3 Alarms & alerts

About alarms and alerts

Alarms provide a warning about a patient condition (such as a vital sign limit violation).

Alerts provide a warning about an equipment condition that needs attention (such as a low battery or detached ECG lead).

Alarms and alerts may be detected either by the monitor or by the network. While connected to the network, alarms or alerts are displayed at the monitor and at the Acuity Central Station. Alarms have a higher priority than alerts.

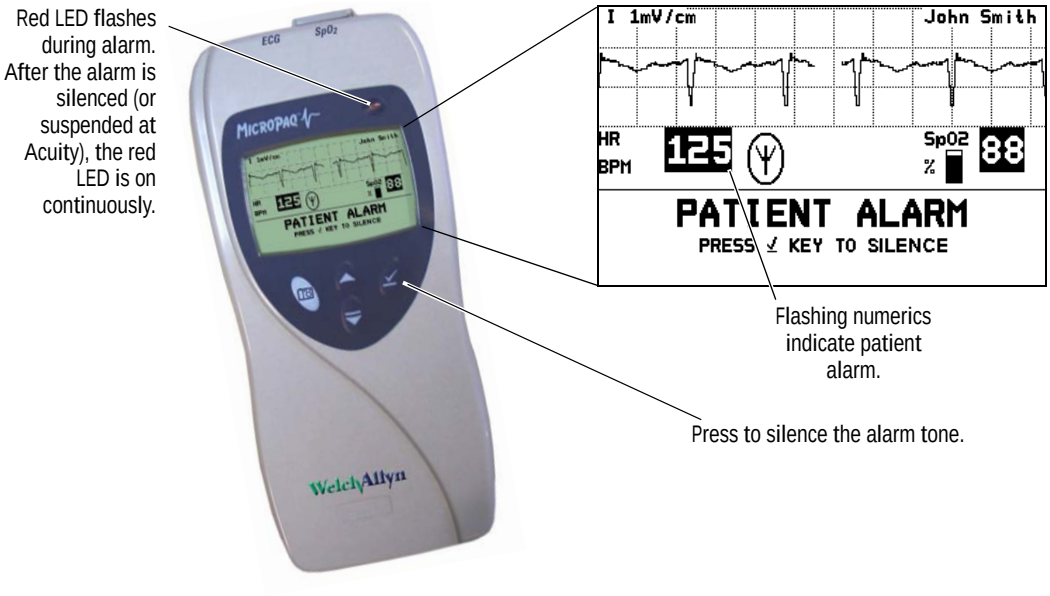
Alarm holdoffs

To help minimize false alarms, the monitor briefly delays or "holds off" triggering alarms for limit violations for HR/PR or SpO_2. After the alarm holdoff period begins, if the monitor detects that the patient's vital sign has returned to acceptable limits, the monitor cancels the alarm holdoff. The next time a vital sign limit is violated, the monitor starts a new holdoff period.

Vital Sign	Alarm Holdoff Period
HR	3 seconds
% SpO_2 or PR	10 seconds

Respond to a patient alarm at monitor

When a patient alarm occurs, the monitor produces an audible tone (if audible tones are enabled). Life-threatening arrhythmia alarms beep at a faster pace than other vital sign alarms (see “Patient alarm and equipment alert specifications” on page 56). The monitor also displays a message similar to the following:



1. Check the patient and provide appropriate care.
2. To silence the alarm tone at the monitor and the Acuity Central Station for 90 seconds, press ✓.

   While the alarm tone is silenced, visual alarm indications continue, and the red alarm indicator on the monitor changes from a flashing display to a continuous display.

   If the alarm condition still exists after 90 seconds, the alarm tone resumes.

Note If you silence an alarm at the monitor and another patient alarm or an equipment alert occurs during the silence period, the tone resumes at the monitor. At Acuity, only life-threatening arrhythmia alarms interrupt the silence period.

If you suspend an alarm at *Acuity*, only life-threatening arrhythmia alarms interrupt the silence period at the monitor and Acuity.

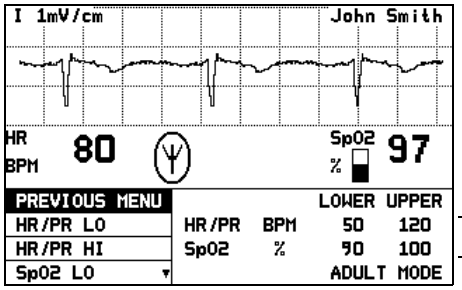
To access the Main Menu during silencing, press ▼.

3. To reset the alarm tone at the monitor and Acuity before the 90 seconds has elapsed, press ▲ at the monitor, or press **Resume** at the Acuity Central Station.
4. After caring for the patient, make sure that the appropriate alarm limits are set and that alarms are on.

Customize patient alarm limits at the monitor

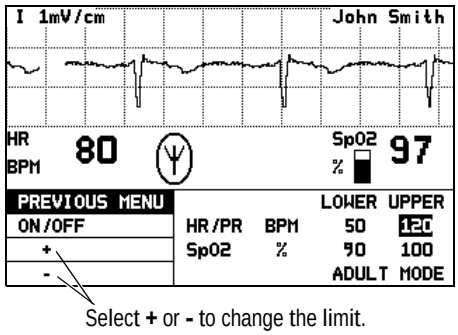
WARNING If the patient's name has not yet been assigned to the monitor, do not adjust any alarm limits until **after** the patient name and ID are confirmed at Acuity. When the patient name and ID are confirmed at Acuity, Acuity downloads the default settings and patient alarm limits for that Acuity unit, thereby overriding any custom alarm limits that were set at the monitor before selecting the patient.

1. Press ▼ to display the Main Menu.
2. Press ▼ to highlight **LIMITS**, then press ✓ to display the Alarm Limits Adjust Menu:



Alarm limits can be adjusted for HR/PR and SpO_2.

3. To change an alarm limit, press ▼ or ▲ to highlight the desired limit, then press ✓ to display the Threshold Adjustment Menu:



Select **+** or **-** to change the limit.

- Scroll and select the **+** or **-** selections to change the limit as desired.
- To turn the highlighted limit on or off, scroll to **ON/OFF** and press ✓.

WARNING If you turn off any alarm limits, be sure to restore the appropriate alarm limits before you resume monitoring. *Only life-threatening arrhythmias will be indicated at the monitor and Acuity* (if connected) when alarms are turned off.

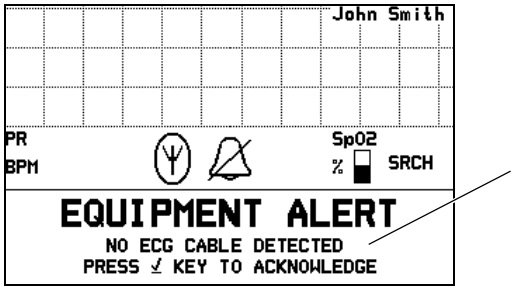
4. To change other limits, scroll to **PREVIOUS MENU**, press ✓, then select another limit to change.
5. When you have completed all changes, scroll to **PREVIOUS MENU**, then **EXIT** on the Alarm Limits Adjust Menu and press ✓ to return to the normal monitoring screen.

Note While the monitor is connected to Acuity, settings can be changed either at the monitor or at Acuity.

