Reverse Cycle Water Chiller / Heat Pump

Installation & Operation Manual

Thank you for purchasing your new Ice Cycle Reverse Cycle Water Chiller/Heat Pump. We have provided this operation manual to ensure correct installation & operation.

When installing please ensure the unit is level and secured to the ground. All water piping should be secured and tested for water leaks. Water inlet & outlet pipe connections are 50mm & clearly marked for correct water flow orientation. Please take time to make sure all air is purged from the system for correct water flow and operation.

Familiarize yourself with the wiring diagram inside the controls cabinet. Here you will find the necessary connections for your incoming power supply & the main circuit board (UC8) where you can read pressures, temperatures, capacities etc... By pushing the black button in the middle of the UC8 you can easily access all the relevant information. When installing a three phase unit, you must ensure correct phase rotation otherwise the compressor will not pump properly & will cause damage with prolonged running. If the phase rotation is incorrect, isolate the electrical supply and reverse any two of the three incoming phases to reverse the direction of motor rotation. All compressors with inverter drives have phase rotation protection & won't start if the direction is incorrect. A _ will be displayed on the UC8 if the phase rotation is incorrect.

A water flow switch should be installed to the water piping circuit to ensure protection against water pump failures etc... The switch should be wired across terminals 0V & On located at the bottom right of the UC8. These are **Voltage Free** contacts & **NO VOLTAGE IS TO BE APPLIED TO THESE CONTACTS**. A **Voltage Free** remote off/on switch can be wired in series with the water flow switch to turn the unit off/on. Ensuring you have sufficient water flow through the unit is critical to performance & reliability. If unsure please contact us to obtain the correct water flow rate for your model unit. Even though the water flow switch indicates there is water flow through the unit, it may not be sufficient water flow for optimum performance.

During the commissioning process please ensure you complete the commissioning form located in the clear pouch on the front of the controls cabinet. Scan or take a photo of the completed form & email a copy to sales@oasisheatpumps.com to ensure warranty.

