OPU-D42-W50 operation terminal for TLR-D42 base units

Features

- Temperature control for 2-pipe and 4-pipe fan coil systems.
- Automatic fan control for three stage fans.
- Control for heating, cooling and fan only operation
- Cost saving option with Economy functionality and set point limitation
- For large rooms: Master – Slave option: One terminal may drive up to 8 base units in parallel.
- Password protected programmable user and control parameters
- External sensor or open contact for remote control, external heat – cool change or auto-changeover on supply or outdoor temperature with selectable activation limits
- One terminal may control up to 8 base units in parallel mode

Deluxe Version:
- Clock and time schedule functions
- Blue backlight for LCD
- Infrared remote controller option:
  With special features for Boost and delayed switching on or off

Ordering

A working controller consists of one operation terminal and at least one base unit.

Item name	Item code	Function	Type	Key-data
TLR-D42-24	40-11 0085	24VAC	Base unit	Fan coil controller with:
TLR-D42-230	40-11 0086	230VAC		1 TI int or ext
OPU-D42	40-10 0166	Standard	Operation terminal (2x4")	3 DO (Relay) Fan control
OPU-D42-D	40-10 0167	Deluxe		2 AO (0-10VDC) PI control 1 DO HEAT/COOL

Accessories				
OPR-1	40-50 0001		2xAAA bat	Infrared remote controller
S-Tn10-2	40-20 0001	Flying lead sensor with 2 m cable		
SD-Tn10-12-2	40-20 0002	Flying lead duct sensor 12cm immersion depth, 2m cable		
SD-Tn10-20-2	40-20 0003	Flying lead duct sensor 20cm immersion depth, 2m cable		
SDB-Tn10-12	40-20 0051	Duct sensor with housing, 12cm immersion depth		
SDB-Tn10-20	40-20 0004	Duct sensor with housing, 20cm immersion depth		
SRA-Tn10	40-20 0005	Room sensor		
SOB-Tn10	40-20 0059	Outdoor sensor		

Selection of actuators, fans and sensors

Temperature Sensors: Use only our approved NTC sensors to achieve maximum accuracy.
Modulating Actuators: Choose actuators with an input signal type of 0-10VDC. The current on the output is limited to 10mA.

Fan motors: Observe power limits and startup currents. Note: startup currents may be a multiple of the rated current of a fan. Verify with the fan supplier if unclear.

Installation Terminal

1. Install the mounting plate to the electrical connection box. Make sure that the nipple with the front holding screw is facing to the ground. Make sure the screw heads do not stand out more than 5 mm of the surface of the mounting plate.
2. Connect the wires of the terminals to the communication wires according wiring diagram.
3. Slide the two latches located on the top of the front part into the hooks of the mounting plate.
4. Lower the front part until located flat on the wall and the mounting plate is not visible anymore. Make sure the connection cable does not get into the way.
5. Tighten the front holding screw to secure the front part to the mounting plate.

Connection base to terminal
- Max. Distance: 200m (565 ft.)
- Normal twisted pair copper wires maybe used for wiring in an EMC-save environment. In an impaired EMC environment use only shielded cables. The operating voltage must comply with the requirements for safety extra-low voltage (SELV) as per EN 60 730.
- 1 terminal may drive up to 8 base units. See wiring for parallel connections. Total wire distance should not exceed 200 m.
- Conductor resistance will influence external temperature reading. 450 Ω will result in an increase of 1°C (2°F). Compensate using UP-08 if external temperature is used to control unit.

