



# MyoSystem 1400A

## *Operation and Technical Manual*



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## **MyoSystem 1400A Installation and Setup**

The Noraxon MyoSystem 1400A is a state-of-the-art modular EMG data collection system. The MyoSystem 1400A offers outputs for each EMG input channel with the capability of expanding up to 16 EMG or sensor input channels in addition to 4 accessory analog input channels.

The setup and installation are actually quite simple. Check to see that you have all the proper parts and components.

### **Step #1 - Unpack All Items and Check Inventory**

The following items should be included with the MyoSystem 1400A. (See figure on next page)

1. MyoSystem 1400A Instrument: White case that contains EMG and BNC input connectors on the front.
2. Detachable power cord: The cord plug is matched to your country's specific wall receptacle configuration.
3. Active Cable: One cable provided per 8 EMG channel. Cables provided according to the number of channels ordered.
4. Preamplified EMG leads: One lead per channel. The reference lead has 3 snaps, all others have 2 snaps.
5. USB cable: For communication between the MyoSystem 1400A and a computer.

### **Step #2 – Connecting the System**

1. Place the MyoSystem 1400A instrument on a level tabletop or a stand adjacent to your computer and testing area.
2. The MyoSystem 1400A was supplied with a detachable power cord. Plug the mating end of the power cord into the receptacle on the rear of the instrument. Note that the opposite end of the power cord has a safety or ground terminal on its plug. It is essential only to plug the power cord into a wall outlet that has a properly grounded receptacle.
3. Plug the Active cable set(s) into the respective input connector(s) on the front of the MyoSystem. The left connector is for the first 8 channels and, if present, the right connector is for higher channels. Please note that each Active cable has 8 plug-in lead terminations. There are two-snap preamplified electrode leads for each EMG channel plus one three-snap preamplified electrode lead (usually lead #1). The longer third snap is to provide an electrical reference to the subject. The electrode connected to this extra snap can be placed in any convenient location. This connection must be used regardless of how many EMG channels are being monitored. Only one reference is required for any number of channels.
4. The unit may now be connected to any USB compatible computer system by use of the USB connector on the back of the instrument.

