SHS900 Series

Modbus Full Configurable Direct Digital Unitary Controllers

DATA SHEET

The SHS900 series are full configurable, RS-485 Modbus/ RTU networked direct digital unitary controller. They are suitable for a variety of applications including 2-pipe or 4-pipe Fan-coil unit, PAHU, CAV/ VAV, Heat Pump, heating system, and other HVAC unitary equipment of on/ off, modulating, floating, or combinatory controls for a variety applications.

The controller measures temperature of air or liquid and then use control on/ off, modulating, or floating actuators in the HVAC system to maintain the room space near the desired temperature set point. The optional 1- to 3- fan speed can be operated in the mode of auto changeover or manual selected continuous mode.

This controller has an optional WBS series wall setter and/or Infrared remote (IR) controller with LCD screen for showing setpoint and the other settings. And it also has optional analogue and digital inputs for a variety of measurement and detection devices such as room occupied/unoccupied detection, window or door open/close detection...etc.

FEATURES

- RS485 Modbus/ RTU open protocol communication with complete baud rate and parity selections
- Effective run time accumulation for system reading/ resetting
- Optional 1- to 3- fan speed can be operated in the mode of auto changeover or manual selected continuous mode.
- Cool, heat, or both auto/ manual changeover with adjustable zero energy band
- Full configurable parameters such as switching differential, cycle time, and etc.
- Proportional plus integral (PI) algorithm applied to on/off control
- Optional wall temperature sensor/ setter
- Optional Remote sensor (RS) input interface for connecting to remote temperature sensor
- Selectable temperature sensor input from wall setter or RS
- Up to 3 extra analogue input interfaces
- Optional energy saving input (ESI) interface for room occupied/unoccupied detection device
- Up to 3 extra digital input interfaces for window or door open/close detection device or status...etc
- Up to 7-stage, or 2-floating and/ or 2-modulating outputs or specified
- Optional Infrared remote (IR) controller
- Adjustable unoccupied setpoints for heating and cooling mode control
- Optional settable countdown Timer (0 to 24 hours) function to stop control outputs when time expires
- Optional sleep mode function for raising 2 ℃ temperature setpoint in 2 hours
- Non-volatile memory (EEPROM) retains user settings during power loss
- Control off output when system at “OFF” status
- Maximum and minimum set-point limits settable

SPECIFICATIONS

Supply Voltage：
24Vac (+/-10%) or 85~260Vac, 50/60 Hz

Communication Interface：
RS485, 2 wires, Modbus/RTU open protocol
1.2/ 2.4/ 4.8/ 9.6/ 14.4/ 19.2/ 38.4/ 57.6kbps baud rate
N81/ N82/ E81/ O81 data format selections

Display Range： -10 to 60.0 °C (14.0 to 140.0 °F)

Display Temperature Unit and Resolution: 0.1 °C/°F

Indication Accuracy： +/-1.0 °C (1.8 °F) at 25 °C

Set-point Range:
0~50 °C / 32~122 °F (default: 10~30 °C /50~86 °F, adjustable), 0.5 °C/°F per setting step

Setpoint Adjustment：

Through WBS series wall setter, IR controller or Modbus communication

Valve, Fan, and Interlock Control Outputs：

1 SPST/SPDT relay for 2-pipe on/off valve control,
2 SPST/SPDT relays for 4-pipe on/off valves control, or 2-pipe floating valve control,

4 SPST relays for 4-pipe floating valves control,

3 SPST relays for Fan control

1 SPST relay for Interlock control

Electrical Rating：

SPDT **–** 1.2A/250Vac, inductive load

SPST **--** 2A/250Vac, inductive load

Minimum Relay Operating Life：

Contacts: 100,000 cycles

Analog Output Signal：
0(2) to 10 Vdc or 10 to 0(2) Vdc
Maximum 3mA

Optional Infrared Remote (IR) Control Interface:
For control through infrared remote controller

Remote Sensor (RS) Input Interface：

For connecting to external NTC Thermistor 3K ohm

Analog Input (AI) Interfaces：

Up to 3 extra AI input interfaces for signal inputs of (0~5Vdc, 0~10vdc, or 4~20mA) or NTC3 ohm

Energy Savings Input (ESI) Interface：

For saving energy by entering into unoccupied mode when ESI is triggered by Normally open (N.O.) or normally close (N.C.) dry contact

Digital Input (DI) Interfaces：

Up to 3 extra DI input interfaces for being triggered by Normally open (N.O.) or normally close (N.C.) dry contact (Note: DI#1 is with a special function for enhanced saving energy by stopping cooling/heating and Fan control outputs when DI#1 is triggered by Normally open (N.O.) or normally close (N.C.) dry contact.) For Example window contacts etc…

Control Performance：

Proportional plus integral (PI) algorithm

Time Proportional Integral Floating control

Differential on/off control

Control action for modulation outputs：
Selectable direct or reverse control action of cooling and heating. Both are direct action by default.

Cooling and/or Heating Control Action --

Control Action	Output Signal
Direct	0(2) to 10 Vdc
Reverse	10 to 0(2) Vdc

Operating Rating：

0 ~ 50°C, 5 ~ 95% RH (non-condensing)

Dimensions：

94×118×34 mm (W × H × D). LCD Wall Unit

156×150x50 mm (W × H × D) Base unit

Mounting： Wall Mounting
Certification: CE

Wiring：

Up to 30 screw-in terminals, each terminal is suitable for 14 to 22 AWG wires or 1.5 mm^2 wires.

RJ-45, 8-position female modular jack for the connection of the WBS wall setter.

