Labkotec Oy
Myllyhaantie 6
FI-33960 Pirkkala, FINLAND
Tel. +358 29 006 260
Fax +358 29 006 1260
Internet: www.labkotec.fi

19.12.2014
D80186Je
36 pages

LID-3300IP Ice Detector

Ice Detector for Wind Turbines and Meteorological Stations

Installation and Operating Instructions

TABLE OF CONTENTS

Symbols in this document


Caution, risk of danger


Caution, hot surface

SUMMARY OF CHANGES AND NEW FUNCTIONALITY

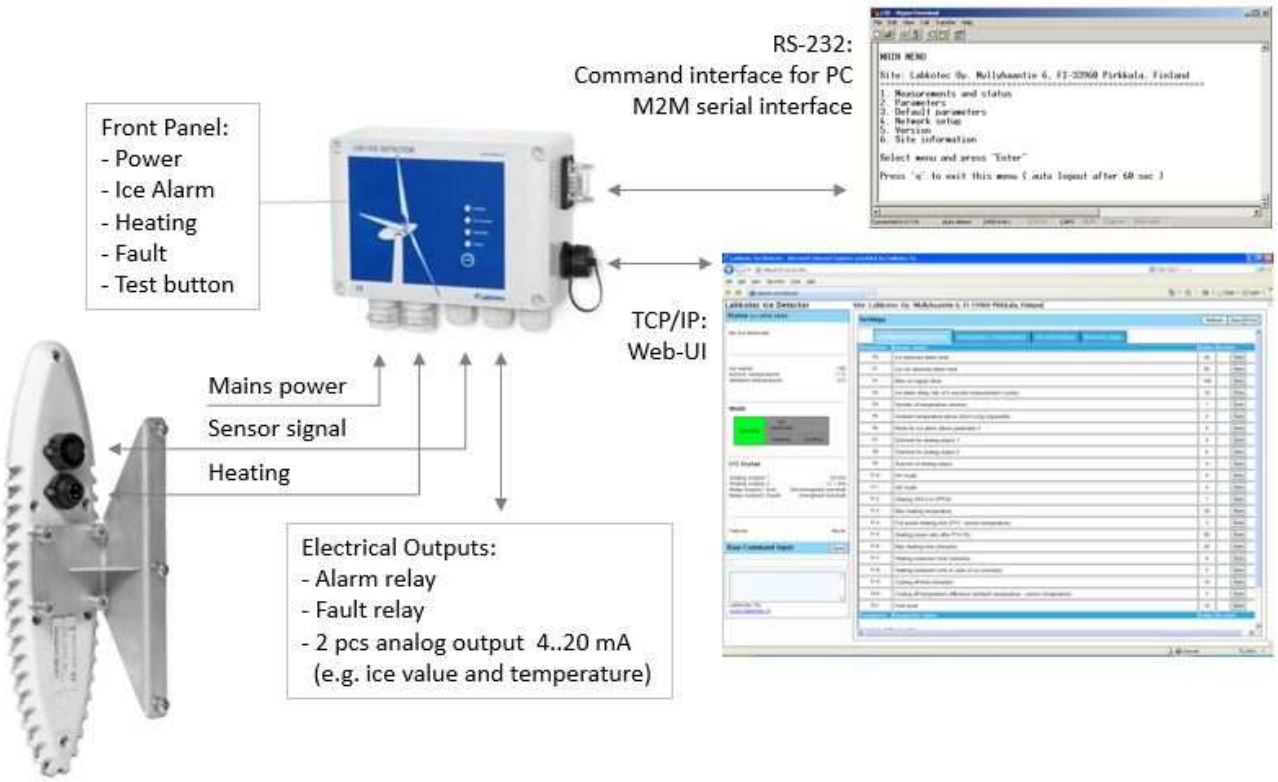
The following table describes the latest changes and major new functionality in LID-3300IP Ice Detector and this user manual.

Changes in LID-3300IP and LID/ISD User Manual	More information in chapters
Component certificate according to GL Rules and Guidelines – IV Industrial Services – Part 1 – "Guideline for the Certification of Wind Turbines", Edition 2010 Certificate No. CC-GL-013A-2014.	6. Technical Specification
Results of functional safety analysis added.	6. Technical Specification
Lightning protection principles added. Other connection diagrams modified accordingly.	Chapter 2.6 Chapter 2.4, App. D
New features added in LID-3300IP software version v1.40 - Event log for ice alarms, faults, parameter settings and other user actions - Clock incl. SNTP and DNS client - New user profile "Tester" - Cancelling of manual Ice Alarm Test in web UI - Command for manual test of fault relay	 Chapter 5.4, App. E Chapter 5.4, App. C Chapter 5.4 Chapter 5.2 Appendix C
Recommendation of different parameter settings for different applications and use cases.	Chapter 3.3
Checking of dirt and dust during annual maintenance added.	Chapter 8
Minimum values of parameters P0 and P1 changed to 10 and 15 respectively.	Appendix B

1 PRODUCT OVERVIEW

LID-3300IP (later referred to also as LID or LID Ice Detector) is an ice detector for wind turbines and meteorological stations. LID-3300IP Ice Detector consists of LID-3300IP Control Unit and LID/ISD Ice Sensor.

LID monitors the icing weather conditions on-line and reports icing events through various interfaces. Ice alarm and other measurement information are available via 2 relay outputs, 2 analog outputs, front panel, serial output either as RS-232 or optical fiber interface and Web user interface.



Ice detection of the LID/ISD Ice Sensor is based on an ultrasonic principle. Ultrasonic signal attenuates when ice is accumulated on the sensor wire.

By default, LID starts to heat itself after an ice detection to get rid of the accumulated ice.

Alarm levels and sensor heating, among other functions, can be controlled by user-configurable parameters. Certain factory parameters have been defined by the manufacturer, which allow start-up and operation without any additional definitions.

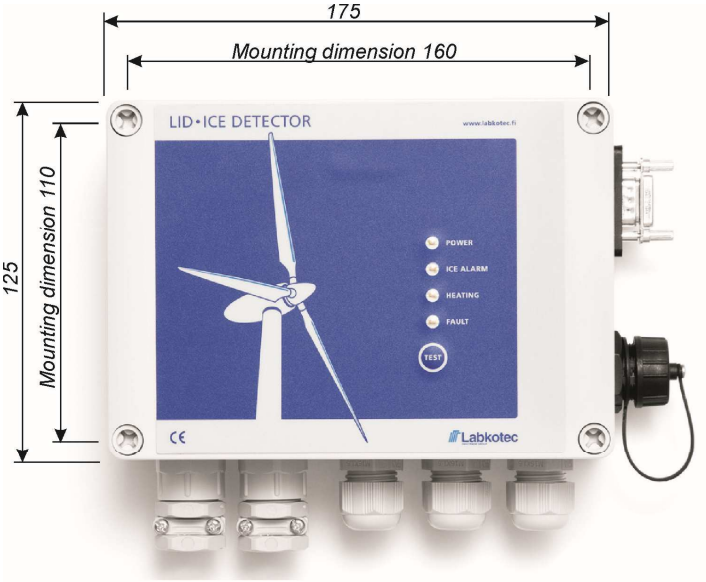
This manual includes instructions for installation, commissioning and operating of the LID-3300IP Ice Detector.

Labkotec products are designed to be safe when operated in the manner described in this manual. The safety of this product cannot be guaranteed if the product is used in any other way than is specified in this manual.

2 INSTALLATION

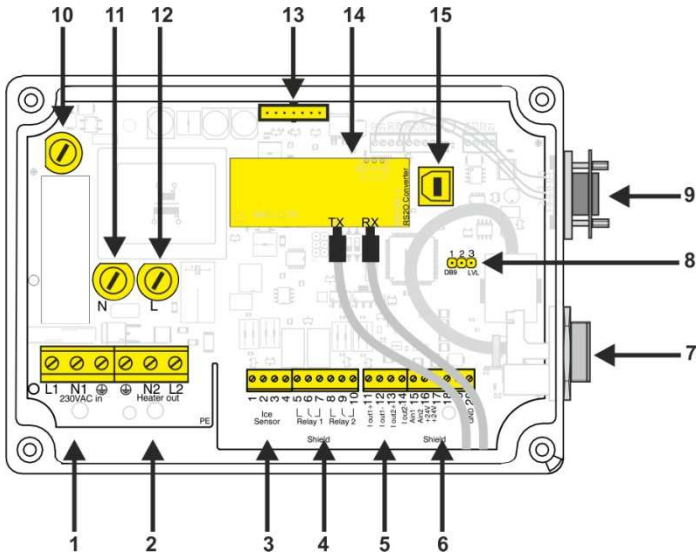
2.1 Installation and interfaces of LID-3300IP Control Unit

The enclosure of LID-3300IP is wall-mounted. Mounting holes are located in the base plate of the enclosure, beneath the mounting holes of the front cover.



Enclosure depth 75 mm
Mounting holes ø4.5 mm

Interfaces and other important components of LID-3300IP Control Unit are described in the below list and picture.



1. **Power**
2. **Sensor heating**
3. **Ice Sensor signal**
4. **Relay outputs**
   - **Fault relay (normally energized = no fault)**
     - **5 = normally closed**
     - **6 = common contact**
     - **7 = normally open**
   - **Ice Alarm relay (normally de-energized = no ice alarm)**
     - **8 = normally open**
     - **9 = common contact**
     - **10 = normally closed**
5. **Analog outputs (source)**
   - **Active current output 1**
     - **11 = Iout1+**
     - **12 = Iout1-**
   - **Active current output 2**
     - **13 = Iout2+**
     - **14 = Iout2-**
6. **Not in use at the moment**
7. **Ethernet RJ-45 connector for Internet Web access**
8. **RS-232 / Optical fiber serial interface selection jumper**
9. **RS-232 D-connector**
10. **Main fuse**
11. **Fuse for sensor heating**
12. **Fuse for sensor heating**
13. **Connector for front panel flat cable**
14. **Optical fiber converter module (RS2O). Tx connector (left), Rx connector (right)**
15. **USB connector for software download**

2.2 Power supply

The device does not have a mains switch. During maintenance and service operations it has to be possible to switch off the main supply.

Only an authorized electrician is allowed to install power supply cable to LID-3300IP control unit.

The installation of power supply can be done by two alternative ways:

- Permanent wiring: using a two pole mains switch (250 Vac 5 A), which isolates both lines (L1, N). Switch must be installed in the main power supply lines in the vicinity of LID-3300IP control unit. Copper wires 1.5 - 2.5 mm^2 (AWG 16 - 13) can be connected to the power supply terminal of the control unit.
- Plug connection: using supply cable with plug that can be disconnect from plug socket when necessary. Remember to tighten the strain relief of cable gland.