## MyoSystem 1400A Components



1. MyoSystem 1400A Instrument



2. Power Cord  
(Country Specific)



3. EMG Active Cable  
(One cable for every 8 channels)



3-snap Pre-Amp lead  
(Includes Ground Lead)  
1 per system

2-snap Pre-Amp lead

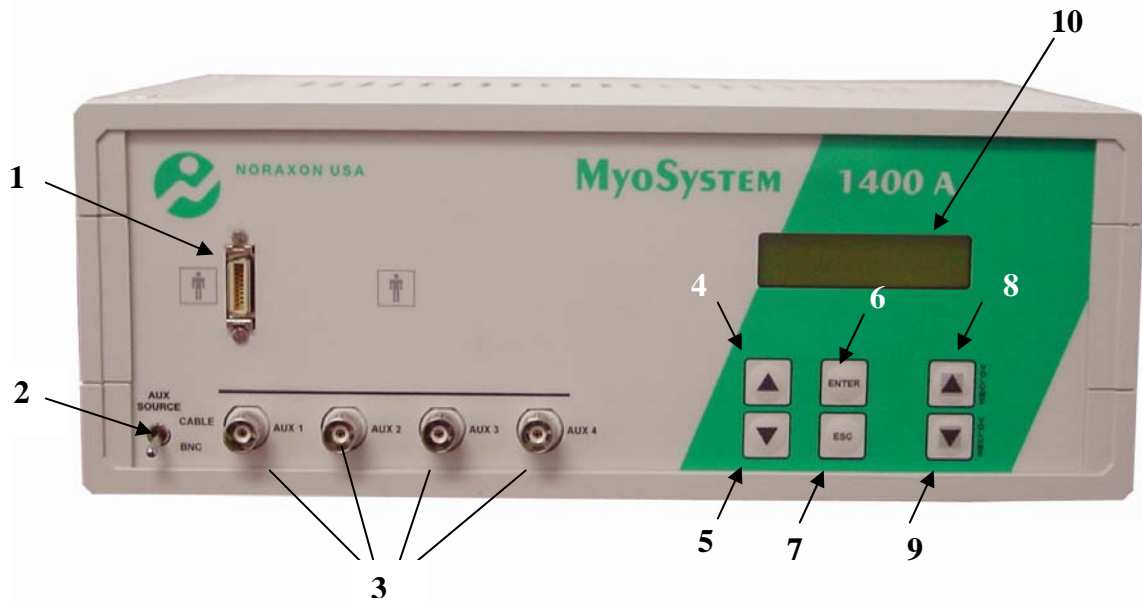
4. EMG Pre-Amplified Electrode Lead



5. USB Cable

## Controls and Displays

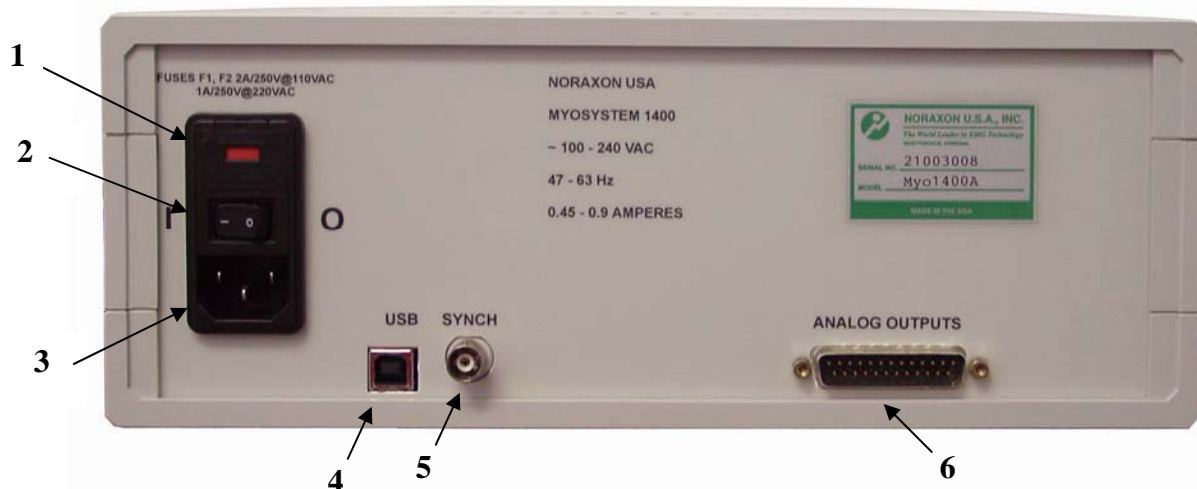
### Front Panel



- 1. Active Cable Connector (Channel 1-8)
- 2. AUX Signal Source Switch
- 3. Auxiliary Input Connectors (AUX 1-4)
- 4. Up Selection Key
- 5. Down Selection Key

- 6. ENTER Control Key
- 7. ESC Control Key
- 8. Increase Audio Volume
- 9. Decrease Audio Volume
- 10. Display

### Back Panel



- 1. Fuse Holder
- 2. Power ON/OFF Switch
- 3. Power Cord Inlet
- 4. USB Connector

- 5. Synch Signal Input Connector
- 6. Analog Output Connector

## *Explanation of Symbols*



Symbol for type BF patient connection. This identifies that the patient electrode connections are electrically isolated from the mains (AC) power source.



Symbol identifying approval to market this product in the European Community as certified by Notified Body #0344, KEMA.

## **MyoSystem 1400A Operating Modes**

The MyoSystem 1400A has three basic operating modes, normal, acquisition and setup.

### **Establishing Normal Mode**

The MyoSystem 1400A automatically enters the normal mode when power is applied. Therefore it is not necessary to activate any control other than the power switch to place the device in its normal operating mode. When in normal mode the instrument display is as shown.



In the normal (stand alone configuration) the MyoSystem 1400A processes the EMG and Auxiliary input signals and makes these signals available at its analog output connector. This begins automatically within seconds after the instrument is powered and allows any user supplied recording or data collecting system to be interfaced using the MyoSystem's analog output connector.

### **Establishing Acquisition Mode**

When the MyoSystem 1400A is used in conjunction with a computer system, its operation can be controlled from Noraxon supplied data acquisition software. While not absolutely necessary the USB cable should be attached between the MyoSystem 1400A and the computer before applying power. First the computer should be powered and its operating system established before turning on power to the MyoSystem. Following this startup order allows the computer system to automatically identify and establish a communication link with the MyoSystem.

Normally Noraxon's *MyoResearch-XP*, *MyoResearch* or *MyoClinical* software is required to communicate with the MyoSystem 1400A using the USB port. When activated the instrument enters acquisition mode and the device display is as shown.

