Operating Manual LCom

Lufft Communicator

Order No.: 8511.EAK

Version V2.24.0 (08/2023)

www.lufft.com

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1 Please Read Before Use

Before using the equipment, please read the operating manual carefully and follow the instructions in every detail.

1.1 Symbols Used

Important information about potential hazards to the user

Important information about correct equipment operation

1.2 Safety Instructions

- Installation and commissioning must only be carried out by suitably qualified specialist personnel.
- Never take measurements on or touch live electrical parts.
- Pay attention to the technical data and storage and operating instructions.

1.3 Designated Use

- The equipment must only be operated within the range of the specified technical data.
- The equipment must only be used under the conditions and for the purposes for which it was designed.
- The safety and operation of the equipment can no longer be guaranteed if it is modified or adapted.

1.4 Guarantee

The guarantee period is 12 months from the date of delivery. The guarantee is forfeited if the designated use is violated.

1.5 Incorrect Use

If the equipment is installed incorrectly

- It may not function at all or its function may be limited

- It may be permanently damaged
- Danger of injury may exist if the equipment is allowed to fall

If the equipment is not connected correctly

- It may not function
- It may be permanently damaged
- The possibility of an electrical shock may exist

1.6 Brand Names

All brand names referred to are subject without limitation to the valid trademark and ownership rights of the respective owner.

2 General

The introduction of UMB technology has enabled Lufft to offer low cost sensors for road traffic technology. UMB sensors can be combined using ISOCON modules and additional analog sensors can be integrated with the ANACON module.

The **LCom** - Lufft Communicator – was developed to provide the UMB sensor data over various communication protocols.
LCom consists of an embedded computer with Windows CE operating system, a touchscreen display (resolution 800x480 pixels and CFL backlighting), and interfaces for a GPRS modem, Party-Line modem and UMB network as well as an Ethernet and USB interface. In addition, LCom has a real-time clock with battery backup.

Currently following protocols are supported:

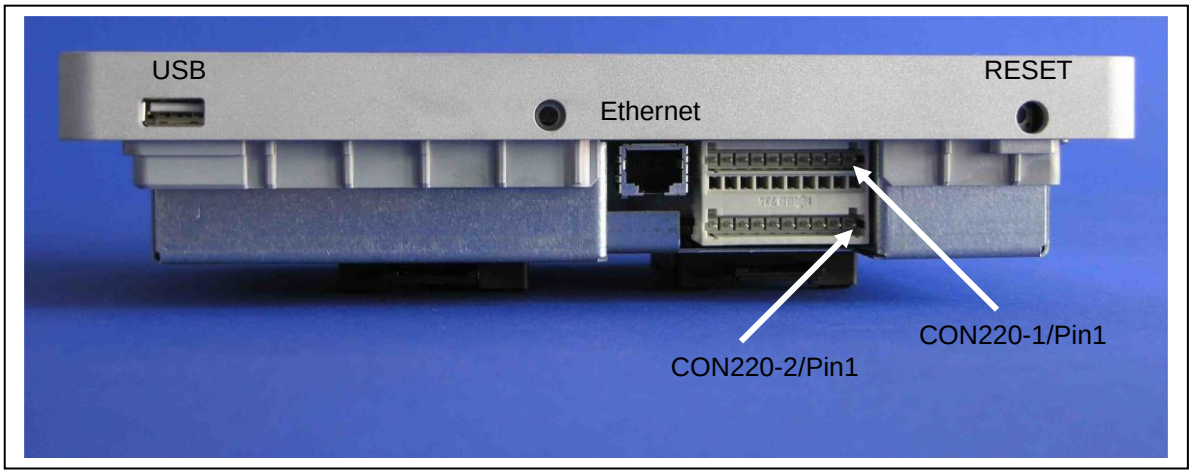
- TLS97
- TLS2002
- TLS2012
- TLS over IP (Asfinag)
- NTCIP (via SNMP)
- MSSI (SOAP) (Lufft/Asfinag)

In TLS mode, LCom operates as an “integrated control module with EAK” (Inselbus), or as “EAK on external control module” (Lokalbus).

Additional protocols planned are:

- DGT (Spain)

3 Hardware Description



LCom Connector

3.1 Power Supply

LCom is powered via UB+/GND (CON220-1) on the UMB-EAK. The allowed voltage range is 10VDC to 28VDC. The input is protected against reverse polarity, surge and burst.

Power supply for the GPRS modem (GUB_2/GND) and Party-Line modem (GUB_3/GND) are provided on connector CON220-1. Depending on the status of the modem, LCom can switch these two voltages on and off to reset the respective modem.

The power supply for the UMB network (GUB1/GND) is available on CON220-1. The maximum output current is 4 amp. If higher currents are required, the sensor heater tapes must be powered and protected separately.

All output voltages are short-cut proof.

3.2 Operation

The standard functions of the LCom can conveniently be used via the touch screen display. For configuration purposes we recommend the connection of a PC keyboard with USB connection, or connecting a PC/Laptop via LAN and using the service program.

3.3 GPRS Modem Connection for Wireless TCP/IP Connections, and Analog Modem for PPP-Dial In Connections.

The supported modem for GPRS Connections is: Wavecom Fastrack GPRS Modem. Serial port settings are 115200 baud, 8 data bits, no parity, 1 stop bit, RTS/CTS hardware handshake enabled.

Alternative modems can be tested on request.

LCom	Connection	GPRS Modem
RXD1 (CON220-1/Pin 7)	RS232	RXD (Pin 6)
TXD1 (CON220-1/Pin 8)	RS232	TXD (Pin 2)
RTS1 (CON220-1/Pin 9)	RS232	RTS (Pin 12)
CTS1 (CON220-1/Pin 10)	RS232	CTS (Pin 11)
GND (CON220-2/Pin 2)	RS232 (if required)	GND
GUB_2 (CON220-2/Pin 1)	Power supply	UB+ - 1V
GND (CON220-2/Pin 2)	Power supply	GND

LCom/GPRS modem wiring

For the PPP Dial In Connection, any Hayes compatible modem may be used. Serial port settings are 57600 baud (configurable, see modem dialog below), 8 data bits, no parity, 1 stop bit, RTS/CTS hardware handshake enabled.

3.4 Party-Line Modem Connection

LOGEM1200 (Keymile) and TD-23 (Westermo) modems are supported.

Interface settings: 1200 baud, 8 data bits, even parity, 1 stop bit, RTS/CTS/DCD hardware handshake enabled.

Alternative modems can be tested on request.

LCom	Connection	Party-Line Modem
RXD_MOD (CON220-2/Pin 5)	RS232	RXD (Pin 2)
TXD_MOD (CON220-2/Pin 6)	RS232	TXD (Pin 3)
RTS_MOD (CON220-2/Pin 7)	RS232	RTS (Pin 7)
DTR_MOD (CON220-2/Pin 8)	RS232	DTR (Pin 4)
CTS_MOD (CON220-2/Pin 9)	RS232	CTS (Pin 8)
DCD_MOD (CON220-2/Pin10)	RS232	DCD (Pin1)
GND (CON220-2/Pin 4)	RS232 (if required)	GND (Pin 5)
GUB_3 (CON220-2/Pin 3)	Power supply	UB+ - 1V
GND (CON220-2/Pin 4)	Power supply	GND

LCom/Party-Line modem wiring

3.5 UMB Connection

The data connection and power supply are provided over the UMB connection. Please note that the maximum current on the LCom's power supply output is 4 amp. If higher currents are required, the sensor heater must be powered and protected separately.
Interface settings: 19200 baud, 8 data bits, no parity, and 1 stop bit.

LCom	Connection	UMB Connection (internal bus)
A (CON220-1/Pin 5)	----------	A1
B (CON220-1/Pin 6)	----------	B1
GUB_1 (CON220-1/Pin 3)	----------	UB+ - 1V
GND (CON220-1/Pin 4)	----------	GND

LCom/internal UMB bus wiring.

3.6 Ethernet

10/100 Mbit with TCP/IP stack
IP address: 192.168.0.50
Net mask: 255.255.255.0
Standard gateway: -
All settings can be changed in Windows CE control panel

3.7 USB

A USB hub, keyboard, mouse and memory stick can be connected to the USB interface.

3.8 Pin Assignment CON220-1 and CON220-2

CON220-1

Pin	Name	Comment
1	UB+	Positive power supply of EAK, 10V... 28V
2	GND	Ground
3	GUB_1	Switched UMB power supply
4	GND	Ground
5	A	A-RS485 for UMB communication
6	B	B-RS485 for UMB communication
7	RXD1	GPRS or Analog modem connection, Receive line
8	TXD1	GPRS or Analog modem connection, Transmit line
9	RTS1	GPRS or Analog modem connection, Ready to send
10	CTS1	GPRS or Analog modem connection, Clear to send

CON220-2

Pin	Name	Comment
1	GUB_2	Switched power supply for GPRS or Analog modem
2	GND	Ground
3	GUB_3	Switched power supply for TLS/Party Line modem (or Camera, see Camera configuration)
4	GND	Ground
5	RXD_MOD	Data modem connection (TLS/Party Line), or Opus200 Receive Data, Input
6	TXD_MOD	Data modem connection (TLS/Party Line), or Opus200 Transmit Data, Output
7	RTS_MOD	Data modem connection (TLS/Party Line), or Opus200 Ready to send, Output
8	DTR_MOD	Data modem connection (TLS/Party Line), Data terminal ready, Output
9	CTS_MOD	Data modem connection (TLS/Party Line), or Opus200 Clear to send, Input

10	DCD_MOD	Data modem connection (TLS/Party Line), Data carrier detect, Input

3.9 Storage Conditions

Allowable ambient temperature : -30°C... +70°C

Allowable relative humidity : 95%, non-condensing

3.10 Operating Conditions

Allowable operating temperature : -25°C... +70°C

Allowable relative humidity : 95%, non-condensing

3.11 Technical Data

Power supply : 10V...28V

Lithium battery for real-time clock : 3V, 250mAh

Power consumption, CFL switched off : approx. 3W

Power consumption, CFL switched on : approx. 10W

4 EC Certificate of Conformity

Product: **LCom**

Type: **8511.EAK**

We herewith certify that the above mentioned equipment complies in design and construction with the Directives of the European Union and specifically the EMC Directive in accordance with 89/336/EC and the Low Voltage Directive in accordance with 73/23/EC.

The above mentioned equipment conforms to the following specific EMC Standards:

EN 61000-6-2:2005 Part 6-2: Generic Standards - Immunity for Industrial Environments

EN 61000-4-2	ESD
EN 61000-4-3	Radiated electromagnetic field
EN 61000-4-4	Burst
EN 61000-4-5	Surge
EN 61000-4-6	Conducted disturbances
EN 61000-4-8	Magnetic field 50Hz

EN 61000-6-3:2001 Part 6-3: Generic Standards - Emission Standard for Residential, Commercial and Light Industrial Environments

EN 55022:1998 +A1:2000 +A2:2003	Line-conducted disturbances
prEN 50147-3:2000	Radiated emission
IEC / CISPR 22 Class B	

Fellbach, 22.02.2008 Axel Schmitz-Hübsch

5 Software Description

5.1 Installation

The following files must be copied to the \FFSDISK directory:

LCom.exe – the LCom application
Text_de.uni – the text modules for the user interface in German
Text_en.uni – the text modules for the user interface in English

The following are also absolutely essential for NTCIP:
Snmpapi.dll – the library for all SNMP functions
Snmp.dll – the “master” SNMP agent (Microsoft)
Snmp_hostmib.dll – the SNMP agent for “host” functions (Microsoft)
Snmp_mibii.dll – the SNMP agent for “MIB-II” functions (Microsoft)
Ftpd.dll – the FTP server (Microsoft)
SnmpNtcipAgent_Vx.x.dll – the SNMP agent for NTCIP functions (Lufft)

The “Start.cmd” file must be copied to the \FFSDISK\Startup directory.
This command file copies the “LCom.exe” file from the \FFSDISK directory to “\” (i.e. to the RAM drive) and starts the application from there. This allows the file “\FFSDISK\LCom.exe” to be overwritten by an update when necessary while the system is running.

5.2 Getting Started

The LCom can be operated using only the touch screen display and the virtual keyboard, but for ease of use it is recommended to connect an USB keyboard to the LCom, or use a PC and the service program.
We recommend that you attach a small USB hub with keyboard and mouse – so you can also attach an USB stick to copy files to (e.g. configuration and program files) and from (e.g. log files) the LCom.

When the LCom starts up, certain registry entries are checked and set if necessary. The system restarts if any changes are required.

Note: A user name and password are required for access to the system via Telnet, or for access to all configuration dialogs on the LCom:

User name: lufft
Password: lufft-lcom

Some settings via the Windows CE control panel also require this password.

After this, the application checks whether a UMB device configuration is available or not. The UMB device configuration is stored in the "**device_data.txt**" and "**sensor_data.txt**" files.
The UMB bus is scanned automatically if no device configuration is available.

The sensor configuration must then be customized to your needs.
The appropriate UMB channels must be activated, and the configuration values for the uplink protocol (see below) must be set if applicable (e.g. for TLS the FG, Type and Channel settings, for MSSI the type and channel settings).

The sensor configuration is maintained in the "Sensor Config" dialog. Like all other configuration dialogs, this dialog is user name and password protected (see "User Interface").

Note: If you want to set up several LCOMs with an identical sensor configuration, you can use the "device_data.txt" and "sensor_data.txt" files to transfer this configuration to other devices. In this case it is best to install these files in the \FFSDISK directory before starting LCom. The TLS and MSSI configuration data for the sensors is also stored in the "sensor_data.txt" file.

5.3 User Interface

Only the first two dialogs, "Status Display" and "Log File", are generally available. A user name and password is required for all other dialogs.

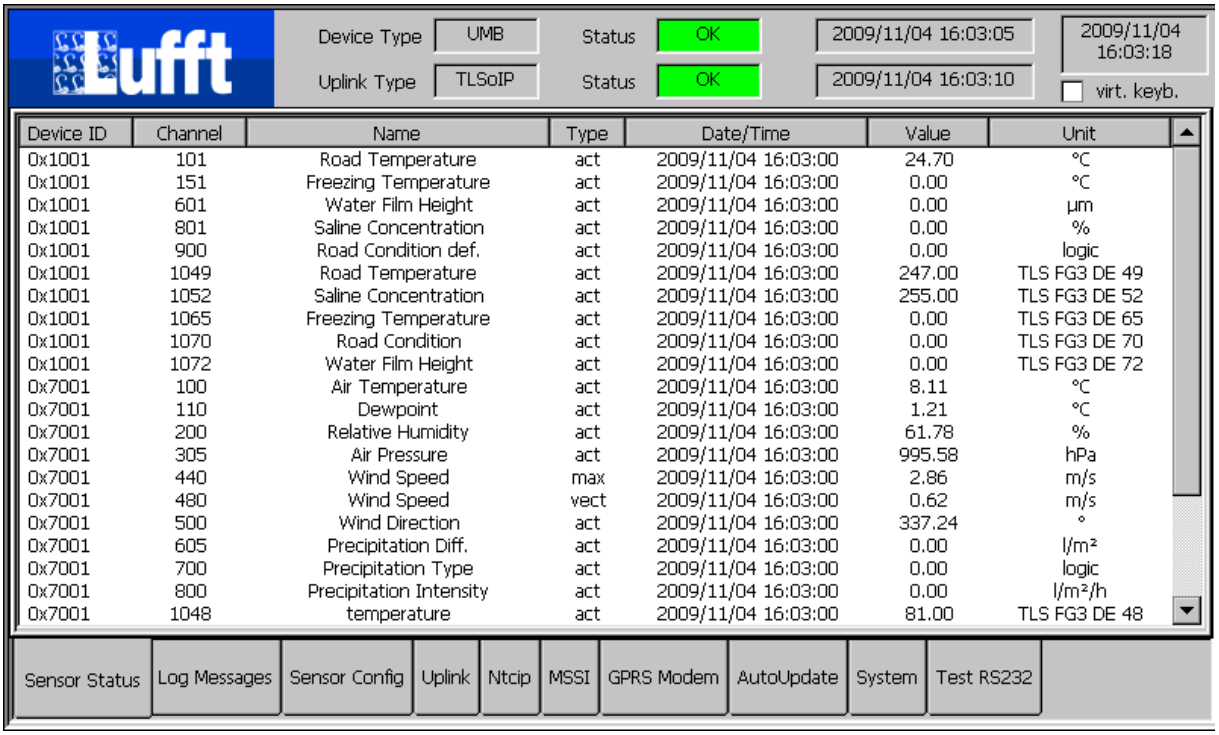
User name: lufft
Password: lufft-lcom

The user is "logged out" if the screensaver is enabled.

Note: the screensaver function in LCom disables the LCD backlight after a configurable amount of time without user interaction (see System Dialog). The backlight is re-enabled (switched on) if the touch screen is touched, or a mouse button is pressed.
As it may happen that the backlight does not start properly when it is re-enabled, the backlight is reset (switched off and on again) if the touch screen (or the mouse button) is continuously pressed for more than 5 seconds.

5.4 Status Display

This dialog is displayed as the default. The status of the active sensors, including the most recent measurements, is displayed together with the general system status (UMB and Uplink communication).



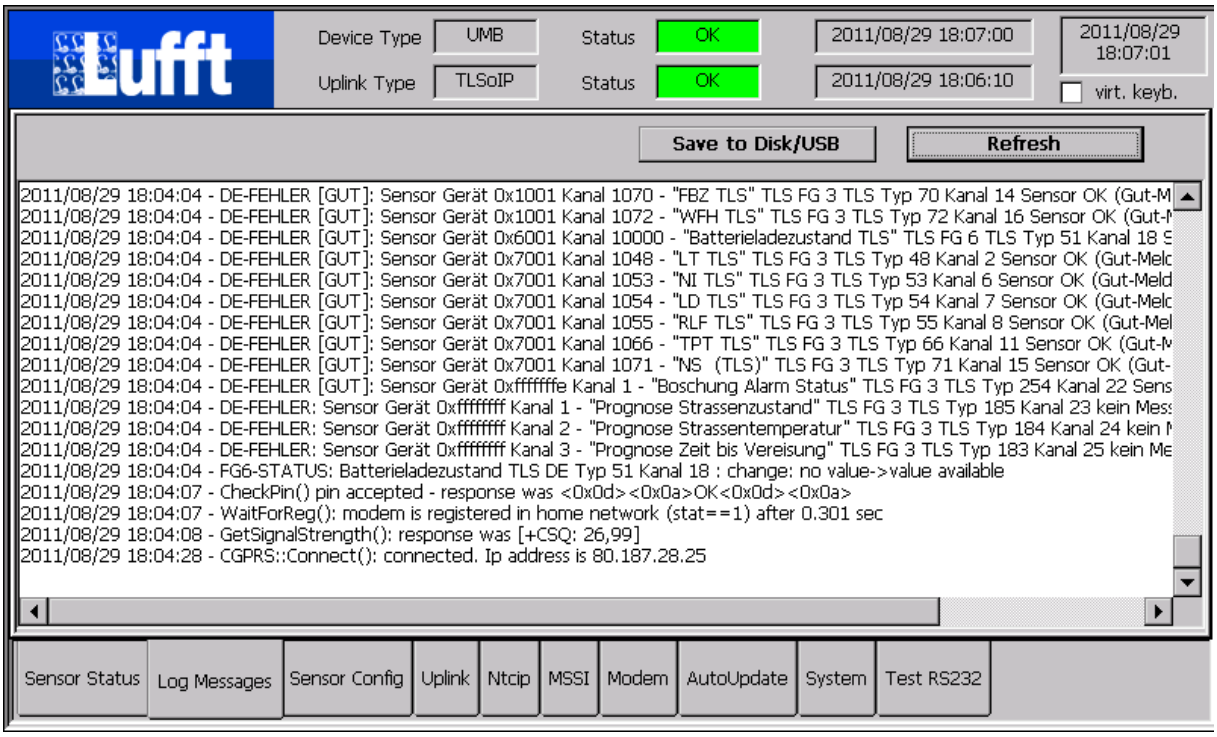
If a sensor value is converted by scaling or value mapping (see below), the calculated value and the original value (in brackets) are shown.

If a range violation for a TLS data type is detected for a value, the value is highlighted in red (the corresponding DE error status is then reported for the sensor).

If the UMB device reports an error value for a sensor channel, the UMB error code is displayed in the “Value” column, highlighted in red. If an UMB device does not report a value for a sensor channel at all (e.g. because the device does not respond) the complete sensor data line is highlighted in red.

5.5 Log File

By clicking the “Refresh” button, the last 200 entries in the error log are displayed.



Save to Disk/USB: saves the error log file(s) to the internal “nonvolatile” memory (e.g. for error analysis). If an USB stick is present, the file(s) can be saved to the USB stick as well

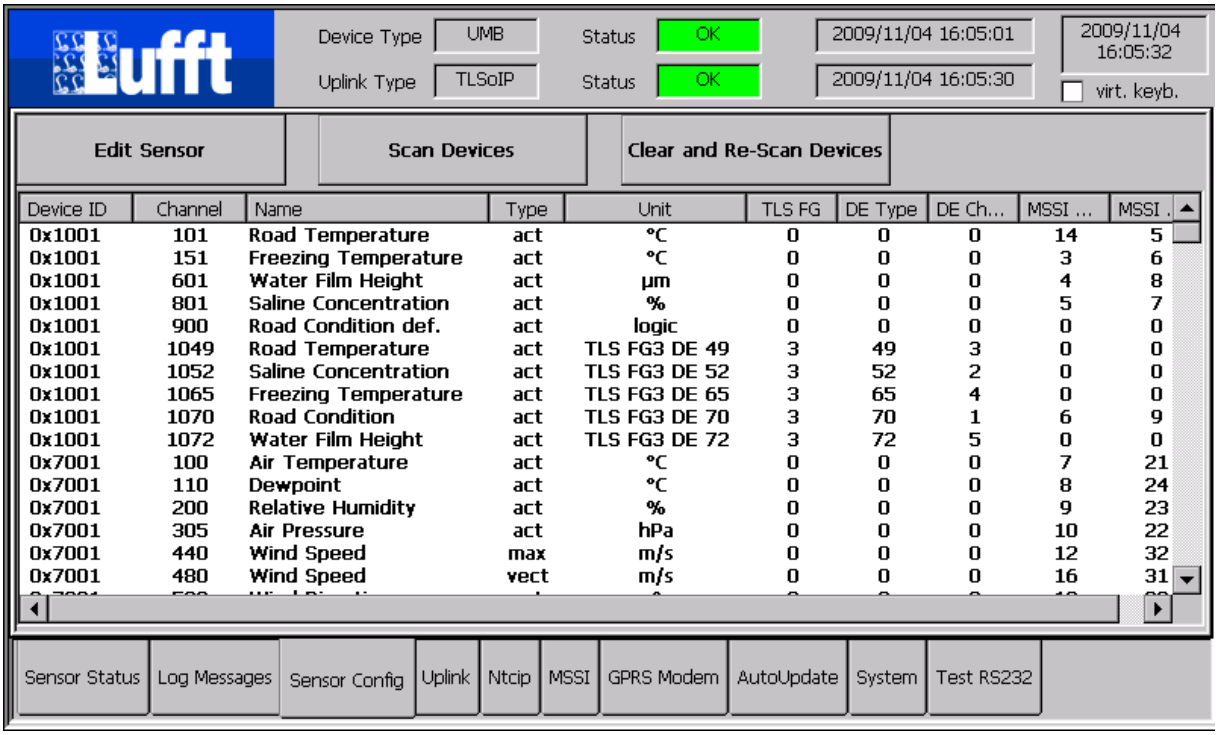
5.6 Sensor Configuration

This dialog displays all channels of the attached UMB devices. Inactive channels are shown in gray, active channels in black.

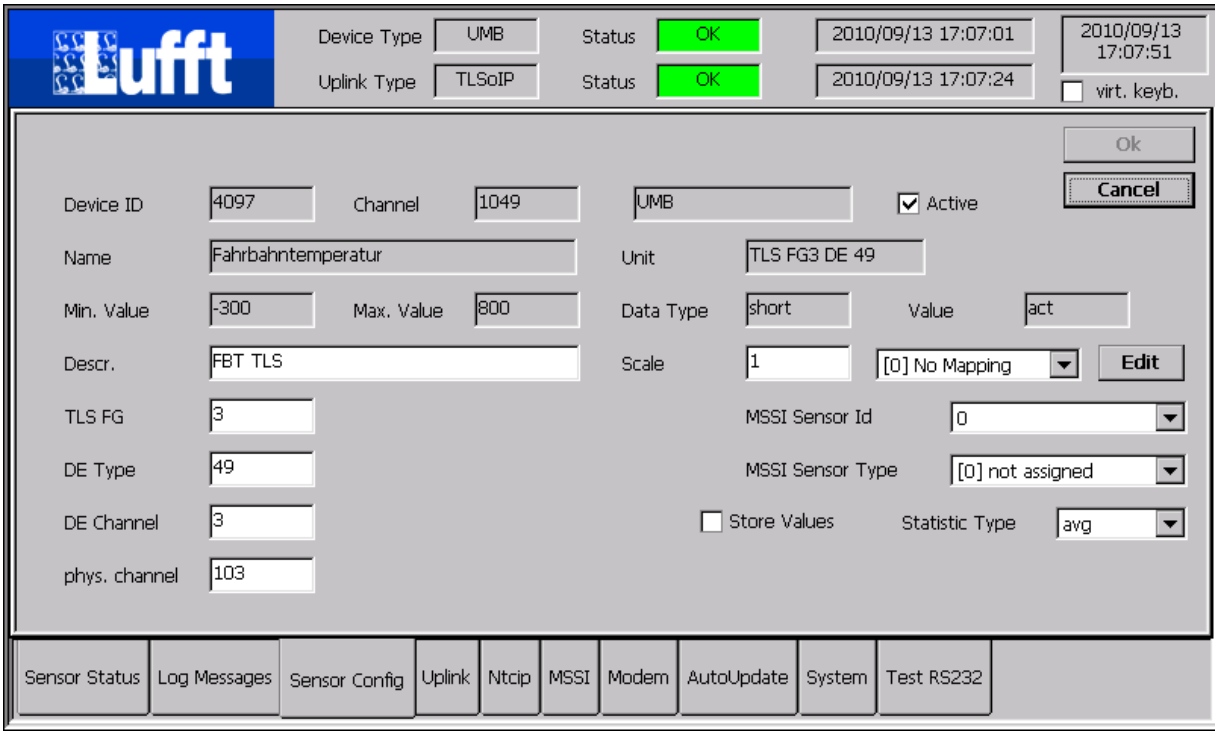
Active channels are displayed at the top of the list.

After starting the application for the first time it may take some time for the system to read the configuration of all UMB devices. You can update the display by clicking “Edit Sensor” if no sensor is displayed in this dialog.

To edit the configuration of a channel/sensor, highlight the corresponding entry on the list and click “Edit Sensor”. Alternatively you can double-click on the entry.



The following attributes can be configured for each sensor channel:



- **Sensor/channel active/inactive** (Attention: see note below)
- **Name:** The name displayed in LCom
- **Scale:** scale factor for the value reported by the UMB device
- **Uplink-Protocol parameter for this sensor channel**, e.g. for TLS:
    - TLS FG: The function group (3 or 6)
    - TLS Type: The TLS type
    - TLS Channel: The TLS channel
    - Phys. Channel: the “physical” TLS channel (not relevant for LCom, but required by the TLS protocol)
- **Value mapping** (conversion of the sensor value via a mapping table or via offset and scaling) – see below.
- **MSSI Sensor-ID:** the MSSI Sensor ID (see below)
- **MSSI Sensor-**Type: the MSSI Sensor Type (see below)
- **Store Values:** if the value store is active (see System) storing of measure values can be activated/deactivated for the sensor channel
- **Statistic Type:** determines, how measure values are calculated if - e.g. via MSSI – data is retrieved from the measure store in intervals greater than the storing interval (which is fixed 1 minute) (see MSSI). Following statistic types are supported:

- **Avg:** the average value over all values in the “reporting interval” is calculated
- **Sum:** the sum value over all values in the “reporting interval” is calculated
- **Min:** the minimum value over all values in the “reporting interval” is calculated
- **Max:** the maximum value over all values in the “reporting interval” is calculated
- **Mod:** the modal value (i.e. the value most often appearing in the interval, for coded values like road condition or precipitation type) over all values in the “reporting interval” is calculated
- **Vect:** the vectorial average value over all values in the “reporting interval” is calculated
- **Last value:** the last value in the “reporting interval”

Note: **The TLS channel configuration MUST be unique, e.g. the same channel must not be assigned more than once.** This is independent of the active/inactive status of a sensor channel!
Each channel with a valid TLS configuration (FG, type and channel != 0) is treated as “configured for TLS”, even if the channel is disabled (a channel can also be enabled/disabled via TLS protocol).
The TLS types supported by LCom for sensor data are listed in Appendix: Supported TLS DE Data Types. TLS FG, type and channel must be set to 0 if a sensor value should be read by the UMB device but not reported via TLS.
So if you want to assign a different UMB sensor channel to a certain TLS channel/type, it is not sufficient to configure the “old” UMB sensor channel as inactive; rather the “old” UMB sensor channel must then be configured with TLS FG=0, Type=0 und Channel=0 (and hence no longer as “valid TLS sensor”) before you can assign the same TLS channel to a different UMB sensor channel.

Note for TLS FG6:
From LCom Version 1.3.9 on, LCom supports – besides the door contact (type 48) and the “extended power supply” status (type 151) the following DE Types as well:

Type 49: temperature control
Type 50: light
Type 51: (standard) power supply
Type 52: heating
Type 53: ventilation
Type 54: surge protection
Type 55: theft/vandalism

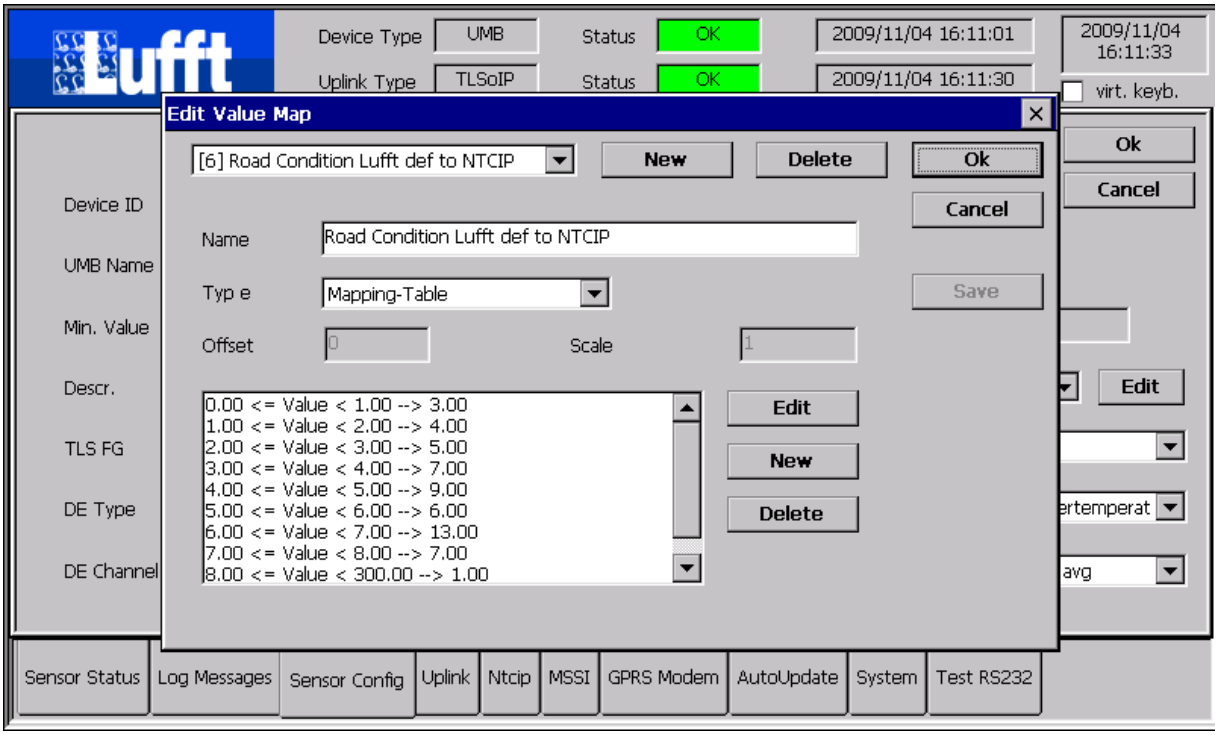
Mapping of the “source” values from the assigned UMB sensor channel to the appropriate TLS coding for each type may have to be done by configuring an appropriate value mapping for the sensor.
Exception: “extended power supply” (type 151): no value mapping (even if configured for the UMB sensor channel) is applied, but the “source” value is processed using the special rules for this user defined TLS type.
For door contact (type 48) channels, the input value (after processed by a configured value mapping if appropriate) is always negated (i.e. a value != 0 is treated as “door closed”, a value == 0 as “door open”).
Furthermore, multiple channels of the same DE type are now supported for TLS FG6.

Note regarding the MSSI sensor configuration:
The MSSI protocol (see below) for the transmission of measured data and camera images is supported from LCom Version 1.3.0. The MSSI protocol can be enabled/configured in addition to an alternative “uplink protocol” (such as TLS), or as the only protocol (if no other uplink protocol is active).

A sensor channel that has a “MSSI Sensor ID” and a MSSI sensor type assigned (i.e. id != 0 and type != 0) is “presented” via MSSI, i.e. the sensor status and the measure value are transmitted.
For most sensor channels, the MSSI sensor type and the MSSI sensor id will be assigned automatically.

5.6.1 Value Mapping

Value mapping allows coded values, such as road condition and precipitation type, to be converted or adjusted. Furthermore, an offset (for additional calibration of a measurement, or unit conversion) and further scaling of the value can also be performed here.



Note: The sequence of the calculation is as follows:

1.) Scaling as specified in the sensor configuration (result = input value * scale factor)

2.) Value mapping calculation

   a. Scale/Offset:

      Result = Offset + (input value * scale factor)

   b. Mapping via values table:

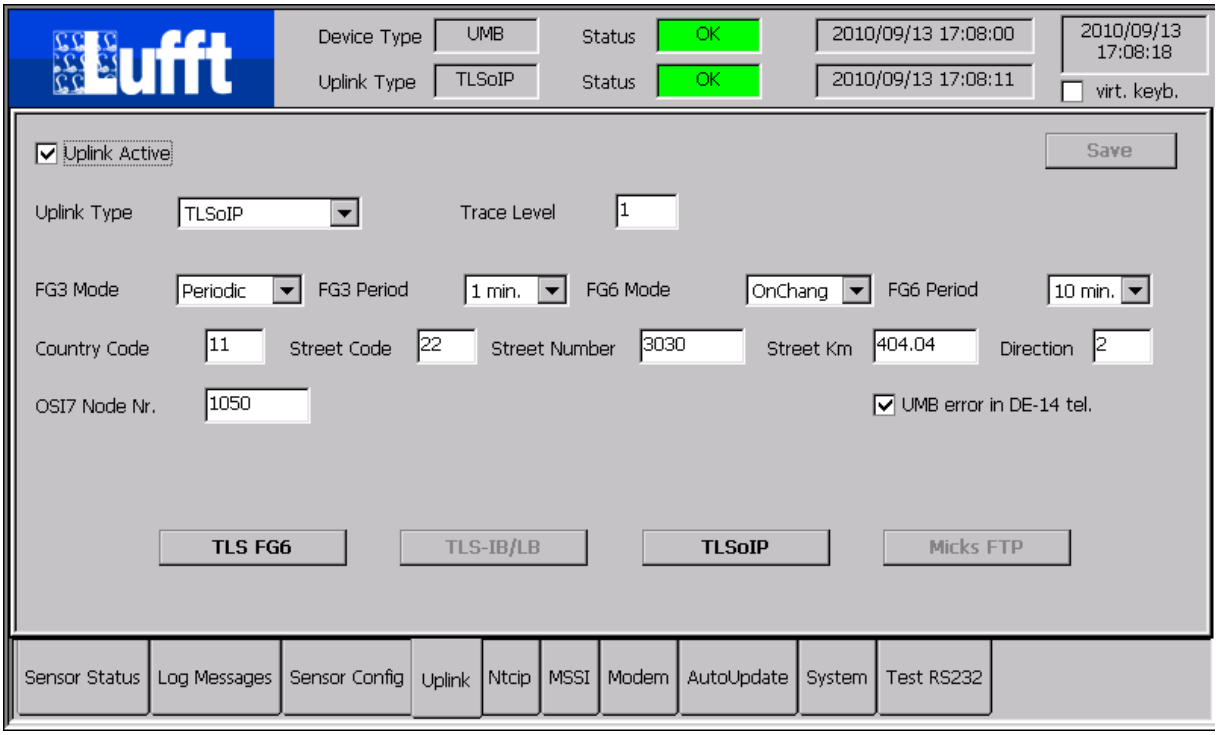
      The values table is searched for an entry which meets the specified condition. If such a value is found, the result value is the corresponding value of this table entry.

      If **no** entry corresponding to the input value is found, the input value is not changed.

5.7 Uplink-Type and common TLS Parameter

The parameters for the Uplink protocol are configured via “Uplink”. At present “TLS” (TC 57), “TLSoIP”, “NTCIP” and “Micks FTP” are supported.

If NTCIP is selected, all TLS parameters are disabled. The parameters for NTCIP are set in the dedicated “NTCIP” dialog (see below).



- Uplink type: TLS-INSELBUS, TLSoIP, TLS-LOKALBUS, Micks-FTP or NTCIP.
- Trace level: Trace level for the transfer protocol (not yet fully implemented).

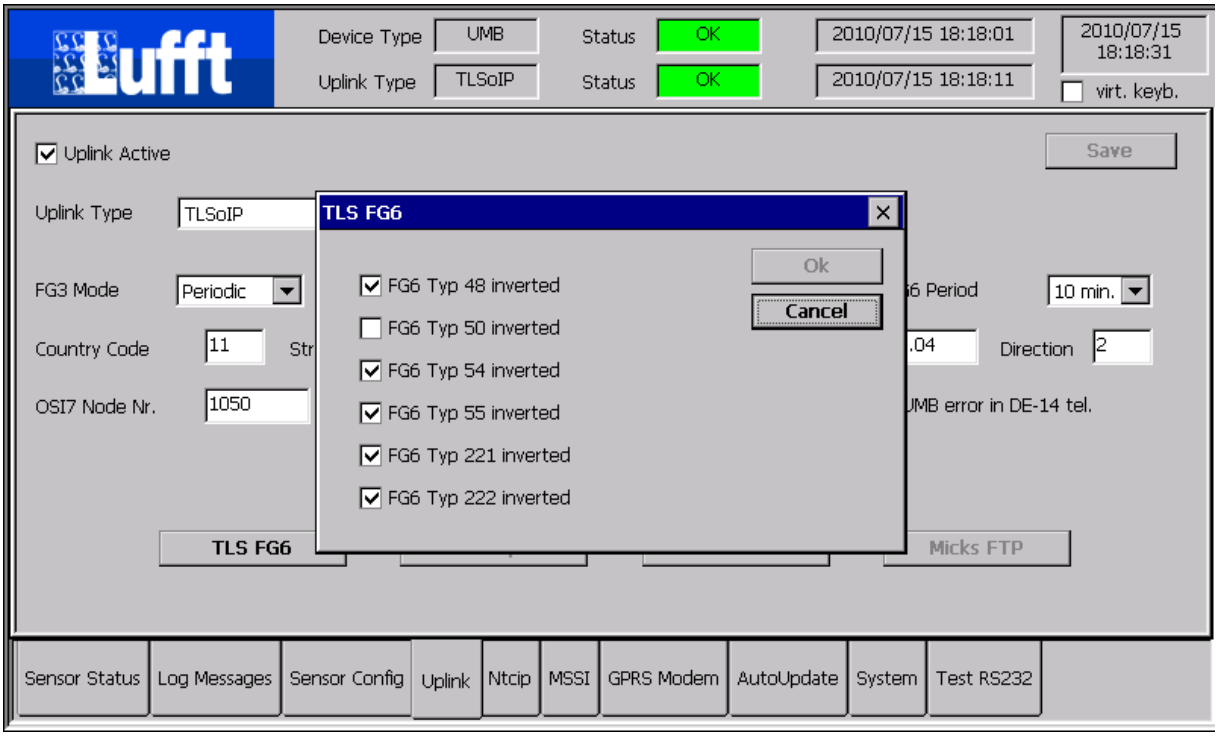
Common TLS parameters are:

- FG3 Mode: The transfer mode for the FG3 data: “Periodic” or “On Request”.
- FG3 Period: The time period in between transmissions for the “Periodic” transmission mode.
- FG6 Mode: The transmission mode for the FG6 data: “Periodic”, “On Request” or “On Change”.
- FG6 Period: The time period in between transmissions in “Periodic” transmission mode.
- OSI7 node number: The unique OSI7 node number for the SM/EAK.
- OSI2 address: The unique OSI2 address of the device on this Inselbus.

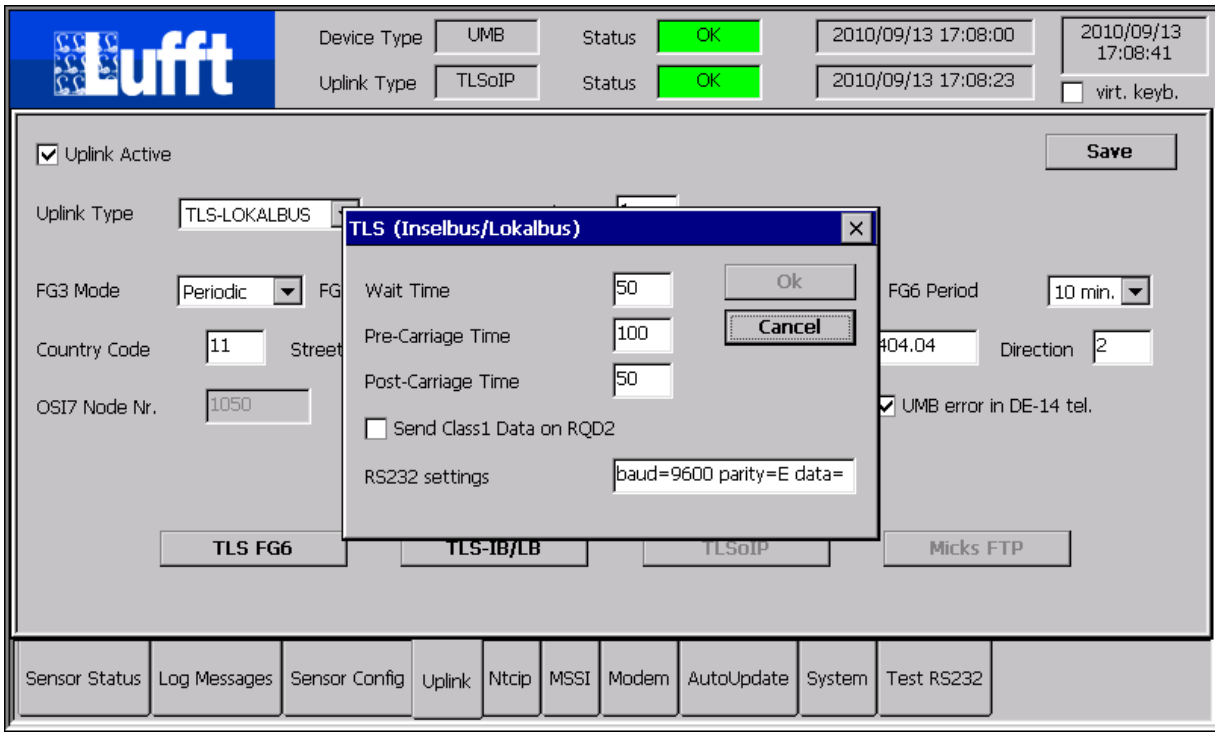
- GEO data:
  Country code / Street Code /Street Number / Street Km and Direction according to TLS type 36.
- UMB error in DE-14 tel.: If the UMB device reports an error value, this parameter can be used to control whether the error byte should be included as an additional “manufacturer specific” error in the extended DE error message (type 14). (see Appendix “extended error message DE-Type 14”)
- Check DE-channel in „set op param:
  if this option is selected, the „DE-Channel“ assignment in the „set op param“ command is checked. If the DE-Channel is set (other than 255 = all), the command is rejected, otherwise the command is applied to all channels of the specified “FG” (Lcom only supports op params per FG, not per channel).

5.7.1 TLS FG6 Parameter

Parameter for supported FG6 data types can be set here, i.e. whether the sensor values should be inverted before transmission.



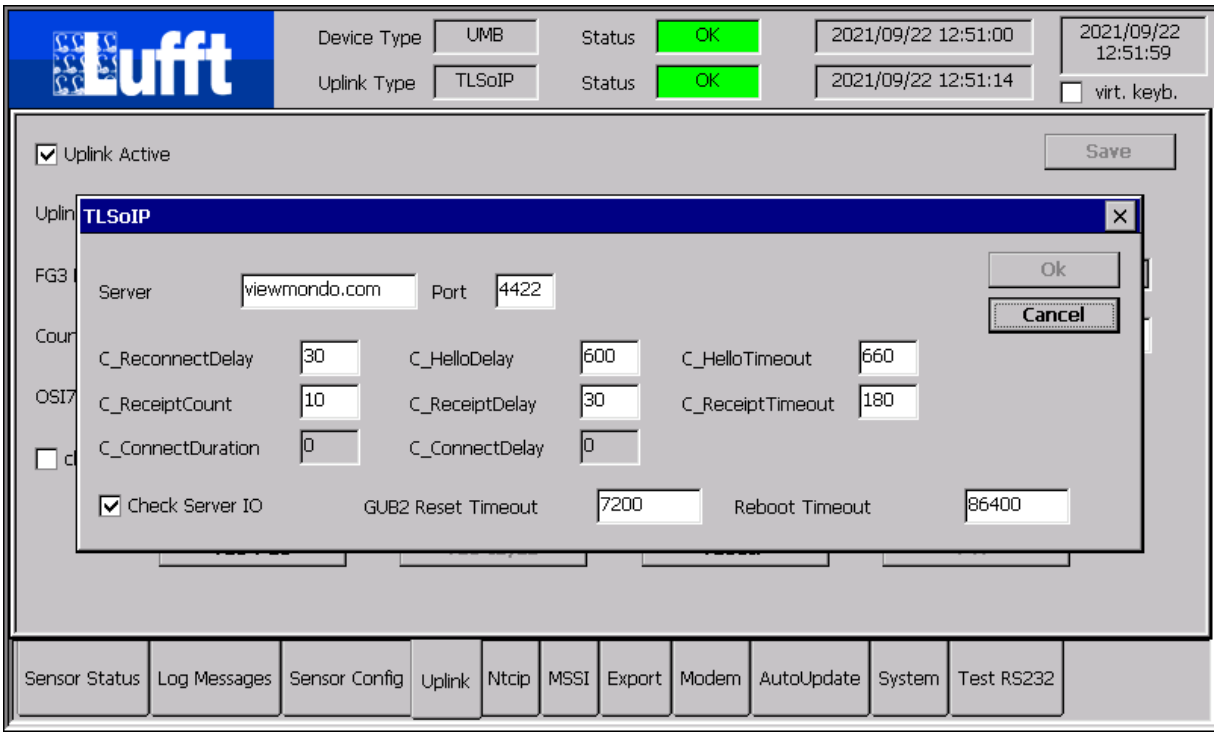
5.7.2 TLS LOKALBUS/INSELBUS Parameter



TLS TC57/Inselbus/AUSA parameters: The timing parameters for Inselbus communication are site and line-dependent and must be adjusted if necessary.

- Wait time: The time waited after receiving an error-free telegram before sending the next telegram (response).
- Pre-Carriage time: time/delay between switching on the carrier signal and sending the first telegram byte.
- Post-Carriage time: (additional parameter, not specified in the standard); time/delay after sending the last byte of the telegram, before switching off the carrier signal.
- Send Class1 data on RQD2: Controls whether data of transmission class 1 are also transmitted on RQD2 requests from the exchange (DE error messages and FG6 data in FG6 “Change” mode) (RQD2 is then treated as RQD3)
- RS232: Parameter for serial connection.
  For Inselbus: baud=1200, parity=E, data=8, stopp=1
  For Lokalbus: baud=9600, parity=E, data=8, stopp=1
  Default values are set when Uplink protocol is changed.

5.7.3 TLSoIP Parameter

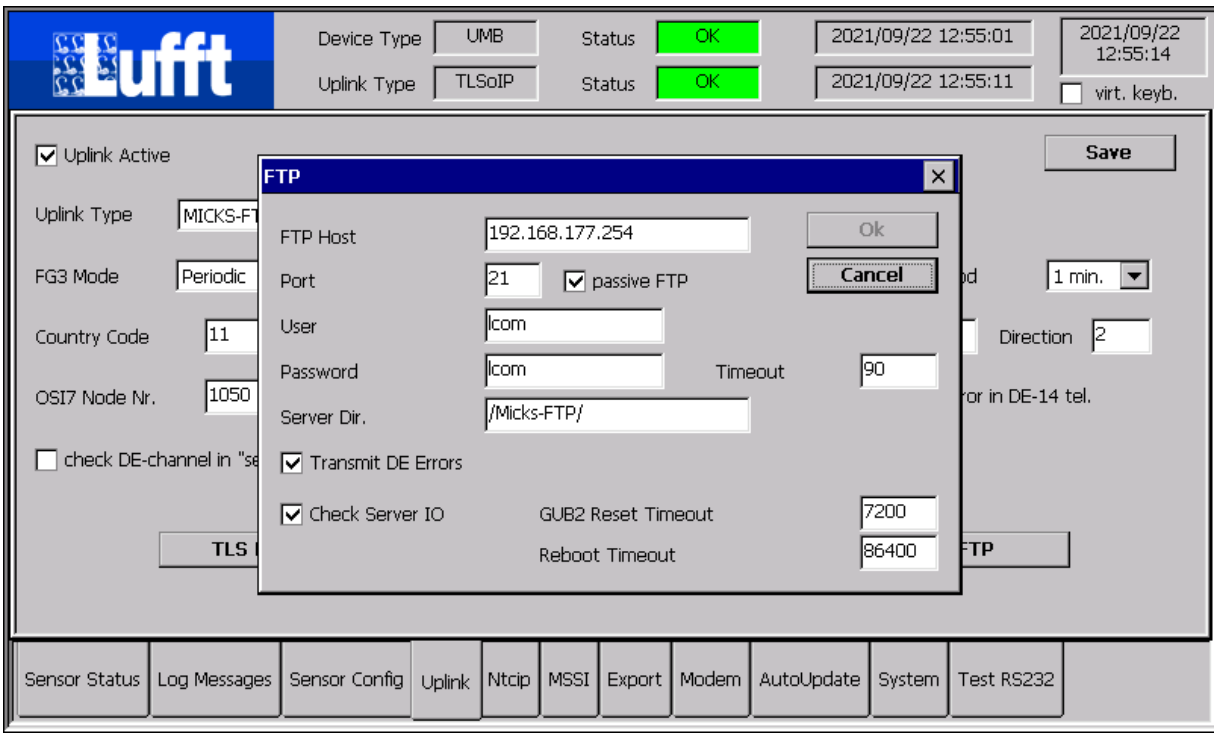


Parameters for TLSoIP according to the TLSoIP Specification (AsfinAG). At the moment only the “bidirectional connection” with a permanent connection to the server is supported.

- C_ConnectDuration: Not used (for “unidirectional connection” only)
- C_ConnectDelay: Not used (for “unidirectional connection” only)
- C_ReconnectDelay: Minimum time between two connection attempts
- C_HelloDelay: Time between “Keep Alive” telegrams
- C_HelloTimeout: Timeout for receiving of “Keep Alive” telegrams
- C_ReceiptCount: Number of data telegrams after which a receipt is sent or expected
- C_ReceiptDelay: Time after receiving a data telegram after which a receipt is sent, even if C_ReceiptCount was not yet reached
- C_ReceiptTimeout: Timeout for receiving a receipt
- Check Server IO: monitor server I/O and reset the modem/router power supply (GUB2) or reboot the LCom after configurable time (see below).
- GUB2 Reset Timeout: minimum time interval between GUB power resets (modem/router) on communication errors.

- Reboot Timeout: minimum time interval after last reboot for a reboot on communication error. 0 = no reboot!

