Spectrum™ and DW-Series Wi-Fi Clock Setup Guide

Revision C: May 2019

Contents

Introduction

The Spectrum™ and DW-series Wi-Fi clocks feature easy-to-follow setup instructions built into the clock. This guide gives more detailed setup instructions, as well as troubleshooting steps and descriptions of the clocks' advanced features. Most users can safely skip over much of the advanced IT-level information presented here. However, you'll want to run the following by your IT team so that they can make the best decisions on how to add the clocks to your building network.

Power and Mounting

Please see the installation instructions for your particular clock model for more information.

IT Requirements

Please check these requirements with your IT department. Virtually any Wi-Fi access point can be configured to work with the following settings.

1) The clock setup can be performed with any laptop, tablet, or phone with built-in Wi-Fi.
2) The network must also be on the 2.4GHz band.
3) The building's Wi-Fi network must support open, WEP, WPA, or WPA2 security with shared passwords. Note that 802.1x support is currently shipping as a beta release, and should be tested with your particular network[1]. If you need to provide a user name to connect to your Wi-Fi, you probably have one of these networks.
4) "Captive portal" guest networks that require a password may block the clock's access to our Internet time servers[2].
5) The network firewall must allow outbound NTP/SNTP traffic (UDP port 123).

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[1] Starting in January 2018, National Time's Wi-Fi clocks are shipping with Beta firmware for connecting to Wi-Fi Enterprise networks. PEAP with MSChapV2 is the most common validated setup, but please try a clock on your particular network before planning a large installation of clocks.

[2] If a captive portal is installed, we recommend using an alternate non-guest network, or making a firewall exception for SNTP network traffic pass through the captive portal.

Default Settings – The Quickest Setup

The fastest and easiest way to set up the clocks is to use the default clock settings. To do this, your IT administrators will configure a hidden Wi-Fi network that matches the default settings of the clocks. If you are in the US Eastern Daylight time zone, you shouldn't need to change any settings, which means you can simply power up the clocks and put them on the wall.

This special clock network has the following advantages:

- Much faster setup
- The clock network can be completely locked down, hidden, and isolated on a VLAN for high security
- The clock network can be independent and isolated from any future IT initiatives or concerns
- MAC address based authentication can be used for added restrictiveness

In this scenario, the following settings can be used to configure the Wi-Fi access points. You will need to show this section to your IT admin and have them set up the network on their end first.

SSID:	TimeWiseWPA2
Password:	NatscoClocks
Security:	WPA2-AES (pre-shared key)
Firewall:	Outbound UDP port 123 (SNTP). HTTP for configuring digital clocks is optional.

IT Information

The following settings should be obtained before installing the clock. Please consult with your IT department to ensure you have the correct settings. Note that if the network is not yet installed in your building, you can still install the clock and set it to the correct time. Once the network comes online, the clock will automatically sync up with the precise network time.

Setting Name	Setting Value	Notes
Wi-Fi Network Name (Also known as SSID)		Wi-Fi network can be WEP, WPA, WPA2 or open.
Wi-Fi Network Password		Network password is optional on open networks.
Clock Password		Optional password for clock's internal webpage. Default is blank, and it can be left blank if desired.
Time Server		Recommended value[3] for clock status reporting is *time.natsco.net*

Advanced Authentication

Some higher-security networks may present some challenges to setting up the clocks, but there several options available that should allow the clocks to work in any environment.

As of 2019, Spectrum and DW series clocks have beta-level support for Enterprise (EAP) authentication. This has been verified to work on MSChapV2/Microsoft RADIUS configurations, but your particular environment may not be completely supported at this time. We recommend a trial clock to determine if this is a good solution for you.

A good alternative to EAP is to use MAC-based authentication. In this case, National Time can provide you with the full MAC address list of all clocks in a factory order. These hardware-specific addresses can be used to provide reliable and simple authentication without compatibility concerns.

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[3] A different server can be used if syncing to internal time servers is required. In this case, contact National Time support for instructions on enabling cloud supervision using a local check-in server.

How a Wi-Fi Clock Works

National Time's Wi-Fi clocks connect to your building's existing Wi-Fi network. Using that network, it connects to a time server to get a time sync. By default, it will use National Time's cloud time server via your Wi-Fi network's Internet connection. However, you can also configure the clock to use your existing local time server or a National Time web-enabled master clock. If you use the cloud service or supervision servers, you can monitor the battery levels, signal strength, and connection status of your clocks.

How Clock Setup Works

For the clock to connect to your building's network, you will need to tell it your building's Wi-Fi network name and password. You will also have a chance to set options like daylight saving time and a server from which the clock will fetch the current time.

The clocks each have their own internal Wi-Fi network that they broadcast during setup. This network is labelled *TimewiseSN*, where *SN* is the serial number of the clock. Using a smartphone or other device, you will connect to each clock in turn to push the settings to the clock. Our RappID Setup feature allows for fast configuration of each clock without needing to re-type the settings for each one.

For most installations, the **Quick Start** mode should be used to configure the clocks. For special circumstances, such as reserved (static) IP addressing, the **Advanced Mode** should be used instead.

Setup Button

Pressing and releasing the setup button powers up the clock's Wi-Fi radio and makes it available for the setup process. There is no need to hold it down for more than a second, as doing so for 10 seconds will reset the unit to default settings (see below).

On DW clocks, the setup button is on the **front** of the clock.

On Spectrum clocks, the setup button is on the **back** of the clock.

If the status light does not activate after pressing the setup button, please check that the batteries are good or that the unit is plugged into a live power source.

Code	Meaning
1 Red	Starting up.
2 Red	Wrong Wi-Fi password.
3 Red	Cannot find Wi-Fi network.
4 Red	Connect failed / Could not get IP Address.
5 Red	Unit is on the network, but has not yet contacted the time server. Check firewall.
6 Green	Unit is online and connected to the time server.

Status Light

The clock has a status light that blinks out a code to indicate the network connection status. The light is red if the connection to the time server is failing, or green if the connection is successful.

The status light turns on when the clock is first powered up, or when the **setup button** is pressed.

Factory Mode

There is also a factory mode. In general, this will not be seen in the field, but factory mode can be exited by simply resetting to defaults (holding the button for 10 seconds). After restoring from factory mode on analog clocks, the clock will return to the "park" position at 12:00. The batteries/power adapter must be removed and replaced before the clock will move again; it's fine to do this while the hands are spinning.

Please note that holding the button on the clock for more than 30 seconds will place it into factory mode. Please take care not to stack the clocks or place them on uneven surfaces, as this can reset the unit to defaults or put it into factory mode inadvertently.

Resetting to Defaults

Restore to default network settings by holding the settings button for 10 seconds. Let go when the red/green lights start blinking together. Wait 15 seconds and then restart the setup.

Note: DW Digital clocks have an additional security feature: resetting to defaults is only possible for one minute after power-up. This is designed to prevent building occupants from tampering with an already configured clock. Spectrum clocks are already secured with the button on the back of the clock.

Quick Start Setup

It is best to perform the clock setup on-site with the actual network to which the clocks will be connecting. This will ensure correct operation. However, you can configure the clocks without a network as long as you are sure of the correct settings.

