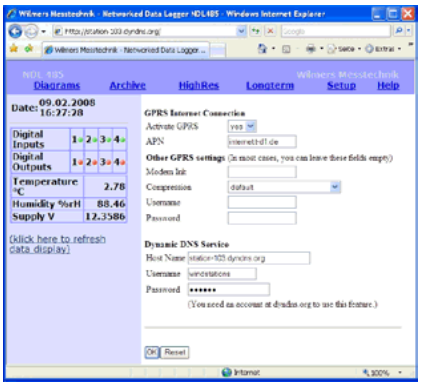
Manual

Data Logger
blueberry NDL 485



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This manual relates to firmware release 3.0.0 on two models of the data logger **blueberry NDL 485**, (partNo. 0102 **basic** and partNo. 0103 **research**). Some functions are only provided by partNo. 0103.

2010-05-30

Contents

BASIC FUNCTIONALITY (ALL MODELS)

The following chapters describe the basic functionality provided by all models of the data logger **blueberry NDL 485**. The **research** model offers additional function, like creation of realtime diagrams and FTP data transfer. These extented functionality is described in part **EXTENDED FUNCTIONALITY**.

Introduction

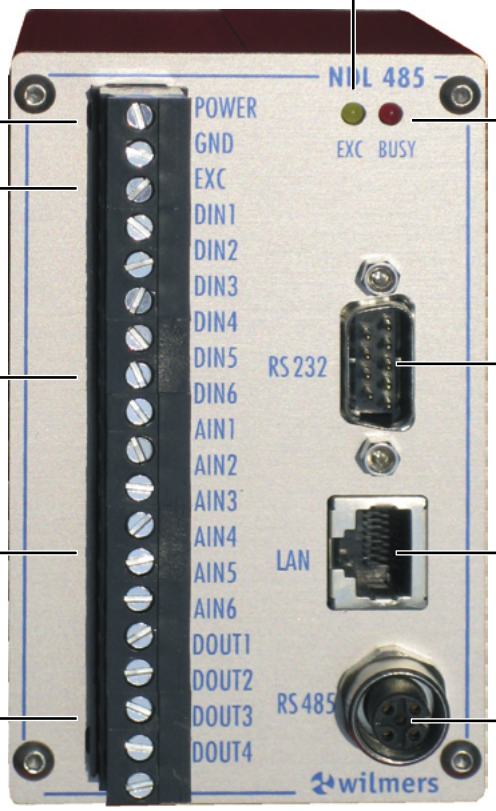
The **blueberry NDL 485** is a modular data logger and control system. It features digital and analogue measurement inputs for the connection of sensors providing pulses, voltage or current signals. A serial **RS485** bus interface allows the connection of sonic anemometers and the extension of the measurement system with **blueberry INPUT Modules**. The digital outputs control external devices and they trigger alarms. The **blueberry NDL 485** is integrated into the Internet via GSM/GPRS or DSL. It sends measured data automatically via E-Mail and FTP. The Ethernet port and the integrated web interface provide fast data transmission to a PC or a LAN and easy access via a web browser.

Getting Started

Scope of Delivery

The following components are supplied with the data logger **blueberry NDL 485:**

- Data logger in an aluminium top-hat rail housing
- RS485 data cable with 5 pin M12x1 connector
- Crosspatch Ethernet cable for local data connection
- Manual



EXC indicator
indication of sensor excitation voltage

POWER + GND
power supply connection
POWER = (+), **GND** = (–)

EXC
switched sensor excitation voltage
(also available at **RS485** connector)

DIN1 .. DIN6
digital measurement inputs

AIN1 .. AIN6
analogue measurement inputs

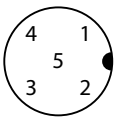
DOUT1 .. DOUT4
switching outputs

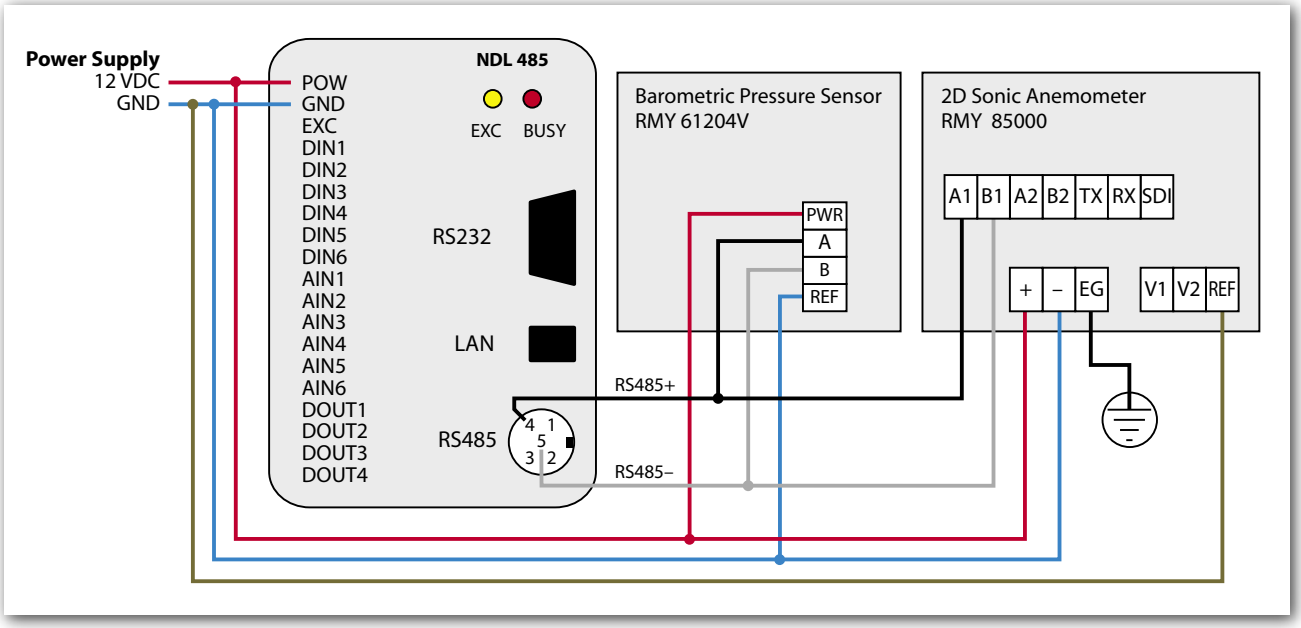
BUSY indicator
flashes every 2 seconds in normal operation

RS232
serial port for connection to a modem or to the **blueberry GSM module**

LAN
Ethernet port for connection to a PC, a router or a PC network

RS485 port + excitation
pin 1 = n.c.
pin 2 = EXC (+)
pin 3 = GND
pin 4 = RS485+
pin 5 = RS485–





Example: wiring of RS485 bus

Installation

Please proceed as follows to install and to test the **NDL 485** data logger:

1. Install the **NDL 485** on a top-hat rail.

2. Connect a power source of 5..24 VDC to the **POWER** and **GND** terminals of the terminal strip. The **BUSY** indicator LED starts flickering or is steadily alight. The boot process takes approx. 2 minutes. The data logger is fully operating when the **BUSY** LED flashes in regular intervals of 2 seconds.

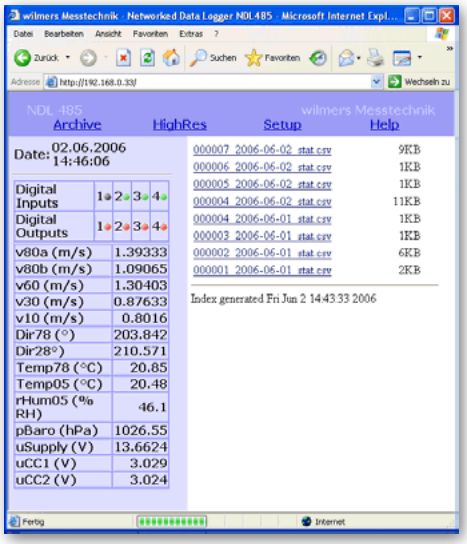
3. Plug the crosspatch cable into the **LAN** connection at the front plate of the **NDL 485**. Connect the crosspatch cable to the Ethernet interface of a PC or notebook.

4. Adapt the network settings of the PC to the IP address and the gateway of the **NDL 485**. The network parameters are indicated on a label at the bottom of the housing of the data logger.

5. Start your Internet browser, enter the IP address of the data logger into the address field and type **<enter>**. Enter the access code into the login dialog:

   user: **admin**
   password: **** *(=admin password)*

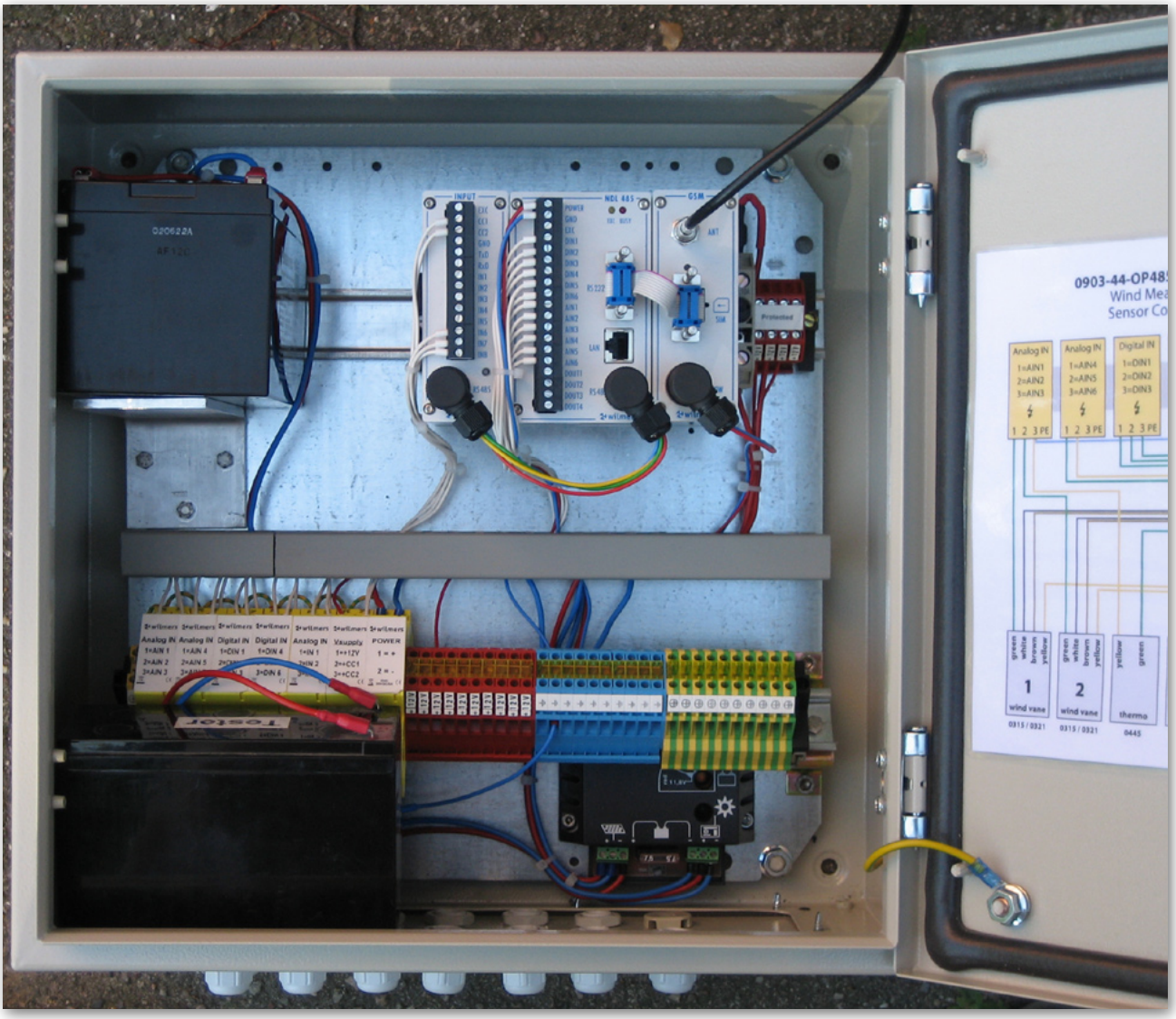
6. You should now see a screen similar to the image below.



Web Interface of the **NDL 485**

7. Connect sensors or test signals to the terminals at **DIN1** .. **DIN6** and **AIN1** .. **AIN6**. Enter the measurement functions according to chapter **Measurement Setup** of this manual.

We recommend to install the **NDL 485** in a shelter box with overvoltage protection modules for all terminals. The following image shows a typical measurement system with the **NDL 485** data logger, one **INPUT module** (20 measurement inputs in total) and the **GSM module** that integrates the data logger into the Internet via GPRS. A solar power supply and a set of overvoltage protection modules complete the system.



Shelter Box **0903-44-OP485** with overvoltage protection, solar power supply, data logger, **blueberry INPUT module** and **blueberry GSM module**

Web Interface

Introduction

The user surface of the data logger **blueberry NDL 485** is a web interface. Configuration of the data logger, display and download of measured data requires a web browser (e.g., Internet Explorer, Opera, Mozilla). The data logger is connected to the PC locally via Ethernet or via remote data transmission (DSL, GSM, GPRS).

Start the browser, enter the IP address of the data logger into the address field and type **<enter>**. Enter the access code into the login dialog. The **NDL 485** provides two user levels:

The user **guest** is allowed to display actual measured values and configuration settings and to download measured data. He cannot delete any data or change configuration settings. He is only allowed to set date and time.