Respond to an equipment alert at the monitor

When the network or the monitor detects an equipment problem, the monitor produces a an audible alert tone (if audible tones are enabled). Equipment alerts beep at a slower pace than patient vital sign alarms (see "Patient alarm and equipment alert specifications" on page 56).

The monitor also displays a flashing yellow light (LED) and an equipment alert message similar to the following:



The monitor has detected that the ECG cable has been disconnected from the monitor.

1. In this instance, press ✓ to acknowledge (dismiss) the alert tone and clear the message.

   If the message says "PRESS ✓ TO SILENCE," when you press ✓, the tone is silenced for 90 seconds instead of dismissed.

   If the monitor displays a chest diagram with a missing lead flashing, you can press ✓ to silence the tone.

   Some alerts do not give you the option to acknowledge the alert or silence the tone. For these alerts, to remove the message and tone, you must correct the problem.

2. If possible, determine what caused the problem and correct it.

Note After you press ✓ to acknowledge or silence some types of alerts, the yellow LED remains on (either flashing or steady yellow) until you correct the problem.

For low battery alerts and no Acuity connection alerts, specific icons also flash.

For a list of possible messages and suggested responses, see "Alert messages and display information" on page 40.

Alert messages and display information

Message and Display Information	Possible Cause(s) and Suggested Response
LOW BATTERY	The monitor will shut down within approximately 30 minutes or less due to a low battery. • Replace the battery as soon as possible.
VERY LOW BATTERY	The monitor will shut down within approximately 5 minutes or less due to a low battery. • Replace the battery as soon as possible.
BATTERY TOO LOW SHUT DOWN IN PROGRESS	The battery is so low the monitor has to shut down operation. • Replace the battery immediately.
ACUITY CONNECTION LOST	The monitor is not connected to the network. • Press ✓ to acknowledge and silence the tone and cancel the message. While disconnected from the network, the off-network icon and the yellow LED continue to flash. NOTE: The monitor will continue to attempt to reconnect until it is successful.
EXCESSIVE ECG OFFSET REPLACE ELECTRODES[a]	The monitor detects poor ECG electrode contact. • Check and replace ECG electrodes as needed.
Chest icon is displayed with flashing ECG electrode(s).[a]	The monitor detects that one or more ECG electrodes are disconnected. • Check and replace or reconnect electrodes as needed.
NO ECG CABLE DETECTED	• If the ECG cable has been intentionally removed from the monitor, press ✓ to cancel the alert tone. • If the ECG cable has been unintentionally removed, plug it back into the monitor. Check the patient and monitor to make sure ECG monitoring resumes properly. • It is normal for this alert to appear with a 3-lead ECG cable when two or more of its leads are disconnected from the patient. Reconnect the disconnected lead wires.
NO SPO2 SENSOR DETECTED	The SpO_2 sensor has been disconnected for more than 5 seconds. • If disconnection is intentional, press ✓ to acknowledge and silence the tone. • If disconnection is not intentional, reconnect the sensor or replace the sensor and reconnect.
DEFECTIVE SPO2 SENSOR[a] *or* UNRECOGNIZED SPO_2 SENSOR[a]	The SpO_2 sensor is either defective or not recognized. • Replace the SpO_2 sensor with a new, compatible SpO_2 sensor.
<*key name*> KEY STUCK[a]	During the power-up self test, the monitor detected that a key is stuck (▼, ▲, 🔊, or ✓). This can happen if you accidentally press a key down before the Main Menu is displayed during power-up. • Remove and then reinsert the battery to power up again and see if the key is still stuck. If it is, contact your biomedical engineering department.
System Error Thread: <*nnn*> Error ID: <*nnn*>	The equipment problem is so serious the monitor cannot be used. • Contact your biomedical engineering department.

a. This alert message can be acknowledged from Acuity, but not from the monitor.

4 Monitor patient at Acuity

While the Micropaq is connected to the FlexNet network, patient data gathered by the monitor is continuously stored at Acuity. You can access this patient information at the Acuity Central Station and perform administrative functions, including:

- Admit (and discharge) a patient in the Acuity unit.
- Edit the patient description (name, physician, etc.).
- Review and print patient data such as trends and waveforms.
- Suspend patient alarm tones for 90 seconds and resume the alarm tones

For more information about using the Acuity Central Workstation, refer to:

- *Acuity Directions For Use*

5 Maintenance

This section provides information to help operators of the monitor and the battery charger perform routine maintenance activities such as changing or recharging batteries, inspection, and cleaning.

Change the battery

1. Remove the depleted battery.
2. Insert a fully-charged battery. Use only batteries supplied by Welch Allyn.

WARNING Before installing a battery, carefully inspect the battery case. If there are any signs of damage, cracks, or leaks, discard the battery properly and do not use it.

Note The Acuity unit can be configured to allow you a short time (typically 30 seconds or more) to change the monitor battery while the monitor is connected to the network without causing an Acuity equipment alert. If the monitor is connected to the network and the battery is removed for longer than the allowable battery changing time, Acuity generates a DROPOUT equipment alert at the Acuity Central Station.

Recharge a battery

Eight-bay battery charger

1. On the monitor battery charger (008-0651-XX), choose an empty battery well where the LED is off.
2. Insert the depleted battery into the battery well.
3. Confirm that the charger displays a flashing green LED by the battery to indicate the battery is detected or is charging.
4. When the green LED is on continuously, the battery is fully charged. Remove the battery.

If the yellow LED is on continuously, the battery may have reached the end of its useful life. Refer to the table below for suggested responses.

Charger LED	Battery Charger Label—LEDs	Battery Status and Possible Response
Green LED on continuously		Battery is fully charged.
Green LED flashing		Battery is charging.
Green LED flashing very slowly		Battery is detected and waiting to be charged.
LED off		No battery is detected.
Yellow LED on continuously		Something is wrong with the battery or the charger. Remove the battery. • If the LED goes off, it is probably a battery problem. Insert a new battery into the same battery well. If the new battery charges correctly, then the battery has a problem; discard the battery. The battery reorder number is 008-0647-XX. If the same problem occurs with the new battery, the charger may need repair. Contact biomedical engineering. • If the LED does not go off when you remove the battery, it is probably a charger problem. Unplug the charger power cord, wait at least 5 seconds, then plug in the charger power cord again. Insert a new battery into the same battery well. If the new battery charges correctly, then the battery has a problem; discard the battery. If the same problem occurs with the new battery, the charger may need repair. Contact biomedical engineering.

The charger can accommodate up to eight batteries. The charger charges a maximum of four batteries at a time. After a battery begins recharging (as indicated by the green LED that flashes on one second, off one second), it is typically fully recharged within four hours at room temperature. After a battery is fully charged, the charger continues to maintain the full charge on the battery until the battery is removed. Leaving a fully-charged battery in the charger will not harm the battery.

Remove batteries from the battery charger if the battery charger will be disconnected from ac power for more than a few days. Do not block the cooling vents at the rear of the battery charger.

The monitor battery charger only charges four batteries at a time. A battery is not fully charged until the green LED is on continuously. Do not remove a battery until it is fully charged, or displays a battery fault.

WARNING The monitor battery is Lithium Ion. Do not incinerate, submerge, crush, disassemble, or autoclave. If a battery has been submerged in liquid, discard the battery properly; do not try to recharge or reuse the battery. Do not short the battery terminals. Do not try to connect the battery to any device except the monitor or the monitor battery charger. Do not expose to high temperature (above 60° C or 140° F). Use only the specified monitor battery charger.

