



Unit Controller (UC8) Quick Reference Operation and Fault Diagnosis

(To be read in conjunction with labels TZ243 (Air-to-Air) & TZ245 (Water-to-Air))

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1. Introduction

This is a **Quick Reference** document covering the features and functions of Unit Controller 8 (UC8) along with connectivity details and fault diagnosis troubleshooting information.

Unit Controller 8 is an electronic controller for air conditioning units. The controller responds to external control signals to dictate overall unit operation and is responsible for system operation and protection. The UC8 was introduced into temperzone air cooled and water sourced models from 2015 and replaces OUC4, HWP Protection Board and UC7 controllers. The UC8 is not an accessory; it is an integral part of each air conditioning system.

2. Where to find additional information

For more detailed information regarding the UC8 functionality and settings refer the documents available on our website **www.temperzone.biz** : -

UC8 Client Wiring	September 2012
UC8 Operation manual - Air-to-Air	22 June 2015
UC8 Operation manual - Hydronics	25 June 2015
UC8 Modbus RTU communications	27 August 2015
UC8 BACnet/IP communications	7 September 2015
UC8 Troubleshooting guide	27 July 2015

3. List of units with UC8 controller

Split systems	OSA 66 & 87RKS
	OSA 116 & 141RKSG
	OSA 116, 141, 164, & 194RKTG
	OSA 224, 294 & 324RKTG,
	OSA 184, 294 & 324RKTF
Water cooled units	HWP 36, 48, 59, 78, 98, 118, 142 & 172CKS
	HWP 36, 48, 59, 78, 98, 118, 142 & 172RKS
	HWP 36, 48, 59, 78, 98, 118, 142, 172CEKS

Features and functions

- Accepts conventional thermostat or BMS connections utilising 12V DC or 24V AC voltages.
- Accepts Modbus RTU serial communications.
- Accepts 0 – 10V DC analogue inputs for capacity control of digital compressor and for indoor fan speed control.
- Reverse cycle operation.
- Indoor coil frost protection.
- Outdoor coil de-ice control.
- High and low head pressure system protection (pressure switches or pressure transducers).
- Protection against rapid cycling of the compressor.
- Loss of refrigerant protection.
- High discharge temperature protection.
- Head pressure control. The methodology can depend on the unit model.
- Optimised performance across a wide operating temperature range.
- On/off compressor control (fixed capacity).
- Digital scroll compressor control (variable capacity).
- Variable speed compressor (inverter) control (variable capacity).
- Fixed or variable indoor air flow (High/Medium/Low or 0 – 10V DC variable).
- Dry mode/dehumidification in cooling cycle.
- Quiet mode for outdoor fans.
- DRED compatible.
- EEV (Electronic Expansion Valve) control.
- Intelligent control of the crankcase heater.
- Remote on/off switching.
- Temperature sensing of compressor discharge line, suction line, outdoor ambient, outdoor coil, indoor coil and de-ice of the outdoor coil.
- System error/fault reporting.
- Connection of external fault alarm signalling.
- BACnet/IP communications over Ethernet possible (with optional additional controller)

4. Inputs available

Signal	Terminals
Power 230V AC	L / N / EARTH
Thermostat / controller:	
High / Medium / Low / Common1	HI / ME / LO / C1
Compressor / Heat / Common2	CT / HT / C2
HP Switch	IN#1
LP Switch	IN#2
Capacity, Analogue 0 – 10V DC	VC / 0V
Indoor fan speed, Analogue 0 – 10V DC	VF / 0V
Modbus RTU RS485#1 (Slave)	B1(-) / A1(+) / 0V
Modbus RTU RS485#2 (Master)	B2(-) / A2(+) / 0V
DRED	D1 / D2 / D3 / SC(0V)
Remote On/Off	On / 0V
Sensors:	
Discharge Line & Suction Line	DL & SL
Outdoor ambient & Outdoor coil De-Ice	AMB & DEI
Outdoor Coil & Indoor Coil	OC & IC
High & Low Pressure Transducer	HPT & LPT