LID-3300IP must always be connected to protective earth (PE).

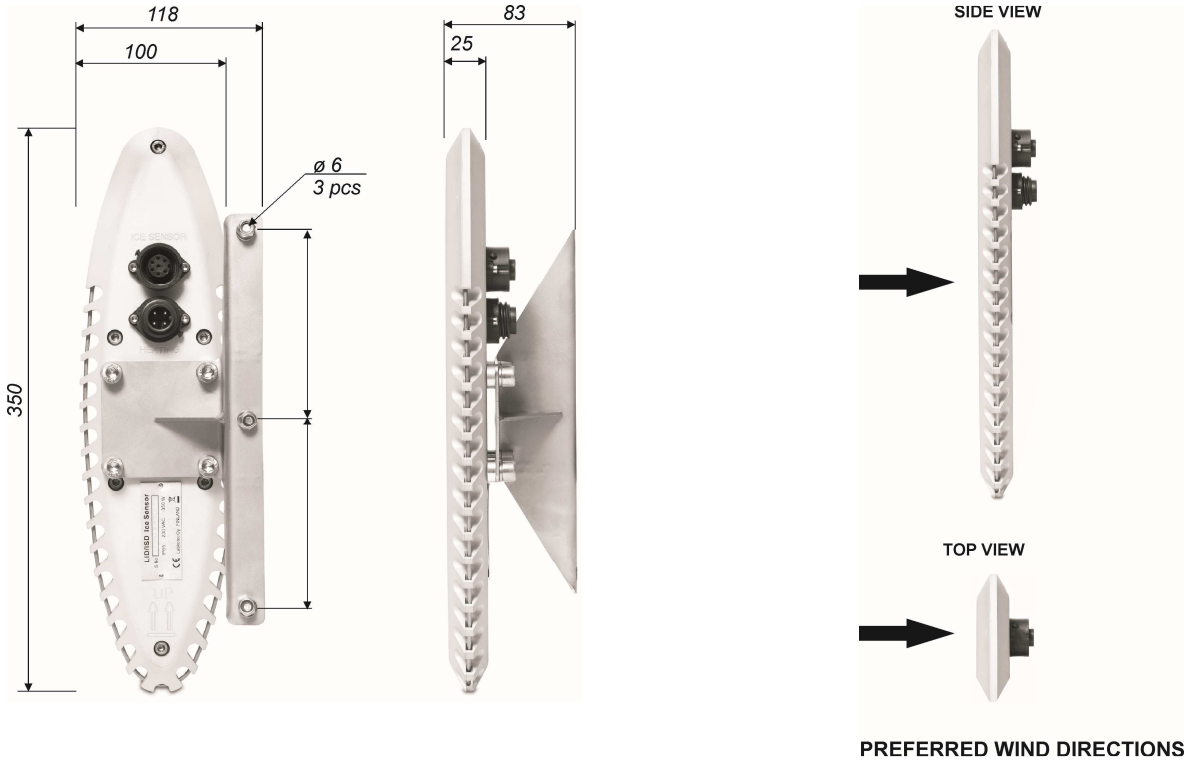
2.3 Installation of LID/ISD Ice Sensor

The LID/ISD Ice Sensor is designed for mounting on a weather mast. The preferred place for installation in a wind turbine is on top of the nacelle. The correct installation position is marked with an upwards-pointing arrow label.

The sensor should be mounted against the wind so that there is free airflow in front of the sensor. See the below figure for the preferred installation direction. Free air distance must be minimum 500 mm.

Avoid installations where there is a possibility that the ice which accumulates to surrounding structures might reach the sensor.

A standard delivery includes a mounting kit for installing the sensor on the weather mast. See the figure below. Other mounting options are also available on request.



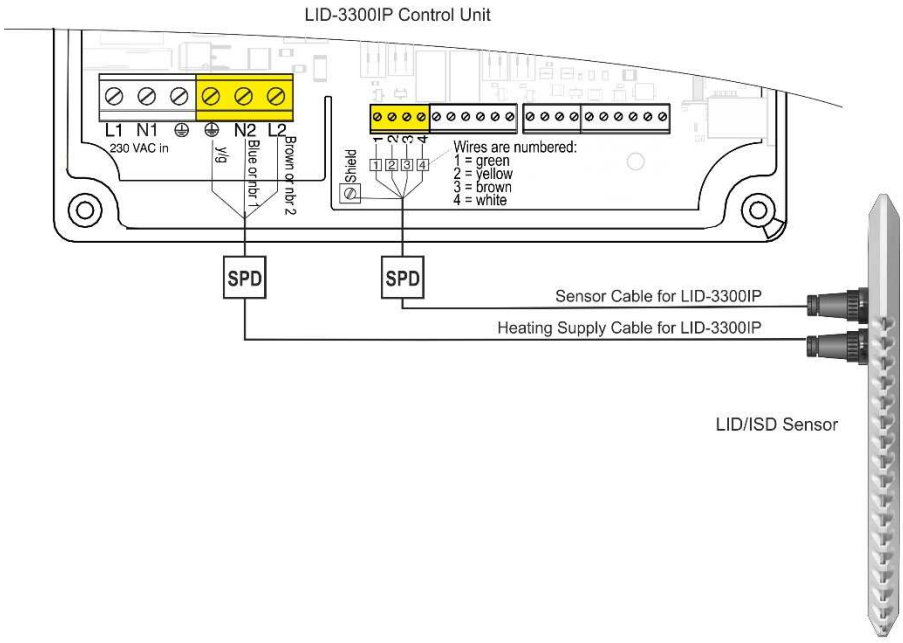
Flammable materials or materials that may melt are not allowed to locate close to the sensor.

The sensor body includes a 350W heating resistor. A temperature sensor T1 (ice sensor temperature) is located in the centre part of the sensor and temperature sensor T2 (ambient temperature) inside the connector of the sensor cable. A safety thermostat is also mounted inside the body of the sensor to break the heating circuit if the sensor temperature rises above +65 ℃.

2.4 Connections between LID/ISD Ice Sensor and LID-3300IP Control Unit

The cables connecting the ice sensor and control unit are included in the delivery. The standard length of the cables is 10 m.

Only an authorized electrician is allowed to install heating cable between LID/ISD sensor and LID-3300IP control unit.



NOTE! Additional measures regarding lightning protection might be needed according to IEC 61400-24. See also chapter 2.6 Lightning protection.

NOTE! Make sure that high voltage cabling and equipment will not interfere ice detector system or cabling of ice detector.

2.5 Commissioning

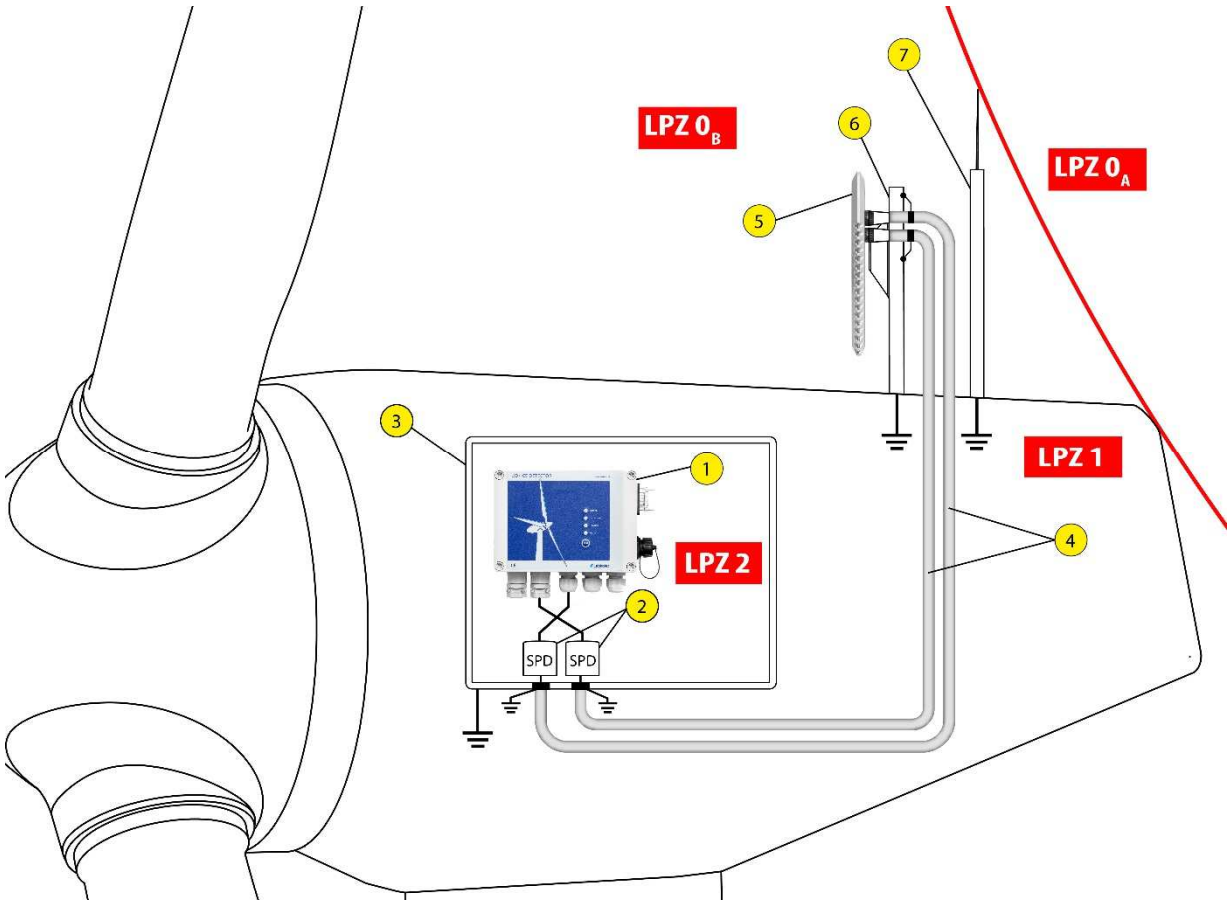
LID-3300IP is ready for operation when sensor and control unit are connected together and power is switched on in the control unit.

However, it may be useful to do at least the following things right after the installation.

1. Check device parameters either via web or serial user interface and make sure they are according to factory settings. Adjust parameters if needed.
2. Define network settings for internet access via MENU 4 in serial interface.
3. Set site name via web or serial interface.
4. Generate an ice alarm with test button or cooling spray.

