WiFi Time Provider
for Arduino Nixie Clock

Operating Instructions

Module version "vx58"

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Contact Information

If you want to get in contact with us, please email to:

nixie@protonmail.ch

We'll usually get back to you right away. We can help you with kits or construction. There is also a forum available at:

https://www.tubeclockdb.com/forum/12-arduino-nixie-clock-kit-support-forum.html

Short link: http://bit.ly/2HmXkIy

Repeat order discounts

We also offer discounts for direct purchases, we save the Ebay fees, and share this with you. Contact us for information. Usually this works out as about 10%.

There are also more shipping options available.

Please go here for more information:

https://www.nixieclock.biz/Store.html

Short link: http://bit.ly/2MvRDwk

Software

The software is available on GitHub at the address:

https://bitbucket.org/isparkes/nixiefirmwarev1/src/master/WifiTimeProviderESP8266/

What this manual is about

This manual describes the set up and initial configuration of the WiFi time module.

For details about the clock setting configuration, please see the manual for the version of the clock you are using!

The WiFi module is an option for all of the clocks based on the Arduino from Nixieclock.biz which have a firmware of

- V56 or later (6-Digit Classic Revision 4 Nixie Clock)
- V356 or later (6-Digit Modular Revision 3 Nixie Clock)
- V656 or later (6-Digit Classic Revision 6 Nixie Clock)
- V456 or later (6-Digit Classic Revision 4 Nixie Clock running 4-Digit firmware)

Description

This is a WiFi time provider for the Arduino Nixie Clock. It makes sure that your clock is always right, (even when daylight savings change), and never drifts because the time is synchronised with network atomic clocks.

The module has the following features:
- Configure and forget. It just runs. No intervention necessary, ever.
- The time never drifts – it is always right within 1 second, year after year, even after daylight savings time changes.
- Really simple configuration: You just have to enter your WiFi SSID and password, and the time zone, and the rest happens automatically.
- Configure the clock setting from the web interface. Makes setting up the clock really easy and quick.
- Logs into your WiFi network. You configure the module with the credentials, and it remembers the settings forever, or until they change.
- Based on the ESP8266 micro-controller: Easy to program with the Arduino IDE and well documented
- Open source software - You may modify and load the software yourself
- Low power consumption.
- All settings are stored in non-volatile memory. Once they are set, they are remembered forever, or until you change them again.

This module is also available as an add-on to existing clocks. It only works with clocks from Nixieclock.biz.

Attaching the module to your clock

The module comes in two versions depending on the Clock you have. It is either as an add-on board (Classic Rev4, All-In-One UNO) which comes pre-assembled:
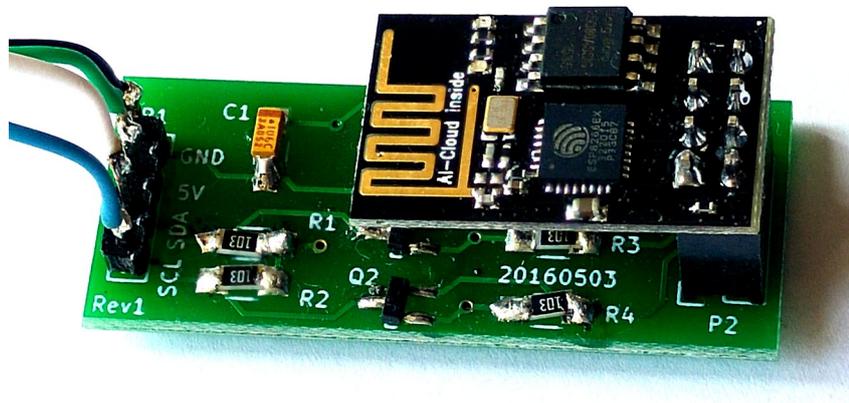
Or as a small package of additional components which are mounted on the main board (All other clock versions) which you will need to assemble on to the main board, either as an SMD or through hole version:

In the case of the add-on board, attach the board to the "I2C" connector, making sure to take into account the pin out. Wire the pins on the I2C connector to the pins of the same name on the WiFi module.

