



TeleMyo 2400T[®]

Transmitter/ PC Card User Manual

Icons and Symbols

The following international icons and symbols are found on the TeleMyo 2400 enclosures. Their meaning is described below.



CE Mark: This symbol indicates the approval to market this product in the European Community as certified by Notified Body #0344, KEMA.



Non Ionizing Radiation: This symbol indicates that the device generates radio frequency energy during operation.



Type B Input: This symbol indicates that the transmitter signal input connections have a level B classification for protection against electric shock. The inputs are not intended for use with AC line powered equipment unless additional isolation measures are utilized.



Attention: This icon alerts the user to important information. Carefully read and understand all sections of this document displaying this symbol.

TeleMyo 2400T Introduction

The TeleMyo 2400 is the latest generation of Noraxon telemetry products. Each transmitter can accommodate eight (8) channels of any combination of sEMG and a variety of analog signals. Multiple transmitters can be coupled together to provide additional channels. The active electrode leads use Noraxon's patented signal processing technology to provide clear, consistent, and reliable data. The TeleMyo 2400 system operates as an IEEE 802.11b wireless local area network. Communication is bi-directional using an internationally accepted direct sequence spread spectrum 2.4GHz radio channel.

The Transmitter (2400T)/PC Card combination allows the user to collect data using only two small components and a computer. Once acquired all data remains in a digital format. An optional receiver unit, the TeleMyo 2400R is available for users who require data in an analog format.

TeleMyo 2400T Setup

Step #1 – UNPACK ALL ITEMS AND CHECK INVENTORY

The following items should be included with the TeleMyo 2400 Transmitter (see following figures).

1. TeleMyo 2400 transmitter device
2. Detachable antenna
3. EMG patient leads – (Number of leads depends on number of channels purchased)
4. Battery charger with country specific power cord
5. Noraxon Wireless PC LAN card device and software on CD
6. Transmitter carrying case with waist belt
7. Transmitter-to-Transmitter Sync cable (Only used on multi-Transmitter systems)

TeleMyo 2400T Components

1. *TeleMyo 2400 Transmitter with antenna*



2. *EMG Active Lead (Quantity depends on number of channels desired)*



3. *Battery Charger Power Source with detachable country specific power cord*



4. *Noraxon Wireless LAN Card*



5. *Transmitter Carrying Case*



6. *Transmitter to Transmitter Sync Cable*



Step #2 – PREPARING THE TRANSMITTER

1. The TeleMyo 2400 transmitter was supplied with a detachable antenna. If not already attached, locate the transmitter antenna and its insulating rubber O-ring. Place the rubber O-ring around the antenna receptacle on the transmitter. Next, screw the antenna to the transmitter to keep the O-ring in place. Tighten the nut on the antenna to ensure a good connection.
2. Place the Transmitter into the carrying case.
3. Remove the protective caps covering the input channel connectors. Keep these covers in a secure place for future use. Plug the numbered EMG active leads into their respective mating end on the TeleMyo 2400 Transmitter. The numbers on the active leads should match the numbers on the transmitter enclosure. Please note that there is one additional snap on the active lead labeled “1”. This extra snap provides an electrical reference to the subject. The electrode connected to this lead should be placed on a non-muscular area or bony prominence, such as the back of the wrist or kneecap. This connection must be used regardless of how many EMG channels are being monitored. Only one is required for any number of channels.
4. If using a multi-Transmitter system (more than 8 channels) connect the Transmitter-to-Transmitter Sync cable from the Sync Out connector on Transmitter 1 to the Sync In connector on Transmitter 2, then Sync Out on Transmitter 2 to Sync In on Transmitter 3 then ... Continue in this method until all Transmitters are connected together. No connection to the Sync In connector on Transmitter 1 is necessary. See illustration below.



All Transmitter-to-Transmitter Sync cable connections and disconnections must be made before attaching EMG leads to the patient. Connecting and disconnecting the Transmitter-to-Transmitter Sync cable when the patient is connected can expose the patient to a shock hazard.



Step #3 INSTALLING THE PCMCIA CARD SOFTWARE**Note:**

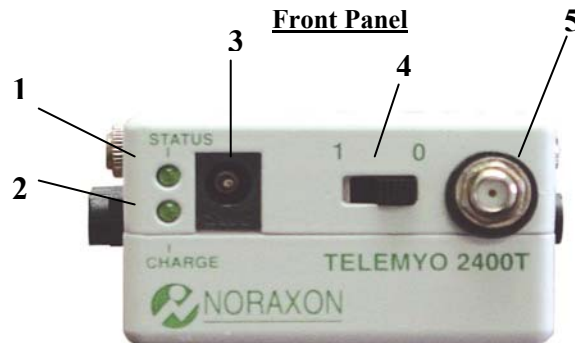
Users who wish to install the system on a computer running Window 98 will need to have their Windows98 Installation CD available. During certain parts of the procedure, Windows98 will ask for this disk. When prompted, remove the MyoResearch 2.11 CD from the disc tray and replace it with the Windows 98 disc and follow the on screen instructions.

1. With your computer turned off, place the Noraxon Wireless PC LAN card into an open PCMCIA slot on your computer.
2. Turn on your computer and wait for the “Add New Hardware Wizard” window to open.
3. When the “Add New Hardware Wizard” window opens, click ‘next’.
4. When the next dialog box opens, select “Search for the best driver for your device” and click ‘next’.
5. Select ‘Specify a Location’, deselect all other options, insert the MyoResearch 2.11 CD into your computer, press ‘Browse’ and find the folder titled Cisco Drivers. Click ‘Ok’. When returned to the wizard screen, press ‘Next’.
6. When the client adapter driver netX500.inf is displayed, click ‘next’ to copy the files.
7. The “Add New Hardware Wizard” will reopen indicating that the installation is complete. Click ‘Finish’.
8. Restart your computer.
9. When the computer reboots, double click ‘My Computer’, ‘Control Panel’, and ‘Network’.
10. Select the ‘Cisco Systems Wireless LAN Adapter’ and click ‘Properties’.
11. In the ‘Properties window, click the ‘Advanced’ tab.
12. In the Advanced window, select SSID and enter “TELEMYO” in the Value text box. This must be entered with all capital letters.
13. In the Advanced window, select ‘Infrastructure Mode’ and enter ‘No’ in the Value pull down box. Click ‘OK’.
14. In the Network window, select ‘Add’ and click on ‘Protocol’ in the “Select Network Component Type” list box. Click ‘Add’.
15. In the Select Network Protocol Window, select ‘Have Disk’. Locate the folder Noraxon Drivers\Wireless and find the “MyoAiro.inf” file on the MyoResearch 2.11 installation disc and click ‘OK’.
16. When complete you should find Noraxon to Aironet Interface protocol in the list of network components in the network window. Click ‘OK’.
17. Again, select ‘Cisco Systems Wireless LAN Adapter’ and click ‘Properties’.
18. In the Bindings Window, click the check box next to the Noraxon to Aironet interface. Click ‘OK’ twice.