Note: The quick-setup procedure detailed below will not save the settings to the clock until the *Save Settings* step. Settings shown prior to saving are defaults or are the settings from the last time the web page was used.

Get a Configuration Device

You can configure your clock with any smartphone, tablet, or laptop. Your device must have its Wi-Fi turned on and it must have permission to join Wi-Fi networks. For the sake of these instructions, we'll assume you're using a phone, but tablets or laptops may be used interchangeably.

Connect to Web Configuration

We'll start off with your phone on your building Wi-Fi or cellular service. Open a web browser and go to **http://natsco.link** to begin. When the page loads, press the *Let's Go* button.

Power Up: Spectrum	Power Up: DW-Series
1) Remove the metal shipping pin from the back. 2) Insert batteries or power plug 3) Status light will begin blinking	1) Insert power plug 2) Status light will begin blinking

Check Power

Once the clock is powered up, a code will blink in red or green on its status light. Spectrum Analog clocks have this light on the back, while DW digital clocks have the light on the front. If the light doesn't blink, try another set of batteries or a known-good power outlet. The light will continue to blink for about 10 minutes before the clocks goes to sleep if there is no additional activity in the setup process. Simply press the setup button again to continue the setup process.

Once you've verified the clock is powered up, press the *Next* button on your phone to go to the next phase of setup.
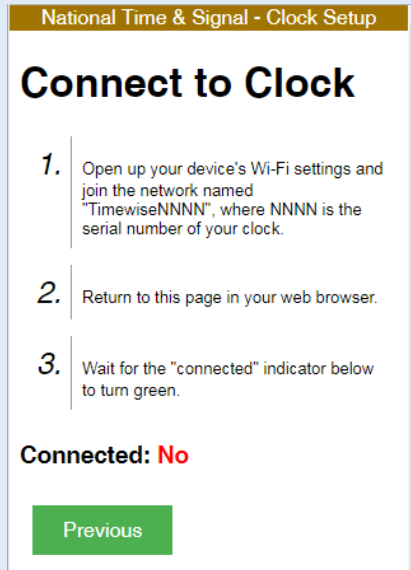
Connect to Clock

Your phone should now be on the *Connect to Clock* screen. Initially, it will say "Connected: *No*" at the bottom. To connect to the clock, we must join your phone to the clock's internal setup Wi-Fi network.

The setup network is broadcast for 10 minutes after the clock is powered on or the setup button on the clock is pressed. If the clock has gone back to sleep, the status light will stop blinking and you must press the button or re-power the clock to continue.

Connect to the *TimewiseNNNN* network, where NNNN is the serial number of your clock. On DW-series clocks, press the button on the front to see the last four digits of the serial number displayed on the screen.

You connect to the Timewise network just as you would any other Wi-Fi network. See below for instructions with Android and iPhone devices.

National Time & Signal - Clock Setup

Connect to Clock

1. Open up your device's Wi-Fi settings and join the network named "TimewiseNNNN", where NNNN is the serial number of your clock.

2. Return to this page in your web browser.

3. Wait for the "connected" indicator below to turn green.
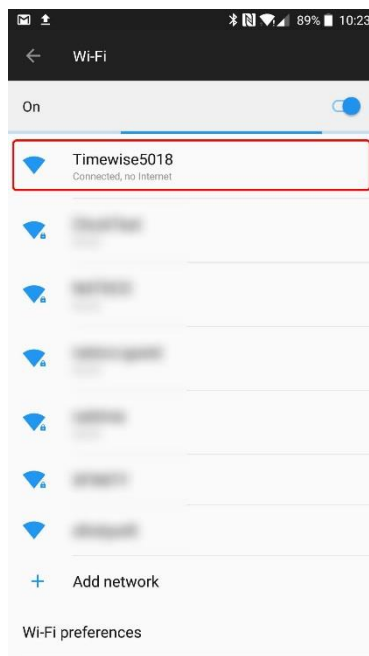
Connected: No

Previous

Android

Swipe down from the top and long-press on the Wi-Fi networks button.

Then select the *TimewiseNNNN* network to connect to the clock.

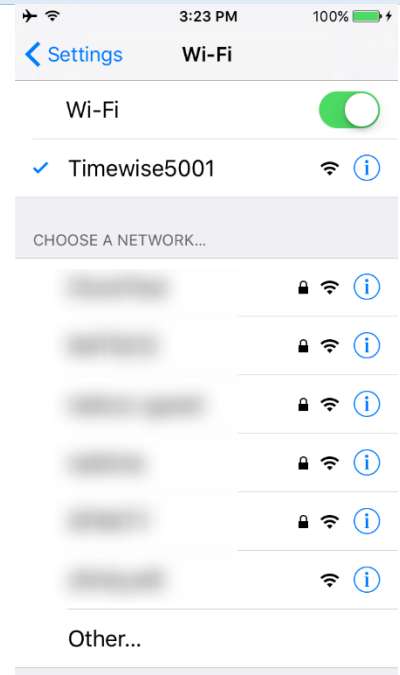The phone may warn that the network has no Internet. In this case, choose "connect anyway."

iPhone

Go to the *Settings* menu from your home screen and choose *Wi-Fi.*

Then select the *TimewiseNNNN* network to connect to the clock.

The phone may warn that the network has no Internet. In this case, choose "connect anyway."

Return to Browser

Once you've joined the Wi-Fi network, return to your phone's web browser. It should now say "Connected: *Yes"*. Press the *Next* button at the bottom of the page. From this stage, you will be viewing pages directly on the clock. You may continue using the Wizard interface to finish the setup, or continue with the detailed instructions below.

RappID Setup

The first page of the clock setup shows the clock's serial number as well as an interval voltage number.

The voltage should be greater than 2.2V for reliable operation. If you see a lower number, please change the batteries or verify that line voltage is good.


Wi-Fi Setup

Enter your building's Wi-Fi network settings here. Be sure that you use the correct capitalization and spacing for these settings.

Wi-Fi Network Name: The name of your building's Wi-Fi network. Also called the *SSID*.

Wi-Fi Network Password: The password for your building's Wi-Fi network. Also called the *Key* or *Pre-Shared Key*. If using EAP/Enterprise authentication, this will be the user password.

Next (Basic): Press this to continue with normal setup (most users).

Next (Enterprise): Press this to enter user name and domain information. This is for EAP/Enterprise/802.1x networks that require a user name to join the Wi-Fi.
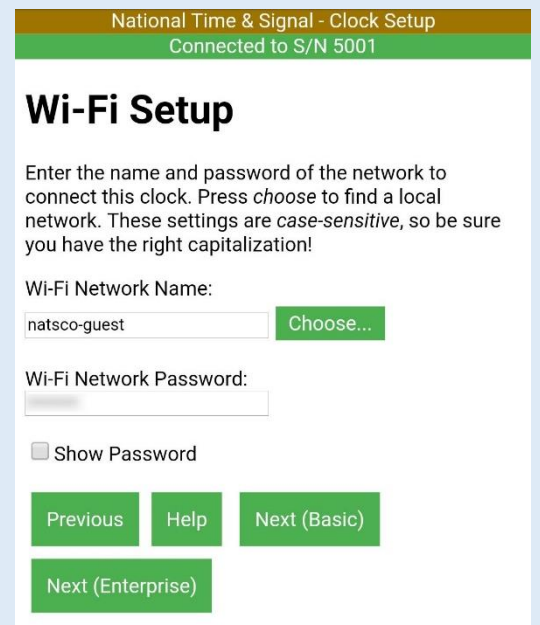
Password Settings

The password allows you to lock down the clock's settings interface. If this setting is configured, future accesses to the clock setup will require this password to make any changes. You can leave this setting **blank** to allow unrestricted access. For easy access, we recommend setting the password to all clocks in a building to be the same.