Technical Specification

Power Supply	Operating Voltage	5V DC ±10%
	Power Consumption	30mA max
	Electrical Connection	Terminal Connectors
	Deluxe type only: Power backup for real time clock	Min 48h if charged for 24h
Signal Inputs	Temperature Inputs Range Accuracy	0…50 °C (32…122 °F) 0.5°C, 1°F
Communication Base - Terminal	Communication Type Cable Type Max Distance	Digital: peer to peer Use twisted pair copper wire 0.8…2.5 mm^2 (AWG18…AWG13) 200m (650ft) use shielded wire in an EMC challenged environment. Conductor resistance must be compensated if external sensor is used
Environment	Operation Climatic Conditions Temperature Humidity	To IEC 721-3-3 class 3 K5 0…50 °C (32…122 °F) <95 % r.H. non-condensing
	Transport & Storage Climatic Conditions Temperature Humidity Mechanical Conditions	To IEC 721-3-2 and IEC 721-3-1 class 3 K3 and class 1 K3 -25…70 °C (-13…158 °F) <95 % r.H. non-condensing class 2M2
Standards	CE conformity EMC Directive Low Voltage Directive	2004/108/EC 2006/95/EC
	Product standards Automatic electrical controls for household and similar use Special requirement on temperature dependent controls	EN 60 730 –1 EN 60 730 – 2 – 9
	Electromagnetic compatibility for domestic sector	Emissions: EN 60 730-1 Immunity: EN 60 730-1
General Terminal	Safety Class	III (IEC 60536)
	Degree of Protection	IP30 to EN 60 529
	Material: Cover, back part Mounting Plate	ABS plastic (UL94 class V-0) Galvanized Steel
	Color	White RAL 9003
	Dimensions (H x W x D) : OPA : OPU :	88 x 88 x 24 mm (3.5 x 3.5 x 0.9 in) 112 x 73 x 18 mm (4.4 x 2.9 x 0.8 in)
	Weight including package: OPA-D42, OPU-D42 OPA-D42-D, OPU-D42-D	180 g (6.3 oz) 190 g (6.7 oz)

Power Failure

All the parameters and set points are memorized and don't need to be reentered. The clock will need to be reset.

Status LED

The status LED is located on the base unit between the two low power terminal connector groups. The status LED may display the following feedback:
No light: No power or unit is damaged
Blink every 1s: Error, terminal – base unit do not match or signal is not clear.
Blink every 2s: Normal communication, base unit detected
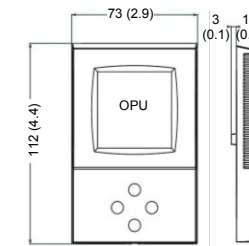Blink every 5s: Base unit operates normal, no terminal detected

Error messages

Err1:   Error temperature sensor. The internal temperature sensor may be damaged or not present.
Err2:   External input for heat / cool auto-change-over missing or damaged.
FP: Frost protection is active.

Wiring Diagram
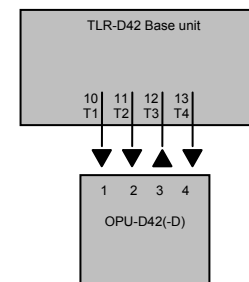
Dimensions Terminal

Configuration parameters for firmware version 2.0 –W50

This controller can be adapted to wide variety of fan coil applications. The adaptation is done with parameters. The parameters can be changed on the unit without the need of additional equipment.

Identifying the firmware version

The parameters and functionality of controller depend on its firmware revision. It is therefore important to use a matching product version and parameter set. The firmware version is shown on the large LCD digits when pressing UP and DOWN buttons for more than 3 seconds simultaneously.

Changing parameters

The parameters may only be accessed by entering a code. There are two levels of parameters: User operation parameters for access control settings and Expert parameters for control functions and unit setup. The codes for user levels and expert levels are different. Only control experts should be given the control parameter code.
The parameters can be changed as follows:
1. Press UP and DOWN button simultaneously for three seconds. The display shows the software version in the large digits and the software revision in the small digits.
2. Pressing the OPTION button will indicate CODE on the small digits and 000 on the large digits.
3. The code for accessing the user parameters is 009
4. Select this using UP or DOWN buttons.
5. Press OPTION button after selecting the correct code.
6. Once logged in, the parameter is displayed immediately.
7. Select the parameters with the UP/DOWN buttons. Change a parameter by pressing the OPTION button. The MIN and MAX symbols show up and indicate that the parameter may be modified now. Use UP or DOWN buttons to adjust the value.
8. After you are done, press OPTION or POWER in order to return to the parameter selection level.
9. Press the POWER button again so as to leave the menu. The unit will return to normal operation if no button is pressed for more than 5 minutes.