5.7.4 Micks FTP / TLS Dump Over FTP Parameter



Parameters for the file transfer in “Micks data format” via FTP

- Ftp host: the ip address or server name for the ftp host
- Port: the ip port
- Passive FTP: use a passive ftp connection
- User: ftp user
- Password: ftp password
- Timeout: timeout for ftp communication (in seconds)
- Server dir: directory on server (Note: filenames will be build automatically using KN<osi7 node nr>_<UTC timestamp>)
- Transmit DE Errors: if this option is selected, DE-Error messages are send (e.g. if a sensor is defective) besides the DE-Result messages (the measure values)
- Check Server IO: monitor server I/O and reset the modem/router power supply (GUB2) or reboot the LCom after configurable time (see below).
- GUB2 Reset Timeout: minimum time interval between GUB power resets (modem/router) on communication errors.

- Reboot Timeout: minimum time interval after last reboot for a reboot on communication error. 0 = no reboot!

Note: as it is not possible to synchronize the LCom clock via FTP, it is recommended to use an NTP Server to synchronize the LCom clock (see NTP Server)

After changes to the uplink configuration the communication is interrupted briefly and then restarted.

5.8 NTCIP

LCom supports NTCIP via SNMP over LAN (Ethernet). The STMP protocol layer is not supported.
In order to use NTCIP protocol with the LCom, the LCom must be connected via LAN to the server. A router/gateway can be used to connect the LCom indirectly to the server/internet.
The TCP/IP port for SNMP (UDP port 161) must be redirected from the router to the LCom.

Alternatively, an analog “dial in” modem for a PPP connection may be used (see modem configuration).

The SNMP protocol on the LCom is based on the Microsoft SNMP library and is implemented by an “extension agent”. This extension agent (SnmpNtcipAgent.dll) is called by the Microsoft SNMP framework when a request for an OID from the NTCIP subtree “iso.org.dod.internet.private.enterprises.nema.transportation” is received. The agent is independent of the LCom application and starts as part of the Microsoft SNMP protocol stack on Windows CE system startup. Various configuration and data files are used as an interface between the LCom application and the agent.

The configuration files for the SNMP agent are managed via the corresponding configuration dialogs in the LCom application and (as the other LCom configuration files) are stored on the internal flash drive (\FFSDISK directory).

The LCom application periodically (whenever the USB device requests new measurements – that is every minute) writes the measurements (already converted to the corresponding units for NTCIP) to a temporary file in the \Temp directory (i.e. to the LCom RAM).

The LCom’s network configuration must be configured for the specific LAN environment (IP address, default gateway, DNS server etc.). If the LCom is connected via a GPRS/CDMA router and the Internet, the GPRS/CDMA router must either work with a static IP address or must support DynDNS (or a similar service) in order for the server to open a TCP/IP (SNMP) connection to the LCom.

The LCom's network configuration is maintained via the Windows CE control panel (can also be started via the LCom system settings and "Control Panel" button).

Note that changes made via the Control Panel to the Network Connection (the LAN Adapter is the DM9CE1 device) are NOT stored permanently unless the registry (where these values are stored) is saved.
The following steps are necessary to change and permanently store the network configuration:

a) configure the network to your needs via the WinCE Control Panel / Network Connections
b) Save the registry settings (permanently)
   If you started the Control Panel via "System" Dialog in LCom, you will be prompted to save the registry after the Control Panel has been closed.
   If you didn't start the Control Panel via "System" Dialog in LCom, you can save the registry by:
   type "ndcucfg" in the "cmd" shell window – this opens a special command interpreter "NetDCU Config Utility"
   type "reg save" – this saves the registry settings

c) Test the connection settings, e.g. by "ping"'ing a known host. You can open a "cmd" shell via Lcom "System" Tab, button "cmd". Type "ping <host or IP address>". If there is a response from the (named) host your network routing (gateway) and DNS setup is correct.

5.8.1 Supported NTCIP "OIDs"

The LCom basically supports all OIDs defined by the NTCIP Standard for ESS Stations (documents 1103v01-16a.pdf (TMP), 1201v0232f.pdf (Global Object Definitions), 1204v0426a (ESS), 2104v0111f.pdf (Ethernet Subnetwork Profile).

In Version 1.12.0, support for OIDs for TSS Stations based on NTCIP TSS 1209v0119f.pdf was added.

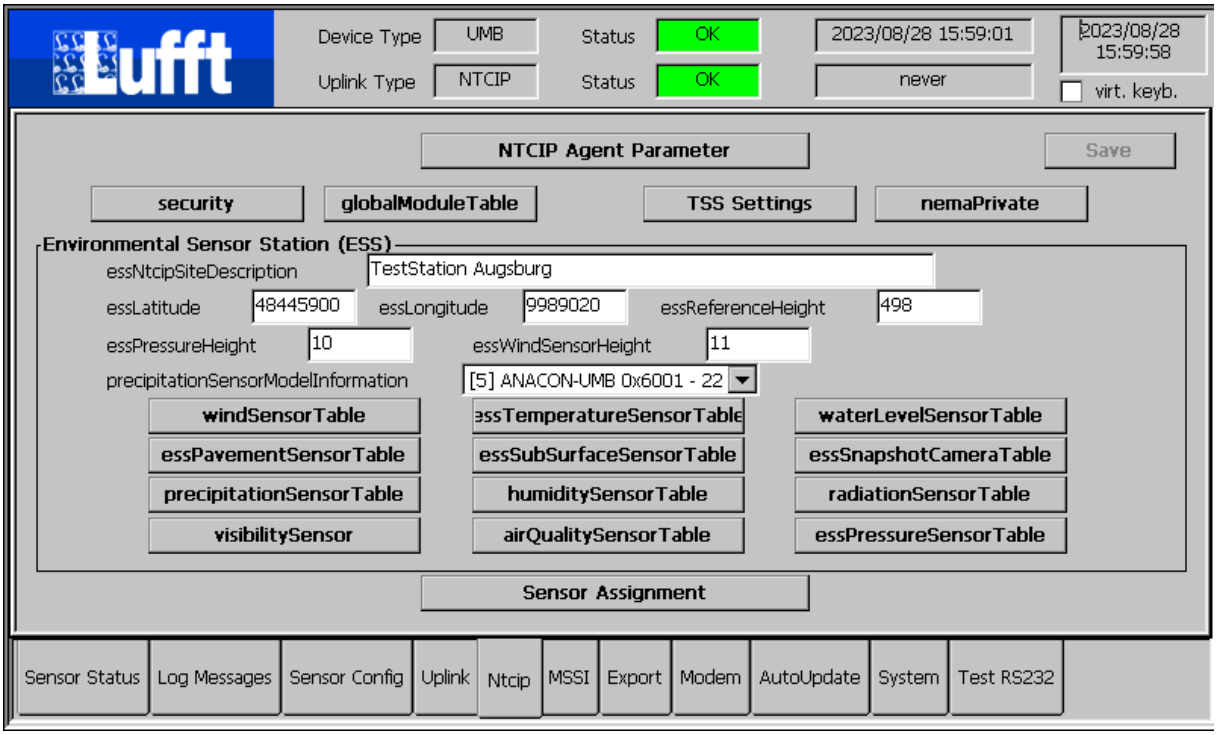
For details please see the listings below.

The LCom will only "show" those OIDs, that actually have sensors assigned (and are not "configuration items") if the configuration parameter "hide inactive oids" is set (which is default).

The LCom will hide (not support) OIDs that are specific to “mobile stations” if the configuration parameter “support mobile station oids” is not set (which is the default).
The LCom will hide (not support) OIDs that are specific to “staffed stations” if the configuration parameter “support staffed station oids” is not set (which is the default).
The LCom will hide (not support) OIDs that have status “deprecated” in NTCIP V2 MIB (1204v0426a.mib) if the configuration parameter “support deprecated oids” is not set (which is the default)

5.8.2 Configuration

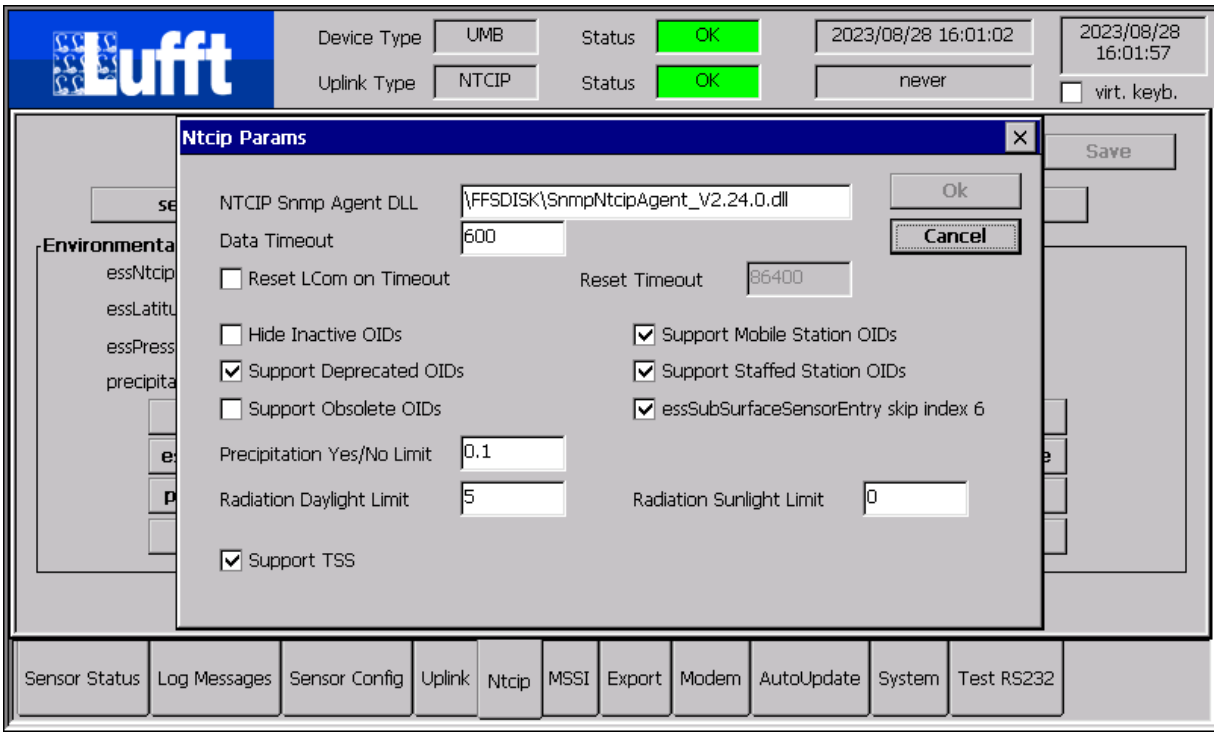
The “Ntcip” dialog on the LCom (or via the service program) is used to configure the NTCIP protocol parameters. The input fields of this dialog are only enabled if “Ntcip” is selected as the protocol in the “Uplink” dialog.



Note: The number of entries in the related tables, i.e. the number of sensors of corresponding type that are available in the system, is set by configuring the respective tables (windSensorTable, essTemperatureSensorTable etc.). Also, sensor values can only be assigned to previously configured table entries via “Sensor Assignment”. So before assigning the actual UMB sensors to the respective NTCIP OIDs, you need to set up the various “sensor tables” (to configure the number of wind sensors, temperature sensors, pavement sensors etc.).

Note for TSS: TSS values are retrieved from a Wavetronix sensor via an UMB Wavecon device. Data storage must be activated for these sensor channels in order to transmit these sensor values via NTCIP-TSS.

5.8.2.1 NTCIP Agent Parameters:



- **DLL Name**: The name of the DLL. As the system calls up this file on startup (and the .dll is in use all the time), a new file name must be used when updating to a new version (because the existing file cannot be overwritten as it is “in use”). This name can be defined here, and is changed with every new release of the NTCIP user agent.

- **Reset LCom on Timeout / Reset Timeout:** if this option is selected, the LCom will reboot/reset if no NTCIP request is received for the configured time interval.

- **Data Timeout**: If the measurements in the corresponding file are older than the seconds indicated here, the NTCIP SNMP agent discards the values from the file and delivers the corresponding error values instead.

- **Hide/Support xxx OIDs:** Defines which OIDs are “hidden” (not shown) from the NTCIP OID tree (see above).

- **essSubSurfaceSensorEntry skip index 6**: if this option is checked (which is the default), the NTCIP version 1, 3 and 4 definition for the

essSubSurfaceSensorEntries is used (i.e. without using index 6), If not, the NTCIP version 2 definition is used (see OID list below for details).

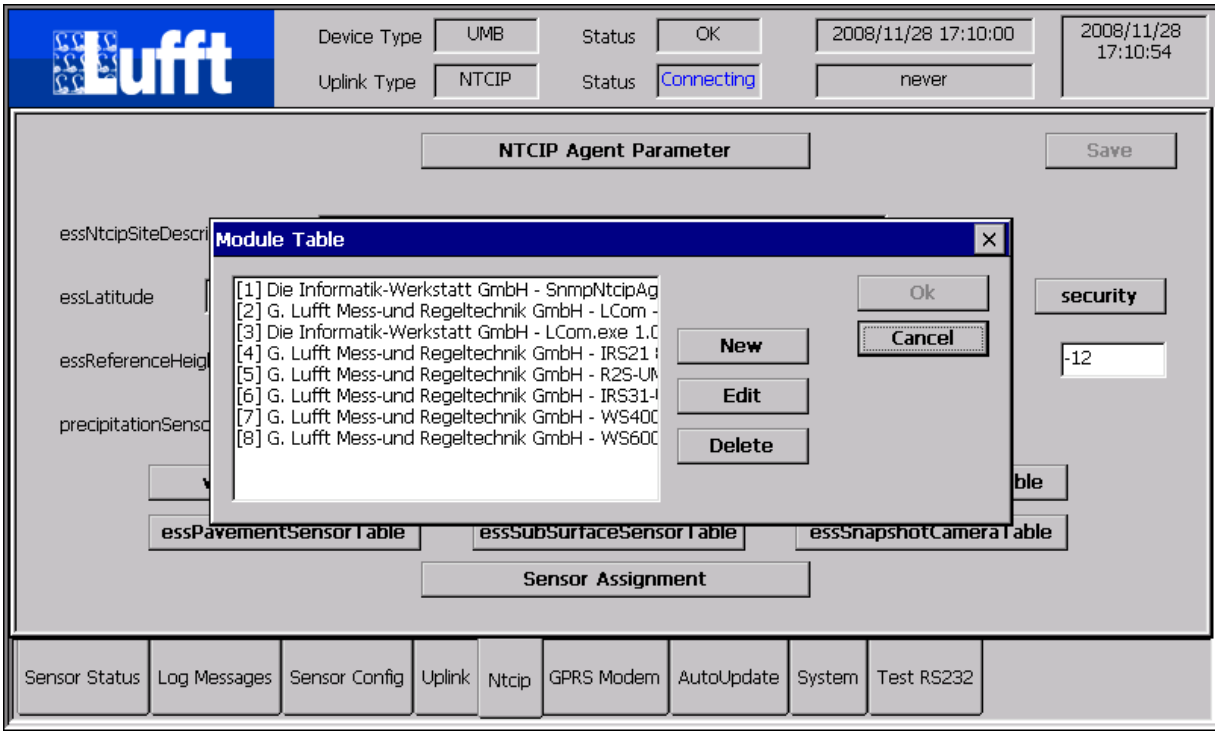
- **Precipitation Yes/No Limit:** Parameter for determining “Precipitation” yes/no (see table below)

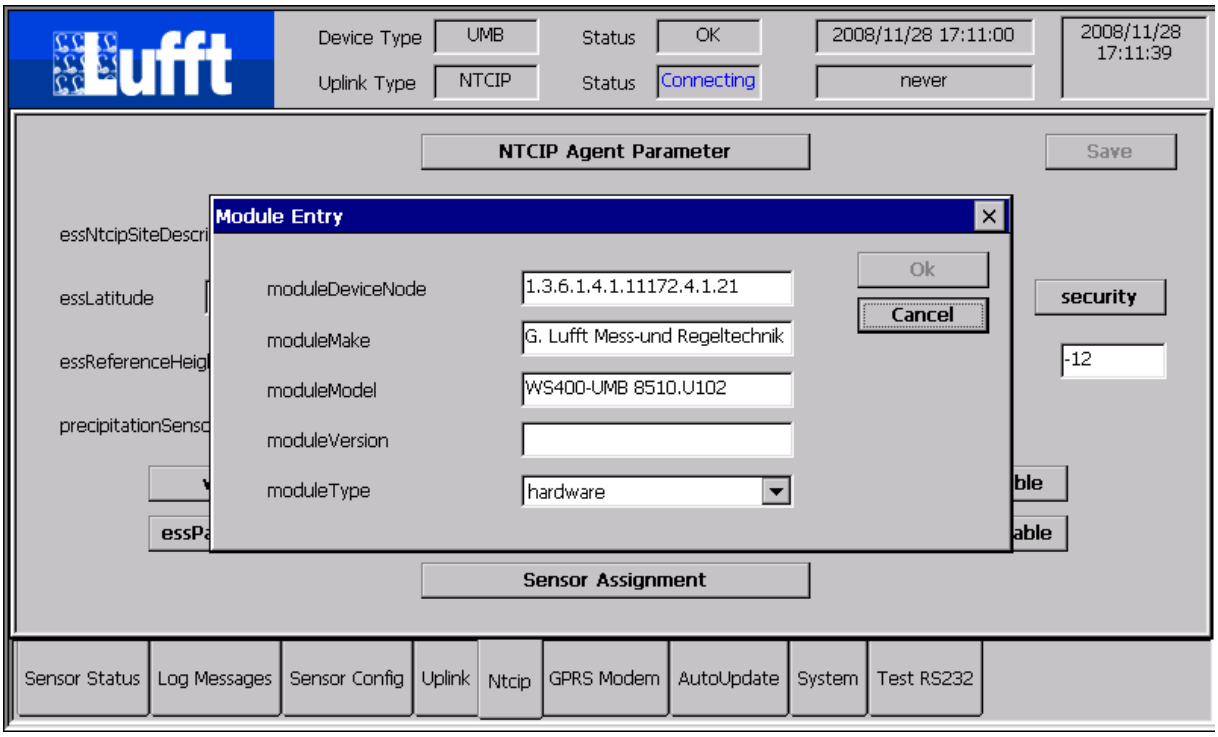
- **Radiation Daylight Limit:** Parameter for determining “Day/Night” (see table below)

- **Radiation Sunlight Limit:** Parameter for determining “Sunshine” yes/no (see table below)

- **Support TSS:** support OIDS for NTCIP 1209TSSv0119f

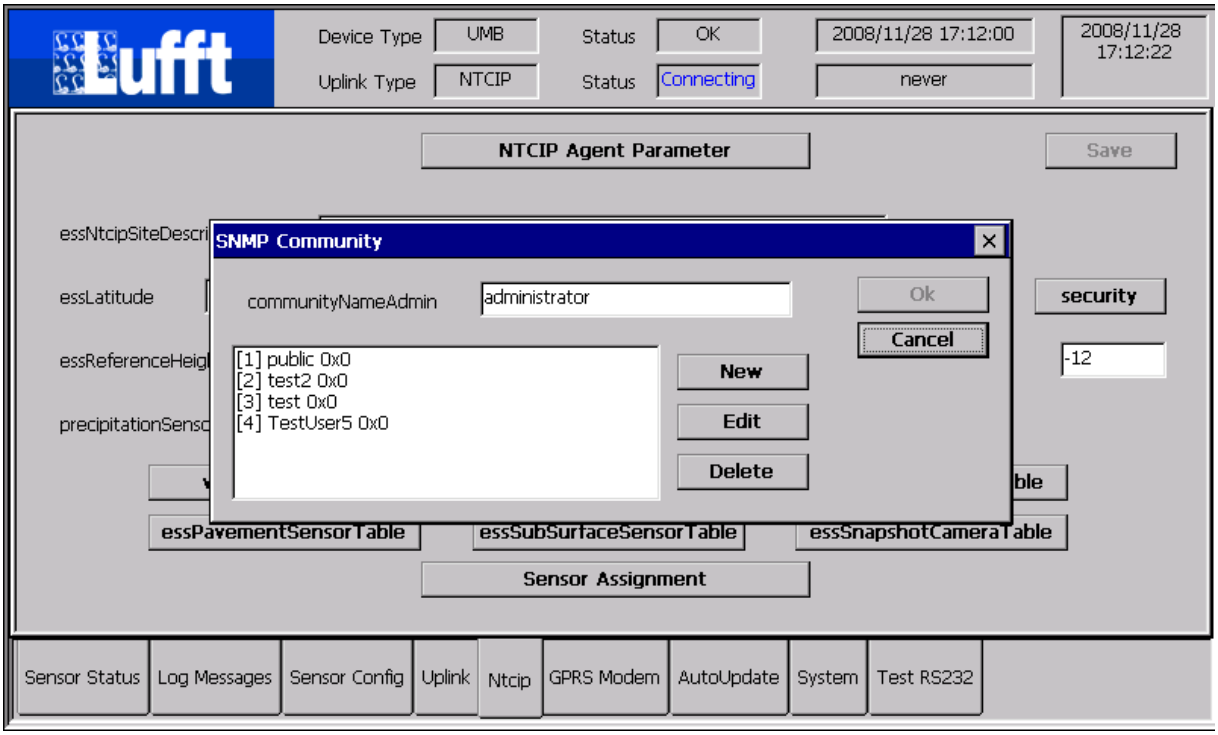
5.8.2.2 Global Module Table





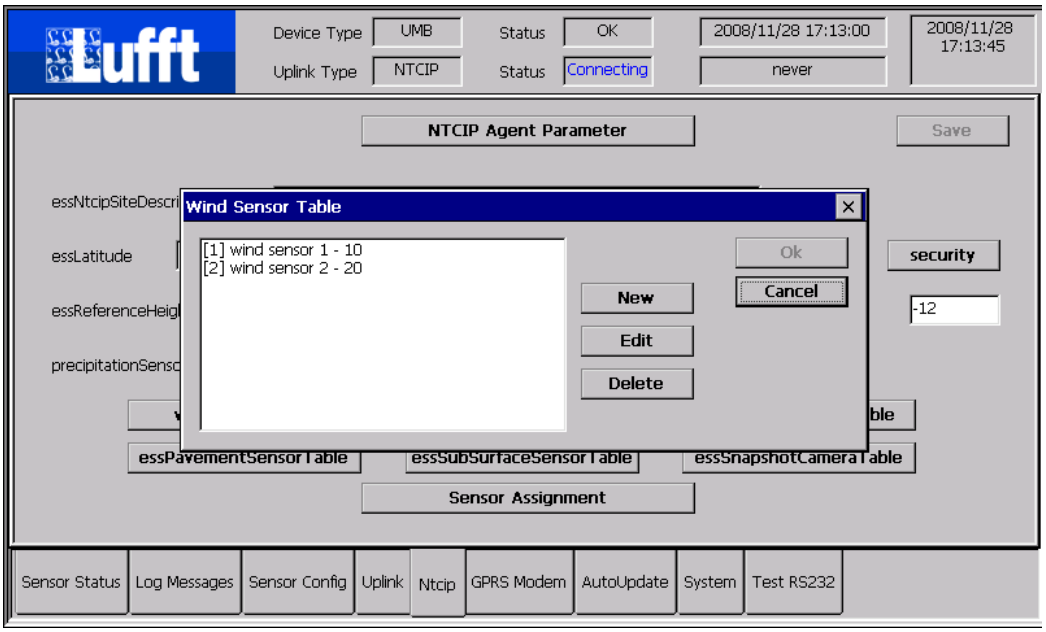
You can configure the entries for the “Global Module Table” here. Note: this table is for documentation/information purposes only.

5.8.2.3 Security



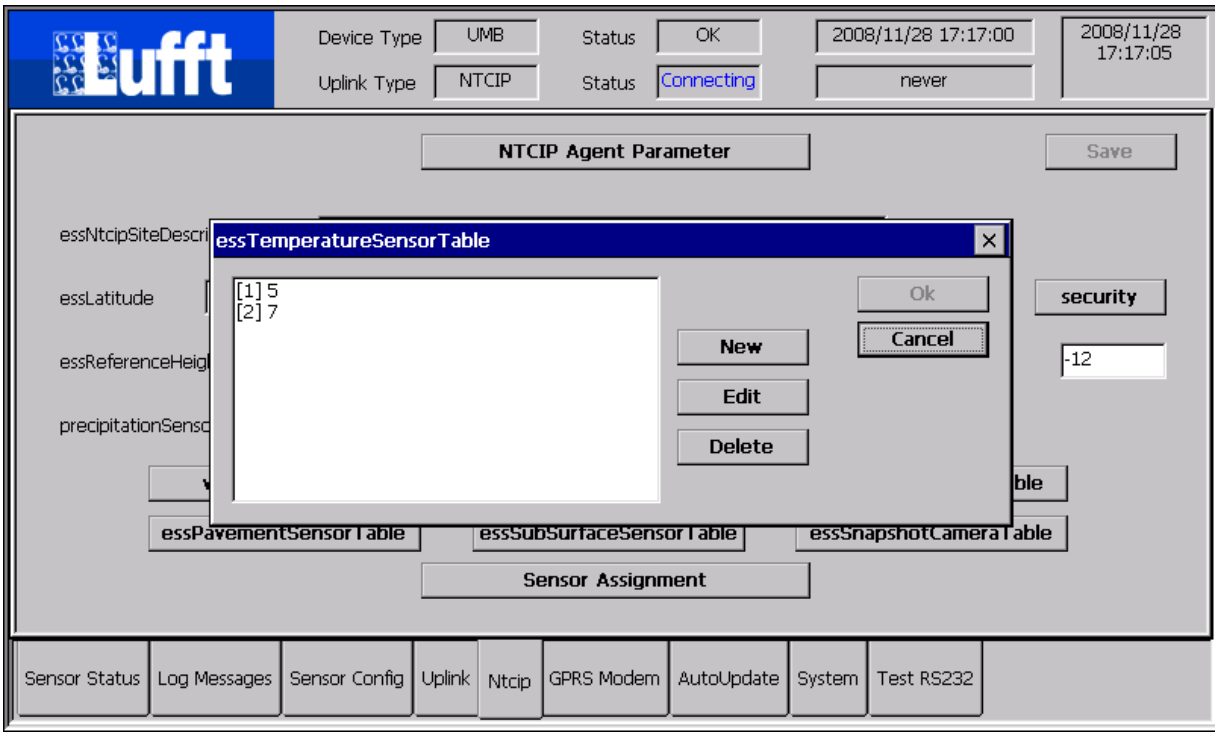
Here you can configure the entries in the SNMP security table that control the access to the SNMP protocol stack. Note: Changes cause a system reboot (after saving the changes).

5.8.2.4 winSensorTable



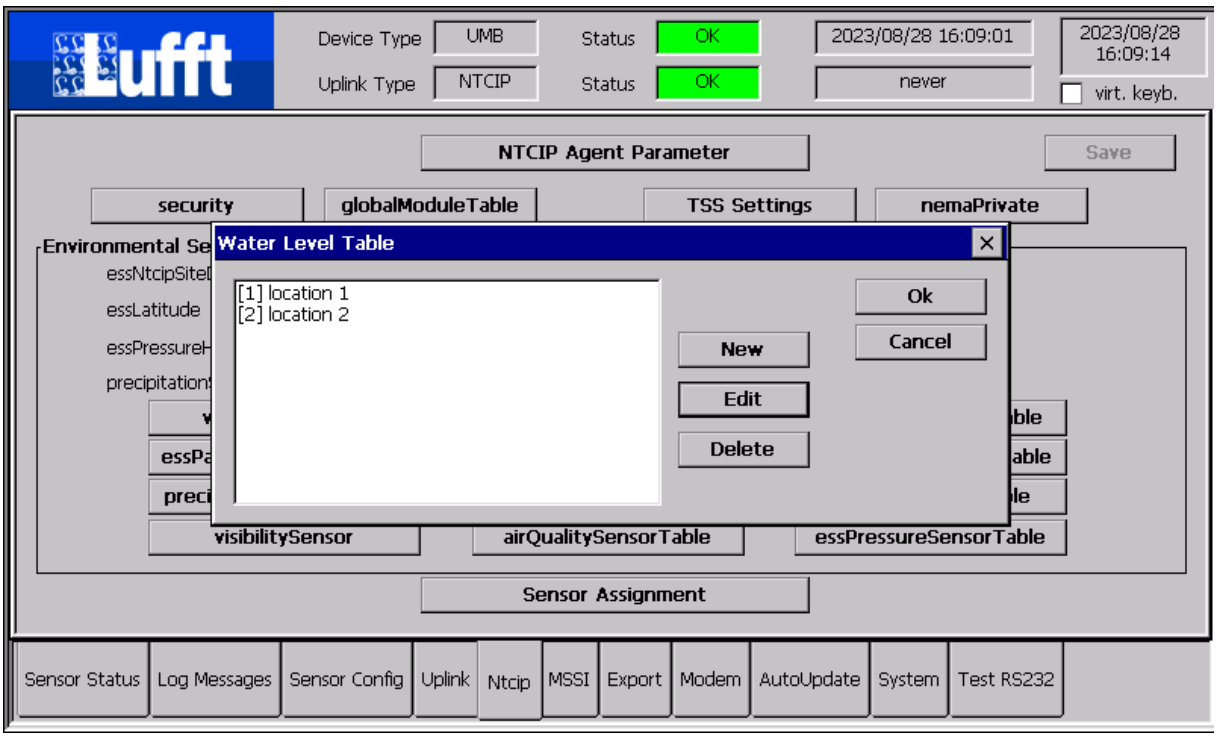
The meta data for each wind sensor (location information etc.) and thereby the number of sensors in the corresponding table is configured here.

5.8.2.5 essTemperatureSensorTable



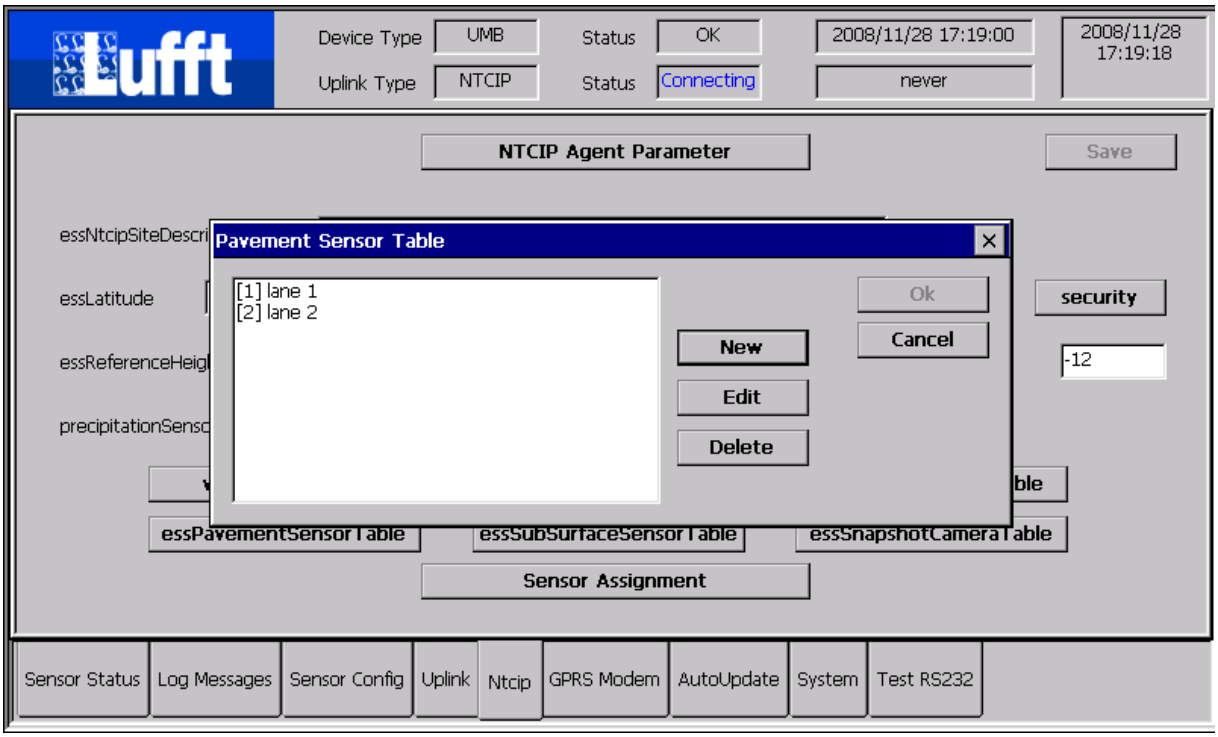
The meta data for each temperature sensor (height, location information etc.) and thereby the number of sensors in the corresponding table is configured here.

5.8.2.6 waterLevelSensorTable



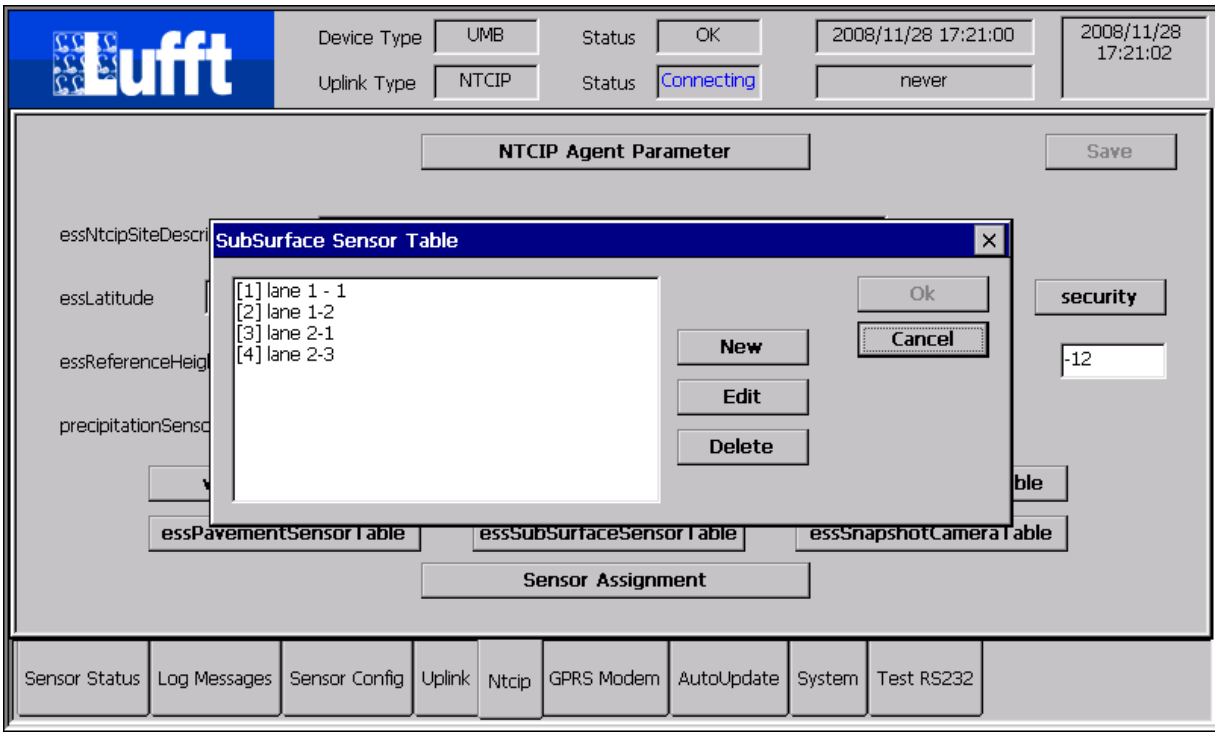
The meta data for each water level sensor (location information etc.) and thereby the number of sensors in the corresponding table is configured here.

5.8.2.7 essPavementSensorTable



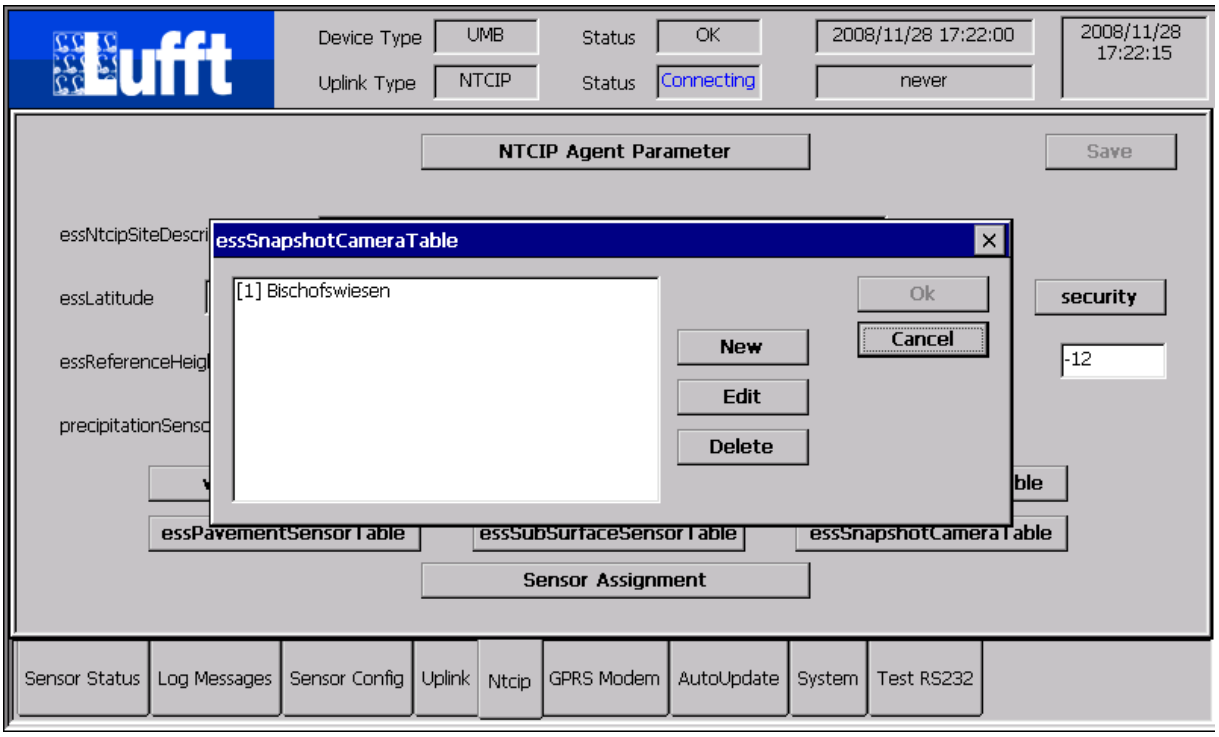
The meta data for each pavement sensor (location information etc.) and thereby the number of sensors in the corresponding table is configured here.

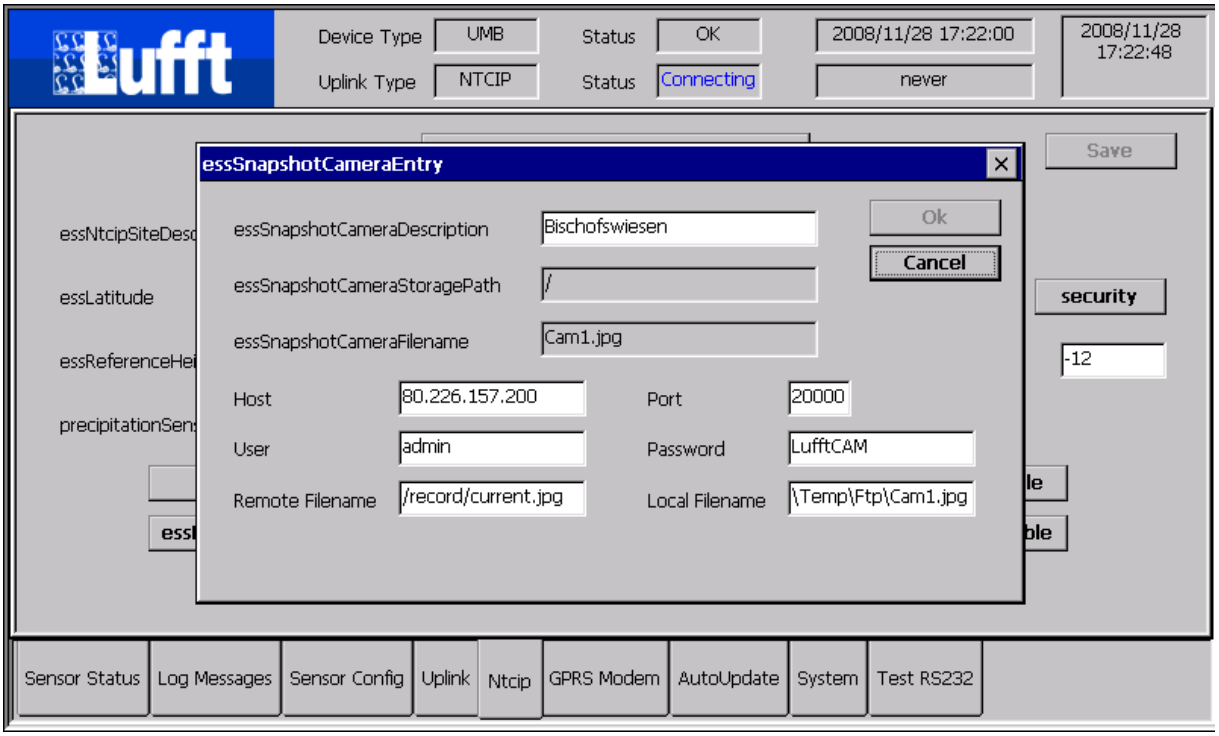
5.8.2.8 essSubSurfaceSensorTable



The meta data for each sub surface sensor (location information etc.) and thereby the number of sensors in the corresponding table is configured here.

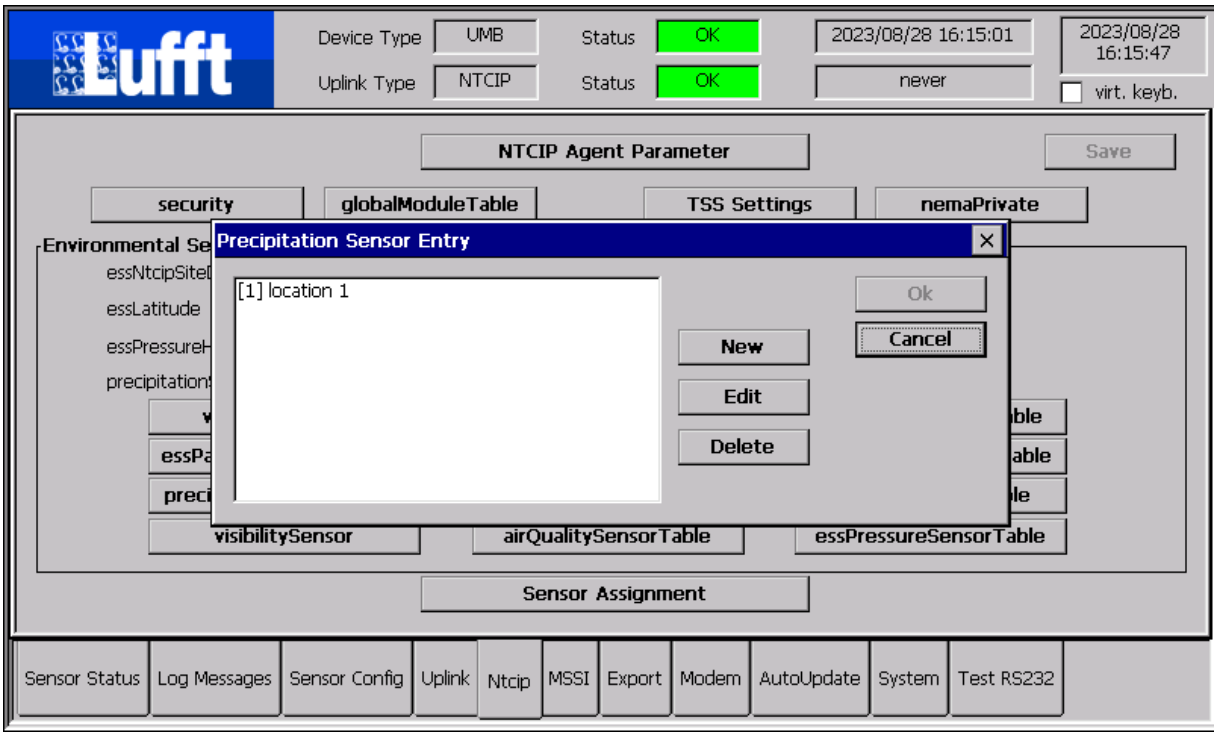
5.8.2.9 essSnapShotCameraTable





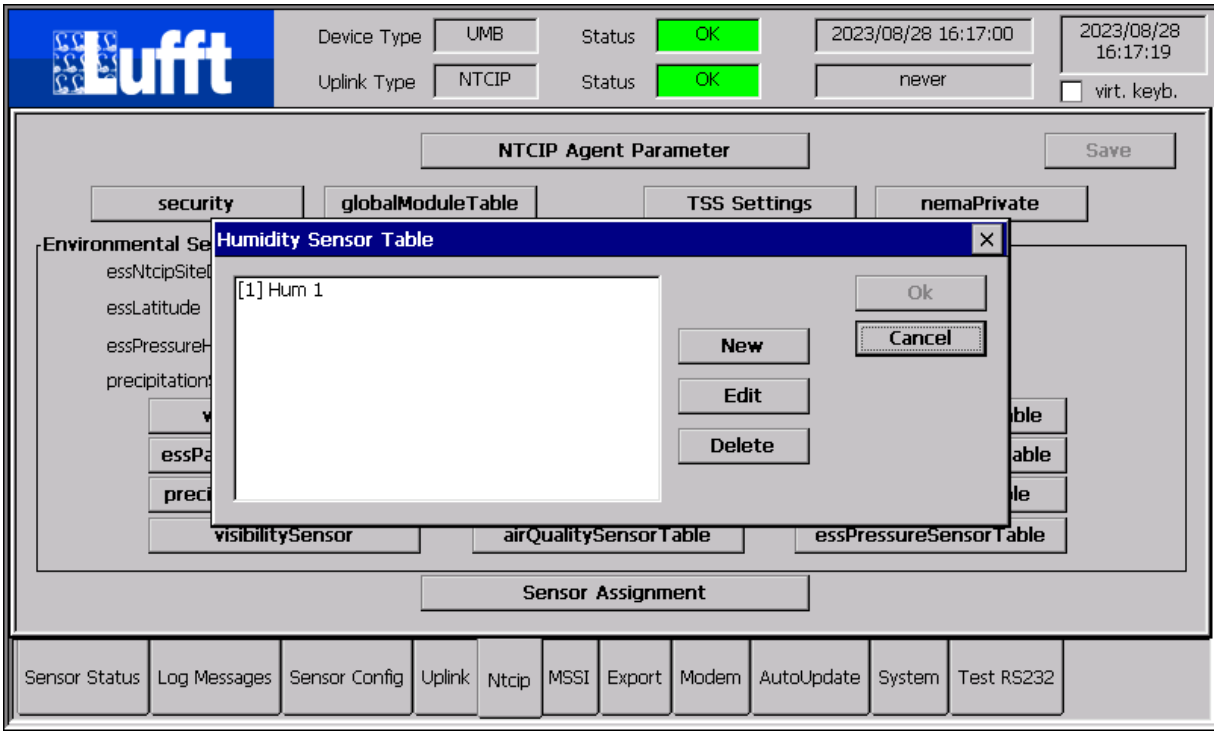
The camera(s) is/are configured here. See Camera Support below.

5.8.2.10 precipitationSensorTable



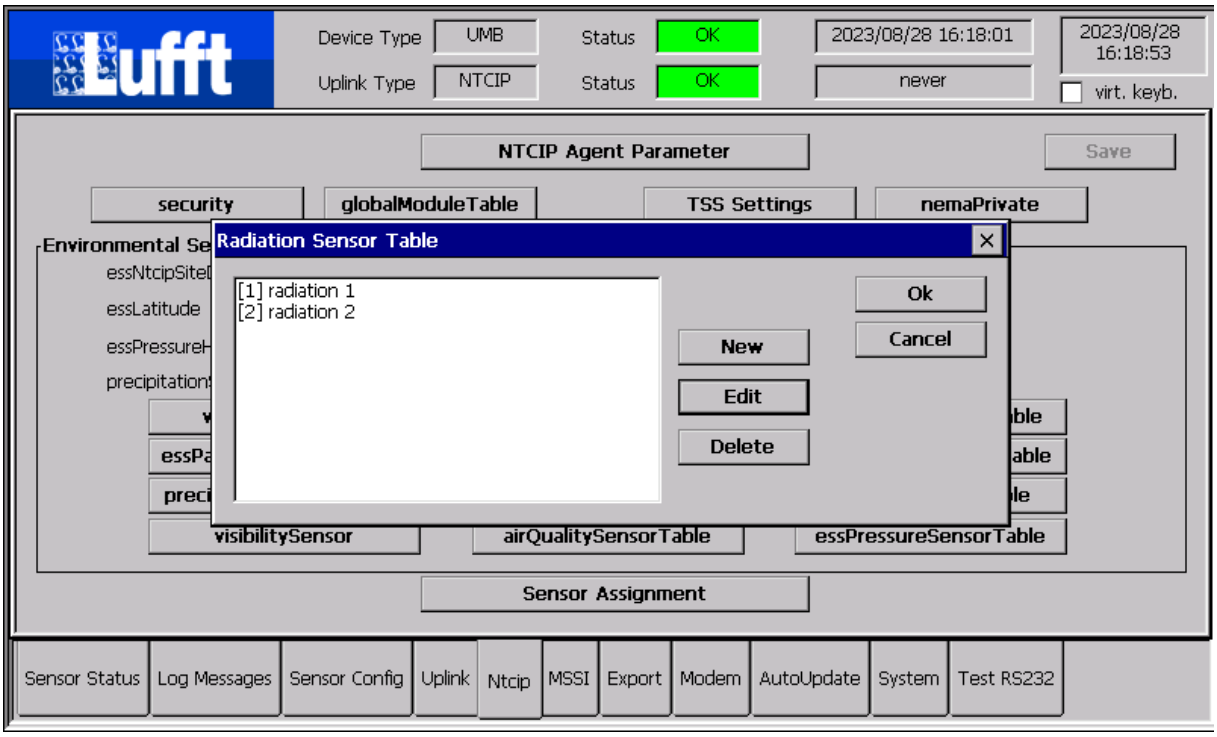
The meta data for each precipitation sensor (location information etc.) and thereby the number of sensors in the corresponding table is configured here.

5.8.2.11 humiditySensorTable



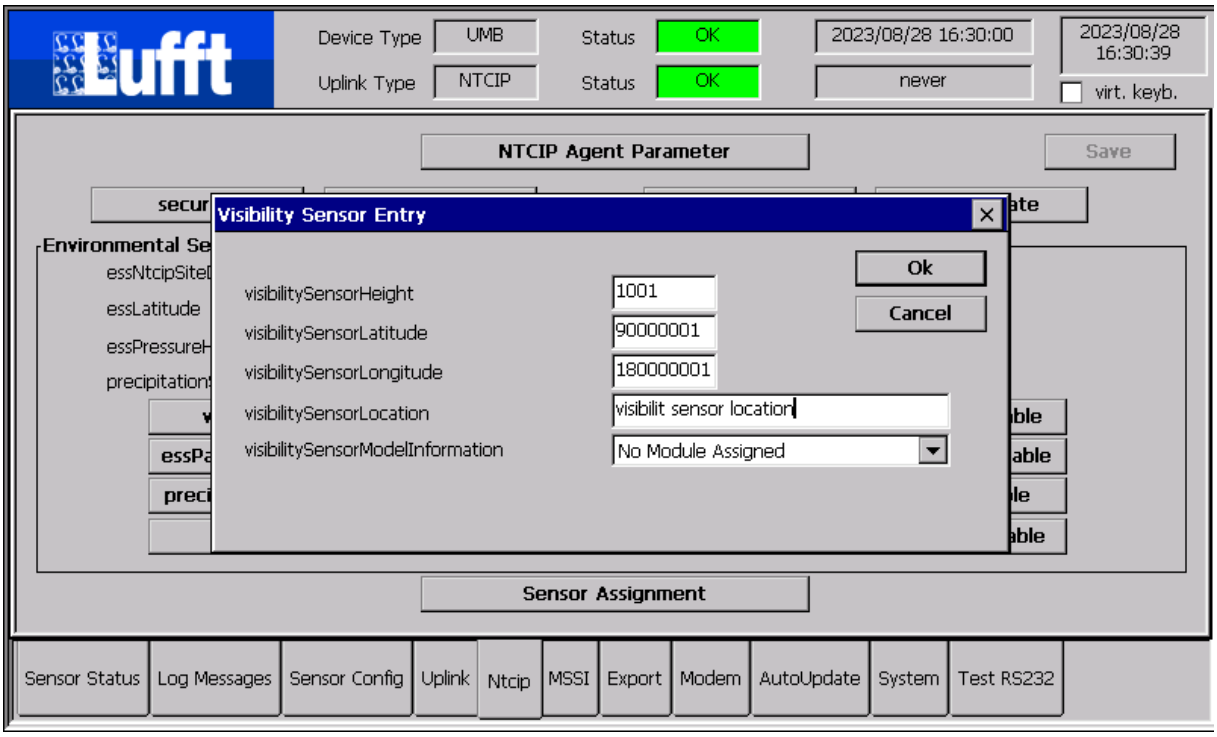
The meta data for each humidity sensor (location information etc.) and thereby the number of sensors in the corresponding table is configured here.

