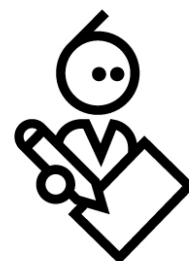




uServer user manual

NABTO/001/USM/006



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2 Abstract

This document describes the uServer and its accompanying evaluation board, what use cases it is intended for and how to use it. A demonstration of the uServer is given to give the reader a hands-on experience of the module.

3 Bibliography

TEN029	NABTO/001/TEN/029: Nabto Platform Specification
DAT002	NABTO/001/DAT/002: uServer Module Datasheet
SCH007	NABTO/001/SCH/007: uServer 1.1 schematic
SCH008	NABTO/001/SCH/008: uServer evaluation board schematic
	PIC18F67J60 at www.microchip.com
	STM1061 at www.st.com

4 Motivation for the uServer

The uServer contrasts a full integration of the Nabto framework into the microcontroller of a customer's product. Whether a full integration or the uServer is the right choice for a given product depends on a number of factors. The following table highlights the advantages of each solution.

uServer	Full integration
Replaces existing serial port interfaces (e.g. MAX232, FT230X)	Lower per device cost
Nabto firmware is isolated from customer firmware	Smaller PCB area
Nabto hardware is isolated from customer hardware	New PCB design not always required
Non/minimal additional resource usage on host microcontroller	Possibly higher throughput and lower latency (depending on host microcontroller)
No need to test Nabto functionality in device	Maximum configuration flexibility
Short time to market	
Device does not need to have Ethernet/Wi-Fi	

Updates to customer firmware can be done through the uServer

5 Use case scenarios

The following use cases illustrate some of the uses of the uServer. This is not meant as a definitive list but is simply intended to highlight some of the benefits of the uServer.

Each use case is described in three steps: current setup, changes and benefits.

5.1 Remote serial port

An existing product uses a proprietary protocol for communication between a host PC and a device. The PC is connected to the device through a USB to serial converter chip that shows up on the PC as a virtual COM port (VCP). The microcontroller on the device communicates with the VCP chip using standard UART signals (RX and TX). The client application uses a standard serial port interface to connect to and communicate through the VCP. The PC acts as the master in the proprietary master-slave request-response protocol used between the PC and the device.

The USB VCP chip is replaced by the uServer with no changes to the device firmware. The client must be modified to use the Nabto stream API instead of the serial port API.

With minimal software changes the PC can now communicate with the device without being connected directly to it.

5.2 Remote logging and firmware update

A product employs a proprietary bootloader which allows firmware updates through the serial port of the microcontroller. The bootloader listens for commands the first second after reboot before starting the application. A standalone application is used to download new firmware to the device. This application uses the DTR signal in the serial port to reset the device to make it start the bootloader.

Furthermore, the device application uses the same serial port for logging during normal application execution. A separate client side application is used to receive logs.

Both the firmware updater and the log receiver application must be modified to use the Nabto stream API instead of the serial port. The bootloader client application must furthermore use the query API to control an IO pin of the uServer to control the device's reset pin.

Both firmware updates and log reception can now be done without being attached to the device making field update and debugging cheaper and faster.

6 The uServer

The uServer contains all the complexity and all the details of the uNabto framework in an easy to use module. The uServer has 11 IO pins 2 of which are reserved for serial communication (UART) with the host microcontroller. The remaining 9 IOs are general purpose digital IOs that are fully controlled by the client.

The illustration below shows the location of each IO pin and the capabilities of each pin. All numbered pins are digital IO pins. Pins with an additional (colored) label have capabilities beyond basic digital IO. These capabilities are currently only available when designing custom firmware.