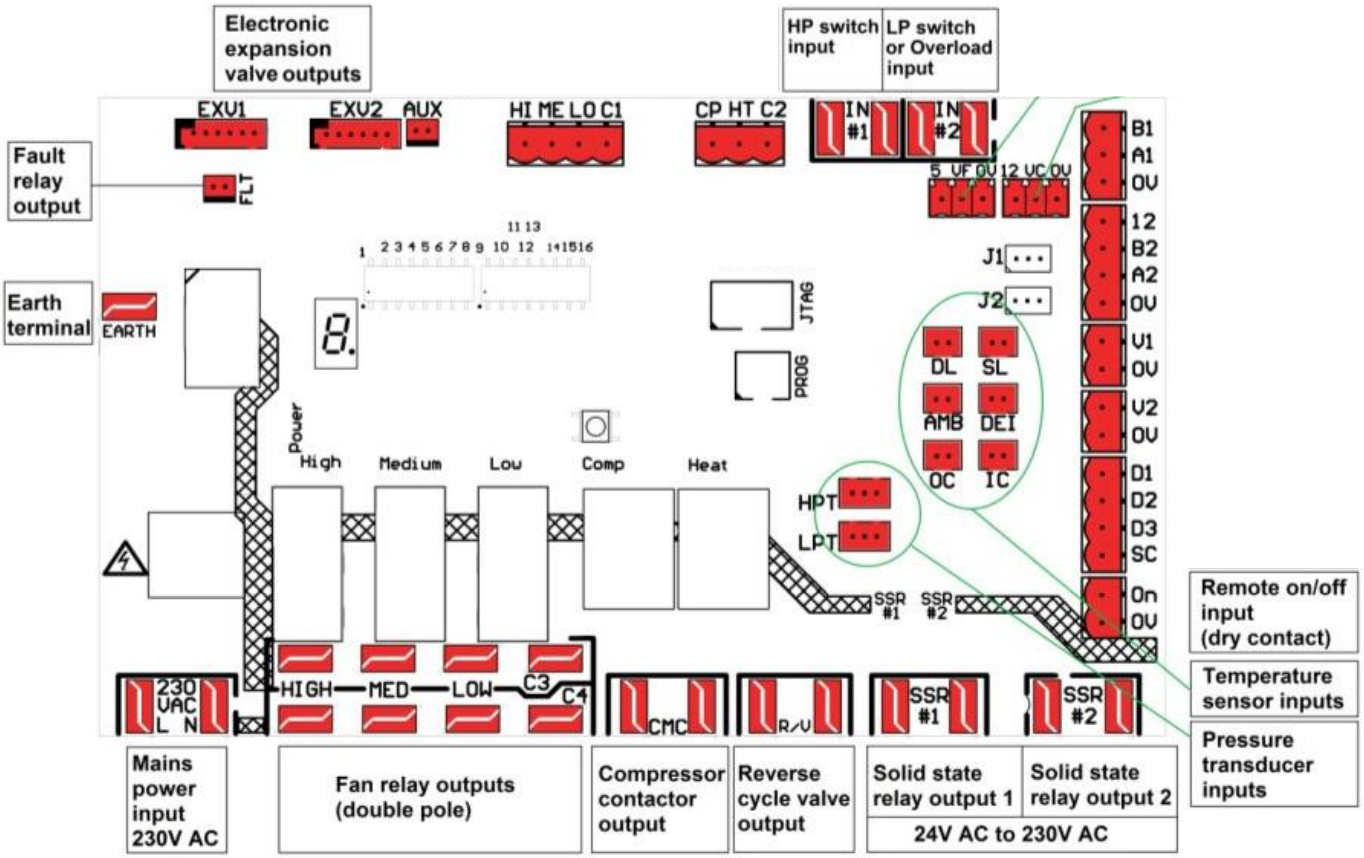
For any queries related to this unit please contact Ph: 0064 6 842 2956
Website: www.osisheatpumps.com

Contents

1. Connections overview for units 1
2. Mains power 1
3. Temperature sensor inputs 2
4. Pressure transducers 2
5. Remote On/Off and Flow Switch..... 3
6. 0-10V Analogue control input VC 3
7. Relay outputs CMC and R/V 3
8. Relay outputs HIGH, MED and LOW 3
9. Display messages (normal operation) 4-5
10. Troubleshooting 5
    10.1 Fault codes 6-8
11. Specifications 9-10
12. Troubleshooting guide 11-25

1. Connections overview for units

The drawing below shows possible connections for units. Most units do not require the use of all input /output signals.



2. 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.

3. Temperature sensor inputs

Note: On units where pressure transducers are connected to the HPT and LPT inputs then coil temperature sensors are not required, leave inputs OC and IC unused.

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)

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

Not all units are equipped with pressure transducers. If no pressure transducer is present then the corresponding switch input (IN#1 and/or IN#2) is configured as an input for a pressure switch.

5. Remote On/Off and Flow Switch

A remote On/Off or flow switch signal ('dry' or 'voltage-free' contacts) can be connected to the "On" and "0V" terminals.

To turn the unit **on** the remote on/off input and flow switch must be **closed-circuit**.

When the unit is off by the remote on/off or flow switch signal the display will show a slowly flashing – symbol.

6. 0-10V Analogue control input VC

Units equipped with a digital scroll- or variable speed- compressor are capable of variable capacity (duty). The required capacity can be set in four ways:

- Via 0-10V analogue input VC on the UC8.
- Automatic in combination with the TZT-100 thermostat.
- Via Modbus RTU serial communications, for example by a BMS (terminals A1, B1).

Notes:
- 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.
- Terminal "0V" is directly connected 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.

Unit capacity is varied linearly with the control voltage applied to input VC. 0V represents 0% (no duty), 10V represents 100% (maximum duty). Note that the UC8 controller imposes a minimum capacity. In most applications the minimum capacity is limited to not less than 25% or 40%; in a close control application the minimum can be as low as 16%.

