Regulation and acoustics

OPTIMIZED CONVECTION

Description of electrical regulation of convectors

Description of electrical regulation of PKOC, PKBOC, PKIOC, PKWOC, OLOC, OKIOC (hereinafter referred to as fan-coils)

Standard regulation:

The regulation is designed for the control of the heating and cooling output of convectors with blow fans. The standard part of the fans is:

- Group of fans with a unique disk type synchronous engine with permanent magnets. It is characterized mainly by very low power consumption – the power input of the engine at the full range of speed does not exceed 7.5 watts; the engine also runs very quietly.
- Connecting terminal (F Box)
- Exchanger temperature sensor (switch)

Optional accessories

The DC power supply source in accordance with the total power input of the controlled fan-coil units. Four types of power sources, rated at 12 V/60 W, 12 V/100 W, 24 V/100 W and 24 V/480 W, are available. The power supply sources are supplied separately for installation in the electrical switchboard on DIN rail.

- R-Box, containing the speed signal galvanic separation module, controlling the fan speed and which also allows the selection and optimization of various degrees of speed. The R-Box is designed for mounting on DIN rail in the switchboard
- Plastic box for the placement of the DC power supply and the R-Box for installations where the switchboard is too far
- Siemens thermostats
- Valves, thermoelectric drive 12 V DC and 24 V DC

Description of function with 12 V DC:

The performance is controlled by the working media On/Off switching valve, if used, and by switching the On/Off the three speed blower fan. When using a Siemens thermostat RDG100T and RDF 600T the speed is controlled automatically. All three speeds of the fan can be smoothly adjusted. The fan speed is given by the size of the voltage control signal CNTRL from the galvanic separation signal module (R-Box). Detailed description of functions and settings is available in the installation instructions supplied with the productor on www.licon.cz in the download section.

Fans are normally blocked by a temperature switch (TS1) at a switching temperature of about 35 °C. This function may be disconnected. This accessory is not supplied for OKIOC. For fan coils with dry-cooling effect it is still necessary to use one cooling medium thermal switch (TS2) connected in parallel to the temperature switch which activates at a temperature below 13 °C. The temperature and speed is controlled by Siemens Thermostats RAB11, RDF 600T or RDG 100T. Contact fields of these thermostats (TS1) are connected to mains voltage, and that is why it is necessary to use the R-Box signals' galvanic separation (the galvanic separation of signals is implemented by using optocouplers).

The thermostat switches the DC power supply source of the output voltage of approx. 12 V. Once the power supply source is switched on the heating medium valves (if used) start opening. Furthermore, the thermostat through galvanic separation module generates the control voltage signal CNTRL. The control voltage signal is of three levels, with each speed level smootly adjustable. The standard regulation enables the use of a themoelectric drive 12 V DC that closes or opens the heating media valve. The function is set in such a way that if heating is required, i.e. after the thermostat switches on, the power supply is activated. The voltage from the power supply source directly supplies the thermoelectric drives of the valve for the control of the heating media inlet to the fan-coil unit. If the heating output is not sufficient without the fan, it is possible to select the required speed of the fan (I. II. III.) with a switch. The standard control allows usage of a 12 V DC actuator, which closes or opens the heating media valve. The function is set in such a way that when the need arises to provide heat, i.e. once the thermostat switches on, the supply source is activated. The supply source feeds directly the valve actuators controlling the heating media entry into the fan-coils.

Description of function with 24 V DC:

The performance is controlled by switching On/Off the working medium valve – provided such valve is implemented – and by switching On/Off the blowing fan. The convector is under permanent voltage of 24 V. The thermostat Siemens RDG 160T controls via thermo-drive the valve of the heating media as On/Off and furthermore it controls the speed of the fan via voltage signal 0–10 V. The speed of the fan may be controlled automatically or manually in three speed levels. The speed levels may be adjusted. The fans are as standard blocked by temperature switch (TS1) at switching temperature of about 35 °C. This function may be disconnected (This accessory is not supplied for OKIOC). As for fan coils with cooling effect the second thermal switch (TS2) for cooling media is implemented to switch On when the temperature falls below 13 °C.

BMS (Building Management System):

The convectors control can be also carried out using a BMS (Building Management System) higher-level output elements. One BMS relay output controls the valve's opening/closing, and the second continuous 0–10 V output controls the speed. Supply voltage of 12-24V DC can be used.

