



UNIT CONTROLLER 8 (UC8) Operation Manual

Air-to-Air Units

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Issue: 4

Note: Information in this document applies to UC8 controllers programmed with software version 2.1.9

To find the UC8 software version:
Turn on mains power to the UC8 controller and observe the display.
First the display will show the characters "UC8", followed by the software version.

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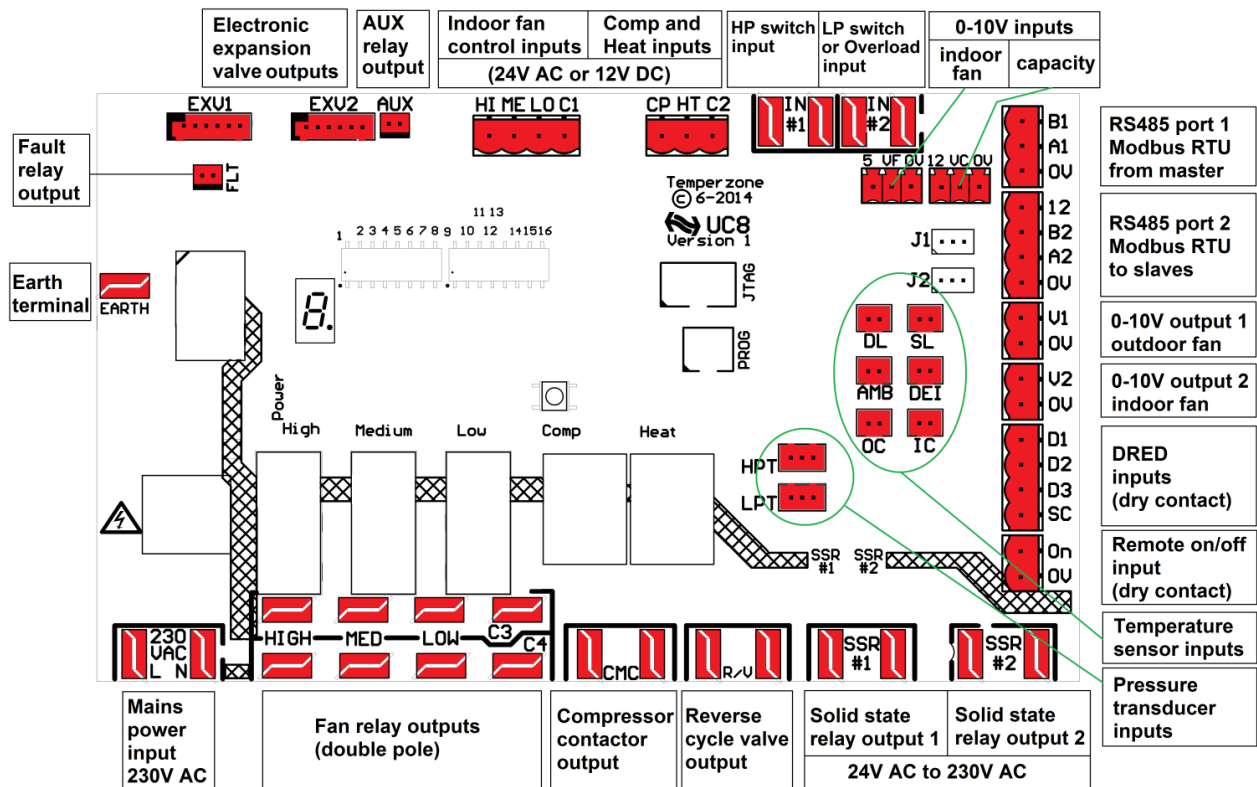
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1. Connections overview for air-to-air units

The drawing below shows typical connections for air-to-air units. Most units do not make use of all input / output signals.



2. Input and output signals

2.1. Mains power

Connect **230V AC** mains live to terminal **L**, neutral to terminal **N**, earth to terminal **EARTH**.

NOTE! The **EARTH** terminal on the UC8 controller board **MUST** always be **directly** connected to the unit earth stud.

2.2. Inputs and outputs summary

HI, ME, LO, CP and HT:	Control signal inputs, 24V AC or 12V to 24V DC
DL, SL, AMB, DEI, OC, IC:	Inputs for Temperzone standard temperature sensors
HPT, LPT:	Inputs for Temperzone standard pressure transducers
IN#1, IN#2, D1, D2, D3, On:	Control signal inputs, dry (voltage free) contact
VC, VF:	Control signal inputs, 0-10V analogue
A1, B1, A2, B2:	Communication ports, RS485 Modbus RTU
HIGH, MED, LOW, C3, C4:	Relay outputs, voltage free dry relay contacts
CMC, R/V:	Relay outputs, voltage free dry relay contacts
SSR#1, SSR#2:	Relay outputs, voltage free solid state contacts
V1 and V2:	Control signal outputs, 0-10V analogue
EXV1, EXV2:	Outputs for 12V DC uni-polar electronic expansion valves
AUX, FLT:	Outputs for 12V DC relay coils

Notes: The UC8 controller **cannot** accept 230V AC signals on any control input.
Terminals marked "0V" and "SC" are electrically directly connected to the EARTH terminal.

2.3. Temperature sensor inputs

Note: If pressure transducers connected to inputs HPT and LPT then coil temperature sensors are not required and inputs OC and IC can be left unconnected.

Connector	Function	Notes
DL	Compressor discharge line	Red
SL	Compressor suction line	White
AMB	Ambient	Yellow or black (not always required)
DEI	De-Ice (on fins of outdoor coil)	Blue (not required on cooling only units)
OC	Outdoor coil	Yellow (not always required)
IC	Indoor coil	Yellow (not always required)

2.4. Pressure transducers

Connector	Function	Default pressure range	Output voltage
HPT	High pressure	0 to 4500kPa (all models)	0.5 to 4.5V
LPT	Low pressure	0 to 3450kPa (all models)	0.5 to 4.5V

Some temperzone air conditioning models use high and low pressure switches instead of pressure transducers:

If the unit does not have a high pressure transducer then input IN#1 becomes an input for a high pressure switch.

If the unit does not have a low pressure transducer then input IN#2 becomes an input for a low pressure switch. Refer also to paragraphs 2.6 and 2.7.

2.5. Inputs HI, ME, LO, CP and HT

A thermostat or other controller that voltage-free relay contact outputs can be used to switch 24V AC or 12V to 24V DC signals to the following inputs:

CP	Compressor on/off
HT	Cooling / heating (leave unconnected for cooling-only installations)
HI – ME – LO	For a three-speed or variable speed indoor fan
HI	For a single-speed indoor fan
C1	Common for inputs HI, ME and LO.
C2	Common for inputs CP and HT.

Common inputs C1 and C2 should connect to the 24V AC Common (or to 0V when using 12V DC control signals). These inputs are electrically isolated from all other circuits.

2.6. Switch input IN #1

High pressure transducer	HP switch	What to do with the IN #1 terminals
Yes	No	Leave un-connected.
No	Yes	Connect to high pressure switch.

2.7. Switch input IN #2

Low pressure transducer	LP switch	Overload switch	What to do with the IN #2 terminals
Yes	No	No	Short circuit (loop).
Yes	No	Yes	Connect to overload switch (normally closed).
No	Yes	No	Connect to low pressure switch.

2.8. Remote On/Off

A remote on/off signal can be connected to the “On” and “0V” terminals (input for a voltage-free relay contact). To turn the unit **on** the remote on/off input must be **closed-circuit**.

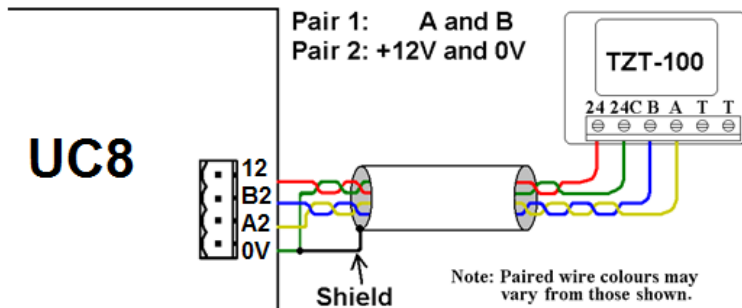
The remote on/off input cannot override the compressor minimum run-time of 90 seconds.

When the remote on/off input is used in combination with a SAT-3 or TZT-100 thermostat then refer to chapter 4.7: Thermostat auto-on/off options.

If no remote on/off function is needed then terminal On must connect to terminal 0V.

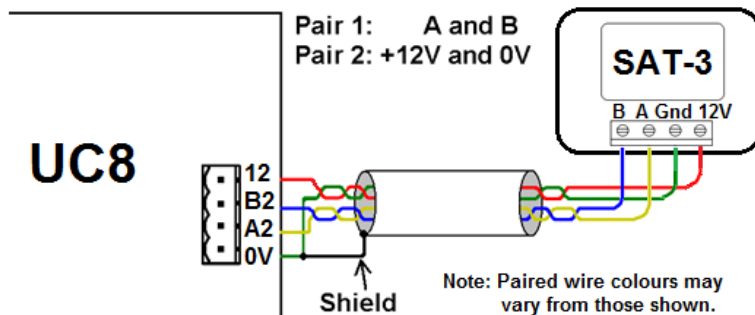
2.9. Digitally communicating thermostats: Temperzone TZT-100 and SAT-3

The UC8 controller can use RS485 serial communications to connect to a TZT-100 or SAT-3 thermostat. When the UC8 and TZT-100 or SAT-3 are communicating the thermostat display shows a small “satellite dish antenna” symbol:



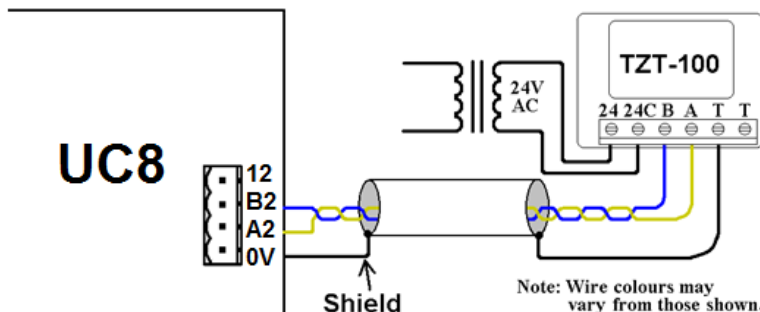
The UC8 provides 12V DC power on terminal “12” that can be used to power the thermostat. Terminal “0V” is ground return for the 12V DC power.

It is recommended to use a shielded cable with two twisted pairs for thermostat connections. Signals **A2** and **B2** must form one twisted wire pair.



If the cable length between the thermostat and the UC8 is greater than about 10m, and the UC8 is located at one end of the cable, then place jumper “J2” on the centre and left pins, otherwise place jumper “J2” on the centre and right pins.

The TZT-100 thermostat can also be powered by an **isolated** 24V AC power source as shown below:



In this case the 24V AC supply to the thermostat should NOT be connected to earth; otherwise differences in earth potential between the thermostat and the outdoor unit could lead to unreliable communications between the thermostat and the UC8.

Note: The SAT-3 thermostat **cannot** be powered with 24V AC!

2.9.1. TZT-100 thermostat DIP switch settings

The UC8 controller requires that DIP switch 4 inside the TZT-100 **must** be **ON**:

Reverse cycle valve ON when Heating

If TZT-100 DIP switch 4 is in the OFF position the UC8 will report fault code F36.

All other DIP switches inside the TZT-100 thermostat can be set as required for the installation.

2.9.2. Thermostat communication settings

The communications format must be set in accordance with Modbus RTU standard settings:

- Baud rate 19200
- 8 Data bits
- Even parity bit
- 1 Stop bit
- TZT-100 modbus device address 7
- SAT-3 modbus device address 8

For procedures to check and adjust the settings in the SAT-3 or TZT-100 thermostat refer to the thermostat installer manual.

2.9.3. Staging

Notes on using 1-stage and 2-stage settings on the TZT-100 and SAT-3 wall thermostats

1. When a TZT-100 thermostat is configured for 2-stage operation (thermostat DIP switch 3 ON) then this thermostat provides only an on/off signal for the indoor fan. In this configuration the TZT-100 cannot support 3-speed indoor fans. If a 3-speed indoor fan is used it will be operated on the high speed setting.
2. Configuring a TZT-100 or a SAT-3 thermostat for 2-stage operation when a unit has only 1 compressor has no effect on operation of the unit except that operation of the indoor fan can be affected as mentioned in note 1 above.
3. If a TZT-100 or SAT-3 wall thermostat is used to control a unit with 2 or more compressors then the UC8 controllers must be connected as one master and one or more slaves. Refer to chapter 3 for master and slave DIP switch settings.
4. For detailed information on capacity control in single- and staged- units refer to chapter 6: Capacity control.
5. For detailed information on wiring of staged units refer to chapter 11: Multiple compressor systems.

2.10. Electronic expansion valves

The UC8 can control:

- Up to 2 electronic expansion valves (EEV) without indoor unit controller (IUC).
- Up to 4 EEV when connected to one indoor unit with IUC.
- Up to 6 EEV when connected to two indoor units with IUC.

Electronic expansion valves must be 12V unipolar types. The connectors must be compatible with type XH (manufactured by JST) and have 6 pins.

UC8 DIP switches 9 and 10 select the expansion valve model:

9	10	Electronic expansion valve type	How to recognise the valve type
OFF	OFF	Dunan DPF series	removable black coil
ON	OFF	Zhe Jiang Sanhua DPF series	non-removable metal coil
OFF	ON	Carel E2V series (& E3V series with unipolar coil)	removable red coil
ON	ON	Reserved (do not select)	-

Below are images that can help to recognise the correct expansion valve used in the unit:



Dunan



Sanhua



Carel

For detailed information of all possible options for the expansion devices the UC8 provides refer to document “*Temperzone UC8 – Expansion device options for Air-to-Air units*”.

2.11. DRED inputs

DRED stands for Demand Reduction Enabling Device. The UC8 can be connected to a DRED, which typically is controlled by the electricity supplier.

When used, inputs D1, D2 and D3 should connect to a set of three voltage-free relay contacts as described in the DRED standard. The SC terminal is the common for the three inputs.

Note: Terminal SC is internally directly connected to ‘0V’ and ‘EARTH’.

DRED input functionality is as follows:

- Input D1 active: The compressor is switched off; the indoor fan is allowed to operate.
- Input D2 active: Average energy consumption of the unit is reduced by 50% (approximately).
- Input D3 active: Average energy consumption of the unit is reduced by 25% (approximately).

When DRED is not used then inputs D1 and D2 can be used for alternate functions. For more information refer to chapter 0: Quiet Mode, chapter 0: Dry Mode and chapter 3: DIP switch settings.

2.12. 0-10V Analogue control input VC

Units with a digital scroll- or variable speed- compressor are capable of variable capacity (duty). The following sources are available for capacity control:

- UC8 0-10V analogue input **VC**
- Autonomous in combination with the TZT-100 thermostat, SAT-3 thermostat or Zone controller
- Modbus RTU serial communications (UC8 terminals **A1, B1**)
- Indoor unit controller (IUC) 0-10V analogue inputs **V+**, **V-**
- Autonomous when the UC8 is configured for supply-air temperature control

Notes:

- UC8 0-10V input VC is directly referenced to unit earth, it is not electrically isolated.
- Terminal “0V” is the reference (return) connection for input VC, this terminal directly connects to the controller EARTH terminal.
- If the 0-10V control signal source is located remotely from the unit then it may be necessary to use a 0-10V isolating amplifier.

When input VC is used for capacity control then capacity varies linearly with the control voltage. 0V represents 0% (no duty), 10V represents 100% (nominal rated duty, digital scroll compressor), 7.5V represents 100% (nominal rated duty, variable speed compressor).

Note: The UC8 controller imposes a minimum capacity and, for variable speed compressors, normally also sets a nominal capacity. Note also that input VC cannot be used to switch the compressor on and off. For more information refer to chapter 6: capacity control.

2.13. 0-10V Analogue control input VF

The following options are available for control of the indoor fan speed:

- UC8 inputs **HI, ME, LO** (24V AC / 12V to 24V DC)
- UC8 0-10V input **VF**
- Indoor unit controller (IUC) inputs **Hi, Me, Lo**
- TZT-100 thermostat or SAT-3 thermostat
- Modbus RTU serial communications over RS485 (UC8 terminals **A1, B1**).
- External fan control (independent of the UC8)

Notes:

- 0-10V input VF is directly referenced to unit earth, it is not electrically isolated.
- Terminal “0V” is the reference (return) connection for input VF, this terminal directly connects to the controller EARTH terminal.
- If the 0-10V control signal source is located remotely from the unit then it may be necessary to use a suitable 0-10V isolating amplifier.

The above is valid for all types of indoor fans: single-speed, three-speed or variable-speed (EC fan, plugfan). For more details on indoor fan speed control refer to chapter 4.9: Indoor fan control.

2.14. Relay outputs CMC and R/V

The two terminals labelled CMC are one set of normally-off relay contacts, fully isolated from all other circuits (voltage-free). The same applies to terminals labelled R/V.

Normally the CMC output is used to control a compressor contactor while the R/V output is used to control a reverse cycle valve. On units with a variable speed compressor contacts CMC are normally not used. On cooling-only units contacts R/V are normally not used.

The refrigeration circuit must be designed with reverse cycle valve OFF for cooling mode, ON for heating mode.

2.15. Relay outputs SSR1, SSR2 and AUX

Digital scroll compressor	SSR1	SSR2	AUX
No	Crank case heater	No function	On status
Yes	Crank case heater	Modulating valve	On status

The “On status” output is active when one or more of the following conditions apply:

- The compressor is on.
- The indoor fan is on.
- The compressor and indoor fan are currently off but the thermostat is on, i.e. the unit is off in deadband, or the compressor may be held off by an internal safety timer or by a protection function.

2.16. Relay outputs HIGH, MED and LOW

Terminals labelled HIGH, MED and LOW connect to three double-pole normally-off relay contacts. Terminal C3 is the common terminal for the upper row of terminals.

Terminal C4 is the common for the lower row of terminals. The two sets of contacts are voltage free and fully isolated from all other circuits.

These terminals can be assigned a number of functions. The tables below list the available combinations:

Packaged unit (or a split unit without IUC)				
Fan type		UC8 Relay function		
Outdoor	Indoor	HIGH	MED	LOW
Single speed	Single speed	Indoor fan on / off	Outdoor fan on / off	-
0-10V EC	Single speed	Indoor fan on / off	Outdoor fan contactor*	-
Single speed	0-10V EC	Indoor fan contactor*	Outdoor fan on / off	-
0-10V EC	Three speed	Indoor fan high	Indoor fan medium	Indoor fan low
Three speed	0-10V EC	Outdoor fan high	Outdoor fan medium	Outdoor fan low
Three speed	Three speed	Not available on packaged units.		
Three speed	Single speed			
Single speed	Three speed			

Split unit with IUC in the indoor unit			
Fan type	UC8 Relay function		
Outdoor	HIGH	MED	LOW
Single speed	-	Outdoor fan on / off	-
0-10V EC	-	Outdoor fan contactor*	-
Three speed	Outdoor fan high	Outdoor fan medium	Outdoor fan low

UC8 DIP switches 3 and 4 select the type of outdoor fan.

