HK INSTRUMENTS
USER-FRIENDLY MEASURING DEVICES

INDOOR AIR QUALITY TRANSMITTERS
SIRO-MOD SERIES

INSTALLATION INSTRUCTIONS

INTRODUCTION

Thank you for choosing an HK Instruments Siro-MOD series indoor air quality transmitter. The Siro-MOD series transmitters are intended for use in building automation systems in the HVAC/R industry.

Siro-MOD is an indoor air quality transmitter with a modern design. The transmitter is available with several optional air quality sensors. The modular device can be equipped with CO_2 concentration and VOC (Volatile Organic Compounds) measurements or alternatively PM (Particulate Matter) measurement and in addition temperature and humidity measurements. It offers easy installation and adjustment, several different model options and various output signals that are configurable separately for each measurement parameter.

The Siro-MOD series devices are available with user interface that includes LCD display and buttons making the configuration of the device quick and easy. An external configuration tool is necessary for commissioning preparations for Siro-MOD without user interface. Configuration is also possible via Modbus network. Siro-MOD utilizes the industry standard NDIR measurement principle with self-calibrating ABC logic™ for CO_2 measurement.

⚠ WARNING

- READ THESE INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING TO INSTALL, OPERATE OR SERVICE THIS DEVICE.
- Failure to observe safety information and comply with instructions can result in PERSONAL INJURY, DEATH AND/OR PROPERTY DAMAGE.
- To avoid electrical shock or damage to equipment, disconnect power before installing or servicing and use only wiring with insulation rated for full device operating voltage.
- To avoid potential fire and/or explosion do not use in potentially flammable or explosive atmospheres.
- Retain these instructions for future reference.
- This product, when installed, will be part of an engineered system whose specifications and performance characteristics are not designed or controlled by HK Instruments. Review applications and national and local codes to assure that the installation will be functional and safe. Use only experienced and knowledgeable technicians to install this device.

APPLICATIONS

Siro-MOD series devices are commonly used to monitor and control:
- indoor air quality in offices, public spaces, meeting rooms and classrooms
- CO_2 and VOC concentration to regulate demand-controlled ventilation and to keep the indoor air quality in a good level
- PM concentration to measures the size and amount of particulates in the indoor air for example to assess the performance of air filters
- temperature and humidity in HVAC/R environment

SPECIFICATIONS

Performance
Measurement ranges:

CO_2:	0–2000 ppm / 400–2000 ppm (selectable via jumper)
VOC:	CO_2eq: 400–2000 ppm TVOC ppm: 0–30.0 ppm TVOC µg/m³: 0–10000 µg/m³ IAQ index: 1–5 (UBA rating)
PM1/PM2.5/PM10:	0–50 µg/m³ / 0–500 µg/m³ (selectable via jumper) IAQ index: 1-5 (WHO rating)
Temperature:	0...50 °C
Relative humidity:	0–100 %rH

Accuracy:

CO_2:	±40 ppm + 3 % of reading (typical), additional ±60 ppm for first weeks
VOC*:	15 % of reading (typical)

*VOC sensor is tuned for typical IAQ Mix of 22 VOCs as defined by Mølhave et al. (1997)

PM:
0...100 µg/m3:

PM2.5:	±15 µg/m³ (at 25 °C ±5 °C)
PM1/PM10*:	±25 µg/m³ (at 25 °C ±5 °C)

100...1000 µg/m3:

PM2.5:	±15 % (at 25 °C ±5 °C)
PM1/PM10*:	±25 % (at 25 °C ±5 °C)

*PM1 and PM10 values are calculated from PM2.5 measurement reading with the default particle distribution.

Temperature:	±0.4 °C (typical at 20 °C)
Relative humidity:	±2.2 %rH (typical at 20 °C, 30 %rH)

Technical Specifications
Media compatibility:
Dry air or non-aggressive gases
Measuring units:

CO_2:	ppm
VOC:	CO_2eq: ppm TVOC: ppm, µg/m³
PM:	PM1/PM2.5/PM10: µg/m³
Temperature:	°C/°F
Relative humidity:	%rH

Measuring element:
CO_2: Non-dispersive infrared (NDIR)
VOC: Complementary Metal Oxide Semiconductor (CMOS)
PM: Laser-based light scattering particle sensing
Temperature: Integrated to CMOS
Relative humidity: Thermoset polymer capacitive sensing element
Calibration:
Automatic self-calibration ABC Logic™ for CO_2 measurement
Environment:
Operating temperature: 0...50 °C
Storage temperature: -20...70 °C
Humidity: 0 to 95 %rH, non condensing

