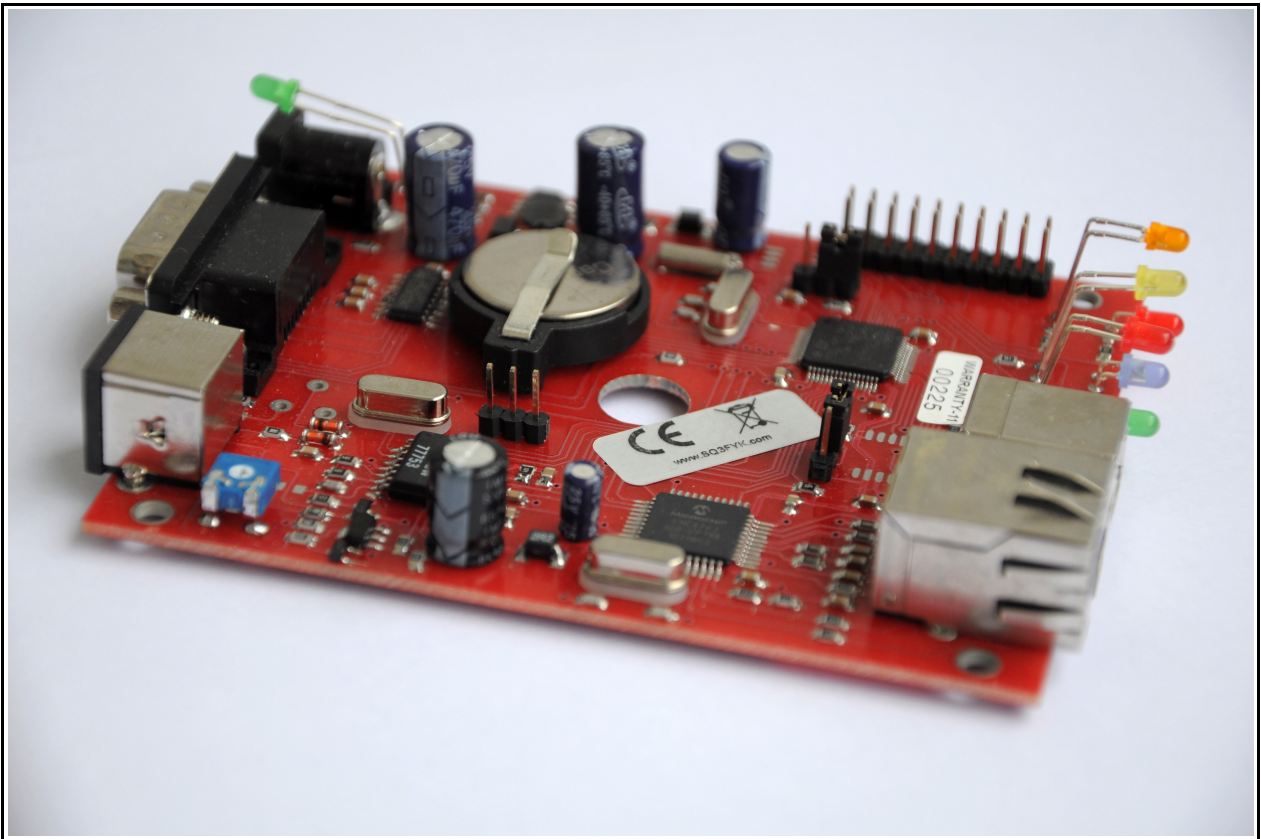


WX3IN1 (v1.14)

APRS DIGIPEATER
APRS-IS CLIENT
APRS-IS MESSAGES FORWARDING
WEATHER STATION SERVER

Instruction manual
Configuration software manual



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1. Technical parameters

Dimensions	111x91x35 mm
Weight	200g
Supply voltage	12VDC typ. (9 - 16VDC)
Power consumption	80mA
Operation temperature	-30°C / +70°C
Humidity	95% max.
Ethernet	10/100 Base-T
Power connector	5,5mm connector
Weather station connector	DB-9 male, RS-232 standard
PC connector	USB-B (printer cable type)
Radio connector	Mini DIN 6 pin (PS/2)