 Note: this is *not* the same as your Wi-Fi password.

> **National Time & Signal - Clock Setup**
> Connected to S/N 5001
>
> ## Password Settings
>
> Change this clock's password from the default password? Leave blank and press next if no password is desired.
>
> Password:
> [   ]
>
> Record this password in a safe place as it will be required to access this clock in the future.
>
> [Previous] [Help] [Next]

Time Zone Settings

Enter your local time zone and daylight-saving time rules here. If the built-in quick-start settings don't cover your local time zone or DST, you may use the advanced time settings page to enter a custom time zone.

You can use this page to set up "world clocks" for multiple cities around the world. Simply select the appropriate time zone for the desired city.

> **National Time & Signal - Clock Setup**
> Connected to S/N 5001
>
> ## Timezone Settings
>
> Select your local time zone settings below.
>
> Time Zone:
> [US Eastern Time (UTC-05:00) ▾]
>
> Daylight Saving Time:
> [United States ▾]
>
> [Previous] [Help] [Next]

Time Server Settings

The clock gets its time from the selected time server. Battery Spectrum clocks get their time at 5:00 each morning, while hardwired digital clocks connect every hour after power-up. If the default server *time.natsco.net* or a *TIMEWiSE* supervision server is used, you will be able to monitor your clocks via http://cloud.natsco.net

If **Set time with phone/laptop** is selected, the clock's initial time will be set from your phone. Setting this to **on** is useful if the Wi-Fi network isn't operational yet. The clock will keep time internally until the network comes online. If the network

> **National Time & Signal - Clock Setup**
> Connected to S/N 5001
>
> ## Time Server
>
> Enter the time server address that the clock will synchronize its time with.
>
> For National Time cloud supervision, use the default of *time.natsco.net* (recommended).
>
> Time Server Address:
> [time.natsco.net]
>
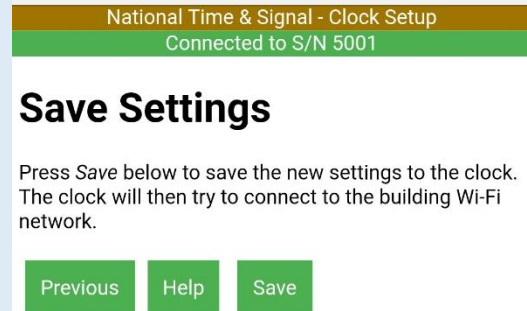> ☑ Set time with phone/laptop if network is unavailable.
>
> [Previous] [Help] [Next]

is already online, leaving this setting **off** can help confirm that the clock is getting the correct time.

Save Settings

Once on this page, all the basic settings have been configured. Until this point, the settings are only stored in the phone. On the *Save Settings* page, those settings are pushed to the clock.

Press the *Save* button to push the settings to the clock.

National Time & Signal - Clock Setup
Connected to S/N 5001

Save Settings

Press *Save* below to save the new settings to the clock. The clock will then try to connect to the building Wi-Fi network.
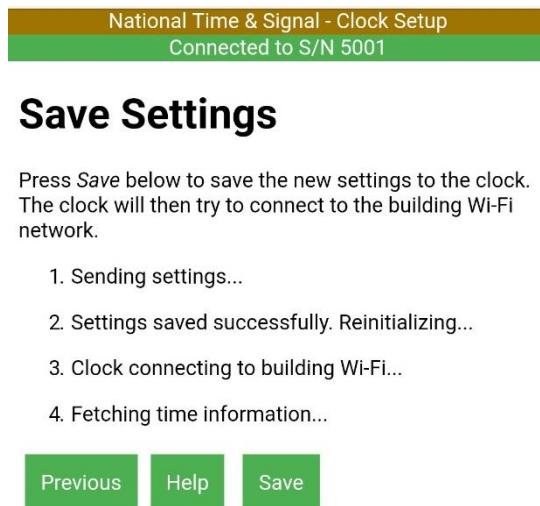
Previous   Help   Save

Save Settings Progress

As the settings are being sent to the clock, the page will display the progress. Once the settings are pushed to the clock, the clock will attempt to join the building's network. If it succeeds, it will then try to fetch the current network time.

During this process, your phone's connection to the clock may drop. If this happens, the page will wait for a bit to try and reconnect. If it fails to reconnect, you may be prompted to re-join the clock's Wi-Fi network.
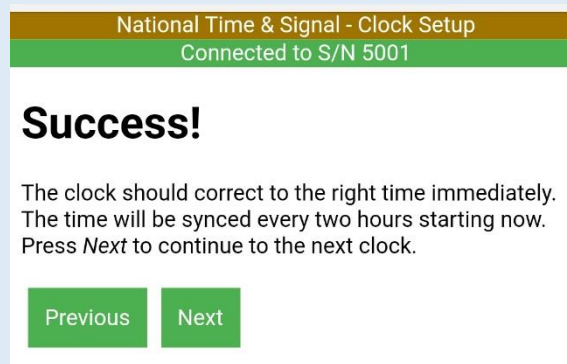
If the connection was successful, you will be presented with a success screen. Otherwise, you can look at the troubleshooting section in this manual for suggestions on how to resolve the issue.

National Time & Signal - Clock Setup
Connected to S/N 5001

Save Settings

Press *Save* below to save the new settings to the clock. The clock will then try to connect to the building Wi-Fi network.

1. Sending settings...
2. Settings saved successfully. Reinitializing...
3. Clock connecting to building Wi-Fi...
4. Fetching time information...

Previous   Help   Save

Success

At this point, the clock is configured and has received time from the network. **DW clocks** will immediately show the correct time.

Spectrum analog clocks will need about 15 minutes to get on-time. The hands will spin around to 12:00 once before going to the correct time. They will further refine their time within 24 hours as the hands are calibrated.

National Time & Signal - Clock Setup
Connected to S/N 5001

Success!

The clock should correct to the right time immediately. The time will be synced every two hours starting now. Press *Next* to continue to the next clock.

Previous   Next

Monitoring

After the success screen, the monitoring screen describes the monitoring setup. Please see the section *Monitoring and Reporting* for detailed instructions.

In general, the best procedure is to configure the clocks all at once, and write down the **serial number** and **room/location** of each clock as you are placing them on the wall. Then you can enter this information into the monitoring site all at once.

If you have more clocks to configure, select *New Clock* to continue. Otherwise, close the browser and switch your phone back to the building Wi-Fi. The clock will go back to sleep in about 10 minutes.