Setting the module up for the first time

Helpful Video

There is a video available that explains the status meanings shown by the onboard blue LED at

https://youtu.be/GAw4mSb_ya4

Set up

To set up the module, you will need a computer, phone or tablet with WiFi access. Any device should work.

When you power on the module for the first time, it will blink the blue LED rapidly. This means that the module is awaiting initial configuration, and is waiting for you to connect to the module. In this mode, the module will open up a WiFi access point called "Nixie":
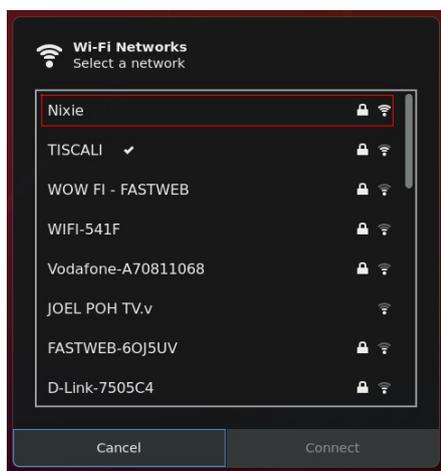
Computer
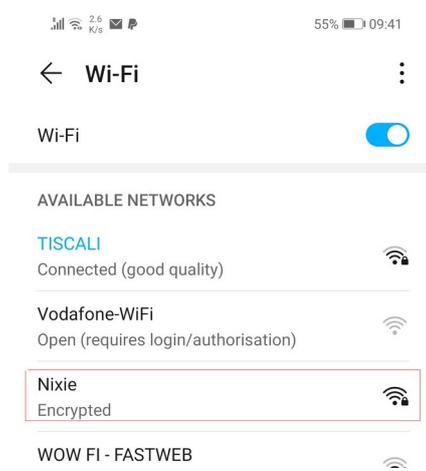
Android

This access point has the credentials:

Credential	Value
SSID	Nixie
Password	SetMeUp!

Note: The password is case sensitive and has an explanation mark in it!

If the access point does not show up immediately, give it a couple of minutes. Some devices take a few minutes to perform a scan for new networks.

After a few seconds, you should be taken to the captive portal of the module automatically, but if this does not happen , please see the next section which is about troubleshooting:
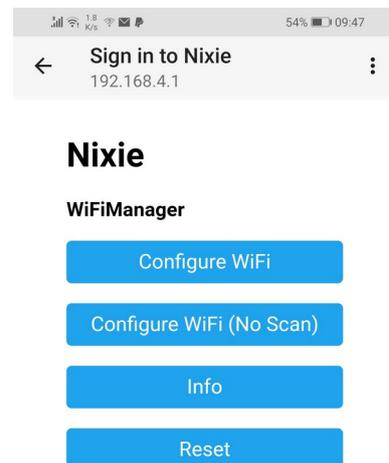
Initial Connection Troubleshooting

The captive portal does not appear

Some browsers don't manage the redirect to "captive portals" correctly, and if the you can connect to the Module correctly, but the captive portal for the hotspot login does not appear, you can also reach it by typing the address http://192.168.4.1 into the address bar (or by clicking on the link).

Internet is not available

On some phones or tablets, you may get the message that "Internet is not available", or that you have to "Sign in to the network". Accept these messages if they appear, at which point you should see that the landing page appears as shown above.
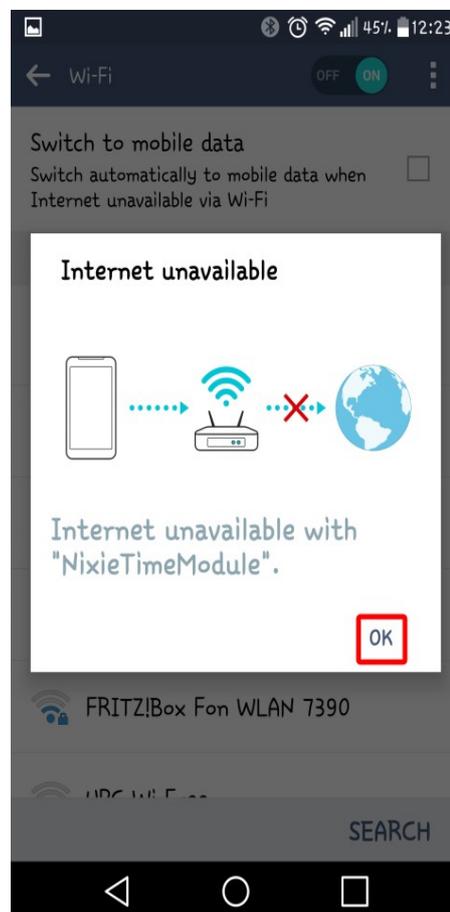
It is normal that the Internet is not available on the WiFi module yet – we have to provide it with the credentials to reach the Internet.

