



UNIT CONTROLLER 8 (UC8)

Troubleshooting guide

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Contents

1.	Cautions	3
2.	Recommended service tool set	3
3.	Recommended set of spare parts	3
4.	Items to check first.....	3
5.	Controller start-up procedure.....	4
6.	Viewing system information	5
7.	Controller test mode	6
8.	Commissioning mode	7
9.	Timer durations.....	7
10.	Troubleshooting procedure.....	8
11.	Fault messages	10
12.	Fault codes.....	13
13.	Inverter fault codes	16
14.	Fault codes shown on a room thermostat	17
	TZT-100 room thermostat fault codes	17
	SAT-3 room thermostat fault codes	17
	SAT-3 internal fault codes	17
	SAT-3 + Zone controller fault codes	17
	SAT-3 + UC8 fault codes.....	18
15.	Protection function details	19
	High pressure protection (HP).....	19
	Low pressure protection (LP).....	19
	Indoor coil frost protection.....	19
	High temperature protection.....	19
	High suction line / evaporating temperature protection	20
	Low discharge side superheat protection	20
	High discharge side superheat protection.....	20
	Freeze protection	20
	Reverse cycle valve fault protection	21
	Overload protection.....	21
	High compression ratio protection	21
	Low compression ratio protection.....	22
16.	Lock-out.....	22
17.	Unit log	23

1. Cautions

- ! Turn off mains power before opening the electrical panel of a unit.
- ! When disconnecting and connecting connectors hold them by the housing. Do not pull on the wires.
- ! Use as little force as possible when replacing electronic circuit boards.
- ! Never pull on individual electronic components.

2. Recommended service tool set

- Set of screwdrivers of various sizes: blades, pozi-drive and Phillips
- Socket set (6mm to 19mm metric)
- Allan keys (5mm to 10mm metric)
- Small and medium size crescent
- Long nose pliers
- Multi-meter and probe leads of good quality
- Bottle with R410a refrigerant
- Refrigerant scales
- Mobile telephone / Smart-phone

Additional potentially useful items:

- Amp-meter clamp
- Temperature probe
- Length of appliance wire, mains voltage rated
- Wire cutting and stripping tool
- Roll of electrical insulation tape
- Quick-connect (spade) terminals (6.3mm, 0.25") (plastic or rubber insulating boots are useful too)
- Quick-connect (spade) crimp tool
- Pressure gauges for R410a refrigerant
- Torch or other battery powered lamp (e.g. headlamp)
- Temperzone wireless service tool (WSU) and a smart phone
- Laptop computer with USB to RS485 converter (Hyperterm or TeraTerm program installed)

3. Recommended set of spare parts

- Known good UC8 controller circuit board, programmed with software version 2.1.9 or later
- Set of Temperzone standard temperature sensors (yellow, blue, red and white leads)
- 34.5 bar and 45 bar pressure transducers
- Temperzone pressure transducer leads

4. Items to check first

- What exactly is the complaint? Does the unit run at all?
- Under which conditions does the problem occur?
- Check mains power is properly connected and is the mains voltage correct.
- Check control wires between indoor and outdoor units and to the thermostat or other controller.
- Check all unit internal wiring is securely fastened and connected.
- Check that DIP switch settings agree with information given in the unit documentation.
- Take careful note of any information shown on the controller board display.

5. Controller start-up procedure

When mains power to the UC8 controller is switched on it follows a defined start-up procedure. The controller start-up procedure is, in this order:

1. The yellow light marked **Power** must illuminate.
2. The display must show the characters **UC8** (one character at a time).
3. The display must show the software version as three numbers with two dots (decimal points) in between. Example: **2.1.9**
4. If the unit was locked out due to repeated trips, then it will next show the cause of the most recent lock-out. **Note this is not a fault!** The message will be shown for about half a minute after which the controller will continue the normal start-up sequence. This message will no longer be shown after the unit has completed at least one normal cooling or heating cycle.
5. The display will show the type/model of the compressor it is configured for. Refer to the table below for a list of available compressors.
6. A controller configured as a master (DIP switches 11 and 12 both OFF) will show the message **dELAY**, for between 10 to 20 seconds.
Air-to-air units only: A controller configured as a slave (one or both DIP switches 11 and 12 ON) will show the message **ctrlL**, until the master controller has made contact with the slave.
7. The display must show a flashing decimal point (a dot). The flashing dot indicates the unit has commenced normal operation and no faults are reported.

List of available compressors:

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	-

6. Viewing system information

When the controller is operating normally the display will show a flashing dot or, if operating in commissioning mode, a flashing letter **c**. Under those conditions it is possible to use the display on the UC8 controller to view information on pressures, temperatures, superheat, expansion valve opening, capacity and the controller Modbus address. This is available regardless whether the compressor is on or off. It is not available when the controller is reporting a fault.

To view system information:

Repeatedly press the pushbutton to cycle the display through the options (in a round robin fashion).

- Temperatures are shown in degrees Celsius (°C). 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 are converted from pressure readings.
- Pressures are shown in kPa. Divide by 6.895 (roughly 7) to convert to PSI.
- If a sensor reading is not available then the display shows a dash, for example: **SLP –**
- If the unit does not have electronic expansion valves then it shows value 0; example: **EE1 0**
- After 2 minutes the display automatically returns to a flashing dot (or **c**).

Display	Meaning	Units
• or c	Normal mode (default)	
SLP	Compressor suction line pressure	kPa
Et	Evaporating temperature	°C
SLt	Compressor suction line temperature	°C
SSH	Suction side superheat	K
dLP	Compressor discharge line pressure	kPa
Ct	Condensing temperature	°C
dLt	Compressor discharge line temperature	°C
dSH	Discharge side superheat	K
ICEt	Outdoor coil de-ice sensor temperature	°C
CAP	Unit capacity (duty)	%
EE1	Expansion valve 1 opening	%
EE2	Expansion valve 2 opening	%
Add	Controller Modbus address	-

7. Controller test mode

A controller test mode is available that can provide a quick check of the operation of relays, contactors and fans. Test mode can only be activated when the unit is not already in commissioning mode, the compressor must be off and the thermostat or BMS must not request to start.