Inspect and clean the monitor and accessories

WARNING Be sure to unplug the monitor battery charger power cord from the electrical power outlet before inspecting or cleaning the battery charger. Exposing the battery charger to liquids such as cleaning solutions while connected to electrical power could result in electrical shock or fire.

WARNING Do not autoclave the monitor, battery, battery charger, or accessories. Do not immerse the monitor, battery, or battery charger in liquid when cleaning. Do not immerse accessories in liquid when cleaning unless the accessory manufacturer's cleaning instructions explicitly instruct you to do so.

Before cleaning, thoroughly inspect the monitor and all accessories for any signs of damage, cracks, or improper mechanical function of keys or connectors. While gently bending and flexing cables, inspect for damage, cracks, cuts, abrasions, extreme wear, exposed wires or bent connectors. Confirm connectors securely engage. Report damage or improper function to your service department. At least every 12 months, be sure to thoroughly inspect the battery charger case and power cord for damage or extreme wear.

To clean the monitor, batteries, or battery charger:

1. Wipe the equipment with a nearly dry cloth moistened with one of the approved cleaning solutions listed in the table on "Approved Cleaning Solutions" on page 46.
2. After cleaning, thoroughly wipe off any excess cleaning solution with a soft cloth dampened with water, then dry. Do not let the cleaning solution run into or accumulate in connector openings, latches, or crevices. If liquid gets into a battery well or connectors, dry the area with warm air, then check the equipment to confirm that it operates properly.

Caution Use only cleaning solutions which are recommended by Welch Allyn for this equipment. Use of solutions which are not recommended or which have a high acid content or are otherwise inappropriate can cause damage to the equipment, including cracking and deterioration of the plastic case. Do not use these solutions or similar products: Butyl alcohol, Denatured ethanol, Freon™, Mild chlorine bleach solution, Isopropyl alcohol (except for the SpO_2 cable), Trichloroethane, Trichloroethylene, Acetone, Vesphene II, Enviroquat®, Staphene®, Misty®, Virex®, Glutaraldehyde, Formula 409®, or Fantastik®.

Equipment	Cleaning Instructions	Approved Cleaning Solutions
Monitor[a] Battery[a] Battery Chargers[a]	• Wipe with a nearly-dry cloth moistened with cleaning solution. • After cleaning, remove excess cleaning solution with a soft cloth dampened with clean water, then dry. Do not let cleaning solution run into connector openings or crevices.[b]	Warm water, Liquid soap, Coverage®, Windex®, Ovation®, Hydrogen peroxide solution, Wex-cide®[c], T.B.Q.®[c]
ECG cable, extension cable	• Wipe gently with damp cloth moistened with a mild detergent solution. • Thoroughly wipe off any cleaning solution.	Mild detergent.
SpO_2 cable, extension cable	• Wipe the cable with a 70% isopropyl alcohol pad and allow it to dry.	70% isopropyl alcohol pad.
Other accessories	• Consult manufacturer's instructions.	Consult manufacturer's instructions.

a. The equipment may be disinfected to comply with OSHA requirements for cleaning and decontaminating spills of blood and other body fluids. (Federal OSHA Standard on bloodborne pathogens: 29 CFR 1910.1030, 12/6/91.)

b. If liquid gets into the battery well or connectors, dry the area with warm air, then check the monitoring functions for proper operation.

c. Wex-cide (Wexford Labs, Inc., Kirkwood, MO) and T.B.Q. (Calgon Vestal Lab., Calgon Corp., St. Louis, MO) are disinfectants that meet OSHA requirements, are EPA approved, and will not harm the outside of the monitor, battery, or battery charger. Wipe away disinfectants with a water-dampened cloth after the manufacturer's recommended period.

Recycling monitor components

When the battery, monitor, or battery charger reaches the end of its life, recycle it locally according to national, state, and local regulations. You can also return the battery, monitor, or charger to Welch Allyn for recycling.

Within the European Union

Do not dispose of this product as "unsorted municipal waste." Prepare it for reuse or separate collection as specified by Directive 2002/96/EC, as amended, of the European Parliament and the Council of the European Union on Waste Electronic and Electrical Equipment (WEEE).

If the monitor or battery (Li++) is contaminated, this directive does not apply. For more specific information, see www.welchallyn.com/weee, or contact Welch Allyn Customer Service.

Li++

Recycle monitor batteries (Li++) according to the Directive 91/157/EEC (Batteries and accumulators containing certain dangerous substances) and Directive 93/86/EEC (Labelling of batteries and accumulators containing certain dangerous substances).

Change the network name

This procedure allows you to change the network name assigned to the monitor (as long as the current network name is one of the pre-set names available in the monitor Network Name Menu).

Note Changing the monitor network name will cause the monitor to re-start and seek to connect with the FlexNet network corresponding to the new name. Do not attempt to change the network name unless you are a qualified biomedical service engineer or technician.

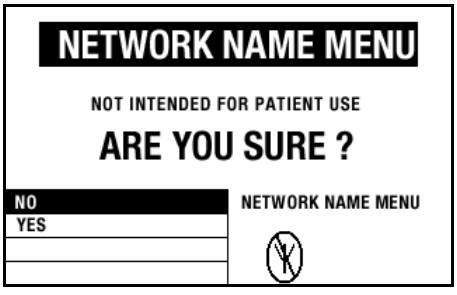
To change the network name:

1. Press ▼ to access the Main Menu, then repeatedly press ▼ until **SERVICE MENU** is highlighted.
2. Press ✓ to display the Service Menu screen.
3. Press and hold ▲ and ▼, then press ✓ to display the Network Name Menu.

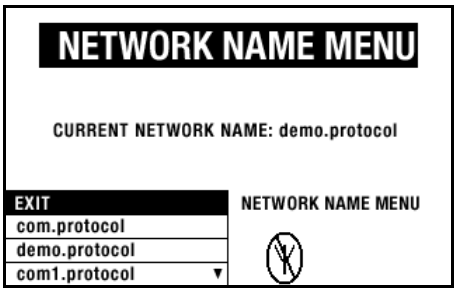
   If the current monitor network name is one of the following pre-set names:

com.protocol	demo.protocol
com1.protocol	com2.protocol
com3.protocol	com4.protocol
com5.protocol	com6.protocol
com7.protocol	com8.protocol

   then the monitor displays the following screen

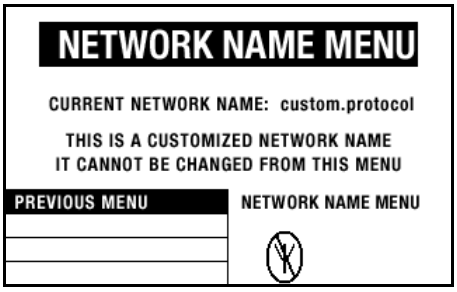


To change the network name, make sure **YES** is highlighted, then press ✓ to display the following screen:



Press ▲ or ▼ to highlight the desired network name, then press ✓. The monitor automatically turns itself off, then turns on and seeks to connect to a FlexNet network with the new network name.

If the current network name is a custom name, the monitor displays the following screen:



You cannot change the network name using the Network Name Menu. Press ✓ to return to the Service Menu. Contact Welch Allyn Technical Support for assistance.

