fan speed etc.

In the protocol, "R" indicates "only read" and "W/R" indicates "write and read".

5.2 Precautions before the Development to the BMS Interface for Duct Type Unit (CAN)

Before software development to BMS interface provided by us, please make sure the DIP switch setting of Modbus gateway is correct and the wire connection is correct.

Precautions to the Software Design:

★(1) When it is in conflict with the ODU type, BMS software setting mode is invalid. The monitoring software is recommended to indicate invalid operation:

When the ODU is cooling only model, heating/floor heating/heat supply/quick heating is invalid;

When the ODU is heating only unit, cooling/dehumidifying setting is invalid;

When the ODU is fan only model, mode setting except fan and fresh air is invalid.

★(2) When the alarm response frame received by BMS system is 0x04, it indicates there is communication error between the unit and gateway.

★(3) All data that the BMS communicates to the gateway should be verified if they are among the effective range.

★(4) When the gateway is de-energized and then energized, it will report alarm response if it hasn't received any valid device data.

★(5) The priority of ODU forced mode is higher than the control of BMS system software. In this case, any control of BMS system is invalid.

★(6) Remote locking

It can be set under any status;

Under remote locking status, ODU forced mode is valid and IDU hardware reset is valid.

★(7) Unit on/off

When the unit is turned off forcibly due to power shortage (error code L8 is displayed), the startup sent by BMS system software will be invalid.

In any other case, unit on/off by BMS system software is valid.

★(8) Filter cleaning reminder and clear: the setting is valid under any status.

★(9) Modbus interface is non-polarity.

Modbus interface of this gateway adopts non-polarity design. If correct data cannot be received within 60s, 485 polarity is switched once every 3 seconds, until data receiving is normal.

★(10) The precautions should be matched with the model connected in the network.

★(11) If unit engineering information changes, please re-debug the gateway.

5.3 Definition of Effective Data

The data for the Modbus communication protocol can be divided into two types: analog value and switching value. The former one indicates the values of temperature, valves and other continuous, multi-mode values, while the later one indicates the value which only has two status, like the temperature sensor failure (with only two options: "Yes" or "No").

1. **Data and Address Distribution of the Analog Values: (Word 0 ~ Word 20)**

Address	Access Type	Data Meaning	Range	Accuracy	Unit	Data Type
Word 0	R	Model ID	Transmission value= Actual value;			uint16
Word 2	W/R	On/Off	Transmission value= Actual value, Actual value: unit on: 0xAA; unit off: 0x55;			uint16
Word 4	R	Indoor ambient temperature	Transmission value= Actual temperature + 100, actual value: -30~138;	1	℃	float
Word 17	W/R	Setting of operation mode	Transmission value= Actual value; Actual value: 0: invalid; 1: fan stops; 2: ultra low speed; 3: low speed; 4: medium low speed; 5: medium speed; 6: medium high speed; 7: high speed; 7: super high speed;			uint16
Word 19	W/R	Setting of fan status	Transmission value= Actual value; Actual value: 0: invalid; 1: fan stops; 2: ultra low speed; 3: low speed; 4: medium low speed; 5: medium speed; 6: medium high speed; 7: high speed; 7: super high speed;			uint16
Word 20	W/R	Temperature setting	Transmission value = Actual temperature*10+1000, actual value: -30~138;	0.1	℃	float

2. **Data and Address Distribution of the Data Status Values: (Bit 0 ~ Bit 224)**

Address	Access Type	Data Meaning	Range	Data type
Bit 2	R	Communication failure between gateway and unit	1: Error; 0: Normal	Error data
Bit 15	R	Indoor fan protection	1: Error; 0: Normal	Error data

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