User Guide

Nicolet™ EEGwireless32/64 Amplifier User Guide

April 27, 2015

Nicolet EEGwireless32/64 Amplifier

Part Number 269-641500 Rev 07

Intended use statement

The device is intended to be used as a front end Nicolet EEGwireless32/64 amplifier with the Nicolet Neurodiagnostic system to record, measure, store, analyze and display cerebral and extracerebral physiologic data for EEG and Sleep studies with or without synchronous digital video. This data includes but is not limited to EEG, EOG, EMG, ECG, respiration, body position, snore, heart rate, oxygen saturation and other physiologic signals. All ages of patients are served, including infants either within a medical facility or outside a medical facility. It is intended for use only under the supervision of medically trained and qualified professionals who will use all available information to aid in the diagnosis of Sleep, Epilepsy and other related disorders. While the Nicolet Neurodiagnostic systems are capable of displaying signals, such as Sp02 and ECG, the system is NOT intended for monitoring such signals for the preservation of life.

Copyright

www.natus.com

Natus Neurology Incorporated
3150 Pleasant View Road
Middleton, WI 53562-3530
USA

About the Nicolet brand system

The range of Multimedia EEG Nicolet brand systems have been designed and manufactured by Natus Neurology Incorporated, which has always had an enviable reputation for innovation and quality of its products.

CE Mark

CE 0086 Compliant to Medical Device Directive 93/42/EEC

Declaration of Conformity

R & TTE Directive - Radio and Telecommunications Terminal Equipment

Hereby, Natus Neurology Incorporated declares that the Nicolet EEGwireless32/64 amplifier, it's derivatives, and its accessories are in compliance with the essential requirements and the other relevant provisions of Directive 1999/5/EC.

[The following signed (and translated) declaration of conformity]:

We, Natus Neurology Incorporated, at 3150 Pleasant View Road, Middleton, WI, USA, declare under our own responsibility that the Nicolet EEGwireless32/64 amplifier to which this declaration refers conforms with the relevant standards or other standardizing documents of EN 50371:2002 according to regulations in Directive 1999/5/EC.

Dan Lombardi, 11 Oct 2010

Director of Hardware Development and Intellectual Property

Middleton, WI USA 53562

FCC wireless compliance

FCC Identifier: XGU-515-015X00A

Name of Grantee: Natus Neurology Incorporated

Equipment Class: Digital transmission system

FCC Rule Parts: 15C

Frequency Range (MHz): 2412.0 - 2462.0

Transmission Power Levels:

Condition	Min	Typ	Max	Unit
802.11b	15	17	19	dBm
802.11g	12	14	16	dBm

NOTE: The Nicolet EEGwireless32/64 amplifier is approved for body worn application. With transmitter enabled, the maximum spatial peak SAR (Specific Absorption Rate) valueis 0.0154 W/kg.

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY RADIO OR TV INTERFERENCE CAUSED BY UNAUTHORIZED MODIFICATIONS TO THIS EQUIPMENT. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT

This hardware uses the FreeRTOS operating system. Go to **www.freertos.org** for more information.

Safety summary

In this manual, two labels identify potentially dangerous or destructive conditions and procedures:

WARNING

The **WARNING** label identifies conditions or practices that may present danger to the patient and/or user.

CAUTION

The **CAUTION** label identifies conditions or practices that could result in damage to the equipment.

NOTE: Notes help you identify areas of possible confusion and avoid potential problems during system operation.

WARNING

Do NOT use cables with unattended and unsupervised children.

Do NOT wrap cables around your neck.

Keep batteries away from children.

Conductive parts or electrodes and their connectors, including the neutral electrode for type BF or cf electroencephalographs are not to contact other conductive parts and earth ground.

Do NOT use outside of the published specification ranges. Use of device outside of the specified ranges may result in inaccurate results.

Do not wrap the Nicolet EEGwireless amplifier in blankets or place under pillows during use.

Use with other equipment

Defibrillators and High Frequency surgical equipment

WARNING **The amplifier is not defibrillator proof. The system must be disconnected from the patient prior to defibrillation.**

MRI equipment

WARNING **The Nicolet EEGwireless32/64 amplifier or patient electrodes are not to be worn by a patient during an MRI study.**

Other patient-connected equipment

WARNING **When used simultaneously with other patient-connected equipment, for example, a cardiac pacemaker or other electrical stimulator, it is unlikely that a safety hazard will arise. However, always consult the documentation supplied with the other patient-connected equipment to ensure all hazards, warnings and cautions are considered before the equipment is used with the amplifier.**

It should be noted that other electrical stimulators can cause noise in the EEG data.

Read the Safety Reference guide

Please read the ***Additional Information and Safety Notes for Assorted Nicolet Brand Products Reference Guide*** 269-594705 on CD part number 482-638702 thoroughly, paying special attention to the **Safety** information before applying power to and using your Nicolet Brand system.

Fixed installation guide

Please see the Fixed Installation guide *Section 3* - 269-620300 and *Section 5* - 269-620500 for installation information.

IT requirements

Please see the Site IT Requirements document 269-644000 for information on wired and wireless networking specifications for operation of the Nicolet EEGwireless32/64 amplifier.

Specification sheet

Please see Specification sheet 169-438800 for information regarding technical specifications of the EEGwireless32/64 amplifier.

Inspecting the system

Routinely check the instrument for exterior damage.

Follow your medical facilities safety guidelines.

Recycling / disposal

WARNING

Many local laws and regulations consider electric equipment-related waste as hazardous or requiring special procedures to recycle or dispose of. This includes batteries, printed circuit boards, electronic components, wiring and other elements of electronic devices. Follow all of your respective local laws and regulations for the proper disposal of batteries and any other parts of your system, such as monitors, amplifiers, keyboards, electrodes, etc.

Refer to the natus.com website for recommended instructions and addresses for proper return or disposal of electronic wastes relating to Natus Neurology Incorporated products in Europe and other localities.

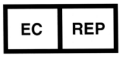
The contact information for the Waste Electrical and Electronic Equipment (WEEE) - In Europe

European authority representative

EC REP

Natus Europe GmbH
Robert-Koch-Str. 1
82152 Planegg
Germany

European Authorized Representative



Natus Europe GmbH
Robert-Koch-Str. 1
82152 Planegg
Germany

CE Mark

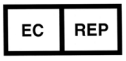
CE 0086 Compliant to Medical Device Directive 93/42/EEC

Technical support

Domestic	International
Natus Neurology Incorporated 3150 Pleasant View Road Middleton, WI USA 53562 1-800-356-0007 madison.helpdesk@natus.com www.Natus.com	Natus Neurology Incorporated Phone: 0049 (0) 180 501 5544 Fax: 0049 (0) 89 83942777 service.europe@natus.com www.Natus.com

Labels and symbols

The following labels and symbols may be affixed to the **Nicolet EEGwireless32/64** system:

	**When applied on device:** Attention: Consult Accompanying Documentation. (ISO 7000-0434A) **When used in documentation:** Caution, Warning or Precaution follows.
	Consult Operating Instructions. Failure to follow operating instructions could place the patient or operator at risk. Image on blue background. (ISO 7010 M002)
	Consult Operating Instructions. (ISO 7000-1641)
	European Authorized Representative.
	Manufacturer. Natus Neurology Incorporated 3150 Pleasant View Road Middleton, WI USA 53562 608-829-8500 1 800-356-0007 Fax: 608-829-8589 www.natus.com
	Disposal at end of operating life instructions.
	CE Mark and Notified Body. (Compliant to Medical Device Directive 93/42/EEC)
	Type BF equipment.
RX Only	**CAUTION:** USA Federal law restricts this device to sale or on the order of a licensed medical practitioner.

Introduction

Using the garment

Cabling the system

Nicolet EEGwireless32/64 Amplifier Operation

Using the Nicolet brand system to setup and acquire EEG

Wireless Operation

Using the EEGwireless32/64 Batteries

Nicolet EEGwireless32/64 Amplifier Onboard Memory

User Configuration Utility

Electromagnetic Compatibility (EMC)

Error Codes

Frequently Asked Questions (FAQ)

1 Introduction

This guide describes how to operate the Nicolet EEGwireless32/64 amplifier in conjunction with the Nicolet EEG system and software.

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About the Nicolet EEGwireless32/64 amplifier unit

The *Nicolet EEGwireless32* and *Nicolet EEGwireless64* amplifiers are unique amplifiers and are referred to as **Nicolet EEGwireless32/64 amplifier** in this manual.

The Nicolet EEGwireless32/64 amplifier is a 32/64 channel EEG amplifier that connects to a Nicolet Brand system via wireless transmission or a standard network port. The Nicolet EEGwireless32/64 amplifier can be used in a hospital setting without the addition of custom network infrastructure.

The Nicolet EEGwireless32/64 amplifier

- captures all signals needed to perform LTM monitoring, EEG, Sleep studies, research, Ambulatory and ICU monitoring.
- provides low signal amplification (alternating current 'AC' recording) of physiological signals, and is designed specifically to amplify EEG and intracranial EEG signals.
- provides wired Ethernet or wireless Ethernet transmission of digitized signals, which interfaces to a Nicolet Acquisition system.
- provides a Stand Alone Mode feature for urgent recording situations.
- provides user selectable parameters including sampling rates and filters.
- includes built in SpO2, patient event button, and provides referential, bipolar recording.
- the amplifier is compact and lightweight with a custom garment wearable by the patient.

Operating system

The Nicolet EEGwireless32/64 amplifier uses **FreeRTOS™** as its operating system. For FreeRTOS™ licensing details, please visit **www.freertos.org/a00114.html**.

FreeRTOS™ is a trademark of Real Time Engineers Ltd.

Power source

The Nicolet EEGwireless32/64 amplifier can derive its power from either an AC outlet through the medical grade power supply, from one or two external battery packs, or in the case of a fixed installation, wallplate power.

The Nicolet EEGwireless32/64 amplifier has a second power port, which allows the addition of a second battery pack for longer recording time or a medical grade power supply. If the medical grade power supply is plugged in while a battery is also plugged in, the battery pack will charge.

There is an internal battery in the Nicolet EEGwireless32/64 amplifier that allows switching the external battery pack while in the middle of a study. When the external battery pack requires changing, it can be removed without interfering with the study as long as it is replaced within 10 minutes of removal.

If an external battery or AC power is connected to the Nicolet EEGwireless32/64 amplifier, the internal battery will be charged.

Communication

EEG data can be transmitted to the Nicolet acquisition system either by an Ethernet cable or wirelessly using a recommended 802.11 b/g access point. The Nicolet EEGwireless32/64 amplifier is IP addressable and can connect directly to a hospital network or private LAN.

Memory card

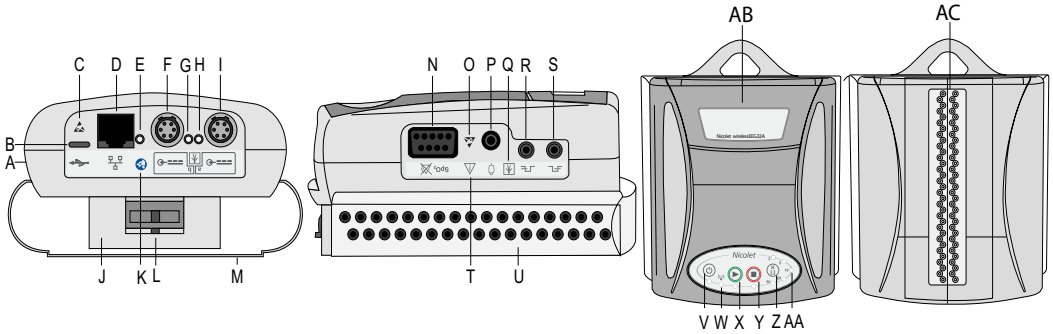
The Nicolet EEGwireless32/64 amplifier also provides onboard storage of EEG. The Nicolet EEGwireless32/64 amplifier has an onboard memory card used to record data. When the memory card reaches within 10 minutes of its capacity, the Nicolet EEGwireless32/64 amplifier produces an audible alert.

Sampling rate

The Nicolet EEGwireless32/64 amplifier provides selectable sampling rates from 128 Hz - 12000 Hz.

When operating at 12 kHz Sample Rate, ensure the electrode lead cover is connected. Also, do not wrap the Nicolet EEGwireless32/64 amplifier in a blanket or place under a pillow.

Nicolet EEGwireless32/64 amplifier symbols and components



	Symbol	Description		Symbol	Description		Symbol	Description
A	-	Amplifier	**K**		Refer to page j in this manual.	**U**	-	Electrode inputs (each side)
B		Diagnostic port	**L**	-	Disconnect headbox latch	**V**		Power on/off button
C		Electrostatic sensitive	**M**	-	Electrode leads cover	**W**		LED - Wireless transmission on
D		Network port	**N**	SpO_2	SpO2	**X**		Start recording button
E	-	LED - Ethernet connectivity	**O**		Electrostatic sensitive	**Y**		Stop recording button
F		Power input for external batteries or power supply	**P**		Event button input	**Z**		Impedance check button
G	-	LED - Power connectivity	**Q**		Type BF equipment	**AA**		LEDs - Impedance range
H	-	LED - Power connectivity	**R**		Trigger output (for Photic, etc.)	**AB**	-	Battery door, under headbox
I		Power input for external batteries or power supply	**S**		Trigger input	**AC**	-	LEDs - Impedance check
J	-	32 or 64 headbox	**T**		Refer to page j in this manual.			

NOTE: External power from Inputs **F** and **I** are interchangeable between two external batteries and a medical power supply.

Activate the internal batteries

1. The first time the Nicolet EEGwireless32/64 amplifier is used, you must pull the two plastic strips out from the battery compartment (Figure 1) to activate the internal batteries for use with the Nicolet EEGwireless32/64 amplifier.

CAUTION Pull the plastic strip labeled 1 first and then pull the plastic strip labeled 2 second to guard against damaging the amplifier.

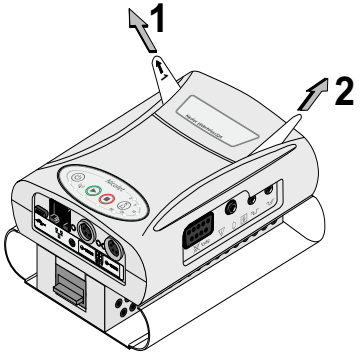


Figure 1

NOTE: The batteries arrive at 40%.

WARNING Contact Natus Neurology Incorporated customer service if you believe your amplifier's internal batteries need to be replaced.