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 in the table below, with a brief pause between each step. When the test sequence is complete the UC8 returns to normal mode and the display will show the suction line pressure (letters SLP followed by the pressure in kPa) or it may return to show a flashing decimal point.

Step	Test	Duration (seconds)	Notes
1	Output R/V (reverse-cycle valve)	2	
2	Outdoor fan low speed	7	1, 3, 4, 5
3	Outdoor fan medium speed	7	
4	Outdoor fan high speed	15	
5	Indoor fan low speed	7	2, 3, 6, 7, 8
6	Indoor fan medium speed	7	
7	Indoor fan high speed	15	
8	Output SSR1	2	
9	Output SSR2	2	
10	Output AUX	2	
11	Pressure transducer test	1	9
12	Output CMC (compressor contactor)	2	

Notes:

- 1 Steps 2, 3 and 4 are skipped on hydronic units (no outdoor fan).
- 2 Steps 5, 6 and 7 are skipped on chillers and water-heating units (no indoor fan).
- 3 If the fan is a three speed type then relays Low, Medium and High activate in turn.
- 4 If the outdoor fan is a variable speed type (0-10V control) then relay Medium will activate, but only if this relay is not required for a three-speed indoor fan.
- 5 If the outdoor fan is a single-speed type then relay Medium activates for 29 seconds in total.
- 6 If the indoor fan is a variable speed type (0-10V control) then relay High will activate, but only if this relay is not required for a three-speed outdoor fan.
- 7 If the indoor fan is a single-speed type then relay High activates for 29 seconds in total.
- 8 If the unit is a split type and the indoor unit has an indoor unit controller (IUC) then the indoor fan is tested via the IUC and steps 5, 6 and 7 will not activate any output on the UC8 controller.
- 9 Step 11 is skipped if the unit does not have both the low- and the high-pressure transducers. If the test is performed then pressure readings are expected to be approximately equal. If they are found to be very different then fault F34 is reported. The fault is cleared automatically when pressures are sufficiently equalised.

8. Commissioning mode

A controller commissioning mode is available that allows doing a quick check of the operation of the entire unit. Commissioning mode can only be activated when the compressor is off and the thermostat or BMS must not request to start.

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

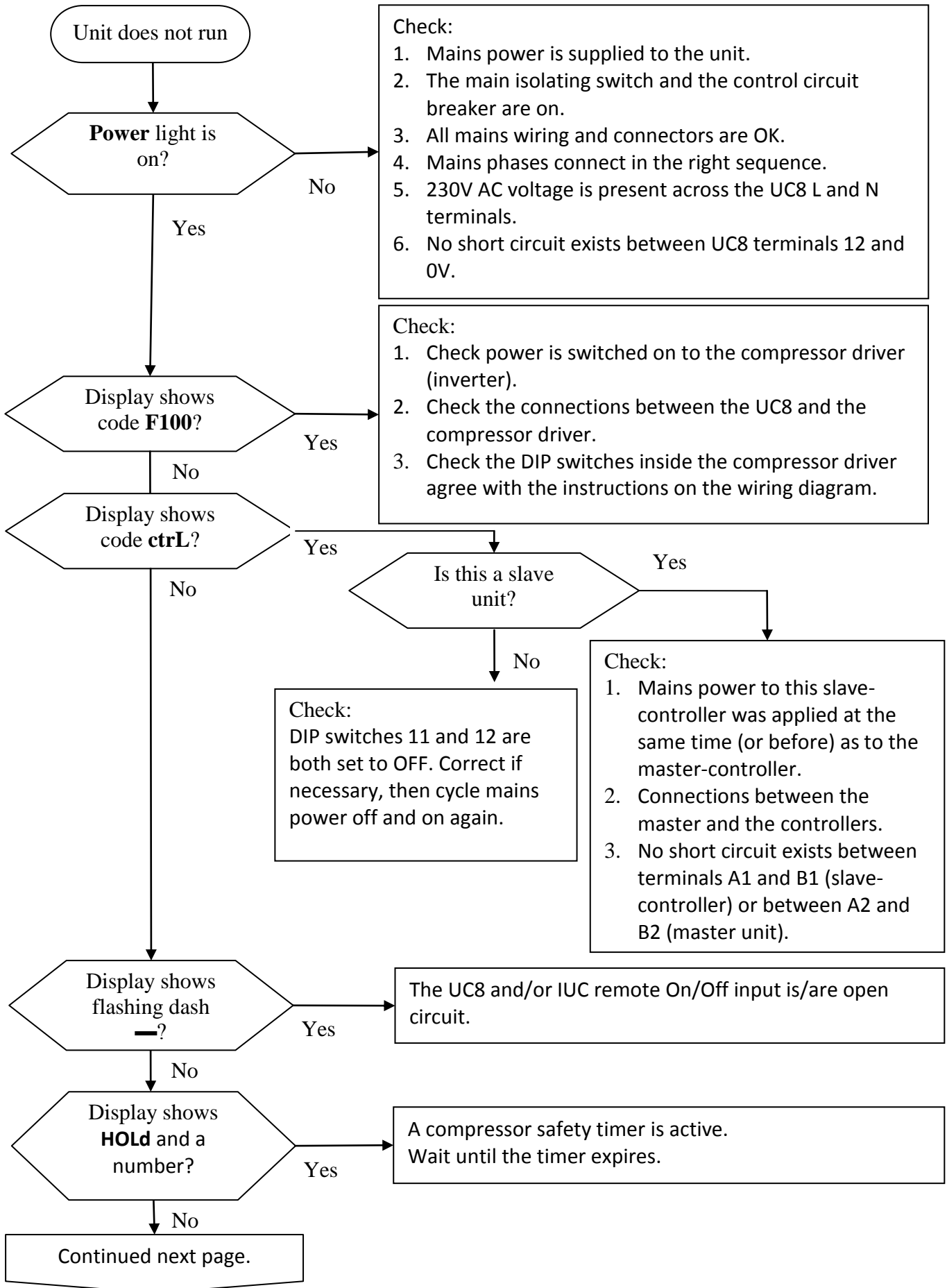
Note:

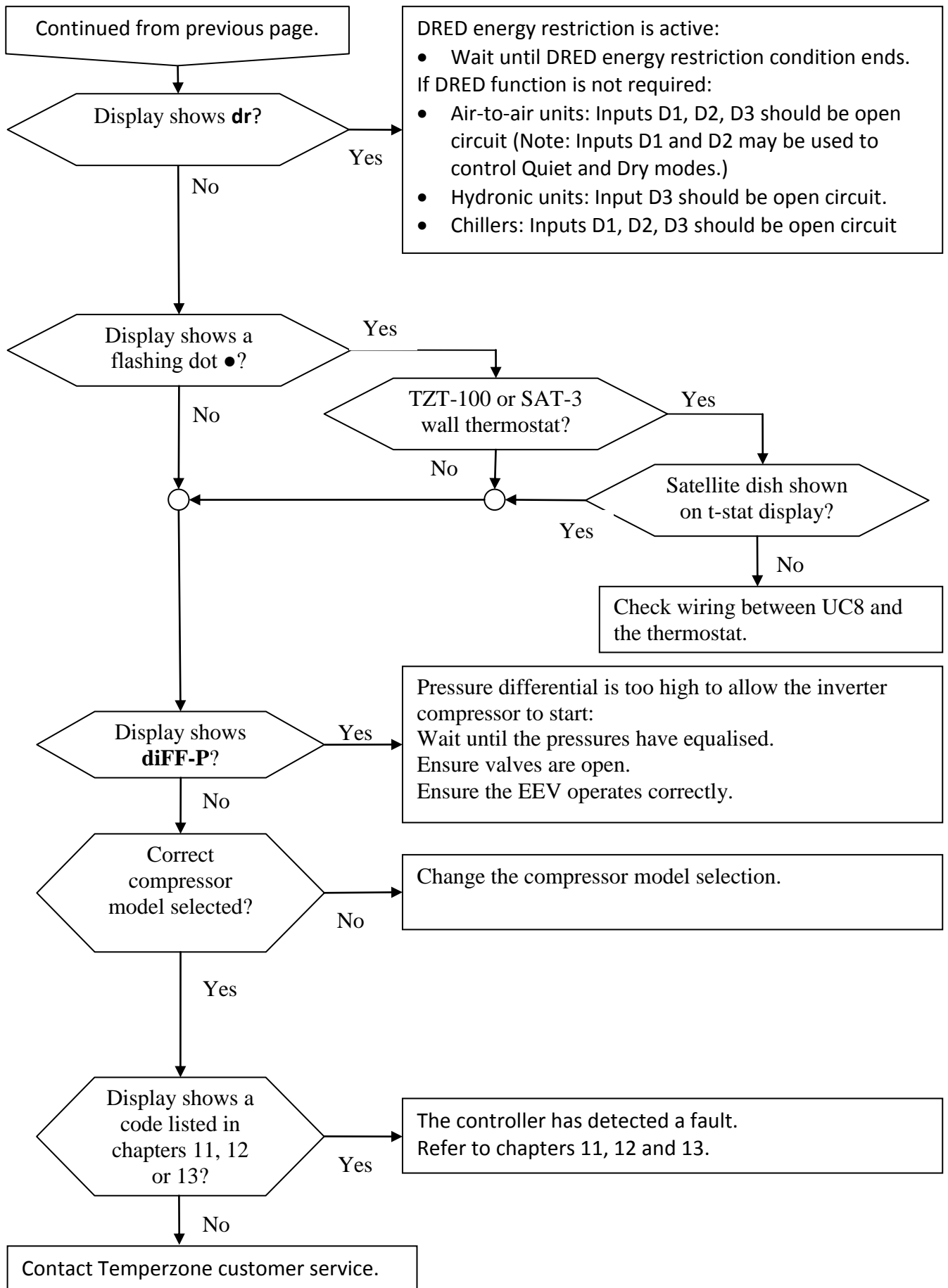
If the unit has a variable speed compressor then the Minimum On-Off time (‘Run’-time) remains set to 90 seconds regardless whether the controller is placed in commissioning mode or not.

9. Timer durations

Safety timer	Duration
Unit start-up delay (after mains power-on)	2 minutes
Minimum compressor run-time (On-to-Off duration)	90 seconds
Minimum compressor off-time (Off-to-On duration)	3 minutes
Minimum compressor cycle-time (On-to-On duration)	6 minutes (a maximum of ten compressor starts per hour)
Hydronic unit compressor start delay (allows time for a water valve to open)	45 seconds
HP protection	3 minutes
LP protection	3 minutes
Compressor high discharge pipe temperature protection	3 minutes
Indoor coil frost protection	6 minutes
Hydronic unit water freeze protection	3 minutes
High suction line temperature/pressure protection	3 minutes
Low / high discharge superheat protection	3 minutes
Overload protection	3 minutes
High / low compression ratio protection	3 minutes