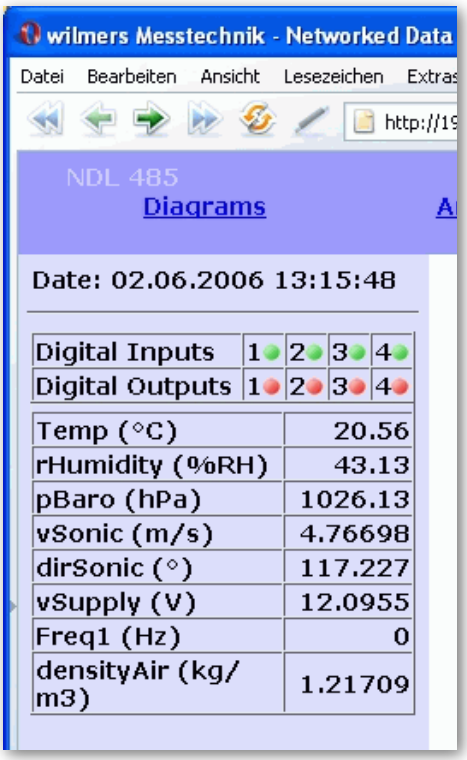
The user **admin** has all rights. In addition to the **guest** rights he is allowed to delete measured data and to change the configuration.

Login Dialogue

Data Display

Displaying Actual Measured Values

The left part of the screen displays in a table all actual measured values. When the data logger is connected locally these values are automatically updated. At remote connections, please click on **Refresh Data View** below the data table in order to update the display. Measured values are displayed as floating point numbers with the significant number of characters after the decimal point.



Realtime Display of Actual Measured Values

N O T E S

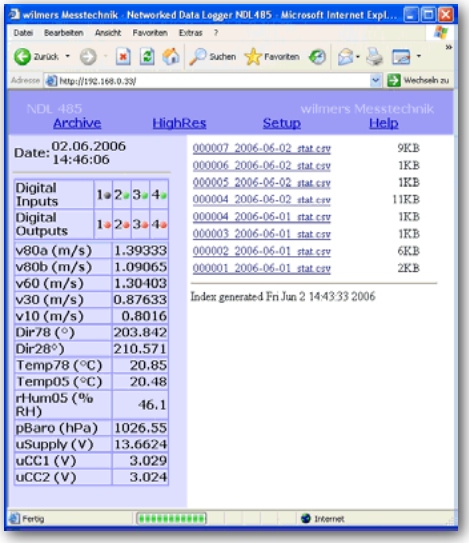
Data Transfer

Downloading Measured Data

The **NDL 485** contains two ring buffer data memories; one for the statistics, one for the samples. Actual data overwrite the oldest data lines which makes the deletion of the memory unnecessary.

Select **Archive** in order to display a list of all stored statistics files. The **NDL 485** creates one statistics file per day. These files contain time series of the statistical evaluations of the samples. The file name contains the index of the actual measurement, the date and the tag **stat** for ‚statistics'. The data logger increments the index every time the configuration is changed or the data logger reboots.

Example: **000024_2004-03-19_stat.csv**

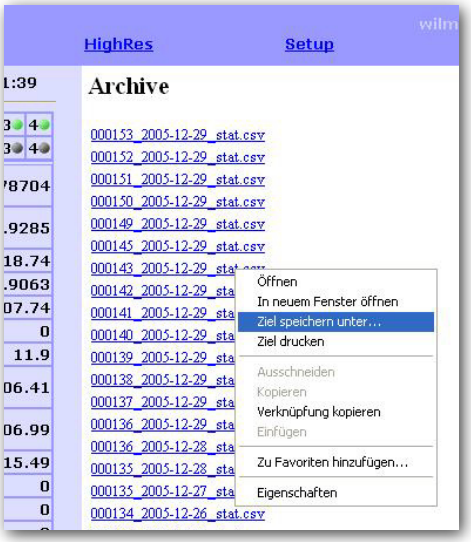


Archive: statistics data files

Select **HighRes** in order to display a list of all stored samples files. The **NDL 485** creates one CSV file per hour. These files contain time series of all measured samples. The file name contains the index of the actual measurement, date and time, and the tag **meas** for ‚measurement'.

Example: **000024_2004-03-19_15_meas.csv**

Download of measured data works like a download from an Internet site: click with the right mouse button on a file, select **Save file as...** from the pulldown menu, enter the destination path and click **OK**.

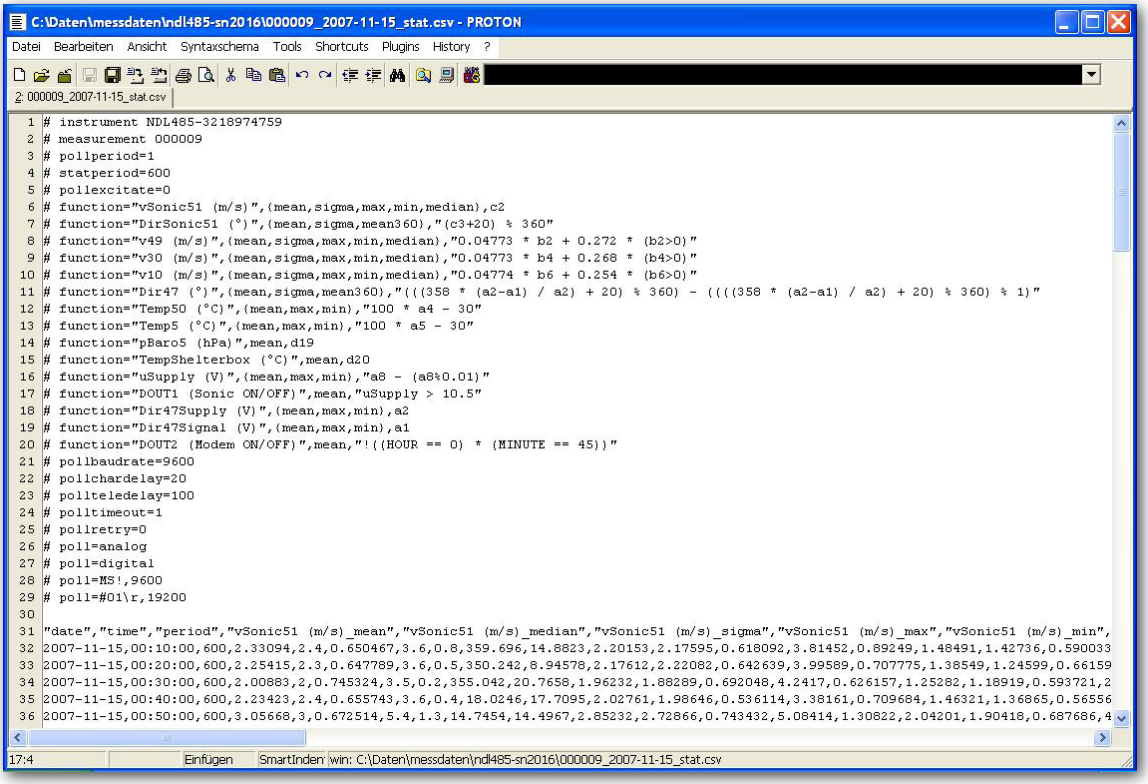


Download of Measured Data

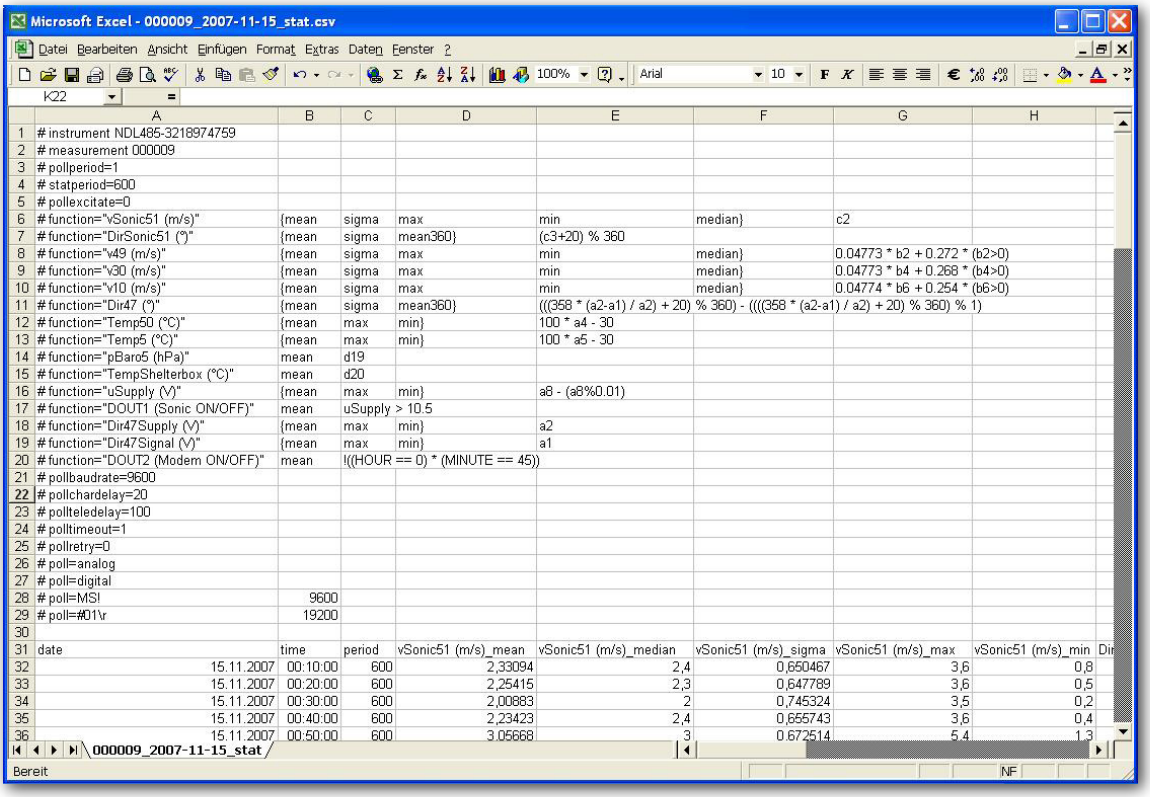
CSV files can be imported into data analysis software like **WAsP** or **WindPRO**. Double-clicking on the CSV file opens it directly in **MS-Excel**.

Data Format

The **NDL 485** stores measured data as comma separated ASCII files (CSV). Each data file contains a header which indicates information about the data logger and the measurement configuration: serial number of the data logger, index of the measurement, measurement functions and parameter settings. The header is followed by an empty line and a line with column headers. The measured data lines have the format: date, time, period, measured values. Decimal delimiter is a dot (e.g., **2.564**).



Statistics data file in an ASCII editor

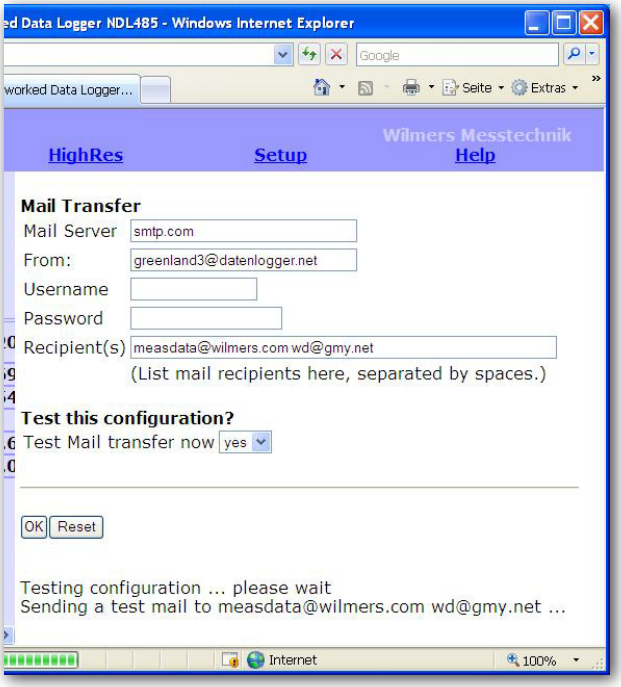


Statistics data file in MS Excel

Transmitting Measured Data via E-Mail

The **NDL 485** sends measured data automatically via e-mail every day at 0:00. The CSV data file of the previous day is attached to the e-mail. If several files have been created since last e-mailing (e.g., because of configuration changes or rebooting of the data logger) all closed files are send. Each file is attached to a separate e-mail. Please first setup the Internet integration via GPRS or DSL.

To setup the e-mail data transfer select
Setup > FTP/Mail.



Setup: E-Mail Data Transmission

Enter the URL of your mail server (SMTP server) in the field **Mail Server**. If your mail server requires authorization enter the user name and password. Enter the mail addresses in the field **Recipient(s)**. Separate more than one mail address by space characters.