19. Restart your computer.
20. Install the Aironet Client Utilities. Locate and open the Aironet Client Utility folder on the MyoResearch 2.11 Installation disc. Double-click the Setup.exe file located inside.
21. At the Welcome screen, click 'Next'.
22. In the Select Program Folder screen, click 'Next'.
23. In the Setup Complete Screen, select 'Finish' to end the installation process.
24. Close all open Windows and return to the Desktop.
25. Restart your computer.
26. Double click on the Aironet Client Utility (ACU) icon.
27. Select the Profile Manager located in the toolbar.
28. In the Profile Management box select the "Add" button. Enter the word "Noraxon" next to the flashing indicator and press 'Enter'. A new window will open.
29. Select the System Parameters tab and type "TELEMYO" in the parameter titled SSID1. The Client Name, SSID2 and SSID3 should be blank. In the Network Type box select 'Ad Hoc'. Press "OK" to leave this window.
30. Press "Apply" in the Profile Manager window to accept all setting. If Noraxon is not already selected in the Profile Management box then do it now. Press "OK".
31. Restart your computer.
32. When the computer reboots, open the MyoResearch 2.11 folder on the MyoResearch disc and double-click the setup.exe file. Follow the on-screen instructions to install the software.
33. Restart your computer.
34. When the computer reboots, double click on the MyoResearch icon. In the A/D setup window select 'MyoAiro Wireless Device'. In the Channel Setup window select 'TeleMyo 2400'.
35. Finally, verify that your Noraxon Wireless PC LAN card has been installed correctly by verifying that its green indicator light blinks.

Controls and Displays

TeleMyo 2400 Transmitter



1. Status Indicator

The status indicator blinks at four different rates. Recognizing these differences is helpful in knowing the state of the wireless communication link between the transmitter and PC card.

1Hz (Slowest Blinking Speed) – In this state the transmitter is searching for a PC radio card to communicate to. No link to the Wireless LAN PC card has been made at this point.

2Hz – When the PC radio Card recognizes the transmitter, the Status indicator will begin to blink at a faster rate. At this point no EMG data is being transferred; however, the wireless link has been established.

4Hz (Fastest Blinking Speed) – When the “acquire EMG data” command has been sent from the PC radio Card to the transmitter, the Status indicator will blink at this rate. When this occurs, EMG data will be moving along the communication link.

Steady (Unblinking) – The Status indicator glows steady when its battery charge has reached a critical level. When this occurs it is important to recharge the transmitter’s internal battery to continue satisfactory operation.

2. Battery Charge Indicator

The battery ‘CHARGE’ indicator will only display when the transmitter’s internal battery is being recharged. When recharging this indicator will initially blink and then glow steady. When the indicator goes off charging is complete. For instructions on how to recharge the batteries please refer to page 14 of this manual.

3. Battery Charger Connector is the port to which the battery charger power source is connected. Only active when unit is switched to the off, ‘0’ or charge state.



The Transmitter cannot be used while it is recharging. To avoid a potential electrical shock, do not have leads attached to a patient while it is being charged.

4. On/Off (Recharge) Switch

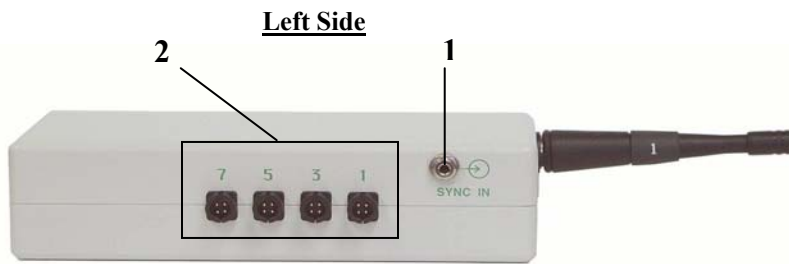
In the “O” or charge position the device is turned off. Also in this position it is possible to charge the batteries. In the “1” position the instrument is on and EMG measurements may be taken.

5. Antenna Connector is the port to which the Antenna is connected.

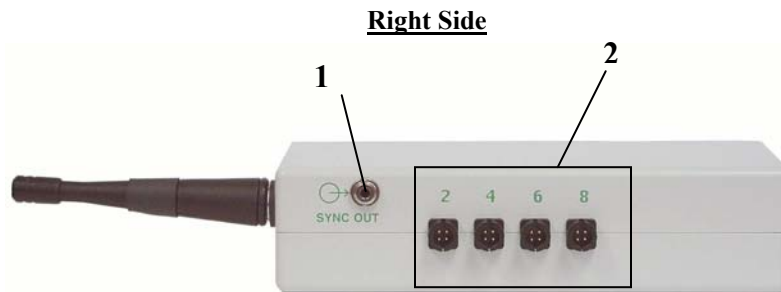


When in use for extended periods of time, position the transmitter’s antenna away from any exposed parts of the body, especially the face or eyes.

Do not operate the transmitter unless the antenna is connected. If the antenna is not connected, the radio may be damaged.