PRODUCT ORDERING INFORMATION

SHS9 □ □ □ - □ □ □ □ □ - □ □ □ □ □ - □ □ □

(1) (2) (3) - (4) (5) (6) (7) (8) - (9) (10)(11)(12) (13) (14) (15) (16)

MODEL: SHS9

Item	CODE	Cooling Control Outputs*
(2)	00	None
	01~07	1~7 stages for multi-stage On/Off control outputs
	08~0F	Reserved
	10	1 stage of floating control output
	30	2 stage of floating control output
	40	1 stage of 0(2)-10Vdc modulating control output
	41	1 stage of 0(2)-10Vdc modulating with 1-on/off control outputs
	42	1 stage of 0(2)-10Vdc modulating with 2-on/off control outputs
	43	1 stage of 0(2)-10Vdc modulating with 3-on/off control outputs
	44	1 stage of 0(2)-10Vdc modulating with 4-on/off control outputs
	50	1 stage of 0(2)-10Vdc modulating with 1-floating control outputs
	70	1 stage of 0(2)-10Vdc modulating with 2-floating control outputs
	80	2 stage of 0(2)-10Vdc modulating control output
	81	2 stage of 0(2)-10Vdc modulating with 1-on/off control outputs
	82	2 stage of 0(2)-10Vdc modulating with 2-on/off control outputs
	83	2 stage of 0(2)-10Vdc modulating with 3-on/off control outputs
	84	2 stage of 0(2)-10Vdc modulating with 4-on/off control outputs
	90	2 stage of 0(2)-10Vdc modulating with 1-floating control outputs
	B0	2 stage of 0(2)-10Vdc modulating with 2-floating control outputs
	X	Specified

Item	CODE	Heating Control Outputs*
(2)	00	None
	01~07	1~7 stages for multi-stage On/Off control outputs
	08~0F	Reserved
	10	1 stage of floating control output
	30	2 stage of floating control output
	40	1 stage of 0(2)-10Vdc modulating control output
	41	1 stage of 0(2)-10Vdc modulating with 1-on/off control outputs
	42	1 stage of 0(2)-10Vdc modulating with 2-on/off control outputs
	43	1 stage of 0(2)-10Vdc modulating with 3-on/off control outputs
	44	1 stage of 0(2)-10Vdc modulating with 4-on/off control outputs
	50	1 stage of 0(2)-10Vdc modulating with 1-floating control outputs
	70	1 stage of 0(2)-10Vdc modulating with 2-floating control outputs
	80	2 stage of 0(2)-10Vdc modulating control output
	81	2 stage of 0(2)-10Vdc modulating with 1-on/off control outputs
	82	2 stage of 0(2)-10Vdc modulating with 2-on/off control outputs
	83	2 stage of 0(2)-10Vdc modulating with 3-on/off control outputs
	84	2 stage of 0(2)-10Vdc modulating with 4-on/off control outputs
	90	2 stage of 0(2)-10Vdc modulating with 1-floating control outputs
	B0	2 stage of 0(2)-10Vdc modulating with 2-floating control outputs
	X	Specified

Item	CODE	Application
(3)	A	2-Pipe Cooling only
	B	4-Pipe Cooling or Heating (Manually Selectable)
	C	4-Pipe Cooling and Heating (Auto Changeover)
	D	2-Pipe Heating only
	E	2-Pipe Heating or Cooling (Manually Selectable)
	X	Specified

Item	CODE	FAN Control Output*
(4)	0	None
	1~3	No. of Fan speeds

Item	CODE	Power voltage of Controller, Valve, FAN – refer to wiring diagram for details
(5)	0	24Vac, 24Vac, None
	1	24Vac, External power, External power
	2	24Vac, 24Vac, External power
	3	24Vac, 24Vac, 24Vac
	4	Reserved
	5	Reserved
	6	Reserved
	7	Reserved
	8	85~260Vac, 85~260Vac, None
	9	Reserved
	A	85~260Vac, 85~260Vac, 85~260Vac
	B	85~260Vac, 85~260Vac, External power
	X	Specified

Item	CODE	Wiring for an On/Off or floating control type of Valve/actuator
(6)	0	None
	2	2-Wires On/Off control type
	3	3-Wires On/Off control type or Floating control type

Item	CODE	Color for Plastic Case
(7)	0	None
	1	Reserved
	2	Black

Item	CODE	Color for LCD Backlit
(8)	0	None
	1	Reserved
	2	Reserved

Item	CODE	No. of input interfaces for Remote Temperature Sensor (RS) and/or 1~3 extra analog inputs (AI) Note: the 3 extra AI could be specified as 1~3 sets of 0-5Vdc, 1~3 sets of 0-10Vdc, 1~2 sets of 4-20mA, or 1~3 sets of RS
(9)	0	None
	1	1-RS inputs
	2~4	1-RS input and 1~3-0~5Vdc inputs
	5~7	1-RS input and 1~3-0~10Vdc inputs
	8~9	1-RS input and 1~2-4~20mA inputs
	A	1-RS input, 2-0~5Vdc inputs, and 1-0~10Vdc input
	B	1-RS input, 1-0~5Vdc input, and 2-0~10Vdc inputs
	C	1-RS input, 2-0~5Vdc inputs, and 1-4~20mA input
	D	1-RS input, 2-0~10Vdc inputs, and 1-4~20mA input
	E	1-RS input, 1-0~5Vdc input, 1-0~10Vdc input, and 1-4~20mA input
	F~I	Reserved
	J~K	2-RS inputs and 1~2-0~5Vdc inputs
	L~M	2-RS inputs and 1~2-0~10Vdc inputs
	N~O	2-RS inputs and 1~2-4~20mA inputs
	P	2-RS inputs, 1-0~5Vdc inputs, and 1-0~10Vdc input
	Q	2-RS inputs, 1-0~5Vdc input, and 1-4~20mA input
	R	2-RS inputs, 1-0~10Vdc inputs, and 1-4~20mA input
	X	Specified