WARNING If the amplifier is going to be stored for extended periods of time (>2 weeks) after pulling the plastic strips, it is recommended to connect the amplifier to an AC power brick or an external battery pack so that the amplifier can be used immediately when needed. If the amplifier will be stored on a cart that is not powered, the amplifier needs to be connected to an external battery pack during storage.

WARNING Do not transfer your amplifier's internal batteries to another amplifier.

Removing the electrode leads plastic cover

1. Grasp the plastic cover on both sides with one hand.
2. Grasp the Nicolet EEGwireless32/64 amplifier with the other hand.
3. Carefully slide the plastic cover off the Nicolet EEGwireless32/64 amplifier (Figure 2).

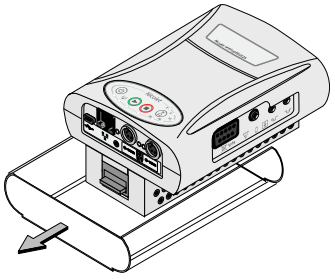


Figure 2

Separating the headbox from the Nicolet EEGwireless32/64 amplifier

1. Press downward on the release **latch** (Figure 1).
2. While firmly holding the Nicolet EEGwireless32/64 amplifier and headbox, pull the headbox towards yourself.
3. Carefully lift off the Nicolet EEGwireless32/64 amplifier from the headbox.

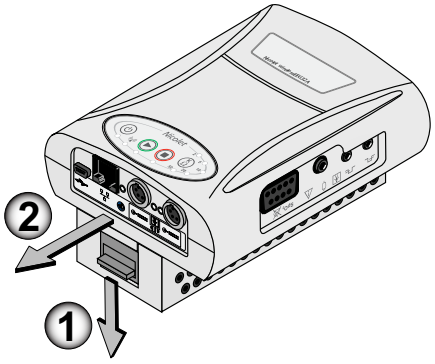


Figure 1

Headbox interchangeability

You cannot use a 64 channel headbox with a 32 channel amplifier, but you can use a 32 channel headbox with a 64 channel amplifier.

NOTE: Montage setups between 32 channel configurations and 64 channel configurations are not interchangeable.

Electrode labels

The electrode label has an area for writing customized electrode nomenclature. For temporary markings, use an **erasable** dry marker. Use **Isopropyl Alcohol** to remove the temporary markings from the labels.

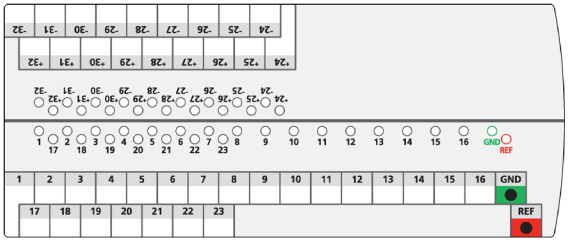


Figure 1: 32 channel electrode label.

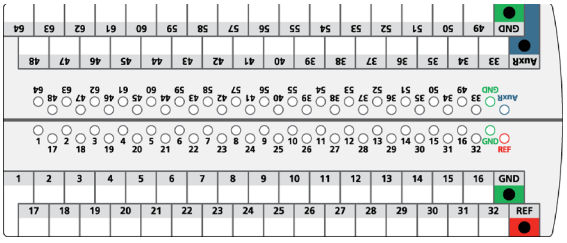


Figure 2: 64 channel electrode label.

NOTE: The two grounds are linked together in the Nicolet EEGwireless32/64 amplifier. You do not need to provide two grounds, but they are available for redundancy. The auxiliary reference is currently disabled, but will be functional in future releases.

Headbox dry erase label information

- Apply the label to the back of the Headbox.
- The overlay is removable and reusable.
- Use only dry erase markers & cleaners on overlay.
- DO NOT use permanent markers.

Inspecting the system

Routinely check the system for exterior damage. Periodically check the system ground integrity, the system leakage current and the leakage current of the Nicolet EEGwireless32/64 amplifier and accessories.

Cleaning instructions

We recommend that you consult with your hospital infection control department and follow all appropriate policies. Routine equipment cleaning recommendations are provided below.

Cleaning the Nicolet EEGwireless32/64 amplifier

The Nicolet EEGwireless32/64 amplifier and accessories are classified as a noncritical item for infection control purposes.

Do not use propanone (acetone) on any part of the equipment. No part of the system may be autoclaved or sterilized by any means. According to the CDC, the proper cleaning method for non-critical medical devices includes the following:

- A456-N
- A428-N
- Cavacide
- 3MQuat
- 70% isopropyl alcohol.

Cleaning the system

Turn **OFF** the system power before cleaning the instrument. Do not permit solutions or cleaning agents to seep into the electronic portions of the system. Take special care around controls, connectors and panel edges. Do not use any abrasive cleaners. Remove any dust from the exterior of the system with a soft brush or clean cloth. Use a brush to dislodge any dirt on or around the connectors and panel edges. Remove stubborn dirt with a clean soft cloth slightly dampened with a mild detergent (soap) or low level disinfectant detergent solution. Allow the items to air dry before next use.

Use of detergent-disinfectants on skin may cause adverse reactions; therefore, gloves are recommended when cleaning with these products.

Cleaning the monitor screen

When the monitor is on, the screen has a slight static charge, which attracts dust. To remove any dust accumulation, wipe the display screen with a soft brush or lint-free cloth. You may use an antistatic spray on the screen to reduce static buildup.

Cleaning the keyboard

Disinfect computer keyboards daily, when visibly soiled, or when they become contaminated with blood. Quaternary ammonium-containing disinfectants may be used on keyboard (Rutala et al. 2006).

CAUTION Before using the disinfecting agent, perform a test on only one key or on an old keyboard to guard against possible bleaching or discoloration of the keys.

If a keyboard cover is used, Rutala et al. (2006) recommends it be disinfected daily.

We recommend that mobile computers used by patients be disinfected before the next patient uses it.

Cleaning the garment

Wash contaminated garments with laundry detergent and hot water or with a phenolic household detergent. The garment should be washed and rinsed a second time without the phenolic.

CAUTION Air dry the garment only.

Cleaning recording equipment and supplies after contact with Jacob Creutzfeld disease

CAUTION Ancillary electroneurodiagnostic supplies and equipment such as cables, marking pencil, and recording instrument should be wiped down with undiluted bleach or a 1 N sodium hydroxide solution (Airman 2000). If items cannot be disinfected in this manner, they should be disposed of and not reused. We recommend that you follow your internal infection control policies.

Preventive maintenance

CAUTION

Electrical safety testing is recommended. It is recommended a schedule be established for these purposes, with at least an annual cleaning and safety testing. This system does not require calibration unless otherwise stated.

Preventative maintenance does not require access to the interior of the instrument and may be performed by the user. For this device, preventative maintenance consists of periodically cleaning and inspecting the exterior of the instrument.

It is recommended that all repairs be performed by a qualified Natus Neurology Incorporated service representative only. You have the sole responsibility for any malfunctions resulting from improper maintenance or repair by anyone other than an authorized Natus Neurology Incorporated representative.

If the system is not functioning properly, do not operate it until all necessary repairs are made and the unit is tested for proper functioning in accordance with Natus Neurology Incorporated published specifications. It is recommended that all repairs be performed by a qualified service representative only.

Switch off all power to the system before attempting any service, maintenance, or preventive maintenance.

If the system or any component is repaired, it is recommended that all system functionality be checked and an electrical safety test be performed prior to resuming use.

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2 Using the garment

This chapter describes how to use the Nicolet EEGwireless32/64 amplifier garment as well as how to clean the garment.

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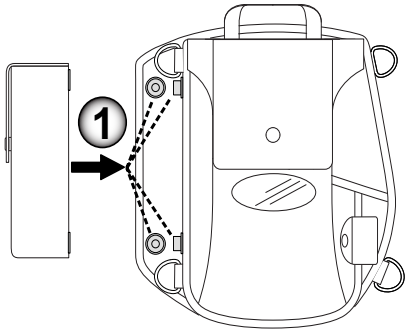
Cable and insert the Nicolet EEGwireless32/64 amplifier into the garment

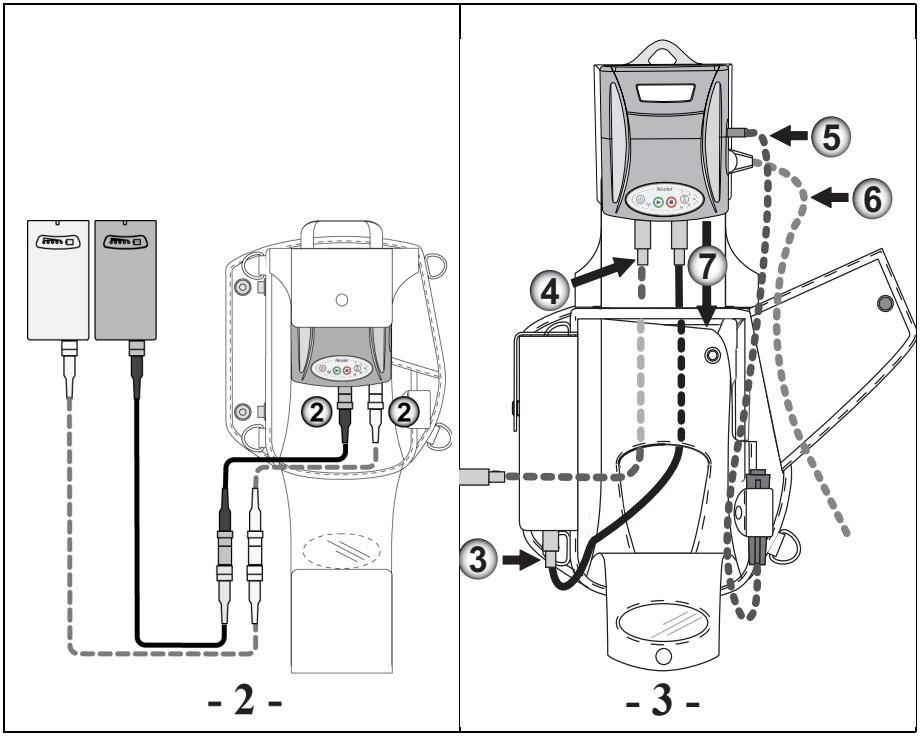
NOTE: See the next chapter for additional cabling information.

1. Snap the battery pouch to the four snaps on the garment (Figure 1).

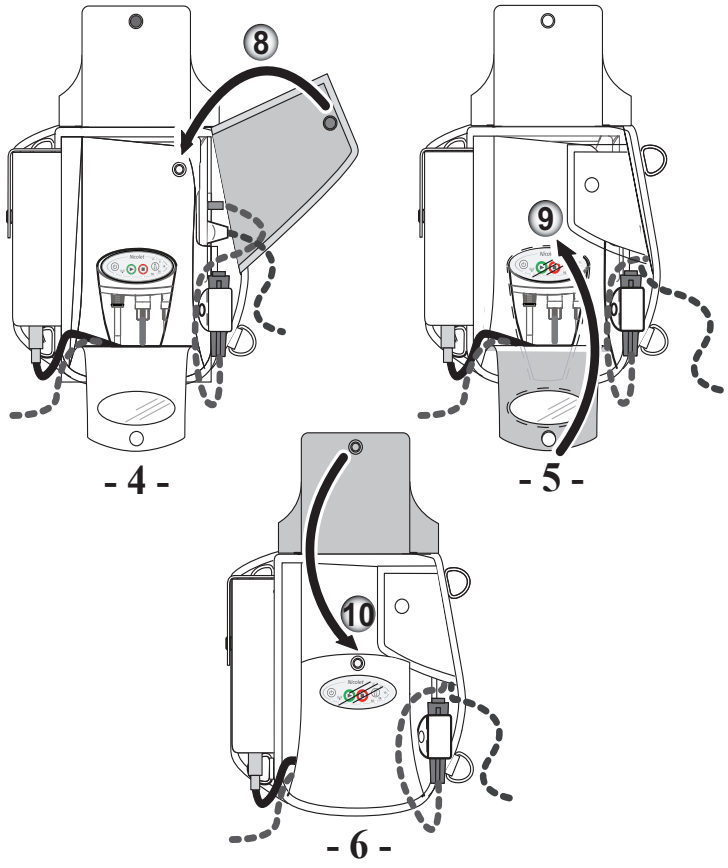


- 1 -

2. (**Optional**) - Connect the optional battery cable extender(s) to the Nicolet EEGwireless32/64 amplifier and then connect the battery cable(s) between the extender cables and the battery(s), (Figure 2). Skip steps 3 and 4.
3. Connect the primary **battery** to the Nicolet EEGwireless32/64 amplifier (Figure 3).
4. Connect the second **battery** cable to the Nicolet EEGwireless32/64 amplifier if using an optional second battery.
5. Connect the optional **Patient Event** button to the Nicolet EEGwireless32/64 amplifier.
6. Connect the optional **SpO2** to the Nicolet EEGwireless32/64 amplifier.
7. Insert the **Nicolet EEGwireless32/64 amplifier** into the carrying case.



8. Fold the **side** flap over the front and snap (Figure 4).
9. Fold the **bottom** flap up (Figure 5).
10. Fold the **top** flap down and snap to the bottom flap (Figure 6).



Attaching the garment

CAUTION **Ensure proper fit before using the garment to guard against injury.**

Option 1 - Without optional second battery

This option straps the Nicolet EEGwireless32/64 amplifier, headbox, battery pouch and electrode sleeve to the patient.

Attach the garment to the patient

1. Clip the shoulder straps to the bottom fastening loop (**R1)** for the right shoulder (Figure 1).
2. Hang the shoulder strap assembly over the patient's shoulder and clip the other end of the shoulder strap to the top fastening loop (**R2**).
3. Repeat steps 1 (**L1**) and 2 (**L2**) for the left shoulder strap.
4. Feed the electrode leads through the electrode sleeve (**4**).
5. Adjust the straps as necessary for a snug fit.

Attach the optional belt to the patient

1. Clip the belt to either the bottom (**B1**) or top (**T1**) fastening loop as shown in Figure 2.
2. Wrap the belt behind the patient.
3. Clip the belt to the bottom (**B2**) or top (**T2**) fastening loop.
4. Adjust the belt as necessary for a snug fit.