5.8.2.12 radiationSensorTable



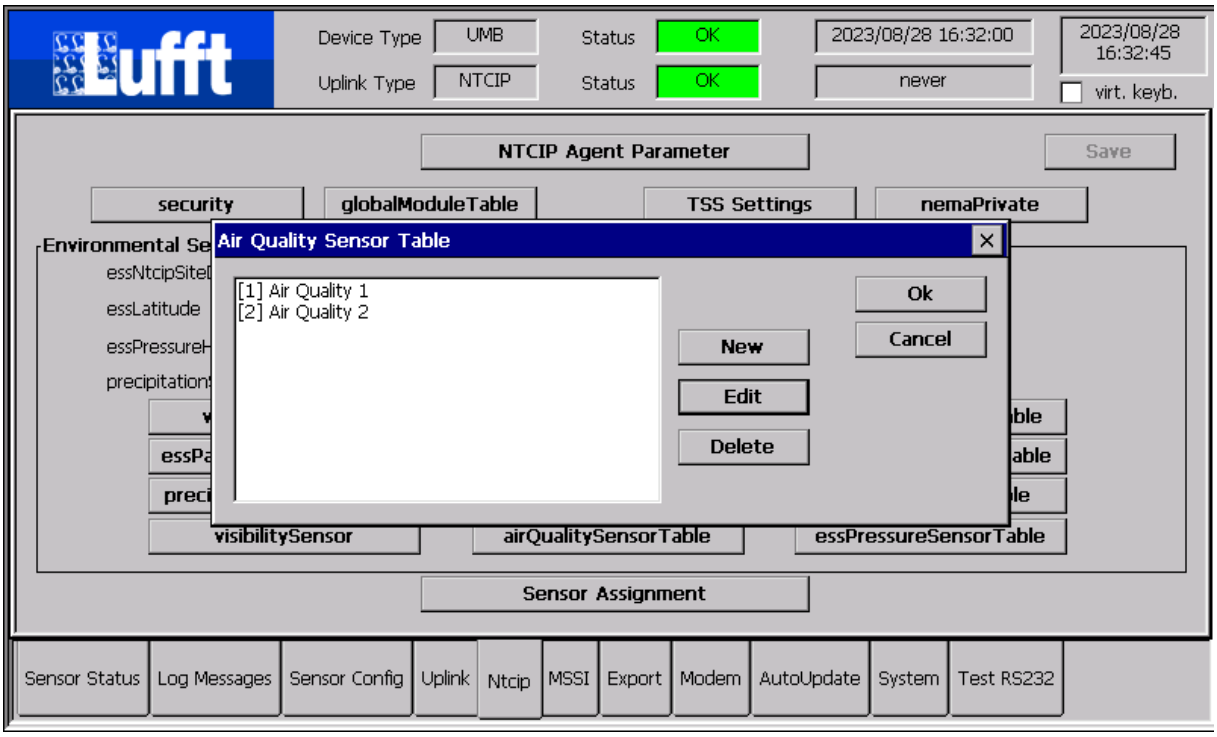
The meta data for each radiation sensor (location information etc.) and thereby the number of sensors in the corresponding table is configured here.

5.8.2.13 visibilitySensor



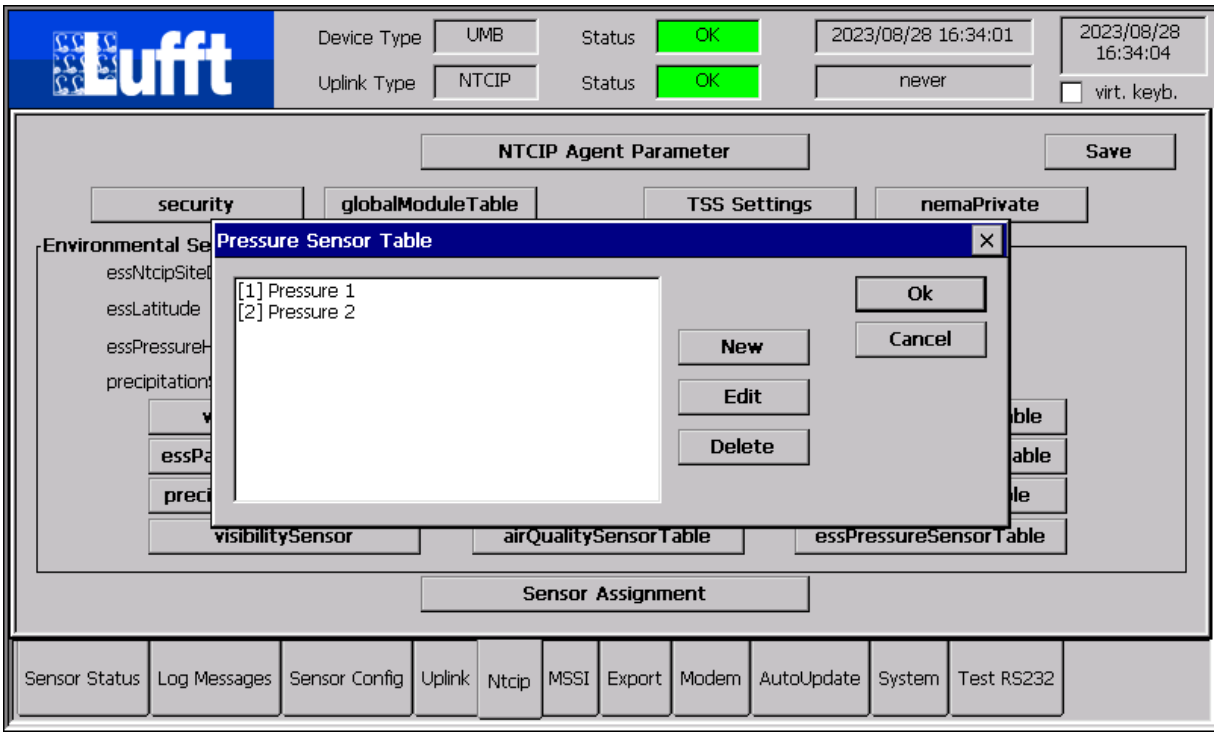
The meta data for the visibility sensor (location information etc.) is configured here.

5.8.2.14 airQualitySensorTable



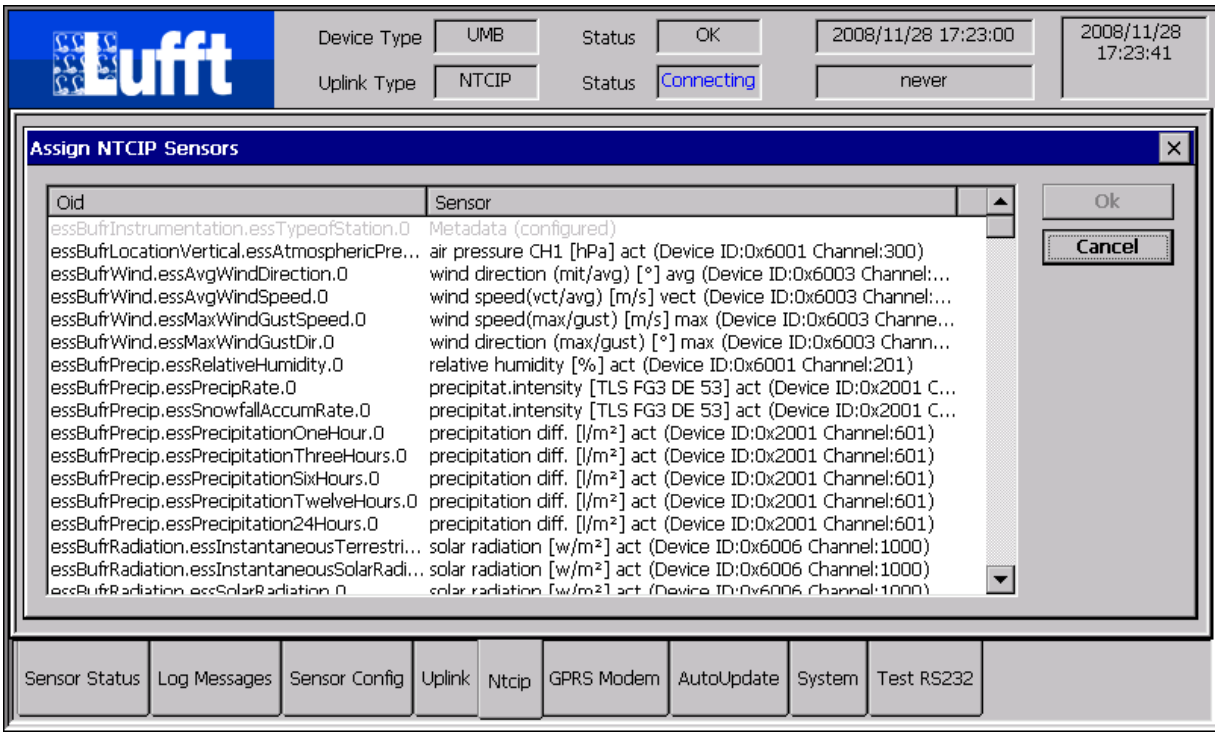
The meta data for each air quality sensor (location information etc.) and thereby the number of sensors in the corresponding table is configured here.

5.8.2.14.1 essPressureSensorTable

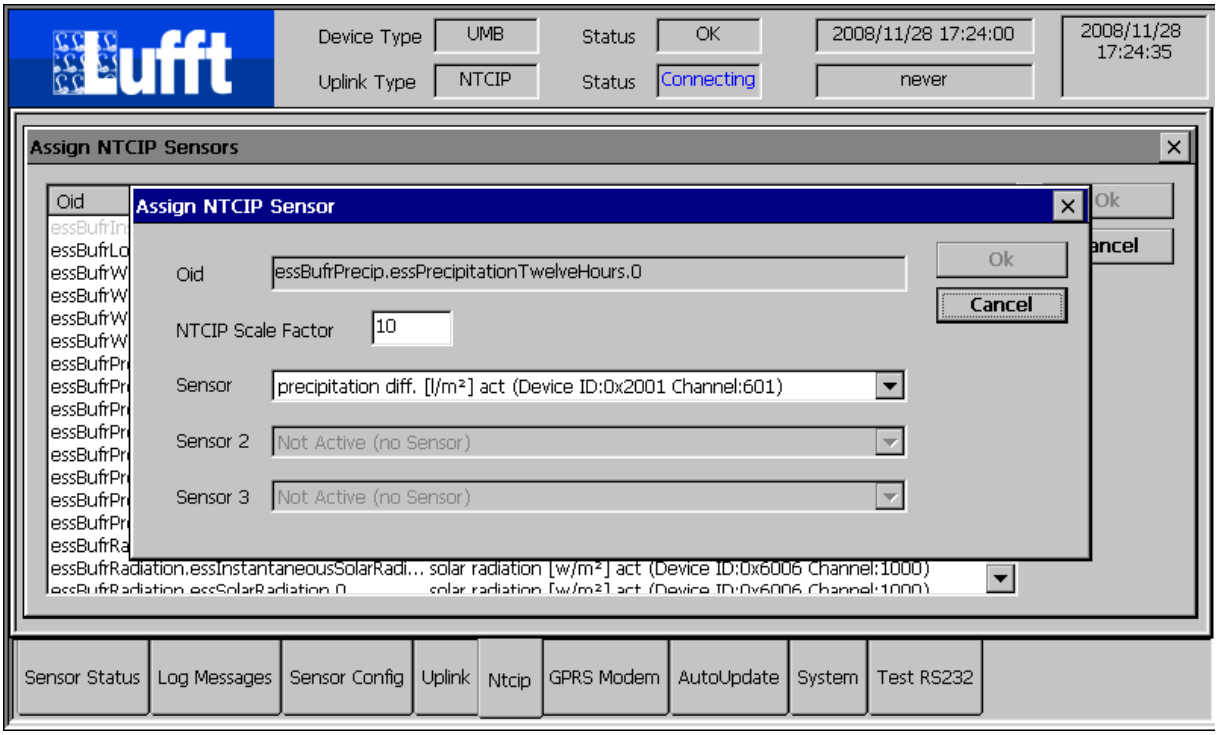


The meta data for each pressure sensor (location information etc.) and thereby the number of sensors in the corresponding table is configured here.

5.8.2.15 Sensor Assignment



The corresponding sensors are assigned to the SNMP OIDs here.

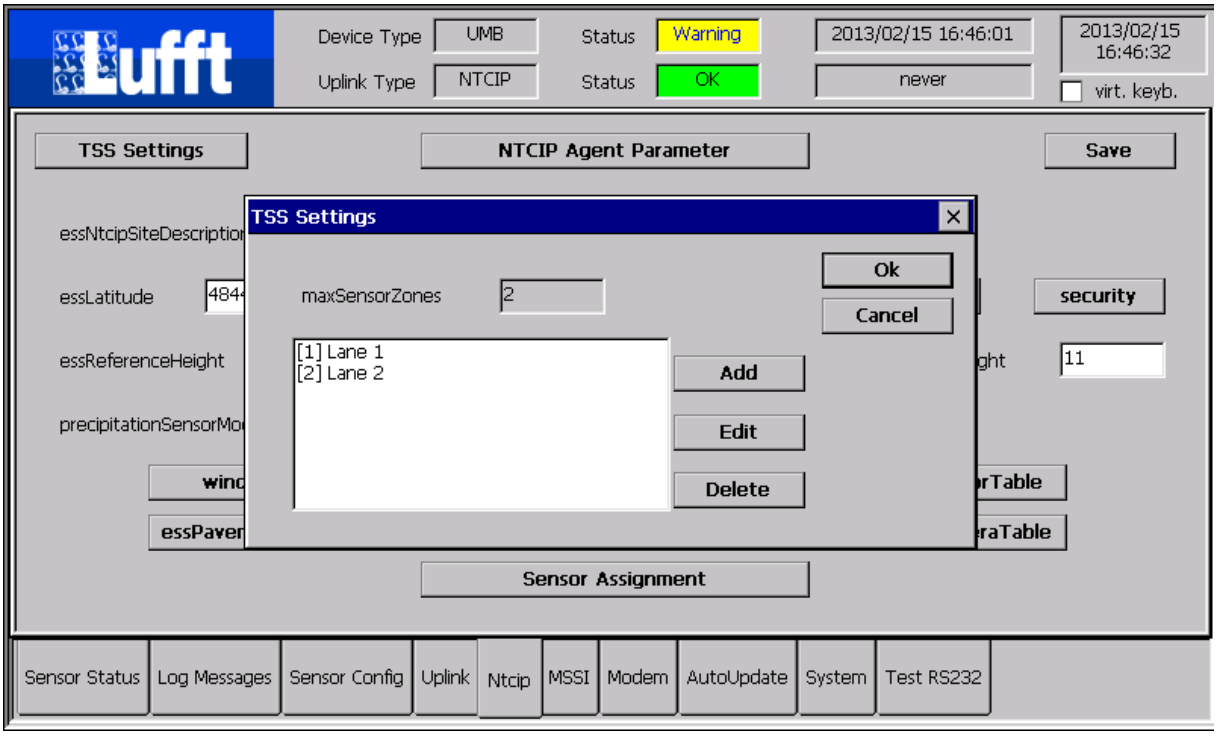


In the case of NTCIP sensors (OIDs) which are calculated from more than one input sensors, a corresponding number of device sensors are assigned (see table below). The “Ntcip Scale Factor” specifies the scaling which is applied AFTER any possible

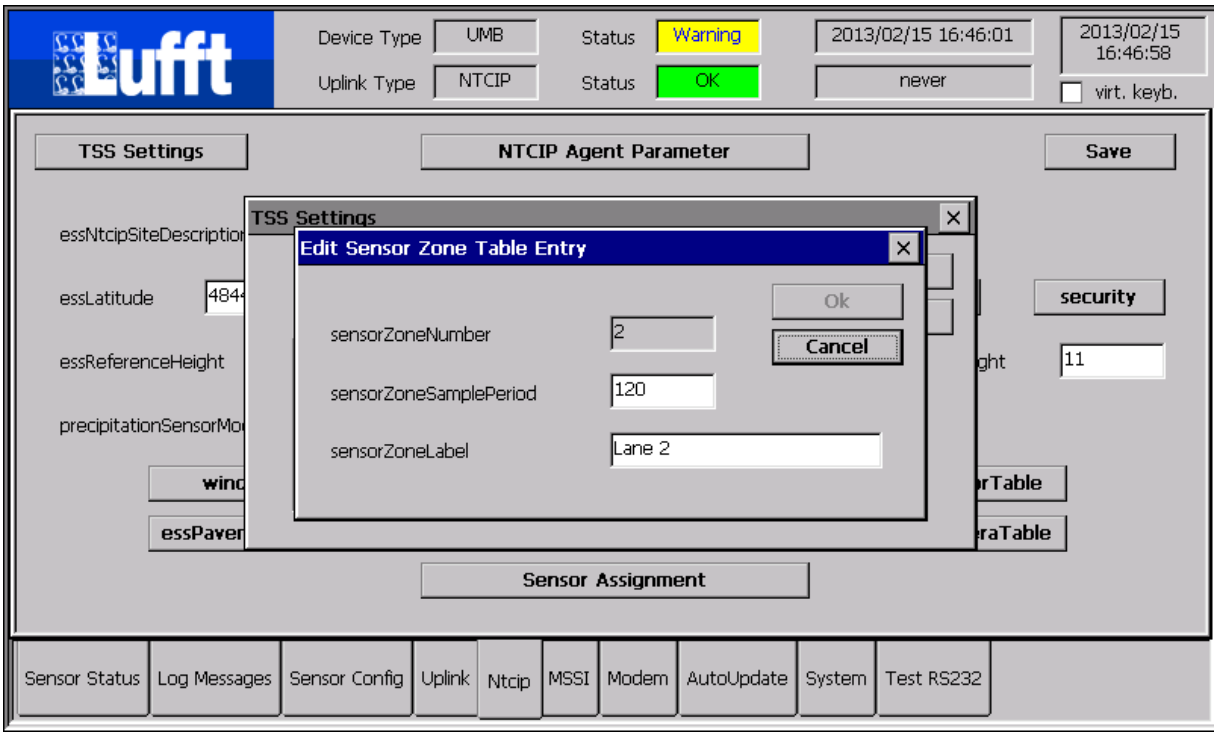
scaling and/or value mapping performed earlier through the LCom sensor configuration. Usually the “Ntcip Scale Factor” is sufficient to convert the “original” values as reported by the UMB device to the relevant “NTCIP encoding” of the value.

5.8.2.16 TSS

If “Support TSS” has been activated in the NTCIP Agent Settings, the TSS sensor zones can be configured here.



TSS settings are limited to the “sensorZoneTable” entries. Every lane is represented by one sensor zone entry.



For every zone/lane, the “sensorZoneSamplePeriod” – which is the time interval used to report the data under “tss.tssDataCollection” in the “dataCollectionTable” and “dataBufferTable” – and a label for the zone/lane can be configured.

Note that the sensorZoneSamplePeriod is limited to the following time intervals:

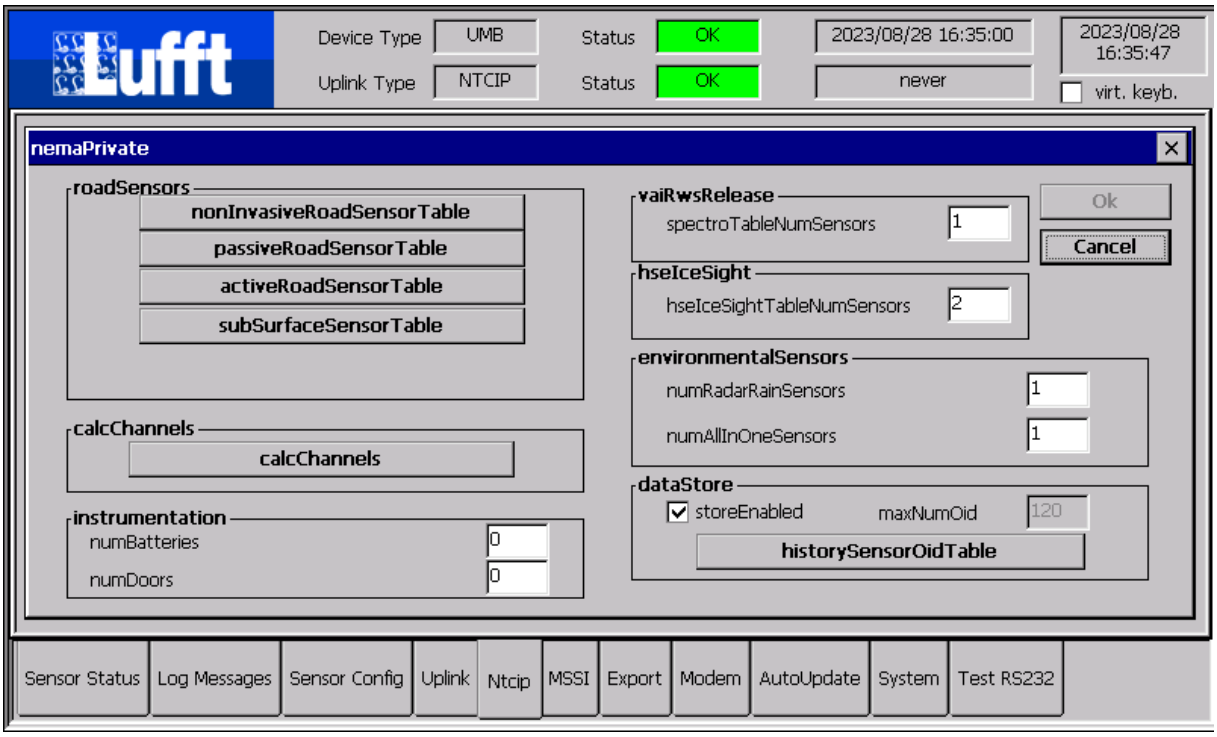
60 = 1 minute
120 = 2 minutes
180 = 3 minutes
240 = 4 minutes
300 = 5 minutes
360 = 6 minutes
480 = 8 minutes
600 = 10 minutes
720 = 12 minutes
900 = 15 minutes
1200 = 20 minutes
1800 = 30 minutes
3600 = 1 hour

Setting a value other than the listed values will set the sensorZoneSamplePeriod to the closest listed value.

Note that the time period calculation in the LCom is always done “aligned”, i.e. all listed time periods will be calculated from the beginning of the full hour (e.g. 6 Minute intervals always start at xx:00:00, xx:06:00, xx:12:00, xx:18:00, xx:24:00, xx:30:00, xx:36:00, xx:42:00, xx:48:00, xx:54:00 etc.)

5.8.2.17 nemaPrivate

The nemaPrivate subtree is used to configure various OID tables and features provided in the private MIB subtree (see chapter 5.8.3.2).

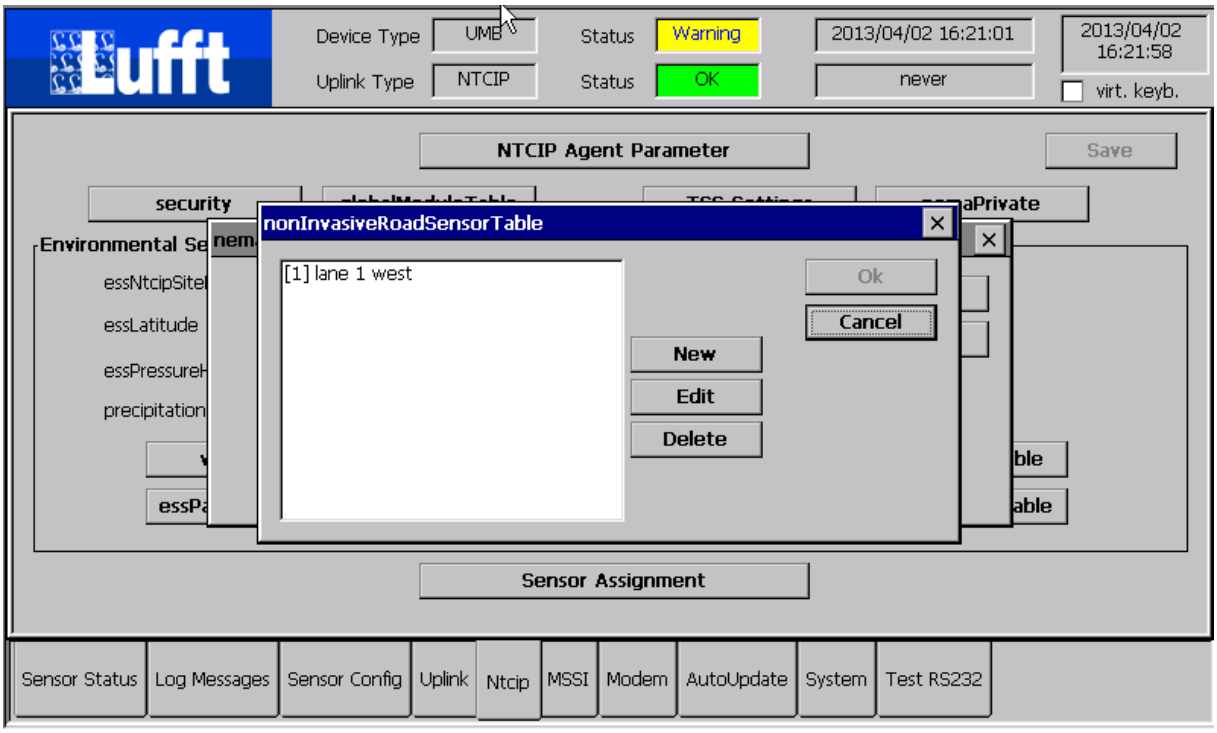


- nonInvasiveRoadSensorTable: a table with all native UMB-NIRS sensor channels (including maintenance information, see OIDs in next chapter)
- passiveRoadSensorTable: a table with all native UMB sensor channels of the IRS31/IRS31Pro passive road sensor
- activeRoadSensorTable: a table with all native UMB sensor channels of the ARS31 active road sensor
- subSurfaceSensorTable: a table with sub surface sensor entries
- calcChannels: settings for various calc channels in the calcChannels subtree

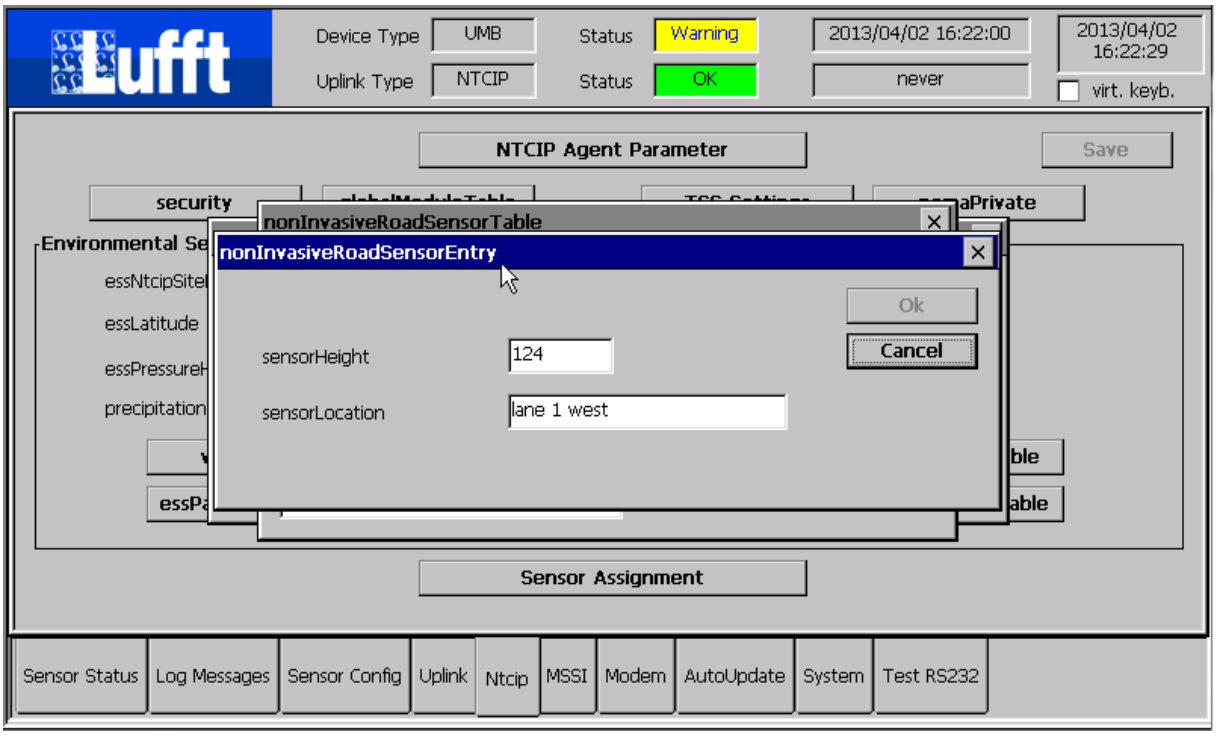
- numBatteries: number of batteries in the instrumentation.batteryStatus table (see next chapter)
- numDoors: number of doors in the instrumentation.doorStatus table (see next chapter).
- spectroTableNumSensors: number of entries in vaiRwsRelease.spectroTable
- hseIceSightTableNumSensors: number of entries in hseIceSight.iceSightTable
- numRadarRainSensors: number of entries in the radarRainSensorTable (which provides all native UMB sensor channels of the R2S radar rain sensor)
- numAllInOneSensors: number of entries in the allInOneSensorTable (which provides all native UMB sensor channels of the WSx all in one sensor)
- dataStore – storeEnabled: enable/disable the NTCIP data store
- maxNumOid: maximum number of sensor OIDs that can be stored. Defaults to 128.

Note: the maximum number of OIDs that can be used in the datastore depends on 2 factors: a) available space on the SD card, and b) MTU size of the network connection used to communicate with the device (since data for all configured sensors is transmitted in one OctetString parameter with size 4 * number of OIDs, which in turn is sent in one UDP packet / one MTU). Typical MTU size is >= 576 byte, i.e. up to 128 OIDs should not cause any problems.

5.8.2.17.1 noninvasive/passive/activeRoadSensorTable



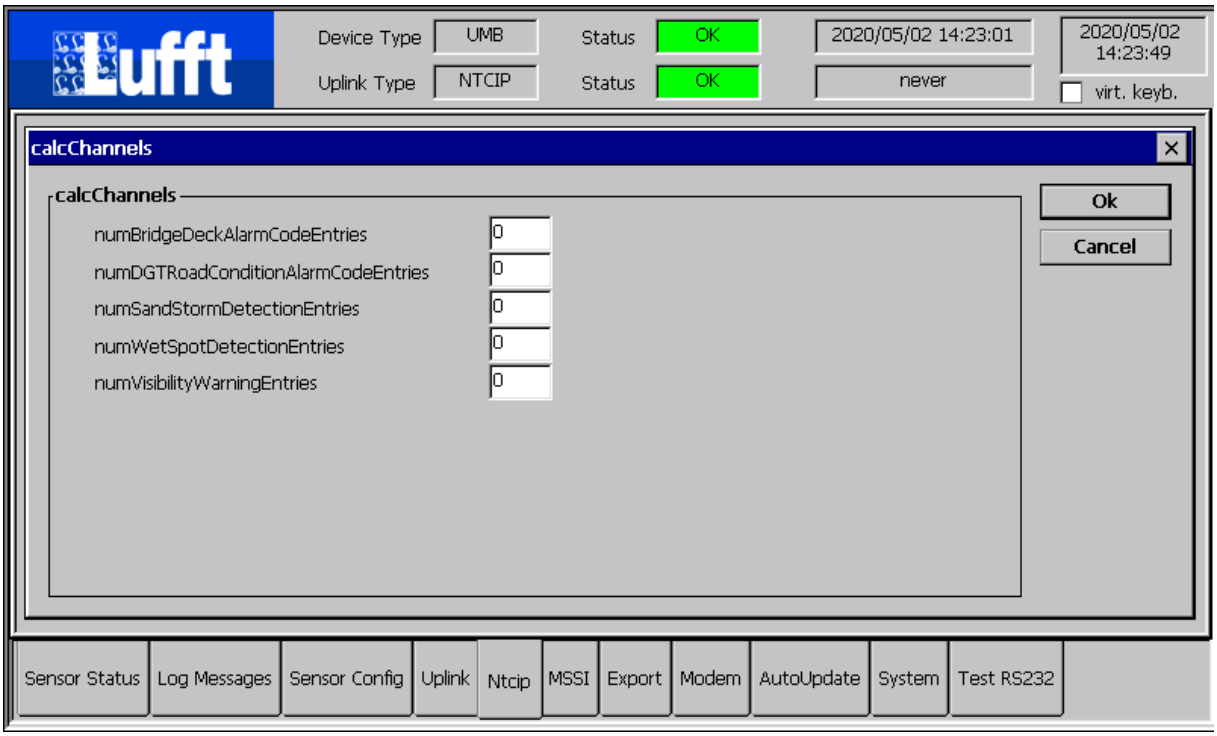
The nonInvasiveRoadSensorTable is used to configure the number of NIR Sensors.



Besides the actual sensor values (see next chapter), height and location can be configured for each NIRS.

The same applies to the passive / activeRoadSensorTable and subSurfaceSensorTable.

5.8.2.17.2 calcChannels



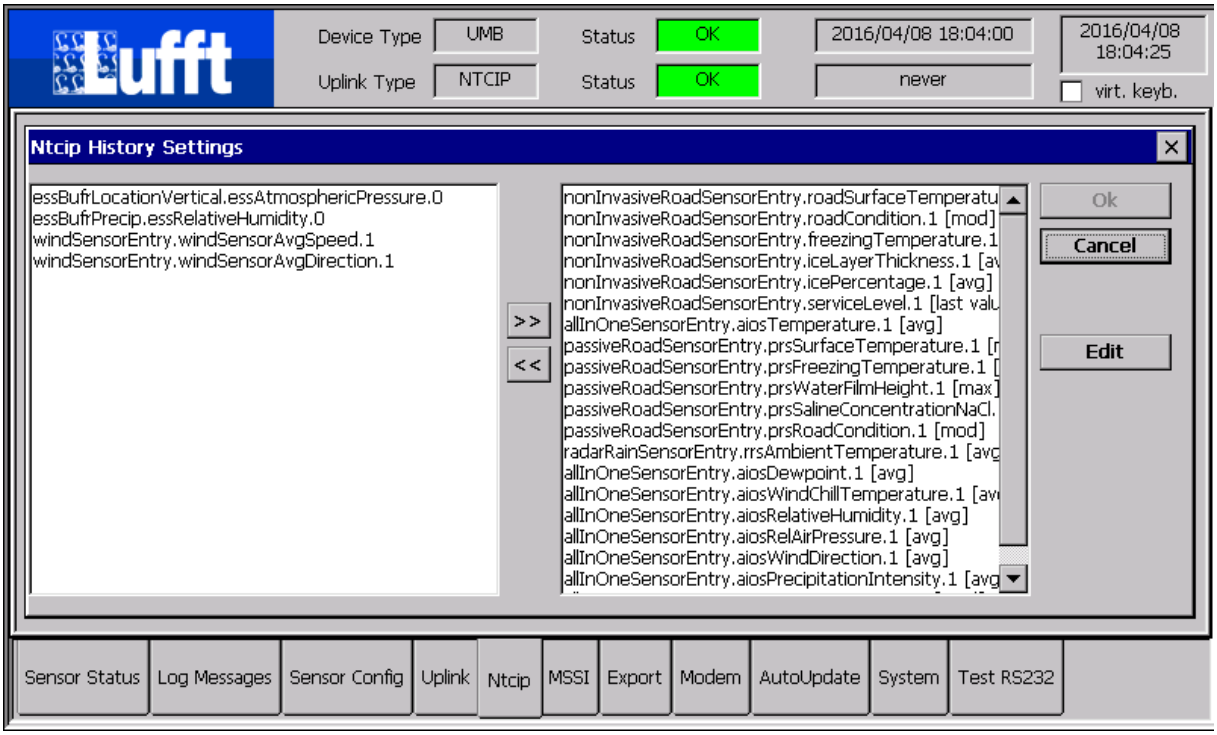
Here, the numbers of entries for the various calc channel result tables can be configured:

- numBridgeDeckAlarmCodeEntries: number of bridge deck alarm code entries in the respective table
- numDGTRoadConditionAlarmCodeEntries: number of DGT Road Condition alarm code entries in the respective table.
- numSandStormDetectionEntries: number of Sand Storm Detection results in the respective table.
- numWetSpotDetectionEntries: number of Wet Spot Detection results in the respective table.
- numVisibilityWarningEntries: number of Visibility Warning results in the respective table.

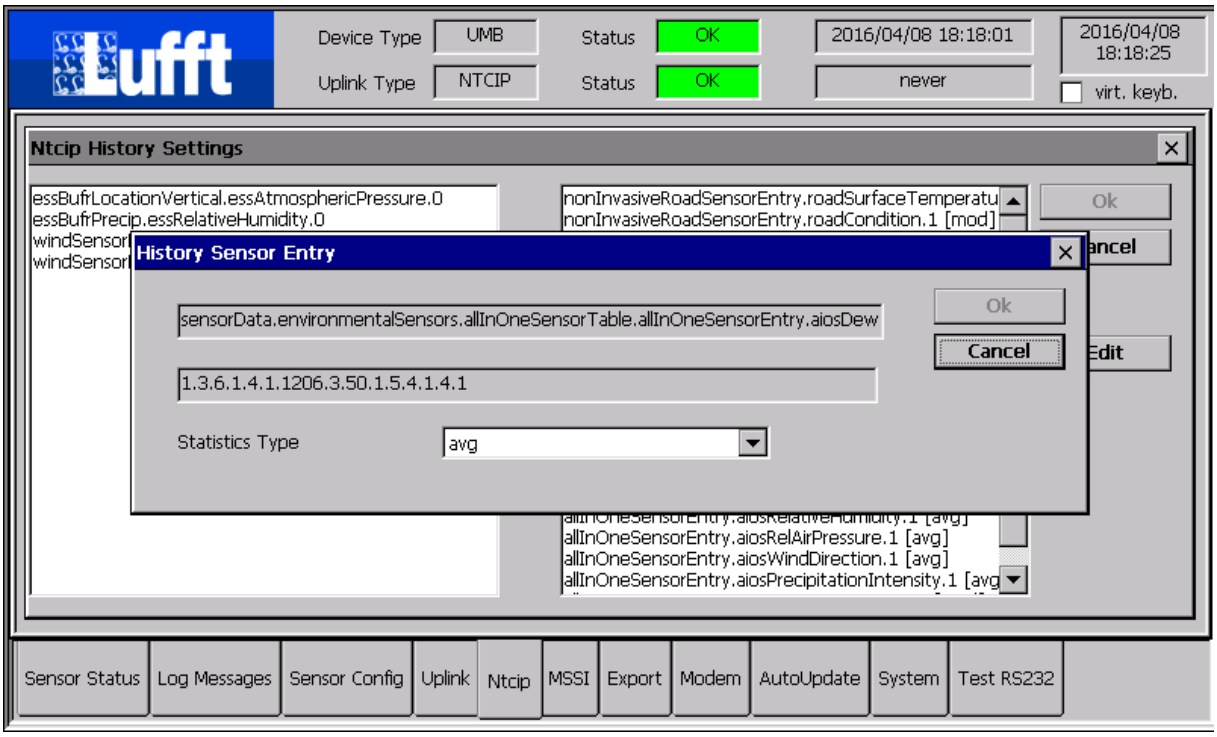
5.8.2.17.3 historySensorOidTable

Here, the OIDs for the NTCIP data store are configured.

On the left side, all OIDs that have a sensor assignment (i.e. should report measure values) and that have not been configured for the data store are listed. On the right side the OIDs already configured for the data store are shown.



For each OID that is configured for data storage, a “statistics type” can be configured. This statistics type is used to calculate an aggregated value for the reporting interval when retrieving data from the data store, if the reporting interval is greater than the actual store interval (which is fixed to 1 minute).



Valid statistics types are

- Avg: average value
- Sum: sum value
- Min: minimum value
- Max: maximum value
- Mod: modal value (used for “coded” values like precipitation type or road condition, reports the value most often used in the respective time interval)
- Vct: vector average
- Last: last stored value (in the respective time interval)

Default statistics type is “last”, which works with all OID types.

5.8.3 NTCIP SNMP OIDs

5.8.3.1 iso.org.dod.internet.mgmt

The standard “Mib II” and “Hostmib” OIDs (provided through the Windows CE SNMP framework) are supported, including the OIDs as required by NTCIP 2104:2003 / RFC 1213.mib.

5.8.3.2 iso.org.dod.internet.private.enterprises.nema.nemaPrivate

All manufacturer specific sensor/measure values are reported under this subtree under node 50 (which has been assigned by Nema to informatikWerkstatt). Following lists all objects (OIDs) as defined in the respective MIB file (IW-NEMAPRIVATE-MIB.mib)

- OIDs which represent measurements are shown in **bold**.
- OIDs which represent configuration elements are shown in gray.

The “Source Sensor Assignment” column shows which sensor/measurement type should be assigned to this OID (in which format/unit), and where appropriate which conversion/scaling should be configured in the LCom sensor configuration, before the measurement is processed in the NTCIP section of the LCom. A scaling is stored in the NTCIP sensor configuration for each OID (independent of any possible scaling/value mapping in the LCom sensor configuration), which usually converts the unit delivered by the UMB sensor channel (e.g. km/h) to the encoding required by the NTCIP standard (e.g. 1/10km/h).

5.8.3.2.1 sensorData.roadSensors subtree

this subtree contains entries for different Lufft road sensors (Non-Invasive Road Sensor (NIRS), passive road sensor (IRS31/IRS31Pro), active road sensors (ARS31)) and allows to report all UMB sensor channels of the respective UMB sensor type in the iso.org.dod.internet.private.enterprises.nema.nemaPrivate.informatikWerkstatt.sensorData.roadSensors

= .1.3.6.1.4.1.1206.3.50.1.1 subtree

roadSensors.numNonInvasiveRoadSensors.0	.1.3.6.1.4.1.1206.3.50.1.1.1.0	Configurable	-
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsRoadSensorIndex.x	.1.3.6.1.4.1.1206.3.50.1.1.2.1.1.x		-
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nisrSensorHeight.x	.1.3.6.1.4.1.1206.3.50.1.1.2.1.2.x	Configurable	-
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsSensorLocation.x	.1.3.6.1.4.1.1206.3.50.1.1.2.1.3.x	Configurable	
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsRoadSurfaceTemperature.x	**.1.3.6.1.4.1.1206.3.50.1.1.2.1.4.x**		**NIRS-UMB Channel 100 (transmitted in 1/10 °C, scale factor 10)**
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsFreezingTemperature.x	**.1.3.6.1.4.1.1206.3.50.1.1.2.1.5.x**		**NIRS UMB Channel 110 (transmitted in 1/10 °C, scale factor 10)**
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsWaterFilmHeight.x	**.1.3.6.1.4.1.1206.3.50.1.1.2.1.6.x**		**NIRS UMB Channel 600 (in µm)**
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsIceLayerThickness.x	**.1.3.6.1.4.1.1206.3.50.1.1.2.1.7.x**		**NIRS UMB Channel 601 (in µm)**
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsRoadCondition.x	**.1.3.6.1.4.1.1206.3.50.1.1.2.1.8.x**		**NIRS UMB Channel 900 (Lufft coded)**
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsIcePercentage.x	**.1.3.6.1.4.1.1206.3.50.1.1.2.1.9.x**		**NIRS UMB Channel 800 (in %)**
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsSalineConcentration.x	**.1.3.6.1.4.1.1206.3.50.1.1.2.1.10.x**		**NIRS UMB Channel 810 (in %)**
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsSnowHeight.x	**.1.3.6.1.4.1.1206.3.50.1.1.2.1.11.x**		**NIRS UMB Channel 610 (in mm)**
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsFriction.x	**.1.3.6.1.4.1.1206.3.50.1.1.2.1.12.x**		**NIRS UMB Channel 820 (transmitted in 1/1000, scale factor 1000)**
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsRoadWeatherIndex.x	**.1.3.6.1.4.1.1206.3.50.1.1.2.1.13.x**		**NIRS UMB Channel 910 (0,1, or 2)**
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsServiceLevel.x	**.1.3.6.1.4.1.1206.3.50.1.1.2.1.14.x**		**NIRS UMB Channel 4000**
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsRemainingTimeToNextService.x	**.1.3.6.1.4.1.1206.3.50.1.1.2.1.15.x**		**NIRS UMB Channel 4001**
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsLampStatus.x	**.1.3.6.1.4.1.1206.3.50.1.1.2.1.16.x**		**NIRS UMB Channel 4002**
roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsMeasureStatus.x	**.1.3.6.1.4.1.1206.3.50.1.1.2.1.17.x**		**NIRS UMB Channel 4003**

roadSensors.nonInvasiveRoadSensorTable.nonInvasiveRoadSensorEntry.nirsEnergyConsumptionRatio.x	**.1.3.6.1.4.1.1206.3.50.1.1.2.1.18.x**		**NIRS UMB Channel 4004**
roadSensors.numPassiveRoadSensors.0	.1.3.6.1.4.1.1206.3.50.1.1.3.0	Configurable	
roadSensors.passiveRoadSensorTable.passiveRoadSensorEntry.prsIndex.x	.1.3.6.1.4.1.1206.3.50.1.1.4.1.1.x		
roadSensors.passiveRoadSensorTable.passiveRoadSensorEntry.prsHeight.x	.1.3.6.1.4.1.1206.3.50.1.1.4.1.2.x	Configurable	
roadSensors.passiveRoadSensorTable.passiveRoadSensorEntry.prsLocation.x	.1.3.6.1.4.1.1206.3.50.1.1.4.1.3.x	Configurable	
roadSensors.passiveRoadSensorTable.passiveRoadSensorEntry.prsSurfaceTemperature.x	**.1.3.6.1.4.1.1206.3.50.1.1.4.1.4.x**		**Transmitted in 1/10 °C – scale factor 10**
roadSensors.passiveRoadSensorTable.passiveRoadSensorEntry.prsExternalTemperature1.x	**.1.3.6.1.4.1.1206.3.50.1.1.4.1.5.x**		**Transmitted in 1/10 °C – scale factor 10**
roadSensors.passiveRoadSensorTable.passiveRoadSensorEntry.prsExternalTemperature2.x	**.1.3.6.1.4.1.1206.3.50.1.1.4.1.6.x**		**Transmitted in 1/10 °C – scale factor 10**
roadSensors.passiveRoadSensorTable.passiveRoadSensorEntry.prsFreezingTemperature.x	**.1.3.6.1.4.1.1206.3.50.1.1.4.1.7.x**		**Transmitted in 1/10 °C – scale factor 10**
roadSensors.passiveRoadSensorTable.passiveRoadSensorEntry.prsWaterFilmHeight.x	**.1.3.6.1.4.1.1206.3.50.1.1.4.1.8.x**		
roadSensors.passiveRoadSensorTable.passiveRoadSensorEntry.prsSalineConcentrationNaCl.x	**.1.3.6.1.4.1.1206.3.50.1.1.4.1.9.x**		
roadSensors.passiveRoadSensorTable.passiveRoadSensorEntry.prsSalineConcentrationMgCl2.x	**.1.3.6.1.4.1.1206.3.50.1.1.4.1.10.x**		
roadSensors.passiveRoadSensorTable.passiveRoadSensorEntry.prsSalineConcentrationCaCl2.x	**.1.3.6.1.4.1.1206.3.50.1.1.4.1.11.x**		
roadSensors.passiveRoadSensorTable.passiveRoadSensorEntry.prsIcePercentage.x	**.1.3.6.1.4.1.1206.3.50.1.1.4.1.12.x**		
roadSensors.passiveRoadSensorTable.passiveRoadSensorEntry.prsFriction.x	**.1.3.6.1.4.1.1206.3.50.1.1.4.1.13.x**		**transmitted in 1/1000, scale factor 1000**
roadSensors.passiveRoadSensorTable.passiveRoadSensorEntry.prsRoadCondition.x	**.1.3.6.1.4.1.1206.3.50.1.1.4.1.14.x**		
roadSensors.passiveRoadSensorTable.passiveRoadSensorEntry.prsCouplingState.x	**.1.3.6.1.4.1.1206.3.50.1.1.4.1.15.x**		
roadSensors.passiveRoadSensorTable.passiveRoadSensorEntry.prsMeasureCounter.x	**.1.3.6.1.4.1.1206.3.50.1.1.4.1.16.x**		
roadSensors.numActiveRoadSensors.0	.1.3.6.1.4.1.1206.3.50.1.1.5.0	Configurable	
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsIndex.x	.1.3.6.1.4.1.1206.3.50.1.1.6.1.1.x		
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsHeight.x	.1.3.6.1.4.1.1206.3.50.1.1.6.1.2.x	Configurable	
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsLocation.x	.1.3.6.1.4.1.1206.3.50.1.1.6.1.3.x	Configurable	
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsRoadSurfaceTemperature.x	**.1.3.6.1.4.1.1206.3.50.1.1.6.1.4.x**		**Transmitted in 1/10 °C – scale factor 10**
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsFreezingTemperature.x	**.1.3.6.1.4.1.1206.3.50.1.1.6.1.5.x**		**Transmitted in 1/10 °C – scale factor 10**
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsFreezinTemperatureNoSmoothing.x	**.1.3.6.1.4.1.1206.3.50.1.1.6.1.6.x**		**Transmitted in 1/10 °C – scale factor 10**
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsFreezingTemperatureCorrected.x	**.1.3.6.1.4.1.1206.3.50.1.1.6.1.7.x**		**Transmitted in 1/10 °C – scale factor 10**
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsSalineConcentrationNaCl.x	**.1.3.6.1.4.1.1206.3.50.1.1.6.1.8.x**		

roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsSalineConcentrationMgCl2.x	**.1.3.6.1.4.1.1206.3.50.1.1.6.1.9.x**		
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsSalineConcentrationCaCl2.x	.1.3.6.1.4.1.1206.3.50.1.1.6.1.10.x		
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsCryotechE36ConcentrationByWeight.x	.1.3.6.1.4.1.1206.3.50.1.1.6.1.11.x		
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsCryotechE36ConcentrationByVolume.x	.1.3.6.1.4.1.1206.3.50.1.1.6.1.12.x		
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsSafewayKFHotConcentration.x	.1.3.6.1.4.1.1206.3.50.1.1.6.1.13.x		
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsSalineConcentrationNaClCorrected.x	.1.3.6.1.4.1.1206.3.50.1.1.6.1.14.x		
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsSalineConcentrationMgCl2Corrected.x	.1.3.6.1.4.1.1206.3.50.1.1.6.1.15.x		
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsSalineConcentrationCaCl2Corrected.x	.1.3.6.1.4.1.1206.3.50.1.1.6.1.16.x		
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsCryotechE36ConcentrationByWeightCorrected.x	.1.3.6.1.4.1.1206.3.50.1.1.6.1.17.x		
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsCryotechE36ConcentrationByVolumeCorrected.x	.1.3.6.1.4.1.1206.3.50.1.1.6.1.18.x		
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsSafewayKFHotConcentrationCorrected.x	.1.3.6.1.4.1.1206.3.50.1.1.6.1.19.x		
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsStatusMeasurement.x	.1.3.6.1.4.1.1206.3.50.1.1.6.1.20.x		
roadSensors.activeRoadSensorTable.activeRoadSensorEntry.arsMeasureCounter.x	.1.3.6.1.4.1.1206.3.50.1.1.6.1.21.x		
roadSensors.numSubSurfaceSensors.0	.1.3.6.1.4.1.1206.3.50.1.1.7.0	Configurable	V 2.24.0 MIB V 11
roadSensors.subSurfaceSensorTable.subSurfaceSensorEntry.subSurfaceSensorIndex.x	.1.3.6.1.4.1.1206.3.50.1.1.8.1.1.x	Table Index	V 2.24.0 MIB V 11
roadSensors.subSurfaceSensorTable.subSurfaceSensorEntry.subSurfaceSensorDepth.x	.1.3.6.1.4.1.1206.3.50.1.1.8.1.2.x	Configurable	V 2.24.0 MIB V 11
roadSensors.subSurfaceSensorTable.subSurfaceSensorEntry.subSurfaceSensorLocation.x	.1.3.6.1.4.1.1206.3.50.1.1.8.1.3.x	Configurable	V 2.24.0 MIB V 11
roadSensors.subSurfaceSensorTable.subSurfaceSensorEntry.subSurfaceTemperature.x	**.1.3.6.1.4.1.1206.3.50.1.1.8.1.4.x**		**V 2.24.0 MIB V 11**
roadSensors.subSurfaceSensorTable.subSurfaceSensorEntry.subSurfaceMoisture.x	**.1.3.6.1.4.1.1206.3.50.1.1.8.1.5.x**		**V 2.24.0 MIB V 11**
roadSensors.subSurfaceSensorTable.subSurfaceSensorEntry.subSurfaceSalinity.x	**.1.3.6.1.4.1.1206.3.50.1.1.8.1.6.x**		**V 2.24.0 MIB V 11**
roadSensors.subSurfaceSensorTable.subSurfaceSensorEntry.subSurfaceSalineConcentration.x	**.1.3.6.1.4.1.1206.3.50.1.1.8.1.7.x**		**V 2.24.0 MIB V 11**