1. EMG Active Lead Connectors 1,3,5 and 7
Ports to which Active Leads or other qualified analog input signals are connected. These ports come supplied with protective rubber caps that must be removed to attach inputs cables. The cap must be reapplied whenever the transmitter is used without an input connection to that channel.
2. Sync Input Connector
When using multiple Transmitters it is necessary to synchronize all units using the Transmitter to Transmitter Sync cable. The cable makes an attachment between the Sync Output of one transmitter to the Sync Input of the next. For instructions on how to use multiple transmitters please refer to page 4.



1. Sync Output Connector
The opposite end of the Transmitter to Transmitter cable is connected to this connector. Please refer to page 4 for instructions.
2. EMG Patient Lead Connectors 2,4,6 and 8
Ports to which Actives Leads or other qualified analog input signals are connected.



Always turn the instrument off (place switch in '0' position) before connecting the Active EMG Leads. Failure to do so may damage internal circuitry.

The protective input connector cap must be applied whenever the transmitter is used without an input connection to that channel. This is necessary to avoid a potential electrical hazard.

Internal Transmitter Settings

There are 2 internal controls that are preset by Noraxon prior to shipment of all TeleMyo 2400T systems. Normally these settings do not need to be changed by the user. They are presented here, however, to aide in understanding overall operation.

1. Transmitter ID (1, 2, 3 or 4)

When multiple transmitters are used there must be a means to identify one transmitter from another. Jumpers internal to the transmitter allow four (4) unique settings. The first setting identifies transmitter '1' which carries channels 1-8. Transmitter '1' is the master unit. All other transmitters are slaves, which means their timing is controlled by the Sync Output of the '1' transmitter.

The second Transmitter ID setting identifies transmitter '2' which carries channels 9-16. Similarly setting three identifies transmitter '3' used for channels 17-24. Setting four is also available for transmitter '4' which carries channels 25-32.

If you have a system with more than one transmitter each transmitter will be identified with the label '1', '2', '3' or '4'.



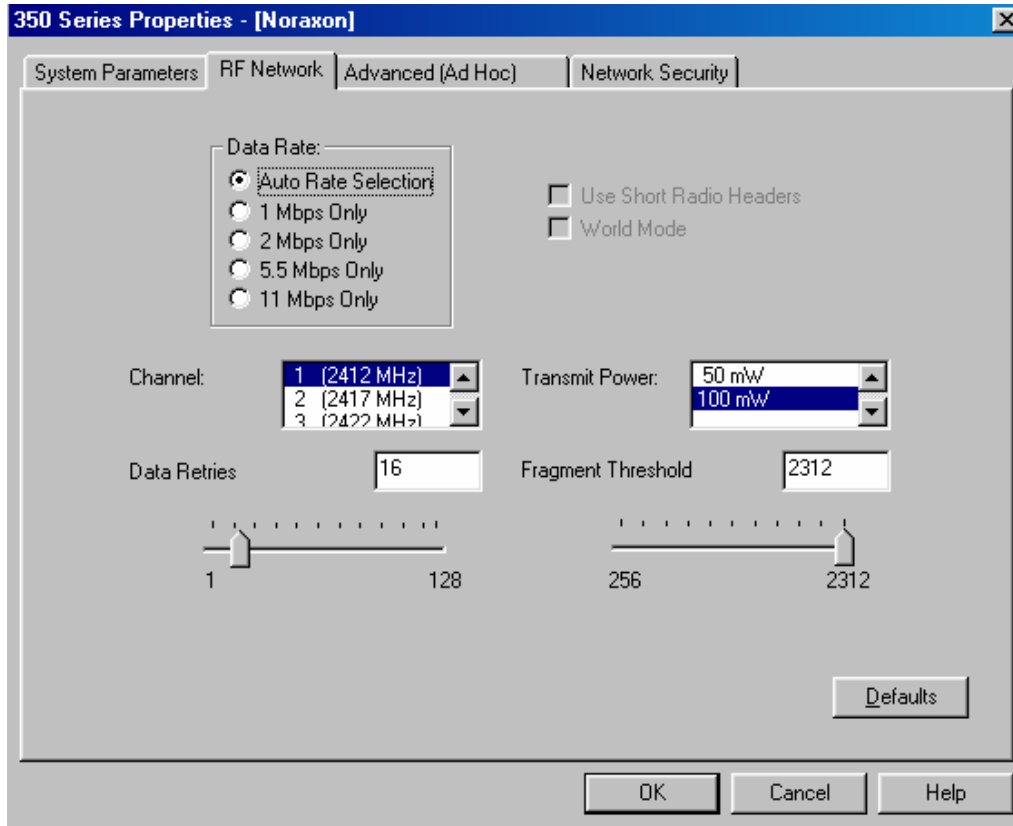
Transmitter 1 must always be active to perform measurements. Transmitters 2, 3 or 4 will not perform measurements unless transmitter 1 is also in use. Transmitter 1 is the only unit that can operate on its own.

2. Radio Channel

The TeleMyo 2400 system can operate on any one of 11 different radio channels between 2.412 GHz (radio channel 1) to 2.462 GHz (radio channel 11). These frequencies and channels are defined by the IEEE802.11b wireless network standard. Not all radio channels are available for use in each country. Based on the destination country, Noraxon presets the radio channel to an allowable frequency prior to shipping the TeleMyo 2400T.

Radio channels 1, 6 and 11 are the most commonly set channels. All transmitters in a group must be set to the same radio channel. The transmitter channels must also agree with the radio channel of the PC radio card or TeleMyo 2400R receiver option. The user must use the supplied accessory software to configure the PC radio card to operate at the same radio channel as the transmitters. The TeleMyo 2400R receiver option comes preset to match the transmitter radio channel and requires no user involvement.

To change the radio settings in the accessory software, open the Aironet Client Utilities from the Start menu and select the Profile Manager. When inside locate the Profile Management pull-down box, select “Noraxon” and press the “Edit” button. In the new window select the RF Network tab. The following screen will appear.