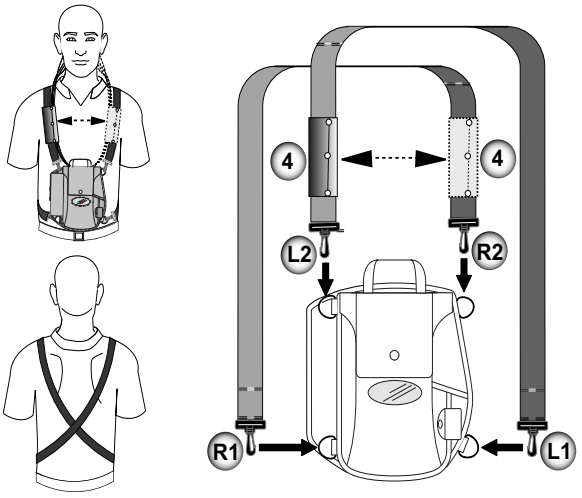
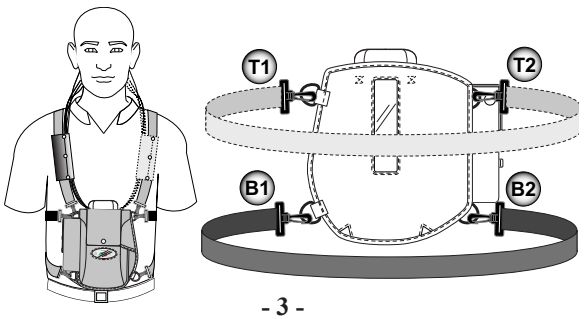


Figure 1: Shoulder straps.



- 3 -

Figure 2: Belt.

Option 2 - With optional second battery

This option straps the Nicolet EEGwireless32/64 amplifier, headbox, battery pouch, electrode sleeve and optional second battery to the patient.

Attach the garment to the patient

1. Clip the shoulder straps to the bottom fastening loop (**R1)** for the right shoulder (Figure 1).
2. Hang the shoulder strap assembly over the patient's shoulder and clip the other end of the shoulder strap to the top fastening loop (**R2**).
3. Repeat steps 1 (**L1**) and 2 (**L2**) for the left shoulder strap.
4. Feed the electrode leads through the electrode sleeve (**4**).
5. Adjust the straps as necessary for a snug fit.

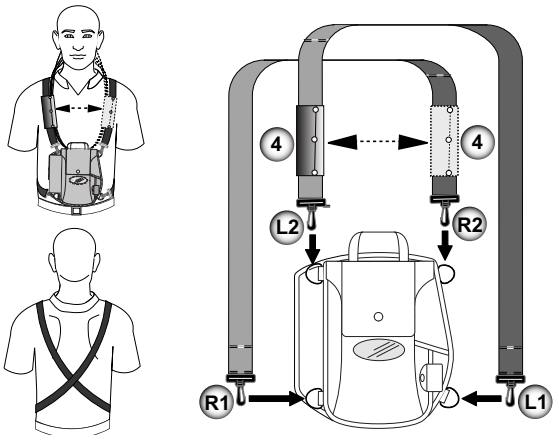


Figure 1: Shoulder straps.

Attach the optional second battery

NOTE: The belt battery can be the primary battery.

1. Feed the belt through the belt loop (**1**) on the back of the battery pouch (Figure 2).
2. Clip the belt strap to the bottom fastening loop (**2)**.
3. Wrap the belt around the patient's waist and clip the belt to the other fastening loop (**3**).
4. Connect the battery cable to the optional second battery (**4**).
5. Adjust the belt as necessary for a snug fit.

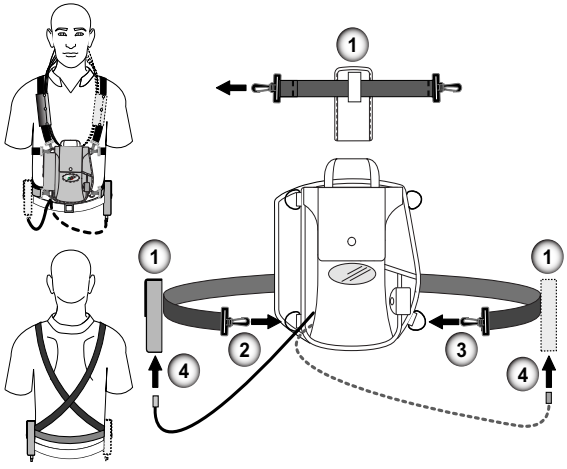


Figure 2: Optional second battery.

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3 Cabling the system

This chapter contains the cabling diagrams for the various configurations available for use with the Nicolet EEGwireless32/64 amplifier.

NOTE: Connector styles in this chapter may vary from those shown.

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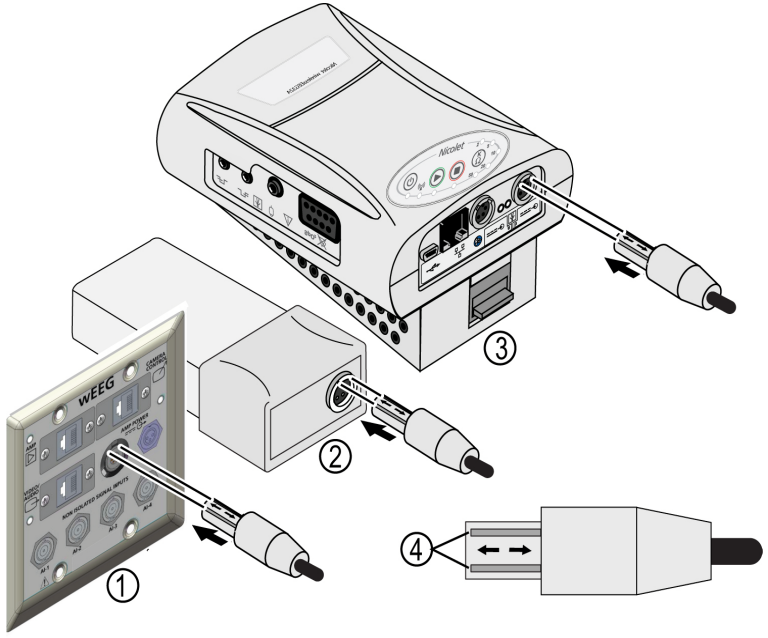
Power cable lengths

The battery cable lengths are 11 inches, 30 inches and 15 feet.

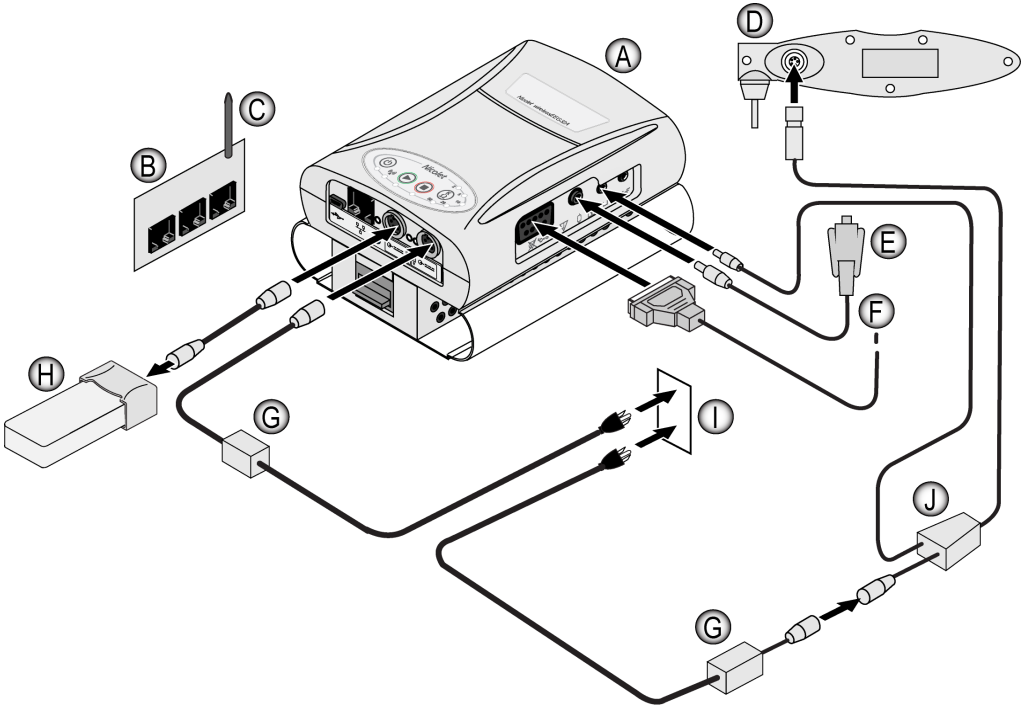
Power connector orientation

The power connection for this amplifier is a keyed push-in connector. The connector has 2 built in keying notches, which are delineated by two arrows indicating the top of the connector plug. This design is intended to guard against the power connector being inserted in the wrong orientation, which can result in damage to the amplifier and/or power connector. Refer to the figure below, which shows the proper orientation of the power connector with the two arrows facing upwards before plugging the connector into the battery, amplifier or wallplate.



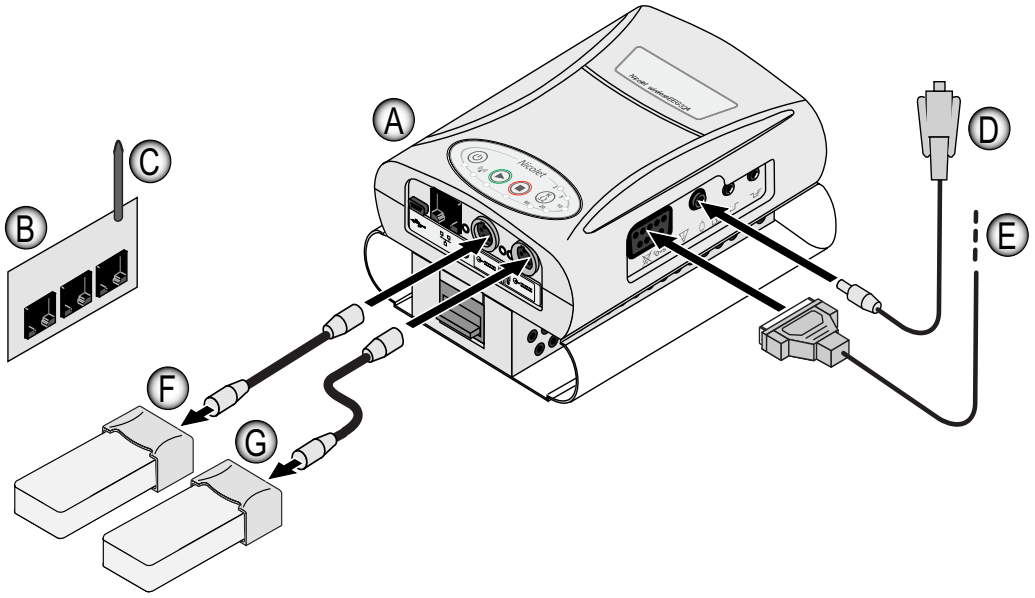
1	wEEG wallplate
2	Battery/Charger
3	Nicolet EEGwireless amplifier
4	Align the two notches with the two connector grooves on the wEEG wallplate, Battery/Charger and Nicolet EEGwireless amplifier before plugging in the connector.

Cabling the amplifier to be wireless with access point and hospital mains power (shown in battery charging mode, fixed install)



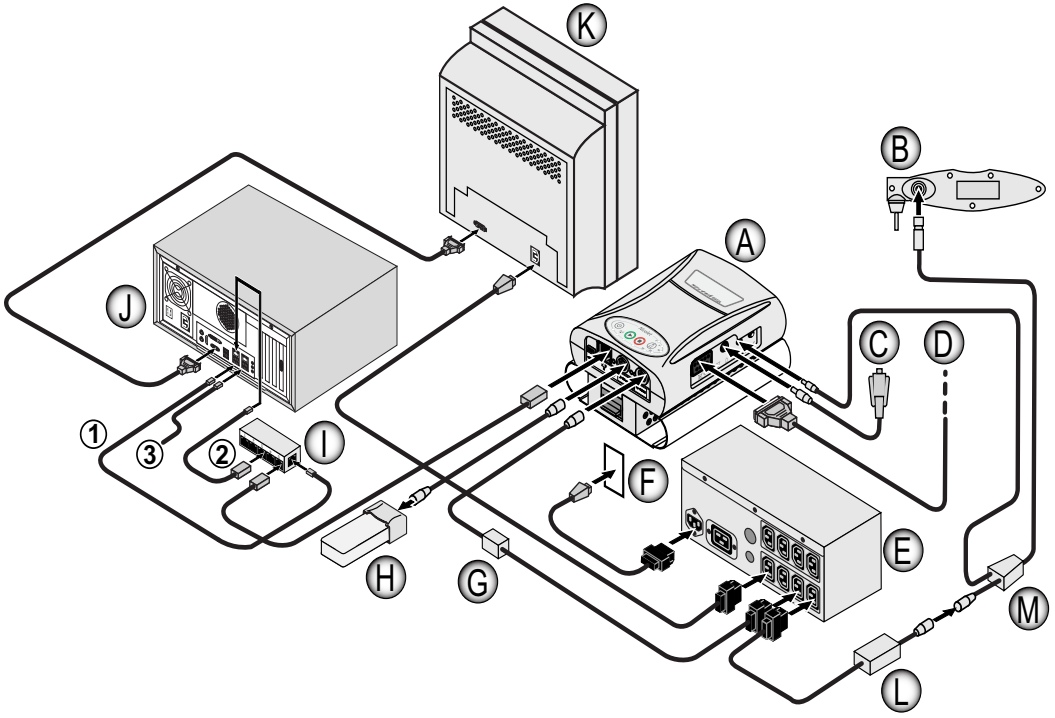
Legend	Description
A	Amplifier
B	Access point (connected to hospital network)
C	Antenna
D	Photic strobe (option)
E	Event button (option)
F	SpO2 (option)
G	Medical grade power supply (PSU-EEG64)
H	Battery with charger (Nicolet CHG1)
I	Hospital mains
J	Photic cable

Cabling the amplifier to be wireless with access point and Battery Power (shown with two battery packs, WiFi - roaming mode)