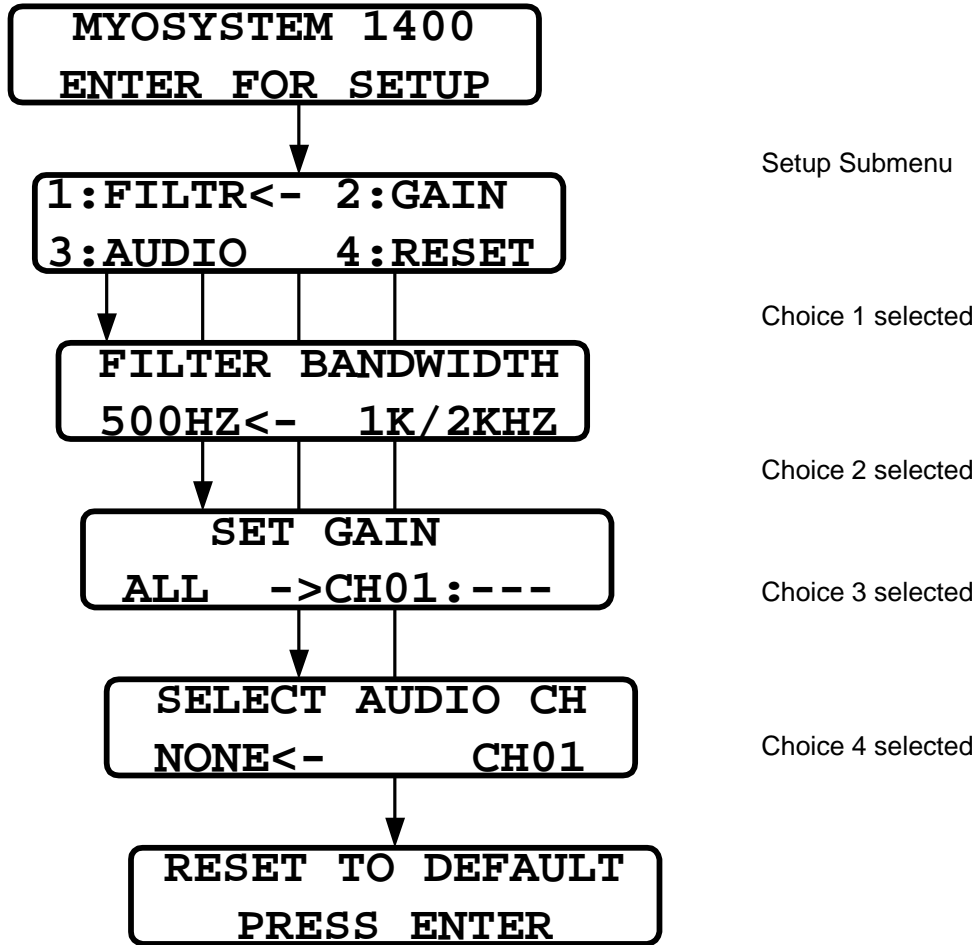


### **Establishing Setup Mode**

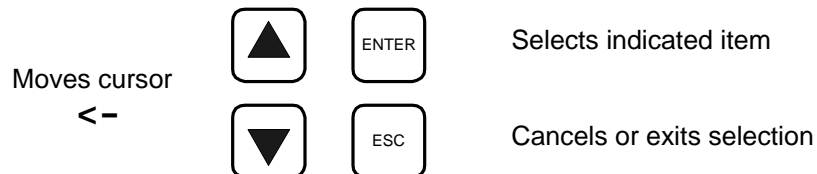
In addition to the normal mode or acquisition mode the MyoSystem 1400A can also be placed in the setup mode. The setup mode is used to manually adjust or modify the operation of the device. The user can activate this mode through the device front panel keypad. Upon completion of the setup the MyoSystem 1400A automatically returns to the normal mode.

### MyoSystem 1400A Front Panel User Interface

The MyoSystem 1400A operational parameters can be manually configured using the keypad and display menus in the setup mode. Pressing the ENTER key directs the instrument into the setup mode where the submenu offers four (4) additional choices. An overview of the setup menu sequence is shown in the following illustration.



Navigation through the MyoSystem 1400A menu system is accomplished using the front panel switches. Switch actions are summarized as shown.



## Optimizing the MS1400A for Surface EMG or Fine Wire EMG

Overall system electrical noise is kept to a minimum by proper signal filtering. The bandwidth of the EMG channels can be adjusted for either sEMG signals (500 Hz upper limit) or for Fine Wire EMG (1000 Hz upper limit). This is accomplished by selecting choice 1: FILTER from the **SETUP** submenu and results in the following display.

**FILTER BANDWIDTH**  
**500HZ<- 1K/2KHZ**



Press to place cursor <- at desired frequency setting



Press to select frequency (and return to **SETUP** submenu)



Press to return to **SETUP** menu (and keep current frequency setting)

- ◆ The filter bandwidth setting effect all EMG channels as a group. It is not possible to individually set the bandwidth for each channel.
- ◆ Any change made remains in effect until reprogrammed either through the keypad or from the PC. The system retains the last frequency setting even when power is removed.
- ◆ When entering this choice, the cursor (<-) points to the currently active setting
- ◆ The filter also processes the EMG signals at the analog output connector
- ◆ The higher bandwidth can be set to either 1KHz or 2KHz (default is 1 KHz) by internally changing a jumper setting.

## Adjusting the Gain of any MS1400A Input Channel

Different gain (amplification) settings are sometimes desirable to accommodate either very small or very large signals. The gain of any input signal channel of the MS1400A can be adjusted in multiples of the baseline gain. Selectable multiples are x1, x2, x4, x5, x8 and x10. For EMG channels (1-16) the baseline gain level is 500 (54 dB) while the auxiliary channels (17-20) have a baseline gain level of 0.5. Gain adjustment is accomplished by selecting choice 2:GAIN from the **SETUP** submenu and results in the following display.

**SET GAIN**  
**ALL ->CH01:---**



Press and hold to place cursor <- at desired channel (or ALL channels)



Press and hold until desired gain multiplier appears at selected channel



Press to return to **SETUP** submenu

- ◆ The ALL selection permits convenient gain adjustment of every channel at once.
- ◆ Any change made remains in effect until reprogrammed either through the keypad or from the PC. The system retains the last gain setting even when power is removed.
- ◆ When advancing the cursor (<-) through the channels, the current gain multiplier for that channel is displayed.
- ◆ The gain selection multipliers are OFF, x1, x2, x4, x5, x8 and x10. The OFF setting means that channel is not in use.
- ◆ The standard (x1) gain for all EMG channels (CH01 ... CH16) is 500.
- ◆ The standard (x1) gain for all auxiliary channels (AX01 ... AX04) is 0.5.
- ◆ The gain multipliers apply only to the internal USB data acquisition system. The signals at the analog output connector have fixed gains of 500 for the EMG channels and 0.5 for the auxiliary channels regardless of the gain multiplier settings.