Physical
Dimensions: Case: 95 x 103 x 30 mm (width x height x depth)
Weight: 130 g
Mounting:
2 screw holes slotted, distance c/c 60 mm
Materials:
Case: ABS
Protection standard: IP20
Display (optional)
Monochrome LCD, 38 x 23 mm
Electrical connections:
10-pin spring loaded terminal block
0.2...1.5 mm² (16-24 AWG)

Electrical
Input: 24 VAC or VDC, ±10 %
Power consumption: 2 W max + 25 mW for each voltage output or 50 mW for each current output
Outputs:
4 outputs, have to select voltage or current
Voltage outputs:
    0–10 V
    2–10 V / 0–5 V (optional, display or configuration tool required)
Current output:
    4–20 mA (optional)
Output signal limits:
    Voltage outputs: R > 1 kΩ
    Current output: R > 20 Ω, R < 500 Ω

Communication
Protocol: MODBUS over Serial Line
Transmission Mode: RTU
Interface: RS485
Byte format 11 bits (10 bits if parity none):
    Coding System: 8-bit binary
    Bits per Byte:
        1 start bit
        8 data bits, least significant bit sent first
        1 bit for parity
        1 stop bit
Baud rate: selectable in configuration
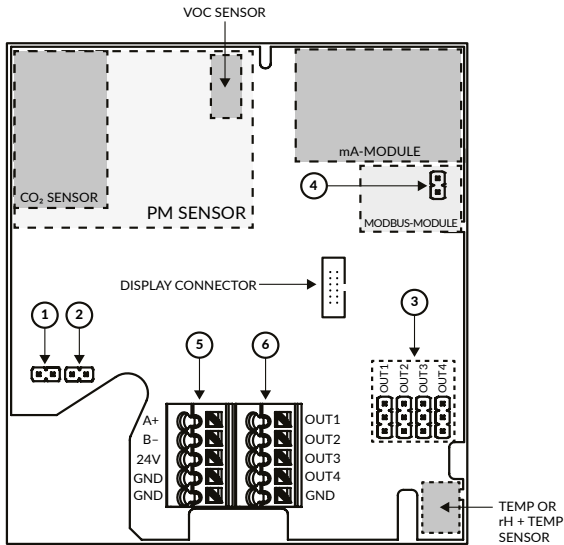Modbus address: 1–247 addresses selectable in configuration menu

Conformance
Meets requirements for:

	CE:	UKCA:
EMC:	2014/30/EU	S.I. 2016/1091
RoHS:	2011/65/EU	S.I. 2012/3032
WEEE:	2012/19/EU	S.I. 2013/3113

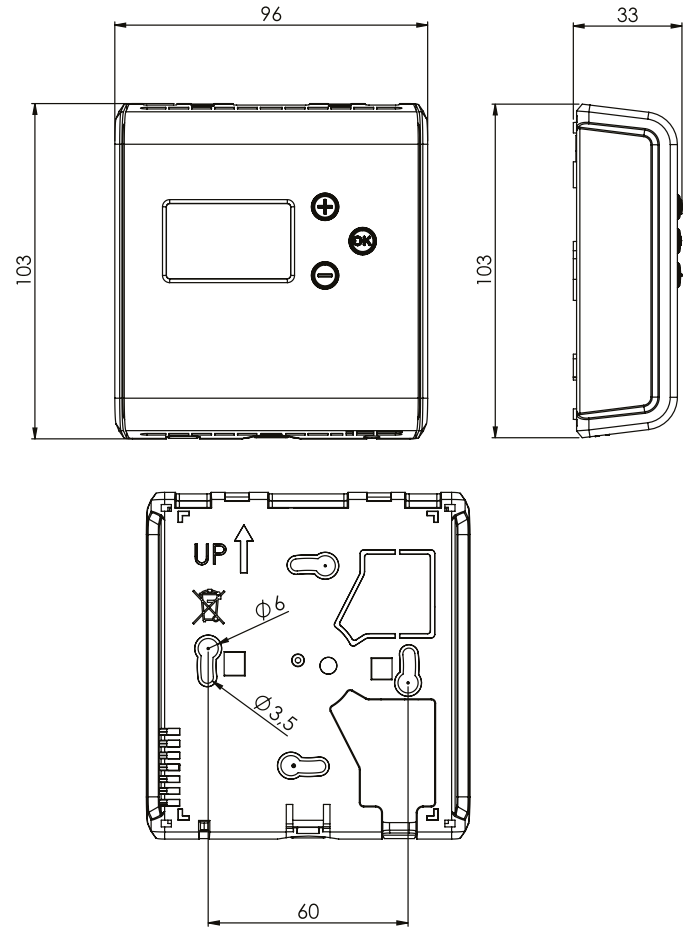COMPANY WITH MANAGEMENT SYSTEM CERTIFIED BY DNV
ISO 9001 · ISO 14001

UKCA CE RoHS COMPLIANT

SCHEMATICS

1	Pin header	Description
		CO₂ / PM output range selection
Open		400…2000 ppm (CO₂ models)
Connected		0…2000 ppm (CO₂ models)
Open		0…500 µg/m³ (PM models)
Connected		0…50 µg/m³ (PM models)

2	Pin header	Description
		Menu lock
Open		Menu lock disabled
Connected		Menu lock enabled

3	Pin header	Description
		Voltage / current output selection
		• Current output is an optional
OUT1		Output 1
OUT2		Output 2
OUT3		Output 3
OUT4		Output 4
GND		Ground

4	Pin header	Description
		Modbus termination
Open		Not terminated
Connected		Terminated

5	Connector	Description
		RS485 Modbus/RTU slave
A+		DATA+
B-		DATA-
		Power supply
24 V		24 VAC/DC ±10 %
GND		Ground
GND		Ground

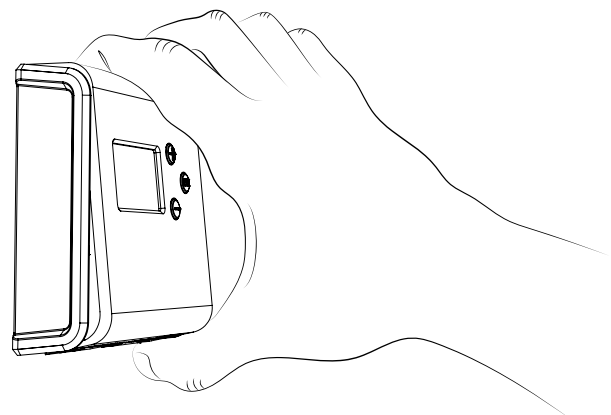| 6	Connector	Description
		Voltage / current outputs
		• Output settings can be modified from the display menu
		• See the lid label for factory default settings.
OUT1		Output 1
OUT2		Output 2
OUT3		Output 3
OUT4		Output 4
GND		Ground

DIMENSIONAL DRAWINGS

INSTALLATION

1) Mount the device in the desired location (see step 1).
2) Route the cables and connect the wires (see step 2).
3) Connect the display cable to the display connector on the PCB. (See schematics)
4) The device is now ready for configuration.

⚠ WARNING! Apply power only after the device is properly wired.

OPENING/CLOSING THE LID

1) Open the lid by pressing the center from the bottom of the lid as in the figure.
2) Close the lid by inserting the top of the lid into the grooves first and pushing the bottom edge as in the figure.

STEP 1: MOUNTING THE DEVICE

1) Select a mounting location on the wall at 1.2–1.8 m (4–6 ft) above the floor and at least 50 cm (20 in) from the adjacent wall. Do not block device air vents from any direction and leave atleast 20 cm (8 in) gap to other devices. Locate the unit in an area with good ventilation and an average temperature, where it will be responsive to changes to the room conditions. The Siro-MOD should be mounted on a flat surface.

Do not locate the Siro-MOD where it can be affected by:
- Direct sunlight
- Drafts or dead areas behind doors
- Radiant heat from appliances
- Concealed pipes or chimneys
- Outside walls or unheated / uncooled areas

2) Use the device as a template and mark the screw holes.
3) Mount the wall plate with screws.