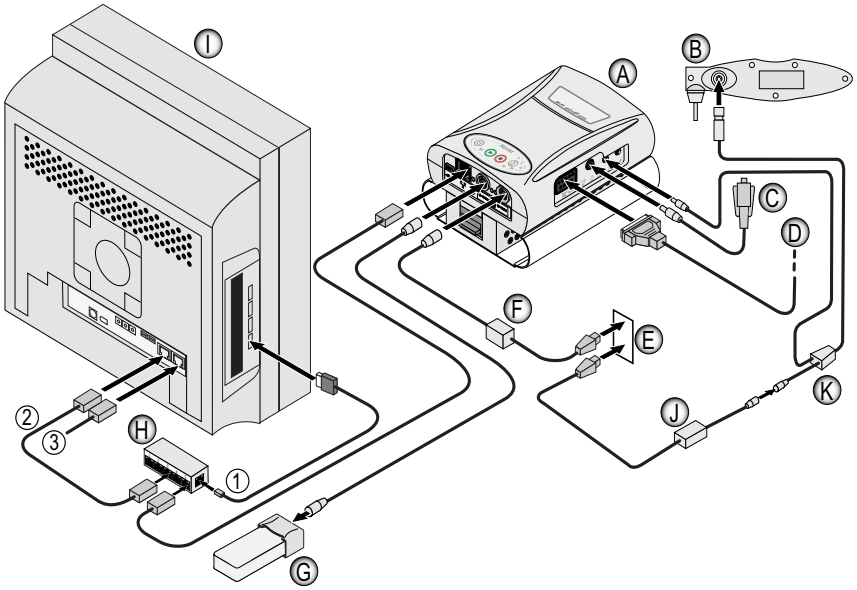
Legend	Description
A	Amplifier
B	Access point (connected to hospital network)
C	Antenna
D	Event button (option)
E	SpO2 (option)
F	Battery with charger (Nicolet CHG1)
G	Optional second battery with charger (Nicolet CHG1)

Cabling the cart based system, wired network communication to a desktop computer with power supply and battery (cart mount, computer peripherals not shown)



Legend	Description	Legend	Description
A	Amplifier	**I**	Network switch
B	Photic strobe (option)	**J**	Computer
C	Event button (option)	**K**	Monitor
D	SpO2 (option)	**L**	Medical grade power supply (PSU-EEG64)
E	Isolation transformer (Required with a Desktop computer in a patient room)	**M**	Photic cable
F	Hospital mains	**1**	Connect to USB Port for power
G	Medical grade power supply (PSU-EEG64)	**2**	Connect to LAN Port
H	Battery with charger (Nicolet CHG1)	**3**	Connect to hospital network

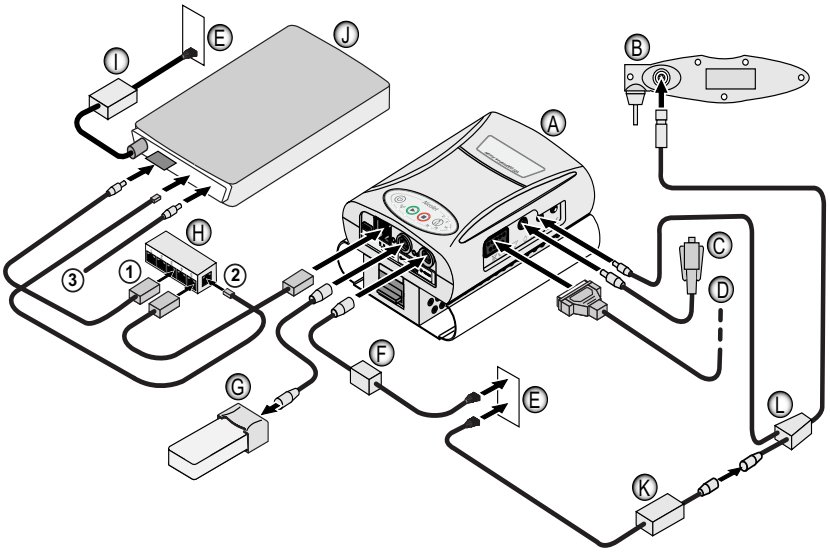
Cabling the PanelPC with wired network communication and a supply or battery



Legend	Description	Legend	Description
A	Amplifier	**H**	Network switch
B	Photic strobe (option)	**I**	PanelPC
C	Event button (option)	**J**	Medical grade power supply (PSU-EEG64)
D	SpO2 (option)	**K**	Photic cable
E	Hospital mains	**1**	Connect to USB Port for power
F	Medical grade power supply (PSU-EEG64)	**2**	Connect to LAN Port
G	Battery with charger (Nicolet CHG1)	**3**	Connect to hospital network

NOTE: US and Canada are required to only use 115VAC input power on the Panel PC Power Pack.

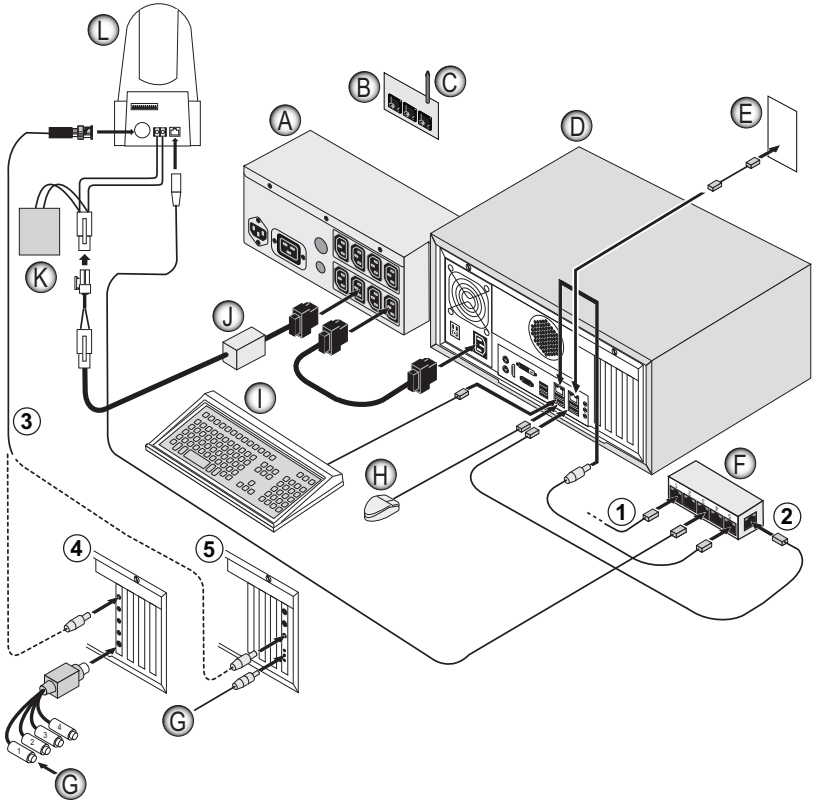
Cabling the wired network communication to a laptop with power supply or battery



Legend	Description	Legend	Description
A	Amplifier	**I**	Laptop Power Supply
B	Photic strobe (option)	**J**	Laptop
C	Event button (option)	**K**	Medical grade power supply (PSU-EEG64)
D	SpO2 (option)	**L**	Photic cable
E	Hospital mains	**1**	Connect to Network Extender Card
F	Medical grade power supply (PSU-EEG64)	**2**	Connect to USB Port (for switch power only)
G	Battery with charger (Nicolet CHG1)	**3**	Connect to hospital Network
H	Network switch		

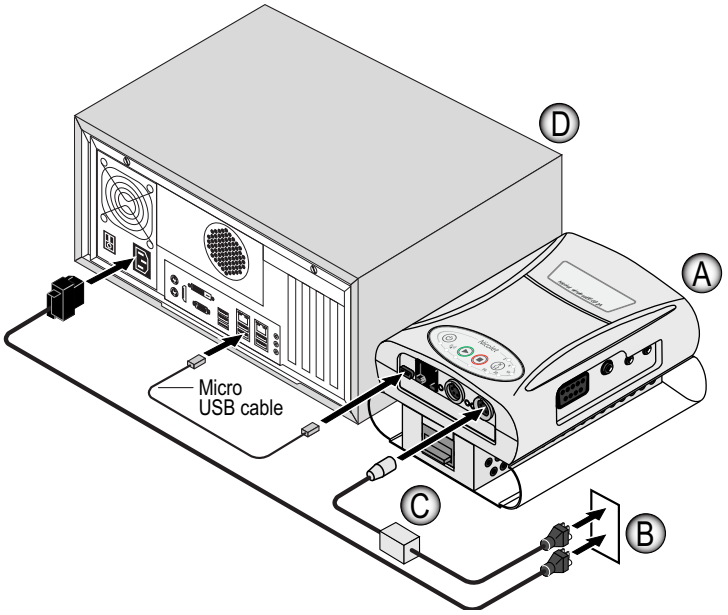
NOTE: US and Canada are required to only use 115VAC input power on the Laptop Power Pack.

Cabling the computer with video options



Legend	Description	Legend	Description
A	Isolation transformer	**J**	Camera power supply
B	Access point (Wireless Amplifier option only)	**K**	IR Illuminator (option)
C	Antenna	**L**	Camera (option)
D	Computer		
E	Ethernet to hospital network wallplate	**1**	From wired amplifier
F	Network switch	**2**	Connect to USB port for power
G	Audio	**3**	Digital Video - to Option 1 (4) or Option 2 (5)
H	Mouse	**4**	Digital Video Option 1
I	Keyboard	**5**	Digital Video Option 2

Cabling the amplifier for use with the configuration utility



Legend	Description	Legend	Description
A	Amplifier	**C**	Medical grade power supply (PSU-EEG64).
B	Hospital mains	**D**	Computer

4 Nicolet EEGwireless32/64 Amplifier Operation

This chapter describes how to operate the Nicolet EEGwireless32/64 amplifier.

Please see *Chapter 5* for instructions on operating the Nicolet EEGwireless32/64 amplifier connected to a Nicolet brand system.

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General information

The Nicolet EEGwireless32/64 amplifier includes safety features that assure that the internal batteries always operate within their required temperature range and that the surface temperature of the amplifier is always within regulatory requirements during normal operation.

Please follow the following general guidelines when the Nicolet EEGwireless32/64 amplifier is worn by the patient:

1. Make sure the Nicolet EEGwireless32/64 amplifier is always visible to the operator, e.g., worn outside a thicker robe or hanging from a bed-rail or head board, either in the garment or the amplifier by itself.
2. Periodically check the LED indicators on the front of the Nicolet EEGwireless32/64 amplifier; if the **Power** button LED turns mainly yellow instead of mainly green, this is an early indication of increased operating temperature; this is no problem by itself, but try to stabilize or decrease the ambient temperature. Refer to the Power LED color code information in Chapter 11 for additional Power LED conditions.
3. Always use the transparent headbox wiring cover.

Turn on the amplifier

1. Press the **Power** button (**A** in Figure 1) for 3 - 5 seconds.

   When power is turned on, the **Power LED** (**B**) illuminates.

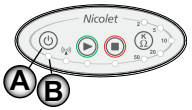


Figure 1

Error codes

Refer to the **Error Codes** chapter at the end of this manual for a description on how the amplifier alerts you to an error and how to manage it.

Perform an impedance test from the amplifier

The Headbox connects to the amplifier and provides an interface for impedance testing without using a Nicolet brand system.

NOTE: If you disconnect the Headbox from the Amplifier during an Impedance test and then reconnect it, the LEDs on the Headbox will not reappear. You must restart the Impedance test to illuminate the LEDs again.

1. Hold down the **Impedance Check** button (**A** in Figure 1) for 12 seconds to initiate the impedance check.
2. Press the **Impedance Check** button repeatedly until the desired impedance range: 2, 5, 10, 20, 50 Kohms LED (**B**) illuminates.

   NOTE: Range changes on release of the button.

3. Hold down the **Impedance Check** button again for 12 seconds to exit the impedance check.
4. In a standalone mode, the impedance values are displayed on the amplifier but are not recorded to the study. It is noted in the study that an impedance test was performed.

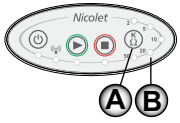


Figure 1

Impedance indications

The LEDs (**A** in Figure 1) on the back of the Headbox indicate the impedance of the connected electrodes within the range selected when the Impedance check button is pushed.

Unlit Impedance LEDs identify “in range” electrode impedances.

Orange Impedance LEDs identify “out of range” electrode impedances.

For electrodes with ‘out of range’ impedances:

1. Check the electrode connections to the amplifier.

   CAUTION **Electrodes with “out of range” impedances may appear noisier than those with “in range” impedances.**

2. Perform troubleshooting steps, if desired.
3. Repeat the impedance steps.

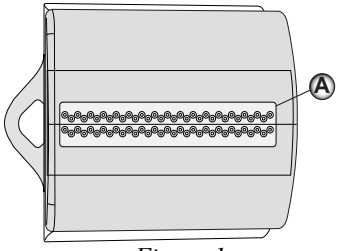


Figure 1

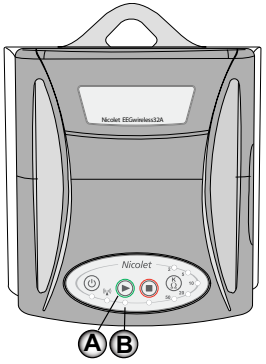
NOTE: This amplifier will always have the LEDs displayed Orange if they are not connected. There is not a way to turn them off if the electrode is not used. This is different than other Nicolet amplifiers where you could disable them if they were not needed.

Stand Alone Mode feature (starting a recording from the amplifier)

You can now start a study from the amplifier without having a Nicolet brand system attached. This study doesn't have patient identification until it is connected to a Nicolet brand system at which time you can register the amplifier and assign patient demographic information in NicVue. If the amplifier has not been connected to a Nicolet brand system, the patient information appears as all zeroes. You can acquire multiple studies from a **single patient** when connected to a Nicolet brand system, all data will appear with appropriate start and stop times and dates marked.

NOTE: To acquire data from another patient, you must first connect to a Nicolet brand system and download all stored data before beginning a recording on a second patient. Only one study can be performed on the amplifier before data is cleared from memory. See *Clearing the amplifier's onboard memory* later in this chapter.

1. Press the **Start Recording** button for 3 - 5 seconds to start a study.
2. The Start Recording LED illuminates when the study starts (Figure 1).



A	Start Recording button
B	Start Recording LED

Figure 1

Start a study from the amplifier

If you attempt to start a study and the Stop Recording button blinks (C in Figure 1), that is an indication that data is present on the amplifier and you cannot start a study. See ***Clearing the amplifier's onboard memory*** section later in this chapter to clear data from the amplifier.

1. Press the **Start Study (Record)** button (**A** in Figure 1) for 3 - 5 seconds to start a study.

   The **Study Started LED** (**B**) illuminates when the study starts.