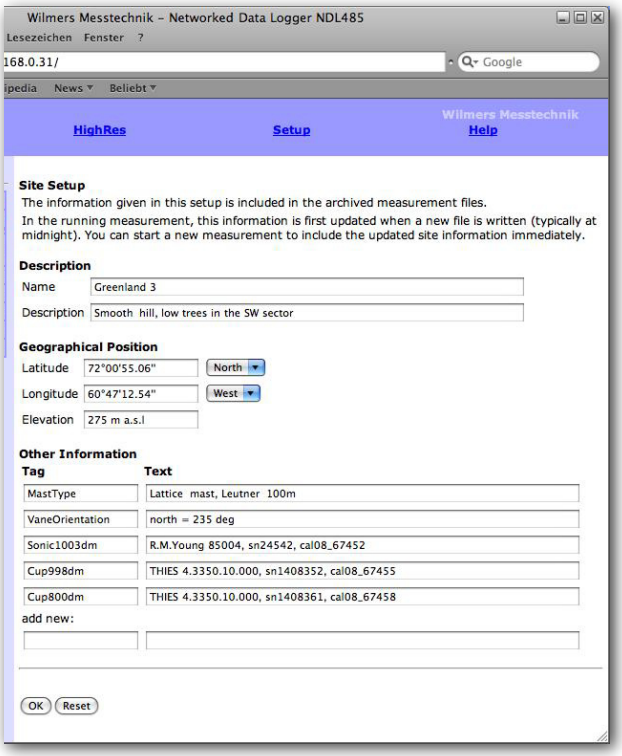
Select **yes** at **Test Mail Transfer now**.

Click **OK** to save the settings. If the **Test Mail** option is active the **NDL485** now sends a test mail to all recipients. A message displays the result of the test mailing. Please check whether the mail has been sent without errors. Otherwise, please check the correctness of your settings.

Site Description (Documentation)

The **NDL 485** saves information about the measurement. They are stored in the header of each CSV data file for proper documentation of the measurement process.

To enter the information about the measurement select **Setup > Site Description**.



Setup > Site Description (Documentation of the Measurement)

Documentation of the measurement includes the following information:

Name Name of the measurement site

Description Description of the measurement location and its environment. Please enter here orography, roughness, obstacles and other elements having an impact on the measurement result.

Geographical Position Enter here latitude, longitude and elevation of the measurement site.

Other Information Use these universal input fields to enter all supplementary information about the measurement: e.g., geographical coordinate system, mast type, mast dimensions, type, serial numbers and calibration numbers of the sensors, dimensions and alignment of sensor mounting booms

Measurement Setup

Setting Measurement Parameters

To define measurement parameters or sensor characteristics select **Setup > Measurement**:

Measure Period Measure period is the time interval in which the data logger records actual measured values (samples) from all sensors.

Statisic Interval Statistic interval is the time interval in which the data logger performs a statistical evaluation of the samples and stores the results in the memory. The variables **a1**..**an** correspond to the first to nth value of the data line sent by the first sensor. The variables **b1**..**bn** correspond to the values sent by the second sensor and so further.

Excitation defines how long the sensor excitation voltage (**EXC**) is switched on before the **NDL 485** sends a poll command.

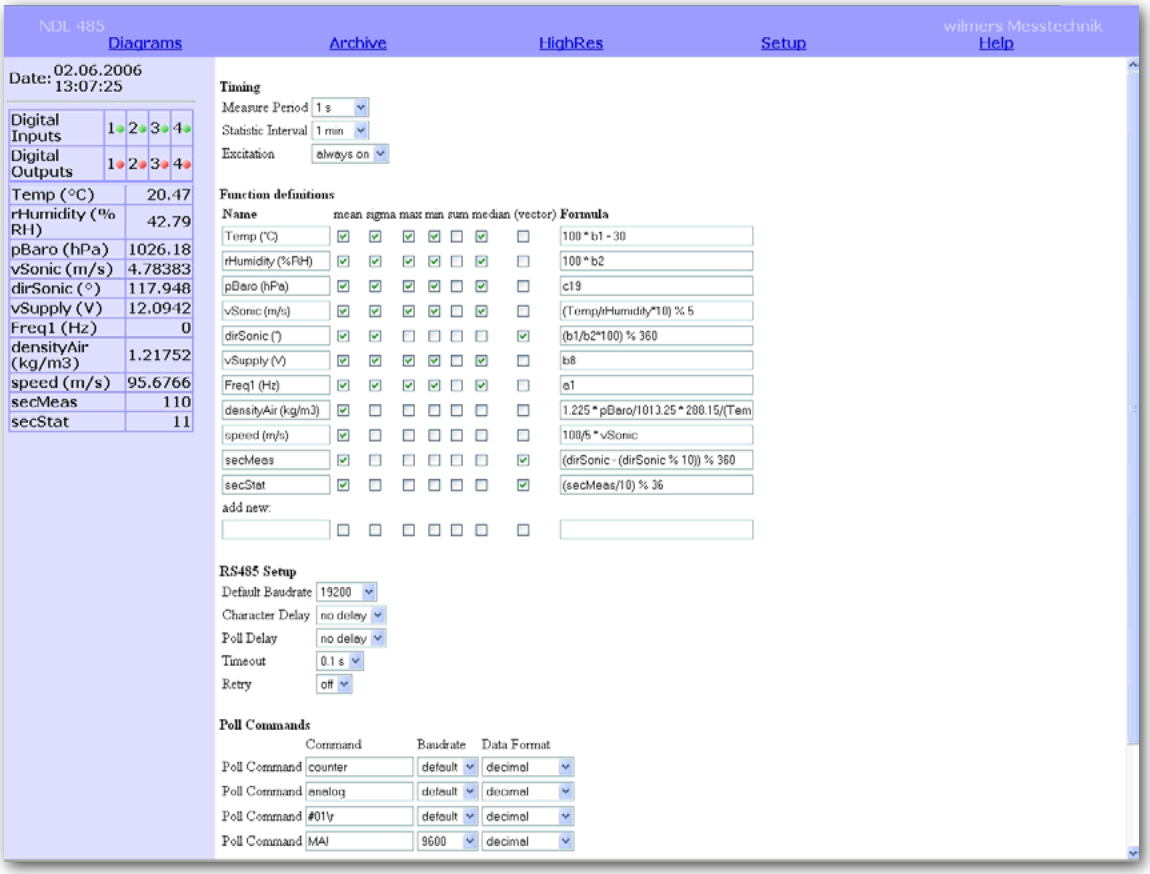
Selecting **always on** switches the excitation voltage continuously on. The **blueberry INPUT Module** requires this setting as it needs a warm-up time of approx. 5 seconds.

Setting Measurement Functions

To add a new measurement function enter a function name in the field **Name,** check the required statistical evaluations and enter the measurement function. Type **<enter>** to transmit the settings to the data logger.

Function Names

Variable names may principally contain umlauts (**ä**, **ö**, **ü**) and special characters like comma (**,**) and period (**.**). If function names are used as variables in further measurement functions the first part of the function name may however only contain the following characters: **A..Z**, **a..z**, **0..9**, **_**. The second part, i.e. the part after the first space character is used as axis label for realtime diagrams. We recommend to use the following syntax for function names: **Value (unit)**.



Setup > Measurement: Measurement Parameters and Measurement Functions

Example:
vWind80m (m/s) *= 0.04727 * b10 + 0.264 * (b10>0)*

The first part of the function name can be used as variable ***vWind80m*** in further measurement functions. The diagram title for this function is **vWind80m**, the y axis label is **(m/s)**.

Maximum length of the measurement function including function name and statistics options is 1023 characters or 64 elements. Each variable or operator counts as one element. Please use the following elements to built the measurement function:

Arithmetic Operators

+ Addition

– Subtraction or minus sign. If a **–** is used to characterize a negative number at the beginning of a measurement function or after another operator the number must be put into parenthesis.

Example: **Negative Numbers**
HumAir (%RF) = ***(–25) + 62.5 * a5***
vSonic (m/s) = ***e2 else (–9999)***

***** Multiplication

/ Division

^ Exponent, real number

Example: **Length of a Vector**
uSonic (m/s)= d2
vSonic (m/s)= d3
*wsHorizontal (m/s)=****(uSonic^2 + vSonic^2)^0.5***

This function converts the **u** and **v** components of a sonic anemometer to horizontal wind speed.

% Modulo division. This operator provides the positive residue of a division. Unlike the general modulo operator defined for integer numbers, the **NDL 485** modulo operator is based on real (floating point) numbers for parameters and for the result. The second parameter of the **%** function must be positive (**a % b** with b>0).

Example: **Wind Direction**
winddirection (°) = ***(360 * b1 / b0 + 268) % 360***

The measured wind direction value with an offset correction of ***268*** degrees is projected into the range of 0..360°.

sin Sine function. The angle must be defined in degrees.

Example: **Vector Component**
vWind (m/s) = *0.04752 * b8 + 0.224 * (b8>0)*
dirWind (°) = *(360 * (a1-a2)/a1) % 360*
vEast (m/s) = ***vWind * sin (dirWind)***

The multiplication of the wind speed with the sine of the wind direction results in the eastern component of the total wind speed vector.

cos Cosine function. The angle must be defined in degrees.

Example: **Vector Component**
vWind (m/s) = *0.04752 * b8 + 0.224 * (b8>0)*
dirWind (°) = *(360 * (a1-a2)/a1) % 360*
vNorth (m/s) = ***vWind * cos (dirWind)***

The multiplication of the wind speed with the sine of the wind direction results in the northern component of the total wind speed vector.

ln Natural logarithm

Example: *log =* ***ln c7***

Boolean Operators

> Comparison **superior to**. The result is **1**, if the condition is true, otherwise it is **0**.

Example: **Calibrated Cup Anemometer**
ws30m (m/s)= ***0.04827 * c2 + 0.19 * (c2 > 0)***

This function suppresses the wind speed offset when the frequency is ***0***. Otherwise, even at total calm the data logger would indicate a wind speed of ***0.19*** m/s.

< Comparison **inferior to**. The result is **1**, if the condition is true, otherwise it is **0**.

Example: **Status from Threshold Value**
*Temperature (Celsius) = 20 * a4 - 40*
Frost = ***Temperature < 0***

The comparison with a threshold value creates the status signal **1 = frost** / **0 = no frost**.

== Comparison **equal**. The result is **1**, if the condition is true, otherwise it is **0**.

Example:
identic = ***(0.2 * a2) == 1.2***

This function compares a measured value with a constant.

!= Comparison **not equal**. The result is **1**, if the condition is true, otherwise it is **0**.

Example:
differentStatus (1=different) = ***c1 != c2***
with third poll command: **DIN**

This function compares the status of digital inputs **DIN1** and **DIN2**.

>= Comparison **superior or equal**. The result is **1**, if the condition is true, otherwise it is **0**.

Example:
condensation = ***Humidity >= 100.1***

Relative humidity of more than 100 %RH is considered as condensation.

<= Comparison **inferior or equal**. The result is **1**, if the condition is true, otherwise it is **0**.

Example:
DOUT1 (Heating) = ***Temperature <= 10.5***

A heating is switched on through switching output **DOUT1** at temperatures of or below 10.5 °C.

! **NOT** operator. This operator inverts the logical level of a boolean value.

Example:
DOUT2 = ***! a1***
with first poll command: **DIN**

Switching output **DOUT2** is set active if the status signal at digital input **DIN1** is low.

valid This operator checks whether a value is a valid number. The result is **0**, if the value is **nan**, otherwise it is **1**.

Examples: **Validity Check**
checkValue (1=Ok) = ***valid (2.45 * a1)***
error (1=invalid) = ***! valid (2.45 * a1)***

if This operator checks whether a value is not **0** or **nan**. The **if** operator is typically combined with the **else** operator.

Example: **Output Limitation**
Hum (%RH) = ***100*a4 if (100*a4<=100) else 100***

In case of condensation, some thermo hygro sensors show measured values above 100 %RH. This function limits the output of relative humidity to 100 %RH.

Example: **Validity Check**
vCup (m/s) = *0.253 * b8 + 0.22 * (b8>0)*
vValid (m/s) = ***vCup if ((vCup>=0)*(vCup<90))***

This function defines a range of ***0*** to ***90*** *m/s* for valid wind speed values. The result of *vValid* is *vCup* if *vCup* is within this range, otherwise it is **nan**.

else replaces a value if the value is **nan**.

Example: **Filtering of invalid Samples**
uSonic (m/s) = ***d2 else #uSonic else 0***

If the sonic anemometer returns an invalid value, the data logger will keep the previous value. If the previous value is also invalid the result is set to ***0***.

Example: **Marking of invalid Samples**
relHum (%RH) = ***100*a2 else (-9999)***

Invalid samples (**nan**) are stored as ***-9999***.

Combining boolean Results:

The multiplication operator ***** corresponds to the logical **AND** operator. The addition operator **+** corresponds to the non exclusive **OR** operator.

Example: **AND, non exclusive and exclusive OR**
AND = ***(a2>=0) * (a2<=100)***
OR = ***(a2<0) + (a5<0)***
XOR = ***((a2<0) + (a5<0)) == 1***

Rounding Operators

abs provides the unsigned floating point value of a signed value.

Example:
alwaysPositive = ***abs (125 * g7 -75)***

int removes the decimal part of the floating point value.

Example:
intValue = ***int (-2.45 * d2 + 100)***

round rounds the floating point value to the nearest integer (up or down).

Example: **Display without Decimals**
LowResDir (deg) = ***round((360 * a2/a1) % 360)***

This function displays the wind direction without decimals.

Example: **Fixed Number of Decimals**
Radiation = ***0.01 * round(100 * (2.645*a2–25))***

The floating point function result is reduced to 2 decimals.