2.6 Lightning protection

Lightning protection for LID-3300IP Ice Detector Control Unit and LID/ISD Ice Sensor shall be done according to standard IEC 61400-24 “Wind turbines – Part 4: Lightning protection” when installed into a wind turbine.



General principles for protecting ice detector system against overvoltage in case of lightning strike is presented in the above picture.

Components in the picture are:

1. LID-3300IP Control Unit
2. Surge protection device
3. Automation cabinet
4. Metal tubes
5. LID/ISD Ice Sensor
6. Holder for ice sensor
7. Air termination rod

3 LID-3300IP ICE DETECTOR IN OPERATION

This chapter explains the basic operation of LID-3300IP. Serial and Web user interfaces are explained in different chapters.

3.1 Operating modes

LID-3300IP operates in different modes which are explained below.

SENSING MODE

LID-3300IP continuously measures the signal level of the ice sensor. The maximum signal amplitude value can be defined by the user by parameter 2. By default, the signal value varies between 0 and 100.

Ice signal value is visible in serial and web user interfaces, and available as continuous current message in the analog output.

ICE DETECTED MODE

When ice signal goes below a defined alarm level (set by parameter 0), LID goes to Ice detected –mode and gives an ice alarm. The delay of an ice alarm can be set by parameter 3.

Ice alarm is visible in the Ice alarm LED of the front panel as well as serial and web interfaces. Ice relay energizes and closes contacts 8 and 9.

Ice alarm and Ice detected mode are active during the Heating and Cooling phases that follow an ice alarm.

Parameter 22 can be used to set a delay for ice alarm deactivation. It will keep the ice alarm active after the heating and cooling phase for the duration of the time delay. This is to prevent repetitive alarms during a long icing event.

HEATING PHASE

Right after the ice alarm is detected, sensor starts to heat itself to get rid of the accumulated ice. It is also possible to disable heating by parameter 12. The whole heating process can be controlled with parameters 12 – 18, 23 and 24. Default heating parameters shoud be useful enough for most weather conditions.

Automatic heating is used to remove soft ice which has slowly accumulated over the sensor in light icing conditions. It does not generate an ice alarm. Automatic heating is controlled with parameters 23 and 24.

COOLING PHASE

When sensor is heated to the maximum heating temperature, LID moves to Cooling phase. Ice signal value is measured all the time and it should be close to the maximum after the Heating phase.

Cooling phase has ended when sensor temperature is close to ambient temperature (parameter 20), or maximum cooling time (parameter 19) has exceeded, or sensor temperature has gone below 0 °C.

Ice alarm is released after the cooling period if ice signal value is above the alarm level.

FAULT MODE

LID indicates a fault or failure if there are problems in ice measurement, temperature measurements, heating or in other operations of the unit.

Fault indication is visible in the Fault LED in the front panel, serial and web user interfaces and in the fault relay output.

Please note that the Fault relay is normally energized, providing thus a

fail-safe operation.

Depending on the fault, LID may continue operating otherwise normally or indicates a critical failure. E.g. ice measurement error is a critical failure but heating failure is not.

Explanation of the fault codes in the serial interface are presented in *Appendix A*.

3.2 LID-3300IP Front Panel

Indicator / button	Meaning
POWER	Green light means power is on. No light means no power.
ICE ALARM	Red light means ICE ALARM. No light means NO ICE ALARM.
HEATING	Red light means HEATING is ON. No light means HEATING is NOT ON.
FAULT	Red light means FAULT is ON. No light means FAULT is NOT ON.
TEST BUTTON	Pushing the test button shortly will generate an ICE ALARM. Pushing the test button longer (about 10 seconds) will reset the device.

3.3 Use of different parameter settings

Functionality of LID-3300IP Ice Detector system is configurable as described in chapter 3.1. All parameters as well as their default and valid values are described in Appendix B. “Parameters”.

In general, parameters can be grouped to following categories:

- Ice detection parameters (P0 - P6, P22)
- Heating parameters (P12 - P20, P23, P24)
- I/O parameters (P7 - P9)

Default parameter values are configured to every device before delivery and they suite perfectly for most of the cases.

Since icing is very different in different locations globally or even locally and in different times of the year, user may want to change parameter values to better suite his application. If parameter values are changed, Labkotec recommends to apply the following guidelines:

Use case	**Recommended parameter values**
Stop wind turbine due to safety risk	30 < P0 > 70, P1 = P0 + 10
Start blade heating (anti-icing)	70 < P0 > 90, P1 = P0 + 10 P16, P17, P18 close to maximum
Extreme icing conditions	P0 > 60, P1 = P0 + 10 P16, P17, P18 close to maximum

Please consult Labkotec when defining parameters for your application.

4 SERIAL INTERFACES: RS-232 AND OPTICAL FIBER

LID-3300IP Ice Detector is equipped by default with an RS-232 serial communication interface for configuration and connection to SCADA systems.

When RS-232 interface is connected permanently to a SCADA system, please use an external powered galvanic isolator.

Also, an optical fiber serial interface is available as an option. This requires an additional RS2O Converter module to be installed inside LID-3300IP Control Unit (item 14 in the lower picture in chapter 2.1.

Only either of the interfaces can be used at a time. Selection of the used interface is done with the RS-232 / Optical fiber interface selection jumper (item 8 in the lower picture in chapter 2.1) as follows:

1. Switch off the power from LID-3300IP control unit
2. Open the cover of LID-3300IP control unit
3. Set selection jumper between
   - pins 1 and 2 (left and middle) for RS-232
   - pins 2 and 3 (middle and right) for RS2O module
4. Connect cable(s) according to the above jumper selection:
   - RS-232 cable to RS-232 D-connector (item 9 in the lower picture in chapter 2.1)
   - Optical fibers to RS20 Converter module through the right side cable gland on LID-3300IP control unit
5. Close the cover of LID-3300IP
6. Connect RS-232 cable or optical fibre to system
7. Switch on the mains power

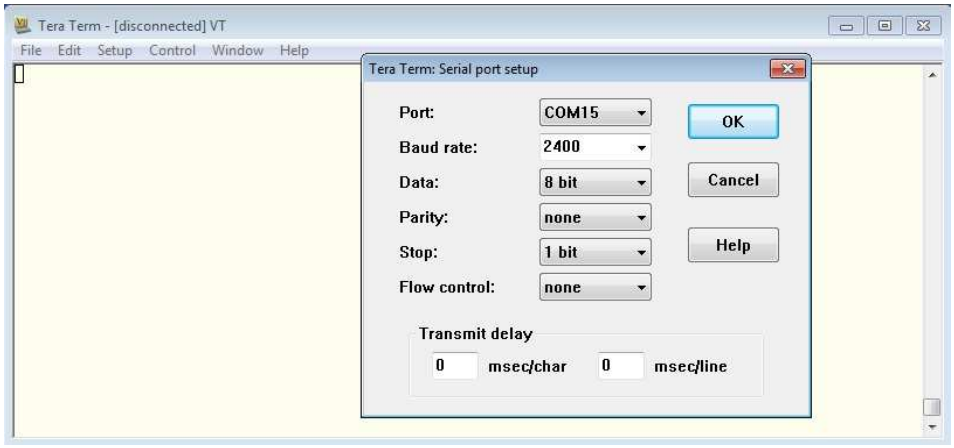
4.1 RS-232 Terminal Settings

Ice signal value, eventual alarms and fault diagnostics can be obtained by using a PC equipped with an ordinary terminal program e.g. Tera Term. It's also possible to change operational parameters with the terminal program. The following procedure describes serial port setting using freeware 'Tera Term' - terminal program.

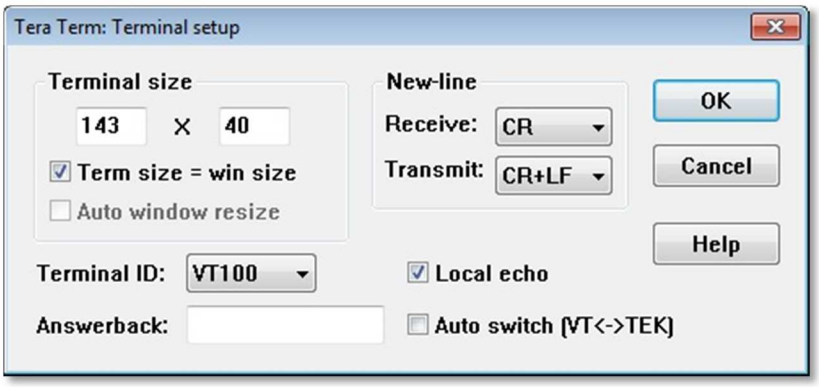
1. Connect the RS-232 port of your PC to the RS-output D-connector on the LID-3300IP control unit. Use USB-to-RS converter if your PC is not equipped with an RS-232 port.

2. Start the terminal program and select **Setup > Serial Port**. Select the RS-232 (COM) port of your PC where the serial cable is connected.

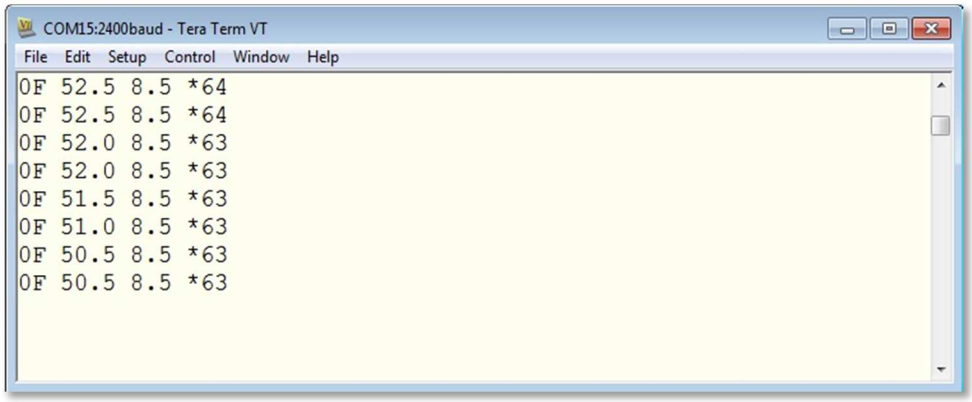
3. Make port settings as below and press **OK**.



4. Select **Setup > Terminal** and set **Local echo** and **New-line** settings as described below. Press **OK**.



LID should start communicating with your PC as seen below.



Finally change the terminal font from menu: **Setup > Font**.

Choose e.g Courier New, regular, Size 9, to view as much text as possible in one window at a time.

Now all the settings are ready for communication.