> National Time & Signal - Clock Setup
> Connected to S/N 5001
>
> # Monitoring
>
> Current Clock time: 4/9/2018, 11:01:36 AM
>
> Voltage: 3.42V (Good)
>
> If you have set your time server to time.natsco.net, you can monitor the clock status on the TIMEWiSE cloud service. If you want to check it out now, first rejoin your phone/laptop to your building's Wi-Fi, then navigate to http://cloud.natsco.net.
>
> If you'd rather set up another clock, just press the "new clock" button below and follow the instructions.
>
> [Previous] [New Clock]

New Clock

Setting up additional clocks is simple – you can either enter new settings, or you can push the same settings to the next clock.

In either case, you should connect to the next clock:

1) Power up the next clock
2) Use your phone's Wi-Fi menu to connect to network *TimewiseYYYY*, where *YYYY* is the serial number of the next clock.
3) Return to the web browser and verify that the New Clock page says "Currently connected to *YYYY*"
4) Press *New Settings* or *Same Settings* to enter new settings or push the same settings out to the new clock.

> National Time & Signal - Clock Setup
> Connected to S/N 5001
>
> # New Clock
>
> Follow these instructions to configure the next clock. The new settings you just entered will be remembered for the next clock.
>
> 1. In your phone/laptop Wi-Fi settings, join the TimeWise<Serial No.> Wi-Fi network, where *Serial No* is the serial number of the next clock.
>
> 2. Wait for the "Connected" bar above to show the serial number of the next clock. Currently connected to 5001
>
> 3. Press *New Settings* below to enter new settings, or press *Same Settings* to reuse the same settings as the previous clock.
>
> [Previous] [New Settings] [Same Settings]

Advanced Setup

Advanced setup gives more options than quick-start, and may be needed for some installations. Quick-start is much faster, so it should be used if possible. Unlike quick-start, the settings on the advanced setup pages are saved directly to the clock when the save button on the bottom of each page is pressed.

To enter advanced setup, power up the clock, connect to it with your phone, and navigate to the clock's web page. For more details on connecting to the clock, see the Quick Start instructions.

Main Advanced Setup Page

The first page of the advanced setup has details of the clock and connections to the rest of the clock setup.

Serial Number: The serial number is unique to each clock and is used on the Natsco Device Cloud web site to check the status of the clock.

Version: Firmware version of the Wi-Fi radio component.

Clock Version: Firmware version of the clock movement or display.

Module Type: Type of clock. This can be useful when identifying an unknown clock on your network.

MAC Address: This hardware address is unique to each clock and may be needed for your IT administrator to aid in troubleshooting or connecting the clock to your network.

WiFi Signal Strength: Ranges from 1-100, this indicates the quality of the connection to the buiding Wi-Fi network. Anything above 20 should be fine.

Voltage: Shows the voltage of the clock. Hardwired units should always be at or above 3.2V. Battery units will vary depending on the battery level. Once batteries reach 2.3V, they should be replaced. Use the Natsco Device Cloud service to track battery voltage.

Clock Location/Description: This can be used to record the clock's location. This setting is only saved on the clock. In most cases, this can be left blank and the clock's location can be entered on your TIMEWiSE master clock or the Natsco Device Cloud web page instead.

Current Time: The time loaded from the network. If the time is in year 1999 or 2000, then the time has not been successfully loaded. Note that this display shows the time according to the phone/laptop time zone. The clock can be configured to different time zones that may not match the phone.

Get Network Time Update: Immediately tries to get time from the network. If the Wi-Fi connection to the building is working, then this will attempt to get the time from the configured time server. If the clock can't fetch the time, it will remain unchanged.

Manually Set Time: Open this page to set an arbitrary time into the clock.

Clock Controls: Depending on the model of clock, this allows direct control of the movement or display.

Network Settings: Used to join the clock to a building network.

Time Settings: Configuration of time zones and time server information.

Bell Settings: On Digital clocks, configures which bell circuit this clock is on. When the master clock or TIMEWiSE supervision scheduler rings a Wi-Fi circuit, the digital clocks with the specified circuit number will activate their beepers or count-down timers.

Password Settings: For protecting the login interface of the clock.

Firmware Update: For updating the clock's radio firmware.

Page Details — Manually Set Time

Enter the time you wish to see on the clock. It will be converted according to your phone's local time zone and then sent to the clock. On digital (DW) clocks, the time will reset immediately. On analog (Spectrum) clocks, use the clock control page to make the clock immediately go to the new time.

Note that the clock may fetch new time from the network that will overwrite the time entered on this page. If you wish to force a specific time that doesn't match the network time, you should first clear the network time server setting on the *Time Settings* page.

National Time & Signal - Clock Setup

Set Current Time

Current Time: 4/21/2018, 9:05:18 AM

Year:	2018	(Use year 2000 or later)
Month:	4	(1-12)
Day:	21	(1-31)
Hour:	9	⦿ AM (1-12) ○ PM
Minute:	5	(0-59)
Second:	18	(0-59)

Save Settings

<< Back to Main

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Page Details — Digital (DW) Clock Controls — Timer Control

On DW Digital clocks, the clock can also be used as a timer. This can be accomplished via plug-in wall controls or through the clock's web interface.

Start/Stop – Starts or stops the counting

Timer/Clock – Press *timer* to switch the display into timer mode. Press *clock* to switch back into normal clock mode. Note that the timer can be running even while the clock is displayed.

Reset – Sets the timer back to its start time. The start time is set via *Set Timer Value*, described below.

Up/Down – Sets the timer into count-up or count-down mode.

Set Timer Value – Sets the current time on the timer to the specified value. On six-digit clocks, all three values will be shown. On four-digit clocks, seconds values will only be shown once hours reach zero.

Beep – Sounds the clock's internal beeper for the specified number of quarter-second intervals. Set to 4 to ring for one second.

Use Physical Switches – If the web interface is used to control a timer that also has physical switches, the physical switches will be ignored until this button is pressed. Once this button is pressed, the timer will switch to whatever mode is set on the physical button switches attached to the clock.

National Time & Signal - Cl

<< Back to Main

Timer Control - Port 1 Only

Start Stop	Reset
Timer Clock	Up Down

Hours
Minutes
Seconds
Set Timer Value

Outputs
Duration: 4   Beep
(1-98 quarter seconds)

Press this button to enable phyical switches on clocks with the optional timer control switches attached.
Use Physical Switches

Page Details — Digital (DW) Clock Controls — Digital Display Settings

This page allows configuration of digital-clock-specific display options.

12/24 Hour Format – Set to *0* for default 12-hour time (AM/PM) display, or set to *1* for 24-hour (military time) format.

Low-Light Brightness – The brightness of the display when in a low-light environment (ie: the room lights are turned off or there is little sunlight). This value should be set to something lower than the high-light brightness. The clock will automatically use this lower brightness to prevent the display from being overwhelming.

High-Light Brightness – The brightness of the display when in a bright environment (ie: the room lights are on or there is bright sunlight). This value should be set to something higher than the low-light brightness. The clock will automatically use this higher brightness to ensure that the clock is visible.

Auto-Dim Threshold – Determines the ambient light level where the clock switches from low-light brightness to high-light brightness. The light sensor is located on the front face of the clock in a hole in metal case in the bottom right corner and to the left of the two smaller settings holes. It can be tested in a lighted room by placing a finger over the sensor to simulate darkness.