6 Reference

Operating settings

The following table lists all of the monitor settings and the default settings.

Parameter	Set at Monitor	Set at Acuity		Previous Setting Retained at Monitor at Power-Up	Monitor Default Setting
		For Each Patient [a]	For Entire Acuity Unit[b]		
Patient Mode Adult (age 13 years and older) Pediatric (age greater than 28 days of age or more than 44 weeks gestation up to 12 years)	No	Yes	No	Yes	Adult
ECG screen mode (Single, Dual, 5 Sec, or Full Screen)	Yes	No	Yes	Yes	Single
ECG 1 Lead Selection	Yes	Yes	Yes	Yes	II
ECG 2 Lead Selection	Yes	Yes	Yes	Yes	V (or III if no V lead)
ECG Size (Scale)	Yes	No	No	Yes	1 mV/cm
Language	No	No	Yes	Yes	English
Mains Filter (off, 50, or 60 Hz)	No	No	Yes	Yes	60
Vital Signs Alarm Volume (high, low, or off) With Acuity Connection Without Acuity Connection	 No No	 No No	 Yes Yes	 No Yes	 off high
Equipment Alert Volume (high, low, or off) With Acuity Connection Without Acuity Connection	 No No	 No No	 Yes Yes	 No Yes	 off low
HR/PR Alarm Limits (Lower, Upper)	Yes	Yes	Yes	Yes	Adult: 50, 120 bpm Ped: 50, 150 bpm
SpO_2 Alarm Limits[c] (Lower, Upper)	Yes	Yes	Yes	Yes	Adult: 90, 100% Ped: 90, 100%
Regulatory settings (U.S., Europe, Japan)	No	No	Yes	Yes	U.S.
Pacer Detection Enable	No	Yes	No	Yes	On
Menu Lockout	No	No	Yes	No	Off
Display Backlight Timeout	No	No	Yes	Yes	120 seconds

a. Set by clinician at Acuity Central Station.

b. Set by Acuity System Administrator during system installation.

c. SpO_2 alarm limit range depends on the software version of the Acuity System to which the monitor is connected. (See "Heart rate and arrhythmia analysis option" on page 53 and "Pulse oximetry (SpO_2) specifications - Nellcor" on page 55.)

Specifications

Monitor radio specifications (5 GHz)

Characteristic	Specification
FlexNet™ Network	5 GHz orthogonal frequency division multiplexing (OFDM) wireless local area network (WLAN) and 10/100/1000 base-T Ethernet network
Modulation	OFDM
Output power	40 mW maximum; country-dependent
IEEE standards	802.11a, 802.11e, 802.11h, 802.1X
Monitors per access point	20 (max.)

Restrictions for use in the 5 GHz bands[a]		
Allowed frequency bands[b]	**Allowed channel numbers[c]**	**Countries**
5.15 to 5.25 GHz	36, 40, 44, 48	Austria
5.15 to 5.35 GHz	36, 40, 44, 48, 52, 56, 60, 64	Cyprus, Czech Republic, France, Hungary, Slovakia
5.15 to 5.35 GHz and 5.470 to 5.725 GHz	36, 40, 44, 48, 52, 56, 60, 64, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140	Belgium, Bulgaria, Denmark, Estonia, Finland, Germany, Greece, Iceland, Ireland, Italy[d], Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland, U.K.

a. This device may be not be operated outdoors when using the bands 5150 to 5350 MHz (Channels 36, 40, 44, 48, 52, 56, 50, 64).

b. This device must be used with Access Points that have employed and activated a radar detection feature required for European Community operation in the 5GHz bands. This device will operate under the control of the Access Point in order to avoid operating on a channel occupied by any radar system in the area. The presence of nearby radar operation may result in temporary interruption in communications of this device. The Access Point's radar detection feature will automatically restart operation on a channel free of radar. You may consult with the local technical support staff responsible for the wireless network to ensure the Access Point device(s) are properly configured for European Community operation.

c. To remain in conformance with European spectrum usage laws for Wireless LAN operation, the above 5 GHz channel limitations apply. The user should check the current channel of operation. If operation is occurring outside of the allowable frequencies as listed above, the user must cease operating the device at that location and consult the local technical support staff responsible for the wireless network.

d. In Italy the end-user must apply for a license from the national spectrum authority to operate this device outdoors.

Monitor radio specifications (2.4 GHz)

Characteristic	Specification
FlexNet Network	2.4 GHz Wireless Local Area Network (WLAN) and 10/100 Base-T Ethernet network
Frequency[a]	2.402 to 2.480 GHz
Modulation	Frequency Hopping Spread Spectrum (FHSS)
Output Power	100 mW
IEEE 802.11 compliant	Yes
Monitors per Access Point	15 (maximum) in most countries. In countries where available frequencies are limited, this number is reduced.

a. When used within certain countries, authorization for use is restricted as follows:
France: The equipment is internally restricted to the 2.448-2.482 GHz frequency range.
Spain: The equipment is internally restricted to the 2.447-2.473 GHz frequency range.
Japan: The equipment is internally restricted to the 2.473-2.495 GHz frequency range.
Italy: Operation requires a user license.
Note: The frequency ranges specified above are subject to geographic-specific regulatory authorities.

ECG specifications

The ECG channel meets all the requirements for Cardiac Monitors Heart Rate Meters and Alarms specified ANSI/AAMI EC13-1992, except for Impulse response at the monitor (section 3.2.9.8 part (c)), and Standardizing Voltage at the monitor and at Acuity (section 3.2.9.9). The channel also meets the American National Standard, Safe Current Limits for Electromedical Apparatus (ANSI/AAMI ES1-1993).

Characteristic	**Specification**
Connector	Hypertronics D01 latching connector
Selectable Leads	
5-Lead Cable	Monitored: II, III, V; Derived: I, aV_R, aV_L, aV_F
3-Lead Application (using 3-lead ECG cable, or 5-lead ECG cable with detachable lead wires; only RA, LA, LL electrodes connected)	Monitored: II
Lead Fault Indicator	Displayed chest icon with flashing indicator for each electrode
ECG Size (sensitivity)	0.2, 0.5, 1, 2, 4, and 8 mV/cm
Display Sweep Speed	25 mm/sec
Bandwidth	
Local display	0.5 to 94 Hz independent of patient mode
To Acuity Central Station	0.05 to 94 Hz independent of patient mode
Sample Rate	364 Hz (182 Hz with turning point decimation to Acuity Central Station)
Input Protection	Electrosurgery and defibrillator protected when used with ECG cables specified in the Welch Allyn *Products and Accessories* booklet (810-0409-XX).
Electrosurgery interference suppression	Included on all vectors.
Lead Fail Sense Current	70 nA dc typical for active leads. 140-280 nA dc typical for reference electrode, depending on number of electrodes attached.
Tall T-wave Rejection	Meets AAMI (USA) EC13-1992, section 3.1.2.1.c, up through 1.2 mV

