TOSHIBA

DG001-05

Design Guideline

VRF Dx-coil Interface(DDC type) Design Guideline

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1 Application

The VRF Dx-coil Interface(DDC type) enables BMS capacity demand control of Toshiba Outdoor units connected to a DX COIL (with a field supplied AHU). It is compatible with either a Toshiba VRF system.

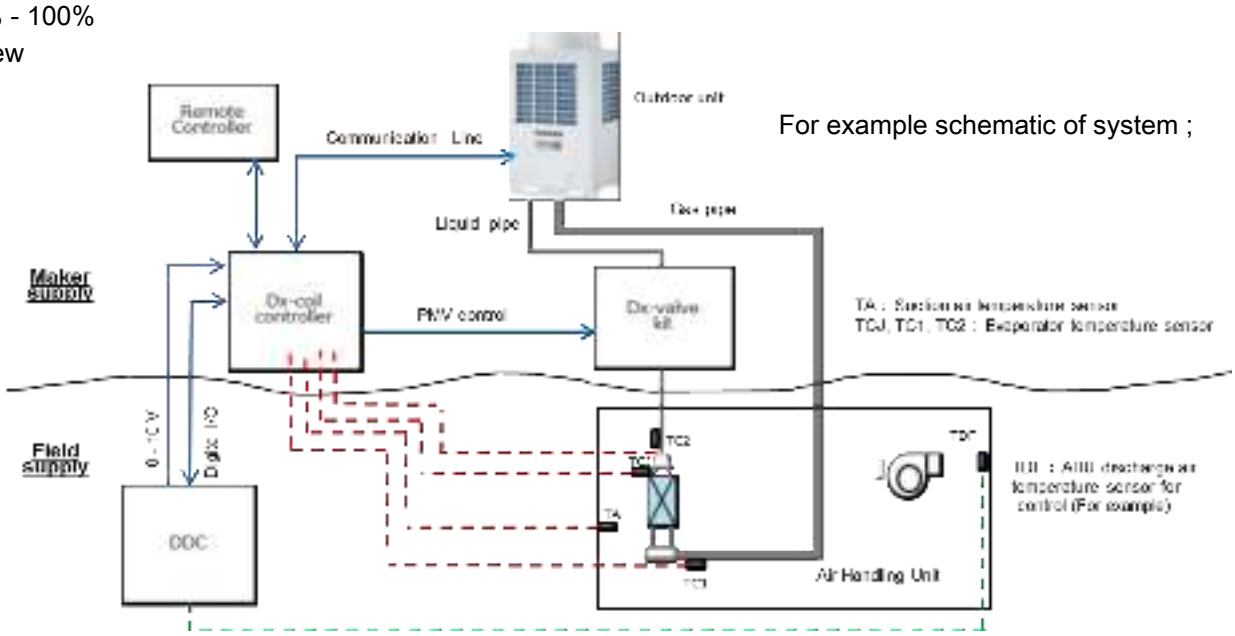
Product	Model name	Capacity	HP
Dx-coil controller	TCB-IFDDC201E	22.4kW , 28.0kW , 45.0kW , 50.4kW , 56.0kW 90kW, 101kW, 112kW	8 , 10 , 16 , 18 , 20 32, 36, 40
Dx-valve kit	RBM-A101VAE	22.4kW , 28.0kW	8 , 10
	RBM-A201VAE	45.0kW , 50.4kW , 56.0kW	16 , 18 , 20

2 System compatibility, Overview

- Outdoor Unit
  - SMMS-e Cooling Only Model (MMY-MAP∗∗∗6T8∗P∗ / MMY-MAP∗∗∗6T7∗P)
  - SMMS-7 Cooling Only Model (MMY-MAP∗∗∗7T8∗P∗ / MMY-MAP∗∗∗7T7∗P)
  - SMMS-e Heat Pump Model (MMY-MAP∗∗∗6HT8∗P∗ / MMY-MAP∗∗∗6HT7∗P∗)
  - SMMS-u Heat Pump Model (MMY-MUP∗∗∗1HT8∗P∗ / MMY-MUP∗∗∗1HT7∗P∗) *
  - SMMS∞ Cooling Only Model (MMY-MUP∗∗∗1T8∗P∗/ MMY-MUP∗∗∗1T7∗P) *

    * : Even if connected with SMMS∞,SMMS-u Heat Pump Model, the sysytem communication type will become "TCC-Link" according to Dx-coil controller(TCB-IFDTA201E, TCC-Link type).
- Diversity
  - 75% - 100%
- Overview

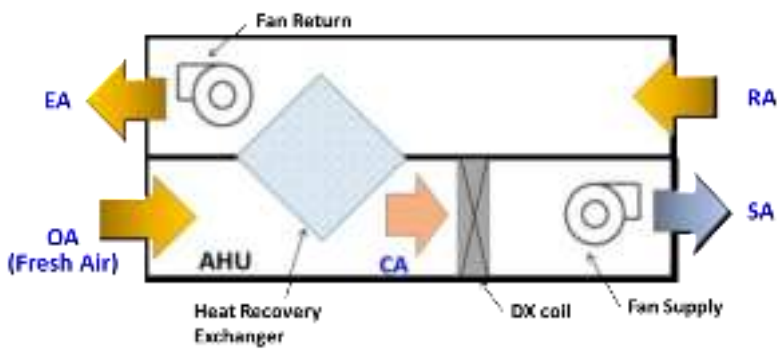
For example schematic of system ;



3 Operating conditions

AHU

Ensure the "Coil on Air" temperature is within the range of the Dx-coil design guideline.



OA	Outdoor Air
SA	Supply Air
CA	Coil on Air (After Heat Recovery Exchanger)
RA	Return Air
EA	Exhaust Air

	Guideline HP (Heating & Cooling)	Guideline for Cooling Only	
		Pattern A	Pattern B
Cooling mode "Coil on Air" temp.	15 - 24˚C WB (18 - 32˚C DB)	15 - 24˚C WB	15 - 32˚C WB
Heating mode "Coil on Air" temp.	12 - 28˚C DB (Pull down to 7˚C)	---	---

Note: If intake air temperature is out of range of the specification, the damage for the system may be caused.

Outdoor unit

Refer to specification of outdoor unit

4 Pipe Size

Outdoor Unit Capacity	Pipe diameter		
	Gas Pipe	Liquid Pipe Valve kit to AHU	Liquid Pipe Valve kit to Y-Joint
8 HP	Ø 19.1 or 22,2	Ø 12.7	-
10 HP	Ø 22.2	Ø 12.7	
16 HP	Ø 28.6	Ø 15.9	
18 HP	Ø 28.6	Ø 15.9	
20 HP	Ø 28.6	Ø 15.9	
32 HP	Ø 34.9	Ø 15.9	Ø 19.1
More than 36HP	Ø 41.3(38.1※1)	Ø 15.9	Ø 22.2

※ 1 Only SMMS-u, SMMS∞

5 Pipe length and height difference

Main pipe equivalent length		Same as piping length restriction of VRF ODU
Total piping length (real length)		120 m (100 m)
Furthest equivalent pipe length L (real length)		100m
Furthest equivalent pipe length between outdoor unit		-
Max. Height Difference	outdoor unit - indoor unit(Upper outdoor unit)	40m
	outdoor unit - indoor unit(Lower outdoor unit)	
Amount of Additional Refrigerant		Refer to specification of Outdoor unit

6 Product Configuration

6.1 Product Configuration

DX COIL tyoe		Normal		
Type		Dx-coil Controller	Dx-Valve kit	
Model Name		TCB-IFDDC201E	RBM-A101VAE	RBM-A201VAE
Connectable Dx-coil Capacity	8HP	1	1	-
	10HP	1	1	-
	16HP	1	-	1
	18HP	1	-	1
	20HP	1	-	1
	32HP	1	-	2
	36HP	1	-	2
	40HP	1	-	2

6.2 Major Specifications

TCB-IFDDC201E (Dx-coil Controller)

Description	Dx-coil controller in Metal Enclosure, comprising:- • MCC-1570 (Main Indoor(DX) P.C. board) • TX-TOS1413 (DDC(0-10V) interface P.C. board) • 24VAC Transformer • TA Sensor. Length : 2.5m. Connector colour : Yellow • TC1 Sensor. Length : 2.5m. Connector colour : Brown • TC2 Sensor. Length : 2.5m. Connector colour : Black • TCJ Sensor, Length : 2.5m, Connector colour : Red • Strainers
External Dimensions H x W x D (mm)	420 x 330 x 95
Net Weight(kg)	6.0 kg

Notes:

Capacity code (DN11) needs to be setup upon installation using wired remote controller (not supplied).

HP	8	10	16	18	20	32	36	40
DN[11]	21	23	26	27	28	35	37	39

- Only Heating and Cooling Modes are available on the TCB-IFDDC201E (No Automatic or Fan Only).
- Components supplied loose, requires brazing and local pipework.

RBM-A101VAE / RBM-A201VAE (Dx-valve kit)

Description	The PMV(Pulse Motor Valve, 2 models), comprising:- • PMV body & PMV Motor • Terminal Block
RBM-A101VAE	8HP & 10HP Size
RBM-A201VAE	16HP & 18HP & 20HP Size

6.3 Control Input / Output Details

- Input functions -

Input	Name	Description
A1 A2	Capacity Demand Analog Input (DC 0 - 10 V)	Analogue Input to control Capacity demand. (Details in section 6.4).
	SW3 bit-2(TX-TOS1413) OFF	STEPPED response to analogue input
	SW3 bit-2(TX-TOS1413) ON	LINEAR response to analogue input
	• To ease the integration of the Dx-coil with the DDC the capacity control is able to operate with a STEPPED or LINEAR function from the analogue input. • To select either a STEPPED(default) or LINEAR response, from the analogue input, use SW03 bit2 located on the DDC(0-10V) interface P.C. board(TX-TOS1413)	
C1 C2	External ON / OFF Input	Digital Input to control ON / OFF:- • ON (Closed) / OFF (Open). External ON/OFF input signal type(pulse / static) is selectable by **Jumper Wire J01** on the Indoor(DX) P.C. board - MCC-1570. • Connect (Default) : Pulse / Cut : Static Note the unit will not operate until there is an appropriate 0-10V Capacity Control signal.
C3 C4	Demand Signal Input	When signal input, AHU is in "thermostat-off" status forcibly.
C5 C6	Safety contact.	If this contact is open for more than 1 minute, the check code "**P10**" is generated and the Dx-coil controller switches off automatically.
C7 C8	Fan Motor Trouble Input	An AHU fan operation monitor (Field supply), could be attached at this dry contact terminal(For example, the abnormality of the fan motor.). A closed contact generates the check code "**L30**".
C23 C24	Operation Mode Input	Digital Input to control Mode:- • HEAT (Closed) / COOL (Open)