Description of regulation of PKBOC

The above described system of regulation applies to pool applications for which this product is intended. The principle is the same but

the electrical equipment of the convector differs the electronics of the motor, F box are located in a plastic box with high degree of protection IP 67 which is placed inside the convector. When installing the connecting cables to the terminal block of the F box must be connected as per instructions. In terms of temperature and speed regulation the same types and variations of thermostats are used with a restriction that the thermostats must not be placed in the pool area. For these purposes we recommend using the temperature sensor which senses the temperature in the pool area, see Accessories. The sensor is designed for thermostats RDF 600T and RDG 100T.
The convector is not designed for continuous flooding by pool water. Get thoroughly familiar with the warranty and operating conditions.
Installation must be performed according to valid standards and safety regulations! The manufacturer is not liable for defects or damage caused by improper installation.

Electrical regulation elements

SIEMENS RAB 11 (for 12 V regulation)

- room thermostat with a speed switch
- switching between heating and cooling
- manual switching of the fan speed
- voltage 24 to 250 V AC, current 0.2 to 6 (2) A
- temperature setting range 8 to 30 °C
- degree of protection class IP 30
- dimensions w × h × d (mm) – 96 × 110 × 35,4

SIEMENS RDF 600T (for 12 V regulation)

- room thermostat with a display and weekly program for two/four-pipe fan-coil units
- automatic switching between heating/cooling
- manual or automatic 3-stage fan speed control
- operating voltage AC 230 V, current loading max. 4 (2) A
- setting range of the required temperature 5–40 °C
- switching hystereses adjustable in the range of 0.5 to 4 K
- possibility of connection of a separate sensor e.g. for applications in a wet environment
- possibility to control the control valve with the use of a thermoelectric drive
- degree of protection class IP 30
- dimensions w × h × d (mm) – 86 × 86 × 57

SIEMENS RDG 100 T (for 12 V regulation)
SIEMENS RDG 160 T (for 24 V regulation)

- room thermostat with a display and weekly program for two/four-pipe fan-coil units
- automatic switching between heating/cooling
- manual or automatic 3-stage fan speed control
- supply voltage, maximum current loading:
  RDG 100T – AC 230V, Y1-Y4 max. 5 (4) A
  RDG 160T – DC 24V, Y50 DC 0…10 V max. 1mA
- setting range of the required temperature 5–40 °C
- switching hystereses adjustable in the range of 0.5 to 6 K
- possibility of connection of a separate sensor e.g. for applications in a wet environment
- possibility of control using the infrared remote control
- degree of protection class IP 30
- dimensions w × h × d (mm) – 93 × 128 × 30

SIEMENS IRA 211

- infrared remote control for RDF 600T/IR and RDG 100T
- operation type selection
- temperature setting
- fan speed selection
- compatible for use with the RDF 600T, RDG 100T thermostats
- power supply 2× 1.5 V, AAA type
- degree of protection class IP 30
- dimensions w × h × d (mm) – 42 × 106 × 18

Room temperature sensor QAA32

- to measure space temperature in systems of heating, where it is not possible to place a thermostat
- suitable for pool application installations
- can be connected to thermostats RDF 600T, RDG 100T
- measurement range: 0–40 °C, accuracy of measurement at 25 °C ± 0.3 K
- measuring sensor – NTC, 3 kΩ at 25 °C
- safety class II according to EN 60 730, degree of protection IP 30 according to EN 60 529
- dimensions w × h × d (mm) – 96.4 × 99.6 × 36

DC power supply source 60 W, 100 W, 480 W

- switching DC power supply
- noiseless operation, high efficiency
- DIN rail mounting
- degree of protection class IP 20

model	DR-60-12	DR-100-12
power supply size	60 W	100 W
input control voltage	230 V AC/0.88 A	230 V AC/1.6 A
heat output voltage	12 V DC/4 A	12 V DC/6.5 A
dimensions w × h × d *(mm)*	78 × 93 × 56	100 × 93 × 56

model	DR-100-24	DR-480-24
power supply size	100 W	480 W
input control voltage	100–240 V AC/3 A	100–240 V AC/5 A
heat output voltage	24 V DC/4,2 A	24 V DC/20 A
dimensions w × h × d *(mm)*	100 × 93 × 56	89 × 126 × 129

R-Box (for 12 V regulation)

- input voltage: 230 V/50 Hz
- output signal: 0 to 10 V/1 kΩ
- galvanically separated 4 kV AC – optocouplers
- degree of protection: IP 20
- instalation on the DIN rail in the switchboard
- incorporates speed signal galvanic separator module
- operating ambient termperature: 0–40 °C
- dimensions w × h × d (mm) – 52 × 23 × 40

Installation box

- wall built-in
- used for the DC power supply source (source DR-60-12, DR-100-12 and DR-100-24) installation and the R-Box in cases where the installation in switchboard is not possible
- IP 40
- dimensions w × h × d (mm) – 258 × 318 × 72

Heating control elements (cooling) medium

Thermoelectric drive

- power supply voltage:
  12 V regulation; 1.8 W
  24 V regulation; 2 W
- CLOSED without power supply
- degree of protection: IP 54
- connection cable 2× 0.75 mm², length 1 m
- closing/opening time < 3 min.