5. Outputs available

Signal	Terminals
Single-speed outdoor fan control	MED / C3 / C4
Single-speed indoor fan control	HIGH / C3 / C4
Three-speed fan control (indoor or outdoor)	HIGH / MED / LOW / C3 / C4
Compressor on / off	CMC
Reverse cycle valve	R/V
Outdoor variable speed (EC) fan 0 – 10V DC	V1 / 0V
Indoor variable speed (EC) fan 0 – 10V DC	V2 / 0V
Crankcase heater	SSR#1
Modulating valve (Digital scroll compressor)	SSR#2
EEV (Electronic Expansion Valves)	EXV1 & EXV2
Fault relay	FLT
Run status	AUX

6. Controller options

Available control signal options:

- 12V DC
- 24V AC
- 0-10V DC
- Modbus RTU over RS485 twisted pair wiring
- BACnet/IP over Ethernet (optional, with suitable converter)

Examples of suitable controllers:

- SAT-2.1 24V AC version
- TZT-100 wall thermostat
- SAT-3 wall thermostat
- BMS controller with relay contact outputs
- BMS controller with Modbus RTU serial communications over RS485

7. Examples of controller connections

Detailed client wiring diagrams can be viewed on and downloaded from the [temperzone internet website](#).

7.1. Temperature controller with relay contact outputs

- SAT-2.1 wall thermostat, 24V AC version
- BMS controller with relay contact outputs

Connect using separate wires for all required functions. Typical connections are:

UC8 terminal	Function
Signal to CP 24V or 12V Common to C2	Compressor On / Off
Control signal to HT 24V or 12V Common to C2	Cooling / Heating
Control signals to HI / ME / LO 24V or 12V Common to C1	Indoor Fan High / Medium / Low

7.2. SAT-3 and TZT-100 wall thermostats

Connect using shielded twisted pair wiring suitable for RS485 communications (part number 201-000-399 available in 100m reels). One twisted pair of wires should be used for signals A and B; the cable shield should connect to UC8 terminal 0V.

UC8 terminal	SAT-3 terminal	TZT-100 terminal
12	12V	24
0V	GND	24C
B2	B	B
A2	A	A

7.3. BMS Modbus RTU

Connect using shielded twisted pair wiring suitable for RS485 communications (part number 201-000-399 available in 100m reels). One twisted pair of wires should be used for signals A and B; the cable shield should connect to UC8 terminal 0V.