Item	CODE	No. of input interfaces for Energy Saving (ESI) and/or 1~3 extra Digital inputs (DI)
(10)	0	None
	1	1 ESI input
	2	1 ESI input with 1 DI
	3	1 ESI input with 2 Dis
	4	1 ESI input with 3 Dis
	5	Specified

Item	CODE	Function of sleep mode
(11)	0	None
	1	Enable

Item	CODE	Function of Timer mode
(12)	0	None
	1	Enable

Item	CODE	No. of Interlock Contact (ILC) signal outputs*
(13)	0	None
	1	1 ILC

Item	CODE	Modbus Parity
(14)	0	N81
	1	O81
	2	E81(default)
	3	N82

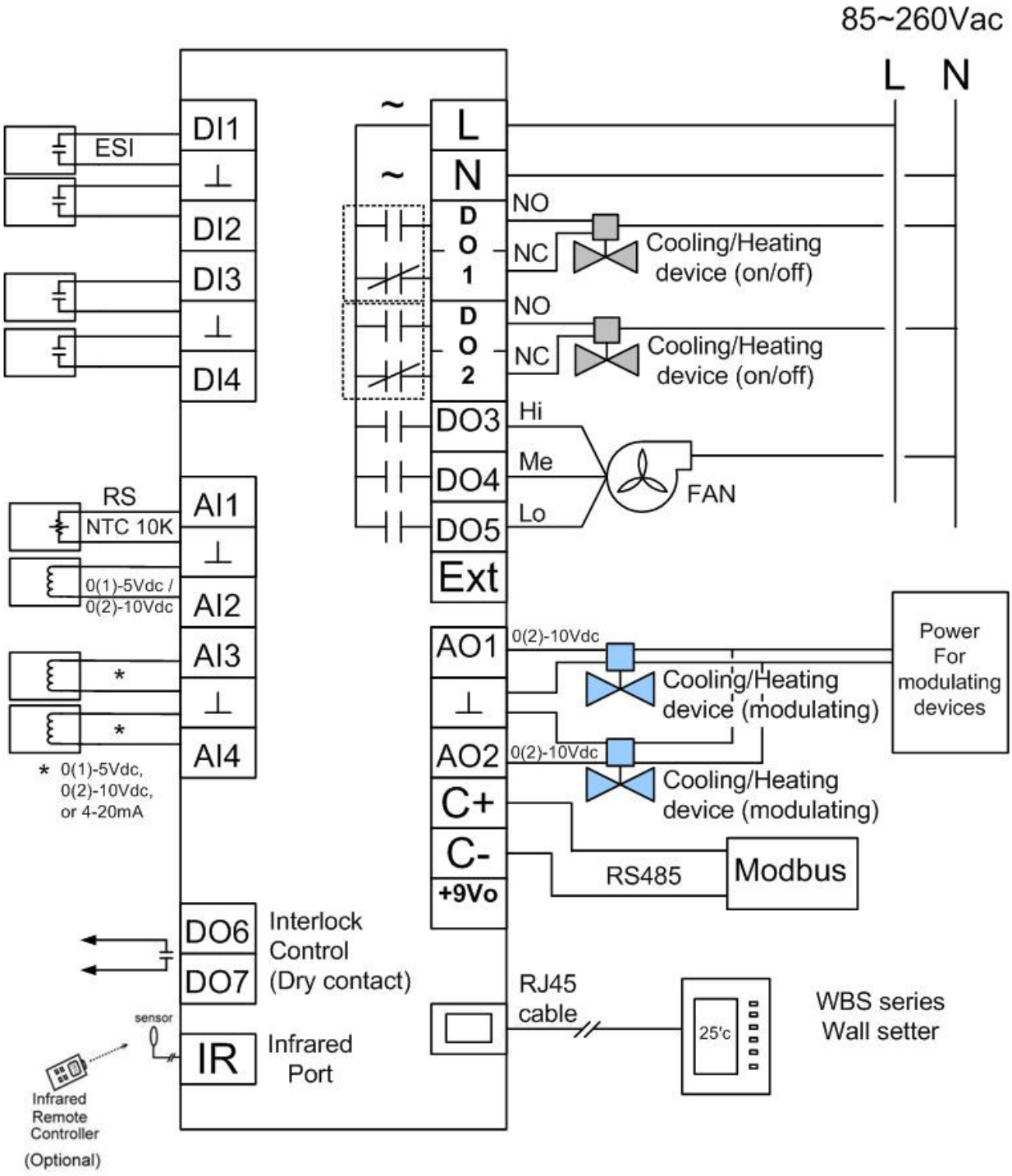
Item	CODE	Modbus Baud Rate(Kbps)
(15)	0	1.2
	1	2.4
	2	4.8
	3	9.6
	4	14.4
	5	19.2(default)
	6	38.4
	7	56

Item	CODE	Infrared Remote (IR) Control
(16)	0	None
	1	With IR control (includes an IR receiver and an IR controller)