DIP switches 5 and 6 select the type of indoor fan, if the indoor fan is controlled by the UC8. Refer to chapter 3: DIP switch selections.

*** Note:**

A relay output configured as a contactor can be used to switch mains power to a 0-10V EC fan. In this case the relay switches on as soon as the fan needs to start (or even when the fan may need to start). The relay switches off 30 seconds after the fan has stopped and no longer needs to operate. If this function is not required then the relay output can be left unused (not connected).

3. DIP switch selections

DIP switch functions for switches 1 to 13.

DIP switch		Function
1		Indoor air flow (refer to chapter 4.9: Indoor fan control and chapter 8 Dry mode)
OFF		Variable indoor air flow: Indoor fan performs a warm start when unit starts heating. Indoor fan stops during de-ice cycles. Indoor fan speed may vary from thermostat request.
ON		Fixed indoor air flow: Indoor fan follows thermostat request even when heating starts. Indoor fan continues during de-ice cycles. Indoor fan speed follows thermostat request.
2		Compressor type (option “dF”, refer to chapter 4.3: Compressor model selection)
OFF		Fixed capacity
ON		Digital scroll
3	4	Outdoor fan selection
OFF	OFF	Three speed fan HIGH/MED/LOW relay outputs
ON	OFF	One speed fan MED relay output
OFF	ON	0-10V EC fan V1 output
ON	ON	Reserved Do not select
5	6	Indoor fan selection, when the UC8 directly controls the indoor fan
OFF	OFF	Three speed fan HIGH/MED/LOW relay outputs
ON	OFF	One speed fan HIGH relay output
OFF	ON	0-10V EC fan V2 output
ON	ON	Reserved Do not select
5	6	Indoor fan speed range selection for split units with IUC (no SAT-3 thermostat) (refer to chapter 4.9: Indoor fan control)
OFF	OFF	Indoor fan speed range is set by DIP switches on the IUC.
ON	OFF	Indoor fan speed range is set by the “H” and “L” fan speed setup modes on the UC8.
OFF	ON	Reserved Do not select
ON	ON	Reserved Do not select
7	8	Electronic expansion valve operating mode
OFF	OFF	Mode 0: No electronic expansion valves (accurators, capillary tube)
ON	OFF	Mode 1: One valve or two electronic expansion valves connected in parallel
OFF	ON	Mode 2: Series valve connection, one valve at the indoor coil, the second valve at the outdoor coil
ON	ON	Mode 3 (default): Dual valves and split indoor coil. <u>Only select on units suitably equipped.</u>
ON	ON	Modes 4 to 8: Refer to chapter 4.8.

Continued on the next page.

DIP switch		Function
9	10	Electronic expansion valve type
OFF	OFF	Dunan DPF series
ON	OFF	Zhe Jiang Sanhua DPF series
OFF	ON	Carel E2V series and E3V series with uni-polar coil
ON	ON	Reserved, do not select
11	12	System number
OFF	OFF	1 master system also select this for single compressor units
ON	OFF	2 first slave system
OFF	ON	3 second slave system
ON	ON	4 third slave system
13		Reserved
		For air-to-air units DIP switch 13 MUST be set to OFF.
14		Close control option, refer to chapter 6: Capacity control
OFF		Close control disabled, minimum unit capacity is (percentage of nominal capacity):
		<ul style="list-style-type: none"> • Fixed capacity compressor 100% • Digital scroll compressor 40% • Variable speed compressor (inverter) 40%
ON		Close control enabled, minimum unit capacity is:
		<ul style="list-style-type: none"> • Fixed capacity compressor 100% • Digital scroll compressor 16% • Variable speed compressor (inverter) 21%
15		Dry mode option (* note)
OFF		Disabled
ON		Enabled (D2 input).
16		Quiet mode option (* note)
OFF		Disabled
ON		Enabled (D1 input).

*** Note:**

If the unit is connected to a communicating BMS, a TZT-100 thermostat, a SAT-3 thermostat or an indoor unit controller (IUC) then Quiet and Dry modes are selectable via these items and inputs D1 and D2 will retain their normal function for a demand reduction enabling device (DRED), regardless of DIP switch settings.

4. UC8 special modes

The UC8 offers a number of modes that allow the factory, installer and service technician to make some changes to the operation of the UC8.

UC8 special modes are selected as follows:

- Apply power to the unit and wait until the power-on sequence is completed.
- The compressor must be off and there must be no request to start (CP signal or thermostat must be OFF, no Modbus RTU or BACnet/IP run request).
- Hold down pushbutton SW3 until the display shows the specific letter for the required configuration mode, then release the button.
- The selected mode starts immediately after the button is released. During the configuration mode use the display and push button to make changes to the settings of the UC8.
- The configuration mode automatically ends when the push button has not been pressed for 30 seconds. Exceptions are commissioning mode which lasts up to 30 minutes, and forced de-ice mode which lasts until ice has been successfully removed from the outdoor coil (maximum 10 minutes).
- When a setting has been changed during a configuration mode, then the controller saves the change in memory which is kept even when power is switched off. Thus changes need to be made only once.

UC8 special modes are:

Special mode	Displayed symbol	Chapter
Test	t	4.1
Commissioning	c	4.2
EC indoor fan high speed adjustment	H	4.9
EC indoor fan low speed adjustment	L	
Modbus device address selection	A	* Note
Compressor model selection	E	4.3
Force an outdoor coil de-ice cycle	d	9.3
Supply-air temperature control selection	Y	4.4
Shared outdoor fan chamber selection	J	4.5
Modbus baud rate selection	b	* Note
Modbus parity and stop bit selection	P	
Thermostat auto-on/off selection	o	2.8 and 4.7
Expansion device configuration selection	n	2.10 and 4.8
Capacity boost mode limiting selection	u	4.9 and 6.4
Outdoor EC fan maximum speed selection	≡	

For detailed information on the special modes refer to the chapters listed in the table above.

* Note: Refer to document *Temperzone UC8 – Modbus communications*.

4.1. Test mode

To activate test mode hold down pushbutton SW3 until the display shows the letter 't', then release the button. During test mode following outputs are activated one by one in the order indicated below with a brief pause between each step:

- R/V
- Outdoor fan low (7s) - medium (7s) – high (15s)
- Indoor fan low (7s) - medium (7s) – high (15s)
- SSR1
- SSR2
- AUX
- CMC

If the unit has high and low pressure transducers then the pressure readings from the two sensors is compared before test mode completes. The two pressure readings are expected to be approximately equal. If the two pressure readings are found to be very different then fault F34 will be reported. The pressure comparison is then repeated every 60 seconds; the fault is cleared when pressures have equalised sufficiently.

When the test sequence is complete the UC8 returns to normal mode and the display will show a blinking decimal point or the suction line pressure (letters SLP followed by the pressure in kPa).

4.2. Commissioning mode

To activate commissioning mode hold down pushbutton SW3 until the display shows the letter 'C', then release the button.

Commissioning mode starts immediately and ends automatically after 30 minutes. It is also possible to manually end commissioning mode either by cycling mains power off and on again, or by pressing the pushbutton again until the display again shows the letter 'C' and then release. When commissioning mode ends the controller returns to normal operating mode.

During commissioning mode some delay times are reduced:

- Minimum On-Off time ('Run'-time) 20 seconds (* **note**)
- Minimum Off-On time ('Off'-time) 20 seconds
- Minimum On-On time ('Cycle'-time) 1 minute
- Cool to heat change-over time 1 minute
- Heat to cool change-over time 1 minute
- De-ice mode hold-off time 3 minutes

*** Note:**

If the unit has a variable speed compressor then the Minimum On-Off time ('Run'-time) remains set to 1 minute and 30 seconds regardless whether the controller is placed in commissioning mode or not.

4.3. Compressor model selection

To select the compressor model hold down push button SW3 until the display shows the letter 'E', then release the button. The UC8 supports the following compressor types, models and variable speed drives:

Compressor	Drive	UC8 display indication	DIP switch 2 setting
Fixed capacity	Not required	dF	Off
Digital scroll			On
Copeland ZPV038	Carel Power+ PSD1024400	038	-
Toshiba DA550	Carel Power+ PSD1018400 or PSD1024400	550	
Siam ANB66	Carel Power+ PSD1024400	66	-
Siam ANB78	Carel Power+ PSD1024400 or PSD1035420	78	-
Siam ANB87	Carel Power+ PSD1035420	87	-
Copeland ZPV063	Emerson CSD100	063	-
Other inverter	Type with 0-10V input	010	-

When mains power is applied to the controller the UC8 display shows the selected compressor. The default setting is for fixed capacity- and digital scroll- compressor (option 'dF').

4.3.1. Carel Power+ configuration

The four DIP switches inside the Power+ compressor drive (inverter) must be set as follows:

- 1 and 4 ON
- 2 and 3 OFF

To access the Power+ DIP switches the plastic front cover must be carefully removed.

The UC8 takes care of other drive configurations via RS485 Modbus communications.

4.3.2. Emerson CSD100 configuration

The Emerson CSD100 (M600) compressor driver (inverter) must be programmed as follows:

- Modbus device address 1 (CSD100 parameter 11.023, value 1, factory default)
- Communication rate 19200 baud (CSD100 parameter 11.026, value 6)

The UC8 takes care of other driver configurations via RS485 Modbus communications.

4.4. Supply-air temperature control option

Units with a digital scroll compressor or a variable speed (inverter) compressor can provide automatic control of the supply-air temperature. To configure for supply-air temperature control hold down pushbutton SW3 until the display shows the letter 'Y', then release the button. The display will then show 0 or 1. Use the pushbutton to select the desired configuration:

- **0** : Disable supply-air temperature control (default value)
- **1** : Enable supply-air temperature control

When supply-air temperature control is enabled:

- Split units with an indoor unit controller (IUC) and a supply-air temperature sensor connected to IUC input T5 use the reading from this sensor to achieve a controlled supply-air temperature.
- Split units without an IUC and packaged units do not directly measure the supply-air temperature. On these systems the controller will regulate evaporating temperature (when cooling) or condensing temperature (when heating).

4.5. Multiple compressor reverse cycle system with shared outdoor fan chamber

The UC8 controller can be configured for use on reverse cycle units with multiple compressors where the outdoor fans and outdoor coils of the refrigeration circuits share one common chamber. **This procedure needs to be followed only on the master UC8 controller.**

The UC8 controllers in the system **must** be configured and connected in master and slave fashion, refer to section 11.90 for the correct connections. DIP switches 11 and 12 must be set to designate one UC8 board as the system master and other UC8 board(s) as slave(s) (refer to section 0).

To configure the master UC8 controller for units with shared outdoor fan chamber hold down pushbutton SW3 until the display shows the letter 'J', then release the button. The display will then show 0 or 1. Use the pushbutton to select the correct configuration:

- **0** : for units with individual outdoor fan chambers (default value)
- **1** : for units with shared outdoor fan chambers

Notes:

1. Re-configuration is not required for cooling-only units.
2. Re-configuration is not required in warm climates where the outdoor coil never forms any ice.
3. ***Incorrect configuration can cause problems in applications where outdoor coil de-icing is required!***
4. If controllers in a multiple compressor system are connected as master and slave(s) but the unit has individual outdoor fan chambers (NOT a shared outdoor fan chamber) then re-configuration for shared outdoor fan chamber is **not recommended** as it may cause reduced heating performance during cold days.
5. If controllers in a multiple compressor system are not connected in master-slave fashion then setting the outdoor fan chamber configuration to 0 or 1 has no effect.

4.6. Modbus device address, communication baud rate and parity bit selection

Refer to document “*Temperzone UC8 – Modbus communications*”.

4.7. Thermostat auto-on/off options

The UC8 can be configured to automatically switch the SAT-3 and TZT-100 thermostat on and off synchronised with the remote on/off input terminal of the UC8 circuit board. To enable or disable this feature hold down pushbutton SW3 until the display shows the letter ‘**O**’, then release the button. The display will then show 0, 1 or 2. Use the pushbutton to select the desired option:

- **0** : Thermostat automatic on/off is disabled (default).
- **1** : Thermostat automatic on/off is enabled.
- **2** : Thermostat automatic on/off is enabled, the unit automatically starts in cooling mode every time the UC8 remote on/off signal changes from off to on.

Option 0 (default):

The auto-on/off feature is disabled. This means that a SAT-3 or TZT-100 thermostat that is switched on can show that a unit is active (cooling, heating or fan-only) even when the unit is actually off because the UC8 remote on/off terminal is made inactive (open-circuit).

Option 1* :

The thermostat shows the actual state of the unit. In this case when a thermostat is on and the UC8 remote on/off signal becomes inactive (open circuit) the thermostat is automatically switched off. While the UC8 remote on/off signal remains inactive the thermostat is held off, pressing the thermostat on/off button is overruled by the UC8 off-command. When the UC8 remote on/off signal becomes active again then the thermostat resumes operation with the same settings that were valid when last active.

Option 2:

This mode is to be used only for **cooling-only** installations; it is unsuitable for installations that also require operation in heating mode. The thermostat is forced to remain off when the UC8 remote-on/off input is inactive. When the UC8 remote on/off signal becomes active the thermostat is automatically switched on in cooling mode.

*** IMPORTANT note for option 1:** If power is removed from the unit while the unit is switched off by the remote on/off signal, then the thermostat will power up in the OFF-state. *The unit will NOT resume operation in the last active mode!* If it is essential that the unit must always come back on after a power-cut then the unit must be configured for option 0 (feature disabled) or option 2 (cooling starts automatically).

4.8. Expansion device options

The UC8 can be used in units with:

Accurators at the indoor- and outdoor coils.

Up to 2 electronic expansion valves (EEV) without indoor unit controller (IUC).

Up to 4 EEV when connected to one indoor unit with an IUC.

Up to 6 EEV when connected to two indoor units each with an IUC.

Selected combinations of accurators and EEV.

Important: To ensure proper operation of the unit the correct expansion device mode must selected.

Mode	Expansion device		Packaged units	Split units (no IUC)	Split units (with IUC)
	Outdoor coil	Indoor coil			
0	Accurators	Accurators	●	●	●
1	One EEV or two EEV connected in parallel (*)		●	●	●
2	EEV	EEV (*)	●	●	●
3	Two EEV & split indoor coil, each coil half connects to one EEV (*)		●	●	●
4	One EEV or two EEV connected in parallel	Accurators	●	●	●
5	One EEV or two EEV connected in parallel	One EEV or two EEV connected in parallel	-	-	●
6	One EEV or two EEV connected in parallel	Two EEV & split indoor coil, each coil half connects to one EEV	-	-	●
7	Accurators	One EEV or two EEV connected in parallel	-	-	●
8	Accurators	Two EEV & split indoor coil, each coil half connects to one EEV	-	-	●

* **Note:** EEV mounted in the outdoor unit.

Refer to **appendices B and C** to view the supported options in graphical form.

4.8.1. Selecting the expansion device mode

Mode	DIP switch		Notes
	7	8	
0	OFF	OFF	-
1	ON	OFF	-
2	OFF	ON	-
3, 4	ON	ON	Can be used on packaged and split units, with and without IUC.
5 to 8			Can be used only on split units with an IUC in the indoor unit.

Factory default setting when DIP switches 7 and 8 are ON is **mode 3**.

To select expansion device modes 4 to 8 follow this procedure:

- Set DIP switches 7 and 8 to ON, then switch on mains power to the controller and wait until the display shows a flashing decimal point.
- Hold down pushbutton SW3 until the display shows the letter 'O', then release the button.
- The display will show the currently selected expansion device mode: a number from 3 to 8.
- Subsequent presses of the pushbutton changes the mode number one step at a time.
- When the required mode has been selected wait 30 seconds. The controller will save the selected mode in non-volatile memory and the controller will make an automatic restart.

4.9. Capacity boost mode options

Refer to chapter 6.4.

5. Indoor fan control

The following inputs are available for control of the indoor fan:

- Modbus RTU serial communications via RS485
 - SAT-3 or TZT-100 or HL2028 thermostat or 6-Zone controller
 - UC8 controller inputs HI, ME, LO (24V AC / 12V to 24V DC)
 - UC8 controller input VF (0-10V)
 - Indoor unit controller (IUC) inputs Hi, Me, Lo
 - External control, independent of the UC8 controller (refer to note)
- If Modbus RTU fan control is used then all other control options are disabled. For more information refer to document "*Temperzone UC8 - Modbus communications*".
 - If control is by SAT-3 or TZT-100 thermostat or 6-Zone controller then the remaining input options are disabled.
 - If the unit is not controlled using Modbus RTU, or by SAT-3 or TZT-100 thermostat, or 6-zone controller then the UC8 selects the input that requests the highest indoor fan speed.

Note:

Some installations do not permit indoor fan speed to vary from the requested speed at any time. For such installations the indoor fan can be controlled directly by an external controller or the fan may be hardwired to run at a constant fixed speed.

If the UC8 (or indoor unit controller, IUC) is not used to control the indoor fan then it is the responsibility of the system- designer and -installer to ensure proper and safe operation of the indoor fan, and the system as a whole, under all operating conditions.

5.1. Variable-speed (EC) indoor fan speed adjustment

The UC8 can provide a 0-10V control signal for a variable speed indoor fan on terminal V2.

Factory default settings for the voltage on terminal V2 are:

Off	0V
Low	5V
Medium	6.5V
High	8V

For most installations the factory default values provide an adequate range of indoor airflow, present a low risk of frost on the indoor coil, low risk of water carry-over and provide low fan noise.

Adjusting indoor fan speed control voltages

Three possibilities exist:

- (1) If the UC8 connects to a SAT-3 room thermostat then use the fan speed adjustment modes provided by the SAT-3 thermostat. Refer to the SAT-3 installer manual.
- (2) If the UC8 does not connect to SAT-3 room thermostat and is a split system with an indoor unit controller (IUC) in the indoor unit, then normally the indoor fan speed settings are set by the DIP switches on the IUC. Refer to document "Temperzone IUC operation manual". However, if it is inconvenient to adjust the indoor fan speed settings at the indoor unit (e.g. there is limited access to the indoor unit) then it is possible to overrule the IUC DIP switch settings by setting UC8 DIP switch 5 to ON, then restart the UC8 controller. The fan speed adjustment procedure as described below will then apply.
- (3) If the UC8 does not connect to SAT-3 room thermostat and is a packaged unit the fan speed adjustment procedure as described below applies.

To adjust the fan high speed setting:

Hold down pushbutton SW3 until the display shows the letter "H", then release the button. The UC8 enters "fan high speed setup mode". Output V2 will provide 8V and the indoor fan will run accordingly; the display will show "8.0".