2. Device features

2.1. APRS client / digipeater

The main purpose of the device is receiving and sending data frames via APRS radio. WX3in1 is capable of receiving an APRS frame, decoding the sender, recipient, path and information field. Then actions are performed in accordance with the options configured by user:

- Frame forwarding via the APRS network,
- Sending a frame to the APRS-IS server,
- Possibility to ignore the frame if it does not meet the specified criteria.

The device firmware implements the following mechanisms:

- Checksum Verification - frames with errors are ignored,
- Anti-flood - repeated frames in a short time interval are not forwarded,
- Path checking - the decision to frame forwarding is based on a path, the user defines whether to forward WIDE1-1, Widen-N, Spn-N frames and the maximum value of n.

WX3in1 also allows you to generate APRS data frames APRS with information field defined by the user and send them in a specified interval. In this way, it is possible to send beacons and objects.

2.2. APRS-IS client

WX3in1 allows you to connect to APRS-IS network servers. After logging to selected server, it is possible to send data received from the APRS radio network. All frames with correct format and checksum are sent by the device.

2.3. APRS-IS messages forwarding

The device allows you to receive messages from the APRS-IS server. Then the destination station is checked if it is heard in the immediate vicinity of the radio APRS network. If a station is heard then message frame is sent via APRS radio and repeated three times in the absence of confirmation ACK.

2.4. Weather station server

WX3in1 allows you to receive weather information from the WS2300 and WS2350 stations via the RS-232 cable. The data is then encoded into the APRS frame and may be sent to a radio network at specified intervals. Additionally WX3in1 allows you to send the same frames to APRS-IS server.



3. Connecting to weather station

WX3in1 works with WS2300 and WS2350 weather stations. Communication between the weather station and WX3in1 is possible using RS-232 cable supplied by the manufacturer of the station. The cable must be connected to the WEATHER DB9-type connector on the WX3in1 rear panel.

It is not necessary to set the time and date in the weather station as WX3in1 has its own internal RTC (Real Time Clock) with battery backup.

It is only necessary to calibrate the atmospheric pressure and reduce it to a value relative to sea level (WX3in1 sends an ABSOLUTE pressure value and not relative, which is not being calibrated in these models of weather stations).



Tips for assembling of the weather station sensors.



The signal from the anemometer and rain gauge is sent to an intermediate unit (thermometer and hygrometer) in an analogue way. Only after the exit of the intermediate unit data is sent to a central unit with LCD display in digital form, so DO NOT install the anemometer and rain gauge directly under the antenna of APRS transmitter, as it can cause incorrect calculation of unit rainfall. Observations show that the rain gauge and anemometer distance of about 6 meters from the antenna does not cause problems in the operation of the receiver.

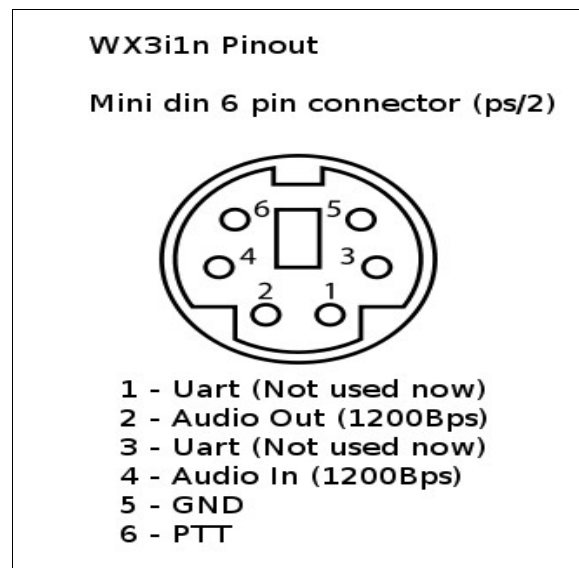
This tip is not part of the weather station installation instructions and it comes from experience and field tests of WS2300 and WS2350 stations.