Thermostatic head fluid with capillary

- regulation range +6.5 to +28 °C
- installation of the actuator into the wall
- length of capilary 5 m
- hysteresis: ≤ 0.6 °C

Shut-off valve

- straight or corner section (according to the order)
- dimension 1/2" G
- material – nickel-plated brass

Preset stage	1	2	3	4	5	6	7	8	9
speed	1 1/4	1 1/2	1 3/4	2	2 1/2	3	3 1/2	4	Complete opening
Kv	0.14	0.20	0.31	0.43	0.60	0.79	1.00	1.20	1.35

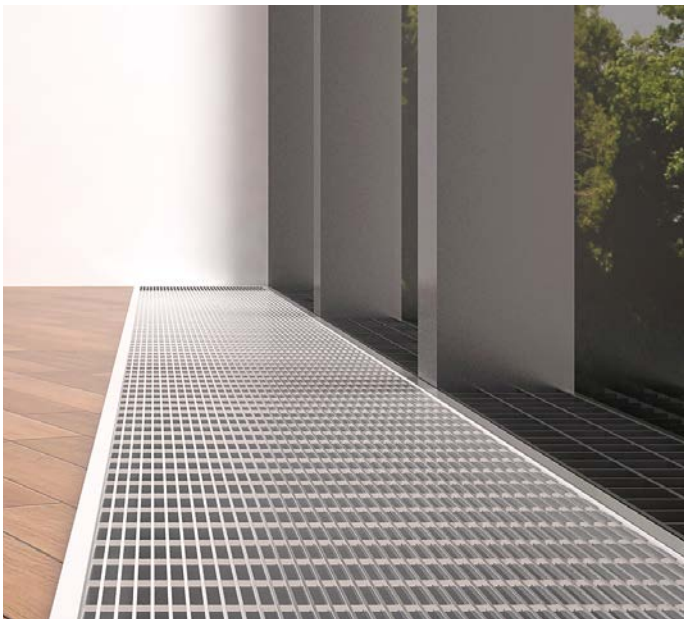
Kv flow coefficient (m³/h)

Thermostatic valve

- straight or corner section (according to the order)
- with preset Kv value
- dimension 1/2" G
- connection dimension of the head M 30 × 1.5
- material – nickel-plated brass
- maximum operating pressure PN 10
- maximum operating temperature 90 °C

Preset stage	1	2	3	4	5	6
Kv (Δt = 2K)	0.10	0.20	0.30	0.40	0.50	0.60
Kvs	0.10	0.20	0.30	0.40	0.57	0.80

Kv flow coefficient (m³/h)
Kvs maximum flow (m³/h)
Δt = 2K valve proportionality band (K)

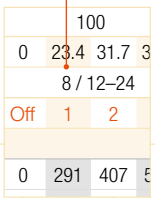


Example of the design calculation of the output of the DC power supply

The electrical intake must be calculated in terms of regulation so that the correct size of the DC power supply source is selected. The total intake power will be a sum of all intake power of the convectors with forced convection which will be controlled through one thermostat.

For example:
According to the project we have the following fan-coil unit types:
2 pcs of PKOC 160/9/28 – we find the intake power of 12 W in the table
1 pc of OLOC 240/15/18 – we find the intake power of 22.5 W in the table
2 pcs of OLOC 100/45/11 – we find the intake power of 8 W in the table
(optionally 4 pieces of thermoelectric drives –
4 x 1.8 W = 7.2 W)

Total power intake:
12 + 12 + 22.5 + 8 + 8 = 62.5 W
Select source rated 100 W.



Acoustics

Apart from the intake power one of the main parameters is the noise level of the fan convectors. Licon develops and designs its products so that they do not exceed under any circumstances the specified noice levels laid down by the health standards for this type of equipment. Generally this limit is 30 dB (A) of the sound power that means that the product does not exceed this limit at the minimum speed. Products marked with the logo OC OPTIMIZED CONVECTION has been optimized for the noise/performance ratio. Licon uses in its products always the most advanced technology, as well as in the case of the fans. The used fans are equipped with a patented disc engine with permanent magnets. Among the main benefits is belong a significant noise reduction and a low energy consumption compared to commercially available ventilators with the rotor and stator.