Configure the WiFi

When you see the landing page, press the "Configure WiFi" button, and you should see a list of available WiFi networks (it might take a few seconds to come up if you have many networks in your area).

Select the network you want and enter the password for it.

Note: The network you are using and the password for it will be remembered in your module, and it will always try to reconnect to the same network.

If for any reason the module can no longer find the network (for example, you have changed network or moved the clock), it will revert to set up mode when you re-power the clock.

Note: If you want to continue to use the same network, just leave the clock as it is: It will reconnect automatically when the network becomes available once more. It may take up to an hour to reconnect, so please have a little patience.

Note: If for any reason you are not asked to go to the captive portal, and you are sure that you are connected, you can also try going to http://192.168.4.1 instead. Some older browsers are not able to detect the redirect.
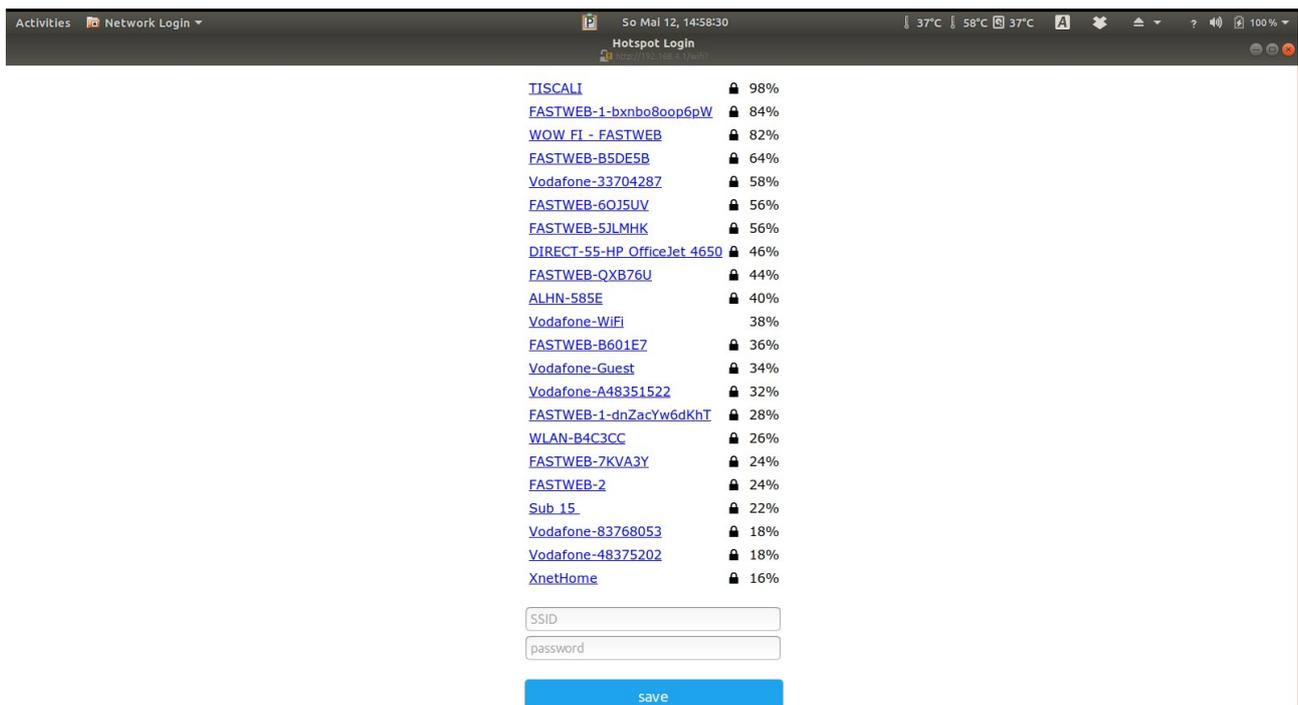
When you have entered the information, the page should close and you will get a message saying that the information has been saved.

