

IntesisBox[®]

DK-RC-MBS-1 v.0.2

MODBUS RTU (RS-485) Interface for Daikin air conditioners.

Compatible with VRV and SKY line air conditioners commercialized by Daikin.

User Manual

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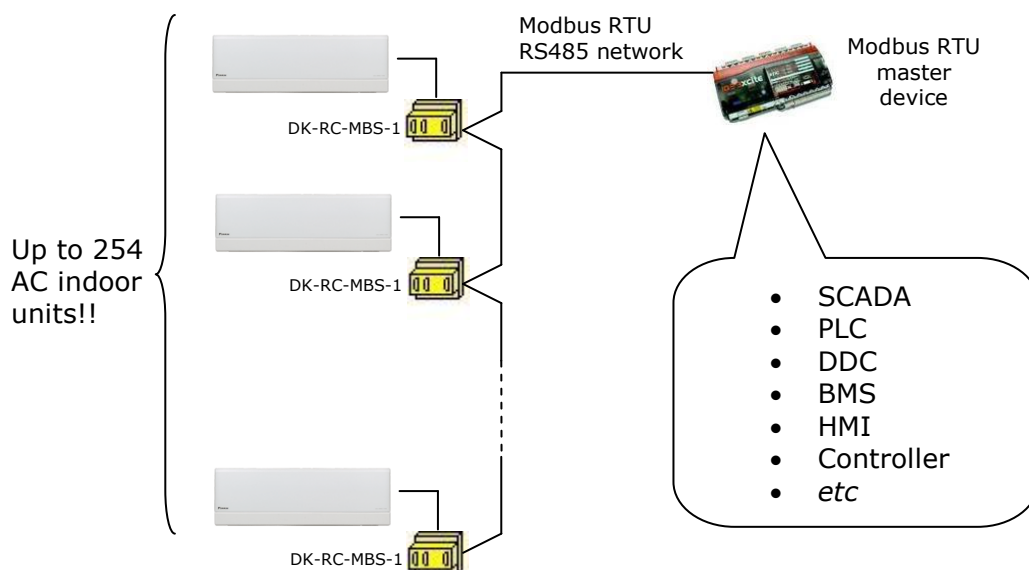
1. Presentation



The DK-RC-MBS-1 interface allows a complete and natural integration of **Daikin** air conditioners into Modbus RTU (RS-485) networks.

Compatible with all SKY Air and VRV models commercialised by DAIKIN

- Reduced dimensions. 93 x 53 x 58 mm.
- Quick and easy installation.
Mountable on DIN rail, wall, or even inside the indoor unit in some models of AC.
- External power not required.
- Direct connection to MODBUS RTU (RS-485) networks. Up to 254 DK-RC-MBS-1 devices can be connected in the same network.
DK-RC-MBS-1 is a Modbus slave device.
- Direct connection to the AC indoor unit.
- Configuration from both on-board DIP-switches and MODBUS RTU.
- Total Control and Supervision.
- Real states of the AC unit's internal variables.
- Allows using simultaneously the IR and wired remote controls and MODBUS RTU.



2. Connection

2.1 Connection of the interface to the AC indoor unit

The DK-RC-MBS-1 connects directly to the Daikin P1/P2 Bus. Depending on which controllers are available the recommended connection methods are the following (details in Figure 2.1):

- **Wired remote control available.** Connect the gateway as Slave in parallel with the wired remote controllers (Wall controller acts as master).
- **Infrared remote control available.** Connect the gateway as Master in parallel with the infrared remote controller (Infrared receiver) as Slave.
- **No remote control available** Connect the gateway directly to the P1/P2 bus of the indoor unit as Master when there is no Daikin remote controller

Disconnect mains power from the AC unit and use a 2 wire cable with a diameter of 0.75mm^2 to 1.25mm^2 for the connection of DK-RC-MBS-1, Daikin's remote controller and its corresponding indoor unit. Screw the suitably peeled cable ends in the corresponding P1/P2 terminals of each device, as summarized in Figure 2.1.

Maximum P1/P2 bus length is 500 meter, cable has no polarity.

2.2 Connection of the interface to Modbus

Use the EIA485 connector in the DK-RC-MBS-1 to connect to the Modbus network.

