Gateway - Socket
Technical Manual

for use with NorthEast Monitoring's Wireless Recorders

Gateway - third edition
Socket Version 1.06

Socket

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1. Introduction to Wireless Recording

The NorthEast Monitoring DR300 and DR400 recorders come with a Wireless feature that uses Bluetooth technology to communicate with a paired device. The communication can occur between the recorder and a paired NorthEast Monitoring Gateway (black box).

Gateway Wireless transmission takes place when the Wireless feature on the recorder is turned "On" and there is event data to transmit. When this occurs, the recorder will look for a paired Gateway (receiver), and when found, will transmit data to the Gateway. In order to receive the data, the Socket software must be running and configured correctly at the receiving location.

For event recording, you will give the patient a paired recorder and Gateway to take home. Once an event is recorded, the event will be transmitted when the patient is in close proximity to the Gateway. Once the data is received, you are able to access this data via the Incoming Files screen in the LX Event software.

For a Gateway transmission, encrypted data is sent via the airways through a cell phone signal to a port on the IP address or domain name listed on the recorder. From there, the Socket Software receives, decrypts and copies the data to a defined location.When the transmission is successful, the receiver will communicate back to the recorder that the data has been successfully received. At that point, the event data will be deleted from the recorder.

If the patient is away from the Gateway for an extended period of time, the recorder will continue to try to transmit at regular intervals and once the patient is back in close proximity to the Gateway, it should eventually catch up and transmit all of the events.

Wireless Settings on the DR300

Your recorder has been set up with wireless settings that are unique to the receiving location. All of these settings must match the settings of the Socket and/or at the receiving location in order for wireless transmission to take place.

On the DR300, the Wireless Settings can be found under General Settings > More > Wireless > URL. The first screen on the recorder lists the three settings that were set up by NorthEast or your distributor and cannot be edited. These settings are required for the Gateway only:

- Remote Server URL - Fixed IP address or domain name of the receiving center
- Remote Server Port (4 or 5-digit number)
- Carrier APN
- Service URL-key which is unique to you

The second screen of the URL screen shows whether or not the recorder has been paired with a Gateway or Bluetooth adapter. The items on this screen are:

- Gate (Gateway)- The MAC address for the paired Gateway
- KEY ID - The receiving center identifier, which is an ID for the actual unique 256-bit encryption key for files sent via the Gateway.

Wireless Settings on the DR400

When paired with a Gateway, the wireless settings for the DR400, explained above, become visible on the PCPatch utility Settings screen. Wireless is the only option for Event recording on the DR400.

2. The Gateway

After being paired with a recorder, the Gateway is sent home with the patient for automatic wireless transmitting to the receiving location. In order for transmission to take place, the Socket Software and a router must be set up and running in order for transmission to take place.

The Gateway Kit includes:

- Gateway (part number NEMP00458)
- Antenna (NEMP00451)
- AC Adapter (NEMP00453)

As per FCC rules section 2.1091, only the antenna supplied is to be used and that the antenna must be in a location where it will be at least 20 CM (8 inches) from locations where any person will commonly be located.

Gateway Specifications

- Voltage: 90-264 volts
- Frequency: 47 to 63 Hz.
- Maximum current: 0.31A.
- Weight: 300 gms.
- Dimensions:

  Gateway: 83 x 133 x 38 mm

  Power adapter: 34 x 72 x 59 mm
- Operating temperature: 0 to 40 C

FCC Class B digital device notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: - Reorient or relocate the receiving antenna. - Increase the separation between the equipment and receiver. - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected. - Consult the dealer or an experienced radio/TV technician for help

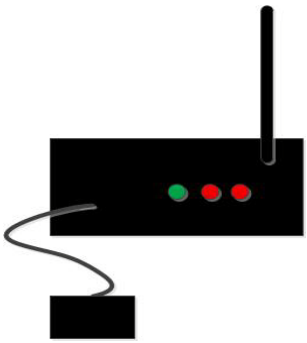
This device complies with Part 15 of the FCC Rules and Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

The Gateway

The Gateway is a transceiver (transmitter + receiver) that communicates with the wireless recorder. The Gateway sends the encrypted data via a wireless phone network to the receiving location. Both the recorder and the Gateway are able to transmit and receive data to ensure that encrypted data arrives at its desired location.

The Gateway comes with a power cord and antenna that need to be attached into the front of the Gateway. The antenna should be in an upright position. When located in the patient's home, the Gateway should be located in a central location. If the patient is away from the Gateway for an extended period of time, like going to work, the transmission will take place when they return.