CAUTION! Incorrect installation may cause a shift in measurements.
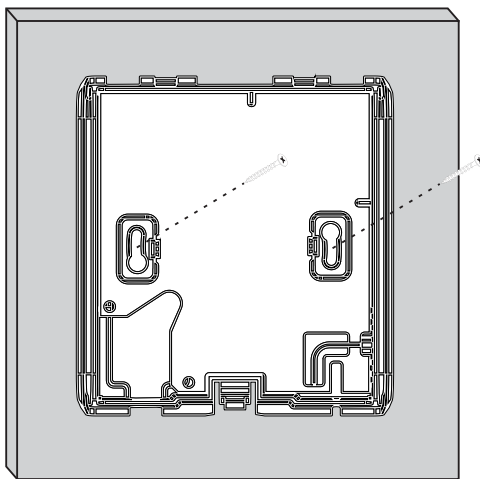

Figure 1a - Surface mounting
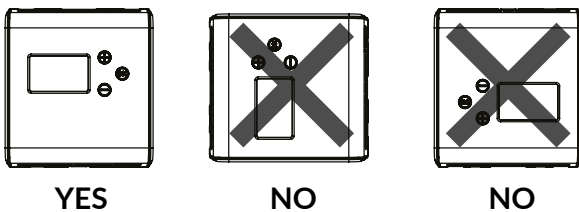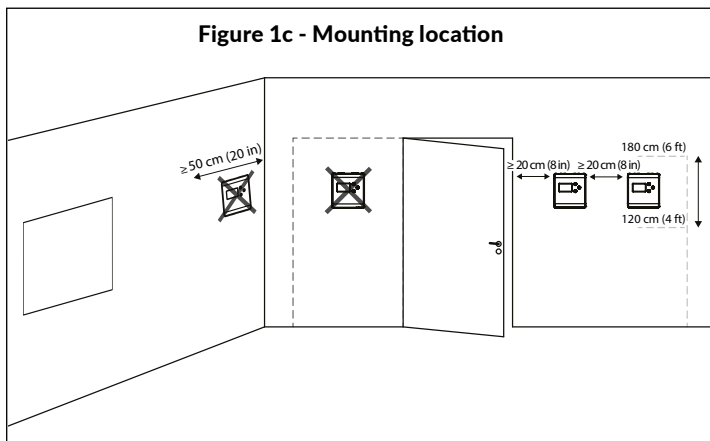

Figure 1b - Mounting orientation

YES   NO   NO

Figure 1c - Mounting location

STEP 2: WIRING DIAGRAMS

CAUTION!
- For CE compliance, a properly grounded shielding cable is required.
- Use copper wire only. Insulate or wire nut all unused leads.
- Care should be used to avoid electrostatic discharge to the device.
- This unit has configuration jumpers. You may need to reconfigure this device for your application.

1) Route the cables through the opening in the back plate or for surface wiring select a knockout on the bottom of the wall plate, as shown in Figure 2a.
2) Connect the wires as shown in Figure 2b and 2c.
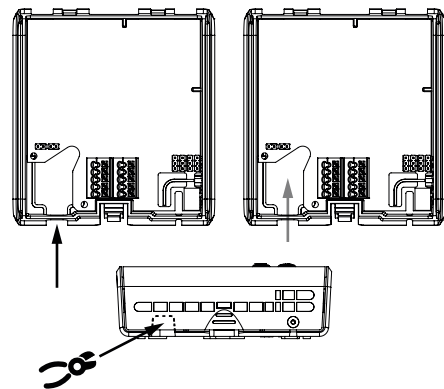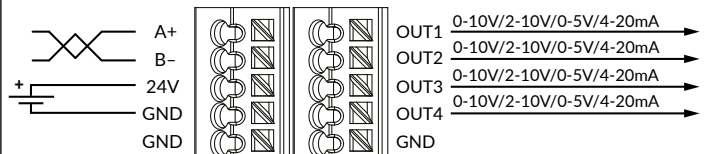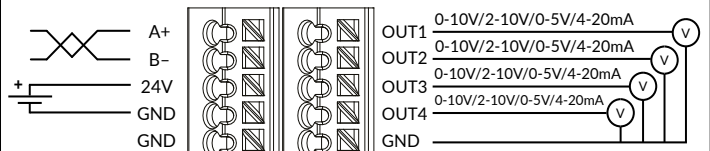

Figure 2a - Routing the cables

Figure 2b - Wiring diagram: Power input & signal output

A+	OUT1	0-10V/2-10V/0-5V/4-20mA
B–	OUT2	0-10V/2-10V/0-5V/4-20mA
24V	OUT3	0-10V/2-10V/0-5V/4-20mA
GND	OUT4	0-10V/2-10V/0-5V/4-20mA
GND	GND	

NOTE! When using long connection wires it may be necessary to use a separate GND wire for voltage output current to prevent measurement distortion. The need for an extra GND wire depends on the cross section and length of the used connection wires. If long and/or small cross section wires are used, supply current and wire resistance may generate a voltage drop in the common GND wire resulting in a distorted output measurement.