5. You can save the session for further use. Select **Setup > Save setup… TERATERM.**

4.2 Serial Output - Streaming Mode Format

Right after the connection to RS-232 serial output has been established, Ice Detector starts to send a data format through the connection. New values are reported once every 4 seconds.

Example (variable length format with two temperature sensors):

```
08 -5.0 -5.5 *100
08 -5.5 -5.5 *100
08 -6.0 -6.0 *100
…
```

There are three different output formats:

- Variable length format (`RSFORMAT 0`)
- Constant length format (`RSFORMAT 1`)
- LID-3210 format (`RSFORMAT 2`)

The output format is read with command `RSFORMAT` and set with command `RSFORMAT <x>`.

In case parameter 4 (Number of temperature sensors) has been set to 1, ambient temperature value is not visible in the RS output.

More detailed definitions of the output formats are presented in *Appendix A*.

4.3 Serial Output – Measurement and Configuration Menu

RS-232 streaming mode can be interrupted at any time by pressing the Enter key. The following menu structure opens with self-explaining instructions.

Please note that menus may vary between different software versions. The following screenshots describe the functionality of software version v1.30.

RS-232 output returns to streaming mode either by pressing ‘q’ or automatically after 60 seconds.

ENTERING COMMANDS

All commands in the menus can be given in capital or small letters.

In addition to the commands listed in the menus, e.g. the following commands are available. They can be entered in any menu view.

- `TEST`

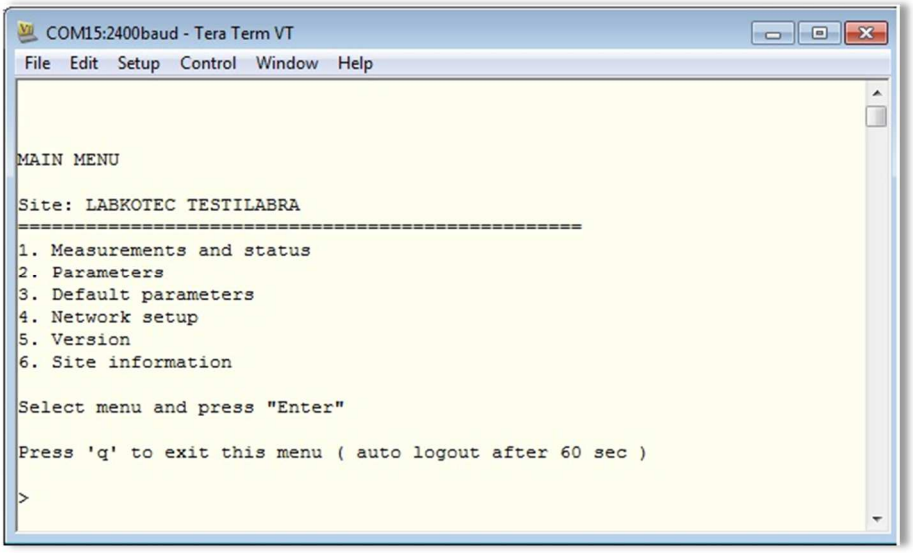
  The test command starts a manual ice alarm test.

- `HEAT`

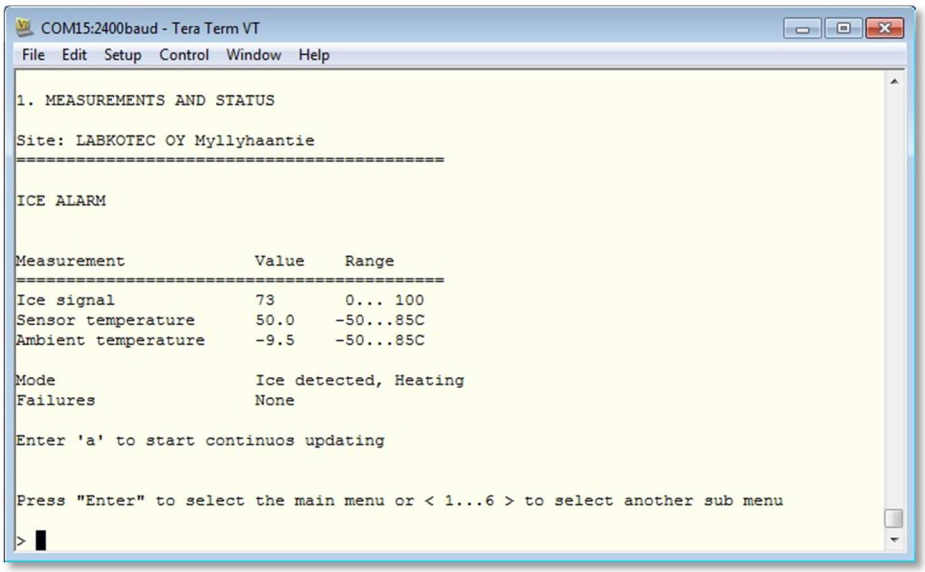
  The heat command starts manual heating.

See *Appendix C* for a complete list of terminal commands.

MAIN MENU



MENU 1. MEASUREMENTS AND STATUS



MENU 2. PARAMETERS

The complete list of parameters is presented in *Appendix B. Parameters*.

To read a parameter, type: `RP<param nbr>`

Example: `RP0`

To change a parameter, type: `SP<param nbr> <value>` and press Enter.

Example: `SP0 50`

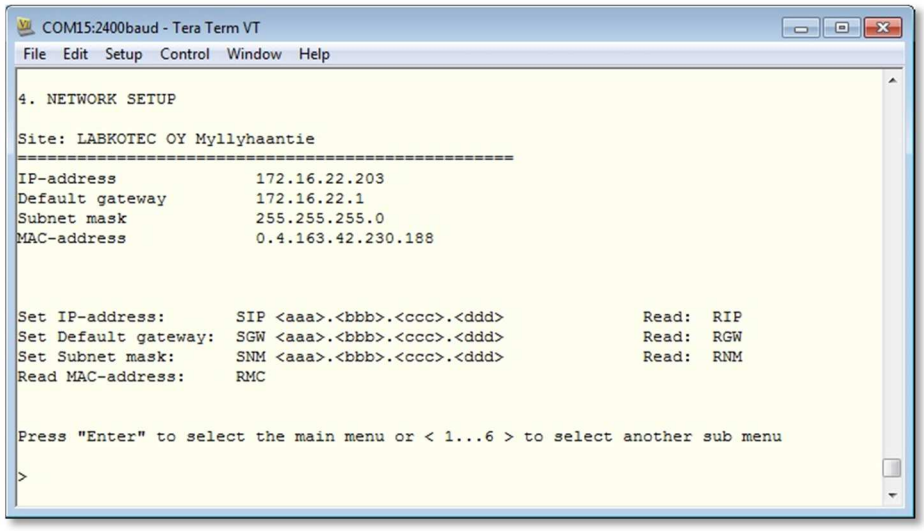
MENU 3. DEFAULT PARAMETERS

The complete list of parameters is presented in *Appendix B. Parameters*.

In case of problems, it might be useful to compare the actual parameter values with the default parameter values.

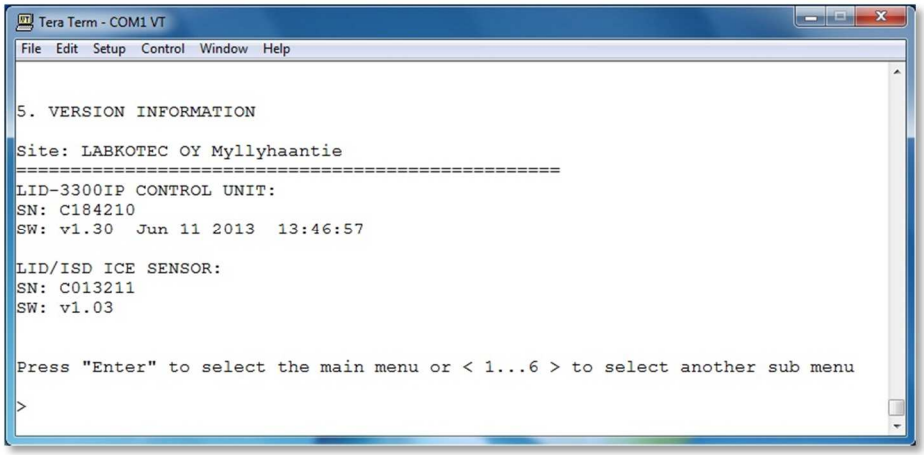
Default parameter values can be restored with command SDF.

MENU 4. NETWORK SETUP



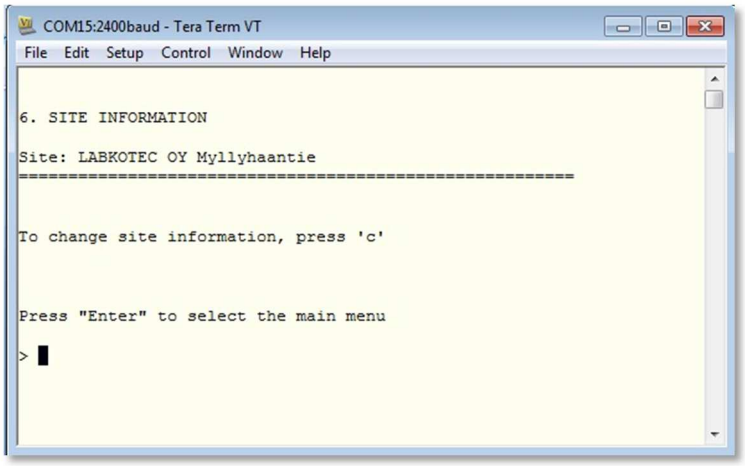
When LID-3300IP is connected to Internet or Intranet, the following settings can be done via this menu: IP-address, Default gateway and Subnet mask. LID-3300IP has a unique MAC address which is also visible through this menu.

MENU 5. VERSION INFORMATION



Version information of LID-3300IP Control Unit and LID/ISD Sensor can be seen from this menu.

MENU 6. SITE INFORMATION



Site name can be changed through this menu. Site information is visible in every menu and in the Web user interface.

5 INTERNET WEB ACCESS

LID-3300IP is equipped with an in-built web server which provides an easy-to-use web-based user interface for Ice Detector measurement data, status and parameters over the Internet.