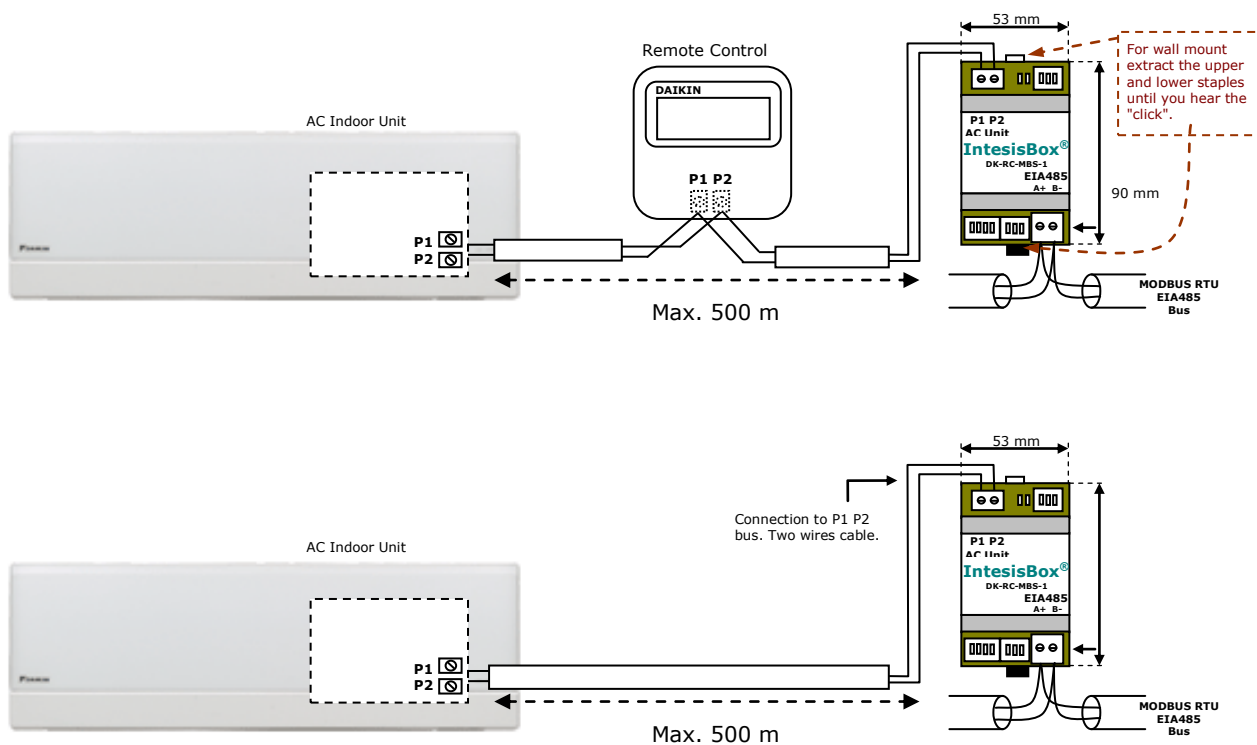


Figure 2.1 DK-RC-MBS-1 Connection diagrams

3. Modbus Interface Specification

3.1 Modbus physical layer

DK-RC-MBS-1 implements a MODBUS RTU (slave) interface, to be connected to an RS-485 line. It performs an 8N1 communication (8 data bits, no parity and 1 stop bit) with several available baudrates (2400 bps, 4800 bps, 9600 bps -default- and 19200 bps).

3.2 Modbus Registers

All registers are of type "16-bit unsigned Holding Register", in standard ModBus' big endian notation.

3.2.1 Control and status registers

Register Addr (protocol address)	Register Addr (PLC address)	R/W	Description
0	1	R/W	AC unit On/Off <ul style="list-style-type: none"> ▪ 0: Off ▪ 1: On
1	2	R/W	AC unit Mode ¹ <ul style="list-style-type: none"> ▪ 0: Auto ▪ 1: Heat ▪ 2: Dry ▪ 3: Fan ▪ 4: Cool
2	3	R/W	AC unit Fan Speed ¹ <ul style="list-style-type: none"> ▪ 1: Low ▪ 2: Mid ▪ 3: High
3	4	R/W	AC unit Vane Position ¹ <ul style="list-style-type: none"> ▪ 1: POS1 (Horizontal) ▪ 2: POS2 (Horizontal) ▪ 3: POS3 (Med) ▪ 4: POS4 (Vert) ▪ 5: POS5 (Vert) ▪ 10: SWING
4	5	R/W	AC unit Temperature Setpoint ^{1,2,3} <ul style="list-style-type: none"> ▪ 16..32 (°C) ▪ 61..90 (°F)
5	6	R	AC unit Ambient Temperature ^{2, 3}
6	7	R/W	Window Contact <ul style="list-style-type: none"> ▪ 0: Closed ▪ 1: Open