When using AC power supply, make sure that the ground potential of the signal is the same as the ground potential of the supply voltage to avoid short circuit through the additional GND wire.

It is recommended to use shielded twisted pair cable for modbus cabling. The cable shield must be earthed only in one point, normally, at the end of the main cable.

Figure 2c - Wiring diagram: Extra GND wire

A+	OUT1	0-10V/2-10V/0-5V/4-20mA
B–	OUT2	0-10V/2-10V/0-5V/4-20mA
24V	OUT3	0-10V/2-10V/0-5V/4-20mA
GND	OUT4	0-10V/2-10V/0-5V/4-20mA
GND	GND	

STEP 3: CONFIGURATION

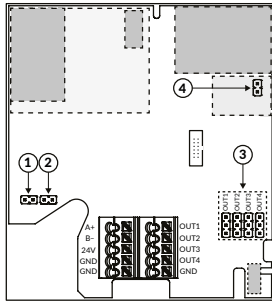Configuration of the Siro-MOD series device consists of:
1) Configuring the jumpers (see step 4).
2) Configuration menu options.
   (Display (-D) or configuration tool required. See the user manual for further details.)

STEP 4: JUMPER SETTINGS

Figure 3 - Jumper installation

1) Configuration of the output modes:

Select the output mode, current (4–20 mA) (optional) or voltage (0–10 V) for each output (1-4) by installing jumpers as shown in Figure 4.
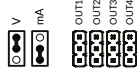
On a display version of the device, the output scale can be changed via the configuration menu. An external configuration tool is available for devices without user interface.
First, select the output mode by jumper, then select the output scale (4–20 mA (optional) / 0–10 V / 2–10 V / 0-5 V) via the configuration menu. Please see the user manual for more details.

NOTE! When using mA output, do not use Vout scalings from the menu.

Using 2-10 V output in some applications it is critical to know immidiately if the wire is broken or the device is damaged. In these cases, a 2-10 voltage output is recommended.

Figure 4

2) Output range selection with CO2- and PM-models:
Install the jumper 1 (figure 3) to change output range. This feature is intended to use only on devices without display. On a display version of the device, the output range can be selected via the configuration menu. Please see the user manual for more details.

1	Pin header	Description
		CO2 / PM output range selection
	Open	400...2000 ppm (CO2 models)
	Connected	0...2000 ppm (CO2 models)
	Open	0...500 µg/m3 (PM models)
	Connected	0...50 µg/m3 (PM models)

3) Locking the display:
Install the jumper 2 (figure 3) to lock the display to prevent access to the configuration menu after installation is completed.

4) Modbus termination:
Install a jumper 4 (figure 3) to terminate Modbus.
In order to avoid signal reflections, Modbus termination jumper must be installed in case if the device is the last one of the bus.

STEP 5: MODBUS REGISTERS

Function code 03 - Read holding registers, Function code 06 - Write single register, Function code 16 - Write multiple registers, Broadcast supported with address 0

Register	Parameter description	Data type	Min value	Max value	Range
4x0001	Offset CO2	16 bit	-200	200	-200..200 ppm
4x0002	Offset Humidity	16 bit	-100	100	-10.0..10.0 %
4x0003	Offset Celsius *1	16 bit	-50	50	-5.0..5.0 °C
4x0004	Offset Fahrenheit *1	16 bit	-90	90	-9.0..9.0 °F
4x0005	Offset TVOC ppm	16 bit	-300	300	-3.00..3.00 ppm
4x0006	Offset TVOC ug/m3	16 bit	-1000	1000	-1000..1000 ug/m3
4x0007	Offset CO2 EQ	16 bit	-200	200	-200..200 ppm
4x0008	Offset PM	16 bit	30	200	0.3..2.0 coefficient
4x0009	Backlight intensity	16 bit	0	100	0..100%
4x0010	Display Celsius *2	16 bit	0	6	Position number, 0=not used
4x0011	Display Fahrenheit *2	16 bit	0	6	Position number, 0=not used
4x0012	Display Humidity	16 bit	0	6	Position number, 0=not used
4x0013	Display CO2	16 bit	0	6	Position number, 0=not used
4x0014	Display CO2 EQ	16 bit	0	6	Position number, 0=not used
4x0015	Display PM2.5 hour	16 bit	0	6	Position number, 0=not used
4x0016	Display PM10 hour	16 bit	0	6	Position number, 0=not used
4x0017	Display IAQ	16 bit	0	6	Position number, 0=not used