10. Troubleshooting procedure





11. Fault messages

Display	Meaning	Possible causes	Possible remedy
LP	Low pressure protection	Check for refrigerant leaks.	Fix leak, evacuate unit, then recharge.
		Expansion valve (EEV) is closed.	Check valve coil is properly fitted onto the valve body. Check UC8 DIP switch settings. Repair wiring to the valve. Replace expansion valve.
		Faulty transducer cable. Faulty transducer. Faulty LP switch.	Repair transducer cable. Replace transducer. Replace LP switch.
		Service valve is closed.	Open service valves.
		Indoor fan does not start (cooling mode) or outdoor fan does not start (heating mode).	Repair fan wiring. Replace fan.
		Incorrect DIP switch settings.	Change DIP switch settings then restart the controller.
		HP	High pressure protection
Unit is overcharged.	Remove excess refrigerant charge.		
EEV is closed.	Check UC8 DIP switch settings. Repair wiring to the expansion valve. Replace expansion valve.		
Faulty transducer cable. Faulty transducer. Faulty HP switch.	Repair cable to the transducer. Replace transducer. Replace HP switch.		
Service valve is closed.	Open service valves.		
Incorrect DIP switch settings.	Change DIP switch settings then restart the controller.		
HI-t	High temperature protection	Insufficient refrigerant.	Add refrigerant.
		Faulty discharge line temperature sensor.	Replace sensor.
		Incorrect DIP switch settings.	Change DIP switch settings then restart the controller.
FROSt	Indoor coil frost protection	Air filter blocked.	Clean or replace air filter.
		Dampers closed.	Check dampers and damper controls.
		Excess amount of cold fresh air introduced.	Check fresh air damper and damper controls.
		Indoor fan speed too low.	Increase indoor fan speed.
		Faulty indoor fan motor. Faulty indoor fan speed controller.	Replace indoor fan motor. Replace indoor fan speed controller.
		Return air temperature too low.	Ensure unit is not operated in cooling mode with very low return air temperature.
		Insufficient refrigerant.	Add refrigerant.

Display	Meaning	Possible causes	Possible remedy
HI-SL	High suction line temperature protection	Insufficient refrigerant.	Add refrigerant.
		Very high room temperature (cooling mode).	Reduce indoor fan speed (temporarily).
		Very high outdoor ambient temperature (heating mode).	Do not operate the unit in heating mode with very high outdoor ambient temperature.
		Faulty suction line temperature sensor.	Replace sensor.
Lo-dSH	Low discharge superheat protection	Unit is overcharged.	Remove excess refrigerant charge.
		Discharge line temperature sensor not properly fitted.	Securely fit the temperature sensor on the compressor discharge pipe and insulate.
		Suction line temperature sensor not properly fitted.	Securely fit the temperature sensor on the compressor suction pipe and insulate.
		Faulty discharge line temperature sensor.	Replace sensor.
		Incorrect expansion valve selection	Correct the DIP switch settings for switches 7, 8, 9 and 10
HI-dSH	High discharge superheat protection	Loss of refrigerant.	Find refrigerant leak and repair. Replace refrigerant with correct charge.
		Faulty discharge line high pressure transducer.	Replace transducer.
		Suction line temperature sensor not properly fitted.	Securely fit the temperature sensor on the compressor suction pipe and insulate.
		Incorrect expansion valve selection	Correct the DIP switch settings for switches 7, 8, 9 and 10
LO-t	Water freeze protection	Insufficient flow of water	Ensure water circulating pump operates. Ensure water valves are open. Bleed air out of the water circuit to prevent air-locks.
		Supply water temperature too low.	Ensure supply water temperature is above +10°C.
		Lack of refrigerant charge.	Add refrigerant.
FLOOd	Sump condensate flooding protection	Condensate drain pipe is blocked	Unblock condensate drain pipe.
		Condensate drain pipe slope is insufficient	Increase pipe slope or install sump condensate pump and float switch.
		No U-trap installed	Install U-trap
		Faulty sump condensate float switch.	Replace float switch.
		Faulty sump condensate pump.	Replace pump.
OL	Overload protection	Indoor fan is overloaded.	Check indoor fan. Check airflow is not obstructed.
		Outdoor fan is overloaded.	Check outdoor fan. Check airflow is not obstructed.
		Compressor overheated.	Wait until compressor has cooled down sufficiently. Check system has adequate refrigerant charge. System design must ensure adequate return of compressor lubricating oil.
		Faulty wiring / connection to input IN#2.	Repair wiring.

Display	Meaning	Possible causes	Possible remedy
CRL	Low compression ratio	Incorrect compressor model selected.	Select the correct compressor model.
		Compressor does not start.	Check compressor contactor. Check compressor and contactor wiring.
CRH	High compression ratio	Unit is overcharged.	Remove excess refrigerant charge.
		EEV does not operate correctly.	Check settings of DIP switches 7, 8, 9, 10. Check wiring to the EEV. Check EEV coil is fitted properly.
		Indoor fan speed too low.	Increase indoor fan speed.
		Air filter is blocked.	Clean or replace air filter.
Lockout	Unit is locked out	Unit has locked out three times in a row without making any successful (complete) cooling or heating cycle.	To unlock the following steps MUST be followed in order: <ol style="list-style-type: none"> 1. Press the UC8 pushbutton to unlock. 2. Fix the cause of the repeating problem. 3. Allow the unit to make at least one successful (complete) cooling or heating cycle.