Use pushbutton SW3 to change the voltage from 3.0V to 10.0V in steps of 0.5V.

When the desired fan high speed has been set then wait 30 seconds, the controller saves the selected setting.

To adjust the fan low speed setting:

Hold down pushbutton SW3 until the display shows the letter "L", then release the button. The UC8 enters "fan low speed setup mode". Output V2 will provide 5V and the indoor fan will run accordingly; the display will show "5.0".

Use pushbutton SW3 to change the voltage anywhere from 1.0V to 8.0V in steps of 0.5V.

When the desired fan low speed has been set then wait 30 seconds, the controller will save selected setting.

Notes:

1. Fan off voltage is always 0V.
2. Fan medium speed voltage is always halfway between the low and high control voltages.
3. If a high speed control voltage is selected that is lower than the current setting for low speed, then the low voltage becomes equal to the high speed voltage.
4. If a low speed control voltage is selected that is higher than the current setting for high speed then the high voltage becomes equal to the low speed voltage.
5. It is allowed to select a low speed voltage that is equal to the high speed voltage.
6. In cases 3, 4 and 5 as outlined above effectively the fan operates as a single-speed fan at the selected control voltage.

When changing the indoor fan speed control voltages care must be taken as follows:

- Some EC fan controllers may not start the fan when the low speed control voltage is set to less than 2.0V. A minimum of 2.0V is recommended for the low speed control voltage to ensure the indoor fan always starts.
- To reduce risk of nuisance frost protection trips and potential unit lock-out avoid fan speeds so low that the evaporating temperature can fall below 0°C (cooling mode).
- To reduce risk of water leaking from supply air vents and diffusers and corrosion of ducting avoid fan speeds so high that condensed moisture may be blown off the fins of the indoor coil.
- Avoid fan speeds so high that the unit may ‘over-condense’ (heating mode) which could possibly lead to extra outdoor coil de-ice cycles (resulting in reduced duty and efficiency).

5.2. Translation from 0-10V fan control input signal VF to a fan output signal

Input VF on the UC8 can be used for a 0-10V control signal for the indoor fan. This input can be used for all fan types (single-speed, three-speed and variable-speed).

Variable-speed indoor fan:

The UC8 does **not** simply copy the input voltage to the output voltage; instead the input voltage is **translated** to a corresponding output voltage that obeys the settings programmed into the UC8. Translation from 0-10V input VF to a voltage on output V2 is as follows, assuming the default settings of 5V to 8V:

Input VF	Output V2	Fan
0.0V to 0.99V	0V	Off
1.0V to 1.49V	0 or 5V	Off or Low (hysteresis zone)
1.5V to 9.50V	5V to 8V	Low to high
9.5V to 10.0V	8V	High

The hysteresis zone reduces the chance of repeated starting and stopping of the fan. To change the minimum and maximum voltage settings follow the procedure described in chapter 0.

Three-speed indoor fan:

The 0-10V input signal VF is converted to Off – Low – Medium - High speed as follows:

Input VF	Fan
0.00V to 0.99V	Off
1.00V to 1.49V	Off or Low (hysteresis zone)
1.50V to 3.70V	Low
3.71V to 4.60V	Low or Medium (hysteresis zone)
4.61V to 6.80V	Medium
6.81V to 7.70V	Medium or High (hysteresis zone)
7.71V to 10.0V	High

The hysteresis zones reduce the chance of “chattering” relays.

Single-speed indoor fan:

The 0-10V input signal VF is converted to Off-On as follows:

Input VF	Fan
0.0V to 0.99V	Off
1.0V to 1.49V	Off or On (hysteresis zone)
1.5V to 10.0V	On

The hysteresis zone reduces the chance of repeated starting and stopping of the fan.

5.3. Translation from Modbus RTU fan control signal to a fan output signal

Refer to document “*Temperzone UC8 - Modbus communications*”.

6. Capacity control

Temperzone units use three types of compressors: fixed duty, digital scroll and variable speed (inverter). A unit with a digital scroll- or a variable speed compressor is capable of variable duty.

6.1. Minimum and maximum capacity

Some differences exist between available capacities, capacity rating point and capacity control values. The table below provides details:

- Top entry: Unit capacity as a percentage of nominal (rated) capacity.
- Middle entry: UC8 input VC 0-10V control voltage.
- Bottom entry: Value to write via Modbus RTU (0 to 100).

Compressor type	Capacity				
	Minimum, close control	Minimum, zoned system	Minimum, standard ctrl.	Nominal (rating)	Boost
Fixed duty	100%				
			-		
			-		
Digital scroll	16% 1.6V 16	30% 3.0V 30	40% 4.0V 40	100% 10.0V 100	Not available - -
Variable speed	21% 1.6V 16	30% 2.25V 22	40% 3.0V 30	100% 7.5V 75	125% 10.0V 100

Recommended operating capacity ranges are:

- Units with a digital scroll compressor - standard control minimum (40%) to nominal (100%).
 Units with a variable speed compressor - close control minimum (21%) to nominal (100%).

6.2. Compressor start-up capacity

Digital scroll compressor: For the first 90 seconds after starting the compressor the minimum capacity is 75%.

Variable speed (inverter) compressor: For the first 90 seconds after starting the unit capacity is fixed to 67% (50% of maximum rated compressor speed).

After these first 90 seconds normal capacity control is available.

6.3. Oil recovery (oil flush) cycles

If a unit continuously operates on low capacity for longer than 1 hour and 40 minutes the controller performs an oil recovery cycle. Oil recovery cycles can be necessary on some installations to return the lubricating oil to the compressor. Oil recovery cycles normally last for 1 minute. During this 1 minute capacity is fixed to 100% (digital scroll compressor) or 80% (variable speed compressor).

It is possible to change the interval between oil recovery cycles (normally 1 hour and 40 minutes). It is also possible to disable oil recovery cycles (not recommended). If this is required contact temperzone customer service.

6.4. Boost mode on units with variable speed compressor

Temperzone units with a variable speed (inverter) compressor are designed to provide rated (nominal) duty and efficiency (EER) with the compressor operating at approximately 70 to 75% of maximum compressor speed. Therefore to run an inverter unit at nominal duty provide a capacity control signal of 7.5V on UC8 input VC or provide value 75 to the capacity control register via Modbus RTU.

It is possible to operate an inverter unit in boost mode which provides higher than nominal duty.

To enable operation in boost mode hold down push button SW3 until the display shows a small letter ‘u’, then release the button. The controller enters ‘boost mode configuration’ mode and the display will show the currently selected option. Use the pushbutton to select the desired boost mode configuration number:

Number	Nominal capacity	Additional boost mode capacity allowed	Time limit
0	100%	0% (default setting)	-
1		Up to 5% extra capacity	15 minutes every 3 hours
2		Up to 10% extra capacity	
3		Up to 15% extra capacity	
4		Up to 20% extra capacity	
5		Up to 25% extra capacity	
6	Approx. 90%	0%	-
7		Up to 5% extra capacity	15 minutes every 3 hours
8		Up to 10% extra capacity	
9		Up to 15% extra capacity	
10		Up to 20% extra capacity	
11		Up to 25% extra capacity	
12	Approx. 75%	0%	-
13		Up to 5% extra capacity	15 minutes every 3 hours
14		Up to 10% extra capacity	
15		Up to 15% extra capacity	
16		Up to 20% extra capacity	
17		Up to 25% extra capacity	
18	Reserved, do not select.		
19	Approx. 125%	0%	Unlimited

Note:

Operation in boost mode provides higher than nominal rated duty but the following aspects must be carefully taken into account:

- unit efficiency (EER) may be reduced
- the unit may produce a higher level of noise
- when operating in heating mode the unit may require extra outdoor coil de-ice cycles.

Mode 0 (factory default setting):

A unit configured for mode 0 does not allow any operation in boost mode. Capacity control signals of 7.5V to 10V / 75% to 100% will operate the unit with the compressor speed equal to 75% of maximum rated speed and deliver unit nominal rated duty.

Modes 1 ~ 5:

A capacity control signal higher than 7.5V / 75% will operate the compressor at a speed faster than 75% of maximum speed, up to the extra speed as specified in the table above, for up to 15 minutes. When the compressor has been operated at a speed higher than 75% for 15 minutes then for the next 3 hours the controller will limit compressor speed to not faster than 75%. After the 3 hour period another 15 minutes of boost mode is allowed.

Example: Mode 4 allows operation up to 75% + 20% = 95% of maximum compressor speed with a 9.5V / 95% control signal for up to 15 minutes.

Modes 6 ~ 11 and 12 ~ 17:

These options operate similar to modes 1 to 5 but with the nominal capacity reduced from 100% to:

- approximately 90% (modes 6 to 11)
- approximately 75% (modes 12 to 17)

These modes can be useful in applications where very low compressor noise is required or to reduce the number of outdoor coil de-icing cycles (when the unit is heating).

Mode 18:

Reserved, do not select.

Mode 19:

Operation at any speed from minimum to full maximum rated compressor speed with no time limits. Use with care!

6.5. Capacity control – single compressor system

Controller: 24V AC on/off and 0-10V capacity signals	
Compressor	Capacity control method
Fixed capacity	Not applicable.
Digital scroll	As per 0-10V capacity control signal, applied to UC8 input VC or IUC inputs V+ & V-. Refer to chapter 6.1.
Variable speed	

Controller: Modbus RTU (or BACnet/IP via BACnet to Modbus gateway)	
Compressor	Capacity control method
Fixed capacity	Not applicable.
Digital scroll	Refer to documents “Temperzone UC8 – Modbus communications” or “Temperzone UC8 – BACnet communications” .
Variable speed	

Controller: SAT-3 or TZT-100 wall thermostat	
Compressor	Capacity control method
Fixed capacity	Not applicable
Digital scroll	Controlled by the UC8 using a closed loop PID function: Capacity is based on the reported room temperature, the selected temperature setpoint and the amount of time elapsed. Thus system capacity is not simply a direct function of the distance between the room temperature and the setpoint.
Variable speed	

6.6. Capacity control – 2 compressor master & slave system

Note: A variable speed compressor in a 2-compressor master & slave system is operated up to nominal (rated) capacity only. Boost mode is not available.

Recommended preferred configurations are shaded in blue.

Controller: 24V AC on/off and 0-10V capacity signals		
Compressor 1	Compressor 2	Capacity control method
Fixed capacity	Fixed capacity	Not applicable
	Digital scroll	0-10V capacity signal for compressor 2
	Variable speed	
Digital scroll	Fixed capacity	0-10V capacity signal for compressor 1
	Digital scroll	0-10V capacity signal for compressors 1 and 2
	Variable speed	0-10V capacity signal for compressors 1 and 2
Variable speed	Fixed capacity	0-10V capacity signal for compressor 1
	Digital scroll	0-10V capacity signal for compressors 1 and 2
	Variable speed	0-10V capacity signal for compressors 1 and 2

Controller: Modbus RTU (or BACnet/IP via BACnet to Modbus gateway)		
Compressor 1	Compressor 2	Capacity control method
Fixed capacity	Fixed capacity	Not applicable
	Digital scroll	Capacity control signal applies to both compressors.
	Variable speed	
Digital scroll	Fixed capacity	Capacity control signal applies to compressor 1.
	Digital scroll	Capacity control signal applies to both compressors.
	Variable speed	Capacity control signal applies to both compressors.
Variable speed	Fixed capacity	Capacity control signal applies to compressor 1.
	Digital scroll	Capacity control signal applies to both compressors.
	Variable speed	Capacity control signal applies to both compressors.

Refer to chapter 6.1 and to documents “Temperzone UC8 – Modbus communications” and “Temperzone UC8 – BACnet communications”.

Recommended preferred configurations are shaded in blue.

Controller: SAT-3 or TZT-100 wall thermostat			
Compressor 1	Compressor 2	Thermostat stage setting	Capacity control method
Fixed capacity	Fixed capacity	1	The master UC8 controls whether compressor 2 should be on or off (* note).
	Digital scroll		
	Variable speed		
	Fixed capacity	2	The thermostat stage 1 and stage 2 signals control on/off for the two compressors (* note).
	Digital scroll		
	Variable speed		
Digital scroll	Fixed capacity	1	The master UC8 controls compressor 1 capacity and whether compressor 2 should be on or off.
	Digital scroll		Both digital scroll compressors run simultaneously and at the same capacity, determined by the master UC8.
	Variable speed		The master UC8 controls compressor 1 capacity and whether compressor 2 should be on or off (note 1).
	Fixed capacity	2	The master UC8 controls compressor 1 capacity. The thermostat stage 1 and stage 2 signals control on/off for the two compressors (* note).
	Digital scroll		
	Variable speed		
Variable speed	Fixed capacity	1	The master UC8 controls compressor 1 capacity and whether compressor 2 should be on or off.
	Digital scroll		The master UC8 controls compressor 1 capacity and whether compressor 2 should be on or off (* note).
	Variable speed		Both variable speed compressors run simultaneously and at the same capacity, determined by the master UC8.
	Fixed capacity	2	The master UC8 controls compressor 1 capacity. The thermostat stage 1 and stage 2 signals control on/off for the two compressors (* note).
	Digital scroll		
	Variable speed		

*** Note:**

In these configurations compressor 2 is operated as if it were a fixed capacity compressor, even if compressor 2 is capable of variable duty (a digital scroll compressor or a variable speed compressor). In other words: The compressor is not modulated / compressor speed is not varied (fixed to nominal duty).

6.7. Capacity control – 3 and 4 compressor master & slaves system

The following options are supported by UC8 master & slave software:

Option	Compressor 1	Compressors 2, 3, 4
1	Fixed capacity	Fixed capacity
2	Digital scroll	Fixed capacity
3	Variable speed (inverter)	Fixed capacity
4	Digital scroll	Digital scroll
5	Variable speed (inverter)	Digital scroll
6	Variable speed (inverter)	Variable speed (inverter)

Other combinations of compressor types are possible but the UC8 master & slave software may not provide full system support. For control of a system not listed in the table above it is recommended to provide compressor, indoor fan and capacity control signals to each UC8 separately as appropriate and not configure the UC8 controllers as a master and slaves.

Note: A variable speed compressor in a 3- or 4-compressor master & slave system is operated up to nominal (rated) capacity only. Boost mode is not available.

Controller: 24V AC on/off and 0-10V capacity signals		
Compressor 1	Compressors 2, 3, 4	Capacity control method
Fixed capacity	Fixed capacity	Not applicable.
Digital scroll	Fixed capacity	Provide a 0-10V capacity signal for compressor 1.
	Digital scroll	Provide 0-10V capacity signals to each UC8. Option: To use the slaved digital scroll compressors as fixed capacity systems link slave UC8 terminals VC and 12.
Variable speed	Fixed capacity	Provide a 0-10V capacity signal for compressor 1.
	Digital scroll	Provide 0-10V capacity signals to each UC8. Option: To use the slaved digital scroll compressors as fixed capacity systems link slave UC8 terminals VC and 12.
	Variable speed	Provide 0-10V capacity signals to each UC8.

Controller: Modbus RTU (or BACnet/IP via BACnet to Modbus gateway)		
Compressor 1	Compressors 2, 3, 4	Capacity control method
Fixed capacity	Fixed capacity	Not applicable.
Digital scroll	Fixed capacity	Capacity control signal applies to compressor 1.
	Digital scroll	Capacity control signal applies to all compressors.
Variable speed	Fixed capacity	Capacity control signal applies to compressor 1.
	Digital scroll	Capacity control signal applies to all compressors.
	Variable speed	

Refer to chapter 6.1 and to documents “**Temperzone UC8 – Modbus communications**” and “**Temperzone UC8 – BACnet communications**”.

7. Quiet Mode

Quiet mode can reduce the amount of noise produced by the outdoor fan. Quiet mode has no effect on the indoor fan or the compressor. Quiet mode is available both when cooling and when heating.

The effectiveness of Quiet mode depends on the outdoor ambient temperature. Limitations are:

- If the unit is heating while the outdoor ambient temperature is below about +10°C then selecting Quiet mode has no effect.
- If the unit is cooling while the outdoor ambient temperature is above about +35°C then Quiet mode has no effect.

Quiet mode can be selected in a number of ways:

- TZT-100 thermostat
- SAT-3 thermostat
- Indoor unit controller (IUC) input Qt
- Modbus RTU
- UC8 input D1

7.1. Enabling quiet mode with TZT-100 thermostat

To select Quiet mode press-and-hold down the MODE button for 3 seconds until the AUX symbol appears on the display of the thermostat. To switch Quiet mode off do the same until the AUX symbol disappears.

Note: This option is available only on TZT-100 thermostats with software version 2.31 or later.

7.2. Enabling quiet mode with SAT-3 thermostat

Refer to the SAT-3 installer manual.

7.3. Enabling quiet mode via Modbus

Refer to document “*Temperzone UC8 - Modbus communications*”.

7.4. Enabling quiet mode with IUC input Qt

Link indoor unit controller (IUC) input Qt to 0V, e.g. with a voltage-free relay contact.

7.5. Enabling quiet mode with UC8 input D1

If quiet mode operation is desirable but no other control for quiet mode is available, then UC8 input D1 can be reconfigured for Quiet mode as follows:

DIP switches			
13	14	15	16
OFF	-	-	ON

The DIP switch setting shown above reserves input D1 as an enable/disable signal to start or stop operation in Quiet mode. Input D1 is then not available for the DRED function.

To start or stop Quiet mode using input D1:

- Input D1 open circuit: Quiet mode OFF
- Input D1 linked to terminal SC (same as 0V): Quiet mode ON

8. Dry mode (de-humidification)

Dry (de-humidification) mode can be selected in a number of ways:

- TZT-100 thermostat
- SAT-3 thermostat
- Indoor unit controller (IUC) input Dy
- Modbus RTU
- UC8 input D2

Depending on the unit model, the UC8 controller can offer several options for de-humidification while cooling the room:

Mode	Available on	Indoor fan speed
Standard cooling	All units	Fixed
High-efficiency cooling	All units	Variable and must be controlled by the UC8
Conventional dry cooling	All units	Variable and must be controlled by the UC8
Advanced dry cooling	Units with dual expansion valves and split indoor coil	Fixed
Super dry cooling	Units with dual expansion valves and split indoor coil	Variable and must be controlled by the UC8

Advanced- and super- dry cooling is possible only on units fitted with dual electronic expansion valves and a split indoor coil. To be able to operate these units in advanced- or super- dry cooling mode the expansion valve operating mode must be one of the following: 3, 6 or 8. Refer to chapter 4.8 and appendices B and C.

- **Standard cooling mode:**

This is the default mode for Temperzone units with UC8 controller when no other cooling mode is activated. In this mode the unit does not actively control the temperature of the indoor coil. The supply air is de-humidified only when the indoor coil temperature remains below the dew point. The indoor fan speed is equal to the speed requested by the thermostat or other controller.

Standard cooling mode is suitable for installations where indoor airflow must remain constant.