- Output functions -

<table>
<tr><th>Output</th><th>Name</th><th>Description</th></tr>
<tr><td>D1 D2</td><td>Fan Motor Digital Output</td><td>A fan control signal is output. It is usually the ON output at the time of operating, but it is the OFF output in defrosting.</td></tr>
<tr><td>D5 D6</td><td>Alarm Active Digital Output</td><td>During Alarm operation, Alarm Active Digital Output is active.</td></tr>
<tr><td>D7 D8</td><td>Defrost Mode Digital Output</td><td>During Defrost operation, Defrost Mode Output is active.</td></tr>
<tr><td>D19 D20</td><td>Thermostat On Digital Output</td><td>Thermostat ON signal is output. It is usually the ON output at the time of operating.</td></tr>
<tr><td>D31 D32</td><td>DO_1 Digital Output1
(User Defined)</td><td>Output function set using rotary switch "SW1" on the DDC(0-10V) interface P.C board(TX-TOS1413)
<table>
<tr><th>SW1</th><th>Output function</th></tr>
<tr><td>0</td><td>lower than capacity demand</td></tr>
<tr><td>1</td><td>higher than capacity command</td></tr>
<tr><td>2</td><td>cooling oil recovery /heating refrigerant recovery</td></tr>
<tr><td>3</td><td>cooling output (operation+no error+cooling mode)</td></tr>
<tr><td>4</td><td>heating output (operation+no error+heating mode)</td></tr>
<tr><td>5</td><td>Thermostat ON</td></tr>
<tr><td>6 ~ F</td><td>No function (for future development)</td></tr>
</table></td></tr>
<tr><td>D33 D34</td><td>DO_2 Digital Output2
(User Defined)</td><td>Output function set using rotary switch "SW2" on the DDC(0-10V) interface P.C board(TX-TOS1413)
<table>
<tr><th>SW2</th><th>Output function</th></tr>
<tr><td>0</td><td>lower than capacity demand</td></tr>
<tr><td>1</td><td>higher than capacity command</td></tr>
<tr><td>2</td><td>cooling oil recovery /heating refrigerant recovery</td></tr>
<tr><td>3</td><td>cooling output (operation+no error+cooling mode)</td></tr>
<tr><td>4</td><td>heating output (operation+no error+heating mode)</td></tr>
<tr><td>5</td><td>Thermostat ON</td></tr>
<tr><td>6 ~ F</td><td>No function (for future development)</td></tr>
</table></td></tr>
</table>

- Summary of Digital input / output function (MCC-1570) -

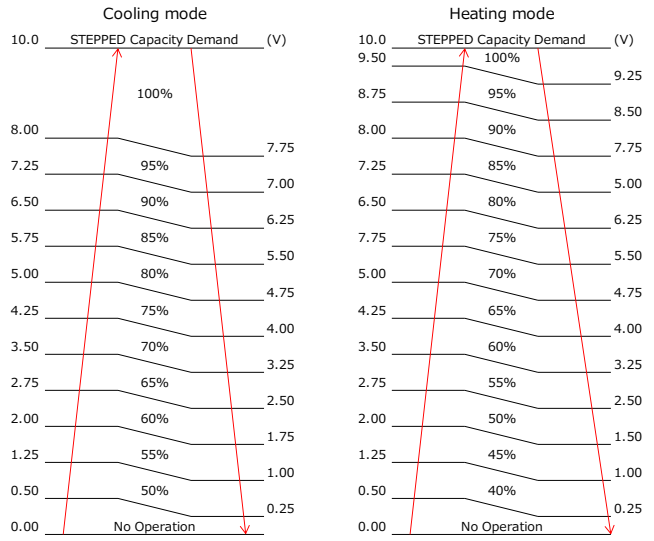
Connector	Pin	Function	Remarks	Standard / Option	Terminal blocks
CN32 (WHI)	1	COM (DC 12V)	---	---	---
	2	Output	Ventilation control (Refer to "APPLICATION CONTROL MANUAL")	Option	---
CN34 (RED)	1	Saftey Contact	Check code P10, Normal close	---	C5
	2	---	---	---	---
	3	Input (DC 12V)	---	Standard	C6
CN60 (WHI)	1	COM (DC 12V)	---	---	D1 / D7
	2	Defrost mode Digital output	ON while outdoor unit defroseted	Standard	D8
	3	---	---	---	---
	4	---	---	---	---
	5	---	---	---	---
	6	Fan motor active Digital output	ON while Fan on	Standard	D2
CN61 (YEL)	1	External ON/OFF Input, Input (DC 5V)	Start/Stop input, Input signal type (pulse / static) is selectable by Jumper Wire J01	Standard	C1
	2	COM (0V) for pin 1, 3	---	---	C2
	3	---	---	---	---
	4	---	---	---	---
	5	COM (DC 12V) for pin 4, 6	---	---	D5
	6	Alarm Active Digital Output	ON while Alarm ON	Standard	D6
CN70 (WHI)	1	Option	Option error input (Refer to "APPLICATION CONTROL MANUAL")	Option	---
	2	COM (0V)	---	---	---
CN73 (RED)	1	COM (0V)	---	---	C3
	2	Demand signal Input, Input (DC 5V)	Forced thermo-OFF input	Standard	C4
CN80 (GRN)	1	Input (DC 12V)	---	---	C7
	2	---	---	---	---
	3	Fan Motor Trouble Input	Error input from outside (interlock, the check code L30)	Standard	C8
CN82 (BLU)	1	---	---	---	---
	2	---	---	---	---
	3	Thermostat On Digital Output	Signal output during thermo-ON	Standard	D19
	4	---	---	---	---
	5	---	---	---	---
	6	COM (DC 12V)	---	Standard	D20
CN510 (WHI)	1	PMV① DC12V(RED)	---	Standard	R_Dx-valve kit 1
	2	PMV① DC12V(BRN)	RBM-A201VAE does not include	Standard	BR_Dx-valve kit 1
	3	PMV①(WHI)	---	Standard	W_Dx-valve kit 1
	4	PMV②(WHI)	Only in normal Dx-coil (32, 36, 40HP)	Standard	W_Dx-valve kit 2
	5	PMV①(YEL)	---	Standard	Y_Dx-valve kit 1
	6	PMV②(YEL)	Only in normal Dx-coil (32, 36, 40HP)	Standard	Y_Dx-valve kit 2
	7	PMV①(ORN)	---	Standard	OR_Dx-valve kit 1
	8	PMV②(ORN)	Only in normal Dx-coil (32, 36, 40HP)	Standard	OR_Dx-valve kit 2
	9	PMV①(BLU)	---	Standard	BL_Dx-valve kit 1
	10	PMV②(BLU)	Only in normal Dx-coil (32, 36, 40HP)	Standard	BL_Dx-valve kit 2
	11	PMV② DC12V(RED)	Only in normal Dx-coil (32, 36, 40HP)	Standard	R_Dx-valve kit 2
	12	PMV② DC12V(BRN)	RBM-A201VAE does not include	Standard	BR_Dx-valve kit 2
	13 ~ 20	---	---	---	---

6.4 Analogue Input Control Details

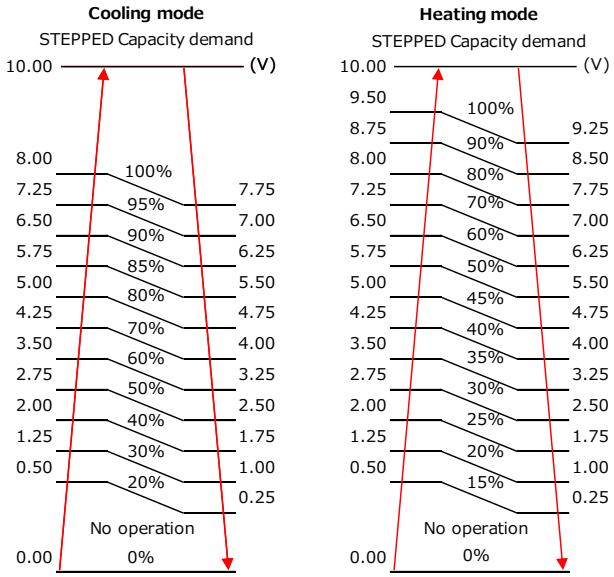
- Capacity Demand signal(analogue input voltage) will be used as the main control value for the compressor frequency.
- The control of capacity may not be able to be performed according to the state of an air-conditioner (During oil recovercontrol, defrost etc.).

1) Demand 0-10V STEPPED control (SW3 bit-2 on the DDC(0-10V) interface P.C board(TX-TOS1413) "OFF")