12. Fault codes.

Display	Fault	Possible causes	Possible remedy
F10	Outdoor fan	Incorrect DIP switch settings.	Change DIP switch settings.
		Loose wiring between UC8 board and outdoor fan speed controller board.	Repair wiring.
		No power to outdoor fan speed controller.	Ensure power is present.
		Faulty outdoor fan speed controller board.	Replace outdoor fan speed controller.
F11	Indoor fan	Incorrect DIP switch settings.	Change DIP switch settings.
		Loose wiring between UC8 board and indoor fan speed controller board.	Repair wiring.
		No power to indoor fan speed controller.	Ensure power is present.
		Faulty indoor fan speed controller board.	Replace indoor fan speed controller.
F12	No low pressure transducer.	Cable has disconnected.	Reconnect cable.
		Incorrect DIP switch settings.	Change DIP switch settings.
		Faulty transducer.	Replace transducer.
F13	No high pressure transducer.	Cable has disconnected.	Reconnect cable.
		Incorrect DIP switch settings.	Change DIP switch settings.
		Faulty transducer.	Replace transducer.
F14	Suction line temperature sensor	Loose connection.	Repair connections.
		Faulty temperature sensor.	Replace sensor.
F15	Discharge line temperature sensor	Loose connection.	Repair connections.
		Faulty temperature sensor.	Replace sensor.
F16	De-Ice temperature sensor	Loose connection.	Repair connections.
		Faulty temperature sensor.	Replace sensor.
F17	Outdoor coil temperature sensor	Loose connection.	Repair connections.
		Faulty temperature sensor.	Replace sensor.
F18	Indoor coil temperature sensor	Loose connection.	Repair connections.
		Faulty temperature sensor.	Replace sensor.
F19	Outdoor ambient temperature sensor	Loose connection.	Repair connections.
		Faulty temperature sensor.	Replace sensor.
F20	Superheat unknown	Check: low pressure transducer, suction line temperature sensor, high pressure transducer, discharge line temperature sensor, outdoor coil temperature sensor, indoor coil temperature sensor, DIP switch settings.	
F21	Thermostat serial comms lost	Loose wiring.	Repair connections.
		Electrical interference.	Use twisted pair screened cable. Signals A and B must form a pair. Connect screen to 0V at the UC8. Re-route cable away from other cables.

Display	Fault	Possible causes	Possible remedy
F22	System 1 or BMS serial comms lost	Loose wiring.	Repair connections.
		Slave system or BMS controller off.	Turn master system or BMS on.
F23	System 2 serial comms lost	Slave system or BMS communications intermittent.	Ensure BMS communicates at least once every 5 minutes.
		Electrical interference.	Use twisted pair screened cables. Signals A and B must form a pair. Connect screen to 0V at the UC8. Re-route cables away from other cabling where possible.
F24	System 3 serial comms lost		
F25	System 4 serial comms lost	Incorrect DIP switch settings.	Check DIP switch settings.
F26	Cannot read DIP switches	Moisture on controller circuit board.	Allow controller to dry.
		Faulty controller.	Replace controller circuit board.
F27	Invalid fan selection	Incorrect DIP switch settings.	Correct DIP switch settings.
		Indoor unit not detected.	Ensure indoor unit powers up at the same time, or before, the outdoor unit. Check connections with the indoor unit.
F28	Missing outdoor coil de-ice temperature sensor	Control signals request heating mode on a cooling-only unit.	Remove heating mode request signal.
		Loose wiring.	Repair connections.
		Faulty outdoor coil de-ice sensor.	Replace sensor.
F29	Microcontroller temperature too high	Wait until the unit has cooled down. Find the cause of extremely high temperature in the electrical compartment.	
F30	Supply voltage out of bounds	Check that 230V AC mains power supply voltage is stable.	
F31	A slave system reports a fault	Check slave systems.	
F32	Internal comms problem	Moisture on controller circuit board.	Allow controller to dry.
		Faulty controller.	Replace controller circuit board.
F33	Refer to "high discharge superheat" (HI-dSH)		
F34	Problem with readings from the pressure transducers	Transducer wires swapped.	Correct transducer wiring.
		Transducers fitted to wrong pipe.	Swap transducers.
		Incorrect transducer type.	Fit correct transducer.
		Expansion valve closed.	Repair EEV wires.
		Faulty transducer.	Replace transducer.
F35	Reverse cycle valve	Loose wiring.	Repair wiring.
		Faulty reverse cycle valve.	Replace reverse cycle valve.
F36	Invalid DIP switch setting on TZT-100 thermostat	Check TZT-100 thermostat DIP switch 4 is ON: The reverse cycle valve is ON when the unit operates in heating mode.	

Display	Fault	Possible causes	Possible remedy
F37	Indoor unit serial comms lost	Loose wiring.	Repair connections.
		Indoor unit has no power.	Restore power to the indoor unit.
		Electrical interference.	Use a twisted pair screened cable. Signals A and B must form a pair. Connect screen to 0V at the UC8. Re-route cables away from other cabling where possible. The indoor unit should use the same earth point as the outdoor unit.
		Faulty indoor unit controller.	Replace indoor unit controller.
F38	Indoor unit controller reports a fault	Loose temperature sensor wiring in indoor unit.	Repair temperature sensor wiring in the indoor unit.
F39	Problem with variable speed compressor inverter	Loose wiring.	Repair connections.
		Inverter has no power.	Restore power to the inverter.
		Faulty inverter.	Replace inverter.
F40	Refer to high compression ratio protection (CRH).		
F41	Refer to low compression ratio protection (CRL).		
F42	High evaporating temperature	Very high room temperature combined with high indoor fan speed (cooling mode).	Temporarily reduce indoor fan speed.
		Excess introduction of fresh (hot outdoor) air.	Reduce amount of fresh air.
F43	Low condensing temperature	Very low room temperature combined with high indoor fan speed (heating mode).	Temporarily reduce indoor fan speed.
		Excess introduction of fresh (cold outdoor) air.	Reduce amount of fresh air.
		Outdoor coil exposed to strong cold wind (cooling mode).	Shelter outdoor unit from strong winds.
F44	Invalid EEV mode selection	Indoor unit not detected.	Ensure indoor unit powers up at the same time, or before, the outdoor unit. Check wiring between outdoor and indoor units.
		Incorrect DIP switch settings.	Change DIP switch settings, then reset the controller.

13. Inverter fault codes

The following fault codes apply only to units with a variable speed compressor and Carel power+ compressor driver (inverter).