If you have the module connected to the clock, you should get a time update after a maximum of two minutes. The module will disconnect you from it.

Note: The time you get will be the time in Switzerland! Don't worry, you can change this right away!

How to access the module after configuration

Once the module is set up, you will need to log into it to configure the time server and set the configuration of the clock. The module has an in-built web server, and you can configure it (and your clock) using a browser.

The module will receive an IP address from your router, and you need to know the address in order to log into the module. The easiest way to find the IP address is to read the address from the display of your clock. When the module connects to the WiFi, it sends the address you need to the clock, and you can read the address from the clock display.

See your user manual for details of how to access the address and read it. The short version is that you can short press the clock button and read the address as it is shown. On 6-Digit clocks you will see something like "19:21:68", then "00:10:47", this means 192.168.1.47. On 4-Digit clocks you will see the same address as "1:92", "1:68", "0:01" and "0:47" (the address is shown as 4 parts instead of 2).

The other alternative is to look on your WiFi router to see the address the module has been given. You should find an entry in the "connected devices" list which starts with "ESP_" with some numbers and letters after it. This is the module, and the IP address assigned will be shown there.

Remember the IP address, or write it down. You will need it to access the module. Once you have reached the summary page, you will also see a link there that is like:

> http://esp_xxxxxx.local

You can click on this link to reach the clock using mDNS. You can also bookmark this link so you can get back to the clock at any time in the future.

Note: If you are on a cable network, it is usual that you will get an address starting with "10" instead of "192.168" (such as "10.10.34.134"). Just follow the same steps but substitute the address you received.

When you have found the address of the WiFi module, you can log into it using any browser. In the example below, the address on a 6-Digit clock was "19:21:68" then "00:11:95":

| Nixie Clock | Summary | Configure Time Server | Configure clock settings | Utility |

Current Status
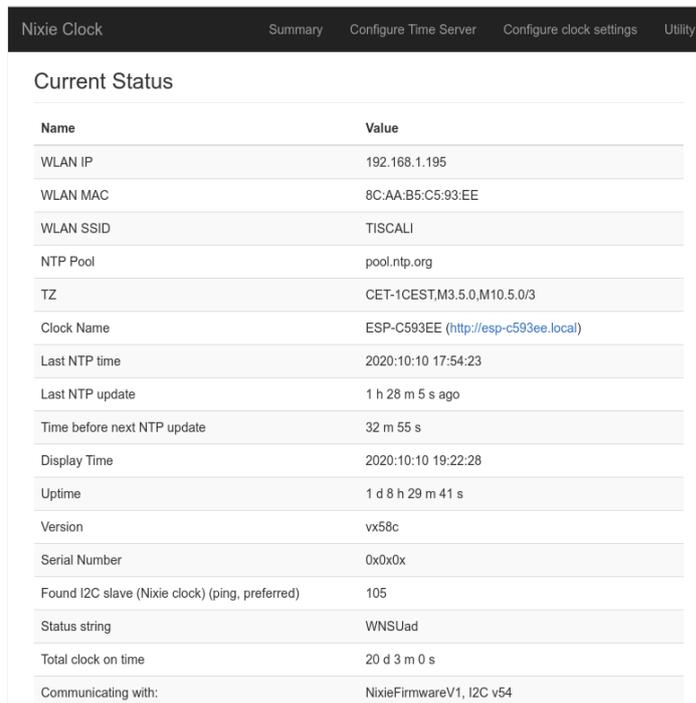
Name	Value
WLAN IP	192.168.1.195
WLAN MAC	8C:AA:B5:C5:93:EE
WLAN SSID	TISCALI
NTP Pool	pool.ntp.org
TZ	CET-1CEST,M3.5.0,M10.5.0/3
Clock Name	ESP-C593EE (http://esp-c593ee.local)
Last NTP time	2020:10:10 17:54:23
Last NTP update	1 h 28 m 5 s ago
Time before next NTP update	32 m 55 s
Display Time	2020:10:10 19:22:28
Uptime	1 d 8 h 29 m 41 s
Version	vx58c
Serial Number	0x0x0x
Found I2C slave (Nixie clock) (ping, preferred)	105
Status string	WNSUad
Total clock on time	20 d 3 m 0 s
Communicating with:	NixieFirmwareV1, I2C v54