Beeper Settings – When countdown events from the built-in timer or from scheduled bell events complete, the internal beeper can be set to sound. Set to zero to disable the beeper.

Save Settings – Press this button to commit the new settings to the clock.

National Time & Signal - Clock Set

Display Settings

12/24 Hour Format:
1
1=12-hour, 0=24-hour format

Low-Light Brightness:
2
0 (dimmest) - 9 (brightest)

High-Light Brightness:
6
0 (dimmest) - 9 (brightest)

Auto-Dim Threshold:
3
0 (dimmest) - 9 (brightest)

Beeper Settings

Duration: 4
Measured in quarter-seconds, 0-98. Beeper sounds for this duration after a timer expires.

Save Settings

Page Details — Analog (Spectrum) Clock Controls — Clock Movement Control

This page allows for direct control of the clock movement. This won't be needed in normal operation, but can be useful for troubleshooting.

Reset to Current Time – Uses the current time on the Wi-Fi module to change the clock position. In normal operation, the clock will be updated with current network time as soon as the Wi-Fi module fetches the time from the network. If you then manually enter a time into the web interface, the clock will not immediately update. This button forces the clock to return to 12:00 and then correct to the current time as displayed on the built-in web page. This process may take 10-15 minutes to complete.

Clock Movement Control

The clock movement takes about ten minutes to finish its reset cycle. It will move to 12:00, and then to the current time. It may stay at 12:00 for several minutes during this process.

Park and Hold will set the clock to 12:00 until the batteries are removed and replaced.

[Reset to Current Time]

[Park and Hold]

[Set Wi-Fi to Sleep]

Park and Hold – Sets the clock's hands to 12:00 and holds them there until power is removed and restored. This can be used to facilitate hand replacement or shipping. When at the 12:00 position, the shipping pin can be inserted into the back of the clock to lock the hands in position.

Set Wi-Fi to Sleep – Forces the clock's Wi-Fi module to go to sleep. It will wake up again at the time specified by the *Time Settings* page. Testing this can ensure that the clock's sleep and wake-up circuitry are functioning properly.

Page Details — Network Settings

The network settings allows for configuration of all the clock's Wi-Fi connection options.

Current Network: The currently connected Wi-Fi SSID.

Current IP Address: IP Address on the building Wi-Fi network.

Local Access Point: If the clock's built-in access point is active, this will show how much longer it will be active. The built-in Wi-Fi can be activated or extended in duration by pressing the clock's *Setup* button (see Quick Start section for details).

Network Name (SSID): The Wi-Fi network to which the clock will connect. Note that capitalization and spacing *must* be correct for the clock to join the network.

Network Mode: *Normal* is used for any network that has a shared password for all users (called a pre-shared key). *Enterprise* (EAP/802.1x) networks require a user name and a per-user name to join the network. Consult with your IT administrator to determine which settings to use.
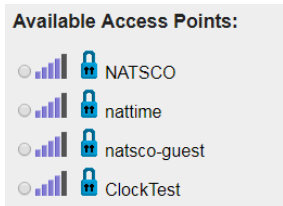
Network Password: The Wi-Fi network password. If using Enterprise mode, this will be the user password.

Available Access Points: Shows access points that are broadcasting locally. Initially this will show as "Scanning…" and after a few seconds it will change to a list of the local networks. Pick one of the networks to automatically set the network name to the selected SSID. This can help prevent typos in the network name field.

Wi-Fi Active Time: (Hardwired clocks only) Hardwired clocks can be configured to either stay on the Wi-Fi network permanently or to disconnect as soon as they fetch the current time. Staying online is required if the clocks will be executing bell/countdown events. However, disconnecting the clocks will free up a small amount of resources on the building's network and is the most secure configuration.

Static IP Settings: If a dedicated IP address must be used, enter it here. Dynamic address is recommended in most cases.

Save Settings: Press this button to commit the new settings to the clock. Unlike the *Quick Start* settings, the settings on this page will immediately get pushed to the clock and the clock will attempt to connect. The connection to the clock may drop temporarily during this process. If necessary, re-join the clock's internal Wi-Fi and/or reload the web page.

Page Details — Time Settings

This page allows for configuring the time zone and time server information.

Time Server: This is an SNTP time server. The default server, *time.natsco.net* is a free service provided by National Time. If you use this server, you will also be able to use our free cloud monitoring service at http://cloud.natsco.net to check the status of your clocks[4]. Other options include a local TIMEWiSE-enabled master clock, which also allows for supervision and monitor of the clock. Finally, you can use any SNTP server (such as pool.ntp.org or a local Windows Server) to provide basic time information[5].

Timezone Offset: Offset in hours from UTC / GMT time. US Eastern Time is -5. For half-hour offsets, decimals may be used. For example, Newfoundland would have a value of "*-3.5*".

Daylight Saving Time Rule: This text defines a custom daylight saving time rule. The common values below can be used, or consult with National Time's tech support for additional regions. To disable DST, set the field to blank.

Region	Rule	Description
United States	3.1.0.2;11.0.0.1;1	Start: Second Sunday in March End: First Sunday in November
Europe	3.5.0.2;10.5.0.1;1	Start: Last Sunday in March End: Last Sunday in October
Australia	10.0.0.1;4.0.0.2;1	Start: First Sunday in October End: First Sunday in April

SNTP Format: Set to *Natsco Cloud* if getting time from *time.natsco.net* or a TIMEWiSE-enabled master clock. This format allows cloud monitoring. In general, the cloud format works with all time servers. However, you can set this option to *Basic* to have the clock use a completely standards-compliant time request format. Set to *Disabled* to prevent all time updates.

Update Days/Hours: (Spectrum Analog Only) Select the days and hours when the clock will fetch time. We recommend every day at 5:00 AM, when network traffic is low.

Save Settings: Press this button to apply the settings and immediately try to fetch the time. Note that analog clocks that have already fetched their time will not re-correct the clock until the next wake-up cycle.

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[4] Some previous versions of firmware incorrectly state that pool.ntp.org provides cloud monitoring. For cloud monitoring, use *time.natsco.net* instead.

[5] **IT Note:** the network firewall must allow UDP port 123 traffic to the selected server.

Page Details — Bell Settings

When a DW digital clock is configured to get time from a National Time master clock or TIMEWiSE supervision server, bell events can be scheduled on the master clock that will activate the beeper or timer countdown functionality on the clocks.

Circuit Settings

Circuit 0 (Clock):
`0`

Circuit 1 (Built-in Relay):
`0`

Save

Circuit 0 (Clock): This is the internal beeper/countdown display. If the bell circuit on the master clock is set to 16, then you would set this to 16 to have the clock beep when a bell event on the master clock triggers circuit 16.

Circuit 1 (Built-in Relay): This is the built-in relay of the clock. If this relay is available on your particular model, it can be used to trigger external devices such as horns or lights when this circuit is activated from the master clock.

Password Settings

New Password:

Re-type New Password:

Save Password

Page Details — Password Settings

This page allows you to set a new password for the clock's web interface. Be sure to keep the new password safe, as it will be required to make any future changes on the web page. If you ever forget the password, you can use the *Setup* button on the clock to reset to defaults.