Notes:

- The fault code shown on the UC8 display is F100 + 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

14. Fault codes shown on a room thermostat

TZT-100 room thermostat fault codes

When the UC8 is connected to a TZT-100 room thermostat and a fault is detected then the thermostat will show the word FAULT on the display (flashing slowly). The TZT-100 room thermostat cannot show individual fault codes.

SAT-3 room thermostat fault codes

The SAT-3 room thermostat is able to show fault codes on the thermostat display (bottom right corner of the display). The tables provide details for the codes.

Notes:

- (1) The SAT-3 display shows each fault code number twice and repeats. For example fault code “A1 A2” is shown on the SAT-3 display as “A1 A1 A2 A2” repeating continuously.
- (2) Codes must be read in sequence from lowest to highest. Thus, for example, codes “A1 A2” and “A2 A1” are the same code.

SAT-3 internal fault codes

SAT-3 display code	Fault description	Possible remedy
t1	Internal temperature sensor error	Replace thermostat
t2	External temperature sensor error	Repair external sensor connections
t3	No communications between SAT-3 and zone controller or UC8	Repair connections between SAT-3 and zone controller or UC8

SAT-3 + Zone controller fault codes

SAT-3 display code	Fault description	Possible remedy
A1	Damper calibration not completed	Wait until dampers are calibrated
A2	Damper calibration failed	Make sure dampers operate freely Repair damper connections
A3	No communications between zone controller and UC8	Repair connections between zone controller and UC8
A1 A2	Combinations of above three faults.	
A1 A3		
A2 A3		
A1 A2 A3		

SAT-3 + UC8 fault codes

SAT-3 display code	UC8 display code	Fault	Notes
Blank	●	No faults	
A4		Lock out	UC8 display shows the cause.
A1 A4	HP	HP trip	
A1 A5	LP	LP trip	
A3 A6	OL	Overload	
A1 A6	Frost	Indoor coil frost protection	
A5 A6	Lo-t	Water freeze protection	HWP and chillers only.
A1 A7	Hi-t	Discharge line high temperature	
A1 A8	Hi-SL	Suction line high temperature	
A5 A7	Flood	Flooded condensate sump	HWP only.
A5 A8	No-Flo	No circulating water flow	HWP and chillers only.
A3 A4	Lo-DSH	Low discharge superheat	
A3 A7	F10	Outdoor fan fault	
	F11	Indoor fan fault	
A3 A8	F12	Low pressure transducer	
	F13	High pressure transducer	
	F14	Suction line temp sensor	
	F15	Discharge line temp sensor	
	F16	De-ice ambient sensor	
	F17	Outdoor temp sensor	
	F18	Indoor coil temp sensor	
	F19	Outdoor ambient sensor	
A1 A2 A8	F20	Superheat unknown	
A1 A2 A4	F21	No communications, thermostat	Code cannot be shown.
A2 A4	F22	No communications, BMS	
A2 A5	F23	No communications, system 2	
A2 A6	F24	No communications, system 3	
A2 A7	F25	No communications, system 4	
A1 A2 A6	F26	Cannot read DIP switches	
	F27	Illegal fan selection	
	F28	Illegal mode	
	F29	High board temperature	
	F30	Supply voltage brown-out	
A2 A3 A4	F31	Slave reports a fault	
A1 A2 A6	F32	UC8 internal problem	Same code as F26...F30.
A3 A5	Hi-DSH	High discharge superheat	
A4 A8	F34	Pressures not equalising	
A2 A3	F35	Reverse cycle valve fault	
A1 A2	F36	TZT-100 DIP switch setting	Code cannot be shown.
A2 A8	F37	No communications, IUC	
A7 A8	F38	IUC reports a fault	
A6 A7	F39	Inverter reports a fault	
A4 A5	F40	Compression ratio too high	
A4 A6	F41	Compression ratio too low	
A4 A7	F42	Evaporating temp too high	
A4 A8	F43	Condensing temp too low	
A1 A2 A5		All other UC8 faults	

15. Protection function details

High pressure protection (HP)

Protects a unit from excessively high refrigerant pressure.

Conditions: Unit with HP switch: When the switch activates (open circuit).
Unit with high pressure transducer: When compressor discharge pressure exceeds 4151 kPa (602 PSI, equivalent to +65°C condensing temperature).
Hydronic reverse cycle units where the high pressure transducer is switched to the suction line when heating: When the indoor coil temperature exceeds 56°C.

Low pressure protection (LP)

Protects a unit from excessively low refrigerant pressure.

Conditions: Unit with LP switch: As soon as the switch activates (open circuit).
If a low pressure transducer is connected there are two levels:
Transient level: When pressure is below 114 kPa (16.5 PSI, equivalent to -35°C).
Normal level: When pressure is below 228 kPa (33.0 PSI, equivalent to -25°C).

Notes: The transient level is always applied.

The normal level is applied when more than 90 seconds have expired since the compressor started and also when more than 90 seconds have expired since the end of a de-ice cycle.

Indoor coil frost protection

Protects a unit from forming too much ice on the indoor coil. Applied only when a unit is cooling in normal mode, not applied when a unit is de-icing the outdoor coil.

The frost protection function activates when the indoor coil condition remains very cold for longer than the frost-protect delay time of 6 minutes.

Conditions: When the evaporating temperature remains below -8°C for longer than 6 minutes or when the compressor suction pipe temperature remains below -4°C for longer than 6 minutes.

High temperature protection

Protects the compressor from overheating which could otherwise cause damage to the compressor motor, to the compression scroll or rotary compression stage, or cause deterioration of the compressor lubricating oil.

On a unit with electric heating protects the unit from becoming extremely hot and burn-out of the electric heating element.

