



Troubleshooting Guide for UC7

Document revision: 3 Date: 19 October 2012

Index

1.	Cautions	2
2.	Items to check before starting.....	2
3.	Troubleshooting procedure	3
4.	Normal display messages	4
5.	Fault messages	5
6.	Fault codes.....	6
7.	Safety timer durations.....	8
8.	Protection functions.....	9
	High pressure protection (HP)	9
	Low pressure protection (LP).....	9
	Indoor coil frost protection.....	9
	High temperature protection	9
	High suction line temperature protection.....	10
	Low discharge superheat protection.....	10
	High discharge superheat protection.....	10
	Freeze protection.....	10
	Overload protection.....	11
9.	Lock-out.....	11
10.	Unit log	12
11.	Expansion valve types and DIP switch settings	13

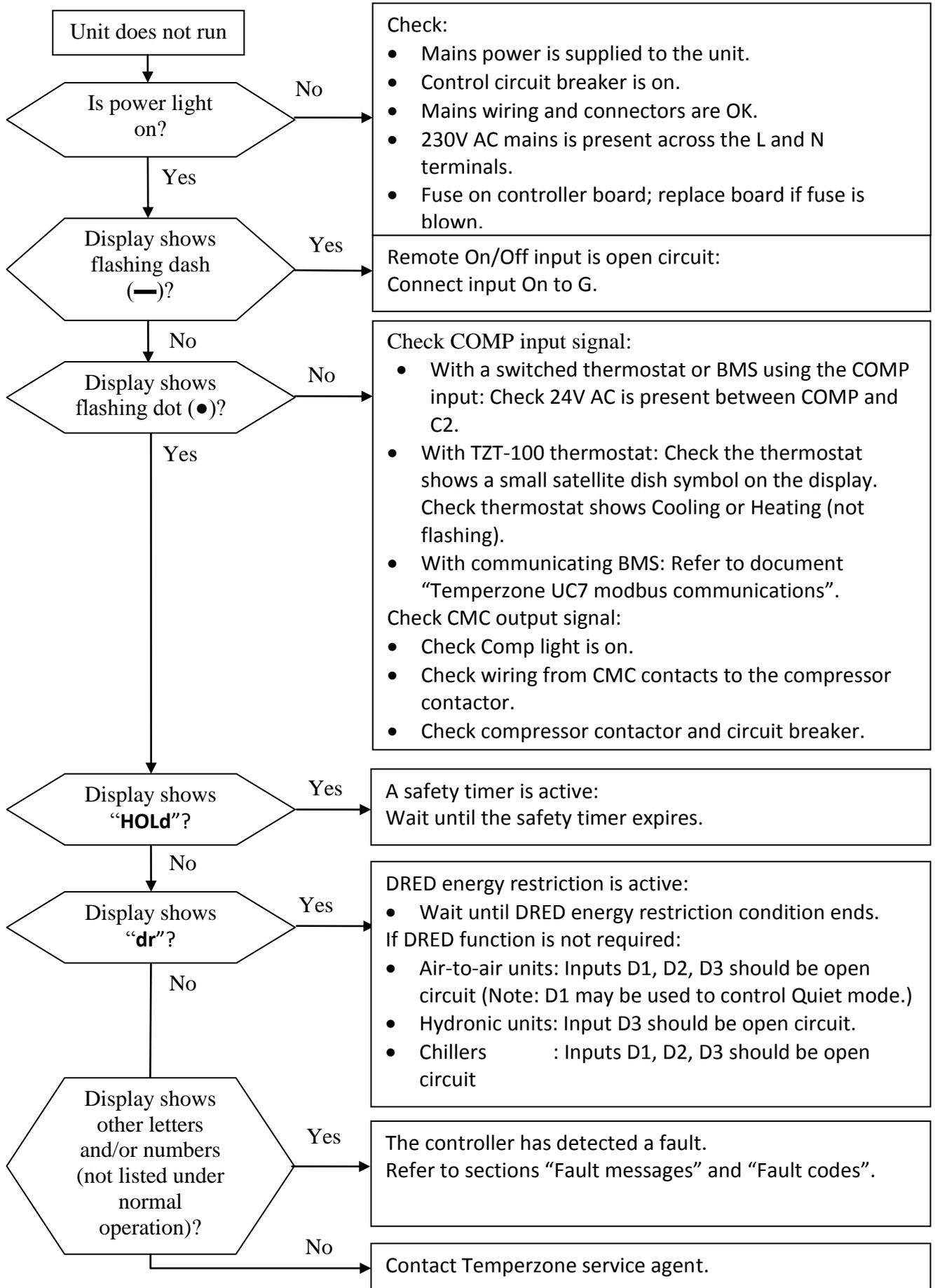
1. Cautions

- ! 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. Items to check before starting

- Thoroughly investigate the customer complaint.
- Does the unit run at all?
- Check mains power is properly connected and is the voltage correct.
- Check control wires between indoor and outdoor units and to the thermostat or other controller.
- Take careful note of any information shown on the controller board display.
- Hydronic units will not run the compressor until:
 - The water pump runs OK.
 - The water flow switch is closed.
- Chiller units will not run the compressor until:
 - The water pump runs OK.
 - The water flow switch is closed.
 - The supply water temperature is above +2°C.

3. Troubleshooting procedure



4. Normal display messages

The UC7 controller display may show one or more of the following during normal operation.

Table 1: Normal controller display messages

Display	Meaning
UC7 4.9	Controller model number (UC7) and software version (shown only after power-on)
0 (flashing)	The expansion valve is initialising (shown only after power-on)
dELAY	The unit waits for a random start-up delay time (up to about 30s, occurs only after power-on)
• (flashing)	Normal operation
— (slowly flashing)	Unit is OFF by Remote On/Off signal
dE-ICE	De-icing the outdoor coil
c	Commissioning mode (automatically expires after 30 minutes)
t	Test mode (automatically expires after about 1 minute)
HOLD	The compressor is held-on or held-off by a safety timer
dr	DRED energy consumption restriction is active

It is possible to use the controller display to view system pressures and temperatures. This is available with the unit in normal mode and in commissioning mode and regardless whether the compressor is on or off. It is not available when the controller is reporting a fault.

To view pressures and temperatures:

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”).

Table 2: Pressure and temperature display messages

Button press	Display	Meaning	Units
0	• or c	Normal mode (default)	
1	SLP	Suction line pressure	kPa
2	Et	Evaporating temperature	°C
3	SLt	Suction line temperature	°C
4	SSH	Suction side superheat	K
5	dLP	Discharge line pressure	kPa
6	Ct	Condensing temperature	°C
7	dLt	Discharge line temperature	°C
8	dSH	Discharge side superheat	K
9	• 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 degrees Celsius (°C). If the indicated temperature is below 0°C then a minus sign is shown before the value. Note: If the unit has one or two pressure transducers then the condensing and/or evaporating temperatures shown are converted from pressure readings.

5. Fault messages

Table 3: Fault messages

Display	Meaning	Possible cause	Possible remedy
LP	Low pressure protection	Check for refrigerant leaks.	Fix leak, evacuate unit, then recharge.
		Expansion valve is closed.	Check valve coil is properly fitted onto the valve body. Check DIP switch settings. Repair wiring to the valve. Replace expansion valve.
		Faulty transducer cable.	Repair transducer cable.
		Faulty transducer.	Replace transducer.
		Service valve is closed.	Open service valves.
HP	High pressure protection	Outdoor fan does not start (cooling mode).	Repair fan or fan wiring. Repair if required.
		Indoor fan does not start (heating mode).	Repair fan or fan wiring. Repair if required.
		Unit is overcharged.	Remove excess refrigerant charge.
		Expansion valve is closed.	Check DIP switch settings. Repair wiring to the valve. Replace expansion valve.
		Faulty transducer cable. Faulty transducer.	Repair cable to the transducer. Replace transducer.
		Service valve is closed.	Open service valves.
HI-t	High temperature protection	Insufficient refrigerant.	Add refrigerant.
		Faulty discharge line temperature sensor.	Replace sensor.
		Problem with expansion valve	Check expansion valve operation (superheat)
FROSt	Indoor coil frost protection	Air filter blocked.	Clean or replace air filter.
		Indoor dampers closed.	Check dampers and damper controls.
		Indoor fan speed too low.	Increase indoor fan speed.
		Indoor fan motor and/or speed controller fault.	Replace indoor fan motor and/or speed controller.
		Return air temperature too low.	Ensure unit is not operated in cooling mode with low return air temperature.
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).	Ensure unit is not operated in heating mode with very high outdoor ambient temperature.
		Faulty suction line temperature sensor.	Replace sensor.