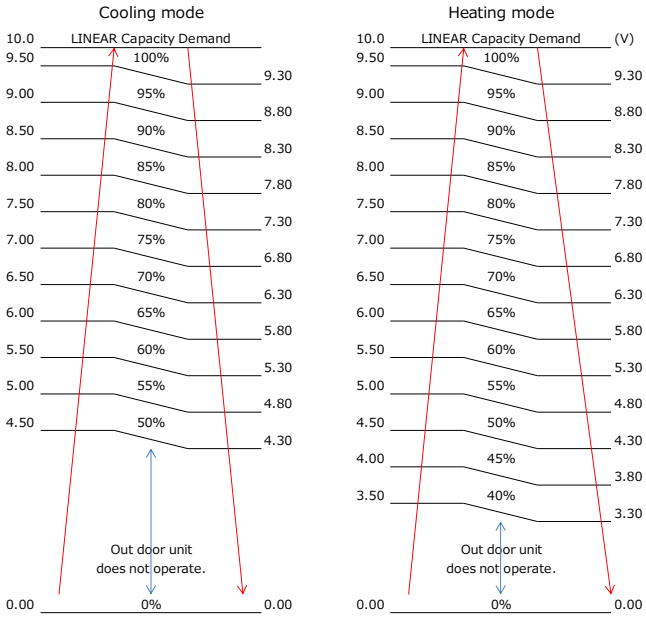
▼ When connected to SMMS-e,7

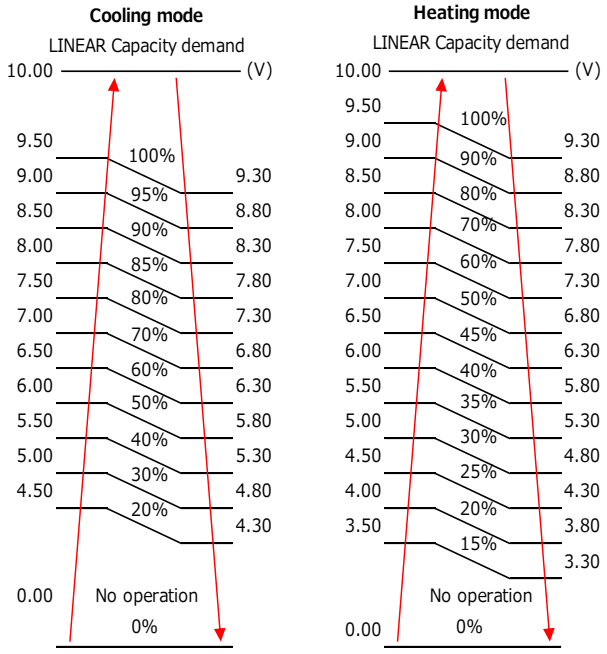


▼ When connected to SMMS-u,∞



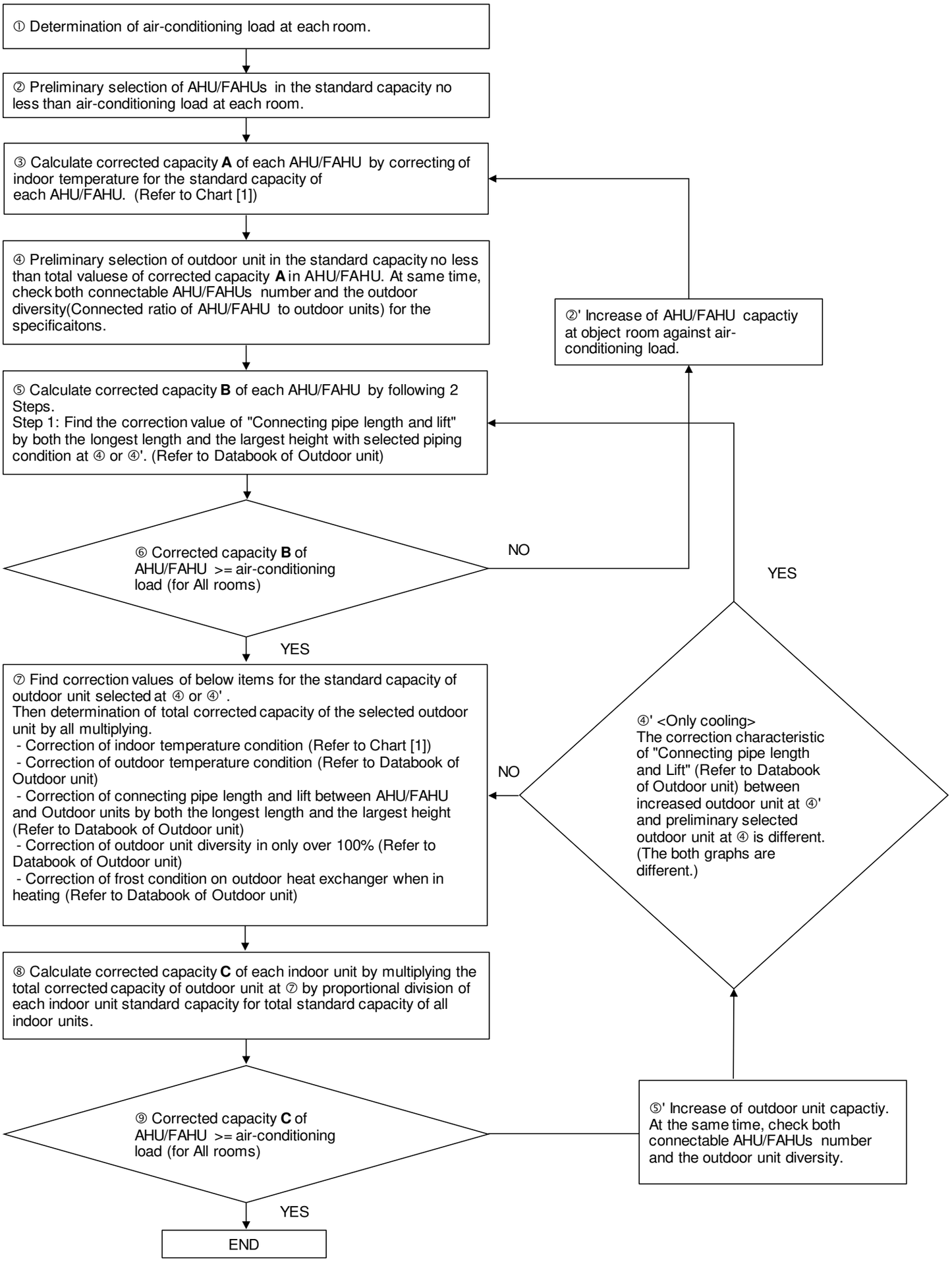
2) Demand 0-10V LINEAR control (SW3 bit-2 on the DDC(0-10V) interface P.C board(TX-TOS1413) "ON")





7 AHU / DX COIL Design

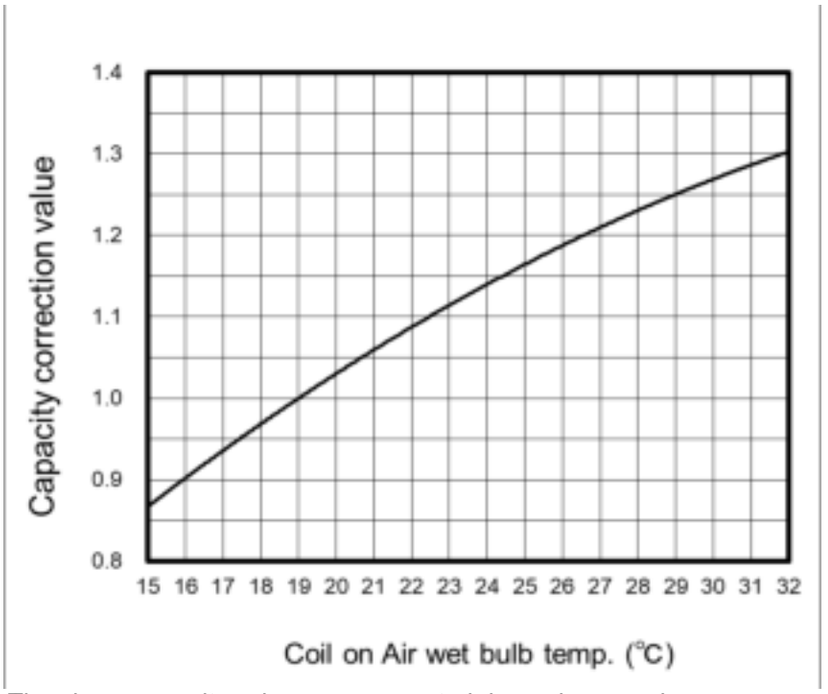
7.1 Equipment selection procedure -Selection flow chart-



7.2 Correction charts for Outdoor unit capacity calculation

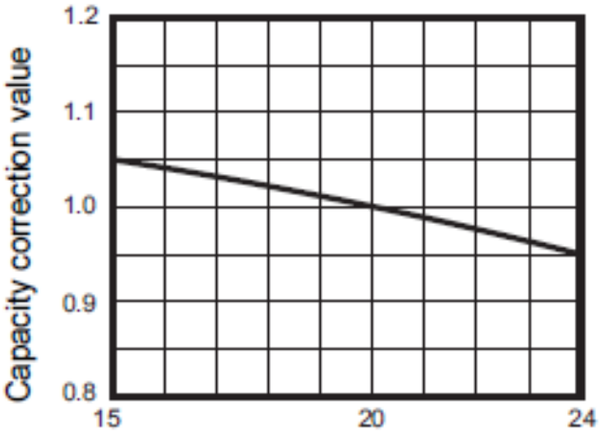
[1] Coil on Air temperature vs. capacity correction value

▼ Cooling

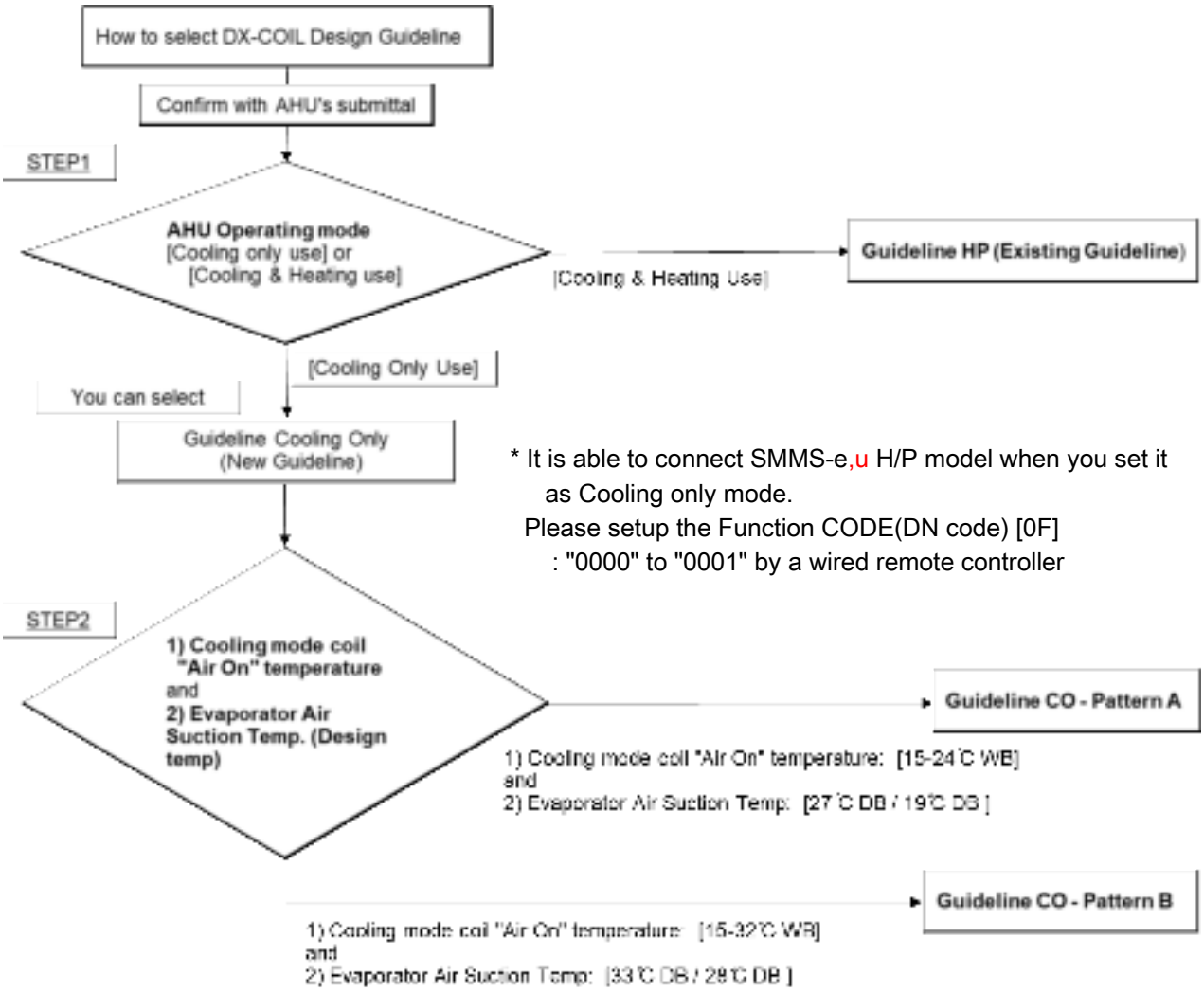


The above capacity values are generated depends on each compressor operation level.

▼ Heating



7.3 How to select DX COIL Design Guideline



AHU / DX COIL Design Notes:

Cooling & Heating output figures are based on calculations and 'general' test data. All figures are to be taken as approximations. The properties of the 3rd Party DX COIL will have an effect on the performance of Outdoor units.