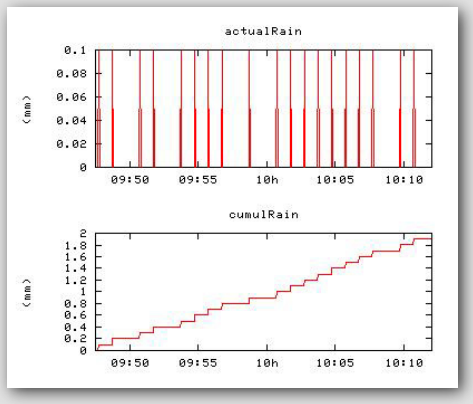
Other Operators

( ) Parantheses structure the function elements and determine the calculation sequence.

provides the previous value of the measurement function.

Example: **Cumulative Rainfall**
actualRain (mm) = *0.1 * b3*
cumulRain (mm) =
(#cumulRain+(actualRain else 0))
else actualRain else 0

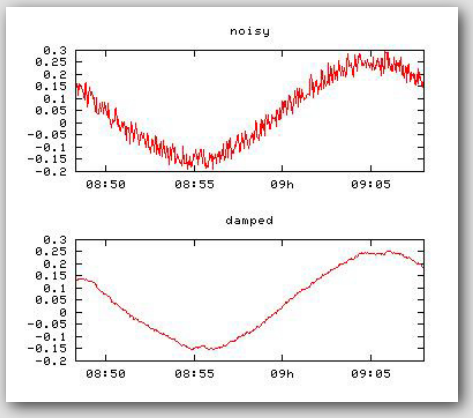
These two functions record actual and cumulative rainfall. *cumulRain* adds the actual rainfall to the previous cumulative rainfall. When the measurement starts ***#cumulRain*** is invalid because no previous value exists. The result is then replaced by *actualRain*. If this value is also invalid the result is set to ***0***. The ***else*** operator defines the starting value and prevents the cumulative value from being reset in case of an invalid value of *actualRain*.



Actual and cumulative rainfall

Example: **Low Pass Filter**
noisy = *62.5 * a6 – 55*
damped = ***(0.1 * noisy + 0.9 * #damped) else noisy***

This function implements a low pass filter that smooths a noisy value. *damped* provides a damped value of the actual measurement value provided by *noisy*.



Low pass filtering of noisy data

Operator Summary

The following table lists examples of results based on the operators with different parameters.

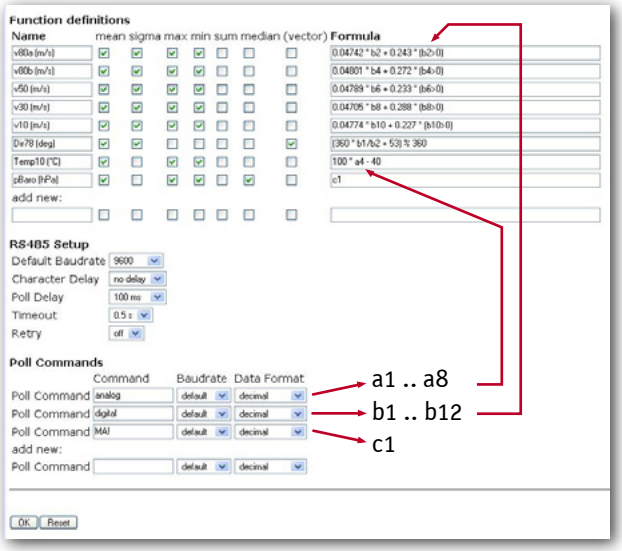
	Results for: a = ...			
	–2.7183	**0**	**+2.7183**	**nan**
a **else** b	–2.7183	0	2.7183	b
b **if** a	b	nan	b	nan
b **if** a **else** c	b	c	b	c
valid a	1	1	1	0
! a	0	1	0	0
a **>** 0	0	0	1	nan
a **<** 0	1	0	0	nan
a **==** 0	0	1	0	nan
a **!=** 0	1	0	1	nan
a **>=** 0	0	1	1	nan
a **<=** 0	1	1	0	nan
a **%** 1	0.2817	0	0.7183	nan
a **%** 0.01	0.0017	0	0.0083	nan
a–(a%0.01)	–2.72	0	2.71	nan
abs a	2.7183	0	2.7183	nan
int a	–2	0	2	nan
round a	–3	0	3	nan
ln a	nan	nan	1.0000	nan

Variables

Variables The variables **a1**..**an** correspond to the first to nth value inside the data line sent by the first sensor. The **blueberry INPUT module** supplies the voltages of all inputs in Volt as well as the frequency in Hertz and the counted pulses. In addition to the variables, other function names can be used inside a measurement function. They must be defined former to the function in which they are used as a variable. A **#** character in front of a function name provides the measurement value of the previous measurement.

Example: **Temperature Gradient**
Temp (°C) = *100 * a3 – 30*
deltaTemp (°C) = ***(Temp – #Temp) else 0***

deltaTemp provides the temperature gradient.



Setup > Measurement: measurement functions and variables

Predefined Variables (Time Info)

The following predefined variables provide time information.

PERIOD provides the actual measurement period in seconds.

Example: **Integration over Time**
flow (m3/s) = *125 * b2*
volume (m3) = ***flow * PERIOD***

The function *volume* uses ***PERIOD*** to convert actual flow into a volume.

TIME provides the time in seconds since 1.1.1970 00:00:00.

DAYTIME provides the time in seconds since 00:00:00 of the current day.

Example: **Flashing Light**
DOUT3 (flash) = ***! (DAYTIME % 10)***

This function flashes a signal lamp every ***10*** seconds.

YEAR provides the actual calendar year as 4 digit integer (e.g., **2007**).

MONTH provides the actual calendar month as integer (January = 1 .. December = 12).

Example: **Season dependent Factors**
factor = ***0.26*(MONTH<4) + 0.22*(MONTH==4) + 0.25*(MONTH>4)***

This function selects a factor depending on the month. Some algorithms for determination of potential evaporation (e.g., HAUDE) use empirical factors that vary with the season of the year.

DAY provides the actual calender day as integer (1 .. 31).

HOUR provides the actual hour as integer (0 .. 23).

MINUTE provides the actual minute as integer (0 .. 59).

SECOND provides the actual second as integer (0 .. 59).

WEEKDAY provides the day of the week as integer (Monday = 1 .. Sunday = 7).

YEARDAY provides the day of the year as integer (1st January = 1).

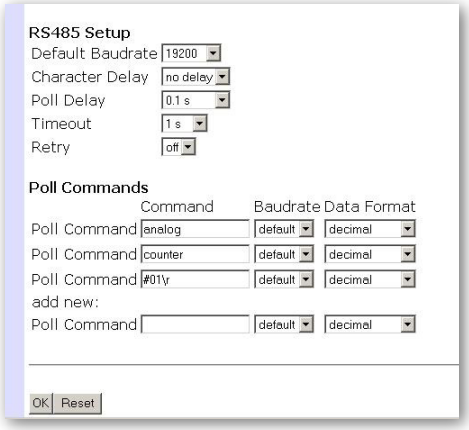
Click **OK** to save the settings into the data logger. As the measurement functions represent virtual channels they are independent of the number of hardware inputs of the data logging system. The user can define an unlimited number of measurement functions.

Setting up Data Polling

The **NDL 485** sends poll commands through the **RS 485** serial port and to the internal measurement interfaces. Each poll command provides a set of return values that are used as variables in the measurement functions. Please set the poll parameters as follows:

Baudrate Select from the **Baudrate** list the baud rate of the serial port. The **blueberry INPUT Module** requires a baud rate of **19200**.

Character Delay Select from the **Character Delay** list the delay between the characters sent by the **NDL 485** to the serial port. Some sensors (e.g., R.M.Young sonic anemometers) require character delays. The **blueberry INPUT Module** is polled with a character delay of **0**.



Setup > Measurement: RS485 Data Polling

Poll Pause defines the delay between the last character of a data line received by the **NDL 485** and the sending of the next poll command. The **blueberry INPUT Module** requires a poll pause of **50 ms**. The poll pause is required because the **RS 485** bus allows only one component (sensor, **INPUT Module** or data logger) at a time to transmit data. All other components work in receiver mode. The poll pause allows to switch from transmitter to receiver mode.

Timeout defines the maximum time the **NDL 485** waits for the answer to a poll command. If the polled component does not answer the poll command will be repeated once or several times depending on the value set for **Retry**. If no data was received the measured values are stored as **nan** („not a number").

Poll Command Enter the poll command into the field **Poll Command** and click **OK** to save the setting into the data logger.

The following poll commands provide measured values from the **NDL 485** data logger itself:

Command: **digital**
Results:

Index	Value	Unit
1	Counter of **DIN1**	-
2	Frequency of **DIN1**	Hz
3	Counter of **DIN2**	-
4	Frequency of **DIN2**	Hz
5	Counter of **DIN3**	-
6	Frequency of **DIN3**	Hz
7	Counter of **DIN4**	-
8	Frequency of **DIN4**	Hz
9	Counter of **DIN5**	-
10	Frequency of **DIN5**	Hz
11	Counter of **DIN6**	-
12	Frequency of **DIN6**	Hz

Command: **DIN**
Results:

Index	Value	Unit
1	Status of **DIN1** (1 = HI, 0 = LO)	-
2	Status of **DIN2** (1 = HI, 0 = LO)	-
3	Status of **DIN3** (1 = HI, 0 = LO)	-
4	Status of **DIN4** (1 = HI, 0 = LO)	-
5	Status of **DIN5** (1 = HI, 0 = LO)	-
6	Status of **DIN6** (1 = HI, 0 = LO)	-

Command: **analog**
Results:

Index	Value	Unit
1	Voltage of **AIN1**	V
2	Voltage of **AIN2**	V
3	Voltage of **AIN3**	V
4	Voltage of **AIN4**	V
5	Voltage of **AIN5**	V
6	Voltage of **AIN6**	V
7	Voltage of **EXC**	V
8	Voltage of power supply	V

The following poll command provides measured values from the **blueberry INPUT Module**:

Command: **#AA\r** (with **AA** = 01..99 = poll address)
Results:
(serial numbers from 4001, firmware version 4.2)

Index	Value	Unit
1	Voltage of **IN1**	V
2	Voltage of **IN2**	V
3	Voltage of **IN3**	V
4	Voltage of **IN4**	V
5	Voltage of **IN5**	V
6	Voltage of **IN6**	V
7	Voltage of **IN7**	V
8	Voltage of **IN8**	V
9	Counter of **IN1**	-
10	Counter of **IN2**	-
11	Counter of **IN3**	-
12	Counter of **IN4**	-
13	Counter of **IN5**	-
14	Counter of **IN6**	-
15	Counter of **IN7**	-
16	Counter of **IN8**	-
17	Frequency of **IN1**	Hz
18	Frequency of **IN2**	Hz
19	Frequency of **IN3**	Hz
20	Frequency of **IN4**	Hz

21	Frequency of **IN5**	Hz
22	Frequency of **IN6**	Hz
23	Frequency of **IN7**	Hz
24	Frequency of **IN8**	Hz
25	Barometric pressure (only partNo.0151-P, else **0.00**)	hPa
26	Onboard temperature (only partNo.0151-P, else **0.0**)	°C
27	Voltage of power supply	V
28	Voltage of **CC1** (constant current supply)	V
29	Voltage of **CC2** (constant current supply)	V

Data Format Select the data format from the list: **decimal** reads the received data values as decimal floating point numbers. **hex** reads the received data values as hexadecimal values and converts them into decimal integer values (e.g., **8A** ⇨ **138**).

Click **OK** to save all settings into the data logger.

Setting the Digital Outputs

The **blueberry NDL485** provides 4 digital outputs. They are used to control peripheric devices or sensors. Digital outputs can be triggered depending on measured values or depending on time.

To set the digital outputs select **Setup > Measurement**. Define a measurement function and use **DOUT1**, **DOUT2**, **DOUT3** or **DOUT4** as function name to switch the respective output. The output is LO if the result of the measurement function is **0**, otherwise it is HI. The DOUTn tag must not be followed directly by another character. If you want to add additional text to the function name please insert a blank character after the DOUTn tag.

Example: **Heating Control**

DOUT1 *(1=Heater ON) =* ***TempAir < 4***

DOUT1 activates a heater at ambient air temperatures below ***4*** °C.

Example: **Reset Timer for GSM Modem**

DOUT2 *(1=Modem On) =* ***!((HOUR==3) * (MINUTE<1))***

DOUT2 switches a GSM modem off for one minute every day at 3:00 a.m.

Example: **Timer for GSM Modem**

DOUT2 *(1=Modem On) =* ***(HOUR>=11) * (HOUR<14)***

DOUT2 switches a GSM modem on every day from 11:00 to 14:00.

Example: **Timer for GSM Modem**

DOUT2 *(1=Modem On) =* ***(HOUR==8) + (HOUR==15)***

DOUT2 switches a GSM modem on every day from 8:00 to 9:00 and from 15:00 to 16:00.

Example: **Flashing Light**

DOUT3 *(Signal) =* ***SECOND%2***

DOUT3 flashes a lamp every ***2*** seconds.

Example: **Wind Speed from a specific Sector**

*WS (m/s) = 0.254 * b12 + 0.213 * (b12>0)*
*WD (deg) = (360 * b1/b2 + 127) % 360*
DOUT4 *(Storm) =* ***(WS>15) * (WD>90) * (WD<180)***

DOUT4 triggers a storm alarm for wind speeds ***WS*** above ***15*** m/s and wind directions ***WD*** from the sector between east and south. The multiplication operator ***** provides the logical **AND** combination of all three conditions.