Page Details — Update Firmware

Occasionally, National Time will release new versions of the Wi-Fi radio firmware to add new features or to address issues found in the field. On these occasions, our support team may send you a file ending in ".bin" for uploading onto the Wi-Fi radio. To update the firmware, follow these steps:

System Information
Serial Number: *5001*
Radio Version: *1.1.8*

Upload your firmware
Select a file to upload. The file must be a firmware binary ending in ".bin".
Choose File | No file chosen
Upload

1) Download the new .bin file onto your laptop
2) Wake up the clock and connect to it via the building Wi-Fi or the clock's internal Wi-Fi.
3) Navigate to the *Update Firmware* page.
4) Click *Choose File* and select the .bin file from step 1.
5) Press *Upload*. You will see a progress indicator, and then the clock will restart. You may need to reconnect to the clock or reload the webpage. When the process is complete, the new firmware version will show under *System Information*.

Monitoring and Supervision

The status of a clock can be monitored using the **Natsco Device Cloud** at http://cloud.natsco.net

Using the Natsco Device Cloud, you can:

1) Directly check the status of a particular clock
2) View clock check-in history
3) Create lists of devices
4) Configure daily or weekly email reports

The Device Cloud can be used from any phone or PC from any location (at home, on the road, etc). As long as your clocks are set to check in with *time.natsco.net* or a National Time master clock, the Device Cloud will keep a log of the clock check-ins.

To begin, open a web browser and navigate to http://cloud.natsco.net

The device cloud has two major sections.

1) Lookup Clock: This option lets you check the status of a particular clock. It is best used for troubleshooting a specific clock.
2) Clock Lists: This option allows you to build lists of clocks for quick status checks of an entire building. You can also use these lists to generate email reports at regular intervals.

Read more about these options below.

Clock Lookup

Using the *Lookup Clock* section on the Device Cloud site, enter the serial number from the back of the clock. In this example, let's look up device 5018. After the serial is entered, press *Get Clock by Serial*.

The status page will appear with a summary of the clock status from the last time it checked in. The fields are as follows.

Device Type: The model of clock.
Last Seen: The time (in UTC) when the clock was last seen.
Battery Voltage: On battery units, a voltage of <2.2V indicates the batteries should be changed.
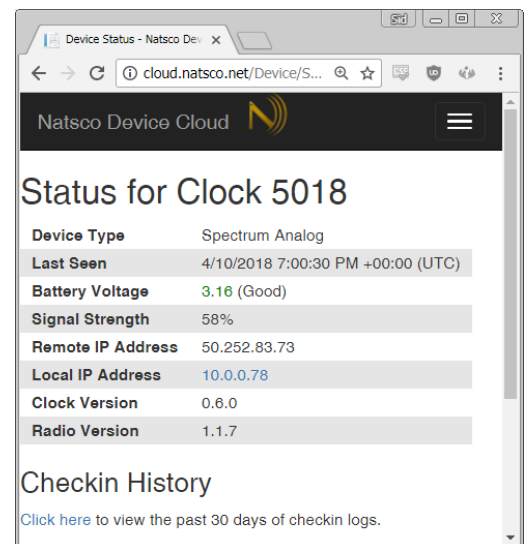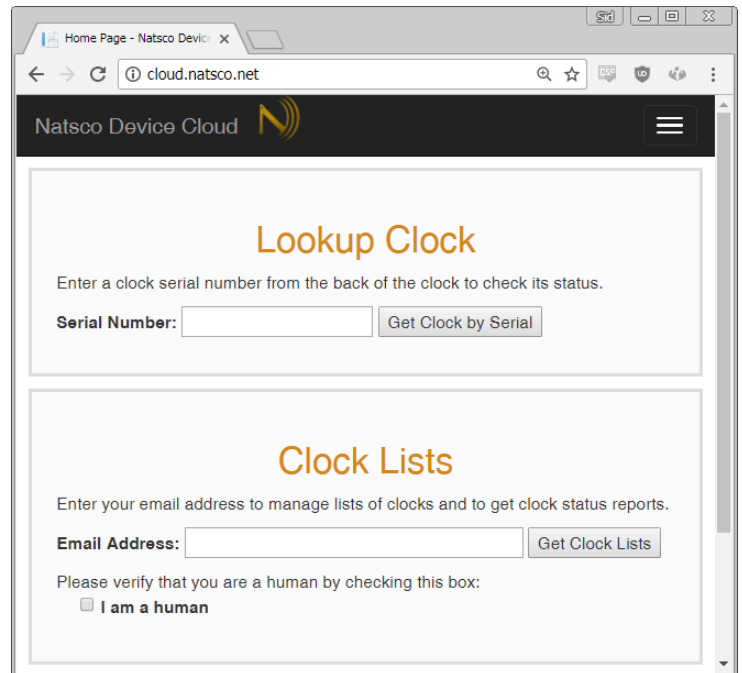
Signal Strength: Signal strength should generally be above 20% for reliable communication.

Remote IP Address: The IP address that the Natsco Device Cloud sees when the clock checks in. This is usually shared within your building.

Local IP Address: The local IP address of the clock. This will only be accessible within your firewall.

**Clock Version:** The firmware version of the clock movement or display.

Radio Version: The firmware version of the Wi-Fi radio chip.

A **Check-in History** option is also available to see the recent check-ins of the clock. This can be used to diagnose connection issues or to inspect network reliability. How often the clocks connect will also depend on their check-in schedule.

Clock Lists

Clock lists provide any easy way to manage a list of your clocks. To begin, enter your email address into the main screen under *Clock Lists* and be sure to choose the *I Am a Human* checkbox.

Once you enter the Clock List screen, you will be presented with all of the lists associated with your email address. If there aren't any yet, you can click *Create a new device list* to make your first list.
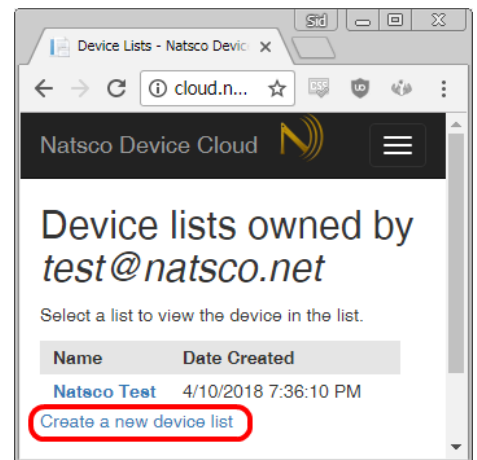
Get a Configuration Device