Licon indicates in its materials a parameter to assess the noise level the sound pressure Lp (A) measured at 1 m from the source. The measurements were carried out by an authorised test laboratory.
The values of the sound power are available on request.

Acoustic pressure

The acoustic pressure is a change of the air pressure generated by a source of noise. Such pressure fluctuations are measured in N/m^2 and expressed by the symbol "p". The acoustic pressure represents the measure of volume. It depends on the distance between the source of the noise and the place of the measurement and also on the characteristics of the space.

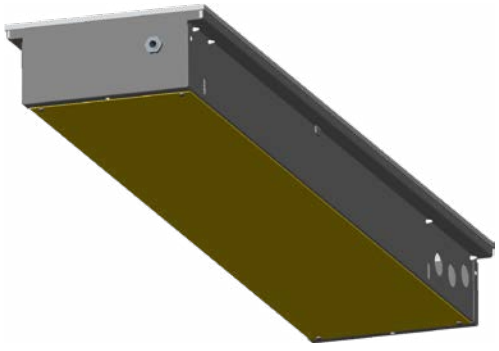
Sound power

The energy converted by a piece of equipment (the source of sound) to sound is referred to the sound power. This sound power is brought to the air in the form of pressure fluctuations.The sound power is not a directly measurable quantity. It is determined by integrating of the sound pressure in the form of a hemisphere or a sphere around the sound source. The sound pressure is on this basis a quantity that is independent of space and distance. It is used for all further calculations. On request, Licon will provide values of sound power of its OC products. Although the sound pressure level and sound power level use the same unit (dB), they are two different physical quantities. The sound power level is the sound generated at the sound source (energy introduced to the space) while the acoustic pressure level is the sound registered at a certain distance from the sound source. This means that the sound power level is generally higher than the acoustic pressure level.

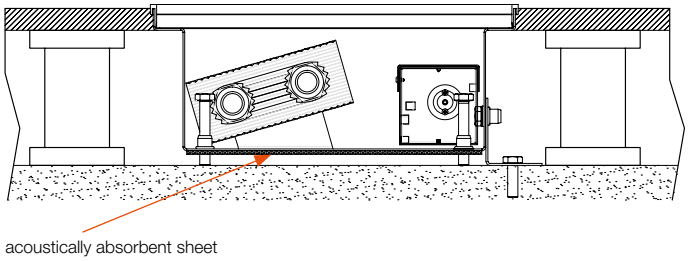
Case with noise-absorbing foil

For further noise reduction, it is possible to order a convector case fitted with noise-absorbing foil. The foil reduces the noisiness by 1 to 3 dB depending on the type, length and speed of the convector.

Anti-noise foil



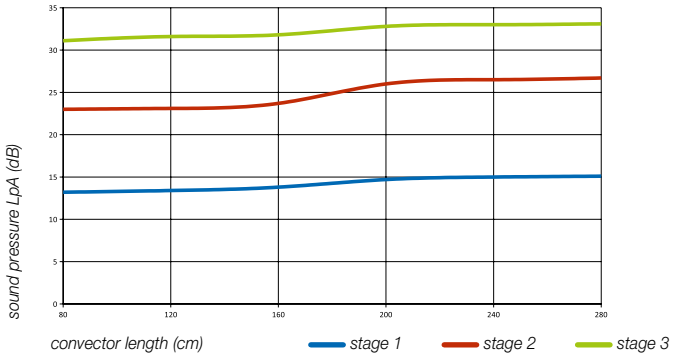
Anti-noise foil – cross section



Graphic representation of the noisiness level of OC convectors

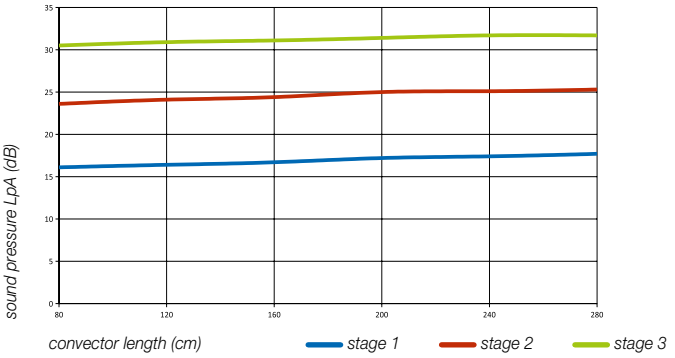
Sound pressure at the distance of 1 m from the convector with forced convection of ∅ 30 mm.