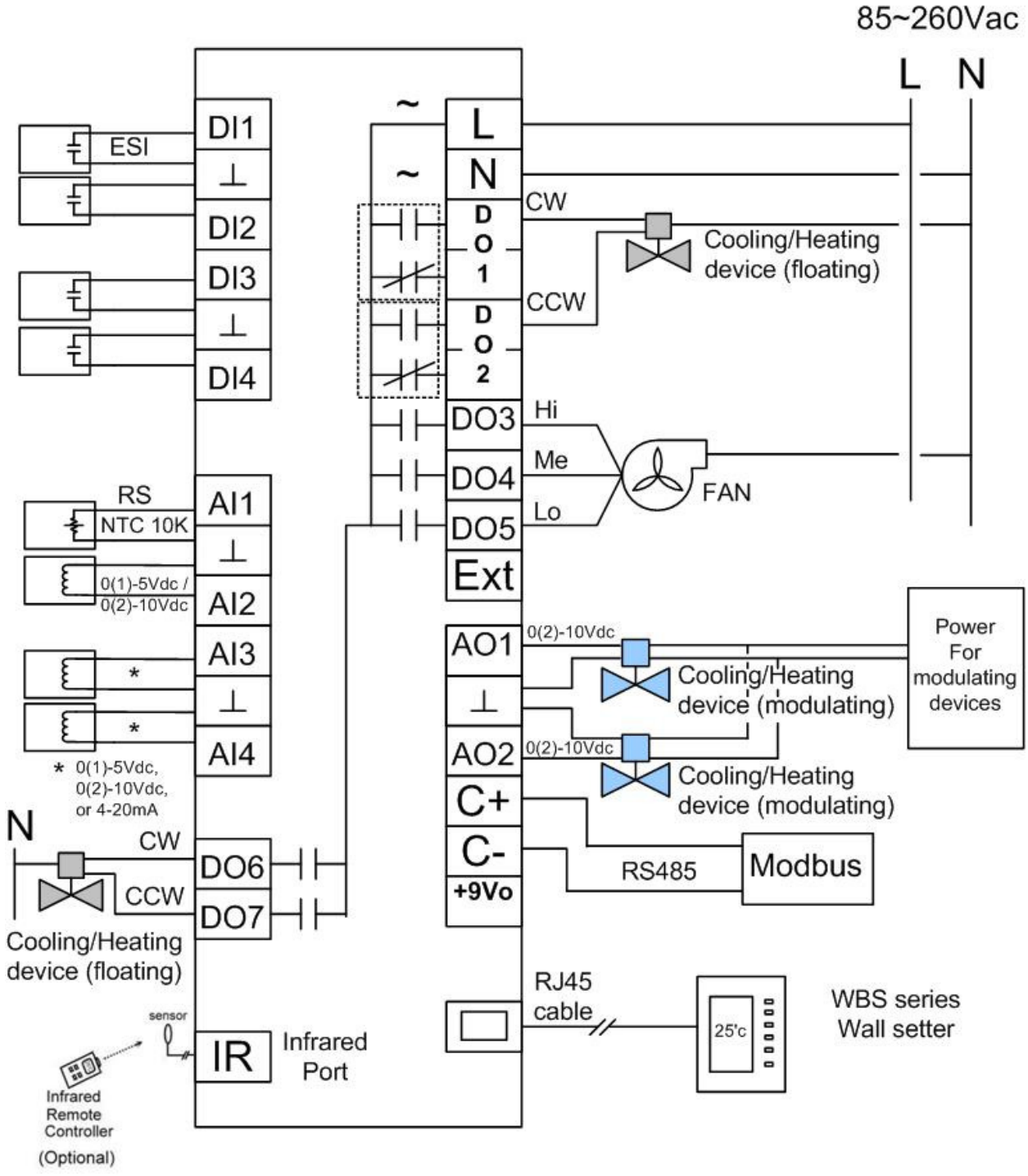
Example: SHS9-0101C-3A220-11000-250: 1 stage of on/off cooling, 1 stage of on/off heating, cooling & heating auto-changeover, 3-speed of FAN control, 85~260Vac power for all, 2-wire valve/actuator, black color for plastic case, no LCD backlit, 1 RS, 1 ESI, No sleep mode function, No Timer function, No ILC, E81, 19.2kbps, without IR control.