- For the AHU/DX COIL prepared on site, please design with referring to submittal of AHU.
- The DX COIL must be suitable for R410A.
- The design should allow operation as Evaporator and a Condenser depends on selected usage.
  (Features: Multiple circuits / Liquid Capillary Distributor / Gas Header)
- The counter flow principle must be observed for the DX COIL design.
- A Drain Pan must be fitted (even if only used in Heat mode) due to defrost cycles.

7.4 DX COIL Guideline HP

- Guideline HP -

HP			8	10	16	18	20	32	36	40
Dx-Coil type Normal	TCB-IFDDC201E		1	1	1	1	1	1	1	1
	RBM-A101VAE	8 HP	1	-	-	-	-	-	-	-
		10 HP	-	1	-	-	-	-	-	-
	RBM-A201VAE	16 HP	-	-	1	-	-	2	-	-
		18 HP	-	-	-	1	-	-	2	-
		20 HP	-	-	-	-	1	-	-	2
AHU Air Flow rate (m3/hr)		Std.	3,600	4,200	7,200	7,800	8,400	14,400	15,600	16,800
		Min.	2,880	3,360	5,760	6,240	6,720	11,520	12,480	13,440
		Max.	4,320	5,040	8,640	9,360	10,080	17,280	18,720	21,160
DX Coil Internal volume		Min.	3,400	4,250	6,800	7,650	8,500	13,600	15,300	17,000
		Max.	4,600	5,750	9,200	10,350	11,500	18,400	20,700	23,000
Copper Tube Dia. (mm)			Ø12.7, Ø9.52, Ø8.00 (Recommended Ø9.52 or Less)							
Cooling	Max. Capacity (kW)		22.4	28.0	45.0	50.4	56.0	90.0	101.0	112.0
	Coil on Air Temp.		15 - 24°CWB (18 - 32°CDB)							
	Evaporating Temp.		6.5°C							
	Superheat		6K							
	Air Suction Temp. (Design temp)		27°CDB / 19°CWB							
Heating	Max. Capacity (kW)		25.0	31.5	50.0	56.0	63.0	100.0	113.0	126.0
	Coil on Air Temp.		12 - 28°CWB							
	Condensating Temp		52°C							
	Sub Cooling		4K							
	Air Suction Temp. (Design temp)		20°CDB							

No. of Ref. Circuit by DX Coil Copper Tube Dia. and DX Coil Size (HP)

	Number of Circuits					
Copper Tube	8.0mm		9.5mm		12.7mm	
Dx Coil HP	Min	Max	Min	Max	Min	Max
8HP	8	12	6	10	4	6
10HP	10	14	8	12	5	7
16HP	16	22	12	16	8	10
18HP	18	24	14	18	8	10
20HP	20	26	16	20	10	12
32HP	32	42	24	30	14	18
36HP	36	48	26	34	16	20
40HP	40	54	30	38	18	22

- Guideline CO Pattern A -

HP			8	10	16	18	20	32	36	40
Dx-Coil type Normal	TCB-IFDDC201E		1	1	1	1	1	1	1	1
	RBM-A101VAE	8 HP	1	-	-	-	-	-	-	-
		10 HP	-	1	-	-	-	-	-	-
	RBM-A201VAE	16 HP	-	-	1	-	-	2	-	-
		18 HP	-	-	-	1	-	-	2	-
		20 HP	-	-	-	-	1	-	-	2
AHU Air Flow rate (m3/hr)		Std.	3,600	4,200	7,200	7,800	8,400	14,400	15,600	16,800
		Min.	No restriction							
		Max.	No restriction							
DX Coil Internal volume (cc)		Min.	3,400	4,250	6,800	7,650	8,500	13,600	15,300	17,000
		Max.	6,400	8,000	12,800	14,400	16,000	25,600	28,800	32,000
Copper Tube Dia. (mm			Ø12.7, Ø9.52, Ø8.00 (Recommended Ø9.52 or Less)							
Cooling	Max. Capacity (kW)		22.4	28.0	45.0	50.4	56.0	90.0	101.0	112.0
	Coil on Air Temp.		15 - 24°CWB							
	Evaporating Temp.		6.5°C							
	Superheat		6K							
	Air Suction Temp. (Design temp)		27°CDB / 19°CWB							
Heating	Max. Capacity (kW)		-	-	-	-	-	-	-	-
	Coil on Air Temp.		-							
	Condensating Temp		-							
	Sub Cooling		-							
	Air Suction Temp. (Design temp)		-							

No. of Ref. Circuit by DX Coil Copper Tube Dia. and DX Coil Size (HP)

	Number of Circuits					
Copper Tube	8.0mm		9.5mm		12.7mm	
Dx Coil HP	Min	Max	Min	Max	Min	Max
8HP	No restriction	12	No restriction	10	No restriction	6
10HP		14		12		7
16HP		22		16		10
18HP		24		18		10
20HP		26		20		12
32HP		42		30		18
36HP		48		34		20
40HP		54		38		22

* It is able to connect SMMS-e H/P model when you set it as Cooling only mode.
Please setup the Function CODE(DN code) [0F] : "0000" to "0001" by a wired remote controller

7.6 DX COIL Guideline CO Pattern B

- Guideline CO Pattern B -

HP			8	10	16	18	20	32	36	40
Dx-Coil type Normal	TCB-IFDDC201E		1	1	1	1	1	1	1	1
	RBM-A101VAE	8 HP	1	-	-	-	-	-	-	-
		10 HP	-	1	-	-	-	-	-	-
	RBM-A201VAE	16 HP	-	-	1	-	-	2	-	-
		18 HP	-	-	-	1	-	-	2	-
		20 HP	-	-	-	-	1	-	-	2
AHU Air Flow rate (m3/hr)		Std.	3,600	4,200	7,200	7,800	8,400	14,400	15,600	16,800
		Min.	No restriction							
		Max.	No restriction							
DX Coil Internal volume (cc)		Min.	1,800	2,250	3,600	4,050	4,500	7,200	8,100	9,000
		Max.	4,000	5,000	8,000	9,000	10,000	16,000	18,000	20,000
Copper Tube Dia. (mm			Ø12.7, Ø9.52, Ø8.00 (Recommended Ø9.52 or Less)							
Cooling	Max. Capacity (kW)		22.4	28.0	45.0	50.4	56.0	90.0	101.0	112.0
	Coil on Air Temp.		15 - 32°CWB							
	Evaporating Temp.		6.5 - 10.0°C							
	Superheat		6K							
	Air Suction Temp. (Design temp)		33°CDB / 28°CWB							
Heating	Max. Capacity (kW)		-	-	-	-	-	-	-	-
	Coil on Air Temp.		-							
	Condensating Temp		-							
	Sub Cooling		-							
	Air Suction Temp. (Design temp)		-							

No. of Ref. Circuit by DX Coil Copper Tube Dia. and DX Coil Size (HP)

	Number of Circuits					
Copper Tube	8.0mm		9.5mm		12.7mm	
Dx Coil HP	Min	Max	Min	Max	Min	Max
8HP	No restriction	12	No restriction	10	No restriction	6
10HP		14		12		7
16HP		22		16		10
18HP		24		18		10
20HP		26		20		12
32HP		42		30		18
36HP		48		34		20
40HP		54		38		22

* It is able to connect SMMS-e H/P model when you set it as Cooling only mode.
Please setup the Function CODE(DN code) [0F] : "0000" to "0001" by a wired remote controller

7.7 DX COIL Manufacturing

• DX COIL & Pipework Design Pressure:	4.15MPa
• DX COIL & Pipework Burst Pressure (without load):	12.45MPa (more than 3 x Design Pressure)

DX COIL Contamination:

- Ensure the DX COIL is cleaned using detergent, after manufacture to remove contaminants from the coil
- Do not use chlorinated detergent during the cleaning process
- Do not leave flux on or inside the DX COIL

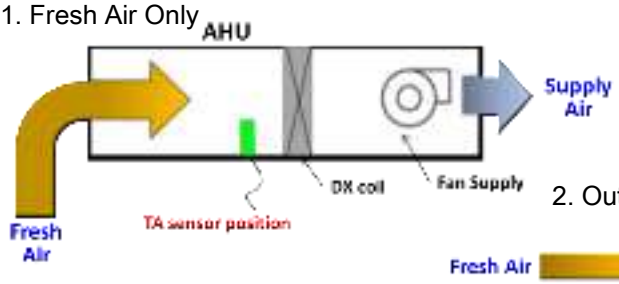
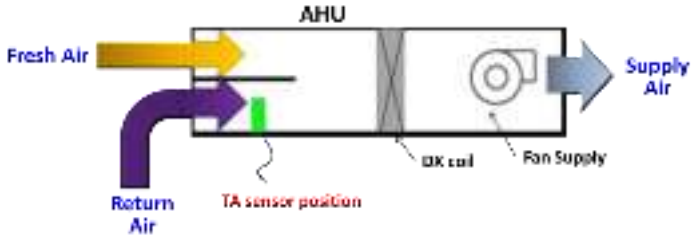
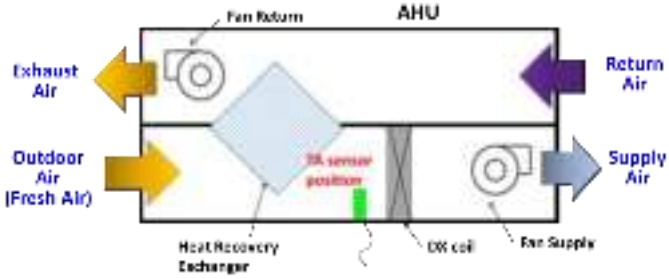
DX COIL & Pipework Contamination (Allowable Limits):	Residual water amount	0.6 mg / m
	Residual oil amount	0.5 mg / m
	Amount of solid contaminants	1.8 mg / m

- DX COIL contaminants must be equal to or less than the values shown above. The allowable contaminant levels shown assumes Ø9.52mm copper tube has been used for the manufacture of the DX COIL