User Parameters (Access Code: 009)

Parameter	Description	Range	Standard
UP 00	Enable change of operation modes,	ON, OFF	ON (Enabled)
UP 01	Enable change of set points	ON, OFF	ON (Enabled)
UP 02	Enable manual control fan speeds	ON, OFF	ON (Enabled)
UP 03	Enable manual change of Heating/Cooling Mode. Applies only for 2-pipe or 4-pipe systems.	ON, OFF	ON (Enabled)
UP 04	Enable Access to time programs	ON, OFF	ON (Enabled)
UP 05	State after power failure: 0 = OFF, 1 = ON, 2 = Last State	0, 1, 2	2
UP 06	Enable Economy (unoccupied) Mode. Shift the setpoint to a lower temperature in winter or higher temperature in summer in order to save energy. May be activated through the POWER button, or with the external input (typically for key card switches in hotel rooms or motion detectors for meeting rooms.)	ON, OFF	OFF (no economy)
UP 07	Celsius or Fahrenheit, OFF for Celsius, ON for Fahrenheit	ON, OFF	OFF (Celsius)
UP 08	Calibrate internal temperature sensor –10° to +10° in 0.1° steps. (Sensor is factory calibrated, use this feature for field adjustment only as required.)	-10…10	0
UP 09	Enable Frost Protection. Activates the output independent of operation mode when the control temperature drops below 5°C or 41°F. The controller returns to normal operation when the temperature increases above 10°C or 50°F.	ON, OFF	ON (Enabled)
UP 10	Select contents of Large LCD display in standard mode: 00 = OFF 03 = Output Fan Speed 01 = Setpoint 04 = Clock 02 = Temperature Sensor 05 = Alternative Sensor 06 = Output in Percent	0…6	02 Temperature
UP 11	Select contents of small LCD display in standard mode 00 = OFF 03 = Output Fan Speed 01 = Setpoint 04 = Clock 02 = Temperature Sensor 05 = Alternative Sensor 06 = Output in Percent	0…6	Standard: 01 Setpoint Deluxe: 04 Clock
UP 12	Contents of vertical bar in standard mode OFF = Fan Speed ON = Control output	ON, OFF	ON (control)
UP 13	Clock display type: Only available for deluxe version OFF = Show 24hour clock ON = Show 12hour clock (AM, PM)	ON, OFF	OFF (24h)
UP 14	Reset timer for override mode: Only available for deluxe version 0 = Reset of override mode is not active. 1…255 = delay in minutes to switch off device if ON/Economy mode is activated while the unit is scheduled to be in OFF mode	0…255	60 (Min)

Control Settings (Access Code: 241)

Warning! Only experts should change these settings!

Set point limits

Parameter	Description	Range	Standard
FC 00	Minimum setpoint limit in Heating mode	-40-60°C (160°F)	16°C (61°F)
FC 01	Maximum setpoint limit in Heating mode	-40-60°C (160°F)	24°C (75°F)
FC 02	Minimum setpoint limit in Cooling mode	-40-60°C (160°F)	18°C (64°F)
FC 03	Maximum setpoint limit in Cooling mode	-40-60°C (160°F)	30°C (86°F)