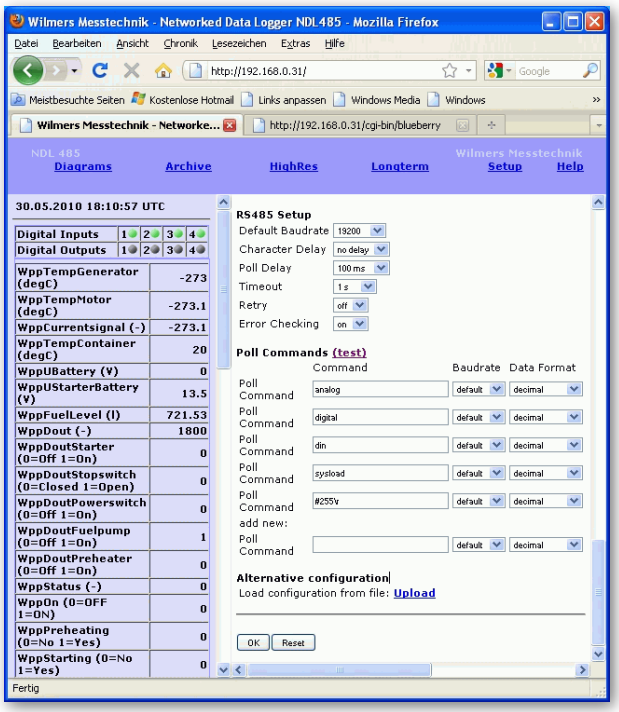
Example: **Switching Output with Hysteresis**

*T (°C) = 100 * a4 - 40*
DOUT1 *(Heating) =* ***(T<0) + (#DOUT1 * (T<4)) else 0***

DOUT1 controls a heating with a hysteresis. Temperatures below ***0*** °C switch the heating on. Temperatures above ***4*** °C switch the heating off.

Testing Poll Commands

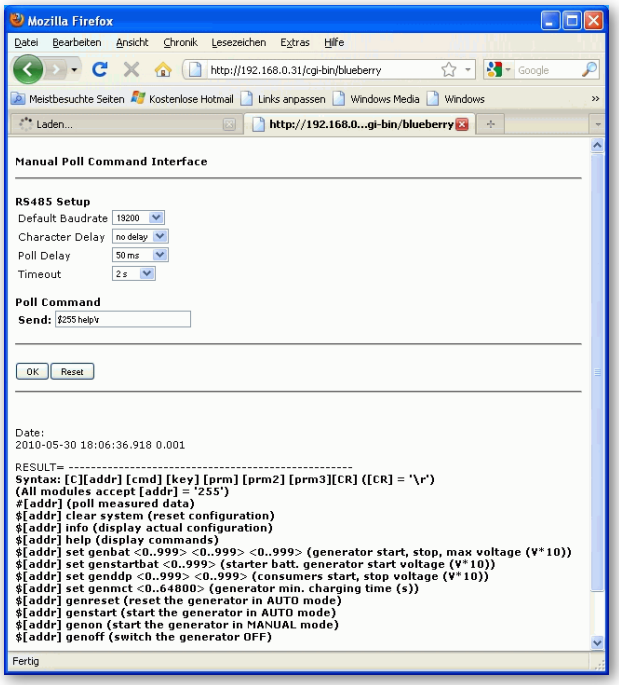
Poll commands can be entered manually in order to test the response of the data logger, a sensor or an **INPUT Module**.



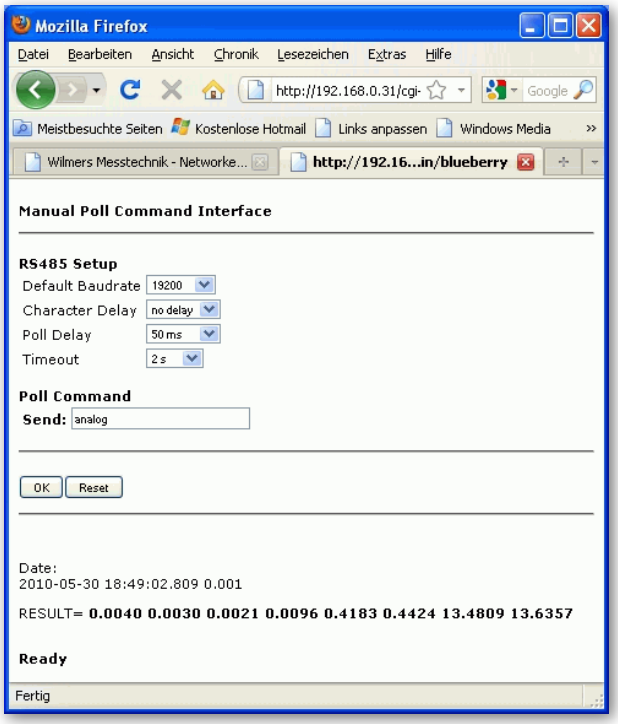
Setup > Measurement > Test poll commands

Select **Setup > Measurement**. Scroll down to **RS485 Setup** and click on **(test)** in the **Poll Commands** section. This opens a new browser window with a text terminal. Please set the RS485 interface parameters appropriate to the device to poll. Enter the poll command into the **Send** field and click on **OK**. The **NDL485** will now record all answers of the polled device during the time period defined by **Timeout** and display it in the lower part of the window.

Manual polling can be used to test whether a sensor provides proper data. It can also be used to read out the configuration of a sensor (e.g., a sonic anemometer) or of the **blueberry INPUT Module** or to change parameters in these devices. The following pictures show the testing of the analogue inputs of the data logger **NDL485** and the use with the controller of the **WindPowerPack** generator system.



Test poll commands for WindPowerPack controller



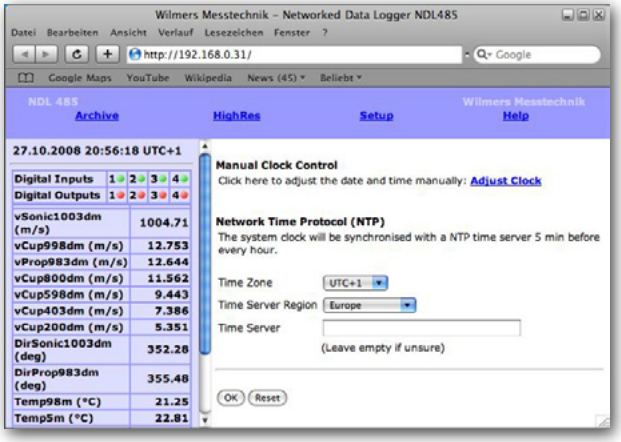
Test poll commands for analogue inputs of **NDL485**

N O T E S

Setting Date and Time

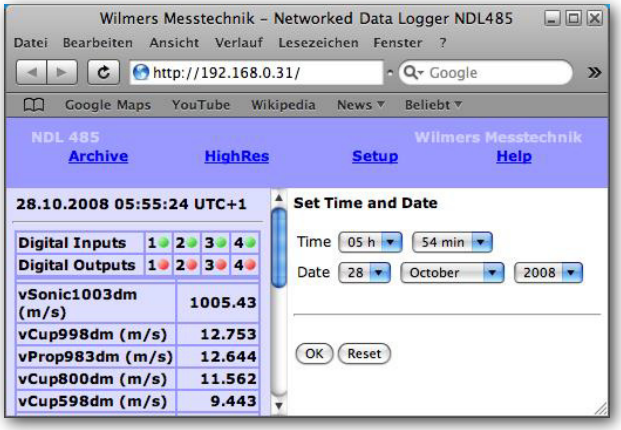
If the **NDL 485** is connected to the Internet the data logger updates its internal realtime clock automatically from an Internet time server. The **NDL 485** adjustes the clock to the time zone set by the user.

Select **Setup > Date & Time** to set the parameters for realtime clock synchronization. Select the time related to UTC. Select the region where the data logger is installed. The **NDL 485** uses the time server the closest to its site in order to provide maximum accuracy. Optionally, select a time server. If you do not define a specific time server the **NDL 485** automatically selects a suitable server from a pool of time servers. Click **OK** to accept the settings.



Setup > Date and Time: automatical synchronization via Internet

If the data logger is not connected to the Internet, select **Adjust Clock** to set the realtime clock manually.



Setup > Date and Time: manual adjustment of realtime clock

Select the settings from the **Time** and **Date** lists and click **OK**.

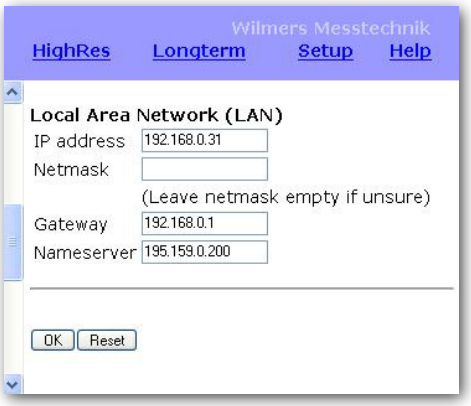
Network Interface

Setting the Network Parameters

The **NDL 485** can be connected locally to a PC via cross-patch cable and it can be integrated into a PC network (LAN) by means of a standard Ethernet cable. The IP address of the data logger has to be adapted to the network.

Select **Setup > Network**.

Assign an IP address to the data logger.



Setup > Network: LAN and local PC Connection

Enter the subnet mask required for your network type. If you are unsure about the subnet mask leave this field empty. In this case, the default subnet mask **255.255.255.0** is used.

Enter the gateway and name server (DNS) of your LAN and click **OK**. The data logger uses the gateway to built up a connection to the Internet in order to send data via e-mail or FTP and to synchronize the internal realtime clock from the Internet.

Internet Integration

The **NDL 485** is integrated into the Internet by means of a DSL router or in remote sites by means of the **blueberry GSM Module**. The **GSM Module** offers remote data transmission and realtime access via cellular phone networks (900 MHz, 1800 MHz and 1900 MHz). Two operation modes are available:

In **GSM mode**, the data logger is called from a PC by means of a telephone modem, similar to the dial-in connection to an Internet provider. This mode offers direct access to the web server of the **NDL 485**. In GSM mode, the telephone costs depend on the connection time.

The **GPRS mode** offers full integration of the **NDL 485** into the Internet. The data logger connects itself automatically to the Internet providing realtime access from any Internet access point. Two password levels protect the data logger against unauthorized access. As GPRS does not use fixed IP addresses a dynamic DNS server (e.g., dyndns.org) manages the dynamic IP address. It provides access via a named URL. The name of the server used by the **NDL 485** to access the Internet is called Access Point Name (**APN**). Private APNs provide outgoing data transmission from the data logger to the Internet, e.g., via FTP or e-mail. However, they block access from outside into the data logger. Public APNs provide both access types. Dynamic DNS requires a public APN! Please make sure that your GSM provider offers a **public APN**. Public APNs are offered among others by T-Mobile (Germany), TIM (Italy), Telenor (Norway), WARID (Pakistan). In GPRS mode, the telephone costs depend on the volume of transmitted data.

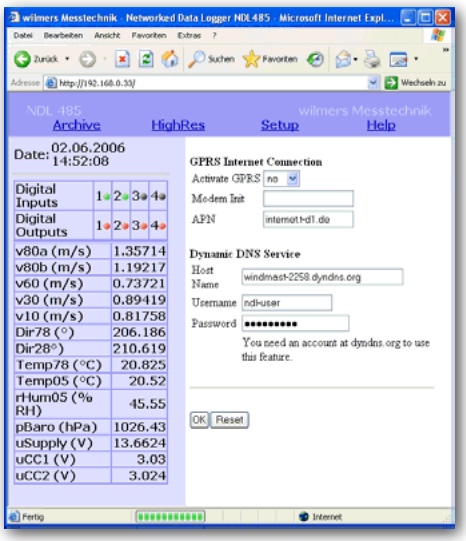
Please prepare the following information for the GSM/GPRS setup of the **NDL 485**:

1. The data number of the SIM card. Please make sure that you are really using the data number. Usually, SIM cards have separate numbers for voice, fax and asynchronous data transmission. We recommend to use SIM cards without voice function. Pure data cards are cheaper than voice cards.

2. The PIN of the SIM card. You must disable the PIN request before use because the **NDL 485** is not able to enter the PIN. Please insert the SIM card into your mobile phone, enter the PIN and disable the PIN request.

3. The APN. Please make sure that you have got a public APN.

Setting up the GPRS Connection



Setup > GPRS/Modem: GPRS Internet Connection

Select **Setup > GPRS** to setup a GPRS connection. Select **yes** at **Activate GPRS** and enter the APN and optionally the user name and password at **GPRS Internet Connection**. Please ask your GSM provider for these data. A list of international APNs is available in the Internet at

http://www.quickim.com/support/gprs-settings.html.

When the **NDL 485** operates in GPRS mode it will switch to GSM mode every day between 20:00 and 21:00. During this time the data logger is accessible via dial-in connection.

Please enter the host name of the data logger in section **Dynamic DNS Service**. Please enter the access code to your **dyndns.org** account in the fields **Username** and **Password**. The host name must be registered at **http://www.dyndns.org** before. Please refer to the following chapter for further details.

Click **OK** to save the settings.