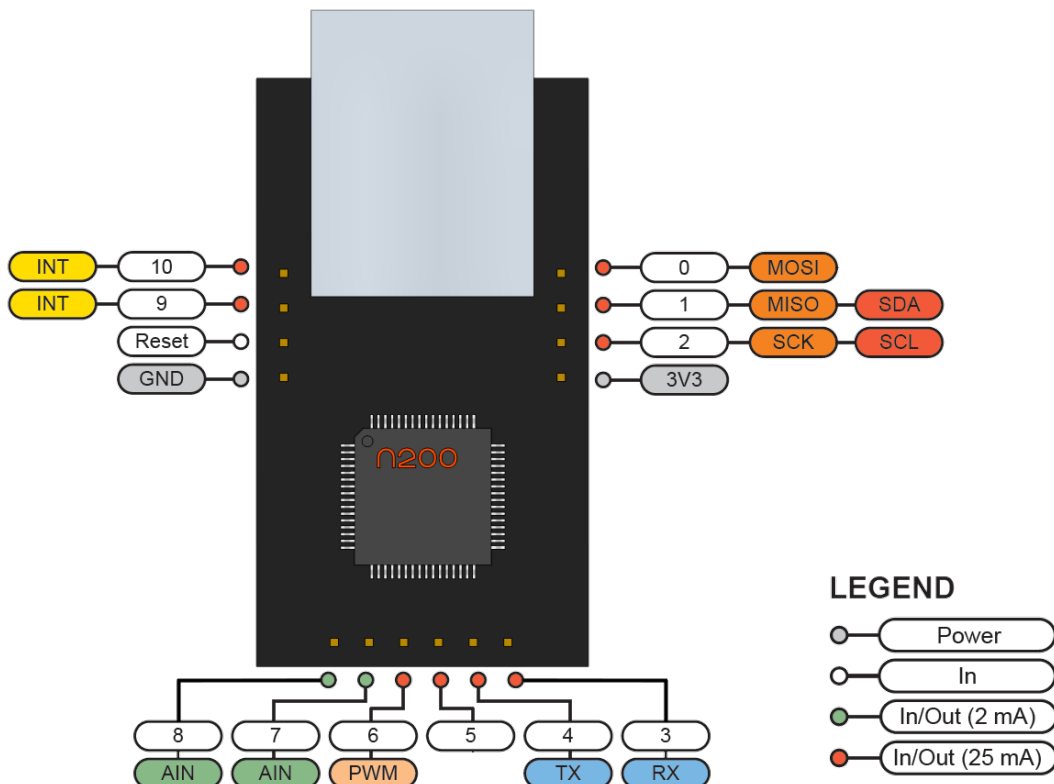


Fig 1 Pin out of the n200M.

The module must be supplied with 3.3 volts and requires 190 mA worst case.

The reset pin is pulled high by an on-board 10 k resistor and driven low by an on-board open drain reset circuit during voltage drop outs. The reset pin can be driven low by an external circuit to reset the uServer but can otherwise be left unconnected.

All IO pins use 3.3 volt levels but are 5 volt tolerant (except for pin 7 and 8). For more detailed electrical specifications on the IO pins, the reset pin and the power pins please refer to the PIC18F67J60 datasheet.

Physical dimensions of the uServer are shown on the illustration below.

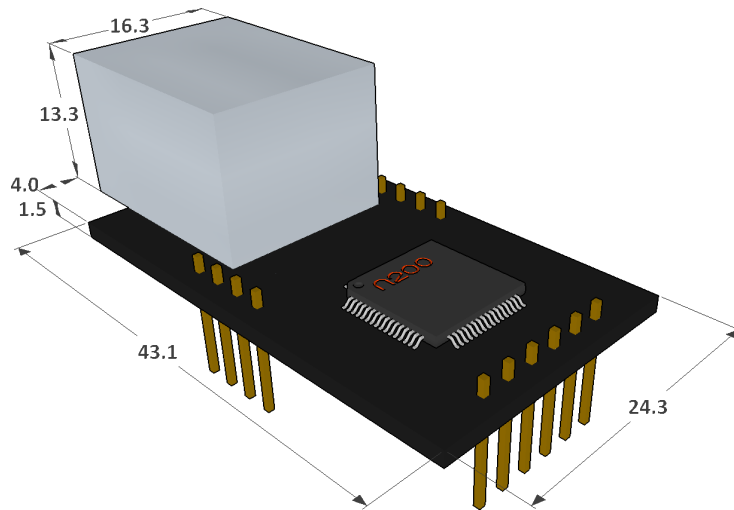


Fig 2 Physical dimensions of the n200M.

6.1 uServer evaluation board

The uServer evaluation board can be used to power the uServer and exposes the following features of the uServer:

- Serial port (through either RS232 or a virtual COM port over USB)
- A button connected to IO pin 5.
- An LED connected to IO pin 6.
- A potentiometer connected to IO pin 7.
- A temperature sensor connected to IO pin 8.
- A button connected to the uServer reset pin.

The RS232 port on the evaluation board can be accessed through a female DB9 connector wired up as a Data Communication Equipment (DCE). To connect a Data Terminal Equipment (DTE) (e.g. a PC) to the RS232 port a straight-through DB9 cable must be used.