## Controlling the EMG Audio Channel

The EMG signal occurring on any channel can be directed to the output of a speaker. In some instances subtle frequency changes in the EMG signal can be more readily assessed audibly rather than visually. This is particularly true for fine wire EMG. Audio channel control is accomplished by selecting choice 3: AUDIO from the **SETUP** submenu and results in the following display.

```
SELECT AUDIO CH
NONE<-      CH01
```



Press and hold to place cursor (<-) at desired channel (or none)



Press to activate audio for selected channel (and return to **SETUP** submenu)



Press to return to **SETUP** submenu (and keep current audio setting)



Press to increase/decrease sound volume



- ◆ Any change made remains in effect until reprogrammed either through the keypad or from the PC. The system retains the last audio setting even when power is removed.
- ◆ When entering this choice, the cursor (<-) points to the currently active audio channel
- ◆ Select the choice NONE to disable the audio

## Restoring Default Settings

The MyoSystem 1400A can be quickly set to a predetermined operational state that is satisfactory for typical surface EMG use. **Caution: use of this selection will cause all current operational settings to be erased.** Reset is accomplished by selecting choice 4:RESET from the **SETUP** submenu and results in the following display.

**RESET TO DEFAULT  
PRESS ENTER**



Press to reset default state (and return to **SETUP** submenu)



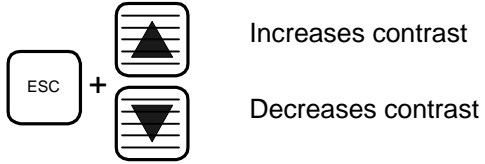
Press to cancel and keep current settings (and return to **SETUP** submenu)

The default state of the MyoSystem 1400A has:

- ◆ Frequency bandwidth set at 500 Hz
- ◆ All channel gain multipliers are set to x1
- ◆ The audio selection is off (set to NONE)

## Adjusting the Display Contrast

On occasion it may be necessary to adjust the contrast of the LCD for better visibility. This can be accomplished at any time by pressing and holding the ESC key while simultaneously pressing the increase or decrease VOLUME keys as illustrated.



## ***MyoSystem 1400A Cable and Accessory Connection/Disconnection***

### **1. Active Cables (General)**

Noraxon uses the term 'Active Cable' to mean that isolated low voltage, low current power is present in the cable. Each active cable carries 8 sEMG (or sensor) leads plus 4 auxiliary signals and terminates in a 20-pin connector. The 20-pin connector on the left of the MyoSystem 1400A front panel (see item 1 in CONTROLS and DISPLAYS) carries sEMG leads 1-8 (or leads 1-4 on a four channel system). Since the MyoSystem 1400A is expandable, there can be either 1 or 2 active cable connectors. The second or right connector, if present, carries sEMG (or sensor) leads 9-16.

Both active cables are electrically identical and may be plugged into either 20-pin connector without harm. However, the input connectors on each active cable are numbered to facilitate identification when the preamplified leads are attached to the cable. Therefore take care to plug the proper active cable (1-8 or 9-16) into its corresponding MyoSystem 1400A connector.

In addition to the 8 sEMG (or sensor) connectors, the active cable also has 2 inputs for AUX signals. In turn, each AUX input connector carries 2 signals, AUX 1&2 or AUX 3&4. If signals are applied to the AUX connectors they will appear on channels 17-20 of the MyoSystem 1400A.



**To route AUX signals from the active cable into the instrument, the AUX SOURCE switch (see item 2 in CONTROLS and DISPLAYS) must be in the 'cable' position.**

The active cables should be secured to the front panel with the locking clips to preserve the integrity of the cable shielding as well as to avoid unintended disconnection. Gently tug on the cable to confirm that the clips are locked into position.

### **2. Preamplified Leads**

The preamplified EMG leads have built in electronics powered from the MyoSystem 1400A active cable. In addition, any of the eight EMG leads can be separately removed or replaced with other leads or sensors. The preamplifier electronics are contained in the removable lead.



**It is advisable to turn off the MyoSystem 1400A power before connecting or disconnecting any active cable or individual lead. Failing to do so could damage the lead electronics.**

The MyoSystem 1400A is designed to accept any battery powered analog signals that are limited to +/- 5 volts. These signals can be substituted for any of the sEMG preamplified leads. Noraxon supplies an extensive line of direct plug-in sensors that can be safely attached. Users planning to apply their own battery powered sensors should contact Noraxon to insure compatibility and safety. If the sensor has its own power source (battery) then the +5 volt and -5 volt power connections on the cable connector should not be made.

The +/- 5 Volt power supplied through the active cable is electrically isolated from the main (50/60 Hz wall power) supply. This power is protected by re-settable fuses, so that if the power lines are accidentally 'shorted' the circuit will open and power is removed. Once the 'short' circuit (i.e. faulty preamplified lead or sensor) is removed the fuse will reset and power will be restored. Re-settable fuses are present on inputs sets 1-4, 5-8, 9-12 and 13-16. If a short develops in any one input of a set, the other 3 inputs in the set will lose power and fail to operate. Less likely, but also possible is a fault inside the active cable itself.



If a set of 4 inputs simultaneously become non-operational, a fault has occurred. To locate the fault, disconnect all non-operational inputs and then one-by-one reinserts them into the active cable.

### 3. Auxiliary Input BNC Connectors (AUX1 - AUX4)

These inputs (see item 3 in CONTROLS and DISPLAYS) accept analog signals up to +/- 10 volts. The inputs are completely isolated from the EMG channels allowing connection to either battery operated or wall powered equipment. All auxiliary inputs are electrically identical and interchangeable. While it is not absolutely necessary it is good practice to turn off the MyoSystem 1400A power before connecting or disconnecting any auxiliary inputs. BNC style connectors are supplied to encourage the use of shielded input signal cables to preserve signal integrity.