5.8.3.2.2 sensorData.calcChannels subtree

in this subtree OIDs to transmit the following calculated channels of the LCom

calcChannels.roadConditionAlarmCode.0	**.1.3.6.1.4.1.1206.3.50.1.2.1.0**		**Boschung Alarm Code (calculated)-**

calcChannels.numBridgeDeckAlarmCodeEntries.0	.1.3.6.1.4.1.1206.3.50.1.2.2.0	Configurable	
calcChannels.bridgeDeckAlarmCodeTable.bridgeDeckAlarmCodeEntry.bridgeDeckAlarmCodeIndex.x	.1.3.6.1.4.1.1206.3.50.1.2.3.1.1.x		
calcChannels.bridgeDeckAlarmCodeTable.bridgeDeckAlarmCodeEntry.bridgeDeckAlarmCode.x	**.1.3.6.1.4.1.1206.3.50.1.2.3.1.2.x**		
calcChannels.numDGTRoadConditionAlarmCodeEntries	.1.3.6.1.4.1.1206.3.50.1.2.4.0	Configurable	
calcChannels.dgtRoadConditionAlarmCodeTable. dgtRoadConditionAlarmCodeEntry dgtRoadConditionAlarmCodeIndex.x	.1.3.6.1.4.1.1206.3.50.1.2.5.1.1.x		
calcChannels.dgtRoadConditionAlarmCodeTable. dgtRoadConditionAlarmCodeEntry dgtRoadConditionAlarmCode.x	**.1.3.6.1.4.1.1206.3.50.1.2.5.1.2.x**		**DGT Road Condition Alarm Code (calculated)**
calcChannels.numSandStormDetectionEntries	.1.3.6.1.4.1.1206.3.50.1.2.6.0	Configurable	
calcChannels.sandStormDetectionTable.sandStormDetectionEntry.sandStormDetectionIndex.x	.1.3.6.1.4.1.1206.3.50.1.2.7.1.1.X		
calcChannels.sandStormDetectionTable.sandStormDetectionEntry.sandStormDetectionCode.x	**.1.3.6.1.4.1.1206.3.50.1.2.7.1.2.x**		**Sand Storm Detection (calculated)**
calcChannels.numWetSpotDetectionEntries	.1.3.6.1.4.1.1206.3.50.1.2.8.0	Configurable	
calcChannels.wetSpotDetectionTable.wetSpotDetectionEntry.wetSpotDetectionIndex.x	.1.3.6.1.4.1.1206.3.50.1.2.9.1.1.x		
calcChannels.wetSpotDetectionTable.wetSpotDetectionEntry.wetSpotDetectionCode.x	**.1.3.6.1.4.1.1206.3.50.1.2.9.1.2.x**		**Wet Spot Detection (calculated)**

5.8.3.2.3 sensorData.digitalOutputStatus subtree

this subtree contains a table to show the status of the digital outputs (e.g. used to control traffic signals) configured as “alarm” outputs. Configuration and status data is directly derived from the alarm configuration, so no sensor channels are assigned to these OIDs.

digitalOutputStatus.numDigitalOutputPorts.0	.1.3.6.1.4.1.1206.3.50.1.3.1.0	Configurable	-
digitalOutputStatus.digitalOutputStatusTable.digitalOutputStatusEntry.digitalOutputStatusIndex.x	.1.3.6.1.4.1.1206.3.50.1.3.2.1.1.x		-
digitalOutputStatus.digitalOutputStatusTable.digitalOutputStatusEntry.deviceName.x	.1.3.6.1.4.1.1206.3.50.1.3.2.1.2.x	Configurable	-
digitalOutputStatus.digitalOutputStatusTable.digitalOutputStatusEntry.devicePort.x	.1.3.6.1.4.1.1206.3.50.1.3.2.1.3.x	Configurable	
digitalOutputStatus.digitalOutputStatusTable.digitalOutputStatusEntry.outputStatus.x	**.1.3.6.1.4.1.1206.3.50.1.1.2.1.4.x**		**Status of the output port (off/on)**
digitalOutputStatus.digitalOutputStatusTable.digitalOutputStatusEntry.**operationsMode.x**	**.1.3.6.1.4.1.1206.3.50.1.3.2.1.5.x**		**Operations mode of the output port . 0= normal, 1= manual, 2=test**

5.8.3.2.4 sensorData.instrumentation subtree

here the status of UPS, batteries and doors can be monitored.

instrumentation.upsStatus.0	**.1.3.6.1.4.1.1206.3.50.1.4.1.0**		**UPS status. 0 = power OK, 1 = power not OK / battery operation, 2= error or missing value**
instrumentation.upsBatteryStatus.0	**.1.3.6.1.4.1.1206.3.50.1.4.2.0**		**UPS battery status 0 = OK 1 = battery power low 2 = error or missing value**
instrumentation.numBatteries.0	.1.3.6.1.4.1.1206.3.50.1.4.3.0	Configurable	-
instrumentation.batteryStatusTable.batteryStatusEntry.batteryStatusIndex.x	.1.3.6.1.4.1.1206.3.50.1.4.4.1.1.x		-
instrumentation.batteryStatusTable.batteryStatusEntry.batteryVoltage.x	**.1.3.6.1.4.1.1206.3.50.1.4.4.1.2.x**		**battery votage in mV**
instrumentation.batteryStatusTable.batteryStatusEntry.batteryChargeVoltage.x	**.1.3.6.1.4.1.1206.3.50.1.4.4.1.3.x**		**battery charge voltage in mV**
instrumentation.batteryStatusTable.batteryStatusEntry.batteryChargeStatus.x	**.1.3.6.1.4.1.1206.3.50.1.4.4.1.4.x**		**battery charge status in %**
instrumentation.numDoors.0	.1.3.6.1.4.1.1206.3.50.1.4.5.0	Configurable	-
instrumentation.doorStatusTable.doorStatusEntry.doorStatusIndex.x	.1.3.6.1.4.1.1206.3.50.1.4.6.1.1.x		-
instrumentation.doorStatusTable.doorStatusEntry.doorStatus.x	**.1.3.6.1.4.1.1206.3.50.1.4.6.1.2.x**		**door status 0 = closed 1 = open 2 = error or missing value**

5.8.3.2.5 sensorData.environmentalSensors Subtree

here the “native” UMB sensor channels of radar rain (R2S) and all in one (WSx) sensors are supported

environmentalSensors.numRadarRainSensors.0	.1.3.6.1.4.1.1206.3.50.1.5.1.0	Configurable	
environmentalSensors.radarRainSensorTable.radarRainSensorEntry.rrsIndex.x	.1.3.6.1.4.1.1206.3.50.1.5.2.1.1.x		
environmentalSensors.radarRainSensorTable.radarRainSensorEntry.rrsAmbientTemperature.x	**.1.3.6.1.4.1.1206.3.50.1.5.2.1.2.x**		**Transmitted in 1/10 °C – scale factor 10**
environmentalSensors.radarRainSensorTable.radarRainSensorEntry.rrsPrecipitationType.x	**.1.3.6.1.4.1.1206.3.50.1.5.2.1.3.x**		
environmentalSensors.radarRainSensorTable.radarRainSensorEntry.rrsNumDrizzeParticles.x	**.1.3.6.1.4.1.1206.3.50.1.5.2.1.4.x**		
environmentalSensors.radarRainSensorTable.radarRainSensorEntry.rrsNumRainParticles.x	**.1.3.6.1.4.1.1206.3.50.1.5.2.1.5.x**		

environmentalSensors.radarRainSensorTable.radarRainSensorEntry.rrsNumSnowParticles.x	**.1.3.6.1.4.1.1206.3.50.1.5.2.1.6.x**		
environmentalSensors.radarRainSensorTable.radarRainSensorEntry.rrsNumHailParticles.x	**.1.3.6.1.4.1.1206.3.50.1.5.2.1.7.x**		
environmentalSensors.radarRainSensorTable.radarRainSensorEntry.rrsDrizzeYesNo.x	**.1.3.6.1.4.1.1206.3.50.1.5.2.1.8.x**		
environmentalSensors.radarRainSensorTable.radarRainSensorEntry.rrsRainYesNo.x	**.1.3.6.1.4.1.1206.3.50.1.5.2.1.9.x**		
environmentalSensors.radarRainSensorTable.radarRainSensorEntry.rrsSnowYesNo.x	**.1.3.6.1.4.1.1206.3.50.1.5.2.1.10.x**		
environmentalSensors.radarRainSensorTable.radarRainSensorEntry.rrsHailYesNo.x	**.1.3.6.1.4.1.1206.3.50.1.5.2.1.11.x**		
environmentalSensors.radarRainSensorTable.radarRainSensorEntry.rrsPrecipitationAmount	**.1.3.6.1.4.1.1206.3.50.1.5.2.1.12.x**		
environmentalSensors.radarRainSensorTable.radarRainSensorEntry.rrsPrecipitationIntensity	**.1.3.6.1.4.1.1206.3.50.1.5.2.1.13.x**		**Transmitted in 1/10 – scale factor 10**
environmentalSensors.numAllInOneSensors.0	.1.3.6.1.4.1.1206.3.50.1.5.3.0	Configurable	
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosIndex.	.1.3.6.1.4.1.1206.3.50.1.5.4.1.1.x		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosTemperature.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.2.x**		**Transmitted in 1/10 °C – scale factor 10**
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosExternalTemperature.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.3.x**		**Transmitted in 1/10 °C – scale factor 10**
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosDewPoint.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.4.x**		**Transmitted in 1/10 °C – scale factor 10**
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosWindChillTemperature.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.5.x**		**Transmitted in 1/10 °C – scale factor 10**
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosWetBulbTemperature.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.6.x**		**Transmitted in 1/10 °C – scale factor 10**
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosWindHeaterTemperature.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.7.x**		**Transmitted in 1/10 °C – scale factor 10**
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosR2STemperature.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.8.x**		**Transmitted in 1/10 °C – scale factor 10**
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosRelativeHumidity.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.9.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosAbsoluteHumidity.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.10.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosMixingRatio.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.11.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosSpecificEnthalpy.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.12.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosAbsAirPressure.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.13.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosRelAirPressure.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.14.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosAirDensity.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.15.x**		**Transmitted in 1/1000 kg/m³ – scale factor 1000**
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosWindSpeed.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.16.x**		**Transmitted in 1/10 – scale factor 10**
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosWindSpeedFast.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.17.x**		**Transmitted in 1/10 – scale factor 10**

environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosWindSpeedStdDev.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.18.x**		**Transmitted in 1/10 – scale factor 10**
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosWindDirection.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.19.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosWindDirectionFast.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.20.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosWindDirectionCorr.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.21.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosWindDirectionStdDev.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.22.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosWindValueQuality.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.23.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosWindValueFastQuality.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.24.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosCompassHeading.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.25.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosPrecipitationAmount.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.26.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosPrecipitationType.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.27.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosPrecipitationIntensity.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.28.x**		**Transmitted in 1/10 – scale factor 10**
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosGlobalRadiation.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.29.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosFlashEventsPerMinute.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.30.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosFlashEventsPerInterval.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.31.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosLeafWettnessmV.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.32.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosLeafWettnessStatus.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.33.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosOperatingPower.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.34.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosPrecipitationDropSize.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.35.x**		
environmentalSensors.allInOneSensorTable.allInOneSensorEntry.aiosNoiseLevel.x	**.1.3.6.1.4.1.1206.3.50.1.5.4.1.36.x**		V 2.24.0 MIB V 11

5.8.3.2.6 rpuConfiguration subtree

this subtree provides configuration information for the rpu – consting of an OID for the current private MIB Version, and a table reporting all OIDs that have a sensor assigned, i.e. that should provide valid measure values.

rpuConfiguration.privateMibVersion.0	.1.3.6.1.4.1.1206.3.50.2.1.0		Version of the private MIB (supported from LCom Version 2.11.0 / MIB Version 5 on)

rpuConfiguration.sensorConfiguration.numSensorOidEntries	.1.3.6.1.4.1.1206.3.50.2.2.1.0		
rpuConfiguration.sensorConfiguration.sensorOidTable.sensorOidEntry.sensorOidTableIndex.x	.1.3.6.1.4.1.1206.3.50.2.2.2.1.1.x		
rpuConfiguration.sensorConfiguration.sensorOidTable.sensorOidEntry.sensorOid.x	.1.3.6.1.4.1.1206.3.50.2.2.2.1.2.x		

5.8.3.2.7 dataStore subtree

this subtree provides mechanisms to access measurement values stored in the rpu data store.

dataStore.storeEnabled.0	.1.3.6.1.4.1.1206.3.50.3.1.0	Configurable	Data store enabled yes/no
dataStore.numHistorySensorEntries.0	.1.3.6.1.4.1.1206.3.50.3.2.0	Configurable	Number of Sensor OIDs configured for the data store
dataStore.historySensorTable.historySensorEntry.historySensorTableIndex.x	.1.3.6.1.4.1.1206.3.50.3.3.1.1.x		
dataStore.historySensorTable.historySensorEntry.historySensorOid.x	.1.3.6.1.4.1.1206.3.50.3.3.1.2.x		
dataStore.historySensorTable.historySensorEntry.historySensorStatisticsType.x	.1.3.6.1.4.1.1206.3.50.3.3.1.3.x		
dataStore.reportingInterval.0	.1.3.6.1.4.1.1206.3.50.3.4.0	Read/write	Reporting interval in minutes. Defaults to 1 minute
dataStore.queryStartTime.0	.1.3.6.1.4.1.1206.3.50.3.5.0	Read/write	Start time (UTC timestamp). Defaults to 0, i.e. 255 “reporting intervals” before current time
dataStore.resultEndTime.0	.1.3.6.1.4.1.1206.3.50.3.6.0		End time (UTC timestamp) for the current query result
dataStore.queryCommandAndStatus.0	.1.3.6.1.4.1.1206.3.50.3.7.0	Read/write	Status of the current query and command to start / end a query processing
dataStore.numRowsInResult.0	.1.3.6.1.4.1.1206.3.50.3.8.0		Number of valid rows in the following result table
queryResultTable.queryResultEntry.queryResultTableIndex.x	.1.3.6.1.4.1.1206.3.50.3.9.1.1.x		
queryResultTable.queryResultEntry.rowMeasureTime.x	.1.3.6.1.4.1.1206.3.50.3.9.1.2.x		Measure time (UTC) for this row
queryResultTable.queryResultEntry.rowValues.x	.1.3.6.1.4.1.1206.3.50.3.9.1.3.x		Result values – octetString in the size of “numHistorySensorEntries” * 4. One 32bit value for each sensor in the historySensorTable – in the same order as shown in the table above.

For more details on how to use this subtree to access the data store, please refer to chapter 5.8.6

5.8.3.2.8 hseIceSight Subtree

hseIceSight.hseIceSightTableNumSensors.0	.1.3.6.1.4.1.1206.3.51.4.1.1.0	Configurable	
hseIceSight.hseIceSightTable.hseIceSightEntry.hseIceSightIndex.X	.1.3.6.1.4.1.1206.3.51.4.1.2.1.1.X		
hseIceSight.hseIceSightTable.hseIceSightEntry.hseIceSightYvvolt.X	.1.3.6.1.4.1.1206.3.51.4.1.2.1.2.X		
hseIceSight.hseIceSightTable.hseIceSightEntry.hseIceSightXvolt.X	.1.3.6.1.4.1.1206.3.51.4.1.2.1.3.X		
hseIceSight.hseIceSightTable.hseIceSightEntry.hseIceSightRatio.X	.1.3.6.1.4.1.1206.3.51.4.1.2.1.4.X		
hseIceSight.hseIceSightTable.hseIceSightEntry.hseIceSightSfcStatus.X	.1.3.6.1.4.1.1206.3.51.4.1.2.1.5.X		
hseIceSight.hseIceSightTable.hseIceSightEntry.hseIceSightSfcFriction.X	.1.3.6.1.4.1.1206.3.51.4.1.2.1.6.X		
hseIceSight.hseIceSightTable.hseIceSightEntry.hseIceSightSfcDirtyLens.X	.1.3.6.1.4.1.1206.3.51.4.1.2.1.7.X		

5.8.3.3 iso.org.dod.internet.private.enterprises.nema.transportation.devices.tss

All traffic sensor/measure values are reported under this subtree (if “Support TSS” is active). Following list shows all objects (OIDs) as defined by the NTCIP standard for TSS (1209_V0119f.pdf).

- OIDs which represent measurements are shown in **bold**.
- OIDs which represent configuration elements are shown in gray.
- OIDs which are “deprecated” or only relevant to “staffed” or “mobile” stations and are not shown by default are shown in *italics*.
- OIDs (or subtrees) which are NOT supported are shown underlined.

The “Source Sensor Assignment” column shows which sensor/measurement type should be assigned to this OID (in which format/unit), and where appropriate which conversion/scaling should be configured in the LCom sensor configuration, before the measurement is processed in the NTCIP section of the LCom. A scaling is stored in the NTCIP sensor configuration for each OID

(independent of any possible scaling/value mapping in the LCom sensor configuration), which usually converts the unit delivered by the UMB sensor channel (e.g. km/h) to the encoding required by the NTCIP standard (e.g. 1/10km/h).

OID (String)	OID (Numeric)	Remarks	Source Sensor Assignment
tss.tssSystemSetup.sensorSystemReset.0	.1.3.6.1.4.1.1206.4.2.4.1.1.0	read/write. Note: only command "restart (1)" is supported !	-
tss.tssSystemSetup.sensorSystemStatus.0	.1.3.6.1.4.1.1206.4.2.4.1.2.0		-
tss.tssSystemSetup.sensorSystemOccupancyType.0	.1.3.6.1.4.1.1206.4.2.4.1.3.0	fixed value ! (write operation not supported)	-
tss.tssSystemSetup.maxSensorZones.0	.1.3.6.1.4.1.1206.4.2.4.1.4.0	fixed value ! (write operation not supported)	-
tss.tssSystemSetup.sensorZoneTable.sensorZoneEntry.sensorZoneNumber.x	.1.3.6.1.4.1.1206.4.2.4.1.5.1.1.x		-
tss.tssSystemSetup.sensorZoneTable.sensorZoneEntry.sensorZoneOptions.x	.1.3.6.1.4.1.1206.4.2.4.1.5.1.2.x	fixed value ! (write operation not supported)	-
tss.tssSystemSetup.sensorZoneTable.sensorZoneEntry.sensorZoneOptionsStatus.x	.1.3.6.1.4.1.1206.4.2.4.1.5.1.3.x		-
tss.tssSystemSetup.sensorZoneTable.sensorZoneEntry.sensorZoneSamplePeriod.x	.1.3.6.1.4.1.1206.4.2.4.1.5.1.4.x	read/write. Restrictions see chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**	-
tss.tssSystemSetup.sensorZoneTable.sensorZoneEntry.sensorZoneLabel.x	.1.3.6.1.4.1.1206.4.2.4.1.5.1.5.x	read/write length: 8…255	-
tss.tssSystemSetup.clockAvailable.0	.1.3.6.1.4.1.1206.4.2.4.2.1.0		
tss.tssControl.maxOutputNumber.0	.1.3.6.1.4.1.1206.4.2.4.2.1.0		-
tss.tssControl.outputConfigurationTable.outputConfigurationEntry.outputNumber.x	.1.3.6.1.4.1.1206.4.2.4.2.2.1.1.x		-
tss.tssControl.outputConfigurationTable.outputConfigurationEntry.outputSensorZoneNumber.x	.1.3.6.1.4.1.1206.4.2.4.2.2.1.2.x	fixed value ! (write operation not supported)	-
tss.tssControl.outputConfigurationTable.outputConfigurationEntry.outputFailsafeMode.x	.1.3.6.1.4.1.1206.4.2.4.2.2.1.3.x	fixed value ! (write operation not supported)	-
tss.tssControl.outputConfigurationTable.outputConfigurationEntry.outputModeStatus.x	.1.3.6.1.4.1.1206.4.2.4.2.2.1.4.x		-
tss.tssControl.maxOutputGroups.0	.1.3.6.1.4.1.1206.4.2.4.2.3.0		-
tss.tssControl.outputGroupTable.outputGroupEntry.outputGroupNumber.x	.1.3.6.1.4.1.1206.4.2.4.2.4.1.1.x		-
tss.tssControl.outputGroupTable.outputGroupEntry.outputGroupOutputState.x	.1.3.6.1.4.1.1206.4.2.4.2.4.1.2.x	fixed value ! (write operation not supported)	-

tss.tssDataCollection.dataCollectionTable.dataCollectionEntry.endTime.x	**.1.3.6.1.4.1.1206.4.2.4.3.1.1.1.x**		**Wavecon channel 5002,5003 or 5004**
tss.tssDataCollection.dataCollectionTable.dataCollectionEntry.volumeData.x	**.1.3.6.1.4.1.1206.4.2.4.3.1.1.2.x**		**Wavecon channel 5002 traffic data (counter)**
tss.tssDataCollection.dataCollectionTable.dataCollectionEntry.percentOccupancy.x	**.1.3.6.1.4.1.1206.4.2.4.3.1.1.3.x**		**Wavecon channel 5004 avg. occupancy (scale factor 10) (%)**
tss.tssDataCollection.dataCollectionTable.dataCollectionEntry.speedData.x	**.1.3.6.1.4.1.1206.4.2.4.3.1.1.4.x**		**Wavecon channel 5003 avg. speed (scale factor 10) km/h**
tss.tssDataCollection.dataCollectionTable.dataCollectionEntry.zoneStatus.x	**.1.3.6.1.4.1.1206.4.2.4.3.1.1.5.x**		**Wavecon channel 5002,5003 or 5004**
tss.tssDataCollection.dataBufferTable.dataBufferEntry.endTimeBuffer.x	**.1.3.6.1.4.1.1206.4.2.4.3.2.1.1.x**		**Wavecon channel 5002,5003 or 5004**
tss.tssDataCollection.dataBufferTable.dataBufferEntry.volumeDataBuffer.x	**.1.3.6.1.4.1.1206.4.2.4.3.2.1.2.x**		**Wavecon channel 5002 traffic data (counter)**
tss.tssDataCollection.dataBufferTable.dataBufferEntry.percentOccupancyBuffer.x	**.1.3.6.1.4.1.1206.4.2.4.3.2.1.3.x**		**Wavecon channel 5004 avg. occupancy (scale factor 10) (%)**
tss.tssDataCollection.dataBufferTable.dataBufferEntry.speedDataBuffer.x	**.1.3.6.1.4.1.1206.4.2.4.3.2.1.4.x**		**Wavecon channel 5003 avg. speed (scale factor 10) (km/h)**
tss.tssDataCollection.dataBufferTable.dataBufferEntry.zoneStatusBuffer.x	**.1.3.6.1.4.1.1206.4.2.4.3.2.1.5.x**		**Wavecon channel 5002,5003 or 5004**

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All environmental sensor/measure values are reported under this subtree. Following list shows all objects (OIDs) as defined by the NTCIP standard in the NTCIP .mib file for ESS (1204v0426a.mib)

- OIDs which represent measurements are shown in **bold**.
- OIDs which represent configuration elements are shown in gray.
- OIDs which are “deprecated” or only relevant to “staffed” or “mobile” stations and are not shown by default are shown in *italics*.
- OIDs (or subtrees) which are NOT supported are shown underlined.

The “Source Sensor Assignment” column shows which sensor/measurement type should be assigned to this OID (in which format/unit), and where appropriate which conversion/scaling should be configured in the LCom sensor configuration, before the measurement is processed in the NTCIP section of the LCom. A scaling is stored in the NTCIP sensor configuration for each OID (independent of any possible scaling/value mapping in the LCom sensor configuration), which usually converts the unit delivered by the UMB sensor channel (e.g. °C) to the encoding required by the NTCIP standard (e.g. 1/10°C).

For measurement values which require “value mapping” (e.g. road condition), a default value mapping is used (e.g. “Road Condition Lufft (def) to NTCIP”) if no other value mapping is set for the corresponding sensor in the LCom sensor configuration. The default value mappings can be freely configured and changed – as can all other value mappings – or a different value mapping can be used by configuring a value mapping for the respective UMB sensor channel in the LCom sensor configuration.

Note for “Precipitation Intensity”: some of the OIDs expect a “source sensor” (see “Source Sensor Assignment” column below) scaled as “1/10 mm/h”. This is provided “native” by the UMB sensor channel for precipitation intensity. If you use other UMB sensor channels here, you might need to either scale the UMB sensor value to 1/10 mm/h, or adjust the scale factor for the respective OID.

OID (String)	**OID (Numeric)**	**Remarks**	**Source Sensor Assignment**
ess.essBufr.essBufrInstrumentation.essTypeofStation.0	.1.3.6.1.4.1.1206.4.2.5.1.2.1.0	Fixed value	
ess.essBufr.essBufrLocationVertical.essAtmosphericPressure.0	**.1.3.6.1.4.1.1206.4.2.5.1.7.4.0**		**Air pressure mbar**
ess.essBufr.essBufrWind.essAvgWindDirection.0	*.1.3.6.1.4.1.1206.4.2.5.1.11.1.0*	*Deprecated*	*Wind Direction (avg/vct)*

ess.essBufr.essBufrWind.essAvgWindSpeed.0	*.1.3.6.1.4.1.1206.4.2.5.1.11.2.0*	*Deprecated*	*Wind Speed (avg/vct) m/s*
ess.essBufr.essBufrWind.essMaxWindGustSpeed.0	*.1.3.6.1.4.1.1206.4.2.5.1.11.41.0*	*Deprecated*	*Wind Speed (max) m/s*
ess.essBufr.essBufrWind.essMaxWindGustDir.0	*.1.3.6.1.4.1.1206.4.2.5.1.11.43.0*	*Deprecated*	*Wind Direction (max) °*
ess.essBufr.essBufrPrecip.essRelativeHumidity.0	**.1.3.6.1.4.1.1206.4.2.5.1.13.3.0**		**Relative Humidity (act) %**
ess.essBufr.essBufrPrecip.essPrecipRate.0	**.1.3.6.1.4.1.1206.4.2.5.1.13.14.0**		**Precipitation Intensity (mm/h) -> scale UMB Sensor from 1/10 mm/h to tenths of grams per square meter per second (for rain, this is approximately to 0.36 mm/hr) !**
ess.essBufr.essBufrPrecip.essSnowfallAccumRate.0	**.1.3.6.1.4.1.1206.4.2.5.1.13.15.0**		**Precipitation Intensity (mm/h) -> scale UMB Sensor from 1/10 mm/h tenths of grams per**

			square meter per second (for rain, this is approximately to 0.36 mm/hr) !
ess.essBufr.essBufrPrecip.essPrecipitationOneHour.0	**.1.3.6.1.4.1.1206.4.2.5.1.13.19.0**		**Precipitation diff (mm)**
ess.essBufr.essBufrPrecip.essPrecipitationThreeHours.0	**.1.3.6.1.4.1.1206.4.2.5.1.13.20.0**		**Precipitation diff (mm)**
ess.essBufr.essBufrPrecip.essPrecipitationSixHours.0	**.1.3.6.1.4.1.1206.4.2.5.1.13.21.0**		**Precipitation diff (mm)**
ess.essBufr.essBufrPrecip.essPrecipitationTwelveHours.0	**.1.3.6.1.4.1.1206.4.2.5.1.13.22.0**		**Precipitation diff (mm)**
ess.essBufr.essBufrPrecip.essPrecipitation24Hours.0	**.1.3.6.1.4.1.1206.4.2.5.1.13.23.0**		**Precipitation diff (mm)**
ess.essBufr.essBufrRadiation.essInstantaneousTerrestrialRadiation.0	**.1.3.6.1.4.1.1206.4.2.5.1.14.17.0**		**Solar Radiation (w/m²)**
ess.essBufr.essBufrRadiation.essInstantaneousSolarRadiation.0	**.1.3.6.1.4.1.1206.4.2.5.1.14.18.0**		**Solar Radiation (w/m²)**
ess.essBufr.essBufrRadiation.essSolarRadiation.0	*.1.3.6.1.4.1.1206.4.2.5.1.14.24.0*	*Deprecated*	*Solar Radiation (J/m²)*
ess.essBufr.essBufrRadiation.essTotalRadiation.0	**.1.3.6.1.4.1.1206.4.2.5.1.14.25.0**		**Solar Radiation (w/m²) – average over last 24 hours above**

			“Radiation Daylight Limit”
ess.essBufr.essBufrRadiation.essTotalSun.0	**.1.3.6.1.4.1.1206.4.2.5.1.14.31.0**		**Source Sensor should indicate “Sunlight”. All (minute) values above “Radiation Daylight Limit” are summed up to calculate the total amount of sunshine. Note: Using a “Solar Radiation” sensor is usually not accurate to calculate “Sunshine” – a special “Ceilometer” or equivalent should be used**
ess.essNtcip.essNtcipIdentification.essNtcipCategory.0	.1.3.6.1.4.1.1206.4.2.5.2.1.1.0	Fixed value	
ess.essNtcip.essNtcipIdentification.essNtcipSiteDescription.0	.1.3.6.1.4.1.1206.4.2.5.2.1.2.0	Configurable	
ess.essNtcip.essNtcipLocation.essLatitude.0	.1.3.6.1.4.1.1206.4.2.5.2.2.1.0	Configurable	
ess.essNtcip.essNtcipLocation.essLongitude.0	.1.3.6.1.4.1.1206.4.2.5.2.2.2.0	Configurable	

ess.essNtcip.essNtcipLocation.essVehicleSpeed.0	*.1.3.6.1.4.1.1206.4.2.5.2.2.3.0*	*Mobile Station*	
ess.essNtcip.essNtcipLocation.essVehicleBearing.0	*.1.3.6.1.4.1.1206.4.2.5.2.2.4.0*	*Mobile Station*	
ess.essNtcip.essNtcipLocation.essOdometer.0	*.1.3.6.1.4.1.1206.4.2.5.2.2.5.0*	*Mobile Station*	
ess.essNtcip.essNtcipHeight.essReferenceHeight.0	.1.3.6.1.4.1.1206.4.2.5.2.3.1.0	Configurable	
ess.essNtcip.essNtcipHeight.essPressureHeight.0	.1.3.6.1.4.1.1206.4.2.5.2.3.2.0	Configurable	
ess.essNtcip.essNtcipHeight.essWindSensorHeight.0	.1.3.6.1.4.1.1206.4.2.5.2.3.3.0	Configurable/ Deprecated	
ess.essNtcip.essNtcipWind.essSpotWindDirection.0	*.1.3.6.1.4.1.1206.4.2.5.2.4.1.0*	*Deprecated*	*Wind Direction (°) act*
ess.essNtcip.essNtcipWind.essSpotWindSpeed.0	*.1.3.6.1.4.1.1206.4.2.5.2.4.2.0*	*Deprecated*	*Wind Speed (m/s) act*
ess.essNtcip.essNtcipWind.essSpotWindSituation.0	*.1.3.6.1.4.1.1206.4.2.5.2.4.3.0*	*Deprecated / Staffed Station*	
ess.essNtcip.essNtcipWind.windSensorTableNumSensors.0	.1.3.6.1.4.1.1206.4.2.5.2.4.7.0	Configurable	
…windSensorTable.windSensorEntry.windSensorIndex.x	.1.3.6.1.4.1.1206.4.2.5.2.4.8.1.1.x	Table Index	
…windSensorTable.windSensorEntry.windSensorHeight.x	.1.3.6.1.4.1.1206.4.2.5.2.4.8.1.2.x	Configurable	
…windSensorTable.windSensorEntry.windSensorLocation.x	.1.3.6.1.4.1.1206.4.2.5.2.4.8.1.3.x	Configurable	
…windSensorTable.windSensorEntry.windSensorAvgSpeed.x	**.1.3.6.1.4.1.1206.4.2.5.2.4.8.1.4.x**		**Wind Speed (m/s) avg/vct**
…windSensorTable.windSensorEntry.windSensorAvgDirection.x	**.1.3.6.1.4.1.1206.4.2.5.2.4.8.1.5.x**		**Wind Direction (°) avg/vct**
…windSensorTable.windSensorEntry.windSensorSpotSpeed.x	**.1.3.6.1.4.1.1206.4.2.5.2.4.8.1.6.x**		**Wind Speed (m/s) act**
…windSensorTable.windSensorEntry.windSensorSpotDirection.x	**.1.3.6.1.4.1.1206.4.2.5.2.4.8.1.7.x**		**Wind Direction (°) act**
…windSensorTable.windSensorEntry.windSensorGustSpeed.x	**.1.3.6.1.4.1.1206.4.2.5.2.4.8.1.8.x**		**Wind Speed (m/s) max**

…windSensorTable.windSensorEntry.windSensorGustDirection.x	**.1.3.6.1.4.1.1206.4.2.5.2.4.8.1.9.x**		**Wind Direction (°) max**
…windSensorTable.windSensorEntry.windSensorSituation.x	*.1.3.6.1.4.1.1206.4.2.5.2.4.8.1.10.x*	*Staffed Station*	
…windSensorTable.windSensorEntry.windSensorLatitude.x	.1.3.6.1.4.1.1206.4.2.5.2.4.8.1.11.x	Configurable	ESS V4
…windSensorTable.windSensorEntry.windSensorLongitude.x	.1.3.6.1.4.1.1206.4.2.5.2.4.8.1.12.x	Configurable	ESS V4
…windSensorTable.windSensorEntry.windSensorModelInformation.x	.1.3.6.1.4.1.1206.4.2.5.2.4.8.1.13.x	Configurable	ESS V4
ess.essNtcip.essNtcipTemperature.essNumTemperatureSensors.0	.1.3.6.1.4.1.1206.4.2.5.2.5.1.0	Configurable	
…essTemperatureSensorTable.essTemperatureSensorEntry.essTemperatureSensorIndex.x	.1.3.6.1.4.1.1206.4.2.5.2.5.2.1.1.x	Table Index	
…essTemperatureSensorTable.essTemperatureSensorEntry.essTemperatureSensorHeight.x	.1.3.6.1.4.1.1206.4.2.5.2.5.2.1.2.x	Configurable	
…essTemperatureSensorTable.essTemperatureSensorEntry.essAirTemperature.x	**.1.3.6.1.4.1.1206.4.2.5.2.5.2.1.3.x**		**Temperature (°C) act**
…essTemperatureSensorTable.essTemperatureSensorEntry.essTemperatureSensorLatitude.x	.1.3.6.1.4.1.1206.4.2.5.2.5.2.1.4.x	Configurable	ESS V4
…essTemperatureSensorTable.essTemperatureSensorEntry.essTemperatureSensorLongitude.x	.1.3.6.1.4.1.1206.4.2.5.2.5.2.1.5.x	Configurable	ESS V4
…essTemperatureSensorTable.essTemperatureSensorEntry.essTemperatureSensorLocation.x	.1.3.6.1.4.1.1206.4.2.5.2.5.2.1.6.x	Configurable	ESS V4
…essTemperatureSensorTable.essTemperatureSensorEntry.essTemperaturerSensorModelInformation.x	.1.3.6.1.4.1.1206.4.2.5.2.5.2.1.7.x	Configurable	ESS V4
ess.essNtcip.essNtcipTemperature.essWetbulbTemp.0	**.1.3.6.1.4.1.1206.4.2.5.2.5.3.0**		**Wet Bulb Temperature (°C) - OR - Temperature (°C) Rel. Humidity (%) [Air Pressure (mBar)]**
ess.essNtcip.essNtcipTemperature.essDewpointTemp.0	**.1.3.6.1.4.1.1206.4.2.5.2.5.4.0**		**Dewpoint Temperature (°C)**
ess.essNtcip.essNtcipTemperature.essMaxTemp.0	**.1.3.6.1.4.1.1206.4.2.5.2.5.5.0**		**Temperature (“C) max**

ess.essNtcip.essNtcipTemperature.essMinTemp.0	**.1.3.6.1.4.1.1206.4.2.5.2.5.6.0**		**Temperature (°C) min**
ess.essNtcip.essNtcipPrecip.essWaterDepth.0	*.1.3.6.1.4.1.1206.4.2.5.2.6.1.0*	*Deprecated*	*Water Depth (cm)*
ess.essNtcip.essNtcipPrecip.essAdjacentSnowDepth.0	**.1.3.6.1.4.1.1206.4.2.5.2.6.2.0**		**Snow Depth (cm)**
ess.essNtcip.essNtcipPrecip.essRoadwaySnowDepth.0	**.1.3.6.1.4.1.1206.4.2.5.2.6.3.0**		**Snow Depth (cm)**
ess.essNtcip.essNtcipPrecip.essRoadwaySnowPackDepth.0	**.1.3.6.1.4.1.1206.4.2.5.2.6.4.0**		**Snow Depth (cm)**
ess.essNtcip.essNtcipPrecip.essPrecipYesNo.0	**.1.3.6.1.4.1.1206.4.2.5.2.6.5.0**		**Precipitation diff (mm) or Precipiation Intensity (mm/h) – compared to "Precipitation Yes/No Limit"**
ess.essNtcip.essNtcipPrecip.essPrecipSituation.0	**.1.3.6.1.4.1.1206.4.2.5.2.6.6.0**		**Precipitation Type (Lufft) or value mapped to NTCIP** **Precipitation Intensity (mm/h)**
ess.essNtcip.essNtcipPrecip.essIceThickness.0	**.1.3.6.1.4.1.1206.4.2.5.2.6.7.0**		**Ice Thickness (mm)**
ess.essNtcip.essNtcipPrecip.essPrecipitationStartTime.0	**.1.3.6.1.4.1.1206.4.2.5.2.6.8.0**		**Precipitation diff (mm) or Precipiation Intensity**

			(mm/h) – compared to "Precipitation Yes/No Limit"
ess.essNtcip.essNtcipPrecip.essPrecipitationEndTime.0	**.1.3.6.1.4.1.1206.4.2.5.2.6.9.0**		**Precipitation diff (mm) or Precipitation Intensity (mm/h) – compared to "Precipitation Yes/No Limit"**
ess.essNtcip.essNtcipPrecip.precipitationSensorModelInformation.0	.1.3.6.1.4.1.1206.4.2.5.2.6.10.0	Configurable	
ess.essNtcip.essNtcipPrecip.waterLevelSensorTableNumSensors.0	.1.3.6.1.4.1.1206.4.2.5.2.6.11.0	Configurable	
…waterLevelSensorTable.waterLevelSensorEntry.waterLevelSensorIndex.x	.1.3.6.1.4.1.1206.4.2.5.2.6.12.1.1.x	Table Index	
…waterLevelSensorTable.waterLevelSensorEntry.waterLevelSensorReading.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.12.1.2.x**		**Water Level (cm)**
…waterLevelSensorTable.waterLevelSensorEntry.waterLevelSensorWarningLevel.x	.1.3.6.1.4.1.1206.4.2.5.2.6.12.1.3.x	Configurable	ESS V4
…waterLevelSensorTable.waterLevelSensorEntry.waterLevelSensorHeigth.x	.1.3.6.1.4.1.1206.4.2.5.2.6.12.1.4.x	Configurable	ESS V4
…waterLevelSensorTable.waterLevelSensorEntry.waterLevelSensorLatitude.x	.1.3.6.1.4.1.1206.4.2.5.2.6.12.1.5.x	Configurable	ESS V4
…waterLevelSensorTable.waterLevelSensorEntry.waterLevelSensorLongitude.x	.1.3.6.1.4.1.1206.4.2.5.2.6.12.1.6.x	Configurable	ESS V4
…waterLevelSensorTable.waterLevelSensorEntry.waterLevelSensorLocation.x	.1.3.6.1.4.1.1206.4.2.5.2.6.12.1.7.x	Configurable	ESS V4
…waterLevelSensorTable.waterLevelSensorEntry.waterLevelSensorModelInformation.x	.1.3.6.1.4.1.1206.4.2.5.2.6.12.1.8.x	Configurable	ESS V4
…waterLevelSensorTable.waterLevelSensorEntry.waterLevelSensorReferencePoint.x	.1.3.6.1.4.1.1206.4.2.5.2.6.12.1.9.x	Configurable	ESS V4
ess.essNtcip.essNtcipPrecip.precipitationSensorTableNumSensors.0	.1.3.6.1.4.1.1206.4.2.5.2.6.13.0	Configurable	ESS V4
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorIndex.x	.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.1.x	Table Index	ESS V4
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorHeight.x	.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.2.x	Configurable	ESS V4
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorLatitude.x	.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.3.x	Configurable	ESS V4
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorLongitude.x	.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.4.x	Configurable	ESS V4
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorLocation.x	.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.5.x	Configurable	ESS V4
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorModelInformation.x	.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.6.x	Configurable	ESS V4
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorPeriod.x	.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.7.x	Configurable	ESS V4

…precipitationSensorTable.precipitationSensorEntry.precipitationSensorAdjacentSnowDepth.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.8.x**		**ESS V4**
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorRoadwaySnowDepth.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.9.x**		**ESS V4**
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorRoadwaySnowPackDepth.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.10.x**		**ESS V4**
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorPrecipYesNo.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.11.x**		**ESS V4**
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorPrecipRate.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.12.x**		**ESS V4**
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorSnowfallAccumRate.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.13.x**		**ESS V4**
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorPrecipSituation.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.14.x**		**ESS V4**
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorIceThickness.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.15.x**		**ESS V4**
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorPrecipitationStartTime.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.16.x**		**ESS V4**
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorPrecipitationEndTime.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.17.x**		**ESS V4**
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorPrecipitationOneHour.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.18.x**		**ESS V4**
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorPrecipitationThreeHours.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.19.x**		**ESS V4**
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorPrecipitationSixHours.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.20.x**		**ESS V4**
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorPrecipitationTwelveHours.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.21.x**		**ESS V4**
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorPrecipitation24Hours.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.22.x**		**ESS V4**
…precipitationSensorTable.precipitationSensorEntry.precipitationSensorPrecipitationUserDefined.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.14.1.23.x**		**ESS V4**
ess.essNtcip.essNtcipPrecip.humiditySensorTableNumSensors.0	.1.3.6.1.4.1.1206.4.2.5.2.6.15.0	Configurable	ESS V4
…humiditySensorTable.humiditySensorEntry.humiditySensorIndex.x	.1.3.6.1.4.1.1206.4.2.5.2.6.16.1.1.x	Table Index	ESS V4
…humiditySensorTable.humiditySensorEntry.humiditySensorHeight.x	.1.3.6.1.4.1.1206.4.2.5.2.6.16.1.2.x	Configurable	ESS V4
…humiditySensorTable.humiditySensorEntry.humiditySensorLatitude.x	.1.3.6.1.4.1.1206.4.2.5.2.6.16.1.3.x	Configurable	ESS V4
…humiditySensorTable.humiditySensorEntry.humiditySensorLongitude.x	.1.3.6.1.4.1.1206.4.2.5.2.6.16.1.4.x	Configurable	ESS V4
…humiditySensorTable.humiditySensorEntry.humiditySensorLocation.x	.1.3.6.1.4.1.1206.4.2.5.2.6.16.1.5.x	Configurable	ESS V4
…humiditySensorTable.humiditySensorEntry.humiditySensorModelInformation.x	.1.3.6.1.4.1.1206.4.2.5.2.6.16.1.6.x	Configurable	ESS V4
…humiditySensorTable.humiditySensorEntry.humiditySensorRelativeHumidity.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.16.1.7.x**		**ESS V4**
…humiditySensorTable.humiditySensorEntry.humiditySensorTemperatureInformation.x	.1.3.6.1.4.1.1206.4.2.5.2.6.16.1.8.x	Configurable	ESS V4
…humiditySensorTable.humiditySensorEntry.humiditySensorWetBulbTemp.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.16.1.9.x**		**ESS V4**
…humiditySensorTable.humiditySensorEntry.humiditySensorDewpointTemp.x	**.1.3.6.1.4.1.1206.4.2.5.2.6.16.1.10.x**		**ESS V4**
ess.essNtcip.essNtcipRadiation.essCloudSituation.0	**.1.3.6.1.4.1.1206.4.2.5.2.7.1.0**		**Cloud Situation / Ceilometer – mapped to**

			NTCIP Coding (mapping needs to be configured !)
ess.essNtcip.essNtcipRadiation.essTotalRadiationPeriod.0	**.1.3.6.1.4.1.1206.4.2.5.2.7.2.0**		**Solar Radiation (w/m²) – seconds over last 24 hours above "Radiation Daylight Limit"**
ess.essNtcip.essNtcipRadiation.radiationSensorTableNumSensors.0	.1.3.6.1.4.1.1206.4.2.5.2.7.3.0	Configurable	ESS V4
…radiationSensorTable.radiationSensorEntry.radiationSensorIndex.x	.1.3.6.1.4.1.1206.4.2.5.2.7.4.1.1.x	Table Index	ESS V4
…radiationSensorTable.radiationSensorEntry.radiationSensorHeight.x	.1.3.6.1.4.1.1206.4.2.5.2.7.4.1.2.x	Configurable	ESS V4
…radiationSensorTable.radiationSensorEntry.radiationSensorLatitude.x	.1.3.6.1.4.1.1206.4.2.5.2.7.4.1.3.x	Configurable	ESS V4
…radiationSensorTable.radiationSensorEntry.radiationSensorLongitude.x	.1.3.6.1.4.1.1206.4.2.5.2.7.4.1.4.x	Configurable	ESS V4
…radiationSensorTable.radiationSensorEntry.radiationSensorLocation.x	.1.3.6.1.4.1.1206.4.2.5.2.7.4.1.5.x	Configurable	ESS V4
…radiationSensorTable.radiationSensorEntry.radiationSensorModelInformation.x	.1.3.6.1.4.1.1206.4.2.5.2.7.4.1.6.x	Configurable	ESS V4
…radiationSensorTable.radiationSensorEntry.essTotalSunV4.x	**.1.3.6.1.4.1.1206.4.2.5.2.7.4.1.7.x**		**ESS V4**
…radiationSensorTable.radiationSensorEntry.essInstantaneousTerrestrialRadiationV4.x	**.1.3.6.1.4.1.1206.4.2.5.2.7.4.1.8.x**		**ESS V4**
…radiationSensorTable.radiationSensorEntry.essInstantaneousSolarRadiationV4.x	**.1.3.6.1.4.1.1206.4.2.5.2.7.4.1.9.x**		**ESS V4**
…radiationSensorTable.radiationSensorEntry.essTotalRadiationV4.x	**.1.3.6.1.4.1.1206.4.2.5.2.7.4.1.10.x**		**ESS V4**
ess.essNtcip.essNtcipVisibility.essVisibility.0	**.1.3.6.1.4.1.1206.4.2.5.2.8.1.0**		**Visibility (m)**
ess.essNtcip.essNtcipVisibility.essVisibilitySituation.0	**.1.3.6.1.4.1.1206.4.2.5.2.8.3.0**		**Appropriate Sensor with mapping to NTCIP coding needs to be configured**
ess.essNtcip.essNtcipVisibility.visibilitySensorHeight.0	.1.3.6.1.4.1.1206.4.2.5.2.8.4.0	Configurable	ESS V4
ess.essNtcip.essNtcipVisibility.visibilitySensorLatitude.0	.1.3.6.1.4.1.1206.4.2.5.2.8.5.0	Configurable	ESS V4

ess.essNtcip.essNtcipVisibility.visibilitySensorLongitude.0	.1.3.6.1.4.1.1206.4.2.5.2.8.6.0	Configurable	ESS V4
ess.essNtcip.essNtcipVisibility.visibilitySensorLocation.0	.1.3.6.1.4.1.1206.4.2.5.2.8.7.0	Configurable	ESS V4
ess.essNtcip.essNtcipVisibility.visibilitySensorModelInformation.0	.1.3.6.1.4.1.1206.4.2.5.2.8.8.0	Configurable	ESS V4
ess.essNtcip.essNtcipPavement.numEssPavementSensors.0	.1.3.6.1.4.1.1206.4.2.5.2.9.1.0	Configurable	
…essPavementSensorTable.essPavementSensorEntry.essPavementSensorIndex.x	.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.1.x	Table Index	
…essPavementSensorTable.essPavementSensorEntry.essPavementSensorLocation.x	.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.2.x	Configurable	
…essPavementSensorTable.essPavementSensorEntry.essPavementType.x	.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.3.x	Configurable	
…essPavementSensorTable.essPavementSensorEntry.essPavementElevation.x	.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.4.x	Configurable	
…essPavementSensorTable.essPavementSensorEntry.essPavementExposure.x	.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.5.x	Configurable	
…essPavementSensorTable.essPavementSensorEntry.essPavementSensorType.x	.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.6.x	Configurable	
…essPavementSensorTable.essPavementSensorEntry.essPavementSurfaceStatus.x	**.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.7.x**		**Road Condition (Lufft) or mapped to NTCIP coding**
…essPavementSensorTable.essPavementSensorEntry.essSurfaceTemperature.x	**.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.8.x**		**Surface Temperature (°C)**
…essPavementSensorTable.essPavementSensorEntry.essPavementTemperature.x	**.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.9.x**		**Pavement Temperature (°C)**
…essNtcipPavement.essPavementSensorTable.essPavementSensorEntry.essSurfaceWaterDepth.x	*.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.10.x*	*Deprecated*	*Water Depth (µm)*
…essPavementSensorTable.essPavementSensorEntry.essSurfaceSalinity.x	**.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.11.x**		**Salinity in % (scaled by 1000 to convert to "parts per 100.000 per weight")**
…essPavementSensorTable.essPavementSensorEntry.essSurfaceConductivity.x	*.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.12.x*	*Deprecated*	*Conductivity in mhos*

…essPavementSensorTable.essPavementSensorEntry.essSurfaceFreezePoint.x	**.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.13.x**		**Freeze Point (°C)**
…essPavementSensorTable.essPavementSensorEntry.essSurfaceBlackIceSignal.x	**.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.14.x**		**Road Condition (mapped using "Lufft to Black ice" value mapping)**
…essPavementSensorTable.essPavementSensorEntry.essPavementSensorError.x	**.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.15.x**		**Road condition**
…essPavementSensorTable.essPavementSensorEntry.essSurfaceIceOrWaterDepth.x	**.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.16.x**		**Water Depth (µm)**
…essPavementSensorTable.essPavementSensorEntry.essSurfaceConductivityV2.x	**.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.17.x**		**Conductivity in mhos/cm**
…essPavementSensorTable.essPavementSensorEntry.pavementSensorModelInformation.x	.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.18.x	Configurable	
…essPavementSensorTable.essPavementSensorEntry.pavementSensorTemperatureDepth.x	.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.19.x	Configurable	
…essPavementSensorTable.essPavementSensorEntry.pavementSensorLatitude.x	.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.20.x	Configurable	ESS V4
…essPavementSensorTable.essPavementSensorEntry.pavementSensorLongitude.x	.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.21.x	Configurable	ESS V4
…essPavementSensorTable.essPavementSensorEntry.pavementSensorSurfaceCondition.x	**.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.22.x**		**ESS V4**
…essPavementSensorTable.essPavementSensorEntry.pavementSensorForecastCondition.x	**.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.23.x**		**ESS V4**
…essPavementSensorTable.essPavementSensorEntry.pavementSensorFrictionCoefficient.x	**.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.24.x**		**ESS V4**
…essPavementSensorTable.essPavementSensorEntry.pavementMonitorLatitude.x	.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.25.x	Configurable	ESS V4
…essPavementSensorTable.essPavementSensorEntry.pavementMonitorLongitude.x	.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.26.x	Configurable	ESS V4
…essPavementSensorTable.essPavementSensorEntry.pavementIcePercentage.x	**.1.3.6.1.4.1.1206.4.2.5.2.9.2.1.27.x**		**ESS V4**
ess.essNtcip.essNtcipPavement.numEssSubSurfaceSensors.0	.1.3.6.1.4.1.1206.4.2.5.2.9.3.0	Configurable	
…essSubSurfaceSensorTable.essSubSurfaceSensorEntry.essSubSurfaceSensorIndex.x	.1.3.6.1.4.1.1206.4.2.5.2.9.4.1.1.x	Table Index	
…essSubSurfaceSensorTable.essSubSurfaceSensorEntry.essSubSurfaceSensorLocation.x	.1.3.6.1.4.1.1206.4.2.5.2.9.4.1.2.x	Configurable	
…essSubSurfaceSensorTable.essSubSurfaceSensorEntry.essSubSurfaceType.x	.1.3.6.1.4.1.1206.4.2.5.2.9.4.1.3.x	Configurable	
…essSubSurfaceSensorTable.essSubSurfaceSensorEntry.essSubSurfaceSensorDepth.x	.1.3.6.1.4.1.1206.4.2.5.2.9.4.1.4.x	Configurable	
…essSubSurfaceSensorTable.essSubSurfaceSensorEntry.essSubSurfaceTemperature.x	**.1.3.6.1.4.1.1206.4.2.5.2.9.4.1.5.x**		**Sub Surface Temperature (°C)**