*** Note:** Total number of cooling plus heating stages, fan control and interlock contact shall be within seven.

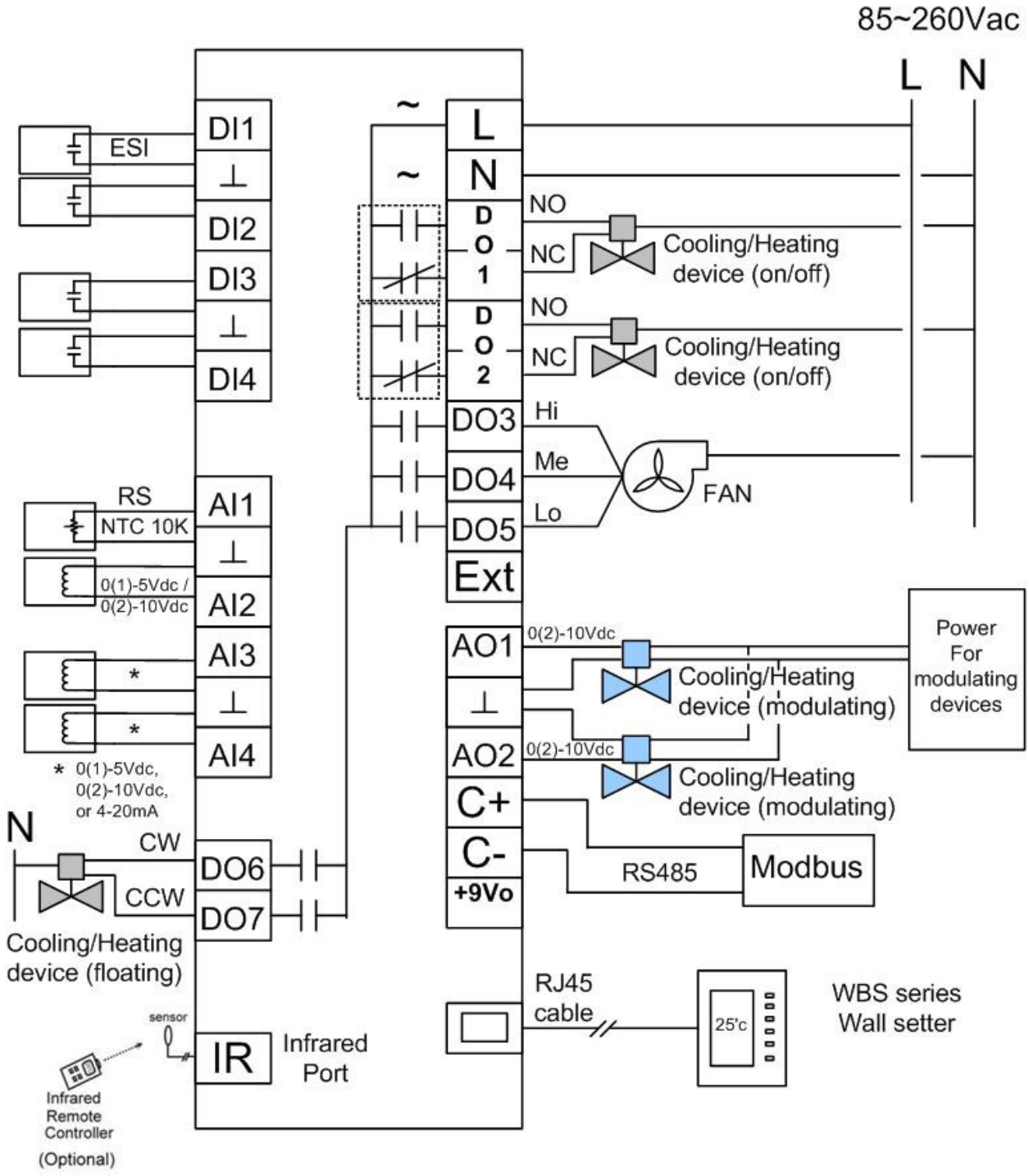
WIRING EXAMPLES



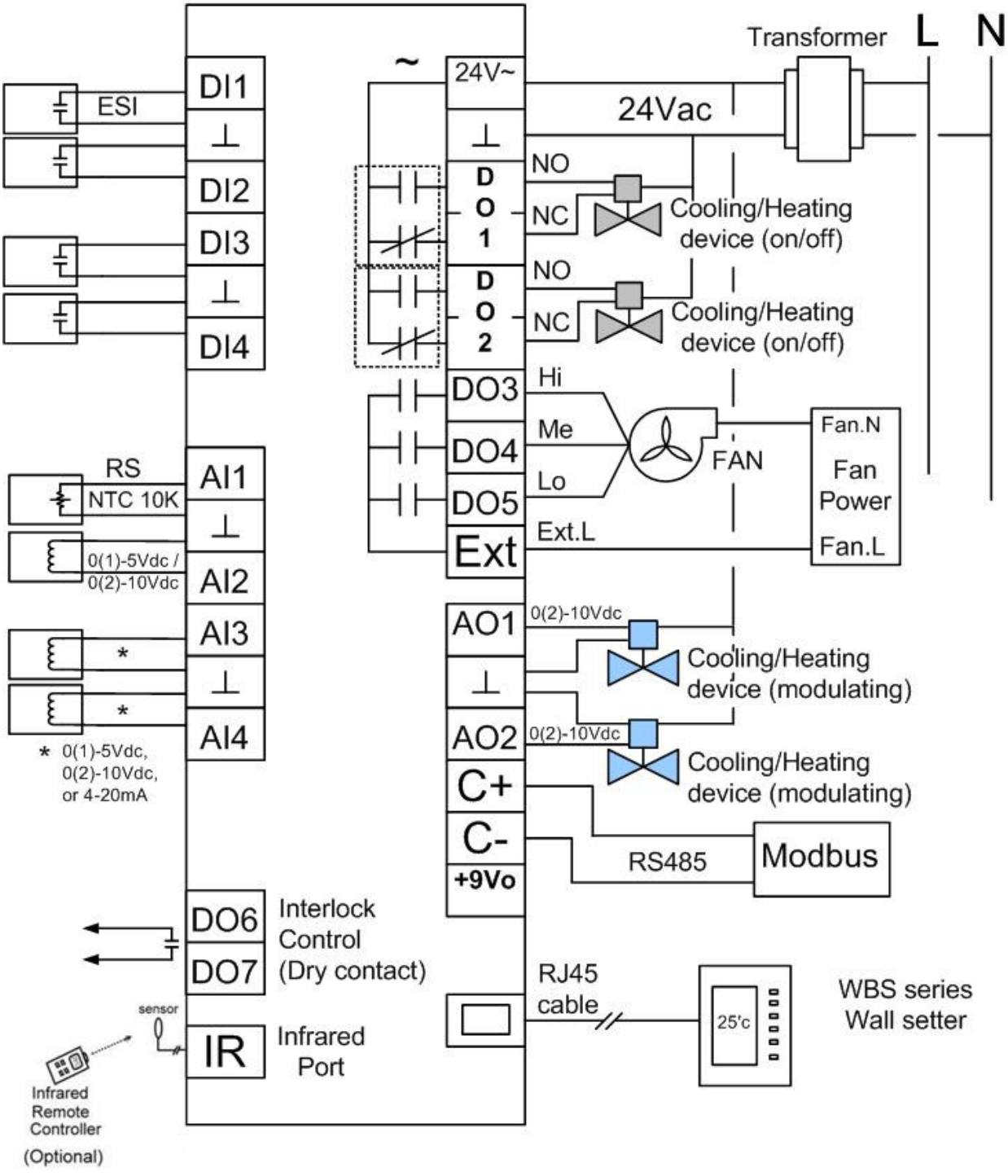
On/off and Modulating control outputs, 85~260VAC controller