7 Accessing the uServer

The uServer can be accessed either through a web browser or through streaming. When using streaming the raw serial port is available to the client.

When using a web browser the areas described in the following sub sections are provided.

The web page seen when accessing a uServer with factory settings is intended as a demonstration. Custom devices will require a custom HTML device driver.

7.1 Device control and monitoring

This section of the page demonstrates how to make queries to the device connected to the uServer. The demonstration device exposes two queries which are explained in detail in the section “Demonstration setup”.

7.2 Evaluation board control and monitoring

The second section on the main uServer web page demonstrates access to the uServer IO pins. Each control in this section corresponds to a physical control on the uServer evaluation board.

Clicking a button will first configure the IO pin to whatever is appropriate for the given control. If it is an output control a value will then be written to the physical control and finally the control on the web page will be updated with the actual value reported back from the uServer.

This section is intended to demonstrate how to use the IO pins on the same page as the device queries. A custom HTML device driver can use the IO pins in a similar manner or use the IO pins internally without the user of the web page ever noticing.

Controlling the IO pins requires the IO control access permission.

7.3 Configuration

This page allows configuration of the baud rate of the serial port. This setting is used for all communication between the uServer and the host controller.

Future configuration parameters will also be accessible from this page.

Modifying the configuration parameters requires the configuration permission. Reading the parameters does not require configuration permission.

7.4 Access Control

The uServer allows fine grained access control for all aspects of the module. The Access Control page presents this through six permission levels as illustrated below.

Level	Permission	Local access	Remote access	Access control	Streaming	IO control	Configuration	Device request	Gateway request
No access									
Local access									
Local access with config									
Remote access									
Remote access with config									
Admin access									

The individual permissions are described in the following table.

Local access	Permission is given to connect to the uServer from the LAN.
Remote access	Permission is given to connect to the uServer from networks other than the LAN.
Access control	Permission is given to read and write the access control settings. Also requires the Gateway request permission.
Streaming	Permission is given to establish streams to the uServer.
IO control	Permission is given to control the IO pins. Also requires the Gateway request permission.
Configuration	Permission is given to change uServer configuration parameters. Also requires the Gateway request permission.
Device request	Permission is given to perform queries on the device.
Gateway request	Permission is given to perform queries on the gateway.

These permission levels can be assigned to specific users, identified in the user list by their email address, or to the anonymous guest user. Any named user not in the user list will be assigned default permissions based on whether the connection between the client and the uServer is local or remote.

It is furthermore possible to disable all remote access to the uServer simply by toggling a switch on the Access Control page.

The first time a uServer is accessed this page is automatically shown to encourage the user to setup appropriate access permissions. This will also happen after a factory reset.

A custom HTML device driver may present these access control permissions in a similar style using levels or allow control of the individual permissions per user.

8 Factory reset

A factory reset restores all configuration parameters of the uServer to their default values which are as follows:

Parameter	Default value
Baud rate	115200
Access control user list	Empty
Guest permission	Admin
Default local permissions	Admin
Default remote permissions	Admin
Remote access	On

To initiate a factory reset, follow the steps below (assumes that uServer is placed in the evaluation board and that the board is powered up):

1. Press and hold the button labeled “SW1”.
2. Press and release the reset button.
3. Wait for yellow LED in the Ethernet connector to light up, turn off and light up again.
4. Factory defaults are now loaded and the button “SW1” may be released.

If the uServer is used in a custom product the equivalent of pressing the button “SW1” is to apply 0 volts to IO pin 5 (pin number 3 in connector P3) of the uServer. This pin should be pulled to 3v3 at all other times to avoid unintentional factory reset!

9 Demonstration setup

To demonstrate the uServer a virtual demonstration device has been created that can be run on a Windows PC.

The schematic below shows how to connect the setup.