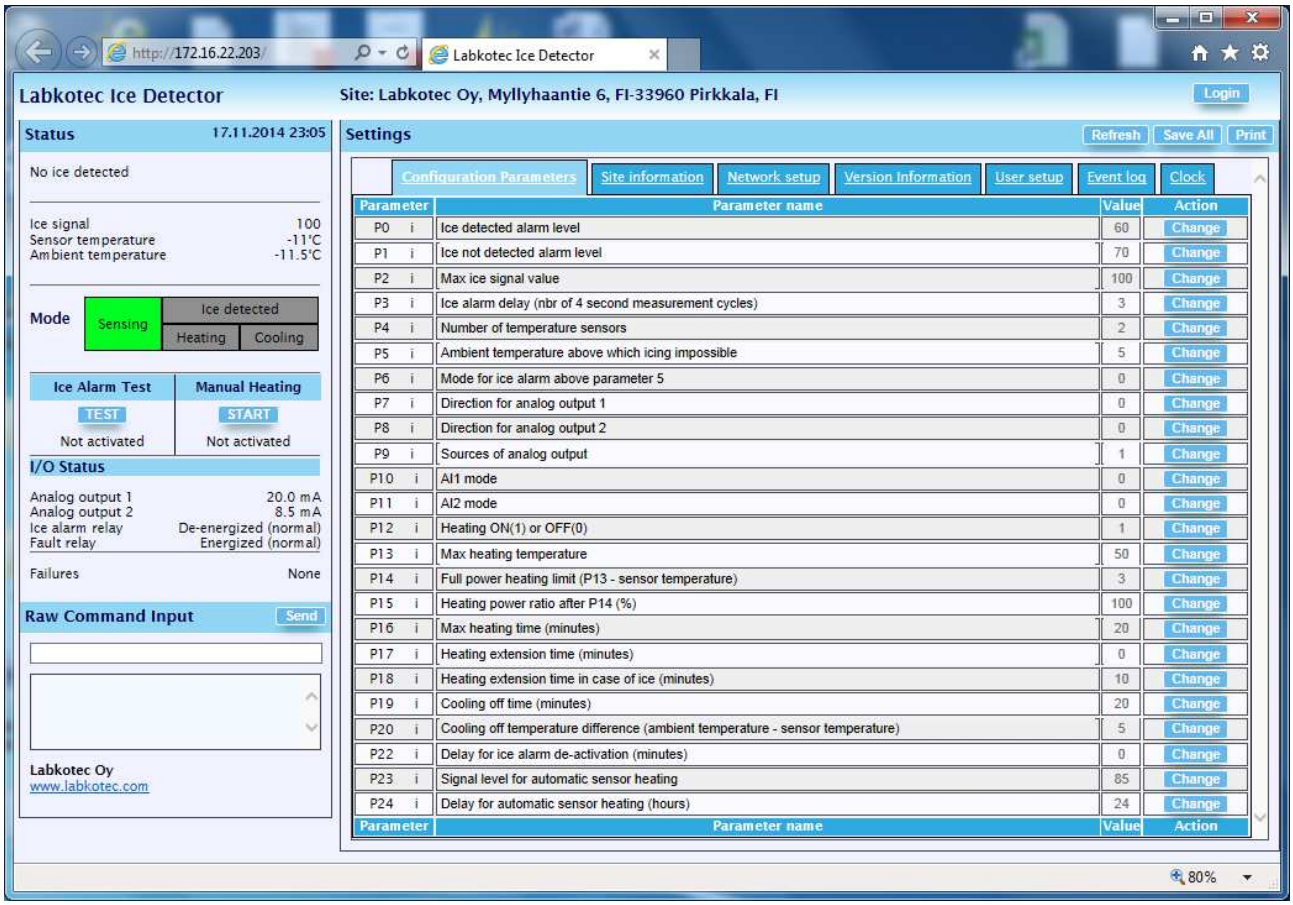
Depending on the configuration of the IT network, the web user interface is available only locally in the local area network (LAN), more widely through wide area network (WAN) or from everywhere e.g. through VPN connections.

Please note that the IP address, Default gateway and Subnet mask settings must be set through the RS-232 interface or through direct web access between PC and LID-3300IP (see chapter 5.5) before the Internet access is possible at all.

Once the network settings are set, open a web browser and type the IP address of the ice detector to the address field of the browser.

Please note that the functionality of the web user interface varies between different software versions of LID-3300IP. The following screenshots describe the functionality of software version v1.40.

LID-3300IP supports most of the available web browsers. However, the look-and-feel may vary a little bit between different browsers.



Web user interface is divided into four sections:

1. Header
2. Status (upper left corner)
3. Raw command Input (lower left corner)

4. Settings (right side of the view)

Each section is explained in more details in the following chapters.

5.1 Web UI - Header

The header section of the web user interface starts with the text **Labkotec Ice Detector**.

In the center of the header, there is space for the individual site name, place or other identification of the Ice Detector. This text can be modified in Site information Tab of the Settings section.

Information on the current user is shown in the upper right corner.

5.2 Web UI – Status

Status section is updated automatically every four seconds with the latest measurement and status data, including

- Status of Ice Detection
  - No ice detected
  - ICE ALARM
  - CRITICAL FAILURE
  - NO ICE DETECTED (HEATING STARTED BY USER)
  - ICE ALARM (TEST)
  - AUTOMATIC SENSOR HEATING
- Measurements:
  - Ice signal strength
  - Sensor temperature
  - Ambient temperature
- Mode of operation
- Ice Alarm Test button (Test can also be cancelled, new feature in v1.40)
- Manual Heating start button
- Status of I/O:
  - Analog output values
  - Relay output values
- Present failures

5.3 Web UI - Raw command input

It is possible to give the same commands, with a couple of exceptions, to LID-3300IP as through the menus of RS-232 serial interface.

5.4 Web UI - Settings

LID-3300IP parameters and settings can be viewed and changed through this interface. Settings are divided into different tabs as follows:

Configuration parameters

All parameters are visible in one view. To change a parameter, click **Change**, type the new value and press **Save**.

Information about each parameter is available by clicking the parameter number.

Site information

In the Site information window it is possible to define the name and additional information of the site where this Ice Detector locates. Site name becomes visible in the header of web user interface and in all menus of RS-232 interface.

Network setup

Network setup information is visible here. An administrator is able to change the IP address, default gateway address and netmask address.

Note that the connection is lost if the IP address is changed.

Version information

Version information of control unit and sensor is available here.

User setup

User setup can be modified by an administrator. Password inquiry is not enabled by default. Log in as an administrator to enable it.

When password inquiry is enabled, there are three user levels:

- **Visitor** is only able to view the status and parameter values.
- **Tester** is able to activate Ice Alarm Test and Manual Heating.
- **User (that has logged in) is able to change parameter values, start an ice alarm test and start manual heating. User cannot change network settings or change user setup.**
- **Administrator** is able to change parameter values, start an ice alarm test, start manual heating, change network settings and change user setup.

The default administrator password is: **a123**.

If the administrator password is changed and forgotten, it is possible to restore the default administrator password through RS-232 interface (see *Appendix C. Terminal commands*).

Event log

Event log is a new functionality in sw version v1.40.

Event log shows history of various events in chronological order. Ice detector saves 500 last events of four different type of events:

- ALARMS shows history of ice alarms
- FAULTS shows various fault events
- SETTINGS shows parameter changes made by users
- OTHER shows general events

Complete list of log messages is available in Appendix D. Event log messages.

NOTE! System clock must be set to enable event logging. See paragraph Clock below for more information.

Clock

Ice detector's real time clock can be set here.

Only an administrator is able to change the settings of system clock.

Clock can be set either

- manually by selecting ***Change*** and setting time in format <DD.MM.YYYY hh:mm>, where
  - DD is date
  - MM is months
  - YYYY is year and
  - hh and mm are hours and minutes, respectively.
- by using ***Sync with PC*** you can set time directly from your PC-computer. NOTE! Your PC might be in different time and time zone than the ice detector.
- by using ***SNTP*** protocol. More information below (*).

Manual Daylight Saving Time setting changes the time one hour ahead or back at the moment when value is changed.

(*) More information about SNTP

System clock can also be synchronised with network time stations using a built-in SNTP-client. SNTP uses UDP-protocol on port 123.

To activate SNTP-client, set first primary and alternative SNTP-server domain names (or IP-addresses), your current time zone related to UTC (Universal Time Coordinated) and finally set SNTP Client ON/OFF – switch to '1'. SNTP-client makes then first time synchronization attempt and updates system time then at intervals of 15 hours.

The following SNTP domain names are used as default:

- Primary SNTP-server time1.google.com
- 1st alternative SNTP-server time.nist.gov
- 2nd alternative SNTP-server time2.google.com

The primary SNTP-server is normally used. In case the primary server is not responding then alternative server(s) will be used.

SNTP-client uses built-in domain name server system (DNS) to get ip-address of selected SNTP-servers. DNS runs on UDP-port 53. Normally it is not necessary to change these ip-addresses, but it's possible to change them using web UI- raw command window or RS-232 interface (see Appendix C. Terminal commands).

Default ip-addresses and service providers used for DNS are:

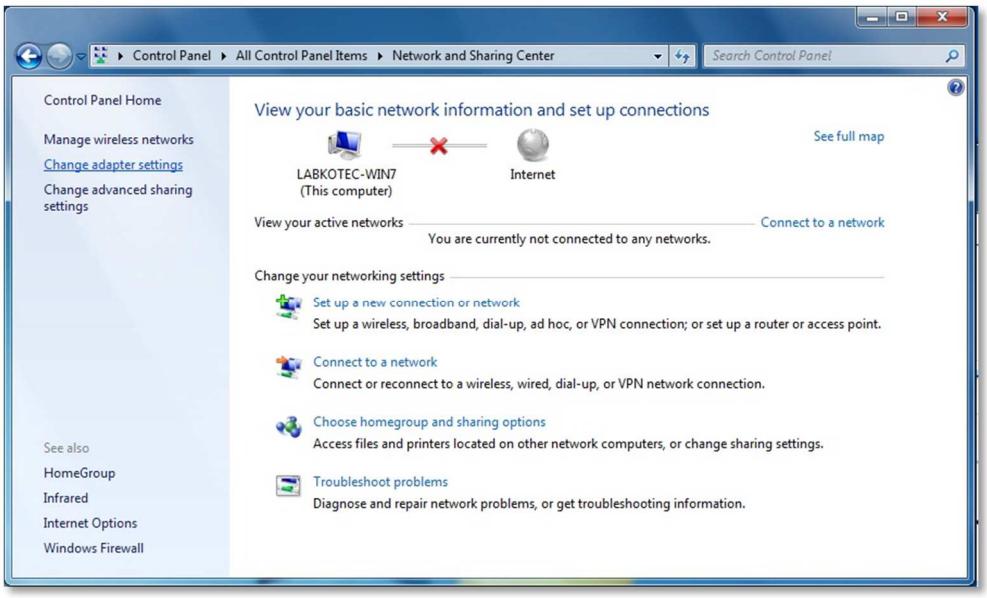
- Primary DNS-server 8.8.8.8 Google
- 1st alternative DNS-server 156.154.70.1 DNS advantage
- 2nd alternative DNS-server 4.2.2.1 Google

In case of power failure the clock has a reserve runtime of approximately 10 days. When connecting the control unit to mains power after a long service break etc, check that the system clock is running if you are not using SNTP to synchronize the clock. If the system clock is stopped, event logging is also disabled and an alert text 'CLOCK IS OUT OF TIME - LOGGING DISABLED!!' will be displayed above the clock display in web UI. You have to set the clock to enable event logging again.