Stop a study from the amplifier

1. Press the **Stop Study** button (**C** in Figure 1) for 12 seconds to stop a study.

   The **Study Stopped LED** (**D**) illuminates and the **Study Started LED** (**B**) turns off when the study stops.

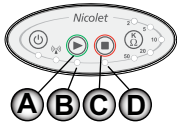


Figure 1

Turn off the amplifier

1. Press the **Power** button (**A** in Figure 2) for 12 seconds.

   When power is turned off, the **Power LED** (**B**) turns off.

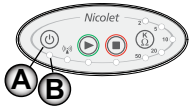


Figure 2

Memory capacity

See Chapter 8 for information about memory capacity. When the amplifier has approximately an hour of storage left, the green **Record** button displays a flashing LED (button **X** on page 1-5) and an auditory warning sounds.

Clearing the amplifier's onboard memory

While recording a study, the amplifier records all data collected to its onboard memory. Data may be erased from this onboard memory only with user intervention. The data must be erased before starting a new study or to continue an extended study.

If the amplifier's data has not been cleared after an exam was completed, the **Amplifier Contains Data** menu appears when attempting to start a recording. This prompt shows the size of the exam located on the amplifier, the patient ID under which it was recorded, and the start/stop time of the recording. There are three options on this screen, which are detailed below.

Delete Data on Amplifier – This deletes the data on the amplifier and allows you to start a recording.

Exit and Retrieve Data – This downloads the data to the currently selected Patient. Choosing this option on a different patient will warn you that the Patient ID's do not match.

Cancel – This option cancels the **Amplifier Contains Data** window. The recorder will still continue to start, with this amplifier not available. The Amplifier Selection menu and the Recorder will have to be closed.

- If you know the Data has been successfully downloaded, you can press **Delete Data on Amplifier** button and continue the recording as planned.
- If you're unsure, and want to check that this patient ID has this exam on the PC, you will have to check your patient/exam list and cancel the recording. This is done by
  1. Select **Cancel** on this menu.
  2. Select **Cancel** on the **Amplifier Selection** screen.
  3. Close the recorder program using the **X** in the top right of the **Amplifier Selection** screen.

  This will return you to the patient list allowing you to search for the Patient ID listed in the **Amplifier Contains Data** menu. If the full exam does not appear in the patient list, you will have to download the data from the Amplifier to the PC.

Downloading data from the Amplifier to the PC

1. Locate the correct **Patient ID** in the Patient List.
2. Right-click **patient name > Acquire > NicoletOne**.
3. The Amplifier Contains Data dialogue box reappears, asking what you would like to do with the Data on the Amplifier.
4. Select **Exit** and **Retrieve Data**.

NOTE: If the Patient ID's do not match, you will receive a message warning that the ID's are different and if you want to proceed.

The Recorder window will open and close briefly, and the File Catch-up Details box will show the status of the exam being copied from the Amplifier to the PC. You may minimize this window, however closing it will stop this process. File Catch-up will need to complete before using the Amplifier again. Once this process completes, you can choose to **Delete Data on Amplifier** when starting a new exam.

NOTE: Choosing **Exit and Retrieve Data** in this fashion will download the EEG data from the amplifier, and will not contain the annotations or events entered by the technician at the beginning of the exam.

These annotations can be preserved by retrieving the data by reviewing the original exam:

1. Connect the amplifier to system. Ensure it is not currently recording, press the **Stop** recording button on the amplifier if necessary.
2. Choose to review the original exam.
3. You will get a prompt stating that there is data on the amplifier and to **Download the data now**, or to **Mark the exam as complete**.
4. Choose **Download the data now**. The Merge Process will start and append the data to the end of this exam, including the original annotations/events.

Internal SpO2 operation

1. The amplifier supports the acquisition of SpO2 data. The amplifier has a built in Nonin model for heart rate, pleth, SpO2. To acquire SpO2 data, connect a Nonin finger probe with optional extension cables to the amplifier. Please refer to the Nicolet Software Reference guide for instructions on using vital signs or an external SpO2 device. See ***Amplifier symbols and components*** in Chapter 1 for the connection port.

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5 Using the Nicolet brand system to setup and acquire EEG

This Chapter describes how to operate the Nicolet EEGwireless32/64 amplifier controls from the Nicolet brand system. Please see the previous chapter for instructions on controlling the Nicolet EEGwireless32/64 amplifier without the Nicolet brand system.

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Using the Nicolet brand system to setup and acquire EEG with the EEGwireless32/64 amplifier

This procedure describes using the Nicolet brand system to setup and acquire EEG.

For more information, please see the Nicolet Software Reference guide 269-604601 (CD part number 482-639403).

Wireless panel information

Figure 1 shows the Wireless information panel. The Wireless panel provides the following information.

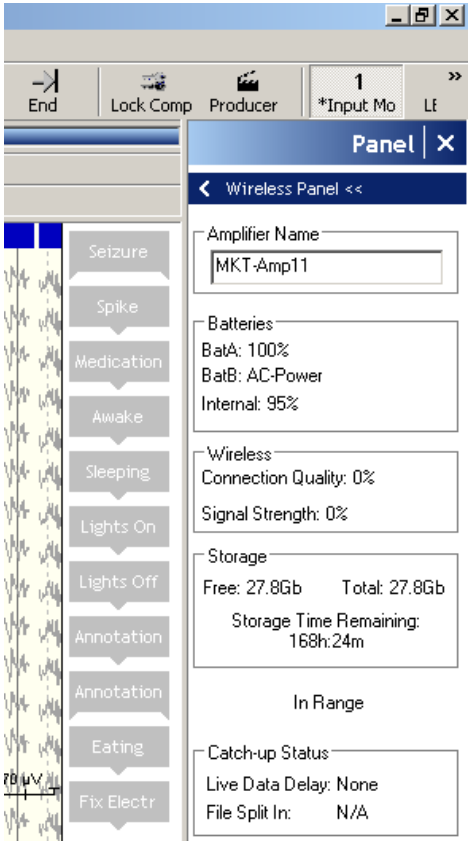


Figure 1: Wireless information panel.

Battery life

Each of the battery ports on the amplifier display either the total battery life remaining, or “AC-Power” if the port is connected to AC Power. The Internal indicator displays the internal battery life remaining.

Connection quality

The Connection Quality indicator indicates the quality of the signal being received by the amplifier

Signal strength

The Signal Strength indicator indicates the strength (power) of the signal being received by the amplifier.

Storage

Both the maximum total storage on the amplifier’s onboard storage as well as the total remaining storage are displayed. An estimate of the total storage time remaining, given the current sampling rate, is also displayed.

Catchup

A display indicating if the amplifier is **In Range** (connected) of the Acquisition station or **Out Of Range** (disconnected) of the Acquisition station is located above the “Catch-up Status” field. **Live Data Delay** indicates how much time lag there is between live data and the data displayed on the Nicolet screen display. The time it takes to show live data may be more or less than this time. **File Split In** indicates the amount of time the amplifier can remain out of range before the current exam file is split.

Starting a study

Select the amplifier for the study

To start a study while connected to a Nicolet acquisition station, either directly or over a network, you must first select an amplifier from which to acquire EEG.

1. Each amplifier has a unique identifier (Figure 2). Select the amplifier from the Wireless Panel dialog with the same identifier as your amplifier. If the dialog in Figure 2 does not appear and you see an "Amplifier Disconnected," select the proper Protocol from the Protocol menu to view the wireless panel dialog.

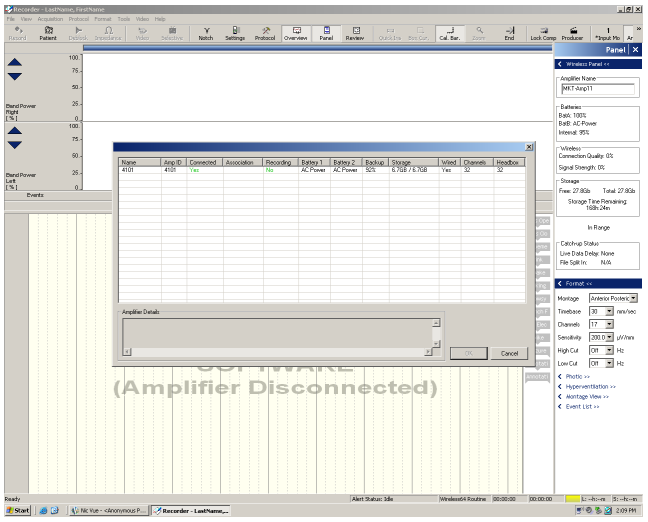


Figure 2.

NOTE: In the event that the amplifier you select is still storing data from a previous exam, you will see a prompt asking you to either download the data or erase the data from the amplifier. If you choose to download the data, the amplifier will perform data catch-up. See **Data Catch-Up** in this chapter for more information. Also see *Clearing the amplifier's onboard memory* in Chapter 4.

Select a protocol

To start an exam through the Nicolet brand system, you must first select a protocol to run.

CAUTION **There are protocols specific to the amplifier that must be selected to ensure proper operation.**

1. From the Options menu, select **Protocols**.
2. Click **Protocol > EEGwireless32** (or **EEGwireless64**) depending on the number of channels with which your amplifier is configured.
3. The amplifier is ready to start acquiring data.

NOTE: If you change to a different protocol (e.g., 64 wireless to a 32 wireless) when Powerloss Recovery is enabled, you will have a two minute delay before you can proceed with the recording.

Change/View the sampling rate

The current sampling rate can be changed and viewed in Acquisition:

1. Select the **Settings** pane.
2. Select **Amplifier**.

The sampling rate can be viewed in Review:

1. Select **Tools > Report > Wireless Audit Log**.

   - or -

2. Select **View > Recorded Channels**.

Check the impedance

NOTE: Skip step 13 if the **Startup in Impedance mode** checkbox was checked earlier (**Tools > Options > Acquisition tab**). Checking this box causes the Impedance window to appear automatically when you open the **Recorder software**. Please refer to the Nicolet Brand System Software Reference Guide, ***Miscellaneous Quick Steps*** chapter, ***Acquisition*** tab for additional information.

NOTE: If you disconnect the Headbox from the Amplifier during an Impedance test and then reconnect it, the LEDs on the Headbox will not reappear. You must restart the Impedance test to illuminate the LEDs again.

3. Select **Impedance**  to display the Impedance Test window.

   - or -

   Select **Acquisition > Impedance**.

4. Select the acceptable impedance range:

   Click on the **Threshold** show menu  button and then select the desired **threshold value**.

   - or -

   Enter a **custom** value.

5. The measured impedance values are displayed for each electrode.
   - Electrodes with in range impedances are displayed in **green**.
   - Electrodes that are out of range are displayed in **red**. Allow time for the Impedance Test window to update as you work to lower impedances as necessary.
6. When the impedances are in range, select **Start**.
7. The Recorder window appears with a watermark that says "Not Recording" and with the EEG scrolling across the screen, but not yet being saved to the hard drive. Select **Record**  to start the recording unless the EEG was initiated using "**Quick Start**".

Impedance threshold check

The impedance threshold check can be performed either from the amplifier or from the software. To check the impedance from the amplifier see Chapter 3.

8. Click on **Options > Impedance Check**.
9. Click **Start Impedance Check**.
10. The impedances are displayed on the Nicolet Acquisition screen.

Start recording EEG

11. If the Impedance Check panel was enabled to appear automatically when the Recorder application was started, the system begins recording as soon as you close the Impedance Check panel.

    If the feature was not enabled, select **Record**  start recording.

    NOTE: Select **Record**  again to stop recording EEG.

    NOTE: If the patient goes out of range while performing an impedance check, the impedance values will not be recorded.

Disconnecting from the system

In the event that the amplifier becomes disconnected from the Nicolet acquisition station or the network, either accidentally or intentionally, the amplifier stores its neurodiagnostic information onboard. For more information see the Catch-up section in Chapter 3.

Optional steps

The following describes how to enable/edit various features/parameters available on the Nicolet acquisition system.

Enabling automatic impedance testing after changing the montage

The system can test the electrode impedances each time you change to a different montage.

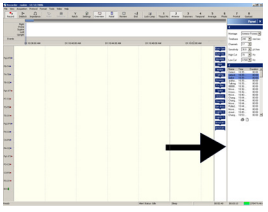
1. Select **Settings**  and then **Misc** at the bottom of the **Editor** window.

   - or -

   Select **Protocol > Settings** and then **Misc** at the bottom of the Editor window.
2. Checkmark **Automatic Impedance Test on Montage Change**.
3. Select **Save**.
4. Select **Close**.

Edit the parameters

Display the Control Panel



1. Select **Panel**  .
2. Select **View > Panel > Format** to display the Format palette, which lets you easily change the sensitivity, LFF, HFF, timebase, montage and the number of channels displayed.

Select the montage

1. From the Control Panel, select the **Montage** button on the **Format** palette and then select the desired **montage**.

   - or -

   Select **Format > Montage** and then select the desired **montage**.

   - or -

   Select the desired **Montage shortcut** button.

   - or -

   Right-click on the **trace labels,** select **Montage** and then select the desired **montage**.

   NOTE: If the **Laplacian** button becomes disabled:

   1. Open the **Calculated Channels** editor.
   2. Select one (and only one) **sensor** on the Head view.
   3. The Laplacian sensor button will be enabled at this point. Once pressed, you will be in the Laplacian mode. Subsequent sensor selections will be weighted appropriately.

Select the Sensitivity

1. From the **Control Panel**, select the **Sensitivity** button on the **Format** palette and then select the desired **sensitivity**.

   - or -

   Select **Montage > Sensitivity** and then select the desired sensitivity**.**

   - or -

   Right-click on the **trace labels,** select **All Traces > Sensitivity** and then select the desired **sensitivity.**

   - or -

   Right-click on the trace labels, select **Adjust Selected** and then select the desired **sensitivity**.

Select the Timebase

1. From the Control Panel, select the **Timebase** button on the **Format** palette and then select the desired timebase.

   - or -

   Select **Montage > Timebase** and then select the desired **timebase.**

   - or -

   Right-click on the **trace labels,** select **All Traces > Timebase** and then select the desired **timebase.**

Select the High Cut/Low Cut filters

1. From the Control Panel, select the **High Cut** or **Low Cut** button on the **Format** palette and then select the desired **filter settings**.

   - or -

   Select **Montage > High Cut/Low Cut** and then select the desired **filter** settings.

   - or -

   Right-click on the **trace labels**, select **All Traces,** select **HighCut/LowCut** and then select the desired **filter** settings.