Example: If minimum capacity is set to 40% then capacity will remain at 40% (when the compressor is on) for all input voltages from 0V to 4V and vary from 40% to 100% for voltages from 4V to 10V.

For the first two minutes after a compressor is started the minimum capacity is raised to 75% (digital scroll compressor) or capacity is held fixed to 50% (variable speed compressor). After these first two minutes normal capacity control is available.

If a unit continuously operates on low capacity for longer than 1 hour and 40 minutes the controller can perform an oil flush cycle. Oil flush cycles can be necessary on some installations to return the lubricating oil to the compressor. Oil flush cycles normally last for 1 minute only and during this 1 minute the capacity is fixed to 100% (digital scroll compressor) or 65% (variable speed compressor).

7. 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 and are voltage free. The same is true for the two 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.

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

8. 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 one set of relay poles (upper row of terminals), terminal C4 does the same for the other set of poles (lower row of terminals. The two sets are voltage free and fully isolated from all other circuits.

9. Display messages (normal operation)

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

Display	Meaning	Notes
UC8 1.5.3	Name and software version	Shown only after power-on
dELAY	Random start-up delay time	Up to 30s, occurs only after power-on
•	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	NOT APPLICABLE
L	Indoor fan low speed selection	NOT APPLICABLE
A	Modbus address selection	Default 44
E	Compressor model selection	See table below for available models
J	Outdoor fan chamber selection	0 = separate, 1 = common (shared)
b	Modbus communications baud rate selection	Default 2 = 19200 Baud
P	Modbus communications parity and stop bit selection	Default 2 = Even
d	Force unit to de-ice the outdoor coil	
HOLd	The compressor is held-on or held-off by a safety timer	
dr	DRED energy consumption restriction is active	NOT APPLICABLE

The following compressor model selections are available:

Display	Meaning
dF	Fixed capacity- or digital scroll-compressor
038	Copeland ZPV038 compressor and Carel Power+ PSD1xx driver
550	Toshiba DA550 compressor and Carel Power+ PSD1xx driver
66	Siam ANB66 compressor and Carel Power+ PSD1xx driver
78	Siam ANB78 compressor and Carel Power+ PSD1xx driver
063	Copeland ZPV063 compressor and Emerson CSD100 (M600) driver

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	%
● 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 are converted from pressure readings. If a reading is not available then the display shows a dash symbol (-).

10. Troubleshooting

When the UC8 controller detects a problem within the system it will activate the fault relay output (FLT). The accompanying fault light will illuminate and a corresponding fault code is shown on the LED display.

Some faults will cause the unit to stop the compressor and the fans. Yet other faults will be signalled but do not stop the unit from operating.

If a serious fault repeatedly stops the unit it may lead to unit lock-out. A locked unit will no longer 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.

Chapter 10.1 lists all possible fault codes.

10.1. Fault codes

Display	Meaning
LP	Low pressure protection is active
HP	High pressure protection is active
HI-t	High temperature protection is active
FROSt	Frost protection is active
HI-SL	High suction line temperature protection is active
Lo-dSH	Low discharge superheat protection active
Hi-dSH	High discharge superheat protection active
OL	Overload protection is active ('IN #2' input is open circuit)

Display	Meaning
F10	Outdoor fan fault
F12	Low pressure transducer fault (will show as LP)
F13	High pressure transducer fault (will show as HP)
F14	Suction line temperature sensor fault
F15	Discharge line temperature sensor fault
F16	De-Ice temperature sensor fault
F17	Outdoor 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 request heating mode but the unit lacks an outdoor coil de-ice sensor)
F29	Microcontroller temperature exceeds +100 °C
F30	Supply voltage out of bounds (+3.3V DC supply voltage on controller PCB)

Display	Meaning
F31	A slave unit reports a fault
F32	0-10V input fault
F33	High discharge superheat protection active
F34	Problem with pressure transducer readings or pressures not equalising
F35	Reverse cycle valve fault
F36	Invalid DIP switch setting on TZT-100 thermostat
F39	Variable speed compressor driver reports a fault
F40	Compression ratio too high
F41	Compression ratio too low
F42	Evaporating temperature too high
F43	Condensing temperature too low

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.