…essSubSurfaceSensorTable.essSubSurfaceSensorEntry.essSubSurfaceMoisture.x	**.1.3.6.1.4.1.1206.4.2.5.2.9.4.1.6.x or (essSubSurfaceSensorEntry skip index 6) .1.3.6.1.4.1.1206.4.2.5.2.9.4.1.7.x**		**Sub Surface Moisture (%)**
…essSubSurfaceSensorTable.essSubSurfaceSensorEntry.essSubSurfaceSensorError.x	**.1.3.6.1.4.1.1206.4.2.5.2.9.4.1.7.x or (essSubSurfaceSensorEntry skip index 6) .1.3.6.1.4.1.1206.4.2.5.2.9.4.1.8.x**		**Sub Surface Temperature (°C) (error condition is derived from sensor value)**
…essSubSurfaceSensorTable.essSubSurfaceSensorEntry.essSubSurfaceSensorLatitude.x	.1.3.6.1.4.1.1206.4.2.5.2.9.4.1.8.x or (essSubSurfaceSensorEntry skip index 6) .1.3.6.1.4.1.1206.4.2.5.2.9.4.1.9.x	Configurable	ESS V4
…essSubSurfaceSensorTable.essSubSurfaceSensorEntry.essSubSurfaceSensorLongitude.x	.1.3.6.1.4.1.1206.4.2.5.2.9.4.1.9.x or (essSubSurfaceSensorEntry skip index 6) .1.3.6.1.4.1.1206.4.2.5.2.9.4.1.10.x	Configurable	ESS V4
…essSubSurfaceSensorTable.essSubSurfaceSensorEntry.essSubSurfaceSensorModelInformation.x	.1.3.6.1.4.1.1206.4.2.5.2.9.4.1.10.x or (essSubSurfaceSensorEntry skip index 6) .1.3.6.1.4.1.1206.4.2.5.2.9.4.1.11.x	Configurable	ESS V4
ess.essNtcip.essNtcipPavement.essPavementBlock.0	.1.3.6.1.4.1.1206.4.2.5.2.9.5.0	Not Supported	
ess.essNtcip.essNtcipPavement.essSubSurfaceBlock.0	.1.3.6.1.4.1.1206.4.2.5.2.9.6.0	Not Supported	
ess.essNtcip.essNtcipMobile.essMobileFriction.0	*.1.3.6.1.4.1.1206.4.2.5.2.10.1.0*	*Mobile Station*	
ess.essNtcip.essNtcipMobile.essMobileObservationGroundState.0	*.1.3.6.1.4.1.1206.4.2.5.2.10.2.0*	*Mobile Station*	
ess.essNtcip.essNtcipMobile.essMobileObservationPavement.0	*.1.3.6.1.4.1.1206.4.2.5.2.10.3.0*	*Mobile Station*	

ess.essNtcip.essNtcipMobile.essMobileObservationGroundStateV4.0	*.1.3.6.1.4.1.1206.4.2.5.2.10.4.0*	*Mobile Station*	*ESS V4*
ess.essNtcip.essNtcipMobile.essMobileObservationPavementV4.0	*.1.3.6.1.4.1.1206.4.2.5.2.10.5.0*	*Mobile Station*	*ESS V4*
ess.essNtcip.essNtcipTreatment.*	.1.3.6.1.4.1.1206.4.2.5.2.11.*	Not Supported	
ess.essNtcip.essAirQuality.essCO.0	**.1.3.6.1.4.1.1206.4.2.5.2.12.1.0**		**CO (ppm)**
ess.essNtcip.essAirQuality.essCO2.0	**.1.3.6.1.4.1.1206.4.2.5.2.12.2.0**		**CO2 (ppb)**
ess.essNtcip.essAirQuality.essNO.0	**.1.3.6.1.4.1.1206.4.2.5.2.12.3.0**		**NO (ppm)**
ess.essNtcip.essAirQuality.essNO2.0	**.1.3.6.1.4.1.1206.4.2.5.2.12.4.0**		**NO2 (ppb)**
ess.essNtcip.essAirQuality.essSO2.0	**.1.3.6.1.4.1.1206.4.2.5.2.12.5.0**		**SO2 (ppb)**
ess.essNtcip.essAirQuality.essO3.0	**.1.3.6.1.4.1.1206.4.2.5.2.12.6.0**		**O3 (pp100b)**
ess.essNtcip.essAirQuality.essPM10.0	**.1.3.6.1.4.1.1206.4.2.5.2.12.7.0**		**PM (µg/m³)**
ess.essNtcip.essAirQuality.essAirQualityBlock.0	.1.3.6.1.4.1.1206.4.2.5.2.12.8.0	Not Supported	
ess.essNtcip.essAirQuality.essPM25.0	**.1.3.6.1.4.1.1206.4.2.5.2.12.9.0**		**ESS V4**
ess.essNtcip.essAirQuality.airQualitySensorTableNumSensors.0	.1.3.6.1.4.1.1206.4.2.5.2.12.10.0	Configurable	ESS V4
ess.essNtcip.essAirQuality.airQualitySensorTable.airQualitySensorEntry.airQualitySensorIndex.x	.1.3.6.1.4.1.1206.4.2.5.2.12.11.1.1.x	Table Index	ESS V4
ess.essNtcip.essAirQuality.airQualitySensorTable.airQualitySensorEntry.airQualitySensorHeight.x	.1.3.6.1.4.1.1206.4.2.5.2.12.11.1.2.x	Configurable	ESS V4
ess.essNtcip.essAirQuality.airQualitySensorTable.airQualitySensorEntry.airQualitySensorLatitude.x	.1.3.6.1.4.1.1206.4.2.5.2.12.11.1.3.x	Configurable	ESS V4
ess.essNtcip.essAirQuality.airQualitySensorTable.airQualitySensorEntry.airQualitySensorLongitude.x	.1.3.6.1.4.1.1206.4.2.5.2.12.11.1.4.x	Configurable	ESS V4
ess.essNtcip.essAirQuality.airQualitySensorTable.airQualitySensorEntry.airQualitySensorLocation.x	.1.3.6.1.4.1.1206.4.2.5.2.12.11.1.5.x	Configurable	ESS V4
ess.essNtcip.essAirQuality.airQualitySensorTable.airQualitySensorEntry.airQualitySensorModelInformation.x	.1.3.6.1.4.1.1206.4.2.5.2.12.11.1.6.x	Configurable	ESS V4
ess.essNtcip.essAirQuality.essCO2V4.0	**.1.3.6.1.4.1.1206.4.2.5.2.12.13.0**		**ESS V4**
ess.essNtcip.essAirQuality.essNOV4.0	**.1.3.6.1.4.1.1206.4.2.5.2.12.14.0**		**ESS V4**
ess.essNtcip.essAirQuality.essO3V4.0	**.1.3.6.1.4.1.1206.4.2.5.2.12.15.0**		**ESS V4**
ess.essNtcip.essNtcipSnapshot.essSnapShotNumberOfCameras.0	.1.3.6.1.4.1.1206.4.2.5.2.14.1.0	Configurable	
…essSnapshotCameraTable.essSnapshotCameraEntry.essSnapshotCameraIndex.x	.1.3.6.1.4.1.1206.4.2.5.2.14.2.1.1.x	Table Index	
…essSnapshotCameraTable.essSnapshotCameraEntry.essSnapshotCameraDescription.x	.1.3.6.1.4.1.1206.4.2.5.2.14.2.1.2.x	Configurable	
…essSnapshotCameraTable.essSnapshotCameraEntry.essSnapshotCameraStoragePath.x	.1.3.6.1.4.1.1206.4.2.5.2.14.2.1.3.x	Configurable	

…essSnapshotCameraTable.essSnapshotCameraEntry.essSnapshotCameraCommand.x	.1.3.6.1.4.1.1206.4.2.5.2.14.2.1.4.x	Command/ Control	
…essSnapshotCameraTable.essSnapshotCameraEntry.essSnapshotCameraError.x	.1.3.6.1.4.1.1206.4.2.5.2.14.2.1.5.x	Implicit value	
ess.essNtcip.essNtcipInstrumentation.essDoorStatus.0	**.1.3.6.1.4.1.1206.4.2.5.2.15.1.0**		**Door Contact (logic)**
ess.essNtcip.essNtcipInstrumentation.essBatteryStatus.0	**.1.3.6.1.4.1.1206.4.2.5.2.15.2.0**		**Battery Status (%)**
ess.essNtcip.essNtcipInstrumentation.essLineVolts.0	**.1.3.6.1.4.1.1206.4.2.5.2.15.3.0**		**Line Volts (V)**
ess.essNtcip.essNtcipInstrumentation.essStationMetaDataBlock.0	.1.3.6.1.4.1.1206.4.2.5.2.15.4.0	Not Supported	
ess.essNtcip.essNtcipInstrumentation.essStationWeatherBlock.0	.1.3.6.1.4.1.1206.4.2.5.2.15.5.0	Not Supported	
ess.essNtcip.essNtcipInstrumentation.essMobileBlock.0	*.1.3.6.1.4.1.1206.4.2.5.2.15.6.0*	*Mobile Station / Not Supported*	
ess.essNtcip.essNtcipInstrumentation.essStationMetaDataV3Block.0	*.1.3.6.1.4.1.1206.4.2.5.2.15.7.0*	*Not Supported*	
ess.essNtcip.essNtcipInstrumentation.essWeatherV3Block.0	*.1.3.6.1.4.1.1206.4.2.5.2.15.8.0*	*Not Supported*	
ess.essNtcip.essNtcipInstrumentation.essStatus.0	.1.3.6.1.4.1.1206.4.2.5.2.15.9.0		ESS V4
ess.essNtcip.essNtcipPressure.essNumPressureSensors.0	.1.3.6.1.4.1.1206.4.2.5.2.16.1.0		ESS V4
ess.essNtcip.essNtcipPressure.essPressureSensorTable.essPressureSensorEntry.essPressureSensorIndex.x	.1.3.6.1.4.1.1206.4.2.5.2.16.2.1.1.x	Table Index	ESS V4
ess.essNtcip.essNtcipPressure.essPressureSensorTable.essPressureSensorEntry.essPressureSensorHeight.x	.1.3.6.1.4.1.1206.4.2.5.2.16.2.1.2.x	Configurable	ESS V4
ess.essNtcip.essNtcipPressure.essPressureSensorTable.essPressureSensorEntry.essPressureSensorLatitude.x	.1.3.6.1.4.1.1206.4.2.5.2.16.2.1.3.x	Configurable	ESS V4
ess.essNtcip.essNtcipPressure.essPressureSensorTable.essPressureSensorEntry.essPressureSensorLongitude.x	.1.3.6.1.4.1.1206.4.2.5.2.16.2.1.4.x	Configurable	ESS V4
ess.essNtcip.essNtcipPressure.essPressureSensorTable.essPressureSensorEntry.essPressureSensorLocation.x	.1.3.6.1.4.1.1206.4.2.5.2.16.2.1.5.x	Configurable	ESS V4
ess.essNtcip.essNtcipPressure.essPressureSensorTable.essPressureSensorEntry.essPressureSensorModelInformation.x	.1.3.6.1.4.1.1206.4.2.5.2.16.2.1.6.x	Configurable	ESS V4
ess.essNtcip.essNtcipPressure.essPressureSensorTable.essPressureSensorEntry.essPressureSensorAtmosphericPressure.x	**.1.3.6.1.4.1.1206.4.2.5.2.16.2.1.7.x**		**ESS V4**

5.8.3.5 iso.org.dod.internet.private.enterprises.nema.transportation.devices.global

OID (String)	OID (Numeric)	Remarks
global.globalConfiguration.globalSetIDParameter.0	.1.3.6.1.4.1.1206.4.2.6.1.1.0	Calculated
global.globalConfiguration.globalMaxModules.0	.1.3.6.1.4.1.1206.4.2.6.1.2.0	Configurable
…globalModuleTable.moduleTableEntry.moduleNumber.x	.1.3.6.1.4.1.1206.4.2.6.1.3.1.1.x	Configurable
…globalModuleTable.moduleTableEntry.moduleDeviceNode.x	.1.3.6.1.4.1.1206.4.2.6.1.3.1.2.x	Configurable
…globalModuleTable.moduleTableEntry.moduleMake.x	.1.3.6.1.4.1.1206.4.2.6.1.3.1.3.x	Configurable
…globalModuleTable.moduleTableEntry.moduleModel.x	.1.3.6.1.4.1.1206.4.2.6.1.3.1.4.x	Configurable
…globalModuleTable.moduleTableEntry.moduleVersion.x	.1.3.6.1.4.1.1206.4.2.6.1.3.1.5.x	Configurable
…globalModuleTable.moduleTableEntry.moduleType.x	.1.3.6.1.4.1.1206.4.2.6.1.3.1.6.x	Configurable
global.globalConfiguration.controllerBaseStandards.0	.1.3.6.1.4.1.1206.4.2.6.1.4.0	Fixed Value
global.globalDBManagement.*	.1.3.6.1.4.1.1206.4.2.6.2.*	Not Supported
global.globalTimeManagement.globalTime.0	.1.3.6.1.4.1.1206.4.2.6.3.1.0	Calculated
global.globalTimeManagement.globalDaylightSaving.0	.1.3.6.1.4.1.1206.4.2.6.3.2.0	Deprecated***
global.globalTimeManagement.timebase.maxTimeBaseScheduleEntries.0	.1.3.6.1.4.1.1206.4.2.6.3.3.1.0	Always 0
global.globalTimeManagement.timebase.maxDayPlans.0	.1.3.6.1.4.1.1206.4.2.6.3.3.3.0	Always 0
global.globalTimeManagement.timebase.maxDayPlanEvents.0	.1.3.6.1.4.1.1206.4.2.6.3.3.4.0	Always 0
global.globalTimeManagement.timebase.dayPlanStatus.0	.1.3.6.1.4.1.1206.4.2.6.3.3.6.0	Always 0
global.globalTimeManagement.timebase.timeBaseScheduleTableStatus.0	.1.3.6.1.4.1.1206.4.2.6.3.3.7.0	Always 0
devices.global.globalTimeManagement.globalLocalTimeDifferential.0	.1.3.6.1.4.1.1206.4.2.6.3.4.0	Deprecated*** !
global.globalTimeManagement.controllerStandardTimeZone.0	.1.3.6.1.4.1.1206.4.2.6.3.5.0	Calculated
global.globalTimeManagement.controllerLocalTime.0	.1.3.6.1.4.1.1206.4.2.6.3.6.0	Calculated
global.globalReport.*	.1.3.6.1.4.1.1206.4.2.6.4.*	Not Supported
global.security.communityNameAdmin.0	.1.3.6.1.4.1.1206.4.2.6.5.1.0	**
global.security.communityNamesMax.0	.1.3.6.1.4.1.1206.4.2.6.5.2.0	Configurable/10
…communityNameTable.communityNameTableEntry.communityNameIndex.x	.1.3.6.1.4.1.1206.4.2.6.5.3.1.1.x	Tab Index
…communityNameTable.communityNameTableEntry.communityNameUser.x	.1.3.6.1.4.1.1206.4.2.6.5.3.1.2.x	**
…communityNameTable.communityNameTableEntry.communityNameAccessMask.x	.1.3.6.1.4.1.1206.4.2.6.5.3.1.3	**

** Note regarding the “global.security” subtree:

- The Microsoft SNMP framework used only supports a simple security model, i.e. a “community name” either has “write/read” access to ALL OIDs, or read-only access to all OIDs (or no access at all). This includes the “global.security” subtree.
- Configuration changes (add/change/delete community names) in the “security” subtree automatically lead to a reboot of the LCom, because these settings only take effect after an operating system reboot.

*** Note regarding “deprecated” OIDs: these OIDs are only supported if the corresponding parameter (“support deprecated OID”) is set for the NTCIP SNMP Agent.

5.8.4 Camera Support

LCom supports the “recording of camera snapshots” as described in the NTCIP standard. All configuration settings for the snapshots (host name, port, user name, password etc.) can be set in the “essSnapshotCameraTable” configuration dialog.

The picture is transferred from the camera via HTTP when the appropriate command is sent to the LCom via NTCIP (a “SET” command on …essSnapshotCameraTable.essSnapshotCameraEntry.essSnapshotCameraCommand.X). The image is stored in the “FTP server’s root” directory on the LCom (usually \temp\ftp, but depending on other configuration might also be "\Storage Card\ftp”).

While the picture is being captured/transferred from the camera, the “…essSnapshotCameraCommand.X” OID will report “captureSnapshot”, and any “SET” commands to the OID will be rejected with an SNMP “General Error”. When the picture transfer to the LCom is finished, the “…essSnapShotCameraCommand.X” will report “ready”. If the transfer was successful, the corresponding “…essSnapshotCameraError.X” OID reports “none” – or “hardware” / “insufficientMemory” if there was an error transferring the picture file.

The FTP server on the LCom allows “anonymous” read-only access to the “\temp\ftp” directory in order to retrieve the camera picture from the LCom (user name: “anonymous”, password: any).

Note: NTCIP camera support is independent of the MSSI camera support (see below).

5.8.5 NTCIP 1209 TSS

Support for NTCIP 1209 TSS is (for now) limited to transmitting the traffic data under tss.tssDataCollection.dataCollectionTable and tss.tssdataCollection.dataBufferTable.

The following values can be transmitted:

volumeData(Buffer): the traffic volume / number of cars per time period
percentOccupancy(Buffer): the average occupancy of the lane per time period
speedData(Buffer): the average speed of the verhicles on the lane per time period

These values correspond to the following Wavecon UMB channels:
5002 Intvl traffic data
5004 Intvl avg. occupancy
5003 Intvl avg speed

The LCom retrieves data from the Wavetronix/Wavecon UMB module every minute, i.e. the sample interval/period in the Wavetronix module is fixed to 60 seconds.

As the data might be retrieved via NTCIP in flexible/greater time intervals (as specified by the settings in the respective tss.tssSystemSetup.sensorZoneTable.sensorZoneEntry.sensorZoneSamplePeriod entry), the values need to be stored/buffered in the LCom.

Therefore, “Use Data Store” in System Settings (see chapter 5.13), and “Store Values” for each of these sensor channels in Sensor Settings (see chapter 5.6) must be activated.

Besides that, “Support TSS” must be activated in the NTCIP Agent Parameters settings (see chapter 5.8.2.1), and for every lane an entry in the tss.tssSystemSetup.sensorZoneTable must be created (see chapter 5.8.2.16).

If a sensor channel is assigned to one of the tssDataCollection.dataCollectionTable (or .dataBufferTable) OIDs in the sensor Assignment dialog, all OID's of this table entry will be assigned appropriate sensor channels of the same Wavecon device (if no channels have been assigned yet).

5.8.6 NTCIP Data Store / History

The dataStore MIB subtree (see chapter 5.8.3.2.7) provides access to the data stored on the rpu (note: this is a private extension of the NTCIP standard, and only supported by the LCom Version 2.11.0 or newer).

The OIDs whose values are stored in the data store are configured in the "historySensorOidTable" (see chaper 5.8.2.17.2).

The simplest way to access the last 255 stored values with a 1-minute reporting interval (i.e. the interval the data is stored on the rpu) is:

a) Read the historySensorTable (i.e. read the number of entries in the historySensorTable via `dataStore.numHistorySensorEntries.0`, and then read the entries). The sequence of these OIDs will be used in the resultsTable to report the respective oid values.
b) Write a value of "2" (runQuery) to the `dataStore.queryCommandAndStatus.0` OID
c) Read the `dataStore.queryCommandAndStatus.0` OID until the status changes from 2 (runQuery) to another value. The resulting value indicates weather the query was successful or not. A value of 3 (dataReady) or 4 (dataPartialReady) indicates the query was successful, and the result is provided in the queryResultsTable
d) Read the number of valid rows in the results table through reading the `dataStore.numRowsInResult.0` OID

   Note: if the query was successful (no error occurred), but there are no values available in the given interval, the number of rows in the result will be reported as 0

e) Read the resultsTable – `dataStore.queryResultsTable.queryResultsEntry.rowMeasureTime.x` will provide the UTC timestamp of the measure values reported by the corresponding `dataStore.queryResultsTable.queryResultsEntry.rowValues.x` OID.

f) Clear the result set (and query parameters) by writing a value of 7 (done) to the `dataStore.queryCommandAndStatus.0` OID.

rowValues is an OctetString – containing one 32bit (signed or unsigned, depending on the corresponding sensor OID entry) integer value for each OID reported in the historySensorOidTable – in exactly the same sequence as the sensor OIDs in above table.

If data for a longer time period, or with a different reporting interval (greater than the store interval of 1 minute) should be reported, the following sequence of SNMP requests can be used:

a) Read the historySensorTable (i.e. read the number of entries in the historySensorTable via `dataStore.numHistorySensorEntries.0`, and then read the entries). The sequence of these OIDs will be used in the resultsTable to report the respective oid values.

b) Write the desired value for the reporting interval (if data should be reported in an interval > 1 minute) to the `dataStore.reportingInterval.0` OID. Valid values are:
1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 30 or 60 minutes.

c) Write the desired start timestamp to the `dataStore.queryStartTime.0` OID. The rpu stores data up to 1 year – so the timestamp might not be more than one year in the past!

d) Write a value of “2” (runQuery) to the `dataStore.queryCommandAndStatus.0` OID

e) Read the `dataStore.queryCommandAndStatus.0` OID until the status changes from 2 (runQuery) to another value. The resulting value indicates weather the query was successful or not. A value of 3 (dataReady) or 4 (dataPartialReady) indicates the query was successful, and the result is provided in the queryResultsTable

Note: the bigger the value for the reporting interval is, and the more Sensor OIDs are configured for the data store, the longer it takes for the rpu to read and calculate the aggregated data for each OID (which is calculated depending on the statistics Type settings for the respective OID in the historySensors table). Calculating the data might take up to several minutes! The maximum number of entries in the resultsTable is 255 – so if more than 255 rows are to be expected, the status reported above will be "dataPartialReady".

f) Read the number of valid rows in the results table through reading the `dataStore.numRowsInResult.0` OID

Note: if the query was successful (no error occurred), but there are no values available in the given interval, the number of rows in the result will be reported as 0.

g) Read the resultsTable – `dataStore.queryResultsTable.queryResultsEntry.rowMeasureTime.x` will provide the UTC timestamp of the measure values reported by the corresponding `dataStore.queryResultsTable.queryResultsEntry.rowValues.x` OID.

h) Read the "dataStore.resultEndTime.0" parameter. This reports the end of the interval analyzed for the current result set. If the data provided does not cover all the time period needed (the `dataStore.queryCommandAndStatus.0` value will be dataPartialReady (4) if more data is available in the data store), re-calculate a new startTime timestamp and repeat from step c) !

i) After all values have been retrieved, clear the result set (and query parameters) by writing a value of 7 (done) to the `dataStore.queryCommandAndStatus.0` OID.

5.9 MSSI

The “MSSI” protocol was specified in co-operation with AsfinAG Austria, to provide an “open protocol” (based on open standards – SOAP, i.e. HTTP and XML) that not only allows to transfer measurement data from road weather stations and camera pictures within the AsfinAG Network, but allows the transfer of any measurement data in any unit without restrictions.
The “AsfinAG compliant” MSSI protocol is a “subset” of the MSSI protocol, in that the type and unit/encoding of sensor values is limited by AsfinAG to a specific set of sensors.
A detailed description of the protocol is provided in the MSSI documentation and the AsfinAG documentation.

The MSSI protocol in the LCom is independent from other “uplink protocols”, i.e. MSSI can be used in addition to TLS, TLSoIP or NTCIP.
However, if the same “source” sensor (UMB sensor channel) is used for both protocols (the “uplink” protocol and MSSI), the same value mapping/encoding (except the specific NTCIP scaling, see above) is used for both protocols, i.e. the encoding/unit of the sensor value is identical.
Note that you can of course configure an UMB “TLS” channel (that reports values in the appropriate TLS encoding) to be only reported via TLS (by setting the MSSI type and/or ID of the sensor to 0), and a different UMB channel (that, for example, reports the standard SI unit °C for temperature) to be only reported via MSSI (by setting the TLS FG/Type and Channel to 0), where both UMB sensor channels actually refer to the same physical sensor.

The MSSI protocol is based on a “SOAP” service. The station (the LCom) is the SOAP “server” (provides the service/data) and the data center (e.g. SmartView3) is the SOAP client, i.e. connects to the client and requests the data (or other operation).

Please note the following limitations in relation to the MSSI specification:

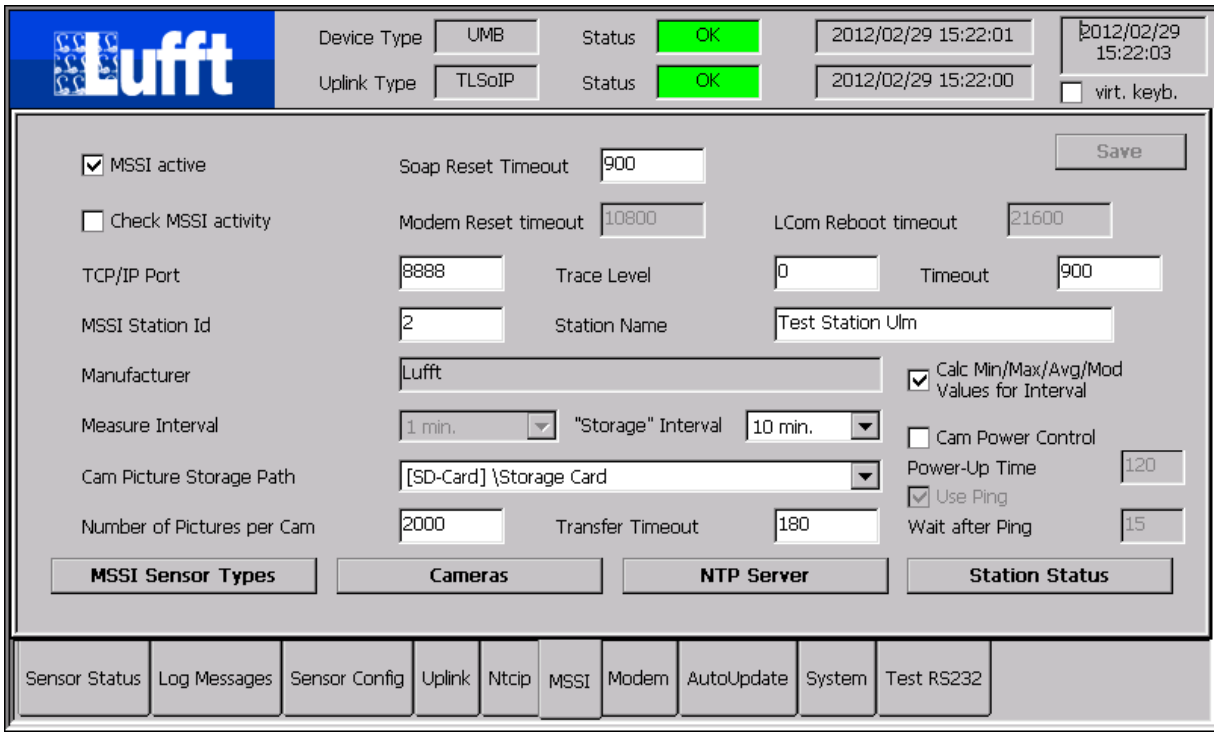
1.) The “measure interval” on the LCom is fixed at 1 minute and can not be changed. The measure interval on the LCom is the same for all channels (not on a “per sensor channel” basis).

2.) The “Storage Interval” on the LCom does not really refer to the interval in which the sensor values are stored in the ring memory (on the SD card). The LCom always stores the measure values in the “Measure Interval” (i.e. every minute).

   However, if the MSSI “Storage Interval” is set to a value greater than one minute, the stored data will be reported in the specified time period (e.g. 10 minutes). If “Calc Min/Max/Avg/Sum Values” is active (the default), the LCom will calculate the min/max/avg or sum for the sensor value over the specified “Storage Interval” (which is in accordance to the MSSI protocol specification). If “Calc Min/Max/Avg/Sum Values” is not active, only the last value for the specified time period will be reported. Note that in this case “sum” values (like precipitation amount) are NOT correct, as the last stored value always only refers to the last minute, not the complete “Storage Interval” time period.

3.) Signaling of warnings and alarms is not supported by the LCom (this is an optional feature of the MSSI protocol).

5.9.1 MSSI Configuration



The following parameters can be set for MSSI protocol:

- **Soap Reset Timeout:** if no Soap/MSSI Request is received within the configured time interval, the Soap/MSSI protocol stack is reset. This is to handle a known problem that the MSSI protocol stack may “hang” sometimes (under unknown circumstances).
- **Check MSSI activity:** if this option is selected, the MSSI requests are monitored, and if the configured time intervals for Modem Reset Timeout or LCom Reboot Timeout is expired without MSSI activity, the appropriate action is taken.
    - **Modem Reset Timeout:** if there was no MSSI activity/request for the configured time interval (in seconds), the GPRS or Analog modem is reset (if either is configured/active). A timeout value of 0 will disable the modem reset.
    - **LCom Reboot Timeout:** if there was no MSSI activity/request for the configured time interval (in seconds), the LCom will be rebooted. A timeout value of 0 will disable rebooting.

- **TCP/IP port:** The TCP/IP port (TCP) for the MSSI SOAP service on the LCom. Default: 8888.
  Note: The LCom must be restarted after changing the TCP/IP port for the change to take effect.
- **Trace level:** The trace level for the MSSI protocol – controls the trace output of the MSSI protocol driver to the log file (usually: 0).
- **MSSI Station ID:** The unique MSSI station ID for this station.
- **Station name:** The name of the station (same as the station name that can be set under “System”).
- **Manufacturer:** The manufacturer of the station (“Lufft”).
- **Measure interval:** The measure interval according to the MSSI standard. Here: the polling interval for the UMB devices.
  Limitation: the measure interval on the LCom is 1 minute and can not be changed.
- **“Storage” interval:** The data storage interval according to the MSSI standard – in the case of LCom this is NOT the actual storage interval in the ring memory on the SD card (the data is always stored at 1 minute intervals here) but merely the interval at which the data is reported when reading stored measurement values via MSSI.
- **Calculate min/max/avg/mod values for interval:** If the “data storage” interval is greater than the measurement interval (1 minute) the minimum/maximum/average/modal or sum of the measure values are calculated over the “storage” interval if this parameter is set. Otherwise, only the last stored value for the “data storage” interval is reported.
- **Images directory:** The local directory/medium where the camera images are to be stored. Possible locations are “SD Card” (“\Storage Card”), USB Stick (“\Hard Disk”) or RAM (“\Temp”).
- **Number of images per camera:** The maximum number of camera images which are to be stored per camera. Default: 500.
  Note: This value should be selected so that sufficient memory space is always available on the corresponding medium under all circumstances. If measurement data are also stored on the medium (SD Card), the

measurement data memory must be configured and initialized (and thus allocated on the SD Card) before the first camera image is saved.

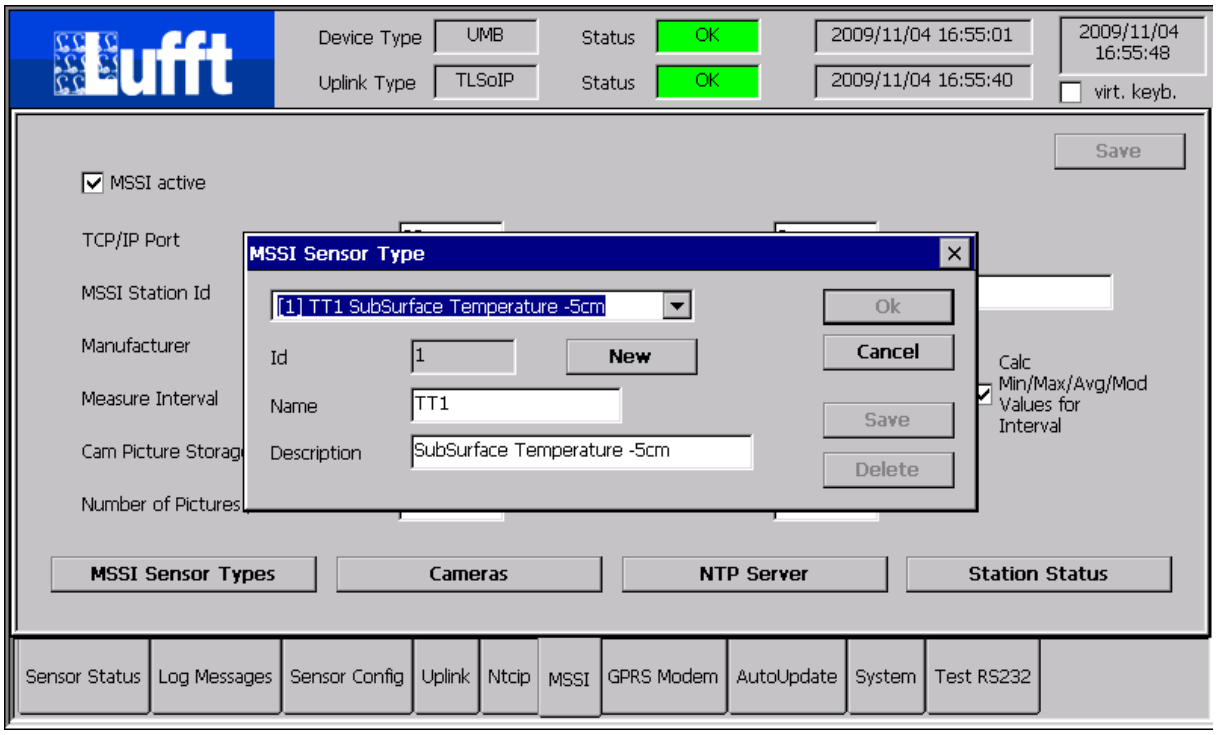
- **Transfer timeout:** The timeout for the transmission of a camera image via MSSI. The transfer is canceled if there is no further action within this time period in relation to an initiated data transfer.
- **Cam Power Control:** if the station is not connected via TLS/Inselbus, the GUB_3 power line can (in conjunction with appropriate hardware, e.g. a relais) be used to control the power for connected camera(s), e.g. the power for the camera is only switched on if a picture is transferred from the camera
- **Power-Up Time:** time (in seconds) to wait after the power is switched on before acquiring a picture from the camera
- **Use Ping:** if this option is selected, “ping” requests are sent to the camera after the power is switched on, until the ping request is answered (or the “power up time” is expired). If the camera responds to the ping request, the “Wait after Ping” time is waited before a picture is acquired from the camera.
- **Wait after Ping:** time (in seconds) to wait after the camera responds to a ping request before acquiring a picture.

The sensor channels that are active for the MSSI protocol are defined via the corresponding UMB sensor channel configuration (see Sensor Configuration above). All sensor channels that have a MSSI sensor ID and MSSI sensor type assigned are presented via the protocol.

Note: AsfinAG limits the sensor types and units/encodings for use within the AsfinAG network to a specific subset (sensor types and units/encodings; see MSSI protocol specification or AsfinAG documentation), e.g. the road condition must be “TLS FG3 DE Type 70” encoded, or the precipitation type must be “WMO standard (similar to TLS FG3 DE Type 71)” encoded.
The appropriate UMB channels, with additional value mapping if necessary, has to be configured.

5.9.2 MSSI Sensor Types

The sensor type (e.g. road condition, road surface temperature, air temperature etc.) is encoded as a numeric value in the MSSI protocol.
Many sensor types are already pre-defined here – however there is an option to specify additional “user defined” types.

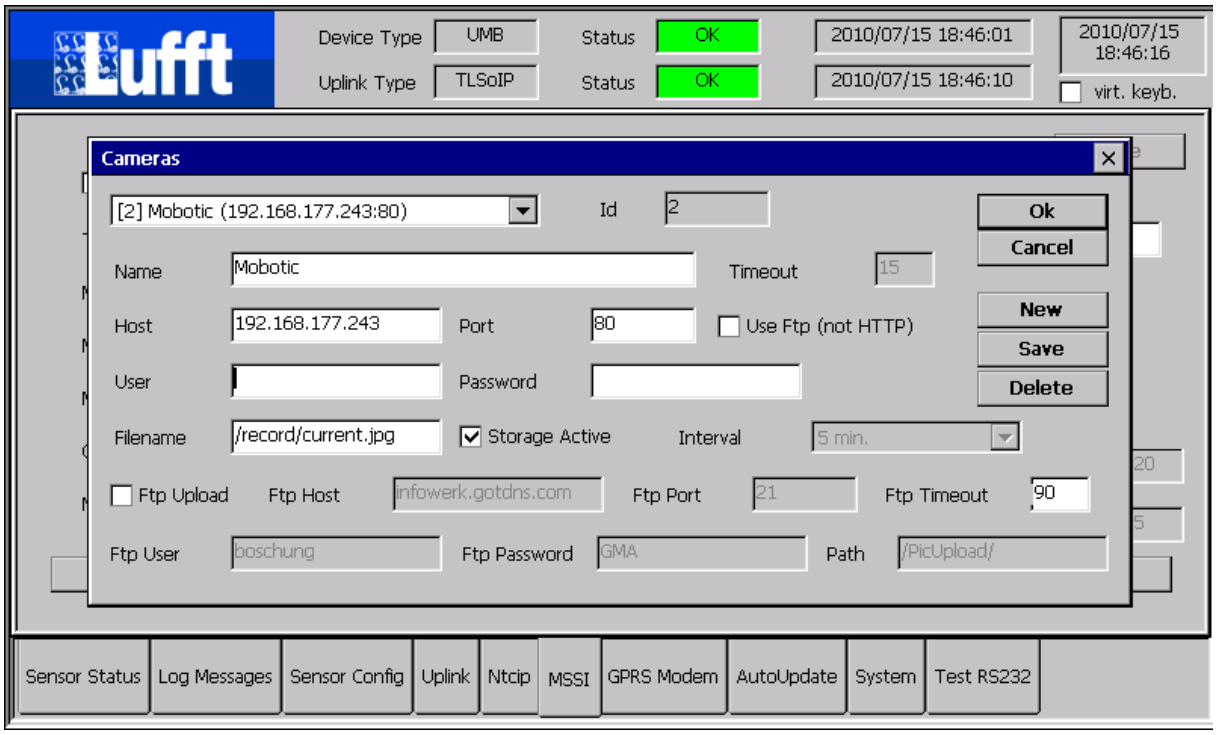


The pre-defined and user-defined types can be configured in the “MSSI Sensor Type” dialog.
Click “New” to create a new user defined sensor type.

(See the MSSI protocol specification or Asfinag documentation for further details).

5.9.3 MSSI Cameras

In addition to the sensor values, camera images can be transmitted via the MSSI protocol. If an SD card or UMB stick is present, the camera pictures can be stored as well.



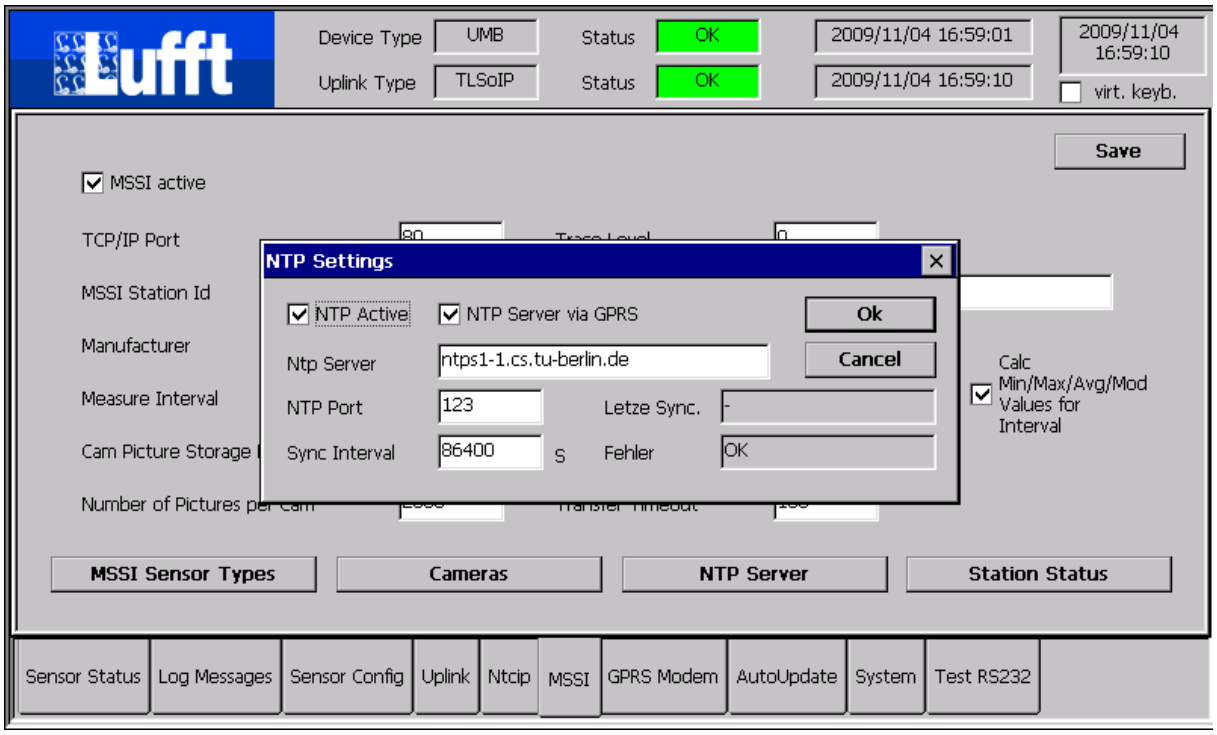
- **Id:** The unique camera ID (per station)
- **Name:** The name of the camera
- **Host:** TCP/IP address or DNS host name of the camera (camera server)
- **Port:** TCP/IP port of the camera (camera server)
- **Use Ftp (not http):** The camera image is transmitted from the camera (to the LCom) via FTP instead of http
- **User:** FTP/http user name
- **Password**: FTP/http password
- **File name:** The file name/URL on the camera (camera server).
- **Storage active:** The camera image is transmitted and stored automatically at the specified interval.

  Note: there are 2 different operations specified in the MSSI protocol to either transmit a “current” camera picture (“GetCurrentCameraPicture()”), or read stored camera pictures from the “picture storage” (“GetStoredCameraPicture()”). If you only plan to transfer a “current” camera image via MSSI, it is not necessary to save the image on the LCom.
- **Interval:** The transmission/storage interval of the camera image.

- **FTP upload:** The transmitted camera image is transferred to a server via FTP.
  FTP host/port/user/password: The access data to the FTP server for the upload.
- **FTP Timeout:** timeout (in seconds) for the FTP communication.
- **Path.** The directory on the FTP server in which the image is to be stored. If a directory name (no extension) is specified, then the remote filename is build using the specified directory name and the MSSI Camera filename (<mssi_station_id>_<mssi_camera_id>_<timestamp>.jpg). If a name with extension is specified, this name is used. Following tags can be used as part of the path/filename:
  <timestamp> the timestamp in format: YYYYMMDDhhmmss
  <date>: the date in format: YYYYMMDD
  <year>: the year in format: YYYY
  <month>: the month in format: MM
  <day>: the day of month in format: DD
  <hour>: the hour of the day in format: hh
  <min>: the minute of the hour in format: mm
  <sec>: the second of the minute in format: ss

5.9.4 NTP Server

The LCom clock can be synchronized with a NTP Server:



- **NTP active:** Time synchronization via NTP is active
- **NTP server via GPRS:** The connection to the NTP server is established over the GPRS modem (if this flag is selected, the connection to the NTP server is only established after the GPRS connection has been established).
- **NTP server:** The DNS name or IP address of the NTP server.
- **NTP port:** The TCP/IP port (standard: 123) for the NTP server.
- **Sync interval:** The synchronization interval in seconds
- **Last sync:** Time of the last synchronization with the NTP server
- **Error:** Error on the last synchronization with the NTP server – or “OK”

5.9.5 Station Status

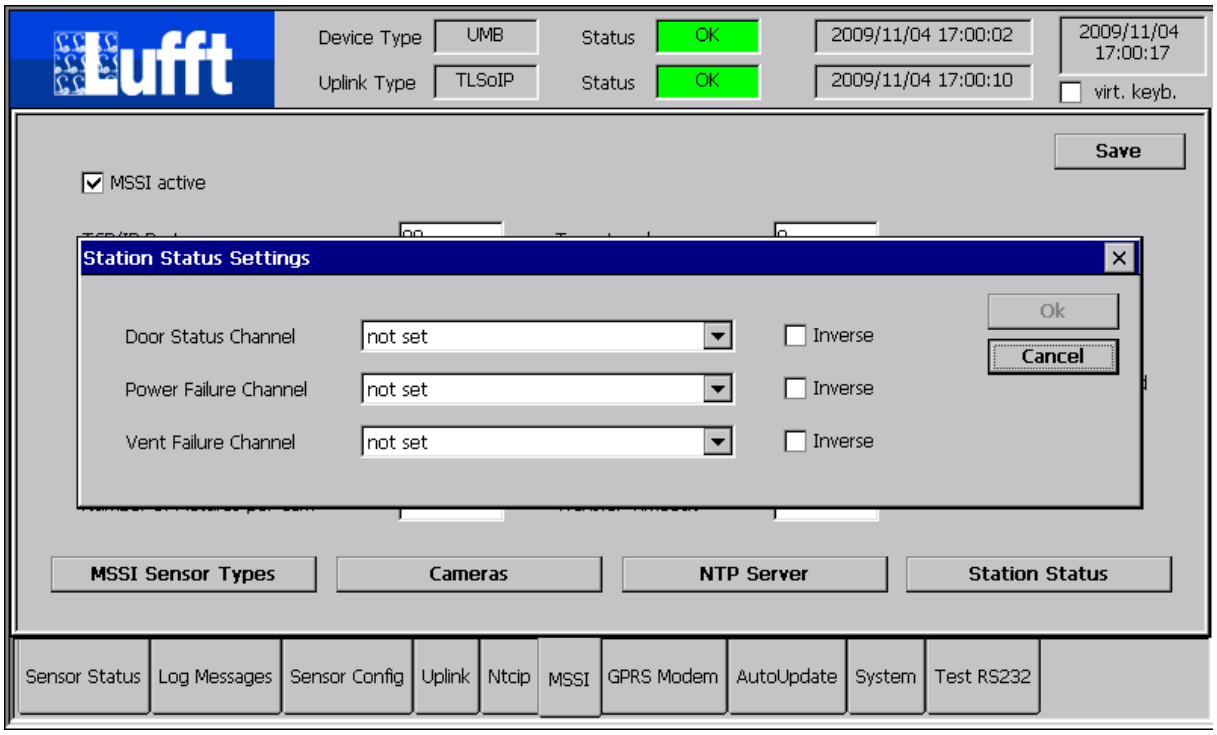
The sensor channels for

- Door contact
- Power failure

and

- Vent failure

can be configured via “Station Status”:

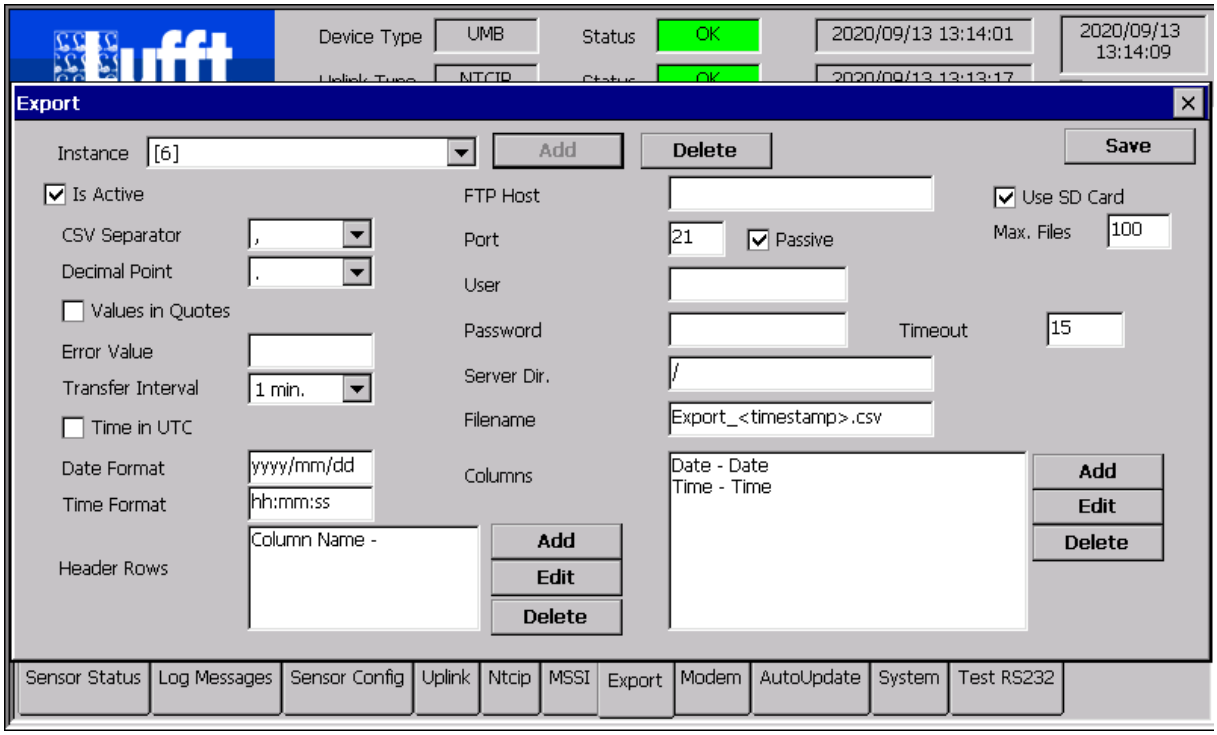


The respective input channels must deliver a “logical” value for the respective condition, i.e. if the value for the corresponding channel = 0, this is interpreted as “No error” or “Door closed”; if the value is != 0, this is interpreted as “Error” or “Door open”. If “Inverse” is enabled on the respective channel the result is inverted accordingly (i.e. a value = 0 is interpreted as “Error” or “Door open”; a value != 0 is interpreted as “No error” or “Door closed”).

Any value mapping configured for the UMB sensor channel is applied before the value is processed for the appropriate station status event.

5.10 Export

Measurement data can be exported to a CSV file and uploaded to a server.