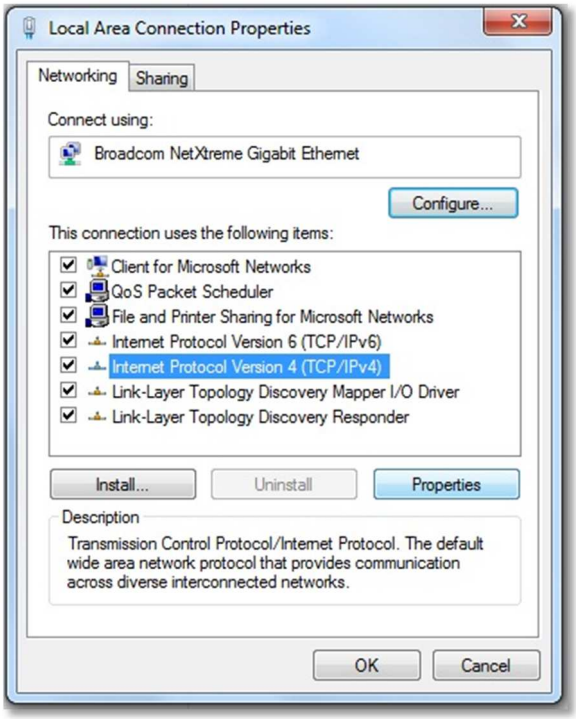
5.5 Direct Web Access between PC and LID

Web user interface can be accessed also directly from a PC by connecting the PC and LID directly with an Ethernet cable. Direct web access can be especially useful during the start-up of LID-3300IP. The IP address of the PC must be changed as described below.

1. Go to Network Connections menu of your PC e.g. from Windows **Start** menu **> Control Panel > Network and Sharing Centre.** The following window opens.



2. From left panel select **Change adapter settings** and from opening window choose **Local Area Connection -> Properties.**
3. Choose **Internet Protocol Version 4 (TCP/Ipv4)** from the Local Area Connection Properties list and click **Properties**.

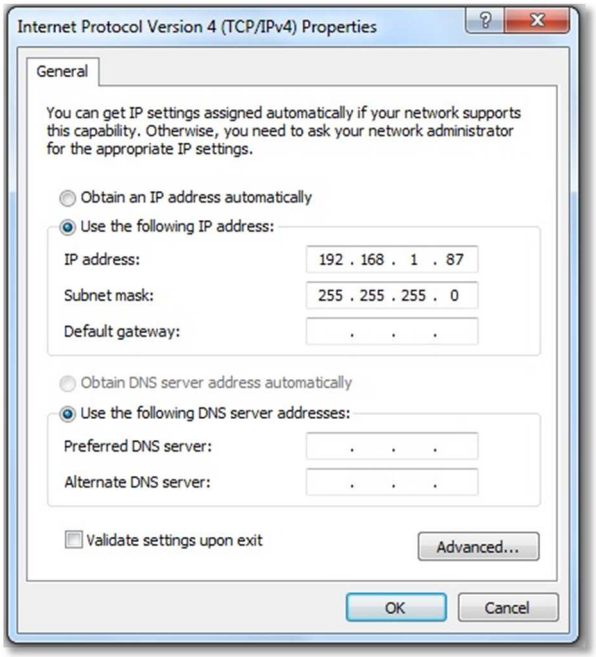


4. Choose **Use the following IP address** and give your PC an IP address which is next to the IP address of the LID.

   The default IP address of LID is 192.168.1.88.

   If you have not changed it, give your PC e.g. the address: 192.168.1.89.

   Now your PC and LID are in the same network and you may open a web browser and connect to the IP address of LID.



6 TECHNICAL SPECIFICATION

LID-3300IP Ice Detector Control Unit	
Enclosure	Dimensions: 125 x 175 x 75 mm (h x w x d) Weight: 800 g. Material: Polycarbonate Degree of protection: IP 65
Operating environment	Temperature:-30 ºC …+55 ºC Max. altitude above sea level: 3000 m
Power supply	230 VAC±10%, 50/60 Hz. Max fuse size in the supply line is 20 A.
Power consumption	Normally 7 VA. Max 350 W during sensor heating
Fuses	F804 50 mAT, F800 and F801 3.15 AT, IEC 127 5 x 20 mm
Analog outputs (source)	2 pcs, active current output 4-20 mA to max. 1 kΩ load (for Ice signal and temperature). Connector numbers 11 – 14. If analog outputs are used, please use galvanic isolation.
Relay outputs	2 pcs (Ice alarm and fault), potential free relay output. Connector numbers 5 – 10. U_{max} 30 V, I_{max} 1 A.
Front panel	LED indication for Power, Ice Alarm, Heating and Fault. Test button to simulate Ice Alarm.
Serial outputs (Only either of the interfaces can be used at a time)	RS-232 serial output for configuration and automatic reading
	Optical fibre serial output for configuration and automatic reading (optional, requires an additional RS2O Converter module): RS2O Converter module is CLASS 1 LASER PRODUCT RS2O Converter module transmitter: HFBR-1522ETX RS2O Converter module receiver: HFBR-2522ETZ Connector for optical fiber in RS2O converter module: HFBR4531 or equivalent Cable type: POF (1 mm) up to 45m
Web server	Integrated Web server and web based user interface for remote access to Ice Detector via Internet. Standard RJ-45 connector. Network settings can be configured via RS-232. Default IP address: 192.168.1.88.
Electrical Safety (LVD)	EN/IEC 61010-1, Class I, CAT II EN/IEC 61010-2-010 UL 61010-1 CAN/CSA-C22.2 NO. 61010-1-04+GI1 CAN/CSA-C22.2 NO. 61010-2-010-04
EMC	EN/IEC 61000-6-4:2007 / A1:2011 (Emission) EN/IEC 61000-6-2:2005 (Immunity)
Functional Safety	Hardware of LID-3300IP ice detector system fullfills the requirements of PL b according to ISO 13849-1.
Approvals	C US US+Canada NRTL-Certificate In the USA and Canada the product is intended to be installed with a 230 Vac wind turbine power system only DNV·GL Component certificate according to GL Rules and Guidelines – IV Industrial Services – Part 1 – “Guideline for the Certification of Wind Turbines” Edition 2010. Certificate No. CC-GL-013A-2014.

LID/ISD Ice Sensor	
Dimensions	350 x 100 x 25 mm (h x w x d)
Weight	1.3 kg (1.7 kg with standard mounting kit)
Material	Aluminum
Degree of protection	IP 65
Operating environment	Temperature: -40 ºC …+60 ºC Max. altitude above sea level 3000 m
Cable diameters	Signal cable: 7.5 mm Heating cable: 11.5 mm
Approvals	C US US+Canada NRTL-Certificate In the USA and Canada the product is intended to be installed with a 230 Vac wind turbine power system only DNV·GL Component certificate according to GL Rules and Guidelines – IV Industrial Services – Part 1 – "Guideline for the Certification of Wind Turbines" Edition 2010. Certificate No. CC-GL-013A-2014.

7 REPAIR AND SERVICE

Fuses 9, 10 and 11 in Figure 2 (F800, F801 and F804) can be changed to another glass tube fuse 5 x 20 mm complying EN/IEC 60127-2/3. See the correct value of the fuses from table Technical specification.

⚠ Before opening the cover make sure that the main supply is switched off. In permanent supply cable installation, turn off the isolation switch. When supply cable is equipped with plug, disconnect it from plug socket.

For more information, contact Labkotec Oy's service: service@labkotec.fi.

8 ANNUAL MAINTENANCE

Ice signal strength

Check the ice signal strength in weather conditions where icing should not be possible. If the signal has become attenuated (the signal value is not the maximum), there could be a need to calibrate the ice signal.

Dirt and dust

Check that the sensor is not covered with dirt or dust and that sensor wire moves freely. I case of dirt or dust, clean up the sensor gently e.g. with water and a brush.

Ice alarm generation

Test the ice alarm in weather conditions where icing should not be possible. Perform the test in one of the following ways:

- Generate an ice alarm by pushing the test button on the control unit. Alternatively, click the test button in the web user interface or type command TEST in the RS-232 interface.
- Use water and cooling spray to freeze the ice sensor.

After the ice alarm test has been initiated, LID-3300IP should go through the normal operating modes: Ice detected, Heating and Cooling. Finally the ice alarm is released and the operating mode will change back to Sensing.

For more information, please contact Labkotec Oy's service.

APPENDIX A. STREAMING MODE OF SERIAL OUTPUT

LID-3300IP reports the measurement data and status in the serial output as explained before in chapter 4.2. This chapter explains the formats in more detail.

There are three different output formats. The format can be read by command RSFORMAT.

Format 0: variable length

Command RSFORMAT 0 sets the variable length format.

The output format consists of the following information:

Fail	Mode	Sensor temperature	Ambient temperature	Ice signal amplitude

The different fields are delimited with a space character. Fail and Mode characters have no space between them. Negative temperature values have a '-'-sign in front of the value, positive values do not. Ice signal amplitude has an asterisk (*) in front of the value.

- Example (one temperature sensor):

  ```
  0F 15.0 *68
  ```

  No fail, Mode: detecting, ice sensed, heating on, Sensor temperature 15.0℃, ice signal amplitude 68.

- Example (two temperature sensors):

  ```
  0F 15.0 -5.0 *68
  ```

  No fail, Mode: detecting, ice sensed, heating on, Sensor temperature 15.0℃, ambient temperature -5.0℃, ice signal amplitude 68.

Format 1: constant length

Command RSFORMAT 1 sets the constant length format.

The output format consists of the following information:

Fail	Mode	Sensor temperature with sign mark (+/-) and leading zeros	Ambient temperature with sign mark (+/-) and leading zeros	Ice signal amplitude with leading zeros	Rsformat (= 1)	16-bit checksum

The different fields are delimited with a space character. Fail and Mode characters have no space between them. Temperature values start with zeros and have a '+' or '-' sign in front of the value. Ice signal amplitude has an asterisk (*) in front of the value. The checksum consist of ASCII coded hex ' 0…F' and is calculated from all preceding bytes (including space characters) by adding them together.