You can configure your clock with any smartphone, tablet, or laptop. Your device must have its Wi-Fi turned on and it must have permission to join Wi-Fi networks. For the sake of these instructions, we'll assume you're using a phone, but tablets or laptops may be used interchangeably.
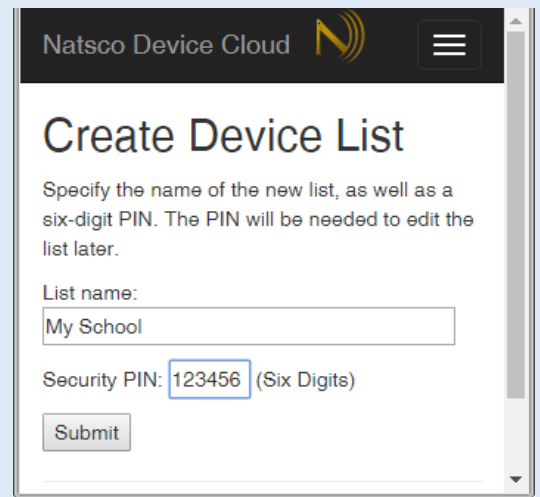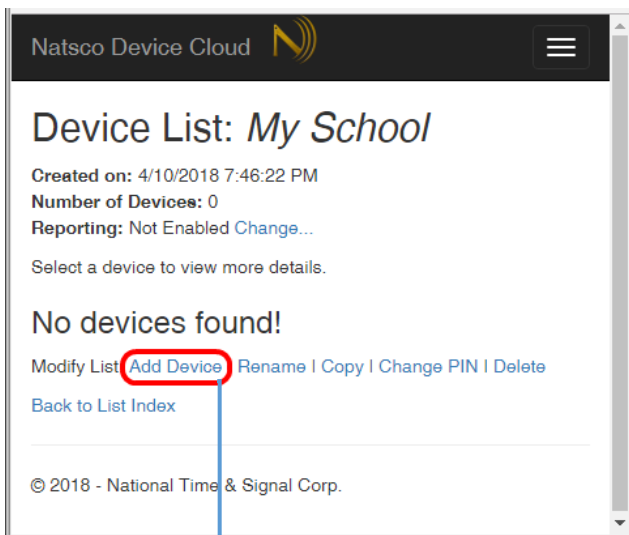
Connect to Web Configuration

We'll start off with your phone on your building Wi-Fi or cellular service. Open a web browser and go to **http://natsco.link** to begin. When the page loads, press the *Let's Go* button.

Creating a Clock List

Name the list (usually with the building name) and assign a six-digit PIN to prevent others from editing your list.

Clocks can be in more than one list, so you can also create extra lists to sub-divide your clocks even further. For example, you could create one list for the entire building and another list for another area. In addition, other users can add the same clocks to their own lists.

Adding Clocks to the List

Initially the list will be empty. Add clocks by clicking *Add Device* at the bottom of the list. It is easiest to add all of the clocks at once after they have been positioned in their various rooms, but you must be sure to record the serial number and location as they are being hung.

List Maintenance

Once the list is created and some clocks are added, you have several options for maintaining it:

Edit allows you to rename a clock.
Remove deletes a clock from the list.
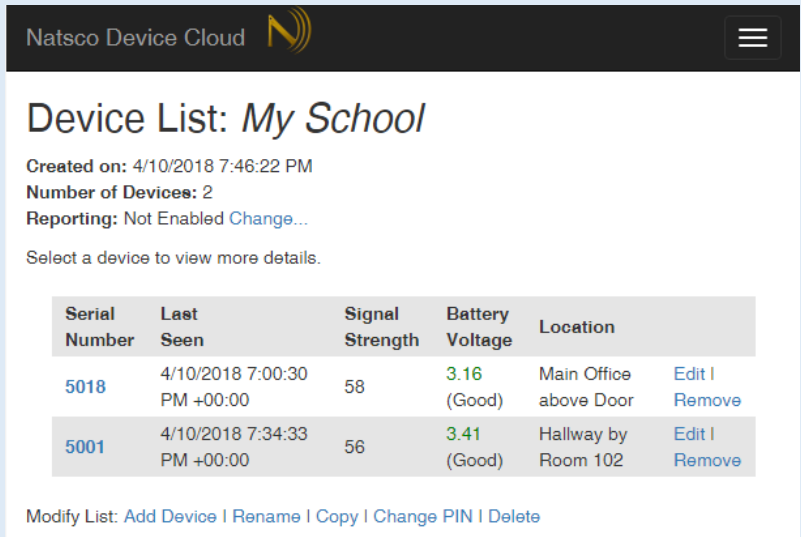**Rename** renames the list.
Copy allows you to copy a list to a new list or a different email address.
Change PIN lets you change the PIN for the list.
Delete deletes the list. All clocks will still be able to check in like normal, and any other lists containing the clocks are unaffected.
Reporting →Change lets you configure daily or weekly status reports on your clocks.

Natsco Device Cloud

Device List: *My School*

Created on: 4/10/2018 7:46:22 PM
Number of Devices: 2
Reporting: Not Enabled Change...

Select a device to view more details.

Serial Number	Last Seen	Signal Strength	Battery Voltage	Location	
5018	4/10/2018 7:00:30 PM +00:00	58	3.16 (Good)	Main Office above Door	Edit I Remove
5001	4/10/2018 7:34:33 PM +00:00	56	3.41 (Good)	Hallway by Room 102	Edit I Remove

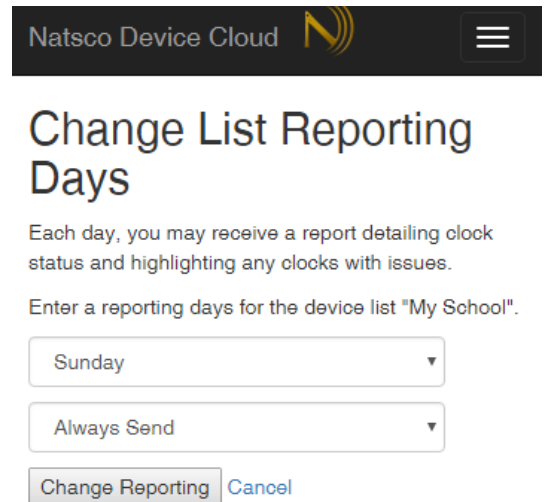Modify List: Add Device I Rename I Copy I Change PIN I Delete

Reporting

Device list reports send daily or weekly reports to the email address with which the list was created.

Day of the Week allows you to pick which day(s) to send the report.

When to Send allows you to always send the report or to only send it if there are clocks that have low battery/signal or which are not checking in for several days.

Sunday is a recommended report day, since it will help identify any daylight saving time issues at the start of the week.

Natsco Device Cloud

Change List Reporting Days

Each day, you may receive a report detailing clock status and highlighting any clocks with issues.

Enter a reporting days for the device list "My School".

| Sunday ▼ |

| Always Send ▼ |

Change Reporting Cancel

Clock Status Email

If the clock status report has been enabled on a list, you will periodically receive email detailing the clock status. To see more details about the clock list, you can simply click *view the clock list here* at the bottom of the email.

Note: a clock might have multiple trouble conditions. For example, a unit might show as off-line *and* low battery if the battery has expired.

🕐 Clock Status Report for **Dexter Cornerstone Elementary**

Total	Healthy	Offline	Low Battery	Low Signal
19	18	0	0	1

For a complete report of every clock, view the clock list here. If you've received this message in error, please notify support@natsco.net for removal.

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Troubleshooting

General or Wi-Fi Connection Issues

Symptom: The status light has a solid green or red, or green and red are blinking together.