Remote Access via Internet

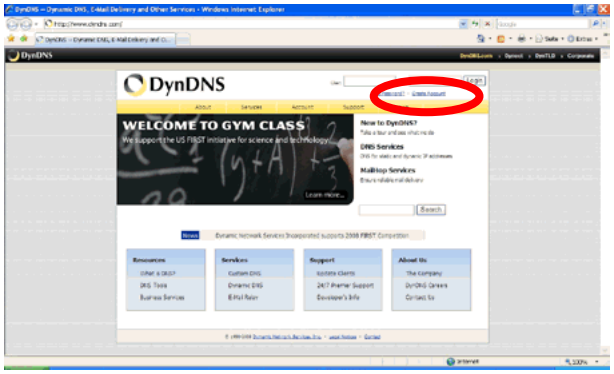
GPRS networks use dynamic IP addresses. Every time the **NDL 485** connects to the Internet it gets a new IP address from the Internet service provider. If we want to access the data logger via Internet we need to know this IP address. **Dynamic DNS** manages dynamic IP addresses and provides access to them. The user defines a host name for his measurement station (e.g., station-103.dyndns.org). When the **NDL 485** connects to the Internet it sends its actual IP address to the **DynDNS** server. The **DynDNS** server translates the IP address to the host name of the data logger. This provides us access to the measurement station without knowing its IP address.

Creating a DynDNS Access

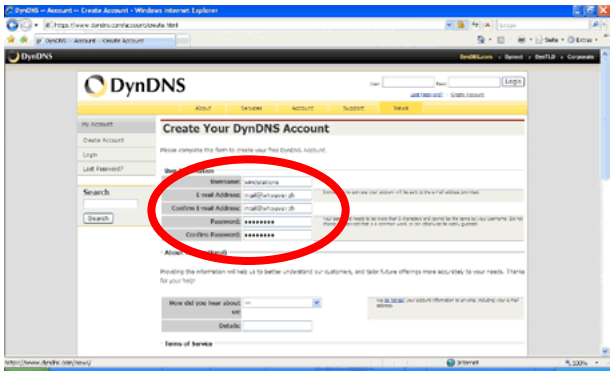
Please proceed as follows to create your account and a host at **DynDNS**:

1. Open your Internet browser and visit the web site **http://www.dyndns.org**.

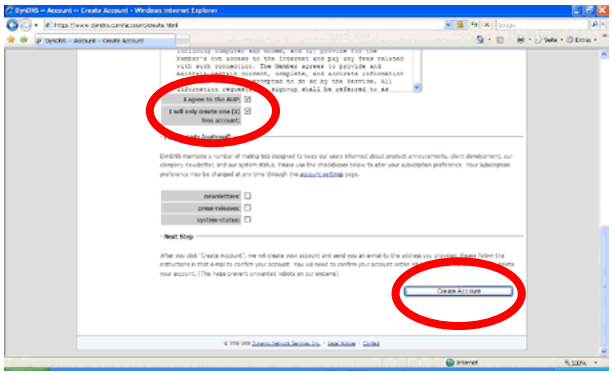
2. Select **Create Account**.



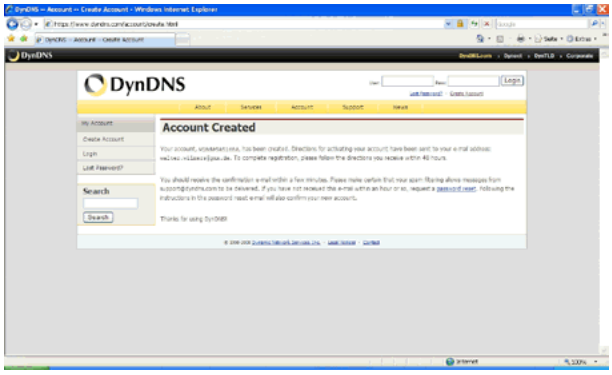
3. Define a user name, a password and enter your e-mail address.



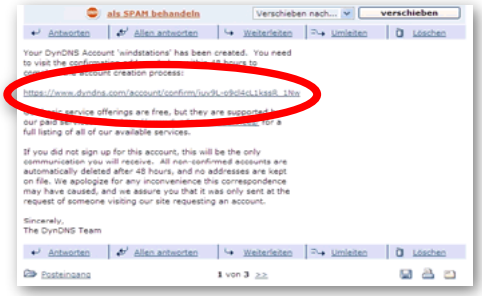
Scroll down and activate **I agree to AUP** and **I will only create one (1) free account**. Click on **Create Account**.



4. A message confirms the creation of your account.



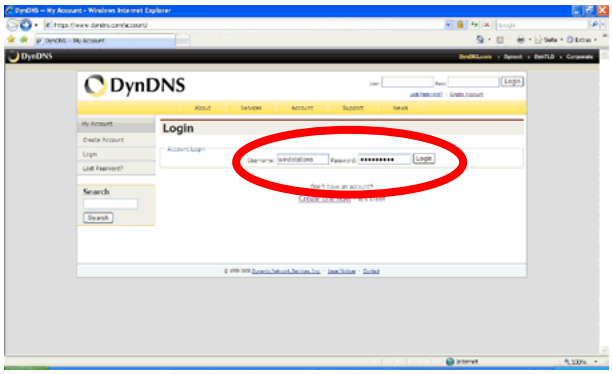
5. You will now receive an e-mail with a confirmation for the **DynDNS** account. This takes typically a few minutes. Open the e-mail and follow the stated link.



You have now created your account. The next steps create a **DynDNS** host.

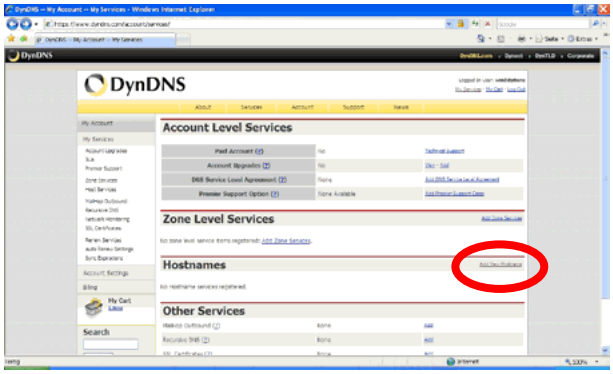
6. Select **Login**.

7. Enter your access code (user name and password) and click **Login**.

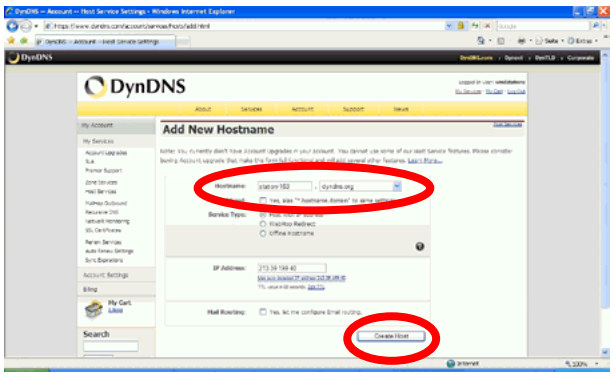


8. Select **My Services**.

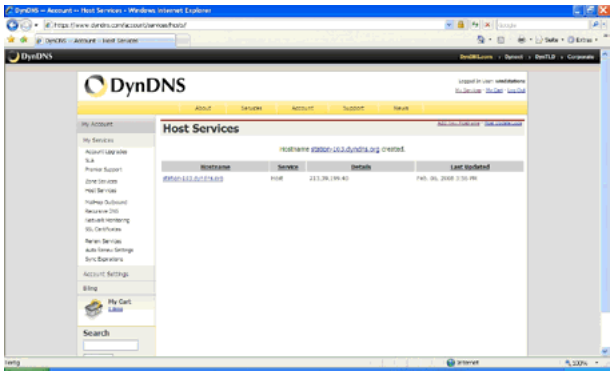
9. Select **Add New Hostname**.



10. Enter a host name and click **Use auto-detected IP address**. Click **Create Host**.



11. A message confirms the creation of the new host.



This host can now be used with the **NDL 485** (see Setting up the GPRS connection). If you want to create further hosts, please click **Add New Hostname** and repeat step 10.

Accessing the NDL485 via Internet

Please proceed as follows to access your **NDL 485** from the Internet:

Start your Internet browser, enter the **DyDNS** host name of your measurement station (e.g., station-103.dyndns.org) into the address field and hit

Internet access to an **NDL 485 research** via **DynDNS** from a desktop PC

<enter>. Do not add **www** to the host name!

The remote Internet access provides the same functionality as the local access via Ethernet. The user can display and download data and diagrams and he can change the configuration.

Accessing the NDL 485 from a Mobile Phone

Internet access via DynDNS from a mobile phone

The **NDL 485** provides a special web interface adapted to small displays of pocket PCs, MDAs and mobile phones.

Please proceed as follows to access your **NDL 485** from an Internet capable mobile device :

1. Connect your mobile device to the Internet and start the Internet browser.

2. Enter the **DynDNS** host name of your measurement station into the address field and add **/compact** to the host name. (e.g., station-103.dyndns.org/compact). Do not add **www** to the host name!

3. Click **Connect**.

4. Enter user name and password of the data logger into the login dialog.

The functionality of the mobile access depends on the browser of your mobile device. Some mobile browsers might not be able of downloading measured data files.

Opera offers a powerful free browser for mobile phones. Please refer to **http://www.operamini.com** for further details.

Remote Access via GSM

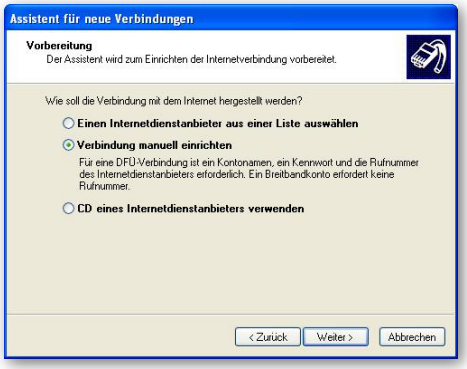
GPRS provides the most flexible and powerful remote access to the **NDL 485**. It requires a public APN. For GSM providers that do not offer a public APN, the **blueberry GSM Module** provides remote connection to the **NDL 485** via PPP. This operation mode is similar to a dial-in connection to an Internet server. It requires a PC with analogue telephone modem.

Setting up the GSM Connection

Please proceed as follows in order to configure your Windows PC for a GSM remote connection:

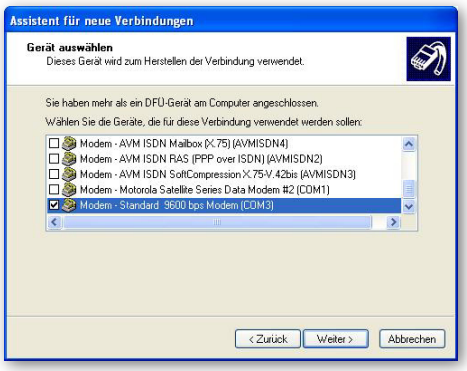
1. Select **Start > Settings > Network and Dial-In Connections > New Connection**. A wizard will lead

you through the configuration process.



2. Click **Next**.

3. Select **Establish an Internet Connection** and click **Next**.

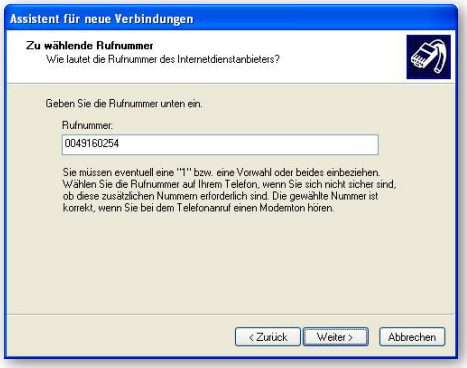


4. Select **Manual Connection** and click on **Next**.

5. Select **Modem Connection** and click **Next**.

6. A list displays all modems available on your PC. Select the modem to be used for remote data transmission and click **Next**.

7. Enter a name for the remote connection, e.g., the



name of the measurement site and click **Next**.

8. Enter the telephone number of the GSM modem.

GSM SIM cards have separate numbers for fax and data transmission. Please make sure to use the data number. Click **Next**.

9. Click **Next** without entering the access code in the dialogue.

10. Click **Next** to finish the configuration.

This chapter describes the configuration process under **MS Windows XP**. Similar wizards assist you at the configuration under **Windows 2000**, **Mac OS** or **Linux**.

Dial-in Connection under Windows XP

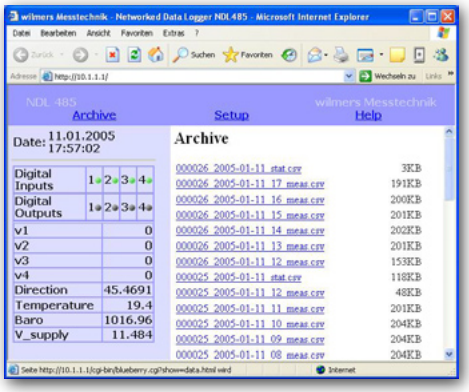
Accessing the NDL 485 via GSM

Please proceed as follows in order to establish a remote connection to the **NDL 485** via GSM:

1. Select **Start > Settings > Network and Dial-In Connections >** ***blueberry-ndl485*** where ***blueberry-ndl485*** is the name of your remote connection.

2. Click on **Dial** without entering the access code. A dialogue diplays the progress while connecting. When the connection has been established the dialogue box changes into an icon in the lower right corner of the task bar.

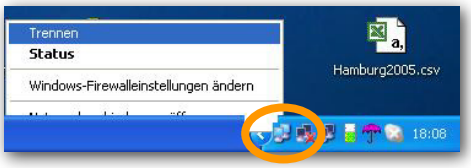
3. Once the connection is established, please start your Internet browser, enter the IP address **10.1.1.1** into the address field of the browser and hit the **<enter>** key. Please note that this IP address is the same for all **NDL 485** units. It is independent of the IP address set at **Local Network Settings**.