- **High efficiency cooling mode:**

The UC8 controller must be allowed to vary the indoor fan speed to obtain an indoor coil temperature for optimum unit duty and efficiency. Note the indoor fan speed can be different from the speed as requested by the thermostat or other controller. The supply air is de-humidified only when the indoor coil temperature remains below the dew point.

High efficiency cooling mode may be unsuitable for installations where indoor airflow must remain constant.

- **Conventional dry cooling mode:**

The UC8 controller must be allowed to vary the indoor fan speed to obtain a low indoor coil temperature to provide de-humidification of the supply air. In this mode often the indoor fan speed will be different from the speed as requested by the thermostat or other controller. Conventional dry cooling mode may be unsuitable for installations where indoor airflow must remain constant.

- **Advanced dry cooling mode:**

Advanced dry mode can provide de-humidification over a wide range of operating conditions and unit duty whilst the indoor fan speed can remain constant. De-humidification of the supply air is achieved by operation of dual electronic expansion valves.

Advanced dry cooling mode is suitable for installations where indoor airflow must remain constant.

- **Super dry cooling mode:**

Super dry cooling mode is a combination of advanced dry mode and conventional dry mode. The UC8 controller must be allowed to vary the indoor fan speed. Under most operating conditions indoor fan speed will be equal to the speed requested by the thermostat or other controller. Only when the desired indoor coil temperature cannot be achieved by the dual electronic expansion valves alone then the controller will adjust the indoor fan speed to obtain de-humidification.

Super dry cooling mode may be unsuitable for installations where indoor airflow must remain constant.

8.1. Enabling the TZT-100 thermostat for dry mode

Note: The following applies to TZT-100 thermostats with software version 2.31 or later.

To configure the TZT-100 thermostat for dry mode:

- Press-and-hold the O/RIDE button for 15 seconds until the PIN code is shown (88:15).
- Use the Up/Down buttons to select the correct PIN code (default is 88:21), then press O/RIDE again. The thermostat is now in installer mode.
- Press O/RIDE a number of times until the screen shows **Fn**.
- Press the Up/Down buttons to select the correct option. Available options are:
 - -- manually select heating / cooling
 - H heating only
 - C cooling only
 - A heating / cooling / auto
 - **d-** manually select heating / cooling / cooling with **dry mode**
 - **dC** cooling / cooling **with dry mode**
 - **dA** heating only / cooling only / cooling with **dry mode** / auto with dry mode
- After selecting the desired option press MODE to exit from installer mode.

8.2. Enabling dry mode with SAT-3 thermostat

Refer to the SAT-3 installer manual.

8.3. Enabling dry mode via Modbus

Refer to document “*Temperzone UC8 - Modbus communications*”.

8.4. Enabling dry mode with IUC input Dy

Link indoor unit controller (IUC) input Dy to 0V, e.g. with a voltage-free relay contact.

8.5. Enabling dry mode with UC8 input D2

If no other control for dry mode is available then input D2 can be re-configured for Dry mode operation as follows:

DIP switches			
13	14	15	16
OFF	-	ON	-

The DIP switches setting shown above reserve input D2 as an enable/disable signal to start or stop operation in Dry mode. Input D2 is then not available for the DRED function.

To start or stop Dry mode via input D2:

- D2 input open circuit: Dry mode OFF
- D2 input shorted to terminal SC (same as ground or G): Dry mode ON

8.6. Conventional dry mode

Applicable EEV modes: 0, 1, 2, 4, 5, 7

To activate conventional dry mode:

- TZT-100 thermostat: Select cool + dry or cool / heat + dry, start the unit in cooling mode. Fan speed must show Low-Med-High.
- SAT-3 thermostat: Select cool + dry or cool / heat + dry, start the unit in cooling mode. Select fan auto-speed (the word AUTO shows on the display).
- Modbus RTU: Refer to document "**Temperzone UC8 - Modbus communications**".
- IUC input Dy: DIP switch 1 OFF (variable indoor airflow). Activate input Dy.
- UC8 input D2: DIP switch 1 OFF (variable indoor airflow). Activate input D2.

8.7. Advanced dry mode

Applicable EEV modes: 3, 6, 8

To activate advanced dry mode:

- TZT-100 thermostat: Select cool + dry or cool / heat + dry, start the unit in cooling mode. Select only one fan speed.
- SAT-3 thermostat: Select cool + dry or cool / heat + dry, start the unit in cooling mode. Select fan fixed speed (the word AUTO **not** shown on the display).
- Modbus RTU: Refer to document "**Temperzone UC8 - Modbus communications**".
- IUC input Dy: DIP switch 1 ON (fixed indoor airflow). Activate input Dy.
- UC8 input D2: DIP switch 1 ON (fixed indoor airflow). Activate input D2.

8.8. Super dry mode

Applicable EEV modes: 3, 6, 8

To activate super dry mode:

- TZT-100 thermostat: Select cool + dry or cool / heat + dry, start the unit in cooling mode. Fan speed must show Low-Med-High.
- SAT-3 thermostat: Select cool + dry or cool / heat + dry, start the unit in cooling mode. Select fan auto-speed (the word AUTO shows on the display).
- Modbus RTU: Refer to document "**Temperzone UC8 - Modbus communications**".
- IUC input Dy: DIP switch 1 OFF (variable indoor airflow). Activate input Dy.
- UC8 input D2: DIP switch 1 OFF (variable indoor airflow). Activate input D2.

9. De-icing the outdoor coil

Ice may form on the outdoor coil when a unit is in heating mode and outdoor ambient temperature is low. It may then be necessary to periodically remove the ice from the outdoor coil. The UC8 controller automatically takes care of this task.

Conditions when an outdoor coil de-ice cycles is initiated:

- the unit is heating
- the de-ice temperature sensor reports a temperature below -4°C
- the previous de-ice cycle was longer than 35 minutes ago

The de-ice temperature sensor is located on the outdoor coil, typically near the bottom. The 35 minute interval between de-ice cycles can become shorter when operating conditions are adverse but will never be less than 10 minutes.

9.1. Outdoor coil de-ice sequence

Start of a de-ice cycle:

When a de-ice cycle starts a fixed capacity compressor is stopped, a digital scroll compressor or a variable speed compressor is operated at minimum capacity. Initially the outdoor fan continues at high speed.

De-ice cycle main part:

After a brief delay the reverse cycle valve switches over to the cooling position, the outdoor fan is stopped and the compressor is restarted or ramps up to high capacity. The outdoor coil will warm up and cause the ice to melt.

During outdoor coil de-ice cycles the indoor fan may be stopped to avoid blowing very cold air into the room. To select indoor fan operation during de-ice cycles set UC8 DIP switch 1 as follows:

- OFF stop the indoor fan during de-ice
- ON indoor fan continues running

If a TZT-100 or SAT-3 thermostat is used to control the unit then the DIP switch 1 setting can be overruled by the selection on the TZT-100 / SAT-3:

- AUTO-FAN stop the indoor fan during de-ice
- FAN-ON the indoor fan continues running

Operation of the indoor fan during de-ice cycles can also be controlled via Modbus RTU and BACnet communications. Refer to documents "**Temperzone UC8 - Modbus communications**" and "**Temperzone UC8 - BACnet communications**".

End of a de-ice cycle:

A de-ice cycle ends when the de-ice sensor reports a temperature of $+12^{\circ}\text{C}$ or when the unit has been in de-ice mode for the last 10 minutes.

Near the end of the de-ice cycle the compressor is stopped or operated at minimum capacity. The outdoor fan is started on high speed to help removing melt-water from the outdoor coil. After a brief delay the unit returns to normal heating mode and the capacity is returned to normal.

If the installation is exposed to strong cold winds this may prevent the de-ice sensor temperature from reaching the required $+12^{\circ}\text{C}$ even though all ice may have melted. For such installations it is recommended that adequate shelter is provided to shield the unit from strong cold winds.

9.2. Outdoor coil de-icing on a multiple-compressor system

In systems where there is more than one compressor often it is undesirable that all systems can de-ice the outdoor coils all at the same time. If this is the case then the UC8 controllers may be connected as master and slave(s). When connected as master and slave a two-compressor system allows only one system to de-ice at any given time, the other system must wait until the first has completed the de-ice cycle. In the case of a three- or four-compressor master and slaves system only two systems are allowed to de-ice at any given time.

If the unit has a common (shared) outdoor fan chamber then all compressor systems must de-ice at the same time. For more information refer to chapter 4.5.

9.3. Forced outdoor coil de-icing

It is possible to force the UC8 controller to perform an outdoor coil de-ice cycle. The procedure is as follows:

- Operate the unit in heating mode for at least 2 minutes.
- Hold down pushbutton SW3 until the LED display shows the letter 'd', then release the button.
- A forced outdoor coil de-ice cycle will start immediately. The LED display will show 'dE-ICE'.
- The de-ice cycle will proceed as normal.
- After completing the de-ice cycle the unit automatically returns to heating mode.

Note. If a fixed duty compressor was started less than 6 minutes ago then the minimum on-to-on timer (cycle timer) may cause the de-ice cycle to be delayed until the 6 minutes have expired. To do a quick de-ice test then first ensure the compressor is off, place the unit in commissioning mode, start the unit in heating mode, then follow the procedure above.

10. Split systems with indoor unit controller (IUC)

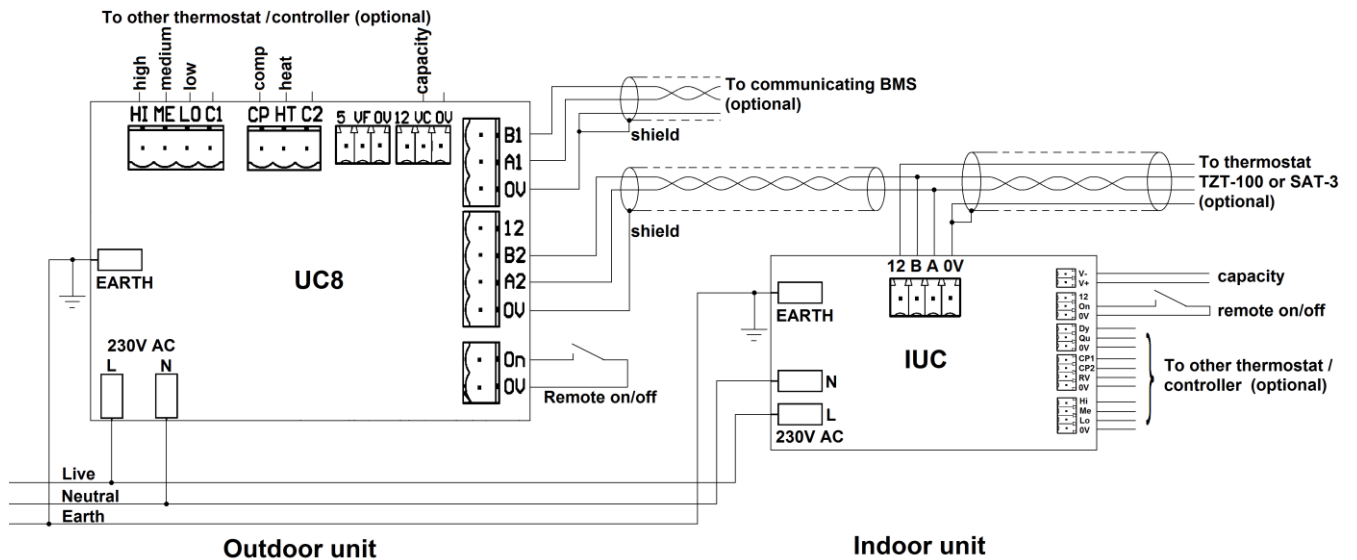
Often a split system has one or two UC8 controllers in the outdoor unit and an IUC in the indoor unit. To provide reliable communications between the UC8 and the IUC these recommendations should be followed:

- The indoor unit earth must connect directly to the outdoor unit earth.
- The communication cable should be shielded twisted pair type.
- Signals A and B must form one twisted pair.
- The cable shield should connect to terminal “0V” only at the UC8.
- Separate control and mains power cables as much as is practical.

Connections to a SAT-3 or TZT-100 thermostat can use the same wires that run from the UC8 to the IUC.

10.1. Split system with one compressor and one indoor unit

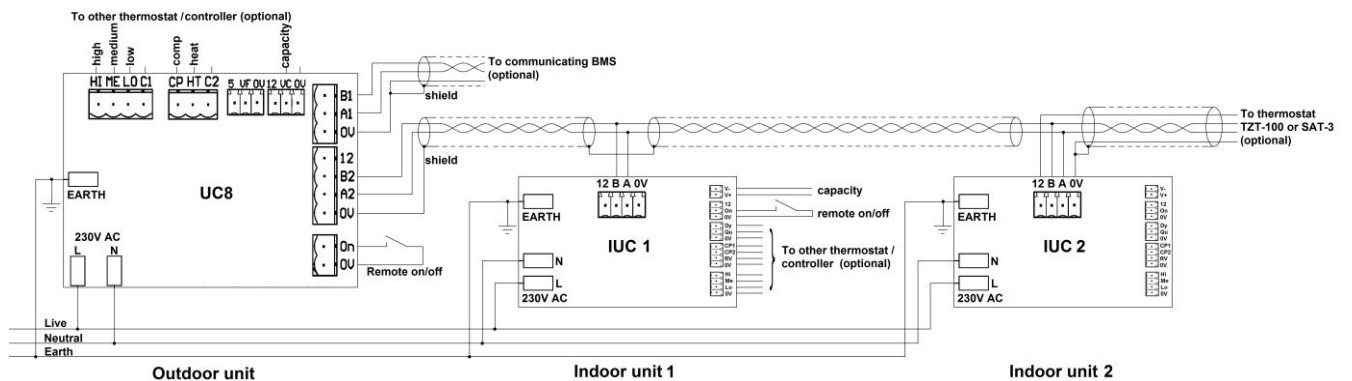
Possible connections between the outdoor- and indoor-units and thermostat or other type of controller are:



10.2. Split system with one compressor and two indoor units

An outdoor unit with one compressor can connect to two indoor units with an IUC in each. The two indoor units will always behave in identical fashion. Possible connections are shown below.

Note: If inputs on the IUC are used this must be the IUC configured as “indoor unit 1”; the inputs in “indoor unit 2” are not active.



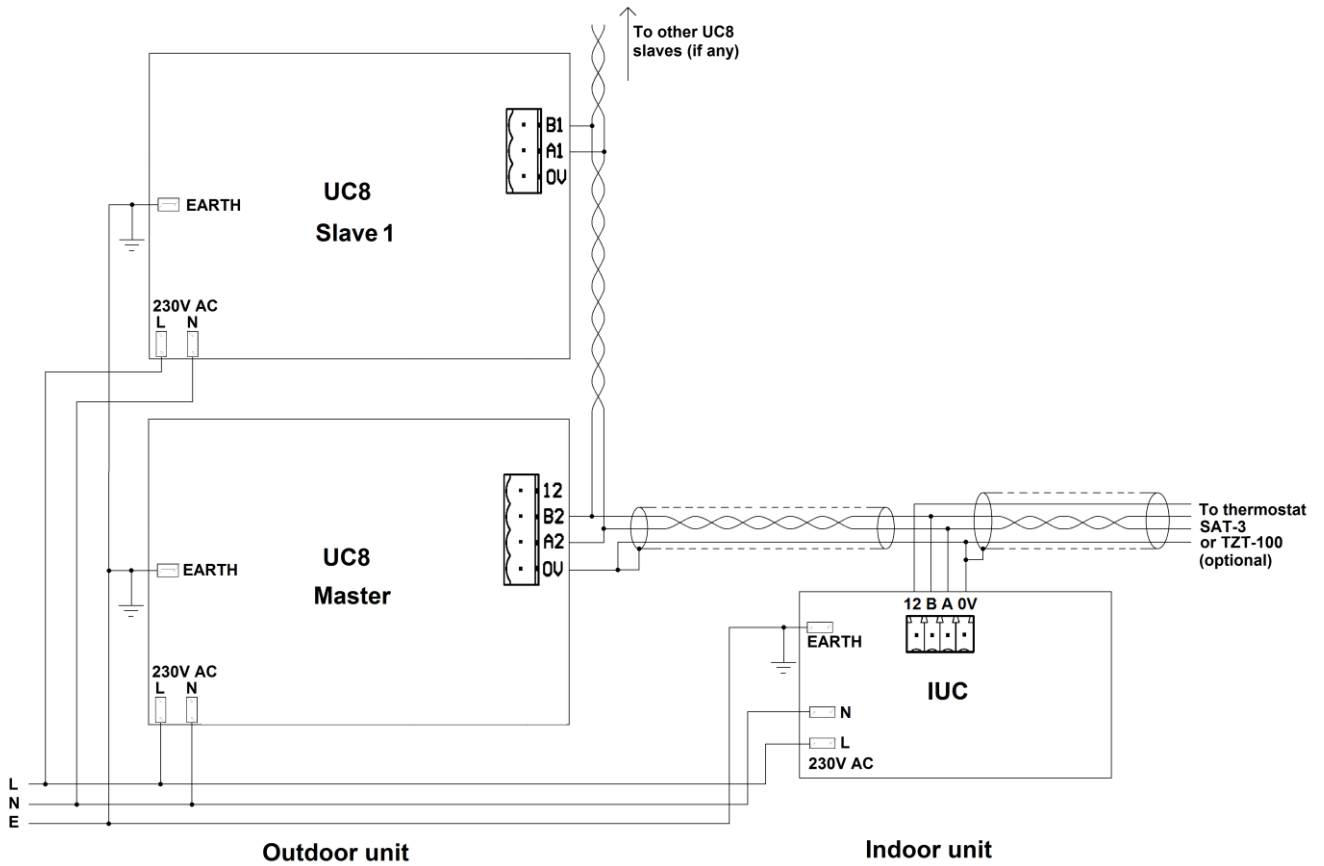
IUC DIP switch settings required are (also refer to “*Temperzone UIC - Operation manual*”):

DIP switch		Indoor unit 1	Indoor unit 2
DS1 (8 switches)	1	OFF	ON
	2 to 7	OFF	OFF
	8	As required	As required
DS2 (4 switches)	1 to 4	ON	ON

10.3. Split system with multiple compressors and one indoor unit

A split system with one indoor unit with IUC and 2, 3 or 4 compressors in the outdoor unit must have the UC8 controllers configured as one master and one or more slave(s) (refer to chapter 3).