Up to 6 independent/parallel instances for FTP Export can be configured

Following parameters can be set:

- **CSV Separator:** the csv separator (comma, semicolon or tab character)
- **Decimal point:** the decimal point (point or comma)
- **Values in Quotes:** the values are placed in quotes
- **Error Value:** a string value to indicate an error
- **Transfer Interval:** the transfer interval
- **Time in UTC:** indicating that the date/time should be in UTC instead of local time
- **Date Format:** the date format string, e.g. yyyy/mm/dd or dd.mm.yyyy
- **Time Format:** the time format string, e.g hh:mm:ss or hh:mm
- **Header Rows:** the header rows (see below)
- **FTP Host:** the ftp host name or IP address
- **Use SD Card:** queue the files to be transmitted on the SD Card instead of the RAM disk

- **Max.** Files: maximum number of files to be queued for transfer (if, for whatever reason, the ftp transfer fails). Note: the filename must “sort” properly in order to always remove the oldest queued file, i.e. it must contain a <timestamp> or similar tag in the name.
- **Port:** the ftp port (default is 21)
- **Passive:** use passive ftp
- **User:** the FTP user
- **Password:** the user’s password
- **Timeout:** transfer timeout in seconds
- **Server Dir:** directory on the server (excluding the filename). Note: the directory name might contain tags that are replaced when the file is transferred (see below). The LCom will try to create the directory if it does not exists.
- **Filename:** the filename (local and server) without directory/path name. Note: the filename might contain tags that are replaced when the file is created (see below)
- **Columns:** the columns in the CSV file (see below)

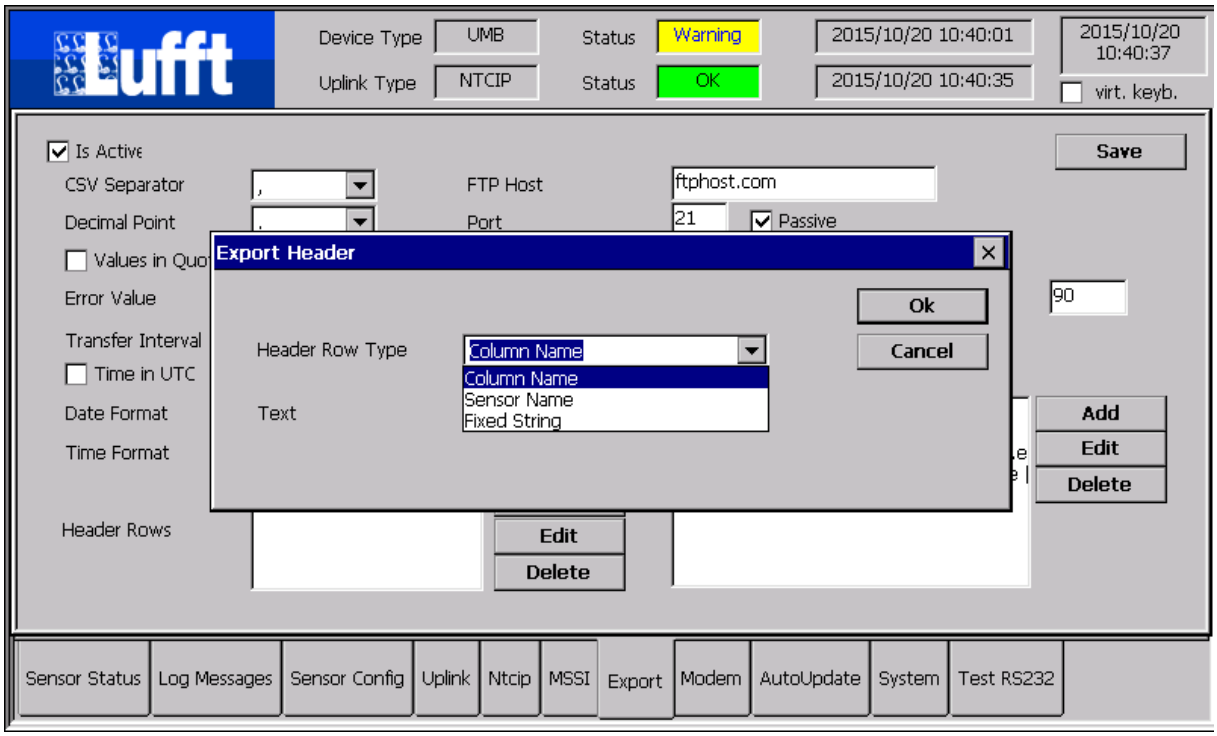
Tags in directory and file names:

Following tags will be replaced when the export file is written and/or the file is transferred to the server:

- <timestamp>: Timestamp in format yyyymmddhhmmss (e.g. 20151020110510)
- <year>: the year (e.g. 2015)
- <month>: the month (e.g. 10)
- <day>: the day of the month (e.g. 20)
- <hour>: the hour of the day (e.g. 11)
- <minute>: the minute (e.g. 05)
- <second>: the second (e.g. 10)

Export Header Rows

Multiple header rows can be configured if needed.

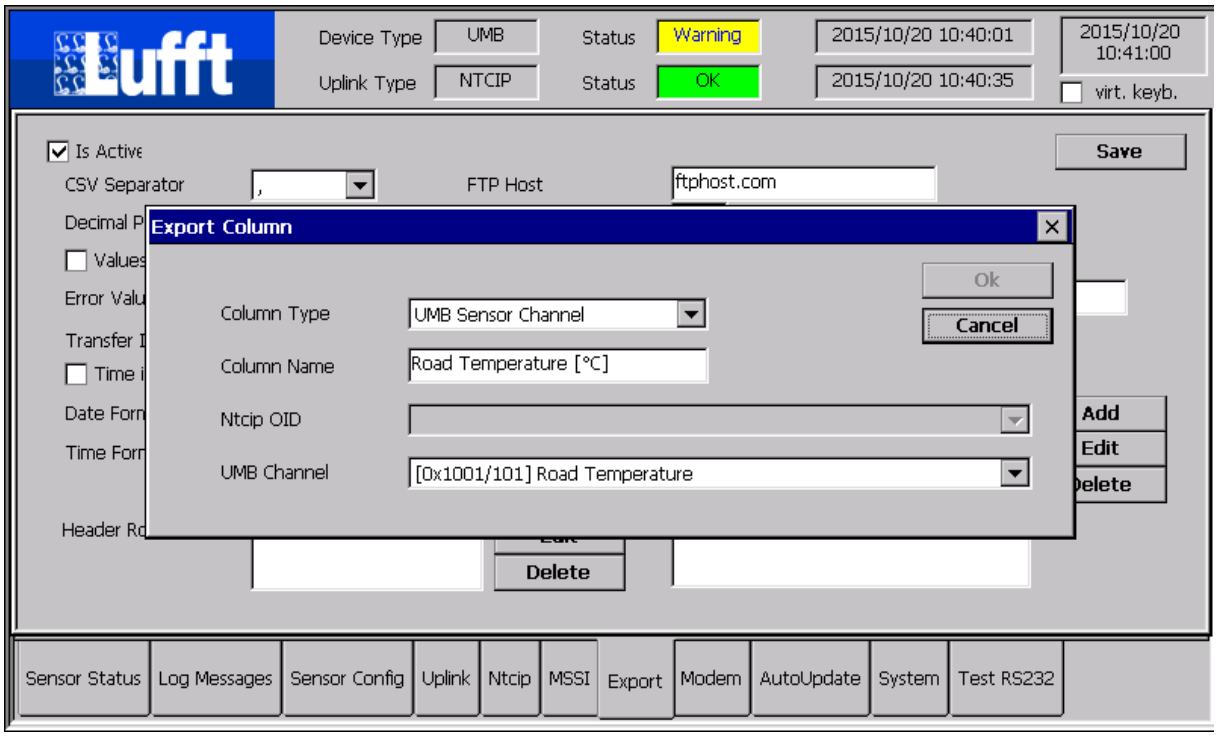


Following header row types are supported:

- **Column Name:** the name of the export column as configured for the column (see below)
- **Sensor Name:** the name of the UMB sensor channel or NTCIP OID (if applicable)
- **Fixed String:** a fixed string as configured in “Text”

Export Columns:

The CSV export columns can be configured in any order. Columns are separated by the configured CSV separator character.



Following column types are supported:

- **Date:** the date for the measurement (format as specified by date format above)
- **Time:** the time for the measurement (format as specified by time format above)
- **Date/Time:** date and time for the measurement (format as specified by date / time format above)
- **Timestamp:** the UTC timestamp (seconds since 01.01.1970) for the measurement
- **UMB Sensor Channel:** a measure value reported by the respective UMB sensor channel (any “value mapping” or scaling configured to the sensor channel is processed)
- **NTCIP OID:** a measure value as reported for the NTCIP OID. Note: NTCIP Uplink Protocol must be active, and the “NTCIP Sensor Assignment” must be configured
- **Fixed String:** a fixed string.

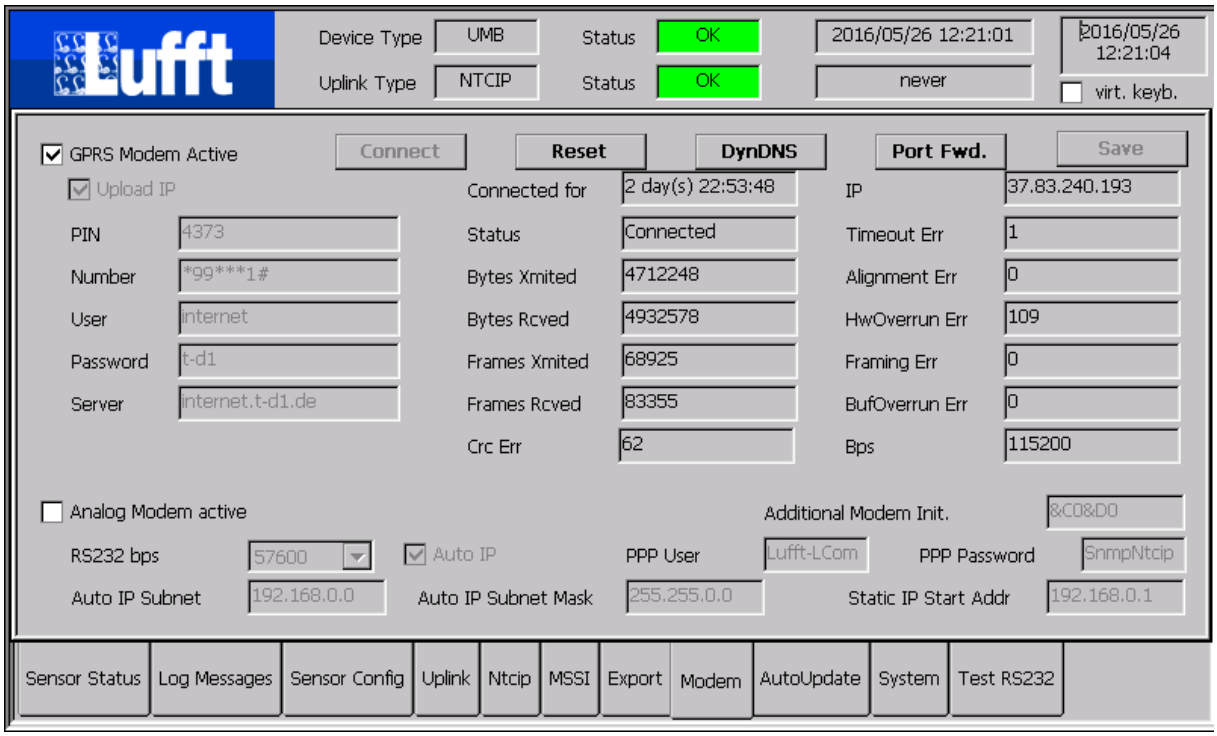
5.11 GPRS / Analog Modem

The parameters for the GPRS connection or the Hayes-Compatible analog modem are configured here.

5.11.1 GPRS Modem

The “PIN” for the SIM card (unless switched off) and the access data (user name/password/server) for the GPRS provider need to be configured here.
After changing the GPRS configuration data the system may have to be rebooted (some parameters are stored in the registry) in order for the changes to take effect.

Note: The RS232 interface on the GPRS modem must be set to 115200 8 N 1 and hardware handshake must be enabled.



If “Upload IP” is selected, and “AutoUpdate” is active (see below), the current IP address is stored in a text file and transmitted to the AutoUpdate server after the connection has been established.

If “GPRS Modem Active” is not active, the GPRS modem parameters can be set/changed, and the connection can be initiated manually via “Connect”.

If “GPRS Modem Active” is selected, the GPRS connection is automatically managed by the LCom.

If a connection is established, various statistical data for the connection is displayed on the right-hand side (updated automatically).

5.11.2 Analog-Modem

Alternatively to the GPRS modem an Analog modem for a PPP dial in connection may be used, if this is supported by the operating system version on your device. Please contact Lufft support if you need this option, but you see the “NOT SUPPORTED” message as shown in above screenshot.

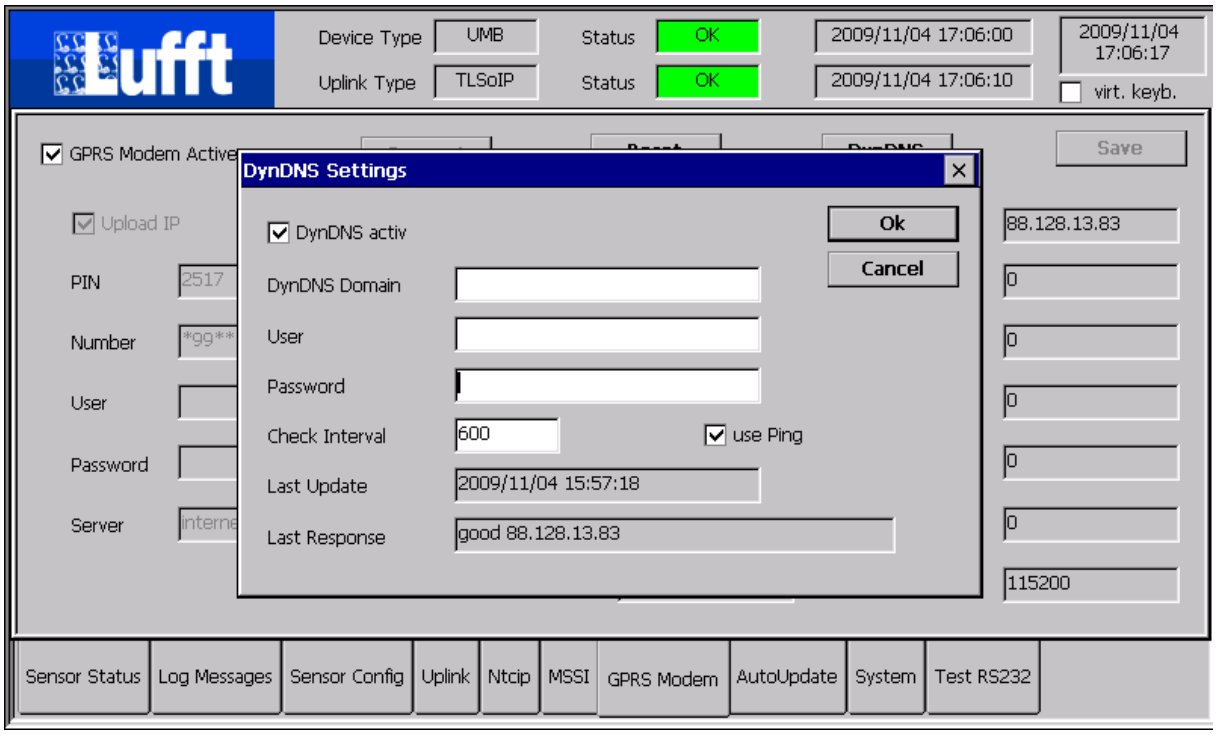
- Additional modem init: additional modem initialization string. Please test if your modem type supports/requires the default settings or requires different settings here.
- RS232 bps: speed for the serial connection to the analog modem
- Auto-IP: automatically assign an IP address (random) from the address pool defined by Auto-IP Subnet / Auto-IP Subnet mask
- PPP-User: the user for the PPP connection
- PPP-Password: the password for the PPP connection
- Auto-IP Subnet: the Auto-IP Subnet
- Auto-IP Subnet Mask: the Auto IP Subnet mask
- Stat. IP Start: start address for the static IP addresses used when Auto-IP is off.

5.11.3 DynDNS

The integrated DynDNS client can be configured via the “DynDNS” dialog. When the client is active and correctly configured, the station’s IP address is uploaded to the DynDNS server every time the GPRS connection is (re-)established, so the station can be accessed using the assigned DynDNS host name.

Note that the IP address provided by the GPRS provider must be “public” (i.e. not blocked behind a firewall) in order to be able to connect to the LCom (and use the DynDNS service) !

See http://www.dyndns.com/ for details about the DynDNS service.



- **DynDNS active**: The DynDNS client is active
- **DynDNS Domain**: The DynDNS host/domain name for this station (must be created in advance at DynDNS.com)
- **User**: The DynDNS user (for which the domain has been registered)
- **Password**: The DynDNS password for the user
- **Check interval:** The interval/delay in seconds after which the current IP address upload to the DynDNS server is repeated if the last attempt failed, and after which a check is made - via a ping to the DynDNS name if “use ping” is enabled (see below) – to check whether the DynDNS name was correctly registered. If successive errors occur (5 x), the GPRS connection (and the GPRS modem) are reset.
- **Use ping:** The DynDNS registration is checked by sending a ping request to the DynDNS name (see Check interval).

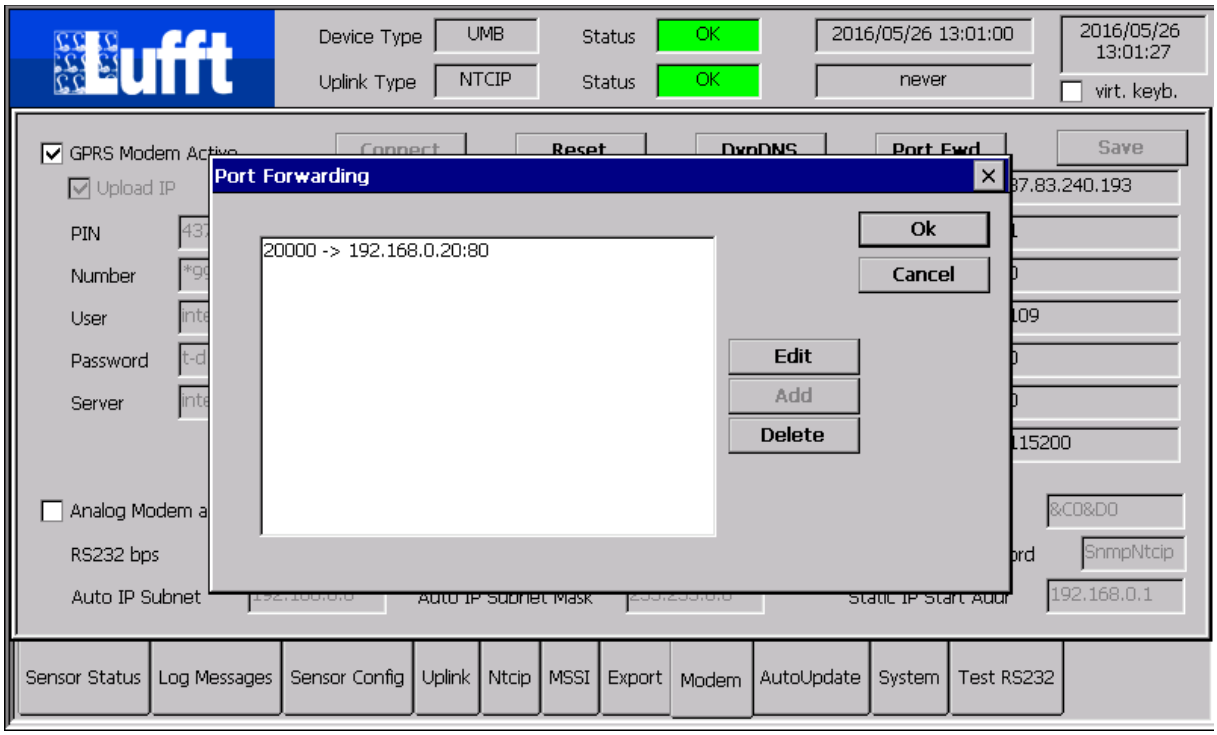
Note: This option must NOT be set on stations without a “public” IP address, as otherwise it always produces an error and the GPRS modem is reset (the use of DynDNS on stations without a public IP address is not meaningful in any case).

- **Last Update**: The time at which the last IP address update was sent to the server.
- **Last response**: The server’s response to the last update. Positive responses from the server are “good <ip address>” (IP address has been registered) or “nochg <ip address>” (IP address did not change).

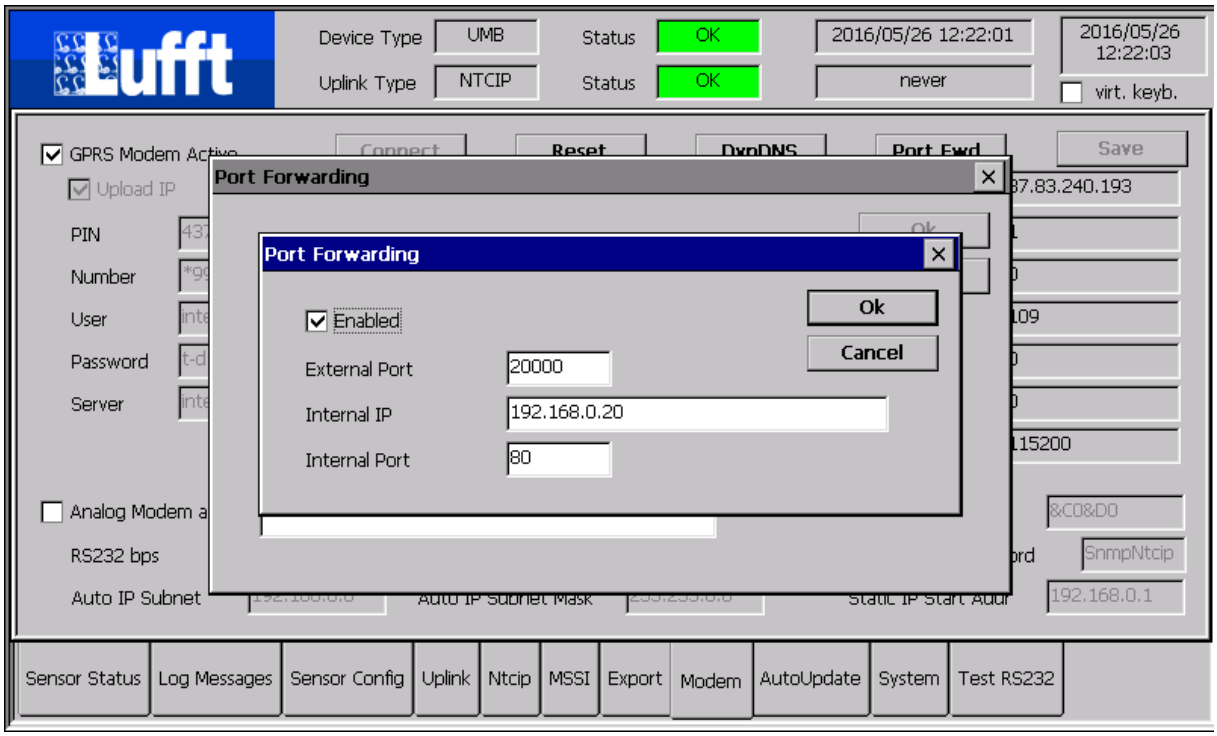
Note: A connection to the DynDNS server is only established after the GPRS connection was (re-)established. If necessary this can be forced by “resetting” the GPRS connection.

5.11.4 Port Forwarding

Port forwarding for TCP connections via GPRS modem to network devices (expecially cameras) that are connected to the LAN adapter of the LCom can be configured here.



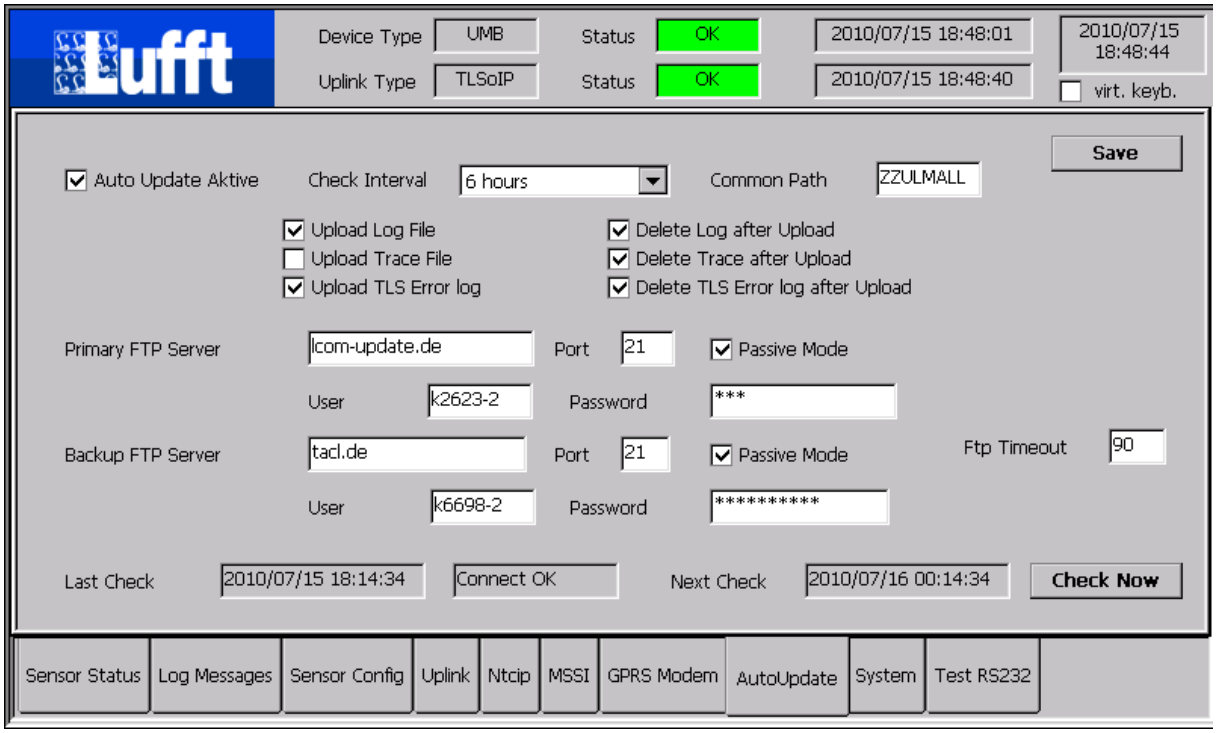
Up to 3 entries can be configured. Each entry needs to be configured with a different external port.



Besides the external port (i.e. the TCP port that will be available on the IP address of the GPRS modem), the internal IP address and port are configured to which this port should be redirected.

5.12 AutoUpdate

The parameters for the automatic update feature are configured here.
The application checks, at the configured interval, whether “general” updates for all stations (that have not yet been processed), or specific update files for this station (see “Serial Number/ID” in the “System” dialog below) are available on the server. If this is the case, the corresponding script file is processed (see Software Update / Remote Maintenance).

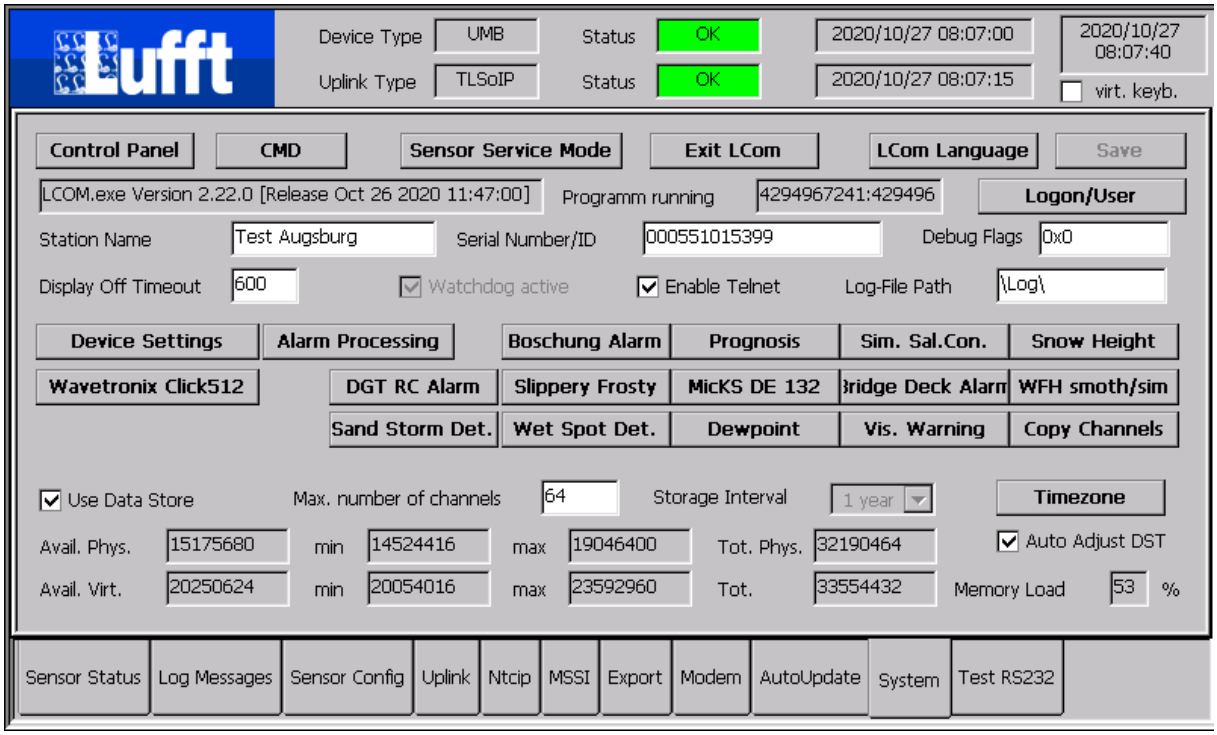


- Common Path.: Directory on the server for “general” updates. By setting this value to a “project specific” value in all LCom that are used in that project, the LCom can be “grouped” (e.g. “BAYERN/”)
- Upload Log File: The log file is zipped and transferred to the server (to the “individual” directory of the station)
- Delete Log File After Upload: The log file on the LCom is deleted after uploading it to the server (to avoid multiple data transmission)
- Upload Trace File: The trace file is zipped and transferred to the server (to the “individual” directory of the station).

- Delete Trace File After Upload: The trace file on the LCom is deleted after uploading it to the server (to avoid multiple data transmission).
- Upload TLS Error.Log: A log file with a trace of the TLS DE error messages is zipped and transferred to the server (to the “individual” directory of the station).
- Delete TLS Error Log After Upload: The log file on the LCom is deleted after uploading it to the server (to avoid multiple data transmission).
- Primary/Backup FTP Server: The access data to the FTP servers. If the primary server cannot be reached, an attempt is made to connect to the backup server.
- Ftp Timeout: timeout (in seconds) for the ftp communication

5.13 System

General System Parameters:



- **Control Panel:** Starts the control panel, e.g. to calibrate the screen
- **CMD:** Starts a command shell.
- **Sensor Service Mode:** switches the LCom into a special service mode. In this service mode all LCom functions (communication with sensor devices, Uplink protocol etc.) are disabled, and the external power supply for the UMB sensors (GUB_1) is active. This allows usage of other tools (like the UMB config tool) with the UMB sensors. Note that the service mode will automatically reset to standard operations mode after the selected time period (default 1 hour).
- **Exit LCom:** Closes the LCom application
- **Logon/User:** opens a dialog to configure the user name and password for this LCom
- **Station name**: Name of the station (for documentation purposes)
- **Serial number/ID**: The unique identifier for this station. Default: The MAC address of the network board as a hex-string. This name is used as the name of the “individual” directory for the station on the auto update server (see above). *A sensible name should be assigned to the station here in order to*

make the “individual” directories on the server (which the station creates automatically) easily assignable (e.g. "SH_WARDER" or "SH_AHRENSBOEK" etc.).

Note: The ID must be selected so that it is a valid directory name on a Unix System (FTP server), i.e. no spaces or special characters (the configuration interface does NOT verify this).

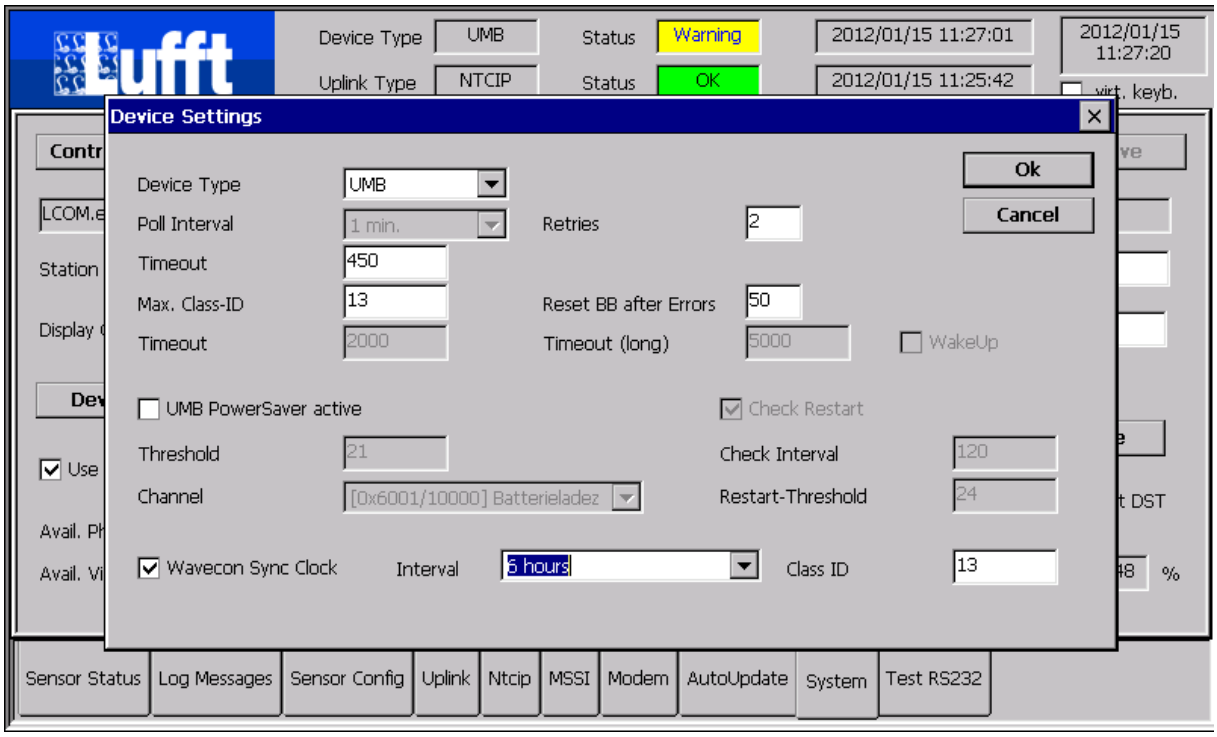
- **Debug Flags**: Settings for debug/trace outputs in the log file.
- **Display Off Timeout**: Time after which the display is switched off (and any logged on user is logged off).
- **Enable Telnet**: Telnet access is enabled or disabled. User name and password are required for Telnet access in all cases.
- **Log File Path**: Directory for the log and trace file. Default is \log\ -> on the RAM drive. It can be changed to a different directory (e.g. \FFSDISK2), if the log files are to be stored permanently.
  Note: Writing to the NAND flash or USB stick takes a relatively long time and can influence the timing/response behavior of the Inselbus (TLS protocol) under certain debug/trace level settings.
- **Device Settings:** parameters for the UMB / Opus device communication (see below)
- **Wavetronix Click512**: parameters for transmitting Wavetronix Click512 events (see below)
- **Auto Adjust DST:** automatically adjust DST / standard time
- **Timezone:** set the timezone for the LCom clock
- **LCom Language:** language settings for the LCom user interface.
  Note: when changing the language settings, the MSSI sensor type and value mapping entries can optionally be re-initialized in the new language. Any changes to the MSSI sensor types or value mapping entries will be lost if this is selected!
- **Use Data Store**: If the system is equipped with an SD card, data storage on the SD card can be enabled here. The maximum number of sensor channels that can be stored depends on the size of the SD card.
  Note 1: The SD card is initialized after enabling this function. This can take a

significant amount of time.

Note 2: Enabling “data storage” does not actually enable the storage of data for any sensor. Whether data for a specific sensor channel is stored or not is set in the UMB sensor configuration (see above).

- **Alarm Processing:** Settings to control a via LAN connected digital I/O board on alarm conditions (see below)
- **Boschung Alarm Code:** Settings to control the calculation of a special “Boschung” Alarm code (see below)
- **Prognosis:** Settings to control the road condition prognosis calculation (see below)
- **Sim. Sal. Con:** Simulation for Saline Concentration and Freeze Temperature
- **Snow Height:** simulation/model calculation for fresh snow height
- **DGT RC Alarm Code:** Settings for the DGT Alarm Code calculation (see below)
- **Slippery Frosty:** model calculation for slippery frosty road condition
- **MicKS DE132:** model calculation for MicKS DE132 Road Condition
- **Bridge Deck Alarm:** model calculation for bridge deck alarm model
- **WFH smooth/sim:** model calculation for water film height smoothing/simulation
- **Sand Storm Det.**: model calculation for Sand Storm Detection
- **Wet Spot Det.**: model calculation for Wet Spot Detection
- **Dewpoint:** calculate dewpoint
- **Vis. Warning:** visibility warning calculation

5.13.1 Device Settings



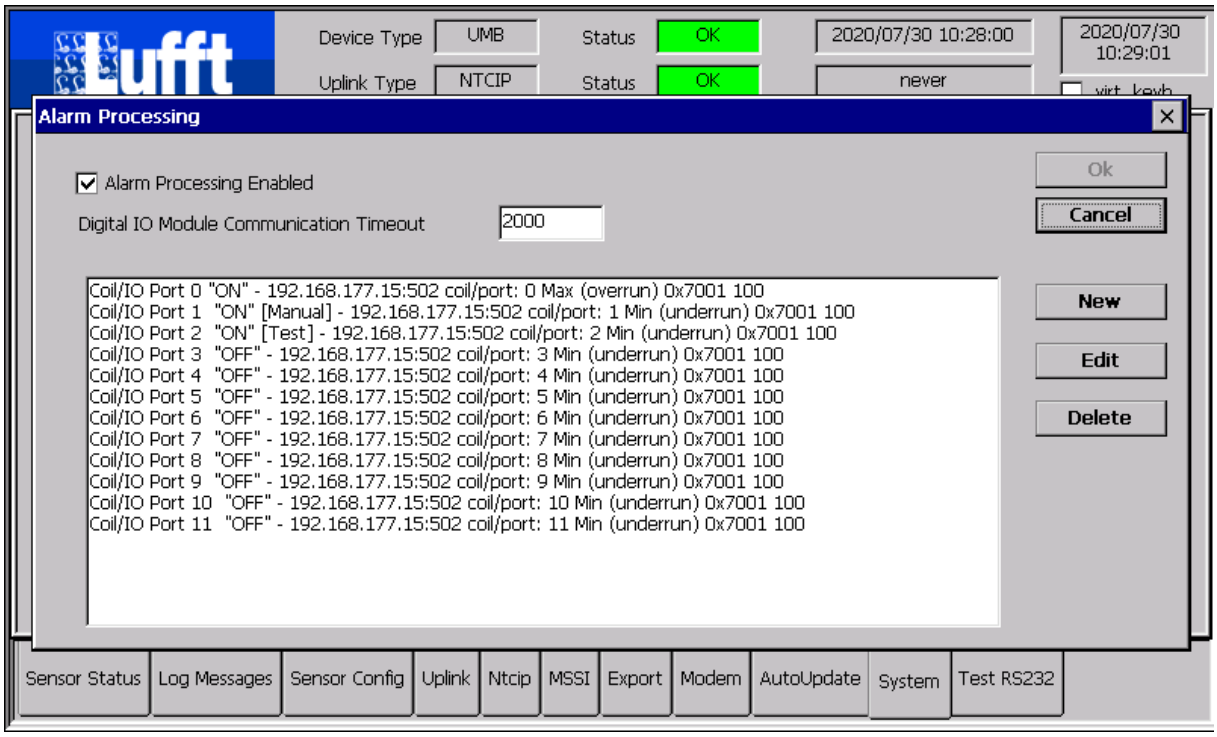
- **Device-Type:** UMB or UMB+OPUS200. If Opus200 devices are connected in addition to the UMB devices, the Opus200 devices are connected to the serial port used for TLS Inselbus/Lokalbus, so these protocols may not be used when Opus200 devices are attached.
- **Poll interval**: Interval at which the measurement data is requested from the UMB devices (fix 1 minute).
- **Retries**: number of retries for the device communication.
- **Timeout**: Timeout for the UMB communication.
- **Max Class-ID:** maximum UMB class ID that is polled when reading the UMB sensor network configuration
- **Reset BB after errors**: If no measurement can be obtained for the entire configured (active) sensor after xx attempts, the baseboard is reset – together with the UMB devices.
- **Timeout/Timeout (long):** Timeouts for the Opus200 communication.
- **UMB PowerSaver active:** if this option is selected, the power supply for the UMB sensor network can be automatically switched off (via GUB_1) if the battery power is below a configured threshold.

If the UMB power is switched off, all sensors will report a special error code 0xF5 (except channels configured to report the battery status via TLS FG6 Type 51). The “Sensor Status” display will show appropriate error message if the UMB power is switched off.

- **Threshold:** if the measure value for the configured sensor channel is below this threshold, the UMB power is switched off
- **Channel:** the sensor channel supplying the battery power.
  Note: when the value is evaluated, only the “scale” value configured for the sensor channel – but not a configured value mapping - is applied to the “raw” measure value. This allows further processing of the measure value via value mapping for later transmission to the server (e.g. TLS FG6 Type 51).
- **Check Restart:** if this option is selected, the UMB power is re-activated after the configured **Check Interval**. If the measure value is above the configured **Restart-Threshold**, the standard operations mode is reactivated.
- **Wavecon Clock Sync:** this option controls synchronizing the Wavecon devices clock with the LCom clock
- **Interval:** the interval for the clock synchronization
- **Class-ID**: the UMB class id for the Wavecon devices

5.13.2 Alarm Processing

Alarm processing allows controlling the status of a digital I/O board connected via TCP/IP depending on measure values.
The “Modbus/IP” protocol (as documented for the Acromag 983EN-4012 module) is used to control the digital I/O board – i.e basically every board supporting this protocol should be controllable. It is, however, only tested with the Acromag 983EN-4012 board.
Basically any number of I/O ports on any number of digital I/O boards can be controlled. For each I/O port an “alarm channel” is configured.

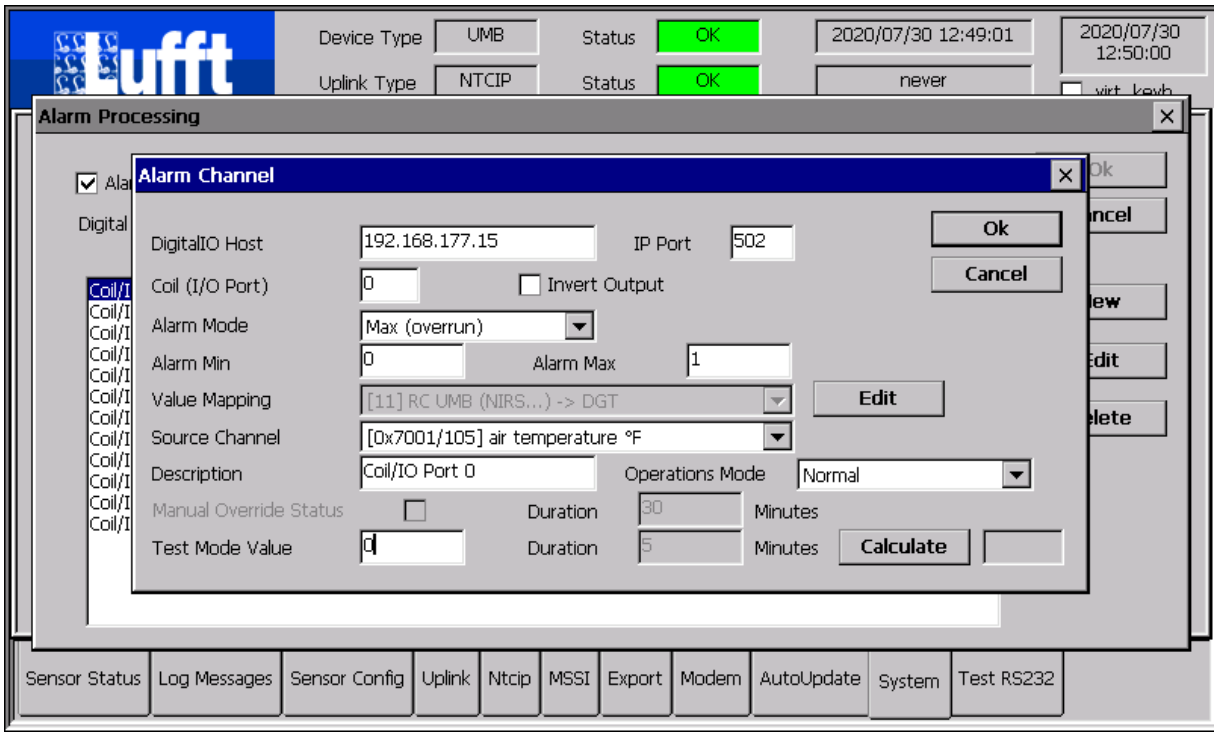


Following information is shown in the alarm channel list:

Description – Status [OpMode] – IP Address:Port Coil/IO Port Alarm Mode UMB Device Id and Channel

Status and Operations Mode shown here are based on the last alarm status calculation (which is processed every minute 15 seconds after the full minute)

- **Alarm Processing Enabled:** controls weather alarm processing is enabled or not.
- **Digital I/O Module Communication Timeout:** the timeout used for the TCP/IP communication with the module
- **New:** add a new alarm channel to the configuration
- **Edit:** edit the selected alarm channel
- **Delete:** delete the selected alarm channel



For each alarm channel following settings are available:

- **DigitalIO Host:** the IP Address or DNS Host name for the digital I/O board
- **IP Port:** the IP Port for Modbus/IP communication (usually 502)
- **Coil (I/O Port):** the Modbus Coil / digital output port number on the digital I/O board. Usually the numbering starts with 0, i.e. the first output port is number 0 not number 1
- **Invert Output:** if this option is selected, the status of the output port is inverted to the alarm status, i.e. if the status is “no alarm” the output is “on”, if the status is an alarm status the output is “off”.
- **Alarm Mode:** following calculation modes are available:
  - ***min (underrun):*** alarm condition is true if the measure value is below the configured “Alarm Min” value
  - ***max (overrun):*** alarm condition is true if the measure value is above the configured “Alarm Max” value
  - ***value mapping:*** alarm condition is calculated using the result of a value mapping. If the result is 0, no alarm condition is assumed. Any value other than 0 is treated as an alarm condition.
- **Alarm Min:** in mode “min” this value determines the threshold from where on the alarm condition is set to “true”. In mode “max” this value determines the

threshold from where on the alarm condition is set to false – i.e. the delta between Alarm Min and Alarm Max determines the hysteresis range.

- **Alarm Max:** in mode “max” this value determines the threshold from where on the alarm condition is set to true. In mode “min” this value determines the threshold from where on the alarm condition is set to false - i.e. the delta between Alarm Min and Alarm Max determines the hysteresis range.
- **Value Mapping:** the value mapping entry for the “value mapping” mode
- **Edit:** opens the edit dialog for value mapping
- **Source Channel:** the sensor channel whose measure value is used for alarm condition calculation
- **Description:** a description for the alarm channel.
- **Operations mode:** the operations mode for the alarm channel. Possible values are:
    - **Normal:** normal operations mode, i.e. output status is calculated based on the respective measure value
    - **Manual:** manual operations mode, i.e. output status is set by the “Manual Override Status” (checked: on, not checked: off).
    - **Test:** test operations mode, i.e. output status is calculated based on the “Test Mode Value”
- **Manual Override Status:** can be set in “manual” operations mode. The output will be set to “ON” if the check box is checked, and to “OFF” if the check box is not checked
- **Duration:** the duration for the manual override status in minutes. This starts when the alarm channel configuration is set. If the timespan is expired, operations mode is reset to “normal”
- **Test Mode Value:** the value to be used in test mode and for calculating the result using the “Calculate” button to the right
- **Duration:** the duration for the test mode. This starts when the alarm channel configuration is set. If the timespan is expired, operations mode is reset to “normal”

- **Calculate:** calculate the result based on the test value, and the alarm channel settings. The resulting value (ON/OFF) will be shown next to the button. Note: this will not set the actual Coil / IO Port status.

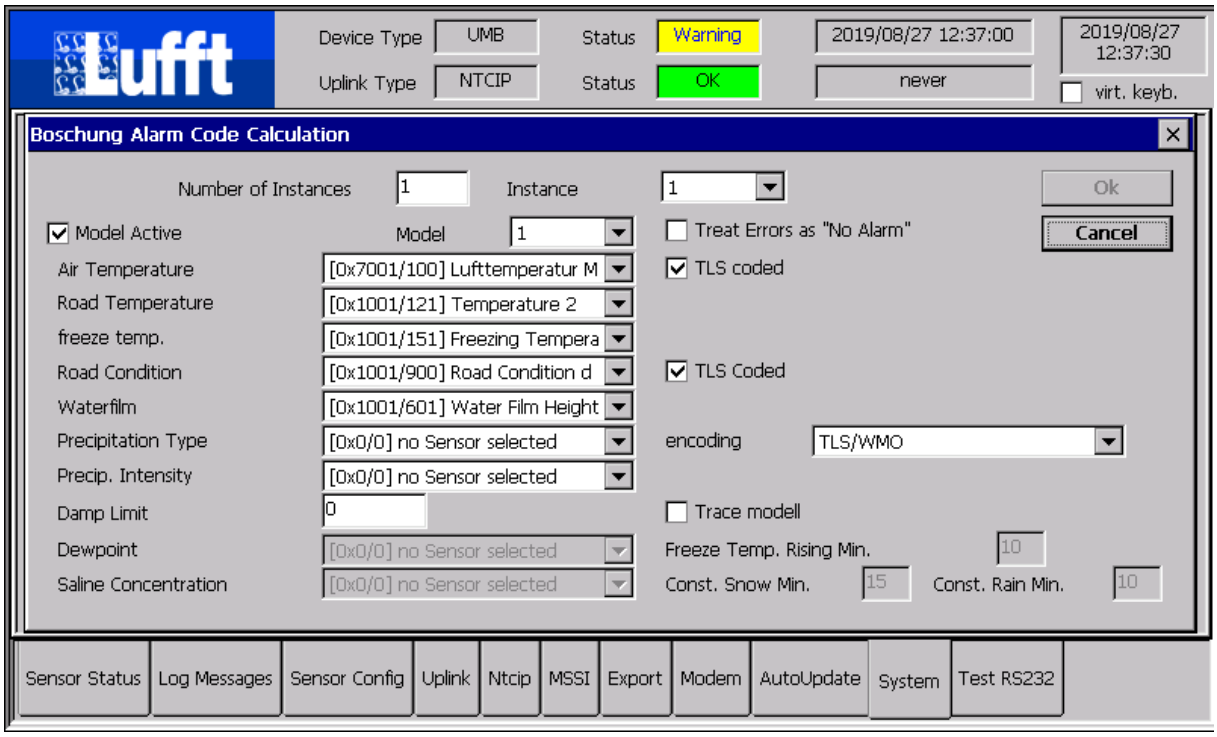
If the alarm condition cannot be calculated for whatever reason (e.g. because no source measure value is available), the alarm condition is always set to “false”;

Note: the alarm status is calculated using the measure value as transmitted from the UMB sensor, i.e. a value mapping that might be configured for the sensor channel will NOT be taken into account when the alarm status is calculated!

Example for alarm on value underrun:
If you want the alarm condition to be set if a measure value is below a certain value, e.g. 0.6, you select “Alarm Mode” = min, set Alarm Min to 0.6, and Alarm Max to a value >= 0.6, e.g. 0.61. Alarm will be set if the measure value is below 0.6, and will be cleared if the measure value is above 0.61

Example for alarm on value overrun:
If you want the alarm condition to be set if a measure value is above a certain value, e.g. 78.5, you select Alarm Mode = max, set Alarm Max to 78.5, and Alarm Min to a value <= 78.5, e.g. 78.2. Alarm will be set if the measure value is above 78.5, and will be cleared if the measure value is below 78.2.

5.13.3 Boschung Alarm Code



Various parameters for calculating the „Boschung Alarm Code“ can be set here: Besides the sensor channels for the input values to the model, coding parameters for these input values can be set as well.

- The “TLS coded” parameter besides the air temperature channel applies to all input temperatures, i.e. if set the input temperatures are treated as 1/10 °C (instead of standard °C)
- The “TLS coded” parameter besides the road condition channel determines whether the input road condition is TLS or Lufft encoded.
- Treat Errors as “No Alarm”: set result value to 0 (no Alarm) on error conditions instead of setting error code for result value.
- “waterfilm wet” sets the waterfilm threshold for “wet” condition
- Trace Modell: if active, trace messages from the model calculation are written to the error log

5.13.3.1 Rules for calculating the Boschung Alarm Code (Model Version 1):

Alarm 1:

Is set if

(AIR-TEMPERATURE or ROAD-TEMPERATURE below 0) AND (WATERFILM greater than <waterfilm wet limit parameter = 0>)

i.e. if air or road temperature are below 0 °C and there is a waterfilm on the road

Alarm 2:

Is set if

FREEZE-TEMPERATURE is greater or equal to (ROAD-TEMPERATURE – 2.0)

i.e. if the freeze temperature is 2 (or less) ° below the road temperature

Alarm 3:

Can be set by the road sensor or the precipitation sensor (if present) as follows

Road Sensor

Alarm 3 is set if

((ROAD-CONDITION is critical) or FREEZE-TEMPERATURE is greater or equal to (ROAD-TEMPERATURE –0.1)

i.e. the road sensor reports a critical road condition („Lufft“ coded values 3 (ice) 4 (snow/ice) 6 (freezing) or 7 (critical), TLS coded values: 64,65,66,67)

or the freeze temperature is 0.1 (or less) ° below the road temperature

Precipitation Sensor

Alarm 3 is set if

- ➔ The precipitation sensor reports „snow“ continuously for at least 10 minutes. The alarm condition will be set as long as the precipitation sensor reports snow. If the precipitation sensor reports a different value and then snow again, the alarm condition will not be set again within 180 minutes/3 hours.
- ➔ The precipitation sensor reports rain, and the ROAD TEMPERATURE is below 0°C

Snow/Rain is differentiated depending on the precipitation sensor encoding:

Opus200:
0…9 no precipitation
10..19 rain
20..60 snow

UMB:
0.. 60 no precipitation
60..66 rain
67..90 snow

TLS:
0 : no precipitation
1..39 unknown
40..69 rain
70..79 snow

If precipitation intensity is available as input sensor as well, and the precipitation type reported is “no precipitation” or “unknown”; the intensity value is used to “detect rain”, i.e. if the precipitation intensity is greater than 0, rainfall is assumed.