Display	Meaning	Possible cause	Possible remedy
Lo-dSH	Low discharge superheat protection	Unit is overcharged.	Remove excess refrigerant charge.
		Discharge line temperature sensor not properly fitted.	Correctly fit the temperature sensor.
		Faulty discharge line temperature sensor.	Replace sensor.
		Incorrect expansion valve selection	Check 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.
		Incorrect expansion valve selection	Check DIP switch settings for switches 7, 8, 9 and 10
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.
		Check wiring and connections to inputs IN#2, COMP and C2.	Repair wiring.

6. Fault codes.

Table 4: Fault codes

Display	Fault	Possible cause	Possible remedy
F10	Outdoor fan (no serial communications)	Incorrect DIP switch settings.	Change DIP switch settings.
		Loose wiring between UC7 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 (no serial communications)	Incorrect DIP switch settings.	Change DIP switch settings.
		Loose wiring between UC7 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	High pressure transducer. Refer to "HP".		
F13	Low pressure transducer. Refer to "LP".		
F14	Suction line temperature sensor	Loose connection.	Repair connections.
		Faulty temperature sensor.	Replace sensor.

Display	Fault	Possible cause	Possible remedy
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	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.	
F21	Thermostat (no serial comms)	Loose wiring.	Repair connections.
F22	System 1 or BMS (no serial comms)	Loose wiring.	Repair connections.
		Master unit or BMS controller off.	Turn master unit or BMS on.
		Master unit or BMS communications intermittent.	Ensure BMS communicates at least once every 5 minutes.
F23	System 2 (no serial comms)	Loose wiring.	Repair connections.
		Incorrect DIP switch settings.	Check DIP switch settings.
F24	System 3 (no serial comms)	Loose wiring.	Repair connections.
		Incorrect DIP switch settings.	Check DIP switch settings.
F25	System 4 (no serial comms)	Loose wiring.	Repair connections.
		Incorrect DIP switch settings.	Check DIP switch settings.
F26	Invalid DIP switches setting		Check DIP switch settings.
F27	Invalid fan selection		Check DIP switch settings.
F28	Invalid economiser selection		Check DIP switch settings.
F29	Microcontroller temperature too high	Wait until the unit has cooled down. Find 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 unit reports a fault	Check slave units.	
F32	0-10V input	Check 0-10V input board is properly and correctly plugged in. Replace 0-10V input board if faulty.	
F33	Refer to "high discharge superheat" (shown as "HI-dSH")		

Display	Fault	Possible cause	Possible remedy
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.
		Incorrect DIP switch 2 setting.	Check DIP switch 2 setting.
		Expansion valve closed.	Repair EEV wires.
F35	Reverse cycle valve	Faulty transducer.	Replace transducer.
		Loose wiring.	Repair wiring.
F36	Invalid DIP switch setting on TZT-100 thermostat	Faulty reverse cycle valve.	Replace reverse cycle valve.
		The TZT-100 thermostat DIP switches must be set to: <ul style="list-style-type: none"> • 1-stage operation • heat-pump equipment type • the reverse cycle valve must be on when the thermostat requests heating mode 	