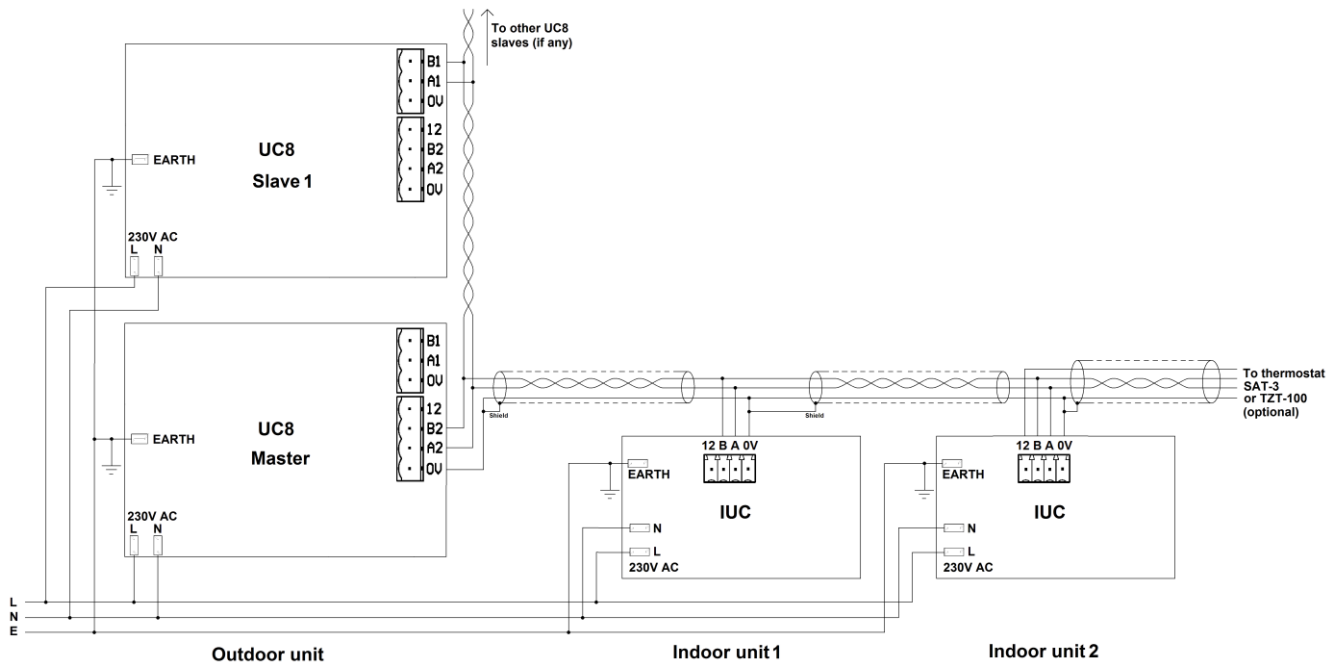
The IUC must connect to the UC8 that is the system master, terminals **A2**, **B2**. The system master UC8 will control the indoor fan on behalf of all compressors.



10.4. Split systems with two compressors and two indoor units

There are two options for a system with two compressors and two indoor units:

- Option 1: Each UC8 controller in the system connects directly to the associated indoor unit controller. The connections for this option are similar to those for single compressor systems with one UC8 and one IUC, refer chapter 10.1.
- Option 2: The master UC8 connects to the two indoor unit controllers. The UC8 master will control the slaved outdoor system and both indoor units. The refrigerant circuit of indoor unit 1 must be connected with the compressor controlled by the master UC8, the refrigerant circuit of indoor unit 2 must be connected with the compressor controlled by the slave UC8.



For the IUC DIP switch settings refer to chapter 10.2.

10.5. Split systems with more than two indoor units

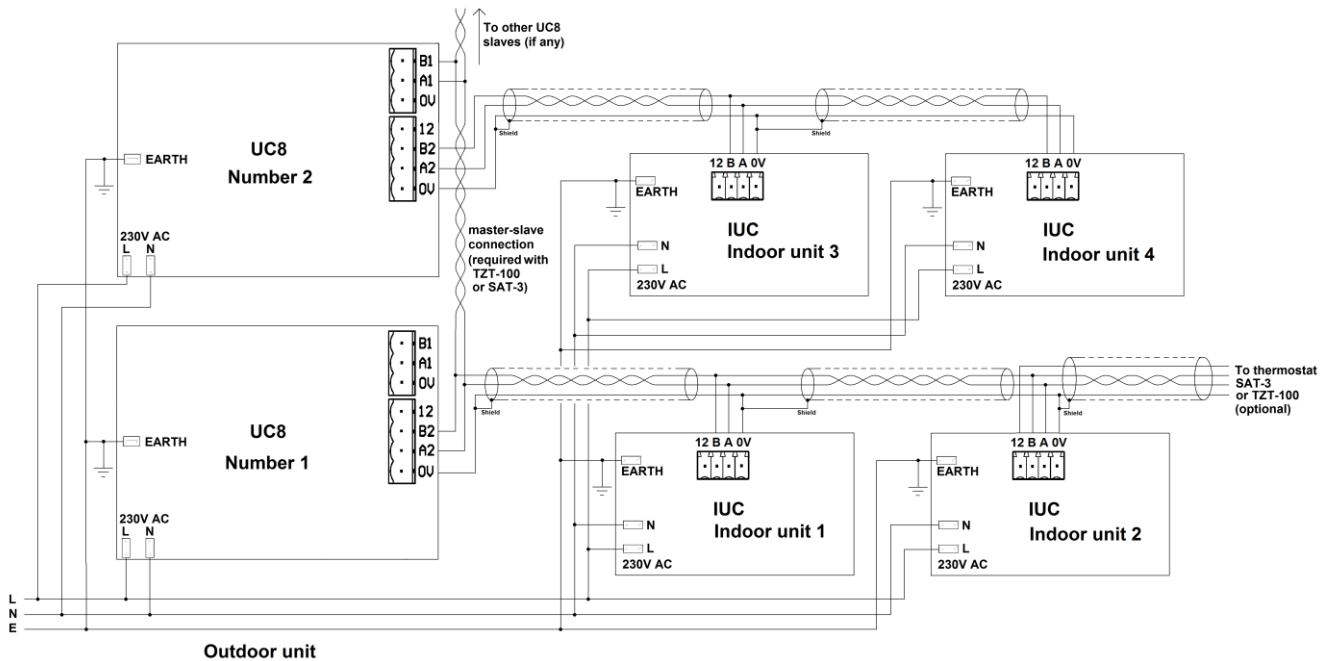
The UC8 can connect to up to two indoor unit controllers. This makes possible to connect to up to four indoor units to an outdoor unit with two-compressors. In such a system:

- indoor units 1 and 2 must connect to UC8 number 1
- indoor units 3 and 4 must connect to UC8 number 2

If the system is controlled with a SAT-3 or a TZT-100 wall thermostat then the two UC8 controllers must be connected as master-and-slave.

If the system is controlled with a third-party controller then master-and-slave connection is optional.

If the system is controlled using Modbus RTU serial communications then it is recommended to operate the UC8 controllers independently (not as master-and-slave).



Refer to chapter 10.2 for the IUC DIP switch settings.

11. Multiple compressor systems

Several configurations are possible to control a multiple compressor system with more than one UC8 controller. The three most common configurations are described in the following chapters. Regardless of the configuration the following two comments always apply:

(1) Lead-lag operation and compressor run-time sharing

UC8 controllers do **NOT** provide any form of compressor LEAD-LAG operation. Neither do they provide compressor run-time sharing. If LEAD-LAG operation and/or compressor run-time sharing is required this must be provided by an external controller, e.g. a BMS or PLC.

(2) Multiple compressor units with a shared (common) outdoor fan chamber

A reverse cycle system where multiple outdoor coils and fans share one common compartment must be configured as per instructions given in chapter 4.5. However, this is not required if the unit is used for cooling only or the outdoor climate is very mild so that ice never forms on the outdoor coil.

11.1. Control of the indoor fan

A multiple compressor system with only a single indoor fan, or with multiple indoor fans that must operate in unison, must run the fan when any one or more compressor(s) is (are) on. The following chapters show the necessary connections for different types of indoor fans.

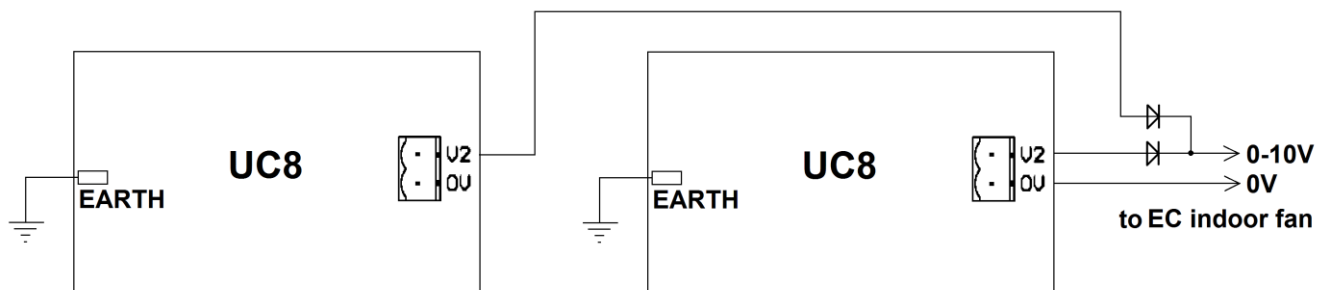
In a packaged unit with the UC8 controllers connected as master and slave(s) the master UC8 can control the indoor fan on behalf of all units within the system; no special wiring arrangements are required. This also applies to a split unit with the UC8 controllers connected as master and slave(s) and where the indoor fan is controlled by the master UC8 through the indoor unit controller (IUC).

It is also possible to use multiple IUC where each IUC connects to the corresponding UC8 board (a multiple compressor – multiple head system). In this case each indoor fan is controlled directly (individually) by the UC8 + IUC pair that the fan connects to.

If the UC8 controllers operate independent from one-another (i.e. they are **not** configured as a master and slaves(s)), then special connections must be made within the unit to ensure that the indoor fan operates correctly for all compressor systems. Refer to sections 11.2, 11.3 and 11.4.

11.2. Control of a 0-10V variable speed (EC) indoor fan

The UC8 uses 0-10V terminal “V2” when configured for a 0-10V variable speed fan. The diagram below shows how a variable speed indoor fan can be controlled by two UC8 controllers in a twin compressor system.



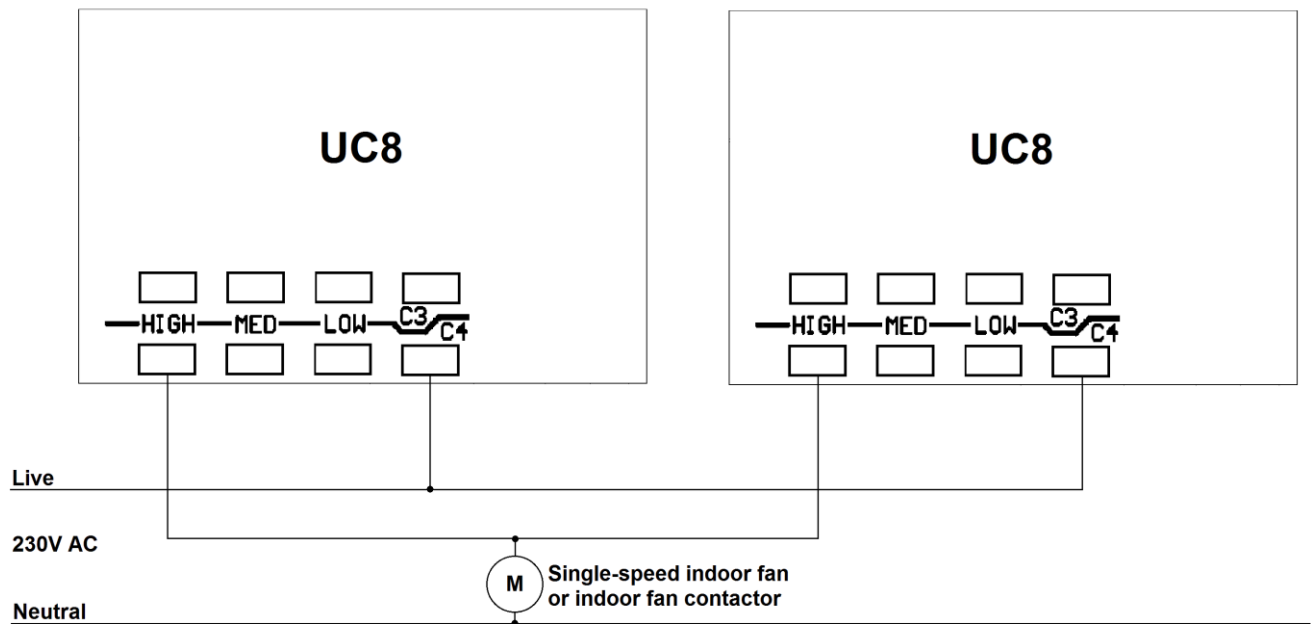
Suitable lead part numbers: 201 000 015 (600 mm long), 201 000 018 (1200 mm long)

The UC8 controllers must connect to the same earth point.

By preference the two diodes (shown in the diagram above) are Schottky barrier type diodes (e.g. suitable types are 1N5817, 1N5818, 1N5819 and similar).

11.3. Control of a single speed indoor fan

The UC8 uses relay contact terminal “HIGH” when configured for a single speed indoor fan. The diagram below shows how to control a single speed indoor fan with two UC8 controllers in a two-compressor system.

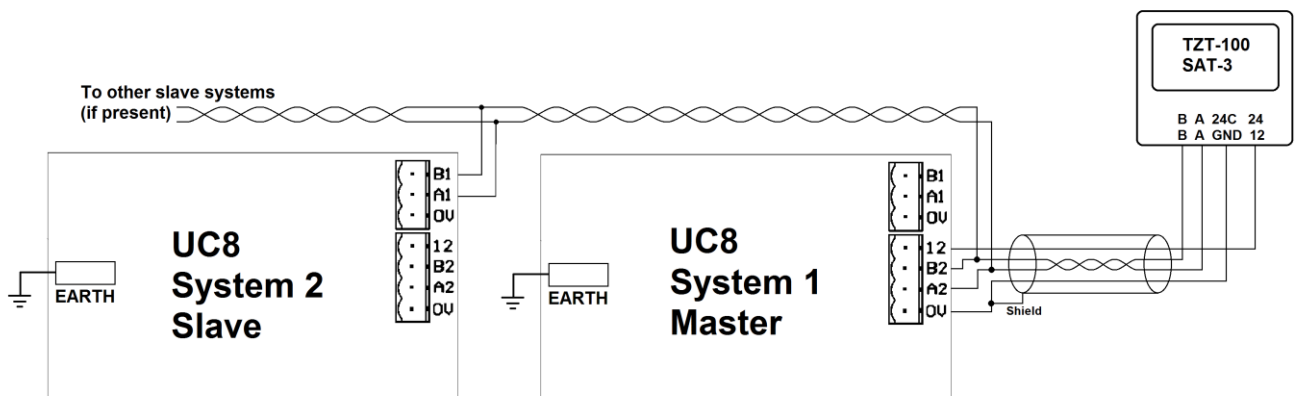


11.4. Control of a three speed indoor fan

Connecting a three-speed induction fan to more than one UC8 is **not possible**.

11.5. TZT-100 or SAT-3 thermostat and UC8 master-slave connection

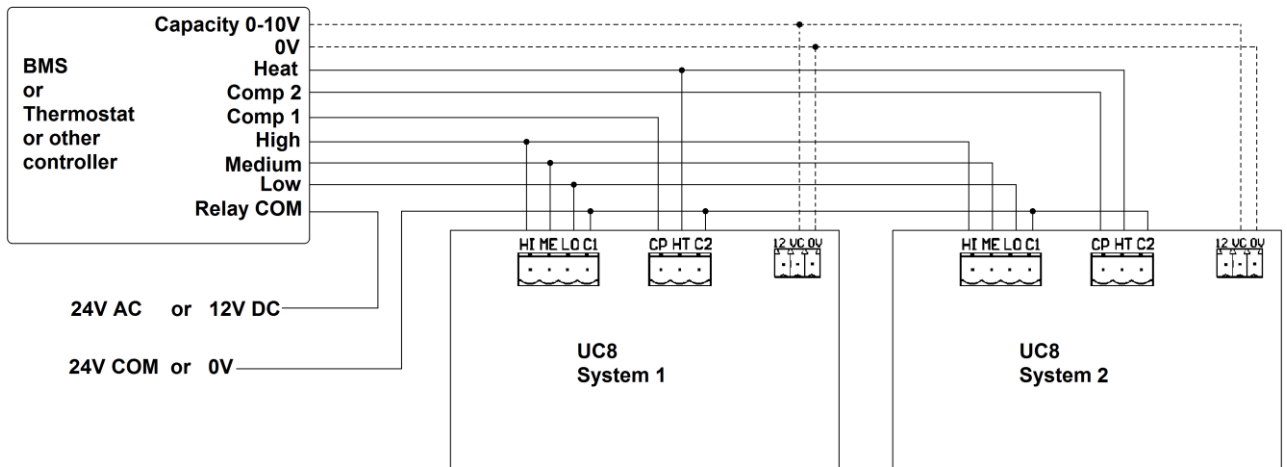
When a TZT-100 or SAT-3 thermostat is used to control a multiple compressor system with UC8 controllers then the UC8 boards must be connected using the master-slave configuration as shown below.



The cable to connect the thermostat should be a shielded twisted pair type suitable for RS485 serial communications. Signals A and B must form one pair, signals 0V and 12 can form a second pair that provides power to the thermostat. Connect the cable shield to UC8 terminal 0V. The UC8 controllers must connect to the same earth point.

11.6. Switched contact type controller and individually controlled systems

A BMS or other controller with switched contact outputs (e.g. relay contacts) can connect to two or more UC8 controllers as shown below.



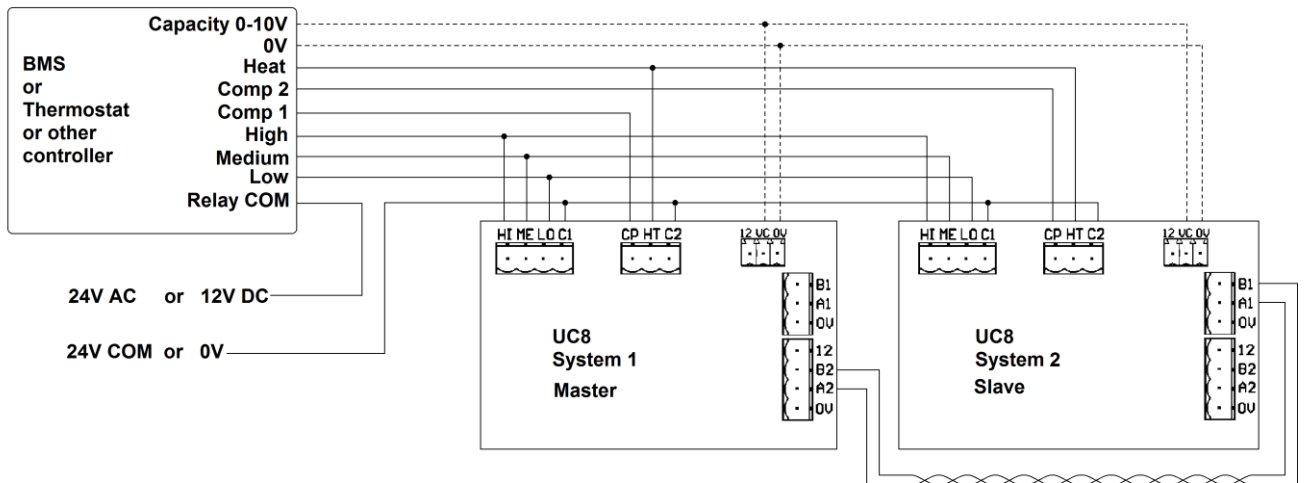
The DIP switches on each UC8 controller must be set as follows:

- DIP switch 11 OFF
- DIP switch 12 OFF

If the BMS provides a 0-10V signal for capacity control then this signal can be connected to input VC on the UC8. This must be a controller with the digital scroll- or variable speed- compressor. Optionally all systems can be fitted with digital scroll- or variable speed-compressors.