UC8 terminal	BMS terminal
0V	REF
B1	B
A1	A

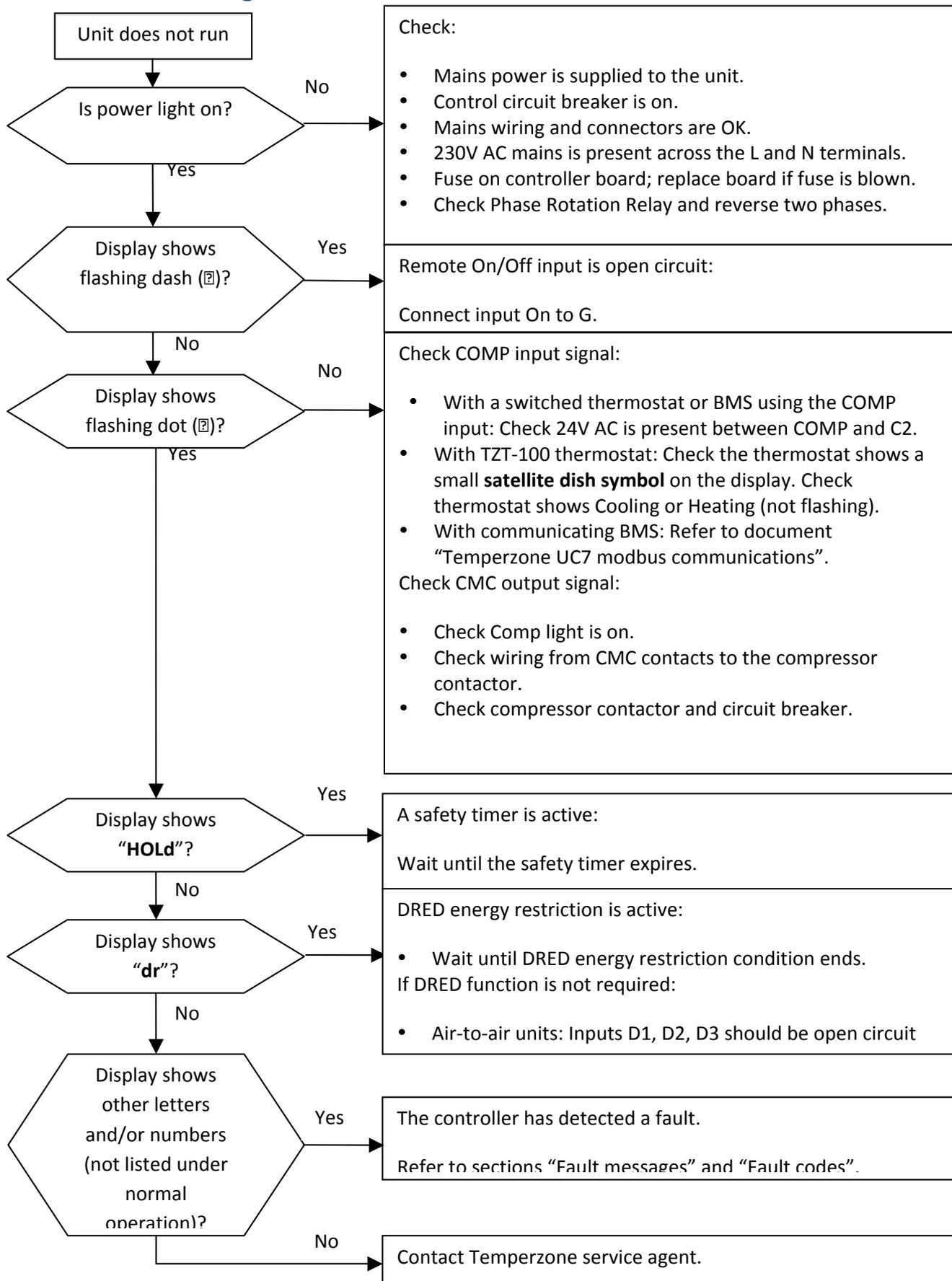
If the unit is controlled by another device such as TZT-100 then a communicating BMS system may still monitor the system via this set of terminals on the UC8.

7.4. Other Connections

Documentation with more information, additional details and more control examples is available for viewing on and downloading from the temperzone internet web site:

www.temperzone.biz .

8. Troubleshooting



9. Fault Codes

Display	Meaning
LP	Low pressure protection is active
HP	High pressure protection is active
HI-t	High compressor discharge temperature protection is active
FROSt	Indoor coil frost protection is active
HI-SL	High compressor suction temperature protection is active
Lo-dSH	Low discharge superheat protection active
Hi-dSH	High discharge superheat protection active
OL	Overload protection is active (input "IN #2" is open circuit)
F10	Outdoor fan fault
F11	Indoor fan fault
F12	Low pressure transducer fault (will show as LP)
F13	High pressure transducer fault (will show as HP)
F14	Compressor suction line temperature sensor fault
F15	Compressor discharge line temperature sensor fault
F16	Outdoor coil De-Ice temperature sensor fault
F17	Outdoor coil temperature sensor fault
F18	Indoor coil temperature sensor fault
F19	Outdoor 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	Thermostat/external controller requests heating from a cooling-only unit
F29	UC8 circuit board temperature too high
F30	UC8 circuit board supply voltage out of bounds
F31	A slave unit reports a fault
F32	UC8 internal fault
F33	High discharge superheat protection active
F34	Pressures not equalizing when compressor is off
F35	Reverse cycle valve fault
F36	Invalid DIP switch settings on TZT-100 thermostat
F37	Communications with indoor unit controller (IUC) lost
F38	Indoor unit controller (IUC) reports a fault
F39	Communications with compressor inverter lost
F40	Compressor high compression ratio protection active
F41	Compressor low compression ratio protection active
F42	Compressor high evaporating temperature protection active
F43	Compressor low condensing temperature protection active