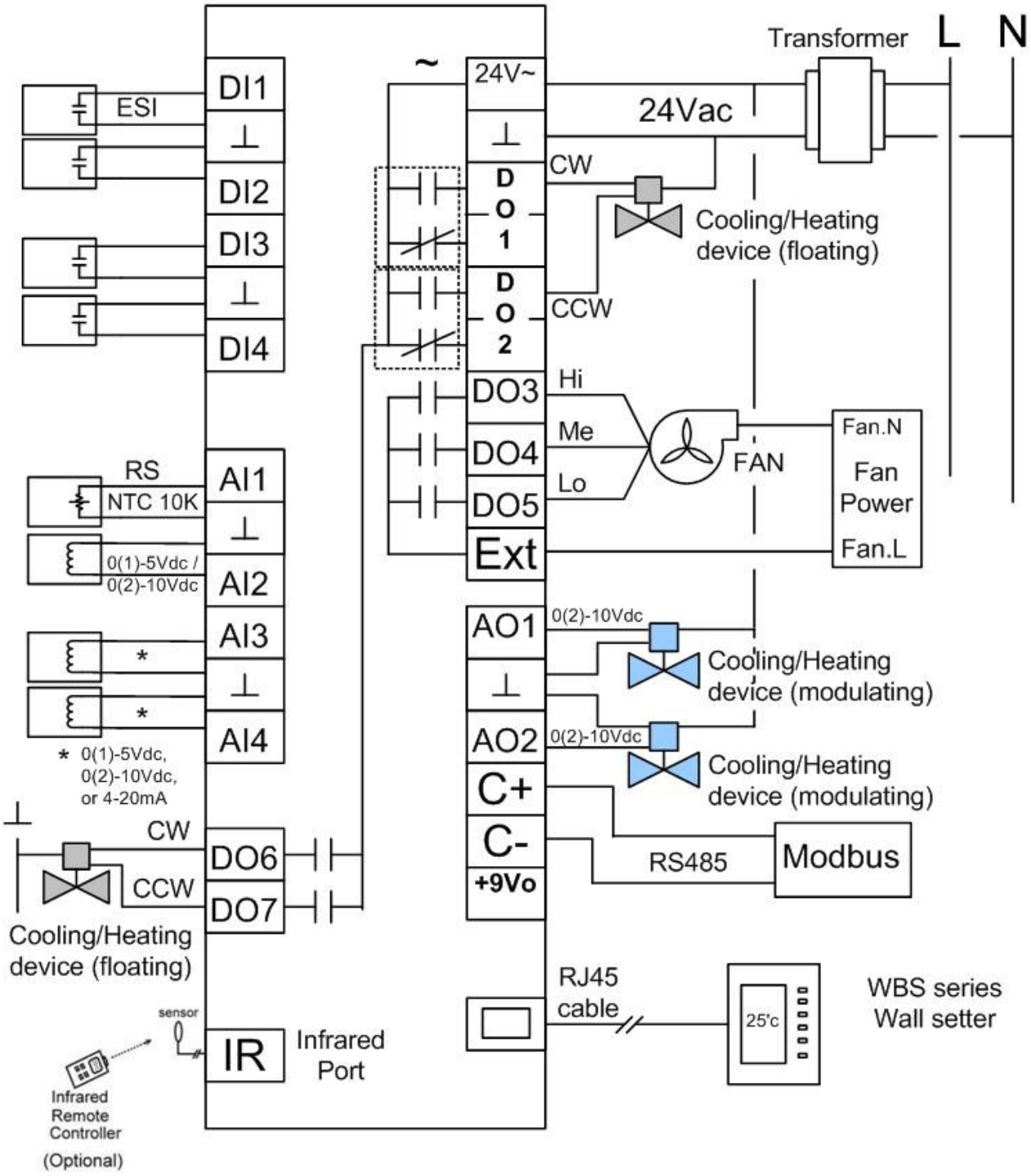
Floating and Modulating control outputs, 85~260VAC controller