Alarms table.

Display	Meaning
F100	No communications between Power+ driver 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
F110	Drive internal error
F112	Excessive drive DC bus ripple (probably: loss of mains phase)
F113	Communication fault
F116	Driver is disabled (input STO is open circuit)
F117	Motor phase fault (possibly a motor wire has become loose)
F118	Internal fan fault
F119	Speed fault

For the Emerson CSD100 (M600) driver:

The fault code shown is F100 or F200 plus a code reported by the CSD100 driver.
A brief summary follows here:

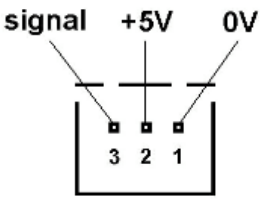
Display	Meaning
F100	No communications between Power+ driver and UC8
F103	Motor current too high
F105	Driver internal power supply fault
F109	Driver internal 24V supply overloaded
F120	Motor too hot
F132	Mains power input voltage imbalance
F140	Motor rotor locked
F141	Motor reverse rotation
F142	Compressor 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

11. 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 ICECYCLE 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	230V AC 50Hz nominal	190V AC minimum	250V AC maximum
Output relays Applies to: HIGH, MED, LOW, CMC and R/V outputs	250V AC, 5A maximum, resistive load 250V AC, 2.5A maximum, inductive load		
Solid state output relays Applies to: SSR1 and SSR2 outputs	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: 12V 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: 12V DC, 275mA maximum per winding		

Isolated inputs Applies to: HI, ME, LO, CP and HT inputs Common terminals are: C1 for HI, ME and LO C2 for CP and HT	**When used with 24V AC input signals:** 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
	When used with 12V DC input signals: Maximum input voltage OFF state: 2V DC Minimum input voltage ON state: 11V DC Absolute maximum input voltage: 35V DC Input impedance: 2.5kΩ
VC and VF 0-10V analogue inputs Referenced to terminal 0V	Absolute maximum input voltage: -2 to +15V DC Nominal input voltage: 0 to +10V DC Input impedance: 13.9kΩ
IN#1 and IN#2 **DRED inputs D1, D2, D3** **Remote On/Off** input Referenced to terminals 0V and SC	Designed to be operated by isolated voltage free contacts. Open circuit voltage: 3.3V DC typical Closed circuit current: 3.3mA DC typical
V1 and V2 0-10V analogue outputs Referenced to terminal 0V	Maximum load: 6.5kΩ Maximum short circuit output current: 30mA
Temperature sensor inputs DL: red SL, DEI: blue AMB: yellow or black OC, IC: yellow	Designed to connect to standard thermistor temperature sensors.
Pressure transducer inputs 	Power: 5.0±0.2V DC, maximum current 50mA Signal: 0.5V at the lowest pressure 4.5V at the highest pressure 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)
Modbus RS485 serial communications format	Baud rate 19200 Data bits 8 Parity even Stop bits 1

12. Troubleshooting Guide

Contents

1. Cautions..... 12
2. Recommended service tool set 12
3. Recommended set of spare parts..... 12
4. Items to check first..... 13
5. Viewing system temperatures and pressures..... 13
6. Troubleshooting procedure..... 14
7. Normal display messages..... 15
8. Fault messages..... 16-18
9. Fault codes..... 19-21
10. Safety timer durations 22
11. Protection functions 23
    - High pressure protection(HP)..... 23
    - Low pressure protection(LP)..... 23
    - Indoor coil frost protection 23
    - High temperature protection..... 23
    - High suction line / evaporating temperature protection..... 24
    - Low discharge superheat protection..... 24
    - High discharge superheat protection 24
    - Overload protection 24
12. Lock-out..... 25