   - or -

   Right-click on the **trace labels**, select **Adjust Selected**, select **HighCut/LowCut** and then select the desired **filter** settings.

Selecting additional Filters

In NicoletOne there is a dropdown list of high cut and low cut filters. Additional filter settings may be selected, up to the Nyquist Rate (one half of the current sampling frequency).

To select custom filter settings:

1. Right-click on the list of channels on the left hand side of the NicoletOne screen.
2. Select **All Channels**.
3. Select **High Cut Filters** or **Low Cut Filters**.
4. Choose **Custom**.
5. You can now enter a numerical value for the filter.

Turn the Notch filter on

1. Select **Notch**  .

   - or -

   Select **Montage > Notch.**

   - or -

   Right-click on the **trace labels**, select **All Traces** and then select **Notch**.

   - or -

   Right-click on the **trace labels**, select **Adjust Selected** and then select **Notch**.

Display the Reader window *(optional)*

1. Select **Review**  to display the Reader window to the left of the Record window if you want to review the EEG (or look back in the EEG) while it is being recorded.

NOTE: The Reader window does not update automatically. To view the latest EEG that was recorded, select **End**  .

Splitting long recordings into multiple files

You can split the recording into multiple files at a specified time or at the end of a predetermined file duration.

1. Select **Settings**  and then select **Misc** at the bottom of the Editor window.

   - or -

   Select **Protocol > Settings** and then select **Misc** at the bottom of the Editor window.

Splitting the recording at a specified file duration

a. Click on the **Maximum File Duration** radio button.
b. Select the **file duration** after which the file will close and a new file begins storing data.
c. Select **Save**.
d. Select **Close**.

Splitting the recording at a specified time

a. Click on the **Start New File at** radio button.
b. Select the **time of day** (AM or PM) at which you want the file to close and a new file begins storing data.
c. Select **Save**.
d. Select **Close**.

Data catch up

In the event that the amplifier fails to communicate to the network or the acquisition station being used to acquire data, the amplifier stores data locally. The amplifier has onboard memory and stores all data acquired (EEG and Patient Event) to its onboard memory. When the amplifier communication is restored to the network or acquisition station, the data stored locally on the amplifier is transmitted along with the current (live) data.

NOTE: The memory card for internal storage is not user accessible.

Data catch up (disconnected less than 10 minutes)

The following applies to an amplifier wired to the Nicolet acquisition station with no wireless capability.

NOTE: If the amplifier is in range of a wireless access point, disconnecting the amplifier's Ethernet cable will not result in an interruption of data to the Nicolet acquisition station.

Scenario

The amplifier is acquiring data for a study and is connected either:

- directly to a Nicolet acquisition station

  - or -

- to a network running the Nicolet acquisition station.

  a. The Ethernet cable connecting the amplifier to the Nicolet acquisition station is disconnected causing the Nicolet software to display an alert that a disconnect has occurred.

  b. The disconnect lasts less than 10 minutes. The default is 10 minutes.

  c. The amplifier is reconnected to the network or to the same Nicolet acquisition station to which it was initially connected.

  d. After a moment, the Nicolet acquisition station displays that the amplifier has been reconnected.

WARNING **Do not stop acquisition from the Nicolet acquisition station until data catchup is complete as indicated when the wireless panel displays 'In Range' and the fast scrolling catchup eeg returns to live data.**

Data catch up (disconnected more than 10 minutes)

The following applies to an amplifier wired to the Nicolet acquisition station or operating in the Wireless mode.

NOTE: If the amplifier is in range of a wireless access point, disconnecting the amplifier's Ethernet cable will not result in an interruption of data to the Nicolet acquisition station.

The amplifier is acquiring data for a study and is connected either:

- directly to a Nicolet acquisition station

  - or -

- to a network running the Nicolet acquisition station

  a. The Ethernet cable connecting the amplifier to the Nicolet acquisition station is disconnected, causing the Nicolet software to display an alert that a disconnect has occurred.

  b. The disconnect lasts longer than 10 minutes.

  c. The amplifier is reconnected to the network or to the same Nicolet acquisition station to which it was initially connected.

  d. After a moment, the Nicolet acquisition station displays that the amplifier has been reconnected. A file split occurs when the amplifier comes back into range.

  e. Click the system tray icon to view the file catchup details including file progress.

⚠WARNING Do not stop acquisition from the Nicolet Acquisition station until data catchup is complete as indicated by the file catchup details window that appears in the system tray. Video will not be available, when reviewing the exam, for the period of time the amplifier was disconnected.

Changing the sampling rate

1. Select **Settings > Amplifier**.
2. Select your sampling frequency from the "Common Sampling Rate" menu (Figure 1). You can select specific sampling frequencies between 128 Hz to 12000 Hz.

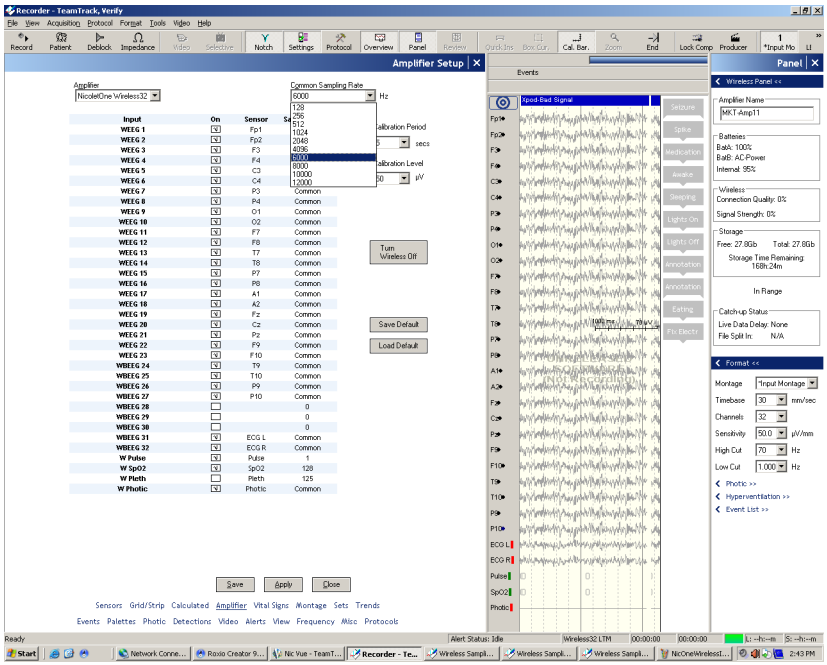


Figure 1.

NOTE: If you select a sampling rate over 4096 Hz while in the wireless mode, you will be prompted to turn the wireless module off. If you choose not to turn it off, your sampling rate will not be changed. If you choose to turn it off, in order to re-enable the wireless module, you must power cycle the amplifier.

6 Wireless Operation

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Wireless operation

The maximum wireless sampling rate is 4096Hz. If you select a sampling rate above this, the Acquisition software will warn you that you need to turn off wireless in order to sample at a higher rate. **If you accept this change, you must power cycle the amplifier in order to regain wireless connectivity.**

Do not use the photic functionality of the wireless amplifier while transmitting wirelessly. If you want to perform photic stimulation, connect the ethernet cable to the Acquisition station or the network.

There is a 10 minute disconnected threshold that determines if a file split needs to be done in order to retrieve data from the amplifier. If the amplifier becomes disconnected from the Acquisition station and then is reconnected to the Acquisition station and if the time the amplifier is disconnected plus the time it takes for NicoletOne to download the data stored on the amplifier is greater than 10 minutes, a file split will occur and a file catchup window will appear. Note that this 10 minute threshold is **not** user configurable.

If the Acquisition station on which NicoletOne is running has a power outage, NicoletOne will attempt to restart acquisition when power is restored to the workstation. If the amplifier that you are using is out of range when NicoletOne restarts, it will not restart acquisition on that amplifier. To restart acquisition:

1. Bring the amplifier back into range or tether the amplifier to the workstation.
2. Select the amplifier from the Amp Selection screen.
3. Restart acquisition.

If you check impedance while recording and out of range, upon coming back into range, the study will display an overflow error and the recording may stop. To resume recording, press the **Record** button in acquisition. Note that this does not happen when file catchup is initiated after coming back in range.

If your wireless amplifier becomes disconnected for extended periods of time, you may end up with a number of exam files in NicVue or Study Room. When this occurs, you will not end up with a single continuous exam file representing the entire study. Each exam segment marked as “DOWNLOADED” is a complete segment of the exam. These “DOWNLOADED” files along with the most recently marked exam file (which may be a downloaded file if the exam was stopped while the amplifier was disconnected) comprise the entirety of the exam.

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7 Using the EEGwireless32/64 Batteries

This chapter contains information about the batteries that may be used with the EEGwireless32/64 amplifier.

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Internal batteries

WARNING Contact Natus Neurology Incorporated Customer Service if you believe your internal batteries need to be replaced.

The external battery charge indicators

The five LEDs on the battery charger indicate the current charge (in percent) as shown in Figure 1.

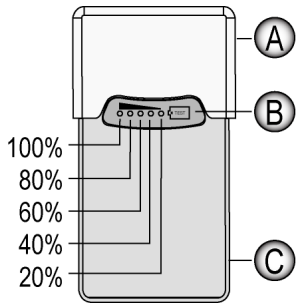

Figure 1.

Legend	Description
A	Charger (Nicolet CHG1)
C	Battery Test Button
B	Battery (Nicolet BAT1)

Checking the batteries charges

1. Display the Wireless Panel pane in the Panel on the right side of the Acquisition window; click **View > Panel > NicoletOne Wireless Amp Panel**.
2. The percent of charge remaining is displayed in the Wireless Panel pane for **Bat A**, **Bat B**, and **Internal** batteries.

Below is information regarding the run and life time of the batteries. Note that the values here are only estimates. The actual run time and life of the batteries depend on how the amplifier is used, how it is charged and other factors.

Battery Life

The following graph shows the expected capacity versus the number of charge cycles. Note that this graph only reflects the capacity if the battery is discharged to 0% and then charged to 100% for each cycle.

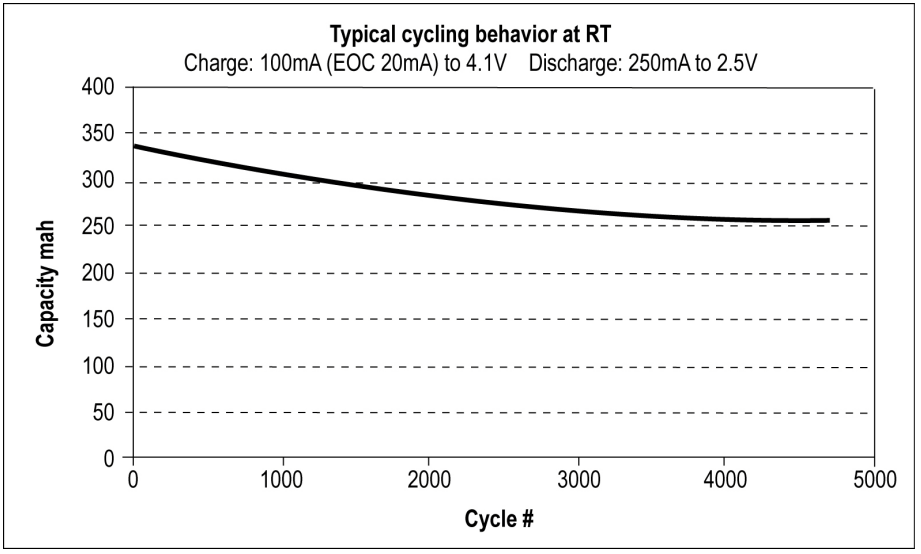

Figure 1 - Source: Tadiran Batteries LTD

Battery pack capacity

The table below indicate the approximate number of hours the amplifier can acquire data without recharging the external battery pack.

NOTE: This is for a single battery pack; your battery life will approximately double with 2 battery packs connected.

Sampling Rate (Hz)	32 Channel		64 Channel	
	Wired (Hours)	Wireless (Hours)	Wired (Hours)	Wireless (Hours)
128	12.1	12.2	9.9	9.8
256	12.1	12.1	9.9	9.8
512	12.1	12.1	9.9	9.8
1024	12.0	12.1	9.9	9.8
2048	12.0	12.0	9.9	9.7
4096	12.0	11.9	9.9	9.7
6000	11.9	*	9.7	*
8000	11.8	*	9.6	*
10000	11.7	*	9.6	*
12000	10.2	*	7.4	*

*-You cannot sample above 4096 Hz in the Wireless mode.

Charging the external batteries

While a medical power brick is attached and a battery pack is attached, that battery pack will charge.

While an external battery pack or a medical power brick is connected, the internal battery will charge.

NOTE: The internal and external batteries will never reach 100% charge (the battery trickle charges).

The amplifier provides a continuous beeping when the external battery pack is below 20% charge, or if no external power is connected (running on internal batteries). Replace the External batteries or the Recorder to a wall outlet.

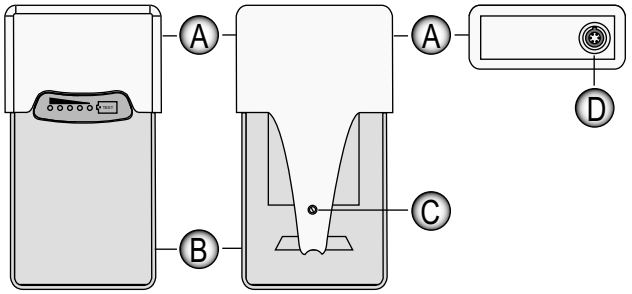

Figure 1: External battery and charger.

Legend	Description
A	Charger (Nicolet CHG1)
B	Battery (Nicolet BAT1)
C	Tool removable
D	Connector (To amplifier or power supply for charging the battery)

Replacing a worn out external battery

The charger can be removed from a worn battery and reused for a new battery.

1. Remove the charger securing screw (C) in Figure 1 above.
2. Slide the charger off from the battery.
3. Slide the charger on to the new battery.
4. Secure the charger securing screw (C) in Figure 1 above to the new battery.