7.8 DX Controller Installation

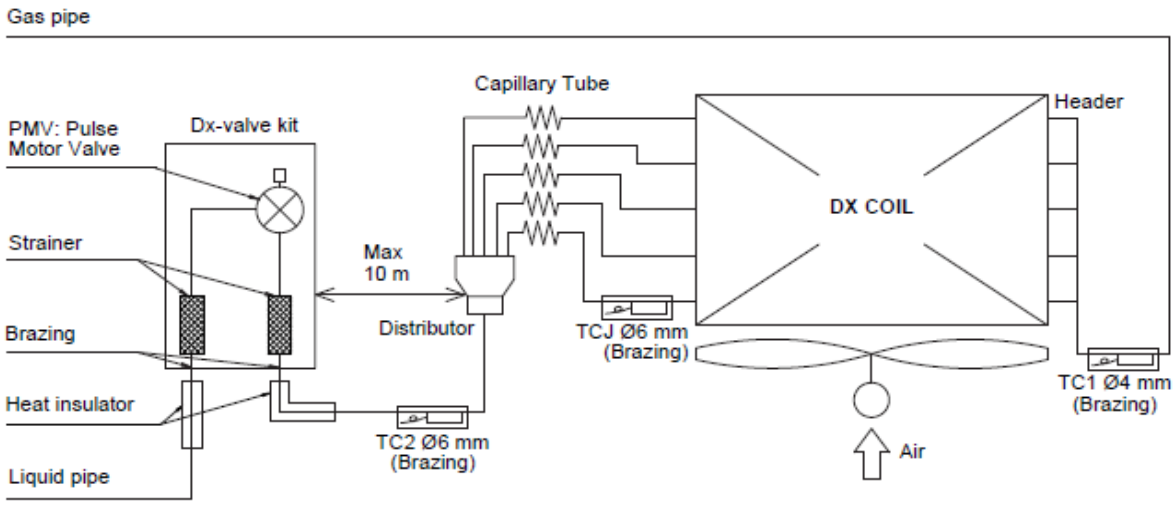
Installation Site	Avoid Direct Sunlight. DO NOT install outside. Avoid locations exposed to steam or oil vapours. Avoid locations where combustible gas may leak, settle or be generated. Avoid installation near machines emitting high-frequency waves. Avoid places where acidic solutions are frequently used. Avoid places where sulphur based or other sprays are frequently used. Avoid places where vibrations may occur. Standard Rating ; IP21
Notes	To avoid damage; when making holes for cable glands, please first remove the Gland Plate from the DX Coil CONTROLLER
Ambient Temperature	0°C to 40°C
Ambient Humidity	Relative humidity 10 ~ 90% (or less). No dew condensation allowed. If the DX-Controller is to be installed where dew condensation could form, locally sourced insulation should be fitted to avoid condensation.
Installation Angle	Vertical Installation

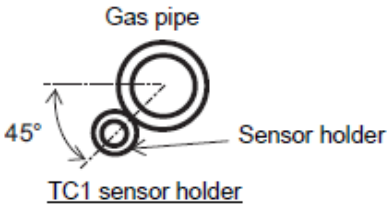
7.9 Sensor Connections

Installation	Sensor holders MUST be brazed to the DX COIL to ensure reliable temperature sensing. Follow the information in the Dx-coil controller Installation Manual for details.
Wire Connections	TC1, TC2, TC and TA which have a 2.5m cable are combined in the Dx-coil controller. If these Sensors are removed during installation ensure the sensors are reconnected to the Dx-coil Controller main PCB (MCC-1570) as shown below: • TC1 Sensor (BRN Plug [2 Pin]) > MCC-1570 CN100 (BLOWN Socket [2 Pin]) • TC2 Sensor (BLK Plug [2 Pin]) > MCC-1570 CN101 (BLK Socket [2 Pin]) • TCJ Sensor (RED Plug [2 Pin]) > MCC-1570 CN102 (RED Socket [2 Pin]) • TA Sensor (YEL Plug[2 Pin]) > MCC-1570 CN104 (YEL Socket [2 Pin]) Take care to re-connect them correctly. The cables should be installed with a U-bend at Sensor ends to stop water dripping into components. The sensor cables vinyl tube can withstand up to 105°C be careful to keep clear of high temperature parts. The extension cables' connectors are not IP rated. Ensure that they are located within the AHU. If these Sensors needs to extend, following the below cable specification(locally sourced): • Cable Specification : VFF, 0.3-0.5 mm^2 • Available Extend Length(m) : Max. 10m (Total: 12.5m) Take care to connect them correctly and carefully handle and prepare the extend cable to prevent getting such as electrical noise, water and dust.
TA Sensor position	The TA sensor which is combined in the Dx-coil controller must be located right position for TOSHIBA control, not demand control. The cooling/heating demand is determined from the DDC. Following the below example picture; 1. Fresh Air Only  2. Outdoor Air(Fresh Air) mixed with Return Air  3. Outdoor Air(Fresh Air) mixed with Return Air by Heat Recovery Exchanger 

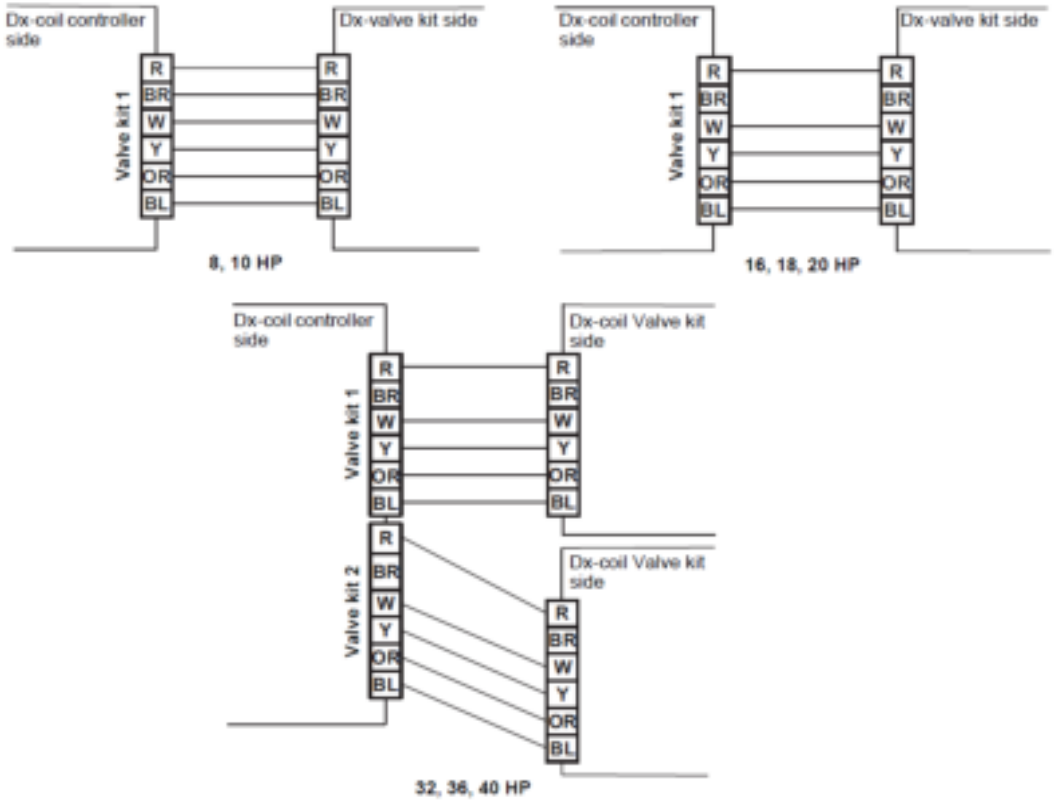
7.10 Dx-valve KIT Installation

Installation	Avoid locations in direct sunlight. Standard Rating ; IP21
Environment	Insulation should be fitted to Dx-valve kit (locally sourced). Ideally the Dx-valve kit should be contained within the AHU. If installed outside, a cover (locally sourced)should be fitted to protect from wind and rain in addition to Insulation.
Installation	The supplied components need to be assembled on to the DX COIL using custom locally sourced pipework. The PMV (Pulse Motor Valve) must be NOT installed upside down (PMV Motor on bottom). The connection angle between PMV body and PMV Motor is fixed at the factory (using thread lock) and should not be changed. The PMV Motor should not be removed from PMV body. Carefully handle and prepare the PMV when fitting to prevent ingress from foreign matter such as dust or water.
Brazing	• **PMV** A) Whilst brazing, the PMV body and PMV Motor must be water cooled to keep the component's temperature does not exceed 120°C. B) Whilst brazing, nitrogen gas must flowed through the PMV body and pipework to prevent internal oxidization. C) Prevent cooling water from getting inside the PMV body and connector of the lead during brazing. D) Take care not to damage the PMV cables during brazing. • **Sensor holders** • To ensure reliable operation, all Sensor holders must be fitted by brazing. • Be careful that the brazing material does not enter into the sensor holder when attaching the TC1, TC2 and TCJ sensor holder. TC1 Sensor : Install it in the collecting part of the gas header. Braze the TC1 sensor on the location of the lowerside 45 ° to detect the stable temperature. TC2 Sensor : Install it in the between the liquid pipe distributor and the PMV. (TC2 sensor is attached to the refrigerant cycle of AHU.) TCJ Sensor : Install it in the pass where the temperature of the capillary tube is the lowest. If the TC1, TC2 or TCJ sensors are easy to be subjected to the surrounding thermal effect, cover them with the heat insulator material, and fix them with the fixing band **TC1, TC2 and TCJ sensor position on DX COIL**





Wire Connections	· Connect the cable from the PMV. Match the color of the wiring of the PMV side and the controller side. · The PMV cable is supplied at the maximum permissible length of 5m. However, If supplied following the below cable specification, it can be extended at the maximum permissible length of 12.5m. - Cable Specification : UL1007 AWG #26



8 Control Outline

8.1 Cautions regard with DDC's programing

(1) Operation Start

- Capacity Demand signal(analogue input voltage) should be output after the AHU's fan operating.

Then, recommend to keep more than 50%(Heating; 40%) Capacity Demand signal during 5mins.

- To protect the compressor, for 5 mins after operation start the compressor will continue to operate even if receives "Zero" demand signal.

(2) Freeze prevention control (Low temperature release)

- When the compressor(s) stopped by Freeze prevention control, it will re-start after maximum 20 mins depends on DX-COIL condition.

(3) Recovery control

- Cooling oil(refrigerant) recovery operation duration is approx. 2 to 5 mins and normally takes place every 2 hrs.
- Heating refrigerant (oil) recovery operation duration is 2 to 10 mins and normally takes place every 1 hr.

(4) Defrost control (Full Defrost)

- The defrost operation terminates based on TE1 & TE2, and re-occur every 55 mins.
  (Just after start-up or upon changeover from cooling to heating, the target cumulative duration is 25 mins.)
- The defrost operation takes maximum 10 mins.

(5) Compressor restart prevention timer

- If the compressor(s) is stopped by Capacity Demand or protection function(except Freeze prevention control), normally the compressor will continue to stop for 2 mins 30 secs, even if receives Capacity Demand signal.

8.2 Protection Function Summary

- Protection Controls varies by Outdoor unit, please see appropriate Outdoor unit service manual for full details
  (Below "Protection Function Summary" is according to SMMS-e.)