11.7. Switched contact type controller and master-slave connection

A BMS or other controller with switched type contact outputs (e.g. relay contacts) can connect two or more UC8 controllers configured as master and slave(s) as shown below.



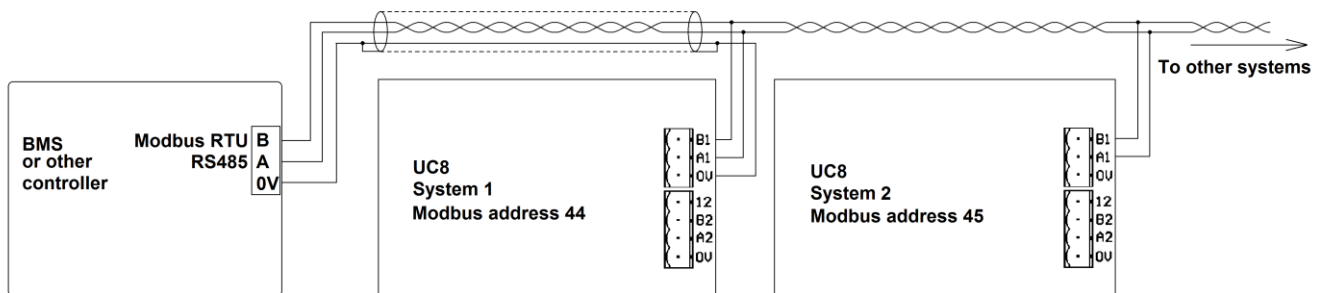
11.8. Communicating BMS controlling multiple systems

Multiple UC8 controllers can be connected to a communicating BMS. The BMS is always the bus master, all UC8 controllers act as Modbus RTU slave devices. The Modbus device address of each UC8 must be set to a unique value.

For this configuration the DIP switches on each UC8 controller must be set as follows:

- DIP switch 11 OFF
- DIP switch 12 OFF

For details how to set the UC8 Modbus device address and for information about control of the UC8 using Modbus RTU refer to document **“Temperzone UC8 – Modbus communications”**.

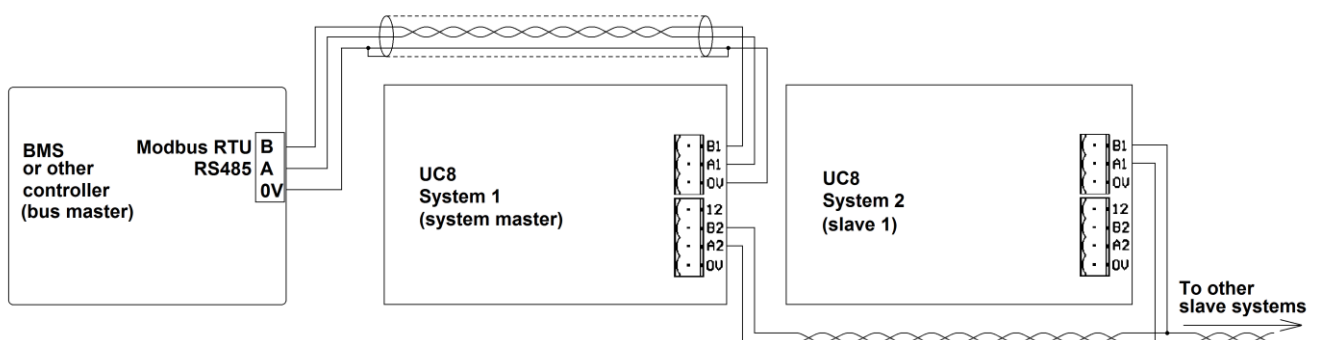


11.9. Communicating BMS controlling a master-slave system

When multiple UC8 controllers are connected as master and slave(s) then a communicating BMS can be used to control and monitor all systems (the master and all connected slaves) via the single connection with the UC8 master. Note: The BMS is always a bus master and must connect to port A1 & B1 of the UC8 that is configured as the system master.

Note: This configuration is not preferred and should be used only where necessary, for example in a multiple compressor reverse cycle system in a cool climate where the outdoor fans share a common compartment. In most other situations the option presented in chapter 11.8 is preferred.

For information about control of the UC8 using Modbus RTU refer to document **“Temperzone UC8 – Modbus communications”**.



For this configuration the DIP switches on the UC8 controllers must be set as follows:

Switch		Function
		System number (for units with multiple compressors)
11	12	
OFF	OFF	1 master system
ON	OFF	2 first slave system
OFF	ON	3 second slave system, if present
ON	ON	4 third slave system, if present

12. Display messages

The LED display on the UC8 circuit board can show the following messages:

Display	Meaning	Notes
UC8 2.2.0	Name and software version	Shown only after power-on
dELAY	Random start-up delay time	Up to 30s, occurs only after power-on
ctrl	A slave is waiting for master UC8 to take control	
•	Ready	Normal operation
–	Unit is OFF by Remote On/Off signal	
dE-ICE	De-icing the outdoor coil	
t	Test mode	
c	Commissioning mode	
H	Indoor fan high speed selection	Default 8.0V
L	Indoor fan low speed selection	Default 5.0V
A	Modbus address selection	Default 44
E	Compressor model selection	Refer to table below
d	Force unit to de-ice the outdoor coil	
Y	Supply-air temperature control	Default 0 = Off
J	Outdoor fan chamber selection	Default 0 = Separate
b	Modbus communications baud rate selection	Default 2 = 19200 Baud
P	Modbus communications parity and stop bit selection	Default 2 = Even
o	Thermostat auto-on/off selection	Default 0 = Off
n	Expansion device configuration selection	Default 0 to 3
u	Capacity boost mode limiting selection	Default = 0 (no boost)
≡	Outdoor EC fan maximum speed selection	Default = 10V
HOLD	The compressor is held-on or held-off by a safety timer. This message is followed by numbers that indicate the remaining seconds left.	
diFF-P	Pressure differential is too high to allow the inverter compressor to start	
dr	DRED energy consumption restriction is active	

The following compressor model & driver combinations can be selected:

Display	Compressor	Driver
dF	Fixed capacity- or digital scroll-compressor	None
038	Copeland ZPV 038	Carel Power+ PSD1xx
550	Toshiba DA 550	
66	Siam ANB 66	
78	Siam ANB 78	
87	Siam ANB 87	
063	Copeland ZPV 063	Emerson CSD100 (M600)
010	Inverter compressor and driver controlled via 0-10V signal from UC8 output V2	

The display can be used to monitor pressures and temperatures while the unit is in normal mode or in commissioning mode. This is available regardless whether the compressor is on or off. Repeatedly press the pushbutton to cycle the display through the options (in a round robin fashion). After 2 minutes the display will automatically return to a flashing dot (or 'c').

Display	Meaning	Units
● or c	Normal mode (default)	-
SLP	Suction line pressure	kPa
Et	Evaporating temperature	°C
SLt	Suction line temperature	°C
SSH	Suction side superheat	K
dLP	Discharge line pressure	kPa
Ct	Condensing temperature	°C
dLt	Discharge line temperature	°C
dSH	Discharge side superheat	K
ICEt	De-ice sensor temperature (located on the outdoor coil fins)	°C
CAP	Unit capacity (duty)	%
EE1	Electronic expansion valve 1 opening	%
EE2	Electronic expansion valve 2 opening	%
Add	UC8 Modbus device address	-
● or c	Back to button press 0	-

Pressures are shown in kPa. Divide by 6.895 (roughly 7) to convert to PSI.

Temperatures are shown in whole degrees Celsius. If the indicated temperature is below 0°C then a minus sign is shown before the value. If the unit has one or two pressure transducers then the condensing and/or evaporating temperatures shown can be converted from pressure readings.

If a reading is not available then the display shows a dash symbol (-).

13. Troubleshooting

When the UC8 controller detects a problem within the system the fault relay output (FLT) is activated. Fault light FLT will illuminate and a fault code is shown on the LED display.

Some faults will stop the compressor and the fans. Other faults may stop the compressor and the outdoor fans but allow the indoor fan to continue running. Yet other faults will be signalled but do not stop the unit from operating.

If a serious fault repeatedly stops the unit it may be locked-out. A locked unit will not run the compressor and the fans. To unlock the unit cycle mains power to the unit off and on again, alternatively a unit can be unlocked via the Modbus RTU serial connections or via BACnet communications.

If a unit locks out three times successively without completing a successful cooling or heating cycle then the unit will be locked out and can only be unlocked by pressing the UC8 pushbutton.

Chapter 13.1 lists the fault codes.

Document “**Temperzone UC8 – troubleshooting guide**” provides more detailed information on the fault codes, possible causes and remedies.

13.1. Fault codes

Display	Alt. code	Meaning
HP	F0	High pressure protection
LP	F1	Low pressure protection
OL	F2	Overload protection (input 'IN #2' is open circuit)
FROSt	F3	Indoor coil frost protection
HI-t	F5	High temperature protection
HI-SL	F6	High suction line temperature protection
Lo-dSH	F9	Low discharge superheat protection
Hi-dSH	F33	High discharge superheat protection
CRL	F41	Low compression ratio protection
CRH	F40	High compression ratio protection
Lockout	-	Unit is locked out, to unlock the pushbutton must be pressed

Display	Meaning
F10	Outdoor fan fault
F11	Indoor fan fault
F12	Low pressure transducer fault
F13	High pressure transducer fault
F14	Suction line temperature sensor fault
F15	Discharge line temperature sensor fault
F16	De-Ice temperature sensor fault
F17	Outdoor coil temperature sensor fault
F18	Indoor coil temperature sensor fault
F19	Ambient temperature sensor fault
F20	Superheat is unknown
F21	Thermostat fault (no serial communications)
F22	System 1 or BMS fault (no serial communications)
F23	System 2 fault (no serial communications)
F24	System 3 fault (no serial communications)
F25	System 4 fault (no serial communications)
F26	Invalid DIP switches setting
F27	Invalid fan selection
F28	Illegal operating mode requested (typically: the thermostat requests heating mode but the unit lacks an outdoor coil de-ice sensor)
F29	Microcontroller temperature too high (> 100 °C)
F30	Internal low voltage out of bounds
F31	A slave unit reports a fault
F32	0-10V input fault
F34	Problem with pressure transducer readings or pressures not equalising
F35	Reverse cycle valve fault
F36	Invalid DIP switch setting on TZT-100 thermostat
F37	Communication with indoor unit controller (IUC) lost
F38	Indoor unit controller (IUC) reports a fault
F39	Variable speed compressor driver reports a fault
F42	Evaporating temperature too high
F43	Condensing temperature too low
F44	Invalid EEV mode selection

The following sets of fault codes apply only to units with a variable speed compressor.

For the Carel Power+ driver:

The fault code shown is F100 plus the error code reported by the Power+ driver. For detailed information about the Power+ fault codes refer to the **Carel Power+ speed drive user manual, chapter 8.3: Alarms table**. A brief summary follows here:

Display	Meaning
F100	No communications between Power+ drive and UC8
F101	Motor over-current
F102	Motor overload
F103	Over-voltage
F104	Under-voltage
F105	Drive too hot
F106	Drive too cold
F107	Drive over-current
F108	Motor too hot
F109	Reserved
F110	Drive internal error
F111	Incorrect parameter
F112	Excessive drive DC bus ripple (unbalanced mains phase voltages)
F113	Communication fault
F114	Internal fault
F115	Auto-tuning fault
F116	Drive disabled (input STO open circuit)
F117	Motor phase fault (possibly a motor wire has become loose)
F118	Drive internal fan fault
F119	Speed fault
F120	Power factor correction circuit overload
F121	Mains input voltage too high
F122	Mains input voltage too low
F123	Drive internal fault
F124	Reserved
F125	High earth current fault
F126	Drive processor overload
F127	Drive memory loss
F128	Drive overload protection
F197	Drive reports incorrect compressor speed
F198	Drive and compressor mismatch
F199	Drive configuration fault

For the Emerson CSD100 (M600) driver:

The fault code shown is F100 or F200 plus a code reported by the CSD100 driver.

For detailed information about the CSD100 codes refer to the **Emerson CSD100 user guide**.

A brief summary follows here:

Display	Meaning
F100	No communications between Power+ driver and UC8
F103	Motor current too high
F105	Driver internal power supply fault
F109	Driver internal 24V supply overloaded
F120	Motor too hot
F132	Mains power input voltage imbalance
F140	Motor rotor locked
F141	Motor reverse rotation
F142	Compressor discharge line temperature too high (disabled by the UC8)
F144	Out of safe compressor operating envelope (disabled by the UC8)
F145	Loss of communications
F146	Mains power input voltage too low
F147	Motor soft start failure
F148	Compressor discharge line temperature sensor fault (disabled by the UC8)
F149	Motor too hot
F150	Motor phase fault
F151	Mains power input phase loss
F198	Motor phase loss
F205	Supply loss
F209	Drive trip
F215	Under voltage

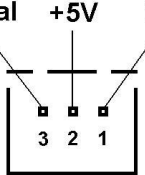
14. Appendix A – UC8 Specifications

Notes:

- *Input and output signals from/to the UC8 are isolated from the mains inputs (L and N).*
- *Relay outputs HIGH, MED, LOW, C3, C4, CMC, R/V, SSR#1 and SSR#2 are isolated from all other circuits. It is permitted to connect these relay outputs to mains live circuits.*
- *Inputs HI, ME, LO, C1, CP, HT and C2 are isolated from all other circuits. These inputs accept 24V AC or 12V DC control signals.*
- *All other input and output signals from/to the UC8 are electrically referenced to the EARTH terminal.*
- *It is recommended that any input signal that is referenced to EARTH and that needs to connect to a circuit external to the temperzone unit to be isolated by a suitable means, for example a relay. Typical examples of this are the remote On/Off input and the DRED inputs.*
- ***For safety, and to ensure correct operation of the unit, the EARTH terminal must directly connect to a unit earth stud located close to the controller board.***

Controller environmental conditions Storage temperature range Operating temperature range Relative humidity	-20 to +75°C -10 to +65°C 20 to 95% non-condensing		
Mains input L and N	Nominal 230V AC 50Hz	Minimum 190V AC 47Hz	Maximum 250V AC 63Hz
Output relays Applies to terminals: HIGH, MED, LOW, CMC and R/V	250V AC, 5A maximum, resistive load 250V AC, 2.5A maximum, inductive load		
Solid state output relays Applies to terminals: SSR1 and SSR2	12V AC minimum, 250V AC maximum (AC only!) 0.25A maximum (continuous) 2.5A maximum (peak, 0.5s)		
AUX and FLT outputs Designed to operate a relay with 12V DC coil.	Open collector and +12VDC output OFF state: leakage current 0.5mA maximum ON state: 11V DC, 100mA maximum		
EXV1 and EXV2 outputs Designed to operate uni-polar electronic expansion valves: 5-wire and 6-wire types.	Open collector and +12VDC output OFF state: leakage current 0.5mA maximum ON state: 11V DC, 275mA maximum per winding		

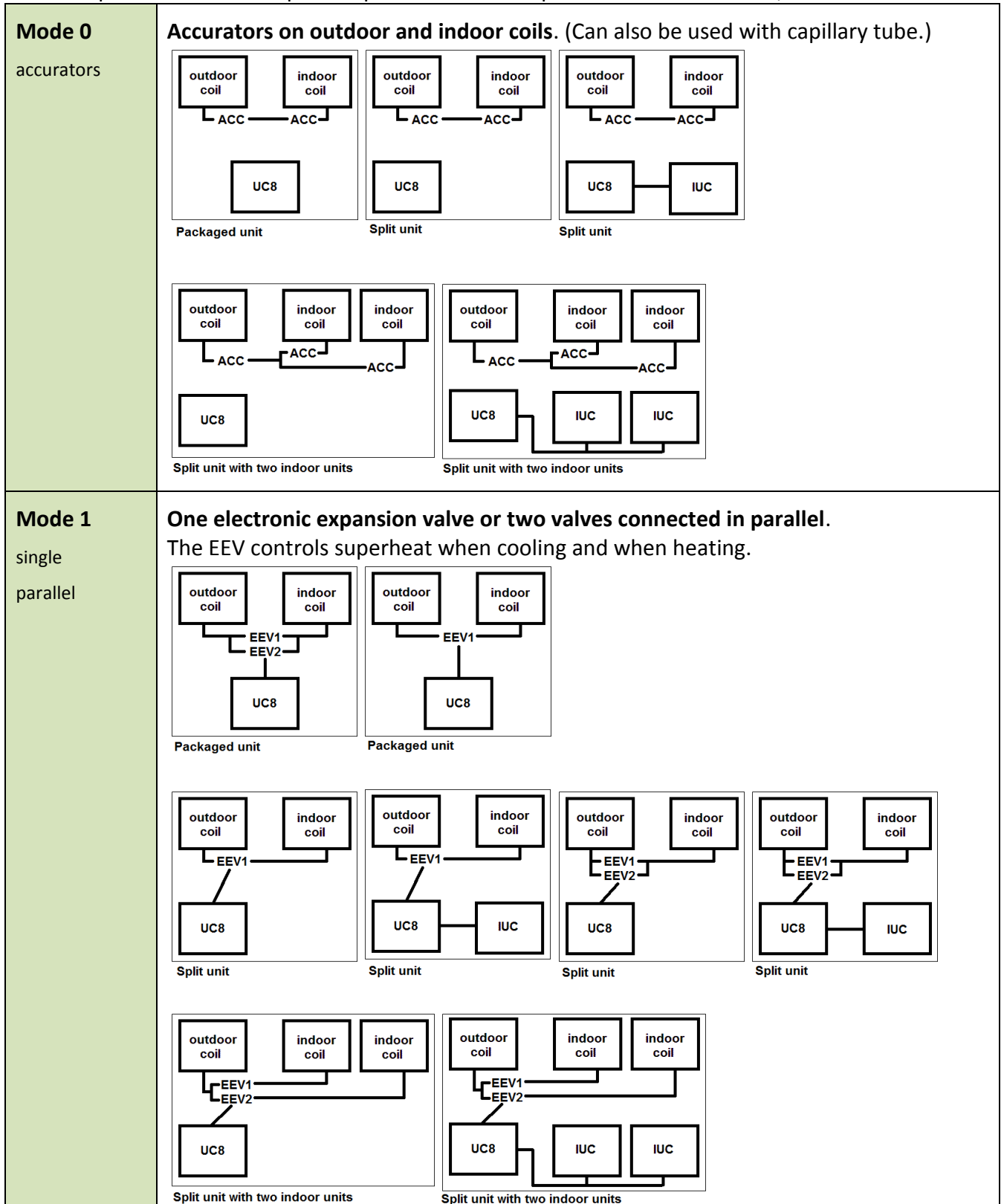
Continued on the next page.