Fan control sequence

Parameter	Description	Range	Standard
FC 04	Economy (unoccupied) Mode temperature shift: The comfort (occupied) setpoint is shifted by the value set with parameter. If heating is active the comfort setpoint will be decreased, if cooling is active, the setpoint will be increased. (Enable with UP06.)	0…10.0K (20°F)	4.0°C (8°F)
FC 05	Switching Span Heating, if set to 0, only 1 fan speed will be used	0…10.0K (20°F)	0.0°C (0.0°F)
FC 06	Switching Span Cooling if set to 0, only 1 fan speed will be used	0…10.0K (20°F)	0.0°C (0.0°F)
FC 07	Switching Hysteresis is the difference between switching on and switching off. A small hysteresis will increase the number of switching cycles and thus the wear on fan and relays contacts.	0…10.0K (20°F)	0.5°C (1°F)
FC 08	Mold Protection: In mold protection, the fan keeps running independent of temperature as long as the unit is switched on.	ON, OFF	ON
FC 09	Delay OFF (Minimum running time)	0…255 s	10s
FC 10	Delay ON (Minimum stopping time)	0…255 s	10s
FC 11	Control option: 0 = Cooling only 1 = Heating only 2 = 2-pipe system 3 = 4-pipe system	0-4	3
FC 12	Dead Zone Span: The Dead Zone Span lies between the heating and the cooling setpoint. The output is off while the temperature is within the dead zone span. A negative dead zone is not possible.	0…100°C (200°F)	2.0°C (4°F)
FC 13	Heat/Cool Changeover Delay (if set to FC11 = 3): A demand to switch between heating and cooling must persist for the length of time set with this parameter before the controller switches. Prevents activation of a sequence during a short-term change in temperature in order to protect equipment (with control overshoot for example)	0…255 min	5 min

PID control sequence

Parameter	Description	Range	Standard
FC 14	P – band heating X_{PH}	0…10.0K (20°F)	2.0°C (4.0°F)
FC 15	P – band cooling X_{PC}	0…10.0K (20°F)	2.0° (4.0°F)
FC 16	K_{IH}, Integral gain heating, in 0.1 steps, 0 disables ID part low value = slow reaction, high value = fast reaction	0…25.5	0.0
FC 17	K_{IC}, Integral gain cooling, in 0.1 steps	0…25.5	0.0

→ **Proportional control (P-band)**
The proportional control function calculates the output based on the difference between setpoint and measured value. The proportional band (P-band) defines the difference between setpoint and measured value which will result in a 100% output. Setting the proportional band to 0 disables proportional control.

→ **Integral gain KI**
The integral gain defines how fast the output increases in case the setpoint is not met by the room temperature. A low value indicates a slow reaction, a high value a fast one. If the value is chosen too high, the controller will start to swing. Depending on the room size and heating / cooling equipment used a value between 0.1 and 1.5 should be sufficient. Below are suggested values:
Heating: KIH: 0.1-0.5, Cooling: KIC: 0.3-0.8

Configuration of Analog outputs

Parameter	Description	Range	Standard
FC 18	Configuration of analog output signal 0 = 0-10V 1 = 2-10V 2 = Manual override (useful for commissioning) When low fan speed: 25% output When medium fan speed 50% output When high fan speed 100% output	0-2	0 (0-10V)
FC 19	Function of analog outputs 0 = Disabled 1 = Control: Heating only (AO1 only) 2 = Control: Cooling only (AO2 only) 3 = Control: Heating and cooling (AO1 and AO2)	0…3	3
FC 20	Output of AO1 in cooling mode if FC19 = 1 or Output of AO2 in heating mode if FC19 = 2	0…100%	0%

→ For heating only or cooling only option, the analog output may set to a fixed output while the binary sequence is active. This is used for VAV systems.

Configuration of binary output

Parameter	Description	Range	Standard
FC 21	Function of binary output 0 = Disabled 1 = Control: Heating only 2 = Control: Cooling only 3 = Control: Heating and cooling 4 = Enable: On if device is on 5 = Enable: On if device is on and in heating mode 6 = Enable: On if device is on and in cooling mode 7 = Frost protection alarm	0…7	1
FC 22	Level to activate binary output if in dual AO-DO mode Dual AO-DO mode = both analog and binary outputs are assigned to same control sequence.	0…100%	65%
FC 23	Level do deactivate binary output if in dual AO-DO mode Dual AO-DO mode = both analog and binary outputs are assigned to same control sequence.	0…100%	15%

→ The three fan outputs are assigned to the fan speed module. Only output 4 can be assigned by this parameter (FC21). Select if the binary output should work as controls output in heating or cooling only or both for heating and cooling mode.