To route AUX signals from the BNC connectors into the instrument, the AUX SOURCE switch (see item 2 in CONTROLS and DISPLAYS) must be in the 'BNC' position.

### 4. Analog Output Cable

All EMG and Auxiliary input signals are available at the back of the MyoSystem 1400A on a 25 pin analog output connector (see item 7 in CONTROLS and DISPLAYS) and are scaled to +/- 5 volts. An output cable with an overall shield is required to assure electromagnetic compatibility.



It is important to turn off the MyoSystem 1400A power before connecting or disconnecting the analog output cable. Failing to do so could damage the output electronics.

### 5. Synch Input

Data collection on the MyoSystem 1400A can be synchronized to an external timing signal via the Synch input (see item 5 in CONTROLS and DISPLAYS). This input is isolated from the EMG and Auxiliary signals and is compatible with a standard TTL logic level signal source. This input is not used as a trigger to initiate data acquisition. Rather, the synch signal level is read and passed along with every data acquisition sample over the USB port. In effect it is an additional data channel with a logic high or low level useful to identify the beginning or end of an event or activity. While it is not absolutely necessary it is good practice to turn off the MyoSystem 1400A power before connecting or disconnecting the synch input.

### 6. USB port

There are both full and low speed versions of USB cables. The MyoSystem 1400A requires a full speed USB cable for attachment to the back panel USB connector (see item 4 in CONTROLS and DISPLAYS). The USB cable may be freely connected or disconnected at any time without damage to the instrument or PC. However, software problems can arise if the USB cable is disconnected when active communication is taking place between the MyoSystem 1400A and the computer.



Beware that loss of all data acquired in a recording is possible if the USB cable is inadvertently disconnected before an active data recording is completed.

## ***Use of Disposables***

While the MyoSystem 1400A 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 MyoSystem 1400A satisfy the requirements for standard ANSI/AAMI EC12-1991 Disposable ECG electrodes.



### **Advisory on Use of Disposables**

**Because disposable electrodes have a shelf life, it is important not to use expired electrodes. 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. A 'skin prepping gel' is a much better way to lower the skin impedance if a reliable electrode connection can not be made.
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.

## ***Maintenance and Cleaning***

The MyoSystem 1400A is designed to be maintenance free. For interested users, Noraxon offers a MultiTester device that can inject standard test signals to confirm proper operation.

Care should be exercised not to place or stack objects (especially liquids) on top of the MyoSystem 1400A case. Not only does this avoid the possibility of accidental liquid spillage into the instrument but allows air to freely circulate through the enclosure ventilation slots.



### **Periodic Cable Inspection**

**The active cable (due to its length) can be subjected to abnormal wear and tear such as being walked upon or being over run by a wheeled cart. In addition the cable may pose a trip hazard and be severely 'yanked' or 'jerked' abruptly. Consequently it is prudent to periodically visually examine the cable outer jacket for cuts or tears as well as checking the connectors for bent pins or exposed wires.**

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.

## Troubleshooting Common Problems

The source of any problem can be quickly determined by an awareness of causes according to their likelihood of occurrence. For EMG measurements, problem sources from most to least likely suggest examination in this order:

- 1) electrode site preparation
- 2) electrode
- 3) improper instrument setting
- 4) subject or muscle site variability
- 5) electrode cable fault
- 6) instrument fault

Keep this sequence in mind whenever troubleshooting EMG problems. As can be noted the highest frequency problems involve electrodes. In recognition of this fact, Noraxon offers a low cost Electrode Impedance Checker device to quickly and efficiently identify electrode fault conditions. Noraxon encourages all users to include electrode impedance testing as part of routine practice. In addition Noraxon offers a MultiTester device that can be used to verify proper operation of the instrument itself.

### Isolating Single Channel Problems

SYMPTOM	CAUSE	DIAGNOSTIC
Noise or artifact	Electrode	MultiTester Impedance exceeds 50 Kohm on that channel
	Intermittent cable lead	Exchange cable lead with another set of electrodes on a working lead, problem will remain with original lead
	Instrument	MultiTester check fails on that channel
Weak/Strong signal	Improper gain	Verify SET GAIN value
	Subject variability	Exchange EMG leads with another set of electrodes on a working lead, problem will now appear on substitute lead

### Isolating Multiple Channel Problems

<b>SYMPTOM</b>	<b>CAUSE</b>	<b>DIAGNOSTIC</b>
Noise or artifact	Electrodes	Electrode Impedance Check fails on several channels
	Reference electrode	Electrode Impedance Check fails on Reference electrode
	Intermittent cable	Problem resolves with replacement of cable
	Ground loop	Problem resolves after disconnecting all other equipment attached to the MyoSystem 1400A
	AC power source	Problem is alleviated by placing an isolation transformer between the MyoSystem 1400A and the AC outlet
	Instrument	MultiTester check fails on several channels
Weak/strong signals	Improper gain	Verify SET GAIN values
	Subject variability	Exchange cable leads with other sets of electrodes on working leads, problems will now appear on substitute leads