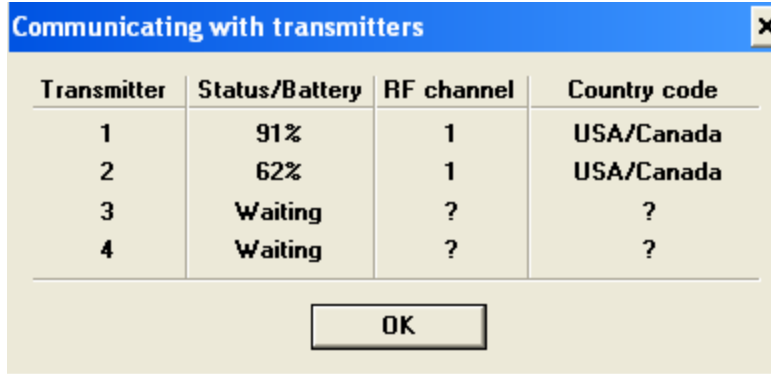
Select Channel 1 in the Channel scroll box unless directed by a Noraxon representative to do otherwise. When complete select the “OK” button to close the Properties window then select “Apply” in the Profile Manager window to keep the new setting. Press “OK” to leave the Aironet Client Utility.



**Never change the radio channel setting without first contacting Noraxon.
Operation on unapproved radio channels is illegal.**

Status and Pre-Measurement Checks

Each transmitter continually sends status information related to the available battery charge as well as the quality of the radio signal transmission. This information can be viewed on the computer screen in two separate situations. One situation is a continual viewing of the status using the transmitter test panel dialog inside Noraxon’s data acquisition software. The second situation is a temporary display of the status information in a brief dialog that appears prior to the beginning of each new measurement. These two situations are illustrated below.



The battery status percentage reveals the level of charge remaining on the battery. This information is meant as a rough guideline as remaining battery life cannot be accurately portrayed. It is best to defer an extended measurement session and recharge the battery whenever the battery status is below 20-30%.

Establishing Measurement

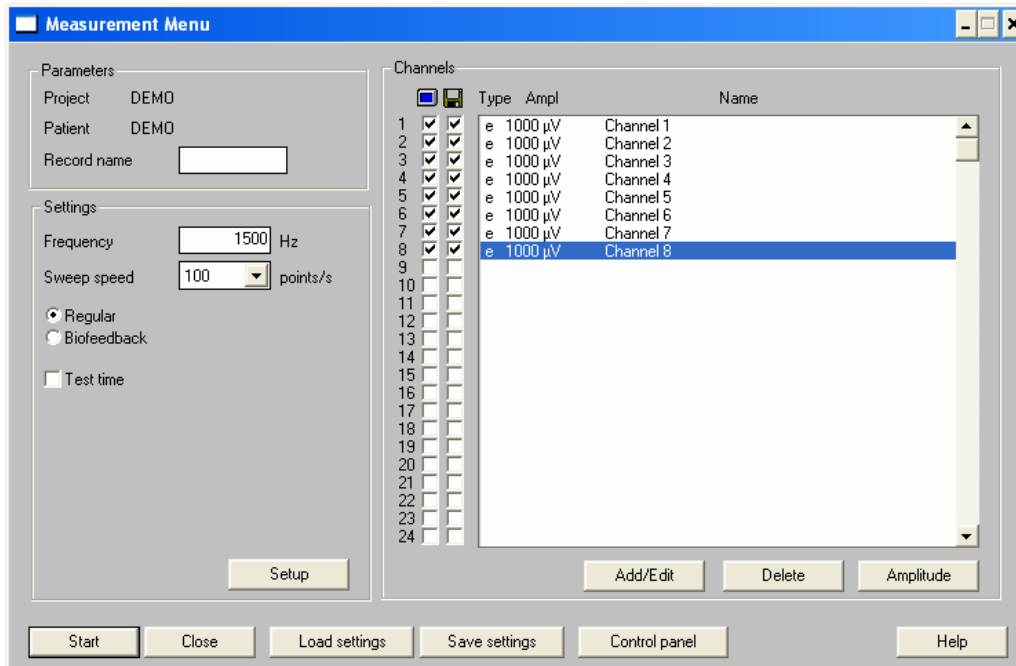
TeleMyo 2400 Transmitter w/ Noraxon Wireless PC LAN Card

Before a measurement can be taken, a few steps must be followed to configure the Noraxon software to allow TeleMyo 2400 measurements.

To setup the software, first, open your Noraxon software (MyoResearch or MyoClinical). From the database menu select 'Setup' and then 'A/D Setup'. The following screen will appear.



Under the Hardware section press the pull down tab on Device and A/D Driver and select TeleMyo 2400 and MYOAIRO wireless device as shown in the picture above. When finished, press ‘OK’. Next, from the Database Menu, select ‘Measure’. The following screen will open.