Conditions: When the compressor discharge pipe temperature remains above
+120°C for longer than 2 seconds **or**
+110°C for longer than 30 minutes.

Hydronic units with electric heating only:

When the fast-acting heating safety temperature sensor (connected to input AMB) remains above +75°C for longer than 2 seconds.

High suction line / evaporating temperature protection

Protects the compressor motor from overheating.

If the unit has a variable duty compressor (digital scroll or variable speed) then high suction pipe / evaporating temperature protection is applied only when capacity is at 50% of nominal duty or higher. If the unit has a fixed duty compressor this protection is always applied.

Conditions: When the evaporating temperature remains above +27.5°C (1665 kPa, 241.5 PSI) and/or the compressor suction pipe temperature remains above +30°C for longer than 15 minutes.

Low discharge side superheat protection

Protects a unit with an electronic expansion valve (EEV) from prolonged flooding of the compressor which otherwise might cause damage to the motor bearings or to the compression stage.

This protection does not apply to units that use accurators.

Discharge side superheat is defined as the difference between the compressor discharge pipe temperature and the condensing temperature.

Conditions for units with fixed duty compressor:

- When discharge side superheat remains below 10K for longer than 15 minutes.

Conditions for units with variable duty compressor (digital scroll and variable speed types):

- At nominal duty and higher: When discharge side superheat remains below 10K for longer than 15 minutes.
- Between standard minimum and nominal duty: Minimum discharge side superheat varies linearly with capacity from 0K at standard minimum duty to 10K at nominal duty.
- At standard minimum duty and below: Protection not applied.

Standard minimum duty: 40%

Nominal duty: 100%

High discharge side superheat protection

Protects a unit from prolonged running with a lack of refrigerant or where the compressor remains otherwise starved of refrigerant. Applied only when the unit operates in normal mode, not applied when a unit is de-icing the outdoor coil.

Discharge side superheat is defined as the difference between the compressor discharge pipe temperature and the condensing temperature.

Conditions: When discharge side superheat remains above 45K for longer than 30 minutes.

Freeze protection

Protects against freezing of the circulating water.

Applies to hydronic reverse cycle units when the unit is heating the room and thus cooling the water. Also applies to chillers when the unit is cooling the water.

Conditions: When the compressor suction pipe temperature remains below 0°C for longer than 1 minute or when the evaporating temperature remains below -4°C for longer than 1 minute.

Reverse cycle valve fault protection

Stops a unit from running in the wrong mode if the reverse cycle valve has not switched to the correct position (cooling or heating). Applied only for air-to-air units. This function has two versions:

Version 1

Applies only to air-to-air units with two pressure transducers (connected to UC8 inputs HPT and LPT) **and** with a temperature sensor fitted to the indoor coil (connected to UC8 input IC for packaged units or connected to IUC input T1 for split units).

Conditions: If the unit is **cooling** and **all** of the next conditions are true:

1. The unit is cooling (not off and not de-icing the outdoor coil).
2. The unit operates at more >50% of nominal capacity.
3. The indoor coil temperature sensor reports a temperature that is closer to the condensing temperature (calculated by the controller from the compressor discharge pipe pressure) than to the evaporating temperature (calculated by the controller from the compressor suction pipe pressure)
4. The difference between the condensing- and evaporating- temperatures remains >20°C for longer than 3 minutes.

If the unit is **heating** the same list of conditions applies except that the indoor coil temperature sensor must give a reading closer to the condensing temperature than to the evaporating temperature.

Version 2

Applies only to air-to-air units without pressure transducers (UC8 inputs HPT and LPT unconnected) but with temperature sensors on the indoor- and the outdoor- coil (UC8 inputs IC and OC respectively, packaged units) and to split units without pressure transducers where the indoor unit controller (IUC) reports indoor coil temperature to the UC8.

Conditions: **All** of the next conditions must true:

1. The unit is cooling or heating (not off and not de-icing the outdoor coil).
2. The unit operates at >50% of nominal capacity.
3. The measured condensing temperature remains more than 10°C colder than the measured evaporating temperature (thus the coil temperatures are the ‘wrong way around’) for longer than 3 minutes.

Overload protection

Protects various components of the system such as the compressor, indoor and outdoor fan motors. Applies only to units with a low pressure transducer connected to UC8 input LPT.

Conditions: When the overload input signal becomes active.

Overload switches should be wired to input IN#2. The switches should be a normally-on type and, if there is more than one overload switch, connected in series. When the UC8 overload input becomes open-circuit the UC8 display shows message **OL** and the compressor is stopped.

High compression ratio protection

A very high compression ratio can bring a risk of overloading of the compressor motor. The maximum compression ratio varies between different compressor models, compressors used by temperzone generally are specified for a maximum compression ratio between 7 and 10. This protection function will stop a compressor as soon as the maximum compression ratio is exceeded.

Conditions: When the compression ratio rises above the maximum value.

Low compression ratio protection

For proper internal circulation of the compressor lubrication oil compressors require a minimum compression ratio or a minimum pressure differential. The exact minimum value varies between different compressor models but generally falls in the range of 1.2 to 1.5. This protection function will stop a compressor when the required minimum high-to-low pressure ratio is not achieved after a certain time interval.

Conditions: When the compression ratio remains below the minimum value for longer than 3 minutes. Applied only during normal cooling or heating; not applied when the unit is de-icing the outdoor coil.

16. Lock-out

The controller counts the number of trip events for each of the safety functions. If any one of the trip counters listed below reaches the count of 3 then the unit is put into lock-out mode. During lock-out mode the compressor and the fans are not allowed to run. The display will show which protection caused the lock-out and the fault relay output will be on.

Trip event counters are reset to zero when the thermostat calls for the compressor to be off and also when mains power to the controller is switched off and on again. A trip event is also removed from the count if the event occurred longer than 12 hours ago.