### Isolating USB Communication Problems

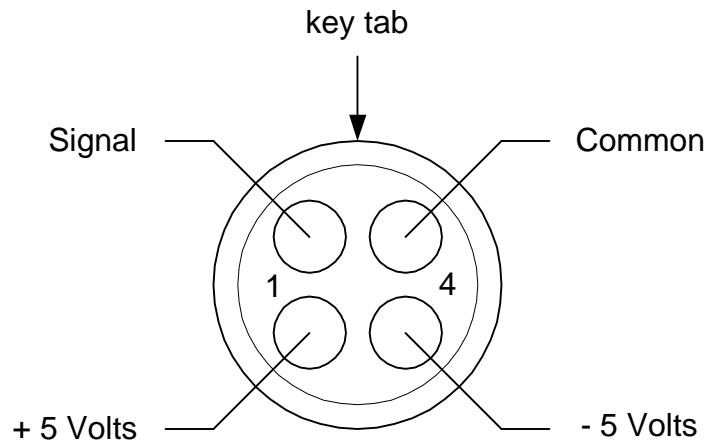
<b>SYMPTOM</b>	<b>CAUSE</b>	<b>DIAGNOSTIC</b>
PC doesn't recognize the MyoSystem 1400A	Missing USB driver or INF file	Check Windows Device Manager's USB settings
Communication frozen	USB driver lockup	Problem resolves when MyoSystem USB cable is unplugged/re-plugged and or Windows is restarted
	Non-compliant USB device	Problem resolves when other USB devices are removed from the USB bus

## Signal Inputs and Outputs

### Preamplified Lead / Sensor Connectors

These connectors are intended for Noraxon supplied lead sets or sensors. Use of other cable sets may reduce signal quality or compromise safety features.

### Active Lead / Sensor Wiring Diagram



Binder Connector  
p/n 09-9764-70-04  
Solder Side Shown

### Auxiliary Input BNC Connectors

These connectors are available for general use with coaxial cables supplied by the user or other device manufacturers. All inputs must not exceed +/- 10 volts.

## Analog Output Connector

This connector is available for general use with shielded cables supplied by Noraxon, the user or other manufacturers. Use of a shielded cable is required to preserve electromagnetic compatibility. All outputs vary between +/- 5 volts. The DB-25 connector pin assignments are as follows:

pin	upper row signals	pin	lower row signals
1	EMG lead 9	14	EMG lead 6
2	EMG lead 13	15	EMG lead 3
3	EMG lead 10	16	EMG lead 7
4	EMG lead 14	17	EMG lead 4
5	EMG lead 11	18	EMG lead 8
6	EMG lead 15	19	signal common
7	EMG lead 12	20	signal common
8	EMG lead 16	21	signal common
9	signal common	22	AUX 4
10	signal common	23	AUX 3
11	EMG lead 1	24	AUX 2
12	EMG lead 5	25	AUX 1
13	EMG lead 2	shell	MyoSystem 1400A enclosure/earth ground

## ***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.

## **Technical Specifications**

### **Outputs**

- Analog +/- 5 volts all sEMG and auxiliary channels
- Digital 12 bit resolution per channel from USB port

### **Inputs**

- 4-16 sEMG channels @ +/- 7 mV max
- 4-16 sensor channels @ +/- 5 Volts max
- 4 Auxiliary channels @ +/-10 Volts max
- Synch input - TTL level
- Power 100-240 VAC @ 50/60 Hz (0.9 A max)

### **SEMG Amplifier Performance**

- 1 uV sensitivity
- < 1 uV RMS baseline noise

### **Data Acquisition**

- 12 bit resolution 20 channels
- selectable per channel sEMG gain of 500, 1000, 2000, 5000
- selectable per channel sensor gain of 1, 2, 4, 10
- selectable per channel AUX gain of 0.5, 1, 2, 5
- selectable sample rate of 1000, 2000 or 3000 samples/sec/channel
- USB update to PC every millisecond

### **High Pass Cutoff**

- to DC on Auxiliary channels
- 10 Hz second order on sEMG channels

### **Low Pass Cutoff**

- 500 Hz on Auxiliary channels
- selectable 500 or 1000 Hz on sEMG channels
- 8<sup>th</sup> order Butterworth (maximally flat)

### **Input Impedance**

- 1 Mohm on Auxiliary channels (isolated to > 3000 Volts)
- > 100 Mohm on sEMG channels (isolated to > 3000 Volts)

### **Common Mode Rejection**

- Min 130 dB @ DC (0 Hz)
- Min 100 dB @ 50-60 Hz
- Min 85 db @ 1000 Hz

### **Physical**

- Width: 11"
- Height: 4"
- Weight: 3 lbs
- Depth: 7.75"

## Technical Description

### General

The MyoSystem 1400A is an electromyographic (EMG) instrument available as a 4, 8, 12 or 16 channel unit. It is designed in compliance with international standard IEC60601-2-40, *Particular requirements for the safety of electromyographs and evoked response equipment*. All EMG inputs are provided with type BF isolation. Four separate analog input channels are also provided for auxiliary signals. The auxiliary inputs have type BF isolation circuitry separate and distinct from that of the EMG input channels. The instrument contains an integral 12 bit analog to digital conversion system for all input channels. Communication with a computer system is provided by means of a Universal Serial Bus (USB) port.