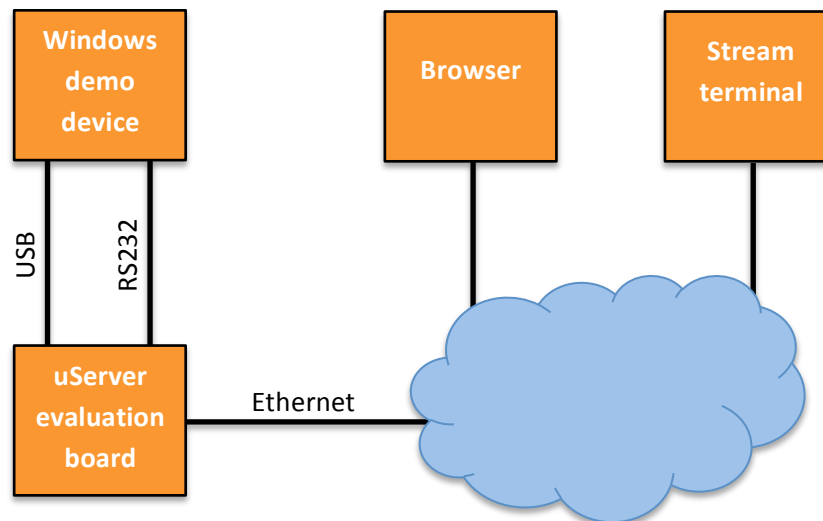


Fig 3 Demonstration setup.

The demonstration device implements a minimalistic weather station that provides two queries to clients: one for requesting wind speed and one for requesting one of five different temperatures. These parameters can be set by the user using the six sliders as can be seen on the screen shot below.

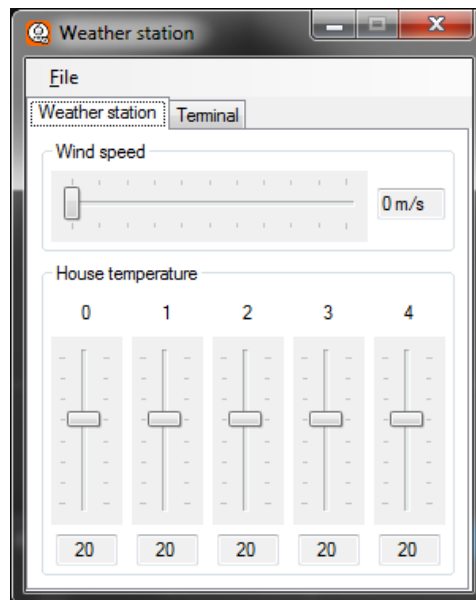


Fig 4 The weather station demo device application.

To use the demonstration device connect a uServer evaluation board to the PC running the demonstration device using either USB or RS232 and follow the steps below to configure and use the demonstration setup.

9.1 Configuration

Before starting the device demo the correct serial port settings must be configured. This is done through the File - > Configure... menu item.

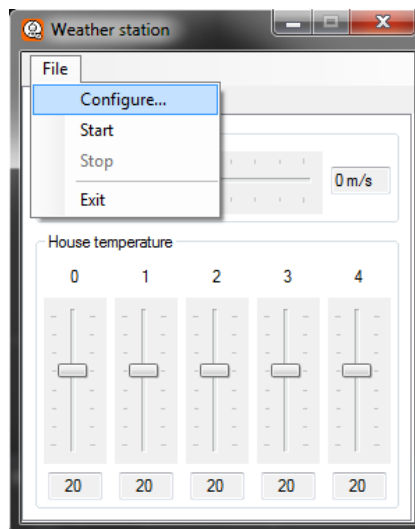


Fig 5 Configuring the demo device.

In the Configure... dialog, set the appropriate settings and click ok. In the screen shot below the baud rate is set to 115200 bps which is the default baud rate of the uServer.

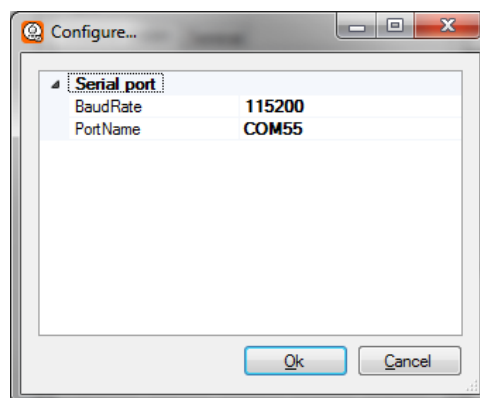


Fig 6 The configuration dialog.

When clicking the Ok button in the Configure... dialog the settings are saved to disk and will be used the next time the application is started.

Click Start in the File menu to open the serial port and start the demonstration device.

9.2 Weather station

The weather station tab shows a virtual weather station with a wind speed sensor and 5 temperature sensors. This demonstrates a customer's device.

Below are screen shots of a session in which a client using a web browser has requested the wind speed and the value of temperature sensor 3 from the demonstration weather station.