Charging the battery with a medical grade power supply

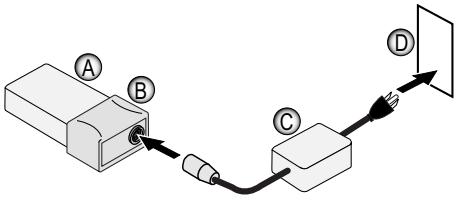

Figure 2

Legend	Description
A	Battery (Nicolet BAT1)
B	Charger (Nicolet CHG1)
C	Medical power supply (PSU-EEG64)
D	Wallplate - Hospital mains

Charging the battery from the amplifier with a medical grade power supply

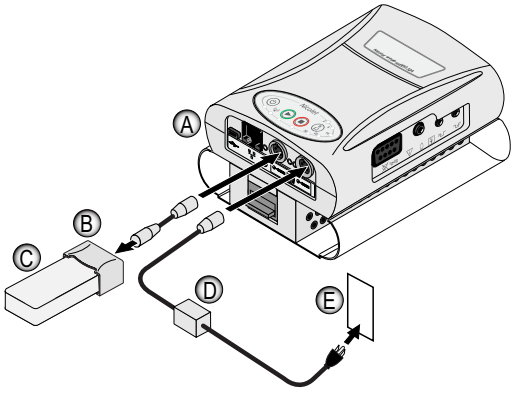

Figure 3

Legend	Description
A	Amplifier
B	Charger (Nicolet CHG1)
C	Battery (Nicolet BAT1)
D	Medical power supply (PSU-EEG64)
E	Wallplate - Hospital mains

Battery indications

The amplifier's Power LED  gives an indication of the current state of the amplifiers batteries.

If the Power LED is green and blinks briefly every 5 seconds, the the amplifier has external power and the internal batteries are charged.

If the Power LED is green and blinks yellow every 5 seconds, then the amplifier has external power and the internal batteries are charging

If the Power LED is yellow and blinks every 5 seconds, then the amplifier is operating on internal battery power only.

If the Power LED is yellow with no blinking, then the amplifier is operating on internal batteries and the internal batteries are low and not charging.

8 Nicolet EEGwireless32/64 Amplifier Onboard Memory

This chapter contains information about the Nicolet EEGwireless32/64 onboard memory.

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Onboard memory

The amplifier has 32GB onboard memory that records neurodiagnostic information. In the event that the amplifier fails to communicate to the network or the Acquisition station being used to acquire data, the amplifier stores data locally. The onboard memory stores all data acquired (EEG Pulse Oximetry, Impedance Tests and Patient Event). When the amplifier communication is restored to the network or Acquisition station, the data stored locally on the amplifier is transmitted along with the current (live) data.

The data on this memory persists through power cycles. The amplifier can be disconnected or out of range for approximately the amount of time shown below, for a given channel count and sampling rate. When the amplifier has approximately an hour of storage left, the green **Record** button displays a flashing LED (button **X** on page 1-5) and an auditory warning sounds.

IMPORTANT: If the amplifier fails to communicate (e.g., Out of Range) for a period of more than 10 minutes (factory set) when performing data catchup, you will not have video with the EEG data.

Storage at:	32 Channels		64 Channels	
	Estimated Data Storage for 1 Hour (Gbytes)	Estimated Storage Time with 32GB SD Card	Estimated Data Storage for 1 Hour (Gbytes)	Estimated Storage Time with 32GB SD Card
12000Hz	4.0	7 Hours	6.6	4 Hours
10000Hz	3.3	8 Hours	5.5	5 Hours
8000Hz	2.6	10 Hours	4.4	6 Hours
6000hz	2.0	14 Hours	3.3	8 Hours
4000Hz	1.3	21 Hours	2.2	12 Hours
2000Hz	0.7	1.5 Days	1.1	1 Day
1000Hz	0.3	3.5 Days	0.6	2 Days
512Hz	0.2	7 Days	0.3	4 Days
256Hz	0.1	14 Days	0.1	8 Days
128Hz	0.1	28 Days	0.1	16 Days

If you are recording at high sampling rates, the exam files size will be very large. We suggest you adjust your file split time and file process settings to compensate for this additional size.

NOTE: The file size indicated by Nicolet in the **Amp Contains Data** window is **not** the same as the .e file size on disk. The downloaded .e file will be approximately 70% of what is indicated in the **Amp Contains Data** window.

Data download rate

If your amplifier's onboard memory is full and you have the amplifier connected with the ethernet cable directly to the Acquisition station, downloading the file will take at least 50 minutes for 32 channels and 60 minutes for 64 channels.

Example modes of operation

Mode 1: Wireless with external battery pack.

This mode provides the most mobility within the wireless network range.

Example - The amplifier is wired and the patient wants to use the restroom. Use the external battery.

Example - You want to change the sheets and need to disconnect the patient for a period of time.

Mode 2: Wireless with AC power.

This mode is used to charge battery packs while recording data.

Example - You are wireless and need to go to a different floor for an ancillary procedure, which does not have wireless access. You can use this mode.

Mode 3: Wired network with external battery pack

Wired modes allow use of higher sampling rates.

Example - You are wired and want the patient to become mobile and still want to see the data. If amplifier is configured with wireless settings disconnecting the network cable will change the amplifiers communication method to wireless. You may experience a brief disconnection time while switching over to wireless.

Mode 4: Wired network with AC power.

Wired modes allow use of higher sampling rates.

Example - You are operating the amplifier on a wired network and the amplifier begins to run low on batteries. Connect the amplifier to AC power.

Example - Patient wants to go to sleep.

9 User Configuration Utility

This chapter describes the configuration utility, which is a piece of software independent of the Nicolet brand system. The purpose of the configuration utility is to allow you to troubleshoot the amplifier in the event of erroneous operation.

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Setup

The configuration utility is installed separately from the Nicolet brand system. To install it, follow the instructions that came on the Nicolet CD with your Nicolet brand system.

NOTE: The User Configuration Utility displays in the **read only** mode.

The amplifier uses a micro USB to USB cable to connect to a computer running the configuration utility. The USB cable is supplied with the amplifier. The amplifier can be connected to a Desktop Computer, PanelPC, or Laptop as shown in Chapter 3 of this guide.

After the amplifier is connected to the computer, you can start the application.

1. Click **Windows > Start > Config Utility**.
2. When the utility launches, you will be prompted for a **password**. See the password that was supplied with the amplifier.

When using the Configuration Utility, you have the ability to set a sampling rate and bipolar settings for channels 23-32. These settings are default settings. They will only be applied if you power on the amplifier with no stored data and proceed to start a study without connecting to NicoletOne. Therefore, for example, if you set the sampling rate to 512Hz and channels 23 and 24 to bipolar and the rest to referential, upon powering down and powering up the amplifier, starting a study will result in a study at 512Hz and with channels 23 and 24 as bipolar. Note that the default settings for bipolar channels only apply when a 32 channel headbox is attached to the amplifier.

Configuration Utility dialog

The following information can be viewed from the User Configuration Utility dialog.

NOTE: Do not disconnect the USB cable from the amplifier while the configuration utility is open.

IP Address / Ports

NOTE: When you upgrade the firmware, all custom settings will be erased. To avoid this, first export the settings and then update the firmware.

This section displays the current IP address of the amplifier and the port on which it is operating.

NOTE: Do not set the port to anything other than **26010** or the amplifier will be unable to connect to the Acquisition station.

MAC Addresses

This section displays the Media Access Control addresses. These are globally unique identifiers assigned to network hardware (i.e., a wireless card or an ethernet card).

NOTE: If you change any of these settings, you must power cycle the amplifier for the settings to take effect.

Status

The Status section displays the current power level of the amplifier and the remaining memory. The memory is displayed in GB, and the power level is displayed as a percentage of the remaining battery life or as “Connected” if the amplifier is connected to AC power.

Access Points

The Access Points section displays the access points that are currently available and in range of the amplifier. Note that after adding all the access point SSID's, you must select **Apply** and reboot the amplifier for the changes to take effect. The amplifier attempts to connect to the access points in the order they appear in the dialogue box regardless of connectivity strength.

NOTE: You can only enter up to **10** access points into the access point list. The more AP’s that you list, the longer the Amplifier will take to successfully negotiate or connect to an access point.

DHCP / Static IP

The DHCP section indicates if the amplifier is operating in the DHCP or Static IP mode. In the **Static IP** mode, the IP address is fixed. In the **DHCP** mode, the IP address of the amplifier is determined by the network.

SSID

This section displays the Service Set Identifier.

Sampling Frequency

The Sampling Frequency section displays the default sampling frequency of the amplifier. This is the sampling frequency that is used for the first study when it is started from the amplifier without connecting to the Nicolet brand system. If the amplifier is connected to the Nicolet brand system and a study is started from the software, the sampling rate selected becomes the new default sampling rate until the amplifier is power cycled.

NOTE: When entering your WEP encryption key in the configuration utility, ensure that it is either **10** or **26** characters and that all of the characters are hexadecimal (i.e., either a digit 0-9 or a letter A, D, C, D, E, or F).

10 Electromagnetic Compatibility (EMC)

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Electromagnetic Compatibility (EMC) Information

WARNING

Portable and mobile RF communications equipment can affect your product. Install and operate your product according to the EMC information presented in this User manual.

The use of accessories, transducers and cables other than those specified, with the exception of servicing parts sold by Natus Neurology Incorporated as replacement parts for internal components, may result in increased EMISSIONS or decreased IMMUNITY of the device.

Your Nicolet Brand system has been tested for EMC emissions and immunity as a stand-alone instrument. Do not use the system adjacent to or stacked with other electronic equipment. If adjacent or stacked use is necessary, the user should verify normal operation in that configuration.

EMI by nature can be a possible source of disturbance to electronic equipment. This device should be used in an environment free* of other equipment that could be affected by interference. **Environment free is described in IEC 1000-2-3, Part 2, First Edition.*

Observe the EN/IEC 60601-1-1 and EN/IEC 60601-1-2 standards in case of connection with other instruments. The connection of the equipment with other devices is allowed only when the safety requirements for the patient, the user and the environment are not compromised. If the Manual does not contain adequate information about the possibility of interconnection with other devices, the user should contact the manufacturer or the nearest authorized servicing center to obtain information about the effects that coupling devices may have on the patient, the user and the environment.

Radio transmitting equipment, cellular phones, etc. shall not be used in the close proximity of the device since this could influence the performance of the device.

Be careful using the equipment in locations disturbed by strong magnetic fields. The equipment is compliant with the EMC requirements (Electromagnetic Compatibility) according to what specified by the EN 60601-1-2 standard. It is recommended that the equipment be kept away from disturbance sources and induced electromagnetic fields surpassing the values prescribed by the standard in order to avoid any possible instabilities and malfunctioning of the equipment.

CAUTION

Medical Electrical Equipment needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in this User manual.

Portable and mobile RF communications equipment can affect the Equipment. Install and operate the Equipment according to the EMC information presented in this manual.

Pins of Trigger In, Trigger Out, Event button, mini-USB and Ethernet connectors identified with the ESD warning symbol should not be touched and connections should not be made to these connectors unless ESD precautionary procedures are used.

Precautionary procedures include:

- Methods to prevent build-up of electrostatic charge (e.g., air conditioning, humidification, conductive floor coverings, non-synthetic clothing);
- Discharging one's body to the frame of the EQUIPMENT or SYSTEM or to earth or a large metal object;
- Bonding oneself by means of a wrist trap to the EQUIPMENT or SYSTEM or to earth.

Staff that could touch connectors identified with the ESD warning symbol should receive this explanation and training. This includes clinical/biomedical engineering and health-care staff.

ESD training should include an introduction to the physics of electrostatic charge, the voltage levels that can occur in normal practice and the damage that can be done to electronic components if they are touched by an OPERATOR who is electrostatically charged. Further, an explanation should be given of methods to prevent build-up of electrostatic charge, and how and why to discharge one's body to earth or to the frame of the EQUIPMENT or SYSTEM, or bond oneself by means of a wrist strap to the EQUIPMENT or SYSTEM or to earth prior to making a connection.

Model	Signal Cable	Maximum Allowable Cable Length Limits
Nicolet EEGwireless32/64 Amplifier	Event button (option)	15ft (457.2cm)
	SpO2	60in (152.4 cm)
	Medical grade power supply (PSU-EEG64).	DC = 15ft (457.2cm) AC = 9ft (274.32cm).
	Battery with charger (Nicolet CHG1)	30in (76.2cm)
	Photic cable	100in (254.0cm)
	Headbox cable	30ft (914.4cm)
	Headcap cable	15ft (457.2cm)

Nicolet EEGwireless32/64 Amplifier - Electromagnetic Compatibility (EMC) Information

Portable and mobile RF communications equipment can affect the Nicolet EEGwireless32/64 amplifier. Install and operate the Nicolet EEGwireless32/64 amplifier according to the EMC information presented on this page and the next 4 pages.

The Nicolet EEGwireless32/64 amplifier has been tested for EMC emissions and immunity as a standalone instrument. Do not use the Nicolet EEGwireless32/64 amplifier adjacent to or stacked with other electronic equipment. If adjacent or stacked use is necessary, the user should verify normal operation in the configuration

Recommended separation distances between portable and mobile RF communications equipment and the Nicolet EEGwireless32/64 amplifier

The Nicolet EEGwireless32/64 amplifier is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the Nicolet EEGwireless32/64 amplifier can help prevent electromagnetic interferences by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Nicolet EEGwireless32/64 amplifier as recommended below, according to the maximum output power of the communications equipment.

Rated Maximum output power of transmitter **W**	**Separation distance according to frequency of transmitter m**		
	150 kHz to 80 MHz $d = 1.17\sqrt{P}$	80 MHz to 800 MHz $d = 1.17\sqrt{P}$	800 MHz to 2.5 GHz $d = 2.23\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

Note 1 At 80 MHz and 800 MHZ, the higher frequency range applies.

Note 2 These guidelines may not apply to all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Nicolet EEGwireless32/64 amplifier connected to a Nicolet brand system

Guidance and manufacturer's declaration - electromagnetic emissions

The Nicolet EEGwireless32/64 amplifier is intended for use in the electromagnetic environment specified below. The customer or the user of the Nicolet EEGwireless32/64 amplifier should assure that it is used in such an environment.

Emissions Test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	The Nicolet EEGwireless32/64 amplifier uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The Nicolet EEGwireless32/64 amplifier is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations / flicker emissions IEC 61000-3-3	Complies	

Nicolet EEGwireless32/64 amplifier storing with battery pack connected and wireless disabled

Guidance and manufacturer's declaration - electromagnetic emissions

The Nicolet EEGwireless32/64 amplifier is intended for use in the el ec to magnetic environment specified below. The customer or the user of the Nicolet EEGwireless32/64 amplifier should assure that it is used in such an environment.