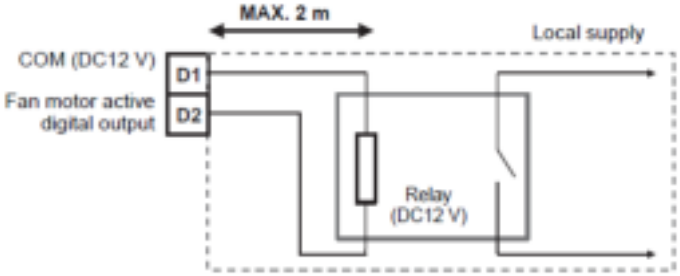
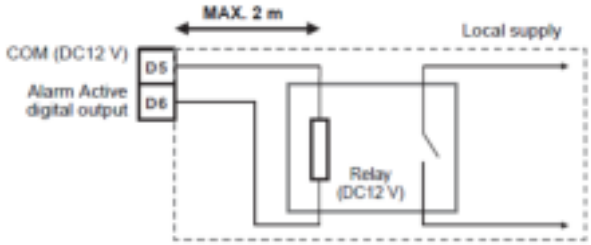
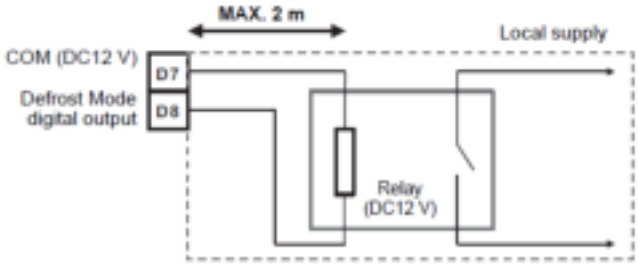
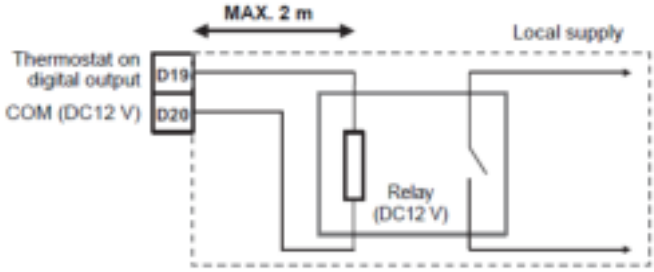
Function	Summary
Freeze prevention control (Low temperature release)	In Cooling Mode prevents low DX-COIL temperatures by controlling compressor speed (based on TC1/TC2/TCJ sensor temperature).
Cooling oil (refrigerant) recovery control	This control periodically increases flow-rate to ensure refrigerant oil does not build up in inter-unit gas pipes (which can occur when operating command is inadequate, or while cooling is progressed under low ambient conditions). During this control the compressors are operated at a target speed, and Dx valve kit PMV is opened to a certain degree. Upon completion of recovery control normal Cooling operation resumes.
Heating refrigerant (oil) recovery control (Heating Start up Control)	This control periodically increases flow-rate to ensure liquid refrigerant trapped inside the DX COIL. It also serves the purpose of recovering DX COIL / Outdoor refrigerant after defrosting and recovering oil present in outdoor heat exchangers during heating overload operation. During this control the compressors are operated at a target speed, and Dx valve kit PMV is opened to a certain degree. Upon completion of recovery control normal Heating operation resumes. Recovery operation normally takes place after defrosting.
Defrost control (Full Defrost)	In Heating mode a defrost operation can be performed to reduce ice build-up on the Outdoor unit (based on TE1 & TE2 sensor). During Defrosting the refrigerant cycle is reversed temporarily cooling the DX COIL. The defrost operation terminates based on TE1 & TE2, and can re-occur every 55 mins. While the outdoor unit is Defrosting the Dx valve kit PMV is opened to a certain degree. Heating Recovery operation normally takes place after defrosting.
High Pressure release control	This control can perform a staged shutdown of the compressors based on PD sensor value and P0 limit:- When Pd ≧ P01 compressor No. 2 (the last one of two compressors in terms of startup order in a two compressor configuration) is shut down. When Pd ≧ P02 compressor No.1 (the first compressor in terms of startup order) is shut down. The compressor(s) will automatically re-start after 2 mins 30 secs. <Heating : P01"3.45MPa" , P02"3.5MPa" > <Cooling : P01"3.85" , P02"3.9MPa">
Case Heater control	There are 2 types of case heaters: a compressor case heater and an accumulator case heater. This control function is aimed at preventing the accumulation of refrigerant in those cases, and is performed by all outdoor units. If the power supply has not been turned on for a specified period before a post installation test run, compressor failure may occur. Similarly, when starting compressors after a long period of no power supply, it is recommended that the power supply be turned on for a while before operation is resumed, just like a post-installation test run.
A3-IPDU control (A3-IPDU = Inverter P.C. board for compressor)	1) Current Release Control To prevent inverter input current from exceeding the specified value, output frequency is controlled with AC input current as detected by T02 mounted on the control P.C. board. 2) Heat sink temperature detection control This control function is aimed at protecting IPM from overheating via a thermistor. This control can increase outdoor fan speed and shutdown the compressors. This control can stop the compressor, which will automatically re-start after 2 mins 30 secs. If the detection is repeated 4 times the unit will not re-start (error code P07). 3) Overcurrent protection When the overcurrent protection circuit on IPDU PCB detects an abnormal current the compressor is shutdown. The compressor is re-started after 2 min 30 secs and the error count is recorded. If the compressor operates for at least 10 mins the error count is cleared. If the detection is repeated 8 times the error is confirmed as final. 4) High Pressure SW control When high pressure switch is activated the compressor is stopped, which will automatically re-start after 2 mins 30 secs. If the detection is repeated 4 times the unit will not re-start (error check code : P04).

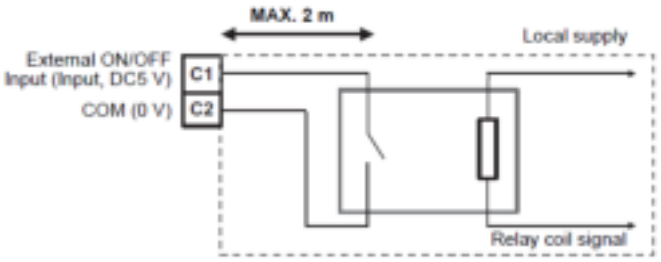
9 Cable specifications

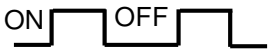
Description	Terminal	Max. Cable Length (m)	Cable Specification
Control wiring between Dx-coil controller and outdoor unit	U1 / U2	1000	Shield wire: ≧ 1.5mm2
		2000	Shield wire: ≧ 2.5mm2
Total wire length of remote controller wiring and remote controller inter - unit wiring = L	A / B	500	Non shield wire:0.75~2.5mm2
Analogue Input (0 - 10V) Capacity Demand	A1 / A2	200	Shield wire:0.5~1.0mm2
Mode Input (Cool / Heat)	C23 / C24	100	Non shield wire:0.5~1.0mm2
Digital Output (DO_1,DO_2)	D31/ D32 D33 / D34	500	Non shield wire:0.5~1.0mm2

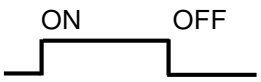
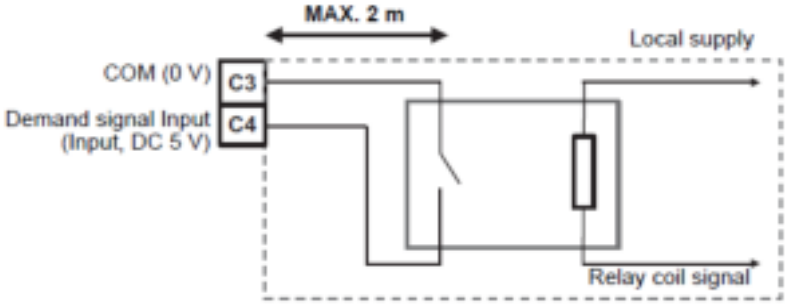
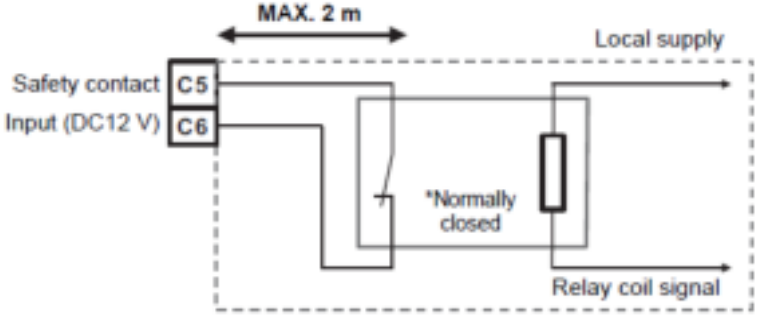
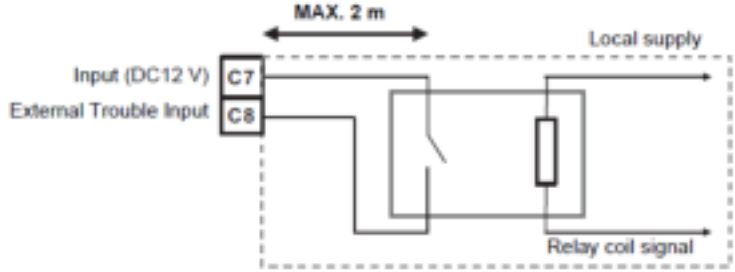
10 Interface requirements for controller

10.1 Indoor(DX) P.C board(MCC-1570) function

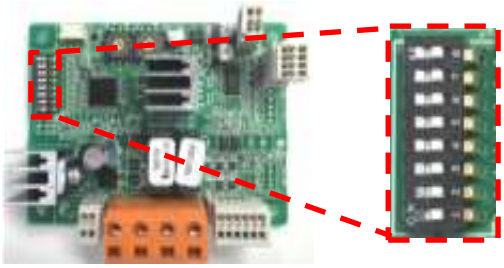
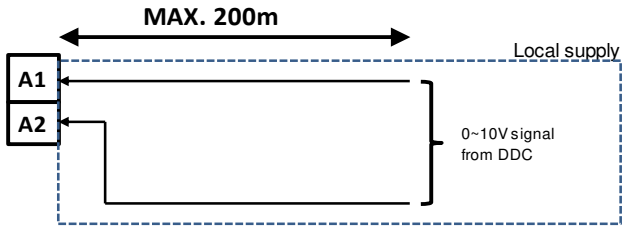
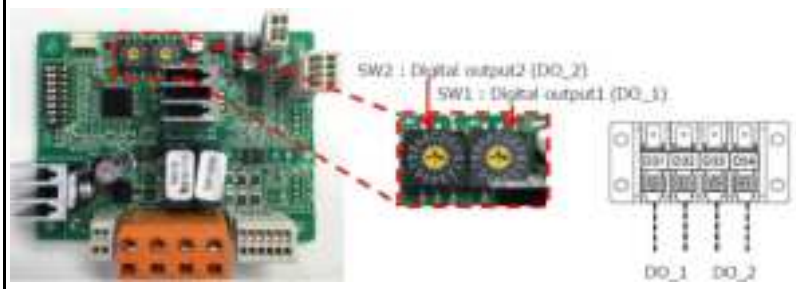
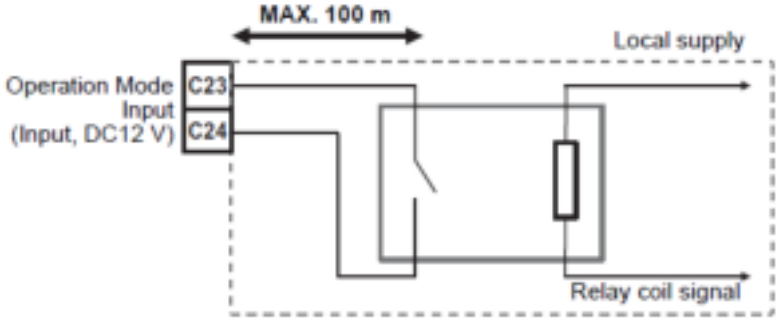
Function	Notes / Control Logic
Fan Motor Active Digital Output Terminal name : D1 / D2 (CN60)	· A fan control signal is output. It is usually the ON output at the time of operating, but it is the OFF output in defrosting. 
Alarm Active Digital Output Terminal name : D5 / D6 (CN61)	· During Alarm operation, Alarm Active Digital Output is active. 
Defrost Mode Digital Output Terminal name : D7 / D8 (CN60)	· During Defrost operation, Defrost Mode Output is active. 
Thermostat On Digital Output Terminal name : D19 / D20 (CN82)	· When the thermostat of DX-COIL is ON, a signal comes out. 

