| General description:

Free Cooling is a ventilation system that uses natural deposits of cold air. Its purpose is to keep the container or room temperature at a desired level by providing cooler ambient air to its interior. Such solution significantly reduces the energy consumption required to maintain the internal temperature the appropriate level.

The system is controlled by PI1 control unit (version PS-01 or PS-02) which according to actual climatic conditions:

+ controls Free Cooling fan (smooth air flow regulation);
+ turn on and off air-conditioner (additional relay placed in distribution panel);
+ turn on and off heater (additional relay placed in distribution panel);
+ generating alarms.

| Application:

+ telecommunication;
+ ICT;
+ industry.

| Features:

+ maintaining precise thermal parameters at a preset level with minimum energy consumption;
+ fluent regulation of injected air flow;
+ fully automatic operation;
+ cooperation with existing air-conditioner;
+ 7 potential-free relay outputs for alarm output;
+ remote monitoring and change parameters of the system (option);
+ large area cassette air filter;
+ power supplied by 48Vdc rated voltage – ventilation system works even during the AC mains failure;
+ high cooling capacity of the ventilation system at low energy consumption;
+ fire-fighting functionalities - during a fire alarm, fan will be turned off (optional).

| Design:

The standard version the FCC Free Cooling system consists:
+ Freecooling Box – cool air inlet and fan module;
+ Warm air exhaust with:
   - rain and snow cover (option),
   - gravity air louver, which opens the ventilation duct during fan operation; closed shutter prevents unwanted windblown cold air to the interior (optional),
   - electrical air louver (optional);
+ PI1 control unit 19" 1U module with:
   - signalization LEDs (version PS-01);
   - signalization LEDs, OLED display, USB port (version PS-02);
+ Control panel depending on the version allows to configure the device and present actual operation parameters;
+ indoor temperature sensor;
+ ambient temperature sensor.

Optionally the system can be equipped with additional modules:

+ Pressostat – which send to the controller information about the filter purse dirtying. Using this feature, there is no need to periodically replace the purse filter;
+ Fire-fighting functionalities - during a fire alarm, fan will be automatically turned off;
+ Hygrostat – during occurrence of high humidity, the hygrostat will activate air-conditioning or fan heater to reduce high humidity;
+ Portable User Interface Module – on OLED display user can read the temperatures and adjust desirable temperature in the container;
+ Fan heater - maintains the desired indoor temperature during the winter.

| Principle of operation:

Free Cooling system operation is to keep the desired internal temperature on the basis of the PID algorithm realized by system controller. The basic task of this controller is to generate an appropriate signal to a regulated object (fan, air-conditioning system) to achieve desired temperature in shortest possible time at optimum energy consumption.

Regulation signal is the difference between the desired and the actual temperature inside the container. If the difference is positive regulator increases the fan speed, otherwise the fan speed will be decreased. Free cooling system allows to maintain precise room temperature and reduce OPEX by significant energy reduction related to classical approach: using only air-conditioning system.

| Benefits:

Energy savings resulting from the implementation of the Free cooling system are dynamic and depend on the outside temperature and the specific of the site*.

Operation time of the air conditioner will depend on the difference between internal (set) and external temperatures.
For moderate climate conditions estimated reduction in energy consumption and overall energy costs of the whole site in comparison with classic approach (air-conditioning system) will be ca. **20%.**

In stable temperature conditions system maintains fan speed at a slow speed, so energy consumed by the fan is low.

* - The specificity of the site consists of the following factors: temperature set, air conditioner activation temperature, power dissipation in the room, the efficiency of the air conditioner and volume of the room.

Basic parameters:

General data:

External dimensions:		(H x W x D):
Free cooling Box	mm	951 x 660 x 635
PI1 control unit	mm	(1U)x (19") x 320mm
Weight	Kg	4,4
Free cooling Box enclosure material	-	Steel, coating - polyester powder paint
Cooling power	W	5 @ Δt ≥7 °C

5kW fan parameters:

Nominal input voltage	V_{dc}	48
Range of input voltage	V_{dc}	36...57
Air flow	m^3/h	~2620
Rotational speed	r.p.m	1930
Speed control	%	10 ÷ 100
Input power	W	208
Acoustic pressure level	dB(A)	69 @Full power

Air filter parameters

Type	-	cassette
Filtration class	-	G4
Number of filters	pcs.	1
External dimensions	mm	595 x 494 x 48 (H x W x D)
Active surface area	m^2	0,6

| Functions of the PI1 control unit:

Basic functions:

+ measurement of two temperatures: internal and external;
+ smooth fan control depending on the temperatures – according to algorithm;
+ control of the Air-con operation by the additional relay placed in the power supply distribution panel, which is controlled by PI1 unit potential-free contacts;
+ send out alarms in the form of dry contacts (configuration logic alarm contacts (NO or NC) by the external software);
+ alarm visualization – backlit symbols on control panel;
+ configuration parameters of the controller by the external software.

Optional functions:

+ remote monitroing and configuration of Free cooling system parameters WinCN 2 client / WinCN 2 WWW application, communication via Ethernet or GSM / GPRS modem.
+ user interface with OLED color display – presentation and configuration system parameters (PI1 PS-02);
+ events history.

Alarms:

+ AC mains failure;
+ Fan failure;
+ Internal temperature sensor failure;
+ External temperature sensor failure;
+ Temperature out of range - too high;
+ Temperature out of range - too low;
+ The critical temperature;
+ High humidity (optional - humidistat);
+ Opened Door of the FC Box;
+ Soiled filter (optional - Pressostat);
+ Fire (optional - smoke detector or connectio to the fire protection system).

| Possible configurations:

The Free Cooling system may operate in two different configurations:

+ **Free Cooling + Air-conditioner** - the ventilation system consists of a Free Cooling system and air-conditioner installed in a container. Control unit will start air-conditioner when the primary free cooling mechanisms will be not sufficient to keep desired temperature;
+ **only Free Cooling** - the ventilation system consists only of a Free Cooling system. In such a configuration may occur temporary excess of the critical temperature. It should be considered providing additional thermal protection for components which should be surrounded by a special concern for high temperature (eg. batteries).