*1=Celsius and Fahrenheit limits are interdependent, and thus a change in one limit of a measurement will also change the limits of the other measurement. Use Function code 06 (write single register) for Celsius or Fahrenheit.
*2= Use Function code 16 (write multiple registers) for display configuration. Valid value (0 / 1...6) needed for all display configuration registers. (see Siro User Guide STEP 1.1: Display view)

MODBUS REGISTERS CONTINUED

Function code 04 - Read input register

Register	Parameter description	Data type	Min value	Max value	Range
3x0001	Program version	16 bit	1	9999	0.01..99.99
3x0002	CO2 reading	16 bit	0	2500	0..2500 ppm
3x0003	rH reading	16 bit	0	1000	0.0..100.0 %
3x0004	Temperature Celsius	16 bit	0	500	0.0..50.0 °C
3x0005	Temperature Fahrenheit	16 bit	320	1220	32.0..122.0 °F
3x0006	TVOC ppm reading	16 bit	0	3200	0.00..32.00 ppm
3x0007	TVOC ug/m3 reading	16 bit	0	10000	0..10000 ug/m3
3x0008	CO2_eq reading	16 bit	0	12000	0..12000 ppm
3x0009	IAQ reading TVOC	16 bit	1	5	1..5 IAQ index
3x0010	IAQ reading PM	16 bit	1	5	1..5 IAQ index
3x0011					
3x0012	PM1 reading	16 bit	0	1000	0..1000 ug/m3
3x0013	PM2.5 reading	16 bit	0	1000	0..1000 ug/m3
3x0014	PM10 reading	16 bit	0	1000	0..1000 ug/m3
3x0015	PM2.5 1h average	16 bit	0	10000	0.0..1000.0 ug/m3
3x0016	PM2.5 24h average	16 bit	0	10000	0.0..1000.0 ug/m3
3x0017	PM10 1h average	16 bit	0	10000	0.0..1000.0 ug/m3
3x0018	PM10 24h average	16 bit	0	10000	0.0..1000.0 ug/m3
3x0019					
3x0020	Error status	16 bit	0	65535	See table below

3x0020 Error status bits

Bit 0 temperature sensor detected,	0 = not detected, 1=detected
Bit 1 humidity sensor detected,	0 = not detected, 1=detected
Bit 2 co2 sensor detected,	0 = not detected, 1=detected
Bit 3 voc sensor detected,	0 = not detected, 1=detected
Bit 4 pm sensor detected,	0 = not detected, 1=detected
Bit 5 display module detected,	0 = not detected, 1=detected
Bit 6 current(mA) module detected,	0 = not detected, 1=detected
Bit 8 sensor warm up	0 = normal operation, 1 = warm up
Bit 9 rht status	0 = normal operation, >0 reading error
Bit 10 CO2 status	0 = normal operation, >0 reading error
Bit 11 pm status	0 = normal operation, >0 reading error
Bit 12 voc status	0 = normal operation, >0 reading error

RECYCLING/DISPOSAL

The parts left over from installation should be recycled according to your local instructions. Decommissioned devices should be taken to a recycling site that specializes in electronic waste.

WARRANTY POLICY

The seller is obligated to provide a warranty of five years for the delivered goods regarding material and manufacturing. The warranty period is considered to start on the delivery date of the product. If a defect in raw materials or a production flaw is found, the seller is obligated, when the product is sent to the seller without delay or before expiration of the warranty, to amend the mistake at his/her discretion either by repairing the defective product or by delivering free of charge to the buyer a new flawless product and sending it to the buyer. Delivery costs for the repair under warranty will be paid by the buyer and the return costs by the seller. The warranty does not comprise damages caused by accident, lightning, flood or other natural phenomenon, normal wear and tear, improper or careless handling, abnormal use, overloading, improper storage, incorrect care or reconstruction, or changes and installation work not done by the seller. The selection of materials for devices prone to corrosion is the buyer's responsibility, unless otherwise is legally agreed upon. Should the manufacturer alter the structure of the device, the seller is not obligated to make comparable changes to devices already purchased. Appealing for warranty requires that the buyer has correctly fulfilled his/her duties arisen from the delivery and stated in the contract. The seller will give a new warranty for goods that have been replaced or repaired within the warranty, however only to the expiration of the original product's warranty time. The warranty includes the repair of a defective part or device, or if needed, a new part or device, but not installation or exchange costs. Under no circumstance is the seller liable for damages compensation for indirect damage.