1) The clock is in factory mode. Factory mode can be entered by pressing the button for 45 seconds, and might happen if the clock is resting on an uneven surface. Factory mode will lead to the hour being wrong at certain times of day. To get the clock out of factory made, simply hold the button on the back for five seconds and then let go. The lights should go back to only one LED being active at a time. *You will need to re-enter the clock settings* after leaving factory mode. On Spectrum Analog clocks, you must also *remove and replace the batteries* after exiting factory mode.
2) Please note that holding the button on the clock for more than 30 seconds will place it into factory mode. Please take care not to stack the clocks or place them on uneven surfaces, as this can reset the unit to defaults or put it into factory mode inadvertently.

Symptom: The status lights are not blinking at all.

1) If a battery-powered unit, check that the batteries are AA Energizer Lithium and that they are still good. Try a new pair of batteries and make sure they aren't backwards in the holder.
2) If a wall transformer unit, ensure that 120V is going into the power adapter and that all wires are connected properly. Try a different outlet and swapping transformers between two different clocks to identify the source of the issue.
3) If a hardwired 120V unit, ensure that the black transformer leads are wired into live 120V power, and that the transformer is putting out 24V. You may need an electrician to check on these measurements and to verify the wiring.
4) If you still don't get any blinking, contact support for an RMA.

Symptom: Status LED is stuck on one red blink.

1) The Status LED should never get stuck on a single blink. This may indicate a hardware failure or low battery. Observe the pattern for 30 more seconds to ensure it doesn't change to another status code. If it changes to a different code, then investigate that code instead. If it stays on a single blink, please check the clock's power source and replace the batteries, if applicable. Otherwise, contact support.

Symptom: Status LED is blinking red two, three, or four times.

1) This indicates a wrong Wi-Fi password. Please ensure that you've chosen the correct Wi-Fi network and password, and be careful that the capitalization is correct. Many phones like to auto-capitalize the first letter of the password and network names. In addition, some networks may indicate a password error when the issue is really with the network name; in either case, it is best to check both settings.

2) Ensure the Wi-Fi network doesn't have a "captive portal" that requires a disclaimer to be acknowledged. This is common on guest networks. In this case, please contact your IT admin for advice on an alternative authentication method.

Symptom: The clock keeps losing its settings.

1) Please note that holding the button on the clock for more than 10 seconds will reset to defaults, and holding it more than 30 seconds will place it into factory mode. Please take care not to stack the clocks or place them on uneven surfaces, as this can reset the unit to defaults or put it into factory mode inadvertently.

Symptom: Status LED is blinking red five times.
1) The time server is not reachable. The default time server is *time.natsco.net*. To reach this server, your IT staff must ensure that the clock's Wi-Fi network can send data through your firewall on UDP port 123.

2) A captive portal may be blocking time packets between the clock and the Internet. Consult with your networking admin.

3) If you've programmed a local time server, ensure that the time server is online and working.

Symptom: I don't see my clock's serial number on the app or my phone's Wi-Fi list. However, I do see a serial number zero or "Timewise0" SSID.

1) This can be caused by a manufacturing issue. The clock will still function and tell time in this case. However, if you want to use the cloud.natsco.net supervision services, you will need a proper serial number. Please contact support for an RMA. If you have multiple clocks plugged in, please be certain you have identified the clock with the issue by removing power from the other units.

Setup Issues

Symptom: Saving fails at "Sending settings…" or "Reinitializing".

1) Ensure that the phone/laptop is still connected to the clock's Timewise network and that the clock is still awake with a blinking LED. Press the button once to wake up the clock if necessary.

Symptom: Saving fails at "connecting to building Wi-Fi".

1) Ensure SSID and password are correct.
2) Ensure that the network is 2.4 GHz. 5 GHz networks are not supported.
3) Ensure that the network doesn't have some protocol such as EAP or MAC-based authentication. See your IT admin for details. Note that if device MAC addresses are needed, National Time tech support can provide a list of MAC addresses for all clocks on an order.

National Time & Signal - Clock Setup
Connected to S/N 5001

Save Settings

Press *Save* below to save the new settings to the clock. The clock will then try to connect to the building Wi-Fi network.

1. Sending settings...

2. Settings saved successfully. Reinitializing...

3. Clock connecting to building Wi-Fi...

4. Fetching time information...

Previous   Help   Save

Spectrum Analog Wi-Fi

Note: most of the resolutions below apply for both the hardwired and battery Wi-Fi. If instructed to remove the batteries on a hardwired unit, simply unplug the clock's power cord barrel plug instead.

Symptom: The Clock Hands are not moving.

1) Start with removing and then replacing the batteries, then wait one minute.
2) After setting the time or putting in batteries, it will take about 4-5 minutes for the hands to move around. The will first move all the way around to 12 to calibrate, and then they will move to the correct time. The entire process may take 10-15 minutes.
3) Ensure that the light on the back of the unit is blinking green. If it is not blinking or blinking a red status code, please correct that issue first.
4) Verify that the *shipping pin* is removed. If the pin was removed *after* the batteries were inserted, the movement may have decided it was jammed and given up on moving. If this happens, simply remove the batteries and replace them after a few seconds. If the hands still won't move after fifteen minutes, please contact support for an RMA.

Symptom: The clock isn't exactly on the right minute.

1) Press the button on the back once and ensure that you have green blinks, indicating a good network time update. If the blinks aren't green, please refer to that symptom first.

Symptom: During setup, the clock went to 2:30 after spinning around a couple times.

1) The clock will go to 2:30 if no time can be found. In this case, the phone was not set to send the time to the clock and the clock can't connect to a valid time server. Examine the number of red blinks on the back and then follow the steps in the "Wi-Fi Connection Issues" troubleshooting section.

Symptom: The clock is on the right minute but the wrong hour.
1) The clock may be in factory mode. Press the button on the back. If you see one of the LEDs go solid, or if both of the LEDs (red and green) are flashing at the same time, the clock is in factory mode. Please refer to that symptom for instructions on reverting to normal operation.
2) The clock may not be picking up network time. Please ensure that there are six green blinks on the back of the unit before proceeding.
3) The clock's time zone or daylight saving time settings may be incorrect. Ensure that the correct settings for your locale have been entered. You can verify these settings via the "advanced" page of the clock's built-in webpage, or you can re-enter them using the quick start web page.
4) If none of the above fix the issue, there may be an internal fault. Please contact support for an RMA.

DW-Series Digital

Symptom: The clock was on time when I set it up, but is slowly drifting off-time.

1) The DW series have a built-in capacitor that can keep the time updated while the clock is powered off during shipping. When you first plug it in, the clock may still be on time, even though it is not connecting to your network. Please verify that the status LED on the front of the clock is blinking green six times. If it is not, please refer to those symptoms for more debugging steps.

Symptom: I'm trying to reset my DW-series clocks to defaults by holding the front button down, but nothing is happening.

1) Since the button on the DW-series is front-facing and easily accessible, the "reset to defaults" behavior is only available for the first minute after power-up. Please note that resetting to defaults won't generally have a useful effect in the field, since programming settings via your phone/laptop will erase the device's settings anyway. The one major exception would be the "internal password" setting. If that needs to be cleared, then you must first power-cycle the clock and *then* hold the button down.

Revision History

Initial Release – May 2018

Revision B – January 2019

Revision C – May 2019