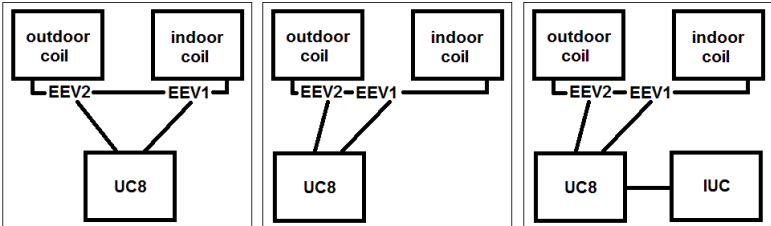
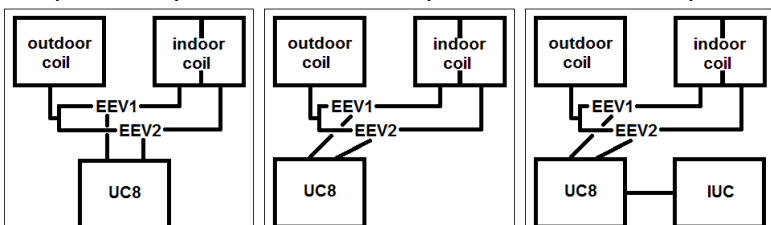
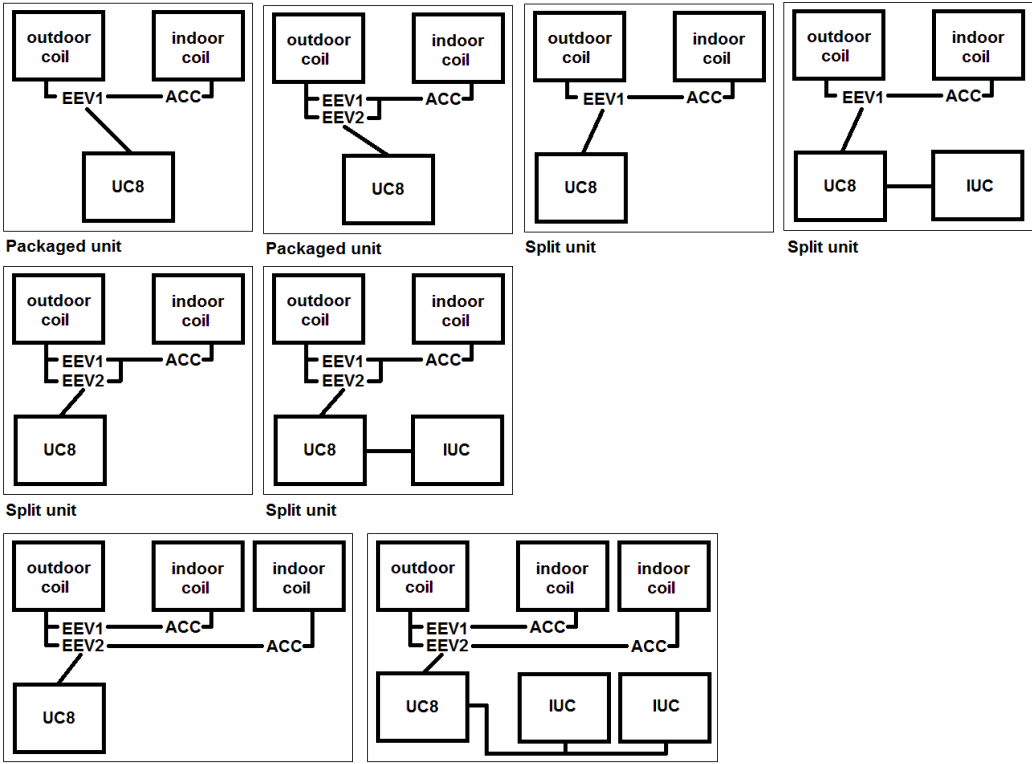
<p>Isolated inputs</p> <p>Applies to terminals: HI, ME, LO, CP and HT</p> <p>Common terminals are: C1 for HI, ME and LO C2 for CP and HT</p>	<p>When used with 24V AC input signals:</p> <p>Maximum input voltage OFF state: 2V RMS AC Minimum input voltage ON state: 18V RMS AC Absolute maximum input voltage: 35V RMS AC Input impedance: 2.5kΩ</p> <hr/> <p>When used with 12V DC input signals:</p> <p>Maximum input voltage OFF state: 2V DC Minimum input voltage ON state: 11V DC Absolute maximum input voltage: 35V DC Input impedance: 2.5kΩ</p>
<p>VC and VF 0-10V analogue inputs Referenced to terminal 0V</p>	<p>Absolute maximum input voltage: -2 to +15V DC Nominal input voltage: 0 to +10V DC Input impedance: 13.9kΩ</p>
<p>IN#1 and IN#2 DRED inputs D1, D2, D3 Remote On/Off input Referenced to terminals 0V and SC</p>	<p>Designed to be operated by isolated voltage free contacts.</p> <p>Open circuit voltage: 3.3V DC typical Closed circuit current: 3.3mA DC typical</p>
<p>V1 and V2 0-10V analogue outputs Referenced to terminal 0V</p>	<p>Maximum load: 6.5kΩ Maximum short circuit output current: 30mA</p>
<p>Temperature sensor inputs</p> <p>DL: red SL, DEI:blue AMB: yellow or black OC, IC: yellow</p>	<p>Designed to connect to standard Temperzone thermistor temperature sensors.</p>
<p>Pressure transducer inputs</p> <p>signal +5V 0V</p> 	<p>Power: 5.0±0.2V DC, maximum current 50mA Signal: 0.5V at the lowest pressure 4.5V at the highest pressure</p> <p>Pressure ranges: LPT, all units: 0 to 3450 kPa (0-34.5 bar, 0-500 PSI) HPT, all units: 0 to 4500 kPa (0-45.0 bar, 0-653 PSI)</p>
<p>Modbus RS485 serial communications format</p>	<p>Baud rate 9600, 19200 (default), 38400 Data bits 8 Parity none, odd, even (default) Stop bits 1 (default), 2</p>

15. Appendix B – Expansion device options - units with independent UC8

The configurations shown in this chapter apply to installations where the UC8 boards, if there is more than one, are **not** configured as master and slave(s). The diagrams are applicable to:

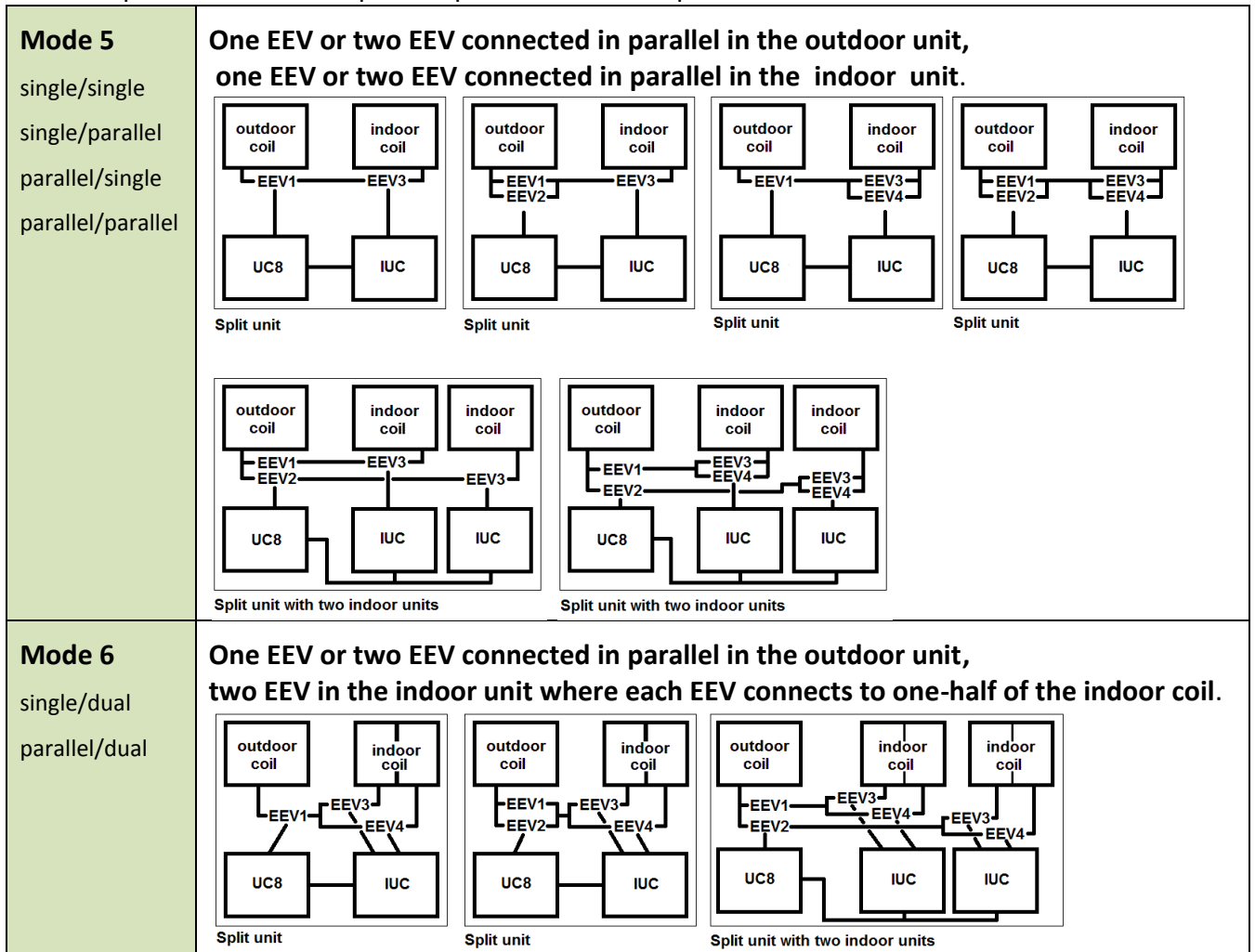
- Packaged units with one compressor
- Packaged units with multiple compressors with independent UC8 controllers
- Split units with one compressor, with and without IUC
- Split units with multiple compressors with independent UC8 controllers, with and without IUC



<p>Mode 2 series</p>	<p>Two electronic expansion valves connected in series. UC8 output EXV1 controls superheat when cooling. UC8 output EXV2 controls superheat when heating.</p>  <p>Packaged unit Split unit Split unit</p>
<p>Mode 3 dual</p>	<p>Two electronic expansion valves, each connects to one-half of the indoor coil. When cooling in standard mode (no de-humidification) and when heating the two EEV assume identical positions to control superheat. When cooling in dry mode (dehumidification) then the two EEV can operate independently to control both superheat and the evaporating temperature.</p>  <p>Packaged unit Split unit Split unit</p>
<p>Mode 4 single/acc parallel/acc</p>	<p>One EEV or two EEV connected in parallel at the outdoor coil, accurators at the indoor coil.</p>  <p>Packaged unit Packaged unit Split unit Split unit Split unit Split unit Split unit with two indoor units Split unit with two indoor units</p>

The following diagrams are applicable to:

- Split units with one compressor and with IUC
- Split units with multiple compressors with independent UC8 controllers and with IUC

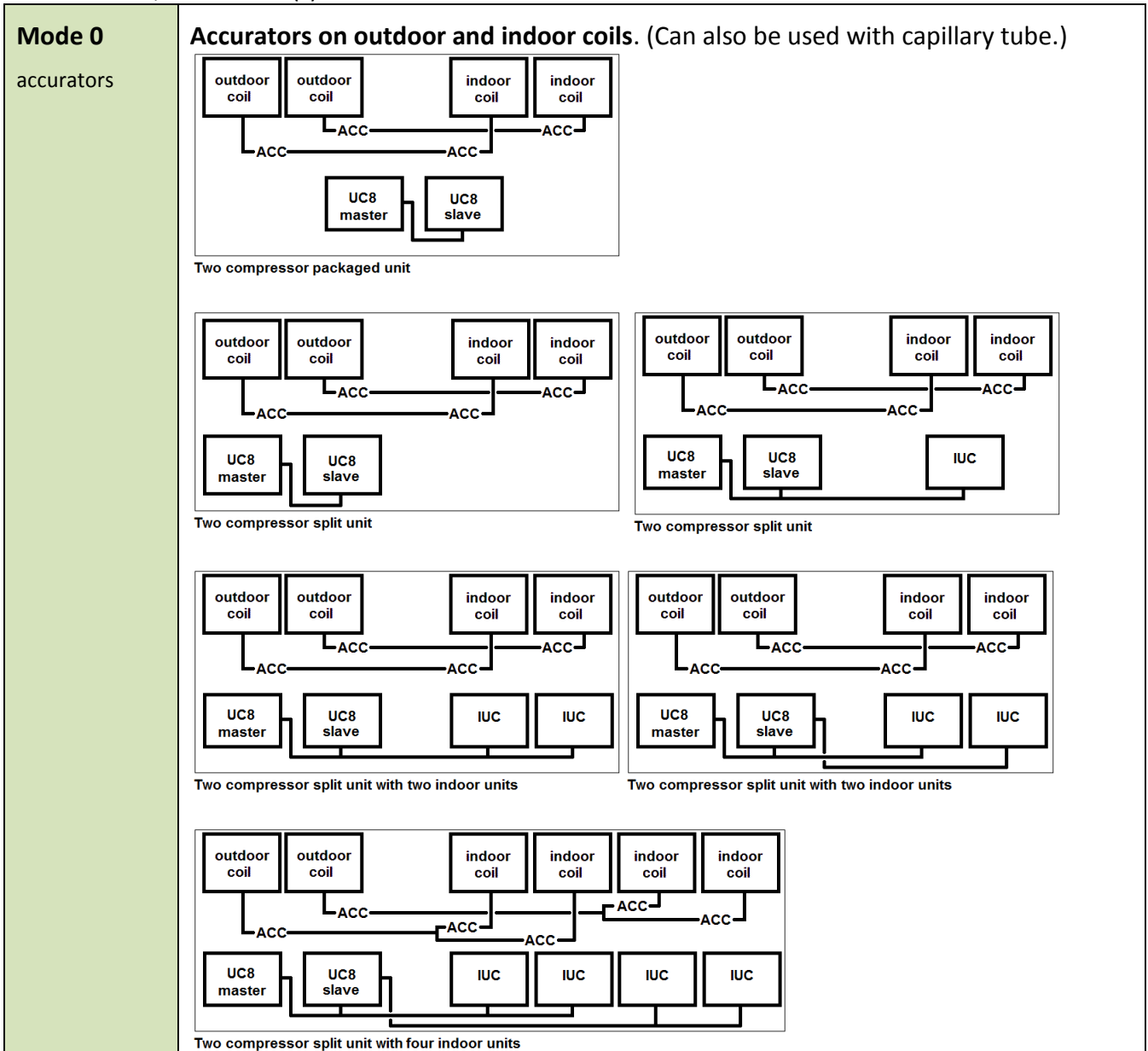


<p>Mode 7 acc/single acc/parallel</p>	<p>Accurators in the outdoor unit, one EEV or two EEV connected in parallel in the indoor unit.</p> <p>Split unit</p> <p>Split unit with two indoor units</p> <p>Split unit</p> <p>Split unit with two indoor units</p>
<p>Mode 8 acc/dual</p>	<p>Accurators in the outdoor unit, two EEV in the indoor unit where each EEV connects to one-half of the indoor coil.</p> <p>Split unit</p> <p>Split unit with two indoor units</p>

16. Appendix C – Expansion device options - units with 2 UC8 as master and slave

The following diagrams are applicable to:

- Packaged units with two compressors and the two UC8 controller boards configured as master and slave
- Split units with two compressors and the two UC8 controller boards configured as master and slave, indoor unit(s) with or without IUC

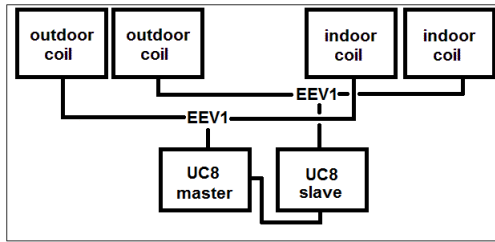


Mode 1

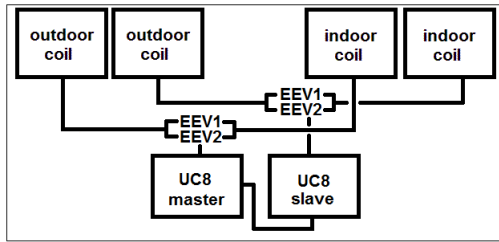
single
parallel

One electronic expansion valve or two valves connected in parallel.

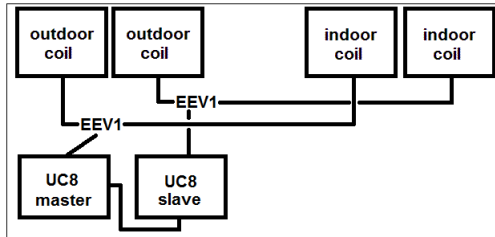
The EEV controls superheat when cooling and when heating.