The Gateway has three lights. The third light (rightmost), is the wireless connection indicator. When initially plugged in, this light will flash red at a very high rate. After that, if the light is blinking between 3 to 4 times in a row, there is an acceptable wireless connection. If it only blinks two



times in a row, there is a questionable connection with the cellular network, and the Gateway should be moved to a better connection. If the light only does a single blink, there is no connection at all to the wireless network.

The middle light is the recorder indicator. It will turn red when the recorder is communicating with the Gateway. This may occur when pairing the recorder with the Gateway or when ECG data is being transmitted.

The green light on the left, indicates that your Gateway is getting a reply from the receiving station. This will flash very quickly when communicating externally.

Pairing the DR300 with a Gateway

In order for wireless transmission to take place from the patient's home, the DR300 recorder must be paired with a single Gateway.

In order to pair the recorder with a Gateway, plug in the Gateway and go to the Wireless menu on the DR300 which can be found at General Settings > More > Wireless. At this point you go to "Pair Bluetooth" in order to find and pair with the Gateway that is plugged in and next to you. While pairing you will see a message when a Gateway is found and another message when pairing is successful.

Note: If you see the message "Found PC", this means that the recorder instead paired with a PC Bluetooth USB instead. You will need to remove the Bluetooth USB in order for pairing to work with the Gateway.

If the DR300 recorder has been on for a period longer than 10 minutes, and you see the message "No connection", you will need to restart the recorder by removing and reinserting the battery to enable the pairing process.

Once paired, you can view the MAC address for both the Gateway and the PC by going to the "URL" screen and clicking ENTER to view the second screen. Here you will see the Gateway MAC and the PC MAC addresses, if they exist. The Gateway MAC address must match the MAC address listed on the Gateway to be a pair.

If the Gateway MAC address on the DR300 does not exist or does not match the Gateway you are trying to pair it with, you can pair it now. Just press ENTER to return to the Wireless menu and click on the item listed "Pair Bluetooth". The DR300 will tell you if you are successful in finding or pairing to the local Gateway or PC on this menu.

Pairing the DR400 with a Gateway

For DR400 recorders to record Event, the DR400 must be paired with a Gateway. In order to pair with a Gateway, your organization must obtain a URL-KEY.dat file from NorthEast Monitoring.

Important: The URL-KEY file must exist in the bin or Remote directory where the PCPatch.exe file is running in order for paring to work. If no URL-key is present, the Pair Gateway button will not be enabled.

The Settings screen in the PCPatch utility has a button which allows for the pairing of the DR400 with a Gateway. You can do the pairing as follows:

1. Plug in the Gateway and allow it to find the wireless signal
2. Plug the DR400 into the PC with the PCPatch utility running
3. Go to the Settings screen and click on Pair Gateway.
4. When sucessful, you should see "Pairing Complete" and the Gateway number and URL-KEY file information will now appear on the Settings screen.

3. Data Reception Method 1 - Institute Based Server Method

System Requirements

The computer at the Service/institute where the Socket software is running must have the following minimal capabilities:

- Windows 7 Operating System;
- One (1) GB of RAM memory;
- Twenty (20) GB of available disk storage;
- Broadband Internet connection; and
- Ports 8000-8009 must be exposed to the Internet, except as otherwise agreed to in writing with North-East.

Setting up the Router

Because there are many types of routers with different instructions for doing this, it is suggested that the help of an IT professional be enlisted to accomplish this. Once set up, the following two items must match the first two Wireless settings on the recorder:

5. Fixed IP address or domain name - The receiving location must have a static IP address to the internet connection or the dynamic connection must use a service such as dyndns.org to provide a fixed name for the connection.
6. Port Forwarding - The IP address of the system location of the computer where the Socket software will be run, must be connected to a router that is set up to forward all UDP packets from port 8000-8009 to the computer with the receiving/socket software.

Additionally, any firewall on the system must have the selected ports opened for incoming UDP traffic.

Port Forwarding

If you are using a different port range, the selected port range must be 10 consecutive ports and the wireless.ini file in the Socket directory must be updated to show the first port number being used in service_port.

Additionally, the recorders must be updated to include a new port range before it can be implemented internally, and in order to accomplish this a new urlkey.dat file is required. You must contact NorthEast Monitoring or your distributor to get more information on how to update the Settings on the recorder.

Testing the Router with NetCat

We highly recommend that you test the router before continuing, and testing software, NetCat, has been supplied with the Socket install. Refer to the Technical section of this manual for instructions on running the test.Testing Router Set-up Using NetCat

Instructions for using nc (NetCat) for testing the router setup for the Socket installation. Steps are as follows:

1. On the computer where the socket software is to be run, open a command line window and change directory to the socket directory location:

```
cd \nm\socket
```

2. Run (that is a lower case l as in lima) not an upper case I:

```
nc -l -p 8000 -u
```

Note that on some installations the antivirus software may consider nc.exe a threat and may have removed it. It is a program which can send or receive arbitrary messages to or from anywhere with no checks.