¹ See Section 5 for detail on indoor unit model differences and function availability

² Magnitude for this register can be adjusted to Celsius (default) or Fahrenheit through DIP itch P5

³ Check Table 3.4 for details

Register Addr (protocol address)	Register Addr (PLC address)	R/W	Description
7	8	--	Reserved
8	9	R/W	Remote Command Disablement ³ <ul style="list-style-type: none"> ▪ 0: Remote Command enabled ▪ 1: Remote Command disabled
9	10	R/W	AC unit Operation Time ⁴ <ul style="list-style-type: none"> ▪ 0..65535 (hours). Counts the time the AC unit is in "On" state.
10	11	R	AC unit Alarm Status <ul style="list-style-type: none"> ▪ 0: No alarm condition ▪ 1: Alarm condition
11	12	R	Error Code Information in section 6

3.2.2 Configuration Registers

Register Addr (protocol address)	Register Addr (PLC address)	R/W	Description
12	13	R/W	Reserved
13	14	R/W	"Open Window" switch-off timeout ^{5,4} <ul style="list-style-type: none"> ▪ 0..30 (minutes) ▪ Factory setting: 30 (minutes)
14	15	R	Modbus RTU baud-rate (bps) <ul style="list-style-type: none"> ▪ 2400 ▪ 4800 ▪ 9600 ▪ 19200
15	16	R	Device's Modbus slave address <ul style="list-style-type: none"> ▪ 1..63
21	22	R	Max number of fan speeds ⁶ <ul style="list-style-type: none"> ▪ 2 ▪ 3
49	50	R	Device Identification DK-RC-MBS-1: 0x800
50	51	R	Software version

⁴ This value is stored in non-volatile memory

⁵ Once window contact is open, a count-down to switch off the AC Unit will start from this configured value

⁶ Configured with S1 (Table 3.1)

3.3 DIP-switch Configuration Interface

In this section the values of the configuration switches and their meaning are specified:

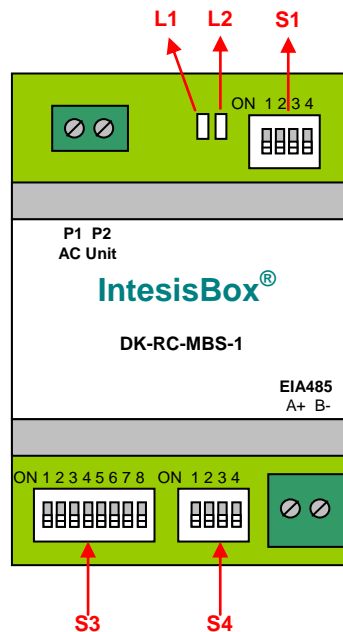


Figure 3.1 DK-RC-MBS

S1 – AC unit configuration: Master/Slave, Master/Slave of Operating Mode, Fan speeds and Vanes

Binary value b ₀ ...b ₄	Decimal value	Switches 1 2 3 4	Description
0xxx	0	↓ x x x	Slave (default value) – A Daikin BRC Controller must be present in P1 P2, configured as Master.
1xxx	1	↑ x x x	Master in P1 P2 bus – Daikin BRC Controller not needed in P1 P2. If existing, BRC must be configured as slave
x0xx	0	x ↓ x x	Master of VRV Operation Mode (For VRV only) ⁷
x1xx	1	x ↑ x x	VRV slave of Operating Mode (For VRV only) (default value)
xx0x	0	x x ↓ x	Indoor unit has 2 Fan Speeds (default value)
xx1x	1	x x ↑ x	Indoor unit has 3 fan speeds
xxx0	0	x x x ↓	Indoor unit has no Vanes
xxx1	1	x x x ↑	Indoor unit has Vanes (default value)