For convectors type PKOC 7/28, 8/16 and 8/28.



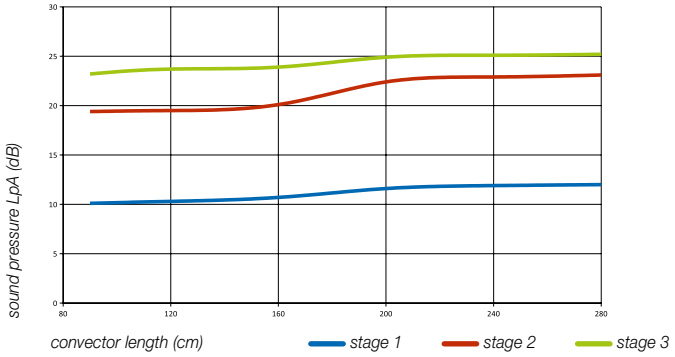
Sound pressure at the distance of 1 m from the convector with forced convection of ∅ 40 mm.

For convectors type PKOC 9/28, 11/20, 11/28, 11/34, 11/42, PKIOC 11/20, PKWOC 13/34.



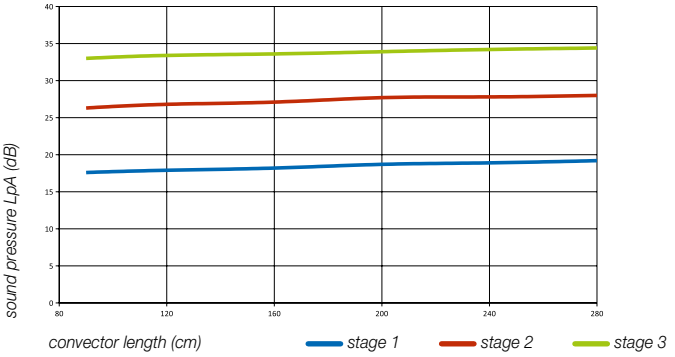
Sound pressure at the distance of 1 m from the convector with forced convection of ∅ 30 mm.

For convectors type OLOC 15/11.



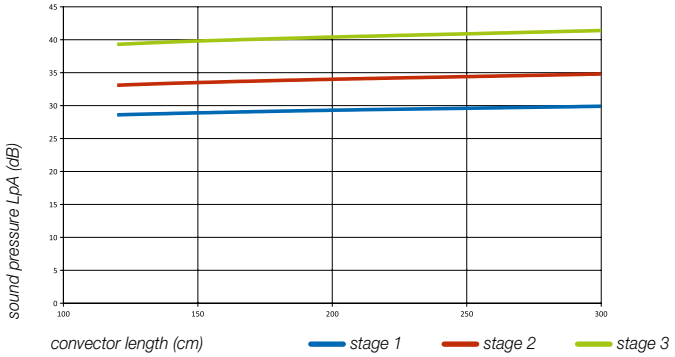
Sound pressure at the distance of 1 m from the convector with forced convection of ∅ 40 mm.

For convectors type OLOC 15/18 and 15/24.



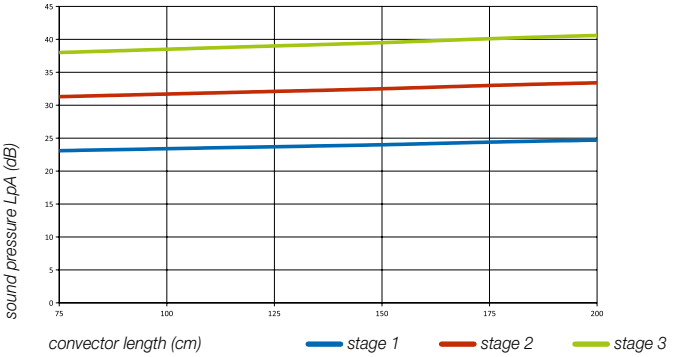
Sound pressure at the distance of 1 m from the convector with forced convection of ∅ 60 mm.

For convector types PKIOC 13/34, PKWOC 13/34.



Sound pressure at the distance of 1 m from the convector with forced convection of ∅ 60 mm.

For convectors type OKIOC 45/11.



Volume of air per 1 m of fan-cooled heat exchanger length (m^3/h)

fan diameter	stage 1 speed	stage 2 speed	stage 3 speed
30 mm	135	180	225
40 mm	180	240	300
60 mm	325	437	512