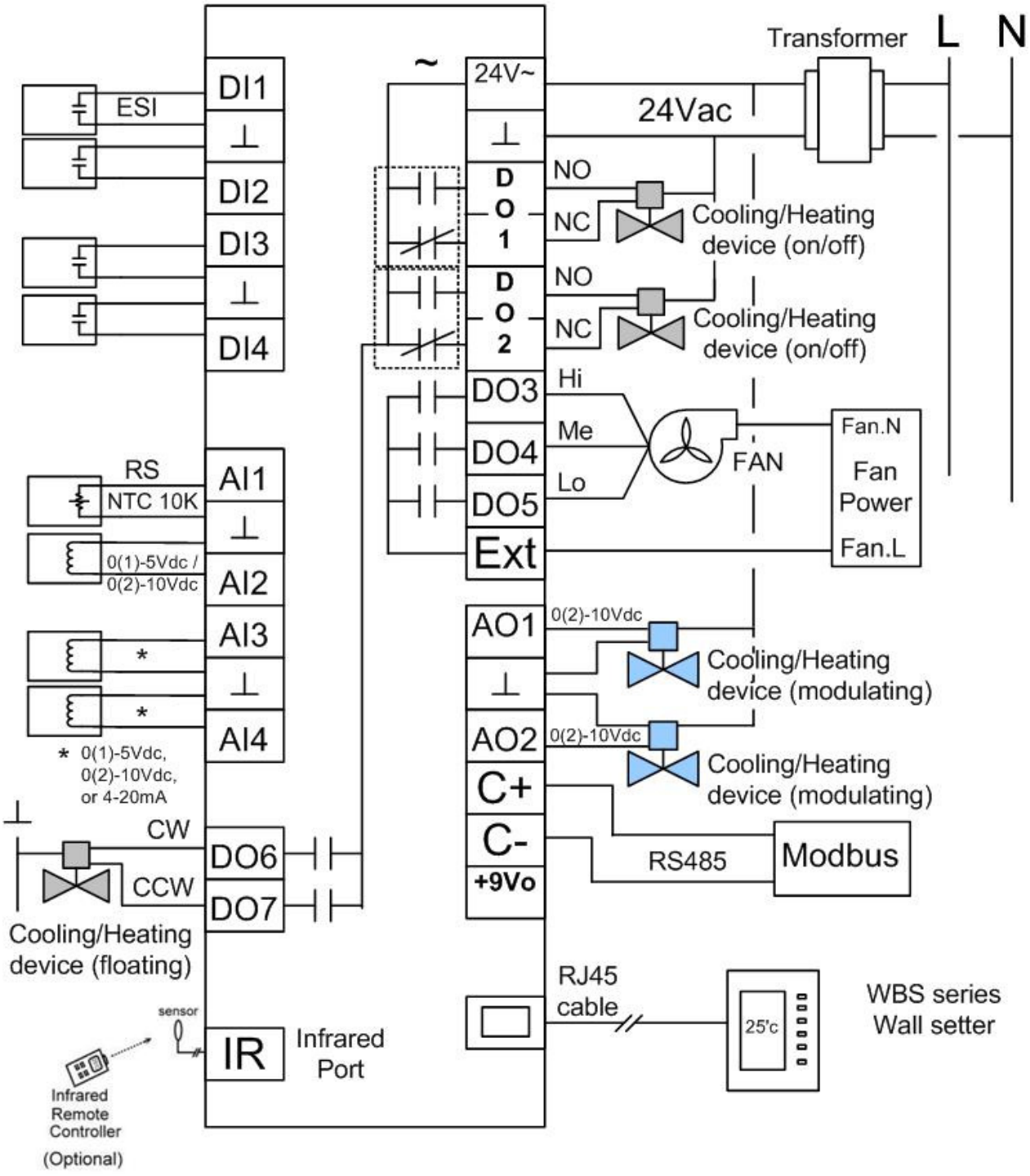
On/off, Floating and Modulating control outputs, 85~260VAC controller