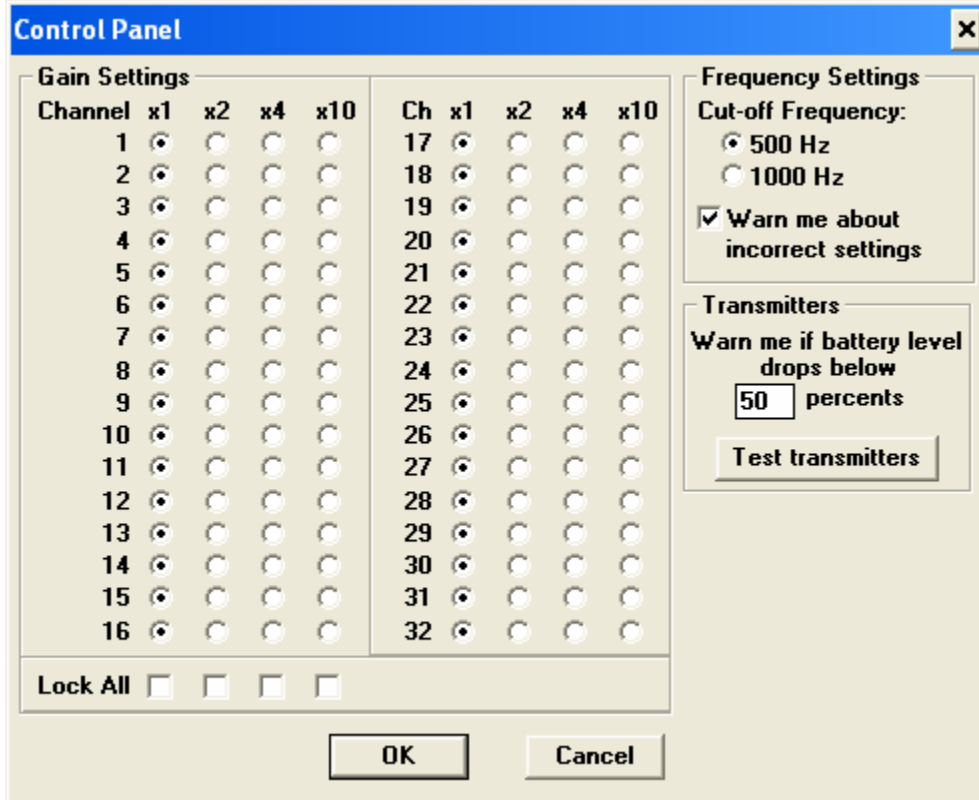
In the Channels box, select the number of channels that will be used to acquire data. For one transmitter you may select up to eight channels. When using two transmitters, up to sixteen channels can be selected. For three transmitters up to twenty four channels can be used.

The sampling frequency field can be set to either 1500 or 3000 Hz. These are the only allowed rates.

When all channels have been selected, turn the switch on the 2400 Transmitter(s) to the “1” position and press the “Start” button on lower left hand corner of the screen. A wireless communication link will be

established between the transmitter(s) and the Noraxon Wireless PC LAN Card. When the measurement is initiated the status indicator on the transmitter(s) will blink at the fast speed of 4Hz. Also the status indicator on the PCMCIA receiver will glow green.

Some settings on the Transmitter can be controlled by Noraxon software. These settings include Gains, and Cutoff Filter frequency. When either of these settings are changed, they will become effective when the next measurement is started. For instruction on how to adjust these setting, please refer to your specific software's instruction manual.



Charging the battery

To charge the TeleMyo 2400 Transmitter's internal battery:

1. Turn the power switch on the Transmitter to the '0' or charge position.
2. Unsnap all active leads attached to patient.
3. Remove the Transmitter from the patient environment.
4. Plug the battery charger power source into a live wall outlet.
5. Insert the female end into the Battery Charger connector located on the front display of the Transmitter.

While the device begins charging the Charge indicator may flash if the battery charge is nearly completely exhausted. As charging continues, the indicator will glow steady. When fully charged the indicator will turn off. Leave the transmitter plugged in for approximately 90 minutes to completely charge the battery. When fully charged the battery will run for 4 hours.

The transmitter batteries should undergo a minimum of 300 recharge cycles before needing to be replaced. Only use replacement battery packs available from Noraxon. Use of unauthorized battery packs may create a safety hazard.



The Transmitter cannot operate while it is recharging. To avoid a possible electrical hazard do not have leads attached to a patient while it is being charged.

The TeleMyo 2400 Transmitter must be recharged using the supplied Transmitter Battery Charger Power Source only. Use of an unauthorized power source may create a safety hazard.

The opposite end of the power cord has a safety or ground terminal on its plug. It is essential to only plug the power cord into a wall outlet that has a properly grounded receptacle at all times to ensure safe operation and full compliance with the relevant standards.

Radio Considerations

The TeleMyo 2400 radio system operates in the 2400 MHz ISM (Industrial, Scientific and Medical) radio band reserved for use in most countries of the world. The radio transfers data digitally using the IEEE802.11b standard (commonly referred to as WiFi). This is the same protocol used by many wireless computer network systems. Other devices operating in this frequency band include computer networks, microwave ovens, cordless phone sets and Bluetooth enabled devices.

Despite all this competing radio activity the TeleMyo 2400 system is able to discern its particular information from all the surrounding radio traffic. Reliable transmission depends on good signal quality. Signal quality will fall with extended distances between the transmitter and the PC card or TeleMyo 2400R receiver. Obstructions (walls, metal structures, trees, etc.) between the transmitter and receiver will also lower the signal quality.

As the signal quality decreases the radio transmission is automatically modified to ensure reliable data flow. This can mean either slowing down the rate of data delivery or else re-transmitting any data that was improperly received.

While the TeleMyo 2400 is quite immune to interference, it does transmit a deliberate radio signal that could effect nearby sensitive equipment. Users should always be aware of this possibility. In a similar manner, although the energy level of the radio is considered harmless to human beings it is still prudent to minimize exposure.

Finally, although available worldwide, each country places certain restrictions on the operation of radios in the 2400 MHz ISM band. These restrictions include allowable transmitter power levels and broadcast frequencies.



Never operate the TeleMyo 2400 within 1 meter of any critical medical device.

When in use for extended periods of time, position the transmitter's antenna away from any exposed parts of the body, especially the face or eyes.

Do not operate the transmitter unless the antenna is connected. If the antenna is not connected, the radio may be damaged.

Do not change or modify the transmitter antenna. This can increase the output power level beyond what a certain country may allow.

Never change the radio channel setting without first contacting Noraxon. Operation on unapproved radio frequencies is not allowed.

Use of Disposable Electrodes

While the TeleMyo 2400 can operate with reusable electrodes, it is most commonly used with disposable surface electrodes. Any good quality silver/silver chloride electrode is acceptable. Noraxon provides several types of quality disposable electrodes for a wide variety of sEMG applications. It is recommended that any electrodes used with the TeleMyo 2400 satisfy the requirements for standard ANSI/AAMI EC12-1991 Disposable ECG electrodes.



Because disposable electrodes have a shelf life, it is important not to use expired parts. Bulk disposable electrodes come packaged in a sealed container or bag. The expiration date can be found printed on the package container. After the sealed bulk container is opened, the remaining electrodes should be used before their gel begins to dry out. Always keep the remaining electrodes in their bulk package until they are used. Avoid using electrodes that are randomly found lying outside of their bulk packaging as their expiration date is uncertain and their gel has been exposed to accelerated drying.