- Example (one temperature sensor):

  ```
  0F +015.0 ----.- *068 1 04B8
  ```

  No fail, Mode: detecting, ice sensed, heating on, Sensor temperature 15.0℃, ice signal amplitude 68, rsform at 1, checksum 04B8.

- Example (two temperature sensors):

  ```
  0F +015.0 -005.0 *068 1 04C9
  ```

  No fail, Mode: detecting, ice sensed, heating on, Sensor temperature 15.0℃, ambient temperature -5.0℃, ice signal amplitude 68, rsformat 1, checksum 04C9.

Format 2: LID-3210 format

Command RSFORMAT 2 sets the output format identical to what was used in LID-3210 Ice Detector.

The output format consists of the following information:

Fail	Mode	Sensor temperature with sign mark (+/-) and leading zeros	Ambient temperature with sign mark (+/-) and leading zeros	Ice signal amplitude with leading zeros

The different fields are delimited with a space character. Fail and Mode characters have no space between them. Temperature values start with zeros and have a '+' or '-' sign in front of the value. Ice signal amplitude has an asterisk (*) in front of the value.

- Example (one temperature sensor):

  ```
  0F +015.0 *068
  ```

  No fail, Mode: detecting, ice sensed, heating on, Sensor temperature 15.0℃, ice signal amplitude 68.

- Example (two temperature sensors):

  ```
  8F -005.0 -005.0 *048
  ```

  Heating failed, Mode: detecting, ice sensed, Sensor temperature -5.0℃, ambient temperature -5.0℃, ice signal ampli tude 48.

Fail and Mode Characters

The reason for failure can be interpreted from the Fail character as follows:

Fail character	Meaning			
	Heating	EEPROM	Temperature sensors	Ice sensing
0	OK	OK	OK	OK
1	OK	OK	OK	Failed
2	OK	OK	Failed	OK
3	OK	OK	Failed	Failed
4	OK	Failed	OK	OK
5	OK	Failed	OK	Failed
6	OK	Failed	Failed	OK
7	OK	Failed	Failed	Failed
8	Failed	OK	OK	OK
9	Failed	OK	OK	Failed
A	Failed	OK	Failed	OK
B	Failed	OK	Failed	Failed
C	Failed	Failed	OK	OK
D	Failed	Failed	OK	Failed
E	Failed	Failed	Failed	OK
F	Failed	Failed	Failed	Failed

The operation mode of the LID-3300IP can be interpreted from the Mode character in table below.

Mode character	Meaning				
	Power-up Mode	Sensing Mode	Detecting Mode	Heating	Ice sensed
0…7	YES	-	-	-	-
8	NO	YES	NO	OFF	NO
C	NO	NO	YES	OFF	NO
D	NO	NO	YES	OFF	YES
E	NO	NO	YES	ON	NO
F	NO	NO	YES	ON	YES

APPENDIX B. PARAMETERS

Par. nbr	Name of the parameter and explanation	Default value	Valid values
0	Ice detected alarm level Ice alarm activates when ice signal goes below this level.	60	10-1023
1	Ice not detected alarm level When ice signal goes above this level, ice is no longer detected. Note! Ice alarm will deactivate after the sensor is heated and cooled down close to ambient temperature	70	15-1023
2	Maximum ice signal value Maximum ice signal level can be adjusted according to user needs. This is useful e.g. when the same maximum signal level (255), that used to be in the older Ice Detectors, is required. Please note that the alarm levels should be adjusted accordingly when maximum ice signal level is changed.	100	0-1000
3	Ice alarm delay (nbr of 4 second measurement cycles) Ice signal must remain below ice detected alarm level for the duration of the entire delay before ice alarm activates. Delay is set as a multiple of 4 second intervals.	3	0-7200
4	Nbr.of temperature sensors Ice detector measures either sensor temperature (when P4 = 1) or both sensor and ambient temperature (when P4 = 2). Sensor temperature is measured inside the sensor, ambient temperature is measured from the cable connector of the sensor. Please note that the value of this parameter affects the RS-232 output format.	2	1-2
5	Ambient temp above which icing is impossible (℃ or F) Temperature limit above which icing should not be possible. This parameter prevents or notifies of possible false ice alarms. Ice detector operation in case of ice above this temperature is determined by parameter 6. This parameter is ignored when performing an ice alarm test.	5	0-50
6	Mode for ice alarm above parameter 5 In case an ice alarm is detected above the temperature set by parameter 5, ice detector behaves the following way according to the parameter value: 0 = No ice alarm or fault is activated (default) 1 = Only ice alarm is activated 2 = Only fault is activated 3 = Both ice alarm and fault are activated Note! When signal value is below the alarm level for more than 24 hours, a fault signal is indicated, regardless of the value of this parameter.	0	0-3
7	Direction of analog output 1 0 = Minimum measurement value equals 4 mA and maximum measurement value equals 20 mA. 1 = Maximum measurement value equals 4 mA and minimum measurement value equals 20 mA. By default ice signal 0 equals 4 mA and ice signal 100 equals 20 mA.	0	0-1
8	Direction of analog output 2 0 = Minimum measurement value equals 4 mA and maximum measurement value equals 20 mA. 1 = Maximum measurement value equals 4 mA and minimum measurement value equals 20 mA. By default temperature value -40C equals 4 mA and +60C equals 20 mA.	0	0-1
9	Sources of analog outputs It is possible to choose which measurements are driving analog outputs. 0 = Ice signal in analog output 1, sensor temperature in analog output 2 1 = Ice signal in analog output 1, ambient temperature in analog output 2	1	0-5

	2 = sensor temperature in analog output 1, ambient temperature in analog output 2 3 = sensor temperature in analog output 1, sensor temperature in analog output 2 4 = ambient temperature in analog output 1, ambient temperature in analog output 2 5 = Ice signal in analog output 1, Ice signal in analog output 2		
10	Not in use at the moment.		
11	Not in use at the moment.		
12	Heating ON (1) or OFF (0) Based on this parameter, heating is either started (1) or not started (0) when ice signal goes below the alarm level. By default, heating is started to melt the ice so that the sensor is capable of measuring the icing situation again. If heating is not started, ice alarm deactivates only after the ice melts naturally away from the sensor.	1	0-1
13	Maximum heating temperature (degrees) Sensor is heated to the temperature set by this parameter to melt the ice during an ice alarm. The parameter value must be set either in Celcius or in Farenheit, depending on the selected unit of temperature. By default, the unit of temperature is Celcius. For safety reasons, there is also a thermostat inside the sensor to stop heating after about +65C (+149F).	50	0-65
14	Full power heating temperature (P13 - sensor temperature) Sensor is heated with a maximum power up to this limit, after which heating power is reduced in order not to exceed the defined maximum heating temperature. Parameter value represents the temperature difference between maximum heating limit and actual sensor temperature.	3	0-30
15	Heating power ratio after P14 (%) Heating power is reduced to the degree set by this paramater after the Full power heating limit (P14).	100	0-100
16	Max heating time (minutes) Maximum heating time is limited with this parameter. Heating will stop if the maximum heating temperature (P13) is not reached after the time set in this parameter. If there is no ice after the heating is stopped, sensor will return to normal operation.	20	1-120
17	Heating extension time (minutes) In very cold and windy atmosphere it might be useful to extend the heating time after the maximum heating temperature is reached in order to melt the ice completely. Sensor temperature is kept in max heating temperature (P13) for an extra time set by this parameter.	0	0-60
18	Heating extension time in case of ice (minutes) If ice is still detected right after the heating and/or heating extension time (P17), heating is extended for the extra time set by this parameter.	10	0-60
19	Cooling off time (minutes) Sensor must cool down after the heating in order to be able to measure icing conditions. Ice alarm is released after the cooling period. This parameter sets a fixed time to stop the cooling period. See also P20. Cooling stops according to parameters P19 and P20, whichever is reached earlier.	10	0-60
20	Cooling off temp difference (ambient temperature - sensor temperature) Sensor must cool down after the heating in order to be able to measure icing conditions. Ice alarm is released after the cooling period. Cooling will be stopped according to this parameter when sensor temperature is close to ambient temperature. See also parameter P19. Cooling stops according to parameters P19 and P20, whichever is reached earlier.	5	0-20
21	System parameter (do not change)		
22	Delay for ice alarm deactivation (minutes)	10	0-120