Setting the time

Now you can set the time configuration by pressing the "Configure Time Server" link at the top of the page. This is stored in non-volatile memory and should never need setting again.

The configuration string you have to enter is a technical descriptor of the way that the time varies from GMT over the year, and also handles Daylight Savings Time (DST). We provide a list of common strings that you can enter at the web page linked under the entry field.

https://www.nixieclock.biz/help/TZ-Variable.html

This is a "POSIX time descriptor" and is an Internet standard.

It is usually not necessary to change the NTP Pool or the update interval, these are both set with values that make sense unless you have a particular need to change them.

If you change the time descriptor, you should see the time change on the clock within a few seconds.

Here is a screenshot of the current settings I am using for central Europe:

Configuring the Nixie Clock

You can also configure all of the usual settings in the clock using the WiFi interface. Only a few very special options are not available in the WiFi interface, and these are not there to avoid people setting them by accident, as some are able to damage the hardware of the clock if used incorrectly.

All the frequently used configuration options are available. Please see your clock user manual for a complete description of what the configuration options do.

Go to the "Configure clock settings" section of the module, and you will see the current settings. All of the possibilities of the clock are laid out here.

You can still set all of the configuration settings using the traditional way directly on the clock, if you want to.

The full contents of the configuration depends on the clock you are using, and full details are in the corresponding clock user manual.

As an example, the main configuration page looks like this (the V1 firmware is shown, V2 has a few additional options):

The Blue Status LED

There is a tiny blue status LED on the Time Module. This gives you a quick check of the status of the module. The LED flashes according to the connection status of the module.

LED Status	Meaning
Very fast flashing, (approx 10 per second)	**Access Point Mode** The module is not connected to the WiFi at all and has opened the Access Point to allow configuration. When the module is in this status, you should be able to find the "Nixie" network available. **Fix**: Check that your WiFi is on and that you have not changed the SSID (WiFi name) or password. If you have, then log into the module and provide the credentials for your WiFi.
On, but with brief off periods	**NTP Missing** The module is connected to the WiFi, but does not have a valid NTP time. **Fix**: Check that the "NTP Pool" setting is correct. If you have a doubt, put "pool.ntp.org" in the field. **Fix**: If the NTP setting is correct, then restart the clock – it should pick up the NTP time. **Fix**: If restarting does not solve the problem, turn the clock off for an hour and turn back on, or change the NTP pool. (NTP Pools have policies to stop clients requesting too many updates – it is possible that you, or someone on your network has asked too much. Blacklisting is usually only temporary, and will resolve itself eventually).
Very short flash once per second	**Running mode** The module is connected to the WiFi and the time is up to date. This is the normal status. The flash is intentionally short because otherwise the blue light can be disturbing in a dark room. To connect to the clock, use the clock button read the IP address and connect to that address.
Slow equally spaced on/off flashes	**Searching mode** The module is searching for the previously available WiFi network. This state will last for only a few seconds, and then it will revert to fast flashing to allow you to redefine the WiFi credentials. **Fix**: Check that your WiFi is available. When the module goes into "open mode", you can change the settings.

A video demonstration of these is available at:

https://youtu.be/GAw4mSb_ya4

Utilities

There is also a collection of useful functions available on the Utilities page:

Option	Meaning
Reset WiFi Only	Resets the WiFi configuration, but leaves the clock configuration alone. This means that the module will go back into Access Point Mode so you can reset the WiFi connection information
Reset Configuration	Resets the clock configuration without changing the WiFi settings.
Reset All	Resets both the WiFi and Clock configuration.
Update Firmware	Allows you to update the firmware on the WiFi Module (but not the clock) using "Over The Air" Update (update using a browser).
Force NTP Update	Make the module get the current NTP time right now, instead of waiting for the next scheduled update.