<table>
<tr><th>Function</th><th>Notes / Control Logic</th></tr>
<tr><td>External ON/OFF Input
Terminal name : C1 / C2 (CN61)</td><td>· If the contact is closed, DX-COIL controller switch on. If the contact is opened, the system switch off.
· External ON/OFF input signal type(pulse / static) is selectable by <u>Jumper Wire J01</u> on the MCC-1570 as table below.
· If the system is switched using and external contact, then switching ON/OFF using the remote controller is still possible.
 

<table>
<tr><th>J01</th><th>Action</th></tr>
<tr><td>Connect</td><td>Pulse input (Default)
 

Pulse width 200 to 300ms
Pulse interval 200ms or more</td></tr>
<tr><td>Cut</td><td>Static input
 
</td></tr>
</table></td></tr>
<tr><td>Demand Signal Input
Terminal name : C3 / C4 (CN73)</td><td>· When signal input, AHU is in "thermostat-off" status forcibly.
 
</td></tr>
<tr><td>Safety contact input
Terminal name : C5 / C6 (CN34)</td><td>· If this contact is open for more than 1 minute, the check code <u>P10</u> is generated and the Dx-coil controller switches off automatically.
 
</td></tr>
<tr><td>Fan motor trouble input
Terminal name : C7 / C8 (CN80)</td><td>· An AHU fan operation monitor (Field supply), could be attached at this dry contact terminal(For example, the abnormality of the fan motor.).
A closed contact generates the check code <u>L30</u>.
 
</td></tr>
</table>

10.2 DDC(0-10V) interface P.C board(TX-TOS1413) Function

Function	Notes / Control Logic
Analogue Input Capacity Demand SW03_2: STEPPED / LINEAR response Terminal name : A1 / A2 (CN5)	 SW3 bit-2(TX-TOS1413) OFF: STEPPED response to analogue input SW3 bit-2(TX-TOS1413) ON: LINEAR response to analogue input ・ Analogue input 0 to 10V from DDC on site. ・ Be sure not input more than DC10V in analogue input terminal. 
Digital Output 1/2 Terminal name : D31 / D32:DO_1 Digital Output1 D33 / D34:DO_2 Digital Output2 (CN3)	・ Output function selected using rotary switches SW1 & SW2 on the DDC(0-10V) interface P.C board(TX-TOS1413). 
Operation Mode Input (Cool / Heat) Terminal name : C23 / C24 (CN2)	・ If the contact is short-circuited, system changes to heat mode. If the contact is open, system changes to cool mode ・ Only cool mode and heat mode are available.  Function / Terminal / **OPEN** / **SHORT** Mode Input Cool / Heat / C23 / C24 / COOL mode active / HEAT mode active

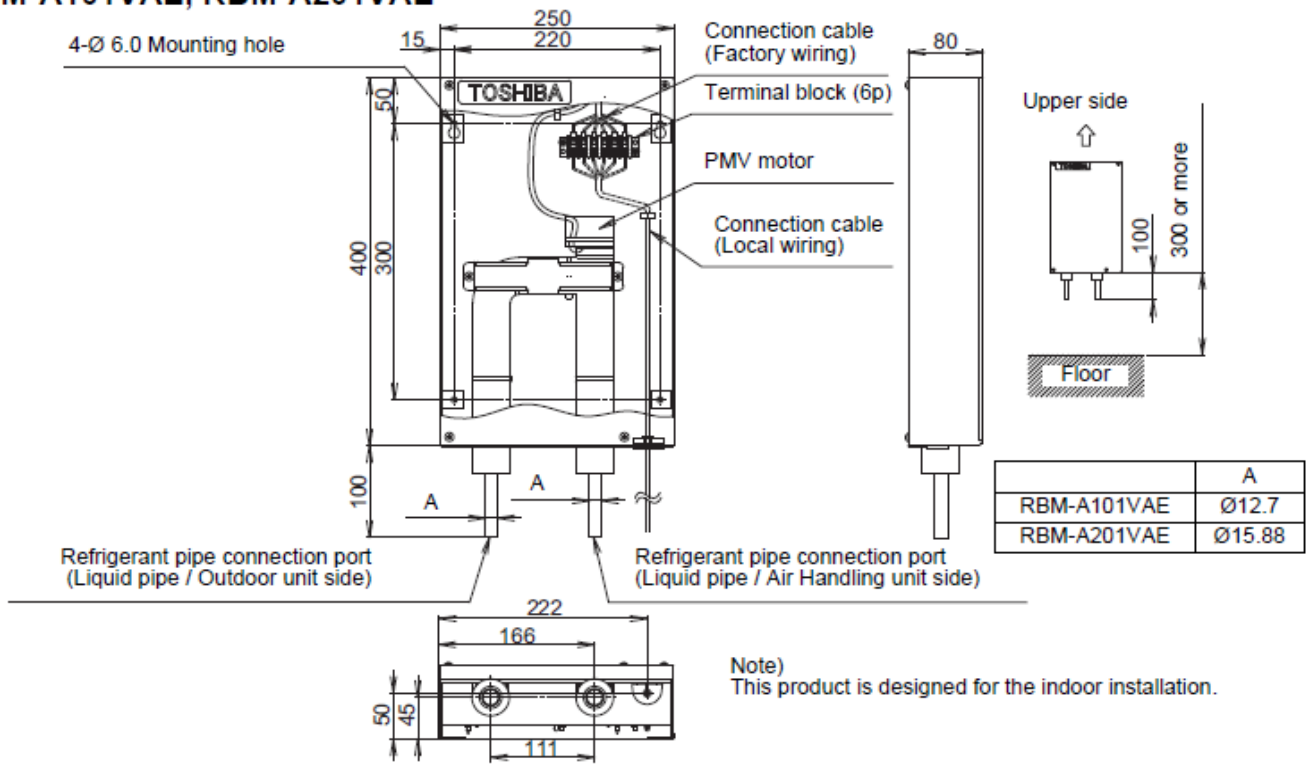
11 Function code (DN code)

▼ Function CODE No.(DN code) table (setting by wired remote controller)

DN	Item	Description	Default(at shipment)
01	Filter display delay timer	0000: None 0001: 150H 0002: 2500H 0003: 5000H 0004: 10000H	0000: None
02	Dirty state of filter	0000: Standard 0001: High degree of dirt (Half of standard time)	0000: Standard
04	Specific indoor unit priority	0000: No priority 0001: Priority	0000: No priority
0F	Cooling only	0000: Heat Pump 0001: Cooling only (No display of [AUTO], [HEAT])	0000: Heat Pump
10	Type	0055: Dx-coil Interface	0055: Dx-coil Interface
11	Indoor unit capacity	0000: Unfixed 0021 (8HP) 0023 (10HP) 0026 (16HP) 0027 (18HP) 0028 (20HP) 0035 (32HP) 0037 (36HP) 0039 (40HP)	0000: Unfixed
12	Line address	0001: No.1 unit to 0030: No.30 unit	0000: Unfixed
13	Indoor unit address	0001: No.1 unit to 0064: No.64 unit	0099: Unfixed
28	Automatic restart of power failure	0000: None 0001: Restart	0000: None
33	Temperature unit select	0000: °C 0001: °F	0000: °C
60	Timer setting (by Wired remote controller)	0000: Available(can be performed) 0001: Unavailable(cannot be performed)	0000: Available
92	Fan trouble input release condition	0000: Operation stopped 0001: Release signal received	0000: Operation stopped

(Unit : mm)