Table 3.1 S1 switch configuration

⁷ Explained in section 7

S3 – Modbus protocol: Slave address and baudrate

Add	Switches								Add	Switches								Add	Switches								Add	Switches							
	1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8
0	↓	↓	↓	↓	↓	↓	x	x	16	↓	↓	↓	↓	↑	↓	x	x	32	↓	↓	↓	↓	↓	↑	x	x	48	↓	↓	↓	↓	↑	↑	x	x
1*	↑	↓	↓	↓	↓	↓	x	x	17	↑	↓	↓	↓	↑	↓	x	x	33	↑	↓	↓	↓	↓	↑	x	x	49	↑	↓	↓	↓	↑	↑	x	x
2	↓	↑	↓	↓	↓	↓	x	x	18	↓	↑	↓	↓	↑	↓	x	x	34	↓	↑	↓	↓	↓	↑	x	x	50	↓	↑	↓	↓	↑	↑	x	x
3	↑	↑	↓	↓	↓	↓	x	x	19	↑	↑	↓	↓	↑	↓	x	x	35	↑	↑	↓	↓	↓	↑	x	x	51	↑	↑	↓	↓	↑	↑	x	x
4	↓	↓	↑	↓	↓	↓	x	x	20	↓	↓	↑	↓	↑	↓	x	x	36	↓	↓	↑	↓	↓	↑	x	x	52	↓	↓	↑	↓	↑	↑	x	x
5	↑	↓	↑	↓	↓	↓	x	x	21	↑	↓	↑	↓	↑	↓	x	x	37	↑	↓	↑	↓	↓	↑	x	x	53	↑	↓	↑	↓	↑	↑	x	x
6	↓	↑	↑	↓	↓	↓	x	x	22	↓	↑	↑	↓	↑	↓	x	x	38	↓	↑	↑	↓	↓	↑	x	x	54	↓	↑	↑	↓	↑	↑	x	x
7	↑	↑	↑	↓	↓	↓	x	x	23	↑	↑	↑	↓	↑	↓	x	x	39	↑	↑	↑	↓	↓	↑	x	x	55	↑	↑	↑	↓	↑	↑	x	x
8	↓	↓	↓	↑	↓	↓	x	x	24	↓	↓	↓	↑	↑	↓	x	x	40	↓	↓	↓	↑	↓	↑	x	x	56	↓	↓	↓	↑	↑	↑	x	x
9	↑	↓	↓	↑	↓	↓	x	x	25	↑	↓	↓	↑	↑	↓	x	x	41	↑	↓	↓	↑	↓	↑	x	x	57	↑	↓	↓	↑	↑	↑	x	x
10	↓	↑	↓	↑	↓	↓	x	x	26	↓	↑	↓	↑	↑	↓	x	x	42	↓	↑	↓	↑	↓	↑	x	x	58	↓	↑	↓	↑	↑	↑	x	x
11	↑	↑	↓	↑	↓	↓	x	x	27	↑	↑	↓	↑	↑	↓	x	x	43	↑	↑	↓	↑	↓	↑	x	x	59	↑	↑	↓	↑	↑	↑	x	x
12	↓	↓	↑	↑	↓	↓	x	x	28	↓	↓	↑	↑	↑	↓	x	x	44	↓	↓	↑	↑	↓	↑	x	x	60	↓	↓	↑	↑	↑	↑	x	x
13	↑	↓	↑	↑	↓	↓	x	x	29	↑	↓	↑	↑	↑	↓	x	x	45	↑	↓	↑	↑	↓	↑	x	x	61	↑	↓	↑	↑	↑	↑	x	x
14	↓	↑	↑	↑	↓	↓	x	x	30	↓	↑	↑	↑	↑	↓	x	x	46	↓	↑	↑	↑	↓	↑	x	x	62	↓	↑	↑	↑	↑	↑	x	x
15	↑	↑	↑	↑	↓	↓	x	x	31	↑	↑	↑	↑	↓	x	x	47	↑	↑	↑	↑	↓	↑	x	x	63	↑	↑	↑	↑	↑	↑	x	x	