Faults that can lead to lock out are:

- HP
- LP
- High temperature protection
- Frost protection
- High suction line / evaporation temperature protection
- Low discharge superheat protection
- High discharge superheat protection
- Freeze protection
- Reverse cycle valve failure protection
- Variable speed compressor driver trip events
- Low compression ratio
- High compression ratio

Lock-out can be cleared in a number of ways:

- By removing and then restoring mains power to the UC8 controller.
- By Modbus RTU command sequence. Refer to document UC8 Modbus communications for details.
- By BACnet command sequence. Refer to document UC8 BACnet communications for details.

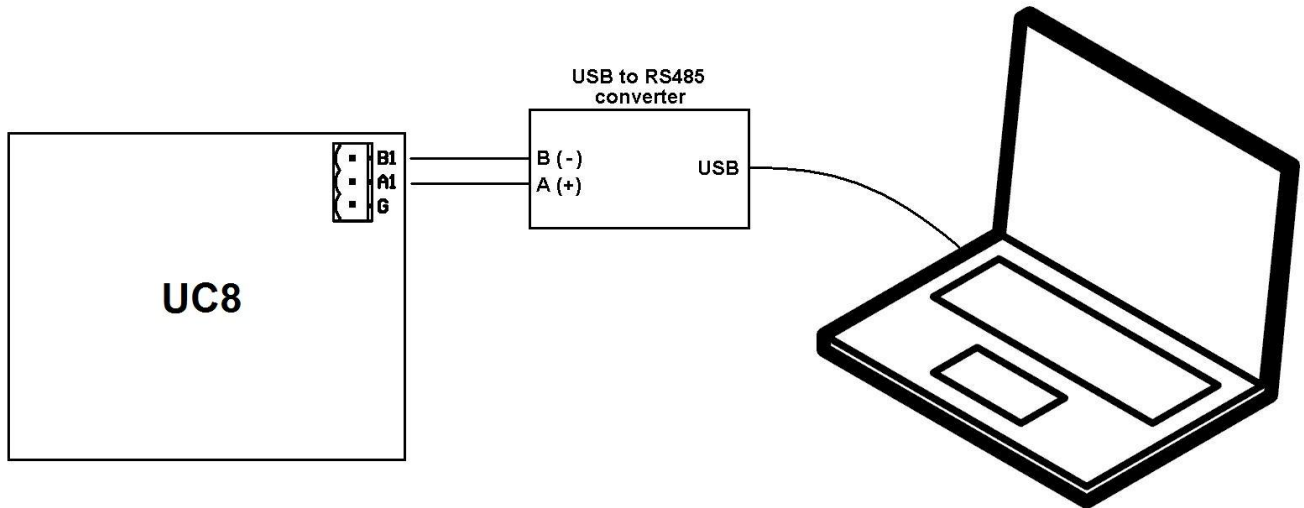
When a unit was locked out and the UC8 controller is reset, e.g. by removing and then restoring mains power, the display will show the previous fault message for 20 seconds (after the normal start-up sequence). After that normal operation resumes. The 20 second long message display will repeat every time mains power is removed and restored until the unit has completed at least one normal compressor-on / compressor-off cycle.

If a unit repeatedly locks out (and is then unlocked) whilst the unit is never able to complete a normal cooling or heating cycle, then as the unit locks out for a third time in a row it becomes “permanently” locked. If this has happened then, to re-activate the unit, the UC8 pushbutton **must** be pressed **and** then the unit must complete at least one full cooling or heating cycle (that is: compressor must start and then then stop the normal way, e.g. under control of a thermostat).

17. Unit log

The controller keeps an internal log of certain information. The log can be viewed as follows:

- Connect a USB to RS485 converter to a computer and to UC8 terminals A1 and B1 respectively.



- On the computer start a communications program such as HyperTerm or TeraTerm.
- Settings of the communications parameters must be: 115200 baud, 8 data bits, no parity bit, 1 stop bit. The COM port number must be that of the USB to RS485 serial interface.
- Switch power to the unit controller off.
- While holding down the UC8 push-button switch power to the unit on. Keep pressing on the button until the display on the controller shows the letter **P**, then release the button.
- The computer screen will now show a small menu as shown here:

```
=====
(C) COPYRIGHT 2015 Temperzone
UC8 bootloader    version 2.1

Please choose an option:
Download new software - 1
Start normal operation - 2
View unit log record - 3
Disable write protection - 4
=====
```

- Choose “View unit log record” by pressing **3** on the computer keyboard.

- The unit log will now be displayed on the computer screen. Example:

```
===== Unit log record:
Cooling hours      : 168
Cooling minutes   : 20
Heating hours     : 35
Heating minutes   : 46
DeIcing hours     : 1
DeIcing minutes   : 12
Cooling cycles    : 68
Heating cycles    : 51
De-ice cycles     : 14
HP events         : 0
LP events         : 0
Frost  events     : 0
Freeze events     : 0
High Temp events  : 0
High S/L events   : 0
Overload events   : 0
Low DSH  events   : 0
High DSH  events  : 0
Power-on resets   : 4
Watchdog resets   : 0
Manual  resets    : 1
Other   resets    : 0
Indoor coil sensor faults : 0
Outdoor coil sensor faults : 0
Ambient temp sensor faults : 0
Discharge line sensor faults : 0
Suction line sensor faults : 0
De-Ice temp sensor faults : 0
High pressure sensor faults : 0
Low  pressure sensor faults : 0
High board temp faults : 0
Reverse cycle valve faults : 0
IUC communication faults : 0
IUC reported faults : 0
Compressor inverter faults : 0
Compressor envelope faults : 0
Normal operation starts now...
```

- The controller will immediately resume the normal unit power-up procedure.
- The information on the computer screen can be copied to any text document using normal select-copy-paste procedures. The text document can then be saved for future reference, emailed to a service centre, etc.

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