5.13.3.2 Rules for calculating the Boschung Alarm Code (Model Version 2):

Alarm 1:
Is set if
(AIR-TEMPERATURE or ROAD-TEMPERATURE below 0) AND (WATERFILM greater than <waterfilm wet limit parameter = 0>)
i.e. if air or road temperature are below 0 °C and there is a waterfilm on the road

Alarm 2:

Is set if FREEZE-TEMPERATURE is rising AND
FREEZE-TEMPERATURE is greater or equal to (ROAD-TEMPERATURE – 2.0)
i.e. if the freeze temperature is rising (over “Freeze Temp Rising Min.” minutes) and 2 (or less) ° below the road temperature

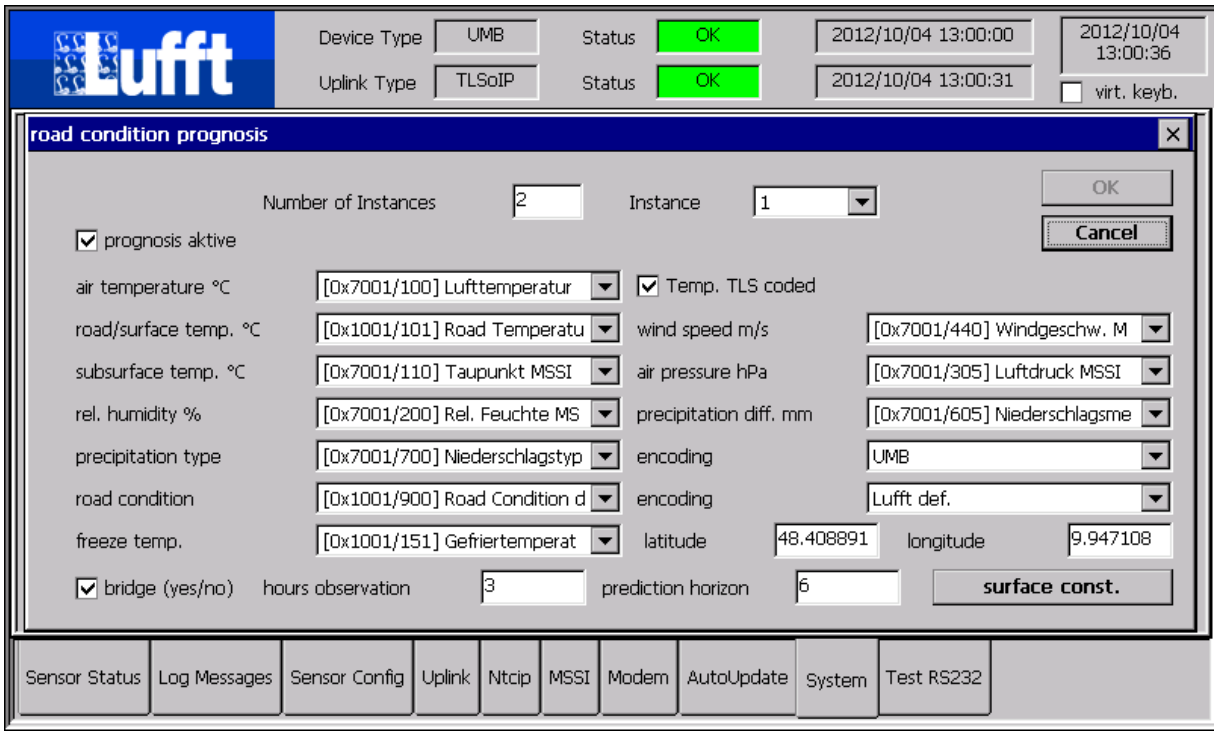
Alarm 3 Freeze Temperature – black ice
Is set if FREEZE-TEMPERATURE is rising AND ((ROAD-TEMPERATURE – FREEZE-TEMPERATURE) < 0.2)
i.e. if the freeze temperature is rising (over “Freeze Temp Rising Min.” minutes) and 0.2 (or less) ° below the road temperature

Alarm 3 Dewpoint – slippery frost
Is set, if (SALINE-CONCENTRATION = 0) AND (ROAD-TEMPERATURE < 0) AND (AIR-TEMPERATURE > (ROAD-TEMPERATURE +2)) AND (DEWPOINT > -4), i.e. if there is no residual salt, and road temperature is below 0 °C and air temperature is at least 2 °C above road temperature, and dewpoint is above -4 °C

Alarm 3 Precipitation – freezing rain
Is set, if (PRECIPITATION-TYPE = “Rain”) for at least “Const. Rain Min.” minutes, and (ROAD-TEMPERATURE < 0), i.e. precipitation type is “Rain” for at least the “Const. Rain Min.” (default 10) minutes, and road temperature is below 0°C.

Alarm 3 Precipitation – snow
Is set, if (PRECIPITATION-TYPE = “Snow”) for at least “Const. Snow Min.” minutes, and (ROAD-TEMPERATURE < 0.2), i.e. precipitation type is “Snow” for at least the “Const. Snow Min.” (default 15) minutes, and road temperature is below 0.2 °C.

5.13.4 Prognosis Road Condition



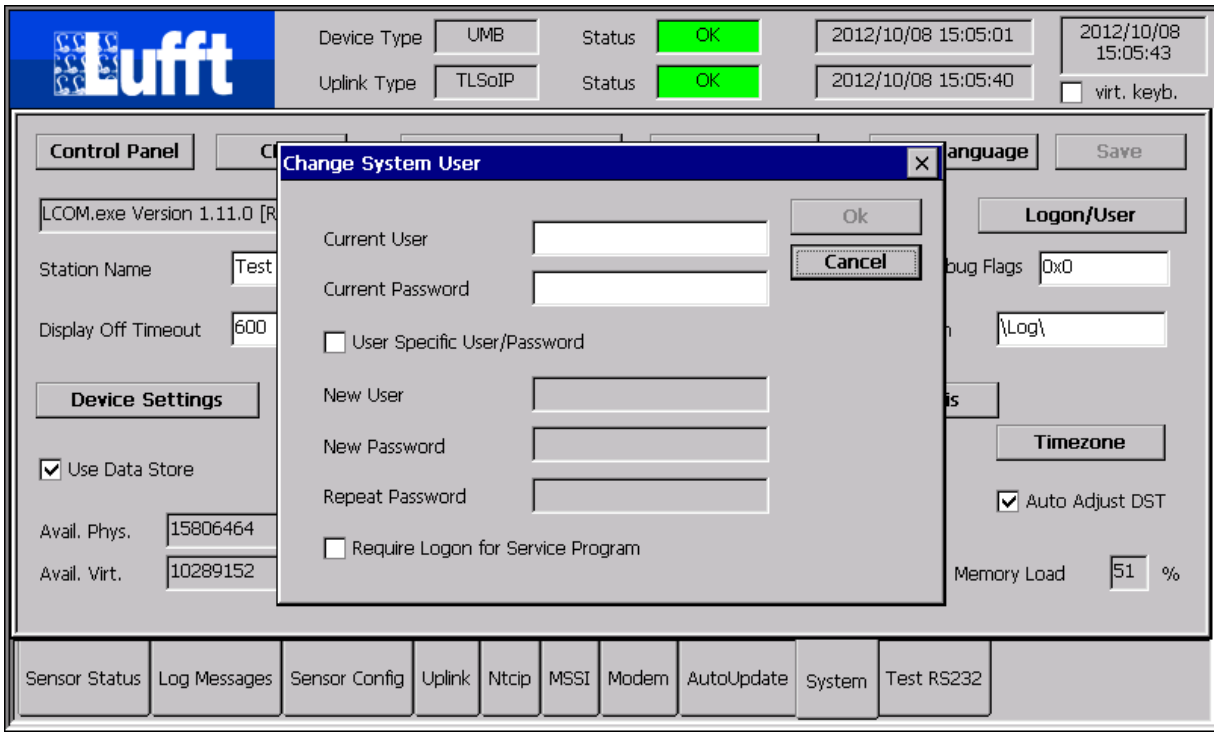
The parameters for the road condition prognosis model are set here.

Up to 15 independent instances for road condition prognosis model can be configured. For each calculation interval (default: 1 minute) only one instance will be calculated, i.e. if multiple instances are configured, they are calculated sequentially over time.

Besides the sensor channels for the input values, there are parameters to set the input value coding, and various other parameters.

Please refer to the (separate available) road condition prognosis model documentation for details.

5.13.5 Change System User



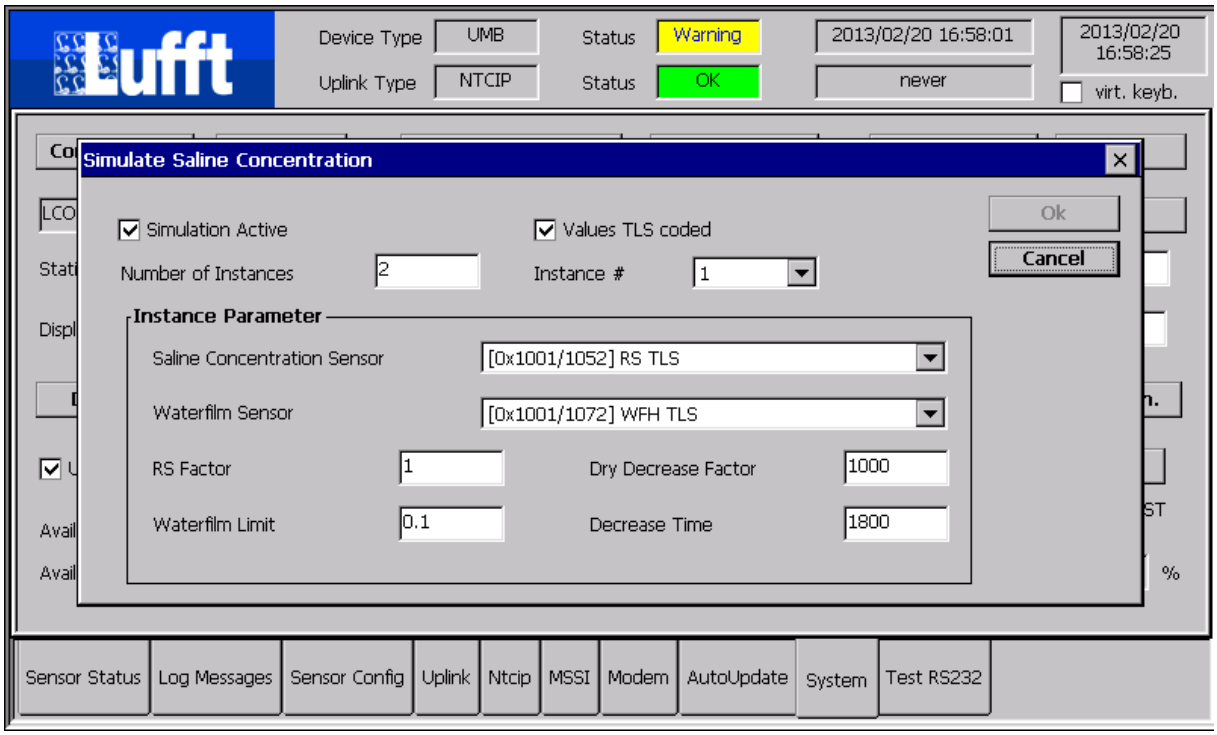
Here the system user and password can be configured. This user and password are used for

- Telnet access to the LCom
- for configuration dialogs on the LCom
- (optional) when connecting via Service Program to the LCom

In order to change the settings, the current user and password must be entered.

5.13.6 Simulation for Saline Concentration

Here, the model calculation for saline concentration and freeze temperature can be activated, and the settings can be changed.



- **Simulation Active:** The simulation model for saline concentration and freeze temperature is activated
- **Values TLS coded:** the input values (waterfilm) are TLS coded. Note that this does not affect the coding of the output values – i.e. the freeze temperature is always reported as °C and may need to be scaled (for transmission via TLS).
- **Number of Instances:** the number of model calculation instances
- **Instance #:** select the instance to be configured via this combo box

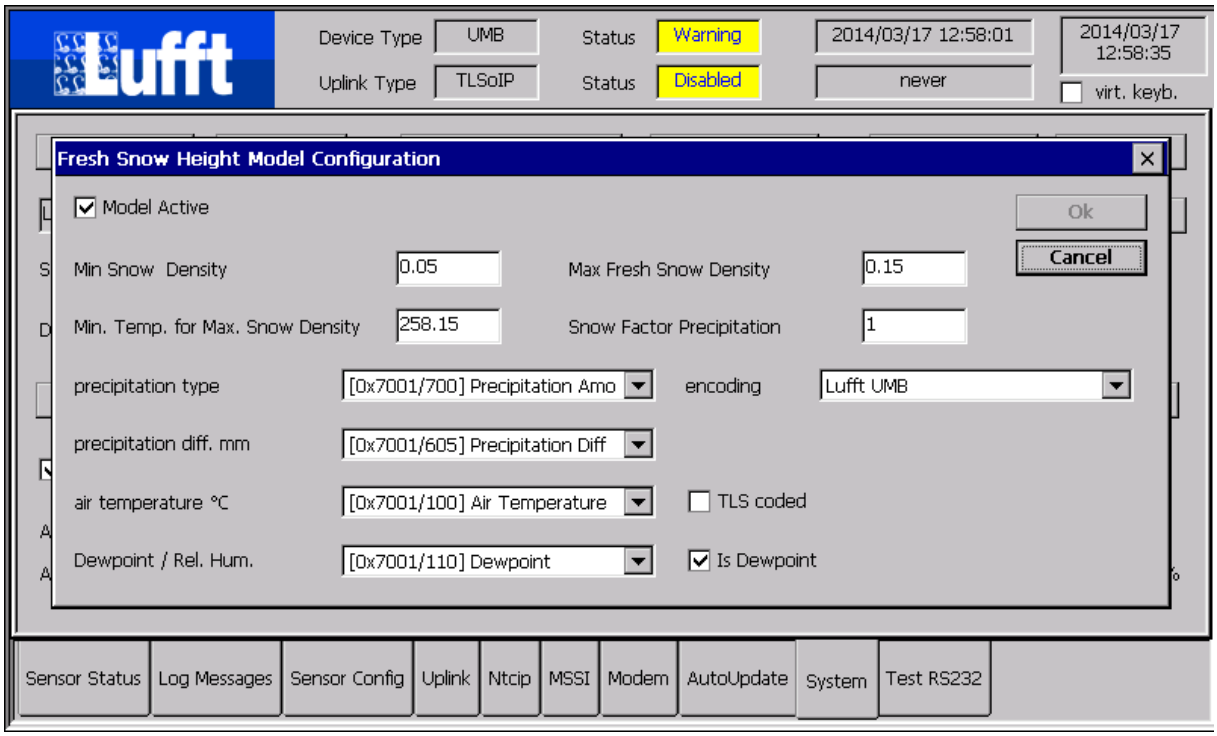
Instance Parameter:

- **Saline Concentration Sensor:** the sensor channel for saline concentration (road sensor output)
- **Waterfilm Sensor:** the sensor channel for water film height (road sensor output)
- **RS Factor:** multiplication factor for raw salinity value
- **Waterfilm Limit:** minimal water film for measured salinity
- **Dry Decrease Factor:** reduction divisor (dry road)
- **Decrease Time:** time constant for reduction on wet road

If the model calculation is active, “virtual” output sensor channels for the simulated saline concentration and freeze temperature are created automatically for every configured instance.

5.13.7 Fresh Snow Height

Here the parameters for the fresh snow height model calculation are configured. The model calculates 2 values that are represented by 2 (virtual) sensor channels: fresh snow amount for measurement interval (i.e. every minute), and fresh snow amount since daybreak.



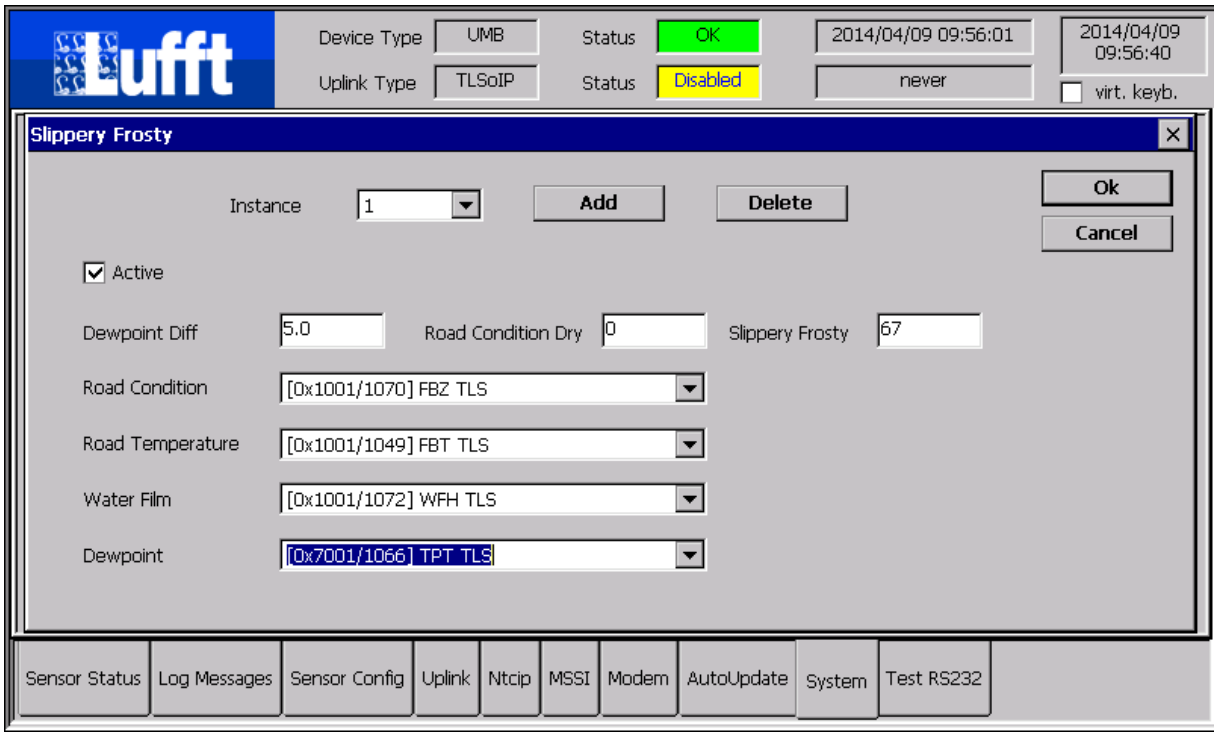
- **Model active:** the model calculation is active/inactive
- **Min Snow Density:** minimum density of snow pack (kg/mm*m²)
- **Max Fresh Snow Density:** maximum density of fresh snow (kg/mm*m²)
- **Min Temp for Max Snow Density:** minimum temperature for maximum snow density (°K)
- **Snow Factor Precipitation:** multiplication factor for precipitation
- **Precipitation Type:** precipitation type sensor

- **Encoding:** encoding of precipitation type (Lufft-UMB, Lufft Frequency or TLS/WMO
- **Precipitation Diff:** sensor channel for precipitation difference (mm)
- **Air Temperature:** sensor channel for air temperature
- **TLS coded:** temperatures (air and dewpoint) are TLS coded (-> in 1/10 °C)
- **Dewpoint / Rel. Hum:** sensor channel for dewpoint or relative humidity
- **Is Dewpoint:** if selected, the sensor channel “Dewpoint / Rel. Hum” is treated as a dewpoint sensor channel. If not, a relative humidity channel is assumed an the dewpoint value is calculated internally from relative humidity and air temperature.

5.13.8 Slippery Frosty

Here the parameters for the model calculation “Slippery Frosty” can be configured. This model calculation extends the road condition by a “slippery frosty” condition. The calculation follows following rule:

IF
Road condition is “dry”
AND water film is 0
AND road temperature is below 0
AND (road temperature plus dewpoint diff) is below dewpoint
THEN road condition is set to “slippery frosty”
OTHERWISE road condition is left unchanged



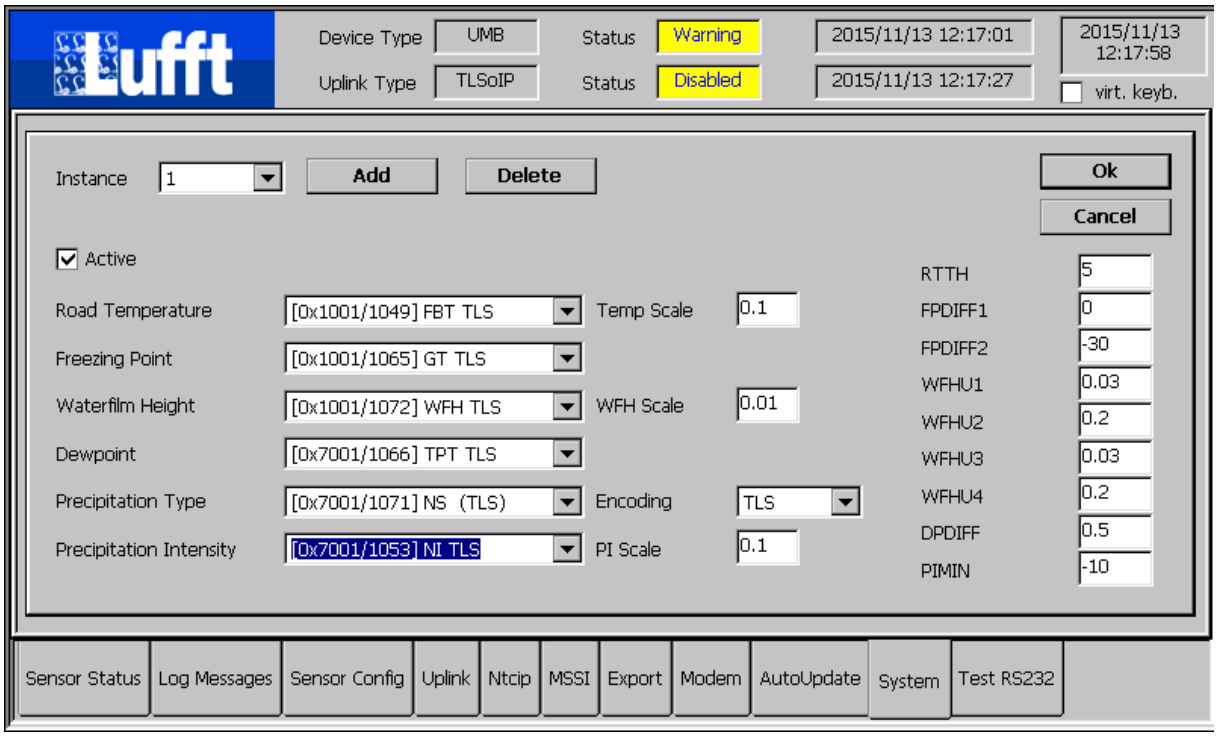
Multiple instances for the model calculation can be configured (in case the station is equipped with more than one road sensor).

Note: the default values are preset for the (German) TLS protocol, e.g. the “Dewpoint diff” value of 5.0 refers to 0.5 °C as the temperatures for TLS are in 1/10 °C.
Please adjust the parameters as needed for the sensor channels configured here.

- Active: this instance of the model calculation is active
- Dewpoint Diff: the value that the road temperature must be below the dew point temperature for “slippery frosty” to be set (see above)
- Road Condition Dry: the road condition code for “dry”
- Slippery Frosty: the road condition code for “slippery frosty”
- Road Condition: the road condition sensor channel
- Road Temperature: the road temperature sensor channel
- Water Film: the water film sensor channel
- Dew point: the dew point sensor cannel

5.13.9 MicKS DE132

Here the parameters for the MicKS TLS Type DE132 model calculation can be set (See 6.1.2.2.3)



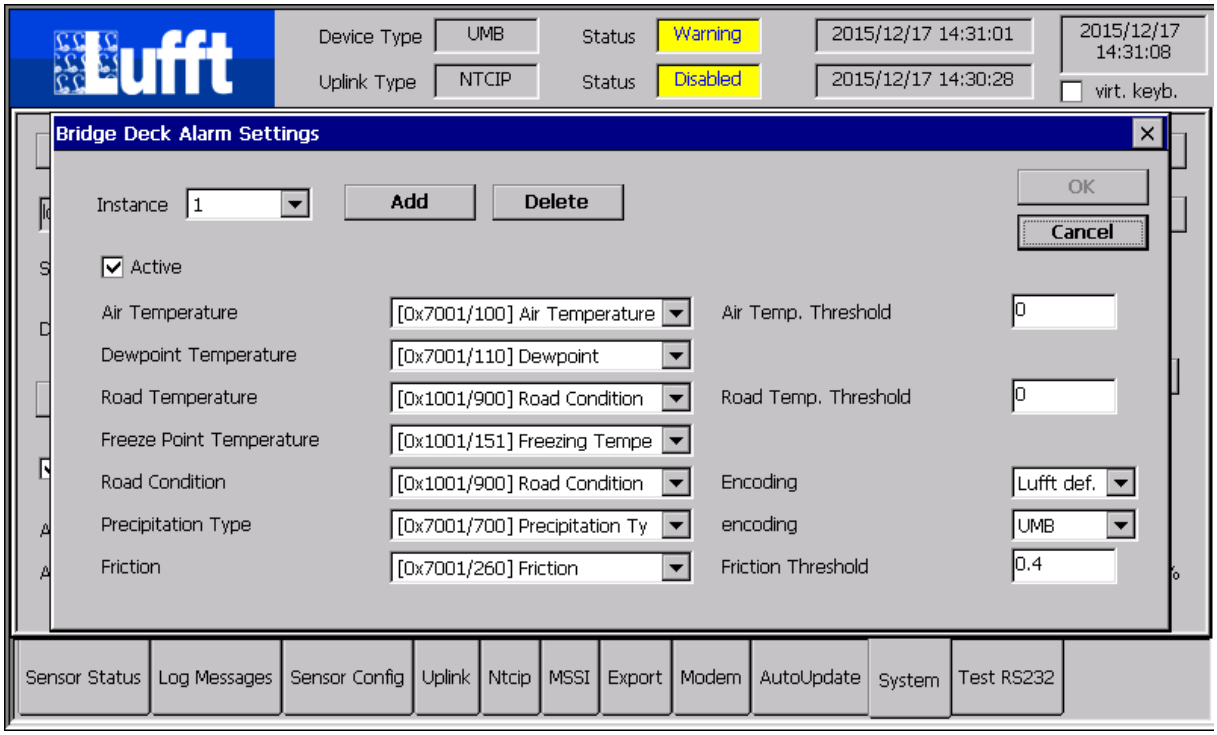
Multiple instances of the model calculation (for multiple road sensors) are supported. The parameters are:

- **Road Temperature:** the road temperature sensor
- **Freezing Point:** the freezing point sensor
- **Waterfilm Height:** the waterfilm height sensor
- **Dewpoint:** the dewpoint sensor
- **Precipitation Type:** the precipitation type sensor
- **Precipitation Intensity:** the precipitation intensity sensor
- **Temp Scale:** scaling factor to convert input temperatures to °C. 0.1 for TLS encoded input sensors. Set to 1.0 if input sensors are already in °C.
- **WFH Scale:** scaling factor to convert water film to mm. 0.01 for TLS. Set to 1.0 if input sensor is already in mm. Set to 0.001 if input sensor is in µm.
- **Encoding:** Precipitation Type Encoding (UMB/Opus200/TLS)
- **RTTH:** Road Temperature Threshold
- **FPDIFF1:** Freezing Point Delta 1

- **FPDIFF2:** Freezing Point Delta 2
- **WFHU1:** Waterfilm parameter 1
- **WFHU2:** Waterfilm parameter 2
- **WFHU3:** Waterfilm parameter 3
- **WFHU4:** Waterfilm parameter 4
- **DPDIFF:** Dewpoint Delta
- **PIMIN:** Precipitation Intensity minimum

5.13.10 Bridge Deck Alarm

The “Bridge Deck Alarm” model calculation has been developed to control a beacon (using “Alarm Processing”, see 5.13.2) according to a customers specification.



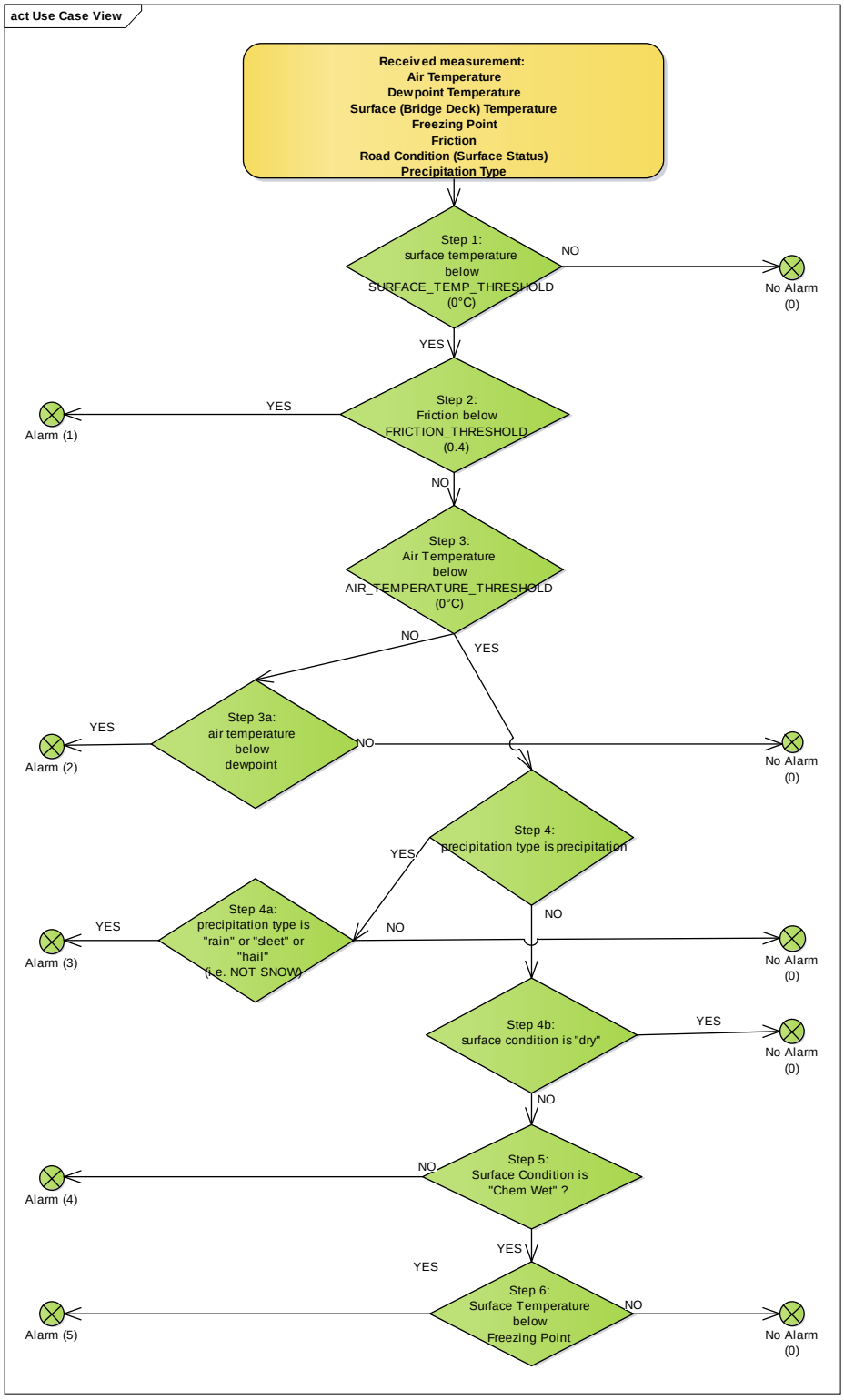
The parameters are:

- **Air Temperature:** the air temperature sensor channel
- **Dewpoint Temperature:** the dewpoint sensor channel
- **Road Temperature:** the road/surface/bridge deck temperature channel
- **Freeze Point Temperature:** the freeze point temperature channel

- **Road Condition:** the road condition sensor channel
- **Precipitation Type:** the precipitation type sensor channel
- **Friction:** the friction sensor channel
- **Air Temp. Threshold:** the air temperature threshold value (default 0)
- **Road Temp**. Threshold: the road temperature threshold value (default 0)
- **Road Condition Encoding:** encoding/type of the road condition sensor channel
- **Precipitation Type Encoding:** encoding/type of the precipitation sensor channel
- **Friction threshold:** the friction threshold (default 0.4)

A result value of 0 indicates no alarm condition, i.e. the beacon should be switched off

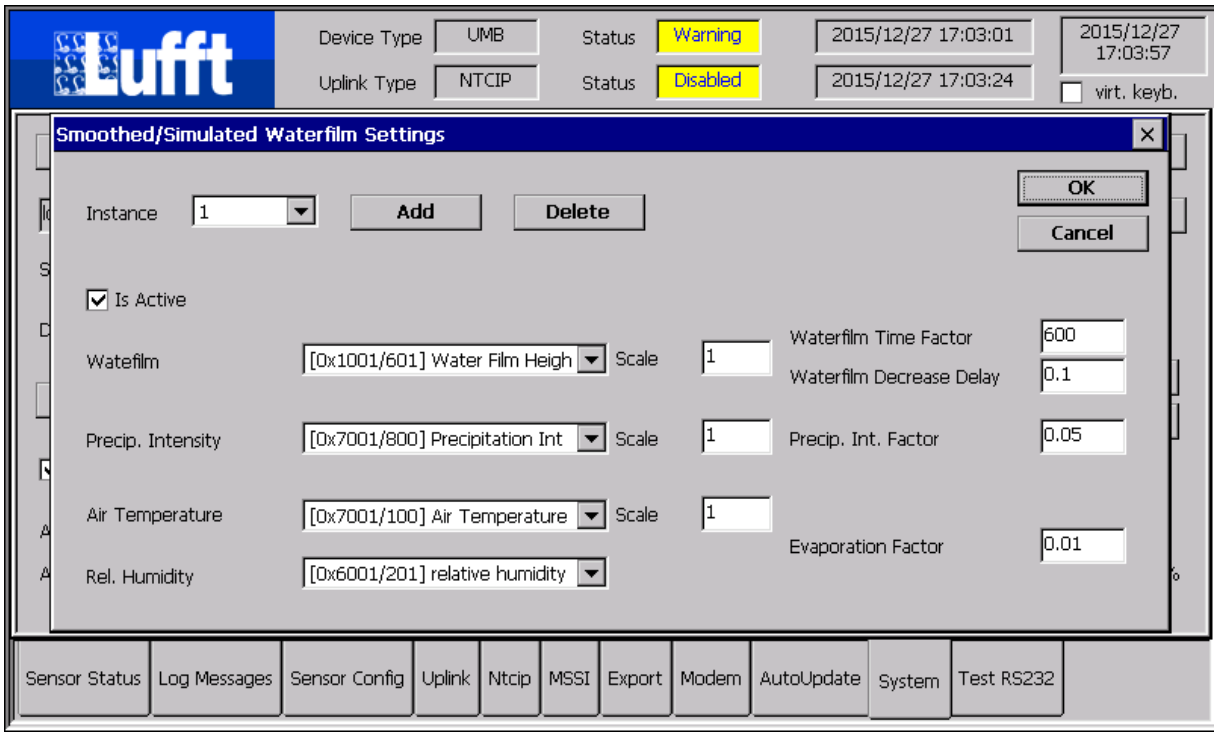
A result value greater than 0 indicates an alarm condition, i.e. the beacon should be switched on. The different alarm values (1…5) indicate which of the alarm conditions shown in the following flow chart was met.



5.13.11 Smoothed/simulated water film height

This model calculates a “smoothed” water film from the water film reported by the sensor (i.e. the decent of the water film is smoothed over time if appropriate), or

(depending on the configured input channels) calculates a simulated (“expected”) value for the water film from precipitation intensity, air temperature and humidity.



The parameters are as follows:

- **Waterfilm:** the waterfilm as measured by the road sensor (in mm)
- **Scale:** a scale factor to convert the waterfilm to mm if the input channel does not report the waterfilm in mm (e.g. a TLS coded input channel)
- **Precip. Intensity:** the precipitation intensity (in mm/h)
- **Scale:** a scale factor to convert the precipitation intensity to mm/h if the input channel does not report the precipitation intensity in mm (e.g. a TLS coded input channel).
- **Air Temperature:** the air temperature (in °C)
- **Scale:** a scale factor to convert the air temperature to °C if the input channel does not report the air temperature in °C (e.g. a TLS coded input channel)
- **Rel. Humidity:** relative humidity (in %)
- **Waterfilm Time Factor:** a time factor used in calculating the smoothed water film height
- **Waterfilm Decrease Delay:** a decrease delay used in calculating the smoothed water film height

- **Precip. Int. Factor:** a factor used to weight the precipitation intensity in calculating the simulated water film height
- **Evaporation Factor:** a factor used to weight the evaporation value calculated from air temperature and relative humidity when calculating the simulated water film height.

The model calculation is based on the following sequence:
Step 1: a “smoothed” water film height is calculated from the current measure value and the last smoothed water film value, using the configured time factor and decrease delay. The result of Step 1 is the “smoothed” value if the smoothed value is higher than the measured value, otherwise the measured value is reported as the result value (i.e. only decreasing values are smoothed, increasing values are taken on from the sensor).

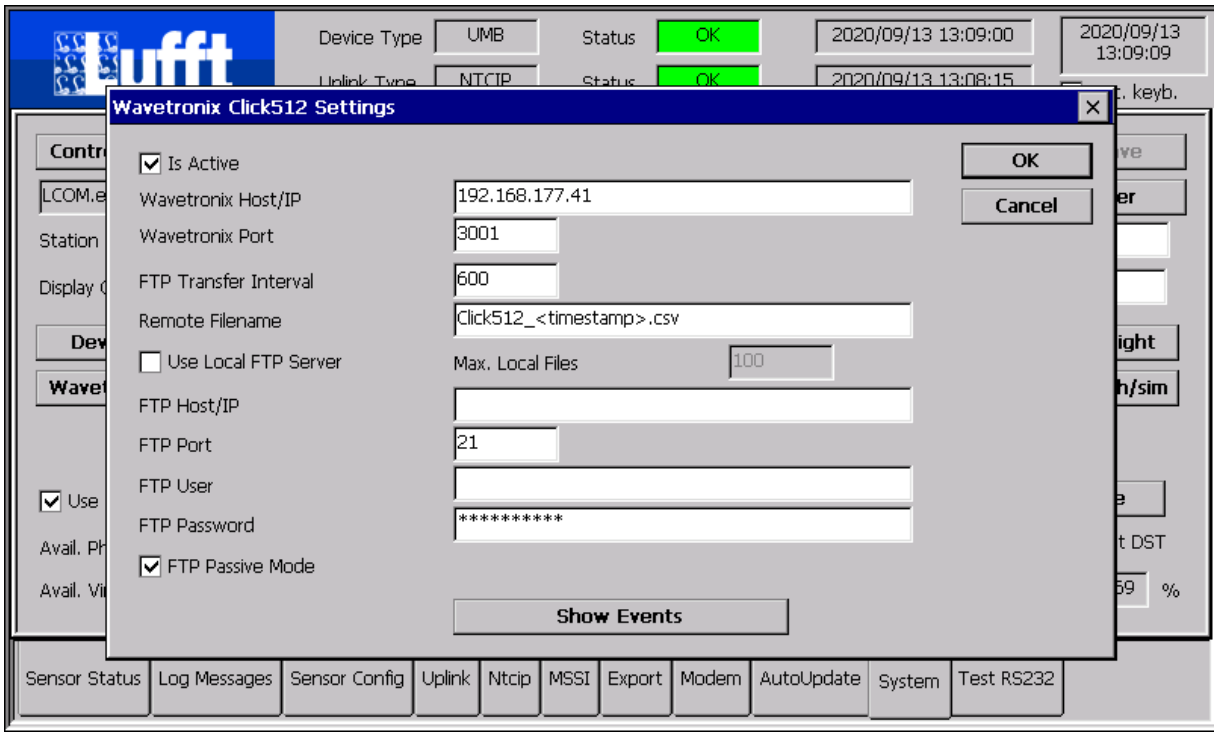
Step 2: if a precipitation intensity value is available, a simulated value for the water film height is derived from the precipitation intensity and the last calculated simulated water film height.
If air temperature and humidity values are available, an additional model is used to calculate the evaporation of water from the road surface, and this value is deducted from the simulated water film height calculated from the precipitation intensity.

The total result is the higher value from Step 1 and Step 2 (if Step 2 was calculated).

The result is a smoothed and/or simulated water film height in mm.

5.13.12 Wavetronix Click 512

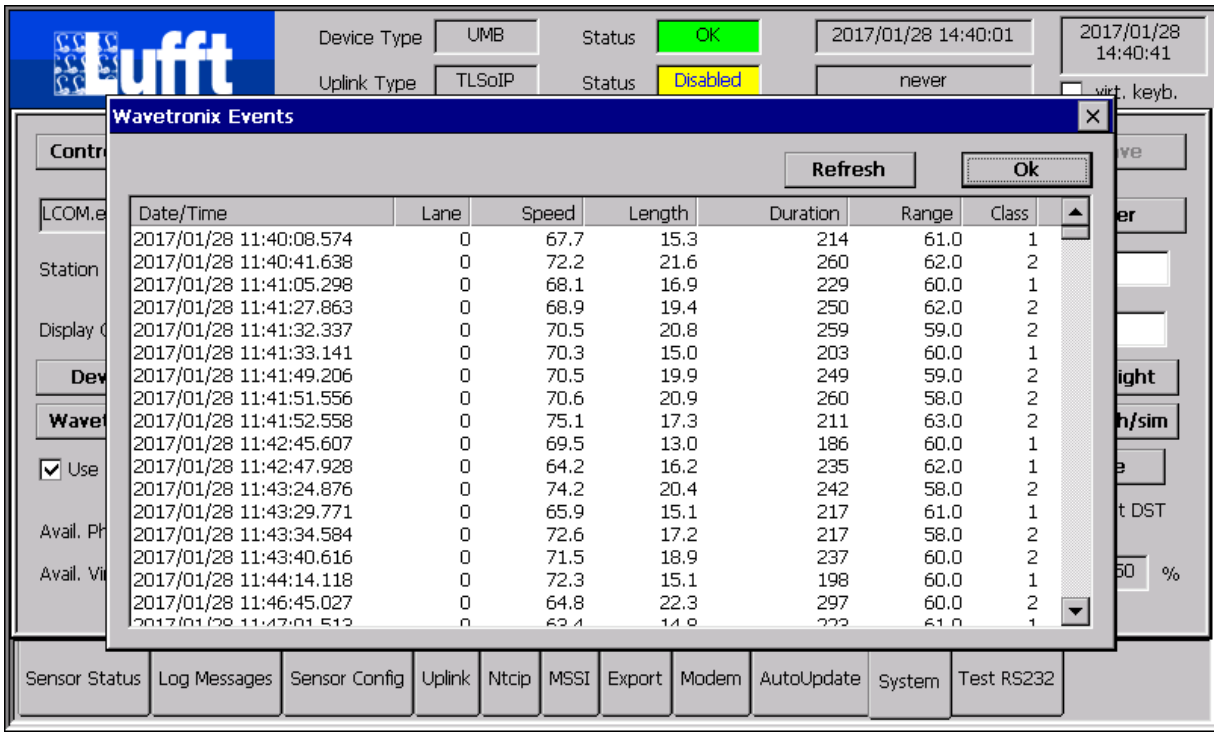
Here, parameters for transmitting events received from a Wavetronix Click 512 can be configured. The events written by the Wavetronix device are collected (in the original format) in a text file on the SD-card of the LCom, and transmitted in configurable intervals to the remote server via FTP, or provided for downloading throught the local FTP server on the LCom device.



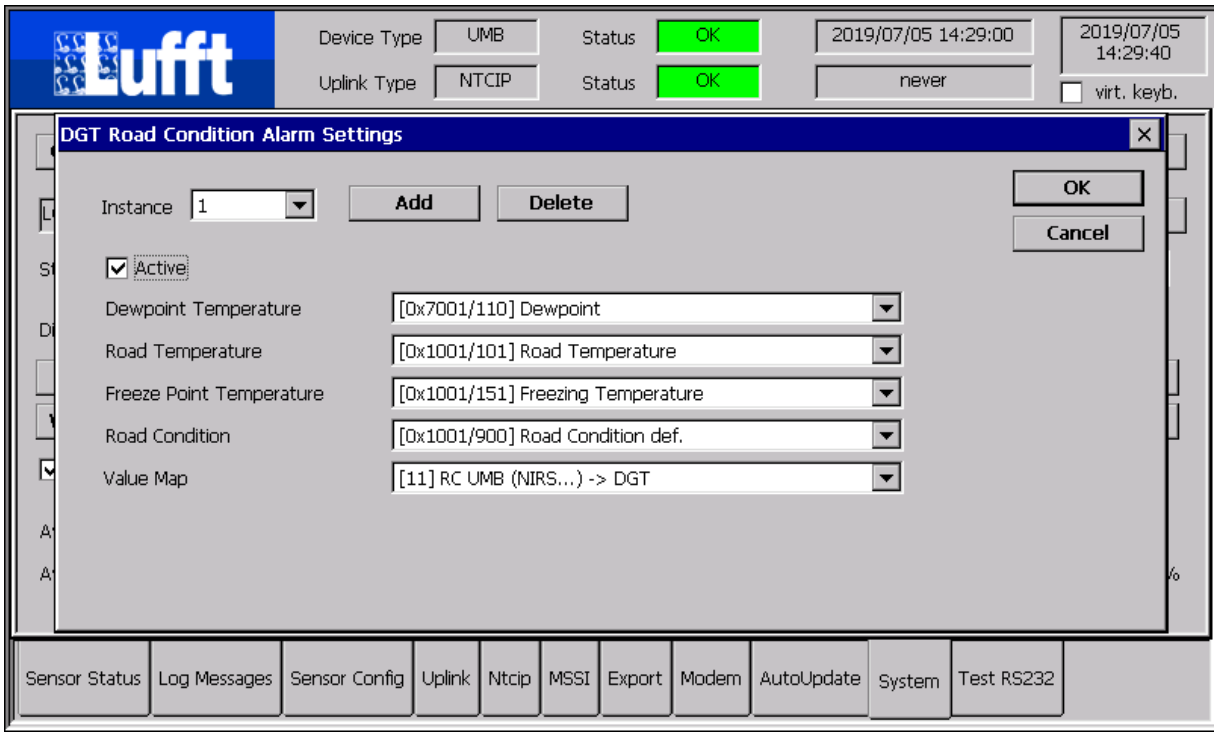
- **Is Active:** Wavetronix event transmission is active/inactive
- **Wavetronix Host/IP:** DNS Hostname or IP address of the RS232/Ethernet interface which is connected to the Wavetronix output.
- **Wavetronix Port:** TCP port of the RS232/Ethernet interface which is connected to the Wavetronix output.
- **FTP Transfer Interval:** Interval (in seconds) in which collected data is transmitted to the server or written to the respective file on the local FTP server.
- **Remote Filename:** server filename or filename on local ftp server. Might contain a folder name. Please do not specify an absolute filename (i.e. the name should not start with / or \).

- **Use Local FTP Server:** provide the „remote filename“ files on the local ftp server instead of pushing the files via FTP to a remote server.
  Note: user and passwort to access the ftp server are the same as the „System User“ (see 5.13.5 Change System User). This user has full access to the ftp server – and can also delete the files after downloading.
- **Max. Local Files**: maximum number of files to be kept on the local ftp server.
  Note: please make sure the filename results in a list sorted by date/time, so that always the „oldest“ file is deleted (e.g. with a <timestamp> in the filename).
- **FTP Host/IP:** DNS name or IP address for the ftp server
- **FTP Port:** TCP port for the ftp server.
- **FTP User:** ftp user-id
- **FTP Password:** ftp password

The button „**show events**“ opens a dialog, showing the events currently stored on the LCom.



5.13.13 DGT RC Alarm Code



Here, the parameter for calculating the DGT RC Alarm Code are configured:

- Dewpoint Temperature: the channel for dewpoint temperature in °C
- Road Temperature: the channel for road temperature in °C
- Freeze Point Temperature; the channel for freeze point temperature in °C
- Road Condition: the channel for road condition
- Value Map: the value mapping to map the road condition to DGT encoding

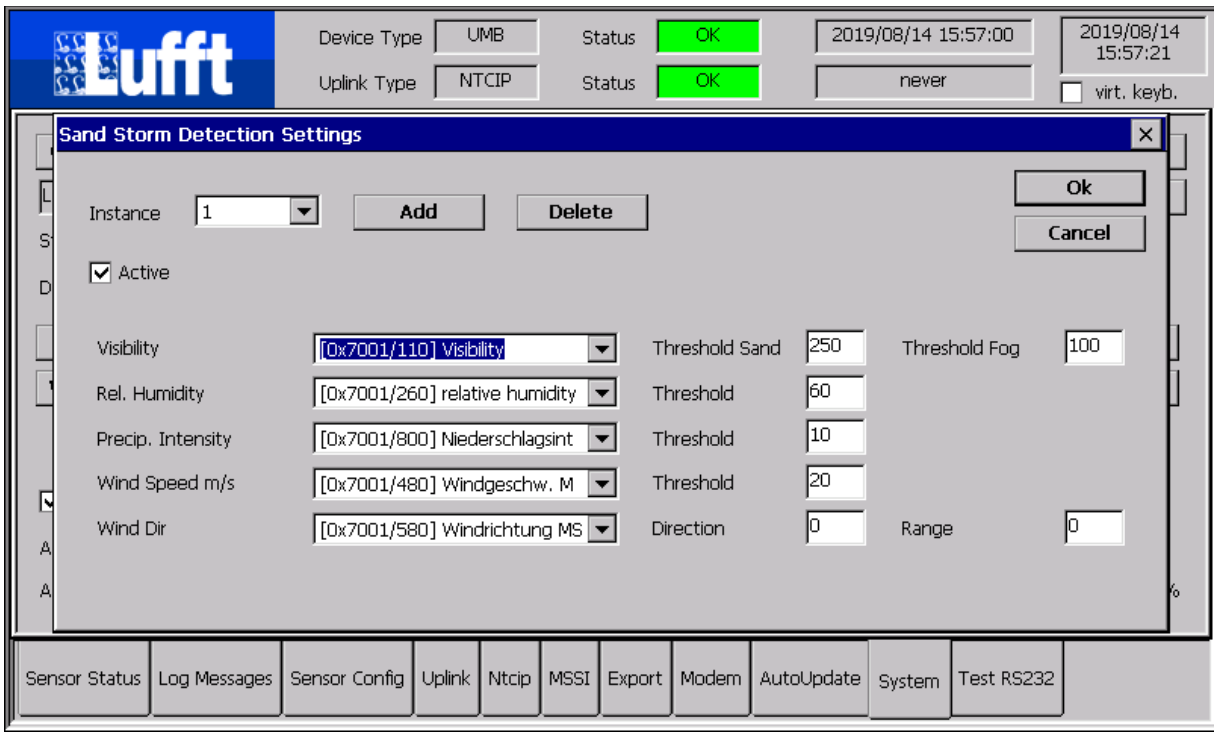
NOTE: to calculate the DGT Road Condition, historical values for dewpoint and road temperature are required, i.e. data storage must be active for at least these 2 channels.