Be aware that when disposable electrodes are removed some individuals may notice a faint red skin discoloration over the site previously occupied by the electrode. This skin discoloration is typically benign and temporary and may be due to a mild allergic reaction to the adhesive or simply be a slight abrasion caused by peeling away the tape. It will usually disappear within 24 hours.

Noraxon discourages any attempt to reuse a disposable electrode, even if it simply is to peel it off and slightly reposition the electrode's muscle placement. Noraxon strongly recommends against the use of dried out electrodes that are re-wetted with electrode gel.

Electrode Application Guidelines and Facts

1. If the subject has a fair amount of hair at the electrode application site, the hair should be clipped. Shaving is not necessary and may irritate the skin.
2. The electrode application site should be clean and dry. The preferred method of cleaning is with soap and water plus drying the skin with a dry cloth. Dry skin contributes to good electrode adhesion and good trace quality.
3. Cleaning with isopropyl alcohol should be avoided or limited to situations where electrode adhesion is an issue (diaphoresis, excessively oily or lotion covered skin), since it may dehydrate the skin thereby causing skin impedance to increase. If alcohol is used, allow it to dry prior to electrode application.
4. Attach the lead wire to the electrode prior to placing the electrode on the skin. This will eliminate the potential for discomfort if snap lead wires are pressed onto the electrode after the electrode has been applied.
5. Electrode application sites should be abraded to lower the skin impedance. Abrasion patches can be found on most electrodes. Simply draw the abrasion patch several times over the skin of the intended application site.

6. Electrodes are the weak link in the EMG measurement chain. Lack of proper attention to electrode quality or site preparation is by far the most common cause of inferior recordings.
7. It may take up to 5 minutes for disposable electrodes to fully stabilize electrically once applied to the skin. If extremely critical or precise measurements are intended the electrodes should be applied several minutes in advance of the recording.
8. Cable motion artifact, if present, can be minimized by immobilizing the electrode lead wires near the snap end of the cable. Taping or wrapping the wires to the subject may prove helpful when very dynamic movements are being measured.
9. When attaching the cable set to the electrodes always connect the Reference lead first. This permits any difference in static electricity between the subject and the instrument to be safely discharged.



When attaching EMG leads, prevent lead snaps that are not yet attached to electrodes from coming into accidental contact with other conductive objects. This will avoid a potential shock hazard. A simple way to ensure this with disposable electrodes is to first attach electrodes to all snaps, then unpeel the adhesive cover and applying the electrodes to the patient.

TeleMyo 2400 Cable and Accessory Connection/Disconnection

1. Active Electrode Leads

Each active electrode lead has a built in preamplifier powered from the TeleMyo 2400. In addition any of these EMG leads can be separately unplugged or replaced. The preamplifier electronics are contained in the removable lead and can be in either single (standard) or a double differential configuration. When connecting each lead to the TeleMyo2400 transmitter, match the numbered cable to the numbered receptacle.



It is important to switch the TeleMyo 2400T to the “0” position before connecting or disconnecting any active lead. Failure to do so could damage the lead electronics.

It is also important to have all leads detached from the patient while the device is being charged. Failure to do so may subject the patient to an unwanted electric shock.

Finally, it is important to inactivate all input leads that are not being used. For active leads this can be done by placing back-to-back electrodes between the lead snaps. Alternately, unplug the lead and place the rubber protective cover over the exposed input connector.

2. Other analog signals

The TeleMyo 2400T input channels can accept analog signals in the range of +/- 5 Volts. Noraxon offers special adapter cables that allow signals from other Noraxon supplied battery operated devices to be used in

conjunction with EMG signals. For example, Noraxon footswitch and electro-goniometer products can be substituted for any of the 8 EMG inputs by exchanging an adapter cable for the active lead.

Noraxon also offers as an option the TM2400 Analog Signal Isolation Unit. This provides 3 or 6 channels of analog signal isolation and is meant for use with analog signals originating from AC (wall powered) equipment. A typical example would be interfacing to an isokinetic machine to monitor joint position and applied torque along with EMG.



Only Noraxon approved analog signal sources should be applied to the transmitter input connectors. Generally signals from battery operated devices pose no concern. However, signals arriving from AC powered devices must never be directly attached to the transmitter.

Frequent plugging and unplugging of inputs can prematurely wear out the transmitter input connectors. It is advisable to always inspect the connectors for bent or loose pins before attaching an input.

3. *Transmitter Battery Charger*

The TeleMyo 2400 Transmitter can be recharged using the supplied Transmitter Battery Charger power source. When using this power source, it is very important to follow the instructions written in the “Charging the Battery” section of this manual to ensure safety. If a replacement power source is needed, contact Noraxon World Headquarters as only Noraxon certified parts and chargers must be used.

4. *Transmitter to Transmitter Sync Cable*

When using more than one TeleMyo 2400 Transmitter, it is necessary to ‘daisy chain’ each system together using the Transmitter to Transmitter Sync Cable. To do this, simply locate the system labeled “A” and connect the Transmitter-to-Transmitter Sync Cable to the Sync Out connector. Next, connect the Transmitter-to-Transmitter Sync Cable to the system labeled “B” to the Sync In connector. When connected properly, both transmitters will communicate to the Receiver (either PC LAN card or TeleMyo 2400 Receiver) in the correct order.



It is important to fully connect all Transmitter-to-Transmitter Sync Cables to all transmitters before applying any EMG leads to the patient. If attached at only one end, the free end of the Sync Cable could touch an electrified object and expose the patient to a shock hazard.

All cables that are attached to the TeleMyo 2400 system are only intended for connection to equipment that comply with IEC 60601-1 and must be supplied or approved by Noraxon. Noraxon will not be held responsible for any failures that occur by using parts that do not comply with these specifications.