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 (metric)
- Allan keys (metric)
- Small and medium size crescent
- Long nose pliers
- Multi-meter and probe leads of good quality
- 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”) (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)

3. Recommended set of spare parts

- Bottle with R410a refrigerant
- Known good UC8 controller circuit board, programmed with software version 1.5.3 or later
- Set of standard temperature sensors (yellow, blue, red and white leads)
- 34.5 bar and 45 bar pressure transducers
- Pressure transducer leads

4. Items to check first

Thoroughly investigate the problem:

- Does the problem appear only under certain conditions?
- Does the unit run at all?
- Check mains power is properly connected and is the mains voltage correct.
- Check control wires between outdoor unit and the thermostat.
- Take careful note of any information shown on the controller board display.

Notes:

- Units will not run the compressor until:
    - The water flow switch (if used) is closed, indicating an adequate flow of water.

5. Viewing system temperatures and pressures

It is possible to use the display on the UC8 controller 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.

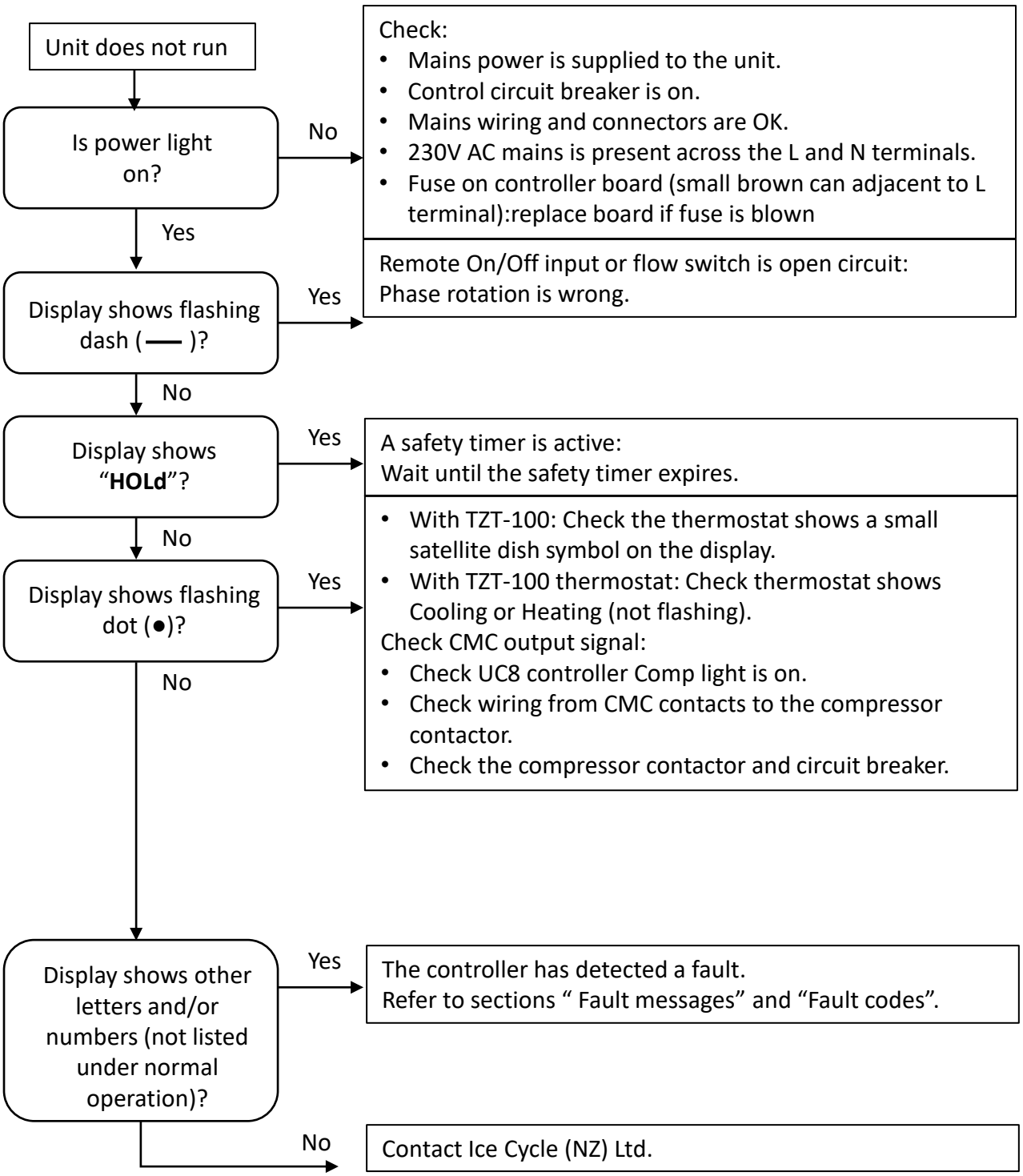
To view pressures, temperatures, superheat and expansion valve information: Repeatedly press the pushbutton to cycle the display through the options (in a round robin fashion). After 2 minutes the display will automatically return to a flashing dot (or “c”).