Be sure to read the installation instructions for WS2300 and WS2350 weather stations supplied by the manufacturer.

It is recommended to make a connection between the weather station and sensors using a cable and dispense with the unreliable and insecure radio communications, which may be further distorted by the APRS antenna.


4. Connecting to radio

Radio MINI DIN 6pin connector is placed on the rear panel of WX3in1. Pinout of this connector is described in the following figure.



Connector pinout description:

1. RS-232/UART pin (currently not used),
2. APRS signal output from the device to the microphone input of radiotelephone. This output also acts as a signal of PTT by shorting pin to ground through a resistor 2k2 - an option for portable radios that do not have a separate PTT output,
3. RS-232/UART pin (currently not used),
4. APRS signal input from radio to WX3in1,
5. Ground pin,
6. PTT output - if the external PTT output is selected in device configuration, this pin is shorted to ground while broadcasting.

 The level of input and output should be individualized in such a way that the frames are decoded correctly. Recommended input signal amplitude is about 0.7V. Potentiometer inside of the device is provided for output signal level adjustment.

5. Connecting to PC

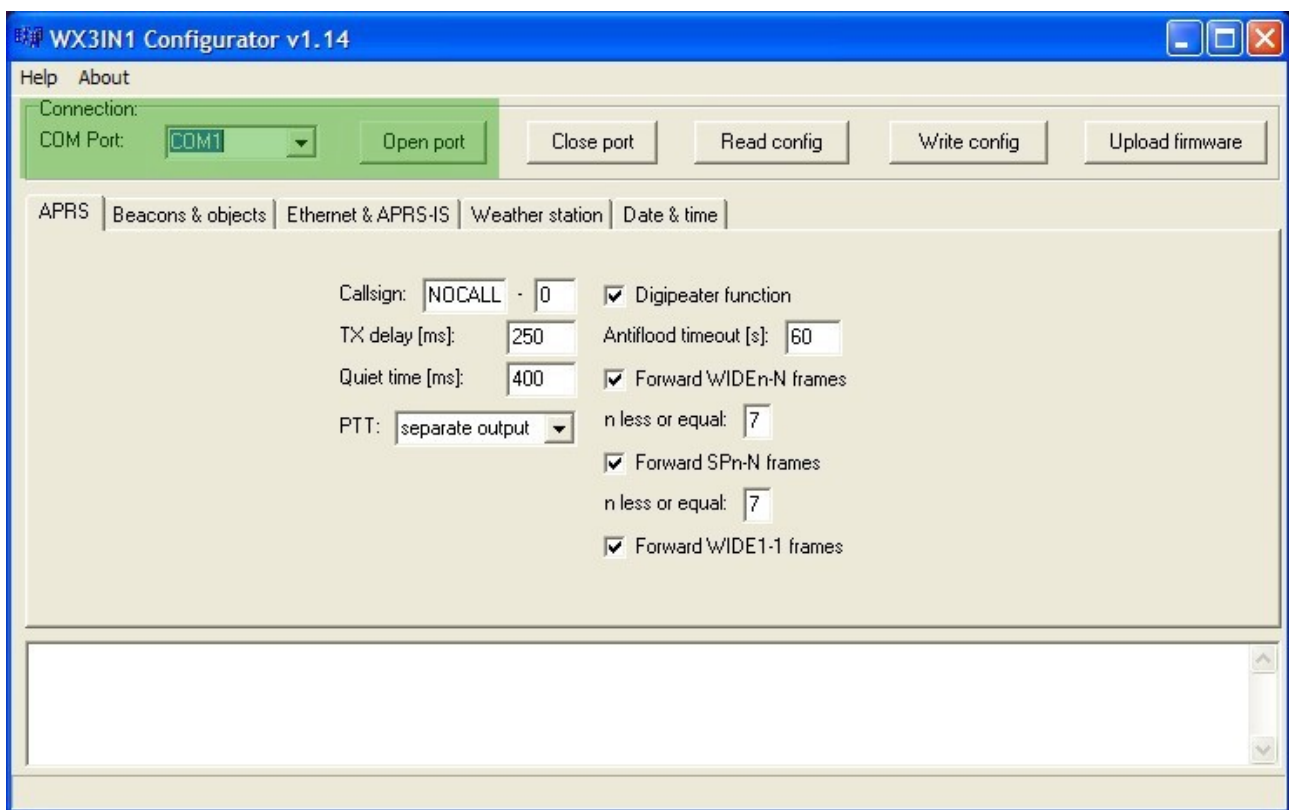
WX3in1 device is configured with the WX3in1 Configurator software. To connect to your computer, follow these steps:


- Power off the WX3in1 device,
- Connect the USB cable to your computer,
- Power on the WX3in1 device,

WX3in1 enters into configuration mode only when USB cable is detected while powering up and it is indicated by SETUP led blinking.

After connecting and powering, WX3in1 is detected in Windows as a new device, then system asks for the drivers that are available in the drivers directory of WX3in1 software package. After this, run the configuration software and select the COM port where the device is installed. Then choose OPEN PORT (successful connection is indicated by a message window).

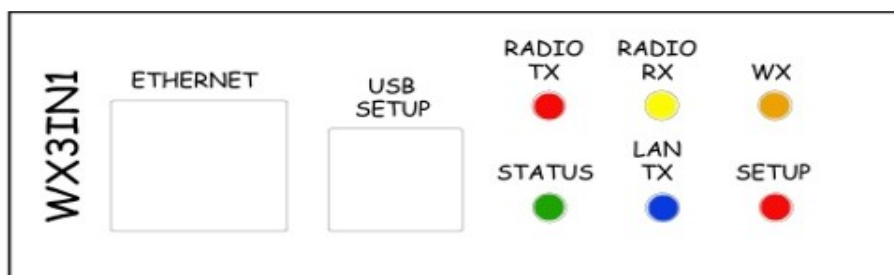
The following image shows the application window, the fields highlighted in green have been discussed above.



 Sometimes WX3in1 can install on a higher port which is not available for selection from within the application configuration. In this situation, please use the Windows Device Manager to find the port of the device and change the COM port number to lower in range of 1-10. Then disconnect the USB and after reconnecting WX3in1 should appear on the appropriate COM port.

6. Connectors and device status LEDs description

There are 6 leds on the front panel that show the status of device operation. The following image shows the location of LEDs and their meaning.



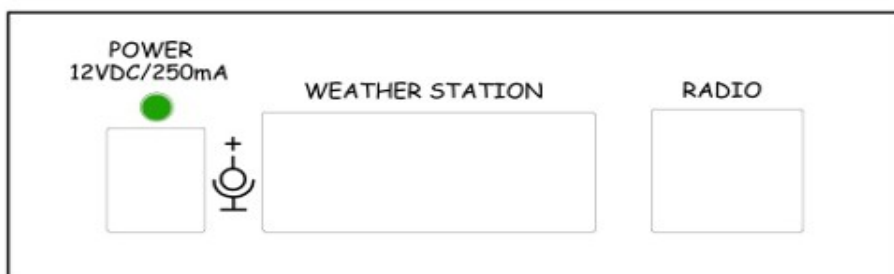
- Radio TX - The red LED lights during transmission - the device sends an APRS data frame,
- Radio RX - Yellow LED illuminates when receiving a signal from the radio (indicates the channel is busy),
- WX - Orange LED indicates proper communication with weather station, it blinks after correct weather data package reception,
- Status - Green LED indicates the status of the device (LED lights up regularly every 3 seconds, indicating correct operation),
- Lan TX - Blue LED illuminates when sending TCP/IP to the Ethernet,
- Setup - The red LED blinks when the device is connected to the PC,

Connectors:

- Ethernet - RJ45 (ethernet network connection)
- USB - a USB socket-B (printer type), used to connect to a computer (PC).