Maintenance

It is recommended that weekly the 2400 Transmitter be left 'on' until its batteries are completely discharged. Doing so eliminates the onset of battery "memory". The term "memory" describes the effect whereby a battery remembers its usual discharge point. For example, if the transmitter batteries are used to 40% capacity every time before recharging, eventually the batteries will not run below that 40% mark. The effect of battery "memory" will be noticed by a significant decrease in the amount of time the transmitter will operate in-between chargings. If this is observed, the transmitter should be charged and fully discharged several times to clear the unwanted memory effect.

With normal use the transmitter battery pack will operate properly through at least 300 charge/discharge cycles. Plug-in replacement battery packs are available from Noraxon. Detailed instructions are provided with the replacement battery pack. Alternately the transmitter can be sent to Noraxon for servicing.



Only use replacement battery packs available from Noraxon. Use of unauthorized battery packs may create a safety hazard.

The Transmitter battery packs are not user replaceable. Only qualified technical personnel may perform the maintenance.

Care should be exercised not to place or stack objects (especially liquids) on top of the TeleMyo 2400 case.

Cleaning

The instrument case and cables can be wiped down with a damp cloth using a mild soap or detergent and water. Isopropyl alcohol can be safely used to remove tape or other adhesive residues from the cables. Before cleaning any portion of the system, the instrument should be unplugged from the wall power outlet.

Cleaning, Disinfecting & Sterilization of Electrode Cables

The electrodes, whether disposable or reusable, surface, fine wire or needle, make the only intimate contact with the patient or subject. However, the electrode cables can and do make physical contact with the individual. For sanitary purposes it is advisable to clean the cables on a regular basis. Electrode cables can be cleaned with a solution of mild soap or detergent and water. Isopropyl alcohol can be used to remove adhesive residue from electrodes or tape.

The electrode cables are not constructed to withstand repeated application of any disinfectant solution. Likewise the cables are not warranted against exposure to any of the conventional forms of sterilization. Users wishing to utilize this equipment in a sterile environment, such as an operating theater, should consult Noraxon for other options. In certain cases cable extenders can be provided to accommodate the attachment of sterile terminal leads to the patient.

Sterilizing Electrodes

Noraxon provides high quality disposable surface electrodes for single use applications. Different types of electrodes: fine wire, needle, vaginal, rectal, or esophageal probes are available from other reputable manufacturers. Consult the product documentation for each specific manufacturer on the advisability and proper means to sterilize reusable electrodes.

Specifications

Power Requirements:

- Transmitter – 6 V NiMH rechargeable battery pack. (Noraxon part number: NEP0019)
- Battery charger operates at 100-240 VAC 50/60 Hz

Battery Life:

- Transmitter – 4 hours (continuous use); Charge time ~ 90 minutes

Output Power & Transmission Frequency (depending on country):

- Up to 100 mW (depending on antenna and country allowance)
- DSSS 2412-2462 MHz on (up to) 11 unique radio channels

Transmission Range:

- Up to 300 feet (100 meters) in open view
- Antenna options maximize range in specific environments

Dimensions:

- Transmitter: 5 ¼ “ L x 2 ¼ “ W x 1 ¼ “ H; 14 oz.

Hardware Filters:

- No notch (50/60 Hz) filters are used
- All sEMG leads have 1st order high pass filters set to 10 Hz +/- 10% cutoff
- All channels have 8th order Butterworth/Bessels low pass anti-alias filters set to either 500 Hz or 1000 Hz +/- 2 % cutoff

EMG Active Leads:

- Baseline noise < 1 uV rms
- Input Impedance > 100 MegOhm
- CMR > 100 dB
- Range +/- 3.5 mV
- Base gain 500

Transmitter Data Acquisition System:

- 12 bit resolution
- Input range +/- 5 V (full scale)
- Noise < 2 LSB
- 8 channels per transmitter
- All channels have individual gain settings
- sEMG channel hardware gains (500) x1, x2, x4, x10
- non sEMG hardware gains x1, x2, x4, x10
- Sample rates 1500 or 3000 samples/second/channel

Technical Description

General

The TeleMyo 2400 is an electromyographic (EMG) instrument available as 4,8,12, 16, 20 or 24 channel systems. This device has been manufactured specifically for sEMG applications and is not intended for use with evoked response equipment. Its design complies with international standard IEC 60601-1, *The International Standard for Medical Electrical Equipment* and IEC60601-2-40, *Particular requirements for the safety of electromyographs and evoked response equipment*. This device also complies with part 15 of the Federal Communication Commission (FCC) Declaration of Conformity Statement. As a result, operation is subject to the following two conditions:

1. The device may not cause harmful interference.
2. The device must accept any interference received, including interference that may cause undesired operation.

Equipment Installation and Restricted Use

The instrument can be charged from all conventional alternating current power sources (i.e. 100-240 VAC 50/60Hz) without modification. A power cord matched to the local service configuration is needed and is included with the unit. The power cord requires an IEC320 style connector for the instrument end. The opposite end of the power cord must terminate with a grounded AC plug. Electrically the TeleMyo 2400T battery charger is a Class I device, the transmitter is internally powered with type-B applied parts. The instrument is not protected against the ingress of water and carries no IPX rating (i.e. ordinary equipment).