10. Fault diagnosis and troubleshooting

Display	Meaning	Possible cause	Possible remedy
LP	Low pressure protection	Lack of refrigerant.	Check for leaks and repair, apply correct amount of refrigerant.
		Expansion valve is closed.	Check expansion valve coil is properly fitted onto the valve body.
		Incorrect DIP switch settings.	Correct DIP switch settings.
		Loose expansion valve connector.	Properly insert connector to the circuit board.
		Damaged valve wiring.	Repair wiring.
		Faulty expansion valve.	Replace expansion valve.
		Faulty transducer cable.	Repair transducer cable.
		Faulty LP switch or LP transducer.	Replace LP switch or LP transducer.
		Service valve is closed.	Open service valve.
		Indoor fan does not run or runs too slow (cooling).	Check indoor fan, fan controller, fan speed settings, DIP switch settings.
		Air filter is blocked (cooling).	Clean filter.
		Outdoor fan does not run (heating).	Check outdoor fan, wiring, connections, fan controller, DIP switch settings.
		Outdoor coil is blocked (heating).	Remove obstruction.
HP	High pressure protection	Expansion valve is closed.	Check expansion valve coil is properly fitted onto the valve body.
		Incorrect DIP switch settings.	Correct DIP switch settings
		Loose connector.	Properly insert connector to the circuit board.
		Damaged valve wiring.	Repair wiring.
		Faulty expansion valve.	Replace expansion valve.
		Faulty transducer cable.	Repair transducer cable.
		Faulty HP switch or HP transducer.	Replace HP switch or HP transducer.
		Service valve is closed.	Open service valve.
		Outdoor fan does not run (cooling).	Check outdoor fan, wiring, connections, fan controller, DIP switch settings.
		Air filter is blocked (heating).	Clean filter.
		Indoor fan does not run (heating).	Check indoor fan, wiring, connections, controller, DIP switch settings.
Excessive unit charge.	Remove excess refrigerant.		
FROSt	Indoor coil frost protection	Air filter blocked.	Clean or replace air filter.
		Dampers closed.	Check dampers, damper operation, wiring and control method.
		Indoor fan speed too low.	Increase indoor fan speed.
		Lack of refrigerant.	Check for leaks and repair, add refrigerant.

Display	Meaning	Possible cause	Possible remedy
HI-t	High discharge line temperature protection	Lack of refrigerant.	Check for leaks and repair, add refrigerant.
		Faulty compressor discharge line temperature sensor.	Replace sensor (red lead).
HI-SL	High evaporating / suction line temperature protection	Very high room temperature (cooling).	(Temporarily) Reduce indoor fan speed.
		Very high outdoor ambient temperature (heating).	Do not operate the unit in heating mode with high outdoor ambient temperature.
		Inadequate insulation on the compressor suction line temperature sensor.	Repair sensor insulation.
		Faulty compressor suction line temperature sensor.	Replace sensor.
		Incorrect or faulty suction line pressure transducer	Fit correct transducer
		Cable to the pressure transducer under tension	Relieve stress on the transducer cable
Lo-dSH	Low discharge superheat protection	Unit is overcharged.	Remove excess refrigerant.
		Compressor discharge line temperature sensor not properly fitted.	Correctly fit the temperature sensor.
		Faulty compressor discharge line temperature sensor.	Replace sensor.
		Incorrect DIP switch settings for the expansion valve.	Correct DIP switch settings.
HI-dSH	High discharge superheat protection	Lack of refrigerant.	Check for leaks and repair, add refrigerant.
		Faulty compressor discharge line high pressure transducer.	Replace HP transducer.
		Incorrect DIP switch settings for expansion valve.	Correct DIP switch settings.
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 correct refrigerant charge. Ensure adequate return of compressor lubricating oil.
		Check wiring and connections to input IN#2.	Repair wiring.