Calculation:

The DGT Road Condition Alarm Code (Altertas Atmosfericas Byte) is calculated as used in the DGT protocol. A value for dewpoint and road temperature is extrapolated (time horizon 2 hours) using linear interpolation, and compared with other values. The result is bit-encoded as follows:

- Bit 0: (TSB): low road temperature
- Bit 1: (RAR): risk of dew
- Bit 2: (RAE): risk of frost
- Bit 3: (RCC): risk of ice

5.13.14 Sand Storm Detection



The Input parameters for sand storm protection are:

- Visibility
- Relative Humidity

And optional

- Precipitation Intensity
- Wind Speed
- Wind Direction

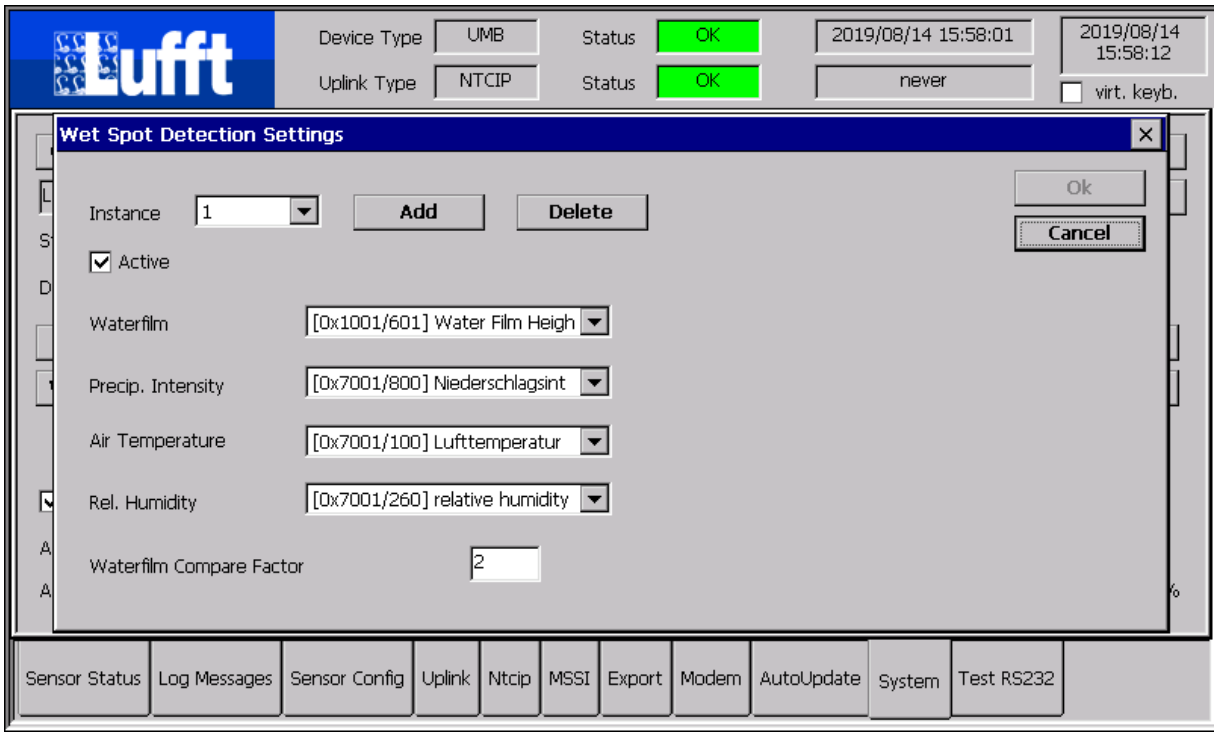
A “Sand Storm” is detected, if the visibility value is below the configured “threshold sand”, and the humidity value is below the configured “threshold” for humidity.
If optional input values are configured, these values need to meet the configured criteria in addition to the basic parameters, i.e.:

If precipitation intensity is configured, the precipitation intensity value has to be below the configured threshold.
If wind speed is configured, the wind speed value has to be above the configured threshold
If wind direction is configured, the wind direction has to be in the configured direction and range. The range specifies the tolerance around the configured direction. E.g. if the “Direction” is set to 170, and Range is set to 50, the wind direction has to be 170 +/- 50 ° (i.e. 120 to 230°).

If the input values do not indicate a “sand storm”, visibility is compared against the “threshold fog” value. If the value is below this threshold, “Fog” is reported. Otherwise “Clear”.

The result is coded as follows:
1 = “Other” – no result could be calculated
2 = “Unknown” – an error occurred
3 = “Clear” – no fog or sand storm was detected
4 = “Fog”
10 = “Dust or Sand” – Sand Storm was detected

5.13.15 Wet Spot Detection



The input values for wet spot detection are

- Waterfilm
- Precipitation Intensity
- Air Temperature
- Relative Humidity

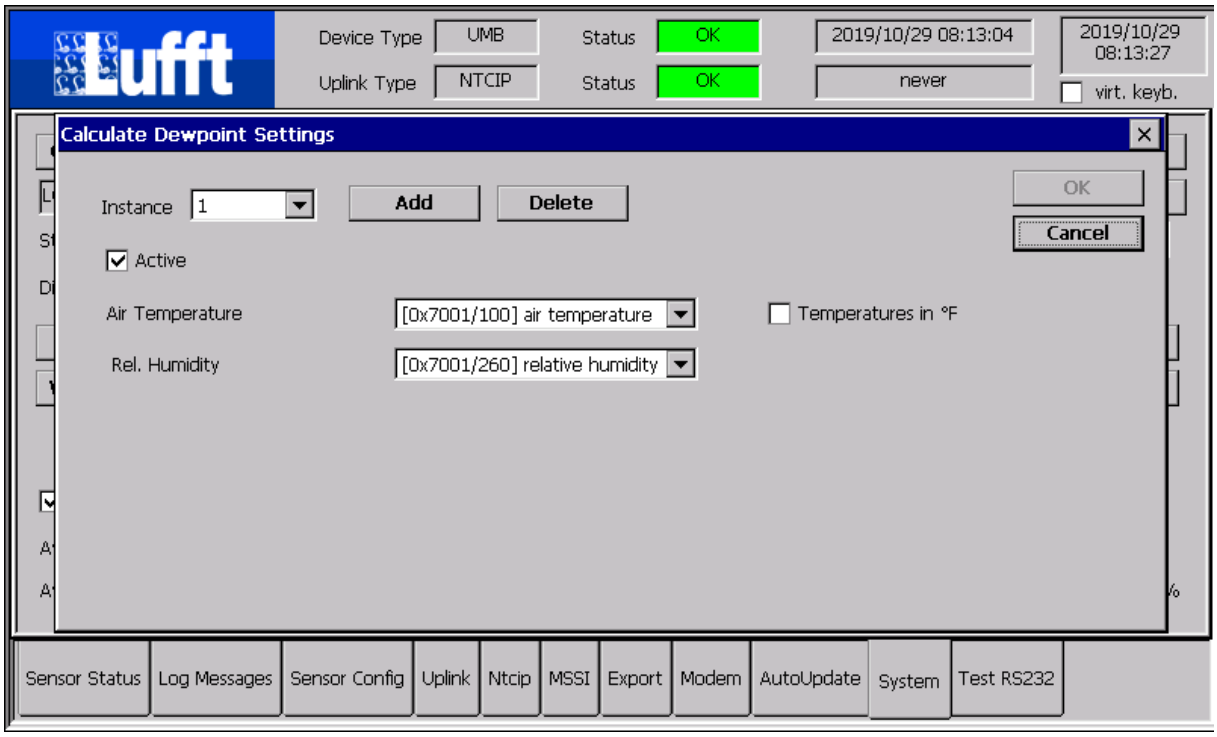
A simulated water film value is calculated from these input measurements. If the measured value for water film level – multiplied by the configured waterfilm compare factor – is above the simulated (=expected) water film level, a “wet spot” is detected.

Result:

0: no wet spot detected

1: wet spot detected

5.13.16 Dewpoint

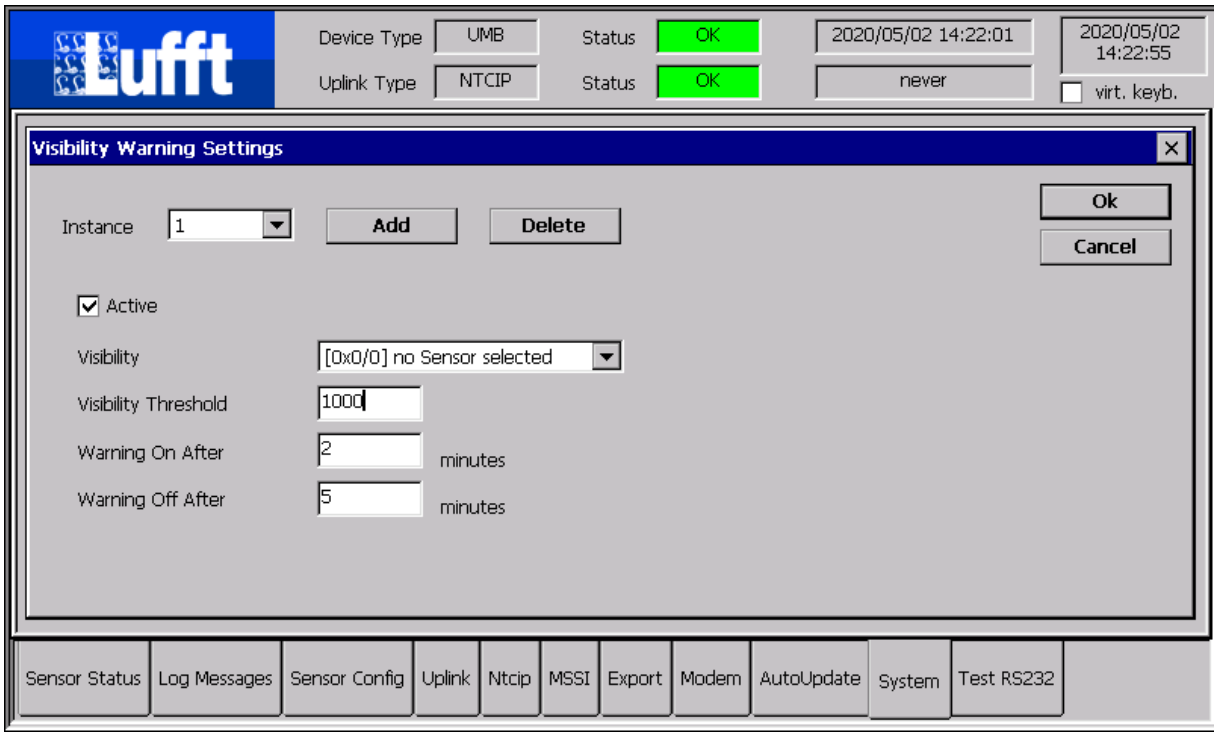


The parameters for dewpoint calculation are as follows:

- Air Temperature: the air temperature (°C or °F)
- Temperatures in °F: select, whether temperatures are in °C or °F
- Rel. Humidity: the relative humidity (%)

Note: the resulting dewpoint temperature unit follows the input air temperature unit, i.e. if “Temperatures in °F” is selected, the dewpoint temperature will be calculated in °F as well.

5.13.17 Visibility Warning



Here, the parameter for visibility warning calculation can be configured:

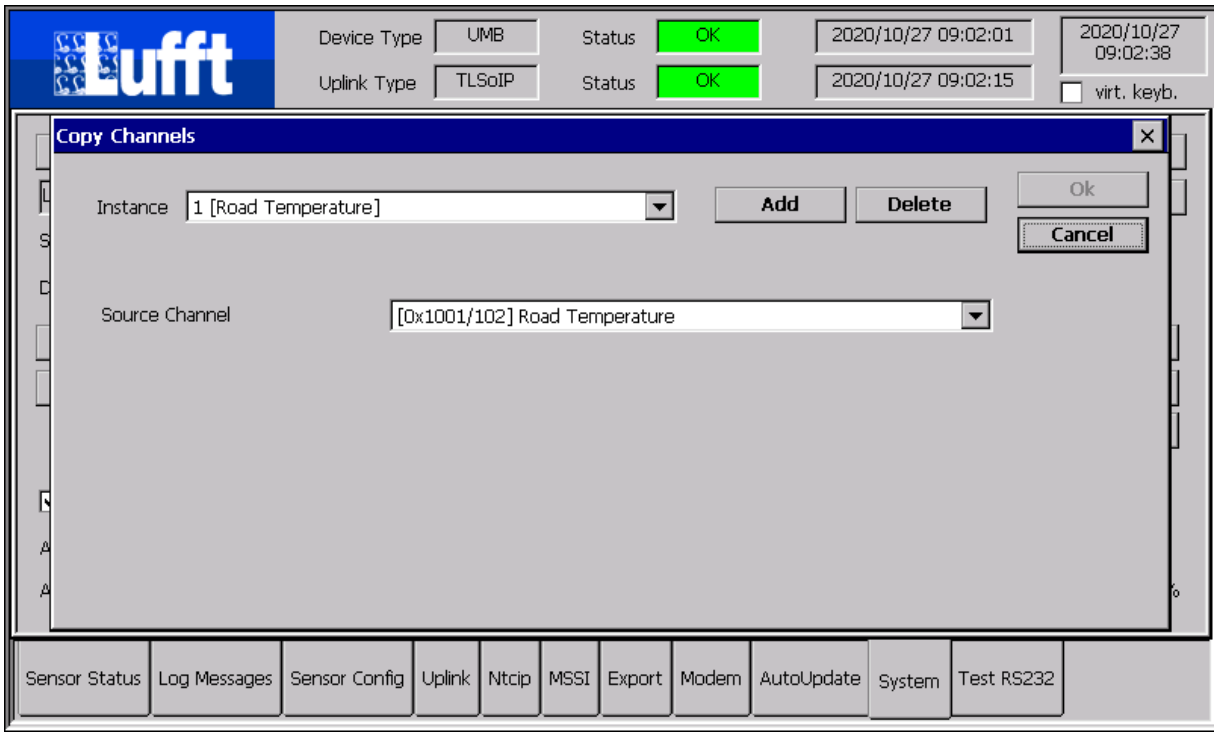
- Visibility: the visibility sensor channel
- Visibility threshold: the threshold (in the unit of the respective sensor channel) below which “bad visibility” is assumed
- Warning On After: the time span for which the value has to be constantly below the configured threshold to set “visibility warning” active
- Warning Off After: the time span for which the value has to be constantly above the configured threshold to set “visibility warning” inactive

The result value is:

0: no visibility warning

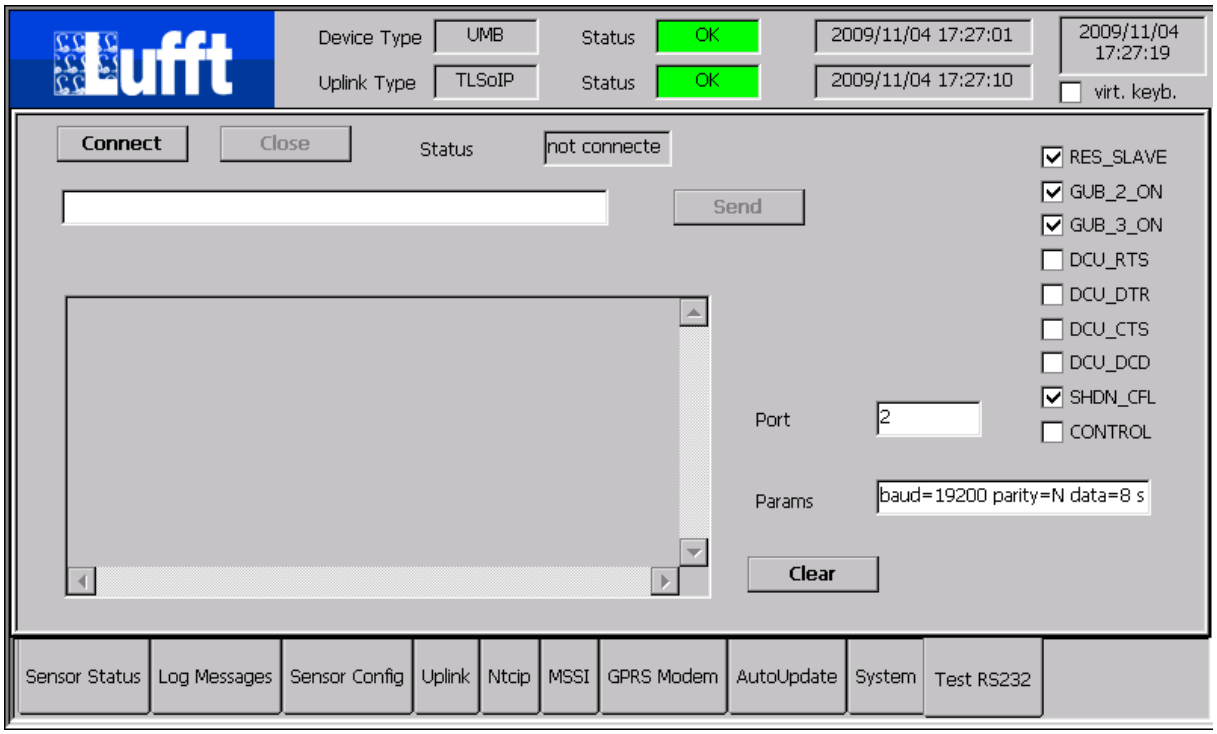
1: visibility warning

5.13.18 Copy Channels



Here, copies of UMB sensor channels can be configured, e.g. if the same source channel is needed to be processed with different value mapping/scaling results.

5.14 Test RS232



A simple test application for RS232 interfaces.

After opening the COM interface by clicking “Connect” you can enter a text in the input field and send this to the serial interface by clicking “Send”.

The digital-IO module ports are shown on the right-hand side and the status of the corresponding signals (on/off) can be set (for “output” signals only).
Note: The DCU_RTS, DCU_DTR, DCU_CTS and DCU_DCD signals are shown/processed here in RS232 logic. The RS232 logic is the opposite to the digital-IO module logic, i.e. if a signal is “on” for the digital module, then it is “off” for the RS232.

Switching the display off by deactivating the SHDN_CFL signal is handled by the LCom like the activation of the screensaver, i.e. the display is switched back on when a mouse button is pressed or the touch screen is touched.

5.15 Software Update / Remote Maintenance

Software updates and (remote) maintenance scripts can be supplied via an FTP server (see AutoUpdate) or USB stick.

Provided that “AutoUpdate” is activated and configured correctly, the software check at pre-set intervals whether a file named “update.txt” is available on the ftp server in the “general” or “device specific” directory, or on an USB stick (i.e. \Hard Disk\update.txt) if an USB stick is connected to the LCom.

5.16 File Update.txt

The “update.txt” file serves to control the update mechanism in the LCom.
The file has the following content:
Line 1: Timestamp (UCT/Unix timestamp as integer) – where appropriate with “readable” date after the Unix timestamp.
Line 2: Optional: The name of the “Update Command File” to be processed (see below). If no name is specified, “update.ucmd” is assumed.

The update is processed depending on where the “Update.txt” file is located:

a) Update.txt in the “general” directory on the FTP server: The LCom reads the file if it has a different “last modified” timestamp than the last time the file was read (or if the LCom was rebooted). The timestamp in the file (first line) is checked. If the timestamp is “newer” (more recent) than the timestamp of the last processed “general” update (which is stored in the LCom), the update “command file” is downloaded and processed. After processing the update a copy of the “command file” - with the processing timestamp and “.ERROR” (if an error occurred) or “.OK” (if the update could be processed successfully) as additional extension - is stored in the “device specific” directory on the server. This file allows to easily check the progress of any “general” updates for the individual LCom.
b) Update.txt in the “device specific” directory on the FTP server: If the file is present this directory, the LCom always processes it, i.e. the assigned command file is transferred and processed. After processing the update, both the“update.txt” and the command file are renamed on the FTP server (which prevents multiple executions). A timestamp and the additional ending “.OK” or “ERROR” is appended to the filename.
c) Update.txt on the USB stick: Whenever a USB stick containing an “update.txt” file is plugged in, the user is prompted whether the update should be processed or not. The dialog is automatically closed after 1 minute (without the update being processed) if the user does not respond. The update can be

reactivated by disconnecting and reconnecting the USB stick (wait time > 3 seconds).

5.17 Command File

The command file (default: update.ucmd) contains the actual commands that are processed by the LCom.

General format:
The command keyword is given in arrow brackets “<…>” at the beginning of the line. This is followed by the command parameters, which are comma-separated. The command itself is not case-sensitive; however the parameters may be case-sensitive (e.g. in the case of file names on the FTP server).

The following commands are currently supported:

Command	Parameter	Description
<put>	Local_File, Server_File	The file with the name “Local File” is transferred to the server
<get>	Server_File, Local_File [,CRC]	The server transfers the “Server File”. If a CRC checksum is specified as the third parameter, this checksum is checked after transfer.
<zip>	File, Archive_File	The file is added to the “Archive_File” ZIP file.
<closezip>		The “Zip File” is closed.
<unzip>	Archive_File, Directory	The files from the “Archive_File” ZIP file are unpacked in the specified directory.
<set-param>	Parameter Name, Parameter Value, Section, [ini-file]	The parameter with the specified name is entered or changed in the section in the ini-file, with the corresponding value.

<reboot>		The LCom is rebooted (e.g. after the transfer of a new LCom version).
<run>	Program	The specified program is started. The system waits for the program to end. The return value of the program is evaluated accordingly.
<delete>	File name	The (local) file is deleted.
<rename>	Current_Name, New_Name	The file “Current Name” is renamed to “New Name”.
<copy>	File name, New_Name	The file is copied.
<rdel>	File name	The file is deleted on the FTP server.
<stop-on-error>		Processing of the command file is stopped immediately if an error occurs (standard setting).
<no-stop-on-error>		The command file continues to be processed even if an error occurs.
<trans-cfg>		All configuration files are packed in a ZIP file and transferred to the “device specific” directory on the server.
<get-version>		The current LCom program version is written in a text file and transferred to the “device specific” directory on the server.
<reset-bb>		The LCom baseboard is “reset” (power is switched off for 5 seconds).
<enable-telnet>		Telnet access to the LCom is enabled.
<disable-telnet>		Telnet access to the LCom is disabled.

<start>	Program name	The specified program is started asynchronously, i.e. processing continues without waiting for the started program to end, and without evaluating any return value.
<kill>	Program name	The specified program is aborted/killed (if possible).
<runcmd>	Command	The specified command is processed in “cmd.exe”.
<firmup>	Device Address, Firmware File, [Verify ON/OFF]	The specified firmware file (.mot) is transferred to the device with the specified address. There is an option to switch verification on (ON) (by re-reading the device data). (Standard is: verification is off). Note: verify MUST be off for Wsx00 compact weather stations!
<csconf>	Device address, channel, active, (0/1 or ON) [id1, (for TLS -> FG) id2, (for TLS -> Type) id3, (for TLS -> Channel) Name, Scaling, str_id1 (reserved) str_id2 (reserved) id4, (for TLS: physical channel) MMSI Id, MMSI Type, Value Map ID, Store active (0/1) Statistic type	The configuration for the corresponding sensor channel is changed. As a minimum, “device address”, “channel” and “active” must be set; all other parameters are optional.
<reset-tls-modem>		The TLS modem is reset by switching off the GUB3 power supply.

<set-ntcip-snmp-dll>	dll-filename	Sets the name of the SNMP agent for NTCIP (dll) in the registry (for updating the SNMP agent to a new version)
<moncmd>	Device address, monitor command	Sends the “monitor” command to the specified device. Command and response are written to a file (MonitorCmd<timstamp>.txt) which is transferred to the update server.
<get-umb-eeprom>	Device address, start address, BYTE|SHORT|USHORT|LONG|ULONG|FLOAT|DOUBLE	Reads the corresponding value from the EEProm of the UMB device. If successful, the result is written to a file and transferred to the server.
<set-umb-eeprom>	Device address, start address, BYTE|SHORT|USHORT|LONG|ULONG|FLOAT|DOUBLE, new value	Sets the corresponding value in the EEProm of the UMB device. The result (successful or not) is written to a file and transferred to the server.
<pin-set-umb-eeprom>	Device address, start address, BYTE|SHORT|USHORT|LONG|ULONG|FLOAT|DOUBLE, new value [,pin]	Sets the corresponding value in the EEProm with PIN protection. The result is written to a file and transferred to the server. The default pin is used if no pin is specified.
<RESET-TLS-CHANNEL-INACT>		Re-sets TLS channel assignment for all channels that are “inactive” to 0 (so channel is not “tls configured but passive” anymore)

5.18 Examples

Note: When transferring ZIP files to the LCom (software update), the ZIP archive should be created with the service program (or similar tool) in order to guarantee that the ZIP archive is compatible with the LCom software (e.g. no path name in the archive…). It is recommended to test all update jobs with a test device.

Program update via USB stick

The following files are on the USB stick:
Update.txt
Update_LCom.txt
LCom.exe
Text_de.uni
Text_en.uni

“Update.txt” file:

1188475324
update_LCom.ucmd

“Update_LCom.ucmd” file:

<COPY>\Hard Disk\LCom.exe, \FFSDISK\LCom.exe
<COPY>\Hard Disk\Text_de.uni, \FFSDISK\Text_de.uni
<COPY>\Hard Disk\Text_en.uni, \FFSDISK\Text_en.uni
<REBOOT>

5.18.1 Firmware Update via USB Stick

The following files are on the USB stick:

Update.txt

Update_firmware.txt

R2S_Release_V48.mot

“Update.txt” file:

1188475324

update_firmware.ucmd

“Update_firmware.ucmd” file:

<COPY>\Hard Disk\R2S_Release_V48.mot, \temp\R2S_Release_V48.mot

<FIRMUP>0x2001, \temp\R2S_Release_V48.mot

5.19 Firmware Update via FTP Server

The following files are stored on the “device-specific” directory on the FTP server:

Update.txt
Update_firmware.txt
R2S_Release_V48.zip

“Update.txt” file:

1188475324
update_firmware.ucmd

“Update_firmware.ucmd” file:

<GET><sernum>/R2S_Release_V48.zip, \temp\R2S_Release_V48.zip
<UNZIP>\temp\R2S_Release_V48.zip, \temp\
<FIRMUP>0x2001, \temp\R2S_Release_V48.mot

5.20 Service Program

The service program connects to the LCom via TCP/IP; it can be used over both LAN and Internet (GPRS/CDMA) connections.

Basically the service program is built like the user interface on the LCom (but without the “RS232 Test” dialog).

After the connection has been established, the clock settings on the LCom are checked and synchronized with the PC if necessary. The LCom’s language (country) setting is also compared with the service program and adjusted if necessary.

The following additional functions are available under the “Edit” menu heading:

- **Update firmware:** The firmware of the active UMB sensors connected to the LCom can be updated by means of this function. In this case the firmware (.mot) file is first transferred to the LCom and then imported into the UMB device.
- **Update LCom software:** The LCom software can be updated.
- **Edit file:** A file is transferred from the LCom and an editor is started. If the file was changed the modified file is transferred back again.
- **File transfer from LCom:** A file is transferred from the LCom to the PC.
- **File transfer to LCom:** A file is transferred from the PC to the LCom.
- **UMB Direct Access Mode:** a “transparent mode” to access the UMB bus on the LCom via a local IP port is started. The LCom cannot access the UMB sensors while the “Direct Access Mode” is active – i.e. the LCom cannot read out measure values etc. while in direct access mode. If the “UMB config tool” is installed on the computer, the UMB config tool is started. Access to the UMB devices is via TCP/IP on localhost, port 8000 (default, can be configured via help/options)

6 Appendix

6.1 Supported TLS DE Data Types

6.1.1 Extended error message DE-Type 14

If configured (see „Uplink“ configuration above), the error code reported by the UMB device for a channel is transmitted as a supplier-defined byte in the DE-Type 14 error message.

Besides the default UMB error codes, following values are possible:

0xF1 : general error (e.g. communication error with UMB device)
0xF2 : range check failed
0xF3 : freezing temperature cannot be determined (only for freezing temperatures – if configured)
0xF4 : no measure value available
0xF5 : UMB power shutdown (only if UMB PowerSaver is active and battery power is below threshold)
0xF6: error calculating the value for a virtual/calculated sensor channel

6.1.2 FG3

6.1.2.1 Standard data types FG3

All types described in TLS Standard 2012 are supported. These are:

Type	Description
48	Air temperature LT
49	Road Surface Temperature FBT
52	Residual Salt RS
53	Precipitation Intensity NI
54	Air Pressure LD
55	Relative Humidity RF
56	Wind Direction WR

57	Wind Speed WG
58	Snow Height SH
60	Visibility SW
61	Luminosity HK
64	Wind Speed (Peak) WGS
65	Freezing Point GT
66	Dew Point TPT
67	Subsurface Temperature 1 TT1
68	Subsurface Temperature 2 TT22
69	Subsurface Temperature 3 TT3
70	Road Condition FBZ
71	Precipitation Type NS
72	Water Film Height WFD
73	Thaw Chemical Concentration TSK
74	Thaw Chemical Amout TSQ
75	Snow Film Height SFD
76	Ice Film Height EFD
77	Grip GR
78	Global Radiation GLS
79	Road Condition for Winter Road Maintenance FZW
80	Stickstoffmonoxid NO
81	Stickstoffdioxid NO2
82	Stickoxide NOx
83	Polluntant PM10
84	Polluntant PM2.5
85	Polluntant PM1
86	Sound Pressure Level LA
87	Sound Pressure Level LAeq
88	Sound Pressure Level LA95
89	Sound Pressure Level LA1

The following types are supported for compatibility with TLS Standard 1993:

Type	Description
50	Road Humidity (8 bit)
51	Road Condition (8 bit)
63	Precipitation Type (8 bit)

Unless adjusted by scaling or value mapping, the value reported by the UMB sensor channel is used for all data types. If the UMB sensor channel does not already report the proper TLS unit (e.g. for the old type 51), an appropriate scale factor and/or value mapping must be configured for the UMB sensor channel.

6.1.2.2 Manufacturer defined data types FG3

Following manufacturer defined data types are supported:

Typ	Beschreibung
129	Ice Percentage (NIRS)
131	Waterfilm, height in 0.1mm (MicKS)
132	Road Condition (MicKS)
183	Prognosis Time until icing
184	Prognosis Road Temperature
185	Prognosis Road Condition
254	Boschung Alarm Status Code

6.1.2.2.1 Typ 129 – Ice Percentage (NIRS)

Wird verwendet mit ID 4 (Ergebnisse) in Antwortrichtung.

Position	*Description*	*Value*
Byte 1	Length	[4]
Byte 2	Channel	[1..254]
Byte 3	DE Type	[129]
Byte 4	TLS Manufacturer Code	[47] = Lufft
Byte 5	Ice percentage (%)	[0…100, 255]

Ice Percentage 0…100 %

255 = Error / no measurement possible

6.1.2.2.2 Type 131 – Water film height in 0.1mm

Position	*Description*	*Value*
Byte 1	Length	3
Byte 2	Channel	[1..254]
Byte 3	DE Type	[131]
Byte 4	Water film height	[0… 254]

6.1.2.2.3 Typ 132 – Road Condition (MicKS)

Position	*Description*	*Value*
Byte 1	Length	[3]
Byte 2	Channel	[1..254]
Byte 3	DE-Type	[132]
Byte 4	Road Condition	[0… 254]

value	
0	Dry / not icy.
1	Damp
3	Wet

65	Snow / Sleet
66	Ice / Ice Warning
67	Rime / Rime Warning
68	Posibility of slippery condition caused by chilly road
255	No value

6.1.2.2.4 Type 183 – Prognosis Time until icing

Position	*Description*	*Value*
Byte 1	Length	[4]
Byte 2	Channel	[1..254]
Byte 3	DE Type	[183]
Byte 4	TLS Manufacturer Code	[47] = Lufft
Byte 5	Time reserve in minutes	[0, 1-90, 254]

Time Reserve:

0 = road condition is currently ice

1..90 (or 1..240) ice warning xxxx minutes

254: no icing expected within prognosis horizont

6.1.2.2.5 Type 184 – Prognosis Road Temperature

Position	*Description*	*Value*
Byte 1	Length	[5 + 2 * n]
Byte 2	Channel	[1..254]
Byte 3	DE Type	[184]
Byte 4	TLS Manufacturer Code	[47] = Lufft
Byte 5	Number of Prognosis values (n)	n=0…36
Byte 6	Time Interval between values	[10..180] minutes
Byte 7	Prognosis-Value 1 low byte	Prognosis-Value Road Temperature
Byte 8	Prognosis-Value 1 high byte	-30..+ 60 °C, In 1/10 °C
…		
…		

Byte 5 + 2*n	Prognosis-Value n low byte
Byte 6 + 2*n	Prognosis-Value n high byte

6.1.2.2.6 Type 185 – Prognosis Road Condition

Position	*Description*	*Value*
Byte 1	Length	[5 + n]
Byte 2	Channel	[1..254]
Byte 3	DE Type	[184]
Byte 4	TLS Manufacturer Code	[47] = Lufft
Byte 5	Number of Prognosis values (n)	n=0…36
Byte 6	Time Interval between values	[10..180] minutes
Byte 7	Prognosis-Value 1	Prognose-Value Road Condition
…		coded as TLS Typ 70
Byte 6 + n	Prognosis-Value n	

6.1.2.2.7 Typ 254: Boschung Alarm Status Code

Position	*Description*	*Value*
Byte 1	Length	[3]
Byte 2	Channel	[1..254]
Byte 3	DE-Type	[254]
Byte 4	AlarmCode	

Coding of alarm stati in AlarmCode:

Alarm 1	Alarm 2	Alarm 3	Hex
-	-	-	00h
x	-	-	01h
x	x	-	02h

x	x	x	03h
x	-	x	04h
-	x	-	05h
-	x	x	06h
-	-	x	07h

For Alarm Model Version 2, additional bits are set as follows:

Bit 4: 1=Alarm A3 Freeze Temperature – black ice

Bit 5: 1=Alarm A3 Dewpoint – slippery frost

Bit 6: 1=Alarm A3 Precipitation – freezing rain

Bit 7: 1=Alarm A3 Precipitation – snow

6.1.3 FG6

6.1.3.1 Standard data types FG6

The FG6 standard data types support the following:

Type	Description
48	Door contact
49	Temperature control
50	Light
51	Power supply
52	Heating
53	Ventilation
54	Surge protection
55	Theft/vandalism

Like with TLS FG3, the appropriate coding to TLS “units” may have to be provided using an appropriate value mapping.

For types 48 (door contact), 50 (light), 54 (surge protection) and 55 (vandalism) the value (after value mapping if appropriate) can be inverted (see uplink configuration above). For Types 48, 54 and 55, the default is to invert the value, e.g. a value of “0” is reported as “door open”, “surge protection defect” or “vandalism alarm” respectively, and a value “not 0” is reported as “door closed”, “surge protection ok” or “no vandalism alarm”.

For types 51, 52 and 53, an appropriate value mapping must be configured and assigned to the sensor channel.

For type 51, a pre-defined “default” value mapping is applied if there is no value mapping assigned to the sensor channel

6.1.3.2 Manufacturer defined data types FG6

6.1.3.2.1 Type 151 – status power supply

Position	*Description*	*Value*
Byte 1	Length	Length of the de block
Byte 2	Channel	[1..254]
Byte 3	DE-Type	[151]
Byte 4	Supplier-code	47 (Lufft)
Byte 5	See table	

BIT	STATUS 0	STATUS 1
0	Power ok (BM=open)	Power failure (BM=closed)
1	UPS ok (BA=open)	UPS defect (BA=closed)
2	n/a	n/a
3	n/a	n/a
4	GFCI (FI) ok	GFCI (FI) fired
5	Circuit breaker (SI) ok	Circuit breaker (SI) off

For this data type, any value mapping assigned to the sensor channel is ignored! A special calculation is used to map the resistance value to the bit map above. The value supplied by the sensor channel must match the expected resistance coding

FI	LS	BA	BM	NOMINAL VALUE (OHM)	VALID VALUE RANGE (OHM)
0	**0**	**0**	**0**	1870	1810…2000
0	**0**	**0**	**I**	1750	1690…1810
0	**0**	**I**	**0**	1630	1570… 1630
0	**0**	**I**	**I**	1510	1450…1570
0	**I**	**0**	**0**	1360	1300…1450
0	**I**	**0**	**I**	1240	1180… 1300
0	**I**	**I**	**0**	1120	1060… 1180
0	**I**	**I**	**I**	1000	940...1060
I	**0**	**0**	**0**	870	810… 940
I	**0**	**0**	**I**	750	690… 810
I	**0**	**I**	**0**	630	570… 690
I	**0**	**I**	**I**	510	450… 570
I	**I**	**0**	**0**	360	300… 450
I	**I**	**0**	**I**	240	180… 300
I	**I**	**I**	**0**	120	60… 180
I	**I**	**I**	**I**	0	0….60

6.1.3.2.2 Type 221: Circuit Breaker

Position	*Description*	*Value*
Byte 1	Length	Length of de-blocj
Byte 2	Channel	[1..254]
Byte 3	DE type	[221]
Byte 4	Supplier code	[47] (Lufft)
Byte 5	Number of results	[1]
Byte 6	Status circuit breaker	[0,1]

Number of results is always 1

Status of the circuit breaker is coded as follows:

0 : circuit breaker on (OK)

1: curcuit breaker off / (error/alarm)

A parameter controls, whether the value reported by the sensor channel is (after applying any configured value mapping) inverted or not.

Default: the value is inverted.

6.1.3.2.3 Type 222: Fuel cell tank level

Position	*Description*	*Value*
Byte 1	Length	Length of de-block
Byte 2	Channel	[1..254]
Byte 3	DE type	[222]
Byte 4	Supplier code	[47] (Lufft)
Byte 5	Number of results	[1]
Byte 6	Status fuel cell tank level	[0,1]

Number of results is always 1

Status of the fuel cell tank level is coded as follows:

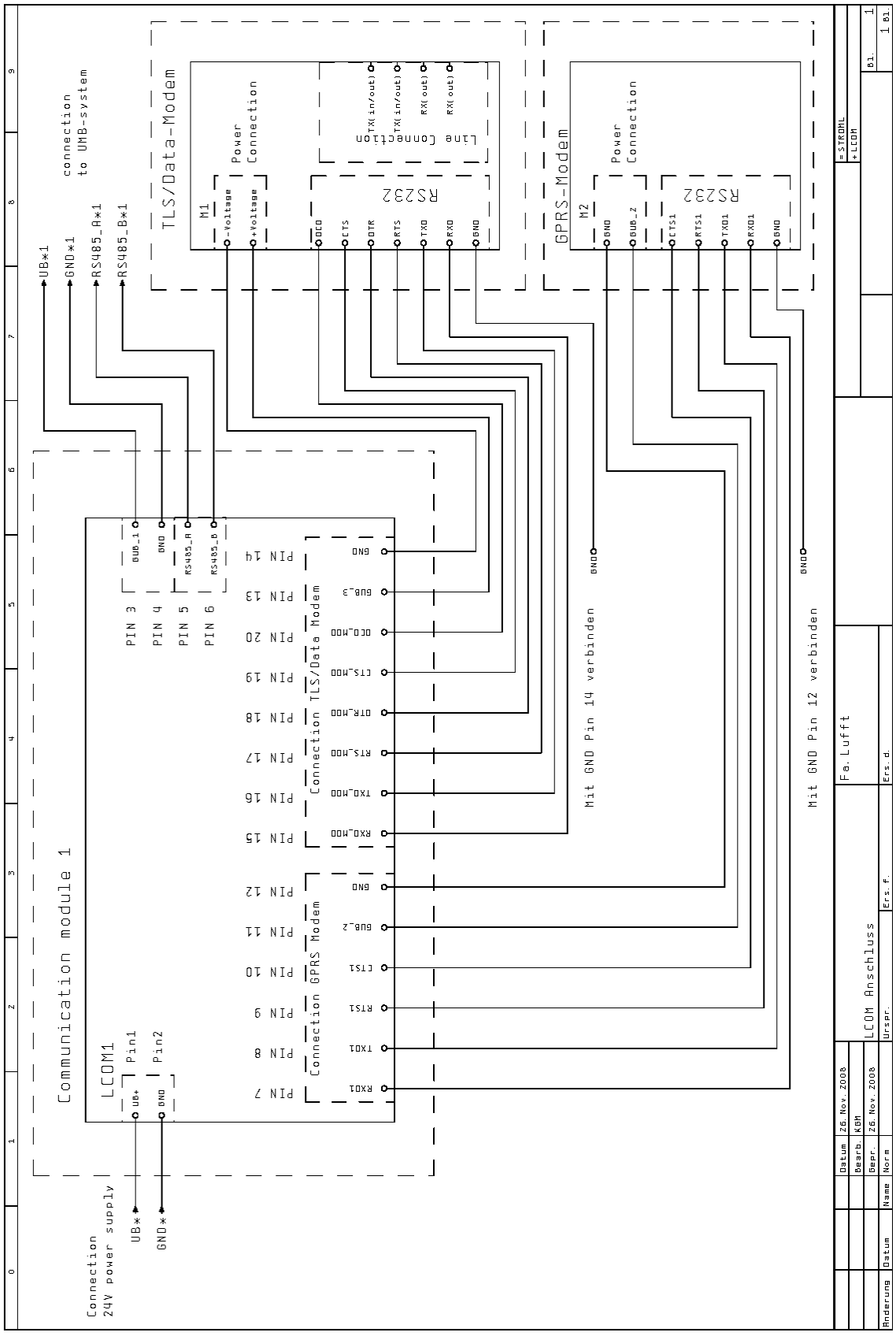
0 : level above threshold (OK)

1: level below threshold / (error/alarm)

A parameter controls, whether the value reported by the sensor channel is (after applying any configured value mapping) inverted or not.

Default: the value is inverted.

6.2 Connection Example



6.3 Change History

November 2009	P. Rau	Version 1.3.9 • Updated English version of manual with screenshots and corrected some translation errors
November 2009	P. Rau	Version 1.3.11 • Improved error handling when transferring cam picture from camera • UMB Firmware update via “update script” -> verify now defaults to OFF (cannot verify WsX00 firmware !) • Service Program: UMB Firmware update now with option “verify” (default:off) • Support for NTCIP Version 1 “essSubSurfaceSensorEntry”
	P. Rau	Version 1.3.12 • Bug Fix timestamp month calculation • Added missing attributes to MSSI responses
February 2010	P. Rau	Version 1.3.13 • Improved Timeout and Error Handling http transfer cam picture from camera to LCom • Reading stored measure values via MSSI now always report at least the last 2 stored values (prevent reporting “no values” when storage interval = poll interval) • Errors reported by the UMB device are now always logged in error log • Only log messages for clock sync events via MSSI or NTP when debug flags are set
April 2010	P. Rau	Version 1.3.14 • Bug Fix handling gaps in data store when retrieving statistical values over time intervals • MSSI: Report UMB error code as value (with error flag set) • Bug Fix TLS: set op-code in init telegram to „D“ (8= Application-Data)
May 2010	P. Rau	Version 1.3.15 • Limit GPRS modem resets via TLSoIP to configurable minimum interval (2 hour) or at least 2 times ReconnectDelay • TLS: corrected accepting OSI3 routing information • Improved error handling for getting current camera picture via MSSI
July 2010	P. Rau	Version 1.4.0 • Show configuration changes made to .ini file for values displayed in Combo-Box elements. • Improved timeout handling internal FTP Client; new parameter ftp timeout for auto-update and cam picture upload • New Uplink Protocol “Micks-FTP” • New parameter for TLS FG6 DE-Types • New supplier-defined TLS DE-Types FG6 type 221 and 222 • Optional “UMB PowerSaver” – switching off power for UMB devices (via GUB_1) on low battery power • Optional “Cam PowerSaver” – controlling power for Camera(s) via GUB_3 (only possible if uplink protocol is NOT TLS), • New Uplink Protocol “Micks-FTP” • Improved class1/class2 data handling in TLS • New “Autoupdate” command <RESET-TLS-CHANNEL-INACT>

		• Warning if UMB channel is set inactive but has a valid TLS configuration
July 2010	P. Rau	Version 1.4.1 • Fixed memory leak in FTP
August 2010	P. Rau	Version 1.5.0 • Support for Opus200 devices • Bug Fix TLS: one response telegram per OSI7-telegram in request • PIN Assignment CON220-1/2 corrected (chapter 3.8) (Labels for GPRS and Party Line Modem connectors and power supply) • Auto reset/reboot LCom if no NTCIP requests are received for a configurable time interval (default 1 day). • Support for „TLS-Lokalbus“ Uplink • TLS: phys. Channel Number configurable • New attributes for update command <csconf>
October 2010	P. Rau	Version 1.5.1 • GPRS Modem: get signal quality (CSQ) after modem has booked in successfully • TLS: log changes to op params; only write params to ini file if the value was changed (not every time the param is set).
October 2010	P. Rau	Version 1.5.2 • MSSI Kamera: a filename (instead of a directory name) can be specified in the “remote path” for automatic ftp upload of the camera picture
November 2010	P. Rau	Version 1.6.0 • Additional retries for AutoUpdate ftp operations (rename, delete file) • Monitoring last MSSI IO with optional reset/reboot on timeout • Uplink type “TLSDumpOverFtp”
January 2011	P. Rau	Version 1.6.1 • Fixed assignment for Opus200 “sub channel” (min/max/avg) to NTCIP OIDs
August 2011	P. Rau	Version 1.7.0 • extended parameters (for TLS and uplink protocol) • automatic update for NTCIP Module Table • copy log files to \FFSDISK2 or USB stick • road condition prognosis • Boschung Alarm Condition
September 2011	P. Rau	Version 1.7.1 • Sensor Service Mode • Bug fix calculating statistic type “last value”
October 2011	P. Rau	Version 1.8.0 • Change LCom user and password in OEM version • Sensor Service Mode can be started via Service Program now – and timeout for Service Mode can be set • On language change MSSI Sensor type and value mapping entries can optionally be re-initialized in new language
November 2011	P. Rau	Version 1.8.1 • Bug fix: maximum length (Osi7 content) for TLS telegram
November 2011	P: Rau	Version 1.8.2 • Bug Fix: assignment of 3rd source sensor for NTCIP OIDs (WetBulbTemperature) • NTCIP WetBulbTemperature can now be assigned only one source sensor (no internal calculation – wet bulb temperature is assumed as input then)

January 2012	P. Rau	Version 1.9.0 • Support clock sync for Wavecon devices • Alarm Module – control Acromag 983EN-4012 via Modbus/IP (WCDC) • Persistent log for LCom reboots on \FFDISK2 • Change IRS21 surrogate model for SH
February 2012	P. Rau	Version 1.10.0 • New Parameter for MSSI: SOAP Timeout -> reset SOAP protocol stack (without resetting Modem or re-booting)
June 2012	P. Rau	Version 1.10.1 • Change IRS21 surrogate model for SH
June 2012	P. Rau	Version 1.10.2 • Improved GPRS modem reset handling for TLSoFTP
October 2012	P. Rau	Version 1.11.0 • Multiple instances for road condition prognosis calculation • New TLS data types from TLS2009v0.3 (73…89) • User configurable user/password and logon via service program
February 2013	P. Rau	Version 1.12.0 • Support for NTCIP 1209 TSS (v0119f)
February 2013	P. Rau / G. Specht	Version 1.13.0 • “Simulation” model for saline concentration and freeze temperature
April 2013	P. Rau	Version 1.14.0 • Support for nemaPrivate subtree (NIRS Table)
May 2013	P. Rau	Version 2.0.0 • Bug Fix managing virtual sensor channels for simulated saline concentration • “Direct UMB access Mode” for UMB Config Tool
October 2013	P. Rau	Version 2.1.0 • New manufacturer defined TLS Type 129 – Ice Percent (NIRS)
November 2013	P. Rau	Version 2.1.1 • IRS31Pro support
March 2014	P. Rau	Version 2.2.0 • Reset modem power supply on MSSI timeout even if no GPRS modem is attached (reset external router etc.) • Fresh snow height model calculation
April 2014	P. Rau	Version 2.3.0 • Slippery Frost model calculation • New private OIDs for road condition alarm code and digital output status
June 2014	P. Rau	Version 2.4.0 • UMB Protocol: reserved bits in address • New private NTCIP OIDs for “Boschung Alarm Code” and “Digital Output Status”
April 2015	P. Rau	Version 2.5.0 • NTCIP: default scale factor 1000 for salinity OID (convert g/100g = % to g/100.000g) • NTCIP: new subtree “instrumentation” in private NTCIP branch
October 2015	P. Rau	Version 2.6.0 • CSV Export
November 2015	P. Rau	Version 2.7.0 • TLS type MicKS DE 132

December 2015	P. Rau	Version 2.8.0 • Support for IRS31Pro Road Condition encoding in Prognosis • "Bridge Deck Alarm" model calculation
December 2015	P. Rau	Version 2.9.0 • Smoothed/simulated water film model calculation
January 2016	P. Rau	Version 2.9.1 • Apply „value mappings" configured on UMB sensor to all model calculations (Boschung Alarm, Sim. Saline Concentr., Snow Amount, Slippery Frost, MicKS DE 132, Bridge Deck Alarm and WFH smoothing/simulation) in case input sensors are connected via Anacon analog inputs and need to be converted before calculating any model results
January 2016	P. Rau	Version 2.10.0 • Support precipitation type encoding "DGT" in model calulations.
April 2016	P. Rau	Version 2.11.0 • NTCIP: extended „private MIB" – new „native" UMB Sensor-Tables and BridgeDeckAlarm • NTCIP: extended „private MIB" – sensor configuration (and MIB version) • NTCIP: „historical data" / NTCIP data store • Optimized Priority for NTCIP Agent
May 2016	P. Rau	V 2.12.0 • Port Forwarding (to access camera via GPRS Modem)
June 2016	P. Rau	V 2.12.1 • Bug Fix filename extension local name for cam picture • French text version
June 2016	P. Rau	V 2.12.2 • Support http digest authentication (for camera pictures)
November 2016	P. Rau	Version 2.12.3 • Support for tags in filenames for cam pictures when transferring to ftp server
January 2017	P. Rau	Version 2.13.0 • Changed MicksDE132 model calculation for missing precipitation values • Added WaveTronix Click 512 event transmission
February 2017	P. Rau	Version 2.13.1 • Bug fix configuration dialog „Bridge Deck Alarm" – setting wrong channel for road temperature on opening dialog.
November 2017	P. Rau	Version 2.13.2 • Allow TLS 2012 „error values" (pass values through instead of handling them as range violation)
March 2018	P. Rau	Version 2.14.0 • NTCIP: support Vaisala Spectro Table OIDs
May 2018	P. Rau	Version 2.15.0 • Boschung Alarm Code: Model Version 2 and multiple instances
July 2019	P. Rau	Version 2.16.0 • New TLS DE Type 90 – precip intensity in 1/100 l/m² resolution • New virtual calc channel "DGT Road Condition Alarm Code" • Extended NTCIP private MIB for DGT Road Condition Alarm Code Table • Extended NTCIP MIB – hseIceSight
August 2019	P. Rau	Version 2.17.0 • New virtual calc channel „Sand Storm Detection" • New virtual calc channel "Wet Spot Detection"

		• Extended private MIB for Sand Storm and Wet Spot Detection • Boschung Alarm Code: optionally treat error conditions as “no alarm”
October 2019	P. Rau	Version 2.18.0 • New calc channel “Dewpoint” • Bug fix maximum number of parameters for Auto-update script commands
November 2019	P. Rau	Version 2.18.1 • Bug Fix “Dewpoint” – use “mapped” values for input (not raw values)
May 2020	P. Rau	Version 2.19.0 • Visibility Warning calc channel • Extended NTCIP MIB for visibility warning calc channel
July 2020	P. Rau	Version 2.20.0 • Manual mode for alarm output (Acromag) • Test mode for alarm output (Acromag) • Show output status for I/O Ports in config list • Prevent configuring same I/O Port multiple times • Extended NTCIP MIB – Digital Output Status – show alarm output mode
September 2020	P. Rau	Version 2.21.0 • Multiple parallel text file ftp exports (queued on SD-Card) • WaveTronix Click 512 files optionally provided on local ftp server (SD-Card) instead of FTP Push to server • NTCIP SnapShot Camera – via FTP Server on SD-Card if WaveTronix Click 512 is using local ftp server
October 2020	P. Rau	Version 2.22.0 • Bug Fix – multiple exports config change might stop exports • Calc channels to copy UMB sensor channels
June 2021	G. Specht / P. Rau	Version 2.22.1 • Adjustments DGT protocol for new sensor variants
August 2021	P. Rau	Version 2.22.2 • Adjusted linker /STACK parameter (avoid crash on stack overflow)
September 2021	P. Rau	Version 2.23.0 • TLSoIP: monitor server connection and reset GUB2 (router/modem) power on failure or reboot (with configurable timeouts)
August 2023	P. Rau	Version 2.24.0 • NTCIP ESS V4 • Extended NTCIP private MIB – subsurfaceSensorTable and noise level entry for all in one sensor entry