There are two additional LEDs in the Ethernet connector that indicate the status of the connection with the router. One of them lit all the time when the connection to the router is correct (it only indicates valid physical connection and not the correct IP address, gateway and netmask settings), a second LED is lit only when sending or receiving data.

The following image shows the location of connectors on the back panel of the device.



The green LED above the power connector indicates power is applied.

Connectors:

- 5.5-type power connector (center pin is a power supply plus)
- Weather station (DB9) - Connects to weather station,
- Radio - (mini din 6 pin) - Connects to radio.

7. Description of configuration software

7.1. Opening a connection

After running the application, it is necessary to select the COM port of WX3in1 assigned by Windows. Then use OPEN PORT to connect to the device.

7.2. Reading configuration from the device

To read the configuration from the device you must use the READ CONFIG button, after this action, the program will download current configuration values from WX3in1 internal memory.

7.3. Writing configuration to the device

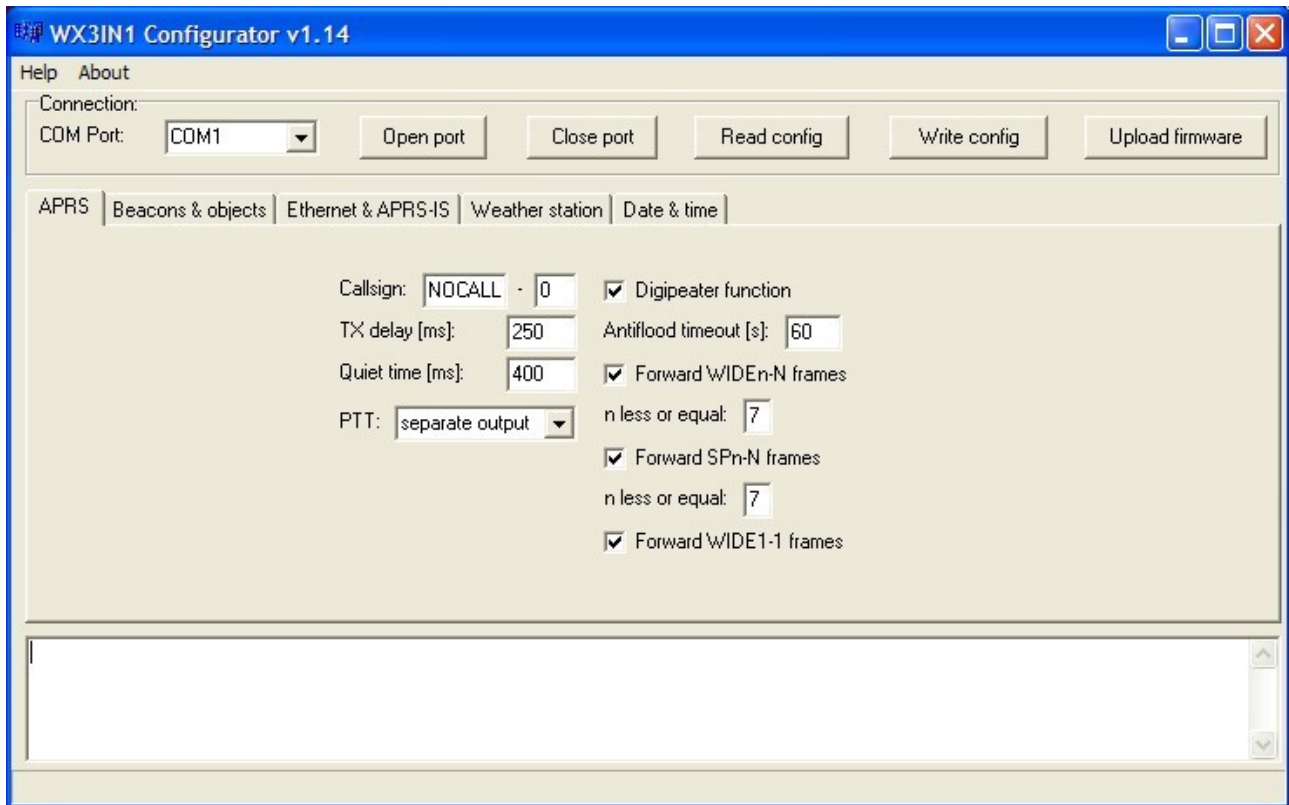
After entering all parameters, such as a characters, objects, beacons, times, etc., choose WRITE CONFIG to upload current configuration to WX3in1 internal memory.