Web Interface in GSM Mode

4. Enter the user name and password for the **NDL 485** and click **OK**.

5. In GSM mode, the web interface provides all functions that are available at local or at GPRS connection.



Windows Task Bar: Disconnect GSM Connection

6. To disconnect the GSM connection click on the connection icon with the right mouse botton and select **Disconnect** from the popup menu.

Password Protection

Two password levels protect the **NDL 485** against unauthorized access:

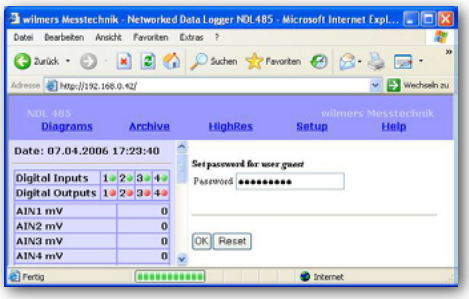
The user **guest** is allowed to view actual measured data and configuration settings and to download measured data. He is allowed to set date and time. The user **guest** is not allowed to delete measured data or to change any configuration settings.

The user **admin** has all rights. He is allowed to delete measured data and to change configuration settings.

Login Dialogue

Setting the User Password

Login as user **admin** and select **Setup > Password**. Enter the new password for user **guest** and click **OK**.



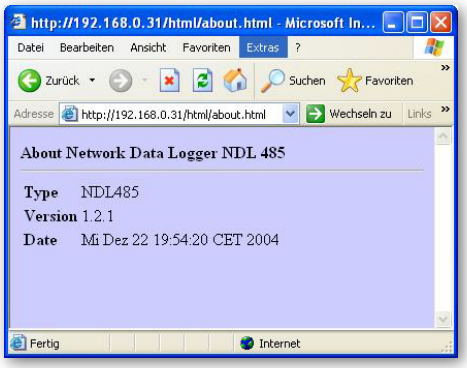
Setup > Password: User password

The password for the user **admin** cannot be changed.

Help Function

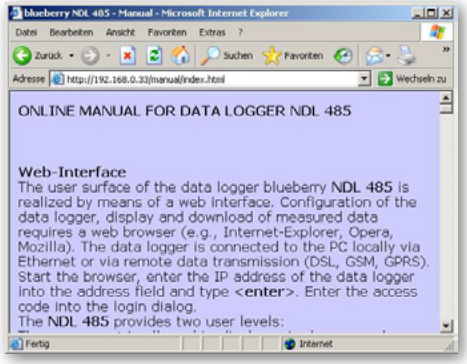
The help function the **NDL 485** provides system information about the data logger as well as an online manual.

Select **Setup > Help > About**. The dialog indicates information about type and firmware version of the data logger.



Help > About: Data Logger System Information

Select **Help > Manual** to view a short manual of the **NDL 485**.

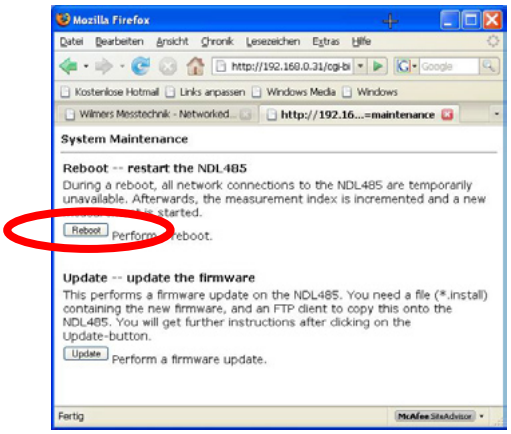


Help > Manual: Online Manual

Rebooting the NDL 485

The **NDL 485** can be rebooted in two ways: by interruption of the power supply and via the web interface. In order to reboot the **NDL 485** via the web interface please proceed as follows:

1. Start the web browser and login to the **NDL 485** as user **admin**.
2. Select **Help > About > Maintenance**.
3. Click on **Reboot** in order to start the update process.



4. Wait 2 minutes until the data logger is up again.

FTP Access

Some operations, like deleting measured data and applying a firmware update require an FTP access to the **NDL 485**. The following describes the establishment of an FTP access by means of the free FTP client **FileZilla**.

Installing FileZilla

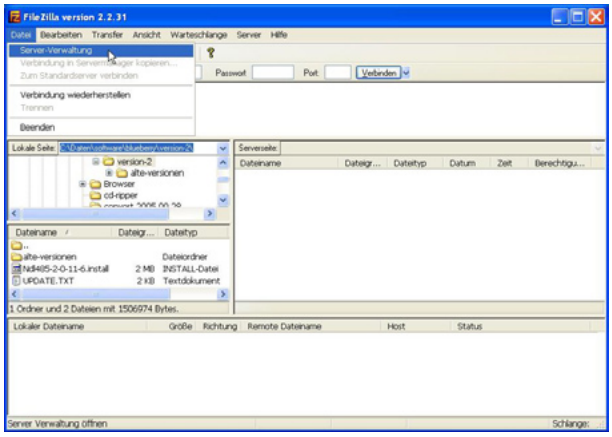
The FTP client **FileZilla** can be downloaded free of charge from the Internet at the following site:

http://sourceforge.net/projects/filezilla

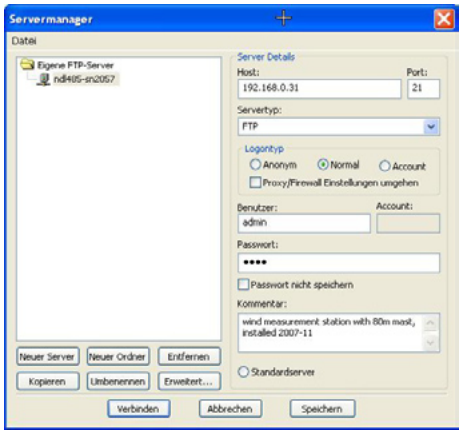
In order to install **FileZilla** and to configure it for the **NDL 485** please proceed as follows:

1. Download the software from the above stated website and install it according to the instructions of the supplier.

2. Start **FileZilla**.



3. Select **File** > **Server Mangement**.



4. Select **New Server** and enter a name for the data logger.

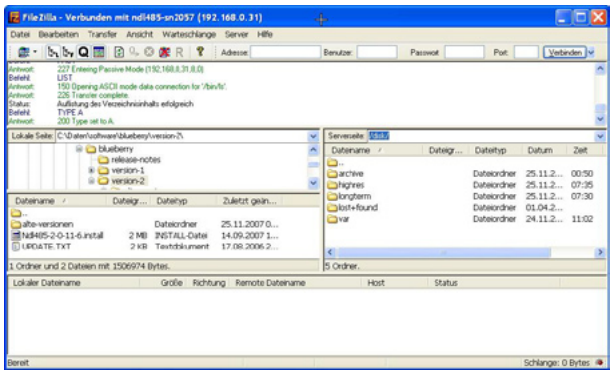
5. Enter the IP address of the **NDL 485** into the **Host** field.

6. Select the logon type **normal**.

7. Enter the user name **admin** and the admin password of your **NDL 485** .

8. Click on **Save** to save the settings.

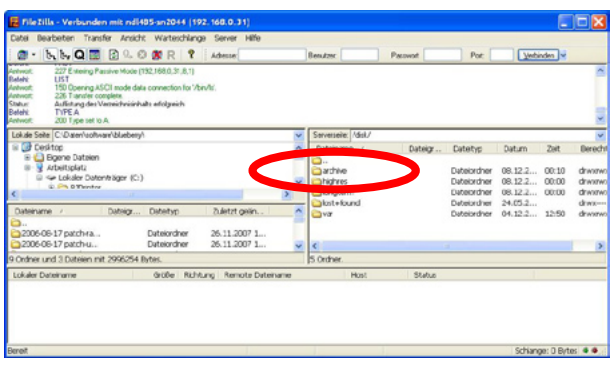
9. Click on **Connect** to built up the connection to the **NDL 485**. The right part of the screen displays the file system of the **NDL 485**. You can use the FTP client like a file explorer to delete measured data files from the **NDL 485** and to move files from the **NDL 485** to your local computer or from your computer to the **NDL 485**.



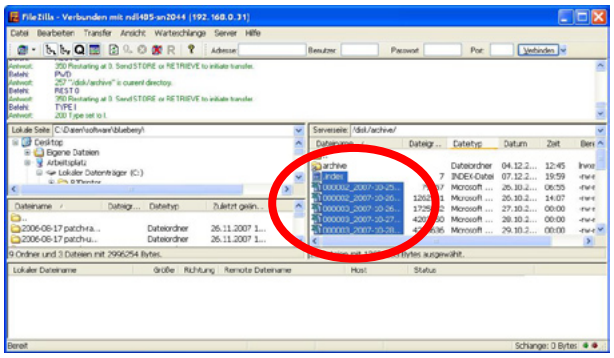
Deleting Measured Data

The **NDL 485** saves measured data in a ring buffer. The oldest data lines are automatically overwritten when the data memory is full. Usually, deleting of measured data is only necessary at the beginning of a new measurement, e.g., if the data logger is moved to another site. In order to delete measured data please proceed as follows:

1. Establish an FTP connection to the **NDL 485**.



2. Double click on **archive** to change to the archive directory.



3. Mark all files to be deleted and press **<Del>**.

If only data files (*.csv) are deleted the measurement index continues with the actual value. In order to reset the index please delete the file **index**.

Updating the Firmware

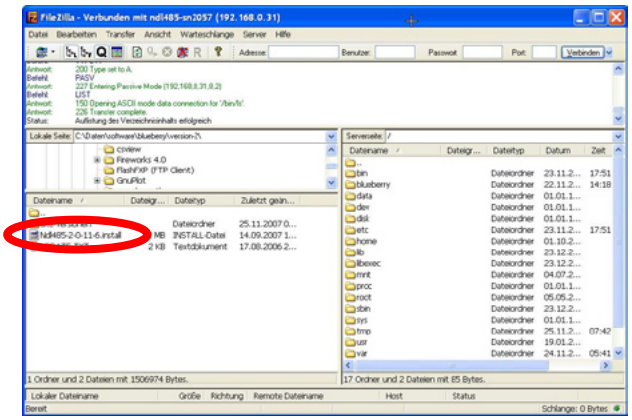
The firmware of the **NDL 485** can be updated via local Ethernet connection or remotely via GSM, GPRS or DSL. In order to update the firmware of the **NDL 485** please proceed as follows:

1. Establish an FTP connection to the **NDL 485**.

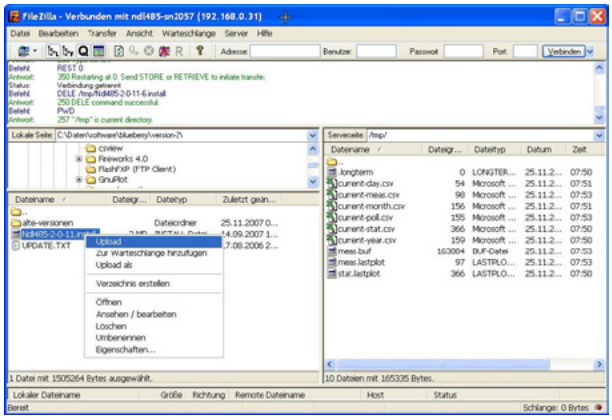
2. Double click on **..** to change to the root directory.

3. Open the folder **/tmp**.

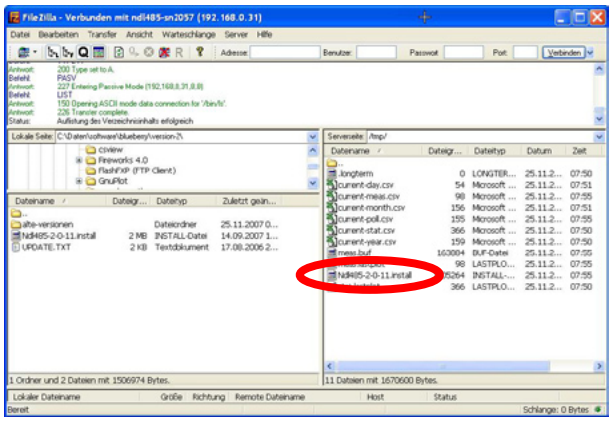
4. Change on the local computer to the folder that contains the firmware update file.



5. Click with the right mouse button on the firmware update file (e.g., Ndl485-2-0-11.install) and select **Upload**. Now, FTP transfers this file to your **NDL 485**.



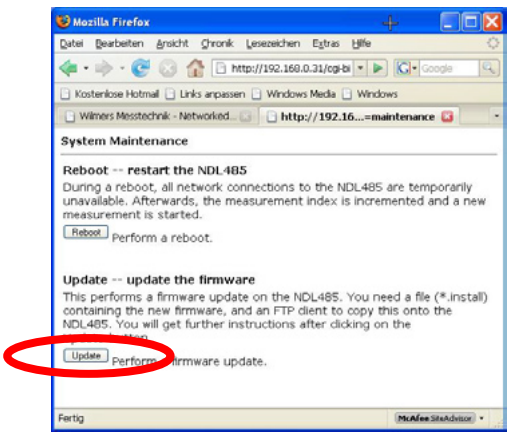
6. Please wait until the transfer is sucessfully completed. The uploaded file is now visible in the **/tmp** folder of the **NDL 485**.