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	Outdoor coil de-ice sensor temperature	°C
CAP	Unit capacity (duty)	%
EE1	Expansion valve 1 opening	%
EE2	Expansion valve 2 opening	%

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.

6. Troubleshooting procedure



7. Normal display messages

The UC8 controller display may show one or more of the following during normal operation.

Table 1: Normal controller display messages

Display	Meaning
UC8 1.5.3	Controller model number (UC8) and software version. (shown only after power-on)
dF	Configured for fixed capacity or digital scroll compressor.
038	Configured for Copeland ZPV038 compressor & Carel Power+ inverter.
550	Configured for Toshiba DA550 compressor & Carel Power+ inverter.
66	Configured for Siam ANB66 compressor & Carel Power+ inverter.
78	Configured for Siam ANB78 compressor & Carel Power inverter.
063	Configured for Copeland ZPV063 compressor & Emerson CSD100 inverter.
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	The unit is 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

8. Fault messages

Display	Meaning	Possible causes	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 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.
		Evaporator is iced up due to insufficient water flow.	De-ice and increase water flow or find restriction and repair.
		Air in the system.	Purge all air from water circuit.
HP	High pressure protection	Outdoor fan does not start.	Repair fan or fan wiring. Replace UC8
		Insufficient water flow.	Increase water flow or find restriction and repair.
		Unit is overcharged.	Remove excess refrigerant charge.
		Expansion valve is closed.	Check UC8 DIP switch settings. Repair wiring to the 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.
		Air in the system.	Purge all air from water circuit.
HI-t	High temperature protection	Insufficient refrigerant.	Add refrigerant.
		Faulty discharge line temperature sensor.	Replace sensor.
		Problem with expansion valve.	Check expansion valve opening.

8. Fault messages

Display	Meaning	Possible causes	Possible remedy
FROSt	Frost protection	Water filter blocked.	Clean filter.
		Evaporator icing up.	Increase water flow.
		Evaporator iced up.	Lack of glycol for low temperature setting.
		Insufficient refrigerant.	Add refrigerant.
HI-SL	High suction line temperature protection	Insufficient refrigerant.	Add refrigerant.
		Very high return water temperature.	Reduce water flow 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.
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

8. Fault messages

Display	Meaning	Possible causes	Possible remedy
LO-t	Water freeze protection	Insufficient flow of water.	Check water circulating pump. Check water valves are open.
		Lack of refrigerant charge.	Add refrigerant.
OL	Overload protection	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.

9. 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.
F12	Low pressure transducer. Refer to “LP”.		
F13	High pressure transducer. Refer to “HP”.		
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.	
F21	Thermostat serial comms lost	Loose wiring.	Repair connections.