Understanding Security

The Access Point

The module is by design already quite secure. There is no known way of connecting to the "Nixie" network and doing anything other than changing the clock settings. There is no known way of accessing through the open network to your WLAN network. However, we designed the software in the module to provide the highest security possible.

The module tries to connect to the configured Wireless LAN on start up. If it manages to connect, it will shut down the "Nixie" access point. You can still get into the module configuration through your WLAN, using the IP address that is shown on the clock.

If for any reason the module is not able to connect to your WLAN (say, you changed the password, or the network name), it will indicate on the tiny blue LED that it is not connected. It will not send any updates to the clock, but the clock will continue to work using it's internal time provider which is not highly accurate.

The "Nixie" access point will not show up until you restart the clock! This is a security feature to make sure you are in control of when the access point is available!

The access point will only turn on after a restart of the clock. It will turn off automatically once it has managed to connect to a network.

Interface security

The interface is protected by a password. You can turn off the configuration password or change the password using the option on the configuration page:

Security

Web Authentication:	○ On ● Off
User Name	admin
Password	setup

Set

Update Security

There is a separate password for "Over The Air" (OTA) updates. It is not the same as the interface password, and cannot be disabled or changed.

Password Defaults

The default credentials (at factory reset) are:

Credential	Username	Password
"Nixie" Access Point		SetMeUp!
Configuration	admin	setup
Update	admin	update

Troubleshooting

If not everything goes as you expect, please refer to the test steps during the construction and the associated troubleshooting tips. If that does not cover the problem you have, please see below. If you still can't find the answer, contact us!

Trouble shooting

I can't find the time "Nixie" network

First check the status of the blue LED on the module. The "Nixie" network is only available if the module is in "Access Point" mode (blue LED flashing rapidly).

Trouble shooting

I can't connect to the time "Nixie" network

This can depend on the device you are using to try and access the module. Not all browsers have the same capabilities, and the module does not have a full HTTP stack in it.

Please try connecting with a different device (for example, if you are trying with a PC, try with a tablet or phone instead).

We're always working on improving the compatibility, but experience shows that we are not in a perfect world yet.

Trouble shooting

The module can't seem to communicate with the clock

If this is the first time that you have powered the clock up, please make sure that the clock is not in startup mode (you have pressed the button to go into normal time mode) and that you have completely restarted the clock.

If you see a message saying "Clock not foundà" like this:

Status string	WNSUAd
Total clock on time	11 m 0 s
Communicating with:	**Clock not found!**

then please completely power off and back on again.

Trouble shooting

The module can't seem to communicate with the clock

First check the status of the blue LED on the module. The module needs to be in "Running" mode. This mode is indicated by the blue LED flashing slowly (1 short flash every second).

If the module is fully configured and still does not communicate with the clock, look at the main summary page for the value for "Found I2C slave at". It should say "105".

If it does say "105", please wait three minutes and see if the time is sent. (The time module sends the time every second, and in some cases the module sends

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the time but it gets missed.

If it does not say "105" please check the connections between the module and the clock.

Trouble shooting

The module is configured, but I don't know the address of it

In this case, you should log into the administrative area of your wireless router and look up the IP address from there. The name of the device will be "ESP_xxxxxxx", where the value of "xxxxxx" depends on your module.

Trouble shooting

I want to reset the module

There is a reset link available at the address "http://your-module-address/reset". Going to this will reset the module and put it back to the status it was when you first received it.

Schematic

Here is the schematic of the board:

Revisions:

V0001a: 01May2016: Initial version
V0001b: 31May2016: Added information about security
V0001c: 27Jul2016: Added Add schematic
V0002a: 16Feb2017: Added troubleshooting tips
V0003: 12May2019: Update for the new firmware
vx58: 11Oct2020: Update for the new firmware vx58
vx58: 12Jul2022: Add a note about restarting the clock