3. On a computer outside the local system (not connected to the router being tested) copy the nc.exe file to a test directory and run:

```
nc -u yourdomain.dyndns.org 8000
or
nc -u yourIPaddress 8000
```

4. On the outside computer type a test message followed by the Enter key. It should look like:

```
nc -u yourdomain.dyndns.org 8000
sending a test message
```

on the outside sending system and:

```
nc -l -p 8000 -u
sending a test message
```

on the local system.

5. The test message should appear on the line after the command in step 2.

6. Exit nc (ctrl C) and do this same sequence with 8009 substitute for 8000 at both location.

7. There may be short delays of up to 2-3 seconds in this transmission

The Socket Software and Key

The Socket software can be found on the nemon.com web-site on the Downloads and Documents page. Save and Run the executable to install the Socket software.

Once the Socket software has been installed, the urlkey.dat provided with the software, must be installed into the c:\nm\socket directory, or wherever the software exists. Do this when the Socket software is not running.

The Socket software will be installed with a default port range of 8000-8009. If you are forwarding to an alternative port range, this must be updated in the wireless.ini file.

When the Socket software is running, you will see the Key on the screen. In order for the Socket software to be able to communicate with a recorder the Key ID from the Socket software must match the “Key” ID on the recorder. If this is not the case, contact NorthEast Monitoring for assistance.

Anti-Virus Software

If the Socket software fails to run, it may be necessary to add an exclusion to anti-virus process to not include the “c:\nm” directory or wherever the software has been installed.

4. Data Reception Method 2 - Cloud Server Method with SFTP Client

If you are using the Cloud Server to receive files, you do not need to install the Socket Software at your facility. Instead, the cloud has been set up to run the Socket Software continuously.

NorthEast monitoring has a Cloud Server available to receive wireless recordings for institutions that do not want to receive the transmissions directly. For this method, the data is received by a cloud server, unencrypted on the same server using the Socket software, and stored on the server until the data is transferred by SFTP protocol to the local system.

Installation and maintenance of the SFPT and the script is the responsibility of the institution's IT staff. SFTP data transfer requires that the institution runs an SFTP server which will allow data to be sent to a location visible by the LX Event installations. The script periodically (10 minute intervals preferred) moves the data from the server to the local system via an SFTP.

System Requirements

For Cloud Server - SFTP Client Application Method, the following must exist unless agreed to otherwise:

- The purchaser will provide an SFTP server which will be acceptable by the cloud server and capable to accepting files from the cloud server. These files will be made visible to any required LX Event work stations as required for their use.
- Local IT personnel to provide for and maintain the SFTP server and file management.

5. Working together - Recorder, Socket software and Gateway

Note: The Socket software and the Gateway will run with both DR300 and DR400 recorders.

If the settings are correct on the router, but are absent or do not match the recorder, a request should be sent to NorthEast Monitoring for a urlkey.dat file with the correct wireless settings.

This request should include the 3 settings that should appear on the recorder, and should be sent to support@nemon.com.

For DR400s. The keys on the DR400 are updated when you pair the DR400 with the Gateway.

For DR300s. Once the urlkey.dat file is received back from NorthEast:

- Load the file onto an SD card as the only file.
- Load this SD card into each DR300 recorder and insert the battery. The recorder will load the file and respond with the number 18 in the upper left corner. This is the verification that the name of the internet location has been loaded in the recorder.
- Remove the card from the recorder immediately after updating or the recorder will not record.

Testing the DR300 and Gateway together

The Socket software (Institute Based Server Method) or the SFTP (Cloud Server Method) must be running for the transmissions to be received. Additionally, the DR300 must have the Wireless setting turned ”On” and be in close proximity to its paired Gateway.

Note: Each Event must be 8 minutes (480 secs.) or shorter in length in order to be transmitted via the Gateway.

To test, start the DR300 in Event recording mode and record an event by pressing the EVENT button. Once an event is saved, you can force the wireless transmission by pressing the ENTER button on the DR300. You should see small numbers appearing in the upper-left hand side of the screen of the recorder. One of the following will occur:

- **You will see a sequence of numbers and the message “Sending Events”** on the recorder. While this is occurring, you will see the “bytes received” column on the Socket screen increasing. Once completed successfully, the recorder will revert to 0/xx recordings. If the number of recordings does not revert to 0, this means that the transmission was interrupted part way through due to a cellular issue. Otherwise the set up is correct.