On/off and Modulating control outputs, 24VAC Controller

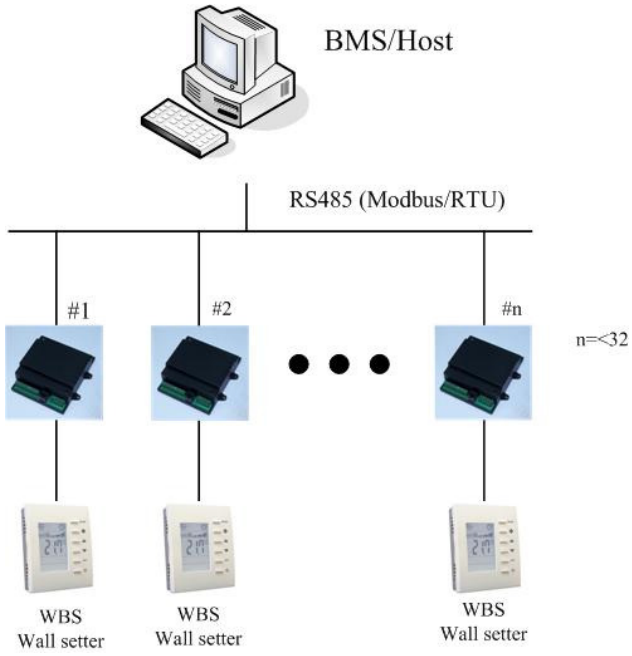


Floating and Modulating control outputs, 24VAC controller

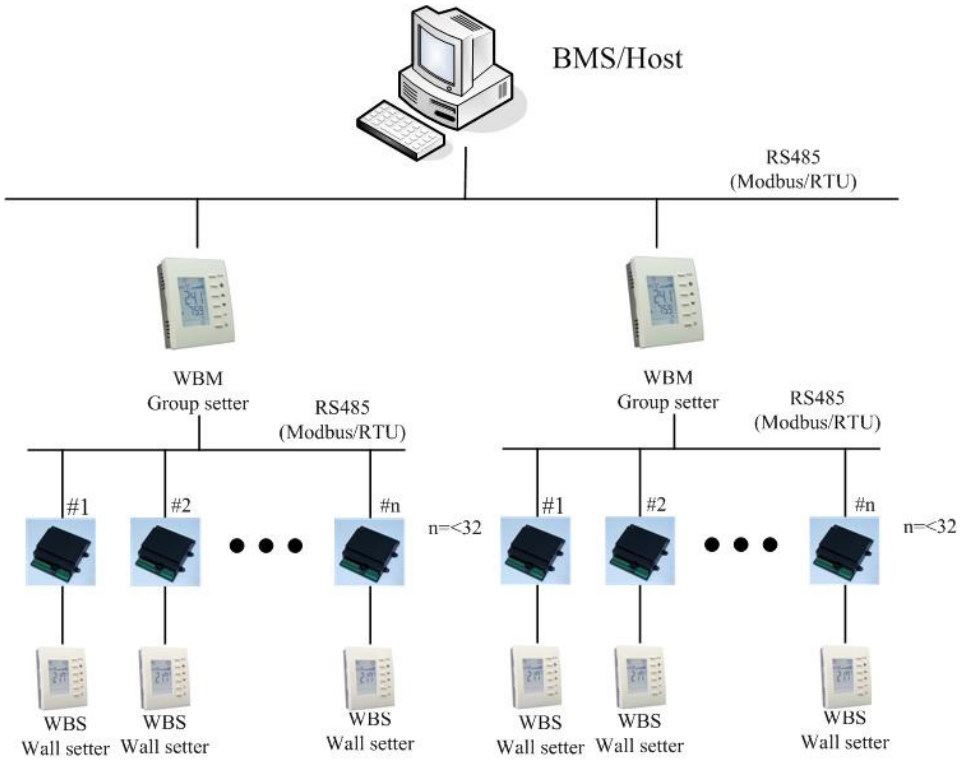


On/off, Floating and Modulating control outputs, 24VAC controller

SYSTEM CONNECTIONS



SHS controllers in grouping by BMS/Host directly



SHS controllers in grouping by WBM group setter

Photos

Dimensions:- 94×118×34 mm (W × H × D) LCD wall unit

WBS wall setter (optional)

WBM group setter (optional)

Dimensions:- 156×150x50 mm (W × H × D) Base unit

SHS900 Controller

1. Engineer mode menu item descriptions:

Item	Mnemonic	Description	℃ Type		℉ Type		Step
			Default	Range	Default	Range	
1	db	Deadband	4.0	0~10.0	7.0	0~18.0	0.5 (℃/℉)
2	ESIC	Unoccupied(ESI) cooling set point	28.0	25.0~30.0	82.0	77.0~86.0	1.0 (℃/℉)
3	ESIH	Unoccupied(ESI) heating set point	15.0	10.0~22.0	59.0	50.0~72.0	1.0 (℃/℉)
4	I-t	Integral Time and Output Cycle Time	90	10~500	90	10-500	10 (Sec.)
5	OP-L	Minimum output voltage in digital value for AO1 when reach Low limit	6(0V)	0~125	6(0V)	0~125	1 (LSB) (0.04V)
6	SPAn	Span Offset	-5(10V)	-55~0	-5(10V)	-55~0	1 (LSB) (0.04V)
7	SP-L	Low limit for temperature set point	10.0	0~50.0	50.0	32.0~122.0	1.0 (℃/℉)
8	SP-H	High limit for temperature set point	30.0	0~50.0	86.0	32.0~122.0	1.0 (℃/℉)
9	OFSt	Current temperature offset	0.0	-10.0~10.0	0.0	-18.0~18.0	0.1 (℃/℉)
10	Pb	Proportional band or stage width	2.0	0~10.0	4.0	0~18.0	0.1 (℃/℉)
11	diFF	Stage differential	0.5	0.1~1.0	0.9	0.1~1.8	0.1 (℃/℉)
12	LOC	Bit Definition --- bit 0: MODE button 1: Down buttons 2: Up button 3: FAN SPEED button 4: Power On/Off button 5: Local ESI contact detection 6: Door/Window detection 7: Not Used *Bit Value 0: Unlock / enable 1: Lock / disable Examples: 0- Unlock/enable all 1- Lock MODE Button 2- Lock Down Button 3- Lock MODE & Down Buttons 4-Lock Up Button 5- Lock MODE & Up Button … 8-Lock Fan SPEED Button … 15-Lock MODE & Down & Up & Fan SPEED Buttons 16-Lock Power Button … 32-Disable local ESI contact detection … 64-Disable Door/Window contact detection … 127- Lock/disable all	0	0-127	0	0-127	1

continued…

13	ESI	ESI contact definition	0	0~1	0	0~1	0: N.O. 1: N.C.
14	rE-C	Modulating Cooling direct/ reverse signal output	0	0-1	0	0-1	0 (direct) 1 (reverse)
15	rE-H	Modulating Heating direct/ reverse signal output	0	0-1	0	0-1	0 (direct) 1 (reverse)
16	rS **	Present Temperature is getting from built-in temperature Sensor, remote temperature sensor, or assigned through Modbus **	0	0~2	0	0~2	0: built-in 1: remote 2: assigned through Modbus
17	-SP-	Display present value of temperature or set-point for Normal Displaying	0	0-1	0	0-1	0: display PV 1: display SP
18	door	Door or Windows contact definition	0	0~1	0	0~1	0: Close 1: Open
19	LFAn	Lowest Fan speed	1	0~3	1	0~3	0: stop 1: low 2: Med. 3: Hi
20	baud	Baud rate	19.2	2.4 kbps 4.8 kbps 9.6 kbps 14.4 kbps 19.2 kbps 38.4kbps	19.2	2.4 kbps 4.8 kbps 9.6 kbps 14.4 kbps 19.2 kbps 38.4kbps	
21	Prty	Parity/ Data/ Stop bits	E81	E81 N81 N82 O81	E81	E81 N81 N82 O81	
22	id	Modbus Node ID	1	1~125	1	1~125	
23	Str	Stroke time of valve/actuator	110	10-1800	110	10-1800	10 (Sec.)
24	FanD	Fan Run on timer	120s	0-600s	120s	0-600s	10 (sec)
25	tESt	Self-Diagnostic					
26	rSt	Reset all parameters as factory defaults					
27	End	Exit Engineer Mode					

Note: "**" When the "rs" parameter is set as 2(present temperature is assigned by Modbus), if Modbus communication disconnects for more than 3 minutes, the present temperature will be changed to get from built-in temperature sensor automatically. I.e. The "rs" parameter will be automatically changed to 0 (present temperature is getting from built-in temperature sensor).