7. Safety timer durations

Safety timer	Duration
Unit start-up delay (after mains power-on)	2 minutes
Minimum compressor run-time (On-to-Off duration)	1 minute 30 seconds
Minimum compressor off-time (Off-to-On duration)	1 minute 30 seconds
Minimum compressor cycle-time (On-to-On duration)	6 minutes (a maximum of ten compressor starts per hour)
Hydronic unit compressor start delay (to allow water flow pump to start and water valve to open)	45 seconds
HP protection	3 minutes
LP protection	3 minutes
High discharge temperature protection	3 minutes
Frost protection (indoor coil)	10 minutes
Freeze protection (hydronic units)	3 minutes
High suction line temperature/pressure protection	3 minutes
Low discharge superheat protection	3 minutes
Overload protection	3 minutes

8. Protection functions

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 4237 kPa (614.5 PSI, equivalent to +66°C condensing temperature).
Hydronic reverse cycle units only (these units switch the high pressure transducer to the suction line when heating): When the indoor coil temperature exceeds 56°C.

Note: A faulty pressure transducer is also reported as an HP fault.

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 3 minutes have expired since the compressor started, or more than 3 minutes after the end of a de-ice cycle.

A faulty pressure transducer is also reported as an LP fault.

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 start conditions persists for longer than the frost-protect delay time. The frost-protect delay time depends on whether the unit has run during the last two hours or not:

The compressor has run during the last 2 hour period: protect delay time 2½ minutes.

The compressor has been off for more than 2 hours : protect delay time 4 minutes.

- Conditions:** When $T(\text{evaporating})$ is below -8°C for longer than the frost-protect delay time.
When $T(\text{evaporating})$ is below -4°C **and** $T(\text{suction line})$ is below +4°C for longer than the frost-protect delay time.
If $T(\text{evaporating})$ is not known to the controller: When $T(\text{suction line})$ is below -10°C for longer than the frost-protect delay time.

High temperature protection

Protects the compressor from overheating.

- Conditions:** When the compressor discharge line temperature exceeds:
+115°C for longer than 2 seconds **or**
+105°C for longer than 1 hour.
For hydronic units with electric heating only:
When the supply air temperature sensor (connected to input AMB) exceeds +75°C for longer than 2 seconds.

High suction line temperature protection

Protects the compressor motor from overheating.

Conditions: When $T_{(\text{suction line})}$ exceeds $+25^{\circ}\text{C}$
and/or $T_{(\text{evaporating})}$ exceeds $+22^{\circ}\text{C}$
and/or $P_{(\text{suction line})}$ exceeds 1428 kPa (207 PSI, equivalent to $+22^{\circ}\text{C}$)
for longer than 5 minutes.

Note: If the unit has a digital scroll compressor then high suction line temperature protection is applied only when capacity is at 100%.

Low discharge superheat protection

Protects a unit from prolonged flooding of the compressor. Applied only when the unit is operating in normal mode, not applied when a unit is de-icing the outdoor coil.

Conditions: When discharge superheat is below 10K for longer than 20 minutes.

Notes: If the unit has a digital scroll compressor then low discharge superheat protection is applied only when unit capacity is at 90% or higher.

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

High discharge superheat protection

Protects a unit from prolonged running with a lack of refrigerant. Applied only when the unit is operating in normal mode, not applied when a unit is de-icing the outdoor coil.

Conditions: When discharge superheat is above 38K for longer than 45 minutes.

Note: Discharge superheat is defined as the difference between the compressor discharge line temperature and the condensing temperature.

Freeze protection

Protects against freezing of the circulating water. This function has start conditions that depend on the type of unit.

For hydronic reverse cycle units:

Applied only while heating.

Conditions: When $T_{(\text{evaporating})}$ is below -6°C for longer than 30 seconds.
When $T_{(\text{evaporating})}$ is below -2°C and $T_{(\text{suction line})}$ is below $+3^{\circ}\text{C}$ for longer than 30 seconds.

For chiller units:

Applied only while cooling.

Conditions: When $T_{(\text{evaporating})}$ is below -12°C for longer than 5 seconds.
When $T_{(\text{evaporating})}$ is below -2°C and $T_{(\text{suction line})}$ is below 0°C for longer than 5 seconds.