7.4. Firmware update

If there is a new software update, you should upload the new firmware attached to WX3in1 Configurator software package. For this purpose, select the option UPLOAD FIRMWARE, then open a new window for selecting files. From the directory WX3in1 Configurator / firmware select the file wx3in1_firmware_vXXX.hash (where XXX is the next version of the firmware). After the update, disconnect the device from the computer and cycle power.

After updating the firmware, you may need to re-upload configuration settings.

7.5. APRS Settings



Below is the description of functions and their meanings:

- Callsign - The sign of our station with SSID extension. The default SSID is 0,
- TX delay (ms) - The delay time TX / RX in milliseconds for sending packages. It is a kind of preamble that is sent before the data frame in order to synchronize the receivers which listen on an APRS network. The recommended value is not less than 250ms,
- Quiet time (ms) - Minimum time off after the radio channel is busy. After this time data frame is sent from the transmit buffer,
- PTT - PTT output selection, we can choose between two options:
 - SEPARATE OUTPUT - PTT output pin is short-circuit to ground while broadcasting,
 - 2K2 RESISTOR - AUDIO OUT is short-circuit to ground with 2k2 Ohm resistor, function used in some handheld radios for broadcasting,
- Digipeater function - Forwarding packets from other stations if the path is set correctly,
- Antiflood timeout (s) - Time in seconds after which the next frame will be forwarded, if it has the same content as the previous one. This function allows you to ignore the stations, which are flooding the network frames with doubled frames,
- Forward WIDEn-N frames - Determine whether to forward Widen-n format. We can also set the maximum number of N to forward. For example, 7 will forward packets WIDE7-7 and below, while entering a different number, eg 3 will reduce digipeater to forward WIDE3-3 and below, with the exception of WIDE1-1 (WIDE1-1 is configured in following fields of the program),

- Forward SPn-N frames - Analogously to Widen-n and the number 2, for example, restricts Spn-N packets forwarding to SP2-2 and lower.
- Forward WIDE1-1 frames - Determine whether to forward WIDE1-1.

7.6. Beacons, objects and status configuration

Dest	DigiPath	Rate [min]	Aprsis	Message (empty messages are ignored, use string <date> to insert rtc date):
APNW01	WIDE2-1	5	<input type="checkbox"/>	@<date>z5223.13N/01658.09E-WX3IN1 Test.
BEACON0	none	30	<input type="checkbox"/>	
BEACON0	none	30	<input type="checkbox"/>	
BEACON0	none	30	<input type="checkbox"/>	
BEACON0	none	30	<input type="checkbox"/>	
BEACON0	none	30	<input type="checkbox"/>	
BEACON0	none	30	<input type="checkbox"/>	
BEACON0	none	30	<input type="checkbox"/>	

- Dest - The destination address when sending beacons, objects, status, etc. We can choose a destination address of APNW01 or BEACON. When frames are sent with the path (eg, WIDE2-2), we can only choose APNW01 as a destination address, which identifies the device as WX3in1,
- DigiPath - APRS path,
- Rate (min) - Parameter, expressed in minutes, in which we determine how often the data frame will be sent,
- Aprsis - You can also choose whether, in addition to the radio path, the frame will be sent also to the APRS-IS server,
- Message - Frame structure field, when the field is empty then the frame is not sent.