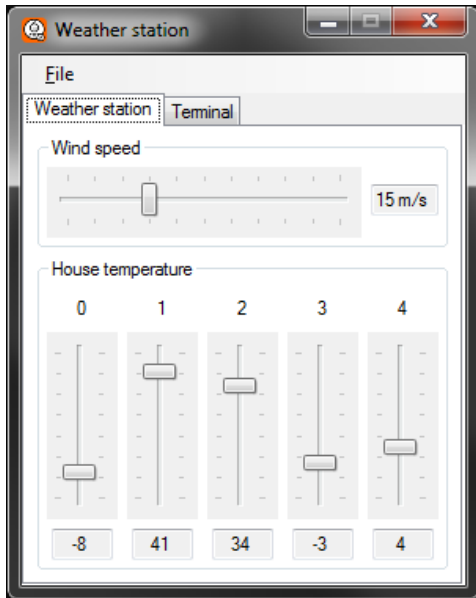


Fig 7 The weather station application in query mode.

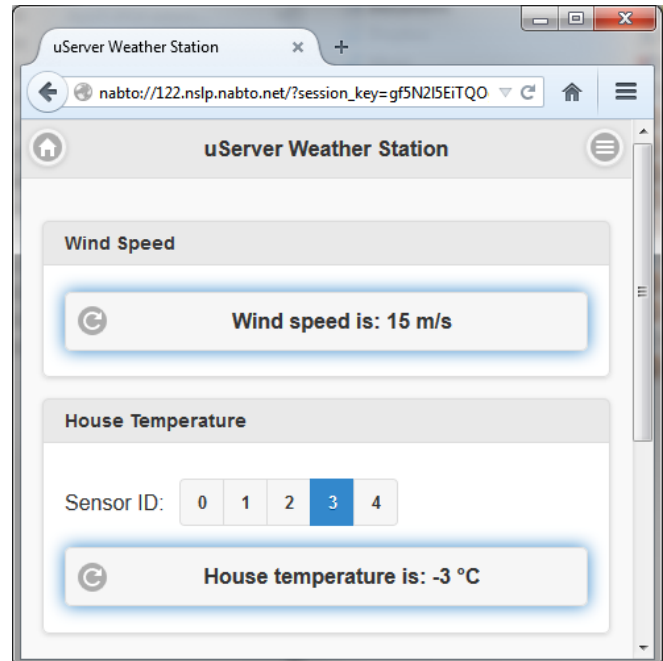


Fig 8 Accessing the weather station from Firefox.

9.3 Terminal

When the Terminal tab is selected the weather station device is shut down and the raw serial port stream is presented in the terminal window.

The right hand side screen shot below shows a stream client (the Nabto Stream Terminal) connected to the demonstration uServer. In the screen shots both ends have sent a message to the other end.

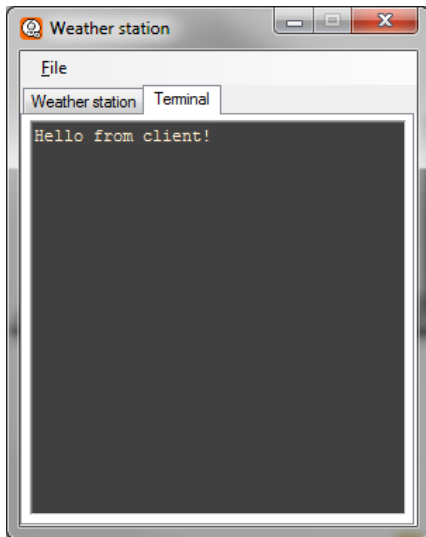


Fig 9 The weather station in streaming mode.

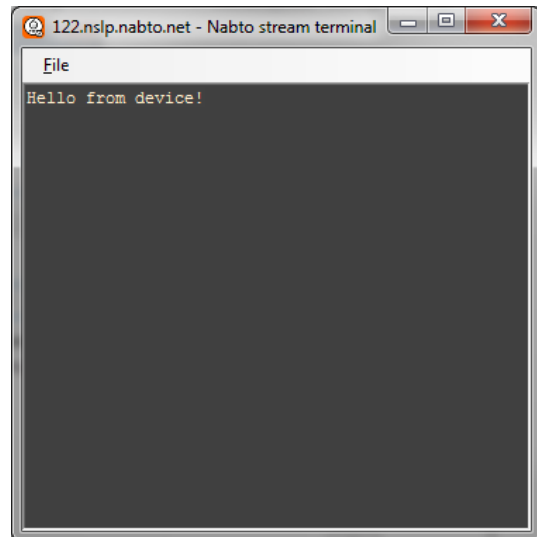


Fig 10 Accessing the weather station from Stream terminal.