Table 3.2 S3 Modbus Slave address

Binary value b ₀ ...b ₈	Decimal value	Switches 1 2 3 4 5 6 7 8	Description
xxxxxx00	0	x x x x x x ↓ ↓	2400bps
xxxxxx10	1	x x x x x x ↑ ↓	4800bps
xxxxxx01	2	x x x x x x ↓ ↑	9600bps (- default value)
xxxxxx11	3	x x x x x x ↑ ↑	19200bps

Table 3.3 S3 Modbus baud rate

S4 – Other: Degrees/Decidegree (x10), temperature magnitude (°C/°F) and EIA485 termination resistor

Binary value b ₀ ...b ₄	Decimal value	Switches 1 2 3 4	Description
0xxx	0	↓ x x x	Temperature values in Modbus register are represented in degrees (x1) (default value)
1xxx	1	↑ x x x	Temperature values in Modbus register are represented in decidegrees (x10)
x0xx	0	x ↓ x x	Temperature values in Modbus register are represented in Celsius degrees (default value)
x1xx	1	x ↑ x x	Temperature values in Modbus register are represented in Fahrenheit degrees
xxx0	0	x x x ↓	EIA485 bus without termination resistor (default value)
xxx1	1	x x x ↑	Internal termination resistor of 120Ω connected to EIA485 bus**

Table 3.4 S4: Temperature and termination configuration

* Default value

** Only in the interfaces connected at both ends of the bus must be activated the termination resistor, not in the rest. The EIA485 bus can be biased through internal jumpers JP2 and JP3.

3.4 Implemented Functions

DK-RC-MBS-1 implements the following standard MODBUS functions:

- 3: Read Holding Registers
- 4: Read Input Registers
- 6: Write Single Register
- 16: Write Multiple Registers (Although this function is allowed, the interface does not allow write operations on more than 1 register with the same request, this means that length field should always be 1 when using this function for writes)

3.5 Device LED indicator

The device includes two LED indicators (check Figure 3.1) to signal its different possible operational states. In this section their meaning is explained

L1 (yellow)			
Operation	ON	OFF	Meaning
Blinking	500 ms	500 ms	Communication error
Flashing	100 ms	1900 ms	Normal operation (configured and working)

L2 (red)			
Operation	ON	OFF	Meaning
Pulse	3 sec	--	Undervoltage

L1 (yellow) & L2 (red)			
Operation	ON	OFF	Meaning
Pulse	5 sec	--	Device start-up
Alternate blinking	500 ms	500 ms	Flash checksum not OK

3.6 RS485 bus. Termination resistors and Fail Safe Biasing mechanism

RS485 bus requires a 120Ω terminator resistor at each end of the bus to avoid signal reflections.

The DK-RC-MBS-1 device includes an on-board terminator resistor of 120Ω that can be connected to the RS485 bus by using DIP-switch (Table 3.4)

A fail safe biasing circuit has also been included in the board of DK-RC-MBS-1, it can be connected to the RS485 bus by placing the internal jumper JP1(see details in Figure 3.2). This fail safe biasing of the RS485 bus must only be supplied by one of the devices connected to the bus

Some Modbus RTU RS485 master devices can provide also internal 120Ω terminator resistor and/or fail safe biasing (consult the technical documentation of the master device connected to the RS485 network in every case).

Location of jumpers and DIP-switches for RS485 bus Termination resistor or Fail Safe Biasing selection:

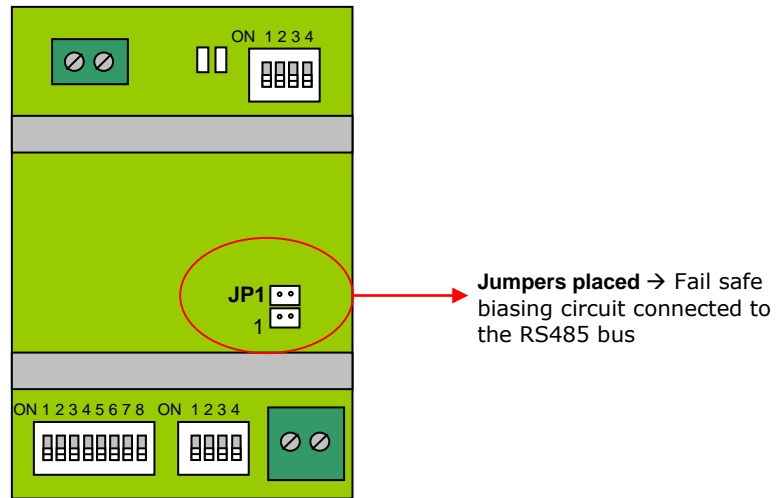


Figure 3.2 Fail Safe jumper

To access to internal jumpers JP2 and JP3, extract the top cover of the interface inserting a small screw-driver or clip in the holes located at both sides of the cover.