Characteristic	Specification
Common Mode Rejection	
FILTER function OFF	<1 mV p-p RTI for 10V rms, 50/60 Hz into unbalanced input
FILTER function ON	<30 µV p-p RTI for 10V rms, 50/60 Hz into unbalanced input
Input Impedance	>2.5 M¾ differential @ 60 Hz
Input Range (ac)	10 mV peak to peak (local display) 10 mV peak to peak (Acuity Central Station)
Input Range (dc)	Up to ±500 mV
System Noise	ð30 µV peak-to-peak, RTI
QRS Detector	Adult or Pediatric Amplitude Range: 0.22 to 5.0 mV (RTI) Adult Width Range (Duration): 70 to 120 msec Pediatric Width Range (Duration): 40 to 120 msec
Heart Rate Range	25 to 350 beats per minute (measurement) 25 to 300 beats per minute (display)
Alarm Limits	25 to 245 beats per minute (lower) 30 to 250 beats per minute (upper)
Heart Rate Meter Response Time	Responds to change in heart rate within 5 to 9 seconds depending on physiological waveform. (As measured per AAMI standard EC13-1992 clause 4.1.2.1 (f), including 3.1.2.1 parts f. and g. waveforms.) Includes 1 second readout update interval.
HR Display Update Interval at monitor	1 second
HR Accuracy	±3 beats per minute or 3%, whichever is greater
Heart Rate Response to ineffectively paced QRS pattern	Indicates rate of 30 to 46 during AAMI EC13-1992 part 3.1.4.1 part (f) and (g) tests. NOTE: AAMI Test 4.1.4 part f and g: Accuracy is affected (i.e., rate increases) when QRS and pacer spikes are nearly simultaneous as occasionally is the case during this AAMI test.
Heart Rate Averaging Method	Heart rate = 60/ latest average interval in seconds. For higher heart rates, latest average interval = 7/8 of previous average interval + 1/8 of latest interval. For lower heart rates, latest average interval = 3/4 of previous average interval + 1/4 of latest interval. Transition rates for choice of formula include hysteresis and are 70 and 80 beats per minute.
Drift Tolerance (AAMI Specification EC13-1992, 3.2.6.3)	80 beats per minute indicated for 80 beats per minute ECG plus drift waveform
Pacer Pulse Display	Pacer indicator shown on screen if PACER display turned ON; pacer spike always shown if of sufficient amplitude.
Pacer Pulse Rejection	Pacer detection range (i.e., will show the dashed vertical marker) for ±3 mV to ±700 mV @ 0.1 ms width, ±2 mV to ±700 mV @ 0.2 to 2 ms pulse width in electrically quiet environment. Thresholds automatically adjust to reject repetitive ambient noise. Operates even while pacer indication is disabled. Will not count as heartbeats approximately 95% of pacemaker pulses within pacer detection range, with or without AAMI (EC13-1992) tails of 4, 25, 50, 75, or 100 ms decay time constant, whose tail amplitudes are up to 25%, 2mV maximum, whether ventricular only, or A-V sequential pulses (150 and 250 ms separation), all per AAMI tests 3.1.4.1 and 3.1.4.2
Response to Irregular Rhythm (AAMI Specification EC13-1992, 3.1.2.1. Part e.)	
Ventricular Bigeminy (VB)	78 to 81 bpm (80 bpm expected)
Slow Alternating VB	57 to 65 bpm (60 bpm expected)
Rapid Alternating VB	118 to 123 bpm (120 bpm expected)
Bidirectional Systole	88 to 93 bpm (90 bpm expected)

Heart rate and arrhythmia analysis option

Method for calculating heart rate	
Monitor	Determined by monitor (displayed at monitor) Heart rate = 60 / latest average interval in seconds. For higher heart rates, latest average interval = 7/8 of previous average interval + 1/8 of latest interval For lower heart rates, latest average interval = 3/4 (previous average interval) + 1/4 latest interval. Transition rates for choice of formula include hysteresis and are 70 and 80 beats per minute.
Acuity System with Arrhythmia Option	Determined by Acuity Arrhythmia Option software (displayed at Acuity Central Station) The beat-to-beat heart rate (HR) value is calculated as follows: HR = 60000/actual RR (bpm). Actual RR = time between last detected QRS complex and previously detected QRS complex (ms). Average HR is calculated on the basis of the mean RR interval in the last 6 seconds or 8 RR intervals (whichever is shorter).
Arrhythmia analysis option when connected to Acuity	
ST Analysis	ST Analysis can be performed for any or all of seven leads, depending on the operator selection. The operator can select a measurement offset. ST segment shifts are recorded in continuous trend data every second. The operator can inspect trend data to see the duration and elevation or depression for each episode for any time period recorded. The operator can also inspect a summary of ST segment shift data within tabular trends.
Heart Rate	Heart rate information is available in the trend data which can be viewed on the display or printed. The operator can inspect the trend data to see the lowest, highest, and median (averaged) heart rates. Trend data also includes the total beats per range of time.
Definition of Pause Arrhythmia Event	A pause is defined as the R-R interval which is greater than or equal to two times the average R-R.

Pulse oximetry (SpO_2) specifications - Masimo

Characteristic	Specification
Saturation (% SpO_2)	
Range	1% to 100%
Resolution	1%
Alarm Limits[a]	
With Acuity 6.0 or higher	50% to 99% (lower); 51% to 100% (upper)
With Acuity 5.4X or lower	80% to 99% (lower); 81% to 100% (upper)
Probe Accuracy (Adults, Pediatrics)	
No Motion	70% to 100% ±2 counts 0% to 69% unspecified
During Motion[b]	70% to 100% ±3 counts 0% to 69% unspecified
Pulse Rate	
Range	26 to 239 beats per minute
Resolution	1 beat per minute
Alarm Limits	25 to 245 beats per minute (lower) 30 to 250 beats per minute (upper)
Pulse Rate Accuracy	
No Motion	±3 beats per minute
During Motion[2]	±5 beats per minute
Display Update Interval at monitor	1 second
Alarm Hold-Off Time Period	10 seconds; resets if the sensor reports levels within limits before 10 seconds elapses
Circuitry	Microprocessor controlled Automatic self-test of oximeter when powered on Automatic setting of default parameters Automatic alarm messages
Electrosurgery interference suppression	Yes
Sensor Compatibility	Compatible only with Masimo sensors listed in the Welch Allyn *Products and Accessories* booklet (810-0409-XX).
Sensor LEDs	
RED Wavelength	660 nm (nominal)
INFRARED Wavelength	905 nm (nominal)
Sensor Energies (Radiant Power)	0.13 mW to 0.79 mW at 50 mA pulsed

a. SpO_2 alarm limit range depends on the software version of the Acuity System to which the monitor is connected.

b. Motion is defined as rubbing and tapping motions at 2 to 4 Hz at an amplitude of 1 to 2 cm and a nonrepetitive motion between 1 to 5 Hz at an amplitude of 2 to 3 cm in induced hypoxia studies in the range of 70-100% SpO_2 against a laboratory co-oximeter and ECG monitor. This variation equals ±1 standard deviation which encompasses 68% of the population.

WARNING Interfering Substances: Carboxyhemoglobin may erroneously increase readings. The level of increase is approximately equal to the amount of carboxyhemoglobin present. Dyes, or any substances containing dyes, that change usual arterial pigmentation may cause erroneous readings.

WARNING Although the SpO_2 alarm limit range can be adjusted down to 50% saturation (with Acuity 6.0 software or higher), the SpO_2 performance and accuracy is not specified below 70%.