→ Dual AO-DO mode: if both the analog and the binary output is assigned as control output to the same sequence, the binary output will then switch on when the analog output reaches the value defined in FC22 for example 95% and switch off when it drops below FC 23 for example 45%. Note: This output does not follow min running and stopping delays. It only reacts to the conditions mentioned above. In order to take advantage of this function we recommend using larger proportional bands.

Configuration of inputs

Parameter	Description	Range	Standard
FC 24	External input: 0 = No external input 1 = External temperature sensor 2 = Occupation sensor – Comfort / Economy 3 = Occupation sensor – Comfort / Off 4 = Heat / Cool changeover 5 = Key card with alternative setpoint 6 = Key card with full reset	0…6	0
FC 25	Activation delay (Minutes) = the time the binary input needs to be open before economy/off mode is activated.	0…255 min	5
FC 26	Auto-changeover limit heating FC24 = 4 or economy setpoint in heating mode if FC24 = 5	-40…60°C (160°F)	28°C (82°F)
FC 27	Auto-changeover limit cooling FC24 = 4 or economy setpoint in cooling mode if FC24 = 5	-40…60°C (160°F)	18°C (64°F)
FC 28	Comfort setpoint in heating mode if FC24 = 6	-40…60°C (160°F)	21°C (70°F)
FC 29	Comfort setpoint in cooling mode if FC24 = 6	-40…60°C (160°F)	24°C (75°F)

Configuring the function of the external input

FC24 = 1	External control input	The external sensor is the control input.
FC24 = 2	Switching Economy and Comfort modes	Economy (unoccupied) and Comfort (occupied) modes are controlled through an external contact by connecting the input through a dry contact to signal common. This function may be used together with key card switches for hotels or motion detectors for offices.
FC24 = 3	Switching Energy Hold OFF and Comfort modes	Opening the input will force the unit into the OFF operation mode. The operation mode cannot be overridden by using the terminal. Connecting the input to signal common returns control of the operation mode to the terminal. This function may be used as window contact to prevent loss of energy.
FC24 = 4	Heat – Cool changeover	Switch heating and cooling mode based on supply media or outside temperature or binary contact. See below for further details.
FC24 = 5	Key card with alternative setpoint	As with FC24 = 2, the key card function switches economy (unoccupied) and comfort (occupied) modes. Instead of using the setpoint shift, the setpoints in unoccupied mode are defined by parameter FC26 in heating mode and FC27 in cooling mode. Fan speed in unoccupied mode is limited to low speed. Fan speed and setpoint will be remembered after re-inserting the key card.
FC24 = 6	Key card with full reset	Similar as FC24 = 5 with the difference that setpoints, fan speed and operation mode are reset each time the key card is inserted. This is helpful for business hotels. Setpoints will be reset to FC28 or FC29.

→ **Configuring auto changeover input if FC24 = 4:**
The auto changeover function automatically changes heating and cooling mode based on supply media temperature or outdoor temperature. The difference between the two is in the values of the changeover limits FC26 and FC27. See table below for recommended settings.

Heating and cooling may be as well changed by an open contact switched to signal ground. Note: all signal ground levels of involved controllers must be the same in case more than one controller is switched.

Recommended settings for FC26 and FC27:

Change over mode FC24=4	Relation FC26 to FC27	Example:FC26	Example:FC27
Supply media	FC26> FC27	28°C (82F)	18°C (64F)
Outside temperature	FC26< FC27	15°C (59F)	25°C (77F)
Dry contact: Heating if contact closed	FC26> FC27	25°C (77F)	15°C (59F)
Dry contact: Cooling if contact closed	FC26< FC27	15°C (59F)	25°C (77F)