9. Fault codes

Display	Fault	Possible causes	Possible remedy
F22	System 1 or BMS serial comms lost	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 serial comms lost	Loose wiring.	Repair connections.
		Incorrect DIP switch settings.	Check DIP switch settings.
F24	System 3 serial comms lost	Loose wiring.	Repair connections.
		Incorrect DIP switch settings.	Check DIP switch settings.
F25	System 4 serial comms lost	Loose wiring.	Repair connections.
		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		Correct DIP switch settings.
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 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	Internal comms problem	Moisture on controller circuit board.	Allow controller to dry.
		Faulty controller.	Replace controller circuit board.

9. Fault codes

Display	Fault	Possible causes	Possible remedy
F33	Refer to “high discharge superheat” (shown as “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.	The TZT-100 thermostat DIP switches must be set to: • 1-stage operation • heat-pump equipment type • the reverse cycle valve must be on when the thermostat requests heating mode	
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	High compression ratio.	Incorrect water flow. Unit is overcharged.	Increase water flow. Remove some refrigerant.
F41	Low compression ratio.	Unit is undercharged.	Add refrigerant.
F42	High evaporating temperature.	Very high return water temperature and water flow in cooling mode.	Temporarily reduce water flow.
F43	Low condensing temperature.	Very low return water temperature and water flow in cooling mode.	Increase water flow.

10. Safety Timer durations

Safety timer	Compressor Off-Duration
Unit start-up delay (after mains power-on)	2 minutes
Minimum compressor run-time (On-to-Off duration)	2 minutes
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)
HP protection	3 minutes
LP protection	3 minutes
High discharge temperature protection	3 minutes
Frost protection	6 minutes
High suction line temperature/pressure protection	3 minutes
Low discharge superheat protection	3 minutes
Overload protection	3 minutes

11. 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).

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 ice on the evaporator. 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 very cold return water conditions persist for longer than the frost-protect delay time of 6 minutes.

Conditions: When T(evaporating) is below -8°C for longer than the frost-protect delay time.
When the sum of T(evaporating) + T(suction line) is below -6°C for longer than the frost protect delay time. For example: T(ev) <= -6°C and T(sl) <= 0°C.
If T(evaporating) is not known to the controller: When T(suction line) is below -8°C for longer than the frost-protect delay time.

High temperature protection

Protects the compressor from overheating and the compressor lubricating oil from deterioration. 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 line temperature exceeds:
+120°C for longer than 2 seconds or
+105°C for longer than 1 hour.

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 line / 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 T(evaporating) exceeds +27.5°C (equivalent to 1665 kPa, 241.5 PSI) and/or T(suction line) exceeds +30°C for longer than 15 minutes.

Low discharge superheat protection

Protects a unit with an electronic expansion valve (EEV) from prolonged flooding of the compressor. This protection does not apply to units that use accurators.

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

Conditions for units with fixed duty compressor:

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

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

- At nominal duty and higher: When discharge superheat is below 10K for longer than 20 minutes.
- Between standard minimum and nominal duty: Minimum discharge 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 for a digital scroll compressor:	40%.
Nominal duty for a digital scroll compressor:	100%.
Standard minimum duty for a variable speed compressor:	25%.
Nominal duty for a variable speed compressor:	65%.

High discharge superheat protection

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

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

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

Overload protection

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

Conditions: When the overload input signal becomes active.
The UC8 controller has a number of options for the overload input signal:

Units with a LP switch connected to UC8 input IN#2: In these units any overload switches can be wired in series with the COMP input signal (option). In this case when an overload signal is active the unit will not run the compressor but the controller display will not show a fault.

Units with a low pressure transducer connected to UC8 input LPT: Overload switches can be wired to input IN#2. If the input becomes inactive the display will show the “OL” message and the compressor is stopped.

12. 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 will be placed 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 is active.

Trip event counters are reset to zero when the thermostat calls for the compressor to be off. 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
- Variable speed compressor driver trip events

Lock-out mode 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.