Display	Meaning	Possible cause	Possible remedy
F12	HP transducer	Refer fault "HP".	
F13	LP transducer	Refer fault "LP".	
F14	Suction line temperature sensor (SL)	Loose connection.	Repair connection.
		Faulty temperature sensor.	Replace sensor.
F15	Discharge line temperature sensor (DL)	Loose connection.	Repair connection.
		Faulty temperature sensor.	Replace sensor.
F16	De-ice temperature sensor (DEI)	Loose connection.	Repair connection.
		Faulty temperature sensor.	Replace sensor.
F17	Outdoor coil temperature sensor (OC)	Loose connection.	Repair connection.
		Faulty temperature sensor.	Replace sensor.
F18	Indoor coil temperature sensor (IC)	Loose connection.	Repair connection.
		Faulty temperature sensor.	Replace sensor.
F19	Ambient temperature sensor (AMB)	Loose connection.	Repair connection.
		Faulty temperature sensor.	Replace sensor.
F20	Superheat unknown	Check: DIP switch settings low pressure transducer high pressure transducer suction line temperature sensor discharge line temperature sensor outdoor coil temperature sensor indoor coil temperature sensor sensor connections	
F21	Thermostat communications lost	Loose wiring	Repair connections
F22	BMS or system 1 communications 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 (first slave) communications lost	Loose wiring	Repair connections
		Incorrect DIP switch settings	Correct DIP switch settings
F24	System 3 (second slave) communications lost	Loose wiring	Repair connections
		Incorrect DIP switch settings	Correct DIP switch settings
F25	System 4 (third slave) communications lost	Loose wiring	Repair connections
		Incorrect DIP switch settings	Correct DIP switch settings

Display	Fault	Possible cause	Possible remedy
F26	Problem reading DIP switches	Excessive electrical noise, very high humidity	Remove mains power, ensure UC8 circuit board is thoroughly dry, re-apply power
F27	Invalid DIP switch settings	Selected combination of indoor- and outdoor- fan is not supported	Correct DIP switch settings
F29	High microcontroller temperature	Find cause of extremely high temperature in the electrical compartment	Wait until the unit has cooled down
F30	Supply voltage out of bounds	Mains supply voltage too low	Check for stable 230V AC mains power supply voltage
		Excessive current draw from UC8 12V DC power (e.g. to thermostat)	Check for short circuits, reduce current drawn from UC8 12 V DC
F31	A slave unit reports a fault	Refer to controller in slave unit(s)	Check slave unit(s)
F32	UC8 internal fault	Moisture on the circuit board	Allow circuit board to thoroughly dry
		Dirt on the circuit board	Carefully clean the circuit board
		Faulty circuit board	Replace board
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
		Expansion valve closed	Repair EEV wires
		Faulty transducer	Replace transducer
F35	Reverse cycle valve	Unit runs in incorrect mode (cooling instead of heating or v.v.)	Repair wiring to reverse cycle valve
		Faulty reverse cycle valve	Replace reverse cycle valve
		Multiple compressor units only: Coil temperature sensor readings influenced by other refrigeration system(s)	Remove mains power, disconnect indoor- and outdoor-coil temperature sensors from the UC8 controller, re-apply mains power
F36	Invalid DIP switch setting on TZT-100 thermostat	The TZT-100 thermostat DIP switches must be set to: <ul style="list-style-type: none"> • 1-stage operation (even for multiple compressor units!) • heat-pump equipment type • reverse cycle valve ON for heating mode 	
F37	Communication with indoor unit lost (IUC)	No power at indoor unit	Check power to the indoor unit
		Faulty wiring between indoor and outdoor units	Check wiring
		High electrical interference	Use shielded twisted pair cables Check shield is properly connected Move control cables away from power cables
F38	Indoor unit reports a fault	Check indoor unit controller	

Display	Fault	Possible cause	Possible remedy
F39	Compressor inverter reports a fault	Inverter overheated	Ensure inverter heatsink airflow is not obstructed
		Inverter overloaded	Operate the unit at reduced capacity
		Compressor failed to start	Check wiring between inverter and compressor
		Attempt to start with high pressure differential	Ensure pressures equalize when compressor is off
		Inverter wiring problem	Correct wiring
F40	High compression ratio	Airflow over indoor and/or outdoor coil(s) obstructed	Remove obstruction
		Indoor or outdoor fan speed too low	Increase fan speed
		Incorrect refrigerant charge	Evacuate unit, apply correct refrigerant charge
		Expansion valve does not open sufficiently	Check expansion valve and wiring Check pressure transducers Check temperature sensors Check DIP switch settings
F41	Low compression ratio	Unit operates on too low duty	Increase requested capacity
		Expansion valve open too far	Check expansion valve and wiring Check pressure transducers Check temperature sensors Check DIP switch settings
F42	High evaporating temperature	Refer fault "HI-SL"	
F43	Low condensing temperature	High indoor fan speed and very low 'indoor coil air-on' temperature (heating mode)	(Temporarily) Reduce indoor fan speed
		Strong cold wind blowing onto the outdoor coil (cooling mode)	Protect outdoor coil from strong cold wind Avoid cooling mode during cold outdoor conditions
		Expansion valve open too far	Check expansion valve and wiring Check pressure transducers Check temperature sensors Check DIP switch settings