Pulse oximetry (SpO_2) specifications - Nellcor

Characteristic	Specification
Saturation (% SpO_2)	
Range	1% to 100%
Resolution	1%
Alarm Limits[a]	
With Acuity 6.0 or higher	50% to 99% (lower); 51% to 100% (upper)
With Acuity 5.4X or lower	80% to 99% (lower); 81% to 100% (upper)
Probe Accuracy[b] [c](Adults, Pediatrics)	70% to 100% (0% to 69% unspecified)
	OxiMax Max-A, Max-AL ±2 counts
	OxiCliq N ±2.5 counts
	D-YS ±3 counts
	DS-100A ±3.5 counts
Pulse Rate	
Range	26 to 239 beats per minute
Resolution	1 beat per minute
Alarm Limits	25 to 245 beats per minute (lower)
	30 to 250 beats per minute (upper)
Pulse Rate Accuracy	±3 beats per minute
Display Update Interval at the monitor	1 second
Alarm Hold-Off Time Period	10 seconds; resets if the sensor reports levels within limits before 10 seconds elapses
Circuitry	Microprocessor controlled Automatic self-test of oximeter when powered on Automatic setting of default parameters Automatic alarm messages
Electrosurgery interference suppression	Yes
Sensor Compatibility	Compatible only with Nellcor sensors listed in the Welch Allyn *Products and Accessories* booklet (810-0409-XX).
Sensor LED Wavelengths	Within 500 to 1,000 nm
Sensor Energies (Radiant Power)	Does not exceed 15 mW

a. SpO_2 alarm limit range depends on the software version of the Acuity System to which the monitor is connected.
b. Refer to the Welch Allyn *Products and Accessories* guide (810-0409-XX) for accuracy specifications for all Nellcor SpO_2 probes recommended for use.
c. Although some of the listed Nellcor sensors can be used with neonates with other pulse oximetry devices, the monitor is only intended for use with adult and pediatric patients, not with neonates.

WARNING Interfering Substances: Carboxyhemoglobin may erroneously increase readings. The level of increase is approximately equal to the amount of carboxyhemoglobin present. Dyes, or any substances containing dyes, that change usual arterial pigmentation may cause erroneous readings.

WARNING Although the SpO_2 alarm limit range can be adjusted down to 50% saturation (with Acuity 6.0 software or higher), the SpO_2 performance and accuracy is not specified below 70%.

Patient alarm and equipment alert specifications

Characteristic	Specification
Visual Alarm Indicator at the monitor	
Flashing GREEN LED	Normal operation
Flashing RED LED	Patient alarm
Continuously ON RED LED	Patient alarms are silenced
Flashing YELLOW LED	An equipment alert or not connected to the network
Continuously ON YELLOW LED	Equipment alert suspended for 90 seconds at Acuity or low battery alert acknowledged (dismissed)
Audio Tone Locations	Monitor Acuity Central Station (when connected)
Audio Tone Frequency	2900 Hz
Life-Threatening Arrhythmia Alarm Tone Pattern	1 second on, 1 second off
Patient Alarm Tone Pattern	1second on, 2 seconds off
Equipment Alert Tone Pattern	1second on, 4 seconds off
Audio Tone Volume	The monitor audio tone volume is configured by the Acuity System to High, Low, or Off. The monitor can be configured with separate audio tone volume settings for when it is connected to an Acuity System and when it is not.
Limits	Setable on all parameters
Alarm Control	Automatic preset or manual settings
Alarm Priority	Highest priority: Patient alarms Lowest priority: Equipment alerts
Alarm on Tachycardias	Most tachycardias will alarm in less than 8 seconds. These include AAMI 3.1.2.1 part f. waveforms. Certain multifocal tachycardias may initially alarm as "low rate."
Alarm Holdoff Time Period[a]	HR = 3 seconds % SpO_2, PR = 10 seconds
Acuity-Configurable Audio Alarm Delay at the monitor	When a monitor is connected to an Acuity System, the audio alarms at the monitor can be delayed up to 4 minutes and 15 seconds. The delay time is selected in Acuity software at the time of Acuity installation. Visual alarm indications are not delayed.
Patient Alarm Tone Silence from the monitor or Suspend from Acuity	The monitor LED is continuously ON RED and the audio tone is silenced for 90 seconds (non-adjustable). If original alarm was silenced from the monitor, new patient alarms or equipment alerts break the silence at the monitor, but only life-threatening arrhythmia alarms break the silence at Acuity. If original alarm suspended at Acuity, only life-threatening arrhythmia alarms break the silence at the monitor and Acuity.
Equipment Alert Acknowledge from the monitor	The LED returns to the pre-alert state (except Low Battery remains continuously ON YELLOW) and the auditory tone is dismissed.
Equipment Alert Suspend from Acuity	The LED is continuously ON YELLOW and the audio tone is silenced for 90 seconds (non-adjustable).
Patient Alarm Tone Reset from the monitor or Resume from Acuity	For a patient alarm tone that has been silenced, resets the tone.
Patient Out of Range; Transmitter Failure	An equipment alert is generated whenever the monitor fails to communicate to an Acuity System after a connection has been successfully established. In addition, the “No Acuity” icon is displayed on the monitor display.

Characteristic	Specification
Transmitter Battery Failure	An equipment alert is generated before the monitor battery becomes exhausted.

a. To help minimize false alarms, the monitor briefly delays or "holds off" triggering both audible and visual alarms for limit violations for these vital signs. After the alarm hold-off period begins, if the monitor detects that the patient's vital sign has returned to acceptable limits, the monitor cancels the alarm hold-off. The next time a vital sign limit is violated, the monitor starts a new hold-off period.

Display specifications

Characteristic	Specification
Type	Monochrome passive matrix; LCD module
Resolution	320 x 200 pixels
Active Viewing Area	2.26 x 1.41 in. (57.5 x 35.9 mm)
Pixel Pitch	0.0071 in. (0.18 mm)
Pixel Size	0.0065 in. (0.165 mm)
Viewing Angle	6 o'clock position
Display Color	black on white

Environmental specifications (with battery installed)

Characteristic	Specification
Operating Temperature	0° to 40° C
Shipping and Storage Temperature	-20° to 60° C
Operating Altitude	-2,000 to 15,000 ft (-610 to 4,572 m)
Shipping and Storage Altitude	-2,000 to 40,000 ft (-610 to 12,192 m)
Operating Relative Humidity	15% to 95%, noncondensing per MIL STD 810E, Procedure 1-natural
Shipping and Storage Relative Humidity	15% to 95%, noncondensing per MIL STD 810E, Procedure 1-natural
Drop	1 meter onto vinyl tile over concrete per EN60601-1
Shock	50 g
Vibration, Random	$0.02g^2$/Hz from 10 to 500 Hz, ramping down to $0.002g^2$/Hz at 2000 Hz. Operating 1 hour per axis, 3 hours per test. Designed to meet RTCA DO-160D, Category C.
Degree of Protection Against Ingress	IPX1 Rating, Drip Proof per EN60529: 1991
Electromagnetic Compatibility (EMC)	EN60601-1-2: 2001

Caution The monitor may not meet performance specifications if it is not used or stored within these environmental specifications.