RBM-A101VAE, RBM-A201VAE

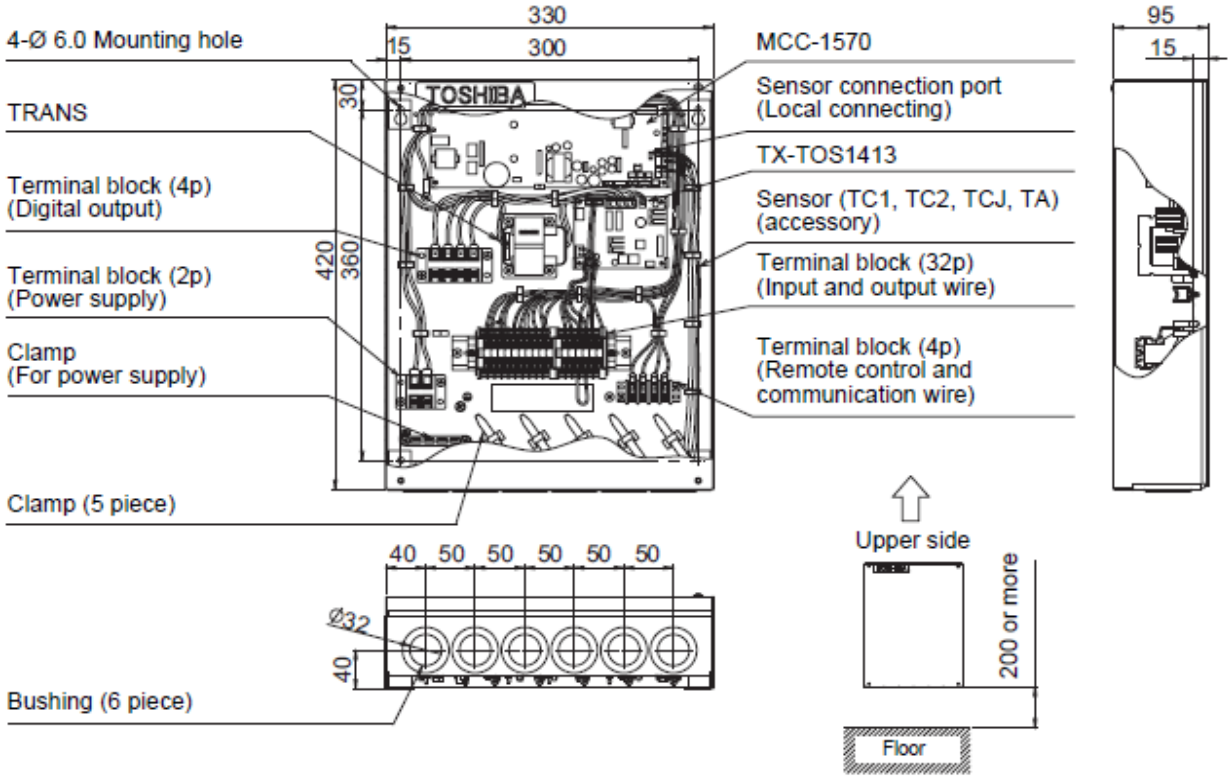


	A
RBM-A101VAE	Ø12.7
RBM-A201VAE	Ø15.88

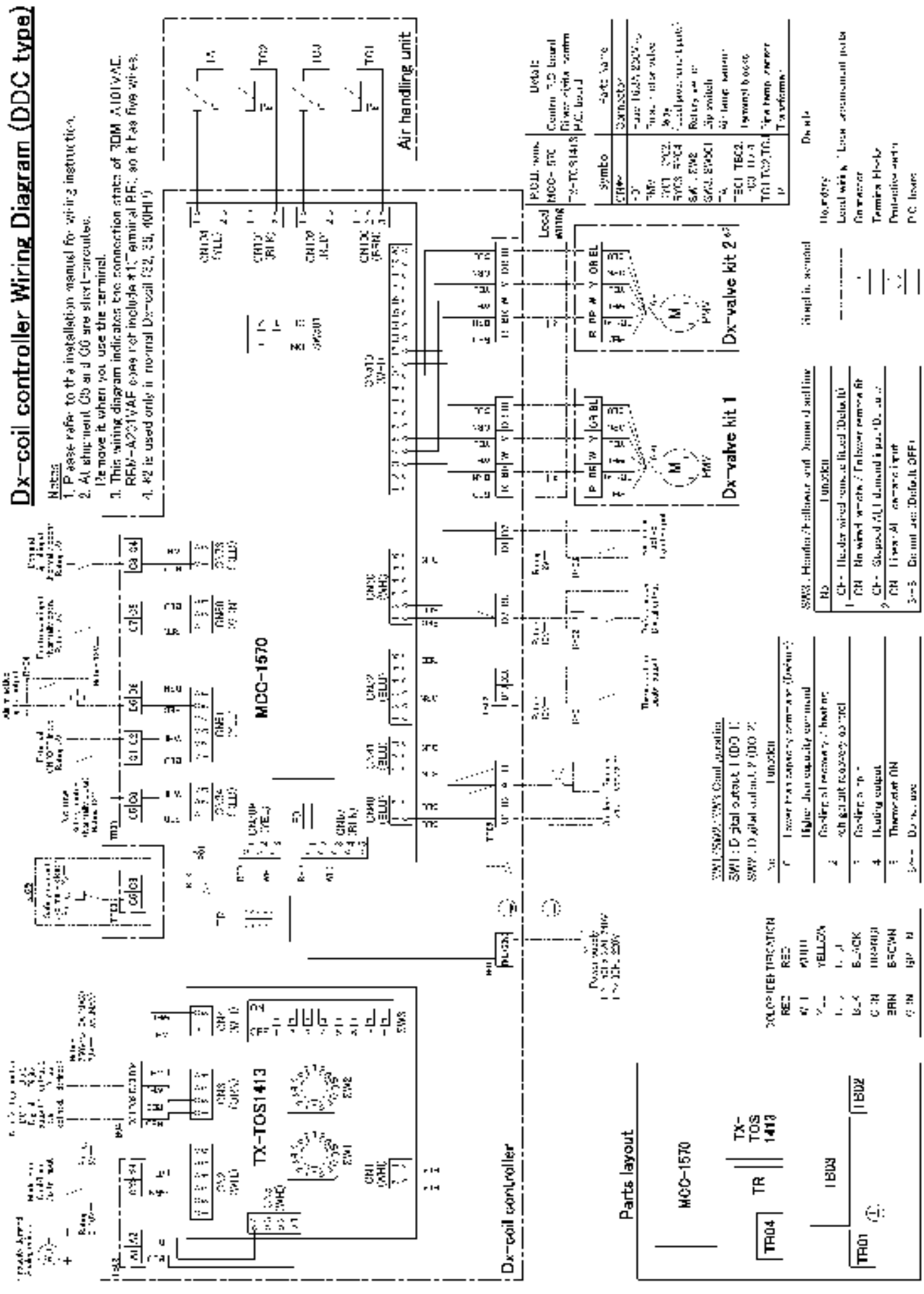
Note)
This product is designed for the indoor installation.

TCB-IFDDC201E

(Unit : mm)



Note)
This product is designed for the indoor installation.


Dx-coil controller Wiring Diagram (DDC type)
Notes
1. Please refer to the installation manual for wiring instruction.
2. Attachment CB and CC are short-circuited.
Remove it when you use the terminal.
3. This wiring diagram indicates the connection state of 3DM A101VAE.
REM-A201VAE does not include #1 terminal R1, so it has five wires.
4. K2 is used only in normal Dx-coil (22, 25, 40HP)
Air handling unit
MDC-1570
TX-TOS1413
Dx-valve kit 1
Dx-valve kit 2
Dx-coil controller
Parts layout
MDC-1570
TX-TOS 1413
TR
TR04
TR01
1B03
1B02

✓ :Available × : Prohibition

Appliance name		Model Name and appearance	
Remonote Controller			
	Wired remote controller	RBC-AMT32E	✓
		RBC-AMS41E	✓
		RBC-AMS54_55E-ES/EN	✓
		RBC-AS41E	✓
		NRC-01HE	×
		RBC-ASC11E	×
Schedule timer and central remote controller			
	Schedule timer	TCB-EXS21TLE	×
	Central remote controller	TCB-CC163TLE2	×
		TCB-SC643TLE	×
Remonote Controller(TU2C-LINK Controls)			
	Wired remote controller	RBC-AMTU31-E(TR)	✓
		RBC-AMSU51(-EN/ES)	✓
		RBC-ASCU11-E(TR)	✓

Appliance name		Model Name and appearance	
Open network and analog interface			
	LON Interface	TCB-IFLN642TLE	×
	Modbus Interface	TCB-IFMB641TLE	×
	BACnet IP	BMS-IFBN640TLE	×
Advanced central control			
	Smart BMS Manager with data analyzer	BMS-SM1281ETLE	×
	Touch Screen Controller	BMS-CT1280E	✓(*)
		BMS-CT5121E	×
	Smart device control interface	BMS-IWF0320E	✓(*)
Individual gateway			
	Modbus Interface	BMS-IFMB0TLR-E	×
	KNX Interface	BMS-IFKX1TLR-E	×

(*) : Monitoring function only

15 Check Codes

Common Check Codes (Note1 : DDC(0-10V) interface P.C. board is classified as a Remote controller)
(Note2 : Regarding outdoor units, refer to their own service manuals)

- **E01 : No master remote controller, faulty remote controller communication**
  The header remote controller has not been set.
  Check the settings of SW3 bit1 located on the DDC(0-10V) interface P.C. board(TX-TOS1413).
  Check the remote controller inter-unit tie cable(A/B).
- **E09 : Duplicated master remote controller**
  Two remote controllers have been set master remote controller.
  Check the settings of SW3 bit1 located on the DDC(0-10V) interface P.C. board(TX-TOS1413).
  Check the remote controller inter-unit tie cable(A/B).
- **E13 : Indoor(DX) P.C. board(MCC-1570) - DDC(0-10V) interface P.C. board(TX-TOS1413) communication trouble**
  Detected at DDC(0-10V) interface P.C. board
  Check connection of tie cables(A/B) between the connector CN41(BLU) located on the Indoor(DX) P.C. board and the connector CN1(WHI) located on the DDC(0-10V) interface P.C. board.
  Check for the trouble in indoor(DX) P.C. board.
- **E14 : Indoor(DX) P.C. board(MCC-1570) - DDC(0-10V) interface P.C. board(TX-TOS1413) communication trouble**
  Detected at Indoor(DX) P.C. board
  Check connection of tie cables(A/B) between the connector CN41(BLU) located on the Indoor(DX) P.C. board and the connector CN1(WHI) located on the DDC(0-10V) interface P.C. board.
  Check DDC(0-10V) interface P.C. board power supply at CN4(WHI).
  Check for the trouble in DDC(0-10V) interface P.C. board.
- **F01 : TCJ Sensor trouble**
  Check connection of TCJ sensor connector and wiring.
  Check resistance characteristics of TCJ sensor.
  Check for trouble in indoor P.C. board.
- **F02 : TC2 Sensor trouble**
  Check connection of TC2 sensor connector and wiring.
  Check resistance characteristics of TC2 sensor.
  Check for trouble in indoor P.C. board.
- **F03 : TC1 Sensor trouble**
  Check connection of TC1 sensor connector and wiring.
  Check resistance characteristics of TC1 sensor.
  Check for trouble in indoor P.C. board.
- **F10 : TA Sensor trouble**
  Check the connection of TA sensor connector and wiring.
  Check resistance characteristics of TA sensor.
  Check for trouble in indoor P.C. board.
- **L02 : Outdoor units model disagreement trouble**
  Check outdoor unit model.
  (Check whether the outdoor unit corresponds to Dx-coil Interface or not.)
- **L09 : Indoor unit Power Code incorrect**
  Check the settings of DN Code 11 (See "DX COIL INTERFACE Configuration").
- **L22 : Incompatible group combination of indoor units**
  Check indoor units model.
  Check for trouble in indoor P.C. board.
- **L30 : Fan Motor operation monitor**
  Check the operation monitoring of the fan at terminals C7 / C8. If this contact is "CLOSED" ,
  the check code "L30" is generated.
- **P10 : Safety contact trouble**
  Check the contact at terminals C5/ C6. If the contact is "OPEN", the check code "P10" is generated.
  If this contact is not used, a bridge connection should be installed on the terminals C5/ C6.

16 Related cautions

(1) Installation work

- Secure enough service space for replacement of the Dx-valve KIT and the thermistors.

After the AHU controller is installed, address setting and unit capacity setting is necessary. Refer to the installation manual for the setting method.

- Refer to the outdoor unit installation manual or the data book for installation of the outdoor unit.

(2) Test run

- Turn on the main power of the unit at least 12 hours before test run to power the crankcase heater. Insufficient powering time may result in compressor damage.
- Ensure the analogue input is voltage is set to ≥ 4.5V before starting the test run.
- As the capacity setting is made at initial setting, a remote controller is necessary. Remove the remote controller after making the initial settings if it is not used.

(Refer to the installation manual for remote controller for more details.)

(3) Operation control

If the error display appears on the remote controller, do not reset an error by yourself. Contact the service firm or the dealer.

- Refer to the data book for system controller when using the system controller.

(4) Service

- Regular maintenance is required to prolong the life of the units. It is recommended that the maintenance contract be concluded with a maintenance firm.

17 Warranty

- Specifications of AHU and compatibility with National / Local regulations must be confirmed by your company.
- Selection of an appropriate AHU (with appropriate specifications to match those of units connected to the AHU such as configuration, dimension, life-span, vibration, noise level, or features) must be made by your company.
- Toshiba Carrier shall not be liable for any damage to the entire system or the AHU main body caused by connected AHU with wrong specification or wrong usage of AHU.
- Toshiba Carrier shall not be liable for any damage to the outdoor units and Dx-coil interface caused by AHU damage.
- Toshiba Carrier shall not be liable for capacity, responsiveness and accuracy of system.

VRF Dx-coil Interface(DDC type) Design Guideline

DG001-05

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Toshiba Carrier Corporation