11. DIP switch selections - Air to Air units

Switch		Function	
1		Indoor air flow	
OFF		Variable indoor air flow: Indoor fan performs a warm start when unit starts heating. Indoor fan stops during de-ice cycles. Indoor fan speed may vary from thermostat request.	
ON		Fixed indoor air flow: Indoor fan follows thermostat request even when heating starts. Indoor fan continues during de-ice cycles. Indoor fan speed follows thermostat request.	
2		Compressor type	
OFF		Fixed capacity.	
ON		Digital scroll.	
3	4	Outdoor fan selection	Terminals
OFF	OFF	Three speed fan	Relay outputs HIGH/MED/LOW
ON	OFF	Single speed fan	Relay output MED
OFF	ON	0-10V EC fan	Output V1
ON	ON	Reserved	Do not select
5	6	Indoor fan selection	
OFF	OFF	Three speed fan	Relay outputs HIGH/MED/LOW
ON	OFF	Single speed fan	Relay output HIGH
OFF	ON	0-10V EC fan	Output V2
		(Select this option when the UC8 does not control the indoor fan.)	
ON	ON	Reserved	Do not select
7	8	Electronic expansion valve operating mode	
OFF	OFF	No electronic expansion valves (e.g. accurators, TX valves...).	
ON	OFF	One valve or two parallel electronic expansion valves, positions always identical. If the unit is capable of advanced dry mode operation then this setting is the 'High Efficiency Mode'.	
OFF	ON	Reserved, do not select	
ON	ON	Advanced Dry Mode. This option must be selected <u>only on units suitably equipped</u>.	
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 and E3V series with uni-polar coil	Removable red coil
ON	ON	Reserved, do not select	
11	12	System number (for units with multiple compressors)	
OFF	OFF	1 (master system, select this for single compressor units)	
ON	OFF	2 (slave system)	
OFF	ON	3 (slave system)	
ON	ON	4 (slave system)	
13		Function of DIP switches 14, 15 and 16	
OFF		Refer to table 2.	
ON		Refer to table 3.	

Table 2, DIP switch functions for switches 14, 15 and 16 **with switch 13 OFF**.

Switch	Function		
14 OFF ON	Minimum unit capacity	Digital scroll compressor	Variable speed compressor
	Standard control	40%	40%
	Close control	16%	21%
15 OFF ON	Function of UC8 input D2		
	Reserved for DRED functionality		
	Reserved for DRY mode (dehumidification) control		
16 OFF ON	Function of UC8 input D1		
	Reserved for DRED functionality		
	Reserved for QUIET mode control		

Table 3, DIP switch functions for switches 14, 15 and 16 **with switch 13 ON**.

Switch			Function
14 ON	15 ON	16 ON	Enable all three following options: Reserve input D1 for QUIET mode control Reserve input D2 for DRY mode control Reserve input D3 for ECO mode control
All other combinations for DIP switches 13, 14, 15 and 16 for air-to-air units are reserved and must not be selected.			

12. DIP switch selection variations for hydronic units (water to air)

Switch		Function	
3 OFF ON	Thermostat type		
	Thermostat provides COMP & HEAT signals		(heatpump type, preferred)
	Thermostat provides COOL & HEAT signals		(not recommended)
Note! The TZT-100 thermostat is automatically detected regardless of the setting of DIP switch 3. The TZT-100 thermostat must be set to COMP & HEAT type (heatpump) operation.			
4 OFF ON	Hydronic unit type		
	Reverse cycle or cooling only. For cooling only units: Leave input HT not connected, disable heating mode on the thermostat.		
	Cooling + electric heating.		
11 OFF	12 OFF	System number	
		1 master system, select this for all hydronic units	
All other combinations for DIP switches 11 and 12 are reserved and must not be selected.			
13 ON	14 ON	15 OFF	16 OFF
Hydronic unit (water to air)			
All other combinations for DIP switches 13, 14, 15 and 16 for hydronic units are reserved and must not be selected.			

13. Notes

Disclaimer:

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