7. Start the web browser and login to the **NDL 485** as user **admin**.

8. Select **Help > About > Maintenance**.

9. Click on **Update** in order to start the update process.

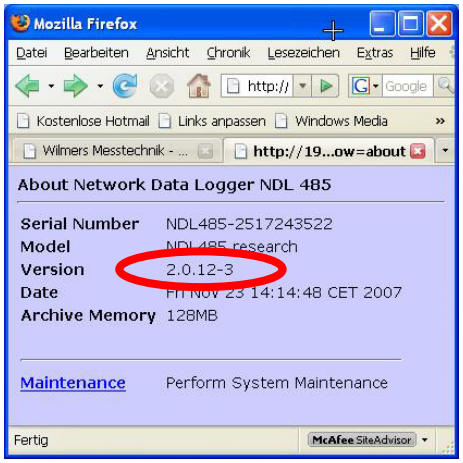


10. Please follow the instructions displayed on the screen. The update process will take approx. 5 minutes. The **NDL 485** will restart automatically after the update is completed. Regular flashing of the **BUSY** LED at the data logger indicates that the **NDL 485** is up again.

IMPORTANT NOTE:
The **NDL 485** must never be disconnected from the power supply during update process! Interruption of the update process can block the operation of the **NDL 485**.

Please restart the web browser and login to the **NDL 485**.

In order to check whether the update was successfull please select **Help > About**. Check whether the indicated firmware version corresponds to the update you went to apply.

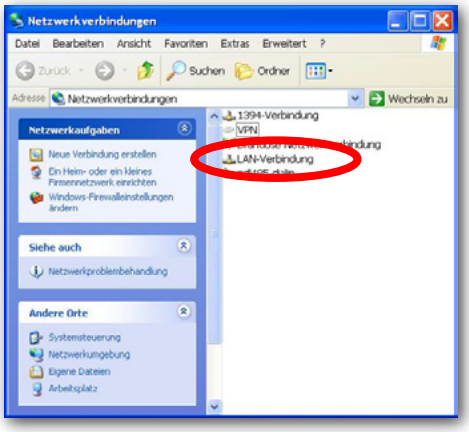


Adapting the PC Network Settings

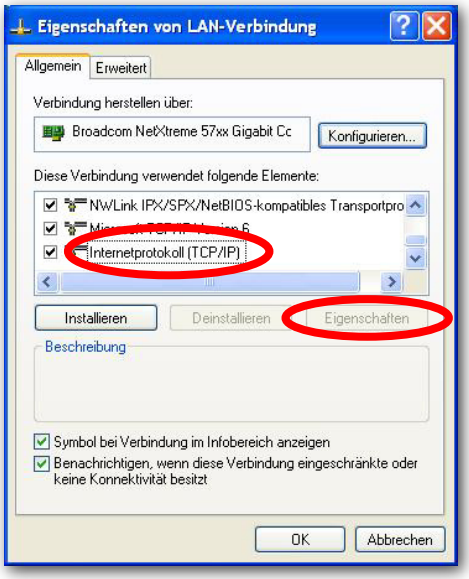
When the **NDL 485** is connected to a PC or a LAN the network settings of the PC must comply to those of the data logger.

In order to change the network settings of the PC please proceed as follows:

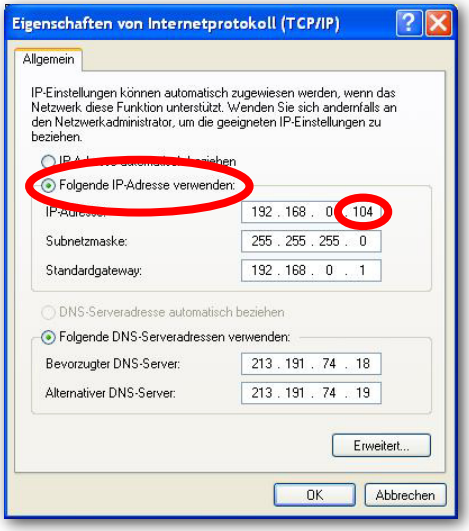
1. Right click on the network icon in the task bar and select **Open Network Settings**.



2. Double click on **LAN Connection**.



3. Select **Internet Protocol (TCP/IP)** from the list and click on **Properties**.



4. Activate **Use the following IP Address**. Enter the IP address, subnet mask and gateway according to the settings in the **NDL 485**. The **NDL 485** has two IP addresses: one is the fixed IP adress **192.168.111.1**. This IP address cannot be changed. The second IP address can be changed by the user. Please refer to the label on the data logger for its default settings. The last entry of the IP address must be different from the setting of the data logger. All other settings must be set identical to the data logger.

   Example:
   Data logger: 192.168.0.**31**
   PC: 192.168.0.**104**

5. Click **Ok** to accept the settings.

EXTENDED FUNCTIONALITY (RESEARCH MODEL)

The following chapters describe the extended functionality provided by the data logger **blueberry NDL 485 research**. Please refer also to the part **Technical Data** for differences between the models **basic** (partNo. 0102) and **research** (partNo. 0103).

The main features of the **blueberry NDL 485 research** are:

- Higher sampling rate (10 Hz)
- Median function for statistics
- Larger data memory (128 MB standard, expandable to up to 1 GB)
- Generation of realtime diagrams
- Automatical data transfer via FTP

Displaying Diagrams

The **NDL 485 research** generates time series plots of actual measured values and displays them as diagrams. The user defines which measurement channels are plottet and in which order the diagrams are displayed. The texts for title and y label of the diagram axes are taken from the name of the measurement function: the first part of the function name is used as diagram title, the second part is used as y axis label. First and second part must be separated by a space character. We recommend to write function names as **Value (unit)**.

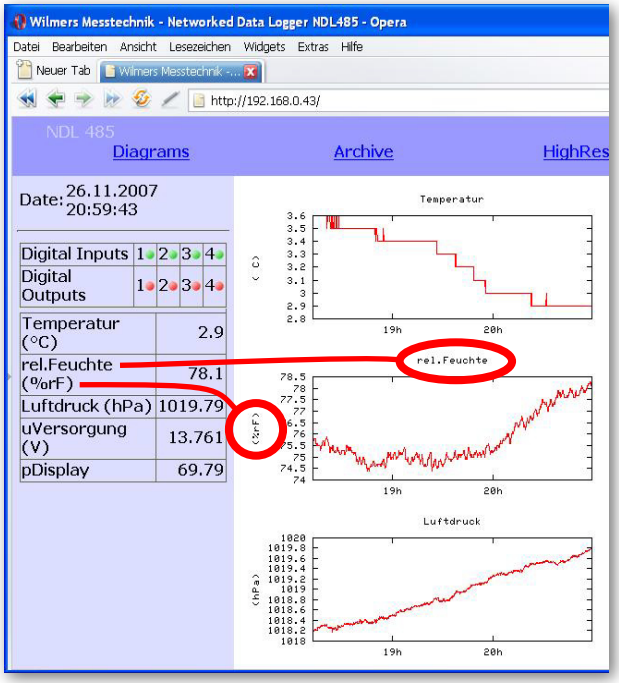
Example:
relFeuchte (%rF) *= 100 * a4*

The diagram titel for this function is ***relFeuchte***, the y axis label is ***(%rF)***.

Select **Diagrams** to display the diagrams.

To define the diagram options select **Setup > Diagrams**.

Enter the index of the channels to be plottet. The index corresponds to the line number in the table of measured values. Separate more than one entry by space characters. Click **OK** to save the settings.

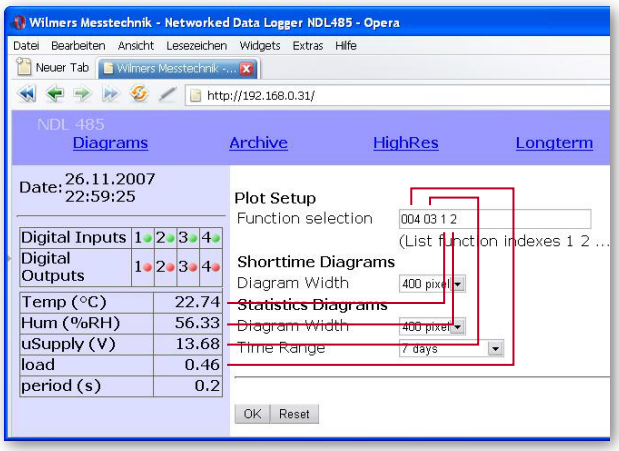


Realtime Data Diagrams

Diagrams are displayed in alphabetical order. Please add the appropriate number of **0** characters in order to determine the display order.

Example:
entered items: **1 5 20 12**
=> display order: **1 12 20 5**

Example:
entered items: **001 005 020 12**
=> display order: **1 5 20 12**



Setup for Realtime Data Diagrams

Shorttime Diagrams

Shorttime diagrams display a time series of the samples. Please enter the width of the diagrams in pixels or enter **disabled** if you do not want to display shortime diagrams.

Statistics Diagrams

Statistics diagrams display a time series of the statistics. Please enter the width of the diagrams in pixels or enter **disabled** if you do not want to display statistics diagrams.

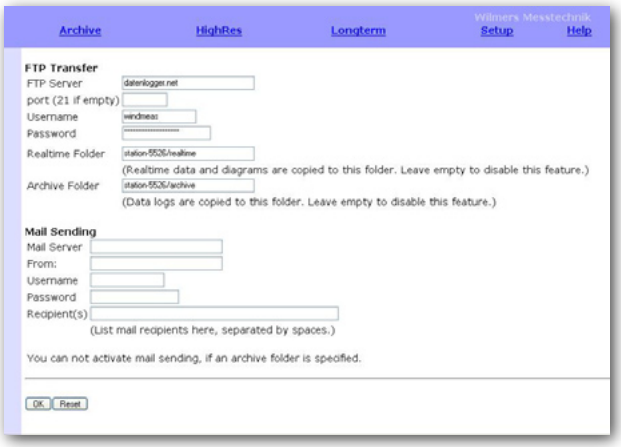
Please enter the length of the time axis of the statistics diagrams in the field **Time Range**.

Shorttime and Statistics Diagrams

Transmitting Measured Data via FTP

The **NDL 485** (only partNo. 0103) sends measured data automatically via FTP to a website or to a data file server. Please first setup the Internet integration via DSL or GPRS.

Select **Setup > FTP/Mail**.



Setup: FTP Data Transmission (only partNo. 0103)

Enter the URL of your FTP server in the field **FTP Server**. Enter the destination folder and access code and click **OK** to save the settings.

ANNEX

Technical Specifications

Model	NDL 485 basic	NDL 485 research
PartNo.	0102	0103
Measuring Inputs		
Digital inputs	6	6
Analogue inputs	6	6
Additional inputs	via INPUT modules (8 x AIN/DIN per module)	
Serial inputs	RS485, half-duplex, optional RS232	
Digital Measuring Inputs (DIN1 .. DIN6)		
Measuring range	frequency 0 .. 2,000 Hz counter 0 .. 2,000 Hz status HI / LO	
Resolution	0.01 Hz	
Accuracy	frequency ± 0.1% counter ± 1 pulse	
Signal level	HI = >2.5 V LO = <0.7 V or potential free switch closure	
Input impedance	>20 kΩ	
Analogue Measuring Inputs (AIN1 .. AIN6)		
Measuring range	0 .. 10 V	
Resolution	16 Bit (0.2 mV)	
Accuracy	± 0.1% of reading ± 1 mV	
Input impedance	>1 MΩ	
Measuring Functions	NDL 485 basic	NDL 485 research
Measuring interval	1 s .. 24 h	0.1 s .. 24 h
Statistic interval	1 s .. 24 h	0.1 s .. 24 h
Statistic funcions	mean value (arithmetic + vector), standard deviation (arithmetic + vector), minimum, maximum, sum	mean value (arithmetic + vector), standard deviation (arithmetic + vector), minimum, maximum, sum, median
Data memory for statistic time series	32 MB non-volatile ring buffer	128 MB, expandable to up to 1 GB, non-volatile ring buffer
Data memory for samples	32 MB non-volatile ring buffer	

Communication	NDL 485 basic	NDL 485 research
Data interface	RS232 interface, 1,200 .. 115,200 baud, RS485 interface, half-duplex, 1,200 .. 115,200 baud, Ethernet interface (LAN), 10 MBit/s, optional MODBUS-TCP protocol	
Remote data transfer	GSM, GPRS, DSL, ISDN router	
Automatical data transmission	via eMail	via eMail and FTP
Internet integration	via GPRS or DSL	
User interface	web interface, Internet browser	
Graphical data display	-	realtime diagrams of measured values, optional custom specific graphical display
Display	-	
Power Supply		
External power supply	5 .. 24 VDC	
Internal power supply	-	
Power consumption	typ. 600 mW (50 mA @ 12 V)	
Sensor excitation **EXC**	5..24 VDC switched, max. 500 mA	
Switching outputs **DOUT1** .. **DOUT4**	4 switching outputs, max. 300 mA, HI = supply voltage, LO = 0 V, time or event triggered	
Mechanic and Operation Conditions		
Casing	65 x 105 x 127 mm, IP20 top-hat rail housing, anodized aluminium	
Connections	screw terminals, connectors	
Temperature range	–40..+70 °C	

CE Compliancy Declaration

Based on test report no. EMV-08/8117-1 of 22.07.2008

Manufacturer: Wilmers Messtechnik GmbH
Hammer Steindamm 35
D-22089 Hamburg / Germany

Product: Data logger **blueberry NDL 485**

Part numbers: 0102 (basic)
0103 (research)

Applied standards:

Index

Symbols

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Capturing the Future

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