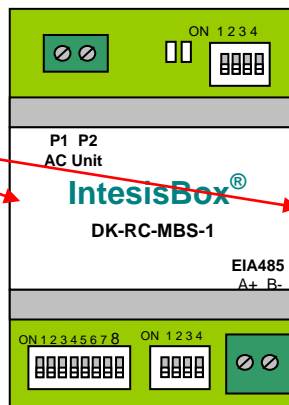
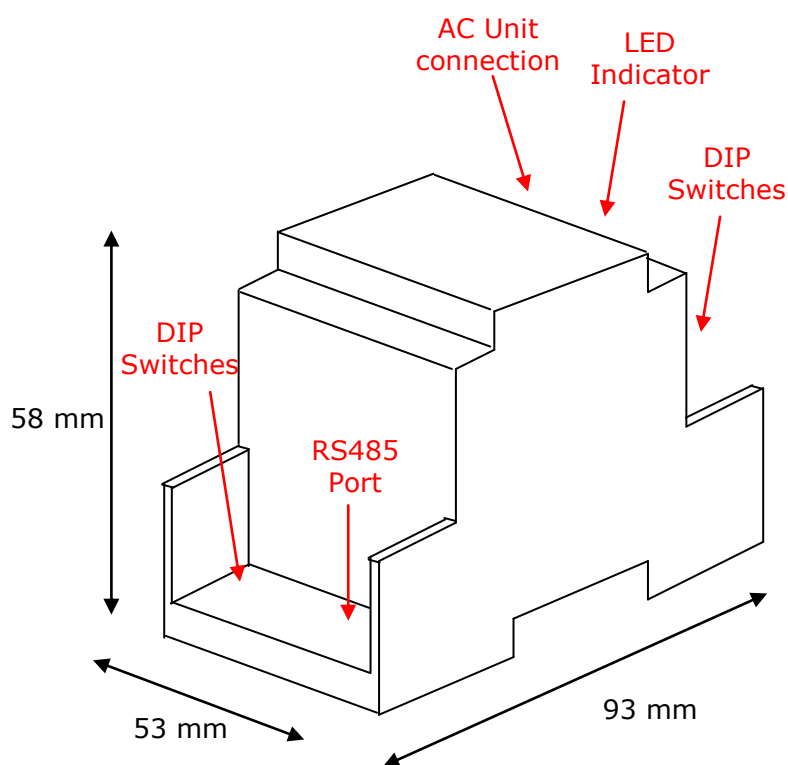


Figure 3.3 Accessing the jumpers

4. Specifications

Dimensions:	93 x 53 x 58 mm
Weight:	85 g
Operating Temperature:	-40 . . . 85°C
Stock Temperature:	-40 . . . 85°C
Operating Humidity:	<95% RH, non-condensing
Stock Humidity:	<95% RH, non-condensing
Isolation voltage:	1000 VDC
Isolation resistance:	1000 MΩ
Modbus Media:	Compatible with Modbus RTU - RS485 networks



5. List of supported AC Unit Types.

A list of Daikin indoor unit model references compatible with DK-RC-MBS-1 and their available features can be found in:

http://www.intesis.com/pdf/IntesisBox_DK-RC-xxx-1_AC_Compatibility.pdf

6. Error Codes

Error Code Modbus	Error in Remote Controller	Error category	Error Description	
0	N/A		No active error	
17	A0	Indoor Unit	External protection devices activated	
18	A1		Indoor unit PCB assembly failure	
19	A2		Interlock error for fan	
20	A3		Drain level system error	
21	A4		Temperature of heat exchanger (1) error	
22	A5		Temperature of heat exchanger (2) error	
23	A6		Fan motor locked, overload, over current	
24	A7		Swing flap motor error	
25	A8		Overcurrent of AC input	
26	A9		Electronic expansion valve drive error	
27	AA		Heater overheat	
28	AH		Dust collector error / No-maintenance filter error	
30	AJ		Capacity setting error (indoor)	
31	AE		Shortage of water supply	
32	AF		Malfunctions of a humidifier system (water leaking)	
33	C0		Malfunctions in a sensor system	
36	C3		Sensor system of drain water error	
37	C4		Heat exchanger (1) (Liquid pipe) thermistor system error	
38	C5		Heat exchanger (1) (Gas pipe) thermistor system error	
39	C6		Sensor system error of fan motor locked, overload	
40	C7		Sensor system of swing flap motor error	
41	C8		Sensor system of over-current of AC input	
42	C9		Suction air thermistor error	
43	CA		Discharge air thermistor system error	
44	CH		Contamination sensor error	
45	CC		Humidity sensor error	
46	CJ		Remote control thermistor error	
47	CE		Radiation sensor error	
48	CF		High pressure switch sensor	
49	E0		Outdoor Unit	Protection devices activated
50	E1			Outdoor unit PCB assembly failure
52	E3			High pressure switch (HPS) activated
53	E4			Low pressure switch (LPS) activated
54	E5			Overload of inverter compressor motor
55	E6			Over current of STD compressor motor
56	E7			Overload of fan motor / Over current of fan motor
57	E8			Over current of AC input
58	E9			Electronic expansion valve drive error
59	EA			Four-way valve error
60	EH			Pump motor over current
61	EC			Water temperature abnormal
62	EJ			(Site installed) Protection device activated
63	EE			Malfunctions in a drain water
64	EF			Ice thermal storage unit error
65	H0			Malfunctions in a sensor system
66	H1			Air temperature thermistor error
67	H2			Sensor system of power supply error
68	H3	High Pressure switch is faulty		
69	H4	Low pressure switch is faulty		
70	H5	Compressor motor overload sensor is abnormal		
71	H6	Compressor motor over current sensor is abnormal		
72	H7	Overload or over current sensor of fan motor is abnormal		
73	H8	Sensor system of over-current of AC input		
74	H9	Outdoor air thermistor system error		
75	HA	Discharge air thermistor system error		
76	HH	Pump motor sensor system of over current is abnormal		
77	HC	Water temperature sensor system error		
79	HE	Sensor system of drain water is abnormal		
80	HF	Ice thermal storage unit error (alarm)		
81	F0	No.1 and No.2 common protection device operates.		
82	F1	No.1 protection device operates.		
83	F2	No.2 protection device operates		
84	F3	Discharge pipe temperature is abnormal		
87	F6	Temperature of heat exchanger(1) abnormal		
91	FA	Discharge pressure abnormal		
92	FH	Oil temperature is abnormally high		
93	FC	Suction pressure abnormal		
95	FE	Oil pressure abnormal		
96	FF	Oil level abnormal		
97	J0	Sensor system error of refrigerant temperature		