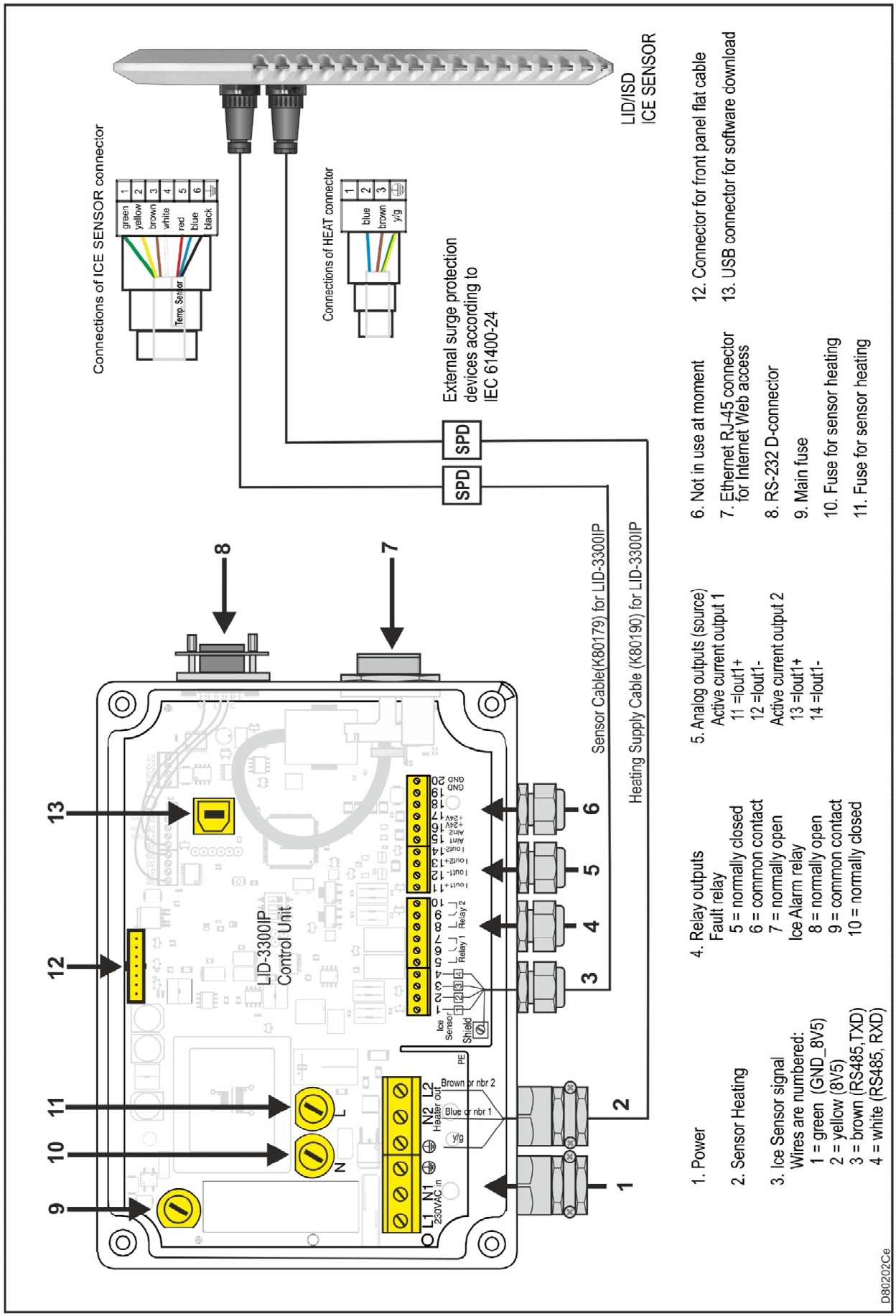
	Delay for ice alarm deactivation is used to prevent repetitive ice alarms in case of long-term icing conditions. Ice alarm will remain active after the cooling period of the sensor during the time delay specified by this parameter. If the ice signal is below the alarm level (P0) after the delay, ice alarm remains active and a new heating and cooling cycle is started. Ice alarm is deactivated if ice signal is above parameter P1 after the delay.		
23	Signal level for automatic sensor heating Automatic heating of the sensor is used to remove the soft ice which has slowly accumulated over the sensor in light icing conditions. Automatic heating is started when ice signal remains constantly below the value of this parameter for a longer time than what is specified by parameter P24. Automatic heating does not generate an ice alarm. The functionality is not in use when parameter value is 0.	80	0-1000
24	Delay for automatic sensor heating (hours) Automatic sensor heating is activated when ice signal remains constantly below the value of parameter P23 for a longer time than what is specified by this parameter.	24	0-100

APPENDIX C. TERMINAL COMMANDS

Comm. nbr	Command	Description	Command parameters	Example	Access from web UI raw command window
1	SP<nr> <xxx>	Set parameter value	<nr> = parameter number, <xxx> = value	SP1 20	yes
2	RP<nr>	Read parameter value	<nr> = parameter number	RP1	yes
3	SAOL <xxx>	Set scaling for 4mA output, ice sensor channel	<xxx> = scaling value for 4mA output	SAOL 10	yes
4	SAOH <xxx>	Set scaling for 20mA output, ice sensor channel	<xxx> = scaling value for 20mA output	SAOH 100	yes
5	RAOL	Read ice sensor 4mA scaling value	None	RAOL	yes
6	RAOH	Read ice sensor 20mA scaling value	None	RAOH	yes
7	SWR	Software reset	None	SWR	yes
8	SUOT <x>	Set temperature degree unit	C = Celsius, F = Fahrenheit	SUOT C	yes
9	RUOT	Read temperature degree unit	None	RUOT	yes
10	SDF	Set default values for parameters	None	SDF	yes
11	HEAT	Start manual heating	None	HEAT	yes
12	TEST	Start manual ice alarm test	None	TEST	yes
13	SDNW	Set network settings to default values	None	SDNW	yes
14	SDPW	Set passwords to default values	None	SDPW	no
15	SIP <XXX>	Set control unit IP-address	<xxx> = IP-address in format aaa.bbb.ccc.ddd	SIP 192.168.11.28	no
16	RIP	Read control unit IP-address	None	RIP	no
17	SGW <xxx>	Set unit default gateway IP-address	<xxx> = IP-address in format aaa.bbb.ccc.ddd	SGW 192.168.1.1	no
18	RGW	Read default gateway IP-address	None	RGW	no
19	SNM <xxx>	Set subnet address mask	<xxx> = subnet mask in format aaa.bbb.ccc.ddd	SNM 255.255.255.0	no
20	RNM	Read subnet mask	None	RNM	no
21	RMC	Read control unit MAC-address	None	RMC	no

22	RSFORMAT <x>	Set RS-232 communication format	0 = variable length, 1 = constant length, 2 = LID-3210	RSFORMAT 1	yes
23	RSFORMAT	Read RS-232 communication format	None	RSFORMAT	yes
24	ST2LOCK	Lock / unlock updating the value of ambient temperature (T2) during heating and cooling phases.	0 = unlock T2 update 1 = lock T2 update	ST2LOCK 0 ST2LOCK 1	yes
25	RT2LOCK	Read ambient temperature (T2) lock state	None	RT2LOCK	yes
26	SDNS<x>< > <aaa.bbb.ccc.ddd>	Set Domain Name Server ip-address	< x> = 1 – 3 < > = space 1 = primary DNS 2 = 1st alt. DNS 3 = 2nd alt. DNS aaa.bbb.ccc.ddd = DNS IP-address	SDNS1 8.8.8.8	yes
27	SNTP<x>< > <abcdefghijkl>	Set network time server name string	<x> = 1 – 3 < > = space 1 = primary NTP 2 = 1st alt. NTP 3 = 2nd alt. NTP abcdefghijkl = server name string	SNTP1 time1.google.com	yes
28	STZN <x>	Set local time zone related to UTC (Universal Time Coordinated). Needed only when SNTP-client is in use.	<x> = integer -12…+12	STZN 2	yes
29	SNWT <x>	Set SNTP- client ON/OFF	< x> = 0 -> OFF < x> = 1 -> ON	SNWT 1	yes
30	SCLOCK< > <DD>.<MM>.<YY><><hh>:<mm>:<ss>	Set system time	< > = space <DD> = date 0-31 <MM> = months 0-12 <YY> = years 0-99 <hh> = hours 0-23 <mm> = minutes 0-59 <ss> = seconds 0 -59	SCLOCK 09.06.14 10:05:00	yes
31	RLOG <x>	Print event log segment to RS-232 terminal.	<x> = 1 - 5 log segment to print. 1 = Alarms 2 = Faults 3 = User settings 4 = General events 5 = All	RLOG 2	
32	FTEST	Test manually fault relay de-energisation	none	FTEST	yes

APPENDIX D. SYSTEM CONNECTION DIAGRAM



APPENDIX E. EVENT LOG MESSAGES

Remarks-column includes a description only when the event text does not explain itself.

Alarm events	Remarks
Ice alarm ON, T(amb)= -2.0	T(amb) = ambient temperature when alarm was activated.
Ice alarm OFF, T(amb)= 5.5	T(amb) = ambient temperature when alarm was deactivated.
Fault events	**Remarks**
Sensor T(sens) fault ON	Ice sensor surface temperature sensor fault
Sensor T(sens) fault OFF	
Sensor T(amb) fault ON	Ambient temperature sensor fault
Sensor T(amb) fault OFF	
Ice sensor fault ON	
Ice sensor fault OFF	
Ice alarm above P5-fault ON	
Ice alarm above P5-fault OFF	
Ice alarm active 10 days-fault ON	
Ice alarm active 10 days-fault OFF	
Parameter memory CRC-error ON	
Parameter memory CRC-error OFF	
Sensor comm failure ON	
Sensor comm failure OFF	
Heater fault ON	
Heater fault OFF	
Setting events	**Remarks**
P0=70, old: 60	Example message for parameter P0-P24 edit. P0 value was set to 70, previous value was 60.
IP-settings changed	ip-address, default router ip-address or network mask was edited.
Passwords edited	
Passwords disabled	
Passwords enabled	
Default P0-P24 restored	Command ‘SDP’ (Set default parameters) was given.
Default network settings restored	
Default passwords restored	
SNTP-client disabled	
SNTP-client enabled	
General events	**Remarks**
‘xxxx’ logged IN	Example message for login event. xxxx can be User1 - 4, Admin1-2 or Tester1-3

‘xxxx’ logged OUT	As above, user logged out.
System reset by user	SWR command was given
Power-up reset	System started after mains power connected.
Watchdog-reset occurred	System built-in watchdog reseted central unit.
Web-users logged OUT	System made automatic log out for unused user connection.
Automatic defrost activated	
Automatic defrost expired	
New sensor found: S/N: 1234567	Ice sensor was changed to another unit.
SW changed to version v1.40	Example message for software update. Central unit SW updated to version v1.40
Web-ui opened	Web connection made to central unit.
System first time deployment	Date and time when central unit has been set in operation.
Manual heating started	User has commanded manual heating
Manual heating expired	Manual heating phase run through
Manual heating aborted by a user	User has aborted manual heating
Manual TEST-run started	User initiated ice alarm test
Manual TEST-run cancelled	User cancelled ice alarm test manually
Manual TEST-run ended	
FAULT RELAY tested manually	FTEST- command was given.

Labkotec
INDUTRADE GROUP

L80182Ae
F80183Ae

Declaration of Conformity

This declaration certifies that the below mentioned apparatus conforms with the essential requirements of the EMC directive 2004/108/EY and Low-Voltage Directive (LVD) 2006/95/EY.

Description of the apparatus: Ice Detector for Wind Turbines and Meteorological Stations

Type:	LID-3300IP Ice Detector, including - LID-3300IP Control Unit and - LID/ISD Ice Sensor
Manufacturer:	Labkotec Oy Myllyhaantie 6 33960 Pirkkala FINLAND

Standards which are used as a basic for conformity:

EMC:

EN 61000-6-4 (2007) / A1 (2011)	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
EN 61000-6-2 (2005)	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments

LVD:

EN 61010-1 (2010)	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
EN 61010-2-010 (2003)	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 2-010: Particular requirements for laboratory equipment for the heating of materials

The apparatus is CE-marked since 2009.

Signature

The authorized signatory to this declaration, on behalf of the manufacturer, and the Responsible Person based within the EU, is identified below.

Pirkkala 18.7.2014

Ari Tolonen
CEO
Labkotec Oy

Labkotec Oy Myllyhaantie 6, FI-33960 Pirkkala, Finland
Tel. +358 29 006 260, fax +358 29 006 1260