### Equipment Installation and Restricted Use

The instrument is equipped to operate from all conventional alternating current power sources (i.e. 90-240VAC 50/60Hz) without modification. A power cord matched to the local service configuration is needed and comes supplied 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 MyoSystem 1400A possesses a Class I type BF equipment rating. Therefore, the protective earth ground connection must be in place at all times to ensure safe operation and full compliance with the relevant standards. The instrument is not protected against the ingress of water and carries no IPX rating (i.e. is Ordinary equipment)

#### Restricted Usage

The MyoSystem 1400A 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 occurs in the vicinity of MRI (magnetic resonance imaging) equipment.
3. In the presence of heavy electrical machinery such as near large motors, elevators, compressors and the like.

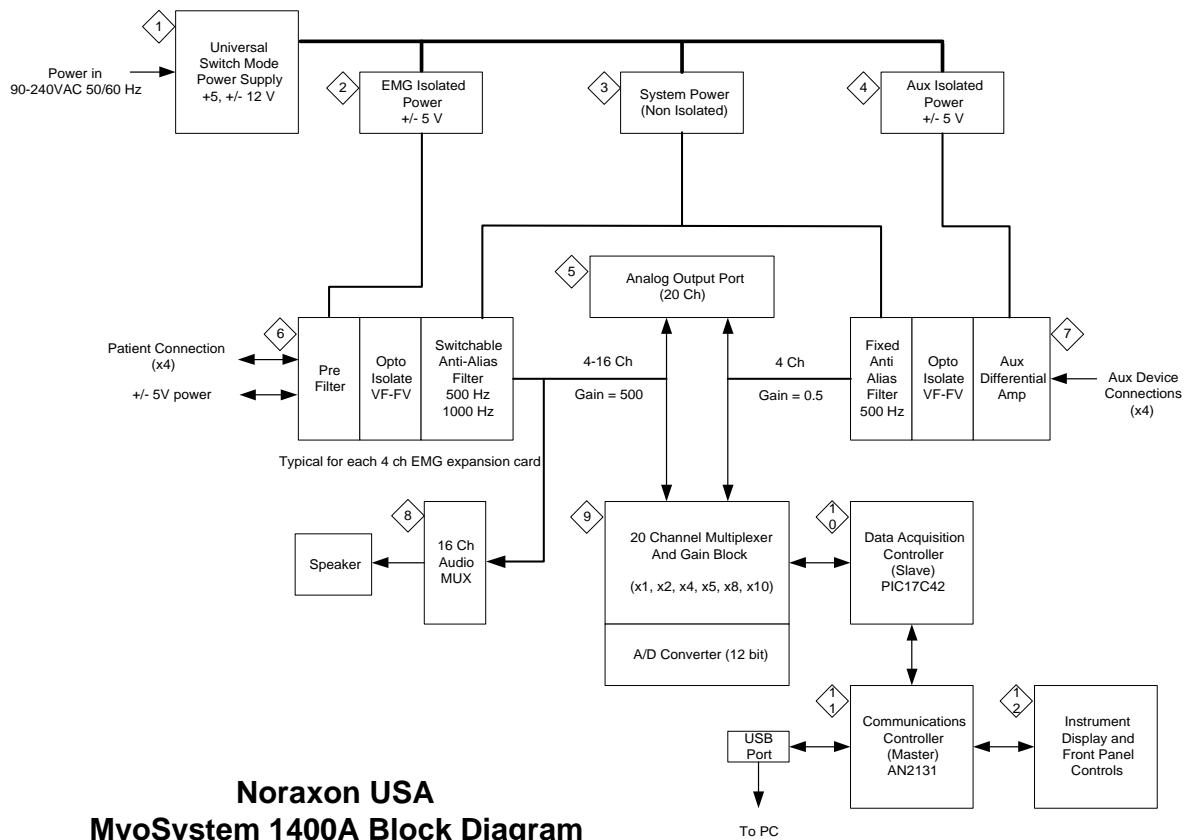
### Fuses and Fuse Replacement

The MyoSystem 1400A has two externally accessible fuses. Ratings for both fuses are identical, 1A 250VAC slow acting. The fuse holder is accessed by prying open a small door on the power inlet module. (Be sure to unplug the power cord first!) Opening the door can be accomplished by inserting a standard screwdriver into the small slot at the top of the power inlet module just above the red rectangle. Using the screwdriver gently pry open the door to expose the red fuse holder. Slide out the fuse holder, remove the spent fuse(s) and replace them as needed.

The fuse holder is designed to accept both English and metric style fuses. Note the position of the old fuse upon its removal and ensure that the replacement fuse is installed in the same position.

## Diagrams, Schematics and Parts List

A general understanding of the operation of the MyoSystem 1400A can be obtained from a review of this section.



### MyoSystem 1400A Block Diagram Descriptions

1. Medical grade switch mode power supply to generate +5 Volts, and +/- 12 Volts. This supply has CE, UL, CSA and TUV approvals.
2. DC/DC converter to generate filtered +/- 5 Volts to supply power to up to 4 EMG expansion cards and the verification test circuitry. Isolation rating to 3000 Volts.
3. DC regulator circuits to supply power to the digital (microprocessor) circuitry and the non-isolated analog circuitry. Regulated voltages of +5, +3.3, and +/- 11 Volts.
4. DC/DC converter to generate filtered +/- 5 Volts to supply power to the 4 auxiliary inputs. Isolation rating of 1500 Volts. This isolation is distinct from the direct patient connection (EMG) isolation circuitry.
5. The analog output port provides amplified (or scaled) and filtered representations of all (EMG and auxiliary) inputs. Since the outputs are isolated from the inputs, these signals can be safely connected to external systems.
6. The EMG expansion card provides 4 channels of EMG. It consists of 3 sub-blocks. The pre-filter sub-block low pass filters the raw signal to keep the signal in the working range of the isolation circuitry. The opto isolation sub-block is a voltage to frequency followed by a frequency to voltage conversion. Separate power sources are used on each side of the conversion process. The final