98	J1		Pressure sensor error
99	J2		Current sensor error
100	J3		Discharge pipe thermistor system error
101	J4		Low pressure equivalent saturated temperature sensor system error
102	J5		Suction pipe thermistor system error
103	J6		Heat exchanger(1) thermistor system error
104	J7		Heat exchanger(2) thermistor system error
105	J8		Oil equalizer pipe or liquid pipe thermistor system error
106	J9		Double tube heat exchanger outlet or gas pipe thermistor system error
107	JA		Discharge pipe pressure sensor error
108	JH		Oil temperature sensor error
109	JC		Suction pipe pressure sensor error
111	JE		Oil pressure sensor error
112	JF		Oil level sensor error
113	L0		Inverter system error
116	L3		Temperature rise in a switch box
117	L4		Radiation fin (power transistor) temperature is too high
118	L5		Compressor motor grounded or short circuit, inverter PCB fault
119	L6		Compressor motor grounded or short circuit, inverter PCB fault
120	L7		Over current of all inputs
121	L8		Compressor over current, compressor motor wire cut
122	L9		Stall prevention error (start-up error) Compressor locked, etc.
123	LA		Power transistor error
125	LC		Communication error between inverter and outdoor control unit
129	P0		Shortage of refrigerant (thermal storage unit)
130	P1		Power voltage imbalance, open phase
132	P3		Sensor error of temperature rise in a switch box
133	P4		Radiation fin temperature sensor error
134	P5		DC current sensor system error
135	P6		AC or DC output current sensor system error
136	P7		Total input current sensor error
142	PJ		Capacity setting error (outdoor)
145	U0	System	Low pressure drop due to insufficient refrigerant or electronic expansion valve error, etc.
146	U1		Reverse phase, Open phase
147	U2		Power voltage failure / Instantaneous power failure
148	U3		Failure to carry out check operation, transmission error
149	U4		Communication error between indoor unit and outdoor unit, communication error between outdoor unit and BS unit
150	U5		Communication error between remote control and indoor unit / Remote control board failure or setting error for remote control
151	U6		Communication error between indoor units
152	U7		Communication error between outdoor units / Communication error between outdoor unit and ice thermal storage unit
153	U8		Communication error between main and sub remote controllers (sub remote control error) / Combination error of other indoor unit / remote control in the same system (model)
154	U9		Communication error between other indoor unit and outdoor unit in the same system / Communication error between other BS unit and indoor/outdoor unit
155	UA		Combination error of indoor/BS/outdoor unit (model, quantity, etc.), setting error of spare parts PCB when replaced
156	UH		Improper connection of transmission wiring between outdoor and outdoor unit outside control adaptor
157	UC		Centralized address duplicated
158	UJ		Attached equipment transmission error
159	UE		Communication error between indoor unit and centralized control device
160	UF		Failure to carry out check operation Indoor-outdoor, outdoor-outdoor communication error, etc.
209	60	Others	All system error
210	61		PC board error
211	62		Ozone density abnormal
212	63		Contamination sensor error
213	64		Indoor air thermistor system error
214	65		Outdoor air thermistor system error
217	68		HVU error (Ventiair dust-collecting unit)
219	6A		Dumper system error
220	6H		Door switch error
221	6C		Replace the humidity element
222	6J		Replace the high efficiency filter
223	6E		Replace the deodorization catalyst
224	6F		Simplified remote controller error
226	51		Fan motor of supply air over current or overload
227	52		Fan motor of return air over current / Fan motor of return air overload
228	53		Inverter system error (supply air side)
229	54		Inverter system error (return air side)
241	40		Humidifying valve error
242	41		Chilled water valve error
243	42		Hot water valve error
244	43		Heat exchanger of chilled water error
245	44	Heat exchanger of hot water error	
258	31	The humidity sensor of return air sensor	
259	32	Outdoor air humidity sensor error	

260	33		Supply air temperature sensor error
261	34		Return air temperature sensor error
262	35		Outdoor air temperature sensor error
263	36		Remote controller temperature sensor error
267	3A		Water leakage sensor 1 error
268	3H		Water leakage sensor 2 error
269	3C		Dew condensation error
339	M2		Centralized remote controller PCB error
345	M8		Communication error between centralized remote control devices
347	MA		Centralized remote control devices inappropriate combination
349	MC		Centralized remote controller address setting error
65535	N/A	DK-RC-MBS-1	Error in the communication of DK-RC-MBS-1 device with the AC unit

In case you detect an error code not listed, contact your nearest Daikin technical support service.

7. Annex 1: Master of Mode

The master of mode only applies under the following conditions:

1. The AC system is VRV
2. The VRV system uses a Heat pump outdoor unit
3. The DK-RC-MBS-1 is configured as Master of the P1/P2 bus (Table 3.1)

If they are not matched the parameter is going to be ignored.

The Heat pump outdoor unit of a VRV system can only work in one mode (either Heat, Cool or fan). The Master of mode is the indoor unit that defines which is the working mode of the outdoor unit. If there is no Master of mode in the system the first AC unit to be turned On is the one controlling the mode.

In a VRV system there can only be one device acting as Master of Mode. If more than one is configured this way the system is not going to work properly.

When a DK-RC-MBS-1 is configured as Master of Mode it can control all the modes of the system (section 3.2.1). The Mode selection of all the other gateways and remote controllers is going to be affected by the one chosen by the Master of Mode (detailed in Table 7.1)

Master of Mode	Slave of Mode
Heat	Heat, Fan
Dry	Cool, Fan, Dry
Fan	Fan
Cool	Cool, Fan, Dry

Table 7.1 Mode correspondence