Emissions Test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	The Nicolet EEGwireless32/64 amplifier uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The (EQUIPMENT or SYSTEM) is suitable for use in all establishments, including domestic establishments and those directly connected to the low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class B	
Voltage fluctuations / flicker emissions IEC 61000-3-3	Complies	

Guidance and Manufacturer's Declaration - Electromagnetic Immunity

The Nicolet EEGwireless32/64 amplifier is intended for use in the electromagnetic environment specified below. The customer or the user of the Nicolet EEGwireless32/64 amplifier should assure that it is used in such an environment.

Immunity Test	IEC 60601 Test level	Compliance Level	Electromagnetic Environment-Guidance
Electrostatic Discharge (ESD) **IEC 61000-4-2**	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be less than 30%.
Electrical fast transient/burst **IEC61000-4-4**	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge **IEC 61000-4-5**	±1 kV differential mode ±2 kV common mode	±1 kV differential mode ±2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply lines **IEC 61000-4-11**	**< 5% *U*T** (>95% dip in *U*T) for 0.5 cycle **40% *U*T** (60% dip in *U*T) for 5 cycles **70% *U*T** (30% dip in *U*T) for 25 cycles **<5% *U*T** (>95% dip in *U*T) for 5 sec	**< 5% *U*T** (>95% dip in *U*T) for 0.5 cycle **40% *U*T** (60% dip in *U*T) for 5 cycles **70% *U*T** (30% dip in *U*T) for 25 cycles **<5% *U*T** (>95% dip in *U*T) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the Nicolet EEGwireless32/64 amplifier requires continued operation during power mains interruptions, it is recommended that the Nicolet EEGwireless32/64 amplifier be powered from an Uninterruptable power supply or its battery.
Power Frequency (50/60 Hz) **IEC 61000-4-8**	3 A/m	Not applicable	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

Note: *U*T is the a.c. mains voltage prior to application of the test level.

Guidance and Manufacturer's Declaration – Electromagnetic Immunity

The Nicolet EEGwireless32/64 amplifier is intended for use in the electromagnetic environment specified below. The customer or the user of the Nicolet EEGwireless32/64 amplifier should assure that it is used in such an environment.

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment – guidance
			Portable and mobile RF communications equipment should be used no closer to any part of the Nicolet EEGwireless32/64 amplifier, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1.17\sqrt{P}$
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3V	$d = 1.17\sqrt{P}$ 80 MHz to 800 MHz
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 2.23\sqrt{P}$ 800 MHz to 2.5 GHz where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m) Field Strengthens from fixed RF transmitters, as determined by an electromagnetic site survey, (a* on the next page) should be less than the compliance level in each frequency range. (b* on the next page) Interference may occur in the vicinity of equipment marked with the following symbol: 

Note 1: At 80 MHz and 800 MHz, the higher frequency range applies.

Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

(a*) Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the Nicolet EEGwireless32/64 amplifier is used exceeds the applicable RF compliance level above, the Nicolet EEGwireless32/64 amplifier should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the Nicolet EEGwireless32/64 amplifier.

(b*) Over the frequency range 150 kHz to 80 MHz, field strengths should be less than [3] V/m.

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11 Error Codes

This chapter contains error codes that may appear while operating the Nicolet EEGwireless32/64 Amplifier.

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Error codes

If an error occurs, the Nicolet EEGwireless32/64 amplifier alternates between flashing on all eight of the LEDs followed by flashing the error code LEDs. Table 1 on the next page identifies the corresponding error codes.

If an error occurs:

1. Turn power off to the Nicolet EEGwireless32/64 amplifier.
2. Turn power on again to Nicolet EEGwireless32/64 amplifier.
3. If the error has been corrected, the LEDs will stop flashing. If the error can not be corrected, please contact Natus Neurology Incorporated Technical support at **1-800-356-0007**, **608 829-8500** or at **madison.helpdesk@natus.com**.

NOTE: Additionally, there is a wireless audit log that tracks information about communication with the amplifier. To access the audit log in the Reader application, select **Tools** > **Create Report**, and then from the report types, select **Wireless Audit Log**.

Power LED color codes

The function of the power LED colors has been extended to aid in diagnosing internal battery status.

a. Amplifier has external power source, internal batteries are charged, temperatures are within set limits.

   • Green LED with short flash off every 5 seconds.

b. Amplifier has external power source, internal batteries are charging. Temperatures are within set limits.

   • Green LED with short yellow LED flash every 5 seconds.

c. Amplifier is operating on internal batteries only. Temperatures are within set limits.

   • Yellow LED with short flash off every 5 seconds.

d. Amplifier has external power, the internal batteries are low and NOT charging. Temperatures are within set limits.

   • Power LED is solid yellow, no flashing.

e. Amp has external power, the internal battery temperature exceed set limits.

   The amplifier may still be used safely, but the internal batteries will not charge until the amplifier cools down. The amplifier will shut down safely when the internal batteries are depleted. The internal batteries will NOT charge until the amplifier temperatures fall under the set limits

   • Yellow LED with short green LED flash every 5 seconds.

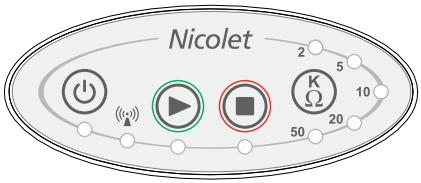
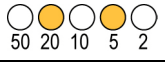
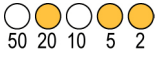
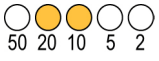
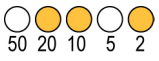
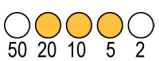
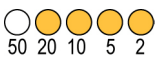
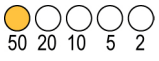
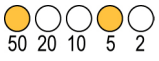
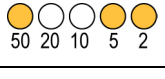
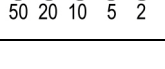


Figure 1

Error Number	LED error code displayed on amplifier	Description
1	50 20 10 5 2	The FPGA or logic chip did not load correctly. An amplifier power cycle will normally fix this problem. If the error remains, try reprogramming the FPGA with configuration utility.
2	50 20 10 5 2	The MAC address of both the wired and wireless Ethernet interface has been reset to defaults. Try cycling power. If the error remains, contact Natus Neurology Incorporated Customer Service
3	50 20 10 5 2	The internal battery voltage is too low to provide adequate reserve power for 50 20 10 5 2 normal operation. The amplifier needs time to charge the internal batteries. Connect the amplifier to power for 15-30 mins.
4	50 20 10 5 2	Error trying to allocate memory for the TCP connection. An amplifier power cycle will normally fix this problem. If the error remains, contact Natus Neurology Incorporated Customer Service.
5	50 20 10 5 2	Error trying to allocate memory for the UDP connection. An amplifier power cycle will normally fix this problem. If the error remains, contact Natus Neurology Incorporated Customer Service.
6	50 20 10 5 2	The internal SD card (on board memory) has not been detected. The SD card has come loose or is not operational. Try cycling the power. If the error remains, contact Natus Neurology Incorporated Customer Service.
7	50 20 10 5 2	The MAC address of both the wireless Ethernet interface has been reset to defaults. Try cycling power. If the error remains, contact Natus Neurology Incorporated Customer Service.
8	50 20 10 5 2	The MAC address of both the wired Ethernet interface has been reset to defaults. Try cycling power. If the error remains, contact Natus Neurology Incorporated Customer Service.
9	50 20 10 5 2	The internal batteries are missing, backwards, or the battery charge is too low. Try cycling the power or charge the amplifier. If the error remains, contact Natus Neurology Incorporated Customer Service.

Error Number	LED error code displayed on amplifier	Description
10		There is no headbox attached to the amplifier. The amplifier cannot be operated without a headbox attached. Attach a headbox and cycle power to remove the error condition.
11		A CPU error has occurred. Try cycling the power. If the error remains, contact Natus Neurology Incorporated Customer Support.
12		The watchdog reset has been tripped. Try cycling the power. If the error remains, contact Natus Neurology Incorporated Customer Support.
13		A brownout condition has been detected. Try replacing the power supply (AC brick) or external battery pack. If the error remains, contact Natus Neurology Incorporated Customer Support.
14		A power-on reset has occurred. Try cycling the power. If the error remains, contact Natus Neurology Incorporated Customer Support.
15		A JTAG reset has occurred. Try cycling the power. If the error remains, contact Natus Neurology Incorporated Customer Support.
16		A reset external to the CPU has occurred. Try cycling the power. If the error remains, contact Natus Neurology Incorporated Customer Support.
17		An over-temperature condition has been detected. Allow the amplifier to cool off. If the error remains, contact Natus Neurology Incorporated Customer Support.
18		Internal batteries are not charging. Try power-cycling the amplifier several times if necessary. Replacement of the internal batteries may be required.
19		Internal batteries over temperature. Allow the amplifier to cool off. Remove any coverings such as a blanket, etc.
20		Amp initialization error. Try power-cycling the amplifier. If the condition continues, contact Natus Neurology Incorporated Customer Support.

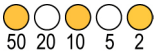
Error Number	LED error code displayed on amplifier	Description
21		Amp power - internal DC voltage. Contact Natus Neurology Incorporated Customer Support to report this condition.
22		Incompatible firmware versions. When combined, AVR Firmware version 1.0.77, Gas Gauge Image version 0.1.6, and FPGA Firmware version 1.0.8 and **higher** are compatible. When combined, AVR Firmware version 1.0.76, Gas Gauge Image version 0.1.5, and FPGA Firmware version 1.0.7 and **lower** are compatible.

Table 1

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12 Frequently Asked Questions (FAQ)

This chapter contains frequently asked questions concerning the Nicolet EEGwireless32/64 Amplifier.

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Question 1: Why can't I select my amplifier from the amplifier selection screen?

There are a number of reasons why you may not be able to select an amplifier. The problem is typically indicated in the "Amplifier Details" box at the bottom of the Wireless Amp selection screen.

Problem: The amplifier is associated with a different computer.

Solution:

You can either delete the current data off the amplifier using the computer with which you started the initial recording, or use the amplifier configuration utility to break the association.

1. Connect the amplifier via the micro USB cable to a computer that has the configuration utility installed.
2. Double-click the **Nicolet Wireless Configuration Utility** icon on the desktop.
3. Go to **Tools** and select **Clear association**.
4. Close the window. The amplifier is now be ready for data acquisition.

Problem: The amplifier either has an incompatible headbox type (a 64 channel headbox on a 32 channel amplifier) or there is no headbox attached to the amplifier. This is indicated in the Amplifier Details.

Solution:

Connect a compatible headbox to the amplifier. If the amplifier is a 32 channel amplifier, the only compatible headboxes are a 32 channel or w10-20HB headbox.

Problem: The last used protocol does not match the required protocol (i.e., using a 32 channel amplifier, you must have a 32 channel or w10-20HB protocol selected). This is indicated in the Amplifier Details.

Solution:

You must select **Cancel** from the amplifier selection screen. When you are presented with the recorder screen, select the proper protocol from the protocol menu. After selecting this protocol, exit NicoletOne recorder and then launch NicoletOne recorder again.

Problem: The amplifier went out of range or was disconnected after the Amplifier Selection window was opened. The intended amplifier will not be listed.

Solution:

Connect the amplifier either by bringing it back into wireless range or by tethering the amplifier with a ethernet cable.

Problem: The data on the amplifier was recorded with a different headbox type (only happens on 64 channel amplifier). The amplifier details indicates this.

Solution:

Connect the correct headbox type to the amplifier to retrieve the data. If you have a 64 channel headbox connected, connect a 32 channel or w10-20HB headbox. If you have a 32 channel headbox connected, connect a 64 channel headbox.

Problem: The bipolars selected in the current protocol do not match the bipolars selected on the amplifier. This is indicated by a dialogue box that appears after the amplifier has been selected.

Solution:

Follow the instructions in the dialogue box by changing the appropriate channels to or from bipolar in the protocol (**Note:** If this happens frequently, change the default bipolar settings in the configuration utility.)

Problem: The current protocol's sampling rate is over 4096Hz and the amplifier is connected wirelessly.

Solution:

Connect the amplifier to the network with an Ethernet cable or cancel the selection screen and choose a protocol with a sampling rate that can be used wirelessly.

Selecting a new protocol with a sample rate that is over 4096 Hz and the amplifier is in the Wireless mode will result in the amplifier not listed in the Amplifier Selection screen. By design the amplifier will only work in the Wireless mode with sample rates less than or equal to 4096 HZ.

Question 2: What happens if I try and review an exam that is incomplete?

If you are in NicVue and you attempt to open an exam that is marked "NicoletOne" in the "Exam" column, two situations can occur depending on the status of the amplifier.

If the amplifier is disconnected from the network, you are prompted to connect the amplifier and retry. If you select **Cancel**, you will be able to review only the data that has been currently downloaded.

If the amplifier is connected to the network, you are prompted to either download the remaining data and merge the files, or mark the exam as complete and review only the data that has been currently downloaded.

Downloading an exam from the Amplifier requires that the exam not be open for review on any other PC's.

Question 3: How do I know if an exam has been completely downloaded by looking in NicVue?

In NicVue there is a column labeled "Exam". If the entry in this column for your exam is "NicoletOne", that is an incomplete exam.

Question 4: Why does a single exam have multiple exam files?

When you have an incomplete exam in NicVue and you then download the remainder of the exam (either through Reader or Recorder), a second exam will appear, which will be marked as complete (i.e., Not have an "Exam" of NicoletOne).

Once the exam has finished and all file catchups are complete, the complete exam file will be marked nEEG, nLTM, nSleep, vEEG, or Monitor with a title of "DOWNLOADED" and have the most recent time stamp.

Question 5: What is an "overflow error"?

Sometimes, when the amplifier is communicating with the Nicolet software, a miscommunication occurs, which inserts an "overflow" event into the log. When this happens, you may see a large artifact appear for up to 10 seconds. If this happens frequently, please contact customer support.

Customer Support: 608 829-2040 or madison.helpdesk@natus.com

Question 6: What if my memory card fills up and I am still recording?

During LTM studies your memory card may fill up completely while you are still conducting the study. When this happens,

NOTE: The recording LED will start to blink and amplifier will beep prior to this happening.

1. Stop the study.
2. Close NicoletOne.
3. Reopen acquisition with the same amplifier.
4. When prompted, clear the onboard memory (provided you are sure that you have all the exam information) and begin a new exam.

NOTE: If you select **Retrieve Data** when entering acquisition, Nicolet will download the entire exam, which will erase any annotations in the current exam. Open the exam in Reader if there is information that has not been downloaded.

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Numerics

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