- sub-block is a switched capacitor 8<sup>th</sup> order Butterworth/Bessel filter with cutoff selectable at 500 or 1000 Hz.
7. The auxiliary input section consists of 3 sub-blocks. The differential amp sub-block de-couples the auxiliary device input and MyoSystem 1400 signal grounds. The opto isolation circuitry is a voltage to frequency followed by a frequency to voltage conversion. Separate power sources are used on each side of the conversion process. The low pass 500 Hz filter sub-block is a 4<sup>th</sup> order Butterworth active filter.
  8. When audio is enabled, any 1 out of the 16 EMG signals can be routed to the audio amplifier and speaker.
  9. The internal data acquisition system consists of a 20 channel multiplexer and selectable gain stage. Normal sample rates are 1000, 2000, or 3000 samples/second/channel.
  10. The data acquisition process is controlled by a separate microprocessor. This microprocessor acts as a slave to the communications controller.
  11. The overall operation of the MyoSystem 1400 is controlled by the communications microprocessor. It handles the display and front panel switches and co-ordinates all communication over the USB port.
  12. The display is a simple 16 character by 2 line LCD. The 6 switches on the front panel are monitored by the communications microprocessor.

Noraxon will make available on request circuit schematics, component parts lists and calibration instructions to assist qualified technical personnel in the service and maintenance of the MyoSystem 1400A. Please contact Noraxon USA at:

Noraxon USA, Inc.  
13430 N. Scottsdale Road Suite 104  
Scottsdale, AZ 85254  
Toll Free: (800) 364-8985 (US/Canada Only)  
Phone: (480) 443-3413  
Fax: (480) 443-4327  
Email: [info@noraxon.com](mailto:info@noraxon.com)

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[i.konrad@velamed.com](mailto:i.konrad@velamed.com)

## Transport and Storage

The MyoSystem 1400A 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	500 HPa to 1060 HPa

### Guidance and manufacturer's declaration – electromagnetic emissions

The MyoSystem 1400A/L is intended for use in the electromagnetic environment specified below. The customer or the user of the MyoSystem 1400A/L should assure that it is used in such an environment.


Emissions Test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	The MyoSystem 1400A/L uses RF energy only for its internal function. Therefore, its RF emissions are very low and not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The MyoSystem 1400A/L is suitable for use in all establishments other than domestic establishments 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	

### Guidance and manufacturer's declaration – electromagnetic immunity

The MyoSystem 1400A/L is intended for use in the electromagnetic environment specified below. The customer or the user of the MyoSystem 1400A/L 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 64000-4-2	±6 kV contact ± 8 kV air	±4 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 at least 30 %. Contact discharges > ± 4kV can cause display dimming but no loss of performance.
Electrical fast transient/burst IEC 61000-4-4	±2kV for power supply lines ±1kV for input/output lines	±2kV for power supply lines ±1kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1kV differential mode ±2kV common mode	±1kV differential mode ±2kV 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 input 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 MyoSystem 1400A/L requires continuous operation during power mains interruptions, it is recommended that the MyoSystem 1400A/L be powered from an uninterruptible power supply.
Power frequency (50/60 Hz) magnetic field 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 MyoSystem 1400A/L is intended for use in the electromagnetic environment specified below. The customer or the user of the MyoSystem 1400A/L should assure that it is used in such an environment.			
Immunity Test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 V	<p>Portable and mobile RF communications equipment should be used no closer to any part of the MyoSystem 1400A/L, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.</p> <p><b>Recommended separation distance</b></p> $d = 1.2\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2,5 GHz	3 V/m	<p><math>d = 1.2\sqrt{P}</math> 80 MHz to 800 MHz</p> <p><math>d = 2.3\sqrt{P}</math> 800 MHz to 2,5 GHz</p> <p>where <math>P</math> is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and <math>d</math> is the recommended separation distance in metres (m).</p> <p>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,<sup>a</sup> should be less than the compliance level in each frequency range.<sup>b</sup></p> <p>Interference may occur in the vicinity of equipment marked with the following symbol:</p> 
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.			
<sup>a</sup> 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 MyoSystem 1400A/L is used exceeds the applicable RF compliance level above, the MyoSystem 1400A/L should be observed to verify normal operation. If abnormal operation is observed, additional measures may be necessary, such as reorienting or relocating the MyoSystem 1400A/L.			
<sup>b</sup> Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.			

<b>Recommended separation distances between portable and mobile RF communications equipment and the MyoSystem 1400A/L</b>			
The MyoSystem 1400A/L is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the MyoSystem 1400A/L can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the MyoSystem 1400A/L 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	80 MHz to 800 MHz	800 MHz to 2,5 GHz
	$d = 1.2\sqrt{P}$	$d = 1.2\sqrt{P}$	$d = 2.3\sqrt{P}$
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 <i>d</i> in metres (m) can be estimated using the equation applicable to the frequency of the transmitter, where <i>P</i> 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 separation distance for 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.			

### Instrument Disposal

The MyoSystem 1400A printed circuit boards contain hazardous materials (primarily lead, Pb). Follow your local governing ordinances for the disposal or recycling of equipment and electrodes.