  You should be able to see the file in the respective c:\nm\ftp\event directory using Windows Explorer.
- **No sequence of numbers** - Wireless is not turned on. Instead you will hear the acoustic transmission. You need to turn Wireless on to conduct this test.
- **1, 2, 91, 92** - This means that the recorder is not communicating with the Gateway. This can occur when:

  1) The Gateway is not present.

  2) The Gateway is not plugged in.

  3) The Gateway is too far away from the recorder to receive the signal. The middle light, which is red, will flash when the recorder and Gateway are in range and communicating.
- **1, 2, 7, 8, 20, 90, 92** (or similar) Any sequence which includes a 7, 8 or 20 shows that the and the Gateway are communicating, but there is a problem with the connection between the Gateway and the receiving location. This can mean one or more of the following:

  1) The PC (receiving location) is turned off.

  2) The Socket software is not running at the receiving location. The Socket software must be running to receive event data via the Gateway.

  3) The Socket software is running, but the settings on the DR300 and the Socket software do not match. If it is running, you should see the Socket window screen on the PC. When the Socket software is running, it will show the Encryption key and Port, which must match the same settings on the DR300. Refer to Chapter 1, DR300 Wireless Settings for additional information.

  4) The router is not set up properly. See Chapter 4, Testing Router Set-up Using NetCat, for additionally information on how to diagnosis and fix this problem.

5) The cellular network is down or overloaded.

Any time you see any of the following codes in the sequence, they mean the following:

- When you see a 7 or 8 in the sequence, this means that the recorder and the Gateway are communicating.
- When you see a 20 in the sequence, this means that the recorder is trying to send data.
- When you see a 90, 91 or 92 in the sequence, the recorder is disconnecting from the Gateway.

Testing the DR400 and Gateway together

The Socket software (Institute Based Server Method) or the SFTP (Cloud Server Method) must be running for the DR400 transmissions to be received. Additionally, the recorder must be in Event recording mode and be in close proximity to its paired Gateway.

To test, start the DR400 in Event recording mode and record an event by pressing the EVENT button quickly. The DR400 will flash green while recording the event. Once an event is finished being saved, you can force the wireless transmission by holding the EVENT button down until it starts flashing green quickly (about 10 seconds).

If all is working, the Gateway will respond and the Socket software will show that an event is being received. You can open the LX Event to view the Incoming Files.

Refer back to *Testing the DR300 and Gateway together*, for troubleshooting the Gateway and the Receiving location connections.

Data Security

For Wireless transmission via the Gateway, data is encrypted using symmetric 256-bit encryption key on the recorder and sent in up to 64 KB data blocks. One or more blocks can be sent at a time. Once the data is received by the Socket Software, the encryption key will be used to decrypt the data into a readable format. The Key visible on the recorder and the software is a easily readable ID. The two Key IDs must match in order for decryption to take place.

Instructions for the Patient

An abbreviated version of these instructions has been included on the label on the top of the Gateway.

1. The Gateway should be placed in a location that the patient will be near (within 10 meters) frequently.
2. The Gateway's power adapter should be plugged into the Gateway, and plugged into an outlet which has power all the time (is not controlled by a wall switch)
3. The Gateway's antenna should be in an upright position.
4. The Gateway has three lights. The third light (rightmost), is the wireless connection indicator. Once plugged in, this light will flash red. If the light is blinking between 3 to 4 times in a row, there is an acceptable wireless connection. If it only blinks two times in a row, there is a questionable connection, and you should probably move the Gateway to a better location. If the light only does a single blink, there is no connection at all to the wireless network.

The recorder and Gateway will automatically transmit any new, previously un-transmitted data when the two are in sufficiently close proximity.

Note: For DR400 use, remind the patient to recharge the battery on the recorder at approximately every 7 days using a micro USB charger and power source. The DR400 will take no more than 2 hours to recharge fully.

6. Troubleshooting Assistance

The recorder, Gateway and Socket software are communicating fine, but the wireless records cannot be seen in LX Event.

First, you will need to find the wireless files using Windows Explorer. The Wireless.ini file in the Socket software will tell you where events and files will be saved when received:

event_destination_path=C:\nm\ftp\event\

If files have been received, you should see on or more zip files in the destination. Each zip file will contain an event.dat and a pat.001 file. A new zip file is created every time data is received.

The LX Event Incoming Files screen pointer can be found in the LXEvent.ini file and must match the event_destination_path in the Socket wireless.ini file. You can adjust either ini file to go where you want it to go. Just be sure to close the software when changing either ini file and move any files that have already been created so that you do not lose any data.

7. Wireless Process Flowchart