Overload protection

Protects various components of the system such as the compressor, indoor and outdoor fan motors.

Conditions: When the overload input signal becomes active.

The UC7 controller has a number of options for the overload input signal:

Unit with LP switch and where the COMP input is used: In these units any overload switches are wired in series with the COMP input signal. In this case when an overload signal is active the unit will not start the compressor but the controller display will not show a fault.

Unit with LP switch and TZT-100 thermostat (or communicating BMS): Overload switches are wired to the COMP input. If the COMP input becomes inactive the display will show the “OL” message.

Unit with low pressure transducer: Overload switches are wired to the IN#2 **and/or** the COMP input. If the IN#2 and/or the COMP input becomes inactive the display will show the “OL” message.

9. Lock-out

The controller counts the number of trip events for each of the safety functions.

All trip event counters are reset to zero when the thermostat calls for the compressor to be off.

If any of the following trip counters reaches the value 3 then the unit will be placed into lock-out mode:

- HP
- LP
- High temperature protect
- Frost protect
- High suction line temperature protect
- Low discharge superheat protect
- Freeze protect

During lock-out mode the compressor is not allowed to run. The display will show which protection caused the lock-out and the fault relay is active.

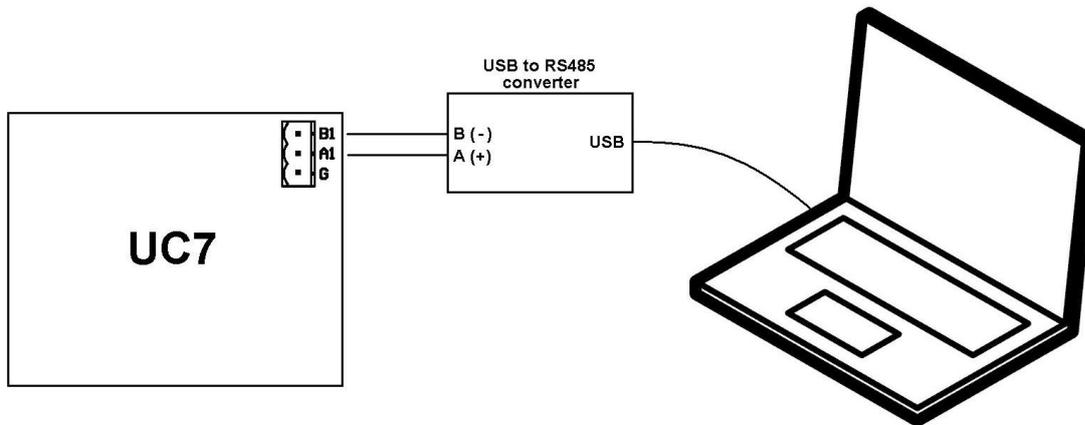
Lock-out mode can be cleared only by removing and then re-applying mains power to the unit.

When a unit was locked out and mains power is removed and then re-applied the display will show the previous fault message for 45 seconds (after the normal start-up sequence). Then normal operation resumes. This 45 seconds message display will repeat every time mains power is removed and re-applied until the unit has completed at least one normal compressor-on - compressor-off cycle.

10. 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 UC7 terminals A1 and B1 respectively.



- On the computer start a simple 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.
- Press the small push-button on the UC7 controller circuit board. While still holding down the push-button switch power to the unit on. Keep pressing (a few seconds) until the display on the controller shows the letter **P**.
- The computer screen will now show a small menu as shown here:

```
=====
(C) COPYRIGHT 2011 Temperzone
UC7 bootloader   version 1.3

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.

```

===== Unit log record:
Hours      : 168
Minutes    : 20
Cooling cycles : 61
Heating cycles : 7
De-ice cycles : 0
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
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 sensor faults : 0
High pressure sensor faults : 0
Low pressure sensor faults : 0
High board temp faults : 0
    
```

Normal operation starts now...

- The unit 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.

11. Expansion valve types and DIP switch settings

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	Custom series	-

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



Dunan



Sanhua



Carel