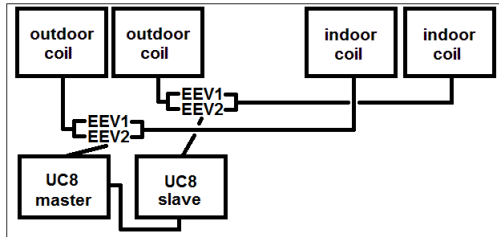
Two compressor packaged unit



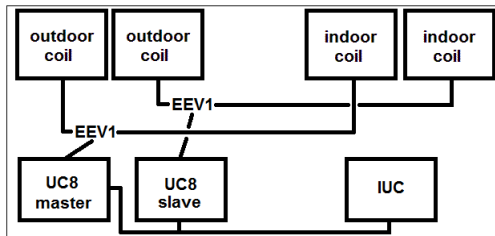
Two compressor packaged unit



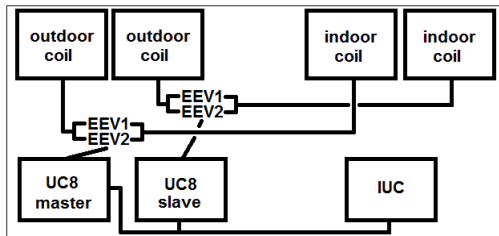
Two compressor split unit without IUC



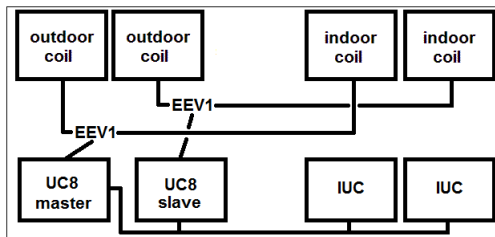
Two compressor split unit without IUC



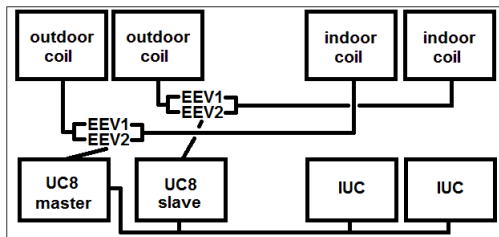
Two compressor split unit, one indoor unit



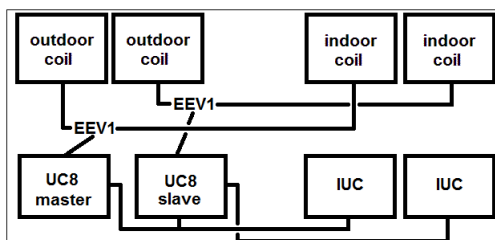
Two compressor split unit, one indoor unit



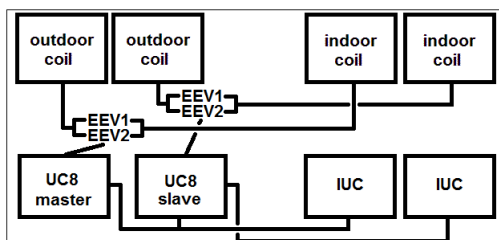
Two compressor split unit, two indoor units



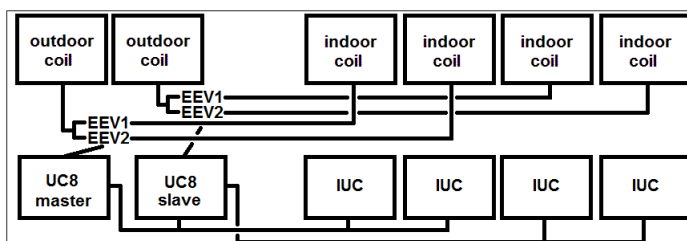
Two compressor split unit, two indoor units



Two compressor split unit, two indoor units



Two compressor split unit, two indoor units



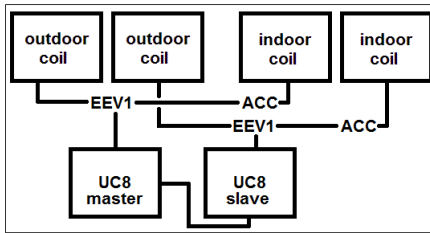
Two compressor split unit, four indoor units

<p>Mode 2 series</p>	<p>Two electronic expansion valves connected in series. One EEV controls superheat when cooling, a second EEV controls superheat when heating.</p> <p>Two compressor packaged unit</p> <p>Two compressor split unit, one or two indoor units without IUC</p> <p>Two compressor split unit, one indoor unit with IUC</p> <p>Two compressor split unit, two indoor units with IUC</p>
<p>Mode 3 dual</p>	<p>Two electronic expansion valves, each connects to one-half of the indoor coil. When cooling in standard mode (no de-humidification) and when heating the two EEV assume identical positions to control superheat. When cooling in dry mode (dehumidification) then the two EEV can operate independently to control both superheat and the evaporating temperature.</p> <p>Packaged unit</p> <p>Two compressors split unit, no IUC, dual EEV, split coils</p> <p>Two compressors split unit, one IUC, dual EEV, split coils</p> <p>Two compressors split unit, two IUC, dual EEV, split coils</p> <p>Two compressors split unit, two IUC, dual EEV, split coils</p>

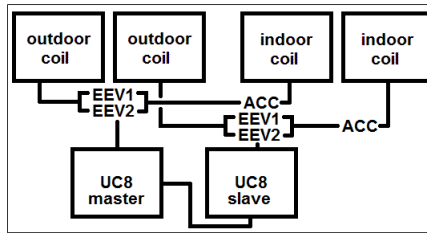
Mode 4

single/acc
parallel/acc

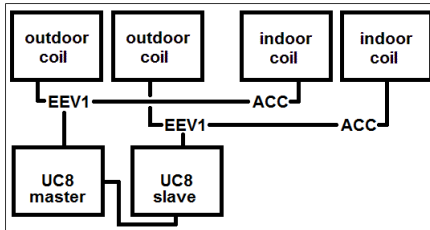
One EEV or two EEV connected in parallel at the outdoor coil, accurators at the indoor coil.



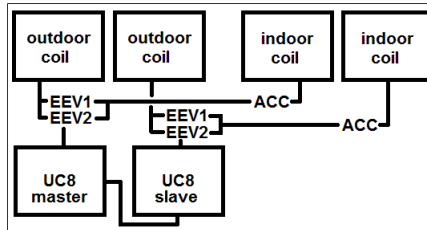
Packaged unit



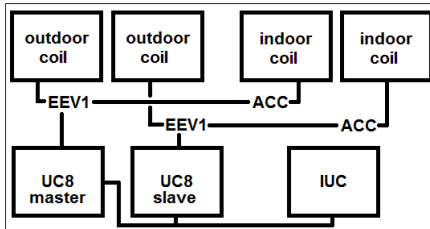
Packaged unit



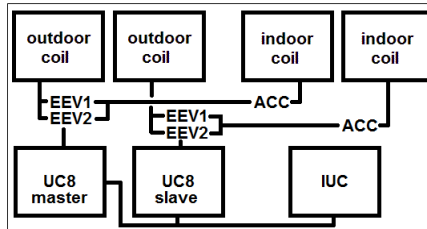
Split unit, one or two indoor units without IUC



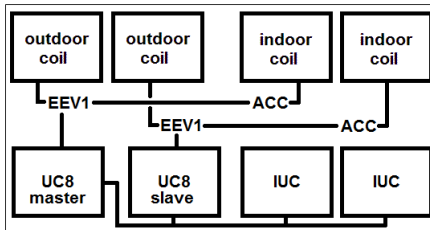
Split unit, one or two indoor units without IUC



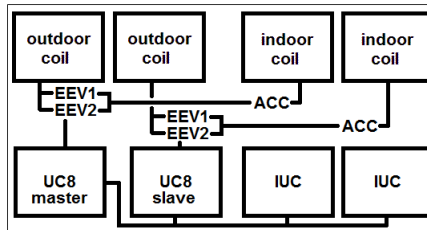
Split unit, one indoor unit with IUC



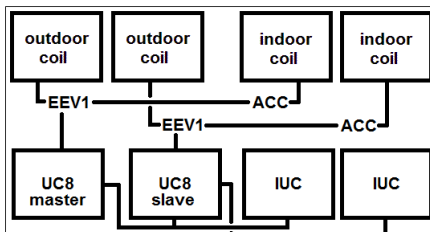
Split unit, one indoor unit with IUC



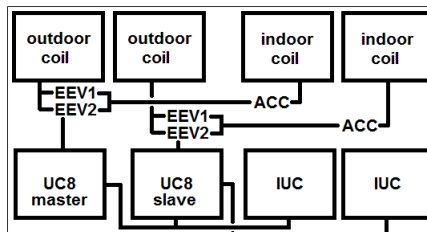
Split unit, two indoor units with IUC



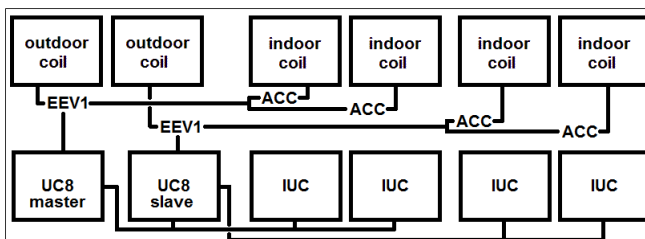
Split unit, two indoor units with IUC



Split unit, two indoor units with IUC



Split unit, two indoor units with IUC

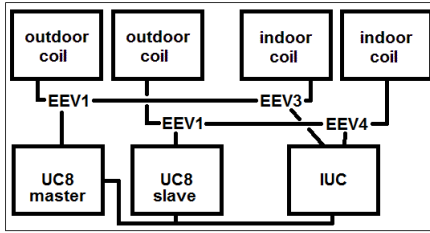


Split unit, four indoor units with IUC

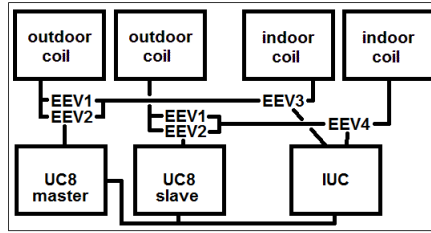
Mode 5

single/single
single/parallel
parallel/single
parallel/parallel

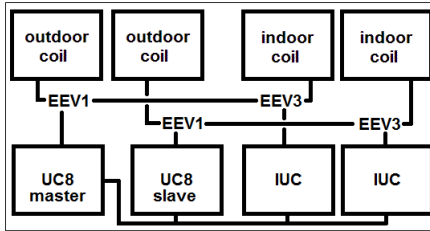
**One EEV or two EEV connected in parallel in the outdoor unit,
one EEV or two EEV connected in parallel in the indoor unit.**



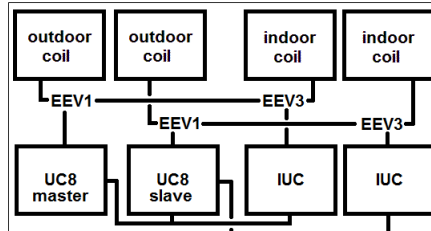
Split unit, one indoor unit with IUC



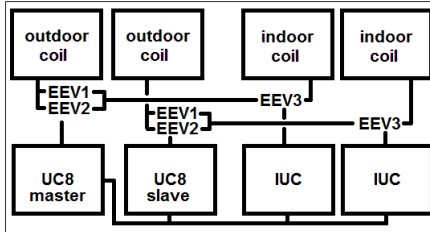
Split unit, one indoor unit with IUC



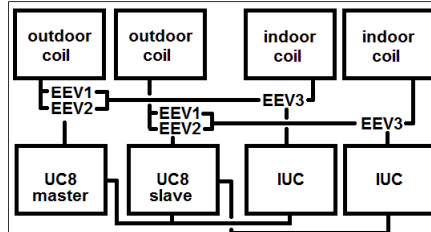
Split unit, two indoor units with IUC



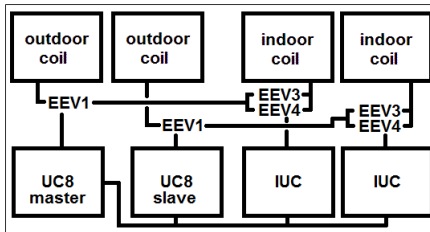
Split unit, two indoor units with IUC



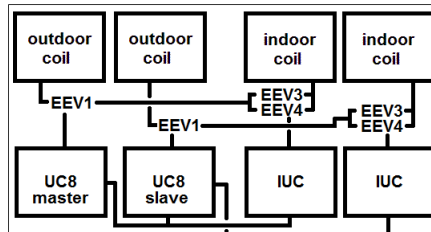
Split unit, two indoor units with IUC



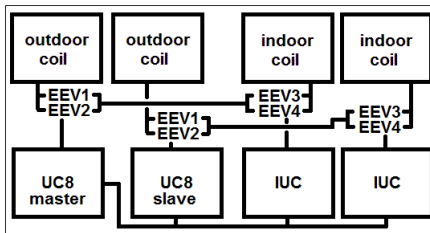
Split unit, two indoor units with IUC



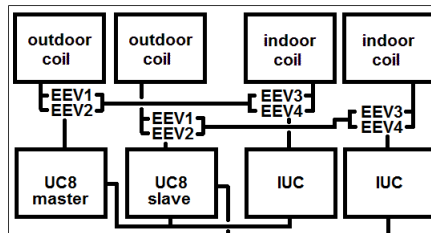
Split unit, two indoor units with IUC



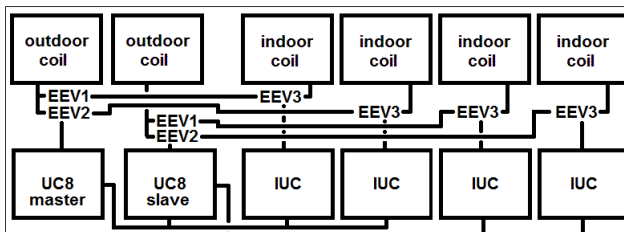
Split unit, two indoor units with IUC



Split unit, two indoor units with IUC



Split unit, two indoor units with IUC

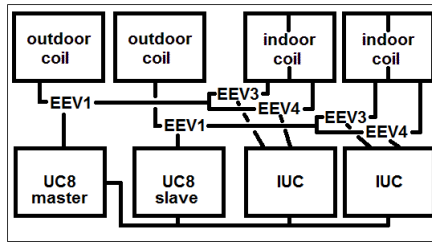


Split unit, four indoor units with IUC

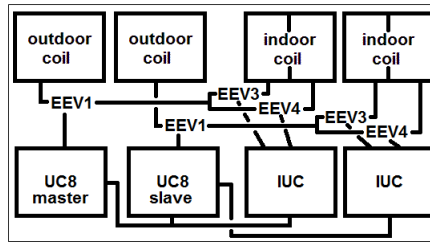
Mode 6

single/dual
parallel/dual

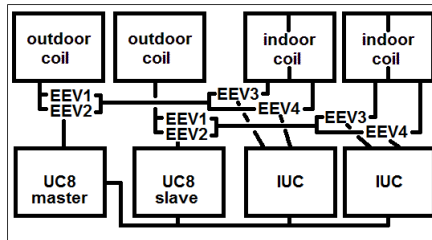
One EEV or two EEV connected in parallel in the outdoor unit, two EEV in the indoor unit where each EEV connects to one-half of the indoor coil.



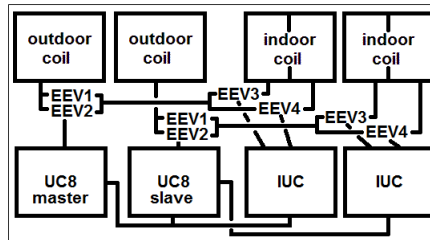
Split unit, two indoor units with IUC



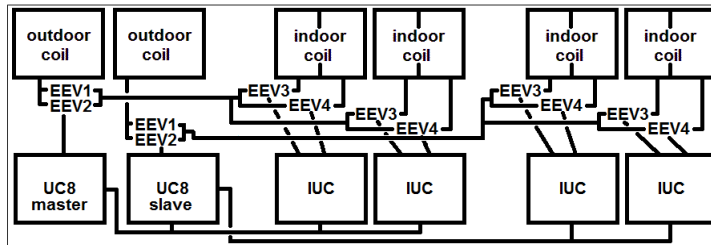
Split unit, two indoor units with IUC



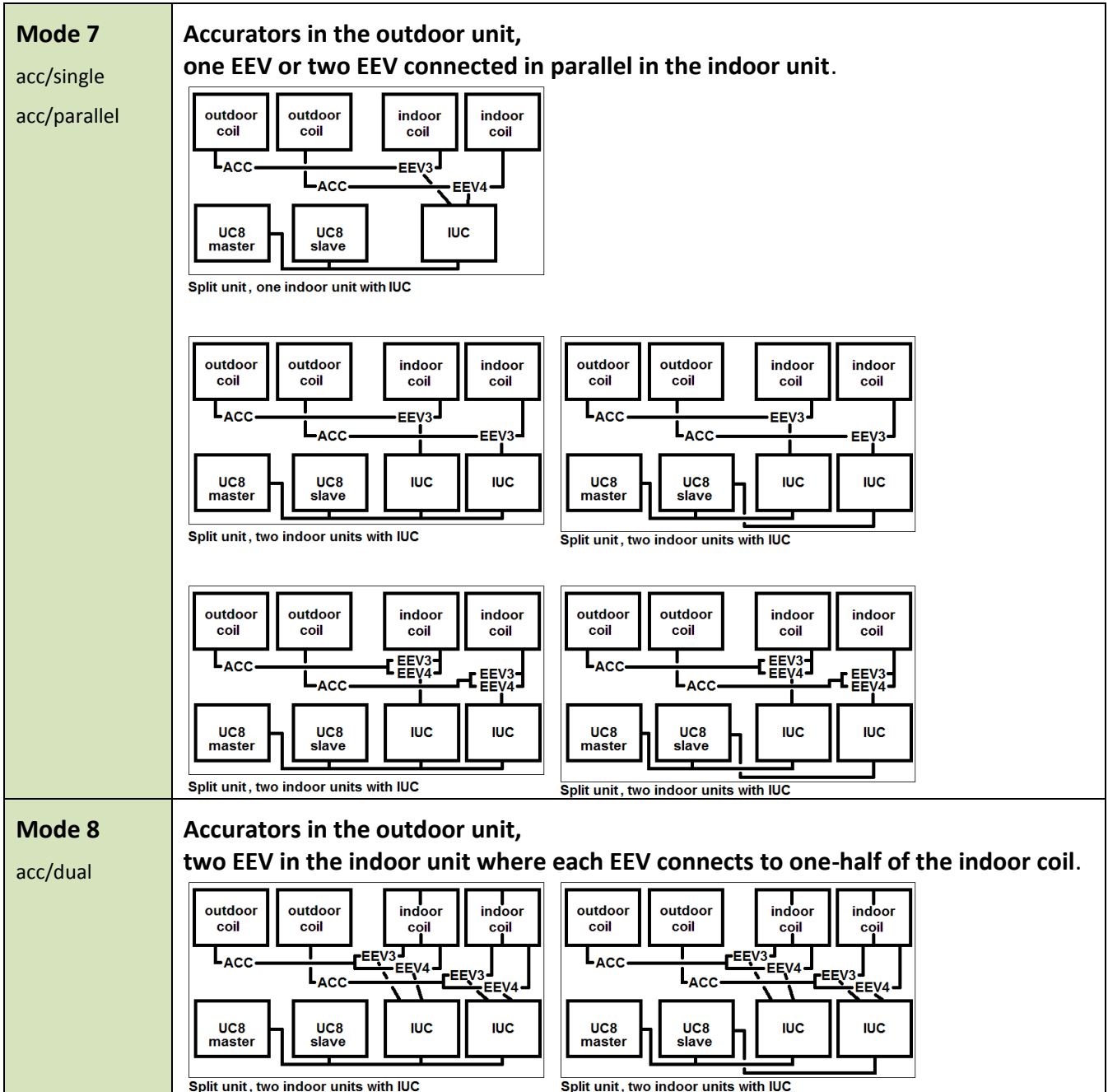
Split unit, two indoor units with IUC



Split unit, two indoor units with IUC



Split unit, four indoor units with IUC



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