Physical specifications

Protection classifications, all configurations	
Characteristic	**Specification**
Type of Protection against Electric Shock—Monitor Type: CF	Battery operation only Battery must be recharged in separate battery charger. IEC EN 60601-1, 2nd Edition
Degree of Protection Against Electric Shock, for Parts Applied to Patients	See monitor labels. CF defibrillator protected. IEC EN 60601-1, 2nd Edition
Recovery time following defibrillator discharge	Less than or equal to 10 seconds
Method of Disinfection	Not suitable for autoclaving (see cleaning instructions on "Inspect and clean the monitor and accessories" on page 45).
Flammable Anesthetics	Not suitable for use with flammable anesthetics.
Height	7.80 in (19.8 cm)
Width	3.50 in (8.9 cm)
Depth	1.96 in (4.9 cm)
Weight (including battery) Model 406 Model 408	 17.0 oz (0.48 kg) 18.6 oz (0.53 kg)

Battery specifications

Characteristic	Specifications
Reorder Number Lithium Ion Battery 2EA Active A	008-0647-XX
Battery Type	Rechargeable, Lithium Ion
Battery Capacity	2 cells, 7.4 V (nominal), 8.4 V (charging), 1800 mA-hr
Battery Weight	4.5 oz (0.13 kg)
Battery Charger	External device
Battery Fuse Rating	5 A, 125 V (not user-accessible) Note: Internal electronic overload circuitry is used as the primary method of protection.
Operating Times on Battery[a]	Monitor w/ ECG only: 25 hrs Monitor w/ ECG and SpO_2: 10 hrs
Battery Recharge Time	4 hours at 25° C (typical)
Battery Lifetime	300 charge/discharge cycles to 70% of original capacity (typical)

a. Battery operating times based on these conditions: new fully-charged battery operating at 25° C, the monitor connected to Acuity, eight patient alarms per hour, minimal motion artifact.

Note The following factors may reduce battery operating time:

- Amount of time not connected to Acuity.
- Frequency and duration of alarms and alerts.
- Amount of operator activity using monitor keys (activates display).
- Age of battery.
- Amount of motion artifact during SpO_2 monitoring.

WARNING The monitor battery is Lithium Ion. Do not incinerate, submerge, crush, disassemble, or autoclave. If a battery has been submerged in liquid, discard the battery properly; do not try to recharge or reuse the battery. Do not short the battery terminals. Do not try to connect the battery to any device except the monitor or the battery charger. Do not expose to high temperature (above 60° C or 140° F). Use only the specified monitor battery charger.

Eight-bay battery charger specifications

Characteristic	Specification
Reorder Number Universal Battery Charger Active C	008-0651-XX
Functional Specifications	
Capacity	Eight charging bays; able to charge four (Lithium Ion) batteries simultaneously.
Protection Classifications[a]	
Duty Cycle	Continuous
Type of Protection Against Electric Shock	Class I, (Protectively Earthed) with Double Insulation
Degree of Protection Against Harmful Ingress of Water	For ordinary, indoor locations only.
Method of Disinfection	Not suitable for autoclaving. (See cleaning instructions on "Inspect and clean the monitor and accessories" on page 45.)
Flammable Anesthetics	Not suitable for use with flammable anesthetics.
Environmental Specifications	
Operating Temperature	0° to 40° C
Shipping and Storage Temperature	-20° to 60° C
Operating Altitude	-2,000 to 15,000 feet (-610 to 4,572 m)
Shipping and Storage Altitude	-2,000 to 40,000 feet (-610 to 12,192 m)
Operating Relative Humidity	15% to 95%, noncondensing
Shipping, Storage Relative Humidity	15% to 95%, noncondensing
Shock	30 g
Vibration	$0.01g^2$/Hz from 5 to 500 Hz, 30 minutes per axis
Electromagnetic Compatibility (EMC)	EN60601-1-2: 2001
Physical Specifications	
Length	15.0 in (38.1 cm)
Width	9.0 in (22.9 cm)
Height	3.6 in (9.1 cm) including feet
Weight	3.5 lb (1.6 kg)
Electrical Specifications	
Rated Input	100 V-240 V AC 600 mA, 50/60 ± 3 Hz, Electrical Class I
Rated Fuses	T1.25 A/250V, Time-Delay 5x20mm
Rated Output per charging bay (Continuous)	8.4 V ± 100 mV dc @1 A max.
Charge Time	4 hours typical for fully discharged battery. Automatic charge termination when charge is completed, or fault detected.
Output Over-Current	Electronic overload protection
Additional Features	Detachable power cord
LED Indicators	
LED OFF	No battery detected.
Flashing GREEN LED 1 sec ON, 3 sec OFF 1 sec ON, 1 sec OFF	 Battery detected, waiting to be charged Battery is charged
Continuously ON GREEN LED	Battery is charged.
Continuously ON YELLOW LED	Battery or charging bay fault.

a. Per EN 60601-1 unless otherwise stated.

7 Compliance

General

The 802.11a Wireless PC Card must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

This product contains encryption. It is unlawful to export out of the U.S. without obtaining a U.S. Export License.

Federal Communications Commission (FCC)

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.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instructions, it may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by tuning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the distance between the equipment and the receiver
- Connect the equipment to outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

The user may find the following booklet prepared by the Federal Communications Commission helpful:

The Interference Handbook

This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402. Stock No. 004-000-0034504.

Welch Allyn is not responsible for any radio or television interference caused by unauthorized modification of the devices included with this Welch Allyn product, or the substitution or attachment of connecting cables and equipment other than specified by Welch Allyn.

The correction of interference caused by such unauthorized modification, substitution or attachment will be the responsibility of the user.

Industry Canada (IC) emissions

This device complies with RSS 210 of Industry Canada.

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of this device.

L'utilisation de ce dispositif est autorisée seulement aux conditions suivantes: (1) il ne doit pas produire de brouillage et (2) l' utilisateur du dispositif doit étre prêt à accepter tout brouillage radioélectrique reçu, même si ce brouillage est susceptible de compromettre le fonctionnement du dispositif.

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conform à la norme NMB-003 du Canada.

European Union

Czech	Welch Allyn tímto prohlašuje, ze tento *RLAN device* je ve shodě se základními po_adavky a dalšími příslušnými ustanoveními směrnice 1999/5/ES.
Danish	Undertegnede Welch Allyn erklærer herved, at følgende udstyr RLAN device overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF
Dutch	Bij deze verklaart Welch Allyn dat deze RLAN device voldoet aan de essentiële eisen en aan de overige relevante bepalingen van Richtlijn 1999/5/EC.
English	Hereby, Welch Allyn, declares that this RLAN device is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
Estonian	Käesolevaga kinnitab Welch Allyn seadme RLAN device vastavust direktiivi 1999/5/EÜ põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.
Finnish	Welch Allyn vakuuttaa täten että RLAN device tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
French	Par la présente, Welch Allyn déclare que ce RLAN device est conforme aux exigences essentielles et aux autres dispositions de la directive 1999/5/CE qui lui sont applicables
German	Hiermit erklärt Welch Allyn die Übereinstimmung des Gerätes RLAN device mit den grundlegenden Anforderungen und den anderen relevanten Festlegungen der Richtlinie 1999/5/EG. (Wien)
Greek	ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ Welch Allyn ΔΗΛΩΝΕΙ ΟΤΙ RLAN device ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 1999/5/ΕΚ
Hungarian	Alulírott, Welch Allyn nyilatkozom, hogy a RLAN device megfelel a vonatkozó alapvetõ követelményeknek és az 1999/5/EC irányelv egyéb elõírásainak.
Italian	Con la presente Welch Allyn dichiara che questo RLAN device è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
Latvian	Ar šo Welch Allyn deklarē, ka *RLAN device* atbilst Direktīvas 1999/5/EK būtiskajām prasībām un citiem ar to saistītajiem noteikumiem.
Lithuanian	Šiuo Welch Allyn deklaruoja, kad šis RLAN device atitinka esminius reikalavimus ir kitas 1999/5/EB Direktyvos nuostatas.
Malti	Hawnhekk, Welch Allyn, jiddikjara li dan RLAN device jikkonforma mal-htigijiet essenzjali u ma provvedimenti ohrajn relevanti li hemm fid-Dirrettiva 1999/5/EC
Portuguese	Welch Allyn declara que este RLAN device está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/CE.
Slovak	Welch Allyn týmto vyhlasuje, ze RLAN device spĺňa základné po_iadavky a všetky príslušné ustanovenia Smernice 1999/5/ES.
Slovene	Šiuo Welch Allyn deklaruoja, kad šis RLAN device atitinka esminius reikalavimus ir kitas 1999/5/EB Direktyvos nuostatas.
Spanish	Por medio de la presente Welch Allyn declara que el RLAN device cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE

Swedish	Härmed intygar Welch Allyn att denna RLAN device står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.

Electromagnetic compatibility

Special precautions concerning electromagnetic compatibility (EMC) must be taken for all medical electrical equipment. This device complies with IEC EN 60601-1-2:2001.

- All medical electrical equipment must be installed and put into service in accordance with the EMC information provided in this document and the *Micropaq Monitor Directions For Use*.
- Portable and mobile RF communications equipment can affect the behavior of medical electrical equipment.

The monitors and battery charger comply with all applicable and required standards for electromagnetic interference.

- It does not normally affect nearby equipment and devices.
- It is not normally affected by nearby equipment and devices.
- It is safe to operate the monitor in the presence of high-frequency surgical equipment.
- However, it is good practice to avoid using the monitor in extremely close proximity to other equipment.

Monitor

Monitor - Guidance and Manufacturer's Declaration—Electromagnetic Emissions

The Model 4XX Series Monitor is intended for use in the electromagnetic environment specified below. The customer or the user of the monitor should assure that it is used in such an environment.

Emissions test	Compliance	Electromagnetic Environment—Guidance
RF emissions CISPR 11	Group 2	The Model 4XX Series Monitor must emit electromagnetic energy in order to perform its intended function. Nearby electronic equipment may be affected.[a]
RF emissions CISPR 11	Class B	The Model 4XX Series Monitor is suitable for use in all establishments, including 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	No connection to mains (battery-operated)	
Voltage fluctuations/flicker emissions IEC 61000-3-3	No connection to mains (battery-operated)	

a. The Model 4XX Series Monitor contains a 5-GHz orthogonal frequency-division multiplexing transmitter or a 2.4-GHz frequency-hopping spread-spectrum transmitter for the purpose of wireless communication. The radio is operated according to the requirements of various agencies, including FCC 47 CFR 15.247 and R&TTE Directive (1995/5/EC). The transmitter is excluded from the EMC requirements of 60601-1-2:2001, but should be considered when addressing possible interference issues between this and other devices.

Monitor - Guidance and Manufacturer's Declaration—Electromagnetic Immunity

The Model 4XX Series Monitor is intended for use in the electromagnetic environment specified below. The customer or the user of the monitor 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 at least 30%.
Electrical fast transient/ burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	No connection to mains (battery-operated). No other cables requiring EFT/Burst testing.	Since there is no connection to the mains, there is no requirement for mains quality.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	No connection to mains (battery-operated).	
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	No connection to mains (battery-operated).	
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	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 AC mains voltage prior to application of the test level.

Monitor - Guidance and Manufacturer's Declaration—Electromagnetic Immunity

The Model 4XX Series Monitor is intended for use in the electromagnetic environment specified below. The customer or the user of the monitor 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 Model 4XX Series Monitor, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended Separation Distance**
Conducted RF IEC 61000-4-6	3 V_{rms} 150 kHz to 80 MHz	3 V_{rms}	$d = 1.2 \sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2 \sqrt{P}$ 80 MHz to 800 MHz $d = 2.3 \sqrt{P}$ 800 MHz to 2.5 GHz where **P** is the maximum output power rating of the transmitter in watts according to the transmitter manufacturer and **d** is the recommended separation distance in meters. Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[a], should be less than the compliance level in each frequency range[b]. 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 Model 4XX Series Monitor is used exceeds the applicable RF compliance level above, the Model 4XX Series Monitor should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the monitor.

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

Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and the Model 4XX Series Monitor

The Model 4XX Series Monitor is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the monitor can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the monitor 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 $d = 1.2\sqrt{P}$	**80 MHz to 800 MHz** $d = 1.2\sqrt{P}$	**800 MHz to 2.5 GHz** $d = 2.3\sqrt{P}$
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 *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 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.

Battery charger for the monitor

Monitor Battery Charger Only- Guidance and Manufacturer's Declaration—Electromagnetic Emissions		
The Battery Charger for the Model 4XX Series Monitor is intended for use in the electromagnetic environment specified below. The customer or the user of the battery charger should assure that it is used in such an environment.		
Emissions test	**Compliance**	**Electromagnetic Environment—Guidance**
RF emissions CISPR 11	Group 1	The Battery Charger 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 Battery Charger is suitable for use in all establishments, including 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	

Monitor Battery Charger Only- Guidance and Manufacturer's Declaration—Electromagnetic Immunity

The Battery Charger for the Model 4XX Series Monitor is intended for use in the electromagnetic environment specified below. The customer or the user of the monitor 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 at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±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 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 Battery Charger requires continued operation during a power mains interruption, it is recommended that the Battery Charger be powered from an uninterruptible power supply or battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	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 AC mains voltage prior to application of the test level.

Monitor Battery Charger Only- Guidance and Manufacturer's Declaration—Electromagnetic Immunity

The Battery Charger for the Model 4XX Series Monitor is intended for use in the electromagnetic environment specified below. The customer or the user of the battery charger 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 Battery Charger, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.
			Recommended Separation Distance
Conducted RF IEC 61000-4-6	3 V_{rms} 150 kHz to 80 MHz	3 V_{rms}	$d = 1.2 \sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2 \sqrt{P}$ 80 MHz to 800 MHz $d = 2.3 \sqrt{P}$ 800 MHz to 2.5 GHz where **P** is the maximum output power rating of the transmitter in watts according to the transmitter manufacturer and **d** is the recommended separation distance in meters. Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[a], should be less than the compliance level in each frequency range[b]. 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 Battery Charger is used exceeds the applicable RF compliance level above, the Battery Charger should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the Battery Charger.

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

Recommended Separation Distances between Portable and Mobile RF Communications Equipment and the Battery Charger for the Model 4XX Series Monitor

The Battery Charger for the Model 4XX Series Monitor is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the Battery Charger can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Battery Charger 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 $d = 1.2\sqrt{P}$	**80 MHz to 800 MHz** $d = 1.2\sqrt{P}$	**800 MHz to 2.5 GHz** $d = 2.3\sqrt{P}$
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 *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 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.

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