The following explanation of how to enter data in the message field.

To properly generate a frame structure, please read the information on the APRS frames. I recommend the website of the polish group's founder Andrew Bartosz SP3LYR APRS, where all is nicely described (in polish): <http://www.aprs.pl>.

Example frame:

@<date>z5223.13N/01658.09E_WX3IN1 Test.

- @ - APRS data ID,
- <date>z - time and date in the format DDHHMM (day / hour / minute), time is not a necessary parameter for each object, beacon, etc., it is dependent on whether you want to send frames with time or not,
- 5223.13N/01658.09E - Position of object, status, etc.,
- „_” - sign after coordinates is a symbol of our beacon station, object, etc., please refer to the table of symbols at <http://aprs.pl/ikony.htm>,
- WX3in1 test - information field, here we can enter our information about the station, beacon, etc.

To send a status of our station, object, etc. we have to introduce a combination of the following example:

>W2,SPn Poznan I-Gate,Digi,WX

In this case ">" means the identifier of APRS. Please refer to the explanation of APRS identifiers.

The data identifier (in our case is ">"), is followed by information field in which we can add our own entries.

7.7. Ethernet and APRS-IS configuration

Below is the description of functions and their meanings:

- IP Address - WX3in1 device IP address,

- IP Mask - WX3in1 network mask,
- Gateway - network gateway,
- APRS-IS Account - APRS-IS account information
 - Username - At this point we enter the call sign for the APRS-IS server, you can use the SSID. For example SR3XXX-10,
 - Password - Validation code obtained during the registration of the callsign in the APRS-IS network,
- APRSIS->RF Messages forwarding - We can select if WX3in1 to send messages received via the Internet for sites that are heard in the APRS network (for which the frames were received by WX3in1 in the past 15 minutes),
- IP1, IP2, IP3 - APRS-IS servers addresses from which messages will be received. WX3in1 tries to connect to the first address and, in case of failure, it connects to the next,
- Port - APRS-IS servers TCPIP port numbers,
- RF->APRSIS frames forwarding - The choice of I-Gate function. WX3in1 collects all packets received by radio (with the exclusion of RFONLY, NOGATE, TCPIP) and sends them to the APRS-IS server,
- IP1, IP2, IP3 - APRS-IS servers addresses to send frames received via radio. WX3in1 tries to connect to the first address and, in case of failure, it connects to the next,
- Port - APRS-IS servers TCPIP port numbers,

7.8. Weather reports configuration

The screenshot shows the 'WX3IN1 Configurator v1.14' window. The 'Weather station' tab is selected. The interface includes a 'Connection' section at the top with a 'COM Port' dropdown set to 'COM1' and buttons for 'Open port', 'Close port', 'Read config', 'Write config', and 'Upload firmware'. Below this is a tabbed menu with 'APRS', 'Beacons & objects', 'Ethernet & APRS-IS', 'Weather station', and 'Date & time'. The 'Weather station' tab contains the following configuration fields:

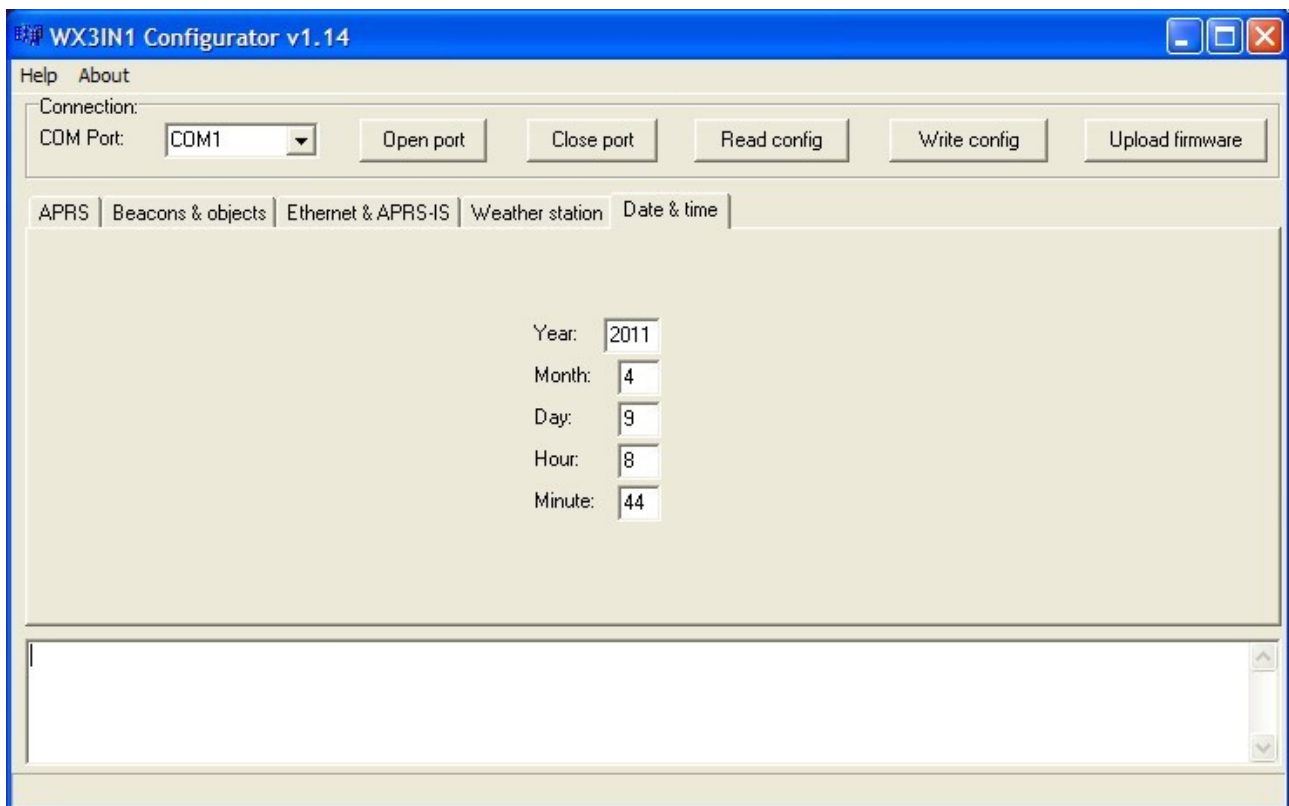
- Latitude: 5221.60N
- Longitude: 01653.63E
- DigiPath: WIDE2-2
- Comment: WX3in1 weather
- ☒ Weather to APRS
- APRS TX Rate [min]: 5
- ☒ Weather to APRSIS
- APRSIS TX Rate [min]: 5

At the bottom of the window is a large empty text area for logs or messages.

Below is the description of functions and their meanings.

- Latitude - north-south position,
- Longitude - east-west position,
- DigiPath - APRS path for weather reports,
- Comment - Weather reports comment field,
- Weather to APRS - If checked, weather reports will be sent to APRS via radio,
- APRS TX Rate - Time, in minutes, how often weather reports will be sent to APRS (minimum time - 5 minutes),
- Weather to APRSIS - If checked, weather reports will be sent to APRS-IS via internet,
- APRSIS TX Rate - Time, in minutes, how often weather reports will be sent to APRS-IS (minimum time - 5 minutes).

7.9. RTC clock configuration



WX3in1 has an internal real time clock to store current date and time in case of power failure. The clock is used for the dating of the position, beacons, objects and weather reports sent via WX3in1.



Real-time clock is maintained by a 3V lithium battery CR2032 type. The current drawn by the clock is ca. 2 uA, which ensures proper maintenance of the clock for about 5 years.

WARNING!

Danger of explosion if battery incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer of the battery.