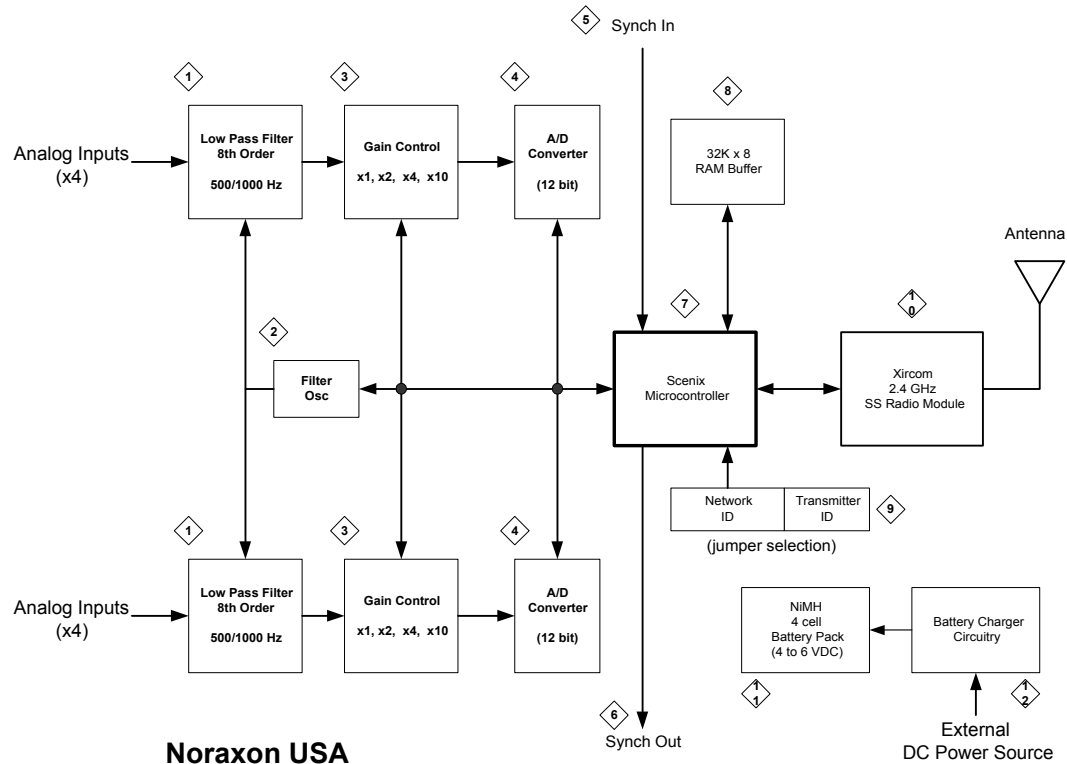
Restricted Usage

The TeleMyo 2400 is not intended for use in the following situations:

1. In the presence of flammable anesthetizing agents or substances.
2. In the presence of strong magnetic fields such as those produced by MRI (Magnetic Resonance Imaging) equipment.
3. In the presence of heavy electrical machinery such as near large motors, elevators, compressors, and the like.
4. Within one-meter proximity of critical medical devices.
5. When the antenna is very close or touching any exposed parts of the body, especially the face or eyes, while transmitting.
6. With evoked response equipment or high frequency surgical equipment. Connection of a patient to high frequency surgical equipment and to an electromyograph simultaneously may result in burns at the site of the biopotential input part electrode and possible damage to the biological amplifiers.

Diagrams

A block diagram of the TeleMyo 2400T transmitter and associated block descriptions are provided in the following pages.



Noraxon USA
TeleMyo 2400 Transmitter Block Diagram
(P-23012T)

TeleMyo 2400 Transmitter Block Diagram Descriptions

1. Low pass filter with selectable bandpass of 500 or 1000 Hz. One filter per analog input.
2. Switched capacitor filter control oscillator operating at 50x the bandpass frequency (i.e. 25 KHz or 50 KHz) selectable under program control.
3. Selectable gain control block providing gains of x1, x2, x4, or x 10. The nominal EMG preamplifier gain is 500. This allows EMG gains of 500, 1000, 2000 or 5000.
4. Four channel 12 bit successive approximation analog to digital converter. Sampling frequencies of 1500 or 3000 sample/second/channel.
5. Logic level input signal to synchronize data collection when more than 8 data channels are being acquired, that is, when two or more transmitters are active simultaneously. One transmitter serves as the master and does not utilize the synch input. Additional transmitters function as slaves. The master transmitter **synch out** signal is daisy chained to the **synch in** of the first slave transmitter. Sampling begins only when **synch in** is active.
6. Logic level synchronizing output which serves as the synchronizing input to the next slave transmitter in the daisy chain.
7. Microcontroller used to coordinate data acquisition, storage of sampled data into buffer memory and transfer of packet data to the radio module for transmission. Data packets are transmitted approximately every 10 milliseconds.

8. RAM buffer memory to store acquired data prior to transmission by the radio.
9. In general a radio system consists of a receiver and one or more transmitters. The jumper selectable **network id** (0x0 to 0xb or 11 combinations) is used to define a 'matching identification' for each transmitter-receiver set. Thus up to 11 wireless networks (TeleMyo) can co-exist in the same vicinity without interference. Also the jumper selectable **transmitter id** (0x0 to 0x3 or 4 combinations) is used to identify a specific transmitter when more than one transmitter is part of a TeleMyo network.
10. Direct sequence spread spectrum radio module operating in the 2.4 GHz band. The module is programmed to respond only to transmissions corresponding to its **network id**. Data packets are sent/received using 'wireless network' protocols (802.11b).
11. Nickel Metal Hydride rechargeable battery pack. Battery capacity is monitored by the microcontroller and its status is reported periodically during radio transmissions to the receiver.
12. Battery charger circuit. Recharge cycle is 3 hours. Full charge is achieved in approximately 1.5 hours and a trickle charge continues for the remaining 1.5 hours.

Schematics and Parts List

Noraxon will make available (on request) circuit diagrams, components parts lists, and calibration instructions to assist qualified technical personnel in the service and maintenance of the TeleMyo 2400. Please contact Noraxon World Headquarters USA at:

Noraxon USA, Inc.
13430 North Scottsdale Rd.
Scottsdale, AZ 85254

Phone: 480/443-3413
Fax: 480/443-4327

Send all technical support questions to: support@noraxon.com.

European users should contact the following European Authorized Representative:

Proxomed Medizintechnik GmbH
Daimlerstrasse 6
D-63755 Alzenau Germany
49-6023-9-16-80 phone
49-6023-91-68-68 fax

Transport and Storage

The TeleMyo 2400 is capable of transport and storage in environmental conditions within the following ranges:

Ambient Temperature: -40 degrees C to +70 degrees C
Relative Humidity: 10% to 100%
Atmospheric Pressure: 500hPa to 1060hPa